



IPPM measurements, G-WiN, 6WiN and GÉANT(2)

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14.12.2004





- **DFN-Labor@RRZE – who are we?**
- **IPPM-DFN Measurement System – that's what we do**
- **Examples:**
 - **G-WiN**
 - **6WiN**
 - **GÉANT(2)**
- **Contact**



- **RRZE**
 - **Regional Computing Center Erlangen**
 - **IT service for the University Erlangen-Nürnberg**
- **DFN**
 - **German research network provider**
- **DFN-Labor@RRZE**
 - **Research project of the DFN at the RRZE**
 - **Network hardware tests**
 - **Development and operation of an IP accounting system**
 - **Quality assurance for the G-WiN SDH/WDM core network**
 - **Development and operation of an IPPM measurement system**



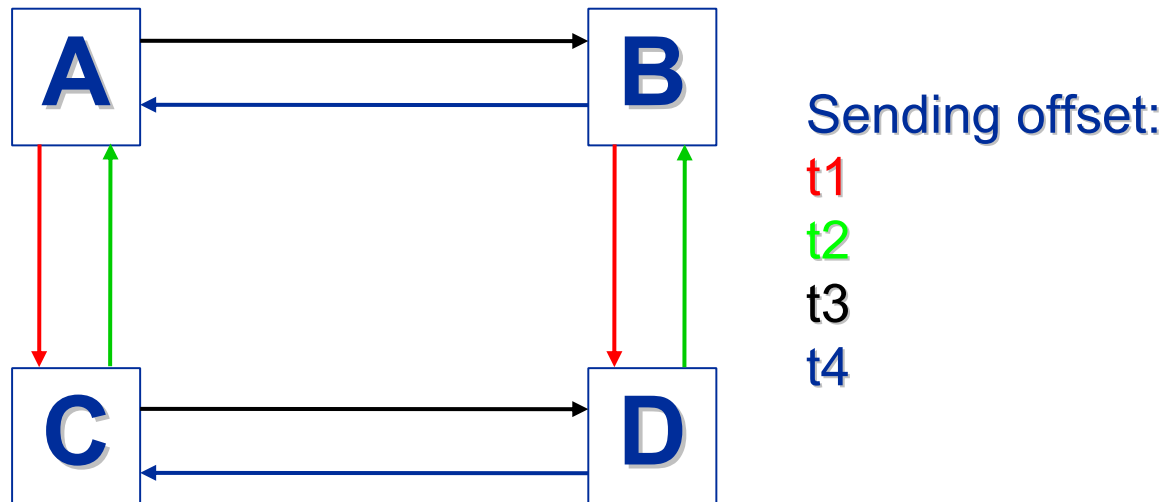
- **Intention of the measurements**
 - **Academic interest to determine the IP Quality of Service parameters**
 - **Verification of provider's network failure data**
 - **Early warning system for network failure**
 - **Correlation of QoS parameters with other network parameters**
 - **Throughput**
 - **Visual quality of video conferencing**
 - **Passive delay measurement**
 - **Analysis of customer's network performance**
 - **Collaboration with DFN video conferencing team**
 - **Mobile boxes**
 - **Second network interfaces**



- **Active measurement**
- **UDP-Packets with timestamp**
- **Packets are sent in groups**
 - **Group median / maximum -> (no) single outliers**
- **Current configuration:**
 - **One group every 30 s**
 - **5 packets per group**
 - **Distance between packets: 20 ms**
- **Configurable:**
 - **ToS bits**
 - **Packet size**
 - **Group size, interval**
 - **Central configuration**

