Performance impact of Mobile Cloud Computing on Wireless LAN

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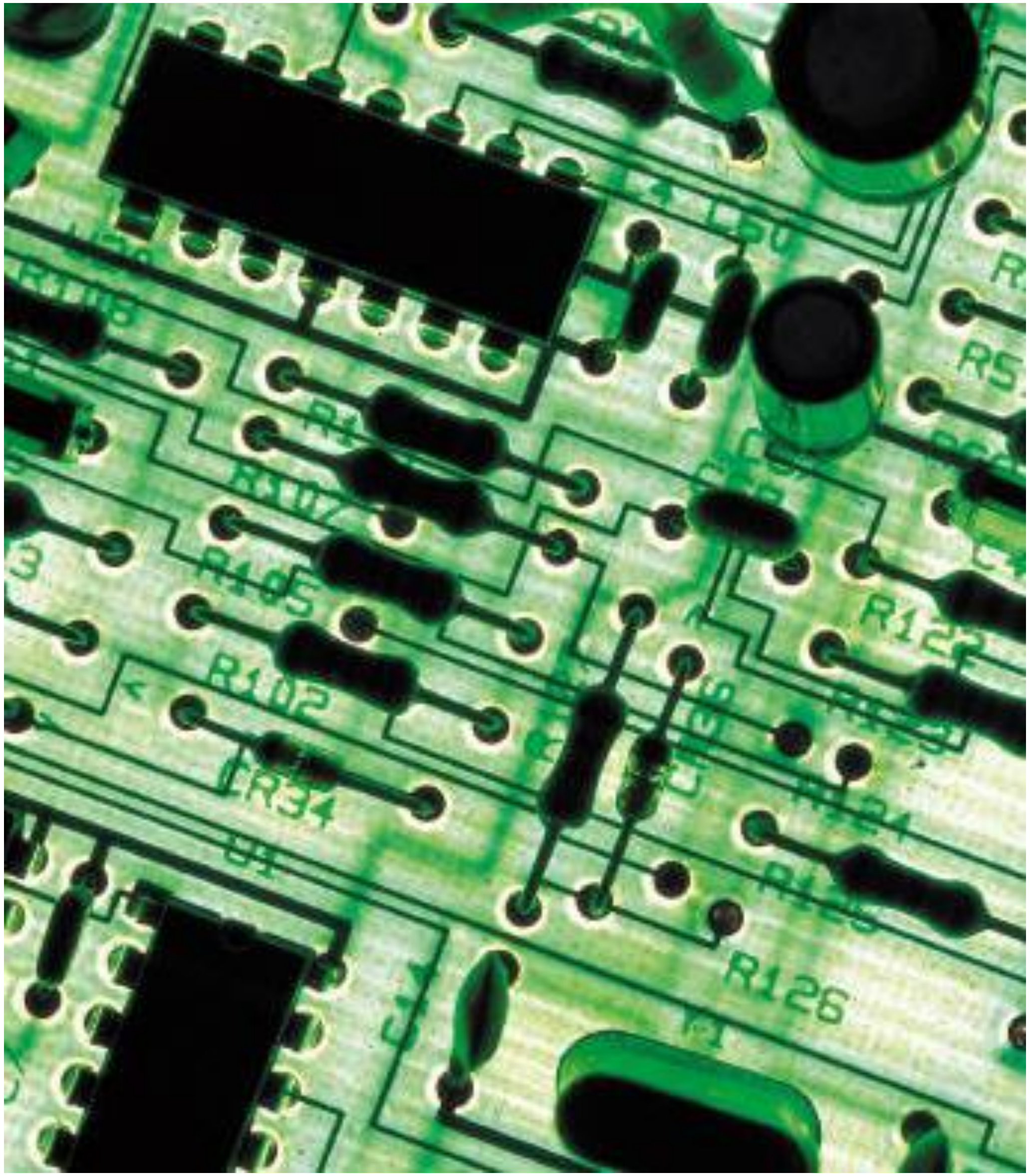


Motivation

- Mobile devices have limited resources (e.g. performance (CPU), graphic power (GPU) and capacity (RAM, hard disk size)
- The lifetime of such a device is 1-3 years and requires regular software updates
- These devices need a network connection for most of the tasks (e.g. Internet Browsing, streaming (video), …)
- New applications require a reliable, secure and fast network Infrastructure (e.g. cloud based time critical application)

Problem:

New scenarios generate new requirements for mobile devices and require a shorter lifetime of the used hardware and software.

Motivation

Possible Solution: Cloud based solution

•"New" cloud based applications require minimum delay

General Question:

Is a wireless enterprise infrastructure capable to
support time critical cloud based applications?

