System Research Lab

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Faculty information

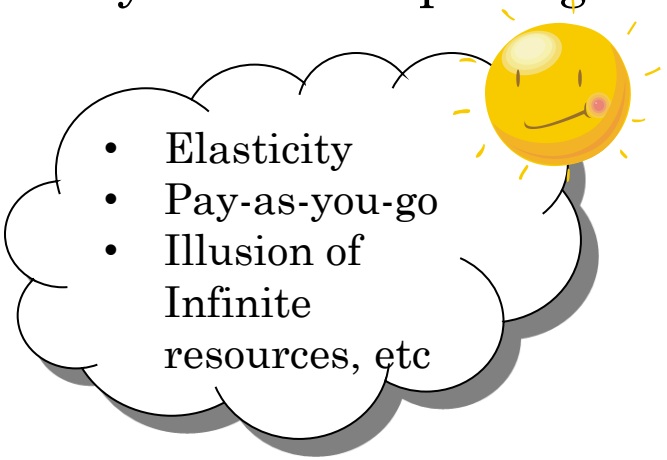
- B.B.A, Information Management, National Taiwan University
- MS and Ph.D., Computer Science & Engineering, University of Michigan, Ann Arbor
- Two years of industry research experience at NEC Labs American in Princeton, New Jersey
- Assistant professor at NTU CSIE since August 2010
- New lab located in Rm 524

Current Research projects

- Cloud computing
  - Performance prediction and debugging
  - Service selection for clients
  - Pricing: collaboration with professors from business school
- Mobile computing
  - Leverage cloud computing to support mobile device
  - Collaborative mobile applications
  - Performance debugging for smart phones

Cloud computing

- A new model to deliver and consume IT services
  - No upfront IT cost and infinite scale-up
  - Delivering models: infrastructure, platform, software
- New service model = new challenges for users to use such service
  - Limited visibility into the infrastructure layer
  - Many cloud computing offerings to choose from



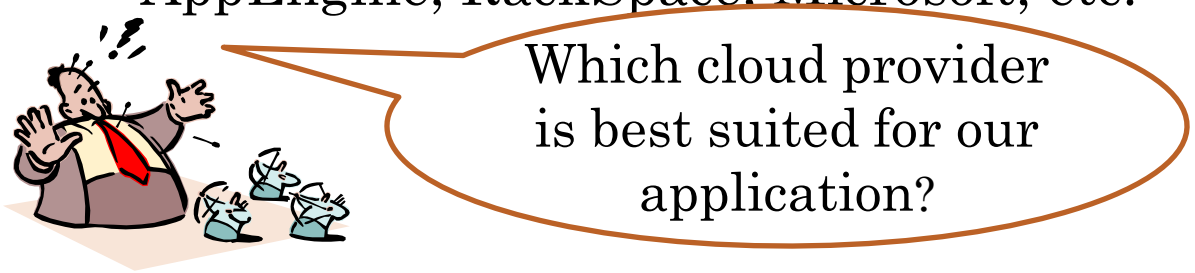
New challenges

Challenges to adapt to cloud computing

- Users face many decisions before migrating legacy applications to cloud
  - Shall we migrate to cloud?
    - What are the benefits
    - What are the risks
  - How to migrate to cloud?
    - Which application, which part to migrate
    - Which cloud provider
  - After migration,
    - Is my application performing well
    - Is the provider giving me adequate resources

How to choose a cloud provider

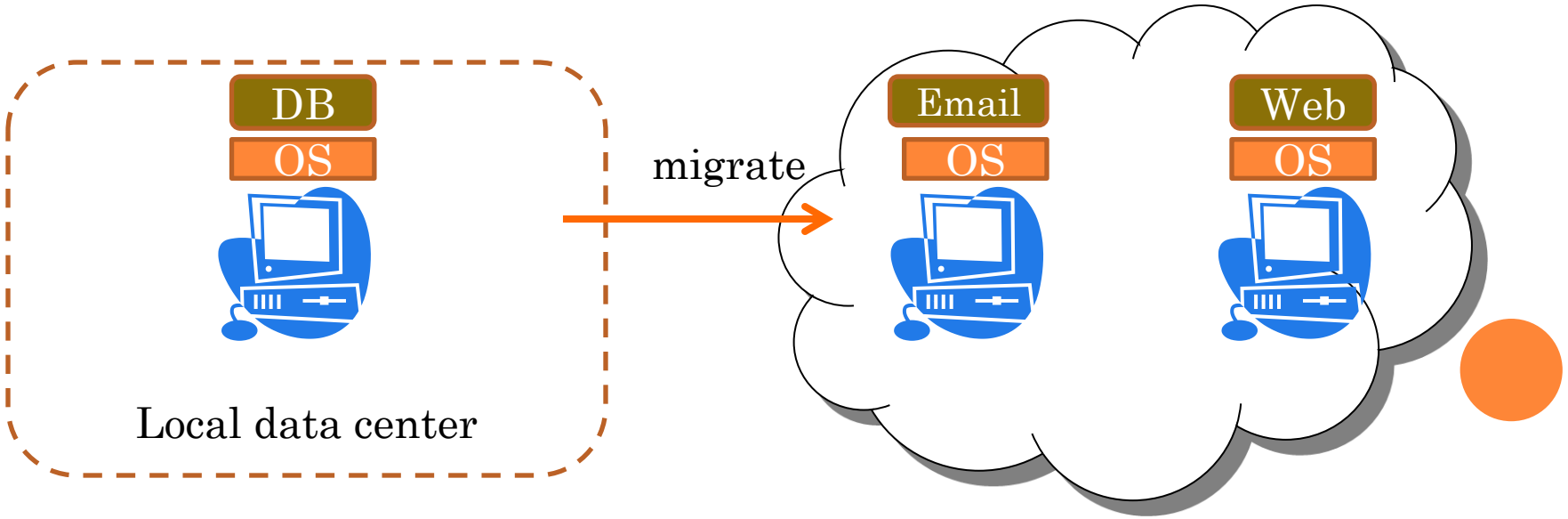
- Some many cloud providers, which one to choose?
  - Types: IaaS, PaaS, Web hosting services,
  - Example providers: Amazon EC2, GoGrid, Google AppEngine, RackSpace. Microsoft, etc.



