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Packets or ports - the decisions of IP switching



Presentation for Voice, Video & Data
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Texas, USA.

2.11.1997 Mika Ilvesmäki - Helsinki University of Technology - Laboratory of Telecommunications Technology

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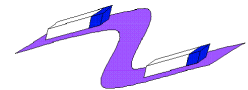


Presentation contents and results

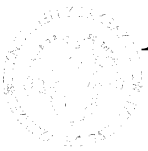
- Brief introduction to
 - IP switching and a simple model of IP switch performance
- Network traffic measurements
 - Concept verification
- Three stage flow analysis
- Major result: Decision to switch should be based on packet count.



IP-flow



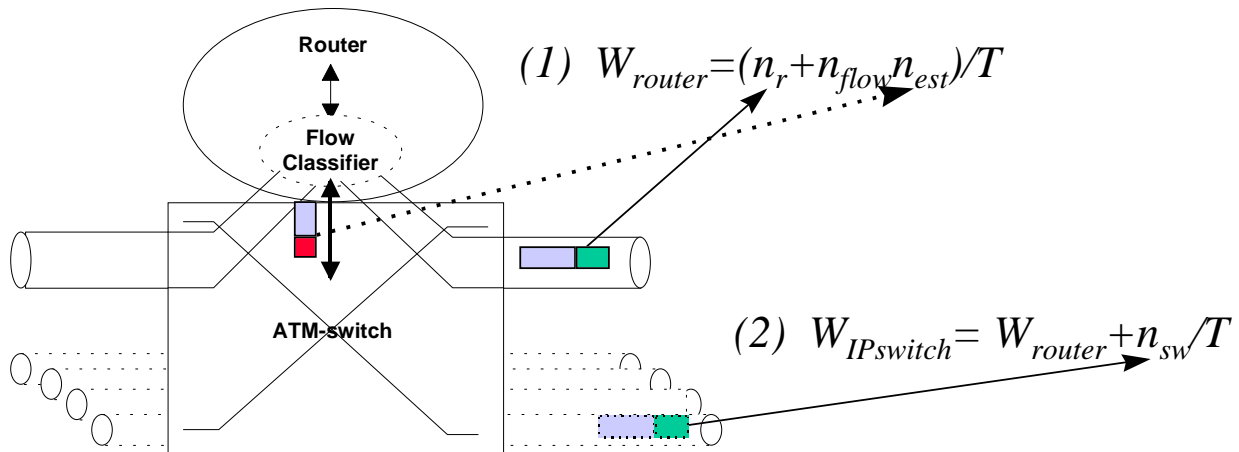
- *An IP-flow consist of IP-packets with similar characteristics*
 - **source and destination addresses**
 - IP Address prefix pairs - coarser granularity
 - **application markers (TCP-ports)**
 - TTL, ToS, etc.



IP switching and the workload model

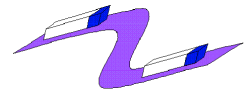


- Do the route look-up for the first packet(s)
- Flow criteria: Address (and Port) pair
 - Threshold to switch: *pktcount/flow*





Traffic Measurements



- Two bridged 10 Mbit/s HUT LANs
 - small network: 10s of users
 - large network: 100s of users
- Working hours(9 a.m. - 11 a.m.)
- TCPDUMP and manual flow analysis



