SAP® NetWeaver® Business Warehouse Accelerator

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Agenda

1. **Technology**
2. Products

Key Technology Trends

1 • **Multicore CPUs**

2 • **In-Memory Processing**

3 • **Columnar Storage**

Multicore CPUs

Single core

Symmetric multiprocessing (SMP)

Instruction level parallelism (ILP)

Increase frequency = increase performance

Increase frequency = increase power consumption

Multi core

Thread level parallelism (TLP)

Increase cores

Massive parallel processing (MMP)
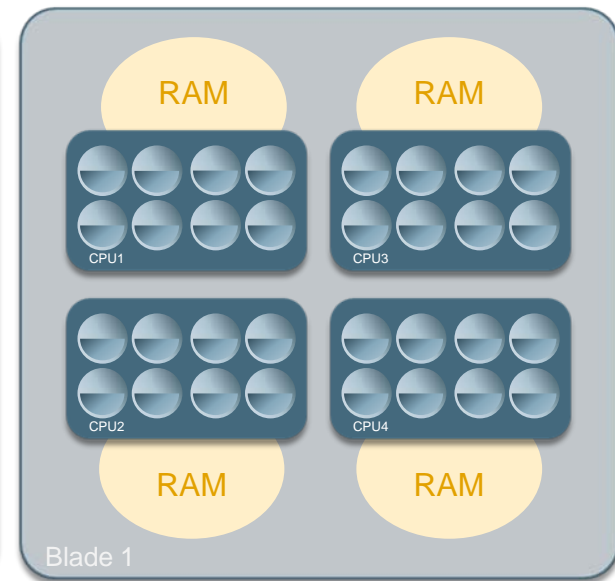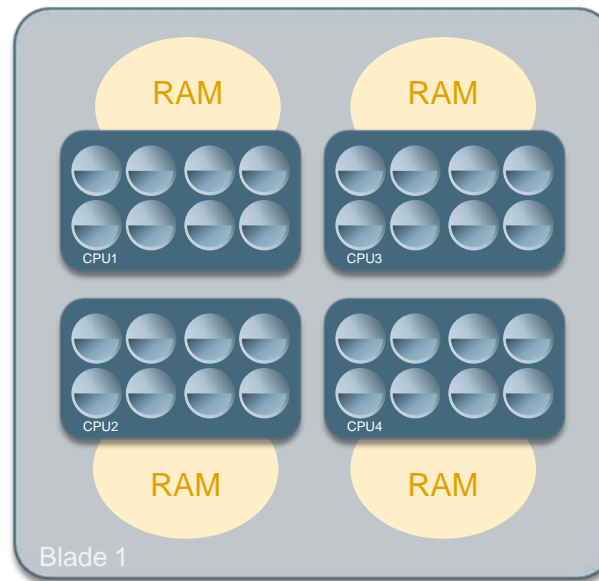
Imperative: applications must be coded for TLP

CPU1

CPU3

CPU2

CPU4

Blade 1

Blade2

Blade 3

Memory

2 • **In-Memory Processing**
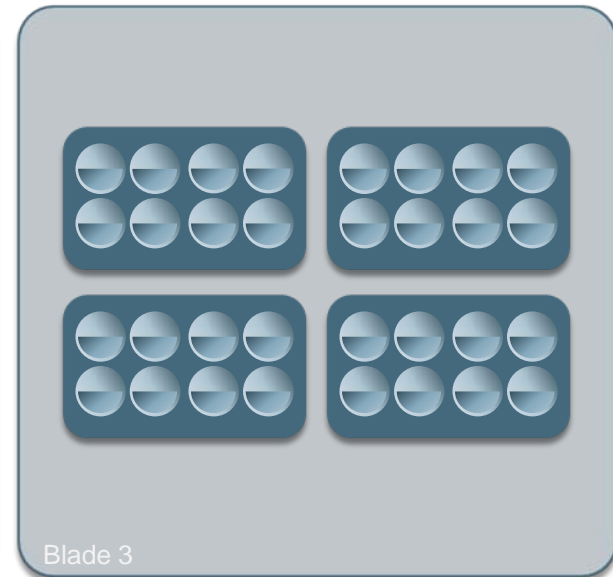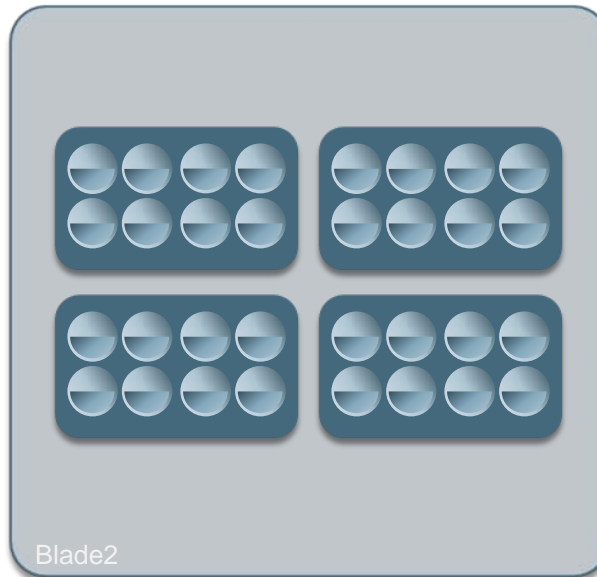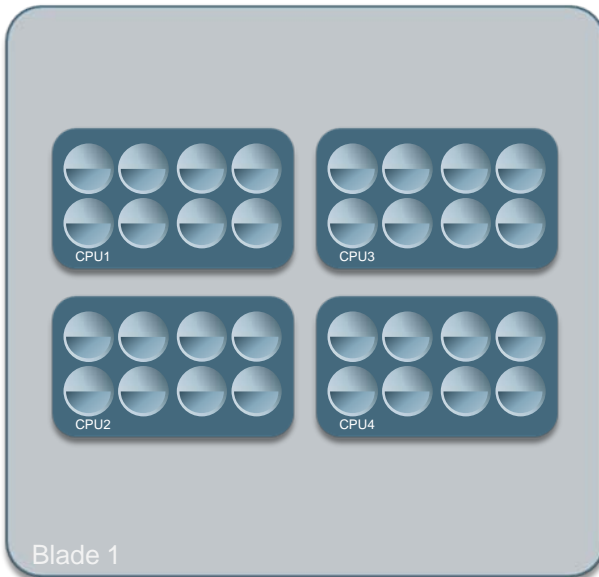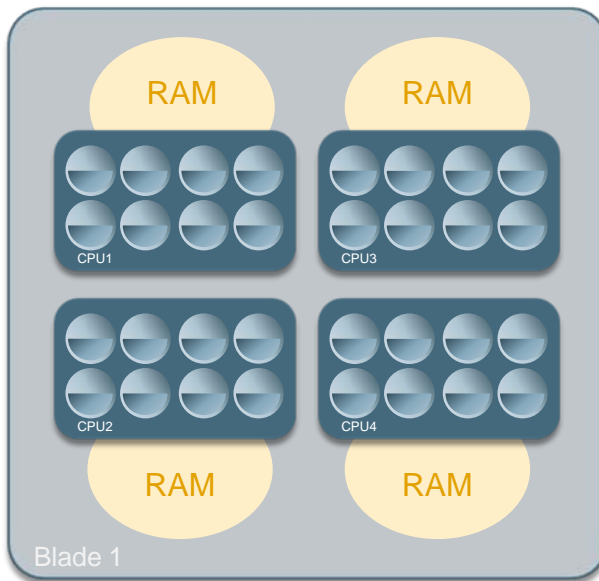
Limited availability of memory

