



Coherence in the Retail Space: A Case Study of Adoption of Coherence at Macys.com



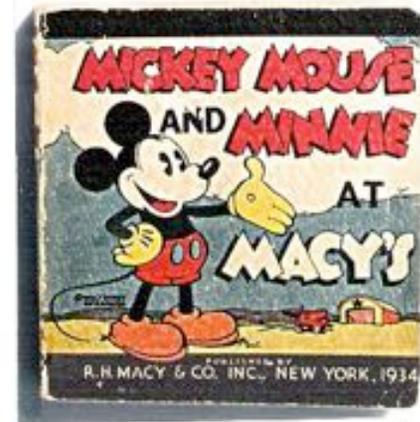


- BS in Computer Science University of Missouri
- Several years in Government sector
- With Macys for 4 years
- Likes Chinese noodles



Y'S

?



★ macy's

Macy's.com

Opened in 1998

- 250,000 products available
- 1M page views a month

Today

- 500,000 products
- 3M page views an hour
- Highly dynamic expression of products

The screenshot shows the Macy's.com website interface. At the top, there is a navigation bar with categories: at home, men's, women's, young attitude, jewelry, lingerie, cosmetics, and fragrance. Below this is the Macy's.com logo and links for SIGN IN, REGISTER, and MY ACCOUNT. A shopping cart icon shows 0 items and a CHECKOUT button. A red banner at the top right says "ATTENTION: You need JavaScript enabled to shop on this site." Below the navigation is a "FREE SHIPPING" banner with the Macy's logo and a "GREAT DEALS" badge. A secondary navigation bar lists departments: for the home, bed & bath, women, men, juniors, kids, beauty & fragrance, shoes, handbags & accessories, and jewelry & watch. A search bar is present with a "GO" button and "CUSTOMERS' TOP RATED" stars. The main content area features a large red banner for a "tax break" on furniture and mattresses, with a "SEMI-ANNUAL FURNITURE SALE" and "LIMITED-TIME SPECIALS". A woman is shown sitting on a large black leather sofa. To the right, a "SOMETHING IS SALE & CLEARANCE" banner offers "EXTRA 25-40% online clearance TOTAL SAVINGS 40-80%". A sidebar on the left includes a "SHOP THE SALE IN STORES!" section with a "HOME SALE" image, a "shop the catalog" link, a "find a store" link, and a "NEW! MATTRESS FINDER" section with a woman on a mattress and a "watch our new mattress TV spot" link. The footer contains links for CUSTOMER SERVICE (order tracking, returns, shipping info), MACY'S CREDIT CARD (pay your bill, view credit account), OUR STORES (store locations & hours, this week in stores, catalogs, store events), MACY'S INC (macy'sJOBS, press room), and a "you said y" section with a woman's face and the text "let the shopping".



Today: Multiple Client Channels

Amazon

Facebook

iPhone

amazon.com Hello, Mariano Hernandez. We have [recommendations](#) for you. ([Not Mariano?](#))
Mariano's Amazon.com [Today's Deals](#) [Gifts & Wish Lists](#) [Gift Cards](#)

Shop All Departments Search Macy's

Home & Garden For The Home Bed & Bath Womens Mens Kids Beauty

★ macy's way to shop™ for the home | bed & bath | womens | mens | kids | beauty | jewelry & watches

BROWSE
Shop by Category
[For The Home](#)
[Bed & Bath](#)
[Womens](#)
[Mens](#)
[Juniors](#)
[Kids](#)
[Beauty](#)
[Jewelry & Watches](#)
[Holiday Lane](#)
[Luggage](#)
[Rugs](#)
[Sale](#)
[Clearance](#)

WOMEN FEATURED CATEGORIES
[DRESSES](#) [JACKETS & BLAZERS](#) [TOPS](#)

MEN FEATURED CATEGORIES
[SWEATERS](#) [OUTERWEAR](#) [SHIRTS](#)

KIDS FEATURED CATEGORIES



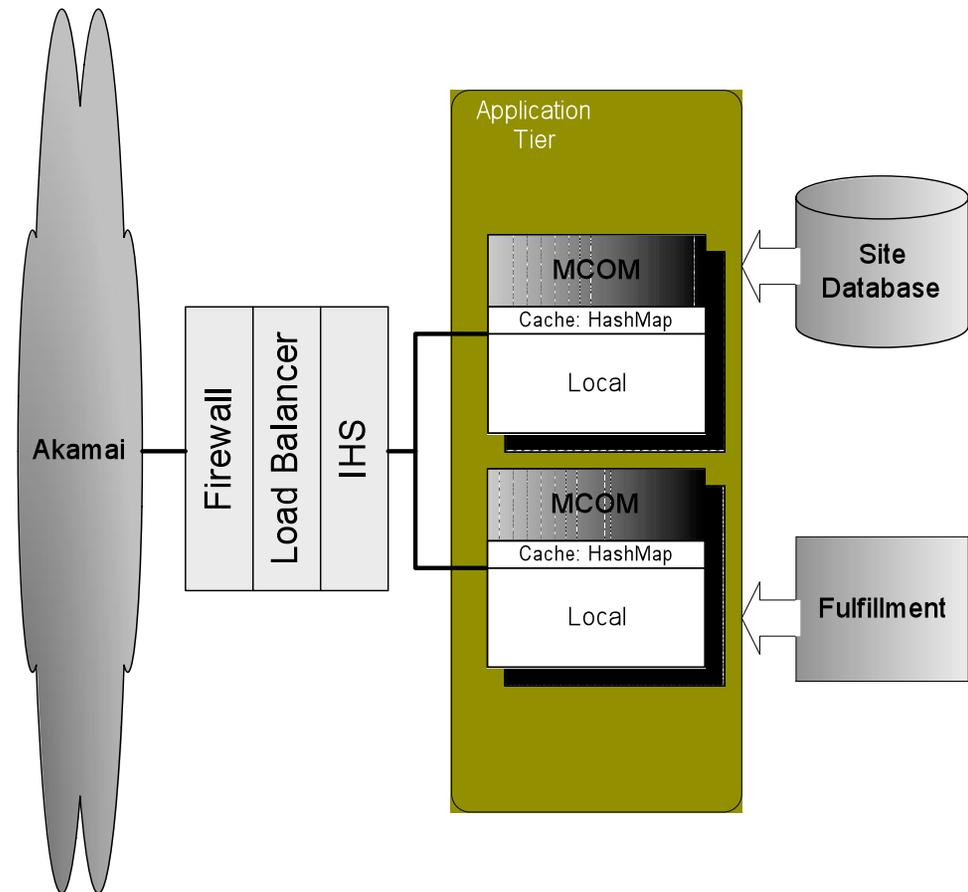


How did we get
here?



