SCION: A Secure Multipath Interdomain Routing Architecture

Adrian Perrig, François Wirz

Network Security Group, ETH Zürich

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SCION Architecture Design Goals

- High availability, even for networks with malicious parties
  - Adversary: access to management plane of router
  - Communication should be available if adversary-free path exists
- Secure entity authentication
  that scales to global heterogeneous (dis)trusted environment
- Flexible trust: enable selection of trust roots
- Transparent operation: clear what is happening to packets and whom needs to be relied upon for operation
- Balanced control among ISPs, senders, and receivers
- Scalability, efficiency, flexibility

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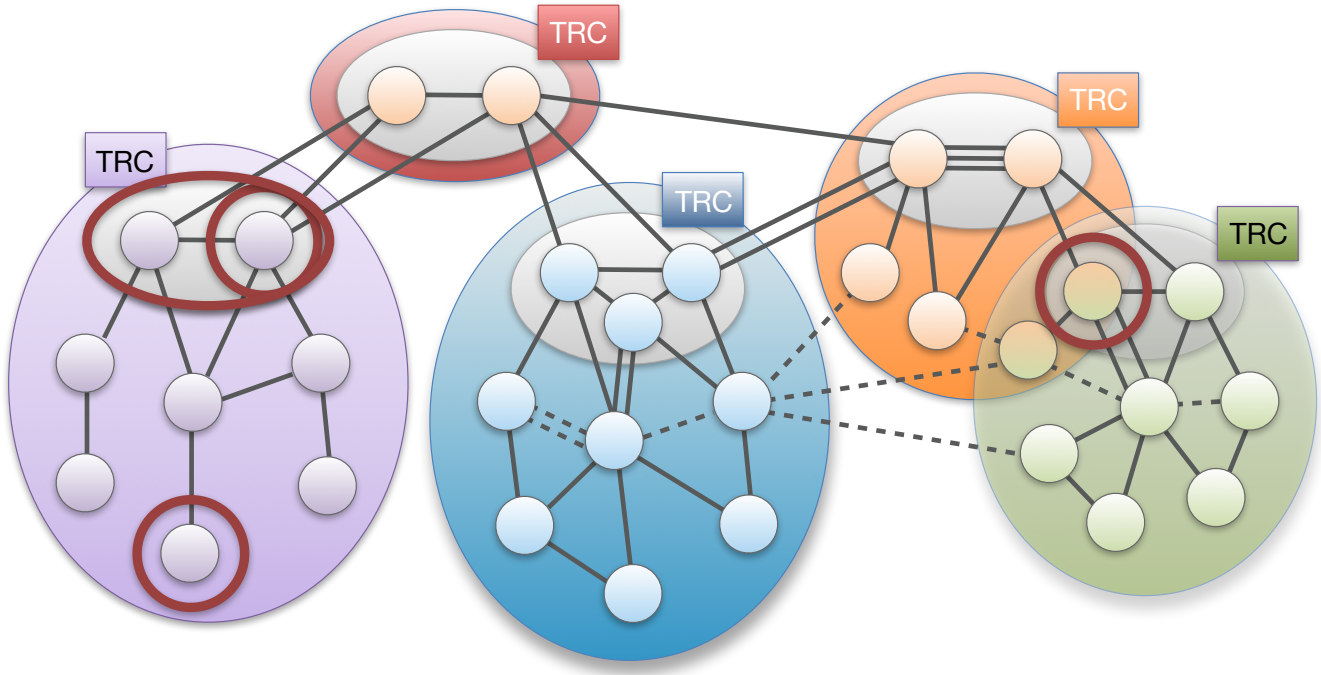
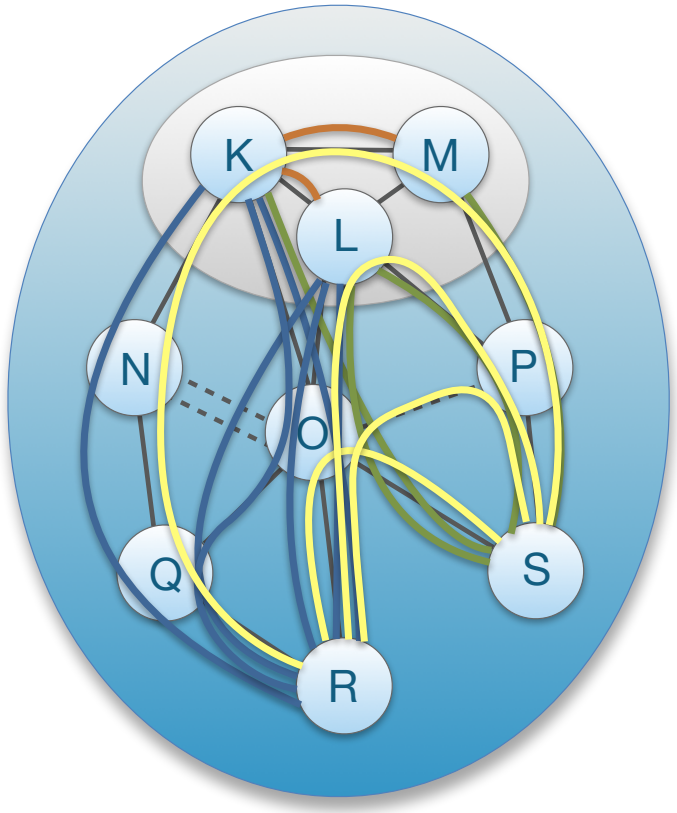
Approach for Scalability: Isolation Domain (ISD)