32 bit address space (maxing out a 4GB per CPU)

Expensive memory modules

Production processes limit denisty of chips (256MB)

Available memory is defined by physical constraints

Plenty of memory

64 bit address space (virtually unlimited memory)

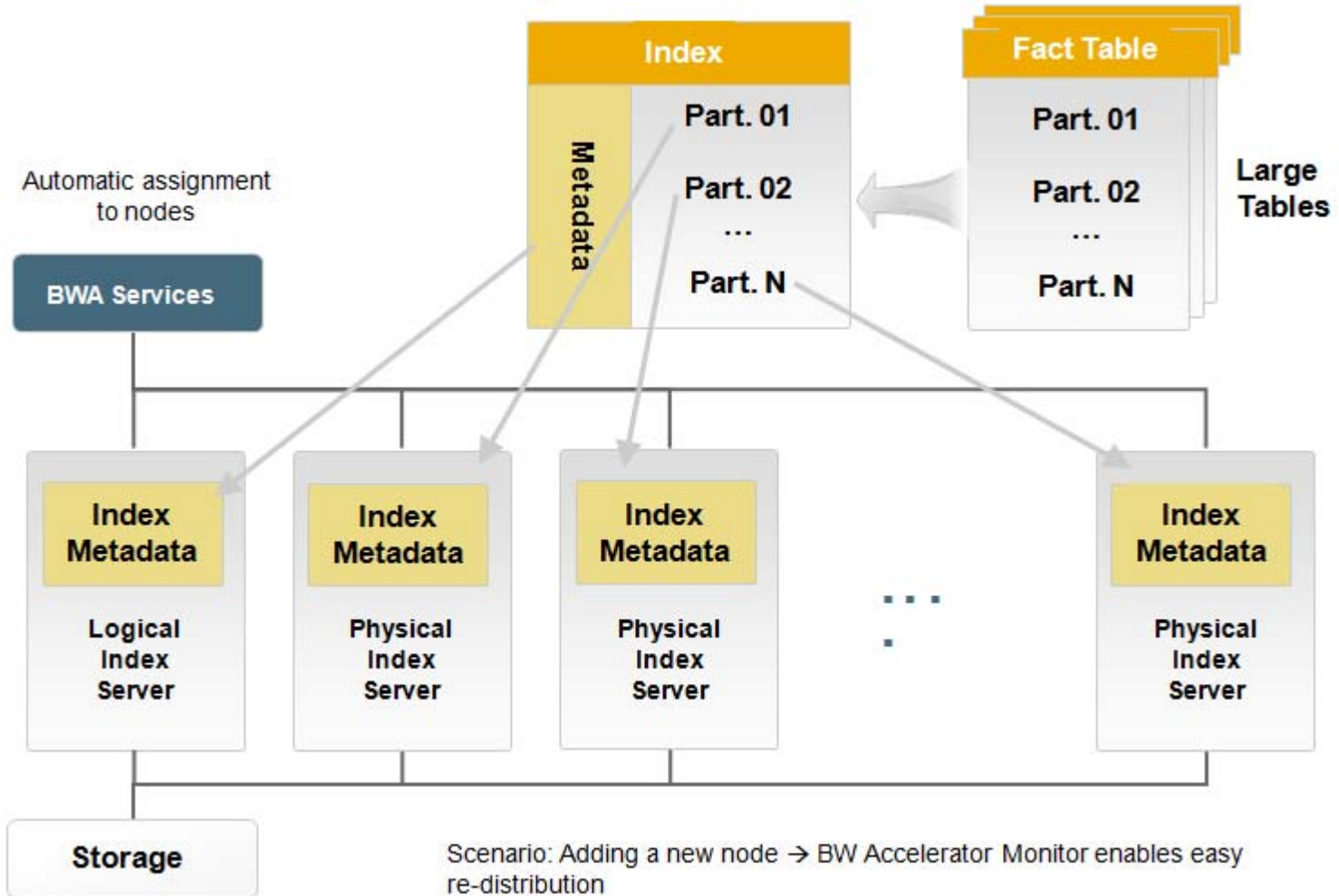Sharp drop in memory price due to prod. processes

