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How Coherence helps solve a surge in data demand

Presenter
Title

Agenda

- Motivation for Oracle Coherence
- What is Oracle Coherence?
  - … and what Oracle Coherence isn't!
- How does Oracle Coherence work?
  - … the underlying design objectives
  - … at the network layer
  - … how data is managed
- Where to use Oracle Coherence?
  - … features
  - … architectural integration patterns
- Why Oracle Coherence?
- Questions…

Motivation…. Scalability

General Rules for Scalability:

#1: Make Applications Stateless (statefulness is hard)

#2: Use Master/Worker Pattern (coordinate tasks)

#3: Use Messaging (notify of state changes)

Motivation….

General Observations:

#1: Where does the data to process come from?

#2: Imposes “take a copy of the data with you”

#3: Imposes “process it all in one place”

#4: Forced to introduce caching to keep data “close”

#5: Introduces single points-of-failure & bottleneck

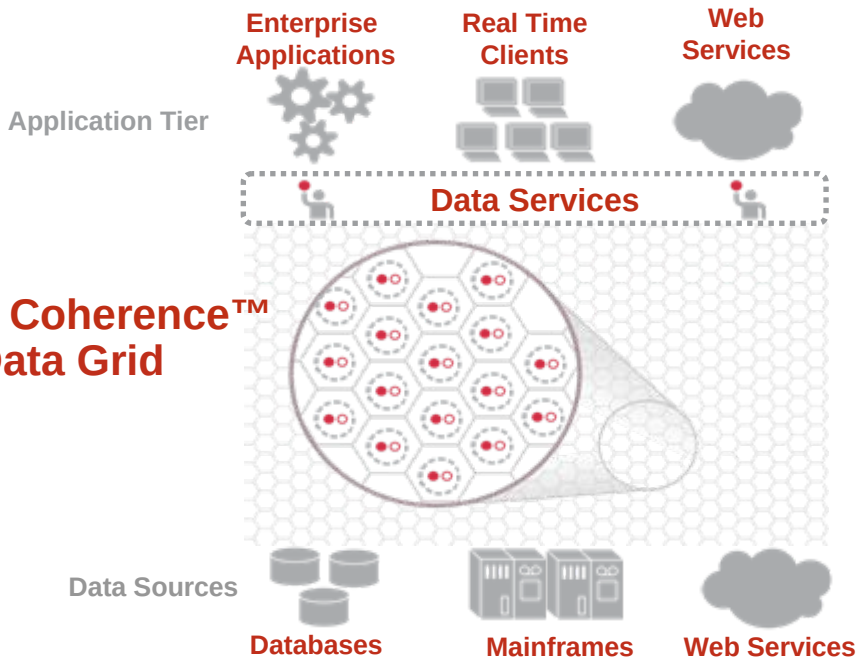
#6: Applications may scale-out (inexpensive), but Data Sources have to scale-up (expensive)

#7: Manual partitioning Data / Services increases complexity

Motivation….

Oracle Coherence is designed to…

- Resolve these challenges
- Extend the life of Data Sources & Architectures
- As a foundation for extreme processing systems



What is Oracle Coherence?

… and what it isn't !

What is Oracle Coherence?

Cluster-based Data Management Solution for Applications

What is Oracle Coherence?

Or… Distributed Memory Data Management Solution

(aka: Data Grid)

What is Oracle Coherence? It's Clustering!

Oracle Coherence Clustering is special… It means…

- Collection of processes (members) that work together
- All members have equal responsibility*
  - for the health of the cluster
- No static/tight coupling of responsibilities to hardware
- No masters and workers/slaves
- No centralized registries of data or services
- No single points of failure
- No single points of bottleneck

***members may be asked to perform individual tasks… eg: Grid Agents**

What is Oracle Coherence? Data

Data in Oracle Coherence…

- Any serializable* Object
- No proprietary classes to extend**
- Fully native Java & .NET interoperability (soon C++)
- No byte-code instruction or multi-layer facades
- Not forced to use Relational Models, Object-Relational-Mapping, SQL etc
- Just real POJOs and PONOs (soon POCOs)
  - **Domain objects are fine!**

***serialization = writing to binary form**

**** implementing specialized interfaces improves performance!**

What is Oracle Coherence? Data

Data in Oracle Coherence…

- Different topologies for your Data
- Simple API for all Data, regardless of Topology
- Things you can do…
  - Distributed Objects, Maps & Caching
  - Real-Time Events, Listeners
  - Parallel Queries & Indexing
  - Data Processing and Service Agents (Grid features)
  - Continuous Views
  - Aggregation
  - Persistence, Sessions…

What is Oracle Coherence? Management Solution

Management Solution…

- Responsible for Clustering, Data and Service management, including partitioning
- Ideally engineers should not have to…
  - design, specify and code how partitioning occurs in a solution
  - handle Remote Exceptions
  - manage the Cluster, either manually or in code
  - shutdown the system to add new resources or repartition
  - use “consoles” to recover or scale a system.
- These are impediments to scaling cost effectively
- As #members → ∞, management cost should be C
  - Ideally log(#members)
- Clustering technology should be invisible in your solution!

What is Oracle Coherence? For Applications

It's for Applications!

- Oracle Coherence doesn't require a container / server
- A single library*
- No external / open source dependencies!
- Won't cause JAR / classloader hell (cf: DLL hell)
- Can be embedded or run standalone
- Runs where Java SE / EE, .NET runs
- Won't impose architectural patterns**

*** May require additional libraries depending on features required.**
EG: spring, web, hibernate, jta integration are bundled as separate libraries.

