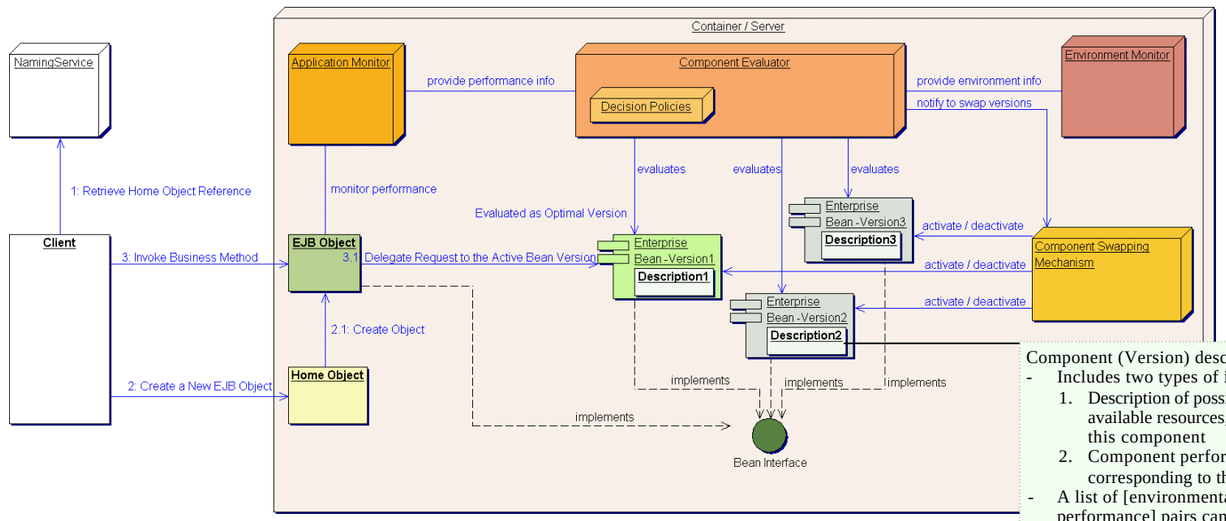
Component Redundancy for Adaptive Software Applications

Ada Diaconescu, John Murphy

Performance Engineering Laboratory

Examples are based on the Enterprise Java Beans (EJB) component technology

Framework Overview – Calling Components



Application Monitor (ApM): ApM

- Monitors the application performance:
  - Continually: monitors the overall performance of application transactions – by monitoring the transaction 'entry-point' components.
  - When overall performance decreases, or periodically: monitors the performance of each component involved in each transaction. Individual component performances influence the overall transaction performance.
- Notifies the CE upon exceptional performance related events (e.g. dramatic component performance decrease or variation)

Environment Monitor (EnM): EnM

- Monitors environmental conditions. These include the available resources (e.g. memory, storage, communications bandwidth, or processing) and the number of client requests for each transaction.

Component Swapping Mechanism (CSM): CSM

- Swaps component versions at run-time, keeping state and reference consistency.

Component Evaluator (CE): CE

- Updates the description information of the active component versions – uses performance information from the ApM and environmental information from the EnM. Different component versions might be faulty in certain (environmental) conditions. The CE learns how to use the component versions to complement each other.
- Evaluates component versions and determines the optimal one in certain conditions
- Decides when component versions need to be swapped
- Notifies the CSM to activate/ deactivate component versions.