High denisty memory chips (4GB)

BW Accelerator Architecture: Horizontal Partitioning

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| 1 | • Multicore CPUs |
| 2 | • In-Memory Processing |

Automatic assignment to nodes

BWA Services

Index

Metadata

Part. 01
Part. 02
...
Part. N

Fact Table

Part. 01
Part. 02
...
Part. N

Large Tables

Index Metadata
Logical Index Server

Index Metadata
Physical Index Server

Index Metadata
Physical Index Server

Index Metadata
Physical Index Server

Storage

Scenario: Adding a new node → BW Accelerator Monitor enables easy re-distribution
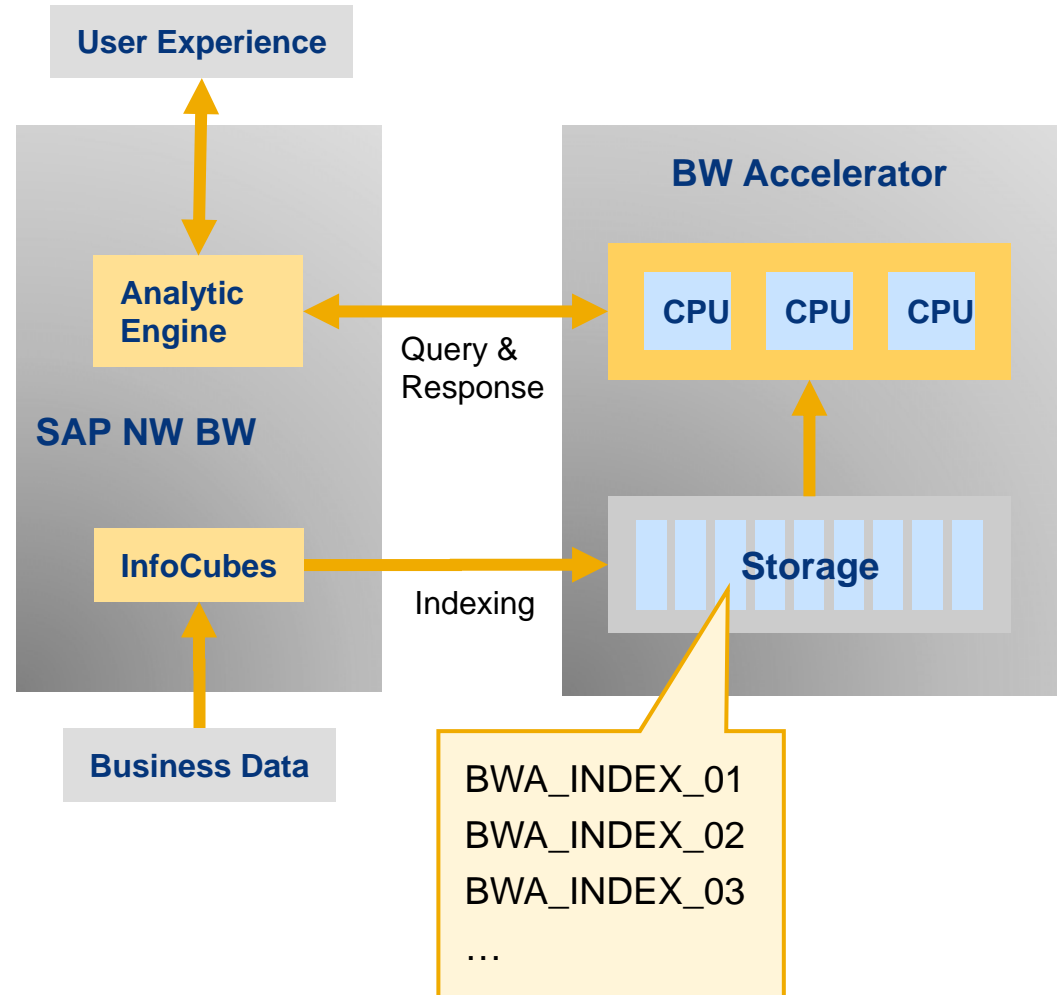
SAP NetWeaver BW Accelerator
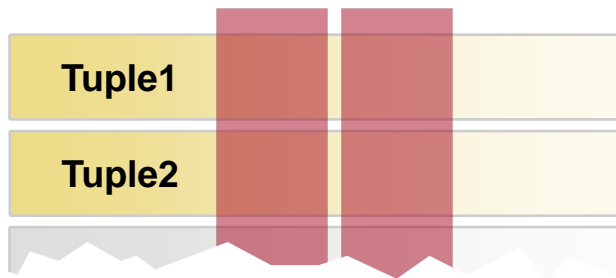# Indexing InfoCubes

A BWA Index

- Contains lists of
    - Index names
    - Join conditions
    - Join paths
    - View attributes
    - Key figures
- Stores metadata
- Enables engine to execute queries
- Corresponds to a BW InfoCube
   - But highly compressed to minimize main memory footprint

