

Is Cloud Computing a new technological fad?

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How do we define it?

How can it be for me?

When does(n't) it make sense?

What are the challenges?

What are our interests/initiatives?

Technological fad???

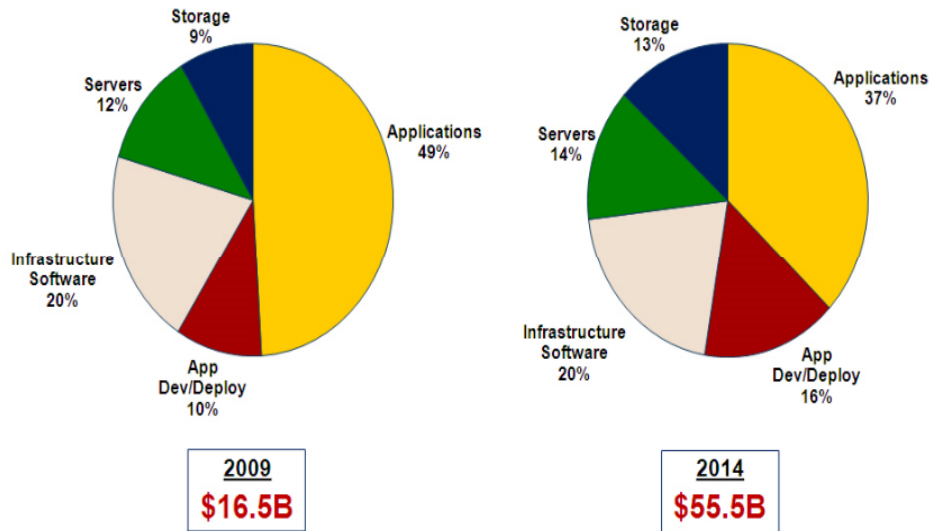
What is Cloud Computing?

“Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction.” (A definition by the US National institute of standards and technology (**NIST**))

- **Some of the characteristics**
 - Distributed computing at a massive scale
 - On demand elasticity
 - Exploiting existing technologies (Grid, Utility, Virtualization)
 - Pay per use model
 - Driven by economies of scale

Market Forecast

Worldwide Public IT Cloud Services* Spending (\$B)
by Offering Category
2009, 2014

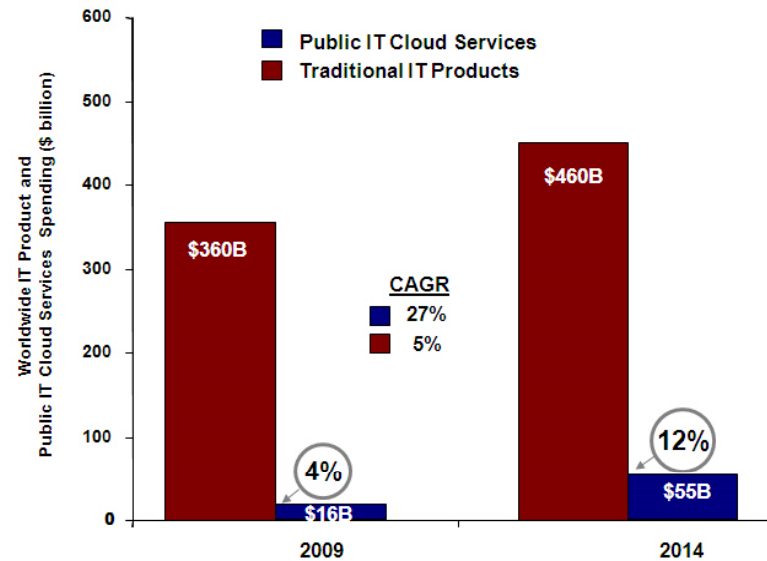


Source: IDC, June 2010

* Includes spending on Applications, Application Development & Deployment Software, Systems Infrastructure Software, Server capacity and Storage capacity provided via the public Cloud Services delivery model.

