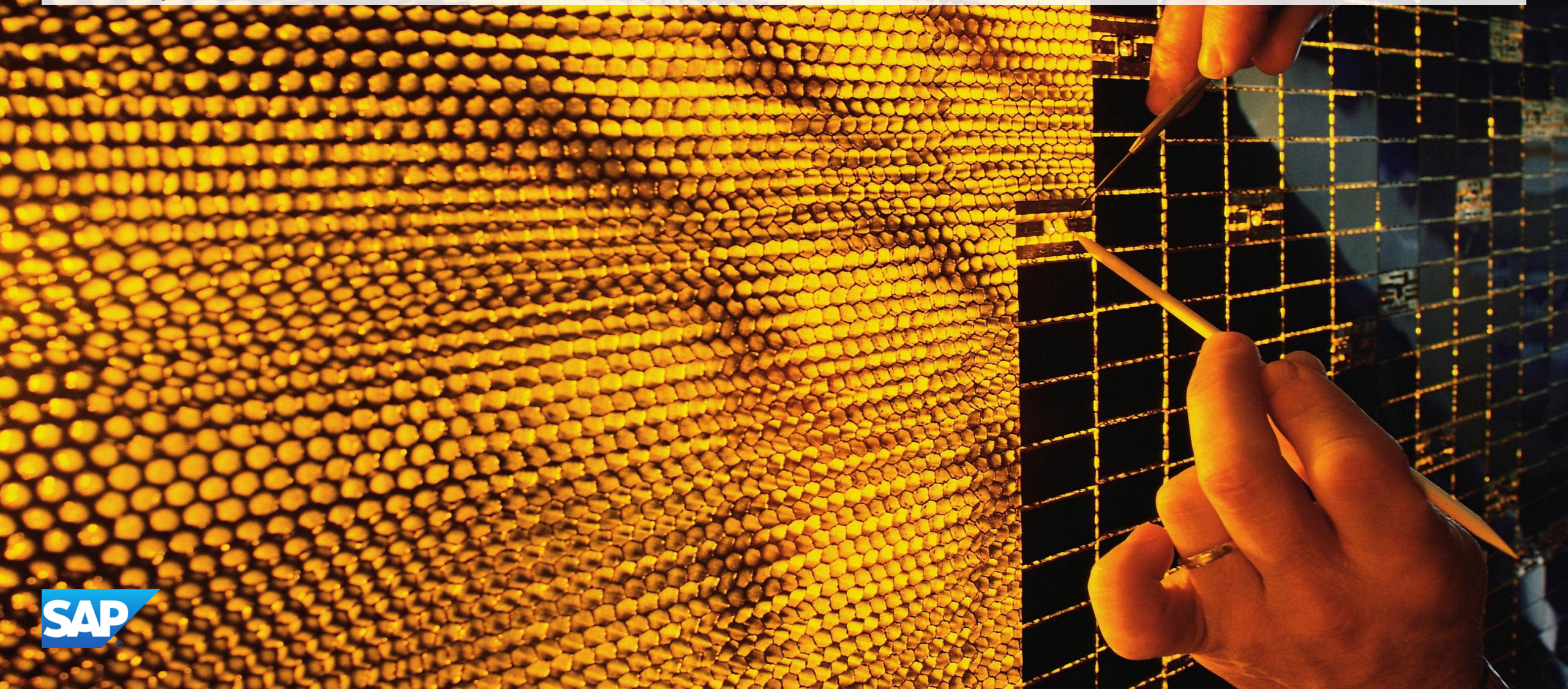
SAP HANA – SAP's In-Memory Database

Dr. Martin Kittel, SAP HANA Development
January 16, 2013



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Having data is not enough!

Do you have real-time business insights?

Customer Insights

- Which customers & channels are more profitable?
- Which customer profiles are suitable for loyalty rewards?
- How dynamic is your customer segmentation strategy?

Product/Service Insights

- How are products/services doing vs. their competition?
- Track complaints from call centers & social data in real-time?
- Where else is this part used in my company?

Operations Insight

- How can you predict supply chain disruptions ahead?
- How do suppliers rank by cost, quality and timeliness?
- How is my “on-time/in full” delivery rate by customer?

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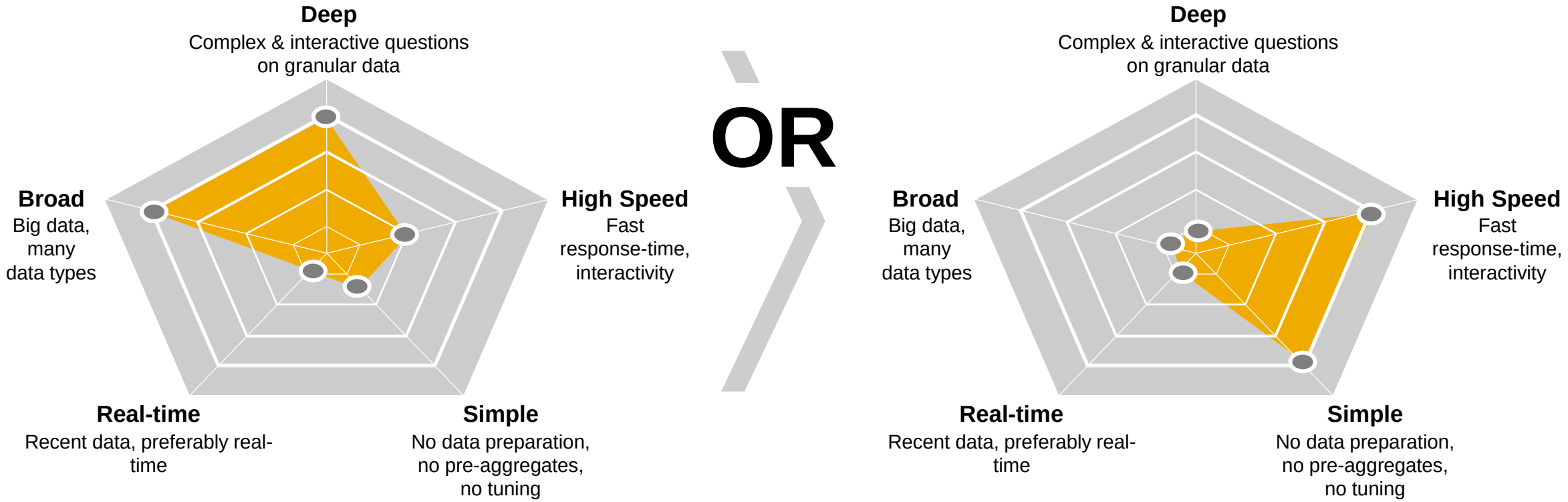
Need a breakthrough technology

Today's technology requires tradeoff



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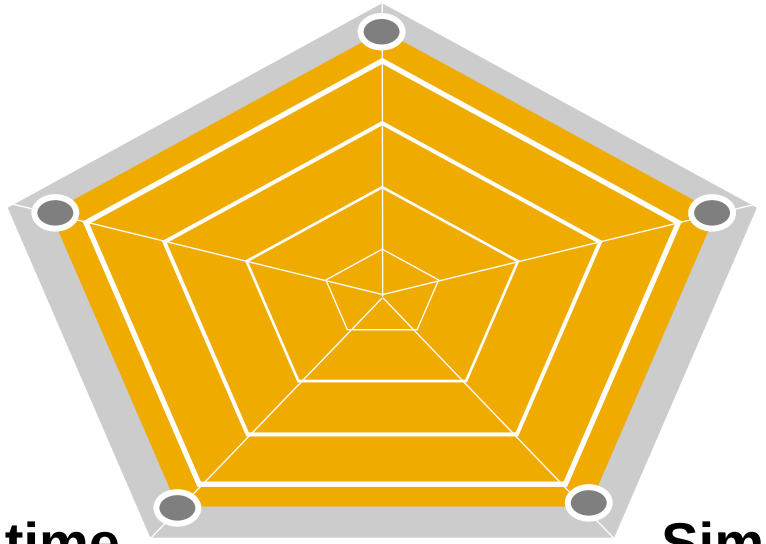
SAP HANA does it all!

