



# Architecting Real-Time Applications on SAP HANA Platform



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# Agenda

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## **Introduction**

In-Memory Computing: Why now?

What is SAP HANA Platform?

Architecting new applications on SAP HANA platform

Getting Started

**R/3**

**ABAP**

**Business Objects**

**ERP**

**CRM**

**HANA**

**Ariba**

**SD, MM**

**BW**

**S/4HANA**

**Sybase**

**SuccessFactors**

**FI-CA**

**Netweaver**

**Concur**

# THE cloud company powered by SAP HANA



**Platform**



**Applications**



**Network**

**86%**

of Global Fortune 500

**98%**

of the 100  
Most Valued Brands

**44 M**

Cloud users

**74%**

of the world transactions

# Agenda

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Introduction

**In-Memory Computing: Why now?**

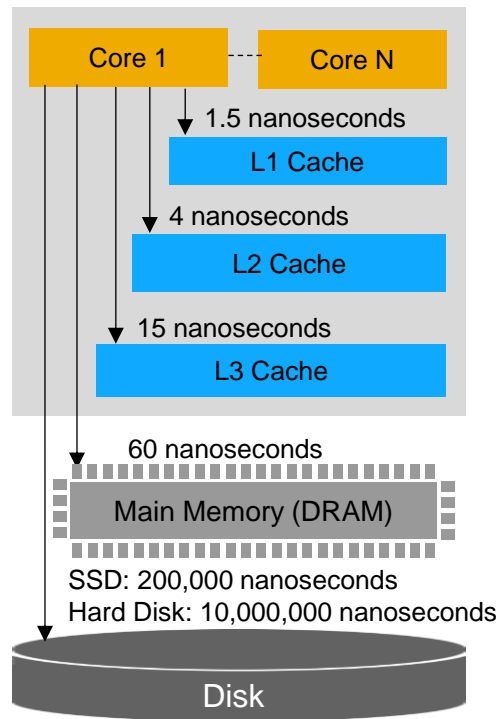
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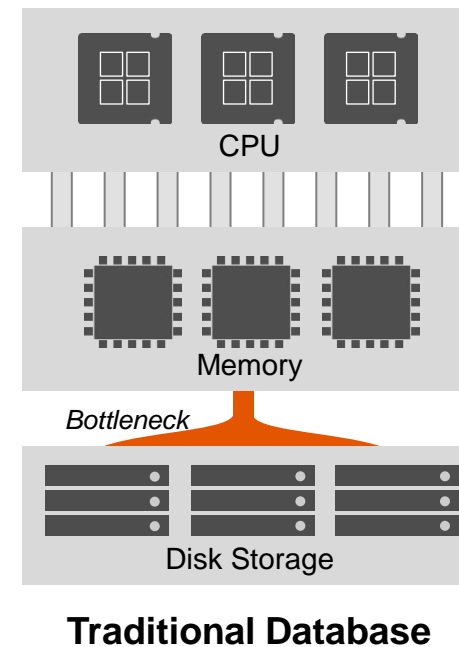
# Disk is too slow

## Data Access Latency



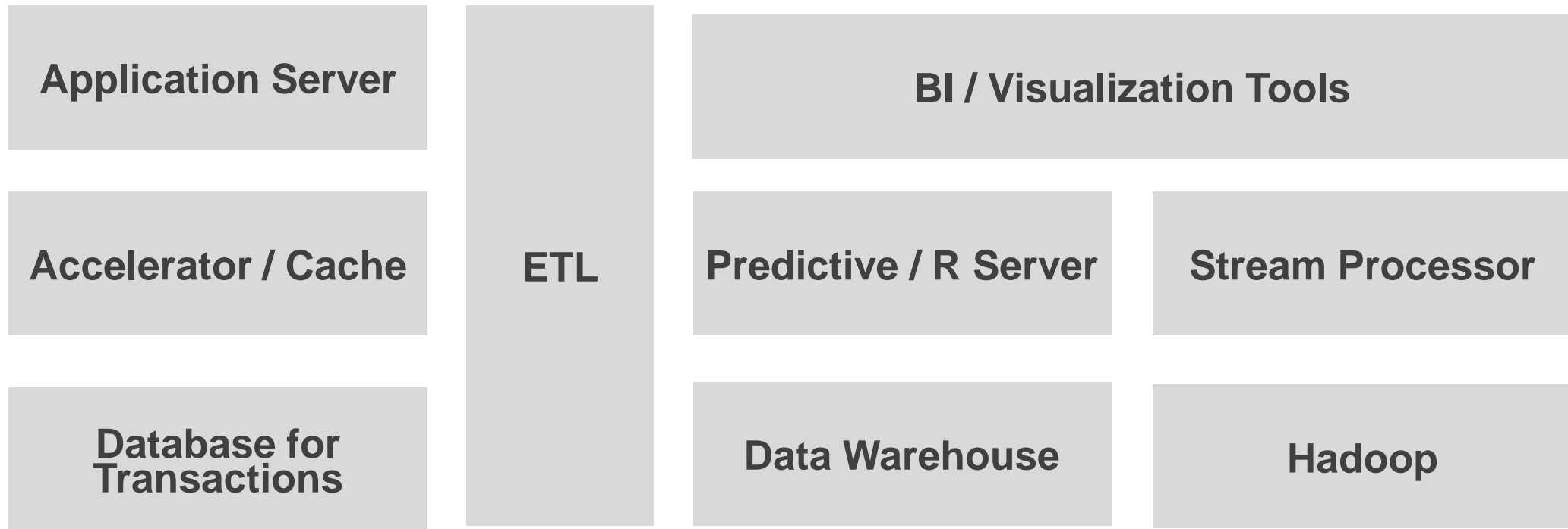
- DRAM is 125,000 times faster than disk
- DRAM is 10-80 times slower than on-chip caches

## Disk is the Bottleneck



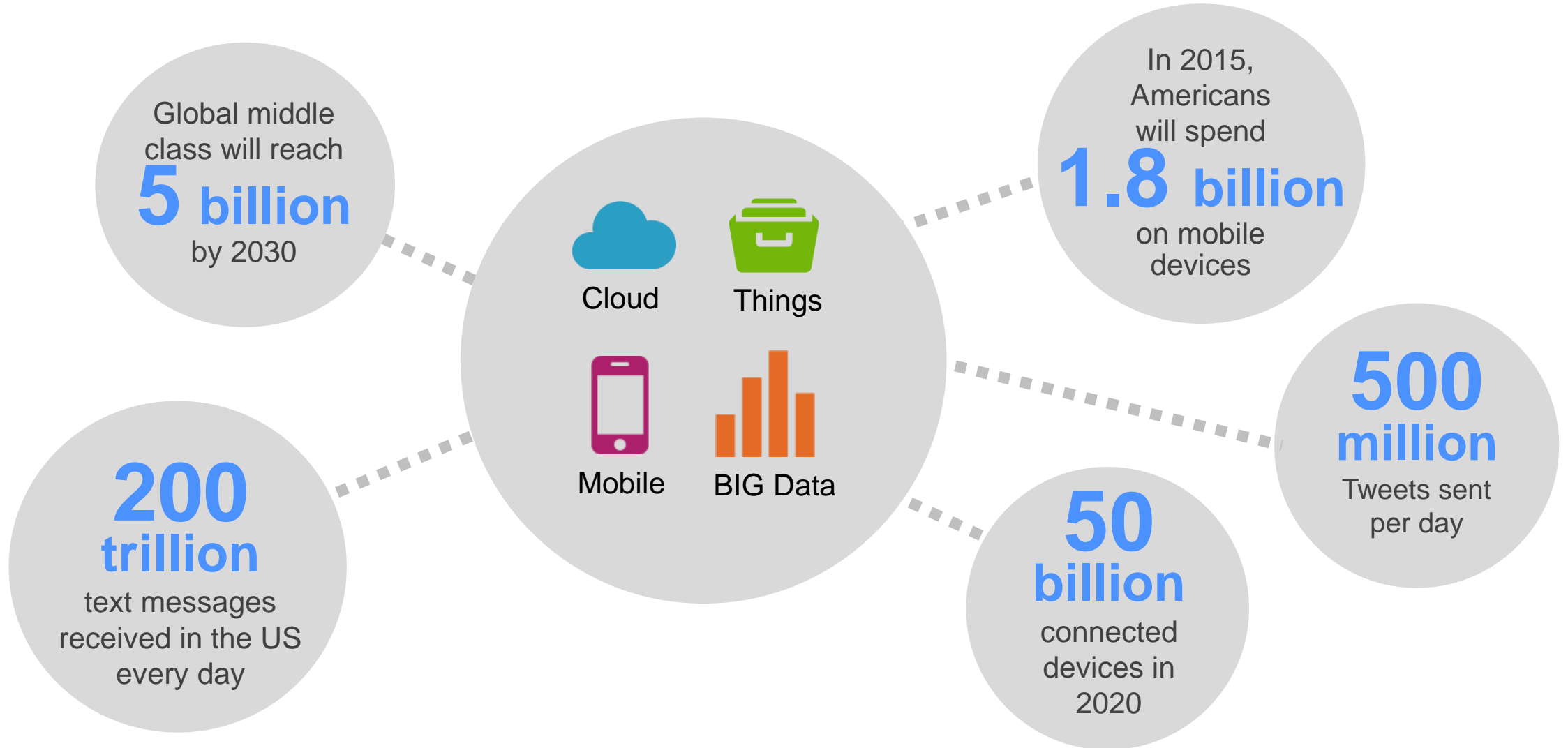
# What does this mean to YOU and Software Architecture?

