

# Refinitiv Real-Time — Optimized

INSTALLATION AND CONFIGURATION FOR CLIENT USE

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# 1 Overview

## 1.1 Audience

This document is for users of the Refinitiv Real-Time — Optimized delivery mechanism for in-cloud distribution of Refinitiv Real-Time content.

## 1.2 Purpose

The purpose of this document is to provide instructions for the following activities:

- Details workflows to consume service
  - Login via the Refinitiv Data Platform and obtain a set of security tokens.
  - Use Security Tokens to connect to Service Discovery to obtain access end points (VIPs).
  - Connect and login to an access end point using a security token.
  - Consume Refinitiv Real-Time — Optimized service.
- Access for Client usage.
- Setup a “Hello World” application to consume Refinitiv Real-Time data.
- Create a PrivateLink connection.
- Create and launch a virtual server in the AWS cloud.

## 1.3 Feedback, Corrections, and Reaching Out

While reading this document, if you encounter any information that is incorrect, or information for which you want to add additional pieces of information, comments, tips, notes, etc., you can contact us at [ProductDocumentation@refinitiv.com](mailto:ProductDocumentation@refinitiv.com).

## 1.4 Conventions Used in This Manual

This manual uses the following stylistic conventions:

- Path names and file names within the text of this document appear in a bold font.  
For example: **us-east-1-aws-2-sm.optimized-pricing-api.refinitiv.net**
- Commands to be entered by the user (exactly as shown) appear in Lucida Console font.  
For example: `/oauth2/v1/token`
- Service names, names of configuration parameters, and configuration values appear in a **bold font**.
- Variables (such as usernames or passwords) are formatted in italics. For example: *username*.
- Command line syntax, command examples, sample output, file listings, code samples, or system messages appear in a plain typewriter font with gray shading.

For example:

```
{
  "expires_in": 7199,
  "token_type": "Bearer",
  "access_token": "<access_token>"
}
```

## 1.5 Glossary of Terms and Acronyms

TERM OR ACRONYM	DESCRIPTION
ADS	Refinitiv Real-Time Advanced Distribution Server
AMI	Amazon Machine Image
AppKey	A unique identifier for an application. This may also be referred to as <code>client_id</code> .
AWS	Amazon Web Services
AZ	Availability Zone
DACS	Refinitiv Data Access Control System
DNS	Domain Name System/Server
EFS	Elastic File System (cloud storage system)
EMA	Enterprise Message API packaged as part of RTSDK. A high performance, open-source, ease-of-use message layer API. This API adds capabilities on top of the Enterprise Transport API to improve development efficiency (e.g. simplified connection management and data parsing) while still providing run-time flexibility and high performance processing of streaming data.
ETA	Enterprise Transport API packaged as part of RTSDK. An open source transport layer API that provides access to Refinitiv Real-Time Feeds and the Refinitiv Real-Time Distribution System. This API provides the highest level of performance, scalability, and tune-ability.
instance	A virtual server in the AWS cloud
JSON	JavaScript Object Notation

**Table 1: Glossary of Acronyms and Terms**

TERM OR ACRONYM	DESCRIPTION
NAT	Network Address Translation
NLB	Network Load Balancer
oAuth	Provides to clients a "secure delegated access" to server resources on behalf of a resource owner.
OMM	Open Message Model. The Open Message Model provides a request/response paradigm and basic building blocks that may be used to build data models.
PrivateLink	AWS PrivateLink provides a secure, private connection between VPCs (and AWS services if needed) using the AWS HyperPlane.
RDP	Refinitiv Data Platform
Refinitiv Real-Time Distribution System	The current Market Data System, which includes the Refinitiv Real-Time Advanced Distribution Server, Refinitiv Real-Time Advanced Data Hub, APIs such as Refinitiv Real-Time SDK (Enterprise Transport and Message APIs), and ancillary systems such as DACS.
ReST	Representational State Transfer.
RTO	Refinitiv Real-Time — Optimized.
RSSL	Refinitiv Source Sink Library, an efficient low-level transport and data encoding/decoding library.
RTSDK	Refinitiv Real-Time SDK (formerly Elektron SDK or ESDK). A suite of open source APIs to access Real-Time content by implementing Refinitiv Wire Format and Open Message Model constructs. This includes the Enterprise Transport and Message APIs. RTSDL is available on <a href="#">GitHub</a> .
RWF	Refinitiv Wire Format. The wire format used for transmission of binary encoded Open Message Model data.
Service	A logical entity comprising one or more source applications that have been configured to provide a single, coherent view of a set of data. Sink applications request data from services.
Update	A data message that supersedes previously transmitted data. A data message that incrementally changes part of a display page without resending all the data on that page.
VIP	Virtual IP address: Refinitiv Data Platform Cloud access points.
VPC	Virtual Private Cloud
WSS	WebSocket secure connection

**Table 1: Glossary of Acronyms and Terms (Continued)**

## 2 Introduction to Refinitiv Real-Time — Optimized

Refinitiv Real-Time - Optimized is part of the Refinitiv Data Platform, connecting your organization not only to our global, real-time exchange, OTC and contributed data, but also an extensive ecosystem of financial services data and analytics to help you drive revenue, reduce costs, manage compliance and better utilize resources.

Refinitiv Real-Time - Optimized is our next generation bandwidth optimized pricing content delivery platform hosted on AWS which deprecates the current client site deployed Elektron Edge data feed devices. The service is offered in multiple regions and supports secure internet, PrivateLink, and Delivery Direct client connectivity options.

The platform offers both wire format optimized compiled APIs and a standards based websocket API delivery for pricing content. Once you decide on the use of a particular API to interact with the platform you will need to refer to Developers Kit documentation for specific examples, but all API workflows involve an interaction with with a Token API and optionally the Service Discovery API.

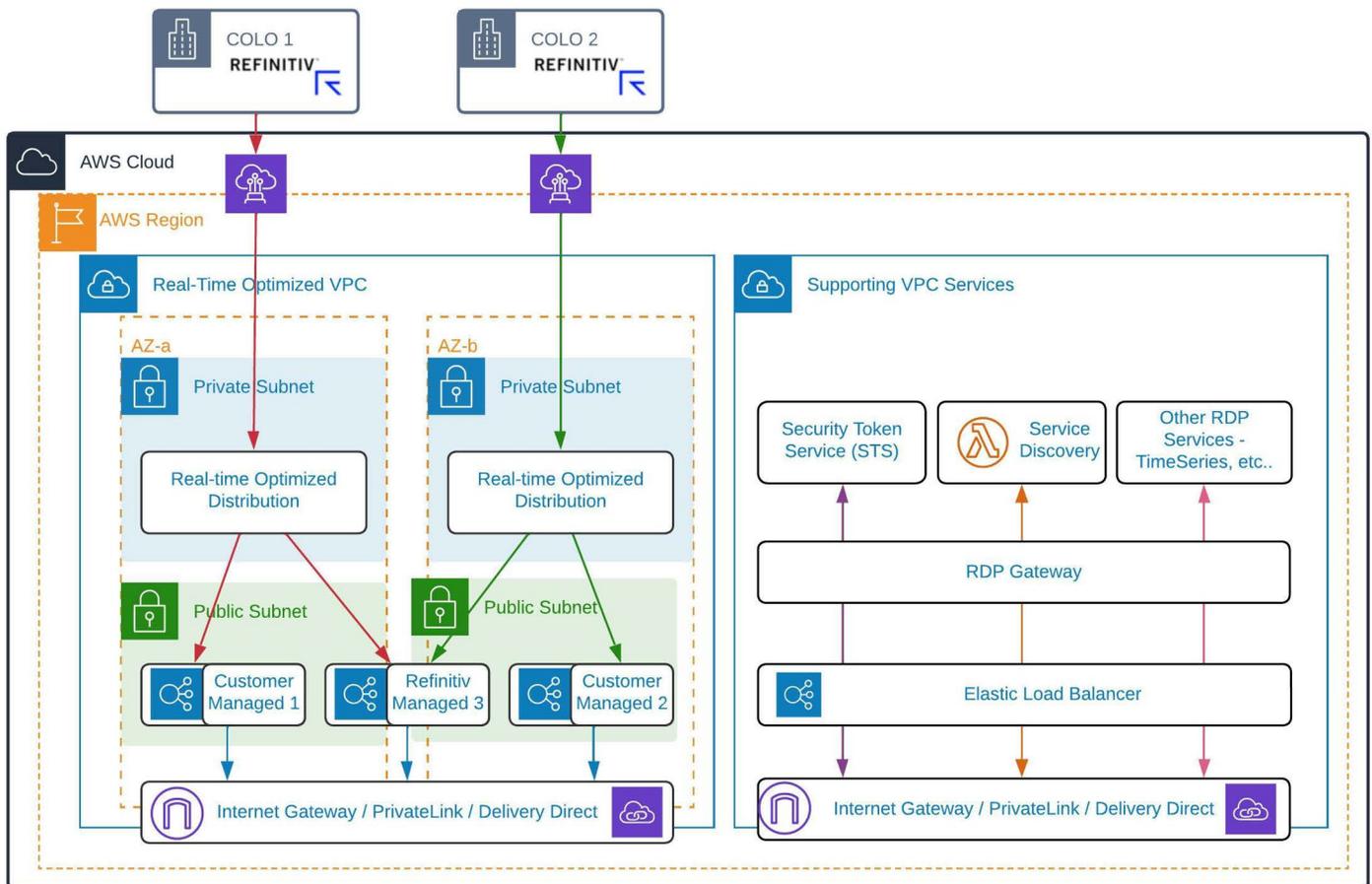


Figure 1. RTO Connectivity Overview

## 2.1 Resiliency Options

Real-Time - Optimized offers two models of resiliency: Refinitiv Managed resiliency and Customer Managed resiliency. Each model has different endpoints which customers should be aware of.

RESILIENCY MODEL	DESCRIPTION
Refinitiv Managed	These endpoints are used for active/standby connectivity to Real-Time Optimized pricing content. Refinitiv manages failover between A and B availability zones of the Real-Time Optimized Infrastructure on the applications behalf.
Customer Managed	These endpoints are used for live/live connectivity to Real-time Optimized. In this model customers connect to independent infrastructure on both the A and B availability zones of the of the Real-time Optimized platform and manage failover between the two themselves.

**Table 2: Resiliency Options**

## 3 Authentication Using Refinitiv Data Platform

Refinitiv Data Platform authentication uses the following workflow:

1. Authenticate via Refinitiv Data Platform Token Service API, using a REST request to obtain a security token aka access token.
2. Either specify an endpoint or discover an endpoint. Discovery of an endpoint is done using the Refinitiv Data Platform Service Discovery API: use a REST request to obtain a list of endpoints. An endpoint or VIP consists of a hostname and a port. Please note that Service Discovery REST request must be done using a valid access token.
3. Establish a connection to a streaming service via an encrypted socket or encrypted websocket connection.
4. Send a Login Request over the active connection using the security token.
5. Request any desired permissioned content.

Every access token has an expiration time. Depending on the version of authentication being used, the expiration requires specific actions:

- With Version 1 authentication using Machine Account credentials, to remain connected to Refinitiv Real-Time — Optimized, your application must proactively renew its token before expiration. If disconnected from the Refinitiv Data Platform or from Refinitiv Real-Time — Optimized, your application must reconnect with a new token. For more details, refer to [Section 3.1](#).
- With Version 2 authentication using Service Account credentials, periodic token renewal to stay connected is no longer necessary. However, if disconnected, applications must present a new valid access token and renew it as needed during reconnection window. For more details, refer to [Section 3.2](#).

### 3.1 V1 Authentication Using Machine Accounts

#### 3.1.1 V1 Authentication

This authentication mechanism uses Machine Account credentials to obtain security tokens from Refinitiv Data Platform using the RESTful authentication token service. The resulting access token is then used in a Login Request message to make a streaming connection to Refinitiv Real-Time — Optimized.

When you subscribe to Refinitiv Real-Time — Optimized, you will receive a Welcome email that provides a link to activate your machine account and create a password. If you did not receive a Welcome email, contact your Refinitiv account team, or if you are not a client, use the [Contact Us](#) page if you would like to try Refinitiv Real-Time data. The Welcome email includes your username (i.e., Machine ID). Additionally a client ID is required to use this authentication.

To obtain a client ID, use the email address from your Welcome email as your credentials in obtaining a **client\_id** from the **AppkeyGenerator** tool. The output of the tool is an AppKey, which is your **client\_id**. For details on these and additional parameters, refer to [Section 3.1.2](#).

V1 token authentication REST request is done using OAuth2 grant types:

- password grant
- refresh\_token grant

Initially, applications must use the password grant to obtain two types of tokens: access token and refresh token. Access tokens have an expiration time. With this authentication mechanism, applications are required to renew the **access\_token** and present a new valid token to RTO to remain connected. Failing to do so prior to token expiration will result in a disconnect from RTO. The response to password grant will result in an **access\_token** and **refresh\_token**. In subsequent access token renewals, the **refresh\_token** is used with the **refresh\_token** grant. The grant is considered to be more secure as the Machine password is not required when using this. Note that the **refresh\_token** also expires periodically. In this case, applications must fall back to password to obtain a new **refresh\_token**. See [Section 3.1.3](#) for more details about grant types.

Upon a disconnect from RTO due to a maintenance window, application must present a valid **access\_token** during connection attempts with token renewals done prior to token expiration.

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**NOTE:** RTDS components, LPC, RTSDK-EMA, and RTSDK-ETA-ValueAdd-Reactor (with/without Watchlist feature enabled) automatically handle authentication, service discovery, and timely RTO token renewal. Customer may develop their own websocket applications referencing the Websocket API sample applications which demonstrate authentication and connectivity to RTO. See respective product documentation for details on how to specify Machine Account and client ID as configuration for that product.

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V1 Authentication URL for access from public Internet access: <https://api.refinitiv.com/auth/oauth2/v1/token>.

