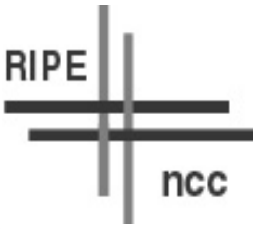


Test Traffic Project

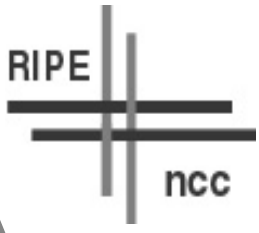
Status Report

Henk Uijterwaal <henk@ripe.net>

RIPE-32

January 27-29, 1999

Amsterdam

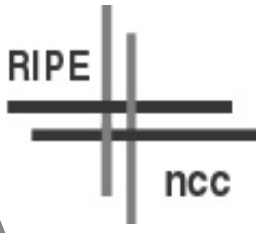


Overview

- Administrativia
- Installation of Test-Boxes
- Analysis
  - Frame-work
  - Hardware
  - Case studies
- Plans for the next months
  - Feedback from the TB-hosts

Administrativia

- Mailing lists for the working-group:
  - tt-wg@ripe.net
    - To subscribe send mail to majordomo@ripe.net
  - tt-host@ripe.net
    - For the test-box contact persons
- Contact address:
  - tt-ops@ripe.net
    - For all day-to-day queries regarding the test-boxes
    - Will become a ticketing system in the future
    - Do not use our personal accounts



Reports on the project

- SANE'98
  - November'98 in Maastricht, the Netherlands.
  - Paper on the web-site
- SunWorld
  - December '98

Installation of the existing Test-Boxes

Status	September'98	January'98	
No Host	3	0	
Configured	0	3	
At remote site	6	2	
Installation Problem	3	3	
Operational	12	15	
No longer participating	0	1	
Total	**24**	**24**	

- The measurement network has been expanded from 12 to 15 active nodes
- Found hosts for the remaining boxes

Installation problems

- Problems at the host side
  - Antenna installation
  - External contractors
  - Customs
  - Contact persons aren't always available
- Problems at our side
  - Lack of manpower
  - Not always time to immediately respond to email
  - Slow response to questions
  - Installation takes longer than necessary

Day to day operations

- More test-boxes installed for a longer time
  - Network changes
  - Queries from users
  - Have to do Data Quality Monitoring (DQM) on a regular basis
- Takes a lot of time
- Solution:
  - We will hire a sys-admin
    - Installation, day-to-day operations
    - Application deadline today.
  - Better and faster support
  - Time to do DQM

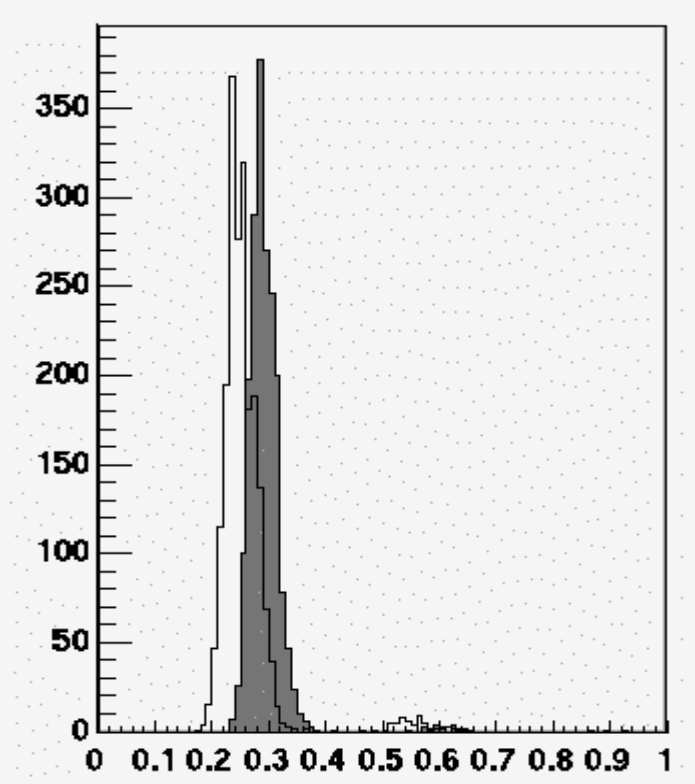
The next series of test-boxes

- 20 new boxes will arrive February 1
  - Slightly different hardware but the same functionality
- Test them, then ask for hosts
  - Update of RIPE-168
  - Free
  - 15 sites have shown interest
- Expect to build more boxes this summer
  - Have to build new clock cards
    - Copy of existing module?
    - Other modules?
  - Hosts will have to pay
    - Details at the May meeting