Delivering across 5 dimensions of modern decision-processing

Deep
Complex & interactive questions on granular data



Broad
Big data, many data types

High Speed
Fast response-time, interactivity

Real-time
Recent data, preferably real-time

Simple
No data preparation, no pre-aggregates, no tuning

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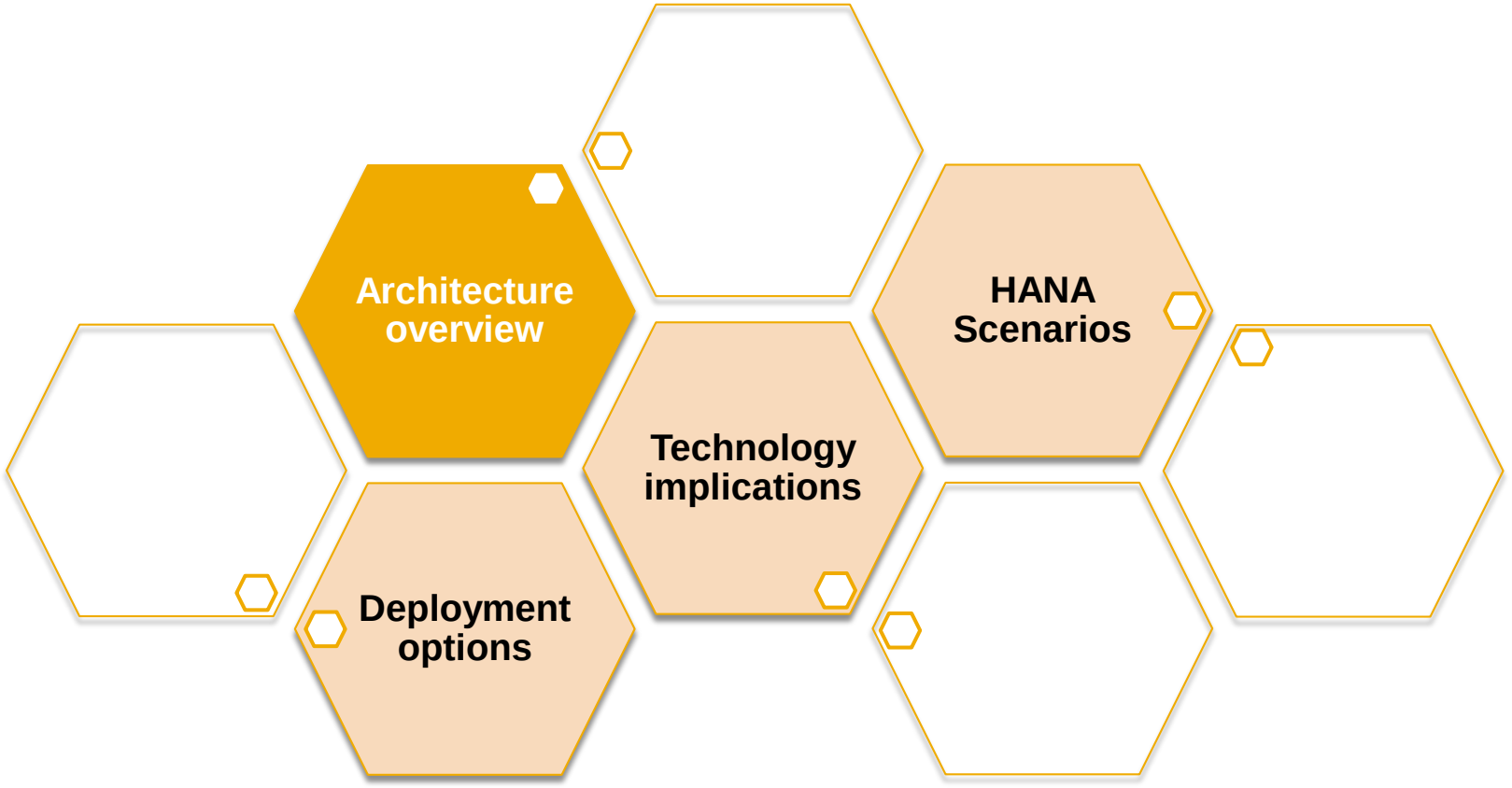
SAP HANA

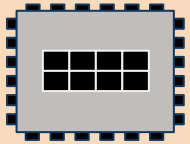
Architecture & Technology



What is In-Memory computing
Orchestrating technology innovations

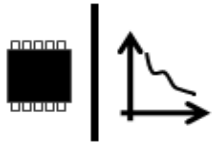
Dramatically improved hardware economics and technology innovations in software have made it possible for SAP to deliver on its vision of the Real-Time Enterprise with in-memory business applications

HW Technology Innovations



Multi-Core Architecture
(8 CPU x 10 Cores per blade)

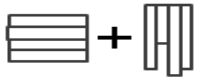
Massive parallel scaling with many blades



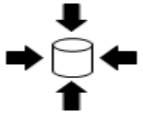
64bit address space – 1TB in current servers

Dramatic decline in price/performance

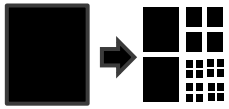
SAP SW Technology Innovations



Row and Column Store

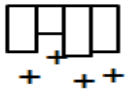


Compression



Partitioning

No Aggregate Tables



Insert Only on Delta

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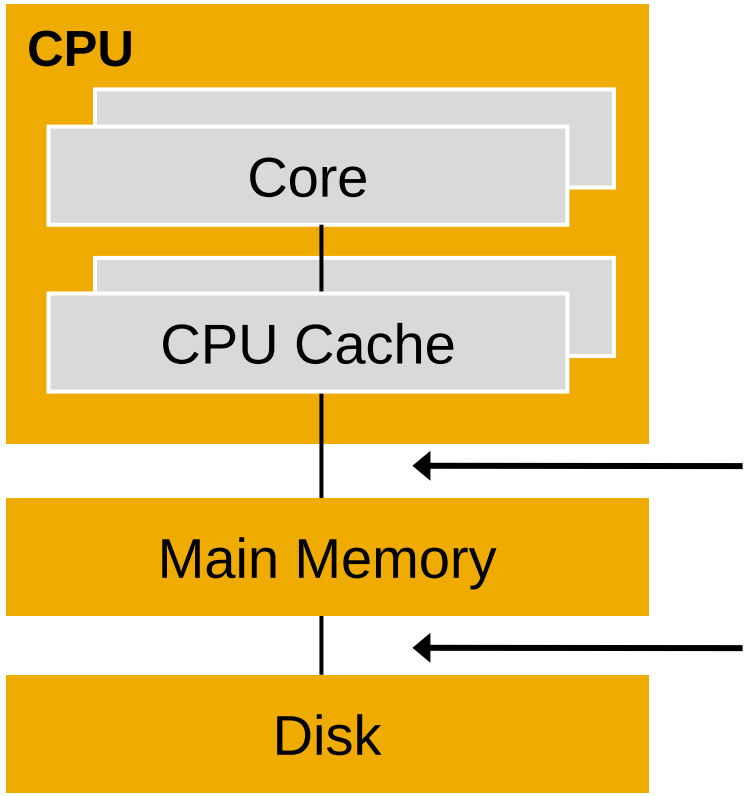
In-Memory computing

Use cache-conscious data-structures and algorithms

Programming against a new scarce resource…



Performance bottleneck today:
CPU waiting for data to be loaded from memory into cache

Performance bottleneck in the past: Disk I/O

… requires cache-conscious data-structures and algorithms.

