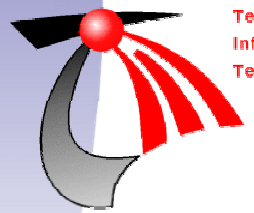
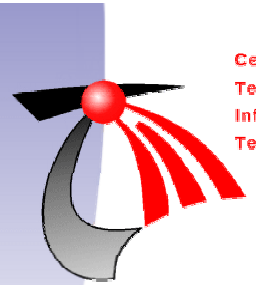




# Initial Analysis of some IPDV measurements in Europe

**Phil Chimento, University of Twente**

**(Supported by SURFnet b.v. Contract 3365)**



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# Introduction

## What is the goal

- Look at a constrained environment
  - One service provider (SURFnet, an NREN)
  - Two stub networks (RIPE and University of Twente)
  - SURVEYOR measurements don't cross service provider boundaries
- Exploratory Data Analysis
  - What is IPDV really like ?
  - What are its characteristics ?

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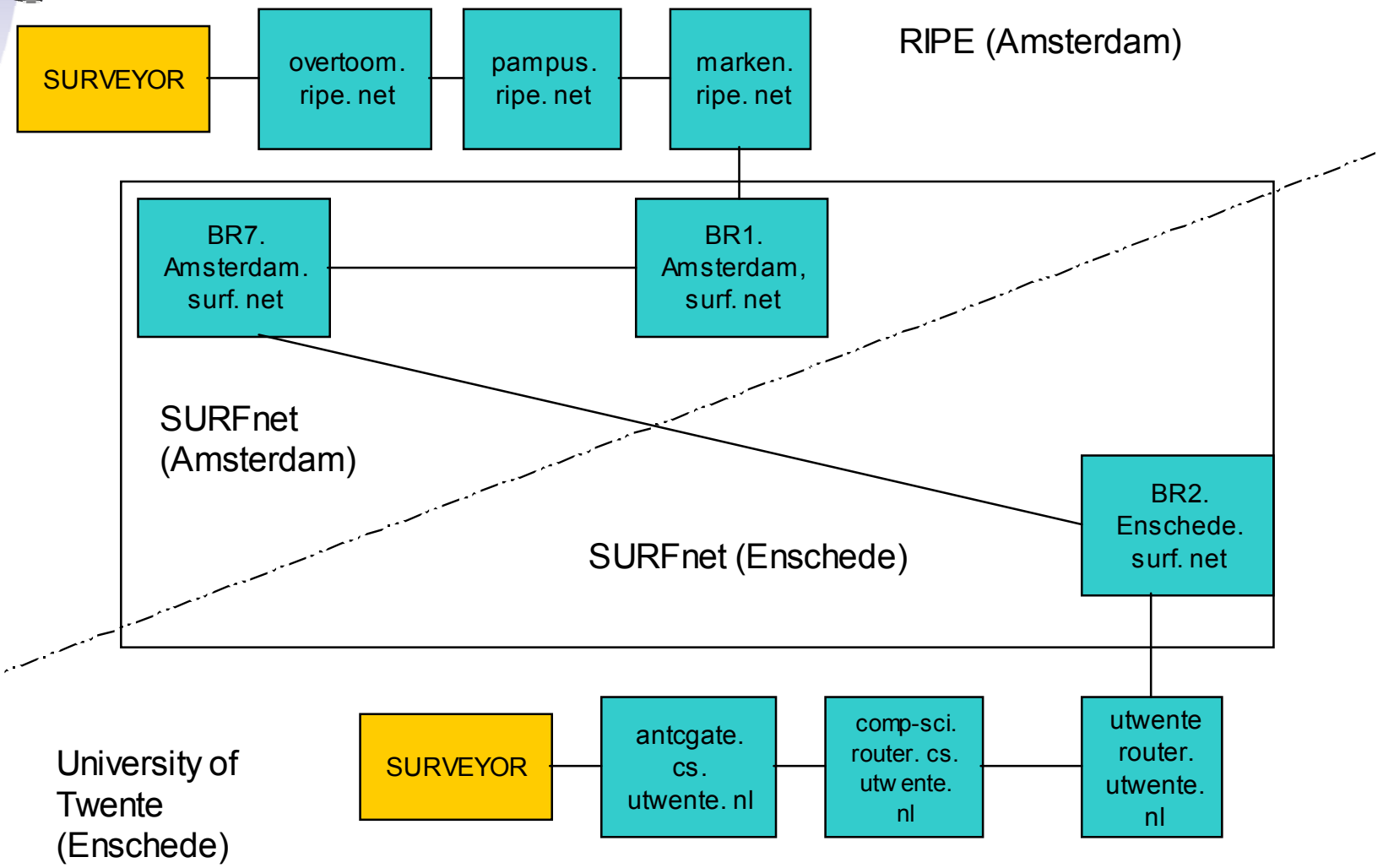
# The Paths