- Isolation Domain (ISD): grouping of ASes
- ISD core: ASes that manage the ISD
- Core AS: AS that is part of ISD core
- Control plane is organized hierarchically
  - Inter-ISD control plane
  - Intra-ISD control plane



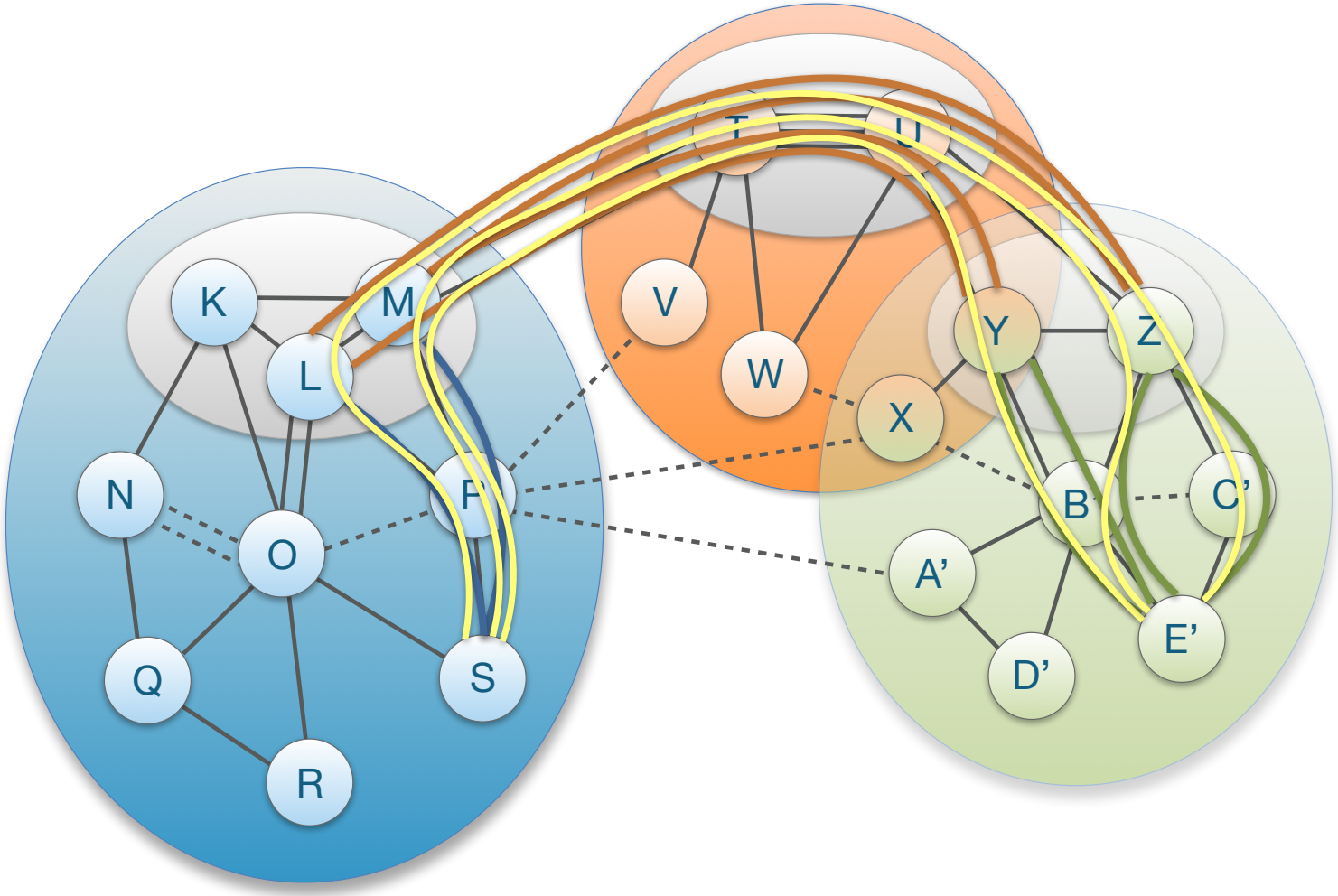
Path Creation: Local ISD

- Client requests path segments to <ISD, AS> from local path server
- If down-path segments are not locally cached, local path server send request to core path server
- Local path server replies
  - Up-path segments to local ISD core ASes
  - Down-path segments to <ISD, AS>
  - Core-path segments as needed to connect up-path and down-path segments



