I²MP - A high precision measurement platform for IP traffic

Detlef Saß, Sascha Junghans

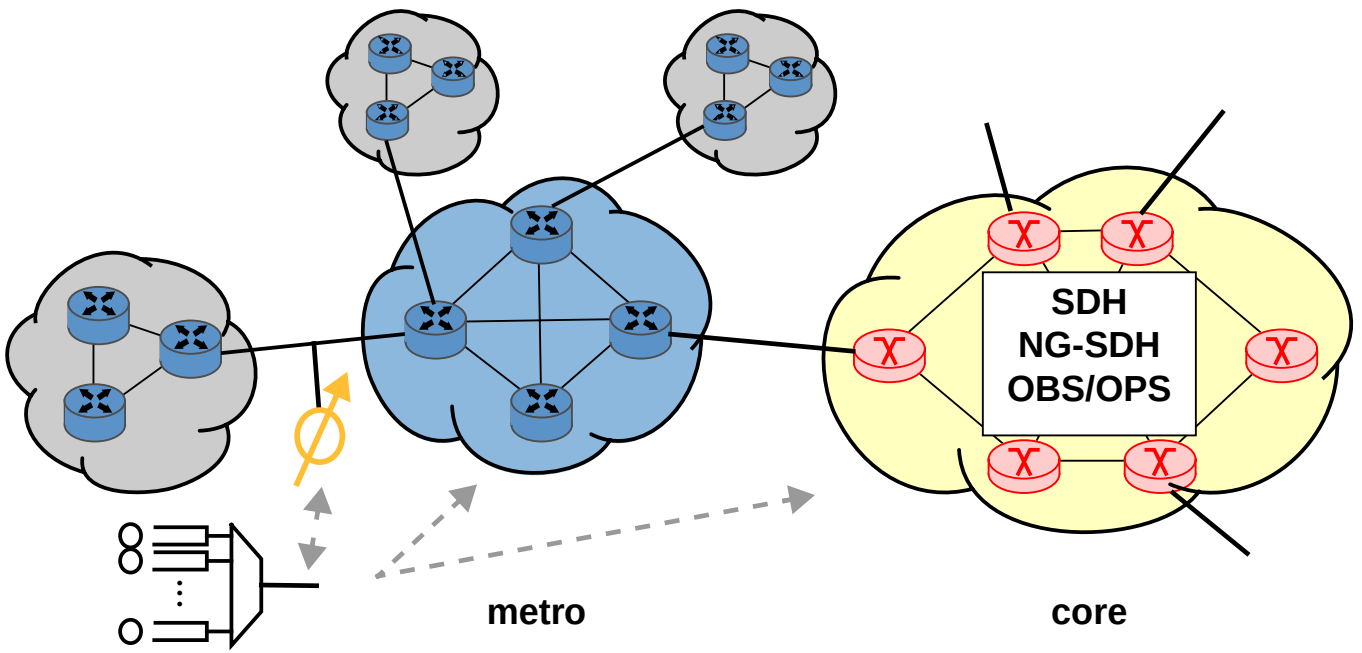
{sass,junghans}@ikr.uni-stuttgart.de

July 28th, 2004

- Motivation
- Overview and features of I2MP
- Comparison SW/HW-based measurement
- Measurement Environment

Motivation

- **Performance evaluation and analysis of networks, technologies,...**
- **Investigation of appropriate models for aggregated traffic of metro/ core networks for**
  - existing network technologies
  - next generation high speed photonic networks (e.g. OBS/OPS)



Motivation (2)

- **Measurement data builds basis for**
  - revealing characteristics of traffic
  - verification of different traffic models and modelling approaches

  ➥ reliable measurement data is mandatory

- **Measurements capture arrival time of packet and packet header**
- **Increasing bandwidth at measurement point results in**
  - smaller packet interarrival times (e.g. min 670 ns for Gigabit Ethernet)
  - higher amount of data and processing burden
- **SW-based measurement has limitations concerning time accuracy and performance due to inherent OS's scheduling and time properties**

➥ **Measurement equipment with high time precision and high performance required to obtain reliable data**