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Architecture is developed based on current limitations and future requirements

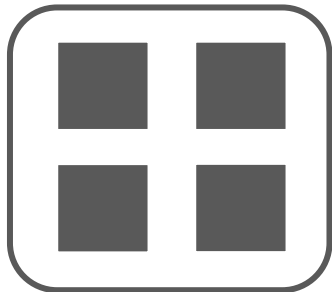
# Today's reality... More data - Big Data, IoT





# Hardware Developments

**20 years ago**



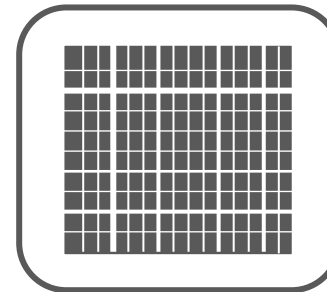
**MEMORY**  
1 GB

**CPU**  
4 X 50 MHz

————— x 6000 —————

————— x 1800 —————

**Today**



**MEMORY**  
6 TB

**CPU**  
120 X 3.5 GHz

**Near Future**

**MEMORY**  
48 TB

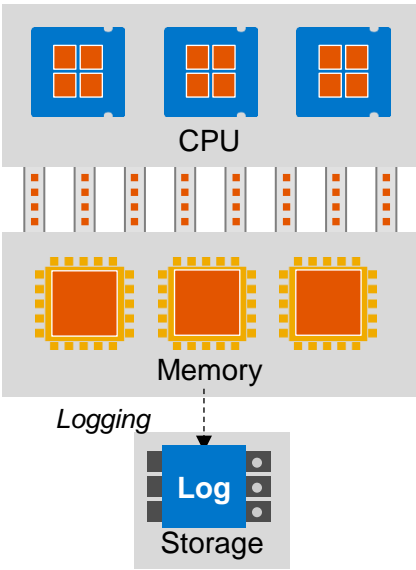
**Cores**  
480

# In-memory computing is a reality

## Cost of DRAM

Year	Price / GB
1980	\$6,328,125
1990	\$103,880
2000	\$1,107
2013	\$5.50

## In-Memory speed



## In-Memory Database

Source: <http://www.statisticbrain.com/average-historic-price-of-ram/>

# What if there is ONE platform....

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**...that can process transactions and analytics**

**...that can process all data types (structured, unstructured, documents, spatial, graph)?**

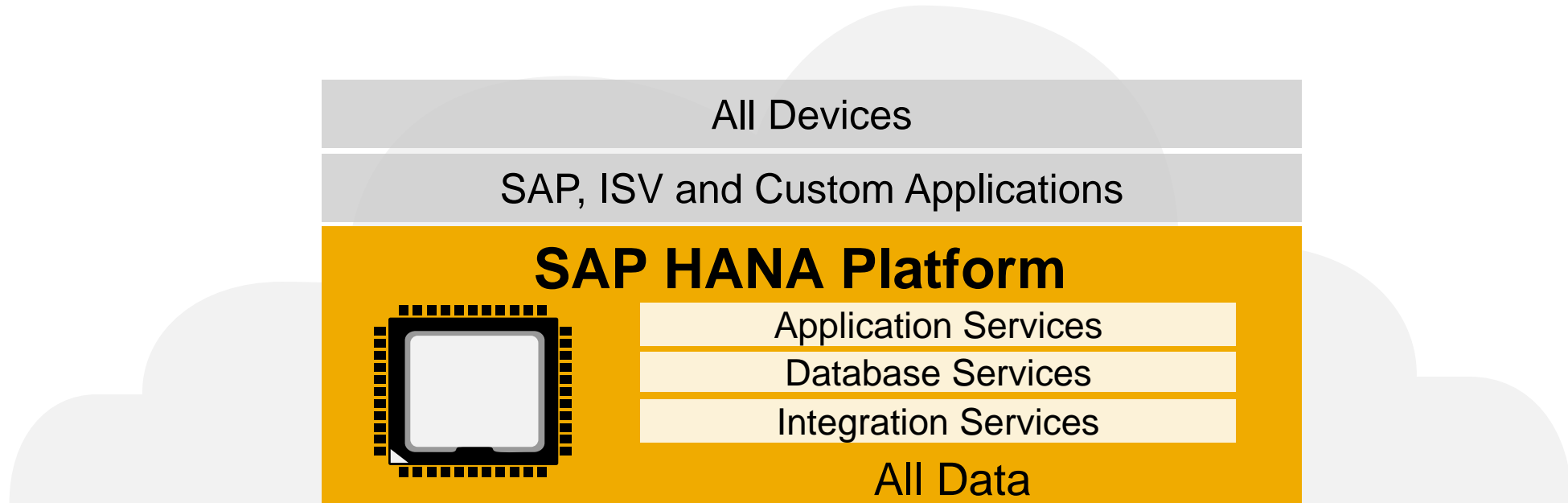
**...where all processing capabilities required to build an application are included?**

**...that is available in public/private cloud and on-premise?**

**How does this change the software architecture?**

# SAP HANA Platform

The in-memory data management and application platform for all applications



**ONE open platform**

**OLTP + OLAP**

**ONE copy of the data**

# Agenda

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In-Memory Computing: Why now?

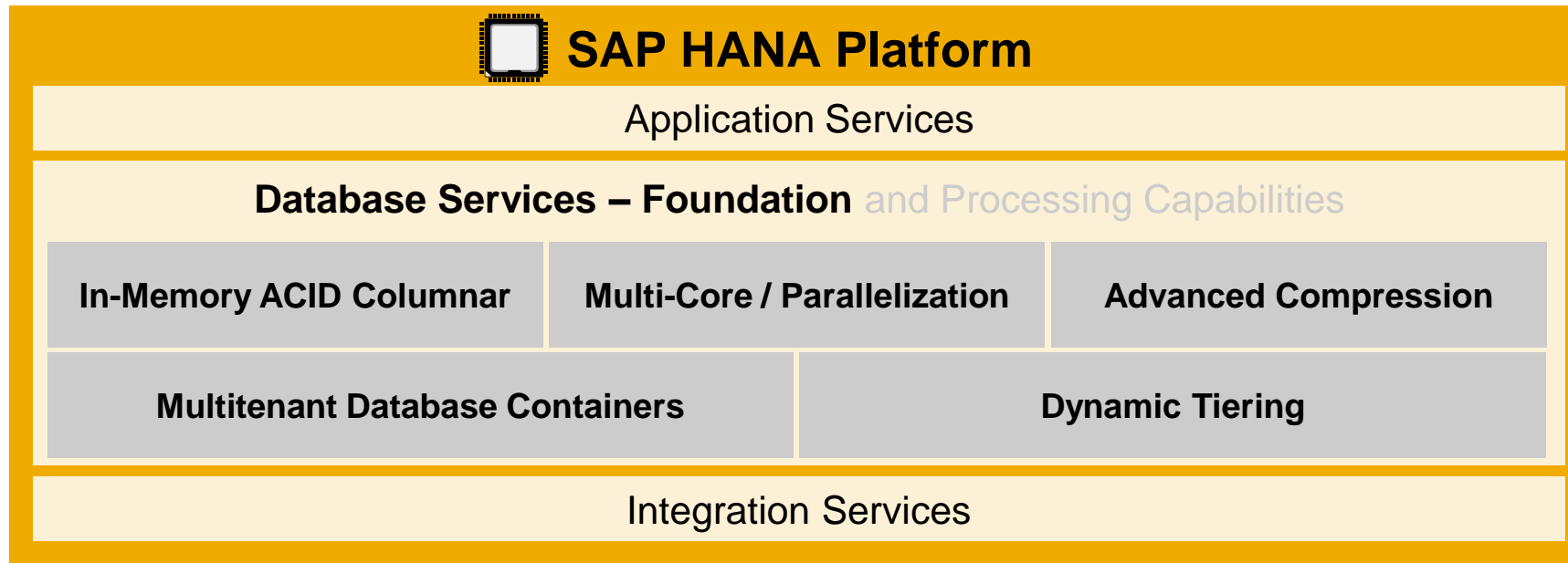
**What is SAP HANA Platform?**

Architecting new applications on SAP HANA platform

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# SAP HANA Platform – Database Services

Breakthrough innovations



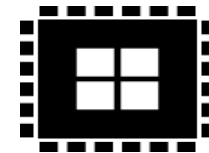
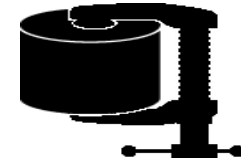
- Turns data into real-time information
- No database tuning required for complex and ad hoc queries
- Run Transactions and Analytics together on one system and one copy of data
- Ready for Cloud, Hybrid, or On-premise deployment
- Not limited by the size of memory

# In-Memory Columnar Store

Faster OLTP + OLAP processing on single copy of data

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- 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



# Columnar Store

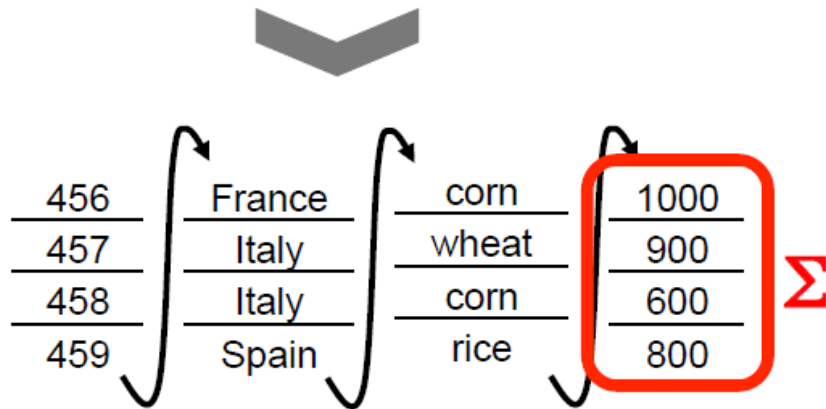
Order	Country	Product	Sales
456	France	corn	1000
457	Italy	wheat	900
458	Italy	corn	600
459	Spain	rice	800



