PEERING: An AS for Us
Giving researchers control over real BGP routing

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Supported By: Google™ NSF amsix Phoenix-IX.net SIX
How to study Internet routing?

- Traditional approaches are limited
  - Measurements: *realism without control*
  - Simulation/emulation: *control without realism*
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- We find it useful
  - LIFEGUARD: route around failures
    [SIGCOMM 2012]
  - PoiRoot: locate root cause of path changes
    [SIGCOMM 2013]
  - Measuring Internet routing policies
    [IMC 2015]
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- We find it useful; so do others
  - **LIFEGUARD**: route around failures
  - **PECAN**: joint content & network routing
  - **PoiRoot**: locate root cause of path changes
  - **ARROW**: deployable fix to routing problems
  - **SDX**: software-defined Internet exchange
  - **Measuring Internet routing policies**
  - **Sprite**: SDN-based inbound traffic engineering
  - **RAPTOR**: Routing attacks on TOR

(bold=us / normal=others)

[SIGCOMM 2012]
[SIGMETRICS 2013]
[SIGCOMM 2013]
[SIGCOMM 2014]
[SIGCOMM 2014]
[IMC 2015]
[SOSR 2015]
[USENIX Security 2015]
Pairing Emulated Experiments with Real Interdomain Network Gateways

**PEERING** is AS47065

With **PEERING**, a researcher:

- **Emulates** an ISP or runs a BGP router
- **Connects** the emulated ISP to *real* ISPs on the Internet via BGP
- **Controls** the ISP, including exchanging traffic & routes with *real* ISPs
Pairing Emulated Experiments with Real Interdomain Network Gateways

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- Owns 184.164.224.0/19

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Peering points around world

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Rich connectivity via IXPs

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  - IXPs: AMS-IX, SEA, Phoenix
  - 500+ peers: Akamai, Google, Hurricane Electric, Terremark, TransTeleCom,…

Amsterdam IX (AMS-IX)
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Researcher allocated: 184.164.224.0/23

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Amsterdam IX (AMS-IX)

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PEERING Server

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184.164.224.0/24

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184.164.225.0/24

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Researcher
What’s new? What’s next?

- **Supporting experiments**
  - *New:* Rebuilt entire platform this year
    - Essentially push button to deploy new experiment, new site, new peer
    - Give experiments independent control over route selection and announcements at IXPs
    - Etc.
  - *Next:* API for easy deployment of simple experiments (in testing)

- **Expansion**
  - *New:* More transit providers at IXPs
  - *Next:* Remote peering
  - *Next:* Emulate a cloud provider
    - Federating with CloudLab’s cloud data centers
    - Wide-area network interconnecting sites (using Internet2’s AL2S)
Forthcoming: Emulate a cloud provider
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Interconnect via WAN
(virtualized via R&E networks)
Forthcoming: Emulate a cloud provider

Cloud datacenters

Interconnect via WAN (virtualized via R&E networks)

PEERING sites
Conclusion

Little innovation in interdomain routing in 20 years
- Yet BGP is at the root of fundamental Internet problems
- Researchers have limited visibility or tools to run experiments

**PEERING provides a new approach to Internet research**
- Connects emulated ISPs with real ISPs on the Internet
- Vision is to let researchers run the ISP of their choice

**A community testbed**
- Contact us if you want to use or contribute!
- [http://peering.usc.edu](http://peering.usc.edu)