ETH zürich
Network Security Group

OTTO VON GUERICKE UNIVERSITÄT MAGDEBURG

SCION ASSOCIATION

The SCION Inter-domain Routing Architecture

From research to deployment

David Hausheer, OVGU Magdeburg
Nicola Rustignoli ETH Zürich, SCION Association

APNIC 54 Singapore – 14 September 2022

We thank the following people for inputs for this presentation from: “**Deployment and Scalability of an Inter-Domain Multi-Path Routing Infrastructure.** ” (CoNEXT '21)
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*ETH Zürich, ‡Anapaya Systems

A New Era for Internet Technologies

- AR / VR with haptic feedback
- IoT for critical infrastructure
- Interactive telepresence
- 3D hologram imaging
- Immersive games
- …

Image source: Siemens, A new era for the Internet of Things

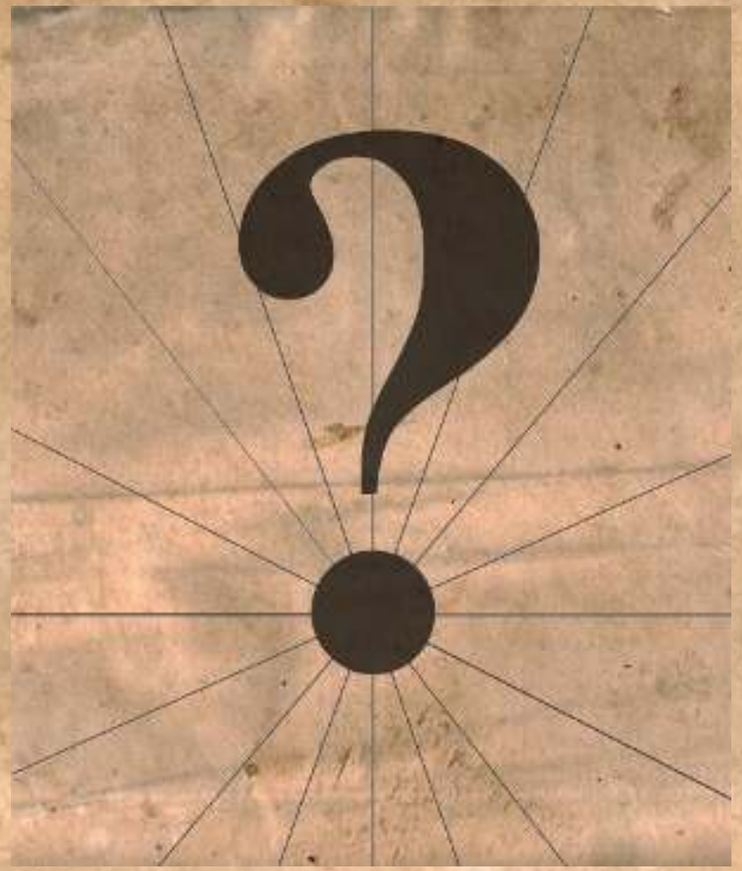
Internet Routing Challenges: Security and Availability

