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TS-5154: XTP: Patterns for Scaling SOA, WOA, and REST Predictably with a Java™ Technology-Based Data Grid

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Oracle

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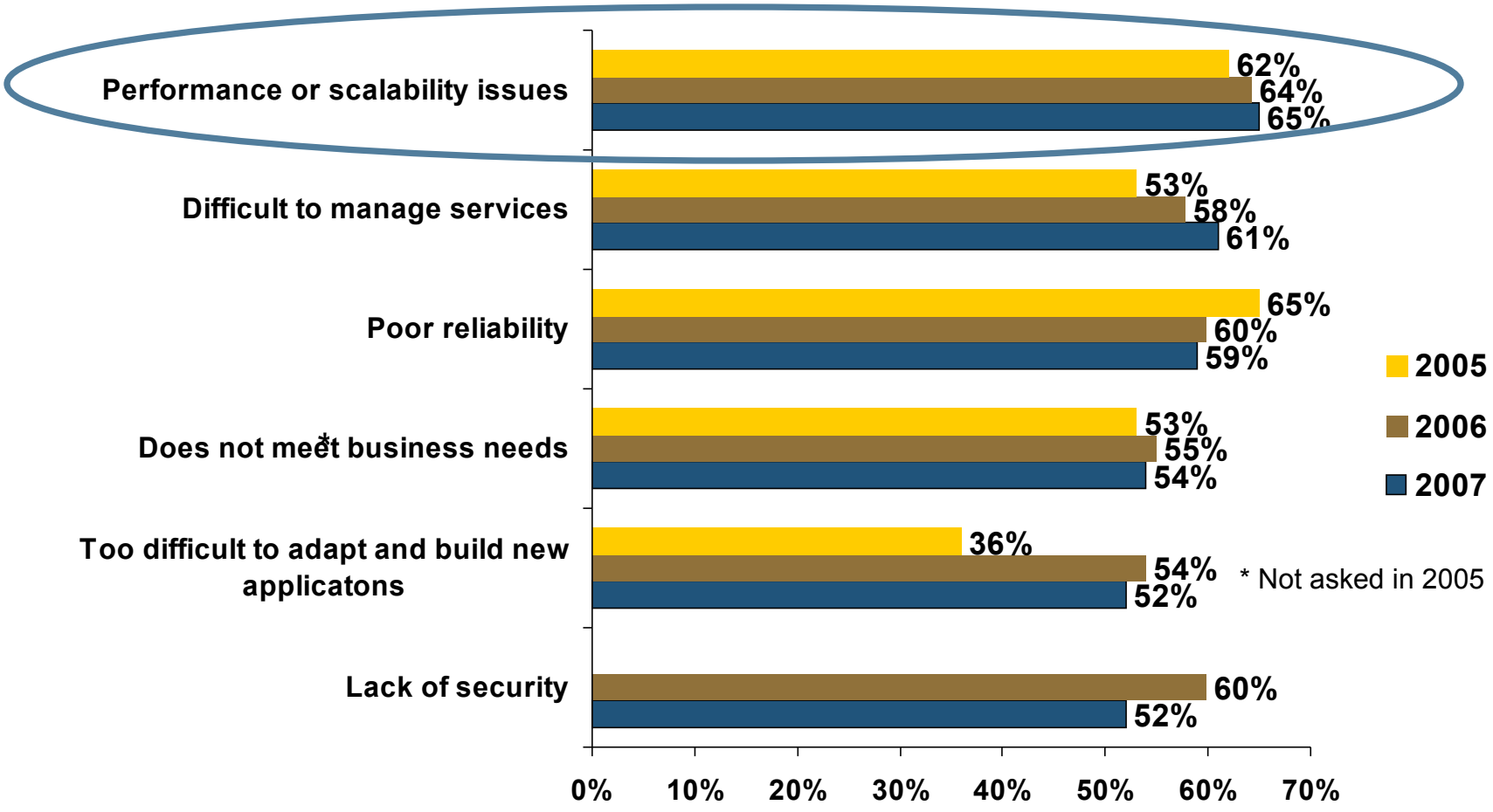
Agenda

- SOA and REST on Application Grid
- Intro to REST
- XTP and Application Grid
- Challenges to Scalability
- Use Cases and Patterns:
  - Shared Web Container State
  - Service-Result-Cache
  - Service State Cache
  - Not Your MOM's Bus
  - XML Grid

"*If you want a 3 second response time, you get 1 sec in the presentation layer, 1 sec in the middle tier, and 1 sec in the backend. Period*!"*

*commenting on the need for middle tier caching and in-memory state management

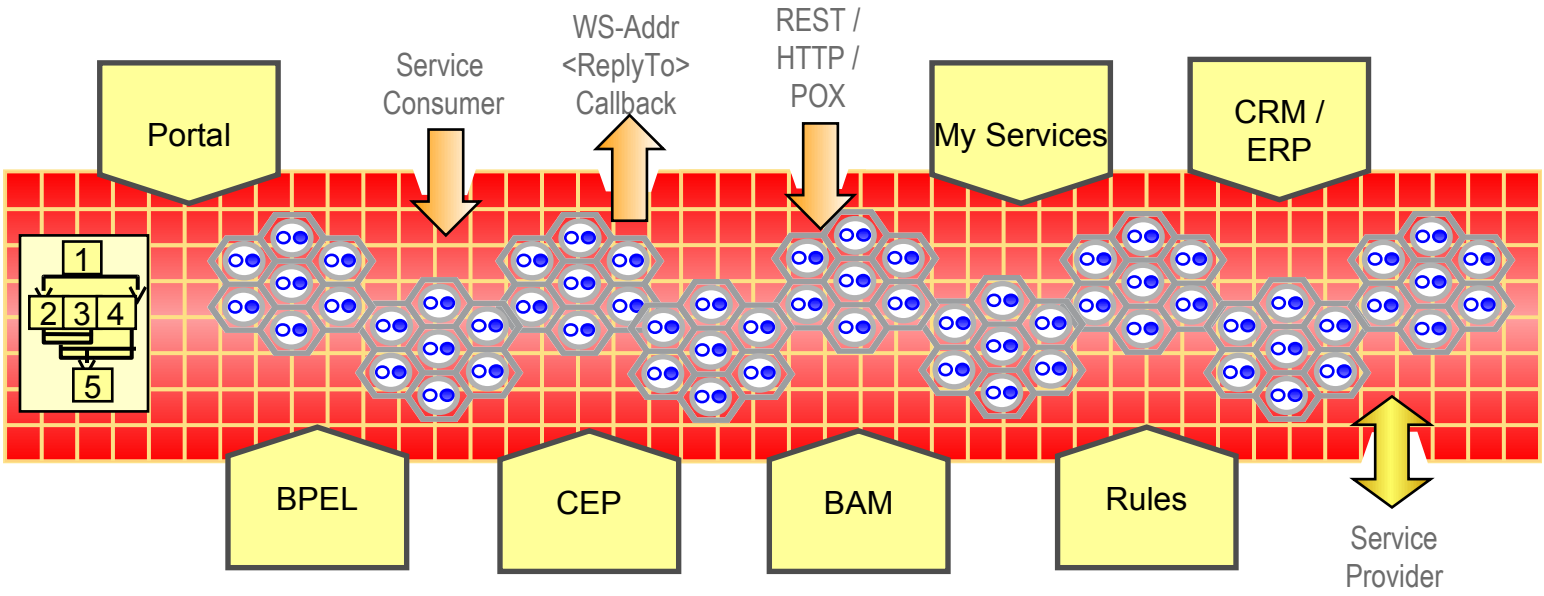
Concerns linger about lack of performance, scalability



Q: What would constitute SOA failure? 2007 Base: 549 / 2006 Base: 473 / 2005 Base: 167 (Among current deployers)

Next Generation SOA and REST on App Grid

Combines Orchestration, Mediation, Service State Caching, EDA,Service Result Caching, Compute Grid, Deterministic GC



State-aware continuous availability for service infrastructure, services, application data, and processing logic

=Service state data

=Stateful Service Orchestration

What is REST

Introducing REST

- **Nouns:** All resources, or nouns, are network-addressable with a global URL. Resources have "href" references to other related resources. The only way to address a resource is with a URL.

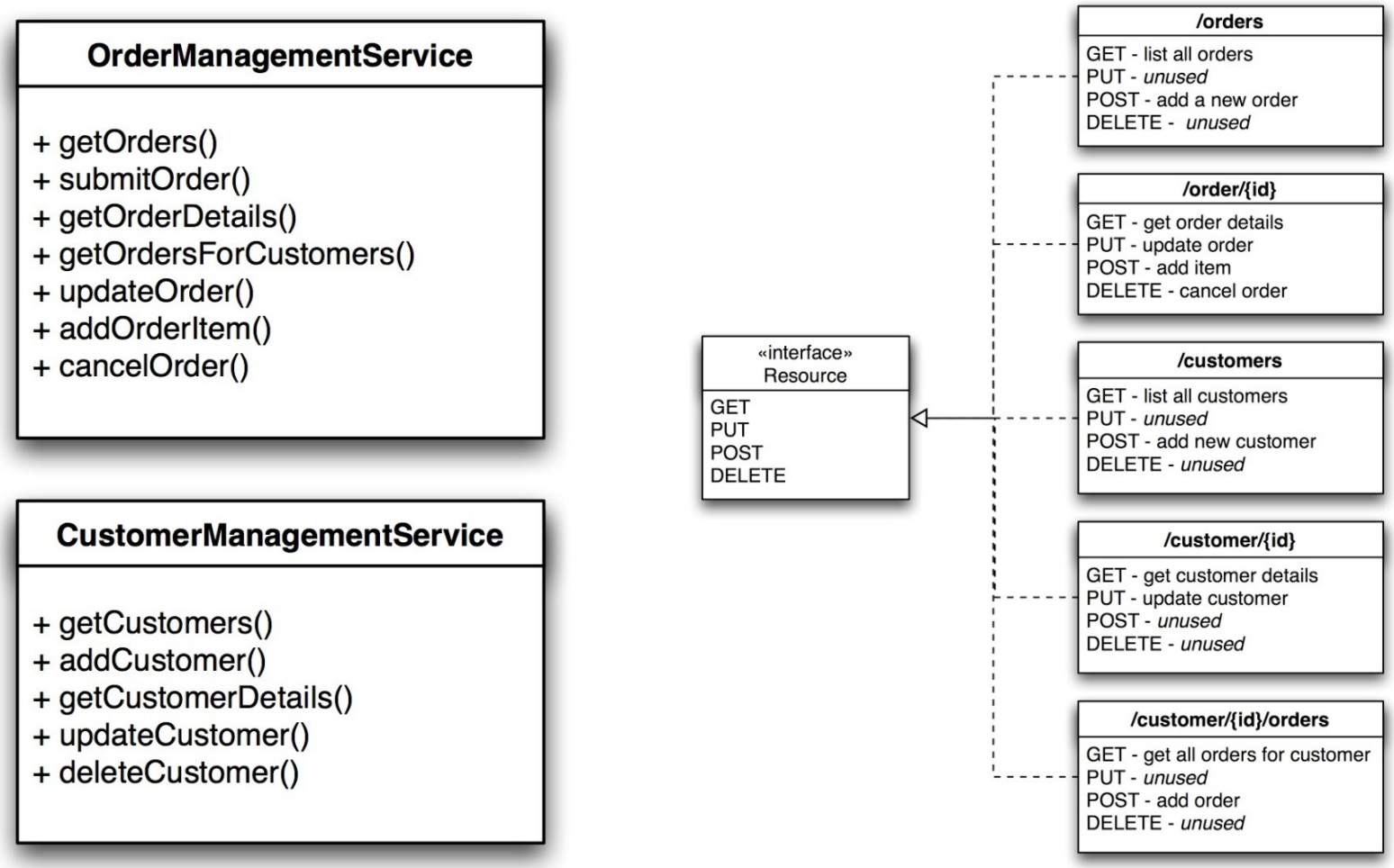
- **Verbs:** A common set of verbs are used to access all resources. The HTTP methods GET, PUT, POST, and DELETE map to retrieve, update, create, and delete (CRUD) functions.

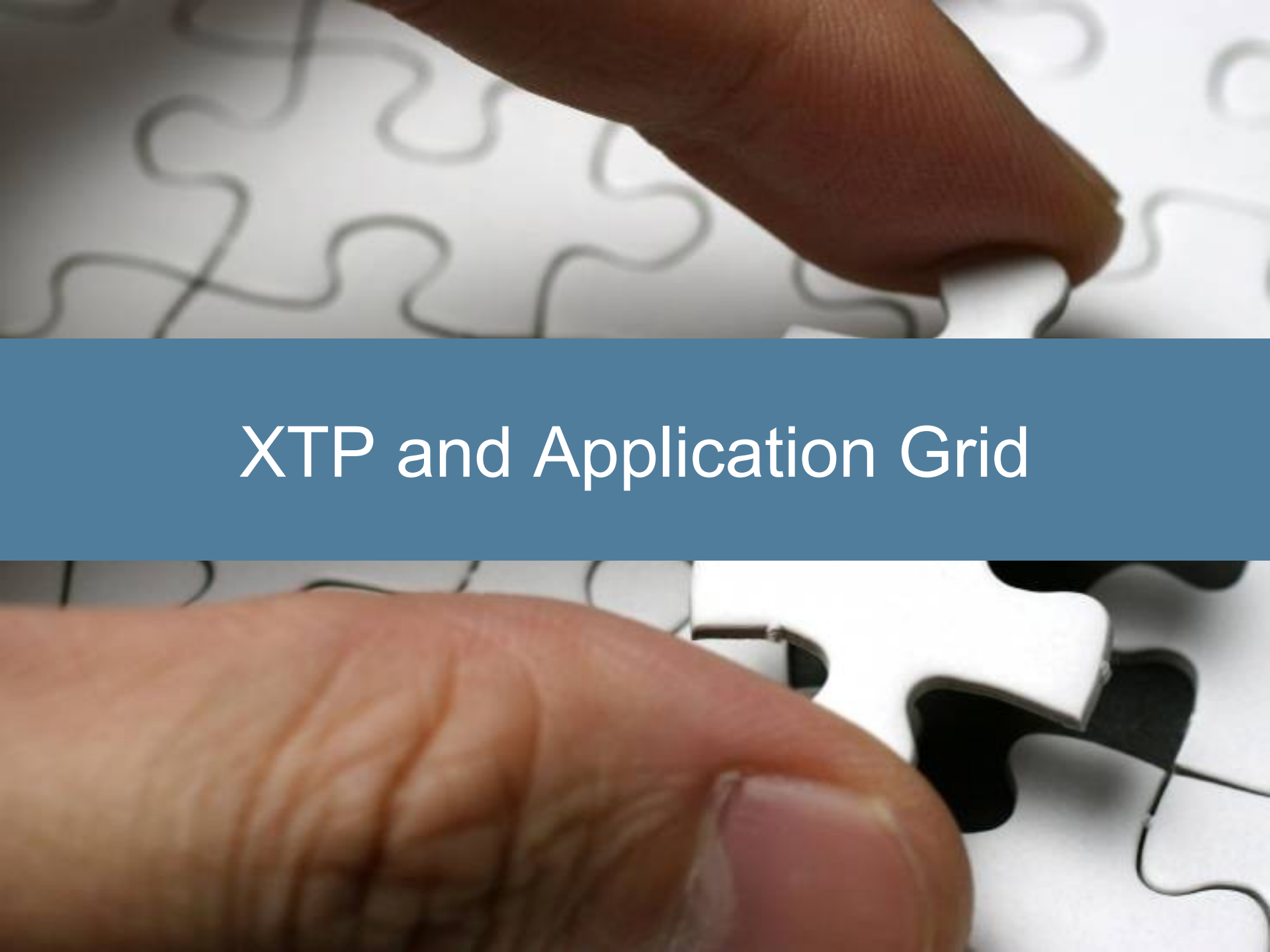
- **Representations:** A resource might be represented as XML, JSON, HTML, text, image, and so on. Instantiating representation from or to the resource is handled on the server. A client can pick its preferred representation via a URI parameter or the "Accept:" header.

