Test Traffic Measurements, Status and Plans

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Outline of this talk

- Introduction
- The existing measurement network
  - Status
  - Improving uptime, lessons for the next series
- The new series of test-boxes
- Analysis, Products and Results
- Conclusions

Status of the measurement network

- Feb 16, 2000:
  - 43 test-boxes at ISP's
  - About 35 taking data
  - Some installation and operational problems

Improving the uptime of the boxes

- Boxes run generally fine but if there is a problem, then they tend to be down for weeks

- Availability of spare parts
  - Underestimated the number of spares that is needed
  - Will order more with the next series
- Make shipping of boxes and spare parts easier
- Improve response time from our side

Outline of this talk

- Introduction

- The existing measurement network
- The new series of test-boxes
  - Hardware
  - Turning TTM into a service $\Rightarrow$ Next Talk
- Analysis, Products and Results

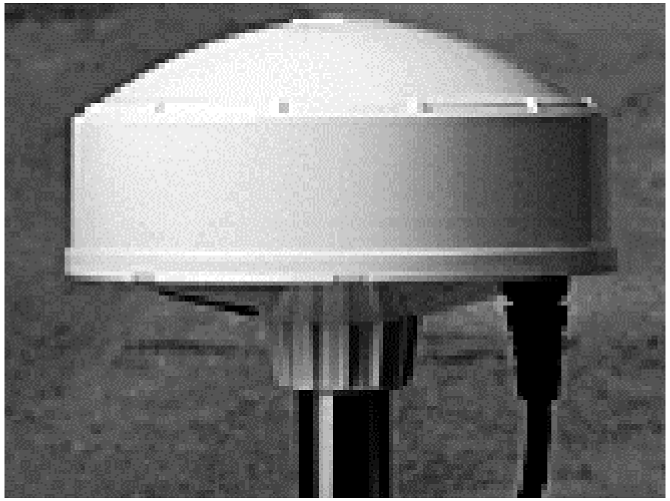
- Conclusions

New series of test-boxes

- Problem with the current design: Clock
  - Receiver in the test-box, antenna on the roof or out the window
  - Need roof or window access
  - Coax between them: installation and maximum length
- Solution:
  - Move the receiver closer to the antenna
  - Use UTP cables that are already there
  - Provide a mounting bracket

Solution?

- Design document, look for products
- Motorola
  - Vague schedules
- Trimble:
  - Palissade or AcutimeII
  - Meet all requirements
  - Single unit
  - 100’s of meters of cable
  - Several mounting options
- NTP drivers exist!
- Tests in progress



Other improvements

- We now have 2 years of experience with operating 40 boxes at remote sites
- Time to check if our current procedures will scale to 100+ boxes:
  - Some will, others won't
- Improve and automate things where necessary:
  - Keeping the software up to date
  - Checks to see if all processes on the box are still running

Outline of this talk

- Introduction
- The existing measurement network
- The new series of test-boxes
- Analysis, Products and Results
  - Raw Data
  - Daily Plots
  - Routing Vectors
  - Network alarms
  - Trends in the data
  - Network performance scores
  - Next steps
- Conclusions