### 3.1.2 V1 Authentication Parameters

The following parameters are required to manage the login process on the Refinitiv Data Platform GW API for compliance with OAuth 2.0 specification:

PARAMETER	DESCRIPTION
grant_type	Specifies the manner in which you request new tokens (including the access token) from the Refinitiv Data Platform. Available values include: <ul style="list-style-type: none"> <li><b>password</b>: Always start a connection to the Refinitiv Data Platform using the a <b>grant_type</b> of <b>password</b> to obtain your security and access tokens. You must also include the <b>username</b>, <b>password</b>, and <b>client_id</b> parameters.</li> <li><b>refresh_token</b>: After connecting to the Refinitiv Data Platform, use a <b>grant_type</b> of <b>refresh_token</b> to refresh your access token before it expires to maintain connectivity.</li> </ul> For further details on using <b>grant_type</b> , refer to <a href="#">Section 3.1.3</a> .
username	<b>Required</b> ; Specifies the username when using a <b>grant_type</b> of <b>password</b> . <b>username</b> is also referred to as your <b>Machine ID</b> .
password	<b>Required</b> ; Specifies the password associated with the <b>username</b> when using a <b>grant_type</b> of <b>password</b> . For details on changing your password, refer to <a href="#">Section 3.1.5</a> .
client_id	<b>Required</b> ; Specifies a unique identifier defined for the user or application and deemed confidential (i.e., not shared between users). You generate a <b>client_id</b> using the <b>AppkeyGenerator</b> . You can pass a <b>client_id</b> parameter in the request body or as an "Authorization" request header encoded as base64. <b>client_id</b> is also referred to as the <b>AppKey</b> .
scope	(Optional) Limits the scope of the generated token, so that the Access token is valid only for a specific data set.
takeExclusiveSignOnControl	<b>Conditional</b> ; If your user credentials permit multiple concurrent sign-ons, this parameter invalidates the Refresh token for all previous sign-ons when it is set to <b>true</b> . By default, if unspecified, it is assumed to be <b>false</b> . Set <b>takeExclusiveSignOnControl</b> to <b>true</b> if you have single sign-on policy or if your refresh token is missing. For further details on when and how to use <b>takeExclusiveSignOnControl</b> , refer to <a href="#">Section 3.1.3.1.1</a> .  <b>NOTE</b> : If the user has only single sign-on, <b>takeExclusiveSignOnControl</b> must be set to <b>true</b> . Otherwise, it should be set or defaulted to <b>false</b> to avoid the unnecessary invalidation of tokens.

**Table 3: Authentication Request Parameters**

### 3.1.3 V1 Authentication Request

When you initially log into the Refinitiv Data Platform, you must use a **grant\_type** of **password** to obtain the access and refresh tokens. After connecting, you may use a **grant\_type** of **refresh\_token** to refresh your access token and maintain connectivity.

#### 3.1.3.1 grant\_type: password with Example

To initiate your connection and retrieve your access and refresh tokens, always use a **grant\_type** of **password**. Your request must include the following parameters: **username**, **password**, **client\_id**, **scope** (optional), and if you have a single-sign on policy, **takeExclusiveSignOnControl**.

Additionally, if you fail to refresh your access token, you need to use a **grant\_type** of **password** to again log into the Refinitiv Data Platform.

The user application makes an initial authentication request by calling method `/auth/oauth2/v1/token` as illustrated in the following example:

```
HTTPS POST api.refinitiv.com/auth/oauth2/v1/token HTTP/1.1
BODY:
```

```
{
  "Accept": "application/json",
  "Authorization": "Basic <client_id>",
  "Content-Type": "application/x-www-form-urlencoded"
}
grant_type=password&scope=trapi&username=<username or MachineID>
  &password=<password>&client_id=<client_id or AppKey>
```

### 3.1.3.1.1 Using the Parameter: `takeExclusiveSignOnControl`

Set `takeExclusiveSignOnControl` to `true` if you have single sign-on policy or if your refresh token is missing.

If your user credentials only give you single sign-on, and `takeExclusiveSignOnControl` is not set to `true` or if you have the ability to sign-on multiple times, and you exceed the number of permitted sign-ons, Refinitiv Real-Time — Optimized sends with the following error:

```
"error": "access_denied" , "error_description": "Session quota is reached."
```

In this scenario, a user might opt to forcefully log out all other signed-in instances and request a new set of tokens. A request with an additional parameter `takeExclusiveSignOnControl=true` forcefully logs out all other signed-in instances:

```
POST https://api.refinitiv.com/auth/oauth2/v1/token HTTP/1.1

Host: api.refinitiv.com
User-Agent: python-requests/2.12.4
Accept-Encoding: gzip, deflate
Accept: application/json
Connection: keep-alive
Content-Length: 112
Content-Type: application/x-www-form-urlencoded
Authorization: Basic RDZENz*****DNkNEREQ3NDo=

grant_type=password&username=<username or Machine ID>&scope=scope&client_id=<client_id or AppKey>&
  password=<password>&takeExclusiveSignOnControl=true
```

### 3.1.3.2 `grant_type: refresh_token`

To maintain connectivity with the Refinitiv Data Platform, you must renew your access token using a `grant_type` of `refresh_token` and provide the parameters: `username` and `scope` (if any).

The user application makes a request for a refresh token by calling method `/oauth2/v1/token` as illustrated in the following example:

```
HTTPS POST api.refinitiv.com/oauth2/v1/token HTTP/1.1
BODY:
{
  "Accept": "application/json",
  "Authorization": "Basic app_id",
  "Content-Type": "application/x-www-form-urlencoded",
}
```

```
grant_type=refresh_token<username or Machine ID>=user&refresh_token=<refresh token>&client_id=<client_id or AppKey>
```

### 3.1.4 V1 Authentication Response

A successful authentication response from the Refinitiv Data Platform for either **grant\_type** (i.e., **password** or **refresh\_token**) contains the following parameters:

- **access\_token**: Specifies the Access token in use.
- **refresh\_token**: Specifies the Refresh token to use to obtain an updated access token before the current token expires.
- **expires\_in**: Specifies the remaining Access token validity time (in seconds).
- **scope**: Specifies a list of all scopes associated with this token.
- **token\_type**: Set to **Bearer** (i.e., the Refinitiv Data Platform token service has generated and sent the Refresh and Access tokens in the response message).

If successful, response code 200 (OK) is returned with two tokens as shown in the following example (the expiration period is specified in the **expires\_in** field):

```
HTTP/1.1 200
Content-Type: applicaton/json charset=utf-8
{
  "access-token": <access token>,
  "expires_in": "300",
  "token_type": "Bearer",
  "scope": "trapi.streaming.pricing.read",
  "refresh_token": <refresh token>
}
```

### 3.1.5 V1 Password Change Using RDP REST Call

You can change your authentication password using the parameter **newPassword**. When changing to a new password, you need to submit the current password.

If a you want to change your password, the request message body must contain a string like the following example:

```
username=***&password=<current password>&grant_type=password&scope=trapi&newPassword=<new password>
```

### 3.1.6 V1 Managing Multiple Connections

If an application needs to establish multiple connections to Refinitiv Real-Time — Optimized, follow these recommendations:

- If multiple connections are established via a single application instance, application may be architected to request token and share it on multiple connections. If applications are written to RTSDK ETA Reactor Layer or Watchlist, where credentials match on multiple connections, API automatically manages requests to share the access token and renew it per renewal requirements. RTSDK EMA configuration may specify the same credentials on multiple connections.
- If multiple instances of an application must share a token, they may use the same credentials. See the note further in this section about maximum permitted connections with shared credentials.

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**NOTE:** Refinitiv Real-Time — Optimized currently supports five simultaneous connections using the same access token.

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For V1 authentication, refer also to the Section [Section 3.1.3.1.1](#) regarding the use of the parameter **takeExclusiveSignOnControl** in managing multiple connections as well as what happens when you exceed the number of permitted sign-ons.

## 3.2 V2 Authentication Using Service Accounts

### 3.2.1 V2 Authentication

This authentication mechanism uses Service Account credentials to obtain security tokens from Refinitiv Data Platform using the RESTful authentication token service. The resulting access token is then used in a Login Request message to make a streaming connection to Refinitiv Real-Time — Optimized.

When you subscribe to Refinitiv Real-Time — Optimized, your organization will provide access to a Platform Administration UI via Welcome email requiring you to reset a password. With this administrator access, your administrator may create Service Credentials. Refer to Platform Administration UI documentation for instructions on how to create Service Accounts. If you have not received a Welcome email, contact your Refinitiv account team, or if you are not a client, use the [Contact Us](#) page if you would like to try Refinitiv Real-Time data.

There are two types of Service Accounts:

- “Secret” aka “Client Credentials With Secret (CCwS)”: This type of service account, when created via the UI, will provide these credentials: Service ID (username) and Secret (password). The password is auto-generated and must be securely stored immediately upon creation. If password is forgotten, it may be re-generated.
- “JWT” aka “Client Credentials With JWT (CCwJ)”: This type of account requires that customer pre-generate a JSON Web Key (JWK) which consists of a private and public keypair. Please consult with your security team to generate this keypair and store it securely. This type of service account, when created via the Platform Administration UI, will provide a Service ID and will permit the administrator to register the generated public key. See Platform Administration UI documentation for the precise format of the public key used for registration. Then, the public and private key pair must be stored securely and provided to the connecting application as part of configuration.

V2 token authentication REST request is done using OAuth2 **grant\_type: client\_credentials**. For more information regarding grant types, refer to section [Section 3.2.2](#).

- For CCwS, this grant type requires a **client\_id** and **client\_secret** as inputs. The Service ID or username is the **client\_id**. The Secret or password is the **client\_secret**.
- For CCwJ, this grant type requires a **client\_id** and a **client\_assertion** as inputs. The Service ID or username is the **client\_id**. Application must use a JWT library to use the JWK to create a signed assertion.

With V2 authentication, the token response will contain an **access\_token** and an expiration time associated with the token. Once an application connects to RTO using a valid **access\_token** obtained using Service Account, application will stay connected. Upon disconnection from RTO, application must re-obtain a new access token for connection attempts. Every reconnect attempt must present a valid unexpired token to RTO. Therefore, since there is a possibility that token expires during connection re-attempts, application must proactively obtain a new access token prior to expiration.

In summary, upon a disconnect from RTO due to a maintenance window, application must present a valid **access\_token** during connection attempts, with token renewals done prior to token expiration.

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**NOTE:** RTDS components, LPC, RTSDK-EMA, and RTSDK-ETA-ValueAdd-Reactor (with/without Watchlist feature enabled) automatically handle authentication, service discovery, and timely RTO token renewal. Customer may develop their own websocket applications referencing the Websocket API sample applications which demonstrate authentication and connectivity to RTO. See respective product documentation for details on how to specify Service Account as configuration for that product.

---

V2 Authentication URL for access from public Internet access: <https://api.refinitiv.com/auth/oauth2/v2/token>.

### 3.2.2 V2 Authentication Parameters

The following parameters are required to manage the login process on the Refinitiv Data Platform GW API for compliance with OAuth 2.0 specification:

PARAMETER	DESCRIPTION
grant_type	Specifies the manner in which you request new tokens (including the access token) from the Refinitiv Data Platform. Available values include: <ul style="list-style-type: none"> <li>• <b>client_credentials</b>: Use this <b>grant_type</b> for both Client Credentials With Secret and Client Credentials With JWT authentication types.</li> </ul> For further details on using <b>grant_type</b> , refer to <a href="#">Section 3.1.3.1</a> .
client_id	<b>Required</b> ; Specifies the Service ID or username as value of <b>client_id</b> when using a <b>grant_type</b> of <b>client_credentials</b> .  <b>NOTE:</b> <b>client_id</b> has a different definition in V2 authentication. V1 <b>client_id</b> ( <b>app_key</b> ) is no longer used in V2 authentication.
client_secret	<b>Required</b> for Client Credentials With Secret authentication type; Specifies the password or secret as value of <b>client_secret</b> when using a <b>grant_type</b> of <b>client_credentials</b> .
client_assertion_type	<b>Required</b> for Client Credentials With JWT authentication type: Specifies the <b>assertion_type</b> . Default value is "urn:ietf:params:oauth:client-assertion-type:jwt-bearer".
client_assertion	<b>Required</b> for Client Credentials With JWT authentication type: Specifies an encoded string produced by JWT library using JSON Web Token (private and public key pair).
scope	Optional. Limits the scope of the generated token, so that the Access token is valid only for a specific data set. Default value is "trapi.streaming.pricing.read" for RTO.
audience	<b>Required</b> for Client Credentials With JWT authentication type: Specifies the value of "aud" or audience claim in a JWT. This must be set as <a href="https://login.ciam.refinitiv.com/as/token.oauth2">https://login.ciam.refinitiv.com/as/token.oauth2</a> for valid token renewal via public Internet, PrivateLink, or Delivery Direct.

**Table 4: V2 Authentication Parameters**

### 3.2.3 V2 Authentication Request

Depending on the type of Service Account created for authentication via Platform Administration UI, refer to the following sections for details about the REST request used for obtaining an access token from Refinitiv Data Platform.

#### 3.2.3.1 Client Credential with Secret

The request must include the following parameters: **client\_id**, **client\_secret** and **scope** (optional). The authentication request is a REST POST request made to RDP URL: </auth/oauth2/v2/token> as illustrated in the following example:

```

HTTPS POST api.refinitiv.com/auth/oauth2/v2/token HTTP/1.1
BODY:
{
  "Accept": "application/json",
  "Content-Type": "application/x-www-form-urlencoded"
}
grant_type=client_credentials&client_id=<client_id>&client_secret=<client_secret>&scope=trapi.s
treaming.pricing.read
  
```

### 3.2.3.2 Client Credentials with JWT

The request must include the following parameters: **client\_id**, **client\_assertion\_type**, **client\_assertion** and scope (optional). The authentication request is a REST POST request made to RDP URL: [/auth/oauth2/v2/token](#) as illustrated in the following example:

```
HTTPS POST api.refinitiv.com/auth/oauth2/v2/token HTTP/1.1
BODY:
{
  "Accept": "application/json",
  "Accept-Encoding": "gzip, deflate",
  "Content-Type": "application/x-www-form-urlencoded"
}
grant_type=client_credentials&client_id=<client_id>&scope=trapi.streaming.pricing.read&client_
assertion_type=urn:ietf:params:oauth:client-assertion-type:jwt-bearer&client_
assertion=<client_assertion>
```

Applications such as RTDS, (ADH, RTC), LPC, RTSDK API and Websocket API automatically generate the **client\_assertion** using JWK libraries. Refer to [RTSDK](#) or [Websocket API sample code](#) which are available on GitHub to alter applications to use Client Credentials with JWT authentication type.

### 3.2.4 V2 Authentication Response

A successful authentication response from Refinitiv Data Platform contains the following parameters:

- **access\_token**: Specifies the security token to be used to connect to RTO.
- **expires\_in**: Specifies the duration for which the access\_token is valid when attempting to connect to RTO.
- **token\_type**: Set to Bearer (i.e., the Refinitiv Data Platform token service has generated and sent the Access token in the response message).

Example:

```
{
  "expires_in": 7199,
  "token_type": "Bearer",
  "access_token": <access token>
}
```

### 3.2.5 V2 Password Change Using Platform Administration UI

Users may change password or “secret” associated with a Service account using the self-service Platform Administration UI portal. Passwords are auto-generated via the UI and may be regenerated if change is required.

### 3.2.6 V2 Managing Multiple Connections

Refinitiv Real-Time — Optimized currently supports five simultaneous connections using the same token or token obtained using same credentials.

## 3.3 Error Responses to Authentication Requests

An authentication request can return a number of different errors to the client, depending on the error condition:

- 300 Errors: Reserved for redirects. Most redirects will be transparent to the end-user and are handled entirely by a user-agent. If you see this error, use the redirect URL in retry.

