SAP HANA

Rethink the Possible with the SAP HANA® Platform

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THE BEST RUN SAP®

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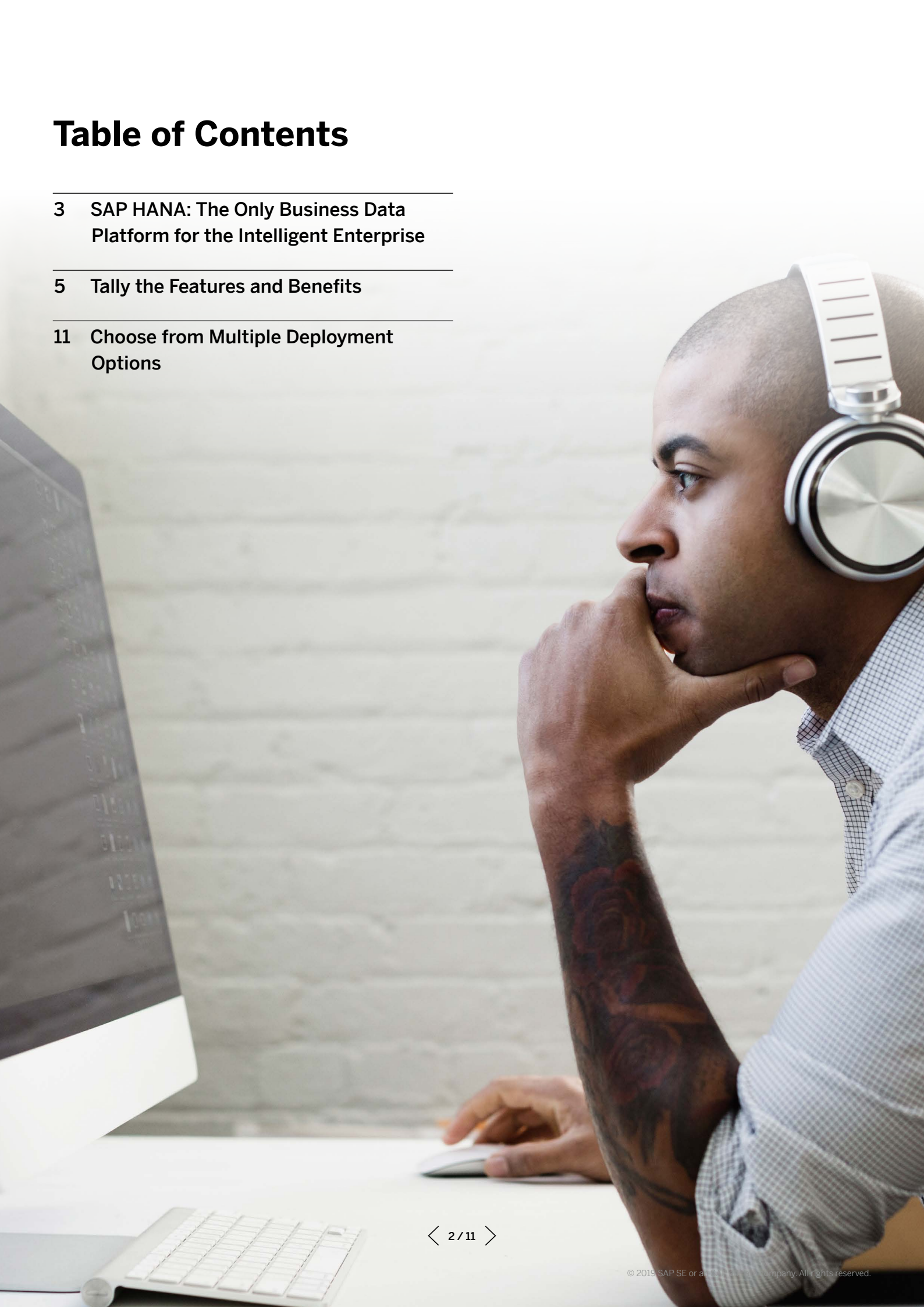

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SAP HANA®: The Only Business Data Platform for the Intelligent Enterprise

An intelligent enterprise requires a business-ready digital platform that helps you **unleash the potential of your data for better business outcomes**. SAP's leadership in enterprise applications and analytics enables organizations to apply data management technology to their data and further enhance business value.