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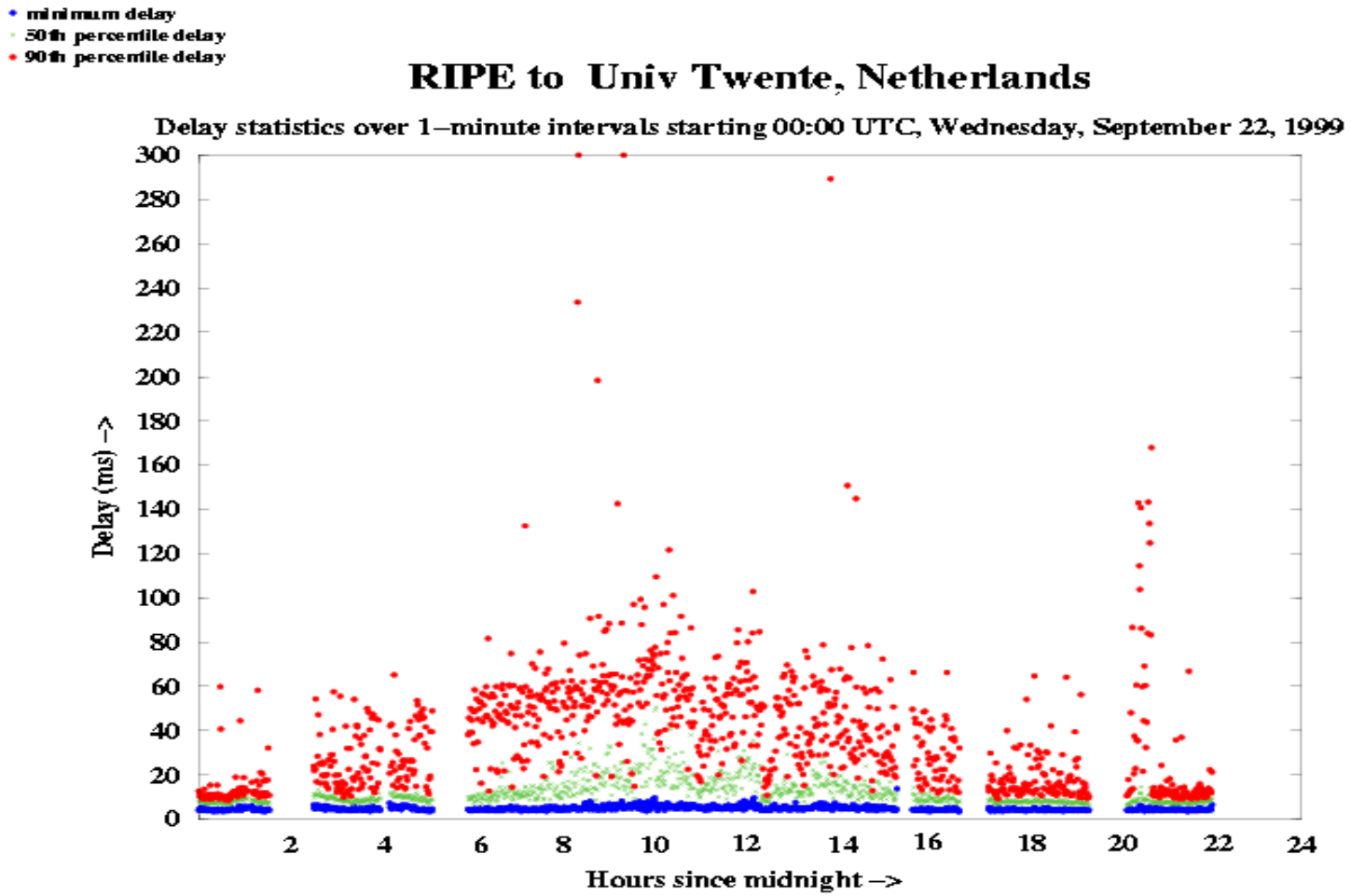
# RIPE-UT 09-22-99