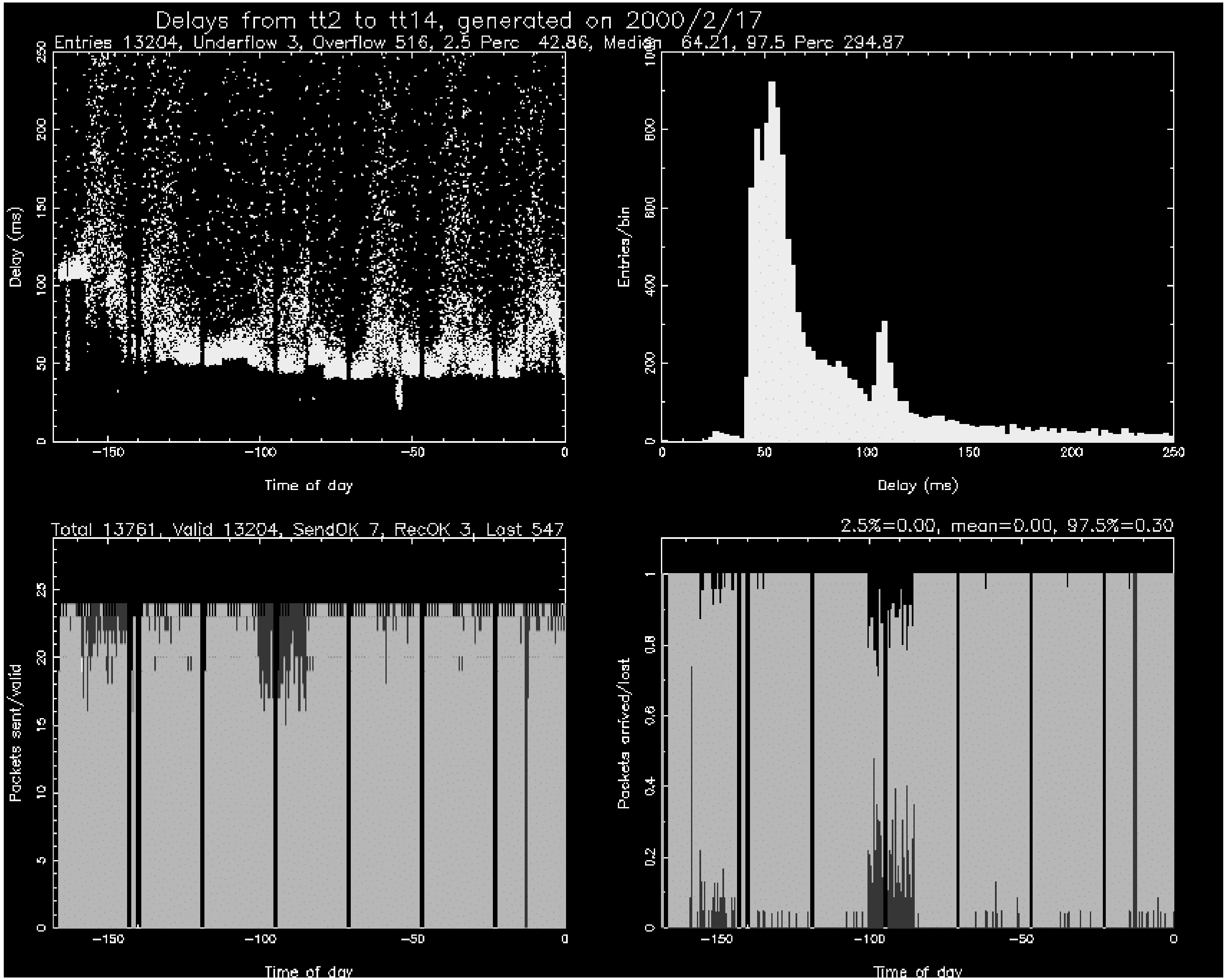
Raw data

- Available on request
  - 1 or 2 requests/month
  - ROOT files
- ROOT instructions on the web:
  - http://www.ripe.net/test-traffic/Host_testbox/root.html
  - More text will be added
  - Let us know if you have specific questions
- Automatic analysis, policy:
  - Now: Always analyze everything
    - Lots of backlog when a box was offline for a while
  - New: Do not analyze data older than 1 week

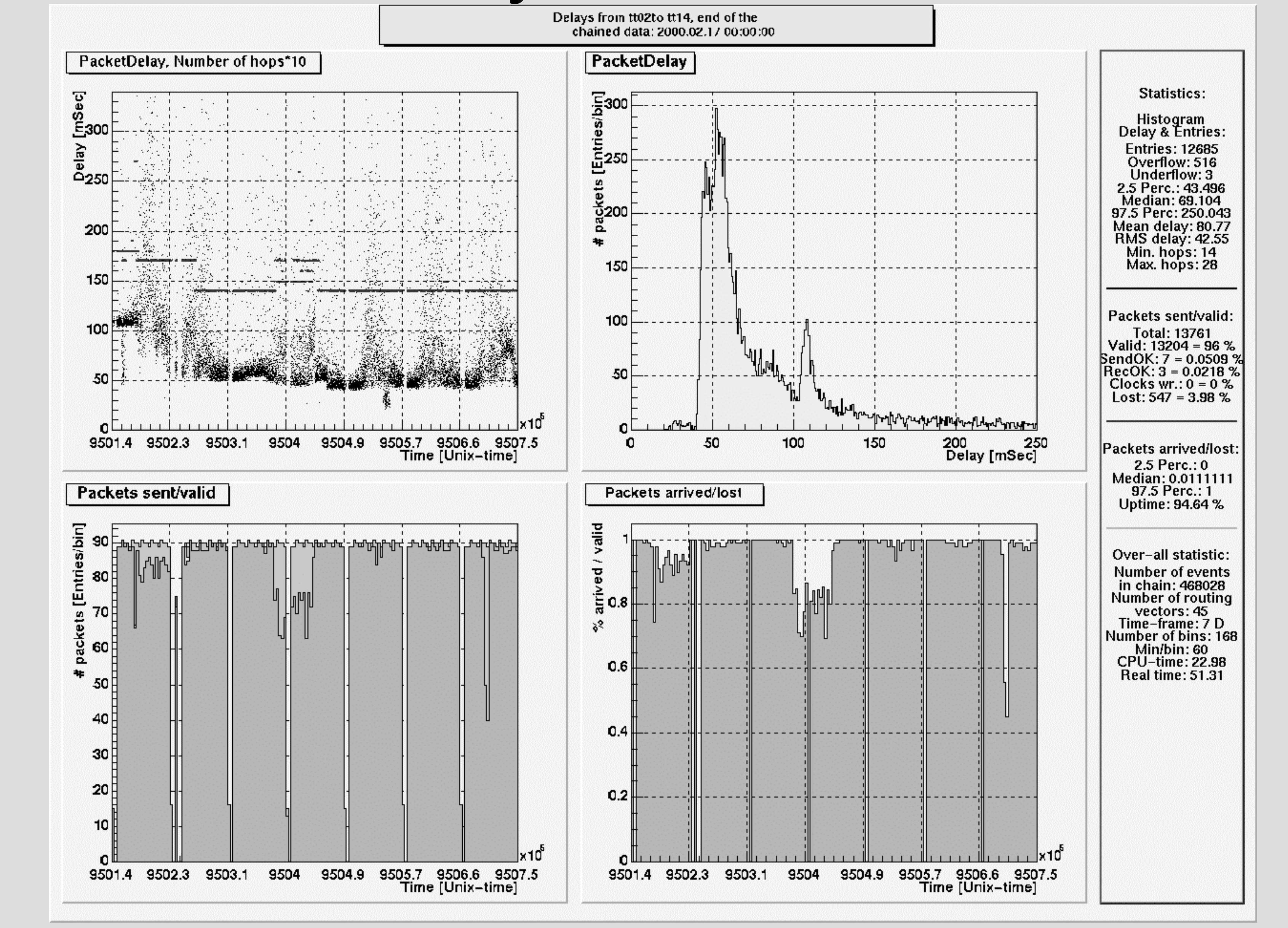
Daily Plots

- Rewritten:
  - Faster
  - Better layout
  - More information
    - Number of hops
    - Statistics
- Will be installed on the web-site in the next weeks
- Next step: looking into a cgi-interface to generate plots on demand

