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SCION™
ELEVATING SECURE COMMUNICATION

SCION: A Next-Generation Internet for Next-Generation Security

IETF update and everyday use cases

Swiss Cyber Storm 2025

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ETH Zurich, Network Security Group

SCION Overview in One Slide

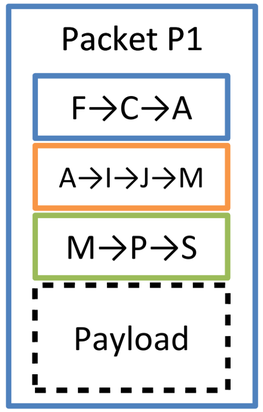
Path-based Network Architecture

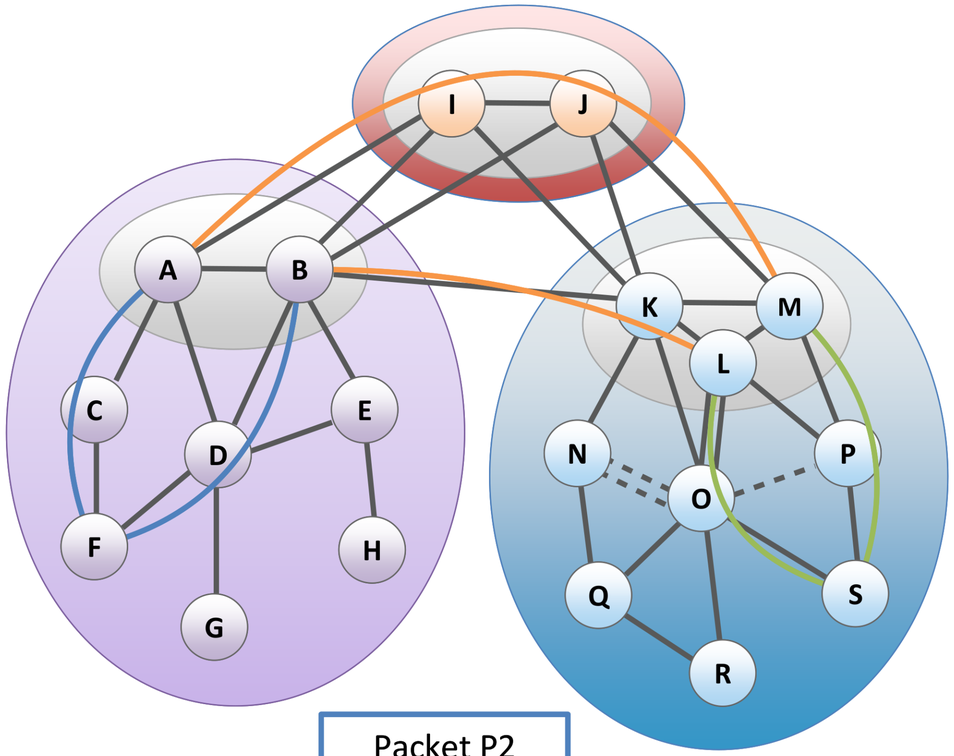
Control Plane - Routing

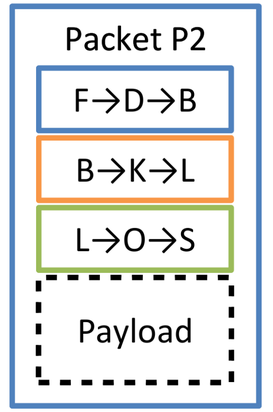
- Constructs and Disseminates Path Segments

Data Plane - Packet forwarding

- Combine Path Segments to Path
- Packets contain Path
- Routers forward packets based on Path
  - Simple routers, stateless operation







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Key benefits

- Path transparency enables geofencing
- Multipath communication
- Failure resilience, rapid failover
- Protection against routing attacks
- Strong Sovereignty via Isolation Domains

Particularly valuable in sectors that require reliable, trusted communication

SS*N created growing ecosystem

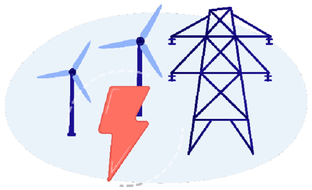
> 20 NSPs offer global SCION connectivity

Native SCION apps can unlock the full potential

Secure Swiss Finance Network (SSFN)

321 participants (banks, insurers)

Secure Swiss Healthcare Network (SSHN)



Secure Swiss Utility Network (SSUN)

Secure Swiss EFTPOS Network (SEPN)

↑ Mostly rely on SCION-IP-Gateway (SIG)

