Simplemux Traffic Optimization in the context of GAIA

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IRTF GAIA Meeting

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Traffic Optimization in the context of GAIA

The **Global Access to the Internet for All (GAIA)** is an IRTF initiative that aims*

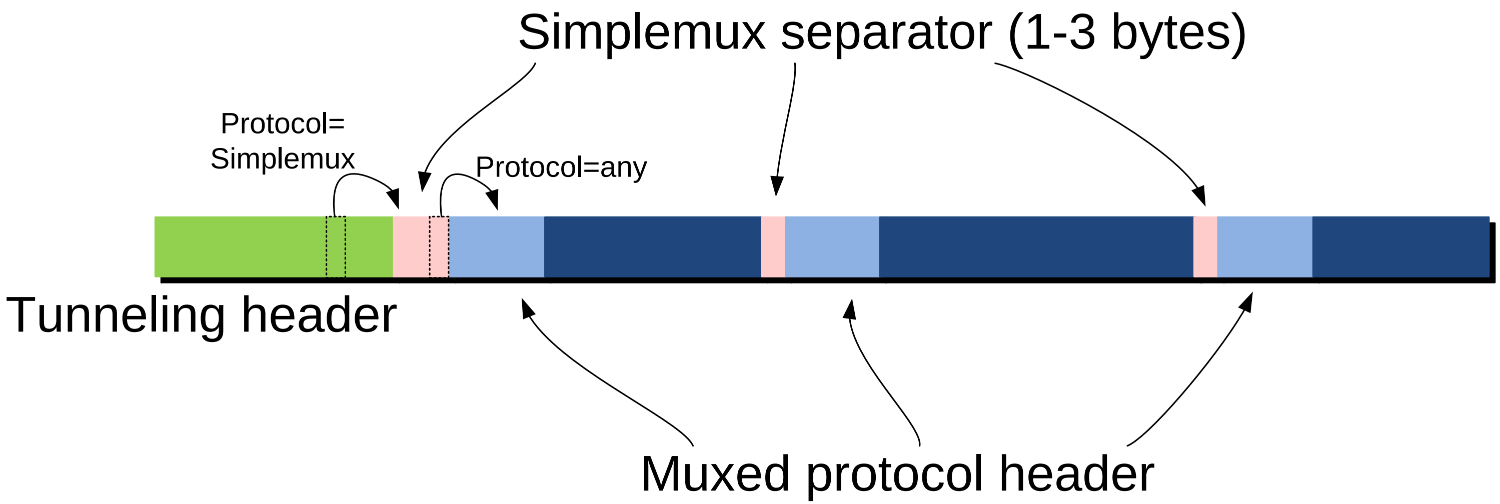
- (1) to create increased visibility and interest among the wider community on the challenges and opportunities in enabling global Internet access, in terms of technology as well as the social and economic drivers for its adoption;
- (2) to create a shared vision among practitioners, researchers, corporations, non governmental and governmental organisations on the challenges and opportunities;
- (3) to articulate and foster collaboration among them to address the diverse Internet access and architectural challenges (including security, privacy, censorship and energy efficiency);
- (4) to document and **share** deployment experiences and **research results** to the wider community through scholarly publications, white papers, presentations, workshops, Informational and Experimental RFCs;
- (5) to document the **costs of existing Internet Access**, the **breakdown of those costs (energy**, manpower, licenses, **bandwidth, infrastructure**, transit, peering), and outline a path to achieve a 10x **reduction in Internet Access costs** especially in geographies and populations with low penetration.
- (6) to develop a longer term perspective on the impact of GAIA research group findings on the standardisation efforts at the IETF. This could include recommendations to protocol designers and architects.

* IRTF GAIA charter, http://datatracker.ietf.org/rg/gaia/charter/

Simplemux: a Generic Multiplexing Protocol

http://datatracker.ietf.org/doc/draft-saldana-tsvwg-simplemux/

- Tunnel of multiplexed packets
  - Different tunneling and multiplexed protocols allowed



- Submitted to Transport Area WG (tsvwg@ietf.org)
- Implementation of Simplemux+ROHC over IPv4 available at:
  https://github.com/TCM-TF/simplemux

Traffic Optimization in the context of GAIA

What is the main idea?

- Join small packets into bigger ones
  - Reduce the amount of packets
  - Amortize the tunnel overhead between a higher number of payloads
- Eventually compress packets (e.g. with header compression*)
- Optimization between different devices and tenants

What can traffic optimization provide?

