NSC-JST workshop

Quality of Service Assurance for Enterprise Cloud Computing (QoSAECC)

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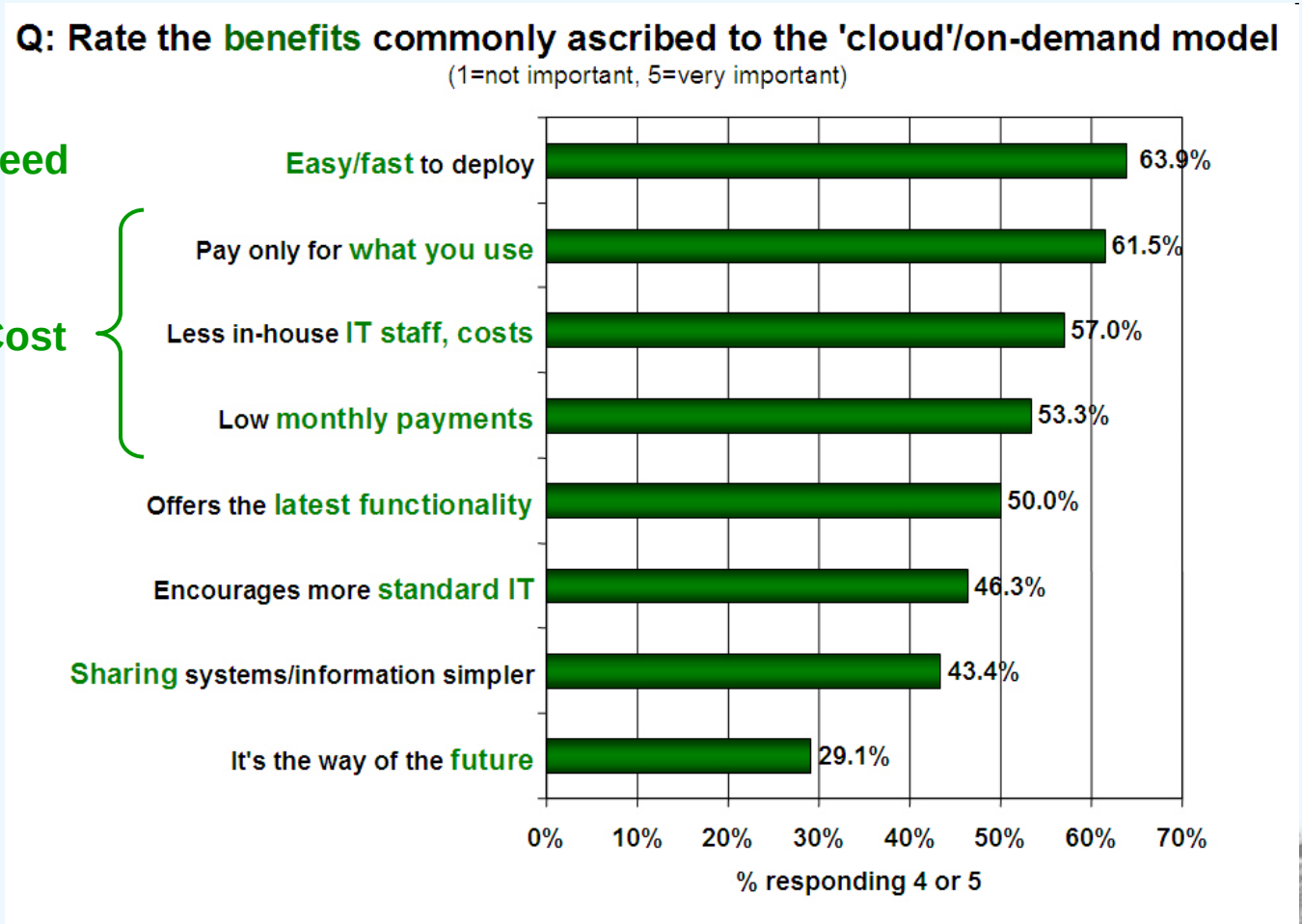
Outline

- Introduction
- Our NSC Proposal -- Quality of Service Assurance for Enterprise Cloud Computing (QoSECC)
- Some preliminary results
- Progress/Future Collaboration

Introduction-

Why Are Enterprises Interested in Cloud?