**** Though we do make some suggestions ☺**

Clustered Hello World…

```
public void main(String[] args) throws IOException {
   NamedCache nc = CacheFactory.getCache(“test”);
   nc.put(“key”, “Hello World”);
   System.out.println(nc.get(“key”));

   System.in.read();  //may throw exception
}
```

- **Joins / Establishes a cluster**
- **Places an Entry (key, value) into the Cache “test” (notice no configuration)**
- **Retrieves the Entry from the Cache.**
- **Displays it.**
- **“read” at the end to keep the application (and Cluster) from terminating**

Clustered Hello World…

```
public void main(String[] args) throws IOException {
   NamedCache nc = CacheFactory.getCache(“test”);
   System.out.println(nc.get(“key”));
}
```

- **Joins / Establishes a cluster**
- **Retrieves the Entry from the Cache.**
- **Displays it**
- **Start as many applications as you like… they all cluster the are able to share the values in the cache**

What Oracle Coherence isn't!

- It's not an in-memory-database
  - Though it's often used for transactional state and as a transient system-of-record
  - Used for eXtreme Transaction Processing
- You can however:
  - Do queries – in a parallel – but not restricted to relational-style (it's not a RDBMS)
  - Use SQL-like queries
  - Perform indexing (like a DB)
  - Do things like Stored Procedures
  - Establish real-time views (like Materialized Views)

What Oracle Coherence isn't!

- It's not a messaging system
  - You can use Events and Listeners for data inserts, updates, deletes
  - You can use Agents to handle data changes
  - You can use Filters to filter events
- It's not "just" a Cache!
  - Caches expire data!
  - Customers actually turn expiry off!
  - Why do they take that risk? Why do we let them?
  - Data management is based on reliable clustering technology. It's stable, reliable and highly available

What is Oracle Coherence?

Dependable, resilient, scalable cluster technology

that

enables developers to effortlessly
cluster stateful applications

so they can

dynamically and reliably share data,
provide services and respond to events

to

scale-out solutions to meet business demand.

How does

Oracle Coherence work?

Clustering is about Consensus!

Oracle Coherence Clustering is very different!

Goal:

- Maintain Cluster Membership Consensus all times
- Do it as fast as physically possible
- Do it without a single point of failure or registry of members
- Ensure all members have the same responsibility and work together to maintain consensus
- Ensure that no voting occurs to determine membership

Clustering is about Consensus!

Why: If all members are always known…

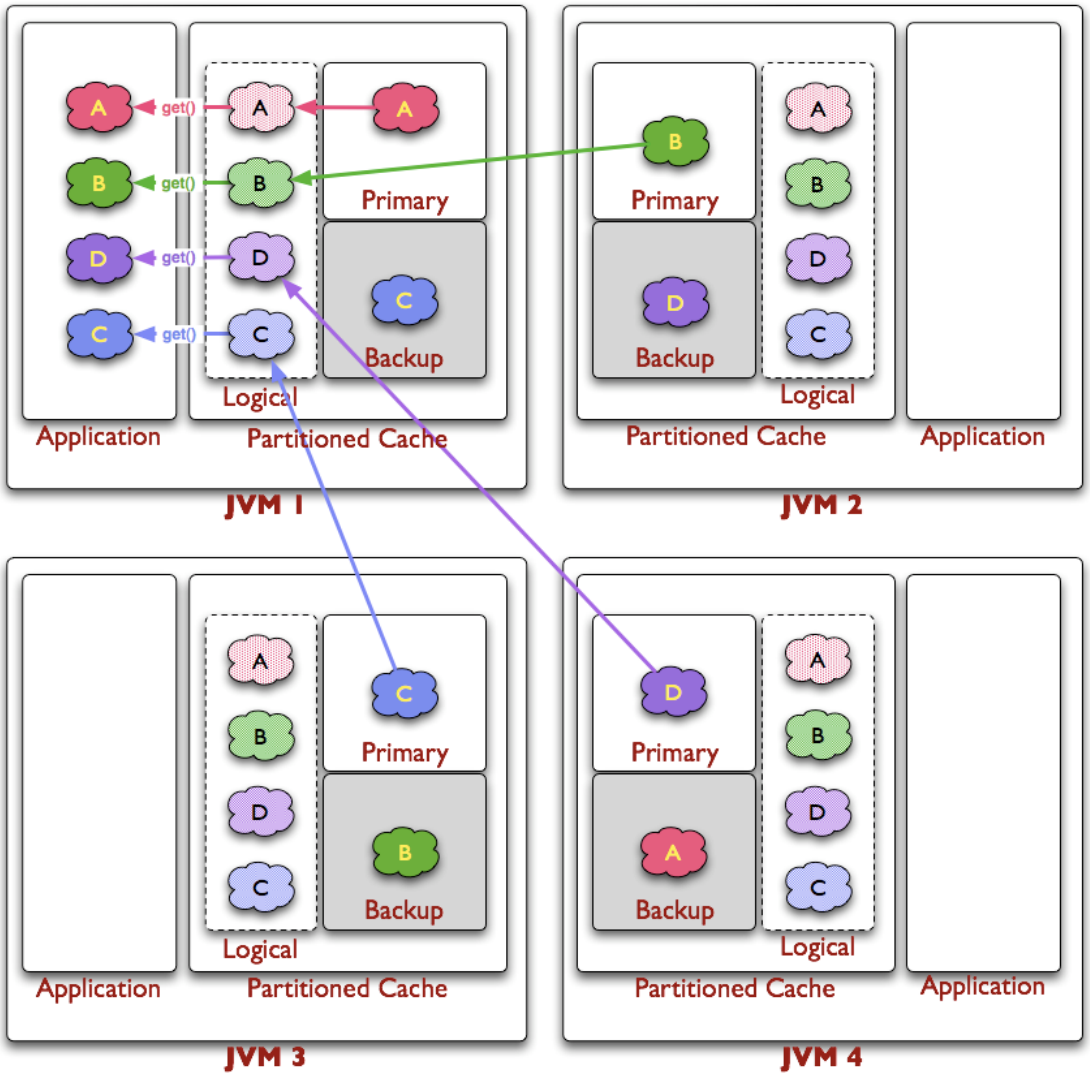
- We can partition / load balance Data & Services
- We don't need to hold TCP/IP connections open (resource intensive)
- Any member can "talk" directly with any other member (peer-to-peer)
- The cluster can dynamically (while running) scale to any size