- Bandwidth savings (and airtime in wireless networks)
- pps reduction
- Energy savings
- Flexibility: optimization can be activated when required. Avoid dimensioning the network for the worst case

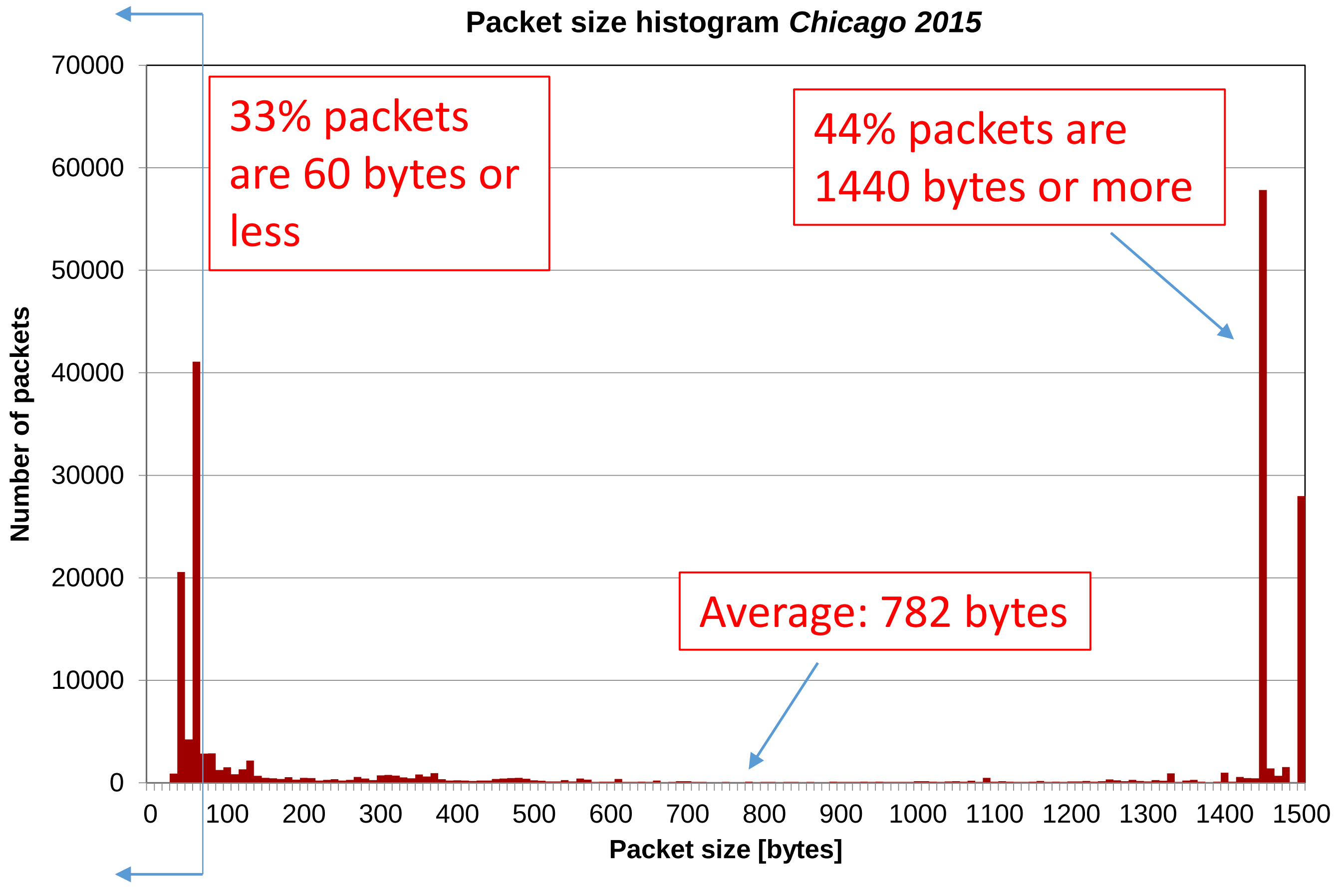
At what cost?

- CPU (not too much, it runs in a low-cost AP)
- I can multiplex packets already in the buffer, but additional buffering delay may be used for increasing the multiplexing rate