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Native SCION Adoption

SCION-enabling Applications

For developers

- Drop-in socket libraries
- Typically < 20 lines of code to SCION-enable application (e.g., netcat)
- Caddy < 100 lines of code

- **Application library will perform bootstrapping, even without any installed prerequisites in OS**

SCION and QUIC/Happy Eyeballs

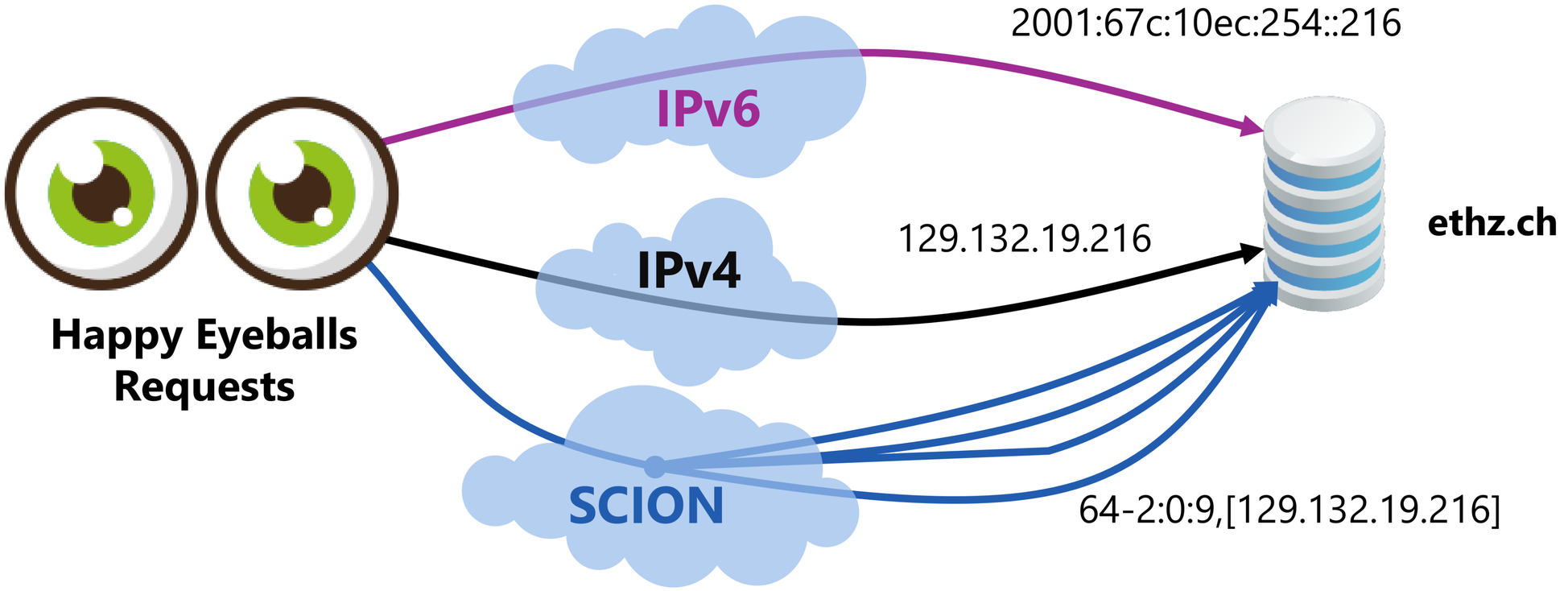
Multipath QUIC - an extension to the QUIC protocol that enables hosts to exchange data over multiple paths for a single connection

- **Opportunities for SCION as it's able to utilize multiple paths by design**
- Initial proposal laid out in draft-zaeschke-scion-quic-multipath
- Use cases: Deadline-aware Multipath Transport Protocol (DMTP) concept to utilize path identifiers to distinguish different paths as may be offered by a SCION network (see draft-tjohn-quic-multipath-dmtp by **OvGu Magdeburg)**

Happy Eyeballs – an IETF algorithm that attempts to connect users via IPv6 as matter of preference.

