Communication Network Measurement Reuse

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Overview

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- Introduction
- What is "Communication Network Measurement Reuse?"
- Collecting Network Measurements
  - Approaches
  - Cost
- Using the Measurements
  - Examples
- Problems to be addressed
  - Technical
  - Legal
  - Financial
- Conclusions

Communication Network Measurement Reuse

- Using the same fundamental network performance data to meet multiple different requirements
- Measurements are a cost overhead and
- Networks face multiple challenges

Collecting Communication Network Performance Measurements - Issues

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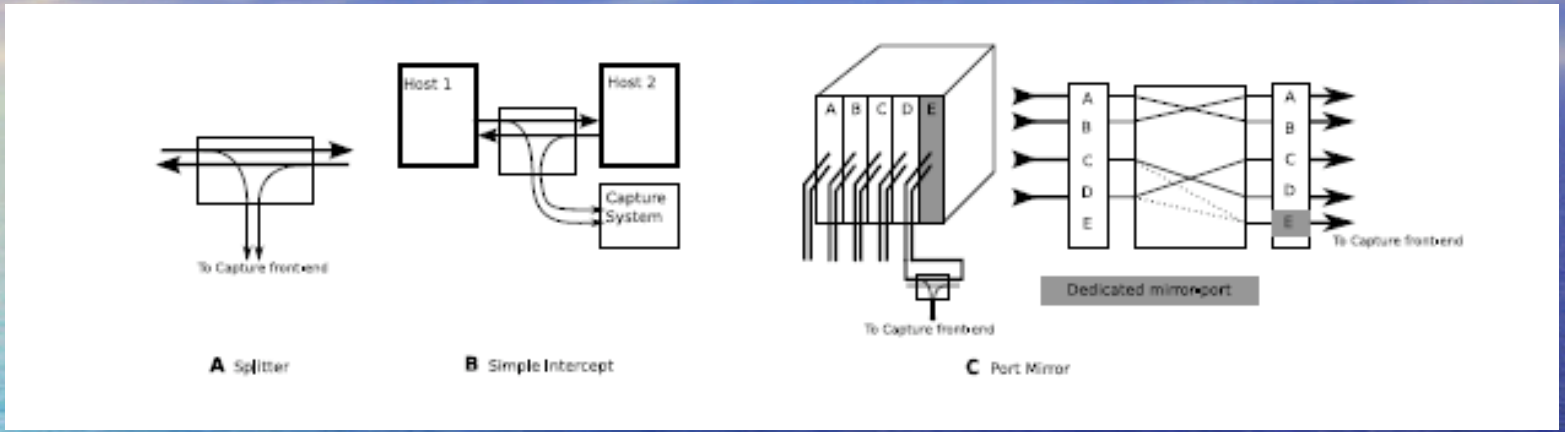
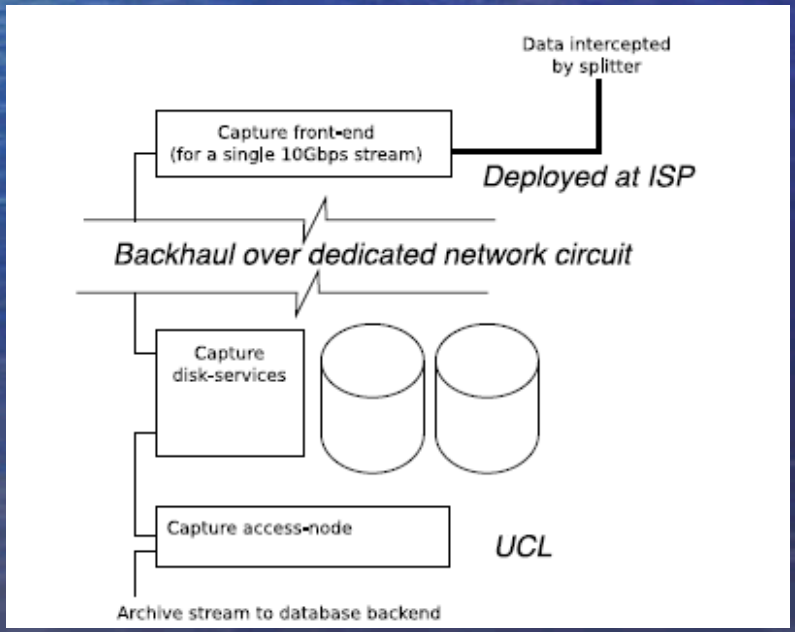
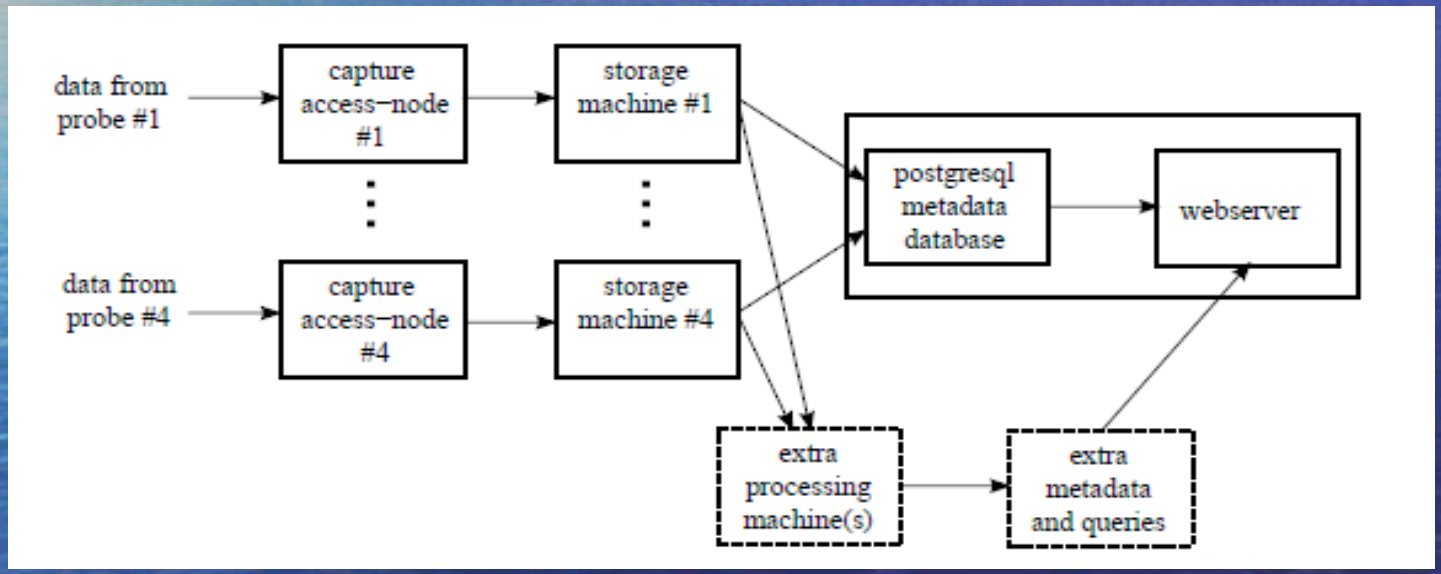
- An Expensive Activity!
- A Hard problem if high data rate network to be measured
  - Where to measure
  - What to measure
- Commercial or Proprietary Solutions
- Storage and Dissemination
- Use to Maximum Benefit

An example – the MASTS Architecture






data from probe #1
capture access–node #1
storage machine #1
data from probe #4
capture access–node #4
storage machine #4
postgresql metadata database
webserver
extra processing machine(s)
extra metadata and queries

Using Measurements

- Understanding network performance
- Diagnostics
- Planning Upgrades
- Predicting Application Performance
- Identifying Applications
- Identifying Attacks and Abuse
- Security
- Identifying SPAM Relays and BotNets
- Reducing energy usage

Often each area (if active) collects its own data.

