Towards Deployment of
a Next-generation Secure
Internet Architecture

Wie können wir die Kommunikation
von Kritischen Infrastrukturen Sichern?

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What's Wrong with the Internet?

(why do we need a next-gen Internet architecture?)

What's Wrong with the Internet?*

- **Scalability** - routing tables are getting too large
- **Availability** - misconfigurations, prefix hijacks, or slow routing protocol convergence leads to unreachability
- **Security** - data protection, mass surveillance, denial of service, no authentication of control plane
- **Authentication** - attacks on TLS PKI
- **Control** - cannot specify communication paths
- **Transparency** - cannot ensure which network path was used

*Not a comprehensive list, not even the tip of the iceberg

Band-aid Solutions

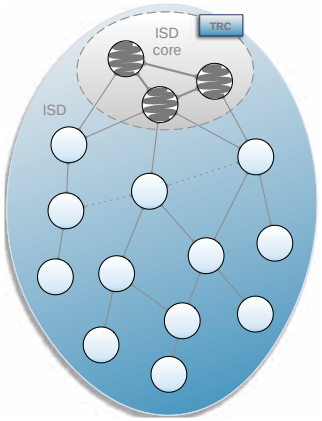
- **Scalability** - prefix aggregation + more memory
- **Availability** - multihoming + failover
- **Security** - encryption, traffic scrubbing
- **Authentication** - TLS, DNSSEC, BGPSEC
- **Control** - multihoming
- **Transparency** - ?

SCION Architectural Design Goals

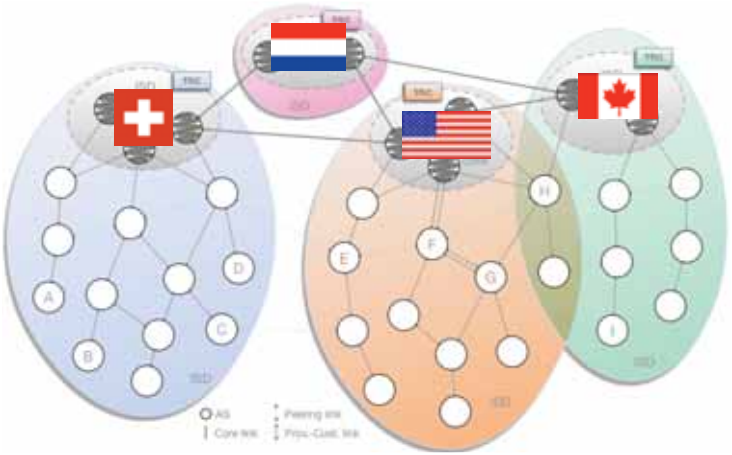
- **High availability**, even in the presence of adversaries
- **Secure entity authentication** that scales to global heterogeneous (dis)trusted environment
- **Flexible trust**: heterogeneous trust environment
- **Transparent operation**: Clear *what* is happening to packets and *whom* needs to be relied upon for operation
- **Balanced control** among ISPs, senders, and receiver
- **Scalability, efficiency, flexibility**

SCION Isolation Domains (ISD)

- Isolation domains are groups of Internet Service Providers (ISPs) that agree to operate under a uniform legal framework and policy
- ISD routing can only be modified by entities inside the ISD
- ISD core manages the domain
- Trust Root Certificate (TRC) specifies the policy

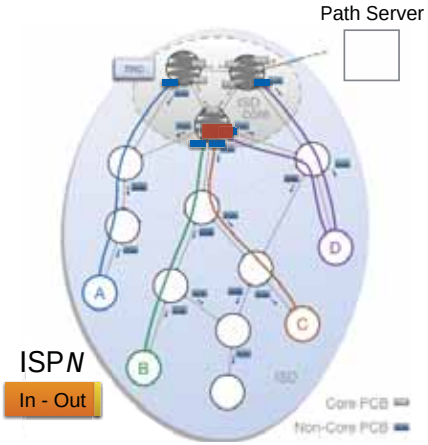


SCION Isolation Domains (ISD)



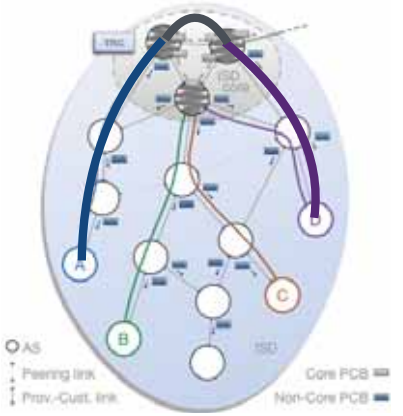
Route Discovery

- Path Construction Beacon (PCBs)
  - Periodic dissemination of path/topological information from the core to leaf ISPs
- Each ISP appends its hop routing information
- Paths to the core are registered at DNS-like “Path Servers”



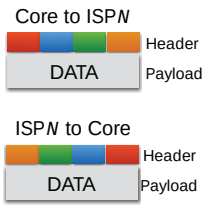
End to End Communication

- Source picks a path to the core (up path)
- Source asks for a path from the core to the destination (down path)
- Source joins those paths to construct an end to end path.

