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Fusion LIBOR Transition Calculator API User Guide

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Document Revision History

Version	Date	Description of Revision(s)
1.8.x	10 February 2025 (Generally Available)	Deployed to Production Updated API Release Version Availability across Environments section on page **198**.
1.8.x	10 January 2025 (Release Preview)	Updated the following sections to include support for IndONIA and ZARNOIA risk-free rates: • Updated the Transition from LIBOR to RFRs section on page **9** for IndONIA and ZARNOIA risk-free rates. • Supported Holiday Calendars section on page **24** • Supported API End Points section starting on page **27** to add information about IndONIA and ZARNOIA risk-free rates. • API Error Codes and Description section on page **193** • Sandbox Environment (Development) section on page **197** • Official Sources of Market Data section on page **199** • Third-Party Data Restrictions section on page **199**
1.7.x	17 July 2023 (Generally Available)	Deployed to Production Updated API Release Version Availability across Environments section on page **198**.
1.7.x	19 June 2023 (Release Preview)	Updated the following sections: • Supported API End Points section starting on page **27** to add information about a new attribute in the API output – *Lookback Date* • API Error Codes and Description section on page **193** • API Release Version Availability across Environments section on page **198** • Get New Access Token – Sandbox Environment section starting on page **210** • Regenerate Access Token – Sandbox Environment section starting on page **216**
1.6.x	12 June 2023 (Generally Available)	Updated Supported Holiday Calendars section on page **24**
1.6.x	27 September 2021 (Generally Available)	Deployed to Production • Updated API Release Version Availability across Environments section on page **198**.
1.6.x	17 August 2021 (Release Preview)	• Updated the Transition from LIBOR to RFRs section on page **9** for other prominent IBORs (Interbank Offered Rates). • Updated Supported API End Points section for the following: o For Calculated Rate: ▪ Updated *riskFreeRate*, *dayCountConvention*, and *rateRoundingDecimalPoints* attributes for Daily Compounded in Arrears (NCCR), Average Compounded in Arrears, and Simple Average calculation methods. o For Interest Calculator: ▪ Updated *InitialPrincipalBalance*, *riskFreeRate*, *dayCountConvention*, *rateRoundingDecimalPoints*, and *principalAmountChange* attributes for Daily Compounded in

Version	Date	Description of Revision(s)
		Arrears (NCCR), Average Compounded in Arrears, and Simple Average calculation methods. o Updated description of the API output attribute *comments* to include the date of the most recent, published rate available in the ARR calculator. This applies to all the API end points in the Supported API End Points section on page **27** o Updated compoundingFactor attribute description for Daily Compounded in Arrears (NCCR) API end points on pages **33** and **88** o Updated Use Case Examples on pages **39**, **53**, and **174** • Scenario where the end date of Lockout period falls on a non-business day is supported – Removed that constraint from the Notes/Restrictions section on page **194**. • Updated Official Sources of Market Data section on page **199**. • Updated Third-Party Data Restrictions section on page **199** with terms of use for ESTR, SORA, TONAR, Refinitiv data. • Added a note about Compounding Factor for NCCR in the Notes/Restrictions section on page **194**. • Updated RFR rate availability information in the ARR Calculator Environments section on page **197**.
1.5.x	17 May 2021 (Generally Available)	Deployed to Production
1.5.x	31 March 2021 (Release Preview)	Introduced support for key ARR conventions that were published by Sterling RFR Working Group. • Updated Supported Alternative Reference Rates Conventions section on page **12** for Legacy Risk Free Rate Floor and CCR Rounding Approach. o Updated Daily Compounding in Arrears (Non-Cumulative Compounded Rate or NCCR) section on page **13** for CCR Rounding approach. ▪ With CCR Rounding Approach ▪ Without CCR Rounding Approach o Updated *Daily Compounding in Arrears (Non-Cumulative Compounded Rate) for Observation Period Shift* section on page **19**. o Added Legacy Risk Free Rate Floor section on page **23**. • Updated Supported API End Points section for the following: o Updated ccrRoundingApplies and ccrRoundingPrecision attributes for Calculated Rate and Interest Calculator [Daily Compounded in Arrears (NCCR)] o Updated legacyRiskFreeRateFloor, derivedRiskFreeRateFloor, and derivedRiskFreeRateFloorApplied attributes for Calculated Rate and Interest Calculator (Daily Compounded in Arrears (NCCR), Average Compounded in Arrears, Simple ARR, and Simple Average) o Updated Use Case Examples with the latest output as per version 1.5.x for the end points mentioned above. • Updated *API Error Codes and Description* section on page **192**. • Updated *Notes/Restrictions* section on page **194**. o Added note on Lockout Days o Added note on Compounding Factor for NCCR o Added additional information on Rounding o Removed the following limitations:

Version	Date	Description of Revision(s)
		▪ For Simple ARR Calculation Method, the known limitation where the display value of interestPeriodDays is inaccurate when the calculateTillDate is either a non-business day or the business day immediately preceding a non-business day. This limitation is fixed in LIQ-122387. ▪ For interest calculation end points, when Observation Period Shift does not apply and if there is a Principal Payment on Saturday, the display value of interestPeriodDays attribute for Friday as well as for Saturday may not be correct. This limitation is fixed in LIQ-122388. For more information, see the Fusion LIBOR Transition Calculator – Version 1.5.x Release Notes. • Updated Official Sources of Market Data section on page **199**. o Removed *Appendix A* prefix from Heading. o Added *Third-Party Data Restrictions* section. • Added *ARR Calculator Environments* section on page **197**. • Added section on 2.6.1.3 - Daily Compounding in Arrears (Non-Cumulative Compounded Rate) for Observation Period Shift – With CCR Rounding on page **22** • Updated section 3.3.1 – Changed required values for InterestPeriodStartDate, interestPeriodEnddate and CalculateTillDate to N, N, and Y respectively on page **56**
1.4.x	15 March 2021 (Generally Available)	Deployed to Production
1.4.x	08 February 2021 (Release Preview)	• Updated *Supported API End Points* sections to remove the restriction for *observationPeriodShift* when interest period start/end date is a non-business day. • Updated *Supported API End Points* sections (Interest Calculator end points) to add more details about *allInRateFloorApplied*, *allInRateCapApplied*, and *calculatedAllInRate* attributes. • Updated Sandbox Environment section on page 197 for SOFR and SONIA Rate range. • Updated *Notes/Restrictions* section on to add information about *interestPeriodDays* display issue.
1.3.x	30 November 2020 (Generally Available)	• Added *Simple Average* section on page **15**. • Added *Calculated Rate – Using Simple Average* section on page **72**. • Added *Interest Calculator – Using Simple Average* section on page **163**. • Updated *Supported Alternative Reference Rates Conventions* section on page **12**. • Updated *Supported API End Points* section on page **27**. • Updated *Features Not Supported* section on page **196**. • Updated *Appendix – How to Access Fusion LIBOR Transition Calculator API* section on page **202**.
All	22 October 2020	• Added *Connecting to the* API Service section on page **208**. • Added *Get New Access Token* section on page **210**. • Updated *Registering on FusionFabric.Cloud* section on page **202**. • Updated *Creating FusionCreator Application* section on page **203**.

Version	Date	Description of Revision(s)
		• Updated *Promoting FusionCreator Application to Test (UAT)* section on page **217**. • Updated *Promoting FusionCreator Application to Production* section on page **218**.
1.2.x	31 August 2020 (Generally Available)	• Added Simple ARR calculation method section on page **15**. • Added *Rates Known Window* section on page **22**. • Added *Calculated Rate – Using Simple* ARR section on page **56** • Added *Interest Calculator – Using Simple* ARR section on page **155.** • Updated Use Case examples in *Supported API End Points* section. • Updated *API Error Codes and Description* section on page **191**. • Updated *Notes/Restrictions* section on page **194.**
1.1.x	15 July 2020 (Generally Available)	• Updated Use Case examples in *Supported API End Points* section. • Updated *Official Sources of Market Data* section on page **199** • Updated *Appendix – How to Access Fusion LIBOR Transition Calculator API* section on page **202**.
1.0.x	3 June 2020 (Generally Available)	Initial version of the document.

CONTENTS

1 Purpose

This user guide is created to help users understand the impact of the risk-free rates (RFRs) on legacy lending systems and how Finastra is enabling its users with additional capabilities of easing operational challenges with its newly introduced service, **Fusion LIBOR Transition Calculator** API.

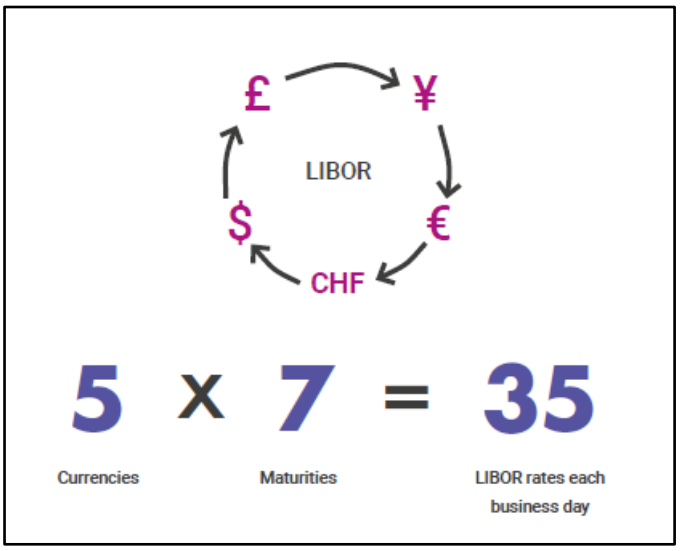
1.1 Business Context

There is no doubt the LIBOR transition is the biggest change the market has seen in lending over the last 20 to 30 years. With banks required to use a unique daily market rate for each currency, released by different authorities at different times, the need for automation is significant. This highly disruptive event in the lending market brings along complexities around interest calculations using these rates and significant operational impact.

1.1.1 Transition from LIBOR to RFRs

The London Interbank Offered Rate or LIBOR is a globally accepted benchmark average interest rate at which major global banks lend to one another in the international interbank market for short-term loans.

LIBOR is based on five currencies (US dollar, Euro, British pound, Japanese yen, and Swiss franc) and serves seven different maturities: overnight, one week, and 1, 2, 3, 6 and 12 months. As such, there are 35 different LIBOR rates each business day. The rate is calculated and published each day by the Intercontinental Exchange (ICE).



On **July 27, 2017**, the Financial Conduct Authority (FCA) announced a phase-out of LIBOR by 2021; stating that the market supporting LIBOR was no longer “sufficiently active” and called for a transition to transaction-based benchmarks. It is expected that various term rates will ultimately become available for use. The transition from LIBOR is expected to be disruptive, because of its universality in the market. The imminent transition from LIBOR to new risk-free rates (RFRs) implies pricing of loans using these new rates. Overnight rates have emerged as the Alternative Reference Rates (ARR).

Overnight rates include the US (Secured Overnight Financing Rate or **SOFR**), the UK (Sterling Overnight Index Average or **SONIA**), Europe (Euro Short Term Rate or **ESTR**), Switzerland (Swiss Average Rate Overnight or **SARON**), and Japan (Tokyo Overnight Average Rate or **TONAR**). Other prominent IBOR (Interbank Offered Rates) replacement rates include Singapore (Singapore Overnight Rate Average or **SORA**), Hong Kong (Hong Kong Dollar Overnight Index Average or **HONIA**), Australia (AUD Overnight Index Average or **AONIA**) Canada (Canadian Overnight Repo Rate Average or **CORRA**), Indonesia

(Indonesia Overnight Index Average or **IndONIA**), and South Africa (South African Rand Overnight Index Average or **ZARONIA**). Each has unique characteristics in currency, posting timing, security and underlying sources of data. This will ultimately lead to complexity for banks that have various loan instruments on their books.

1.1.2 Business Challenges

Legacy lending systems lack the ability to process ARR/RFR priced loans as these systems were not designed to perform such calculations. Users may not have the flexible infrastructure or consolidated solution in place for ARR rate and interest calculation as yet and implementing complex system changes can be costly.

Finastra understands the need to provide a flexible solution that can expand over time as these ARR/RFR methodologies evolve and has created a calculation service for applications and legacy lending systems that are unable to calculate their own ARR/RFR based rates and interest accruals.

With Finastra's **Fusion LIBOR Transition Calculator** API (known as C*orporate Lending Alternative Reference Rates* on FusionFabric.cloud), applications can calculate key backward-looking, compounded ARR rates, for a given period or for a predefined set of tenors, based on the published ARR rates or the ARR Compounded Index, as well as the corresponding interest amounts.

The Fusion LIBOR Transition Calculator API would independently source the ARR/RFRs from external official sources such as the Federal Reserve Bank of New York for SOFR and other data sources, then calculate rates – average compounded in arrears rate, daily noncumulative compounded rates, or simple ARR rates, along with corresponding interest accrued amounts for a set of inputs.

1.2 Fusion LIBOR Transition Calculator API – How it Works

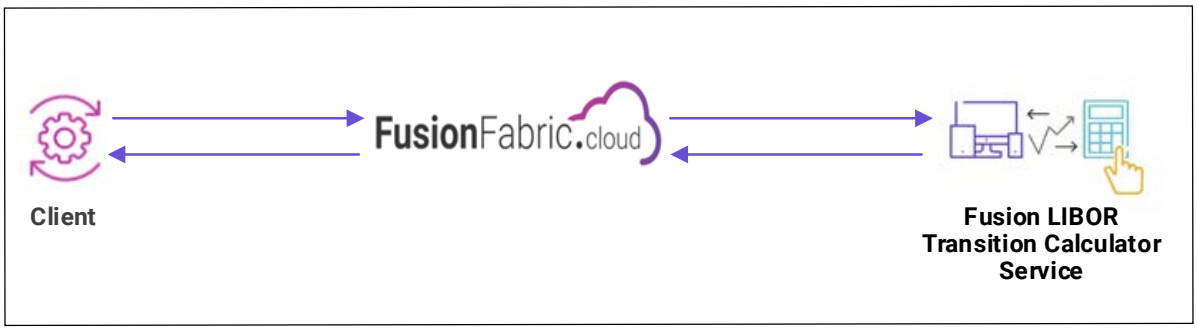
A client can call the ARR/RFR Calculator Service by passing certain loan parameters (such as Interest cycle start and end dates, spread, and so on) and ARR/RFR parameters (such as Rate Type, Lookback/Lockout Days, Spread Adjustments, and so on) and be returned the Average Compounded ARR Rates (Average Compounded in Arrears Rate or Daily Non-Cumulative Compounded Rates), or simple ARR rates, and/or interest accrued for the specified period. These calculated rate values and/or accrued interest amounts can directly be plugged into the legacy lending system to perform conventional interest accrual calculations.

As an added benefit, Fusion LIBOR Transition Calculator API provides ability to retrieve the official Compounded ARR Period Averages for standard tenors wherever published, and otherwise, calculates them for a set of non-standard tenors, for certain key risk-free reference rates. It also provides an alternate option to calculate the Average Compounded ARR Rate using daily published ARR Index, wherever available.

The key highlights of the Fusion LIBOR Transition Calculator Service are that it is based on a **trusted methodology** that follows Finastra's **Fusion Loan IQ** ARR Calculations; it provides **seamless integration** with legacy lending systems that are not prepared for the transition, thereby **reducing operational costs** and **operational risks** to users; and it is going to be **constantly invested into/expanded** in line with the **evolving** market trends, thereby future proofing the client's business.

1.2.1 Workflow Overview

The following diagram provides a high-level understanding of Fusion LIBOR Transition Calculator API:



For more information, see Appendix – How to Access Fusion LIBOR Transition Calculator API section on page **202**.

2 Supported Alternative Reference Rates Conventions

Fusion LIBOR Transition Calculator API (known as C*orporate Lending Alternative Reference Rates* on FusionFabric.cloud) supports the following Alternative Reference Rates (ARR) conventions. These conventions are also supported in **Fusion Loan IQ** in the exact same way.

- Calculation Methods
    - Average Compounded In Arrears (Cumulative Compounded Rate or CCR)
    - Daily Compounding in Arrears (Non-Cumulative Compounded Rate or NCCR)
    - Simple ARR – **Available in version 1.2.x and later**.
    - Simple Average – **Available in version 1.3.x and later.**
- Rate Basis
- Lookback Days
- Lockout Days
- Spread Adjustment
- Observation Period Shift
- Rates Known Window
- Legacy Risk Free Rate Floor – **Available in version 1.5.x and later.**
- Compounded ARR Period Averages
- ARR Index

2.1 Calculation Methods

The supported calculation methods in Fusion LIBOR Transition Calculator solution are Average Compounded In Arrears and Daily Compounding in Arrears (Non Cumulative Compounded Rate).

2.1.1 Average Compounded In Arrears (Cumulative Compounded Rate or CCR)

In this method, the solution uses the reference rates published, calculates the Compounded in Arrears Rate for the Interest Period based on the loan parameters provided, then applies the Compounded Rate from the Cycle Start Date (for each business day in the interest period).

The following is the formula for calculation of Interest Rate:

R *Compounded Average Rate* =

$$\left[\prod_{i=1}^{d_b} \left(1 + \frac{n_i \times r_i}{N}\right) - 1 \right] \times \frac{N}{d_c}$$

Where,

d_b	the number of business days for the Alternative Reference Rate (ARR). The alternative reference rate is published for each business day (value date).
d_c	the number of calendar days in the interest period
r_i	the interest rate applicable on ARR business day *i*
n_i	the number of calendar days for which the rate r_i applies. On most days, n_i will be 1, but on a Friday, it will generally be 3, and it will also be larger than 1 on the business day before a holiday. This can also be stated as the number of calendar days from and including business days *I* to but excluding the following business day.

N	the market convention for quoting the number of days in the year (in the United States, the convention for money markets is N = 360, while in the UK it is N=365).

R_m *Compounded to date Average Rate for day m =*

$$\left[\prod_{i=1}^{d_{bm}} (1 + \frac{n_i \times r_i}{N}) \quad - 1 \right] \times \frac{N}{d_{cm}}$$

Sample Calculation:

Compounded in Arrears						
Interest Period 19-Aug to 26 Aug				Rate Basis	360 N	
Days	Date	Rate (%)	Principal	Interest Factor	Compounded to Date Rate	Cumulative Accrual
n_i		r_i			R_m	
3	23-Aug-19	2.10	10000000	1.000175000	2.10460%	4092.28
1	22-Aug-19	2.09	10000000	1.000058056	2.10769%	2341.87
1	21-Aug-19	2.10	10000000	1.000058333	2.11346%	1761.21
1	20-Aug-19	2.13	10000000	1.000059167	2.12006%	1177.81
1	19-Aug-19	2.11	10000000	1.000058611	2.11000%	586.11
Compounded Average Rate (%)		2.10460 R				
Interest for the Period		4092.28				

2.1.2 Daily Compounding in Arrears (Non-Cumulative Compounded Rate or NCCR)

2.1.2.1 With CCR Rounding Approach

Beginning version 1.5.x, the Cumulative Compounded Rate (CCR) Rounding approach is introduced as recommended by Sterling RFR Working Group to calculate Non-Cumulative Compounded Rate. This approach ensures that that for a given interest period, the interest amounts for Non-Cumulative Compounded Rate (NCCR) with CCR Rounding (without Observation Period Shift) and Compounded in Arrears with the same rounding precision when principal is constant must match. (For details on CCR Rounding Approach with Observation Period Shift, please refer to 2.6.1.3)

Note: The cumulative interest amount for the interest period matches between CCR and NCCR methods for the same interest period with constant principal.

In this method, the solution uses the rounded annualized cumulative compounded rate basis which the unannualized cumulative compounded rate is arrived. The unannualized cumulative compounded rate is used to arrive at the unrounded non-cumulative compounded rate

The following is the formula for calculation of Interest Rate:

Step 1: Annualised Cumulative Compounded Rate (ACR_i)

$$\left[\prod_{i=1}^{d_b} (1 + \frac{n_i \times r_i}{N}) \quad - 1 \right] \times \frac{N}{d_c}$$

Note: $ACRi$ must be rounded daily to CCR rounding precision.

Step 2: Unannualised Cumulative Compounded RFR (UCR_i)

$$ACR_i \text{ x } \frac{tn_i}{N}$$

Note: $UCRi$ must not be rounded.

Step 3: Non-Cumulative Compounded RFR (NCR_i)

$$= \left(UCR_i - UCR_{i\,-\,1BD}\right) \mathrm{x} \frac{N}{n_i}$$

Note: $NCRi$ must not be rounded

Where,

d_b	the number of business days for the Alternative Reference Rate (ARR). The alternative reference rate is published for each business day (value date).
d_c	the number of calendar days in the interest period
r_i	the interest rate applicable on ARR business day *i*
n_i	the number of calendar days for which the rate r_i applies. On most days, n_i will be 1, but on a Friday, it will generally be 3, and it will also be larger than 1 on the business day before a holiday. This can also be stated as the number of calendar days from and including business days *I* to but excluding the following business day.
tni	total number of *ni* as of the relevant Business Day within the Interest Period.
N	the market convention for quoting the number of days in the year
BD	Business Day for the specific RFR

Sample NCCR Calculations using CCR Rounding Approach

Interest period: 19-Aug-19 to 26-Aug-19

Date	Principal Amount	Days	Rate Applied	Annualised Cumulative Compounded RFR (Step 1)	Unannualised Cumulative Compounded RFR (Step 2)	Non Cumulative Compounded RFR (Step 3)	Interest Amount	Cumulative Interest Amount
26 Aug 2019	1000000000	1	2.1	2.104100000000%	0.00046757778	2.100600000000%	58,350.00	467,577.78
23 Aug 2019	1000000000	3	2.1	2.104600000000%	0.00040922778	2.100466666667%	175,038.89	409,227.78
22 Aug 2019	1000000000	1	2.09	2.107700000000%	0.00023418889	2.090300000000%	58,063.89	234,188.89
21 Aug 2019	1000000000	1	2.1	2.113500000000%	0.00017612500	2.100300000000%	58,341.67	176,125.00
20 Aug 2019	1000000000	1	2.13	2.120100000000%	0.00011778333	2.130200000000%	59,172.22	117,783.33
19 Aug 2019	1000000000	1	2.11	2.110000000000%	0.00005861111	2.110000000000%	58,611.11	58,611.11

Note: Calculation of Cumulative Interest amount using CCR method for the same interest period is **467,577.78**. This value matches with the Cumulative Interest amount calculated using NCCR as shown in the table above.

2.1.2.2 Without CCR Rounding Approach

In this method, the solution uses the reference rates published, calculates Compounded Rate Daily based on the loan parameters provided, then applies Daily Compounded Rate for that Day.

The following is the formula for calculation of Interest Rate:

R_m *Compounded Rate for the day m in the interest Cycle* =

$$[P_m - P_{m-1}] \times \frac{N}{n_i}$$

P_m *Compounded interest factor for day m in the interest cycle (P0= 0)* =

$$\left[\prod_{i=1}^{d_m} \left(1 + \frac{n_i \times r_i}{N}\right) \right] - 1$$

Where,

d_m	the number of business days for the Alternative Reference Rate (ARR) till day m (inclusive). The alternative reference rate is published for each ARR business day (value date).
r_i	the interest rate applicable on ARR business day *i*
n_i	the number of calendar days for which the rate ri applies. On most days, ni will be 1, but on a Friday, it will generally be 3, and it will also be larger than 1 on the business day before a holiday. This can also be stated as the number of calendar days from and including business days I to but excluding the following business day.
N	the market convention for quoting the number of days in the year (in the United States, the convention for money markets is N = 360, while in the UK it is N=365).
i	represents a series of ordinal numbers representing each business day in the interest period.

Sample Calculation:

Daily Compounded Rate						
Interest Period 19-Aug to 26 Aug				Rate Basis	360 N	
Days	Date	Rate (%)	Principal	Comp. Interest Factor	Compounded Daily Rate	Cumulative Accrual
n_i		r_i		P_m	R_m	
3	23-Aug-19	2.10	10000000	0.000409228	2.10049%	4092.28
1	22-Aug-19	2.09	10000000	0.000234187	2.09037%	2341.87
1	21-Aug-19	2.10	10000000	0.000176121	2.10025%	1761.21
1	20-Aug-19	2.13	10000000	0.000117781	2.13012%	1177.81
1	19-Aug-19	2.11	10000000	0.000058611	2.11000%	586.11
Interest for the Period		4092.28				

2.1.3 Simple ARR

Available in version 1.2.x and later, Fusion LIBOR Transition Calculator API is enhanced to support *Simple ARR* calculation method. In this calculation method, the Calculator directly references the daily published reference rate, based on lookback and lockout days, and directly uses it as the applied rate for interest accrual calculations. To clarify, this calculation method does **not** perform any compounding average calculations on the published reference rates.

2.1.4 Simple Average

Available in version 1.3.x and later, in this method, the solution uses the Simple average rates for the Interest Period based on the loan parameters provided, then applies the Simple Average Rate from the Cycle Start Date (for each business day in the interest period).

The following is the formula for calculation of Interest Rate:

$$Simple\ Interest\ Formula = \left[\sum_{i=1}^{d_b} \left(\frac{r_i \times n_i}{N} \right) \right] \times \frac{N}{d_c}$$

Where,

d_b	the number of business days in the interest period
d_c	the number of calendar days in the interest period

r_i	the interest rate applicable on ARR business day *i*
n_i	the number of calendar days for which the rate r_i applies. On most days, n_i will be 1, but on a Friday, it will generally be 3, and it will also be larger than 1 on the business day before a holiday. This will be as per the ARR business calendar.
N	the market convention for quoting the number of days in the year (in the United States, the convention for money markets is N = 360, while in the UK it is N=365).
i	represents a series of ordinal numbers representing each business day in the period.

2.2 Rate Basis

For the purpose of Compounded Base Rate calculation, Fusion LIBOR Transition Calculator API currently supports the following Rate Basis:

- Actual/360
- Actual/365, and
- Actual/Actual

2.3 Lookback Days

Lookback days refers to the fixed date (business days prior to) from which the system is expected to derive and use ARR to calculate interest. This functionality is designed to provide timely notice of payment at the end of an interest period. Flexibility of defining the Lookback days is introduced in Fusion LIBOR Transition Calculator API.

For example,

Start Date	01-Jul-2019
Repricing Frequency	1 Months
End Date	31-Jul-2019
Current Business Day	25-Jul-2019 If the user performs accruals on this day, owing to the pricing delay/lag for SOFR (T+1), the system may not contain rates to compute interest for the accrual period. To avoid such situations, the user can define Lookback days (usually 3 to 5 business days prior to the end of interest period. For example, *3*), so that on 25-Jul-2019 the interest calculated, for the cycle will be based on the ARR applicable on *22-Jul-2019*.

Note: If the start day of the interest period is a non-business day as per the ARR calendar, the start day of the Lookback will be **k** business days preceding the first business day of the Interest Period. This means that the same rate will be used for the non-business days and the first business day under the daily compounded rate calculation method. In case of Compounded In Arrears calculation method, determination of start date of the Lookback will be as if the interest period has commenced on the first working day of the interest period.

2.4 Lockout Days

Lockout days refers to the period (business days) in which the applicable ARR is derived using Lookback days and applied to all the days defined as Lockout days (usually 2 to 5 days). Flexibility of defining the Lockout days is introduced in Fusion LIBOR Transition Calculator API.

For example,

Start Date	01-Jul-2019
Repricing Frequency	1 Months
End Date	31-Jul-2019
Current Business Day	31-Jul-2019 If the user performs accruals on this day, owing to the pricing delay/lag for SOFR (T+1), the system may not contain rates to compute interest for the accrual period on the end of the cycle. To avoid such circumstances, the user can define Lockout days (usually 2 to 5 business days prior to the end of the cycle period. For example, 3), so that on 31-Jul-2019 the interest calculated for 29-Jul-2019 to 31-Jul-2019 is based on the Lookback Days (26-Jul-2019). Rates published for 29-Jul-2019, 30-Jul-2019, and 31-Jul-2019 with T+1 delay will not be taken into consideration to compute interest as these days are locked out for rate changes.

2.5 Spread Adjustment

As ARR is a risk-free-rate, similar to spread applied on LIBOR loans, an additional spread is required for risk-free rate loans and this is captured in the Spread Adjustment parameter. Therefore, the All-in rate for an ARR loan will include the Spread Adjustment as well.

Note: Spread Adjustment is not a part of compounding.

For example,

Calculated Compounded Rate	2.420000000000%
Spread	1.000000000000%
Spread Adjustment	1.000000000000%
All-in Rate	4.420000000000%

2.6 Observation Period Shift

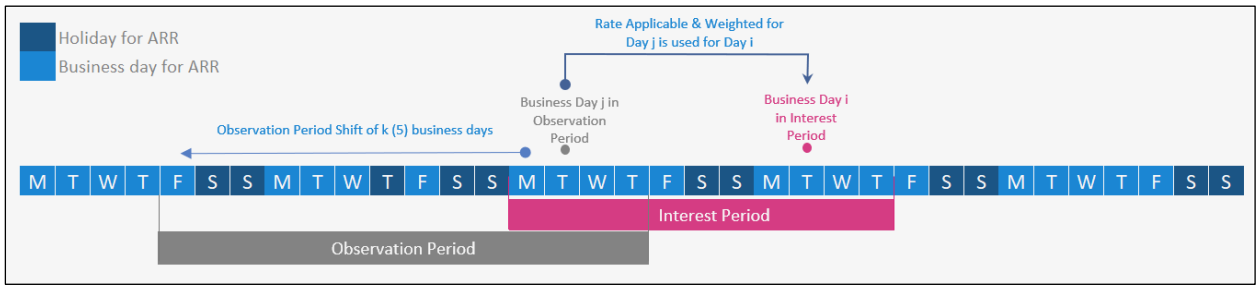
Observation Period Shift is a newly introduced functionality for ARR loans, where the calculation/computation for interest is performed within the observation period (backward-shifted period), which is an equal period commencing ‘x’ number of business days (lookback) prior to the start (first day) of the interest period. As the period over which the reference rate is observed is backward-shifted, this backward-shift includes both the rate and the weighting of that rate. The weighting is intended to account for calendar days on which the ARR rates is not published. On most days, the weighting of a rate will be equal to “1”, but on a Friday, it will generally be 3, (assuming the following Monday is a business day). It will also be larger than 1 on the business day before a holiday. The rate and weighting are determined based on the day of the observation period rather than the day of the interest period.

For example,

Start Date	1-Jan
Adjusted Due Date:	31-Jan
Lookback Days	5 If Observation Period Shift is selected, then the start date for the observation period will be 1-Jan minus 5 days = 27-Dec. So, the interest period calculation is from 27-Dec to 27-Jan.
Lockout Days	0

2.6.1 Calculations under Observation Period Shift

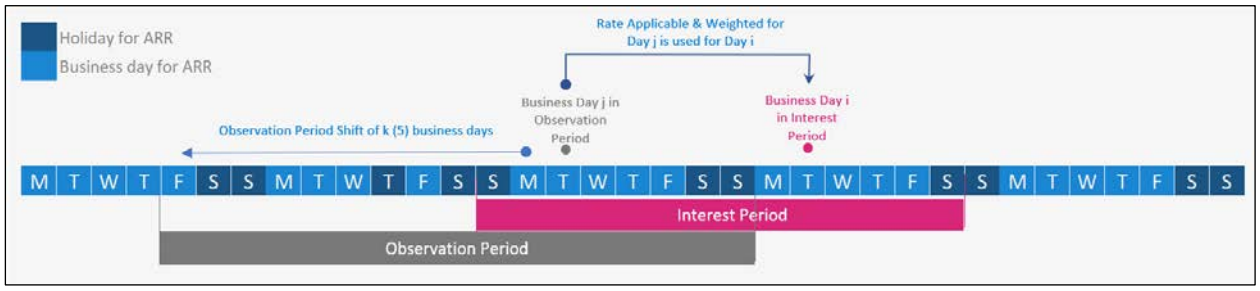
Based on feedback from clients, an approach that is based on business day mapping between the Interest Period and the Observation Period is implemented. In this approach, the interest rate computation is performed over the Observation Period which is a period commencing **k** business days preceding the first day of the interest period and ending (**k-1**) business days preceding the last day of the interest period.



Reference 1 – Base Case Example

Key Highlights

- Interest Period and Observation Period have the same number of business days for the Alternative Reference Rate (ARR).
- While the interest rate calculation is as per the Observation Period, the calculation of the interest amount is as per the interest period.



Reference 2: Interest Cycle Start & End Dates on non-business days

2.6.1.1 Compounded In Arrears Calculation for Observation Period Shift

Calculation of the Rate

Formula for Calculation of Interest Rate is as follows:

R_{ca} Compounded Average Rate =

$$\left[\prod_{j=1}^{d_{ob}} \left(1 + \frac{n_j \times r_j}{N}\right) - 1 \right] \times \frac{N}{d_{oc}}$$

Where,

d_{ob}	the number of business days in the Observation Period
d_{oc}	the number of calendar days in the Observation Period
r_j	the interest rate applicable on business day j in the Observation Period Business day j in the Observation Period is a day which is k business days preceding the business day i in the Interest Period as per the specified ARR calendar.
n_j	the number of calendar days in the Observation Period for which rate r_j applies (on most days, n_j will be 1, but on a Friday, it will generally be 3, and it will also be larger than 1 on the business day before a holiday). This can also be stated as the number of calendar days from and including business day j to but excluding the following business day.
N	the market convention for quoting the number of days in the year (in the United States, the convention for money markets is N = 360, while in the UK it is N=365).
j	represents a series of ordinal numbers representing each business day in the observation period for the Alternative Reference Rate (ARR).

For any interim day in the interest period, dob and doc will represent business days and calendar days respectively from the start date in the Observation Period to the corresponding interim date (inclusive).

Interest Accrual

Interest Calculation will be as per the interest period.

Interest Amount = $\sum_{i=1}^{d_{ib}} (P_i \times n_i \times R_{ca}) / N$

Where,

P_i	principal outstanding on business day i in the Interest Period
n_i	the number of calendar days in the Interest Period for which interest is to be processed (the number of calendar days from and including business day i to but excluding the following business day)
d_{ib}	the market convention for quoting the number of days in the year (in the United States, the convention for money markets is N = 360, while in the UK it is N=365).
i	represents a series of ordinal numbers representing each business day in the Interest Period for the Alternative Reference Rate (ARR).

2.6.1.2 Daily Compounding in Arrears (Non-Cumulative Compounded Rate) for Observation Period Shift – Without CCR Rounding

Note: The method described in the following section is applicable in version 1.5.x and later.

Available in version 1.5.x and later, per the key ARR conventions that were published by Sterling RFR Working Group, the formula to compute Non Cumulative Compounded Rate (NCCR) with Observation Period Shift is modified to ensure that for a given interest period, the interest accrued amount for a

constant principal match the corresponding interest amount computed for Cumulative Compounded Rate (CCR) with Observation Period Shift.

Calculation of the Rate

Formula for Calculation of Interest Rate is as follows:

R_i Compounded Daily Rate for the day i in the interest Cycle =

$$\left[(P_j - 1) * X_j - (P_{j-1}) - 1)) * X_{j-1}\right] \times \frac{N}{n_i}$$

X_j =

$$\left[\sum_{i=1}^{d_{ib}} n_i\right] \Big/ \left[\sum_{j=1}^{d_{ob}} n_j\right]$$

Where,

d_{ib}	the number of calendar days in the Interest Period for which interest is to be processed (the number of calendar days from and including business day i to but excluding the following business day)
d_{ob}	the number of business days in the Observation Period till the day j in the observation period that corresponds to day i in the interest period (inclusive).
n_i	the number of calendar days in the Interest Period for which interest is to be processed (the number of calendar days from and including business day i to but excluding the following business day)
n_j	the number of calendar days in the Observation Period for which rate r_j applies (on most days, n_j will be 1, but on a Friday, it will generally be 3, and it will also be larger than 1 on the business day before a holiday). This can also be stated as the number of calendar days from and including business day j to but excluding the following business day.
i	represents a series of ordinal numbers representing each business day in the Interest Period for the Alternative Reference Rate (ARR).
N	the market convention for quoting the number of days in the year (in the United States, the convention for money markets is N = 360, while in the UK it is N=365).
j	represents a series of ordinal numbers representing each business day in the Observation Period for the Alternative Reference Rate (ARR).
X_j	On the business day j in the Observation period corresponding to business day i in the interest period, Ratio of number of calendars days in the interest period till and including day i and the number of calendars days in the observation period till and including day j

Interest Accrual

Interest Calculation will be as per the interest period.

Interest Accrual Amount for day i in the Interest Period for calendar days

$$n_i = \frac{P_i \text{ x } n_i \text{ x } R_i}{N}$$

Where,

P_i	principal outstanding on business day i in the Interest Period
n_i	the number of calendar days in the Interest Period for which interest is to be processed (the number of calendar days from and including business day i to but excluding the following business day)

N	the market convention for quoting the number of days in the year (in the United States, the convention for money markets is N = 360, while in the UK it is N=365).

Note: The method described in the following section is applicable in versions prior to 1.5.x.

Calculation of the Rate

Formula for Calculation of Interest Rate is as follows:

R_i Compounded Daily Rate for the day i in the interest Cycle =

$$\left[A_j - A_{j-1}\right] \times \frac{N}{n_j}$$

A_j Compounded interest accumulation factor for **the j day in the Observation Period that corresponds to day i in the Interest Period** (A_0= 1) =

$$\left[\prod_{j=1}^{d_{ob}} (1 + \frac{n_j \times r_j}{N}) \right]$$

Where,

d_{ob}	the number of business days in the Observation Period till the day j in the observation period that corresponds to day i in the interest period (inclusive).
r_j	the interest rate applicable on business day j in the Observation Period that corresponds to day i of the Interest Period Business day j in the Observation Period is a day which is k business days preceding the business day i in the Interest Period as per the specified ARR calendar.
n_j	the number of calendar days in the Observation Period for which rate r_j applies (on most days, n_j will be 1, but on a Friday, it will generally be 3, and it will also be larger than 1 on the business day before a holiday). This can also be stated as the number of calendar days from and including business day j to but excluding the following business day.
N	the market convention for quoting the number of days in the year (in the United States, the convention for money markets is N = 360, while in the UK it is N=365).
j	represents a series of ordinal numbers representing each business day in the Observation Period for the Alternative Reference Rate (ARR).

Interest Accrual

Interest Calculation will be as per the interest period.

Interest Accrual Amount for day i in the Interest Period for calendar days

$$n_i = \frac{P_i \text{ x } n_i \text{ x } R_i}{N}$$

Where,

P_i	principal outstanding on business day i in the Interest Period
n_i	the number of calendar days in the Interest Period for which interest is to be processed (the number of calendar days from and including business day i to but excluding the following business day)
N	the market convention for quoting the number of days in the year (in the United States, the convention for money markets is N = 360, while in the UK it is N=365).

2.6.1.3 Daily Compounding in Arrears (Non-Cumulative Compounded Rate) for Observation Period Shift – With CCR Rounding

Available in version 1.5.x and later, per the key ARR conventions that were published by Sterling RFR Working Group, the formula to compute Non-Cumulative Compounded Rate (NCCR) with Observation Period Shift with CCR Rounding Approach is as follows:

Step 1: Annualised Cumulative Compounded Rate (ACR_i)

$$\left[\prod_{j=1}^{d_{ob}} \left(1 + \frac{n_j \times r_j}{N}\right) - 1 \right] \times \frac{N}{d_{oc}}$$

Note: $ACRi$ must be rounded daily to CCR rounding precision.

This Step is same as CCR rate calculation using Observation Period Shift, as elaborated under Section 2.6.1.1

Step 2: Unannualised Cumulative Compounded RFR (UCR_i)

$$ACR_i \times \frac{tcn_i}{N}$$

Note: $UCRi$ must not be rounded.

This Step is same as Step 2 for calculating NCCR using CCR Rounding Approach, as elaborated under Section 2.6.2.1

Step 3: Non-Cumulative Compounded RFR (NCR_i)

$$\left[\quad UCR_i - UCR_{i-1BD} \right] \times \frac{N}{cn_i}$$

Note: $NCRi$ must not be rounded

This Step is same as Step 2 for calculating NCCR using CCR Rounding Approach, as elaborated under Section 2.6.2.1

Where,

n_i	the number of calendar days in the Interest Period for which interest is to be processed (the number of calendar days from and including business day i to but excluding the following business day)
cn_i	the number of calendar days for which r_i applies in the relevant Interest Period.
tcn_i	total number of cn_ias of the relevant Banking Day within the Interest Period.
d_{oc}	the number of calendar days in the Observation Period
n_j	the number of calendar days in the Observation Period for which rate r_j applies (on most days, n_j will be 1, but on a Friday, it will generally be 3, and it will also be larger than 1 on the business day before a

	holiday). This can also be stated as the number of calendar days from and including business day j to but excluding the following business day.
r_i	the interest rate applicable on ARR business day *i*
N	the market convention for quoting the number of days in the year
BD	Business Day for the specific RFR
i	represents a series of ordinal numbers representing each business day in the Interest Period for the Alternative Reference Rate (ARR).

2.7 Rates Known Window

Rates Known Date is the earliest date in the interest period by when the ARR rates for the complete interest period can be calculated/determined. Rates Known Window is the period starting from the Rates Known Date in the interest period.

Rates Known Date = Interest Period End Date + 1^ - (Lookback + Lockout) (business days)

^ - Indicates the delay in the number of business days the rate is published.

Example:

Start Date	01-Jul-2020 (Wednesday)
Calculation Period	1 Month
End Date	31-Jul-2020 (Friday)
Risk Free Rate	SOFR
Lookback Days	5
Lockout Days	0
Observation Period Shift	False

In this example, Rates Known Date using the formula above comes to 27-Jul-2020. So, the ARR rates for the complete interest period can be determined from this date onwards.

2.8 Legacy Risk Free Rate Floor

Available in version 1.5.x and later, the support for Legacy Risk Free Rate Floor is introduced for legacy LIBOR loans that are transitioning to ARR.

As per conventions, when ARR is used in with Spread Adjustment, only ARR is subject to compounding. To address this limitation, an optional attribute called *Legacy Risk Free Rate Floor* is introduced to enable the Fusion LIBOR Transition Calculator API to incorporate the existing LIBOR floor value from legacy credit agreements. The Fusion LIBOR Transition Calculator API then derives the floor such that:

```
Risk Free Rate Floor + Spread Adjustment = Legacy Risk Free Rate Floor
```

For instance, if the legacy credit agreement had a LIBOR floor value of 0% and the Spread Adjustment is 0.25%, the Fusion LIBOR Transition Calculator API calculates the effective floor value as -0.25%. This derived floor value is used as the floor for the ARR rate value, indirectly ensuring that the equation mentioned above is true at all times.

Therefore, instead of manually calculating the RFR floor and entering it as a separate value, users only need to provide the LIBOR floor value from the legacy credit agreement and the Spread Adjustment as inputs in the Fusion LIBOR Transition Calculator API.

Following table provides an overview of the functionality.

Risk Free Rate Floor	Legacy Risk Free Rate Floor	Result	Comment
Not Provided	Not Provided	Risk Free Rate is not floored.	Existing functionality
Provided	Not Provided	Raw Risk Free Rate is floored using Risk Free Rate Floor and the floored Risk Free Rate Floor is used for compounding.	Existing functionality
Not Provided	Provided	Derived Risk Free Rate is computed using the formula; Legacy Risk Free Rate Floor – Spread Adjustment. The derived Risk Free Rate Floor is used for flooring, and the floored Risk Free Rate Floor is used for computation.	New functionality introduced in version 1.5.x
Provided	Provided	Risk Free Rate is floored using Risk Free Rate Floor and the floored Risk Free Rate is used for compounding.	New functionality introduced in version 1.5.x

2.9 Supported Holiday Calendars

Fusion LIBOR Transition Calculator API follows the respective RFR publishing holiday calendar, which is listed in the following table:

RFR Name	Holiday Calendar Publisher	Reference URL
SOFR	Securities Industry and Financial Markets Association (SIFMA)	https://www.sifma.org/resources/general/holiday-schedule/ **Note:** Refer only to the **U.S. Holiday Recommendations** section in the hyperlink listed above.
SONIA	Bank of England	https://www.gov.uk/bank-holidays **Note:** Refer to the **UK bank holidays** section in the hyperlink listed above.
TONAR	Bank of Japan	https://www.boj.or.jp/en/about/outline/holi.htm/
SORA	Ministry of Manpower, Singapore Government	https://www.mom.gov.sg/employment-practices/public-holidays
€STR	European Central Bank	https://www.ecb.europa.eu/paym/target/target2/html/index.en.html **Note:** Refer to the days that are listed in **How does TARGET2 work?** section in the hyperlink listed above.
IndONIA	Bank Indonesia	https://setkab.go.id/en/ **Note:** To find the relevant list of holidays: 1. Go to the Search field on the website and enter keywords such as **holidays 2025** or **holidays 2024**. 2. On the results page, scroll down to the appropriate result. 3. Click the result/article to view the list.
ZARONIA	South African Reserve Bank (SARB)	https://www.gov.za/about-sa/public-holidays

Note: The Fusion LIBOR Transition Calculator API uses the SIFMA US holiday list as the basis for determining the SOFR publishing holiday calendar. However, in unique cases where SOFR is not published on a specific day, despite SIFMA not classifying it as a non-business day, Finastra relies on guidance from the benchmark publishers, industry participants such as LSTA/LMA, and clients.

For instance, on April 7, 2023 (Friday), the New York Fed did not publish the SOFR rate, even though it was considered a business day according to SIFMA. Taking into account feedback from our client base, the ARR Working Group, and guidance from LSTA/LMA, Finastra included April 7, 2023, as a business day in the Fusion LIBOR Transition Calculator API. The SOFR rate used for April 7, 2023, was set to be the same as the rate published for the preceding business day, Thursday, April 6, 2023, which was made available on Monday, April 10, 2023.

It is important to note that adopting this approach may impact the compounding calculations. In scenarios where an interest period includes April 7, 2023, the cumulative compounded rate calculations performed using the Fusion LIBOR Transition Calculator API (using the "Average Compounded in Arrears" calculation method) may not align with published SOFR Averages or cumulative compounded rates calculated from the published SOFR Index.

2.10 Compounded ARR Period Averages

Note: This feature is included in the Fusion LIBOR Transition Calculator API only and is not supported **as-is** in Fusion Loan IQ's ARR module.

Fusion LIBOR Transition Calculator API supports the Compounded Period Averages for all the tenors for which LIBOR is published (7 days, 30 days, 60 days, 90 days, 180 days and 360 days). It retrieves **as-is** the published Compounded Period Averages where it is available (for example, for SOFR, 30/90/180 calendar day Compounded SOFR Averages are retrieved as-is). In other cases, the Calculator calculates the Compounded Period Averages using the daily published risk-free reference rates.

The Compounded Period Average can be leveraged for use-cases where Compounding in Advance is used, whereby the interest rate for the coming period (for example, April 1 to June 30) is based on the interest in the previous period (from Jan 1 to Mar 31).

For mathematical formula and calculation, refer to the Average Compounded In Arrears section on page **12**.

2.11 ARR Index

Note: This feature is included in the Fusion LIBOR Transition Calculator API only and is not supported in Fusion Loan IQ's ARR module.