Provider	Service type	Services provided	Pricing
Amazon AWS	IaaS	EC2,S3, …	Small/big instance,
Google AppEngine	PaaS	Datastore, memcache,..	…
…	…	…	…

Understand application properties

- Which part of the applications to migrate
  - Application are composed of multiple components
- Application operation mode:
  - Cloud mode: run the whole application in the cloud V.S.
  - Hybrid mode: split between cloud and local



Match application requirements to providers

- List provider services
  - Benchmark results for each service
  - Useful tool: CloudCmp[1]
- Calculate price according to application need

Provider	Service type	Services provided	Comp $	Network $	Storage $
Amazon AWS	IaaS	EC2,S3, …	Small: $/hr Big: $$/hr	Internal: free External:$/GB	
Google AppEngine	PaaS	Datastore, memcache,..	…		
Microsoft Azure	Mixed	…	…		
RackSpace					

[1] "CloudCmp: Shopping for a Cloud Made Easy", Li et al, HotCloud 2010

Research Directions

- Cloud computing
  - Performance prediction and debugging
  - Service selection for clients
  - Pricing: collaboration with professors from business school
- Mobile computing
  - Leverage cloud computing to support mobile device
  - Collaborative mobile applications
  - Performance debugging for smart phones

Motivation

- Mobile computers are everywhere
  - Smartphone Sales Increased 96 Percent in 2010 3rd quarter
  - Connected mobile consumer electronics will reach 102 million units in 2010. By 2014, media tablets will represent 58% of this market
- Users have mobile computations at hand
  - Local: computing, sensing, storage, and network
  - Remote: scalable cloud services

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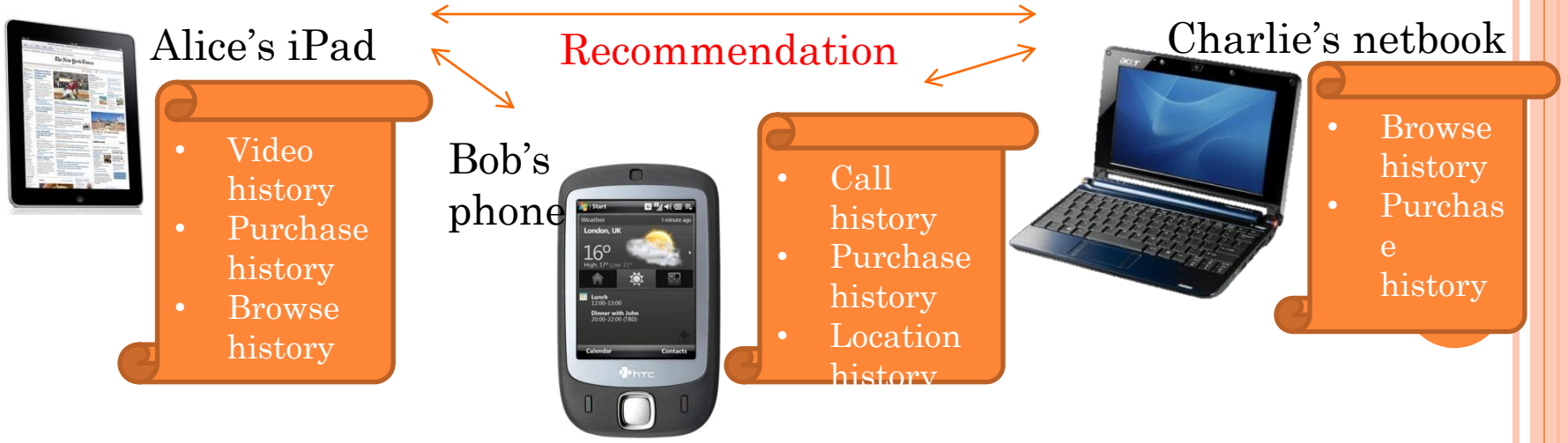
amazon web services™

1. http://www.gartner.com/it/page.jsp?id=1466313
2. http://www.gartner.com/DisplayDocument?ref=clientFriendlyUrl&id=1451714

Opportunities: collaborative mobile applications

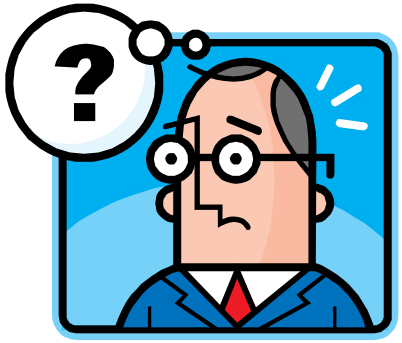
- Ad-hoc multi-user mobile applications are useful
  - Games: multi-party distributed gaming
  - Social applications: recommendation, group coordination
  - Learning: virtual classroom participations
  - Multimedia: distributed video editing
- No good support for such collaborative applications



Performance debugging for smart phones

- Smart phones are like your desktop computer
  - Apps may hang, slow, not able to reach network
- How can we help users to determine when an app is having performance problem?

App slow?



What is going on?

- Develop a tool to help user find out the problem is

Other potential research topics

- Wireless sensor network
- Data center management
- Multi-core issues