



# Use of a TTbox in day to day operations



RIPE #48 - Amsterdam

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BELNET

- ★ box details
- ★ routes changes
- ★ IPv4 – IPv6 comparison
- ★ DNS root servers reachability
- ★ delays
- ★ SLA measurements ?
- ★ Improvements

# Box details



- ★ tt62.ripe.net
- ★ online since june 2003
- ★ BELNET, Belgium, Gent
- ★ IPv6 enabled

# Routes changes



- ★ detect route changes
- ★ detect asymmetric routes
- ★ check global connectivity of our transit providers and/or when changing transit providers

# Routes changes : example



See folder *Traceroute example*

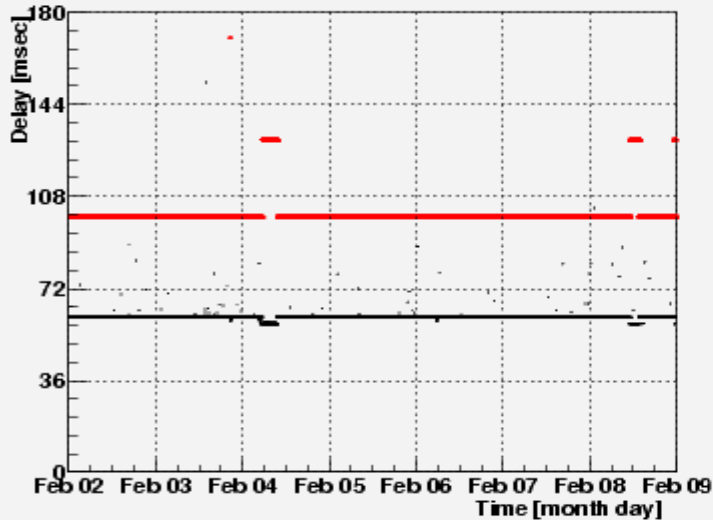
- BELNET - Internet2
- route flapping between our transit providers
- direct and reverse route affected
- assymmetric route
- route changed
  - better delays
  - more hops

# Routes changes : example (2)

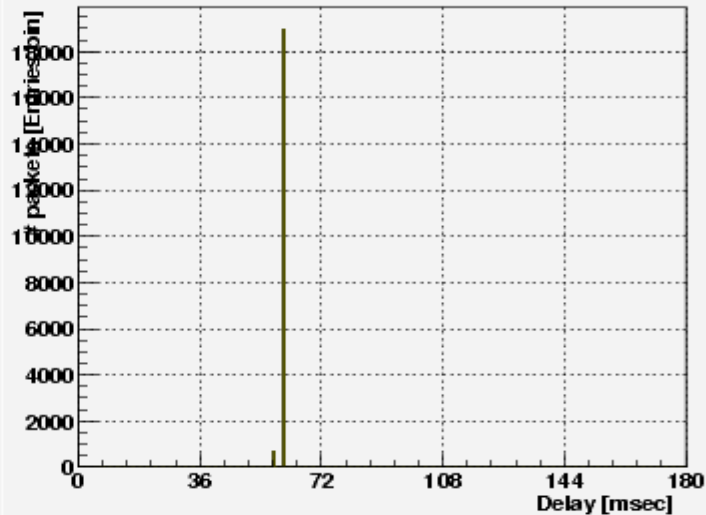


Delays from tt62 to tt23. Start: 2004-02-02 00:00 End: 2004-02-09 00:00 UTC

PacketDelay, Number of hops\*10



PacketDelay



**STATISTICS:**

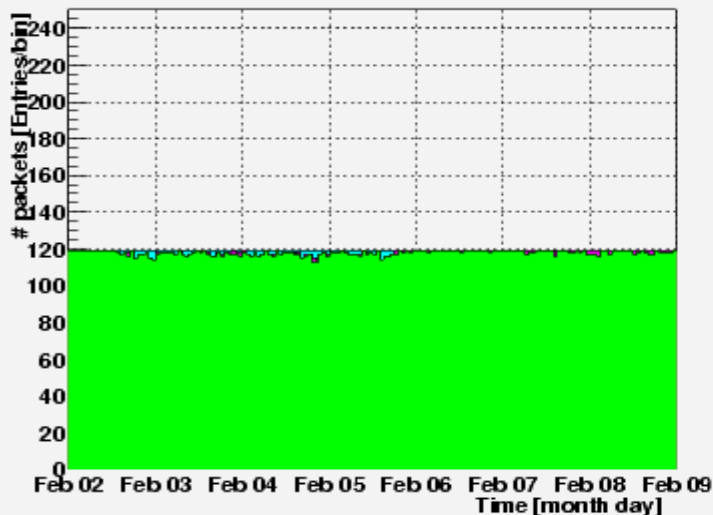
**Delay & Hops:**

Entries: 19804  
 Overflow: 0  
 Underflow: 0  
 2.5 Perc: 58.1ms  
 Median: 60.7ms  
 97.5 Perc: 61.0ms  
 Mean: 60.7ms  
 RMS: 1.1ms  
 Min. hops: 10  
 Max. hops: 17

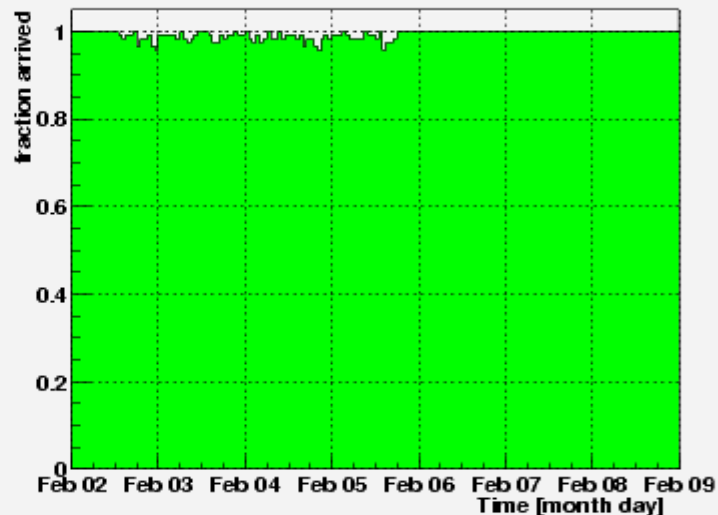
**Packets sent/valid:**

Total: 19992  
 Valid: 19804 = 99.1 %  
 Send bad: 62 = 0.31 %  
 Recv bad: 0 = 0 %  
 2 Clocks bad: 0 = 0 %  
 Lost: 126 = 0.63 %