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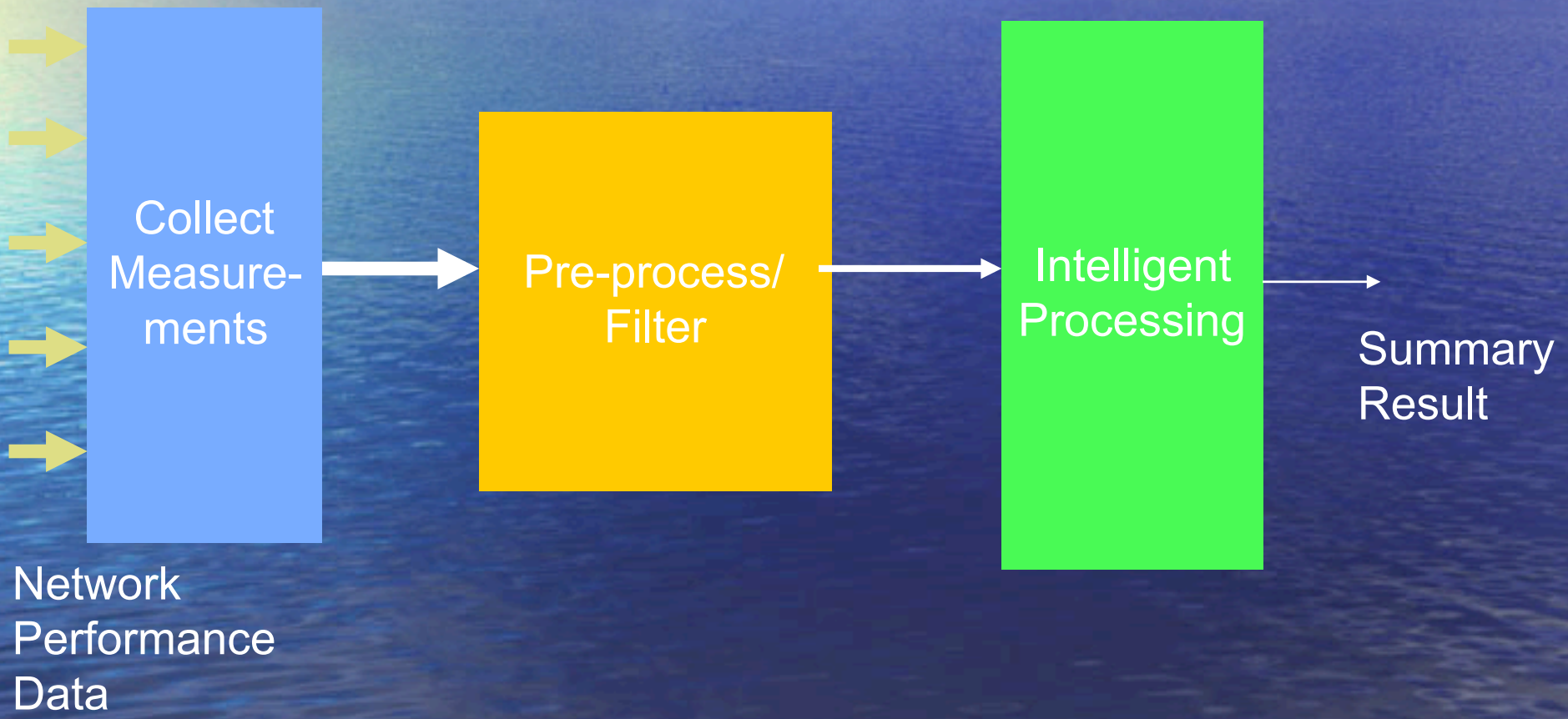
Generic Approach



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Some Specific Examples:

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Application Detection

- An approach to the identification of applications generating traffic on a network.
  - Port Number not always valid
  - Deep Packet analysis not usable due to high data rates or encryption.
- Using the Packet Size Distribution as a "fingerprint".

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Using Packet Size Distributions

- Packet Size Distribution used as an alternative application 'Signature'
  - Statistical approach
  - Doesn't require every packet to be captured
  - Doesn't rely on the data portion of the packet

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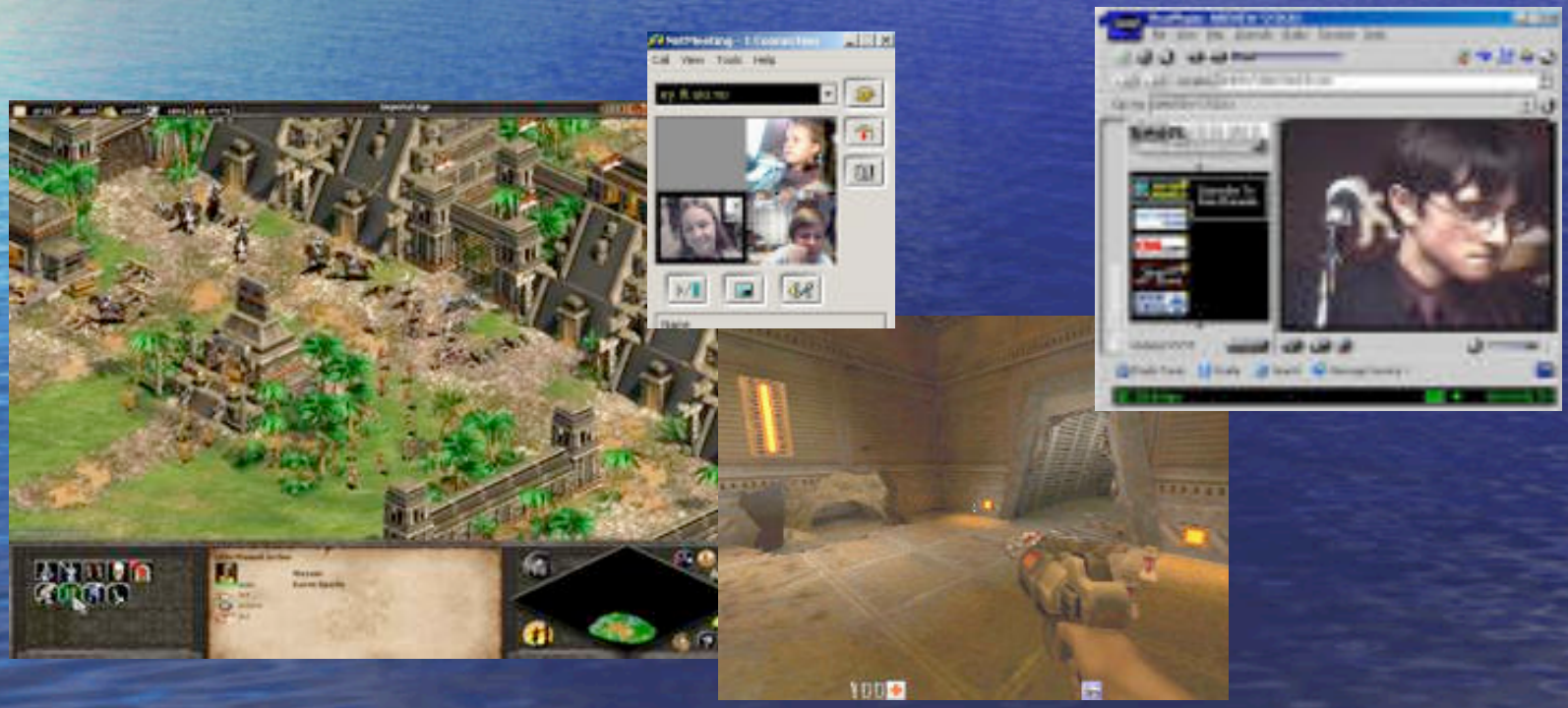
Using Packet Size Distributions