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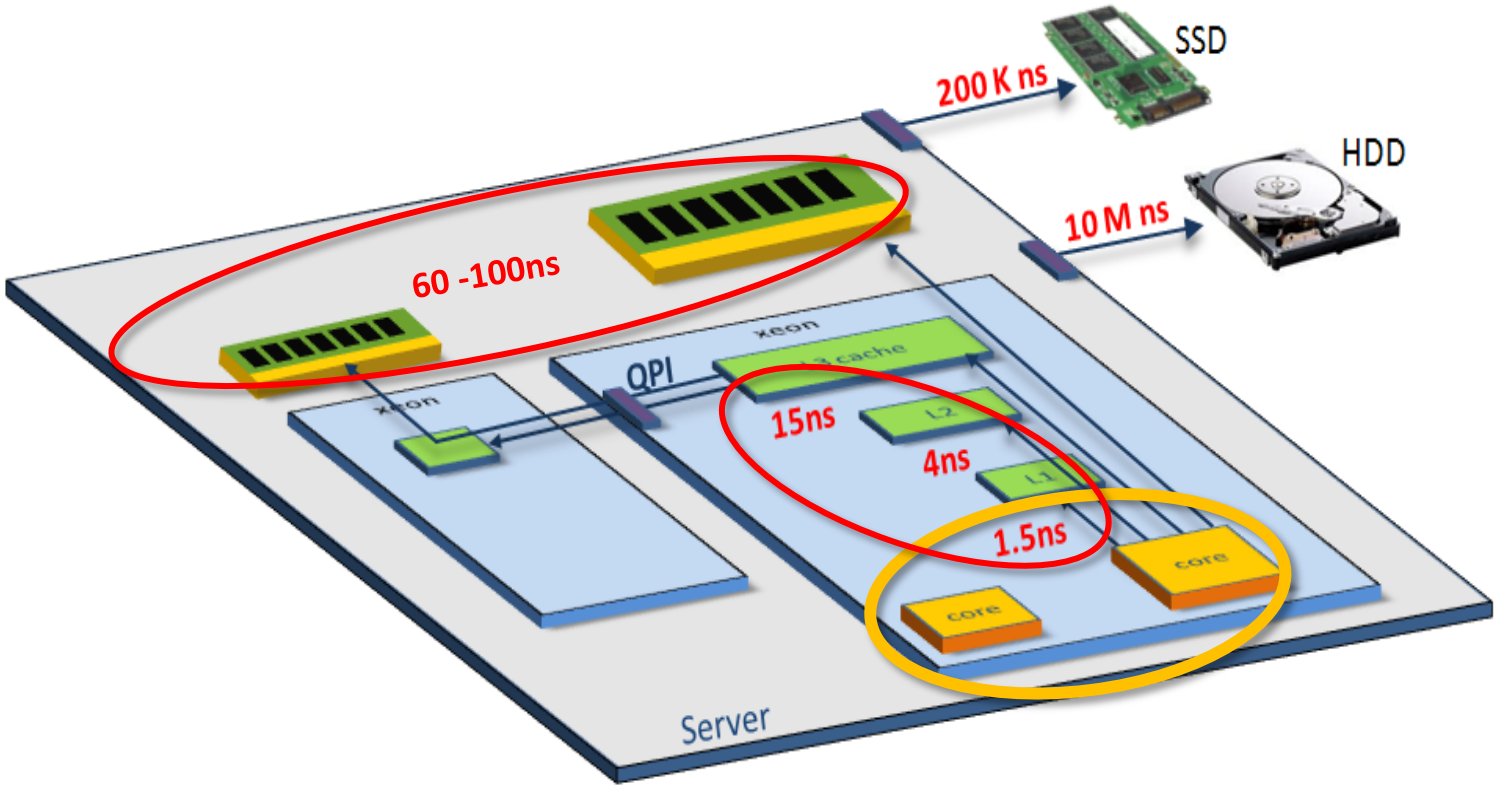
In-Memory computing
Challenges of In-memory Computing



- **Challenge 1: Parallelism!**
  Take advantage of tens, hundreds of cores
- **Challenge 2: Data locality!**
  - Yes, DRAM is 100,000 times faster than disk…
  - But DRAM access is still 4-60 times slower than on-chip caches

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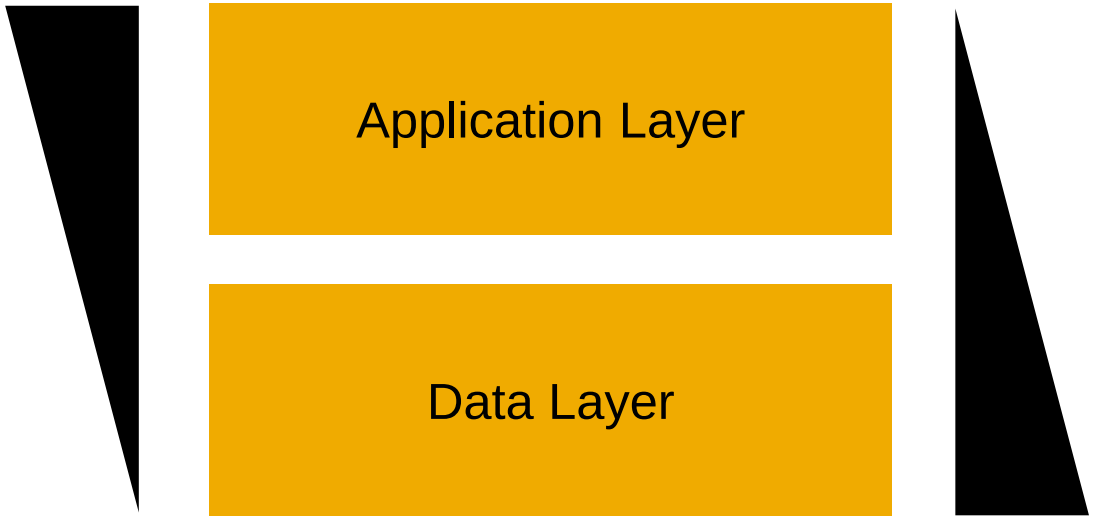
In-Memory computing

Delegation of data intense operations to the in-memory computing

Today‘s applications execute many data intense operations in the application layer



High performance apps delegate data intense operations to the in-memory computing

In-Memory Computing Imperative: Avoid movement of detailed data
Calculate first, then move results

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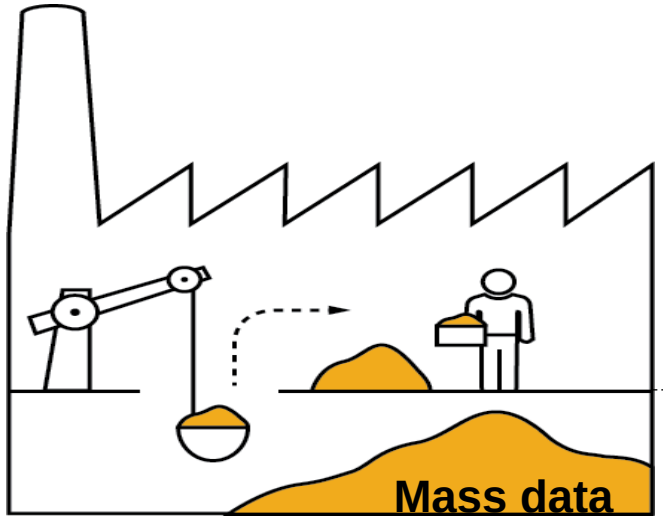
In-Memory computing