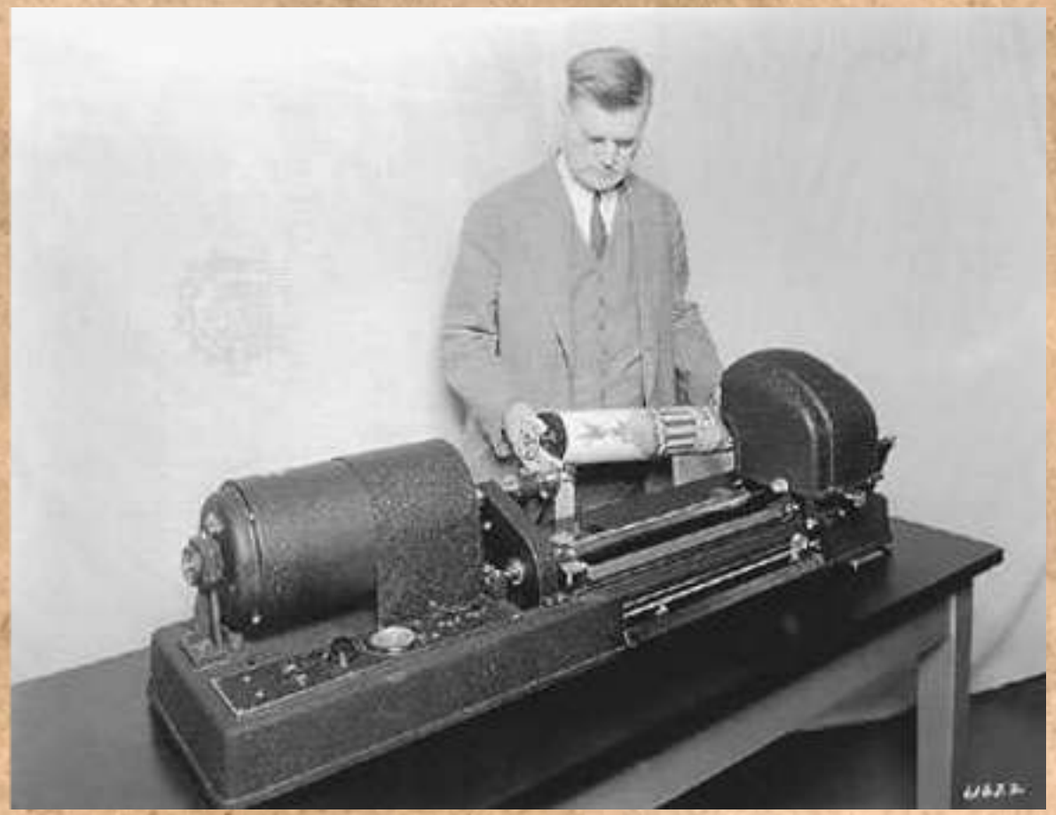
This SLA and any applicable Service Levels do not apply to any performance or availability issues:

1. *Due to factors outside our reasonable control (for example, **natural disaster, war, acts of terrorism, riots, government action**, or a **network** or device **failure** external to our data centers, including at your site or **between your site and our data center**);…*

Microsoft Azure SLA

Who bought the first fax machine?





Difficulties in Deployment

New technologies lacking early adopters' incentives …

Egress filtering

BGPsec

DNSsec

… experience limited deployment in real-world

In this presentation...