Path Creation: Remote ISD

- Host contacts local path server requesting <ISD, AS>
- If path segments are not cached, local path server will contact core path server
- If core path server does not have path segments cached, it will contact remote core path server
- Finally, host receives up-, core-, and down-segments



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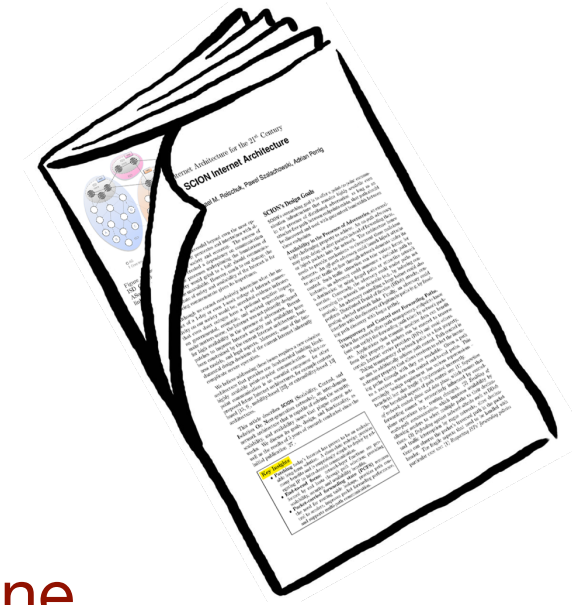
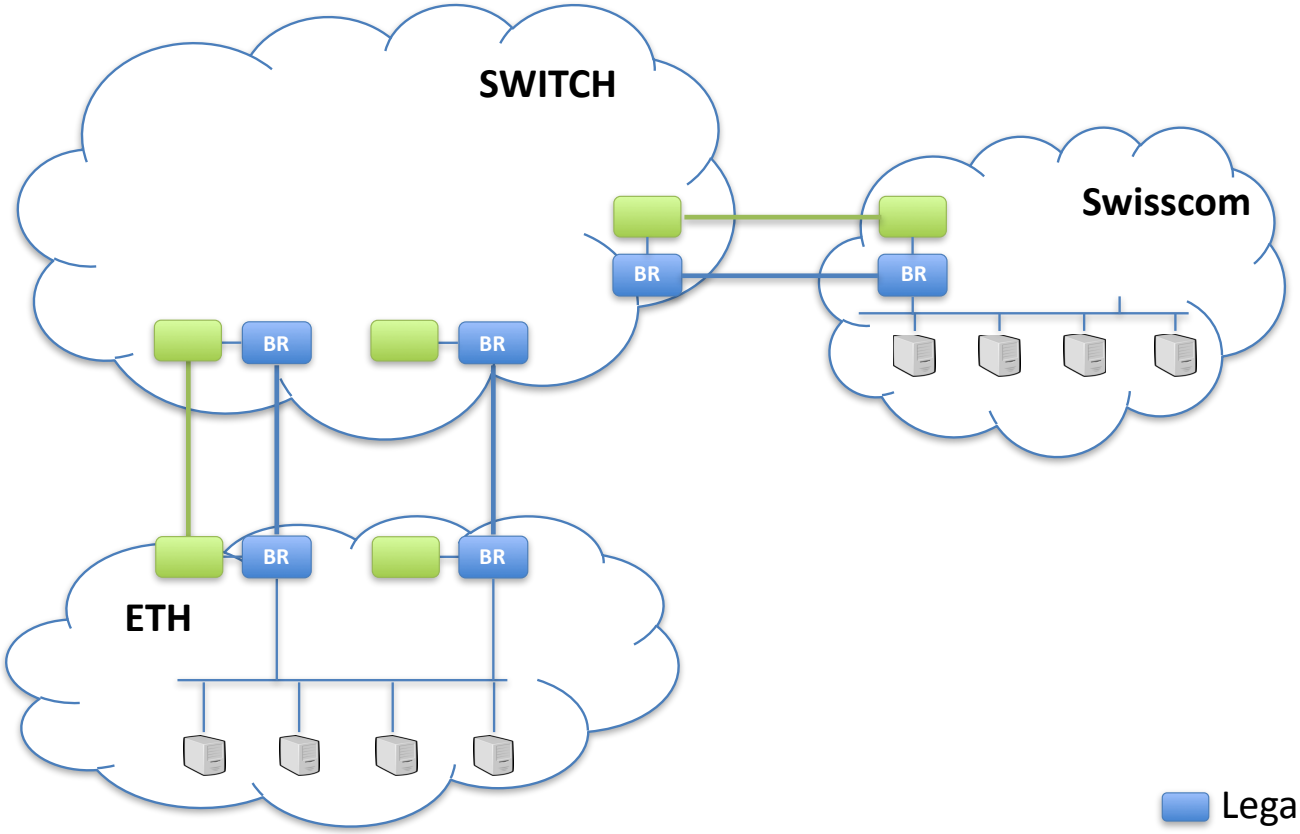
SCION Summary