Packets sent/valid



Packets arrived/lost



**Packets lost:**

2.5 Perc: 0.0%  
 Median: 0.0%  
 97.5 Perc: 3.4%  
 Uptime: 100 %

**Over-all statistic:**

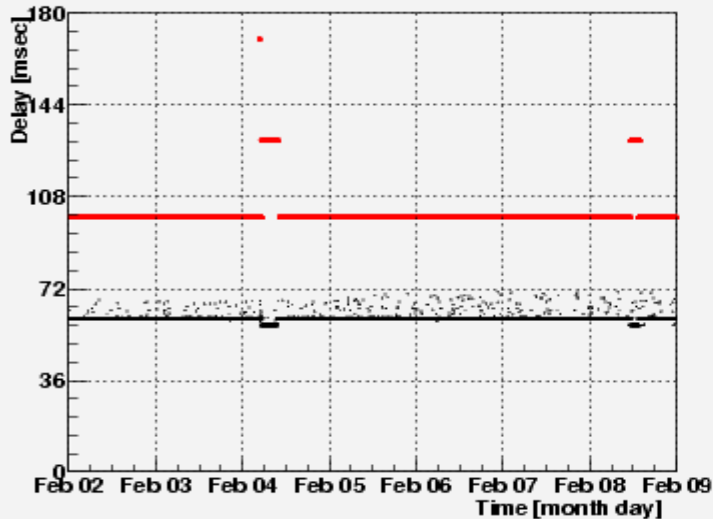
Time period: 7 days  
 Number of routing vectors: 4  
 flaps: 18  
 Number of bins: 168  
 Minutes/bin: 60

# Routes changes : example (3)

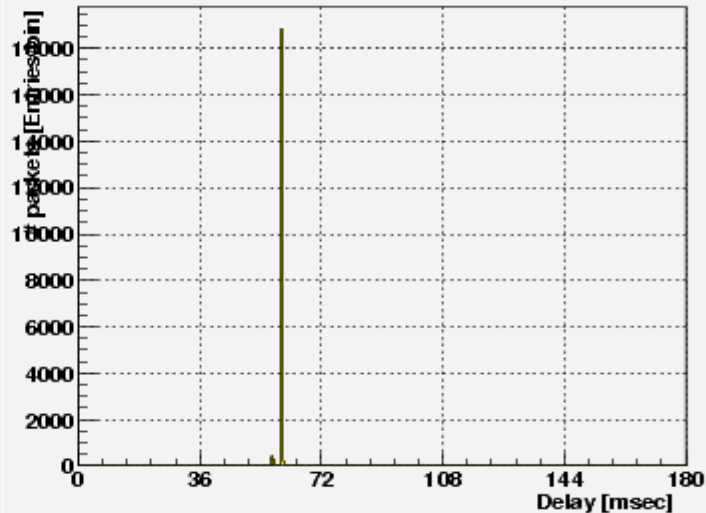


Delays from tt23 to tt62. Start: 2004-02-02 00:00 End: 2004-02-09 00:00 UTC

PacketDelay, Number of hops\*10



PacketDelay



**STATISTICS:**

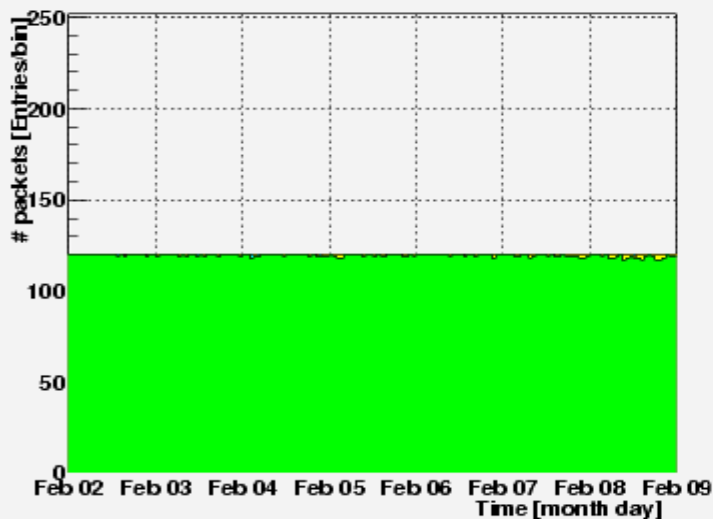
**Delay & Hops:**

Entries: 20075  
 Overflow: 0  
 Underflow: 0  
 2.5 Perc: 57.6ms  
 Median: 60.2ms  
 97.5 Perc: 60.4ms  
 Mean: 60.2ms  
 RMS: 0.8ms  
 Min. hops: 10  
 Max. hops: 18

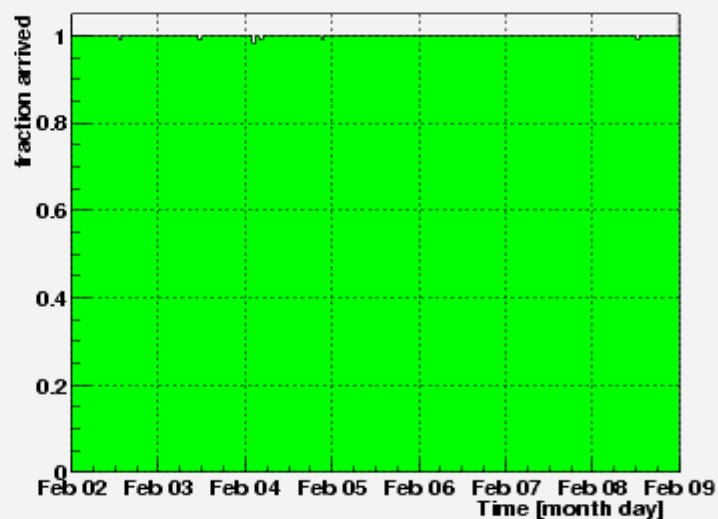
**Packets sent/valid:**

Total: 20160  
 Valid: 20075 = 99.6 %  
 Send bad: 0 = 0 %  
 Recv bad: 78 = 0.39 %  
 2 Clocks bad: 0 = 0 %  
 Lost: 7 = 0.035 %

