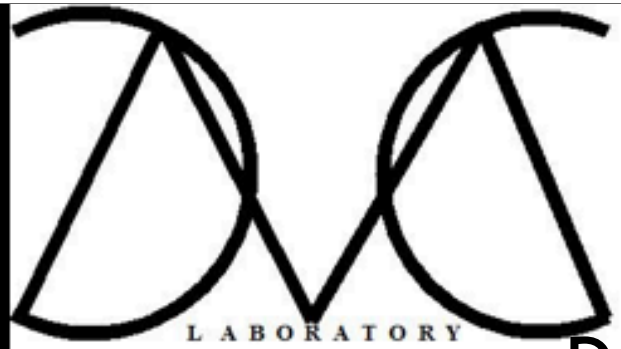
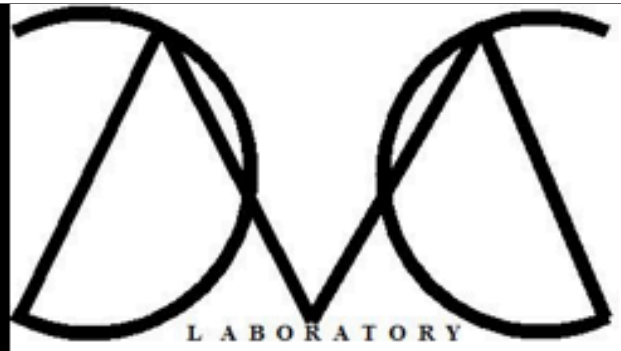


Distributed & Cloud Computing

kartick.mondal@jadavpuruniversity.in

Dr. Kartick Chandra Mondal
Assistant Professor
Department of Information Technology
Jadavpur University
Kolkata



CLOUD COMPUTING

Cloud Computing

Cloud Computing

1. Definition

Cloud Computing

1. Definition
2. Deployment Models

Cloud Computing

1. Definition
2. Deployment Models
3. Service Models

Cloud Computing

1. Definition
2. Deployment Models
3. Service Models
4. Speciality

Cloud Computing

1. Definition
2. Deployment Models
3. Service Models
4. Speciality
5. Advantages & Disadvantages

Cloud Computing

1. Definition
2. Deployment Models
3. Service Models
4. Speciality
5. Advantages & Disadvantages
6. Applications

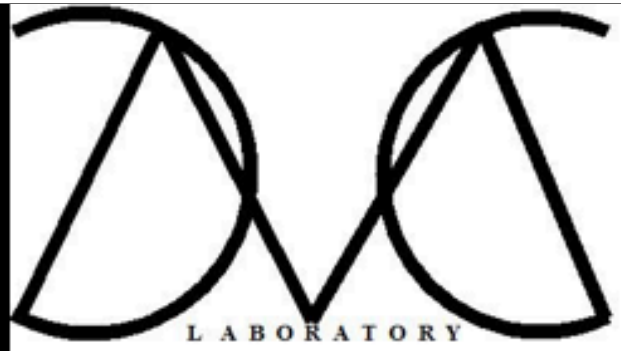
Why Cloud Computing?

Why Cloud Computing?

- Information and Communication Technology (ICT) is generally accepted to mean
  - All TECHNOLOGIES (devices, networking components, applications and systems)
  - That combined, allow
  - People and organizations(I.e., businesses , nonprofit agencies, governments and criminal enterprises)
  - To interact in the digital world.

Why Cloud Computing?

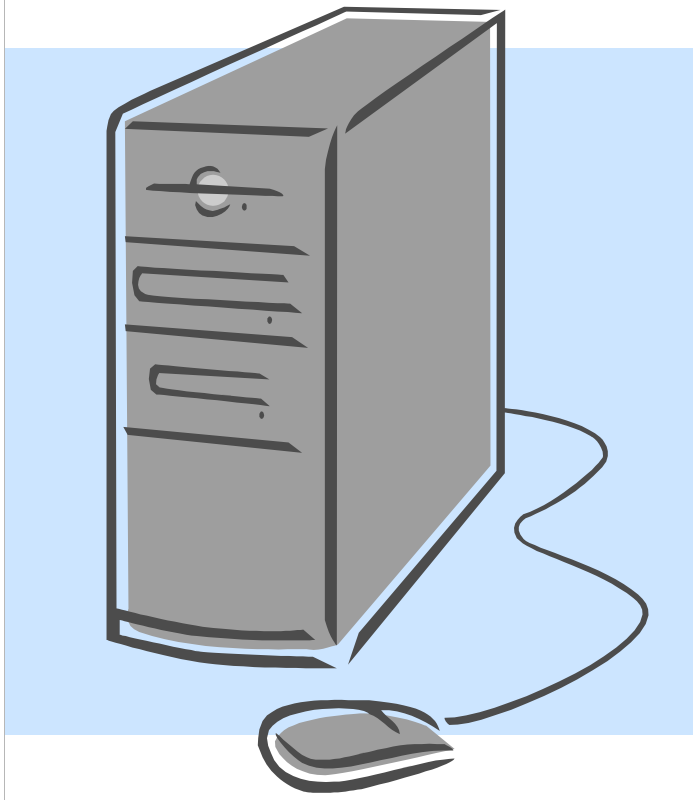
Why Cloud Computing?



Ground Reality

FROM GROUND TO CLOUD

Ground Reality



Standard Computer Tower or Central Processing Unit (CPU)

Software

Storage

Inside the Computer

Storage

Storage

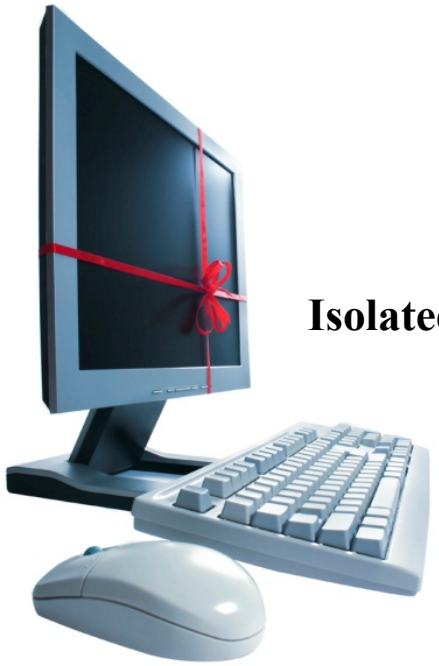
- To use content must return to THAT computer

Storage

- To use content must return to THAT computer
- Cannot access this content from another device or computer

Storage

- To use content must return to THAT computer
- Cannot access this content from another device or computer



Isolated Device

External Storage

External Storage

- Allows your content to become mobile

CD/DVD

Thumb Drive

External Storage

- Allows your content to become mobile
- Take device to any compatible computer

CD/DVD

Thumb Drive

External Hard Drive

External Storage

- Allows your content to become mobile
- Take device to any compatible computer
- Open and use content

