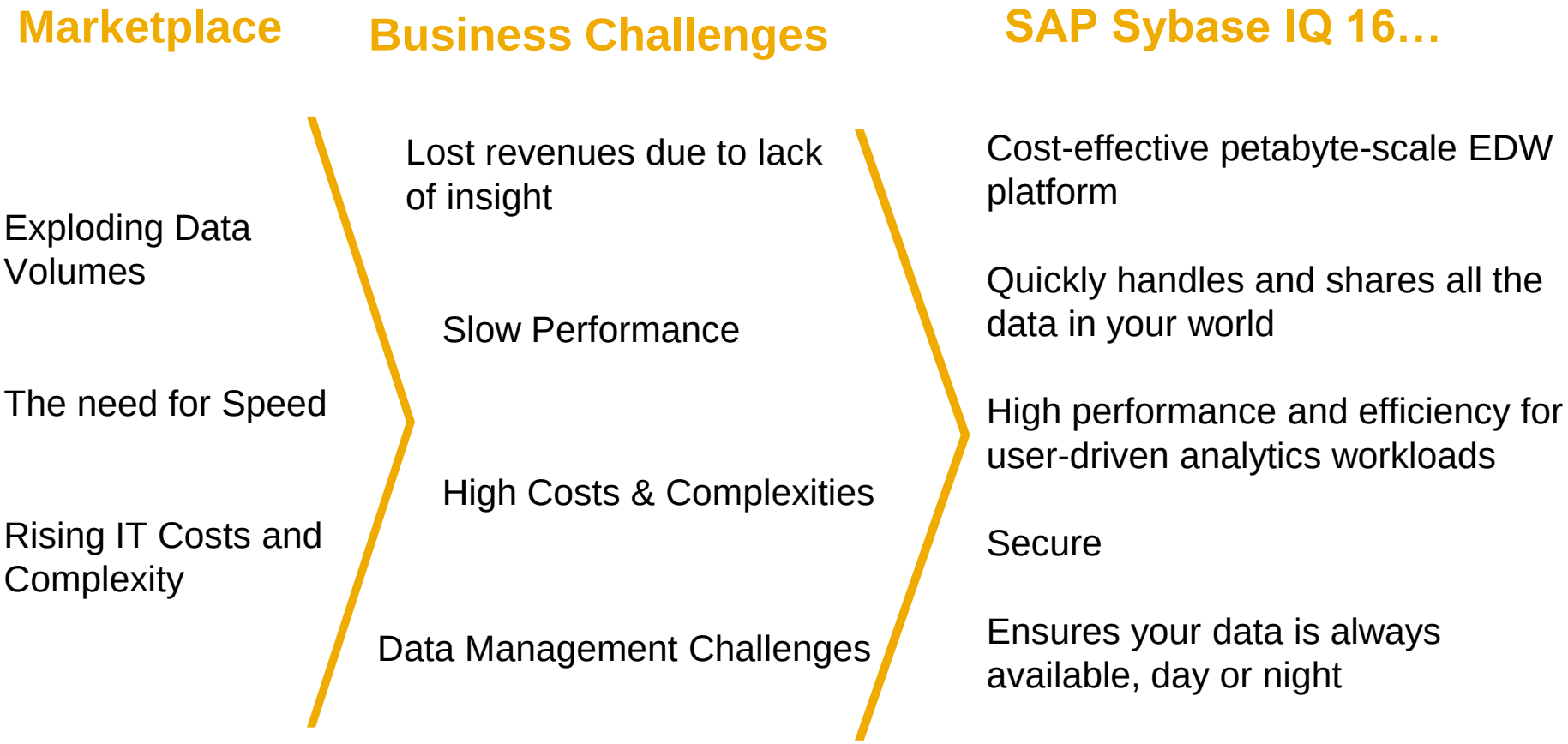
SAP Sybase IQ 16
Product Overview

What was the motivation for SAP Sybase IQ 16?



SAP Sybase IQ 16

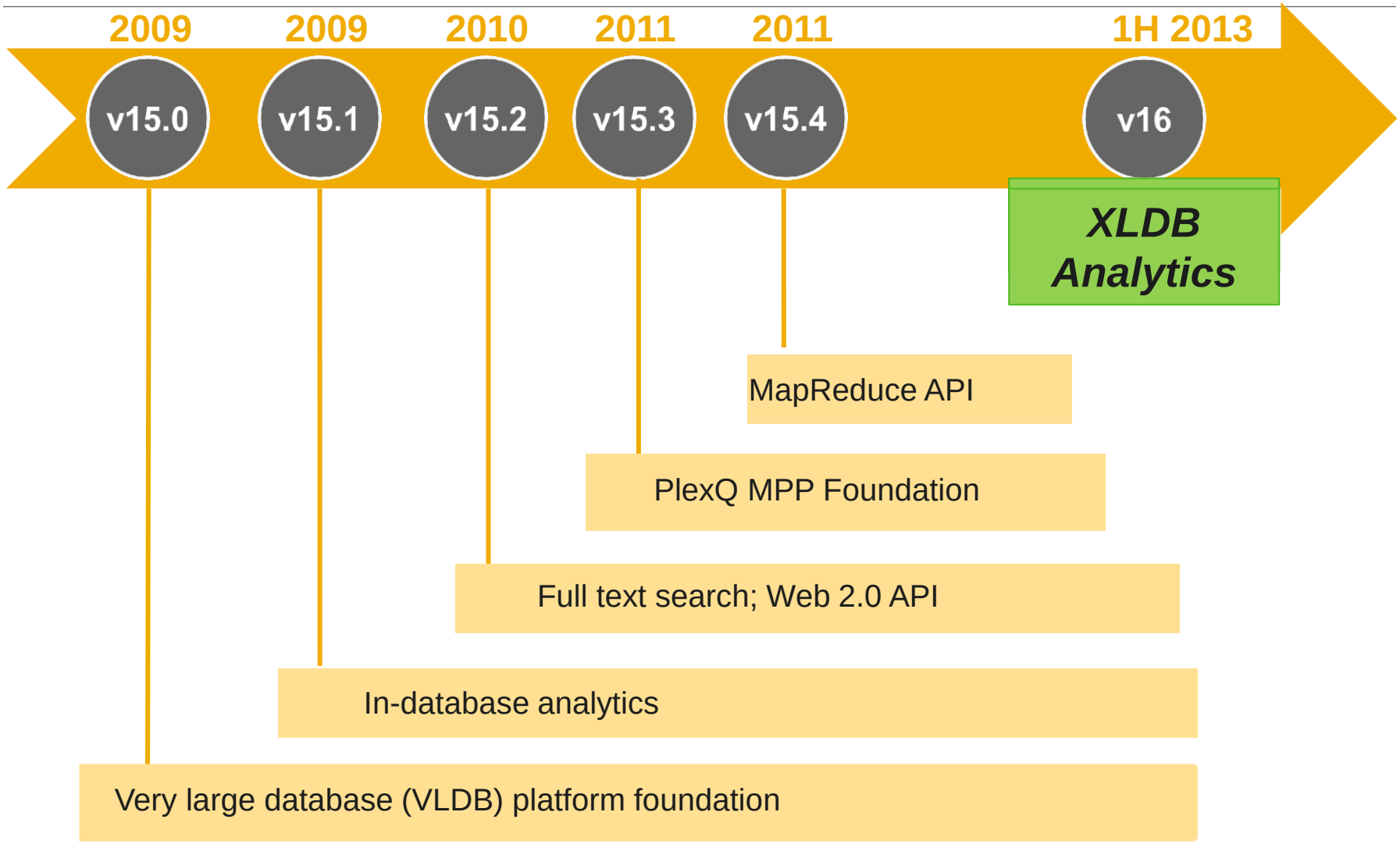
SAP Sybase IQ transforms the way companies compete and win through actionable intelligence delivered at the speed of business to more people and processes.