University of Twente
The Netherlands



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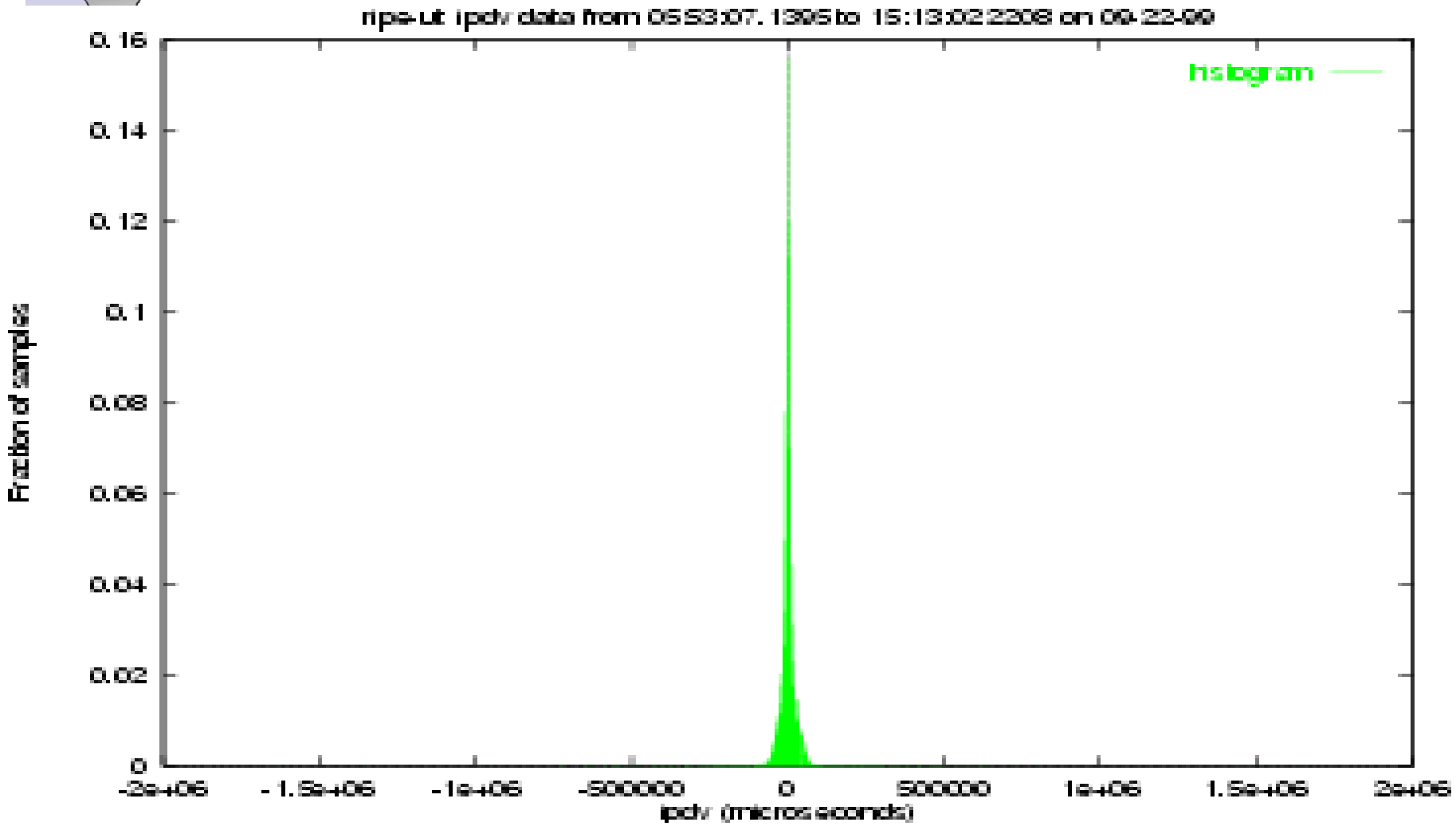
# Ripe-UT 06:00 – 15:13