CD/DVD

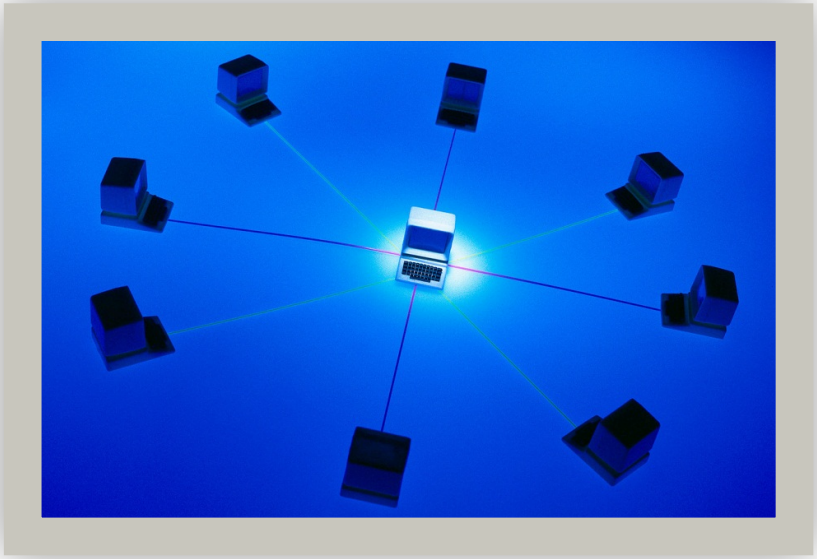
Thumb Drive

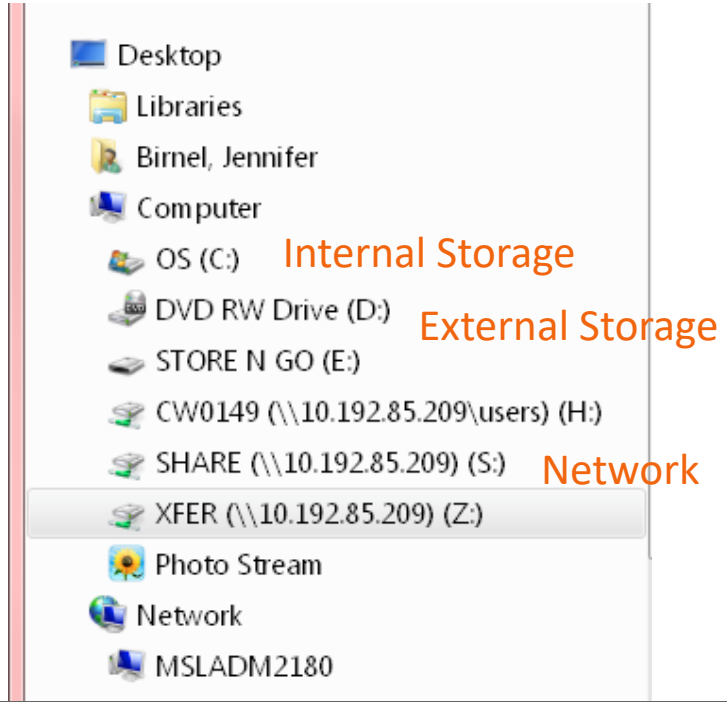
External Hard Drive

SD Card

Micro SD Card

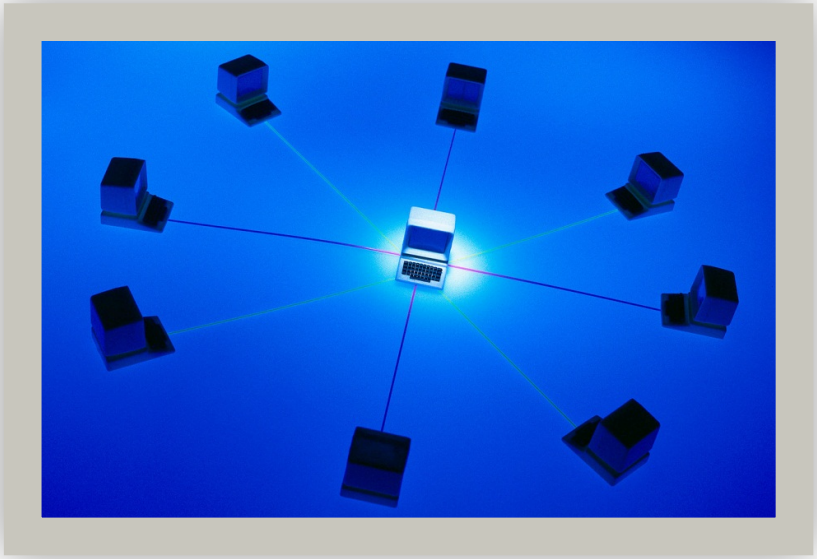
Network Storage

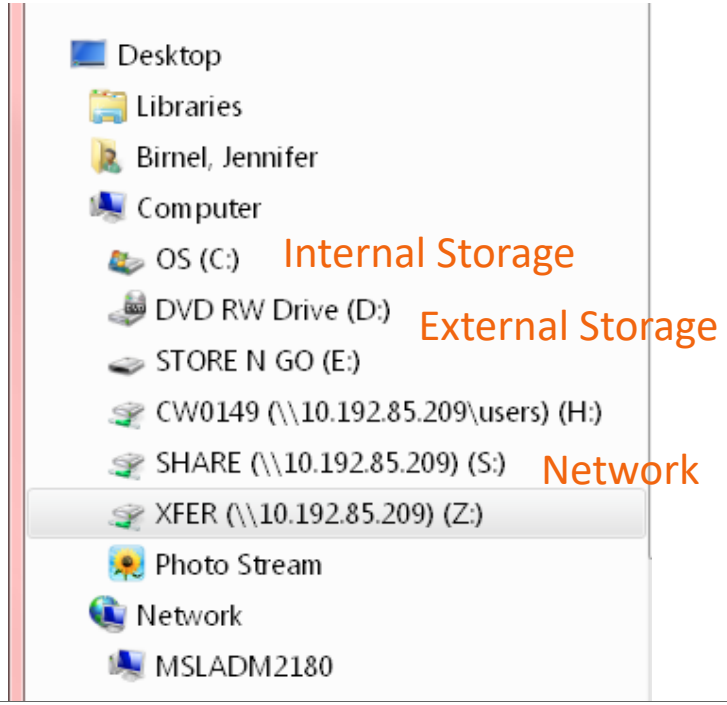




Network Storage

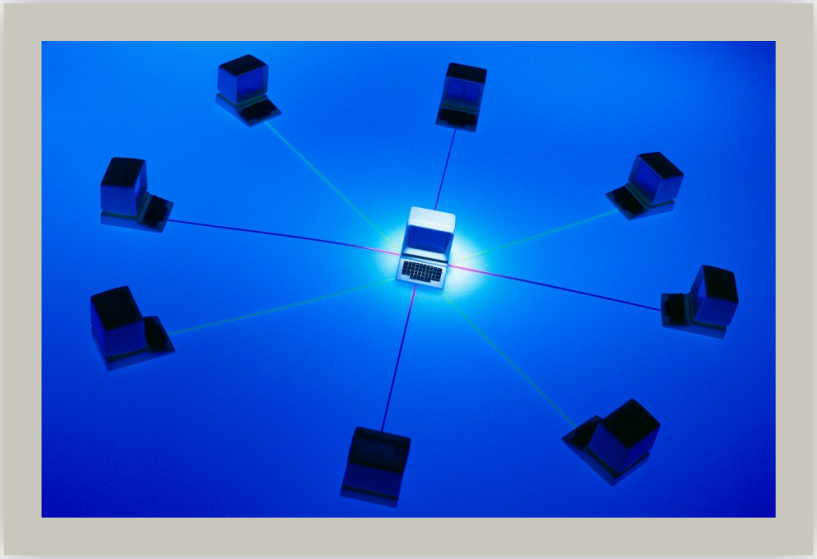
- Multiple work stations talk to one unit that stores information and data.

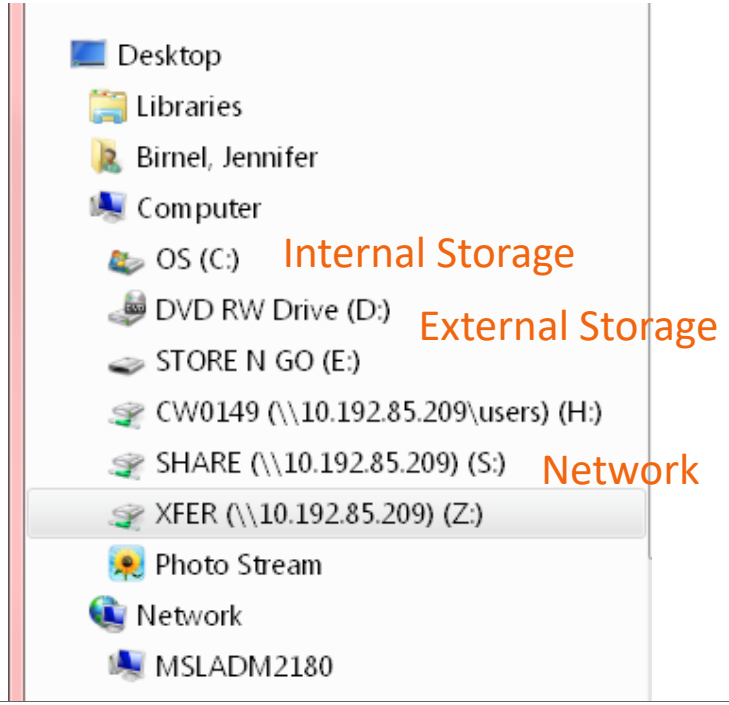




Network Storage

- Multiple work stations talk to one unit that stores information and data.
- Can retrieve the data stored to the network from any of the connected workstations.





Cloud Storage

- Create an Account – User name and password
- Content lives with the account in the cloud
- Log onto any computer with Wi-Fi to find your content

Access Cloud Storage

- Download a cloud based app to a computer **you own**
- The app lives on your Computer
- Save files to and from the cloud through the app
- When connected to the Internet it will sync with the cloud
- The Cloud can be accessed from any Internet connection

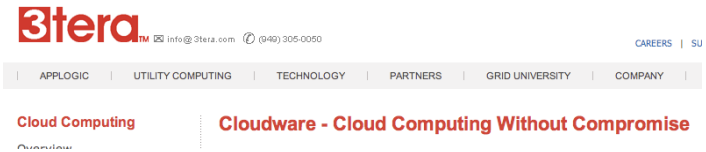
Only Storage is Cloud?

Only Storage is Cloud?

- Software and applications

Only Storage is Cloud?

- Software and applications



Only Storage is Cloud?

CLOUD TAXONOMY

Infrastructure Services

Storage
- Amazon S3
- Amazon EBS
- CTERA Portal
- Mosso Cloud Files
- Nirvanix

Compute
- Amazon EC2
- Serve Path GoGrid
- Elastra
- Mosso Cloud Servers
- Joyent Accelerators
- AppNexus
- Flexiscale
- Elastichosts
- Hosting.com CloudNine
- Terramark
- GridLayer
- iTRiCiTY
- LayeredTech

Services Management
- RightScale
- enStratus
- Scalr
- CohesiveFT
- Kaavo
- CloudStatus
- Ylastic
- Dynect
- CloudFoundry
- NewRelic
- Cloud42

Cloud Software

Data