- Complete re-design of network architecture resolves numerous fundamental problems
  - BGP protocol convergence issues
  - Separation of control and data planes
  - Isolation of mutually untrusted control planes
  - Path control by senders and receivers
  - Simpler routers (no forwarding tables)
  - Root of trust selectable by each ISD
- An isolation architecture for the control plane, but a transparency architecture for the data plane.



Deployment @ ETH



Legacy device
SCION border router

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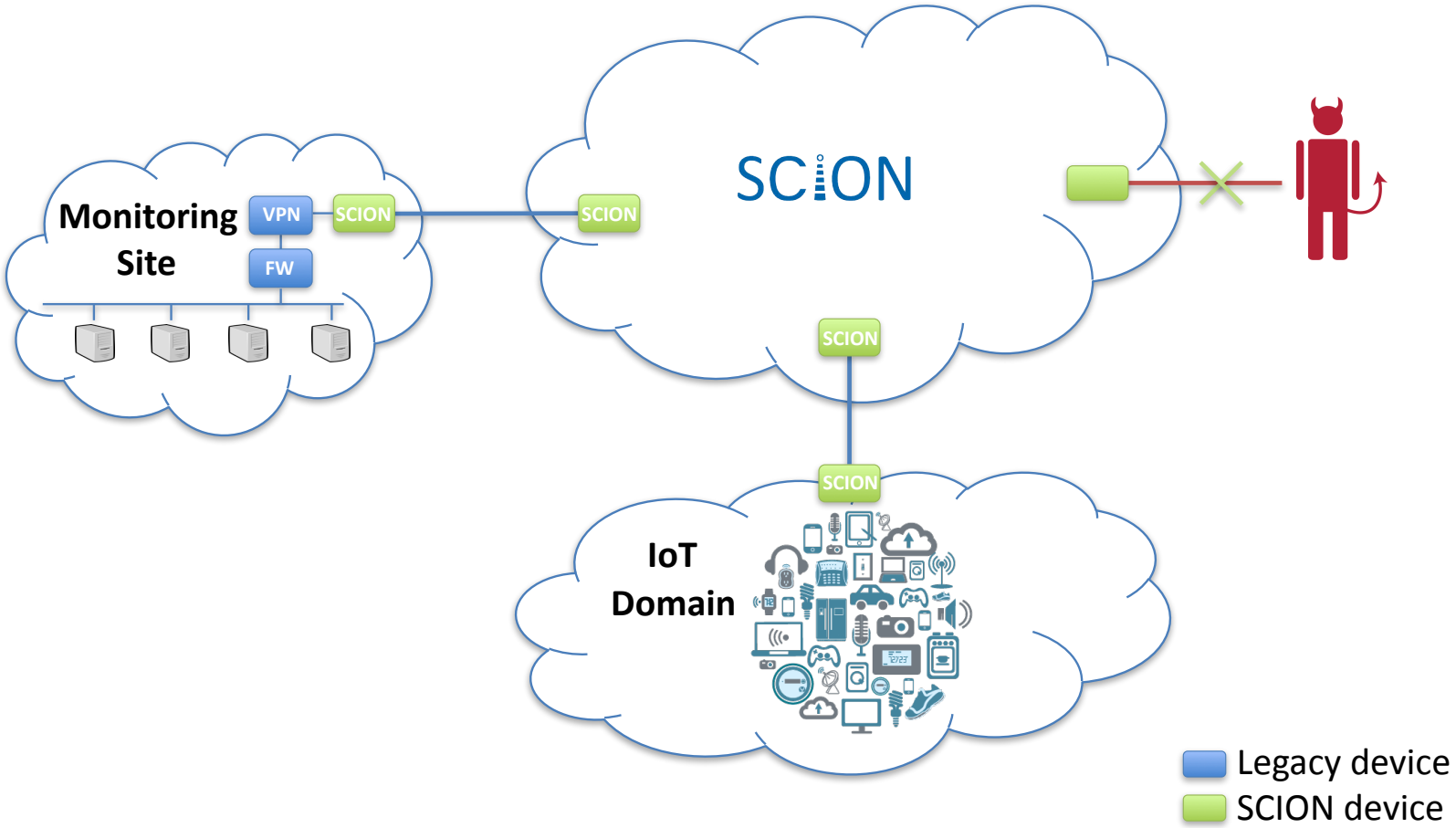
Use Case: IoT Protection through Default Off