We explore a path towards a next-generation Internet

SCION: Next-Generation Internet

Path-based Network Architecture

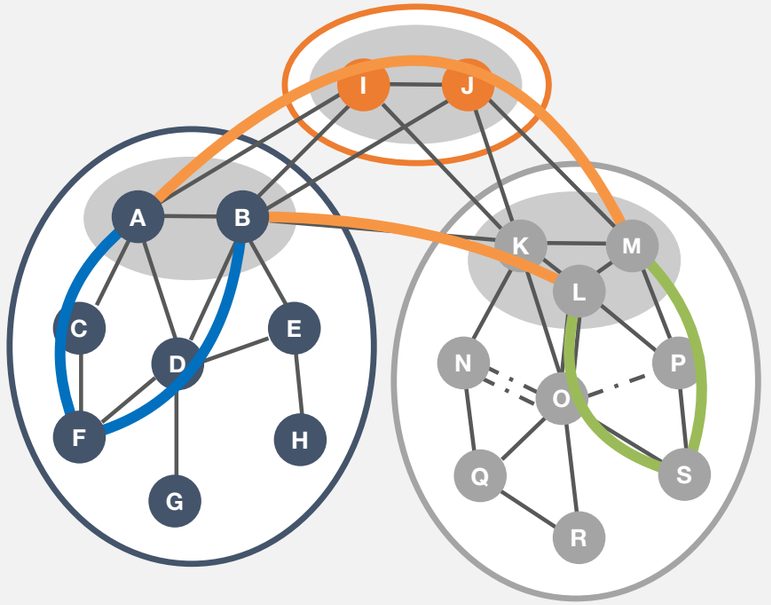
Control Plane - Routing

- 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



Packet P1

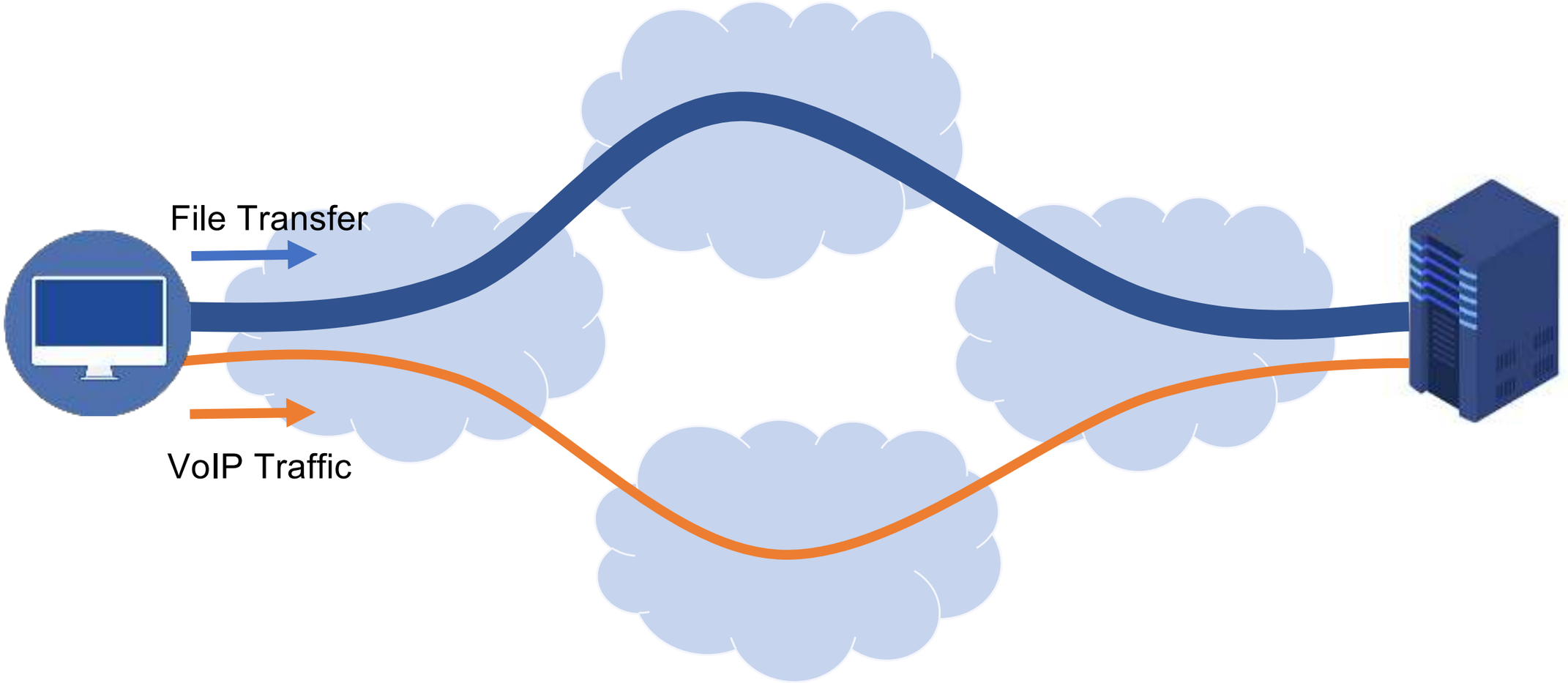
- F→C→A
- A→I→J→M
- M→P→S

Packet P2

- F→D→B
- B→K→L
- L→O→S

