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National
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Centre

GridWeaver

The GridWeaver Project

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GridWeaver

Agenda

- System Configuration and Grids
- The GridWeaver Project
 - Tool Survey
 - Case Studies
 - Configuration, SmartFrog (HP) and LCFG (Informatics)
 - The Combined Framework and the GPrint Demonstrator
- Future Directions



Configuration and the Grid

An effective Grid for the support of e-Science, e-Commerce, or e-Government, assumes the existence of reliable, correctly configured fabrics which form the foundations of the distributed services used by Grid applications.



Configuration Tasks

- Specify the configuration
 - For the whole fabric
- System installation (load software)
- Initial configuration
- Maintain the configuration
 - When the specification changes
 - When the real system changes (due to failures)

- Why Automate?
 - Not just a question of efficiency
 - Necessary for correctness
 - Necessary for reliability
- Requirements
 - Handle scale
 - Handle diversity
 - Handle change
 - Support devolved management
 - Provide understandable, high-level descriptions
 - Etc, etc ...



The GridWeaver Project

- An NeSC eScience funded project
 - August 2002 – July 2003
- Informatics, HP Research Labs and EPCC
- Survey existing tools
- Study existing (and projected) problems
- Investigate how Informatics and HP technologies might be combined to solve some of these problems
- Build a demonstrator as a proof-of-concept
- Identify directions for future research and development

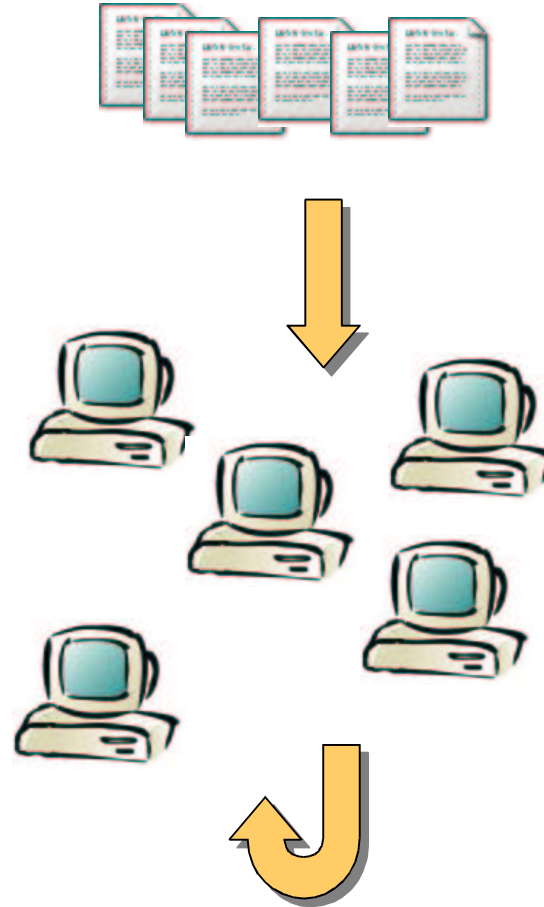
Tool Survey

- Technologies for Large-Scale Configuration Management:
 - <http://www.gridweaver.org/WP1/report1.pdf>
- Identify the requirements and scope
- Classify approaches and techniques
- Survey a representative sample of existing tools
- Conclusions
 - Many tools perform basic installation
 - Ongoing configuration maintenance often not addressed
 - Explicit, high-level specifications not usually present
 - Little support for inter-node relationships
 - In summary, existing tools inadequate

- Experiences and Challenges of Large-Scale System Configuration
 - <http://www.gridweaver.org/WP2/report2.pdf>
- Talk to managers of real large installations
 - Identify current and projected problems
- Projected use cases
 - Illustrate future “ideal” solutions
- Conclusions
 - Frequent management of clients, but not servers
 - Many manual processes with dependencies on staff
 - Increasing scale and complexity requires more automation
 - Current tools barely adequate for present situation

A Configuration Architecture

- Manage the whole fabric
 - Servers as well as end-nodes
 - Relationships
- A Declarative Specification
 - Not procedural
- Deployment/Installation
 - No manual intervention
- Autonomic Maintenance
 - Fabric reconfigures to track specification changes
 - Fabric reconfigures to absorb failures



SmartFrog and LCFG

- LCFG is a configuration tool developed in Informatics at Edinburgh
- SmartFrog is a framework developed by HP Research Labs
- Both have elements of configuration description languages and deployment mechanisms
 - These are complementary
- Combining the tools
 - Look at modelling real configuration problems and LCFG concepts in the SmartFrog language
 - Build a testbed allowing both deployment mechanisms to be used in combination



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- Overview of LCFG
- Overview of SmartFrog
- LCFG/SmartFrog Integration
- Test Bed
- GPrint Demonstrator
- Summary & Conclusions

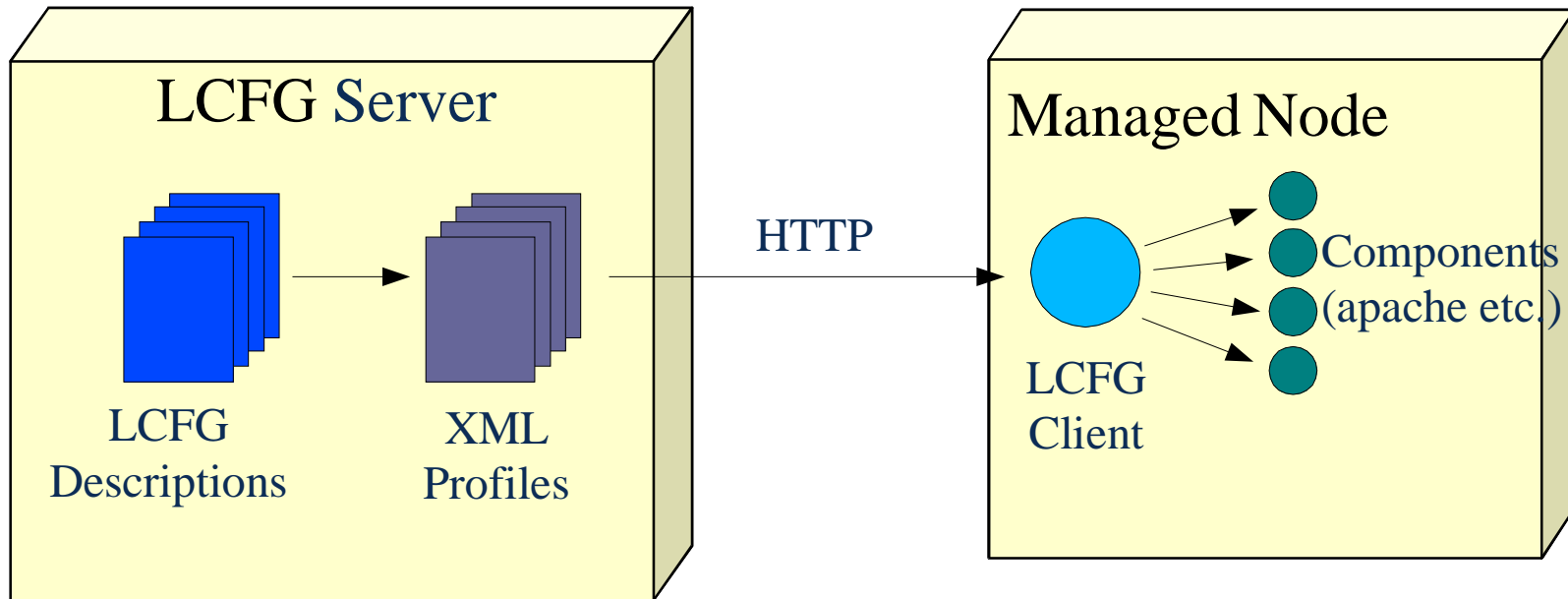
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LCFG (Local Configuration):

