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Transforming the Reconciliation Process

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Agenda

- What is the Reconciliation Process?
- The types of Reconciliation
- Why do we need to “Transform” it?
- Will a Data Grid help?
- Introducing Event-Based Reconciliation
- Demonstration
- Next Steps?

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What is Reconciliation?

What is Reconciliation?

- **Reconciliation:**
  “The process of comparing and matching figures from your records against those presented on a statement issued by a third party” - Wikipedia.

- **Purpose:**
  “… allow detection of possible discrepancies.”

- **Why:**
  Discrepancies == Risk and/or Loss

Two causes of “discrepancies”

Accidental

Deliberate

Failure to Reconcile increases Risk

- **Observation 1:**
  As the time between completed reconciliation processes ➔ ∞, potential losses tend to ➔ ∞

- **Observation 2:**
  Continuing to trade without knowing how much money you really have is really stupid (and often illegal)

Examples

- **Example 1:**
  Hedge Fund reconciled trading charges each quarter. At the end of a quarter discovered they overpaid $250,000. The broker could not repay the over payment immediately.

- **Example 2:**
  Investment manager failed to regularly reconcile positions with custodian. Trader managed to personally trade (and lose) investment funds

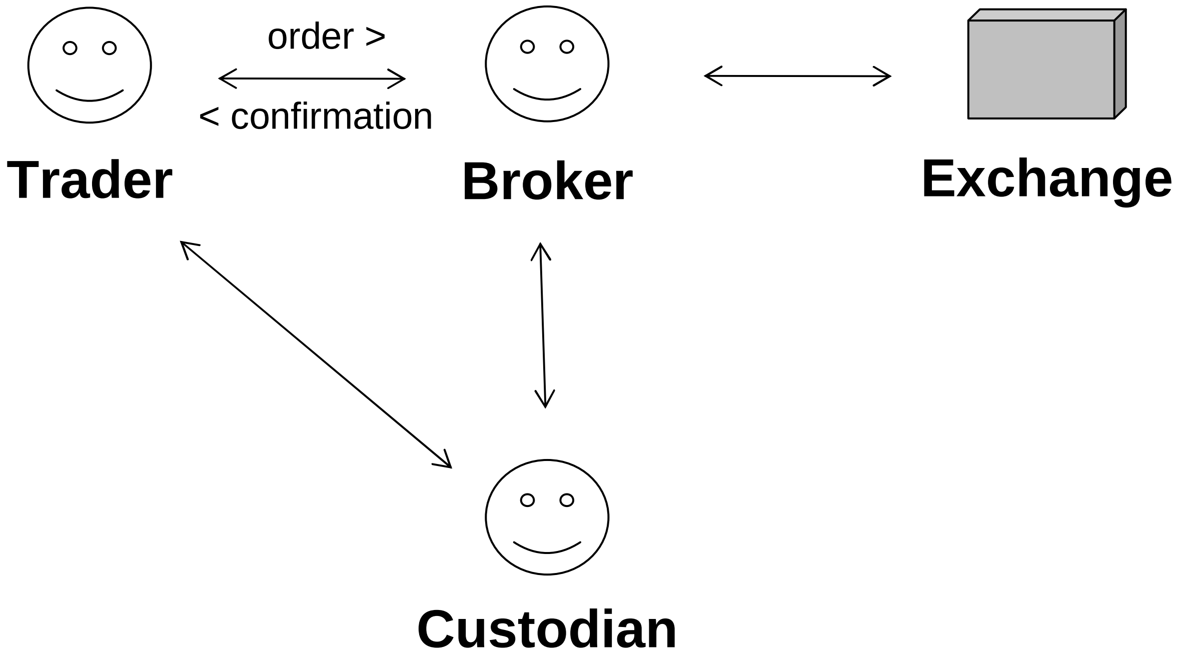
  ie: insider trading

Examples

- **Example 3:**
  Bob Cratchit (A Christmas Carol) could not go home on Christmas Eve until the bank reconciliation had been completed (for Ebenezer Scrooge)

Types of Reconciliation

Trading Relationships



Types of Reconciliation

- **Trade Reconciliation:** Do the trade confirmations (from our brokers) match our instructions (ie: orders)?
- **Position Reconciliation:** Does our position match what is held by the Custodian(s).
- **Cash Reconciliation:** Does the cash generated/lost by our trading match our bank balance?
- **Charges Reconciliation:** Do the charges/taxes we have to pay match our estimate(s)?