- Traces of Applications Required



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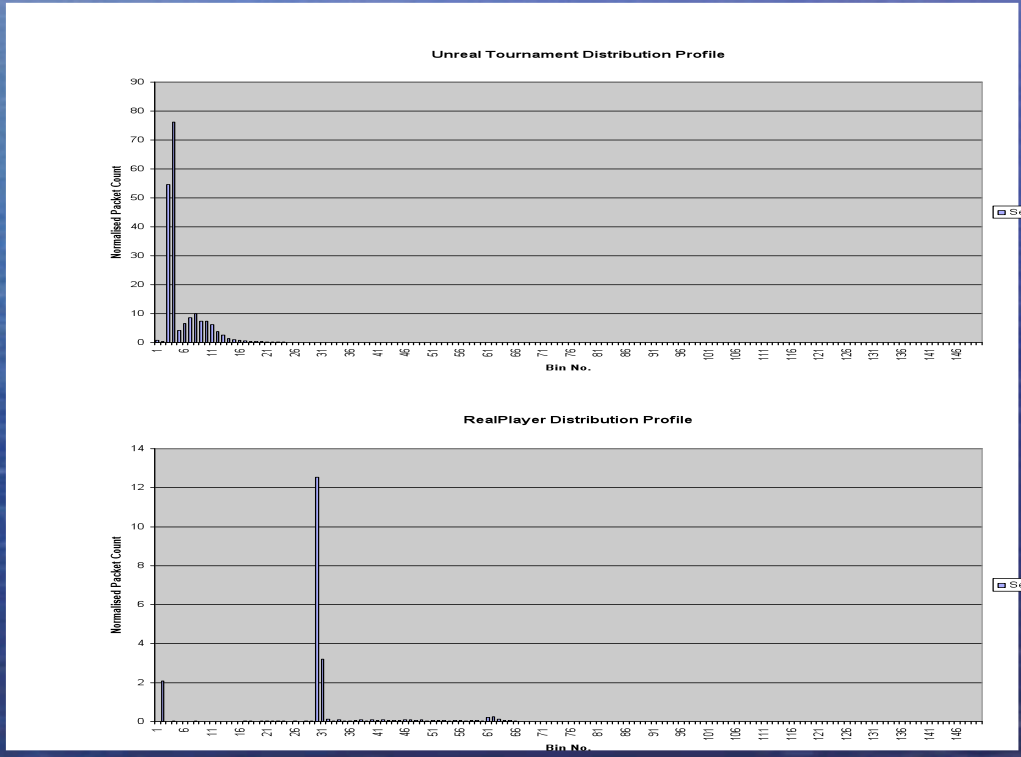
Using Packet Size Distributions

Unreal Tournament

Real Player



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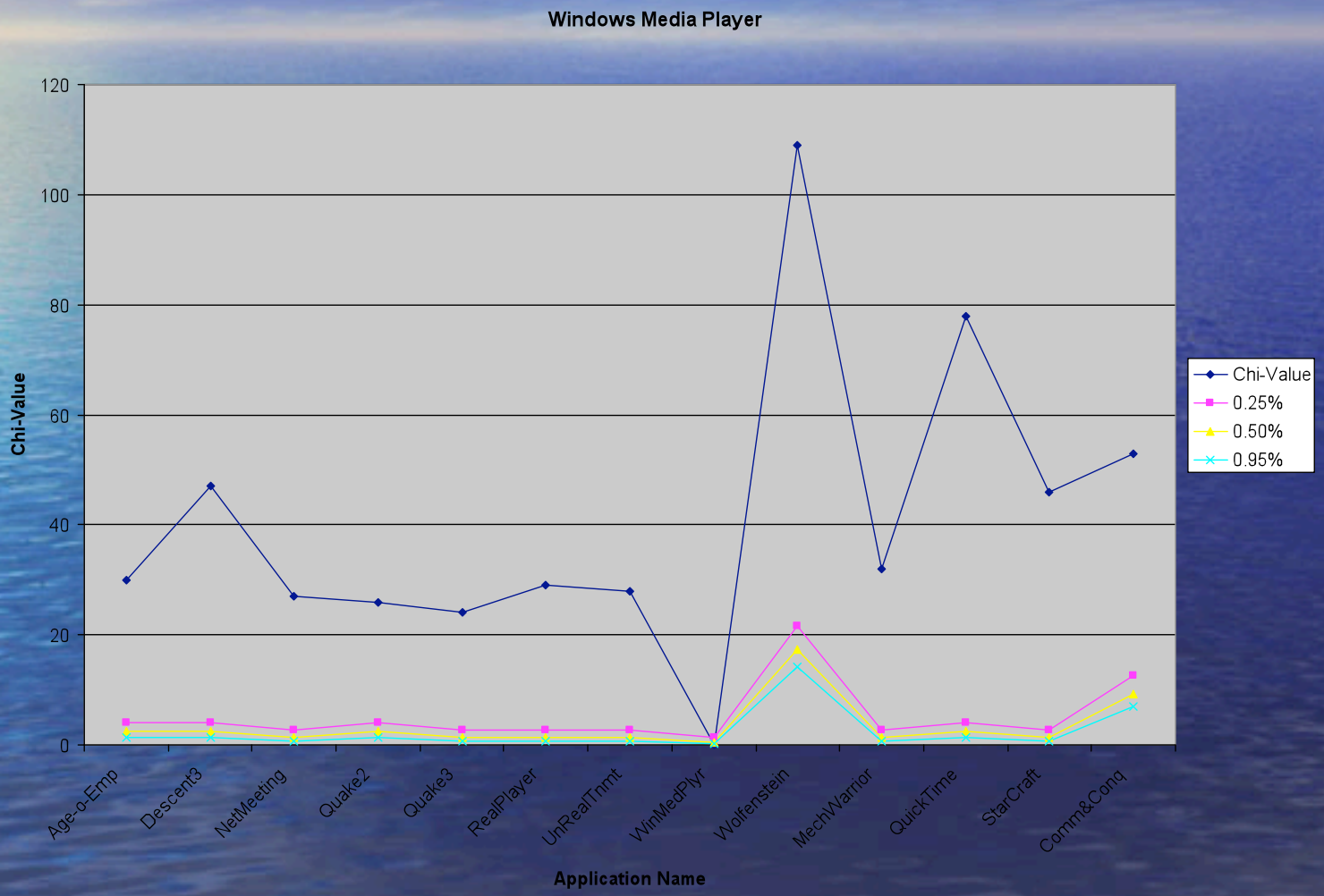
Using Packet Size Distributions



