SAP Solution in Detail
SAP HANA

SAP HANA®: The Database for the Intelligent Enterprise

THE BEST RUN SAP®

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Quick Facts

Summary
SAP HANA® combines a robust database with services for creating innovative applications. It enables real-time business by converging transactions and analytics on one in-memory database. Running on premise or in the cloud, SAP HANA helps untangle IT complexity and democratize in-memory computing, bringing significant savings in data management and empowering decision-makers with new insight and predictive power.

Objectives
- Accelerate data to value while simplifying IT
- Acquire and integrate data from a wide range of sources to boost visibility
- Uncover new insights to help stakeholders work smarter
- Ride the next wave of change with innovative new applications
- Maintain security and business continuity
- Connect SAP and third-party data
- Deliver new applications that leverage data of any type
- Scale efficiently with one solution

Solution
- Advanced in-memory processing to reduce latency to a minimum
- Real-time insight from the edge to the cloud
- Embedded data virtualization to provide a single gateway to your data
- Support for modern applications that use smart multimodel data such as geospatial, graph, and JavaScript Object Notation (JSON) documents
- Tools to help keep business secure, minimize downtime, and support compliance with security standards

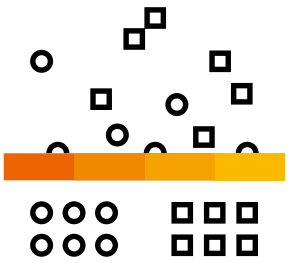
Benefits
- **Adapt with agility** using a single pane of glass to access data of many sizes and from many locations
- **Renovate IT landscapes** without disruption by virtualizing data access
- **Transform data on the fly** to quickly adapt to business needs with virtual data models
- **Extend data footprint and workloads** across on-premise and cloud landscapes
- **Innovate without boundaries** by handling workloads on various data types with one solution
- Store and easily **perform complex processing** of many data types
- Augment transactions with **advanced analytics**
- **Innovate with modern applications** that combine transactional and analytical workloads on a single data set
- **Simplify for efficiency and at scale** with an all-in-one platform
- Choose preferred infrastructure and **managed database** deployments across hybrid environments
- Optimize performance and costs using **advanced in-memory management** and data tiering with elastic scalability
- **Preserve privacy and trust** while deriving value from data with real-time data anonymization and security

Learn more
For more on using SAP HANA, visit us **online**.

Introduction

An intelligent enterprise requires a business-ready database that helps you **find the signal in the noise and unleash your data's potential** for better business outcomes. SAP HANA® provides the next-generation data management foundation for SAP® solutions. It also helps you develop applications that deliver solutions for the intelligent enterprise quickly.

SAP HANA has reshaped the database industry as one of the first databases to handle both transactions and analytics in memory on a single data set. It converges a future-proof database with advanced analytical processing and capabilities for application development, data integration, and data quality. Embedded in a robust, modern security framework, it supports compliance with the latest security standards and data-protection regulations. You gain a single secure environment for your mission-critical data assets. You can also manage large volumes of structured and unstructured data efficiently, leveraging the value of your business data while improving total cost of ownership (TCO).



With SAP HANA, you can **manage large volumes of structured and unstructured data** efficiently, leveraging the value of your business data.

Adapt with Agility

To help you maintain agility, SAP HANA scales up and out to support many deployment scenarios and is available for use in public and private cloud environments. For on-premise installations, SAP HANA supports performance-optimized deployment on hardware appliances from SAP partners, as well as the tailored data-center integration model, which lets you use existing hardware and infrastructure components for your deployment of SAP HANA.

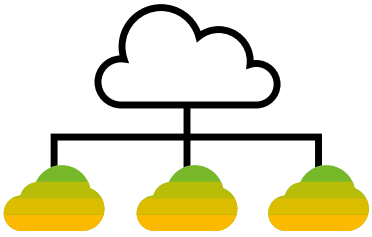
A hyperconverged infrastructure provides an IT framework for software-based, centralized management of computing, storage, network, and other components in a single environment. This helps simplify management of your private cloud deployment, build the bridge to the public cloud, reduce data-center complexity, and increase scalability.

With the multi-cloud capabilities of SAP HANA, you can manage, deploy, virtualize, move, and scale from on-premise, hybrid, or cloud infrastructure as a service (IaaS) supported by SAP or third-party software. Examples include Amazon Web Services, Google Cloud, IBM Cloud, and Microsoft Azure. As a result, you can avoid vendor lock-in and integrate with other cloud-native services to build composite applications.