Advantages of self-developed measurement equipment

- **More flexibility and design freedom**
  - adaptable to actual needs
    e.g. different media interface cards
  - easily extendable, changeable
  - detailed knowledge of quality of implementation and realisation
- **Benefit form rich knowledge of Digital System Design**
- **Build competence regarding**
  - physical constraints at higher speeds
  - time synchronisation requirements

I²MP Properties

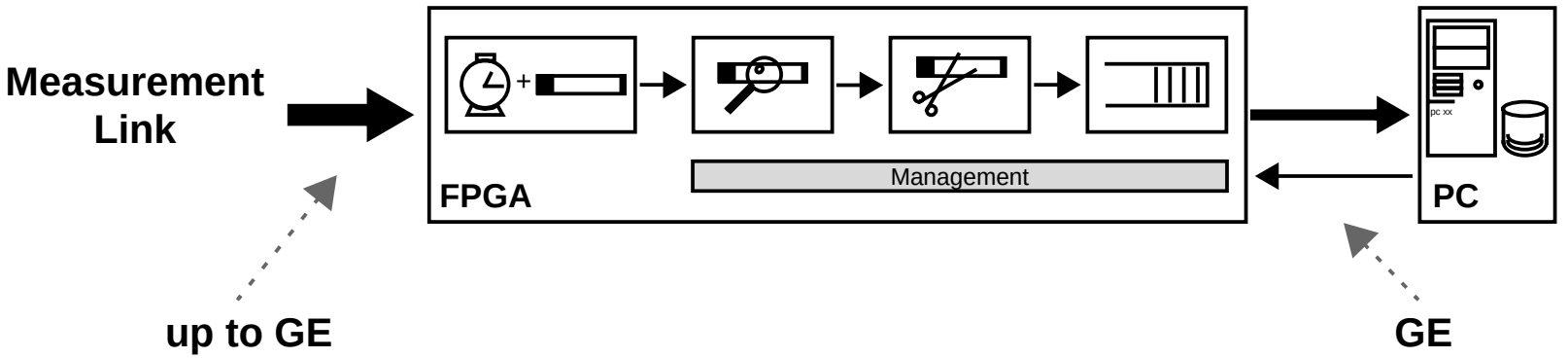
I²MP: IKR's Internet Measurement Platform

- **Passive measurement platform**
- **Time and performance critical tasks are performed highly accurately by HW**
- **Storage & control functionality realised on standard PC**

- **Gigabit Ethernet interface cards (TX/LX)**
- **Time synchronisation via DCF receiver**
- **HW-Unit and Storage PC interconnected via standard Gigabit Ethernet**

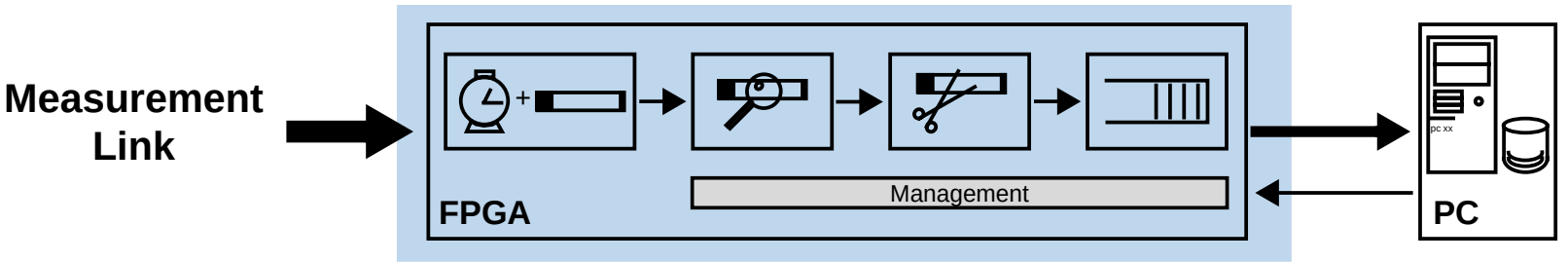
- **Trace data in ascii and libpcap format**
- **Offline processing tools**

