Grid Application Model and Design and Implementation of Grid Services

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The Scientific Imperative

- Computation and data management infrastructure
- Data intensive science
  - Prospect of federating many archives from different globally distributed sources
  - Virtual observatory, lab
- Simulation-based science
  - Compute intensive
- Remote access to experimental/expensive apparatus
- Virtual community science

The Industrial Imperative

- Evolution of technology: Phase I: Development phase: How to build, how it works, feasibility, trial and error, … popularity of technology grows leading standardization and mass production.
- Phase II: Post technology. Adoption of well tested technology, general public simply assumes the technology. Its existence is transparent.
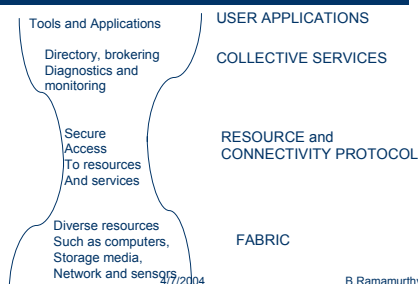
The Social Imperative

- Computing benefits delivered to the masses as a commodity or utility.
- People don't have to own a computer to access computing.
- Resources among participants will be trustfully shared.
- Virtual organization concept will lead to creative business models.

Grid Architecture

Tools and Applications — USER APPLICATIONS

Directory, brokering Diagnostics and monitoring — COLLECTIVE SERVICES

Secure Access To resources And services — RESOURCE and CONNECTIVITY PROTOCOL

Diverse resources Such as computers, Storage media, Network and sensors — FABRIC

Applications

- Predictive maintenance: distributed aircraft engine diagnostics
  - distributed, data centric
  - Requires collaboration among a number of diverse actors within the stakeholder organizations, who may need to deploy a range of different engineering and computational tools to analyze a problem.
  - VO to support services, individuals and systems.

Distributed Telepresence

- The NEESGrid earthquake engineering collaboratory
  - Broad range of activities performed by a community of engineers and researchers engaged in improving performance of buildings and other structures when subjects to effects of earthquake.
  - Expensive experimental facilities
  - Simulation systems
  - Real earthquake prone areas
  - Teleobservation and telecontrol

Scientific Data Federation

- The world-wide telescope
- Astronomy community has a fairly unified taxonomy and metrics and units.
- Cross-comparison of data from various sources, media, and times.
- Making discoveries
- Virtual observatory enabled by the grid
- Statistics and computationally intensive operations

Medical Data Federation

- Biomedical informatics research network: National Institute of Health (NIH) is pioneering use of grid structure for medical research and patient care through Biomedical Informatics Research Network (BIRN) project.
- Scalable infrastructure consisting of advanced network, federated distributed data collections, computational resources and software technologies to handle evolving needs of users.
- Imaging, morphology, mouse models, information mediation.
- Sharing expensive research results.

Knowledge Integration

- In silico experiments in bioinformatics: is a procedure that uses computer-based information repositories and computational analysis to test a hypothesis, derive a summary, search for patterns, or demonstrate a known fact.
- Mygrid is one such experiment.
- More service orientation.
- Services for data-intensive integration.
- Semantic discovery and metadata management.
- Forming experiments.
- See Figure 9.2

Distributed Data Analysis

- CMS: Compact Muon Solenoid is a high-energy physics at European Center for Nuclear Research (CERN) near Geneva, Swiz.
- To be completed in 2007.
- Will record data from highest-energy proton-proton collision.
- Will shed light on fundamental scientific issues.
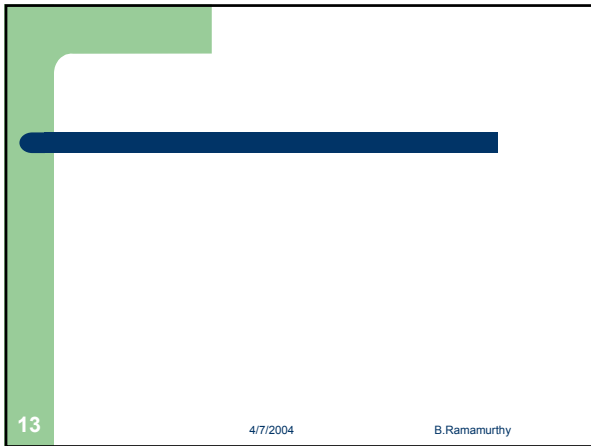- Condor is one of the predominant software used.