Daily Plots/Current



Daily Plots/New



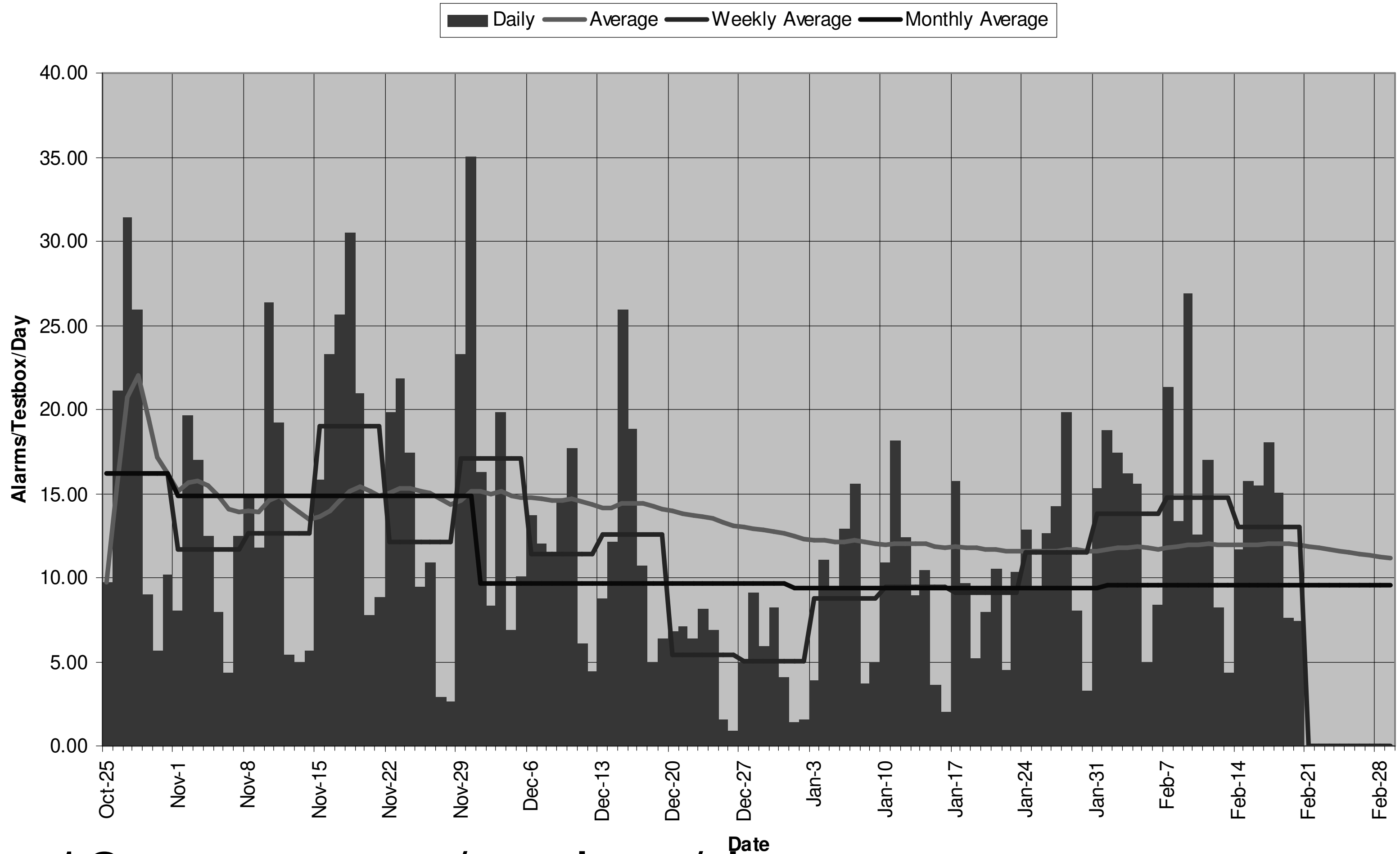
Routing Vectors

- Current setup did not scale properly for 1600 routes and 100,000's of vectors
  - Slow, time-outs
  - High load on the web-server
- Being re-written:
  - Better data-base with more indexing
- Functionality will be the same
- Expected: Mid-March
- UI will not change