REST Patterns 2/2

- Resources with multiple representations
  - GET /customers/1234 HTTP/1.1
    Host: example.com
    Accept: application/vnd.mycompany.customer+xml
  - GET /customers/1234 HTTP/1.1
    Host: example.com
    Accept: text/x-vcard
- Communicate statelessly
  - Cookies shouldn't be used to encode information that can be transferred by other, more standardized means

Processes and Resources





XTP and Application Grid

eXtreme Transaction Processing (XTP)

- Telco call setup and billing
- Online gaming
- Securities trading
- Risk management
- Online travel booking
- Traffic sensor data

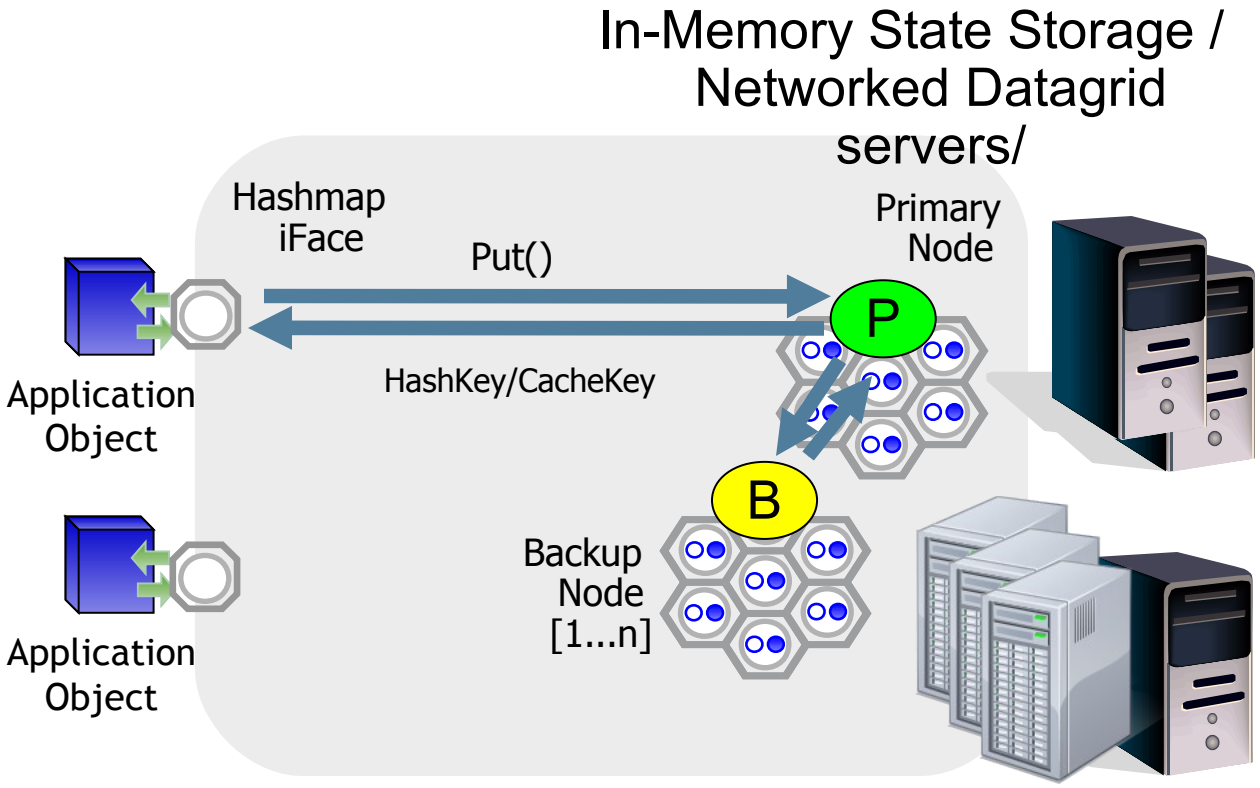
Rest of the World That Needs to Scale

- Portal apps that need to scale up to thousands of customers
- Backend systems never designed to handle load
- Peak processing times at certain times of year
  - Retail – holiday shopping
  - Health Insurance – Enrollment time
  - Product launch
  - Marketing programs

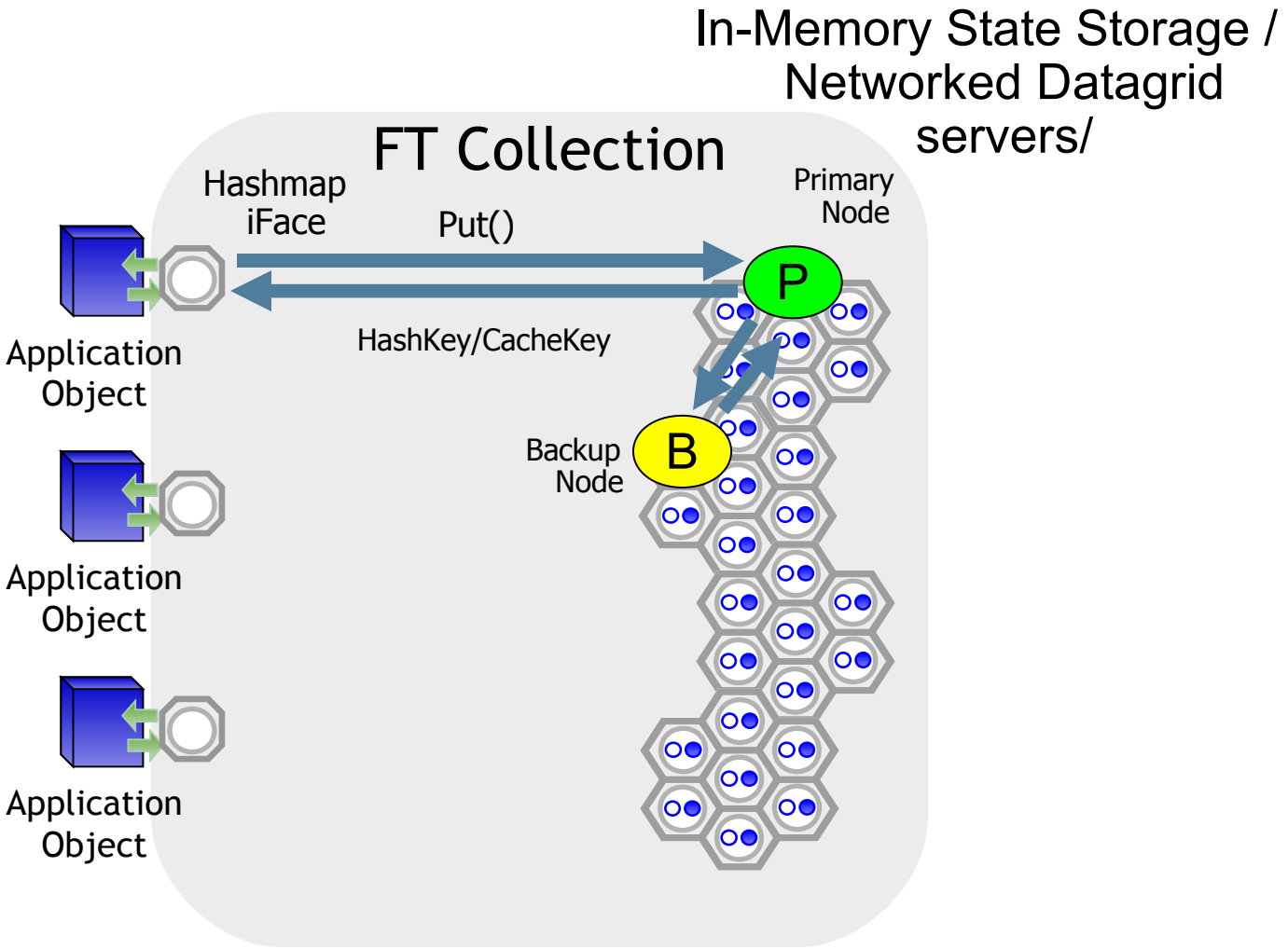
Application Grid

- Data Grid and Compute Grid
  - Linearly scalable shared memory and logic
  - Intelligent co-location and affinity between processing logic and Grid storage
  - Parallel Processing and Queries against in-memory native object data

Fault-Tolerant Collection - Primary/Backup Synchronization



Fault-Tolerant Collection - Primary/Backup Synchronization



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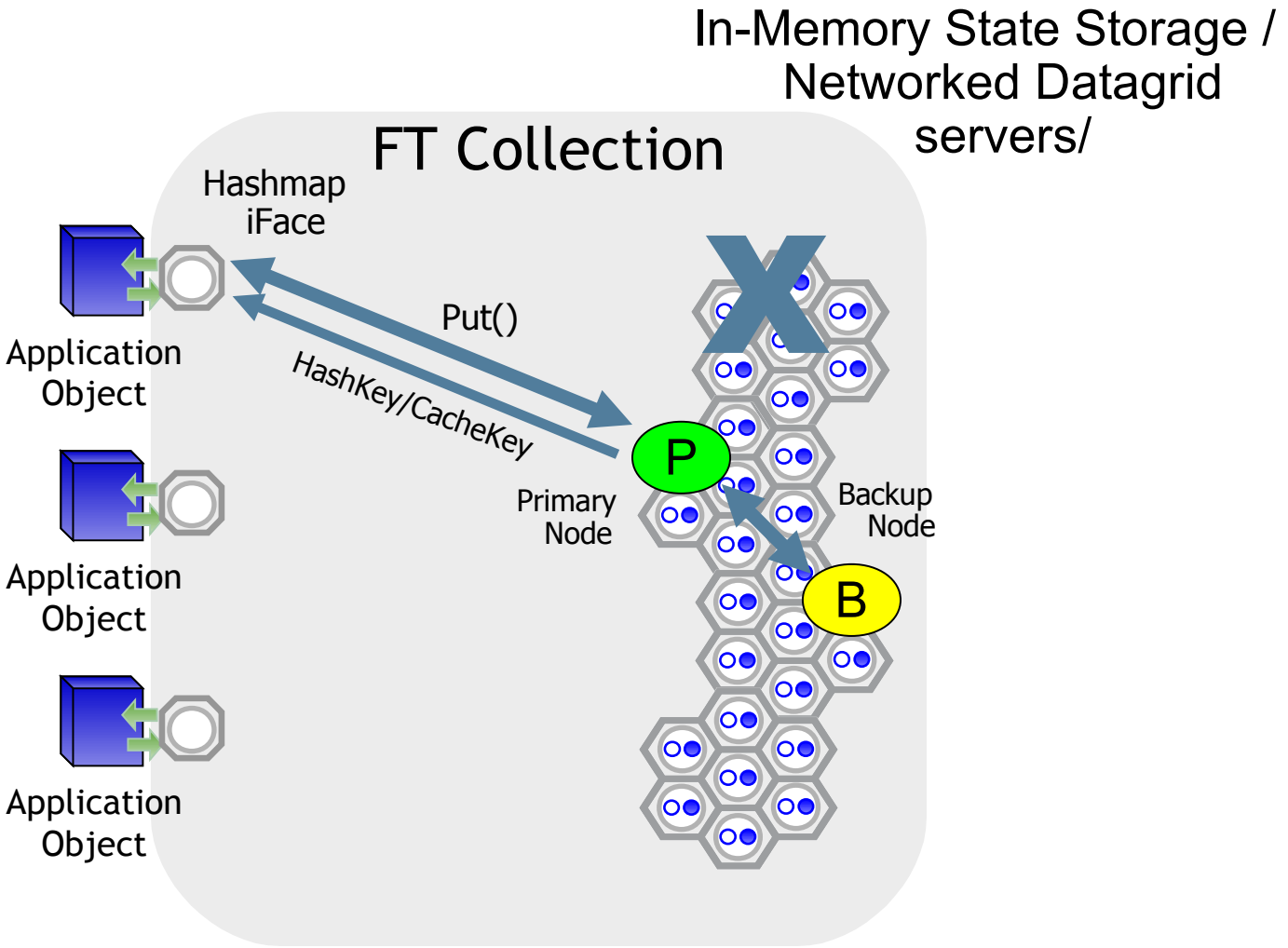
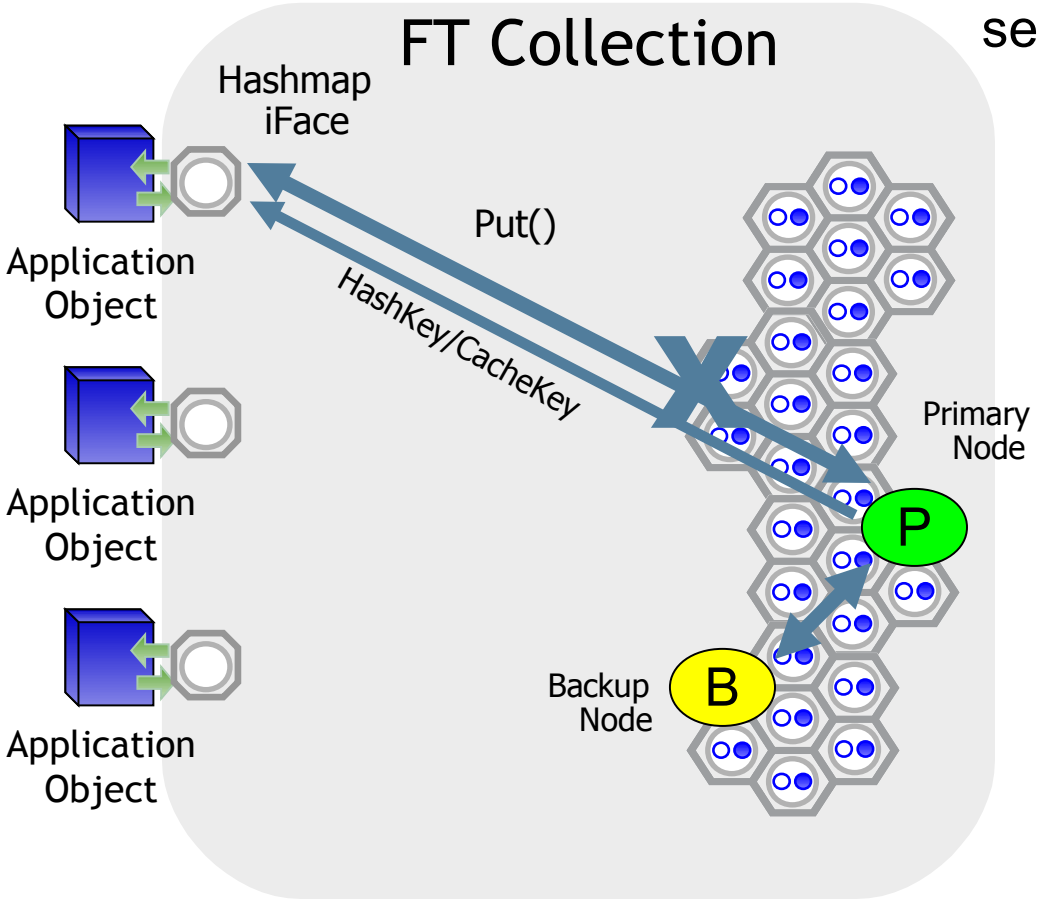


Fault-Tolerant Collection - Primary/Backup Synchronization

In-Memory State Storage / Networked Datagrid servers/



SOA and REST on App Grid Value Proposition

- Reduce cost of hitting back-end systems multiple times over the life of a session
- Improve response times for service requests and web apps while keeping load off backend systems
- Improved fault tolerance without sacrificing performance
- Ensuring predictable latency under increased sustained loads
- Achieving dramatic overall increase in performance and throughput
- Predictable scalability for **XTP**
  - Based on advanced software clustering techniques
  - Scales out linearly, whether 2 or 2,000 servers
  - Heterogeneous Environment
  - High-end / low-cost commodity hardware

Key Capabilities Highlighted in Case Studies and Patterns

- **Case Study: Shared Web Session State Across Multiple Portal Environments**
- **Seamless State Management for Stateful Services**
  - Without the need to enforce “state passing” design patterns across the organization
  - Reduced/Eliminate dependency on disk persistence and State Repositories
  - Without sacrificing HA
- **Pattern: SOA Caching in the Application Grid**
  - Hold data reliably in-memory
  - DB interaction Patterns: sync write thru, asynch write behind, multi-level cached read
- **Pattern: Inline Service State Cache**
  - Sharing state data in-memory across service boundaries
- **Case Study and Pattern: Service-Result-Cache**
  - To offload loads on backend services and SOA Infrastructure use side cache to cache results of service calls, c.f. Web cache
  - Without sacrificing consistency and programmability
- **Case Study: Multi-Dimensional graphs of data in the Grid**
  - Eliminate Bulky Nested XML
- **Pattern: XML Grid –**
  - Efficiently Handle / Process XML Payloads within SOAs
  - Increasing throughput and decreasing latency
- **Pattern: Not Your MOM’s Bus**
  - Reliable and sharable state caching ensures QoS without pushing large JMS, SOAP, or REST messages across the bus

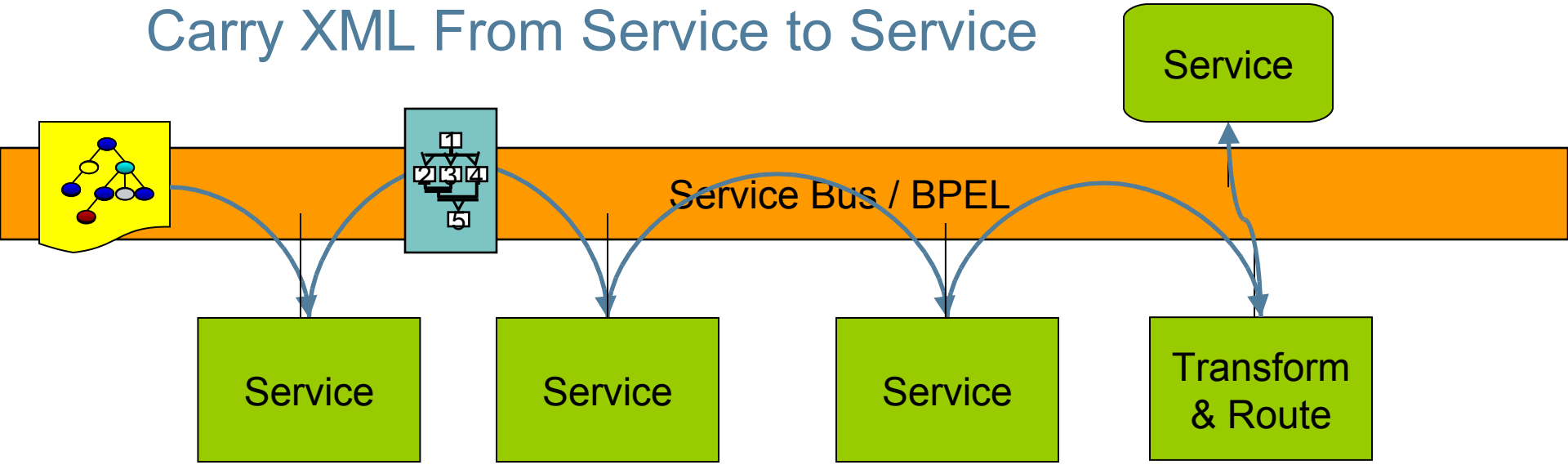
Challenges for Scalability

Challenges for SOA Scalability

- Performance tuning of Monolithic Applications is a relatively known science
- Performance throughput testing of individual services can also be done in isolation
- Breaking up monolithic applications into loosely coupled service level components and putting them together in new ways to form composite apps introduces new challenges.
  - Boundary costs
  - Sharing data reliably

