

Long Haul QoS Measurements between CERN and Cracow

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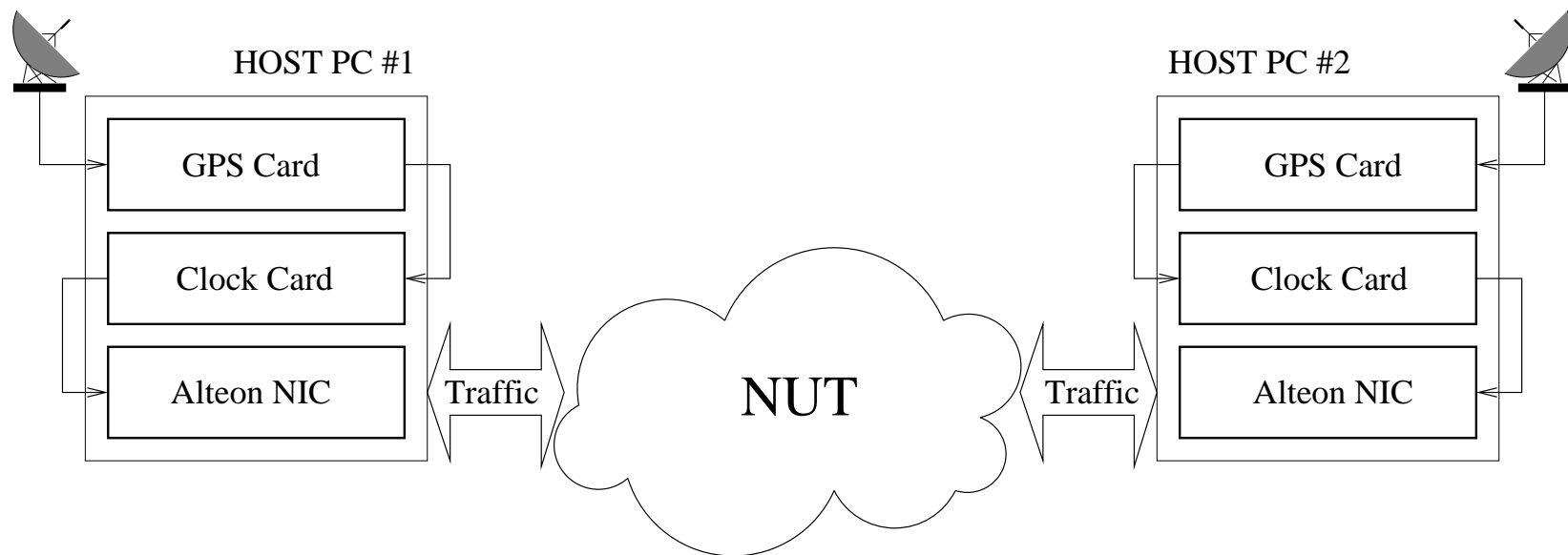
DataTAG meeting - February 7th, 2003



Why do long haul QoS measurements from CERN to Cracow ?

- part of feasibility studies on moving ATLAS event filter to off-site institutes (see accompanying talk of Bob Dobinson for more details)

