Resource Management I

- Dr Peter Dickman
- Email: pd@dcs.gla.ac.uk
- Materials: `/users/students4/software/public/GCM`

- Multiple different perspectives available:
  - Solving a sub-problem in Grid Computing
  - Application of non-Computing concepts
  - Tool development

1988 ACM SIGOPS European Workshop

Autonomy or Interdependence in Distributed Systems

- Principles for Autonomy
- Application requirements for Autonomy
- The domain model of Autonomy
- Navigation in Autonomous Systems
- Autonomy, authentication and security
- Different ideas
- Autonomy in distributed operating systems
- Autonomy and storage

Where is the resource management?

Autonomy: Consider this. . .

with thanks to Sape Mullender. . .

- Nobody may use mine
- Especially not while I'm using it
- I get a new one each year
- I use it every day
- It has no local disk
- Easy management
- Gives me a big smile

- I only use it for my teeth
  I have a bigger one I use for the floor

When is sharing appropriate?

How to we manage that sharing?

Autonomy: and this. . .

with thanks to Jerry Saltzer. . .

- Autonomous is robust, inter-dependent is fragile
  - but dependence with alternates is less fragile

- Have fallbacks

- Don't use services you don't need
- Do it yourself
- So it yourself with mid-course correction
- Use replication
- Use fallbacks
- Ensure $1 \gg p(\text{wrong answer}) \geq 0$
- Interdependence need not be fatal, but requires care

Interesting Survey

Klaus Krauter, Rajkumar Buyya & Muthucumaru Maheswaran

A taxonomy and survey of grid resource management systems for distributed computing

Software — Practice and Experience
Vol 32, pp.135–164 (2002)

Read it. Explore a little further. It does not tell the whole story, but ranges far beyond Globus.

GRAM

- Grid Resource Allocation and Management service
- part of the Globus toolkit
- WS GRAM Documentation
  - WS GRAM : User's Guide
    - www-unix.globus.org/toolkit/docs/3.2/gram/ws/user/index.html
    - "This page is under construction."
  - WS GRAM: System Administrator's Guide
    - Lots of detail on how to install the software etc
  - Familiarise yourself with the architecture diagram
- Where is the resource management?
  - people are doing it, with clumsy software assistance

GRAM goals

- simplify the use of remote systems by providing a single standard interface' for requesting and using remote system resources for the execution of "jobs"
- reduces the number of mechanisms required for using remote resources
  - schedulers
  - queueing systems
  - reservation systems
  - control interfaces
- suppsedly exemplifies the classic Globus hourglass model
  - applications
  - metaschedulers, brokers
  - GRAM
  - local management mechanisms

Some History — VAX/VMS 4.0

Extracted from "Guide to VAX/VMS System Management and Daily Operations" (September 1984)

- Part I: Setting up the System
  - 6. Resource Control
    - Setting limits on reusable system resources
    - Setting priorities for user processes
    - Assigning privileges
    - Accounting for the use of system resources
- Part II Maintaining the System
  - 9. Batch and Print Jobs
    - Creating and Manipulating Queues
    - Establishing Batch Queues
    - Establishing Output Queues
    - Controlling Printer and Batch Queues
    - Managing the Card Reader

Fundamental Principles I

- Understand your goals
  - Motivation
    - Large Hadron Collider
    - BioInformatics
    - Engineering Simulation Composition
  - Environment
    - Supercomputer centres
    - Scientists with access to workstation clusters
    - Need to demonstrate cooperative working
    - Efficiencies in working collaboratively

Fundamental Principles II

- Resource Sharing
  - Whole world sharing
    - XenSource
  - Pairwise agreements (private vocabulary)
  - Pairwise agreements (shared vocabulary)
  - Open communities (e.g. peer-to-peer)
  - Domain specific sharing
    - Particle Physicists
    - Astronomers
    - BioInformatics communities
  - The value and limits of ontologies
- Why do autonomous organisations want to share?

Fundamental questions

- How does one discover a community exists?
- How does one gain membership in that community?
- What is the membership fee?
  - money
  - contributing resources
  - establishing credentials through scientific achievement
- What does membership provide?
  - access to resources
  - guarantes about behaviour of other members
  - regulatory framework
- c.f. medieval guilds and London Clubs

Dull aspects of Resource Management

- Advance reservation
- Usage fees
  - payments
  - fees received
- Enforcement of agreements
- Guarantees of performance

- Resource Discovery and Location
  - name servers
  - DNS
  - Chord/tapestry/DHTs
  - Naming/Addressing schemes
  - Web Services