University of Twente
The Netherlands



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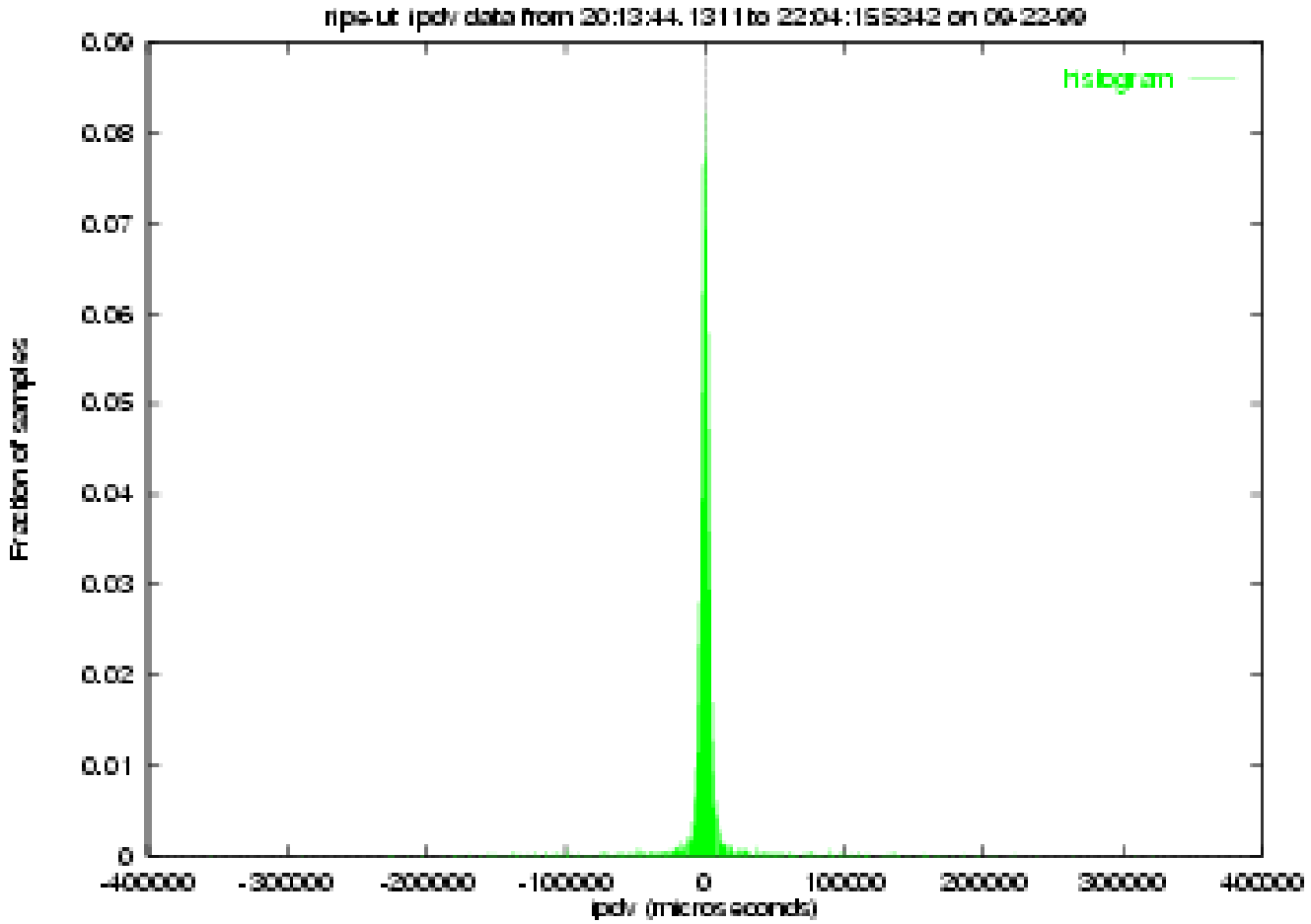
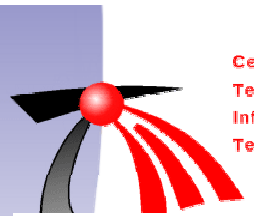
# RIPE-UT 20:00-22:00