I²MP Architecture

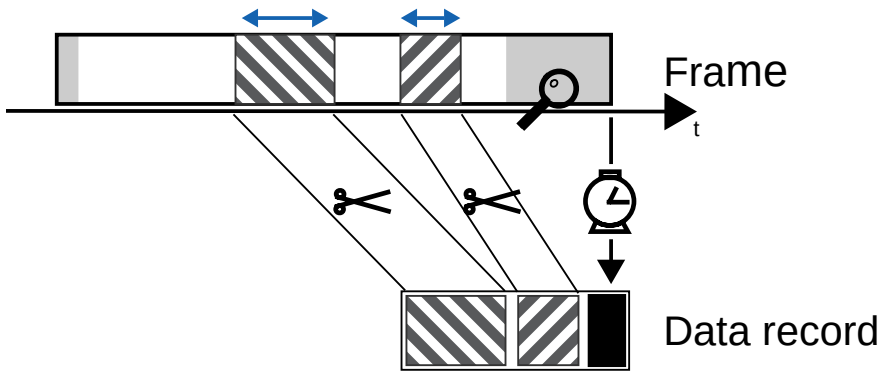


GE ... Gigabit Ethernet

I²MP - HW-Unit

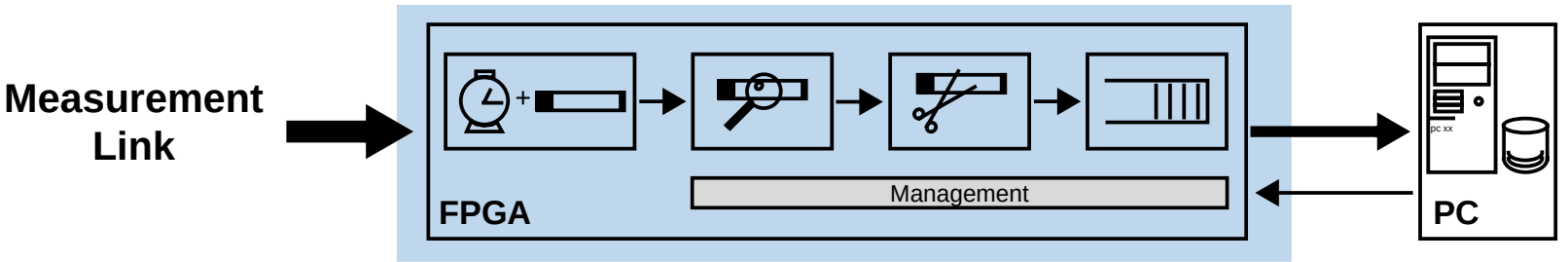


- **FPGA based (Altera)**
- **Time resolution < 100 ns**
- **Amount of captured data is configureable**
  - complete packet
  - two independent selection windows

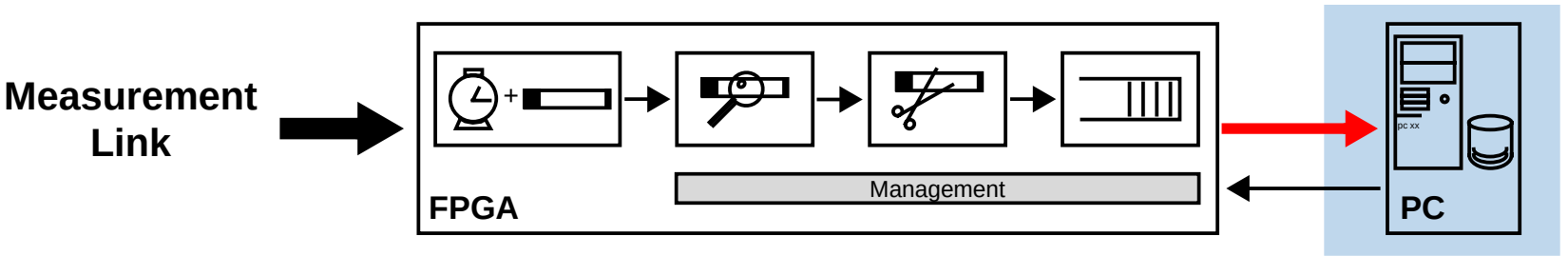


- **Filtering on L2 protocol type field and L2 addresses**
- **Transfer of captured data records to Storage PC in burst mode**

