Panel
"Clouds Meet Energy and Resources Savings for Society Services"

Moderator
Yuri Demchenko, University of Amsterdam, Netherlands

Panelists
Wolf Zimmermann, University of Halle, Germany
Ethan Hadar, CA Technologies, USA
Steven Greenspan, CA Technologies, USA
Orazio Tomarchio, University of Catania, Italy
Yong Woo Lee, University of Seoul, Korea (* by slides)
Resource saving issue

- Cloud is actively pushed by business and aggressive marketing
  - Do we know any example of business activity (aka gold rush) that have been motivated by resource saving?
- Can cloud create new jobs? Indeed save something in one place without loosing in another place?
- Is business and resources consolidation with clouds good for the global community?
  - Can cloud decrease digital divide?
  - Can developing countries benefit from cloud?
Energy saving issue

• Is this a statement, intention, wish or discussion challenge?

• Is cloud computing becoming a dirty technology that brings ecology challenge?
  – Should we put cloud datacenters to still ecological clean places (tundra/polar, desert), or should we move/keep them at already devastated places like big cities and Chernobyl/Nevada zones?

• What real step has been done to contain ecology impact of the modern ITC and Clouds?
  – Is standardisation important? What to standardise?
Standardisation and Initiatives

• Standardisation is an important part of achieving community coordination to reach common goal
  – Especially in the technology area

• Existing standardisation in the area of “green” technologies

• GreenSonar BOF at OGF35 - 17-19 June 2012, Delft, NL
Sustainability requires Green-IT in all kinds of resources, compute, network, storage, sensor, …

Measure to know; information needed for smart infrastructure.

Basic idea: been there done that in Networking!

Why not apply NM & PerfSonar methods and architecture to Green & Energy information?

Need also application information.

Big hurdle: energy metrics on heterogeneous resources

BOF/Charter meeting at OGF36, Chicago.
ECO-Scheduling @ GreenSonar BOF OGF35

Slides on GreenSonar BOF at OGF35 – Courtesy Prof. Cees de Laat (UvA)
Panel Summary
Panel Summary

• Software is an important factor of energy saving
  – Energy aware program engineering
  – However needs better tools and underlying hardware and OS platform information
• Market factors are key in shaping cloud technology to social and community needs
  – More offering of cloud resources will drive cloud move to more energy and resource saving
  – Current cloud and high performance communication technologies are still not energy saving technology
• Globalisation in cloud offering will involve customers’ factor in pushing/moving clouds to resource and energy saving
  – Businesses themselves can not create critical factors here
  – When customers have a choice they will create these factors
• Transparency in cloud architecture and cloud applications will provide a basis for market feedback and regulation
  – This will allow to rise a so-called “cloud curtain” in cloud technologies
• Standardisation will play an important role in facilitating “green” technologies
  – We need both eco/green “navigator” and “taximeter"
• Cloud is a new technology, a new “living space” that we have not built before
  – We need many things to built in a new way
  – It provides a new virtual living space for people, communities,
Cloud Service Offerings in future public cloud markets

Orazio Tomarchio

Dep. Of Electrical, Electronic and Computer Engineering
University of Catania (Italy)
Current cloud market

- Which cloud platform should I use?
- Can I change if I am not satisfied?

Lack of interoperability $\rightarrow$ vendor lock-in problem
A future open cloud market

Improving interoperability

Increasing competitiveness

New providers – new (and more differentiated) cloud offerings

Customer can obtain better services
Providers perspective

- Diversification of cloud offerings to serve “at best“ customers:
  - Price models
  - Quality of Service

- To reduce costs (also including energy savings):
  - Smarter resource management schemes
  - Need more info about customers application features
Customers perspective

- Mechanisms to identify and compare the value of offerings
  - New models to calculate and compare costs and revenue

- The user must/wants to be able to assess the quality of the provided services, in accordance with the contractual agreements
Customers perspective

There must be a better way of choosing cloud providers!
How to effectively support the supply-demand matchmaking of cloud resources?
IMHO

- Methodologies, models, mechanisms and tools to favour:
  - The definition and advertisement of providers’ offers
    (from a business point of view – price vs. quality)
  - The definition of the application requirements and customers’ requests
  - Offer-request matchmaking

Semantic technologies and ontologies
Thank you for your attention ☺️
Do Clouds save Energy?