Flow analysis stage 1



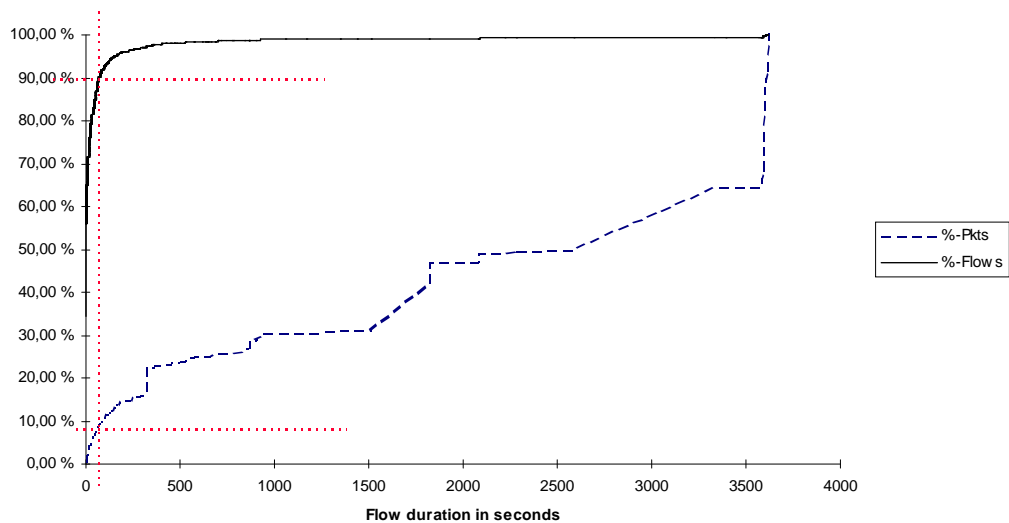
- Objective: Find out the proportion of flows and packets these flows carry.
 - If there are lots of packets on few flows, the switching of the flows might be justified.
 - New IP address pair -> New flow
 - 60 second flow timeout
 - Measure packets sent in a flow



Large network - flow analysis 1



The cumulative proportions of packets and flows compared to flow duration



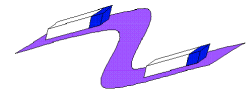
Results from flow analysis 1



- Main result: 10 % of the longest flows contain over 90% packets
 - Flow switching is justified and could be applied
 - Speed of flow setups and pkts/s
 - Flow criteria: Address pairs
 - Small network
 - 0.28 flow setups/s and 28 pkts/s
 - Large network
 - 1.97 flow setups/s and 152 pkts/s



Flow analysis stage 2



- Objective: Traffic profile and indication of services suitable for switching and the effect on flow setup speed of selecting flows to be switched
 - Flow criteria
 - Address pairs **and** port pairs



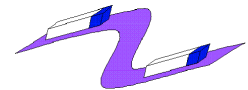
Flow analysis 2 - Results



- Main Result: 10 times higher flow setup speeds than in flow analysis 1 (2.8/28 flow setups/s)
 - If 50 % protocols are selected we achieve approximately 50 % of deduction flow setup speed
 - Still much higher than in flow analysis 1