User Experience

BW Accelerator

Analytic Engine

CPU CPU CPU

Query & Response

SAP NW BW

InfoCubes

Indexing

Storage

Business Data

BWA_INDEX_01

BWA_INDEX_02

BWA_INDEX_03

…

BW Accelerator Architecture: Vertical Decomposition

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3 • **Columnar Storage**

Classical DB
stores tables by row

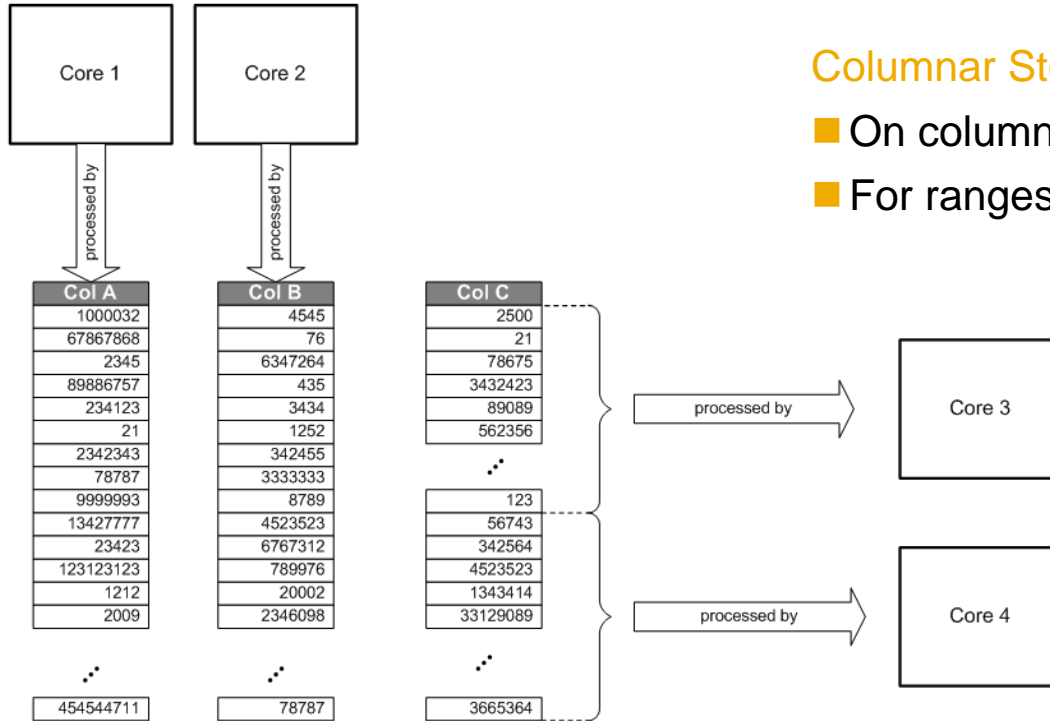| Tuple1 |
| Tuple2 |

To find all instances of an attribute value:

- Go to the first row
- Check the attribute value
- Go to the next row
- Check the attribute value
- Repeat for each row in the table

BW Accelerator
stores tables by column

Att1 Att2 Att3 Att4 Att5
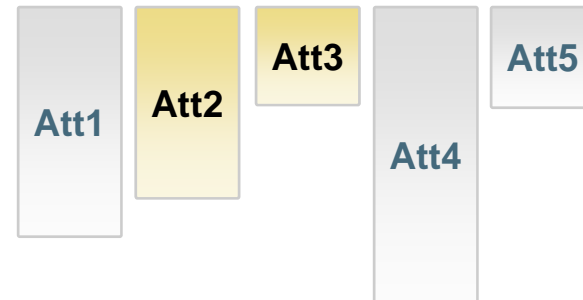
To find all instances of an attribute value:

- Go to the attribute column
- Read its row values

Columnar Storage: Advantages

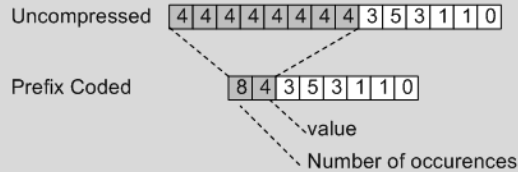**Columnar Storage Supports Parallelization**

- On column level (vertical)
- For ranges of columns (horizontal)
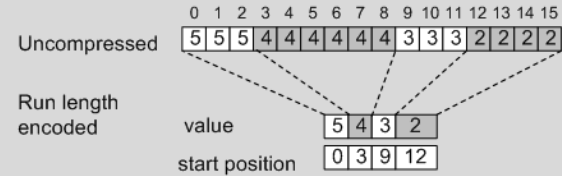
Columnar Storage

- Allows Compression such as run-length coding
- High speed of aggregation and scanning: several MB/sec
  - Allows eliminating materialized aggregates in many cases
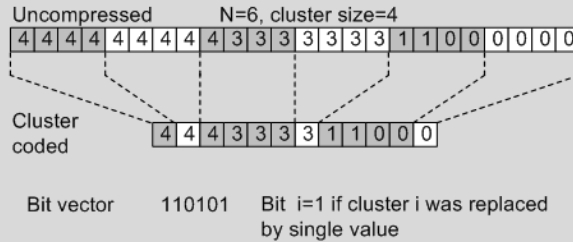 - Makes additional indexes unnecessary in many cases