Value of SAP Sybase IQ 16

1. **Exploits the value of Big Data**
2. **Transforms businesses through deeper insights**
3. **Extends the power of analytics across the entire enterprise**

SAP Sybase IQ 16

Path to Actionable Intelligence



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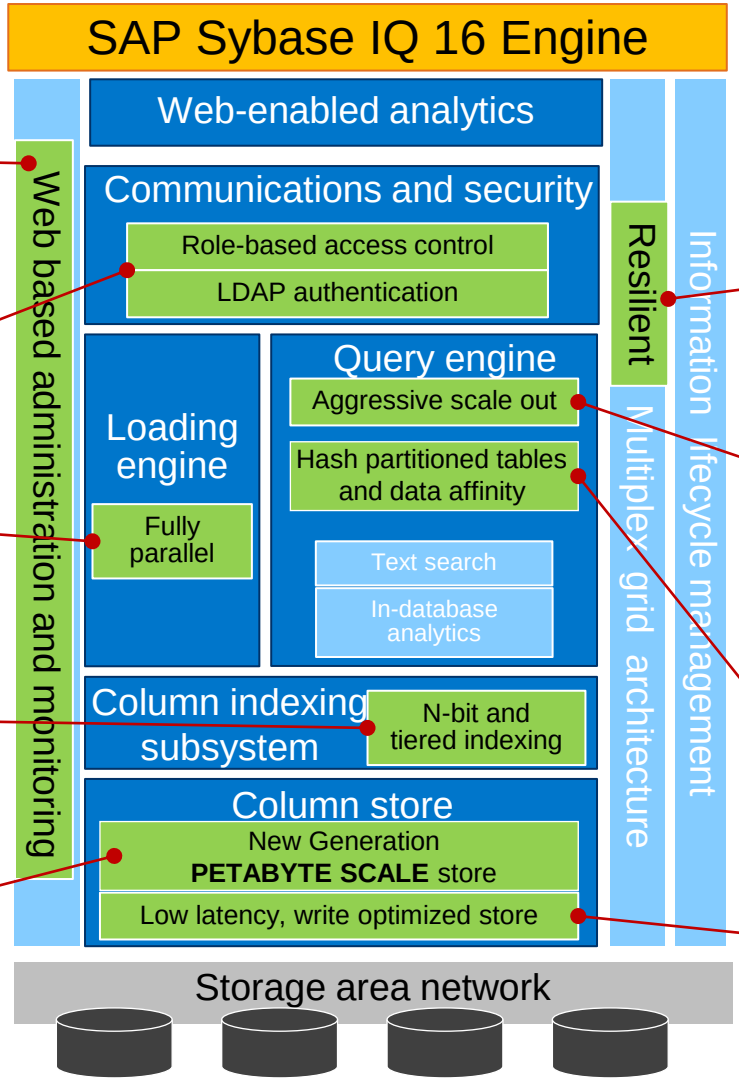
What's New!



Comprehensive web-based monitoring and administration

Enterprise-grade RBAC authorization and LDAP authentication

High performance, fully parallel bulk loading

New indexing technology for increased compression and fast, incremental batch loads

Re-engineered column store for extreme data volumes

Resilient Multiplex grid withstands network interrupts and server failures

Aggressively scaled out query engine

Intelligent query engine with data affinity for "shared nothing" performance on a flexible "shared everything" architecture