Partitioned Topology : Data Access

- Oracle Coherence provides many Topologies for Data Management
- Local, Near, Replicated, Overview, Disk, Off-Heap, Extend (WAN), Extend (Clients)

Partitioned Topology

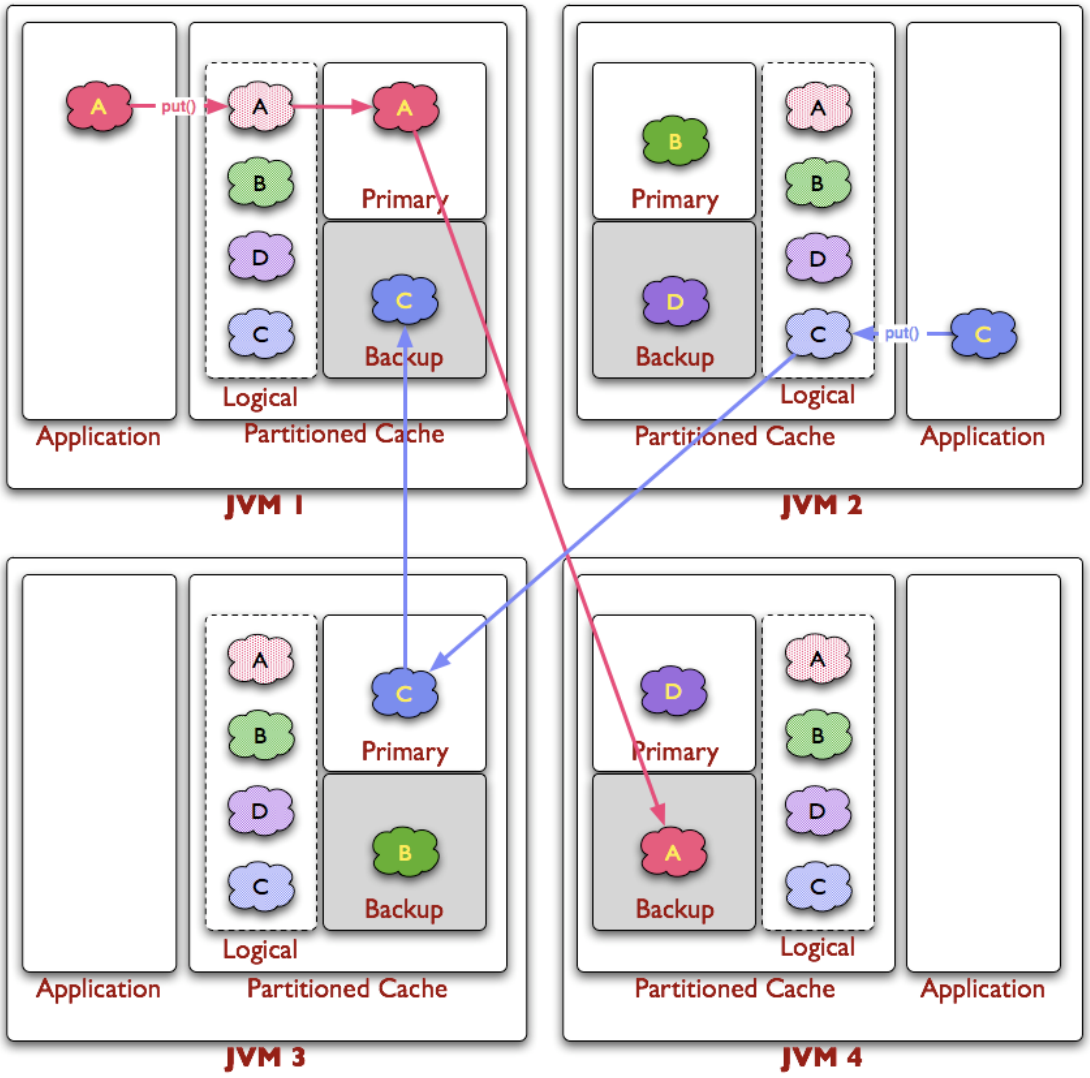
- Data spread and backed up across Members
- Transparent to developer
- Members have access to all Data
- All Data locations are known – no lookup & no registry!



