

Path Validation in SCION

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Motivation and background

- SCION is a path-aware inter-domain architecture that provides:
 - Path authorization
 - High assurance that packet follows desired path
 - Proof-of-transit (as an extension)
- Existing work focuses on intra-domain path validation

SCION Overview draft-dekater-panrg-scion-overview

SCION Component Analysis draft-rustignoli-panrg-scion-components

Control Plane PKI

Authentication

draft-dekater-scion-pki

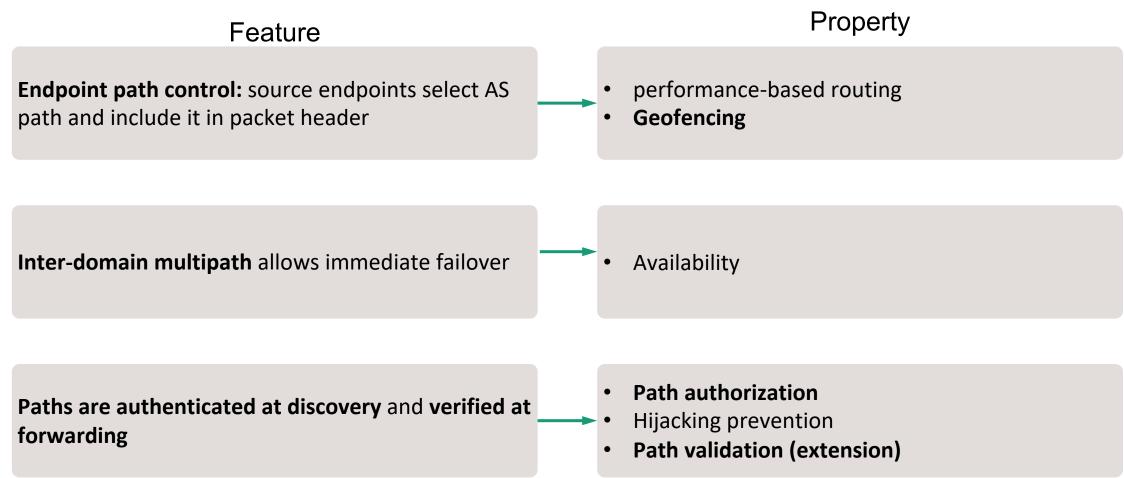
Control Plane

Routing

draft-dekater-scion-controlplane

Data PlanePacket forwarding
draft-dekater-scion-dataplane

Background: the SCION *inter-domain* routing architecture



SCION: Approach

| Property | Approach | Component |
|---------------------------------|--|------------------------|
| Path authorization (hop by hop) | Information at each hop is authenticated with a MAC (Message Authentication Code), checked by border routers at forwarding. Each AS only forwards traffic on paths that are explicitly authorized by the AS. | Standard SCION |
| Proof of Forwarding | EPIC adds short <i>per-packet</i> MACs at each SCION hop . Source authentication and path validation are enabled by the additional use of efficiently derivable symmetric keys. | EPIC extension, L3 [1] |
| Trust-enhanced networking | Extended path policies include attributes about border routers, so that endpoints can select routers/ASes with bases on specific path policies. Approach takes care of inter-domain paths, that are mapped to policy-compliant intra-domains paths. are attested by a third party, specific to each AS. | FABIRD extension [2] |

- 1. Legner, Markus, et al. "EPIC: every packet is checked in the data plane of a Path-Aware Internet." 29th USENIX Security Symposium (USENIX Security 2020).
- 2. Krähenbühl, C., Wyss, M., Basin, D., Lenders, V., Perrig, A. and Strohmeier, M., 2023. FABRID: Flexible Attestation-Based Routing for Inter-Domain Networks. (USENIX Security '23)

SCION: some use cases & adopters

- Internet-based enterprise communication for critical infrastructure
 - Connect multiple organizations, branches with performance-based routing, path control and inter-domain multipath (e.g. finance, power, blue lights, government, ...)
- Geofencing: keeping traffic in a trusted area of the network

Some adopters:

- Swiss inter-banking network <u>SSFN</u>, <u>Swiss healthcare network</u>
- Swiss Internet Exchange
- Global education network
- Sui validator network
- and others being tested

Path validation: use cases in combination with inter-domain path-aware networking?

Why **is path validation** especially interesting for path-aware architectures?

- Geofencing (use only paths with routers in a given area, based on geolocation, jurisdiction, ...)
- Trust-enhanced networking: Route based on attested router policies (e.g. vendor, patch level, ...)
- Path stability can be assured over time

Conclusion

- Path validation provides interesting use cases in combination with inter-domain path-aware networking (geofencing, trust-enhanced networking)
- We see a gap in inter-domain path validation
 - SCION is inter-domain only, therefore It can can potentially reuse or build on top of other intra-domain path-validation techniques
 - Further work is required in this area (e.g. building on top of RATS)

Questions?

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