Wolf Zimmermann

Martin-Luther-University Halle-Wittenberg

CLOUD COMPUTING 2012
Yes, Clouds save Energy and Resources

**Traditional View**

- Desktop is connected by LAN to a server
- Physical Machine

\[ E = E_{\text{Desktop On}} + E_{\text{Server Busy}} + E_{\text{Server Idle}} \]

**Virtual Machines and Cloud**

- Desktop is connected to a cloud server
- Cloud starts virtual machine for the desktop
- Idle times can be used by other clients
- Requires clever scheduling

Wolf Zimmermann
Yes, Clouds save Energy and Resources

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Virtual Machines and Cloud

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\[ E' = E_{\text{Desktop on}} + E_{\text{Transmission}} + E_{\text{VirtualMachine}} + E_{\text{CloudAdmin}} \]

Remark: \( E_{\text{VirtualMachine}} \) may vary by choosing adequate nodes

\[ \Rightarrow E_{\text{VirtualMachine}} \ll E_{\text{Server Busy}} \text{ may be possible} \]
No, Clouds cost Energy and Ressources

Problem

$$E_{VirtualMachine} \gg E_{Server Busy}$$ may lead to more energy consumption using clouds

- Old technology for cloud servers, modern energy-efficient technology for traditional servers
- A Traditional server is located in northern regions, the cloud server in southern regions

⇒ Traditional server consumes less energy due to air-conditioning

Software Service $S$ on the Cloud

Traditional:

Cloud:

Observation: $E' > E$ is not unlikely to happen
No, Clouds cost Energy and Resources

Problem

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\[ \implies \text{Traditional server consumes less energy due to air-conditioning} \]

Software Service \( S \) on the Cloud

Traditional:  
\[ E = E_{\text{S on Server}} + E_{\text{Desktop On}} \cdot \frac{T_{\text{S on Server}}}{T_{\text{Desktop On}}} \]

Cloud:  
\[ E' = E_{\text{S on Cloud}} + E_{\text{Transmission}} + E_{\text{Desktop On}} \cdot \frac{(T_{\text{S on Cloud}} + L)}{T_{\text{Desktop On}}} \]

Observation

\[ E' > E \] is not unlikely to happen
Challenges

- Identification of the breakeven points between savings and additional costs?
  - Requires adequate energy model
  - Energy aware scheduling?
  - Energy aware cloud administration?
  - Energy consumption as a service quality/SLA?

- Requires analysis of energy consumption of services on different devices and locations

- The same kind of observation and questions apply to other resources such as e.g. memory or execution time
Cloud Computing in the Ubiquitous City to Meet Energy and Resources Savings for Society Services

Presented by Yong Woo LEE, Ph.D.
The President of Ubiquitous City Consortium
Director of Seoul Grid Center
Professor, Univ. of Seoul, Korea
Chair, Korea National Standard Committee for ISO JTC1/ SC22
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For the Cloud Computing 2012 Panel Discussion
2012. 7. 25
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  - It will save energy and resources and make Seoul a Green IT City.

The Smart (Ubiquitous) City Consortium
New Seoul U-City Network for Cloud & Ubiquitous Computing
New Seoul U-City Network

Converged Network.

WWAN  WMAN  WLAN  WPAN

3G
W-CDMA
CDMA2000

WiMAX*
IEEE 802.16

Wi-Fi*
IEEE 802.11

UWB
Bluetooth

RFID
Seoul IT Complex to manage Cloud & Ubiquitous Computing
Seoul IT Complex to manage Cloud & Ubiquitous Computing
Thank You!
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Technologies available – Complexity remains

- SAGE
- CGLX
- Chromium
- OCCI
- JSDL
- SAGA
- GIR
- NSI
- NetConf
- SNMP
- OpenFlow
- Perf
- Sonar
- DIAS
- ByteIO
- iRODs
- OCCI
- JSDL
- SAGA
- DIAS
- ByteIO
- iRODs
- OGSA
- WebServ

Service Plane

Cloud Computing 2012
Panel - Energy and Resources Saving
Are Community-Clouds Sustainable?

Steven Greenspan
SERVICE COMPUTATION 2012 July 2012
Data Center Demand For Electricity Is Growing Rapidly

- Approx. $450bn US dollars spent annually on new data center space\(^1\)
- Estimated electricity demand of data centers: 31GW globally\(^2\)
  - Increase of 19% in 2012 from 2011
- Global mobile data traffic grew by 133% in 2011\(^3\)
  - 597 petabytes of data sent by mobiles every month

## Date Center Report Card

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<th>Coal</th>
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<th>Renewables &amp; Advocacy</th>
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Cloud Computing: Some Pros and Cons

Benefits of Cloud Computing

- Virtualization & Resource Pooling
  - Large centralized utility model
  - High utilization & efficiency
  - Redundancy & load balancing
- Workload optimization

Reducing energy footprint

- Decrease air conditioning
- Locate where energy is cheap
- Shift workloads
- Avoid over building

Sustainability Issues

- Possibility of large scale, systemic outages
  - Amazon (C3) outage
  - Vendor lock-in
- Constraints on growth
- PUE ≠ Carbon Footprint
Are Community Clouds sustainable

Sustainability Benefits

- May improve resource planning
  - Members are both providers and consumers
  - Policies and operational decisions reflect membership
- Heterogeneous infrastructure
- Balanced approach to usage
  - Similar to smart grid approach, where consumers regulate usage during peak load
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Community-Commerce Brokering Arena for Opportunistic Cloud

Steven Greenspan & Ethan Hadar
SERVICE COMPUTATION 2012  July 2012
Who are we?