Description of our measurement system



NUT = Network Under Test

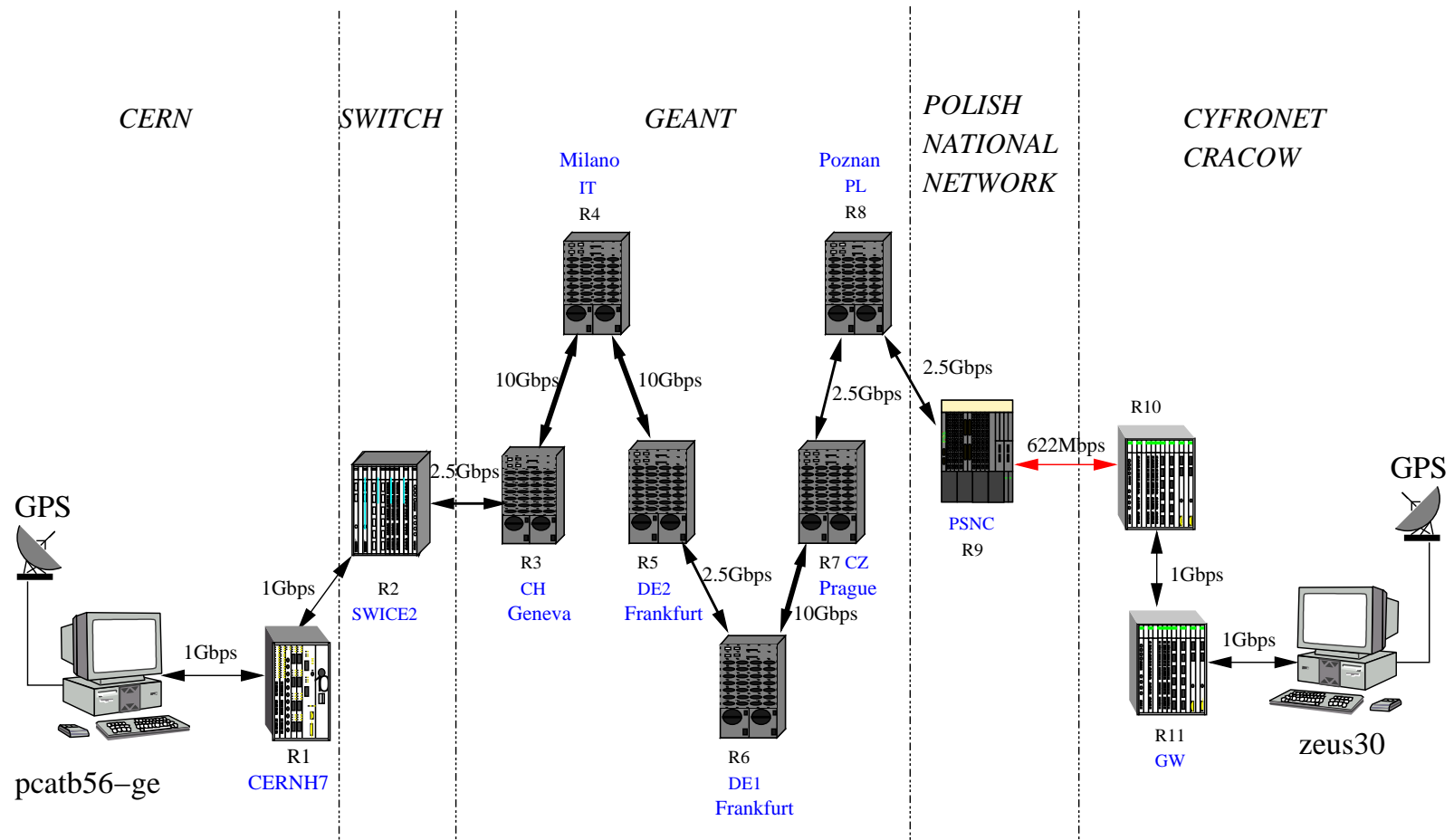
What can we measure ?

Network QoS parameters

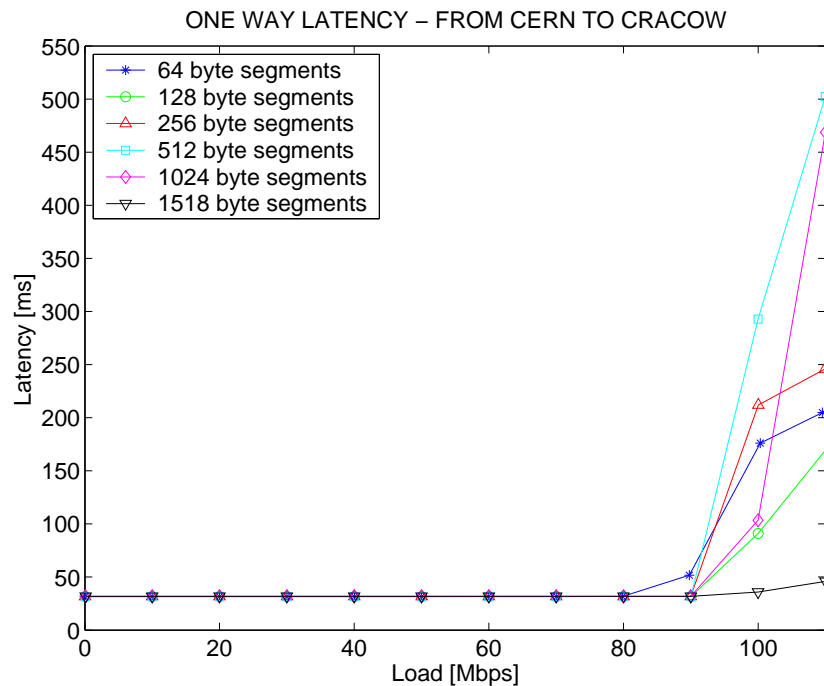
- one-way average latency*
- packet loss*
- average throughput*
- jitter
- latency histograms
- inter packet arrival time histograms
- IP packet re-ordering detection and quantification*