Low latency, concurrent write optimized delta store

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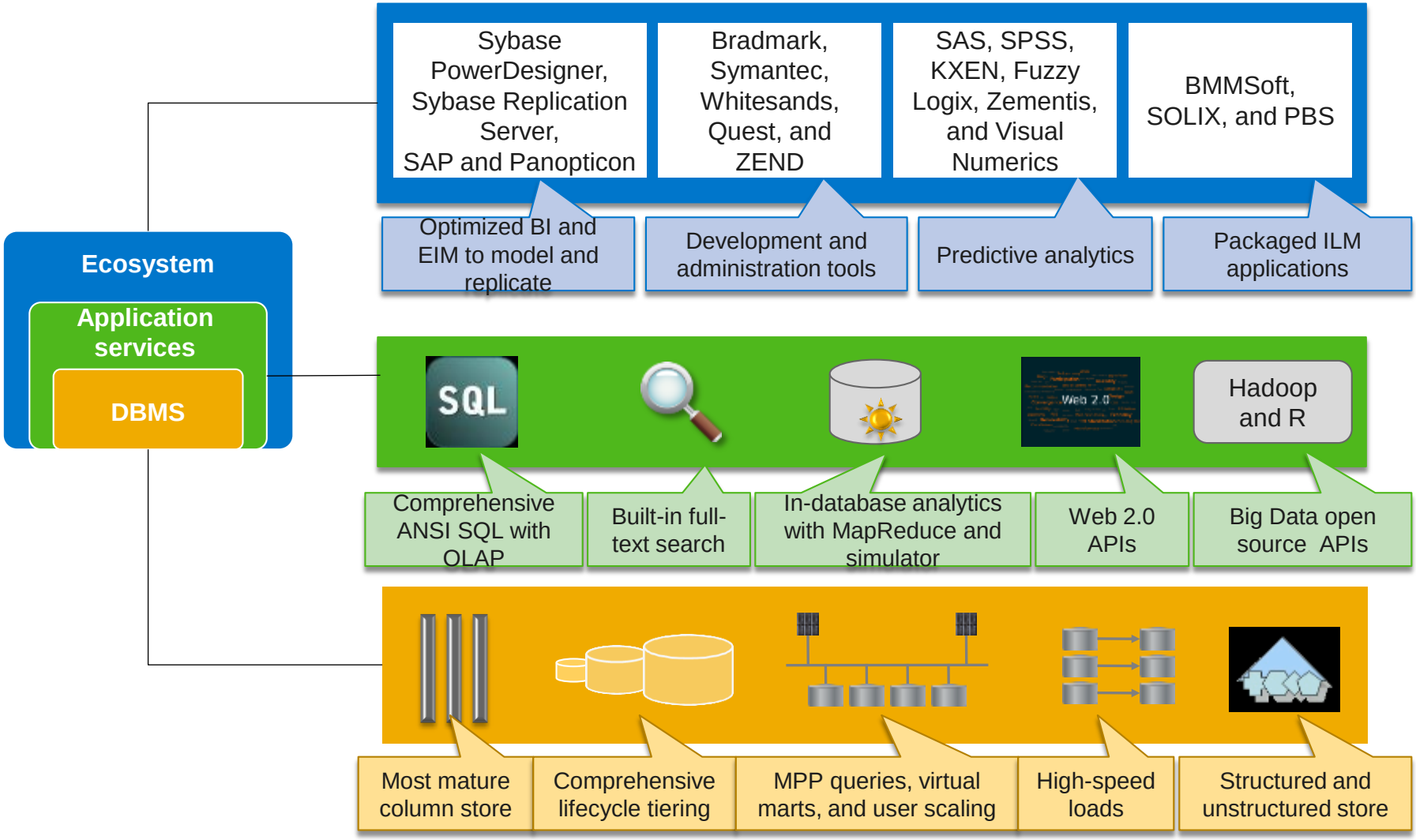
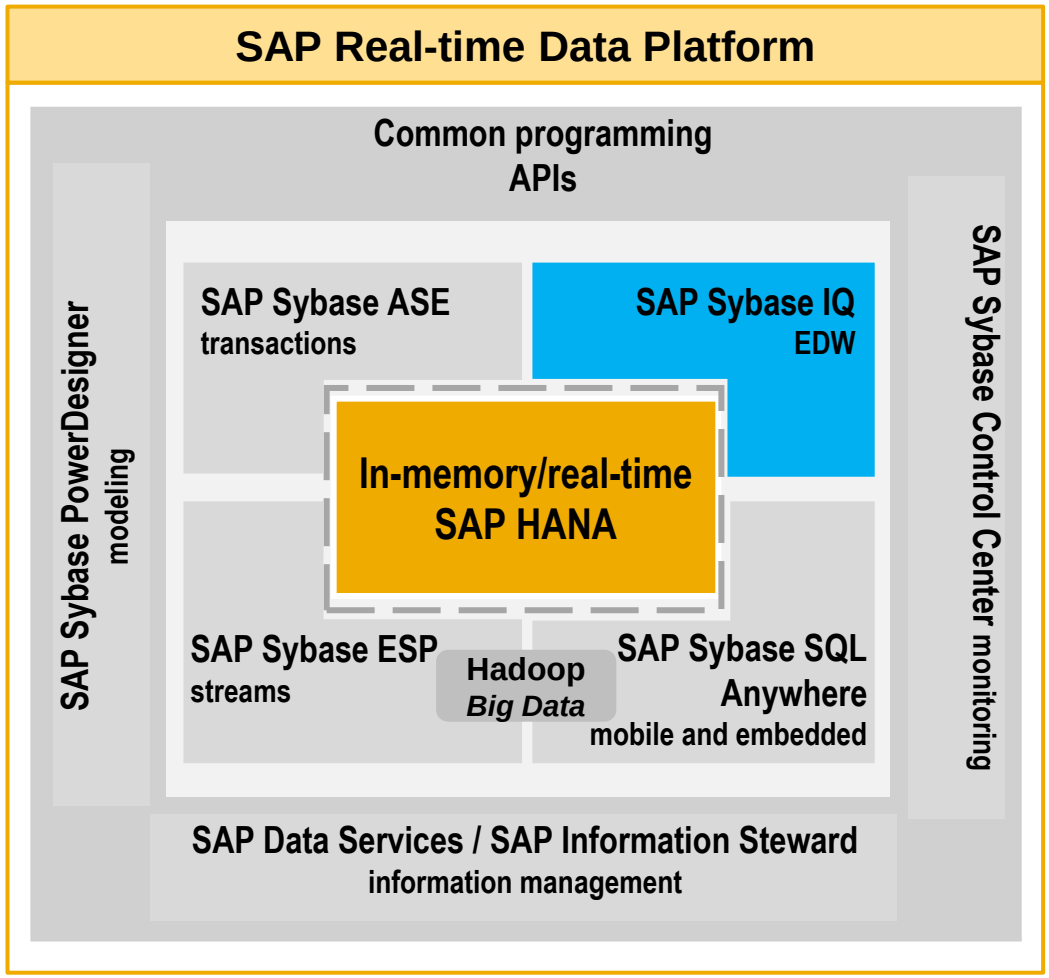
A comprehensive analytics platform



