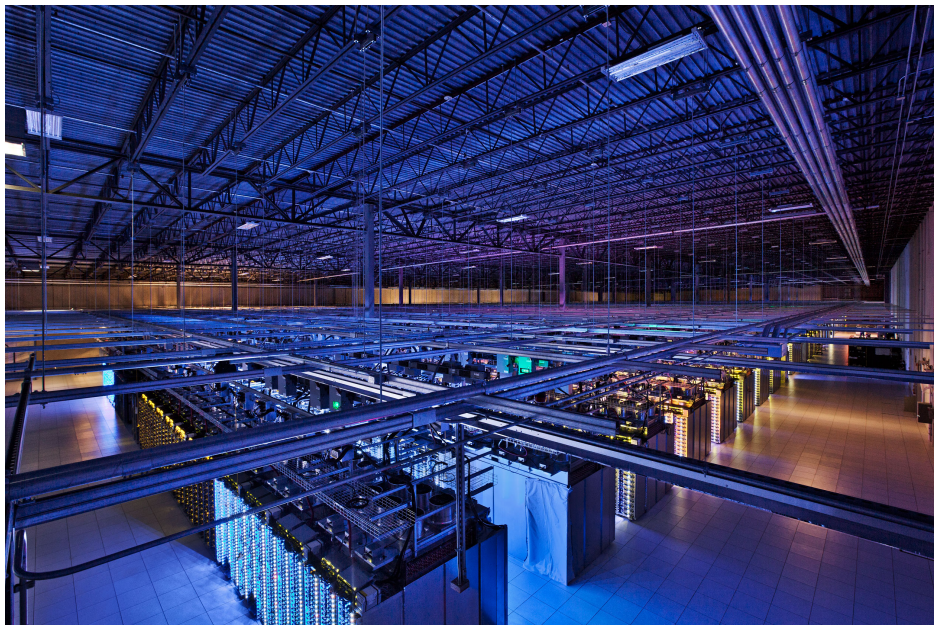
# SIGCOMM Preview Session: Datacenter Networking



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Computer Science and Engineering

# Internet growth trends

- 1977: 111 hosts on Internet
- 1981: 213 hosts
- 1983: 562 hosts
- 1984: 1,000 hosts
- 1987: 10,000 hosts

**(First SIGCOMM)**

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- 1989: 100,000 hosts
- 1992: 1,000,000 hosts (i.e., on the order of Google or FB)
- 2002: over 200 million hosts
- 2011: over 2 **billion** users
- 2014: mobile users surpasses desktop (~1.75B each)
- 2018: almost 4 billion users (earth population 7.6B)

# Today's Internet: The "Cloud"

Google

amazon.com

NETFLIX

Microsoft Office 365

Spotify

Google docs

bing

salesforce

facebook

# Massive-scale datacenters…

# Deployed across the planet

## Data center locations

We own and operate data centers around the world to keep our products running 24 hours a day, 7 days a week. Find out more about our data center locations, community involvement, and job opportunities in our locations around the world.