Motivation

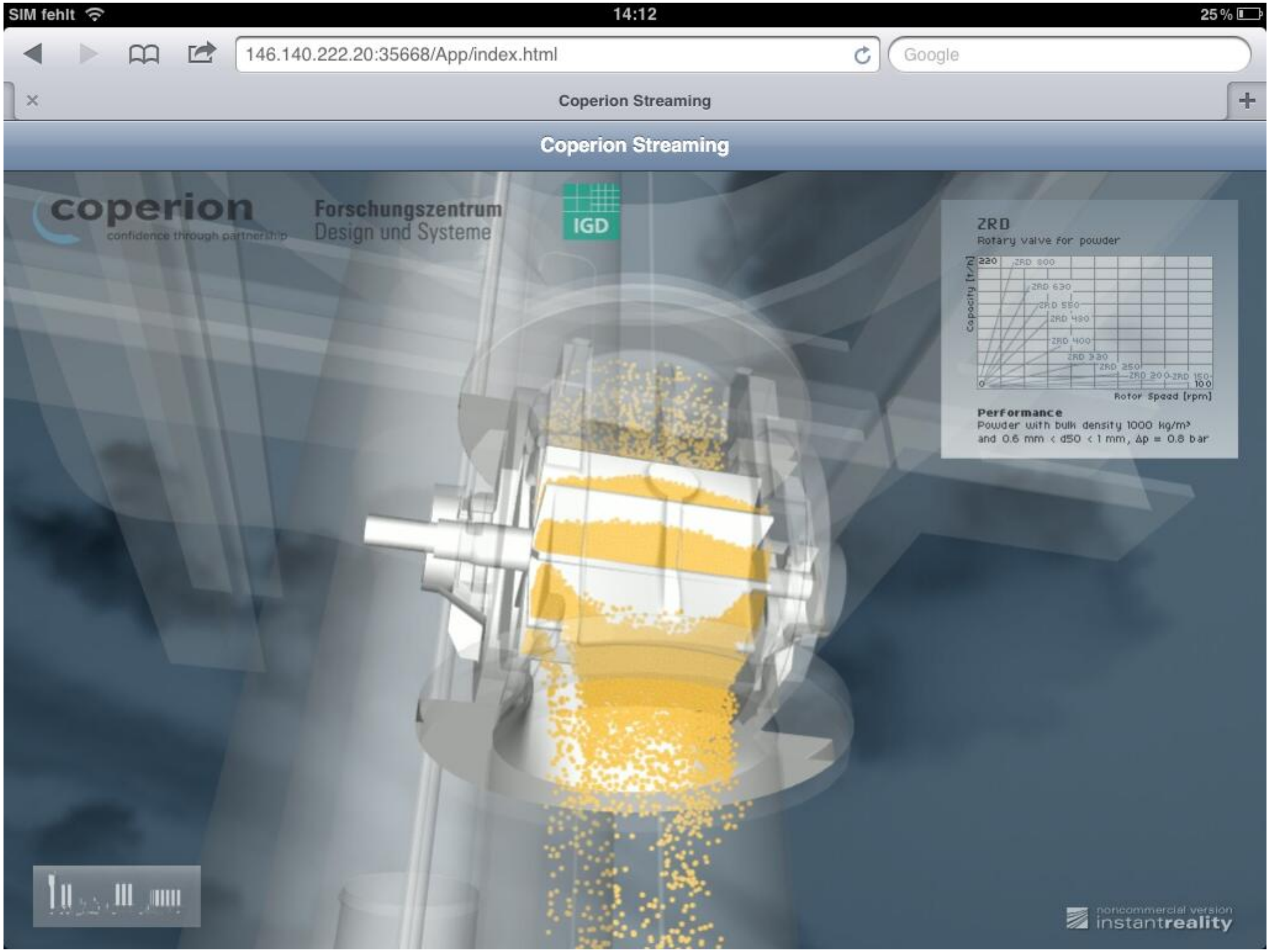
- Voice traffic tolerates a maximum one way delay of 150 ms.
- What about user interaction on cloud based applications?
- What are the requirements on the given network infrastructure?

Assumption:

With this new applications we are facing a new problem
that can only be fixed trough the network infrastructure.

