Enabling Traffic Management without DPI

DPI Is Dead, Long Live Traffic Management

Mirja Kühlewind

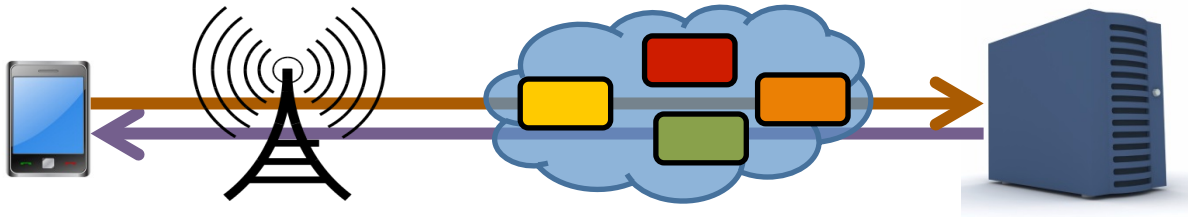
Dirk Kutscher

Brian Trammell

Managing Radio Networks in an Encrypted World (MaRNEW) Workshop
Atlanta, September 24/25 2015

„Cooperative Traffic Management“

- Common denominator for many workshop contributions
- ***„Extend current connection-based encryption approaches by integrating middleboxes into the loop“***

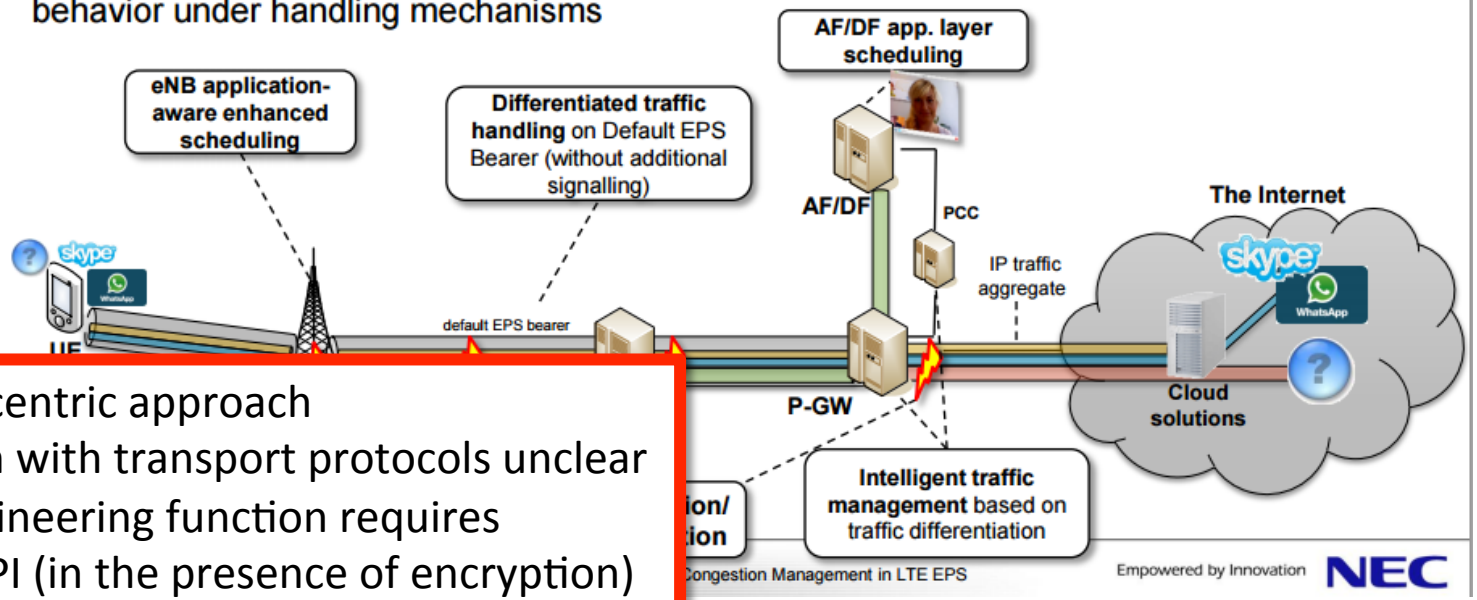


- **Difficult to do right and to manage reliably**
  - Trust?
  - Robustness?
  - Performance?