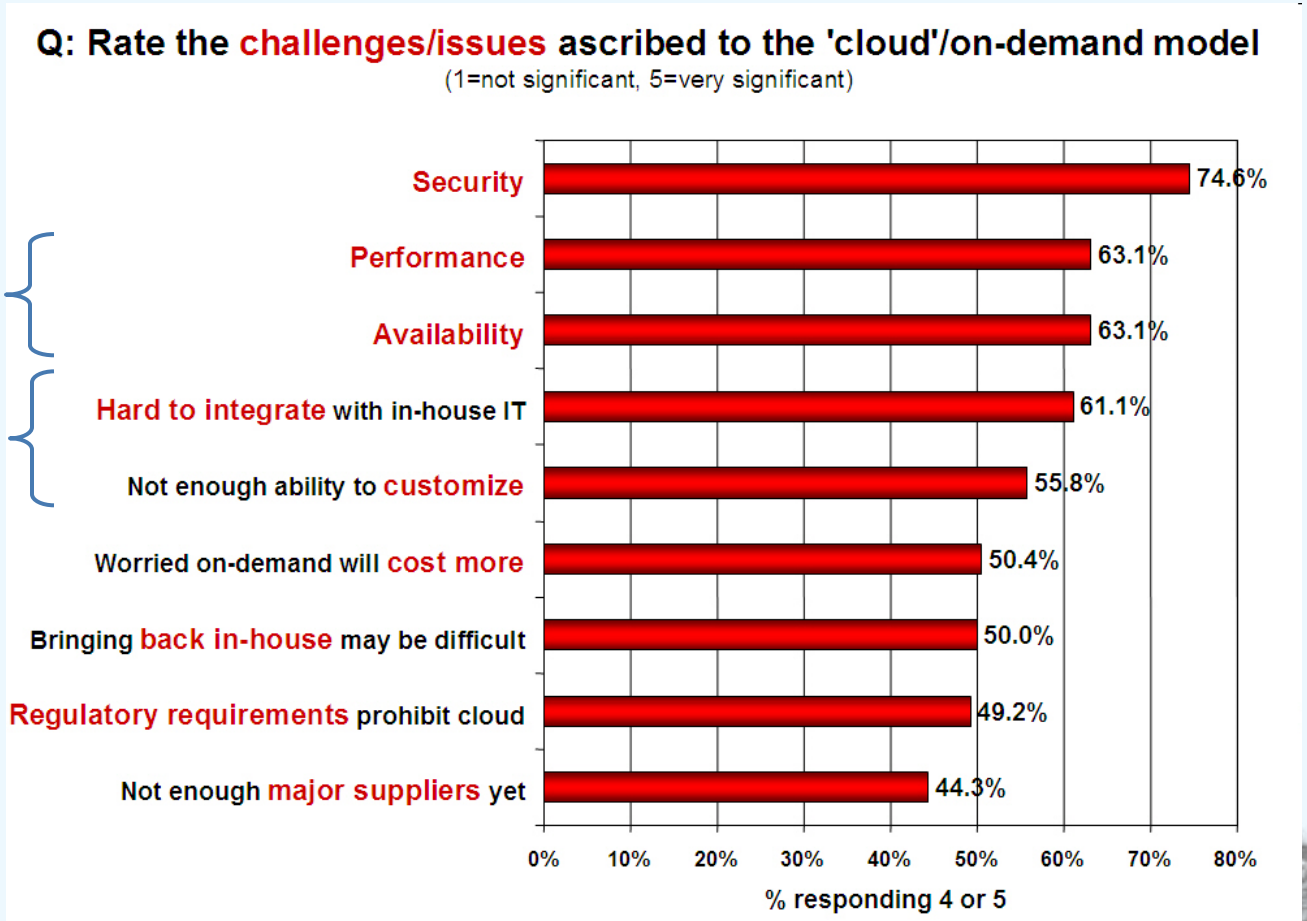
Source: IDC eXchange, "IT Cloud Services User Survey, pt. 2: Top Benefits & Challenges," (http://blogs.idc.com/ie/?p=210), October 2, 2008

Introduction --
What Are the Challenges Enterprises Face?