SAP Sybase IQ is a Key Component in the SAP Real-Time Data Platform

Unified open software platform for real-time business



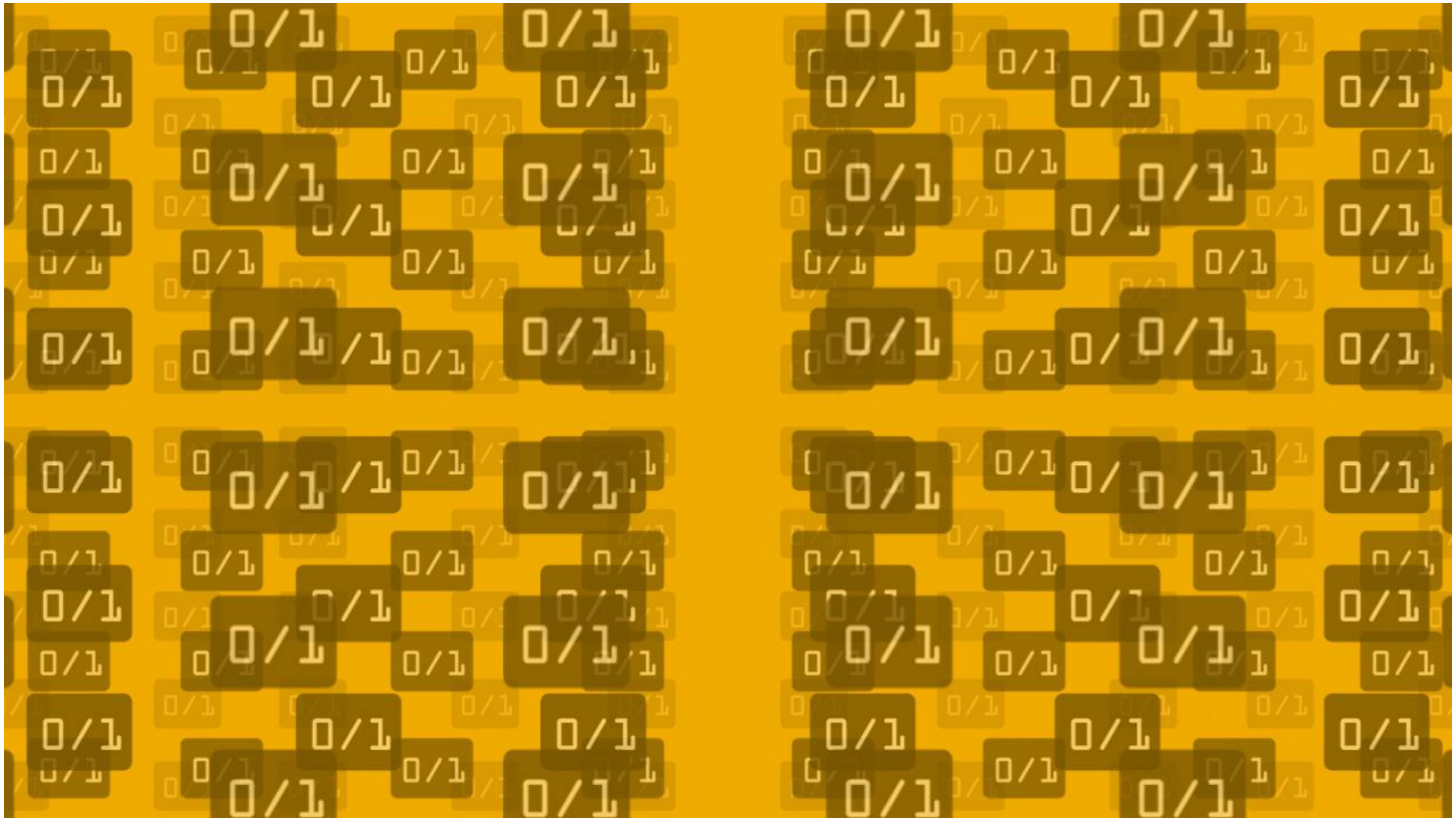
SAP Real-Time Data Platform foundations

- **Cross-paradigm data access** for new models of value discovery.
- **Hyper-performance** on all classes of application and usage scenarios
- **Price-Performance** value across all use cases

Benefits

- Execute, record, analyze, and optimize without system limitations
- Embrace and extend across variations of data forms and processing models
- Common modeling, integrated development environment, shared systems management infrastructure, and deployment-independent solutions
- Trusted and unified data environment

SAP Sybase IQ 16 Architectural Details



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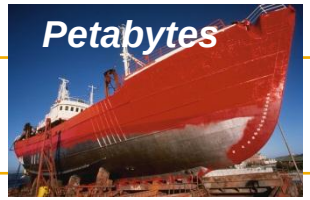
Innovations for extremely large databases (XLDB)

