



## SAP CAPM Tools and Capabilities - Part3

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### ABSTRACT

The SAP Cloud Application Programming Model (CAPM) is a comprehensive framework for building sophisticated, cloud-native applications within the SAP ecosystem. Grounded in domain-driven design (DDD), CAP empowers developers to model complex business domains using Core Data Services (CDS). CDS' unified, declarative syntax streamlines development by defining entities, relationships, and business logic in one place. This approach aligns applications closely with business needs, enabling rapid iteration and adaptation. CAP fosters modular, independently deployable services that seamlessly interact with each other and external systems through robust API capabilities. Leveraging Node.js for server-side logic, CAP applications excel in scalability, responsiveness, and handling asynchronous operations.

CAP combines proven open-source and SAP technologies. Its infrastructure supports Node.js and Java, offering developers flexibility. The Node.js SDK, built on Express, provides a rich ecosystem of libraries. CAP also supports Java for enterprises. SAP offers tools for both environments, including SAP Business Application Studio and Visual Studio Code. Core Data Services (CDS) is CAP's foundation, modeling both domain models and service definitions. CDS models can be deployed to databases like SAP HANA. CAP's service SDKs for Node.js and Java enable service implementation and access to SAP Business Technology Platform services like authentication and authorization.

CAP smoothly integrates with the SAP Cloud Platform and SAP S/4HANA enhancing data accessibility, security, and implementation. This collaboration maximizes investments and broadens functionalities throughout the SAP environment. Prioritizing features, for businesses, adaptability and expandability CAP enables companies to develop adaptable scalable applications that fulfill contemporary business needs and foster innovation moving forward.

**Keywords:** SAP CAP, SAP BTP, SAP Fiori, Node.js, Java, SAP S4 HANA

### INTRODUCTION

**SAP Business Technology Platform (BTP)** is a cloud-based platform that allows users to develop integrate and enhance SAP applications. It provides Platform as a Service (PaaS) features such, as analytics, artificial intelligence/machine learning (AI/ML), and Internet of Things (IoT) facilitating development and growth opportunities

**SAP Fiori** provides user interfaces, for SAP software. Its user-friendly and adaptable layout boosts efficiency, on devices by streamlining business operations.

**Node.js**, a JavaScript runtime built on Chrome's V8 engine, excels at scalable, real-time applications. Its non-blocking I/O and event-driven architecture optimize server-side programming.

**Java** is an object-oriented programming language recognized for its adaptability and dedicated user base. It drives business applications on platforms. Plays a crucial role, in numerous backend operations.

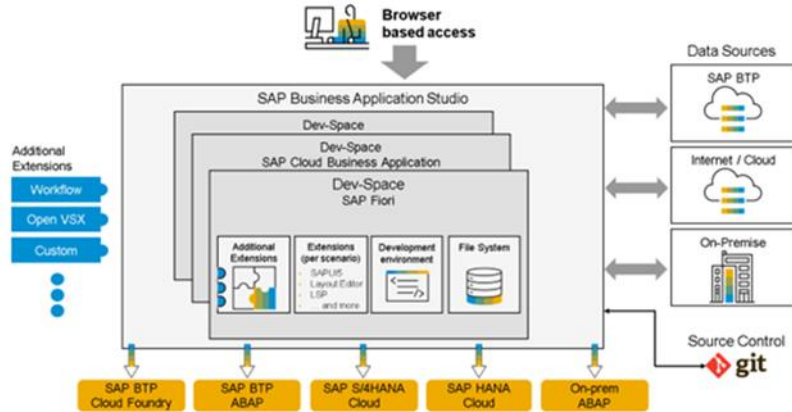
**SAP HANA** is an in-memory database and application platform that accelerates data processing and analytics. Offering real-time insights, predictive analytics, spatial processing, and machine learning, it's a core technology for modern enterprises.

Pre-requisite: To understand this paper thoroughly prerequisite is the SAP CAPM Tools and Capabilities - Part 1 and 2.