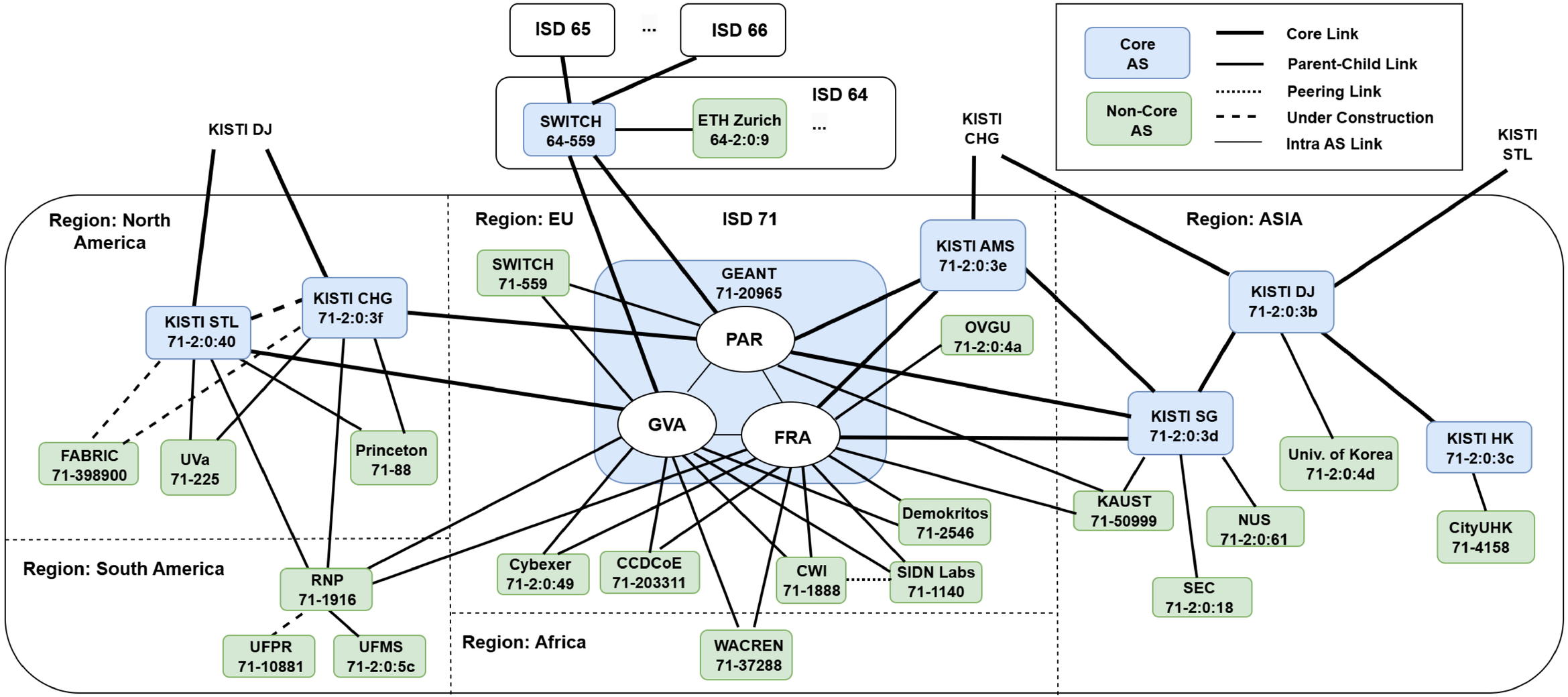
- **The next version is being steered towards a more protocol-abstract approach, so it could be extended to support other protocols such as SCION**

IPv6 paves the way for native SCION



QUIC-MP library can use all (SCION) paths at the same time!