Market study on worldwide public IT cloud services by category

Worldwide IT Spending* by Consumption Model
2009, 2014 (\$B)



Source: IDC, June 2010

* Includes spending on Applications, Application Development & Deployment Software, Systems Infrastructure Software, Server capacity and Storage capacity via both traditional product model and the public Cloud Services model.

Market study on worldwide IT spending by consumption model

Service and Deployment Models

Software as a Service (SaaS)

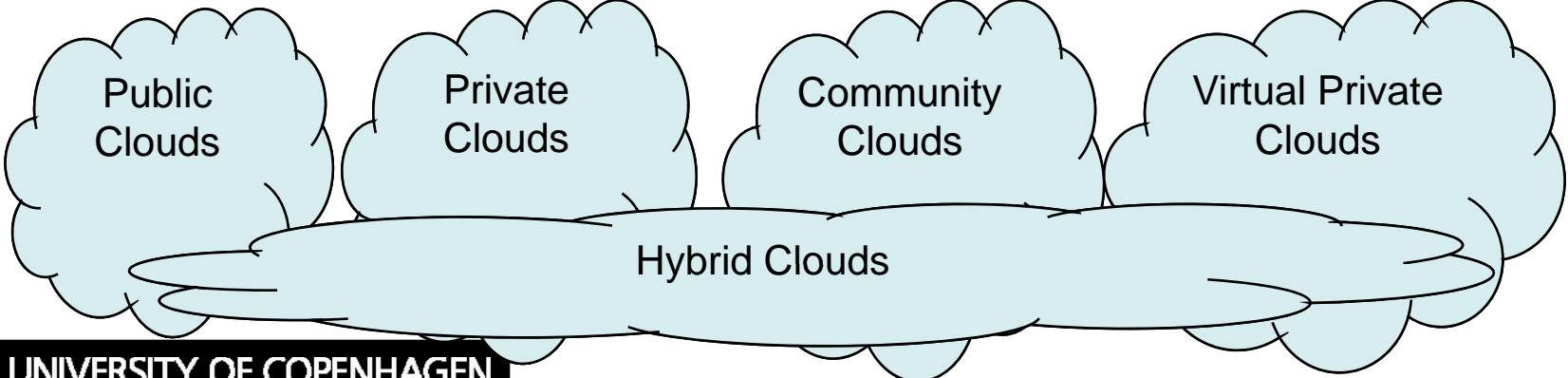
Google Apps	Zoho	Salesforce CRM	Microsoft Cloud Services
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Platform as a Service (PaaS)

Google App Engine	Microsoft Azure	Force.com	Yahoo Open Strategy
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Infrastructure as a Service (IaaS)

Amazon EC2	Eucalyptus	IBM – Computing On Demand (DoC)	VMWare vSphere
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Service Models

Deployment Models

Is Cloud Computing for Me?