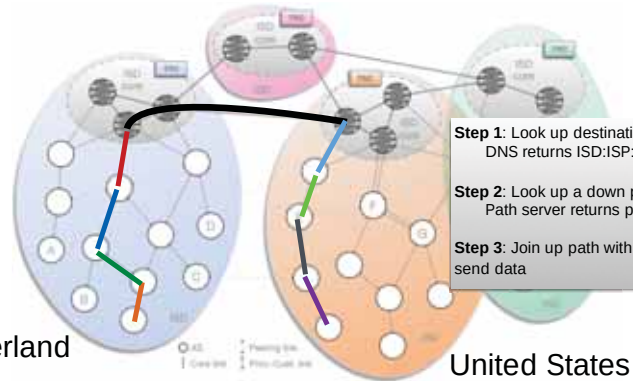


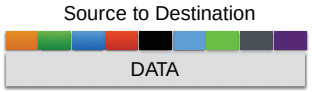
Data Transmission

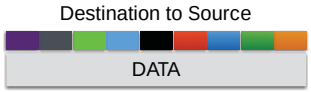
- Stateless: packets carry forwarding information in their headers (PCFS).
- No routing tables or lookups



Data Transmission







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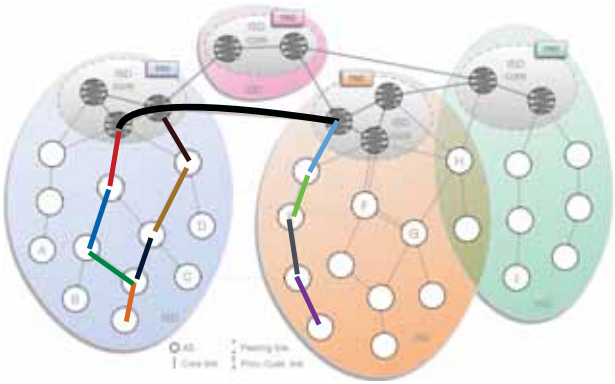

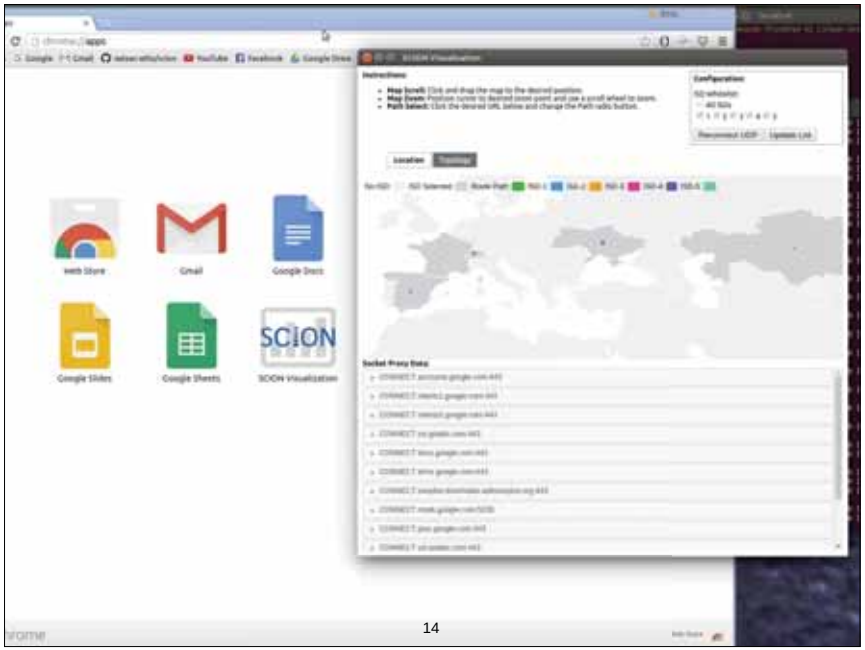

SCION Extensions

Summary

- SCION is a new inter-domain routing architecture to replace and free us of all the problems with BGP
- SCION provides network foundation for: high availability, DDoS defenses, high-speed anonymous communication, pervasive end-to-end encryption, fault localization, and more!
- Status: SCION routers currently deployed at Swisscom, SWITCH, KDDI, ETH Zurich, CMU, Korea University, etc. Testbed constantly growing
- Try it out: https://SCIONproto.net
- Get more information: https://scion-architecture.net