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Identifying Unauthorised Use

- Use Case Based Reasoning
  - Build a "profile" for each user group
- Filter "acceptable" applications at the Detector
- Use CBR to identify known usage

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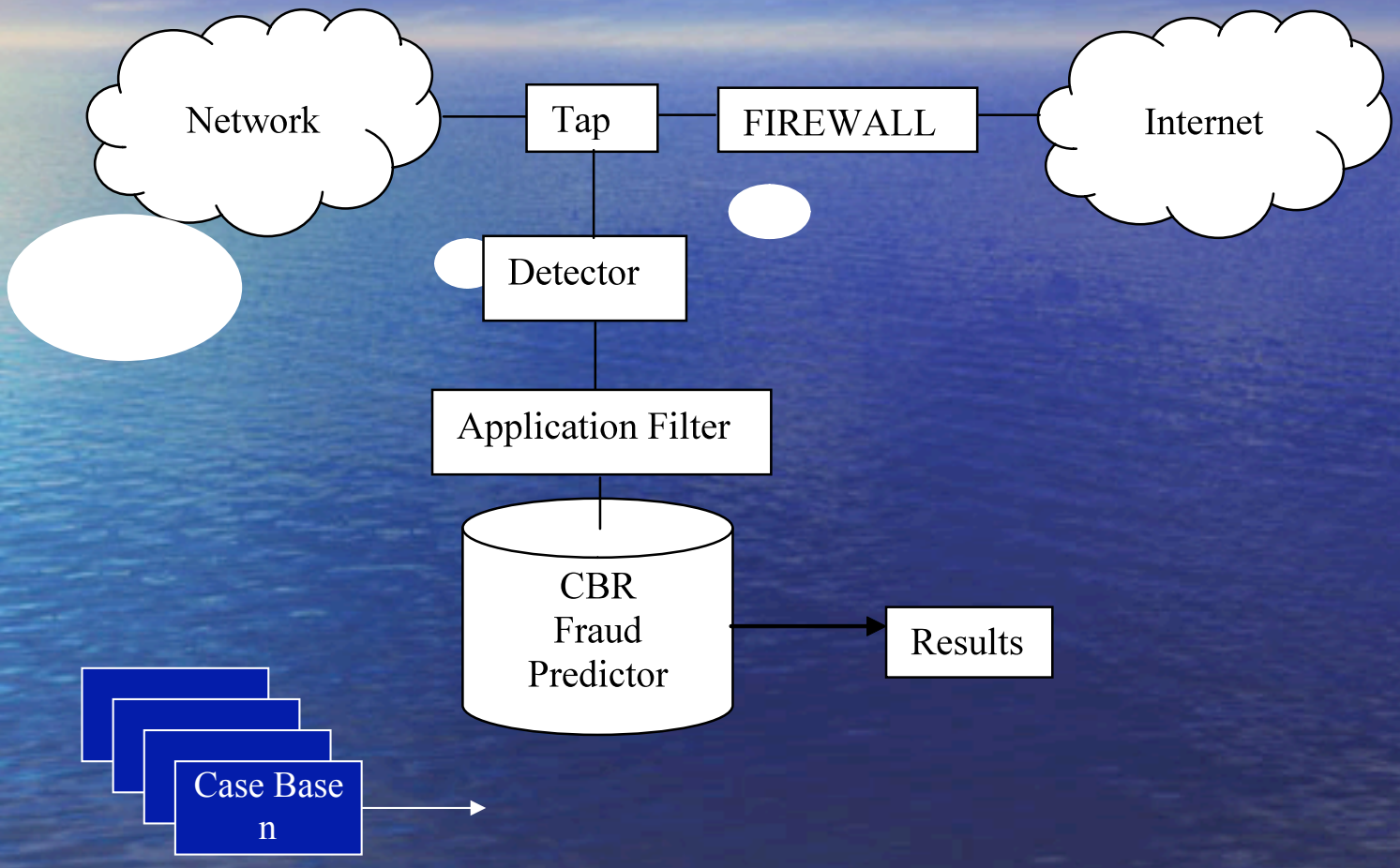
Outline Solution



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Detecting Criminal Activities in the Internet

- Identify illegal activity inside the network core
  - Sometimes Necessary
  - Some prevention best done here
  - Use statistical traffic summaries of headers to identify anomalies using Data Mining
    - Processing Overhead
    - High Throughput
    - No user data

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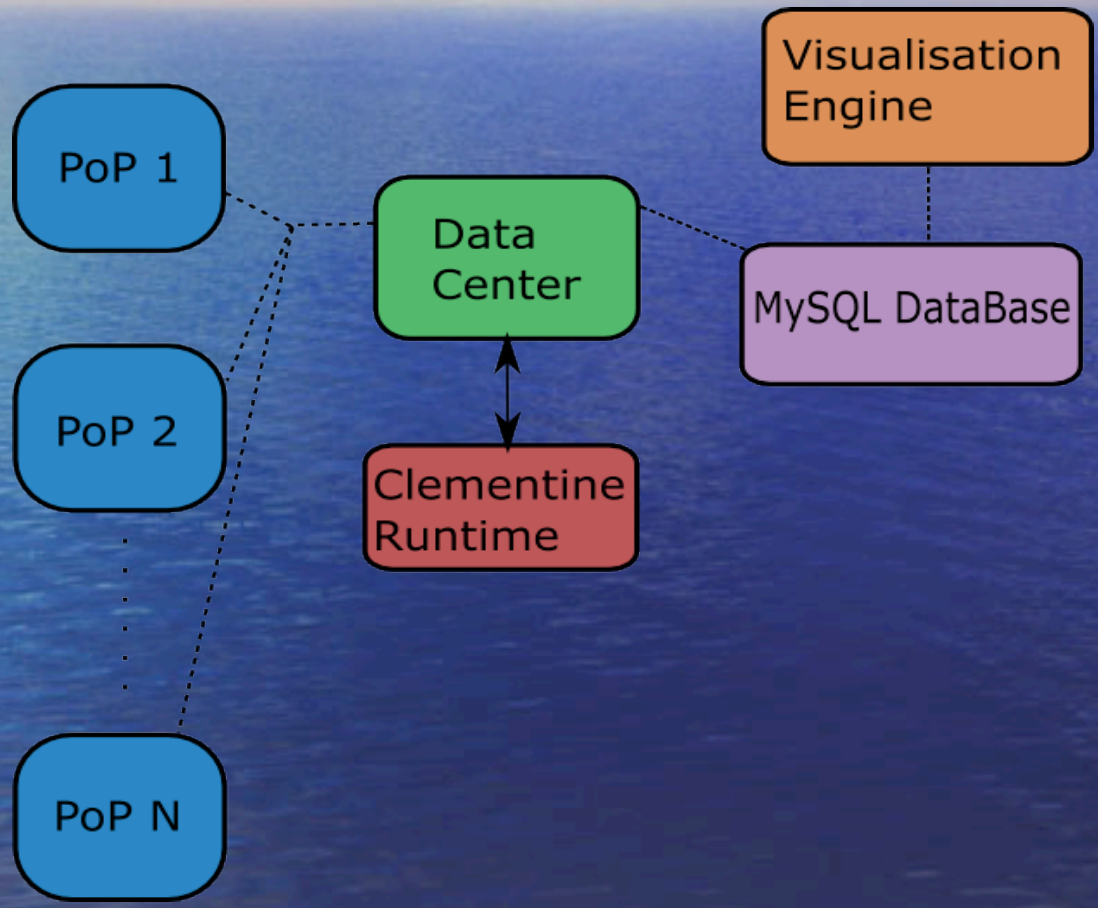
Overall System Concept