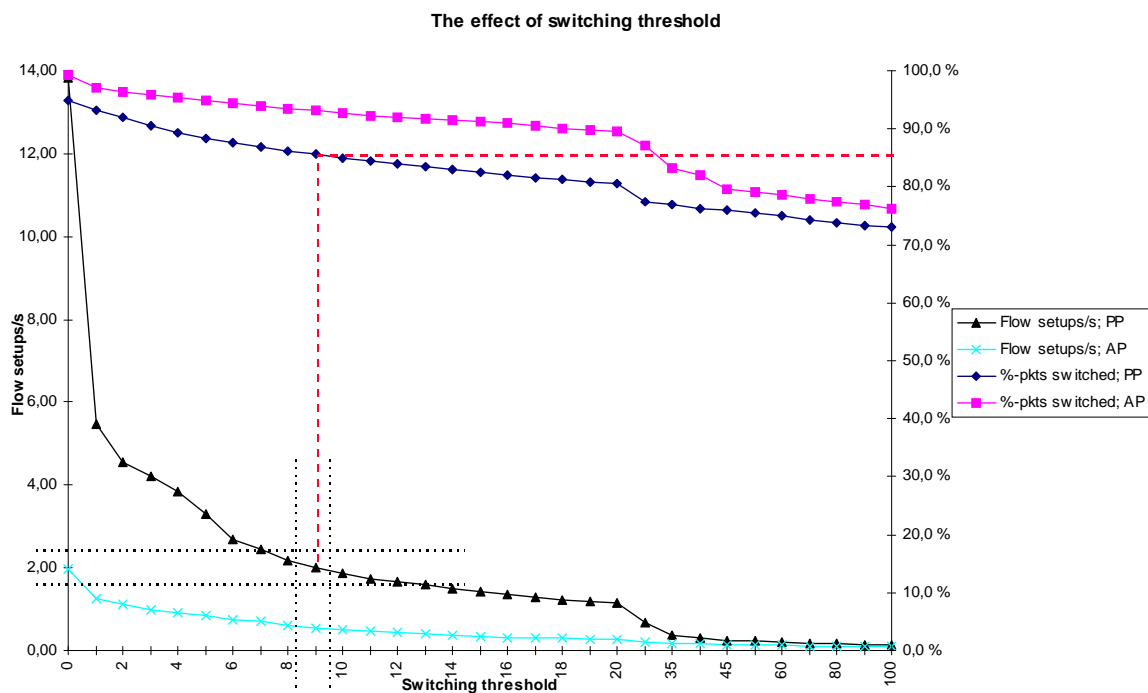
Flow analysis stage 3



- Objective: Pick out only those flows containing “enough” packets.
 - Determine flow setup speeds on different levels of “enough”
- Flow criteria
 - Address pairs **and** port pairs **and** packet count threshold on an individual flow

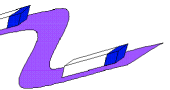


Large network - flow analysis 3





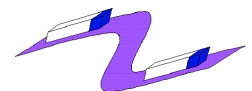
Results from flow analysis 3



- Main Result: If a packet count threshold is applied we achieve flow setup speeds that are in the same magnitude as those obtained in the flow analysis 1
 - We achieve the high performance with segregate service profile -> ability to offer QoS
 - At forementioned threshold levels using port pair -flows over 80% pkts get switched



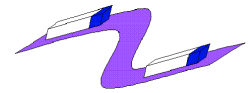
Workloads for different components



- Router/Classifier
 - workload is reduced 70 % (avg.) at 8 to 15 packets threshold
- Whole IP switch workload reduced when using packet count
 - workload is significantly reduced at 10 to 25 packets threshold



