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SAP HANA Streaming Analytics 2.0 SP 04

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# SAP HANA Streaming Analytics: Master Guide

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# 1 SAP HANA Streaming Analytics: Master Guide

Get a high-level understanding of SAP HANA streaming analytics, some of its use cases, and how you can implement it.

# 2 Introduction to SAP HANA Streaming Analytics

SAP HANA streaming analytics enables you to collect, process, and analyze events from streaming sources in real time.

## In this section:

### [About this Document \[page 4\]](#)

This guide is the starting point for information about SAP HANA streaming analytics.

### [What is SAP HANA Streaming Analytics? \[page 5\]](#)

SAP HANA streaming analytics processes streams of incoming event data in real time, and collects and acts on this information.

### [SAP HANA Streaming Analytics within the SAP HANA Platform \[page 7\]](#)

Streaming analytics absorbs incoming events delivered via streams, in real time, and at high rates. It filters and transforms data, and efficiently captures desired portions of the data in the SAP HANA database.

### [Continuous Computation Language \[page 8\]](#)

Continuous Computation Language (CCL) is the primary event processing language of SAP HANA streaming analytics. You define projects using CCL.

### [Utilizing Streaming for the Internet of Things \[page 9\]](#)

The Internet of Things can produce an enormous amount of data to be analyzed and acted upon in real-time. Streaming analytics allows for real-time analysis and automated action.

### [Machine Learning and Streaming Analytics \[page 9\]](#)

You can combine streaming analytics and machine learning algorithms to learn from and make predictions based on incoming data in real time.

### [SAP HANA Streaming Analytics Documentation \[page 11\]](#)

Functionality specific to streaming analytics is detailed in the streaming analytics documentation. SAP HANA documentation also discusses some aspects of streaming analytics.

## 2.1 About this Document

This guide is the starting point for information about SAP HANA streaming analytics.

It provides the following information about streaming analytics:

- Overview
- Use cases
- Implementation and operation

For information about new features introduced in this release, see *What's New in SAP HANA Streaming Analytics*.

## Related Information

[What's New in SAP HANA Streaming Analytics 2.0 SP 04](#)

## 2.2 What is SAP HANA Streaming Analytics?

SAP HANA streaming analytics processes streams of incoming event data in real time, and collects and acts on this information.

Streaming analytics is ideally suited for situations where data arrives as events happen, and where there is value in collecting, understanding, and acting on this data right away. Some examples of data sources that produce streams of events in real time include:

- Sensors
- Smart devices
- Web sites (click streams)
- IT systems (logs)
- Financial markets (prices)
- Social media

Data flows into streaming projects from various sources, typically through adapters, which connect the sources to the streaming analytics server. The streaming projects contain business logic, which they apply to the incoming data, typically in the form of continuous queries and rules. These streaming projects are entirely event-driven, turning the raw input streams into one or more derived streams that can be captured in the SAP HANA database, sent as alerts, posted to downstream applications, or streamed to live dashboards.

### Streaming Cluster Nodes

An SAP HANA streaming analytics cluster consists of one or more nodes, with one node per host. Each tenant is associated with only one cluster. By default, up to seven tenants can run on a streaming host (a host that has the streaming role assigned). You can add more, if needed, by reserving additional ports. To do this, edit the `[multidb] reserved_instance_numbers` property in the `global.ini` file.

#### **i** Note

Throughout the documentation, we also refer to streaming nodes as streaming servers.

A cluster contains one or more workspaces, each with one or more projects. Nodes run and manage the projects and adapters running on those workspaces. All workspaces are available to the entire cluster. You share a project within the cluster or within a workspace with other users. You can adjust the settings of the clustered projects using SAP HANA cockpit.

## Streaming Workspaces

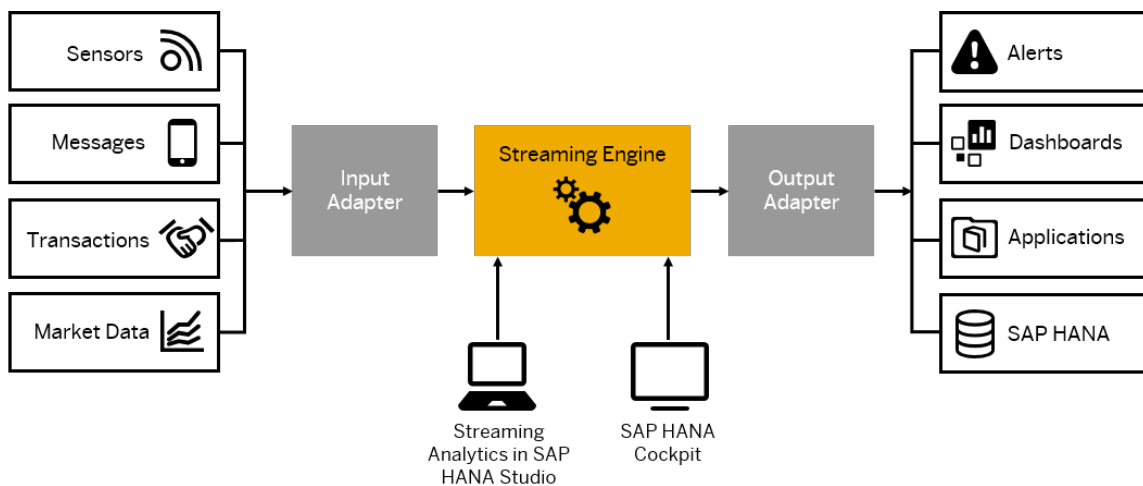
Projects are deployed in at least one workspace on a streaming cluster. A workspace provides a namespace for the project and allows you to control permissions at the workspace level.