Delegation of data intense operations to the in-memory computing

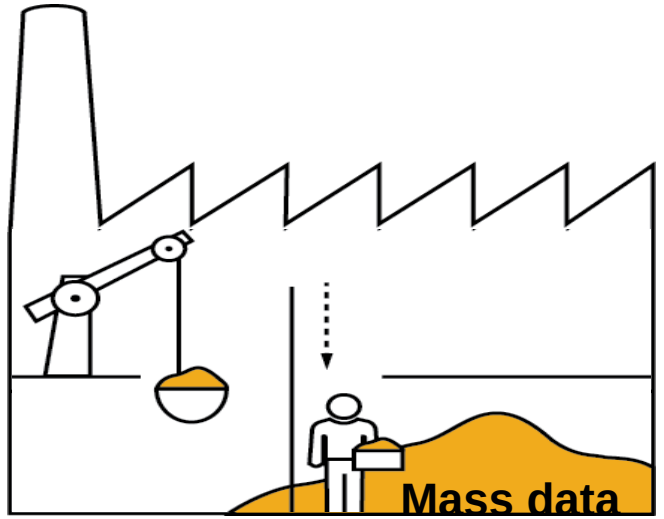
Traditional



Application

Database

In-Memory Computing



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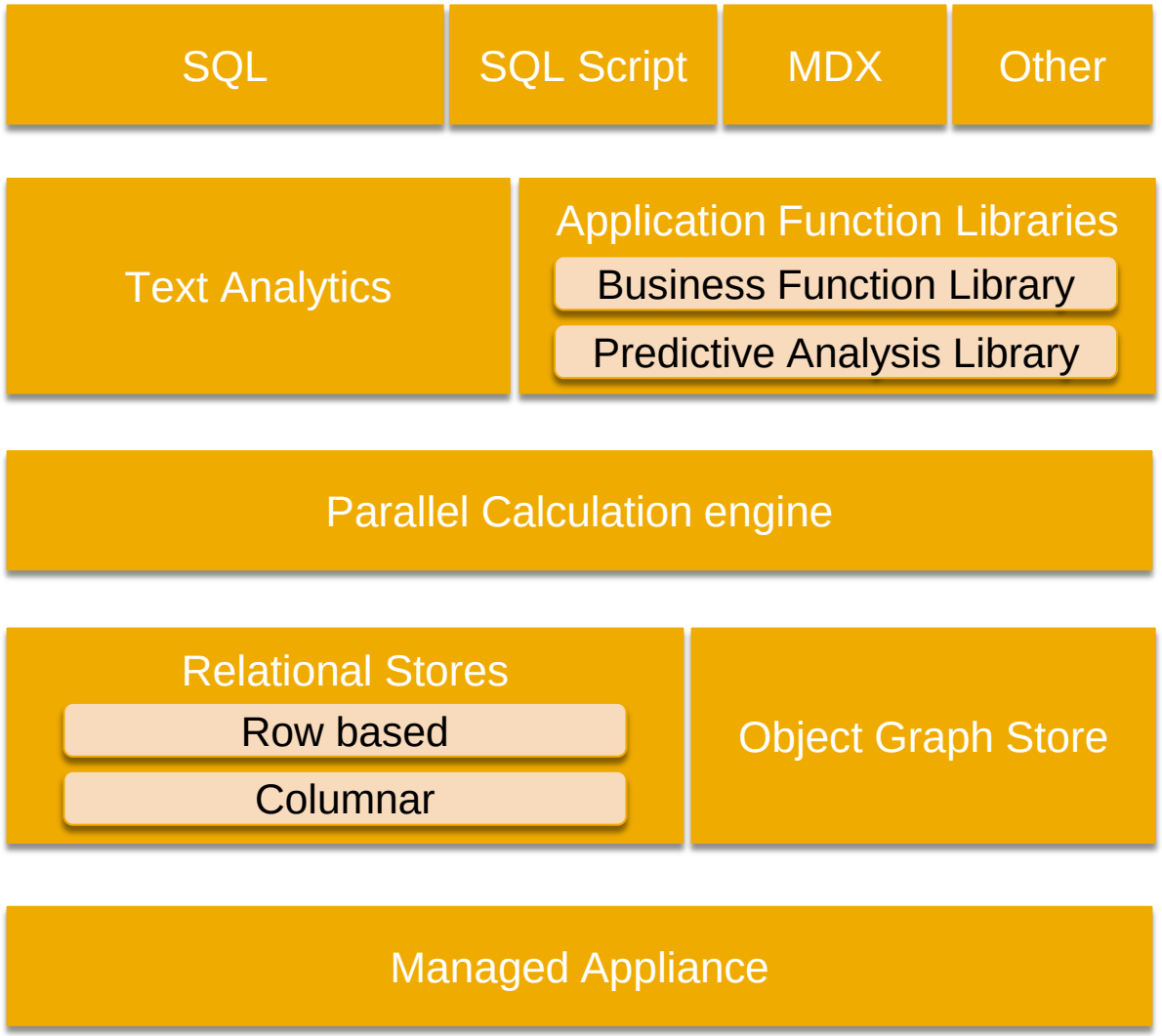
SAP HANA
Software component view



- **Analytical and Special interfaces**
- **Application logic extensions**
- **Parallel data flow computing model**
- **Multiple in-memory stores**
- **Appliance Packaging**

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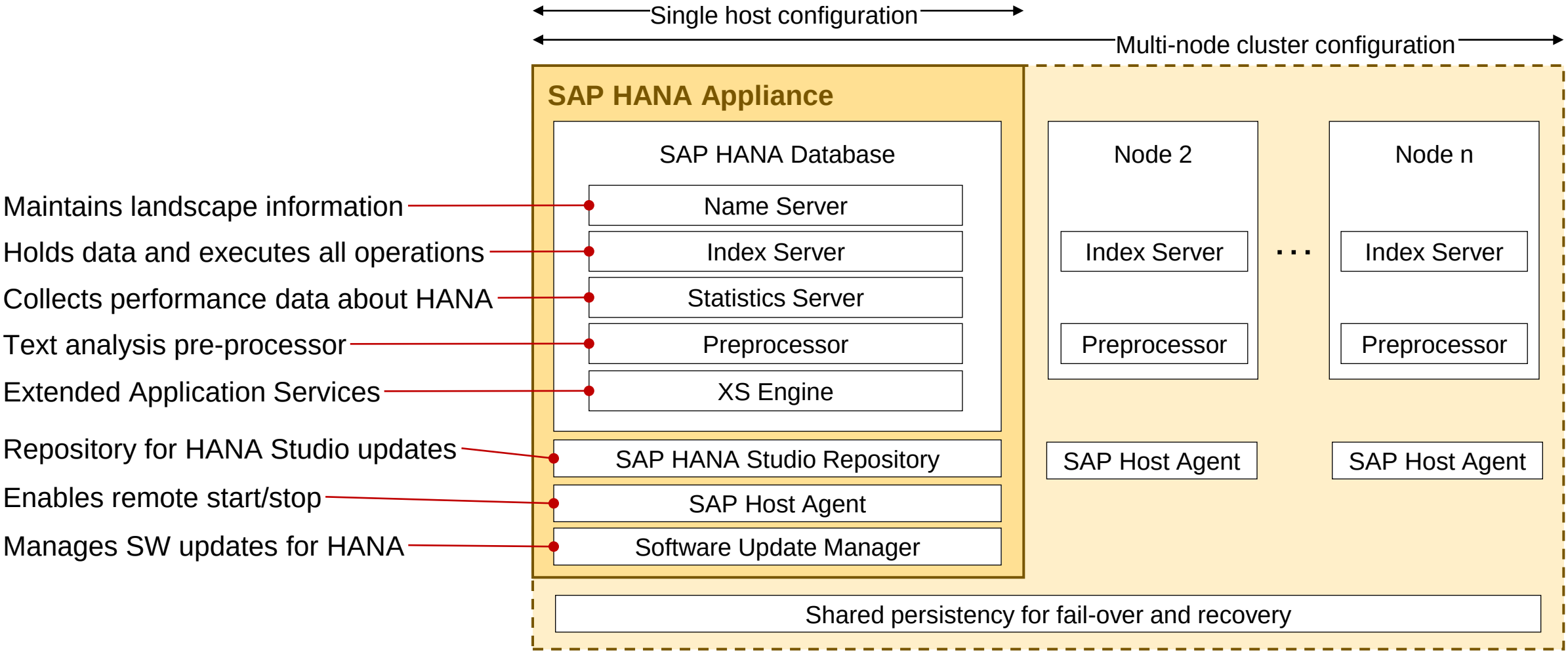
SAP HANA
Deployment view



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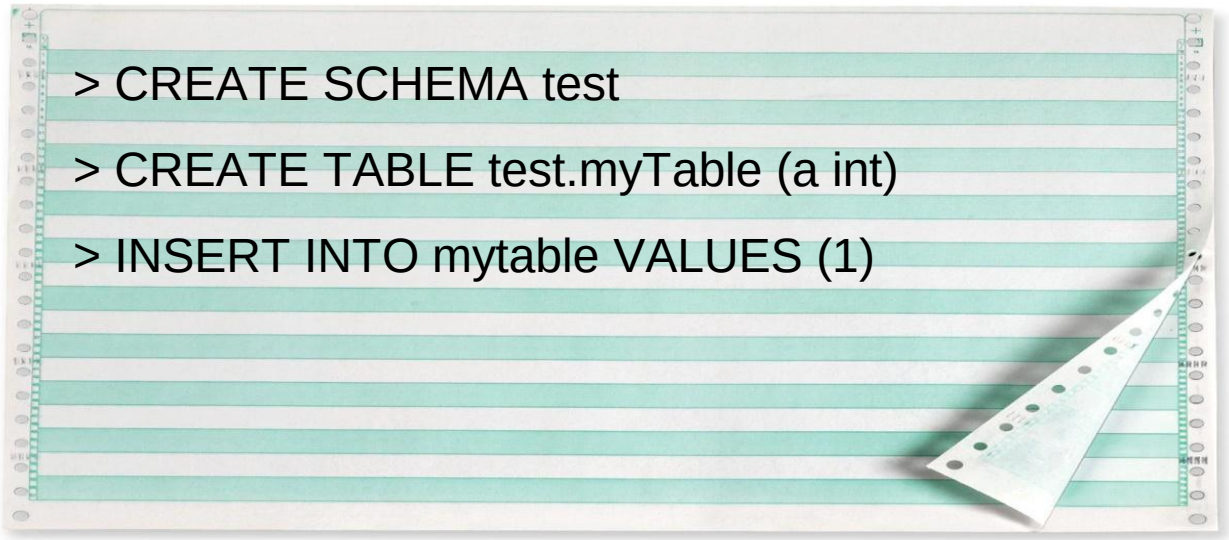
How do I use SAP HANA?