* RFC 5795, RObust Header Compression, https://tools.ietf.org/html/rfc5795

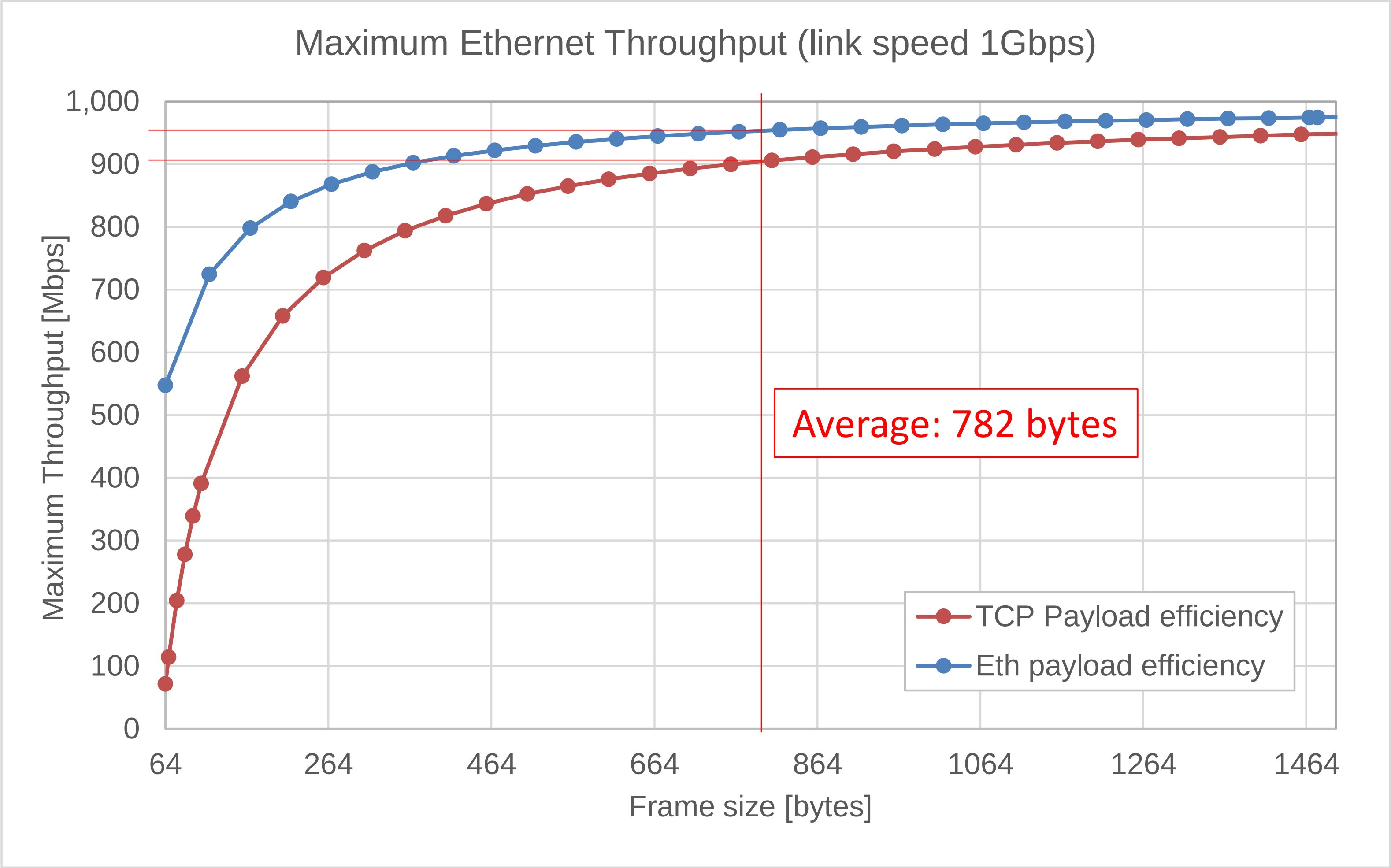
Traffic profile in a public Internet node

Small packets in the public Internet (trace from CAIDA.org *)



Source: *https://data. caida.org/datasets/passive-2015/equinix-chicago/20150219-130000.UTC/equinix-chicago.dirA.20150219-125911.UTC.anon.pcap.gz.* Only first 200,000 packets used