Traditional SOA Data Payload Model

Carry XML From Service to Service



Traditional SOA Data Payload Model

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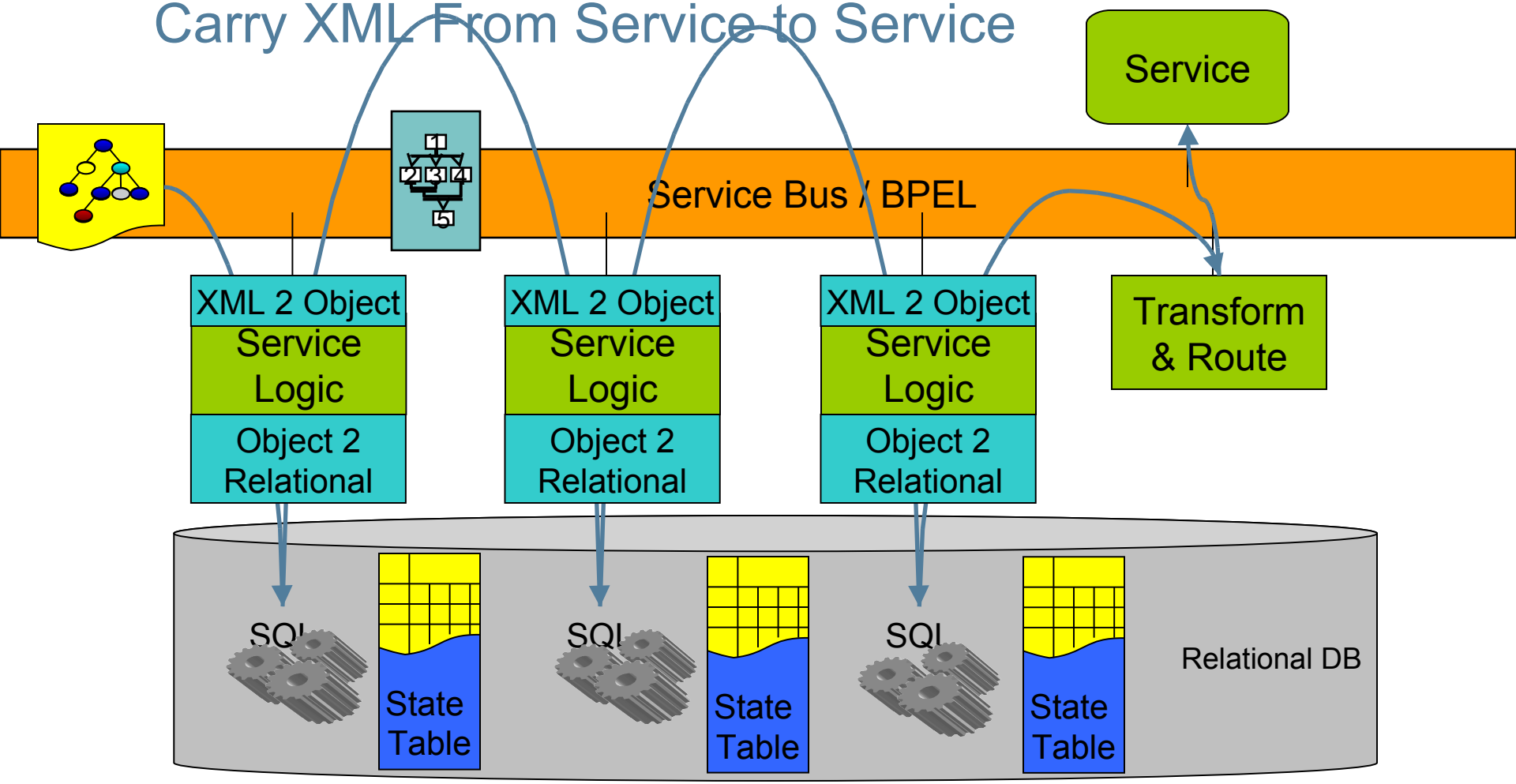
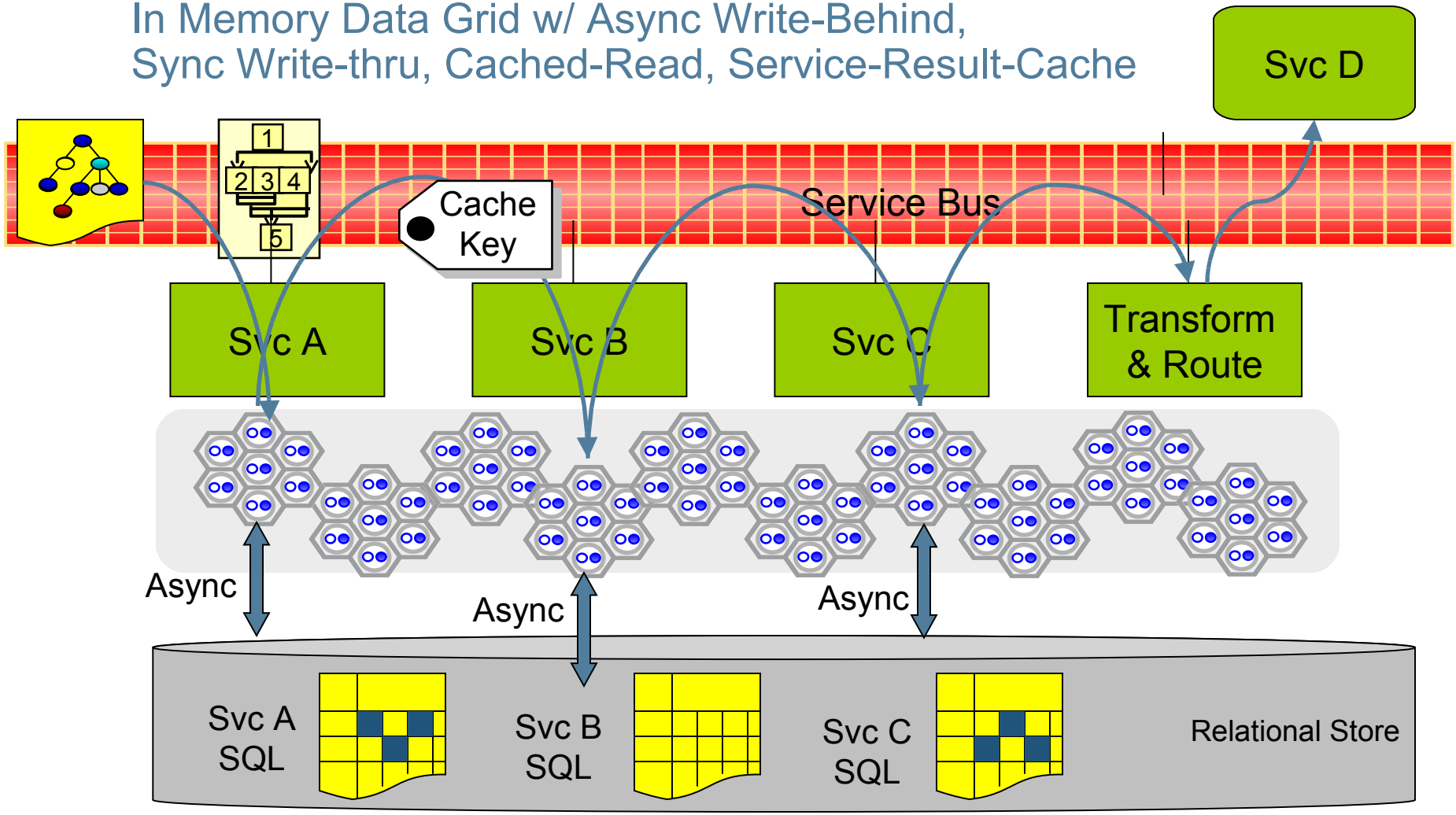


What does the scalable architecture need to ensure

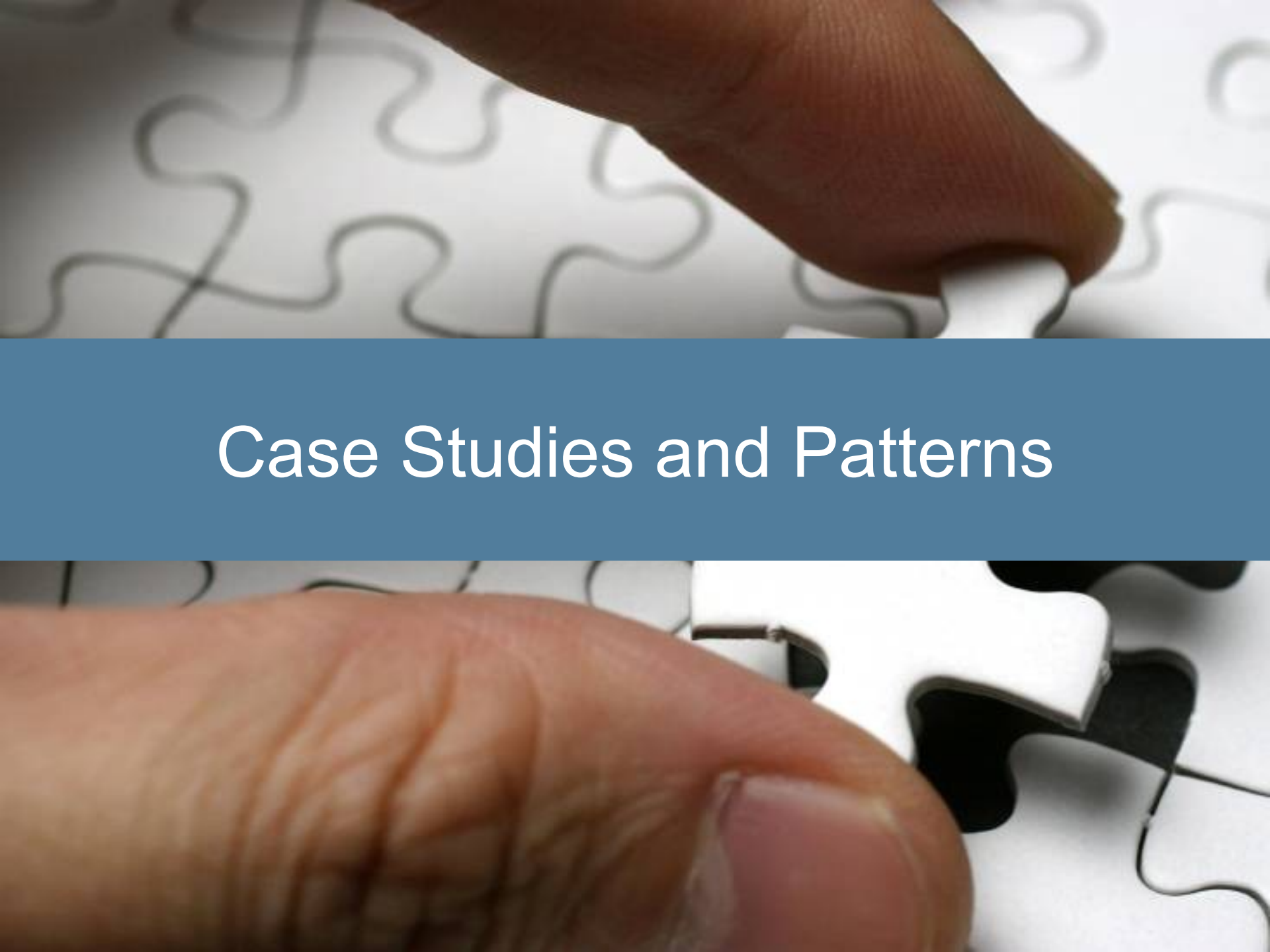
- Avoid processing where possible
- Avoid I/O where possible
- Avoid serialization and de-serialization
- Avoid sending large documents over network
- Avoid distributed file schemes as your app scales up
- Avoid driving increasing traffic to backend systems
- Architect for performance from the beginning aka *not* throwing hardware at the problem!

SOA Caching Using a Datagrid

In Memory Data Grid w/ Async Write-Behind, Sync Write-thru, Cached-Read, Service-Result-Cache



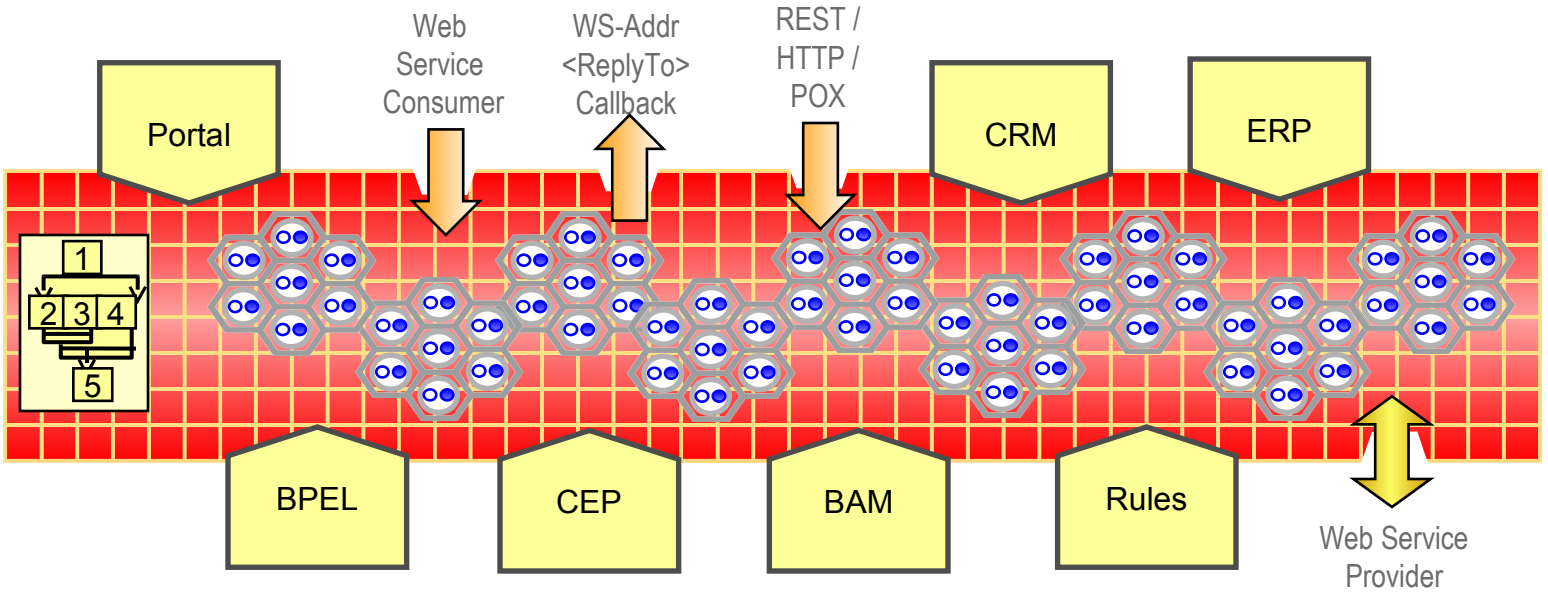
Cache Key = "Claim check" carrying the key to data cached in the grid



Case Studies and Patterns

Case Study: Not Your MOM's Bus

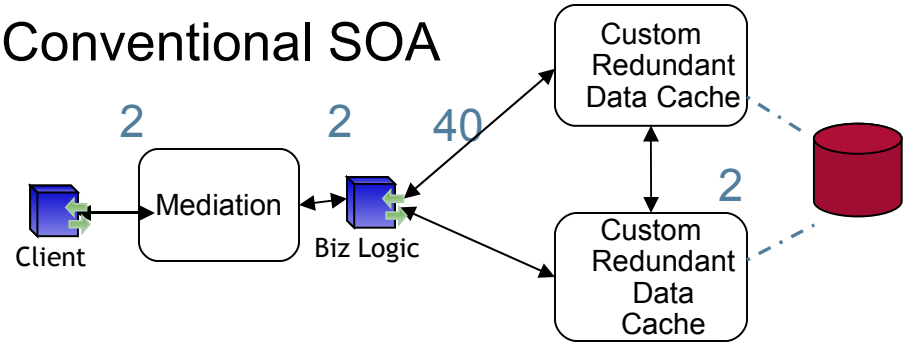
Why send it when its already there?

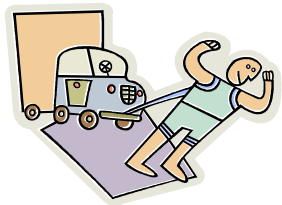


Reliable and sharable state caching ensures QoS without pushing large JMS or SOAP messages across the bus