## Streaming Projects

A project defines one or more event streams and the business logic applied to incoming event data to produce results. It may also include adapters to establish connections to event sources as well as destinations (including SAP HANA tables). At its most basic level, a project consists of streams, windows, and adapters.

- Adapters connect a stream or window to a data source or destination.
- A stream processes incoming events without retaining and storing data, and produces output events according to an applied continuous query.
- A window receives data, but can also retain and store data. Incoming events can add, update, or delete rows in the window's table.

This figure shows a typical streaming analytics deployment. Continuous queries, developed and tested as projects using the streaming analytics plugin for SAP HANA studio, are deployed to a streaming analytics server. Output adapters translate rows processed by the server into message formats that are compatible with external destinations, such as SAP HANA, and send those messages downstream. SAP HANA cockpit provides an operations console for configuring streaming analytics.



SAP HANA Streaming Analytics Deployment

## Getting Results from a SAP HANA Streaming Analytics Project

The output from streaming analytics can be used in several ways. These options are not mutually exclusive, and can be used in any combination.

You can:

- Push output into SAP HANA database tables, either by logging events in the tables, or by updating database tables based on the results of continuous queries.

- Send output to downstream applications to act on the information. The output can be pushed directly to an application (via an adapter), or published onto a message bus. For example, you can open an urgent work order in response to new information, or change a price based on market conditions.
- Stream output to a live operational dashboard, or other custom UI, typically via WebSockets.
- Start a new streaming project that binds (connects) to an output stream in a running project.
- Query event windows maintained in streaming projects using SAP HANA Smart Data Access.

## 2.3 SAP HANA Streaming Analytics within the SAP HANA Platform

Streaming analytics absorbs incoming events delivered via streams, in real time, and at high rates. It filters and transforms data, and efficiently captures desired portions of the data in the SAP HANA database.

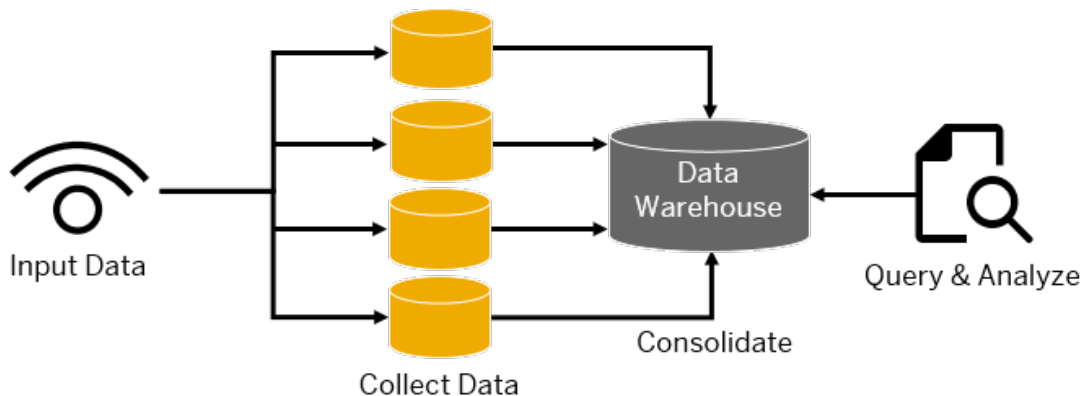
Streaming analytics provides active monitoring of event streams, with the ability to generate immediate alerts, notifications or responses when something happens.

Streaming analytics extends the capabilities of the SAP HANA platform by:

- Capturing data that is arriving at high speeds as individual events.
- Micro-batching and parallel processing to optimize load speeds.
- Capturing events that are published from such streaming sources as a message bus.
- Filtering, transforming or enriching incoming data so that it is in the form you require.
- Prioritizing and directing data to SAP HANA, or in other directions such as into Hadoop.
- Monitoring incoming event streams, watching for trends and patterns, and detecting missing events.
- Continuously updating and monitoring aggregate statistics.
- Generating alerts and notifications and initiating immediate responses.

Streaming analytics is not a replacement for databases. While databases excel at storing and querying static data, and reliably processing transactions, streaming analytics excels at continuously analyzing fast moving streams of data.

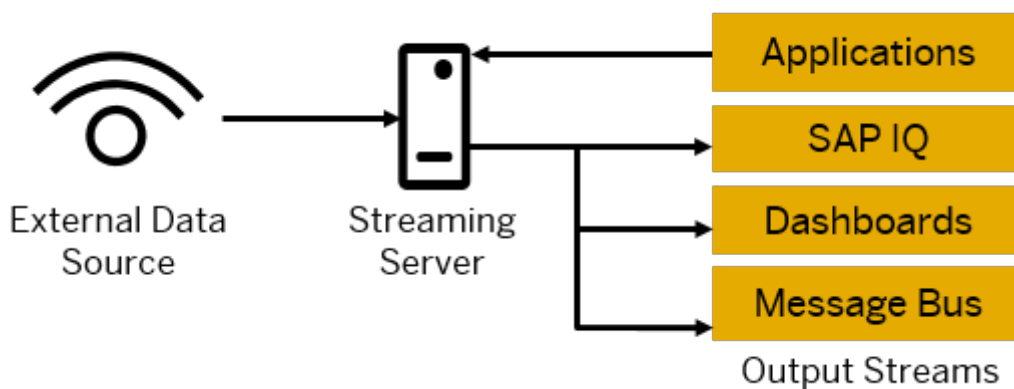
- Traditional databases must store all data on disk before beginning to process it.
- Streaming analytics can evaluate queries incrementally as data arrives.