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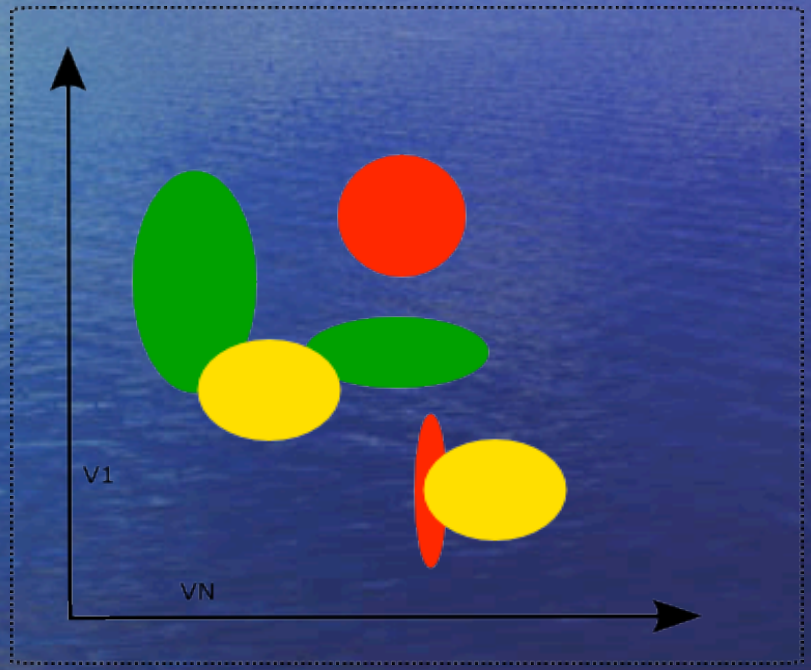
Anomaly Approach



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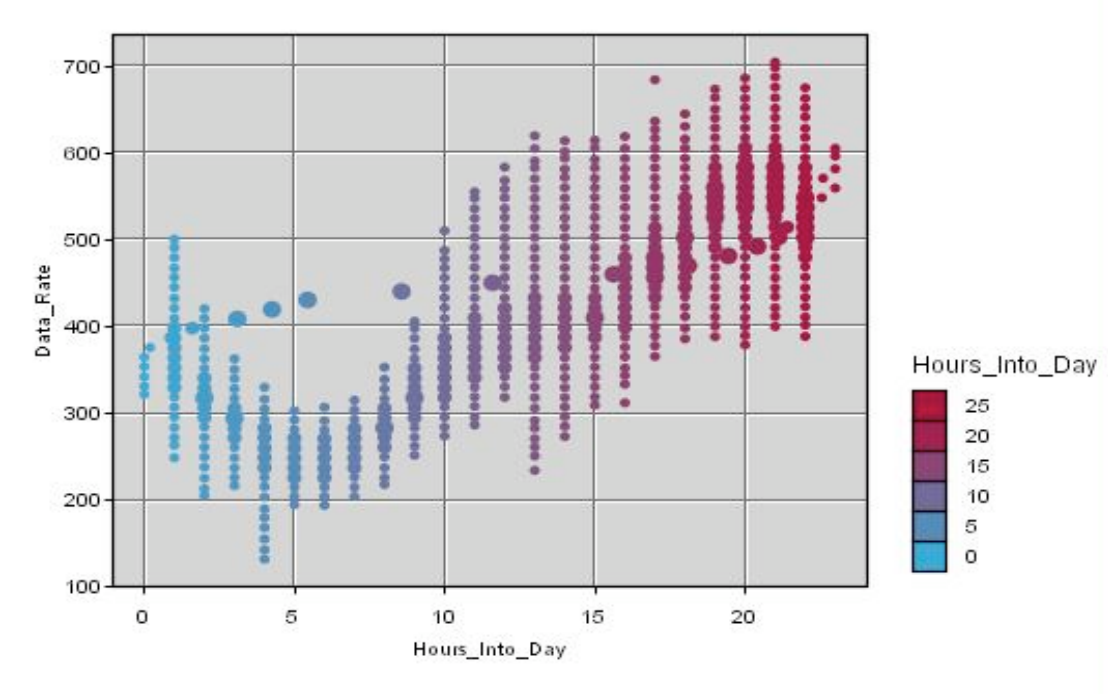
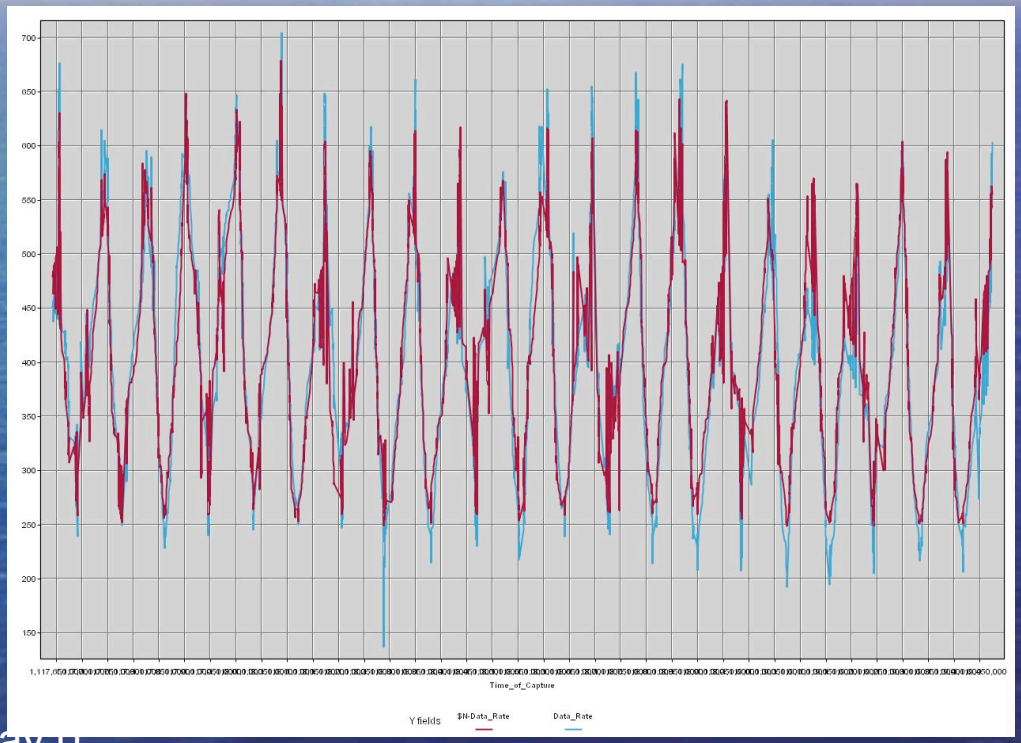
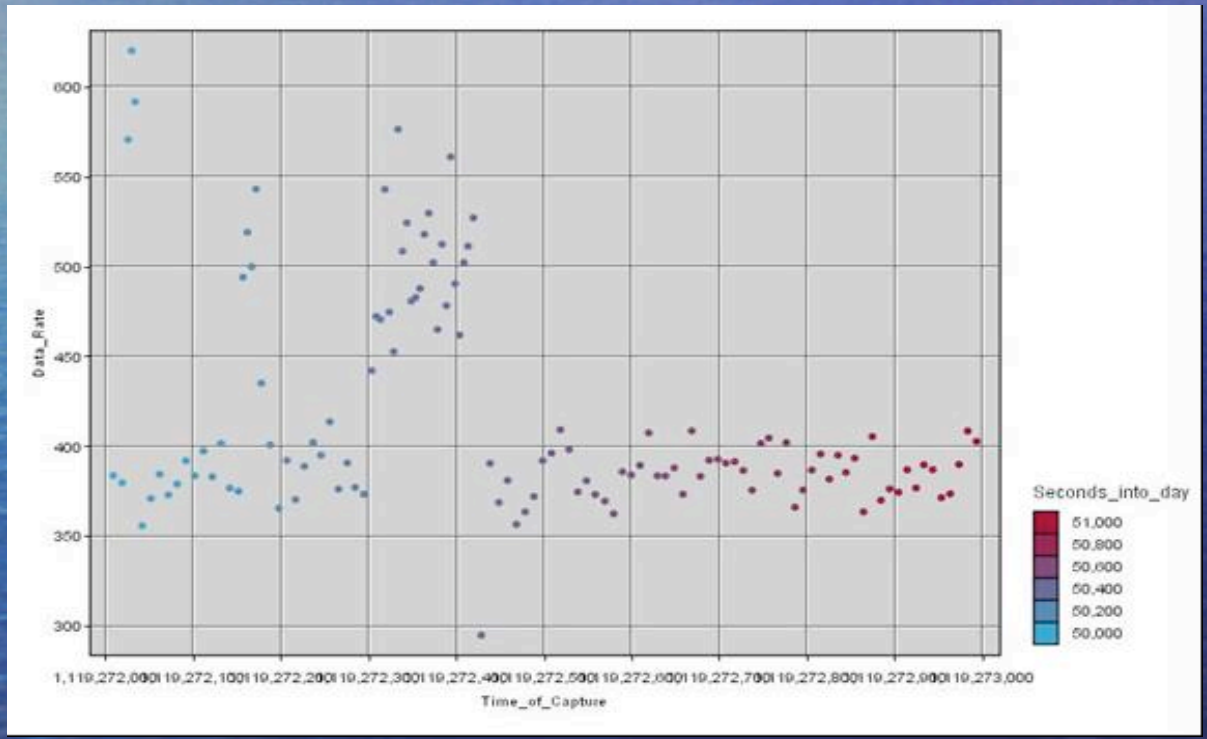
Data Rates