Partitioned Topology : Data Update

Partitioned Topology

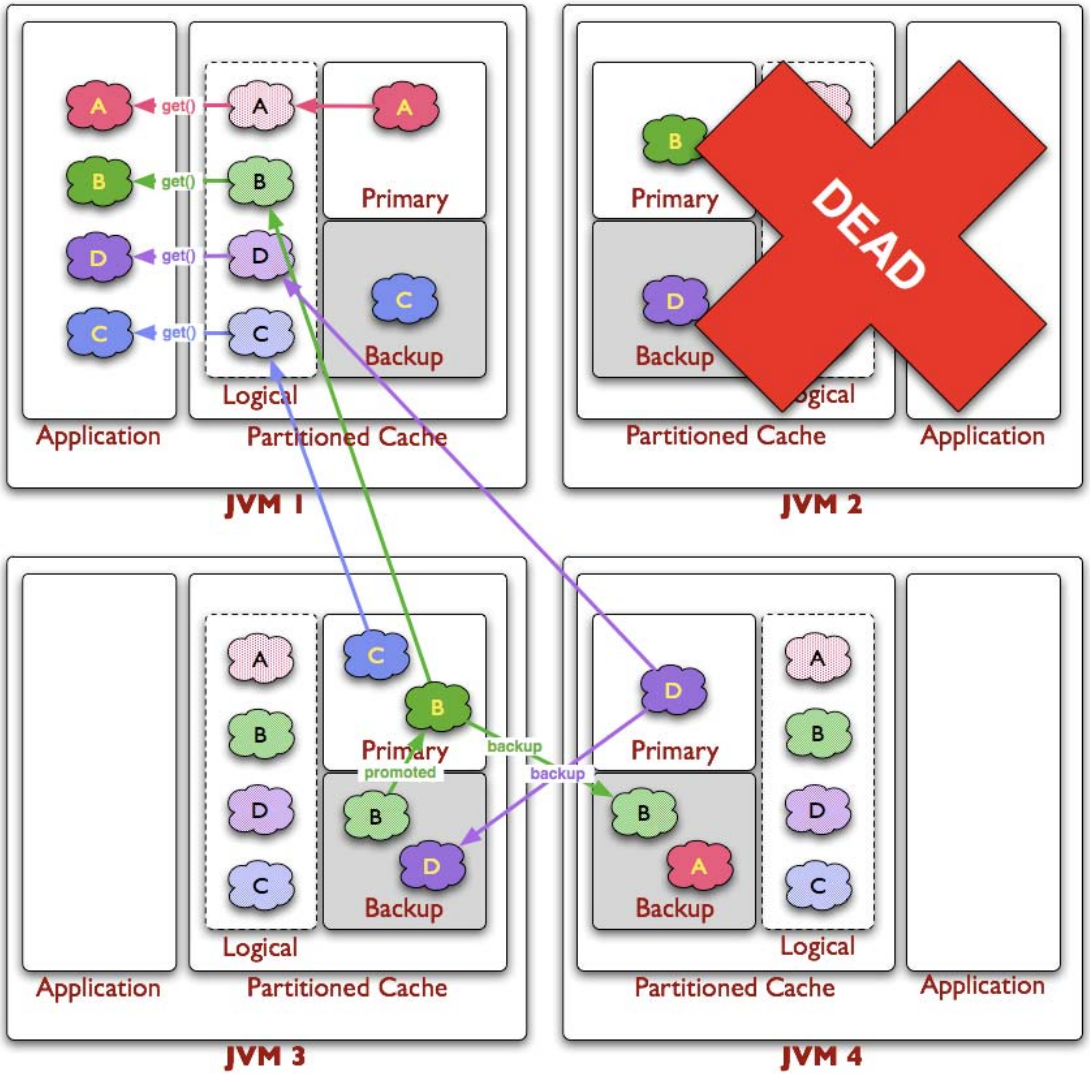
- Synchronous Update
- Avoids potential Data Loss & Corruption
- Predictable Performance
- Backup Partitions are partitioned away from Primaries for resilience
- No engineering requirement to setup Primaries or Backups
- Automatically and Dynamically Managed



Partitioned Topology : Recovery

Partitioned Topology

- **Membership changes (new members added or members leaving)**
- **Other members, in parallel, recover / repartition**
- **No in-flight operations lost**
- **Some latencies (due to higher priority of recovery)**
- **Reliability, Availability, Scalability, Performance are the priority**
- **Degrade performance of some requests**