Antenna's

- RIPE31:
  - RG58 doesn't work above 10..15m
  - Use low loss coax (Aircell7)
  - In situ tests in October
- October'98: Tests at 3 sites:
  - 25m: Works fine, even with a bad spot for the antenna
  - 48m: Works fine
  - 60m: too long, even with a good spot for the antenna

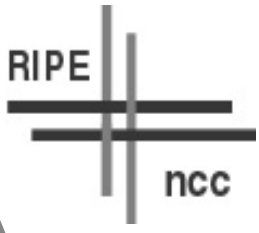
Antenna's (2)



- Some sites need longer cables
  - GPS receiver in a separate box
  - Extend RS232 cable
- 225m works in our office
  - Regular cat5 cable
  - Expect 0.6 μs offset in the delays
  - Test shows 30..50 μs
  - Not clear what causes this (yet)

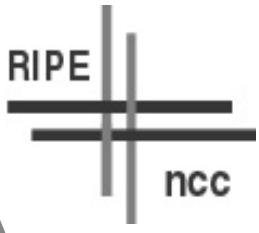
Antenna's (3)

- Conclusion
  - 45..50m is the maximum length for the antenna cable when using Aircell7
  - Continue to investigate other solutions



Analysis Framework

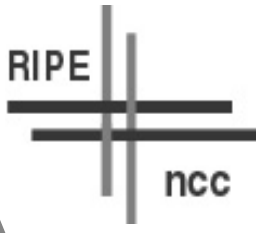
- Looked at several products for data-storage and analysis
- ROOT looked like the most attractive solution
  - Data analysis framework for LHC experiments
  - Environment with PBytes of data.



ROOT provides:

- Object oriented storage mechanism
- User defined data-types and methods
- Plotting facilities
- Fitting and statistical analysis code
- Command and batch mode
- Macro’s
- Software libraries that can be used in other programs

