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# Force.com Streaming API Developer Guide

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# GETTING STARTED WITH FORCE.COM STREAMING API

## CHAPTER 1 Introducing Streaming API

### In this chapter ...

- [Push Technology](#)
- [Bayeux Protocol, CometD, and Long Polling](#)
- [Streaming API Terms](#)
- [How the Client Connects](#)
- [Message Reliability](#)
- [Message Durability](#)

Use Streaming API to receive notifications for changes to Salesforce data that match a SOQL query you define, in a secure and scalable way.

These events can be received by:

- Pages in the Salesforce application.
- Application servers outside of Salesforce.
- Clients outside the Salesforce application.

The sequence of events when using Streaming API is as follows:

1. Create a PushTopic based on a SOQL query. This defines the channel.
2. Clients subscribe to the channel.
3. A record is created, updated, deleted, or undeleted (an event occurs). The changes to that record are evaluated.
4. If the record changes match the criteria of the PushTopic query, a notification is generated by the server and received by the subscribed clients.


Streaming API is useful when you want notifications to be pushed from the server to the client based on criteria that you define. Consider the following applications for Streaming API:

### Applications that poll frequently

Applications that have constant polling action against the Salesforce infrastructure, consuming unnecessary API calls and processing time, would benefit from Streaming API which reduces the number of requests that return no data.

### General notification

Use Streaming API for applications that require general notification of data changes in an organization. This enables you to reduce the number of API calls and improve performance.

 **Note:** You can use Streaming API with any organization as long as you enable the API. This includes both Salesforce and Database.com organizations.

## Push Technology

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Push technology, also called the publish/subscribe model, transfers information that is initiated from a server to the client. This type of communication is the opposite of pull technology in which a request for information is made from a client to the server.

The information sent by the server is typically specified in advance. When using Streaming API, you specify the information that the client receives by creating a `PushTopic`. The client then subscribes to the `PushTopic` channel and is notified of events that match the `PushTopic` criteria.

In push technology, the server pushes out information to the client after the client has subscribed to a channel of information. For the client to receive the information, the client must maintain a connection to the server. Streaming API uses the Bayeux protocol and CometD, so the client to server connection is maintained through long polling.

## Bayeux Protocol, CometD, and Long Polling

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Streaming API uses the Bayeux protocol and CometD for long polling.

- Bayeux is a protocol for transporting asynchronous messages, primarily over HTTP.
- CometD is a scalable HTTP-based event routing bus that uses an AJAX push technology pattern known as Comet. It implements the Bayeux protocol.
- Long polling, also called Comet programming, allows emulation of an information push from a server to a client. Similar to a normal poll, the client connects and requests information from the server. However, instead of sending an empty response if information isn't available, the server holds the request and waits until information is available (an event occurs). The server then sends a complete response to the client. The client then immediately re-requests information. The client continually maintains a connection to the server, so it's always waiting to receive a response. In the case of server timeouts, the client connects again and starts over.

If you're not familiar with long polling, Bayeux, or CometD, review the [CometD documentation](#).

Streaming API supports the following CometD methods:

Method	Description
<code>connect</code>	The client connects to the server.
<code>disconnect</code>	The client disconnects from the server.
<code>handshake</code>	The client performs a handshake with the server and establishes a long polling connection.
<code>subscribe</code>	The client subscribes to a channel defined by a <code>PushTopic</code> . After the client subscribes, it can receive messages from that channel. You must successfully call the <code>handshake</code> method before you can subscribe to a channel.
<code>unsubscribe</code>	The client unsubscribes from a channel.

## Streaming API Terms

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Learn about terms used for Streaming API.

Term	Description
Event	The creation, update, delete, or undelete of a record. Each event might trigger a notification.



Term	Description
Notification	A message in response to an event. The notification is sent to a channel to which one or more clients are subscribed.
PushTopic	A record that you create. The essential element of a PushTopic is the SOQL query. The PushTopic defines a Streaming API channel.

## How the Client Connects

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Streaming API uses the HTTP/1.1 request-response model and the Bayeux protocol (CometD implementation). A Bayeux client connects to Streaming API in multiple stages.

1. Sends a handshake request.
2. Sends a subscription request to a channel.
3. Connects using *long polling*.

The maximum size of the HTTP request post body that the server can accept from the client is 32,768 bytes, for example, when you call the CometD `subscribe` or `connect` methods. If the request message exceeds this size, the following error is returned in the response: 413 Maximum Request Size Exceeded. To keep requests within the size limit, avoid sending multiple messages in a single request.

The client receives events from the server while it maintains a long-lived connection.

- If the client receives events, it should reconnect immediately to receive the next set of events. If the reconnection doesn't occur within 40 seconds, the server expires the subscription and the connection closes. The client must start over with a handshake and subscribe again.
- If no events are generated and the client is waiting and the server closes the connection, after two minutes the client should reconnect immediately.

If a long-lived connection is lost due to unexpected network disruption, CometD will automatically attempt to reconnect. If this reconnection is successful, clients must re-subscribe, since this new connection has gone through a re-handshake that removes previous subscribers. Clients can listen to the `meta/handshake` meta channel to receive notifications when a connection is lost and re-established.

For details about these steps, see [Bayeux Protocol, CometD, and Long Polling](#).

## Message Reliability

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As of API version 37.0, Streaming API provides reliable message delivery by enabling you to replay past events. In API version 36.0 and earlier, clients might not receive all messages in some situations.

In API version 37.0 and later, Streaming API stores events for 24 hours, enabling you to replay past events. With durable streaming, messages aren't lost when a client is disconnected or isn't subscribed. When the client subscribes again, it can fetch past events that are within the 24-hour retention period. The ability to replay past events provides reliable message delivery.

In API version 36.0 and earlier, Streaming API doesn't maintain client state nor keeps track of what's delivered. The client might not receive messages for several reasons, including:

- When a client first subscribes or reconnects, it might not receive messages that were processed while it wasn't subscribed to the channel.

- When a client disconnects and starts a new handshake, it could be working with a different application server, so it receives only new messages from that point on.
- Some events are dropped when the system is being heavily used.
- If an application server is stopped, all messages being processed but not yet sent are lost. Clients connected to that application server are disconnected. To receive notifications, the client must reconnect and subscribe to the topic channel.

## Message Durability

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Salesforce stores events for 24 hours. With API version 37.0 and later, you can retrieve events that are within the retention window. The Streaming API event framework decouples event producers from event consumers. A subscriber can retrieve events at any time and isn't restricted to listening to events at the time they're sent.

## Event Replay Process

Each event message is assigned an opaque ID contained in the `ReplayId` field. The `ReplayId` field value, which is populated by the system, refers to the position of the event in the event stream. Replay ID values are not guaranteed to be contiguous for consecutive events. For example, the event following the event with ID 999 can have an ID of 1,025. A subscriber can store a replay ID value and use it on resubscription to retrieve events that are within the retention window. For example, a subscriber can retrieve missed events after a connection failure. Subscribers must not compute new replay IDs based on a stored replay ID to refer to other events in the stream.

This JSON message shows the `replayId` field in the event object for a generic event.

```
{
  "clientId": "alps4wpe52qytvcvbsko09tapc",
  "data": {
    "event": {
      "createdDate": "2016-03-29T19:05:28.334Z",
      "replayId": 55
    },
    "payload": "This is a message."
  },
  "channel": "/u/TestStreaming"
}
```

This JSON message shows the `replayId` field in the event object for a PushTopic event.

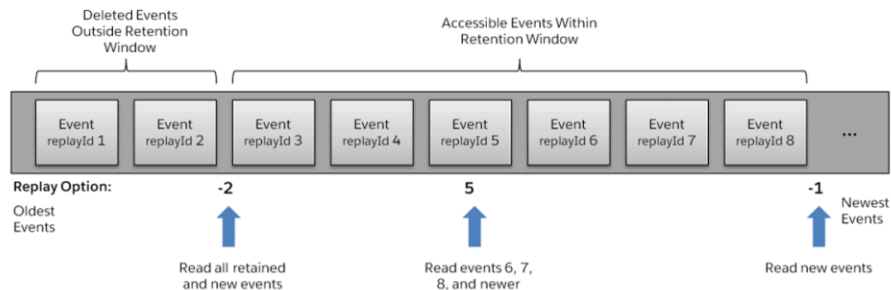
```
{
  "clientId": "2t80j2hcog29sdh9ihjd9643a",
  "data": {
    "event": {
      "createdDate": "2016-03-29T16:40:08.208Z",
      "replayId": 13,
      "type": "created"
    },
    "subject": {
      "Website": null,
      "Id": "001D000000KnaXjIAJ",
      "Name": "TicTacToe"
    }
  },
  "channel": "/topic/TestAccountStreaming"
}
```

**Note:** In API version 37.0 and later, the time format of the `createdAtDate` field value has changed to make it consistent with the time format used in the Salesforce app. The time portion now ends with a `Z` suffix instead of `+0000`. Both suffixes denote a UTC time zone.

## Replaying Events

A subscriber can choose which events to receive, such as all events within the retention window or starting after a particular event. The default is to receive only the new events sent after subscribing. Events outside the 24-hour retention period are discarded.

This high-level diagram shows how event consumers can read a stream of events by using various replay options.



**Table 1: Replay Options**

Replay Option	Description
Replay ID	Subscriber receives all events after the event specified by its <code>replayId</code> value.
-1	Subscriber receives new events that are broadcast after the client subscribes.
-2	Subscriber receives all events, including past events that are within the 24-hour retention window and new events sent after subscription.

To replay events, use the Streaming API endpoint.

```
https://Salesforce_Instance/cometd/41.0/
```

**Note:** Durable streaming is supported at this endpoint starting with API version 37.0. Durable Generic Streaming is supported in version 36.0 at this alternative endpoint: `https://Salesforce_Instance/cometd/replay/36.0/`. However, we recommend you upgrade to version 37.0 and use the main Streaming API endpoint.

The replay mechanism is implemented in a Salesforce-provided CometD extension. A sample extension is provided in JavaScript and another in Java. For example, you can register the extension as follows in JavaScript.

```
// Register streaming extension
var replayExtension = new cometdReplayExtension();
replayExtension.setChannel(<Streaming Channel to Subscribe to>);
replayExtension.setReplay(<Event Replay Option>);
cometd.registerExtension('myReplayExtensionName', replayExtension);
```

 **Note:**

- The argument passed to `setReplay()` is one of the replay options listed in [Replay Options](#). We recommend that clients subscribe with the `-1` option to receive new events or with a specific replay ID. If the channel contains many event messages, subscribing frequently with the `-2` option can cause performance issues.
- The first argument passed to `registerExtension()` is the name of the replay extension in your code. In the example, it's set to `myExtensionName`, but it can be any string. You use this name to unregister the extension later on.
- If the `setReplay()` function isn't called, or the CometD extension isn't registered, only new events are sent to the subscriber, which is the same as the `-1` option.

After calling the `setReplay()` function on the extension, the events that the subscriber receives depend on the replay value parameter passed to `setReplay()`.

After a client times out because it hasn't reconnected within 40 seconds or a network failure has occurred, it attempts a new handshake request and reconnects. The replay extension saves the replay ID of the last message received and uses it when resubscribing. That way, the client receives only messages that were sent after the timeout and doesn't receive duplicate messages that were sent earlier.

## Code Samples

### Visualforce Sample

For a sample and code walkthrough that uses Visualforce and a CometD extension in JavaScript, see [Example: Subscribe to and Replay Events Using a Visualforce Page](#)

### Java Samples

For a Java client sample that uses the CometD extension, see the [Example: Subscribe to and Replay Events Using a Java Client](#)

SEE ALSO:

[Bayeux Protocol, CometD, and Long Polling Clients and Timeouts](#)

## CHAPTER 2 Quick Start Using Workbench

This quick start shows you how to get started with Streaming API by using Workbench. This quick start takes you step-by-step through the process of using Streaming API to receive a notification when a record is updated.

- [Prerequisites](#)
- [Step 1: Create an Object](#)
- [Step 2: Create a PushTopic](#)
- [Step 3: Subscribe to the PushTopic Channel](#)
- [Step 4: Test the PushTopic Channel](#)

### Prerequisites

---

You need access and appropriate permissions to complete the quick start steps.

- Access to a Developer Edition organization.

If you are not already a member of the Force.com developer community, go to [developer.salesforce.com/signup](https://developer.salesforce.com/signup) and follow the instructions for signing up for a Developer Edition organization. Even if you already have Enterprise Edition, Unlimited Edition, or Performance Edition, use Developer Edition for developing, staging, and testing your solutions against sample data to protect your organization's live data. This is especially true for applications that insert, update, or delete data (as opposed to simply reading data).

- The "API Enabled" permission must be enabled for your Developer Edition organization. This permission is enabled by default, but may have been changed by an administrator.
- The "Streaming API" permission must be enabled.



**Note:** To verify that the "API Enabled" and "Streaming API" permissions are enabled in your organization, from Setup, enter *User Interface* in the *Quick Find* box, then select **User Interface**.

- The logged-in user must have "Read" permission on the PushTopic standard object to receive notifications.
- The logged-in user must have "Create" permission on the PushTopic standard object to create and manage PushTopic records.
- The logged-in user must have "Author Apex" permissions to create a PushTopic by using the Developer Console.

### Step 1: Create an Object

---

The first step is to create an InvoiceStatement object.

After you create a PushTopic and subscribe to it, you'll get notifications when an InvoiceStatement record is created, updated, deleted, or undeleted. You'll create the object with the user interface.

1. From your management settings for custom objects, if you're using Salesforce Classic, click **New Custom Object**, or if you're using Lightning Experience, select **Create > Custom Object**.

2. Define the custom object.
  - In the **Label field**, type *Invoice Statement*.
  - In the **Plural Label** field, type *Invoice Statements*.
  - Select **Starts with vowel sound**.
  - In the **Record Name** field, type *Invoice Number*.
  - In the **Data Type** field, select *Auto Number*.
  - In the **Display Format** field, type *INV- {0000}*.
  - In the **Starting Number** field, type *1*.
3. Click **Save**.
4. Add a Status field.
  - a. Scroll down to the Custom Fields & Relationships related list and click **New**.
  - b. For Data Type, select *Picklist* and click **Next**.
  - c. In the Field Label field, type *Status*.
  - d. Type the following picklist values in the box provided, with each entry on its own line.

```
Open
Closed
Negotiating
Pending
```

- e. Select the checkbox for **Use first value as default value**.
  - f. Click **Next**.
  - g. For field-level security, select *Read Only* and then click **Next**.
  - h. Click **Save & New** to save this field and create a new one.
5. Now create an optional Description field.
    - a. In the Data Type field, select *Text Area* and click **Next**.
    - b. In the Field Label and Field Name fields, enter *Description*.
    - c. Click **Next**, accept the defaults, and click **Next** again.
    - d. Click **Save** to go the detail page for the Invoice Statement object.

Your InvoiceStatement object should now have two custom fields.

SEE ALSO:

[Salesforce Help: Find Object Management Settings](#)

## Step 2: Create a PushTopic

---


Use the Developer Console to create the PushTopic record that contains a SOQL query.

Event notifications are generated for updates that match the query. Alternatively, you can also use Workbench to create a PushTopic.


1. Open the Developer Console.

2. Click **Debug > Open Execute Anonymous Window**.
3. In the Enter Apex Code window, paste in the following Apex code, and click **Execute**.

```
PushTopic pushTopic = new PushTopic();
pushTopic.Name = 'InvoiceStatementUpdates';
pushTopic.Query = 'SELECT Id, Name, Status__c, Description__c FROM Invoice_Statement__c';
pushTopic.ApiVersion = 41.0;
pushTopic.NotifyForOperationCreate = true;
pushTopic.NotifyForOperationUpdate = true;
pushTopic.NotifyForOperationUndelete = true;
pushTopic.NotifyForOperationDelete = true;
pushTopic.NotifyForFields = 'Referenced';
insert pushTopic;
```

 **Note:** If your organization has a namespace prefix defined, then you'll need to preface the custom object and field names with that namespace when you define the PushTopic query. For example, `SELECT Id, Name, namespace__Status__c, namespace__Description__c FROM namespace__Invoice_Statement__c`.

Because `NotifyForOperationCreate`, `NotifyForOperationUpdate`, `NotifyForOperationDelete` and `NotifyForOperationUndelete` are set to `true`, Streaming API evaluates records that are created, updated, deleted, or undeleted and generates a notification if the record matches the PushTopic query. Because `NotifyForFields` is set to `Referenced`, Streaming API will use fields in both the `SELECT` clause and the `WHERE` clause to generate a notification. Whenever the fields `Name`, `Status__c`, or `Description__c` are updated, a notification will be generated on this channel. For more information about `NotifyForOperationCreate`, `NotifyForOperationUpdate`, `NotifyForOperationDelete`, `NotifyForOperationUndelete`, and `NotifyForFields`, see [Event Notification Rules](#).

 **Note:** In API version 28.0 and earlier, notifications are only generated when records are created or updated. The `NotifyForOperationCreate`, `NotifyForOperationUpdate`, `NotifyForOperationDelete`, and `NotifyForOperationUndelete` fields are unavailable and the `NotifyForOperations` enum field is used instead to set which record events generate a notification. For more information see [PushTopic](#).


SEE ALSO:

[Salesforce Help: Open the Developer Console](#)


## Step 3: Subscribe to the PushTopic Channel

---

In this step, you subscribe to the channel that you created with the PushTopic record in the previous step.