Fusion LIBOR Transition Calculator API provides the additional ability to calculate the Average Compounded in Arrears Rate for a custom interest period by leveraging the daily published ARR Index, rather than the published risk-free reference rates. The rate calculation using the ARR Index is based the following formula:

Average Compounded In Arrears for the interest period starting (and including) “x” and ending (and including) “y-1” =

$$\left[\frac{ARR\ Index_y}{ARR\ Index_x} - 1 \right] \times \frac{360}{d_c}$$

Where,

x	the Value/Publication Date of the ARR Index corresponding to the start of the interest period
y	the Value/Publication Date of the ARR Index corresponding to one calendar day following the interest period end date
d_c	the number of calendar dates in the calculation period spanning the period between *x* and *y-1*.

Note: Currently, only SOFR Compounded in Arrears rate calculation based on SOFR Index is supported.

3 Supported API End Points

Fusion LIBOR Transition Calculator API (known as C*orporate Lending Alternative Reference Rates* on FusionFabric.cloud) supports the following end points which are exposed through API:

- Calculated (ARR) Rates using Daily Compounding
- Calculated (ARR) Rate using Compounded in Arrears
- Calculated (ARR) Rates using Simple ARR
- Calculated (ARR) Rates using Simple Average
- ARR based Interest Calculation using Daily Compounding
- ARR based Interest Calculation using Compounded in Arrears
- ARR based Interest Calculation using Simple ARR
- ARR based Interest Calculation using Simple Average
- Calculated Rates for Non-standard Tenors
- Calculated Rates Based on ARR Index

Note: Available from version 1.7.x or later, *lookBackDate* is introduced in the API output for all the end points mentioned above except for *Calculated Rates for Tenors* and *Calculated Rate Based on ARR Index*. For more details, refer Output Attributes description in the following sections for each of the applicable end points.

3.1 Calculated Rate – Using Daily Compounded in Arrears (NCCR)

Fusion LIBOR Transition Calculator API calculates the ARR rates based on Daily Compounding in Arrears (Non-Cumulative Compounded Rate) for the provided start/end dates (such as interest period dates) and other ARR parameters, by leveraging the daily published risk-free reference rate. Alternative Reference Rates supported are SOFR (USD), SONIA (GBP), ESTR (EUR), TONAR (JPY), SORA (SGD), IndONIA (IDR), and ZARONIA (ZAR).

Important: Beginning with ARR Calculator version 1.8.x, support for **IndONIA** (Indonesian Overnight Index Average) and **ZARONIA** (South African Rand Overnight Index Average) risk-free rates have been added. These newly introduced enhancements are separately licensed and are not available by default with the ARR Calculator API. If you are not licensed for this enhancement and would like more information, contact your Account Manager.

3.1.1 API Input and Output Attributes

The following section lists the user input attributes (request) and the expected output attributes (response).

Input Attribute Name	Description and Validation	Characteristics	Additional Remarks
interestPeriodStartDate	The start date of the interest period from (and including) which the ARR Compounding Calculation should be performed. The date is in ISO 8601 Date Format, that is, yyyy-mm-dd	required: Y type: string	--
interestPeriodEndDate	The end date of the interest period to (and including) which the ARR compounding calculation should be performed. The date is in ISO 8601 Date Format yyyy-mm-dd.	required: Y type: string	• It is also used by the Calculator to identify if the interest period is in the rates known window or not. • If calculateTillDate is not provided, the interest period end date can be an intermediate date in the interest period up to (and including) which the compounded rates are calculated.
riskFreeRate	The name of the Risk Free Rate/Alternative Reference Rate Available values: SOFR, SONIA, SORA, ESTR, TONAR, IndONIA, and ZARONIA	required: Y type: string	IndONIA and ZARONIA are separately licensed enhancements. If the client (bank) is not licensed for these enhancements but includes it as an input in the API request, the API will return an error.

Input Attribute Name	Description and Validation	Characteristics	Additional Remarks
We riskFreeRateFloor	**Available in version 1.2.x and later.** The Floor value (as a percentage) for the published risk-free reference rate. Accepts up to 6 decimal points. Minimum Value = -100, Maximum Value = 100	required: N type: integer	--
legacyRiskFreeRateFloor	**Available in version 1.5.x and later.** Risk Free Rate Floor (percentage) for legacy LIBOR contracts. This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations. Up to 6 decimals points are supported. Minimum Value = -100, Maximum Value = 100 For more information, see Legacy Risk Free Rate Floor section on page **23**.	required: N type: Number	--
spreadAdjustment	**Available in version 1.5.x and later.** Spread Adjustment (percentage) during the interest period. Up to 6 decimals points are supported. Minimum Value = -100, Maximum Value = 100 Default value is 0.	required: N type: integer	Only applicable if legacyRiskFreeRateFloor is provided.
lookBackDays	Lookback days refers to the fixed date (business days prior to) from which the calculator is expected to use the published Risk Free Rate/Alternative Reference Rate Minimum Value = 0 (Default), Maximum Value = 99 For more information, see Lookback Days section on page **16**.	required: N type: integer	--
lockoutDays	Lockout days refers to the period (business days) in which the applicable ARR is derived using Lookback days and applied to all the days defined as Lockout days Minimum Value = 0 (Default), Maximum Value = 99, and Default Value = 0 For more information, see Lockout Days section on **16**.	required: N type: integer	--
observationPeriodShift	Indicates whether Observation Period Shift is applicable or not. Not supported if lockout days is non-zero. Values supported are True or False. Default value is False. For more information, see Observation Period Shift section on page **17**.	required: N type: boolean	--

Input Attribute Name	Description and Validation	Characteristics	Additional Remarks
dayCountConvention	The Day Count Conventions supported. Valid Value are - ACT/360, ACT/365, and ACT/ACT. Default value: for SOFR = ACT/360, SONIA = ACT/365, ESTR = ACT/360, TONAR = ACT/365, SORA = ACT/365, IndONIA = ACT/360, ZARONIA = ACT/365	required: N type: string	
ccrRoundingApplies	**Available in version 1.5.x and later.** Indicates whether rounded Cumulative Compounded Rate is used to calculate the dailyCompoundedRate (Value = true) or not (Value = false). This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations. Default value is false.	required: N type: boolean	--
ccrRoundingPrecision	**Available in version 1.5.x and later.** If ccrRoundingApplies is true, rounds the Cumulative Compounded Rate to the specified decimal precision. If ccrRoundingApplies is false, this attribute is ignored. This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations. Minimum Value = 1, Maximum Value = 10 Default value is 4. For more information, see CCR Rounding Approach on page 13.	required: N type: integer	Rounding is done on the percentage value.
rateRoundingDecimalPoints	Rounds the calculated ARR Compounded Rate to the specified decimal precision. Minimum Value = 2, Maximum Value = 12 Default value: SOFR = 5, SONIA = 4, ESTR = 4, TONAR = 5, SORA = 4, IndONIA = 5, and ZARONIA = 3	required: N type: integer	Rate rounding is done on the percentage value of the calculated ARR Compounded Rate. rateRoundingDecimalPoints is not considered when ccrRoundingApplies is set to true.
showDailyDetails	Indicates whether the Calculated Compounded Rates in the output appear for all business days (Value = True) OR only for the calculateTillDate or last business day for the interest period (Value = False), based on whether calculateTillDate is outside the rates-known window or not, respectively Default value: false.	required: N type: boolean	--

Input Attribute Name	Description and Validation	Characteristics	Additional Remarks
calculateTillDate	**Available in version 1.2.x and later.** The Date up to (and including) which the calculated compounded rates are expected in the output. The date is in ISO 8601 Date Format yyyy-mm-dd.	required: N type: string	--

Output Attribute Name	Description	Additional Remarks
calculatedDailyCompoundingRate	• If showDailyDetails = true, dailyRateSummary displays the averageCompoundedRate upto (and including) calculateTillDate, if it is outside the Rate Known Window, or up to (and including) the interestPeriodEndDate otherwise. • If showDailyDetails = false, dailyRateSummary displays the averageCompoundedRate only for calculateTillDate, if it is outside the Rate Known Window, or only for the last business day for the interest period otherwise.	if calculateTillDate is not provided and rates are known for the interest period, then the output appears for all business days in the interest period else error message will be displayed. The following attributes are supported for multi-record: • interestPeriodDate • interestPeriodDays • observationPeriodDate • observationPeriodDays • publishedRiskFreeRate • rateApplied • riskFreeRateFloorApplied • compoundingFactor • dailyCompoundedRate
interestPeriodDate	The date in the interest period for which calculated ARR Compounded Rate is displayed in the output. The date is in ISO 8601 Date Format yyyy-mm-dd.	• If interestPeriodStartDate is a non-business day, then interestPeriodDate for the first CalculatedCompoundedInArrearsRates record is same as the interestPeriodStartDate • If calculateTillDate is a non- business day, then the previous business date is shown as interestPeriodDate for that CalculatedCompoundedInArrearsRates record."

Output Attribute Name	Description	Additional Remarks
interestPeriodDays	Number of days in the interest period (from and including the interestPeriodStartDate) for which the calculated Compounded Rate is applicable.	When Observation Period shift does not apply, this is same as the rate weightage (ni) in the calculation formula for NCCR.
observationPeriodDate	The date in the observation period for which the published ARR rate (rateApplied) and the corresponding weightage of that rate is used for ARR Compounding calculation. Populated only if the observationPeriodShift is True Observation Period is defined as commencing 'x' number of "business" days (lookback days) prior to the start (first day) of the interest period. The date is in ISO 8601 Date Format yyyy-mm-dd.	--
observationPeriodDays	Number of days in the observation period (from and including the start of Observation Period). Populated only if the *observationPeriodShift* is true.	When Observation Period shift applies, this is same as the rate weightage (ni) in the calculation formula for NCCR.
lookBackDate	**Available in version 1.7.x and later.** Lookback Date displays the corresponding date for which the publishedRiskFreeRate is displayed. This date is derived based on the lookBackDays and the interestPeriodDate. Not displayed when: 1. lookBackDays is not provided OR 2. observationPeriodShift=TRUE	**--**
publishedRiskFreeRate	**Available in version 1.2.x and later.** The published ARR rate applied (percentage) for the interestPeriodDate (if observationPeriodShift = false) or observationPeriodDate (if observationPeriodShift = true).	**--**
rateApplied	The ARR Rate applied (percentage) This field's value is the higher of publishedRiskFreeRate and the riskFreeRateFloor/derivedRiskFreeRateFloor (as applicable).	--
riskFreeRateFloorApplied	**Available in version 1.2.x and later.** Indicates whether the riskFreeRateFloor value has been factored in for the interestPeriodDate (Value = TRUE) or not (Value = FALSE). The riskFreeRateFloor value is applied on the publishedRiskFreeRate.	**--**

Output Attribute Name	Description	Additional Remarks
compoundingFactor	Ratio of dailyCompoundedRate and the rateApplied.	If rateApplied = 0 for the first interest period date, then the compounding factor is set as 1 else the previous days compounding factor is applied. The compoundingFactor is not rounded as per rateRoundingDecimalPoints and is displayed up to 12 decimal points.
derivedRiskFreeRateFloor	**Available in version 1.5.x and later.** The Derived Risk Free Rate Floor Value (percentage) calculated as a difference between legacyRiskFreeRateFloor and spreadAdjustment. Will be displayed only if legacyRiskFreeRateFloor is provided and riskFreeRateFloor is not provided. This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations. The derivedRiskFreeRateFloor value is applied on the publishedRiskFreeRate.	--
derivedRiskFreeRateFloorApplied	**Available in version 1.5.x and later.** Indicates whether the derivedRiskFreeRateFloor value has been factored in for the interestPeriodDate (Value = TRUE) or not (Value = FALSE). This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations. The derivedRiskFreeRateFloor value is applied on the publishedRiskFreeRate.	--
dailyCompoundedRate	The calculated Daily Compounded Rate (Non Cumulative Compounded Rate) as a percentage, applicable for the interestPeriodDays, rounded to rateRoundingDecimalPoints, if ccrRoundingApplies =false. (dot) is the only character supported for decimal place separator. This field's value provides the calculated Daily Compounded Rate (Non Cumulative Compounded Rate).	If ccrRoundingApplies is set to true, then the unrounded dailyCompoundedRate is displayed up to 12 decimals. If ccrRoundingApplies is set to false, then the dailyCompoundedRate rounded as per rateRoundingDecimals is displayed.
comment	It displays the time stamp when the calculation was completed. Format "Computed time : yyyy-MM-dd 'T' HH:mm:ss z Z." Additionally, it shows the date of the most recent published RFR rate available in the Calculator. It may display additional narration for the calculations performed, as required.	--

Output Attribute Name	Description	Additional Remarks
lastUpdatedFromSource	The most recent timestamp when the published ARR rate data was consumed by the Calculator from Refinitiv. Format in ISO 8601 is “yyyy-MM-dd'T'HH:mm:ssXXX”.	--
legalDisclaimer	The End User Terms for using the Risk Free Rates as laid out by the respective benchmark provider.	--

3.1.2 Use Case Examples

The following are examples of values entered for the input attributes and the resulting output/response from the end point.

3.1.2.1 Example 1: Daily Compounded Rate in Arrears (NCCR) with Lookback

Daily Compounded Rate in Arrears (NCCR) with Lookback and interest period in rates known window.

Input Attribute Name	Value Entered
interestPeriodStartDate	2020-03-03
interestPeriodEndDate	2020-03-09
riskFreeRate	SOFR
lookBackDays	3
observationPeriodShift	false
rateRoundingDecimalPoints	5
showDailyDetails	true
calculateTillDate	2020-03-07

3.1.2.1.1 Example 1: Output

Note: The output is updated for version 1.7.x.


```
{
```

```
    "comment": " The most recent published SOFR RFR rate is available as-of: 2023-06-21. Computed time : 2023-06-
23T06:42:34+00:00. Computed time is the time stamp when the calculation was completed.  Note : SOFR rate was not published on o
r for April 7th, 2023 (Friday) by New York Fed, even though April 7th was a business day as per SIFMA (Securities Industry and
Financial Markets Association). Given that there was no SOFR rate available for April 7th, 2023 Finastra had added April 7th as
 a SOFR publishing holiday in the ARR Calculator. However, based on subsequent feedback from our client base, ARR Working Group
, and conversations with LSTA/LMA, Finastra has decided to keep April 7th 2023 as a business day, with the SOFR rate used for 7
th April, 2023 to be the same value of the rate for preceding business day, Thursday, April 6th, 2023 (which was published on M
onday, April 10th, 2023). This change will ensure lookback dates are aligned with the market expectation.Note that choosing thi
s approach has a impact on the compounding calculations - For a given interest period that includes 7th Apr, Cumulative Compoun
ded Rate Calculations done on the ARR Calculator (Calculation Method: Average Compounded in Arrears) will not match with publis
hed SOFR Averages or Cumulative Compounded Rate calculated based on published SOFR Index.This change is effective from Monday,
June 12th, 2023 and impacts all the rate calculation methods only for SOFR rate. Other RFR rates are not impacted.Please be adv
ised that if you have used ARR Calculator for rate/interest calculations for SOFR Loans whose interest/lookback/observation per
iod includes 7 April 2023, you may want to relook at the rate/interest calculations if this change impacts those loans.",
    "lastUpdatedFromSource": "2023-06-22T12:35:16+00:00",
    "legalDisclaimer": "Use subject to New York Fed Terms of Use for Select Rate Data.  New York Fed has no liability for your
use.  Refer the following link for more details: https://www.newyorkfed.org/markets/reference-rates-terms-of-use",
    "requestParameters": {
        "interestPeriodStartDate": "2020-03-03",
        "interestPeriodEndDate": "2020-03-09",
        "riskFreeRate": "SOFR",
        "lookBackDays": 3,
        "observationPeriodShift": false,
        "rateRoundingDecimalPoints": 5,
        "showDailyDetails": true,
        "calculateTillDate": "2020-03-07"
    },
    "dailyRateSummary": [
        {
            "interestPeriodDate": "2020-03-09",
            "interestPeriodDays": 1,
            "lookBackDate": "2020-03-04",
            "publishedRiskFreeRate": 1.23,
```

```
        "rateApplied": 1.23,
        "riskFreeRateFloorApplied": false,
        "compoundingFactor": 1.000269190628,
        "dailyCompoundedRate": 1.23033
    },
    {
        "interestPeriodDate": "2020-03-06",
        "interestPeriodDays": 3,
        "lookBackDate": "2020-03-03",
        "publishedRiskFreeRate": 1.64,
        "rateApplied": 1.64,
        "riskFreeRateFloorApplied": false,
        "compoundingFactor": 1.000132505852,
        "dailyCompoundedRate": 1.64022
    },
    {
        "interestPeriodDate": "2020-03-05",
        "interestPeriodDays": 1,
        "lookBackDate": "2020-03-02",
        "publishedRiskFreeRate": 1.59,
        "rateApplied": 1.59,
        "riskFreeRateFloorApplied": false,
        "compoundingFactor": 1.000088335284,
        "dailyCompoundedRate": 1.59014
    },
    {
        "interestPeriodDate": "2020-03-04",
        "interestPeriodDays": 1,
        "lookBackDate": "2020-02-28",
        "publishedRiskFreeRate": 1.6,
        "rateApplied": 1.6,
        "riskFreeRateFloorApplied": false,
        "compoundingFactor": 1.000043888889,
```

```
            "dailyCompoundedRate": 1.60007
        },
        {
            "interestPeriodDate": "2020-03-03",
            "interestPeriodDays": 1,
            "lookBackDate": "2020-02-27",
            "publishedRiskFreeRate": 1.58,
            "rateApplied": 1.58,
            "riskFreeRateFloorApplied": false,
            "compoundingFactor": 1.000000000000,
            "dailyCompoundedRate": 1.58000
        }
    ]
}
```


Note: In **Scenario 1** if showDailyDetails was ***false***, then the output returned would be:


```
{
    "comment": " The most recent published SOFR RFR rate is available as-of: 2023-06-21. Computed time : 2023-06-
23T06:43:02+00:00. Computed time is the time stamp when the calculation was completed.  Note : SOFR rate was not published on o
r for April 7th, 2023 (Friday) by New York Fed, even though April 7th was a business day as per SIFMA (Securities Industry and
Financial Markets Association). Given that there was no SOFR rate available for April 7th, 2023 Finastra had added April 7th as
 a SOFR publishing holiday in the ARR Calculator. However, based on subsequent feedback from our client base, ARR Working Group
, and conversations with LSTA/LMA, Finastra has decided to keep April 7th 2023 as a business day, with the SOFR rate used for 7
th April, 2023 to be the same value of the rate for preceding business day, Thursday, April 6th, 2023 (which was published on M
onday, April 10th, 2023). This change will ensure lookback dates are aligned with the market expectation.Note that choosing thi
s approach has a impact on the compounding calculations - For a given interest period that includes 7th Apr, Cumulative Compoun
ded Rate Calculations done on the ARR Calculator (Calculation Method: Average Compounded in Arrears) will not match with publis
hed SOFR Averages or Cumulative Compounded Rate calculated based on published SOFR Index.This change is effective from Monday,
June 12th, 2023 and impacts all the rate calculation methods only for SOFR rate. Other RFR rates are not impacted.Please be adv
ised that if you have used ARR Calculator for rate/interest calculations for SOFR Loans whose interest/lookback/observation per
iod includes 7 April 2023, you may want to relook at the rate/interest calculations if this change impacts those loans.",
    "lastUpdatedFromSource": "2023-06-22T12:35:16+00:00",
```

```
    "legalDisclaimer": "Use subject to New York Fed Terms of Use for Select Rate Data.  New York Fed has no liability for your use.  Refer the following link for more details: https://www.newyorkfed.org/markets/reference-rates-terms-of-use",
    "requestParameters": {
        "interestPeriodStartDate": "2020-03-03",
        "interestPeriodEndDate": "2020-03-09",
        "riskFreeRate": "SOFR",
        "lookBackDays": 3,
        "observationPeriodShift": false,
        "rateRoundingDecimalPoints": 5,
        "showDailyDetails": false,
        "calculateTillDate": "2020-03-07"
    },
    "dailyRateSummary": [
        {
            "interestPeriodDate": "2020-03-09",
            "interestPeriodDays": 1,
            "lookBackDate": "2020-03-04",
            "publishedRiskFreeRate": 1.23,
            "rateApplied": 1.23,
            "riskFreeRateFloorApplied": false,
            "compoundingFactor": 1.000269190628,
            "dailyCompoundedRate": 1.23033
        }
    ]
}
```

3.1.2.2 Example 2: Daily Compounded Rate in Arrears (NCCR) with Lookback and Observation Period Shift

Daily Compounded Rate in Arrears (NCCR) with observation period shift and interest period in rates known window.

Input Attribute Name	Value Entered
interestPeriodStartDate	2020-03-03
interestPeriodEndDate	2020-03-09
riskFreeRate	ESTR
lookBackDays	3
observationPeriodShift	true
rateRoundingDecimalPoints	5
showDailyDetails	true
calculateTillDate	2020-03-07

3.1.2.2.1 Example 2: Output

Note: The output is updated for version 1.7.x.


```
{
    "comment": " The most recent published ESTR RFR rate is available as-of: 2023-06-21. Computed time : 2023-06-
23T06:43:38+00:00. Computed time is the time stamp when the calculation was completed.",
    "lastUpdatedFromSource": "2023-06-22T07:05:40+00:00",
    "legalDisclaimer": "Use of euro short-
term rate (€STR) is subject to the ECB's €STR disclaimer under https://www.ecb.europa.eu/stats/financial_markets_and
_interest_rates/euro_short-term_rate/html/index.en.html#disclaimer.",
    "requestParameters": {
        "interestPeriodStartDate": "2020-03-03",
        "interestPeriodEndDate": "2020-03-09",
        "riskFreeRate": "ESTR",
```

```
        "lookBackDays": 3,
        "observationPeriodShift": true,
        "rateRoundingDecimalPoints": 5,
        "showDailyDetails": true,
        "calculateTillDate": "2020-03-07"
    },
    "dailyRateSummary": [
        {
            "interestPeriodDate": "2020-03-09",
            "interestPeriodDays": 1,
            "observationPeriodDate": "2020-03-04",
            "observationPeriodDays": 1,
            "publishedRiskFreeRate": -0.541,
            "rateApplied": -0.541,
            "riskFreeRateFloorApplied": false,
            "compoundingFactor": 0.999909947149,
            "dailyCompoundedRate": -0.54095
        },
        {
            "interestPeriodDate": "2020-03-06",
            "interestPeriodDays": 3,
            "observationPeriodDate": "2020-03-03",
            "observationPeriodDays": 1,
            "publishedRiskFreeRate": -0.542,
            "rateApplied": -0.542,
            "riskFreeRateFloorApplied": false,
            "compoundingFactor": 0.997501027702,
```

```
        "dailyCompoundedRate": -0.54065
    },
    {
        "interestPeriodDate": "2020-03-05",
        "interestPeriodDays": 1,
        "observationPeriodDate": "2020-03-02",
        "observationPeriodDays": 1,
        "publishedRiskFreeRate": -0.542,
        "rateApplied": -0.542,
        "riskFreeRateFloorApplied": false,
        "compoundingFactor": 0.998114548497,
        "dailyCompoundedRate": -0.54098
    },
    {
        "interestPeriodDate": "2020-03-04",
        "interestPeriodDays": 1,
        "observationPeriodDate": "2020-02-28",
        "observationPeriodDays": 3,
        "publishedRiskFreeRate": -0.54,
        "rateApplied": -0.54,
        "riskFreeRateFloorApplied": false,
        "compoundingFactor": 1.001829435185,
        "dailyCompoundedRate": -0.54099
    },
    {
        "interestPeriodDate": "2020-03-03",
        "interestPeriodDays": 1,
```

```
    "observationPeriodDate": "2020-02-27",
    "observationPeriodDays": 1,
    "publishedRiskFreeRate": -0.538,
    "rateApplied": -0.538,
    "riskFreeRateFloorApplied": false,
    "compoundingFactor": 1.000000000000,
    "dailyCompoundedRate": -0.53800
}
```

3.2 Calculated Rate – Using Average Compounded in Arrears

Fusion LIBOR Transition Calculator API calculates the ARR rate based on Average Compounded in Arrears for the provided start/end dates (such as interest period dates) and other ARR parameters, by leveraging the daily published risk-free reference rate. into legacy lending systems to perform conventional interest accrual calculations. Alternative Reference Rates supported are SOFR (USD), SONIA (GBP), ESTR (EUR), TONAR (JPY), SORA (SGD), IndONIA (IDR), and ZARONIA (ZAR).

Important: Beginning with ARR Calculator version 1.8.x, support for **IndONIA** (Indonesian Overnight Index Average) and **ZARONIA** (South African Rand Overnight Index Average) risk-free rates have been added. These newly introduced enhancements are separately licensed and are not available by default with the ARR Calculator API. If you are not licensed for this enhancement and would like more information, contact your Account Manager.

3.2.1 API Input and Output Attributes

The following section lists the user input attributes (request) and the expected output attributes (response).

Input Attribute Name	Description and Validation	Characteristics	Additional Remarks
interestPeriodStartDate	The start date of the interest period from (and including) which the ARR Compounding Calculation should be performed. The date is in ISO 8601 Date Format, that is, yyyy-mm-dd.	required: Y type: string	--
interestPeriodEndDate	The end date of the interest period to (and including) which the ARR Compounding Calculation should be performed. The date is in ISO 8601 Date Format yyyy-mm-dd.	required: Y type: string	• It is also used by the ARR Calculator, along with the calculateTillDate value, to identify if the reference rates are known for the interest period or not, based on rates known window. • If calculateTillDate is not provided, the interest period end date can be an intermediate date in the interest period up to (and including) which the compounded rates are calculated.
riskFreeRate	The name of the Risk Free Rate/Alternative Reference Rate. Available values: SOFR, SONIA, SORA, ESTR, TONAR, IndONIA, and ZARONIA.	required: Y type: string	IndONIA and ZARONIA are separately licensed enhancements. If the client (bank) is not licensed for these enhancements but includes it as an input in the API request, the API will return an error.

Input Attribute Name	Description and Validation	Characteristics	Additional Remarks
riskFreeRateFloor	**Available in version 1.2.x and later.** The Floor value (as a percentage) for the published risk-free reference rate. Accepts up to 6 decimal points. Minimum Value = -100, Maximum Value = 100	required: N type: integer	--
legacyRiskFreeRateFloor	**Available in version 1.5.x and later.** Risk Free Rate Floor (percentage) for legacy LIBOR contracts. This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations. Up to 6 decimals points are supported. Minimum Value = -100, Maximum Value = 100 For more information, see Legacy Risk Free Rate Floor section on page **23**.	required: N type: number	--
spreadAdjustment	**Available in version 1.5.x and later.** Spread Adjustment (percentage) during the interest period. Up to 6 decimals points are supported. Minimum Value = -100, Maximum Value = 100 Default value is 0.	required: N type: number	Only applicable if legacyRiskFreeRateFloor is provided.
lookBackDays	Lookback days refers to the fixed date (business days prior to) from which the calculator is expected to use the published Risk Free Rate/Alternative Reference Rate. Minimum Value = 0 (Default), Maximum Value = 99 For more information, see Lookback Days section on page **16**.	required: N type: integer	--
lockoutDays	Lockout days refers to the period (business days) in which the applicable ARR is derived using Lookback days and applied to all the days defined as Lockout days. Minimum Value = 0, Maximum Value = 99. Default Value = 0 For more information, see Lockout Days section on **16**.	required: N type: integer	--
observationPeriodShift	Indicates whether Observation Period Shift is applicable or not. Not supported if lockout days is non-zero. Available values: True or False. Default value is False. For more information, see Observation Period Shift section on page **17**.	required: N type: boolean	--

Input Attribute Name	Description and Validation	Characteristics	Additional Remarks
dayCountConvention	The Day Count Conventions supported. Valid Value are - ACT/360, ACT/365, and ACT/ACT. Default value: for SOFR = ACT/360, for SONIA = ACT/365, ESTR = ACT/360, TONAR = ACT/365, SORA = ACT/365, IndONIA = ACT/360, ZARONIA = ACT/365	required: N type: string	--
rateRoundingDecimalPoints	Rounds the calculated ARR Compounded Rate and Compounding Factor to the specified decimal precision. Minimum Value = 2, Maximum Value = 12 Default value: SOFR = 5, SONIA = 4, ESTR = 4, TONAR = 5, SORA =4, IndONIA = 5, and ZARONIA = 3	required: N type: integer	Rate rounding is done on the percentage value.
showDailyDetails	Indicates whether the Calculated Compounded Rates in the output appear for all business days (Value = True) OR only for the calculateTillDate or last business day for the interest period (Value = False), based on whether calculateTillDate is outside the rates-known window or not, respectively. Default value: false	required: N type: boolean	--
calculateTillDate	**Available in version 1.2.x and later.** The Date up to (and including) which the calculated compounded rates are expected in the output. The date is in ISO 8601 Date Format yyyy-mm-dd.	required: N type: string	--

Output Attribute Name	Description	Additional Remarks
calculatedCompoundedInArrearsRates	• IIf showDailyDetails = true, dailyRateSummary displays the averageCompoundedRate upto (and including) calculateTillDate, if it is outside the Rate Known Window, or up to (and including) the interestPeriodEndDate otherwise. • If showDailyDetails = false, dailyRateSummary displays the averageCompoundedRate only for calculateTillDate, if it is outside the Rate Known Window, or only for the last business day for the interest period otherwise.	if calculateTillDate is not provided and rates are known for the interest period, then the output appears for all business days in the interest period else error message will be displayed. The following attributes are supported for multi-record: • interestPeriodDate • interestPeriodDays • observationPeriodDate • observationPeriodDays • publishedRiskFreeRate • rateApplied • riskFreeRateFloorApplied • averageCompoundedRate
interestPeriodDate	The date in the interest period for which calculated ARR Compounded Rate is displayed in the output. The date is in ISO 8601 Date Format yyyy-mm-dd.	• If interestPeriodStartDate is a non-business day, then interestPeriodDate for the first CalculatedCompoundedInArrearsRates record is same as the interestPeriodStartDate • If calculateTillDate is a non- business day, then the previous business date is shown as interestPeriodDate for that CalculatedCompoundedInArrearsRates record.
interestPeriodDays	Number of days in the interest period (from and including the interestPeriodStartDate) for which the calculated Compounded Rate is applicable.	--
observationPeriodDate	The date in the observation period for which the published ARR rate (rateApplied) and the corresponding weightage of that rate is used for ARR Compounding calculation. Populated only if the observationPeriodShift is True. Observation Period is defined as commencing ‘x’ number of business days (lookback days) prior to the start (first day) of the interest period. The date is in ISO 8601 Date Format yyyy-mm-dd.	--

Output Attribute Name	Description	Additional Remarks
observationPeriodDays	Number of days in the observation period (from and including the start of Observation Period). Populated only if the *observationPeriodShift* is true	--
lookBackDate	**Available in version 1.7.x and later.** Lookback Date displays the corresponding date for which the publishedRiskFreeRate is displayed. This date is derived based on the lookBackDays and the interestPeriodDate. Not displayed when: 1. lookBackDays is not provided OR 2. observationPeriodShift=TRUE	**--**
publishedRiskFreeRate	**Available in version 1.2.x and later.** The published ARR rate applied (percentage) for the interestPeriodDate (if observationPeriodShift = false) or observationPeriodDate (if observationPeriodShift = true).	**--**
rateApplied	The ARR Rate applied (percentage) This field's value is the higher of publishedRiskFreeRate and the riskFreeRateFloor/derivedRiskFreeRateFloor(as applicable).	--
riskFreeRateFloorApplied	**Available in version 1.2.x and later.** Indicates whether the riskFreeRateFloor value has been factored in for the interestPeriodDate (Value = TRUE) or not (Value = FALSE). The riskFreeRateFloor value is applied on the publishedRiskFreeRate.	**--**
derivedRiskFreeRateFloor	**Available in version 1.5.x and later.** The Derived Risk Free Rate Floor Value (percentage) calculated as a difference between legacyRiskFreeRateFloor and spreadAdjustment. Will be displayed only if legacyRiskFreeRateFloor is provided and riskFreeRateFloor is not provided. This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations. The derivedRiskFreeRateFloor value is applied on the publishedRiskFreeRate.	--

Output Attribute Name	Description	Additional Remarks
derivedRiskFreeRateFloorApplied	**Available in version 1.5.x and later.** Indicates whether the derivedRiskFreeRateFloor value has been factored in for the interestPeriodDate (Value = TRUE) or not (Value = FALSE). This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations. The derivedRiskFreeRateFloor value is applied on the publishedRiskFreeRate.	--
averageCompoundedRate	The calculated Average Compounded in Arrears Rate (percentage), applicable for the interestPeriodDays, rounded to rateRoundingDecimalPoints. (dot) is the only character supported for decimal place separator. This field's value provides the calculated Average Compounded in Arrears Rate.	--
comment	It displays the time stamp when the calculation was completed. Format "Computed time : yyyy-MM-dd 'T' HH:mm:ss z Z." Additionally, it shows the date of the most recent published RFR rate available in the Calculator. It may display additional narration for the calculations performed, as required.	--
lastUpdatedFromSource	The most recent timestamp when the published ARR rate data was consumed by the Calculator from Refinitiv. Format in ISO 8601 is “yyyy-MM-dd'T'HH:mm:ssXXX”	--
legalDisclaimer	The End User Terms for using the Risk Free Rates as laid out by the respective benchmark provider.	--

3.2.2 Use Case Examples

The following are examples of values entered for the input attributes and the resulting output/response from the end point.

3.2.2.1 Example 1: Average Compounded Rate in Arrears with Lookback

Average Compounded Rate in Arrears with Lookback and interest period in rates known window.

Input Attribute Name	Value Entered
interestPeriodStartDate	2020-03-03
interestPeriodEndDate	2020-03-09
riskFreeRate	SOFR
lookBackDays	3
observationPeriodShift	false
rateRoundingDecimalPoints	5
showDailyDetails	true
calculateTillDate	2020-03-07

3.2.2.1.1 Example 1: Output

Note: The output is updated for version 1.7.x.


```
{
    "comment": " The most recent published SOFR RFR rate is available as-of: 2023-07-05. Computed time : 2023-07-
07T10:01:21+00:00. Computed time is the time stamp when the calculation was completed.  Note : SOFR rate was not published on o
r for April 7th, 2023 (Friday) by New York Fed, even though April 7th was a business day as per SIFMA (Securities Industry and
Financial Markets Association). Given that there was no SOFR rate available for April 7th, 2023 Finastra had added April 7th as
 a SOFR publishing holiday in the ARR Calculator. However, based on subsequent feedback from our client base, ARR Working Group
, and conversations with LSTA/LMA, Finastra has decided to keep April 7th 2023 as a business day, with the SOFR rate used for 7
th April, 2023 to be the same value of the rate for preceding business day, Thursday, April 6th, 2023 (which was published on M
onday, April 10th, 2023). This change will ensure lookback dates are aligned with the market expectation.Note that choosing thi
```

```
s approach has a impact on the compounding calculations - For a given interest period that includes 7th Apr, Cumulative Compoun
ded Rate Calculations done on the ARR Calculator (Calculation Method: Average Compounded in Arrears) will not match with publis
hed SOFR Averages or Cumulative Compounded Rate calculated based on published SOFR Index.This change is effective from Monday,
June 12th, 2023 and impacts all the rate calculation methods only for SOFR rate. Other RFR rates are not impacted.Please be adv
ised that if you have used ARR Calculator for rate/interest calculations for SOFR Loans whose interest/lookback/observation per
iod includes 7 April 2023, you may want to relook at the rate/interest calculations if this change impacts those loans.",
    "lastUpdatedFromSource": "2023-07-06T12:35:16+00:00",
    "legalDisclaimer": "Use subject to New York Fed Terms of Use for Select Rate Data.  New York Fed has no liability for your
use.  Refer the following link for more details: https://www.newyorkfed.org/markets/reference-rates-terms-of-use",
    "requestParameters": {
        "interestPeriodStartDate": "2020-03-03",
        "interestPeriodEndDate": "2020-03-09",
        "riskFreeRate": "SOFR",
        "lookBackDays": 3,
        "observationPeriodShift": false,
        "rateRoundingDecimalPoints": 5,
        "showDailyDetails": true,
        "calculateTillDate": "2020-03-07"
    },
    "dailyRateSummary": [
        {
            "interestPeriodDate": "2020-03-09",
            "interestPeriodDays": 7,
            "lookBackDate": "2020-03-04",
            "publishedRiskFreeRate": 1.23,
            "rateApplied": 1.23,
            "riskFreeRateFloorApplied": false,
            "averageCompoundedRate": 1.56017
        },
        {
            "interestPeriodDate": "2020-03-06",
            "interestPeriodDays": 6,
            "lookBackDate": "2020-03-03",
```

```
        "publishedRiskFreeRate": 1.64,
        "rateApplied": 1.64,
        "riskFreeRateFloorApplied": false,
        "averageCompoundedRate": 1.61514
    },
    {
        "interestPeriodDate": "2020-03-05",
        "interestPeriodDays": 3,
        "lookBackDate": "2020-03-02",
        "publishedRiskFreeRate": 1.59,
        "rateApplied": 1.59,
        "riskFreeRateFloorApplied": false,
        "averageCompoundedRate": 1.59007
    },
    {
        "interestPeriodDate": "2020-03-04",
        "interestPeriodDays": 2,
        "lookBackDate": "2020-02-28",
        "publishedRiskFreeRate": 1.6,
        "rateApplied": 1.6,
        "riskFreeRateFloorApplied": false,
        "averageCompoundedRate": 1.59004
    },
    {
        "interestPeriodDate": "2020-03-03",
        "interestPeriodDays": 1,
        "lookBackDate": "2020-02-27",
        "publishedRiskFreeRate": 1.58,
        "rateApplied": 1.58,
        "riskFreeRateFloorApplied": false,
        "averageCompoundedRate": 1.58000
    }
]
```

```
}
```


Note: In **Example 1** if showDailyDetails was ***false***, then the output returned would be:


```
{
    "comment": " The most recent published SOFR RFR rate is available as-of: 2023-07-05. Computed time : 2023-07-
07T10:01:55+00:00. Computed time is the time stamp when the calculation was completed.  Note : SOFR rate was not published on o
r for April 7th, 2023 (Friday) by New York Fed, even though April 7th was a business day as per SIFMA (Securities Industry and
Financial Markets Association). Given that there was no SOFR rate available for April 7th, 2023 Finastra had added April 7th as
 a SOFR publishing holiday in the ARR Calculator. However, based on subsequent feedback from our client base, ARR Working Group
, and conversations with LSTA/LMA, Finastra has decided to keep April 7th 2023 as a business day, with the SOFR rate used for 7
th April, 2023 to be the same value of the rate for preceding business day, Thursday, April 6th, 2023 (which was published on M
onday, April 10th, 2023). This change will ensure lookback dates are aligned with the market expectation.Note that choosing thi
s approach has a impact on the compounding calculations - For a given interest period that includes 7th Apr, Cumulative Compoun
ded Rate Calculations done on the ARR Calculator (Calculation Method: Average Compounded in Arrears) will not match with publis
hed SOFR Averages or Cumulative Compounded Rate calculated based on published SOFR Index.This change is effective from Monday,
June 12th, 2023 and impacts all the rate calculation methods only for SOFR rate. Other RFR rates are not impacted.Please be adv
ised that if you have used ARR Calculator for rate/interest calculations for SOFR Loans whose interest/lookback/observation per
iod includes 7 April 2023, you may want to relook at the rate/interest calculations if this change impacts those loans.",
    "lastUpdatedFromSource": "2023-07-06T12:35:16+00:00",
    "legalDisclaimer": "Use subject to New York Fed Terms of Use for Select Rate Data.  New York Fed has no liability for your
use.  Refer the following link for more details: https://www.newyorkfed.org/markets/reference-rates-terms-of-use",
    "requestParameters": {
        "interestPeriodStartDate": "2020-03-03",
        "interestPeriodEndDate": "2020-03-09",
        "riskFreeRate": "SOFR",
        "lookBackDays": 3,
        "observationPeriodShift": false,
        "rateRoundingDecimalPoints": 5,
        "showDailyDetails": false,
        "calculateTillDate": "2020-03-07"
    },
    "dailyRateSummary": [
```

```
        {
            "interestPeriodDate": "2020-03-09",
            "interestPeriodDays": 7,
            "lookBackDate": "2020-03-04",
            "publishedRiskFreeRate": 1.23,
            "rateApplied": 1.23,
            "riskFreeRateFloorApplied": false,
            "averageCompoundedRate": 1.56017
        }
    ]
}
```


3.2.2.2 Example 2: Average Compounded Rate in Arrears with Lookback and Observation Period Shift

Average Compounded Rate in Arrears with observation period shift and interest period in rates known window.

Input Attribute Name	Value Entered
interestPeriodStartDate	2020-03-03
interestPeriodEndDate	2020-03-09
riskFreeRate	ESTR
lookBackDays	3
observationPeriodShift	true
rateRoundingDecimalPoints	5
showDailyDetails	true

3.2.2.2.1 Example 2: Output

Note: The output is updated for version 1.7.x.


```
{
```

```
    "comment": " The most recent published ESTR RFR rate is available as-of: 2023-07-06. Computed time : 2023-
07-07T10:02:37+00:00. Computed time is the time stamp when the calculation was completed.",
    "lastUpdatedFromSource": "2023-07-07T07:05:40+00:00",
    "legalDisclaimer": "Use of euro short-
term rate (€STR) is subject to the ECB’s €STR disclaimer under https://www.ecb.europa.eu/stats/financial_marke
ts_and_interest_rates/euro_short-term_rate/html/index.en.html#disclaimer.",
    "requestParameters": {
        "interestPeriodStartDate": "2020-03-03",
        "interestPeriodEndDate": "2020-03-09",
        "riskFreeRate": "ESTR",
        "lookBackDays": 3,
        "observationPeriodShift": true,
        "rateRoundingDecimalPoints": 5,
        "showDailyDetails": true
    },
    "dailyRateSummary": [
        {
            "interestPeriodDate": "2020-03-09",
            "interestPeriodDays": 7,
            "observationPeriodDate": "2020-03-04",
            "observationPeriodDays": 7,
            "publishedRiskFreeRate": -0.541,
            "rateApplied": -0.541,
            "riskFreeRateFloorApplied": false,
            "averageCompoundedRate": -0.54041
        },
        {
            "interestPeriodDate": "2020-03-06",
```

```
        "interestPeriodDays": 6,
        "observationPeriodDate": "2020-03-03",
        "observationPeriodDays": 6,
        "publishedRiskFreeRate": -0.542,
        "rateApplied": -0.542,
        "riskFreeRateFloorApplied": false,
        "averageCompoundedRate": -0.54032
    },
    {
        "interestPeriodDate": "2020-03-05",
        "interestPeriodDays": 3,
        "observationPeriodDate": "2020-03-02",
        "observationPeriodDays": 5,
        "publishedRiskFreeRate": -0.542,
        "rateApplied": -0.542,
        "riskFreeRateFloorApplied": false,
        "averageCompoundedRate": -0.53999
    },
    {
        "interestPeriodDate": "2020-03-04",
        "interestPeriodDays": 2,
        "observationPeriodDate": "2020-02-28",
        "observationPeriodDays": 4,
        "publishedRiskFreeRate": -0.54,
        "rateApplied": -0.54,
        "riskFreeRateFloorApplied": false,
        "averageCompoundedRate": -0.53949
```

```
        },
        {
            "interestPeriodDate": "2020-03-03",
            "interestPeriodDays": 1,
            "observationPeriodDate": "2020-02-27",
            "observationPeriodDays": 1,
            "publishedRiskFreeRate": -0.538,
            "rateApplied": -0.538,
            "riskFreeRateFloorApplied": false,
            "averageCompoundedRate": -0.53800
        }
    ]
}
```

3.3 Calculated Rate – Using Simple ARR

Note: Available in Fusion LIBOR Transition Calculator API version 1.2.x and later.

Fusion LIBOR Transition Calculator API applies the Simple ARR method for the provided interest period start, end dates, or an interim date in the interest period and other ARR parameters, by leveraging the daily published risk-free reference rate. Alternative Reference Rates supported are SOFR (USD) and SONIA (GBP).

3.3.1 API Input and Output Attributes

The following section lists the user input attributes (request) and the expected output attributes (response).

Input Attribute Name	Description and Validation	Characteristics	Additional Remarks
interestPeriodStartDate	The start date of the interest period. The date is in ISO 8601 Date Format yyyy-mm-dd	required: N type: string	--

Input Attribute Name	Description and Validation	Characteristics	Additional Remarks
interestPeriodEndDate	The end date of the interest period to (and including) which the Simple ARR method is applied. The date is in ISO 8601 Date Format yyyy-mm-dd	required: N type: string	It is also used by the ARR Calculator to identify if the interest period is in the rates known window or not.
riskFreeRate	The name of the Risk Free Rate/Alternative Reference Rate. Available values: SOFR, SONIA	required: Y type: string	--
riskFreeRateFloor	**Available in version 1.2.x and later.** The Floor value (as a percentage) for the published risk-free reference rate. Accepts up to 6 decimal points. Minimum Value = -100, Maximum Value = 100	required: N type: integer	--
legacyRiskFreeRateFloor	**Available in version 1.5.x and later.** Risk Free Rate Floor (percentage) for legacy LIBOR contracts. This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations. Up to 6 decimals points are supported. Minimum Value = -100, Maximum Value = 100 For more information, see Legacy Risk Free Rate Floor section on page **23**.	required: N type: number	--
spreadAdjustment	**Available in version 1.5.x and later.** Spread Adjustment (percentage) during the interest period. Up to 6 decimals points are supported. Minimum Value = -100, Maximum Value = 100 Default value is 0.	required: N type: number	Only applicable if legacyRiskFreeRateFloor is provided.
lookBackDays	Lookback days refers to the fixed date (business days prior to) from which the calculator is expected to use the published Risk Free Rate / Alternative Reference Rate. Minimum Value = 0, Maximum Value = 99 Default value: 0 For more information, see Lookback Days section on page **16**.	required: N type: integer	--

Input Attribute Name	Description and Validation	Characteristics	Additional Remarks
lockoutDays	Lockout days refers to the period (business days) in which the applicable ARR is derived using Lookback days and applied to all the days defined as Lockout days. Minimum Value = 0, Maximum Value = 99 Default value: 0 For more information, see Lockout Days section on **16**.	required: N type: integer	--
dayCountConvention	The Day Count Conventions supported. Valid Value are - ACT/360, ACT/365, and ACT/ACT. **Note:** Default value for SOFR is ACT/360, for SONIA is ACT/365.	required: N type: string	--
rateRoundingDecimalPoints	Rounds the rateApplied in the API output to the specified decimal precision. Minimum Value = 2, Maximum Value = 6 Default value: for SOFR =2, for SONIA = 4	required: N type: integer	Rate rounding is done on the percentage value.
showDailyDetails	Indicates whether ARR Rates in the output appear for all business days (Value = True) OR only for the calculateTillDate or last business day for the interest period (Value = False), based on whether calculateTillDate is outside the rates-known window or not, respectively. Default value: false	required: N type: boolean	--
calculateTillDate	**Available in version 1.2.x and later.** The Date up to (and including) which the ARR rates are expected in the output. The date is in ISO 8601 Date Format yyyy-mm-dd.	required: Y type: string	--

Output Attribute Name	Description	Additional Remarks
simpleARRRates	• If showDailyDetails = true, dailyRateSummary displays the daily ARR Rates upto (and including) calculateTillDate, if it is outside the Rate Known Window, or upto (and including) the interestPeriodEndDate otherwise. • If showDailyDetails = false, dailyRateSummary displays the daily ARR Rate only for calculateTillDate, if it is outside the Rate Known Window, or only for the last business day for the interest period otherwise.	• If interestPeriodStartDate is not provided but interestPeriodEndDate is provided, the output appears for all business days from calculateTillDate to interestPeriodEndDate(showDailyDetails = True) OR only for the calculateTillDate or last business day for the interest period (showDailyDetails = False), based on whether calculateTillDate is outside the rates-known window or not, respectively . • If interestPeriodEndDate is not provided but interestPeriodStartDate is provided, the output appear for all business days from interestPeriodStartDate to calculateTillDate (showDailyDetails = True) OR only for the calculateTillDate (showDailyDetails = False) • If both interestPeriodStartDate and interestPeriodEndDate are not provided, the output appears for the calculateTillDate. The following attributes are supported for multi-record: • interestPeriodDate • interestPeriodDays • publishedRiskFreeRate • rateApplied • riskFreeRateFloorApplied
interestPeriodDate	The date in the interest period for which rateApplied is displayed. The date is in ISO 8601 Date Format yyyy-mm-dd.	• If interestPeriodStartDate is a non-business day, then interestPeriodDate for the first SimpleARRRates record is same as the interestPeriodStartDate • If calculateTillDate is a non- business day, then the previous business date is shown as interestPeriodDate for that SimpleARRRates record.

