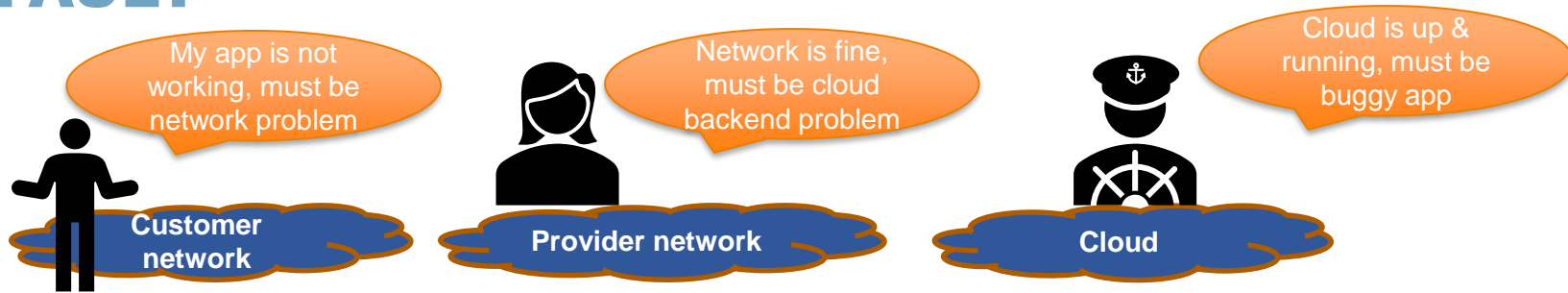


› PROGRAMMABLE INTEGRATED TELEMETRY – RON20 PLANS

Piotr Zuraniewski, Paweł Maćkowiak

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MY APP IS NOT WORKING AND THIS IS YOUR FAULT




- › Apps delivered as containerized microservices
 - › ... mixed with traditional bare metal/VMs/standalone containers
 - › ... transported both over static and highly dynamic, reconfigurable, layered networks
 - › ... transiting several domains
- › Increased complexity makes troubleshooting difficult
 - › Think: ephemeral flows, on-demand containers, domain borders

TELEMETRY TO THE RESCUE ? BUT WHAT'S NEW ?

- › Telemetry – obviously not new, possibility to measure at various points, lots of opensource
- › Programmable Telemetry
 - › Some solutions available: Barefoot INT, ONOS, previous RONS
 - › Measure on-demand, choose granularity, select app/traffic of interest
- › Programmable Integrated Telemetry – collect app-related information from:
 - › app container, VM, host NIC, switch ports ('vertical' integration)
 - › various domains – consumer, network provider, cloud ('horizontal' integration)
 - › certain solutions also available

