



... for a brighter future

Control System Studio and Web Services

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EPICS Collaboration Meeting – DESY, April 2007



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Motivation

■ General Education

- Learn Eclipse and CSS Plug-in development
 - *Have been reluctant for some time. I've been a long-time Java/Swing advocate, but I'm starting to come around ...*
- Learn Web Services (as in SOAP with WS-* specifications)

■ Explore Service Oriented Architecture for large scale controls

- Modern update to software in use at the Advanced Photon Source
 - *PEM – Procedure Execution Manager (Tcl/Tk environment)*
 - *SDDS toolkit – Self-Describing Data Sets*
- Also similar to XAL tools/services package
- EPICS Archiver (XML-RPC) probably closest living example in EPICS

Technology Components

■ Control System Studio

- Rationale clear and stated elsewhere
- No need to elaborate on it here

■ Globus Toolkit 4.0 Web Services Core

- Based on Apache Axis, a well-known web services implementation
- Takes conservative approach, and only adopts minimum set of WS specifications needed to get the job done.
- Implements WS-I Basic Profile 1.1 to further interoperability
- Takes highest-performance SOAP encoding option:
 - *Remote Procedure Call (RPC) encoding*
 - *RPC-literal encoding*
 - *document-literal encoding* * - globus uses this

Globus Web Services Core

- Globus Toolkit has many loosely coupled components. For now, two are of interest, and easily used standalone:
 - Java Web Services Core
 - C Web Services Core
 - Plus good installation guide and development tutorials

- Web Services Core implements some or all of the following specifications:
 - WS-Resource
 - *Deals with how to manage state in services*
 - WS-Addressing
 - *Deals with how to reference service instances*
 - WS-Notification
 - *Provides asynchronous messaging (publish/subscribe topics)*
 - WS-Security

Design Patterns for Services

- Services with state
 - Uses WS-Resource and WS-Addressing

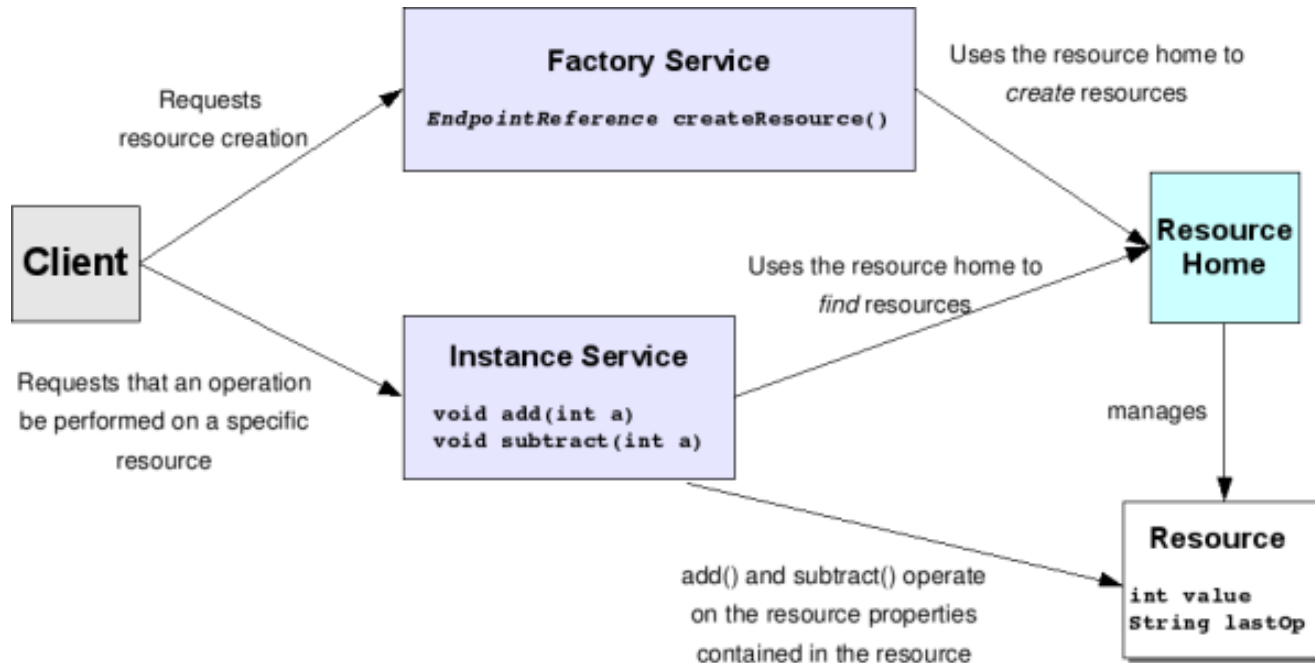
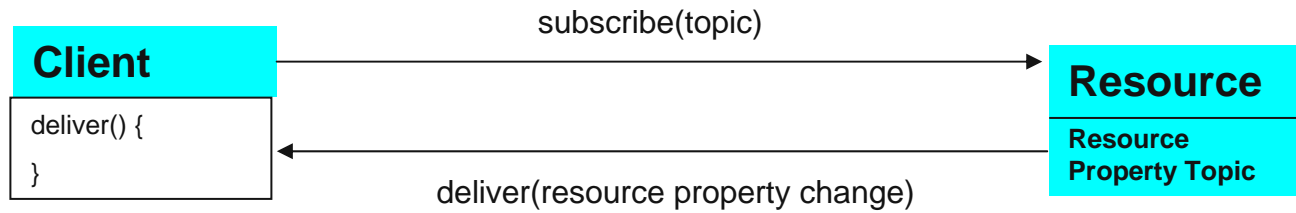