- 400 Errors: Standard http errors.
  - Catch-all Error Condition that can typically be resolved by re-authenticating with the user credentials:

---

**NOTE:** If a request attempt fails, limit the number of your reattempts to two. Before further attempts, either restart the application or implement a graduated back-off period. Repeated failed requests can result in your account being locked.

---

```
400 Bad Request
error=invalid_request
```

- Code Parameter Omitted

```
400 Bad Request
error=invalid_request&error_description=Missing%20code%20parameter.
```

- Invalid or Missing Client ID

```
400 Bad Request
error=invalid_request&error_description=Invalid%20client_id%20parameter%20value.
```

- Unsupported Grant Type Parameter

```
400 Bad Request
error=unsupported_grant_type
```

- Invalid or Missing Grant Type Parameter

```
400 Bad Request
error=invalid_grant
```

- 401 Errors: These are client side errors that are resolved by re-authenticating.
- 500 Errors: These are server side errors.

## 4 Connectivity to Refinitiv Real-Time — Optimized

### 4.1 Overview

This chapter provides details on how to discovery endpoints in deployed sites. It also provides a list of endpoints to use as an alternative to discovering them. In addition, this chapter provides details on applications used to connect to RTO.

After you obtain an authentication token, depending on its authorization and scope, you can use it to retrieve content from the Refinitiv Data Platform and connect to Refinitiv Real-Time — Optimized. To connect to Refinitiv Real-Time — Optimized, one can either specify an endpoint (VIP) or discover the endpoint (VIP) using a Refinitiv Data Platform service called **Service Discovery**.

You can use RTSDK APIs to handle both use cases: specifying an endpoint or making a REST request to Service Discovery to choose an endpoint. Websocket framework examples (Websocket API) also demonstrate how to perform Service Discovery.

If you would like to specify an endpoint, follow product documentation for the application you are using to connect to RTO. See [Appendix A](#) for more details regarding Service Discovery bypass.

### 4.2 Currently Deployed Sites

Refinitiv Real-Time — Optimized is currently deployed to the following sites based on geographic location:

GEOGRAPHIC LOCATION	CLOUD PROVIDER	REGION	
AMERS	AWS	N. Virginia	us-east-1
AMERS	AWS	Ohio	us-east-2
EMEA	AWS	Ireland	eu-west-1
EMEA	AWS	Frankfurt	eu-central-1
APAC	AWS	Singapore	ap-southeast-1
APAC	AWS	Japan	ap-northeast-1

### 4.3 Service Discovery to Determine VIP

After you successfully obtain an access token by authenticating via the Refinitiv Data Platform, to connect to RTO, you must determine the endpoint (VIP and port) to which you want your application to connect. You may choose from a list of VIPs provided in Section 4.4. Or you may choose to do another RESTful call to get a list of VIPs. This call is referred to as Service Discovery. This section describes how to perform Service Discovery and interpret the response.

Refinitiv defines VIPs by tier, region, and availability zone. The RESTful call to Service Discovery auto-filters by tier, using the maximum number of items (known as max-watchlist) as specified by your Machine ID configuration. Users can further filter the list of service endpoints by specifying a transport in the service discovery call. If you want to filter your endpoints based on protocol / data format, you can use the optional parameters from [Section 4.3.4](#).

Service discovery is not meant to be confused with service levels such as Full Tick, bandwidth optimized/conflated, or delay. From any endpoint discovered, users can access the level of service for which they are entitled from among available services in Refinitiv Real-Time — Optimized.

APIs that support Service Discovery:

- [Refinitiv Real-Time SDK](#) will automatically perform Service Discovery on behalf of the application (ETA Reactor layer and above); please see RTSDK documentation for more details. Websocket API sample applications also demonstrate how Service Discovery may be performed. See RTSDK documentation for more information on how to use various API layers to enable service discovery.
- Websocket API provides [examples](#) in several languages to show how Service Discovery is done. For each supported language, please refer to README.md for more information on which examples support Service Discovery.

For example, if you were using the WebSocket API written to python, there are three sample applications that demonstrate Service Discovery: <https://github.com/Refinitiv/websocket-api/tree/master/Applications/Examples/RDP/python>

1. `market_price_rdpwg_service_discovery.py`: Does V1 authentication and uses the resulting access token to perform Service Discovery.
2. `market_price_rdpwg_client_cred_auth.py`: Does V2 authentication with ClientID/ClientSecret and uses the resulting access token to perform Service Discovery.
3. `market_price_rdpwg_jwt_auth.py`: Does V2 authentication with ClientID/JWK and uses the resulting access token to perform Service Discovery.

Sample Service Discovery command line syntax using python application using V2 authentication to choose a Refinitiv resilient endpoint in region eu-west-1:

```
python market_price_rdpwg_client_cred_auth.py --clientid <your clientID aka ServiceID> --clientsecret <your_secret> [--region eu-west-1]
```

### 4.3.1 Service Discovery Request

To perform the Service Discovery RESTful call and retrieve VIPs, your application must do an HTTPS GET request to <https://api.refinitiv.com/streaming/pricing/v1/>. By default, the endpoints in the Service Discovery response are not filtered (i.e., endpoints for both TCP and WebSockets are returned). If you want to filter your endpoints based on protocol / data format, you can use the optional parameters in [Section 4.3.4](#).

### 4.3.2 Service Discovery Response

The response for a Service Discovery request contains an array of services with each element of the array consisting of endpoints for various regions, transports and resiliency characteristics (two or more AZs indicates a Refinitiv resilient endpoint).

Refer to the following sections for sample requests and responses:

- For a sample Service Discovery Response that is unfiltered, refer to [Section 4.3.3](#).
- For a sample Service Discovery Response filtered by transport, refer to [Section 4.3.5](#).

---

**NOTE:** The order in which endpoints appear in a Service Discovery response is not guaranteed.

---

Each element in the array of services (endpoints) returned in the Service Discovery response has the following fields:

SERVICE	SERVICE DESCRIPTION
provider	Indicates public cloud provider (currently only <b>aws</b> ).
location	Indicates where the infrastructure is deployed. For AWS, it is in terms of availability zone (AZ). If more than one availability zone is stated, it means the Refinitiv Data Platform-RealTime performs cross AZ failover on behalf of client.
transport	Indicates which transport type to be used to access service. Currently, it is either <b>tcp</b> or <b>websocket</b> . It determines presentation message protocol. The Refinitiv Data Platform-RealTime only supports WebSocket at this time. Support for additional protocols will be added in the future.
dataFormat	Indicates the data format used. It is the presentation of wire protocol format. It can be either <b>rwf</b> or <b>tr_json2</b> , and this is determined by the transport. The Refinitiv Data Platform-RealTime only supports WebSocket at this time. Support for additional protocols will be added in the future.
port	Indicates TCP/IP port number used to establish connection.
endpoint	Specifies the DNS name of service access endpoint

**Table 5: Returned Services**

### 4.3.3 Sample Service Discovery Response: Unfiltered

The following example calls all available services:

```
HTTPS GET api.refinitiv.com/streaming/pricing/v1 HTTP/1.1
```

If successful, the response code 200 (OK) is returned with all available services as follows:

```
HTTP/1.1 200
Content-Type: application/json charset=utf-8
{
  "services": [
    {"port":14002,"location":["ap-northeast-1a"],"transport":"tcp","provider":"aws",
      "endpoint":"ap-northeast-1-aws-1-sm.optimized-pricing-api.refinitiv.net",
      "dataFormat":["rwf"]},
    {"port":14002,"location":["ap-northeast-1a","ap-northeast-1b"],"transport":"tcp",
      "provider":"aws","endpoint":"ap-northeast-1-aws-3-sm.optimized-pricing-api.refinitiv.net",
      "dataFormat":["rwf"]},
    {"port":14002,"location":["ap-northeast-1b"],"transport":"tcp","provider":"aws",
      "endpoint":"ap-northeast-1-aws-2-sm.optimized-pricing-api.refinitiv.net",
      "dataFormat":["rwf"]},
    {"port":14002,"location":["ap-southeast-1a"],"transport":"tcp","provider":"aws",
      "endpoint":"ap-southeast-1-aws-1-sm.optimized-pricing-api.refinitiv.net",
      "dataFormat":["rwf"]},
    {"port":14002,"location":["ap-southeast-1a","ap-southeast-1b"],"transport":"tcp",
      "provider":"aws","endpoint":"ap-southeast-1-aws-3-sm.optimized-pricing-api.refinitiv.net",
      "dataFormat":["rwf"]},
    {"port":14002,"location":["ap-southeast-1b"],"transport":"tcp","provider":"aws",
      "endpoint":"ap-southeast-1-aws-2-sm.optimized-pricing-api.refinitiv.net",
      "dataFormat":["rwf"]},
    {"port":14002,"location":["eu-west-1a"],"transport":"tcp","provider":"aws",
      "endpoint":"eu-west-1-aws-1-sm.optimized-pricing-api.refinitiv.net","dataFormat":["rwf"]},
    {"port":14002,"location":["eu-west-1a","eu-west-1b"],"transport":"tcp","provider":"aws",
      "endpoint":"eu-west-1-aws-3-sm.optimized-pricing-api.refinitiv.net","dataFormat":["rwf"]},
    {"port":14002,"location":["eu-west-1b"],"transport":"tcp","provider":"aws",
      "endpoint":"eu-west-1-aws-2-sm.optimized-pricing-api.refinitiv.net","dataFormat":["rwf"]},
    {"port":14002,"location":["us-east-1a"],"transport":"tcp","provider":"aws",
      "endpoint":"us-east-1-aws-1-sm.optimized-pricing-api.refinitiv.net","dataFormat":["rwf"]},
    {"port":14002,"location":["us-east-1a","us-east-1b"],"transport":"tcp","provider":"aws",
      "endpoint":"us-east-1-aws-3-sm.optimized-pricing-api.refinitiv.net","dataFormat":["rwf"]},
    {"port":14002,"location":["us-east-1b"],"transport":"tcp","provider":"aws",
      "endpoint":"us-east-1-aws-2-sm.optimized-pricing-api.refinitiv.net","dataFormat":["rwf"]},
    {"port":14002,"location":["us-east-2a"],"transport":"tcp","provider":"aws",
      "endpoint":"us-east-2-aws-1-sm.optimized-pricing-api.refinitiv.net","dataFormat":["rwf"]},
    {"port":14002,"location":["us-east-2a","us-east-2b"],"transport":"tcp","provider":"aws",
      "endpoint":"us-east-2-aws-3-sm.optimized-pricing-api.refinitiv.net","dataFormat":["rwf"]},
    {"port":14002,"location":["us-east-2b"],"transport":"tcp","provider":"aws",
      "endpoint":"us-east-2-aws-2-sm.optimized-pricing-api.refinitiv.net","dataFormat":["rwf"]},
    {"port":443,"location":["ap-northeast-1a"],"transport":"websocket","provider":"aws",
      "endpoint":"ap-northeast-1-aws-1-sm.optimized-pricing-api.refinitiv.net",
      "dataFormat":["tr_json2"]},
  ]
}
```

```

{"port":443,"location":["ap-northeast-1a","ap-northeast-1b"],"transport":"websocket",
  "provider":"aws","endpoint":"ap-northeast-1-aws-3-sm.optimized-pricing-api.refinitiv.net",
  "dataFormat":["tr_json2"]},
{"port":443,"location":["ap-northeast-1b"],"transport":"websocket","provider":"aws",
  "endpoint":"ap-northeast-1-aws-2-sm.optimized-pricing-api.refinitiv.net",
  "dataFormat":["tr_json2"]},
{"port":443,"location":["ap-southeast-1a"],"transport":"websocket","provider":"aws",
  "endpoint":"ap-southeast-1-aws-1-sm.optimized-pricing-api.refinitiv.net",
  "dataFormat":["tr_json2"]},
{"port":443,"location":["ap-southeast-1a","ap-southeast-1b"],"transport":"websocket",
  "provider":"aws","endpoint":"ap-southeast-1-aws-3-sm.optimized-pricing-api.refinitiv.net",
  "dataFormat":["tr_json2"]},
{"port":443,"location":["ap-southeast-1b"],"transport":"websocket","provider":"aws",
  "endpoint":"ap-southeast-1-aws-2-sm.optimized-pricing-api.refinitiv.net",
  "dataFormat":["tr_json2"]},
{"port":443,"location":["eu-central-1a"],"transport":"websocket","provider":"aws",
  "endpoint":"eu-central-1-aws-1-sm.optimized-pricing-api.refinitiv.net",
  "dataFormat":["tr_json2"]},
{"port":443,"location":["eu-central-1a","eu-central-1b"],"transport":"websocket",
  "provider":"aws","endpoint":"eu-central-1-aws-3-sm.optimized-pricing-api.refinitiv.net",
  "dataFormat":["tr_json2"]},
{"port":443,"location":["eu-central-1b"],"transport":"websocket","provider":"aws",
  "endpoint":"eu-central-1-aws-2-sm.optimized-pricing-api.refinitiv.net",
  "dataFormat":["tr_json2"]},
{"port":443,"location":["eu-west-1a"],"transport":"websocket","provider":"aws",
  "endpoint":"eu-west-1-aws-1-sm.optimized-pricing-api.refinitiv.net",
  "dataFormat":["tr_json2"]},
{"port":443,"location":["eu-west-1a","eu-west-1b"],"transport":"websocket","provider":"aws",
  "endpoint":"eu-west-1-aws-3-sm.optimized-pricing-api.refinitiv.net",
  "dataFormat":["tr_json2"]},
{"port":443,"location":["eu-west-1b"],"transport":"websocket","provider":"aws",
  "endpoint":"eu-west-1-aws-2-sm.optimized-pricing-api.refinitiv.net",
  "dataFormat":["tr_json2"]},
{"port":443,"location":["us-east-1a"],"transport":"websocket","provider":"aws",
  "endpoint":"us-east-1-aws-1-sm.optimized-pricing-api.refinitiv.net",
  "dataFormat":["tr_json2"]},
{"port":443,"location":["us-east-1a","us-east-1b"],"transport":"websocket","provider":"aws",
  "endpoint":"us-east-1-aws-3-sm.optimized-pricing-api.refinitiv.net",
  "dataFormat":["tr_json2"]},
{"port":443,"location":["us-east-1b"],"transport":"websocket","provider":"aws",
  "endpoint":"us-east-1-aws-2-sm.optimized-pricing-api.refinitiv.net",
  "dataFormat":["tr_json2"]},
{"port":443,"location":["us-east-2a"],"transport":"websocket","provider":"aws",
  "endpoint":"us-east-2-aws-1-sm.optimized-pricing-api.refinitiv.net",
  "dataFormat":["tr_json2"]},
{"port":443,"location":["us-east-2a","us-east-2b"],"transport":"websocket","provider":"aws",
  "endpoint":"us-east-2-aws-3-sm.optimized-pricing-api.refinitiv.net",
  "dataFormat":["tr_json2"]},
{"port":443,"location":["us-east-2b"],"transport":"websocket","provider":"aws",
  "endpoint":"us-east-2-aws-2-sm.optimized-pricing-api.refinitiv.net",
  "dataFormat":["tr_json2"]}
]
}

```

### 4.3.4 Filtering Endpoints Using Optional Parameters

You can filter returned endpoints by using one of the optional parameters **transport** or **dataformat**. These parameters are mutually exclusive, such that if you specify one parameter you do not need to specify the other. For example, if you specify a transport, service discovery automatically uses the correct data format for that transport. Likewise, if you specify a data format, you do not need to specify a transport because Service Discovery automatically uses the correct one.