### Americas

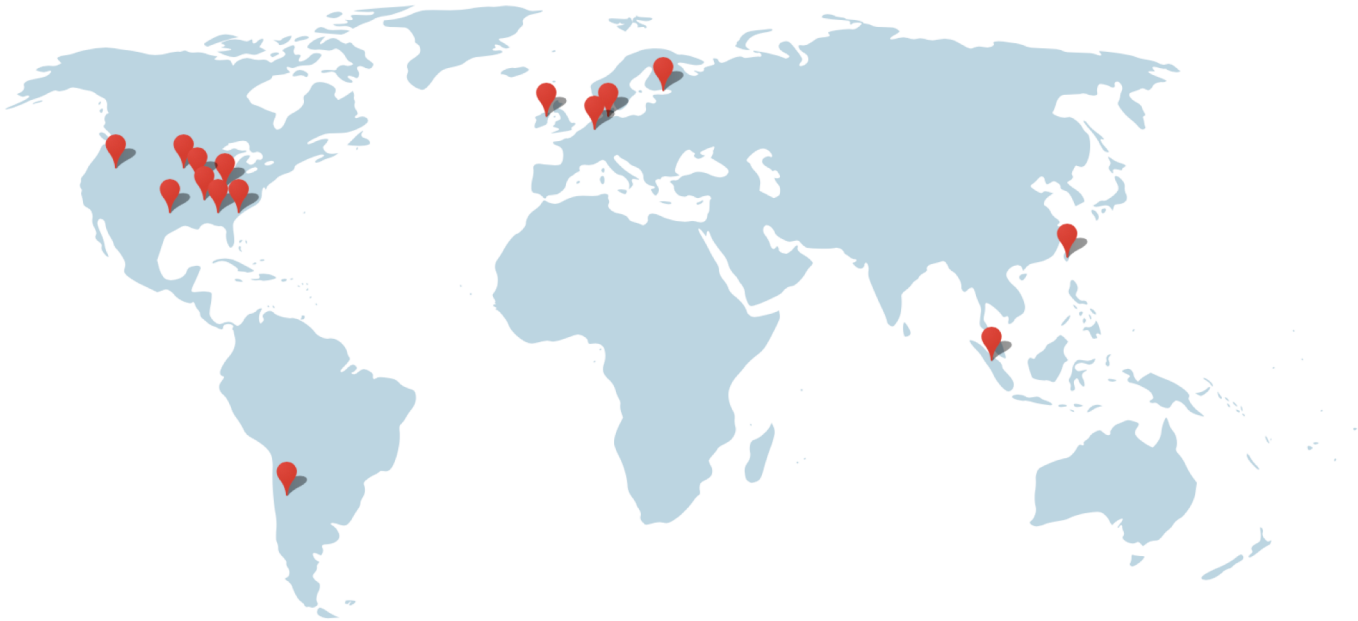
Berkeley County, South Carolina
Council Bluffs, Iowa
Douglas County, Georgia
Jackson County, Alabama
Lenoir, North Carolina
Mayes County, Oklahoma
Montgomery County, Tennessee
Quilicura, Chile
The Dalles, Oregon

### Asia

Changhua County, Taiwan
Singapore

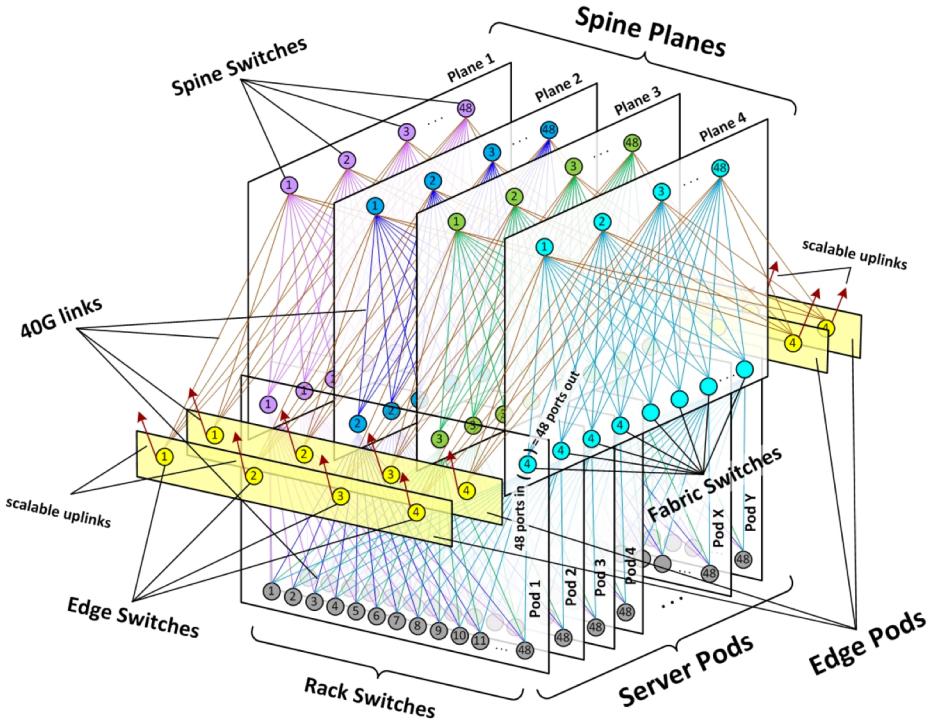
### Europe

Dublin, Ireland
Eemshaven, Netherlands
Hamina, Finland
St Ghislain, Belgium



**[Google]**

# Inside: An engineering marvel




[Facebook's Fabric Topology]