Case Study: Not Your MOM's Bus

Conventional SOA

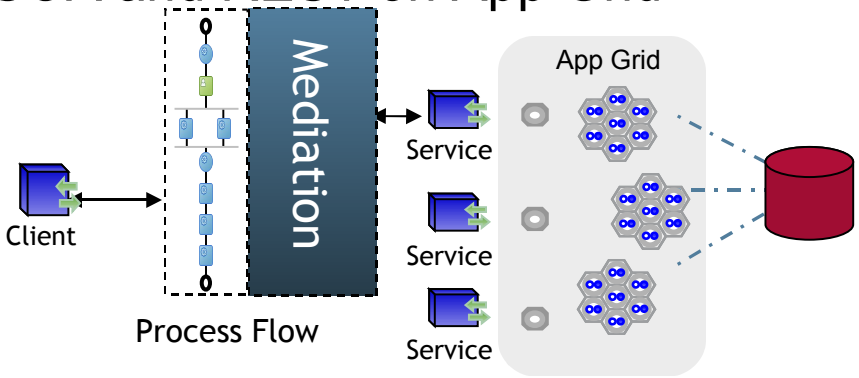


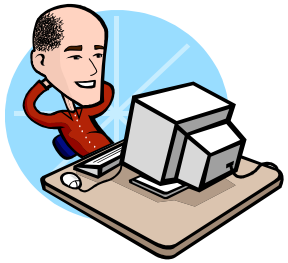


46 network hops/data serialization steps

46 Boundary Crossings

SOA and REST on App Grid



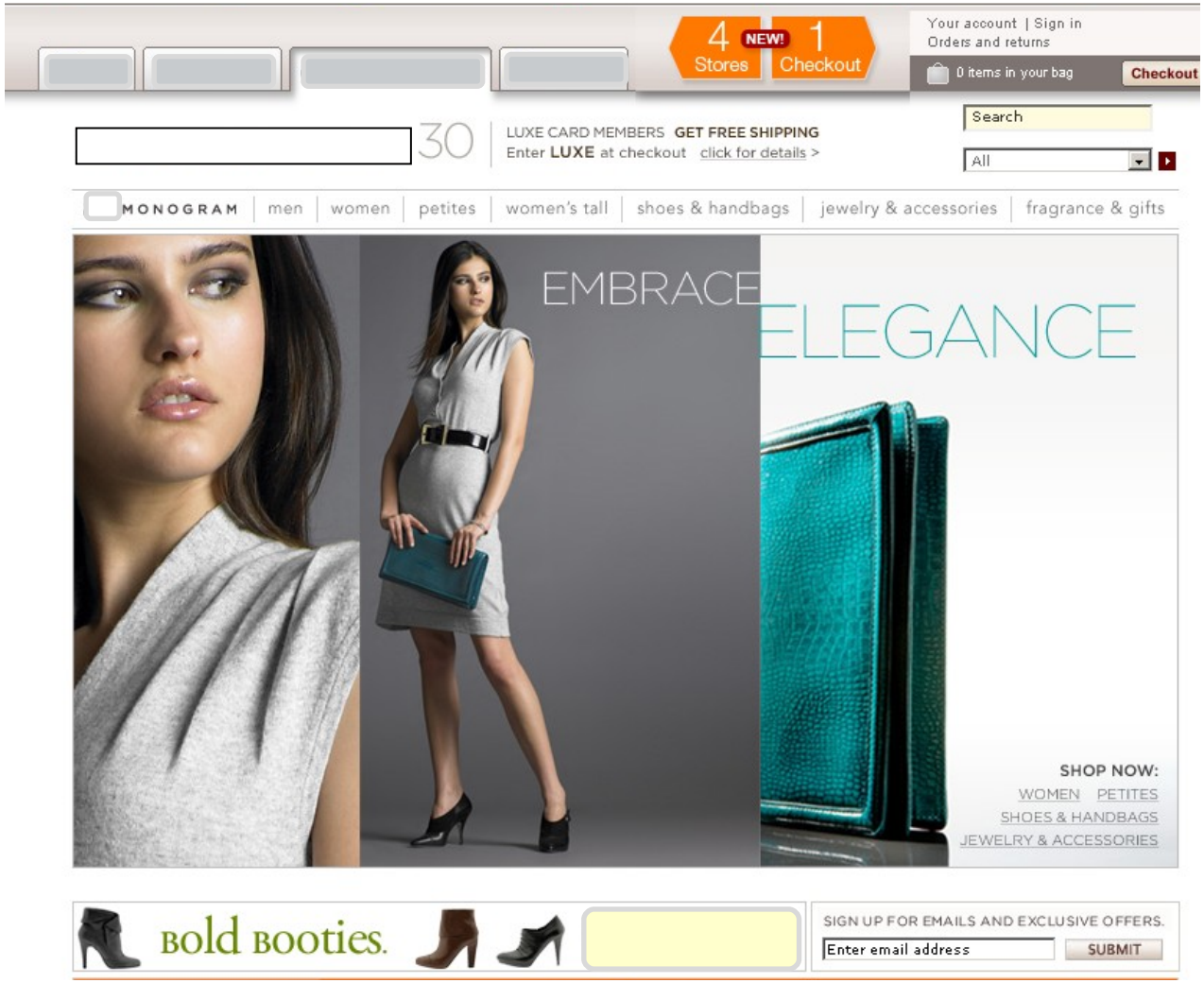


5 - 7 network hops/data serialization steps

Horizontally scalable

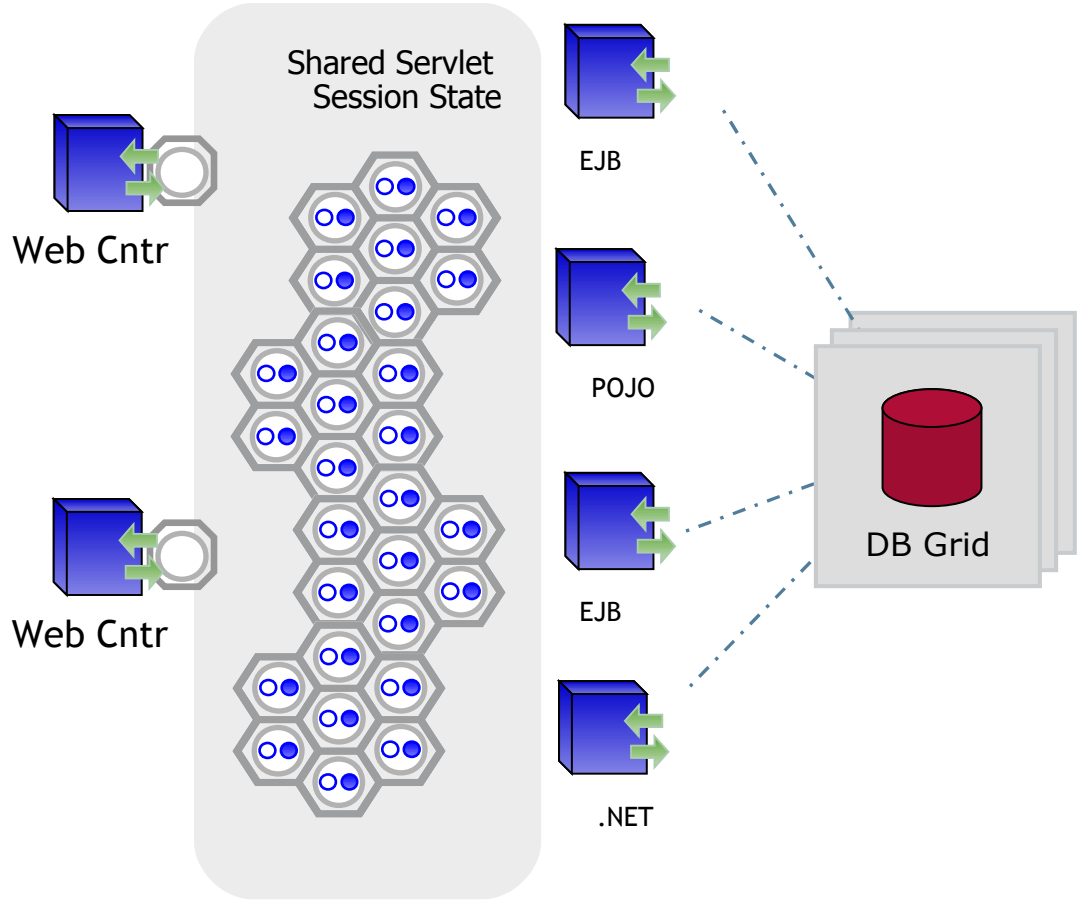
5-7

Case Study: Multiple Store Fronts - Sister Tabs



*OOW2008 S299392 - Beyond Performance: Pushing Transaction…

Pattern: State Management using App Grid: Shared Web Session State



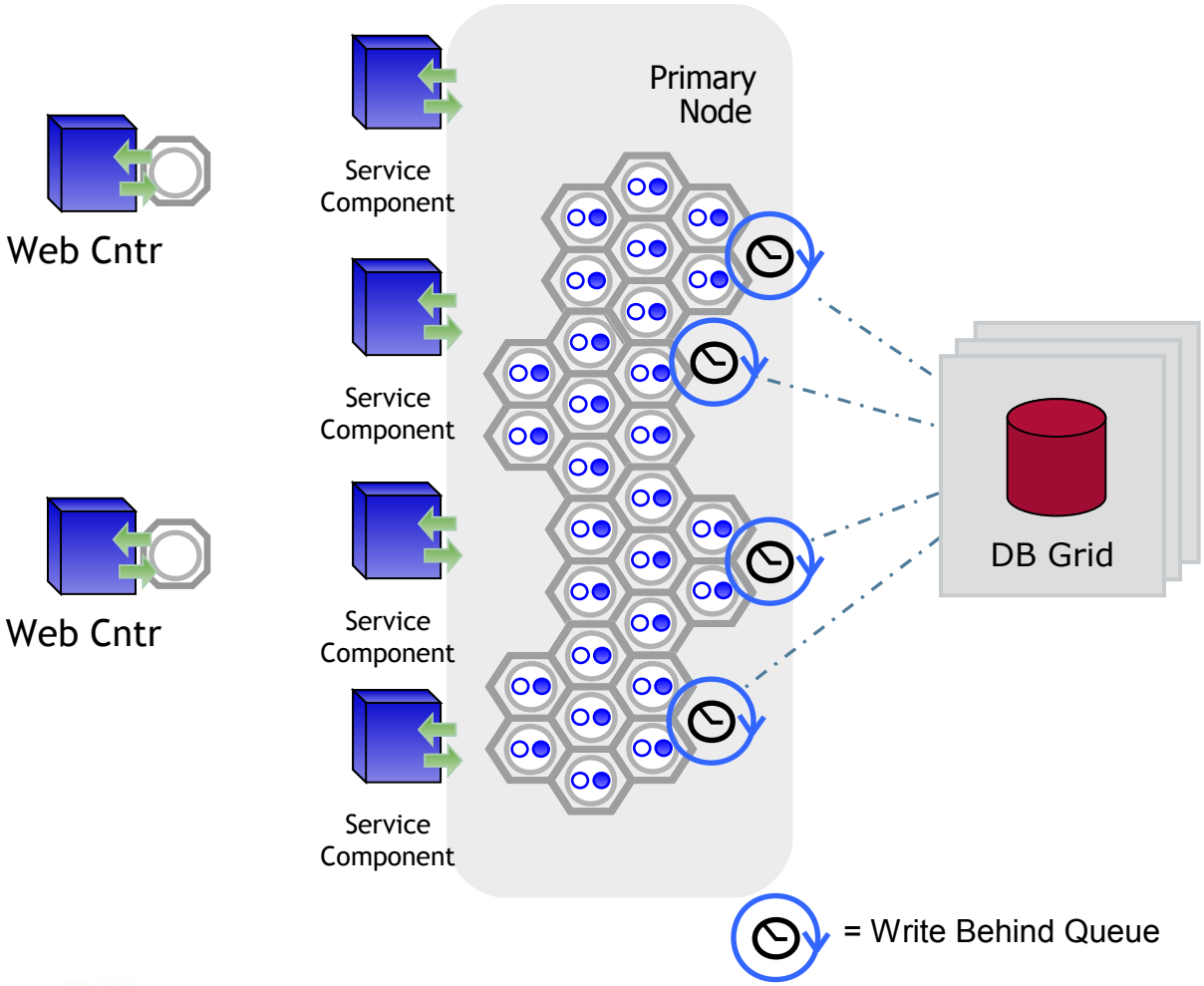
Business logic: Traditional middle tier EJB

Data Grid: Web Containers share servlet session state via data grid

Database:

Use for storing, managing transactions

State Management with RESTful SOA on Application Grid: Shared Service State Data



Business logic:

Services manage their state in the data grid

Data Grid:

Use for managing transient state (read and write)

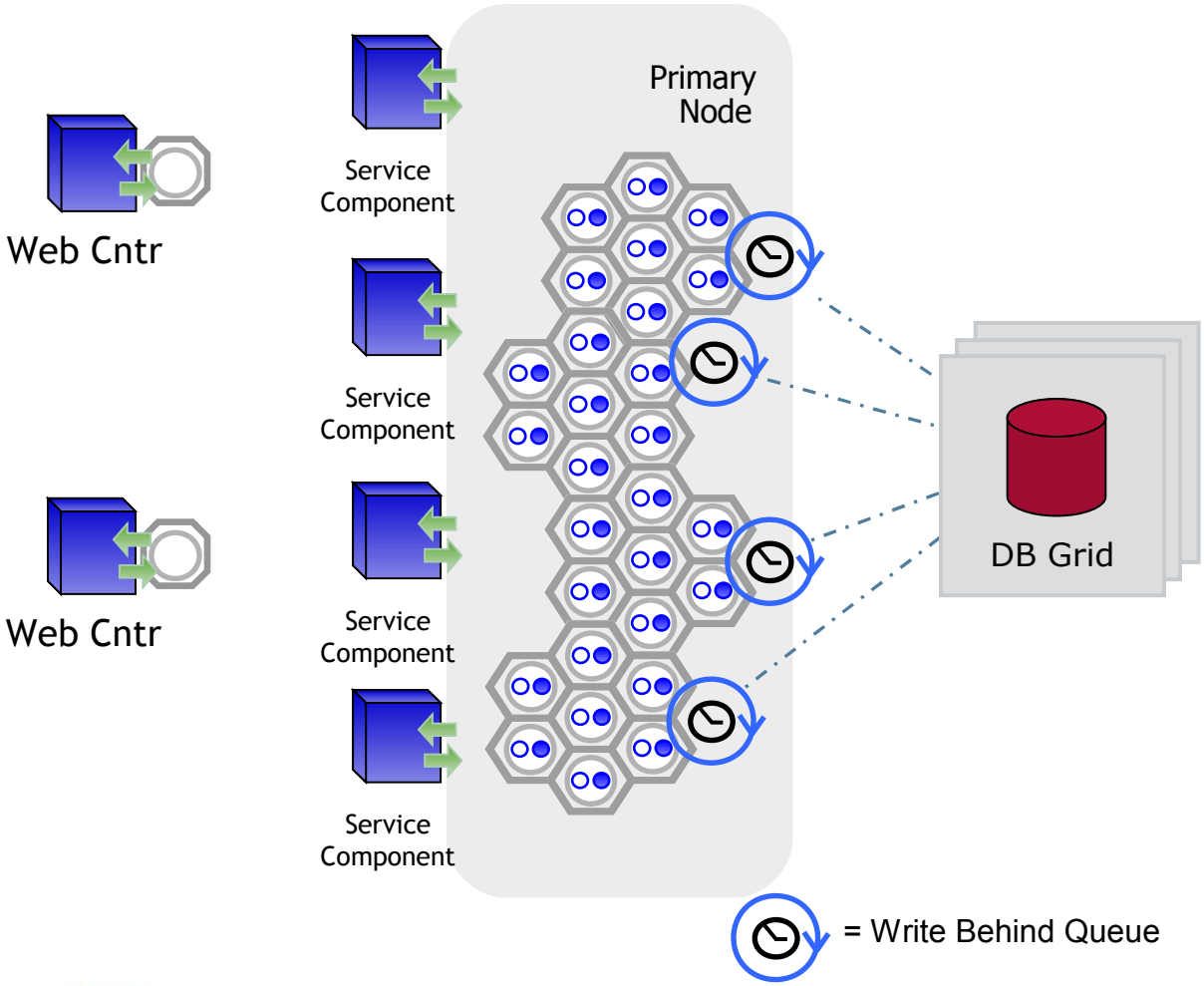
Database:

Use for storing, managing transactions

Write through for state information from data grid

Similar architecture, similar benefits!

DB Interaction: Asynchronous Write-behind



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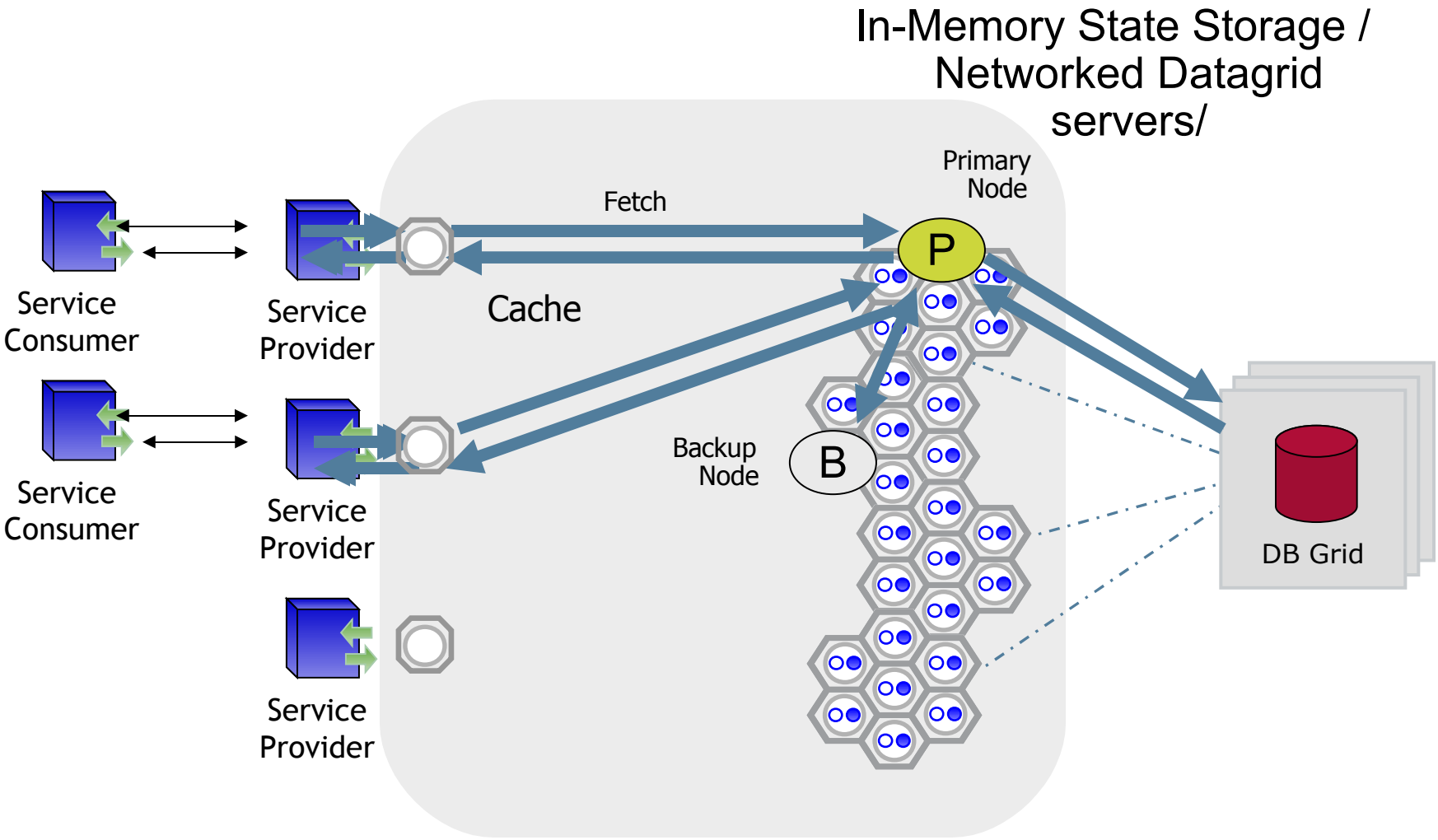
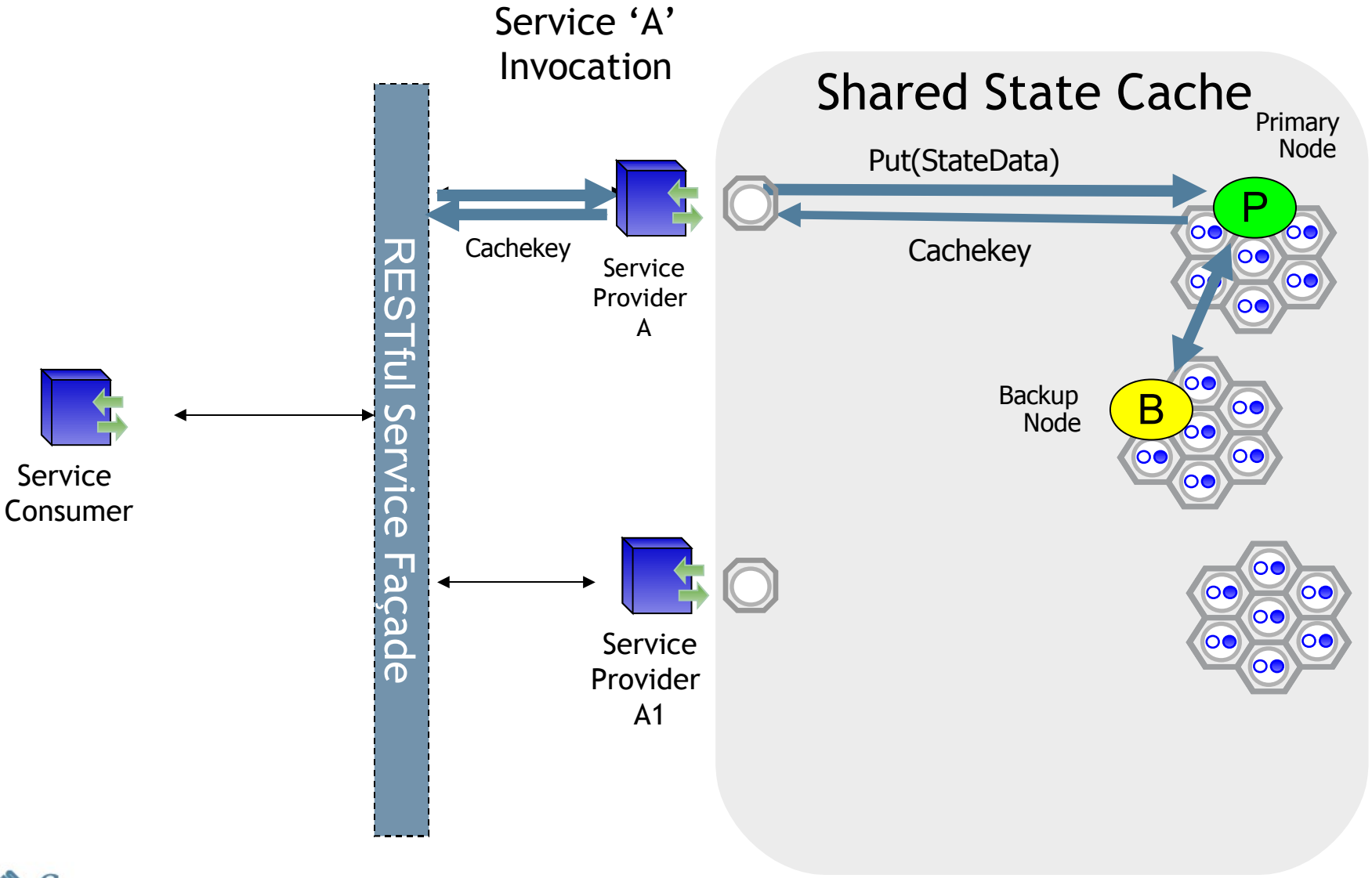
DB Interaction: Near-Cache Optimization