*real time in Alteon NIC

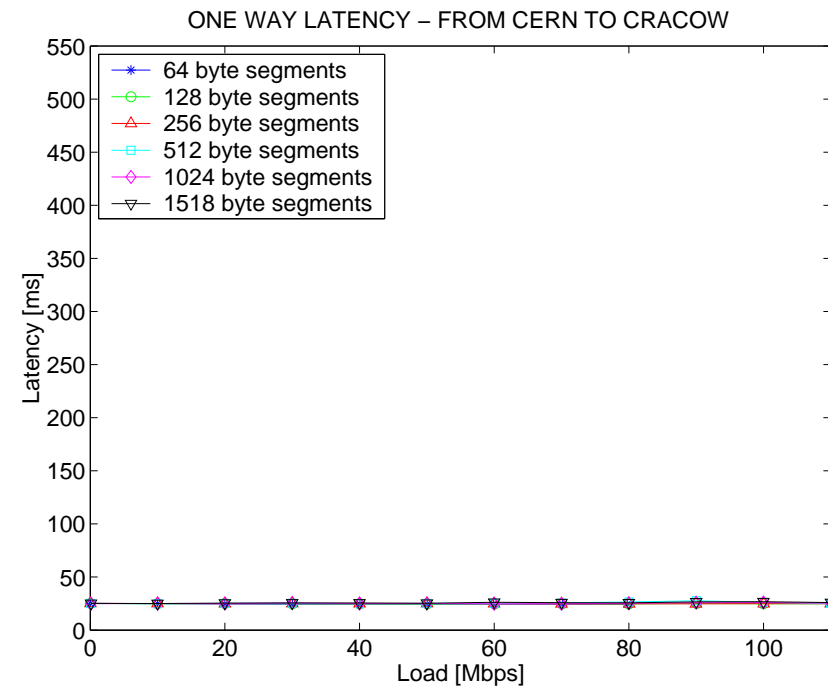
Setup



Average latency (CERN-Cracow)