INCREASE EFFICIENCY, DEEPEN INSIGHT, AND ADAPT TO CHANGE QUICKLY

Help your business accelerate the pace of innovation by moving to the SAP HANA® platform. Choose the game-changing in-memory platform that combines a database that complies with the standards for atomicity, consistency, isolation, and durability (ACID) with multimodel capabilities, application development, advanced analytical processing, and flexible data integration. Remove the burden of maintaining separate legacy systems and their silos of data so you can become an intelligent enterprise in this ever-changing digital economy, where new technologies and solutions emerge every other day.

One of the most challenging roadblocks to innovation today is the sheer complexity of IT systems. SAP HANA can help you simplify your data management infrastructure. As illustrated in the figure, SAP HANA converges database management, application development, advanced analytical processing (analytics, text analysis, spatial processing, streaming, and machine learning), and data integration in-memory to process transactions in one system. You can operate in real time and accelerate business transformation by integrating core business processes with customer data, supplier data, and data from the Internet of Things.

The massively parallel, in-memory paradigm underlying SAP HANA speeds information processing by a quantum leap. This architecture converges transactional and analytical workloads in a single data set in an in-memory, column-based data store. SAP HANA, in short, eliminates data redundancy, disk latency, and data movement among applications and analytical tools. And it provides advanced integration capabilities such as data federation, replication, bulk loading, transformation, cleansing, and remote data synchronization in the same architecture. It further simplifies application development and processing across data sources by providing a single virtualized view of data across your organization.

Perform all transaction and analytical processing in-memory and make all data immediately available from **a single system**.

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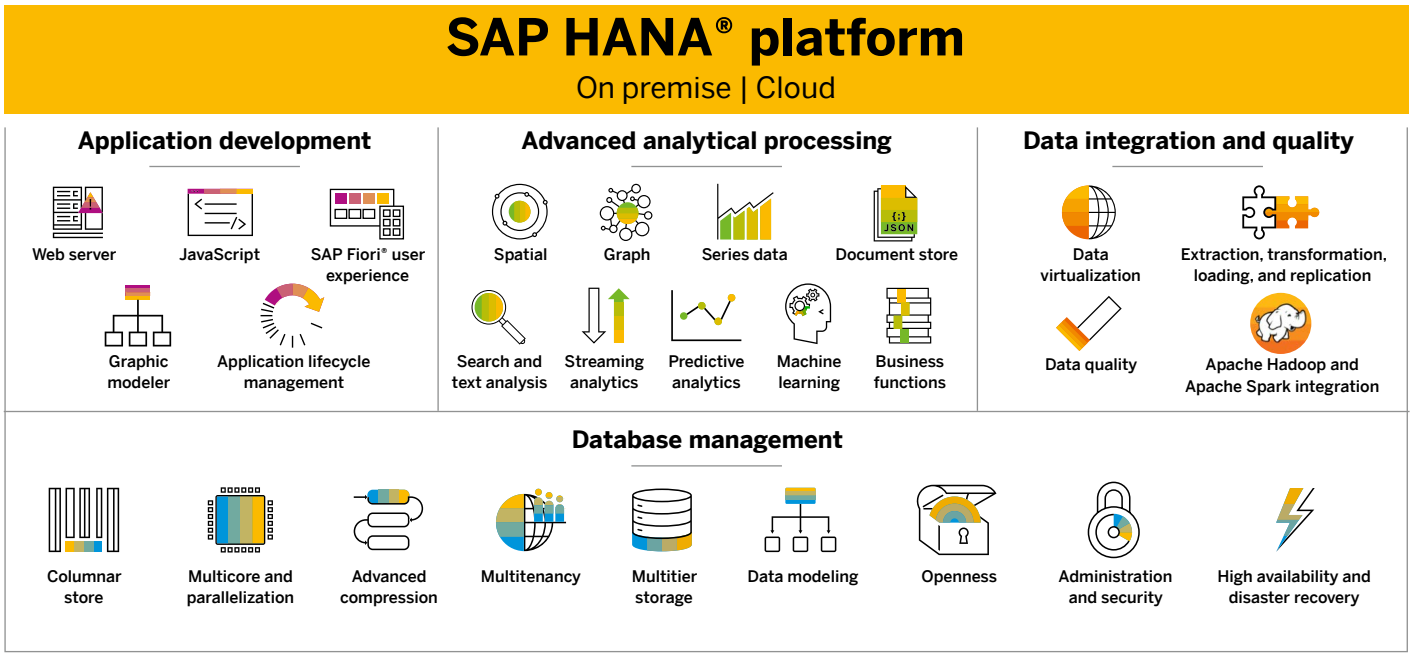
SAP HANA is the platform for all existing applications – your legacy software, third-party software, and SAP® software – and is the optimal platform for building and deploying next-generation, real-time applications; machine learning applications; and predictive analytics. You can perform business operations and data analysis in minutes rather than hours, untangle your data center operations by integrating all data into a single source, and lay the groundwork for reimagining business models.