SCION: Next-Generation Internet

Path-aware Internet architecture which enables endpoint path control

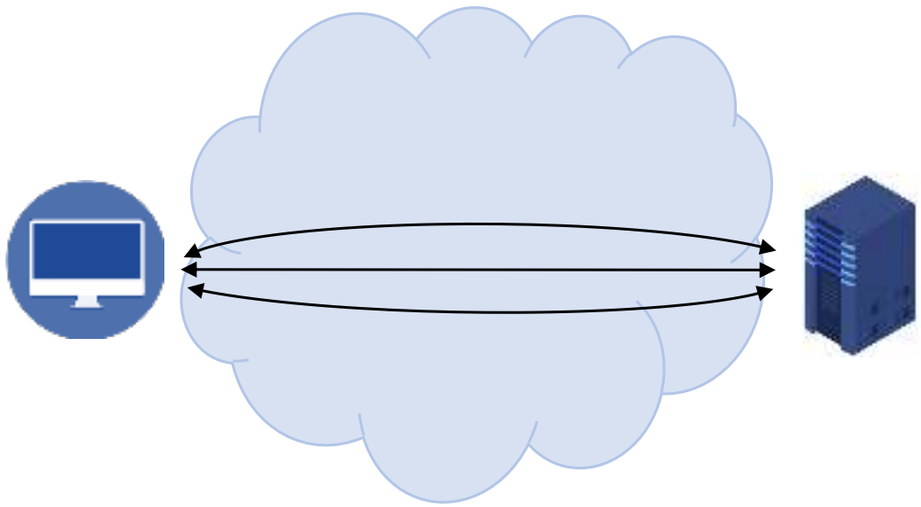


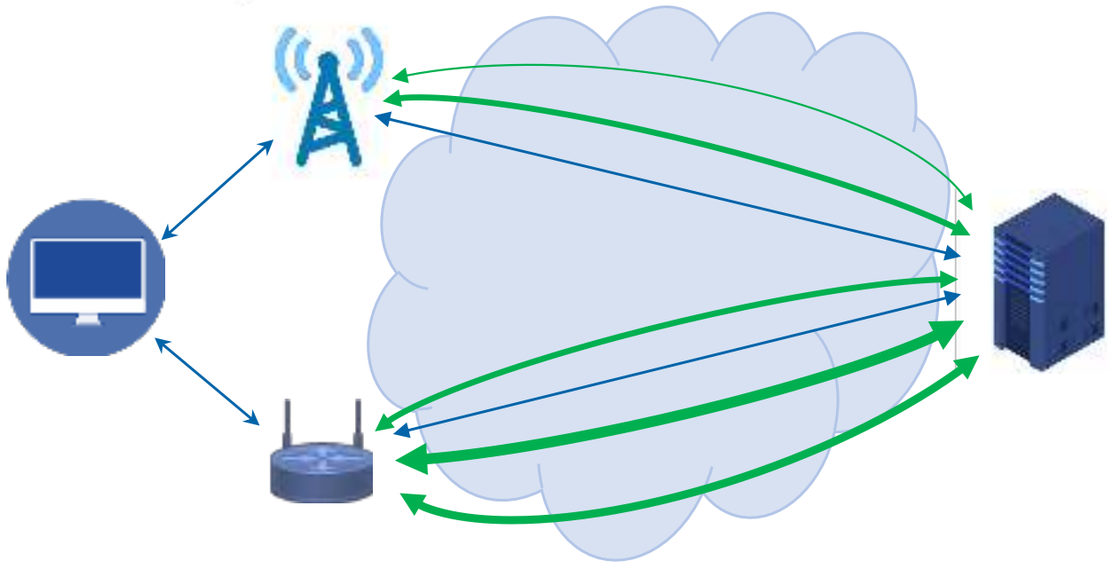
SCION: Next-Generation Internet

Provides in-network multi-path

→ even if single-homed

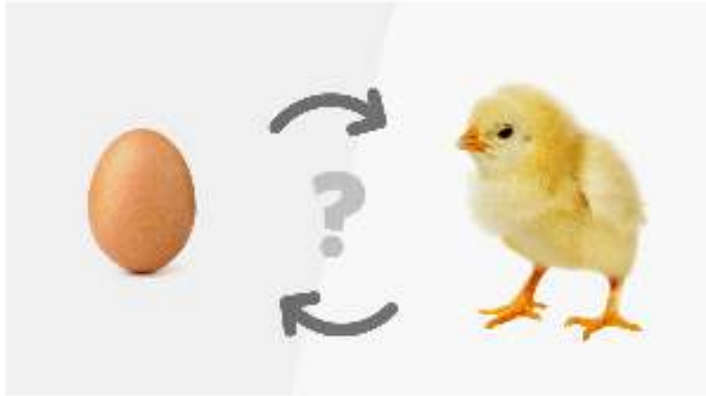
→ further benefits from multi-homing





This seems impossible to deploy!