Packets sent/valid



Packets arrived/lost



**Packets lost:**

2.5 Perc: 0.0%  
 Median: 0.0%  
 97.5 Perc: 0.8%  
 Uptime: 100 %

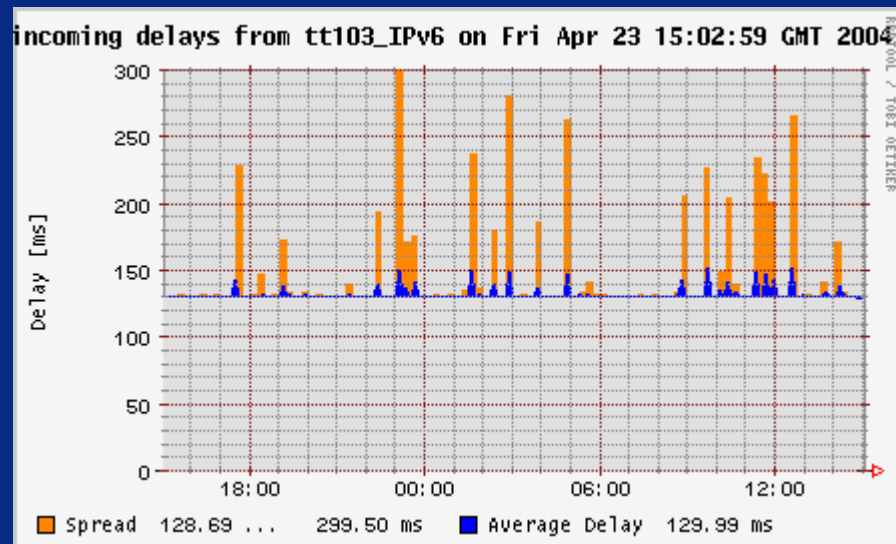
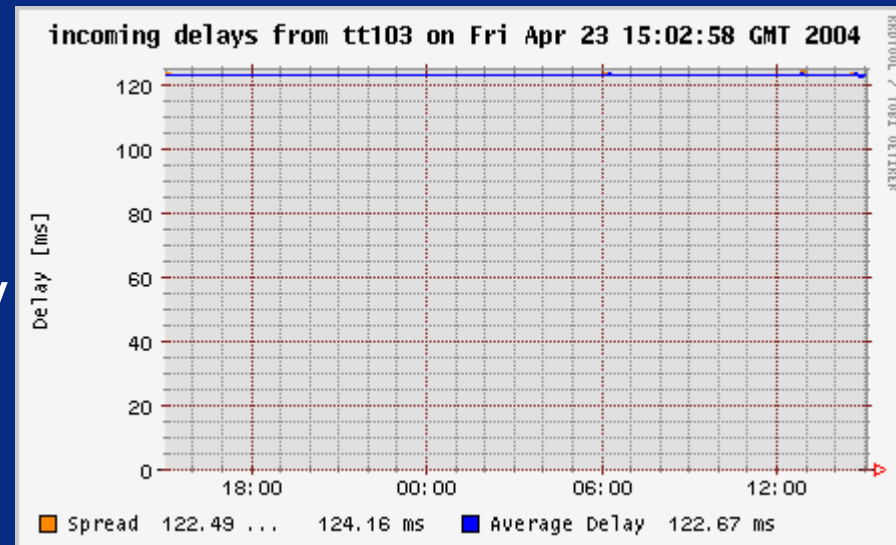
**Over-all statistic:**

Time period: 7 days  
 Number of routing vectors: 6  
 flaps: 14  
 Number of bins: 168  
 Minutes/bin: 60

# IPv4 – IPv6 comparison

## IPv6 networks

- about same delay
- more jitter

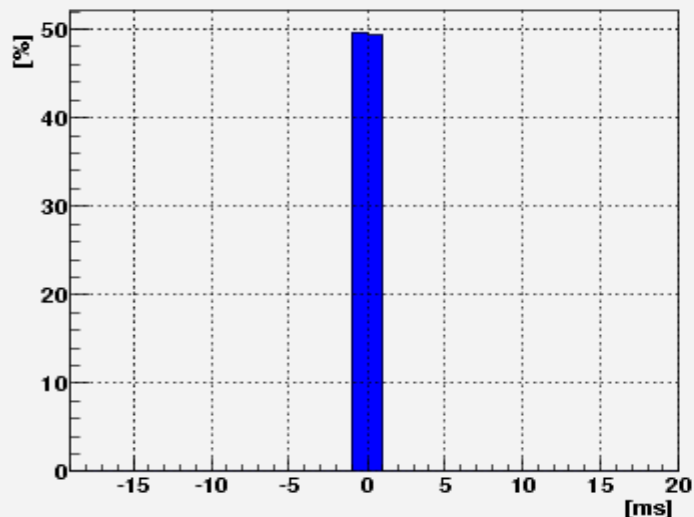




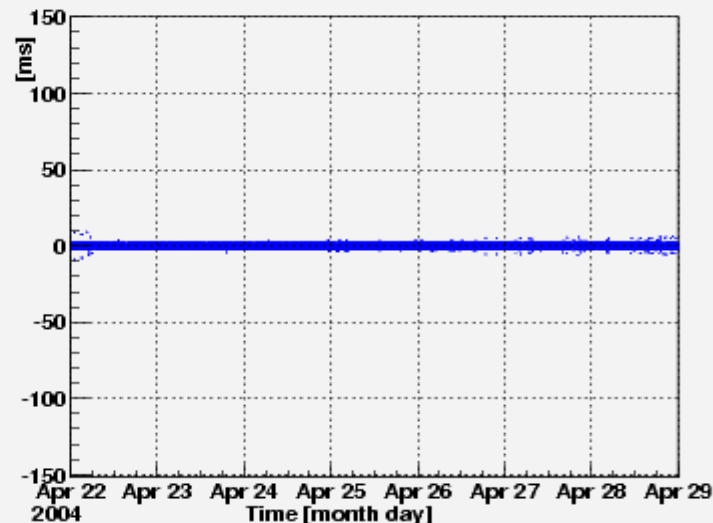
# IPv4 – IPv6 comparison (2)