SAP HANA is optimized for the latest persistent-memory technology from Intel. Furthermore, it provides several data-tiering options and is available through various deployment models in the cloud and on premise, so you can choose the deployment that best fits your business needs without compromising flexibility and cost. SAP HANA democratizes in-memory computing so you stand ready to expand and diversify your business with minimal IT growing pains.

Figure: SAP HANA – In-Memory Platform to Build Next-Generation Applications



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Tally the Features and Benefits

The following tables summarize the features of SAP HANA that contribute to making it unique in the industry.

Database

Feature	Description
In-memory, columnar, massively parallel database processing	The SAP HANA® platform permits transactional and analytical workloads using a single instance of the data on a single platform. It stores data in high-speed memory, organizes it in columns, and partitions and distributes it among multiple servers. This delivers faster queries more efficiently than aggregate data while avoiding costly full-table scans, materialized views, and analytic indexes.
Full ACID compliance	SAP HANA helps ensure compliance with all requirements for atomicity, consistency, isolation, and durability (ACID) standards. A two-phase commit protocol protects atomicity, while multiversion concurrency control and distributed transactions help guarantee consistency. A built-in transaction manager safeguards isolation, and the logger provides durability by writing commit-log entries to persistent storage.
Multitenancy	SAP HANA allows multiple tenant databases to run in one system, sharing the same memory and processors. Each tenant database is fully isolated, with its own database users, catalog, repository, data files, and log files for maximum security and control. You can move or copy tenants to other systems. Your high-availability and disaster-recovery settings apply for all tenants. Backup and recovery are supported at the tenant level or the system level.
Multitier storage	SAP HANA offers various software solutions to manage multitemperature data (hot, warm, and cold) with an improved price-performance ratio. SAP HANA native storage extension is a built-in capability to store warm data in persistent storage, such as a solid-state drive. Tables, columns, and partitions can be paged to disk, and administrators receive automated recommendations based on actual usage for data that could be moved to warm storage. Data is intelligently moved back into memory if queried by users. SAP HANA extension node is an option in scale-out configurations. SAP HANA dynamic tiering provides massive scale through a separate low-cost node with persistent column storage capabilities.
Persistent memory support	With the new Intel® Optane™ DC persistent memory, you can process larger volumes of data in real time with increased memory capacity while reducing total cost of ownership through lower data management and storage costs. Business continuity is improved and downtime is reduced through minimized time to load data at the startup of SAP HANA, as data is persistent in main memory, enabling near-DRAM performance in a more affordable way. For more information, visit www.sap.com/persistent-memory.