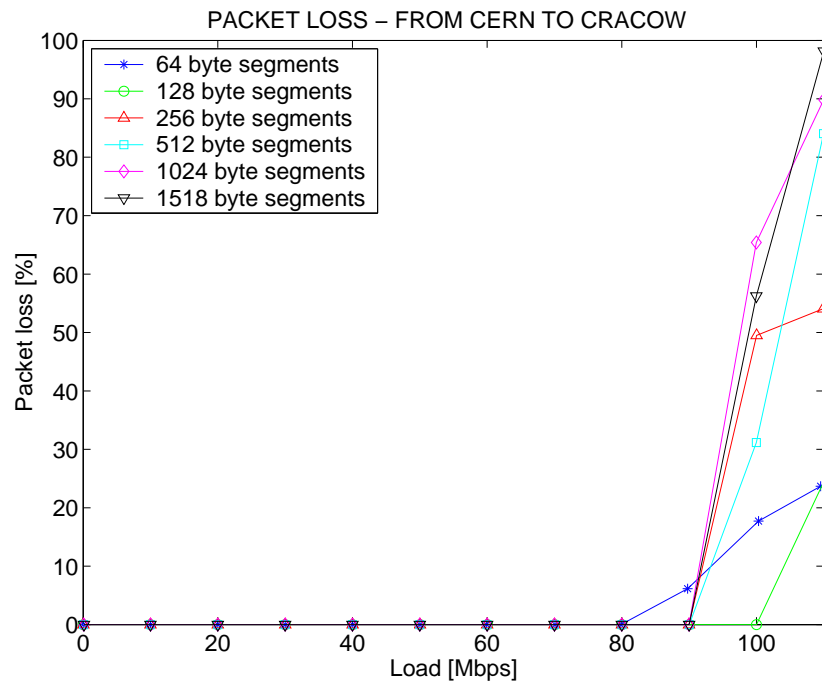


with allocated channel

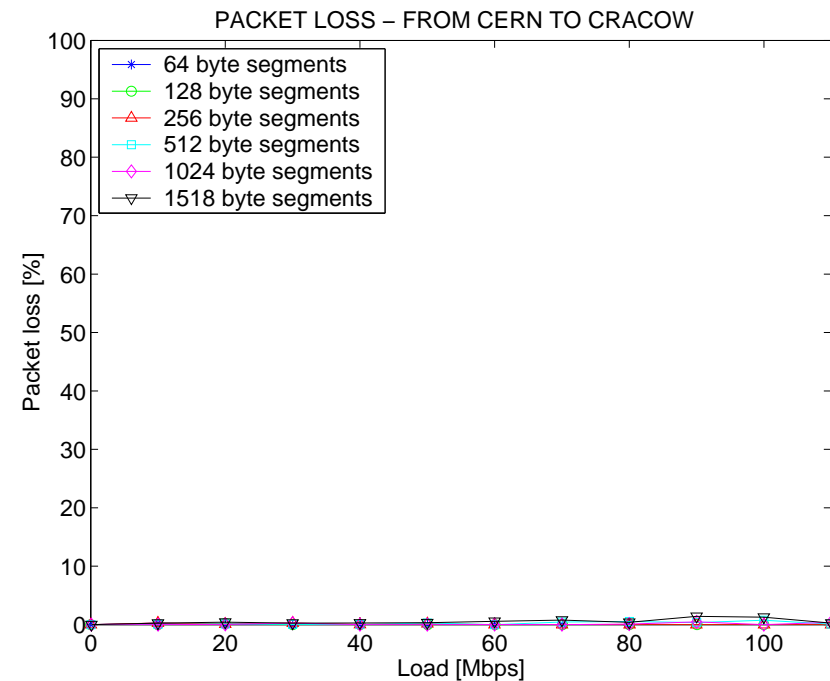


best effort

Packet loss (CERN - Cracow)