Delay Variations from tt103 to tt62 Start: 2004-Apr-22, 00:00 End: 2004-Apr-29, 00:00 UTC

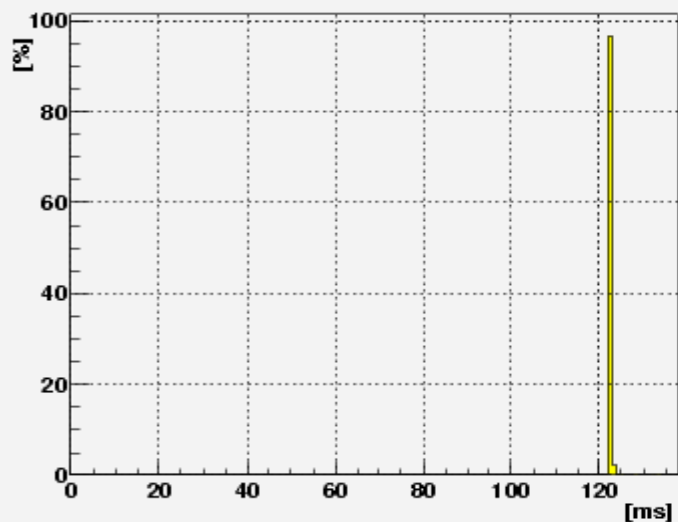
IPDV



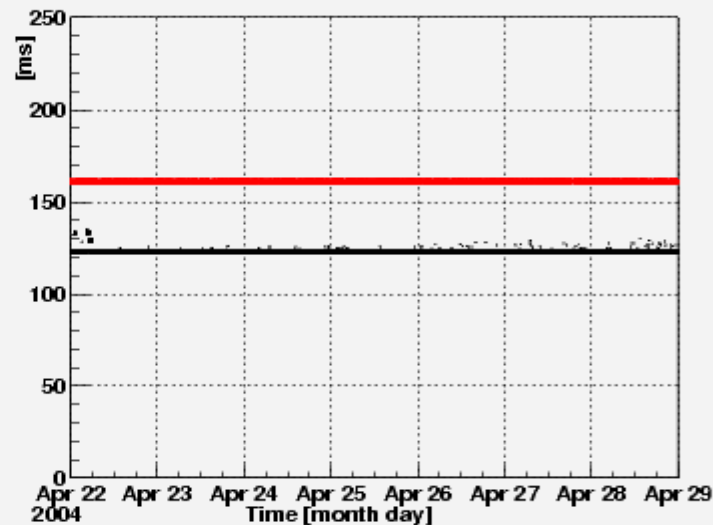
IPDV vs time



PacketDelay



delay (black) and hops\*10 (red)



## STATISTICS

**Packets sent/valid**  
 Total: 19911=100.00%  
 Valid: 19798=99.43%

Number of Routing  
 flaps: 21

## IPDV Percentiles

Mean: -0.00ms  
 RMS: 0.61ms  
 50% > -0.1ms  
 50% < 0.1ms  
 85.0% > -0.1ms  
 85.0% < 0.1ms  
 97.5% > -0.2ms  
 97.5% < 0.2ms

## Delay Distribution

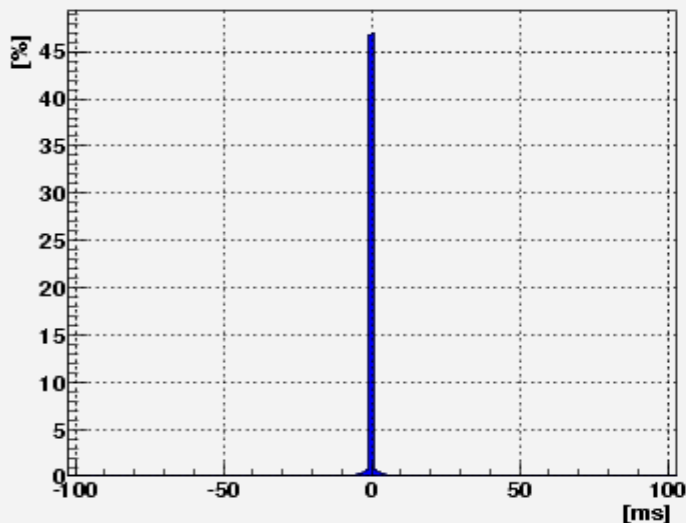
Mean: 122.61ms  
 RMS: 0.87ms

# IPv4 – IPv6 comparison (3)

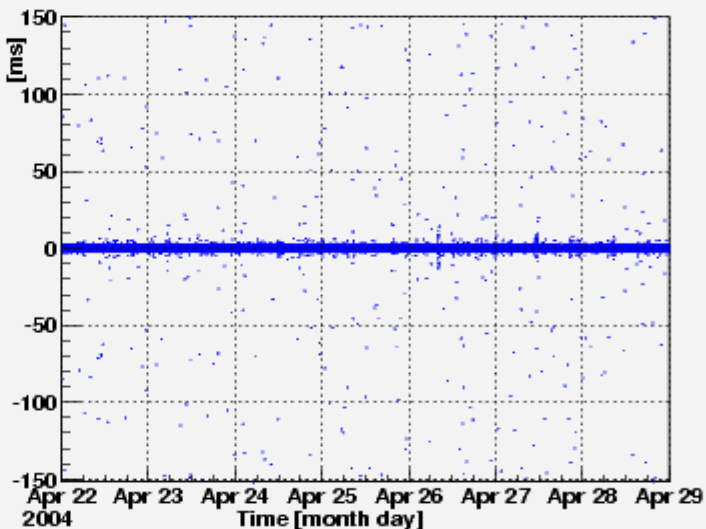
IPv6

Delay Variations from tt103 to tt62 Start: 2004-Apr-22, 00:00 End: 2004-Apr-29, 00:00 UTC