Image courtesy of Borja Sotomayor, University of Chicago

Design Patterns for Services (2)

- Asynchronous notification
 - Uses WS-Notification



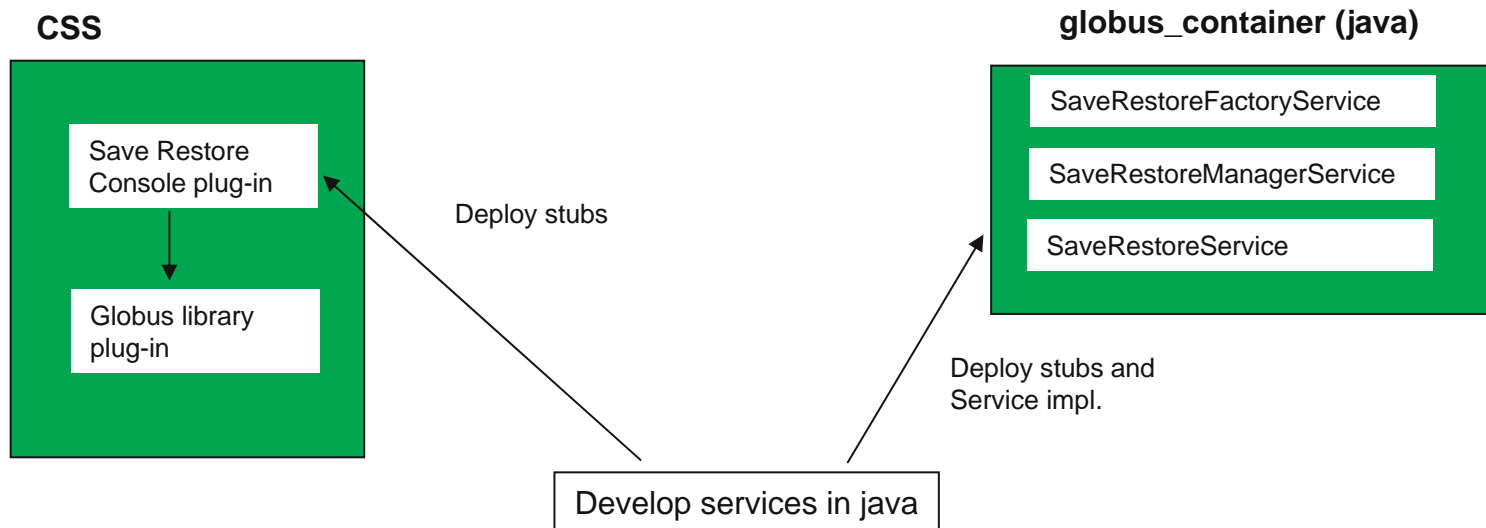
Prototype Case: A Save/Restore Service

■ Requirements

- Initiate a save or restore job
- Track progress of an individual job
- Track list of all submitted jobs from all clients