Output Attribute Name	Description	Additional Remarks
interestPeriodDays	Number of days in the interest period for which rateApplied is applicable.	--
lookBackDate	**Available in version 1.7.x and later.** Lookback Date displays the corresponding date for which the publishedRiskFreeRate is displayed. This date is derived based on the lookBackDays and the interestPeriodDate.Not displayed when: 1. lookBackDays is not provided OR 2. observationPeriodShift=TRUE	--
publishedRiskFreeRate	**Available in version 1.2.x and later.** The published ARR Rate (percentage) for the interestPeriodDate.	--
rateApplied	The ARR Rate applied (percentage), after factoring in the riskFreeRateFloor value, for the interestPeriodDate, rounded to rateRoundingDecimalPoints If the published risk-free rate is lower than the floor value, rateApplied = riskFreeRateFloor. Otherwise, rateApplied = publishedRiskFreeRate	--
riskFreeRateFloor Applied	**Available in version 1.2.x and later.** Indicates whether the rateApplied has factored the riskFreeRateFloor value, for the interestPeriodDate (Value = true) or not (Value = false).	--
derivedRiskFreeRateFloor	**Available in version 1.5.x and later.** The Derived Risk Free Rate Floor Value (percentage) calculated as a difference between legacyRiskFreeRateFloor and spreadAdjustment. Will be displayed only if legacyRiskFreeRateFloor is provided and riskFreeRateFloor is not provided. This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations.	--
derivedRiskFreeRateFloorApplied	**Available in version 1.5.x and later.** Indicates whether the rateApplied has factored in the derivedRiskFreeRateFloor value, for the interestPeriodDate (Value = true) or not (Value = false). Will be displayed only if legacyRiskFreeRateFloor is provided and riskFreeRateFloor is not provided. This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations.	--

Output Attribute Name	Description	Additional Remarks
comment	It displays the time stamp when the calculation was completed. Format "Computed time : yyyy-MM-dd 'T' HH:mm:ss z Z." Additionally, it shows the date of the most recent published RFR rate available in the Calculator. It may display additional narration for the calculations performed, as required.	--
lastUpdatedFrom Source	The most recent timestamp when the published ARR rate data was consumed by the Calculator from Refinitiv. Format in ISO 8601 is “yyyy-MM-dd'T'HH:mm:ssXXX”.	--
legalDisclaimer	The End User Terms for using the Risk Free Rates as laid out by the respective benchmark provider.	--

3.3.2 Use Case Examples

The following are examples of values entered for the input attributes and the resulting output/response from the end point.

3.3.2.1 Example 1: Simple ARR Rate with Lookback

Simple ARR with interest period start date and interest period end date along with lookback and interest period in rates known window.

Input Attribute Name	Value Entered
interestPeriodStartDate	2020-02-04
interestPeriodEndDate	2020-02-10
riskFreeRate	SONIA
riskFreeRateFloor	0.075
lookBackDays	3
rateRoundingDecimalPoints	6
showDailyDetails	true
calculateTillDate	2020-02-05

3.3.2.1.1 Example 1: Output

Note: The output is updated for version 1.7.x.


```
{
    "comment": " The most recent published SONIA RFR rate is available as-of: 2023-06-20. Computed time : 2023-06-
23T06:56:07+00:00. Computed time is the time stamp when the calculation was completed.",
    "lastUpdatedFromSource": "2023-06-22T09:35:09+00:00",
    "legalDisclaimer": "The SONIA benchmark is used subject to the terms of the UK Open Government License v.3.0 (https://www.n
ationalarchives.gov.uk/doc/open-government-
licence/version/3/) and the Bank of England's disclaimer for SONIA (set out below)*. The "SONIA" mark is used with the consent
of the Bank of England (the benchmark administrator of SONIA), and the use of such mark does not imply or express any approval
or endorsement by the Bank of England. "Bank of England" and "SONIA" are registered trade marks of the Bank of England. The Ban
k of England has no liability for your use of the calculator service herein.\n*Bank of England's disclaimer for SONIA: SONIA is
 copyright the Bank of England. The trade marks "Bank of England" and "SONIA" are registered trade marks of the Bank of England
. All Rights Reserved. The SONIA benchmark includes the proprietary information of the Bank of England and the data comprising
the benchmark may not be copied or distributed except as specifically authorised. The SONIA benchmark is not intended to be rel
ied upon as authoritative or taken in substitution for the exercise of judgement. The SONIA benchmark is not, and should not be
 construed as, an offer, bid or solicitation in relation to any financial instrument. The Bank of England does not guarantee, a
nd expressly disclaims any liability for, and makes no representations or warranties whether express or implied, as to the curr
ency, accuracy, timeliness, completeness or fitness for any particular purpose of the SONIA benchmark. The Bank of England acce
pts no liability whatsoever for any loss (including, but not limited to any direct, indirect or consequential loss, whether or
not such loss is foreseeable and whether or not the Bank of England has been appraised of the use to which the SONIA benchmark
will be put) howsoever arising from the use, the timeliness of delivery or the failure of delivery of the SONIA benchmark.",
    "requestParameters": {
        "interestPeriodStartDate": "2020-02-04",
        "interestPeriodEndDate": "2020-02-10",
        "riskFreeRate": "SONIA",
        "riskFreeRateFloor":.075,
        "lookBackDays": 3,
        "rateRoundingDecimalPoints": 6,
        "showDailyDetails": true,
        "calculateTillDate": "2020-02-05"
```

```
},
"dailyRateSummary": [
    {
        "interestPeriodDate": "2020-02-10",
        "interestPeriodDays": 1,
        "lookBackDate": "2020-02-05",
        "publishedRiskFreeRate": 0.7107,
        "rateApplied": 0.710700,
        "riskFreeRateFloorApplied": false
    },
    {
        "interestPeriodDate": "2020-02-07",
        "interestPeriodDays": 3,
        "lookBackDate": "2020-02-04",
        "publishedRiskFreeRate": 0.7104,
        "rateApplied": 0.710400,
        "riskFreeRateFloorApplied": false
    },
    {
        "interestPeriodDate": "2020-02-06",
        "interestPeriodDays": 1,
        "lookBackDate": "2020-02-03",
        "publishedRiskFreeRate": 0.7104,
        "rateApplied": 0.710400,
        "riskFreeRateFloorApplied": false
    },
    {
        "interestPeriodDate": "2020-02-05",
        "interestPeriodDays": 1,
        "lookBackDate": "2020-01-31",
        "publishedRiskFreeRate": 0.7117,
        "rateApplied": 0.711700,
        "riskFreeRateFloorApplied": false
```

```
        },
        {
            "interestPeriodDate": "2020-02-04",
            "interestPeriodDays": 1,
            "lookBackDate": "2020-01-30",
            "publishedRiskFreeRate": 0.7099,
            "rateApplied": 0.709900,
            "riskFreeRateFloorApplied": false
        }
    ]
}
```

3.3.2.2 Example 2: Simple ARR Rate with Lookback

Simple ARR with calculate till date along with lookback outside rates known window.

Input Attribute Name	Value Entered
interestPeriodStartDate	2020-08-02
interestPeriodEndDate	2020-09-02
riskFreeRate	SOFR
riskFreeRateFloor	0.075
lookBackDays	3
rateRoundingDecimalPoints	6
showDailyDetails	true
calculateTillDate	2020-08-26

3.3.2.2.1 Example 2: Output

Note: The output is updated for version 1.7.x.

```
{
```

```
    "comment": " The most recent published SOFR RFR rate is available as-of: 2023-06-21. Computed time : 2023-06-
23T06:54:49+00:00. Computed time is the time stamp when the calculation was completed.  Note : SOFR rate was not publi
shed on or for April 7th, 2023 (Friday) by New York Fed, even though April 7th was a business day as per SIFMA (Securi
ties Industry and Financial Markets Association). Given that there was no SOFR rate available for April 7th, 2023 Fina
stra had added April 7th as a SOFR publishing holiday in the ARR Calculator. However, based on subsequent feedback fro
m our client base, ARR Working Group, and conversations with LSTA/LMA, Finastra has decided to keep April 7th 2023 as
a business day, with the SOFR rate used for 7th April, 2023 to be the same value of the rate for preceding business da
y, Thursday, April 6th, 2023 (which was published on Monday, April 10th, 2023). This change will ensure lookback dates
 are aligned with the market expectation.Note that choosing this approach has a impact on the compounding calculations
 - For a given interest period that includes 7th Apr, Cumulative Compounded Rate Calculations done on the ARR Calculat
or (Calculation Method: Average Compounded in Arrears) will not match with published SOFR Averages or Cumulative Compo
unded Rate calculated based on published SOFR Index.This change is effective from Monday, June 12th, 2023 and impacts
all the rate calculation methods only for SOFR rate. Other RFR rates are not impacted.Please be advised that if you ha
ve used ARR Calculator for rate/interest calculations for SOFR Loans whose interest/lookback/observation period includ
es 7 April 2023, you may want to relook at the rate/interest calculations if this change impacts those loans.",
    "lastUpdatedFromSource": "2023-06-22T12:35:16+00:00",
    "legalDisclaimer": "Use subject to New York Fed Terms of Use for Select Rate Data.  New York Fed has no liability
for your use.  Refer the following link for more details: https://www.newyorkfed.org/markets/reference-rates-terms-of-
use",
    "requestParameters": {
        "interestPeriodStartDate": "2020-08-02",
        "interestPeriodEndDate": "2020-09-02",
        "riskFreeRate": "SOFR",
        "riskFreeRateFloor":.075,
        "lookBackDays": 3,
        "rateRoundingDecimalPoints": 6,
        "showDailyDetails": true,
        "calculateTillDate": "2020-08-26"
    },
    "dailyRateSummary": [
        {
            "interestPeriodDate": "2020-09-02",
            "interestPeriodDays": 1,
```

```
        "lookBackDate": "2020-08-28",
        "publishedRiskFreeRate": 0.07,
        "rateApplied": 0.075000,
        "riskFreeRateFloorApplied": true
    },
    {
        "interestPeriodDate": "2020-09-01",
        "interestPeriodDays": 1,
        "lookBackDate": "2020-08-27",
        "publishedRiskFreeRate": 0.07,
        "rateApplied": 0.075000,
        "riskFreeRateFloorApplied": true
    },
    {
        "interestPeriodDate": "2020-08-31",
        "interestPeriodDays": 1,
        "lookBackDate": "2020-08-26",
        "publishedRiskFreeRate": 0.07,
        "rateApplied": 0.075000,
        "riskFreeRateFloorApplied": true
    },
    {
        "interestPeriodDate": "2020-08-28",
        "interestPeriodDays": 3,
        "lookBackDate": "2020-08-25",
        "publishedRiskFreeRate": 0.08,
        "rateApplied": 0.080000,
        "riskFreeRateFloorApplied": false
    },
    {
        "interestPeriodDate": "2020-08-27",
        "interestPeriodDays": 1,
        "lookBackDate": "2020-08-24",
```

```
        "publishedRiskFreeRate": 0.08,
        "rateApplied": 0.080000,
        "riskFreeRateFloorApplied": false
    },
    {
        "interestPeriodDate": "2020-08-26",
        "interestPeriodDays": 1,
        "lookBackDate": "2020-08-21",
        "publishedRiskFreeRate": 0.07,
        "rateApplied": 0.075000,
        "riskFreeRateFloorApplied": true
    },
    {
        "interestPeriodDate": "2020-08-25",
        "interestPeriodDays": 1,
        "lookBackDate": "2020-08-20",
        "publishedRiskFreeRate": 0.07,
        "rateApplied": 0.075000,
        "riskFreeRateFloorApplied": true
    },
    {
        "interestPeriodDate": "2020-08-24",
        "interestPeriodDays": 1,
        "lookBackDate": "2020-08-19",
        "publishedRiskFreeRate": 0.09,
        "rateApplied": 0.090000,
        "riskFreeRateFloorApplied": false
    },
    {
        "interestPeriodDate": "2020-08-21",
        "interestPeriodDays": 3,
        "lookBackDate": "2020-08-18",
        "publishedRiskFreeRate": 0.09,
```

```
        "rateApplied": 0.090000,
        "riskFreeRateFloorApplied": false
    },
    {
        "interestPeriodDate": "2020-08-20",
        "interestPeriodDays": 1,
        "lookBackDate": "2020-08-17",
        "publishedRiskFreeRate": 0.10,
        "rateApplied": 0.100000,
        "riskFreeRateFloorApplied": false
    },
    {
        "interestPeriodDate": "2020-08-19",
        "interestPeriodDays": 1,
        "lookBackDate": "2020-08-14",
        "publishedRiskFreeRate": 0.09,
        "rateApplied": 0.090000,
        "riskFreeRateFloorApplied": false
    },
    {
        "interestPeriodDate": "2020-08-18",
        "interestPeriodDays": 1,
        "lookBackDate": "2020-08-13",
        "publishedRiskFreeRate": 0.09,
        "rateApplied": 0.090000,
        "riskFreeRateFloorApplied": false
    },
    {
        "interestPeriodDate": "2020-08-17",
        "interestPeriodDays": 1,
        "lookBackDate": "2020-08-12",
        "publishedRiskFreeRate": 0.09,
        "rateApplied": 0.090000,
```

```
        "riskFreeRateFloorApplied": false
    },
    {
        "interestPeriodDate": "2020-08-14",
        "interestPeriodDays": 3,
        "lookBackDate": "2020-08-11",
        "publishedRiskFreeRate": 0.10,
        "rateApplied": 0.100000,
        "riskFreeRateFloorApplied": false
    },
    {
        "interestPeriodDate": "2020-08-13",
        "interestPeriodDays": 1,
        "lookBackDate": "2020-08-10",
        "publishedRiskFreeRate": 0.09,
        "rateApplied": 0.090000,
        "riskFreeRateFloorApplied": false
    },
    {
        "interestPeriodDate": "2020-08-12",
        "interestPeriodDays": 1,
        "lookBackDate": "2020-08-07",
        "publishedRiskFreeRate": 0.09,
        "rateApplied": 0.090000,
        "riskFreeRateFloorApplied": false
    },
    {
        "interestPeriodDate": "2020-08-11",
        "interestPeriodDays": 1,
        "lookBackDate": "2020-08-06",
        "publishedRiskFreeRate": 0.09,
        "rateApplied": 0.090000,
        "riskFreeRateFloorApplied": false
```

```
},
{
    "interestPeriodDate": "2020-08-10",
    "interestPeriodDays": 1,
    "lookBackDate": "2020-08-05",
    "publishedRiskFreeRate": 0.09,
    "rateApplied": 0.090000,
    "riskFreeRateFloorApplied": false
},
{
    "interestPeriodDate": "2020-08-07",
    "interestPeriodDays": 3,
    "lookBackDate": "2020-08-04",
    "publishedRiskFreeRate": 0.09,
    "rateApplied": 0.090000,
    "riskFreeRateFloorApplied": false
},
{
    "interestPeriodDate": "2020-08-06",
    "interestPeriodDays": 1,
    "lookBackDate": "2020-08-03",
    "publishedRiskFreeRate": 0.10,
    "rateApplied": 0.100000,
    "riskFreeRateFloorApplied": false
},
{
    "interestPeriodDate": "2020-08-05",
    "interestPeriodDays": 1,
    "lookBackDate": "2020-07-31",
    "publishedRiskFreeRate": 0.10,
    "rateApplied": 0.100000,
    "riskFreeRateFloorApplied": false
},
```

```
        {
            "interestPeriodDate": "2020-08-04",
            "interestPeriodDays": 1,
            "lookBackDate": "2020-07-30",
            "publishedRiskFreeRate": 0.10,
            "rateApplied": 0.100000,
            "riskFreeRateFloorApplied": false
        },
        {
            "interestPeriodDate": "2020-08-03",
            "interestPeriodDays": 1,
            "lookBackDate": "2020-07-29",
            "publishedRiskFreeRate": 0.09,
            "rateApplied": 0.090000,
            "riskFreeRateFloorApplied": false
        },
        {
            "interestPeriodDate": "2020-08-02",
            "interestPeriodDays": 1,
            "lookBackDate": "2020-07-29",
            "publishedRiskFreeRate": 0.09,
            "rateApplied": 0.090000,
            "riskFreeRateFloorApplied": false
        }
    ]
}
```

3.4 Calculated Rate – Using Simple Average

Note: Available in Fusion LIBOR Transition Calculator API version 1.3.x and later.

Fusion LIBOR Transition Calculator API calculates the ARR rate based on Simple Average for the provided start/end dates (such as interest period dates) and other ARR parameters, by leveraging the daily published risk-free reference rate into legacy lending systems to perform conventional interest accrual calculations. Alternative Reference Rates supported are SOFR (USD), SONIA (GBP), ESTR (EUR), TONAR (JPY), SORA (SGD), IndONIA (IDR), and ZARONIA (ZAR).

Important: Beginning with ARR Calculator version 1.8.x, support for **IndONIA** (Indonesian Overnight Index Average) and **ZARONIA** (South African Rand Overnight Index Average) risk-free rates have been added. These newly introduced enhancements are separately licensed and are not available by default with the ARR Calculator API. If you are not licensed for this enhancement and would like more information, contact your Account Manager.

3.4.1 API Input and Output Attributes

The following section lists the user input attributes (request) and the expected output attributes (response).

Input Attribute Name	Description and Validation	Characteristics	Additional Remarks
interestPeriodStartDate	The start date of the interest period from (and including) which the ARR Simple Average Calculation must be performed. The date is in ISO 8601 Date Format yyyy-mm-dd.	required: Y type: string	--
interestPeriodEndDate	The end date of the interest period to (and including) which the ARR Simple Average calculation should be performed. The date is in ISO 8601 Date Format yyyy-mm-dd.	required: Y type: string	• It is also used by the Calculator, along with the calculateTillDate value, to identify if the reference rates are known for the interest period or not, based on rates known window. • If calculateTillDate is not provided, the interest period end date can be an intermediate date in the interest period up to (and including) which the compounded rates are calculated.

Input Attribute Name	Description and Validation	Characteristics	Additional Remarks
riskFreeRate	The name of the Risk-Free Rate/Alternative Reference Rate Available values: SOFR, SONIA, SORA, ESTR, TONAR, IndONIA, and ZARONIA.	required: Y type: string	IndONIA and ZARONIA are separately licensed enhancements. If the client (bank) is not licensed for these enhancements but includes it as an input in the API request, the API will return an error.
riskFreeRateFloor	The Floor value (as a percentage) for the published risk-free reference rate. Accepts up to 6 decimal points. Minimum Value = -100, Maximum Value = 100"	required: N type: integer	--
legacyRiskFreeRateFloor	**Available in version 1.5.x and later.** Risk Free Rate Floor (percentage) for legacy LIBOR contracts. This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations. Up to 6 decimals points are supported. Minimum Value = -100, Maximum Value = 100 For more information, see Legacy Risk Free Rate Floor section on page **23**.	required: N type: number	--
spreadAdjustment	**Available in version 1.5.x and later.** Spread Adjustment (percentage) during the interest period. Up to 6 decimals points are supported. Minimum Value = -100, Maximum Value = 100 Default value is 0.	required: N type: number	Only applicable if legacyRiskFreeRateFloor is provided.
lookBackDays	Lookback days refers to the fixed date (business days prior to) from which the calculator is expected to use the published Risk Free Rate/Alternative Reference Rate. Minimum Value = 0, Maximum Value = 99 Default value: 0 For more information, see Lookback Days section on page **16**.	required: N type: integer	--

Input Attribute Name	Description and Validation	Characteristics	Additional Remarks
lockoutDays	Lockout days refers to the period (business days) in which the applicable ARR is derived using Lookback days and applied to all the days defined as Lockout days. Minimum Value = 0, Maximum Value = 99 Default value: 0 For more information, see Lockout Days section on **16**.	required: N type: integer	--
observationPeriodShift	Indicates whether Observation Period Shift is applicable or not. Not supported if lockout days is non-zero. Default value: false	required: N type: boolean	--
dayCountConvention	The Day Count Conventions supported. Valid Value are - ACT/360, ACT/365 & ACT/ACT. Default Value: for SOFR= ACT/360, for SONIA = ACT/365, ESTR = ACT/360, TONAR = ACT/365, SORA = ACT/365, IndONIA = ACT/360, and ZARONIA = ACT/365.	required: N type: string	--
rateRoundingDecimalPoints	Rounds the calculated ARR Average Rate to the specified decimal precision. Minimum Value = 2, Maximum Value = 12 Default value: SOFR = 5, SONIA = 4, ESTR = 4, TONAR = 5, SORA = 4, IndONIA = 5, and ZARONIA = 3.	required: N type: integer	Rate rounding is done on the percentage value.
showDailyDetails	Indicates whether the Calculated Average Rates in the output appear for all business days (Value = True) OR only for the calculateTillDate or last business day for the interest period (Value = False), based on whether calculateTillDate is outside the rates-known window or not, respectively Default value: false	required: N type: boolean	--
calculateTillDate	The Date up to (and including) which the calculated Average rates are expected in the output. The date is in ISO 8601 Date Format yyyy-mm-dd	required: N type: string	--

Output Attribute Name	Description	Additional Remarks
dailyRateSummary	• If showDailyDetails = true, dailyRateSummary displays the SimpleAverageRate upto (and including) calculateTillDate, if it is outside the Rate Known Window, or up to (and including) the interestPeriodEndDate otherwise. • If showDailyDetails = false,dailyRateSummary displays the simpleAverageRate only for calculateTillDate, if it is outside the Rate Known Window, or only for the last business day for the interest period otherwise.	if calculateTillDate is not provided and rates are known for the interest period, then the output appears for all business days in the interest period else error message will be displayed
interestPeriodDate	The date in the interest period for which calculated ARR Simple Average Rate is displayed in the output. The date is in ISO 8601 Date Format yyyy-mm-dd.	• If interestPeriodStartDate is a non-business day, then interestPeriodDate for the first CalculatedCompoundedInArrearsRates record is same as the interestPeriodStartDate. • If calculateTillDate is a non- business day, then the previous business date is shown as interestPeriodDate for that CalculatedCompoundedInArrearsRates record.
interestPeriodDays	Number of days in the interest period (from and including the interestPeriodStartDate) for which the calculated Simple Average Rate is applicable.	--
observationPeriodDate	The date in the observation period for which the published ARR rate (rateApplied) and the corresponding weightage of that rate is used for ARR Average calculation. Populated only if the observationPeriodShift is True Observation Period is defined as commencing 'x' number of ""business"" days (lookback days) prior to the start (first day) of the interest period. The date is in ISO 8601 Date Format yyyy-mm-dd	--
observationPeriodDays	Number of days in the observation period (from and including the start of Observation Period). Populated only if the observationPeriodShift is true.	--
lookBackDate	**Available in version 1.7.x and later.** Lookback Date displays the corresponding date for which the publishedRiskFreeRate is displayed. This date is derived based on the lookBackDays and the interestPeriodDate.Not displayed when: 1. lookBackDays is not provided OR 2. observationPeriodShift=TRUE	**--**

Output Attribute Name	Description	Additional Remarks
publishedRiskFreeRate	The published ARR rate applied (percentage) for the interestPeriodDate (if observationPeriodShift = false) or observationPeriodDate (if observationPeriodShift = true).	--
rateApplied	The ARR Rate applied (percentage), after factoring in the riskFreeRateFloor value, for the interestPeriodDate. If the published risk-free rate is lower than the floor value, rateApplied = riskFreeRateFloor. Otherwise, rateApplied = publishedRiskFreeRate.	--
riskFreeRateFloorApplied	Indicates whether the rateApplied has factored the riskFreeRateFloor value, for the interestPeriodDate (Value = true) or not (Value = false).	--
derivedRiskFreeRateFloor	**Available in version 1.5.x and later.** The Derived Risk Free Rate Floor Value (percentage) calculated as a difference between legacyRiskFreeRateFloor and spreadAdjustment. Will be displayed only if legacyRiskFreeRateFloor is provided and riskFreeRateFloor is not provided. This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations.	--
derivedRiskFreeRateFloorApplied	**Available in version 1.5.x and later.** Indicates whether the rateApplied has factored in the derivedRiskFreeRateFloor value, for the interestPeriodDate (Value = true) or not (Value = false). Will be displayed only if legacyRiskFreeRateFloor is provided and riskFreeRateFloor is not provided. This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations.	--
simpleAverageRate	The calculated Simple Average Rate, applicable for the interestPeriodDays, rounded to rateRoundingDecimalPoints.	--
comment	It displays the time stamp when the calculation was completed. Format "Computed time : yyyy-MM-dd 'T' HH:mm:ss z Z." Additionally, it shows the date of the most recent published RFR rate available in the Calculator. It may display additional narration for the calculations performed, as required.	--
lastUpdatedFromSource	The most recent timestamp when the published ARR rate data was consumed by the Calculator from Refinitiv. Format in ISO 8601 is “yyyy-MM-dd'T'HH:mm:ssXXX”	--

Output Attribute Name	Description	Additional Remarks
legalDisclaimer	The End User Terms for using the Risk Free Rates as laid out by the respective benchmark provider.	--

3.4.2 Use Case Examples – Simple Average

The following are examples of values entered for the input attributes and the resulting output/response from the end point.

3.4.2.1 Example : Simple Average with Lookback

Simple Average with Lookback and interest period in rates known window.

Input Attribute Name	Value Entered
interestPeriodStartDate	2019-08-10
interestPeriodEndDate	2019-08-19
riskFreeRate	SOFR
lookBackDays	3
observationPeriodShift	false
riskFreeRateFloor	0.01
showDailyDetails	true
calculateTillDate	2019-08-15

3.4.2.1.1 Example 1: Output

Note: The output is updated for version 1.7.x.


```
{
    "comment": " The most recent published SOFR RFR rate is available as-of: 2023-06-21. Computed time : 2023-06-
23T07:13:14+00:00. Computed time is the time stamp when the calculation was completed.  Note : SOFR rate was not published on o
r for April 7th, 2023 (Friday) by New York Fed, even though April 7th was a business day as per SIFMA (Securities Industry and
Financial Markets Association). Given that there was no SOFR rate available for April 7th, 2023 Finastra had added April 7th as
```

```
 a SOFR publishing holiday in the ARR Calculator. However, based on subsequent feedback from our client base, ARR Working Group
, and conversations with LSTA/LMA, Finastra has decided to keep April 7th 2023 as a business day, with the SOFR rate used for 7
th April, 2023 to be the same value of the rate for preceding business day, Thursday, April 6th, 2023 (which was published on M
onday, April 10th, 2023). This change will ensure lookback dates are aligned with the market expectation.Note that choosing thi
s approach has a impact on the compounding calculations - For a given interest period that includes 7th Apr, Cumulative Compoun
ded Rate Calculations done on the ARR Calculator (Calculation Method: Average Compounded in Arrears) will not match with publis
hed SOFR Averages or Cumulative Compounded Rate calculated based on published SOFR Index.This change is effective from Monday,
June 12th, 2023 and impacts all the rate calculation methods only for SOFR rate. Other RFR rates are not impacted.Please be adv
ised that if you have used ARR Calculator for rate/interest calculations for SOFR Loans whose interest/lookback/observation per
iod includes 7 April 2023, you may want to relook at the rate/interest calculations if this change impacts those loans.",
    "lastUpdatedFromSource": "2023-06-22T12:35:16+00:00",
    "legalDisclaimer": "Use subject to New York Fed Terms of Use for Select Rate Data.  New York Fed has no liability for your
use.  Refer the following link for more details: https://www.newyorkfed.org/markets/reference-rates-terms-of-use",
    "requestParameters": {
        "interestPeriodStartDate": "2019-08-10",
        "interestPeriodEndDate": "2019-08-19",
        "riskFreeRate": "SOFR",
        "riskFreeRateFloor": 0.01,
        "lookBackDays": 3,
        "observationPeriodShift": false,
        "showDailyDetails": true,
        "calculateTillDate": "2019-08-15"
    },
    "dailyRateSummary": [
        {
            "interestPeriodDate": "2019-08-19",
            "interestPeriodDays": 10,
            "lookBackDate": "2019-08-14",
            "publishedRiskFreeRate": 2.13,
            "rateApplied": 2.13,
            "riskFreeRateFloorApplied": false,
            "simpleAverageRate": 2.12300
        },
```

```
{
    "interestPeriodDate": "2019-08-16",
    "interestPeriodDays": 9,
    "lookBackDate": "2019-08-13",
    "publishedRiskFreeRate": 2.16,
    "rateApplied": 2.16,
    "riskFreeRateFloorApplied": false,
    "simpleAverageRate": 2.12222
},
{
    "interestPeriodDate": "2019-08-15",
    "interestPeriodDays": 6,
    "lookBackDate": "2019-08-12",
    "publishedRiskFreeRate": 2.12,
    "rateApplied": 2.12,
    "riskFreeRateFloorApplied": false,
    "simpleAverageRate": 2.10333
},
{
    "interestPeriodDate": "2019-08-14",
    "interestPeriodDays": 5,
    "lookBackDate": "2019-08-09",
    "publishedRiskFreeRate": 2.11,
    "rateApplied": 2.11,
    "riskFreeRateFloorApplied": false,
    "simpleAverageRate": 2.10000
},
{
    "interestPeriodDate": "2019-08-13",
    "interestPeriodDays": 4,
    "lookBackDate": "2019-08-08",
    "publishedRiskFreeRate": 2.09,
    "rateApplied": 2.09,
```

```
            "riskFreeRateFloorApplied": false,
            "simpleAverageRate": 2.09750
        },
        {
            "interestPeriodDate": "2019-08-12",
            "interestPeriodDays": 3,
            "lookBackDate": "2019-08-07",
            "publishedRiskFreeRate": 2.1,
            "rateApplied": 2.1,
            "riskFreeRateFloorApplied": false,
            "simpleAverageRate": 2.10000
        },
        {
            "interestPeriodDate": "2019-08-10",
            "interestPeriodDays": 2,
            "lookBackDate": "2019-08-07",
            "publishedRiskFreeRate": 2.1,
            "rateApplied": 2.1,
            "riskFreeRateFloorApplied": false,
            "simpleAverageRate": 2.10000
        }
    ]
}
```

3.5 Interest Calculator – Using Daily Compounded in Arrears (NCCR)

Fusion LIBOR Transition Calculator calculates the ARR rate based on Daily Compounding in Arrears (Non-Cumulative Compounded Rate) and accrued interest amounts for the provided loan parameters such as interest period dates, loan balance amount, and so on, and other ARR parameters, using the daily published risk-free reference rate. Alternative Reference Rates supported are SOFR (USD), SONIA (GBP), ESTR (EUR), TONAR (JPY), SORA (SGD), IndONIA (IDR), and ZARONIA (ZAR).

Important: Beginning with ARR Calculator version 1.8.x, support for **IndONIA** (Indonesian Overnight Index Average) and **ZARONIA** (South African Rand Overnight Index Average) risk-free rates have been added. These newly introduced enhancements are separately licensed and are not available by default with the ARR Calculator API. If you are not licensed for this enhancement and would like more information, contact your Account Manager.

3.5.1 API Input and Output Attributes

The following section lists the user input attributes (request) and the expected output attributes (response).

Input Attribute Name	Description and Validation	Characteristics	Additional Remarks
InitialPrincipalBalance	Principal Balance as on the interestPeriodStartDate. Currency assumed is USD if riskFreeRate = SOFR, GBP if riskFreeRate = SONIA, EUR if riskFreeRate = ESTR, JPY if riskFreeRate = TONAR, SGD if riskFreeRate = SORA, IDR if riskFreeRate = IndONIA, ZAR if riskFreeRate = ZARONIA.	required: Y type: number	--
interestPeriodStartDate	The start date of the interest period from (and including) which the ARR Compounding Calculation must be performed. The date is in ISO 8601 Date Format, that is, yyyy-mm-dd	required: Y type: string	--
interestPeriodEndDate	The end date of the interest period to (and including) which the ARR compounding calculation should be performed. The date is in ISO 8601 Date Format yyyy-mm-dd.	required: Y type: string	• It is also used by the Calculator to identify if the interest period is in the rates known window or not. • If calculateTillDate is not provided, the interest period end date can be an intermediate date in the interest period up to (and including) which the compounded rates are calculated.

Input Attribute Name	Description and Validation	Characteristics	Additional Remarks
riskFreeRate	The name of the Risk Free Rate /Alternative Reference Rate Available values: SOFR, SONIA, SORA, ESTR, TONAR, IndONIA, and ZARONIA.	required: Y type: string	IndONIA and ZARONIA are separately licensed enhancements. If the client (bank) is not licensed for these enhancements but includes it as an input in the API request, the API will return an error.
riskFreeRateFloor	**Available in version 1.2.x and later.** The Floor value (as a percentage) for the published risk-free reference rate. Accepts up to 6 decimal points. Minimum Value = -100, Maximum Value = 100	required: N type: integer	--
legacyRiskFreeRateFloor	**Available in version 1.5.x and later.** Risk Free Rate Floor (percentage) for legacy LIBOR contracts. This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations. Up to 6 decimals points are supported. For more information, see Legacy Risk Free Rate Floor section on page **23**.	required: N type: number	--
allInRateFloor	**Available in version 1.3.x and later.** The Floor value (as a percentage) for the all in rate. Accepts up to 6 decimal points. Minimum Value = -100, Maximum Value = 100	required: N type: integer	--
allInRateCap	**Available in version 1.3.x and later.** The Cap value (as a percentage) for the all in rate. Accepts up to 6 decimal points. Minimum Value = -100, Maximum Value = 100	required: N type: integer	--
lookBackDays	Lookback days refers to the fixed date (business days prior to) from which the calculator is expected to use the published Risk Free Rate/Alternative Reference Rate Minimum Value = 0 (Default), Maximum Value = 99 For more information, see Lookback Days section on page **16**.	required: N type: integer	--

Input Attribute Name	Description and Validation	Characteristics	Additional Remarks
lockoutDays	Lockout days refers to the period (business days) in which the applicable ARR is derived using Lookback days and applied to all the days defined as Lockout days Minimum Value = 0 (Default), Maximum Value = 99, and Default Value = 0 For more information, see Lockout Days section on **16**.	required: N type: integer	--
observationPeriodShift	Indicates whether Observation Period Shift is applicable or not. Not supported if lockout days is non-zero Values supported are True or False. Default value is False. For more information, see Observation Period Shift section on page **17**.	required: N type: boolean	--
spread	Spread (percentage) applicable during the interest period. Default Value: 0.00%. Up to 6 decimals points are supported. Minimum Value = -100, Maximum Value = 100. Default value is 0.	required: N type: number	--
spreadAdjustment	Spread Adjustment (percentage) during the interest period. Default Value: 0.00%. Minimum Value = -100, Maximum Value = 100. Default value is 0.	required: N type: number	--
dayCountConvention	The Day Count Conventions supported. Valid Value are - ACT/360, ACT/365, and ACT/ACT. Default value: for SOFR = ACT/360, for SONIA = ACT/365, ESTR = ACT/360, TONAR = ACT/365, SORA = ACT/365, IndONIA – ACT/360, ZARONIA = ACT/365.	required: N type: string	--
ccrRoundingApplies	**Available in version 1.5.x and later.** Indicates whether rounded Cumulative Compounded Rate is used to calculate the dailyCompoundedRate (Value = true) or not (Value = false). This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations. Default value is false.	required: N type: boolean	--

Input Attribute Name	Description and Validation	Characteristics	Additional Remarks
ccrRoundingPrecision	**Available in version 1.5.x and later.** If ccrRoundingApplies is true, rounds the Cumulative Compounded Rate to the specified decimal precision. If ccrRoundingApplies is false, this attribute is ignored. This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations. Minimum Value = 1, Maximum Value = 10 Default value is 4. For more information, see CCR Rounding Approach on page 13.	required: N type: integer	Rounding is done on the percentage value.
rateRoundingDecimalPoints	Rounds the calculated ARR Compounded Rate to the specified decimal precision. Minimum Value = 2, Maximum Value = 12 Default value: SOFR = 5, SONIA = 4, ESTR = 4, TONAR = 5, SORA = 4, IndONIA = 5, and ZARONIA = 3.	required: N type: integer	Rate rounding is done on the percentage value of the calculated ARR Compounded Rate. rateRoundingDecimalPoints is not considered when ccrRoundingApplies is set to true.
paymentRounding	Rule to round the calculated interest accrued amounts. Default Value: Nearest Enum: [ACTUAL, UP, DOWN, NEAREST]	required: N type: string	--
principalAmountChange	The amount of the Principal Change. Principal Decreases are negative. Principal Change Currency is assumed as USD if riskFreeRate = SOFR, GBP if riskFreeRate = SONIA, EUR if riskFreeRate = ESTR, JPY if riskFreeRate = TONAR, SGD if riskFreeRate = SORA, IDR if riskFreeRate = IndONIA, ZAR if riskFreeRate = ZARONIA.	required: N type: number	The API returns an error if Principal changes beyond *calculateTillDate* are provided in the input.
date	Date from which the Principal change is effective from.	required: N type: string	--
showDailyDetails	Indicates whether the Calculated Compounded Rates in the output appear for all business days (Value = True) OR only for the calculateTillDate or last business day for the interest period (Value = False), based on whether calculateTillDate is outside the rates-known window or not, respectively Default value: false	required: N type: Boolean	--

Input Attribute Name	Description and Validation	Characteristics	Additional Remarks
calculateTillDate	The Date up to (and including) which the calculated compounded rates are expected in the output. The date is in ISO 8601 Date Format yyyy-mm-dd. **Note:** If the rates are known on calculatetTillDate, then the output appears for the entire business cycle, else the output appears only until the calculateTillDate (if rates are available).	required: N type: string	--

Output Attribute Name	Description	Additional Remarks
calculatedDailyCompoundingInterest	• If showDailyDetails = true, interestSummary displays the averageCompoundedRate upto (and including) calculateTillDate, if it is outside the Rate Known Window, or up to (and including) the interestPeriodEndDate otherwise. • If showDailyDetails = false, interestSummary displays the averageCompoundedRate only for calculateTillDate, if it is outside the Rate Known Window, or only for the last business day for the interest period otherwise.	If calculateTillDate is not provided and rates are known for the interest period, then the output appears for all business days in the interest period else error message will be displayed. The following attributes are supported for multi-record: • interestPeriodDate • interestPeriodDays • observationPeriodDate • observationPeriodDays • principalBalance • publishedRiskFreeRate • rateApplied • riskFreeRateFloorApplied • dailyCompoundedRate • allInRate • interestAmount • cummulativeInterestAmount
principalBalance	Principal balance as on interestPeriodDate	--

Output Attribute Name	Description	Additional Remarks
lookBackDate	**Available in version 1.7.x and later.** Lookback Date displays the corresponding date for which the publishedRiskFreeRate is displayed. This date is derived based on the lookBackDays and the interestPeriodDate. Not displayed when: 1. lookBackDays is not provided OR 2. observationPeriodShift=TRUE	--
observationPeriodDate	The date in the observation period for which the published ARR rate (rateApplied) and the corresponding weightage of that rate is used for ARR Compounding calculation. Populated only if the observationPeriodShift is True Observation Period is defined as commencing 'x' number of "business" days (lookback days) prior to the start (first day) of the interest period. The date is in ISO 8601 Date Format yyyy-mm-dd	--
observationPeriodDays	Number of days in the observation period (from and including the start of Observation Period). Populated only if the *observationPeriodShift* is True	--
interestPeriodDate	The date in the interest period for which calculated ARR Compounded Rate is displayed in the output. The date is in ISO 8601 Date Format yyyy-mm-dd.	• If interestPeriodStartDate is a non-business day, then interestPeriodDate for the first CalculatedDailyCompoundingInterest record is same as the interestPeriodStartDate • If calculateTillDate is a non- business day, then the previous business date is shown as interestPeriodDate for that CalculatedDailyCompoundingInterest record.
interestPeriodDays	Number of days in the interest period (from and including the interestPeriodStartDate) for which the calculated Compounded Rate is applicable	--
publishedRiskFreeRate	**Available in version 1.2.x and later.** The published ARR rate applied for the interestPeriodDate (if observationPeriodShift = false) or observationPeriodDate (if observationPeriodShift = true)	--

Output Attribute Name	Description	Additional Remarks
rateApplied	The ARR Rate applied (percentage) This field's value is the higher of publishedRiskFreeRate and the riskFreeRateFloor/derivedRiskFreeRateFloor(as applicable).	--
riskFreeRateFloorApplied	**Available in version 1.2.x and later.** Indicates whether the riskFreeRateFloor value has been factored in for the interestPeriodDate (Value = TRUE) or not (Value = FALSE). The riskFreeRateFloor value is applied on the publishedRiskFreeRate.	--
allInRateFloorApplied	**Available in version 1.3.x and later.** Indicates whether the allInRate has factored the allInRateFloor value, for the interestPeriodDate (Value = true) or not (Value = false). Appears only if allInRateFloor is provided	--
allInRateCapApplied	**Available in version 1.3.x and later.** Indicates whether the allInRate has factored the riskFreeCapFloor value, for the interestPeriodDate (Value = true) or not (Value = false). Appears only if allInRateCap is provided.	--
calculatedAllInRate	**Available in version 1.3.x and later.** The calculated All-in Rate before applying the All in Rate Cap or Floor. Equals sum of averageCompoundedRate, spread, and spreadAdjustment, rounded to roundingDecimalPoints. Appears only if allInRateFloor or allInRateCap is provided.	If ccrRoundingApplies is set to true, then the calculatedAllInRate as sum of unrounded dailyCompoundedRate, Spread and Spread Adjustment and is displayed up to 12 decimals, else (ccrRoundingApplies is set to false) calculatedAllInRate as sum of rounded dailyCompoundedRate, spread and spread adjustment rounded as per rate roundingDecimalPoints.
allInRate	The All-in Rate applied, after factoring in the allInRateFloor or allInRateCap value, to the calculatedAllInRate Value, based on the following criteria, rounded to rateRoundingDecimalPoints. This field is used for accrued interest computation. • If the calculatedAllInRate is lower than the allInRateFloor value, rateApplied = allInRateFloor. • If the calculatedAllInRate is greater than the allInRateCap value, rateApplied = allInRateCap. Otherwise, allInRate = calculatedAllInRate.	If ccrRoundingApplies is set to true, then the All-in Rate applied displays unrounded value up to 12 decimals, else (ccrRoundingApplies is set to false) All-in Rate applied is rounded as per rate roundingDecimalPoints.

Output Attribute Name	Description	Additional Remarks
cumulativeInterestAmount	Calculated cumulative interest accrued amount for all the interestPeriodDays from (and including) the interestPeriodStartDate. Rate Basis used for interest computation is as per DayCountConvention.	Unrounded interest amount for each interestPeriodDate date is consider for calculating the cumulativeInterestAmount and the final value is rounded as per paymentRounding.
interestAmount	Calculated interest accrued amount from (and including) the interestPeriodDate to (but excluding) the next business day. Rate Basis used for interest computation is as per DayCountConvention.	Interest amount calculated for each interest period date is rounded as per paymentRounding.
compoundingFactor	Ratio of dailyCompoundedRate and the rateApplied	If rateApplied = 0 for the first interest period date, then the compounding factor is set as 1 else the previous days compounding factor is applied. The compoundingFactor is not rounded as per rateRoundingDecimalPoints and is displayed up to 12 decimal points.
derivedRiskFreeRateFloor	**Available in version 1.5.x and later.** The Derived Risk Free Rate Floor Value (percentage) calculated as a difference between legacyRiskFreeRateFloor and spreadAdjustment. Will be displayed only if legacyRiskFreeRateFloor is provided and riskFreeRateFloor is not provided. This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations. The derivedRiskFreeRateFloor value is applied on the publishedRiskFreeRate.	--
derivedRiskFreeRateFloorApplied	**Available in version 1.5.x and later.** Indicates whether the derivedRiskFreeRateFloor value has been factored in for the interestPeriodDate (Value = TRUE) or not (Value = FALSE). This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations. The derivedRiskFreeRateFloor value is applied on the publishedRiskFreeRate.	--

Output Attribute Name	Description	Additional Remarks
dailyCompoundedRate	The calculated Daily Compounded Rate (Non Cumulative Compounded Rate) as a percentage, applicable for the interestPeriodDays, rounded to rateRoundingDecimalPoints, if ccrRoundingApplies =false. (dot) is the only character supported for decimal place separator.This field's value provides the calculated Daily Compounded Rate (Non Cumulative Compounded Rate).	If ccrRoundingApplies is set to true, then the unrounded dailyCompoundedRate is displayed up to 12 decimals. If ccrRoundingApplies is set to false, then the dailyCompoundedRate rounded as per rateRoundingDecimals is displayed.
currencyCode	Currency code for the principalBalance and cumulativeInterestAmount	--
comment	It displays the time stamp when the calculation was completed. Format "Computed time : yyyy-MM-dd 'T' HH:mm:ss z Z." Additionally, it shows the date of the most recent published RFR rate available in the Calculator. It may display additional narration for the calculations performed, as required.	--
lastUpdatedFromSource	The most recent timestamp when the published ARR rate data was consumed by the Calculator from Refinitiv. Format in ISO 8601 is “yyyy-MM-dd'T'HH:mm:ssXXX”	--
legalDisclaimer	The End User Terms for using the Risk Free Rates as laid out by the respective benchmark provider.	--

3.5.2 Use Case Examples – Daily Compounded in Arrears (NCCR)

The following are examples of values entered for the input attributes and the resulting output/response from the end point.

3.5.2.1 Example 1: Daily Compounded Rate in Arrears (NCCR) with Lookback

Daily Compounded Rate in Arrears (NCCR) with Lookback and interest period in rates known window.