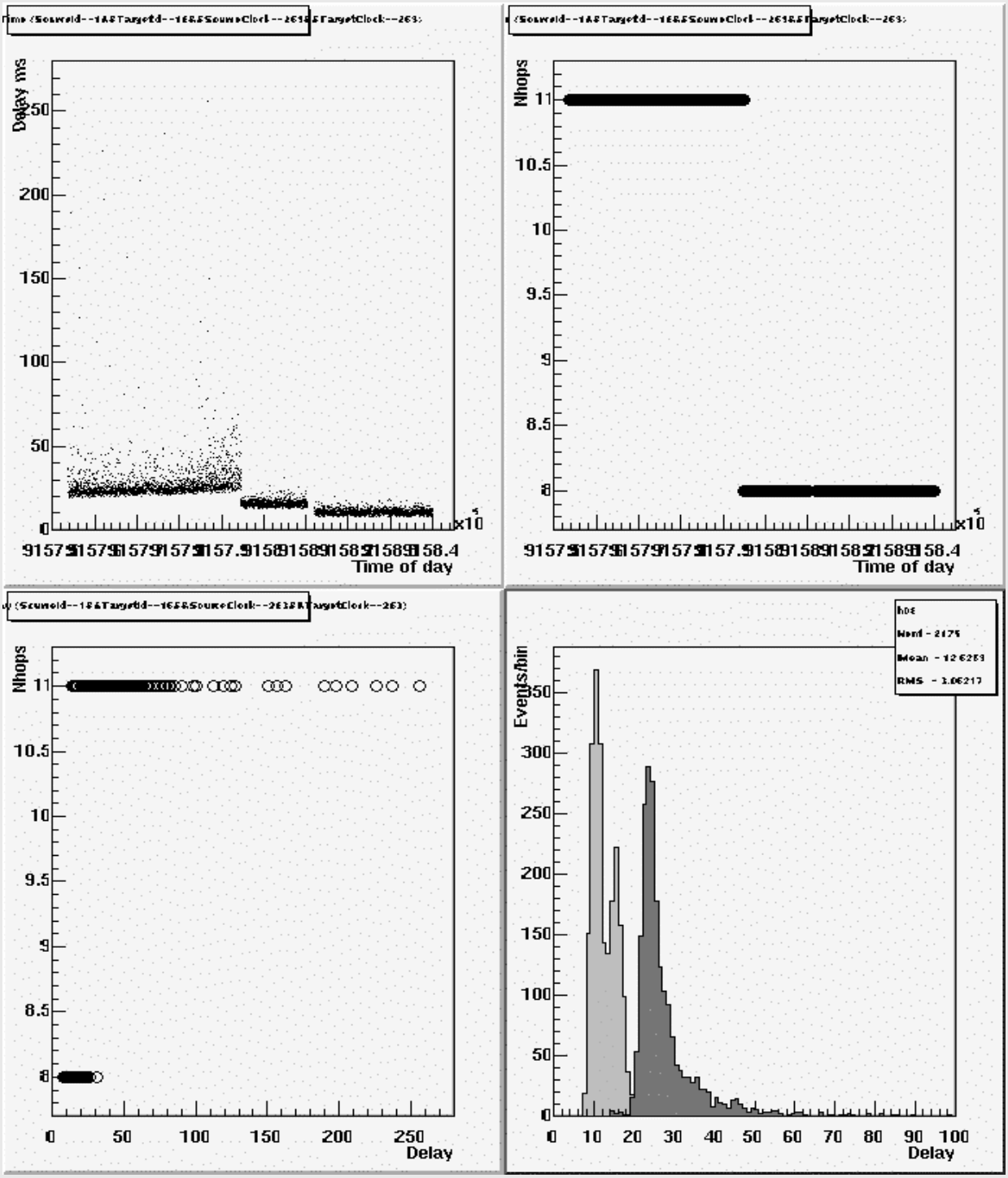
- Example on the next page

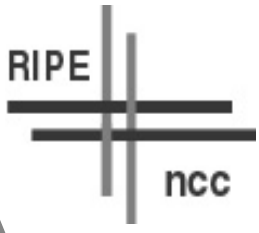


Example of a ROOT macro

```
void macro (int start, int end, char* filter) {

// Declare variables
c1 = new TCanvas("c1","",200,10,700,900);
pad1 = new TPad ("pad1", "", 0.00, 0.50, 0.50, 1.00);
// …
pad1->Draw();
pad1->cd();

// First Plot
T->SetMarkerStyle(1);
T->Draw("PacketDelay:ArrivalTime", filter);
htemp->SetXTitle("Time of day");
htemp->SetYTitle("Delay ms");

// Second plot
pad2->cd();
T->Draw("Nhops::ArrivalTime", filter);

// Third Plot
pad3->cd();
T->Draw("PacketDelay:ArrivalTime", filter);

// Last Plot
pad4->cd();
T->Draw("PacketDelay", filter1);
T->Draw("PacketDelay", filter2, "same");

}
```

The output of the macro

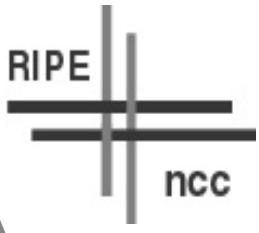




Other advantages of ROOT

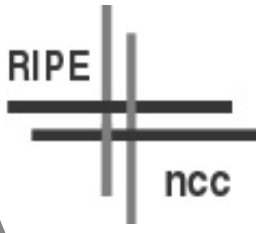
- Free, no licensing problems
- Download and docs at http://root.cern.ch
- Available for most Unix flavors, Win95/NT and Mac
- Large user community
- User-support through an active mailing-list
- LHC will run until 2015

- Data compression on the fly
- Trivial to loop over multiple data-sets



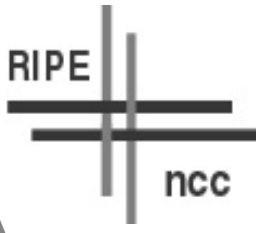
Disadvantages

- Steep learning curve
- One has to learn (some) C++



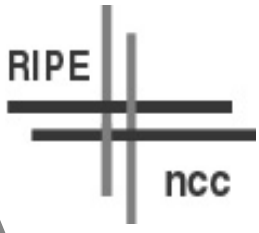
Our experience with ROOT

- Extensive tests with ROOT
  - Months of data in ROOT files
  - No show-stoppers
- Decided to use ROOT as the main analysis tool
- In the future
  - Data will be made available as ROOT files
  - Example macros will appear on the web-site



Central analysis machine

- Tasks:
  - Control the experiment
  - Collect and store the data
  - Do the first steps in the analysis
  - Location where TB-hosts can download data
- Decided to buy
  - A Sun CPU
  - Hard-disk capacity for 3 months of data from 100 TB's
  - A tape jukebox: 1 year of data online
    - All this data can be accessed by the hosts of the test-boxes



