PANAPI, Milestone 2

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Outline

1. Introduction
2. Project Overview
3. Project Status
4. Next Steps

Quick Refresher: Project Motivation

- Premise: Next-gen Networking Architectures will bring Path Awareness to the Internet
- Insight: Adoption of new network technology and features tends to happen behind the scenes. Users and App developers shouldn't have to be directly involved
- Implication: New functionality must (first) be added at deeper levels of the network stack
- Implication: Network programming needs modern high-level abstractions
- Conclusion: Need to innovate Interaction between the network layers

(These views are shared at the IETF. The TAPS working group has been laying some theoretical groundwork that we can leverage)

Quick Refresher: About SCION

- Proposed new Internet architecture, designed to supersede BGP
- Provides practical path-awareness at the end host and multipath at the inter-domain level
- Already deployed in the wild
- Developed at ETH Zürich

https://scion-architecture.net

PANAPI[1] - Overview

- Adopts existing sensible modern networking abstractions from IETF community
- Adds support for path-awareness (specifically SCION) to TAPS
- Scriptable back end to test out new networking features and adjust behavior
- Open source

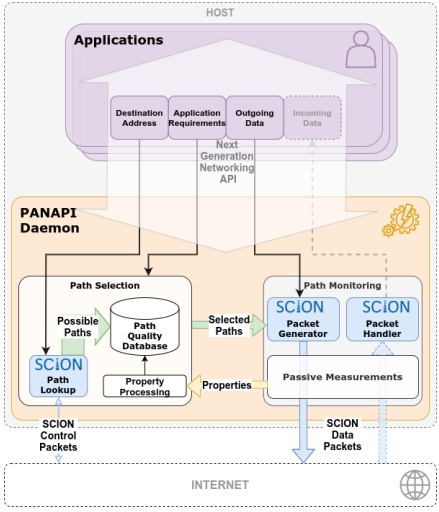
[1] https://dl.acm.org/doi/pdf/10.1145/3472727.3472808

PANAPI - Design

- Written in Go
- Backend scriptable in Lua
- Support for TCP/UDP/QUIC as well as SCION with (UDP/QUIC)
- Frontend API follows the IETF TAPS architecture as much as possible

PANAPI - Backend

- Currently SCION-specific
- Collects and caches network performance information per Path ✅
- Scriptable path quality estimation
  - scriptability ✅
  - scripts themselves ☐
- Scriptable path choice per Message/Packet ✅
- Scriptable active latency measurements per Path (stretch goal, good progress)



PANAPI - Code Example

```
r := taps.RemoteEndpoint{
     Address: "19-ffaa:0:1303,203.0.113.42:1337",
     Protocols: []taps.Protocol{quic.Protocol()},
}

tp := taps.NewTransportProperties()
tp.Multipath = taps.ACTIVE

p := taps.NewPreconnection(r, tp, taps.NewSecurityParameters())
p.ConnectionProperties.MultipathPolicy = taps.AGGREGATE
p.ConnectionProperties.CapacityProfle = taps.CAPACITY_SEEKING

Connection, err := p.Initiate()
if err != nil { ... }

err = Connection.Send(Request)
if err != nil { ... }

Response, err := Connection.Receive()
if err != nil { ... }

Connection.Close()
```

Project Milestones - Overview

- Milestone 1: Ethics Approval & Kick Off ✅
- **Milestone 2: Basic Path Selection** ✅
- Milestone 3: Advanced Path Selection ☐
- Milestone 4: Evaluation of Path Selection ☐

Milestone 2: "Basic Path Selection"

KPI Description

Design and implementation of the basic path selection mechanism as a novel socket API

KPI Means of Verification

Successful testing of our basic prototype and presentation of the early results at an IETF meeting

Milestone 2: Results

Design and implementation of basic path selection mechanism

- Completed ✅
- `https://github.com/netsys-lab/panapi`

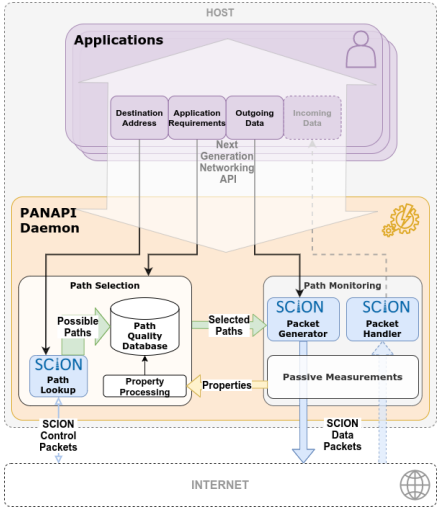
Successful testing of our basic prototype

- Completed ✅

Presentation of the early results at an IETF meeting

- Completed[1] ✅

[1] Upon request by the IETF Working Group chair, the presentation focused on providing feedback about implementation hazards and lessons learned



Demo

Fruitful IETF Interaction

Practical Feedback on Drafts

- Closed Discussion about property inheritance and scope
  - `https://github.com/ietf-tapswg/api-drafts/issues/1001`
- Closed Emphasize that different approaches to asynchronicity are equally valid
  - `https://github.com/ietf-tapswg/api-drafts/issues/1009`
- Open Discussion about property types and states
  - `https://github.com/ietf-tapswg/api-drafts/issues/1012`

Interaction with the TAPS WG is ongoing and already has been extremely fruitful

Next Steps

Advanced Path Selection Strategies
(Now that the scripting interface is in place)

Finalize API
(Needs to happen before API can see wide-spread use)

Port existing SCION application to PANAPI
(Test out path selection under different scenarios)

Questions?