Application

Application



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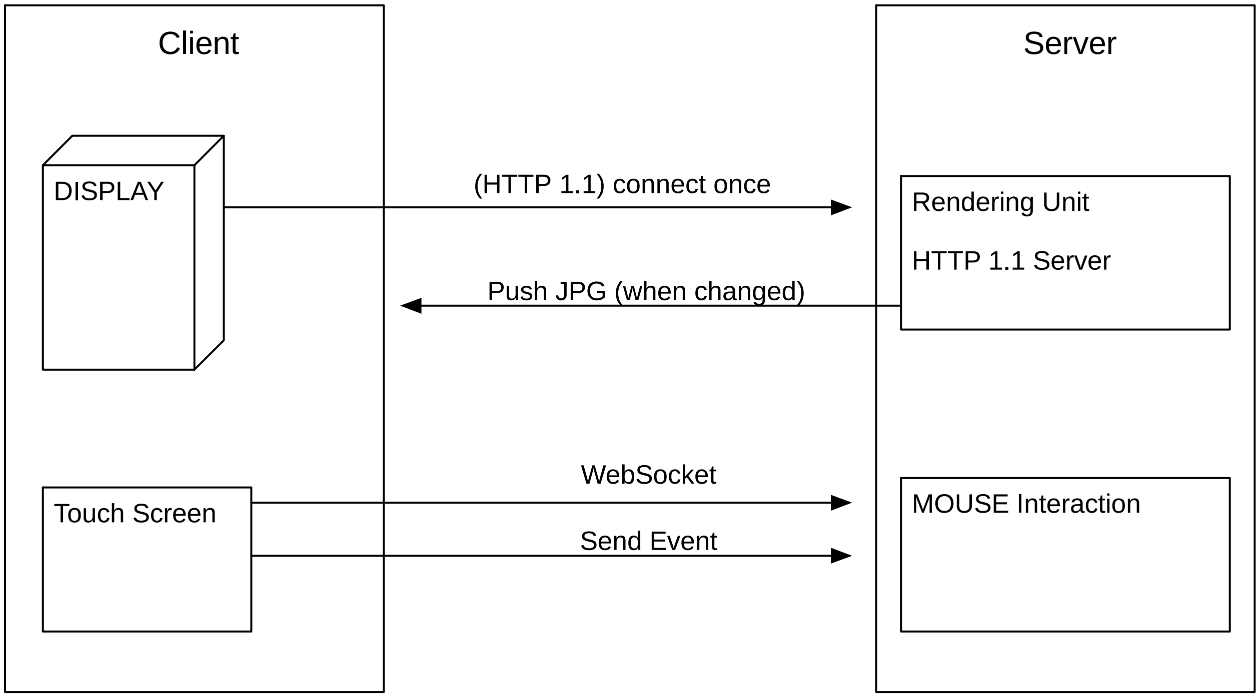
Cloud Based Application



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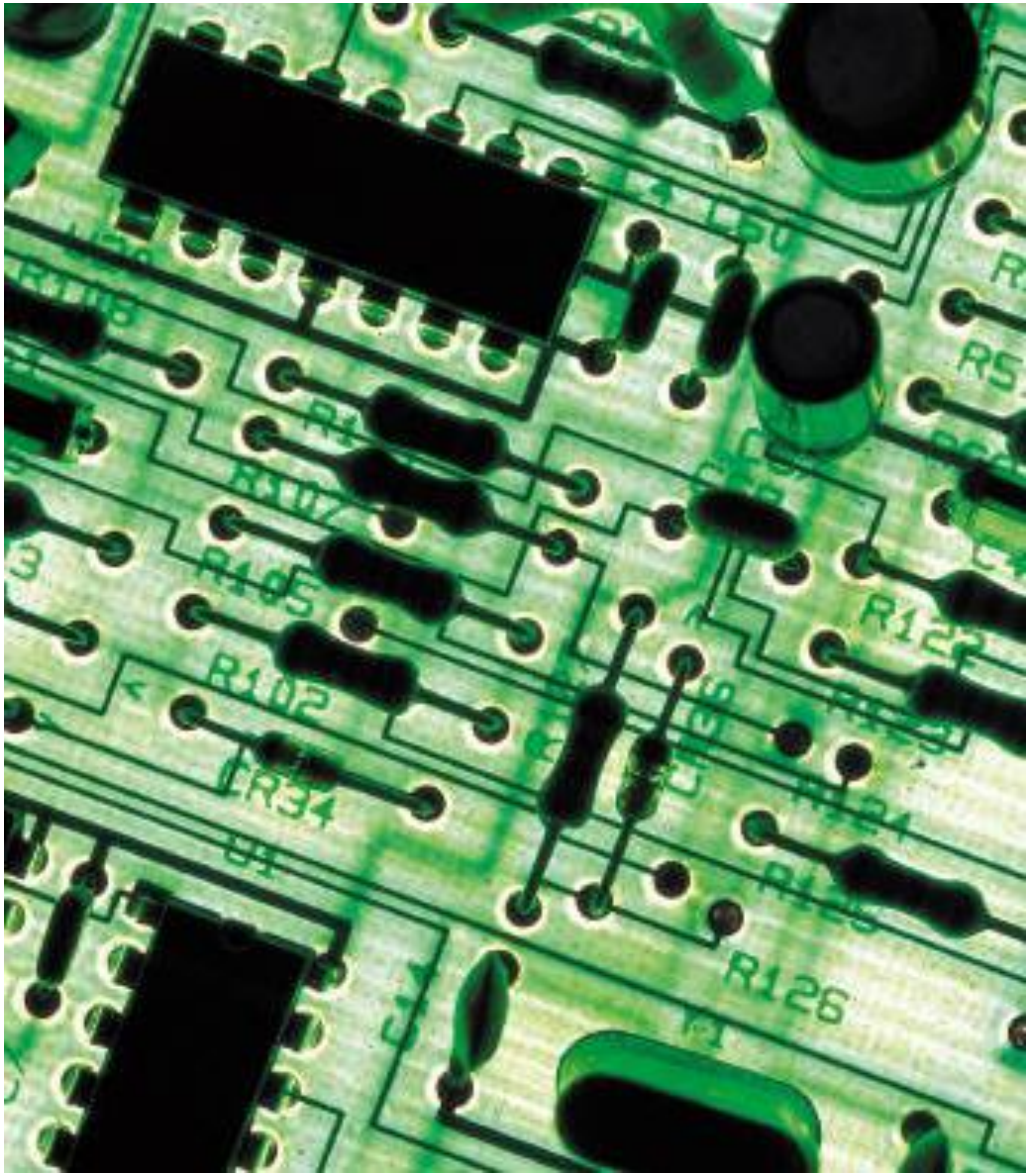

