Hybrid Cloud Computing for FOSS4G

Bastian Schäffer, Theodor Foerster & Bastian Baranski

52°North
Google Trends

cloud computing 1.00  grid computing 1.50  distributed computing 0.95

Search Volume index
7.50
5.00
2.50
0

2004  2005  2006  2007  2008  2009

News reference volume

Google Trends

www.52north.org/security
Aspects

Categories
- SaaS
- PaaS
- IaaS

Models
- Private Cloud
- Public Cloud
- Hybrid Cloud

Provider Types
- Provider
- Enabler

Activities
- Research
- Commercial Offering
- Usage

Roles
- User
- Broker
- Customer
- Provider

Characteristics
- Virtualization
- Ubiquität
- Elasticity
- Scalability
- Reliability
- Diversity
- Service Level Agreements
- Pay-per-use
- On-demand

Benefits
- Flexibility
- High performance
- Risk minimization
- Geographic independence

Constraints
- Data Privacy
- Data Disjunction
- Data Recovery

Composition
- Hardware
- Software
- Devices
- Support

Source: Fraunhofer IAO, IAT Universität Stuttgart
Aspects

Characteristics
- Virtualization
- Ubiquität
- Elasticity
- Scalability
- Reliability
- Diversity
- Service Level Agreements
- Pay-per-use
- On-demand

Roles
- User
- Broker
- Customer
- Provider

Provider Types
- Provider
- Enabler

Activities
- Research
- Commercial Offering
- Usage

Categories
- SaaS
- PaaS
- IaaS

Models
- Private Cloud
- Public Cloud
- Hybrid Cloud

Benefits
- Flexibility
- High performance
- Risk minimization
- Geographic independence

Constraints
- Data Privacy
- Data Disjunction
- Data Recovery

Composition
- Hardware
- Software
- Devices
- Support

Source: Fraunhofer IAO, IAT Universität Stuttgart
Cloud Computing

- The cloud metaphor is used to represent efficient, elastic, scalable and reliable computational infrastructures
- Provisioning of resources (server, storage, applications … whole IT infrastructures) via services and web-applications over the network
- Outsourcing data and applications to external service providers
- Replacing classical desktop software with web-based applications
# Categories

| Software as a Service (SaaS) | - Dynamic Software and data provisioning (outsourcing, on-demand)  
| - Allows pay-per-use revenue models |
| Platform as a Service (PaaS) | - Software development and deployment platform  
| - Quality of Service, QoS (scalability) managed by cloud provider |
| Infrastructure as a Service (IaaS) | - Virtualized and dynamically managed (elasticity) IT infrastructure  
| - Dynamic resource (server, storage) provisioning (on-demand)  
| - Delivers computational infrastructures as services over the network |

![Diagram of Server and Storage](image-url)
IT investments & maintenance

requests vs. time

- 20,000$
- 40,000$
- 80,000$

Taifun?
IT investments & maintenance

requests

120.000$
80.000$
40.000$
20.000$

20.000$
40.000$
80.000$
120.000$

time
IT investments & maintenance

- Time
- Requests
- 20,000$
- 80,000$
- 120,000$
- 40,000$
Hybrid Clouds

- Private Cloud
- Hybrid Cloud
- Public Cloud
Hybrid Clouds
Static Model
Architecture

Intel Pentium D CPU
2.80GHz
2GB RAM

Intel Core 2 Duo CPU E6850
3.00GHz
4GB RAM

Intel Core 2 Duo CPU E8500
3.16GHz
4GB RAM
Architecture
Architecture

- Head Node
- Worker Node 1
- Worker Node 2
Architecture

Head Node

Worker Node 1

Worker Node 2
Head Node

Cloud Controller
Cluster Controller
Architecture

Head Node

Worker Node 1

Worker Node 2
Worker Node

sysstat: CPUMon
Big Picture

Apache HTTP SERVER PROJECT

Eucalyptus Systems

NGINX

52north

VM

KVM

VM

KVM

VM

KVM

VM

KVM

VM

KVM

VM

KVM

VM

KVM

VM
Dynamic Model
Big Picture
Big Picture
Big Picture
Big Picture

Apache HTTP SERVER PROJECT

Eucalyptus Systems

NGINX

52north

VM 1

VM 2

KVM

KVM
Big Picture

Apache HTTP SERVER PROJECT

Eucalyptus Systems

NGINX

52north

VM 1,2

52north

VM 1

VM 2

KVM

KVM
Big Picture

Apache HTTP SERVER PROJECT

Eucalyptus Systems

NGINX

52north

VM

VM

1, 2

1, 2

1

2

KVM

KVM

Core 2 Duo

Core 2 Duo

www.52north.org/security
Big Picture

Apache HTTP Server Project

Eucalyptus Systems

NGINX

52north

VM 1, 2

KVM

VM 1, 2

KVM

FOSS4G 2010

www.52north.org/security
Big Picture

Apache HTTP Server Project

Eucalyptus Systems
1, 2, 3, 4

NGINX
1, 2, 3, 4

52north

VM 1, 2, 3, 4

VM 5, ...

KVM

Amazon Web Services™
Dashboard
Transparent
Summary

• Hybrid Cloud Evolution
• Cost effective and elastic setup
• Scaleable
• Transparent
• Manageable
Future Work

• Performance Tests
• ROI/Break Even