The CHAMPS System: CHAnge Management with Planning and Scheduling

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Impact of Changes (TPC-W Storefront Example)

CHAMPS provides planning for change management.

Emphasize planning for the deploy stage of artifact lifecycles.
Task Graph Builder: Install TPC-W bestsell Servlet (1)

TPC-W Application

Servlet Container

WAS Servlet Container

Web Application Server

WAS Runtime

Dependency Strengths between Systems: 25%, 50%, 75%, 100%

Database

DB2 UDB 8.1

IP Service

OS

Linux 7.2

OS

AIX 4.3.3

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ITEM

COUNTRY

ADDRESS

ORDER_LINE

SHOP_CART

ORDERS

SHOP_CART_L

AUTHOR

CC_XACTS

CUSTOMER
Task Graph Builder Example: Install bestsell Servlet (2)

Goal: Maximize Parallelism for time-consuming Tasks, gather Information from Deployment Descriptors
Task Graph Builder Example: Install *bestsell Servlet* (3)

- Using Workflows for Task Graphs and Change Plans:
  - COTS Tools
  - Offload state-checking of Activities to Workflow Engine

- **BPWS4J** is a BPEL4WS Workflow Environment
  - Workflow Editor
  - Workflow Engine
  - Available on IBM Alphaworks

- Per-Host Structure defined by outermost Sequences
- Cross-System Dependencies inserted as links between Activities
Planner & Scheduler

- Determines sequencing of RFCs
- Binds tasks to servers/resources
- Determines when tasks execute
Optimization Problem Formulation

Maximize Revenue

\[ \sum_{j} V_j x_j - \sum_{j} \sum_{k} \sum_{i} \sum_{p} a_{\beta,j,k,j,p} \int_{s_{\alpha,j,k,j}}^{c_{\beta,j,k,j,p}} C_{j,k}(t) dt \]
Parameterization according to Objective Functions

- Maximize profits
  * if $C_{j,k}(t) \equiv 0$
- Maximize number of jobs done
  * if $C_{j,k}(t) \equiv 0$ and $V_j \equiv 1$
- Minimize costs
  * $V_j \equiv 0$
- Minimize downtime due to jobs
  * if $V_j \equiv 0, K_j = 1, \alpha_{j,1} = 1, \beta_{j,1} = I_j, C_{j,1}(t) = 1$
- Minimize total execution time
  * if $V_j \equiv 0, K_j = I_j, \alpha_{j,k} = \beta_{j,k} = k, C_{j,k}(t) = 1$

Job = RFC
Planner & Scheduler: Scheduling 7 RFCs

- Performs Assignment of Tasks to Resources from Pools (Late Binding)
- Supports very general Objective Functions:
  - Minimize penalties from SAM-style SLA step functions with multiple deadlines
    - On an RFC and/or task basis
  - Minimize sums of RFC makespans
    - Or weighted sums of RFC makespans
  - Minimize average response (flow) times
    - Or weighted average response times
- Any combination of these and other objective functions
Status, Lessons learned & Outlook

- CHAMPS Components architected & implemented
  - Task Graph Builder (dependency acquisition from SMDs/IUDDs, automated workflow creation in BPEL4WS)
  - Planner & Scheduler (resource assignment, build optimized Schedule)
- BPEL4WS is a viable alternative to express change management workflows
  - Concurrent execution, Deadlines, Links across different workflows

Current Work Items
- Task Graph Library for reusable Change Plans
- On-line Plan Adjustment
  - In Case Provisioning Activities are running behind Schedule
  - Based on SLAs and Policies
- Workflow-driven Provisioning with BPWS4J Workflow Engine
  - Integration of BPWS4J Workflow Engine & Tivoli Intelligent Orchestrator