For an example of filtering endpoints, refer to [Section 4.3.4](#).



**WARNING!** Do not specify a transport with an unsupported data format (for example, do not specify a **transport** of **tcp** while at the same time specifying a **dataformat** of **tr\_json2**). Unsupported combinations are considered invalid input and return an error.

Because the defaults are already properly paired and there is no need to specify both parameters at the same time, use only one of these optional parameters at a time.

PARAMETER	DESCRIPTION
transport	<p>States the desired transport protocol to access the service. When specified, the service endpoints will be filtered by transport. Possible values are:</p> <ul style="list-style-type: none"> <li><b>websocket</b>: If you use <b>websocket</b>, the data format automatically defaults to the correct value of <b>tr_json2</b>.</li> <li><b>tcp</b>: If you use <b>tcp</b>, the data format automatically defaults to the correct value of <b>rwf</b>.</li> </ul> <p>For example: <code>\$service-discovery-url/streaming/pricing/v1?transport=websocket</code></p> <p><b>NOTE:</b> In applications written to the RTSDK, users can access rssl over a TCP transport only. WebSocket samples are written to demonstrate connectivity via the WebSocket transport.</p>
dataformat	<p>States the desired data format protocol to access service. The service endpoints returned will show supported data formats. Possible values are:</p> <ul style="list-style-type: none"> <li><b>tr_json2</b>: If you use <b>tr_json2</b>, the data format automatically defaults to the correct value of <b>websocket</b>.</li> <li><b>rwf</b>: If you use <b>rwf</b>, the data format automatically defaults to the correct value of <b>tcp</b>.</li> </ul>

**Table 6: Service Discovery Parameters**

### 4.3.5 Sample Service Discovery Response: Filter by Transport

The following example calls all available services with the desired **transport** protocol specified as **websocket**:

```
HTTPS GET api.refinitiv.com/streaming/pricing/v1?transport=websocket HTTP/1.1
```

If successful, the response code 200 (OK) is returned with all available services supporting **websocket** as follows:

```
HTTP/1.1 200
Content-Type: application/json charset=utf-8
{
  "services": [
    {
      "port": 443, "location": ["ap-northeast-1a"], "transport": "websocket", "provider": "aws",
      "endpoint": "ap-northeast-1-aws-1-sm.optimized-pricing-api.refinitiv.net",
      "dataFormat": ["tr_json2"]
    },
    {
      "port": 443, "location": ["ap-northeast-1a", "ap-northeast1b"], "transport": "websocket",
      "provider": "aws", "endpoint": "ap-northeast-1-aws-3-sm.optimized-pricing-api.refinitiv.net",
      "dataFormat": ["tr_json2"]
    }
  ]
}
```

```

{"port":443,"location":["ap-northeast-1b"],"transport":"websocket","provider":"aws",
  "endpoint":"ap-northeast-1-aws-2-sm.optimized-pricing-api.refinitiv.net",
  "dataFormat":["tr_json2"]},
{"port":443,"location":["ap-southeast-1a"],"transport":"websocket","provider":"aws",
  "endpoint":"ap-southeast-1-aws-1-sm.optimized-pricing-api.refinitiv.net",
  "dataFormat":["tr_json2"]},
{"port":443,"location":["ap-southeast-1a","ap-southeast-1b"],"transport":"websocket",
  "provider":"aws","endpoint":"ap-southeast-1-aws-3-sm.optimized-pricing-api.refinitiv.net",
  "dataFormat":["tr_json2"]},
{"port":443,"location":["ap-southeast-1b"],"transport":"websocket","provider":"aws",
  "endpoint":"ap-southeast-1-aws-2-sm.optimized-pricing-api.refinitiv.net",
  "dataFormat":["tr_json2"]},
{"port":443,"location":["eu-central-1a"],"transport":"websocket","provider":"aws",
  "endpoint":"eu-central-1-aws-1-sm.optimized-pricing-api.refinitiv.net",
  "dataFormat":["tr_json2"]},
{"port":443,"location":["eu-central-1a","eu-central-1b"],"transport":"websocket",
  "provider":"aws","endpoint":"eu-central-1-aws-3-sm.optimized-pricing-api.refinitiv.net",
  "dataFormat":["tr_json2"]},
{"port":443,"location":["eu-central-1b"],"transport":"websocket","provider":"aws",
  "endpoint":"eu-central-1-aws-2-sm.optimized-pricing-api.refinitiv.net",
  "dataFormat":["tr_json2"]},
{"port":443,"location":["eu-west-1a"],"transport":"websocket","provider":"aws",
  "endpoint":"eu-west-1-aws-1-sm.optimized-pricing-api.refinitiv.net",
  "dataFormat":["tr_json2"]},
{"port":443,"location":["eu-west-1a","eu-west-1b"],"transport":"websocket","provider":"aws",
  "endpoint":"eu-west-1-aws-3-sm.optimized-pricing-api.refinitiv.net",
  "dataFormat":["tr_json2"]},
{"port":443,"location":["eu-west-1b"],"transport":"websocket","provider":"aws",
  "endpoint":"eu-west-1-aws-2-sm.optimized-pricing-api.refinitiv.net",
  "dataFormat":["tr_json2"]},
{"port":443,"location":["us-east-1a"],"transport":"websocket","provider":"aws",
  "endpoint":"us-east-1-aws-1-sm.optimized-pricing-api.refinitiv.net",
  "dataFormat":["tr_json2"]},
{"port":443,"location":["us-east-1a","us-east-1b"],"transport":"websocket","provider":"aws",
  "endpoint":"us-east-1-aws-3-sm.optimized-pricing-api.refinitiv.net",
  "dataFormat":["tr_json2"]},
{"port":443,"location":["us-east-1b"],"transport":"websocket","provider":"aws",
  "endpoint":"us-east-1-aws-2-sm.optimized-pricing-api.refinitiv.net",
  "dataFormat":["tr_json2"]},
{"port":443,"location":["us-east-2a"],"transport":"websocket","provider":"aws",
  "endpoint":"us-east-2-aws-1-sm.optimized-pricing-api.refinitiv.net",
  "dataFormat":["tr_json2"]},
{"port":443,"location":["us-east-2a","us-east-2b"],"transport":"websocket","provider":"aws",
  "endpoint":"us-east-2-aws-3-sm.optimized-pricing-api.refinitiv.net",
  "dataFormat":["tr_json2"]},
{"port":443,"location":["us-east-2b"],"transport":"websocket","provider":"aws",
  "endpoint":"us-east-2-aws-2-sm.optimized-pricing-api.refinitiv.net",
  "dataFormat":["tr_json2"]}
]
}

```

### 4.3.6 Service Discovery: Capacity Levels and Tier Sizes

Refinitiv Real-Time service is available in multiple capacity levels, currently provided in 3 tiers: small, medium, and large. Service discovery should identify the tier to which the client connects depending on transport type and watchlist size for the client's UUID.

#### 4.3.6.1 Tier Sizing

Service discovery provides information about endpoint tier limits.

WATCHLIST RANGE	SMALL TIER	MEDIUM TIER	LARGE TIER
RSSL	1 - 15,000	15,001 - 100,000	100,001 - 500,000
WS	1 - 3,000	3,001 - 20,000	20,001 - 50,000

**Table 7: Tier Sizing**

## 4.4 Connecting to Refinitiv Real-Time — Optimized VIP

Clients should choose the VIP/port based on the supported protocol and required resiliency level (Customer or Refinitiv Managed Resiliency) prior to establishing the connection.

- Use the appropriate port for the protocol that you use (e.g., 443 for WebSocket).
- The Refinitiv Managed Resiliency connection configuration has a single connection to VIP supporting autofailover.
  - The VIP `us-east-1-aws-3-sm.optimized-pricing-api.refinitiv.net` is served by AWS AZ IDs `use1-az2` and `use1-az4`.
  - The VIP `us-east-2-aws-3-sm.optimized-pricing-api.refinitiv.net` is served by AWS AZ IDs `use2-az1` and `use2-az2`.
  - The VIP `eu-central-1-aws-3-sm.optimized-pricing-api.refinitiv.net` is served by AWS AZ IDs `eu1-az2` and `eu1-az3`.
  - The VIP `eu-west-1-aws-3-sm.optimized-pricing-api.refinitiv.net` is served by AWS AZ IDs `euw1-az2` and `euw1-az3`.
  - The VIP `ap-northeast-1-aws-3-sm.optimized-pricing-api.refinitiv.net` is served by AWS AZ IDs `apne1-az4` and `apne1-az1`.
  - The VIP `ap-southeast-1-aws-3-sm.optimized-pricing-api.refinitiv.net` is served by AWS AZ IDs `apse1-az1` and `apse1-az2`.
  - If the AZ serving clients encounters a failure, client connection is disconnected, and when the client application retries, the connection can be served by a deployment in the other AZ. In the event of a single point failure, client service may be interrupted but can be resumed by reconnecting to the service.
- A Customer Managed Resiliency service is available in which clients can establish more than one connection to independent infrastructure and subscribe to the same content simultaneously among connections. This option is for applications that need higher levels of availability.

A client can connect to the following infrastructure combinations:

INFRASTRUCTURE COMBINATION	SERVED BY
<code>us-east-1-aws-1-sm.optimized-pricing-api.refinitiv.net</code> <code>us-east-1-aws-2-sm.optimized-pricing-api.refinitiv.net</code>	Deployments in <code>us-east-1a</code> and <code>us-east-1b</code> respectively.
<code>us-east-2-aws-1-sm.optimized-pricing-api.refinitiv.net</code> <code>us-east-2-aws-2-sm.optimized-pricing-api.refinitiv.net</code>	Deployments in <code>us-east-2a</code> and <code>us-east-2b</code> respectively.
<code>eu-central-1-aws-1-sm.optimized-pricing-api.refinitiv.net</code> <code>eu-central-1-aws-2-sm.optimized-pricing-api.refinitiv.net</code>	Deployments in <code>eu-central-1a</code> and <code>eu-central-1b</code> respectively.
<code>eu-west-1-aws-1-sm.optimized-pricing-api.refinitiv.net</code> <code>eu-west-1-aws-2-sm.optimized-pricing-api.refinitiv.net</code>	Deployments in <code>eu-west-1a</code> and <code>eu-west-1b</code> respectively.
<code>ap-northeast-1-aws-1-sm.optimized-pricing-api.refinitiv.net</code> <code>ap-northeast-1-aws-2-sm.optimized-pricing-api.refinitiv.net</code>	Deployments in <code>ap-northeast-1a</code> and <code>ap-northeast-1b</code> respectively.

INFRASTRUCTURE COMBINATION	SERVED BY
ap-southeast-1-aws-1-sm.optimized-pricing-api.refinitiv.net ap-southeast-1-aws-2-sm.optimized-pricing-api.refinitiv.net	Deployments in ap-southeast-1a and ap-southeast-1b respectively.

If an AZ fails, the connection to the failed AZ disconnects, but market data still streams to the client via the second connection. No data loss occurs even though there is a single point of failure.

---

**NOTE:** When two connections are established, the application is responsible for correctly processing the two interdependent data streams.

---

## 4.5 Coding to Connect to Refinitiv Real-Time — Optimized

To access the Refinitiv Real-Time — Optimized service, user applications should have the following capabilities:

- Make RESTful API calls to authenticate with the Refinitiv Data Platform for login and to do service discovery. Also make on going calls for session management.
- Connect to Refinitiv Real-Time — Optimized either with WebSocket or TCP to access Refinitiv Real-Time streaming or snapshot content using a discovered endpoint.

You must have either Machine Account (for V1 authentication) or Service Account (for V2 authentication) credentials. For more information about each type of authentication and obtaining credentials, refer to [Section 3.1](#) and [Section 3.2](#).

For details on managing multiple connections, refer to [Section 3.1.6](#).



**WARNING!** Standard SSL/TLS certificate encryption is used between the application and Refinitiv Real-Time — Optimized. Refinitiv Real-Time supports TLS 1.2 only.

As application provider, it is your responsibility to maintain the root and intermediate root certificate chain relationships. Refinitiv reserves the right to change the Certificate Authority provider of our certificates presented by the Refinitiv Real-Time — Optimized service.

### 4.5.1 Example Applications

There are several sample applications available to get started with connectivity to RTO. To build your applications, you may use open-sourced RTSDK APIs or write your applications using any Websocket framework by referencing the Websocket protocol specification and sample applications package as Websocket API. RTSDK and Websocket API frameworks are available on the [Developer Community portal](#) as well as GitHub as follows

- GitHub Websocket Examples: <https://github.com/Refinitiv/websocket-api/tree/master/Applications/Examples/RDP>. WebSocket examples showcase service discovery and session management in various languages in Refinitiv Data Platform examples.
- General RTSDK GitHub location: <https://github.com/Refinitiv/Real-Time-SDK>. The SDK section includes examples written to the Enterprise Transport and Message APIs, which support session management (token renewal) and/or service discovery (endpoint discovery). The Refinitiv Real-Time SDK provides libraries for service discovery and session management automatically on behalf of users.

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**NOTE:** To ensure continued support and proper functionality with Refinitiv Real-Time — Optimized, Refinitiv recommends that you use RTSDK Version 1.5.1.L1 or later.

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Additional documentation, officially released packages, Q&A, and FAQs are also available on the [Developer Portal](#). To test connectivity to RTO, you may also use testclient distributed with RTDS components such as ADS or RTC.

### 4.5.2 RTSDK Examples

For RTSDK examples, you can refer to the following examples which come with the APIs:

- In the Refinitiv Real-Time Enterprise Transport API, refer to the VAConsumer and Watchlist Consumer examples.
- In the Refinitiv Real-Time Enterprise Message API, refer to refer to the following examples:
  - For V1 session management: Cons113 (**ex113\_MP\_SessionMgmt** in Java and **113\_MP\_SessionMgmt** in C++)
  - For V1 service discovery: Cons450 (**ex450\_MP\_QueryServiceDiscovery** in Java and **450\_MP\_QueryServiceDiscovery** in C++)
  - For V2 session management and service discovery for CCwS: Cons451 (**ex451\_MP\_OAuth2Callback\_V2** in Java and **451\_MP\_OAuth2Callback\_V2** in C++)
  - For V2 session management and service discovery for CCwJ: Cons452 (**ex452\_MP\_OAuth2Callback\_V2JWT** in Java and **452\_MP\_OAuth2Callback\_V2JWT** in C++)

The READMEs that come with the RTSDK APIs explain in detail how to run your application and includes details on specifying `-- ric` as a parameter.