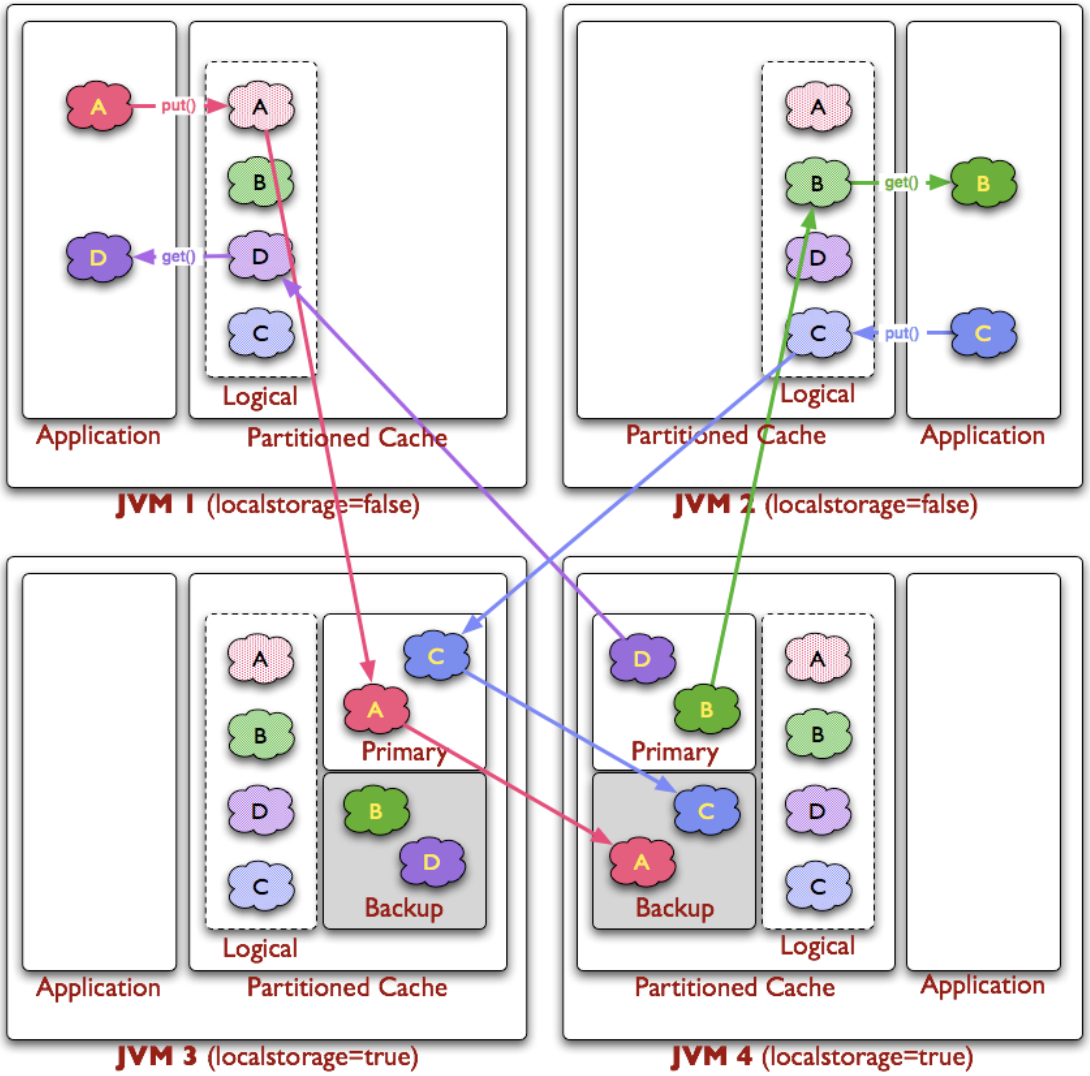
Partitioned Topology

- Deterministic latencies for data access and update
- Linearly scalable by design
  - Including Capacity
- All operations point-to-point (without multi-cast)
- No TCP/IP connections to create / maintain
- No loss of in-flight operations while repartitioning
- No requirement to shutdown cluster to
  - recover from member failure
  - add new members
  - add named caches
- No network exceptions to catch during repartitioning
- Dynamic repartitioning means scale-out on demand

Partitioned Topology : Local Storage

Partitioned Topology

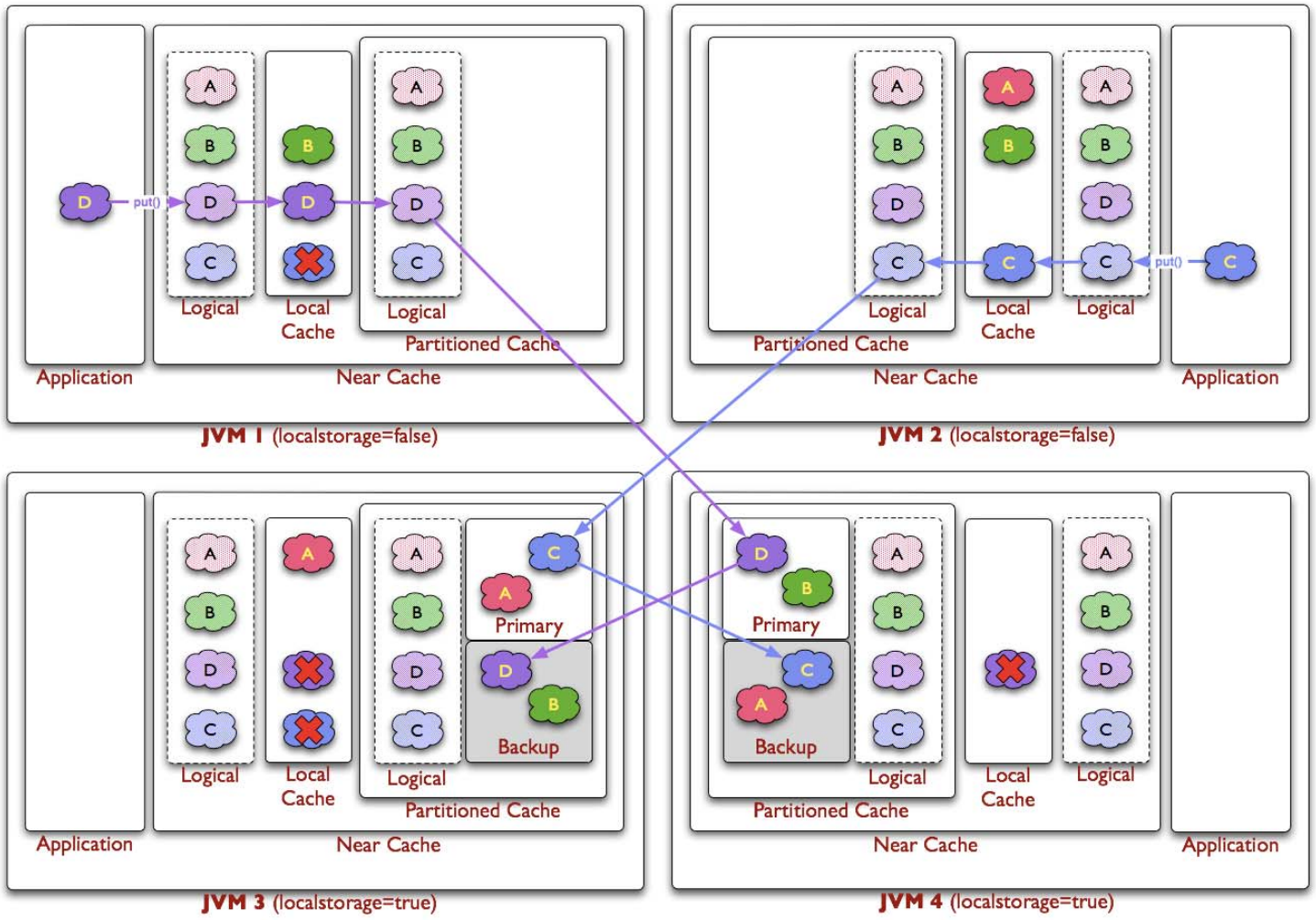
- Some members are temporary in a cluster
- They should not cause repartitioning
- Repartitioning means work for the other members (and network traffic)
- So turn off storage!



Topology Composition : Near Topology

- Oracle Coherence allows Topologies to the Composed
- Base Topologies
  - Local, Replicated, Partitioned / Distributed, Extend
- Composition Topologies
  - Near, Overflow…
- Near Topology
  - Compose a Front and a Back Topology
  - Permit L1 and L2 caching
  - Both Front and Back may be completely different
  - Both may have different Expiry Policies
- Expiry Policies
  - LRU, LFU, Hybrid, Seppuku, Custom…

Topology Composition : Near Topology



Where to use

Oracle Coherence?

Features : Traditional

- Implements Map interface
  - Drop in replacement. Full concurrency control. Multi-threaded. Scalable and resilient!

