Transfers & Activity Bank
3 April 2014
Coherence Special Interest Group

Coherence with HotCache Implementation

TUI Travel PLC
Accommodation & Destinations

Who we are

activities
transfers & experiences

- Transfers and Activities Bank is a new business unit inside Hotelbeds division, TUI Travel PLC Accomodation and Destination Services.
- We were born in June 2012
- We have an aggressive business plan with a growing perspective between 80 and 100% every year.
- Oracle Weblogic 11g, Coherence 3.6 and Exadata were already present in the organization, but we went to 12c.
- We needed to plan a new architecture to fastly deliver our product to our integrated clients and grow fast with the business.

Business overview and Strategy

In 2015 is forecasted to have +250% more Transfers routes and approximately 140% increased in Transfers TTV

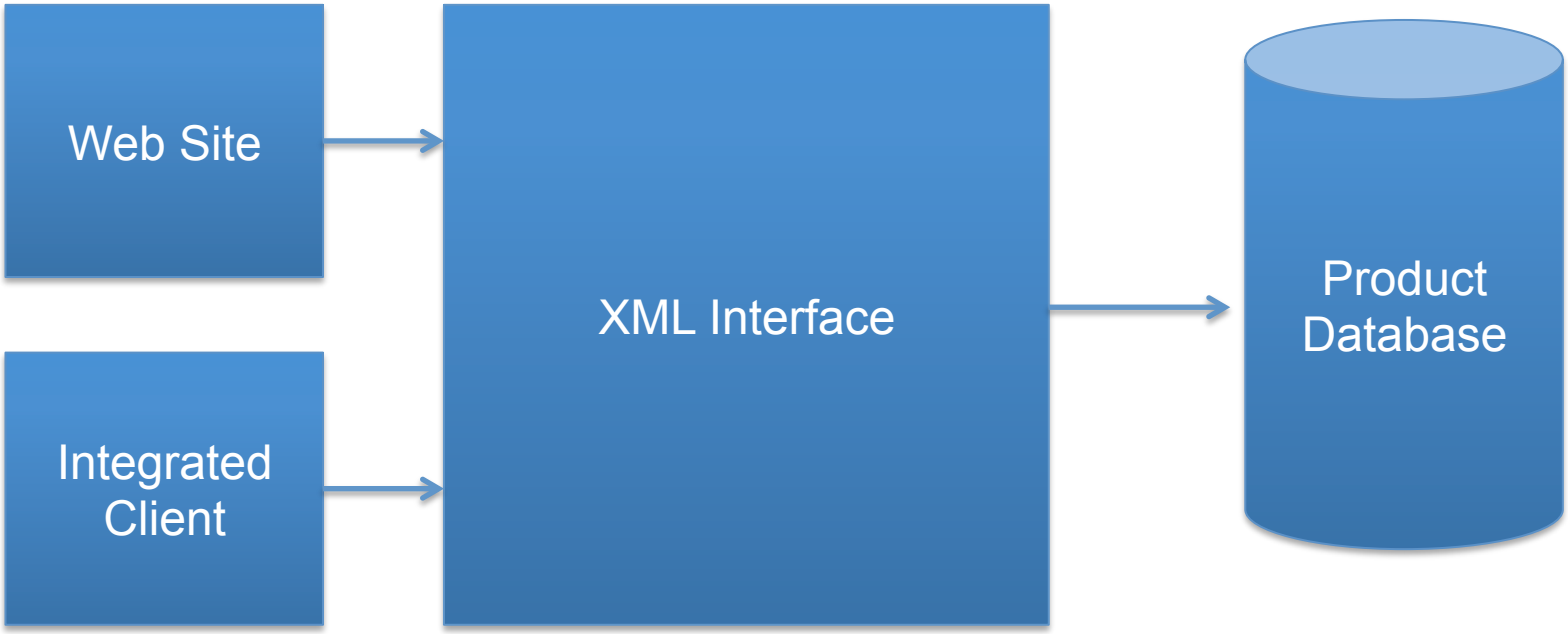
Production Environment

activities
transfers & experiences

- Two datacenters connected at 10Gbs
- 4 + 4 Weblogic 12c Servers. 24 CPU Cores per server = 288 CPU cores.
- 1 + 1 Coherence 12c Servers. 64 GB per server = 128GB.
- Exadata
- F5 Big IP Load balancers

(Very) High level architecture model

activities
transfers & experiences



Product delivered through XML platform and consumed by our websites and integrated clients