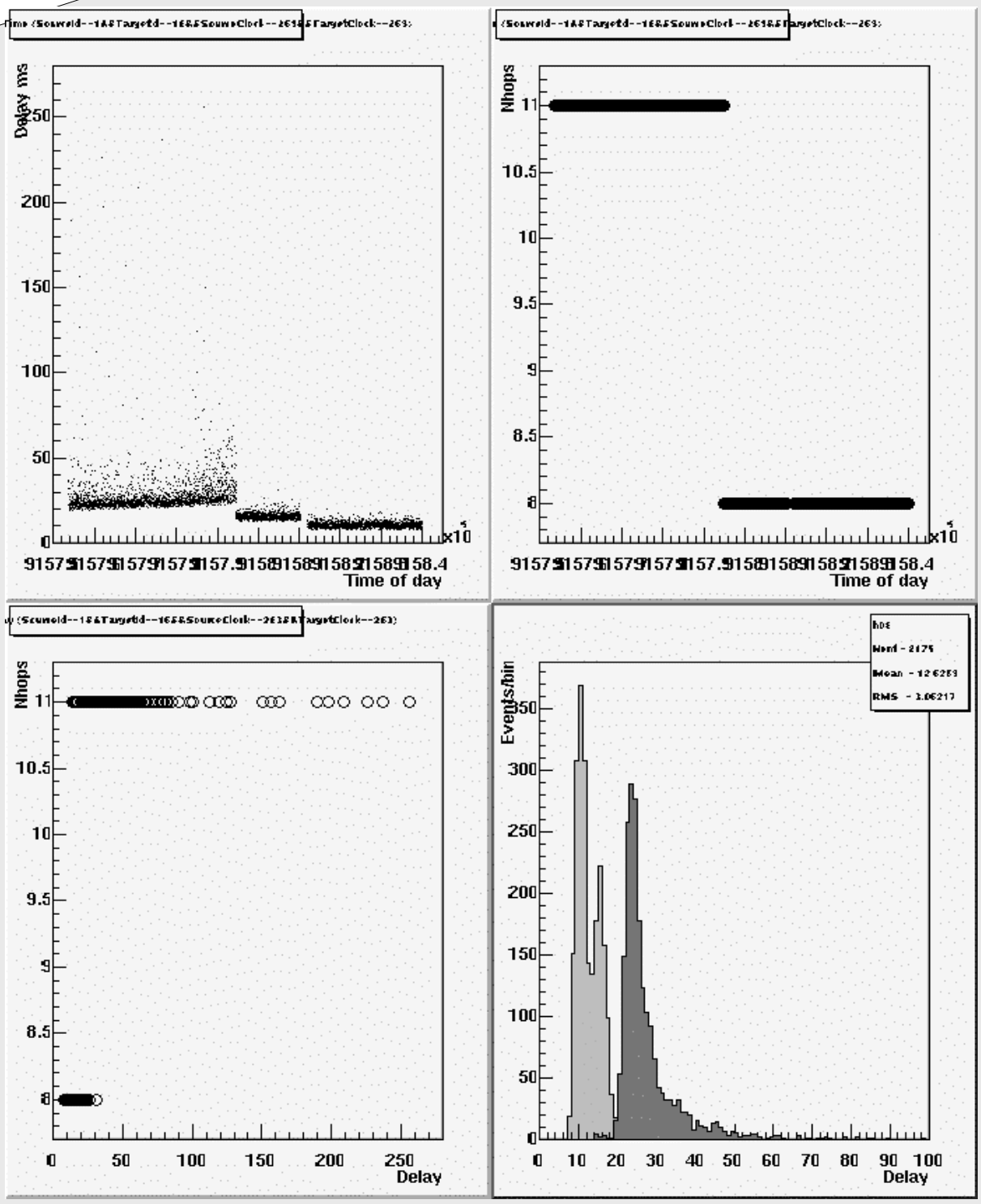
Analysis

- Lots of interesting effects in the data
- 3 case studies:
  - tt01 and tt16
  - tt15 and tt17
  - tt01, tt02 and tt23
- Also see the plots near our demo

tt01.ripe.net to tt16.ripe.net

- tt01 in Amsterdam, tt16 in Denmark
- Until January 8, 11.30 MET
  - Path: RIPE, AMS-IX, US, Denmark
- Host of tt16 joined the AMS-IX on January 8
  - Path: RIPE, AMS IX, Denmark
- Does this affect the delays?
- Yes!
- Feedback of performance change within 24 hours