456	France	corn	1000
457	Italy	wheat	900
458	Italy	corn	600
459	Spain	rice	800

Typical Database

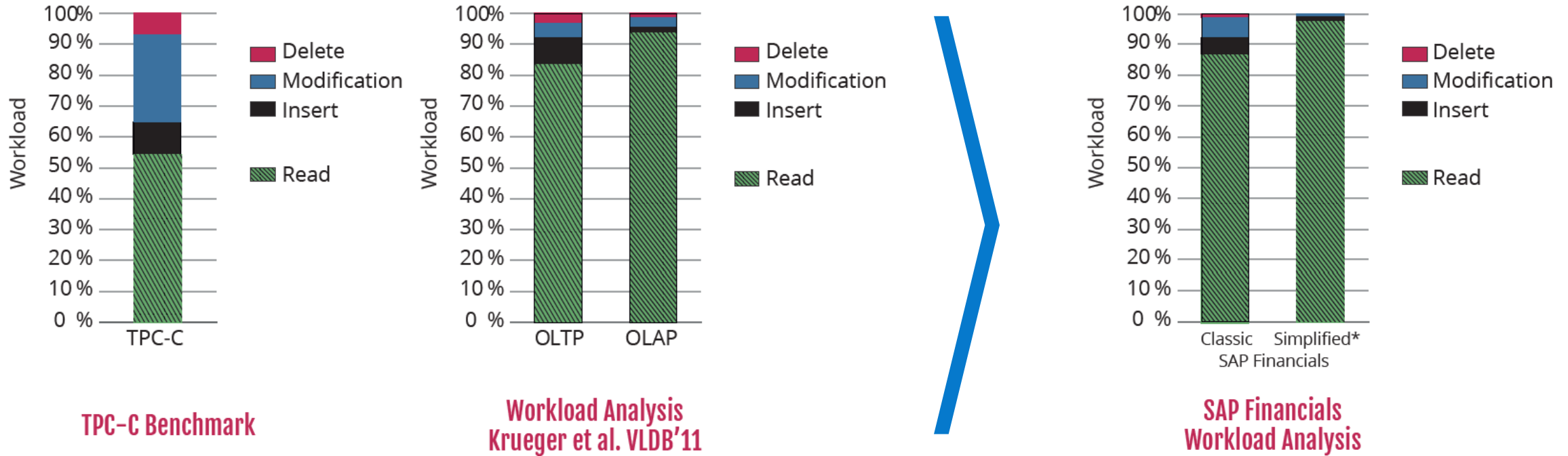
```
SELECT Country, SUM(sales) FROM SalesOrders
WHERE Product = 'corn'
GROUP BY Country
```



SAP HANA: column order



# Workload Analysis in OLTP & OLAP applications



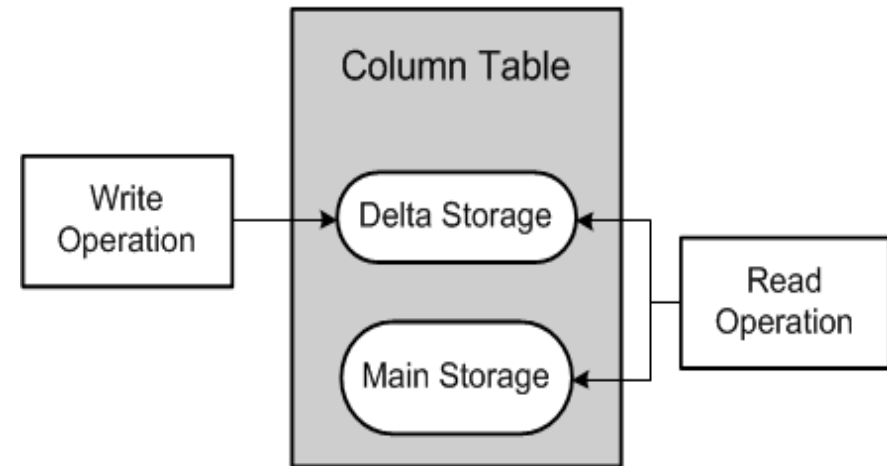
Workload in enterprise applications are mainly read queries (OLTP 83%, OLAP 94%)

\* Without Transaction-Maintained Aggregates

# Columnar store to process transactions and queries

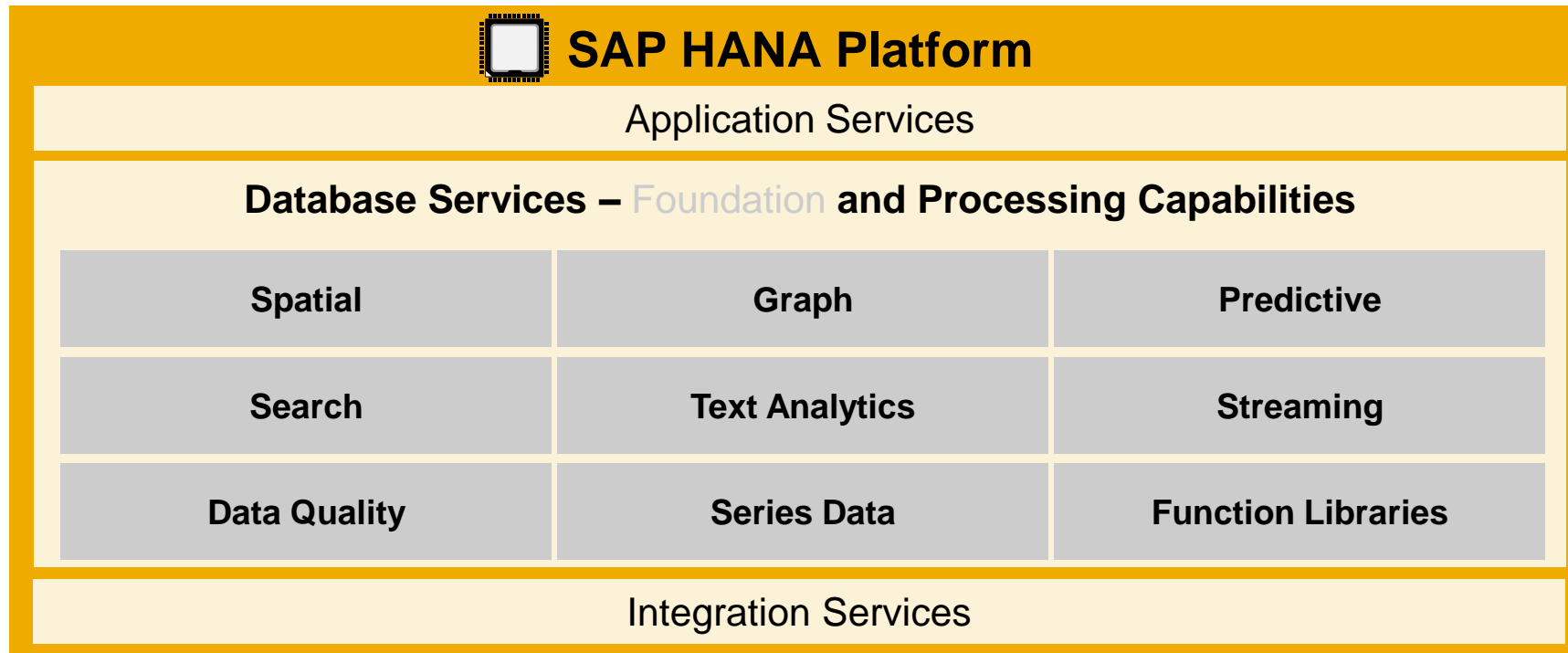
OLTP+OLAP on single copy of data

- 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



# SAP HANA Platform – Database Services

Comprehensive advanced data processing and analytics



- Run applications with dramatically different datatype characteristics in the same system
- Optimize streaming, graph, planning, and spatial applications on the same data
- Empower your business via built-in predictive analytics, business functions, and data quality

# Build more logic inside the database

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## **Eclipse Based IDE & Web IDE**

## **Modeling tools to build application logic inside the database**

- Views, Calculation Views, Stored Procedures, Decision Tables

## **Core Data Services (CDS)**

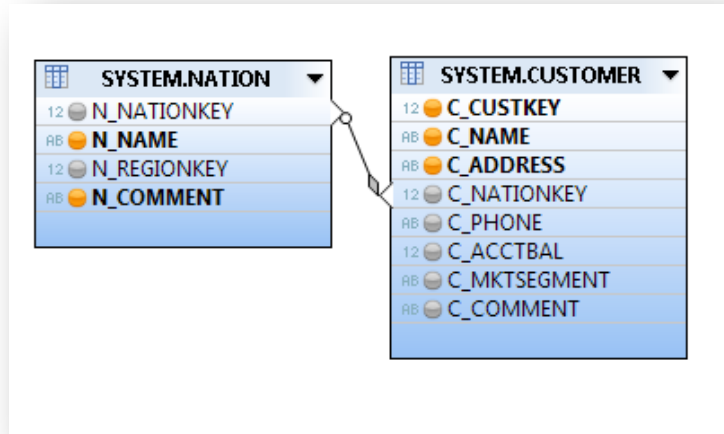
## **SQL for spatial, search, text processing, predictive and graph**

