

# Exploring Analytics in SAP S/4HANA Cloud: Capabilities, Integration, and Business Value

Mahesh Babu Munjala

Information & Technology Enterprise Systems & Processes, CSL

**Abstract** - With the accelerated adoption of modern cloud-based enterprise resource management (ERP) systems, organizations recognize the importance of integrated analytics capabilities to drive data driven business insights and gain a competitive edge. This study explores the real-time analytics architecture of SAP S/4HANA Cloud, a leading cloud ERP system, and its potential to improve decision-making and enhance operational excellence. Existing research has primarily focused on analytics in the conventional S/4HANA system. Thus, technical documentation, industry blogs, and implementation expertise are used to provide an overview of SAP S/4HANA Cloud's analytics capabilities, including architecture, data modeling, extensibility, business value, and external integrations. Research shows that the SAP S/4HANA Cloud provides applications for monitoring KPIs, generating reports, visualizing data using embedded SAP Analytics Cloud (SAC), and seamless OData integration. Technology leaders will gain valuable perspectives on how modern cloud ERPs like S/4HANA Cloud, with their unified analytics capabilities drive faster response times to market changes and optimize costs through insights influencing the evolution of intelligent enterprise systems.

**Key Words:** SAP S/4HANA Cloud, embedded analytics, embedded SAC, Cloud ERP, SAP HANA, S/4HANA Cloud analytics

## 1. INTRODUCTION

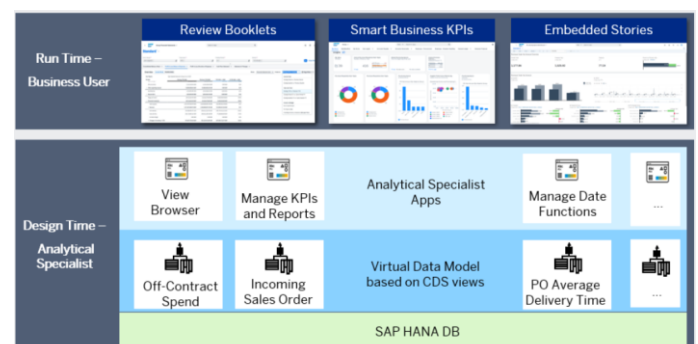
The SAP S/4HANA Cloud [1] offers a wide range of business applications and services, allowing organizations to enhance their performance, lower costs, and gain valuable insights from data for operational improvements [2]. This cloud-based ERP system promotes process streamlining in line with industry standards while providing flexibility and scalability to meet evolving business requirements. One of the many functionalities of SAP S/4HANA Cloud is its embedded analytics capabilities, which enable organizations to perform real-time reporting and analysis on live transactional data.

The embedded analytics functionality in SAP S/4HANA Cloud leverages the high-speed processing and large-scale data analysis capabilities of the SAP HANA [3] in-memory database. By seamlessly integrating business intelligence capabilities, S/4HANA Cloud eliminates the need for separate, standalone analytics and visualization tools to enable analytics on operational data.

SAP S/4HANA Cloud incorporates SAP Analytics Cloud (SAC) [4] to offer advanced analytical features within the ERP system [5]. This integration is known as embedded SAC and provides a subset of capabilities available in the SAC. For comprehensive analytics, including predictive analytics, machine learning, and planning features, organizations need to set up an individual stand-alone SAC with the appropriate licensing. However, S/4HANA Cloud does provide all the necessary functionalities for data visualization and reporting. The OData service-based API interfaces offered by SAP S/4HANA Cloud enable seamless integration of external systems for data exchange. It includes a variety of virtual data models based on CDS technology, custom extensibility apps, preconfigured reports, dashboards, and controlled software deployment applications.

## 2. OVERVIEW OF S/4 HANA CLOUD ANALYTICS

The SAP S/4HANA Cloud analytics is designed to provide real-time insights on live data. It leverages the power of HANA, and the architecture is built around the concept of 'embedded analytics', which integrates analytics capabilities directly into the ERP system, eliminating the need for separate analytics or BI systems [6].