- Declarative language for defining fabric configurations
- Framework for deploying configurations
- Centrally controlled fabric management
- Bare metal installations

Overview of LCFG



Agenda

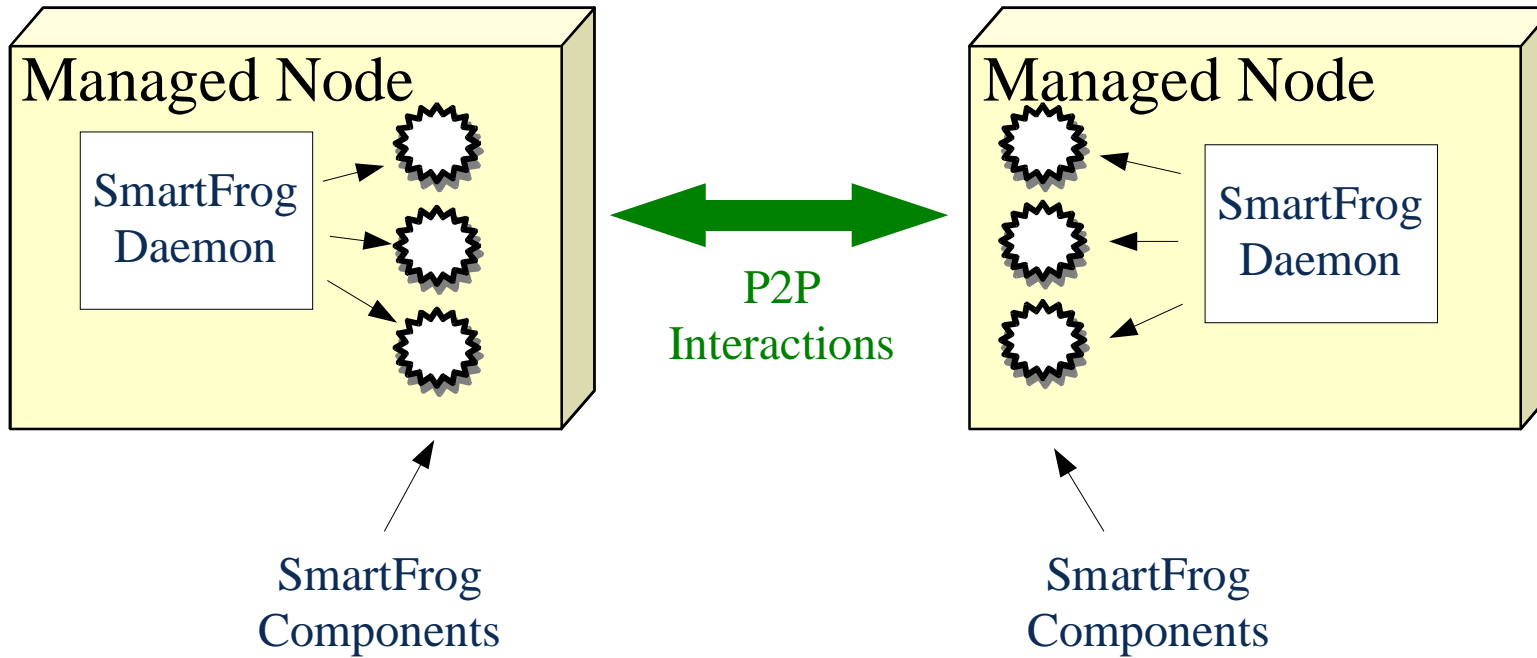
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Overview of SmartFrog

Smart Framework For Object Groups

- Declarative language for defining fabric configurations
- Framework for deploying configurations
- No central server:
 - P2P
 - Framework for distributed Java objects to communicate
- A framework not a solution

Overview of SmartFrog



Overview of SmartFrog

Has support for the following P2P interactions:

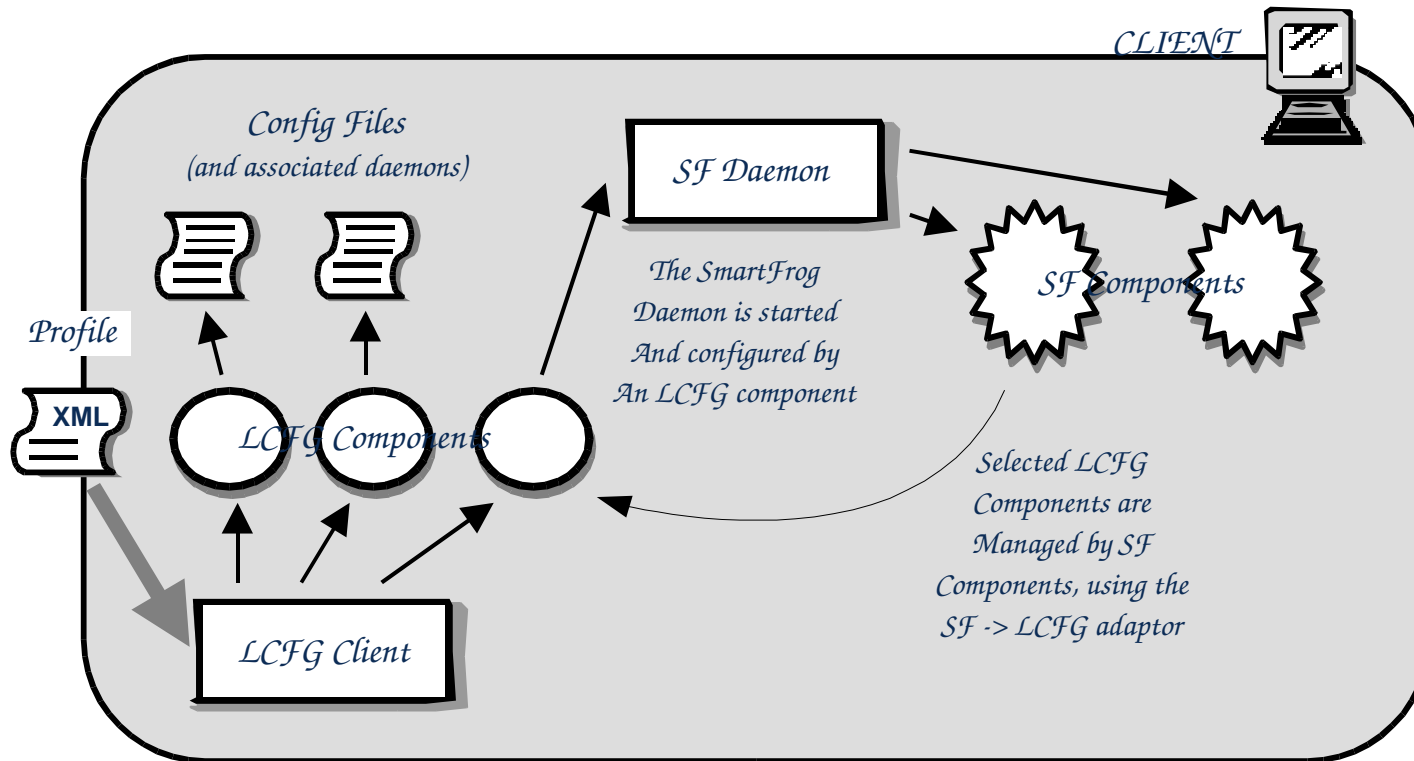
- Service Location Protocols (SLP)
- Group Membership Protocols with Leadership Election
- Dynamic Configuration Deployment
- Workflow Coordination
- Java RMI Communication



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LCFG SmartFrog Integration





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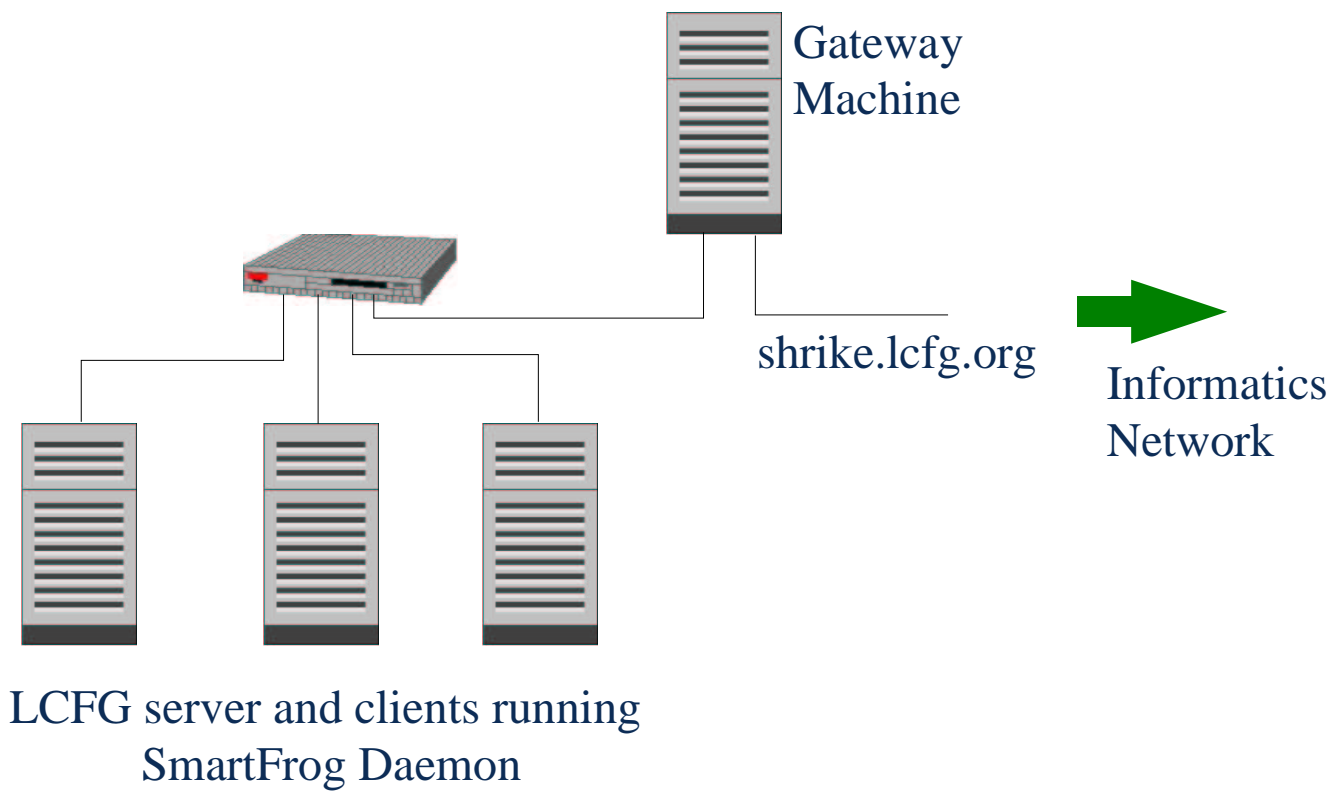


Test Bed

Test bed for the Integration:

- Set up at Informatics and HP Laboratories
- Private subnet:
 - LCFG server
 - Set of Managed Nodes
 - Gateway machine bridging to the main Network

