The Design and Implementation of Federated Cloud in WIDE Project

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Motivation

• We need “Cloud” for Researchers.
  • Why?
  • Need servers for analysis and computation for measured data
  • Need storage for measured data
• Reducing daily operational costs
  • Hardware trouble, blackout for legal inspection
• Reducing costs for building environment
  • Prepare servers for computation, network experiments
Motivation

• A number of universities and research institutes are joined in WIDE Project
  • We build “Cloud” for Researchers
  • We can share resources.
  • Interconnection of clouds => Federated cloud
Challenges

• We evaluate possibility of Federated cloud in actual environment.

• Interconnecting clouds
  • Each Universities has different policy, facilities and networks.

• Providing flexible resource allocation
  • CPU is allocated from NAIST, Storage is allocated from JAIST, Network is allocated from KEIO.

• Migration of resources
  • Avoiding interruption due to blackout, network maintenance.
Design

- Four components for Virtualization
  - CPU
  - Storage
  - Network
  - I/O
- Each component should be migratable.
Implementation

• Hypervisor
  • kvm, xen

• Storage
  • iSCSI, NFS
  • Distributed filesystem, Cluster filesystem

• Network
  • NEMO, Stateless NAT

• I/O
  • Internet (not dedicated line)
Current Status

- Interconnecting clouds on each universities
  - Merging different technologies on each universities.
- Implemented Controller for Federated cloud
  - Controlling different network, facilities
- It works
Storage Performance measurement

• Measured I/O performance between CPU and Storage

• Preliminary result
  • iSCSI + Linux on kvm
  • Average of 20 times evaluation
  • 1G link, 1500byte MTU
  • Write
    • 64kbytes – 2Gbyte files
    • 4kbytes – 1024kbytes records
• Red lines: iSCSI storage mounted on each VM
• Green lines: iSCSI storage mounted on HyperVisor
Actual Application up to today

- GIT web server of research project.
  - USAGI Project
    http://www.linux-ipv6.org/gitweb/gitweb.cgi

- WIDE web server for avoiding power outage

- Web and programming server for university lecture

- P2P broadcasting server for the 2nd budget screening meeting by government
  (第2回事業仕分け)

- Please use for research purpose.
Future Works

• Distributed filesystem
  • Not replication, **shared filesystem** like a RAID5 using network.

• Flexible Network
  • **Network Mobility**

• High Availability
  • VM duplication and synchronization
  • **Automatic migration for avoiding troubles** – algorithms

• Security Management
  • Accommodate different policies for network
  • Encryption of storage and I/O