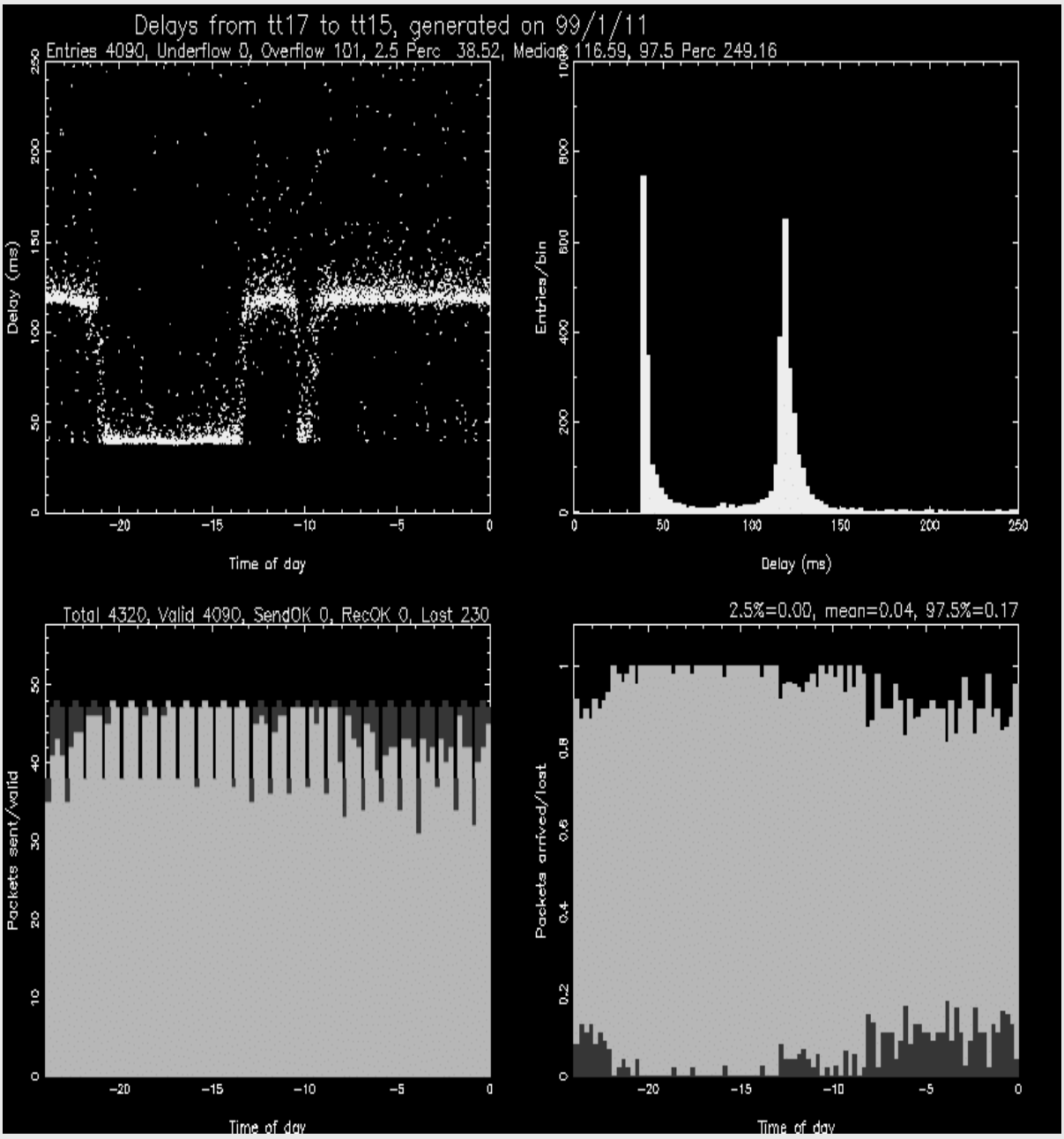
Delays Amsterdam-Denmark



tt17 to tt15

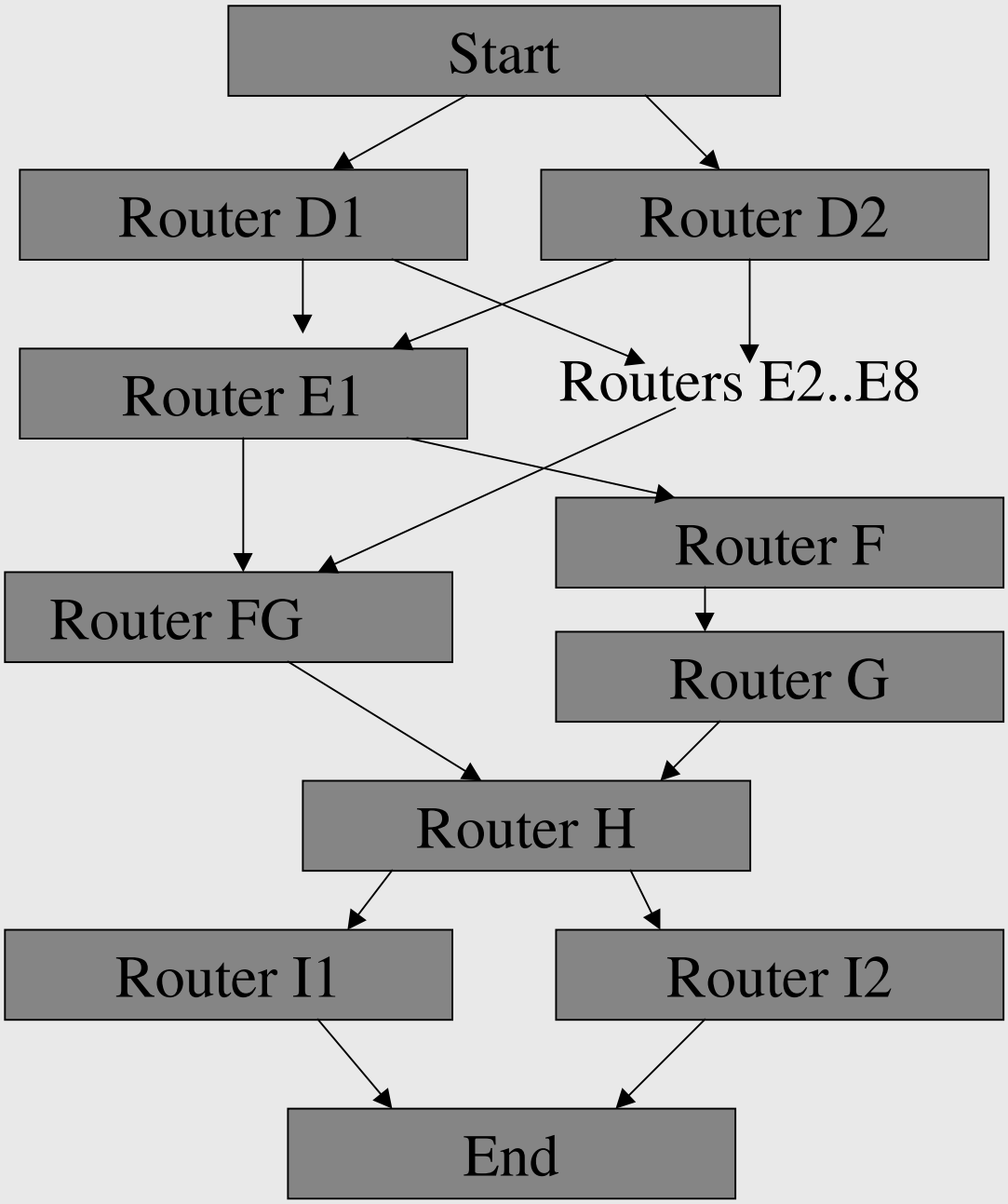
- We want to generate network alarms
- Look for sudden changes in performance
- Good example

tt17 to tt15



- From the daily web page Jan 11.