Traditional Business Intelligence: On-Demand Queries



Streaming analytics is not an in-memory database, although it stores all data in memory. Streaming analytics is optimized for continuous queries, rather than on-demand queries and transaction processing.



Query Runs Continuously on Changing Data Minimal Latency – Fast Response

## 2.4 Continuous Computation Language

Continuous Computation Language (CCL) is the primary event processing language of SAP HANA streaming analytics. You define projects using CCL.

CCL is based on Structured Query Language (SQL), and adapted for stream processing.

CCL supports sophisticated data selection and calculation capabilities, including features such as data grouping, aggregations, and joins. However, CCL also includes features that are required to manipulate data during real-time continuous processing, such as windows on data streams, and pattern and event-matching.

A SQL query typically executes only once each time it is submitted to a database server, and is resubmitted every time a user or an application needs to re-execute the query. By contrast, a CCL query can continuously process dynamic data, making it a key distinguishing feature. Once you define a CCL query in the project, it is registered for continuous execution and stays active indefinitely. When the project is running in the streaming analytics server, a registered query executes each time an event arrives from one of its datasources.

Although CCL borrows SQL syntax to define continuous queries, the streaming analytics server does not use a SQL query engine. Instead, it compiles CCL into a highly efficient byte code that is used by the streaming analytics server to construct continuous queries within the data-flow architecture.

CCL queries are converted to an executable form by the CCL compiler. Streaming analytics servers are optimized for incremental processing, so the query optimization is different than for databases. Compilation is typically performed within the SAP HANA studio, but you can also compile projects by invoking the CCL compiler from the command line.

### CCLScript

CCLScript is a scripting language that brings extensibility to CCL, allowing you to create custom operators and functions that go beyond standard SQL. CCLScript consists of expressions used to compute values from other values, as well as variables and looping constructs, with the ability to organize instructions in functions.

CCLScript syntax is similar to C and Java, though it also has similarities to languages that solve relatively small



programming problems, such as AWK and Perl. CCLScript also allows you to define any complex computations using procedural logic rather than a relational paradigm. You can learn more about CCL Script in the *SAP HANA Streaming Analytics: CCL Reference*.

## Related Information

[SAP HANA Streaming Analytics: CCL Reference](#)

## 2.5 Utilizing Streaming for the Internet of Things

The Internet of Things can produce an enormous amount of data to be analyzed and acted upon in real-time. Streaming analytics allows for real-time analysis and automated action.

With streaming analytics, you can capture data arriving as individual events (potentially vast numbers of events per second), and use micro-batching and parallel processing to optimize load speeds. You can capture only the data you want, in the form you need it, and prioritize, filter, transform, or enrich the data as required.

You can actively monitor data arriving from sensors and smart devices, and set alerts to be triggered when immediate attention is warranted, for example, alerting operations staff to imminent equipment failure or targeting marketing offers to customers based on context.

For information on using streaming analytics with edge components, see *Introduction to Streaming Lite*.

## Related Information

[Introduction to Streaming Lite \[page 24\]](#)

## 2.6 Machine Learning and Streaming Analytics

You can combine streaming analytics and machine learning algorithms to learn from and make predictions based on incoming data in real time.

Streaming analytics provides both supervised and unsupervised machine learning algorithms. Both types of algorithms are specifically optimized to deal with streaming data; the algorithms can respond in real time without onerous long-term storage of massive amounts of previously seen data.

We currently support four kinds of incremental machine learning functions:

- **Hoeffding Tree Training for Classification**, which continuously works to discover predictive relationships, even as the streaming data changes.
- **Hoeffding Tree Scoring for Classification**, which applies the trained predictive model to the data.

- **Decision Tree Scoring**, which applies a predictive model to trained models imported from SAP HANA tables.
- **DenStream Clustering**, which groups and prunes data object points based on their weighted significance.

Traditional supervised learning algorithms train data models based on historical, static data. In the traditional scenario, training and retraining are infrequent events that require a large pre-existing data set to be maintained. Once training is complete, a learned model is stored in a table. When new data arrives, the scoring function makes predictions based on this stored model. As patterns change, the model must be retrained with more historical, labeled, data to ensure the accuracy of the algorithm. In contrast, supervised learning in streaming can continuously learn as new data arrives and is labeled, thus allowing accurate scoring in real time, which adapts to changing situations.

Traditional unsupervised learning algorithms analyze a large dataset to detect hidden patterns in data, without any labels being provided to the algorithm. When new data needs to be analyzed, the entire dataset must be reexamined to determine patterns. Conversely, unsupervised learning in streaming can detect novel patterns in streaming data in real time without any reanalysis of previously examined data.

Combining streaming analytics with integrated machine learning algorithms lets you leverage both supervised and unsupervised learning to train models, then score and cluster trained data. SAP HANA streaming analytics does all of this in real time with modest memory and storage requirements.

