The SME InnoRoute in Munich, Germany provides solutions to make the Internet more secure, more reliable and to provide better quality of service (QoS). The latter is supported by a new concept called YouQoS, a network technology where the receiver controls the Quality of Service (QoS). Initially it was invented to solve the problem shown in Figure 1: a subscriber receives many independent packet streams, so that overload might occur at the bottleneck of the 1st Mile (e.g. DSL).

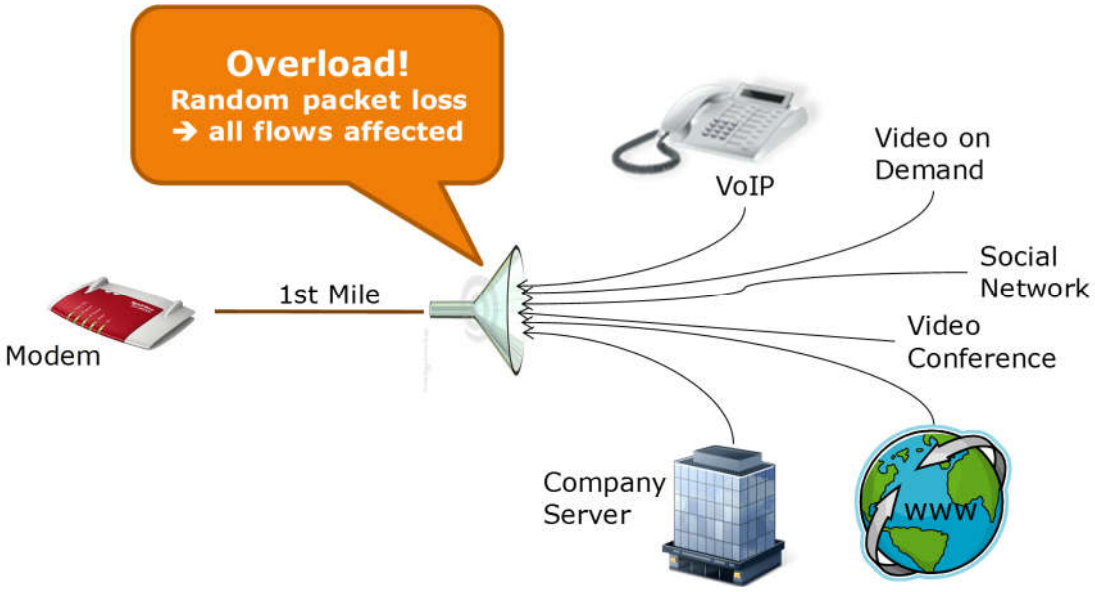


Figure 1: Bottleneck 1st Mile

The problem is solved by a feedback loop from the receiver back to the access network operator. In detail, four steps are necessary:

1. The end user decides which application (s)he likes most, for example by clicking on the respective window of the screen.
2. A prioritization App running in the background transfers the respective flow identifiers to the YouQoS controller in the network. Flow identifier is for example the so-called five-tuple (IP addresses, Port numbers, payload type) of the packet headers
3. A YouQoS controller in the cloud receives the messages and converts them to configuration messages to a switch within the access network.
4. The switch detects the respective packets and changes their priority.

In a national research project[1] a first proof of concept of YouQoS was successfully done[2] in a laboratory setup.

In the Fed4FIRE experiment "Tuning User-driven Network Re-provisioning" TUNER the single bottleneck per user (Figure 1) was replaced by several bottlenecks shared by several users. This case is more realistic but also much more complex. In order to achieve guaranteed QoS, bandwidth and queuing delays must be considered at each bottleneck. The TUNeR setup shown in Figure 2 (left) consisted of two nodes. The investigated target traffic stream (orange arrow) is distorted by cross traffic (black arrows) which is statistically generated. A mathematical solution with a bunch of inequalities was compared to a heuristic approach based on measurements. Packet delay times for various use cases were statistically accumulated to obtain hull curves as shown in Figure 2 (right).