Input Attribute Name	Value Entered
InitialPrincipalBalance	1000000
interestPeriodStartDate	2020-03-03
interestPeriodEndDate	2020-03-09
riskFreeRate	SOFR

Input Attribute Name	Value Entered
riskFreeRateFloor	2.10
allInRateFloor	0.088055
allInRateCap	1.634570
lookbackdays	3
observationPeriodShift	false
spread	0.5
spreadAdjustment	0.25
rateRoundingDecimalPoints	5
principalAmountChanges	
date	2020-03-05
principalAmountChange	-50000
date	2020-03-06
principalAmountChange	51000
showDailyDetails	true
calculateTillDate	2020-03-07

3.5.2.1.1 Example 1: Output

Note: The output is updated for version 1.7.x.


```
{
    "comment": " The most recent published SOFR RFR rate is available as-of: 2023-06-21. Computed time : 2023-06-
23T08:20:45+00:00. Computed time is the time stamp when the calculation was completed.  Note : SOFR rate was not published on o
r for April 7th, 2023 (Friday) by New York Fed, even though April 7th was a business day as per SIFMA (Securities Industry and
Financial Markets Association). Given that there was no SOFR rate available for April 7th, 2023 Finastra had added April 7th as
 a SOFR publishing holiday in the ARR Calculator. However, based on subsequent feedback from our client base, ARR Working Group
, and conversations with LSTA/LMA, Finastra has decided to keep April 7th 2023 as a business day, with the SOFR rate used for 7
```

```
th April, 2023 to be the same value of the rate for preceding business day, Thursday, April 6th, 2023 (which was published on M
onday, April 10th, 2023). This change will ensure lookback dates are aligned with the market expectation.Note that choosing thi
s approach has a impact on the compounding calculations - For a given interest period that includes 7th Apr, Cumulative Compoun
ded Rate Calculations done on the ARR Calculator (Calculation Method: Average Compounded in Arrears) will not match with publis
hed SOFR Averages or Cumulative Compounded Rate calculated based on published SOFR Index.This change is effective from Monday,
June 12th, 2023 and impacts all the rate calculation methods only for SOFR rate. Other RFR rates are not impacted.Please be adv
ised that if you have used ARR Calculator for rate/interest calculations for SOFR Loans whose interest/lookback/observation per
iod includes 7 April 2023, you may want to relook at the rate/interest calculations if this change impacts those loans.",
    "lastUpdatedFromSource": "2023-06-22T12:35:16+00:00",
    "legalDisclaimer": "Use subject to New York Fed Terms of Use for Select Rate Data.  New York Fed has no liability for your
use.  Refer the following link for more details: https://www.newyorkfed.org/markets/reference-rates-terms-of-use",
    "interestCalculatorCriteria": {
        "initialPrincipalBalance": 1000000.0,
        "interestPeriodStartDate": "2019-08-02",
        "interestPeriodEndDate": "2019-08-15",
        "riskFreeRate": "SOFR",
        "riskFreeRateFloor": 2.1,
        "allInRateFloor": 0.088055,
        "allInRateCap": 1.63457,
        "observationPeriodShift": true,
        "spread": 0,
        "spreadAdjustment": 0,
        "rateRoundingDecimalPoints": 10,
        "legacyRiskFreeRateFloor": -0.6567,
        "ccrRoundingApplies": true,
        "ccrRoundingPrecision": 6,
        "showDailyDetails": true,
        "calculateTillDate": "2019-08-15"
    },
    "currencyCode": "USD",
    "interestSummary": [
        {
            "interestPeriodDate": "2019-08-15",
```

```
        "interestPeriodDays": 1,
        "observationPeriodDate": "2019-08-15",
        "observationPeriodDays": 1,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.18,
        "rateApplied": 2.18,
        "riskFreeRateFloorApplied": false,
        "compoundingFactor": 1.000766055046,
        "dailyCompoundedRate": 2.181670000000,
        "calculatedAllInRate": 2.181670000000,
        "allInRate": 1.634570000000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "interestAmount": 45.40,
        "cummulativeInterestAmount": 635.67
    },
    {
        "interestPeriodDate": "2019-08-14",
        "interestPeriodDays": 1,
        "observationPeriodDate": "2019-08-14",
        "observationPeriodDays": 1,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.13,
        "rateApplied": 2.13,
        "riskFreeRateFloorApplied": false,
        "compoundingFactor": 1.000715492958,
        "dailyCompoundedRate": 2.131524000000,
        "calculatedAllInRate": 2.131524000000,
        "allInRate": 1.634570000000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "interestAmount": 45.40,
        "cummulativeInterestAmount": 590.26
```

```
},
{
    "interestPeriodDate": "2019-08-13",
    "interestPeriodDays": 1,
    "observationPeriodDate": "2019-08-13",
    "observationPeriodDays": 1,
    "principalBalance": 1000000.00,
    "publishedRiskFreeRate": 2.16,
    "rateApplied": 2.16,
    "riskFreeRateFloorApplied": false,
    "compoundingFactor": 1.000650462963,
    "dailyCompoundedRate": 2.161405000000,
    "calculatedAllInRate": 2.161405000000,
    "allInRate": 1.634570000000,
    "allInRateFloorApplied": false,
    "allInRateCapApplied": true,
    "interestAmount": 45.40,
    "cummulativeInterestAmount": 544.86
},
{
    "interestPeriodDate": "2019-08-12",
    "interestPeriodDays": 1,
    "observationPeriodDate": "2019-08-12",
    "observationPeriodDays": 1,
    "principalBalance": 1000000.00,
    "publishedRiskFreeRate": 2.12,
    "rateApplied": 2.12,
    "riskFreeRateFloorApplied": false,
    "compoundingFactor": 1.000593867925,
    "dailyCompoundedRate": 2.121259000000,
    "calculatedAllInRate": 2.121259000000,
    "allInRate": 1.634570000000,
    "allInRateFloorApplied": false,
```

```
        "allInRateCapApplied": true,
        "interestAmount": 45.40,
        "cummulativeInterestAmount": 499.45
    },
    {
        "interestPeriodDate": "2019-08-09",
        "interestPeriodDays": 3,
        "observationPeriodDate": "2019-08-09",
        "observationPeriodDays": 3,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.11,
        "rateApplied": 2.11,
        "riskFreeRateFloorApplied": false,
        "compoundingFactor": 1.000416429700,
        "dailyCompoundedRate": 2.110878666667,
        "calculatedAllInRate": 2.110878666667,
        "allInRate": 1.634570000000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "interestAmount": 136.21,
        "cummulativeInterestAmount": 454.05
    },
    {
        "interestPeriodDate": "2019-08-08",
        "interestPeriodDays": 1,
        "observationPeriodDate": "2019-08-08",
        "observationPeriodDays": 1,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.09,
        "rateApplied": 2.1,
        "riskFreeRateFloorApplied": true,
        "compoundingFactor": 1.000358095238,
        "dailyCompoundedRate": 2.100752000000,
```

```
        "calculatedAllInRate": 2.100752000000,
        "allInRate": 1.634570000000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "interestAmount": 45.40,
        "cummulativeInterestAmount": 317.83
    },
    {
        "interestPeriodDate": "2019-08-07",
        "interestPeriodDays": 1,
        "observationPeriodDate": "2019-08-07",
        "observationPeriodDays": 1,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.1,
        "rateApplied": 2.1,
        "riskFreeRateFloorApplied": false,
        "compoundingFactor": 1.000300952381,
        "dailyCompoundedRate": 2.100632000000,
        "calculatedAllInRate": 2.100632000000,
        "allInRate": 1.634570000000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "interestAmount": 45.40,
        "cummulativeInterestAmount": 272.43
    },
    {
        "interestPeriodDate": "2019-08-06",
        "interestPeriodDays": 1,
        "observationPeriodDate": "2019-08-06",
        "observationPeriodDays": 1,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.11,
        "rateApplied": 2.11,
```

```
        "riskFreeRateFloorApplied": false,
        "compoundingFactor": 1.000242654028,
        "dailyCompoundedRate": 2.110512000000,
        "calculatedAllInRate": 2.110512000000,
        "allInRate": 1.634570000000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "interestAmount": 45.40,
        "cummulativeInterestAmount": 227.02
    },
    {
        "interestPeriodDate": "2019-08-05",
        "interestPeriodDays": 1,
        "observationPeriodDate": "2019-08-05",
        "observationPeriodDays": 1,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.13,
        "rateApplied": 2.13,
        "riskFreeRateFloorApplied": false,
        "compoundingFactor": 1.000182159624,
        "dailyCompoundedRate": 2.130388000000,
        "calculatedAllInRate": 2.130388000000,
        "allInRate": 1.634570000000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "interestAmount": 45.40,
        "cummulativeInterestAmount": 181.62
    },
    {
        "interestPeriodDate": "2019-08-02",
        "interestPeriodDays": 3,
        "observationPeriodDate": "2019-08-02",
        "observationPeriodDays": 3,
```

```
            "principalBalance": 1000000.00,
            "publishedRiskFreeRate": 2.19,
            "rateApplied": 2.19,
            "riskFreeRateFloorApplied": false,
            "compoundingFactor": 1.000000000000,
            "dailyCompoundedRate": 2.190000000000,
            "calculatedAllInRate": 2.190000000000,
            "allInRate": 1.634570000000,
            "allInRateFloorApplied": false,
            "allInRateCapApplied": true,
            "interestAmount": 136.21,
            "cummulativeInterestAmount": 136.21
        }
    ]
}
```


3.5.2.2 Example 2: Daily Compounded Rate in Arrears (NCCR) with Lockout

Daily Compounded Rate in Arrears (NCCR) with Lockout and interest period in rates known window

Input Attribute Name	Value Entered
InitialPrincipalBalance	10000000
interestPeriodStartDate	2020-03-03
interestPeriodEndDate	2020-03-09
riskFreeRate	SOFR
riskFreeRateFloor	0
lockoutDays	2
observationPeriodShift	false
spread	0.5
spreadAdjustment	0.25

Input Attribute Name	Value Entered
paymentRounding	ACTUAL
principalAmountChanges	
date	2020-03-05
principal amount change	-50000
date	2020-03-06
principal amount change	51000
showDailyDetails	true
calculateTillDate	2020-03-07

3.5.2.2.1 Example 2: Output

Note: The output is updated for version 1.7.x.


```
{
    "comment": " The most recent published SOFR RFR rate is available as-of: 2023-06-21. Computed time : 2023-06-
23T10:07:47+00:00. Computed time is the time stamp when the calculation was completed.  Note : SOFR rate was not published on o
r for April 7th, 2023 (Friday) by New York Fed, even though April 7th was a business day as per SIFMA (Securities Industry and
Financial Markets Association). Given that there was no SOFR rate available for April 7th, 2023 Finastra had added April 7th as
 a SOFR publishing holiday in the ARR Calculator. However, based on subsequent feedback from our client base, ARR Working Group
, and conversations with LSTA/LMA, Finastra has decided to keep April 7th 2023 as a business day, with the SOFR rate used for 7
th April, 2023 to be the same value of the rate for preceding business day, Thursday, April 6th, 2023 (which was published on M
onday, April 10th, 2023). This change will ensure lookback dates are aligned with the market expectation.Note that choosing thi
s approach has a impact on the compounding calculations - For a given interest period that includes 7th Apr, Cumulative Compoun
ded Rate Calculations done on the ARR Calculator (Calculation Method: Average Compounded in Arrears) will not match with publis
hed SOFR Averages or Cumulative Compounded Rate calculated based on published SOFR Index.This change is effective from Monday,
June 12th, 2023 and impacts all the rate calculation methods only for SOFR rate. Other RFR rates are not impacted.Please be adv
ised that if you have used ARR Calculator for rate/interest calculations for SOFR Loans whose interest/lookback/observation per
iod includes 7 April 2023, you may want to relook at the rate/interest calculations if this change impacts those loans.",
    "lastUpdatedFromSource": "2023-06-22T12:35:16+00:00",
```

```
    "legalDisclaimer": "Use subject to New York Fed Terms of Use for Select Rate Data.  New York Fed has no liability for your
use.  Refer the following link for more details: https://www.newyorkfed.org/markets/reference-rates-terms-of-use",
    "interestCalculatorCriteria": {
        "initialPrincipalBalance": 1000000.0,
        "interestPeriodStartDate": "2019-08-02",
        "interestPeriodEndDate": "2019-08-15",
        "riskFreeRate": "SOFR",
        "riskFreeRateFloor": 2.1,
        "allInRateFloor": 0.088055,
        "allInRateCap": 1.63457,
        "observationPeriodShift": true,
        "spread": 0,
        "spreadAdjustment": 0,
        "rateRoundingDecimalPoints": 10,
        "legacyRiskFreeRateFloor": -0.6567,
        "ccrRoundingApplies": true,
        "ccrRoundingPrecision": 6,
        "showDailyDetails": true,
        "calculateTillDate": "2019-08-15"
    },
    "currencyCode": "USD",
    "interestSummary": [
        {
            "interestPeriodDate": "2019-08-15",
            "interestPeriodDays": 1,
            "observationPeriodDate": "2019-08-15",
            "observationPeriodDays": 1,
            "principalBalance": 1000000.00,
            "publishedRiskFreeRate": 2.18,
            "rateApplied": 2.18,
            "riskFreeRateFloorApplied": false,
            "compoundingFactor": 1.000766055046,
            "dailyCompoundedRate": 2.181670000000,
```

```
        "calculatedAllInRate": 2.181670000000,
        "allInRate": 1.634570000000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "interestAmount": 45.40,
        "cummulativeInterestAmount": 635.67
    },
    {
        "interestPeriodDate": "2019-08-14",
        "interestPeriodDays": 1,
        "observationPeriodDate": "2019-08-14",
        "observationPeriodDays": 1,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.13,
        "rateApplied": 2.13,
        "riskFreeRateFloorApplied": false,
        "compoundingFactor": 1.000715492958,
        "dailyCompoundedRate": 2.131524000000,
        "calculatedAllInRate": 2.131524000000,
        "allInRate": 1.634570000000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "interestAmount": 45.40,
        "cummulativeInterestAmount": 590.26
    },
    {
        "interestPeriodDate": "2019-08-13",
        "interestPeriodDays": 1,
        "observationPeriodDate": "2019-08-13",
        "observationPeriodDays": 1,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.16,
        "rateApplied": 2.16,
```

```
        "riskFreeRateFloorApplied": false,
        "compoundingFactor": 1.000650462963,
        "dailyCompoundedRate": 2.161405000000,
        "calculatedAllInRate": 2.161405000000,
        "allInRate": 1.634570000000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "interestAmount": 45.40,
        "cummulativeInterestAmount": 544.86
    },
    {
        "interestPeriodDate": "2019-08-12",
        "interestPeriodDays": 1,
        "observationPeriodDate": "2019-08-12",
        "observationPeriodDays": 1,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.12,
        "rateApplied": 2.12,
        "riskFreeRateFloorApplied": false,
        "compoundingFactor": 1.000593867925,
        "dailyCompoundedRate": 2.121259000000,
        "calculatedAllInRate": 2.121259000000,
        "allInRate": 1.634570000000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "interestAmount": 45.40,
        "cummulativeInterestAmount": 499.45
    },
    {
        "interestPeriodDate": "2019-08-09",
        "interestPeriodDays": 3,
        "observationPeriodDate": "2019-08-09",
        "observationPeriodDays": 3,
```

```
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.11,
        "rateApplied": 2.11,
        "riskFreeRateFloorApplied": false,
        "compoundingFactor": 1.000416429700,
        "dailyCompoundedRate": 2.110878666667,
        "calculatedAllInRate": 2.110878666667,
        "allInRate": 1.634570000000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "interestAmount": 136.21,
        "cummulativeInterestAmount": 454.05
    },
    {
        "interestPeriodDate": "2019-08-08",
        "interestPeriodDays": 1,
        "observationPeriodDate": "2019-08-08",
        "observationPeriodDays": 1,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.09,
        "rateApplied": 2.1,
        "riskFreeRateFloorApplied": true,
        "compoundingFactor": 1.000358095238,
        "dailyCompoundedRate": 2.100752000000,
        "calculatedAllInRate": 2.100752000000,
        "allInRate": 1.634570000000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "interestAmount": 45.40,
        "cummulativeInterestAmount": 317.83
    },
    {
        "interestPeriodDate": "2019-08-07",
```

```
        "interestPeriodDays": 1,
        "observationPeriodDate": "2019-08-07",
        "observationPeriodDays": 1,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.1,
        "rateApplied": 2.1,
        "riskFreeRateFloorApplied": false,
        "compoundingFactor": 1.000300952381,
        "dailyCompoundedRate": 2.100632000000,
        "calculatedAllInRate": 2.100632000000,
        "allInRate": 1.634570000000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "interestAmount": 45.40,
        "cummulativeInterestAmount": 272.43
    },
    {
        "interestPeriodDate": "2019-08-06",
        "interestPeriodDays": 1,
        "observationPeriodDate": "2019-08-06",
        "observationPeriodDays": 1,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.11,
        "rateApplied": 2.11,
        "riskFreeRateFloorApplied": false,
        "compoundingFactor": 1.000242654028,
        "dailyCompoundedRate": 2.110512000000,
        "calculatedAllInRate": 2.110512000000,
        "allInRate": 1.634570000000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "interestAmount": 45.40,
        "cummulativeInterestAmount": 227.02
```

```
},
{
    "interestPeriodDate": "2019-08-05",
    "interestPeriodDays": 1,
    "observationPeriodDate": "2019-08-05",
    "observationPeriodDays": 1,
    "principalBalance": 1000000.00,
    "publishedRiskFreeRate": 2.13,
    "rateApplied": 2.13,
    "riskFreeRateFloorApplied": false,
    "compoundingFactor": 1.000182159624,
    "dailyCompoundedRate": 2.130388000000,
    "calculatedAllInRate": 2.130388000000,
    "allInRate": 1.634570000000,
    "allInRateFloorApplied": false,
    "allInRateCapApplied": true,
    "interestAmount": 45.40,
    "cummulativeInterestAmount": 181.62
},
{
    "interestPeriodDate": "2019-08-02",
    "interestPeriodDays": 3,
    "observationPeriodDate": "2019-08-02",
    "observationPeriodDays": 3,
    "principalBalance": 1000000.00,
    "publishedRiskFreeRate": 2.19,
    "rateApplied": 2.19,
    "riskFreeRateFloorApplied": false,
    "compoundingFactor": 1.000000000000,
    "dailyCompoundedRate": 2.190000000000,
    "calculatedAllInRate": 2.190000000000,
    "allInRate": 1.634570000000,
    "allInRateFloorApplied": false,
```

```
            "allInRateCapApplied": true,
            "interestAmount": 136.21,
            "cummulativeInterestAmount": 136.21
        }
    ]
}
```

3.5.2.3 Example 3: Daily Compounded Rate in Arrears (NCCR) with Lookback and Observation Period Shift

Daily Compounded Rate in Arrears (NCCR) with observation period shift and interest period in rates known window

Input Attribute Name	Value Entered
InitialPrincipalBalance	10000000
interestPeriodStartDate	2020-03-03
interestPeriodEndDate	2020-03-09
riskFreeRate	SOFR
riskFreeRateFloor	0
lookBackDays	3
observationPeriodShift	true
spread	0.5
spreadAdjustment	0.25
paymentRounding	ACTUAL
principalAmountChanges	
date	2020-03-05
principal amount change	-50000
date	2020-03-06
principal amount change	51000

Input Attribute Name	Value Entered
showDailyDetails	true
calculateTillDate	2020-03-07

3.5.2.3.1 Example 3: Output

Note: The output is updated for version 1.7.x.


```
{
    "comment": " The most recent published SOFR RFR rate is available as-of: 2023-06-21. Computed time : 2023-06-
23T10:08:40+00:00. Computed time is the time stamp when the calculation was completed.  Note : SOFR rate was not published on o
r for April 7th, 2023 (Friday) by New York Fed, even though April 7th was a business day as per SIFMA (Securities Industry and
Financial Markets Association). Given that there was no SOFR rate available for April 7th, 2023 Finastra had added April 7th as
 a SOFR publishing holiday in the ARR Calculator. However, based on subsequent feedback from our client base, ARR Working Group
, and conversations with LSTA/LMA, Finastra has decided to keep April 7th 2023 as a business day, with the SOFR rate used for 7
th April, 2023 to be the same value of the rate for preceding business day, Thursday, April 6th, 2023 (which was published on M
onday, April 10th, 2023). This change will ensure lookback dates are aligned with the market expectation.Note that choosing thi
s approach has a impact on the compounding calculations - For a given interest period that includes 7th Apr, Cumulative Compoun
ded Rate Calculations done on the ARR Calculator (Calculation Method: Average Compounded in Arrears) will not match with publis
hed SOFR Averages or Cumulative Compounded Rate calculated based on published SOFR Index.This change is effective from Monday,
June 12th, 2023 and impacts all the rate calculation methods only for SOFR rate. Other RFR rates are not impacted.Please be adv
ised that if you have used ARR Calculator for rate/interest calculations for SOFR Loans whose interest/lookback/observation per
iod includes 7 April 2023, you may want to relook at the rate/interest calculations if this change impacts those loans.",
    "lastUpdatedFromSource": "2023-06-22T12:35:16+00:00",
    "legalDisclaimer": "Use subject to New York Fed Terms of Use for Select Rate Data.  New York Fed has no liability for your
use.  Refer the following link for more details: https://www.newyorkfed.org/markets/reference-rates-terms-of-use",
    "interestCalculatorCriteria": {
        "initialPrincipalBalance": 1000000.0,
        "interestPeriodStartDate": "2019-08-02",
        "interestPeriodEndDate": "2019-08-15",
        "riskFreeRate": "SOFR",
        "riskFreeRateFloor": 2.1,
```

```
        "allInRateFloor": 0.088055,
        "allInRateCap": 1.63457,
        "observationPeriodShift": true,
        "spread": 0,
        "spreadAdjustment": 0,
        "rateRoundingDecimalPoints": 10,
        "legacyRiskFreeRateFloor": -0.6567,
        "ccrRoundingApplies": true,
        "ccrRoundingPrecision": 6,
        "showDailyDetails": true,
        "calculateTillDate": "2019-08-15"
    },
    "currencyCode": "USD",
    "interestSummary": [
        {
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            "interestPeriodDays": 1,
            "observationPeriodDate": "2019-08-15",
            "observationPeriodDays": 1,
            "principalBalance": 1000000.00,
            "publishedRiskFreeRate": 2.18,
            "rateApplied": 2.18,
            "riskFreeRateFloorApplied": false,
            "compoundingFactor": 1.000766055046,
            "dailyCompoundedRate": 2.181670000000,
            "calculatedAllInRate": 2.181670000000,
            "allInRate": 1.634570000000,
            "allInRateFloorApplied": false,
            "allInRateCapApplied": true,
            "interestAmount": 45.40,
            "cummulativeInterestAmount": 635.67
        },
        {
```

```
        "interestPeriodDate": "2019-08-14",
        "interestPeriodDays": 1,
        "observationPeriodDate": "2019-08-14",
        "observationPeriodDays": 1,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.13,
        "rateApplied": 2.13,
        "riskFreeRateFloorApplied": false,
        "compoundingFactor": 1.000715492958,
        "dailyCompoundedRate": 2.131524000000,
        "calculatedAllInRate": 2.131524000000,
        "allInRate": 1.634570000000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "interestAmount": 45.40,
        "cummulativeInterestAmount": 590.26
    },
    {
        "interestPeriodDate": "2019-08-13",
        "interestPeriodDays": 1,
        "observationPeriodDate": "2019-08-13",
        "observationPeriodDays": 1,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.16,
        "rateApplied": 2.16,
        "riskFreeRateFloorApplied": false,
        "compoundingFactor": 1.000650462963,
        "dailyCompoundedRate": 2.161405000000,
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        "allInRate": 1.634570000000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "interestAmount": 45.40,
```

```
        "cummulativeInterestAmount": 544.86
    },
    {
        "interestPeriodDate": "2019-08-12",
        "interestPeriodDays": 1,
        "observationPeriodDate": "2019-08-12",
        "observationPeriodDays": 1,
        "principalBalance": 1000000.00,
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        "rateApplied": 2.12,
        "riskFreeRateFloorApplied": false,
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        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "interestAmount": 45.40,
        "cummulativeInterestAmount": 499.45
    },
    {
        "interestPeriodDate": "2019-08-09",
        "interestPeriodDays": 3,
        "observationPeriodDate": "2019-08-09",
        "observationPeriodDays": 3,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.11,
        "rateApplied": 2.11,
        "riskFreeRateFloorApplied": false,
        "compoundingFactor": 1.000416429700,
        "dailyCompoundedRate": 2.110878666667,
        "calculatedAllInRate": 2.110878666667,
        "allInRate": 1.634570000000,
```

```
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "interestAmount": 136.21,
        "cummulativeInterestAmount": 454.05
    },
    {
        "interestPeriodDate": "2019-08-08",
        "interestPeriodDays": 1,
        "observationPeriodDate": "2019-08-08",
        "observationPeriodDays": 1,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.09,
        "rateApplied": 2.1,
        "riskFreeRateFloorApplied": true,
        "compoundingFactor": 1.000358095238,
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        "allInRate": 1.634570000000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "interestAmount": 45.40,
        "cummulativeInterestAmount": 317.83
    },
    {
        "interestPeriodDate": "2019-08-07",
        "interestPeriodDays": 1,
        "observationPeriodDate": "2019-08-07",
        "observationPeriodDays": 1,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.1,
        "rateApplied": 2.1,
        "riskFreeRateFloorApplied": false,
        "compoundingFactor": 1.000300952381,
```

```
        "dailyCompoundedRate": 2.100632000000,
        "calculatedAllInRate": 2.100632000000,
        "allInRate": 1.634570000000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
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        "cummulativeInterestAmount": 272.43
    },
    {
        "interestPeriodDate": "2019-08-06",
        "interestPeriodDays": 1,
        "observationPeriodDate": "2019-08-06",
        "observationPeriodDays": 1,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.11,
        "rateApplied": 2.11,
        "riskFreeRateFloorApplied": false,
        "compoundingFactor": 1.000242654028,
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        "allInRate": 1.634570000000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "interestAmount": 45.40,
        "cummulativeInterestAmount": 227.02
    },
    {
        "interestPeriodDate": "2019-08-05",
        "interestPeriodDays": 1,
        "observationPeriodDate": "2019-08-05",
        "observationPeriodDays": 1,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.13,
```

```
            "rateApplied": 2.13,
            "riskFreeRateFloorApplied": false,
            "compoundingFactor": 1.000182159624,
            "dailyCompoundedRate": 2.130388000000,
            "calculatedAllInRate": 2.130388000000,
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            "allInRateFloorApplied": false,
            "allInRateCapApplied": true,
            "interestAmount": 45.40,
            "cummulativeInterestAmount": 181.62
        },
        {
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            "interestPeriodDays": 3,
            "observationPeriodDate": "2019-08-02",
            "observationPeriodDays": 3,
            "principalBalance": 1000000.00,
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            "rateApplied": 2.19,
            "riskFreeRateFloorApplied": false,
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            "calculatedAllInRate": 2.190000000000,
            "allInRate": 1.634570000000,
            "allInRateFloorApplied": false,
            "allInRateCapApplied": true,
            "interestAmount": 136.21,
            "cummulativeInterestAmount": 136.21
        }
    ]
}
```


3.5.2.4 Example 4: Daily Compounded Rate in Arrears (NCCR) with CCR Rounding and Legacy Risk Free Rate Floor

Input Attribute Name	Value Entered
InitialPrincipalBalance	1000000
interestPeriodStartDate	2019-08-02
interestPeriodEndDate	2019-08-15
riskFreeRate	SONIA
spreadAdjustment	0.25
lookBackDays	3
observationPeriodShift	false
allInRateCap	1.634570
allInRateFloor	0.088055
legacyRiskFreeRateFloor	2.9
showDailyDetails	true
ccrRoundingApplies	true
ccrRoundingPrecision	4
calculateTillDate	2019-08-15

3.5.2.4.1 Example 4: Output

Note: The output is updated for version 1.7.x.


```
{
    "comment": " The most recent published SOFR RFR rate is available as-of: 2023-06-21. Computed time : 2023-06-
23T10:17:11+00:00. Computed time is the time stamp when the calculation was completed.  Note : SOFR rate was not published on o
r for April 7th, 2023 (Friday) by New York Fed, even though April 7th was a business day as per SIFMA (Securities Industry and
Financial Markets Association). Given that there was no SOFR rate available for April 7th, 2023 Finastra had added April 7th as
 a SOFR publishing holiday in the ARR Calculator. However, based on subsequent feedback from our client base, ARR Working Group
, and conversations with LSTA/LMA, Finastra has decided to keep April 7th 2023 as a business day, with the SOFR rate used for 7
th April, 2023 to be the same value of the rate for preceding business day, Thursday, April 6th, 2023 (which was published on M
```

```
onday, April 10th, 2023). This change will ensure lookback dates are aligned with the market expectation.Note that choosing thi
s approach has a impact on the compounding calculations - For a given interest period that includes 7th Apr, Cumulative Compoun
ded Rate Calculations done on the ARR Calculator (Calculation Method: Average Compounded in Arrears) will not match with publis
hed SOFR Averages or Cumulative Compounded Rate calculated based on published SOFR Index.This change is effective from Monday,
June 12th, 2023 and impacts all the rate calculation methods only for SOFR rate. Other RFR rates are not impacted.Please be adv
ised that if you have used ARR Calculator for rate/interest calculations for SOFR Loans whose interest/lookback/observation per
iod includes 7 April 2023, you may want to relook at the rate/interest calculations if this change impacts those loans.",
    "lastUpdatedFromSource": "2023-06-22T12:35:16+00:00",
    "legalDisclaimer": "Use subject to New York Fed Terms of Use for Select Rate Data.  New York Fed has no liability for your
use.  Refer the following link for more details: https://www.newyorkfed.org/markets/reference-rates-terms-of-use",
    "interestCalculatorCriteria": {
        "initialPrincipalBalance": 1000000.0,
        "interestPeriodStartDate": "2019-08-02",
        "interestPeriodEndDate": "2019-08-15",
        "riskFreeRate": "SOFR",
        "riskFreeRateFloor": 2.1,
        "allInRateFloor": 0.088055,
        "allInRateCap": 1.63457,
        "observationPeriodShift": true,
        "spread": 0,
        "spreadAdjustment": 0,
        "rateRoundingDecimalPoints": 10,
        "legacyRiskFreeRateFloor": -0.6567,
        "ccrRoundingApplies": true,
        "ccrRoundingPrecision": 6,
        "showDailyDetails": true,
        "calculateTillDate": "2019-08-15"
    },
    "currencyCode": "USD",
    "interestSummary": [
        {
            "interestPeriodDate": "2019-08-15",
            "interestPeriodDays": 1,
```

```
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        "observationPeriodDays": 1,
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        "calculatedAllInRate": 2.181670000000,
        "allInRate": 1.634570000000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "interestAmount": 45.40,
        "cummulativeInterestAmount": 635.67
    },
    {
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        "observationPeriodDate": "2019-08-14",
        "observationPeriodDays": 1,
        "principalBalance": 1000000.00,
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        "rateApplied": 2.13,
        "riskFreeRateFloorApplied": false,
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        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "interestAmount": 45.40,
        "cummulativeInterestAmount": 590.26
    },
```

```
{
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    "principalBalance": 1000000.00,
    "publishedRiskFreeRate": 2.16,
    "rateApplied": 2.16,
    "riskFreeRateFloorApplied": false,
    "compoundingFactor": 1.000650462963,
    "dailyCompoundedRate": 2.161405000000,
    "calculatedAllInRate": 2.161405000000,
    "allInRate": 1.634570000000,
    "allInRateFloorApplied": false,
    "allInRateCapApplied": true,
    "interestAmount": 45.40,
    "cummulativeInterestAmount": 544.86
},
{
    "interestPeriodDate": "2019-08-12",
    "interestPeriodDays": 1,
    "observationPeriodDate": "2019-08-12",
    "observationPeriodDays": 1,
    "principalBalance": 1000000.00,
    "publishedRiskFreeRate": 2.12,
    "rateApplied": 2.12,
    "riskFreeRateFloorApplied": false,
    "compoundingFactor": 1.000593867925,
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    "calculatedAllInRate": 2.121259000000,
    "allInRate": 1.634570000000,
    "allInRateFloorApplied": false,
    "allInRateCapApplied": true,
```

```
        "interestAmount": 45.40,
        "cummulativeInterestAmount": 499.45
    },
    {
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        "interestPeriodDays": 3,
        "observationPeriodDate": "2019-08-09",
        "observationPeriodDays": 3,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.11,
        "rateApplied": 2.11,
        "riskFreeRateFloorApplied": false,
        "compoundingFactor": 1.000416429700,
        "dailyCompoundedRate": 2.110878666667,
        "calculatedAllInRate": 2.110878666667,
        "allInRate": 1.634570000000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "interestAmount": 136.21,
        "cummulativeInterestAmount": 454.05
    },
    {
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        "interestPeriodDays": 1,
        "observationPeriodDate": "2019-08-08",
        "observationPeriodDays": 1,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.09,
        "rateApplied": 2.1,
        "riskFreeRateFloorApplied": true,
        "compoundingFactor": 1.000358095238,
        "dailyCompoundedRate": 2.100752000000,
        "calculatedAllInRate": 2.100752000000,
```

```
        "allInRate": 1.634570000000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "interestAmount": 45.40,
        "cummulativeInterestAmount": 317.83
    },
    {
        "interestPeriodDate": "2019-08-07",
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        "observationPeriodDays": 1,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.1,
        "rateApplied": 2.1,
        "riskFreeRateFloorApplied": false,
        "compoundingFactor": 1.000300952381,
        "dailyCompoundedRate": 2.100632000000,
        "calculatedAllInRate": 2.100632000000,
        "allInRate": 1.634570000000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "interestAmount": 45.40,
        "cummulativeInterestAmount": 272.43
    },
    {
        "interestPeriodDate": "2019-08-06",
        "interestPeriodDays": 1,
        "observationPeriodDate": "2019-08-06",
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        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.11,
        "rateApplied": 2.11,
        "riskFreeRateFloorApplied": false,
```

```
        "compoundingFactor": 1.000242654028,
        "dailyCompoundedRate": 2.110512000000,
        "calculatedAllInRate": 2.110512000000,
        "allInRate": 1.634570000000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "interestAmount": 45.40,
        "cummulativeInterestAmount": 227.02
    },
    {
        "interestPeriodDate": "2019-08-05",
        "interestPeriodDays": 1,
        "observationPeriodDate": "2019-08-05",
        "observationPeriodDays": 1,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.13,
        "rateApplied": 2.13,
        "riskFreeRateFloorApplied": false,
        "compoundingFactor": 1.000182159624,
        "dailyCompoundedRate": 2.130388000000,
        "calculatedAllInRate": 2.130388000000,
        "allInRate": 1.634570000000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "interestAmount": 45.40,
        "cummulativeInterestAmount": 181.62
    },
    {
        "interestPeriodDate": "2019-08-02",
        "interestPeriodDays": 3,
        "observationPeriodDate": "2019-08-02",
        "observationPeriodDays": 3,
        "principalBalance": 1000000.00,
```

```
            "publishedRiskFreeRate": 2.19,
            "rateApplied": 2.19,
            "riskFreeRateFloorApplied": false,
            "compoundingFactor": 1.000000000000,
            "dailyCompoundedRate": 2.190000000000,
            "calculatedAllInRate": 2.190000000000,
            "allInRate": 1.634570000000,
            "allInRateFloorApplied": false,
            "allInRateCapApplied": true,
            "interestAmount": 136.21,
            "cummulativeInterestAmount": 136.21
        }
    ]
}
```

3.6 Interest Calculator – Using Average Compounded in Arrears

Fusion LIBOR Transition Calculator API calculates the ARR rate based on Average Compounded in Arrears and accrued interest amounts for the provided loan parameters such as interest period dates, loan balance amount, and so on, and other ARR parameters, using the daily published risk-free reference rate. Alternative Reference Rates supported are SOFR (USD), SONIA (GBP), ESTR (EUR), TONAR (JPY), SORA (SGD), IndONIA (IDR), and ZARONIA (ZAR).

Important: Beginning with ARR Calculator version 1.8.x, support for **IndONIA** (Indonesian Overnight Index Average) and **ZARONIA** (South African Rand Overnight Index Average) risk-free rates have been added. These newly introduced enhancements are separately licensed and are not available by default with the ARR Calculator API. If you are not licensed for this enhancement and would like more information, contact your Account Manager.

3.6.1 API Input and Output Attributes

The following section lists the user input attributes (request) and the expected output attributes (response).

Input Attribute Name	Description and Validation	Characteristics	Additional Remarks
InitialPrincipalBalance	Principal Balance as on the interestPeriodStartDate. Currency assumed is USD if riskFreeRate = SOFR, GBP if riskFreeRate = SONIA, EUR if riskFreeRate = ESTR, JPY if riskFreeRate = TONAR, SGD if riskFreeRate = SORA, IDR if riskFreeRate = IndONIA, ZAR if riskFreeRate = ZARONIA.	required: Y type: number	--
interestPeriodStartDate	The start date of the interest period from (and including) which the ARR Compounding Calculation must be performed. The date is in ISO 8601 Date Format, that is, yyyy-mm-dd	required: Y type: string	--
interestPeriodEndDate	The end date of the interest period to (and including) which the ARR compounding calculation should be performed. The date is in ISO 8601 Date Format yyyy-mm-dd.	required: Y type: string	• It is also used by the Calculator, along with the calculateTillDate value, to identify if the reference rates are known for the interest period or not, based on rates known window. • If calculateTillDate is not provided, the interest period end date can be an intermediate date in the interest period up to (and including) which the compounded rates are calculated.

Input Attribute Name	Description and Validation	Characteristics	Additional Remarks
riskFreeRate	The name of the Risk Free Rate/Alternative Reference Rate Available values: SOFR, SONIA, SORA, ESTR, TONAR, IndONIA, and ZARONIA.	required: Y type: string	IndONIA and ZARONIA are separately licensed enhancements. If the client (bank) is not licensed for these enhancements but includes it as an input in the API request, the API will return an error.
riskFreeRateFloor	**Available in version 1.2.x and later.** The Floor value (as a percentage) for the published risk-free reference rate. Accepts up to 6 decimal points. Minimum Value = -100, Maximum Value = 100	required: N type: integer	--
legacyRiskFreeRateFloor	**Available in version 1.5.x and later.** Risk Free Rate Floor (percentage) for legacy LIBOR contracts. This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations. Up to 6 decimals points are supported. Minimum Value = -100, Maximum Value = 100 For more information, see Legacy Risk Free Rate Floor section on page **23**.	required: N type: number	--
allInRateFloor	**Available in version 1.3.x and later.** The Floor value (as a percentage) for the all in rate. Accepts up to 6 decimal points. Minimum Value = -100, Maximum Value = 100	required: N type: integer	--
allInRateCap	**Available in version 1.3.x and later.** The Cap value (as a percentage) for the all in rate. Accepts up to 6 decimal points. Minimum Value = -100, Maximum Value = 100	required: N type: integer	--
lookBackDays	Lookback days refers to the fixed date (business days prior to) from which the calculator is expected to use the published Risk Free Rate/Alternative Reference Rate Minimum Value = 0 (Default), Maximum Value = 99 For more information, see Lookback Days section on page **16**.	required: N type: integer	--

Input Attribute Name	Description and Validation	Characteristics	Additional Remarks
lockoutDays	Lockout days refers to the period (business days) in which the applicable ARR is derived using Lookback days and applied to all the days defined as Lockout days Minimum Value = 0 (Default), Maximum Value = 99, and Default Value = 0 For more information, see Lockout Days section on **16**.	required: N type: integer	--
observationPeriodShift	Indicates whether Observation Period Shift is applicable or not. Not supported if lockout days is non-zero. Values supported are True or False. Default value is False. For more information, see Observation Period Shift section on page **17**.	required: N type: boolean	--
spread	Spread (percentage) applicable during the interest period. Default Value: 0.00%. Up to 6 decimals points are supported. Minimum Value = -100, Maximum Value = 100. Default value is 0.	required: N type: number	--
spreadAdjustment	Spread Adjustment (percentage) during the interest period. Default Value: 0.00%. Minimum Value = -100, Maximum Value = 100. Default value is 0.	required: N type: number	--
dayCountConvention	The Day Count Conventions supported. Valid Value are - ACT/360, ACT/365, and ACT/ACT. Default value: for SOFR = ACT/360, for SONIA = ACT/365, ESTR = ACT/360, TONAR = ACT/365, SORA = ACT/365, IndONIA = ACT/360, ZARONIA = ACT/365.	required: N type: string	--
rateRoundingDecimalPoints	Rounds the calculated ARR Compounded Rate to the specified decimal precision. Minimum Value = 2, Maximum Value = 12 Default value: SOFR = 5, SONIA = 4, ESTR = 4, TONAR = 5, SORA = 4, IndONIA = 5, and ZARONIA = 3.	required: N type: integer	Rate rounding is done on the percentage value.

Input Attribute Name	Description and Validation	Characteristics	Additional Remarks
paymentRounding	Rule to round the calculated interest accrued amounts Default Value: Nearest Enum: [ACTUAL, UP, DOWN, NEAREST]	required: N type: string	--
principalAmountChange	The amount of the Principal Change. Principal Decreases are negative. Principal Change Currency is assumed as USD if riskFreeRate = SOFR, GBP if riskFreeRate = SONIA, EUR if riskFreeRate = ESTR, JPY if riskFreeRate = TONAR, SGD if riskFreeRate = SORA, IDR if riskFreeRate = IndONIA, ZAR if riskFreeRate = ZARONIA.	required: N type: number	The API returns an error if Principal changes beyond *calculateTillDate* are provided in the input.
date	Date from which the Principal change is effective from	required: N type: string	--
showDailyDetails	Indicates whether the Calculated Compounded Rates/Interest computations in the output appear for all business days (Value = True) OR only for the calculateTillDate or last business day for the interest period (Value = False), based on whether calculateTillDate is outside the rates-known window or not, respectively. Default value: false	required: N type: boolean	--
calculateTillDate	The Date up to (and including) which the calculated compounded rates are expected in the output. The date is in ISO 8601 Date Format yyyy-mm-dd. **Note:** If the rates are known on calculatetTillDate, then the output appears for the entire business cycle, else the output appears only until the calculateTillDate (if rates are available).	required: N type: string	--

Output Attribute Name	Description	Additional Remarks
calculatedCompoundedInArrearsInterest	• If showDailyDetails = true, interestSummary displays the averageCompoundedRate upto (and including) calculateTillDate, if it is outside the Rate Known Window, or upto (and including) the interestPeriodEndDate otherwise. • If showDailyDetails = false, interestSummary displays the averageCompoundedRate only for calculateTillDate, if it is outside the Rate Known Window, or only for the last business day for the interest period otherwise.	if calculateTillDate is not provided and rates are known for the interest period, then the output appears for all business days in the interest period else error message will be displayed. The following attributes are supported for multi-record: • interestPeriodDate • interestPeriodDays • observationPeriodDate • observationPeriodDays • principalBalance • publishedRiskFreeRate • rateApplied • riskFreeRateFloorApplied • averageCompoundedRate • allInRate • cummulativeInterestAmount
principalBalance	Principal balance as on interestPeriodDate	--
lookBackDate	**Available in version 1.7.x and later.** Lookback Date displays the corresponding date for which the publishedRiskFreeRate is displayed. This date is derived based on the lookBackDays and the interestPeriodDate. Not displayed when: 1. lookBackDays is not provided OR 2. observationPeriodShift=TRUE	--
interestPeriodDate	The date in the interest period for which calculated ARR Compounded Rate is displayed in the output. The date is in ISO 8601 Date Format yyyy-mm-dd.	• If interestPeriodStartDate is a non-business day, then interestPeriodDate for the first CalculatedCompoundedInArrearsInterest record is same as the interestPeriodStartDate • If calculateTillDate is a non- business day, then the previous business date is shown as interestPeriodDate for that CalculatedCompoundedInArrearsRates record.

Output Attribute Name	Description	Additional Remarks
interestPeriodDays	Number of days in the interest period (from and including the interestPeriodStartDate) for which the calculated Compounded Rate is applicable.	--
observationPeriodDate	The date in the observation period for which the published ARR rate (rateApplied) and the corresponding weightage of that rate is used for ARR Compounding calculation. Populated only if the observationPeriodShift is True. Observation Period is defined as commencing 'x' number of "business" days (lookback days) prior to the start (first day) of the interest period. The date is in ISO 8601 Date Format yyyy-mm-dd.	--
observationPeriodDays	Number of days in the observation period (from and including the start of Observation Period). Populated only if the *observationPeriodShift* is True	--
publishedRiskFreeRate	**Available in version 1.2.x and later.** The published ARR rate applied (percentage) for the interestPeriodDate (if observationPeriodShift = false) or observationPeriodDate (if observationPeriodShift = true).	--
rateApplied	The ARR Rate applied (percentage) This field's value is the higher of publishedRiskFreeRate and the riskFreeRateFloor/derivedRiskFreeRateFloor(as applicable).	--
riskFreeRateFloorApplied	**Available in version 1.2.x and later.** Indicates whether the riskFreeRateFloor value has been factored in for the interestPeriodDate (Value = TRUE) or not (Value = FALSE). The riskFreeRateFloor value is applied on the publishedRiskFreeRate.	--

Output Attribute Name	Description	Additional Remarks
derivedRiskFreeRateFloor	**Available in version 1.5.x and later.** The Derived Risk Free Rate Floor Value (percentage) calculated as a difference between legacyRiskFreeRateFloor and spreadAdjustment. Will be displayed only if legacyRiskFreeRateFloor is provided and riskFreeRateFloor is not provided. This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations. The derivedRiskFreeRateFloor value is applied on the publishedRiskFreeRate.	--
derivedRiskFreeRateFloor Applied	**Available in version 1.5.x and later.** Indicates whether the derivedRiskFreeRateFloor value has been factored in for the interestPeriodDate (Value = TRUE) or not (Value = FALSE). This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations. The derivedRiskFreeRateFloor value is applied on the publishedRiskFreeRate.	--
allInRateFloorApplied	**Available in version 1.3.x and later.** Indicates whether the allInRate has factored the allInRateFloor value, for the interestPeriodDate (Value = true) or not (Value = false). Appears only if allInRateFloor is provided.	--
allInRateCapApplied	**Available in version 1.3.x and later.** Indicates whether the allInRate has factored the riskFreeCapFloor value, for the interestPeriodDate (Value = true) or not (Value = false). Appears only if allInRateCap is provided.	--
calculatedAllInRate	**Available in version 1.3.x and later.** The calculated All-in Rate (percentage) before applying the All in Rate Cap or Floor. Equals sum of averageCompoundedRate, spread, and spreadAdjustment, rounded to roundingDecimalPoints. Appears only if allInRateFloor or allInRateCap is provided.	--

Output Attribute Name	Description	Additional Remarks
allInRate	The All-in Rate applied (percentage), after factoring in the allInRateFloor or allInRateCap value, to the calculatedAllInRate Value, based on the following criteria, rounded to rateRoundingDecimalPoints. This field is used for accrued interest computation. • If the calculatedAllInRate is lower than the allInRateFloor value, rateApplied = allInRateFloor. • If the calculatedAllInRate is greater than the allInRateCap value, rateApplied = allInRateCap. • Otherwise, allInRate = calculatedAllInRate.	--
cummulativeInterest Amount	Calculated cumulative interest accrued amount for the interestPeriodDays. Rate Basis used for interest computation is as per DayCountConvention.	--
averageCompoundedRate	The calculated Average Compounded in Arrears Rate (percentage), applicable for the interestPeriodDays, rounded to rateRoundingDecimalPoints. (dot) is the only character supported for decimal place separator. This field's value provides the calculated Average Compounded in Arrears Rate.	--
currencyCode	Currency code for the principalBalance and cumulativeInterestAmount.	--
comment	It displays the time stamp when the calculation was completed. Format "Computed time : yyyy-MM-dd 'T' HH:mm:ss z Z." Additionally, it shows the date of the most recent published RFR rate available in the Calculator. It may display additional narration for the calculations performed, as required.	--
lastUpdatedFromSource	The most recent timestamp when the published ARR rate data was consumed by the Calculator from Refinitiv. Format in ISO 8601 is “yyyy-MM-dd'T'HH:mm:ssXXX”.	--
legalDisclaimer	The End User Terms for using the Risk Free Rates as laid out by the respective benchmark provider.	--

3.6.2 Use Case Examples – Average Compounded in Arrears

The following are examples of values entered for the input attributes and the resulting output/response from the end point.