Network Delay Alarms

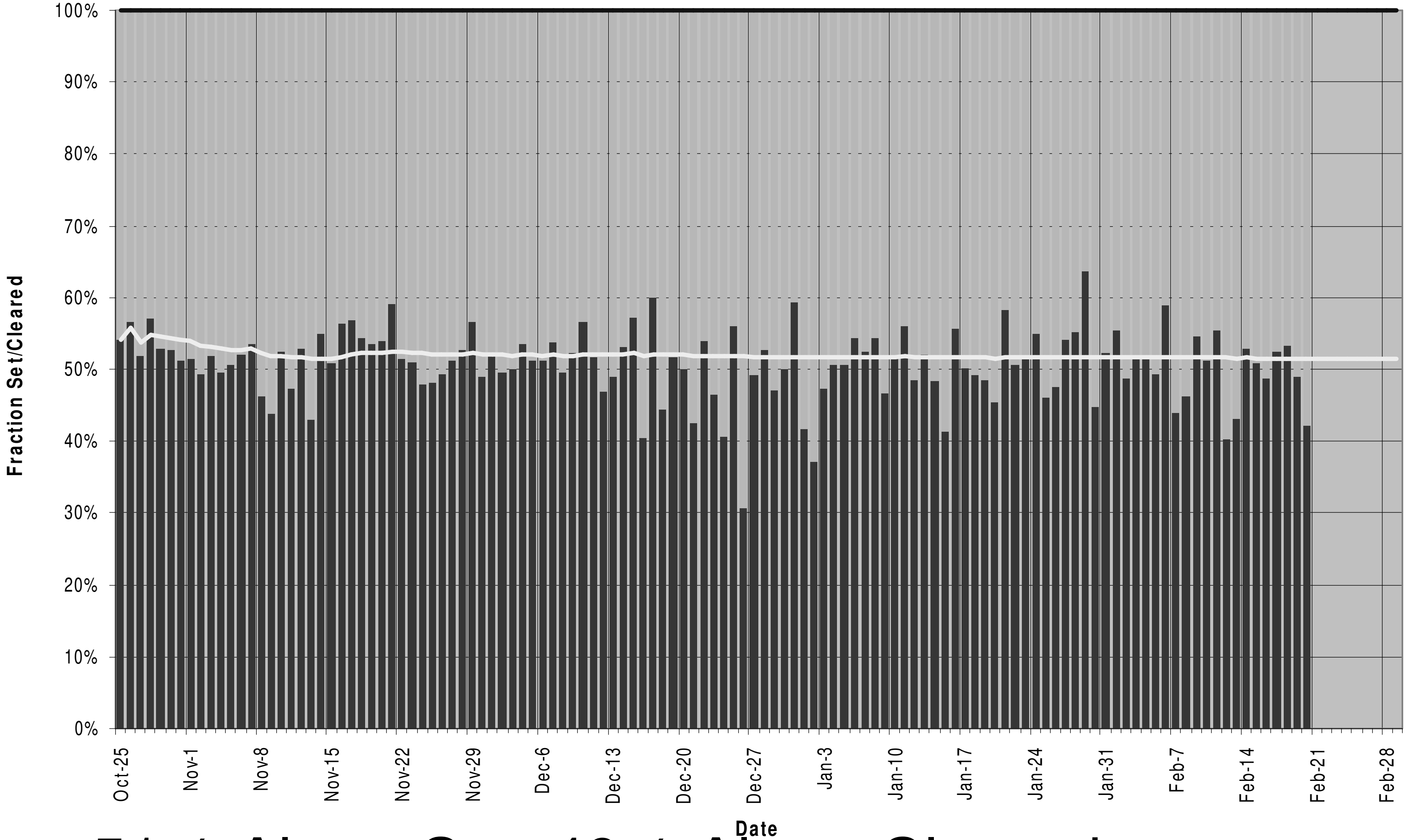
- Goal: detect unusual changes in network delays and warn test-box hosts
- Algorithm discussed at RIPE34
  - If 95% of the measurements outside the expected range, set the alarm
  - Email to a specified address
- Installed on the test-boxes late October
- First analysis
  - Looked at plots
  - Some statistical analysis

Number of Alarms per Day



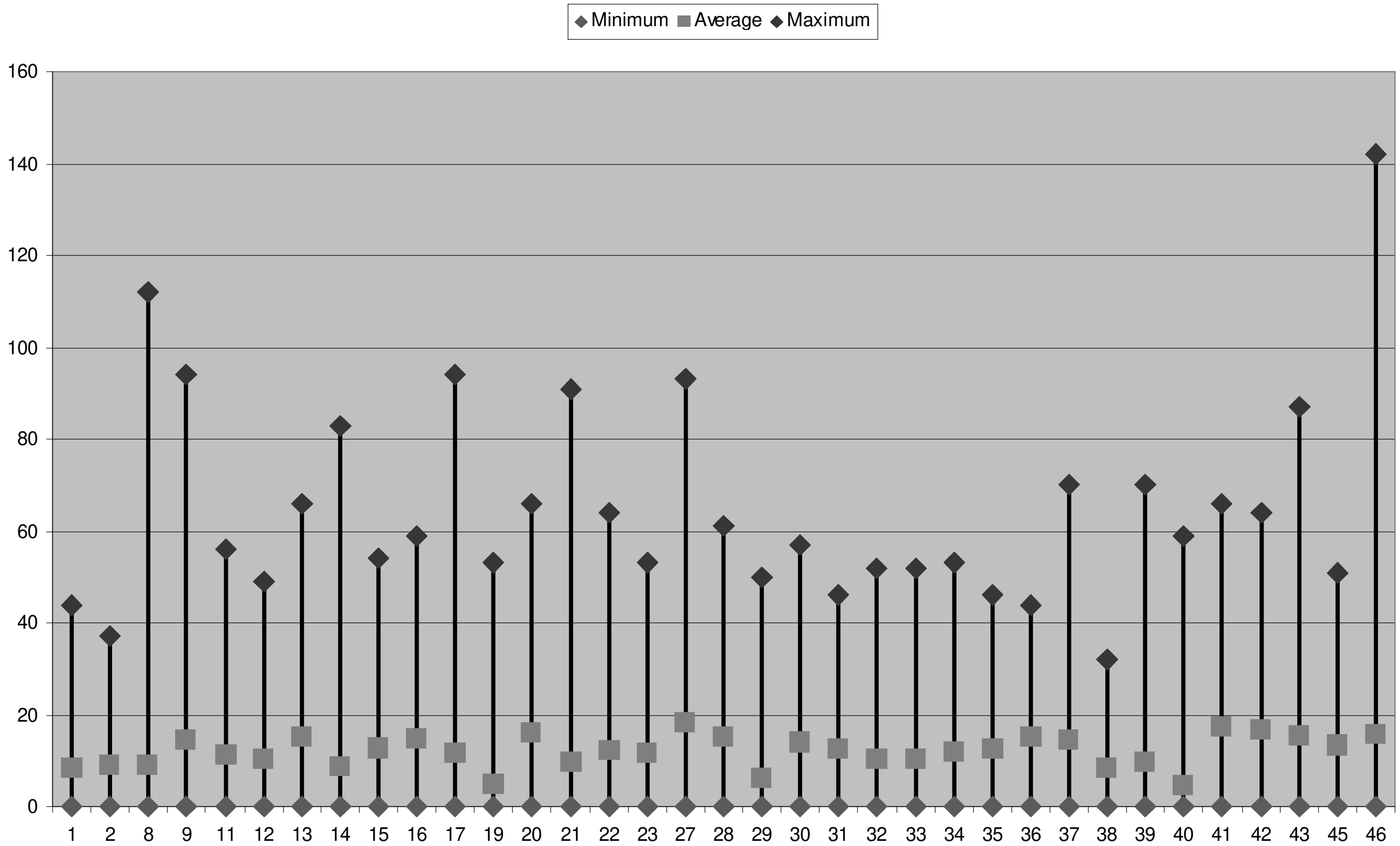
- 12 messages/testbox/day
- Weekend/Weekday effects