There are many applications for this capability. For example:

- You could train a model using census data such as age, education level, marital status, and postal region to predict, with a specific probability of certainty, the receptivity to purchasing a financial product such as a mortgage.
- You could cluster data from social media feeds to analyze public sentiment, and predict a response to a product.
- As data streams in, you could set up threat detection by analyzing malicious threats, and predicting how they might appear in the future.

Use machine learning functions within a streaming project through CCL elements. To use a function, first define its model and configure its parameters. You can add, edit, or delete models either through SAP HANA studio, using the data services view in the SAP HANA Streaming Development perspective, or through the streaming runtime tool for SAP Web IDE for SAP HANA. Once configured, use saved models in streaming projects to run analytic algorithms on sets of incoming data.

When you create a model, schemas are automatically created so if you accidentally delete them, you can simply create a new model to recreate them. To learn how to do this, see [Creating a Model](#) in the streaming analytics documentation.

For more information, see *Machine Learning with Streaming* in the *SAP HANA Streaming Analytics: Developer Guide*.

## Related Information

[SAP HANA Streaming Analytics: Developer Guide](#)  
[Machine Learning with Streaming Analytics](#)  
[Workflow: Using Machine Learning with Streaming in Streaming Runtime Tool](#)  
[Workflow: Using Machine Learning with Streaming in SAP HANA Studio](#)  
[Model Management](#)

[Why Machine Learning with Streaming is a Winning Combination](#)

[Applying Machine Learning to Real Time Streaming Analytics - SAP TechEd Lecture of the Week](#)

[Machine Learning Algorithms - Hoeffding Tree](#)

[Machine Learning Algorithms - DenStream Clustering](#)

## 2.7 SAP HANA Streaming Analytics Documentation



Functionality specific to streaming analytics is detailed in the streaming analytics documentation. SAP HANA documentation also discusses some aspects of streaming analytics.

The documentation for SAP HANA streaming analytics is available on the SAP Help Portal at [https://help.sap.com/viewer/p/HANA\\_STREAMING](https://help.sap.com/viewer/p/HANA_STREAMING).

<b><i>SAP HANA Streaming Analytics: Master Guide</i></b>	Use this guide as your entry point for getting familiar with SAP HANA streaming analytics at a high-level and some of its use cases. Plan your installation based on the provided implementation and operation details.
<b><i>What's New in SAP HANA Streaming Analytics</i></b>	Use this guide to learn about new features or changed functionality. See concise feature summaries for each release.
<b><i>SAP HANA streaming analytics: Installation and Update Guide</i></b>	Use this guide to learn how to install, update, or uninstall SAP HANA streaming analytics. Learn about hardware and software requirements, and how to troubleshoot your installation. This guide also shows you how to install the streaming lite specialized component.
<b><i>SAP HANA Streaming Analytics: Configuration and Administration Guide</i></b>	Use this guide to learn how to configure and administer SAP HANA streaming analytics. It covers everything from configuring streaming analytics for the first time, or configuring clusters and external database access, to deploying adapters and projects to a cluster and monitoring and administering streaming analytics using SAP HANA cockpit.
<b><i>SAP HANA Streaming Analytics: Security Guide</i></b>	Use this guide to learn how to administer security across SAP HANA streaming analytics. Learn about security topics such as sandboxing, user authorization policies, SSL connections, generating keys and trust stores, and encrypting passwords.
<b><i>SAP HANA Streaming Analytics: Developer Guide</i></b>	Use this guide to get started and get familiar with the concepts and components of streaming analytics. Learn about Continuous Computation Language (CCL) and how to use it to develop streaming analytics projects through the SAP HANA Streaming Development and SAP HANA Streaming Run-Test perspectives for SAP HANA studio.
<b><i>SAP HANA Streaming Analytics: CCL Reference</i></b>	Use this guide as a reference point as you develop more complex SAP HANA streaming analytics projects. If you are experienced with CCL, learn how to customize your project beyond the basics with CCL language components, statements, clauses, and functions, as well as by incorporating CCL Script into a streaming project.
<b><i>SAP HANA Streaming Analytics: Examples Guide</i></b>	Use this guide to learn more about SAP HANA streaming analytics, its components, and CCL by using the CCL examples included with it.

<b><i>SAP HANA Streaming Analytics: Adapters Guide</i></b>	Use this guide to learn how to configure and optimize the input and output adapters, as well as the Streaming Web Service and Web Services Provider that are included with streaming analytics, to subscribe to and publish data.
<b><i>SAP HANA Streaming Analytics: Building Custom Adapters</i></b>	Use this guide to learn how to design and create a custom adapter using the streaming analytics adapter toolkit.
<b><i>SAP HANA Streaming Analytics: SDK Guide</i></b>	Use this guide to learn how to connect, publish, and subscribe to streaming projects using the SDK included with streaming analytics.
<b><i>SAP HANA Streaming Analytics: Utilities Guide</i></b>	Use this guide to learn how to use the full suite of executables provided with SAP HANA streaming analytics. Use these executables to do everything from managing user permissions to starting and stopping an adapter.
<b><i>SAP HANA Streaming Analytics: Troubleshooting Guide</i></b>	Use this guide to work around common performance and connectivity issues. Troubleshoot issues such as connecting to a cluster or a project, or failure to start an adapter.