- 10Gen MongoDB
- Oracle Coherence
- Gemstone Gemfire
- Apache CouchDb
- Apache HBase
- Hypertable
- TerraCotta
- Tokyo Cabinet
- Cassandra
- memcached

Compute
- Globus Toolkit
- Xeround
- Beowulf
- Sun Grid Engine
- Hadoop
- OpenCloud
- Gigaspaces
- DataSynapse
- Xeround

Cloud Management
- 3Tera App Logic
- OpenNebula
- Open.ControlTier
- Enomaly Enomalism
- Altor Networks
- VMware vSphere
- OnPathTech
- CohesiveFT VPN Cubed
- Hyperic
- Eucalyptus
- Reductive Lbs Puppet
- OpenQRM
- Appistry

Appliances
- PingIdentity
- Symplified
- rPath
- Vordel

File Storage
- EMC Atmos
- ParaScale
- Zmamda
- CTERA

Platform Services

General Purpose
- Force.com
- Etelos
- LongJump
- AppJet
- Rollbase
- Bungee Labs Connect
- Google App Engine
- Engine Yard
- Caspio
- Qrimp
- MS Azure Services Platform
- Mosso Cloud Sites

Business Intelligence
- Aster DB
- Quantivo
- Cloud9 Analytics
- Blink Logic
- K2 Analytics
- LogiXML
- Oco
- Panorama
- PivotLink
- Sterna
- ColdLight Neuron
- Infobright
- Vertica

Integration
- Amazon SQS
- MuleSource Mule OnDemand
- Boomi
- SnapLogic
- OpSource Connect
- Cast Iron
- Microsoft BizTalk Services
- gnip
- SnapLogic SaaS Solution Packs
- Appian Anywhere
- HubSpan
- Informatica On-Demand

Development & Testing
- Keynote Systems
- Mercury
- SOASTA
- SkyTap
- Aptana
- LoadStorm
- Collabnet
- Dynamsoft

Database
- Google BigTable
- Amazon SimpleDB
- FathomDB
- Microsoft SDS

OpenCrowd

Software Services

Billing
- Aria Systems
- eVapt
- OpSource
- Redi2
- Zuora

Financials
- Concur
- Xero
- Workday
- Beam4d

Legal
- DirectLaw
- Advologix
- Fios
- Sertifi

Sales
- Xactly
- LucidEra
- StreetSmarts
- Success Metrics

Desktop Productivity
- Zoho
- IBM Lotus Live
- Google Apps
- Desktoptwo
- Parallels
- ClusterSeven

