D3.1: Use Cases and Requirements

Mirja Kühlewind

July 14, 2016, Berlin

mami

measurement and architecture for a middleboxed internet

measurement | architecture | experimentation

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 688421.The opinions expressed and arguments employed reflect only the authors' view. The European Commission is not responsible for any use that may be made of that information.

Supported by the Swiss State Secretariat for Education, Research and Innovation under contract number 15.0268. The opinions expressed and arguments employed herein do not necessarily reflect the official views of the Swiss Government.

Outline of D3.1

1. **First Principles:** Explicit Cooperation, Declarative Signaling, Property Binding to Packet Groups, Internet Deployability & Mobile Access Network Deployability, Failure Transparency

2. **Use Cases**
   - Low Latency Support in Mobile Access Networks
   - Throughput Guidance for Congestion Management in Mobile Networks
   - Web Identity Translation (WIT) as a Network Service
   - Multipath Bonding of Mobile and Fixed Network Capacity

3. **Requirements:** functional and some security reqs from draft-trammell-spud-req-04

4. **Security Analysis:** Trust Model (Zero Trust/Middlebox Authentication) and Attacker Model

Low Latency Support in Mobile Access Networks

1. ***Varying traffic characteristics*** of applications: voice, web, messaging, streaming, high-volume interactive applications
   - e.g. WebRTC: various streams with different characteristics and requirements
2. 3GPP networks designed to classify traffic to select appropriate ***bearer to each flow***
   - Assumption: 5-tuple represents a single flow with a given set of stable QoS attributes
3. ***Opportunistic encryption*** does not provide a means for a proper bearer identification

➡ Lack of information to perform classification translates into a degradation of mobile network stability and a poorer service to users

Information Exposed

- Declarative signaling of trade-off bt. latency-sensitivity vs. loss-sensitivity
- Indication of the maximum acceptable single-hop queueing delay per tube

Throughput Guidance for Congestion Management in Mobile Networks

1. ***Application-limited, adaptive traffic*** (e.g. streaming video) vs. bandwidth probing
   - Overshoot degrades application performance
   - Undershoot degrades link/network performance
2. Mobile network ***knows how much RAN bandwidth*** (and hence capacity) is available and can predict what will be available to any user's mobile device

Information Exposed

- Maximum capacity available to a tube, e.g. similar to QuickStart
- Explicit per-tube indication of the maximum intended data rate

Web Identity Translation (WIT) as a Network Service

1. Ad agencies' use trackers to enabled the ***free-to-use model of the web vs. invasion of privacy concerns***
2. ***Web Identity Translation (WIT)*** service proxy between users and web-sites, configured to intercept tracking cookie (in encrypted traffic):

   When a particular user's browsing habits start making her uniquely identifiable, WIT intervenes via the ***private-to-public cookie mappings*** based on local policies aimed at restoring user anonymity within the context of the Online Behavioral Advertising (OBA) ecosystem.

Information Exposed

- Visited domains: this data allows building user history vectors
- Cookies: WIT requires cookie access to strip them off during quarantine and manipulate them to allow intervention

Multipath Bonding of Mobile and Fixed Network Capacity

1. ***Aggregate fixed and mobile capacity***, especially in areas with marginal fixed connectivity, e.g. using MPTCP proxies
2. Layer 3 Multipath bonding can handle all traffic (not only TCP) but needs to ***re-order at proxy egress***
3. Likely that new protocols will be designed to be ***(more) robust to re-ordering***

Information Exposed

- Reordering sensitivity as a per-tube signal
- Policy indications to the scheduler about which channel is preferred for which tube or packet

Functional (and Security) Requirements Derived from the Use Cases and Principles

- Grouping of Packets and Bidirectionally
- Signaling of Per-Tube Properties
- Path to Receiver Signaling under Sender Control
- Receiver to Sender Feedback
- Direct Path to Sender Signaling
- Tube Start and End Signaling
- Additional Per-Packet Signaling
- Declarative signaling
- Extensibility and Common Vocabulary
- Privacy
- Authentication
- Integrity
- Encrypted Feedback