400X Improvement on Reads, 40X Improvement on Writes

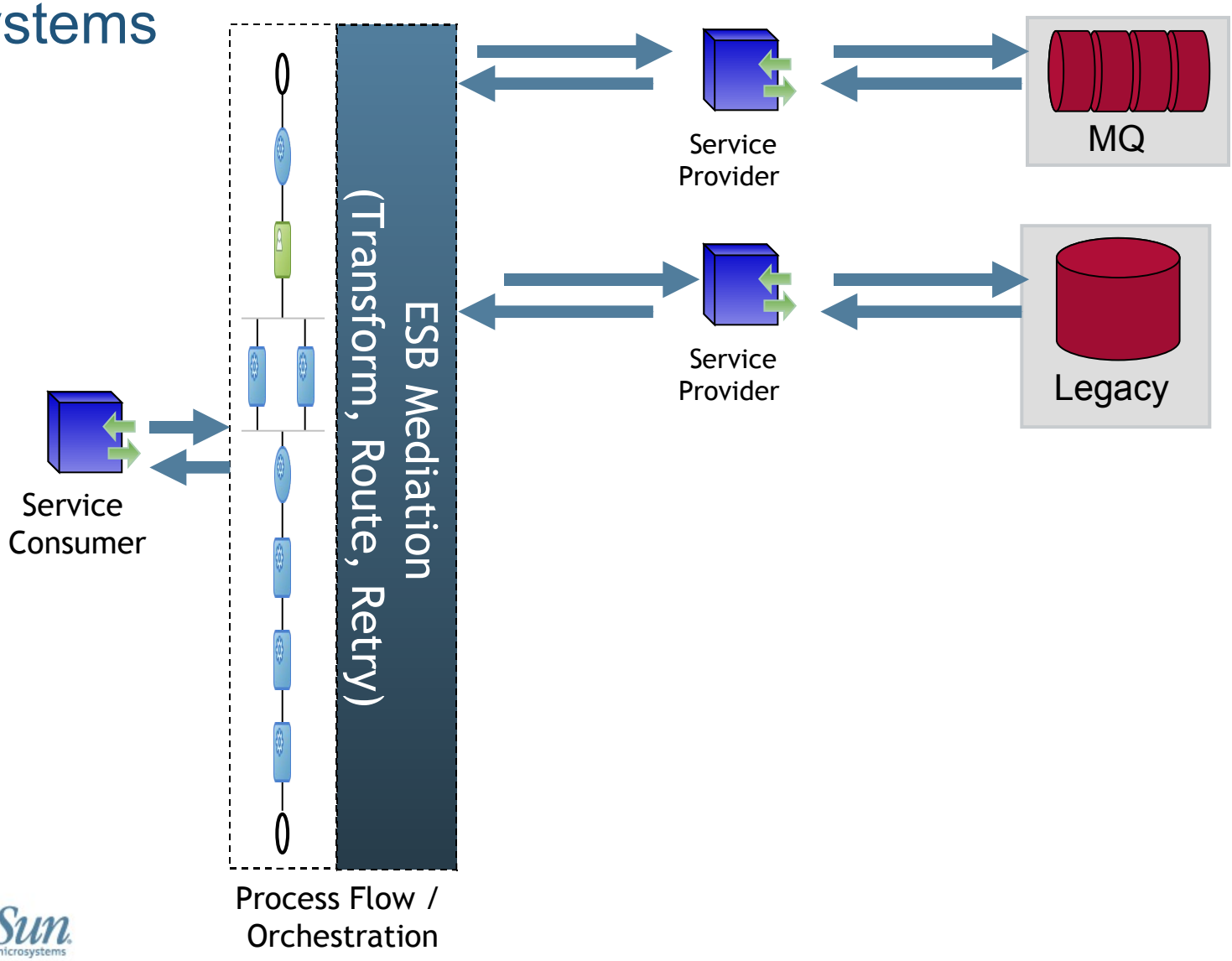
Service Pattern: Inline Shared State Cache



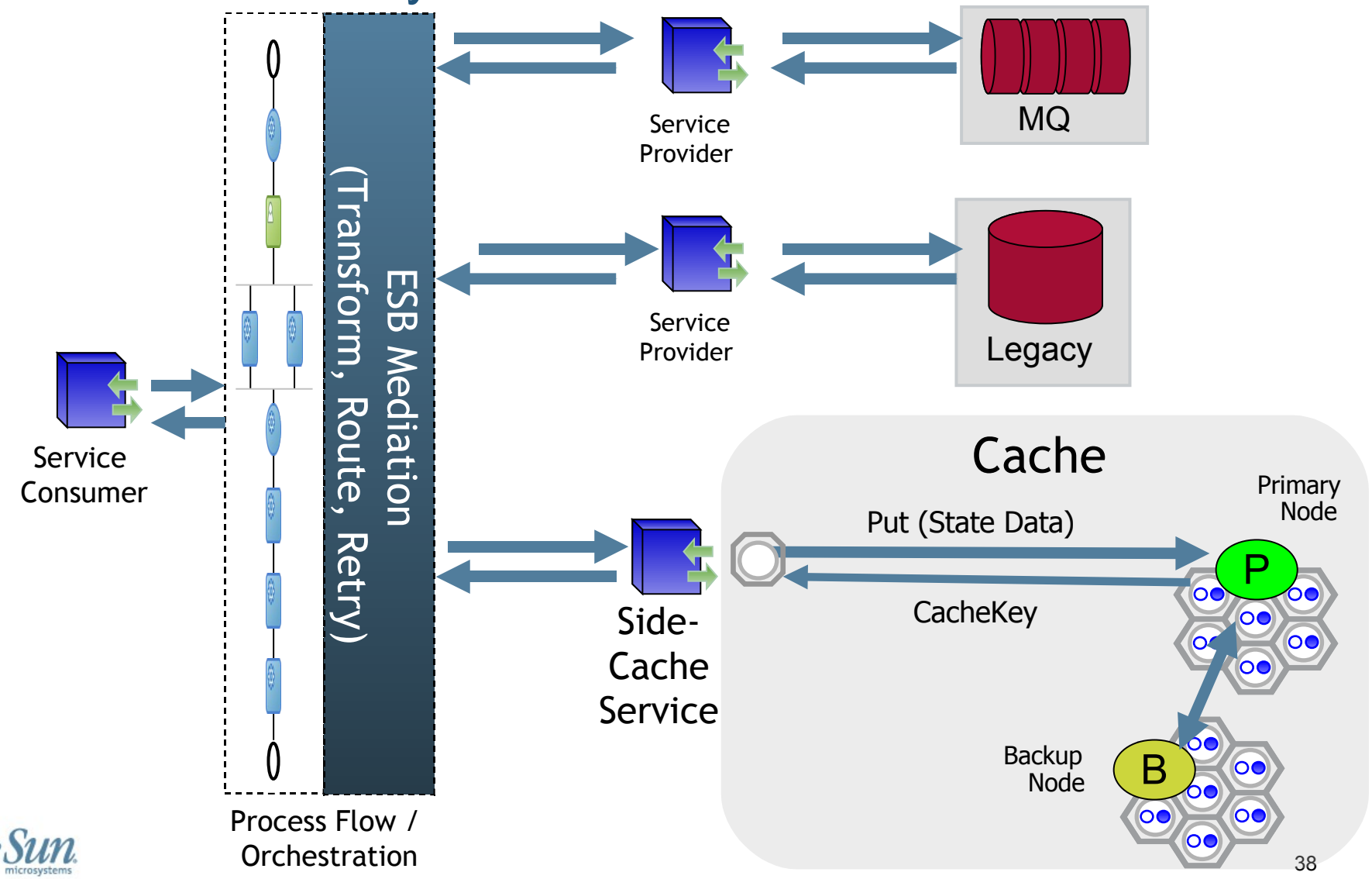
Case Study: Pharmaceutical Intranet Portal

- Scenario
- Internal sales portal
  - Gathers information about physicians to sell to
  - Requests to backend systems sometimes yields10 web pages of data
  - 3 seconds on a single backend service call thru an MQ queue to a mainframe
  - Solution
- Cache Results of first call using Service Result Cache pattern
  - Offloading expensive backend calls
  - Reduction in mainframe traffic
  - Improved user experience

Before | Caching Results to Service Calls to Backend Systems



Service-Result-Cache | Caching Results to Service Calls to Backend Systems



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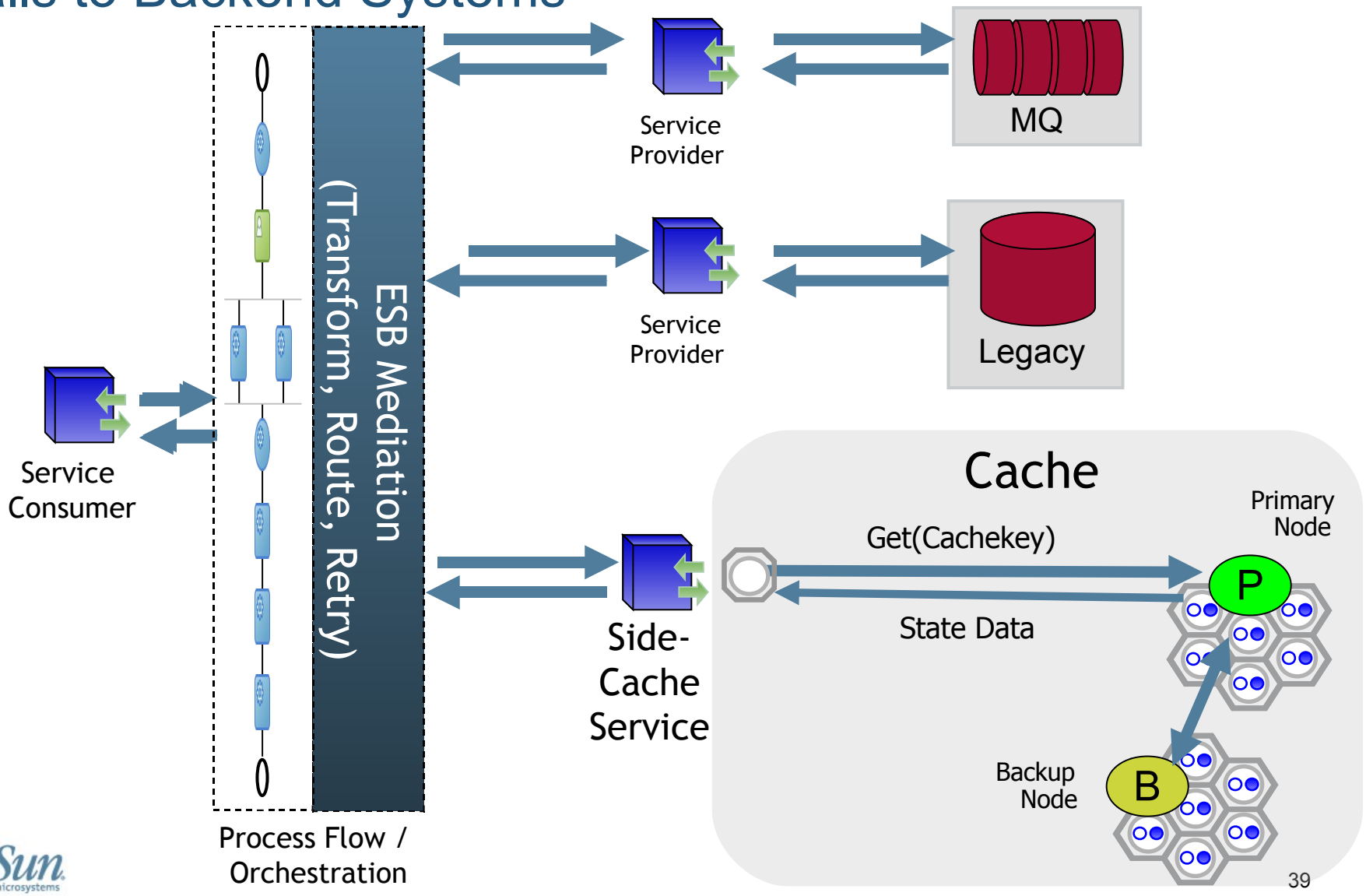