 **Important:** Workbench is a free, open source, community-supported tool (see the Help page in Workbench). Salesforce provides a hosted instance of Workbench for demonstration purposes only—Salesforce recommends that you do not use this hosted instance of Workbench to access data in a production database. If you want to use Workbench for your production database, you can download, host, and configure it using your own resources. You can download Workbench from <https://github.com/ryanbrainard/forceworkbench/releases>.

1. In your browser, navigate to <https://workbench.developerforce.com/login.php>.
2. For Environment, select **Production**.
3. For API Version, select **36.0**.

 **Note:** Workbench supports Streaming API in versions 36.0 and earlier only.

4. Accept the terms of service, and click **Login with Salesforce**.
5. After you successfully establish a connection to your database, you land on the Select page.
6. Select **queries > Streaming Push Topics**.
7. In the Push Topic field, select **InvoiceStatementUpdates**.
8. Click **Subscribe**.

You'll see the connection and response information and a response like "Subscribed to /topic/InvoiceStatementUpdates."

Keep this browser window open and make sure that the connection doesn't time out. You'll be able to see the event notifications triggered by the InvoiceStatement record you create in the next step.

## Step 4: Test the PushTopic Channel

Make sure the browser that you used in [Step 3: Subscribe to the PushTopic Channel](#) stays open and the connection doesn't time out. You'll view event notifications in this browser.

The final step is to test the PushTopic channel by creating a new InvoiceStatement record in Workbench and viewing the event notification.

1. In a new browser window, open an instance of Workbench and log in using the same username by following the steps in [Step 3: Subscribe to the PushTopic Channel](#).



**Note:** If the user that makes an update to a record and the user that's subscribed to the channel don't share records, then the subscribed user won't receive the notification. For example, if the sharing model for the organization is private.

2. Click **data > Insert**.
3. For Object Type, select **Invoice\_Statement\_\_c**. Ensure that the **Single Record** field is selected, and click **Next**.
4. Type in a value for the **Description\_\_c** field.
5. Click **Confirm Insert**.
6. Switch over to your Streaming Push Topics browser window. You'll see a notification that the invoice statement was created. The notification returns the `Id`, `Status__c`, and `Description__c` fields that you defined in the SELECT statement of your PushTopic query. The message looks something like this:

```
{
  "channel": "/topic/InvoiceStatementUpdates",
  "data": {
    "event": {
      "type": "created",
      "createdDate": "2011-11-14T17:33:45.000+0000"
    },
    "subject": {
      "Name": "INV-0004",
      "Id": "a00D00000008oLi8IAE",
      "Description__c": "Test invoice statement",
      "Status__c": "Open"
    }
  }
}
```



## CHAPTER 3 Code Examples

### In this chapter ...

- Example: Subscribe to and Replay Events Using a Visualforce Page
- Example: Interactive Visualforce Page without Replay
- Example: Subscribe to and Replay Events Using a Java Client
- Example: Authentication

Check out code examples for PushTopic and generic events in Visualforce and Java, and an authentication example.

## Example: Subscribe to and Replay Events Using a Visualforce Page

---

This sample app shows you how to subscribe to durable streaming events for PushTopic and generic events. The app contains two interactive Visualforce pages: one for PushTopic events and one for generic events. You can generate test events and view them on each page. You specify which events are retrieved and displayed by setting replay options.

For each Visualforce page, the logic for replaying events is contained within a Visualforce component. The component registers the Salesforce-provided CometD extension and sets replay options.

### IN THIS SECTION:

#### [Prerequisites](#)

Set up permissions that are required to run the durable streaming samples.

#### [Deploy a Sample Project to Your Org](#)

Use Workbench to copy all project components to your org.

#### [Durable PushTopic Streaming Sample](#)

The Durable PushTopic Streaming Visualforce sample shows you how to use replay options to subscribe and receive durable PushTopic event notifications.

#### [Durable Generic Streaming Sample](#)

The Durable Generic Streaming Visualforce sample shows you how to use replay options to subscribe and receive durable generic event notifications.

#### [Replay Events Sample: Code Walkthrough](#)


Learn how to register and use the CometD replay extension in JavaScript.

## Prerequisites

Set up permissions that are required to run the durable streaming samples.

- You must have access to a Developer Edition org and have the “API Enabled” and “Streaming API” permissions enabled. The “API Enabled” permission is enabled by default, but an administrator might have changed it.

If you are not already a member of the Force.com developer community, go to [developer.salesforce.com/signup](https://developer.salesforce.com/signup) and follow the instructions for signing up for a Developer Edition organization. Even if you already have Enterprise Edition, Unlimited Edition, or Performance Edition, use Developer Edition for developing, staging, and testing your solutions against sample data to protect your organization’s live data. This is especially true for applications that insert, update, or delete data (as opposed to simply reading data).

 **Note:** To verify that the “API Enabled” and “Streaming API” permissions are enabled in your organization, from Setup, enter *User Interface* in the *Quick Find* box, then select **User Interface**.

- To receive notifications, the logged-in user must have “Read” permission on the StreamingChannel standard object.
- To create and manage notifications, the logged-in user must have “Create” permission on the StreamingChannel standard object.
- To save the Apex class, the logged-in user must have the “Author Apex” permission.
- To save the Visualforce page, the logged-in user must have the “Customize Application” permission.

## Deploy a Sample Project to Your Org

Use Workbench to copy all project components to your org.

1. Download the [Salesforce Durable Streaming Demo .zip](#) file from the *developerforce* github repository. If you want, you can browse the contents of the project at <https://github.com/developerforce/SalesforceDurableStreamingDemo>. The sample app contains two Visualforce pages with related components and some common components. The following common components are installed in your org when you deploy the .zip file.

Component	Description
<a href="#">cometdReplayExtension</a>	Static resource representing a CometD extension in JavaScript. This extension implements the replay mechanism for Streaming API.
cometd, jquery, jquery_cometd, json2	Static resources for CometD 3.1.0, jquery, and JSON.

The following app components are for the Durable PushTopic Streaming page.


Component	Description
<a href="#">DurablePushTopicEventDisplay</a>	A Visualforce component that uses the CometD extension <code>cometdReplayExtension</code> to replay events. The extension handles the handshake and subscribe calls and sets replay options.  Having the replay functionality in a Visualforce component allows you to add it to your Visualforce page for reuse in your app.
<a href="#">DurablePushTopicStreamingController</a>	Apex controller that holds the logic behind the Visualforce page.
<a href="#">DurablePushTopicStreamingDemo Visualforce Page</a>	Visualforce page. This page is the main page you use to generate, view, and replay durable PushTopic events.

The following app components are for the Durable Generic Streaming page.

Component	Description
<a href="#">DurableGenericEventDisplay</a>	A Visualforce component that uses the CometD extension <code>cometdReplayExtension</code> to replay events. The extension handles the handshake and subscribe calls and sets replay options.  Having the replay functionality in a Visualforce component allows you to add it to your Visualforce page for reuse in your app.
<a href="#">DurableGenericStreamingController</a>	Apex controller that holds the logic behind the Visualforce page.
<a href="#">StreamingChannel</a>	Custom object used for creating streaming channels.
<a href="#">DurableGenericStreamingDemo Visualforce Page</a>	Visualforce page. This page is the main page you use to generate, view, and replay durable generic events.
<a href="#">DurableStreamingDemo Permission Set</a>	Permission set used to grant read and create access to the <code>StreamingChannel</code> sObject.

You use Workbench to migrate the zip file to your org.

2. Log in to Workbench at <https://workbench.developerforce.com/login.php>.

 **Important:** Workbench is a free, open source, community-supported tool (see the Help page in Workbench). Salesforce provides a hosted instance of Workbench for demonstration purposes only—Salesforce recommends that you do not use this hosted instance of Workbench to access data in a production database. If you want to use Workbench for your production database, you can download, host, and configure it using your own resources. You can download Workbench from <https://github.com/ryanbrainard/forceworkbench/releases>.

3. For **Environment**, keep the production default value.
4. Ensure that the value for **API Version** is at least 37.0.
5. Accept the service terms, and then click **Login with Salesforce**.
6. Enter your Developer Edition org username and password, and then click **Log In**.
7. Select **migration > Deploy**.
8. Click **Choose File** and locate the .zip file that you downloaded.
9. Click **Next**, and then click **Deploy**.
10. Wait until the deployment finishes and the status of the deployment changes to Succeeded.
11. Log in to your org in another browser tab.

SEE ALSO:

[GitHub: Streaming Replay Client Extensions](#)

## Assign a Permission Set

1. From Setup, enter *Permission Sets* in the **Quick Find** box, then select **Permission Sets**.
2. Click **DurableStreamingDemo**, and then click **Manage Assignments**.
3. Click **Add Assignments**.
4. Click the checkbox next to the user who is running the sample, and then click **Assign**.
5. Click **Done**.

## Durable PushTopic Streaming Sample

The Durable PushTopic Streaming Visualforce sample shows you how to use replay options to subscribe and receive durable PushTopic event notifications.

## Use a Visualforce Page to Generate and Replay PushTopic Events

In this step, you use a Visualforce page to generate your own PushTopic streaming events and replay those events by using different options.

When the Visualforce page is loaded, it creates a PushTopic for the Account object. The page also subscribes to this topic to receive notifications for account creations, updates, and deletions, with an option to replay events. You can specify the name of the account to create, update, and delete on the Visualforce page. These operations generate event notifications, which are displayed in the Notifications

section. You can control which events are received and displayed by subscribing with replay options. After generating events, you can replay events starting from:

- All events after a particular event specified by a replay ID.
- The first event broadcast right after subscribing (replay option -1).
- The earliest retained event in your org that's less than 24 hours old (replay option -2). The sample uses replay option -2 as the default option.

This Visualforce sample is part of the Durable Streaming Demo app.

1. Open the **Durable Streaming Demo** app.

2. Click the **Durable PushTopic Streaming Demo** tab.

The Visualforce page loads and subscribes to the PushTopic it created for the Account object.

3. On the Visualforce page, generate some events for an account. For example, *Test account*.

4. Click **Create, Update, Delete New Account**.



**Note:** The page subscribes to all new and old events by default (-2). The page first displays debug information about the CometD connection in the Notifications section followed by the events received. The first time you generate events, there are no stored events, and you see only the new events.

5. To change the point in time when events are read, enter the replay ID to read from in the **Replay From Id** field. For example, to read all events after the event with replay ID 2, enter *2*. Then click **Update Subscription**.

The Notifications section is updated and shows only the last event with replay ID 3.

The screenshot shows a Visualforce page with three main sections:

- Replay Settings:** Contains a dropdown menu for 'Channel' set to '/topic/TestAccountStreaming', a text input for 'Replay From Id' with the value '2', a note '(-2 = earliest, -1 = no replay)', and an 'Update Subscription' button.
- Generate DML Events:** Contains a text input for 'New Account Name' with the value 'Test account' and a 'Create, Update, Delete New Account' button.
- Notifications:** Displays a message 'Received notifications should appear here...' followed by two debug messages:
 

```
DEBUG: Unsubscribe Successful {"clientId":"1yiss5qwe8y5t19tm2mxkh1p9","channel":"/meta/unsubscribe","id":"8","subscription":"/topic/TestAccountStreaming","successful":true}
DEBUG: Subscribe Successful /topic/TestAccountStreaming: {"clientId":"1yiss5qwe8y5t19tm2mxkh1p9","channel":"/meta/subscribe","id":"9","subscription":"/topic/TestAccountStreaming","successful":true}
```

 Below the debug messages is a notification:
 

```
Notification on channel: "/topic/TestAccountStreaming"
Replay Id: 3
Type: "deleted"
SObject data: {"Id":"001D000000Ky76IAR"}
Full message: {"data":{"event":{"createdDate":"2017-05-22T20:54:09.552Z","replayId":3,"type":"deleted"},"subject":{"Id":"001D000000Ky76IAR"},"channel":"/topic/TestAccountStreaming"}}
```

6. To receive only the events that are sent after you subscribe, enter *-1* in the **Replay From ID** field. Then click **Update Subscription**. The Notifications section is cleared, because only new events from this point on are shown.

7. Generate some new events like you did previously using *Lightning* for the account name. The Notifications section is updated with the new events and doesn't show the old events.

**▼ Replay Settings**

Channel: /topic/TestAccountStreaming  
 Replay From Id:   
 (-2 = earliest, -1 = no replay)

**▼ Generate DML Events**

New Account Name:

---

**Notifications**

Received notifications should appear here...

```
DEBUG: Unsubscribe Successful {"clientId":"1yiss5qwe8y5t19tmf2mxkh1p9","channel":"/meta/unsubscribe","id":"11","subscription":"/topic/TestAccountStreaming","successful":true}
DEBUG: Subscribe Successful /topic/TestAccountStreaming: {"clientId":"1yiss5qwe8y5t19tmf2mxkh1p9","channel":"/meta/subscribe","id":"12","subscription":"/topic/TestAccountStreaming","successful":true}
```

Notification on channel: "/topic/TestAccountStreaming"  
 Replay Id: 4  
 Type: "created"  
 SObject data: {"Website":null,"Id":"001D000000Ky76NIAR","Name":"Lightning"}  
 Full message: {"data":{"event":{"createdDate":"2017-05-22T20:55:54.051Z","replyId":4,"type":"created"},"subject":{"Website":null,"Id":"001D000000Ky76NIAR","Name":"Lightning"},"channel":"/topic/TestAccountStreaming"}}

Notification on channel: "/topic/TestAccountStreaming"  
 Replay Id: 5  
 Type: "updated"  
 SObject data: {"Website":null,"Id":"001D000000Ky76NIAR","Name":"Lightning\_UPDATED"}  
 Full message: {"data":{"event":{"createdDate":"2017-05-22T20:55:54.421Z","replyId":5,"type":"updated"},"subject":{"Website":null,"Id":"001D000000Ky76NIAR","Name":"Lightning\_UPDATED"},"channel":"/topic/TestAccountStreaming"}}

Notification on channel: "/topic/TestAccountStreaming"  
 Replay Id: 6  
 Type: "deleted"  
 SObject data: {"Id":"001D000000Ky76NIAR"}  
 Full message: {"data":{"event":{"createdDate":"2017-05-22T20:55:54.965Z","replyId":6,"type":"deleted"},"subject":{"Id":"001D000000Ky76NIAR"},"channel":"/topic/TestAccountStreaming"}}

8. Switch the replay option back to -2.  
 The page displays all events, including events that were sent earlier.

```

Notifications

Received notifications should appear here...
DEBUG: Unsubscribe Successful {"clientId":"1yiss5qwe8y5t19tmf2mxkh1p9","channel":"/meta/unsubscribe","id":"15","subscription":"/topic/TestAccountStreaming","successful":true}
DEBUG: Subscribe Successful /topic/TestAccountStreaming:
{"clientId":"1yiss5qwe8y5t19tmf2mxkh1p9","channel":"/meta/subscribe","id":"16","subscription":"/topic/TestAccountStreaming","successful":true}

Notification on channel: "/topic/TestAccountStreaming"
Replay Id: 1
Type: "created"
SObject data: {"Website":null,"Id":"001D000000Ky76IAR","Name":"Test account"}
Full message: {"data":{"event":{"createdDate":"2017-05-22T20:54:05.657Z","replayId":1,"type":"created"},"subject":{"Website":null,"Id":"001D000000Ky76IAR","Name":"Test account"},"channel":"/topic/TestAccountStreaming"}

Notification on channel: "/topic/TestAccountStreaming"
Replay Id: 2
Type: "updated"
SObject data: {"Website":null,"Id":"001D000000Ky76IAR","Name":"Test account_UPDATED"}
Full message: {"data":{"event":{"createdDate":"2017-05-22T20:54:06.490Z","replayId":2,"type":"updated"},"subject":{"Website":null,"Id":"001D000000Ky76IAR","Name":"Test account_UPDATED"},"channel":"/topic/TestAccountStreaming"}

Notification on channel: "/topic/TestAccountStreaming"
Replay Id: 3
Type: "deleted"
SObject data: {"Id":"001D000000Ky76IAR"}
Full message: {"data":{"event":{"createdDate":"2017-05-22T20:54:09.552Z","replayId":3,"type":"deleted"},"subject":{"Id":"001D000000Ky76IAR"},"channel":"/topic/TestAccountStreaming"}

Notification on channel: "/topic/TestAccountStreaming"
Replay Id: 4
Type: "created"
SObject data: {"Website":null,"Id":"001D000000Ky76NIAR","Name":"Lightning"}
Full message: {"data":{"event":{"createdDate":"2017-05-22T20:55:54.051Z","replayId":4,"type":"created"},"subject":{"Website":null,"Id":"001D000000Ky76NIAR","Name":"Lightning"},"channel":"/topic/TestAccountStreaming"}

Notification on channel: "/topic/TestAccountStreaming"
Replay Id: 5
Type: "updated"
SObject data: {"Website":null,"Id":"001D000000Ky76NIAR","Name":"Lightning_UPDATED"}
Full message: {"data":{"event":{"createdDate":"2017-05-22T20:55:54.421Z","replayId":5,"type":"updated"},"subject":{"Website":null,"Id":"001D000000Ky76NIAR","Name":"Lightning_UPDATED"},"channel":"/topic/TestAccountStreaming"}

Notification on channel: "/topic/TestAccountStreaming"
Replay Id: 6
Type: "deleted"
SObject data: {"Id":"001D000000Ky76NIAR"}
Full message: {"data":{"event":{"createdDate":"2017-05-22T20:55:54.965Z","replayId":6,"type":"deleted"},"subject":{"Id":"001D000000Ky76NIAR"},"channel":"/topic/TestAccountStreaming"}

```

## Durable Generic Streaming Sample

The Durable Generic Streaming Visualforce sample shows you how to use replay options to subscribe and receive durable generic event notifications.