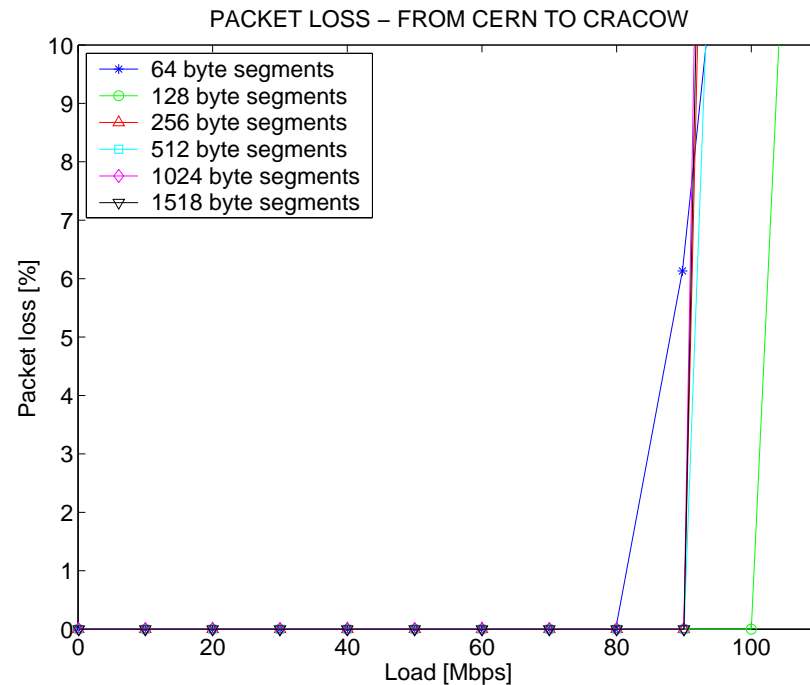


with allocated channel

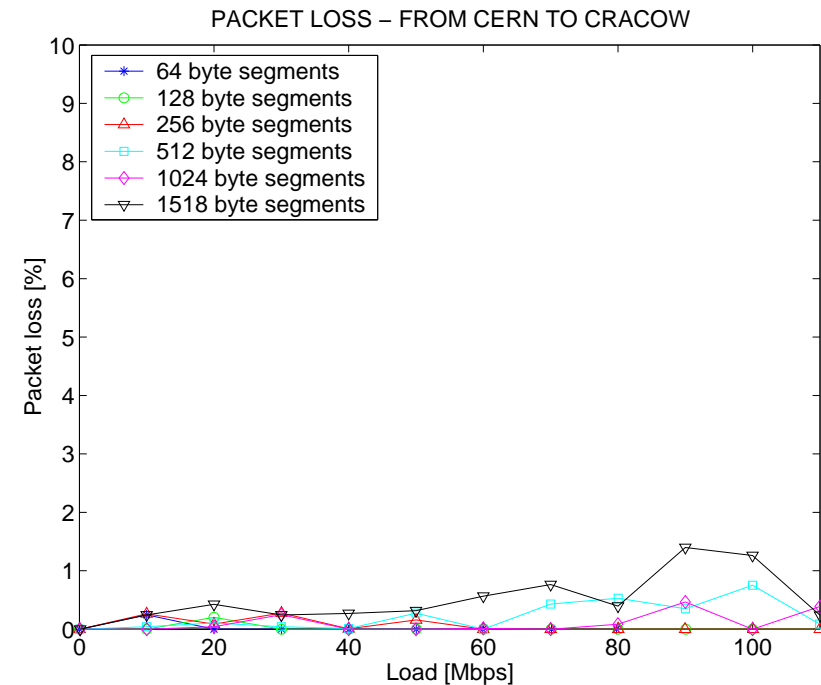


best effort

Packet loss - detail (CERN - Cracow)