**Fig -1:** SAP S/4HANA Cloud Analytics architecture [6]

The core building block of SAP S/4HANA Cloud's analytics is the use of Core Data Services (CDS) views. CDS views allow developers to define semantic data models on top of database tables, which can then be used to create analytical reports. This streamlines the data modeling process and ensures that the data remains current, as it is directly sourced from the underlying database tables.

SAP S/4HANA Cloud also embeds SAP Analytics Cloud, a cloud-based analytics tool that provides advanced analytics capabilities. This integration allows users to generate interactive dashboards, KPIs, multi-dimensional reports, and perform ad-hoc analysis, all within the context of the ERP

system. The key analytics components include virtual data models based on CDS views, extensibility apps, and analytical applications as illustrated in Fig -1.

### 3. DATA MODELING

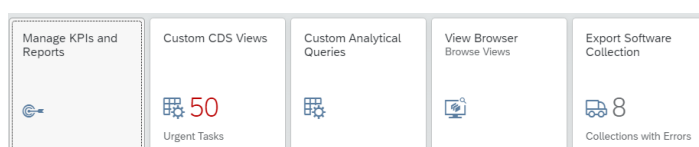
As you can imagine, S/4HANA Cloud being a SaaS offering will not have direct database table level access, hence SAP delivers pre-built virtual data models (VDM) based on CDS technology for customers with capabilities to create custom data models using the extensibility apps provided.

These released CDS views serve as the foundation for data modeling in SAP S/4HANA Cloud. These available CDS views are the sole resources for any custom development. Data modeling principles play a crucial role in building custom virtual data models in SAP S/4HANA Cloud. Defining a data modeling strategy from the beginning will go a long way in ensuring the effective reusability and scalability of your custom analytical solution with reduced maintenance overhead.

A layered data modeling approach can keep the custom app development from becoming too complex. Based on the implementation experience, it is advisable to begin with a foundational level of level 1 CDS views that directly consume SAP's released VDM as the primary data source and merge relevant data with a standardized set of predefined rules. This method aids in ensuring uniformity and consistency in the base layer data models throughout the organization. Moving to the next layer, Level 2, custom CDS views can be developed, which expand upon the base layer views by introducing additional business rules, calculations, and aggregations to meet specific analytical needs; depending on the complexity of the data flow, this view may become your analytical cube including semantic expansion to master data. The final layer, level 3, allows for creating custom CDS views that serve as consumption query views for reporting purposes. The analytical cube at Level 2 can establish business rules that serve a specific purpose within an organization, such as allowing customer service teams to run multiple data analysis queries at Level 3 for sales.

### 4. CUSTOM EXTENSIBILITY

The released CDS views are broadly classified into basic, composite, and consumption views by the SAP S/4HANA Cloud platform offers various tools and apps for custom application development and promotion of the content as depicted in Fig -2. The functionality is limited to adding filters, calculations, and aggregate functions.



**Fig -2:** Analytics Extensibility Apps

**View Browser App:** This app is used to explore and view all the analytical content CDS views including the custom development, make sure to only filter to the "Released views for cloud development". In SAP S/4HANA Cloud, Core Data Services (CDS) views are classified into three types: basic, composite, and consumption views. Basic views are used to define a single entity, while composite views combine multiple entities or basic views into a single view. Consumption views are used to consume data from other views and are directly exposed to analytical applications [7]. These views are integral components of SAP S/4HANA Cloud's data modeling and access capabilities. In addition to the search function, users can create and manage analytical applications that can be displayed as a Fiori tile.

**Custom CDS views App:** This is a crucial tool for extending the data models for custom analytics. It allows users to create their own CDS views by defining the required fields, relationships, filters, and calculations. There are several types of CDS available for varied use cases as detailed below.