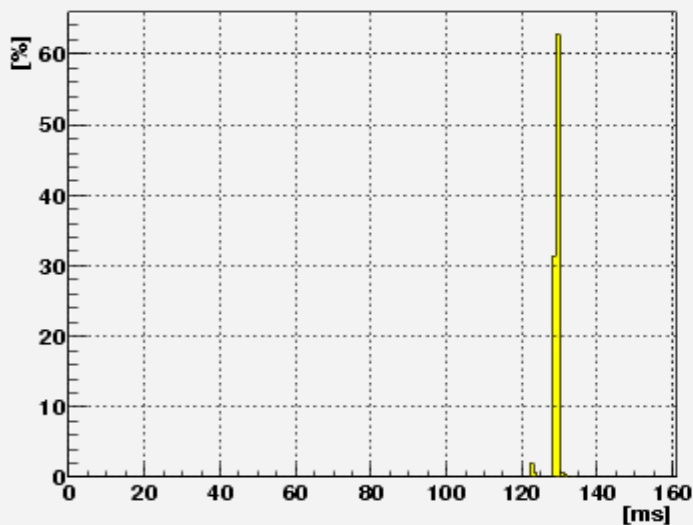
IPDV



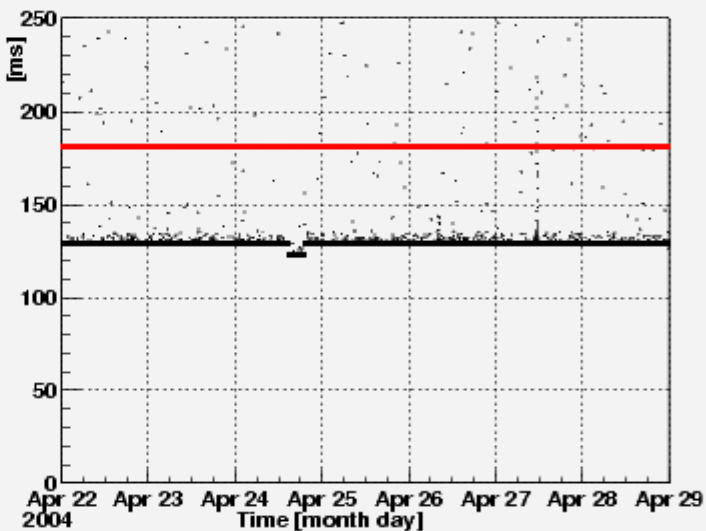
IPDV vs time



PacketDelay



delay (black) and hops\*10 (red)



## STATISTICS

**Packets sent/valid**  
Total: 19877=100.00%  
Valid: 19773=99.48%

Number of Routing  
flaps: 853

## IPDV Percentiles

Mean: 0.00ms  
RMS: 6.08ms  
50% > -0.2ms  
50% < 0.2ms  
85.0% > -0.4ms  
85.0% < 0.4ms  
97.5% > -5.1ms  
97.5% < 5.3ms

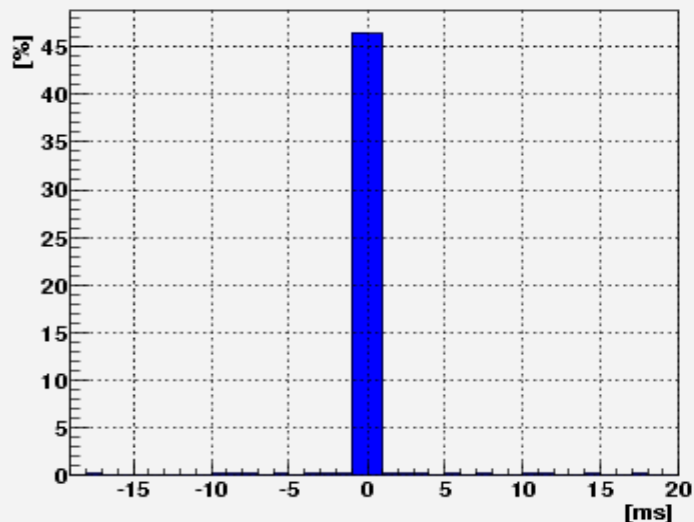
## Delay Distribution

Mean: 129.10ms  
RMS: 1.54ms

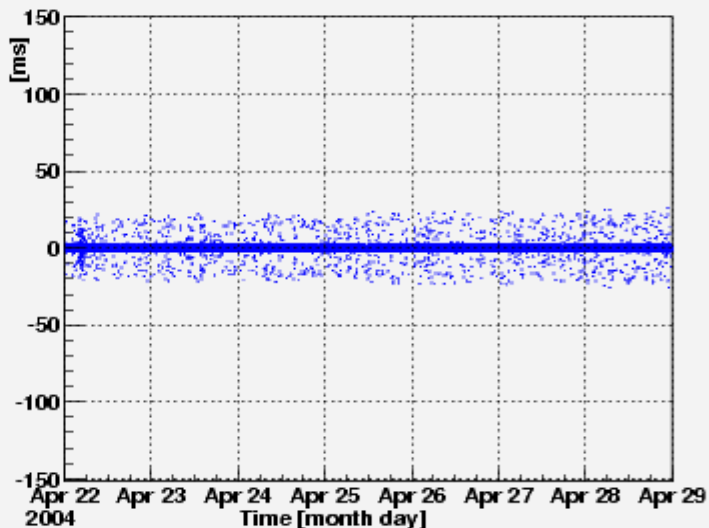
# IPv4 – IPv6 comparison (4)

Delay Variations from tt62 to tt103 Start: 2004-Apr-22, 00:00 End: 2004-Apr-29, 00:00 UTC