Previously

UPCON – Solution outline

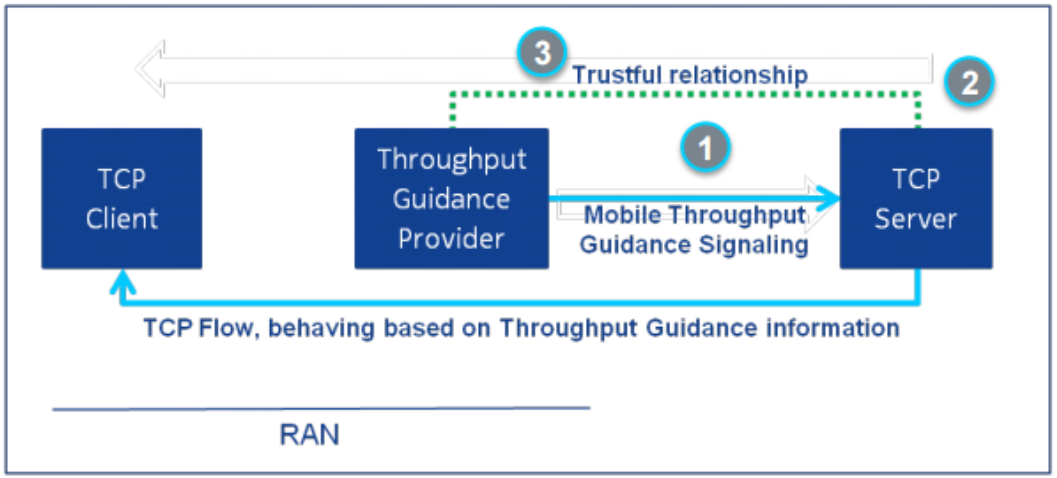
1. **Detect user plane congestion** in Radio Access, Backhaul or Core Network entities
2. **Apply different traffic handling / QoS schemes** to user plane traffic, based on Subscriber profile, Application type, Content type
3. **Develop adequate traffic scheduling and traffic engineering mechanisms**, such as per-user or per-flow queuing, application-aware QoE scheduling, flow-based handover, media compression, etc.
4. **Enable policy-based control for operators** to flexibly configure the traffic the network behavior under handling mechanisms



- Operator-centric approach
- Interaction with transport protocols unclear
- Traffic engineering function requires massive DPI (in the presence of encryption)

Currently Proposed

Throughput Guidance Solution Architecture



1 Throughput Guidance per user is sent to the TCP video server

ion control decisions and also to ensure that the application-
radio downlink

provider and the TCP server

vodafone Google YouTube NOKIA

hroughput-guidance/

- Application-provider-centric approach
- Conveying information about estimated current base station capacity to TCP senders
- Only works with TCP
- Implemented as TCP Option – interaction with middleboxes?
- Very specific – generality?