### SAP BUSINESS APPLICATION STUDIO

SAP Business Application Studio (BAS) is a cloud-based development environment designed to streamline the creation and management of business applications. Built on a robust foundation, BAS offers a desktop-like experience while leveraging the power of cloud technology. At the core of BAS are dev spaces, customizable

environments tailored to specific development tasks. These preconfigured spaces accelerate setup and enhance productivity by providing essential tools and runtimes for various business scenarios. By combining a modern interface with deep integration into the SAP ecosystem, BAS empowers developers to efficiently build, test, and deploy applications, driving innovation and business value.



Key features and capabilities of SAP Business Application Studio include:

**Cloud-based Development:** BAS is hosted on the cloud, allowing developers to access it from anywhere with an internet connection. This eliminates the need for local installation and ensures consistency across development environments.

**Integrated Development Environment (IDE):** It provides a full-fledged IDE with a set of tools and editors tailored for developing SAP Fiori apps, SAP Business Application Programming Model (CAP) applications, SAP Cloud Platform (SCP) extensions, and more.

**Extensibility and Customization:** Developers can extend BAS functionality through plugins and customize their development environment to suit specific project requirements. This flexibility enhances productivity and developer experience.

**Collaboration:** BAS supports collaboration features such as sharing projects, real-time editing, and integrated code reviews, fostering teamwork and enhancing productivity among development teams.

**Containerization and Deployment:** It supports container-based development and deployment models, leveraging technologies like Docker and Kubernetes for scalability and portability of applications.

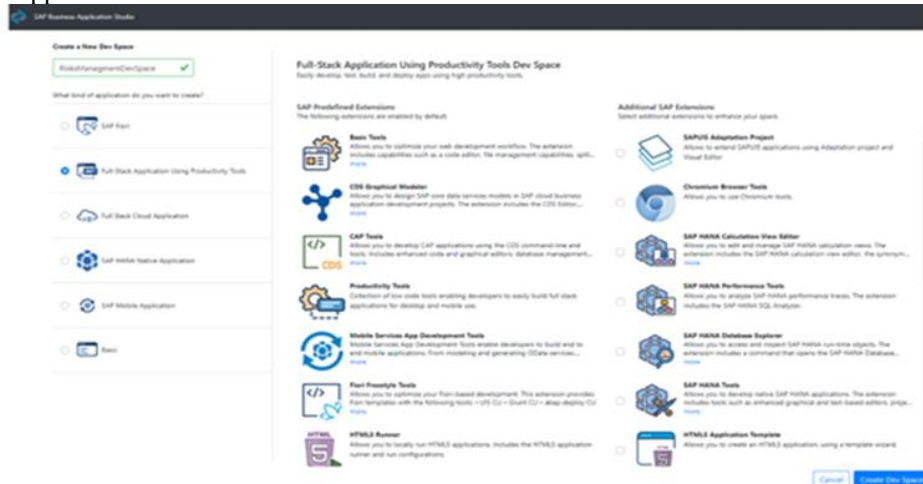
**Integration with SAP Services:** BAS integrates seamlessly with various SAP services and platforms, enabling developers to leverage SAP's extensive ecosystem of enterprise applications, databases, and services.

**Continuous Integration/Continuous Deployment (CI/CD):** It includes built-in support for CI/CD pipelines, enabling automated testing, deployment, and monitoring of applications, which helps in maintaining quality and agility in development processes.

**Open Development Platform:** BAS supports open standards and languages like JavaScript, TypeScript, Java, and others, allowing developers to choose the tools and frameworks that best fit their needs.

**Dev Spaces:**

A dev space is a development environment with all the tools, capabilities, and resources needed for developing your application. Each type of application requires a different development environment. Based on the type of application that you choose to build, you're provided with a different set of tools. You can add additional tools to supplement the application with additional extensions for the scenario.



Dev spaces offer a self-contained development environment mirroring a local setup. With features like terminal access and the ability to test applications without external deployment, developers can work efficiently.

