3. Cloud Computing (3/4)

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Agenda

- What is Cloud Computing ?
  - Different perspectives
  - Properties and characteristics
  - Benefits from cloud computing
- Service and deployment models
  - Three service models
  - Four deployment models

What can we gain from cloud ?

WHAT IS CLOUD COMPUTING ?

Benefits From Cloud

- Cloud computing brings many benefits :
  - For the market and enterprises
    - Reduce initial investment
    - Reduce capital expenditure
    - Improve industrial specialization
    - Improve resource utilization
  - For the end user and individuals
    - Reduce local computing power
    - Reduce local storage power
    - Variety of thin client devices in daily life

For Market and Enterprises

Reduce Initial Investment

- Traditional process of enterprises to initiate business :
  - Survey and analysis the industry and market
  - Estimate the quantity of supply and demand
  - Purchase and deploy IT infrastructure
  - Install and test the software system
  - Design and develop enterprise specific business service
  - Announce the business service to clients
- Some drawbacks :
  - The survey, analysis and estimation may not 100% correct
  - Infrastructure deployment is time consuming
  - Enterprises should take the risk of wrong investment

Reduce Initial Investment

- Initiate business with Cloud Computing services :
  - Survey and analysis the industry and market
  - Chose one cloud provider for enterprise deployment
  - Design and develop business service upon cloud environment
  - Announce the business service to clients
- Some benefits :
  - Enterprise do not need to own the infrastructure
  - Enterprise can develop and deploy business service in short time
  - Enterprise can reduce the business loss of wrong investment

Reduce Initial Investment

- What dose cloud computing achieve ?

	Traditional	With Cloud Computing
Investment Risk	*Enterprise takes the risk*	*Cloud reduces the risk*
Infrastructure	*Enterprise owns the infrastructure*	*Cloud provider owns the infrastructure*
Time duration	*Long deployment time*	*Fast to business ready*

Reduce Capital Expenditure

- Traditional capital expenditure of enterprises :
  - Each enterprise should establish its own IT department
  - IT department should handle the listing jobs
    - Manage and administrate hardware and software
    - Apply regular data backup and check point process
    - Purchase new infrastructure and eliminate outdated one
    - Always standby for any unexpected IT problems

- Some drawbacks :
  - Enterprise pays for IT investment which is not its business focus
  - Enterprise should take the risk of hardware/software malfunction
  - Replacing and updating infrastructure is time consuming and risky

Reduce Capital Expenditure

- Capital expenditure with Cloud Computing service :
  - Enterprise can almost dismiss its IT department
  - The jobs of IT department can be achieved by cloud provider
    - Dynamically update and upgrade hardware or software
    - Dynamically provision and deploy infrastructure for enterprise
    - Automatically backup data and check consistency
    - Self-recover from disaster or system malfunction
- Some benefits :
  - Enterprise can shift effort to its business focus
  - Enterprise can reconfigure its IT services in short time
  - Enterprise pays to cloud provider as many as the service used

Reduce Capital Expenditure

- What dose cloud computing achieve ?

	Traditional	With Cloud Computing
Business focus	*Need to own its IT department*	*Cloud provider takes care everything*
Payment	*Pay for all investment and human resource*	*Enterprise pays as the service used*
Time duration	*Long establish time*	*Fast to business ready*

Improve Industrial Specialization

- Traditional industry and market :
  - Every enterprise has to own its IT department
  - IT resource is managed by enterprise themselves
  - IT complexity should be well taken care by enterprise themselves
- Some drawbacks :
  - IT department is not the business focus of enterprise
  - Most of enterprises do not well maintain their IT resources
  - Enterprise seldom optimizes their IT resource usage

Improve Industrial Specialization

- Collaboration with Cloud providers :
  - Cloud providers centrally maintain IT infrastructure for clients
  - Cloud providers employ experts for management and administration
  - Cloud providers focus on providing reliable IT services
  - Enterprises only rent the service they need and care
- Some benefits :
  - Industrial specialization will be improved
  - IT service performance will be optimized
  - Enterprise business focus will be enhanced
  - IT resource waste will be reduced

Improve Industrial Specialization

- What dose cloud computing achieve ?

	Traditional	With Cloud Computing
Collaboration	*Enterprise needs to take care everything*	*Enterprise focuses on its own business*
Management	*Enterprise works with poor manageability*	*Cloud provider applies professional control*
Relationship	*Stand alone enterprise*	*Win-Win partnership*

Improve Resource Utilization

- Traditional industry and market :
  - Enterprise seldom takes care about IT resource utilization
  - Enterprise owns their IT resource without well management
  - IT resource usually over invested for peak demand
- Some drawbacks :
  - Power and space utilization among enterprises are wasted
  - IT resources across enterprises cannot be shared

Improve Resource Utilization

- Collaboration with Cloud providers :
  - IT resources are centrically managed and optimized
    - Cloud provider builds performance optimized hardware
    - Cloud provider builds consolidated cooling system
    - Cloud provider will consider the geographic issues
    - Cloud provider will consider legal policy issues
- Some benefits :
  - IT infrastructure can be shared among enterprises
  - IT infrastructure performance and utilization can be optimized
  - Large-scale integrated optimization can be applied

Improve Resource Utilization

- What dose cloud computing achieve ?