BWA Data Compression
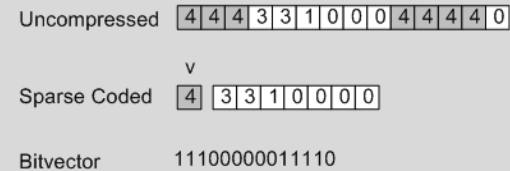

1) Prefix Coding

Uncompressed: 4 4 4 4 4 4 4 4 3 5 3 1 1 0

Prefix Coded: 8 4 3 5 3 1 1 0

value
Number of occurences

2) Run Length Coding

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Uncompressed: 5 5 5 4 4 4 4 4 4 3 3 3 2 2 2 2

Run length encoded:
value: 5 4 3 2
start position: 0 3 9 12

3) Cluster Coding

Uncompressed   N=6, cluster size=4
4 4 4 4 4 4 4 4 4 3 3 3 3 3 3 3 1 1 0 0 0 0 0 0

Cluster coded: 4 4 4 3 3 3 3 1 1 0 0 0

Bit vector   110101   Bit i=1 if cluster i was replaced by single value

4) Sparse Coding

Uncompressed: 4 4 4 3 3 1 0 0 0 4 4 4 4 0
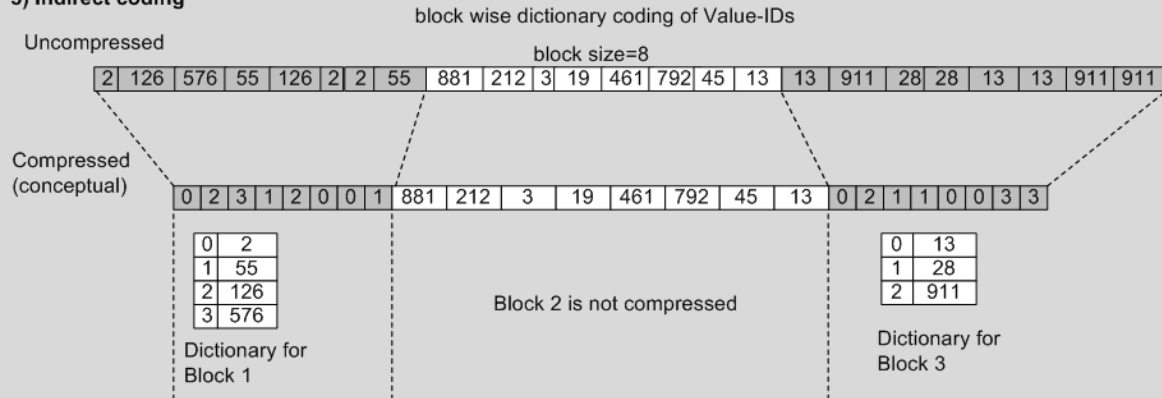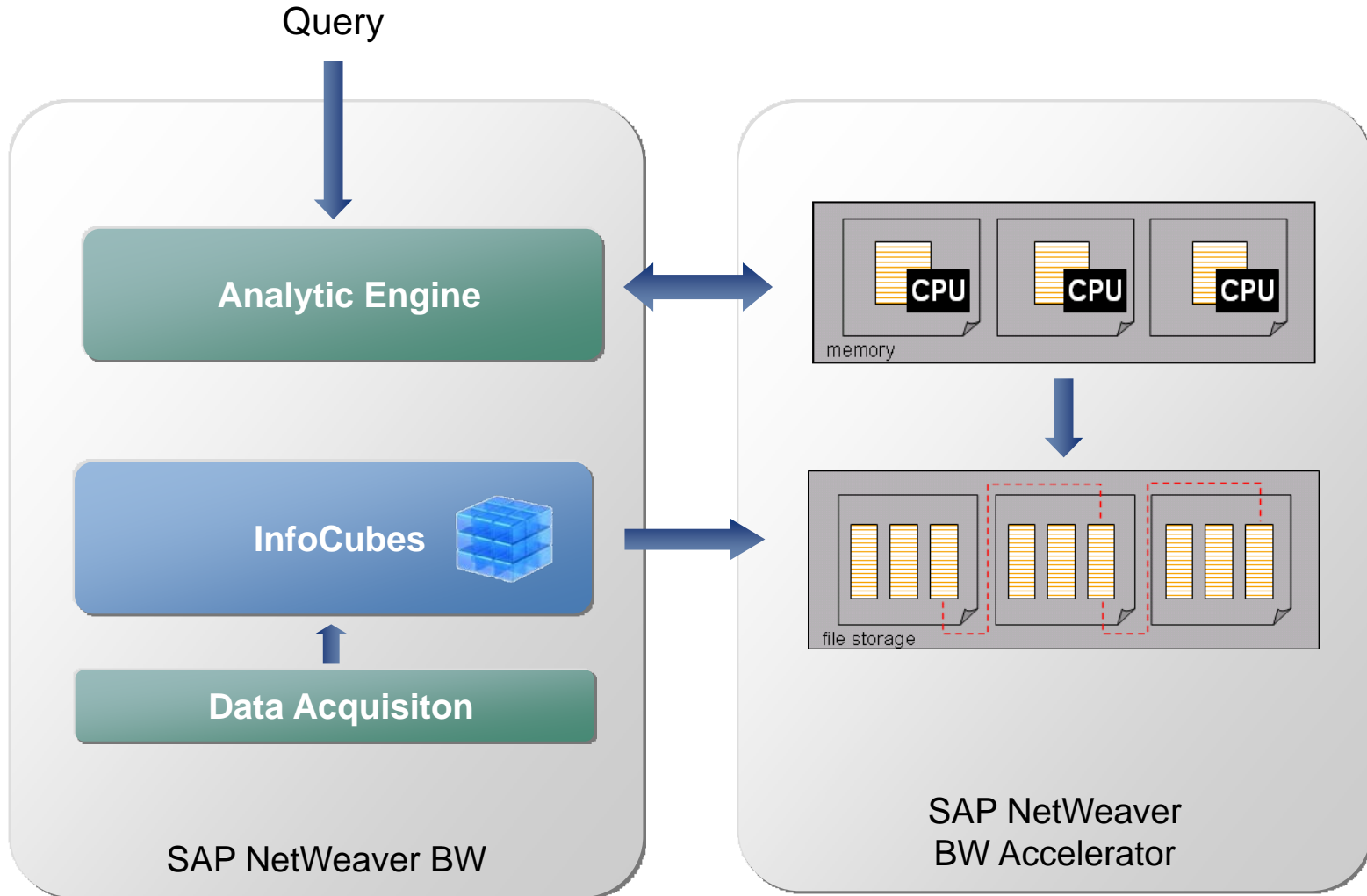
v
Sparse Coded: 4   3 3 1 0 0 0 0