Test Bed



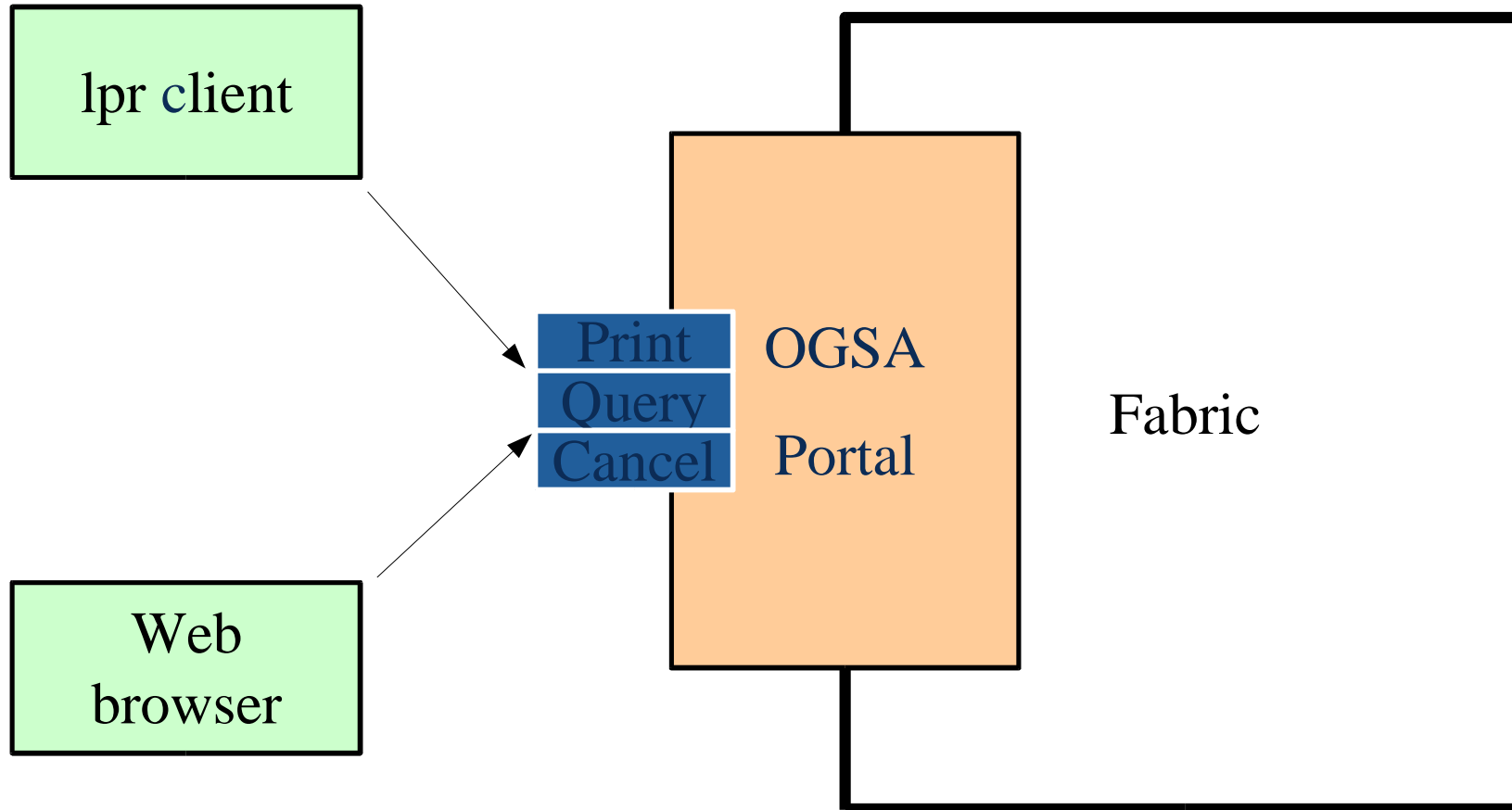
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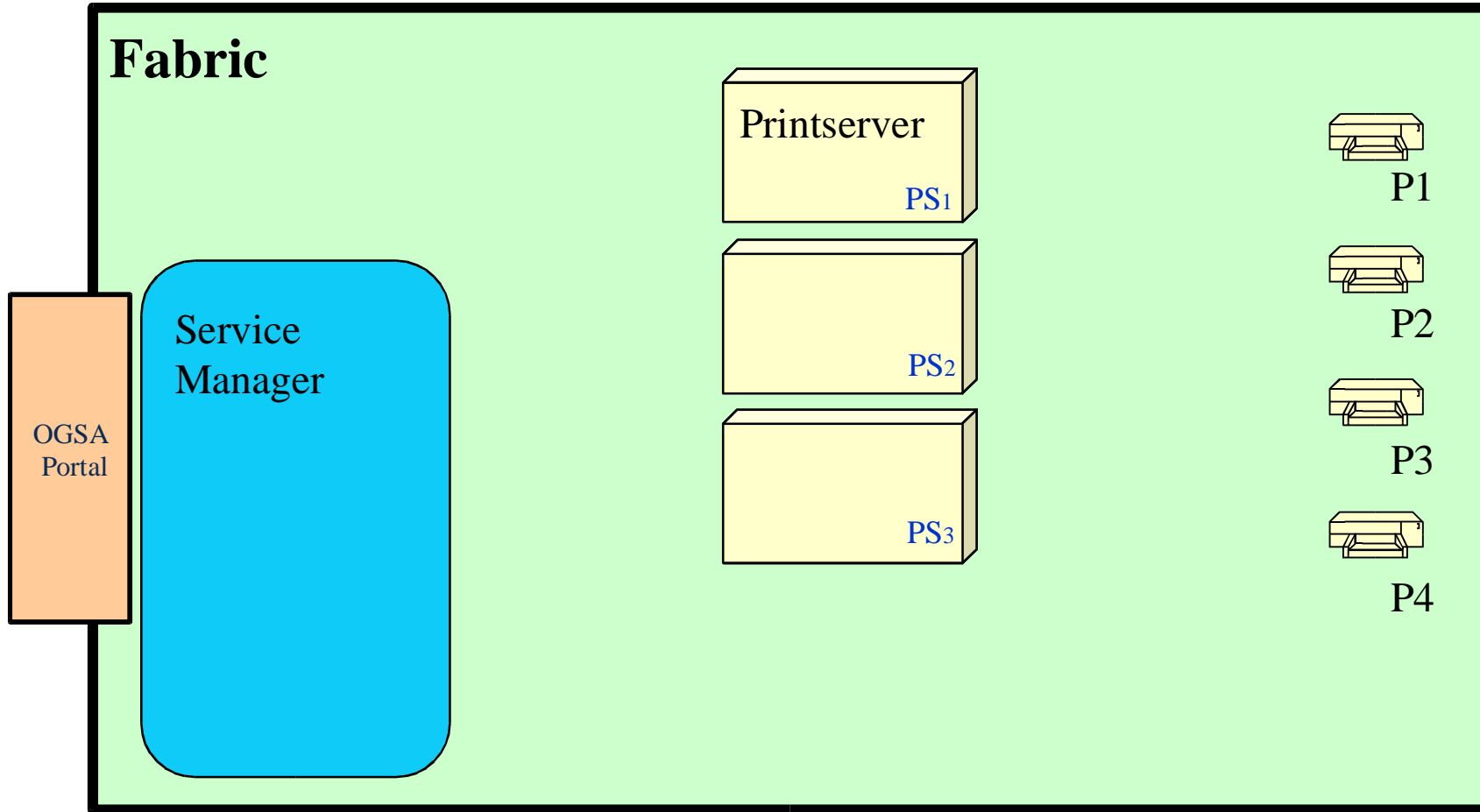
Grid Printing System