- **Standard CDS View** – serves as the foundational entry CDS for further custom data modeling. Users can leverage the pre-existing CDS views from SAP to expand and adapt according to their needs. This corresponds to the basic view in the pre-delivered SAP content terminology.
- **Analytical Dimension** – This custom CDS view is utilized to specify a dimension for analytical reporting, aligning with the basic view in SAP's pre-delivered content terminology.
- **Analytical Cube** – The CDS view is utilized to create a cube for analytical reporting, which aligns with the composite view in the pre-delivered SAP content terminology.
- **External API** – This CDS view is utilized to exchange data with external systems through OData services, facilitating smooth integration with various applications and platforms. API supports the usage of standard and analytical cube-type CDS only.
- **Value Help** – These are used to provide value help for fields in a data model.
- **Data Extraction** – These are dedicated CDS views used to extract data from SAP S/4HANA Cloud and integrate it with target systems like SAP BW/4HANA [8].

**Custom Analytical Queries App:** Used to develop custom analytical reports based on the Analytical Cube type CDS, as other types of CDS cannot be used to create a query. These align with the consumption views in the pre-delivered content. Notable features include restricted and calculated measures, aggregations, filters, and user parameter options.

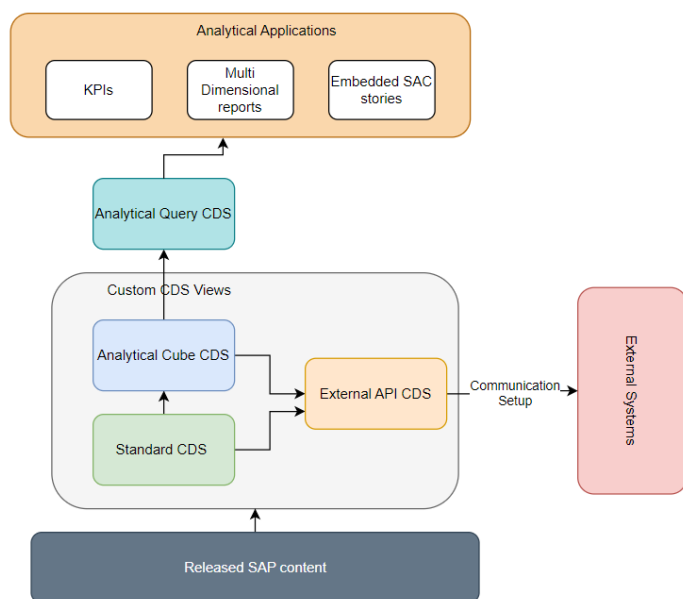
**Manage KPIs and Reports App:** This application within SAP S/4HANA Cloud enables users to create various analytical artifacts leveraging Key Performance Indicators (KPIs), reports, multidimensional reports, and embedded SAC stories. By unifying a wide array of analytical artifacts from KPIs to advanced visualizations, this app enables actionable and contextual insights. The key application types that can be built are:

- **KPI Monitoring** – Facilitates tracking of KPIs on the Fiori launchpad, enabling drill-down into further analytics or transactions.
- **Overview Pages** – Offers consolidated domain views for consuming and acting on analytical tables and charts.
- **Multidimensional Reports** – Allows analysis and visualization of data across multiple dimensions using slice-dice on cubes.
- **SAP Analytics Cloud Dashboards and Stories** – Embeds SAC content in Fiori apps using interactive elements.
- **Generic Drill Down Reports** – Employs smart charts and filters for flexible visualization and mini-chart configuration.

## 5. DEVELOPMENT APPROACH

The development of custom analytical solutions in SAP S/4HANA Cloud initiates with examining the existing released content. The View Browser application contains an alternative search feature to locate released views based on SAP table or column specifications. Upon identifying an appropriate view, configuring foundational standard Core Data Services (CDS) views establishes the groundwork. These can be integrated and associated leveraging joins or associations with the primary transactional data source.

Subsequently, a comprehensive customized data model is constructed utilizing the Custom CDS Views application under the Analytical Cube category. This facilitates creating advanced CDS queries through the Custom Analytical Queries application. Once the custom queries are available, multiple analytical application types can be built to deliver the end-user experience, most commonly using KPIs, multidimensional reports, and embedded SAP Analytics Cloud stories. The detailed process is illustrated in Fig -3.