Bitvector: 11100000011110

Removes the value v which occurs most often. Bit vector indicates positions of v in the original sequence.

5) Indirect coding

block wise dictionary coding of Value-IDs

Uncompressed
block size=8
2 | 126 | 576 | 55 | 126 | 2 | 2 | 55 | 881 | 212 | 3 | 19 | 461 | 792 | 45 | 13 | 13 | 911 | 28 | 28 | 13 | 13 | 911 | 911

Compressed (conceptual)
0 2 3 1 2 0 0 1 | 881 | 212 | 3 | 19 | 461 | 792 | 45 | 13 | 0 2 1 1 0 0 3 3

0	2
1	55
2	126
3	576

Dictionary for Block 1

Block 2 is not compressed

0	13
1	28
2	911

Dictionary for Block 3

BW Accelerator

Query

Analytic Engine

InfoCubes

Data Acquisiton

SAP NetWeaver BW

CPU CPU CPU

memory

file storage

SAP NetWeaver
BW Accelerator

SAP NetWeaver BW Accelerator Value Proposition

Cost of Operation

- **Save time to build and maintain aggregates**

- **Save disk space**

- **Take load off BW hardware**

- **Consolidate BW landscape**

Performance / Scalability

- **Ready for high data volumes (retail, utilities, banking …)**

- **Challenging response time SLA**

- **Ad hoc reporting with stable response times**

- **Scalable blade server platform**

IT

Time for Development

- **Less focus on performance aspects**

- **Faster development of new models and queries**

Extend Reach of BI

- **Empower additional user groups with user-friendly BI tools**

Business

Data Latency

- **Much shorter times for roll-ups and change runs**

- **Opportunity for more frequent data alignments**

- **Compression not always needed**

New Business Scenarios

- **Get more detailed insight into your business**

Agenda

1. Technology
2. **Products**

SAP NetWeaver BW Accelerator 7.00

Proven Technology – large installed base

- Outstanding query performance for SAP NetWeaver BW queries

- TCO reduction for SAP NetWeaver BW - no aggregations, less disk space, reduced systems workload

- Data latency reduction – shortened rollup and change runs times, opportunity for more frequent data alignments

- Broader acceptance – broader adoption of BW environments by the business community

SAP NetWeaver BW Accelerator

Aggregation Engine

Index

SAP NetWeaver BW

SAP NetWeaver BW Accelerator 7.20
New capabilities
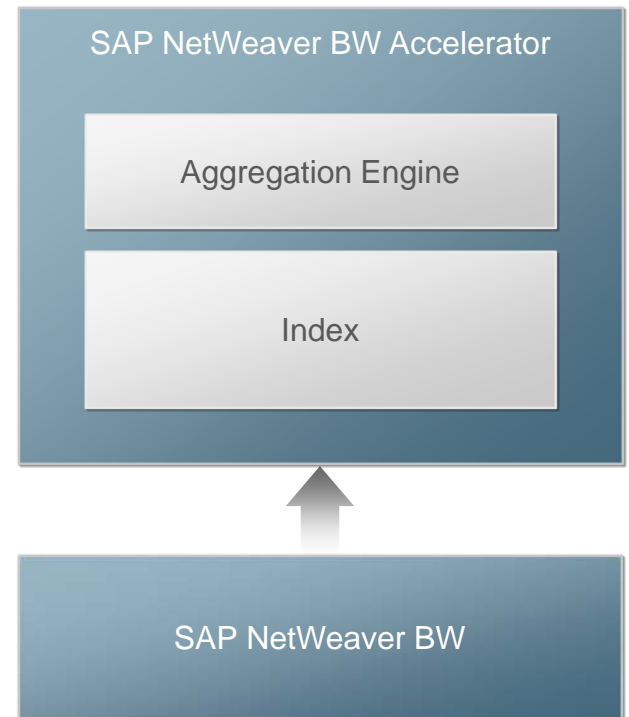
Taking the BW Accelerator to the next level of performance

- Enhanced built-in analytical capabilities*
  - F4 Value help
  - Hierarchy support
  - MultiProvider calculation handling
  - Exception aggregation
    (min,max, avg, count distinct, topk)
  - Analytic indexes

- Advanced features*
  - BWA based InfoCube
  - Use DataStore Objects to create indexes
 - Leverage SAP Business Suite data directly