See the Certified and Supported SAP HANA Hardware Directory for a choice of certified and supported hardware, software, or IaaS offerings from SAP partners. For details on deployment options for SAP HANA, refer to the Landscape Definition Guide for SAP HANA.

SAP HANA Cloud is a managed in-memory cloud database as a service. As the cloud-based data foundation for SAP Business Technology Platform, it is your single gateway to data. SAP HANA Cloud offers multi-cloud connectivity, multitemperature data storage, and a multi-petabyte data lake. Sign up for a free SAP HANA Cloud trial here.

Enhanced real-time table replication in SAP HANA Cloud allows you to act on live business data and extend on-premise workloads and storage in the cloud. This makes cloud and on-premise data accessible through a single access point, connecting object stores, data lakes, and databases. It further enables extended queries or analysis to remote sources such as Amazon Web Services Athena or Google BigQuery.



Sign up for your **free trial** of SAP HANA Cloud now.

SAP HANA helps you renovate your IT landscape without disruption by virtualizing data access through a single pane of glass – from many data sources, by many integration styles, and within one unified framework.

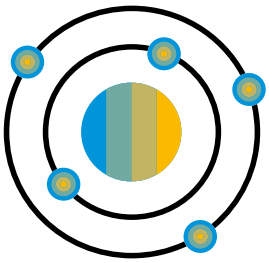
SAP HANA offers built-in functionality to virtualize access to data within the enterprise to deliver information agility. Data can be integrated, cleansed and synchronized. This includes support for connecting to and federating optimized queries to remote sources. It is transparent to the consumer while delivering trusted data to the enterprise.

With SAP HANA smart data access, you can federate queries to external data sources, such as other databases, Web services, files, cloud, Apache Hadoop, and Apache Spark, to perform queries without costly data movement. When you need to move data into SAP HANA in batch or real time or from SAP HANA to other software systems, SAP HANA smart data integration helps you do so to support informed decision-making with visibility.

With SAP HANA smart data quality, you can parse, standardize, and validate attributes such as name and address, perform geocoding, and identify duplicates and relationships between entities.

In addition, features for remote data synchronization help you synchronize data bidirectionally between SAP HANA and the SAP SQL Anywhere® suite. The remote data may be embedded in devices or applications on the edge, beyond the reach of high-bandwidth connections. That means you can synchronize data on the edge and shorten response times across the enterprise. SAP HANA offers cloud-based address cleansing for more than 240 countries. You can benefit from optimized metadata synchronization that avoids inconsistencies between local and remote data.

Finally, SAP Services and Support offers data governance, architecture, integration, and migration services as well as expert advice to help you optimize your data. **See this infographic** for more details.



SAP HANA helps you renovate your IT landscape without disruption by virtualizing data access **through a single pane of glass**.

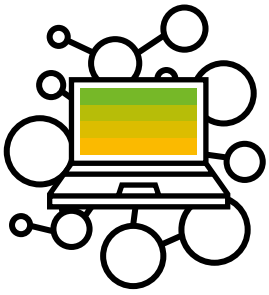
Innovate Without Boundaries

SAP HANA provides next-generation hybrid transactional and analytical processing with advanced analytics capabilities to help business leaders understand information in context and achieve situational awareness to act in the moment. This includes built-in high-performance predictive and machine learning algorithms, as well as integration with TensorFlow and R to reuse existing algorithms in these third-party solutions. As a result, users can reveal meaningful patterns in data and build applications that can learn and automate manual business processes. SAP HANA also provides native Python and R machine learning APIs, enabling data scientists to easily train algorithms and analyze data at in-memory speed in environments they're used to. Text analysis and search capabilities help extract real insights from unstructured textual data in many different languages.

Advanced services simplify custom modeling and help accelerate the development of location-aware business applications. Services include geocoding, open-source geospatial services and APIs available in the cloud, ready-to-use statistical models, and an intuitive labeling tool based on machine learning. SAP HANA also supports native spatial data types and algorithms to make it easier to work with spatial data. What's more, SAP HANA and SAP HANA Cloud are certified by Esri for use with ArcGIS Enterprise and ArcGIS Pro.

SAP HANA provides many smart multimodel capabilities, enabling to you to work with many different data types within a single database, driving developer productivity and lower overall TCO. For instance, SAP HANA can store, query, and apply machine learning to streaming data from sensors, plant equipment, and IoT devices; time-series data such as price fluctuations and information on machine efficiency; and highly interconnected graph data. It also provides a JSON document store. These powerful capabilities can be leveraged with standard SQL, enabling data to be combined from standard relational databases, spatial and graph data, and data stored in a JSON document. These capabilities can help you reimagine business models. For an overview of these capabilities, see the **figure** on the following page.