### Create a Streaming Channel

You must have the appropriate Streaming API permissions enabled in your org.

Create a StreamingChannel object by using the Salesforce UI.

1. Log in to your Developer Edition org.
2. If you're using Salesforce Classic, under All Tabs (+), select **Streaming Channels**. If you're using Lightning Experience, from the App Launcher, select **All Items**, and then click **Streaming Channels**.
3. On the Streaming Channels page, click **New** to create a streaming channel.
4. Enter `/u/TestStreaming` in **Streaming Channel Name** and add an optional description. Your new Streaming Channel page looks something like this:

Streaming Channel  
New Streaming Channel

Streaming Channel Edit Save Save & New Cancel

Streaming Channel = Required Information

Streaming Channel Name /w/TestStreaming

Owner Name Test User

Description Test User Channel

Save Save & New Cancel

5. Click **Save**. You now have a streaming channel that clients can subscribe to for notifications.

StreamingChannel is a regular, creatable Salesforce object, so you can also create one programmatically using Apex or a data API like the SOAP API or REST API, or using a tool such as Workbench. For more information, see [StreamingChannel](#).


## Use a Visualforce Page to Generate and Replay Generic Events

In this step, you use a Visualforce page to generate your own streaming events and replay those events by using different options.

The Visualforce page simulates a streaming client that subscribes to events with options to replay events. The Visualforce page allows you to supply the event's message and specify the number of messages to create. The page listens to events and displays the received events in the Notifications section. After generating events, you can replay events starting from:

- All events after a particular event specified by a replay ID.
- The first event broadcast right after subscribing (replay option -1).
- The earliest retained event in your org that's less than 24 hours old (replay option -2). The sample uses replay option -2 as the default option.

This Visualforce sample is part of the Durable Streaming Demo app.

1. Open the **Durable Streaming Demo** app.
2. Click the **Durable Generic Streaming Demo** tab.  
The Visualforce page loads and subscribes to the test channel you created earlier.
3. In the Visualforce page, generate some events. Enter any text for the message text, for example, *Test message*. For Number of Events, enter *10*.
4. Click **Generate**.
  -  **Note:** The page subscribes to all events by default (-2). The page first displays debug information about the CometD connection in the Notifications section followed by the events received. The first time you generate events, there are no stored events, and you see only the new events.
5. To change the point in time when events are read, enter the replay ID to read from in the **Replay From Id** field. For example, to read all events after the event with replay ID 5, enter *5*. Then click **Update Subscription**.  
The Notifications section is updated and shows only the last five events starting from replay ID 6.



**▼ Replay Settings**

Channel: /u/TestStreaming (id: 0M6D0000004CBnKAM)  
 Replay From Id:  (-2 = earliest, -1 = no replay)

**▼ Generate New Events**

Message:   
 Number of Events:

---

**Notifications**

Received notifications should appear here...

DEBUG: Unsubscribe Successful ("clientId":"31r01442zf1gokc3g2wsc3tszI","channel":"/meta/unsubscribe","id":"9","subscription":"/u/TestStreaming","successful":true)  
 DEBUG: Subscribe Successful /u/TestStreaming: ("clientId":"31r01442zf1gokc3g2wsc3tszI","channel":"/meta/subscribe","id":"10","subscription":"/u/TestStreaming","successful":true)

Notification on channel: "/u/TestStreaming"  
 Payload: "Test message"  
 Replay Id: 6  
 Full message: {"data":{"payload":"Test message","event":{"createdDate":"2017-05-19T23:12:20.065Z","replayId":6},"channel":"/u/TestStreaming"}}

Notification on channel: "/u/TestStreaming"  
 Payload: "Test message"  
 Replay Id: 7  
 Full message: {"data":{"payload":"Test message","event":{"createdDate":"2017-05-19T23:12:20.066Z","replayId":7},"channel":"/u/TestStreaming"}}

Notification on channel: "/u/TestStreaming"  
 Payload: "Test message"  
 Replay Id: 8  
 Full message: {"data":{"payload":"Test message","event":{"createdDate":"2017-05-19T23:12:20.066Z","replayId":8},"channel":"/u/TestStreaming"}}

Notification on channel: "/u/TestStreaming"  
 Payload: "Test message"  
 Replay Id: 9  
 Full message: {"data":{"payload":"Test message","event":{"createdDate":"2017-05-19T23:12:20.066Z","replayId":9},"channel":"/u/TestStreaming"}}

Notification on channel: "/u/TestStreaming"  
 Payload: "Test message"  
 Replay Id: 10  
 Full message: {"data":{"payload":"Test message","event":{"createdDate":"2017-05-19T23:12:20.066Z","replayId":10},"channel":"/u/TestStreaming"}}

6. To receive only the events that are sent after you subscribe, enter `-1` in the **Replay From Id** field. Then click **Update Subscription**. The Notifications section is cleared, because only new events from this point on are shown.
7. Generate some new events like you did in step 3 with `new events` for the message. The Notifications section is updated with the new events and doesn't show the old events.

**▼ Replay Settings**

Channel: /u/TestStreaming (id: 0M6D0000004CBnKAM)  
 Replay From Id:  (-2 = earliest, -1 = no replay)

**▼ Generate New Events**

Message:   
 Number of Events:

---

**Notifications**

Received notifications should appear here...

```
DEBUG: Unsubscribe Successful {"clientId":"31r01442zftgokc3g2wsc3tszl","channel":"/meta/unsubscribe","id":"13","subscription":"/u/TestStreaming","successful":true}
DEBUG: Subscribe Successful /u/TestStreaming: {"clientId":"31r01442zftgokc3g2wsc3tszl","channel":"/meta/subscribe","id":"14","subscription":"/u/TestStreaming","successful":true}
```

Notification on channel: "/u/TestStreaming"  
 Payload: "New Events"  
 Replay Id: 11  
 Full message: {"data":{"payload":"New Events","event":{"createdDate":"2017-05-19T23:16:52.545Z","replyId":11},"channel":"/u/TestStreaming"}

Notification on channel: "/u/TestStreaming"  
 Payload: "New Events"  
 Replay Id: 12  
 Full message: {"data":{"payload":"New Events","event":{"createdDate":"2017-05-19T23:16:52.573Z","replyId":12},"channel":"/u/TestStreaming"}

Notification on channel: "/u/TestStreaming"  
 Payload: "New Events"  
 Replay Id: 13  
 Full message: {"data":{"payload":"New Events","event":{"createdDate":"2017-05-19T23:16:52.573Z","replyId":13},"channel":"/u/TestStreaming"}

8. Switch the replay option back to -2.  
 The page displays all events, including events that were sent earlier.

**Replay Settings**

Channel: /u/TestStreaming (id: 0M6D0000004CBnKAM)  
 Replay From Id: -2 (-2 = earliest, -1 = no replay)  
 Update Subscription

**Generate New Events**

Message: New Events  
 Number of Events: 10  
 Generate

**Notifications**

Received notifications should appear here...

DEBUG: Unsubscribe Successful {"clientId":"31r01442zf1gokc3g2wsc3tszI","channel":"/meta/unsubscribe","id":"16","subscription":"/u/TestStreaming","successful":true}

DEBUG: Subscribe Successful /u/TestStreaming: {"clientId":"31r01442zf1gokc3g2wsc3tszI","channel":"/meta/subscribe","id":"17","subscription":"/u/TestStreaming","successful":true}

Notification on channel: "/u/TestStreaming"  
 Payload: "Test message"  
 Replay Id: 1  
 Full message: {"data":{"payload":"Test message","event":{"createdDate":"2017-05-19T23:12:20.028Z","replayId":1},"channel":"/u/TestStreaming"}}

Notification on channel: "/u/TestStreaming"  
 Payload: "Test message"  
 Replay Id: 2  
 Full message: {"data":{"payload":"Test message","event":{"createdDate":"2017-05-19T23:12:20.064Z","replayId":2},"channel":"/u/TestStreaming"}}

Notification on channel: "/u/TestStreaming"  
 Payload: "Test message"  
 Replay Id: 3  
 Full message: {"data":{"payload":"Test message","event":{"createdDate":"2017-05-19T23:12:20.065Z","replayId":3},"channel":"/u/TestStreaming"}}

Notification on channel: "/u/TestStreaming"  
 Payload: "Test message"  
 Replay Id: 4  
 Full message: {"data":{"payload":"Test message","event":{"createdDate":"2017-05-19T23:12:20.065Z","replayId":4},"channel":"/u/TestStreaming"}}

Notification on channel: "/u/TestStreaming"  
 Payload: "Test message"  
 Replay Id: 5  
 Full message: {"data":{"payload":"Test message","event":{"createdDate":"2017-05-19T23:12:20.065Z","replayId":5},"channel":"/u/TestStreaming"}}

## Replay Events Sample: Code Walkthrough

Learn how to register and use the CometD replay extension in JavaScript.

### JavaScript Sample for Replaying Events

The Visualforce components in the durable streaming sample implement a CometD client that subscribes with replay options. The components are embedded in Visualforce pages.

- For generic events, the Visualforce component is [DurableGenericEventDisplay](#).
- For PushTopic events, the Visualforce component is [DurablePushTopicEventDisplay](#).

If you want to implement a CometD client with replay options, you can reuse the Visualforce components or adapt the JavaScript code for your app. Portions of the sample component are highlighted in this section.

The first step is to register the Salesforce-provided CometD extension `cometdReplayExtension` to replay events. This snippet also sets the streaming channel and the replay option. The first argument in `registerExtension` is an arbitrary name, which you use to unregister the extension.

```
// Register Generic Streaming Replay extension
var replayExtension = new cometdReplayExtension();
```

```
replayExtension.setChannel(<Streaming Channel to Subscribe to>;
replayExtension.setReplay(<Event Replay Option>;
cometd.registerExtension('myReplayExtensionName', replayExtension);
```

Next, the client connects to the CometD replay endpoint. The API version in the endpoint must be 37.0 or later. The session ID value of the current session is passed in the `Authorization` header. The client calls the `cometd.configure()` function to set up the connection and specify the endpoint and authorization header. Next, the client performs a handshake by calling `cometd.handshake()` function.

```
// Connect to the CometD endpoint
cometd.configure({
  url: window.location.protocol+'//'+window.location.hostname+
    (null != window.location.port ? (':' + window.location.port) : '') +
    '/cometd/37.0/',
  requestHeaders: { Authorization: 'OAuth {!$Api.Session_ID}' }
});
cometd.handshake();
```

To ensure that every step in the connection process is successful before moving on to the next step, the client uses listeners. For example, a listener for the `/meta/handshake` channel checks whether the handshake is successful. If it is successful, the `subscribe()` function is called.


```
if(!metaHandshakeListener) {
  metaHandshakeListener = cometd.addListener('/meta/handshake', function(message) {
    if (message.successful) {
      $('#content').append('<br><br> DEBUG: Handshake Successful: ' +
        JSON.stringify(message)+' <br><br>');

      if (message.ext && message.ext[REPLAY_FROM_KEY] == true) {
        isExtensionEnabled = true;
      }
      subscribedToChannel = subscribe(channel);
    } else
      $('#content').append('DEBUG: Handshake Unsuccessful: ' +
        JSON.stringify(message)+' <br><br>');
  });
}
```

The last step is to specify a callback for the CometD `subscribe()` function. CometD calls this callback function when a message is received in the channel. In this sample, the callback function displays the message data to the page. It appends the data to the `div` HTML element whose ID value is "content".

```
function subscribe(channel) {
  // Subscribe to a topic.
  // JSON-encoded update will be returned in the callback.
  return cometd.subscribe(channel, function(message) {
    var div = document.getElementById('content');
    div.innerHTML = div.innerHTML + '<p>Notification ' +
      'on channel: ' + JSON.stringify(message.channel) + '<br>' +
      'Payload: ' + JSON.stringify(message.data.payload) + '<br>' +
      'Replay Id: ' + JSON.stringify(message.data.event.replayId) + '<br>' +
      'Full message: ' + JSON.stringify(message) + '</p><br>';
  });
}
```

## cometdReplayExtension Extension

 **Note:** The extension is a prerequisite for the replay functionality in a CometD client. In the durable streaming sample, the Visualforce components register and use the extension. If you implement a CometD client, include the replay extension in your project, but you don't have to modify it.

The `cometdReplayExtension` contains cometd extension functions that are called for incoming and outgoing messages. These extension functions implement the logic that checks for the extension's registration on handshake and sets the replay option on subscription.

On handshake, the function for incoming messages checks whether the replay extension has been registered. If so, it sets the `_extensionEnabled` variable to `true`. This function also saves the replay ID of the received message so that it can be used when a client reconnects after a timeout.

```
this.incoming = function(message) {
  if (message.channel === '/meta/handshake') {
    if (message.ext && message.ext[REPLAY_FROM_KEY] == true) {
      _extensionEnabled = true;
    } else if (message.channel === _channel && message.data && message.data.event &&
              message.data.event.replayId) {
      _replay = message.data.event.replayId;
    }
  }
}
```


On subscription, the function for outgoing messages checks whether the replay extension has been registered by inspecting the `_extensionEnabled` variable. If the extension is registered, the function subscribes to events based on the specified replay option. The sample sets the replay option by calling the extension's `setReplay()` function.

```
this.outgoing = function(message) {
  if (message.channel === '/meta/subscribe') {
    if (_extensionEnabled) {
      if (!message.ext) {
        message.ext = {};
      }
      var replayFromMap = {};
      replayFromMap[_channel] = _replay;
      // add "ext : { "replay" : { CHANNEL : REPLAY_VALUE } }"
      // to subscribe message.
      message.ext[REPLAY_FROM_KEY] = replayFromMap;
    }
  }
};
```

## Example: Interactive Visualforce Page without Replay

This code example shows you how to implement Streaming API from a Visualforce page. The sample uses the Dojo library and CometD to subscribe to PushTopic events.

On the Visualforce page, you enter the name of the PushTopic channel you want to subscribe to and click **Subscribe** to receive notifications on the page. Click **Unsubscribe** to unsubscribe from the channel and stop receiving notifications.

 **Note:** This sample doesn't use the replay extension and can't receive past events. To use a replay option, check out [Example: Subscribe to and Replay Events Using a Visualforce Page](#).

## IN THIS SECTION:

[Prerequisites](#)

You need access and appropriate permissions to complete the code example.

[Step 1: Create an Object](#)[Step 2: Create a PushTopic](#)[Step 3: Create the Static Resources](#)[Step 4: Create a Visualforce Page](#)[Step 5: Test the PushTopic Channel](#)

## Prerequisites

You need access and appropriate permissions to complete the code example.

- Access to a Developer Edition organization.

If you are not already a member of the Force.com developer community, go to [developer.salesforce.com/signup](https://developer.salesforce.com/signup) and follow the instructions for signing up for a Developer Edition organization. Even if you already have Enterprise Edition, Unlimited Edition, or Performance Edition, use Developer Edition for developing, staging, and testing your solutions against sample data to protect your organization's live data. This is especially true for applications that insert, update, or delete data (as opposed to simply reading data).

- The "API Enabled" permission must be enabled for your Developer Edition organization. This permission is enabled by default, but may have been changed by an administrator.
- The "Streaming API" permission must be enabled.



**Note:** To verify that the "API Enabled" and "Streaming API" permissions are enabled in your organization, from Setup, enter *User Interface* in the *Quick Find* box, then select **User Interface**.

- The logged-in user must have "Read" permission on the PushTopic standard object to receive notifications.
- The logged-in user must have "Create" permission on the PushTopic standard object to create and manage PushTopic records.
- The logged-in user must have "Author Apex" permissions to create a PushTopic by using the Developer Console.

## Step 1: Create an Object

To perform this example, you must first create the InvoiceStatement object. If you haven't already created this object, see [Step 1: Create an Object](#).

## Step 2: Create a PushTopic

To perform this example, you must create a PushTopic. If you haven't already done so, see [Step 2: Create a PushTopic](#).

## Step 3: Create the Static Resources

1. Download this static resource .zip file: [streaming\\_api\\_interactive\\_visualforce\\_demo-v40.zip](#)
2. Extract the following files from the .zip file:

File Name	Description
cometd.zip	Files for CometD version 3.1.0 and the Dojo toolkit used by <code>demo.js</code> . When you define a .zip archive file as a static resource, Visualforce can access the files in that archive. The .zip file becomes a virtual file system.
demo.css	The CSS code that formats the Visualforce page.
demo.js	The code used by the page to subscribe to the channel, receive and display the notifications, and unsubscribe from the channel.
json2.js	The JavaScript library that contains the <code>stringify</code> and <code>parse</code> methods.
StreamingApiDemo	The Visualforce page that displays the Streaming API notifications.

- From Setup, enter *Static Resources* in the Quick Find box, then select **Static Resources** to add the extracted files with the following names:

File Name	Static Resource Name
cometd.zip	<code>cometd_zip</code>
demo.css	<code>demo_css</code>
demo.js	<code>demo_js</code>
json2.js	<code>json2_js</code>

For more information about static resources, see [Deliver Static Resources with Visualforce](#).

## Step 4: Create a Visualforce Page

Create a Visualforce page to display the channel notifications.