- Test/demonstrate LCFG <-> SmartFrog Integration
- Fault tolerant printing system:
 - no single point of failure
 - autonomic recovery from node failure
- Minimal Management
- Integrate with Globus Toolkit (GT3) & OGSA:
 - LCFG managed installation of GT3
 - OGSA application interacting with printing system
- Presented at GGF8

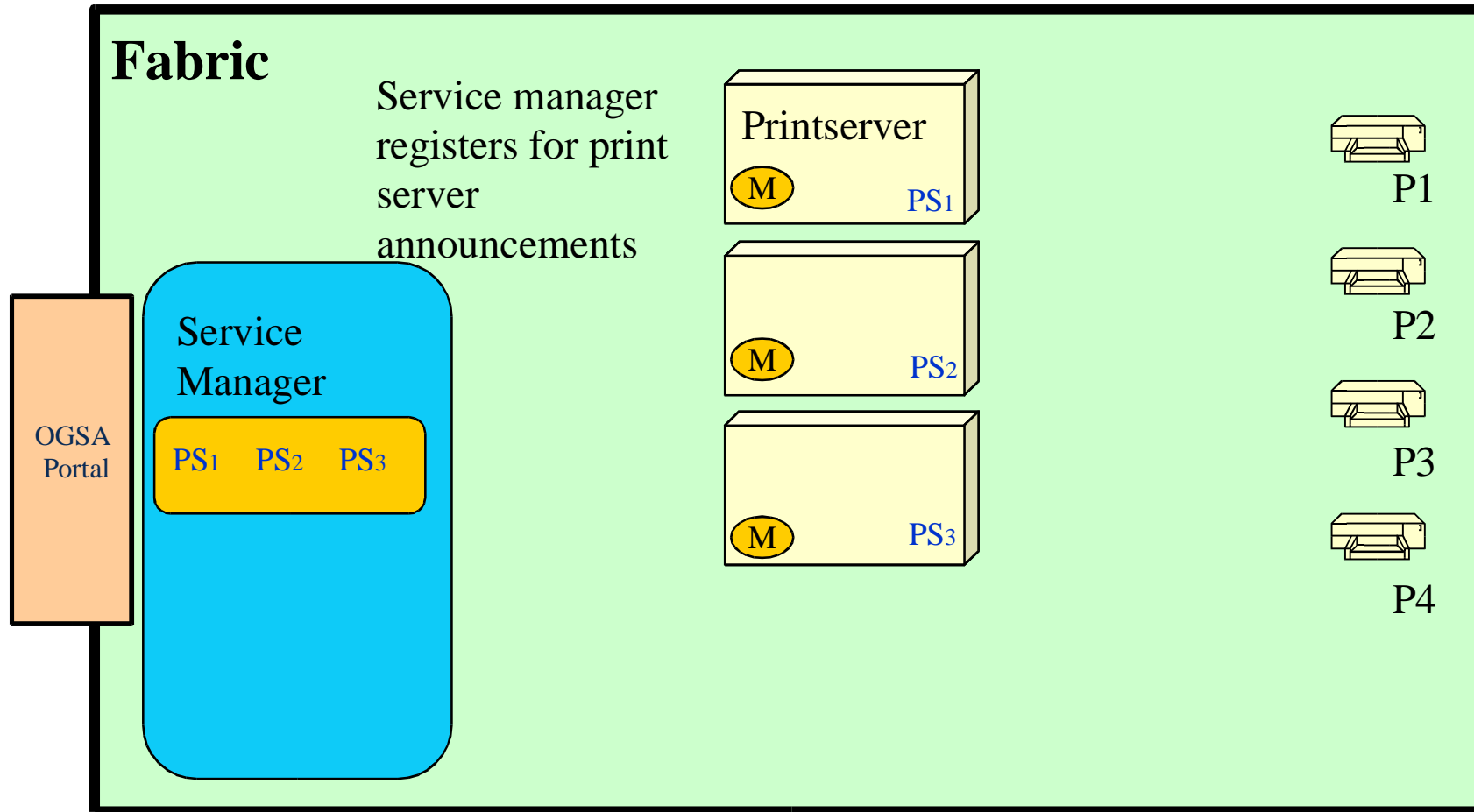
External View



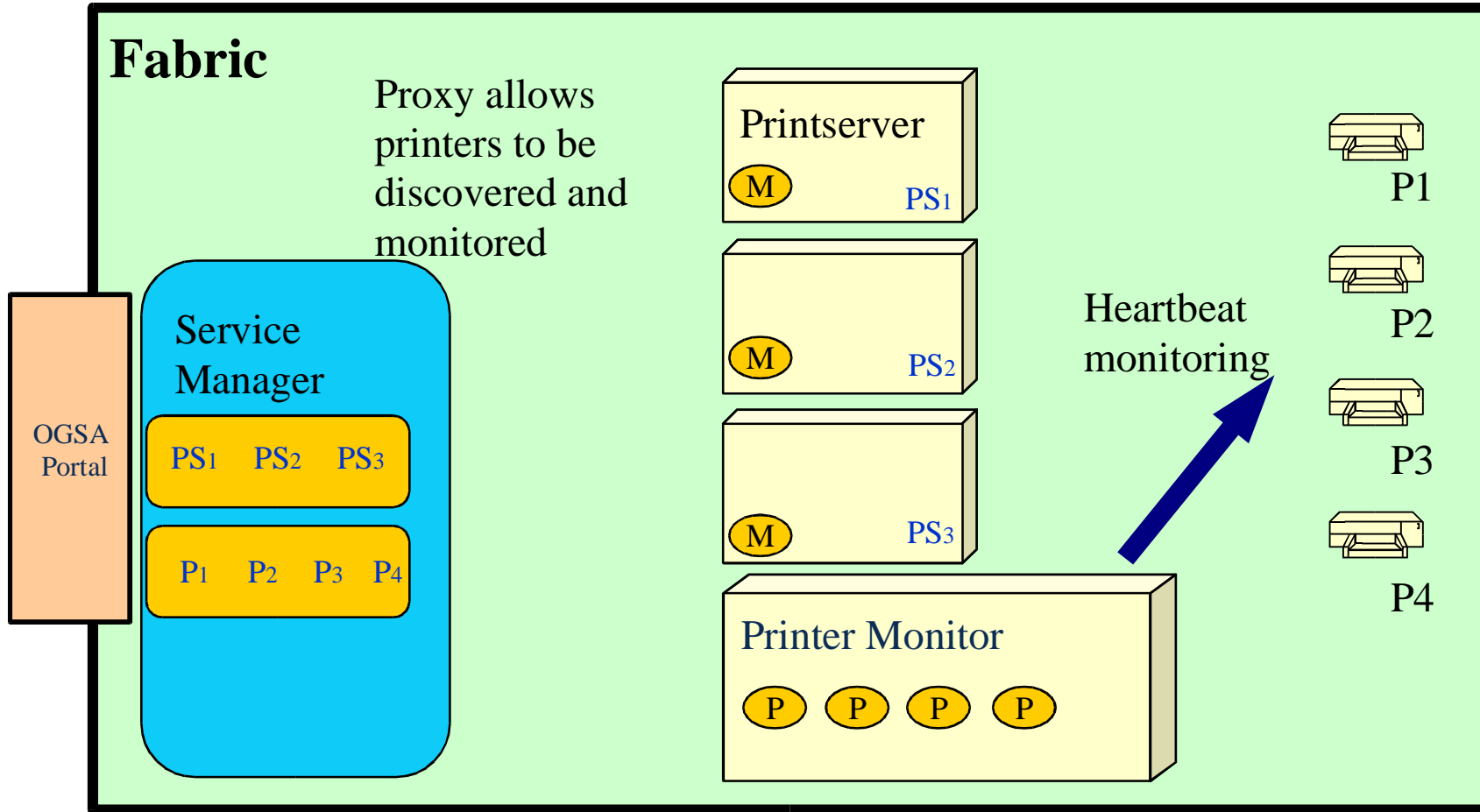
Internal View