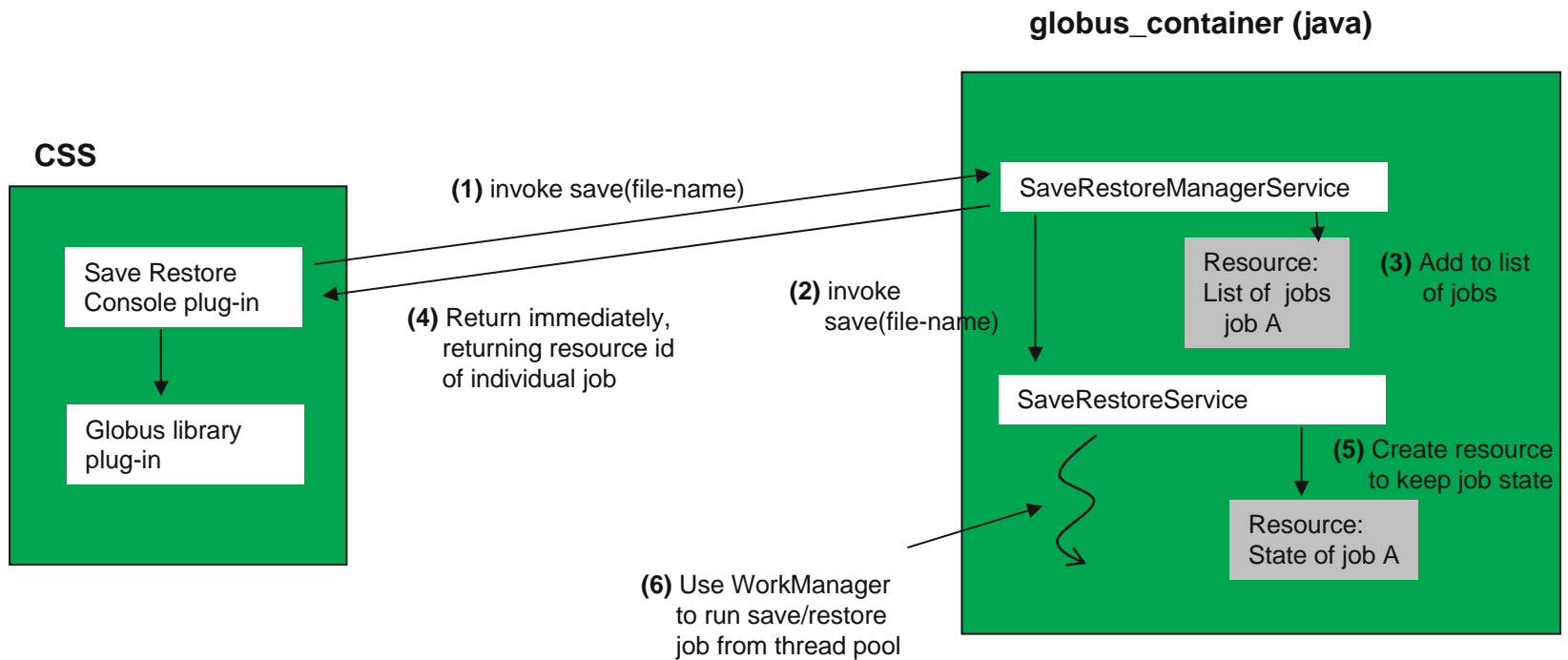
■ I have not actually implemented the save/restore part

- Just using as an example to prototype a general pattern that would be useful for many different controls services