    `get, put, putAll, size, clear, lock, unlock…`

- Implements JCache interface
  - Extensive support for a multitude of expiration policies, including none!

- More than “just a Cache”. More than “just a Map”

Features : Observable Interface

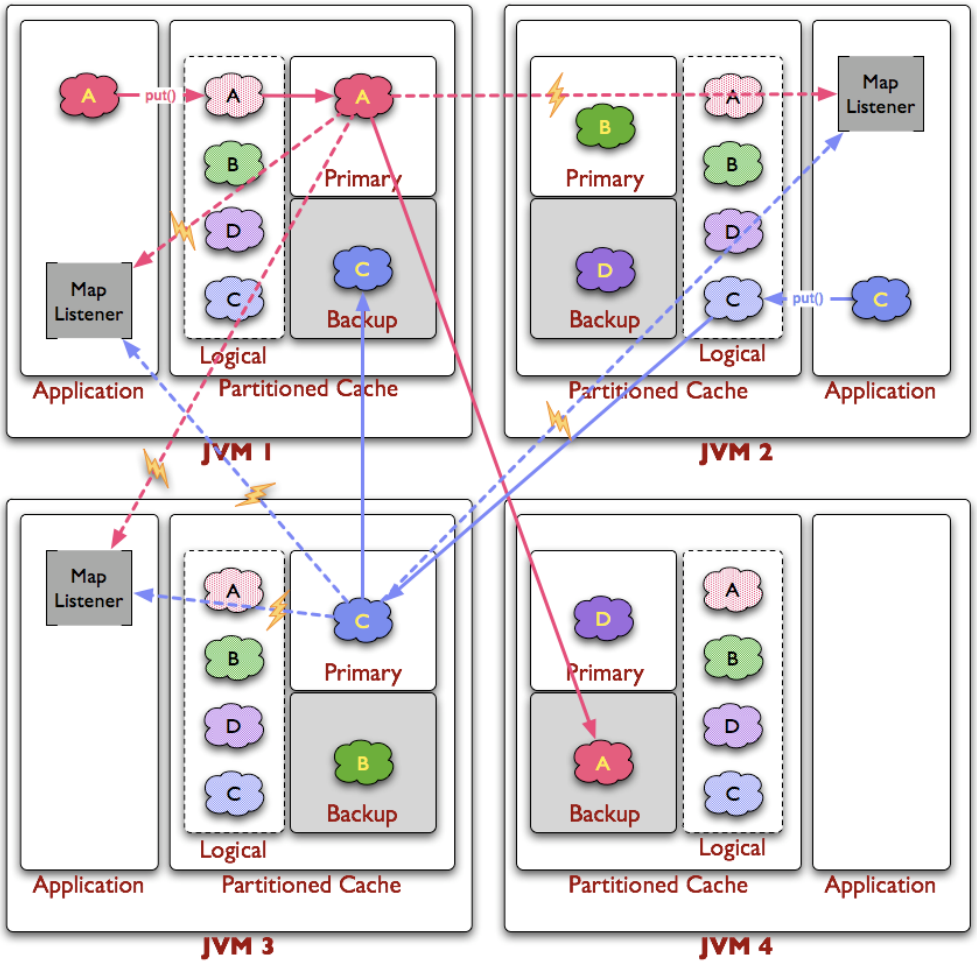
- Real-time filterable (bean) events for entry insert, update, delete
- Filters applied in parallel (in the Grid)
- Filters completely extensible
- A large range of filters out-of-the-box:

```
All, Always, And, Any, Array, Between, Class,
Comparison, ContainsAll, ContainsAny,
Contains, Equals, GreaterEquals, Greater, In,
InKeySet, IsNotNull, IsNull, LessEquals,
Less, Like, Limit, Never, NotEquals, Not, Or,
Present, Xor…
```

- Events may be synchronous*

```
trades.addMapListener(
  new StockEventFilter("ORCL"),
  new MyMapListener(…));
```