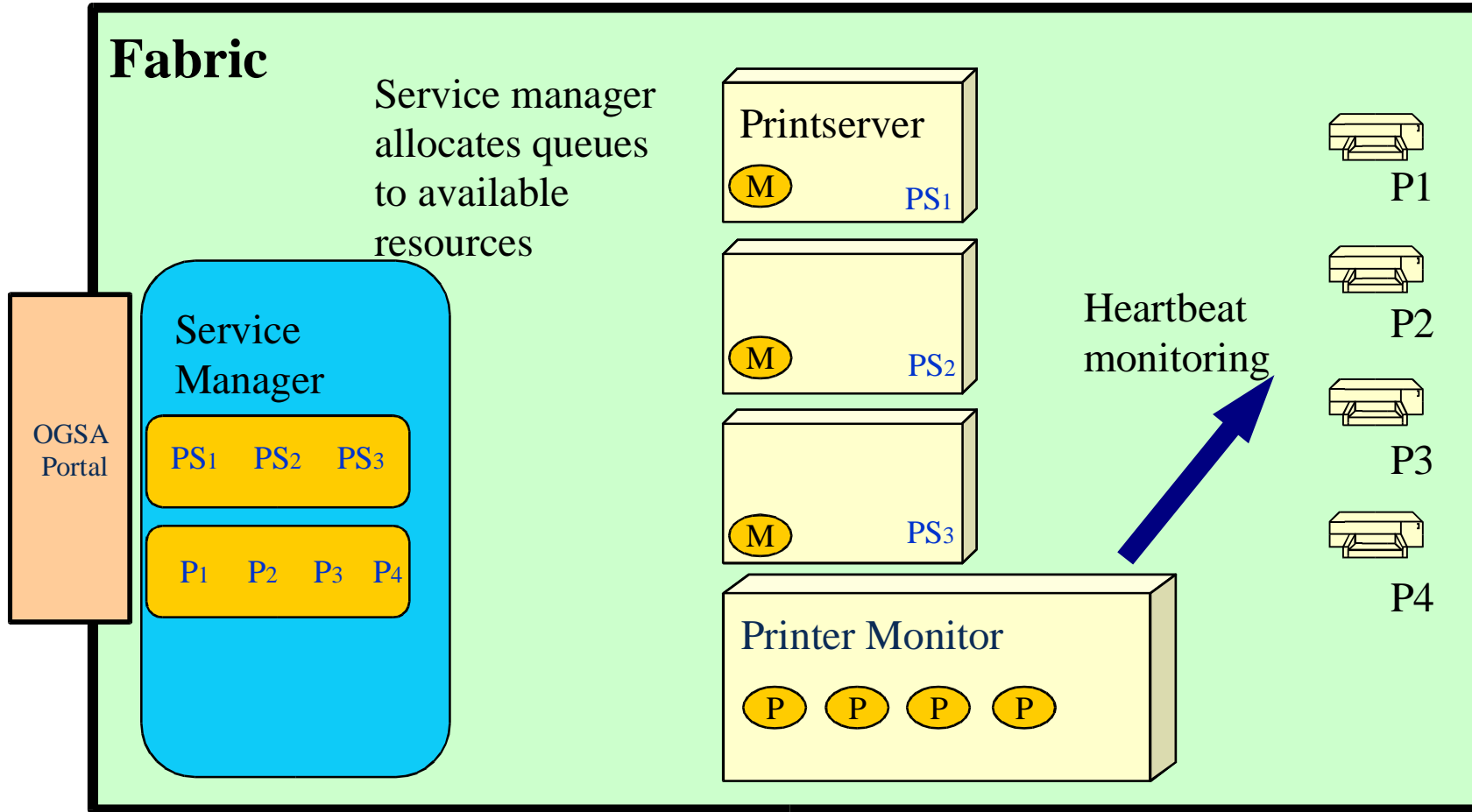
Internal View



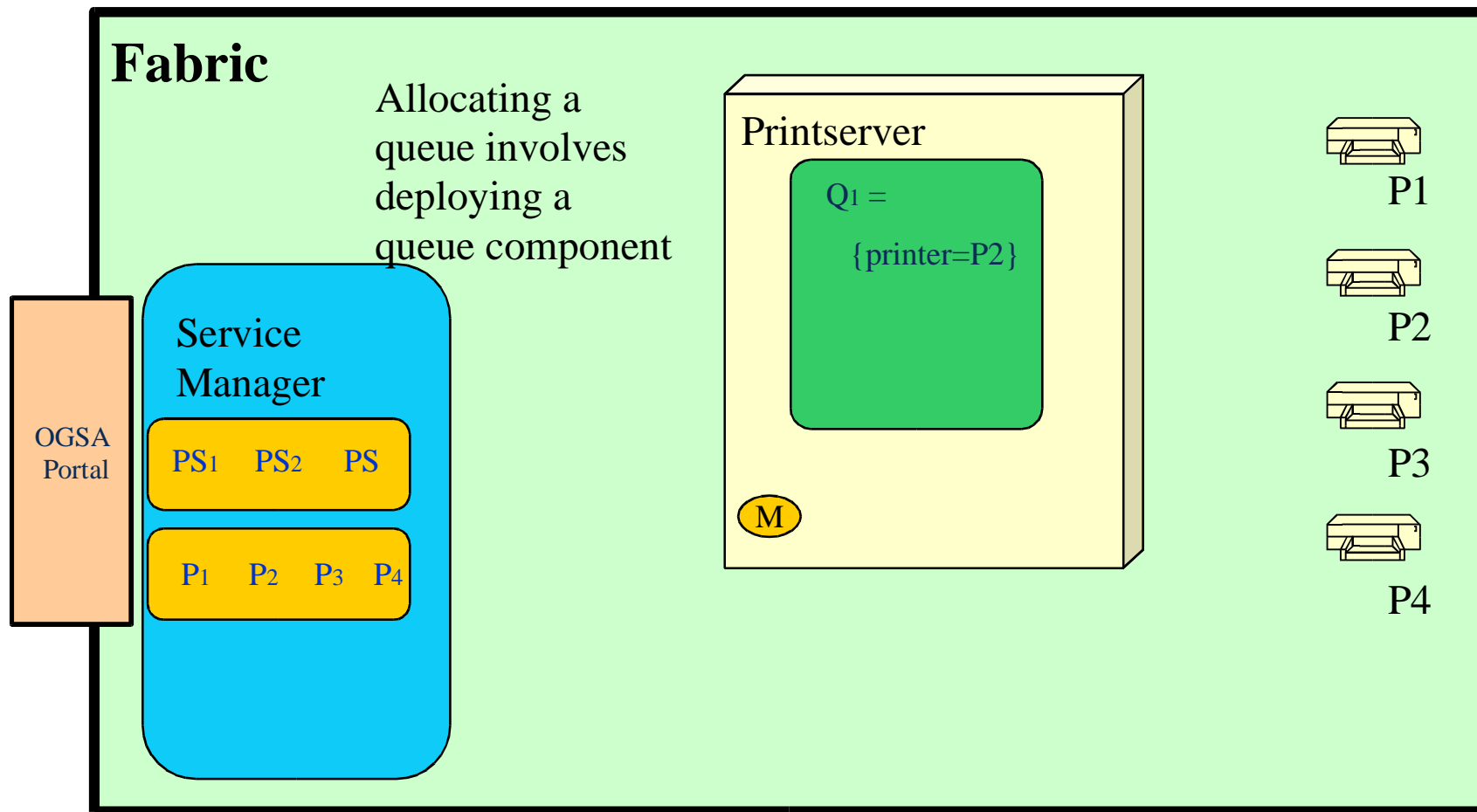
Internal View



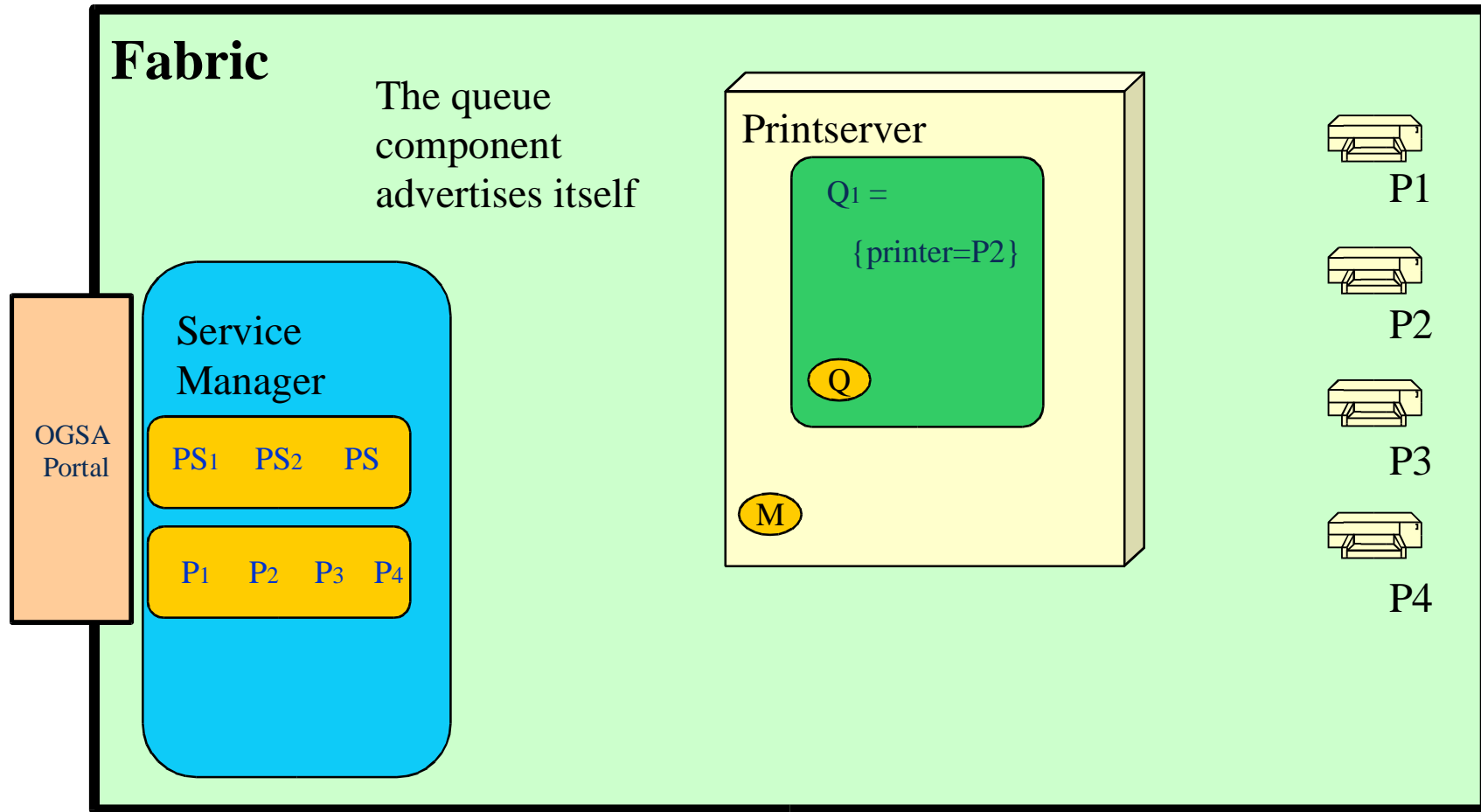
Internal View



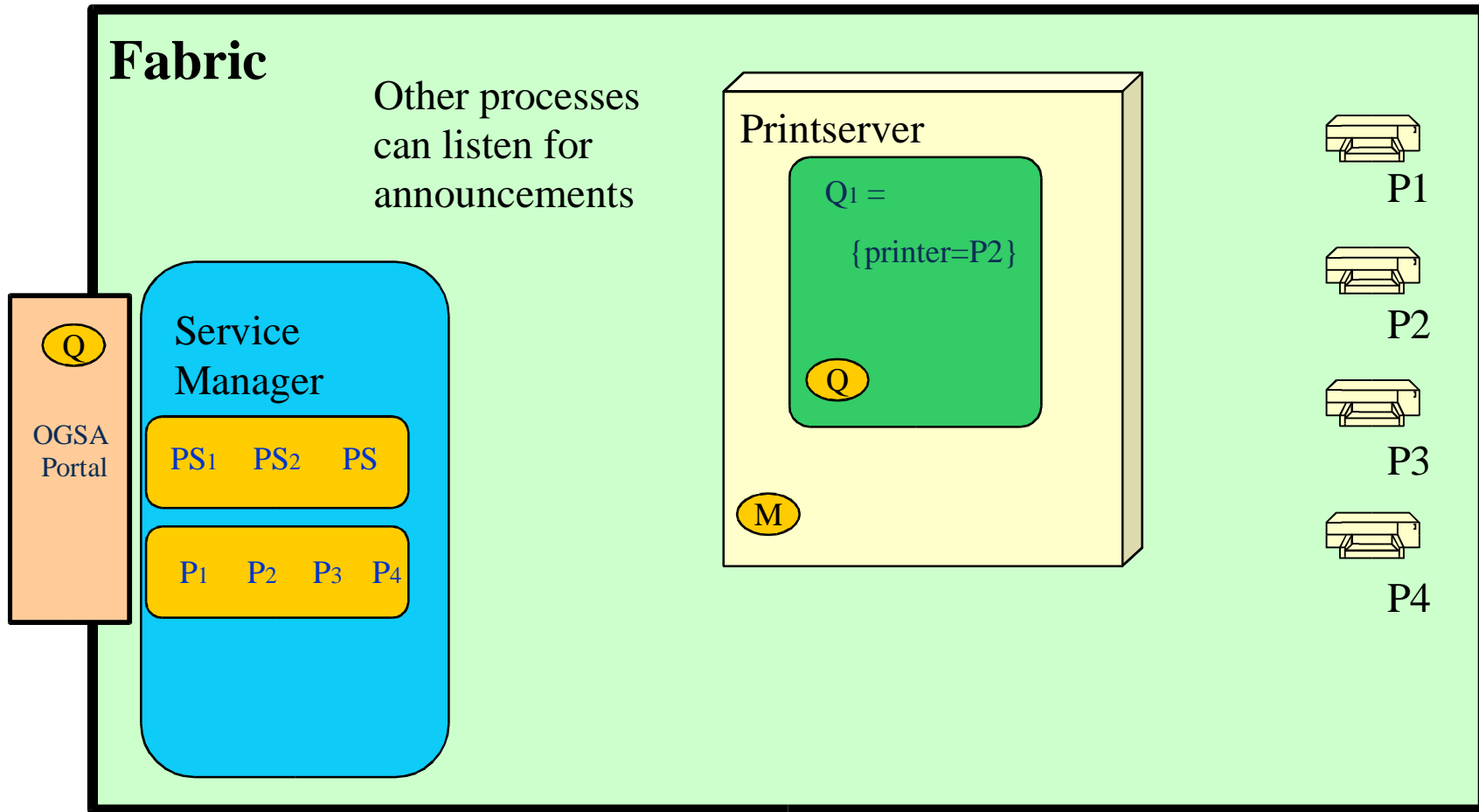
Internal View



Internal View



Internal View





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Summary

Project Reports (<http://www.gridweaver.org>)

- Report 1: Technologies for Large-Scale Configuration Management
- Report 2: Experiences and Challenges of Large-Scale System Configuration
- Report 3: LCFG/SmartFrog Integration
- Report 4: GPrint Demonstrator
- Report 5: Project Summary and Conclusions

Demonstration Video

- <http://boombox.ucs.ed.ac.uk/ramgen/informatics/gridweaver.rm>
- <http://boombox.ucs.ed.ac.uk/ramgen/informatics/gridweaver-v8.rm>

From a research prototype to a production system

- LCFG is open source (GPL)
- SmartFrog release to open source (LGPL) in '03
- Work needed to create a portable, production-quality system

Unified description language

- Complete fabric description using one, powerful representation
- SmartFrog v2 language is a candidate



Future Work

Many other interesting research problems

- Representing time-based properties in configurations
- Devolving control of different configuration aspects, securely
- Constraint satisfaction