SAP NetWeaver BW Accelerator

Calculation Engine

Aggregation Engine

Index
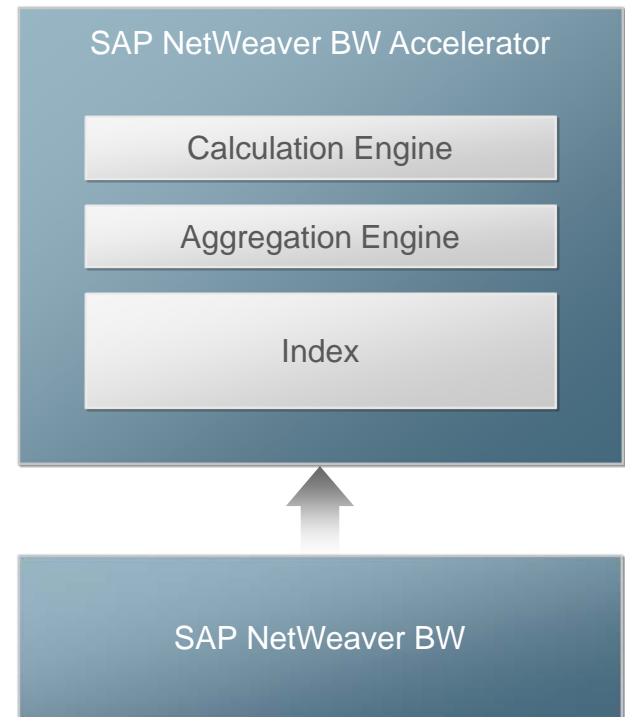
SAP NetWeaver BW

* Features require update/future release
of SAP NetWeaver to be leveraged

Flexible modeling with APD & BWA in SAP NetWeaver BW

- Any output of an APD process can be materialized as a analytic index

- Analytic Indexes are exposed as an Info-Provider for Queries definitions on top of it

- Composite Provider: Simple modeling of compositions of analytic indexes (unions, joins)

- Join/Union operation is processed on the fly

- CompositeProviders are exposed as standard SAP NetWeaver BW InfoProvider for BI client consumption
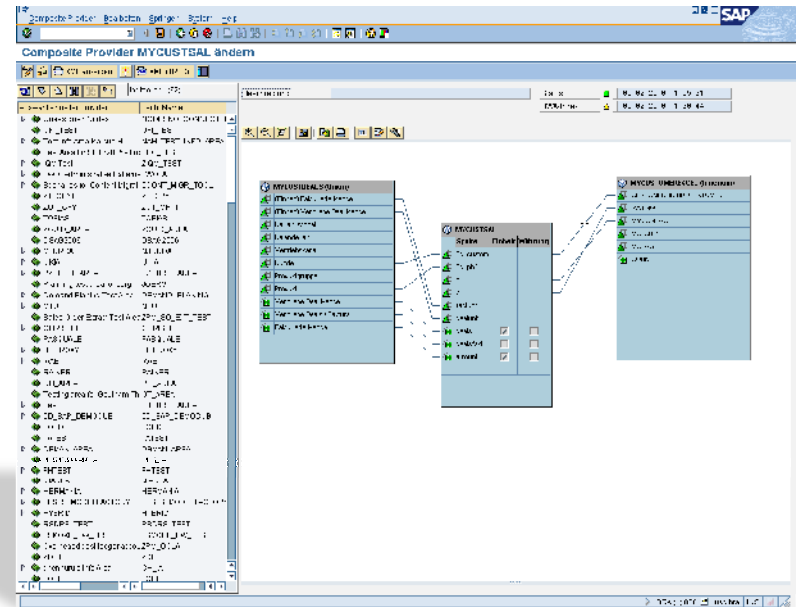
Lab Preview

SAP BusinessObjects Explorer
accelerated version for SAP NetWeaver BW

SAP

Search and discover –
for intuitive enterprise data exploration

- Intuitive user experience for casual business users

- Search and explore large volumes of enterprise data to discover relationships and uncover root cause

- Business users gain immediate 'insight at the speed of thought' without needing assistance from a business analyst or IT