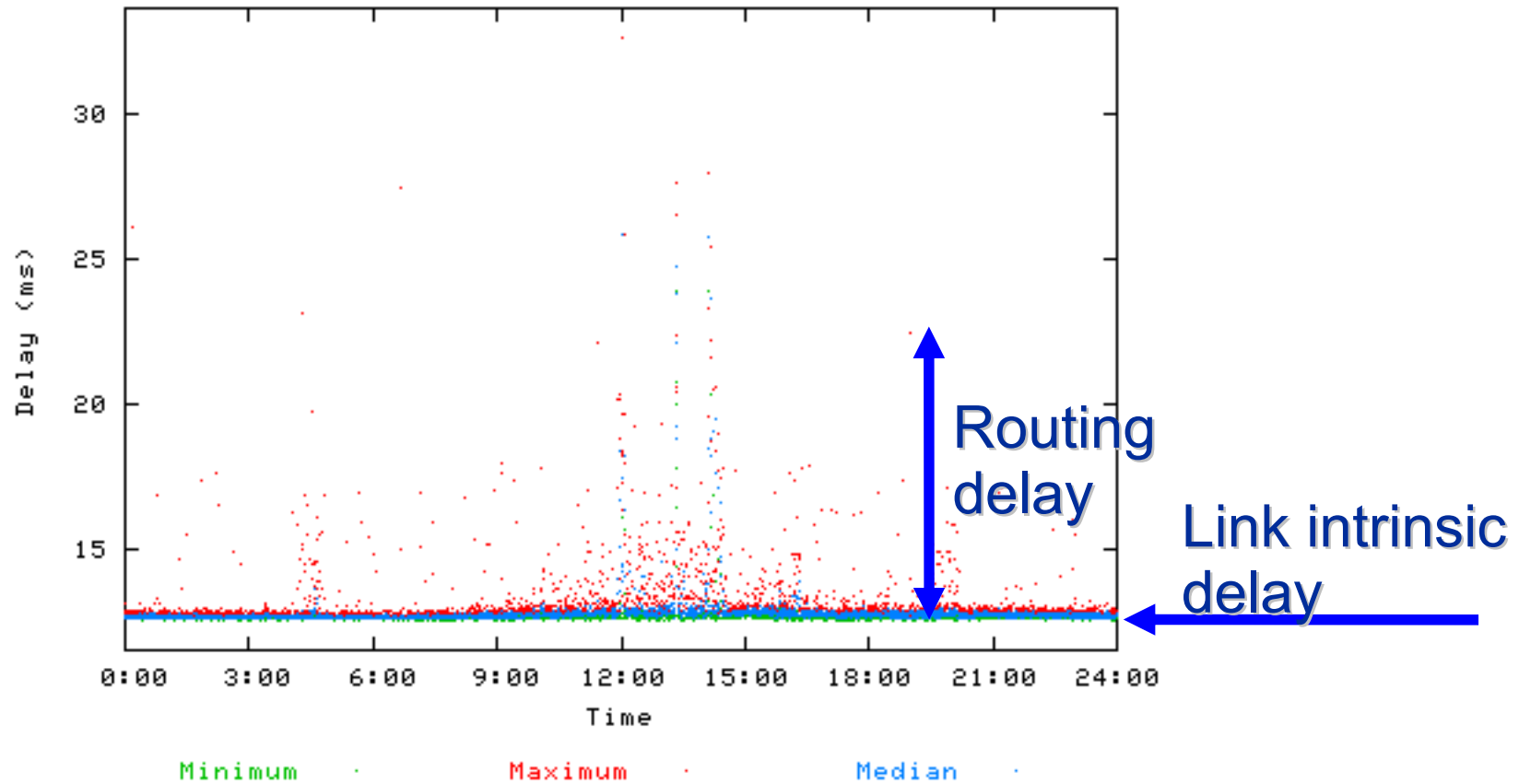


- 1 sending and 1 receiving process for every measurement connection
- Time offset between processes at every measurement PC to avoid collisions