### 4.5.3 WebSocket Examples

The user application can use the WebSocket API to subscribe to the service.

- WebSocket provides market data in easy to digest JSON format.
- The WebSocket API enables easy integration to a multitude of client technology environments such as scripting and web.
- The destination is the "wss://" plus VIP. It relies on DNS to resolve the actual IP address.
- For the login request, the user application sends a login message with **NameType** as **AuthnToken**. See the following example:
  - For **ApplicationId**, put **256**.
  - For **Position**, put the application IP address followed by **/hostname**. For example: **1.1.1.1/myhost**
- For more information about how to use this transport with a variety of open source frameworks refer to the *WebSocket API Specifications and Developers Guide* at <https://developers.refinitiv.com/en/api-catalog/refinitiv-real-time-opnsrc/refinitiv-websocket-api/documentation#web-socket-api-developer-guide>.

```
{
  "Domain": "Login",
  "ID": 1,
  "Key": {
    "Elements": {
      "ApplicationId": "256",
      "AuthenticationToken": "aBcDeFgHiJkLmNoPqRsTuVwXyZ",
      "Position": "ip_of_consuming_host/hostname"
    },
    "NameType": "AuthnToken"
  }
}
```

### 4.5.4 testclient

You can use **testclient** utility distributed with the Refinitiv Real-Time Distribution System as an example client application to connect to Refinitiv Real-Time — Optimized for RSSL- and WebSocket-type connections.

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**NOTE:** **testclient** using WebSocket converts JSON into RSSL, and then displays only the RSSL.

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For further details on how to use the **testclient** application, refer to the *Refinitiv Real-Time Distribution System Demo Tools* document.

## 4.6 Available AMIs

Refinitiv provides two AMIs created from official, free public-facing base AMIs for its products:

- RTSDK/Websocket Example AMI: For use with RTSDK and Websocket API software so that you can easily connect to the Refinitiv Data Platform. To locate this Refinitiv AMI, launch it, and run examples using valid credentials to connect to the Refinitiv Data Platform for Refinitiv Real-Time content. Refer to instructions at <https://developers.refinitiv.com/en/article-catalog/article/how-to-setup-refinitiv-amazon-ec2-machine-image-for-elektron-r>. To search for the latest AMI, use the search term: Refinitiv Real-Time Examples.
- Refinitiv Real-Time Connector: For details on launching an Refinitiv Real-Time Connector Amazon Linux Machine Image (AMI) in the Amazon Marketplace, refer to the *Refinitiv Real-Time Distribution System Docker Manual* and *Refinitiv Real-Time Connector Cloud Administration Manual* (specific to the version that you want to run) on [MyRefinitiv](#) (to access these documents, you need a MyRefinitiv login).

For reasons of security and functionality, you should update your AMIs on a regular basis (whenever launching an EC2) to get the latest patches.

# 5 Refinitiv Real-Time — Optimized Connectivity Options

Refinitiv Real-Time — Optimized offers the following connectivity options:

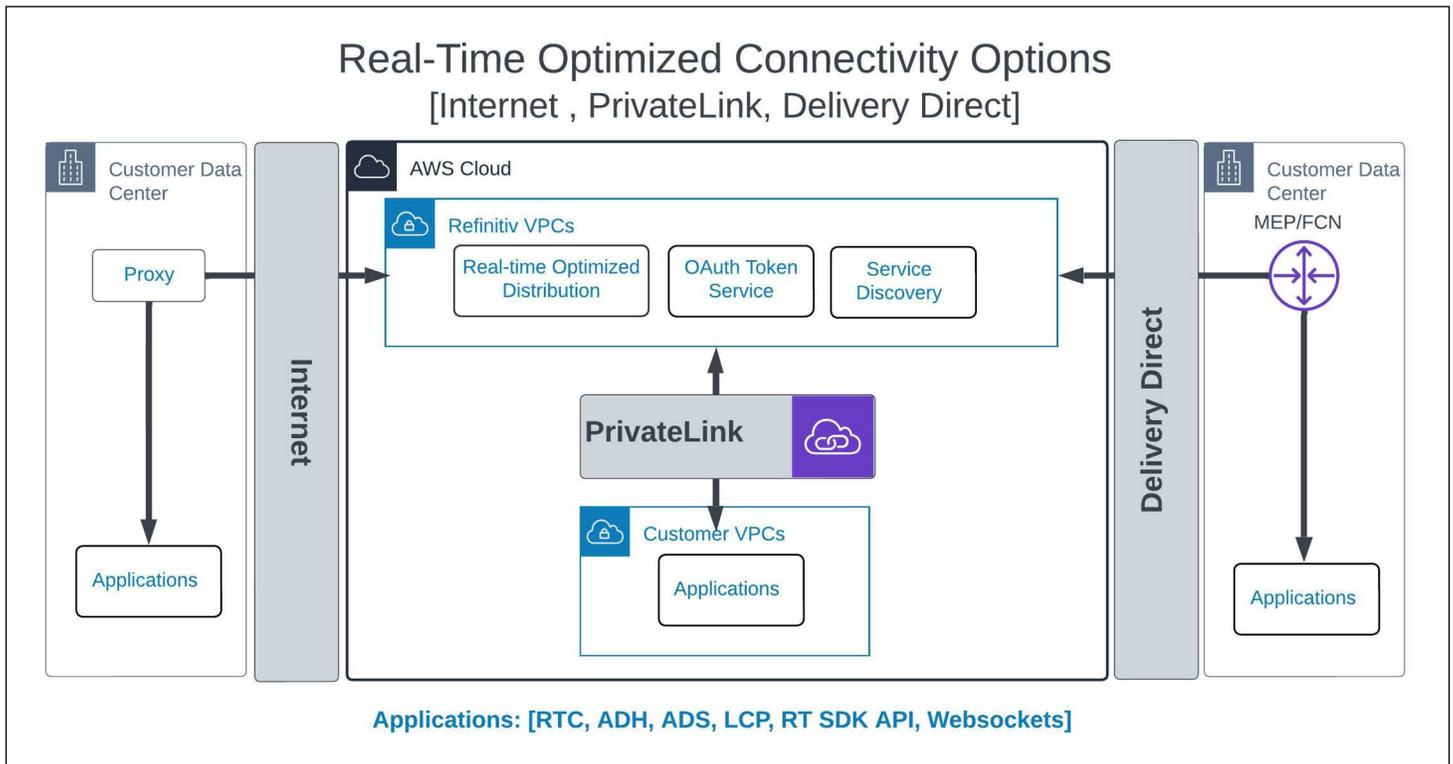
- Public Internet
- AWS PrivateLink
- Delivery Direct

Refinitiv services that are offered on both the public Internet and via Delivery Direct share a common domain “refinitiv.net”. This designation allows for services to be steered by client site DNS to either a public or private network delivery depending on the customers preferences. The Refinitiv Real-Time — Optimized Service Discovery API only returns the .net domain for endpoint services, but it is possible to explicitly override connectivity by domain if desired. The domains availability is described in the following table.

DOMAIN	AVAILABILITY
refinitiv.net	Available on both Internet and/or extranet DNS
refinitiv.biz	Only available on extranet/Delivery Direct eDNS
refinitiv.com	Only available on public DNS

**Table 8: Domains Availability**

The following diagram represents an overview of the Refinitiv Real-Time — Optimized connectivity options.



**Figure 2. Refinitiv Real-Time — Optimized Connectivity Overview**

## 5.1 Connecting to Refinitiv Real-Time — Optimized Using Public Internet

To establish a connection to Refinitiv Real-Time — Optimized, the client must first connect to the Refinitiv Data Platform instance to obtain a security token and all applicable DNS addresses for NLB instances across regions. The client then chooses a Load Balancer instance to connect to and provides the security token to that instance. When a Refinitiv Real-Time Advanced Distribution Server accepts a connection, it verifies the provided token to determine whether a streaming connection should be permitted.

## 5.2 Connecting to Refinitiv Real-Time — Optimized Using AWS PrivateLink

To achieve best performance for your applications, Refinitiv recommends that you use AWS PrivateLink, which provides a secure, private connection between VPCs (and AWS services if needed) using the AWS HyperPlane. AWS PrivateLink essentially eliminates exposure to public Internet while exchanging data between VPCs in the same or different AWS accounts. The following figure illustrates the AWS PrivateLink connectivity (courtesy of AWS).

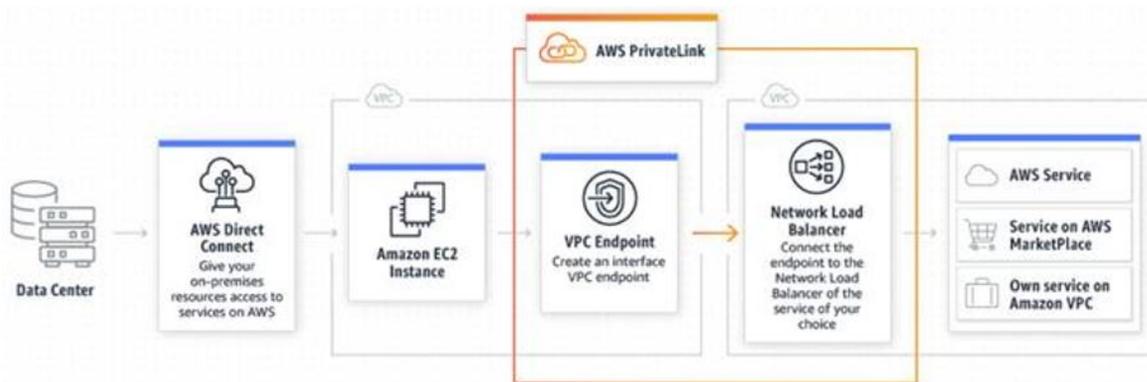


Figure 3. AWS PrivateLink Connectivity

Advantages of PrivateLink:

- Provides private connectivity between VPCs securely on the Amazon network, so data flow does not traverse the Internet, thus reducing the exposure to threat vectors such as brute force and distributed denial-of-service attacks.

**NOTE:** To request authentication tokens or do service discovery, you must establish an AWS PrivateLink connection to RDP Gateway and make requests using that connection.

- Simplifies internal network architecture. You can connect services across different accounts and VPCs without the need for firewall rules, path definitions, or route tables. You no longer a need to configure an Internet gateway or a VPC peering connection.
- Client VPC setup is simple. The footprint required is small, and at the same time you achieve a more secure environment.
- Using AWS network backbone provides better service in-line quality. The available bandwidth is in terms of GB, and the latency is low.

### 5.2.1 Using Service Discovery for PrivateLinks

Service discovery provides information about the DNS name for service endpoints based on the requested transport/dataformat.

#### 5.2.1.1 Service Discovery Parameters: transport and dataformat

The service provided is `http GET`, where the only query string parameters `transport` and `dataformat` are supported. Using `transport` and `dataformat` is optional and described in detail in [Section 4.3.4](#).

By default, the response returns endpoints for all service levels (Refinitiv Managed, Customer Managed1, Customer Managed2), locations, and transports but without information about private link endpoints, tier watchlist size limits, or the Availability Zone ID (**AZID**). You can include optional parameters to return this information (for details, refer to [Section 5.2.1.2](#)).

### 5.2.1.2 Service Discovery Parameters: Optional Boolean Parameters

This release introduces several optional boolean parameters (listed on the following table), with the only expected value being **true**.

For example:

`$service-discovery-url/streaming/pricing/v1?transport=tcp&dataformat=rwf&privatelink=true&tier=true&locationid=true`.

### 5.2.1.3 Tier Sizing with PrivateLink

PARAMETER	DESCRIPTION
locationid	Indicates interest in including the Availability Zone ID ( <b>AZID</b> ) in response. <b>AZID</b> allows the retrieval of account-independent information about the availability zone.
tier	Indicates interest in including information about watchlist size limits in response to a provided endpoint and transport.
privatelink	Indicates interest in including information about the <b>servicename</b> of the Private Link endpoint for the provided service endpoint and transport.

**Table 9: Service Discovery Boolean Parameters**

If using PrivateLink, Refinitiv recommends that you create endpoints for all tiers as follows:

- If Refinitiv Managed Resiliency service is in use that would lead to creating 3 VPC Endpoints per region, 1 for each tier. Refer to [Section 4.3.6](#) for information regarding tiers and capacity levels.
- If Customer Managed Resiliency service is in use that would require creating per region 3 VPC Endpoints for Customer Managed1 (1 for each tier) and 3 VPC Endpoints for Customer Managed2 (1 for each tier).

### 5.2.2 AWS PrivateLink Access Configuration

The AWS PrivateLink design eliminates exposure to the public Internet by creating secure connections between Amazon Virtual Private Clouds (VPCs). The following figure shows PrivateLink connections between the client VPC and the NLBs.