3.6.2.1 Example 1: Average Compounded Rate in Arrears with Lookback

Average Compounded Rate in Arrears with Lookback and interest period in rates known window.

Input Attribute Name	Value Entered
InitialPrincipalBalance	10000000
interestPeriodStartDate	2020-03-03
interestPeriodEndDate	2020-03-09
riskFreeRate	SOFR
riskFreeRateFloor	0
allInRateFloor	0.088055
allInRateCap	1.634570
lookbackdays	3
observationPeriodShift	false
spread	0.5
spreadAdjustment	0.25
rateRoundingDecimalPoints	5
principalAmountChanges	
date	2020-03-05
principal amount change	-50000
date	2020-03-06
principal amount change	51000
showDailyDetails	true

Input Attribute Name	Value Entered
calculateTillDate	2020-03-07

3.6.2.1.1 Example 1: Output

Note: The output is updated for version 1.7.x.


```
{
    "comment": " The most recent published SOFR RFR rate is available as-of: 2023-06-21. Computed time : 2023-06-
23T10:34:39+00:00. Computed time is the time stamp when the calculation was completed.  Note : SOFR rate was not published on o
r for April 7th, 2023 (Friday) by New York Fed, even though April 7th was a business day as per SIFMA (Securities Industry and
Financial Markets Association). Given that there was no SOFR rate available for April 7th, 2023 Finastra had added April 7th as
 a SOFR publishing holiday in the ARR Calculator. However, based on subsequent feedback from our client base, ARR Working Group
, and conversations with LSTA/LMA, Finastra has decided to keep April 7th 2023 as a business day, with the SOFR rate used for 7
th April, 2023 to be the same value of the rate for preceding business day, Thursday, April 6th, 2023 (which was published on M
onday, April 10th, 2023). This change will ensure lookback dates are aligned with the market expectation.Note that choosing thi
s approach has a impact on the compounding calculations - For a given interest period that includes 7th Apr, Cumulative Compoun
ded Rate Calculations done on the ARR Calculator (Calculation Method: Average Compounded in Arrears) will not match with publis
hed SOFR Averages or Cumulative Compounded Rate calculated based on published SOFR Index.This change is effective from Monday,
June 12th, 2023 and impacts all the rate calculation methods only for SOFR rate. Other RFR rates are not impacted.Please be adv
ised that if you have used ARR Calculator for rate/interest calculations for SOFR Loans whose interest/lookback/observation per
iod includes 7 April 2023, you may want to relook at the rate/interest calculations if this change impacts those loans.",
    "lastUpdatedFromSource": "2023-06-22T12:35:16+00:00",
    "legalDisclaimer": "Use subject to New York Fed Terms of Use for Select Rate Data.  New York Fed has no liability for your
use.  Refer the following link for more details: https://www.newyorkfed.org/markets/reference-rates-terms-of-use",
    "interestCalculatorCriteria": {
        "initialPrincipalBalance": 1000000.0,
        "interestPeriodStartDate": "2019-08-02",
        "interestPeriodEndDate": "2019-08-15",
        "riskFreeRate": "SOFR",
        "riskFreeRateFloor": 2.1,
        "allInRateFloor": 0.088055,
        "allInRateCap": 1.63457,
```

```
        "spread": 0,
        "spreadAdjustment": 0,
        "rateRoundingDecimalPoints": 10,
        "legacyRiskFreeRateFloor": -0.6567,
        "showDailyDetails": true,
        "calculateTillDate": "2019-08-15"
    },
    "currencyCode": "USD",
    "interestSummary": [
        {
            "interestPeriodDate": "2019-08-15",
            "interestPeriodDays": 14,
            "principalBalance": 1000000.00,
            "publishedRiskFreeRate": 2.18,
            "rateApplied": 2.18,
            "riskFreeRateFloorApplied": false,
            "averageCompoundedRate": 2.1386274535,
            "calculatedAllInRate": 2.1386274535,
            "allInRate": 1.6345700000,
            "allInRateFloorApplied": false,
            "allInRateCapApplied": true,
            "cummulativeInterestAmount": 635.67
        },
        {
            "interestPeriodDate": "2019-08-14",
            "interestPeriodDays": 13,
            "principalBalance": 1000000.00,
            "publishedRiskFreeRate": 2.13,
            "rateApplied": 2.13,
            "riskFreeRateFloorApplied": false,
            "averageCompoundedRate": 2.1353156447,
            "calculatedAllInRate": 2.1353156447,
            "allInRate": 1.6345700000,
```

```
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "cummulativeInterestAmount": 590.26
    },
    {
        "interestPeriodDate": "2019-08-13",
        "interestPeriodDays": 12,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.16,
        "rateApplied": 2.16,
        "riskFreeRateFloorApplied": false,
        "averageCompoundedRate": 2.1356322568,
        "calculatedAllInRate": 2.1356322568,
        "allInRate": 1.6345700000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "cummulativeInterestAmount": 544.86
    },
    {
        "interestPeriodDate": "2019-08-12",
        "interestPeriodDays": 11,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.12,
        "rateApplied": 2.12,
        "riskFreeRateFloorApplied": false,
        "averageCompoundedRate": 2.1332890101,
        "calculatedAllInRate": 2.1332890101,
        "allInRate": 1.6345700000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "cummulativeInterestAmount": 499.45
    },
    {
```

```
        "interestPeriodDate": "2019-08-09",
        "interestPeriodDays": 10,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.11,
        "rateApplied": 2.11,
        "riskFreeRateFloorApplied": false,
        "averageCompoundedRate": 2.1344922132,
        "calculatedAllInRate": 2.1344922132,
        "allInRate": 1.6345700000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "cummulativeInterestAmount": 454.05
    },
    {
        "interestPeriodDate": "2019-08-08",
        "interestPeriodDays": 7,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.09,
        "rateApplied": 2.1,
        "riskFreeRateFloorApplied": true,
        "averageCompoundedRate": 2.1446117818,
        "calculatedAllInRate": 2.1446117818,
        "allInRate": 1.6345700000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "cummulativeInterestAmount": 317.83
    },
    {
        "interestPeriodDate": "2019-08-07",
        "interestPeriodDays": 6,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.1,
        "rateApplied": 2.1,
```

```
        "riskFreeRateFloorApplied": false,
        "averageCompoundedRate": 2.1519215500,
        "calculatedAllInRate": 2.1519215500,
        "allInRate": 1.6345700000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "cummulativeInterestAmount": 272.43
    },
    {
        "interestPeriodDate": "2019-08-06",
        "interestPeriodDays": 5,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.11,
        "rateApplied": 2.11,
        "riskFreeRateFloorApplied": false,
        "averageCompoundedRate": 2.1621797329,
        "calculatedAllInRate": 2.1621797329,
        "allInRate": 1.6345700000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "cummulativeInterestAmount": 227.02
    },
    {
        "interestPeriodDate": "2019-08-05",
        "interestPeriodDays": 4,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.13,
        "rateApplied": 2.13,
        "riskFreeRateFloorApplied": false,
        "averageCompoundedRate": 2.1750971813,
        "calculatedAllInRate": 2.1750971813,
        "allInRate": 1.6345700000,
        "allInRateFloorApplied": false,
```

```
            "allInRateCapApplied": true,
            "cummulativeInterestAmount": 181.62
        },
        {
            "interestPeriodDate": "2019-08-02",
            "interestPeriodDays": 3,
            "principalBalance": 1000000.00,
            "publishedRiskFreeRate": 2.19,
            "rateApplied": 2.19,
            "riskFreeRateFloorApplied": false,
            "averageCompoundedRate": 2.1900000000,
            "calculatedAllInRate": 2.1900000000,
            "allInRate": 1.6345700000,
            "allInRateFloorApplied": false,
            "allInRateCapApplied": true,
            "cummulativeInterestAmount": 136.21
        }
    ]
}
```

3.6.2.2 Example 2: Average Compounded Rate in Arrears with Lockout

Average Compounded Rate in Arrears with Lockout and interest period in rates known window.

Input Attribute Name	Value Entered
InitialPrincipalBalance	10000000
interestPeriodStartDate	2020-03-03
interestPeriodEndDate	2020-03-09
riskFreeRate	SOFR
riskFreeRateFloor	0
lockoutDays	2
observationPeriodShift	false
spread	0.5
spreadAdjustment	0.25
paymentRounding	ACTUAL
principalAmountChanges	
date	2020-03-05
principal amount change	-50000
date	2020-03-06
principal amount change	51000
showDailyDetails	true
calculateTillDate	2020-03-07

3.6.2.2.1 Example 2: Output

Note: The output is updated for version 1.7.x.


```
{
    "comment": " The most recent published SOFR RFR rate is available as-of: 2023-06-21. Computed time : 2023-06-
23T10:40:15+00:00. Computed time is the time stamp when the calculation was completed.  Note : SOFR rate was not published on o
r for April 7th, 2023 (Friday) by New York Fed, even though April 7th was a business day as per SIFMA (Securities Industry and
Financial Markets Association). Given that there was no SOFR rate available for April 7th, 2023 Finastra had added April 7th as
 a SOFR publishing holiday in the ARR Calculator. However, based on subsequent feedback from our client base, ARR Working Group
, and conversations with LSTA/LMA, Finastra has decided to keep April 7th 2023 as a business day, with the SOFR rate used for 7
th April, 2023 to be the same value of the rate for preceding business day, Thursday, April 6th, 2023 (which was published on M
onday, April 10th, 2023). This change will ensure lookback dates are aligned with the market expectation.Note that choosing thi
s approach has a impact on the compounding calculations - For a given interest period that includes 7th Apr, Cumulative Compoun
ded Rate Calculations done on the ARR Calculator (Calculation Method: Average Compounded in Arrears) will not match with publis
hed SOFR Averages or Cumulative Compounded Rate calculated based on published SOFR Index.This change is effective from Monday,
June 12th, 2023 and impacts all the rate calculation methods only for SOFR rate. Other RFR rates are not impacted.Please be adv
ised that if you have used ARR Calculator for rate/interest calculations for SOFR Loans whose interest/lookback/observation per
iod includes 7 April 2023, you may want to relook at the rate/interest calculations if this change impacts those loans.",
    "lastUpdatedFromSource": "2023-06-22T12:35:16+00:00",
    "legalDisclaimer": "Use subject to New York Fed Terms of Use for Select Rate Data.  New York Fed has no liability for your
use.  Refer the following link for more details: https://www.newyorkfed.org/markets/reference-rates-terms-of-use",
    "interestCalculatorCriteria": {
        "initialPrincipalBalance": 1000000.0,
        "interestPeriodStartDate": "2019-08-02",
        "interestPeriodEndDate": "2019-08-15",
        "riskFreeRate": "SOFR",
        "riskFreeRateFloor": 2.1,
        "allInRateFloor": 0.088055,
        "allInRateCap": 1.63457,
        "spread": 0,
        "spreadAdjustment": 0,
        "rateRoundingDecimalPoints": 10,
```

```
        "legacyRiskFreeRateFloor": -0.6567,
        "showDailyDetails": true,
        "calculateTillDate": "2019-08-15"
    },
    "currencyCode": "USD",
    "interestSummary": [
        {
            "interestPeriodDate": "2019-08-15",
            "interestPeriodDays": 14,
            "principalBalance": 1000000.00,
            "publishedRiskFreeRate": 2.18,
            "rateApplied": 2.18,
            "riskFreeRateFloorApplied": false,
            "averageCompoundedRate": 2.1386274535,
            "calculatedAllInRate": 2.1386274535,
            "allInRate": 1.6345700000,
            "allInRateFloorApplied": false,
            "allInRateCapApplied": true,
            "cummulativeInterestAmount": 635.67
        },
        {
            "interestPeriodDate": "2019-08-14",
            "interestPeriodDays": 13,
            "principalBalance": 1000000.00,
            "publishedRiskFreeRate": 2.13,
            "rateApplied": 2.13,
            "riskFreeRateFloorApplied": false,
            "averageCompoundedRate": 2.1353156447,
            "calculatedAllInRate": 2.1353156447,
            "allInRate": 1.6345700000,
            "allInRateFloorApplied": false,
            "allInRateCapApplied": true,
            "cummulativeInterestAmount": 590.26
```

```
},
{
    "interestPeriodDate": "2019-08-13",
    "interestPeriodDays": 12,
    "principalBalance": 1000000.00,
    "publishedRiskFreeRate": 2.16,
    "rateApplied": 2.16,
    "riskFreeRateFloorApplied": false,
    "averageCompoundedRate": 2.1356322568,
    "calculatedAllInRate": 2.1356322568,
    "allInRate": 1.6345700000,
    "allInRateFloorApplied": false,
    "allInRateCapApplied": true,
    "cummulativeInterestAmount": 544.86
},
{
    "interestPeriodDate": "2019-08-12",
    "interestPeriodDays": 11,
    "principalBalance": 1000000.00,
    "publishedRiskFreeRate": 2.12,
    "rateApplied": 2.12,
    "riskFreeRateFloorApplied": false,
    "averageCompoundedRate": 2.1332890101,
    "calculatedAllInRate": 2.1332890101,
    "allInRate": 1.6345700000,
    "allInRateFloorApplied": false,
    "allInRateCapApplied": true,
    "cummulativeInterestAmount": 499.45
},
{
    "interestPeriodDate": "2019-08-09",
    "interestPeriodDays": 10,
    "principalBalance": 1000000.00,
```

```
        "publishedRiskFreeRate": 2.11,
        "rateApplied": 2.11,
        "riskFreeRateFloorApplied": false,
        "averageCompoundedRate": 2.1344922132,
        "calculatedAllInRate": 2.1344922132,
        "allInRate": 1.6345700000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "cummulativeInterestAmount": 454.05
    },
    {
        "interestPeriodDate": "2019-08-08",
        "interestPeriodDays": 7,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.09,
        "rateApplied": 2.1,
        "riskFreeRateFloorApplied": true,
        "averageCompoundedRate": 2.1446117818,
        "calculatedAllInRate": 2.1446117818,
        "allInRate": 1.6345700000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "cummulativeInterestAmount": 317.83
    },
    {
        "interestPeriodDate": "2019-08-07",
        "interestPeriodDays": 6,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.1,
        "rateApplied": 2.1,
        "riskFreeRateFloorApplied": false,
        "averageCompoundedRate": 2.1519215500,
        "calculatedAllInRate": 2.1519215500,
```

```
        "allInRate": 1.6345700000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "cummulativeInterestAmount": 272.43
    },
    {
        "interestPeriodDate": "2019-08-06",
        "interestPeriodDays": 5,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.11,
        "rateApplied": 2.11,
        "riskFreeRateFloorApplied": false,
        "averageCompoundedRate": 2.1621797329,
        "calculatedAllInRate": 2.1621797329,
        "allInRate": 1.6345700000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "cummulativeInterestAmount": 227.02
    },
    {
        "interestPeriodDate": "2019-08-05",
        "interestPeriodDays": 4,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.13,
        "rateApplied": 2.13,
        "riskFreeRateFloorApplied": false,
        "averageCompoundedRate": 2.1750971813,
        "calculatedAllInRate": 2.1750971813,
        "allInRate": 1.6345700000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "cummulativeInterestAmount": 181.62
    },
```

```
        {
            "interestPeriodDate": "2019-08-02",
            "interestPeriodDays": 3,
            "principalBalance": 1000000.00,
            "publishedRiskFreeRate": 2.19,
            "rateApplied": 2.19,
            "riskFreeRateFloorApplied": false,
            "averageCompoundedRate": 2.1900000000,
            "calculatedAllInRate": 2.1900000000,
            "allInRate": 1.6345700000,
            "allInRateFloorApplied": false,
            "allInRateCapApplied": true,
            "cummulativeInterestAmount": 136.21
        }
    ]
}
```


3.6.2.3 Example 3: Average Compounded Rate in Arrears with Lookback and Observation Period Shift

Average Compounded Rate in Arrears with observation period shift and interest period in rates known window.

Input Attribute Name	Value Entered
InitialPrincipalBalance	10000000
interestPeriodStartDate	2020-03-03
interestPeriodEndDate	2020-03-09
riskFreeRate	SOFR
riskFreeRateFloor	0
lookBackDays	3
observationPeriodShift	true
spread	0.5
spreadAdjustment	0.25

Input Attribute Name	Value Entered
paymentRounding	ACTUAL
principalAmountChanges	
date	2020-03-05
principal amount change	-50000
date	2020-03-06
principal amount change	51000
showDailyDetails	true
calculateTillDate	2020-03-07

3.6.2.3.1 Example 3: Output

Note: The output is updated for version 1.7.x.


```
{
    "comment": " The most recent published SOFR RFR rate is available as-of: 2023-06-21. Computed time : 2023-06-
23T10:41:37+00:00. Computed time is the time stamp when the calculation was completed.  Note : SOFR rate was not published on o
r for April 7th, 2023 (Friday) by New York Fed, even though April 7th was a business day as per SIFMA (Securities Industry and
Financial Markets Association). Given that there was no SOFR rate available for April 7th, 2023 Finastra had added April 7th as
 a SOFR publishing holiday in the ARR Calculator. However, based on subsequent feedback from our client base, ARR Working Group
, and conversations with LSTA/LMA, Finastra has decided to keep April 7th 2023 as a business day, with the SOFR rate used for 7
th April, 2023 to be the same value of the rate for preceding business day, Thursday, April 6th, 2023 (which was published on M
onday, April 10th, 2023). This change will ensure lookback dates are aligned with the market expectation.Note that choosing thi
s approach has a impact on the compounding calculations - For a given interest period that includes 7th Apr, Cumulative Compoun
ded Rate Calculations done on the ARR Calculator (Calculation Method: Average Compounded in Arrears) will not match with publis
hed SOFR Averages or Cumulative Compounded Rate calculated based on published SOFR Index.This change is effective from Monday,
June 12th, 2023 and impacts all the rate calculation methods only for SOFR rate. Other RFR rates are not impacted.Please be adv
ised that if you have used ARR Calculator for rate/interest calculations for SOFR Loans whose interest/lookback/observation per
iod includes 7 April 2023, you may want to relook at the rate/interest calculations if this change impacts those loans.",
    "lastUpdatedFromSource": "2023-06-22T12:35:16+00:00",
```

```
    "legalDisclaimer": "Use subject to New York Fed Terms of Use for Select Rate Data.  New York Fed has no liability for your
use.  Refer the following link for more details: https://www.newyorkfed.org/markets/reference-rates-terms-of-use",
    "interestCalculatorCriteria": {
        "initialPrincipalBalance": 1000000.0,
        "interestPeriodStartDate": "2019-08-02",
        "interestPeriodEndDate": "2019-08-15",
        "riskFreeRate": "SOFR",
        "riskFreeRateFloor": 2.1,
        "allInRateFloor": 0.088055,
        "allInRateCap": 1.63457,
        "spread": 0,
        "spreadAdjustment": 0,
        "rateRoundingDecimalPoints": 10,
        "legacyRiskFreeRateFloor": -0.6567,
        "showDailyDetails": true,
        "calculateTillDate": "2019-08-15"
    },
    "currencyCode": "USD",
    "interestSummary": [
        {
            "interestPeriodDate": "2019-08-15",
            "interestPeriodDays": 14,
            "principalBalance": 1000000.00,
            "publishedRiskFreeRate": 2.18,
            "rateApplied": 2.18,
            "riskFreeRateFloorApplied": false,
            "averageCompoundedRate": 2.1386274535,
            "calculatedAllInRate": 2.1386274535,
            "allInRate": 1.6345700000,
            "allInRateFloorApplied": false,
            "allInRateCapApplied": true,
            "cummulativeInterestAmount": 635.67
        },
```

```
{
    "interestPeriodDate": "2019-08-14",
    "interestPeriodDays": 13,
    "principalBalance": 1000000.00,
    "publishedRiskFreeRate": 2.13,
    "rateApplied": 2.13,
    "riskFreeRateFloorApplied": false,
    "averageCompoundedRate": 2.1353156447,
    "calculatedAllInRate": 2.1353156447,
    "allInRate": 1.6345700000,
    "allInRateFloorApplied": false,
    "allInRateCapApplied": true,
    "cummulativeInterestAmount": 590.26
},
{
    "interestPeriodDate": "2019-08-13",
    "interestPeriodDays": 12,
    "principalBalance": 1000000.00,
    "publishedRiskFreeRate": 2.16,
    "rateApplied": 2.16,
    "riskFreeRateFloorApplied": false,
    "averageCompoundedRate": 2.1356322568,
    "calculatedAllInRate": 2.1356322568,
    "allInRate": 1.6345700000,
    "allInRateFloorApplied": false,
    "allInRateCapApplied": true,
    "cummulativeInterestAmount": 544.86
},
{
    "interestPeriodDate": "2019-08-12",
    "interestPeriodDays": 11,
    "principalBalance": 1000000.00,
    "publishedRiskFreeRate": 2.12,
```

```
        "rateApplied": 2.12,
        "riskFreeRateFloorApplied": false,
        "averageCompoundedRate": 2.1332890101,
        "calculatedAllInRate": 2.1332890101,
        "allInRate": 1.6345700000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "cummulativeInterestAmount": 499.45
    },
    {
        "interestPeriodDate": "2019-08-09",
        "interestPeriodDays": 10,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.11,
        "rateApplied": 2.11,
        "riskFreeRateFloorApplied": false,
        "averageCompoundedRate": 2.1344922132,
        "calculatedAllInRate": 2.1344922132,
        "allInRate": 1.6345700000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "cummulativeInterestAmount": 454.05
    },
    {
        "interestPeriodDate": "2019-08-08",
        "interestPeriodDays": 7,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.09,
        "rateApplied": 2.1,
        "riskFreeRateFloorApplied": true,
        "averageCompoundedRate": 2.1446117818,
        "calculatedAllInRate": 2.1446117818,
        "allInRate": 1.6345700000,
```

```
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "cummulativeInterestAmount": 317.83
    },
    {
        "interestPeriodDate": "2019-08-07",
        "interestPeriodDays": 6,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.1,
        "rateApplied": 2.1,
        "riskFreeRateFloorApplied": false,
        "averageCompoundedRate": 2.1519215500,
        "calculatedAllInRate": 2.1519215500,
        "allInRate": 1.6345700000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "cummulativeInterestAmount": 272.43
    },
    {
        "interestPeriodDate": "2019-08-06",
        "interestPeriodDays": 5,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.11,
        "rateApplied": 2.11,
        "riskFreeRateFloorApplied": false,
        "averageCompoundedRate": 2.1621797329,
        "calculatedAllInRate": 2.1621797329,
        "allInRate": 1.6345700000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "cummulativeInterestAmount": 227.02
    },
    {
```

```
            "interestPeriodDate": "2019-08-05",
            "interestPeriodDays": 4,
            "principalBalance": 1000000.00,
            "publishedRiskFreeRate": 2.13,
            "rateApplied": 2.13,
            "riskFreeRateFloorApplied": false,
            "averageCompoundedRate": 2.1750971813,
            "calculatedAllInRate": 2.1750971813,
            "allInRate": 1.6345700000,
            "allInRateFloorApplied": false,
            "allInRateCapApplied": true,
            "cummulativeInterestAmount": 181.62
        },
        {
            "interestPeriodDate": "2019-08-02",
            "interestPeriodDays": 3,
            "principalBalance": 1000000.00,
            "publishedRiskFreeRate": 2.19,
            "rateApplied": 2.19,
            "riskFreeRateFloorApplied": false,
            "averageCompoundedRate": 2.1900000000,
            "calculatedAllInRate": 2.1900000000,
            "allInRate": 1.6345700000,
            "allInRateFloorApplied": false,
            "allInRateCapApplied": true,
            "cummulativeInterestAmount": 136.21
        }
    ]
}
```

3.6.2.4 Example 4: Average Compounded Rate in Arrears with Legacy Risk Free Rate Floor

Input Attribute Name	Value Entered
InitialPrincipalBalance	1000000
interestPeriodStartDate	2019-08-02
interestPeriodEndDate	2019-08-15
riskFreeRate	SOFR
spreadAdjustment	0.25
lookBackDays	3
observationPeriodShift	false
allInRateCap	1.634570
allInRateFloor	0.088055
legacyRiskFreeRateFloor	2.9
showDailyDetails	true
calculateTillDate	2019-08-15

3.6.2.4.1 Example 4: Output

Note: The output is updated for version 1.7.x.


```
{
    "comment": " The most recent published SOFR RFR rate is available as-of: 2023-06-21. Computed time : 2023-06-
23T10:44:57+00:00. Computed time is the time stamp when the calculation was completed.  Note : SOFR rate was not published on o
r for April 7th, 2023 (Friday) by New York Fed, even though April 7th was a business day as per SIFMA (Securities Industry and
Financial Markets Association). Given that there was no SOFR rate available for April 7th, 2023 Finastra had added April 7th as
 a SOFR publishing holiday in the ARR Calculator. However, based on subsequent feedback from our client base, ARR Working Group
, and conversations with LSTA/LMA, Finastra has decided to keep April 7th 2023 as a business day, with the SOFR rate used for 7
th April, 2023 to be the same value of the rate for preceding business day, Thursday, April 6th, 2023 (which was published on M
onday, April 10th, 2023). This change will ensure lookback dates are aligned with the market expectation.Note that choosing thi
```

```
s approach has a impact on the compounding calculations - For a given interest period that includes 7th Apr, Cumulative Compoun
ded Rate Calculations done on the ARR Calculator (Calculation Method: Average Compounded in Arrears) will not match with publis
hed SOFR Averages or Cumulative Compounded Rate calculated based on published SOFR Index.This change is effective from Monday,
June 12th, 2023 and impacts all the rate calculation methods only for SOFR rate. Other RFR rates are not impacted.Please be adv
ised that if you have used ARR Calculator for rate/interest calculations for SOFR Loans whose interest/lookback/observation per
iod includes 7 April 2023, you may want to relook at the rate/interest calculations if this change impacts those loans.",
    "lastUpdatedFromSource": "2023-06-22T12:35:16+00:00",
    "legalDisclaimer": "Use subject to New York Fed Terms of Use for Select Rate Data.  New York Fed has no liability for your
use.  Refer the following link for more details: https://www.newyorkfed.org/markets/reference-rates-terms-of-use",
    "interestCalculatorCriteria": {
        "initialPrincipalBalance": 1000000.0,
        "interestPeriodStartDate": "2019-08-02",
        "interestPeriodEndDate": "2019-08-15",
        "riskFreeRate": "SOFR",
        "riskFreeRateFloor": 2.1,
        "allInRateFloor": 0.088055,
        "allInRateCap": 1.63457,
        "spread": 0,
        "spreadAdjustment": 0,
        "rateRoundingDecimalPoints": 10,
        "legacyRiskFreeRateFloor": -0.6567,
        "showDailyDetails": true,
        "calculateTillDate": "2019-08-15"
    },
    "currencyCode": "USD",
    "interestSummary": [
        {
            "interestPeriodDate": "2019-08-15",
            "interestPeriodDays": 14,
            "principalBalance": 1000000.00,
            "publishedRiskFreeRate": 2.18,
            "rateApplied": 2.18,
            "riskFreeRateFloorApplied": false,
```

```
        "averageCompoundedRate": 2.1386274535,
        "calculatedAllInRate": 2.1386274535,
        "allInRate": 1.6345700000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "cummulativeInterestAmount": 635.67
    },
    {
        "interestPeriodDate": "2019-08-14",
        "interestPeriodDays": 13,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.13,
        "rateApplied": 2.13,
        "riskFreeRateFloorApplied": false,
        "averageCompoundedRate": 2.1353156447,
        "calculatedAllInRate": 2.1353156447,
        "allInRate": 1.6345700000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "cummulativeInterestAmount": 590.26
    },
    {
        "interestPeriodDate": "2019-08-13",
        "interestPeriodDays": 12,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.16,
        "rateApplied": 2.16,
        "riskFreeRateFloorApplied": false,
        "averageCompoundedRate": 2.1356322568,
        "calculatedAllInRate": 2.1356322568,
        "allInRate": 1.6345700000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
```

```
        "cummulativeInterestAmount": 544.86
    },
    {
        "interestPeriodDate": "2019-08-12",
        "interestPeriodDays": 11,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.12,
        "rateApplied": 2.12,
        "riskFreeRateFloorApplied": false,
        "averageCompoundedRate": 2.1332890101,
        "calculatedAllInRate": 2.1332890101,
        "allInRate": 1.6345700000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "cummulativeInterestAmount": 499.45
    },
    {
        "interestPeriodDate": "2019-08-09",
        "interestPeriodDays": 10,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.11,
        "rateApplied": 2.11,
        "riskFreeRateFloorApplied": false,
        "averageCompoundedRate": 2.1344922132,
        "calculatedAllInRate": 2.1344922132,
        "allInRate": 1.6345700000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "cummulativeInterestAmount": 454.05
    },
    {
        "interestPeriodDate": "2019-08-08",
        "interestPeriodDays": 7,
```

```
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.09,
        "rateApplied": 2.1,
        "riskFreeRateFloorApplied": true,
        "averageCompoundedRate": 2.1446117818,
        "calculatedAllInRate": 2.1446117818,
        "allInRate": 1.6345700000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "cummulativeInterestAmount": 317.83
    },
    {
        "interestPeriodDate": "2019-08-07",
        "interestPeriodDays": 6,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.1,
        "rateApplied": 2.1,
        "riskFreeRateFloorApplied": false,
        "averageCompoundedRate": 2.1519215500,
        "calculatedAllInRate": 2.1519215500,
        "allInRate": 1.6345700000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "cummulativeInterestAmount": 272.43
    },
    {
        "interestPeriodDate": "2019-08-06",
        "interestPeriodDays": 5,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.11,
        "rateApplied": 2.11,
        "riskFreeRateFloorApplied": false,
        "averageCompoundedRate": 2.1621797329,
```

```
        "calculatedAllInRate": 2.1621797329,
        "allInRate": 1.6345700000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "cummulativeInterestAmount": 227.02
    },
    {
        "interestPeriodDate": "2019-08-05",
        "interestPeriodDays": 4,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.13,
        "rateApplied": 2.13,
        "riskFreeRateFloorApplied": false,
        "averageCompoundedRate": 2.1750971813,
        "calculatedAllInRate": 2.1750971813,
        "allInRate": 1.6345700000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "cummulativeInterestAmount": 181.62
    },
    {
        "interestPeriodDate": "2019-08-02",
        "interestPeriodDays": 3,
        "principalBalance": 1000000.00,
        "publishedRiskFreeRate": 2.19,
        "rateApplied": 2.19,
        "riskFreeRateFloorApplied": false,
        "averageCompoundedRate": 2.1900000000,
        "calculatedAllInRate": 2.1900000000,
        "allInRate": 1.6345700000,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "cummulativeInterestAmount": 136.21
```

```
        }
    ]
}
```

Note: The cumulative interest amount for the interest period of Compounding in Arrears method (Use Case Example 3.5.2.3.1) matches with the of Daily compounding in arrears method (Use Case Example 3.6.2.4.1) when the principal is constant. On 2019-08-15, the cumulative interest amount is 635.67 for both the calculation methods

3.7 Interest Calculator – Using Simple ARR

Note: Available in Fusion LIBOR Transition Calculator API version 1.2.x and later.

Fusion LIBOR Transition Calculator API applies the Simple ARR method and calculates the accrued interest amounts for the provided loan parameters such as interest period dates, loan balance amount, and so on, and other ARR parameters, using the daily published risk-free reference rate. Alternative Reference Rates supported are SOFR (USD) and SONIA (GBP).

3.7.1 API Input and Output Attributes

The following section lists the user input attributes (request) and the expected output attributes (response).

Input Attribute Name	Description and Validation	Characteristics	Additional Remarks
InitialPrincipalBalance	Principal Balance as on the interestPeriodStartDate. Currency assumed is USD if riskFreeRate = SOFR, or GBP if riskFreeRate = SONIA. . (dot) is the only character supported for decimal place separator. Cannot have a thousands separator.	required: Y type: number	--
interestPeriodStartDate	The start date of the interest period. The date is in ISO 8601 Date Format yyyy-mm-dd.	required: Y type: string	--

Input Attribute Name	Description and Validation	Characteristics	Additional Remarks
interestPeriodEndDate	The end date of the interest period to (and including) which the Simple ARR method is applied. The date is in ISO 8601 Date Format yyyy-mm-dd.	required: Y type: string	• It is also used by the Calculator to identify if the interest period is in the rates known window or not. • If calculateTillDate is not provided, the interest period end date can be an intermediate date in the interest period up to (and including) which the published ARR reference Rate is retrieved.
riskFreeRate	The name of the Risk Free Rate/Alternative Reference Rate Available values: SOFR, SONIA	required: Y type: string	--
riskFreeRateFloor	**Available in version 1.2.x and later.** The Floor value (as a percentage) for the published risk-free reference rate. Accepts up to 6 decimal points. Minimum Value = -100, Maximum Value = 100	required: N type: integer	--
legacyRiskFreeRateFloor	**Available in version 1.5.x and later.** Risk Free Rate Floor (percentage) for legacy LIBOR contracts. This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations. Up to 6 decimals points are supported. Minimum Value = -100, Maximum Value = 100 For more information, see Legacy Risk Free Rate Floor section on page **23**.	required: N type: number	--
allInRateFloor	**Available in version 1.3.x and later.** The Floor value (as a percentage) for the all in rate. Accepts up to 6 decimal points. Minimum Value = -100, Maximum Value = 100	required: N type: integer	--
allInRateCap	**Available in version 1.3.x and later.** The Cap value (as a percentage) for the all in rate. Accepts up to 6 decimal points. Minimum Value = -100, Maximum Value = 100	required: N type: integer	--

Input Attribute Name	Description and Validation	Characteristics	Additional Remarks
lookBackDays	Lookback days refers to the fixed date (business days prior to) from which the calculator is expected to use the published Risk Free Rate/Alternative Reference Rate Minimum Value = 0 (Default), Maximum Value = 99 For more information, see Lookback Days section on page **16**.	required: N type: integer	--
lockoutDays	Spread (percentage) applicable during the interest period Default Value: 0.00%. Up to 6 decimals points are supported. Minimum Value = -100, Maximum Value = 100 For more information, see Lockout Days section on **16**.	required: N type: integer	--
spread	Spread (percentage) applicable during the interest period. Default Value: 0.00%. Up to 6 decimals points are supported. Minimum Value = -100, Maximum Value = 100. Default value is 0.	required: N type: number	--
spreadAdjustment	Spread Adjustment (percentage) during the interest period. Default Value: 0.00%. Minimum Value = -100, Maximum Value = 100. Default value is 0.	required: N type: number	--
dayCountConvention	The Day Count Conventions supported. Valid Value are - ACT/360, ACT/365, and ACT/ACT. **Note:** Default value for SOFR is ACT/360, for SONIA is ACT/365.	required: N type: string	--
rateRoundingDecimalPoints	Rounds the calculated ARR Compounded Rate to the specified decimal precision. Minimum Value = 2, Maximum Value = 6 Default value: for SOFR =2, for SONIA = 4	required: N type: integer	Rate rounding is done on the percentage value.
paymentRounding	Rule to round the calculated interest accrued amounts Default Value: Nearest Enum: [ACTUAL, UP, DOWN, NEAREST]	required: N type: string	--

Input Attribute Name	Description and Validation	Characteristics	Additional Remarks
principalAmountChange	The amount of the Principal Change. Principal Decreases are negative. Principal Change Currency is assumed as USD if riskFreeRate = SOFR, or GBP if riskFreeRate = SONIA	required: N type: number	The API returns an error if Principal changes beyond *calculateTillDate* are provided in the input.
date	Date from which the Principal change is effective from	required: N type: string	--
showDailyDetails	Indicates whether ARR Rates/Interest computations in the output appear for all business days (Value = True) OR only for the calculateTillDate or last business day for the interest period (Value = False), based on whether calculateTillDate is outside the rates-known window or not, respectively Default value: false	required: N type: Boolean	--
calculateTillDate	The Date up to (and including) which the calculated compounded rates are expected in the output. The date is in ISO 8601 Date Format yyyy-mm-dd **Note:** If the rates are known on calculatetTillDate, then the output appears for the entire business cycle, else the output appears only until the calculateTillDate (if rates are available).	required: N type: string	--

Output Attribute Name	Description	Additional Remarks
calculatedSimpleARRInterest	• If showDailyDetails = true, interestSummary displays the daily ARR Rates upto (and including) calculateTillDate, if it is outside the Rate Known Window, or up to (and including) the interestPeriodEndDate otherwise. • If showDailyDetails = false,interestSummary displays the daily ARR Rate only for calculateTillDate, if it is outside the Rate Known Window, or only for the last business day for the interest period otherwise.	If calculateTillDate is not provided and rates are known for the interest period, then the output appears for all business days in the interest period else error message will be displayed. The following attributes are supported for multi-record: • interestPeriodDate • interestPeriodDays • publishedRiskFreeRate • rateApplied • riskFreeRateFloorApplied • interestAmount • allInRate • cummulativeInterestAmount
principalBalance	Principal balance as on interestPeriodDate	--
lookBackDate	**Available in version 1.7.x and later.** Lookback Date displays the corresponding date for which the publishedRiskFreeRate is displayed. This date is derived based on the lookBackDays and the interestPeriodDate. Not displayed when: 1. lookBackDays is not provided OR 2. observationPeriodShift=TRUE	**--**
interestPeriodDate	The date in the interest period for which rateApplied is displayed. The date is in ISO 8601 Date Format yyyy-mm-dd.	• If interestPeriodStartDate is a non-business day, then interestPeriodDate for the first calculatedSimpleARRInterest record is same as the interestPeriodStartDate • If calculateTillDate is a non- business day, then the previous business date is shown as interestPeriodDate for that calculatedSimpleARRInterest record.
interestPeriodDays	Number of days in the interest period for which rateApplied is applicable.	--
publishedRiskFreeRate	**Available in version 1.2.x and later.** The published ARR Rate (percentage) for the interestPeriodDate.	--

Output Attribute Name	Description	Additional Remarks
rateApplied	The ARR Rate applied (percentage), after factoring in the riskFreeRateFloor value, for the interestPeriodDate, rounded to rateRoundingDecimalPoints If the published risk-free rate is lower than the floor value, rateApplied = riskFreeRateFloor. Otherwise, rateApplied = publishedRiskFreeRate.	--
riskFreeRateFloorApplied	**Available in version 1.2.x and later.** Indicates whether the rateApplied has factored the riskFreeRateFloor value, for the interestPeriodDate (Value = true) or not (Value = false).	--
allInRateFloorApplied	**Available in version 1.3.x and later.** Indicates whether the allInRate has factored the allInRateFloor value, for the interestPeriodDate (Value = true) or not (Value = false). Appears only if allInRateFloor is provided.	--
allInRateCapApplied	**Available in version 1.3.x and later.** Indicates whether the allInRate has factored the riskFreeCapFloor value, for the interestPeriodDate (Value = true) or not (Value = false). Appears only if allInRateCap is provided.	--
derivedRiskFreeRateFloor	**Available in version 1.5.x and later.** The Derived Risk Free Rate Floor Value (percentage) calculated as a difference between legacyRiskFreeRateFloor and spreadAdjustment. Will be displayed only if legacyRiskFreeRateFloor is provided and riskFreeRateFloor is not provided. This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations.	--
derivedRiskFreeRateFloorApplied	**Available in version 1.5.x and later.** Indicates whether the rateApplied has factored in the derivedRiskFreeRateFloor value, for the interestPeriodDate (Value = true) or not (Value = false). Will be displayed only if legacyRiskFreeRateFloor is provided and riskFreeRateFloor is not provided. This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations.	--

Output Attribute Name	Description	Additional Remarks
calculatedAllInRate	**Available in version 1.3.x and later.** The calculated All-in Rate (percentage) before applying the All in Rate Cap or Floor. Equals sum of averageCompoundedRate, spread, and spreadAdjustment, rounded to roundingDecimalPoints. Appears only if allInRateFloor or allInRateCap is provided.	--
allInRate	The All-in Rate applied (percentage), after factoring in the allInRateFloor or allInRateCap value, to the calculatedAllInRate Value, based on the following criteria, rounded to rateRoundingDecimalPoints. This field is used for accrued interest computation. • If the calculatedAllInRate is lower than the allInRateFloor value, rateApplied = allInRateFloor. • If the calculatedAllInRate is greater than the allInRateCap value, rateApplied = allInRateCap. Otherwise, allInRate = calculatedAllInRate.	--
interestAmount	Calculated interest accrued amount from (and including) the interestPeriodDate to (but excluding) the next business day. Rate Basis used for interest computation is as per DayCountConvention.	Interest amount calculated for each interest period date is rounded as per paymentRounding.
cummulativeInterestAmount	Calculated cumulative interest accrued amount for the interestPeriodDays. Rate Basis used for interest computation is as per DayCountConvention.	Unrounded interest amount for each interestPeriodDate date is consider for calculating the cumulativeInterestAmount and the final value is rounded as per paymentRounding.
currencyCode	Currency code for the principalBalance and cumulativeInterestAmount	--
comment	It displays the time stamp when the calculation was completed. Format "Computed time : yyyy-MM-dd 'T' HH:mm:ss z Z." Additionally, it shows the date of the most recent published RFR rate available in the Calculator. It may display additional narration for the calculations performed, as required.	--
lastUpdatedFromSource	The most recent timestamp when the published ARR rate data was consumed by the Calculator from Refinitiv. Format in ISO 8601 is “yyyy-MM-dd'T'HH:mm:ssXXX”	--
legalDisclaimer	The End User Terms for using the Risk Free Rates as laid out by the respective benchmark provider.	--

3.7.2 Use Case Example – Simple ARR

The following is an example of values entered for the input attributes and the resulting output/response from the end point.

3.7.2.1 Example: Simple ARR with Lookback

Simple ARR with interest period start date and interest period end date along with lookback and interest period in rates known window

Input Attribute Name	Value Entered
InitialPrincipalBalance	1000000
interestPeriodStartDate	2020-03-03
interestPeriodEndDate	2020-03-09
riskFreeRate	SOFR
riskFreeRateFloor	2.10
allInRateFloor	0.088055
allInRateCap	1.634570
lookbackdays	3
spread	0.5
spreadAdjustment	0.25
rateRoundingDecimalPoints	5
principalAmountChanges	
date	2020-03-05
principalAmountChange	-50000
date	2020-03-06
principalAmountChange	51000
showDailyDetails	true
calculateTillDate	2020-03-07

3.7.2.1.1 Example: Output

Note: The output is updated for version 1.7.x.


```
{
    "comment": " The most recent published SOFR RFR rate is available as-of: 2023-07-05. Computed time : 2023-07-
07T09:51:08+00:00. Computed time is the time stamp when the calculation was completed.  Note : SOFR rate was not published on o
r for April 7th, 2023 (Friday) by New York Fed, even though April 7th was a business day as per SIFMA (Securities Industry and
Financial Markets Association). Given that there was no SOFR rate available for April 7th, 2023 Finastra had added April 7th as
 a SOFR publishing holiday in the ARR Calculator. However, based on subsequent feedback from our client base, ARR Working Group
, and conversations with LSTA/LMA, Finastra has decided to keep April 7th 2023 as a business day, with the SOFR rate used for 7
th April, 2023 to be the same value of the rate for preceding business day, Thursday, April 6th, 2023 (which was published on M
onday, April 10th, 2023). This change will ensure lookback dates are aligned with the market expectation.Note that choosing thi
s approach has a impact on the compounding calculations - For a given interest period that includes 7th Apr, Cumulative Compoun
ded Rate Calculations done on the ARR Calculator (Calculation Method: Average Compounded in Arrears) will not match with publis
hed SOFR Averages or Cumulative Compounded Rate calculated based on published SOFR Index.This change is effective from Monday,
June 12th, 2023 and impacts all the rate calculation methods only for SOFR rate. Other RFR rates are not impacted.Please be adv
ised that if you have used ARR Calculator for rate/interest calculations for SOFR Loans whose interest/lookback/observation per
iod includes 7 April 2023, you may want to relook at the rate/interest calculations if this change impacts those loans.",
    "lastUpdatedFromSource": "2023-07-06T12:35:16+00:00",
    "legalDisclaimer": "Use subject to New York Fed Terms of Use for Select Rate Data.  New York Fed has no liability for your
use.  Refer the following link for more details: https://www.newyorkfed.org/markets/reference-rates-terms-of-use",
    "interestCalculatorCriteria": {
        "initialPrincipalBalance": 1000000.0,
        "interestPeriodStartDate": "2020-02-01",
        "interestPeriodEndDate": "2020-02-05",
        "riskFreeRate": "SOFR",
        "riskFreeRateFloor": 0.075,
        "allInRateFloor": 0.088055,
        "allInRateCap": 1.63457,
        "lookBackDays": 1,
        "lockoutDays": 4,
        "spread": 0.5,
```

```
        "spreadAdjustment": 1.5,
        "rateRoundingDecimalPoints": 6,
        "legacyRiskFreeRateFloor": -0.6567,
        "paymentRounding": "ACTUAL",
        "principalAmountChanges": [
            {
                "date": "2020-02-02",
                "principalAmountChange": -50000.0
            }
        ],
        "showDailyDetails": true,
        "calculateTillDate": "2020-02-04"
    },
    "currencyCode": "USD",
    "interestSummary": [
        {
            "interestPeriodDate": "2020-02-05",
            "interestPeriodDays": 1,
            "principalBalance": 950000.00,
            "lookBackDate": "2020-01-31",
            "publishedRiskFreeRate": 1.6,
            "rateApplied": 1.600000,
            "riskFreeRateFloorApplied": false,
            "calculatedAllInRate": 3.600000,
            "allInRate": 1.634570,
            "allInRateFloorApplied": false,
            "allInRateCapApplied": true,
            "interestAmount": 43.13,
            "cummulativeInterestAmount": 217.94
        },
        {
            "interestPeriodDate": "2020-02-04",
            "interestPeriodDays": 1,
```

```
        "principalBalance": 950000.00,
        "lookBackDate": "2020-01-31",
        "publishedRiskFreeRate": 1.6,
        "rateApplied": 1.600000,
        "riskFreeRateFloorApplied": false,
        "calculatedAllInRate": 3.600000,
        "allInRate": 1.634570,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "interestAmount": 43.13,
        "cummulativeInterestAmount": 174.81
    },
    {
        "interestPeriodDate": "2020-02-03",
        "interestPeriodDays": 1,
        "principalBalance": 950000.00,
        "lookBackDate": "2020-01-31",
        "publishedRiskFreeRate": 1.6,
        "rateApplied": 1.600000,
        "riskFreeRateFloorApplied": false,
        "calculatedAllInRate": 3.600000,
        "allInRate": 1.634570,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "interestAmount": 43.13,
        "cummulativeInterestAmount": 131.67
    },
    {
        "interestPeriodDate": "2020-02-02",
        "interestPeriodDays": 1,
        "principalBalance": 950000.00,
        "lookBackDate": "2020-01-31",
        "publishedRiskFreeRate": 1.6,
```

```
            "rateApplied": 1.600000,
            "riskFreeRateFloorApplied": false,
            "calculatedAllInRate": 3.600000,
            "allInRate": 1.634570,
            "allInRateFloorApplied": false,
            "allInRateCapApplied": true,
            "interestAmount": 43.13,
            "cummulativeInterestAmount": 88.54
        },
        {
            "interestPeriodDate": "2020-02-01",
            "interestPeriodDays": 1,
            "principalBalance": 1000000.00,
            "lookBackDate": "2020-01-31",
            "publishedRiskFreeRate": 1.6,
            "rateApplied": 1.600000,
            "riskFreeRateFloorApplied": false,
            "calculatedAllInRate": 3.600000,
            "allInRate": 1.634570,
            "allInRateFloorApplied": false,
            "allInRateCapApplied": true,
            "interestAmount": 45.40,
            "cummulativeInterestAmount": 45.40
        }
    ]
}
```

3.8 Interest Calculator – Using Simple Average

Note: Available in Fusion LIBOR Transition Calculator API version 1.3.x and later.

