



CS541 2: SHEDDING LIGHT ON THE CLOUDY FUTURE

Lecture XXV

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We've come a long way!

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- In 12 weeks we've looked at
 - ▣ The client side of cloud computing
 - ▣ The impact the cloud is having on the Internet
 - ▣ Issues associated with mobility and multihosting
 - ▣ The roles of various tiers of the cloud
 - ▣ All sorts of specific technologies: Browsers, RON, Chord, Pastry, Kelips, BitTorrent, BigTable, GFS, Astrolabe, T-Man, roles of virtualization, cloud economics...
 - ▣ CAP and FLP theorem, BASE, snapshot isolation
 - ▣ Paxos and Isis2, Byzantine Fault Tolerance, Gossip

Cloud (mis)conceptions

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- Many people assume that the cloud is basically a fancy name for Amazon EC2
- In fact the cloud is really “about” federation and integration: Amazon and MSN and Google and even the HPC clusters operated by NOA
- These services run on lots of systems and come together to provide integrated solutions to the user
- Some rules of thumb that seem to have big payoffs: ways of building systems that are highly elastic and that put responsiveness and performance first, layering consistency and other properties in a “secondary goals”



Today's cloud



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- Already a hundreds-of-billions of dollars per year industry and growing at a crazy rate
- Yet *only scratching the service*: Almost entirely focused on applications that don't provide guarantees
- The even larger opportunity: a fully capable cloud that can tackle high assurance needs too

Who needs a high-assurance cloud?

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- The most popular and most standard solution often ends up dominating and pushing everything else off the table
- If that trend plays out for the cloud, there won't be any other options!

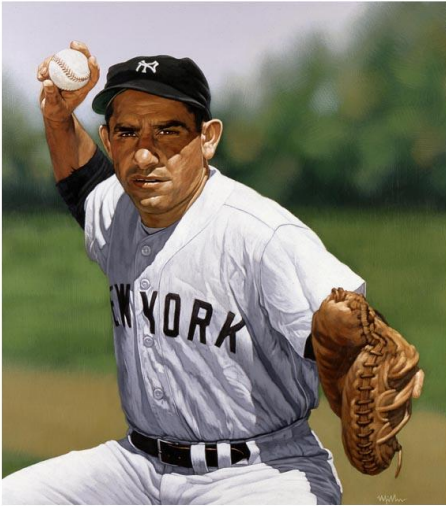
CS541 2 perspective?

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- High assurance is definitely possible on a cloud
 - But it isn't easy
- Today you need to know a lot about some very esoteric technologies to build strongly assured cloud computing services that also perform and scale well
 - But with more research and better tools this could get easier.
 - Easy to see how the picture could be better in 5 years

Yogi Berra's warning

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“It’s tough to make predictions, especially about the future.”

- This seems to apply equally to those who predict wide use of the cloud for high assurance and those who are certain that the cloud will never offer strong properties!

How can one learn more?

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- For many people, learning by doing works best
 - ▣ The cloud is an incredible job-creation engine
 - ▣ All of you will have great job prospects!
 - ▣ Building things is a very good way to think issues through
- Some of us should do basic research and create powerful new kinds of tools

Useful courses to consider

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- Security for large-scale distributed systems
- Advanced networking
- Mobile networks
- Large-scale information systems
- The “science of networks” (not the Internet)
- Machine learning
- Software Engineering

Rapidly growing cloud “industries”

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- Everything relating to applications for social/mobile computing
- Healthcare systems, not just in the doctor’s office but also in the home and in your whole life
- Building a smarter environment: the smart power grid, better traffic guidance systems, helping people in cities find parking, using “green” power

Navigating in a growth field



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- You might not get there on day one
 - ▣ Ideally, you find the ideal job right away, or perhaps your company has a unit and you switch to it
 - ▣ But some people will start in one job, then hear about something from a friend, and as they gain skills will also move closer to their target setting

- Believe in yourself and maintain a clear vision and you can do amazing things over time