Following data down the rabbit hole

Storing data in SAP HANA

At its heart, SAP HANA is a SQL DBMS…



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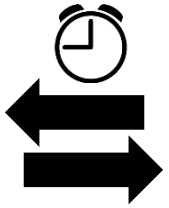
Storing data in SAP HANA

Applications writing
directly into SAP HANA

Real-time replication using
SAP LT Replication Service



Data loaded from files
using IMPORT / INSERT

Message queue integration
with Sybase CEP

Data loaded at certain events
using Business Objects Data Services

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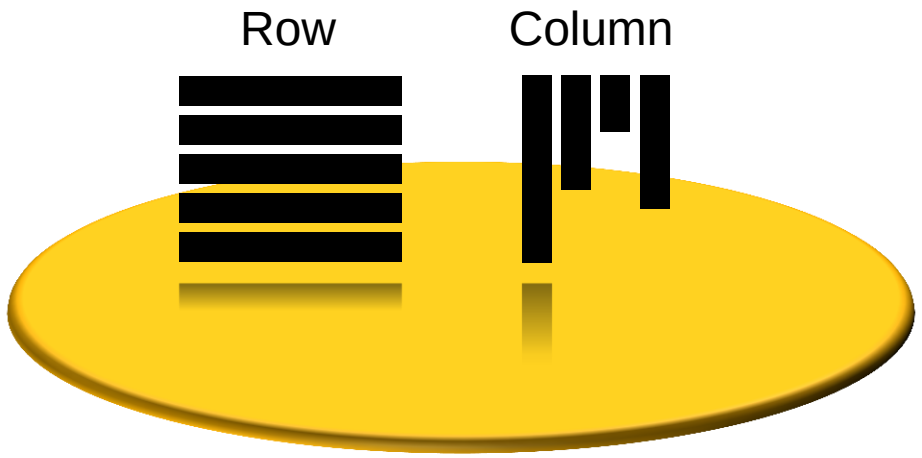
Storing data in SAP HANA

SAP HANA uses a hybrid store to combine the benefits of row- and column-wise data handling.



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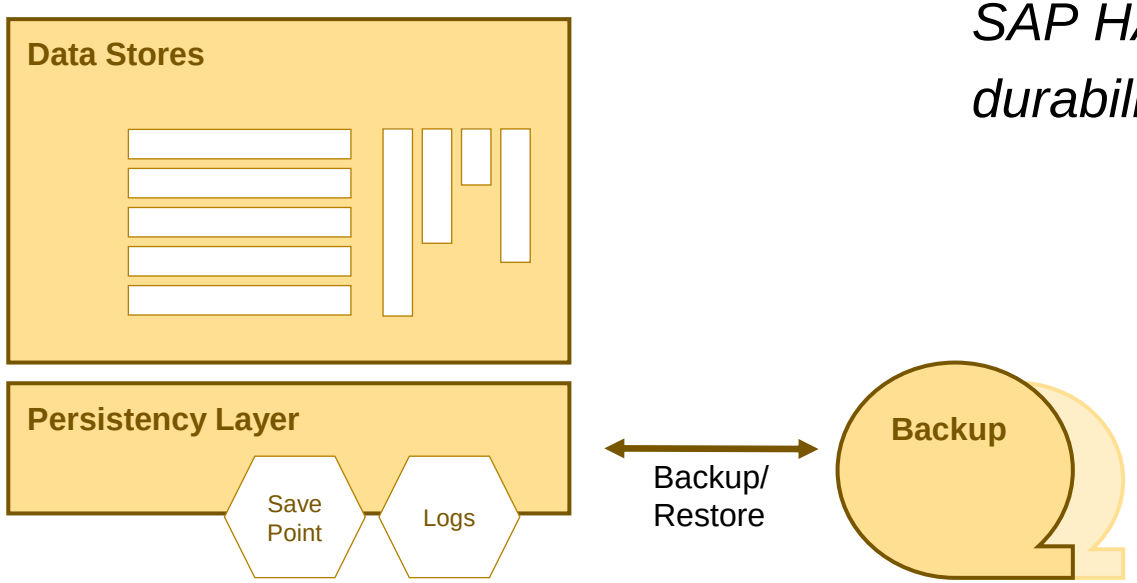
Storing data in SAP HANA



SAP HANA has a safety net which ensures the durability of all data – the persistency layer.

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Using data in SAP HANA

SAP HANA speaks SQL and MDX – use Excel as your frontend if you like.

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Using data in SAP HANA

You define views, to make data easily accessible to everyone.

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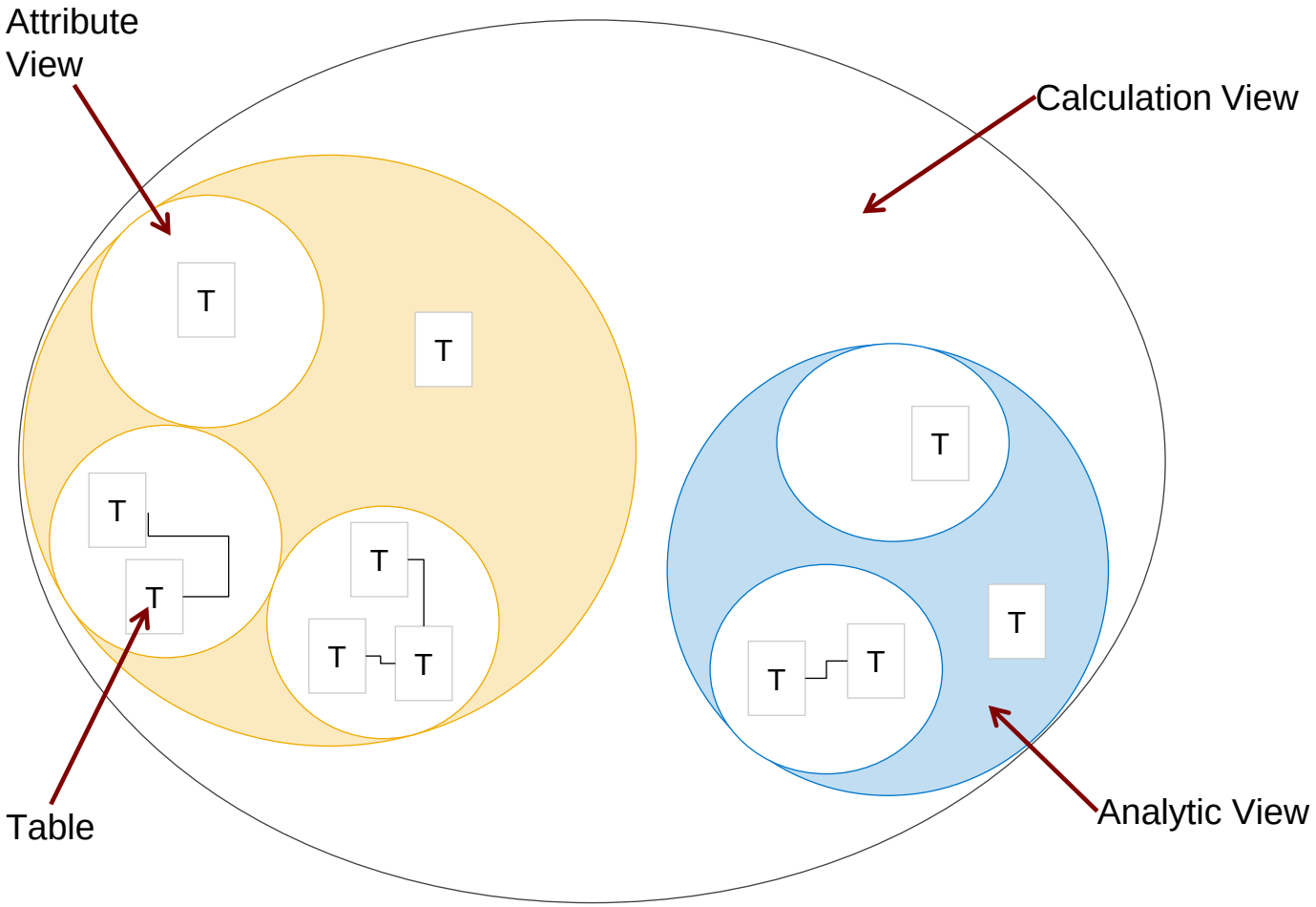
Using data in SAP HANA



Views enable real real-time computing by transforming data on the fly.

