Special Topics: CSci 8980
Edge Cloud Research

Jon B. Weissman (jon@cs.umn.edu)

Department of Computer Science
University of Minnesota
Introduction

• Introductions - all

• Who are you?

• What interests you and why are you here?
Introduction (cont’d)

• What is this course about?
  – the cloud
    • centralized data-centers => distributed resources
  – mobile/IoT (i.e. the far edge)
    • phones, tablets, sensors, robots, wearables

• Focus is on “systems” and applications for edge cloud computing
Web Site

• web site
The “Standard” Cloud

Data in

“No limits”
- Storage
- Computing

Results out

Computation

Results

Storage

Computing

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Big Data: hyper-exponential growth

The mobile web will contribute greatly to the big data explosion
Technical Course Goals

• Learn about the cloud, edge cloud, mobile, sensing, IoT, and applications

• Identify general problems and solutions

• Relate to classic problems and solutions in distributed systems, DB, networking, etc.

• What is new ... what is old
Non-Technical Course Goals

• Learn how to write critiques (blogs)
• Learn how to present papers and lead discussions
• Do a team research project
  – Idea formation
  – Writeup
  – Experiment
  – Present
  – (fingers-crossed) publish a (workshop) paper
Major Topics

• Edge History (Grids/P2P/CDNs)
• Outsourcing to the Edge and Cloud
• Cloudlets
• Edge Architecture and Services
• IoT and Device Clouds
• Geo-distributed Edge
• Crowd/Cloud Sourcing at the Edge
• Augmented Reality and other Edge Applications
• Edge Miscellaneous
• Edge Networking

• There is some overlap!
Course structure

• Grading ...
  – Presentations: 2 (maybe 3) of them (10% each)
  – Take-home mid-term: 20%
  – Final project: 30%
  – Written critiques (blogging): 10%
    • Approximately 4 of these per person
  – Discussions: 20%
Edge Database

• Please let me know if you find any interesting publications, web-sites, applications, or systems!
Presentations

• Two presentations
  – 1 presentation = 2 related short papers or 1 longer one
• Give paper’s context and background
• Key technical ideas
• It’s relation to other papers or ideas
• Positive/Negative points (and why)
• 25 min max to leave time for discussion
• Keep it interesting!
  – tough job: don’t want gory paper details nor do we want total fluff
  – audience: smart CS/EE students and faculty
  – demos are great!!
Presentations (cont’d)

• Research/Discussion questions
  – go beyond the claims in the paper
  – limitations, extensions, improvements
  – “bring up” any blog discussions

• You may find ppt online BUT
  – put it in your own words
  – understand everything you are presenting
Critiques/Blogging

• Brief overview
• Positives and negatives
  – Hint: only one of these will be in the abstract 😊
• Discussion points
• Due before paper is presented so presenter has a chance to see it
Projects

• Talk about ideas in a few weeks ...
  – present a list of things that are useful, open to other ideas

• Work in a team of 2 or 3

• Large groups are fine
  – Plan C could be an issue

• Risk encouraged ... and rewarded (even if you fall short)
Projects (cont’d)

• Implementation project done on cloud and/or mobile infrastructure:
  – Azure, Amazon AWS, Google Compute, Planetlab, more TBD
  – 1 page proposals will be due in early March

• May present status to the class in late March (forcing function)

• Will present final results at the end
Near-term Schedule

- **web site**
- Next three lectures+
  - I will present, no blogging necessary
- Need volunteers for upcoming papers (see ? next to papers on the website)
  - I will hand-pick “volunteers” if necessary 😊
  - I will pick bloggers
Questions?
The Edge: Gentle Intro

• The Emergence of Edge Computing
  Satya

• Edge-centric Computing: Vision and Challenges
  Epema, Iamnitchi, and others
What is it?
Background

• Terms
  – edge, fog, cloudlets, micro/nano datacenters, cyber foraging
  – depends on context: e.g. fog ~ IoT infrastructure scalability vs. cloudlets ~ mobile interactive performance
Taxonomy

• Far edge: mobile, sensor/IoT, human
  – limited networking
• The “edge”:
  – local compute, storage
  – 1 hop to far edge, Internet connected
• ?
• Centralized cloud
Satya

• Centralization => Dispersion
• Four reasons
  – Proximity/latency: highly responsive cloud services/applications (e.g. AR, VR)
    • Low latency, high b/w, low jitter
  – Scalability via edge analytics
    • Local processing of high b/w sensors (e.g. cameras)
  – Privacy enforcement
    • First point of contact between far edge and system
  – Masking cloud outages
Why Now?

• Networking: SDN, NFV, Ultra-low-latency 5G

• Computing power: smartphones, wearables, etc.

• Big Data at the edge
Technical Challenges

• Edge architecture and middleware
• Algorithms, systems for collective control and sharing of edge resources
• Complexity management
• Weaker security perimeter
• Non-technical: bootstrapping
Edge-centric

• Cloud = loss of privacy requires unilateral trust

• Key Points
  – Proximity is in the edge
  – Intelligence is in the edge
  – Trust …
  – Control …
  – Humans …
Challenges

• Human-driven distributed systems
• Edge architectures and middleware
• Security and privacy
• Scalability
Scenarios

• Personal spaces in the edge
• Social spaces in the edge
• Public spaces in the edge
• Project ideas lurking here?
On Thursday

Edge History

- Grid: Condor and the Grid
- P2P: Chord: A Scalable Peer-to-peer Lookup Service for Internet Applications
- CDN: On your own