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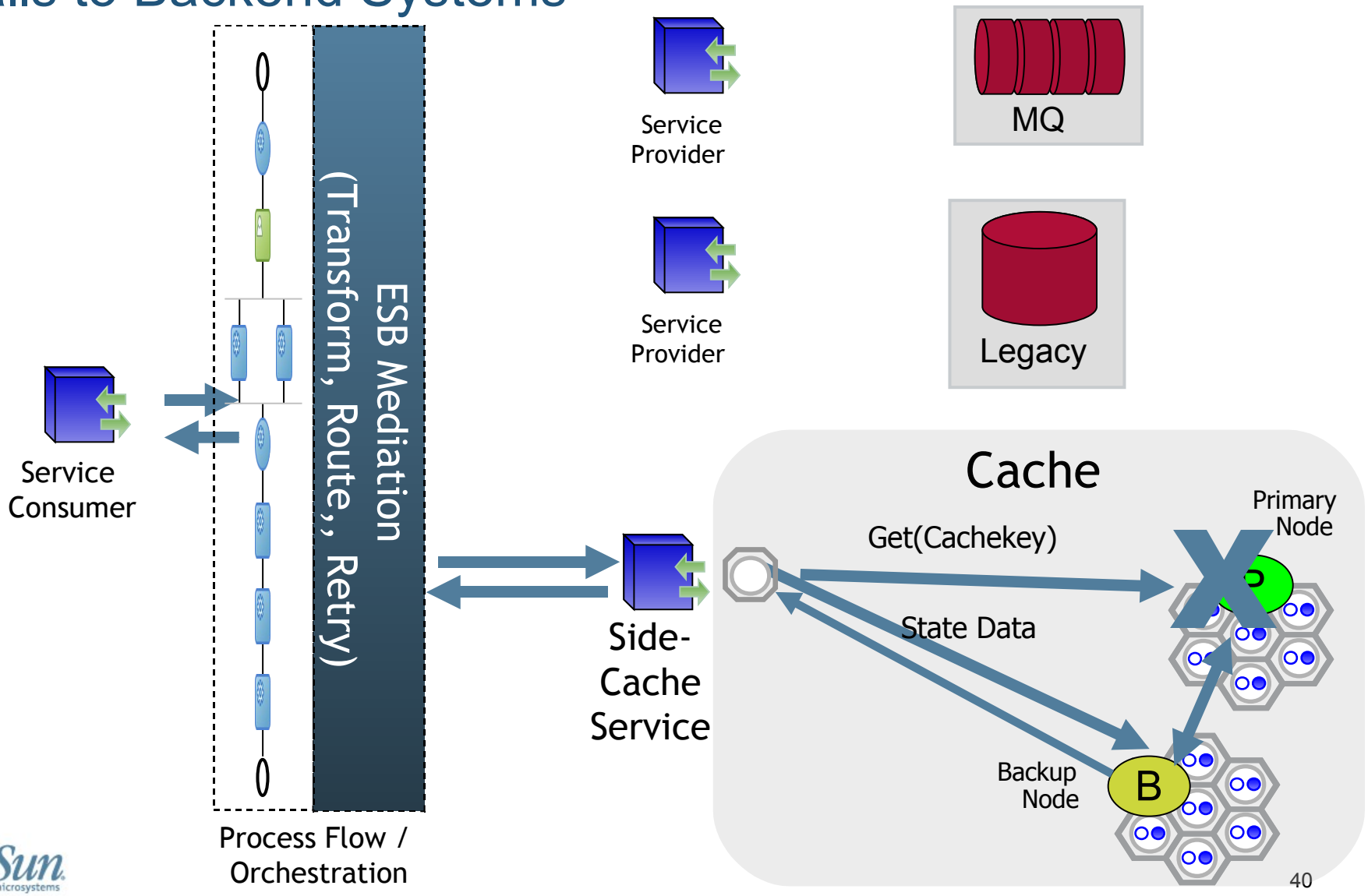
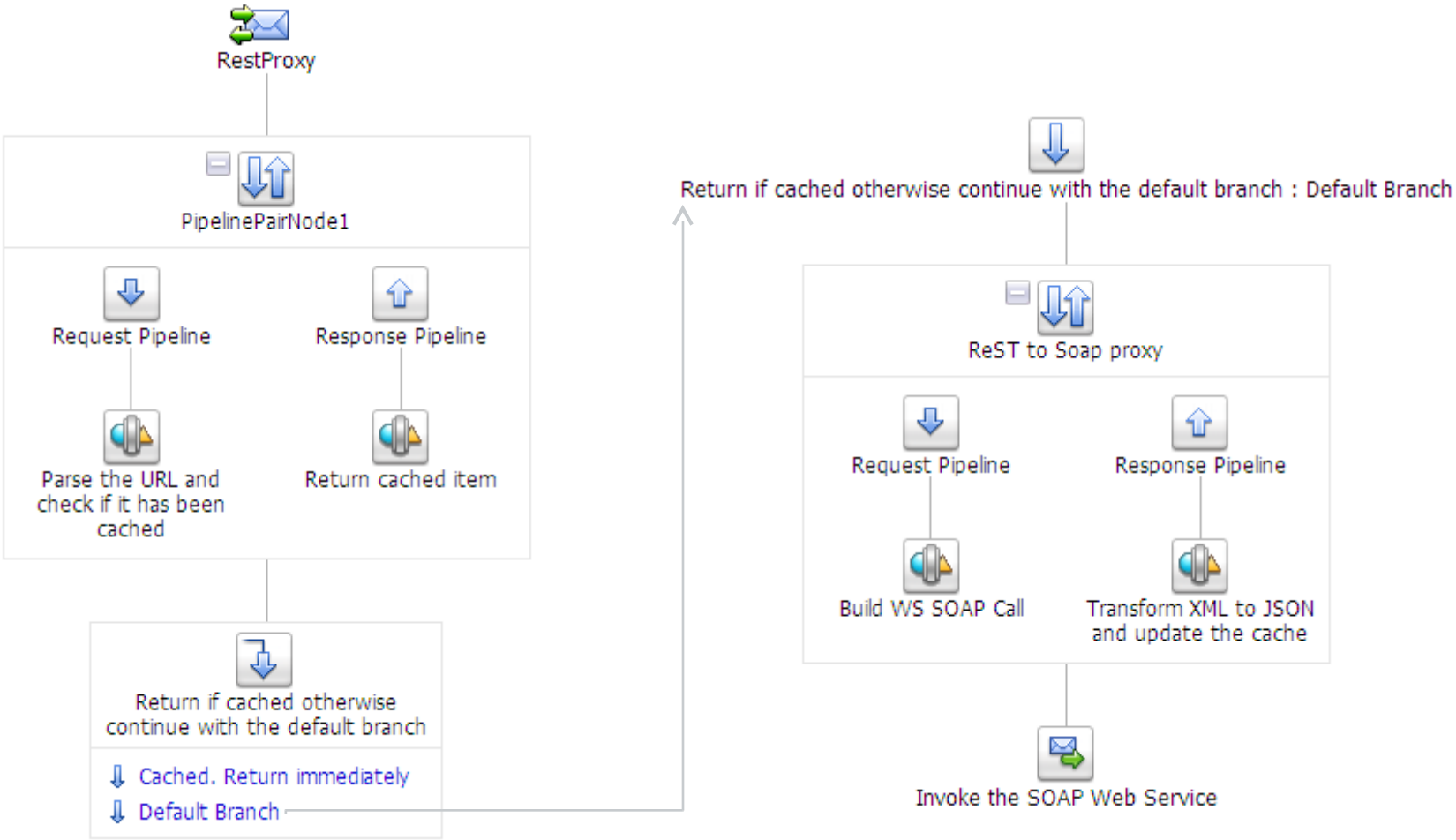
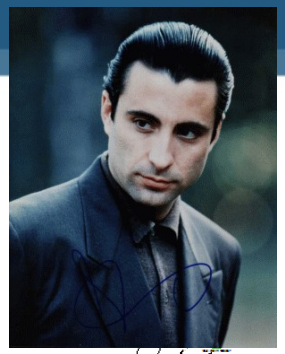


Variation: Restful SOA Datagrid - ESB pipeline



Case Study: Ministry of Justice Anti Money Laundering System

- Use Case
  - Track illicit money laundering activities
  - Build Network of people, criminal organizations, police records
  - Identify patterns of suspicious cash transactions
- Problem
  - Build large dependency Graphs
    - Crime families, associations
  - 10K – 20K XML messages
- Solution: SOA on App Grid
  - BPEL for Orchestration, Coherence for State
  - Caching results of WS calls
    - Reference data from external agencies, banks, etc
- XML Nodes fragmented across Coherence
  - Converted to java objects
  - Can be serialized on demand

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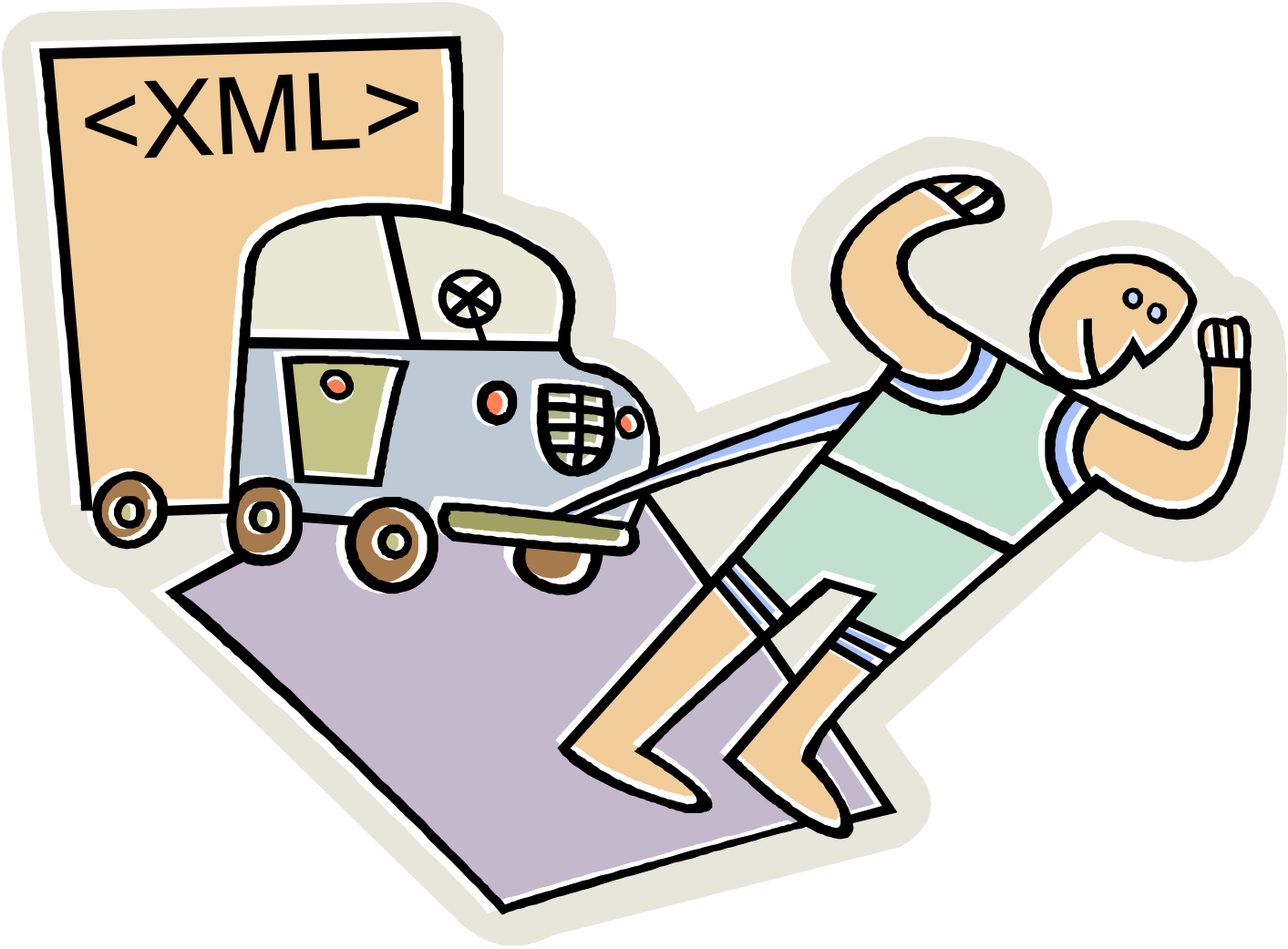
Pattern: XML Grid



Pattern: XML Grid

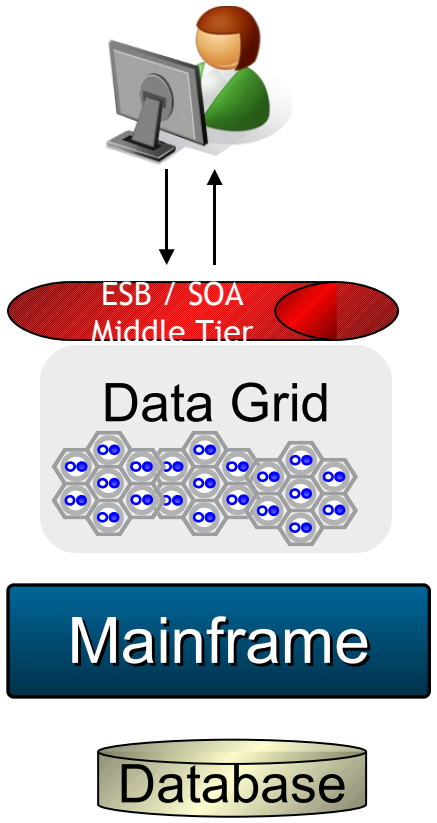
- Problem statement - “Large” XML
  - Serializing, transporting, consuming, parsing, manipulating of large XML documents is costly
    - Consumes resources
    - Introduces latency due to bottlenecks
    - Inhibits scalability
- Potential solutions
  - Streaming solves part of the problem, however
    - Still may need to fully materialize document in memory
    - Still need to serialize, deserialize, and transport
    - No easy way to do CRUD operations

Pattern: XML Grid

- Solution: XML in the App Grid
  - Use streaming parse to read document into the grid
  - Break it up into its constituent parts
  - Use JAXB to convert to Java Objects
  - Use distributed, parallel query and aggregation capabilities of App Grid to query and update objects in the grid
  - App Grid scales out horizontally simply by adding new JVMs to the cluster.
  - No limit to the size of the XML document or the number of them
  - Article in SOA Journal this month http://soa.sys-con.com/node/976701

The Benefits, Quality of Service Goes Up, Costs Go Down!

- **Improved response time**
  - In-memory Cache provides sub-second response time
- **Improved scalability**
  - RESTful SOA on an App Grid will scale linearly with increased demand
  - As demand increases, new grid servers are easily added
- **Improved availability**
  - Linear scalability protects against unexpected shutdowns from sudden spikes in volume
  - If the backend systems go down, the middle tier can still service transactions against cached data
- **Reduced mainframe costs**
  - Eliminate millions in annual mainframe costs



For More Information

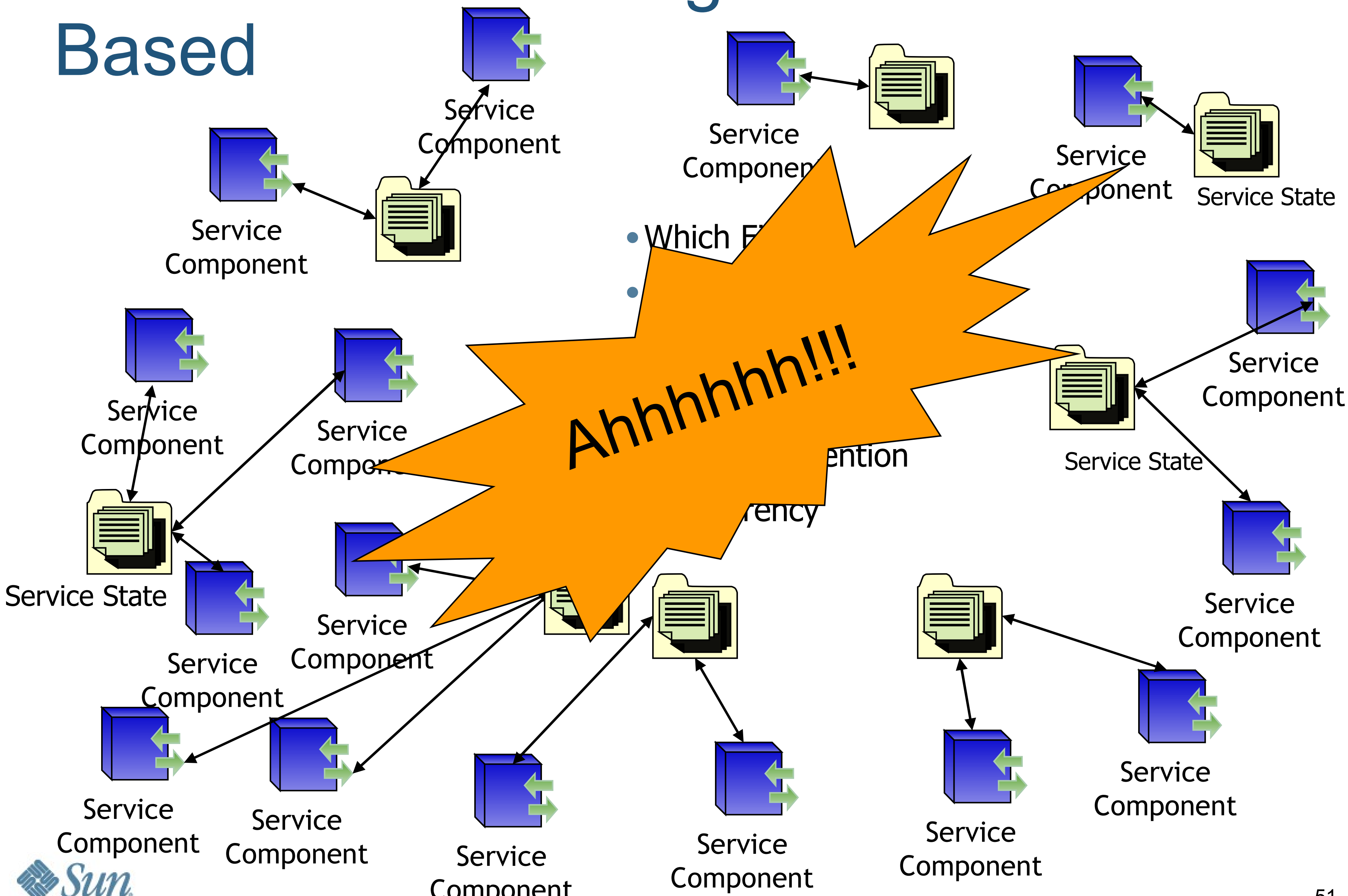
- XML Grid
  - http://soa.sys-con.com/node/976701
- Making SOA Leaner and Cleaner to Maximize Products
  - http://www.ebizq.net/topics/soa/features/10393.html
- David Chappell Blog
  - http://blogs.oracle.com/davidchappell
- Restful SOA Datagrid
  - http://www.slideshare.net/EmilianoPecis/the-restful-soa-datagrid-with-oracle

Appendix

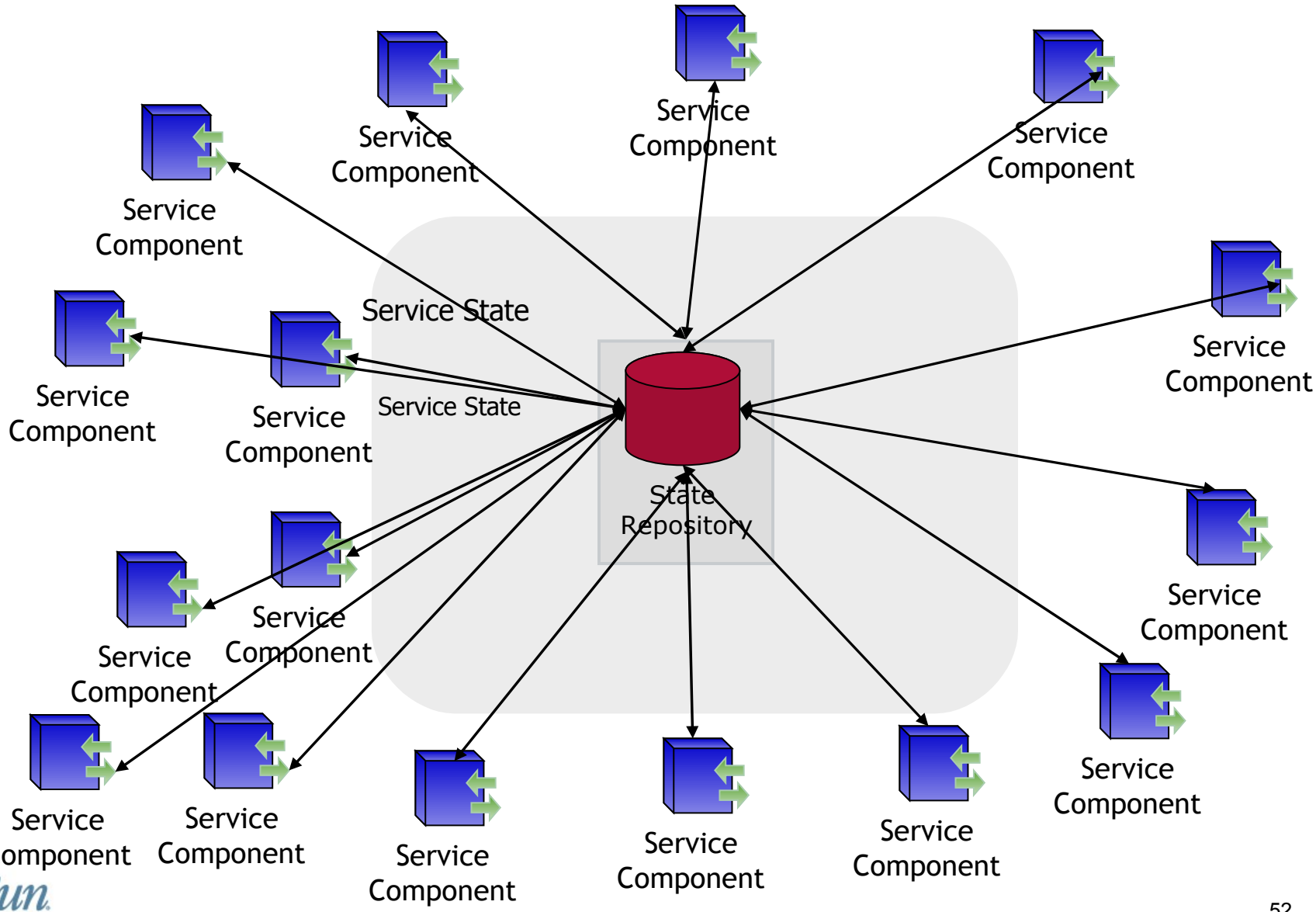
SOA Grid Patterns

- SOA Grid: Basic Patterns for State Management Using Middle Tier Caching
  - Fault Tolerant Collection
  - Inline Service State Cache
  - Side Cache
  - Stateful Service Load Balancing
  - Stateful Service Availability/Failover
- Advanced State Management Patterns
  - State Based Notification
  - Asynch DB Update
  - Near Cache Optimization
  - Sticky Load Balancers and Cached Service State
  - Business Logic Affinity
  - Claim Check/Pass-by-ref/Deferred State