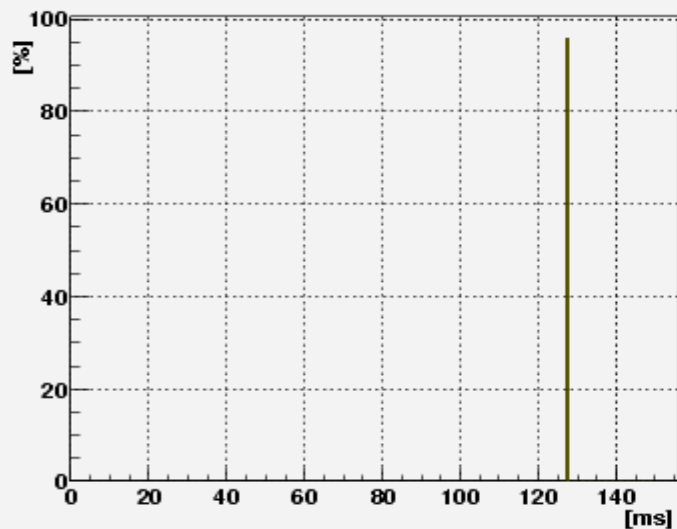
IPDV



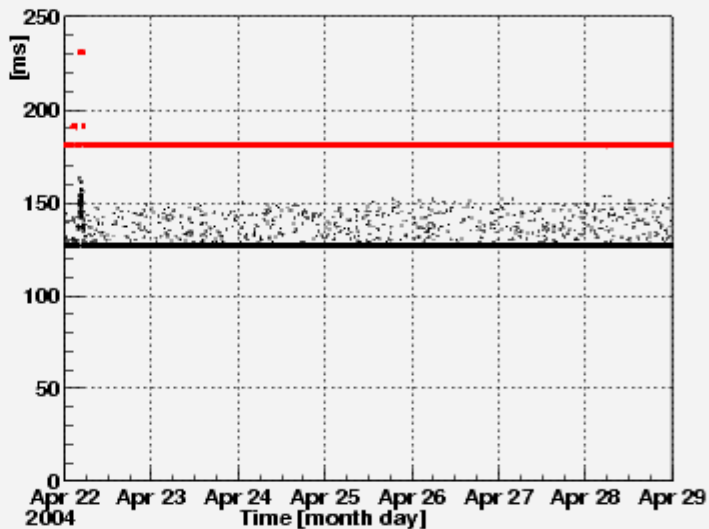
IPDV vs time



PacketDelay



delay (black) and hops\*10 (red)



## STATISTICS

**Packets sent/valid**  
Total: 19710=100.00%  
Valid: 19583=99.36%

Number of Routing  
flaps: 25

## IPDV Percentiles

Mean: -0.00ms  
RMS: 2.90ms  
50% > -0.1ms  
50% < 0.1ms  
85.0% > -0.2ms  
85.0% < 0.2ms  
97.5% > -13.9ms  
97.5% < 13.9ms

## Delay Distribution

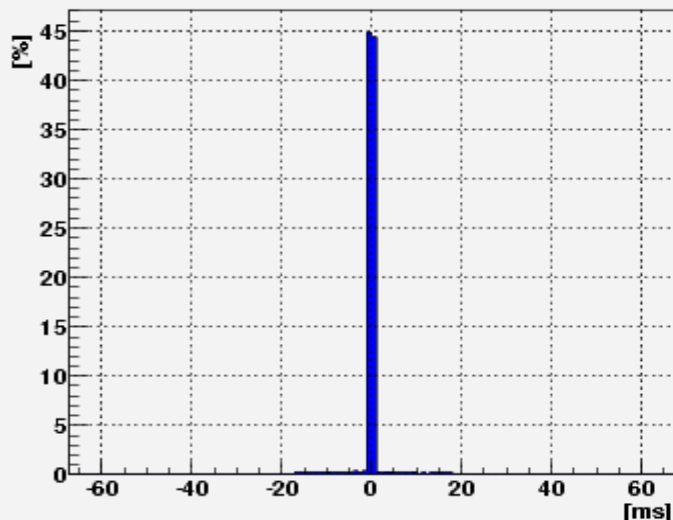
Mean: 127.97ms  
RMS: 2.68ms

# IPv4 – IPv6 comparison (5)

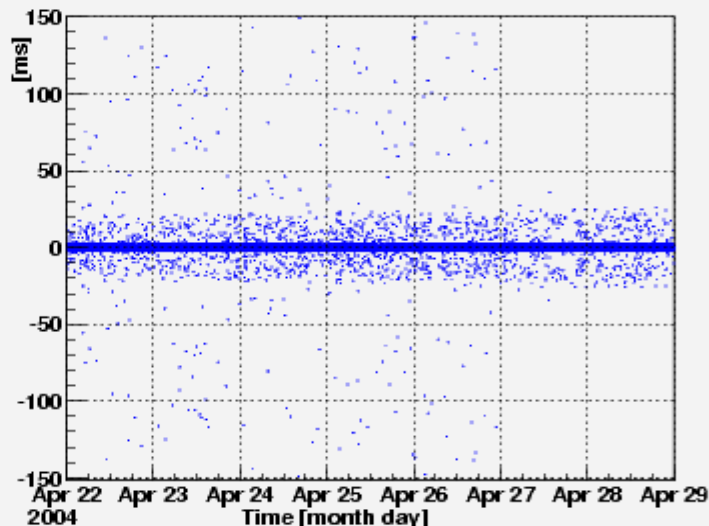
**IPv6**

Delay Variations from tt62 to tt103 Start: 2004-Apr-22, 00:00 End: 2004-Apr-29, 00:00 UTC