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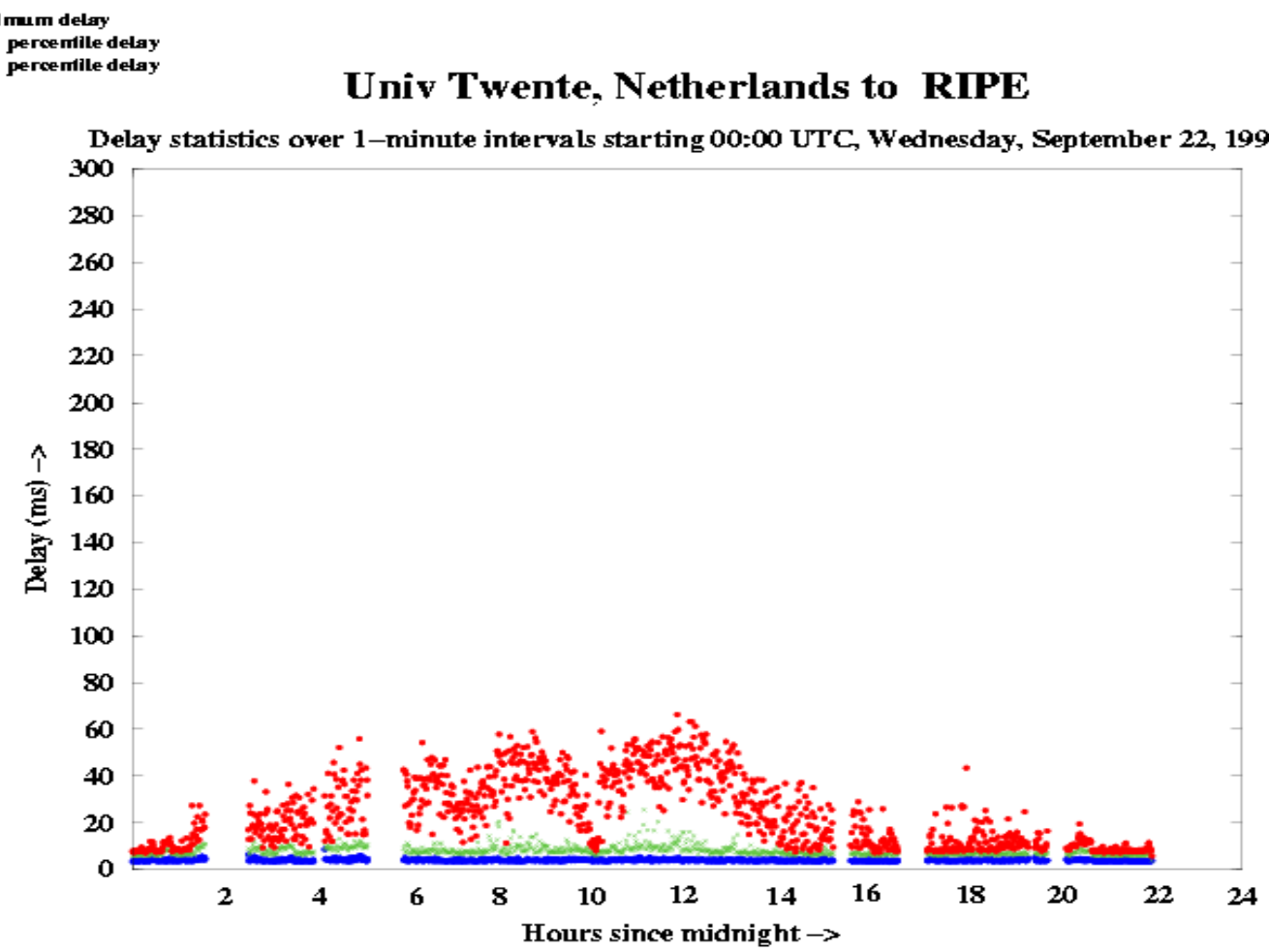
# UT-RIPE 09-22-99