Storage Architecture

- New generation column store
- New partitioning and compression

Loading Engine

- Fully parallel bulk loading
- Real-time loading into delta store



SAP Sybase IQ XLDB Analytics

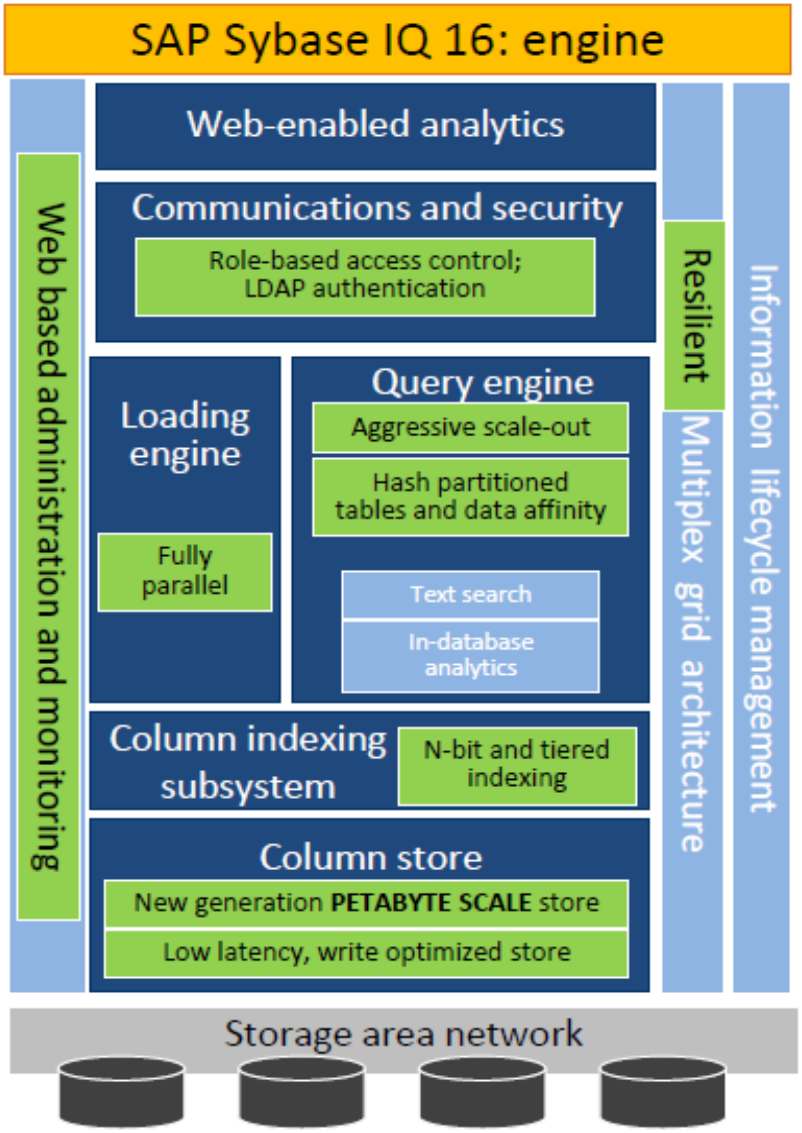
System Reliability

- Grid resiliency
- LDAP and role-based security

Query Processing

- Data affinity
- Aggressively parallel and distributed

SAP Sybase IQ 16 Architecture



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NEW COLUMN STORE ARCHITECTURE

Value proposition

Enhanced compression

Storage savings

Improved I/O bandwidth

Architectural considerations

Support variable number of cells per page

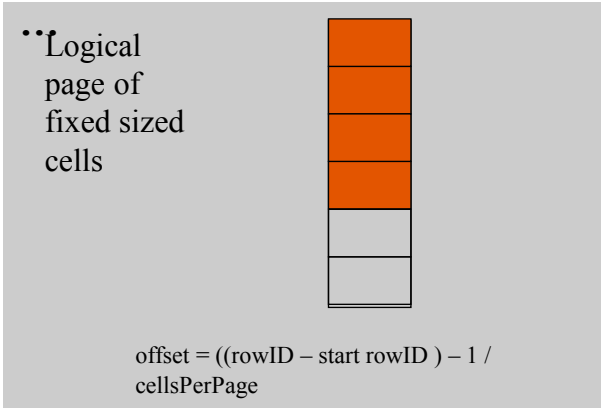
Support various page formats within a column

High performance access paths

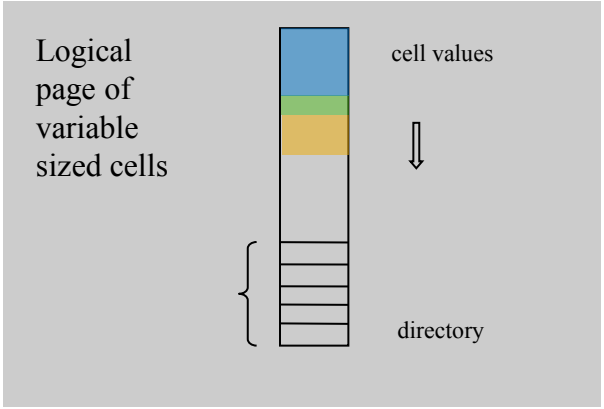
Even with variable length data, insert/update/delete efficiently into an existing page

Richer metadata

Before



NOW…



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N-BIT DICTIONARY COMPRESSION

Value proposition

Reduced memory footprint

Improved effective I/O rates

More efficient table scans

Reduced disk space

Raw Data = 400 MB; 1 Billion 4-byte integer values fn (N)

N	Token Size	Savings
2	(1B * 2) / 8 = 250MB	93.75%
3	(1B * 3) / 8 = 375MB	90.6%
4	(1B * 4) / 8 = 500MB	87.5%
	…….	
24	(1B * 24) / 8 = 3000MB	25%

Architectural considerations

N-bit FP, instead of 1, 2 and 3-byte FPs

Different data pages for same column can have different values of “N” for N-bit

- No more requirement to rollover FP format for all column data

Column is N-bit by default, unless otherwise specified to be flat

Options provided to set threshold for rollover to flat (to prevent large dictionaries)

Options provided to prevent rollover to flat (to prevent long rollover time)

Compatibility mode allows the database to mimic IQ 15 rollover behavior

```
2->3
3->4
4->5
5->6
6->8
8->10
10->12
12->16
16->21
21->24
```

SMALL BATCH LOAD PERFORMANCE

Value proposition

Improved performance of frequent, small batch loads

Predictable performance of small batch loads:

- performance is proportional to the size of the data being loaded, not the table being updated

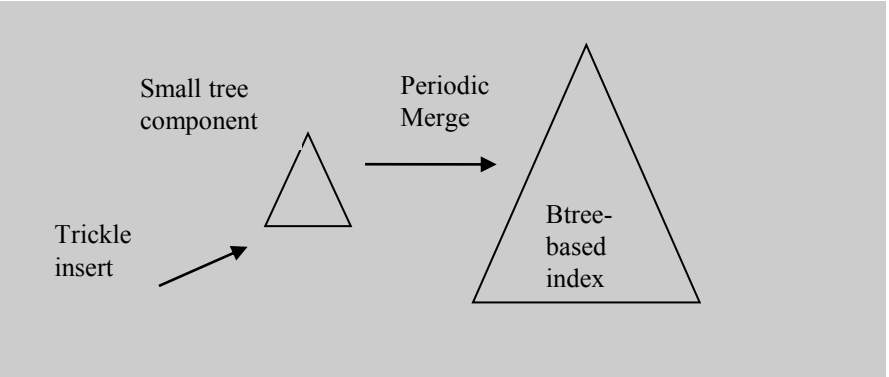
Architectural considerations

Inserting into a large High Group (HG) b-tree index is costly

HG index will have a tiered structure with a small tree component and a large tree component