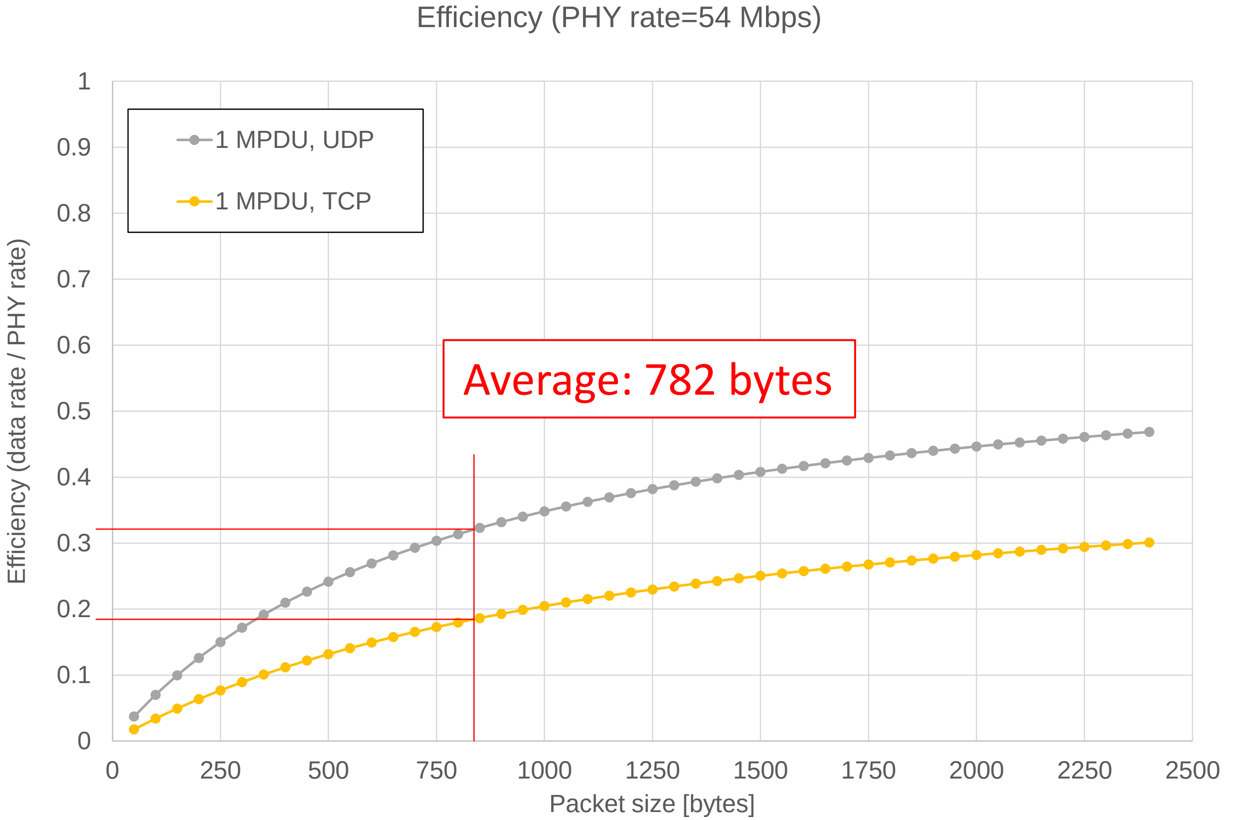
Overhead in wired networks (Ethernet)



Source: *Small Packet Traffic Performance Optimization for 8255x and 8254x Ethernet Controllers*, http://www.intel.com/content/dam/doc/application-note/8255x-8254x-ethernet-controllers-small-packet-traffic-performance-appl-note.pdf

Overhead in 802.11 networks

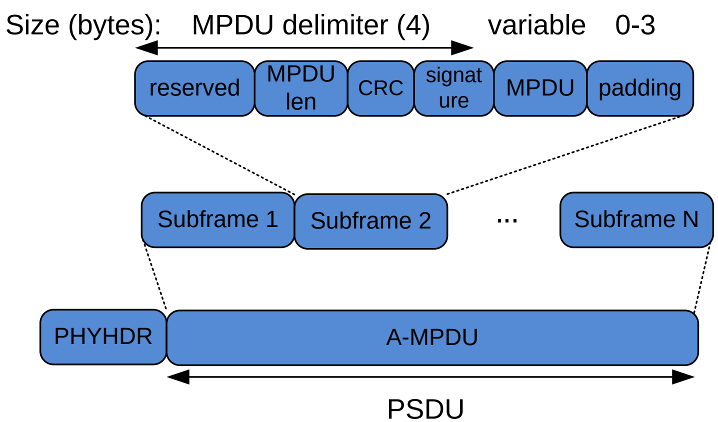
MAC mechanisms cause a low efficiency, and even lower for small packets



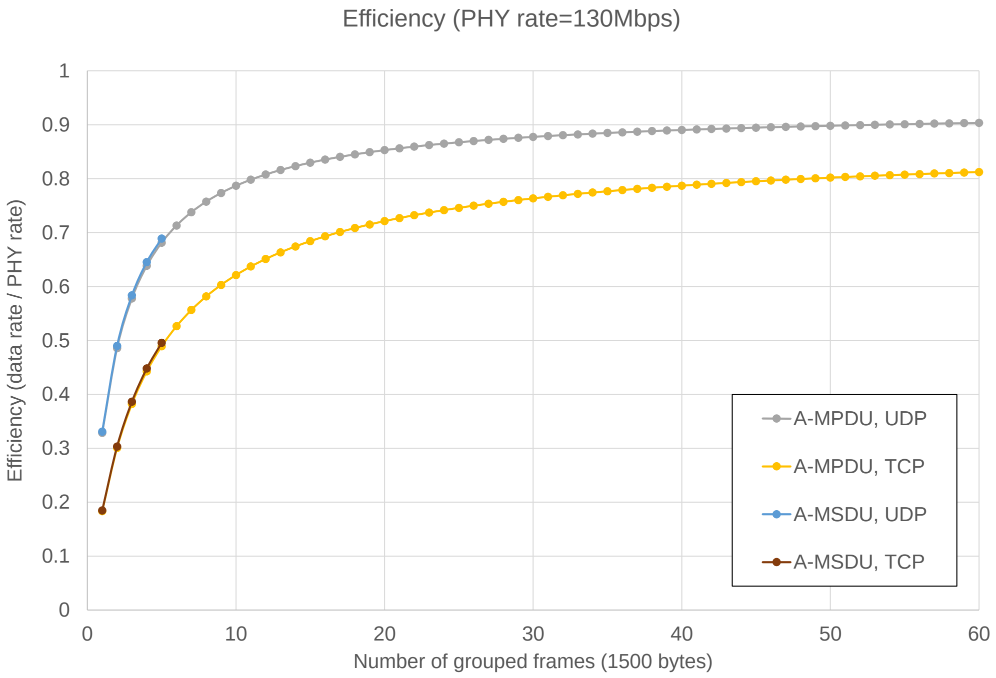
Source: Model developed by Ginzburg, B.; Kesselman, A., "*Performance analysis of A-MPDU and A-MSDU aggregation in IEEE 802.11n*," Sarnoff Symposium, 2007 IEEE , vol., no., pp.1,5, April 30 2007-May 2 2007

