

Cloud Based Computing: Are we Ready?

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What is cloud computing?

Scaleable IT-enabled capabilities are delivered as a service to users via internet technologies.

Cloud computing didn't just appear, it's part of a continuum.

How did we get here?

In *The Big Switch* Nicholas Carr equates the rise of cloud computing in the information age to electrification in the industrial age.

Once upon a time

Organizations used to have to provide their own power

Water wheels, windmills

Barriers to entry limited who could enter businesses and where they could operate

Determined by available capital and natural resources

Power was the key

Water or wind

Direct mechanical connection

Limits location options

Electricity

Generated on site

Distribution infrastructure breaks down
geographic barriers

In the beginning there was ENIAC

ENIAC: Electronic Numerical Integrator And Computer - the first general-purpose, electronic computer. It was a digital computer capable of being reprogrammed to solve a full range of computing problems.

1946, Univ of Pennsylvania Moore School of Electrical Engineering

1000X faster than any previously existing electro mechanical calculating machine.

Waves of innovation

Mainframes 60s-70s

Microcomputer 80s-90s

PCs 1985 -

Client - Server 1990 - 1995

IP networks 1995 -

Mobile devices 2001 -

Today's forecast - Increasing cloudiness

IP networks

Converged and Mobile Devices

Increasingly leveraging Cloud based resources

Email, social media, etc

Data, like power, now flows

Electrical power has become a commodity

Connectivity is rapidly becoming a commodity

Can processing power be far behind?

Universities used to hold all the keys

Main Frames

Internet connections

PC based Computer labs

Dial-in modem pools

Email

No longer

Most universities have a computer requirement for students

Gartner, Forester et al predict that by the Fall 2013 semester 90% of students will have smart phones or similar devices.

Ubiquitous computing

Nearly 90% of households have computers, over 80% have internet access *

Gmail - 176 million monthly users

Hotmail - over 500 million users

Facebook - over 500 million active users

* <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1560660/>

Who's cloud is it?