SAP HANA connects with existing applications using open standards and offers a choice of ways to build applications that are Web based or based on microservices. Developers can work in the application-development environment that best fits their needs: Web-based, ABAP®, or Eclipse Java development tools. SAP Web IDE for SAP HANA offers a comprehensive lightweight tool set for data modeling and application development on premise. SAP Business Application Studio, the evolution of SAP Web IDE, provides a modern cloud-based environment for developing smart business applications in the cloud.



SAP HANA provides smart multimodel capabilities, enabling data to be combined from relational databases, spatial and graph data, and data stored in a JSON document in a **single database**.

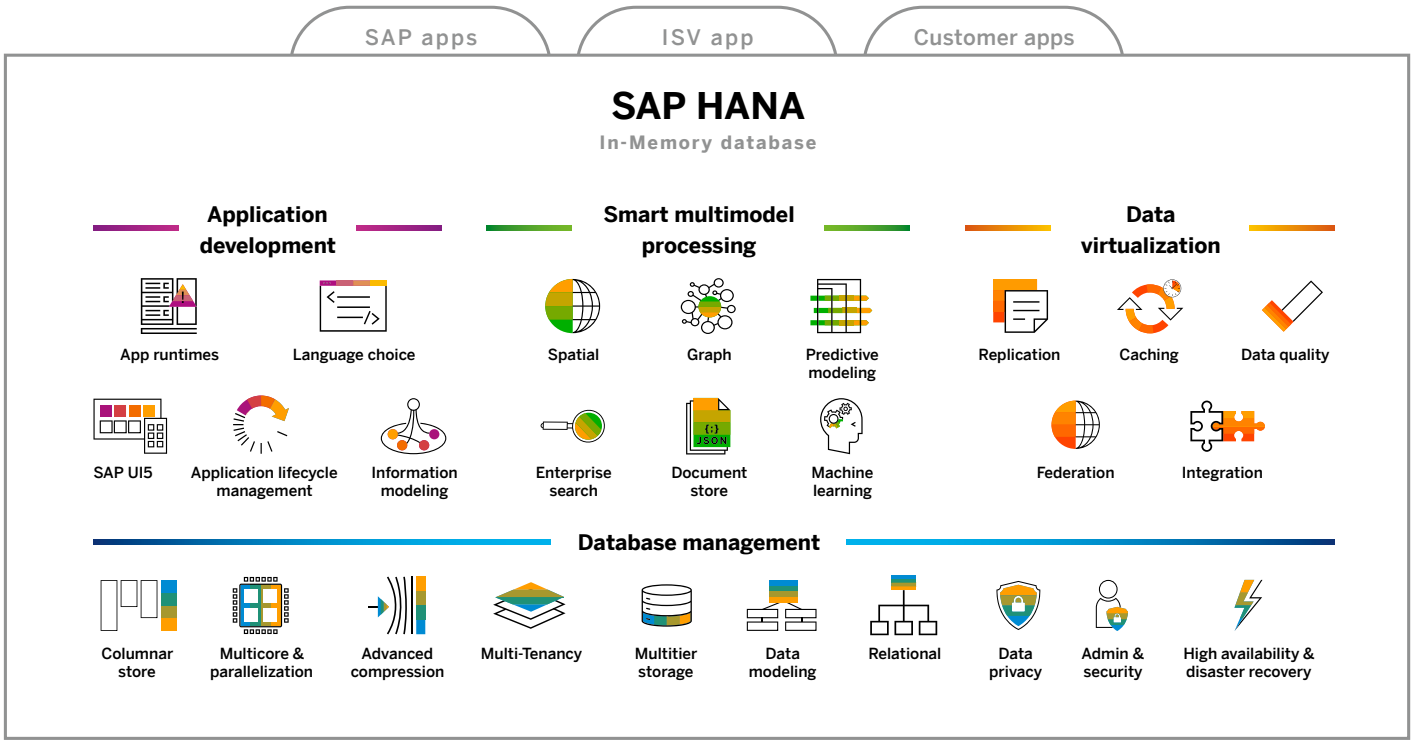
SAP HANA Cloud is available as a database service on SAP Business Technology Platform. You can start with architecture and design and transfer models between on-premise and cloud versions in hybrid cloud environments. ABAP developers and users of SAP PowerDesigner® software can leverage the power of SAP HANA with their preferred tools as well.