Reconciliation Gotcha’s

- “Perfect” matching may not be possible

- **One Possible Scenario:**
  - Trader:
    - Buy 1000 ORCL @ $13.50 (order id: 1)
  - Broker:
    - Confirm 600 ORCL @ $13.70 (order id: 1)
    - Confirm 100 ORCL @ $13.80 (order id: 1)
      <delay of several hours or a day!>
    - Confirm 200 ORCL @ $14.00 (order id: 1)
    - Confirm 100 ORCL @ $13.50 (order id: 1)

Reasons to “Transform” the Reconciliation Process?

The desire:

Real-time Risk Assessment!

Current Reconciliation Processes…

- Use client + server architectures
  - “Clients” perform the matching (move a lot of data)
- Use disk-based storage (flat files, databases)
  - Good Capacity (for handling trades)
  - Poor Performance (for matching)
- Are batch-based
  - Usually and over-night process
    (not real time)
  - May not complete in time for the next day
    (when volumes spike)

Possible Solution…

- Solution: Just do matching in memory?

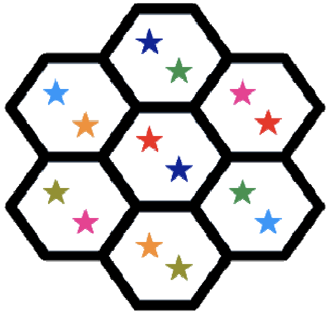
- How to address the…
  - Capacity Challenge?
  - Availability Challenge?

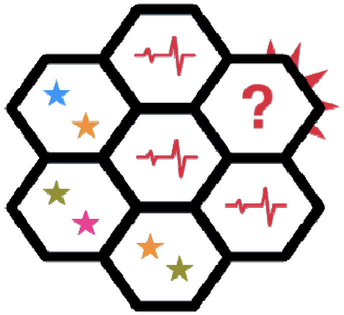
- Will a Data Grid help?
  - Solves Capacity Challenge (spreads trades across servers)
  - Solves Availability Challenge (iff resilient Data Grid)

Introduction to Data Grids

Oracle Coherence: A Unique Approach

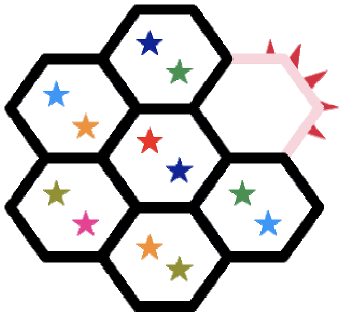
- Data is automatically partitioned and load-balanced across the Server Cluster
- Data is synchronously replicated for continuous availability



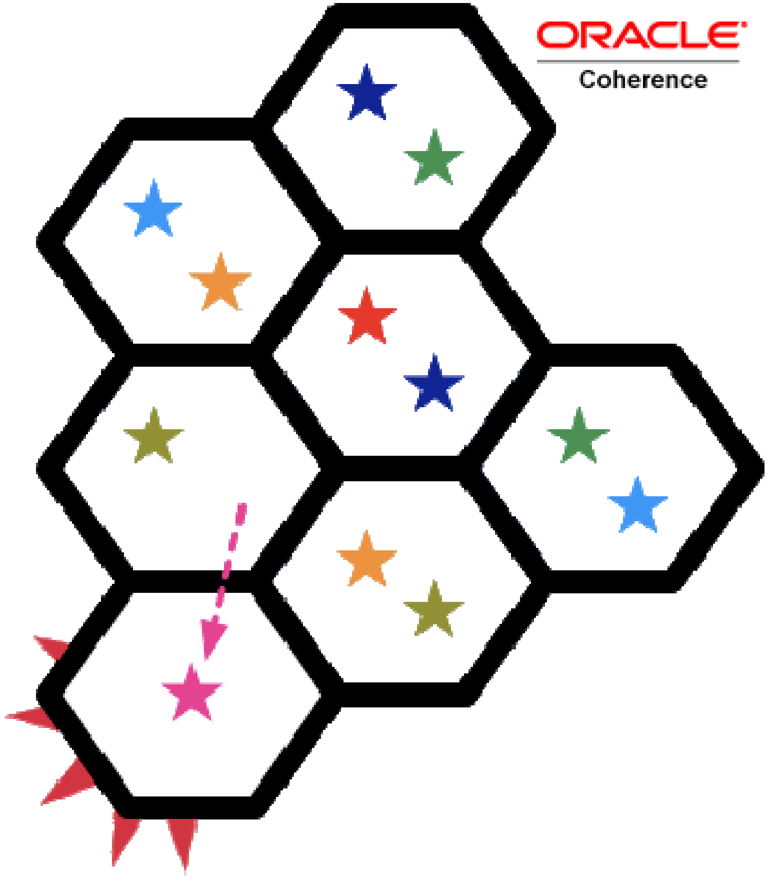


- Servers monitor the health of each other
- When in doubt, servers work together to diagnose status

