# Relevance of Grid Computing for India in the era of Cloud Computing

# Presentation Outline

- A little about C-DAC
- Grid Computing
- How Grid Computing differs from Cloud Computing
- Why Grid Computing matters for India
- Challenges faced by Grid Computing

# A little about C-DAC

- Centre for Development of Advanced Computing
- Premier R&D organization of the Ministry of Electronics and Information Technology (MeitY), Government of India
- C-DAC in HPC, Grid & Cloud
  - PARAM series of Supercomputers
  - GARUDA
    - India's National Grid Computing Initiative
  - SuMegha Scientific Cloud

# What is Grid Computing

- Distributed Computing Paradigm
  - Geographically distributed resources
- Various organizations contribute resources
- Huge computational and storage requirements can be addressed
  - Can connect supercomputers
  - Make a virtual supercomputer
- The three criteria
  - Open standards
  - No centralized administration
  - Non-trivial quality of service

# How Grid Computing differs from Cloud

- Grid emphasizes collaboration of
  - Hardware resources
  - Software resources
  - Human expertise
- Collaboration improves innovation
  - Very important for science
- Access mechanisms can be different
  - Grid may employ Certificate-based access mechanism
  - Cloud may employ credit-card-based access mechanism
- Grid is the next level of parallel computing
  - Cloud doesn’t have a bias towards parallel computing

# How Grid Computing differs from Cloud

- Payment mechanism can be different
  - Public Cloud typically has payment mechanism based on usage
  - Grid may employ a fixed minimum charges or usage-based charges
  - Grid may even waive off payment completely for a few deserving users
    - Though accounting will be done
- Virtualization is not required in the Grid
  - Cloud is heavily dependent on virtualization

# How Grid Computing differs from Cloud

- Multiple organizations may contribute resources
  - Not just one
- No centralized administration
- Users themselves may provide resources.
  - Not third-party
- Likely to be dominated by High end systems
  - In contrast to Cloud, which may consist of commodity systems
- Grid may give a lot of importance to performance
  - Though maximum system utilization also is a major goal

# Grid Computing matters for India

- Grid Computing can co-exist with Cloud Computing
  - By targeting different types of users
- High end computing facilities are maturing in India
  - Fastest supercomputer in India 45th in 52nd edition of top 500 list
- In special cases, users can get access without payment
  - Can motivate more users towards research
- Huge talent pool
  - But need access to systems for implementing the research
- Grid is optimized for HPC
  - High end systems
  - Multi-level and efficient scheduling

# Grid Computing matters for India

- Grid can make optimal utilization of available resources
  - By making resources available to a wider audience
  - But still without sacrificing performance
- Users don't need credit card
  - Vast majority of the population still do not own credit cards
- National Knowledge Network (NKN)
  - Huge enabling factor for Grid
  - Network is very highly important for Grid

# Grid Computing matters for India

- National Supercomputing Mission (NSM)
  - Envisages setting up multiple supercomputer installations across India
  - Grid can interconnect these resources
    - Thereby providing access to users from multiple localities and organization
  - Grid in combination with NSM & NKN can make India self-reliant in supercomputing resources
- Grid Computing targets a niche category of users
  - For e.g., the parallel computing community, scientific community
- India is a developing country.
  - Not many researchers can afford cloud

# Challenges faced by Grid Computing

- Return on Investment
  - May not be consistent, since it is not market-oriented like Cloud
- Providing access to users who do not belong to any organization
  - Verifying credentials may not be straight forward
- May end up being dominated by Government players
  - Can reduce innovation because of lesser number of players
- Research may not always give fruitful results
  - Importance of work may get questioned

# Thank You!