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# UT-RIPE 06:00-15:10

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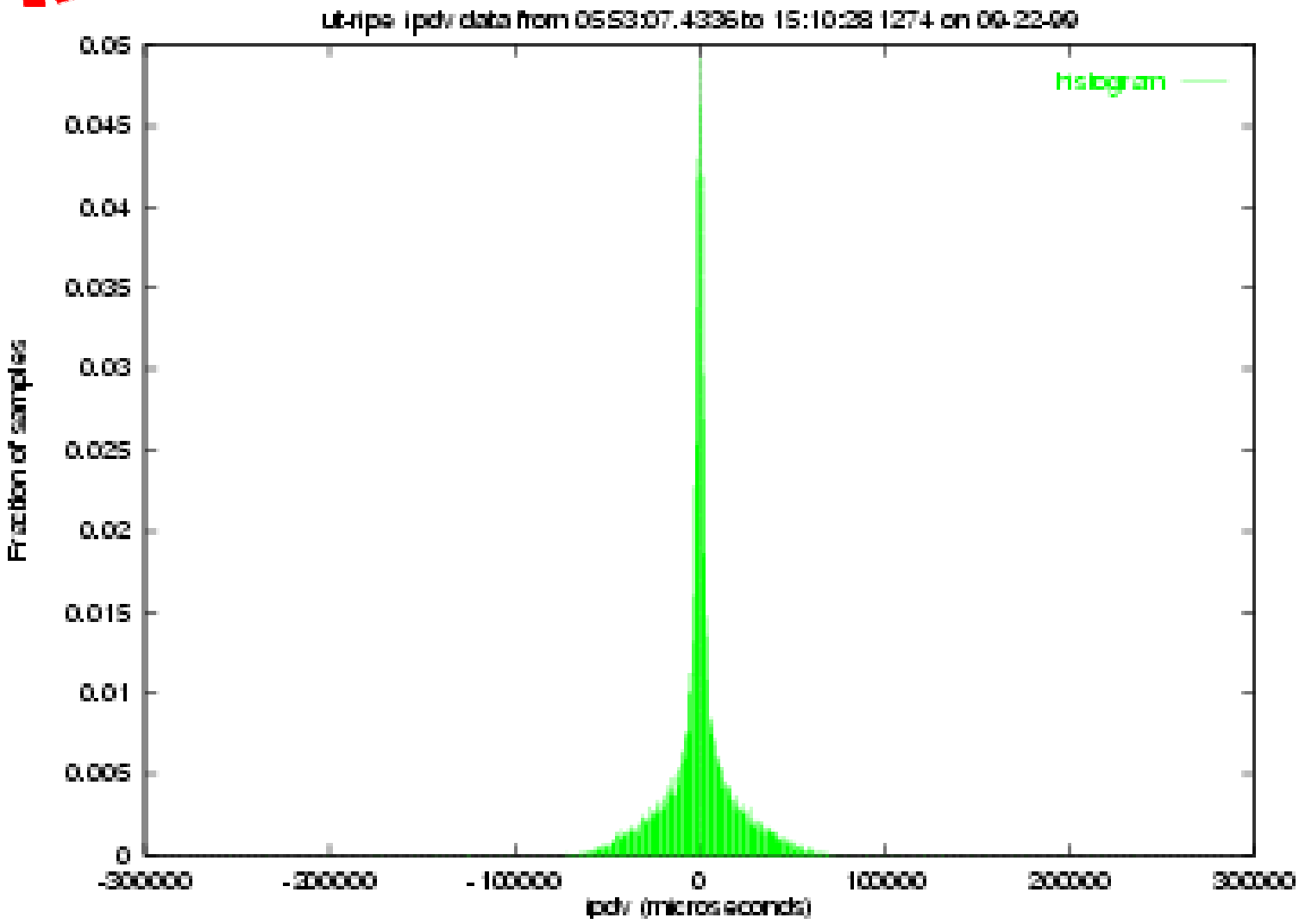