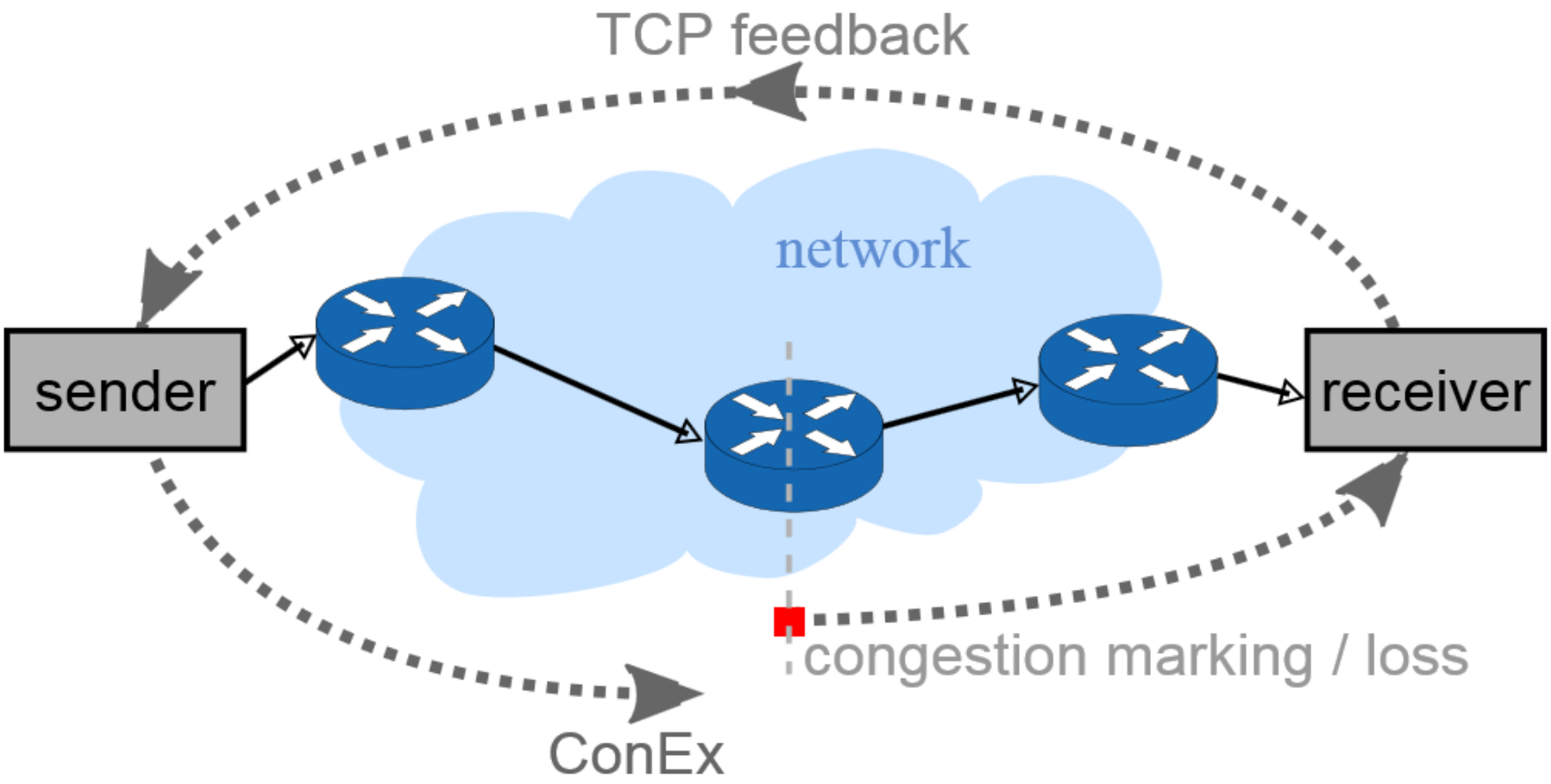
Thesis: Two Main Concerns

1. **Meaningful Capacity Sharing**
   - Enabling low-latency communication in the presence of high network utilization
   - Incentivize application/sender adaptivity
2. **Reacting correctly to (wireless) link layer conditions**
   - Distinguish from congestion events

Traffic Management Requirements

- **Application-independence: permission-less innovation**
  - No DPI required
  - Should work with all (future) application types
  - Should work with all (future) transport protocols
- **Efficiency and Effectiveness**
  - Should interact well with transport
  - … Without complex management frameworks
- **Generality**
  - Should not be limited to specific systems or configurations
- **Privacy-friendly**
  - In-band cooperation tools should only expose essential traffic management information