Small, batch loads into the HG index are written to the small tree component quickly and synchronously

The small tree component is periodically merged into the large tree component as a background task



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FULLY PARALLEL BULK LOAD

Value proposition

Improved performance

Maximize use of existing cores on the machine

Dynamic load balancing

Architectural considerations

Load an index/column concurrently with multiple threads

Remove all bottlenecks which contribute to inefficient use of CPU and storage

Dynamically scale up and down degree of parallelism depending on the workload

Before…

Serial and parallel two phase load process

Raw data and bitmapped indexes – partly parallel: mixture of horizontal and vertical processing

B-Tree based indexes (HG, TEXT. WD) – fully parallel

Numerous bottlenecks:

Complex thread scheduling

Expensive synchronization points

Steps that are executed too infrequently to keep threads busy

NOW

Fully parallel two phase load process

Raw data– fully parallel

All secondary indexes – fully parallel

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HIGH VELOCITY DATA LOADING

Value proposition

Continuous analytics over operational data

High velocity, concurrent data modifications

Exploit large memory and core footprints

Architectural considerations

Write optimized in-memory In-memory RLV (Row-level versioned) store

Row level locking, and statement snapshot isolation

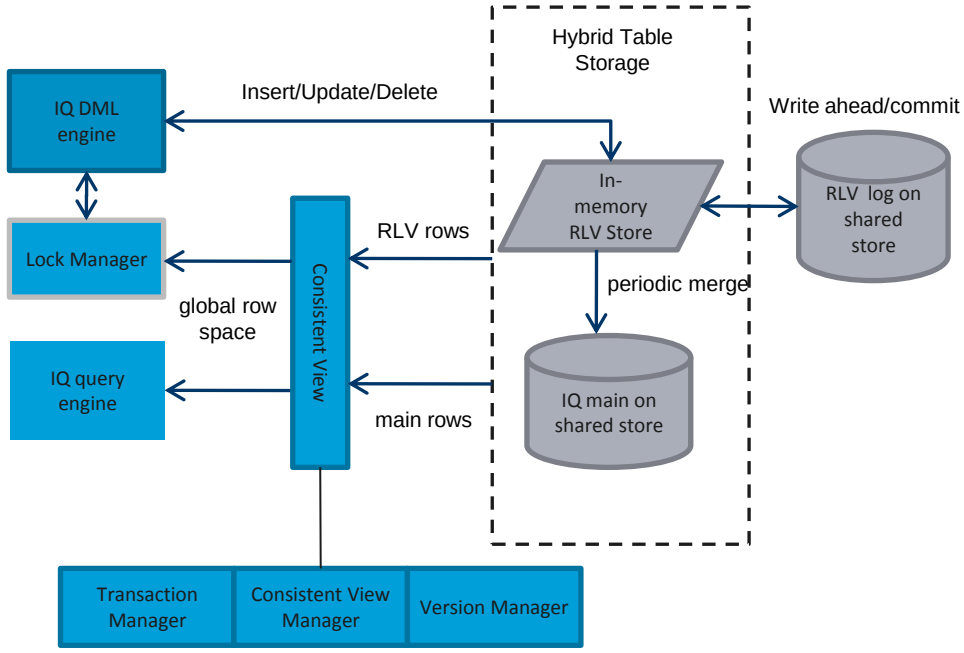
Low latency micro operations

In-memory RLV store has reduced compression, no sorting, no indexing

Fully recoverable with dedicated transaction log

Asynchronous data transfer from In-memory RLV store to IQ main store

Users choose which tables are In-memory RLV tables



QUERY SCALE OUT – HASH PARTITIONING

Value proposition

Gives best of both worlds of shared everything and shared nothing

Decreases hardware needs and localizes processing

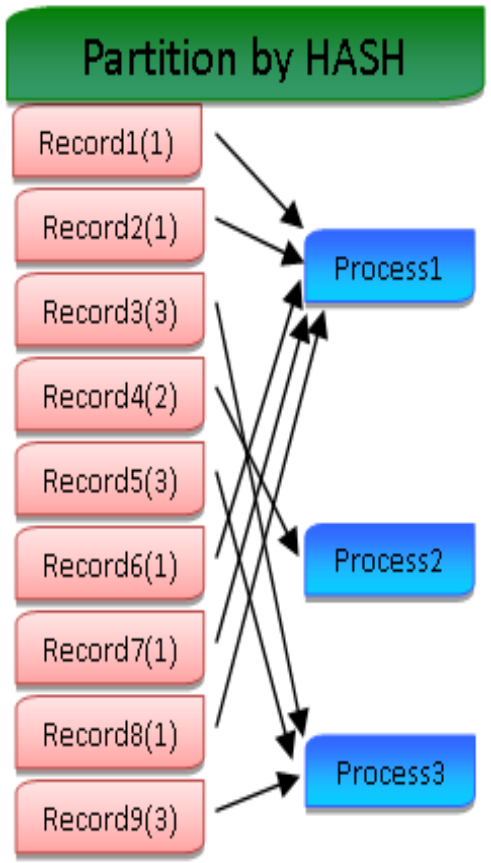
Architectural considerations

Data is automatically partitioned during loading with built-in hash algorithms

Data is divided into persistent subsets

- Reduces results sharing
- More efficient CPU usage
- Reduces instantaneous temp usage

Optimizer will use hash partitions for join and group by when available



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QUERY SCALE OUT – DATA AFFINITY

Value proposition

Provides efficient utilization of cluster-wide cache resources such as shared temp

Achieves ultra low-latency data access while preserving elastic multiplex capabilities