Other Applications

- Desktop grids
- Enterprise integration
- Multiplayer gaming infrastructure
- Service virtualization
- Group oriented collaboration systems
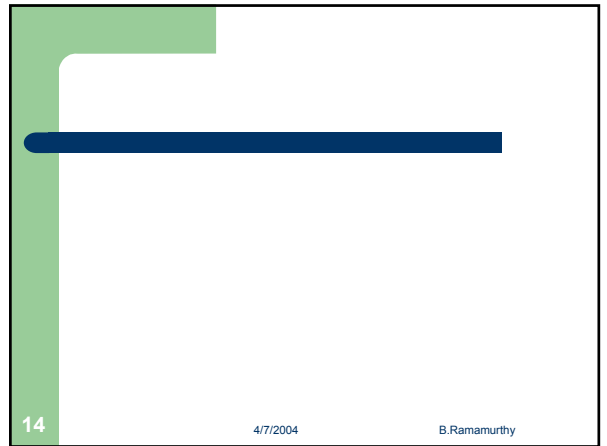- Astrophysics: black holes, novas, stars and galaxies
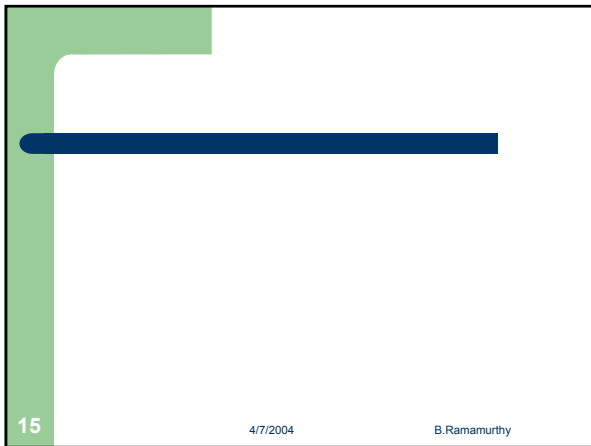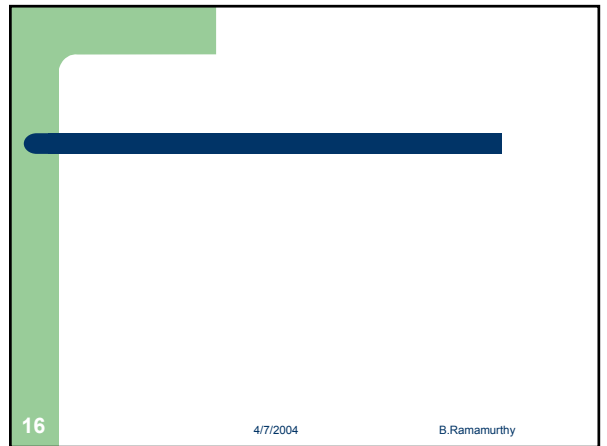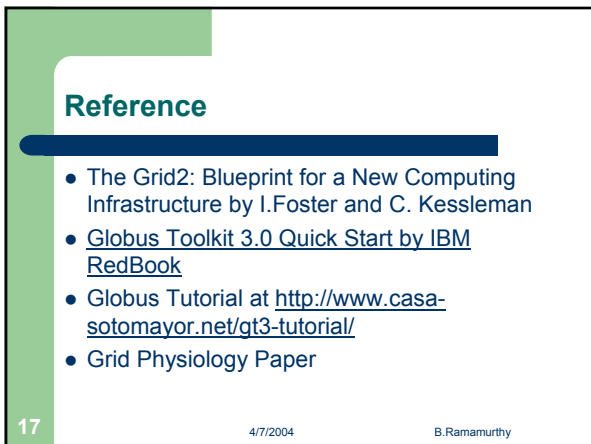
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Reference

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