- From Setup, enter *Visualforce Pages* in the Quick Find box, then select **Visualforce Pages**.
- Click **New**.
- In the **Label** field, enter the name of the page `StreamingAPIDemo`.
- Replace the code in the page with the code from the `StreamingApiDemo` file that you downloaded.

```
<apex:page >
<apex:includeScript value="{!$Resource.json2_js}"/>
<script type="text/javascript" src="{!URLFOR($Resource.cometd_zip, 'dojo/dojo.js')}
data-dojo-config="async: 1"></script>
<apex:stylesheet value="{!$Resource.demo_css}"/>
<script>var token = '{!$Api.Session_ID}';</script>
  <div id="demo">
    <div id="datastream"></div>
    <script type="text/javascript" src="{!$Resource.demo_js}">
</script>

    <div id="input">
```

```

        <div id="join">
            <table>
                <tbody>
                    <tr>
                        <td>&nbsp;</td>
                        <td> Enter Topic Name </td>
                        <td>
                            <input id="topic" type="text" />
                        </td>
                        <td>
                            <button id="subscribeButton"
                                class="button">Subscribe</button>
                        </td>
                    </tr>
                </tbody>
            </table>
        </div>
        <div id="joined">
            <table>
                <tbody>
                    <tr>
                        <td>
                            <button id="leaveButton"
                                class="button">Unsubscribe</button>
                        </td>
                    </tr>
                </tbody>
            </table>
        </div>
    </div>
</apex:page>

```

5. Click **Save** to save the page.

## Step 5: Test the PushTopic Channel

1. To load the Visualforce page in a web browser, click **Preview** on the Visualforce page editor:
2. In the text box, enter the channel name: `/topic/InvoiceStatementUpdates`.
3. To subscribe to the channel, click **Subscribe**.
4. Create or modify an InvoiceStatement in a different browser tab. The page displays some debug messages and event notifications. The output resembles the following:

```

DEBUG: Handshake Successful: {
  "ext":{"replay":true,"payload.format":true},
  "minimumVersion":"1.0",
  "clientId":"41kdiuvigig2tfxdh9weakuiwyh",
  "supportedConnectionTypes":["long-polling"],
  "channel":"/meta/handshake",
  "id":"1","version":"1.0","successful":true,"reestablish":false}

DEBUG: Connection Successful : {

```



```

"clientId":"41kdiuvgig2tfxdh9weakuiwyh",
"advice":{
  "interval":2000,"multiple-clients":true,"reconnect":"retry",
  "timeout":110000},"channel":"/meta/connect","id":"2",
  "successful":true}

DEBUG: Subscribe Successful /topic/InvoiceStatementUpdates:
{"clientId":"41kdiuvgig2tfxdh9weakuiwyh","channel":"/meta/subscribe",
  "id":"15","subscription":"/topic/InvoiceStatementUpdates","successful":true}

{
  "event": {
    "createdDate": "2017-05-16T23:05:50.173Z",
    "replayId": 1,
    "type": "created"
  },
  "subject": {
    "Description__c": "New invoice.",
    "Id": "a00D0000009YbwQIAS",
    "Status__c": "Open",
    "Name": "INV-0001"
  }
}

-----

{
  "event": {
    "createdDate": "2017-05-16T23:06:11.529Z",
    "replayId": 2,
    "type": "updated"
  },
  "subject": {
    "Description__c": "New invoice.",
    "Id": "a00D0000009YbwQIAS",
    "Status__c": "Negotiating",
    "Name": "INV-0001"
  }
}

-----

```

The debug messages contain information about the subscription status. The first event notification shows the notification data when an invoice statement is created. The second notification shows the notification data when an invoice statement is updated.


Click **Unsubscribe** to unsubscribe from the channel and stop receiving notifications.

## Example: Subscribe to and Replay Events Using a Java Client

This code example implements Streaming API from a Java client using a library called Enterprise Messaging Platform (EMP) Connector. EMP connector is a thin wrapper around the CometD library. It hides the complexity of creating a CometD client and subscribing to Streaming API in Java. The example subscribes to a channel, receives notifications, and supports replaying events with durable streaming.

 **Important:** EMP Connector is a free, open-source, community-supported tool. Salesforce provides this tool as an example of how to subscribe to events using CometD. To contribute to the EMP Connector project with your own enhancements, submit pull requests to the repository at <https://github.com/forcedotcom/EMP-Connector>.

EMP Connector is based on Java 8 and uses CometD version 3.0.9. The connector supports PushTopic and generic streaming. It also supports username and password authentication and OAuth bearer token authentication.

 **Note:** The example requires API version 37.0 or later. For a code example that supports earlier API versions, refer to an earlier version of this documentation.

#### IN THIS SECTION:

##### [Prerequisites](#)

You need access and appropriate permissions to complete the code example.

##### [Step 1: Create an Object](#)

##### [Step 2: Create a PushTopic](#)

##### [Step 3: Download and Build the Project](#)

Before you can run the connector examples, download the Java source files and build the Java project.

##### [Step 4: Use the Connector with Username and Password Login](#)

Now that you've downloaded and built the EMP connector, use its functions to connect to CometD and subscribe to the PushTopic.

##### [Step 5: Use the Connector with OAuth Bearer Token Login](#)

This step uses the connector with OAuth authentication as an alternative to username and password authentication. This step is optional and requires an OAuth token.

##### [Learn More About EMP Connector](#)

Let's take a closer look at the components of EMP Connector.


## Prerequisites

You need access and appropriate permissions to complete the code example.

- Java Development Kit 8. See [Java Downloads](#).
- Eclipse IDE for Java Developers. Download a recent version from <http://www.eclipse.org/downloads/eclipse-packages/>.
- Access to a Developer Edition organization.

If you are not already a member of the Force.com developer community, go to [developer.salesforce.com/signup](https://developer.salesforce.com/signup) and follow the instructions for signing up for a Developer Edition organization. Even if you already have Enterprise Edition, Unlimited Edition, or Performance Edition, use Developer Edition for developing, staging, and testing your solutions against sample data to protect your organization's live data. This is especially true for applications that insert, update, or delete data (as opposed to simply reading data).

- The "API Enabled" permission must be enabled for your Developer Edition organization. This permission is enabled by default, but may have been changed by an administrator.
- The "Streaming API" permission must be enabled.

 **Note:** To verify that the "API Enabled" and "Streaming API" permissions are enabled in your organization, from Setup, enter *User Interface* in the *Quick Find* box, then select **User Interface**.

- The logged-in user must have "Read" permission on the PushTopic standard object to receive notifications.
- The logged-in user must have "Create" permission on the PushTopic standard object to create and manage PushTopic records.

- The logged-in user must have “Author Apex” permissions to create a PushTopic by using the Developer Console.

## Step 1: Create an Object

To perform this example, you must first create the InvoiceStatement object. If you haven’t already created this object, see [Step 1: Create an Object](#).

## Step 2: Create a PushTopic

To perform this example, you must create a PushTopic. If you haven’t already done so, see [Step 2: Create a PushTopic](#).

## Step 3: Download and Build the Project

Before you can run the connector examples, download the Java source files and build the Java project.

### Prerequisites:

- Java Development Kit 8. See [Java Downloads](#).
- Eclipse IDE for Java Developers. Download a recent version from <http://www.eclipse.org/downloads/eclipse-packages/>.

The EMP connector project includes examples under the [GitHub repository’s example folder](#) that use the connector to log in and subscribe to events. In the next steps, you run the following examples locally on your system.

- [LoginExample.java](#)
- [BearerTokenExample.java](#)

To download and build the EMP connector project:

1. To download the project files, do one of the following.
  - a. Clone the EMP-Connector project using git.


```
git clone https://github.com/forcedotcom/EMP-Connector
```

- b. Download the project zip file from GitHub, and then extract the zip to a local folder.

2. In Eclipse, import the Maven project from the folder where you cloned or extracted the project.

The dependencies that are specified in the Maven’s `pom.xml` file, such as CometD, are added in the Java project in Eclipse.

3. If the Java project wasn’t automatically built, build it.

-  **Note:** If you prefer to run the tool from the command line, generate the JAR file using the Maven command: `mvn clean package`. After you run this command, a JAR file is generated that includes the connector and the `LoginExample` functionality. The JAR file is a shaded JAR—it contains all the dependencies for the connector so you don’t have to download them separately. The JAR file has a `-phat` Maven classifier. You can run the login example from the command line, as follows.

```
java -jar emp-connector-0.0.1-SNAPSHOT-phat.jar <username> <password> <topic>
[optional_replayId]
```

EMP Connector is an open-source project, which means that you can contribute to it with your own enhancements by submitting pull requests to the repository.

## Step 4: Use the Connector with Username and Password Login

Now that you've downloaded and built the EMP connector, use its functions to connect to CometD and subscribe to the PushTopic.

Let's run an example that uses username and password login.

1. Under the `/src/main/java/` folder, open the `LoginExample.java` Java source file from the example package folder.

```

/*
 * Copyright (c) 2016, salesforce.com, inc.
 * All rights reserved.
 * Licensed under the BSD 3-Clause license.
 * For full license text, see LICENSE.TXT file in the repo root or
https://opensource.org/licenses/BSD-3-Clause
 */
package com.salesforce.emp.connector.example;

import static com.salesforce.emp.connector.LoginHelper.login;

import java.util.Map;
import java.util.concurrent.TimeUnit;
import java.util.function.Consumer;

import com.salesforce.emp.connector.BayeuxParameters;
import com.salesforce.emp.connector.EmpConnector;
import com.salesforce.emp.connector.TopicSubscription;

/**
 * An example of using the EMP connector using login credentials
 *
 * @author hal.hildebrand
 */
public class LoginExample {
    public static void main(String[] argv) throws Exception {
        if (argv.length < 3 || argv.length > 4) {
            System.err.println("Usage: LoginExample username password topic
[replayFrom]");
            System.exit(1);
        }
        long replayFrom = EmpConnector.REPLAY_FROM_EARLIEST;
        if (argv.length == 4) {
            replayFrom = Long.parseLong(argv[3]);
        }

        BayeuxParameters params;
        try {
            params = login(argv[0], argv[1]);
        } catch (Exception e) {
            e.printStackTrace(System.err);
            System.exit(1);
            throw e;
        }

        Consumer<Map<String, Object>> consumer = event -> System.out.println(
            String.format("Received:\n%s", event));
        EmpConnector connector = new EmpConnector(params);

```

```

connector.start().get(5, TimeUnit.SECONDS);

TopicSubscription subscription = connector.subscribe(argv[2],
    replayFrom, consumer).get(5, TimeUnit.SECONDS);

System.out.println(String.format("Subscribed: %s", subscription));
}
}

```

2. Run the `LoginExample` class and provide the following argument values.

Argument	Value
<code>username</code>	Username of the logged-in user.
<code>password</code>	Password for the <code>username</code> (or logged-in user).
<code>topic</code>	<code>/topic/InvoiceStatementUpdates</code>

The sample fetches the earliest saved events within the past 24 hours. Optionally, you can supply a replay ID as the last argument to receive different events. Valid values are:

- `-1`—Get all new events sent after subscription.
  - `-2`—Get all new events sent after subscription and all past events within the last 24 hours.
  - Specific number—Get all events that occurred after the event with the specified replay ID.
3. In a browser window, create or modify an invoice statement. After you create or change data that corresponds to the query in your `PushTopic`, the output looks similar to the following.

```

Subscribed: Subscription [/topic/InvoiceStatementUpdates:-2]
Received:
{event={createdDate=2016-12-12T22:31:48.035Z, replayId=1, type=created},
subject={Status__c=Open, Id=a070P00000pn0hyQAA, Name=INV-0001, Description__c=blah}}
Received:
{event={createdDate=2016-12-12T22:32:06.440Z, replayId=2, type=updated},
subject={Status__c=Negotiating, Id=a070P00000pn0hyQAA, Name=INV-0001,
Description__c=blah}}
Received:
{event={createdDate=2016-12-12T22:32:57.404Z, replayId=3, type=created},
subject={Status__c=Open, Id=a070P00000pn0lfQAA, Name=INV-0002, Description__c=Laptops
and accessories.}}

```

Generally, do not handle usernames and passwords of others when running code in production. In a production environment, delegate the login to OAuth. The next step connects to Streaming API with OAuth.

## Step 5: Use the Connector with OAuth Bearer Token Login

This step uses the connector with OAuth authentication as an alternative to username and password authentication. This step is optional and requires an OAuth token.

### Prerequisites

Obtain an OAuth bearer access token for your Salesforce user. You supply this access token in the connector example.

See [Set Up Authentication with OAuth 2.0](#). Also, see [Authenticate Apps with OAuth](#) in [Salesforce Help](#) and [Understanding Authentication](#) in the [Force.com REST API Developer Guide](#).

Let's run an example that uses OAuth bearer token login.

1. Under the `/src/main/java/` folder, open the `BearerTokenExample.java` Java source file from the example package folder.

```

/*
 * Copyright (c) 2016, salesforce.com, inc. All rights reserved. Licensed under the BSD
 * 3-Clause license. For full
 * license text, see LICENSE.TXT file in the repo root or
 * https://opensource.org/licenses/BSD-3-Clause
 */
package com.salesforce.emp.connector.example;

import java.net.MalformedURLException;
import java.net.URL;
import java.util.Map;
import java.util.concurrent.TimeUnit;
import java.util.function.Consumer;

import com.salesforce.emp.connector.BayeuxParameters;
import com.salesforce.emp.connector.EmpConnector;
import com.salesforce.emp.connector.TopicSubscription;

/**
 * An example of using the EMP connector using bearer tokens
 *
 * @author hal.hildebrand
 */
public class BearerTokenExample {
    public static void main(String[] argv) throws Exception {
        if (argv.length < 2 || argv.length > 4) {
            System.err.println(
                "Usage: BearerTokenExample url token topic [replayFrom]");
            System.exit(1);
        }
        long replayFrom = EmpConnector.REPLAY_FROM_EARLIEST;
        if (argv.length == 4) {
            replayFrom = Long.parseLong(argv[3]);
        }

        BayeuxParameters params = new BayeuxParameters() {

            @Override
            public String bearerToken() {
                return argv[1];
            }

            @Override
            public URL host() {
                try {
                    return new URL(argv[0]);
                }
            }
        };
    }
}

```

```

        } catch (MalformedURLException e) {
            throw new IllegalArgumentException(
                String.format("Unable to create url: %s", argv[0]), e);
        }
    }
};

Consumer<Map<String, Object>> consumer = event -> System.out.println(
    String.format("Received:\n%s", event));
EmpConnector connector = new EmpConnector(params);

connector.start().get(5, TimeUnit.SECONDS);

TopicSubscription subscription = connector.subscribe(argv[2],
    replayFrom, consumer).get(5, TimeUnit.SECONDS);

System.out.println(String.format("Subscribed: %s", subscription));
}
}

```

2. Run the `BearerTokenExample` class, and provide the following argument values.

Argument	Value
<code>url</code>	The URL of the Salesforce instance of the logged-in user.
<code>token</code>	The access token returned by the OAuth authentication flow.
<code>topic</code>	<code>/topic/InvoiceStatementUpdates</code>

The sample fetches the earliest saved events within the past 24 hours. Optionally, you can supply a replay ID as the last argument to receive different events. Valid values are:

- -1—Get all new events sent after subscription.
  - -2—Get all new events sent after subscription and all past events within the last 24 hours.
  - Specific number—Get all events that occurred after the event with the specified replay ID.
3. In a browser window, create or modify an invoice statement. After you create or change data that corresponds to the query in your PushTopic, the output looks similar to the following.

```

Subscribed: Subscription [/topic/InvoiceStatementUpdates:-2]
Received:
{event={createdDate=2016-12-12T22:31:48.035Z, replayId=1, type=created},
subject={Status__c=Open, Id=a070P00000pn0hyQAA, Name=INV-0001, Description__c=blah}}
Received:
{event={createdDate=2016-12-12T22:32:06.440Z, replayId=2, type=updated},
subject={Status__c=Negotiating, Id=a070P00000pn0hyQAA, Name=INV-0001,
Description__c=blah}}
Received:
{event={createdDate=2016-12-12T22:32:57.404Z, replayId=3, type=created},
subject={Status__c=Open, Id=a070P00000pn0lfQAA, Name=INV-0002, Description__c=Laptops
and accessories.}}

```

## Learn More About EMP Connector

Let's take a closer look at the components of EMP Connector.

### Authenticating

User credential information is passed in to the `login` function. The `login` function's return value is passed in to the main connector class later.

```
BayeuxParameters params = login("<username>", "<password>");
```

For OAuth authentication, use the `BayeuxParameters` constructor to override the methods in the `BayeuxParameters` class and provide the token and URL values.

```
BayeuxParameters params = new BayeuxParameters() {

    @Override
    public String bearerToken() {
        return "<token>";
    }

    @Override
    public URL host() {
        try {
            return new URL("<URL>");
        } catch (MalformedURLException e) {
            throw new IllegalArgumentException(
                String.format("Unable to create url: %s", argv[0]), e);
        }
    }
};
```

### Listening to Events

To listen to events, the connector uses the Java event in a lambda expression. This statement prints the event message to the output for each received event notification. Place this statement before the statement that subscribes to the topic.

```
Consumer<Map<String, Object>> consumer = event -> System.out.println(
    String.format("Received:\n%s", event));
```

### Subscribing to a Topic

The `EmpConnector` class is the main class that exposes the functionality of starting a connection and subscribing. The class contains functions to create a connection, subscribe to a topic, cancel a subscription, and stop a connection.

```
// Instantiate the EMP connector
EmpConnector connector = new EmpConnector(params);

// Wait for handshake with Streaming API
connector.start().get(5, TimeUnit.SECONDS);

// Subscribe to a topic
// Block and wait for the subscription to succeed for 5 seconds
```



```
TopicSubscription subscription = connector.subscribe("/topic/myTopic",
    replayFrom, consumer).get(5, TimeUnit.SECONDS);
```

To end a subscription, call these functions.

```
// Cancel a subscription
subscription.cancel();

// Stop the connector
connector.stop();
```

## Example: Authentication

---


You can set up a simple authentication scheme for developer testing. For production systems, use robust authorization, such as OAuth 2.0.