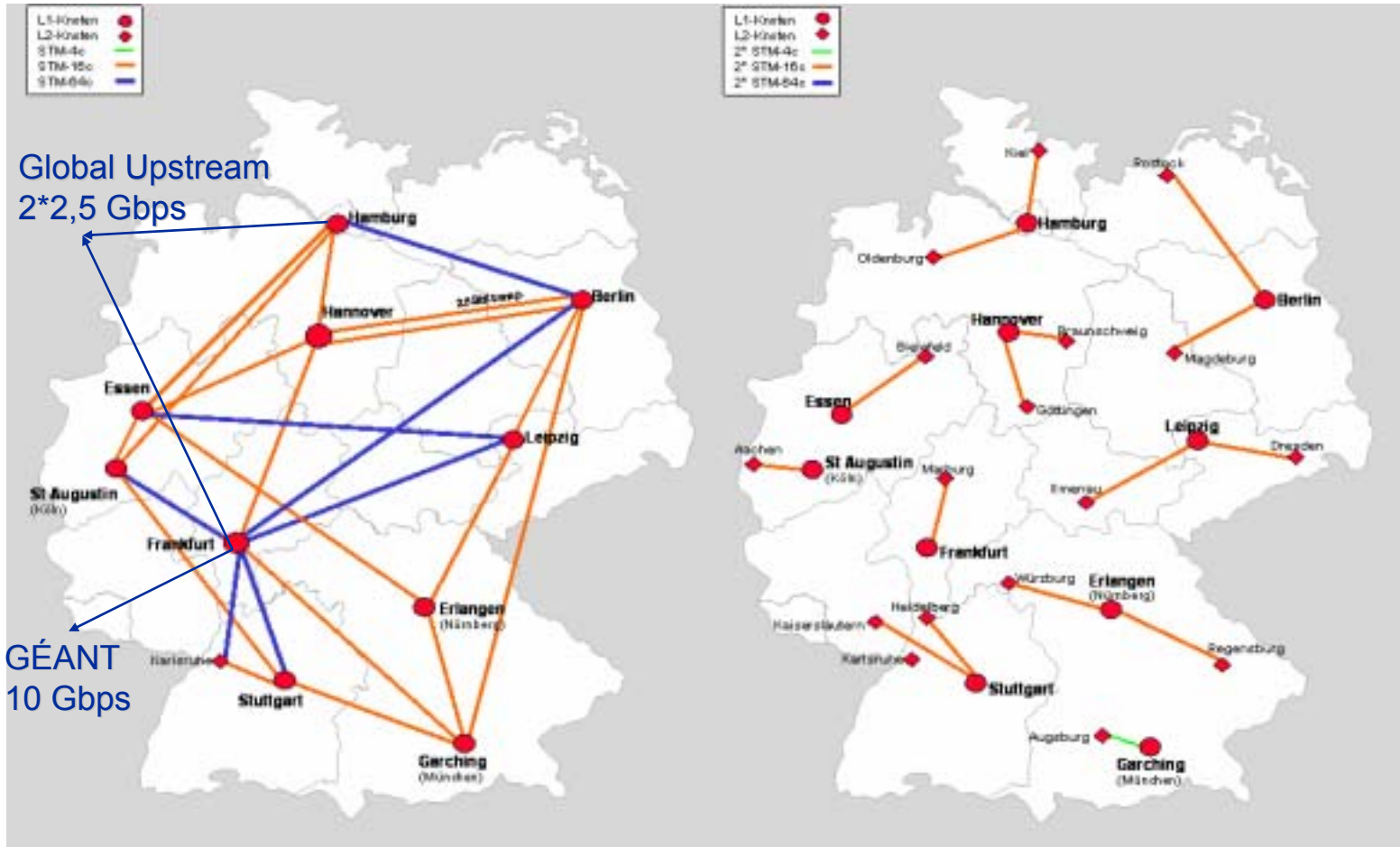




One way delay plot



Current G-WiN - Topology





- **G-WiN: National backbone of DFN**
 - 10 level 1 sites, 17 level 2 sites
 - 7 x 10 Gbps, 31 x 2.4 Gbps, 1 x 622 Mbps
- **Current measurements**
 - 27 active Measurement Points
 - > 1200 connections in total, running 24/7 “full meshed”
 - Up to 100 connections per PC
- **Central data analysis station**
 - Fetches raw data regularly (≈ 200 MB / d)
 - Computes:
 - Timestamps, delay, jitter, loss
 - Group minimum, median, maximum
 - Traceroutes
 - Stores analyzed data (≈ 240 MB / d)



Measurement Point Selection:

01.12.2004

- - - - -

Bitte Messstation und Datum auswählen

Messstation	24.11.	25.11.	26.11.	27.11.	28.11.	29.11.	30.11.	01.12.	02.12.	03.12.	04.12.	05.12.	06.12.	07.12.	08.12.
Aachen_DFN	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Augsburg_DFN	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Berlin_DFN	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bielefeld_DFN	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Bielefeld_Uni	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



Path Selection:

09.12.2004

Messstrecken für Erlangen_DFN am 09.12.2004

	Metriken
<input checked="" type="checkbox"/>	One Way Delay
<input checked="" type="checkbox"/>	Delay Variation
<input checked="" type="checkbox"/>	Paketverluste
<input checked="" type="checkbox"/>	Traceroute-Log