Fusion LIBOR Transition Calculator API applies the Simple ARR method and calculates the accrued interest amounts for the provided loan parameters such as interest period dates, loan balance amount, and so on, and other ARR parameters, using the daily published risk-free reference rate. Alternative Reference Rates supported are SOFR (USD), SONIA (GBP), ESTR (EUR), TONAR (JPY), SORA (SGD), IndONIA (IDR), and ZARONIA (ZAR).

Important: Beginning with ARR Calculator version 1.8.x, support for **IndONIA** (Indonesian Overnight Index Average) and **ZARONIA** (South African Rand Overnight Index Average) risk-free rates have been added. These newly introduced enhancements are separately licensed and are not available by default with the ARR Calculator API. If you are not licensed for this enhancement and would like more information, contact your Account Manager.

3.8.1 API Input and Output Attributes

The following section lists the user input attributes (request) and the expected output attributes (response).

Input Attribute Name	Description and Validation	Characteristics	Additional Remarks
InitialPrincipalBalance	Principal Balance as on the interestPeriodStartDate. Currency assumed is USD if riskFreeRate = SOFR, GBP if riskFreeRate = SONIA, EUR if riskFreeRate = ESTR, JPY if riskFreeRate = TONAR, SGD if riskFreeRate = SORA, IDR if riskFreeRate = IndONIA, ZAR if riskFreeRate = ZARONIA.	required: Y type: number	--
interestPeriodStartDate	The start date of the interest period from (and including) which the ARR Simple Average Calculation should be performed. The date is in ISO 8601 Date Format yyyy-mm-dd	required: Y type: string	--
interestPeriodEndDate	The end date of the interest period to (and including) which the ARR Simple Average calculation should be performed. The date is in ISO 8601 Date Format yyyy-mm-dd.	required: Y type: string	• It is also used by the Calculator, along with the calculateTillDate value, to identify if the reference rates are known for the interest period or not, based on rates known window. • If calculateTillDate is not provided, the interest period end date can be an intermediate date in the interest period up to (and including) which the compounded rates are calculated.

Input Attribute Name	Description and Validation	Characteristics	Additional Remarks
riskFreeRate	The name of the Risk Free Rate /Alternative Reference Rate Available values: SOFR, SONIA, SORA, ESTR, TONAR, IndONIA, and ZARONIA.	required: Y type: string	IndONIA and ZARONIA are separately licensed enhancements. If the client (bank) is not licensed for these enhancements but includes it as an input in the API request, the API will return an error.
riskFreeRateFloor	The Floor value (as a percentage) for the published risk-free reference rate. Accepts up to 6 decimal points. Minimum Value = -100, Maximum Value = 100	required: N type: integer	--
legacyRiskFreeRateFloor	**Available in version 1.5.x and later.** Risk Free Rate Floor (percentage) for legacy LIBOR contracts. This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations. Up to 6 decimals points are supported. Minimum Value = -100, Maximum Value = 100 For more information, see Legacy Risk Free Rate Floor section on page **23**.	required: N type: number	--
allInRateFloor	The Floor value (as a percentage) for the all in rate. Accepts up to 6 decimal points. Minimum Value = -100, Maximum Value = 100	required: N type: integer	--
allInRateCap	The Cap value (as a percentage) for the all in rate. Accepts up to 6 decimal points. Minimum Value = -100, Maximum Value = 100	required: N type: integer	--
lookBackDays	Lookback days refers to the fixed date (business days prior to) from which the calculator is expected to use the published Risk Free Rate / Alternative Reference Rate Minimum Value = 0, Maximum Value = 99 Default value: 0 For more information, see Lookback Days section on page **16**.	required: N type: integer	--

Input Attribute Name	Description and Validation	Characteristics	Additional Remarks
lockoutDays	Lockout days refers to the period (business days) in which the applicable ARR is derived using Lookback days and applied to all the days defined as Lockout days Minimum Value = 0, Maximum Value = 99 Default value: 0 For more information, see Lockout Days section on **16**.	required: N type: integer	--
observationPeriodShift	Indicates whether Observation Period Shift is applicable or not. Not supported if lockout days is non zero. Default value: false For more information, see Observation Period Shift section on page **17**.	required: N type: boolean	--
spread	Spread (percentage) applicable during the interest period. Default Value: 0.00%. Up to 6 decimals points are supported. Minimum Value = -100, Maximum Value = 100. Default value is 0.	required: N type: number	--
spreadAdjustment	Spread Adjustment (percentage) during the interest period. Default Value: 0.00%. Minimum Value = -100, Maximum Value = 100. Default value is 0.	required: N type: number	--
dayCountConvention	The Day Count Conventions supported. Valid Value are - ACT/360., ACT/365 & ACT/ACT. Default Value: for SOFR= ACT/360, for SONIA = ACT/365, ESTR = ACT/360, TONAR = ACT/365, SORA = ACT/365, IndONIA = ACT/360, ZARONIA = Act/365.	required: N type: string	--
rateRoundingDecimalPoints	Rounds the calculated ARR Simple Average Rate, Calculated All in rate and All-In Rate to the specified decimal precision. Minimum Value = 2, Maximum Value = 12 Default value: SOFR = 5, SONIA = 4, ESTR = 4, TONAR = 5, SORA = 4, IndONIA = 5, and ZARONIA =3.	required: N type: integer	Rate rounding is done on the percentage value.

Input Attribute Name	Description and Validation	Characteristics	Additional Remarks
paymentRounding	Rule to round the calculated interest accrued amounts Default Value: Nearest Enum: [ACTUAL, UP, DOWN, NEAREST]	required: N type: string	--
principalAmountChange	The amount of the Principal Change. Principal Decreases are negative. Principal Change Currency is assumed as USD if riskFreeRate = SOFR, GBP if riskFreeRate = SONIA, EUR if riskFreeRate = ESTR, JPY if riskFreeRate = TONAR, SGD if riskFreeRate = SORA, IDR if riskFreeRate = IndONIA, ZAR if riskFreeRate = ZARONIA.	required: N type: number	The API returns an error if Principal changes beyond *calculateTillDate* are provided in the input.
date	Date from which the Principal change is effective from	required: N type: string	--
showDailyDetails	Indicates whether the Calculated Simple Average Rates/Interest computations in the output appear for all business days (Value = True) OR only for the calculateTillDate or last business day for the interest period (Value = False), based on whether calculateTillDate is outside the rates-known window or not, respectively Default value: false	required: N type: Boolean	--
calculateTillDate	The Date up to (and including) which the calculated Simple average rates are expected in the output. The date is in ISO 8601 Date Format yyyy-mm-dd	required: N type: string	--

Output Attribute Name	Description	Additional Remarks
interestSummary	• If showDailyDetails = true, interestSummary displays the simpleAverageRate up to (and including) calculateTillDate, if it is outside the Rate Known Window, or up to (and including) the interestPeriodEndDate otherwise. • If showDailyDetails = false, interestSummary displays the simpleAverageRate only for calculateTillDate, if it is outside the Rate Known Window, or only for the last business day for the interest period otherwise.	if calculateTillDate is not provided and rates are known for the interest period, then the output appears for all business days in the interest period else error message will be displayed
principalBalance	Principal balance as on interestPeriodDate	--

Output Attribute Name	Description	Additional Remarks
lookBackDate	**Available in version 1.7.x and later.** Lookback Date displays the corresponding date for which the publishedRiskFreeRate is displayed. This date is derived based on the lookBackDays and the interestPeriodDate. Not displayed when: 1. lookBackDays is not provided OR 2. observationPeriodShift=TRUE	--
interestPeriodDate	The date in the interest period for which calculated ARR Average Rate is displayed in the output. The date is in ISO 8601 Date Format yyyy-mm-dd	• If interestPeriodStartDate is a non-business day, then interestPeriodDate for the first CalculatedCompoundedInArrearsInterest record is same as the interestPeriodStartDate • If calculateTillDate is a non- business day, then the previous business date is shown as interestPeriodDate for that CalculatedCompoundedInArrearsRates record.
interestPeriodDays	Number of days in the interest period (from and including the interestPeriodStartDate) for which the calculated Average Rate is applicable.	--
observationPeriodDate	The date in the observation period for which the published ARR rate (rateApplied) and the corresponding weightage of that rate is used for ARR Average calculation. Populated only if the observationPeriodShift is True Observation Period is defined as commencing 'x' number of ""business"" days (lookback days) prior to the start (first day) of the interest period. The date is in ISO 8601 Date Format yyyy-mm-dd	--
observationPeriodDays	Number of days in the observation period (from and including the start of Observation Period). Populated only if the observationPeriodShift is *True*.	--
publishedRiskFreeRate	The published ARR rate applied (percentage) for the interestPeriodDate (if observationPeriodShift = false) or observationPeriodDate (if observationPeriodShift = true).	--
rateApplied	The ARR Rate applied (percentage), after factoring in the riskFreeRateFloor value, for the interestPeriodDate. If the published risk-free rate is lower than the floor value, rateApplied = riskFreeRateFloor. Otherwise, rateApplied = publishedRiskFreeRate	--

Output Attribute Name	Description	Additional Remarks
riskFreeRateFloorApplied	Indicates whether the rateApplied has factored the riskFreeRateFloor value, for the interestPeriodDate (Value = true) or not (Value = false).	--
allInRateFloorApplied	Indicates whether the allInRate has factored the allInRateFloor value, for the interestPeriodDate (Value = true) or not (Value = false). Appears only if allInRateFloor is provided.	--
allInRateCapApplied	Indicates whether the allInRate has factored the riskFreeRateCap value, for the interestPeriodDate (Value = true) or not (Value = false). Appears only if allInRateCap is provided.	--
derivedRiskFreeRateFloor	**Available in version 1.5.x and later.** The Derived Risk Free Rate Floor Value (percentage) calculated as a difference between legacyRiskFreeRateFloor and spreadAdjustment. Will be displayed only if legacyRiskFreeRateFloor is provided and riskFreeRateFloor is not provided. This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations.	--
derivedRiskFreeRateFloorApplied	**Available in version 1.5.x and later.** Indicates whether the rateApplied has factored in the derivedRiskFreeRateFloor value, for the interestPeriodDate (Value = true) or not (Value = false). Will be displayed only if legacyRiskFreeRateFloor is provided and riskFreeRateFloor is not provided. This Aligns with Sterling Risk-Free Reference Rates Working Group Recommendations.	--
calculatedAllInRate	The calculated All-in Rate (percentage) before applying the All in Rate Cap or Floor. Equals sum of simpleAverageRate, spread, and spreadAdjustment, rounded to roundingDecimalPoints. Appears only if allInRateFloor or allInRateCap is provided.	--

Output Attribute Name	Description	Additional Remarks
allInRate	The All-in Rate applied (percentage), after factoring in the allInRateFloor or allInRateCap value, to the calculatedAllInRate Value, based on the following criteria, rounded to rateRoundingDecimalPoints. This field is used for accrued interest computation. • If the calculatedAllInRate is lower than the allInRateFloor value, rateApplied = allInRateFloor. • If the calculatedAllInRate is greater than the allInRateCap value, rateApplied = allInRateCap. • Otherwise, allInRate = calculatedAllInRate	
cumulativeInterestAmount	Calculated cumulative interest accrued amount for the interestPeriodDays. Rate Basis used for interest computation is as per DayCountConvention.	Unrounded interest amount for each interestPeriodDate date is consider for calculating the cumulativeInterestAmount and the final value is rounded as per paymentRounding.
simpleAverageRate	The calculated Simple Average Rate (percentage), applicable for the interestPeriodDays, rounded to rateRoundingDecimalPoints	
currencyCode	Currency code for the principalBalance and cumulativeInterestAmount	
comment	It displays the time stamp when the calculation was completed. Format "Computed time : yyyy-MM-dd 'T' HH:mm:ss z Z." Additionally, it shows the date of the most recent published RFR rate available in the Calculator. It may display additional narration for the calculations performed, as required.	--
lastUpdatedFromSource	The most recent timestamp when the published ARR rate data was consumed by the Calculator from Refinitiv. Format in ISO 8601 is “yyyy-MM-dd'T'HH:mm:ssXXX”	--
legalDisclaimer	The End User Terms for using the Risk Free Rates as laid out by the respective benchmark provider.	--

3.8.2 Use Case Example – Simple Average

The following is an example of values entered for the input attributes and the resulting output/response from the end point.

3.8.2.1 Example 1: Simple Average with Lookback

Simple Average with interest period start date and interest period end date along with lookback and interest period in rates known window

Input Attribute Name	Value Entered
InitialPrincipalBalance	10000000
interestPeriodStartDate	2019-08-01
interestPeriodEndDate	2019-08-09
riskFreeRate	TONAR
riskFreeRateFloor	0
allInRateFloor	0.088055
allInRateCap	1.634570
lookbackdays	3
spread	0.023
spreadAdjustment	0.04567
rateRoundingDecimalPoints	5
principalAmountChanges	
date	2019-08-08
principalAmountChange	-9876.84
showDailyDetails	true
calculateTillDate	2019-08-08

3.8.2.1.1 Example 1: Output

Note: The output is updated for version 1.7.x.


```
{
    "comment": " The most recent published SOFR RFR rate is available as-of: 2023-07-05. Computed time : 2023-07-
07T08:59:59+00:00. Computed time is the time stamp when the calculation was completed.  Note : SOFR rate was not pub
lished on or for April 7th, 2023 (Friday) by New York Fed, even though April 7th was a business day as per SIFMA (Se
curities Industry and Financial Markets Association). Given that there was no SOFR rate available for April 7th, 202
3 Finastra had added April 7th as a SOFR publishing holiday in the ARR Calculator. However, based on subsequent feed
back from our client base, ARR Working Group, and conversations with LSTA/LMA, Finastra has decided to keep April 7t
h 2023 as a business day, with the SOFR rate used for 7th April, 2023 to be the same value of the rate for preceding
 business day, Thursday, April 6th, 2023 (which was published on Monday, April 10th, 2023). This change will ensure
lookback dates are aligned with the market expectation.Note that choosing this approach has a impact on the compound
ing calculations - For a given interest period that includes 7th Apr, Cumulative Compounded Rate Calculations done o
n the ARR Calculator (Calculation Method: Average Compounded in Arrears) will not match with published SOFR Averages
 or Cumulative Compounded Rate calculated based on published SOFR Index.This change is effective from Monday, June 1
2th, 2023 and impacts all the rate calculation methods only for SOFR rate. Other RFR rates are not impacted.Please b
e advised that if you have used ARR Calculator for rate/interest calculations for SOFR Loans whose interest/lookback
/observation period includes 7 April 2023, you may want to relook at the rate/interest calculations if this change i
mpacts those loans.",
    "lastUpdatedFromSource": "2023-07-06T12:35:16+00:00",
    "legalDisclaimer": "Use subject to New York Fed Terms of Use for Select Rate Data.  New York Fed has no liabilit
y for your use.  Refer the following link for more details: https://www.newyorkfed.org/markets/reference-rates-
terms-of-use",
    "interestCalculatorCriteria": {
        "initialPrincipalBalance": 10000000,
        "interestPeriodStartDate": "2019-08-01",
        "interestPeriodEndDate": "2019-08-09",
        "riskFreeRate": "SOFR",
        "riskFreeRateFloor": 0,
        "allInRateFloor": 0.088055,
        "allInRateCap": 1.63457,
        "lookBackDays": 0,
        "lockoutDays": 7,
```

```
        "spread": 0.0023,
        "spreadAdjustment": 0.04567,
        "rateRoundingDecimalPoints": 5,
        "legacyRiskFreeRateFloor": -0.6567,
        "principalAmountChanges": [
            {
                "date": "2019-08-08",
                "principalAmountChange": -9876.84
            }
        ],
        "showDailyDetails": true,
        "calculateTillDate": "2019-08-08"
    },
    "currencyCode": "USD",
    "interestSummary": [
        {
            "interestPeriodDate": "2019-08-09",
            "interestPeriodDays": 9,
            "principalBalance": 9990123.16,
            "lookBackDate": "2019-08-01",
            "publishedRiskFreeRate": 2.19,
            "rateApplied": 2.19,
            "riskFreeRateFloorApplied": false,
            "simpleAverageRate": 2.19000,
            "calculatedAllInRate": 2.23797,
            "allInRate": 1.63457,
            "allInRateFloorApplied": false,
```

```
        "allInRateCapApplied": true,
        "cummulativeInterestAmount": 4085.53
    },
    {
        "interestPeriodDate": "2019-08-08",
        "interestPeriodDays": 8,
        "principalBalance": 9990123.16,
        "lookBackDate": "2019-08-01",
        "publishedRiskFreeRate": 2.19,
        "rateApplied": 2.19,
        "riskFreeRateFloorApplied": false,
        "simpleAverageRate": 2.19000,
        "calculatedAllInRate": 2.23797,
        "allInRate": 1.63457,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "cummulativeInterestAmount": 3631.93
    },
    {
        "interestPeriodDate": "2019-08-07",
        "interestPeriodDays": 7,
        "principalBalance": 10000000.00,
        "lookBackDate": "2019-08-01",
        "publishedRiskFreeRate": 2.19,
        "rateApplied": 2.19,
        "riskFreeRateFloorApplied": false,
        "simpleAverageRate": 2.19000,
```

```
        "calculatedAllInRate": 2.23797,
        "allInRate": 1.63457,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "cummulativeInterestAmount": 3178.33
    },
    {
        "interestPeriodDate": "2019-08-06",
        "interestPeriodDays": 6,
        "principalBalance": 10000000.00,
        "lookBackDate": "2019-08-01",
        "publishedRiskFreeRate": 2.19,
        "rateApplied": 2.19,
        "riskFreeRateFloorApplied": false,
        "simpleAverageRate": 2.19000,
        "calculatedAllInRate": 2.23797,
        "allInRate": 1.63457,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "cummulativeInterestAmount": 2724.28
    },
    {
        "interestPeriodDate": "2019-08-05",
        "interestPeriodDays": 5,
        "principalBalance": 10000000.00,
        "lookBackDate": "2019-08-01",
        "publishedRiskFreeRate": 2.19,
```

```
        "rateApplied": 2.19,
        "riskFreeRateFloorApplied": false,
        "simpleAverageRate": 2.19000,
        "calculatedAllInRate": 2.23797,
        "allInRate": 1.63457,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "cummulativeInterestAmount": 2270.24
    },
    {
        "interestPeriodDate": "2019-08-02",
        "interestPeriodDays": 4,
        "principalBalance": 10000000.00,
        "lookBackDate": "2019-08-01",
        "publishedRiskFreeRate": 2.19,
        "rateApplied": 2.19,
        "riskFreeRateFloorApplied": false,
        "simpleAverageRate": 2.19000,
        "calculatedAllInRate": 2.23797,
        "allInRate": 1.63457,
        "allInRateFloorApplied": false,
        "allInRateCapApplied": true,
        "cummulativeInterestAmount": 1816.19
    },
    {
        "interestPeriodDate": "2019-08-01",
        "interestPeriodDays": 1,
```

```
            "principalBalance": 10000000.00,
            "lookBackDate": "2019-08-01",
        }
    ]
}
```

3.9 Calculated Rates for Tenors

Fusion LIBOR Transition Calculator API calculates the Average Compounded in Arrears rate for a set of tenors (7 days, 30 days, and so on) for the provided date and other ARR parameters, by leveraging the daily published risk-free reference rate. Wherever the published compounded averages are available for a specific tenor, the compounded average value is retrieved as is. Alternative Reference Rates supported are SOFR (USD) and SONIA (GBP).

Note: Applies to Average Compounded in Arrears methodology only.

3.9.1 API Input and Output Attributes

Input Attribute Name	Description and Validation	Characteristics	Additional Remarks
valueDate	The date corresponding to one calendar day following the interest period end date. For Compounding in Advance use cases, this date corresponds to the start of the interest period. Interest period end date corresponds to the date to (and including) which the ARR compounding calculation is performed. Aligns with the definition of publication date of SOFR compounded averages by New York Federal Reserve. The date is in ISO 8601 Date Format yyyy-mm-dd.	required: Y type: number	--
riskFreeRate	The name of the Risk Free Rate/Alternative Reference Rate. Available values: SOFR, SONIA	required: Y type: string	--

Input Attribute Name	Description and Validation	Characteristics	Additional Remarks
tenor	Tenor(s) for which the ARR Compounded Rates are needed. Each Tenor corresponds to an interest period starting (and including) exact number of calendar days in the Tenor before the Value Date, to (but excluding) the Value Date. Available values: 7D, 30D, 60D, 90D, 180D, 360D 'D' denotes the number of calendar days If no value is provided, then Compounded in Arrears Rates are displayed for all the 6 tenors in the output.	required: N type: string	--
rateRoundingDecimalPoints	Rounds the calculated Average Compounded in arrears Rate to the specified decimal precision. Not applicable to SOFR compounded averages for standard tenors (30D, 90D and 180D) published by New York Federal Reserve that are displayed as is in the output. Minimum Value = 2, Maximum Value = 12 **Note:** Default value for SOFR is 5 decimal points, for SONIA is 4 decimal points.	required: N type: integer	--

Output Attribute Name	Description	Additional Remarks
calculatedCompoundedInArrearsRatesForTenors	--	The following attributes are supported for multi-record: • interestPeriodDate • interestPeriodDays • averageCompoundedRate • publishedRate
tenor	Tenor(s) for which the ARR Compounded in Arrears Rates are displayed.	--
interestPeriodStartDate	The start date of the interest period from (and including) which the ARR Compounding Calculation should be performed. The date is in ISO 8601 Date Format yyyy-mm-dd.	--

Output Attribute Name	Description	Additional Remarks
interestPeriodEndDate	The end date to (and including) which the ARR compounding calculation should be performed. This can correspond either to the interest accrual end date or in certain cases, any intermediate date in the interest period up to (and including) which the ARR Compounding Calculation is needed. The date is in ISO 8601 Date Format yyyy-mm-dd.	
averageCompoundedRate	If publishedRate is false, the calculated Average Compounded in Arrears Rate for the tenor, rounded to rateRoundingDecimalPoints. If publishedRate is true, SOFR compounded averages for standard tenors (30D, 90D and 180D) published by New York Federal Reserve are displayed. . (dot) is the only character supported for decimal place separator.	--
publishedRate	Indicates if averageCompoundedRate (percentage) is a calculated rate (Value = false) or a published rate (Value = true).	--
comment	It displays the time stamp when the calculation was completed. Format "Computed time : yyyy-MM-dd 'T' HH:mm:ss z Z." Additionally, it shows the date of the most recent published RFR rate available in the Calculator. It may display additional narration for the calculations performed, as required.	--
lastUpdatedFromSource	The most recent timestamp when the published ARR rate data was consumed by the Calculator from Refinitiv. Format in ISO 8601 is "yyyy-MM-dd'T'HH:mm:ssXXX"	--
legalDisclaimer	The End User Terms for using the Risk Free Rates as laid out by the respective benchmark provider.	--

3.9.2 Use Case Examples

The following are examples of values entered for the input attributes and the resulting output/response from the end point.

3.9.2.1 Example 1: Use the **published** 30 Days SOFR Period Average for Compounding in Advance

For an upcoming 30 days Compounding in Advance interest period starting 03-Mar-2020, the output returns the **published** SOFR Compounded Average for the 30 days period prior to this date (02-Feb-2020 till 02-Mar-2020).

Input Attribute Name	Value Entered
valueDate	2020-03-03
riskFreeRate	SOFR
rateRoundingDecimalPoints	5
tenor	30D

3.9.2.1.1 Example 1: Output

Note: The output is updated for version 1.7.x.


```
{
    "comment": " The most recent published SOFR RFR rate is available as-of: 2023-07-
05. The most recent published SOFR Averages are available as-of: 2023-07-06. Computed time : 2023-07-
07T09:03:22+00:00. Computed time is the time stamp when the calculation was completed.  Note : SOFR rate was not published on o
r for April 7th, 2023 (Friday) by New York Fed, even though April 7th was a business day as per SIFMA (Securities Industry and
Financial Markets Association). Given that there was no SOFR rate available for April 7th, 2023 Finastra had added April 7th as
 a SOFR publishing holiday in the ARR Calculator. However, based on subsequent feedback from our client base, ARR Working Group
, and conversations with LSTA/LMA, Finastra has decided to keep April 7th 2023 as a business day, with the SOFR rate used for 7
th April, 2023 to be the same value of the rate for preceding business day, Thursday, April 6th, 2023 (which was published on M
onday, April 10th, 2023). This change will ensure lookback dates are aligned with the market expectation.Note that choosing thi
s approach has a impact on the compounding calculations - For a given interest period that includes 7th Apr, Cumulative Compoun
ded Rate Calculations done on the ARR Calculator (Calculation Method: Average Compounded in Arrears) will not match with publis
hed SOFR Averages or Cumulative Compounded Rate calculated based on published SOFR Index.This change is effective from Monday,
June 12th, 2023 and impacts all the rate calculation methods only for SOFR rate. Other RFR rates are not impacted.Please be adv
ised that if you have used ARR Calculator for rate/interest calculations for SOFR Loans whose interest/lookback/observation per
iod includes 7 April 2023, you may want to relook at the rate/interest calculations if this change impacts those loans.",
    "lastUpdatedFromSource": "2023-07-06T12:35:16+00:00",
    "legalDisclaimer": "Use subject to New York Fed Terms of Use for Select Rate Data.  New York Fed has no liability for your
use.  Refer the following link for more details: https://www.newyorkfed.org/markets/reference-rates-terms-of-use",
    "requestParameters": {
        "valueDate": "2020-03-03",
        "riskFreeRate": "SOFR",
```

```
        "rateRoundingDecimalPoints": 5,
        "tenor": "30D"
    },
    "calculatedCompoundedInArrearsRatesForTenors": [
        {
            "tenor": "30D",
            "interestPeriodStartDate": "2020-02-02",
            "interestPeriodEndDate": "2020-03-02",
            "averageCompoundedRate": 1.58698,
            "publishedRate": true
        }
    ]
}
```


3.9.2.2 Example 2: Use the **calculated** 60 Days SOFR Period Average for Compounding in Advance

For an upcoming 60 days Compounding in Advance interest period starting 05-Feb-2020, the output returns the **calculated** SOFR Compounded Average for the 60 days period prior to this date (07-Dec-2019 till 04-Feb-2020).

Input Attribute Name	Value Entered
valueDate	2020-02-05
riskFreeRate	SOFR
rateRoundingDecimalPoints	8
tenor	60D

3.9.2.2.1 Example 2: Output

Note: The output is updated for version 1.7.x.


```
{
    "comment": " The most recent published SOFR RFR rate is available as-of: 2023-07-
05. The most recent published SOFR Averages are available as-of: 2023-07-06. Computed time : 2023-07-
```

```
07T09:06:13+00:00. Computed time is the time stamp when the calculation was completed.  Note : SOFR rate was not published on o
r for April 7th, 2023 (Friday) by New York Fed, even though April 7th was a business day as per SIFMA (Securities Industry and
Financial Markets Association). Given that there was no SOFR rate available for April 7th, 2023 Finastra had added April 7th as
 a SOFR publishing holiday in the ARR Calculator. However, based on subsequent feedback from our client base, ARR Working Group
, and conversations with LSTA/LMA, Finastra has decided to keep April 7th 2023 as a business day, with the SOFR rate used for 7
th April, 2023 to be the same value of the rate for preceding business day, Thursday, April 6th, 2023 (which was published on M
onday, April 10th, 2023). This change will ensure lookback dates are aligned with the market expectation.Note that choosing thi
s approach has a impact on the compounding calculations - For a given interest period that includes 7th Apr, Cumulative Compoun
ded Rate Calculations done on the ARR Calculator (Calculation Method: Average Compounded in Arrears) will not match with publis
hed SOFR Averages or Cumulative Compounded Rate calculated based on published SOFR Index.This change is effective from Monday,
June 12th, 2023 and impacts all the rate calculation methods only for SOFR rate. Other RFR rates are not impacted.Please be adv
ised that if you have used ARR Calculator for rate/interest calculations for SOFR Loans whose interest/lookback/observation per
iod includes 7 April 2023, you may want to relook at the rate/interest calculations if this change impacts those loans.",
    "lastUpdatedFromSource": "2023-07-06T12:35:16+00:00",
    "legalDisclaimer": "Use subject to New York Fed Terms of Use for Select Rate Data.  New York Fed has no liability for your
use.  Refer the following link for more details: https://www.newyorkfed.org/markets/reference-rates-terms-of-use",
    "requestParameters": {
        "valueDate": "2020-03-05",
        "riskFreeRate": "SOFR",
        "rateRoundingDecimalPoints": 8,
        "tenor": "60D"
    },
    "calculatedCompoundedInArrearsRatesForTenors": [
        {
            "tenor": "60D",
            "interestPeriodStartDate": "2020-01-05",
            "interestPeriodEndDate": "2020-03-04",
            "averageCompoundedRate": 1.56530347,
            "publishedRate": false
        }
    ]
}
```

3.10 Calculated Rate Based on ARR Index

Fusion LIBOR Transition Calculator API calculates the Average Compounded in Arrears Rate for the provided index start/end dates by leveraging the daily published SOFR Index. The Alternative Reference Rate supported is SOFR (USD).

Note: Applies to Average Compounded in Arrears methodology only. This functionality is only applicable for SOFR.

3.10.1 API Input and Output Attributes

Input Attribute Name	Description and Validation	Characteristics	Additional Remarks
indexStartDate	The Value/Publication Date of the ARR Index corresponding to the start of the interest period. indexStartDate and indexEndDate cannot be the same. The date is in ISO 8601 Date Format yyyy-mm-dd	required: Y type: string	--
indexEndDate	The Value/Publication Date of the ARR Index corresponding to one calendar day following the interest period end date. indexStartDate and indexEndDate cannot be the same. The date is in ISO 8601 Date Format yyyy-mm-dd	required: Y type: string	--
riskFreeRate	The name of the Risk Free Rate /Alternative Reference Rate Available values: SOFR	required: Y type: string	--
rateroundingDecimalPoints	Rounds the calculated Average Compounded in arrears Rate to the specified decimal precision. Minimum Value = 2, Maximum Value = 12 Default value for SOFR = 5.	required: N type: integer	--

Output Attribute Name	Description	Additional Remarks
effectiveStartDate	Corresponds to *indexStartDate*.	This attribute is supported for multi-record.
effectiveEndDate	Corresponds to *indexEndDate*.	This attribute is supported for multi-record.
averageCompoundedRate	The calculated Average Compounded in Arrears Rate (percentage) using the index value, rounded to *roundingDecimalPoints*. This rate corresponds to the interest period starting from (and including) the indexStartDate to (and excluding) the indexEndDate.	This attribute is supported for multi-record.
indexAtEffectiveStartDate	ARR index value for value date equal to *indexStartDate*	This attribute is supported for multi-record.
indexAtEffectiveEndDate	ARR index value for value date equal to *indexEndDate*	This attribute is supported for multi-record.
comment	It displays the time stamp when the calculation was completed. Format "Computed time : yyyy-MM-dd 'T' HH:mm:ss z Z." Additionally, it shows the date of the most recent published RFR rate available in the Calculator. It may display additional narration for the calculations performed, as required.	--
lastUpdatedFromSource	The most recent timestamp when the published ARR rate data was consumed by the Calculator from Refinitiv. Format in ISO 8601 is "yyyy-MM-dd'T'HH:mm:ssXXX".	--
legalDisclaimer	The End User Terms for using the Risk Free Rates as laid out by the respective benchmark provider.	--

3.10.2 Use Case Example

The following is an example of Compounded in Arrears rate using published ARR Index.

3.10.2.1 Example: Average Compounded Rate in Arrears Using Published ARR Index

Input Attribute Name	Value Entered
indexStartDate	2020-03-23
indexEndDate	2020-04-22
riskFreeRate	SOFR

3.10.2.1.1 Example: Output

Note: The output is updated for version 1.7.x.


```
{
    "comment": " The most recent published SOFR Index is available as-of: 2023-07-06. Computed time : 2023-07-
07T09:09:37+00:00. Computed time is the time stamp when the calculation was completed.  Note : SOFR rate was not published on o
r for April 7th, 2023 (Friday) by New York Fed, even though April 7th was a business day as per SIFMA (Securities Industry and
Financial Markets Association). Given that there was no SOFR rate available for April 7th, 2023 Finastra had added April 7th as
 a SOFR publishing holiday in the ARR Calculator. However, based on subsequent feedback from our client base, ARR Working Group
, and conversations with LSTA/LMA, Finastra has decided to keep April 7th 2023 as a business day, with the SOFR rate used for 7
th April, 2023 to be the same value of the rate for preceding business day, Thursday, April 6th, 2023 (which was published on M
onday, April 10th, 2023). This change will ensure lookback dates are aligned with the market expectation.Note that choosing thi
s approach has a impact on the compounding calculations - For a given interest period that includes 7th Apr, Cumulative Compoun
ded Rate Calculations done on the ARR Calculator (Calculation Method: Average Compounded in Arrears) will not match with publis
hed SOFR Averages or Cumulative Compounded Rate calculated based on published SOFR Index.This change is effective from Monday,
June 12th, 2023 and impacts all the rate calculation methods only for SOFR rate. Other RFR rates are not impacted.Please be adv
ised that if you have used ARR Calculator for rate/interest calculations for SOFR Loans whose interest/lookback/observation per
iod includes 7 April 2023, you may want to relook at the rate/interest calculations if this change impacts those loans.",
    "lastUpdatedFromSource": "2023-07-06T12:35:16+00:00",
    "legalDisclaimer": "Use subject to New York Fed Terms of Use for Select Rate Data.  New York Fed has no liability for your
use.  Refer the following link for more details: https://www.newyorkfed.org/markets/reference-rates-terms-of-use",
    "requestParameters": {
        "indexStartDate": "2020-03-23",
        "indexEndDate": "2020-04-22",
        "riskFreeRate": "SOFR"
    },
    "effectiveStartDate": "2020-03-23",
    "effectiveEndDate": "2020-04-22",
    "indexAtEffectiveStartDate": 1.04136531,
    "indexAtEffectiveEndDate": 1.04137919,
    "averageCompoundedRate": 0.01599
}
```

4 API Error Codes and Description

An API error can occur because of multiple reasons, but the most common one is because of an invalid input/bad request. The following is a sample of an error response from Fusion LIBOR Transition Calculator API for an invalid input:

```
{
  "message": "interestPeriodStartDate cannot be greater than interestPeriodEndDate date",
  "type": "https://api.finastra.com/validation-error",
  "title": "STDT_GT_THAN_ENDDT",
  "status": 400,
  "detail": "string"
}
```

The table lists the HyperText Transfer Protocol (HTTP) – **400** (Invalid input provided or bad request) response status codes in Fusion LIBOR Transition Calculator API:

Title	Description
STDT_GT_THAN_ENDDT	interestPeriodStartDate cannot be greater than interestPeriodEndDate date
ENDDT_NULL	interestPeriodEndDate is required
STDT_NULL	interestPeriodStartDate is required
VLDT_NULL	valueDate is required
VLDT_GT_THAN_CURRENTDT	valueDate cannot be greater than current date
DAY_COUNT_CONVENTION_INVALID	Invalid value passed for dayCountConvention
INITIAL_PRINCIPAL_LESS_THAN_CHANGE_AMT	Total principalAmountChange cannot be greater than the initialPrincipalBalance
PRINC_BALANCE_LESS_ZERO	principalAmountChange must not make the Principal Balance negative
STDT_DATA_UNAVAILABLE	Rate is not available for the interestPeriodStartDate provided
ENDDT_DATA_UNAVAILABLE	Rate is not available for the interestPeriodEndDate provided
RISK_FREE_RATE_NULL	riskFreeRate is required
INVALID_RISK_FREE_RATE	Invalid value passed for riskFreeRate

Title	Description
INVALID_DATE_FORMAT	Invalid date or date format for interestPeriodStartDate
INVALID_DATE_FORMAT	Invalid date or date format for interestPeriodEndDate
INVALID_VLDT_DATE_FORMAT	Invalid date or date format for valueDate
INVALID_DAY_CNT_FORMAT	Invalid value passed for dayCountConvention
NO_INDEX_REPO_FOR_START	Index is not available for the indexStartDate provided
NO_INDEX_REPO_FOR_START	indexstartdate is a non-business day. Hence Index is not available
INDEX_ST_GT_END	Index start date is greater than index end date
INDEX_ST_EQ_END	indexStartDate and indexEndDate cannot be the same
NO_INDEX_REPO_FOR_END	Index is not available for the indexEndDate provided
LOOKBACK_DAYS_OUT_OF_RANGE	LookBackDays must be between 0 and 99
LOCKOUT_DAYS_OUT_OF_RANGE	LockOutDays must be between 0 and 99
ROUNDING_DPS_OUT_OF_RANGE	rateRoundingDecimalPoints must be between 2 to 12
INITIAL_PRINCIPAL_BALANCE_NEGATIVE_OR_NULL	initialPrincipalBalance cannot be null or less than or equal to 0
PRINC_CHANGE_AFTER_END	Principal amount change date cannot be after interestPeriodEndDate
PRINC_CHANGE_BEFORE_START	Principal change date cannot be before interestPeriodStartDate
PRINC_CHANGE_DATE_ISNULL	Principal amount change date cannot be null
PRINC_CHANGE_IN_FUTURE	Principal change date is greater than current date
INVALID_PRINC_CHANGE_FORMAT	Invalid date or date format for principal amount change date
SPREAD_NEGATIVE	spread percentage cannot be negative
SPREAD_ADJUSTMENT_NEGATIVE	spreadAdjustment percentage cannot be negative
RATE_ROUNDING_DPS_OUT_OF_RANGE	rateRoundingDecimalPoints must be between 2 to 12
RATE_ROUNDING_INVALID	Invalid value passed for rateRoundingDecimalPoints
INTERNAL_SERVER_ERROR	An internal error occurred please try after some time

Title	Description
INVALID_OBS_SHIFT	observationPeriodShift with lockOutdays having non zero values is not supported
NUMERIC_COMMA_CHECK	The COMMA (thousand seperator) symbol is not allowed for number Formats
NUMERIC_INVALID_FORMAT_SPREAD	Invalid value passed for spread
NUMERIC_INVALID_FORMAT_SPRD_ADJ	Invalid value passed for spreadAdjustment
NUMERIC_INVALID_FORMAT_INITPRIN	Invalid value passed for initialPrincipalBalance
NUMERIC_INVALID_FORMAT_PRIN	Invalid value passed for principalChangeAmount
SPREAD_OUT_RANGE	spread must not be greater than 100%
SPREADADJ_OUT_RANGE	spreadAdjustment must not be greater than 100%
PAYMENT_RND_INVALID	Invalid value passed for paymentRounding
SHOW_DAILY_INVALID	Invalid value passed for showDailyDetails
OBS_SHIFT_INVALID	Invalid value passed for observationPeriodShift
LOOKBACK_INVALID	Invalid value passed for lookBackDays
LOCKOUT_INVALID	Invalid value passed for lockoutDays
TENOR_INVALID	Invalid value passed for tenor

The following error codes are added as part of the features introduced in Fusion LIBOR Transition Calculator API version 1.2.x

Title	Description
NUMERIC_OUT_RANGE_FLOOR_RATE	riskFreeRateFloor must not be more than 6 decimal points
FLOOR_RATE_OUT_RANGE	riskFreeRateFloor must not be greater than 100%
ROUNDING_DPS_OUT_OF_RANGE_SIMPLE_ARR	rateRoundingDecimalPoints must be between 2 to 6
INVALID_TILL_DATE_FORMAT	Invalid date or date format for calculateTillDate
VLDT_DATA_UNAVAILABLE	Rate is not available for the valueDate provided
LOCKOUT_INVALID_SIMPLE_ARR	lockout not applicable when interestPeriodEndDate not provided

Title	Description
CTDT_NULL	calculateTillDate is required
STDT_GT_THAN_CTDT	interestPeriodStartDate cannot be greater than calculateTillDate
CTDT_GT_THAN_ENDDT	calculateTillDate cannot be greater than interestPeriodEndDate date
CTDT_DATA_UNAVAILABLE	Rate is not available for the calculateTillDate provided

The following error codes are added as part of the features introduced in Fusion LIBOR Transition Calculator API version 1.3.x

Title	Description
FLOOR_GT_THAN_CAP	All in rate floor cannot be greater than all in rate cap
NUMERIC_OUT_RANGE_FLOOR_ALLINRATE	allInRateFloor must not be more than 6 decimal points
NUMERIC_INVALID_FORMAT_AIR_FLOOR	Invalid value passed for allInRateFloor
FLOOR_ALLINRATE_OUT_RANGE	allInRateFloor must not be greater than 100% or less than -100%
NUMERIC_OUT_RANGE_CAP_ALLINRATE	allInRateCap must not be more than 6 decimal points
NUMERIC_INVALID_FORMAT_AIR_CAP	Invalid value passed for allInRateCap
NUMERIC_INVALID_FORMAT_AIR_CAP	allInRateCap must not be greater than 100% or less than -100%

The following error codes are added as part of the features introduced in Fusion LIBOR Transition Calculator API version 1.5.x

Title	Description
NUMERIC_OUT_RANGE_LEGACY_FLOOR_RATE	legacyRiskFreeRateFloor must not be more than 6 decimal points
LEGACY_FLOOR_RATE_OUT_RANGE	legacyRiskFreeRateFloor must not be greater than 100% or less than -100%
NUMERIC_INVALID_FORMAT_LEGACY_RFR_FLOOR	Invalid value passed for legacyRiskFreeRateFloor
CCR_ROUNDING_DPS_OUT_OF_RANGE	ccrRoundingPrecision must be between 1 to 10
CCR_ROUNDING_PRECISION_INVALID	Invalid value passed for ccrRoundingPrecision
CCR_ROUNDING_APPLIES_INVALID	Invalid value passed for ccrRoundingApplies

Note: No new error codes were added as part of the features introduced in Fusion LIBOR Transition Calculator API version 1.6.x

The following error codes are added/modified as part of the features introduced in Fusion LIBOR Transition Calculator API version 1.7.x

Title	Description
VLDT_DATA_UNAVAILABLE	Rate is not available for the valueDate provided. The most recent published <RFR> RFR rate is available from: <date>.
REPO_DATA_UNAVAILABLE	Rate is not available for the given interest period date range. <RFR> RFR rate is not available for <date>.
VALUEDT_DATA_UNAVAILABLE	Rate is not available for the valueDate provided. The most recent published <RFR> RFR rate is available from: <date>.
NO_INDEX_REPO_FOR_START	Index is not available for the indexStartDate provided. The most recent published <RFR> RFR rate is available from: <date>.
NO_INDEX_REPO_FOR_END	Index is not available for the indexEndDate provided. The most recent published <RFR> RFR rate is available from: <date>.
STDT_DATA_UNAVAILABLE	Rate is not available for the interestPeriodStartDate provided. The most recent published <RFR> RFR rate is available from: <date>.
CTDT_DATA_UNAVAILABLE	Rate is not available for the calculateTillDate provided. The most recent published <RFR> RFR rate is available from: <date>.
ENDDT_DATA_UNAVAILABLE	Rate is not available for the interestPeriodEndDate provided. The most recent published <RFR> RFR rate is available as-of: <date>.

The following error codes are added as part of the features introduced in Fusion LIBOR Transition Calculator API version 1.8.x

Title	Description
INVALID_RFR_USER	Access to this RFR requires a separate license. Please reach out to the Finastra Account Manager for details.

5 Notes/Restrictions

This section lists the various notes/restrictions that are applicable for Fusion LIBOR Transition Calculator API.

Lookback Days

- If the start day of the interest period is a non-business day as per the ARR calendar, the start day of the Lookback will be **k** business days preceding the first business day of the Interest Period. This means that, the same rate will be used for the non-business days and the first business day under the daily compounded rate calculation method. In case of Compounded In Arrears calculation method, determination of start date of the Lookback will be as if the interest period has commenced on the first working day of the interest period.

Spread and Spread Adjustment

- Spread change within a cycle is not supported in Fusion LIBOR Transition Calculator.
- Spread Adjustment is not a part of compounding.

ARR Index

- Currently, only SOFR Compounded in Arrears rate calculation based on SOFR Index is supported.
- The SOFR Index reflects the same arithmetic as the SOFR Averages, rates calculated using the SOFR Index with the same start and end dates as the SOFR Averages should effectively produce equivalent results. However, as the SOFR Index is rounded, averages calculated from Index values do not maintain the same precision as the SOFR Averages; as a result, minor differences from the published averages may occasionally occur at the fifth decimal place, when the *rateRoundingDecimalPoints* points is set to 5 or more decimal points. For more information, refer to the New York Fed website (Section: *Data and Calculation Methodology for SOFR Averages and Index*)

Calculated Rate – Average Compounded in Arrears, Daily Compounded in Arrears (NCCR), Simple ARR, and Simple Average.

- Observation Period Shift is not supported if Lockout days in non-zero.

  Note: Observation Period Shift is not applicable for Simple ARR

- If Lockout is greater than business days in the cycle, the rate of the interest period start date (with Lookback/ Observation Period Shift) will be applied for the entire cycle.
- When ACT/ACT day count convention is used:
  - If the interest period occurs within a year (non-Leap year), the system considers the day count as 365 else 366.
  - If an interest period spans across two different years, where one year is a Leap year, the system considers the day count as 365.
- Compounding Factor for NCCR – In certain scenarios when the raw RFR rate drops to zero or close to zero, the Compounding Factor may not represent primarily the effect of compounding but have a high computed value due to differing number calendar days in the interest period and the observation period. In such scenarios, the calculated compounding factor can go to less than -10 or more than 10.
- **Beginning with ARR Calculator version 1.8.x**, support for **IndONIA** (Indonesian Overnight Index Average) and **ZARONIA** (South African Rand Overnight Index Average) risk-free rates have been added. These newly introduced enhancements are separately licensed and are not

available by default with the ARR Calculator API. If you are not licensed for this enhancement and would like more information, contact your Account Manager.