I²MP - HW-Unit



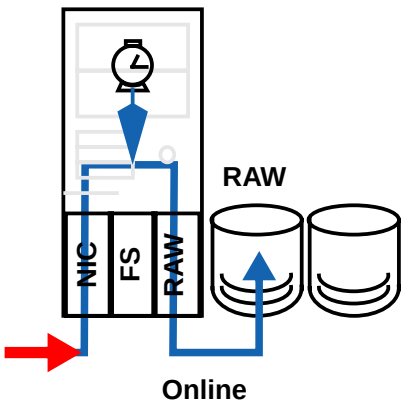
I²MP - Storage and Processing Unit



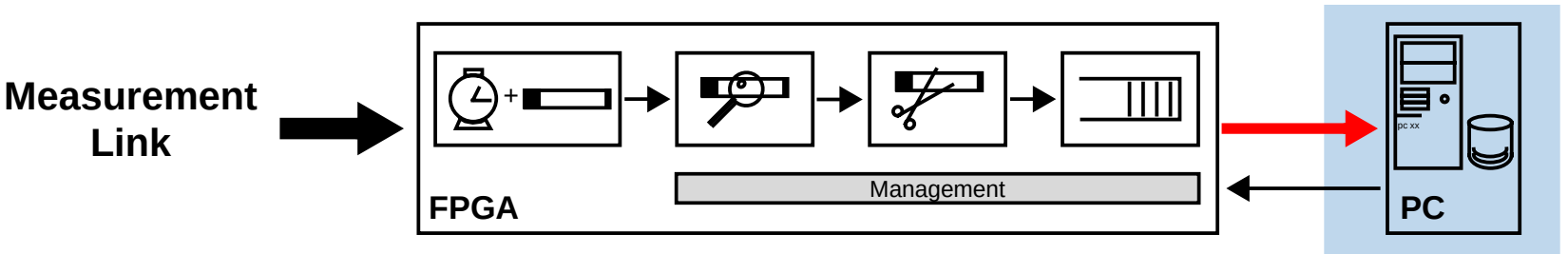
During measurement sessions

- **Raw devices are used for very fast write operations**
- **No processing of data**

  -

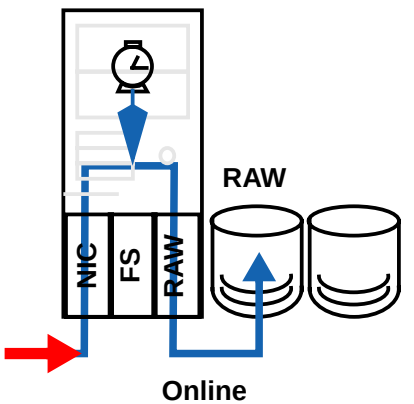


I²MP - Storage and Processing Unit



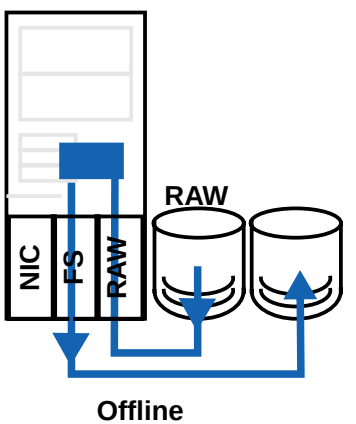
During measurement sessions

- **Raw devices are used for very fast write operations**
- **No processing of data**



Offline

- **Transfer from raw device into filesystem (fs)**
- **Processing of trace data during transfer phase, e.g**
  - further selection of packet fields
  - manipulation (e.g anonymization of IP addresses)
  - data compression
  - change of data format

