

SCION border router with P4

Joeri de Ruyter and Victor Reijs

TNC19 side meeting | Tallinn | 20 June 2019



Outline

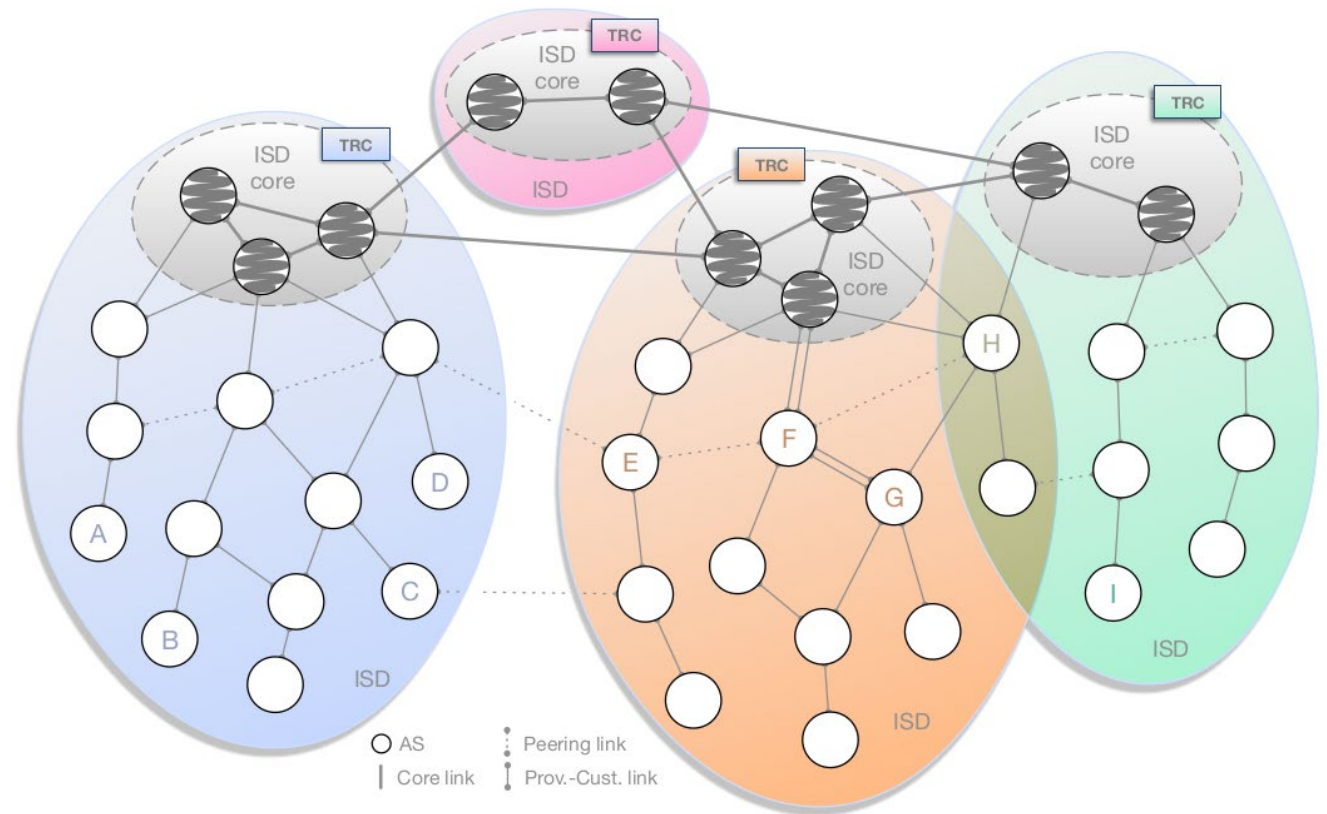
- Some SCION principles...
- SCION at SIDN Labs...
- Challenges in hardware...

Some SCION principles

- Scalability, Control, and Isolation On Next-generation Networks
- New inter-networking architecture
- Routes authenticated both in control and data plane
 - Path control by sender: transparency
 - Multiple paths: stable
- Scalability and security through Isolation Domains (ISDs)
 - Isolation of compromise: security
 - For instance per country or jurisdiction: transparency
- Research at ETH Zürich

Isolation Domains

- PKI organised per Isolation Domain (ISD)
- core ASes managing the ISD core
 - For instance per country or jurisdiction
- Hierarchical control plane
 - Inter-ISD control plane
 - Intra-ISD control plane