IN THIS SECTION:

- [Set Up Authentication for Developer Testing](#)
- [Set Up Authentication with OAuth 2.0](#)

## Set Up Authentication for Developer Testing

To set up authorization for developer testing:

 **Important:** This authorization method is simple to use and recommended for testing your code quickly. However, we recommend that you use OAuth 2.0 in a production environment for more robust security. The OAuth authentication method with a connected app provides restricted access and other benefits.

1. Log in using the SOAP API `login()` and get the session ID.
2. Set up the HTTP authorization header using this session ID:

```
Authorization: Bearer sessionId
```

The CometD endpoint requires a session ID on all requests, plus any additional cookies set by the Salesforce server.

For more information, see [Step 4: Use the Connector with Username and Password Login](#).

## Set Up Authentication with OAuth 2.0


Setting up OAuth 2.0 requires some configuration in the user interface and in other locations. If any of the steps are unfamiliar, you can consult the [Force.com REST API Developer Guide](#) or [OAuth 2.0 documentation](#).

The sample Java code in this chapter uses the Apache HttpClient library which may be downloaded from <http://hc.apache.org/httpcomponents-client-ga/>.

1. In Salesforce Classic, from Setup, enter *Apps* in the **Quick Find** box, then select **Apps**. Or in Lightning Experience, enter *App* in the **Quick Find** box, then select **App Manager**. Click **New** in the Connected Apps related list to create a new connected app.

The `callback URL` you supply here is the same as your Web application's callback URL. Usually it's a servlet if you work with Java. It must be secure: `http://` doesn't work, only `https://`. For development environments, the callback URL is similar to

`https://my-website/_callback`. When you click **Save**, the `Consumer Key` is created and displayed, and a `Consumer Secret` is created (click the link to reveal it).

 **Note:** The OAuth 2.0 specification uses “client” instead of “consumer.” Salesforce supports OAuth 2.0.

The values here correspond to the following values in the sample code in the rest of this procedure:

- `client_id` is the `Consumer Key`
- `client_secret` is the `Consumer Secret`
- `redirect_uri` is the `Callback URL`.

An additional value you must specify is: the `grant_type`. For OAuth 2.0 callbacks, the value is `authorization_code` as shown in the sample. For more information about these parameters, see

[https://developer.salesforce.com/page/Digging\\_Deeper\\_into\\_OAuth\\_2.0\\_on\\_Force.com](https://developer.salesforce.com/page/Digging_Deeper_into_OAuth_2.0_on_Force.com).

If the value of `client_id` (or `consumer key`) and `client_secret` (or `consumer secret`) are valid, Salesforce sends a callback to the URI specified in `redirect_uri` that contains a value for `access_token`.


2. From your Java or other client application, make a request to the authentication URL that passes in `grant_type`, `client_id`, `client_secret`, `username`, and `password`. For example:

```
HttpClient httpClient = new DefaultHttpClient();
HttpPost post = new HttpPost(baseUrl);

List<BasicNameValuePair> parametersBody = new ArrayList<BasicNameValuePair>();

parametersBody.add(new BasicNameValuePair("grant_type", password));
parametersBody.add(new BasicNameValuePair("client_id", clientId));
parametersBody.add(new BasicNameValuePair("client_secret", client_secret));
parametersBody.add(new BasicNameValuePair("username", "auser@example.com"));
parametersBody.add(new BasicNameValuePair("password", "swordfish"));
```

 **Important:** This method of authentication should only be used in development environments and not for production code.

 **Example:** This example gets the session ID (authenticates), and then follows a resource, `https://instance.salesforce.com/id/00Dxxxxxxxxxxxxx/005xxxxxxxxxxxxx` contained in the first response to get more information about the user.

```
public static void oAuthSessionProvider(String loginHost, String username,
    String password, String clientId, String secret)
    throws HttpException, IOException
{
    // Set up an HTTP client that makes a connection to REST API.
    DefaultHttpClient client = new DefaultHttpClient();
    HttpParams params = client.getParams();
    HttpClientParams.setCookiePolicy(params, CookiePolicy.RFC_2109);
    params.setParameter(HttpConnectionParams.CONNECTION_TIMEOUT, 30000);

    // Set the SID.
    System.out.println("Logging in as " + username + " in environment " + loginHost);

    String baseUrl = loginHost + "/services/oauth2/token";
    // Send a post request to the OAuth URL.
    HttpPost oauthPost = new HttpPost(baseUrl);
    // The request body must contain these 5 values.
```

```

List<BasicNameValuePair> parametersBody = new ArrayList<BasicNameValuePair>();
parametersBody.add(new BasicNameValuePair("grant_type", "password"));
parametersBody.add(new BasicNameValuePair("username", username));
parametersBody.add(new BasicNameValuePair("password", password));
parametersBody.add(new BasicNameValuePair("client_id", clientId));
parametersBody.add(new BasicNameValuePair("client_secret", secret));
oauthPost.setEntity(new UrlEncodedFormEntity(parametersBody, HTTP.UTF_8));

// Execute the request.
System.out.println("POST " + baseUrl + "...\\n");
HttpResponse response = client.execute(oauthPost);
int code = response.getStatusLine().getStatusCode();
Map<String, String> oauthLoginResponse = (Map<String, String>)
    JSON.parse(EntityUtils.toString(response.getEntity()));
System.out.println("OAuth login response");
for (Map.Entry<String, String> entry : oauthLoginResponse.entrySet())
{
    System.out.println(String.format(" %s = %s", entry.getKey(), entry.getValue()));
}
System.out.println("");

// Get user info.
String userIdEndpoint = oauthLoginResponse.get("id");
String accessToken = oauthLoginResponse.get("access_token");
List<BasicNameValuePair> qsList = new ArrayList<BasicNameValuePair>();
qsList.add(new BasicNameValuePair("oauth_token", accessToken));
String queryString = URLEncodedUtils.format(qsList, HTTP.UTF_8);
HttpGet userInfoRequest = new HttpGet(userIdEndpoint + "?" + queryString);
HttpResponse userInfoResponse = client.execute(userInfoRequest);
Map<String, Object> userInfo = (Map<String, Object>)
    JSON.parse(EntityUtils.toString(userInfoResponse.getEntity()));
System.out.println("User info response");
for (Map.Entry<String, Object> entry : userInfo.entrySet())
{
    System.out.println(String.format(" %s = %s", entry.getKey(), entry.getValue()));
}
System.out.println("");

// Use the user info in interesting ways.
System.out.println("Username is " + userInfo.get("username"));
System.out.println("User's email is " + userInfo.get("email"));
Map<String, String> urls = (Map<String, String>)userInfo.get("urls");
System.out.println("REST API url is " + urls.get("rest").replace("{version}",
"41.0"));
}

```

The output from this code resembles the following:

```

Logging in as auser@example.com in environment https://login.salesforce.com
POST https://login.salesforce.com/services/oauth2/token...

```

```

OAuth login response

```

```

id = https://login.salesforce.com/id/00D30000000ehjIEAQ/00530000003THy8AAG
issued_at = 1334961666037
instance_url = https://instance.salesforce.com
access_token =
00D30000000ehjI!ARYAQHc.0Mlmz.DCg3HRNF.SmsSn5njPkry2SM6pb6rjCOqfAODaUkv5CGksRSPRb.xb
signature = 8M9VWBoaEk+Bs//yD+BfrUR/+5tkNLgXAIwall1PMwsY=

User info response
  user_type = STANDARD
  status = {created_date=2012-04-08T16:44:58.000+0000, body=Hello}
  urls = {subjects=https://instance.salesforce.com/services/data/v{version}/subjects/,
feeds=https://instance.salesforce.com/services/data/v{version}/chatter/feeds,
users=https://instance.salesforce.com/services/data/v{version}/chatter/users,
query=https://instance.salesforce.com/services/data/v{version}/query/,
enterprise=https://instance.salesforce.com/services/Soap/c/{version}/00D30000000ehjI,
recent=https://instance.salesforce.com/services/data/v{version}/recent/,
feed_items=https://instance.salesforce.com/services/data/v{version}/chatter/feed-items,
search=https://instance.salesforce.com/services/data/v{version}/search/,
partner=https://instance.salesforce.com/services/Soap/u/{version}/00D30000000ehjI,
rest=https://instance.salesforce.com/services/data/v{version}/,
groups=https://instance.salesforce.com/services/data/v{version}/chatter/groups,
metadata=https://instance.salesforce.com/services/Soap/m/{version}/00D30000000ehjI,
profile=https://instance.salesforce.com/00530000003THy8AAG}
  locale = en_US
  asserted_user = true
  id = https://login.salesforce.com/id/00D30000000ehjIEAQ/00530000003THy8AAG
  nick_name = SampleNickname
  photos = {picture=https://instance.content.force.com/profilephoto/005/F,
thumbnail=https://c.instance.content.force.com/profilephoto/005/T}
  display_name = Sample User
  first_name = Admin
  last_modified_date = 2012-04-19T04:35:29.000+0000
  username = auser@example.com
  email = emailaddr@example.com
  organization_id = 00D30000000ehjIEAQ
  last_name = User
  utcOffset = -28800000
  active = true
  user_id = 00530000003THy8AAG
  language = en_US

Username is auser@example.com
User's email is emailaddr@example.com
REST API url is https://instance.salesforce.com/services/data/v41.0/

```

# USING STREAMING API

## CHAPTER 4 Working with PushTopics

### In this chapter ...

- [PushTopic Queries](#)
- [Event Notification Rules](#)
- [Replay PushTopic Streaming Events](#)
- [Filtered Subscriptions](#)
- [Bulk Subscriptions](#)
- [Deactivating a Push Topic](#)

Each PushTopic record that you create corresponds to a channel in CometD. The channel name is the name of the PushTopic prefixed with `"/topic/"`, for example, `/topic/MyPushTopic`. A Bayeux client can receive streamed events on this channel. The channel name is case-sensitive when you subscribe.



**Note:** Updates performed by the Bulk API won't generate notifications, since such updates could flood a channel.

As soon as a PushTopic record is created, the system starts evaluating record creates, updates, deletes, and undeletes for matches. Whenever there's a match, a new notification is generated. The server polls for new notifications for currently subscribed channels every second. This time may fluctuate depending on the overall server load.

The PushTopic defines when notifications are generated in the channel. This is specified by configuring the following PushTopic fields:

- [PushTopic Queries](#)
- [Events](#)
- [Notifications](#)



**Note:** To receive notifications, users must have read access on both the object in the PushTopic query and the PushTopic itself.

## PushTopic Queries

The PushTopic query is the basis of the PushTopic channel and defines which record create, update, delete, or undelete events generate a notification. This query must be a valid SOQL query. To ensure that notifications are sent in a timely manner, the following requirements apply to PushTopic queries.

- The query `SELECT` clause must include `Id`. For example: `SELECT Id, Name FROM...`
- Only one entity per query.
- The object must be valid for the specified API version.

The fields that you specify in the PushTopic `SELECT` clause make up the body of the notification that is streamed on the PushTopic channel. For example, if your PushTopic query is `SELECT Id, Name, Status__c FROM InvoiceStatement__c`, then the `Id`, `Name` and `Status__c` fields are included in any notifications sent on that channel. Following is an example of a notification message that might appear in that channel:

```
{
  "channel": "/topic/InvoiceStatementUpdates",
  "data":
  {
    "event":
    {
      "type": "updated",
      "createdDate": "2011-11-03T15:59:06.000+0000"
    },
    "subject":
    {
      "Name": "INV-0001",
      "Id": "a00D00000008o6y8IAA",
      "Status__c": "Open"
    }
  }
}
```

If you change a PushTopic query, those changes take effect immediately on the server. A client receives events only if they match the new SOQL query. If you change a PushTopic `Name`, live subscriptions are not affected. New subscriptions must use the new channel name.

## Security and the PushTopic Query

Subscribers receive notifications about records that were created, updated, deleted, or undeleted if they have:

- Field-level security access to the fields specified in the `WHERE` clause
- Read access on the object in the query
- Read access on the PushTopic
- Visibility of the new or modified record based on sharing rules

If the subscriber doesn't have access to specific fields referenced in the query `SELECT` clause, then those fields aren't included in the notification. If the subscriber doesn't have access to all fields referenced in the query `WHERE` clause, then they will not receive the notification.

For example, assume a user tries to subscribe to a PushTopic with the following Query value:

```
SELECT Id, Name, SSN__c
FROM Employee__c
WHERE Bonus_Received__c = true AND Bonus_Amount__c > 20000
```

If the subscriber doesn't have access to `Bonus_Received__c` or `Bonus_Amount__c`, the subscription fails. If the subscriber doesn't have access to `SSN__c`, then it won't be returned in the notification.

If the subscriber has already successfully subscribed to the PushTopic, but the field-level security then changes so that the user no longer has access to one of the fields referenced in the WHERE clause, no streamed notifications are sent.

## Supported PushTopic Queries

All custom objects are supported in PushTopic queries. The following subset of standard objects are supported in PushTopic queries: Account, Campaign, Case, Contact, Lead, Opportunity, Task. The following standard objects are supported in PushTopic queries through a pilot program: ContractLineItem, Entitlement, LiveChatTranscript, Quote, QuoteLineItem, ServiceContract.

**Important:** Tasks that are created or updated using the following methods don't appear in task object topics in the streaming API.

- Lead conversion
- Entity merge
- Mass email contacts/leads

Also, the standard SOQL operators as well as most SOQL statements and expressions are supported. Some SOQL statements aren't supported. See [Unsupported PushTopic Queries](#).

The following are examples of supported SOQL statements.

- Custom object

```
SELECT Id, MyCustomField__c FROM MyCustomObject__c
```

- Standard objects (may include custom fields)

- Account

```
SELECT Id, Name FROM Account WHERE NumberOfEmployees > 1000
```

- Campaign

```
SELECT Id, Name FROM Campaign WHERE Status = 'Planned'
```

- Case

```
SELECT Id, Subject FROM Case WHERE Status = 'Working' AND IsEscalated = TRUE
```

- Contact

```
SELECT Id, Name, Email FROM Contact;
```

- Lead

```
SELECT Id, Company FROM Lead WHERE Industry = 'Computer Services'
```

- Opportunity

```
SELECT Id, Name, Amount FROM Opportunity WHERE CloseDate < 2011-06-14
```

- Task


```
SELECT Id, Subject, IsClosed, Status FROM Task WHERE isClosed = TRUE
```

 **Important:**

- To receive notifications on the `IsClosed` field, the subscriber must subscribe to the `Status` field referenced in the query.
- To receive notifications on the `WhoCount` and `WhatCount` fields, the subscriber must subscribe to the `WhoId` and `WhatId` fields. Subscriptions based only on the `WhoCount` or `WhatCount` fields aren't supported.

## Compound Fields in PushTopic Queries

By default, the support of compound fields, such as `Name` or `Address` fields, depends on which fields are present in the PushTopic query. For `Name` compound fields, you must specify the `Name` field. For `Address` and `Geolocation` fields, you must specify the constituent fields.

 **Note:** If the PushTopic field `NotifyForFields` is set to `All`, compound fields are supported. In this case, it's not necessary to explicitly reference compound or constituent fields in the PushTopic query. The special behavior listed in the following sections applies only for the default `NotifyForFields` setting (`Referenced`) or when `NotifyForFields` is set to `Select` or `Where`.

### Name Compound Field

To detect changes on the `Name` compound field, include the `Name` field in the `SELECT` or `WHERE` clause. The constituent fields, such as `firstName` and `lastName`, are optional, but the `Name` field is required. The returned notification message includes all constituent field values. If the `Name` field is omitted, changes can't be detected, even if the constituent fields are present.

The following table shows supported and unsupported `SELECT` statements. These statements contain fields for the `Name` compound field on `Contact` or `Lead`.

Fields	Supported?
<code>SELECT Id, Name</code>	Yes
<code>SELECT Id, Name, firstName, lastName</code>	Yes
<code>SELECT Id, firstName, lastName</code>	No

### Address Compound Field

To detect changes of `Address` compound fields, include the constituent fields in the `SELECT` or `WHERE` clause. The `Address` field, such as `MailingAddress` on `Contact` or `ShippingAddress` on `Account`, is optional, but the constituent fields are required. If the constituent fields are omitted, changes can't be detected, even if the `Address` field is present.

The following table shows supported and unsupported `SELECT` statements. These statements contain `MailingAddress` fields of `Contact`.



Fields	Supported?
<code>SELECT Id, MailingAddress</code>	No
<code>SELECT Id, MailingAddress, MailingCity, MailingStreet</code>	Yes
<code>SELECT Id, MailingCity, MailingStreet</code>	Yes

## Geolocation Compound Field

To detect changes of Geolocation compound fields, include the latitude and longitude constituent fields in the SELECT or WHERE clause. The Geolocation field is optional, but the constituent fields are required. If the constituent fields are omitted, changes can't be detected, even if the Geolocation field is present.

The following table shows supported and unsupported SELECT statements. These statements contain a custom Geolocation field called `location__c` and its constituent fields.