Frame grouping in 802.11 networks

New versions of Wi-Fi (from 802.11n) include mechanisms for frame grouping: A-MPDU and A-MSDU.



A-MPDU aggregation

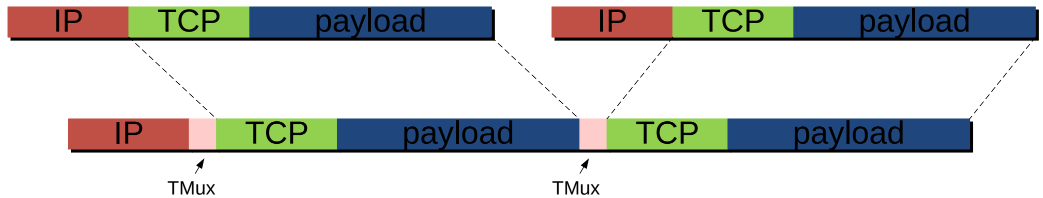


Source: Ginzburg, B.; Kesselman, A., "*Performance analysis of A-MPDU and A-MSDU aggregation in IEEE 802.11n*," Sarnoff Symposium, 2007 IEEE , vol., no., pp.1,5, April 30 2007-May 2 2007

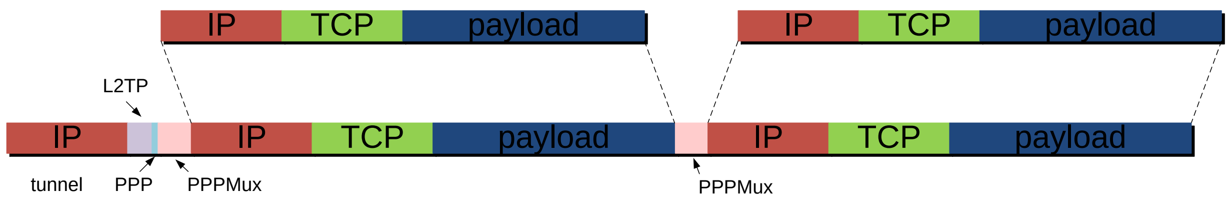
The maximum number of frames in an A-MPDU is 64. The maximal A-MSDU size is 7935 bytes and thus it may contain at most 5 frames.

Can packets be grouped at higher layers?

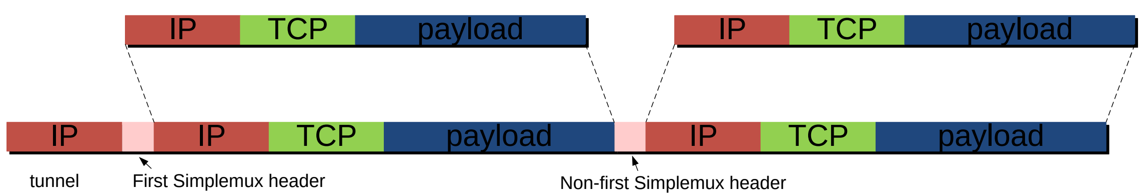
- **TMux** [RFC1692] multiplexes a number of TCP segments between the same pair of machines.



- **PPPMux** [RFC3153] is able to multiplex complete IP packets, using separators. It requires the use of PPP and L2TP.