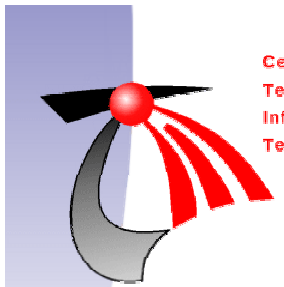

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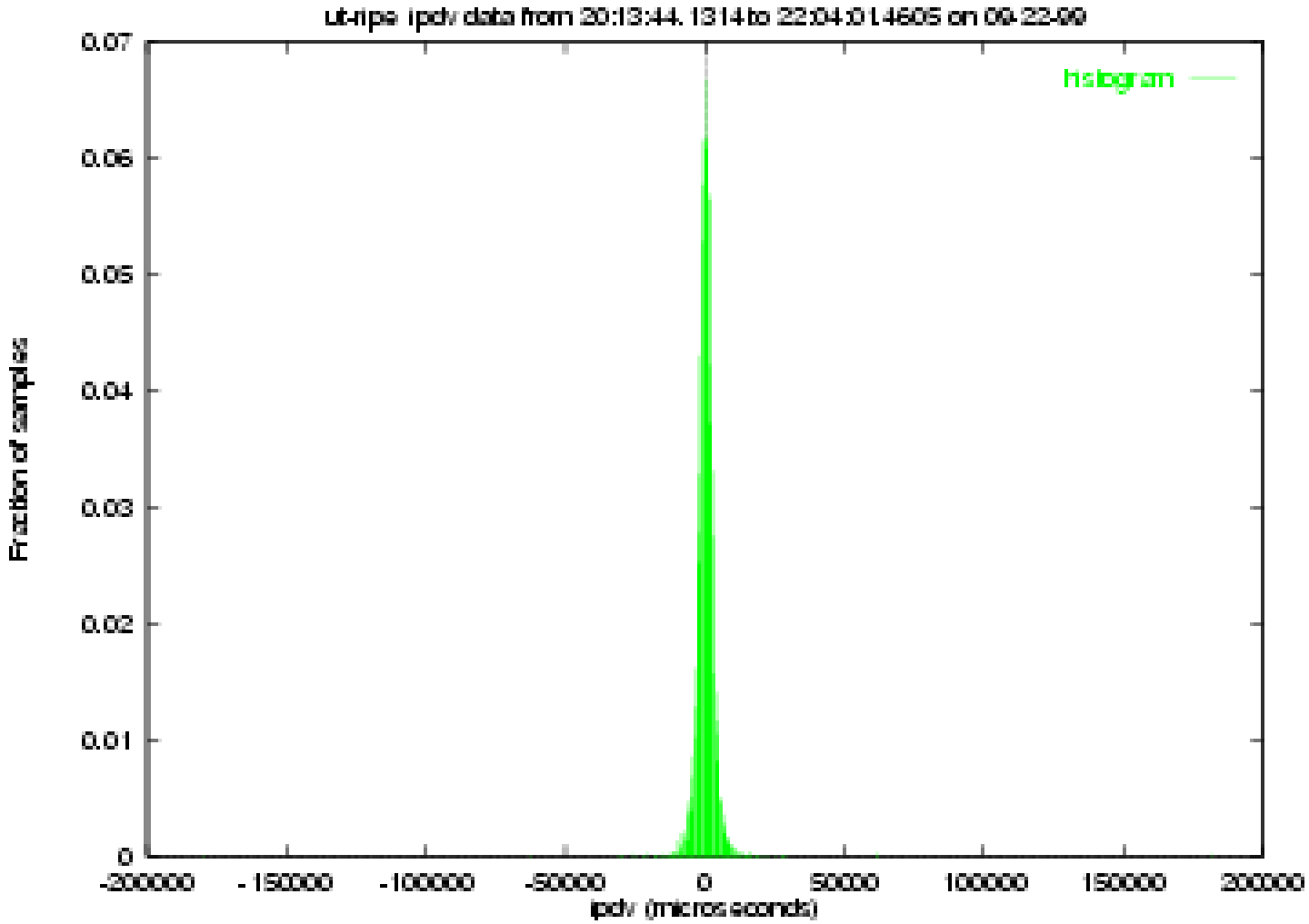
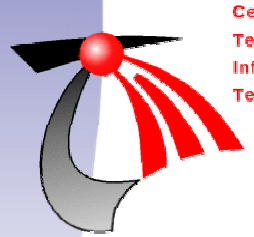
# UT-RIPE 20:00-22:00