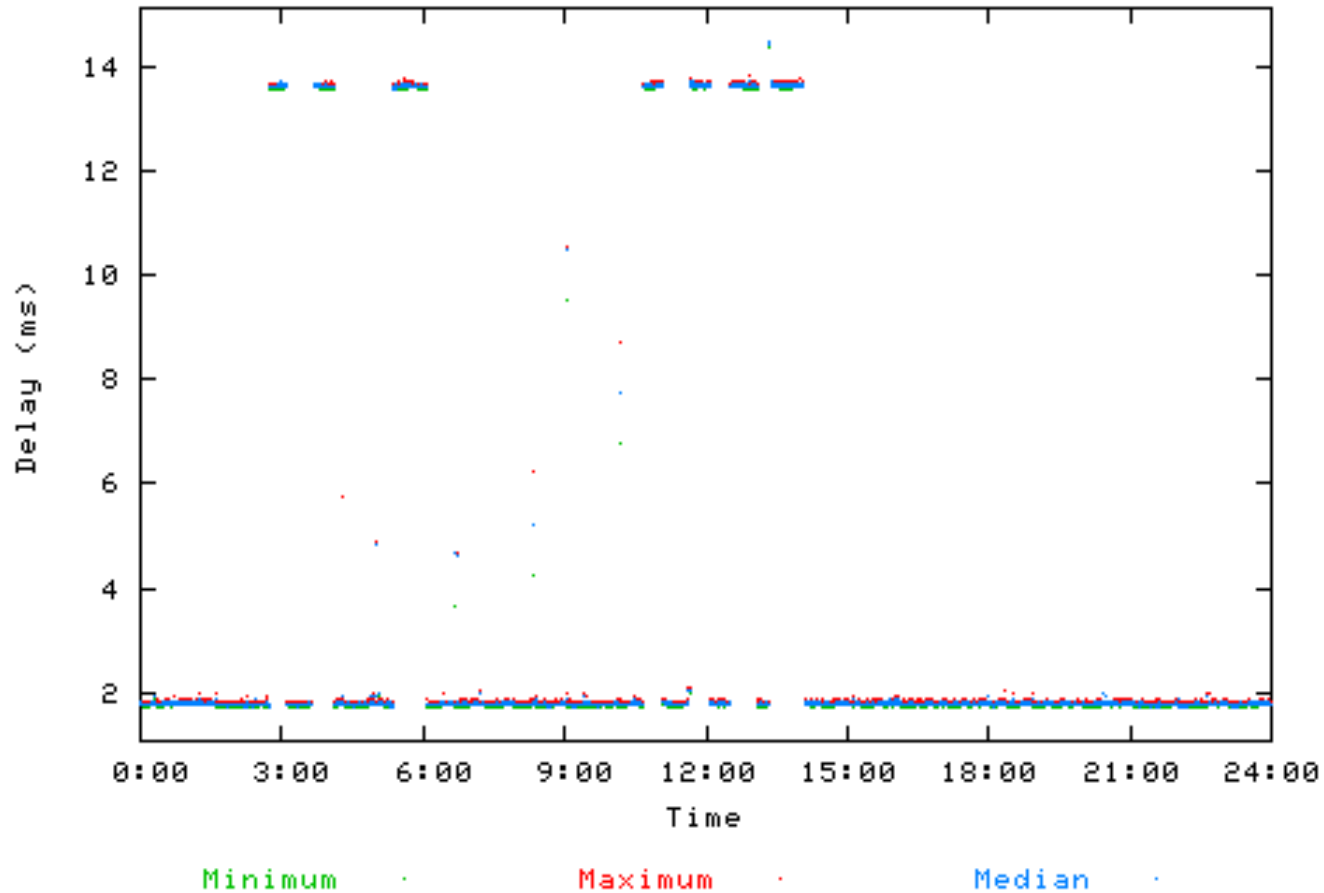
[Alle selektieren](#) - [Alle deselektieren](#)

	Von	Nach		Von	Nach
<input checked="" type="checkbox"/>	Aachen_DFN	Erlangen_DFN	<input checked="" type="checkbox"/>	Erlangen_DFN	Aachen_DFN
<input checked="" type="checkbox"/>	Augsburg_DFN	Erlangen_DFN	<input checked="" type="checkbox"/>	Erlangen_DFN	Augsburg_DFN
<input checked="" type="checkbox"/>	Berlin_DFN	Erlangen_DFN	<input checked="" type="checkbox"/>	Erlangen_DFN	Berlin_DFN
<input type="checkbox"/>	Bielefeld_DFN	Erlangen_DFN	<input type="checkbox"/>	Erlangen_DFN	Bielefeld_DFN



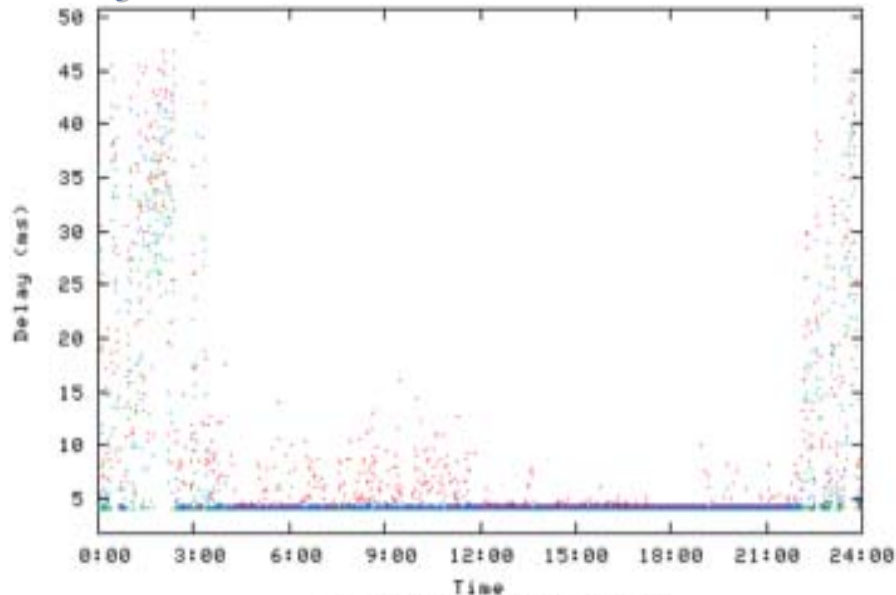
Route flapping

OWD from Erlangen DFN to Garching DFN
(2003/11/10)

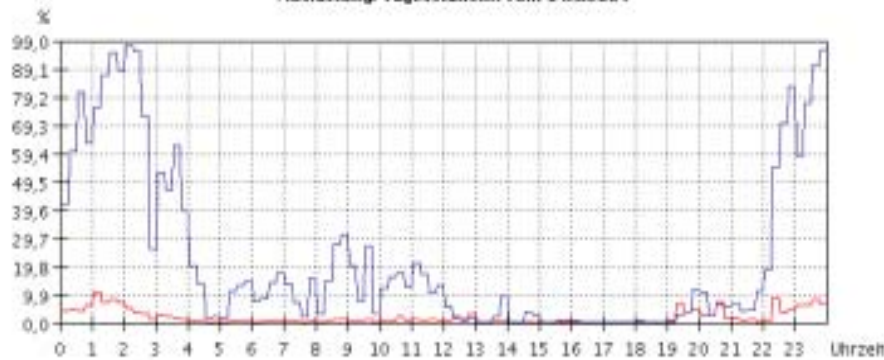




Delay and network utilization



Auslastung: Tagesstatistik vom 14.3.2004



Long-time (15 min) average network load vs. delay shows at different customers either:

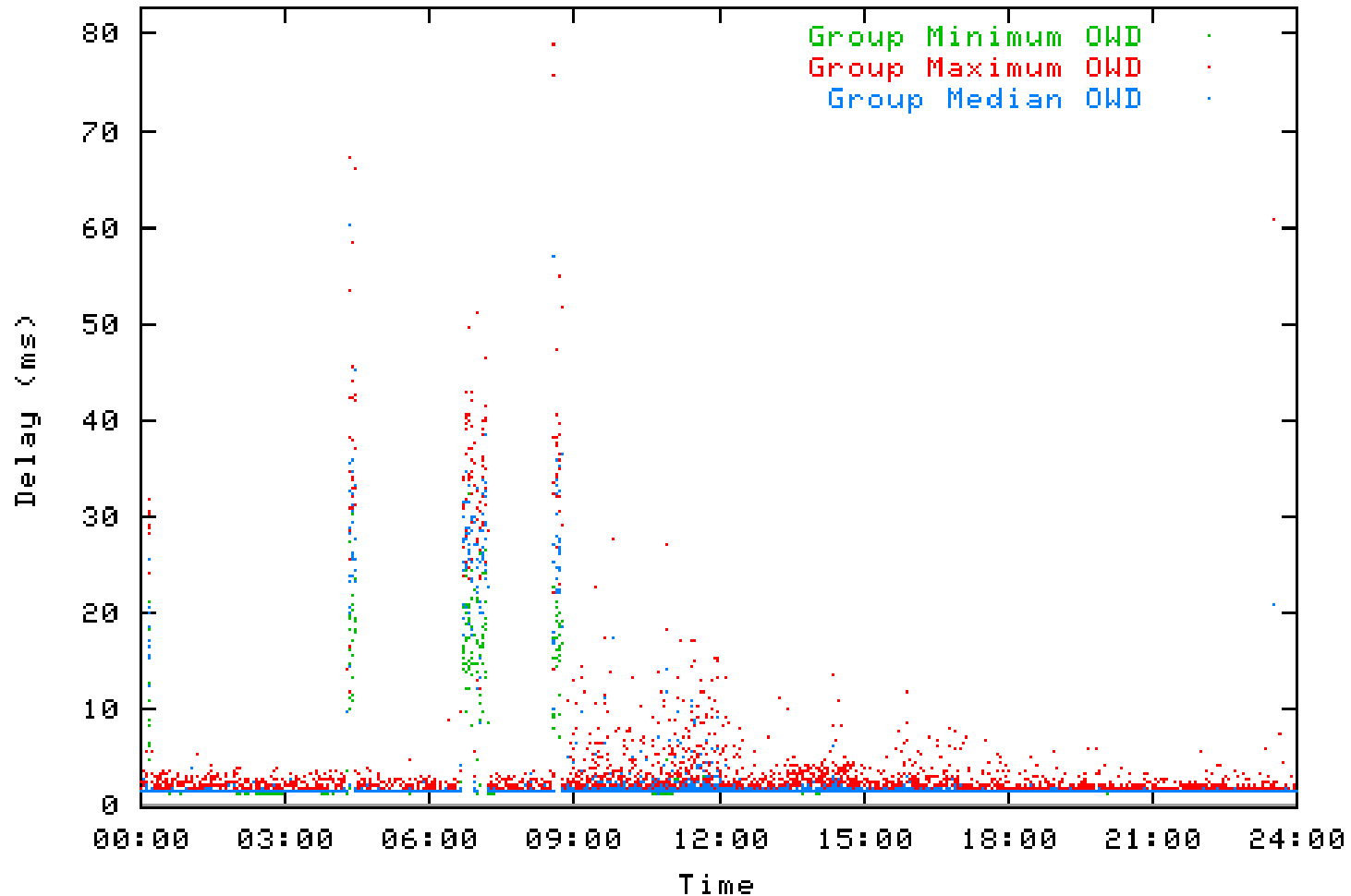
- Correlation
- High delay without high load
- High load without increased delay