## Related Information

[What's New in SAP HANA Streaming Analytics 2.0 SP 04](#)  
[SAP HANA Streaming Analytics: Installation and Update Guide](#)  
[SAP HANA Streaming Analytics: Configuration and Administration Guide](#)  
[SAP HANA Streaming Analytics: Security Guide](#)  
[SAP HANA Streaming Analytics: Developer Guide](#)  
[SAP HANA Streaming Analytics: CCL Reference](#)  
[SAP HANA Streaming Analytics: Examples Guide](#)  
[SAP HANA Streaming Analytics: Adapters Guide](#)  
[SAP HANA Streaming Analytics: Building Custom Adapters](#)  
[SAP HANA Streaming Analytics: SDK Guide](#)  
[SAP HANA Streaming Analytics: Utilities Guide](#)  
[SAP HANA Streaming Analytics: Troubleshooting Guide](#)  
[SAP Developer Center](#)   
[SAP HANA Streaming Analytics YouTube Playlist](#) 

## 3 Use Cases

Streaming analytics can be applied to many different use cases.

The overall process is similar, regardless of the use case:

1. Equipment sensors can stream information about status and events back to a central SAP HANA system. These sensors could be monitoring statistics such as humidity level and temperature, or machine status.
2. The devices can post messages to the SAP HANA system through an adapter, or through a customized interface such as the Streaming Web Service.
3. The messages are consumed by streaming analytics, which applies filters to transform or normalize the data, thus capturing high-value information in the SAP HANA database. For example, if you have sensors that track humidity levels and temperature data, as data from these sensors flows in, you can isolate the temperature and humidity values and join them to a table of values from the SAP HANA database.
4. The streaming analytics model continuously computes a set of summary information that is streamed to a live operational dashboard. For example, you could look at the current data (in the stream) and compare it with time-stamped entries in the SAP HANA table to compare current values to values that are 5, 10, or 15 minutes old. You could use this data to identify trends: Is your equipment heating up at a steady rate, or too quickly? What impact does humidity play on machine performance?
5. The streaming analytics data model also actively monitors the incoming data for conditions that warrant immediate action or attention, and generates alerts and notifications (by sending an email or text message) when those scenarios are detected.

## 4 Use Case Illustration: Bicycle Sharing Program

By way of illustration, streaming analytics could be used to enhance a solution designed to manage an urban bicycle sharing program.

Every bicycle share station in the Urban Bicycle Sharing Program sends information back to the operations center:

- Check-out events (bike ID, time, location, user)
- Check-in events (bike ID, time, location, user, bike status)
- Inventory events (periodic)
- Heartbeat events
- Service requests

Bicycle stations send this information as HTTP messages to the Web Services Provider connected through REST.

Streaming analytics filters and normalizes the data. Since the bike share stations are not all the same age, message formats differ by station. Streaming analytics normalizes the data into a common data model in SAP HANA.

- Check-in events are sent to one SAP HANA database table.
- Check-out events are sent to another table.
- Service requests are sent to a third.
- Inventory events and heartbeat events are not stored in the SAP HANA database, but are written to a file to maintain an archive.

Streaming analytics also correlates each check-in event with the preceding check-out event for that bicycle, computes the duration, and records a usage event in the SAP HANA database. This usage event contains the start and end times and locations.

Streaming analytics monitors available in-service inventory at each station. If the inventory falls below the set target number for a station (each station can have a different target inventory), an alert is sent to the redistribution van to deliver bicycles to that station. Streaming analytics determines the alert priority using various factors, including the time of day, weather, and station location. In addition, streaming analytics monitors heartbeats and inventory, and issues an alert for a station that is not reporting data. Streaming analytics also monitors check-in events and sends an alert to the redistribution van if a station has reached the maximum desirable capacity for that station.

The streaming analytics monitor compares inventory events to check-in and check-out events to detect discrepancies. It streams data to a live operational dashboard in the operations center, indicating healthy stations.

# 5 Implementation and Operation

The implementation and operation of streaming analytics depends on the installation scenario and technical deployment.

## In this section:

### [Deployment Options \[page 15\]](#)

You can install SAP HANA and SAP HANA streaming analytics each on a dedicated server (referred to as a dedicated host deployment) or on the same server (referred to as a same host deployment).

### [License Keys \[page 16\]](#)

An SAP HANA streaming analytics license, separate from the SAP HANA license, is required for streaming analytics.

### [Installation \[page 17\]](#)

SAP HANA and SAP HANA streaming analytics are delivered on separate installation media. Streaming analytics has three installation packages available.

### [Updates \[page 18\]](#)

Upgrade your system using one of two methods: regular and optimized.

### [Security \[page 18\]](#)

User authentication for streaming analytics relies on standard SAP HANA authentication, whereas roles and permissions related to streaming are managed using either the SAP HANA cockpit or the streaming cluster administration utility.

### [Administration \[page 20\]](#)

You can use the SAP HANA cockpit, the streaming analytics runtime tool for SAP Web IDE, or SAP HANA studio to administer and monitor SAP HANA streaming analytics.

### [Development \[page 21\]](#)

There are a number of ways to create, edit, and deploy SAP HANA streaming analytics projects. The most common approach is to start by using the design time tools that are available for SAP HANA.

## 5.1 Deployment Options

You can install SAP HANA and SAP HANA streaming analytics each on a dedicated server (referred to as a dedicated host deployment) or on the same server (referred to as a same host deployment).

Additional streaming hosts can be added to the streaming cluster independently of the number of SAP HANA core hosts.