Demonstration: Multi-domain Ethernet OAM monitoring tools

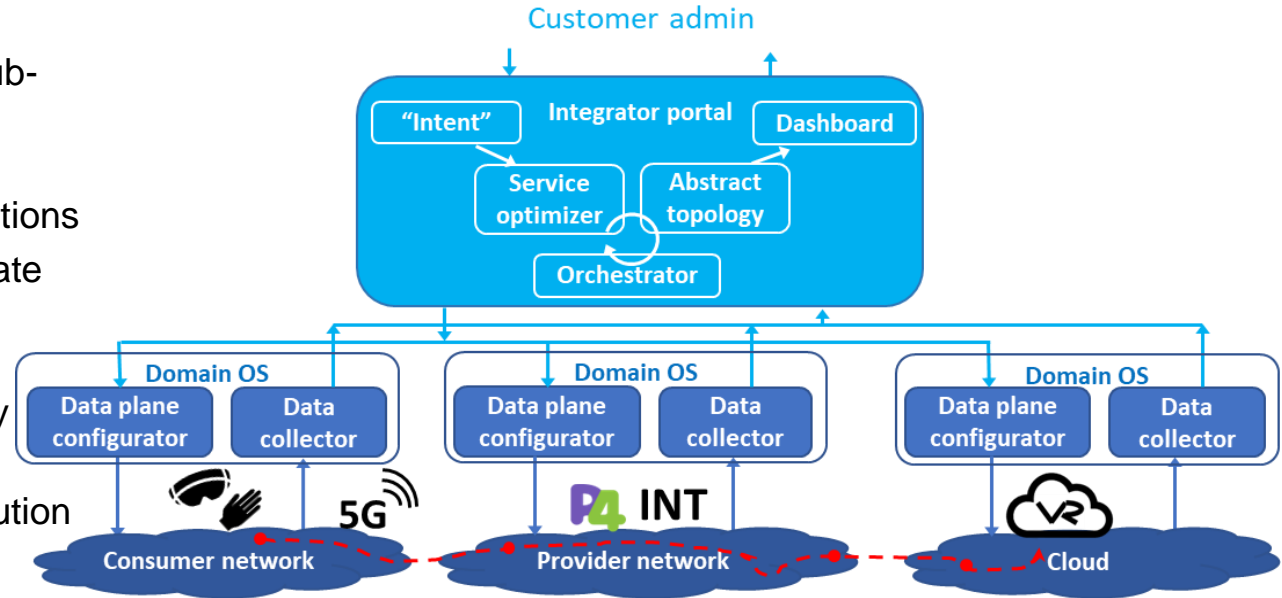
 Erik Ruiter (SURFsara), Piotr Zuraniewski (TNO)

When: 03/06/2013 12:30-13:30

Where: SURFnet booth

PROGRAMMABLE INTEGRATED TELEMETRY (PIT) SYSTEM OVERVIEW

- › PIT system composed of domain-specific telemetry sub-systems
- › Re-use as much as possible available (open-source) solutions
- › Use (open) APIs to orchestrate end-to-end collection and analysis of data
- › Follow progressing telemetry standards (e.g., IETF)
- › Aim for open-source contribution