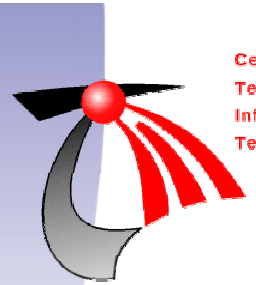






# Some basic stats

| Direction | Times GMT | Average IPDV | Min | Max | Number of samples |
|---|---|---|---|---|---|
| UT-RIPE | 05:53-15:10 | -10.17 µsec | -255,392 µsec | 295,125 µsec | 32,554 |
| UT-RIPE | 20:13 – 22:04 | -0.50 µsec | -180,680 µsec | 181,628 µsec | 6599 |
| RIPE-UT | 05:53-15:13 | 50.13 µsec | -1,647,343 µsec | 1,651,002 µsec | 31,908 |
| RIPE-UT | 20:13-22:04 | -46.13 µsec | -354,059 µsec | 321,326 µsec | 6584 |

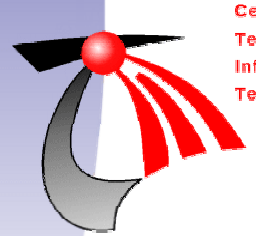




# Processing

## Difficult point of “infinite delay” packets

- We assume that IPDV is not interesting in this case
- Computations are on the basis of ‘arrived’ packet pairs
  - If either of a packet pair is “infinite” then we don’t use the sample
  - Computations run through successive “good” packet pairs
  - Pairs with one or both “infinite” are skipped
- Claim: This provides a conditional distribution and conditional expection (given that both packets of the pair arrive at the destination).



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# Where do we go from here ?

## What do we want to know ?

- What exactly is IPDV telling us about the network ?
- Does IPDV have any predictive power ?
- How is IPDV correlated to delay ?

## Next steps in the analysis

- Look at dynamic behaviour of both delay and IPDV
  - This means doing a time-series analysis
- Look for delay increase events in the measurements and look at the corresponding IPDV sequences
  - This means doing cross-correlations of one-way-delay and IPDV