## **Built-in business function libraries for complex computations**

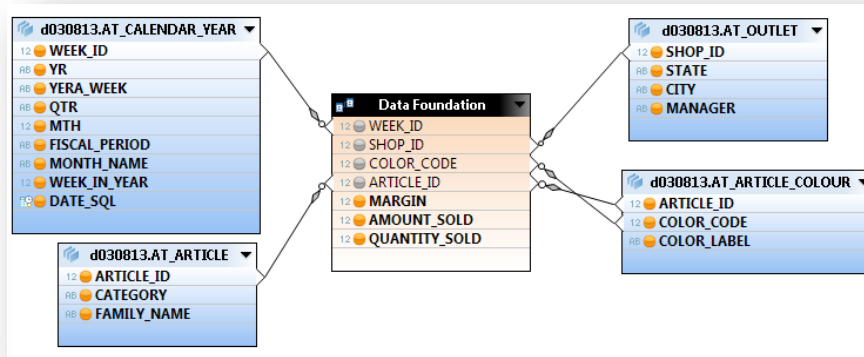
## **60+ predictive libraries**

# Build more logic inside the database – Views – 1/3

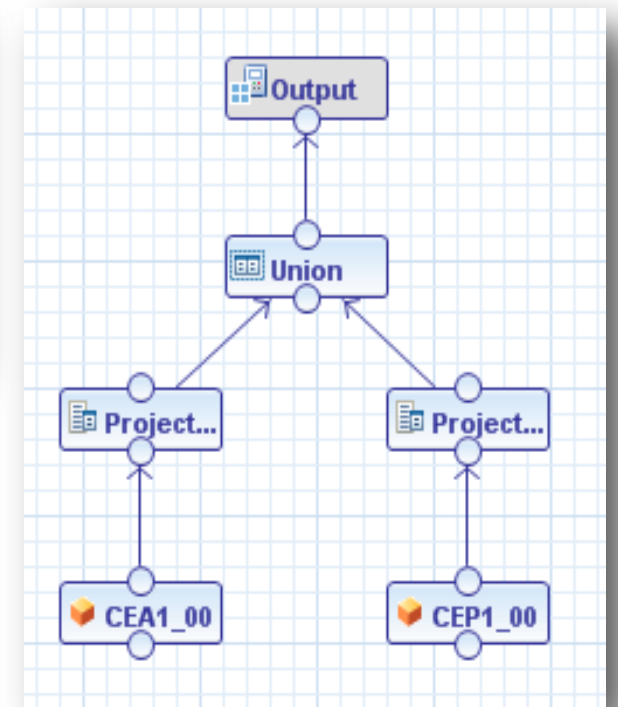
## Attribute View



## Analytical View



## Calculation View



## Calculation View with Script

Scenario

Details of Script\_View

```

/***** Begin Procedure Script *****/
BEGIN

/* Actual */
SQL_A_VIEW = CE_OLAP_VIEW ( "_SYS_BIC"."eim360-00/CEA1_00",
SQL_A = CE_PROJECTION ( :SQL_A_VIEW, [ "MATNR", "PERIO", "V

/* Planned */
SQL_P_VIEW = CE_OLAP_VIEW ( "_SYS_BIC"."eim360-00/CEP1_00",
SQL_P = CE_PROJECTION ( :SQL_P_VIEW, [ "MATNR", "PERBL" AS

/* Union */
var_out = CE_UNION_ALL (:SQL_A, :SQL_P);

END /***** End Procedure Script *****/

```

Output of Script\_View

```

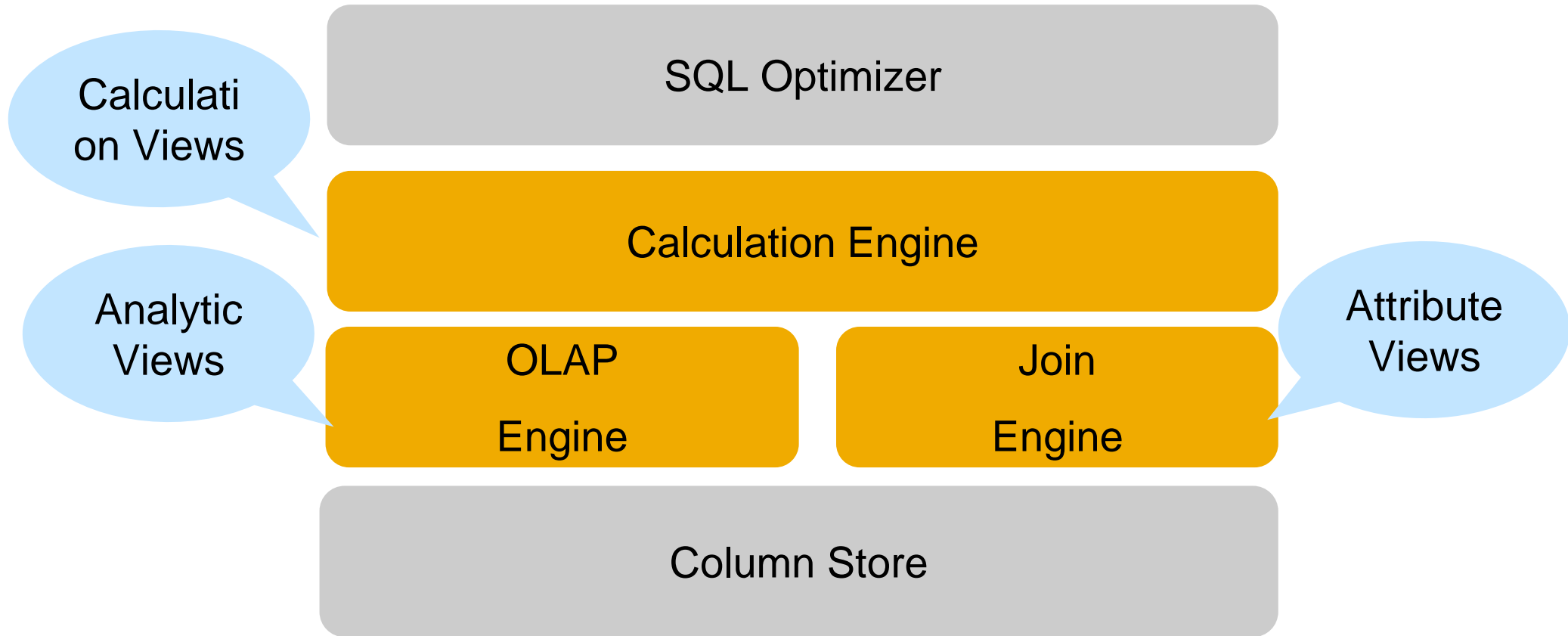
Output Parameter var_out
- MATNR
- PERIO
- VKORG
- PLIKZ
- NETREV

```

## Currency Conversions

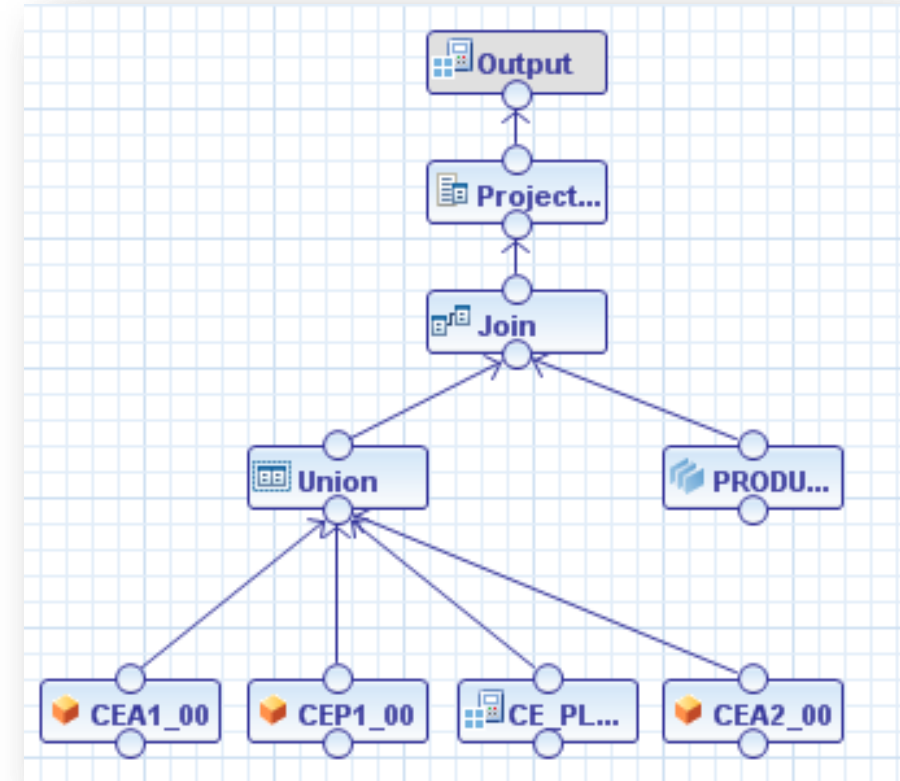
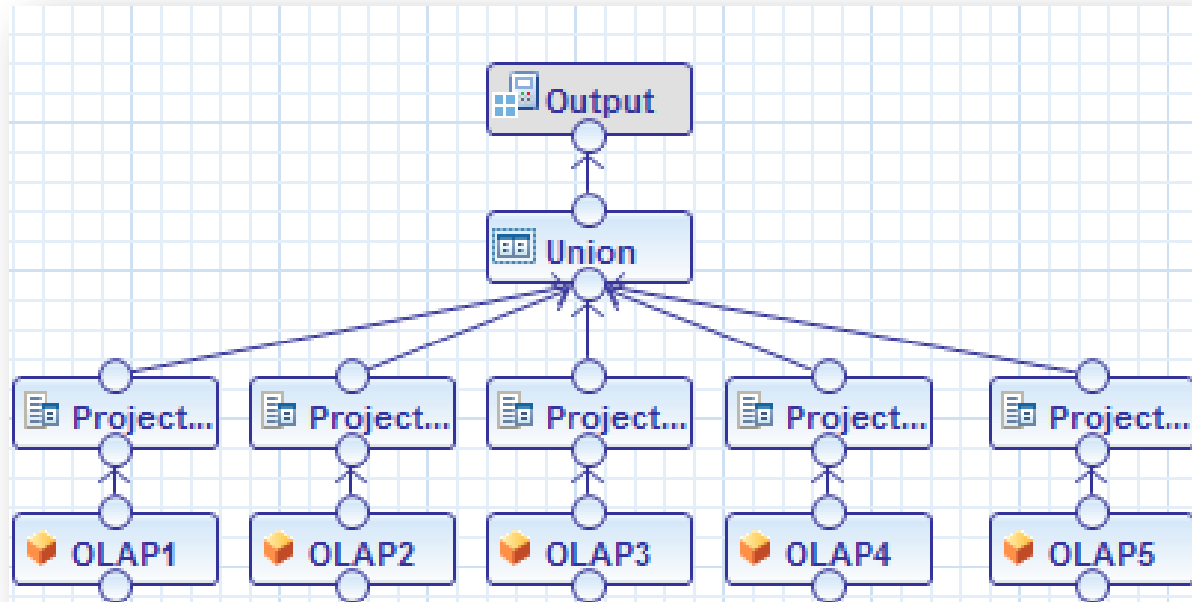
# Build more logic inside the database – Views – 2/3

