Control and Observation in Distributed Environments

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Motivation and Approach

- Large and distributed set of resources, services, applications
- There will be failures
- The grid must be managed
- Develop a general framework for observation and control
  - Observe and control a variety of resources and services
  - Support observation and control of user applications
- Extend the framework for specific tasks
  - Add components to observe new things
  - Add components to perform new actions
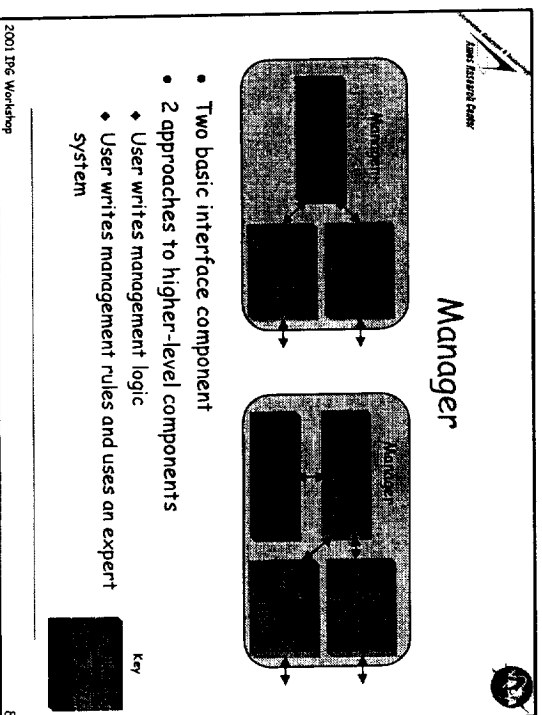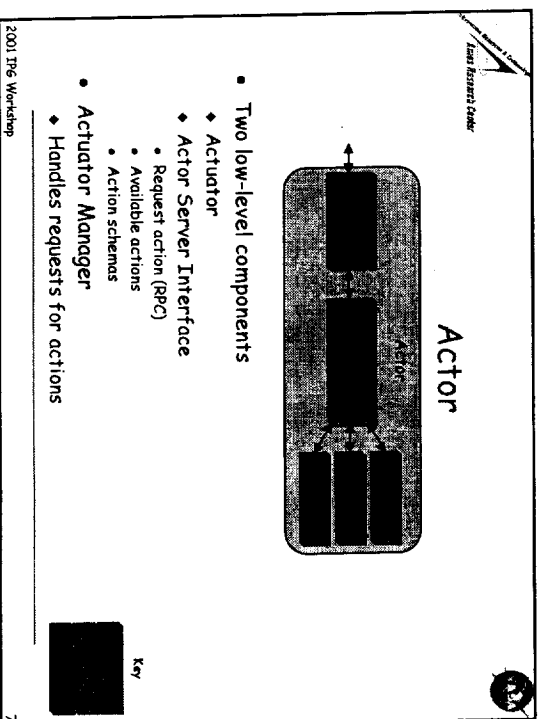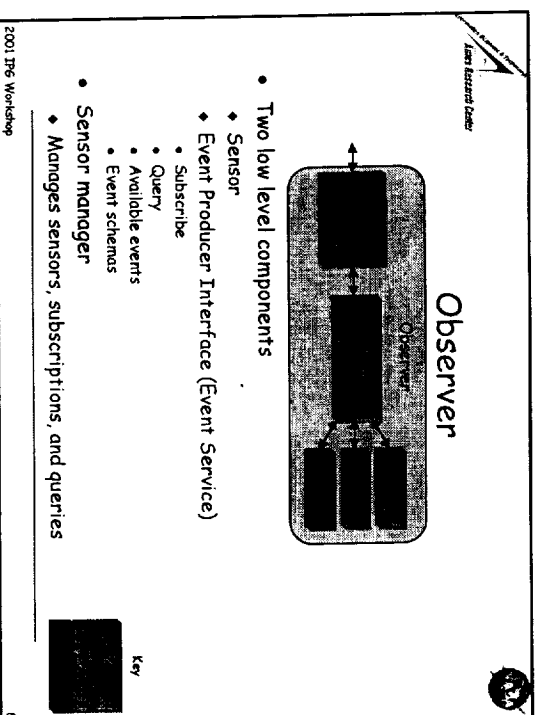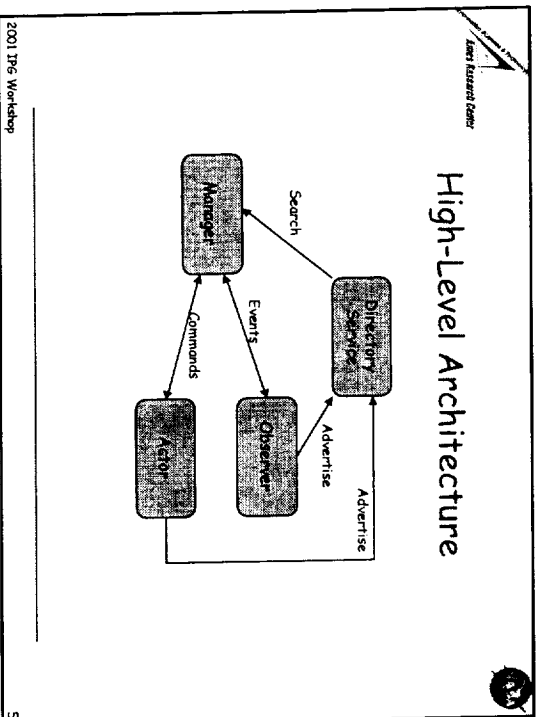 - Add new logic for management