Fields	Supported?
<code>SELECT Id, location__c</code>	No
<code>SELECT Id, location__c, location__latitude__s, location__longitude__s</code>	Yes
<code>SELECT Id, location__latitude__s, location__longitude__s</code>	Yes


## Unsupported PushTopic Queries

The following SOQL statements are not supported in PushTopic queries.

- Queries without an `Id` in the selected fields list
- Semi-joins and anti-joins
  - Example query: `SELECT Id, Name FROM Account WHERE Id IN (SELECT AccountId FROM Contact WHERE Title = 'CEO')`
  - Error message: `INVALID_FIELD, semi/anti join sub-selects are not supported`
- Aggregate queries (queries that use `AVG`, `MAX`, `MIN`, and `SUM`)
  - Example query: `SELECT Id, AVG(AnnualRevenue) FROM Account`
  - Error message: `INVALID_FIELD, Aggregate queries are not supported`
- `COUNT`
  - Example query: `SELECT Id, Industry, Count(Name) FROM Account`
  - Error message: `INVALID_FIELD, Aggregate queries are not supported`
- `LIMIT`
  - Example query: `SELECT Id, Name FROM Contact LIMIT 10`

- Error message: `INVALID_FIELD, 'LIMIT' is not allowed`
- Relationships aren't supported, but you can reference an ID:
  - Example query: `SELECT Id, Contact.Account.Name FROM Contact`
  - Error message: `INVALID_FIELD, relationships are not supported`
- Searching for values in Text Area fields.
- `ORDER BY`
  - Example query: `SELECT Id, Name FROM Account ORDER BY Name`
  - Error message: `INVALID_FIELD, 'ORDER BY' clause is not allowed`
- `GROUP BY`
  - Example query: `SELECT Id, AccountId FROM Contact GROUP BY AccountId`
  - Error message: `INVALID_FIELD, 'Aggregate queries are not supported'`
- Formula fields in WHERE clauses (formula fields are supported in SELECT clauses though.)
- `NOT`
  - Example query: `SELECT Id FROM Account WHERE NOT Name = 'Salesforce.com'`
  - Error message: `INVALID_FIELD, 'NOT' is not supported`

To make this a valid query, change it to `SELECT Id FROM Account WHERE Name != 'Salesforce.com'`.

 **Note:** The `NOT IN` phrase is supported in PushTopic queries.

- `OFFSET`
  - Example query: `SELECT Id, Name FROM Account WHERE City = 'New York' OFFSET 10`
  - Error message: `INVALID_FIELD, 'OFFSET' clause is not allowed`
- `TYPEOF`
  - Example query: `SELECT TYPEOF Owner WHEN User THEN LastName ELSE Name END FROM Case`
  - Error message: `INVALID_FIELD, 'TYPEOF' clause is not allowed`

 **Note:** `TYPEOF` is currently available as a Developer Preview as part of the SOQL Polymorphism feature. For more information on enabling `TYPEOF` for your organization, contact Salesforce.

## Event Notification Rules

---

Notifications are generated for record events based on how you configure your PushTopic. The Streaming API matching logic uses the `NotifyForOperationCreate`, `NotifyForOperationUpdate`, `NotifyForOperationDelete`, `NotifyForOperationUndelete`, and `NotifyForFields` fields in a PushTopic record to determine whether to generate a notification.

Clients must connect using the `cometd/29.0` (or later) Streaming API endpoint to receive delete and undelete event notifications.

## Events

Events that may generate a notification are the creation, update, delete, or undelete of a record. The PushTopic `NotifyForOperationCreate`, `NotifyForOperationUpdate`, `NotifyForOperationDelete`, and

`NotifyForOperationUndelete` fields enable you to specify which events may generate a notification in that PushTopic channel. The fields are set as follows:

Field	Description
<code>NotifyForOperationCreate</code>	<code>true</code> if a create operation should generate a notification, otherwise, <code>false</code> .
<code>NotifyForOperationDelete</code>	<code>true</code> if a delete operation should generate a notification, otherwise, <code>false</code> .
<code>NotifyForOperationUndelete</code>	<code>true</code> if an undelete operation should generate a notification, otherwise, <code>false</code> .
<code>NotifyForOperationUpdate</code>	<code>true</code> if an update operation should generate a notification, otherwise, <code>false</code> .

In API version 28.0 and earlier, you use the `NotifyForOperations` field to specify which events generate a notification, and can only specify create or update events. The `NotifyForOperations` values are:

<code>NotifyForOperations</code> Value	Description
All (default)	Evaluate a record to possibly generate a notification whether the record has been created or updated.
Create	Evaluate a record to possibly generate a notification only if the record has been created.
Update	Evaluate a record to possibly generate a notification only if the record has been updated.
Extended	A value of <code>Extended</code> means that neither create or update operations are set to generate events. This value is provided to allow clients written to API version 28.0 or earlier to work with Salesforce organizations configured to generate delete and undelete notifications.

The event field values together with the `NotifyForFields` value provides flexibility when configuring when you want to generate notifications using Streaming API.

## Notifications

After a record is created or updated (an event), the record is evaluated against the PushTopic query and a notification might be generated. A notification is the message sent to the channel as the result of an event. The notification is a JSON formatted message. The PushTopic field `NotifyForFields` specifies how the record is evaluated against the PushTopic query. The `NotifyForFields` values are:

<code>NotifyForFields</code> Value	Description
All	Notifications are generated for all record field changes, provided the evaluated records match the criteria specified in the WHERE clause.
Referenced (default)	Changes to fields referenced in the SELECT and WHERE clauses are evaluated. Notifications are generated for the evaluated records only if they match the criteria specified in the WHERE clause.

<code>NotifyForFields</code> Value	Description
Select	Changes to fields referenced in the SELECT clause are evaluated. Notifications are generated for the evaluated records only if they match the criteria specified in the WHERE clause.
Where	Changes to fields referenced in the WHERE clause are evaluated. Notifications are generated for the evaluated records only if they match the criteria specified in the WHERE clause.

The fields that you specify in the PushTopic query SELECT clause are contained in the notification message.

## NotifyForFields Set to All


When you set the value of `PushTopic.NotifyForFields` to `All`, a change to any field value in the record causes the Streaming API matching logic to evaluate the record to determine if a notification should be generated. Changes to record field values cause this evaluation whether or not those fields are referenced in the PushTopic query SELECT clause or WHERE clause.

Event	A notification is generated when
Record is created	The record field values match the values specified in the WHERE clause
Record is updated	The record field values match the values specified in the WHERE clause

## Examples

PushTopic Query	Result
<pre>SELECT Id, f1, f2, f3 FROM InvoiceStatement</pre>	Generates a notification if any field values in the record have changed.
<pre>SELECT Id, f1, f2 FROM InvoiceStatement WHERE f3 = 'abc' AND f4 LIKE 'xyz'</pre>	Generates a notification if any field values in the record have changed and f3 and f4 match the values in the WHERE clause.
<pre>SELECT Id FROM InvoiceStatement</pre>	When Id is the only field in the SELECT clause, a notification is generated if any field values have changed.
<pre>SELECT Id FROM InvoiceStatement WHERE f3 = 'abc' AND f4 LIKE 'xyz'</pre>	Generates a notification if any field values in the record have changed and f3 and f4 match the values in the WHERE clause.
<pre>SELECT Id FROM InvoiceStatement WHERE Id IN ('a07B0000000KwZ7IAO', 'e10R0000000KEU9IAO', 'v32B0000000KwZ7YEP')</pre>	Generates a notification if any field values in the record have changed and the record ID is contained in the WHERE clause IN list.
<pre>SELECT Id, f1, f2 FROM InvoiceStatement WHERE</pre>	Generates a notification if any field values in the record have changed and the record ID is contained in the WHERE clause IN list.

PushTopic Query	Result
<pre>Id IN ('a07B0000000KWZ7IAO', 'e10R0000000KEU9IAO', 'v32B0000000KWZ7YEP')</pre>	
<pre>SELECT Id, f1, f2 FROM InvoiceStatement WHERE f3 = 'abc' AND f4 LIKE 'xyz' AND Id IN ('a07B0000000KWZ7IAO', 'e10R0000000KEU9IAO', 'v32B0000000KWZ7YEP')</pre>	Generates a notification if any field values in the record have changed, f3 and f4 match the WHERE clause, and the record ID is contained in the WHERE clause IN list.

 **Warning:** Use caution when setting `NotifyForFields` to `All`. When you use this value, then notifications are generated for all record field changes as long as the new field values match the values in the WHERE clause. Therefore, the number of generated notifications could potentially be large, and you may hit the daily quota of events limit. In addition, because every record change is evaluated and many notifications may be generated, this causes a heavier load on the system.

## NotifyForFields Set to Referenced

When you set the value of `PushTopic.NotifyForFields` to `Referenced`, a change to any field value in the record as long as that field is referenced in the query SELECT clause or WHERE clause causes the Streaming API matching logic to evaluate the record to determine if a notification should be generated.

If the `PushTopic.NotifyForFields` value is `Referenced`, then the PushTopic query must have a SELECT clause with at least one field other than ID or a WHERE clause with at least one field other than ID.

Event	A notification is generated when
Record is created	The record field values match the values specified in the WHERE clause
Record is updated	<ul style="list-style-type: none"> <li>A change occurs in one or more record fields that are specified in the PushTopic query SELECT clause or</li> <li>A change occurs in one or more record fields that are specified in the PushTopic query WHERE clause and</li> <li>The record values of the fields specified in the WHERE clause all match the values in the PushTopic query WHERE clause</li> </ul>

## Examples

PushTopic Query	Result
<pre>SELECT Id, f1, f2, f3 FROM InvoiceStatement__c</pre>	Generates a notification if f1, f2, or f3 have changed.

PushTopic Query	Result
<pre>SELECT Id, f1, f2 FROM InvoiceStatement__c WHERE f3 = 'abc' AND f4 LIKE 'xyz'</pre>	Generates a notification if f1, f2, f3, or f4 have changed and f3 and f4 match the values in the WHERE clause.
<pre>SELECT Id FROM InvoiceStatement__c WHERE f3 = 'abc' AND f4 LIKE 'xyz'</pre>	Generates a notification if f3 and f4 have changed and f3 and f4 match the values in the WHERE clause.
<pre>SELECT Id, f1, f2 FROM InvoiceStatement__c WHERE Id IN ('a07B0000000KWZ7IAO', 'e10R0000000KEU9IAO', 'v32B0000000KWZ7YEP')</pre>	Generates a notification if f1 or f2 have changed and the record ID is contained in the WHERE clause IN list.
<pre>SELECT Id, f1, f2 FROM InvoiceStatement__c WHERE f3 = 'abc' AND f4 LIKE 'xyz' AND Id IN ('a07B0000000KWZ7IAO', 'e10R0000000KEU9IAO', 'v32B0000000KWZ7YEP')</pre>	Generates a notification if f1, f2, f3, or f4 have changed, f3 and f4 match the values in the WHERE clause, and the ID is contained in the WHERE clause IN list.

## NotifyForFields Set to Select

When you set the value of `PushTopic.NotifyForFields` to `Select`, a change to any field value in the record as long as that field is referenced in the query `SELECT` clause causes the Streaming API matching logic to evaluate the record to determine if a notification should be generated.

If the `PushTopic.NotifyForFields` value is `Select`, then the `PushTopic` query must have a `SELECT` clause with at least one field other than ID.

Event	A notification is generated when
Record is created	The record field values match the values specified in the WHERE clause
Record is updated	<ul style="list-style-type: none"> <li>A change occurs in one or more record fields that are specified in the PushTopic query <code>SELECT</code> clause and</li> <li>The record values of the fields specified in the WHERE clause all match the values in the PushTopic query WHERE clause</li> </ul>

## Examples

PushTopic Query	Result
<pre>SELECT Id, f1, f2, f3 FROM InvoiceStatement__c</pre>	Generates a notification if f1, f2, or f3 have changed.

PushTopic Query	Result
<pre>SELECT Id, f1, f2 FROM InvoiceStatement__c WHERE f3 = 'abc' AND f4 LIKE 'xyz'</pre>	Generates a notification if f1 or f2 have changed and f3 and f4 match the values in the WHERE clause.
<pre>SELECT Id, f1, f2 FROM InvoiceStatement__c WHERE Id IN ('a07B0000000KWZ7IAO', 'e10R0000000KEU9IAO', 'v32B0000000KWZ7YEP')</pre>	Generates a notification if f1 or f2 have changed and ID is contained in the WHERE clause IN list.
<pre>SELECT Id, f1, f2 FROM InvoiceStatement__c WHERE f3 = 'abc' AND f4 LIKE 'xyz' AND Id IN ('a07B0000000KWZ7IAO', 'e10R0000000KEU9IAO', 'v32B0000000KWZ7YEP')</pre>	Generates a notification if f1 or f2 have changed, f3 and f4 match the values in the WHERE clause, and the ID is contained in the WHERE clause IN list.

## NotifyForFields Set to Where

When you set the value of `PushTopic.NotifyForFields` to `Where`, a change to any field value in the record as long as that field is referenced in the query WHERE clause causes the Streaming API matching logic to evaluate the record to determine if a notification should be generated.

If the `PushTopic.NotifyForFields` value is `Where`, then the PushTopic query must have a WHERE clause with at least one field other than `Id`.

Event	A notification is generated when
Record is created	The record field values match the values specified in the WHERE clause
Record is updated	<ul style="list-style-type: none"> <li>A change occurs in one or more record fields that are specified in the PushTopic query WHERE clause and</li> <li>The record values of the fields specified in the WHERE clause all match the values in the PushTopic query WHERE clause</li> </ul>

## Examples

PushTopic Query	Result
<pre>SELECT Id, f1, f2 FROM InvoiceStatement__c WHERE f3 = 'abc' AND f4 LIKE 'xyz'</pre>	Generates a notification if f3 or f4 have changed and the values match the values in the WHERE clause.
<pre>SELECT Id FROM InvoiceStatement__c WHERE f3 = 'abc' AND f4 LIKE 'xyz'</pre>	Generates a notification if f3 or f4 have changed and the values match the values in the WHERE clause.

PushTopic Query	Result
<pre>SELECT Id, f1, f2 FROM InvoiceStatement__c WHERE f3 = 'abc' AND f4 LIKE 'xyz' AND Id IN ('a07B0000000KWZ7IAO', 'e10R0000000KEU9IAO', 'v32B0000000KWZ7YEP')</pre>	Generates a notification if f3 or f4 have changed, f3 and f4 match the values in the WHERE clause, and the record ID is contained in the WHERE clause IN list.

## Notification Scenarios

Following is a list of example scenarios and the field values you need in a PushTopic record to generate notifications.

Scenario	Configuration
You want to receive all notifications of all record updates.	<ul style="list-style-type: none"> <li>• <b>MyPushTopic</b>.Query = <code>SELECT Id, Name, Description__c FROM InvoiceStatement</code></li> <li>• <b>MyPushTopic</b>.NotifyForFields = All</li> </ul>
You want to receive notifications of all record changes only when the Name or Amount fields change. For example, if you're maintaining a list view.	<ul style="list-style-type: none"> <li>• <b>MyPushTopic</b>.Query = <code>SELECT Id, Name, Amount__c FROM InvoiceStatement</code></li> <li>• <b>MyPushTopic</b>.NotifyForFields = Referenced</li> </ul>
You want to receive notification of all record changes made to a specific record.	<ul style="list-style-type: none"> <li>• <b>MyPushTopic</b>.Query = <code>SELECT Id, Name, Amount__c FROM InvoiceStatement WHERE Id='a07B0000000KWZ7IAO'</code></li> <li>• <b>MyPushTopic</b>.NotifyForFields = All</li> </ul>
You want to receive notification only when the Name or Amount field changes for a specific record. For example, if the user is on a detail page and only those two fields are displayed.	<ul style="list-style-type: none"> <li>• <b>MyPushTopic</b>.Query = <code>SELECT Id, Name, Amount__c FROM InvoiceStatement WHERE Id='a07B0000000KWZ7IAO'</code></li> <li>• <b>MyPushTopic</b>.NotifyForFields = Referenced</li> </ul>
You want to receive notification for all invoice statement record changes for vendors in a particular state.	<ul style="list-style-type: none"> <li>• <b>MyPushTopic</b>.Query = <code>SELECT Id, Name, Amount__c FROM InvoiceStatement WHERE BillingState__c = 'NY'</code></li> <li>• <b>MyPushTopic</b>.NotifyForFields = All</li> </ul>
You want to receive notification for all invoice statement record changes where the invoice amount is \$1,000 or more.	<ul style="list-style-type: none"> <li>• <b>MyPushTopic</b>.Query = <code>SELECT Id, Name FROM InvoiceStatement WHERE Amount &gt; 999</code></li> <li>• <b>MyPushTopic</b>.NotifyForFields = Referenced</li> </ul>



## Replay PushTopic Streaming Events

---

Salesforce stores PushTopic-based events for 24 hours and allows you to retrieve stored and new events. Subscribers can choose which events to receive by using replay options.

For more information about durable events, see [Message Durability](#).

## Code Samples

- [GitHub: Durable PushTopic Streaming Demo](#)
- [GitHub: Streaming Replay Client Extensions](#)

## Filtered Subscriptions

---

Reduce the number of PushTopic event notifications by specifying record fields to filter on when you subscribe to a channel.


Specify the filter criteria in an expression you append to the subscription URI, as follows.

```
/topic/ChannelName?<expression>
```

*ChannelName* is the channel, and *<expression>* is the expression containing one or more conditions. Join conditions with the & operator. Only the & operator is supported. Use this syntax for the *<expression>*.

```
?fieldA=valueA&fieldB=valueB&...
```

Include each field used in a filter condition in the PushTopic query. The & operator acts like the logical OR operator, so record events are matched if any condition is true.