Security

QoS

Fit

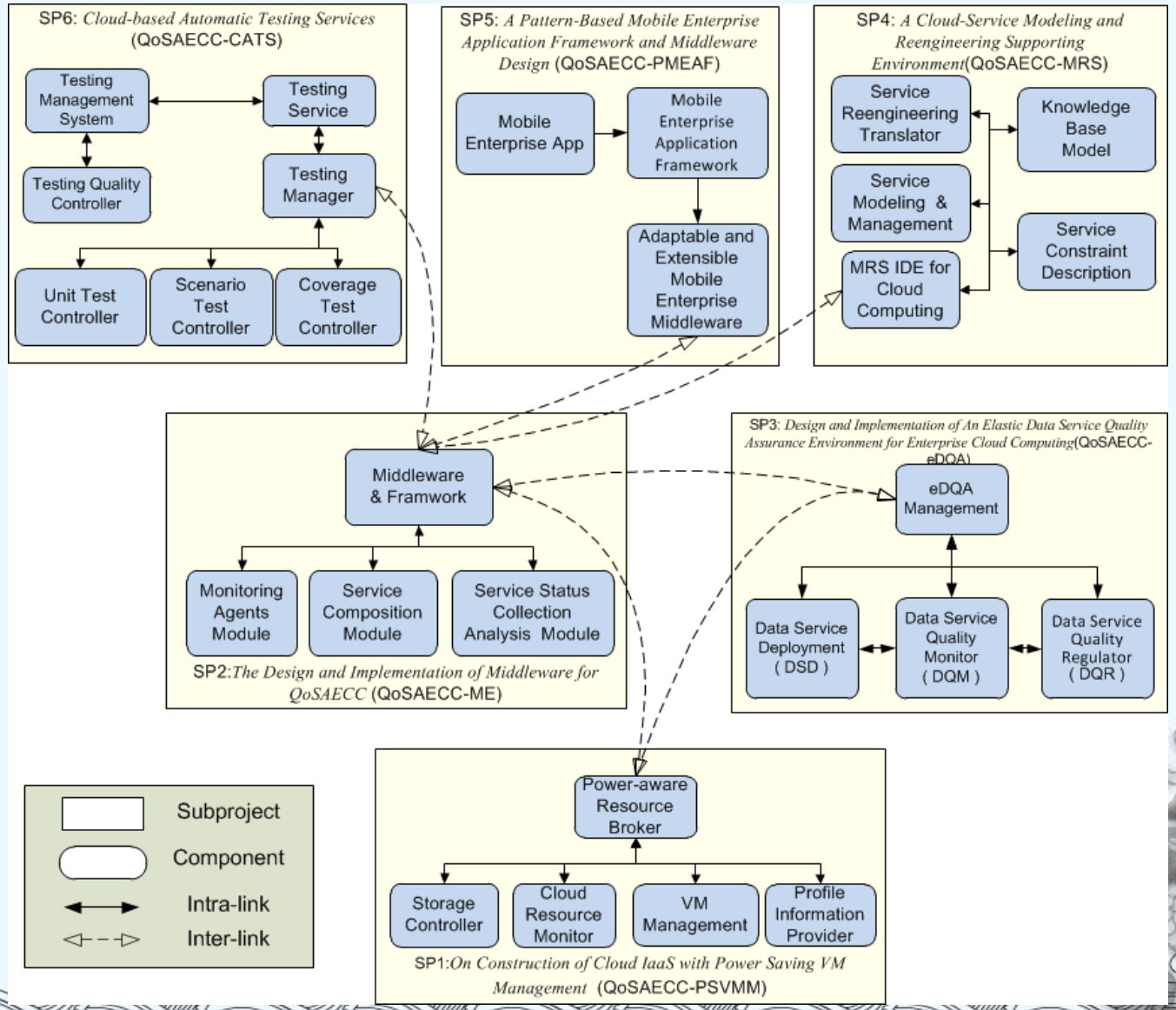


Source: IDC eXchange, "IT Cloud Services User Survey, pt. 2: Top Benefits & Challenges," (http://blogs.idc.com/ie/?p=210), October 2, 2008