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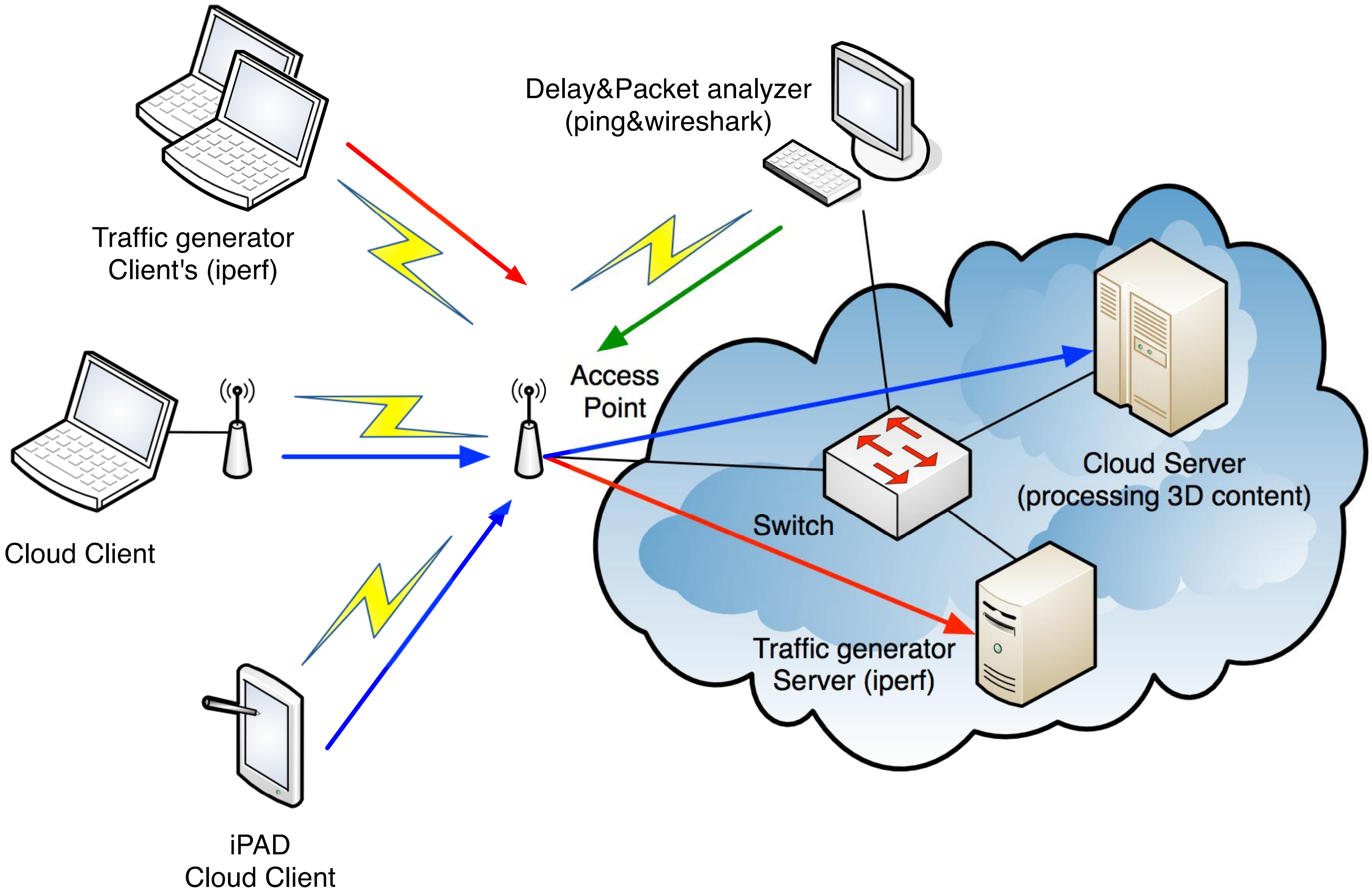
Experiment



Traffic generator
Client's (iperf)
Delay&Packet analyzer
(ping&wireshark)
Access
Point
Cloud Client
Switch
Cloud Server
(processing 3D content)
Traffic generator
Server (iperf)
iPAD
Cloud Client

Experiment

Infrastructure (WLAN):

- 2.4GHz spectrum
- Throughput of up to 144 Mbit/s
- 2(Tx) x 3(Rx) x 2(Spatial Streams) MIMO