SCION Research and Education Network



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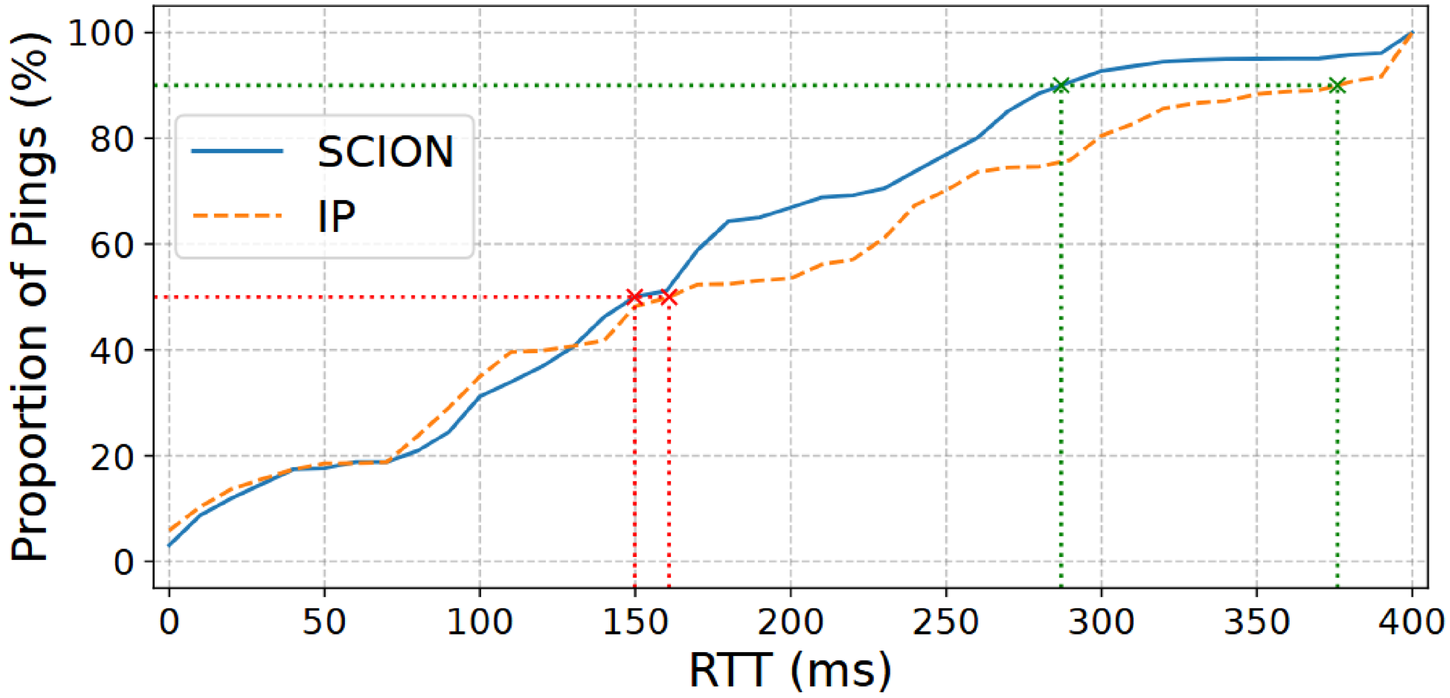
SCIERA Evaluation – Connectivity & Multipath

- Pings
  - ICMP Ping
  - SCMP (SCION) Ping
    - Shortest, fastest, most disjoint
- 11 ASes (5 EU, 2 Asia, 3 NA, 1 SA)
- 20-day period
- 265M ping measurements
  - Dataset publicly available



CDF of ping latency for SCION and IP

RTT median ↓ 6.9% vs IP (160.9 → 149.8 ms)

90th percentile RTT ↓ 23.7%

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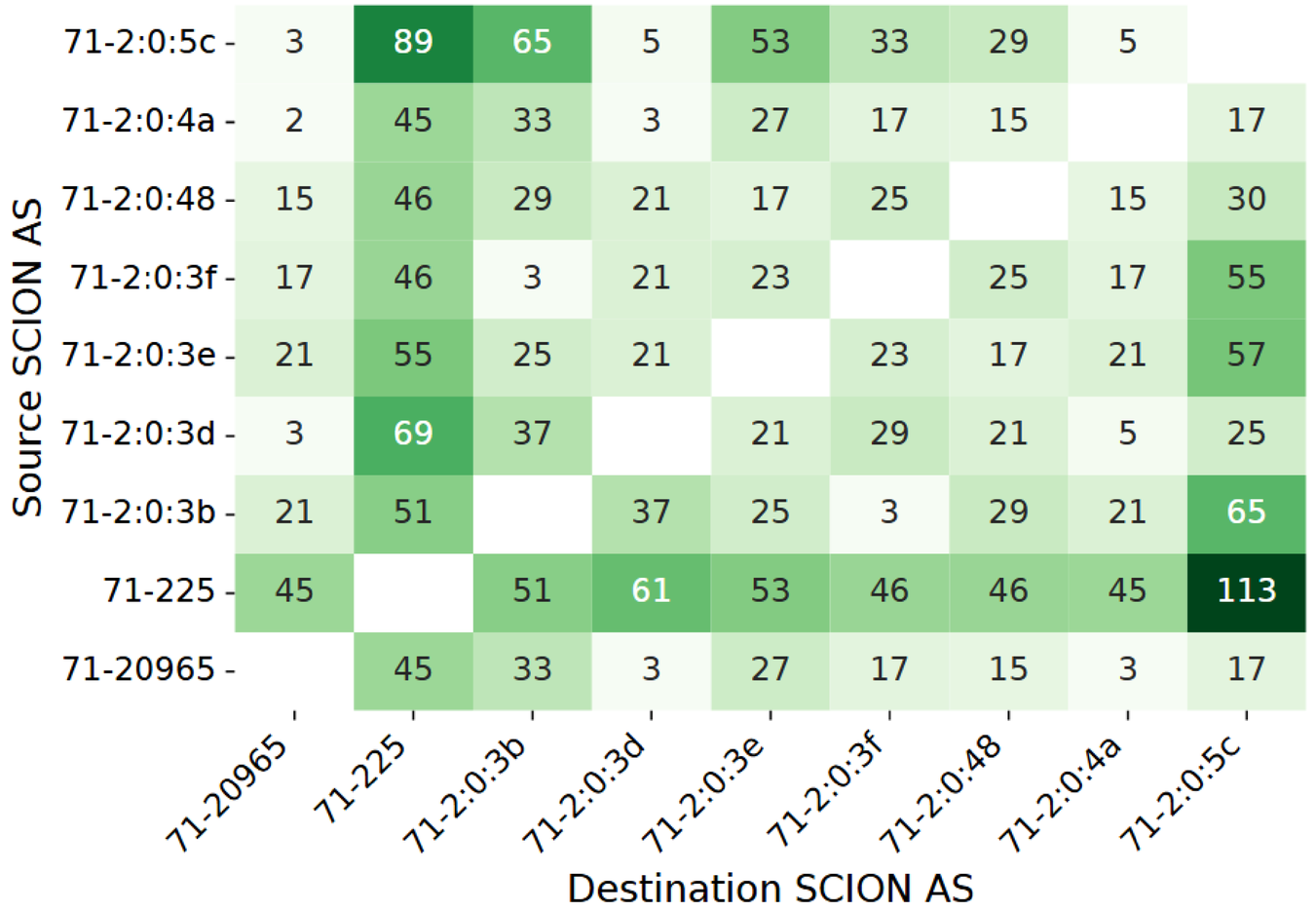
SCIERA Evaluation – Connectivity & Multipath