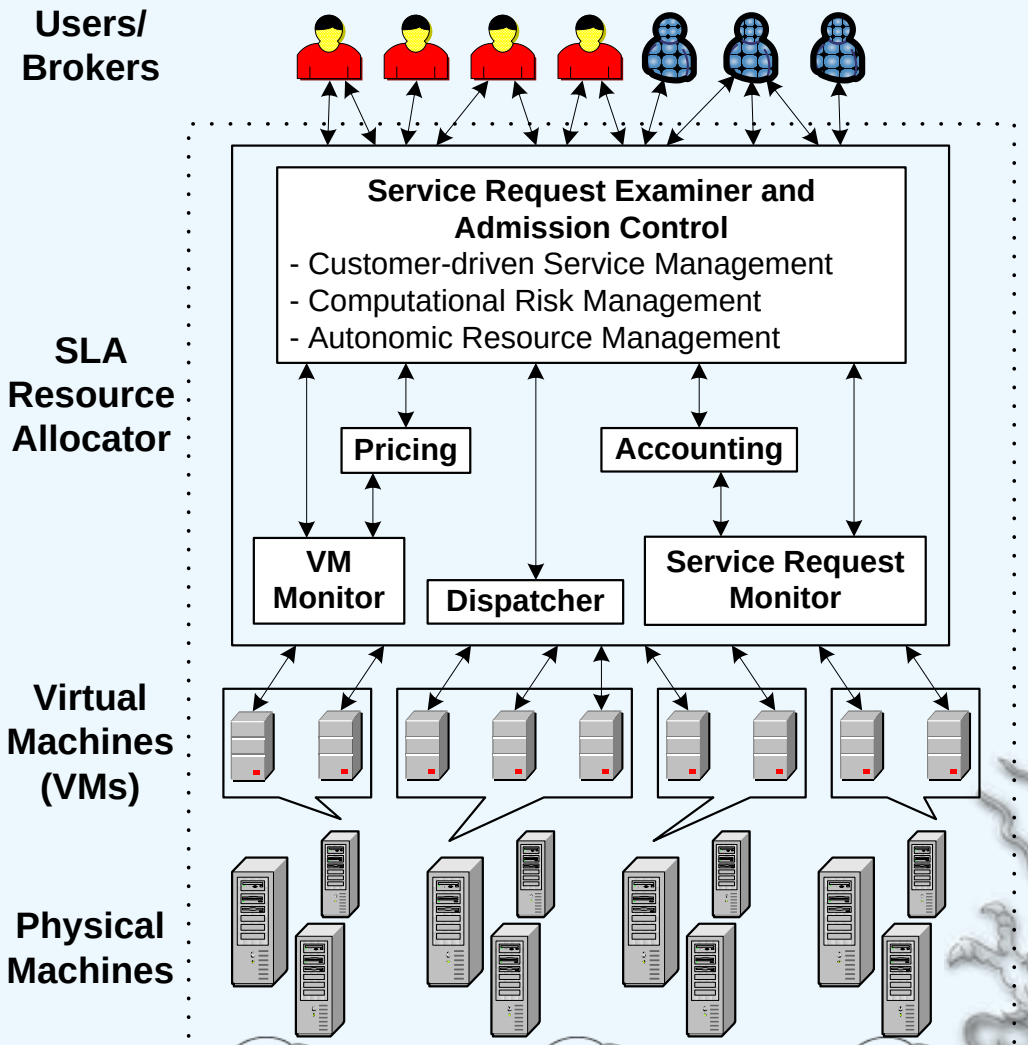
What problems are we trying to solve for Enterprise Cloud Computing?