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Feature	Description
Data modeling and stored procedures	SAP HANA offers a native language called SQLScript that lets you build stored procedures and use advanced capabilities to create complex logic that runs inside the database. It includes a business function library with built-in, parameter-driven financial functions. In addition, it includes a framework that lets you build custom algorithms and run them securely inside the database. Core data services and calculation views further simplify and accelerate the creation of database logic. With the SAP® Enterprise Architecture Designer Web application, designing a data architecture is possible even before the SAP HANA platform has been set up. Thanks to a flexible model-to-model generation option for hybrid cloud environments, data models can be transferred between on-premise and cloud versions. The Web application enables end-to-end data privacy management to support compliance requirements.
Administration	SAP HANA provides comprehensive administration tools to support various levels of administrative capabilities from any device and location. You can use these tools for various platform lifecycle, performance, and landscape management operations and automation, such as start, stop, restart, back up, and recover. You can perform offline diagnostics, automate updates, customize and orchestrate SAP HANA environments, and analyze, simulate, and optimize workloads. SAP HANA cockpit is a modern, user-friendly Web administration tool based on the SAP Fiori® user experience that supports multiple instances of SAP HANA in your system landscape. SAP HANA cockpit includes advisors that provide recommendations based on actual operating conditions for system optimization, data distribution, and data tiering. Furthermore, there are tools to analyze SQL execution plans and CPU and memory use over time to pinpoint problems.
Security	Embedded technology for real-time data anonymization lets you squeeze maximum value from all your data while supporting compliance with increasingly strict data protection regulations. Robust authentication, user management, and authorization protocols help ensure that users access only the data they have permission to see and handle. 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, 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, while data access can be recorded in the standard auditing framework. And since complex security authorizations can be shared easily between native SAP HANA applications and extensions and SAP business applications, developers can create innovative applications on SAP HANA covered by the same 360-degree security strategy. For more information, visit www.sap.com/hanasecurity and www.sap.com/data-anonymization.

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Feature	Description
High availability and disaster recovery	SAP HANA supports high availability and disaster recovery to meet a broad range of service levels through an array of techniques such as backup; storage mirroring; synchronous, asynchronous, and multitarget system replication; hot standby; auto restart; invisible takeover; and auto failover. It supports standbys at campus, metropolitan, and remote locations for maximum availability. Several third-party backup and recovery tools are certified to work with SAP HANA as well, so you have your choice of approaches. The SAP HANA, active/active read-enabled option allows IT organizations to leverage secondary systems to offload read-intensive workloads for additional load balancing, local read access to data, and better hardware utilization.
Scaling up and out	SAP HANA supports multiple terabytes of data in a single server and scales further by implementing a shared-nothing architecture across multiple servers in a cluster. You can distribute large tables across these servers automatically, based on round-robin, hash, or range-partitioning rules.

Multimodel and Advanced Analytics

Feature	Description
Spatial processing	The SAP HANA® platform provides native support for spatial data and spatial functions. Spatial processing is supported by SQL through Open Geospatial Consortium standards, International Standards Organization rules for SQL multimedia and application-specific packages (ISO SQL/MM), and geospatial JavaScript Open Notation (GeoJSON) standards to store, query, and access location-enabled content. The use of open standards lets you exchange spatial information with third-party spatial solutions to develop enterprise-wide location intelligence. SAP HANA includes base maps with political boundaries and points of interest to accelerate development of modern, location-aware business applications. Third-party spatial solutions can also use SAP HANA as a high-performance, in-memory data store for managing and processing spatial data. SAP HANA spatial services, available in the cloud, integrate with custom business applications. Live spatial intelligence helps organizations create location-aware business applications faster and adopt advanced spatial capabilities, helping eliminate the barriers to accessing geospatial data. For more information, visit www.sap.com/spatial.
Graph	SAP HANA lets you store and process highly connected data using a dynamic data model called a property graph. Storing and querying graph data is supported through SQL and Cypher, the graph database query language from the openCypher project. A graph provides full transactional consistency and guaranteed compliance with atomicity, consistency, isolation, and durability (ACID) standards without replicating live transaction data. Native graph algorithms are provided to uncover relationships in your data in real time. You can also combine graph data processing with additional advanced analytical processing functionality in SAP HANA, such as text, predictive, and spatial analytics. The graph viewer delivered as part of SAP HANA helps you visualize and explore graph data.