Human Resources
- Taleo
- Workday
- iCIMS

Content Management
- Clickability
- SpringCM
- CrownPoint

Backup & Recovery
- JungleDisk
- Mozy
- Zmanda Cloud Backup
- OpenRSM
- Syncplicity

CRM
- NetSuite
- Parature
- Responsys
- Rightnow
- Salesforce.com
- LiveOps
- MSDynamics
- Oracle On Demand

Document Management
- NetDocuments
- Questys
- DocLanding
- Aconex
- Xythos
- Knowledge TreeLive
- SpringCM

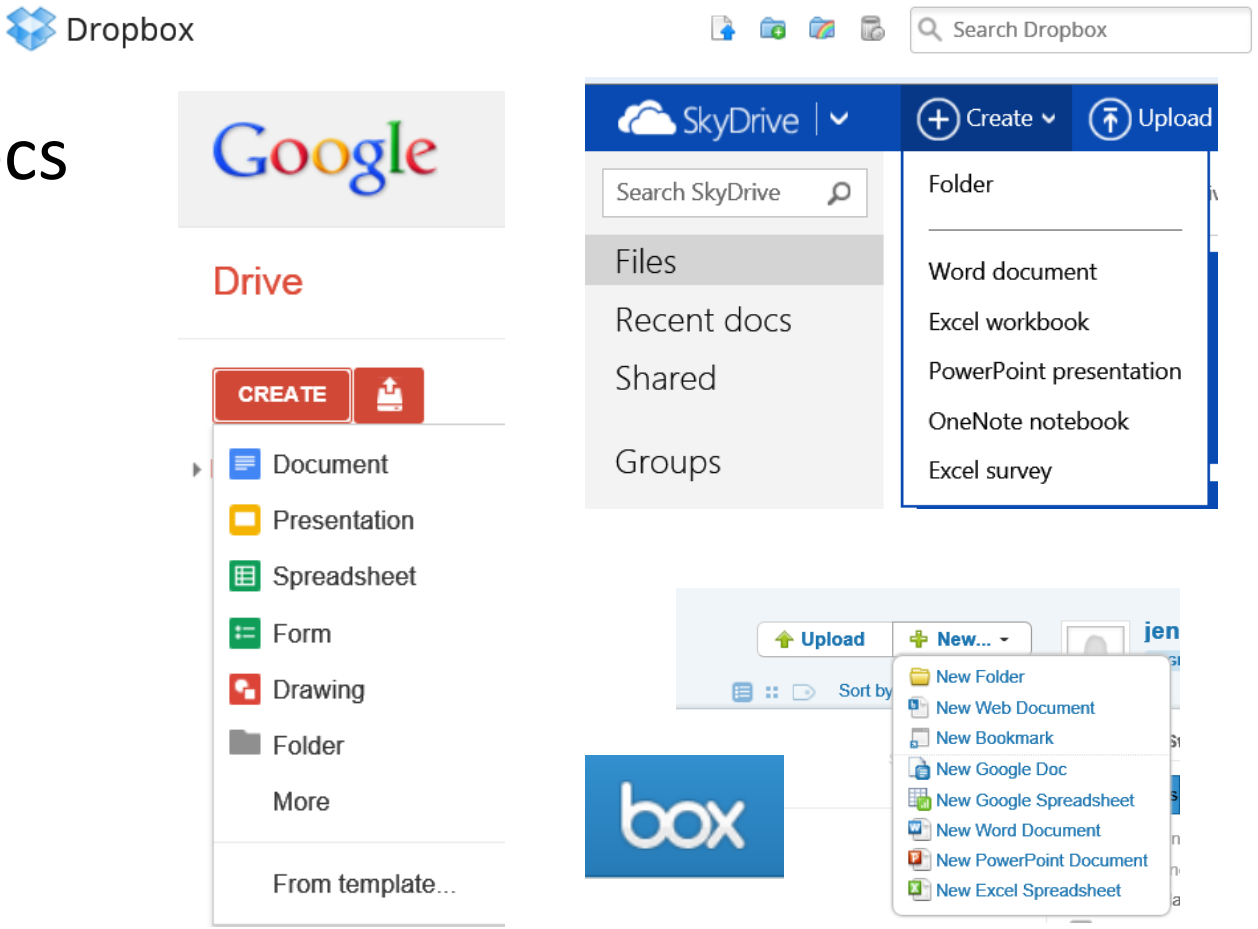
Collaboration
- Box.net
- DropBox

Social Networks
- Ning
- Zembly
- Amitive

Updated as of May 4, 2009

Document Creation

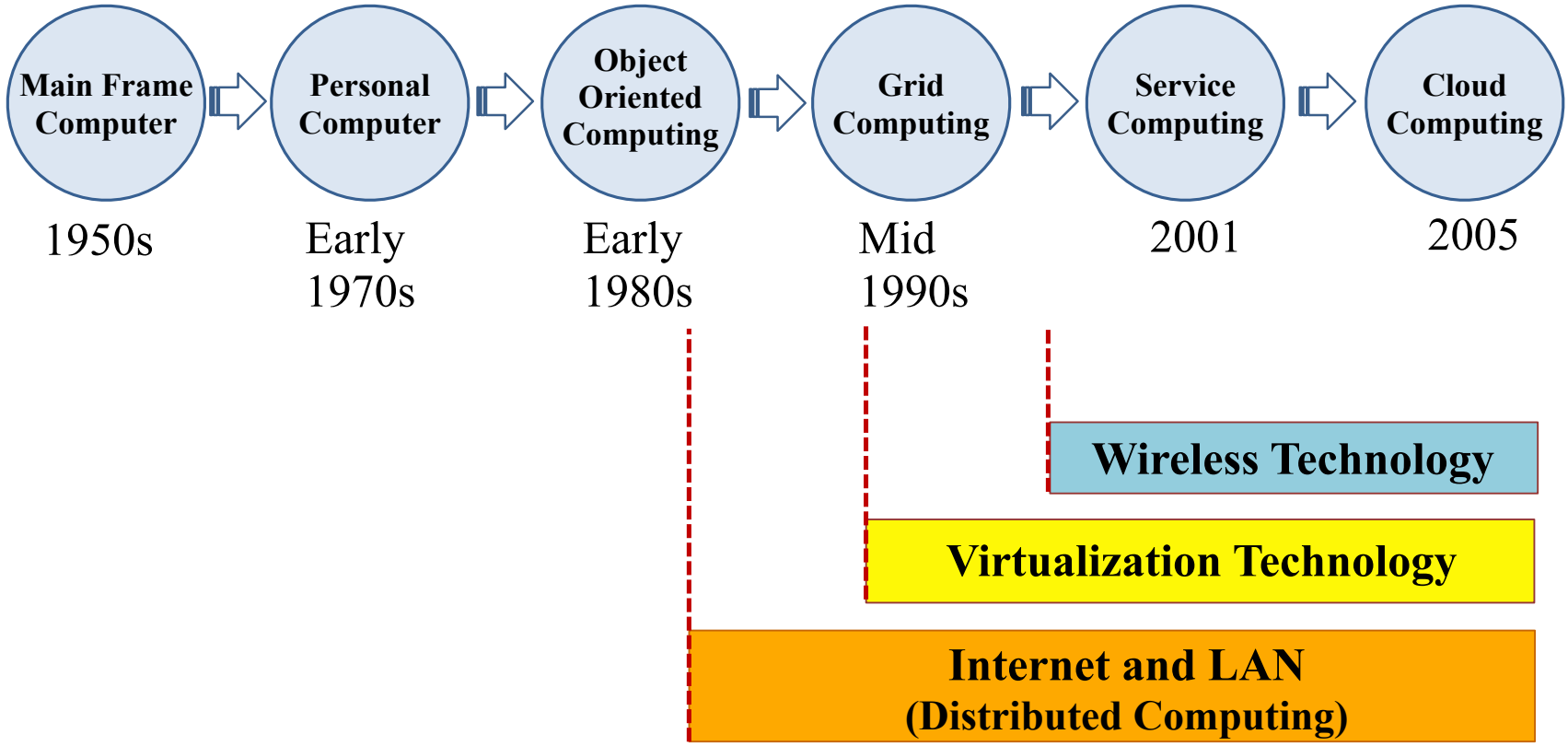
- Google Docs
- DropBox
- SkyDrive
- Box