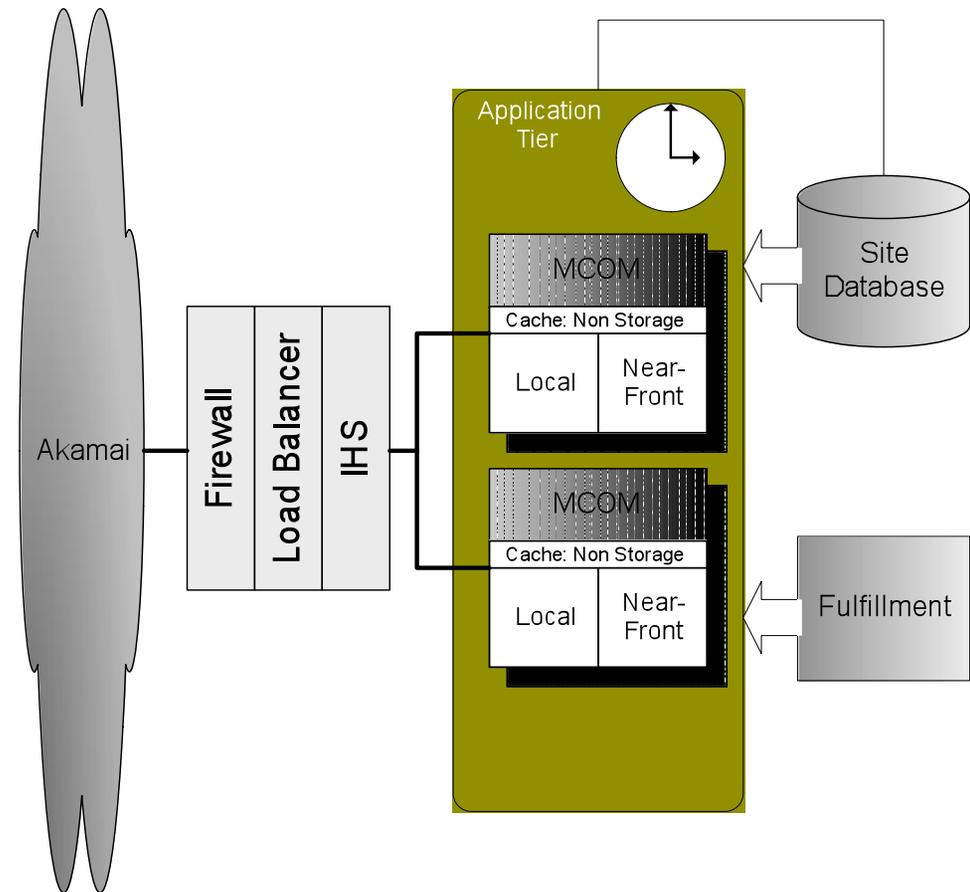
Initial Issue - 1:

- JVMs cache by HashMap
- First Hit SLAs require cache preload
- Upper Limit of 2 concurrent preloads
- Each Cycle is 30 minutes
- No Incremental data; fresh data required full recycle
- Can't scale past 3 load cycles and meet nightly go live SLA



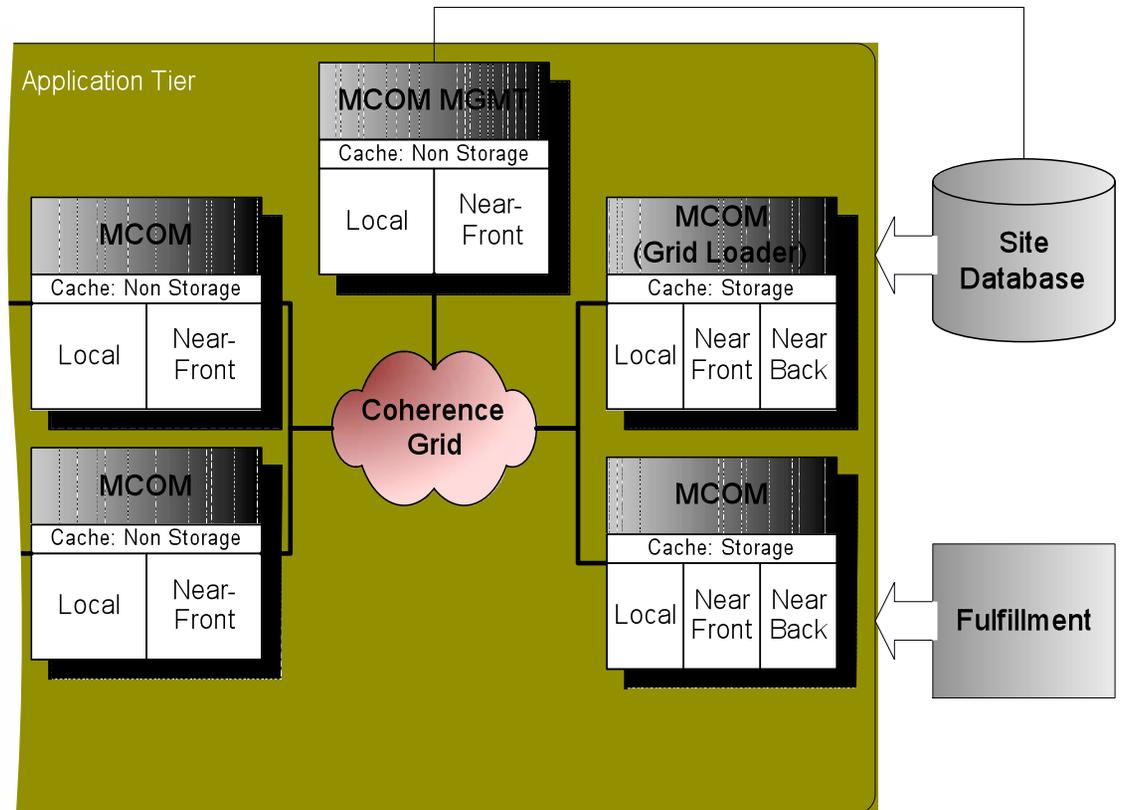
Initial Issue - 2:

- Each JVM has to update its local product availability
- Process ran on 15s timer
- Caused numerous contentions on availability table