Before installing SAP HANA and streaming analytics on the same host, make sure your host has sufficient resources for both. For example, it should have a good number of CPU cores and NUMA nodes. To help manage resource use, the system administrator can bind streaming processes to CPU cores. Use the `numactl - hardware` command to figure out how many NUMA nodes are available and what range of CPU cores are



available on each node. Then, you can bind a streaming analytics server to CPU cores across NUMA nodes – utilizing all cores in a NUMA node before utilizing more NUMA nodes, as needed. You can do this by setting processor affinities in the CCR Project Configuration editor in the streaming analytics plugin for HANA studio or by using the `taskset -c <range>` command.

You can only deploy SAP HANA streaming analytics in an SAP HANA tenant database system. For more information about the architecture of tenant database systems, see the section *Overview of SAP HANA Architecture* in the *SAP HANA Administration Guide*.

To install SAP HANA and streaming analytics for non-production and test purposes, install streaming analytics on the master SAP HANA host. To learn more, see [Installing Same Host Deployment](#) in the streaming analytics documentation.

The streaming analytics client can be installed on a host running Linux or Windows, and the streaming analytics plugin for SAP HANA studio can be installed on a host running Linux, Windows, or MacOS. If you're installing the streaming analytics plugin for SAP HANA studio on Windows, you may also need to download and install some OS updates.

## Related Information

[SAP HANA Administration Guide](#)

[SAP HANA Streaming Analytics: Installation and Update Guide](#)

[Updated Installation Videos](#) 

## 5.2 License Keys


An SAP HANA streaming analytics license, separate from the SAP HANA license, is required for streaming analytics.

Only one SAP HANA streaming analytics license is required per installation of streaming analytics, regardless of the number of streaming hosts within the single SAP HANA system.

Here's a summary of the licenses offered:

- When you first install streaming analytics, you'll get a temporary 90-day trial license. After that period, you'll need a permanent one.
- There are two types of permanent license keys available for SAP HANA and its options: unenforced and enforced. The difference between the two is that your system will not lock down with an unenforced license key if its memory consumption exceeds the licensed amount of memory.
- If your permanent license expires, you'll receive a temporary 28-day license.

You can get streaming analytics license for your SAP HANA system through the [SAP Support Portal](#) .

The process is similar to requesting an SAP HANA license, except you pick **SAP HANA Streaming Analytics** when choosing a license type. Find out more about it in the [blog](#) .

### i Note

Make sure to reapply for a permanent license during this time period, or else streaming analytics will stop working.

License keys for streaming analytics are generated from SAP Service Marketplace and installed following the same process as SAP HANA core licenses. For more information, see *Managing Licenses* in the *SAP HANA Administration Guide*.

## Related Information

[SAP HANA Administration Guide](#)

## 5.3 Installation

SAP HANA and SAP HANA streaming analytics are delivered on separate installation media. Streaming analytics has three installation packages available.

1. The streaming server package contains the streaming analytics server and all of the tools to administer the server, including adapters and the streaming command line tools. When you install this package, add one or more streaming analytics hosts, one for every streaming node.
2. The streaming client package contains the set of provided adapters for connecting to other data sources, the SDK, the streaming ODBC driver and driver manager, and the streaming command line tools.
3. The streaming studio plugin package contains the streaming analytics plugin for SAP HANA studio, which allows for visual development of streaming projects.

Both the SAP HANA server and the SAP HANA client are required in order to use streaming analytics (unless you have another system that is already able to connect to a streaming analytics server, in which case the SAP HANA client is not required). If you have SAP HANA installed and want to install streaming analytics:

- SAP HANA Platform Edition SPS 09 or later is a prerequisite. If you do not have SPS 09 or later, you must upgrade. See the *SAP HANA Server Installation and Update Guide*.
- You'll need to download streaming analytics from the SAP Support Portal. Extract the download using the SAPCAR utility (which you can also download from the same place), and then install it using the SAP HANA platform lifecycle management tool.
- Once you have upgraded to the latest SAP HANA support package stack, install streaming analytics. See the *SAP HANA Streaming Analytics: Installation and Update Guide*.

### i Note

After installing SAP HANA streaming analytics, use the `hdblcm` or `hdblcmgui` tool to add streaming analytics hosts as needed. For more information, see the *SAP HANA Streaming Analytics: Installation and Update Guide*.

## Related Information

[SAP HANA Streaming Analytics: Installation and Update Guide](#)

[SAP HANA Server Installation and Update Guide](#)

[Updated Installation Videos](#) 

[Studio Plugin Installation](#) 

## 5.4 Updates

Upgrade your system using one of two methods: regular and optimized.

A regular update updates your SAP HANA system (including streaming analytics) in one step, but requires system downtime for the entire process. An optimized update updates in a two-phased process, requiring system downtime only for the second phase.

To migrate existing work from ESP to streaming analytics, before using older ESP projects (5.1 SP08 or earlier) in streaming analytics, you'll need to migrate some datatypes. This comes in two parts:

1. Running the `streamingmigratedatatypes` utility on each CCL project file that you're migrating.
2. Manually editing some tags in custom adapter configuration files.

To learn more, see [Migrating Existing SAP Event Stream Processor Projects to SAP HANA Streaming Analytics](#) in the streaming analytics documentation.

## Related Information

[Updating SAP HANA Streaming Analytics](#)

[Updating Smart Data Streaming \(and SAP HANA\)](#) 

## 5.5 Security

User authentication for streaming analytics relies on standard SAP HANA authentication, whereas roles and permissions related to streaming are managed using either the SAP HANA cockpit or the streaming cluster administration utility.