- **CA Technologies is an IT management software and solutions company**
  - Our products enable customers to **manage** and **secure** IT environments and deliver **more flexible IT services**.
  - Mainframe, Distributed Enterprise, and Cloud solutions

- **Dr. Ethan Hadar** – Distinguished Engineer & SVP Corporate Technical Strategy
  - Distinguished Engineer and Senior Vice President, Corporate Technical Strategy, as well as for leading CA Technologies Israel Research & Development
  - Ph.D. from the Department if System Analysis and Operations Research at the Technion, and an M.Sc. and B.Sc. in Mechatronics

- **Dr. Steve Greenspan**
  - Senior Vice President and a Research Staff Member in CA Labs
  - Chair of Industry Advisory Board for the Center for Dynamic Data Analytics
  - Co-inventor on over 20 US awarded patents
  - PhD in Cognitive Psychology
Overview of Talk

- Introduction
  - Delivery Models & Service-Oriented Business Ecosystems
  - Community Clouds
- Community-Commerce Brokers
- Conceptual Architecture
  - Broker
  - Provider Side
  - Requestor (Consumer Side)
- Discussion
**Introduction:**

Delivery Models & Service-Oriented Business Ecosystems

- **Public Cloud**
  - Single provider; multiple consumers

- **Private Cloud**
  - Single provider; single consumer

- **Community Cloud**
  - Multiple providers; multiple consumers

- **Hybrid Cloud**
  - Cloud-bursting is the typical scenario

- Each delivery model requires a customized resource coordination and brokering model
Introduction:
Community Clouds - examples

- Government
- Financial
- Open Innovation R&D
  - Pharmaceutical: hospitals, universities, manufacturers
- Supply Chain
  - R&D, manufacturing, distribution

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Many providers and many consumers within a single community
- Exclusive use by a specific community of consumers who are also providers
- May exist per-project, within a community
- Shared concerns (e.g., mission, policies)
- Resource sharing
- Services may be available opportunistically

Coordination & QOS may be brokered by a single organization or distributed across organizations
- Provide information on available services
- Coordinate, Monitor and Manage
- Supply “core” services, e.g.,
  - Service orchestration tools
  - QOS Reports
- Facilitate negotiations among members & external vendors
- Record who provides resources and services, and who consumes
  - Companies may expect compensation for services delivered
Conceptual Architecture
Community-Commerce Brokering Arena for Opportunistic Cloud

Provider Side

Brokering System

Requestor (Consumer) Side

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Role of Brokering System

- Conducts matchmaking between potential service providers and requestors, and facilitates the negotiations between the two sides.
- Identifies gaps between needs and available services
- Manages rewards vs. costs
Role of Provider Side

- Enables the IT provider to publish the potential services offerings
- Publishes the opportunistic availability of the service
Role of Requestor Side

- System enables the requestor of services to subscribe to services registered in the brokering system.
  - The requestors can define criteria for the services
Benefits

- Maximize capacity utilization
- Promote “fair” sharing of resources
- Negotiate with external IT service providers and consumers
  - Promote revenue generation
- Detect new business opportunities
Thank you for your questions and attendance
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New Seoul U-City Network for Cloud & Ubiquitous Computing

- Internet
- Infrastructure
- Network Services
- Cloud Computing
- Ubiquitous Computing
- City Network for Cloud & Ubiquitous Computing

- 1G/10G
- 2G/20G
- 1G
- 2G/20G
- 1G/10G
- 1G/10G
- 1G

- Districts:
  - Youngsan
  - Jung
  - Jongno
  - Seongdong
  - Dongdaemun
  - Gangnam
  - Gwangjin
  - Gangbuk
  - Seongbuk
  - Nam
  - Seongdong
  - Gangnam
  - Gwangjin
  - Gangbuk
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  - Gangbuk
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  - Gangnam
  - Gwangjin
  - Gangbuk
  - Seongbuk
  - Nam

- Equipment:
  - BD6808(GbE)
  - Alpine3808(GbE)
Converged Network.
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to manage Cloud & Ubiquitous Computing
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