Interest Calculator – Average Compounded in Arrears, Daily Compounded in Arrears (NCCR), Simple ARR, and Simple Average

- Observation Period Shift is not supported if Lockout days in non-zero.

  Note: Observation Period Shift is not applicable for Simple ARR

- If Lockout is greater than business days in the cycle, the rate of the interest period start date (with Lookback/ Observation Period Shift) will be applied for the entire cycle.
- When ACT/ACT day count convention is used:
  - If the interest period occurs within a year (non-Leap year), the system considers the day count as 365 else 366.
  - If an interest period spans across two different years, where one year is a Leap year, the system considers the day count as 365.
- If principal change occurs on a holiday, then the principal amount change is effective from the date of the change.
- In a scenario where Interest Period Start Date is a non-business day and there is a principal change on the Interest Period Start Date, the rate applied based on lookback days is inaccurate. This is applicable for all the calculation methods
- For Daily Compounding in Arrears (NCCR) method if CCR Rounding Approach is used, it is recommended that Spread/Spread Adjustment decimal precision must not be higher than the CCR Rounding Precision. If the Spread/Spread Adjustment precision is higher than the CCR Rounding Precision, then the accrued interest amounts for NCCR for a given interest period and for constant principal may not match the corresponding accrued interest amounts using Average Compounded in Arrears for the same interest period.
- **Additional information on Rounding**
  - Simple ARR
    - Daily Interest amount:

      The rounded Simple ARR rate, based on roundingDecimalPoints, is used for calculating daily Interest amount for each interest period date. This amount is rounded as per Payment Rounding in the API output.

    - Cumulative Interest amount

      The **unrounded** daily interest amount for each Interest Period Date is added to calculate the Cumulative Interest Amount and the final amount value is rounded as per Payment Rounding.

  - Daily Compounding in Arrears (NCCR)
    - **CCR Rounding applies = true**
      - Daily Interest amount calculation

        The unrounded NCCR rate (with maximum precision) is used for Interest amount calculation for each interest period date and rounded as per Payment Rounding.

      - Cumulative Interest amount calculation

        The **unrounded** interest amount for each interest Period Date is added for calculating the cumulative Interest amount and the final amount value is rounded as per Payment Rounding.

    - **CCR Rounding applies = false**

      The same rounding behavior as Simple ARR applies (hyperlink to above sub-section)

- Average Compounded in Arrears and Simple Average

  Cumulative interest amount: The rounded rate (CCR rate or Simple Average) is used for calculating the cumulative Interest amount. This amount is rounded as per Payment Rounding.

- **Beginning with ARR Calculator version 1.8.x**, support for **IndONIA** (Indonesian Overnight Index Average) and **ZARONIA** (South African Rand Overnight Index Average) risk-free rates have been added. These newly introduced enhancements are separately licensed and are not available by default with the ARR Calculator API. If you are not licensed for this enhancement and would like more information, contact your Account Manager.

Tenors

- For *tenors* of 30/90/180 days, if the published averages are not available for start or end date because of a holiday, then the system will calculate the rate.
- If tenor is not passed (where rates are calculated for all the tenors) and risk free rates are not available for any of the tenors, then the calculator returns Compounded Averages only for the tenors for which rate data is available.

5.1 Features Not Supported

This section lists the features/items that are currently not in scope/supported in this release of Fusion LIBOR Transition Calculator API.

- Swiss Average Rate Overnight or **SARON** is currently not supported in Fusion LIBOR Transition Calculator API.

6 ARR Calculator Environments

6.1 Overview

Finastra provides three environments for accessing the Fusion LIBOR Transition Calculator API.

6.1.1 Sandbox Environment (Development)

Purpose	Development or Initial test/evaluation
RFR Rate Data Availability	Note that this environment is set up with limited published rate data. The published rate data available in the Sandbox (Development) environment is as follows: • RFR Rates (SOFR, SONIA, TONAR, and SORA): from 2019-01-01 to 2020-12-31. • RFR Rates (ESTR): from 2019-10-01 to 2020-12-31 • SOFR Compounded Averages and SOFR Index Data from 2020-03-02 to 2020-12-31. • RFR Rates (IndONIA and ZARONIA): o IndONIA: from 2019-01-01 to 2020-12-31. o ZARONIA: from 2023-11-03 to 2024-11-01. ▪ **Note:** IndONIA and ZARONIA are separately licensed enhancements. Access to these enhancements in the Sandbox environment is made available on demand. To request access, contact your Finastra Account Manager with the following details: A: The FusionCreator *Application ID* used to access the Sandbox environment. The ID can be found at the top right of the reference image. If you need assistance with your Application ID, contact platformsupport@finastra.com B: The RFR Rate (IndONIA, ZARONIA, or both) for which access is required. Therefore, it is advised to provide inputs to the API within this data range to get results.
API Calls chargeable as per API subscription	No
How to Access	Refer to section 8.1 till 8.3 for the detailed steps

6.1.2 UAT Environment

Purpose	User Acceptance Testing for a more comprehensive testing with the API.
RFR Rate Data Availability	Latest RFR rate data is available as described under Section 7. This environment replicates the live-production environment. **Note:** IndONIA and ZARONIA are separately licensed enhancements. If you are not licensed for this enhancement and would like more information, contact your Account Manager.
API Calls chargeable as per API subscription	Yes
How to Access	Refer to section 8.4 for the detailed steps.

Note: The UAT Environment is available from version 1.5.x and later.

6.1.3 Production Environment

Purpose	Live/Production Usage for clients.
RFR Rate Data Availability	Latest RFR rate data is available as described under Section 7.
API Calls chargeable as per API subscription	Yes.
How to Access	Refer to section 8.5 for the detailed steps.

6.2 API Release Version Availability across Environments

Environment	API Release Version	Date Released
Sandbox (Development)	1.8.x	13-Jun-25
UAT	1.8.x	13-Jun-25
Production	1.8.x	10-Feb-25

7 Official Sources of Market Data

The latest SOFR rate data (SOFR rate, SOFR Compounded Averages, and SOFR Index), SONIA*, ESTR, TONAR, SORA, IndONIA, and ZARONIA are retrieved and made available in the Calculator from Refinitiv. This includes any republication of the rates, wherever applicable.

***Note:** SONIA rate for all the calculation methods is retrieved from Refinitiv, except for Simple ARR calculation method. For Simple ARR method **only**, the SONIA rate is pulled in from the Bank of England Website, and is available two (2) working days after the date to which it relates to. See Rate Availability section below for more details.

Rate Availability

Latest rates are pulled in from Refinitiv within a short period of time of them being made available in Refinitiv.

For Simple ARR method **only**, the SONIA rate is pulled in from the Bank of England Website, and is available two (2) working days after the date to which it relates to, within a short period of time of it being published on the Bank of England website.

> For example, on a given business day, say 2020-05-13 (Wednesday), the Calculator will have SONIA rate related to 2020-05-11 (Monday) as the most recent SONIA rate **for Simple ARR method only**
>
> As another example, post a long weekend in the UK, 2020-05-23 (Saturday) to 2020-05-25 (Monday), on 2020-05-26 (Tuesday), the Calculator will have SONIA rate related to 2020-05-21 (Thursday) as the most recent SONIA rate **for Simple ARR method only**

The following attributes in the API output provide information on the RFR rates availability in the Calculator:

- "lastUpdatedFromSource" provides the most recent timestamp when the rate data was retrieved from Refinitiv (or the Bank of England website, in case of SONIA for Simple ARR method, as elaborated in the note mentioned above).

  In a scenario where a particular RFR rate is republished by its benchmark administrator, a "lastUpdatedFromSource" timestamp value that is after the republication cut-off time indicates that the republished rate has been retrieved by the Calculator.

- "comments" now additionally provide the date of the most recent published rate available in the ARR calculator.

7.1 Third-Party Data Restrictions

Following are the third-party data restrictions for accessing the market data from the Fusion LIBOR Transition Calculator API

- **SOFR**

  Use subject to New York Fed Terms of Use for Select Rate Data. New York Fed has no liability for your use. Refer the following link for more details:
  https://www.newyorkfed.org/markets/reference-rates-terms-of-use

- **SONIA**

  SONIA and SONIA Compounded Index are copyright the Bank of England. The trademarks "Bank of England" and "SONIA" are registered trademarks of the Bank of England. All Rights Reserved. The SONIA benchmark and SONIA Compounded Index include the proprietary information of the Bank of England and the data comprising the SONIA benchmark and SONIA Compounded Index may not be copied or distributed except as specifically authorized. The SONIA benchmark and SONIA Compounded Index are not intended to be relied upon as authoritative or taken in substitution for the exercise of judgement and do not constitute

investment advice. The SONIA benchmark and SONIA Compounded Index are not, and should not be construed as, an offer, bid or solicitation in relation to any financial instrument. The Bank of England does not guarantee, and expressly disclaims any liability for, and makes no representations or warranties whether express or implied, as to the currency, accuracy, timeliness, completeness or fitness for any particular purpose of the SONIA benchmark or the SONIA Compounded Index. The Bank of England accepts no liability whatsoever for any loss (including, but not limited to any direct, indirect or consequential loss, whether or not such loss is foreseeable and whether or not the Bank of England has been appraised of the use to which the SONIA benchmark or SONIA Compounded Index will be put) howsoever arising from the use, the timeliness of delivery or the failure of delivery of the SONIA benchmark or SONIA Compounded Index.

- **ESTR**

  Use of euro short-term rate (€STR) is subject to the ECB's €STR disclaimer under https://www.ecb.europa.eu/stats/financial_markets_and_interest_rates/euro_short-term_rate/html/index.en.html#disclaimer.

- **SORA**

  SORA-related statistics, the 1-month, 3-month and 6-month Compounded SORA rates, and the SORA Index, are provided on an "as is" basis, without warranties of any kind. MAS shall not be liable for any damage or loss, which may arise from reliance on such data obtained from the MAS website. Please refer to the Terms of Use (https://www.mas.gov.sg/terms-of-use) on accessing and using any part of the MAS website.

- **TONAR**

  Use of TONAR is subject to the Bank of Japan's Terms of Use ; see https://www.boj.or.jp/en/statistics/outline/exp/data/exmutan2.pdf.

- **IndONIA**

  The use of IndONIA published on the Bank Indonesia website is the sole responsibility of the parties to the transaction.

- **ZARONIA**

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8 Appendix – How to Access Fusion LIBOR Transition Calculator API

The **Fusion LIBOR Transition Calculator** API is accessible through the **Finastra FusionFabric.Cloud** platform. This secure platform allows you to trigger API calls and receive the required calculated values in a prescribed format for your consumption.

In order to use the API service, the user must do the following in sequence.

1. Register on FusionFabric.Cloud.
2. Create FusionCreator Application.

8.1 Registering on FusionFabric.Cloud

To register on FusionFabric.Cloud, do the following:

1. Go to the Finastra FusionFabric.Cloud portal - https://developer.fusionfabric.cloud/.
2. Click the **Register** button that is available on the top navigation bar.

The *Sign up* page is displayed with the following fields.

Registration Field	Description
Organization	Select the appropriate option from the drop-down list.
Company name	Provide accurate company name
First name	First Name
Last name	Last Name
Email	Standard email format
Job title	Job Description
Country	Select country from the drop-down list
Solution of Interest	Select **Corporate Banking** from the drop-down list

3. After entering the required details, the user must acknowledge the following by clicking the respective check boxes:
    - You agree to the Developer Terms and Conditions
    - You agree to the Acceptable Use Policy
    - You acknowledge the Privacy Notice
4. Click **Submit** to complete the registration process.

   After the registration is submitted, the user's registration enters a queue for review and validation. If the user's registration is successfully validated (that is, granted consent by FFDC), the user will receive the account details (*Username and one-time password*) by email within a maximum of 3 business days.

Note: After the user has logged in using the Username and one-time password, the user can now update the password to a password of their choice that can be reused for subsequent log ins.

8.2 Creating FusionCreator Application

After logging on to FusionFabric.Cloud with the credentials, the next step is the creation and registration of a FusionCreator application. The FusionCreator application will act as the interface between the ARR Calculator API and the client application, allowing the user to combine the API in the most relevant way for business use case.

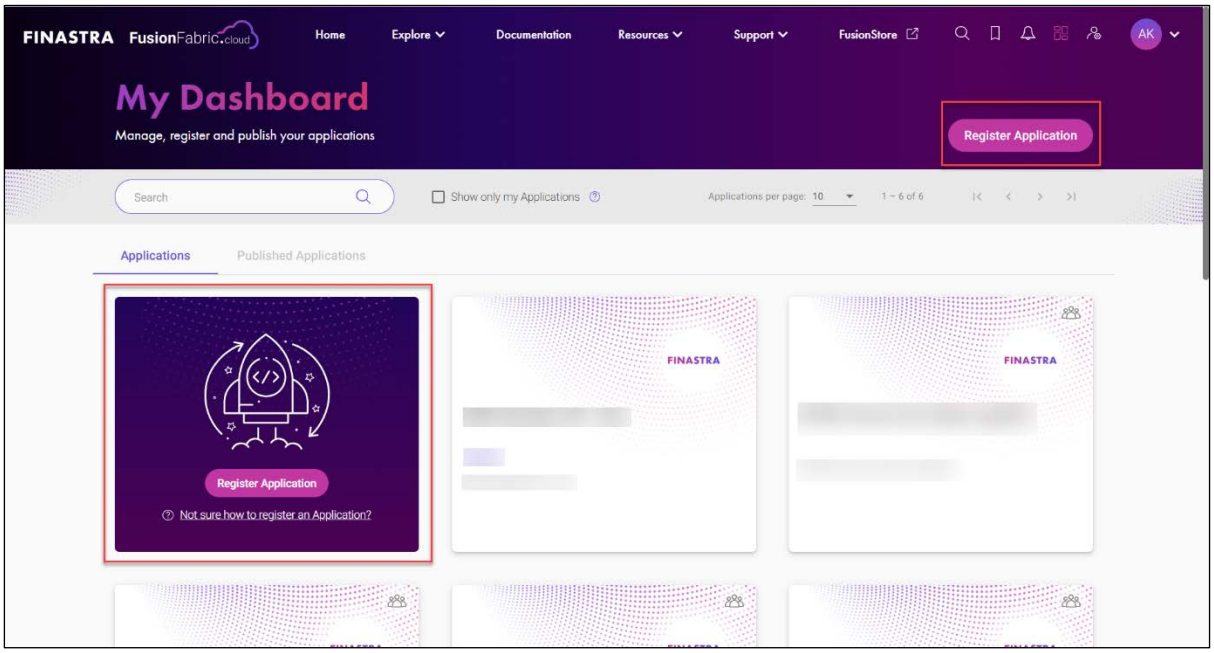
Being uniquely identifiable with an ID that is automatically assigned during its creation, an application allows you to make authorized calls to the registered APIs, through OAuth2 authentication.

1. Go to the Finastra FusionFabric.Cloud portal - https://developer.fusionfabric.cloud/.
2. Click the **Sign in** button that is available on the top navigation bar and sign in with the FusionFabric.Cloud account details (*Username and Password*).

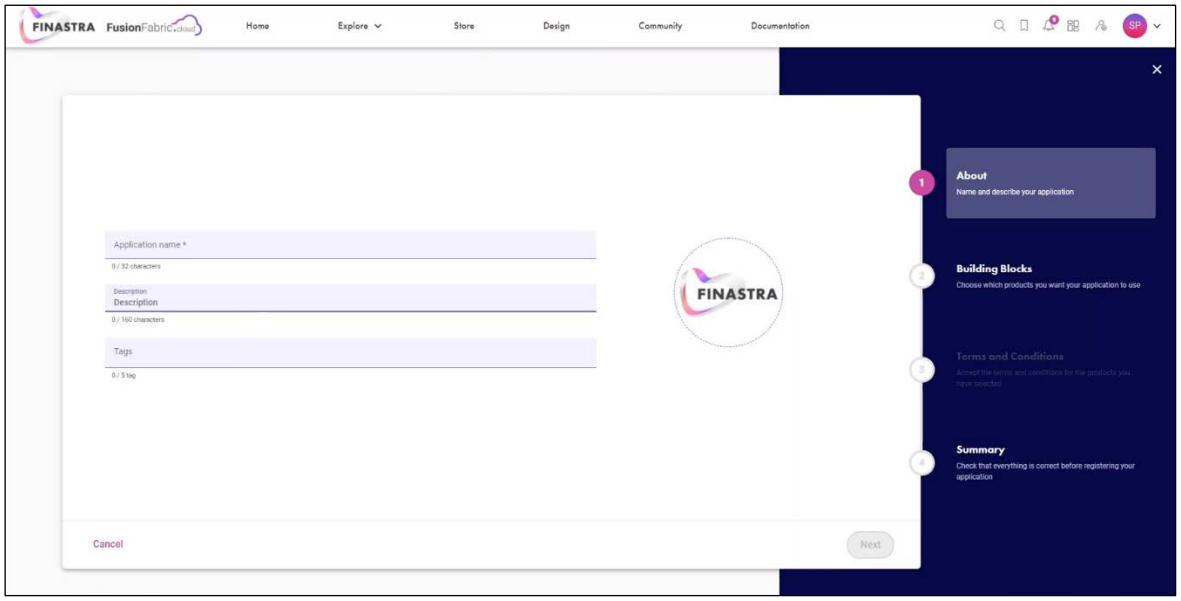
Note: After signing in, the user must create and register a FusionCreator application using the **My Dashboard** icon. The user can also create and register a FusionCreator application using the *Application Creation Wizard* or *Bookmark Menu*. For more information, see https://developer.fusionfabric.cloud/documentation/get-started/index.

3. Click **My Dashboard** icon and then click the **Register Application** button. The **About** page is displayed.

Note: The user can also click the **Register Application** thumbnail instead of the *Register Application* button to proceed to the next step.



4. On the application registration page, do the following:
   a. In the **About** page, the user must provide the following details in the appropriate field.
      - **Application name** (mandatory) – The user must provide an application name that can be used to identify the type of feature/service the application controls.
      - **Description** – The user can provide a short description of the application (usage).
      - **Tags** – The user can enter up to 5 tags that can be used later to filter/identify the application from the Search field.
   b. After entering the required details, click **Next**.



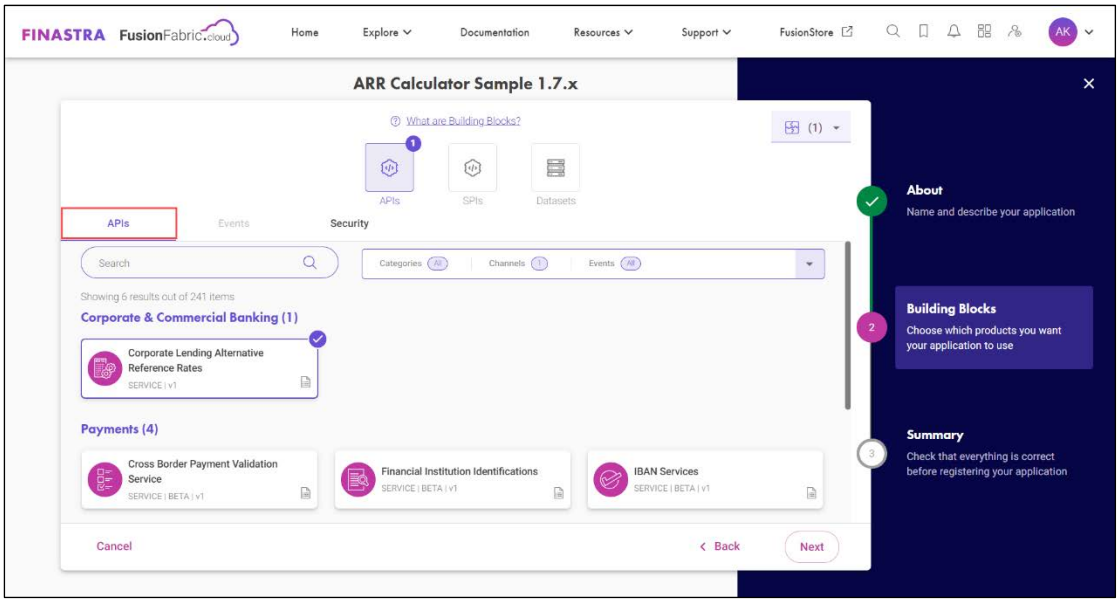
The **Building Blocks** page is displayed.

c. In the **Building Blocks** page, the user must select the required API service that they want to register for.

i. Select **APIs** category, then do one of the following:

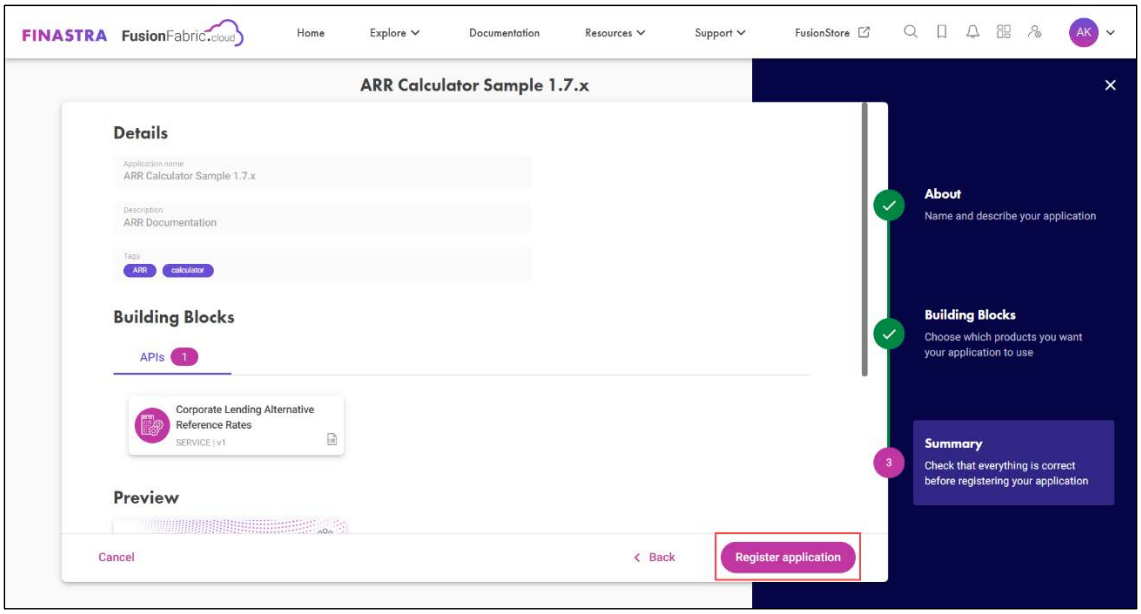
- In the Search box, enter the term **alternative** or
- In the Filter by drop-down list, select **SERVICE** and minimize/close the Filter by drop-down list.

ii. Select **Corporate Lending Alternative Reference Rates** from the Corporate Banking group and click **Next**. The *Details* page is displayed.

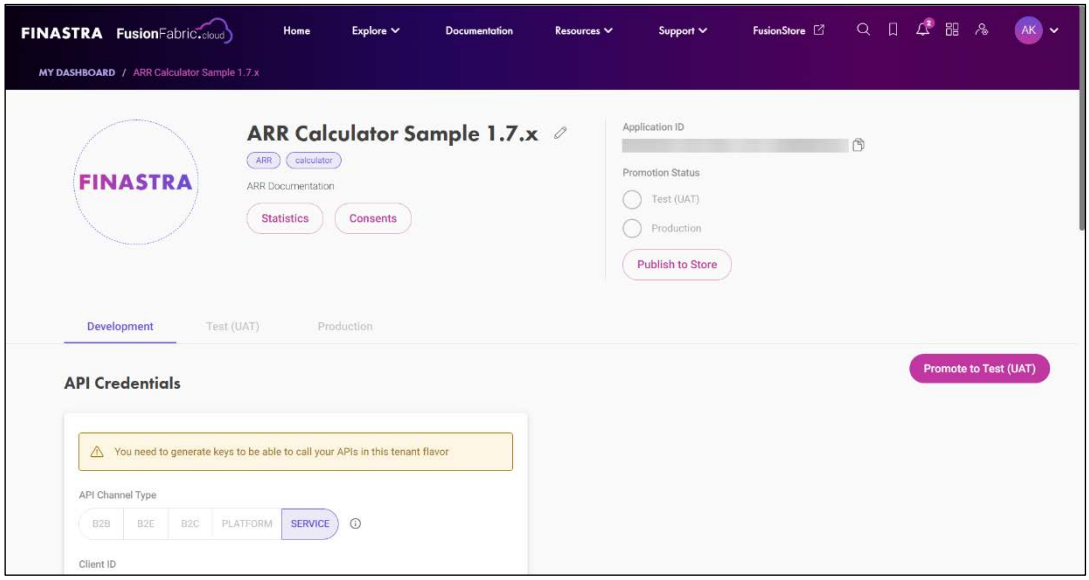


Note: Ensure that the service selected is highlighted and listed as **1** (item) in the APIs list.

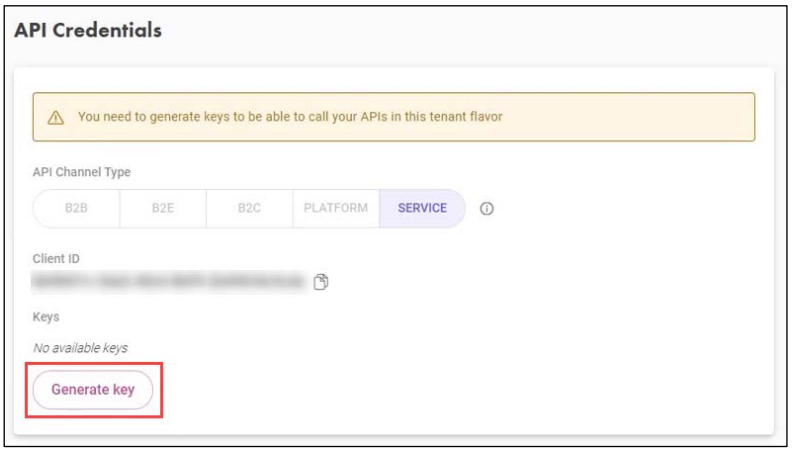
d. Review the selection and confirm by same by clicking the **Register application** button at the bottom of the page.



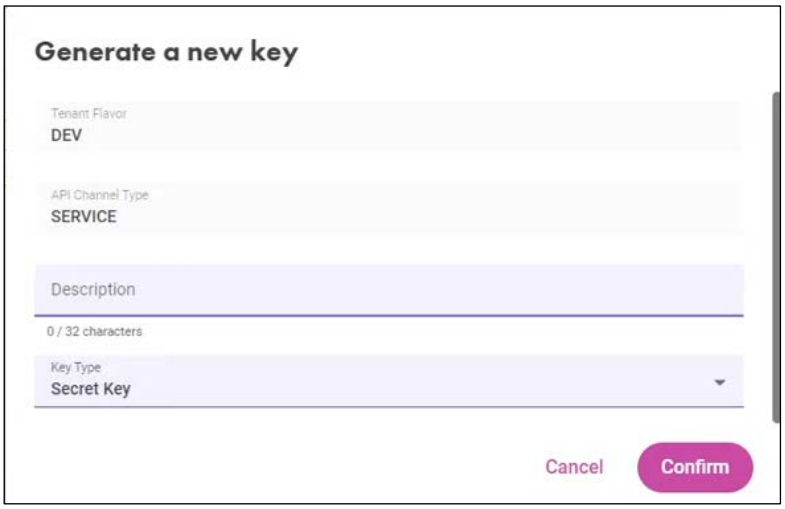
After the application is registered successfully, the user is directed to the *API Credentials* page.



5. Now, the user must generate a key for the application by clicking the **Generate key**. The *Generate a new key* window is displayed.

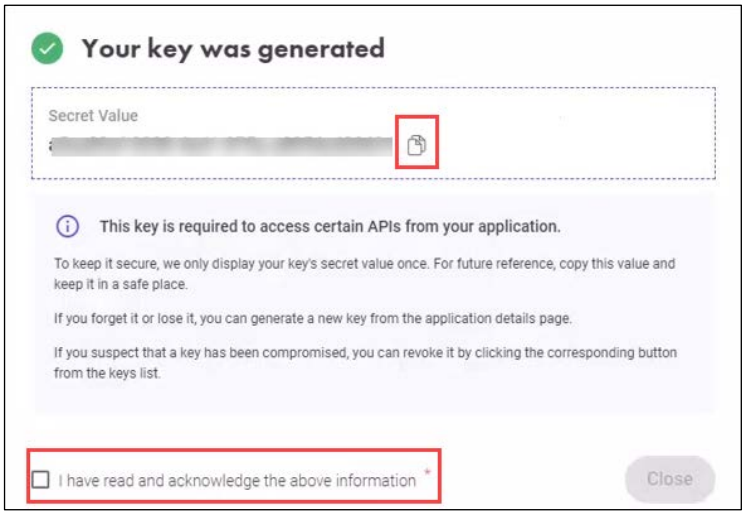


6. In the Generate a new key window, enter a description and click **Confirm** to generate the key. The *Your key was generated* window is displayed.

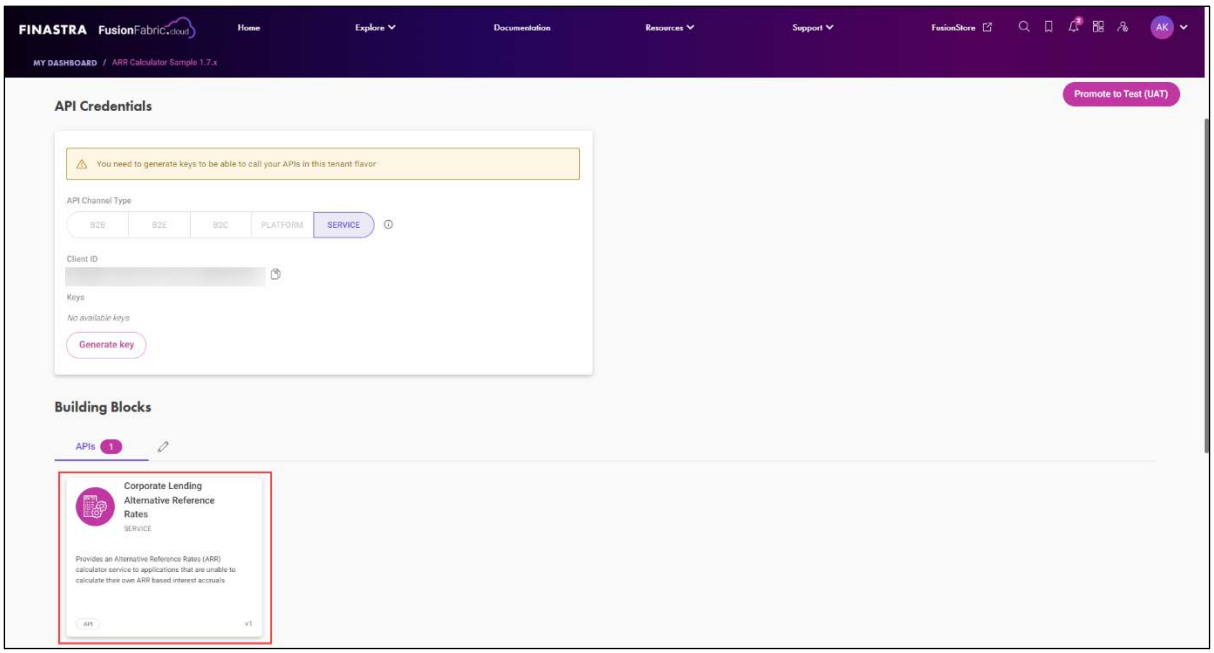


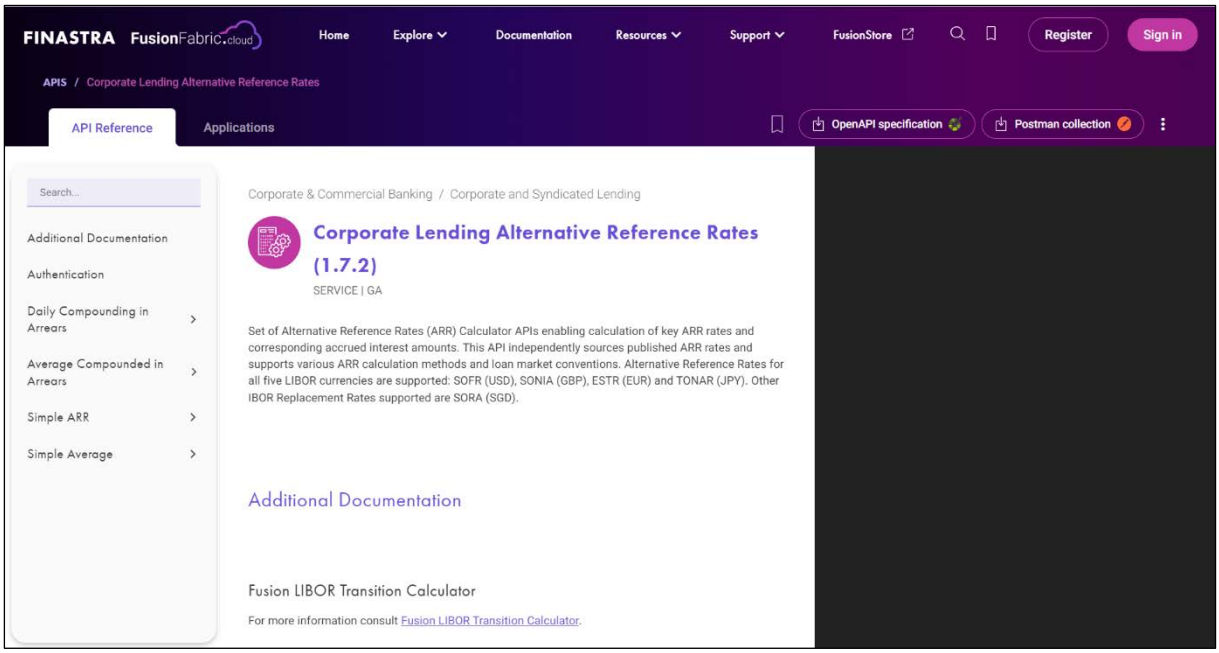
Note: If there are multiple keys generated for an application, the **Description** helps in identifying the appropriate application key. Therefore, it is recommended that the user provides a self-explanatory description for future use.

7. After the key is generated, copy and save the secret key for future use, read and acknowledge the important information before closing the window.



After the FusionCreator application is created and registered, the application is by default connected to the *Sandbox* (Development) environment (or tenant) where the application can be used for testing purposes on limited risk-free rate data available in Sandbox. For more information on rate data availability in sandbox, see *Sandbox Environment* section.



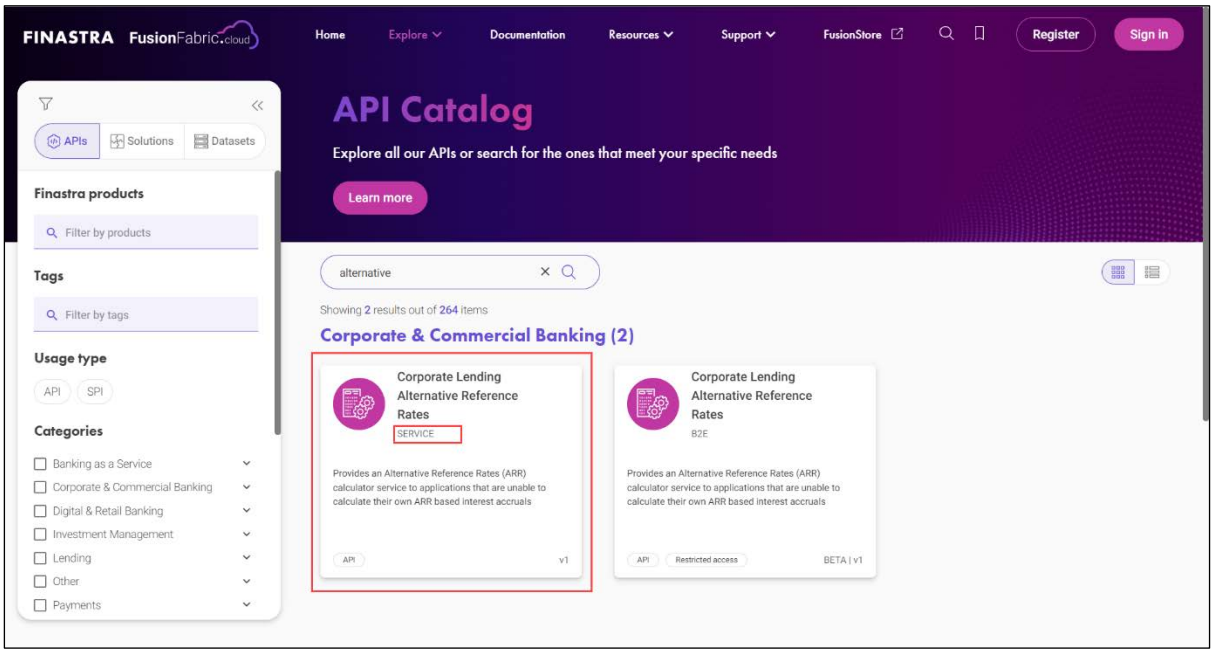


8.3 Connecting to the API Service for the First Time

To connect to the API service, the user must do the following:

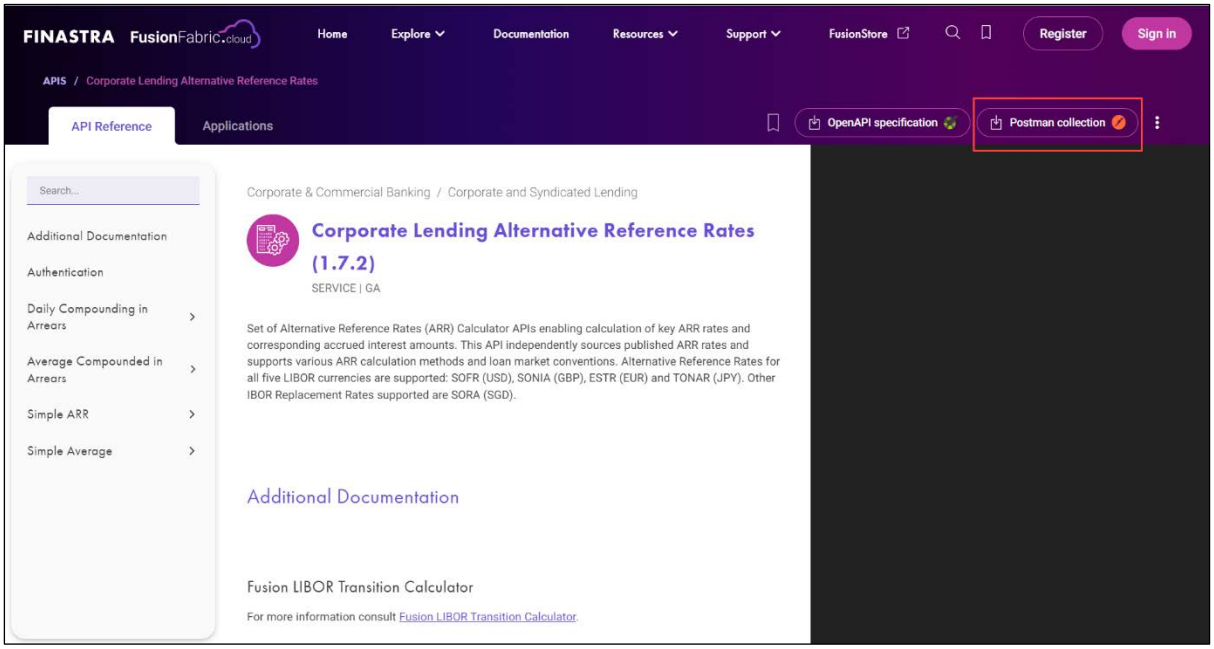
Note: Ensure Postman (application) is installed on the user's system before proceeding with the instructions in this section.

1. Go to https://developer.fusionfabric.cloud/ (FFDC portal) and sign in with the FFDC credentials, access the *API Catalog* section from the **Explore** tab, and click **Corporate Lending Alternative Reference Rates** (SERVICE).

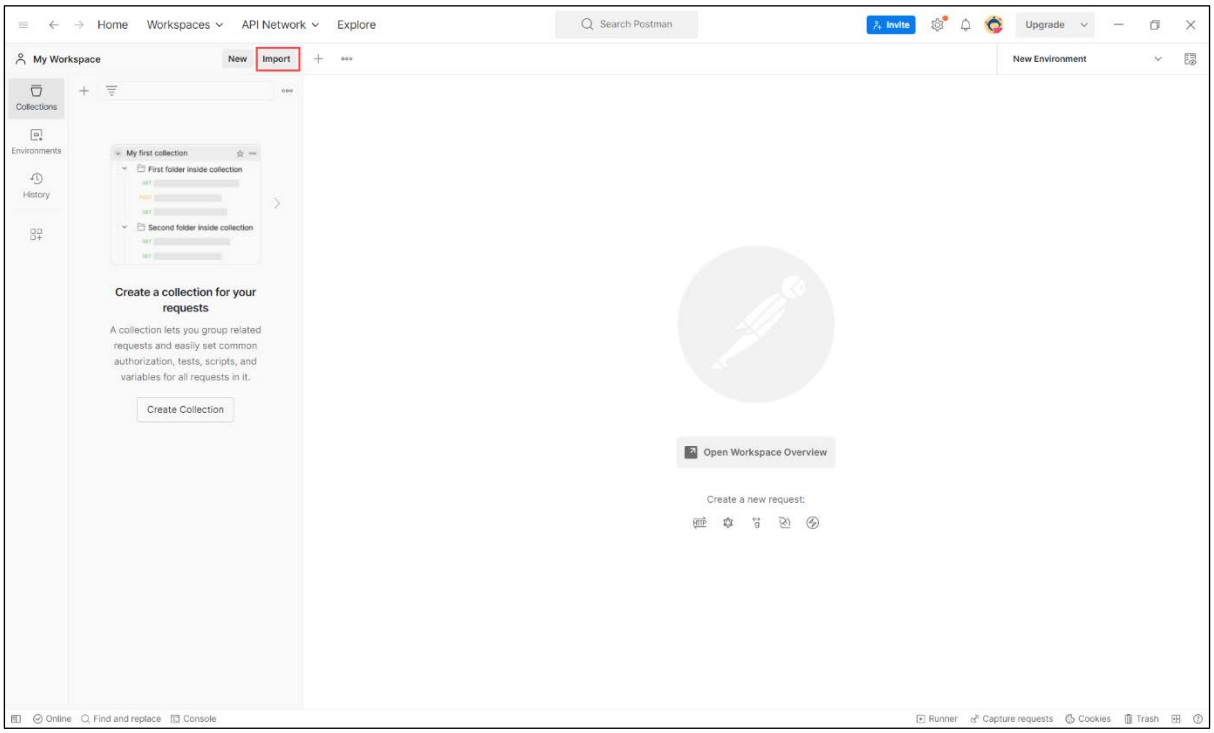


Note: The user can also click the ARR API application created in the *Creating FusionCreator Application* section to download Postman collection.

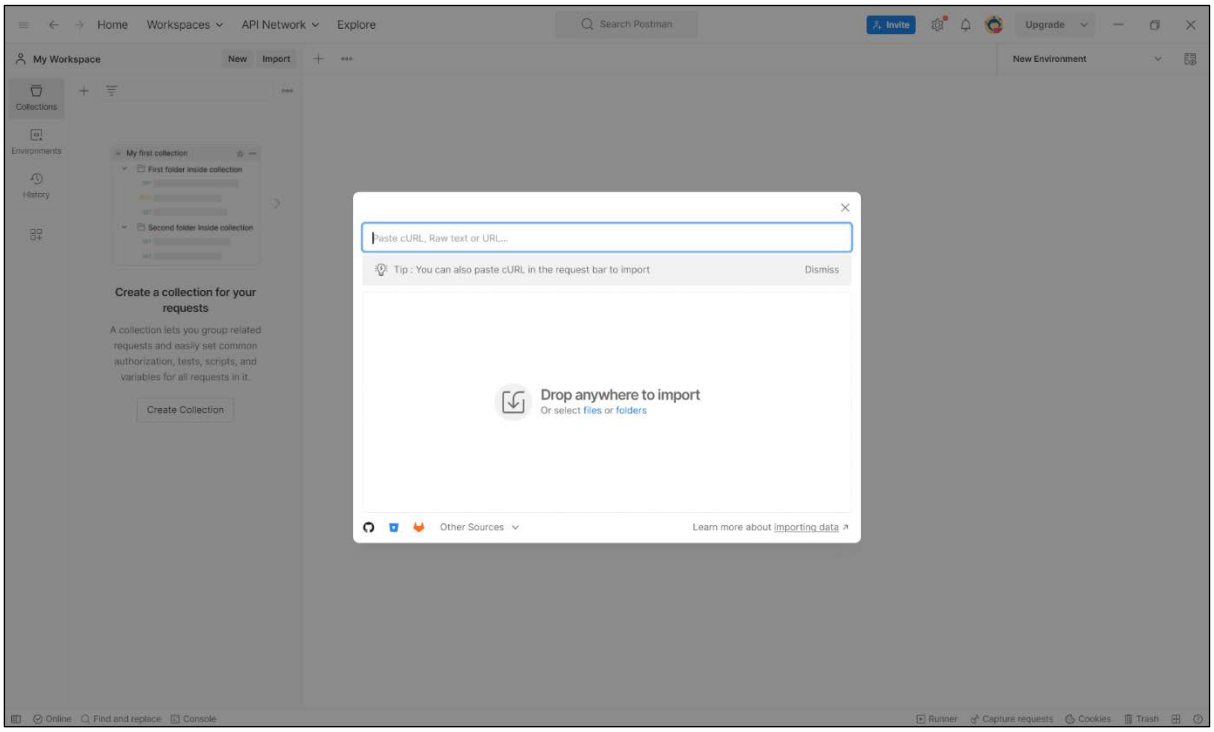
2. Click the download Postman collection option available on the top-right section of the screen.