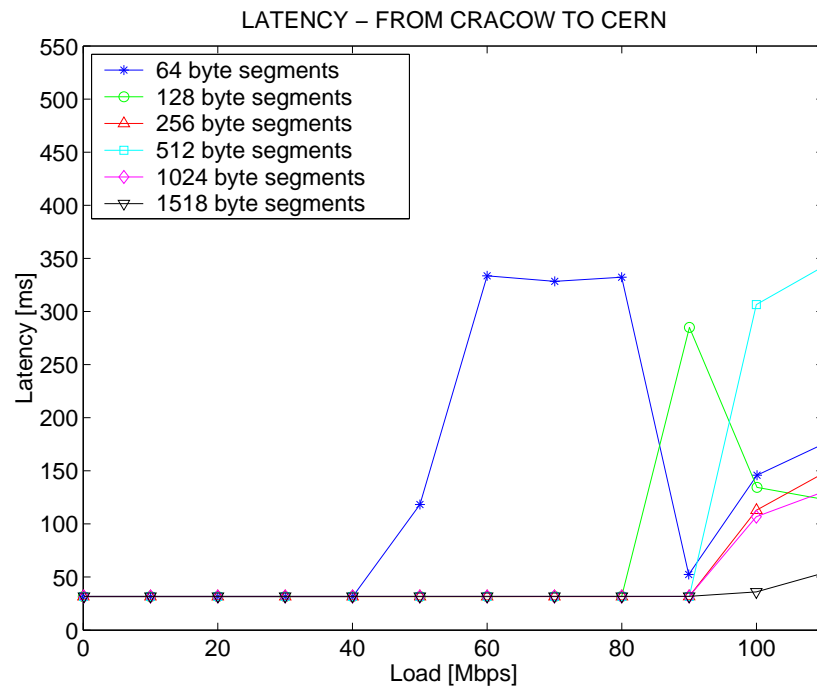


with allocated channel

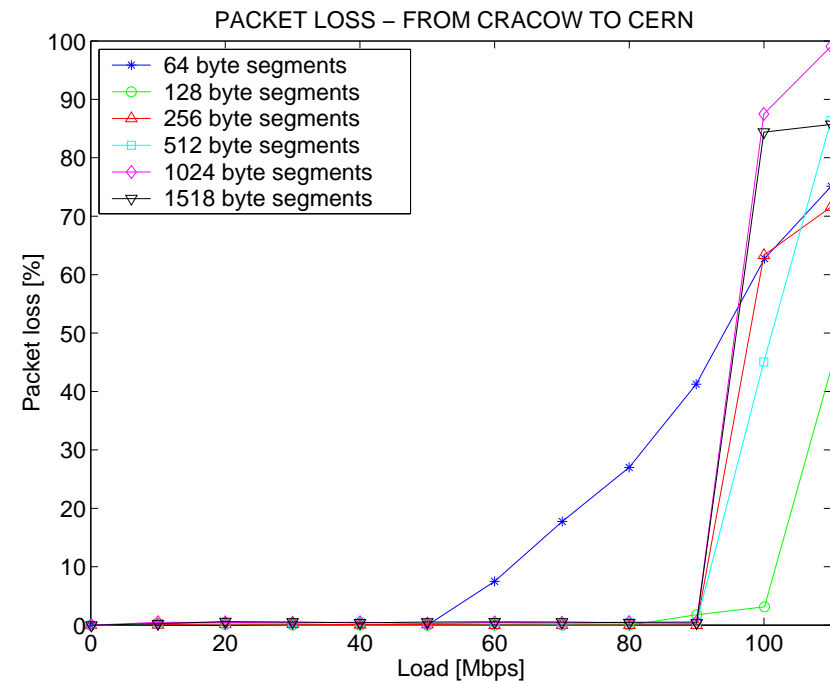


best effort

Allocated channel (Cracow - CERN)