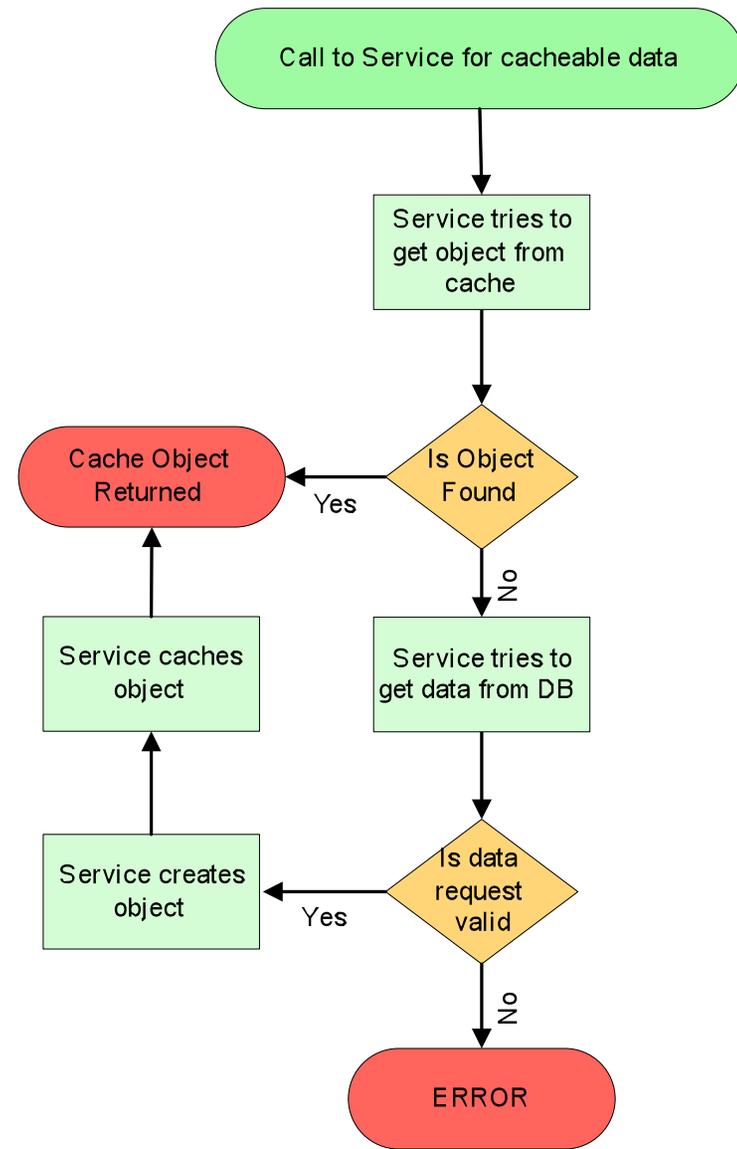


Solution:

- Connect all nodes to grid using mix of near and local caches
- Forward facing nodes are non-storage
- Single Data loader on back
- Single Availability process using Command Cache

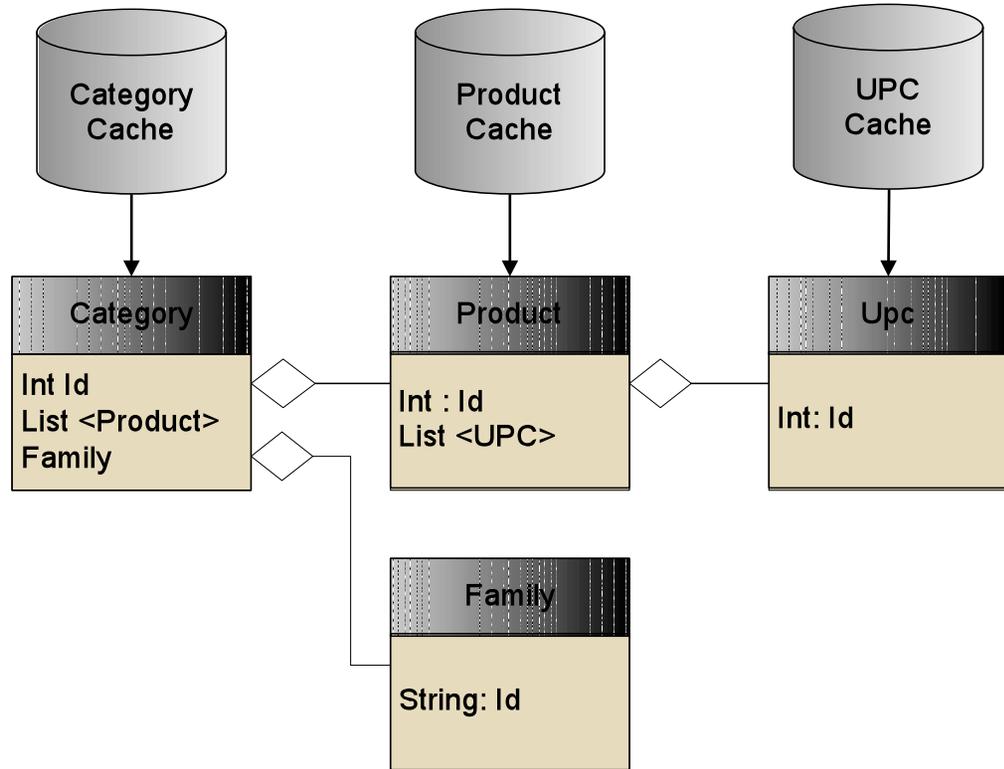


Implementation: Side Cache



Implementation: Traditional OOD

Cat 1
 Prod X
 UPC A
 Prod Y
 UPC B
Cat 2
 Prod X
 UPC A



Implementation: Traditional OOD

Category Cache

Cat 1

Prod X

UPC A

Prod Y

UPC B

Cat 2

Prod X'

UPC A'

Product Cache

Prod X''

UPC A''