Purpose built engines to optimize execution



# Build more logic inside the database – Views – 3/3

## Graphical Calculation Views



- No SQL Script coding needed
- Includes Union, Join, Projection and Aggregation nodes
- Uses Analytic Views, Attribute Views, Calculation Views and tables
- Supports calculated columns
- Supports debugging

# Build more logic inside the database – Core Data Services – 1/2

## Entities & Associations

### Custom-defined Type

```
type Amount {  
  value : Decimal;  
  currency : Association to Currency;  
}
```

### Entity

```
entity Address {  
  streetAddress; zipCode; city; // snipped type defs  
  kind : enum { home, business };  
}
```

### Association

```
entity Employee {  
  addresses : Association[0..*] to Address;
```

### Calculated Field

```
  homeAddress = addresses[kind=home];
```

### Structured Field

```
  salary : Amount;
```

### Views

```
define view EmployeesInOrg as  
  SELECT from Employee {  
    ID, name,  
    salary,  
    orgunit {  
      name,  
      manager,  
    },  
    homeAddress  
  }
```

Query in CDS QL



# Build more logic inside the database – Core Data Services – 2/2

- **Path expressions along Associations**

```
SELECT c.id, c.name, a.zipCode FROM Customer c
  JOIN $Customer2Address c2a ON c2a.customer = c.id
  JOIN Address a ON c2a.address = a.id
  AND a.type='deliveryAddr'
WHERE ...
```



```
SELECT id, name,
  deliveryAddress.zipCode FROM Customer
WHERE ...
```

- **XPath-like filter expressions in paths**

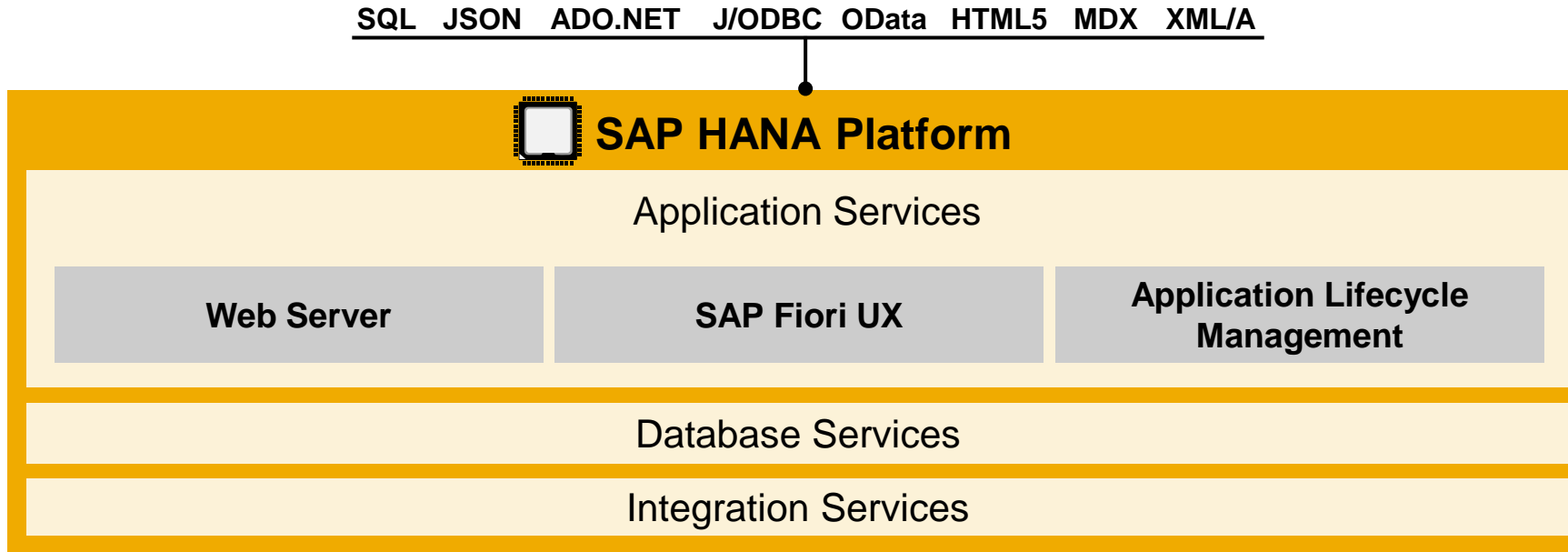
```
SELECT name, addresses[type=deliveryAddr].city AS deliveryAddress,
  addresses[type=invoiceAddr].city AS invoiceAddress FROM Customer ...
```

- **Nested projection clauses → structured result sets**

```
SELECT id, name,
  deliveryAddress { streetAddress, zipCode, city }
FROM Customer WHERE ...
```

# SAP HANA Platform – Application Services

Web server and database in one system reducing data movements



- Deliver consumer-grade User Experiences for any device, automatically
- Support for open development standards – HTML5, JSON, Java Script
- Built-in tools to develop, version-control, bundle, transport, and install applications

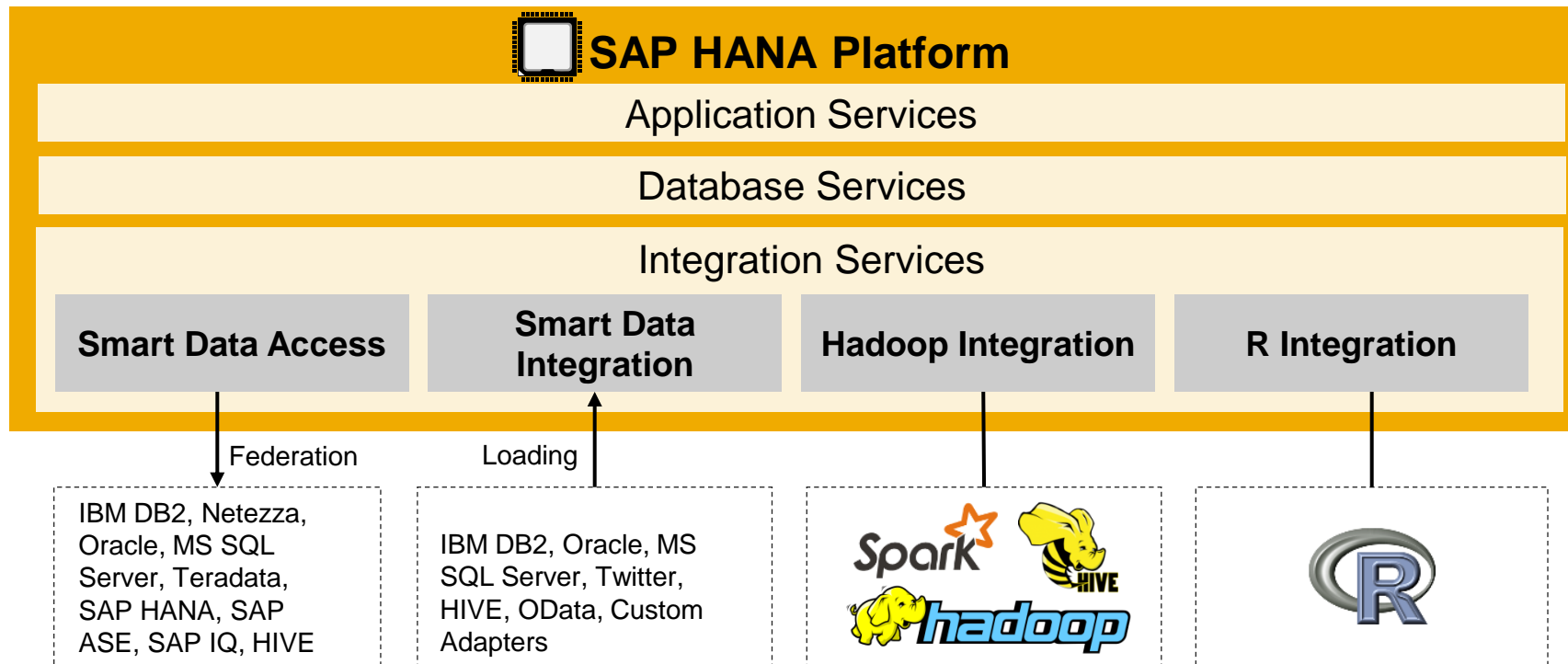
# Beautiful User Experience on All Devices



- Model-View-Control(MVC) based JavaScript UI libraries to render client-side HTML5
- Based on OpenUI5 libraries
- 180+ UI controls and charts included
- Works with JSON, XML and OData models