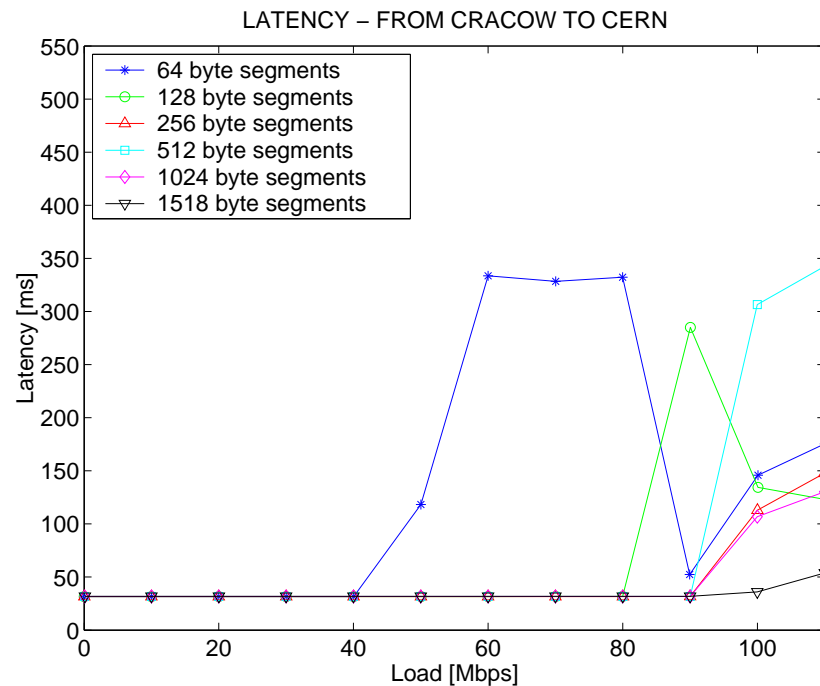


average latency

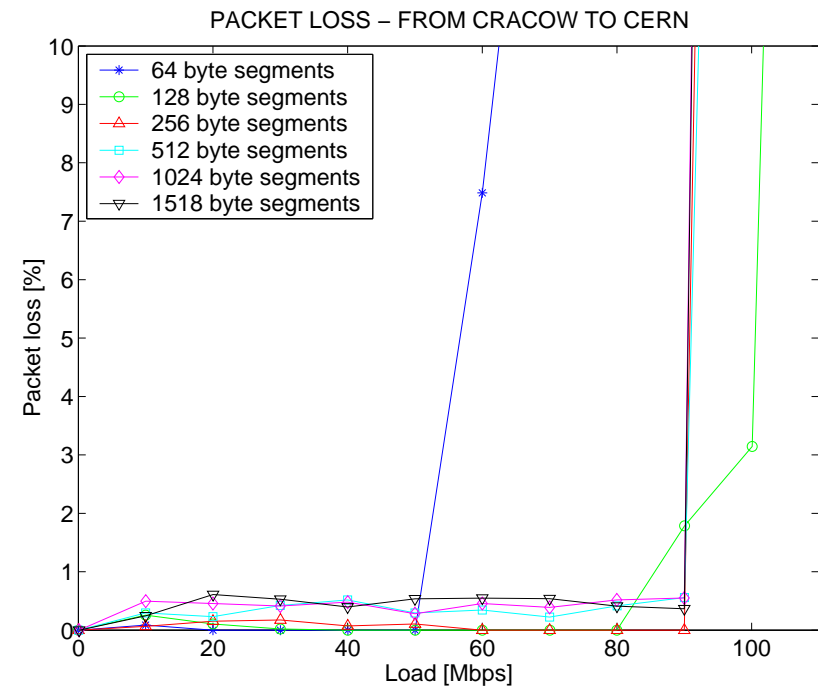


packet loss

Allocated channel - detail (Cracow - CERN)