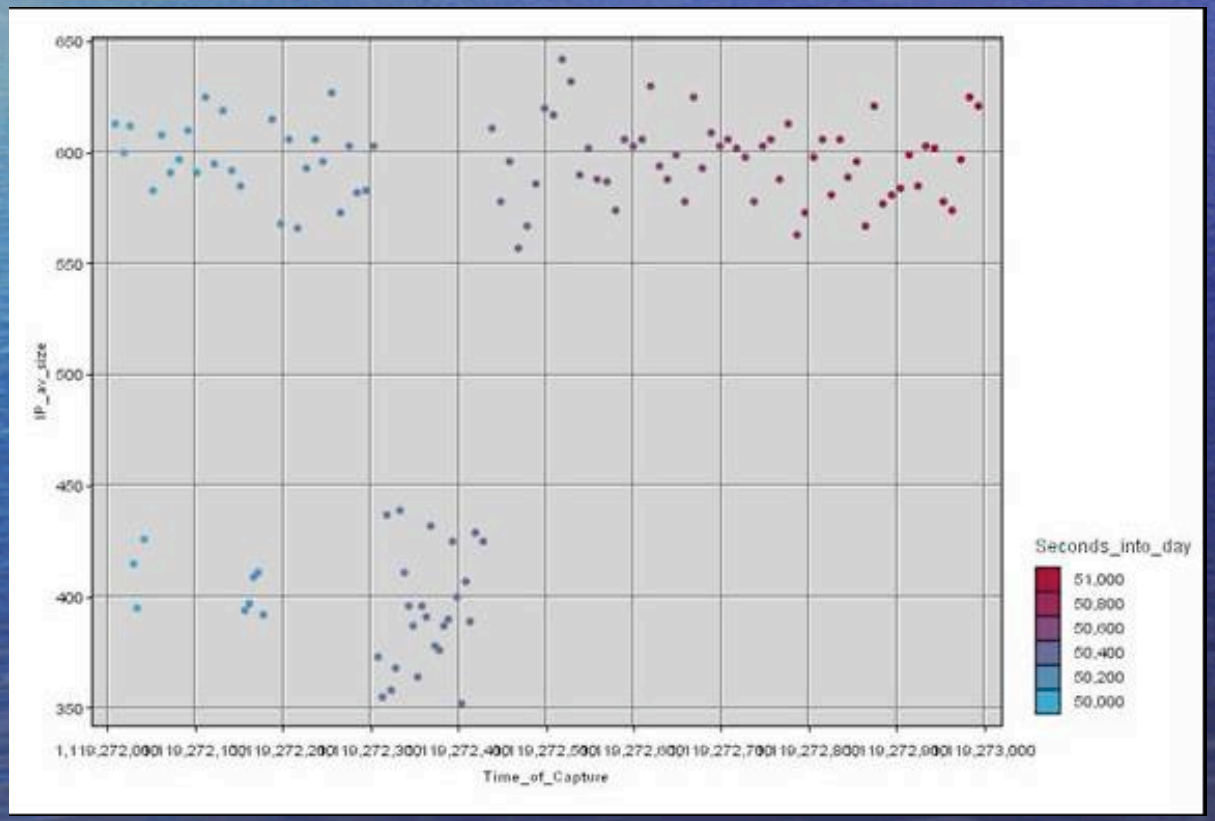
Model of Data Rate



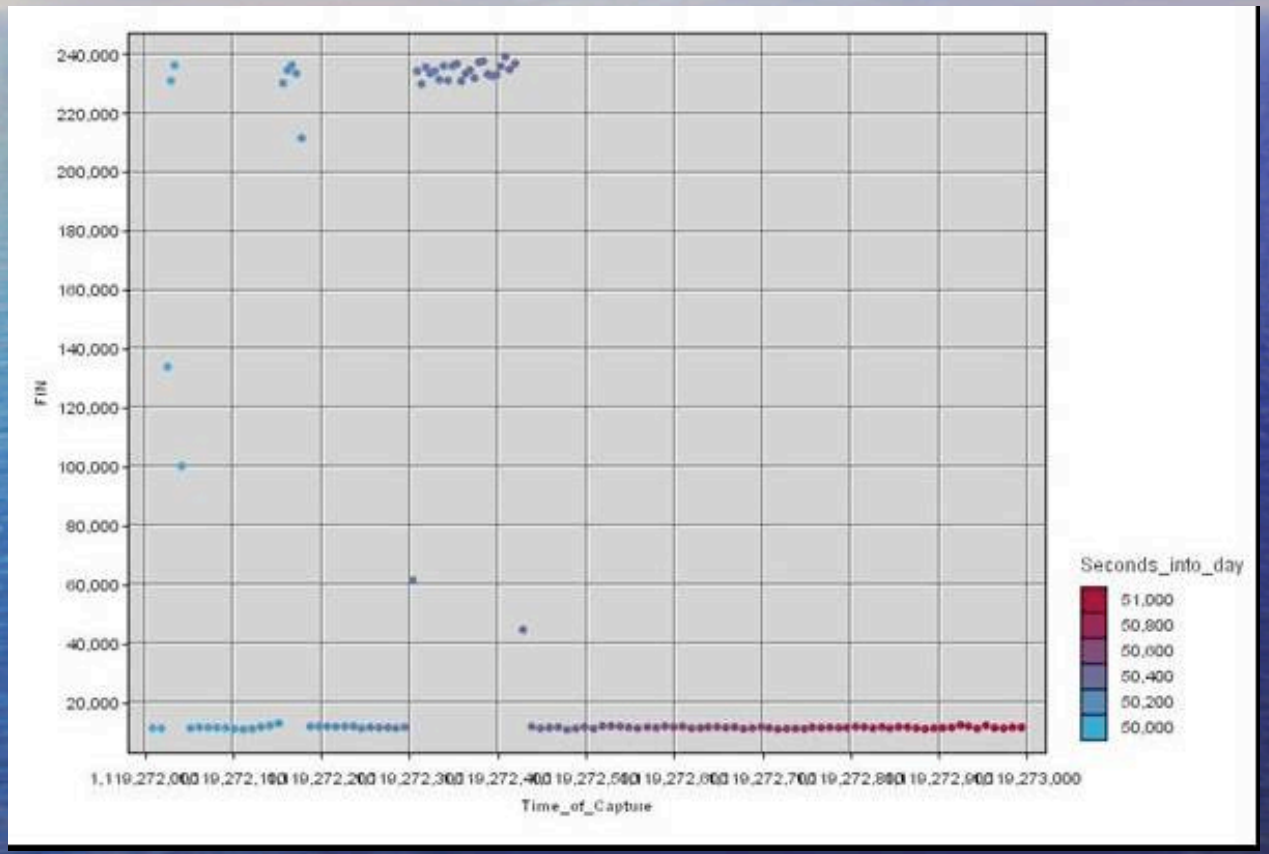
Anomaly Example – Data Rate



Anomaly Example – Average Packet Size