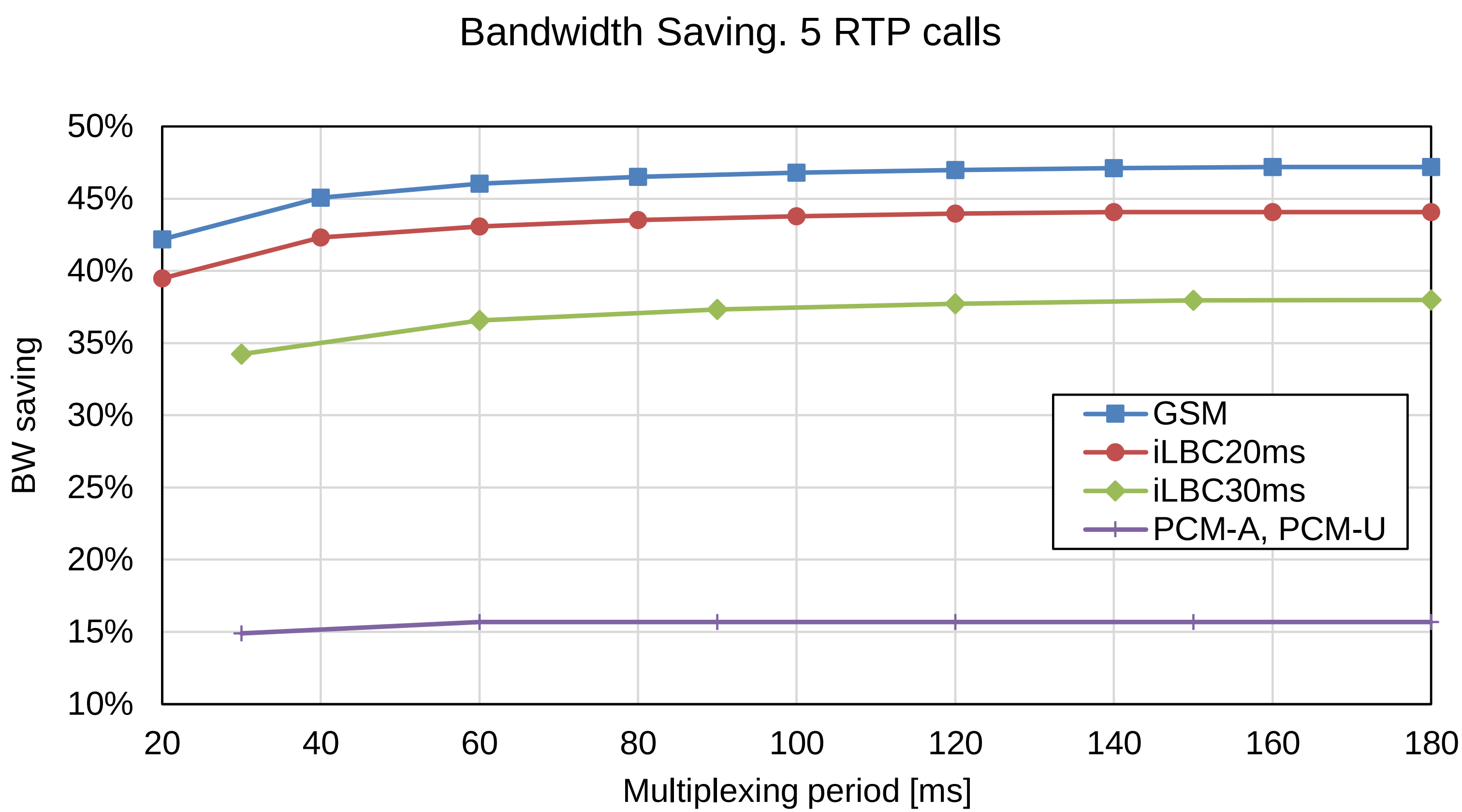


- **Simplemux**



Some results with a Simplemux implementation

5 VoIP calls sharing an Ethernet link (RTP with different codecs)



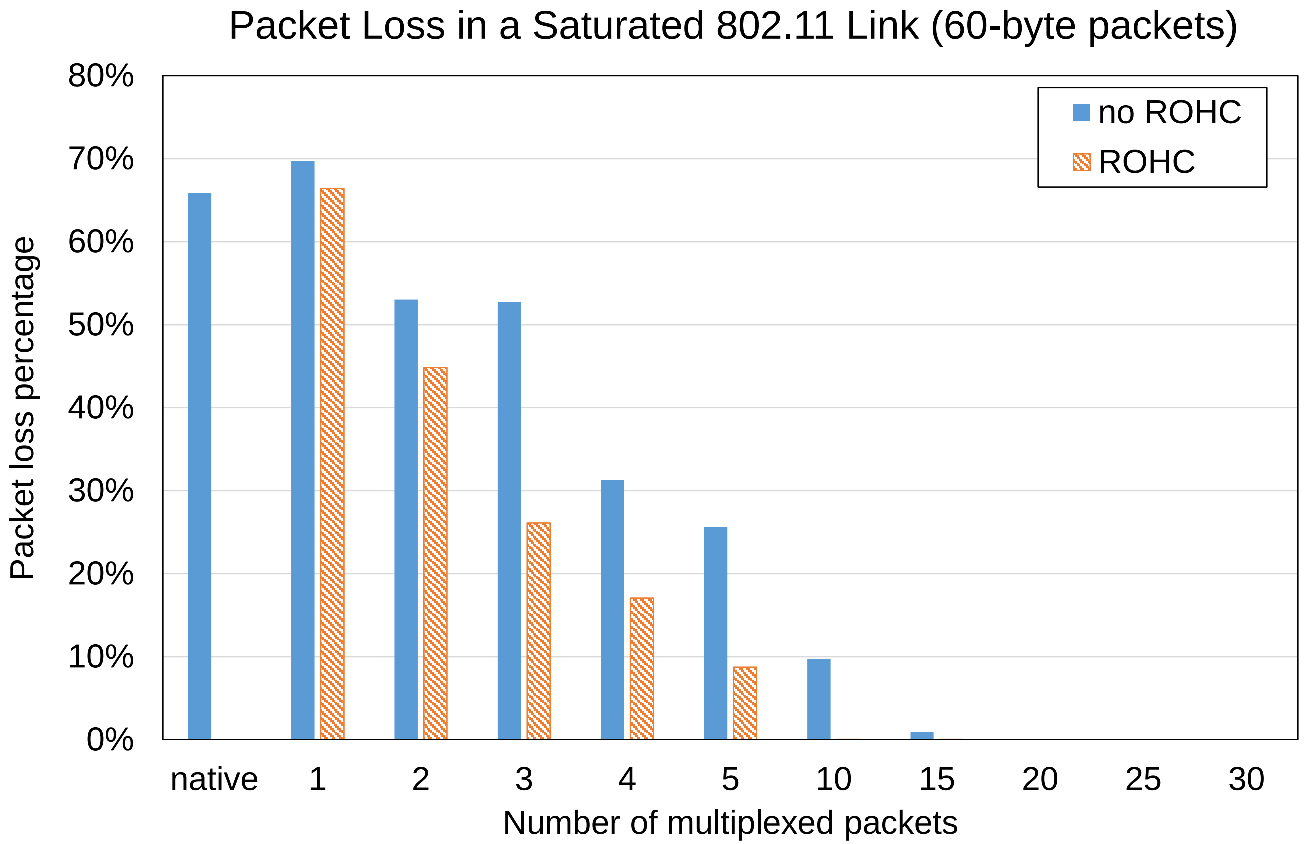
Simplemux implementation: https://github.com/TCM-TF/simplemux