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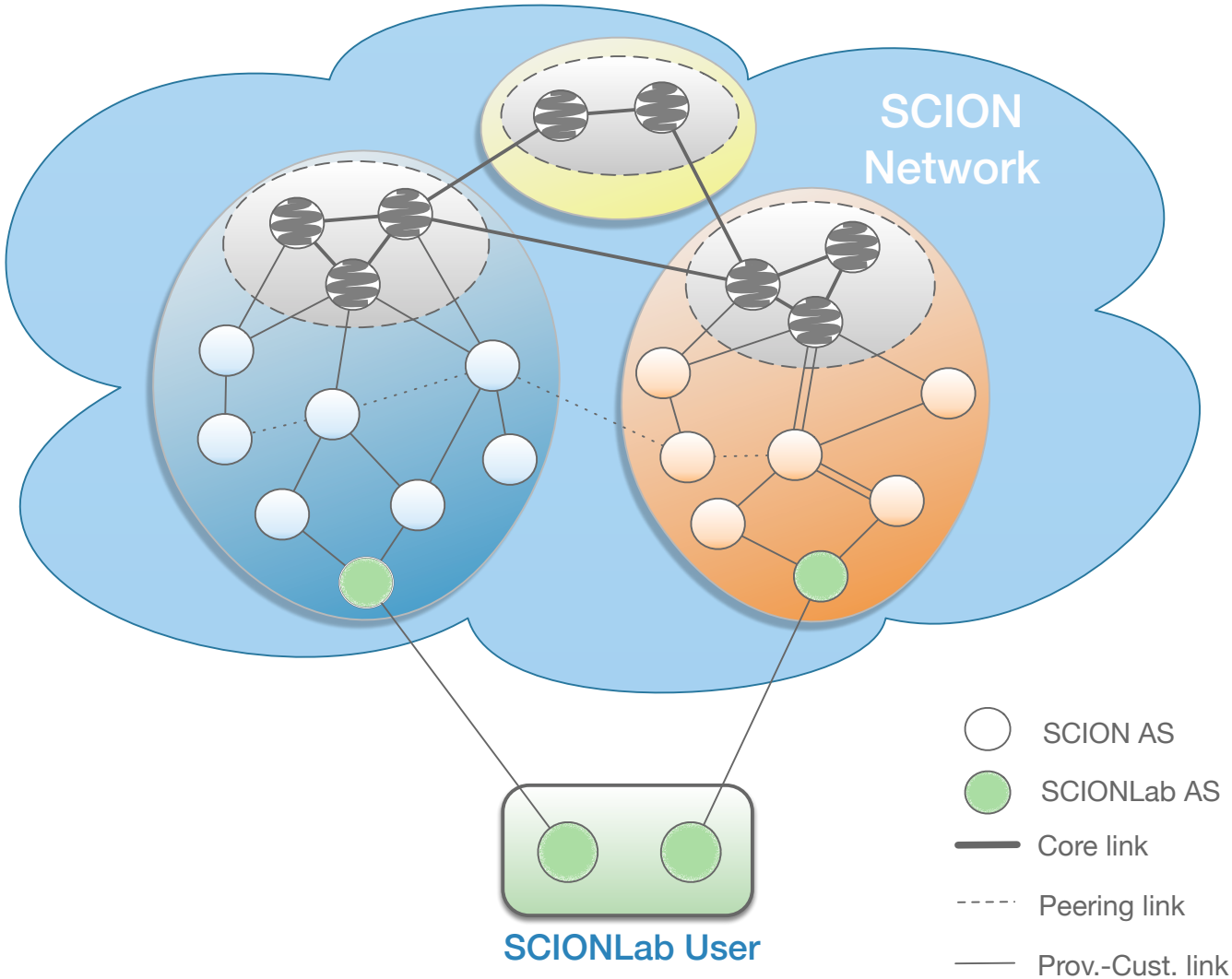
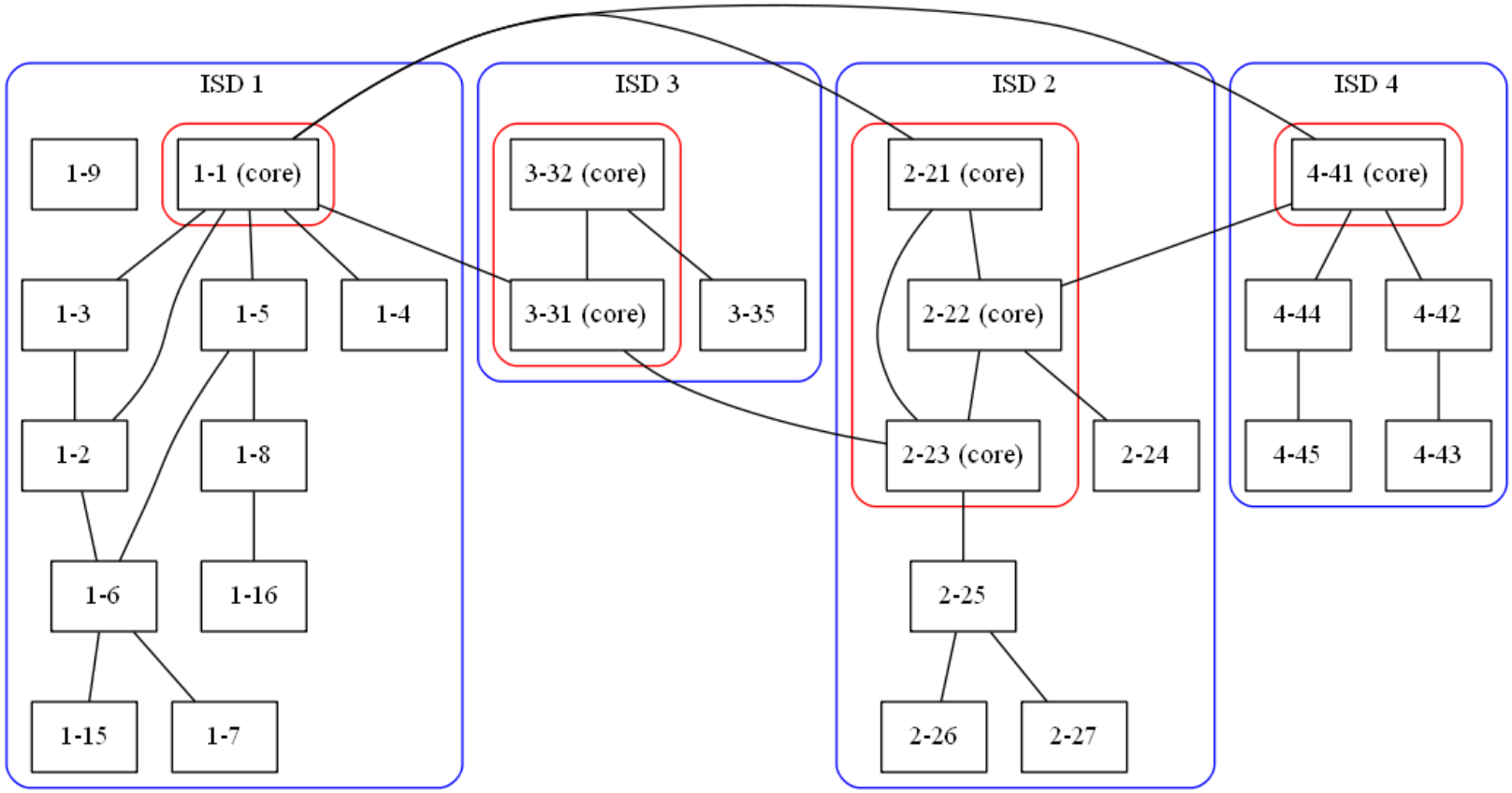
SCIONLab