Anomaly Example – FIN Count



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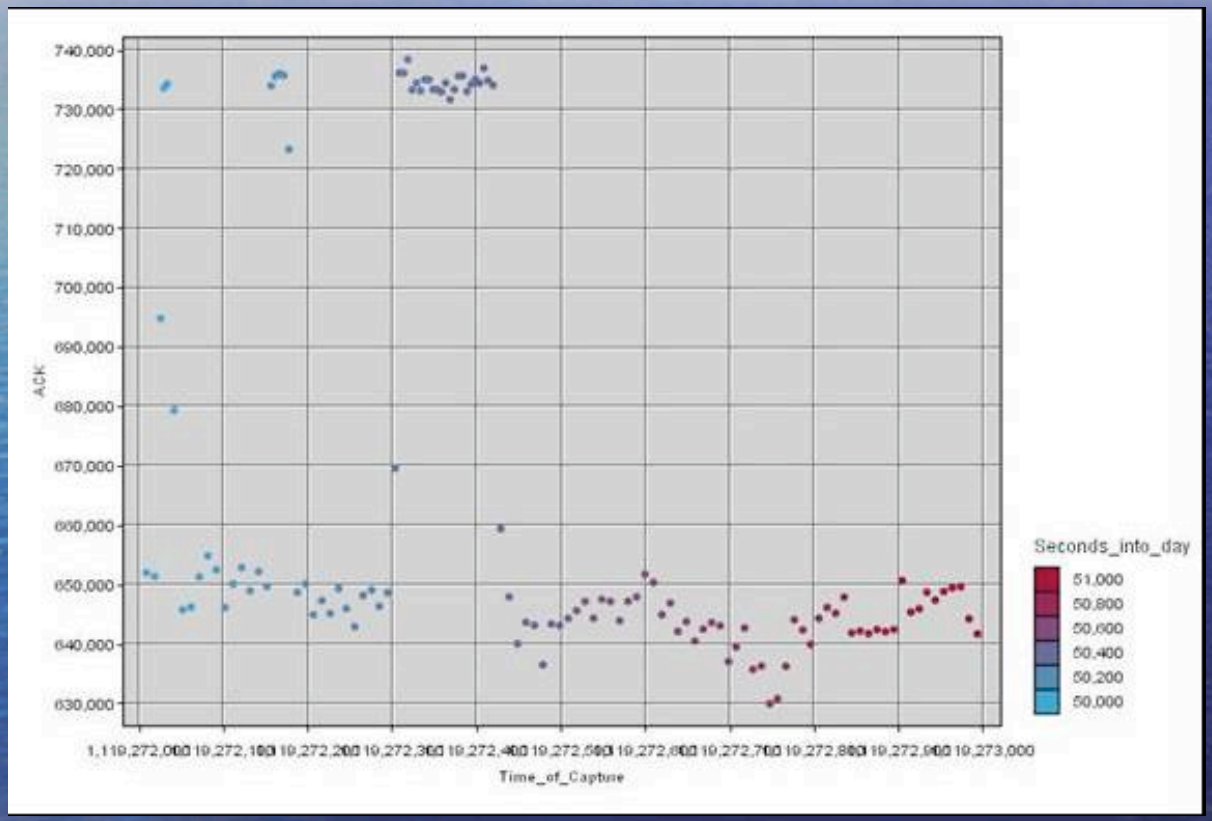
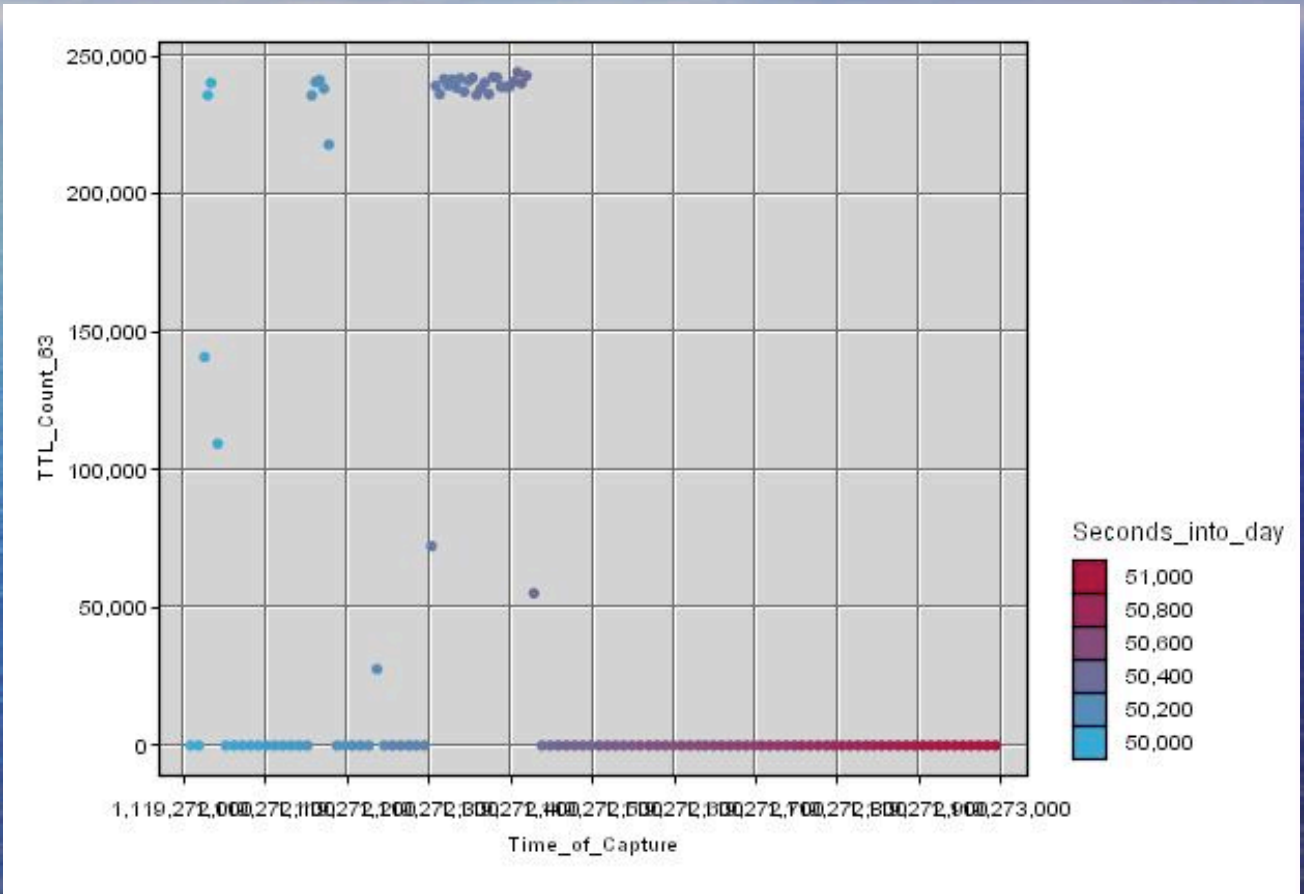
Anomaly Example – Ack Count