SAP NetWeaver BW Accelerator

Aggregation Engine

Index
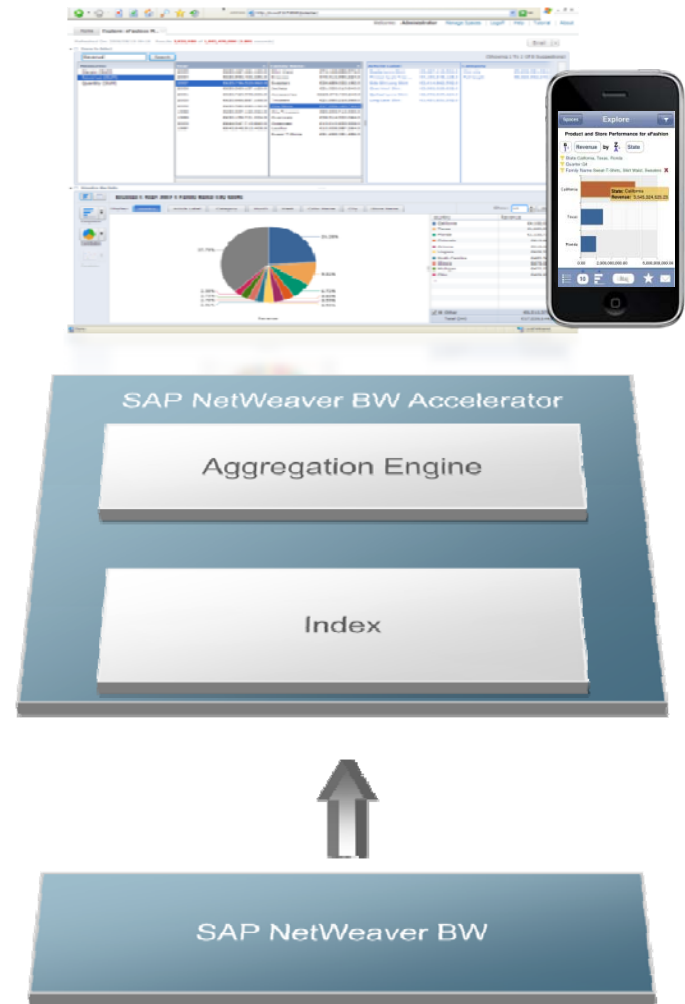
SAP NetWeaver BW

SAP BusinessObjects Explorer accelerated
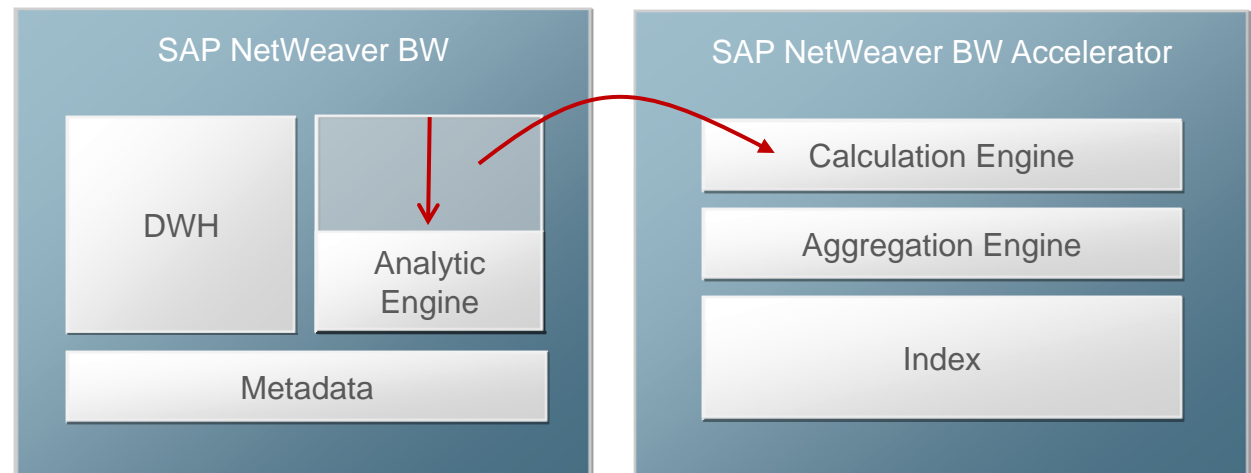## Accelerated version for any Data

Extended support for BW and any data – using the Search and Explore paradigm

- Extended support for SAP NetWeaver BW data models including hierarchies

- Load any kind of data into SAP NetWeaver Accelerator using SAP Business Objects Data Services

- New calculation engine providing support for calculated key figures and restricted key figures

- Updated user interface

SAP NetWeaver BW Accelerator

Calculation Engine

Aggregation Engine

Index

SAP NetWeaver BW

Any Data
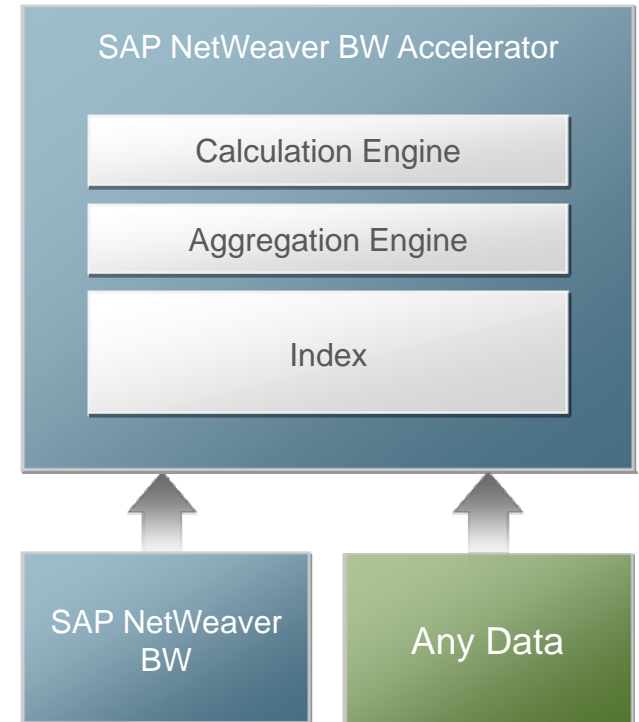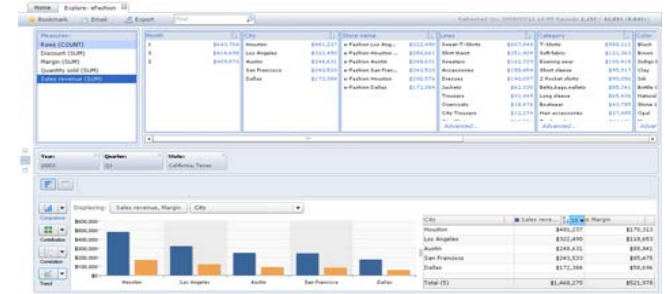
In-memory imperative – bring data and operations together at the CPU

- Move data intense operations to the data residing in memory
  - Avoid moving data around (leverage 64bit memory address space)
  - Leverage parallel processing (indexes across cores, CPUs, and blades)
  - Extend calculation capablities (leverage CPU compute power)

Thank you!