SCION
Network
SCIONLab User
SCION AS
SCIONLab AS
Core link
Peering link
Prov.-Cust. link

SCIONLab Network



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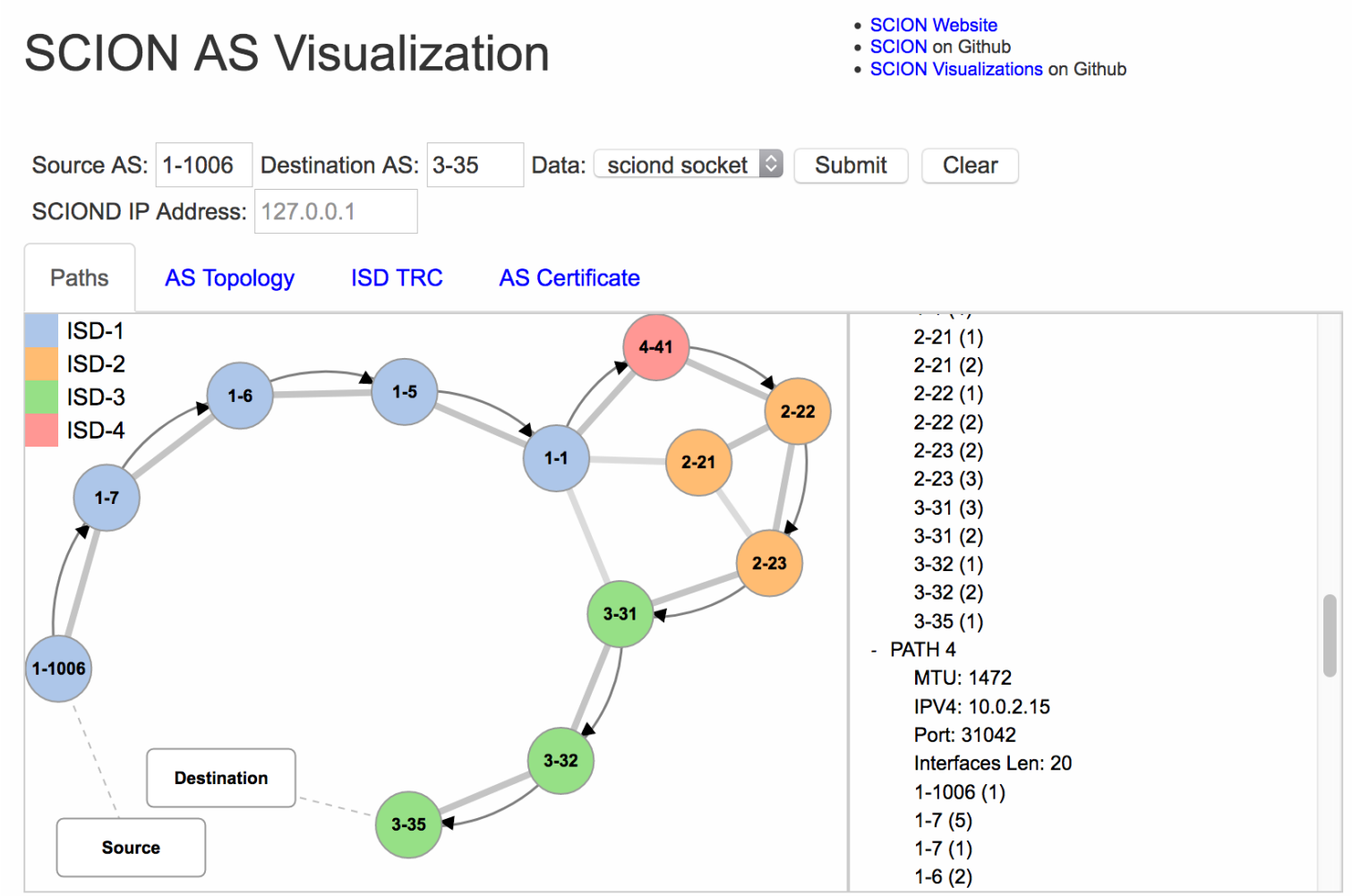
SCION Visualization System