Path from tt17 to tt15



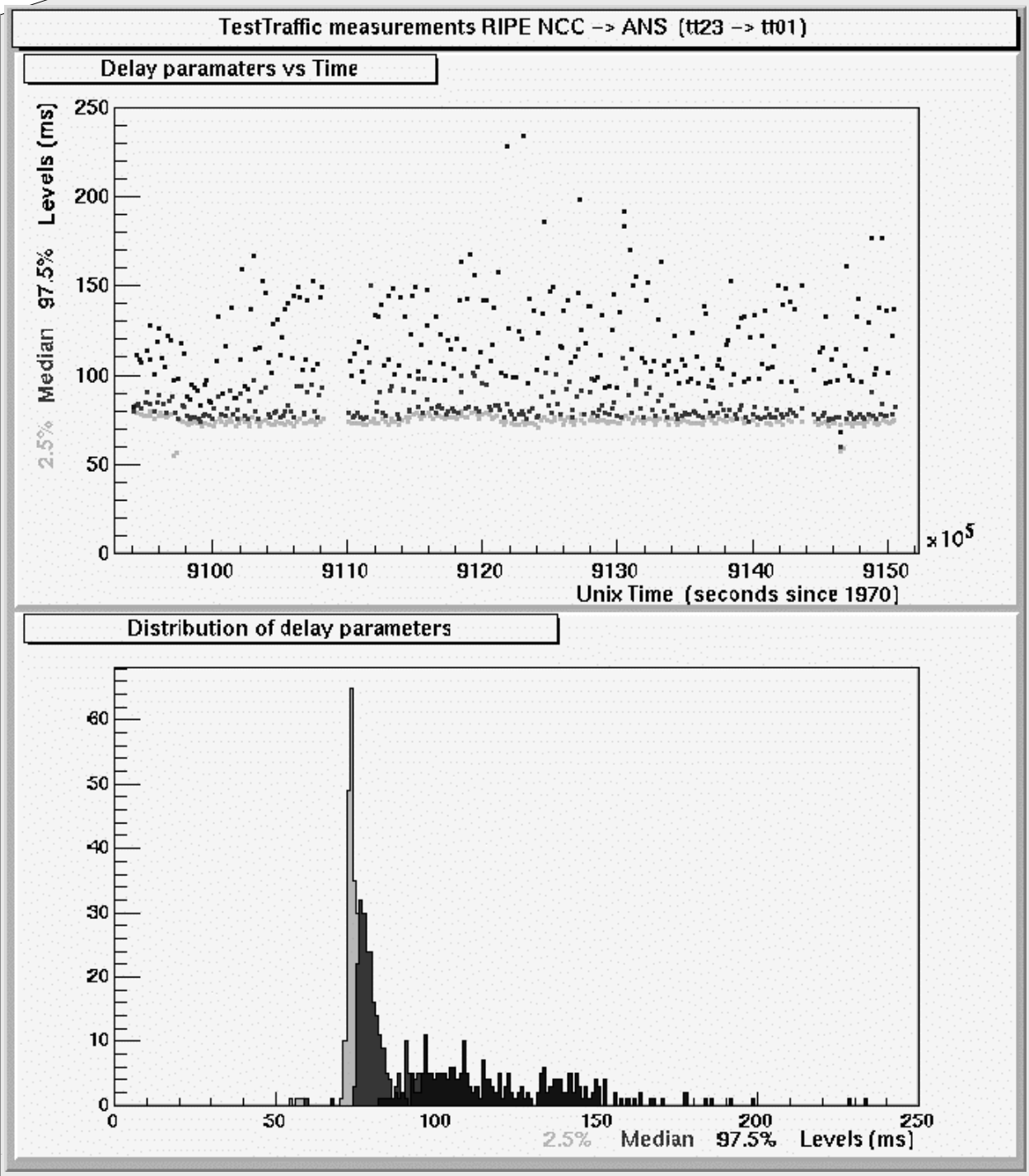
tt17 to tt15

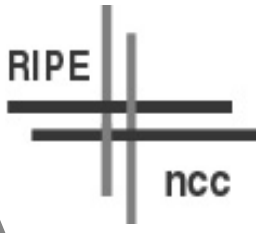
- 48 possible paths
- At least 40 of them are being used
- Jumps in performance
  - No clear relation between delays and path
  - But the path changes rapidly, so traceroute is unlikely to find the correct path
- But clearly something to trigger an alarm
  - How to parameterize this?
  - When to generate an alarm?

tt01 to tt23

- RIPE-ANS
- Summarize the results of the delay measurements.
  - IETF IPPM guidelines
  - Percentiles
    - Value where y% of the packets has a delay below that value.
  - Calculate
    - 2.5%, “Best Case”
    - 50% or Median. “Normal case”
    - 97.5%, “Worst Case”
- Overview of the performance during a longer period