- Regular topologies
  - Sophisticated link and switch technologies
- Hardware/software co-design
  - Custom protocols
- Stringent performance requirements
  - Low latency
  - Rapid failure recovery

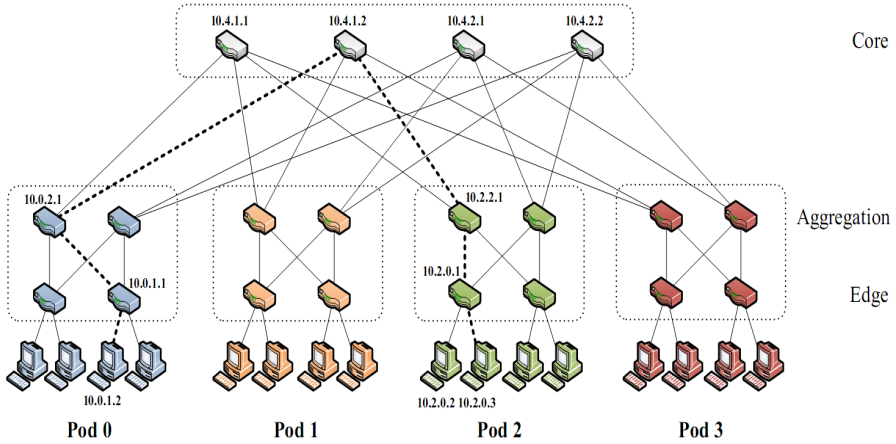
# A researcher's dream!

| The Internet | Data Center Network (DCN) |
|---|---|
| Many autonomous systems (ASes) | One administrative domain |
| Distributed control/routing | Centralized control and route selection |
| Single shortest-path routing | Many paths from source to destination |
| Hard to measure | Easy to measure, but lots of data… |
| Standardized transport (TCP and UDP) | Many transports (DCTCP, pFabric, …) |
| Innovation requires consensus (IETF) | Single company can innovate |
| **"Network of networks"** | **"Supercomputer backplane"** |