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Application: IoT Access

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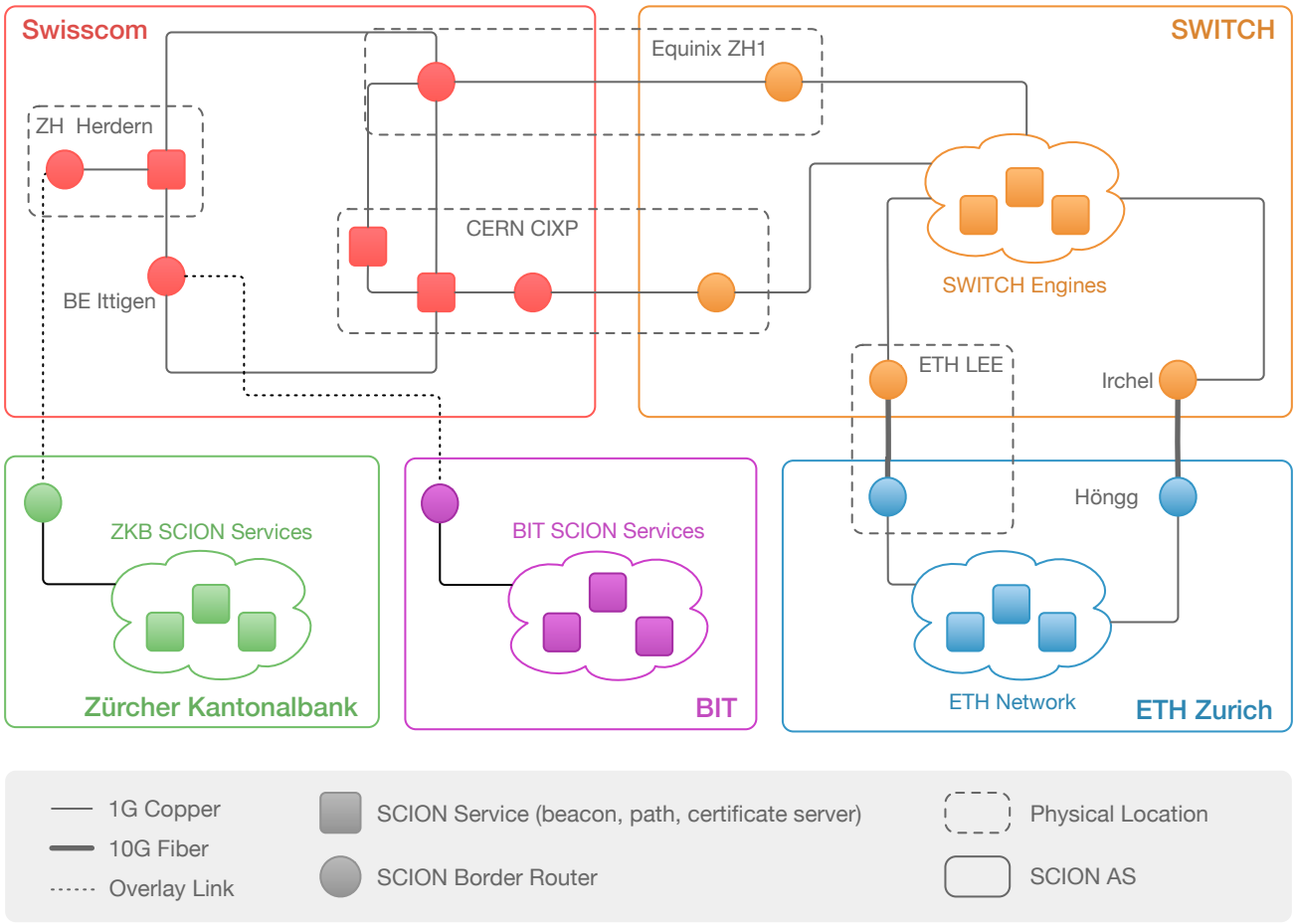
Swiss SCION Network

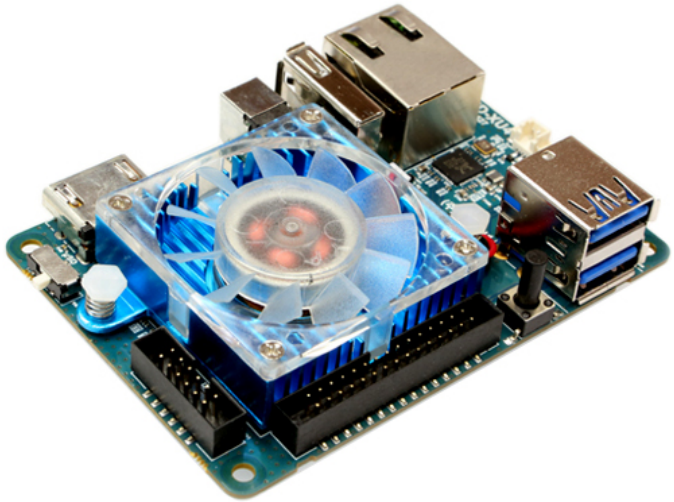


Growing Global Testbed

- Over 40 deployed SCION routers and servers

SCION AS runs on ODROID and Raspberry Pi

ODROID
Hardkernel



Raspberry Pi

Belief that Internet is Immutable

- Evidence appears overwhelming that Internet is immutable: IPv6, BGPSEC, DNSSEC, etc.
- However, benefits are limited, esp. for early deployers
- Our goal: provide many benefits, even for early adopters, such that one cannot turn back

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Conclusions

- SCION is a secure Internet architecture that we can start using today
- Open source
- Numerous opportunities for researchers
  - Multipath routing architecture offers multitude of path choices for meaningful diverse path selection
  - Security: routing, DDoS, source authentication
  - Next-generation PKI architecture
- Natural quality scalability with increasing global adoption

SCION Projekt Team

- Netsec: Daniele Asoni, Chen Chen, Laurent Chuat, Sergiu Costea, Sam Hitz, Tobias Klausmann, Tae-Ho Lee, Chris Pappas, Adrian Perrig, Benjamin Rotenberger, Stephen Shirley, Jean-Pierre Smith, Pawel Szalachowski, Brian Trammell, Ercan Ucan
- Infsec: David Basin, Tobias Klenze, Christoph Sprenger, Thilo Weghorn
- Programming Methodology: Marco Eilers, Peter Müller

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anapaya systems

www.anapaya.net

Additional Information

- https://www.scion-architecture.net
  - Book
  - Papers
  - Videos
  - Newsletter signup
- https://www.anapaya.net
  - Commercializing SCION equipment
- https://github.com/netsec-ethz/scion