Number of Set/Clear Messages



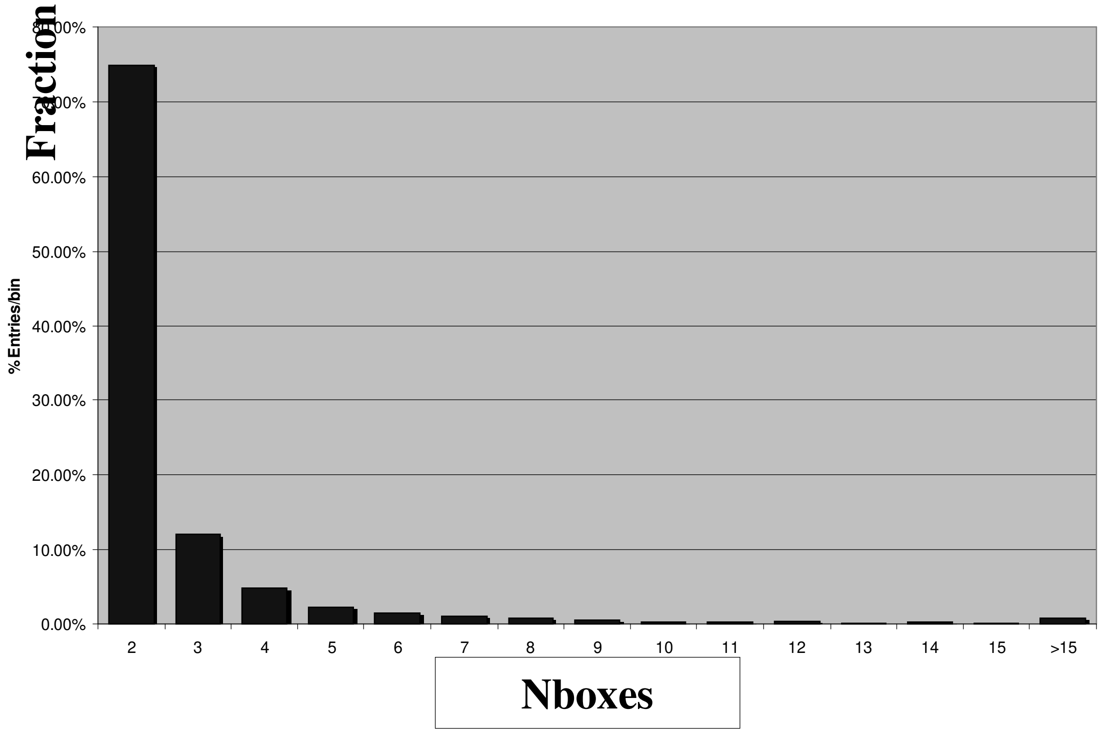
- 51% Alarm Set, 49% Alarm Cleared

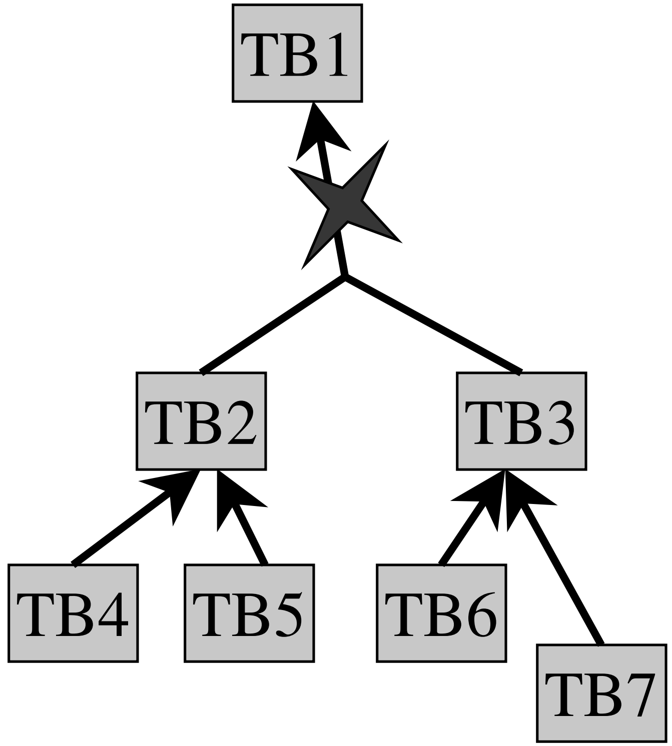
Number of Messages/Box/Day



- Huge variations but the average is about the same for all boxes

Number of Hosts per Message





- Suggested not to send message to >N hosts
- 88% of all messages involves 2 or 3 machines
- Little point in doing this