Covering the entire development lifecycle, dev spaces support project creation, coding using SAP-specific tools, testing, and deployment as multi-target applications (MTAs). This streamlined approach accelerates development and enhances productivity.

**Dev Space types:**

**SAP Fiori:** Develop SAP Fiori applications based on various environments, including Cloud Foundry, ABAP Cloud, and SAP S/4HANA.

**Full-Stack Application Using Productivity Tools:** Easily develop, test, build, and deploy apps using high-productivity tools.

**Full Stack Cloud Application:** Build business services, and business applications, and extend S/4HANA using the SAP Cloud Application Programming Model, Fiori, and Java.

**SAP HANA Native Application:** Build and deploy native SAP HANA applications or analytical models. This dev space contains a comprehensive set of editors to support the creation of database artefacts (calculation views, tables, SQLScript procedures, and more), as well as tools to enable an end-to-end development flow from project creation to deployment to the SAP BTP.

**SAP Mobile Application:** The SAP Mobile Development Kit (MDK) lets you customize, deploy, and manage your customized iOS and Android apps in the cloud.

**Characteristics of dev spaces:**

**Automatic installation of extensions:** the latest version of the selected extensions are installed. Extensions are updated automatically when the dev spaces restart.

**Isolation:** they are completely isolated from one another. There is no way to access the file system and processes of one dev space from another dev space.

**Disposable:** Dev spaces are disposable. If for some reason your dev space is not working as expected you can always create a new workspace. Downloading the data from the previous one and moving to the new one.

**Restorable:** to save resources dev spaces are stopped after 3 hours of inactivity. Don't worry about the dev spaces including the files it contained, these will be restored once you start the dev spaces again.

**Preserved:** they will be preserved as long as your subscription to SAP BAS is in place and are not explicitly deleted.

**Productivity toolkit offered by SAP Business Application Studio:**

SAP Business Application Studio (BAS) is a powerful, cloud-based development environment that empowers developers to create enterprise-grade applications efficiently. With a flexible interface and customizable workspace, BAS adapts to diverse developer preferences.

BAS offers a visual toolkit to streamline application development, from data models to user interfaces. The Storyboard provides a high-level overview of application components, facilitating navigation and understanding. The CDS Graphical Modeler simplifies data modeling, enabling developers to visually define entities, relationships, and annotations. The Project Explorer offers a clear structure of application components for easy management. By combining these visual tools with traditional coding options, BAS accelerates development while ensuring full control over the application.

The service center provides a central entry point to explore SAP business services from various service providers. You can use the services as data sources in your application, and you can trigger application development from the Service Center.

During your application development, you can easily test run it by choosing the Run and Debug button. This button is located on the top on the top right part of the screen. Alternatively you can use the Run Configurations panel. Opening the integrated terminal allows you to access the underlying system. You can create multiple terminals open to different locations, and easily navigate between them. The terminal is a convenient tool because you don't need to switch windows or change the state of an existing terminal to perform a quick command-line task.

The Command Palette is an interactive window that provides access to all the SAP Business Application Studio functionalities. This access includes keyboard shortcuts for the common operations. These keyboard shortcuts enable you to: Open files. Execute editor commands. Connect to the Cloud Foundry environment. Launch the SAP Business Application Studio high productivity tools.

The File Explorer is used to browse, open, and manage the files and folders in your project. You can create, delete, and rename files and folders, move files and folders with drag and drop, and use the context menu to explore all options.

SAP Business Application Studio provides extensive search and replace capabilities within your workspace using the Search view or from the find input box (Ctrl+F). We support regular expressions, matches, include and exclude terms, grouping conditions, ranges, and more.

In SAP Business Application Studio, you will find out-of-the-box support for code completion, content assistance, and code hinting for UI5, CDS, JavaScript, TypeScript, JSON, HTML, CSS, and more, depending on the dev space you created. Just type a character, and if the language service knows possible completions, a suggestion will pop up.

If you continue typing characters, the list of members (variables, methods, and so on) is filtered to only include members containing your typed characters.