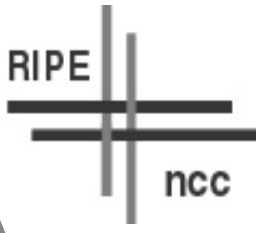
tt01 to tt23


TestTraffic measurements RIPE NCC -> ANS (tt23 -> tt01)
Delay paramaters vs Time
2.5% Median 97.5% Levels (ms)
250
200
150
100
50
0
9100
9110
9120
9130
9140
9150
x10^5
Unix Time (seconds since 1970)
Distribution of delay parameters
60
50
40
30
20
10
0
0
50
100
150
200
250
2.5% Median 97.5% Levels (ms)



Comparison tt01-tt23

- ANS has installed a Surveyor box in Amsterdam
  - Measures the delays on the same path
  - 2 independent measurements
  - Ideal to cross-check results of the experiments
- Plans
  - Analyze the data
  - Exchange results
  - Compare, understand differences
  - Present joint report at IETF44



Future Plans

- Continue to develop the measurement network
- Feedback from the hosts
- Marketing aspects

Plans for the next months

- Continue to run a network of test-boxes
  - 20..40 machines
  - Better user support
  - Data base with all the data
  - Standard analysis
- Development work
  - SNMP
  - Trend analysis
  - New measurements
  - Compare results from RIPE and ANS
  - Analysis suggested by users

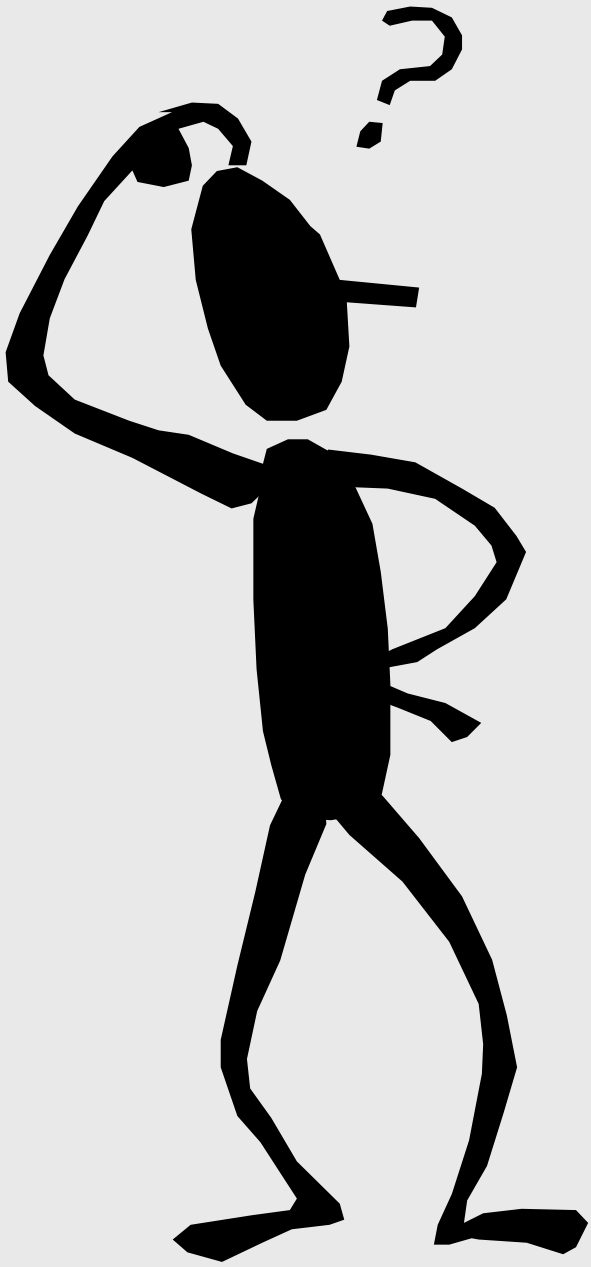
Feedback from the hosts

- Discussion in the IPPM-WG at IETF-43
  - We have a lot of data about the networks
  - All “Low Level” Metrics
  - ISP’s and their customers want “real performance numbers” or “Derived metrics”
  - “Develop services”, that is, provide those numbers
  - But what do ISP’s really want?
- More discussion at the next IETF
  - But we need your input for this

Marketing Aspects

- So-far, the test-boxes are free but, after the 1st 40 have been installed, the hosts will have to pay for a box.
- Issues:
  - Price?
  - Services that come with the box?
  - User support?
  - Can test-boxes be used for other projects?
  - PR?
- Started to discuss this internally
- Plan to have a proposal ready by the May meeting

Conclusions

- Measurement network has been expanded
- Selected data-management and analysis tools
- Lots of interesting data
- More analysis to come
- Lots of plans for the coming months

Questions?