Congestion Exposure Principle

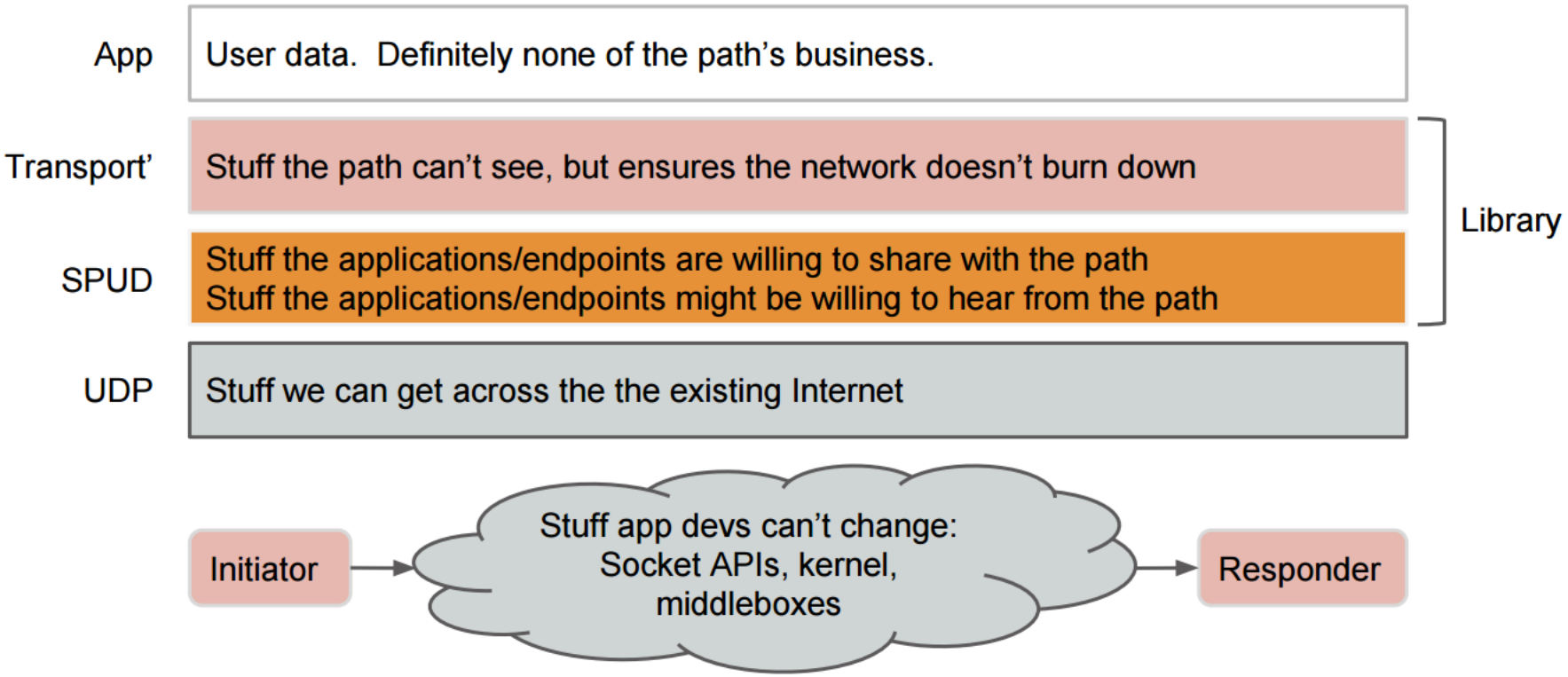


Lessons Learned from ConEx

- Congestion exposure: means to incentivize application/sender adaptivity
- Mechanism vs policy
- Making current congestion visible to network and endpoints may not be enough
- IP not designed for in-band management
- Authentication needed

Substrate Protocol for User Datagrams

Architecture



Extensible and Efficient Traffic Management

- **More flexible traffic management transport**
  - Allow for generally encrypted traffic
  - SPUD prototype as a platform for experiments
  - Design for flexibility – without ignoring efficiency requirements
  - **Finding minimum set of information to expose (PII issue)**

- **Re-think capacity sharing**
  - Congestion accountability != TCP fairness
  - **Incentivizing adaptability and immediate response to congestion**
  - Support for low-latency: DCTCP-like
  - **Simple QoS** – distinguish interactive real-time from rest of traffic at bottlenecks
  - Additional **signaling for non-congestion-induced events** (wireless)
  - Hop-by-hop optimization and end-to-end control loops