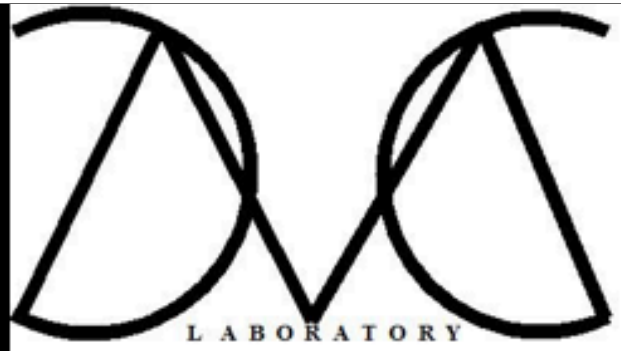


Other Software Services

- Photo Editing Software
- Online Banking Apps
- Social Media Apps
- Communication
- Library Specific Services
  - WorldCat
  - MSC
  - Ebsco
  - Discover It

Evolution of Computing Paradigms





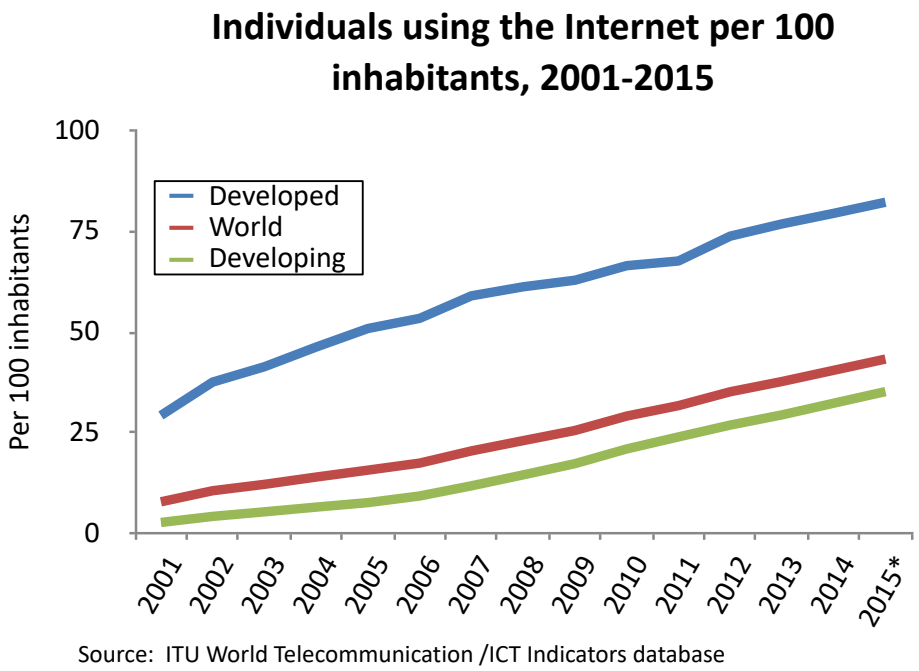
WHY SUDDEN SHIFT?

Internet Penetration

Source: ITU World Telecommunication /ICT Indicators database

Internet Penetration

The number of internet users globally will have attained almost 3 billions, two-thirds of the world internet users are from the developing world, in developing countries, the number of internet users will have doubled in 5 years, from 974 million in 2009 to 1,9 billion



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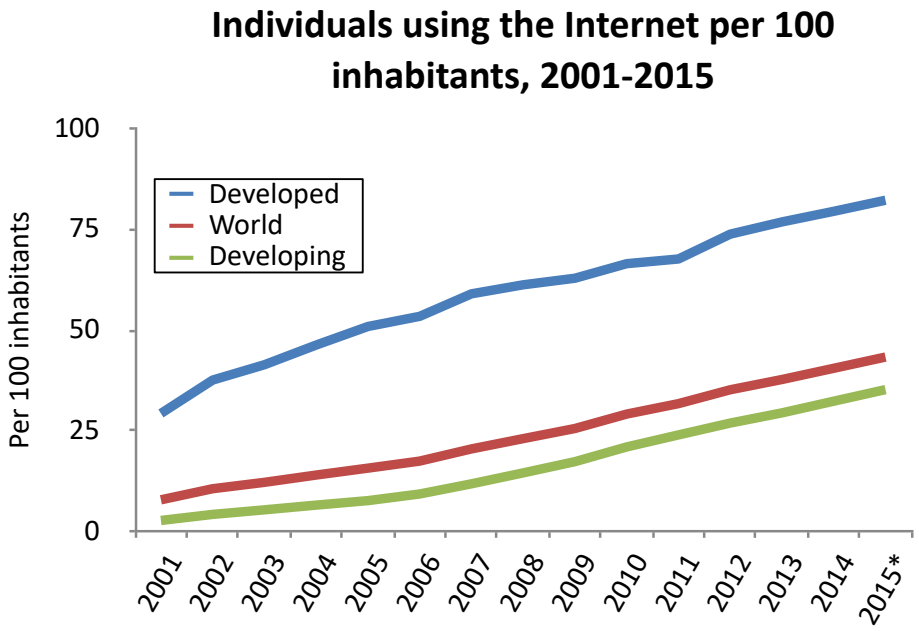