Higher time resolution of network load (< 1 s) necessary

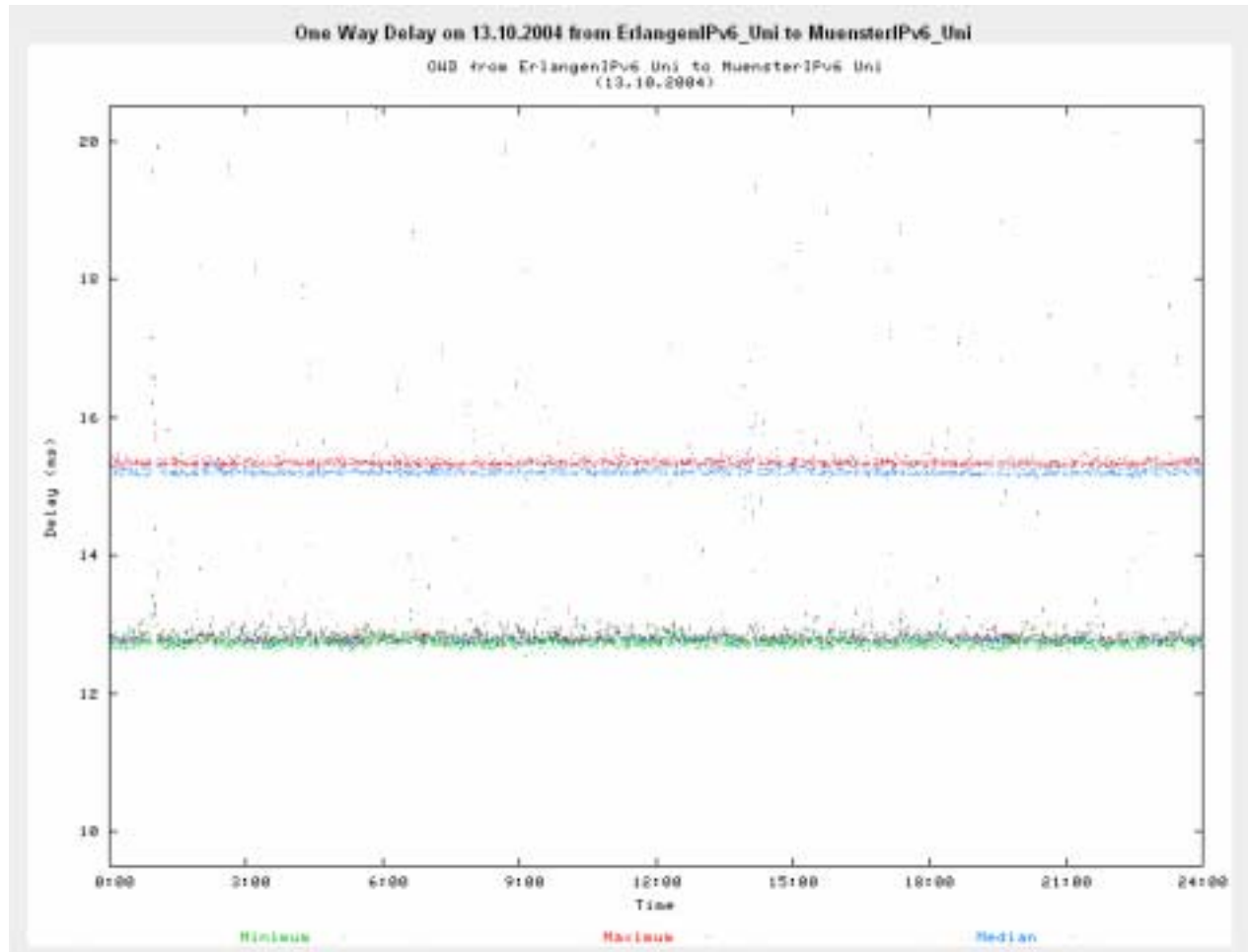
Lab tests!



Increased delay due to network equipment failure

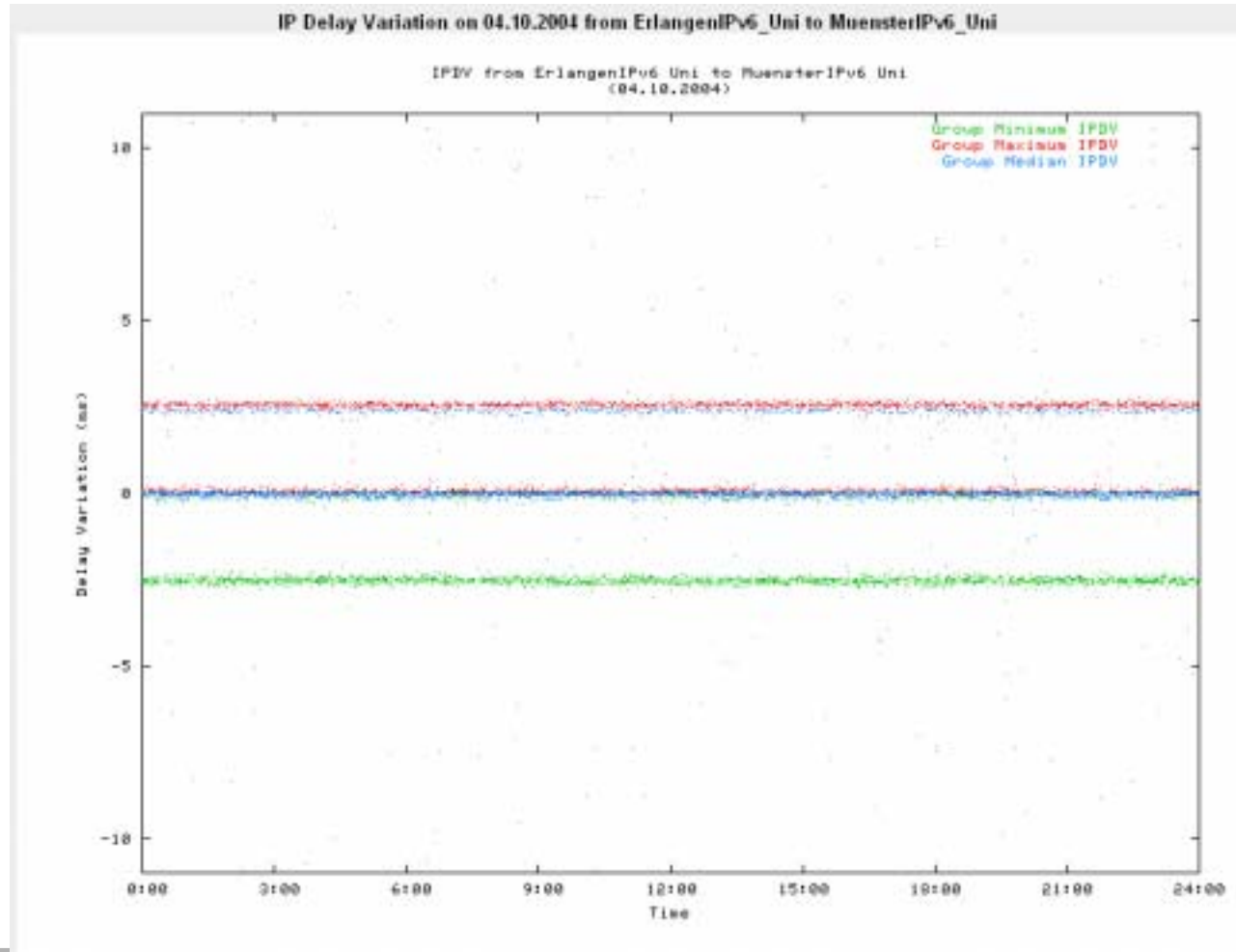


■ Measurements between Erlangen and Münster (Delay)