Group by and Order by benefit

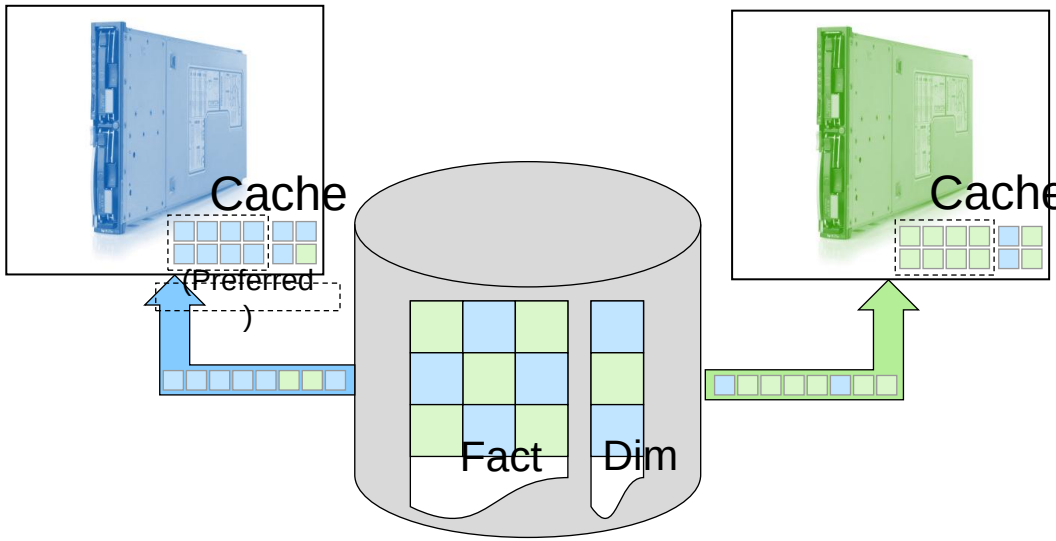
Architectural considerations

Affinity is automatically configured and used in multiplex

Adapts to query workloads and self manages

Data must be hash or logically partitioned

Each partition is assigned to a specific node



QUERY SCALE OUT – Query Runtime and DQP Optimization

Value proposition

Eliminates SMP (single node) and DQP (distributed query processing) bottlenecks

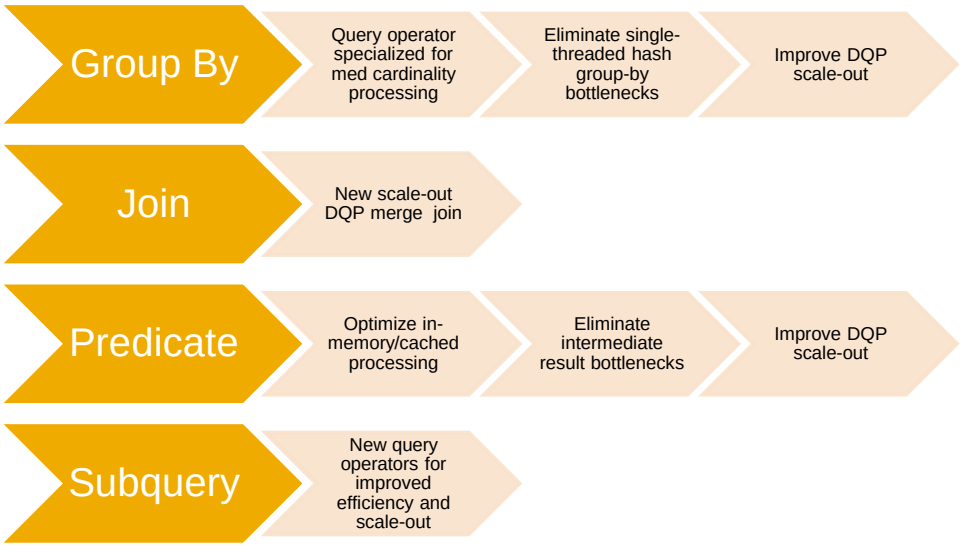
Leverages large memory and scale out

Lowers shared temp and interconnect bandwidth

Architectural considerations

Takes place automatically as optimizer selects best plan based on cost

For non-partitioned data, new Join and Group algorithms reduce the amount of intermediate results exchanged



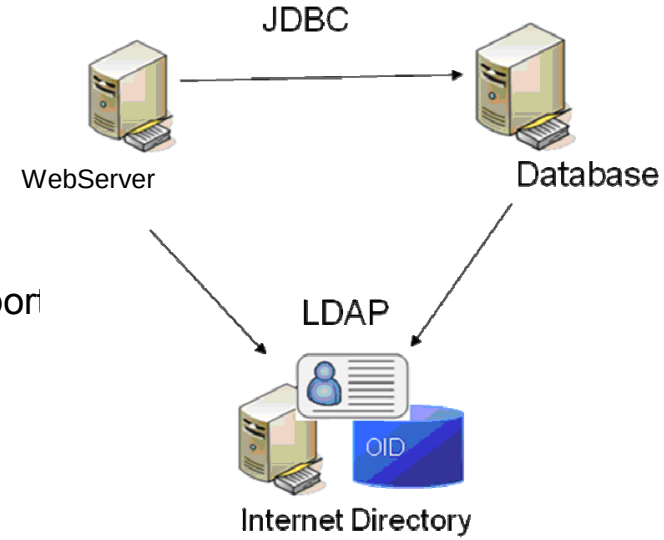
LDAP AUTHENTICATION

Value proposition: Reduced TCO and improved security

Enable customers to hook into existing enterprise infrastructures for managing users and passwords

Enable central management of password complexity policies

Multiple domains and multiple LDAP servers



Architectural considerations:

Secure communication with LDAP server using TLS

Deployable across various vendor's Directory Service that support Lightweight Directory Access Protocol (LDAP)

Support 24x7 operation: Automatic failover and failback

Efficient design for frequent, short-lived connections

No client side changes needed

SQL Anywhere, Sybase IQ, and ASE can share common user repository

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ROLE BASED ACCESS CONTROL

Value Proposition

Support separation of duties and principle of least privilege

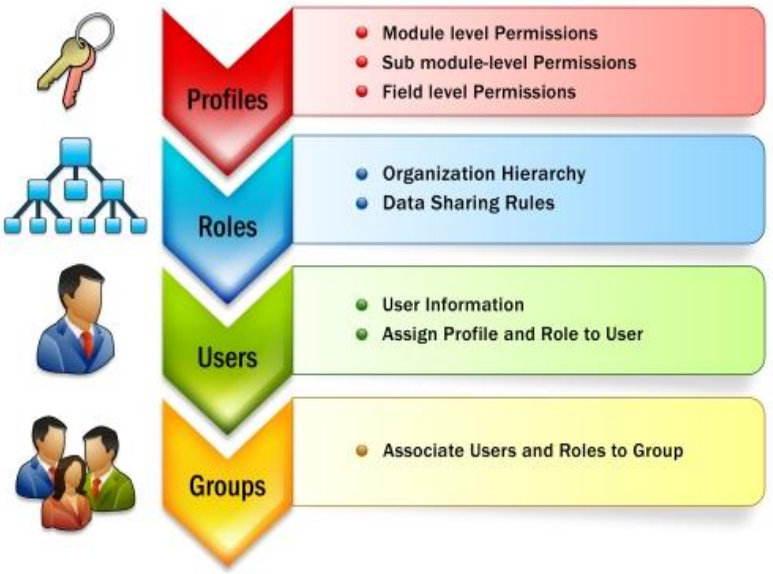
Breakdown privileged operations into fine grained sets that can be individually granted