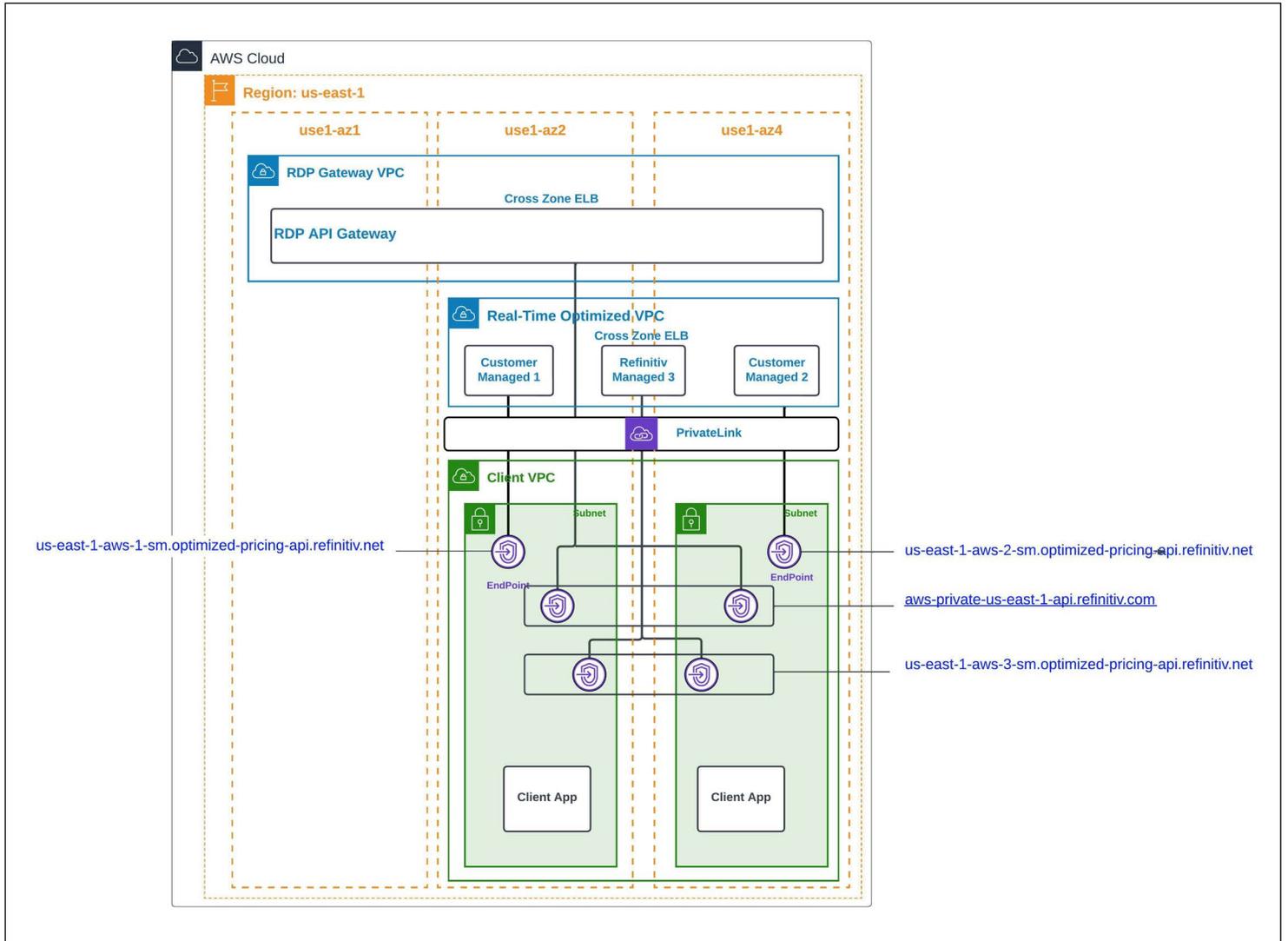


Figure 4. AWS PrivateLink Connections

**NOTE:** When establishing PrivateLink connectivity to a cross zone NLB, an endpoint is created in each AZ for which the customer VPC has AZ ID alignment. The .2 DNS resolver in the customer VPC round robins between the PrivateLink Private NDS endpoint records.

### 5.2.3 Configuring PrivateLink — Creating VPC Endpoints

VPC endpoints for AWS PrivateLink connectivity must be in the same Availability Zone (AZ).

On the client side there are two options.

- Create VPC infrastructure in the same AZ as the NLBs. This option is more cost efficient.
- Create a subnet in the same AZ as the NLBs, and create the VPC endpoint in that AZ. Route traffic from existing AZ through the created VPC endpoint in different AZ. This option is recommended if it is problematic to create/move the client infrastructure into the same AZ as the NLBs.

AZ names may not match for different AWS accounts. Verify you are using the same AZ as Refinitiv. For example: AZ ID 'use1-az5' could resolve into name 'us-east-1a' for account A and into 'us-east-1c' for account B. Refer to [Section 5.2.3.3](#) for the list of current endpoints. Check with your account manager to determine specific dates for these future endpoints).

Refinitiv recommends that you use service discovery to connect to Refinitiv Real-Time — Optimized. Using service discovery does not require code changes. Once new VIPs are active, any subsequent service discovery call automatically routes to the correct VIPs. However, others connecting to the endpoints will need to make appropriate changes.

### 5.2.3.1 Firewall Whitelisting

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**NOTE:** If you use a firewall to restrict outbound connections, you must white list the endpoints for all tiers and service models on which your applications depend.

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The following is a comprehensive list of domains that you must add to the whitelist on your firewalls to support uninterrupted Refinitiv Real-Time — Optimized services.

CONNECTION TYPE	DOMAINS FOR WHITELISTING
Internet/PrivateLink	<ul style="list-style-type: none"> <li>• refinitiv.com</li> <li>• refinitiv.net</li> <li>• public.inf0.net</li> <li>• amazonaws.com</li> <li>• crl.comodoca.com</li> </ul>
Delivery Direct	<ul style="list-style-type: none"> <li>• refinitiv.net</li> <li>• refinitiv.biz</li> </ul>

**Table 10: Domains for Whitelisting**

### 5.2.3.2 PrivateLink DNS

Real-time Optimized PrivateLink endpoint services are equipped with private DNS. It is highly recommended to enable the private DNS feature during endpoint creation for Refinitiv Real-Time — Optimized services to avoid certificate errors.

When you create an endpoint with the private DNS feature enabled, the Route53 resolver within the client VPC will allow the local endpoint to be resolvable by DNS. These DNS names are the same as the public DNS names retrieved from the Service Discovery API (refinitiv.net) to allow applications to easily migrate between private and public network delivery for pricing content.

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**NOTE:** To use private DNS names, ensure that the attributes “Enable DNS hostnames” and “Enable DNS Support” are set to “true” for your VPC.

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To create a VPC endpoint using the AWS CLI, run the command `ec2 create-vpc-endpoint` and ensure that the `--private-dns-enabled` flag is used.

To update an existing VPC endpoint using the AWS CLI, run the command `ec2 modify-vpc-endpoint` and add the `--private-dns-enabled` flag.

For more information about the creation of VPC endpoints, refer to [Section 5.2.3.4](#).

### 5.2.3.3 RTO PrivateLink Endpoints

Refinitiv divides its endpoints based on region:

- [Region: US-EAST-1](#)
- [Region: US-EAST-2](#)
- [Region: EU-CENTRAL-1](#)
- [Region: EU-WEST-1](#)
- [Region: AP-NORTHEAST-1](#)
- [Region: AP-SOUTHEAST-1](#)

Ensure these endpoints are added into any firewall white-list you use (if required, refer to [Section 5.2.3.1](#)).

## 5.2.3.3.1 Region: US-EAST-1

TIER	SERVICE	AZ ID	VPC ENDPOINT SERVICE NAME	DNS NAME / ELASTIC IP
sm	Customer Managed1	use1-az2	com.amazonaws.vpce.us-east-1.vpce-svc-04b75a16bc641742c	<ul style="list-style-type: none"> <li>DNS: us-east-1-aws-1-sm.optimized-pricing-api.refinitiv.net</li> <li>Elastic IP: 54.84.167.136</li> </ul>
	Customer Managed2	use1-az4	com.amazonaws.vpce.us-east-1.vpce-svc-09fc496a0e5ee5740	<ul style="list-style-type: none"> <li>DNS: us-east-1-aws-2-sm.optimized-pricing-api.refinitiv.net</li> <li>Elastic IP: 3.213.205.50</li> </ul>
	Refinitiv Managed	use1-az2 use1-az4	com.amazonaws.vpce.us-east-1.vpce-svc-0e8c56e89190dac82	<ul style="list-style-type: none"> <li>DNS: us-east-1-aws-3-sm.optimized-pricing-api.refinitiv.net</li> <li>Elastic IPs: <ul style="list-style-type: none"> <li>- 34.200.157.185</li> <li>- 34.232.190.113</li> </ul> </li> </ul>
med	Customer Managed1	use1-az2	com.amazonaws.vpce.us-east-1.vpce-svc-040b24121132850dd	<ul style="list-style-type: none"> <li>DNS: us-east-1-aws-1-med.optimized-pricing-api.refinitiv.net</li> <li>Elastic IP: 54.175.82.60</li> </ul>
	Customer Managed2	use1-az4	com.amazonaws.vpce.us-east-1.vpce-svc-036d8f4405ea9da47	<ul style="list-style-type: none"> <li>DNS: us-east-1-aws-2-med.optimized-pricing-api.refinitiv.net</li> <li>Elastic IP: 3.234.12.51</li> </ul>
	Refinitiv Managed	use1-az2 use1-az4	com.amazonaws.vpce.us-east-1.vpce-svc-03518d23d434742ea	<ul style="list-style-type: none"> <li>DNS: us-east-1-aws-3-med.optimized-pricing-api.refinitiv.net</li> <li>Elastic IPs: <ul style="list-style-type: none"> <li>- 18.213.196.167</li> <li>- 3.228.72.181</li> </ul> </li> </ul>
lrg	Customer Managed1	use1-az2	com.amazonaws.vpce.us-east-1.vpce-svc-01471d3731ac3b0ba	<ul style="list-style-type: none"> <li>DNS: us-east-1-aws-1-lrg.optimized-pricing-api.refinitiv.net</li> <li>Elastic IP: 54.84.28.210</li> </ul>
	Customer Managed2	use1-az4	com.amazonaws.vpce.us-east-1.vpce-svc-0a27bbd7a671f7da5	<ul style="list-style-type: none"> <li>DNS: us-east-1-aws-2-lrg.optimized-pricing-api.refinitiv.net</li> <li>Elastic IP: 34.233.28.108</li> </ul>
	Refinitiv Managed	use1-az2 use1-az4	com.amazonaws.vpce.us-east-1.vpce-svc-0477c887a5d85f86b	<ul style="list-style-type: none"> <li>DNS: us-east-1-aws-3-lrg.optimized-pricing-api.refinitiv.net</li> <li>Elastic IPs: <ul style="list-style-type: none"> <li>- 34.204.222.90</li> <li>- 54.175.101.219</li> </ul> </li> </ul>

Table 11: US-EAST-1 Endpoints as of December 1, 2021 (By Region)

## 5.2.3.3.2 Region: US-EAST-2

TIER	SERVICE	AZ ID	VPC ENDPOINT SERVICE NAME	DNS NAME / ELASTIC IP
sm	Customer Managed1	use2-az1	com.amazonaws.vpce.us-east-2.vpce-svc-0205cb0fab7891367	<ul style="list-style-type: none"> <li>DNS: us-east-2-aws-1-sm.optimized-pricing-api.refinitiv.net</li> <li>Elastic IP: 3.130.156.118</li> </ul>
	Customer Managed2	use2-az2	com.amazonaws.vpce.us-east-2.vpce-svc-0c08acd0501ef5162	<ul style="list-style-type: none"> <li>DNS: us-east-2-aws-2-sm.optimized-pricing-api.refinitiv.net</li> <li>Elastic IP: 3.129.199.137</li> </ul>
	Refinitiv Managed	use2-az1 use2-az2	com.amazonaws.vpce.us-east-2.vpce-svc-08022a566c1a6d4b8	<ul style="list-style-type: none"> <li>DNS: us-east-2-aws-3-sm.optimized-pricing-api.refinitiv.net</li> <li>Elastic IPs: <ul style="list-style-type: none"> <li>- 18.116.134.33</li> <li>- 3.13.146.76</li> </ul> </li> </ul>
med	Customer Managed1	use2-az1	com.amazonaws.vpce.us-east-2.vpce-svc-05b0c28ef5e94957e	<ul style="list-style-type: none"> <li>DNS: us-east-2-aws-1-med.optimized-pricing-api.refinitiv.net</li> <li>Elastic IP: 3.21.131.188</li> </ul>
	Customer Managed2	use2-az2	com.amazonaws.vpce.us-east-2.vpce-svc-0cb43499920be260b	<ul style="list-style-type: none"> <li>DNS: us-east-2-aws-2-med.optimized-pricing-api.refinitiv.net</li> <li>Elastic IP: 18.223.27.123</li> </ul>
	Refinitiv Managed	use2-az1 use2-az2	com.amazonaws.vpce.us-east-2.vpce-svc-096097e3759dcf8f1	<ul style="list-style-type: none"> <li>DNS: us-east-2-aws-3-med.optimized-pricing-api.refinitiv.net</li> <li>Elastic IPs: <ul style="list-style-type: none"> <li>- 3.132.159.175</li> <li>- 3.13.185.151</li> </ul> </li> </ul>
lrg	Customer Managed1	use2-az1	com.amazonaws.vpce.us-east-2.vpce-svc-05664aba59a28408c	<ul style="list-style-type: none"> <li>DNS: us-east-2-aws-1-lrg.optimized-pricing-api.refinitiv.net</li> <li>Elastic IP: 18.116.107.133</li> </ul>
	Customer Managed2	use2-az2	com.amazonaws.vpce.us-east-2.vpce-svc-070af04013aebf405	<ul style="list-style-type: none"> <li>DNS: us-east-2-aws-2-lrg.optimized-pricing-api.refinitiv.net</li> <li>Elastic IP: 3.143.128.133</li> </ul>
	Refinitiv Managed	use2-az1 use2-az2	com.amazonaws.vpce.us-east-2.vpce-svc-0c61e46b907786a0c	<ul style="list-style-type: none"> <li>DNS: us-east-2-aws-3-lrg.optimized-pricing-api.refinitiv.net</li> <li>Elastic IPs: <ul style="list-style-type: none"> <li>- 52.15.72.68</li> <li>- 3.18.19.66</li> </ul> </li> </ul>

Table 12: Current Endpoints as of September 2021 (By Region)

## 5.2.3.3.3 Region: EU-CENTRAL-1

TIER	SERVICE	AZ ID	VPC ENDPOINT SERVICE NAME	DNS NAME / ELASTIC IP
sm	Customer Managed1	euc1-az2	com.amazonaws.vpce.eu-central-1.vpce-svc-06d888dcd12b3acdb	<ul style="list-style-type: none"> <li>DNS: eu-central-1-aws-1-sm.optimized-pricing-api.refinitiv.net</li> <li>Elastic IP: 3.68.38.160</li> </ul>
	Customer Managed2	euc1-az3	com.amazonaws.vpce.eu-central-1.vpce-svc-0450a96fb0b7028fc	<ul style="list-style-type: none"> <li>DNS: eu-central-1-aws-2-sm.optimized-pricing-api.refinitiv.net</li> <li>Elastic IP: 3.75.104.182</li> </ul>
	Refinitiv Managed	euc1-az2 euc1-az3	com.amazonaws.vpce.eu-central-1.vpce-svc-0a1751f146875b67b	<ul style="list-style-type: none"> <li>DNS: eu-central-1-aws-3-sm.optimized-pricing-api.refinitiv.net</li> <li>Elastic IPs: <ul style="list-style-type: none"> <li>- 3.65.175.198</li> <li>- 3.74.173.127</li> </ul> </li> </ul>
med	Customer Managed1	euc1-az2	com.amazonaws.vpce.eu-central-1.vpce-svc-0f5ab1e0754bf7cfc	<ul style="list-style-type: none"> <li>DNS: eu-central-1-aws-1-med.optimized-pricing-api.refinitiv.net</li> <li>Elastic IP: 3.125.92.240</li> </ul>
	Customer Managed2	euc1-az3	com.amazonaws.vpce.eu-central-1.vpce-svc-0a71c223fb2a419f9	<ul style="list-style-type: none"> <li>DNS: eu-central-1-aws-2-med.optimized-pricing-api.refinitiv.net</li> <li>Elastic IP: 3.73.223.220</li> </ul>
	Refinitiv Managed	euc1-az2 euc1-az3	com.amazonaws.vpce.eu-central-1.vpce-svc-025bfd813df48bbc2	<ul style="list-style-type: none"> <li>DNS: eu-central-1-aws-3-med.optimized-pricing-api.refinitiv.net</li> <li>Elastic IPs: <ul style="list-style-type: none"> <li>- 52.58.183.240</li> <li>- 18.194.65.34</li> </ul> </li> </ul>
lrg	Customer Managed1	euc1-az2	com.amazonaws.vpce.eu-central-1.vpce-svc-0b429347ca6c0a760	<ul style="list-style-type: none"> <li>DNS: eu-central-1-aws-1-lrg.optimized-pricing-api.refinitiv.net</li> <li>Elastic IP: 3.121.190.201</li> </ul>
	Customer Managed2	euc1-az3	com.amazonaws.vpce.eu-central-1.vpce-svc-079ad034ceb357874	<ul style="list-style-type: none"> <li>DNS: eu-central-1-aws-2-lrg.optimized-pricing-api.refinitiv.net</li> <li>Elastic IP: 18.196.229.127</li> </ul>
	Refinitiv Managed	euc1-az2 euc1-az3	com.amazonaws.vpce.eu-central-1.vpce-svc-0bc8e926f28a9d11f	<ul style="list-style-type: none"> <li>DNS: eu-central-1-aws-3-lrg.optimized-pricing-api.refinitiv.net</li> <li>Elastic IPs: <ul style="list-style-type: none"> <li>- 3.124.88.123</li> <li>- 18.158.133.105</li> </ul> </li> </ul>