Experiment

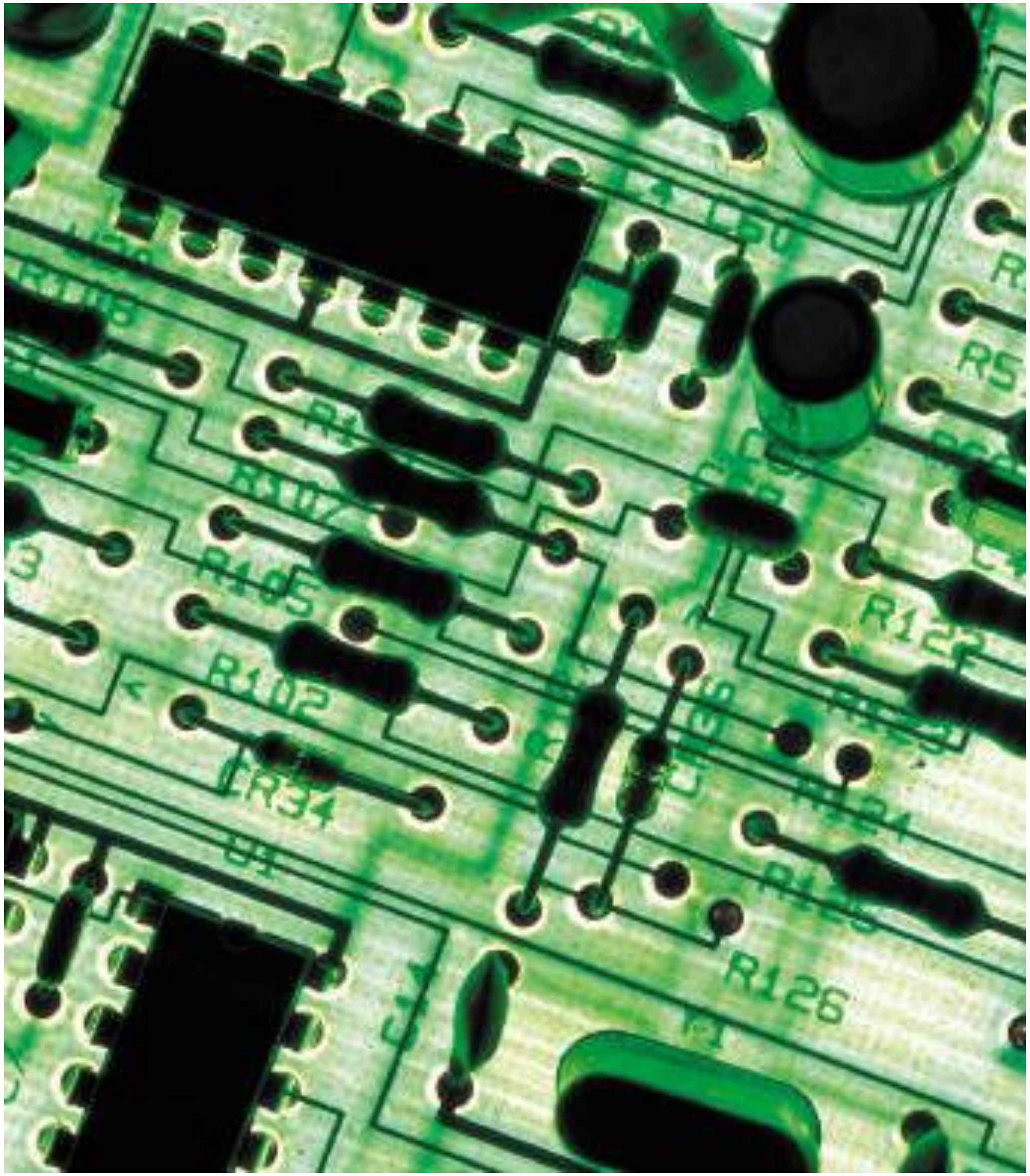
Application requirement: 4.6 Mbit/s bandwidth

Delay <=100 ms
Jitter <= 50 ms

Background traffic: 90 Mbit/s, 144 Mbit/s, 2x 144 Mbit/s

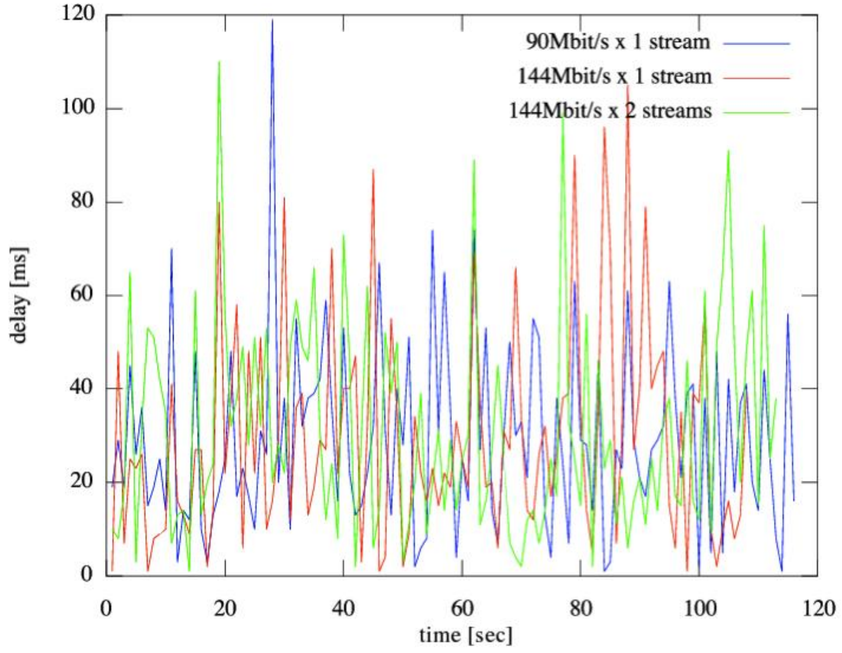
first scenario: no app. running
second scenario: app. running
third scenario: app. running + QoS