Need early adopters deploying the architecture

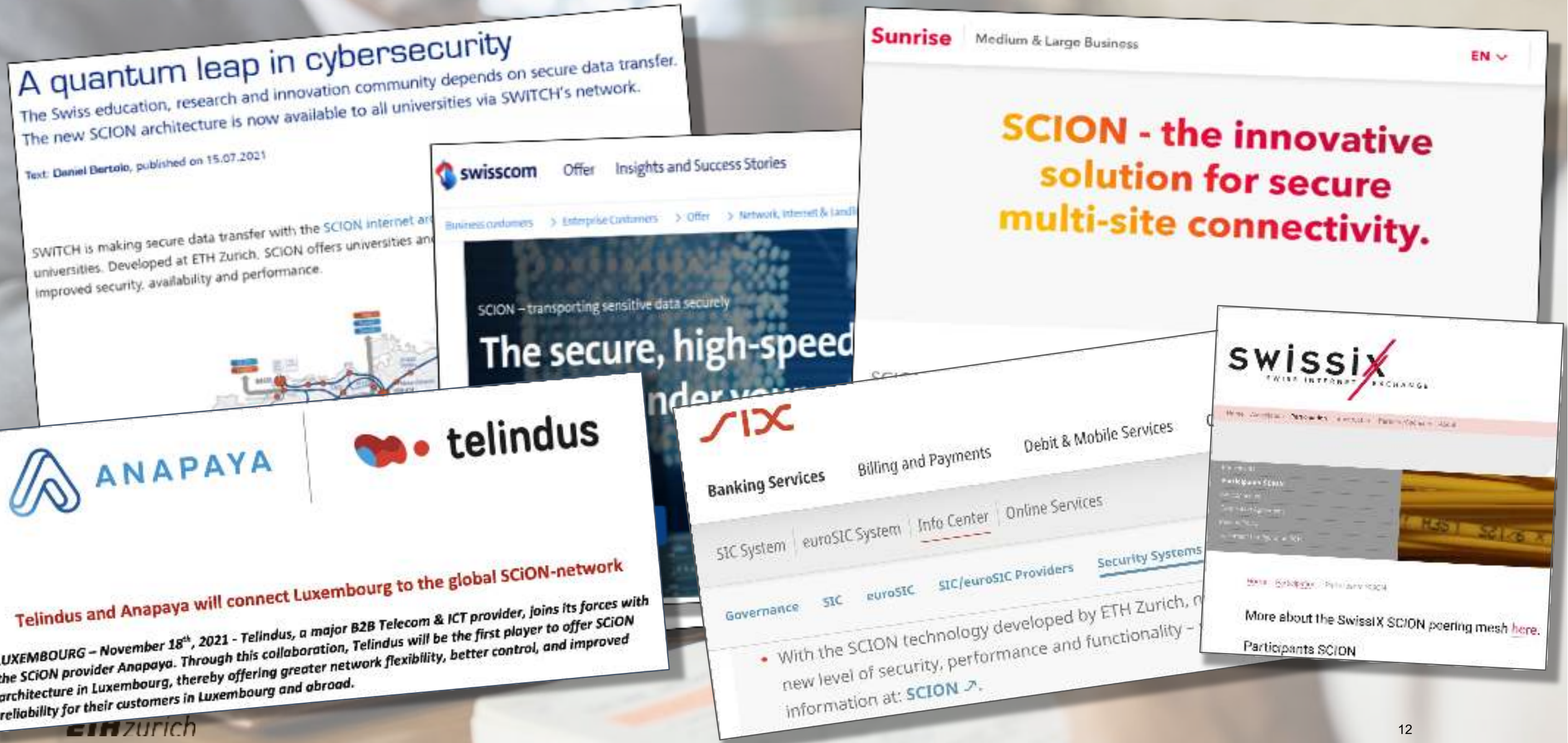


Need initial deployment to convince early adopters

Need long-term incentives for providers

- New opportunities to generate revenue
- Reduce operational network cost

From the Lab to ISPs Selling Products



How did we get here?