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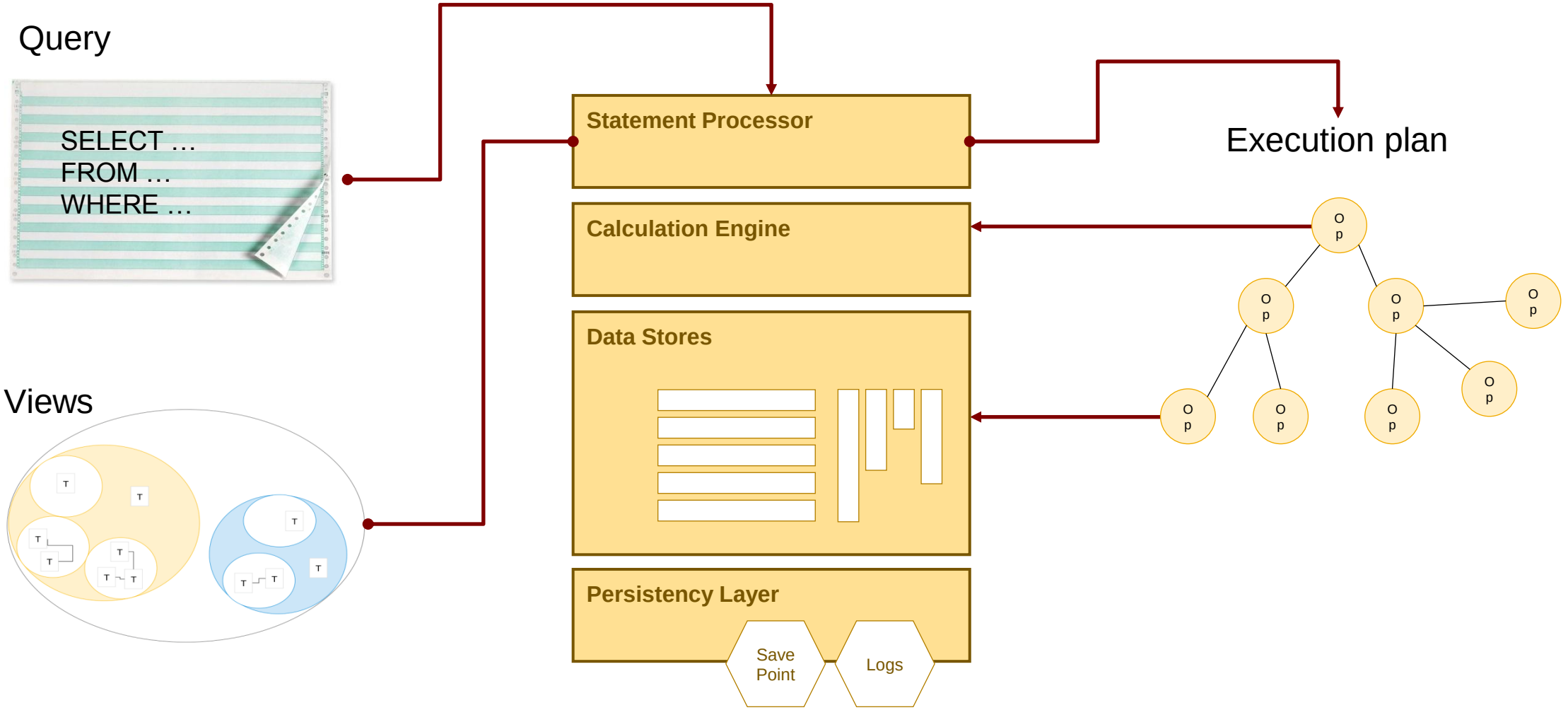
Using data in SAP HANA



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Using data in SAP HANA

Set Operations

Calculations on Data

Business Function Calls

Predictive Analytics Algorithms

R Procedure Calls

Operations can be all sorts of operations on data – not just basic SQL operations but also more complex logic

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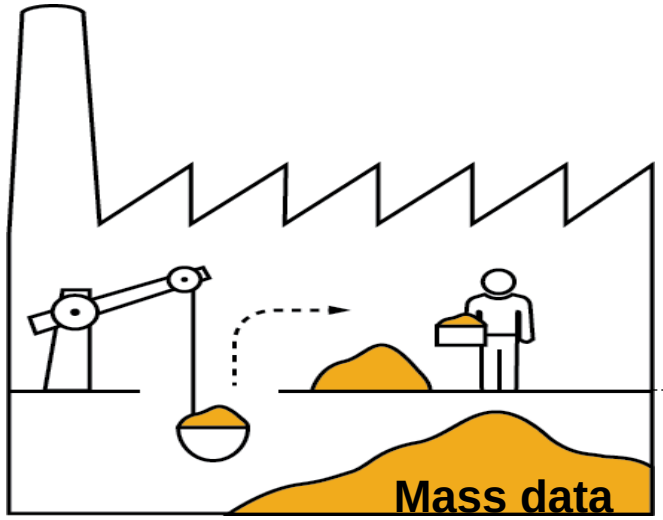
In-Memory computing

Delegation of data intense operations to the in-memory computing

Traditional

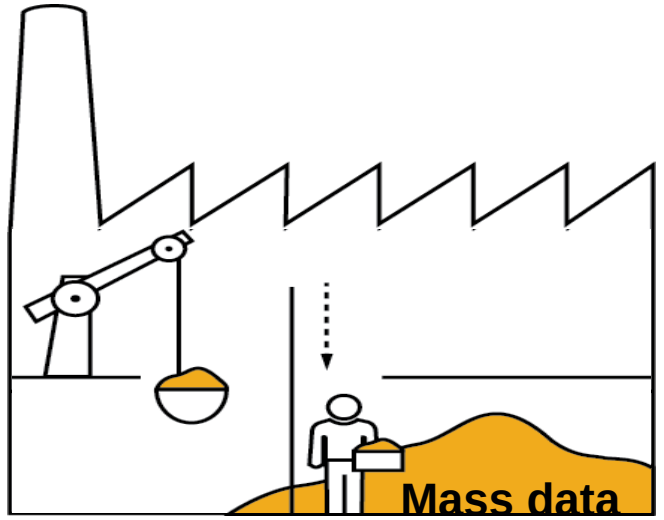


Typical assumption: DB is too slow, app server must optimize (caching)

Application

Database

In-Memory Computing



Assumption: do everything with the data where the data is

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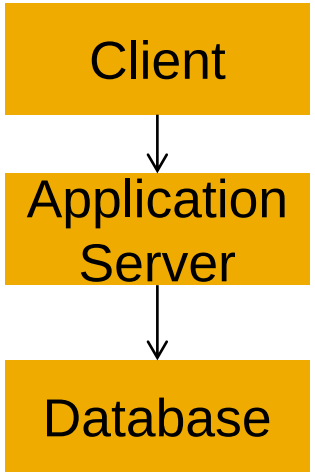
In-Memory computing
Security implications

Traditional

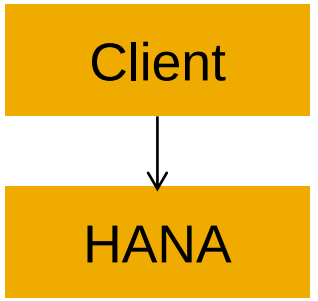


3 tier architecture:

- Users exist in application server only
- Authorization is handled by application server
- DB is accessed with technical user

Security is handled by application server

In-Memory Computing



2 tier architecture:

- Users log on directly to HANA
- Users exist in HANA
- Authorization is handled by HANA