 **Note:** If you use an ID in filter criteria, use the 18-character ID format; 15-character IDs aren't supported.

 **Example:** This subscription returns event notifications for records whose industry is Energy *or* shipping city is San Francisco.

```
/topic/myChannel?Industry='Energy'&ShippingCity='San Francisco'
```

The PushTopic query for this subscription includes the `Industry` and `ShippingCity` fields.

## Bulk Subscriptions

---

You can subscribe to multiple topics at the same time.

To do so, send a JSON array of subscribe messages instead of a single subscribe message. For example this code subscribes to three topics:

```
[
  {
    "channel": "/meta/subscribe",
    "clientId": "Un1q31d3nt1f13r",
    "subscription": "/topic/foo"
  },
  {
    "channel": "/meta/subscribe",
    "clientId": "Un1q31d3nt1f13r",
    "subscription": "/topic/bar"
```

```
    },  
    {  
      "channel": "/meta/subscribe",  
      "clientId": "Un1q31d3nt1f13r",  
      "subscription": "/topic/baz"  
    }  
  ]
```

For more information, see the [Bayeux Specification](#).

## Deactivating a Push Topic

---

You can temporarily deactivate a PushTopic, rather than deleting it, by setting the `isActive` field to false.

- To deactivate a PushTopic by Id, execute the following Apex code:

```
PushTopic pt = new PushTopic(Id='0IFD000000008jOAA', IsActive = false);  
update(pt);
```

## CHAPTER 5 Streaming API Considerations

### In this chapter ...

- Clients and Timeouts
- Clients and Cookies for Streaming API
- Supported CometD Versions
- HTTPS Recommended
- Debugging Streaming API Applications
- Monitoring Events Usage
- Notification Message Order
- Considerations for Multiple Notifications in the Same Transaction

Streaming API helps you create near real-time update notifications of your Salesforce data. This chapter covers some client and troubleshooting considerations to keep in mind when implementing Streaming API.

## Clients and Timeouts

---

Streaming API imposes two timeouts, as supported in the Bayeux protocol.

### Socket timeout: 110 seconds


A client receives events (JSON-formatted HTTP responses) while it waits on a connection. If no events are generated and the client is still waiting, the connection times out after 110 seconds and the server closes the connection. Clients should reconnect before two minutes to avoid the connection timeout.

### Reconnect timeout: 40 seconds

After receiving the events, a client needs to reconnect to receive the next set of events. If the reconnection doesn't happen within 40 seconds, the server expires the subscription and the connection is closed. If this happens, the client must start again and handshake, subscribe, and connect.

Each Streaming API client logs into an instance and maintains a session. When the client handshakes, connects, or subscribes, the session timeout is restarted. A client session times out if the client doesn't reconnect to the server within 40 seconds after receiving a response (an event, subscribe result, and so on).

Note that these timeouts apply to the Streaming API client session and not the Salesforce authentication session. If the client session times out, the authentication session remains active until the organization-specific timeout policy goes into effect.

 **Note:** In addition to timeouts, a client might disconnect from the channel due to network failures. For more information, see [Short Network Failures](#) and [Long Network Failures or Server Failures](#) in the [CometD Reference Documentation](#).

## Clients and Cookies for Streaming API

---

The client you create to work with the Streaming API must obey the standard cookie protocol with the server. The client must accept and send the appropriate cookies for the domain and URI path, for example `https://instance_name.salesforce.com/cometd`.

Streaming API requirements on clients:

- The `"Content-Type: application/json"` header is required on all calls to the `cometd` servlet if the content of the post is JSON.
- A header containing the Salesforce session ID or OAuth token is required. For example, `Authorization: Bearer sessionId`.
- The client must accept and send back all appropriate cookies for the domain and URI path. Clients must obey the standard cookie protocol with the server.
- The subscribe response and other responses might contain the following fields. These fields aren't contained in the CometD specification.
  - `EventType` contains either `created` or `updated`.
  - `CreatedDate` contains the event's creation date.

## Supported CometD Versions

---

Use CometD version 3.1.0 or later in your clients to connect to Streaming API. Earlier versions aren't supported and could result in unexpected behavior. To prevent potential issues with old CometD versions in your clients, upgrade the CometD library to a supported version. For more information, see <https://cometd.org/>.

## HTTPS Recommended

---

Streaming API follows the preference set by your administrator for your organization. By default this is HTTPS. To protect the security of your data, we recommend you use HTTPS.

## Debugging Streaming API Applications

---

You must be able to see all of the requests and responses in order to debug Streaming API applications. Because Streaming API applications are stateful, you need to use a proxy tool to debug your application. Use a tool that can report the contents of all requests and results, such as [Burp Proxy](#), [Fiddler](#), or [Firebug](#).

The most common errors include:

- Browser and JavaScript issues
- Sending requests out of sequence
- Malformed requests that don't follow the Bayeux protocol
- Authorization issues
- Network or firewall issues with long-lived connections

Using these tools, you can look at the requests, headers, body of the post, as well as the results. If you must contact us for help, be sure to copy and save these elements to assist in troubleshooting.

The first step for any debugging process is to follow the instructions in the [Quick Start Using Workbench, Example: Interactive Visualforce Page without Replay](#), or [Example: Subscribe to and Replay Events Using a Java Client](#) and verify that you can implement the samples provided. The next step is to use your debug tool to help isolate the symptoms and cause of any problems.

## 402 Error

You may sometimes receive an error notification that contains “402::Unknown client” and looks something like this:

```
Thu Mar 29 06:08:08 PDT 2012 [CHANNEL:META_CONNECT]: {"id":"78","error":"402::Unknown client","successful":false,"advice":{"interval":500,"reconnect":"handshake"}}
```

This can be caused by various conditions including when your client connection times out. If you see this error, you should reconnect to the server with a handshake. For more information about client timeouts and Streaming API limits, see

[Clients and Timeouts](#) and [Streaming API Limits](#).

## Monitoring Events Usage

---

The number of events that can be generated in a 24-hour period depends on your type of organization. For more information, see [Streaming API Limits](#). You can monitor Streaming API events usage on the Company Information page.

- From Setup, enter *Company Information* in the **Quick Find** box, then select **Company Information**.

If you refresh the Company Information page, the Streaming API Events value may fluctuate slightly. Regardless of these small fluctuations, your limits are being assessed accurately.

## Notification Message Order

---

Changes to data in your organization happen in a sequential manner. However, the order in which you receive event notification messages in Streaming API isn't guaranteed. On the client side, you can use `createdDate` to order the notification messages returned in a channel. The value of `createdDate` is a UTC date/time value that indicates when the event occurred.

This code shows multiple messages, one generated by the creation of a record and one generated by the update of a record.

```
{
  "channel": "/topic/InvoiceStatementUpdates",
  "clientId": "1g177wgjj14omtdo3rc10hjhm4w",
  "data": {
    "event": {
      "type": "updated",
      "createdDate": "2013-05-10T18:16:19.000+0000"
    },
    "subject": {
      "Name": "INV-0002",
      "test_ds__Status__c": "Negotiating",
      "test_ds__Description__c": "Update to invoice statement #2",
      "Id": "a00D0000008pvxcIAA"
    }
  }
}

{
  "channel": "/topic/InvoiceStatementUpdates",
  "clientId": "1g177wgjj14omtdo3rc10hjhm4w",
  "data": {
    "event": {
      "type": "created",
      "createdDate": "2013-05-10T18:15:11.000+0000"
    },
    "subject": {
      "Name": "INV-0003",
      "test_ds__Status__c": "Open",
      "test_ds__Description__c": "New invoice statement #1",
      "Id": "a00D0000008pvzdIAA"
    }
  }
}
```

## Considerations for Multiple Notifications in the Same Transaction

---

Check out these knowledge articles to learn about the behavior of Streaming API when multiple notifications are delivered within the same transaction.

- [Streaming API Notifications Are Sent in Reverse Order Within a Transaction](#)
- [Multiple Streaming API Notifications for the Same Record - Notifications Are Sent for Untracked Fields](#)
- [\(API Version 36.0 and Earlier\) Only Last Push Topic Notification is sent out of multiple notifications done in short time](#)

# GENERIC STREAMING

## CHAPTER 6 Introducing Generic Streaming

### In this chapter ...

- [Replay Generic Streaming Events with Durable Generic Streaming](#)

Generic streaming uses Streaming API to send notifications of general events that are not tied to Salesforce data changes.

Use generic streaming when you want to send and receive notifications based on custom events that you specify. You can use generic streaming for any situation where you need to send custom notifications, such as:

- Broadcasting notifications to specific teams or to your entire organization
- Sending notifications for events that are external to Salesforce

To use generic streaming, you need:

- A [StreamingChannel](#) that defines the channel, with a name that is case-sensitive
- One or more clients subscribed to the channel
- The [Streaming Channel Push](#) REST API resource that lets you monitor and invoke push events on the channel

## Replay Generic Streaming Events with Durable Generic Streaming

---

A client can receive generic streaming events after it subscribes to a channel and as long as the Salesforce session is active. Events sent before a client subscribes to a channel or after a subscribed client disconnects from the Salesforce session are missed. However, a client can fetch the missed events within the 24-hour retention window by using Durable Generic Streaming.

For more information about durable events, see [Message Durability](#).

### Code Sample

See these code samples about replaying generic streaming events.

- [Generic Streaming Quick Start](#)
- [Example: Subscribe to and Replay Events Using a Visualforce Page](#)



## CHAPTER 7 Generic Streaming Quick Start

This quick start shows you how to get started with generic streaming in Streaming API. This quick start takes you step-by-step through the process of using Streaming API to receive a notification when an event is pushed via REST and lets you specify replay options.

### IN THIS SECTION:

#### [Create a Streaming Channel](#)

Create a new StreamingChannel object by using the Salesforce UI.

#### [Run a Java Client with Username and Password Login](#)

Run a Java client that uses EMP Connector to subscribe to the channel with username and password authentication.

#### [Run a Java Client with OAuth Bearer Token Login](#)

Run a Java client that uses EMP Connector to subscribe to the channel with OAuth authentication.

#### [Generate Events Using REST](#)

Use the Streaming Channel Push REST API resource to generate event notifications to channel subscribers.

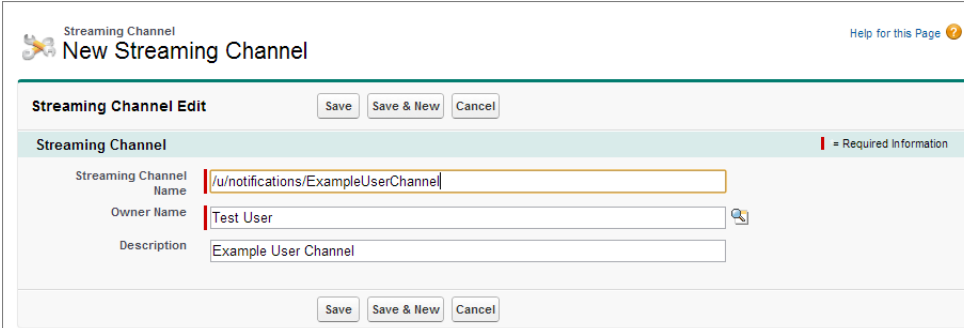
## Create a Streaming Channel

---

Create a new StreamingChannel object by using the Salesforce UI.

You must have the proper Streaming API permissions enabled in your organization.

1. Log in to your Developer Edition organization.
2. If you're using Salesforce Classic, under All Tabs (+), select **Streaming Channels**. If you're using Lightning Experience, from the App Launcher, select **All Items**, and then click **Streaming Channels**.
3. On the Streaming Channels page, click **New** to create a streaming channel.
4. Enter `/u/notifications/ExampleUserChannel` in **Streaming Channel Name**, and an optional description. Your new Streaming Channel page should look something like this:



The screenshot shows the 'New Streaming Channel' form in Salesforce. At the top, it says 'Streaming Channel' and 'New Streaming Channel'. Below that, there are three buttons: 'Save', 'Save & New', and 'Cancel'. The form has a header 'Streaming Channel' with a red exclamation mark icon and the text '= Required Information'. The form fields are: 'Streaming Channel Name' with the value '/u/notifications/ExampleUserChannel', 'Owner Name' with the value 'Test User' and a magnifying glass icon, and 'Description' with the value 'Example User Channel'. At the bottom, there are three buttons: 'Save', 'Save & New', and 'Cancel'.

5. Select **Save**. You've just created a streaming channel that clients can subscribe to for notifications.

StreamingChannel is a regular, creatable Salesforce object, so you can also create one programmatically using Apex or any data API like SOAP API or REST API.

Also, if you need to restrict which users can receive or send event notifications, you can use user sharing on the StreamingChannel to control this. Channels shared with public read-only or read-write access send events only to clients subscribed to the channel that also are using a user session associated with the set of shared users or groups. Only users with read-write access to a shared channel can generate events on the channel, or modify the actual StreamingChannel record. To modify user sharing for a StreamingChannel, from Setup, enter *Sharing Settings* in the **Quick Find** box, then select **Sharing Settings** and create or modify a StreamingChannel sharing rule.

Generic Streaming also supports dynamic streaming channel creation, which creates a StreamingChannel when a client first subscribes to the channel. To enable dynamic streaming channels in your org, from Setup, enter *User Interface* in the **Quick Find** box, then select **User Interface** and enable **Enable Dynamic Streaming Channel Creation**.

## Run a Java Client with Username and Password Login

Run a Java client that uses EMP Connector to subscribe to the channel with username and password authentication.

1. Get the EMP Connector project from GitHub. See [Download and Build the Project](#).
2. Under the `/src/main/java/` folder, open the `LoginExample.java` Java source file from the example package folder.

```

/*
 * Copyright (c) 2016, salesforce.com, inc.
 * All rights reserved.
 * Licensed under the BSD 3-Clause license.
 * For full license text, see LICENSE.TXT file in the repo root or
https://opensource.org/licenses/BSD-3-Clause
 */
package com.salesforce.emp.connector.example;

import static com.salesforce.emp.connector.LoginHelper.login;

import java.util.Map;
import java.util.concurrent.TimeUnit;
import java.util.function.Consumer;

import com.salesforce.emp.connector.BayeuxParameters;
import com.salesforce.emp.connector.EmpConnector;
import com.salesforce.emp.connector.TopicSubscription;

/**
 * An example of using the EMP connector using login credentials
 *
 * @author hal.hildebrand
 */
public class LoginExample {
    public static void main(String[] argv) throws Exception {
        if (argv.length < 3 || argv.length > 4) {
            System.err.println("Usage: LoginExample username password topic
[replayFrom]");
            System.exit(1);
        }
    }
}

```

```

    long replayFrom = EmpConnector.REPLAY_FROM_EARLIEST;
    if (argv.length == 4) {
        replayFrom = Long.parseLong(argv[3]);
    }

    BayeuxParameters params;
    try {
        params = login(argv[0], argv[1]);
    } catch (Exception e) {
        e.printStackTrace(System.err);
        System.exit(1);
        throw e;
    }

    Consumer<Map<String, Object>> consumer = event -> System.out.println(
        String.format("Received:\n%s", event));
    EmpConnector connector = new EmpConnector(params);

    connector.start().get(5, TimeUnit.SECONDS);

    TopicSubscription subscription = connector.subscribe(argv[2],
        replayFrom, consumer).get(5, TimeUnit.SECONDS);

    System.out.println(String.format("Subscribed: %s", subscription));
}
}

```

3. Run the `LoginExample` class and provide the following argument values.

Argument	Value
<code>username</code>	Username of the logged-in user.
<code>password</code>	Password for the <code>username</code> (or logged-in user).
<code>topic</code>	<code>/u/notifications/ExampleUserChannel</code>

The sample fetches the earliest saved events within the past 24 hours. Optionally, you can supply a replay ID as the last argument to receive different events. Valid values are:

- `-1`—Get all new events sent after subscription.
  - `-2`—Get all new events sent after subscription and all past events within the last 24 hours.
  - Specific number—Get all events that occurred after the event with the specified replay ID.
4. When you run this client app and generate notifications using the REST resource, the output will look something like:

```

Subscribed: Subscription [/u/notifications/ExampleUserChannel:-2]
Received:
{payload=Broadcast message to all subscribers,
event={createdDate=2016-12-13T00:57:36.020Z, replayId=1}}
Received:
{payload=Another message, event={createdDate=2016-12-13T00:58:16.591Z, replayId=2}}

```

Generally, do not handle usernames and passwords of others when running code in production. In a production environment, delegate the login to OAuth. The next step connects to Streaming API with OAuth.

## Run a Java Client with OAuth Bearer Token Login

---

Run a Java client that uses EMP Connector to subscribe to the channel with OAuth authentication.

### Prerequisites

Obtain an OAuth bearer access token for your Salesforce user. You supply this access token in the connector example.

See [Set Up Authentication with OAuth 2.0](#). Also, see [Authenticate Apps with OAuth](#) in [Salesforce Help](#) and [Understanding Authentication](#) in the [Force.com REST API Developer Guide](#).

Let's run an example that uses OAuth bearer token login.

