

Cloud Computing



Cloud Computing

I don't know what it is.

Many, many, many different views, opinions.

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Cloud

- All classes need to decide what goes in, and what doesn't
- There are other distributed computing, parallel and distributed, advanced OS, etc. classes.
- This shouldn't be YADCC (yet another distributed computing class)
- SO... My view of cloud computing (and this class) is using publicly available, commercial, cloud service computing.
- AWS (Amazon), Google, IBM, and Azure (the biggest ones.)
- There are others.

Cloud

- Use several facilities on public cloud service providers.
- I don't know what **THE** cloud is. I think there are many.
- We will focus on something __aaS (as a service)
- Platform (PaaS), Software (SaaS), Database, Storage, many others
- Some overlap, some unclear, some very clear
- Anyone who says they are an “expert” probably isn't
- But many people are very knowledgeable.

Cloud

- Important:
- Pay as you go (not monthly or prepaid - mostly)
- Seemingly infinite resources: raw storage (files), databases, memory, “virtualized” CPUs (instances), network; (payments, search, voice, mail,...)
- Elastic use
- Choose your level of management, control:
 - Favorite (any) OS, programming language, data base (AWS)
 - Or not: Some OS with Python and a good SQL (Google App Engine)

Cloud

- Computers used to be expensive

Cloud, Time Sharing

- So you shared (for example “time sharing”)
- \$500 for an hour of time. Reserve, pay for, use.

Cloud, Multix

- Project MULTIX – MIT, GE (computers, then Honeywell), Bell Labs
- Many novel ideas, implemented in PL/I, file systems...
- Pay as you go. A few dozen computers across US, with network, support all users on teletypes.
- Failed. Before failing 2 guys at Bell Labs took a few of the great ideas and in a few months invented a tiny kind of PL/I (called B, then C), made “MULT” into “UN”-ix (pun), wrote a new OS, some utilities, all so they could develop a computer game to play.
- The game, C, and Unix may still be around.

Cloud, Multix

- MULTIX – R.I.P.
- Time Sharing lasted a long time
- Then when Amazon bought a bunch of computers to support Amazon sales, there was an economy crash. They were left with a bunch of computing power, no place to sell. (Amazon??) Got a few developers, got a team together in Cape Town, and developed a pay as you go, scalable, distributed, web service based “cloud” – AWS.
- AWS is about 1/3 of all cloud service, the next three combined, are somewhat smaller.

Cloud, Why Now (10 years ago)

- Commodity computers – cheap, (basically off-the-shelf) computers. CPU – X86, lots of memory, cheap, fast disk storage, cheap fast networking (some of these are evolving, most are not.)
- Virtualization allows big resource system (say 4 CPUs of 12 cores each) with 128 GB of memory (for example) to be “virtualized” (divided) into 1 Jumbo instance (all resources as one “computer”), or 10 Large instances or 50 Small or 200 Tiny computers, all on same hardware. Done dynamically.
- Virtualization allows economical slices as well as security. Critical need.

Cloud

- According to DOE (Dept of Energy) there are 3 Million Data Centers in the US (!) More than 2% of all energy in US. (not just electric)
- There are more than 100 Million servers in the world, or maybe the US. Maybe 200 million?
- But... probably... AWS has several million in the US, so does MicroSoft Azure, Google, and Facebook.
- These are (obviously) important competitive data, so estimates fluctuate wildly.
- We have several data centers here, at UTA, including some in this building.

Cloud

- Millions of users – or billions. Millions of “programmers”. Or designers, architects, engineers, etc. Billions of end users, world-wide.
- A very large part of income and profit to Amazon, MicroSoft, and IBM.
- Giant “users” include: Banks, Airlines, and Netflix.
- Amazon data centers are mostly 25 to 32 MegaWatt, between 80,000 and 300,000 computers in each datacenter. Including fairly close to here. (No, they don’t give tours...)

Cloud

- Netflix, alone, is (was?) about one third to half of ALL peak Internet network traffic in north America. Off peak... nothing (not quite, but very little).
- Almost all of this goes to AWS.
- Including ALL video on demand north America network traffic... including YouTube, Netflix, Amazon Prime, UTA Echo 360 (not cloud based), this is the only thing that the Internet does.

Cloud

- There are many interesting use-case examples:
- Netflix (their tech blogs are great)
- Airlines, on-line store, etc.
- UTA MyMav.
- Considering: usability, robustness, scalability,
- 40 million+ can simultaneously watch Netflix,
- .0005 of that can not use MyMav concurrently.

Cloud

- So: how do you design, implement and test:
 - Robust, stable systems
 - Scalable
 - Secure (?)
 - Inexpensive
 - Maintainable, testable
 - Quickly

Cloud

- Starting with simple storage as a system with a simple interface.
- Using structure in data – databases.
- Simple data analysis – machine learning
- Visualizing results – pictures
- Scaling up, scaling down
- Measuring and optimizing performance – time
- Requirements->Design->Build->Test->Optimize

Cloud

- There is no “guaranteed” job, such as the past:
- 1950’s - FORTRAN
- 1960’s - COBOL
- 1990’s - JAVA
- 2010’s - NOT CLOUD. Maybe cloud...

Cloud



Cloud

- Last Slide