# SAP HANA Platform – Integration Services

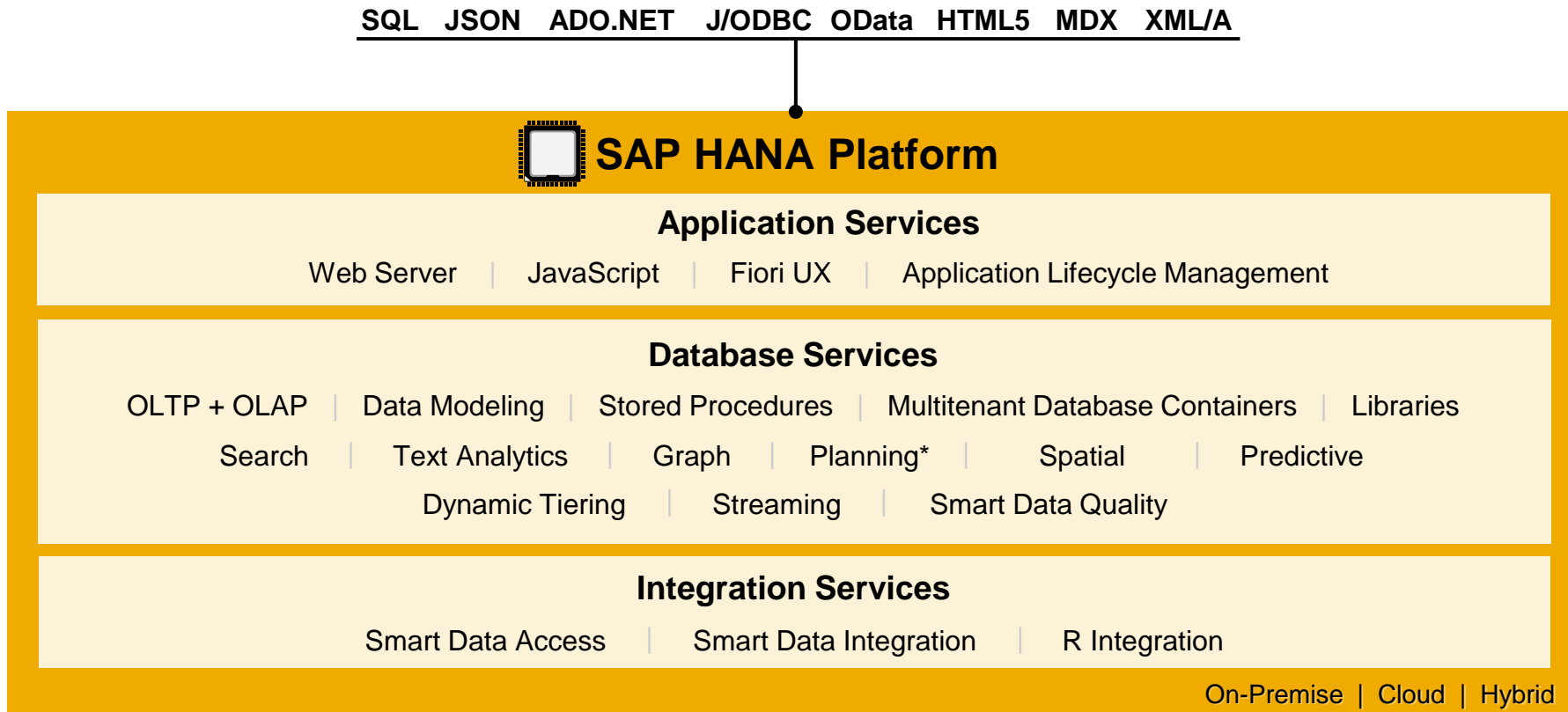
Data from any source for a complete view of the business



- Access information stored in data silos while keeping the data in place
- Replicate and move any type of data in real-time to the cloud and on-premise when necessary
- Multiple access points from HANA to Hadoop data: thru Spark, Hive, HDFS and Map Reduce functions
- Run R applications directly from SAP HANA

# SAP HANA: The Platform for all Applications

Comprehensive services to make information available to any application



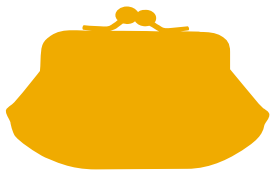
\* Not available for external use. Available with SAP products – SAP Business Warehouse powered by HANA, Business Planning & Consolidation(BPC), Sales & Operations Planning(S&OP).

# SAP HANA delivers results for business today

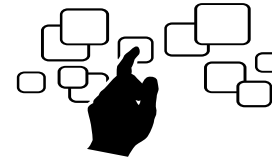


**5,800+**

SAP HANA customers



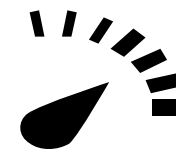
Forrester reports **37%** cost savings using a single system for Analytics and Transactions



**1,850+** SAP Business Suite and **1,600+** BW powered by SAP HANA customers



**1,800+** startups from **57** countries innovating on SAP HANA



**10,000** times faster reports



**37+** SAP HANA Cloud Data Centers Worldwide (from SAP and IBM)

# Agenda

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Introduction

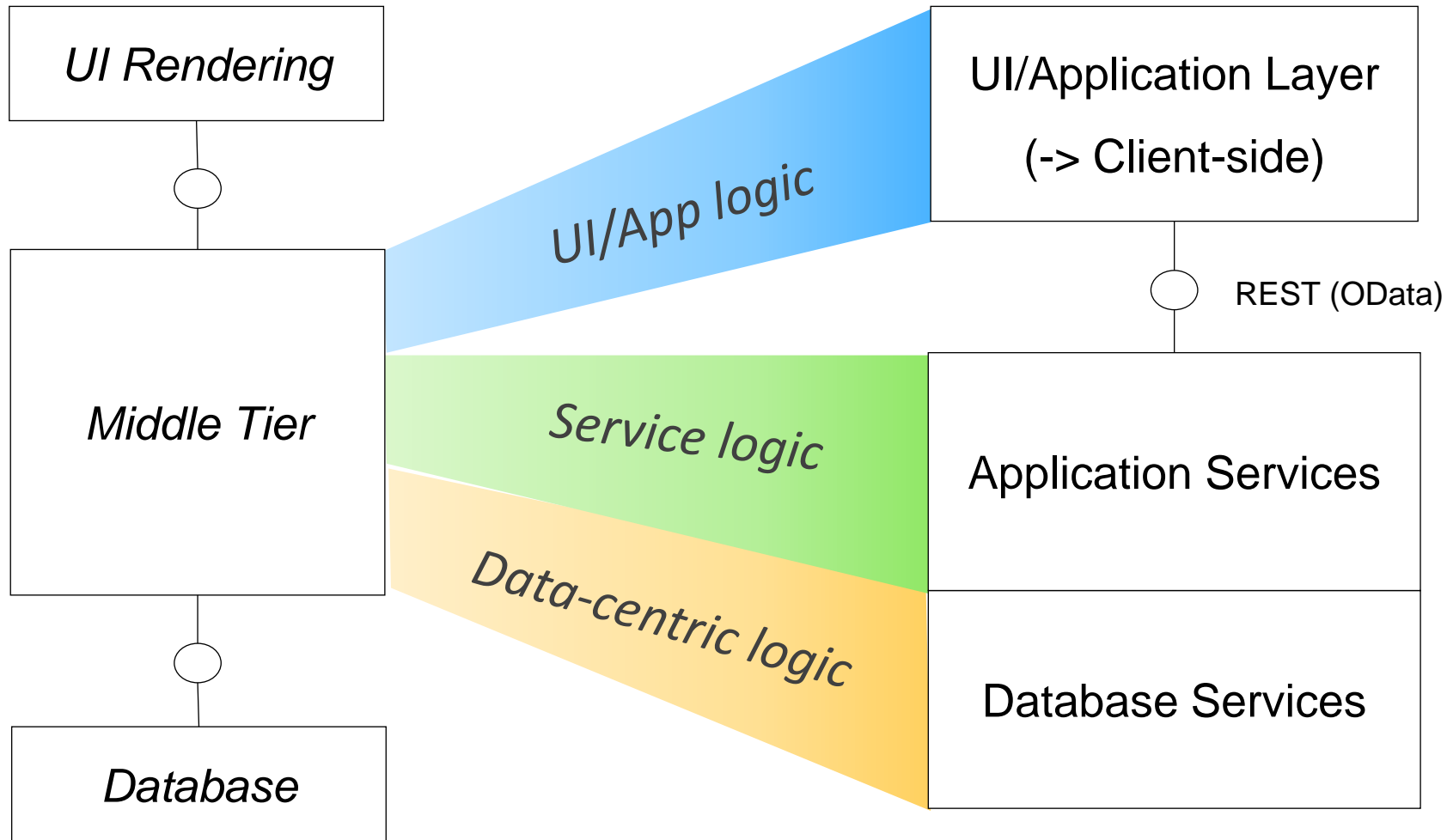
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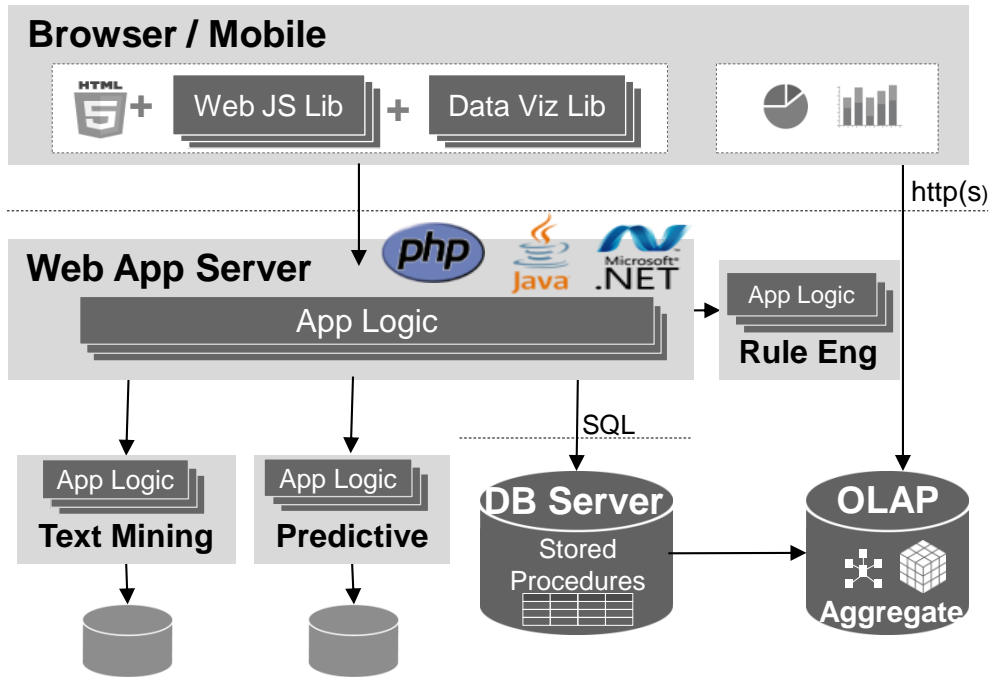
# Architecture changes with SAP HANA Platform – 1/2