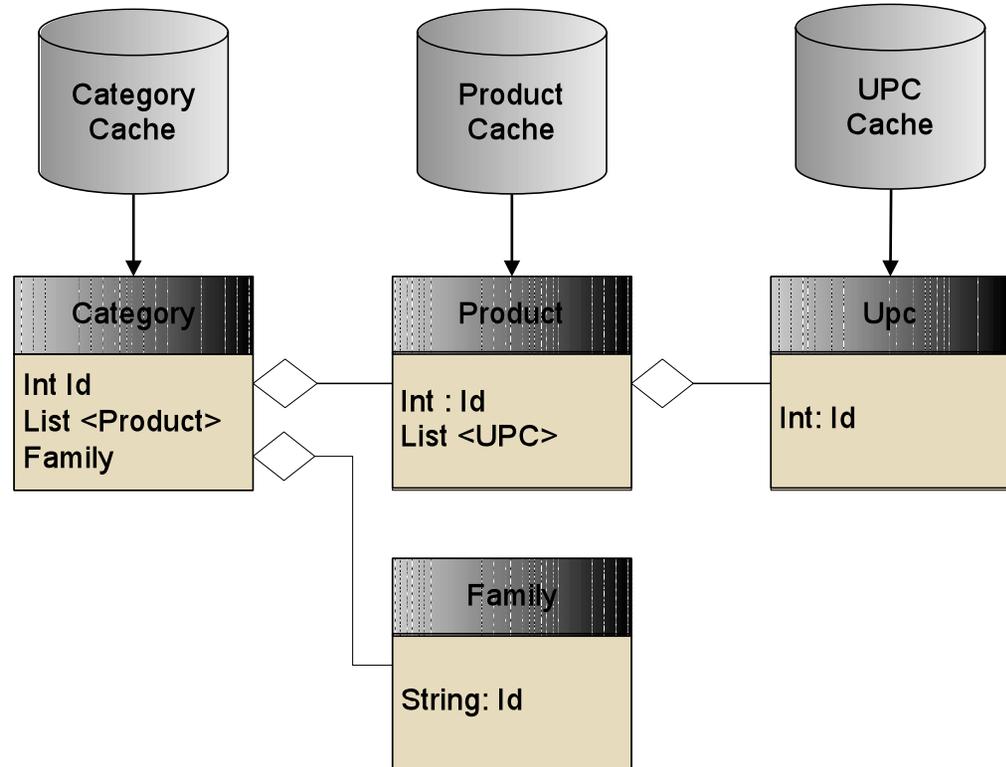
Prod Y'

UPC B'

UPC Cache

UPC A'''

UPC B''



Implementation: Modified OOD

Category Cache

Cat 1

Prod X.Id

Prod Y.Id

Cat 2

Prod X'.Id

Product Cache

Prod X

UPC A'.Id

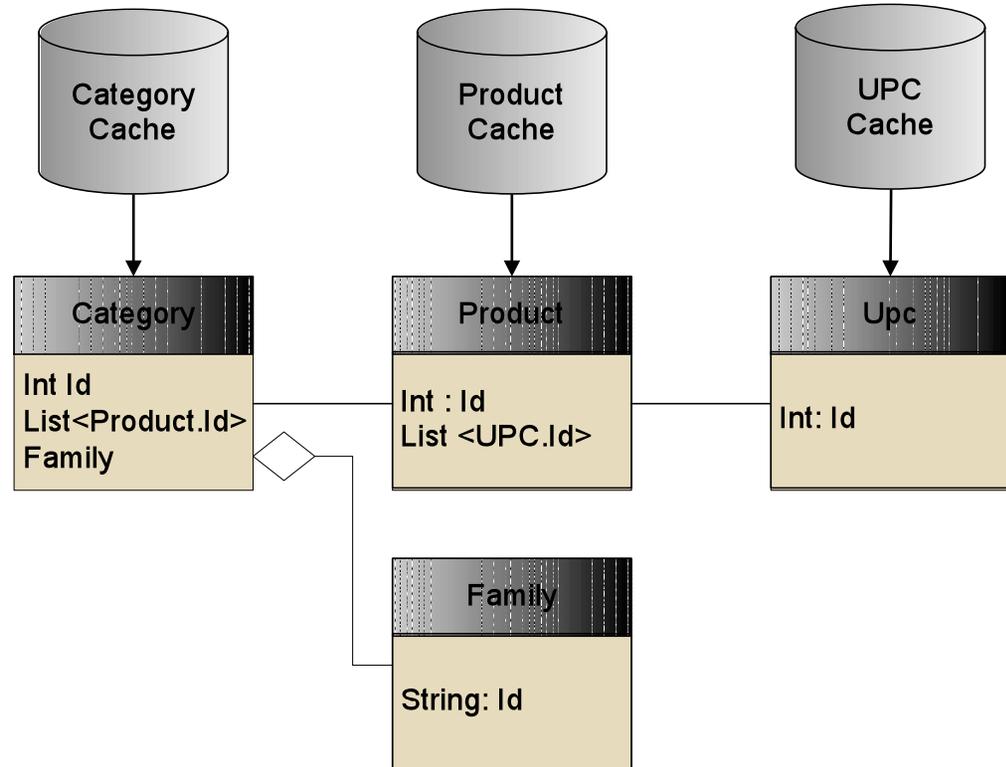
Prod Y

UPC B.Id

UPC Cache

UPC A

UPC B



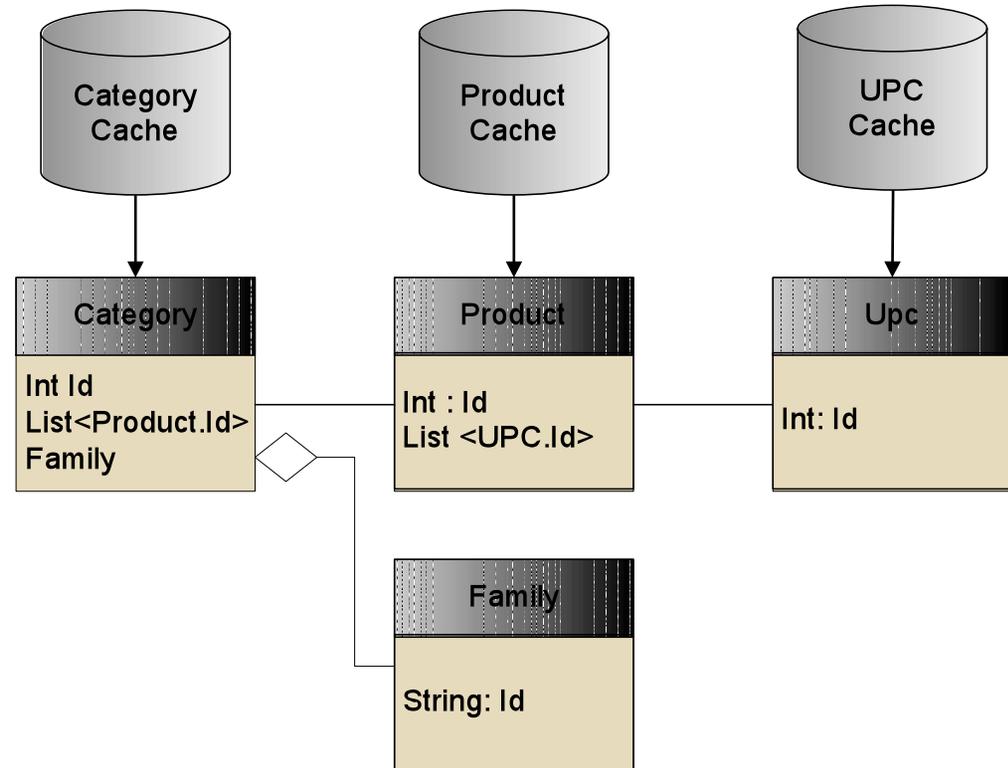
Object becomes responsible
for resolving Ids



Implementation: Flyweights

What about the Category to Family Relationship?