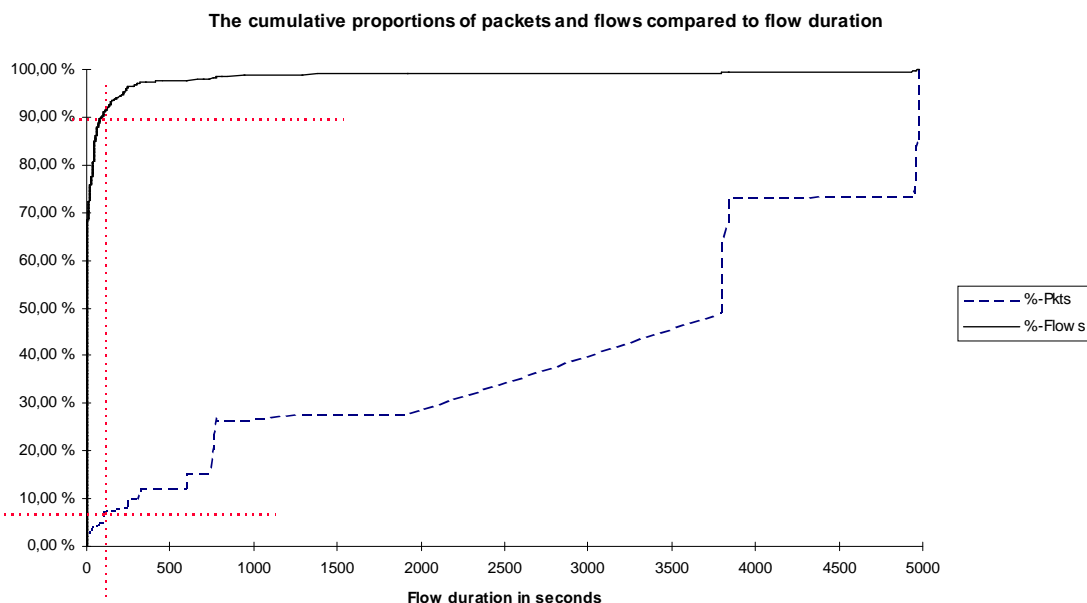
Conclusions and results



- Using port pairs with packet count threshold, router workload may be reduced 70% compared to using port pairs without packetcount threshold
- Measurement based traffic profile should be investigated
 - Difficult to determine switchable services based purely on TCP-port numbers
 - Neural Networks, Pattern recognition and DSP-methodology in general