## SAP HANA Platform



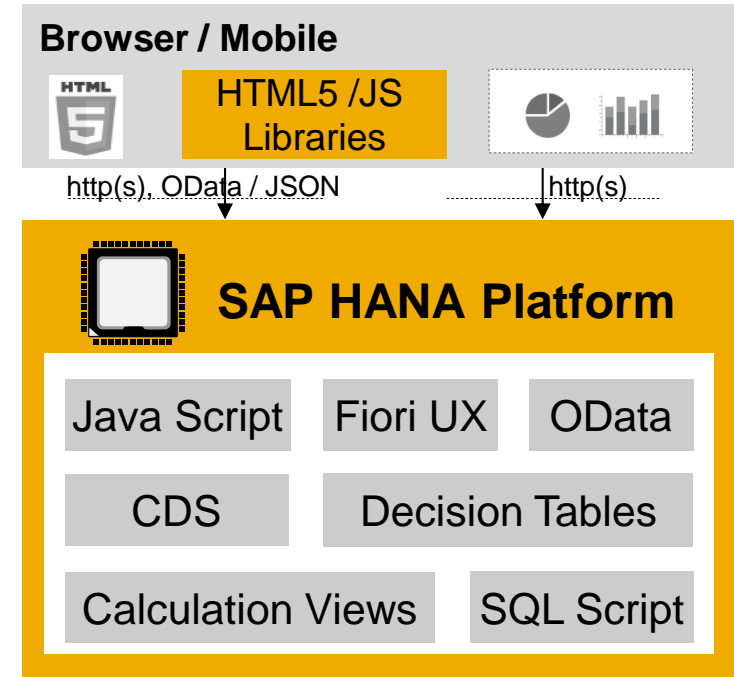
# Architecture changes with SAP HANA Platform – 2/2



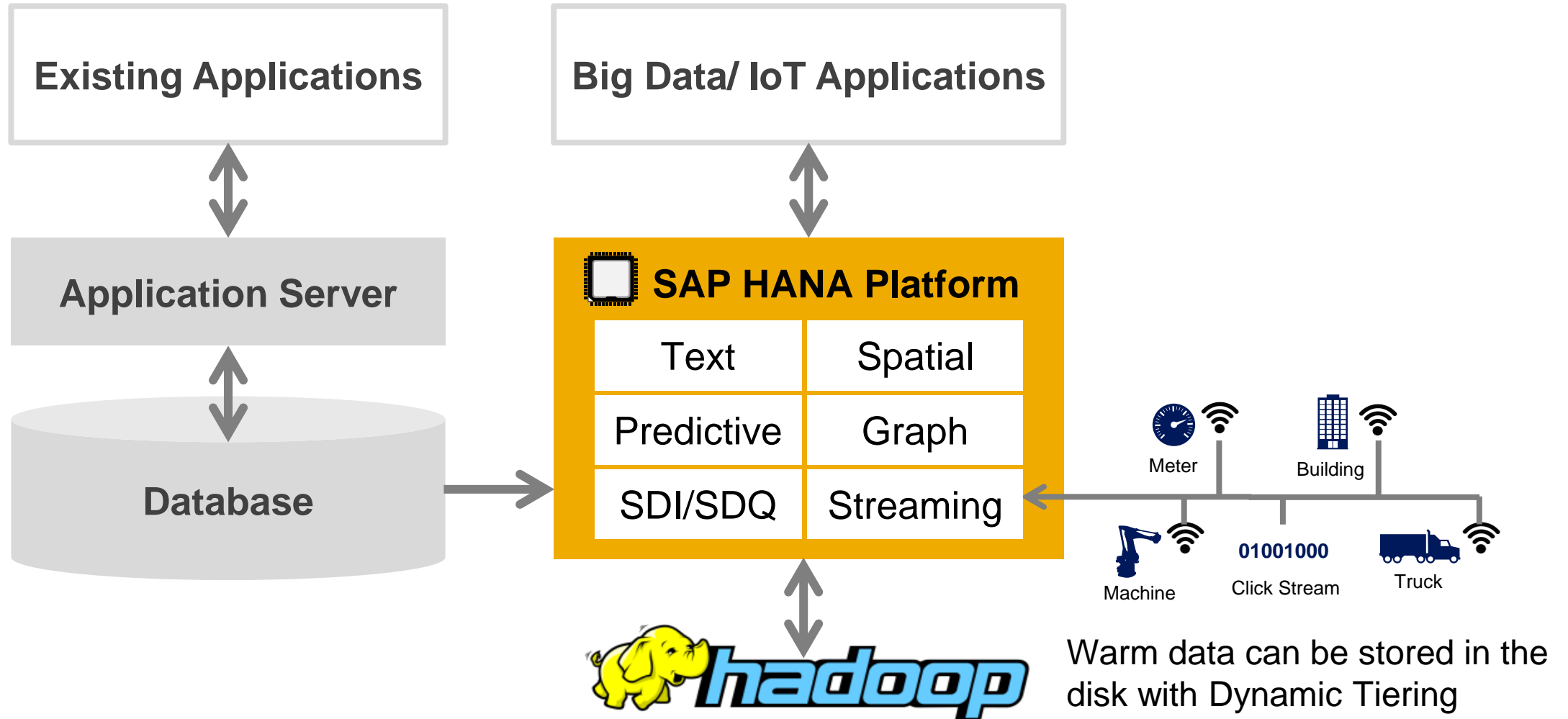
**Push-down code** to database using views / CDS / SQL Script and consume through OData.

**Execute with built-in application services** to avoid multiple layers of buffering and to reduce data transfers.

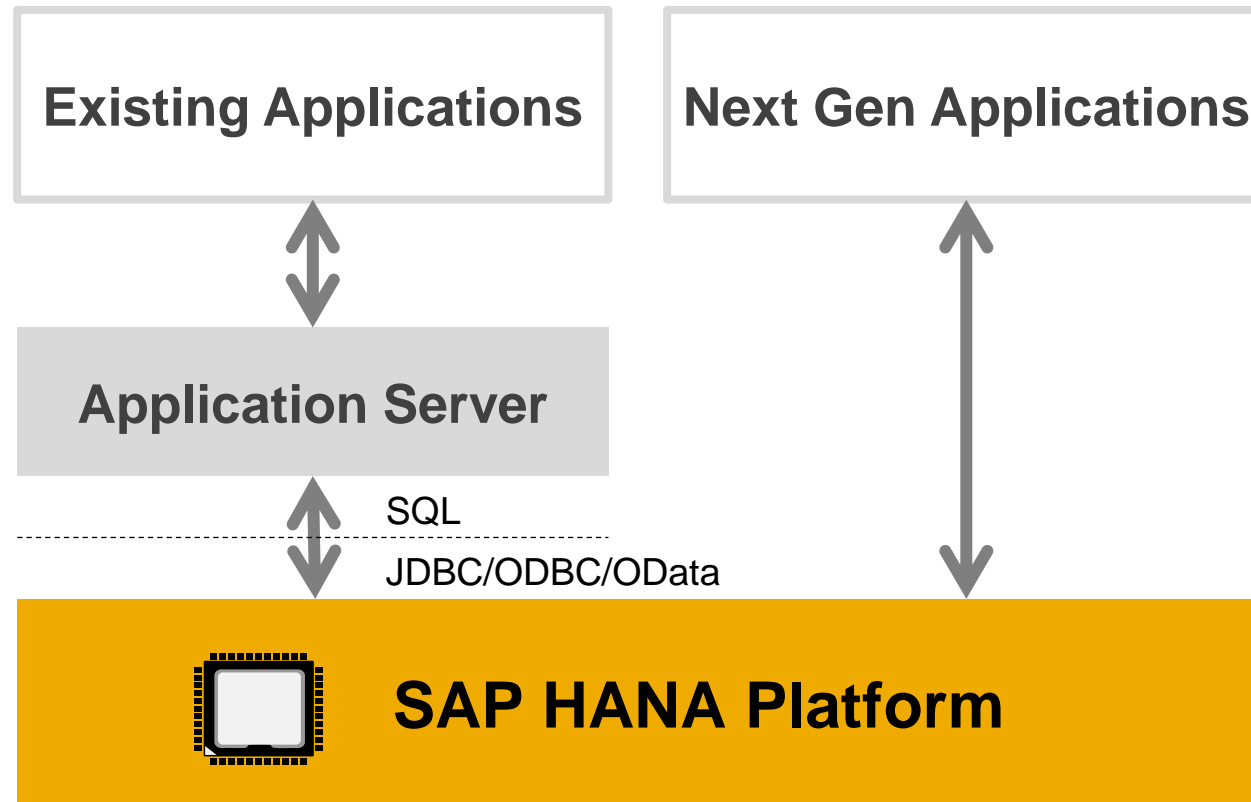
**Use Insert-Only** to reduce time consuming updates and deletes and get change logs for free.