Decision: 3 – Tier Architecture + Coherence Caché

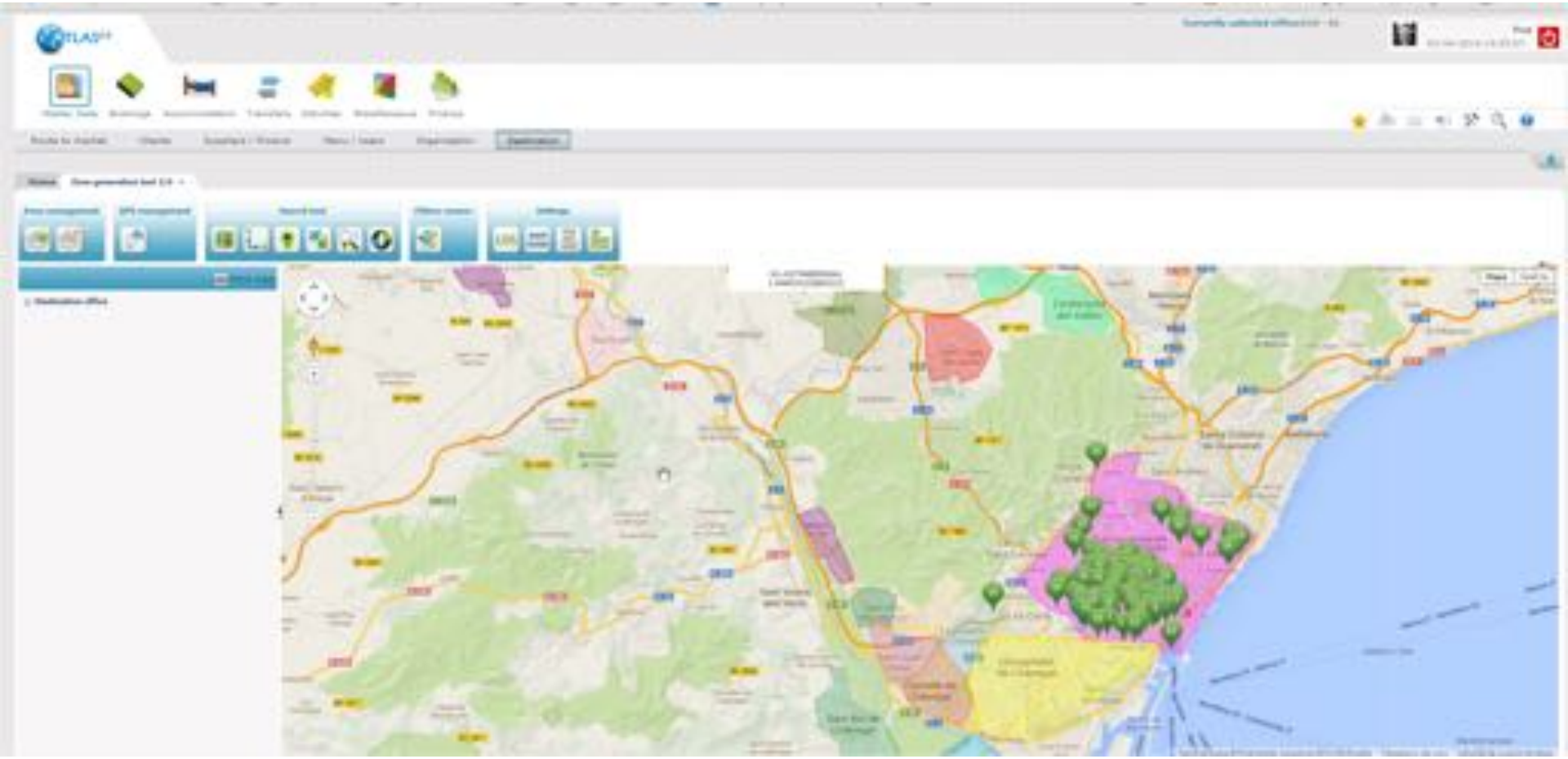
activities
transfers & experiences

- Classical JEE approach:
  - User Interface (Web or REST interface)
  - Business layer (EJB 3.1)
  - Data Layer (JPA + MyBatis)
- Fits perfectly into a WL based infrastructure
- Database in the Exadata
- Coherence support for:
  - Cache (Data)
  - Grid (Heavy calculation)
- Software Packaging with EAR + GAR
  - Eases deployments in WL + Coherence

Our backoffice (ATLAS) developed in ADF

activities
transfers & experiences

Users can define the transfer and activities areas in a map



Problems solved with Coherence

activities
transfers & experiences

- Deliver availability by using GPS points and polygons
- Store contents (text) for transfers and activities
- Perform fast searches in the contents stored
- Scale horizontally

Transfers Quotation

- Quotation for transfers can be perfomed:
  - From an airport to an hotel
  - By using arbitrary GPS Points (door to door)

- Our contracts are based in zones and we converted the zones in polygons over a map by using an ADF based user interface

- The zones containing the GPS Zones needed to be resolved to provide the quotation for all the transfers available

- Point in Polygon was developed to be executed into the Coherence 12c Grid

- A fully packaged EAR with a GAR is deployed to the WL and Coherence servers by using the WL administration console. Deployments are fast and easy.