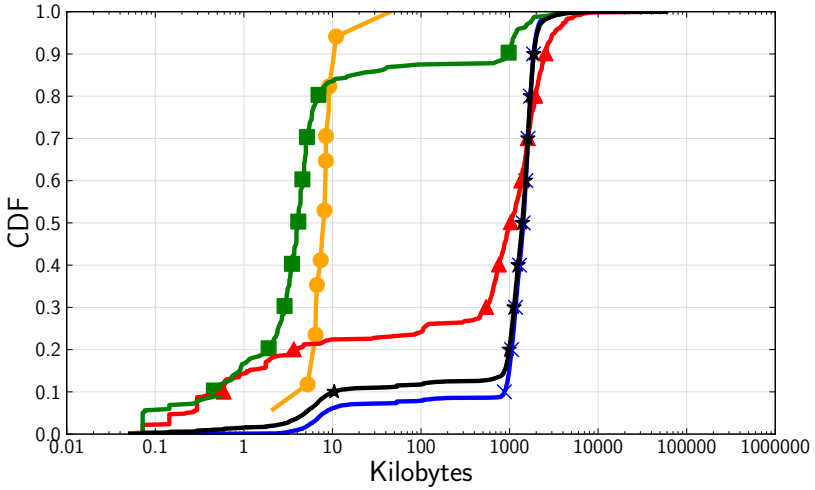
**[Slide stolen from George Porter]**

# Now an established area

- Topology and architecture
- Traffic engineering and congestion control

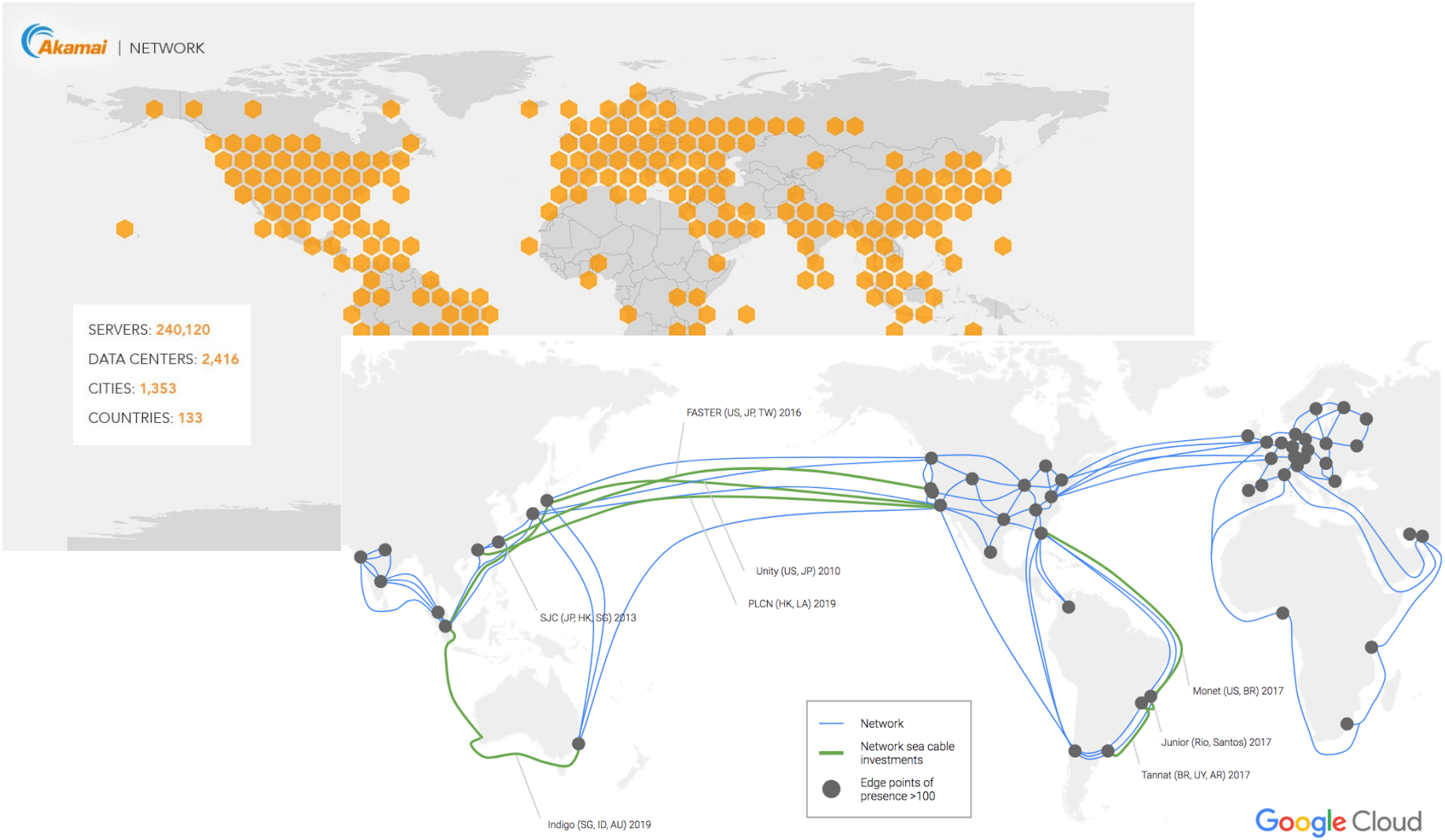



**[Al-Fares et al. SIGCOMM '08]**
**One of this year's ToT winners!