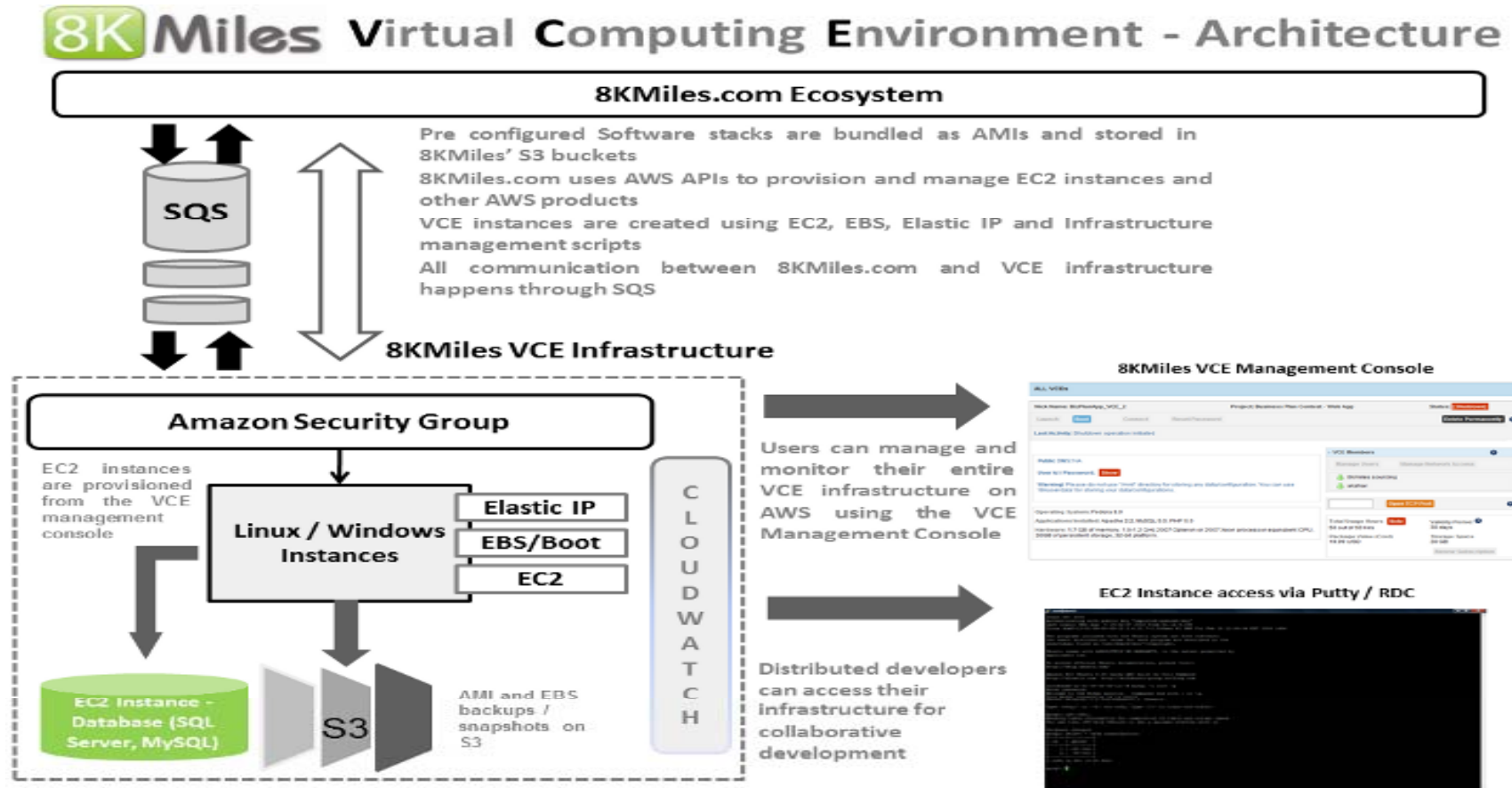
- For end users
 - Cost reduction: From capital investment to operational expense (pay per use)
 - Ease of use via standardized mechanisms, e.g. Browser
 - Flexibility and short time-to-result
- Services providers
 - Reduction of the entrance barrier
 - Reduction of time to market
- Private Cloud
 - Maximize the utilisation of computing resources
 - Minimize operational costs and the organisation keeps full control of its data centres



When Does a Cloud Make Sense?