Public Cloud

Private Cloud

Hybrid

Each approach offers different strengths and different vulnerabilities

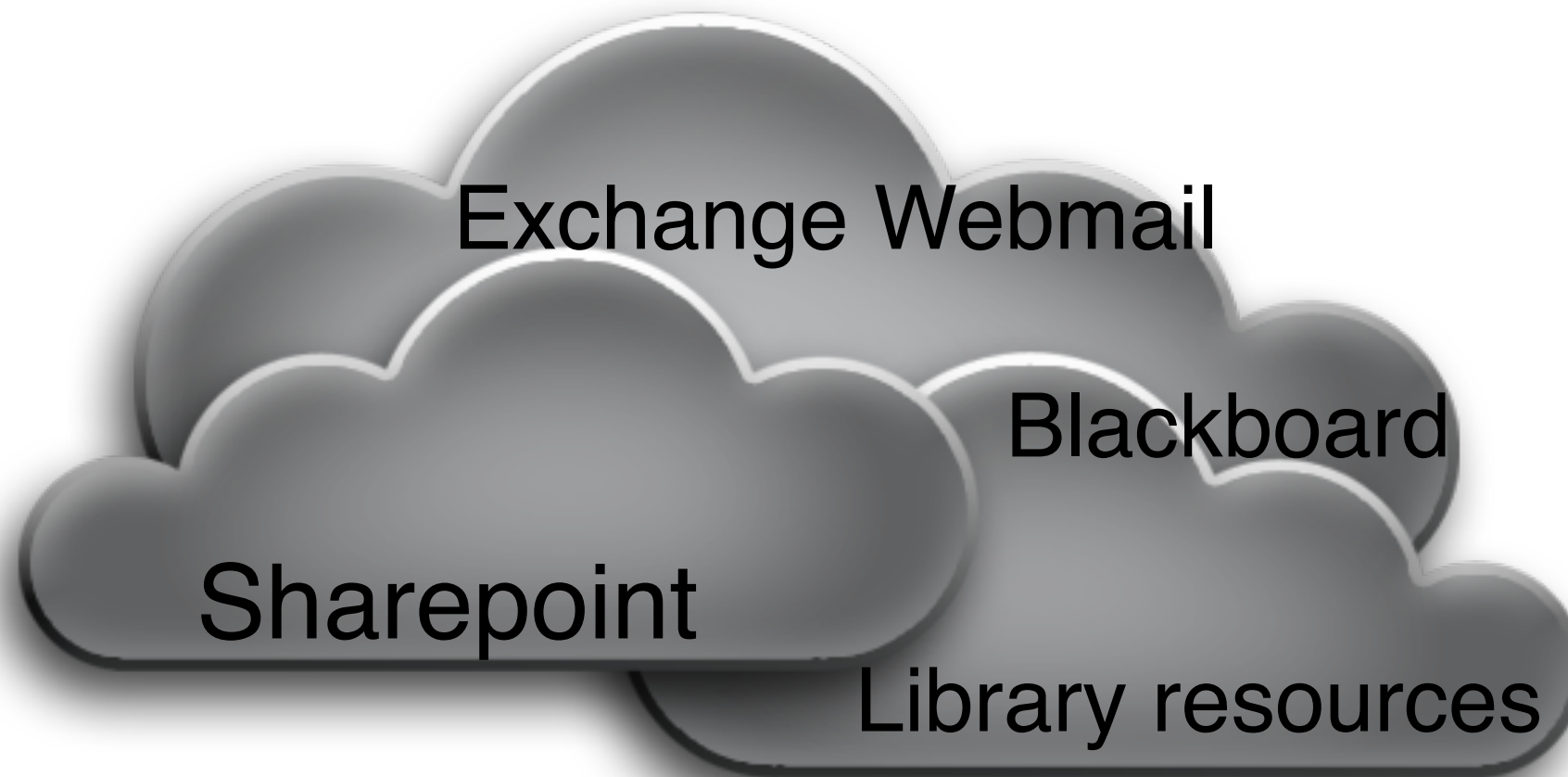
Public Cloud

A company offers some web enabled services



Private Cloud

Institution offers web enabled version of some internally available computational resource



Hybrid Cloud

Multiple internal and/or external providers



vcl.unc.edu

Microsoft Live Student email

Hosted Blackboard

GMail Student/Faculty/Staff

Is that a cirrus or cumulus?

- Who defines what is and is not a cloud?
 - Competing standards being offered by various stakeholders
- Cloud computing is still in it's infancy, so beware vendor lock-in.
- You don't want to get stuck with a Betamax - remember it's not always the "best" technology that wins

SPI Framework

Commonly agreed upon framework for describing cloud computing resources

Acronym stands for the three major services provided through the cloud

Software-as-a-Service (SaaS)

Platform-as-a-Service (PaaS)

Infrastructure-as-a-Service (IaaS)

Open Cloud Consortium

The Open Cloud Consortium (OCC) is a member driven organization that:

Supports the development of standards for cloud computing and frameworks for interoperating between clouds;

Develops benchmarks for cloud computing;

Supports reference implementations for cloud computing, preferably open source reference implementations;

Manages testbeds for cloud computing, including the Open Cloud Testbed and the Intercloud Testbed;

Manages cloud computing infrastructure to support scientific research, such as the Open Science Data Cloud.

What makes it cloudy?

5 key attributes

multitenancy (shared resources)

massive scalability

elasticity

pay as you go

self-provisioning

Multitenancy

Unlike previous approaches which assumed dedicated resources on the back end, cloud computing is based on a model in which resources are shared at the network, host, and application level

Massive scalability

Although organizations might have thousands of hosts, cloud computing provides the ability to scale to tens or hundreds of thousands of systems, as well as the ability to dynamically scale bandwidth and storage.

Elasticity

Users can increase or decrease computing resources as needed

Resources are released back into a common pool for reallocation to others

Pay as you go

Pay only for resources actually used, and only for the time they are used

Self-provisioning

Users self-provision resources, such as additional system (processing capacity, software, storage) and network resources.

What do you see?

Is that cloud a cute little bunny or a locomotive bearing down on us?

Cloud computing offers unique opportunities and threats for colleges and universities.

It all comes down to CIA

Confidentiality

Can we guarantee that the information is only appropriately accessed?

Integrity

Can we insure that the information hasn't been inappropriately changed either intentionally or unintentionally?

Availability

Will the information be there when we need it?

Public Cloud

Public pros

Clearest ROI

Outsourcing of cost and risk

pay as you go only for what you actually use

DR is someone else's problem

Public cons

loss of control

safe harbor requirements - can they be met?

How sure are you that you know where your data is?

Private Cloud

Private Pros

- Leaves you in control

- makes compliance/audit simpler

- easier to avoid vendor lock-in/ proprietary technologies

Private Cons

- requires that you provide resources, continuing support/maintenance

- scalability

- DR and BCP are all on you

Hybrid Cloud

Hybrid Pros

infrastructure and maintenance cost can be spread across service providers

can be more robust/ better BC and DR

Hybrid Cons

less clear ROI

less control

integration hurdles, especially in case of evolving standards

Common issues

What encryption model do you use?

Who owns the keys?

Who owns the data?

What happens after a merger?

What if your vendor goes out of business?

Additional issues

Compliance

Who is responsible in the event of a breach?

eDiscovery

Who pays?