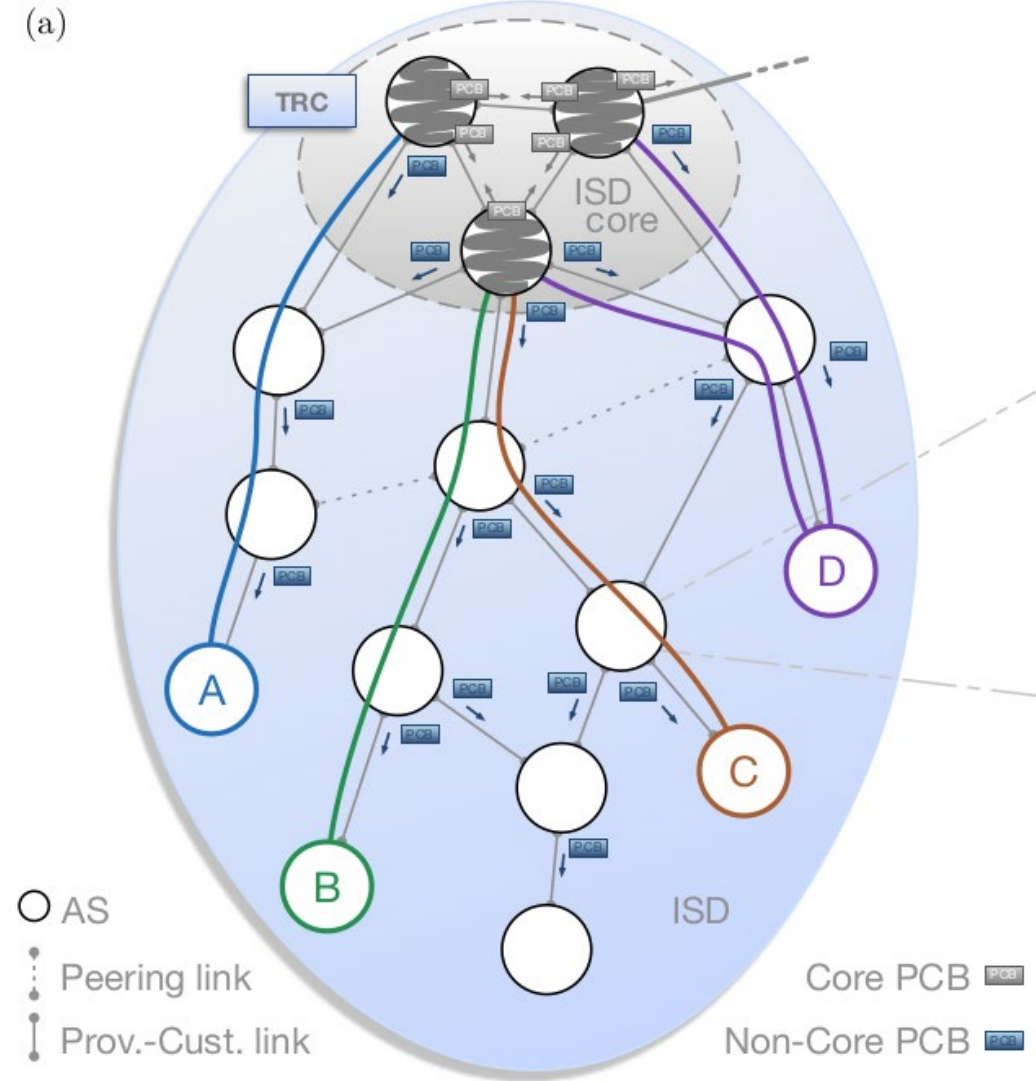
Source: The SCION Internet Architecture: An Internet Architecture for the 21st Century, Barrera et al., 2017

Path discovery

- Inter-ISD
 - Performed by core ASes
 - Flooding similar as with BGP
 - Less ASes involved (only core ASes)
- Intra-ISD...
 - Downstream multi-path flooding

Intra-ISD path discovery

- Path Construction Beacons (PCBs) sent downstream using multi-path flooding
 - Initiated by ISD core nodes
 - Extended and forwarded by receiving ASes
 - Add IN and OUT interface and optional peerings
- Eventually all nodes know how ISD core can be reached
- AS registers preferred down-segments (path from ISD core to AS) with Path Server in the ISD core
- Preferred up-segments registered with Local Path Server



Isolation of compromise

- Path Construction Beacons are signed by every AS along the path:
 - Can be verified within ISD
- Contain Hop-Fields (HF) for use in later select paths
 - Contain Message Authentication Code (MAC) computed using Hop-Field key
 - Only processed locally by AS
- Provides security (DDoS, route hijacking)

Path control by sender

- Path construction performed by sender
- Request route to (ISD, AS) from Local Path Server
- Local Path Server replies with lists of
 - up-path segments to local ISD core
 - core-path segments to connect up-path and down-path segments
 - down-path segment in remote ISD from ISD core to destination AS
- Sender combines segments to determine path
- Provides transparency

Routing

Path information included in SCION packet header

- Corresponding Hop-Field included

 - Contain Message Authentication Code (MAC) computed using Hop-Field key

 - Only processed locally

- No forwarding tables necessary at routers

- Packet-carried forwarding state (PCFS)