**Fig -3: Custom Analytics Development**

While the graphical interface limits writing custom code for extensions, it provides sufficient tools and functions for most operational analytics needs within SAP S/4HANA Cloud. However, additional custom development may be required

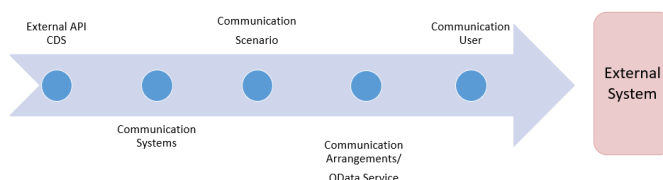
using external data warehousing or reporting solutions for certain advanced requirements beyond the platform's capabilities.

SAP offers the Export Software Collection application for custom application migration, which can be used to gather all dependency objects, perform a consistency check, and complete the final export.

When creating customized analytical queries, it is crucial to consider the impact on performance and organize them efficiently for data retrieval and processing. Certain strategies for enhancing performance encompass making reports or stories mandatory with parameters, layering data models, integrating the data filter criteria in the base level CDS views and passing parameters as filters to restrict data result sets down to the lowest level.

## 6. INTEGRATION WITH SAP S/4HANA CLOUD

SAP S/4HANA Cloud provides strong integration capabilities to assist organizations in their digital transformation within complex system landscapes. The integration approach provided by SAP leverages External API-based CDS technology combined with OData, enabling smooth connectivity with various systems, including other SAP solutions, Business Partner Solutions, third-party cloud, or on-premises solutions. This diverse integration support enables organizations to harness the complete potential of SAP S/4HANA Cloud within their specific business environments.



**Fig -4: S/4HANA Cloud in-app Extensibility**

Integration with external systems is facilitated with manual change data capture mechanisms to retrieve only new or modified data records for transfer to external data platforms. SAP S/4HANA cloud provides support for integration with SAP Data Services, SAP landscape transformation (SLT), SAP BW/4HANA, and SAP Business technology platform (BTP), along with change data capture capabilities.

Communication management in SAP S/4HANA Cloud involves establishing secure communication between the SAP S/4HANA Cloud system and other integrated systems or solutions [9]. This functionality is crucial for enabling smooth data exchange and interoperability within diverse system landscapes. The communication management capabilities of SAP S/4HANA Cloud support various integration scenarios by facilitating the configuration of communication arrangements, systems, and users. Fig -4 shows the steps to connect external systems.



## 7. BUSINESS VALUE OF ANALYTICS IN SAP S/4HANA CLOUD

The embedded analytics capabilities of SAP S/4HANA Cloud coupled with advanced business intelligence features of SAP Analytics Cloud provide significant business value across various dimensions. By enabling real-time data analysis, organizations can achieve enhanced decision-making and improved efficiency. Embedding analytics directly into the cloud ERP system eliminates data silos and ensures that all business functions have access to the same set of data. This underscores the significant business value of SAP S/4HANA Cloud's analytics capabilities.

The seamless access to insights within business processes also reduces latency between analysis and action. Organizations can promptly adapt to evolving market conditions and new opportunities with quicker, more targeted decision-making. From strategic planning to daily transactions, data-driven intelligence informs every business activity in real time. This leads to a sustainable competitive edge.

From my previous experience and professional evaluations, integrating SAP S/4HANA Cloud OData APIs with data virtualization solutions provided a scalable and cost-effective approach for a comprehensive enterprise analytics platform. This integration allowed the incorporation of real-time S/4HANA Cloud data with external sources facilitating diverse analytical solutions from inventory analysis to sales forecasting using historical order trends. Moreover, this method helped overcome constraints of standardized embedded analytics within S/4HANA Cloud by enabling access to external data and advanced analytical modeling tailored to the organization's needs.

SAP S/4HANA Cloud analytics unlocks multidimensional value by enhancing processes, reducing costs, and enabling data-centric growth. With the ability to turn data into insights and action, organizations can achieve operational excellence and business success.

## 3. CONCLUSIONS

The study has explored the integrated analytical functionalities of SAP S/4HANA Cloud and its ability to empower organizations with real-time data insights. The underlying architecture encompassing SAP HANA, CDS views, and embedded SAP Analytics Cloud was explored to understand how it provides speed and a unified environment for analytics. Custom extensibility enables tailoring analytics to business needs through custom data models, cubes, and queries built on released CDS views. Integration methods like APIs and change data capture facilitate incorporating external data into a comprehensive analysis. The research indicates S/4HANA Cloud analytics can yield multiple benefits for organizations by eliminating information silos, enabling quick response to market changes, optimizing costs, and providing data-driven growth opportunities. However, some challenges remain around customization, flexibility, and large data

volume management. As cloud ERP systems continue maturing, embedded analytics integrated across

complementary technologies will play a key role in realizing future intelligent enterprises. The in-depth perspective into the analytics capabilities of a leading cloud ERP platform can guide technology decision-makers on how modern systems like S/4HANA Cloud can transform operational analytics. Organizations can move towards more agile, unified, and data-centric ways of working, driving innovation. With solutions like this, every business decision can be enhanced through real-time data.

## REFERENCES

- [1] "SAP S/4HANA Cloud, public edition," SAP. Accessed: Dec. 30, 2023. [Online]. Available: <https://www.sap.com/products/erp/s4hana.html>
- [2] PricewaterhouseCoopers, "Defining a cloud strategy powered by SAP S/4HANA Cloud," PwC. Accessed: Dec. 30, 2023. [Online]. Available: <https://www.pwc.com/us/en/services/alliances/sap-implementation/sap-s4-hana-cloud.html>
- [3] "What is SAP HANA?," SAP. Accessed: Dec. 30, 2023. [Online]. Available: <https://www.sap.com/products/technology-platform/hana/what-is-sap-hana.html>
- [4] "SAP Analytics Cloud | BI, Planning, and Predictive Analysis Tools," SAP. Accessed: Dec. 27, 2023. [Online]. Available: <https://www.sap.com/products/technology-platform/cloud-analytics.html>
- [5] "Accelerate Business Decisions with SAP Analytics Cloud and S/4HANA," SAP. Accessed: Dec. 30, 2023. [Online]. Available: <https://www.sap.com/products/technology-platform/cloud-analytics/accelerate-decision-making-with-sap-s4hana.html>
- [6] "Analytics Architecture | SAP Help Portal." Accessed: Dec. 30, 2023. [Online]. Available: [https://help.sap.com/docs/SAP\\_S4HANA\\_CLOUD/a630d57fc5004c6383e7a81efee7a8bb/599db5e2921c46ac95475567b9aa68c2.html](https://help.sap.com/docs/SAP_S4HANA_CLOUD/a630d57fc5004c6383e7a81efee7a8bb/599db5e2921c46ac95475567b9aa68c2.html)
- [7] A. Pattanayak, "SAP S/4HANA Embedded Analytics: An Overview," *J. Comput. Commun.*, vol. 05, no. 09, pp. 1–7, 2017, doi: 10.4236/jcc.2017.59001.
- [8] "Extend and Integrate Your SAP S/4HANA Cloud | SAP Help Portal." Accessed: Dec. 31, 2023. [Online]. Available: [https://help.sap.com/docs/SAP\\_S4HANA\\_CLOUD/0f69f8fb28ac4bf48d2b57b9637e81fa/7139c1648de84c0bbd7637589ed7c92a.html](https://help.sap.com/docs/SAP_S4HANA_CLOUD/0f69f8fb28ac4bf48d2b57b9637e81fa/7139c1648de84c0bbd7637589ed7c92a.html)
- [9] T. Saueressig, *SAP S/4HANA cloud: an introduction*, 2nd edition. Boston: Rheinwerk Publishing, 2022.

## BIOGRAPHIES



A highly experienced leader in data and analytics with over a decade of experience in designing enterprise solutions across various industries. I have extensive expertise in architecting and modernizing large-scale data platforms and leading innovative initiatives. With a focus on compliance-driven solutions, I have overseen significant strategic projects within the healthcare sector, contributing to pioneering advancements in the field.