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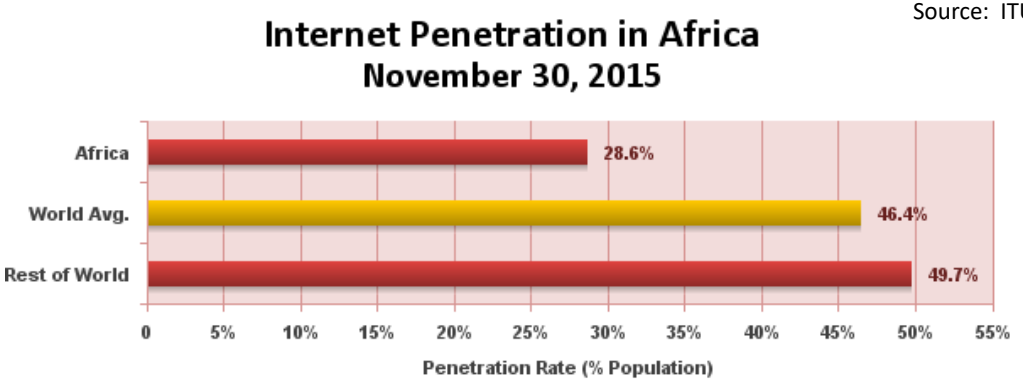

Source: Internet World Stats - www.internetworldstats.com/stats1.htm

The penetration remains is still low compared with other countries

Why adopt


Google apps
talk
cloud
Netbooks
Smartphones
Notebooks
Thin Clients
Desktops & Servers

Cloud Computing by Numbers

Cloud Computing by Numbers

Source: [1]IDC [Worldwide and Regional Public IT Cloud Services 2010 – 2014 Forecast, June 2010].
[2]Accenture ["Mind the Gap – Insights from the 3rd global High Performance IT research study, Nov, 2010]. [3]Accenture [Cloudrise: Rewards and Risk at the Dawn of Cloud Computing" Nov, 2010], [4]Center for Economics and Business Research [The cloud dividend, Dec, 2010]

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33% [2]
of global companies have deployed or are piloting the more mature layer of clouds, SaaS. 23% of high performing IT companies have already deployed SaaS

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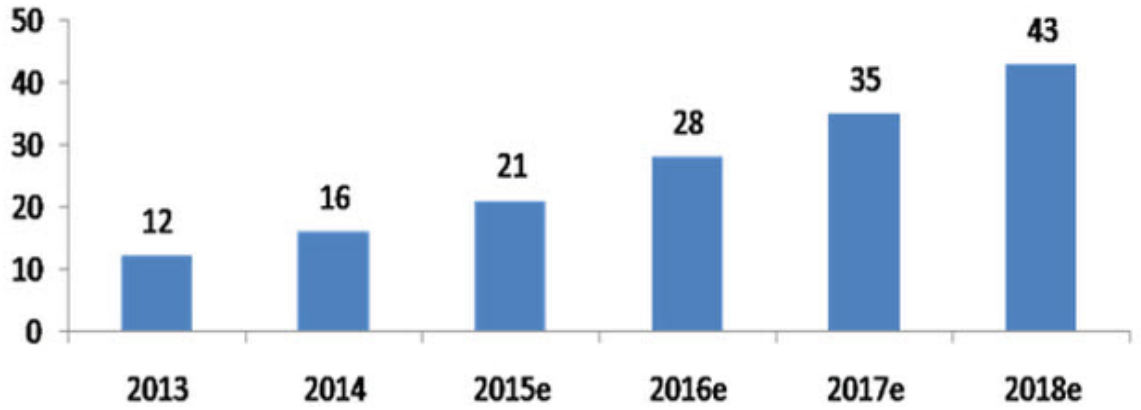
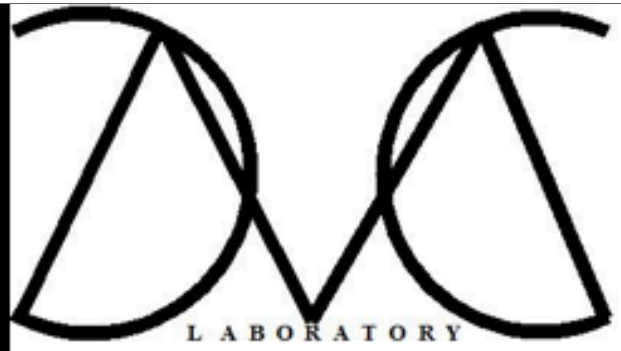
Cloud computing by the numbers

Cloud Computing Infrastructure and Platform Market
($ Billions, 2013 – 2018e)



Source : Goldman Sachs Research
http://www.forbes.com/sites/louiscolumbus/2015/09/27/roundup-of-cloud-computing-forecasts-and-market-estimates-q3-update-2015/#11c433986c7a



DEFINING SYSTEMS AND THEIR PROBLEMS

A System

A System

Software

- Moodle

Platform

- PHP
- MySQL
- Apache
- Ubuntu

Infrastructure

- IBM BladeCenter HS22
- Network Connection

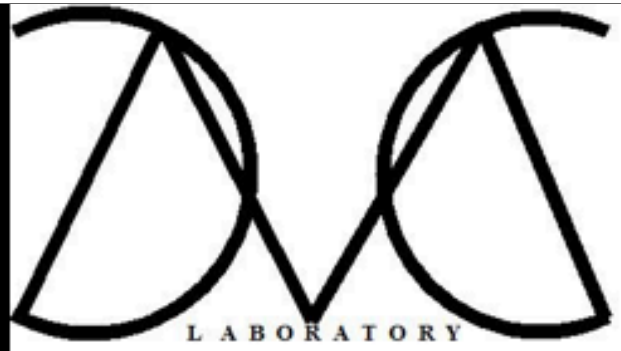
Problems with Systems

Problems with Systems

- Basic Assumptions When Creating Systems
  - Number of Users
  - Amount of Storage
  - Supporting Requirements
  - Amount of Computing Power

Problems with Systems

- Basic Assumptions When Creating Systems
  - Number of Users
  - Amount of Storage
  - Supporting Requirements
  - Amount of Computing Power
- Issues Faced with Maintaining Systems
  - Cost of Updating Systems
  - Scaling Systems



CLOUD COMPUTING: CHANGING THE WAY WE PROVIDE SYSTEMS

Defining The CLOUD

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  - http://csrc.nist.gov/groups/SNS/cloud-computing/
- Cloud Computing is a model

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  - To a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services)

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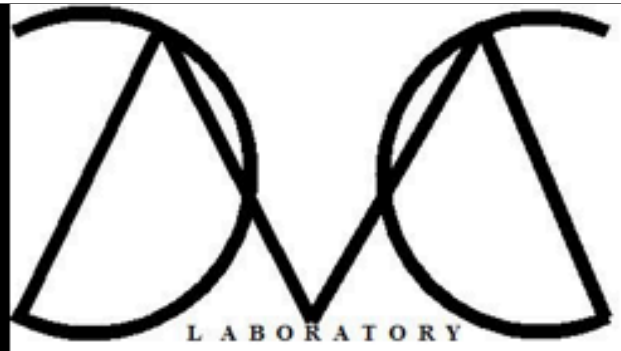
  - For enabling ubiquitous, convenient, on-demand network access
  - To a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services)
  - That can be rapidly provisioned and released
  - With minimal management effort or service provider interaction.