Response Times

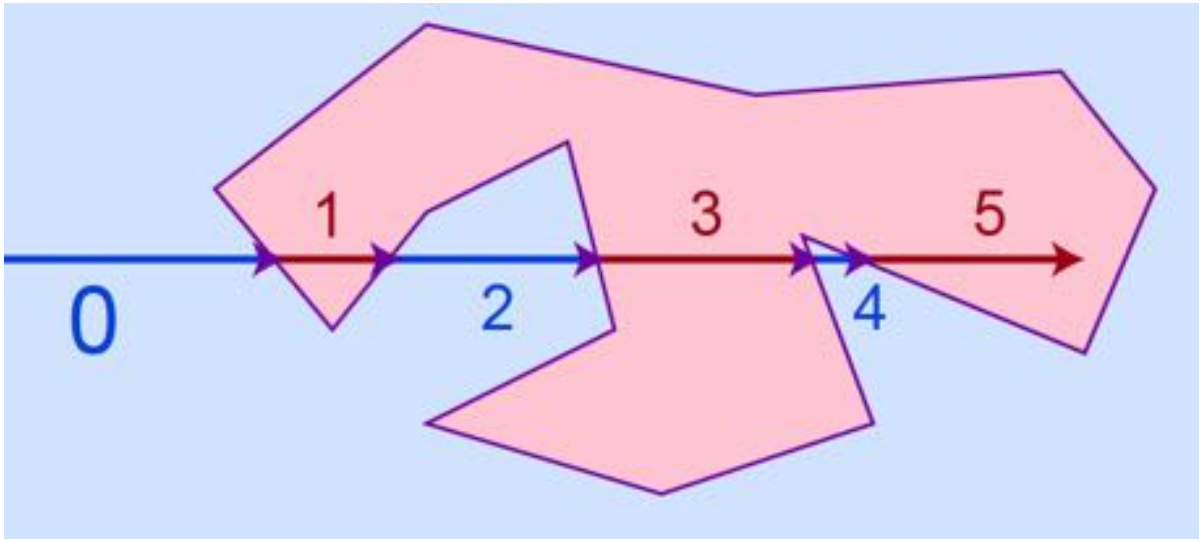
- First tests performed were spectacular:
- 7 miliseconds for WL to return all the products available
- Sub milisenconds to execute point in polygon for 500.000 polygons around the world (see next slides)
- 0,7 seconds to deliver contents while searching into the contents cache

Find the zone(s) that contain a given point

- Preliminary definitions
  - Zones are defined geographically using polygons
  - Polygons are stored in an Oracle Database as SDO_GEOMETRY objects
  - A point is a set of geographic coordinates (latitude, longitude)
  - Zones can overlap, so a given point could lie in zero, one, or more zones
- Use case: find the zone(s) that contain a given point
- Obvious solution: this can be done in SQL using the Spatial Operator SDO_CONTAINS and creating R-tree SPATIAL_INDEX indices
- Constraints: the response time is crucial while calculating availability and we don't want to put more load on the database. Everything else runs in-memory.
- Chosen solution:
  - All the polygons are pre-loaded in a partitioned Coherence storage
    - They are kept up to date by reloading them periodically
    - A bounding box is calculated for each polygon on load
  - The search algorithm is run in grid
    - For a given point, each node runs the PiP algorithm on all its polygons
    - Only the polygons containing the given point are returned
    - Optimization: the bounding box is checked first. This safely discards many polygons without actually running the PiP algorithm on them.