Content

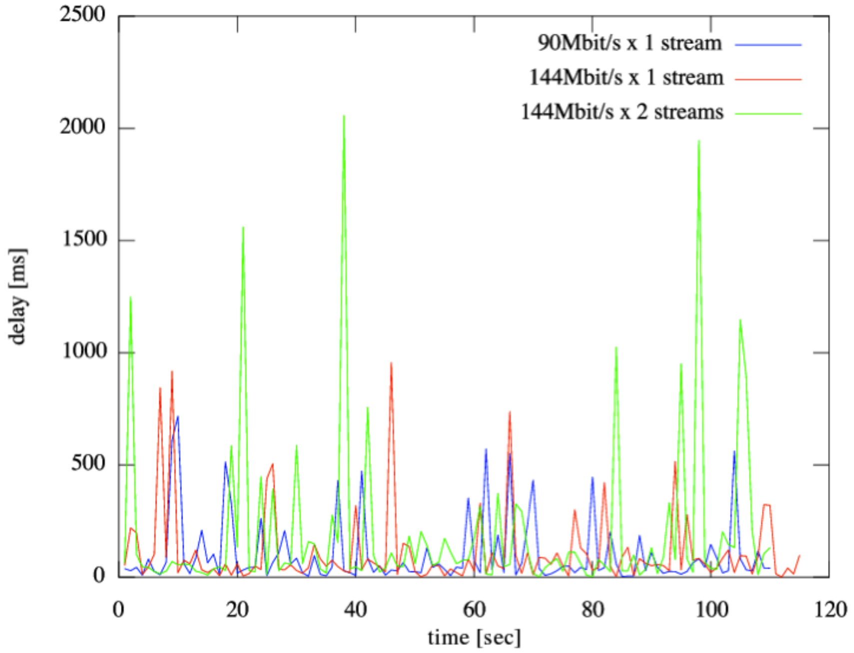


Results – Delay (1)

no app. running



app. running



Background Traffic	Delay
1x 90 Mbit/s	36 ms
1x 144 Mbit/s	32 ms
2x 144 Mbit/s	36 ms

Background Traffic	Delay
1x 90 Mbit/s	101 ms
1x 144 Mbit/s	110 ms
2x 144 Mbit/s	196 ms

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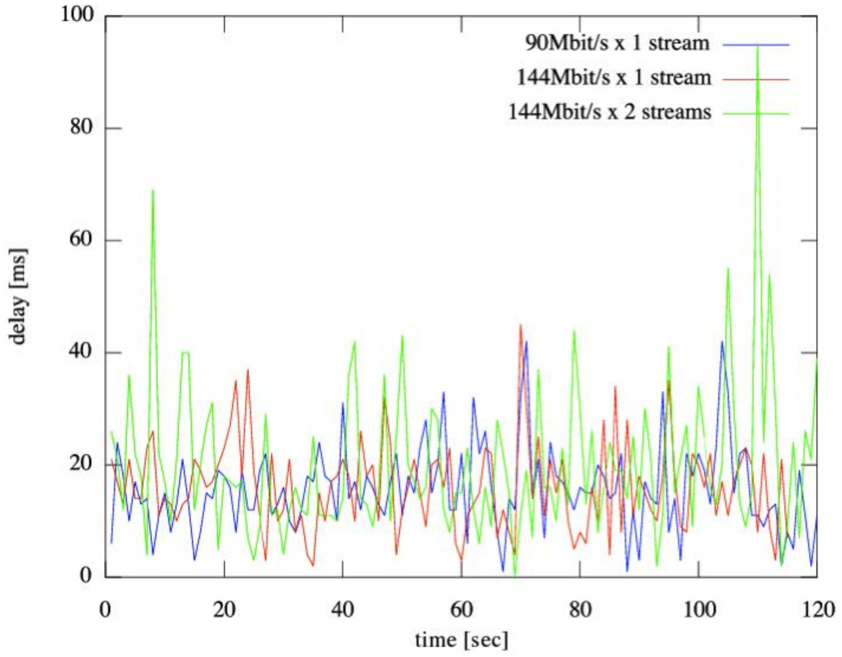
Results – Delay (2)

app. running + QoS



Background Traffic	Delay
1x 90 Mbit/s	17 ms
1x 144 Mbit/s	17 ms
2x 144 Mbit/s	20 ms