- “Green Field” projects or Startups
 - Focus on the core business without being worried about the setup cost and maintenance of IT infrastructure
- Cloud bursting – Massive computing resources required for executing one time task
 - for example, Enrolling 40,000 students in two days; testing new applications for scalability and reliability
- Legal regulations may prohibit the use of Clouds
 - Privacy, security, and location of data storage
- Response critical application may not be deployed on Clouds
 - Application monitoring stock exchange for automated trading

Example of Start up – 8K Miles

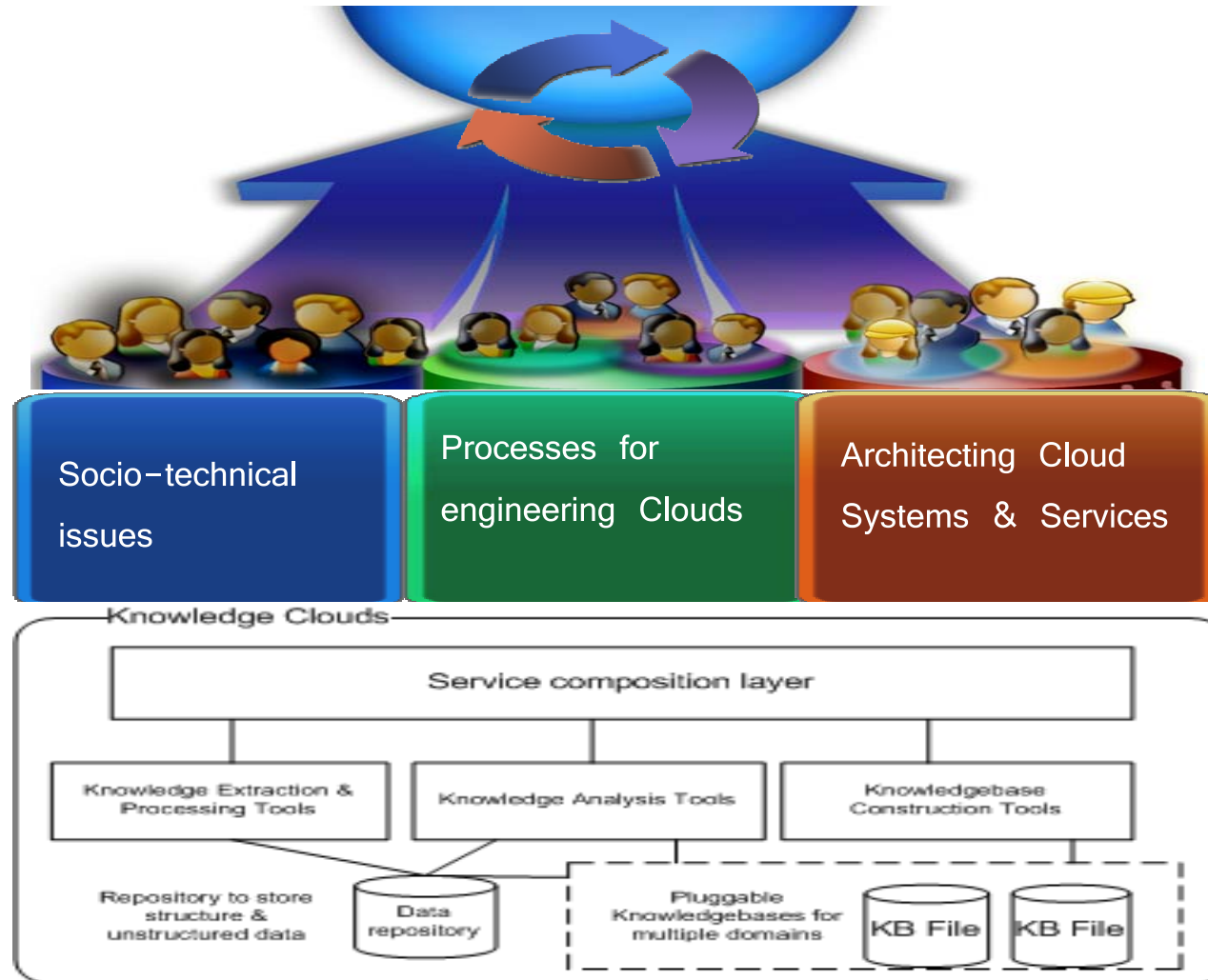


Source: <http://aws.amazon.com/solutions/case-studies/8kmiles/>

Some of the Challenges!!!