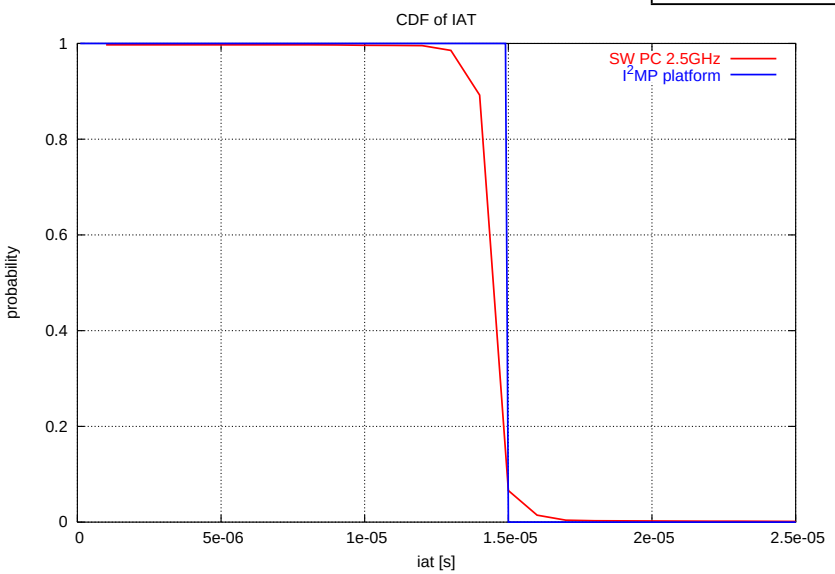


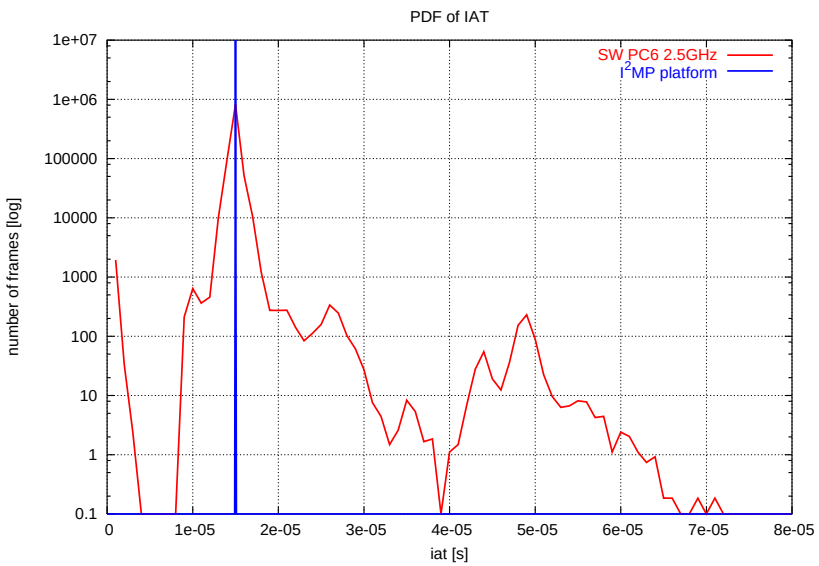
Comparison SW/HW Measurement

- **100 Mbps Ethernet link with ~50 % utilisation**
- **traffic source:**

  frames length 68 B, interarrival time 15µs
- **Generator: Agilent traffic analyzer**
- **Measurement results**

	HW	SW
mean	14.96µs	14.69µs
stdev	2.84e-8	1.53e-6





Summary & Issues

- **High precision passive measurement platform I^{2}MP available**
  - HW-support for time critical tasks
  - SW/PC-support for storage and control
- **Tested**
  - with synthetic traffic
  - long-term measurement at student computer pool

- **Advanced filter and selection options in HW-unit**
- **Live measurement at speeds of Gigabit Ethernet**
- **Extension of processing and analysis SW**

Future Work

- **Comparison with commercial products**
- **Cooperation with partners of EuorNGI**
- **Extension of the measurement platform functionalities**

Measurement context

- **Student dormitory network on University of Stuttgart campus (Selfnet)**
- **Approx. 800 (soon 1000) connected students**
- **Student's access link rate of 100 Mbps**
- **Uplinks of 100 Mbps**
- **Measurement point: uplink to Internet**

➥ **can be considered as a future scenario for residential areas where "broadband for all" is available**

➥ **identification & verification of models for metro/core traffic**

Universität Stuttgart

INSTITUT FÜR
KOMMUNIKATIONSNETZE
UND RECHNERSYSTEME
Prof. Dr.-Ing. Dr. h. c. mult. P. J. Kühn

I²MP - A high precision measurement platform for IP traffic

Detlef Saß, Sascha Junghans

{sass,junghans}@ikr.uni-stuttgart.de

July 28th, 2004