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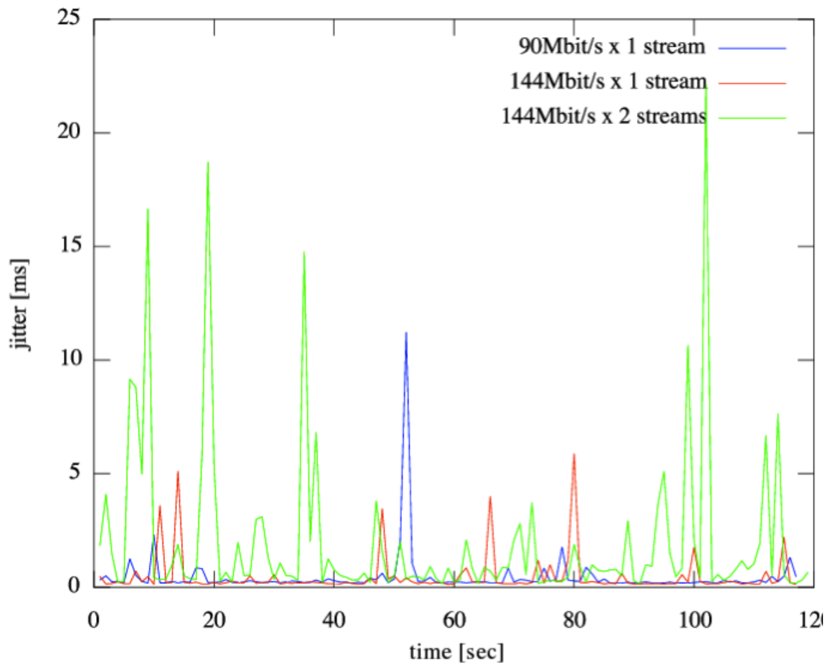
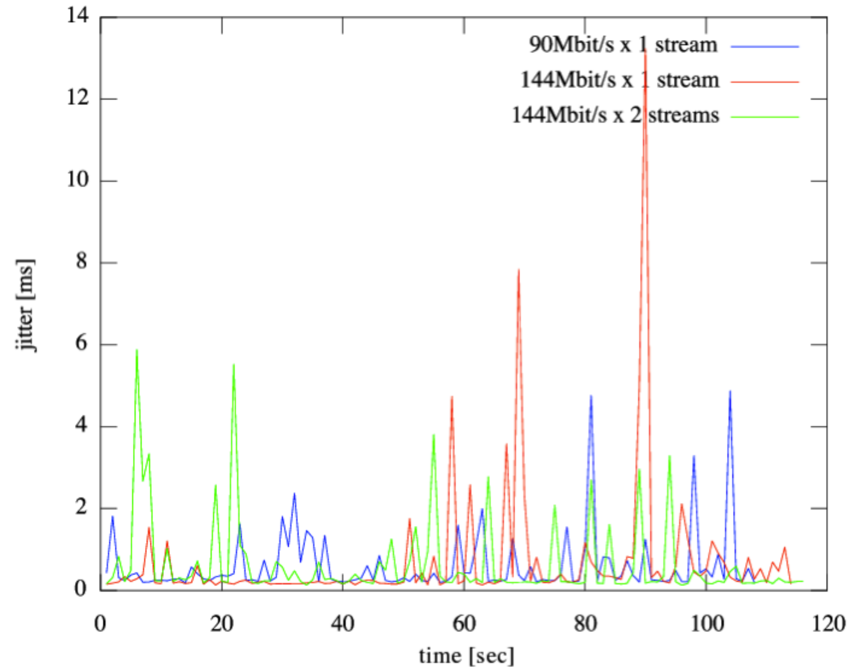
Results – Jitter (1)

no app. running



app. running



Background Traffic	Delay
1x 90 Mbit/s	0.5 ms
1x 144 Mbit/s	0.5 ms
2x 144 Mbit/s	1 ms

Background Traffic	Delay
1x 90 Mbit/s	0.6 ms
1x 144 Mbit/s	0.6 ms
2x 144 Mbit/s	0.7 ms

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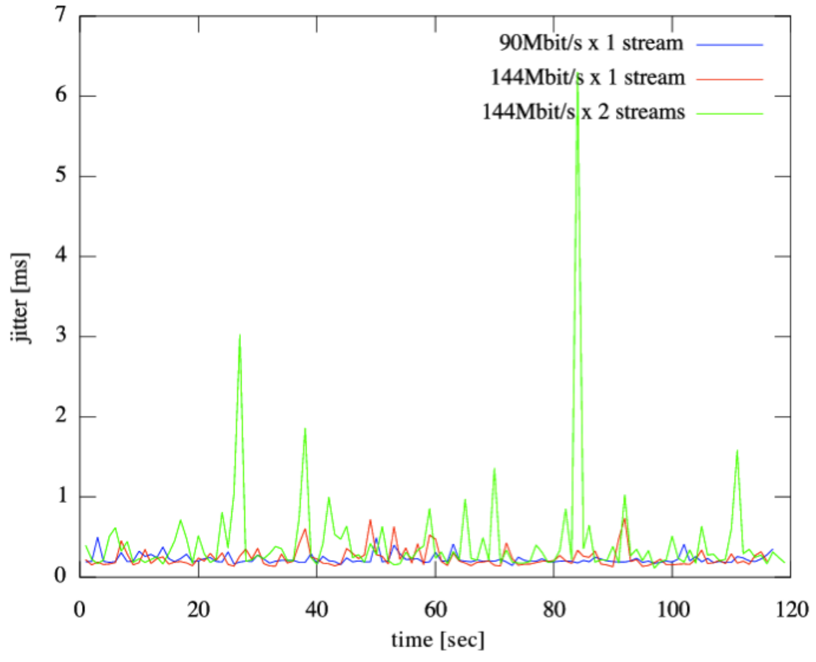
Results – Jitter (2)

app. running + QoS



Background Traffic	Delay
1x 90 Mbit/s	0.2 ms
1x 144 Mbit/s	0.2 ms
2x 144 Mbit/s	0.4 ms