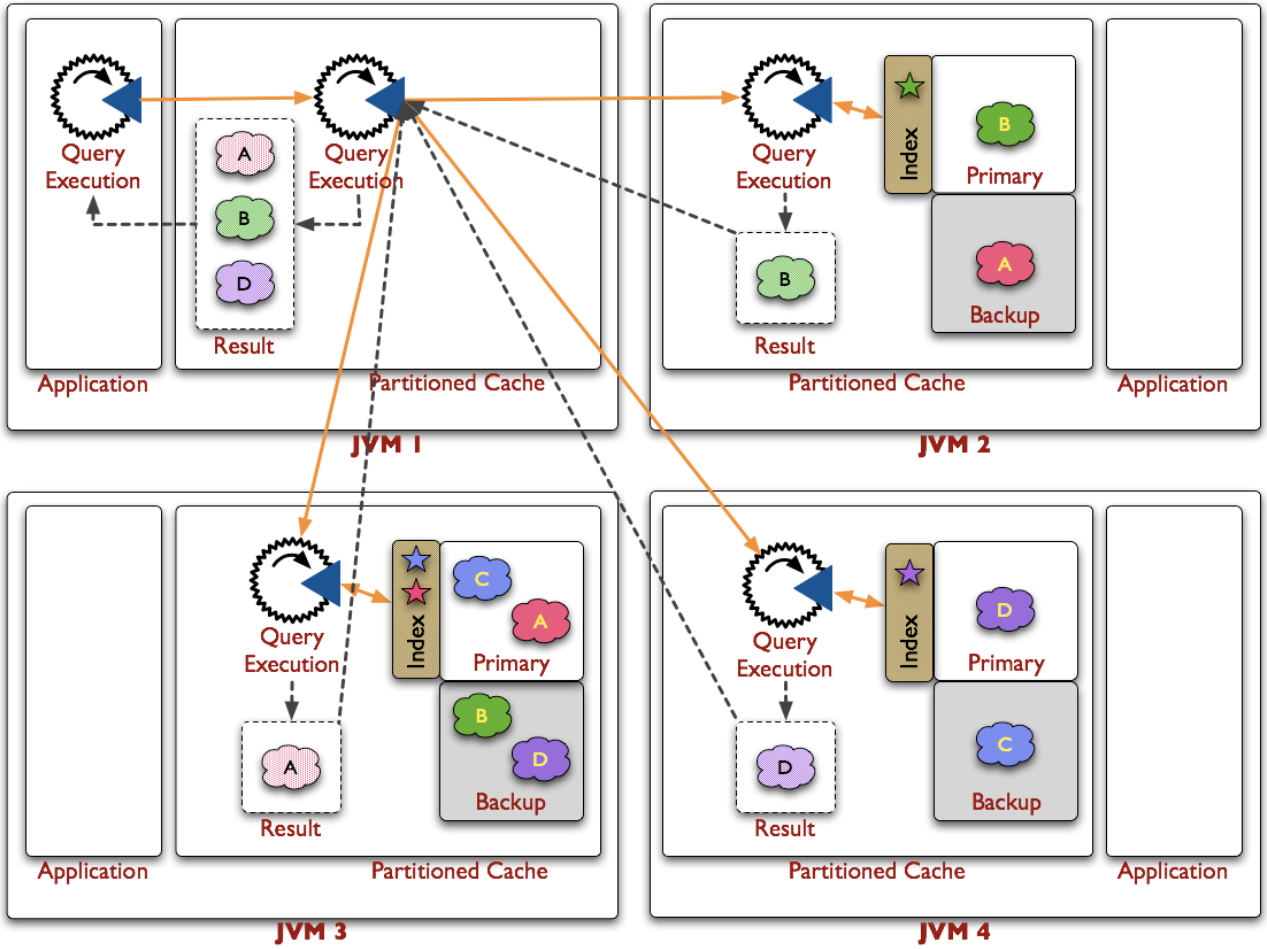
Features : Observable Interface



Features : QueryMap Interface

- Find Keys or Values that satisfy a Filter.
  `entrySet(…), keySet(…)`
- Define indexes (on-the-fly) to extract and index any part of an Entry
- Executed in Parallel
- Create Continuous View of entries based on a Filter with real-time events dispatch
  - Perfect for client applications “watching” data

Features : QueryMap Interface



Features : InvocableMap Interface

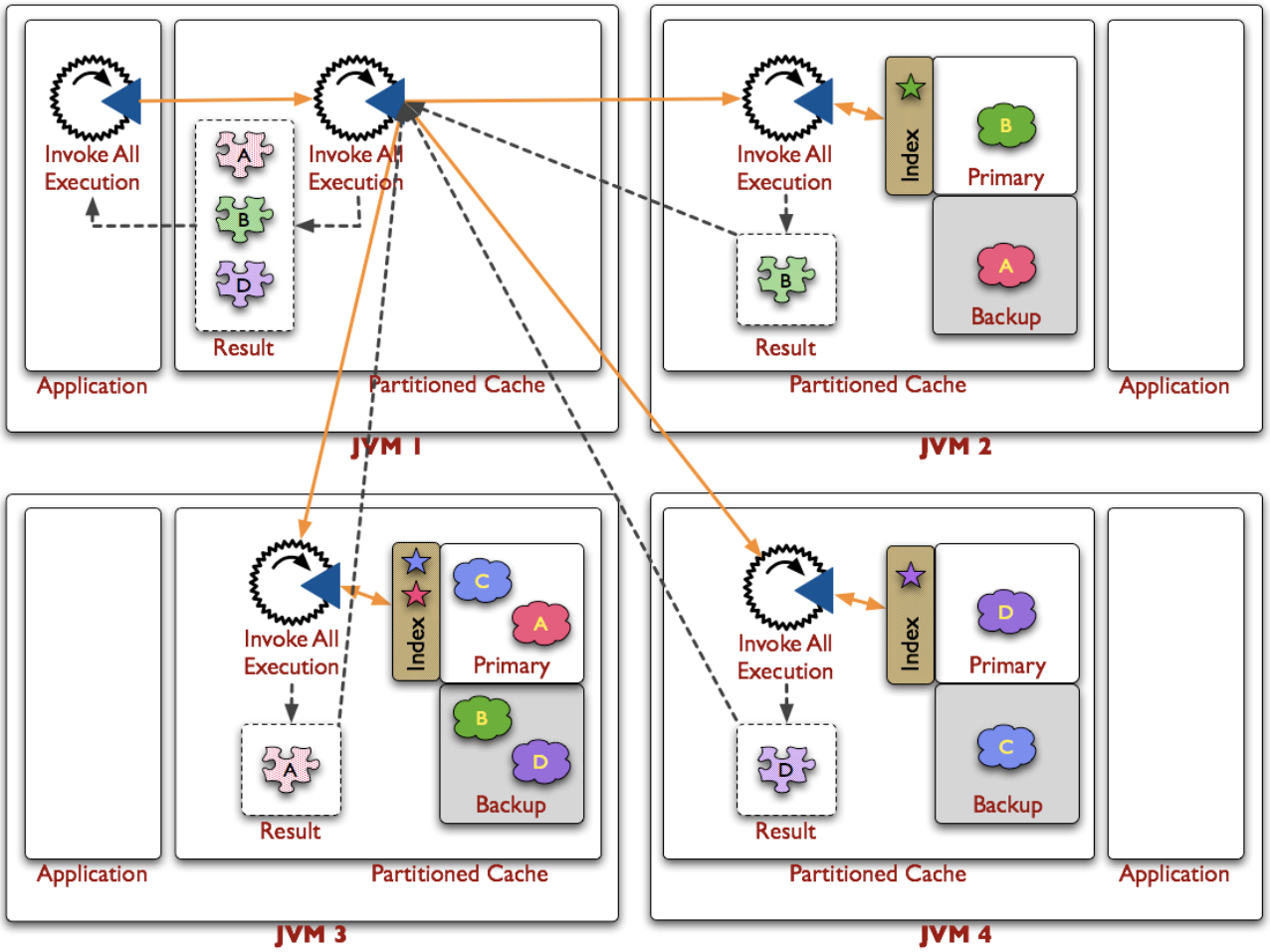
- Execute processors against an Entry, a Collection or a Filter
- Executions occur in parallel (aka: Grid-style)
- No “workers” to manage!
- Processors may return any value

```
trades.invoke(
    new EqualsFilter(“getSecurity”,“ORCL”),
    new StockSplit(2.0));
```

