**Notes on the Cloud Landscape – CSE 40822 – Cloud Computing**
Prof. Douglas Thain, University of Notre Dame, January 2016

*Caution: These are high level notes that I use to organize my lectures.   You may find them useful for reviewing main points, but they aren't a substitute for participating in class.*

References:

- Michael Armbrust et al, "A View of Cloud Computing", Communications of the ACM, Volume 53, Number 4, DOI: 10.1145/1721654.1721672, April 2010. http://cacm.acm.org/magazines/2010/4/81493-a-view-of-cloud-computing/fulltext
- Daniel Reed and Jack Dongarra, "Exascale Computing and Big Data" Communications of the ACM, Volume 58, Number 7, DOI:10.1145/2699414 http://cacm.acm.org/magazines/2015/7/188732-exascale-computing-and-big-data/fulltext

The term "cloud" is very broad and encompasses a wide variety of computing techniques.  Some of them have been around for a long time (e.g. distributed computing) while others are relatively new (pay-as-you-go).

Some key aspects of cloud computing:
(but not everything called "cloud" has all of these)

>       Centralized Data Center
>       Pay-as-You-Go
>       Interoperability
>       Services, not Programs
>       Resource Virtualization
>       Distributed/Parallel Computing

A Brief History of Computing

| | | |
|---|---|---|
| Mainframes | Centralized | (MULTICS-Utility Computing) |
| Minicomputers | In Between | (VAX/VMS + Terminals) |
| Personal Computers | Distributed | (IBM PCs) |
| Networks of Workstations | In Between | (Sun + NFS, PCs + Novell) |
| Internet and Peer to Peer | Distributed | |
| Grid Computing | Distributed Data Centers | |
| Cloud Computing | Centralized | |

Many aspects of computing writ large can be seen as pendulum that swing from one extreme to another with both technology and society.  Centralization/Distribution is one of these pendulums.

Cloud Architecture Layers
    Physical Resources
    Virtualized Resources
    Cloud Software (Middleware, Operating System)
    Applications
    Web Interface
    End User

(Note the comparison of architectures in the Reed paper!)

Layers of Service Delivery
    IaaS – e.g. Intel Machines
    PaaS –e.g. Linux Maciness
    SaaS – e.g. Hadoop Installation

How does this change things for IT and business as a whole?

    Provision Business Functions
    Replicate Configurations Accurately
    High Throughput Computing
    Match Resources to Load (Friendster vs Facebook)
    Data Analytics - Compute Close to Data
    Store Configurations
    Backup, Reliability, Availability
    Software Development for Services

Cloud and related terms:

    Cloud - Clients access big remote services.
    Grid - Multiple sites interoperating.
    Cluster - Everything in one room.
    Parallel - Everything on one backplane.
    Multithreaded - Everything on one chip.
    Exascale – High performance computing >= 1 Exa-Flop per Second
    Big Data – Volume, Variety, Velocity.

Cloud on the Hype Cycle

    Notice "hybrid clouds" in the trough of disillusionment!