- Security
 - Would my data be more secure with Cloud provider?
- Interoperability
 - Significant risk of vendor lock-in – Standardized interfaces not available, incompatible programming models
- Reliability
 - Use of commodity hardware, prone to failure ...Cloud 2.0
- Laws and regulations
 - Privacy, security, and location of data storage
- Organizational changes
 - Changing authorities of IT departments, compliance policies
- Cost
 - Purchase vs. Lease, migration cost, models to design capital and operational budgets, cost of cloud providers

Main Areas of Our Interest



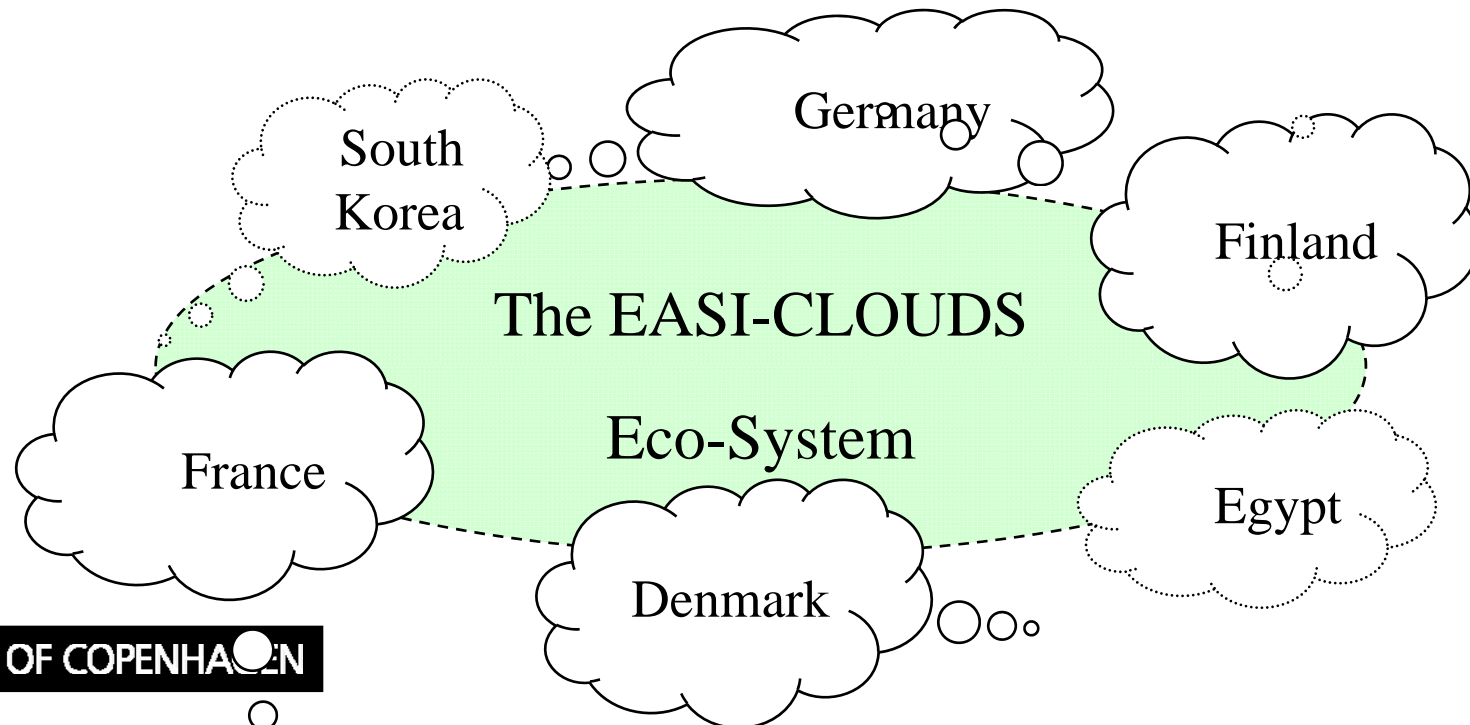
Empowering Clouds with Architectural Principles and Practices