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Why not use an existing system?

- No existing system met all our needs
  - Cannot be embedded in tools or applications
  - Limited fault management functionality
  - System- or application-specific information but not both
  - Lack of extensible data forwarding and gathering mechanisms
  - Incompatibility with security and authentication requirements of IPG
- Testbed for standards developed in the Grid Forum

Goals of our Infrastructure

- Develop a general framework for observation and control
  - Observe and control a variety of resources, services, and applications
  - Scalable
  - Secure
- Framework should be extensible for specific tasks
  - Add new components for observing and performing actions
  - Easily add new logic for management
  - Modular
- Compatible with emerging standards
  - Grid Forum Performance Working Group
  - Grid Forum Event Service Working Group?

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High-Level Architecture

Manager — Search — Directory Service
Events — Commands — Advertise
Actor — Observer — Advertise

Slide 7

Actor

- Two low-level components
  - Actuator
  - Actor Server Interface
    - Request action (RPC)
    - Available actions
    - Action schemas
- Actuator Manager
  - Handles requests for actions

Key

Slide 6

Observer

- Two low level components
  - Sensor
  - Event Producer Interface (Event Service)
    - Subscribe
    - Query
    - Available events
    - Event schemas
- Sensor manager
  - Manages sensors, subscriptions, and queries

Key

Slide 8

Manager

- Two basic interface component
- 2 approaches to higher-level components
  - User writes management logic
  - User writes management rules and uses an expert system

Key

Directory Service

- Information about observers and actors
  - Contact location and protocol
  - Available events and actions
  - Who has access
- Event and action schemas
- Future: information about event consumers
  - Archives
  - Channels

Implementation

- Primary version written in C++
  - pthreads
  - CLIPS expert system
  - Communicates using TCP, UDP, or SSL
  - XML encoding of messages
  - expat parser
  - OpenSSL for authentication and security
    - Compatible with Globus Security Infrastructure identities
  - Currently runs under IRIX, Solaris, Linux
- Manager code also in Java for GUIs
  - TCP, but no UDP or SSL yet
  - Xerces XML parser
- Follows emerging Grid Forum standards