**




**[Roy et al. SIGCOMM '15]**

# And moving (back) to WAN



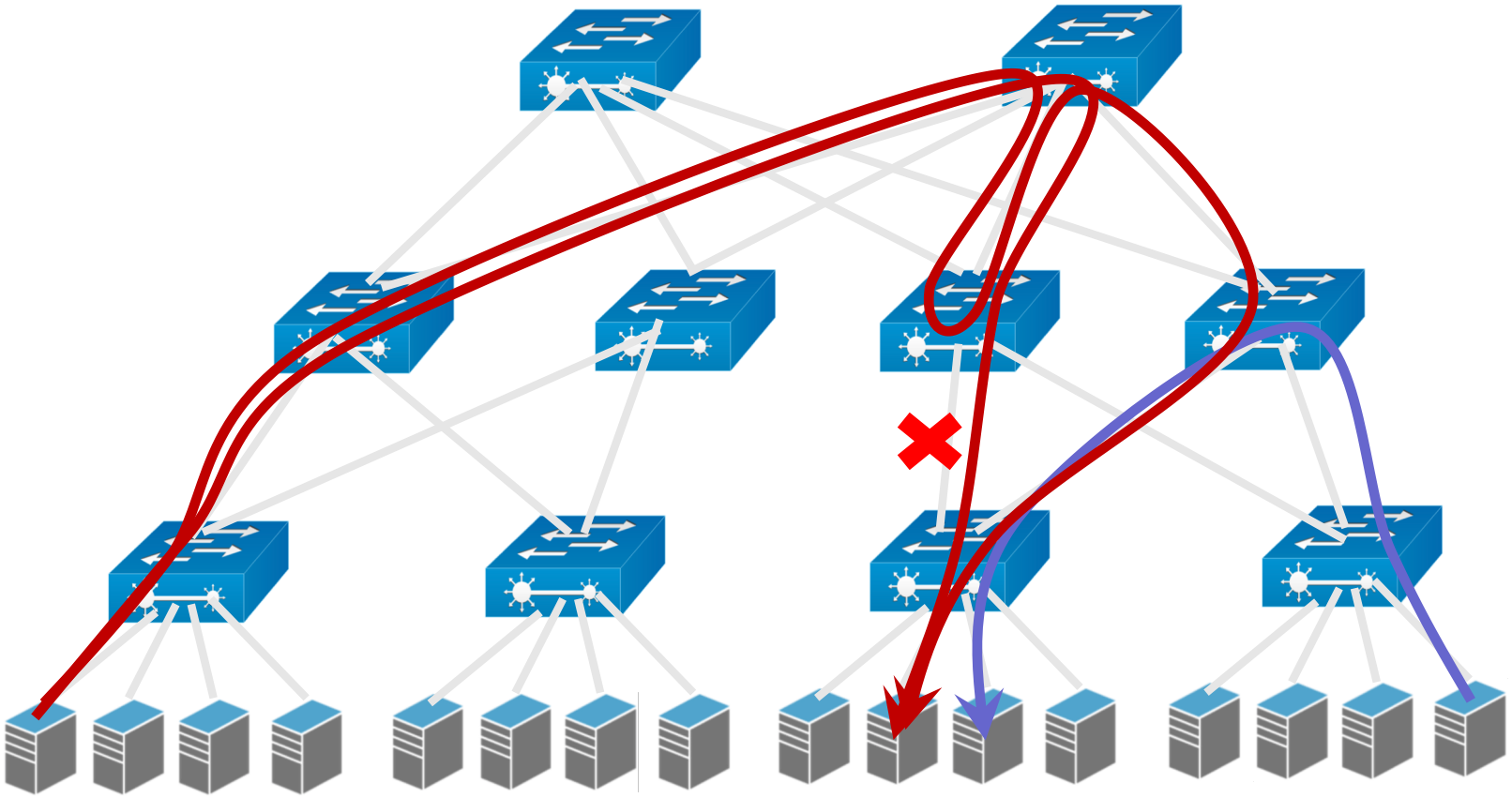
# Papers in the session

**8:40 am - 10:20 am Main-Conference Session 4: Data Center Networking**

Session Chair: Dina Papagiannaki *(Google, USA)*
Location: Vigadó, 2nd-Floor Ceremonial Hall