- Management issues while migrating to cloud)
- Modeling (SLA based Static/Dynamic analysis)
- Monitoring(assuring QOS and the fullfilment of SLAs)
- Data Governance(Data privacy, data consistency, data sharing and analysis)
- Supporting Mobile Enterprise
- Re-Engineering legacy systems to cloud
- System Lock-in problem
- Domain specific service issues, eg. elderly people health care cloud, integration with legacy medical systems and devices

QOSECC NSC Project



QoS and SLAs negotiation among XaaS
(Note that IaaS, PaaS, and SaaS may be from different providers)



Sub-Project 1 : On Construction of Cloud IaaS with Power Saving VM Management

- The purpose of this sub-project is to use **virtualization technology** and **power management** approach to achieve targets of saving energy consumptions on physical machines
- SLA-based Virtual machine **Resource Load Balancing and Power Saving Management**

  For example, when the service is running at low usage conditions, such as processor utilization of 10%, its total power consumption reaches at least 60% of the peak. Idle resources and energy waste are the main reasons to low energy efficiency of data centers.

Sub-Project 1 : On Construction of Cloud IaaS with PowerSaving VM Management (Continued)

- **Cloud Resource Broker (CRB)** to is designed and implemented to **detect recourses sharing** on the physical computers. **The recourses will be adjusted automatically while the total loading loses its balance.** We will design and implement a system as a resource load balancing with **Dynamic Resource Allocation (DRA)** algorithm to deal with virtualization machines on physical machines.
- **Distributed Replicated Block Device (DRBD)** is used by mirroring a whole block device via a specified network. The natural combination of **DRA** and **DRBD** provides us with a highly reliable solution called **Virtualization Fault Tolerance (VFT).** Because of VFT, we have increased the stability of virtual machines on the cloud.

Sub-project 2: *The Design and Implementation of Middleware for QoSECC*

- Design **SLA-based QOS Monitoring mechanism**
- The implementation of **Monitoring Framework**
- Design **standard interface** for the communication of XaaS
- Cross XaaS **Resource status collection/Analysis** to assure QOS
- Design **standard SOA-based architecrure** (Prevention of of System lock-in problem)

Sub-project 3 : Design and Implementation of An Elastic Data Service Quality Assurance Environment for Enterprise Cloud Computing

- **Data as a Service (DaaS), For example elderly people data analysis service**
- **Data integration, analysis, deployment,**
- **Data Service Quality Monitor, DQM**
- **Data QOS Management**
- **Data Fault tolerance and consistency assurance**
- **Data high availability**
- **Efficient Storage Utilization**

Sub-project 4: A Cloud-Service Modeling and Reengineering Supporting Environment

- **Modeling** of cloud computing environment **(Deployment, SLAs of services, Properties and Constraints** of IaaS, PaaS, SaaS..etc**)**
- **System modeling** consists of abstract descriptions of systems requirements, processes, work flow, function descriptions, behaviors and constraints, and data and object composition. With proper modeling and analysis, we can manage if the services meet the user requirements, and detect violations of the rules such as SLAs
- **Static analysis** of cloud computing environment **---** Can QOS be assured?
- **Cloud computing re-engineering**

  Cloud reengineering is not only restructuring to cloud based structure, which also need to accompany with services that fulfill the required SLAs, therefore extra service components may be composed into the functionality that original legacy system provides. It is more complicated.

Sub-project 5:A Pattern-Based Mobile Enterprise Application Framework and Middleware Design

- The purpose of this sub-project is to fasten the development of the **mobile** enterprise application and **simplify its integration** with enterprise cloud**,**
- To apply the technologies of **design patterns**, **service-oriented architecture(SOA)** to develop a mobile application framework and middleware**.**
- With the design pattern technology, our mobile application framework is designed with high flexibility for different mobile application platforms. With the SOA technology, our middleware is developed as a pluggable architecture where a new enterprise operation or function can be seamlessly integrated with the mobile application**.**