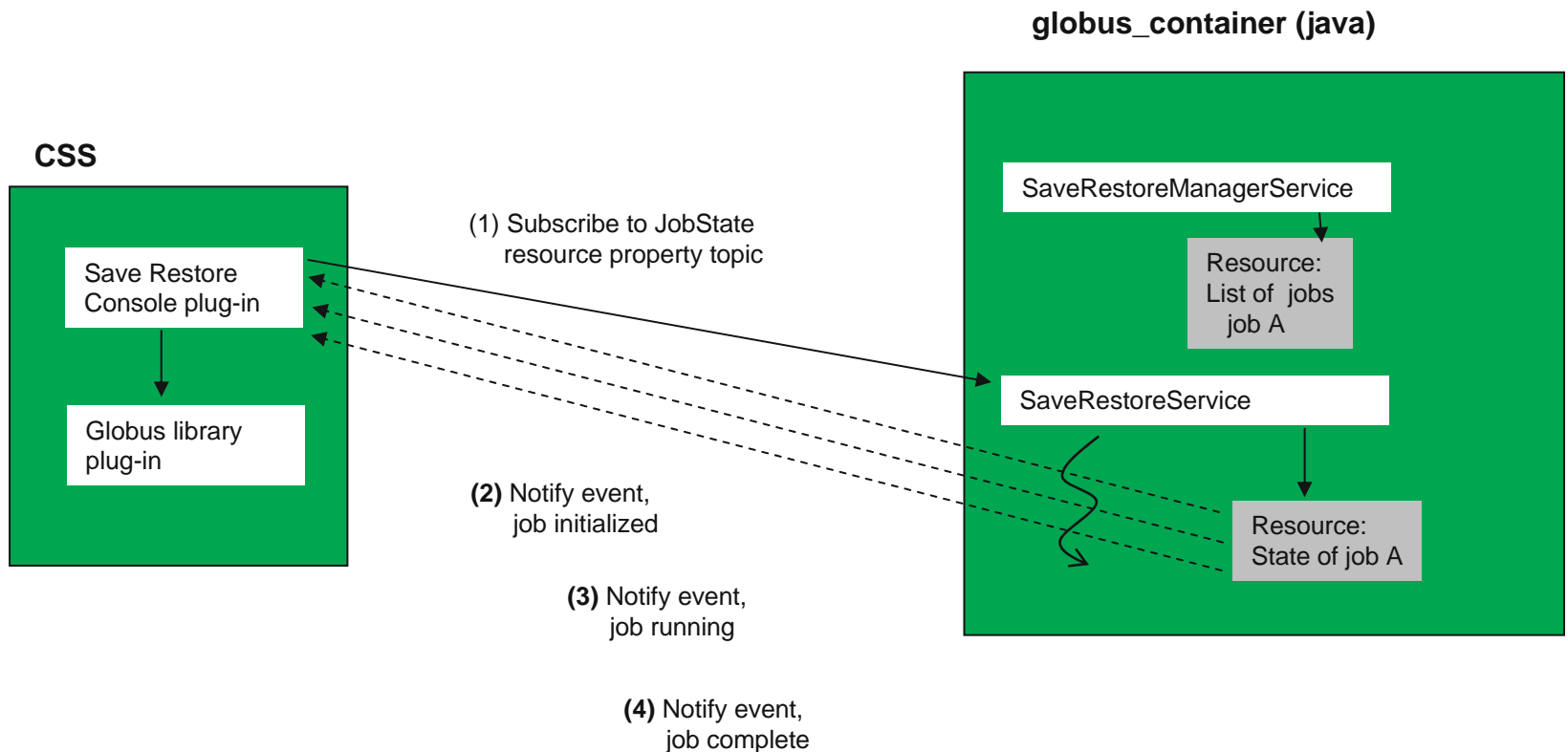
Save/Restore Service – initiating a save or restore

Note: removed SaveRestoreFactoryService to simplify presentation



Save/Restore Service – tracking progress of a job

- Note: same idea for tracking list of all jobs from all clients
 - notify event: job added or removed from list of jobs



Conclusions

- Learning curve for Eclipse/CSS plus that for Globus Toolkit (just the web services core) was pretty steep. Still have much to learn about both.
- Difficulties
 - Getting Globus web services core to work as plug-in a challenge
 - *Main problem is that Globus accesses lots of files in GLOBUS_LOCATION directory structure*
 - Need way to package as resources on classpath instead
 - *Globus uses commons-logging, not CSS CentralLogger, so duplicate logging support was used. Not sure how to unify...*
 - Tedious getting service interface (WSDL) working as expected. Lots of debugging logging available in Globus, but still a challenge.
 - Globus API is low-level and flexible, so a lot of work is required to build higher-level abstractions upon which applications should be built.
 - *But this only has to be done once*

Conclusions (2)

■ Possibilities

- For coarse grained work units, with relatively complex service interfaces, Web Services is a good option.
- WSDL, XML, and XSD a good way to document interfaces in readable fashion.
- Snooping on message traffic much easier than with binary protocol.
- Next version of Globus Toolkit will support WS-Attachments
 - *Use Web Services to negotiate efficient transfer of specialized binary formats along with instructions on what to do with data.*
- Support for data streaming ?