Introduction and Overview

- “the grid” – a proposed distributed computing infrastructure for advanced science and engineering.
- Purpose: grid concept is motivated by a real and specific problem.
- The Internet, enterprise, distributed fields and peer-to-peer computing can benefit from Grid technologies.

Introduction and Overview

- Distributed Computing companies seek to harness idle computers on an international scale but, currently can only support highly centralized access to those resources.

- Example: SETI

Introduction and Overview

- Assumption in article: Grid technologies complement rather than compete with existing distributed computing technologies.
- Is this true?

Introduction and Overview

- Underlying problem: coordinated resource sharing and problem solving in dynamic, multi-institutional virtual organizations.
- For research purposes, refer to a set of individuals and/or institutions who will share a set of resources as a VIRTUAL ORGANIZATION
  - Example: consultants engaged by a car manufacturer to perform scenario evaluation during planning for a new factory

Introduction and Overview

- Virtual organizations vary, thus need broad set of common concerns and requirements
- Standards:
  1. Highly flexible sharing relationship
  2. Sophisticated and precise levels of control over how resources are shared
  3. Sharing of varied resources
  4. Diverse usage modes

Introduction and Overview

Implementation Issue #1

- Trust in virtual organizations
- A number of mutually distrustful participants with varying degrees of prior relationship want to share resources in order to perform of prior relationship

- ie. *crisis management team responds to a chemical spill by using local weather and soil models to estimate the spread of the spill, determining the impact based on population location as well as geographic features such as rivers and water supplies, creating a short-term mitigation plan, and tasking emergency response personnel by planning and coordinating evacuation, notifying hospitals, and so forth.*

Introduction and Overview

Implementation Issue #2

- Each resource owner makes resources available, subject to constraints on when, where and what can be done.
- Resource consumers may also place constraints on properties of the resources they are prepared to work with.
- Implementation of constraints requires mechanisms
  1. for expressing policies
  2. for establishing identity of consumer or resources
  3. for determining whether an operation is consistent with applicable sharing relationships.

Implementation Requirements/ Open problems

- mechanisms for discovering and characterizing the nature of the relationships that exist at a particular point in time (dynamic nature).
- Resource sharing/usage standards: includes performance metrics, expectations and limitations (lack of a priori knowledge).
- Ability to establish sharing relationships among ANY potential participants (security)
- Interoperability (to avoid bilateral sharing).

Grid Architecture

- Components within each layer share common characteristics but can build on capabilities and behaviors provided by any lower layer.
- Architectural description is high level and places few constraints on design and implementation.

Grid Architecture

PICTURE HERE

Grid Architecture
Fabric layer

- provides the resources to which shared access is mediated by Grid protocols
- implement local, resource-specific operations that occur on specific resources as a result of sharing operations at higher levels.
- Resources should implement enquiry mechanisms that permit discovery of their structure, state and capabilities
- Resource management mechanisms that provide some control of delivered quality of service.

Grid Architecture
Connectivity layer

- Connectivity layer defines core communication and authentication protocols required for Grid-specific network transactions.
- Enable the exchange of data between Fabric layer resources.
- Include transport, routing and naming.

Grid Architecture
Resource layer

- Builds on connectivity layer.
- Resource layer implementations of these protocols call fabric layer functions to access and control local resources.
- Resource layer protocols are concerned entirely with individual resources.
- 2 primary classes:
  - Information Protocols: used to obtain info about structure and state of a resource
  - Management Protocols: used to negotiate access to a shared resource, specifying resource requirements to be performed, such as process creation, or data access.

Grid Architecture
Collective layer

- Contains protocols and services that are not associated with any one specific resource but rather are global in nature and capture interactions across collections of resources.
- Collective components may be tailored to the requirements of a specific user community, VO or application domain.
- The larger the target user community, the more important it is that a Collective component's protocol(s) be standards based.