Open Source Software(OSS) based development

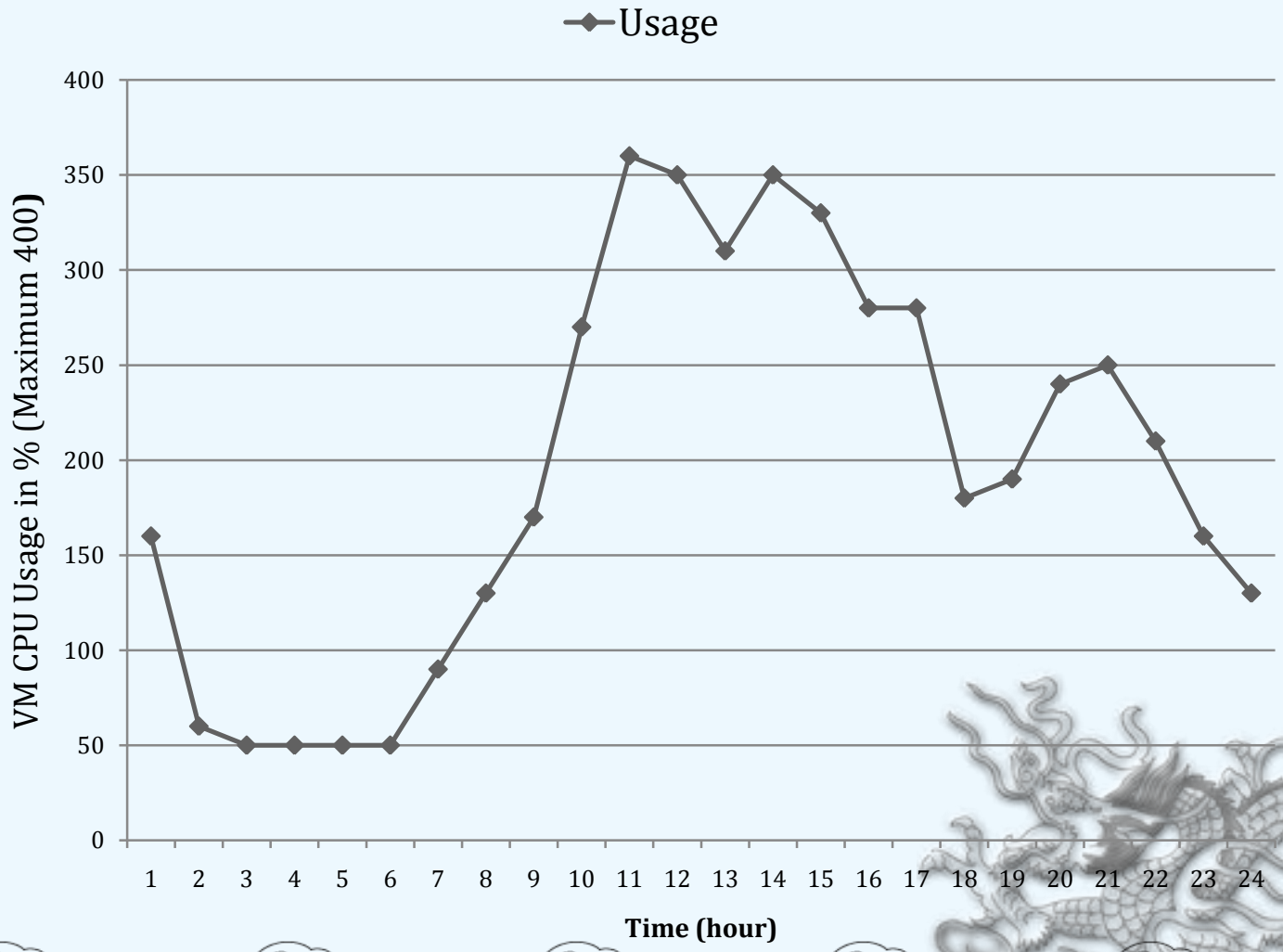
- Light CMMI compliance, i.e. Light CMMI documents are required and Software Engineering process is enforced.)
- IaaS
  - OpenNebula/KVM, OpenSTACK
  - FreeNAS/GlusterFS
- PaaS
  - JBoss
  - Hadoop/MapReduce
- SaaS
  - XML
  - Android/Eclipse/Web-based IDE