	Traditional	With Cloud Computing
IT Resource Utilization	*IT resource under utilized most of time*	*Share to improve utilization of IT resource*
Power Consumption	*Waste power and cooling system*	*Cloud system should be global optimized*

For End User and Individual

Reduce Local Computing Power

- Traditional local computing power requirement :
  - One need to buy your own personal computer
  - Buy powerful processor if you need intensive computing
  - Buy large memory to meet application requirement
  - Install plenty of applications in need
- Some drawbacks :
  - One can hardly replicate the same system environment
  - One needs to regularly update or upgrade software and hardware
  - One needs to reinstall all applications if you reinstall the OS

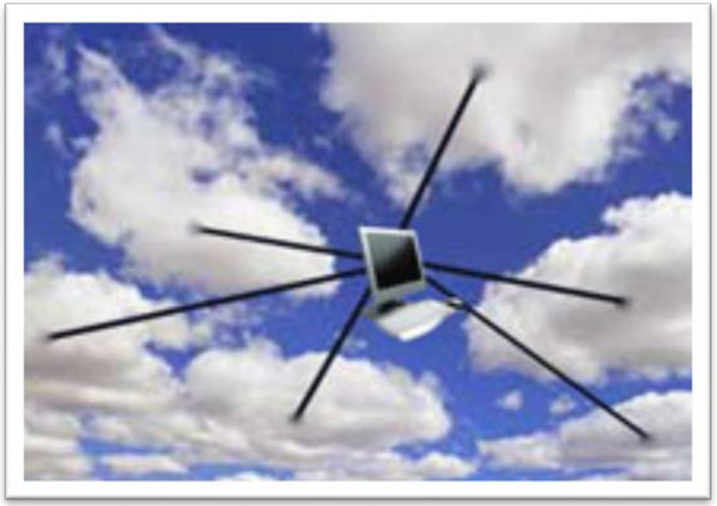
Reduce Local Computing Power

- Using Cloud Computing services :
  - One can utilize the remote computing power in the cloud
  - One needs only basic computing power to connect to internet
  - Application in the cloud will automatically upgrade
- Some benefits :
  - One can access his/her applications anywhere through the Internet
  - One can dynamically request for computing power on demand
  - Application may need not to be reinstalled even reinstall the OS

Reduce Local Computing Power

- What does cloud computing achieve ?

	Traditional	With Cloud Computing
Hardware Requirement	*User needs to buy powerful hardware*	*Only basic hardware to connect to internet*
Software Requirement	*Install application in local computer*	*No local installation requirement*
Portability	*Hard to be portable*	*Natively portable*



Reduce Local Storage Power

- Traditional local storage power requirement :
  - User programs and data files are stored in local devices
  - User has to backup data regularly preventing hardware damage
- Some drawbacks :
  - Storage space may not enough for burst data requirement
  - Storage space may be over needed which result in resource waste
  - Data consistency is hard to maintain between computers
  - Need to sacrifice part of storage space for data backup

Reduce Local Storage Power

- Using Cloud Computing services :
  - User programs and data files are stored in the cloud
  - Cloud service provider will guarantee the data availability
- Some benefits :
  - One can dynamically allocate storage space on demand
  - One can access data anywhere through the Internet
  - No need to care about data consistency between computers
  - No need to care about data loss due to hardware damage

Reduce Local Storage Power

- What dose cloud computing achieve ?

	Traditional	With Cloud Computing
Storage Space	*Limited to local disk, may be under utilized*	*Dynamically allocated on demand*
Storage Data Consistency	*Difficult to maintain data consistency*	*Data consistency maintained by cloud*
Availability	*Regular user backup*	*Cloud service guarantee*

Variety of End Devices

- Traditional computing resource :
  - One can connect to the Internet by personal computer
  - Only personal computer can deliver reasonable computing power
  - Small devices cannot perform incentive computation due to their power and hardware limitation
- Some drawbacks :
  - Computing power is not portable
  - Small devices can only perform simplified works

Variety of End Devices

- Devices collaborate with Cloud services :
  - Device connects to the Internet through wireless network
  - Device accesses cloud services through web service interface
  - Device sends computing incentive jobs into cloud and wait for results
- Some benefits :
  - User can easily access cloud service through small devices
  - User can access almost unlimited computing power anywhere
  - Small devices can be intelligently managed through cloud

Variety of End Devices

- What dose cloud computing achieve ?

	Traditional	With Cloud Computing
Computing Power	*Only accessed through desktop computer*	*Accessed through small smart devices*
Small Device Intelligence	*Functionalities was limited due to their power consumption*	*Shift computing incentive jobs into cloud, and then wait for results*