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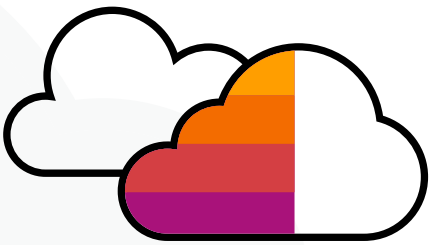
Feature	Description
Document store	You can build enterprise-class, non-SQL (NoSQL) applications with the support to store schema-flexible data in JSON format within SAP HANA in compliance with ACID. Fully integrated with SAP HANA, the document store supports all administrative operations of SAP HANA as well as complex joins across data in SAP HANA tables and the document store. You can combine JSON data with structured data and query or analyze it using SQL.
Search	You can use SQL to locate text quickly across multiple columns and binary files, such as Adobe PDF files, HTML, RTF, MSG, Microsoft Office documents, and flat text files. SAP HANA lets you run both full-text and advanced fuzzy searches for numerous languages.
Text analytics	Text analytics in SAP HANA includes advanced natural-language processing and entity extraction capabilities such as segmentation, stemming, tagging, and sentiment analysis. SAP HANA extracts "triples" – sequences of subject, verb, and object. These functionalities help pull meaning from unstructured data and transform it into structured data for analysis. SAP HANA also supports algorithms for text mining and sentiment analytics to derive relevant keywords from documents, even if written in character sets other than Latin, such as Kanji.
Streaming analytics	You can capture and process streams of events from many sources in real time using the highly scalable smart data streaming engine within SAP HANA. SAP HANA supports an SQL-like processing language to combine streams with contextual data and analyze the result on the fly. To improve scalability, SAP HANA comes with a "streaming lite" component you can deploy on the streaming data source to analyze and filter streams before they reach SAP HANA.
Series data	Internet of Things data and data from sensors arrive in a time-series format. SAP HANA processes time-series data and other kinds of series data efficiently to discover trends over a period. Whether you are monitoring price fluctuations, seasonal shifts, machine efficiency, energy consumption, or network flow, monitoring data over time helps you discover patterns you can exploit to your competitive advantage.



SAP HANA democratizes in-memory computing and offers a broad range of **multi-cloud deployment options** across public and private clouds.

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Application Development

Feature	Description
SAP HANA® extended application services	This offering is a built-in application server that helps you develop services, such as REST and OData as well as Web-based applications that can run on premise, in the cloud, and on mobile devices for efficient processing of large amounts of data. The extended application services engine is independently scalable from the database server to meet demanding requirements of applications. In addition to supporting multiple programming languages, including Java, JavaScript (Node.JS), and Python, it also allows you to bring your own language and reuse existing code or function libraries, enabling a high degree of efficiency and making it ideal for building applications based on a microservices architecture. An advanced extended-services cockpit makes all these activities available through a modern UI. With SAP HANA, you can choose among various open-source development tools, such as Git, GitHub, and Apache Maven.
Clients	SAP HANA provides many client libraries for accessing the SAP HANA platform from other application platforms. It includes standard ODBC/JDBC drivers; ADO.NET and .Net Core support; and native libraries for Python, Go, Node.js, Ruby, and Hibernate support. SAP recently released native Python and R machine learning APIs to leverage SAP HANA and its built-in machine learning libraries directly from common Python and R environments.
Responsive Web applications	SAP HANA includes an HTML5 and JavaScript framework (SAPUI5) based on the SAP Fiori® UI that lets you develop responsive Web applications. These applications run on any device and adapt automatically to screen size, delivering a consistent look and feel across all touch points.
Application lifecycle management	Integrated application lifecycle management helps you build and package applications, transport them from development to test to production, and deploy and upgrade them.
Application development tools	To develop applications with SAP HANA, you can use lightweight, Web-based development tools. SAP® Web IDE for SAP HANA is a browser-based development environment for data modeling, application development, database administration, and security management. And, if you prefer the ABAP® programming language, the development environment in ABAP now includes optimized features that help you build extensions to SAP applications on SAP HANA with a minimal learning curve. You can also use SAP PowerDesigner® software – or the edition of the SAP Enterprise Architecture Designer Web application that works with SAP HANA – to model data for building enterprise architecture (see also "Data modeling and stored procedures" in the "Database" table).