100+ path options between some AS pairs

Maximum number of active paths between AS pairs

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Importance of Technical Specifications

Openness of the ecosystem to new entrants through freely available documents

Interoperability among multiple implementations (e.g., SCION Open source, Anapaya) and with other protocols

Gather community feedback

The SCION Association

- Promoting openness and collaboration to unlock the full potential of SCION
- Non-profit association established in 2022
- Open for membership to all entities interested in SCION

https://www.scion.org

COMMUNITY

Raising awareness of SCION, encouraging adoption, developing its community, and providing marketing support to implementors and deployers

SPECIFICATIONS

Developing the specifications to implement SCION, and representing it at SDOs such as the IETF

OPEN SOURCE

Maintaining and coordinating the SCION implementation for research, development, and experimental deployments

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SCION Association's Role

The TC Standardization is a group of technical experts providing input and guidance to the SCION specifications process

Working with researchers to further interoperate with other protocols (e.g. QUIC, Happy Eyeballs)

Some numbers on the SCION core specification:

224	10	1.5
pages	revisions	Years at ISE

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IETF Specifications

- Goal: share with the IETF community and lay foundations for potential future standards work.
- SCION core components as they are today are documented in 3 Internet Drafts
- Currently under review in the IETF Independent Submission Stream (for protocols developed outside the IETF process, like SCION)

HTTPS://DATATRACKER.IETF.ORG

SCION PKI	draft-dekater-scion-pki
SCION Control Plane	draft-dekater-scion-controlplane
SCION Data Plane	draft-dekater-scion-dataplane

Workgroup: Network Working Group
Internet-Draft:
draft-dekater-scion-controlplane-06
Published: 19 October 2024
Intended Status: Informational
Expires: 22 April 2025
Authors: C. de Kater (SCION Association), N. Rustignoli (SCION Association), S. Hitz (Anapaya Systems)

SCION Control Plane

Abstract

This document describes the Control Plane of the path-aware, inter-domain network architecture SCION (Scalability, Control, and Isolation On Next-generation networks). One of the basic characteristics of SCION is that it gives path control to SCION-capable endpoints that can choose between multiple path options, enabling the optimization of network paths. The Control Plane is responsible for discovering these paths and making them available to the endpoints.

The main goal of the SCION Control Plane is to create and manage path segments which can then be combined into forwarding paths to transmit packets in the data plane. This document discusses how path exploration is realized through beaconing and how path segments are created and registered. Each SCION Autonomous System (AS) can

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Conclusion

SCION as a core connectivity technology next to IPv4 and IPv6 available on hundreds of millions of devices within 3-5 years

Steps to reaching this goal

- Drive specification
- Availability of native connectivity
- Extension of QUIC and HE libraries

Call for help: we can reach this as a community!

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