Deployment Milestones

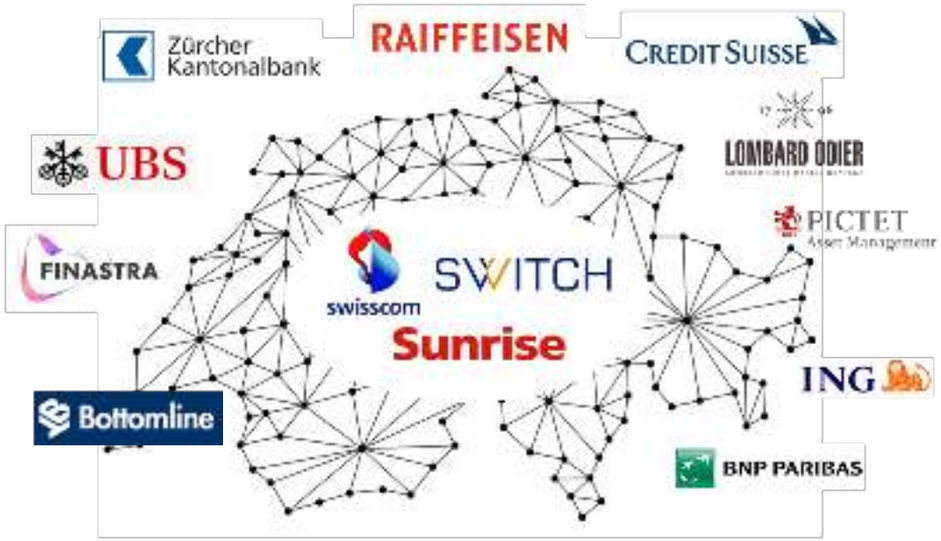
Example: SSFN

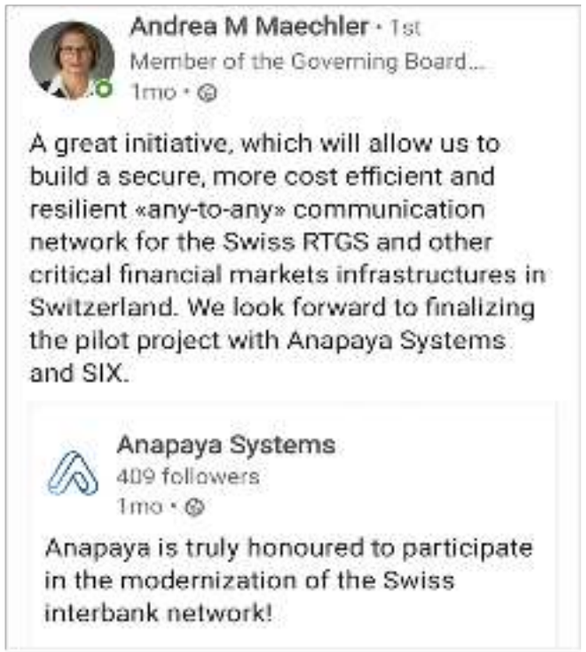
The Swiss Interbanking Clearing system in numbers:

- 321 participants, including 280 banks, 14 insurance companies and 12 securities firms
- 2.9 million transaction representing 178 billion CHF per day

SSFN: Secure Swiss Finance Network

- The new secure, reliable, community-based and sovereign network announced in July 2021:





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Logos are illustrative

SCION is federated

SCION is federated and offered as a product deployed by several ISPs

Any ISP can join SCION and benefit from its properties

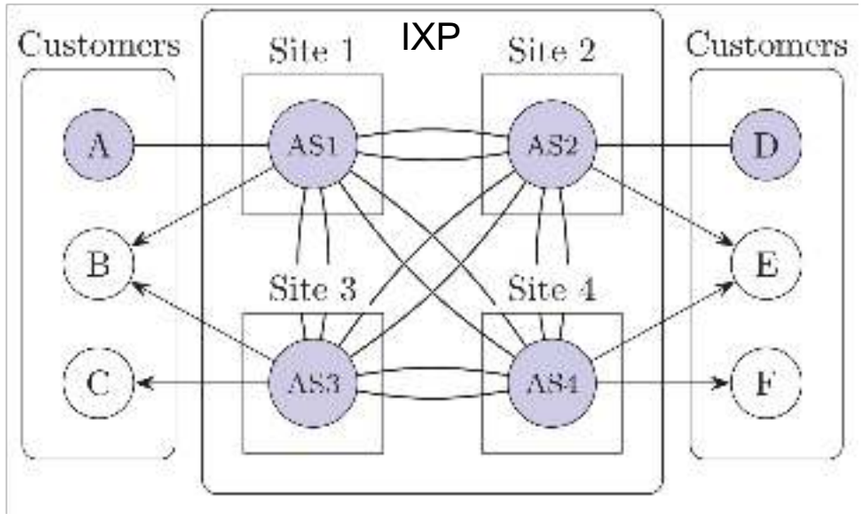
Currently building a global SCION Education Network

IXP Deployment: model

SCION supports peering links.