[1] http://www.ikr.uni-stuttgart.de/Content/ResearchProjects/View/Full.html?youqos
[2] http://link.springer.com/chapter/10.1007/978-3-319-13488-8_11

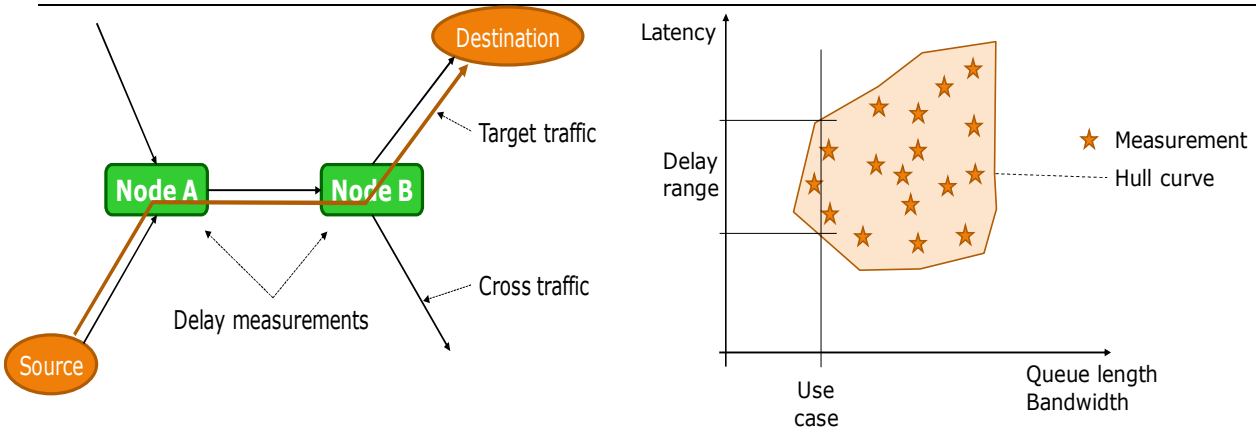


Figure 2: TUNER experiment setup (left) and results analysis (right)

Measurements were made in two FIRE networks, Virtual Wall and FUSECO playground. Analysis of many measurements obtained these results:

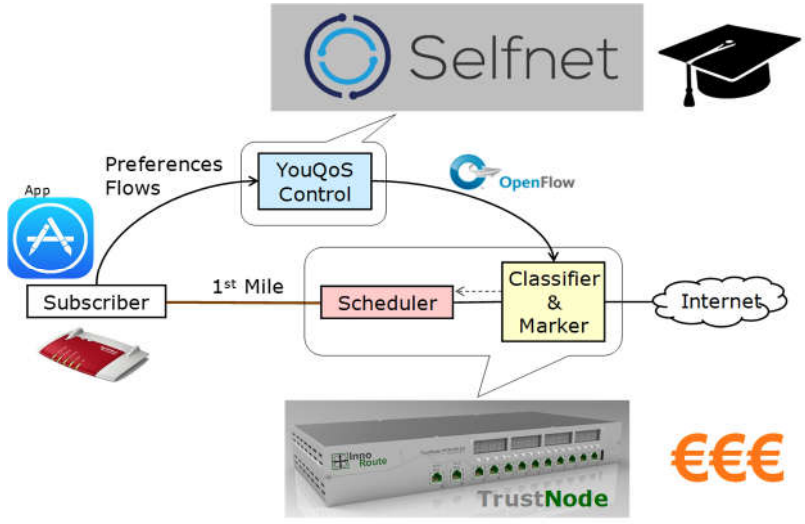
1. For 100% load the packet loss probability is very high
2. For close to 100% load the calculation of loss probability is complex due to convolutions in N-space. This is not feasible in real time in a working system.
3. For load values significantly below 100% (typically 10…40%) wide simplification is possible, resulting in a practical solution.

An artefact of the FIRE networks was that PC based systems try to accumulate packets for efficiency, but this produces bursts. A real HW scheduler would work more smoothly.

The results encouraged us to continue with YouQoS. We started improving the data plane by adding smooth schedulers to our experimental router. This product, the "TrustNode" also includes OpenFlow switch functionality with the option to add proprietary functions for the change of packet priority.

Currently the network part of YouQoS is investigated in the 5G-PPP project SELFNET[3]. The implementation in SELFNET uses the TrustNode.

The final step to make YouQoS technology market ready is the App in the user terminal. We plan a further research project for that purpose.



YouQoS Benefits:

1. Better quality to the end user
2. New business cases for operators
3. Conforming to network neutrality rules.

Figure 3: TUNeR Exploitation: scientific and commercial

Contact: Andreas Foglar, foglar@innoroute.de, www.innoroute.com

[3] https://selfnet-5g.eu/