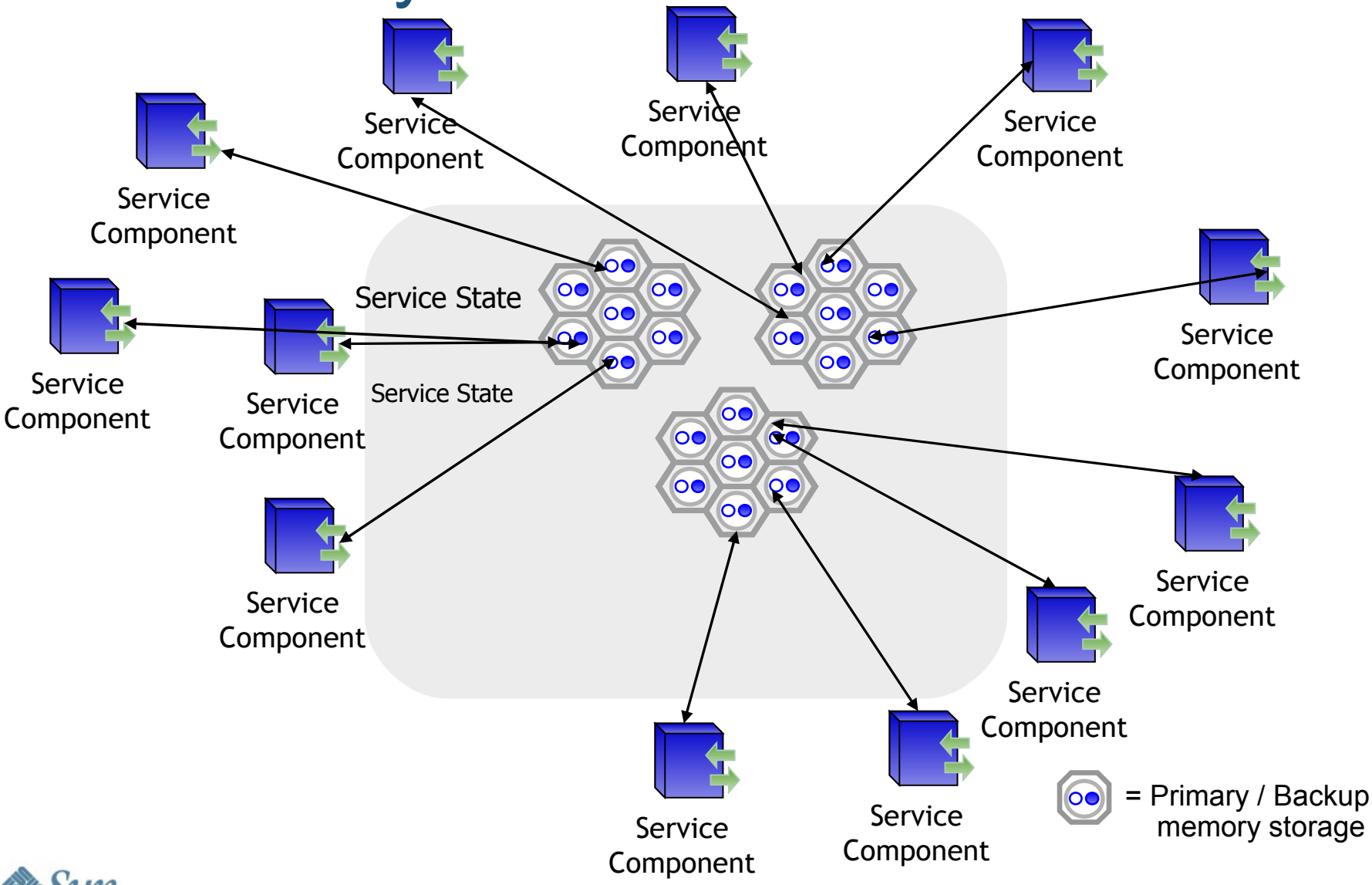
Service State Management – File Based



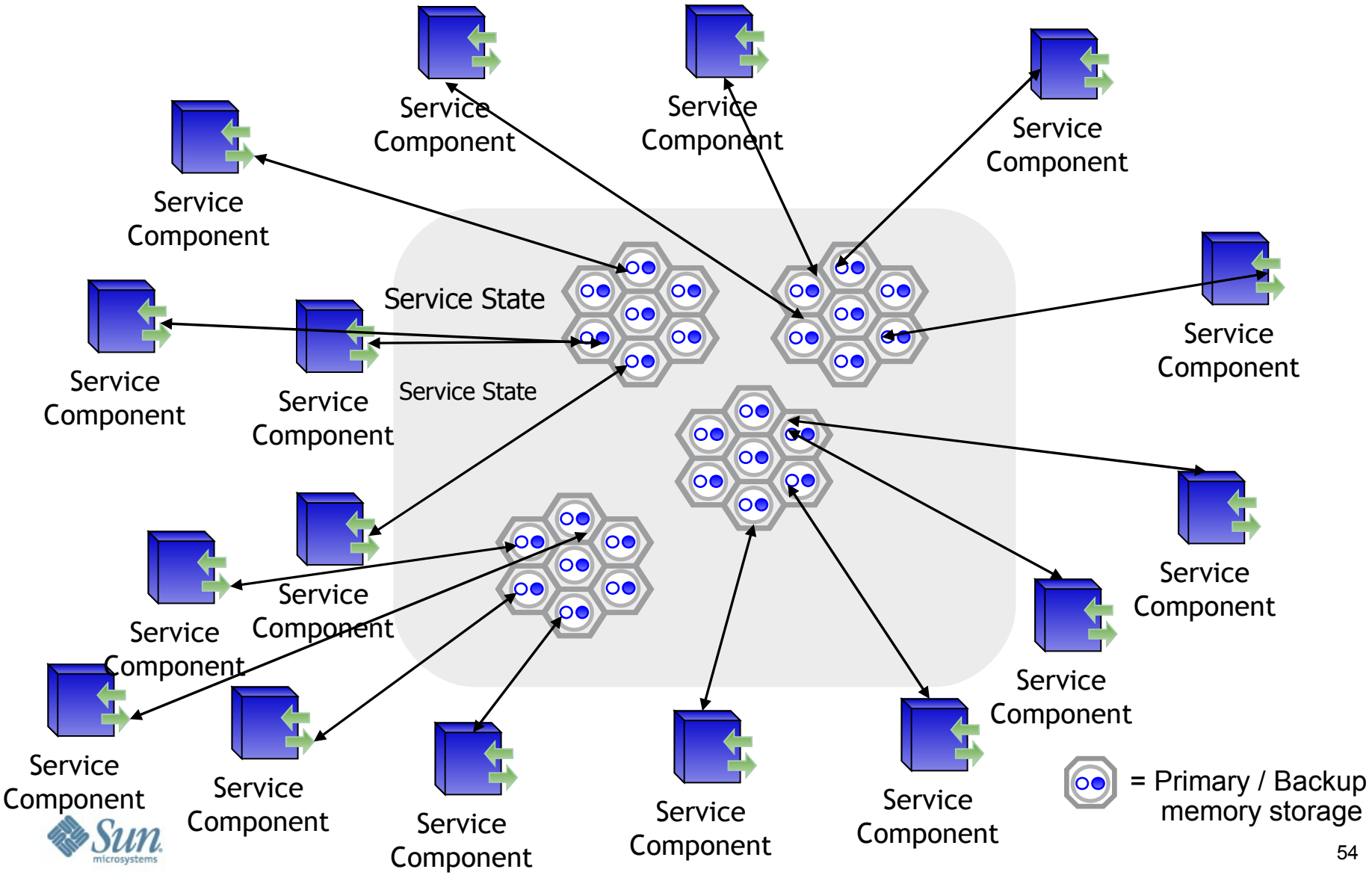
Service State Repository



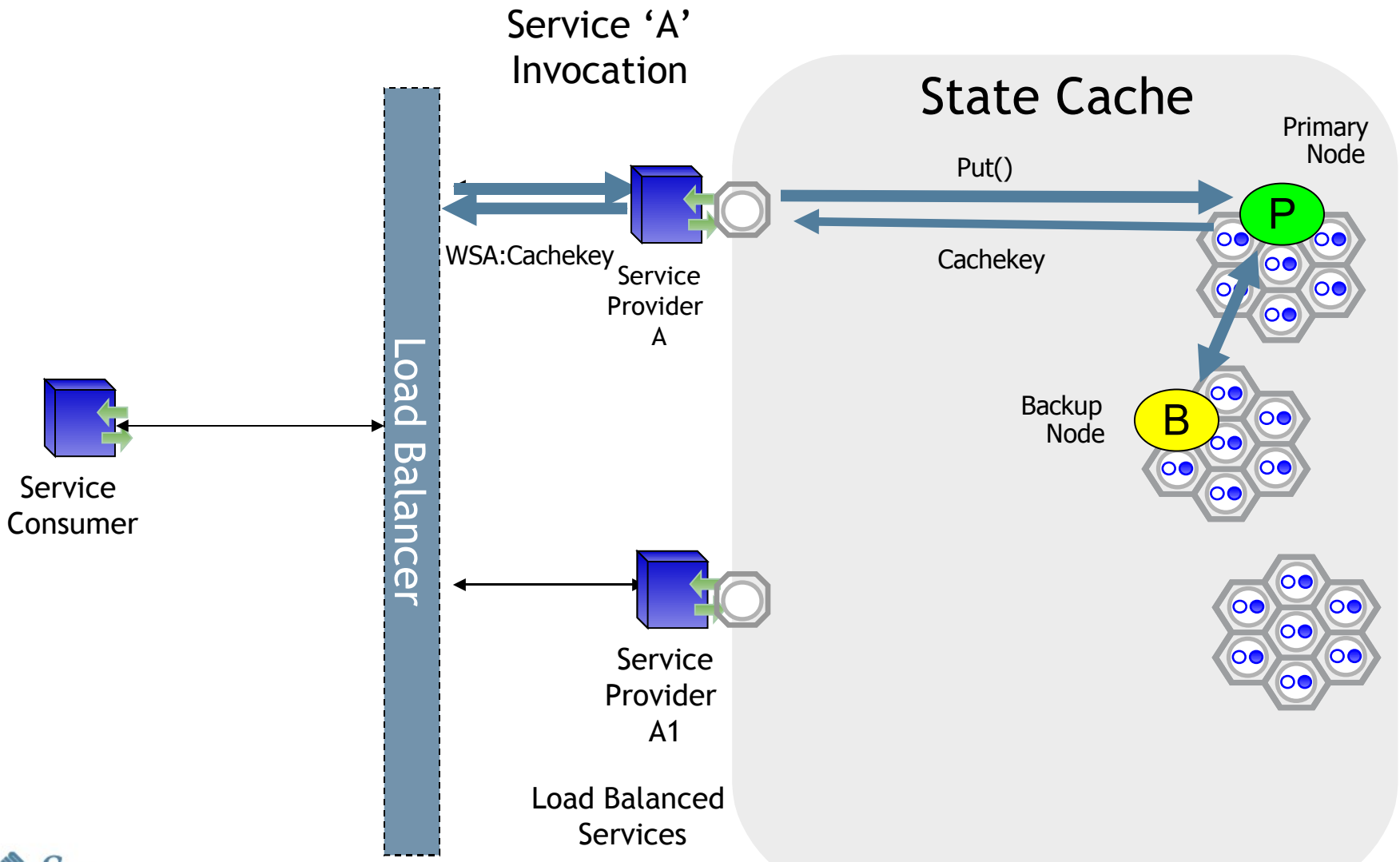
In-Memory FT Service State



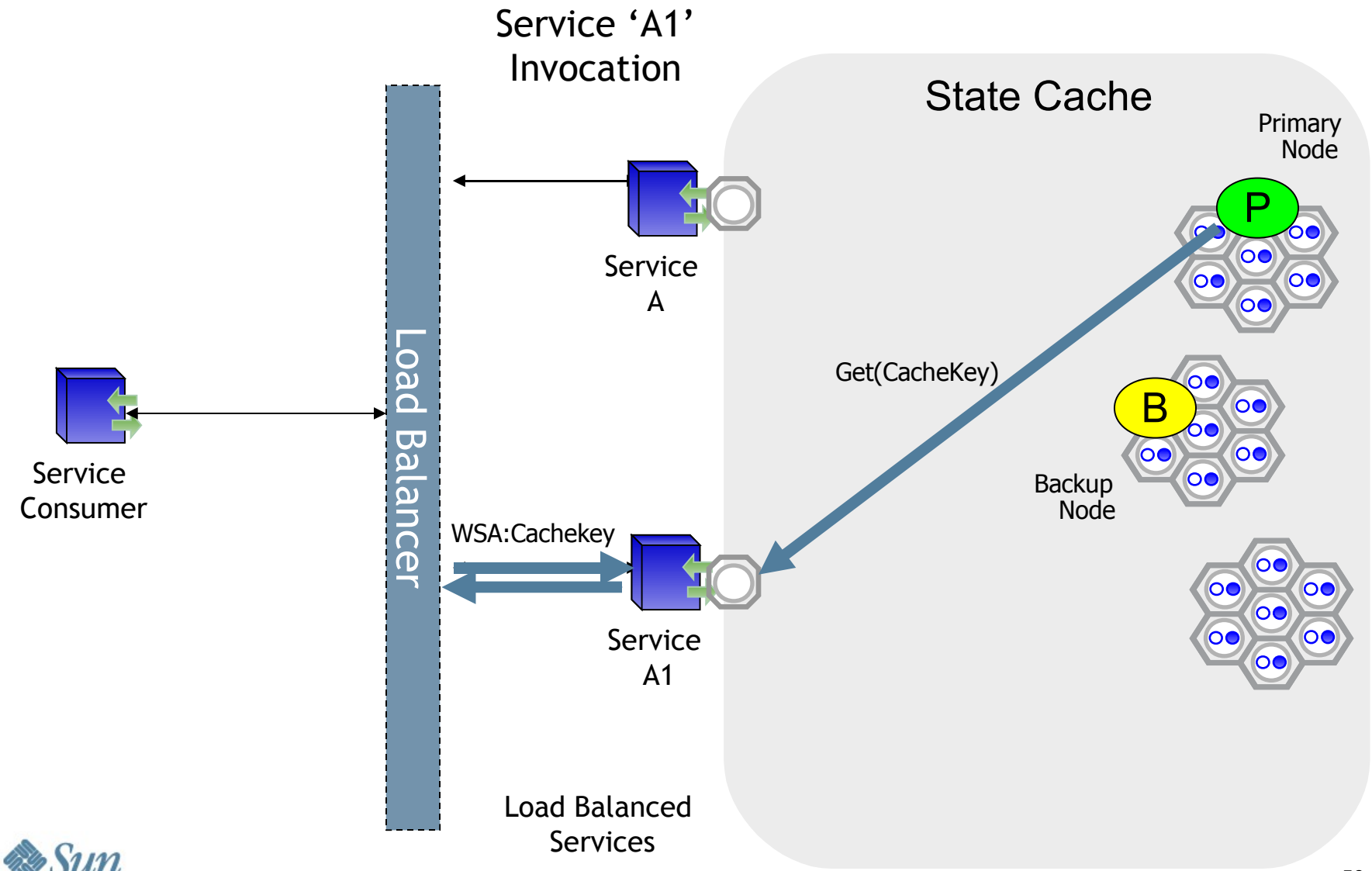
In-Memory FT Service State



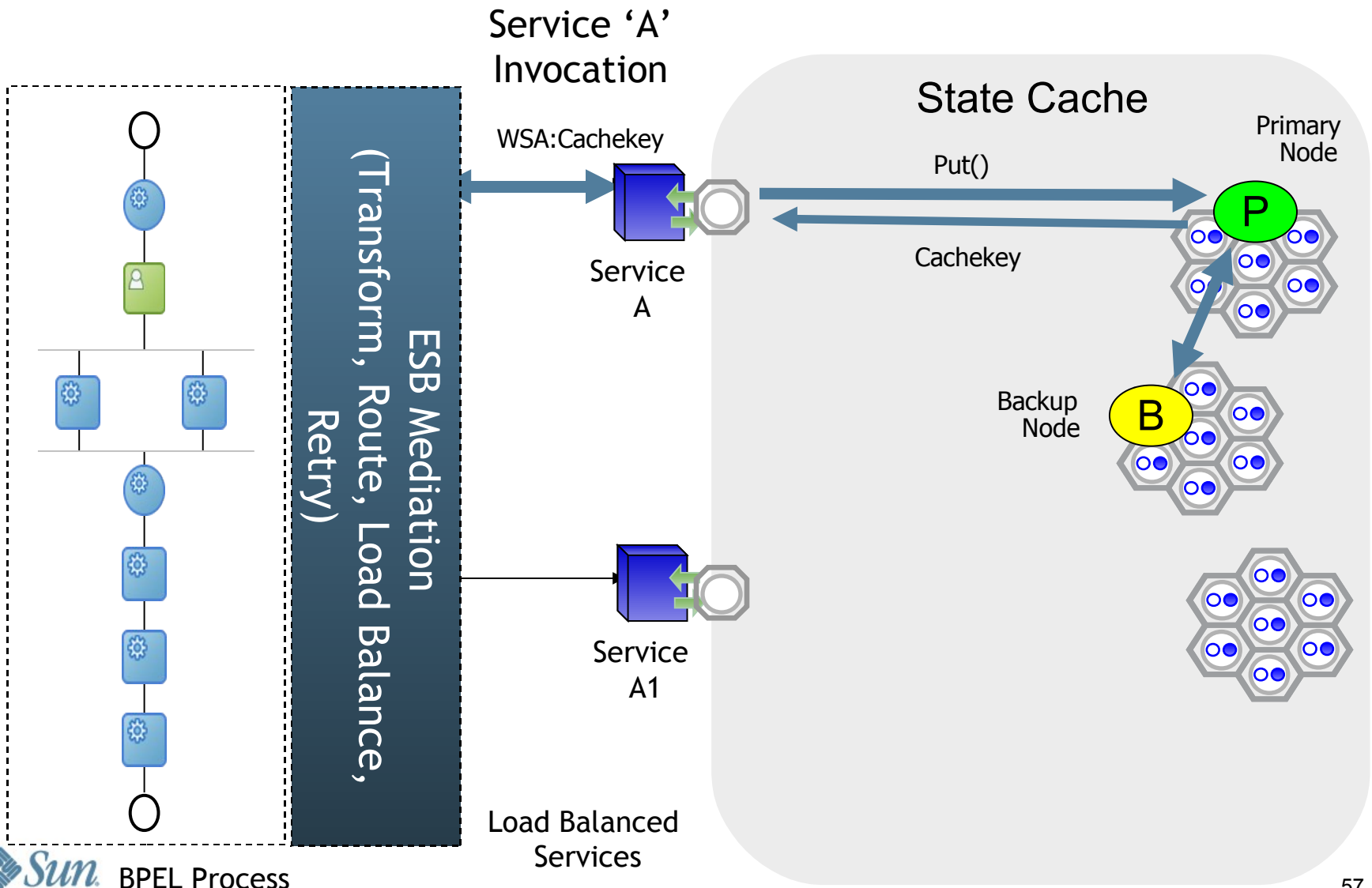
Stateful Service load balancing



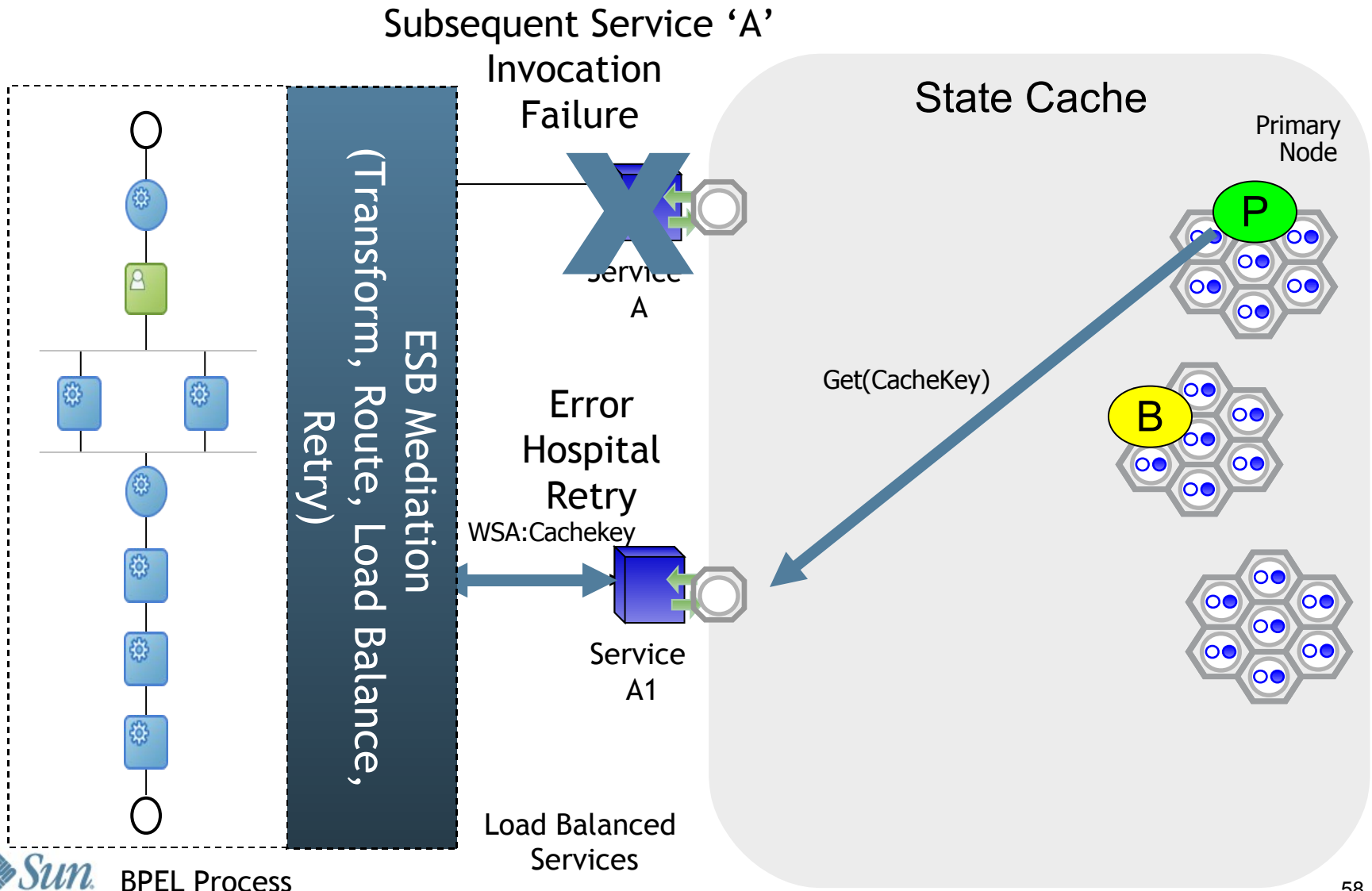
Stateful Service load balancing



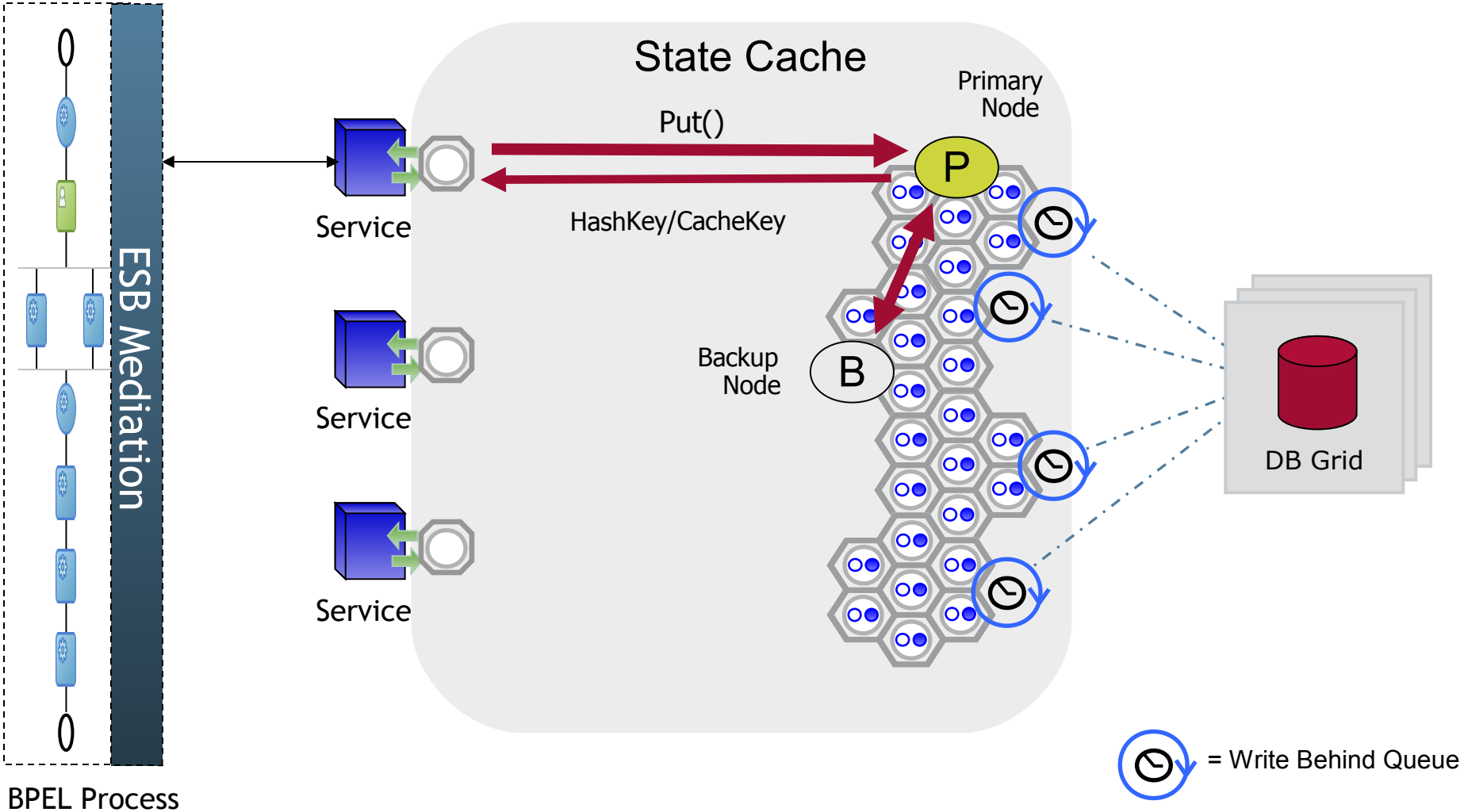
Stateful Service availability/failover



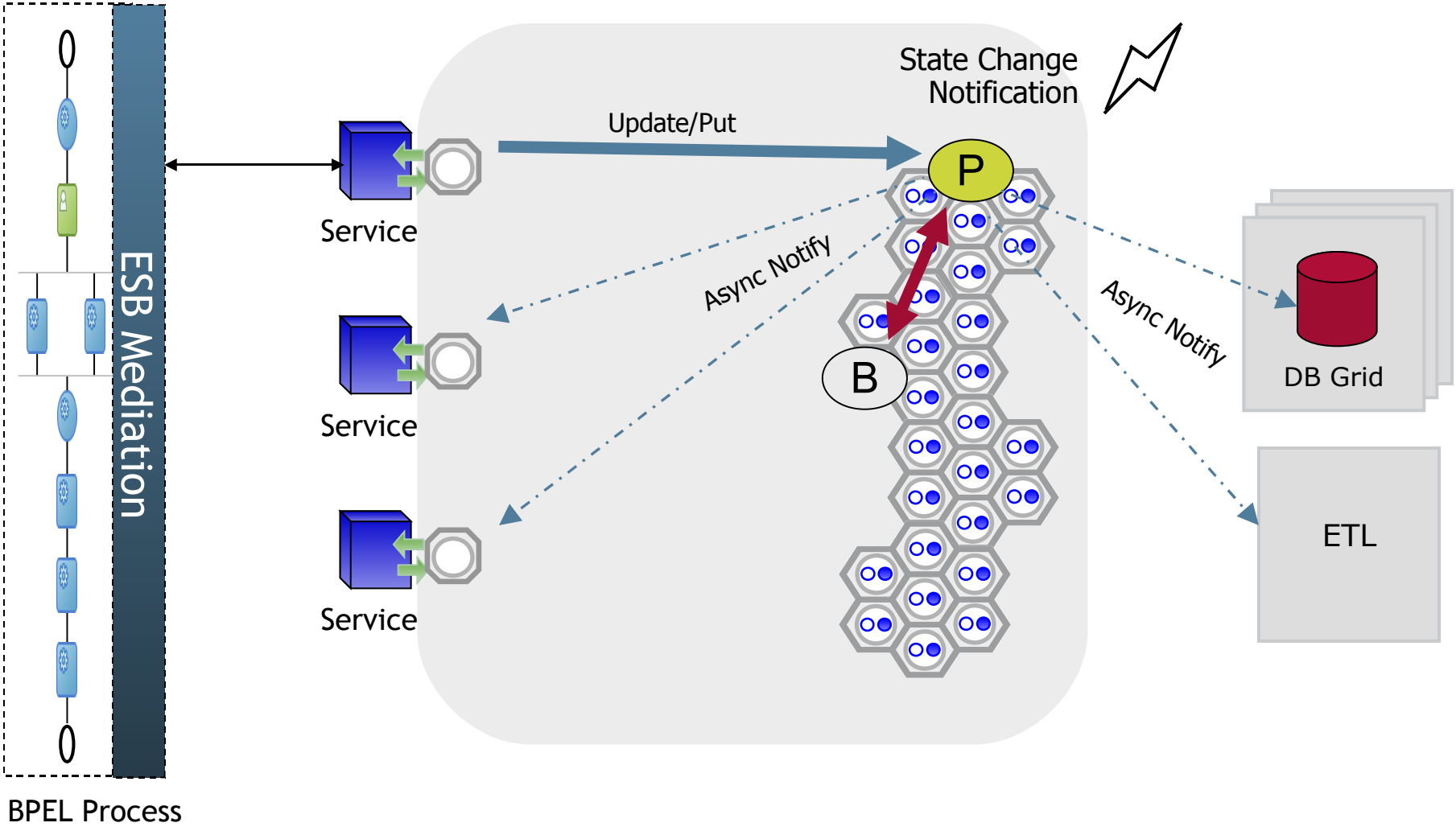
Stateful Service availability/failover