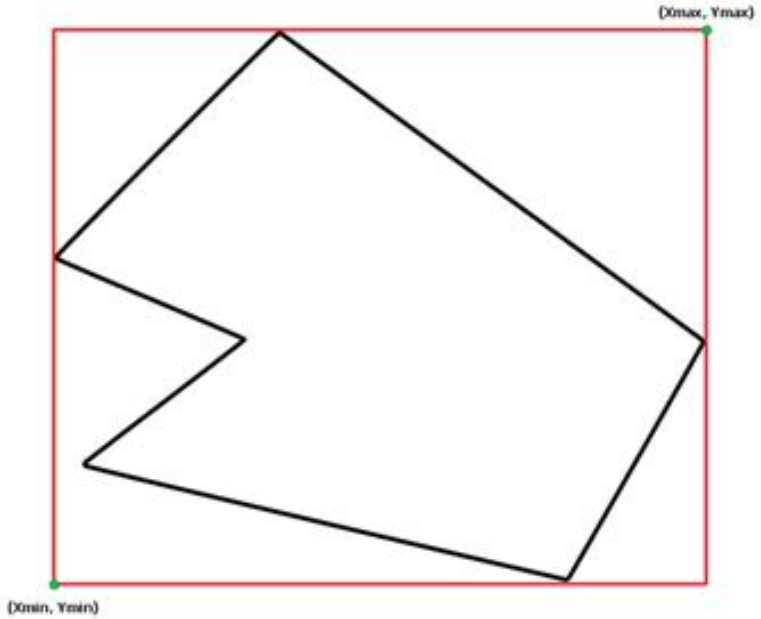
Point-in-Polygon (PiP): the Ray Casting Algorithm

- Is a given point inside or outside a given polygon?
  - Cast a ray starting from the point and going any fixed direction
  - Test how many times the ray intersects the edges of the polygon
    - If it's odd the point is inside the polygon.
    - If it's even the point is outside the polygon.
- This can be implemented by calculating and counting the intersections between the ray and the edges.
- Computational cost: O(N) for N-sided polygons (floating point products).