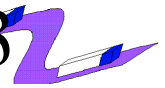


Small network - flow analysis

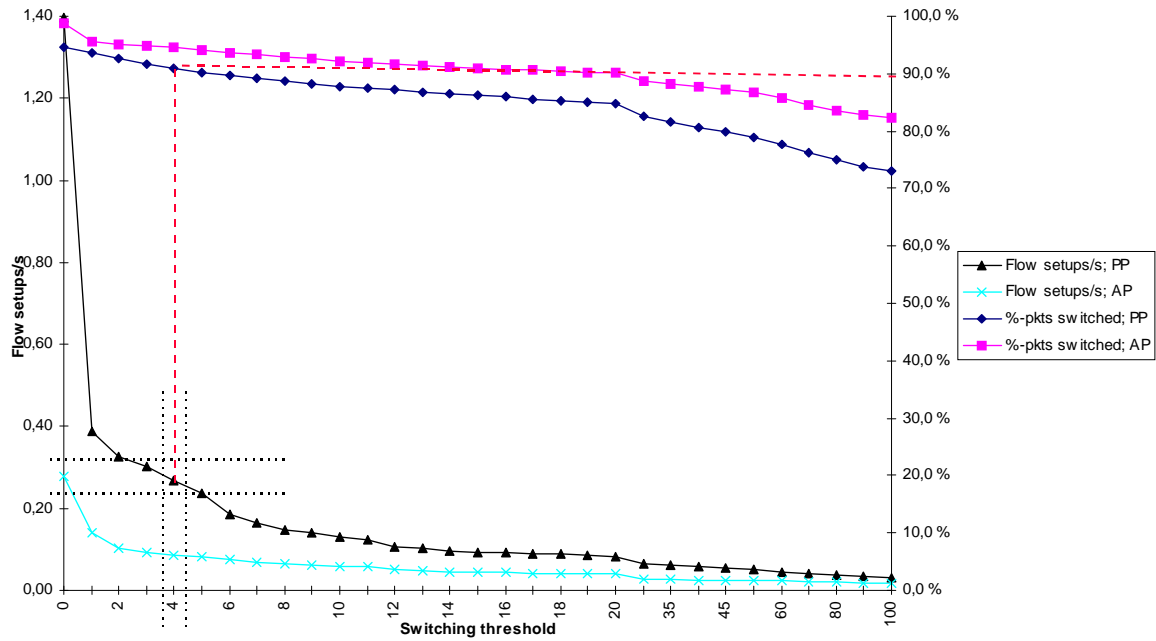




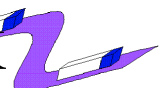
Small network - flow analysis 3



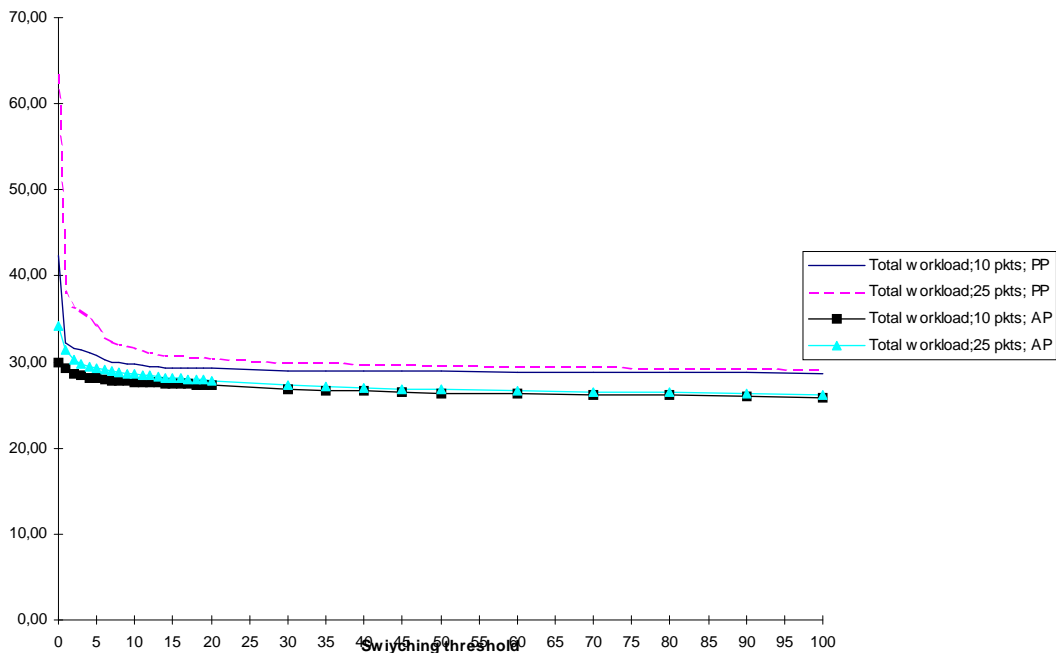
The effect of switching threshold



Workload: IPsw small network

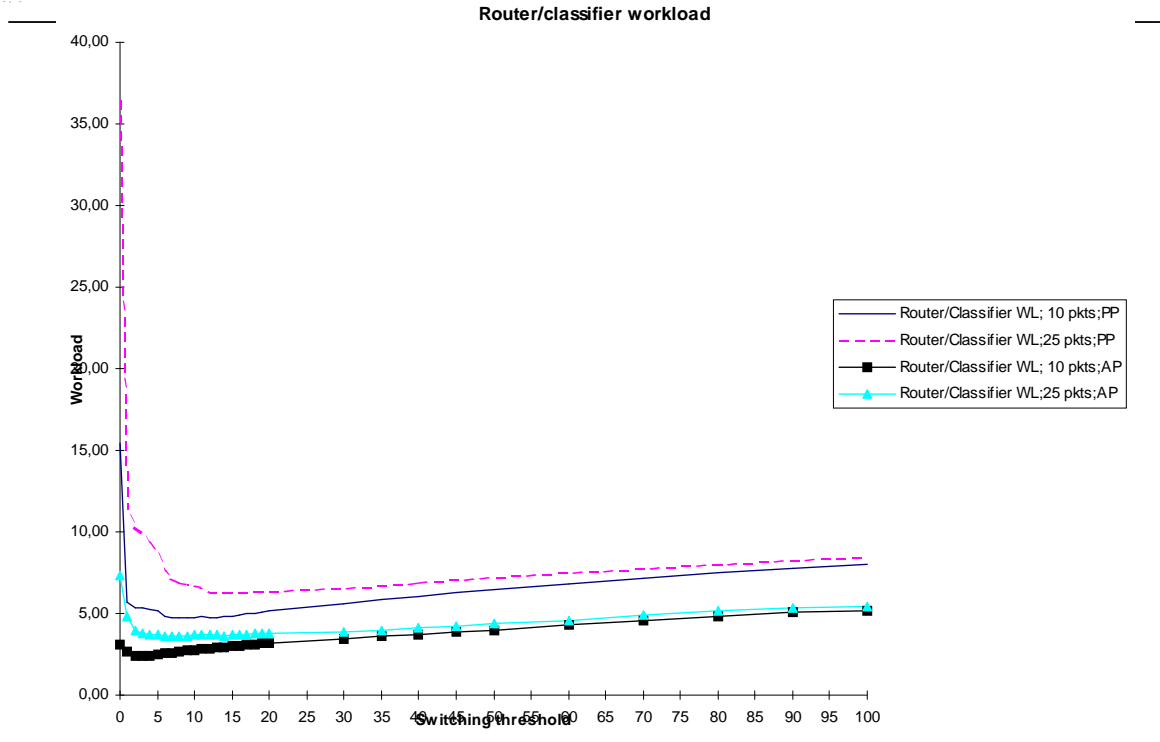
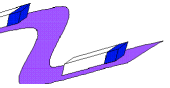