Defining The CLOUD

- Cloud computing can be thought of as anything that involves delivering hosted services over the Internet.
- 5 Characteristics
- 4 Deployment Models
- 3 Service Models



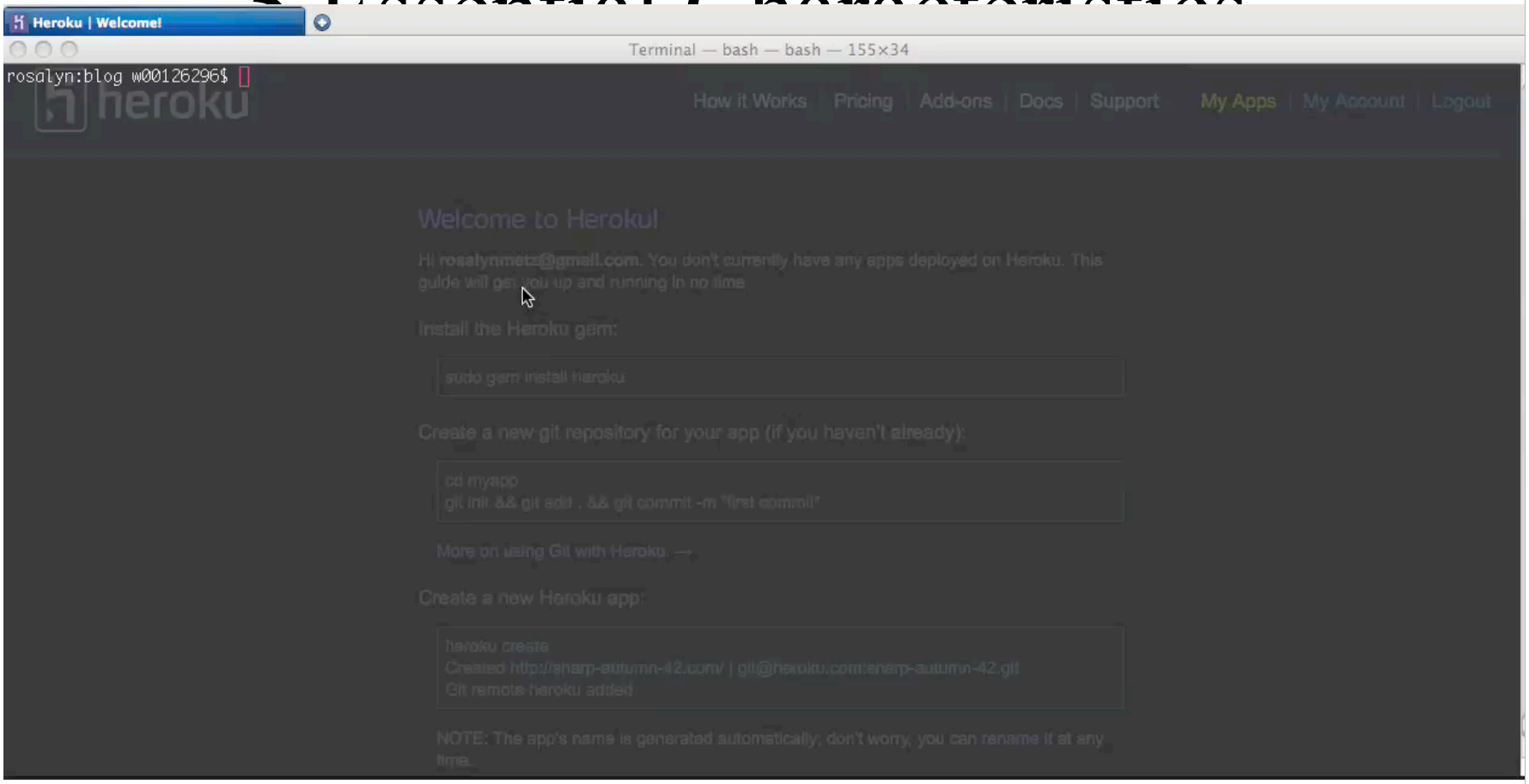
DEFINING THE CLOUD: 5 CHARACTERISTICS

5 Essential Characteristics

5 Essential Characteristics

- *On-demand self-service*
  - A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service provider.

5 Essential Characteristics



5 Essential Characteristics

- *On-demand self-service*
  - A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service provider.
- *Broad network access*
  - Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (e.g., mobile phones, tablets, laptops, and workstations).

5 Essential Characteristics

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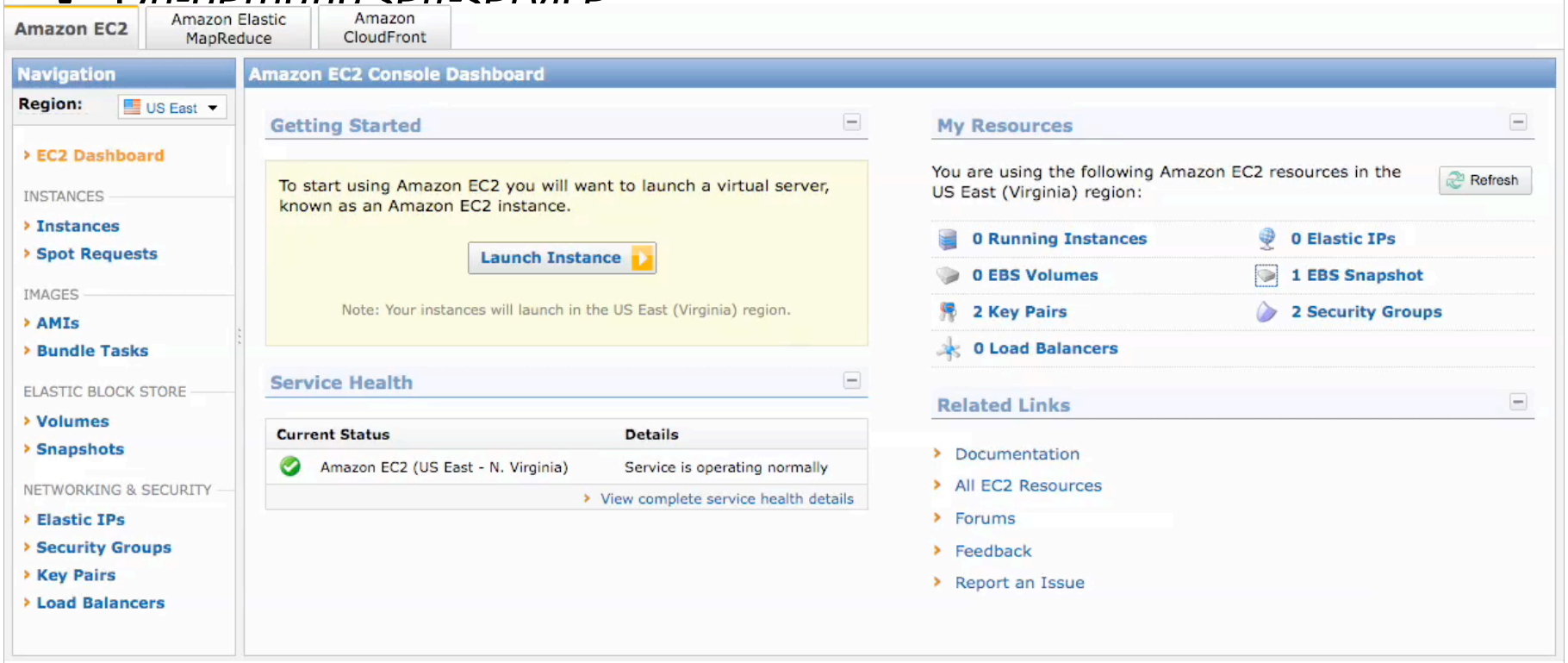
- *Broad network access*
  - Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (e.g., mobile phones, tablets, laptops, and workstations).
- *Resource pooling*
  - The provider's computing resources are pooled to serve multiple consumers. Resources can be dynamically assigned and reassigned according to customer demand. Customer generally may not care where the resources are physically located but should be aware of risks if they are located offshore