Table 13: Current Endpoints as of November 2022 (By Region)

## 5.2.3.3.4 Region: EU-WEST-1

TIER	SERVICE	AZ ID	VPC ENDPOINT SERVICE NAME	DNS NAME / ELASTIC IP
sm	Customer Managed1	euw1-az2	com.amazonaws.vpce.eu-west-1.vpce-svc-06d6013436e89509d	<ul style="list-style-type: none"> <li>DNS: eu-west-1-aws-1-sm.optimized-pricing-api.refinitiv.net</li> <li>Elastic IP: 46.51.184.146</li> </ul>
	Customer Managed2	euw1-az3	com.amazonaws.vpce.eu-west-1.vpce-svc-070449e31d3848ad2	<ul style="list-style-type: none"> <li>DNS: eu-west-1-aws-2-sm.optimized-pricing-api.refinitiv.net</li> <li>Elastic IP: 54.75.0.128</li> </ul>
	Refinitiv Managed	euw1-az2 euw1-az3	com.amazonaws.vpce.eu-west-1.vpce-svc-0bcf9da83ec687ab9	<ul style="list-style-type: none"> <li>DNS: eu-west-1-aws-3-sm.optimized-pricing-api.refinitiv.net</li> <li>Elastic IPs: <ul style="list-style-type: none"> <li>- 54.78.155.139</li> <li>- 79.125.70.69</li> </ul> </li> </ul>
med	Customer Managed1	euw1-az2	com.amazonaws.vpce.eu-west-1.vpce-svc-016f9cc234d270638	<ul style="list-style-type: none"> <li>DNS: eu-west-1-aws-1-med.optimized-pricing-api.refinitiv.net</li> <li>Elastic IP: 54.73.125.239</li> </ul>
	Customer Managed2	euw1-az3	com.amazonaws.vpce.eu-west-1.vpce-svc-0f63ac38e34a7cf9e	<ul style="list-style-type: none"> <li>DNS: eu-west-1-aws-2-med.optimized-pricing-api.refinitiv.net</li> <li>Elastic IP: 34.246.230.113</li> </ul>
	Refinitiv Managed	euw1-az2 euw1-az3	com.amazonaws.vpce.eu-west-1.vpce-svc-0b781d1b6239f454d	<ul style="list-style-type: none"> <li>DNS: eu-west-1-aws-3-med.optimized-pricing-api.refinitiv.net</li> <li>Elastic IPs: <ul style="list-style-type: none"> <li>- 63.32.155.241</li> <li>- 54.217.126.53</li> </ul> </li> </ul>
lrg	Customer Managed1	euw1-az2	com.amazonaws.vpce.eu-west-1.vpce-svc-0c9ce8b723dde96c5	<ul style="list-style-type: none"> <li>DNS: eu-west-1-aws-1-lrg.optimized-pricing-api.refinitiv.net</li> <li>Elastic IP: 34.247.185.141</li> </ul>
	Customer Managed2	euw1-az3	com.amazonaws.vpce.eu-west-1.vpce-svc-0a10c76c954b5cd65	<ul style="list-style-type: none"> <li>DNS: eu-west-1-aws-2-lrg.optimized-pricing-api.refinitiv.net</li> <li>Elastic IP: 54.195.122.233</li> </ul>
	Refinitiv Managed	euw1-az2 euw1-az3	com.amazonaws.vpce.eu-west-1.vpce-svc-0dc5826b27c771f0e	<ul style="list-style-type: none"> <li>DNS: eu-west-1-aws-3-lrg.optimized-pricing-api.refinitiv.net</li> <li>Elastic IPs: <ul style="list-style-type: none"> <li>- 54.246.13.205</li> <li>- 52.31.160.0</li> </ul> </li> </ul>

Table 14: Current Endpoints as of September 2021 (By Region)

## 5.2.3.3.5 Region: AP-NORTHEAST-1

TIER	SERVICE	AZ ID	VPC ENDPOINT SERVICE NAME	DNS NAME / ELASTIC IP
sm	Customer Managed1	apne1-az4	com.amazonaws.vpce.ap-northeast-1.vpce-svc-0bbf7c9425d0a8db9	<ul style="list-style-type: none"> <li>DNS: ap-northeast-1-aws-1-sm.optimized-pricing-api.refinitiv.net</li> <li>Elastic IP: 54.95.234.42</li> </ul>
	Customer Managed2	apne1-az1	com.amazonaws.vpce.ap-northeast-1.vpce-svc-0f26e3310cb49fda6	<ul style="list-style-type: none"> <li>DNS: ap-northeast-1-aws-2-sm.optimized-pricing-api.refinitiv.net</li> <li>Elastic IP: 52.194.54.177</li> </ul>
	Refinitiv Managed	apne1-az4 apne1-az1	com.amazonaws.vpce.ap-northeast-1.vpce-svc-07150a21dc145312e	<ul style="list-style-type: none"> <li>DNS: ap-northeast-1-aws-3-sm.optimized-pricing-api.refinitiv.net</li> <li>Elastic IPs: <ul style="list-style-type: none"> <li>- 3.113.130.54</li> <li>- 3.113.82.164</li> </ul> </li> </ul>
med	Customer Managed1	apne1-az4	com.amazonaws.vpce.ap-northeast-1.vpce-svc-00edae4ecc9268bed	<ul style="list-style-type: none"> <li>DNS: ap-northeast-1-aws-1-med.optimized-pricing-api.refinitiv.net</li> <li>Elastic IP: 35.75.102.206</li> </ul>
	Customer Managed2	apne1-az1	com.amazonaws.vpce.ap-northeast-1.vpce-svc-0577b492fc6b5bcd3	<ul style="list-style-type: none"> <li>DNS: ap-northeast-1-aws-2-med.optimized-pricing-api.refinitiv.net</li> <li>Elastic IP: 3.114.38.65</li> </ul>
	Refinitiv Managed	apne1-az4 apne1-az1	com.amazonaws.vpce.ap-northeast-1.vpce-svc-04cb068e45c310768	<ul style="list-style-type: none"> <li>DNS: ap-northeast-1-aws-3-med.optimized-pricing-api.refinitiv.net</li> <li>Elastic IPs: <ul style="list-style-type: none"> <li>- 54.250.181.79</li> <li>- 35.75.51.42</li> </ul> </li> </ul>
lrg	Customer Managed1	apne1-az4	com.amazonaws.vpce.ap-northeast-1.vpce-svc-0bb21f04500984a83	<ul style="list-style-type: none"> <li>DNS: ap-northeast-1-aws-1-lrg.optimized-pricing-api.refinitiv.net</li> <li>Elastic IP: 18.180.85.54</li> </ul>
	Customer Managed2	apne1-az1	com.amazonaws.vpce.ap-northeast-1.vpce-svc-01b01880976004f4c	<ul style="list-style-type: none"> <li>DNS: ap-northeast-1-aws-2-lrg.optimized-pricing-api.refinitiv.net</li> <li>Elastic IP: 35.74.13.87</li> </ul>
	Refinitiv Managed	apne1-az4 apne1-az1	com.amazonaws.vpce.ap-northeast-1.vpce-svc-0910b43752a24a383	<ul style="list-style-type: none"> <li>DNS: ap-northeast-1-aws-3-lrg.optimized-pricing-api.refinitiv.net</li> <li>Elastic IPs: <ul style="list-style-type: none"> <li>- 35.75.226.194</li> <li>- 3.115.145.254</li> </ul> </li> </ul>

Table 15: Current Endpoints as of July 2022 (By Region)

## 5.2.3.3.6 Region: AP-SOUTHEAST-1

TIER	SERVICE	AZ ID	VPC ENDPOINT SERVICE NAME	DNS NAME / ELASTIC IP
sm	Customer Managed1	apse1-az1	com.amazonaws.vpce.ap-southeast-1.vpce-svc-0b77062e990485c0c	<ul style="list-style-type: none"> <li>DNS: ap-southeast-1-aws-1-sm.optimized-pricing</li> <li>Elastic IP: 3.1.255.247</li> </ul>
	Customer Managed2	apse1-az2	com.amazonaws.vpce.ap-southeast-1.vpce-svc-0ac84f9322d0ede87	<ul style="list-style-type: none"> <li>DNS: ap-southeast-1-aws-2-sm.optimized-pricing</li> <li>Elastic IP: 175.41.147.210</li> </ul>
	Refinitiv Managed	apse1-az1 apse1-az2	com.amazonaws.vpce.ap-southeast-1.vpce-svc-094565326c4d786f7	<ul style="list-style-type: none"> <li>DNS: ap-southeast-1-aws-3-sm.optimized-pricing</li> <li>Elastic IPs: <ul style="list-style-type: none"> <li>- 18.138.110.13</li> <li>- 18.136.145.111</li> </ul> </li> </ul>
med	Customer Managed1	apse1-az1	com.amazonaws.vpce.ap-southeast-1.vpce-svc-0918c4a57a0977f37	<ul style="list-style-type: none"> <li>DNS: ap-southeast-1-aws-1-med.optimized-pricing</li> <li>Elastic IP: 3.0.141.36</li> </ul>
	Customer Managed2	apse1-az2	com.amazonaws.vpce.ap-southeast-1.vpce-svc-0bcf5bdb34ebcdade	<ul style="list-style-type: none"> <li>DNS: ap-southeast-1-aws-2-med.optimized-pricing</li> <li>Elastic IP: 3.0.216.215</li> </ul>
	Refinitiv Managed	apse1-az1 apse1-az2	com.amazonaws.vpce.ap-southeast-1.vpce-svc-09f8db034044af999	<ul style="list-style-type: none"> <li>DNS: ap-southeast-1-aws-3-med.optimized-pricing</li> <li>Elastic IPs: <ul style="list-style-type: none"> <li>- 13.228.150.62</li> <li>- 54.254.18.215</li> </ul> </li> </ul>
lrg	Customer Managed1	apse1-az1	com.amazonaws.vpce.ap-southeast-1.vpce-svc-00e3ffe637874dd8c	<ul style="list-style-type: none"> <li>DNS: ap-southeast-1-aws-1-lrg.optimized-pricing</li> <li>Elastic IP: 52.74.229.169</li> </ul>
	Customer Managed2	apse1-az2	com.amazonaws.vpce.ap-southeast-1.vpce-svc-021981e239cd88c69	<ul style="list-style-type: none"> <li>DNS: ap-southeast-1-aws-2-lrg.optimized-pricing</li> <li>Elastic IP: 18.139.176.30</li> </ul>
	Refinitiv Managed	apse1-az1 apse1-az2	com.amazonaws.vpce.ap-southeast-1.vpce-svc-0a0940e6af4d4de2b	<ul style="list-style-type: none"> <li>DNS: ap-southeast-1-aws-3-lrg.optimized-pricing</li> <li>Elastic IPs: <ul style="list-style-type: none"> <li>- 54.151.163.132</li> <li>- 3.1.87.174</li> </ul> </li> </ul>

Table 16: Current Endpoints as of September 2021 (By Region)

### 5.2.3.3.7 RDP Gateway Endpoints

REGION	AZ ID	VPC ENDPOINT SERVICE NAME	PRIVATE LINK DNS NAME
us-east-1	use1-az1 use1-az2 use1-az4	com.amazonaws.vpce.us-east-1.vpce-svc-004e62381340662c0	aws-private-us-east-1-api.refinitiv.com
eu-west-1	euw1-az2 euw1-az3 euw1-az1	com.amazonaws.vpce.eu-west-1.vpce-svc-0c2c7cc6d26fae7cd	aws-private-eu-west-1-api.refinitiv.com
ap-southeast-1	apse1-az1 apse1-az2 apse1-az3	com.amazonaws.vpce.ap-southeast-1.vpce-svc-0d5d680e15cbe05a3	aws-private-ap-southeast-1-api.refinitiv.com

**Table 17: RDP Gateway Points**

### 5.2.3.4 Creating VPC Endpoint Using AWS CLI

#### ► To create VPC endpoint using AWS CLI:

1. Verify AWS CLI is installed and configured.

Refer to <https://docs.aws.amazon.com/cli/index.html>.

---

**NOTE:** The environment variable names **MYREGION**, **MYVPC**, **MYSUBNET**, **MYSECURITYGROUP**, and **MYSERVICENAME** used in the following steps are examples. You can use custom names for your configuration as needed.

---

2. Identify the region that will be used for connectivity, and save its name in the environment variable **MYREGION**.
3. Identify VPC that will be used for connectivity, and save its name in environment variable **MYVPC**.
4. Identify the subnet in the same Availability Zone serviced by Refinitiv Real-Time — Optimized for that region, and save its name in the environment variable **MYSUBNET**.

---

**NOTE:** For Refinitiv Managed Resiliency connectivity, you can create one VPC Endpoint in any of the serviced AZs. For the AZ ID serviced by the applicable region and associated endpoints, refer to [Section 5.2.3.3.7](#).

---

5. Create security group that allows in/out TCP traffic on ports **14002** and **443**. Save the name of the group in environment variable **MYSECURITYGROUP**.
6. Lookup the service name for the AWS PrivateLink Endpoint, and save as environment variable **MYSERVICENAME**.  
For endpoint service names, refer to [Section 5.2.3.3](#).
7. Create VPC Endpoint using following command:

```
aws ec2 create-vpc-endpoint --region $MYREGION --vpc-id $MYVPC --subnet-ids $MYSUBNET
--security-group-ids $MYSECURITYGROUP --service-name $MYSERVICE --vpc-endpoint-type
Interface --private-dns-enabled
```

**NOTE:**

- You can specify more than one subnet in different Availability Zones (as supported by the service) to ensure that your interface endpoint is resilient to Availability Zone failures. In that case, create an endpoint network interface in each subnet that you specify.
- Specify the security groups to associate with the endpoint network interface. The security group rules control the traffic to the endpoint network interface from resources in the VPC. If you do not specify a security group, AWS assigns the default security group for the VPC.