- Family fully contained by Category
- # of Family objects = # of Category objects
- Object bloat if unique # of Family is smaller than Category



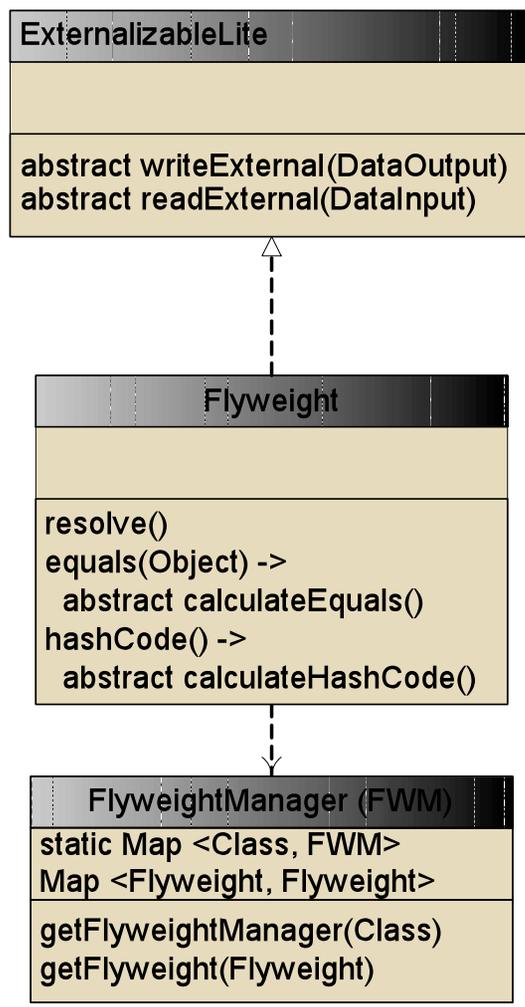
Implementation: Flyweights

FlyweightManager

- Maintains all FlyweightManagers by class
- Uses Map to look for a matching flyweight, if none then saves as new object

Flyweight

- Overrides equals(Object) and hashCode() to call abstract methods
- Method to resolve Flyweight into managed Flyweight



Implementation: Flyweights

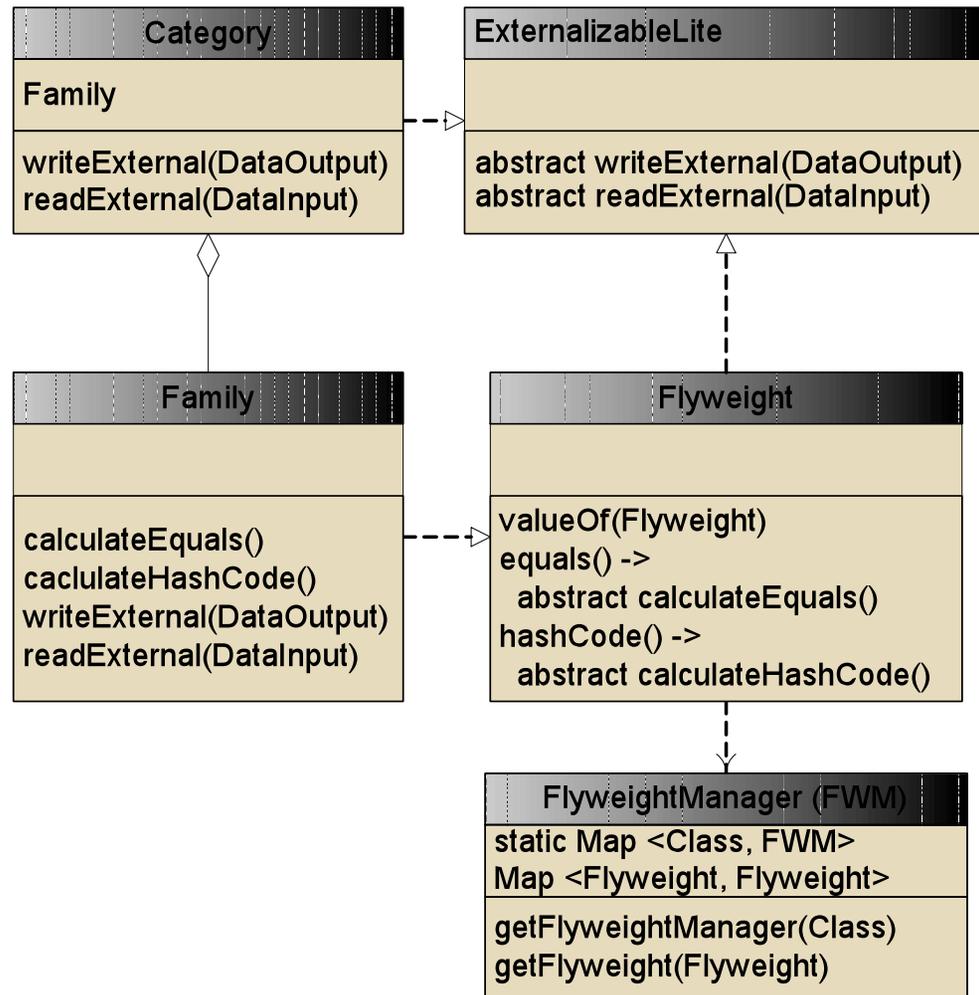
Implement Family calculate methods

- Compare uniquely identifying class members for equals.