The application-development capabilities of SAP HANA include support for a variety of server-side programming languages, including JavaScript (Node.js), Java, R, and Python, but they also let you bring in additional languages and runtimes.

SAP HANA contains several embedded business functions, such as discounted cash flow and interest rate management, to help accelerate development. The functions run inside the database for optimal performance and can be called directly from SQL or used within SQLScript.

SAP HANA also includes a framework that lets you create your own data-processing algorithms to run inside the database. You can build enterprise-class non-SQL (NoSQL) applications with support to store schema-flexible data in JSON format. You can combine JSON data with structured data, then query or analyze it using SQL.

Figure: Capabilities of SAP HANA Powering the Intelligent Enterprise



Simplify for Efficiency

SAP HANA is built on an in-memory columnar store optimized for both transactional and analytical workloads, enabling the benefits of modern central processing unit (CPU) architectures, CPU extensions such as Intel AVX2 instructions, multicore processing, and modern storage technology such as Intel® Optane™ persistent memory or IBM Virtual Persistent Memory on POWER9 servers. It's compliant with requirements for the atomicity, consistency, isolation, and durability (ACID) standards.

Intuitive modeling tools and preconfigured function libraries let you run complex business logic directly inside the database. That means you can avoid latencies from moving data between the database and application server tiers.

Multitenant databases can be managed as one while maintaining their isolation from one another. The intelligent data-tiering capabilities of SAP HANA allow you to maximize your value by balancing performance and cost of data storage. This enables administrators to control which data is kept in memory and which is kept in alternative persistent data storage.

SAP HANA native storage extension optimizes the cost-to-performance ratio for warm data access by providing simplified, scalable data tiering for various data types and workloads in both scale-up and scale-out configurations. The feature loads warm data from a disk into memory automatically when queries need to access it. A data-tiering advisor maintains database-access pattern statistics and gives recommendations on which database objects to tier to warm storage.

The data lake component of SAP HANA Cloud enables petabyte-scale storage and access through standard SAP HANA Cloud clients. With this data lake, you can expand your data storage into the cloud whether you run SAP HANA on premise or in the cloud.

To safeguard business continuity and minimize downtime while restarting the database, you can choose from different options, such Linux OS-based tmpfs file systems.

SAP HANA is the first major database optimized for Intel Optane persistent memory, enabling it to process larger volumes of data in real time with increased memory capacity while reducing TCO. To learn more, visit us online.

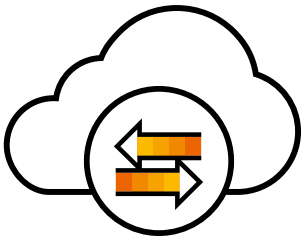
The data lake of SAP HANA Cloud enables **petabyte-scale storage**.

SAP HANA protects your business against a broad range of outages, from software errors to natural disasters. You can minimize downtime and shorten recovery times using multitier and multitarget secondary system-replication options that can change replication paths automatically after system failures. You can offload read-intensive workloads to secondary systems at regional locations with the SAP HANA active/active read-enabled option for additional load balancing, hardware utilization, and local-read access to data. And you can follow the sun and optimize the latency for written transactions across geographically distributed landscapes by rotating the primary system across data centers as business activities come to life in new time zones.

Back up and restore your SAP HANA database directly to and from the Amazon S3 object store using the BACKINT SDK for SAP HANA tool. Scale up easily, buy additional storage if required, and access your cloud backup from many locations. Manage your backup transfer securely and cost-efficiently using the Secure Sockets Layer (SSL) protocol and by using SAP HANA cockpit, the SAP HANA studio, or SQL commands.

Several tools are available to help you monitor infrastructure health:

- SAP HANA cockpit is a Web-based tool that lets you manage and monitor multiple instances of SAP HANA and provides recommendations for system optimization and data tiering based on actual operating conditions. A security dashboard in the cockpit helps you meet compliance requirements with confidence and operate applications running on SAP HANA on the same solid security foundation.
- SAP Solution Manager supports holistic monitoring of SAP applications running on SAP HANA.
- A modern tool set for platform lifecycle and performance and landscape management, operations, and automation provides in-depth insights on query-execution plans and resource utilization.
- You can analyze and confirm proper infrastructure for SAP HANA with the SAP HANA hardware and cloud measurement tool. Use the tool to obtain details and possible explanations for certain KPIs and optimize your hardware and cloud landscape accordingly.
- SAP Landscape Management software helps you monitor and manage your infrastructure from a single pane of glass.