Security is handled by database

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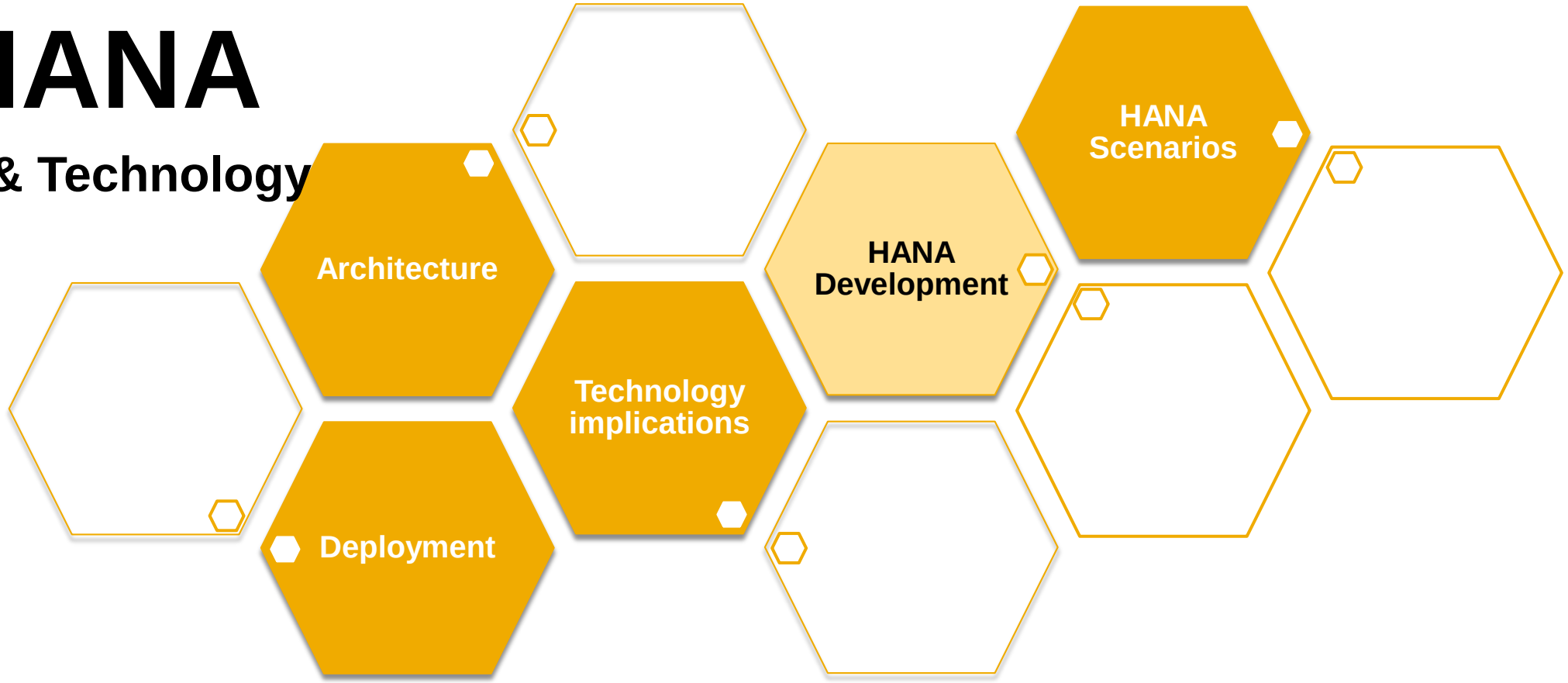
SAP HANA

Architecture & Technology



SAP HANA: Ancestors

- BWA/TREX (column store)
- pTime (row store)
- MaxDB (persistence)

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SAP HANA: Development locations

- Walldorf (column store, XS engine, applications, QA)
- Seoul (row store, catalog)
- Berlin (Backup/Recovery, Security, Admin tools, Make tools)

- Bulgaria, Israel, Palo Alto, …

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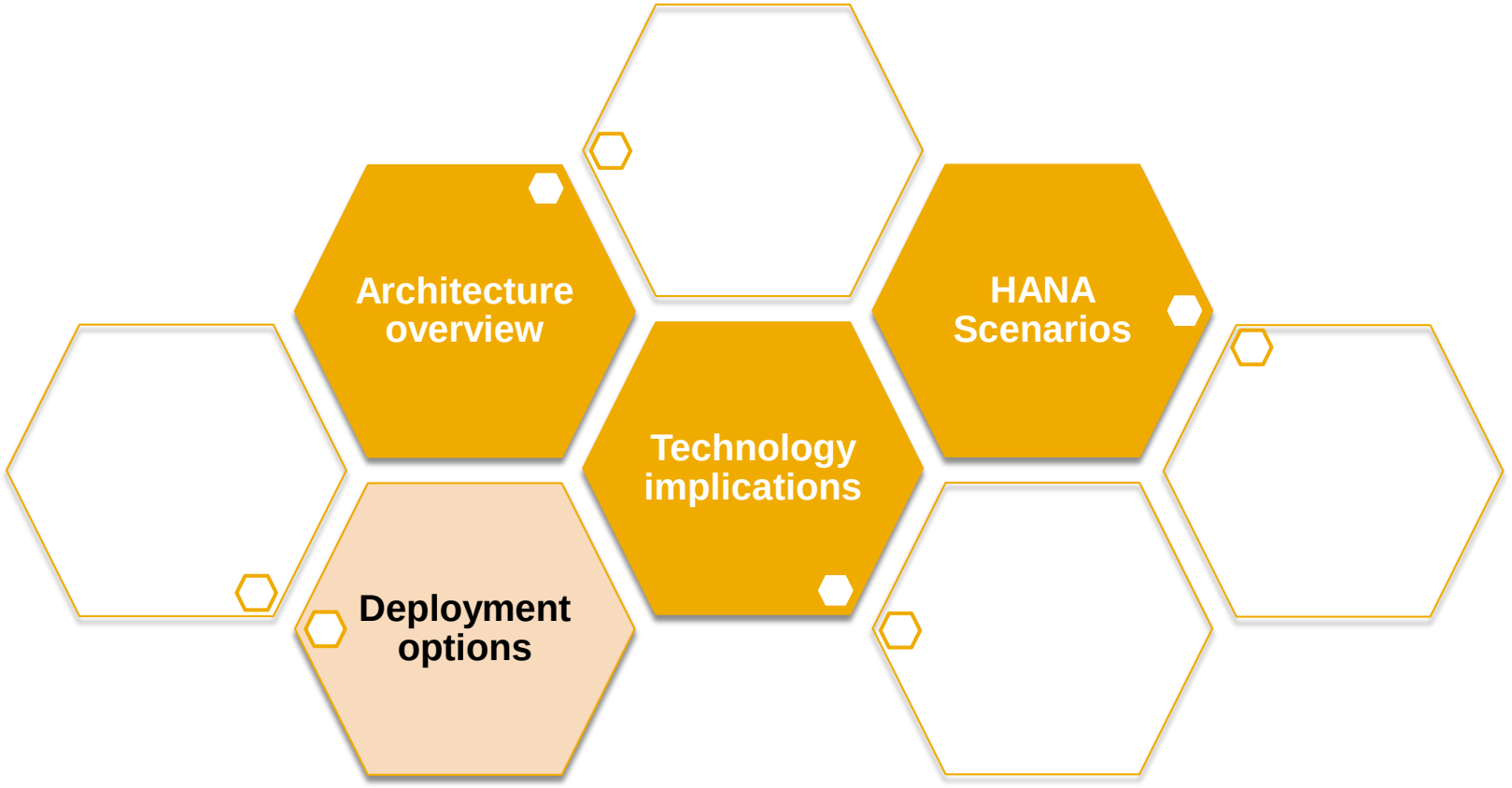
SAP HANA

Architecture & Technology



SAP HANA
In-Memory Strategy

	Side-by-side	Primary persistence	One store
Capabilities	• **SAP HANA real-time operational analytics** • Complete Business Intelligence (BI) Suite with BI 4 runs on SAP HANA	• **SAP BW powered by SAP HANA** • **SAP HANA platform for in-memory apps** • Further optimization of BI 4 Suite for SAP HANA • Industry and LOB Analytic Apps • Development Platform for ISV and Start-ups	• **SAP Business Suite optimized for in-memory computing** • SAP HANA only persistence layer for SAP Business Suite • Enhanced Sybase and SAP HANA integration • SAP Success Factors on SAP HANA • Custom Application platform
Benefits	• Flexible real time analysis of operations on detail level	• Primary persistence and optimized for SAP Business Warehouse (BW)	• Reduced landscape complexity • Value chain transformation

See Appendix for abbreviations

This is the current state of planning and may be changed by SAP at any time.