Total workload for an IP switch

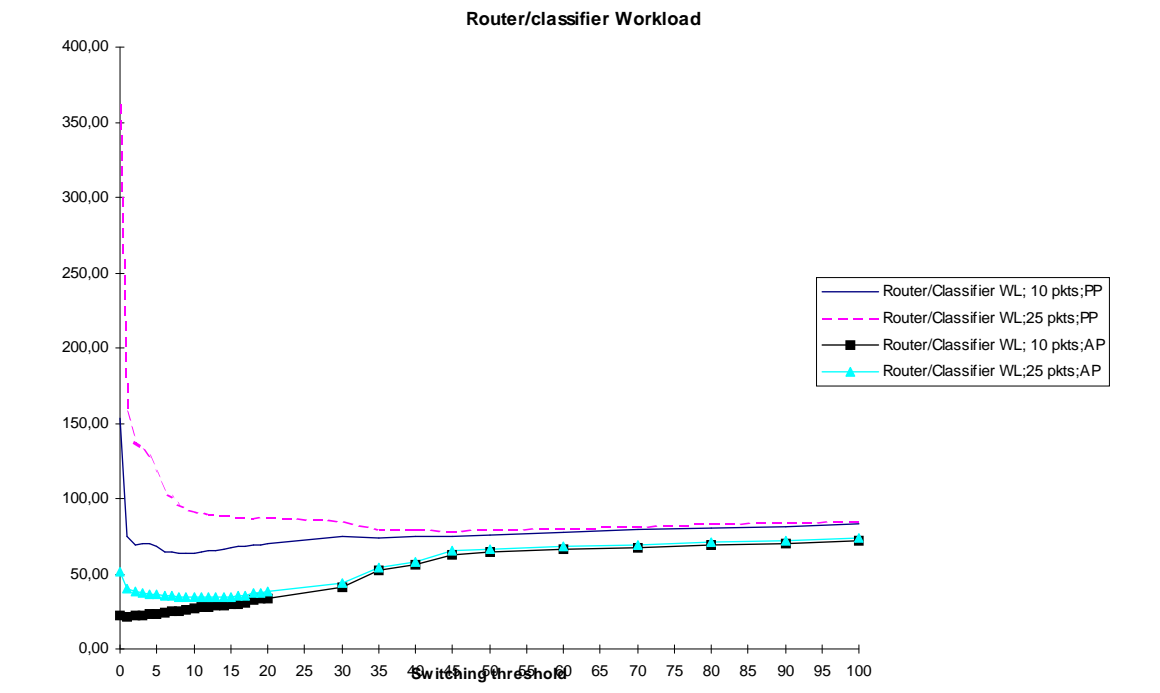
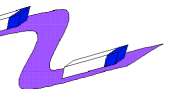




Workload: R/C small network

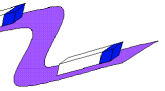


Workload: R/C large network





Workload: IPsw large network



Total workload for an IP switch