1. Get the EMP Connector project from GitHub. See [Download and Build the Project](#).
2. Under the `/src/main/java/` folder, open the `BearerTokenExample.java` Java source file from the example package folder.

```
/*
 * Copyright (c) 2016, salesforce.com, inc. All rights reserved. Licensed under the BSD
 * 3-Clause license. For full
 * license text, see LICENSE.TXT file in the repo root or
 * https://opensource.org/licenses/BSD-3-Clause
 */
package com.salesforce.emp.connector.example;

import java.net.MalformedURLException;
import java.net.URL;
import java.util.Map;
import java.util.concurrent.TimeUnit;
import java.util.function.Consumer;

import com.salesforce.emp.connector.BayeuxParameters;
import com.salesforce.emp.connector.EmpConnector;
import com.salesforce.emp.connector.TopicSubscription;

/**
 * An example of using the EMP connector using bearer tokens
 *
 * @author hal.hildebrand
 */
public class BearerTokenExample {
    public static void main(String[] argv) throws Exception {
        if (argv.length < 2 || argv.length > 4) {
            System.err.println(
                "Usage: BearerTokenExample url token topic [replayFrom]");
            System.exit(1);
        }
        long replayFrom = EmpConnector.REPLAY_FROM_EARLIEST;
        if (argv.length == 4) {
            replayFrom = Long.parseLong(argv[3]);
        }
    }
}
```

```

BayeuxParameters params = new BayeuxParameters() {

    @Override
    public String bearerToken() {
        return argv[1];
    }

    @Override
    public URL host() {
        try {
            return new URL(argv[0]);
        } catch (MalformedURLException e) {
            throw new IllegalArgumentException(
                String.format("Unable to create url: %s", argv[0]), e);
        }
    }
};

Consumer<Map<String, Object>> consumer = event -> System.out.println(
    String.format("Received:\n%s", event));
EmpConnector connector = new EmpConnector(params);

connector.start().get(5, TimeUnit.SECONDS);

TopicSubscription subscription = connector.subscribe(argv[2],
    replayFrom, consumer).get(5, TimeUnit.SECONDS);

System.out.println(String.format("Subscribed: %s", subscription));
}
}

```

3. Run the `BearerTokenExample` class, and provide the following argument values.

Argument	Value
<code>username</code>	Username of the logged-in user.
<code>password</code>	Password for the <code>username</code> (or logged-in user).
<code>topic</code>	<code>/u/notifications/ExampleUserChannel</code>

The sample fetches the earliest saved events within the past 24 hours. Optionally, you can supply a replay ID as the last argument to receive different events. Valid values are:

- `-1`—Get all new events sent after subscription.
- `-2`—Get all new events sent after subscription and all past events within the last 24 hours.
- Specific number—Get all events that occurred after the event with the specified replay ID.

4. When you run this client app and generate notifications using the REST resource, the output will look something like:

```

Subscribed: Subscription [/u/notifications/ExampleUserChannel:-2]
Received:
{payload=Broadcast message to all subscribers,

```

```
event={createdDate=2016-12-13T00:57:36.020Z, replayId=1}}
Received:
{payload=Another message, event={createdDate=2016-12-13T00:58:16.591Z, replayId=2}}
```

In the next step, you learn how to generate notifications using REST.

## Generate Events Using REST

Use the Streaming Channel Push REST API resource to generate event notifications to channel subscribers.

You'll use Workbench to access REST API and send notifications. Workbench is a free, open source, community-supported tool (see the Help page in Workbench). Salesforce provides a hosted instance of Workbench for demonstration purposes only—Salesforce recommends that you do not use this hosted instance of Workbench to access data in a production database. If you want to use Workbench for your production database, you can download, host, and configure it using your own resources. You can download Workbench from <https://github.com/ryanbrainard/forceworkbench/releases>.

1. In a browser, navigate to <https://developer.salesforce.com/page/Workbench>.
2. For Environment, select **Production**.
3. For API Version, select 41.0.
4. Accept the terms of service and click **Login with Salesforce**.
5. Once you successfully establish a connection to your database, you land on the Select page.
6. Find the StreamingChannel ID by clicking **queries > SOQL Query** and doing a SOQL query for `SELECT Name, ID FROM StreamingChannel`. Copy down the StreamingChannel ID for `/u/notifications/ExampleUserChannel`.
7. Click **utilities > REST Explorer**.
8. In the URL field, enter `/services/data/v<API version>/objects/StreamingChannel/<Streaming Channel ID>/push`, where `v<API version>` is `v41.0` and `<Streaming Channel ID>` is the ID of the StreamingChannel you found in Step 6.
9. Set the HTTP method by selecting **POST**. In **Request Body**, enter the JSON request body shown in "Example POST REST request body" below.
10. With your Java subscriber client running, click **Execute**. This sends the event to all subscribers on the channel. You should receive the notification with the payload text in your Java client. The REST method response will indicate the number of subscribers the event was sent to (in this case, `-1`, because the event was set to broadcast to all subscribers).

You've successfully sent a notification to a subscriber using generic streaming. Note that you can specify the list of subscribed users to send notifications to instead of broadcasting to all subscribers. Also, you can use the GET method of the Streaming Channel Push REST API resource to get a list of active subscribers to the channel.

 **Example:** Example POST REST request body:

```
{
  "pushEvents": [
    {
      "payload": "Broadcast message to all subscribers",
      "userIds": []
    }
  ]
}
```



# REFERENCE

## CHAPTER 8 PushTopic

Represents a query that is the basis for notifying listeners of changes to records in an organization. This is available from API version 21.0 or later.

### Supported Calls

---

REST: DELETE, GET, PATCH, POST (query requests are specified in the URI)

SOAP: `create()`, `delete()`, `describe()`, `describeSObjects()`, `query()`, `retrieve()`, `update()`

### Special Access Rules

---

- This object is only available if Streaming API is enabled for your organization.
- Only users with "Create" permission can create this record.

### Fields

---

Field	Field Type	Description
<code>ApiVersion</code>	double	Required. API version to use for executing the query specified in <code>Query</code> . It must be an API version greater than 20.0. If your query applies to a custom object from a package, this value must match the package's <code>ApiVersion</code> .  Example value: 41.0 <b>Field Properties:</b> Create, Filter, Sort, Update
<code>Description</code>	string	Description of the PushTopic. Limit: 400 characters <b>Field Properties:</b> Create, Filter, Sort, Update
<code>ID</code>	ID	System field: Globally unique string that identifies a record. <b>Field Properties:</b> Default on create, Filter, Group, idLookup, Sort
<code>isActive</code>	boolean	Indicates whether the record currently counts towards the organization's limit. <b>Field Properties:</b> Create, Default on create, Filter, Group, Sort, Update



Field	Field Type	Description
IsDeleted	boolean	System field: Indicates whether the record has been moved to the Recycle Bin ( <code>true</code> ) or not ( <code>false</code> ). <b>Field Properties:</b> Default on create, Filter, Group, Sort
Name	string	Required. Descriptive name of the PushTopic, such as <code>MyNewCases</code> or <code>TeamUpdatedContacts</code> . Limit: 25 characters. This value identifies the channel and must be unique. <b>Field Properties:</b> Create, Filter, Group, Sort, Update
NotifyForFields	picklist	Specifies which fields are evaluated to generate a notification. Valid values: <ul style="list-style-type: none"> <li>• All</li> <li>• Referenced (default)</li> <li>• Select</li> <li>• Where</li> </ul> <b>Field Properties:</b> Create, Filter, Sort, Update
NotifyForOperations	picklist	Specifies which record events may generate a notification. Valid values: <ul style="list-style-type: none"> <li>• All (default)</li> <li>• Create</li> <li>• Extended</li> <li>• Update</li> </ul> <b>Field Properties for API version 28.0 and earlier:</b> Create, Filter, Sort, Update <b>Field Properties for API version 29.0 and later:</b> Filter, Sort In API version 29.0 and later, this field is read-only, and will not contain information about delete and undelete events. Use <code>NotifyForOperationCreate</code> , <code>NotifyForOperationDelete</code> , <code>NotifyForOperationUndelete</code> and <code>NotifyForOperationUpdate</code> to specify which record events should generate a notification. A value of <code>Extended</code> means that neither create or update operations are set to generate events.
NotifyForOperationCreate	boolean	<code>true</code> if a create operation should generate a notification, otherwise, <code>false</code> . Defaults to <code>true</code> . This field is available in API version 29.0 and later.
NotifyForOperationDelete	boolean	<code>true</code> if a delete operation should generate a notification, otherwise, <code>false</code> . Defaults to <code>true</code> . Clients must connect using the <code>cometd/29.0</code> (or later) Streaming API endpoint to receive delete and undelete event notifications. This field is available in API version 29.0 and later.

Field	Field Type	Description
NotifyForOperationUndelete	boolean	<code>true</code> if an undelete operation should generate a notification, otherwise, <code>false</code> . Defaults to <code>true</code> . Clients must connect using the <code>cometd/29.0</code> (or later) Streaming API endpoint to receive delete and undelete event notifications. This field is available in API version 29.0 and later.
NotifyForOperationUpdate	boolean	<code>true</code> if an update operation should generate a notification, otherwise, <code>false</code> . Defaults to <code>true</code> . This field is available in API version 29.0 and later.
Query	string	Required. The SOQL query statement that determines which record changes trigger events to be sent to the channel.  Limit: 1,300 characters  <b>Field Properties:</b> Create, Filter, Sort, Update

## PushTopic and Notifications

---

The PushTopic defines when notifications are generated in the channel. This is specified by configuring the following PushTopic fields:

- [PushTopic Queries](#)
- [Events](#)
- [Notifications](#)

## CHAPTER 9 StreamingChannel

Represents a channel that is the basis for notifying listeners of generic Streaming API events. Available from API version 29.0 or later.

### Supported Calls

---

REST: DELETE, GET, PATCH, POST (query requests are specified in the URI)

SOAP: `create()`, `delete()`, `describe()`, `describeLayout()`, `describeSObjects()`, `getDeleted()`, `getUpdated()`, `query()`, `retrieve()`, `undelete()`, `update()`

### Special Access Rules

---

- This object is available only if Streaming API is enabled for your organization.
- Only users with “Create” permission can create this record.
- You can create a permission set and grant users read and create access to all streaming channels in the org. This access isn’t for a specific channel, like with user sharing.
- You can apply user sharing to StreamingChannel. You can restrict access to receiving or sending events on a channel by sharing channels with specific users or groups. Channels shared with public read-only or read-write access send events only to clients subscribed to the channel that also are using a user session associated with the set of shared users or groups. Only users with read-write access to a shared channel can generate events on the channel, or modify the actual StreamingChannel record.

### Dynamic Streaming Channel

---

Generic Streaming also supports dynamic streaming channel creation, which creates a StreamingChannel when a client first subscribes to the channel. To enable dynamic streaming channels in your org, from Setup, enter *User Interface* in the *Quick Find* box, then select **User Interface** and enable **Enable Dynamic Streaming Channel Creation**.

### Fields

---

Field	Field Type	Description
Description	string	Description of the StreamingChannel. Limit: 255 characters. <b>Field Properties:</b> Create, Filter, Group, Nillable, Sort, Update <b>Label:</b> Description

---

## StreamingChannel

Field	Field Type	Description
ID	ID	System field: Globally unique string that identifies a StreamingChannel record. <b>Field Properties:</b> Default on create, Filter, Group, idLookup, Sort
IsDeleted	boolean	System field: Indicates whether the record has been moved to the Recycle Bin ( <code>true</code> ) or not ( <code>false</code> ). <b>Field Properties:</b> Default on create, Filter, Group, Sort
IsDynamic	boolean	<code>true</code> if the channel gets dynamically created on subscribe if necessary, <code>false</code> otherwise. <b>Field Properties:</b> Default on create, Filter, Group, Sort
LastReferencedDate	date	The timestamp for when the current user last viewed a record related to this record. <b>Field Properties:</b> Filter, Sort
LastViewedDate	date	The timestamp for when the current user last viewed this record. If this value is null, this record might only have been referenced ( <code>LastReferencedDate</code> ) and not viewed. <b>Field Properties:</b> Filter, Sort
Name	string	Required. Descriptive name of the StreamingChannel. Limit: 80 characters, alphanumeric and “_”, “/” characters only. Must start with “/u/”. This value identifies the channel and must be unique. <b>Field Properties:</b> Create, Filter, Group, idLookup, Sort, Update <b>Label:</b> Streaming Channel Name
OwnerId	reference	The ID of the owner of the StreamingChannel. <b>Field Properties:</b> Create, Default on create, Filter, Group, Sort, Update <b>Label:</b> Owner Name

## CHAPTER 10 Streaming Channel Push

Gets subscriber information and pushes notifications for Streaming Channels.

### Syntax

---

#### URI

`/vXX.X/subjects/StreamingChannel/Channel ID/push`

#### Available since release

29.0

#### Formats

JSON, XML

#### HTTP methods

GET, POST

#### Authentication

Authorization: Bearer *token*

#### Request body

For GET, no request body required. For POST, a request body that provides the push notification payload. This contains the following fields:

Name	Type	Description
<code>pushEvents</code>	array of push event payloads	List of event payloads to send notifications for.

Each push event payload contains the following fields:

Name	Type	Description
<code>payload</code>	string	Information sent with notification. Cannot exceed 3,000 single-byte characters.
<code>userIds</code>	array of User IDs	List of subscribed users to send the notification to. If this array is empty, the notification will be broadcast to all subscribers on the channel.

#### Request parameters

None

#### Response data

For GET, information on the channel and subscribers is returned in the following fields:

## Streaming Channel Push

Name	Type	Description
OnlineUserIds	array of User IDs	User IDs of currently subscribed users to this channel.
ChannelName	string	Name of the channel, for example, <i>/u/notifications/ExampleUserChannel</i> .

For POST, information on the channel and payload notification results is returned in an array of push results, each of which contains the following fields:

Name	Type	Description
fanoutCount	number	The number of subscribers that the event got sent to. This is the count of subscribers specified in the POST request that were online. If the request was broadcast to all subscribers, fanoutCount will be -1. If no active subscribers were found for the channel, fanoutCount will be 0.
userOnlineStatus	array of User online status information	List of User IDs the notification was sent to and their listener status. If <code>true</code> the User ID is actively subscribed and listening, otherwise <code>false</code> .

## Example

The following is an example JSON response of a GET request for `services/data/v29.0/subjects/StreamingChannel/0M6D00000000g7KXA/push`:

```
{
  "OnlineUserIds" : [ "005D0000001QXi1IAG" ],
  "ChannelName" : "/u/notifications/ExampleUserChannel"
}
```

Using a POST request to `services/data/v29.0/subjects/StreamingChannel/0M6D00000000g7KXA/push` with a request JSON body of:

```
{
  "pushEvents": [
    {
      "payload": "hello world!",
      "userIds": [ "005xx000001Svq3AAC", "005xx000001Svq4AAC" ]
    },
    {
      "payload": "broadcast to everybody (empty user list)!",
      "userIds": []
    }
  ]
}
```

the JSON response data looks something like:

```
[
  {
    "fanoutCount" : 1,
    "userOnlineStatus" : {
```

## Streaming Channel Push

```
        "005xx000001Svq3AAC" : true,  
        "005xx000001Svq4AAC" : false,  
    }  
},  
{  
    "fanoutCount" : -1,  
    "userOnlineStatus" : {  
    }  
}  
]
```

## CHAPTER 11 Streaming API Limits

Limits protect shared resources. These default limits are for basic consumers of Streaming API.


If your application exceeds these limits, or you have scenarios for which you need to increase the number of clients per topic or the number of concurrent clients across all topics, contact Salesforce.

### PushTopic Streaming Limits

---

The following limits apply to PushTopic Streaming in all API versions.


Description	Performance and Unlimited Editions	Enterprise Edition	All other supported editions
Maximum number of topics (PushTopic records) per org	100	50	40
Maximum number of clients (subscribers) per topic	2,000	1,000	20
Maximum number of concurrent clients (subscribers) across all topics	2,000	1,000	20
Maximum number of events within a 24-hour period	1,000,000	200,000	50,000 (10,000 for free orgs)
Socket timeout during connection (CometD session)	110 seconds	110 seconds	110 seconds
Timeout to reconnect after successful connection (keepalive)	40 seconds	40 seconds	40 seconds
Maximum length of the SOQL query in the <code>QUERY</code> field of a PushTopic record	1,300 characters	1,300 characters	1,300 characters
Maximum length for a PushTopic name	25 characters	25 characters	25 characters

 **Note:** For free orgs, the maximum number of events within a 24-hour period is 10,000. Free orgs include Developer Edition orgs and trial orgs (all editions), such as partner test and demo orgs created through the Environment Hub. Sandboxes get the same limits as their associated production orgs.



## Generic Streaming Limits

Description	Performance and Unlimited Editions	Enterprise Edition	Professional Edition	Free Orgs
Maximum streaming channels per org	1,000	1,000	1,000	200
Maximum events within a 24-hour period with Generic Streaming (API version 36.0 and earlier)	100,000	100,000	100,000	10,000
Maximum events within a 24-hour period with Durable Generic Streaming (API version 37.0 and later)	1,000,000	200,000	100,000	10,000

 **Note:** Free orgs include Developer Edition orgs and trial orgs (all editions), such as partner test and demo orgs created through the Environment Hub. Sandboxes get the same limits as their associated production orgs.

Generic Streaming has the same limits for the maximum number of clients and maximum number of concurrent clients as PushTopic Streaming. The following limits apply to Generic Streaming and Durable Generic Streaming.

Description	Performance and Unlimited Editions	Enterprise Edition	All other supported editions	
Maximum clients (subscribers) per generic streaming channel		2,000	1,000	20
Maximum concurrent clients (subscribers) across all generic streaming channels		2,000	1,000	20

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