Name and Status, not cached date

- Use same members to build hashCode

Using Apache's
HashCodeBuilder build
HashCode from Name
and Status



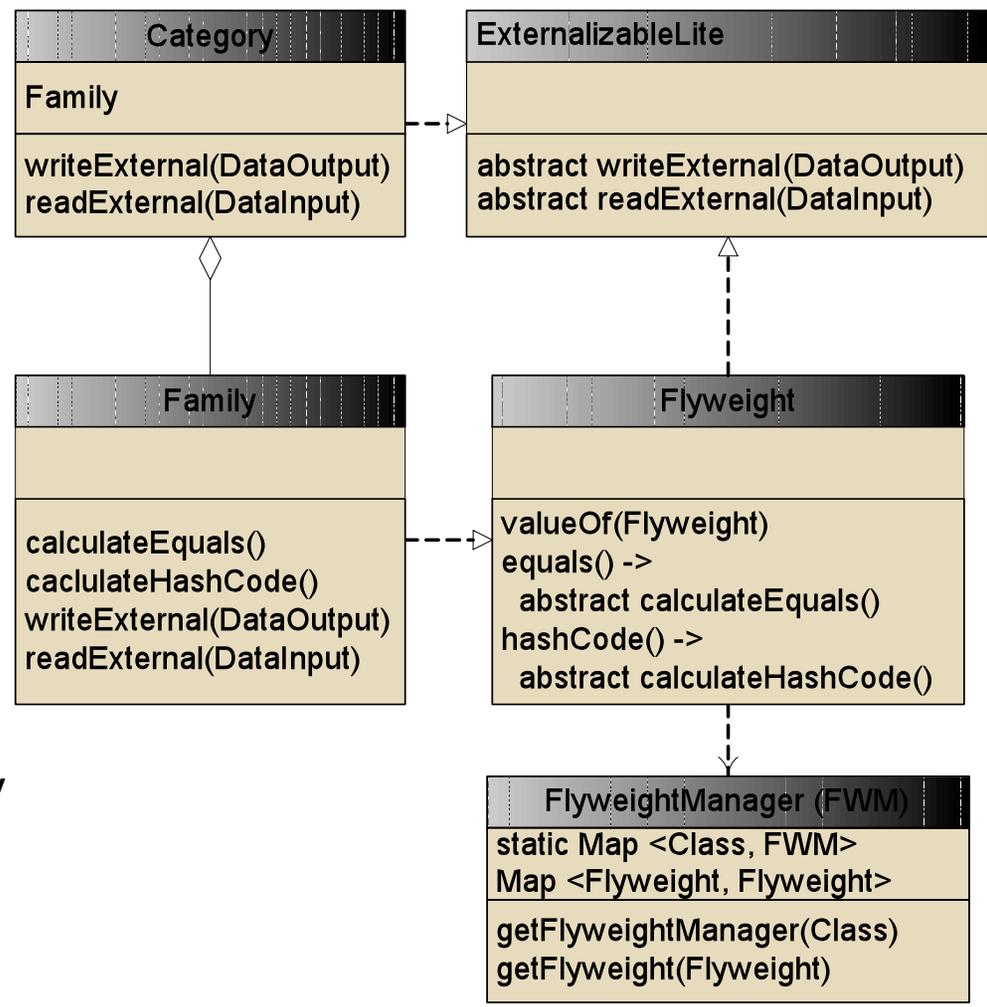
Implementation: Flyweights

Writing/Reading Family

- Nothing special, just write what belongs to Family and read in the same order

Writing/Reading Category

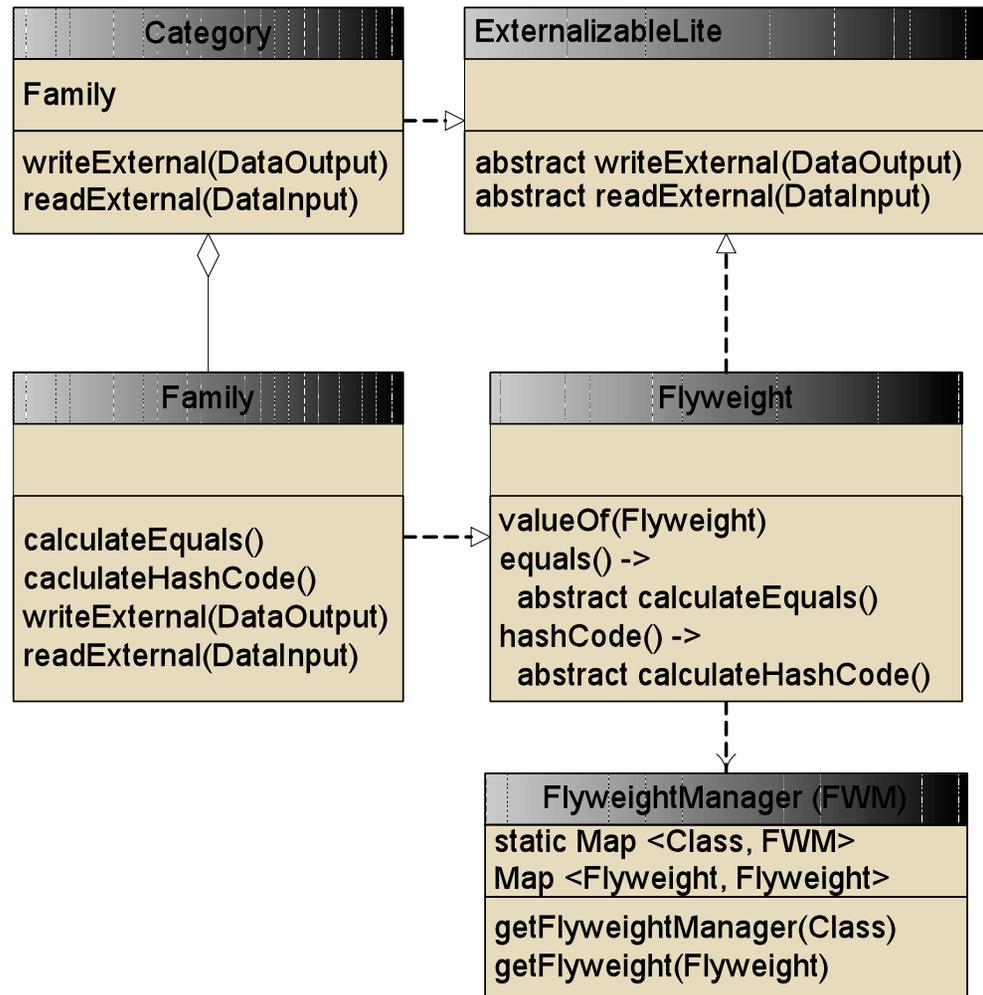
- Category writes contained Objects, including Family
- Read all Objects in same order. Call resolve() on Family and set to class family member



Implementation: Flyweights

Cost: duplication of Family on storage nodes

Benefit: reduced heap on front storage nodes.



Implementation: Spring Enabling

A brief introduction

Spring allows initialization and wiring of Objects (*beans*) by XML

Beans can define lifecycle methods and Spring will call them at the appropriate times.