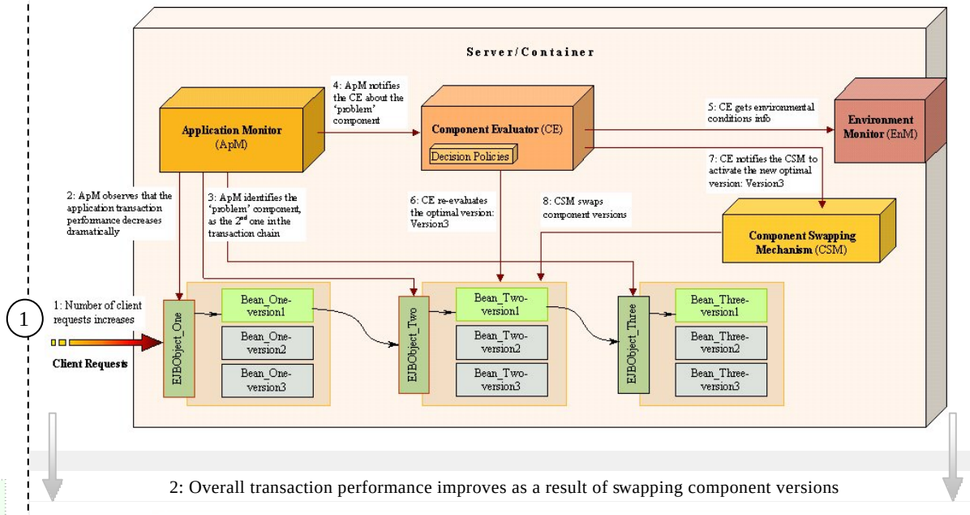
The CE decides to swap component versions, based on:
- Performance information on the current active and passive component versions
- Information on the current environmental conditions–from the EnM.
- Decision Policies - specify in what conditions component versions are to be swapped.

Component (Version) description:
- Includes two types of information:
  1. Description of possible environmental conditions: available resources, number of client requests for this component
  2. Component performance parameters corresponding to these environmental conditions
- A list of [environmental conditions, corresponding performance] pairs can be available.
- Initially provided based on estimations, test results, or previous experience with this component version.
- Updated while the component is active, with data provided by the EnM (first info type) and ApM (second info type)

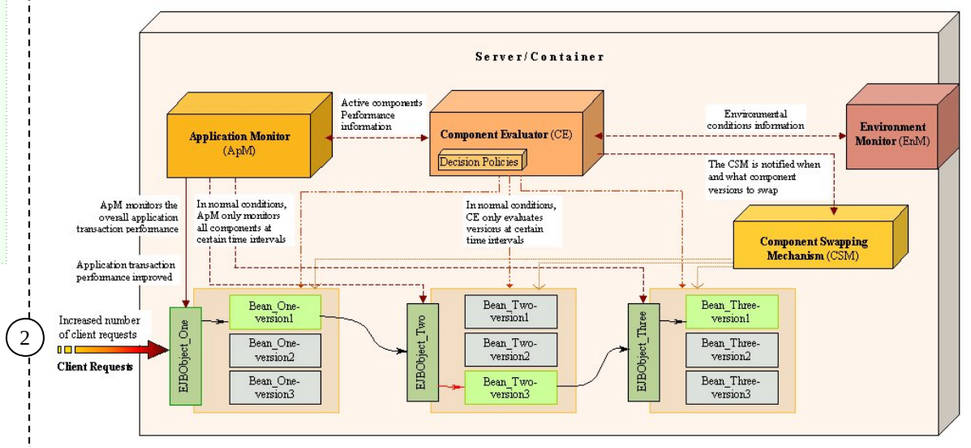
The component evaluation process is triggered:
- When exceptional events occur:
  - Addition/ removal/ failure/ congestion of resources
  - Variation in the number and type of (client) requests
- Periodically, for optimisation purposes, as more accurate performance information is gathered.
- If the EnM can predict future environmental events, the optimal component version is anticipated and activated before possible performance problems occur

Typical Scenario: Component Versions are swapped because of environmental changes

1: Overall transaction performance decreases as a result of the increase in the number of client requests



2: Overall transaction performance improves as a result of swapping component versions



Ada Diaconescu (diacones@eeng.dcu.ie)
Performance Engineering Laboratory
Dublin City University, Dublin, Ireland
http://www.eeng.dcu.ie/~diacones
Author available……

Message Board:

ECOOP Málaga 2002