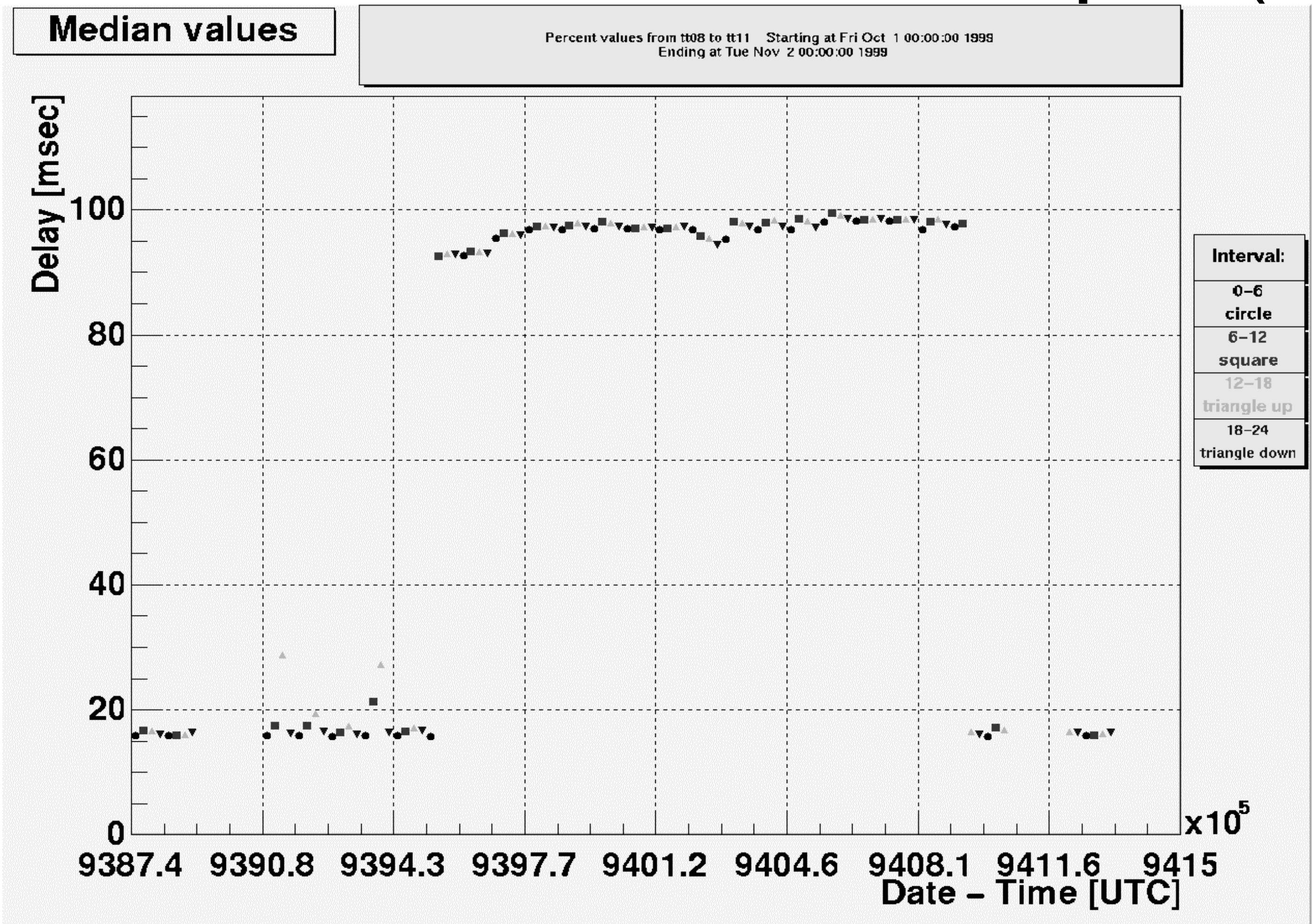
Network Delay Alarms/ Next Steps

- Still room for fine-tuning
  - Lots of parameters
- This is hard to do without your input
  - Did your connections change?
  - Problems at your site?
  - Did you get an unusual number of messages even though *"you didn't touch anything"*?
  - …
- Integrate with existing monitoring systems
  - Suggestions welcome