All beans are contained by a *context*. Contexts may have parent/child relationships.

```
<beans xmlns="http://www.springframework.org/schema/beans"
       xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="
       http://www.springframework.org/schema/beans http://www
       http://www.springframework.org/schema/util http://www

<bean id="contextAggregator" class="com.macy.wis.mainte

<bean id="cacheClusterAdminService"
      class="com.macy.wis.services.caching.dataaccess.CacheClusterAdminService"
      init-method="performFullMaintenance">

  <description>Provides information for the cache cluster</description>
  <property name="serverInfo">
    <ref bean="serverInfoFactory" />
  </property>

  <property name="dataSource" ref="dataSource" />
  <property name="useInlineCacheCluster">
```



Implementation: Spring Enabling

Starting Coherence

Configure coherence using
System.setProperty()

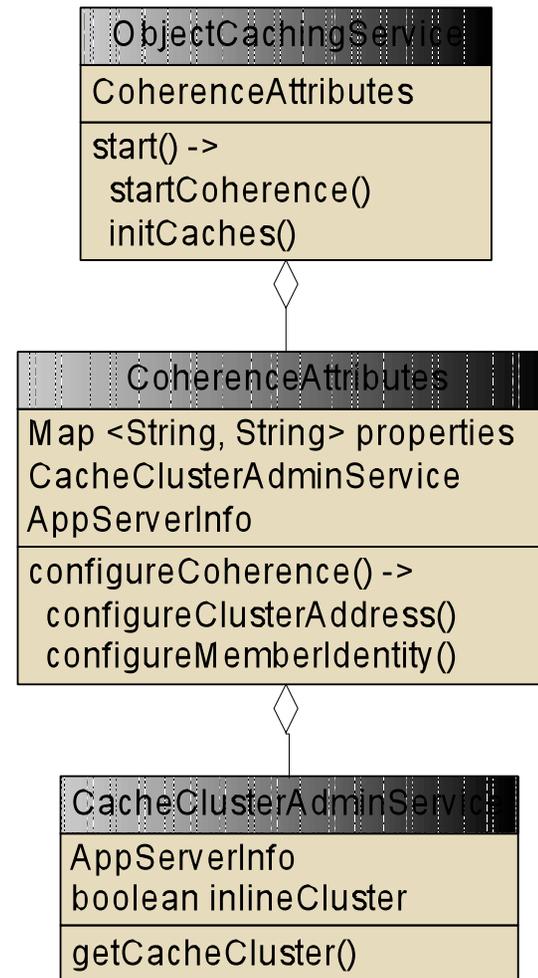
tangosol.coherence.clusteraddress

CoherenceAttributes.properties
directly injected

CacheCluster Use AppServerInfo to
define cluster address

InlineCacheCluster randomly
generates cluster address/port

DatabaseCacheCluster gets
cluster address/port from DB



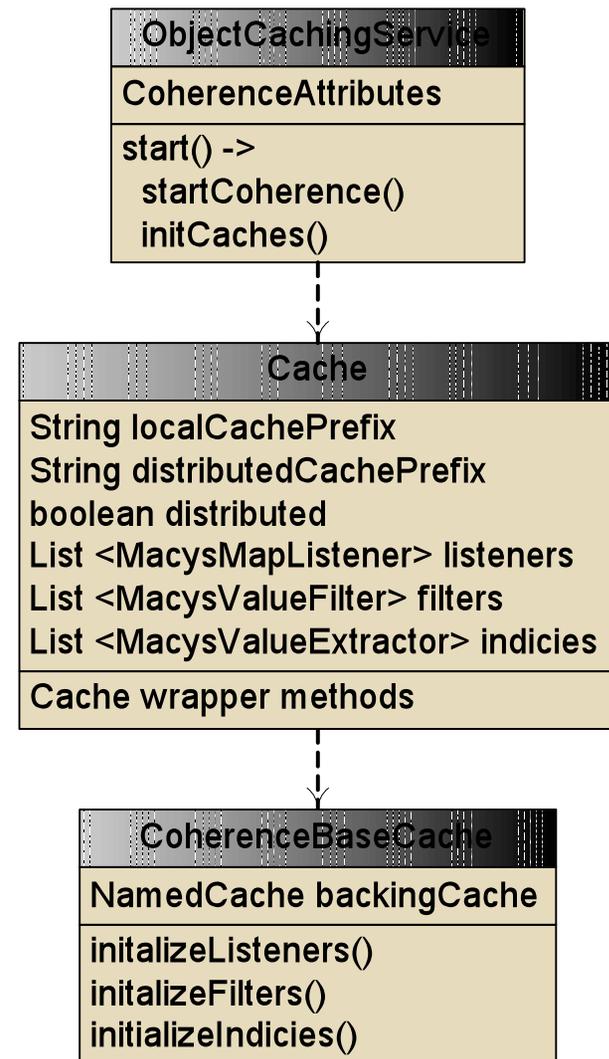
Implementation: Spring Enabling

Initializing Caches

ObjectCachingService iterates over *Cache* beans defined within Spring context calling *init()*.

Cache.init() creates backing cache, uses *<prefix>-beanName* as cache name and passes in listeners, filters, and indicies.

CoherenceBaseCache calls *CacheFactory.getCache* with name then initalizes its listeners, filters, and indicies.



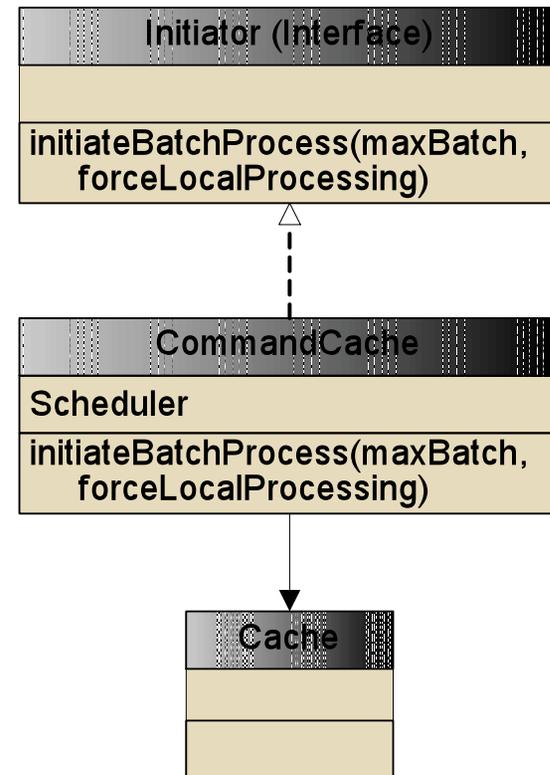


Implementation: Command Cache

Use Case: Product is no longer available. Change might trigger a series of tasks, and prefer to have work done close to the UPC data.