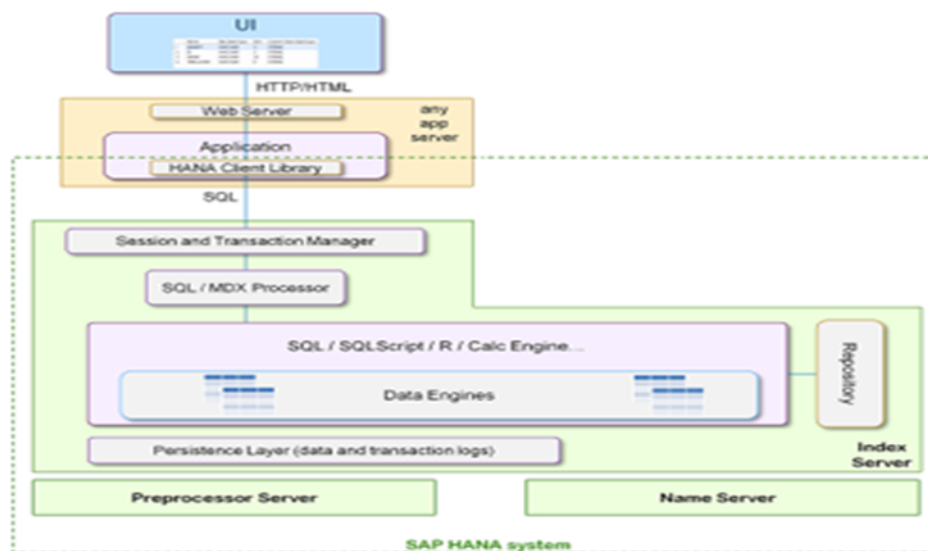
### BENEFITS OF SAP HANA

The digital revolution has ushered in an era of unprecedented data growth. Fueled by the proliferation of mobile devices, social media, and the Internet of Things (IoT), businesses are grappling with vast and diverse data sets. Traditional data models, primarily structured data, are insufficient to capture the richness and complexity of this new data landscape. Unstructured text, spatial, and graph data have emerged as critical components for deriving valuable insights.

Database performance has been a longstanding challenge. Conventional disk-based databases faced limitations due to the constant transfer of data between disk and memory, impacting application responsiveness.

SAP HANA has transformed this paradigm. By storing the entire database in memory, SAP HANA eliminates the performance bottlenecks associated with disk I/O. This groundbreaking innovation, coupled with the integration of persistent memory (PMEM), delivers unparalleled speed and efficiency. SAP HANA's intelligent data management capabilities optimize data placement across DRAM and PMEM, maximizing performance and reliability.

You can aggregate on the fly from any line item table. You do not need pre-built aggregates. SAP HANA can generate any view of the data at runtime, all from the same source tables. SAP HANA organizes data using column stores, which means that indexes are not needed. They can still be created but offer little improvement. As well as removing the aggregates and indexes from the database, you can also remove huge amounts of application code that deals with aggregates and indexes. You are left with a simplified core data model as well as simplified application code. It is now much easier to enhance the applications and integrate additional functions.



#### Push-Down Process:

An application should now send all data instructions, whether simple or complex, to SAP HANA. SAP HANA processes the data in memory and sends back only the results. This means that less data passes between the database and application layer. Moving the data processing tasks from the application layer to the database layer is called push-down. Applying the push-down approach means that application developers need to rethink the way they code. In the past, all coding was done in the application layer, but now with SAP HANA, large parts of the coding can be developed directly in the database.

#### Compression:

The amount by which data reduction can take place is driven by the shape of the business data. Compression is most impressive when there is a lot of repetition in the data values. Compression strips out the repetition and stores each unique value once in a dictionary store. SAP HANA then uses integers to represent the business values in the original store, as this takes up far less space and is very efficient for scanning. SAP HANA links the dictionary entries to the actual table using special reference stores. These reference stores identify the position where the original value was and its corresponding business value from the dictionary store. This mechanism is embedded deep in the SAP HANA database. The processing happens invisibly.

#### Parallel Processing:

With recent hardware developments, especially new multi-core processors, we can build instant response applications by spreading the processing tasks across all the cores. SAP HANA automatically spreads workloads across all cores and ensures that all parts of the hardware are contributing to the throughput. SAP HANA is scalable. This means that you can easily add more processors as required, to increase the parallelization and

therefore the speed of processing. To take advantage of the built-in parallel processing capabilities of SAP HANA, you can use column store tables. Column store tables are automatically processed in parallel. Each column can be processed by one core. The more cores you add to the SAP HANA landscape, the more parallelization occurs.

Data processing capabilities of HANA:

SAP HANA is a versatile platform capable of processing diverse data types. It handles unstructured text (social media, logs), spatial data (maps, locations), graph data (networks, relationships), and time-series data (sensor readings) with equal proficiency.

HANA's connectivity empowers businesses to leverage data from various sources. It seamlessly integrates with enterprise systems (like SAP S/4HANA), data warehouses (like SAP BW), archives, big data platforms (like Hadoop), file systems, databases, social networks, and IoT devices.

Real-time insights are made possible through HANA's ability to access and process remote data without the need for local storage. Applications perceive remote data as if it were stored locally, enabling immediate analysis and decision-making.

#### **SAP HANA is a platform:**

The SAP HANA platform is a comprehensive suite designed to support and enhance applications through a wide array of integrated services. It encompasses all the essential components needed for both SAP and non-SAP applications, including:

**Database Management:** SAP HANA provides a powerful in-memory database that supports real-time data processing.

**Data Processing:** It integrates advanced capabilities for handling various types of data, including text, spatial, and graphic data, alongside traditional business transactions.

**Application Development:** The platform includes a full development environment with productivity tools that streamline design and runtime processes, enabling developers to build applications with ease.

**Lifecycle Management:** SAP HANA offers tools for managing the entire lifecycle of applications, from development through deployment and maintenance.

**Data Integration:** It features robust capabilities for integrating and synchronizing data from various sources, including big data stores like Hadoop and IoT devices.

One of the key advantages of SAP HANA is its ability to support applications with a two-tier architecture, eliminating the need for a separate application server. For instance, a web application that allows a project manager to check team members' timesheet completion can operate directly with SAP HANA, which handles both business logic and database services.

SAP HANA excels in processing new types of data through its native in-memory engines, offering real-time analytics and data management. It supports various data consumption options, including:

- **Real-time Streaming Data Analysis:** Continuously analyzing streaming data for immediate insights.
- **Remote Data Access:** Reading data from external sources and Big Data stores.
- **Bidirectional Synchronization:** Synchronizing data with remote databases and IoT devices.

Additionally, SAP HANA includes built-in Extraction, Transformation, and Loading (ETL) capabilities, removing the need for external software to clean, enrich, and profile data. Designed for high performance, SAP HANA is an in-memory column-and-row store database optimized for both Online Transaction Processing (OLTP) and Online Analytical Processing (OLAP). It features automatic data compression, efficient data management across storage tiers, and high-availability functions to ensure uninterrupted operation and support for mission-critical applications.

### **CONCLUSION**

SAP Business Application Studio (BAS) is a cutting-edge cloud development environment that streamlines the creation of innovative business applications. Offering a comprehensive toolkit and seamless integration with SAP services, BAS empowers developers to rapidly build and deploy solutions across diverse platforms. Its intuitive interface and advanced features accelerate development cycles, enhancing productivity and application quality.

SAP HANA is a high-performance, in-memory database platform that revolutionizes data management and analytics. Its ability to handle vast volumes of structured and unstructured data with exceptional speed and agility positions it as a cornerstone of modern enterprise architectures. By combining advanced data processing capabilities with robust integration options, SAP HANA empowers organizations to extract maximum value from their data and drive informed decision-making.

Declarations

**Ethics approval and consent to participate:** Not Applicable

**Availability of data and materials:** Not Applicable

**Competing interests:** Not Applicable

**Funding:** Not Applicable

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