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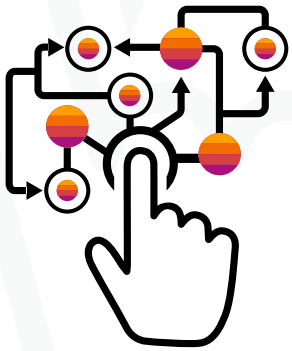
Data Management

Feature	Description
Data virtualization, federation, and integration	Data federation using smart data access lets you access information transparently from many remote data sources without moving data from remote sources to the SAP HANA® platform. SAP HANA provides built-in adapters to help you access data from a wide array of sources and a software development kit (SDK) to build custom adapters. SAP HANA supports comprehensive features to handle all data integration scenarios. These include real-time data replication as well as bulk-load processing, data transformation, cleansing services, and data enrichment services. Adapters are available for loading data from several databases, cloud sources, and Apache Hadoop, along with a custom SDK for building your own adapters. SAP HANA includes functionality to enrich geospatial data and algorithms to cleanse personal names, titles, phone numbers, firm names, and e-mail and street addresses. SAP HANA provides multiple options to analyze Apache Hadoop data, including the SAP® Data Hub solution, the SAP Data Intelligence cloud service, an Apache Spark adapter, and Apache Hive. You can access data in the Hadoop distributed file system and access MapReduce functions as data sources in SQL using user-defined virtual functions.
Remote data sync	With remote data synchronization, you can synchronize data bidirectionally between SAP HANA and databases in the SAP SQL Anywhere® suite that are embedded in devices or located at the edge of your network. Now, you can make enterprise data available to remote workplaces or locations beyond the reach of high-bandwidth connections. In addition, your enterprise can collect and analyze remote data to monitor devices at distant locations – empowering your stakeholders to be more responsive across the entire extended enterprise.



Become an **intelligent enterprise**
in a data-driven economy.

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Choose from Multiple Deployment Options

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, with an option to build custom hardware based on a tailored data-center model, or to choose a hyperconverged infrastructure (HCI) environment. A tailored data-center model lets you use existing hardware and infrastructure components, such as storage and network devices and processors, for your deployment of SAP HANA. You can find more about certified and supported hardware here.

For companies that have embarked on a software-defined data-center strategy, SAP HANA supports virtualization software and hardware logical partitioning.

In the cloud, SAP HANA is available in a database-as-a-service model known as SAP Cloud Platform, SAP HANA service, which is a comprehensive infrastructure combined with managed services; or through either SAP HANA Enterprise Cloud, which is a private cloud service managed by SAP, or public cloud service providers such as Amazon Web Services, Google Cloud Platform, IBM Cloud, and Microsoft Azure. In any deployment you choose, SAP stands behind privacy, security, and availability. For details on the various deployment options of SAP HANA, refer to the Landscape Definition Guide for SAP HANA.

To jump-start innovation, SAP HANA, express edition, offers a streamlined version of SAP HANA that is available free of charge in a basic configuration. It can be installed on your laptop or desktop computer (Windows PC or Apple Macintosh), on Linux-based servers, or on a virtual machine. Alternatively, you can deploy it on various popular cloud platforms. For more information, visit us online.

SAP HANA provides the most comprehensive **multimodel and advanced analytic processing** on any data in real time, be it local or virtually connected.

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