## User Authorization in Streaming

You can access SAP HANA cockpit using your SAP HANA username and password. In addition to standard SAP HANA users, streaming analytics provides two preconfigured users:

- The SYS\_STREAMING user can perform policy administration functions such as granting and revoking privileges in streaming analytics.
- The SYS\_STREAMING\_ADMIN user has privileges to perform all tasks in streaming analytics, except publishing or subscribing to streams.

The SAP HANA user SYSTEM has privileges to perform all tasks in streaming analytics.

Roles and permissions specifically related to streaming analytics are managed using either the SAP HANA cockpit or the `streamingclusteradmin` utility. For information on how to use the SAP HANA cockpit to manage roles and permissions, see the [Managing Streaming Permissions](#). For more detailed information on managing access control for the streaming cluster and projects, see the [User Authorization Policies](#).

## User Authorization in the Streaming Plugin for SAP Web IDE and the Streaming Runtime Tool

Working with streaming projects entirely through SAP Web IDE and the streaming runtime tool does not require any streaming analytics permissions. Instead, user authorization is based on XS Advanced (XSA) roles and role templates. See [Getting Started in SAP Web IDE for SAP HANA](#) and [Streaming Analytics Runtime Tool](#) in the *SAP HANA Streaming Analytics: Developer Guide* for more information.

## Sandboxing

Sandboxing restricts access to project data files in a cluster and limits the directory that adapters and log stores use for reading and writing. Because of this, a sandbox makes sure that adapters and streaming analytics projects don't share data within the same workspace, and don't overwrite any important files.

In streaming analytics, sandboxing is enabled by default as a security feature and can't be disabled.

To learn more, see [Sandboxing](#) in the streaming analytics documentation.

## Related Information

[SAP HANA Streaming Analytics: Developer Guide](#)

[SAP HANA Security Guide](#)

[SAP HANA Streaming Analytics: Security Guide](#)

[SAP HANA Streaming Analytics: Configuration and Administration Guide](#)

## 5.6 Administration

You can use the SAP HANA cockpit, the streaming analytics runtime tool for SAP Web IDE, or SAP HANA studio to administer and monitor SAP HANA streaming analytics.

### SAP HANA Cockpit

Most streaming analytics managing and monitoring tasks can be performed through the SAP HANA cockpit, which provides an enhanced view of your streaming environment within the context of your SAP HANA system.

For example, you can edit your cluster configuration by:

- setting the key store encrypted password
- configuring the heartbeat interval, timeout, and timeout retry
- editing node names
- managing settings for the Streaming Web Service and the Web Services Provider

The SAP HANA cockpit displays content arranged in tiles. From these tiles, you can drill down into the relevant application for more detailed information and functions. To access these tiles, the database user needs to have the CATALOG READ system privilege.

The SAP HANA cockpit implements a role-based concept so that users only have access to content for which they are authorized.

For an overview, see *SAP HANA Cockpit* in the *SAP HANA Administration Guide*. For streaming analytics-specific details, see *Managing Streaming Analytics with SAP HANA Cockpit* in the *SAP HANA Streaming Analytics: Configuration and Administration Guide*.

### Streaming Analytics Runtime Tool

The streaming analytics runtime tool works together with the SAP HANA streaming analytics plugin for SAP Web IDE. You can use this tool to do various administrative tasks such as starting and stopping projects, creating and managing data services, creating, importing, and managing machine learning models, and more. See the Streaming Analytics Runtime Tool section in the *SAP HANA Streaming Analytics: Developer Guide* for more details.

### Related Information

[SAP HANA Administration Guide](#)

[SAP HANA Streaming Analytics: Configuration and Administration Guide](#)

[SAP HANA Streaming Analytics: Developer Guide](#)

[Managing Streaming Analytics with SAP HANA Cockpit](#)

[Create or Enable a Cockpit User](#)

## 5.7 Development

There are a number of ways to create, edit, and deploy SAP HANA streaming analytics projects. The most common approach is to start by using the design time tools that are available for SAP HANA.

### SAP Web IDE for SAP HANA

SAP Web IDE for SAP HANA is a browser-based, integrated development environment (IDE). Use the streaming analytics plugin for the SAP Web IDE to create and build CCL projects.

Using SAP Web IDE, you can create and edit CCL and CCR files directly through any browser. You can view and edit visual representations of your projects or edit the CCL directly using the text or visual tabs of the CCL Editor. Using the streaming analytics runtime tool, you can run and test the projects you deployed using SAP Web IDE.

Deciding whether you should use streaming analytics or not depends on your streaming analytics system:

If you use...	Then use...
SAP HANA streaming analytics for the SAP HANA developer edition	SAP Web IDE for SAP HANA
SAP HANA streaming analytics, on-premise version	<ul style="list-style-type: none"><li>• SAP Web IDE for SAP HANA: use any browser.</li><li>• SAP HANA studio: use local application.</li></ul>

If you choose to try out streaming analytics for an on-premise installation, you may need to manually install XS Advanced (XSA), the streaming service broker, and the streaming analytics runtime tool. See the *SAP HANA Streaming Analytics: Installation and Update Guide* for more information.

For more information on Web IDE, see *Getting Started in SAP Web IDE for SAP HANA*, *Developing Projects*, and *Running and Testing Projects*.