Some results with a Simplemux implementation

Packet loss reduction in a saturated 802.11 link:

Link: 802.11ac. 5.56GHz. 9Mbps

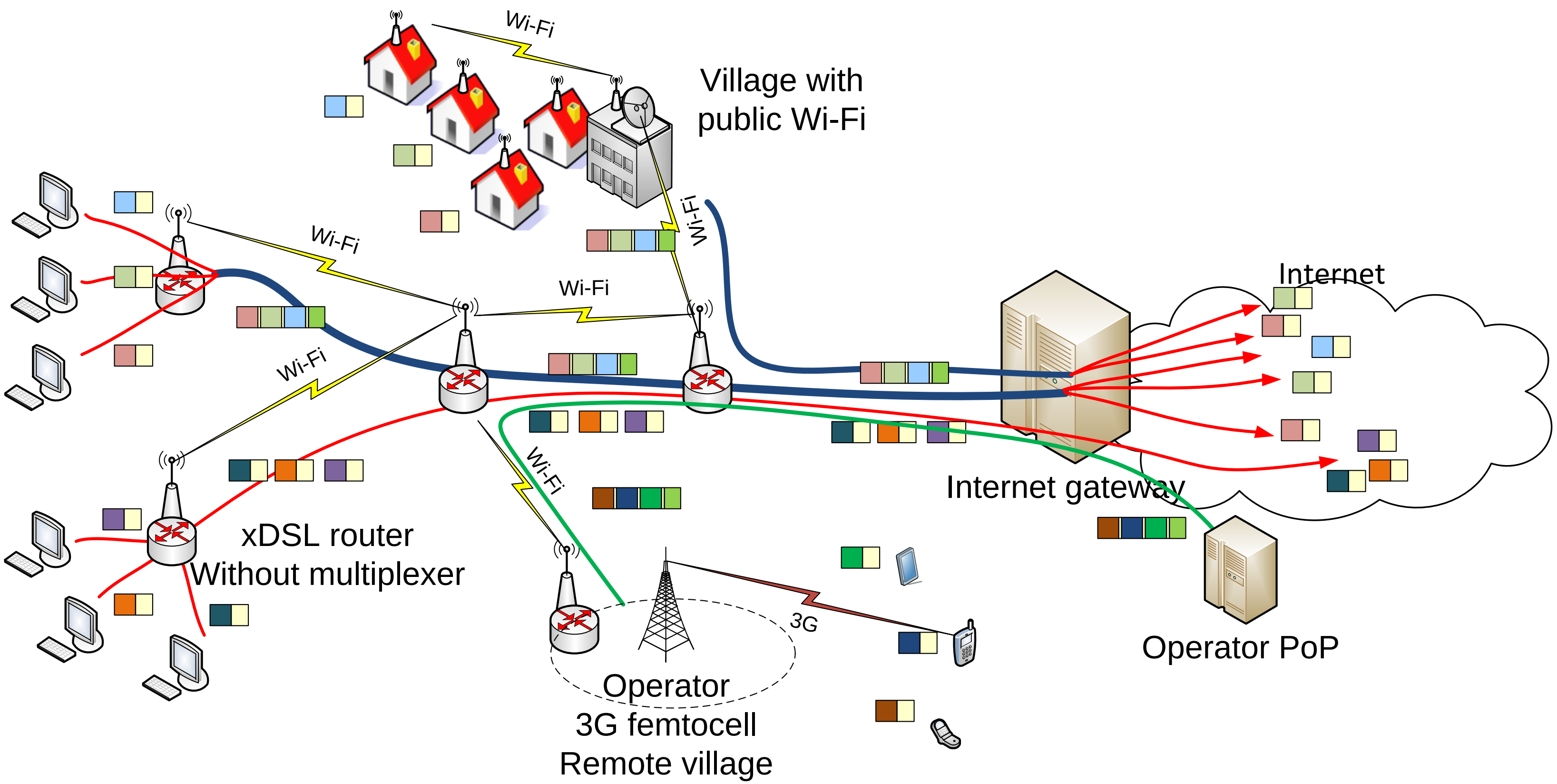
Offered traffic (IP level): 15,000 pps * 60 bytes = 7.2 Mbps



