SAP HANA Platform
The platform for all applications

SAP HANA Platform / November 2016
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SAP HANA Platform is easy to adopt
Standard-based and open

### SAP HANA PLATFORM

<table>
<thead>
<tr>
<th>APPLICATION SERVICES</th>
<th>PROCESSING SERVICES</th>
<th>INTEGRATION &amp; QUALITY SERVICES</th>
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<tr>
<td><strong>Database Services</strong></td>
<td><strong>Processing Services</strong></td>
<td><strong>Integration &amp; Quality Services</strong></td>
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<tr>
<td>- Standard RDBMS</td>
<td>- Execute advanced data processing using SQL</td>
<td>- Data movement and federation with existing DBs</td>
</tr>
<tr>
<td>- ACID, SQL 92 Compliant</td>
<td>- Spatial processing follows OGC standards, ISO SQL/MM, GeoJSON</td>
<td>- Framework to build custom adaptors</td>
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<tr>
<td>- Accessible thru JDBC, ODBC, JSON, OData</td>
<td>- Built-in predictive libraries and supports R</td>
<td>- Integration with Spark and Hadoop</td>
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<td>- Standard security model</td>
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<tr>
<td>- Choice of third-party administration tools</td>
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### Application Services
- Choice of application servers and webservers
- Eclipse-based and web development tool
- Include web application server with JavaScript, Java, Node.js, C++ runtime support
- Support git, github, maven tools
- Include HTML5 UI libraries
Choice of application architecture
Leverage existing assets and skills

- ABAP developers use CDS and Open SQL to leverage SAP HANA without coding SAP HANA objects
- Custom application developers choose any application server and any database interface
- SAP HANA native application developers use SAP HANA application services inside the platform
SAP HANA Platform: The platform for all applications
Simplify, accelerate, innovate

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**All Devices**

**SAP, ISV and Custom Applications**

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<td>Graph*</td>
<td>ELT &amp; Replication</td>
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<td>Fiori UX</td>
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<td>Series Data</td>
<td>Hadoop &amp; Spark Integration</td>
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<td>OLTP+OLAP</td>
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<td>Multi-Core &amp;</td>
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<tr>
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**ONE Open Platform**

**OLTP + OLAP**

**ONE Copy of the Data**

* Graph is in controlled availability

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New! SAP HANA Desktop Edition For Developers*
Smaller Footprint – run SAP HANA on a laptop.

Downloadable Virtual Machine Image for SAP HANA.

- Pre-configured SAP HANA – free to download and use for development purposes.
- No need for a certified appliance – can run on a laptop.
- Limitations – 32GB RAM only.
- Community Support via SCN.
- Early Adopter version to be launched at Sapphire.

Product Capabilities

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ONE Open Platform

OLTP + OLAP

ONE Copy of the Data
Choice of SAP HANA High Availability (HA) and Disaster Recovery (DR) options
Ensuring the most demanding service-levels

Supports campus, metro, and geo clusters with multiple standbys

Host Auto-Failover (HA)
- Within one scale-out system
- N active nodes, M standby node(s)
- Automatically switch to standby node

System Replication (HA & DR)
- Across multiple systems/locations
- Continuous data transfer from memory
- Fast switch-over on system failure

Storage Replication (DR)
- Across multiple systems/locations
- Transfer data using storage mirroring
- Low cost option

Secondary system can be used for Dev/QA
HANA in detail
In-memory columnar store
Faster OLTP + OLAP processing on single copy of data

- ACID compliant
- High speed transactions support
- Aggregations on fly
- No indexes for fast access
- Process compressed data
- Optimized for multi-core parallel processing
- Single Instruction, Multiple Data (SIMD) processing support
- NUMA optimization to enable future support for very large (12TB+) nodes (CPU/Memory)
Parallel processing and SIMD
Faster data processing

Each processor can scan a column or portion of a column in parallel

With Single Instruction, Multiple Data (SIMD) processing, the same processor operation works on multiple data blocks simultaneously
Columnar store to process transactions and queries
OLTP+OLAP on single copy of data

• Delta storage is optimized for transactions
• Delta storage is merged periodically with main storage
• No data duplication – data kept either in delta storage or in main storage
Multitenant database containers
Lower capital and operating expenditure – cloud-ready

- Manage multiple databases as a unit
- Strong separation of data, resources and users among tenant databases
- Lower capital expenditure with better utilization of system resources
- Lower operating expenditure with simplified management
Dynamic tiering
Right price/performance balance between memory and disk

- Utilize disk-based, column-store technology to store less frequently used data
- Support petabyte scale deployment – not confined by the size of memory
- Is integral part of the single SAP HANA instance – no data duplication
- Transparently manage large data volumes by automatically moving data among memory, disk and Hadoop/SAP IQ using Data Lifecycle Manager (DLM)
Spatial processing
New insights from enriching business data with spatial data

- Store and process spatial data with other data types
- No need to create spatial indexes, tessellation, etc.
- Support open standards compliance (Open Geospatial Consortium - OGC)
- Spatial data types
  - Points, lines, polygons
  - Multi-dimensional support including 3D and measurement dimension
- Spatial functions
  - Area, distance, within, touches, intersects, adjacent
- Built in geo-content
  - Maps, political boundaries, roads, Point of Interests (POI)
- Spatial join operators for SQL and Calculation Views
  - Contains, crosses, intersects, overlaps, touches, within
  - Automatically add latitude and longitude to address
Predictive analytics
Transforming the future with today’s insights

- 70+ prepackaged predictive algorithms
  - Supports association, clustering, classification, regression, time series etc.
  - Supports variety of data – structured, spatial, text, streaming and series data