Control over propagation of privileges

Who can grant which privileges

Complete backwards compatibility and clean migration

Stay competitive



Architectural Considerations

Support ANSI SQL role semantics, system defined roles and user defined roles

Minimum number of role administrators

Grantable system privileges for privileged database operations

Secure system stored procedures with SQL SECURITY INVOKER

Minimize performance impact by adding connection level cache mechanism

Restrict impersonation through SET USER to adhere to RBAC model

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MULTIPLEX ENHANCEMENTS

- **Shared System Temp**
  - Reduces the size of local temporary store
  - Simplifies sizing requirements for temp stores
  - DQP_ENABLED_OVER_NETWORK allows DQP to use the network instead of the shared system temp DBSpace

- **Logical Server – Login redirection**
  - Zero changes on client side on dynamic changes to logical servers
  - Single point to connection “redirector”
  - HA with multiple servers in the connection string to prevent a single point of failure

- **Cache Ejection Policy improvements for better cache hits**
  - Better infrastructure to track on disk changes and maximize cache hits to increase performance

- **Global Transaction Resiliency**
  - Suspend/resume global DML transactions, with a timeout, during INC disconnect/reconnect, coordinator downtime

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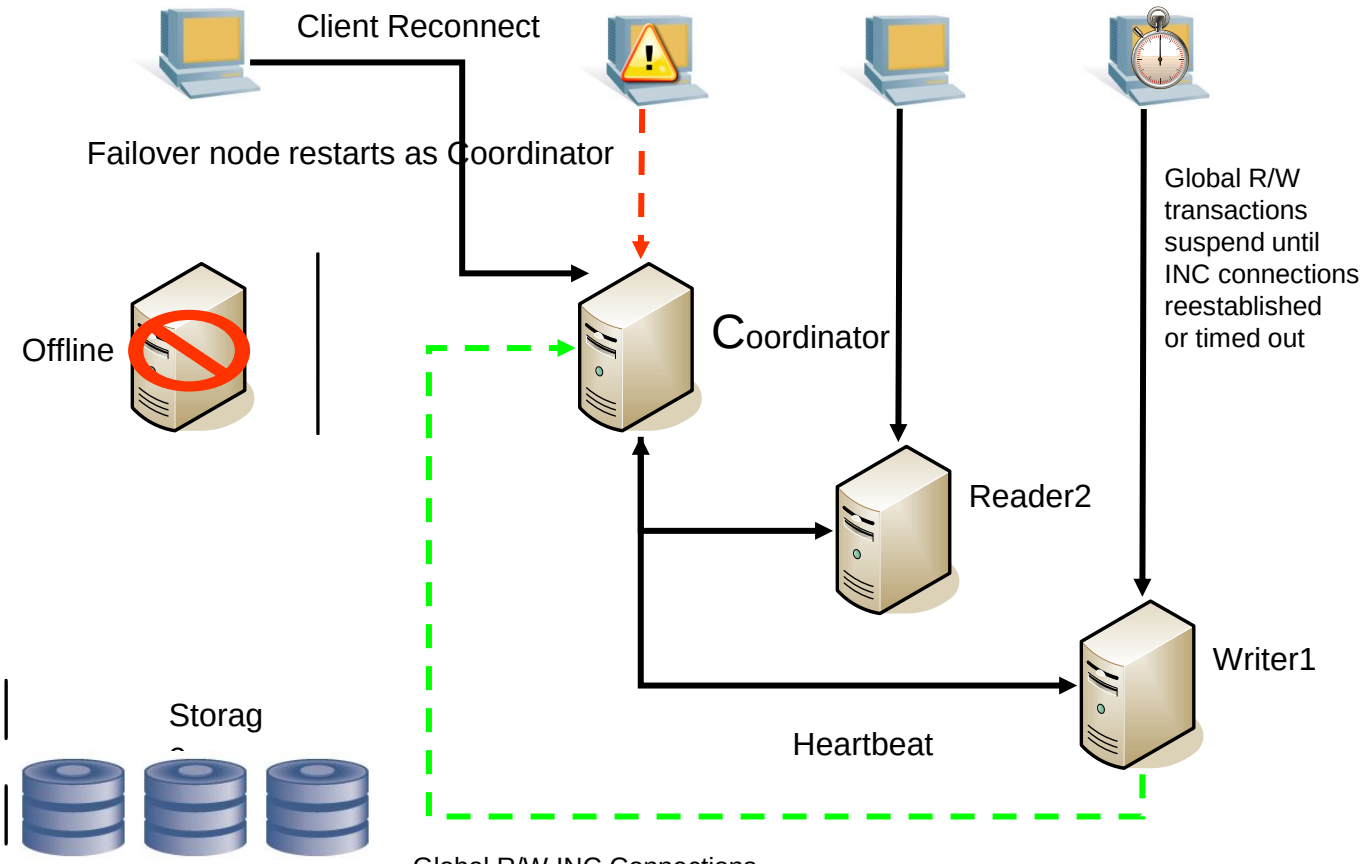
MULTIPLEX – GBL TRANSACTION RESILIENCY



Global R/W INC Connections
automatically reconnect and resume transaction
after a coordinator failover.
In most cases long-running loads will transparently resume.

Summary

- Market-Leading product with tremendous momentum
- 96%+ customer satisfaction rates
- Pioneering Column-store with 10+ patents
- IQ is used by **twice as many companies** as the next leading provider
- Focused sales and support teams
- SAP commitment to product leadership

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