- Impact of Cloud computing on architecture of software and, more generally, systems
- Architecture support for enhancing Cloud computing interoperability among applications on private and public Clouds, e.g., middleware support for large scale data transfers - MeDici
- Architecting secure software for clouds
- Architectures for autonomic monitoring and resource management of Cloud-Aware services
- Evaluation methods and tools for Cloud architectures

EASI-CLOUDS - Project Proposal

Extendable Architecture and Service Infrastructure for Cloud-Aware Software

The project aims at advancing Cloud computing in Europe, Egypt, and Korea by building a cloud computing eco-system to leverage national initiatives for moving the cloud computing to the next level of technological advances



Why EASI-CLOUDS?

- Widespread adoption of Cloud computing needs an open technology that:
 1. enables enterprises to deploy, experiment and test cloud computing concepts behind the firewall,
 2. enables to migrate between clouds (e.g. private => public)
 3. will lead up to the creation / enforcement of de facto standards, thus
 4. encourages the creation of a competitive market based around standards
 5. SLA, Interoperability, Security, Performance, Business Models....

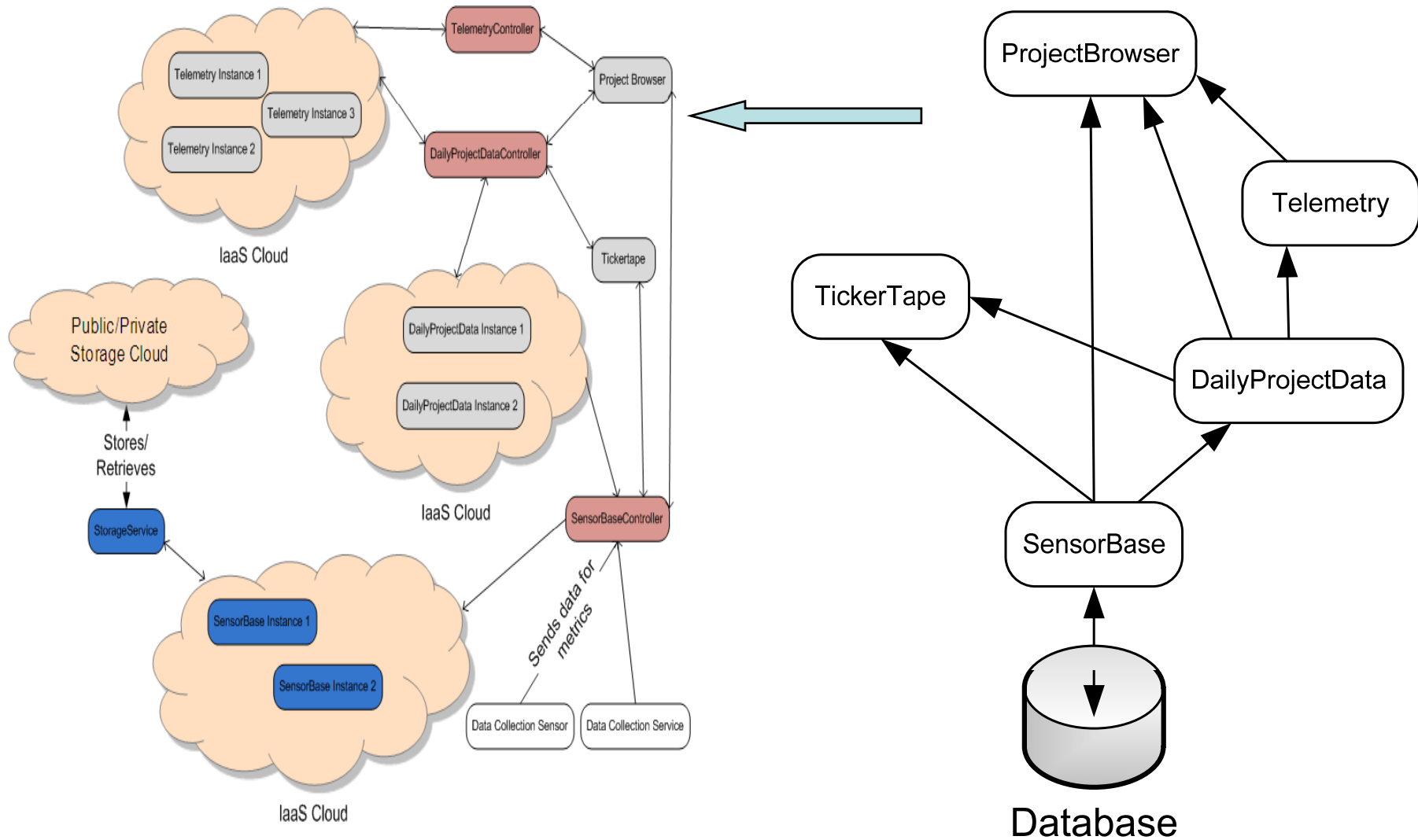
EASI-CLOUDS Vision:

A globally competitive open and trusted cloud ecosystem to empower society, industry and research in Europe and beyond.

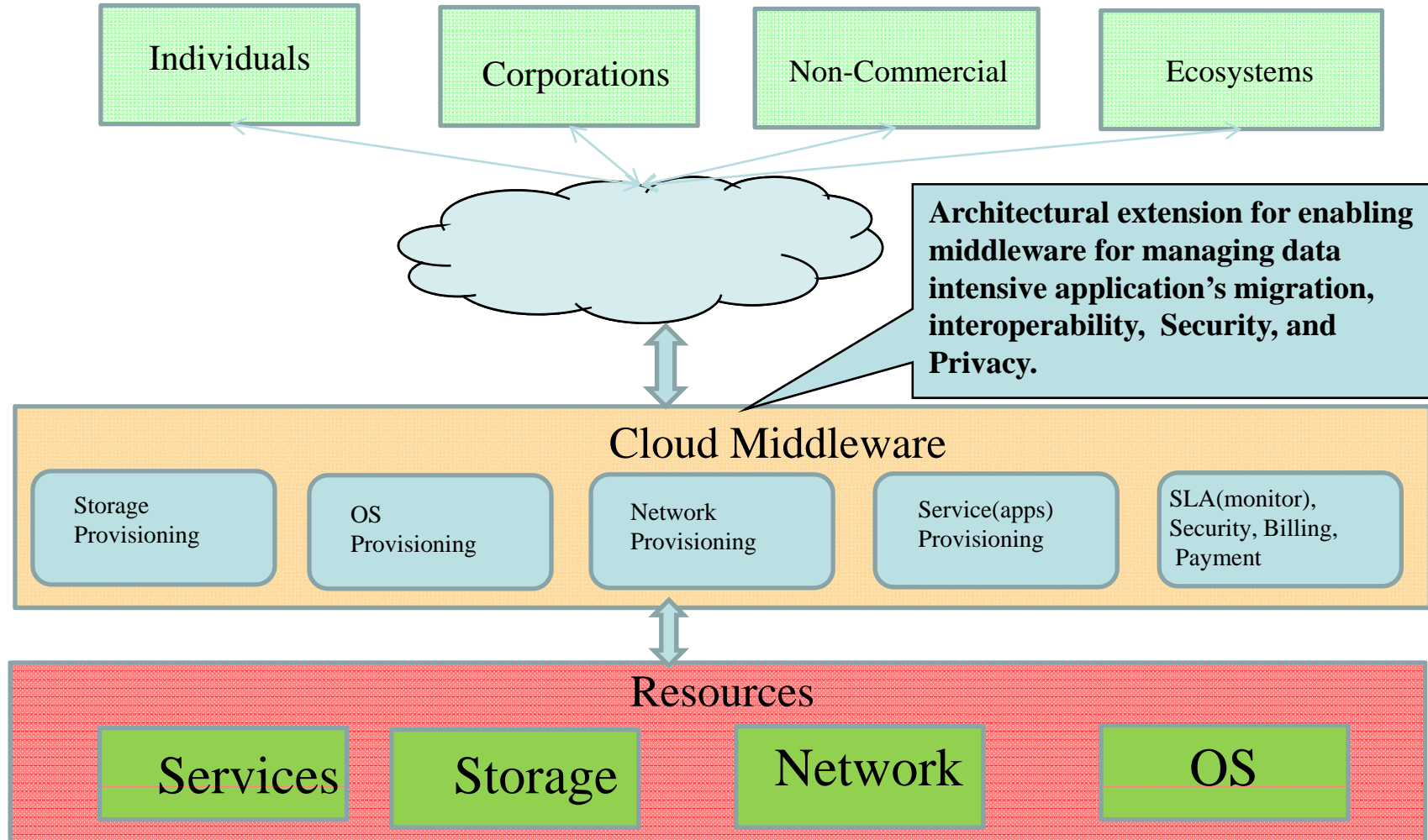
Migrating Systems to Clouds

- Migration methods and processes are required
- Architectural changes and decisions will play a significant role
- We are migrating an open source system, Hackstat, for collection and analysis of process and product metrics
- Motivation for this effort
 - Exploiting Hackstat for ultra large teams
 - Supporting large number of organizations to use the same system for process and product metrics
 - Gaining elasticity for computing and storage resources
 - Hackystat to act as a SaaS using IaaS provided by others

Hackystat's Architectures



Middleware for Data Intensive Scientific Applications - MeDiCi



NexGen CDE

- Context
 - Software development teams need supportive technologies for collaboration, communication and coordination
- Challenges
 - Integrated and end-to-end support missing without using dozens of different tools
 - Some commercial tools (IBM SameTime and MS Communicator) available but across vendor integration problem and expensive
 - Not much support for Just In Time (JIT) Composition and Use of tooling services for collaboration
 - Misalignment between tools, processes, and culture
- Proposed solution
 - Composing and using Just-in-Time (JIT) collaborative environments supported by Cloud-based infrastructures



- Initiated a knowledge sharing platform for debating the challenges and opportunities of Cloud computing
 - First gathering August 27, 2010
 - Five keynote speakers (all International)
 - 40+ local participants, mainly from industry
 - Identification of:
 - Burning problems in this area: practitioners' viewpoints!
 - Potential solutions to the identified problems
 - Knowledge and training needs
- Annual event supported by a portal

A New Course on Cloud Computing

- Objectives
 - Obtain the fundamental knowledge, understanding, and skills required for designing, building, and evolving large scale IT systems and infrastructures to exploit cloud computing paradigm
 - Gain the technical and non-technical knowledge necessary for exploiting Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Software as a Service (SaaS), Data as a Service (DaaS), and Human as a Service (HaaS).
- When
 - Spring 2011 – 7.5 ECTS

Summary – Technological Fad?

- Cloud computing is an emerging paradigm, essentially driven by a new economic model
 - Different way of getting IT infrastructure and computing resources
- An increasing number of providers and consumers
 - Billions of Euros being invested by vendors and providers
 - Market projected to be in billions of Euros
 - A projected adoption rate of more than 20% in public sector
 - Risks and challenges are going to be around but

Cloud Computing is real

- Several technical and non-technical areas yet to be explored by researchers

Acknowledgements

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- Contributions from my students, especially Aafeef Chauhan who is playing a key role in enabling Hackstat for Cloud Computing infrastructure

References

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Thank you!