Standardization

- Performance Working Group of the Grid Forum
  - Architecture
  - Event representations
  - Directory service schema
  - Producer-consumer communication protocols
- Grid Event Service Working Group?
- This framework is compatible with the developing standards
- http://www.gridforum.org
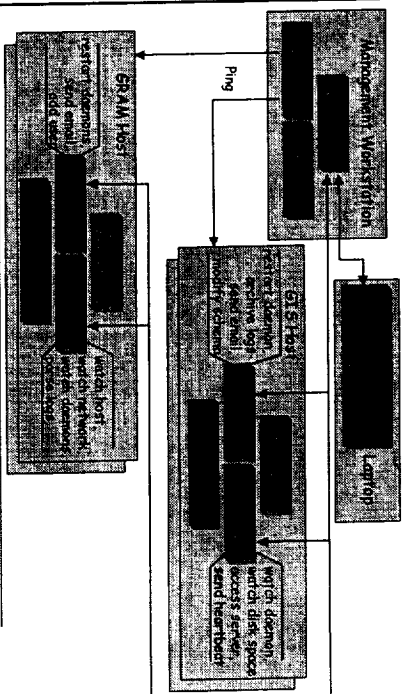- http://www-didc.lbl.gov/GridPerf

Uses of Infrastructure

- Management of a Globus-based computational grid
- Basis for an alternative Grid Information Service
  - Grid accounting
  - Application performance analysis
  - Application steering

Grid Management System

- As grids get larger, it gets difficult to manage grids
- Things to observe:
  - Resource status and usage
  - Grid daemons
    - Grid Information Service servers
    - GRAM reporter daemons
  - Log files
    - Gatekeeper log
    - GRAM reporter log
- Things to control
  - Restarting/configuring GIS servers
  - Restarting GRAM daemons
  - Add/remove user mappings in grid-mapfiles
  - Add/remove certificate authorities
- Provide a nice GUI to do all this

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Grid Management System

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Grid Management System

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Basic GUI

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An Alternative GIS

- Explore different ways to implement information services
- Take advantage of high-performance commercial LDAP servers
- Satisfy requirements of our users
  - ◆ Modification of schemas by users
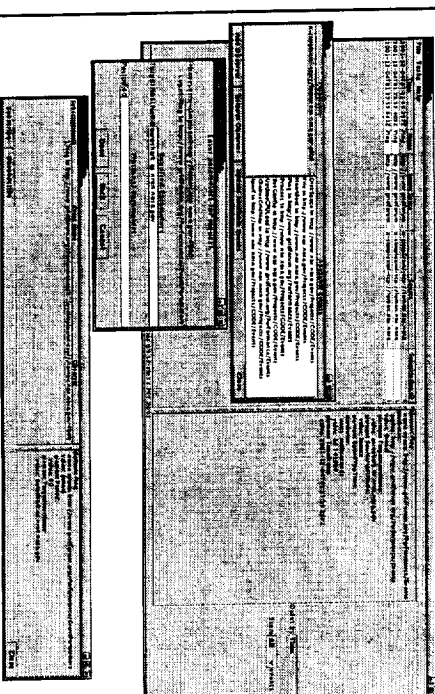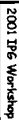 - ◆ User areas
  - ◆ Availability: no root server, replicate top of LDAP hierarchy at each site
- Build using CODE framework
  - ◆ Observers to gather data
  - ◆ Actors to modify LDAP server operation
- Compare to Globus MDS
- Deploy on IPG?

Alternative GIS Status

- Initial design complete
- Basic observation and control functionality ready
- Starting to implement now
  - ◆ Event-to-LDAP gateway
  - ◆ Sensors for exact LDAP entries
    - • What LDAP information do we want?
    - • Start with MDS 2 (not much from Grid Forum yet)
  - ◆ LDAP server management
  - ◆ GSI SASL in IPlanet servers (steal from Globus)
- First version, hopefully, in 2-3 months

Alternative GIS Architecture

Status and Future Work

- Current Status:
  - ◆ Available very soon to U.S. on a per-request basis
    - • Public release in several months???
  - ◆ Code is beta quality, some missing functionality in Java
  - ◆ Preliminary grid management system
- Our future plans include:
  - ◆ Turn observers and actors into web services (convert protocols to SOAP/HTTP with WSDL defs)
  - ◆ More use of LDAP
  - ◆ Complete Java version (UDP and SSL)
  - ◆ More ports of C++ code (UNICOS, ...)
  - ◆ Develop more sensors and actuators
  - ◆ More testing and documentation
  - ◆ A public release!
  - ◆ Use the framework to build tools
  - ◆ Stay compatible with Grid Forum standards

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