### SAP HANA Studio with the SAP HANA Streaming Analytics Plugin

SAP HANA studio is the Eclipse-based development environment for building applications that run on SAP HANA. The streaming analytics plugin for SAP HANA studio provides two specific perspectives to create, edit, test, and deploy CCL projects: the SAP HANA Streaming Run-Test and SAP HANA Streaming Development perspectives.

- The SAP HANA Streaming Development perspective includes a choice of two different editors – a syntax-aware text editor, and a drag-and-drop visual editor. You can easily switch between the visual editor and the text editor at any time, and any changes you make in one editor are reflected in the other.
- The SAP HANA Streaming Run-Test perspective provides a variety of tools that make it easy to test streaming projects. You can deploy projects to the server, stream in sample data, and view output. Additional tools facilitate debugging and performance tuning.

You can maintain streaming projects in the SAP HANA repository and include them in SAP HANA Delivery Units.

For more information, see *Getting Started with the Streaming Plugin for SAP HANA Studio* and *Developing Projects*.

## Application-Generated Content

Applications can generate and deploy dynamic streaming content. Similar to the way applications can create database content by executing SQL DDL commands, applications can create and deploy CCL projects. An application can deploy predefined CCL projects as needed, or alternatively, an application can dynamically create and deploy CCL. The SAP HANA streaming analytics server provides a REST interface that applications can use to deploy CCL to the server. Alternatively, there is a Java library that you can use for applications written in Java. These applications can connect to the SAP HANA system via TCP sockets. For Java programmers, there is also a library to read and write CCL files.

## Text Editors, Command Line Tools, and Other Methods

Because streaming projects are simple text files, you can also use any editor to create, view, and edit CCL projects. You can compile and deploy through the command line tools (which are documented in the *SAP HANA Streaming Analytics: Utilities Guide*), the REST interface provided by the streaming analytics server, or the Java API.

## Project Deployment

You can publish data from streaming analytics to multiple destinations, including multiple SAP HANA systems even if they don't have streaming analytics installed. To publish to an SAP HANA system, you'll need to use the SAP HANA Output adapter.

There are different deployment options; hot and warm. Hot standby deployment is when two instances of a project are running simultaneously in a cluster. Hot standby projects are typically configured so that the cluster starts the two instances of the project on different nodes. This avoids the risk of a single point of failure at the project level. Note that in earlier versions of the documentation, we referred to hot standby as active-active. To deploy a project in hot standby mode, set `<Project ha="true">` in the project configuration (.ccr) file. You can edit this file using the CCR Project Configuration editor in SAP HANA studio or using the SAP Web IDE.

Warm standby is when a failed project switches to another server to continue processing. Failover typically happens during a project restart, though a strong positive affinity to a node that isn't available can prevent a project from restarting. You can limit restarts based on failure intervals and restarts per interval. To enable warm standby, use the CCR Project Configuration editor in SAP HANA studio and set the Failover property to enabled. You'll also want to specify an interval and the number of restart attempts a project can have within a given interval. You can also use SAP Web IDE to do this.

Hot standby deployment and warm standby are about ensuring an instance of a project is always running to avoid data loss, while system replication is about ensuring that a second instance of your entire system is ready to take over in case of a data center outage. We recommend learning about all three to determine how they can benefit your specific setup.



## Related Information

[SAP HANA Streaming Analytics: Developer Guide](#)

[SAP HANA Streaming Analytics: Utilities Guide](#)

# 6 Introduction to Streaming Lite

Streaming lite is a to-the-edge component that can gather, filter, aggregate, and send data through the Streaming Web Service to an SAP HANA streaming analytics project.

Streaming lite is designed to deploy streaming analytics projects on remote gateway devices: you can use streaming analytics for CCL development and testing, and then deploy the project in streaming lite. Streaming lite is a self-contained, independent server that is not a part of the SAP HANA streaming analytics cluster. There is certain functionality that is not available when using streaming lite. For complete details, see the *Streaming Lite* section of the *SAP HANA Streaming Analytics: Developer Guide*. For more information on the Streaming Web Service, see the *SAP HANA Streaming Analytics: Adapters Guide*.

## Streaming Lite Platform and Installation

Streaming lite is optional and not required as part of a standard streaming analytics installation. The streaming lite package from SAP Service Marketplace is downloadable as a separate component only. As a separate component, streaming lite can run on the following platforms, independent of the platform on which you are running SAP HANA streaming analytics:

Platform for Streaming Lite	Product Build Environment	Product Build Compiler	Supported Operating System	Minimum Requirements
Linux -x86 64 bit	RHEL 7.4	GCC 6.3.1	RHEL 7.4	512MB RAM, 1GB HDD, 1 core CPU
Linux-ARM 32 bit	RHEL 7.4	GCC (gcc-linaro-6.3.1-2017.05-x86_64_arm-linux-gnueabihf)	Raspbian Jessie (kernel 4.4+)	Raspberry Pi 3 Model B (ARMv8-A) with default configuration

You can download the Linux and/or the ARM versions of the streaming lite tarball if you have an SAP HANA streaming analytics license for any platform. For detailed instructions, see the [Installing the Streaming Lite Specialized Component](#) topic in the *SAP HANA Streaming Analytics: Installation and Update Guide*.

## Related Information



- [Streaming Lite](#)
- [SAP HANA Streaming Analytics: Developer Guide](#)
- [SAP HANA Streaming Analytics: Installation and Update Guide](#)
- [SAP HANA Streaming Analytics: Adapters Guide](#)

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