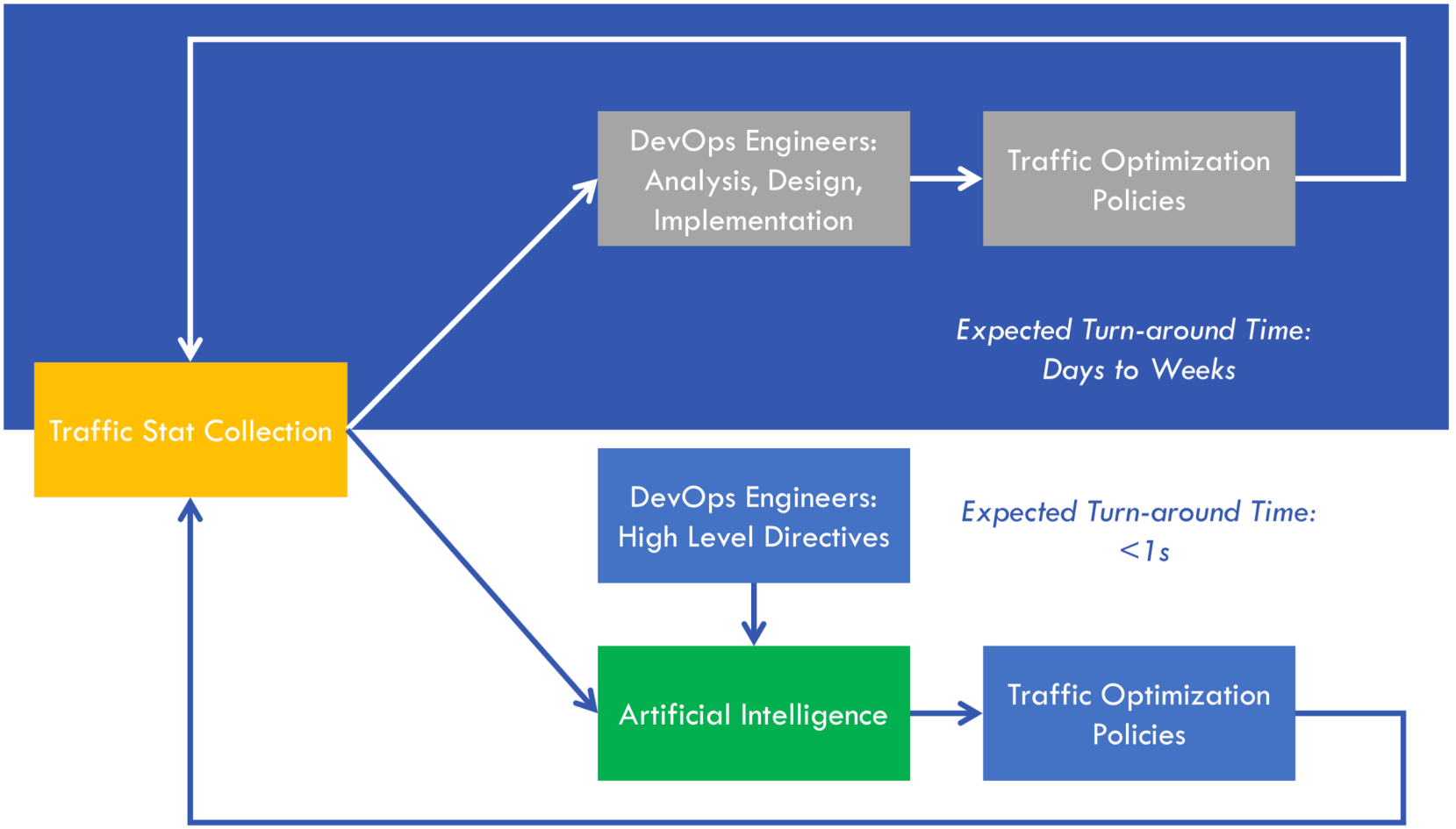
| | |
|---|---|
| 8:40 am - 9:05 am | **Masking Failures from Application Performance in Data Center Networks with Shareable Backup**<br>Dingming Wu, Yiting Xia, Xiaoye Steven Sun, Xin Sunny Huang, Simbarashe Dzinamarira, T. S. Eugene Ng *(Rice, USA)* |
| 9:05 am - 9:30 am | **AuTO: Scaling Deep Reinforcement Learning to Enable Datacenter-Scale Automatic Traffic Optimization**<br>Li Chen, Justinas Lingys, Kai Chen *(HKUST, China)*, Feng Liu *(SAIC, China)* |
| 9:30 am - 9:55 am | **Leveraging Interconnections for Performance: The Serving Infrastructure of a Large CDN**<br>Florian Wohlfart *(TU Munich, Germany)*, Nikolaos Chatzis, Caglar Dabanoglu *(Akamai, Germany)*, Georg Carle *(TU Munich, Germany)*, Walter Willinger *(NIKSUN, USA)* |
| 9:55 am - 10:20 am | **Homa: A Receiver-Driven Low-Latency Transport Protocol Using Network Priorities**<br>Behnam Montazeri, Yilong Li *(Stanford, USA)*, Mohammad Alizadeh *(MIT, USA)*, John Ousterhout *(Stanford, USA)* |