- Healthy servers assume responsibility for failed server (in parallel)
- Continuous Operation: No interruption to service or data loss due to a server failure

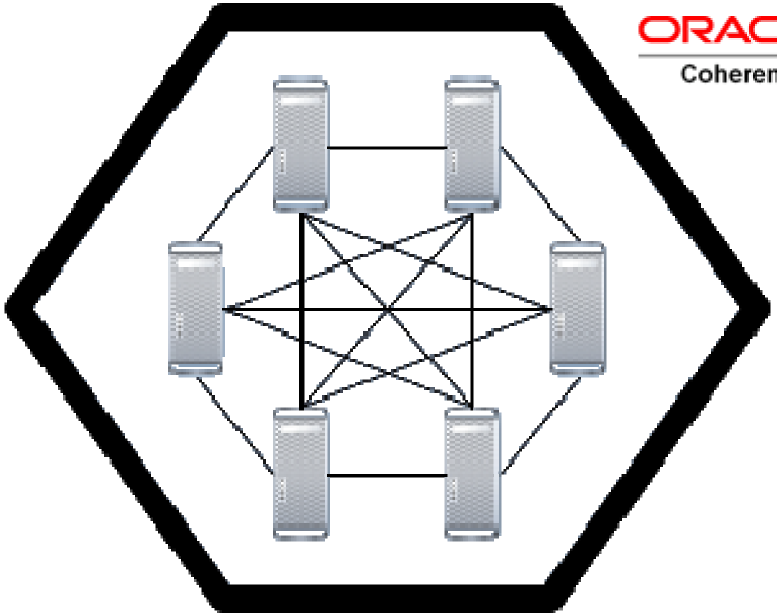


Oracle Coherence: A Unique Approach



- Dynamically scale-out during operation
- Data automatically load-balanced to new servers in the cluster
- No repartitioning required
- No reconfiguration required
- No interruption to service during scale-out
- Scale capacity and processing on-the-fly

Oracle Coherence: A Unique Approach



ORACLE Coherence

- Peer-to-Peer Clustering and Data Management Technology
- No Single Points of Failure
- No Single Points of Bottleneck
- No Masters / Slaves / Registries etc
- All members have responsibility to;
  - Manage Cluster Health & Data
  - Perform Processing and Queries
  - Work as a “team” in parallel
- Communication is point-to-point (not TCP/IP) and/or one-to-many
- Scale to limit of the back-plane
- Use with commodity infrastructure
- Linearly Scalable By Design

Will a Data Grid really help?

- **Observation 1:** Client + Data Grid architecture for matching won’t really help.
  - Problem: Network Latency becomes the bottleneck
  - Solution: Avoid moving all Data to the client. Have Data Grid perform matching **(in-place)**

Will a Data Grid really help?

- **Observation 2:** Matching Algorithms are often O(n^2).
  - Problem: Matching is essentially a “join” operation (compare all trades with all other trades)
  - Problem: In a Data Grid, a naïve “join” means every server talking with every other server.
  - Solution: Exploit parallelism of the Data Grid (ie: map reduce) and use Batching where possible.

Introducing Event-Based Reconciliation

How To: Event-based Reconciliation

- **Step 1: Loading**
  Load Trades into Data Grid as they are received (in real-time)

- **Step 2: Event processing triggers matching**
  When STREET trades are received, use map-reduce (in parallel) across the Grid to find potential matches to HOUSE trades

- **Step 3: Acknowledge Matches (in place)**
  Use in-place-updates (Entry Processors) to perform signal matches.

Event-based Reconciliation

- **Step 4: Use Events to Observe Reconciliation**
  Monitor the reconciliation process using Data Grid update events

- **Step 5: Use Data Grid Queries for Reports**
  Use Data Grid queries to produce real-time reports (reports executed in parallel)

Demonstration

Next Steps?

Next Steps?

- Opportunities for reducing network traffic
  - Increase “Batching”
    (batch updates instead of one-at-a-time)
  - Use Partition-based Map Reduce
    (reduce “entire” grid queries)
  - Use Data Affinity
- Graphical Front-End (excel integration)
- Release onto Coherence Incubator

Thanks…

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