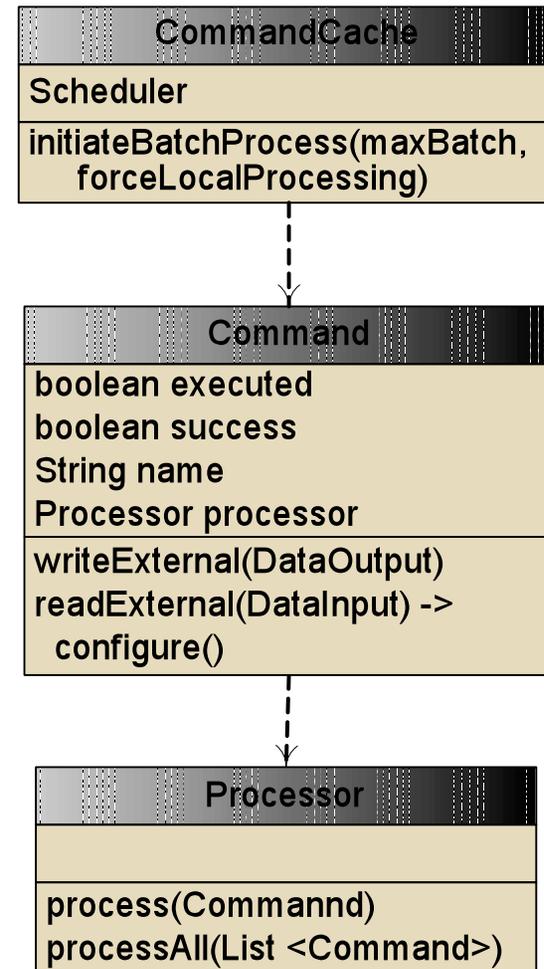
Implementation: Command Cache

- CommandCache uses an outside Scheduler (Quartz) because CachingService threads are reentrant and might cause deadlocks.
- Scheduler is only defined on storage nodes ensuring separation
- CommandCache locks itself when processing, blocking other nodes
- Can force processing to nodes that contain commands, otherwise done by FIFO.



Implementation: Command Cache

- Command requires a name. Used by configure() to find its Processor from Spring.
- At initiateBatchProcess Filter is used to select non executed commands
- Commands are grouped by Processor
- Processor executes each command within its group



Implementation: Monitoring

RTView for Coherence

- Provides great visibility into cache activity
- Provides customized screens functional group drill downs and heat maps.

Special issues:

- Data overload due to large number of caches
- Compatibility with JDK 1.4



Implementation: Monitoring

RTView for Coherence

- Provides great visibility into cache activity
- Provides customized screens functional group drill downs and heat maps.

Special issues:

- Data overload due to large number of caches
- Compatibility with JDK 1.4



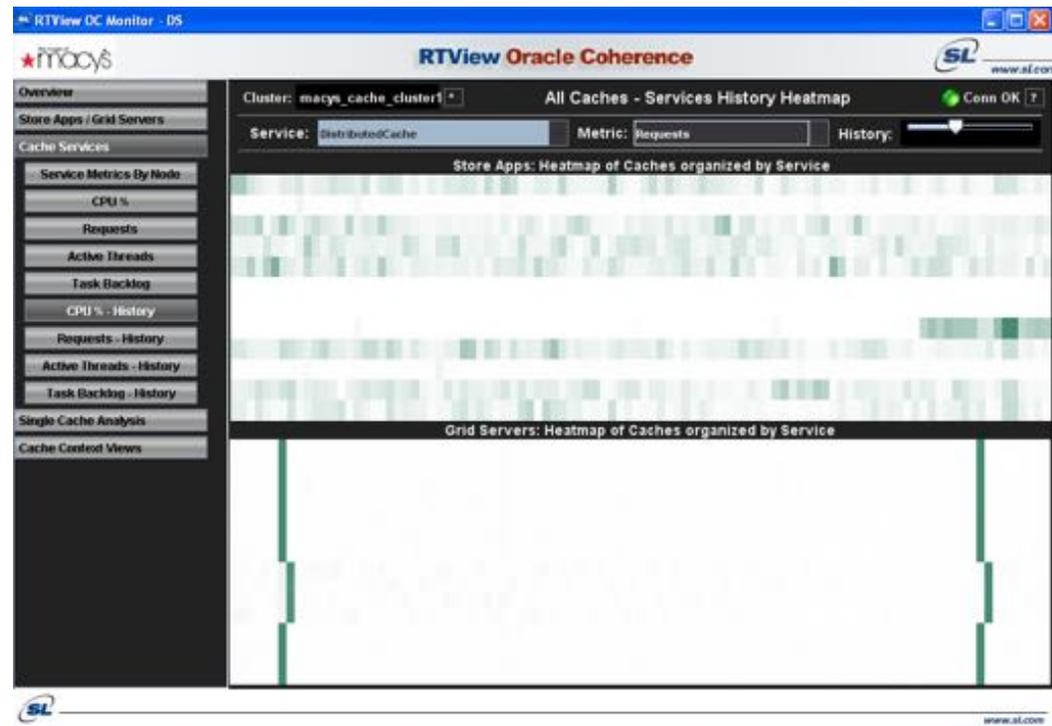
Implementation: Monitoring

RTView for Coherence

- Provides great visibility into cache activity
- Provides customized screens functional group drill downs and heat maps.

Special issues:

- Data overload due to large number of caches
- Compatibility with JDK 1.4



Findings:

- Too much cache wrapping makes Coherence difficult to extend
- Difficult to trace problems down into coherence layer.
- Provides for centralized runtime management of the application

Tomorrow: Personalization



Personalized links display based upon Janet's shopping interests and behavior/pattern.

Janet's personalized content.

The screenshot shows the Macy's website interface. At the top, it says "the magic of macy's" and "we're on facebook! become our fan". A navigation bar includes categories like "for the home", "bed & bath", "women", "men", "juniors", "kids", "beauty & fragrance", "shoes", "handbags & accessories", "jewelry & watches", and "sale". A search bar contains the name "Janet" and a personalized message: "Janet, welcome! Checkout your macy's (Not Janet?)". A large red banner advertises "FREE SHIPPING on fantastic finds you need right now!". The main content area features a large "ONLINE FASHION CLEARANCE SAVE 50-75%" promotion. Below this, a grid of personalized links is shown, with red arrows pointing to it from the text on the left. The links are: women (sweaters, tops, jeans), men (pants, suits, jackets), and kids (girls 2-6x, shoes). To the right, there are sections for "Top Finds for You" and "Recently Viewed", each displaying product images and prices. The footer contains customer service links, credit card information, store locations, and a "thanks for shopping" message with a 10% rewards offer.



Tomorrow: Service Delivery Platform

Oracle Coherence is a key enabler of the new, agile, SOA architecture

Services use Near Cache allows accelerated random access to the grid

Grid used as the transport media for event exchange
Special issues:

