The Role of RIRs and LIRs in SCION

BoF at RIPE81

Date: Monday, 26 October 2020, 11:00 - 12:00 CET

Registration: RIPE 81 will take place as a virtual meeting using Meetecho. The meeting is open to all and free. Please register here: https://ripe81.ripe.net/attend/register/

Abstract: SCION is a clean-slate Internet architecture designed to provide route control, failure isolation, and explicit trust information for end-to-end communication. This BoF session aims to address the following questions related to the potential role of RIRs and LIRs in the SCION architecture: How can we involve RIPE in a SCION Internet? Should RIRs assist with the establishment of ISDs? We expect 10-100 times more ASes. Should RIRs hand out these AS numbers? What about IP address space (it seems that this is not relevant any more)? What about AS certificates, should RIRs take on a similar role as in RPKI?

Description: SCION (Scalability, Control, and Isolation on Next-Generation Networks) is the first clean-slate Internet architecture designed to fundamentally solve many security issues of today's Internet through route control, failure isolation, and explicit trust information for end-to-end communication. A core concept of SCION are its isolation domains (ISDs), which organize multiple autonomous systems (ASes) into independent routing planes and substantially increase both scalability and security properties of the network: On the one hand, ISDs enable a separation of the routing protocol into an intra-ISD and an inter-ISD process, which reduces the overall complexity---similar to the separation if the Internet into ASes or a division of an AS into areas by existing intra-domain routing protocols (e.g., OSPF and IS-IS). On the other hand, by isolating the routing process within an ISD from all external actions, ISDs limit the effect of misconfigurations and routing attacks. Furthermore, all routing messages are authenticated based on a secure but flexible public-key infrastructure (PKI) in which each ISD can independently define its own roots of trust. This allows network entities to select which ISD's trust roots they want to rely upon for verification and rules out global kill switches, which do exist in several of today's PKIs (e.g., DNSSEC and RPKI). As a result, the SCION architecture provides strong resilience and security properties as an intrinsic consequence of its design.

In contrast to today's Internet, where all routing decisions are taken by the network nodes, SCION also provides path transparency and control to end hosts: End hosts learn about

available network path segments, combine them into end-to-end paths according to their own preferences, and embed the corresponding forwarding information into the packet headers. In addition to allowing end hosts to influence the path of their packets and circumvent untrusted ASes, this packet-carried forwarding state enables a robust and efficient forwarding process, as routers no longer need to store large forwarding tables in expensive content-addressable memory. Thanks to embedded cryptographic mechanisms, path construction is constrained to the route policies of Internet service providers (ISPs) and receivers, thus offering path choice to all network entities: senders, receivers, and ISPs. In addition, SCION's path awareness directly enables multi-path communication, which is an important approach for high availability, rapid failover in case of network failures, increased end-to-end bandwidth, dynamic traffic optimization, and resilience to distributed denial-of-service (DDoS) attacks.

SCION is an **inter-domain** Internet architecture and thus does not restrict the internal infrastructure and networking protocols of ISPs and other ASes. This substantially facilitates SCION's deployment, as only the border routers of an AS need to be upgraded while all other network infrastructure can be reused. SCION has been developed since 2009 and since August 2017, it has been in production use by a large Swiss bank, where several branches are connected to the data center exclusively over the SCION network. To date, the native (BGP-free) SCION network spans 7 ISPs (all offering SCION connections to customers) and 2 continents and is in production use by several Swiss banks and the Swiss government, in addition to several blue-chip companies.

The SCION secure Internet architecture provides several features that enable not only high security for communication, but also higher performance than traditional Internet approaches. In particular, SCION's symmetric key derivation system enables high-speed packet authentication at routers and firewalls at less than 100 ns on commodity hardware. The Path Aware Networking (PAN) concept empowers end hosts to obtain information about end-to-end network paths and select the path for each packet, enabling multi-path communication which can further speed up communication. For more information about SCION, cf. https://www.scion-architecture.net/

In this context, RIRs / LIRs have several opportunities to take on an important role in SCION networks. In particular:
- Should RIRs assist with the establishment of ISDs? We expect 10-100 times more ASes.
- Should RIRs hand out these AS numbers? How to coordinate with traditional Internet AS numbers? In particular, owners of an AS in the traditional Internet would often want to obtain multiple AS numbers for different domains to take advantage of SCION's features.
- What about IP address space (it seems that this is not relevant any more)?
- What about AS certificates, should RIRs take on a similar role as in RPKI?
- For current IP prefixes, could RIRs provide certificates that enable the owner to prove ownership? This could be based on RPKI, but require the active use of the private key for authentication / key establishment purposes.

Tentative Session Agenda

Victor Reijs (SIDN): Welcome and introductions (10min)

Adrian Perrig (ETHZ): SCION overview, ambition and progress (10min)
https://drive.google.com/file/d/1LzN4J9nE7tVNx7oyb5N5eYrXwx6sJ8oe/view?usp=sharing

BoF Discussion: The new roles of RIRs and LIRs in a SCION Internet (40min)

    Moderator: Victor Reijs (SIDN) will serve as a neutral facilitator for the session.

    Participants:

- A ccTLD's Viewpoint:
    - Caspar Schutijser / Joeri de Ruiter (SIDN)

- The Network Providers / NRENs Perspective:
    - Marijke Kaat / Ronald van der Pol (SURF)
    - Kurt Baumann / Simon Leinen (SWITCH)

- The Role of IXPs:
    - Henk Steenman / Stavros Konstantaras (AMS-IX)
    - Jeroen van de Lagemaat (NDIX)

- A LIR's Perspective:
    - Fritz Steinmann (SIX)

- SCION's New Opportunities:
    - Adrian Perrig (ETHZ)
    - David Hausheer (OVGU Magdeburg)