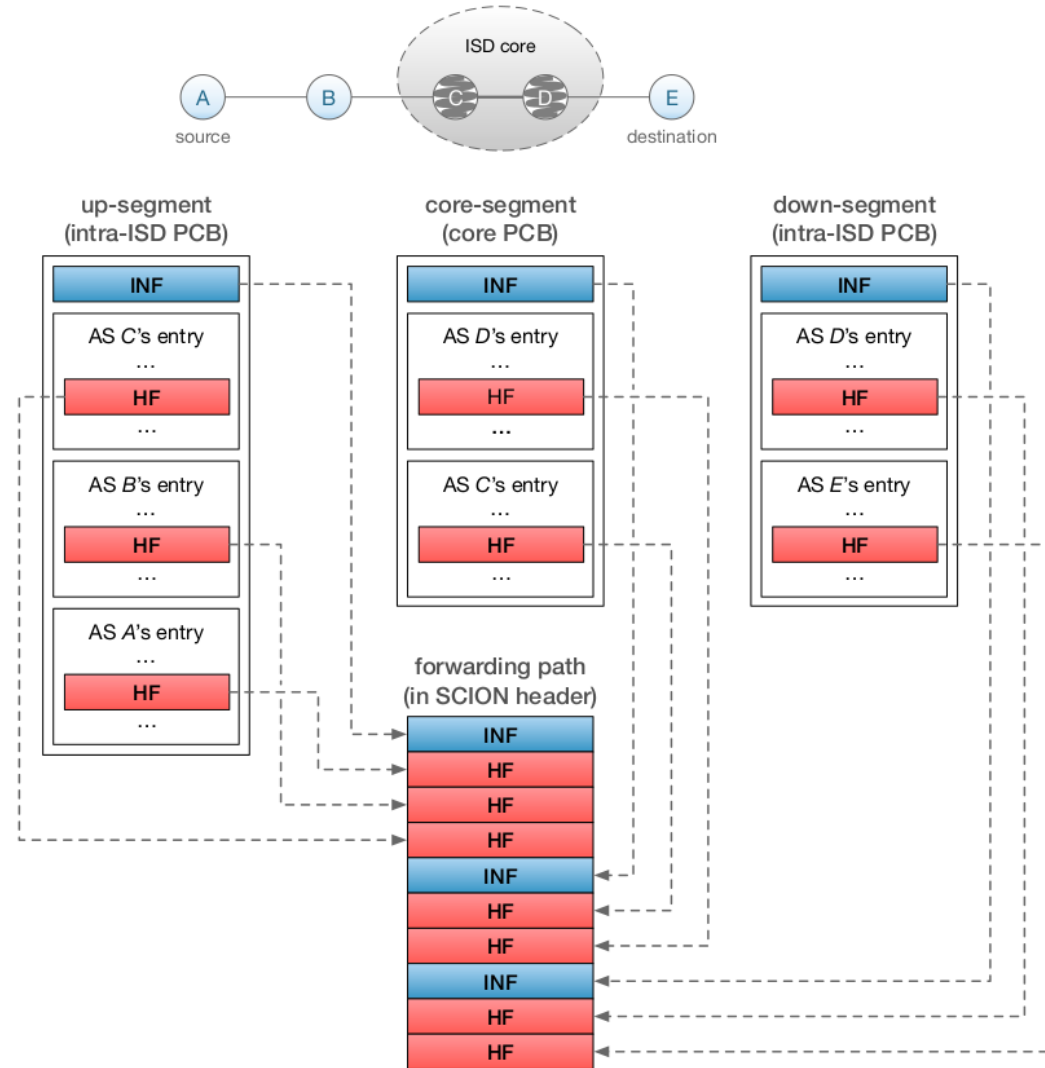
Sender selects the path

- Possible to use multiple paths

Recipient address no longer used to route between ASs

- Only used by the destination AS

Routing



Source: SCION: A Secure Internet Architecture, Perrig et al., 2017

SCION at SIDN Labs

SCION at SIDN Labs

- Connected to international testbed SCIONLab
- Developed SCION application: Snetcat
- Visualisation of SCION paths
- Implementation of SCION in P4
 - Implementation working in P4 simulation (simple_switch)
 - Implementation for hardware work in progress...
 - Both at ETH Zürich and SIDN Labs

Challenges in hardware

Challenges in hardware

- Implicit lengths of addresses
- Absolute reference
- Implicit number of Info-Fields
- Selection of Info-Fields and Hop-Fields
- Number of Hop-Fields variable

Questions?

- Do people know about guidelines how to defined protocols with hardware in mind?

Volg ons

 SIDN.nl

 @SIDN

 SIDN

Thanks for your attention!

www.sidnlabs.nl | stats.sidnlabs.nl

Joeri de Ruiter: joeri.deruiter@sidn.nl and Victor Reijs, victor.reijs@sidn.nl