Automatic Testing Services

- Requirements coverage based testing
- Risk-based structured test approach
- Test Plan / Test Phases
- Test Cases / Test Data / Test Automation
- Defect Management / Functional Test
- Use of off-shore resources / Virtualization

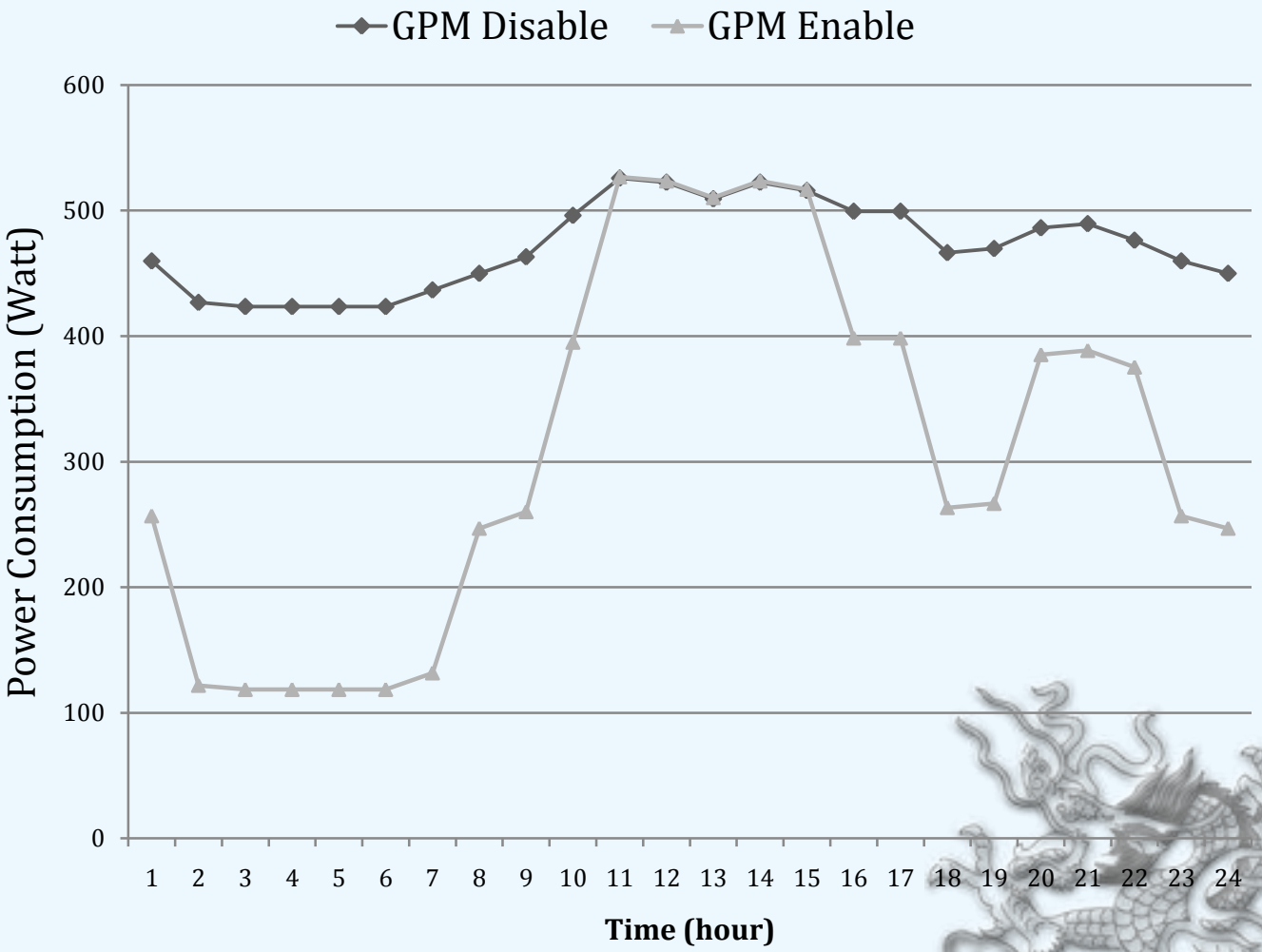
Experimental Results

CPU Average Usage Vary Per Hour



Experimental Results

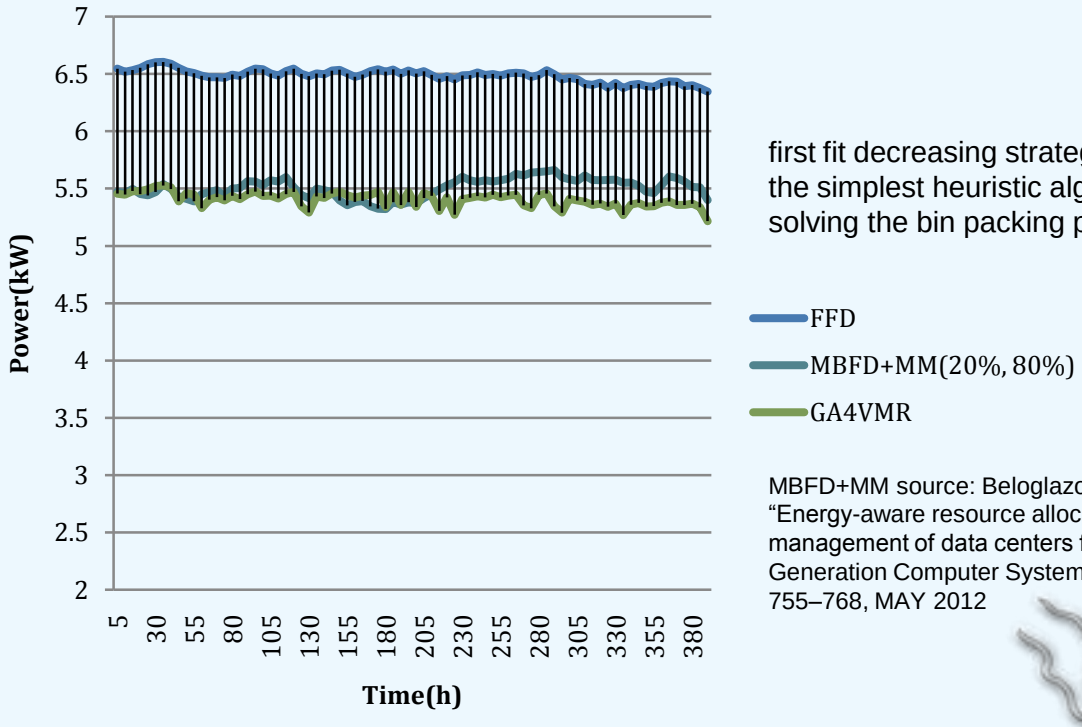
Power Average Consumption Vary Per Hour



Energy Aware Dynamic VM Consolidation

- When to migrate VMs?
  - Host overload detection algorithms
  - Host underload detection algorithms
- Which VMs to migrate?
  - VM selection algorithms
- Where to migrate VMs?
  - VM placement algorithms
- We now implement a VM placement strategy based on Genetic Algorithm

Energy Aware Dynamic VM Consolidation



power consumption comparison

first fit decreasing strategies are among the simplest heuristic algorithms for solving the bin packing problem

MBFD+MM source: Beloglazov, A., Abawajy, J., Buyya, R., "Energy-aware resource allocation heuristics for efficient management of data centers for Cloud computing," Future Generation Computer Systems, Vol. 28, Issue 5, Pages 755–768, MAY 2012

Progress and Future Collaboration

- Migrating Enterprise information system to cloud environment needs a lot of efforts and techniques to support.
- Enterprise cloud computing needs both general cloud computing techniques as well as domain specific middleware supports
- Applying to QOSECC to Enterprise Specific Domain application – Genotology and Geriatric health care system(Elderly Health U-care system), collaborating with Taichung Veterans General hospital --- our QOSECC project is open source based and will be open sourece as well.
- We welcome a future collaboration on Enterprise cloud computing issues.

Thanks for your attention!

Q&A