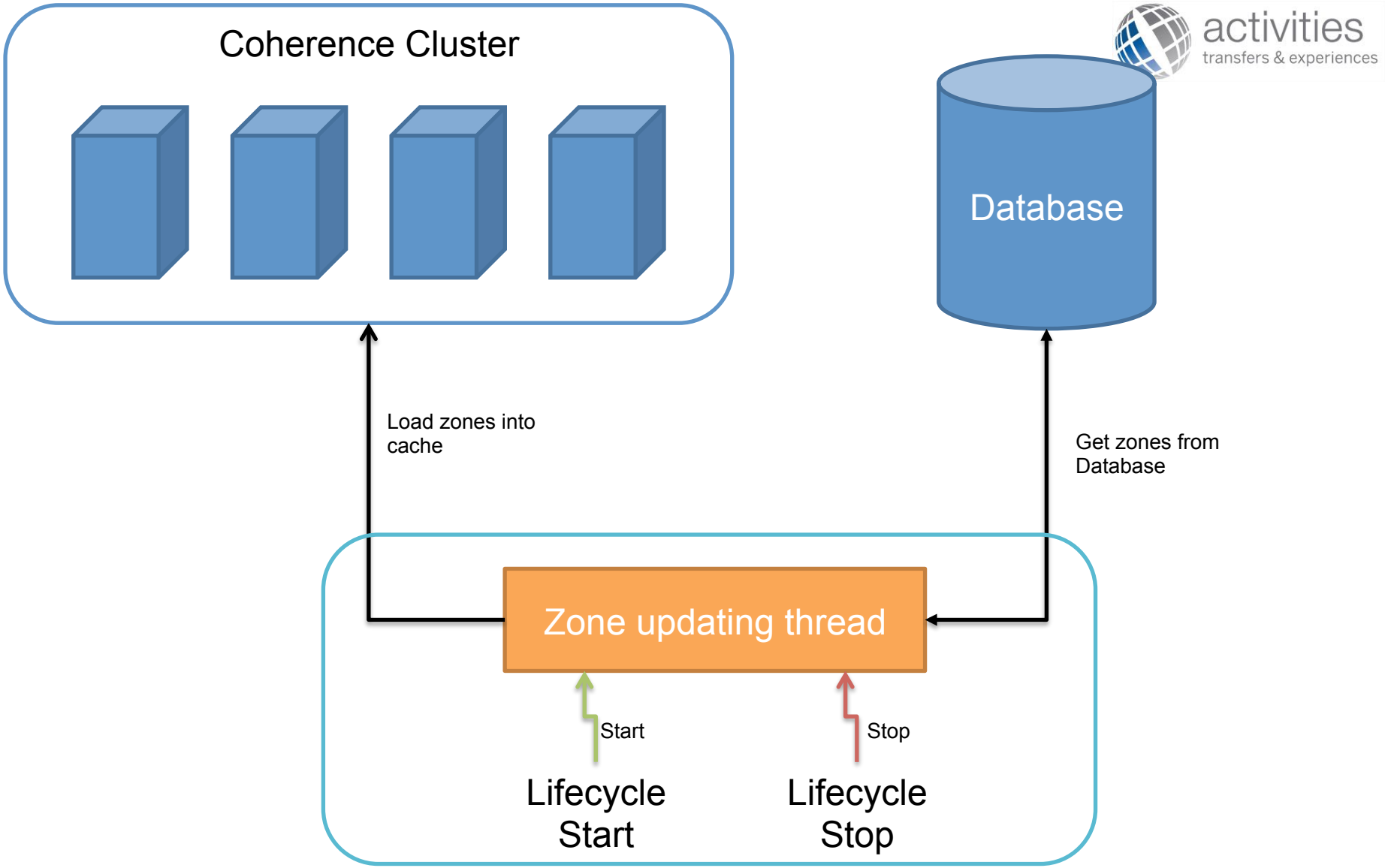


Bounding box

- The bounding box is *the minimum rectangle enclosing a given polygon*
- If the polygon vertices are N points (xi, yi) for i = 1…N, the bounding box is defined by the minimum (Xmin, Ymin) and the maximum (Xmax, Ymax).
  - Computational cost: O(N) for N-sided polygons (floating point additions).
- If a point lies inside a bounding box it **may** be inside the polygon so the PiP algorithm is required. But if a point lies outside a bounding box it **must** be outside the polygon and no further testing is required.
- Testing if a point lies inside a bounding box is as simple as testing if its (x, y) are bigger than (Xmin, Ymin) and smaller than (Xmax, Ymax).
  - Computational cost: O(1)

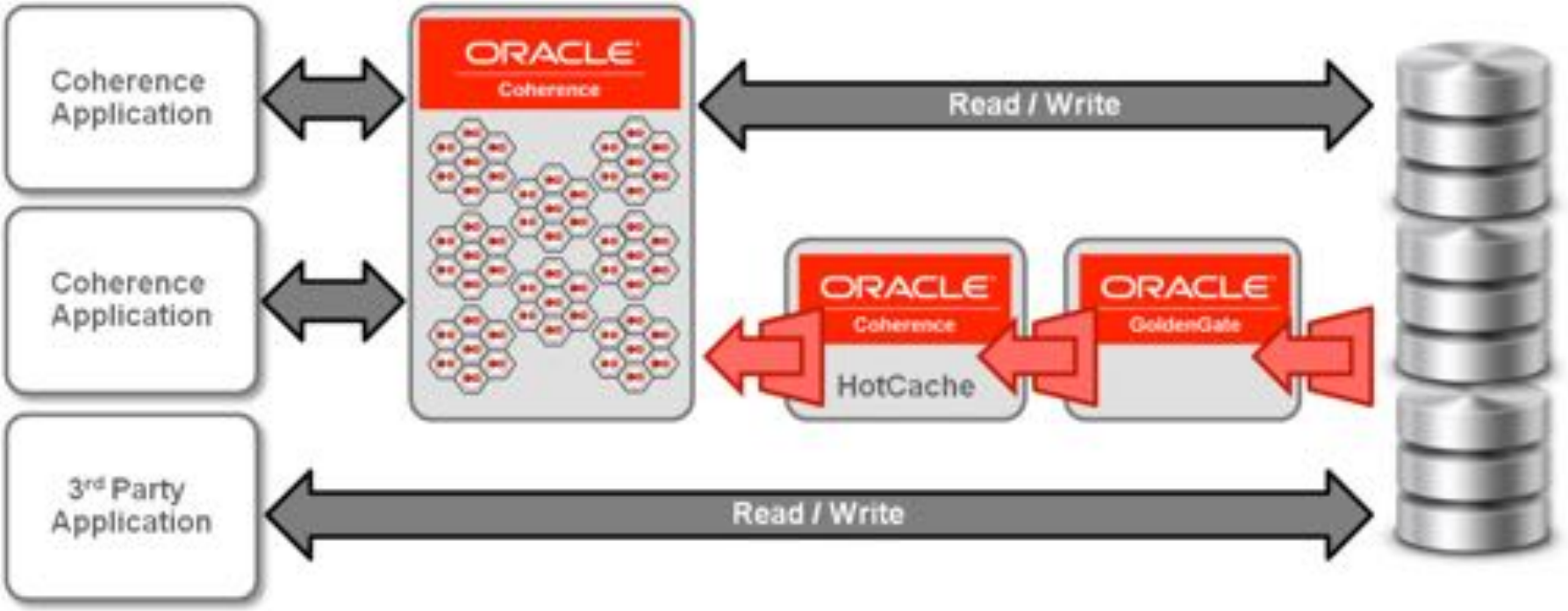


Zone loading: First approach



Improvement: HotCache

activities
transfers & experiences



activities
transfers & experiences

Questions?

activities
transfers & experiences

THANKS!!