The CHAMPS System: Standards-based Autonomic Change Management with WS-BPEL, WS-Agreement and Solution Install

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CHAMPS: Standards-based Change Management

Stakeholder → Requirement

Customer

Developer

Customer

Solution Install

WS-BPEL

WS-Agreement

Request for Change

Deployment Descriptor

Service Level Agreement

CHAMPS

Task Graph Builder

Task Graph

Planner & Scheduler

Task Graph Library

Forward Schedule of Change

Status Feedback

Tivoli Provisioning Manager

Data Center Resources

Policies and Best Practices

Administrator
Example: DB2/WAS Provisioning for SPECJAppServer2004

CHAMPS Goal:
- Automatic construction of BPEL workflows from
  - RFC
  - Solution Install Deployment Descriptors
  - Cost/profit considerations (SLAs)
  - Constrained Resources
- Addresses the P/E parts of MAPE loop

**DB2:**
- create user
- install wiz (db2)
- select features (2)
- specify cfg. params (7, 5 def.)
- reboot
- app cmd (cli)
- env var (3)
- cfg file (1 line)
- app cmd (cli)
- start svc (db2)

**WAS:**
- install wiz (db2)
- select features (4)
- app cmd (cli)
- app cmd (cli)
- install wiz (was)

Knowledge
- user/pass
- db_name
- db2host
- db2_port
- Instance
- svc_name

- node alias

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CHAMPS

Sensor

Effector

Configuration Files

Log

Commands

Events

APIs

Sensor

Effector

Events

APIs

Configuration Files

Log

Commands


= workflow

= cfg data flow
Step 1: Specify SLAs in WS-Agreement

- **Costs and profits are specified the same way**

- **Time intervals**

- **Additional penalties if not resolved within a certain time period**

- **Additional bonus for continuous uptime**

- **5 $ per Minute**
Step 2: Solution Install: Expressing Dependencies between the SPECjAppServer2004 Components and their Middleware

- **Customer wants to provision a J2EE Solution**

- **3 Layers:**
  - **Overall Solution**
    - Defined by Solution Architect
  - **Application Components**
  - **Middleware Stack**
    - Shrink-wrapped Software Components
Step 3: Generate Forward Schedule of Change in WS-BPEL

Installable Units (IUs) for WAS 5.1

Temporal Constraints when output data from DB2 is needed for WAS configuration

Parallel deployment of DB2 and WAS
SPECjAppServer2004 Solution Provisioning
Solution Provisioning Prototype

Tivoli Provisioning Manager

SI Multi-System Runtime

- Request for Change
- Task Graph Builder
- Planner & Scheduler
- Chg. Exec
- Event Sieve
- Forward Schedule of Change

Task Graph Library

- Task Graph
- Task Graph Metadata

Task Graph

- Task Graph Metadata

SI Dep Checker

- IU Tree
- Task Graph

CMDB-RR

WS-BPEL Engine (IBM WPC)

Administrators

SMD

TPM Software Library

SI 1.2

WS-Agreement Adapter

Resource Pools

Bare Metal

OS Installed

WAS Installed

ISI Multi-System Runtime

Logical Device Operations

- Task Graph
- Task Graph Metadata

CIM_Application

- CIM_SoftwareFeature
- CIM_SoftwareFeatureComponent
- CIM_SoftwareElement

SI 1.2

SI 1.2

Task Graph

WS-BPEL Engine (IBM WPC)

Event Sieve

Chg. Exec

Status

Request for Change
## CHAMPS Evaluation & Leverage of Standards

<table>
<thead>
<tr>
<th>Activity type</th>
<th>Average times [minutes.seconds] for:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DB2 UDB 8.1 / RT Client</td>
</tr>
<tr>
<td>Deployment (file transfer / unpack of install image)</td>
<td>5.56 / 1.14</td>
</tr>
<tr>
<td>Installation</td>
<td>6.42 / 1.34</td>
</tr>
<tr>
<td>Start</td>
<td>0.16</td>
</tr>
<tr>
<td>Configuration (incl. DB creation and loading of data)</td>
<td>5.28</td>
</tr>
<tr>
<td><strong>Total time (strictly sequential, no think time)</strong></td>
<td>50 min 25 sec.</td>
</tr>
<tr>
<td><strong>Total time (CHAMPS workflow)</strong></td>
<td>34 min 00 sec.</td>
</tr>
<tr>
<td><strong>Total savings (time seq.–time CHAMPS)/time seq.</strong></td>
<td>16 min 25 sec (~33%)</td>
</tr>
</tbody>
</table>

1. **SPECjAppServer2004 Provisioning:** CHAMPS yields 33% time savings
   - Strictly sequential (no awareness of Dependencies): ~50 Min.
   - CHAMPS workflow (exploiting opportunities for Concurrency): ~34 Min.

2. **WS-Agreement works well for expressing flexible cost and profit functions**
   - Needed as input parameters for Planner & Scheduler to guide resource assignment

3. **Solution Install provides application dependency information**
   - Facilitates creation of Provisioning Workflows
   - Standardized in new OASIS Solution Deployment Descriptor (SDD) working group

4. **WS-BPEL is a viable option for expressing change management workflows**
   - Concurrent execution, Deadlines, Links across different workflows
More Information

- **CHAMPS Architecture & Optimization Problem Formulation**

- **WS-BPEL for Change Management**

- **Quantitative Evaluation of CHAMPS**