Trends in the data

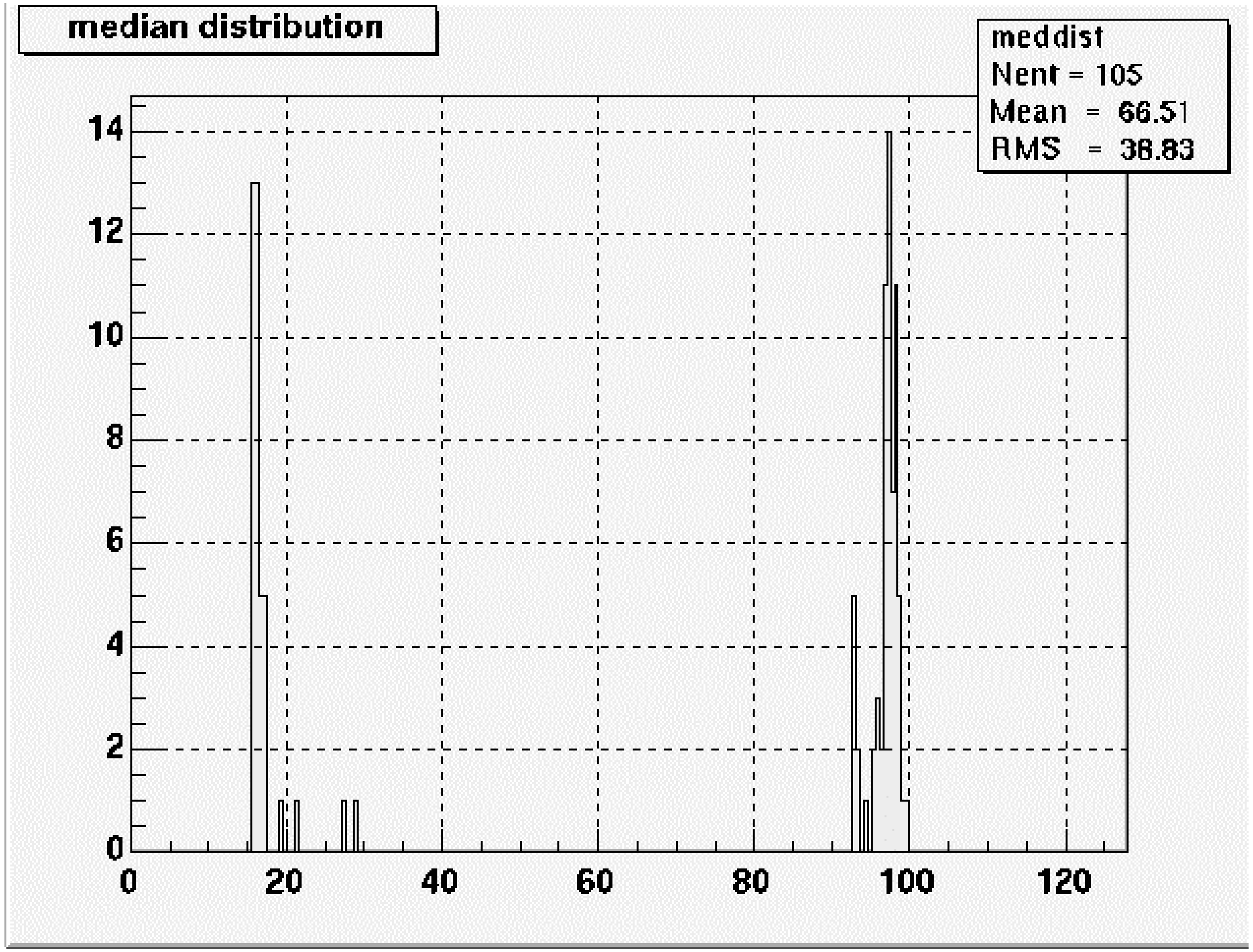
- How do delays develop over longer periods?
- Hard to look at all individual measurements
  - 100,000’s of data points
- Summarize in percentiles:
  - 2.5%: best case (≈ line-speed)
  - 50%: normal case
  - 97.5%: worst case
- Handful of numbers each month
- Automatically find plots with big changes

Trends in the data/Example (2)



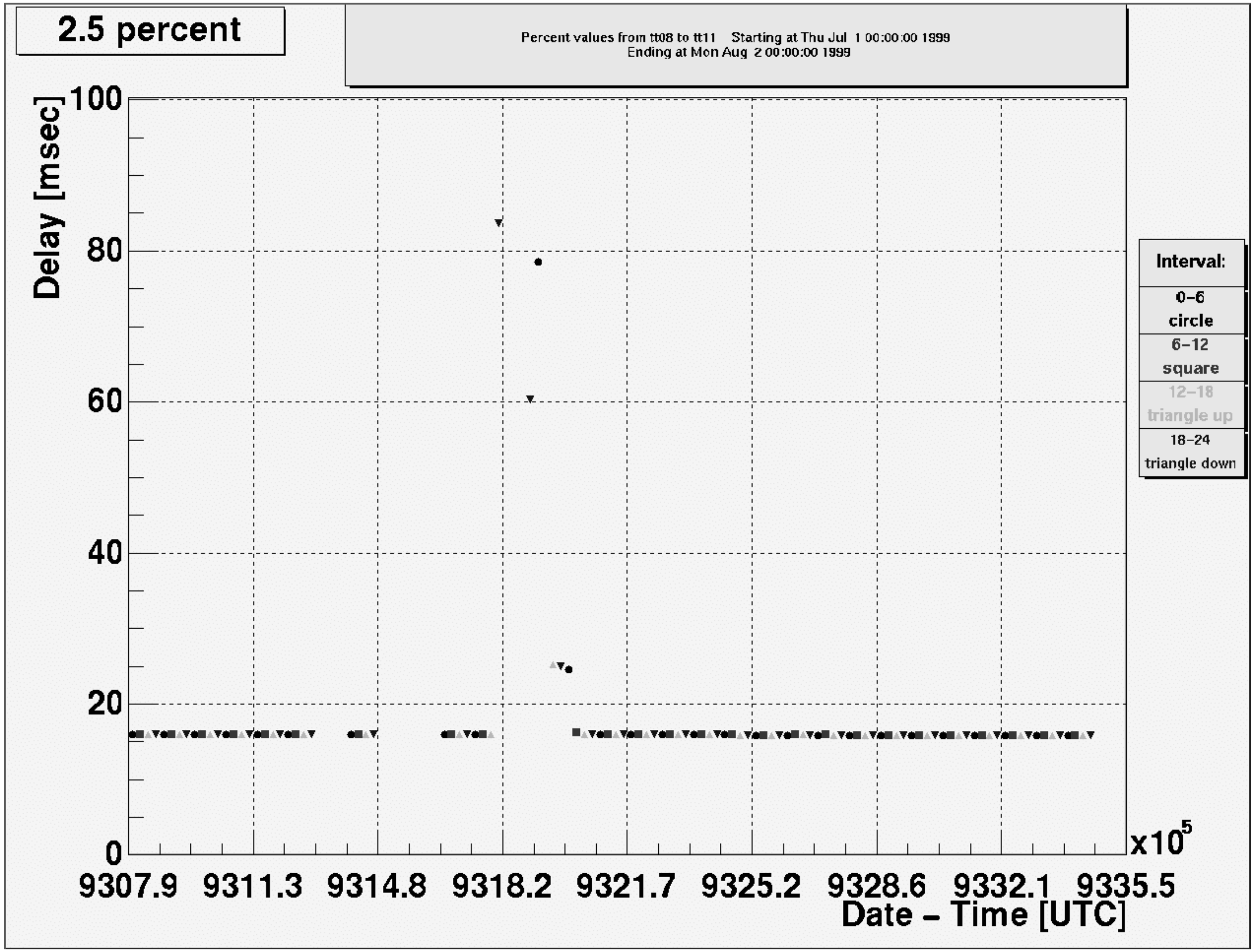
- Different behavior from 10-26, change in routing?