Two IXP Deployment Models:

- **Traditional**: An IXP is treated as a large layer 2 switch between its customer ASes
- **Multipath**: an IXP exposes its internal structure by modelling each site as an individual AS



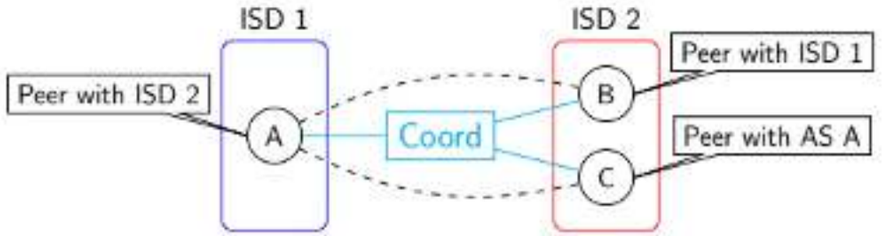
IXP Deployment: considerations

SwissIX productive SCION Peering Mesh:

- Add-on to regular peering
- www.swissix.ch/participation/participants-scion
- 8/8 sites, with 1/10/100G ports.
- L2 peering mesh, independent from BGP

No multilateral peering in SCION

- experimental peering coordinator available, automating configuration of peering links, like a “SCION route server”. (In collaboration with DE-CIX, Germany)



Further research collaborations with SIDN Labs/AMS-IX

Preparing to reach the summit

What are the next steps?
How can I join?

SCION ASSOCIATION

Ecosystem

Accelerate adoption, nurture an ecosystem with partners across verticals

Standardization

Establish SCION as a global internet standard

Certification

Ensure compliance and global interoperability

Development

Develop open source

Do you want to deploy or develop a SCION service? Get in touch! info@scion.org

Ongoing IETF work

- PANRG
  - Overview draft-dekater-panrg-scion-overview
  - Component analysis draft-rustignoli-panrg-scion-components
  - PKI draft-dekater-scion-pki
  - DRKey draft-garciapardo-panrg-drkey
  - …
- TAPS
  - PANAPI: a path-aware transport API

Path Aware Networking RG
Internet-Draft
Intended status: Informational
Expires: 27 February 2023

N. Rustignoli
C. de Kater
ETH Zürich
26 August 2022

SCION Components Analysis
draft-rustignoli-panrg-scion-components-01

Abstract

SCION is an inter-domain Internet architecture that focuses on security and availability. Its fundamental functions are carried out by a number of components.

This document analyzes its core components from a functionality perspective, describing their dependencies, outputs, and properties provided. The goal is to answer the following questions:

* What are the main components of SCION and their dependencies? Can they be used independently?

* What existing protocols are reused or extended? Why (or why not)?

In addition, it focuses on the properties achievable, motivating cases when a greenfield approach is used. It then briefly touches on the maturity level of components and some extensions.

About This Document

This note is to be removed before publishing as an RFC.

Open Issues

Assignment of SCION numbers

- Now handled by Anapaya, one of the deploying entities
- Every ISD needs a globally unique number
  - Could RIRs take a role for numbering in the SCION Internet?

Certificate Issuance

- Each ISD is free to delegate its own CA
- Each SCION AS requires an AS certificate, issues by a CA
- It binds the public key to an ISD-AS identity
- Could RIRs play a role?

Conclusion

- SCION is an inter-domain multi-path Internet architecture
- Operating on publicly available federated networks
- Deployed in practice
- Innovation in inter-domain routing is possible
- Ongoing work on standardisation, numbering

Thank you!

- https://www.scion-architecture.net
  - Book, documents, videos, tutorials
- http://scion.org/
  - SCION Association
- https://www.scionlab.org
  - SCIONLab testbed
- https://www.anapaya.net
  - ETH-Spin-off offering SCION-based products

Book: The Complete Guide to SCION, 2022, Springer Verlag

We thank the following people for inputs for this presentation:
Cyrill Krähenbühl*, Seyedali Tabaeiaghdaei*, Christelle Gloor*, Jonghoon Kwon*, Adrian Perrig*‡, Dominik Roos‡
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And for their work: "**Deployment and Scalability of an Inter-Domain Multi-Path Routing Infrastructure.** " (CoNEXT '21)

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Nicola Rustignoli nic@scion.org

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Backup slides

End-Domain Deployment

Native deployment provides the biggest SCION benefits

SCION IP Gateway (SIG) simplifies deployment