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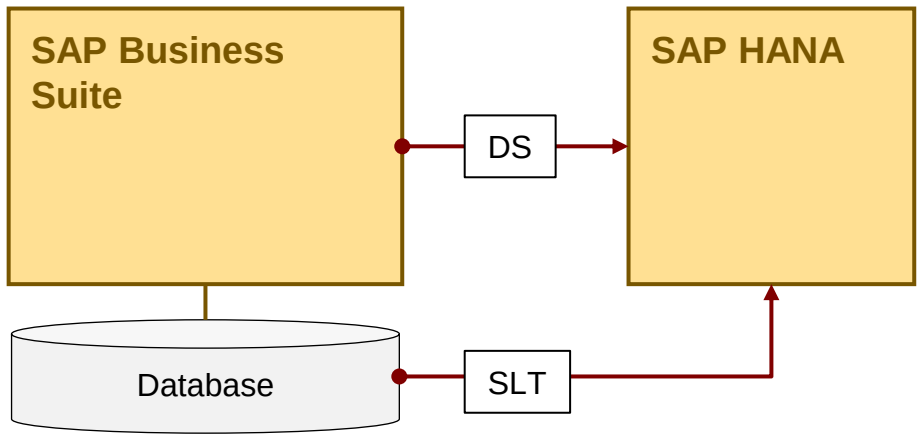
Side-by-side scenarios
Operational data marts



Operational Data Marts

- Views calculate results for reports in real time on the actual operational data
- No transformation during load step (only selection of relevant data if applicable)
- Real-time replication of time critical data (SLT)

Core Value Proposition SAP HANA

- Real time reporting on operational data

DS: Data Services; DXC: Direct Extractor Connector; SLT: SAP Landscape Transformation

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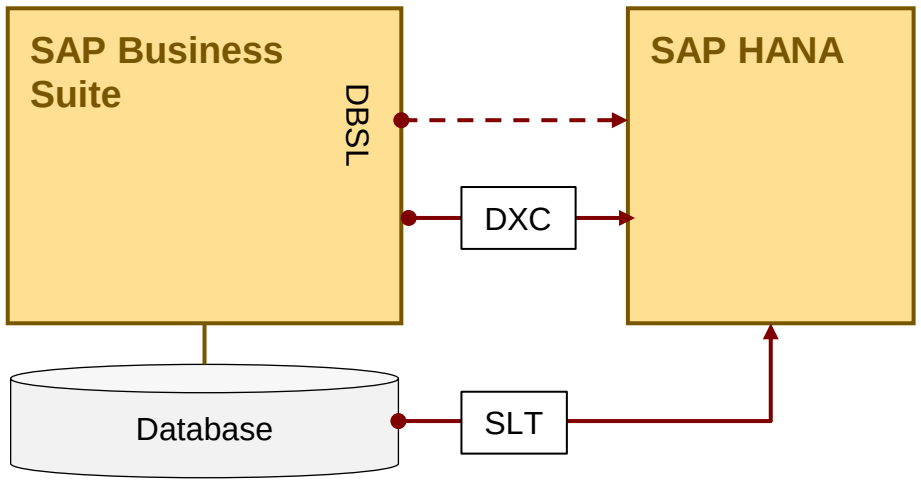
Side-by-side scenarios
SAP HANA based accelerators



HANA Accelerators

- Turnkey solution to accelerate
  - Standard ABAP reports
  - Business processes in ERP
- Flexible reporting using Business Objects BI Clients
- Examples: CO/PA, FIN, Material Ledger

Core Value Proposition SAP HANA

- Turnkey accelerator for ERP customers

DXC: Direct Extractor Connector; SLT: SAP Landscape Transformation; DBSL: Database Shared Library

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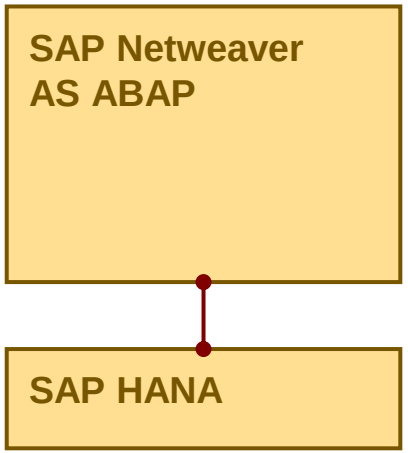
Integration scenarios
SAP HANA as primary persistence



SAP Netweaver BW, powered by SAP HANA

SAP Business Suite, powered by SAP HANA *

- SAP HANA Database becomes primary persistence of ABAP application server
- All Objects and BW loading procedures are accelerated by in memory technology
- High modeling flexibility

Core Value Proposition SAP HANA

- Speed and simplification for SAP BW / Business Suite

**) planned; BW: Business Warehouse*

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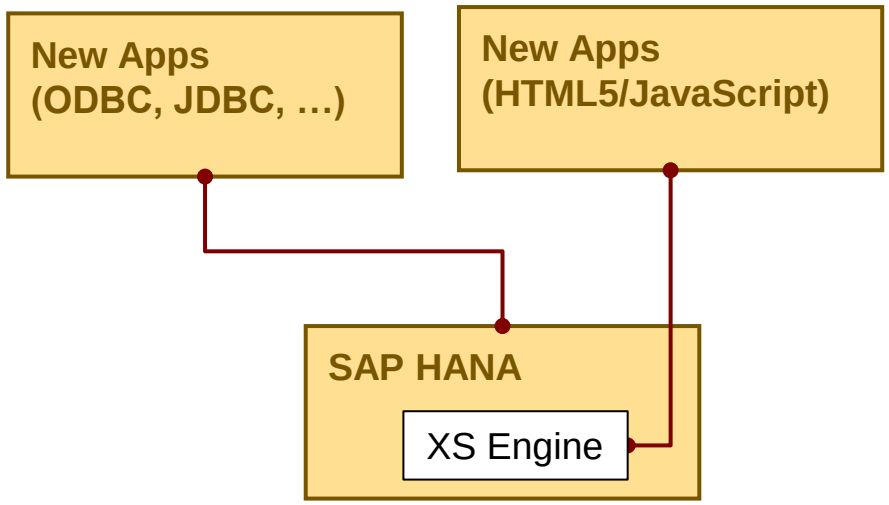
Transformation scenarios
SAP HANA as platform



Next Generation HANA Apps

- Netweaver AS ABAP leveraging HANA
- iOS apps running against HANA
- Java applications running against HANA

Core Value Proposition SAP HANA

- Simplification: lean code – mean apps

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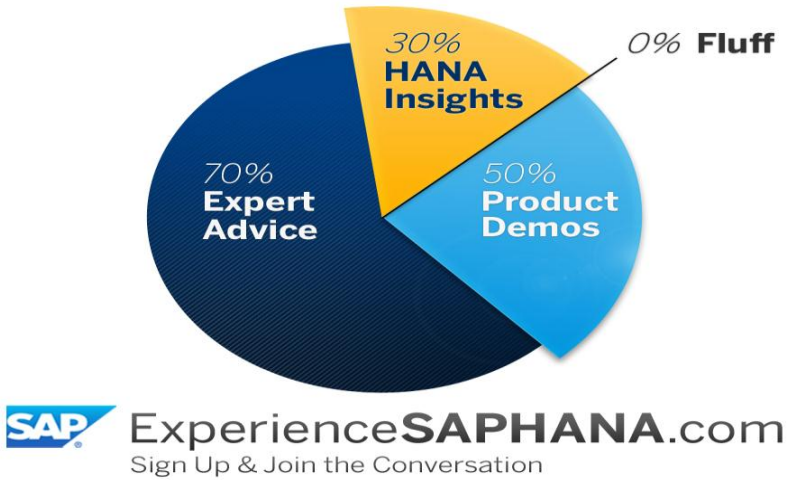
Further Information

SAP Public Web

http://www.sap.com/hana

http://experiencesaphana.com/

http://scn.sap.com/community/hana-in-memory



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