5 Essential Characteristics

- *On-demand self-service*



5 Essential Characteristics

- *On-demand self-service*
  - A consumer can unilaterally provision computing capabilities, such as server time and network storage, as needed automatically without requiring human interaction with each service provider.
- *Broad network access*
  - Capabilities are available over the network and accessed through standard mechanisms that promote use by heterogeneous thin or thick client platforms (e.g., mobile phones, tablets, laptops, and workstations).
- *Resource pooling*
  - The provider's computing resources are pooled to serve multiple consumers. Resources can be dynamically assigned and reassigned according to customer demand. Customer generally may not care where the resources are physically located but should be aware of risks if they are located offshore
- *Rapid elasticity*
  - Capabilities can be expanded or released automatically (i.e., more cpu power, or ability to handle additional users) to the customer this appears seamless, limitless, and responsive to their changing requirements

ELASTIC DEMAND

ELASTICITY OF DEMAND

$$= \frac{\%\ \text{CHANGE IN QUANTITY}}{\%\ \text{CHANGE IN PRICE}}$$

EXAMPLE:

Because there are so many housing options, it is easy for people to not have to pay more than they want to.

the balance

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- *Measured service/Pay-as-you-go*
  - Customers are charged for the services they use and then amounts. There is a metering concept where customer resource usage can be monitored, controlled, and reported, providing transparency for both the provider and consumer of the utilized service

Characteristics

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requiring human interaction with each service

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- *Resource*
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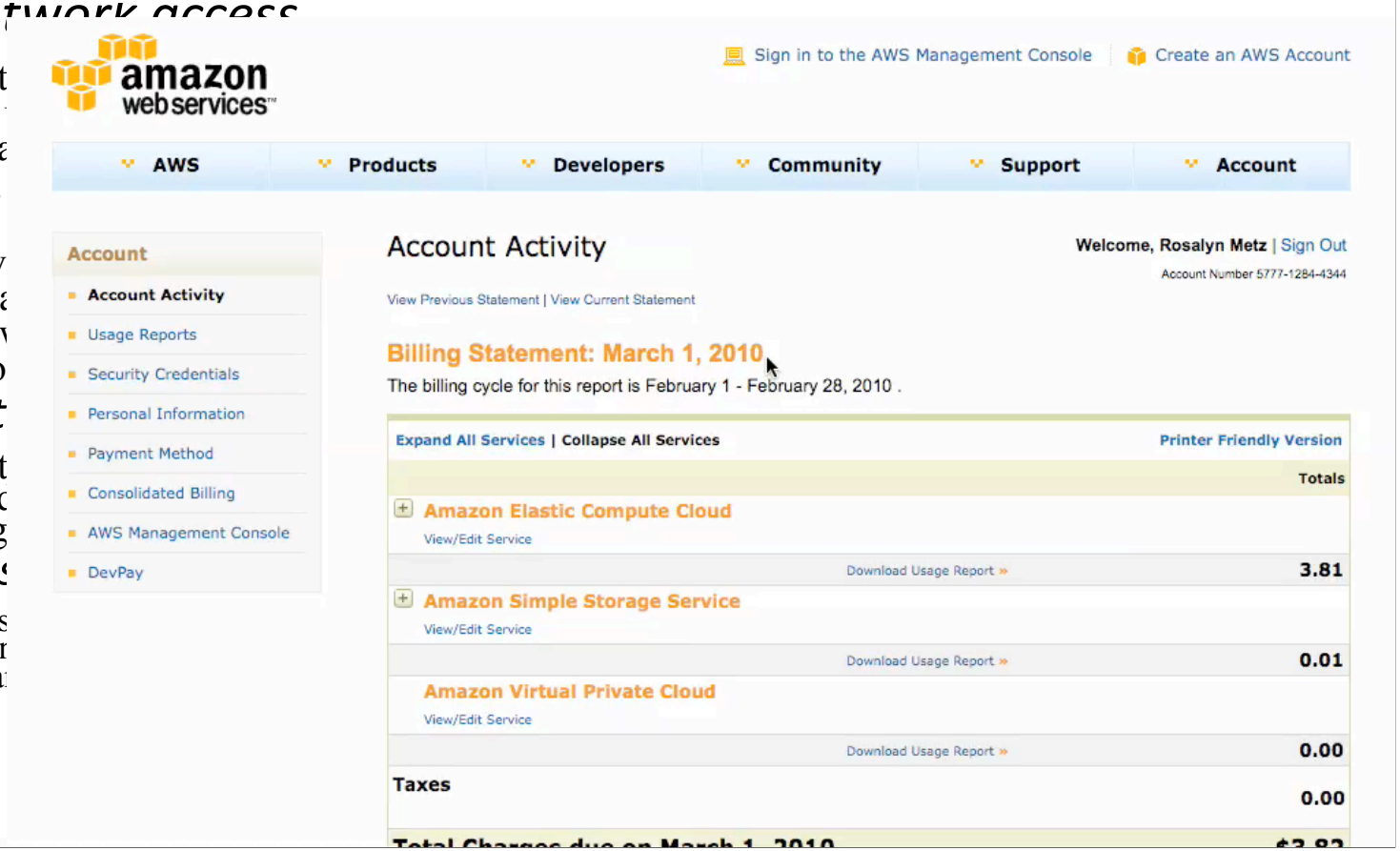

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