You can **minimize downtime and shorten recovery times** using multitier and multitarget secondary systems and one of several high-availability and disaster-recovery solutions delivered with SAP HANA.

SAP HANA's comprehensive authorization framework provides highly granular access control. Roles are used to bundle and structure privileges into sets of privileges for dedicated user groups. Privileges are based on standard SQL object privileges and SAP HANA–specific extensions for business applications.

Tools for user administration and role assignment, as well as adapters for the SAP Identity Management component and the SAP Access Control application, allow integration into existing user-provisioning infrastructures.

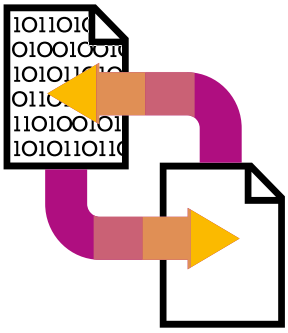
Extended Lightweight Directory Access Protocol (LDAP) integration enables automated user provisioning and native LDAP authentication. Combined with sophisticated encryption for data both at rest and in motion and redo log and native backup encryption, these techniques give SAP HANA solid security against cyberattacks and unauthorized data access. Dynamic data masking for tables and views lets you display only what each user is authorized to see, and it is done on the fly so it leaves the data available for processing.

Real-time, embedded data anonymization technology lets you squeeze maximum value from your data while supporting compliance with increasingly strict data-protection regulations. Modern data anonymization techniques such as k-anonymity, differential privacy, and l-diversity render personal data disconnected from an individual. This empowers business users and data scientists to "know without seeing" and explore new business opportunities for data as a service.

SAP HANA offers highly configurable, policy-based audit logging for critical system events such as changes to roles or the database configuration. It can also record access to sensitive data, write-and-read access to objects such as tables or views, as well as execute procedures.

And since complex security authorizations can be easily shared between native applications and extensions running on SAP HANA and SAP applications, developers can create innovative applications on SAP HANA covered by the same 360-degree security.

To safeguard security, take advantage of data security services and SAP expert advice on cybersecurity from SAP Services and Support.



Real-time, embedded data anonymization technology lets you squeeze maximum value from your data while supporting compliance with increasingly strict data-protection regulations.

Getting Started with SAP HANA

Companies worldwide use SAP HANA to transform their business and create value. To deliver timely action, SAP HANA can help you unleash next-level performance with a modern all-in-one, no-compromise architecture that democratizes in-memory computing. To support situational awareness, SAP HANA provides next-generation hybrid transactional and analytical processing with advanced analytics, so you can experience real-time data at your fingertips.

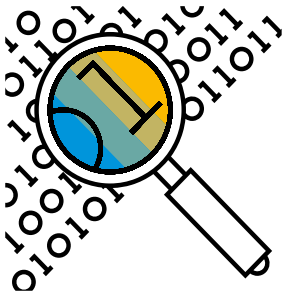
To **adapt with agility**, SAP HANA gives you the freedom to virtualize data access and move to the cloud at your own pace without cloud vendor lock-in. SAP HANA and SAP HANA Cloud allow you to adapt to change safely by embracing a next-generation hybrid and multi-cloud data management environment with petabyte-scale storage for the cloud environment and a single gateway for your data.

Innovate without boundaries by developing live, intelligent applications that enable real-time, in-context data analysis for deeper insights and informed decision-making. Operationalize machine learning across data types with smart multimodel data processing and advanced analytics.

At the same time, SAP HANA helps you **simplify for efficiency** by consolidating your IT landscape on your preferred infrastructure and by flexibly aligning data storage choices with business priorities. SAP HANA offers a holistic security framework with advanced real-time data anonymization that helps you maintain data privacy and trust and lets you know without seeing.

For more information:

- Estimate your SAP HANA Cloud capacity.
- Fast track your modernization journey on premise and in the cloud with the SAP Database Migration Factory program.
- Talk to an expert and learn how SAP Services and Support can help you to build your data solution with modern architecture and a simplified landscape while accessing data from a single solution to bring intelligence to your business.
- Can't wait to get started? Sign up for your free trial of SAP HANA Cloud now or download the express edition of SAP HANA for deploying an on-premise developer version directly on your PC, Mac, or in your private cloud.



With its unified database that stores, processes, and analyzes various types of smart multimodel data, SAP HANA enables **real-time insight and in-context data analysis**.

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