Trends in the data/Example (3)



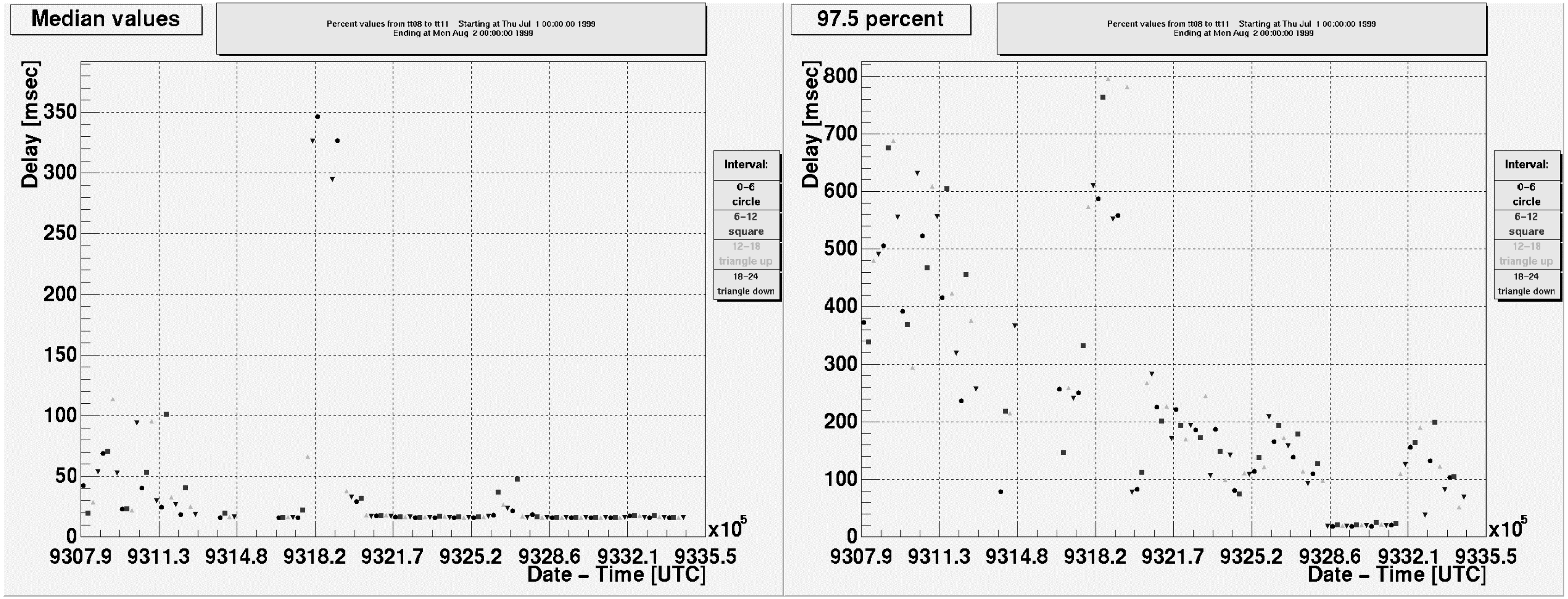
- 2 distinct peaks
- Put plot on the "to be looked at by a human" list

Trends in the data/Example (4)



- Line speed constant, boring???

Trends in the data/Example (5)



- Normal and “worst case” behavior got better over time
- Less network load? Higher bandwidth?

Trends in the data/Next steps

- Finish research
  - Hard deadline May 1st
  - Produce a Write-up/M.Sc.Thesis
- Turn experimental code into production software
- Make results available on the web:
  - Plots
  - List of plots that deserve human attention
  - Numbers that went into the plots
- Correlate with input from NOC's

Network performance scores

- Why?
  - 100 test-boxes means 200 connections from/to your site and thus 100’s of plots and numbers
  - Your manager just wants a quick overview
- Reduce data to a few numbers
- Introduce a scoring method for network connections:
  - **1000: perfect connection**
    - No packet loss
    - Minimal delays (given the distance between boxes)
    - Little variation in the delays
  - **0: no connection at all**

Network performance scores (2)

- Several formulae under consideration that can map network behavior to a 0 to 1000 scale
- Planned to have a document ready for this meeting
- *Delayed*
- Don’t want to start a theoretical discussion here without numbers

- Postponed to RIPE36

Next analysis steps

- Continue with this work
- Other topics:
  - Modeling of data
  - N^2 problem
  - Full TCP sessions
  - QoS, DiffServ
  - TE work
  - ...
- Your suggestions are always welcome

Conclusions

- Getting ready to expand the measurement network again
  - Next talk
- New products:
  - Delay alarms
  - Trends in the data
  - Performance Scores
- Need your feedback!

Questions, Discussion