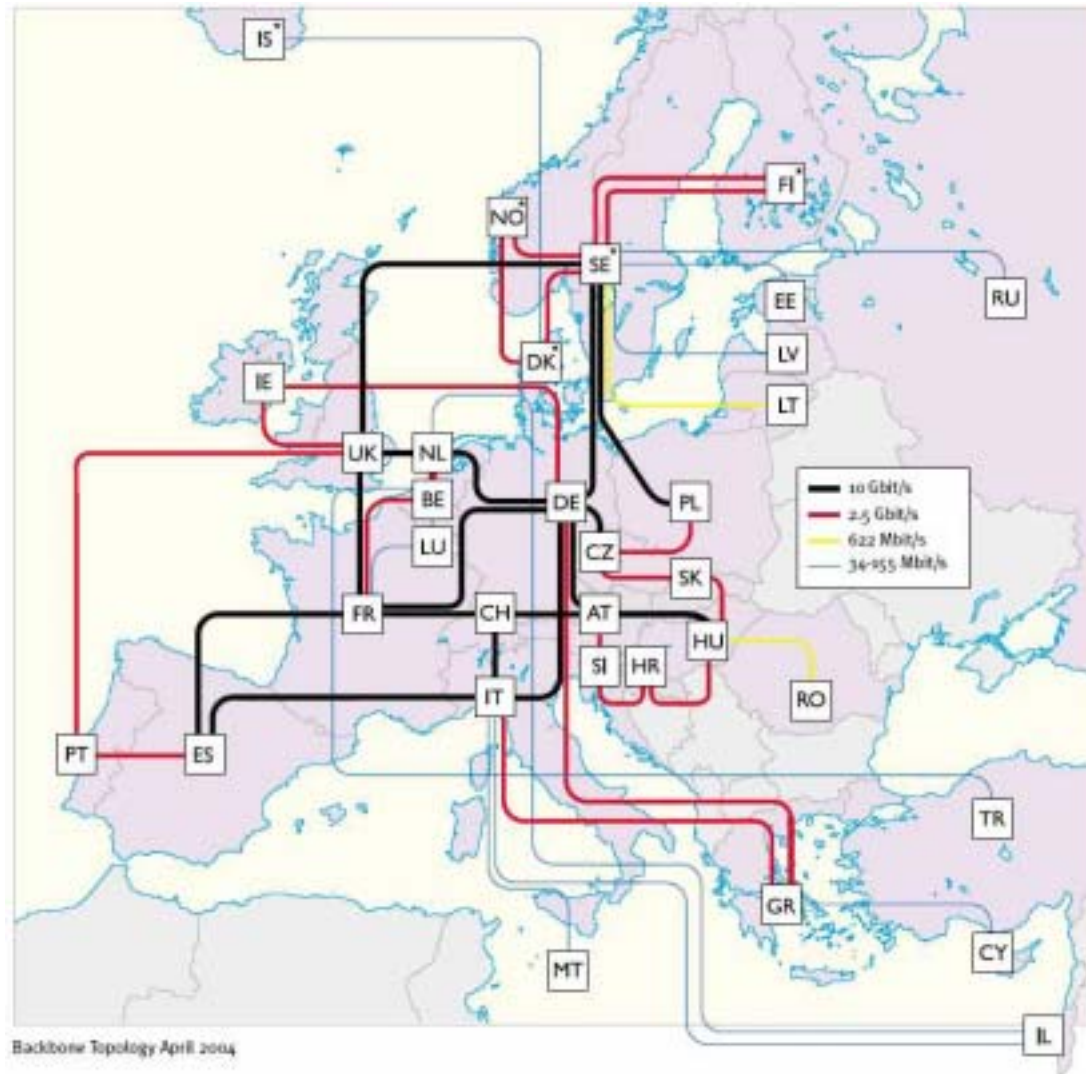




Measurements between Erlangen and Münster (Delay Variation)



■ Topology





Current Activities

- **Currently, five Measurement Nodes installed and running**
 - **Paris, Frankfurt, Rome, Poznan, Tel Aviv**
 - **<http://www.win-labor.dfn.de/cgi-bin/geant/auswahl.pl>**
 - **IPv4 measurements running**
 - **Currently: “part” of the G-WiN measurement system**
- **Ongoing development**
 - **IPv6**
 - **Make IPPM conform to one way delay protocol (OWDP)**
 - **Traceroute**
 - **Throughput / bandwidth**
 - **Interface to raw / analyzed data**
 - **More user interaction**
 - **ToS**
 - **Mobile boxes**



- **Network Monitoring Activity JRA1**
 - In Geant2 (four years project, started sep. 2004) there is a whole research activity (JRA1) on network monitoring;
 - JRA1 focuses not only on enhancing existing tools but also on integrating them in a coherent architecture
 - This architecture should be multi-domain and allow users to access measurement services and measurement results over well defined interfaces
 - There is an ongoing coordination with Internet 2 to reach an aligned design of this monitoring architecture
- **Future of IPPM-DFN**
 - IPPM as activity within GÉANT2
 - Measurements in the European research networks (approx. 20 nodes)



- **Internet:**
 - <http://www.win-labor.dfn.de/>
- **email:**
 - WiN-Labor@dfn.de
 - G-Lab@rrze.uni-erlangen.de
- **phone:**
 - **09131 85-28800**