Provisioning Resources in DRE Systems with Lightweight CCM

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Motivation

Resource Manager with the following desired properties:

- Distributed
- Multi-Layered
- Modular
- Reusable elements
- Tracks latest lightweight CCM (LWCCM) specifications
  - Specs in flux
  - Special Distributed Resource Manager needs
    - Multi-Dimensional QoS requirements
    - Non-component applications
- Short step to full CCM compliance when
  - Full D+C implementation is available
  - DRE-related QoS property management is integrated
Distributed Resource Manager (DRM) in Context

**Applications**
- PDA Applications
- Mission Critical Applications

**Domain Specific Services**
- Control Data Distribution
- Status Data Analysis
- Multi-Layer Resource Management (domain adapters)

**Common Middleware Services**
- Security
- Naming
- RT Event Channel
- RT Data Distribution
- Multi-Layer Resource Management (core services)

**Realtime Distribution Middleware**
- Portable Object Adapter Framework
- Extensible Transport Framework
- Portable Interceptor Framework
- Policy Deployment Framework

**OS and Network**
- Security Mechanisms
- Scheduling Mechanisms
- Bandwidth Control Mechanisms

**Technology**
- Standardized Technology
- Proprietary Technology
- Evolving Technology
Distributed Resource Manager
Overview (1 of 2)

- Domain Layer (Top Level)
  - Control flows down
  - Status info flows up
- Resource Pool Layer
  - Resources grouped by
    - Physical Location
    - Security Considerations
    - Application Group
- Application Group
  - Apps grouped by QoS properties
    - End-to-end deadline
    - Publish/Subscribe
    - Task Type
- Resource Layer
  - Node - host/hardware
  - Application - executable
Distributed Resource Manager
Overview (2 of 2)
Node Provisioner in Action

**Application Data**
- QoS Properties
- Security Requirements
- Interdependencies

**Application Group Manager**
- Proxy Object References

**Pool Manager**

**Resource Allocator**
- QoS Properties

**Node Provisioner**

**Deployment Data**
- Priorities
- Scheduling Policy

**Control Applications**
- Control Resources

**Spawn Applications**
- Create Proxy Objects
## Comparisons with LWCCM (1 of 2)

<table>
<thead>
<tr>
<th>DRM</th>
<th>Semantics</th>
<th>Equiv. LWCCM</th>
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<tbody>
<tr>
<td>Pool Manager</td>
<td>▪ Uses <strong>Resource Allocator</strong> to arrive at allocation decisions.</td>
<td>TargetManager +</td>
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<td></td>
<td>▪ Exposes a transactional type interface to higher layers.</td>
<td>ExecutionManager</td>
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<td>▪ Uses <strong>Resource Status Service</strong> to gather dynamic resource utilization.</td>
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<tr>
<td>Resource Allocator</td>
<td>▪ Encapsulates different algorithms for allocating applications across various nodes.</td>
<td>TargetManager +</td>
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<td></td>
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<td>ExecutionManager</td>
</tr>
<tr>
<td>Resource Status</td>
<td>▪ Gathers dynamic resource usage using a data model which is unique.</td>
<td>TargetManager +</td>
</tr>
<tr>
<td>Service</td>
<td>▪ Node level heart beat mechanism.</td>
<td>ExecutionManager</td>
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## Comparisons with LWCCM (2 of 2)

<table>
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| **Application Group Manager** | - Based on QoS properties and resource availability decides on pools where the application group splits across.  
- Can control resource usage of applications to add more applications to pools in its control. | No equivalent                 |
| **Node Provisioner**       | Spawn Applications                                                        | NodeManager + NodeApplication-Manager |
Conclusions

- LWCCM provides a number of capabilities for managing component resources.
  - New D+C spec is the focus of improvement.
  - Evolving as implementors relay lessons learned.
- LWCCM abstractions could be extended or refined to deal with
  - Mission-critical QoS properties.
  - Dynamic resource & application management.
- Distributed Resource Manager’s abstractions are useful for a wide range of DRE systems.
Updated Slides

http://dre.vanderbilt.edu/~parsons/ppt/DRM_NodeProvisioner.ppt