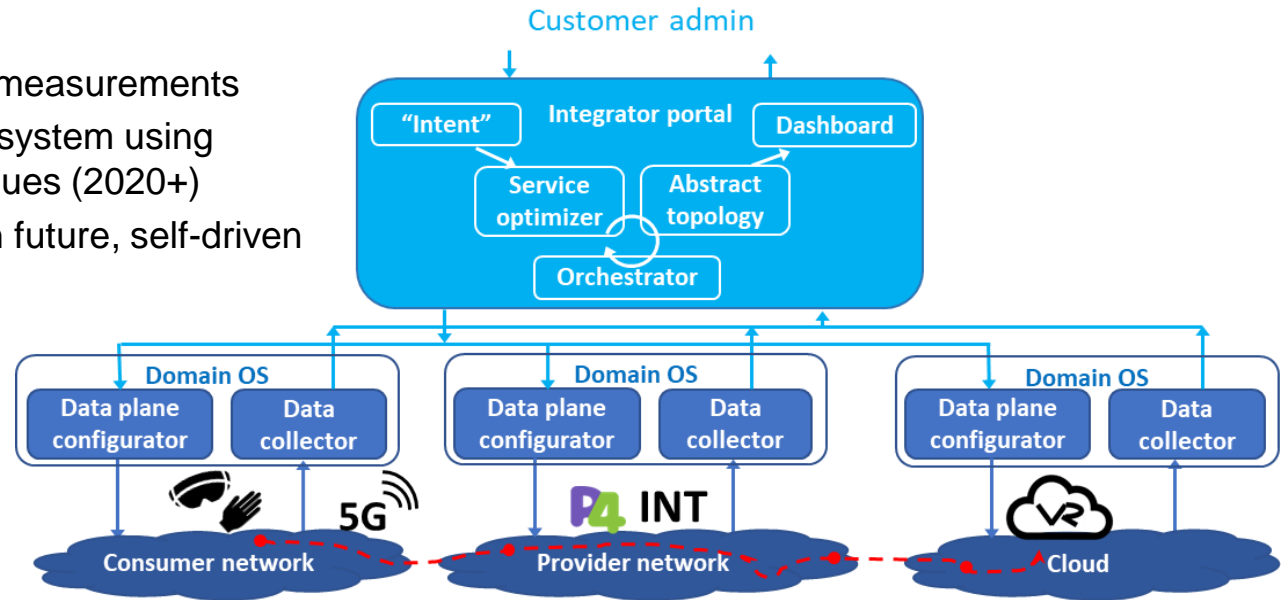
PLANNED RESEARCH ACTIVITIES

- › PIT architecture refinement
- › Use case selection
 - › Tentative: VR teleconference with haptics
- › Inventory of available domain-specific telemetry solutions
 - › app, cloud, switching fabric,...
- › Proof-of-concept development
 - › Data collection strategy and its implementation
 - › Programmability: 'zoom-in' on demand
 - › Data analysis -> 'actionable information'
 - › Single/multi-domain aspects
 - › Validation: in-house and with partners



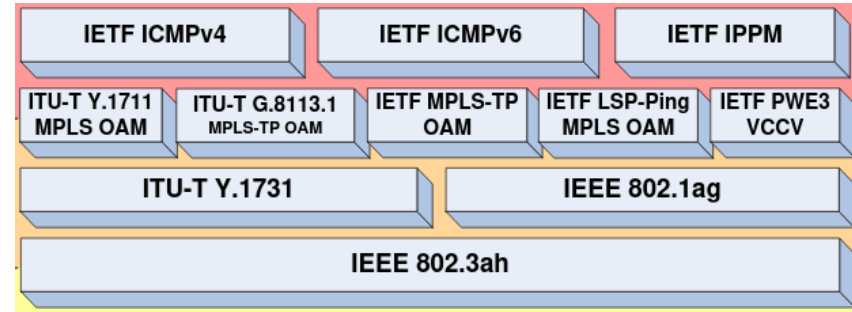
MULTI-DOMAIN

- › Horizontal integration
 - › Needed for end-to-end measurements
- › Data collection for analytics system using Data Science and AI techniques (2020+)
 - › Assisting applications in future, self-driven networks



THE CHALLENGE OF INTEGRATION

- › Different Operations, Administration, and Maintenance (OAM) Tools
- › Measurement approaches
 - › Passive
 - › Active
 - › Ping, traceroute
 - › Hybrid
 - › In-Band Network Telemetry
 - › In-situ OAM



THE CHALLENGE OF INTEGRATION

"...operator of such a domain is expected to put provisions in place to ensure that IOAM data does not leak beyond the edge of an IOAM domain ..." - draft-ietf-ippm-ioam-data

› Implications

- › Limiting the potential attack vectors to within single network domain
- › Reduced overhead caused by telemetry header size (compared to end-to-end)
- › Localization of the Data Collector within domain
- › Potentially centralized analysis or 'multi-party computation'

THE CHALLENGE OF INTEGRATION

- › Security and privacy concerns
 - › General Data Protection Regulation (GDPR)
 - › National Security
- › Privacy versus utility tradeoff.
- › Secure Multi Party Computation – jointly compute output while keeping inputs private
 - › Network monitoring produces voluminous input
 - › Which MPC techniques are applicable?
- › How to make the most out of it?

A nighttime photograph of a city street. In the foreground, a modern, curved pedestrian bridge with a metal mesh railing is illuminated from below. The background shows multi-story buildings with lit windows and long, horizontal light trails from moving vehicles, including a prominent green light trail. The overall scene is a vibrant urban night.

› **THANK YOU FOR YOUR
ATTENTION**

Take a look:
[TNO.NL/TNO-INSIGHTS](https://www.tno.nl/tno-insights)

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