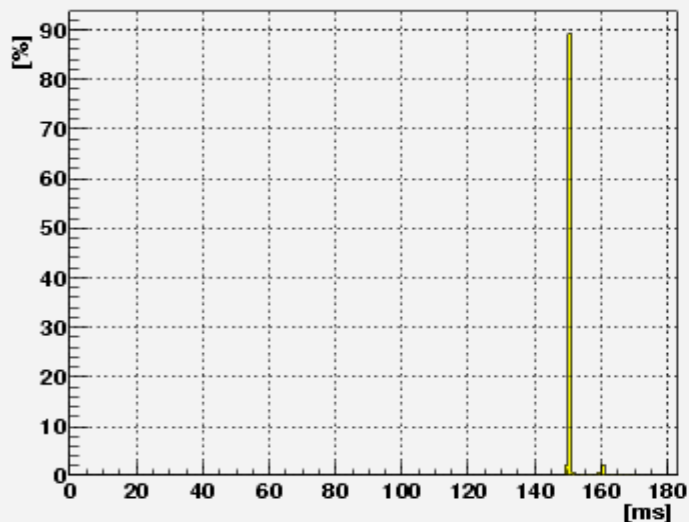
**IPDV**



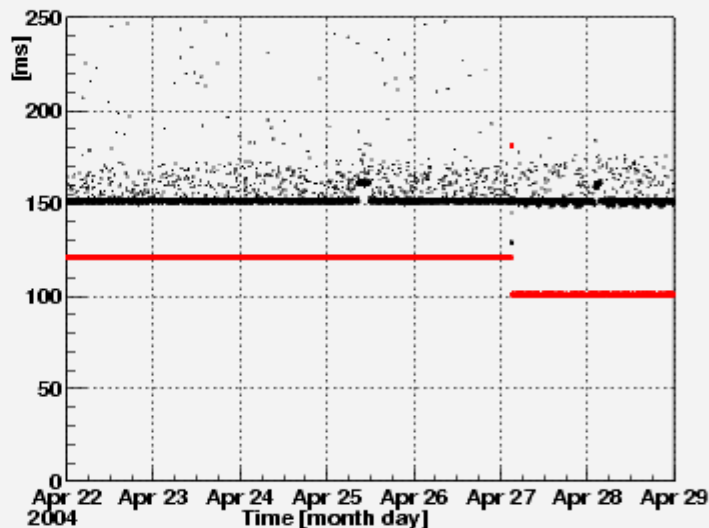
**IPDV vs time**



**PacketDelay**



**delay (black) and hops\*10 (red)**



**STATISTICS**

**Packets sent/valid**  
Total: 19727=100.00%  
Valid: 19607=99.39%

Number of Routing  
flaps: 718

**IPDV Percentiles**

Mean: -0.00ms  
RMS: 4.87ms  
50% > -0.1ms  
50% < 0.1ms  
85.0% > -0.3ms  
85.0% < 0.4ms  
97.5% > -18.6ms  
97.5% < 18.5ms

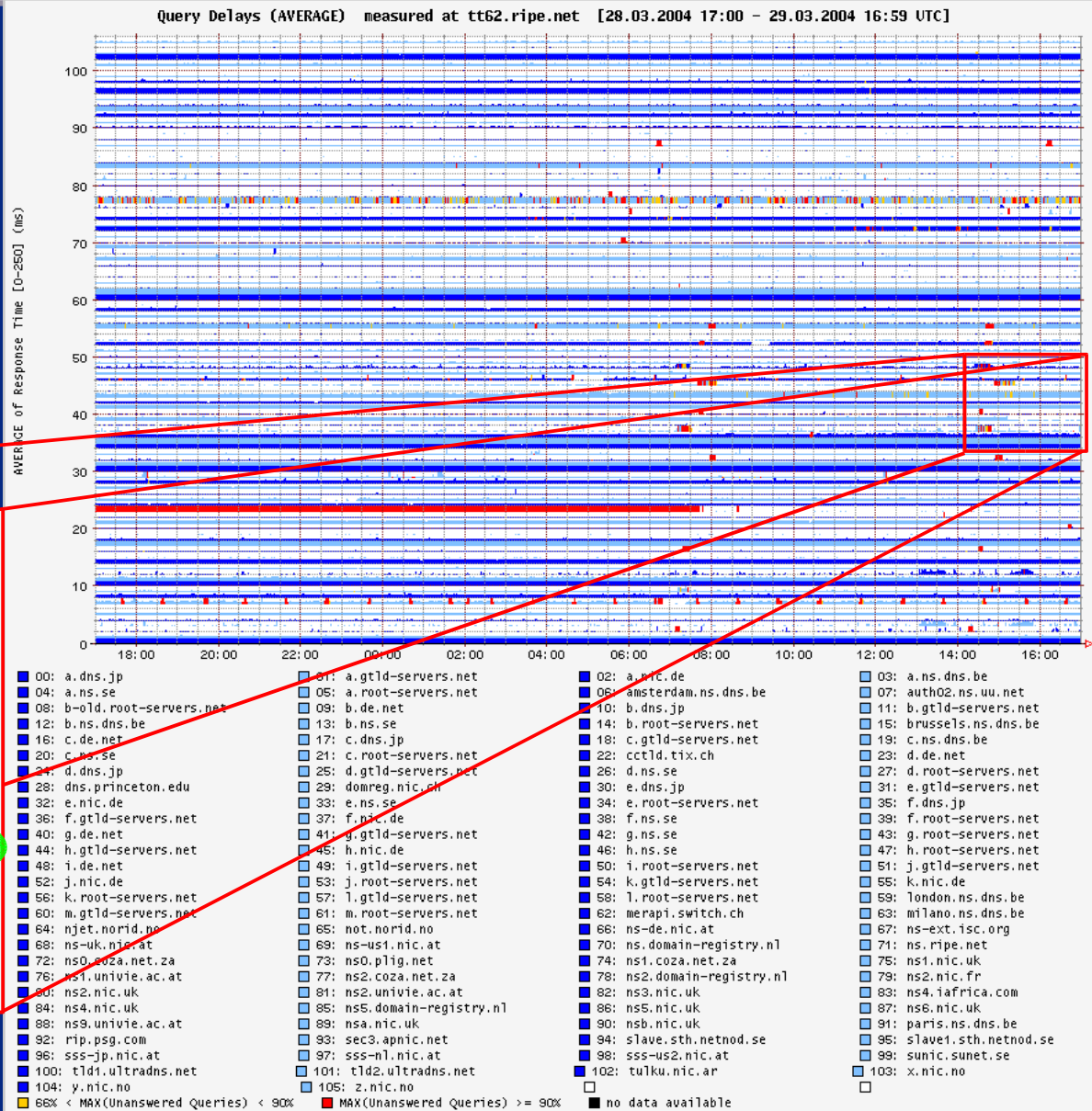
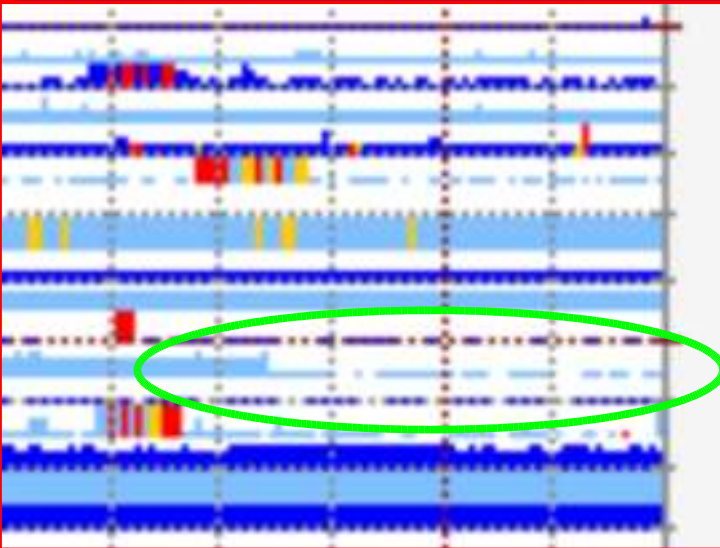
**Delay Distribution**