# Improved failure handling



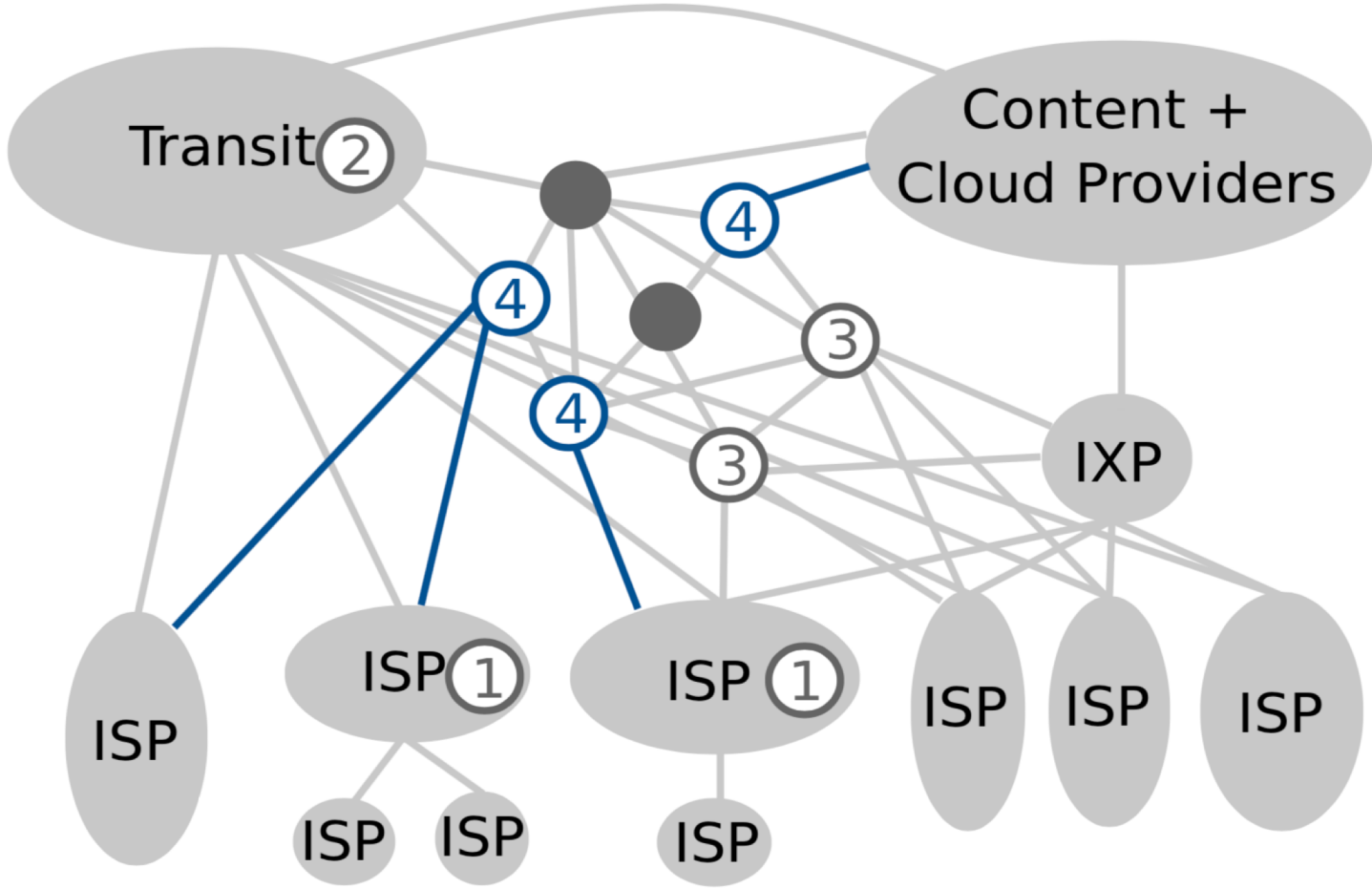
[Wu et al. SIGCOMM ‘18]