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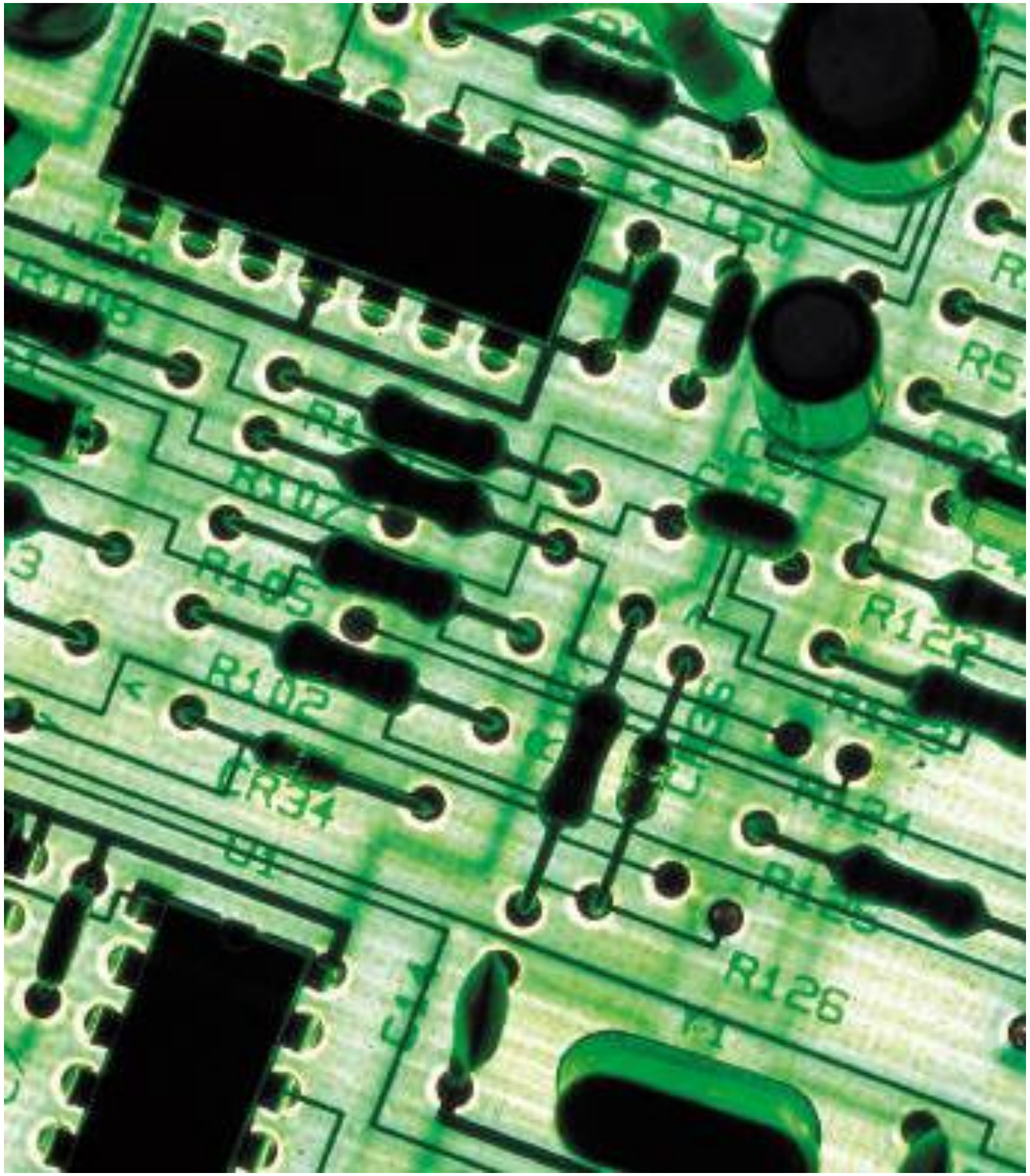

Conclusion

- QoS (IEEE 802.11e) improved delay as well as jitter thereby solved the problem

Another Problem:

QoS could only be implemented through the modification of lower layer parameters, i.e. class of service adjustments.

- Typical web application developers do normally not consider QoS and may not implement their application the right way or do not have the capability to implement QoS (e.g. when using a standard web-browser).

Further Question:

How do we implement QoS if the standard application layer (e.g. web-browser) does not support the necessary APIs?

What do you think?