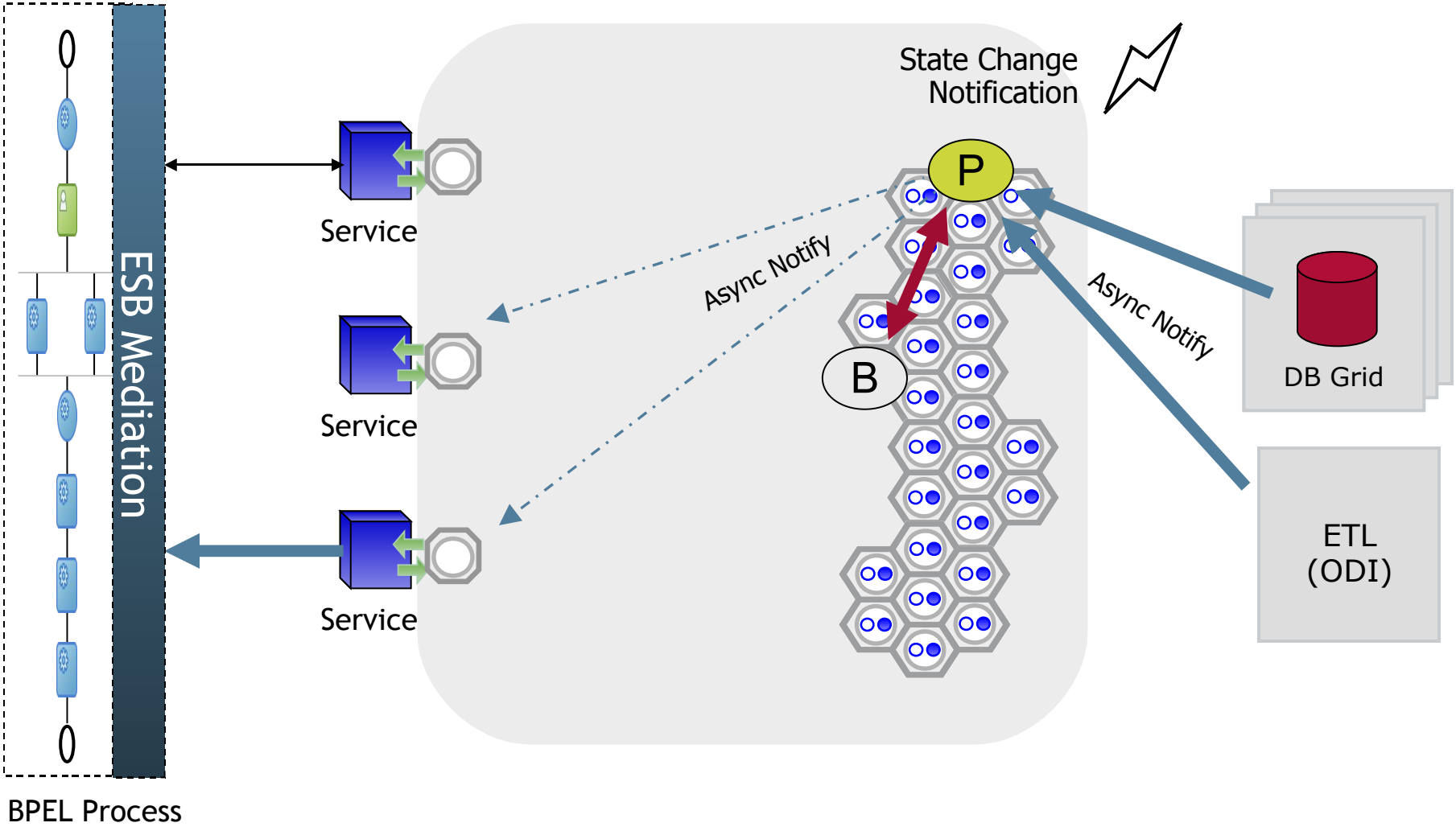
Asynchronous DB Updates



State-Based Notifications



State-Based Notifications



REST Patterns

- Give every “thing” an ID (URI):
  - http://example.com/orders/2007/11
- Link things together (Hypermedia links):
  - <order self='http://example.com/customers/1234' >
    <amount>23</amount>
    <product ref='http://example.com/products/4554' />
    <customer ref='http://example.com/customers/1234' />
    </order>
- Use standard methods (HTTP verbs)
  - GET is safe and idempotent
  - PUT and DELETE are not safe but are idempotent
  - POST is neither safe nor idempotent