- Aggregate Entries based on a Filter

```
positions.aggregate(
    new EqualsFilter(“getSecurity”,“ORCL”),
    new SumFilter(“amount”));
```

Features : InvocableMap Interface



Architectural Integration Possibilities!

Data Source Integration (customizable per cache)

Read Through: Read from CacheLoader when data not in grid

Write Through: Write to CacheStore when data inserted, updated, removed in grid

Write Behind: Asynchronous and coalesced updates to CacheStore when data inserted, updated, deleted in grid

Session Management

Oracle Coherence Web = drop-in replacement to reliably cluster and scale out session management (Java and .NET) across a grid

Architectural Integration Possibilities!

Direct Data Integration:

- **Oracle Coherence Behind:** Use Oracle Coherence as L2 cache for OR/M (Hibernate)
- **Oracle Coherence To-The-Side:** Application manages Data CRUD in Oracle Coherence next to OR/M
- **Oracle Coherence On-Top:** Oracle Coherence is System of Record. Use CacheLoaders and CacheStores to integrate with Data Sources

Service Integration:

- **Oracle Coherence WorkManager:** Use Oracle Coherence to resiliently manage and execute “tasks” across the members.
- **Invocation Service:** Directly use Oracle Coherence Invocation Service to execute tasks on individual, sets or all members (sync or async)

Architectural Integration Possibilities!

Spring Integration:

Data Grid For Spring:

Data Grid Spring Beans managed by Oracle Coherence. Beans become shared singletons and offer both Data and Services to Spring Applications

Spring Applications naturally become clustered, including cluster events to determine cluster membership changes

Expose Oracle Coherence Caches as Beans in Spring Configuration

Architectural Integration Possibilities!

Provide:

Push / Pull data model based on subscription and event notification

Client / Data Grid model where clients connect to Oracle Coherence for data and services

Why Oracle Coherence?

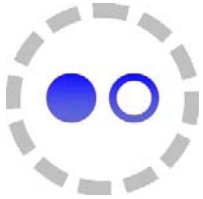
Why Oracle Coherence?

- Scale-out stateful applications
- “If you need business agility!”
- Save resources!
  - Avoid managing clusters
  - Avoid designing systems around specialized “cluster masters”
  - Avoid manually “coding in” data and service partitions
- If you want to share a collection of Data and Services
  - Oracle Coherence does more than just Caching!
  - Oracle Coherence manages clusters
  - Oracle Coherence can manage a Grid
  - Oracle Coherence can manage your data in a Grid
  - Oracle Coherence can provide your services within a Grid to clients
- If you want truly native language support! No wrappers or embedded third-party libraries

Why Oracle Coherence?

- If you want predictable scale-out costs, without re-coding or reconfiguring!
- If you want the most trusted and recognized best-of-breed clustering and Data Management platform inside your solutions.
- If you want a platform on which to reliably perform eXtreme Transaction processing

Why Oracle Coherence?



Caching

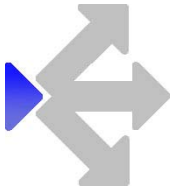
Applications request data from the Data Grid rather than backend data sources

Analytics

Applications ask the Data Grid questions from simple queries to advanced scenario modeling

Transactions

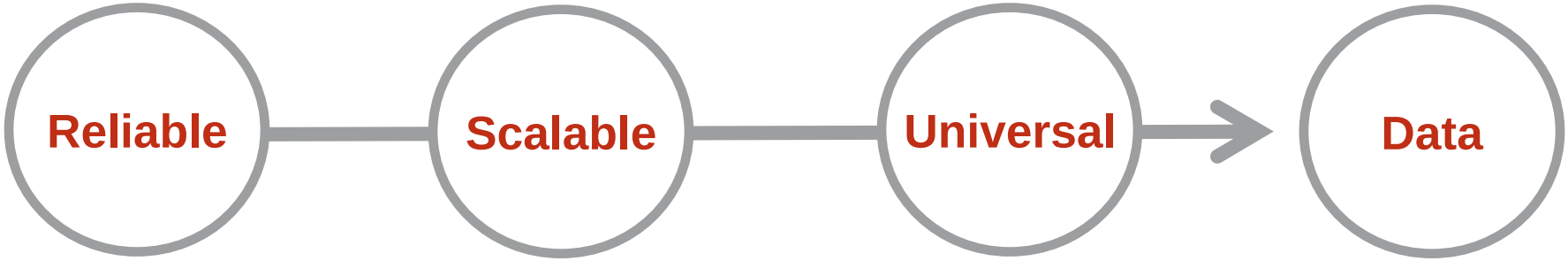
Data Grid acts as a transactional System of Record, hosting data and business logic



Events

Automated processing based on event

Why Oracle Coherence?



- Built for continuous operation
- Data Fault Tolerance
- Self-Diagnosis and Healing
- “Once and Only Once” Processing

- Dynamically Expandable
- No data loss at any volume
- No interruption of service
- Leverage Commodity Hardware
- Cost Effective

- Single view of data
- Single management view
- Simple programming model
- Any Application
- Any Data Source

- Data Caching
- Analytics
- Transaction Processing
- Event Processing

For More Information

http://search.oracle.com

or

http://www.oracle.com/products/middleware/coherence/index.html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