Simplemux implementation: https://github.com/TCM-TF/simplemux

Scenarios: Wireless Community Network

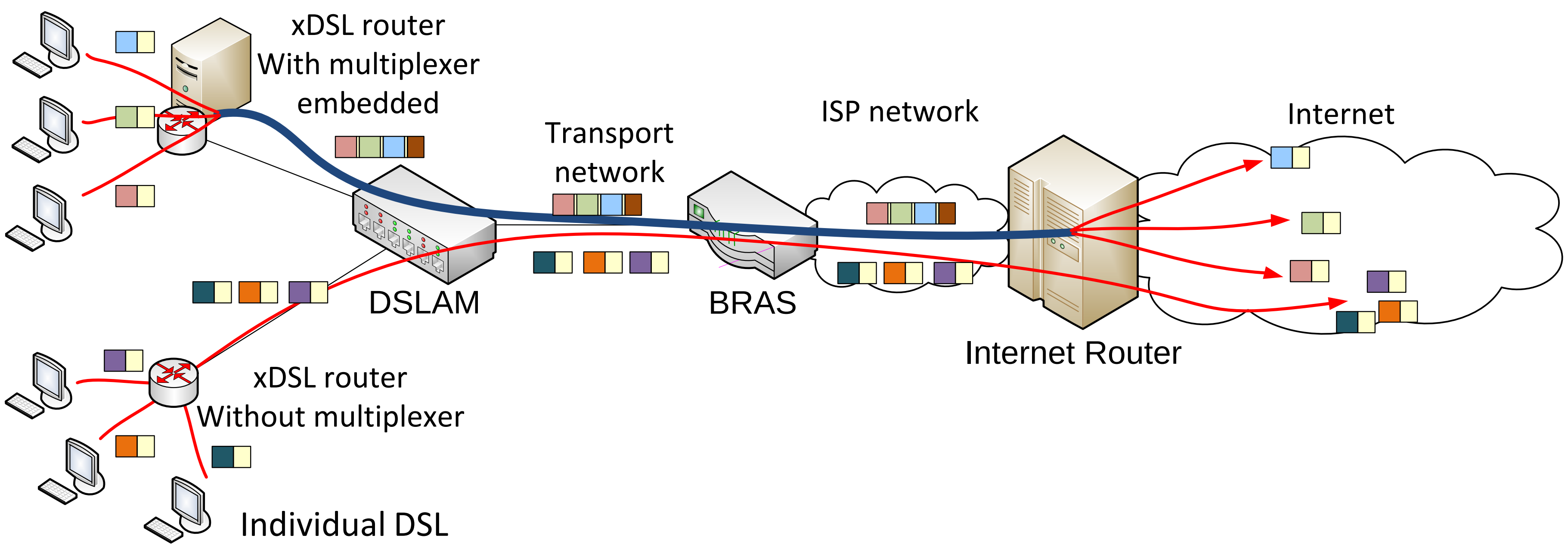
- Optimization can be activated when required
- Substituting 802.11 aggregation in legacy devices (prior to 802.11n)
- Optimization covers a number of hops (in 802.11 it covers only one)



Scenarios: Low-bandwidth residential access

Collaboration router-network operator may save bandwidth in a limited access network

Home network with a number of users (e.g. Internet Café, access shared by neighbors)



Thanks a lot

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Bar-BOF **Thursday** (July 23) **20:15 Registration Desk**

Detailed explanation, real tests, discussion, etc.

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