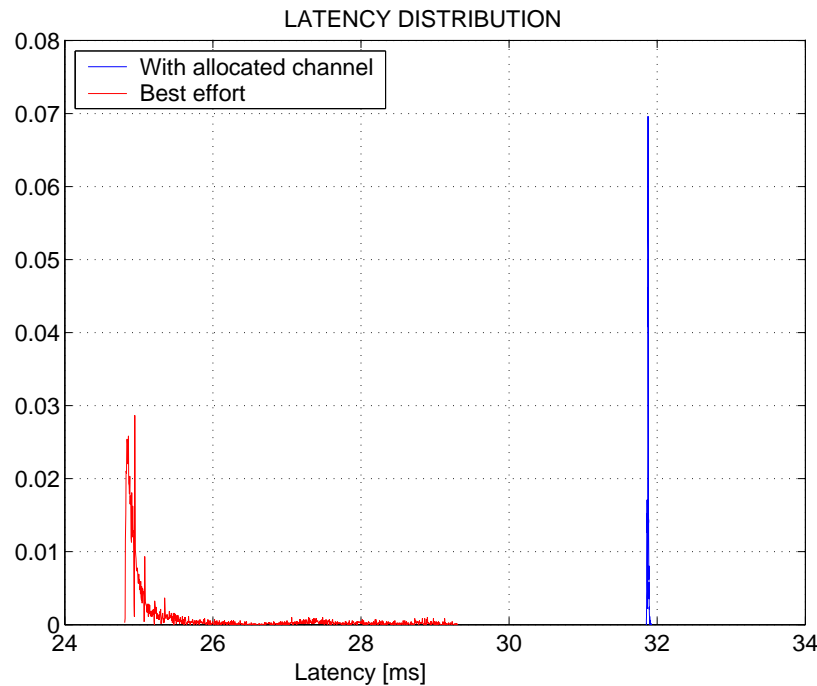
average latency



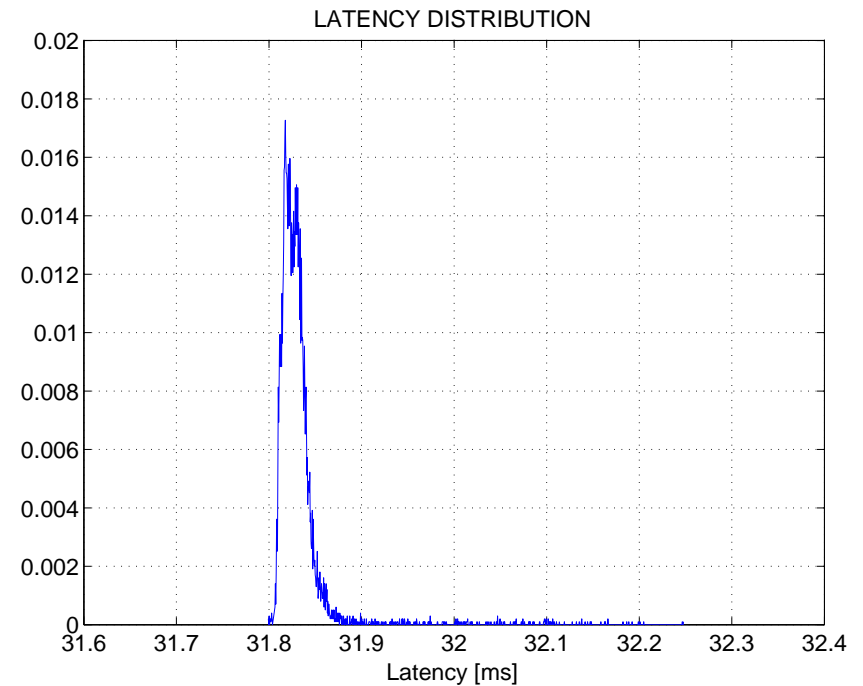
packet loss

Latency histograms

(1518 byte IP packets, 90 Mbps load, CBR traffic)



From CERN to Cracow



From Cracow to CERN

Comparison between the two directions

	CERN-Cracow direction	Cracow-CERN direction
with allocated channel	<ul style="list-style-type: none">* average latency almost constant* zero packet loss (for loads smaller than 90 Mbps)	<ul style="list-style-type: none">* higher variance for the average latency* small packet loss greater for 64 byte packets (for loads smaller than 90 Mbps)
best effort	<ul style="list-style-type: none">* average latency almost constant* very small packet loss (for all rates)	not reproducible



TCP/IP streaming - Preliminary results (I)

Conditions

- 1 Gbyte of data transferred from CERN to Cracow
- out-of-box TCP/IP
- custom application, used for laboratory tests, at rates approaching 100 Mbps
- no parameter tuning for TCP/IP
- asymmetric network conditions (worse for the return/acknowledgment path)



TCP/IP streaming - Preliminary results (II)

	With allocated channel	Without allocated channel
Average duration	579.66 s	567.18 s
Standard deviation	12.34	28.37
Average rate	13.8 Mbps	14.1 Mbps

Conclusions (I)

- the route from CERN to Cracow passes through the same routers, but the QoS behaviour of the network is asymmetric, being different in each direction
- in one direction, i.e. from Cracow to CERN, the network QoS parameters show larger variation than in the opposite direction
- the results for the best effort measurements (without the allocated channel), in the direction from Cracow to CERN, are not reproducible



Conclusion (II)

- allocation of a dedicated channel introduces an extra delay, but guarantees upper limits for the average latency and packet loss (if the rate doesn't approach the dedicated channel's capacity)
- there was no IP packet re-ordering detected during our tests
- for TCP/IP streaming - the average duration of the transfer is smaller (but not significantly) when there is no dedicated channel, but the standard deviation is larger
- obtained rate was far away from the capacity of the dedicated channel



Future work

- a better understanding of the Layer I and Layer II layouts for the CERN - Cracow connection (i.e. SONET and ATM)
- a more detailed investigation of the QoS behaviour of the network connection from Cracow to CERN
- a better understanding of the architecture of the network in Poland
- a more thorough study of TCP/IP transfer behaviour
- new measurements by summer, when the link between Poznan and Cracow will be upgraded to 3 Gbps
- new measurements with NBI, Copenhagen



Many thanks to people that helped us

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