Mean: 151.24ms  
RMS: 3.12ms

# DNS root servers reachability



- ★ F root server
- @ SFINX
- before peering
- after peering



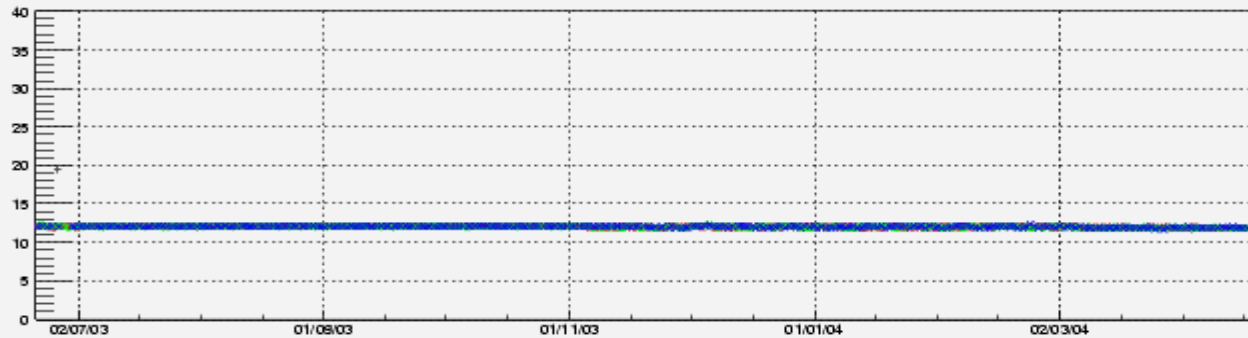
- ★ check delays after major network events
  - change of transit provider
  - adding IX peerings
  - routers upgrade
  - DoS attacks

# Delays : example

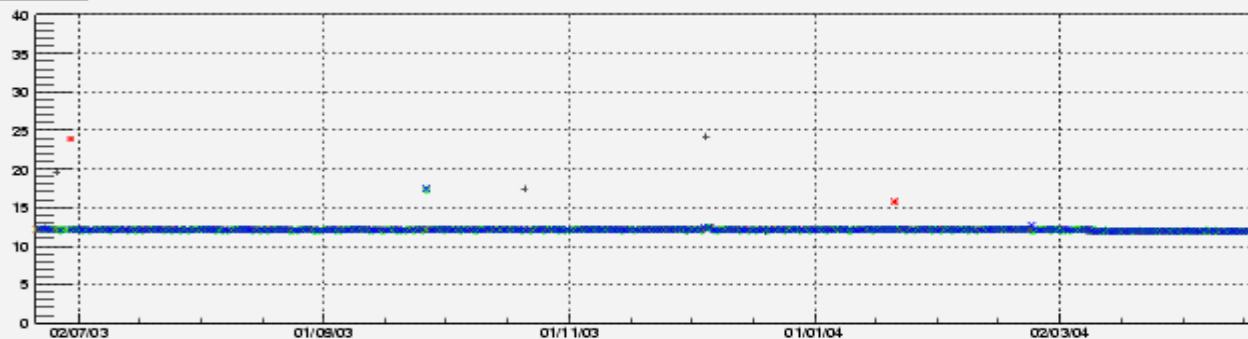


Trends from tt22 to tt62. Start: 2003-06-22 00:00 End: 2004-04-22 00:00 UTC

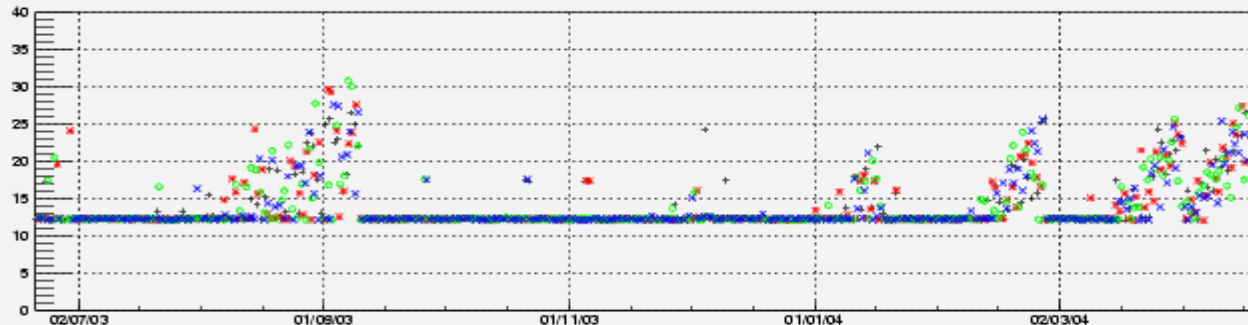
2.5% Level vs. time



Median vs. time



97.5% Level vs. time



## STATISTICS:

Time period 305 days  
4 intervals per day

Time 0:00 - 6:00 h

Median values:

2.5% = 12.02

Median = 12.06

97.5% = 12.26

Time 6:00 - 12:00 h

Median values:

2.5% = 12.01

Median = 12.07

97.5% = 12.27

Time 12:00 - 18:00 h

Median values:

2.5% = 12.01

Median = 12.07

97.5% = 12.28

Time 18:00 - 24:00 h

Median values:

2.5% = 12.02

Median = 12.07

97.5% = 12.27

- ★ Now : internal tools for SLA measurements and reporting
- ★ Use of TTbox data ?
  - direct data from the box (telnet 9142)
  - ROOT data from ftp, short delay in availability
  - both needs developpement on our side before being useful, so not yet done
  - better trust because operated by 3<sup>rd</sup> party



# Improvements



- ★ IPv6 autoconfiguration (if desirable ?)
- ★ speed of webinterface (plots on demand)
- ★ (dual NIC auto fallback ?)