# Fabric Automation
## The Challenge of LHC Scale Fabrics

LHC Computing Grid Workshop
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# How do we deal with LHC reality ?

- Several Thousand Machines
  - Software and Hardware maintenance
- Geographically Distributed System
  - Multiple system administrators and policies
  - Wide area networking
- Tens of PB of data
  - Random access patterns
- Thousands of Physicists
  - Many potential failure modes
  - No clear solutions for QOS, Fault tolerance etc.

**The Challenge is “Creative Simplification”**

# Distributed Model

- Run jobs at CERN
  - LXBatch
- Run jobs across European Grid
  - EDG Testbeds
- Run jobs across World-Wide Grid
  - Start with US-EU Interconnect
  - GLUE, DataTag initiatives

The GRID is currently the technology framework

# GRID Framework

- Application Environment
  - RedHat, Grid services (e.g GAT from GridLab) etc.
- High level middleware functions
  - Resource Broker, Information Server, Storage Element etc.
- Distributed components
- Common protocols
  - TCP/IP, HTTP, SOAP, XML Document Exchange etc

While everything works, no problem …

# LHC GRID System Requirements

- Predictable Behaviour
  - Understand failure modes (Disk, Server, Network)
- Change Management
  - The dreaded “Certification” process
- Scalability
  - Understand how scalable the systems really are.
  - Experience needed
- Cost Effectiveness

# Architectural Considerations

- What does it take to make a predictable system ?
  - Hardware, Fabric, Middleware, Applications
  - Maximise automated corrective actions
    - Must be part of the architectural design
    - Must be part of the software implementation
    - Must be part of the hardware selection
- The cost of failures must be understood so must not:
  - Cause panic
  - Require expert assistance in every case
  - “Bring down” the system

# Cost Effectiveness

- Computer center organisation is important
  - Managing 20’000 machines
    - Physical Logistics
    - “Locatability”
    - Upgrade Strategies
  - Increased Automated Tasks
    - Even one manual intervention not tolerable
    - Causal Analysis
  - Human tasks must be kept Manageable

# Overall Architecture Needs

- A “Systems level” Approach
  - How do we manage state in the grid ?
    - Workflow
    - Recovery Strategies
  - What functions are distributed/replicated where, how, and location strategies ?
  - Data Storage/Management Strategies
    - Pb disk farms ? SAN/NAS Interconnects ?
    - Data Organisation ?
  - Node Management Strategies
    - Node Downtime Impact

# Fabric Management Overview

- Fabric management
  - Manage the nodes
    - Configuration, Installation, Maintenance
    - monitoring, scheduling, fault tolerance
  - Interface the Grid
    - Grid to local policy mapping
  - Monitoring the resource
    - Information on activity, performance etc to other grid functions.
    - Error reporting

# Current Activities

- EDG-WP4
  - Working on producing an automated testbed by end 2003.
- Many computer centers have their own solutions
- Some commercial products exist
  - Solutions target specific problems and environments
- CERN computing services
  - Running production services (~1000 servers)
  - Should integrate WP4 functions as they become available.
- GGF
  - No apparent focus on FM although parts are in other activities, e.g. Grid-Local policy mapping, various monitoring activities.

# LCG Strategy

- Move towards increasingly automated production environments as soon as possible
- Work with existing initiatives
  - Accelerate some developments
  - Work within the constraints of existing production environments.
- Inject resources into “productisation”
  - Address reliability, manageability and cost-effectiveness

# Implementation Strategy

- Work from the “Bottom up”
  - Review periodically to understand the hardware technology strategy in the 3 year timeframe.
    - Theory and Practice
  - Productise the best in configuration management.
  - Productise the best in installation management
  - Productise the best in monitoring
  - Work with a common middleware software environment
- Work from the “Top down”
  - Define a common application environment
  - Design overall workflow and resource strategies
  - Define farm management strategies

# High Level FM Objectives 2002

- Complete a first technology review.
- Configuration system for managing software installations and updates in production.
  - Work with EDG-WP4 technologies
- Monitoring system for data collection and provide alerts in production.
  - Gain initial experience using scalable technologies.
  - Combine work of WP4 and IT/FIO Group (SCADA)
- Production Hierarchy

  Testbed->LXProto->LXShare->LXBatch (LXPlus)

# Configuration Management Actions

- Target September 2002
- Complete work to put in place a configuration management EDG-LCFG server
  - Test the HLD components in practice
- Create EDG-LCFG client scripts to replace SUE and BIS capabilities
- Create infrastructure to enable automated RPM installation
  - Scalable access to RPM files
  - RPM management

# Monitoring Actions (SCADA)

- Prototype 0 (March)
  - Re-implementation of PEM with PVSS
  - Monitor major farms (LXPlus, LXShare, LXBatch)
  - Capable of 100 parameters/machine
- Prototype 1 (Mid-year)
  - Monitor software components (e.g. castor)
  - Automate simple actions
  - Connect to configuration management system

# Conclusions

- There is a consensus amongst everyone that production environments are important now.
  - Must evolve our understanding of what makes a predictable environment.
    - Architectural, Development and Technology issues.
    - We will start taking developments into production in 2002.
  - Much is to be done and much work is still underway. **Simplification is the key.**
- Must track developments
  - Web services and architectural evolution
  - Commercial interest in providing solutions