# Big Data / IoT applications – Use SAP HANA platform as side car



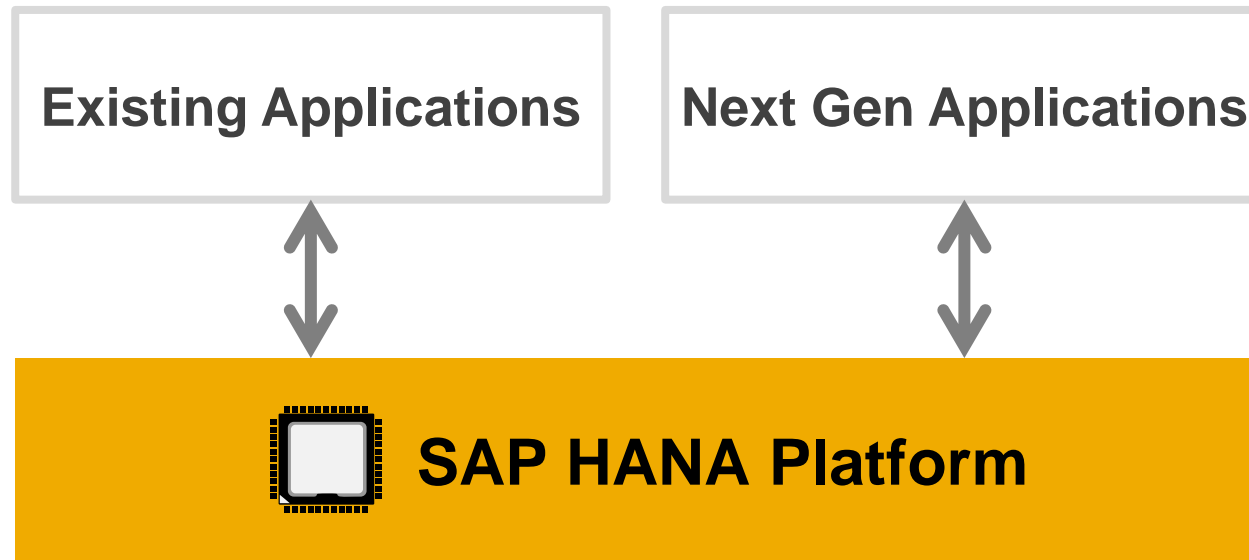
# Migrate data to SAP HANA platform



Build Insight to Action applications

# Run all applications on SAP HANA Platform

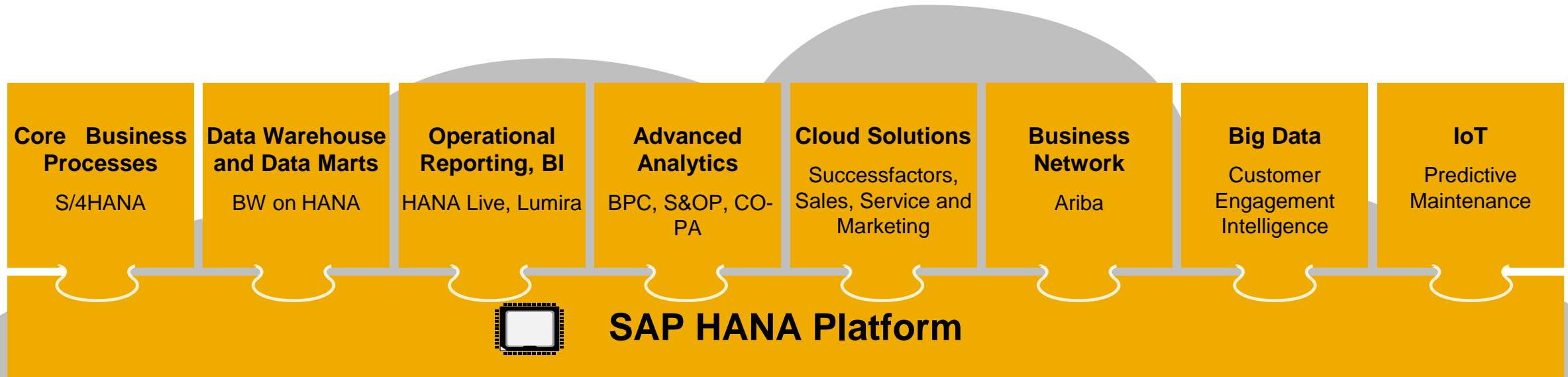
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No data duplicates | No data movement | No data latency | Simplified Landscape

# All SAP applications run better on SAP HANA

SAP HANA is central to SAP strategy



- Every product from SAP already runs in / will soon be optimized for SAP HANA
- SAP HANA powers both on-premise and cloud applications
- SAP HANA enables managed private cloud (HEC) and SAP Platform-as-a-Service (HCP)

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# Getting Started

## Free Developer Instance

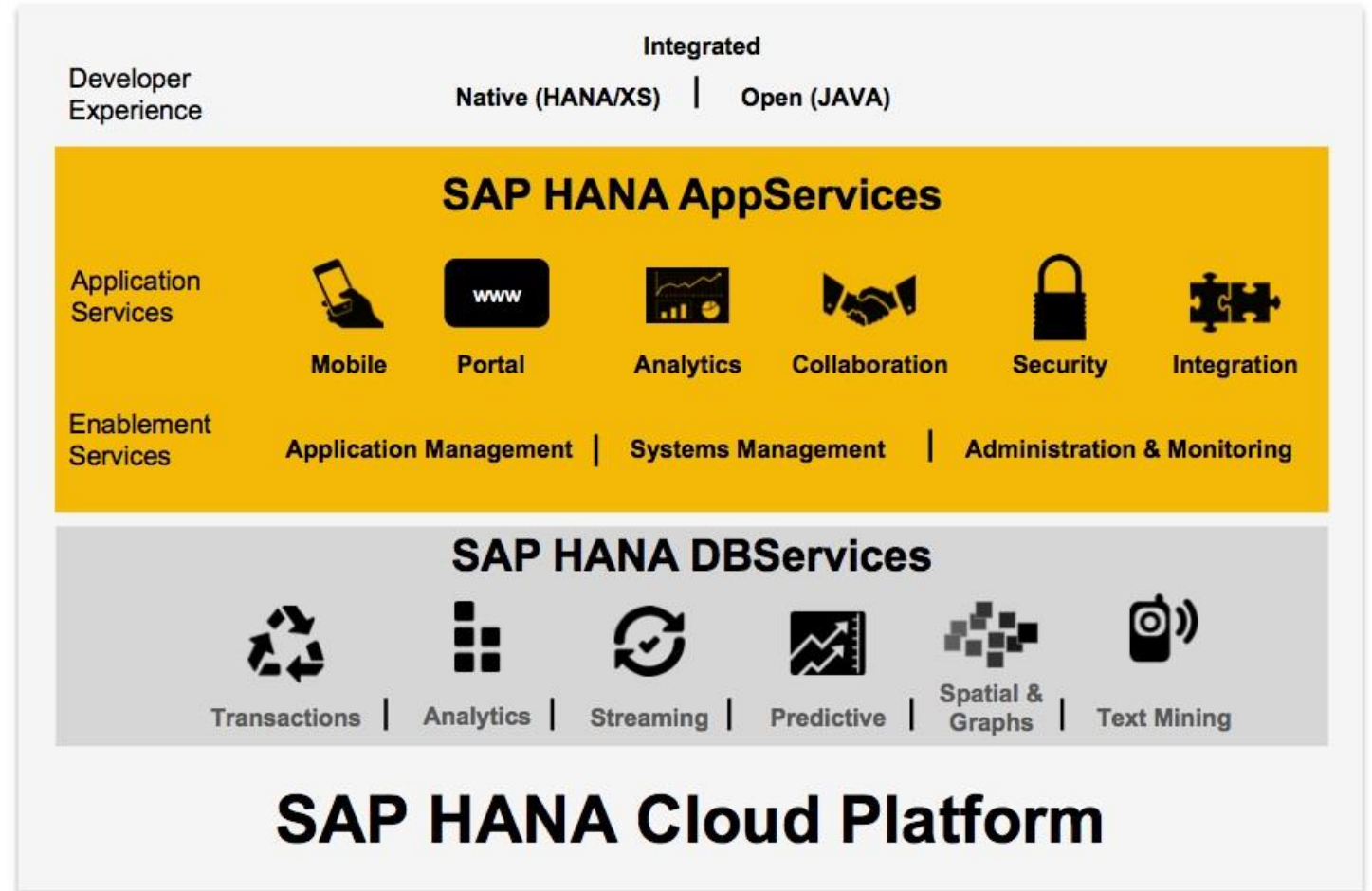
## HANA Developer Edition on Azure



## HANA One on AWS



## HANA Cloud Platform



# Additional Information

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## Learn about SAP HANA

- SAP HANA Academy : <https://www.youtube.com/user/saphanaacademy>
- Free Massive Open Online Course (MOOC) :
  - [An Introduction to SAP HANA](#)
  - [Introduction to Software Development on SAP HANA](#)

SAP HANA Guides: [http://help.sap.com/hana\\_platform/](http://help.sap.com/hana_platform/)

SAP HANA Home Page: <http://www.saphana.com>

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# Thank you

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