- AFM graphical modeling tool support to develop predictive applications using PAL and R-Script

- SAP Predictive Analytics leverage Automated Predictive Libraries (APL) libraries and PAL

- SAS processing run natively in SAP HANA eliminating date redundancy

- Leverage R advanced functions transparently

- Predictive analytics across multiple data types
## Association Analysis
- Apriori
- Apriori Lite
- FP-Growth
- KORD – Top K Rule Discovery

## Classification Analysis
- CART
- C4.5 Decision Tree Analysis
- CHAID Decision Tree Analysis
- K Nearest Neighbour
- Logistic Regression
- Back-Propagation (Neural Network)
- Naive Bayes
- Support Vector Machine
- Confusion Matrix
- Parameter Selection & Model Evaluation

## Regression
- Multiple Linear Regression
- Polynomial Regression
- Exponential Regression
- Bi-Variate Geometric Regression
- Bi-Variate Logarithmic Regression

## Cluster Analysis
- ABC Classification
- DBSCAN
- K-Means
- K-Medoid Clustering
- K-Medians
- Kohonen Self Organized Maps
- Agglomerate Hierarchical
- Affinity Propagation
- Gaussian Mixture Model
- Latent Dirichlet Allocation (LDA)

## Time Series Analysis
- Single Exponential Smoothing
- Double Exponential Smoothing
- Triple Exponential Smoothing
- Forecast Smoothing
- ARIMA/Seasonal Arima
- Brown Exponential Smoothing
- Croston Method
- Forecast Accuracy Measure
- Linear Regression with Damped Trend and Seasonal Adjust
- Test for White Noise, Trend, Seasonality

## Probability Distribution
- Distribution Fit
- Cumulative Distribution Function
- Quantile Function

## Outlier Detection
- Inter-Quartile Range Test (Tukey’s Test)
- Variance Test
- Anomaly Detection
- Grubbs Outlier Test

## Link Prediction
- Common Neighbors
- Jaccard’s Coefficient
- Adamic/Adar
- Katzβ

## Data Preparation
- Sampling
- Random Distribution Sampling
- Binning
- Scaling
- Partitioning
- Principal Component Analysis (PCA)

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## Statistic Functions (Univariate)
- Mean, Median, Variance, Standard Deviation
- Kurtosis
- Skewness

## Statistic Functions (Multivariate)
- Covariance Matrix
- Pearson Correlations Matrix
- Chi-squared Tests:
  - Test of Quality of Fit
  - Test of Independence
- F-test (variance equal test)

## Other
- Weighted Scores Table
- Substitute Missing Values
- DenStream clustering
- Adaptive Hoeffding Tree
- Random forest
- Area Under Curve calculation
- Survival analysis (Kaplan-Meier estimate)
R integration
Use leading open source data mining software transparently

- Embed R script within SQL script
- Execute R script inside R server
- Use R vector-oriented format rather than JDBC/ODBC
- Execute multiple R processes in parallel
- Leverage 3,500+ R statistical and graphical packages
Search, text analytics and mining
Insights from unstructured data

- Store text and binary files in SAP HANA for native text analysis and search
- Support various file formats (txt, html, xml, pdf, doc, ppt, xls, rtf, msg)
- Automatically detects 31 languages
- Search
  - Fuzzy, linguistic, synonymous search, using SQL
- Text Analytics
  - Extract relevant information from text (Linguistic Markup, Entity, Sentiment Extraction)
- Text Mining
  - Rank and Categorize documents by comparing with a set of pre-classified documents
Web server
Reduced data movement – app and database services in one platform

- Scale applications independently from the database services with new web application server
- Supports choice of programming languages – Server side JavaScript on Node.js, Java on TomEE and C++ Runtime container
- Core Data Services allow developers to create database objects and relationships without SQL
- Accelerate application development with open source code management tools – Git, GitHub and Maven
- Simplify authentication and authorization with single sign-on support between application and database services
- Scheduled execution of JavaScript and SQLScript programs
Choice of application architecture
Leverage existing assets and skills

- ABAP developers use CDS and Open SQL to leverage SAP HANA without coding SAP HANA objects
- Custom application developers choose any application server and any database interface
- SAP HANA native application developers use SAP HANA application services inside the platform
Smart data access
Access any data from any source

- Manage and query remote tables as local virtual tables
  - Support virtual tables in calculation view and SQL
  - Virtual tables can be combined with PAL, BFL, and Spatial
- Push query processing to remote databases
- Complement functionalities in remote database with SAP HANA capabilities
- Support remote query results caching with HIVE
- Provide SDK for adapters based on ODBC
Hadoop integration
Ad-hoc query capabilities and processing of unstructured data

- Indirect access using Spark and Hive with Smart Data Access
- Direct access using Virtual User Defined Function (vUDF)
  - Access HDFS without need for the package, mapper, and reducer specification
  - Invoke custom Map Reduce jobs
  - Embed vUDF in SQL
- Load data from Hadoop with Smart Data Integration
- Unified admin and monitoring tool for SAP HANA and Hadoop cluster
- Speed-up Hadoop data analysis with new SAP HANA Vora connector
SAP HANA Cockpit
Simplify administration and monitoring

Fiori UX-based web administration tool manages SAP HANA from any device

SAP HANA Cockpit

- Catalog of Fiori tiles to manage hardware resource utilization and SAP HANA processes
- Analyze diagnostic files while the database is down for faster fault detection and correction
- Security dashboard in SAP HANA Cockpit to achieve visibility into security KPIs
- Integrated delta backup capabilities in SAP HANA Cockpit
Demo