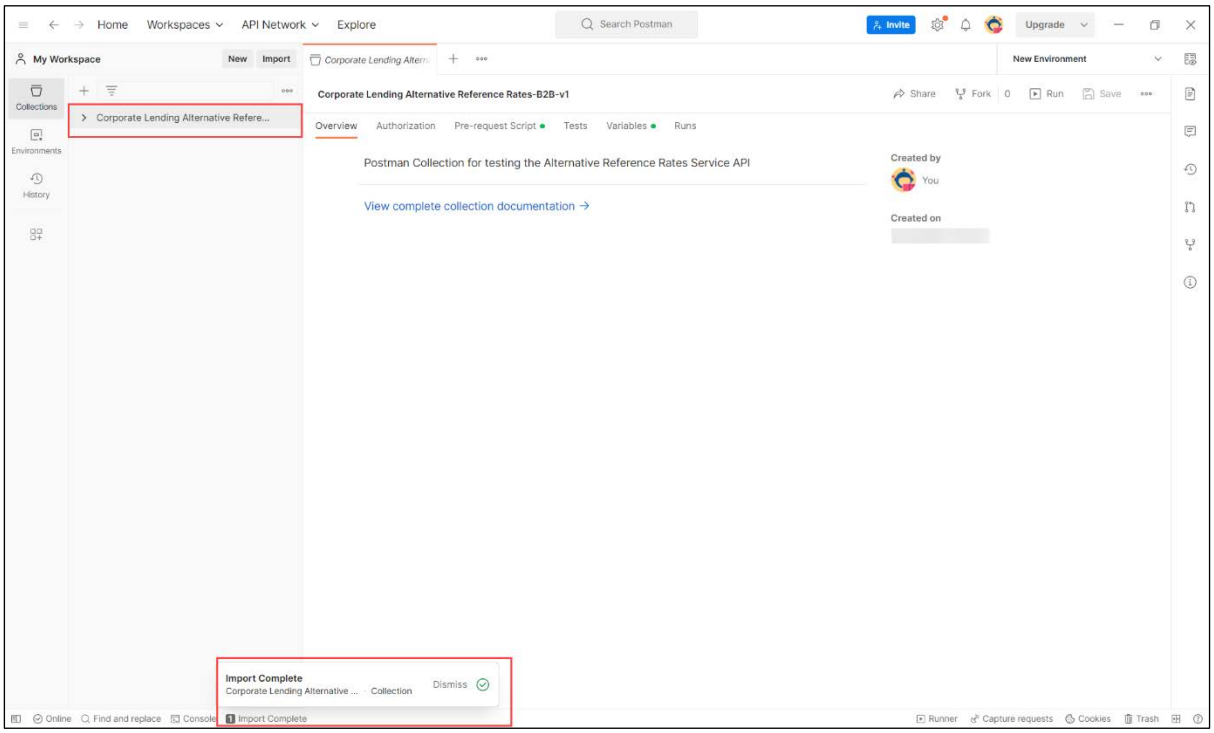
3. Save the Postman collection to a local folder for future use.
4. Download and install The Postman app.
5. Open Postman and click **Import**. The *Import* window is displayed.



6. On the Import screen, click **files** and browse to the folder where the postman collections is saved to import the file or drag and drop the downloaded Postman collection on the Import screen.



The Postman collection is successfully imported, and the collection are displayed on the left pane.

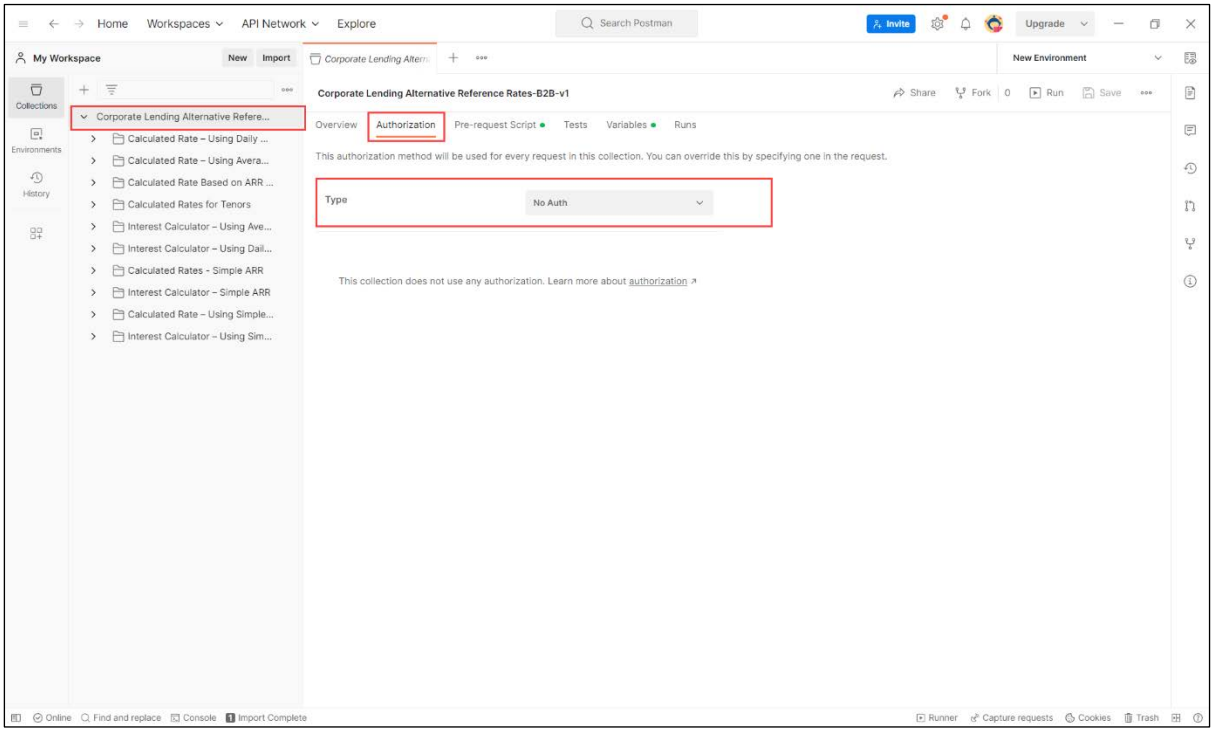


8.3.1 Get New Access Token – Sandbox Environment

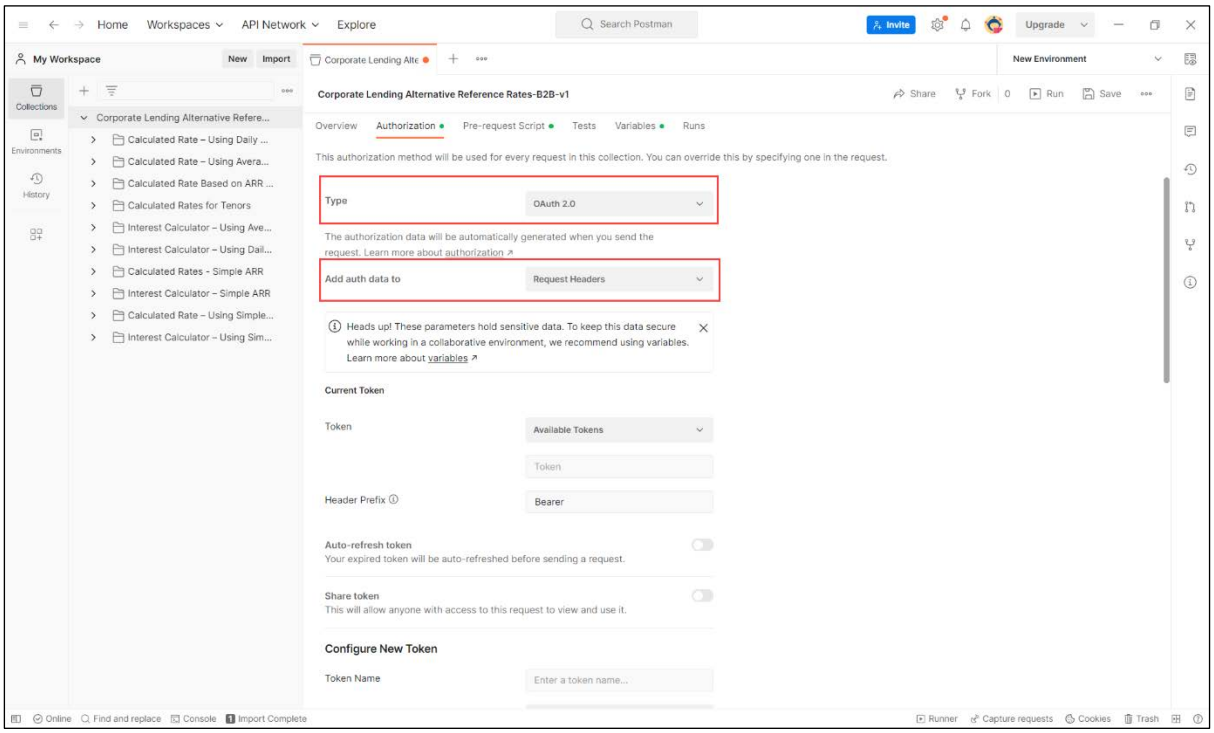
To be able to use the Postman collection to run API requests, the user must get an access token which is provided based FFDC consent. The user can then use Client ID, Client Secret, and Access Token URL for the API tenant (Sandbox/Development).

To get a new access token, do the following:

1. Open Postman, click the postman collection. The **Authorization** screen is displayed.

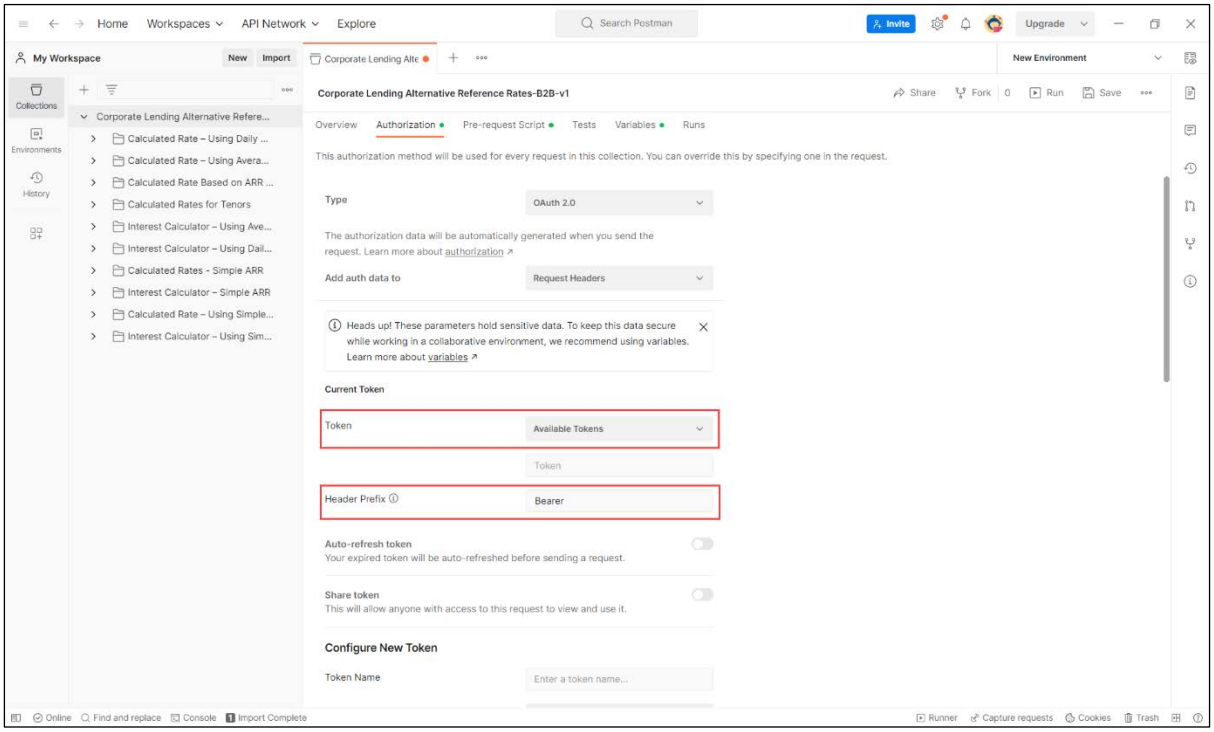


2. On the **Authorization** screen do the following:
   a. In the **Type** drop-down list, select and **OAuth 2.0**.
   b. In the **Add auth data to** drop-down list, select **Request Headers**.



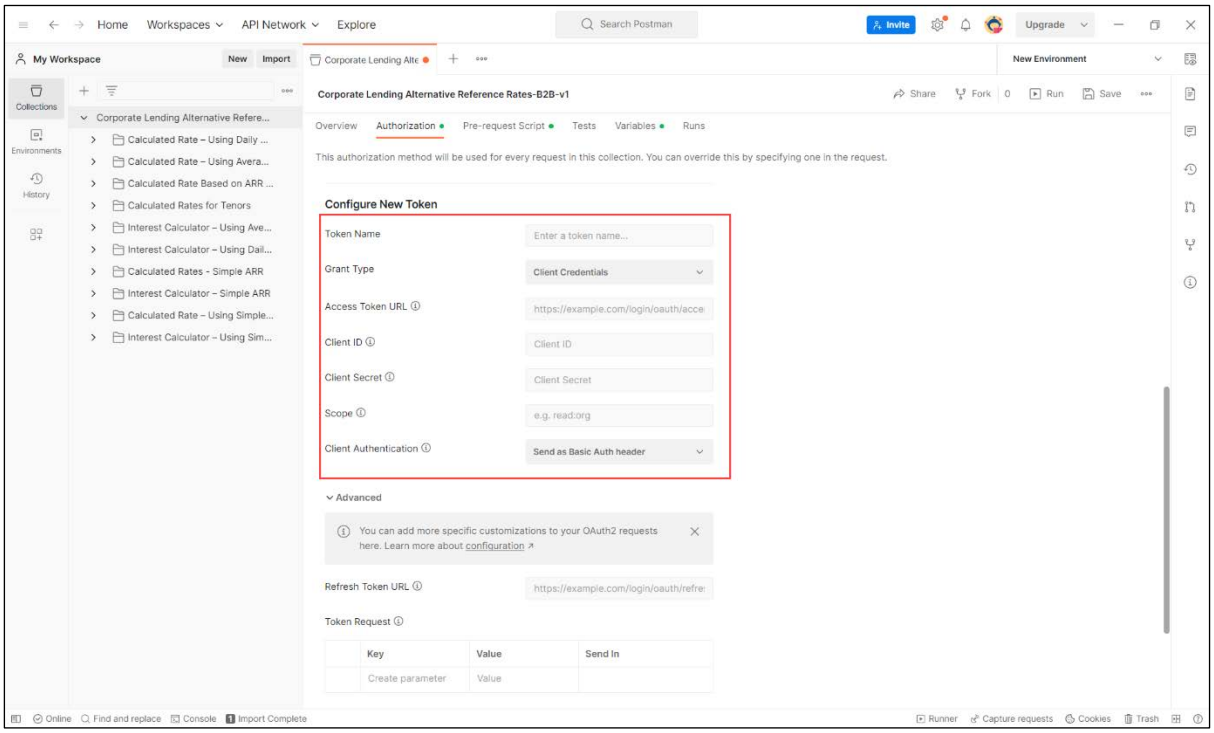
c. In the **Current Token** group, do the following:

- **Token** – Select a name for the token or leave it as default.
- **Use Token Type** – Select **Access Token**.
- **Header Prefix** – Ensure the value is **Bearer**.



d. In the **Configure New Token** group, do the following:

- **Token Name** – Enter a name for the token or leave it as default.
- **Grant Type** – Select **Client Credentials**.
- **Access Token URL** – https://api.fusionfabric.cloud/login/v1/finastra-dev/oidc/token (Sandbox/Development)
- **Client ID** – From the application on FFDC. For reference, click.
- **Client Secret** – From the secret key generated for the application on FFDC. For reference, click.
- **Client Authentication** – Select **Send as Basic Auth header**.
- Click **Get New Access Token**. The authorization process commences.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Calculated Rate Based on ARR ...
Calculated Rates for Tenors
Interest Calculator – Using Ave...
Interest Calculator – Using Dail...
Calculated Rates - Simple ARR
Interest Calculator – Simple ARR
Calculated Rate – Using Simple...
Interest Calculator – Using Sim...
Corporate Lending Alternative Reference Rates-B2B-v1
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Run
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Overview
Authorization
Pre-request Script
Tests
Variables
Runs
This authorization method will be used for every request in this collection. You can override this by specifying one in the request.
Configure New Token
Token Name
Enter a token name...
Grant Type
Client Credentials
Access Token URL
https://example.com/login/oauth/acce
Client ID
Client ID
Client Secret
Client Secret
Scope
e.g. read:org
Client Authentication
Send as Basic Auth header
Advanced
You can add more specific customizations to your OAuth2 requests here. Learn more about configuration
Refresh Token URL
https://example.com/login/oauth/refre
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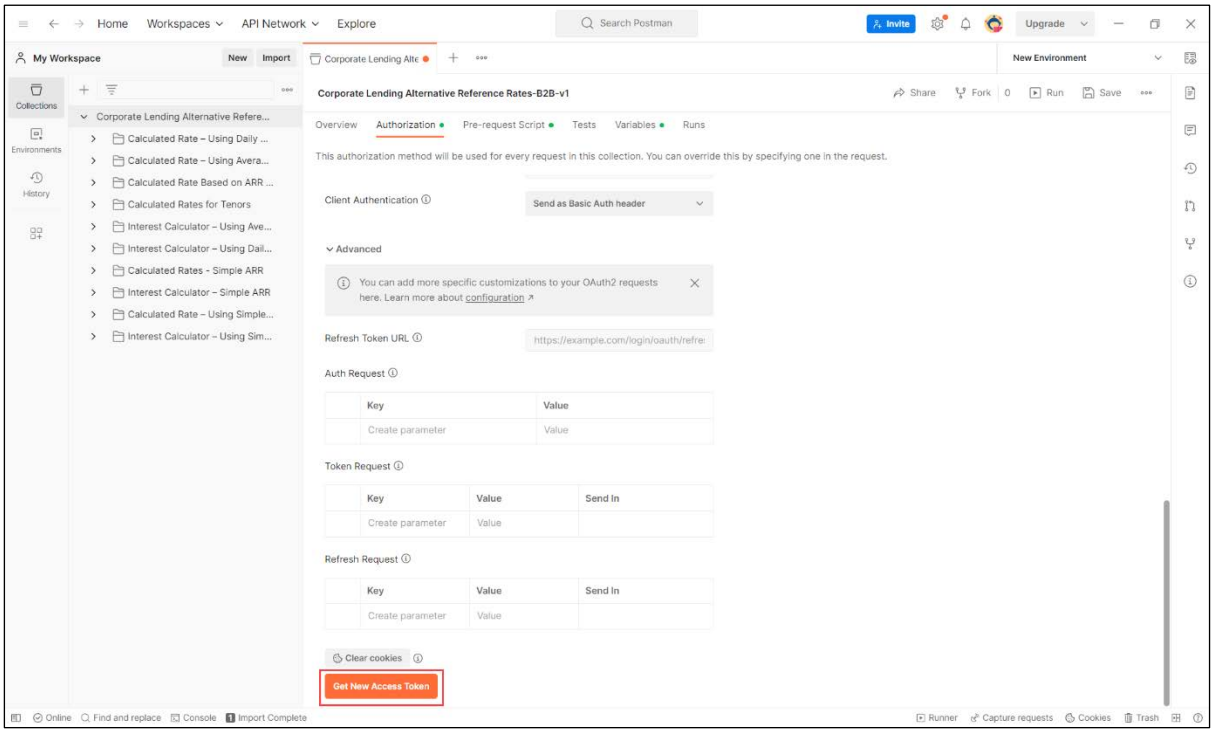
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Calculated Rates - Simple ARR
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Interest Calculator – Using Sim...
Corporate Lending Alternative Reference Rates-B2B-v1
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Fork
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Run
Save
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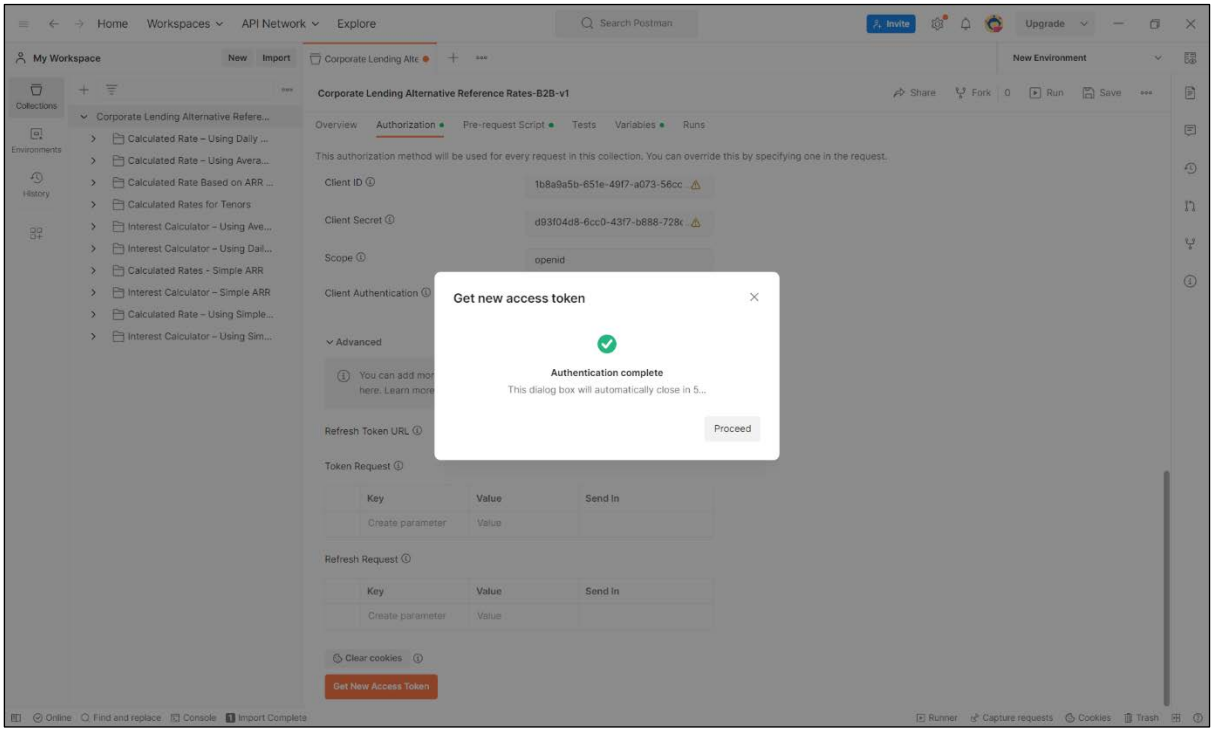
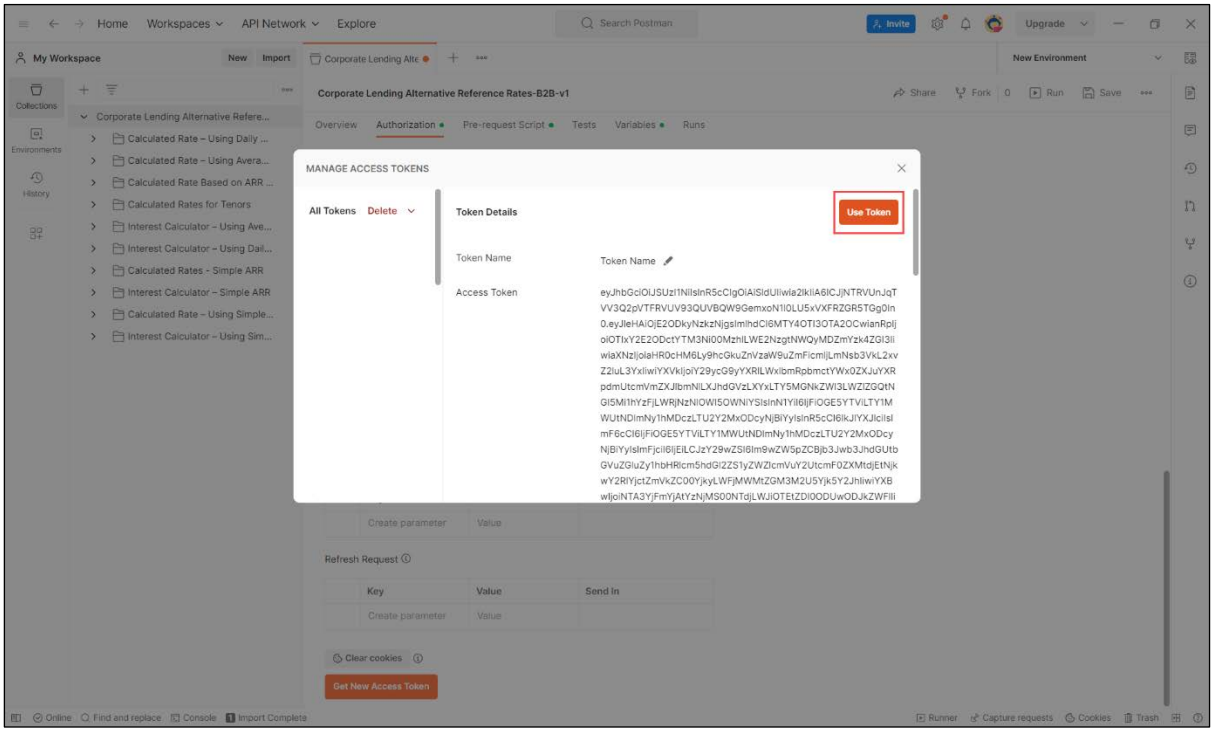
Authorization
Pre-request Script
Tests
Variables
Runs
This authorization method will be used for every request in this collection. You can override this by specifying one in the request.
Client Authentication
Send as Basic Auth header
Advanced
You can add more specific customizations to your OAuth2 requests here. Learn more about configuration
Refresh Token URL
https://example.com/login/oauth/refre
Auth Request
Key
Value
Create parameter
Value
Token Request
Key
Value
Send In
Create parameter
Value
Refresh Request
Key
Value
Send In
Create parameter
Value
Clear cookies
Get New Access Token
Online
Find and replace
Console
Import Complete
Runner
Capture requests
Cookies
Trash

3. After the Authorization is successful, click **Proceed** to view the MANAGE ACCESS TOKENS window.

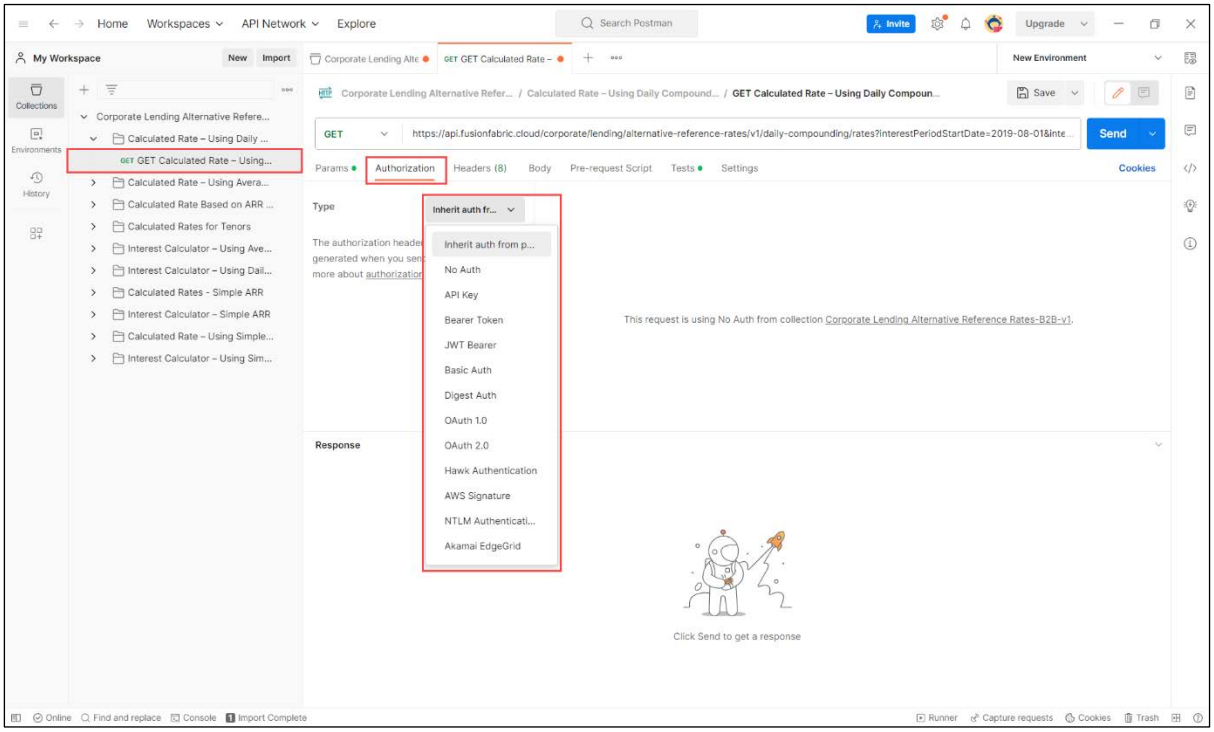


4. On the MANAGE ACCESS TOKENS window, click **Use Token**. The user is redirected to the Authorization screen.

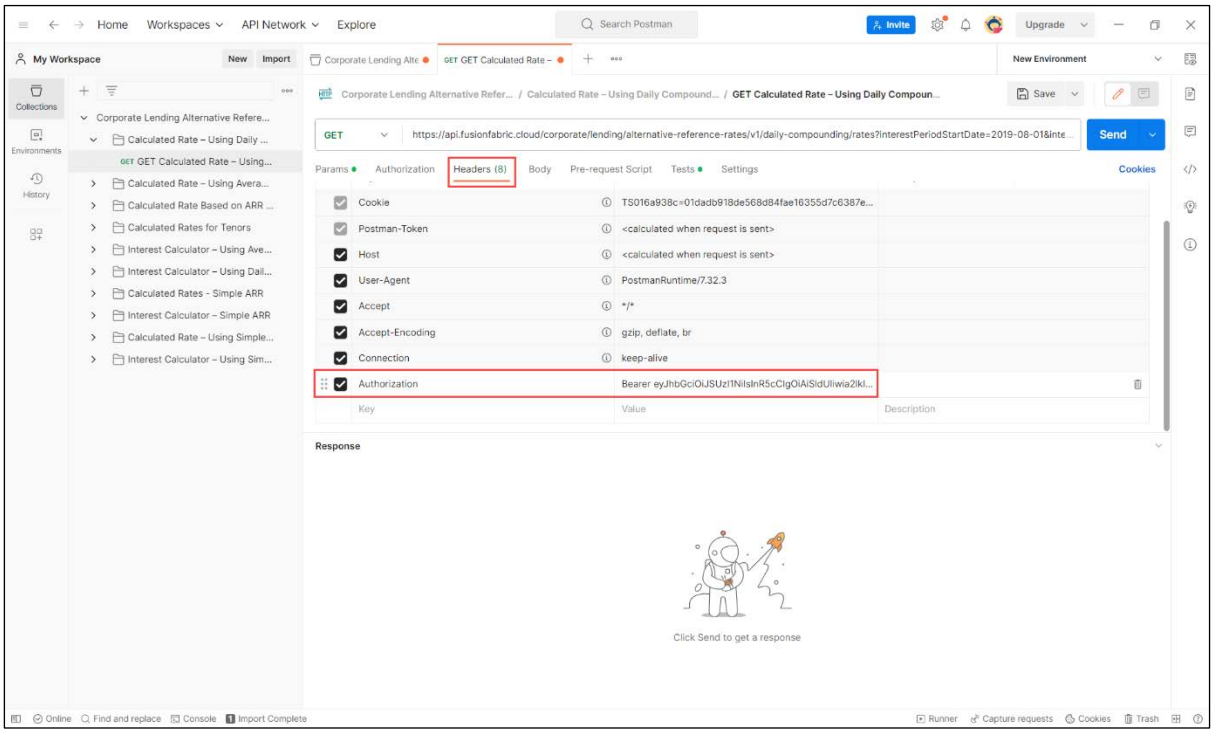
Note: The latest token is automatically updated in the **Current Token** section on the Authorization page.



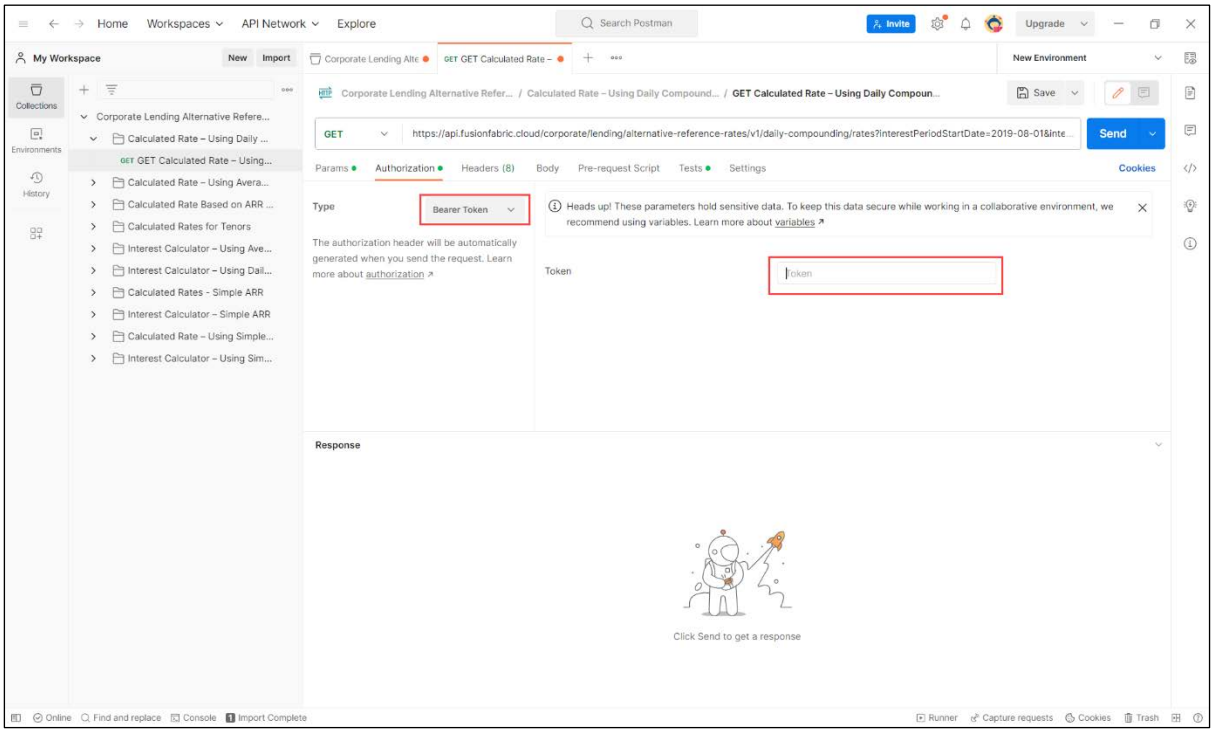
5. Before you run any API request on Postman, do one of the following:
    a. Go the Authorization page of the GET or POST API call.



    b. Verify the Authorization Type, and do one for the following:
        - If the **Type** is set as **Inherit auth from parent**, then click the **Headers** tab/page and add an **Authorization** parameter with the value as **Bearer *<copy-paste latest token>***.



- If the **Type** is updated to **Bearer Token**, then copy-paste the latest token in the **Token** field.



The user can now run API requests using the Postman collection.

Important: If the API request fails, check the error code in the response and perform the required actions to remediate the issue.

8.3.2 Regenerate Access Token – Sandbox Environment

Each access token that is generated expires after certain amount of usage/time. The user is not allowed to run API requests if the access token expires. The user can regenerate the access token to continue running API requests. To regenerate the access token, do the following:

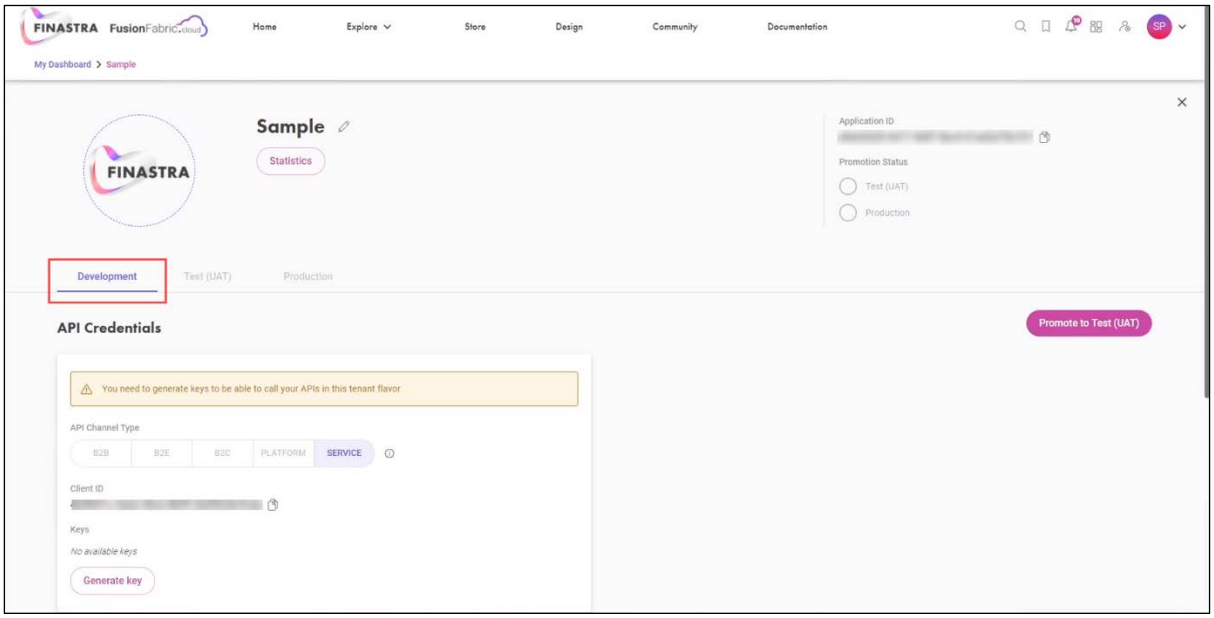
1. Open Postman, click the postman collection. The **Authorization** screen is displayed.
2. On the Authorization screen, scroll down the page and click **Get New Access Token**.
3. After the Authorization is successful, click **Proceed** to view the MANAGE ACCESS TOKENS window.
4. On the MANAGE ACCESS TOKENS window, click **Use Token**. The user is redirected to the Authorization screen.

   Note: The latest token is automatically updated in the **Current Token** section on the Authorization page.

5. The latest token must be updated in the **Authorization** page of the GET or POST API call.

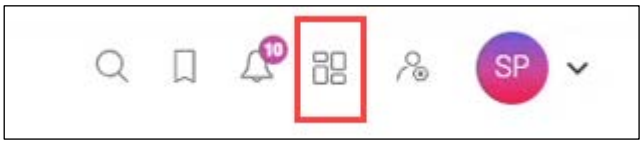
8.4 Promoting FusionCreator Application to Test (UAT)

The user can promote the application from Sandbox/Development (limited data) to *Test (UAT)*, where the application has access to validate UAT scenarios with real-time rate data.

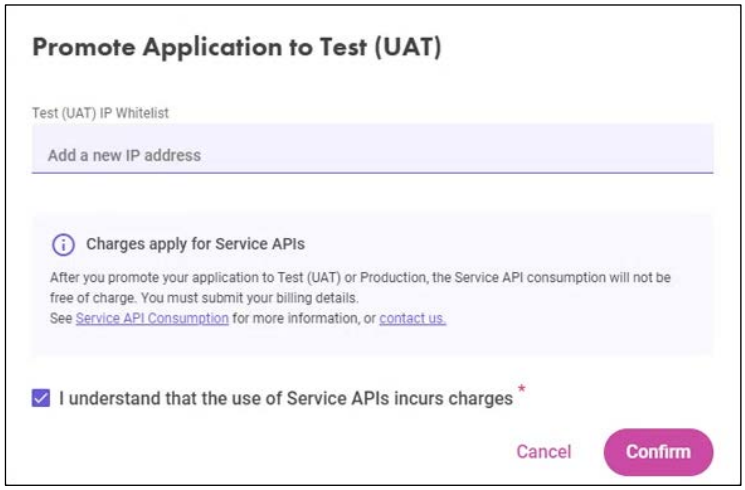


To promote the application:

1. Go to https://developer.fusionfabric.cloud/ (FFDC portal) and sign in with the FFDC credentials.
2. Click **My Dashboard** icon to open the registered applications list. The **Your Applications** window is displayed.

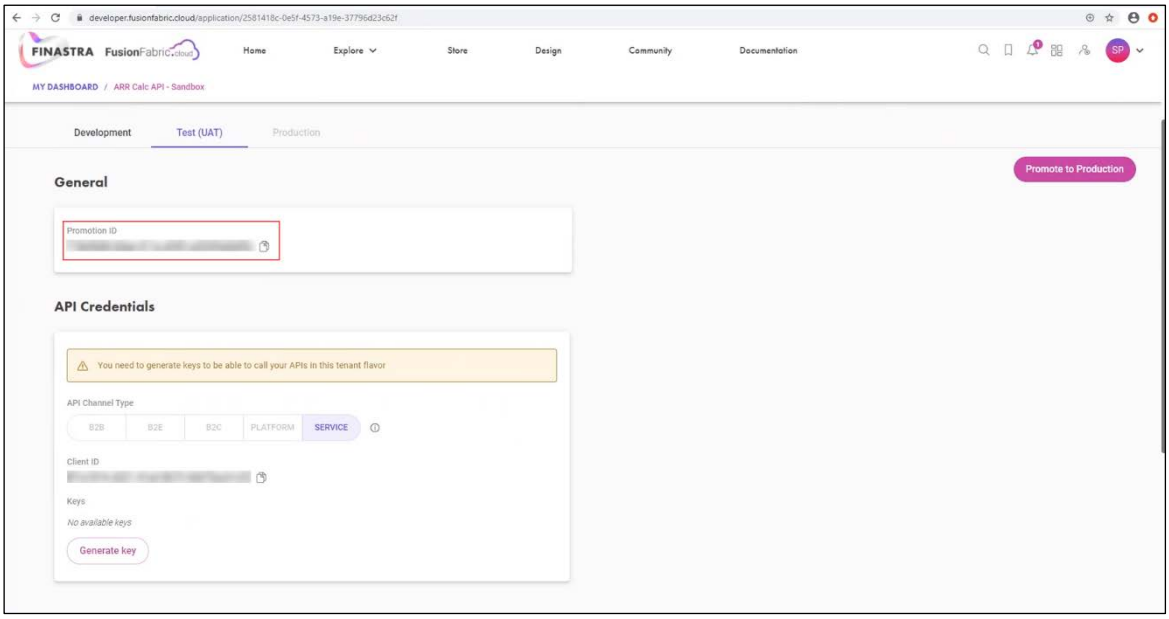


3. From the Your Applications list, click the application created by the user in the *Creating FusionCreator Application* section.
4. To promote the application, the user must click the **Promote to Test (UAT)** button. A popup message appears.



5. Read, accept, and **Confirm** when the following popup message appears.

Note: The **Test (UAT) IP Whitelist** field allows the user to restrict the IP access for the application. That is, going forward, the user will be allowed to run API requests only from that particular IP.



6. The user must access the promoted application and generate a new secret key (similar to the steps shown in the Creating FusionCreator Application section). The updated credentials must be used to configure/connect to the Test (UAT) version of the ARR Calculator API.

Note: Ensure that the **Application ID**, **Promotion ID**, **Client ID**, and **Secret key** are copied and saved for future use.

8.4.1 Connecting to the API Service – Test (UAT) Environment

If the user has not connected to the API service earlier, the use must first connect to the API Service before the user can run API requests. To connect to the API service, refer to the *Connecting to the API Service for the First Time* section.

8.4.1.1 Get New Access Token – Test (UAT) Environment

The user requires an access token to connect to the Test (UAT) environment and run API requests. To get an access token, refer to the *Get New Access Token* section.

To successfully generate an access token for Test (UAT), when the GET NEW ACCESS TOKEN window appears, enter the following and click **Request Token**.

Note: The user gets a valid token for Test (UAT) only when their request for promotion is granted consent by the FFDC team. This consent (approval) is provided based on contractual agreement. Although the Client ID is changed/updated and the user is able to generate a new Secret key, if FFDC consent is not provided, the user will not be able to generate a valid token to run API requests.

- **Token Name** – Enter a name for the token or leave it as default.
- **Grant** Type – Select Client Credentials.
- **Access Token URL** – https://api.fusionfabric.cloud/login/v1/finastra-uat/oidc/token (Test (UAT))

- **Client ID** – Received post promotion of application to Test (UAT) environment on FFDC. For reference, click.
- **Client Secret** – The secret key generated for the application post promotion to Test (UAT) environment on FFDC. For reference, click.
- **Client Authentication** – Select Send as Basic Auth header.
- Click **Get New Access Token**. The authorization process commences**.**

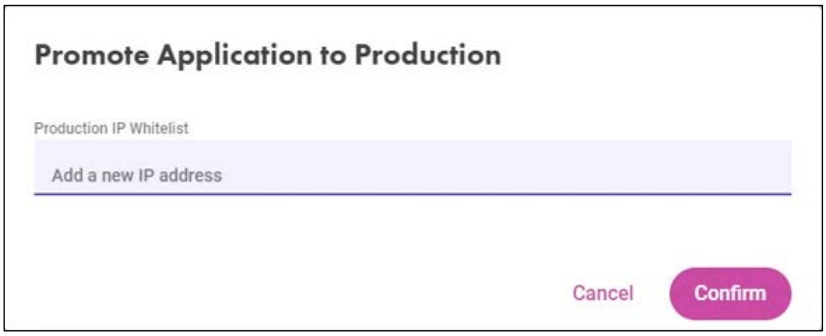
8.4.1.2 Regenerate Access Token – Test (UAT) Environment

When the access token expires, the user can regenerate the token to continue running API requests. To regenerate the relevant access token, refer to the *Regenerate Access Token* section.

8.5 Promoting FusionCreator Application to Production

After the FusionCreator application is promoted to *Test (UAT)*, see prior section for information, the user can promote the application to Production, where the application gets access to with real-time rate data for production usage.

1. Similar to how the application was promoted to *Test (UAT)*, see prior section for information, the user must access the appropriate application, and click the **Promote to Production** button. A popup message appears.



2. Click **Confirm** when the following popup message appears.

Note: The **Production IP Whitelist** field allows the user to restrict the IP access for the application. That is, going forward, the user will be allowed to run API requests only from that particular IP.

3. The user must access the promoted application and generate a new secret key (similar to the steps shown in the Creating FusionCreator Application section). The updated credentials must be used to configure/connect to the Production version of the ARR Calculator API.

Note: Ensure that the **Application ID**, **Promotion ID**, **Client ID**, and **Secret key** are copied and saved for future use.

8.5.1 Connecting to the API Service – Production

If the user has not connected to the API service earlier, the use must first connect to the API Service before the user can run API requests. To connect to the API service, refer to the *Connecting to the API Service for the First Time* section.

8.5.1.1 Get New Access Token – Production Environment

The user requires an access token to connect to the Production environment and run API requests. To get an access token, refer to the *Get New Access Token* section.

To successfully generate an access token for Production, when the GET NEW ACCESS TOKEN window appears, enter the following and click **Request Token**.

Note: The user gets a valid token for Production only when their request for promotion is granted consent by the FFDC team. Although the Client ID is changed/updated and the user is able to generate a new Secret key, if FFDC consent is not provided, the user will not be able to generate a valid token to run API requests.

- **Token Name** – Enter a name for the token or leave it as default.
- **Grant** Type – Select Client Credentials.
- **Access Token URL** – https://api.fusionfabric.cloud/login/v1/finastra-prod/oidc/token (Production)
- **Client ID** – Received post promotion of application to Production environment on FFDC. For reference, click.
- **Client Secret** – The secret key generated for the application post promotion to Production environment on FFDC. For reference, click.
- **Client Authentication** – Select Send as Basic Auth header.
- Click **Get New Access Token**. The authorization process commences**.**

8.5.1.2 Regenerate Access Token – Production Environment

When the access token expires, the user can regenerate the token to continue running API requests. To regenerate the relevant access token, refer to the *Regenerate Access Token* section.

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