Top 9 Reasons to Care About Mobile Edge Clouds

Ellen Zegura
Fleming Professor in Computer Science
Georgia Tech
PERFECTO Keynote, 1 May 2017
Reason 1: Teenagers

Lots (and lots) of Gilmore Girls
All watched on a phone
Why Mobile Edge Clouds?

• *Reduce bandwidth congestion on Internet backbone*
Reason 2: Game Players
Why Mobile Edge Clouds?

- Reduce bandwidth congestion on Internet backbone
- *Reduce delay*
Reason 3: Privacy

Source: Science Progress, The Problems of Policing Internet Privacy, July 11, 2011
“Your” Data

Source: J.D. Crowe at al.com
What Happened?
[Source: The Hill, April 3, 2017]

• President Trump signed a bill on Monday repealing internet privacy rules passed last year by the Federal Communications Commission (FCC) that would have given internet users greater control over what service providers can do with their data, a White House spokeswoman confirmed.

• The FCC regulations would have required broadband companies to get permission from their customers in order to use their “sensitive” data — including browsing history, geolocation and financial and medical information — to create targeted advertisements.
Or In Layman’s Terms

• “I guarantee you there is not one person, not one voter of any political stripe anywhere in America who asked for this,” Stephen Colbert said on “The Late Show” last week. “No one in America stood up in a town hall and said, ‘Sir, I demand you let somebody else make money off my shameful desires. Maybe blackmail me someday.’”
Why Mobile Edge Clouds?

• Reduce bandwidth congestion on Internet backbone
• Reduce delay
• *Keep private data closer to source*
Reason 4: Sharing

Crowdfunding and the Sharing Economy, By James Mackonochie - December 11, 2015
Will Future Adults Share?

Frequency of Internet Use by Teens
% of teens ages 13 to 17 who use the internet with the following frequencies


Pew Research Center
Pilot Study on Sharing

1. A for-profit business company needs to go through its database of customers to find ones that meet specific criteria for a product. A lot of computing power is necessary to go through the thousands of customers in the database.

2. Video games can provide suggestions for the next moves the player can make to get them closer to winning. The computation to foretell the outcomes of the game requires great computing power, which can be provided by individuals.

3. Scientists are examining how carbon from the atmosphere sinks into the ocean, which alters marine ecosystems. To conduct this research, a large amount of computing power is needed to analyze data from the Earth’s oceans.

4. A child has been lost. There are many public cameras in the area, but the images need to be processed for the child to be found. A lot of computing power is needed to process the images, so the more people that contribute computing power the better.
Method and Takeaway

- Approx 50 ugrad and grad students at GT
- It appears that individuals rationalize sharing their computational resources differently depending on the borrower.
- People were still willing to share their resources with the for-profit business, saying that if they get paid then it’s okay, even if they are not interested in the cause (businesses could have more money and therefore pay more).
- For the other scenarios, the actual cause was the reason people decided to share or not share their resources.
Why Mobile Edge Clouds?

• Reduce bandwidth congestion on Internet backbone
• Reduce delay
• Keep private data closer to source
• Lots of user-owned capacity and sharing economy (opportunity; lower cost?)
Reason 5: IoT

Ahmed Banafa, Fog Computing: From the Center to the Edge of the Cloud, August 22, 2014, LinkedIn
It was a weeknight, after dinner, and the baby was in bed. My wife and I were alone—we thought—discussing the sorts of things you might discuss with your spouse and no one else. (Specifically, we were critiquing a friend’s taste in romantic partners.) I was midsentence when, without warning, another woman’s voice piped in from the next room. We froze.

“I HELD THE DOOR OPEN FOR A CLOWN THE OTHER DAY,” the woman said in a loud, slow monotone. It took us a moment to realize that her voice was emanating from the black speaker on the kitchen table. We stared slack-jawed as she—it—continued: “I THOUGHT IT WAS A NICE JESTER.”

“What. The hell. Was that,” I said after
Data Minimization

• Principle: collecting covered information only as needed for legitimate business purposes and to retaining covered information no longer than determined necessary for legitimate business purposes

• Where should this be enforced?
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- *Reduce and manage private data nearby*
Reason 6: Internet Access
Not Just “Over There”

“Without Access Rural”
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• *Improve local access to some services*
Reason 7: Opportunity
Edge Clusters and Stability

Serendipity [3]
Non-clustered Highly-Mobile Devices

Coffeeshop
Public Transit [CloudInBus]

Theater, Home & Classroom [2]
Mont-Blanc Project [1]

Increased Cluster Stability

Generic Model for Elastic Clouds

- Arriving Tasks
- Results
- Initiator

- Task/Cloud Interface
- Execution Prediction Module
- Execution Prediction Module
- Task Assignment & Scheduling Module
- Network Management

Elastic Cloud Computing Core Functionalities
## Multiple Dimensions

<table>
<thead>
<tr>
<th>System</th>
<th>Stability</th>
<th>Task Origin</th>
<th>Tasks</th>
<th>Network</th>
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<tr>
<td>Mont-Blanc</td>
<td>Extremely Stable</td>
<td>Outside</td>
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<td>CWG</td>
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<td>Serendipity</td>
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<td>Inside</td>
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• Interesting design space and semantics for clusters
Reason 8: Purple People Eater

- (Mobile edge) clouds or Mobile (edge clouds)?
- What’s mobile?
  - Clients
  - Cloud resources
  - Both
- “Everything” is mobile
Mobile High Performance Computing

MHPC
High-performance computer mounted on a vehicle

HPC
Sample HPC module, TSY-300X 3U VPX by Themis Computers

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• *Everything is mobile; why not edge clouds*
Reason 9: Your Reason/Discussion

• What did I leave out?
• What would change the mobile edge computing picture?
  – Technologies?
  – Applications?
  – Socio-technical reasons?
• What does this have to do with cellular networks?
Thank you!