# ML for traffic engineering



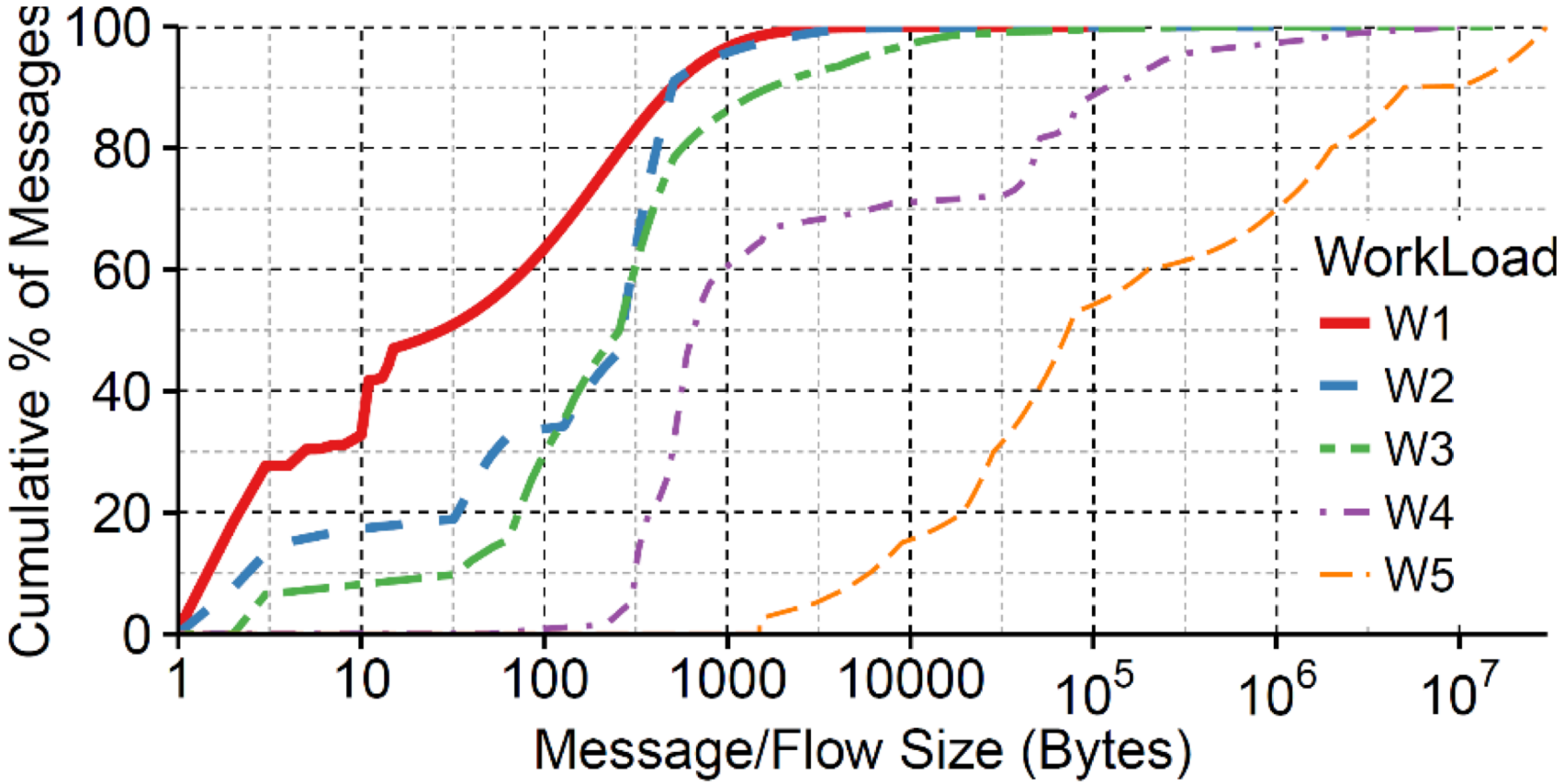

[Chen et al. SIGCOMM '18]

# A view of CP connectivity




[Wohlfart et al. SIGCOMM '18]

# Focusing on small messages




[Montazeri et al. SIGCOMM '18]