Follow the Sun through the Clouds: Application Migration for Geographically Shifting Workloads

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Supercloud Demo
Supercloud Demo

VM

Nested VM

HTTP

VM

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Supercloud Demo

VM

HTTP

VM

Nested VM

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Highlights

• Automatic VM placement and migration
• Migrated VMs are LIVE
• IP addresses are not changed
• TCP connections are not broken
Demo  (Full video available at [http://supercloud.cs.cornell.edu](http://supercloud.cs.cornell.edu))
Full Demo (http://supercloud.cs.cornell.edu)
Highlights

• Automatic VM placement and migration
• Migrated VMs are LIVE
• IP addresses are not changed
• TCP connections are not broken

• Appears as a unified private cloud that spans all clouds
• Controlled by the user!
Research Challenges

• How to migrate across incompatible virtualization platforms?

• How to keep IP addresses unchanged and TCP connections unbroken?

• How to decide when and where to migrate?

• How to make the system efficient?
Supercloud is the first system that supports automatic, efficient, and live VM migration across heterogeneous cloud providers without changing IP addresses or breaking TCP connections.
Supercloud Architecture

• Computation
  • Nested hypervisor: Xen-Blanket
  • Support all major platforms

• Network
  • SDN overlay
  • Support migration with public IP

• Storage:
  • Geo-replicated storage
  • Optimized for serving VM images

• Resource management
  • OpenStack platform
  • Automatic scheduling framework
Supercloud Networking

• Challenges:
  • Optimal routing without extra forwarding
  • Migration without changing IP addresses

• Solution:
  • VPN overlay with full-mesh tunnels
  • Frenetic SDN controller
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VM Migration with Public IP Address

54.172.26.213

VM

Pub IP front-end

54.172.26.213

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VM Migration with Public IP Address
VM Migration with Public IP Address

54.172.26.213

Dynamic DNS?
- Can be delayed due to cache
- Can cause connection interrupts
- Some applications might not work

Pub IP front-end

54.172.26.213

VM
VM Migration with Public IP Address

54.172.26.213

52.69.94.195
VM Migration with Public IP Address

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Centralized VM Image Storage

Long latency; Low throughput
Geo-Replicated VM Image Storage
Geo-Replicated VM Image Storage
Geo-Replicated VM Image Storage

Challenges:
- Strong consistency requirement
- Long latency and low throughput in WAN

Supercloud VM image storage:
- Decoupling consistency from data propagation
- Propagating data according to disk access patterns
In the Paper

• Comparison with application-level migration
• Placement policies for different types of applications
• Detail design of the image storage
• Hierarchical network topology
• Evaluations
Conclusion

• **Supercloud**: application migration for geographically shifting workloads
  • Crossing heterogeneous cloud providers
  • Automatic placement and migration
  • Geo-replicated image storage
  • Wide-area SDN

• A unified private cloud that spans all clouds

• Controlled by the user!

• More at [http://supercloud.cs.cornell.edu](http://supercloud.cs.cornell.edu)

Thank You.
Questions?