If you are unable to utilize private DNS with your endpoints, you will require a workaround for certificate errors.

If you attempt to access Refinitiv Real-Time — Optimized service by a randomly generated DNS name for the endpoint or by local endpoint IP, there will be certificate errors. This occurs because the resource name/IP being used to access the service does not align with the name in the certificate indicating a man-in-the-middle attack. Customers can workaround this problem by creating a local DNS and/or `/etc/host` file entry with the appropriate resource name.

For example: If you are trying to connect to Refinitiv Managed Resiliency service in US-EAST-1 region for the medium watchlist-size tier, use the DNS name `us-east-1-aws-3-med.optimized-pricing-api.refinitiv.net` for the medium-sized watchlist tier from [Section 5.2.3.3.1](#) (for details on watchlist-size tiers, refer to [Section 4.3.6](#)). Then create an alias by adding an entry similar to the following in `/etc/hosts`:

```
XX.XX.XX.XX us-east-1-aws-3-med.optimized-pricing-api.refinitiv.net
```

Where `XX.XX.XX.XX` is ip address of created above VPC Endpoint.

The Windows equivalent file is `c:\windows\system32\drivers\etc\hosts`.

Additional options for adding an alias:

- Use DNS Resolver
- Create alias in Private Hosted Zone in AWS Route53.

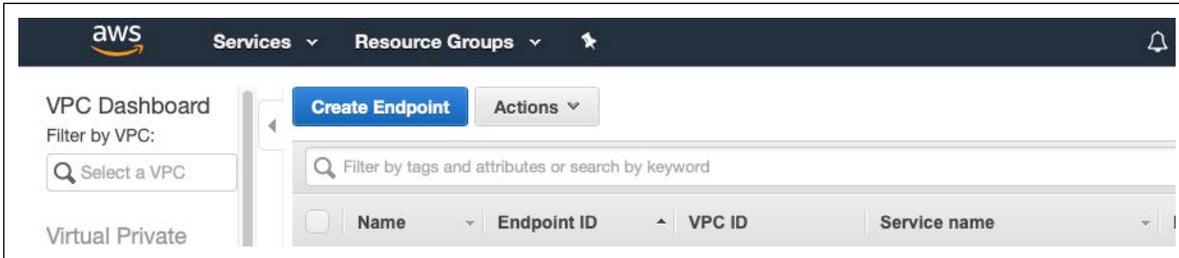
**NOTE:** The order of name lookup for Linux is controlled by hosts in the `/etc/nsswitch.conf` file. To ensure that `us-east-1-aws-3-med.optimized-pricing-api.refinitiv.net` for the medium watchlist size tier resolves to the IP of the VPC Endpoint that was added to the `/etc/hosts` file, verify that `hosts` has files listed first in `nsswitch.conf`.

For example: `hosts: files dns myhostname`

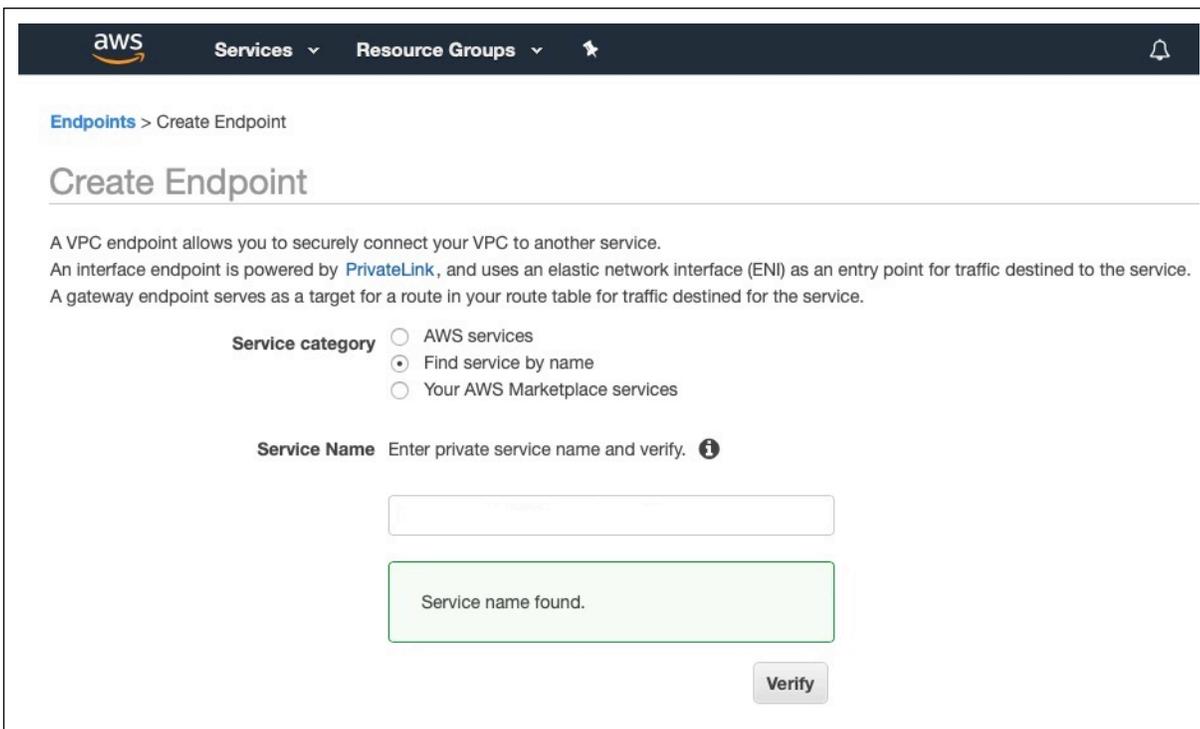
### 5.2.3.5 Creating VPC Endpoint Using AWS Console

► To create a VPC endpoint using the AWS Console:

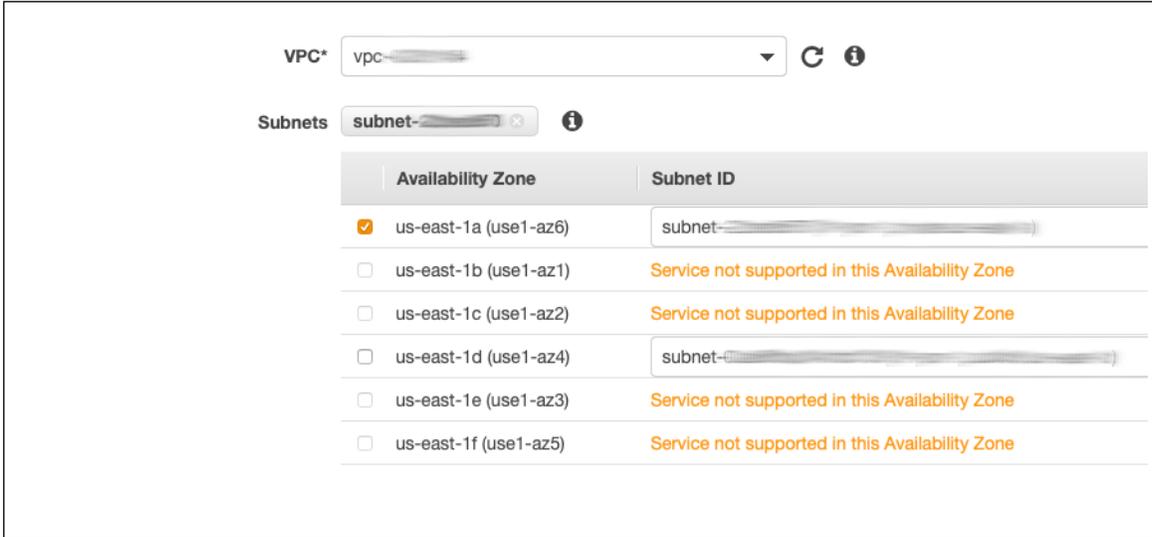
1. In the **VPC Dashboard**, select **Endpoints**.
2. Select **Create Endpoint**.



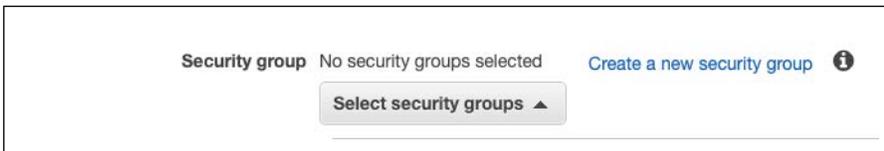
3. Select the **Find services by name** button and enter the name of the Refinitiv Real-Time — Optimized service in the box for **Service Name**.
4. Click **Verify** to verify the service name.



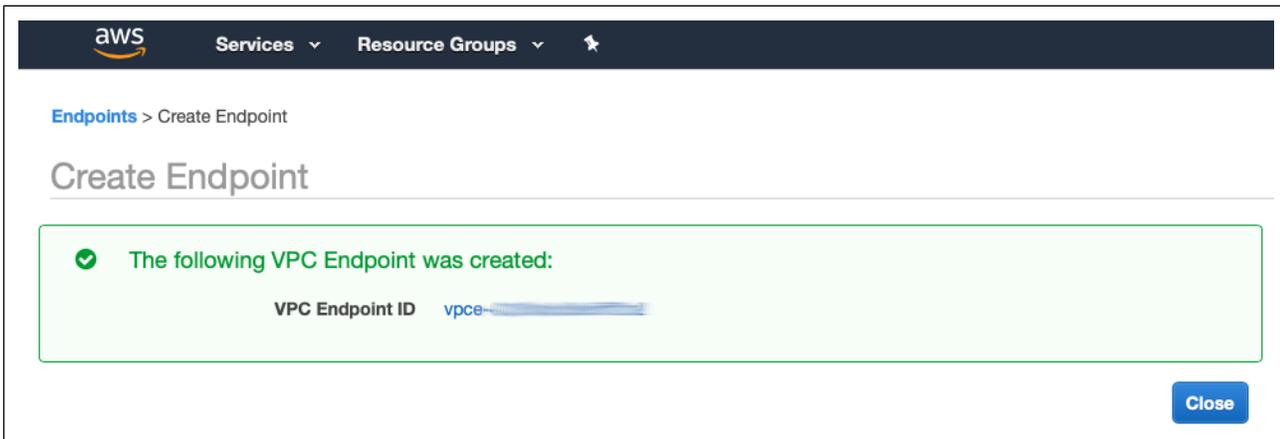
- Select the applicable **VPC** from the drop-down, and then select the **Availability Zone**.



- Select the security group from the **Select security groups** drop-down that allows in/out on ports 14002 and 443. If the security group is not available, click **Create a new security group** and create a security group that allows in/out on ports 14002 and 443.



- Click the link for the endpoint that you created for endpoint details.  
Take note of the DNS name.



- Obtain the IP address for the new endpoint by entering the following command:

```
host DNS_name
```

Where ***DNS\_name*** is the DNS name of the VPC endpoint.

9. The DNS name is automatically generated and different for each client. Therefore, it cannot be validated with the Refinitiv NLB. Refinitiv recommends creating a DNS name alias with the appropriate name from the tables provided in [Section 5.2.3.3](#) that resolves to the newly created VPC Endpoint IP address.

---

**NOTE:** If your application does not support DNS name validation, you can connect directly to the endpoint's IP address instead of creating an alias.

---

For example: If you are trying to connect to Refinitiv Managed Resiliency service in AMERS region, use DNS name **us-east-1-aws-3-med.optimized-pricing-api.refinitiv.net** for the medium watchlist size tier from the tables in [Section 5.2.3.3](#). Then create an alias by adding an entry similar to the following in `/etc/hosts`:

```
IPAddress us-east-1-aws-3-med.optimized-pricing-api.refinitiv.net
```

Where **IPAddress** is the VPC endpoint's IP address.



**TIP:** The Windows equivalent file is located in `c:\windows\system32\drivers\etc\hosts`.

---

Additional options for adding an alias:

- Use a DNS Resolver
- Create an alias in the Private Hosted Zone in AWS Route53.

---

**NOTE:** The order of name lookup for Linux is controlled by hosts in the `/etc/nsswitch.conf` file. To ensure that **us-east-1-aws-3-med.optimized-pricing-api.refinitiv.net** for the medium watchlist size tier resolves to the IP of the VPC Endpoint that was added to the `/etc/hosts` file, verify that `hosts` has the files listed first in `nsswitch.conf`.

For example: `hosts: files dns myhostname`

---

### 5.3 Connecting to Refinitiv Real-Time — Optimized Using Delivery Direct

See the supplement to this document titled [Real-Time - Optimized and Delivery Direct, Client Guide v1.3](#) on MyRefinitiv.com for more details on configuring applications to use Real-Time Optimized with Delivery Direct.

## Appendix A Service Discovery Bypass

If desired, the service discovery interaction can be overridden or bypassed to explicitly use Internet (.com) or Delivery Direct (.biz) endpoints. This can be useful when you want to be explicit about network delivery method rather than relying on DNS steering. To do so, make the changes described in the sample configuration below directly in your RTDS config. You will **NOT** see a step during tconfig asking you whether or not you would like to bypass service discovery unless the **-a** (advanced) argument is specified during route configuration. For further details on bypassing service discovery, refer to the [Service Discovery Bypass documentation](#).

Here is sample configuration for ADH connecting to RTO which disables service discovery and specifies a host/endpoint in the **hostList** parameter:

```
*adh*serviceDiscoveryUrl : https://eu-west-1-api.refinitiv.biz/streaming/pricing/v1
*adh*tokenServiceUrl : https://eu-west-1-api.refinitiv.biz/auth/oauth2/v1/token
rtds1*adh*cloud_route.route*encryptionProtocol : TLSv1.2
rtds1*adh*cloud_route.route*location :
rtds1*adh*cloud_route.route*proxyHost :
rtds1*adh*cloud_route.route*proxyPort :
rtds1*adh*cloud_route.route*serviceDiscovery : False
rtds1*adh*cloud_route.route*tokenManagement : True
rtds1*adh*cloud_route.route*useReactor : True
rtds1*adh*cloud_route.route*userPassword : (enter obfuscated password)
rtds1*adh*cloud_route.route*rsslConnectionType : encrypted
rtds1*adh*cloud_route.route*userName : (enter username)
rtds1*adh*cloud_route*hostList : eu-west-1-aws-3-sm.optimized-pricing-api.refinitiv.biz
rtds1*adh*cloud_route*port : 14002
rtds1*adh*cloud_route*pingInterval : 10
```

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