Anomaly TTL - 63



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Header Significance for Detection

Input Field	*Value*
Values of most common packet sizes	1
ID Ratio	0.85
TTL Field	0.45
TCP Flags	0.30
Average Packet Size	0.23
IP Address Counts	0.20
Frequency of most common packet sizes	0.17

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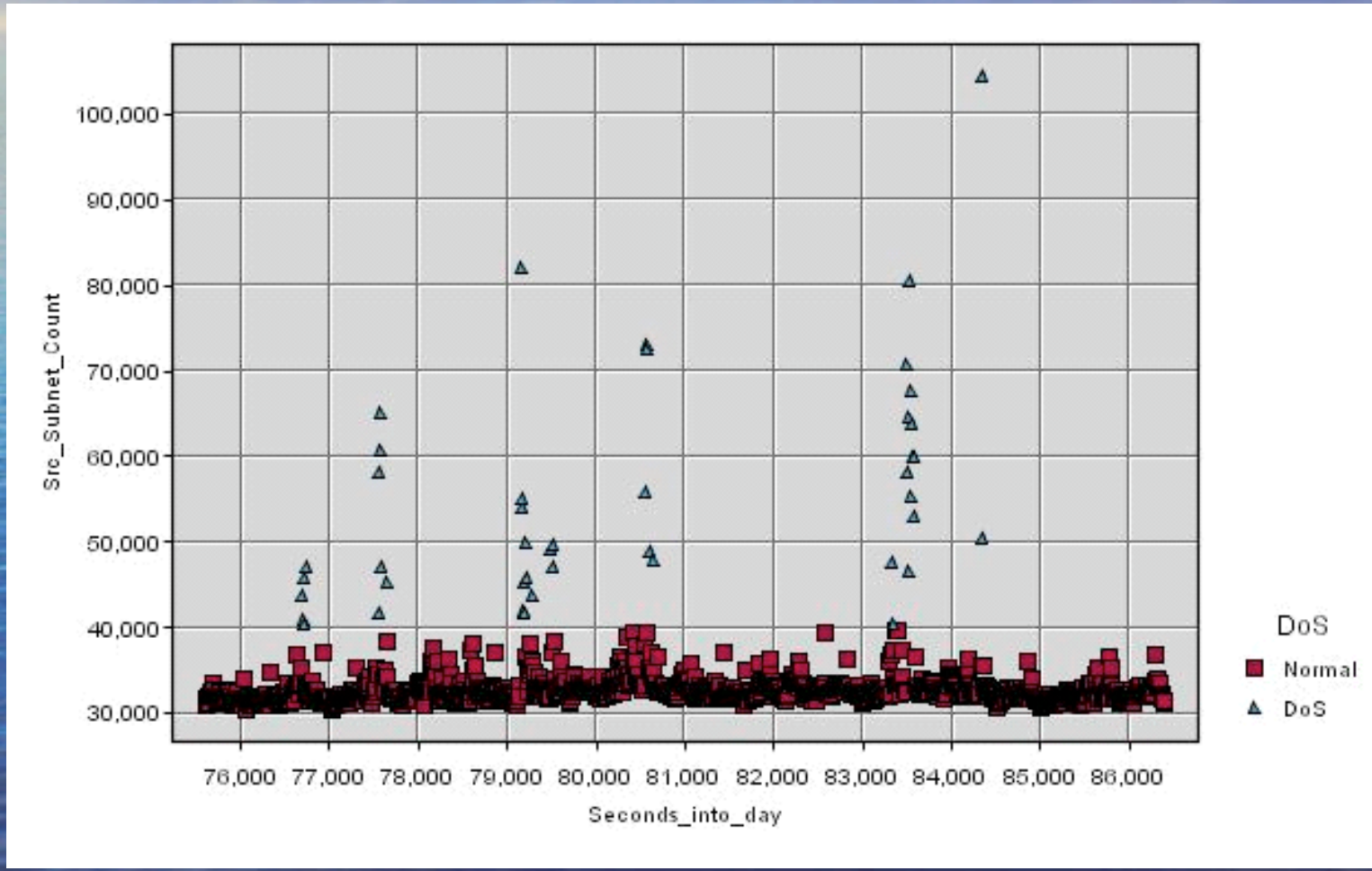
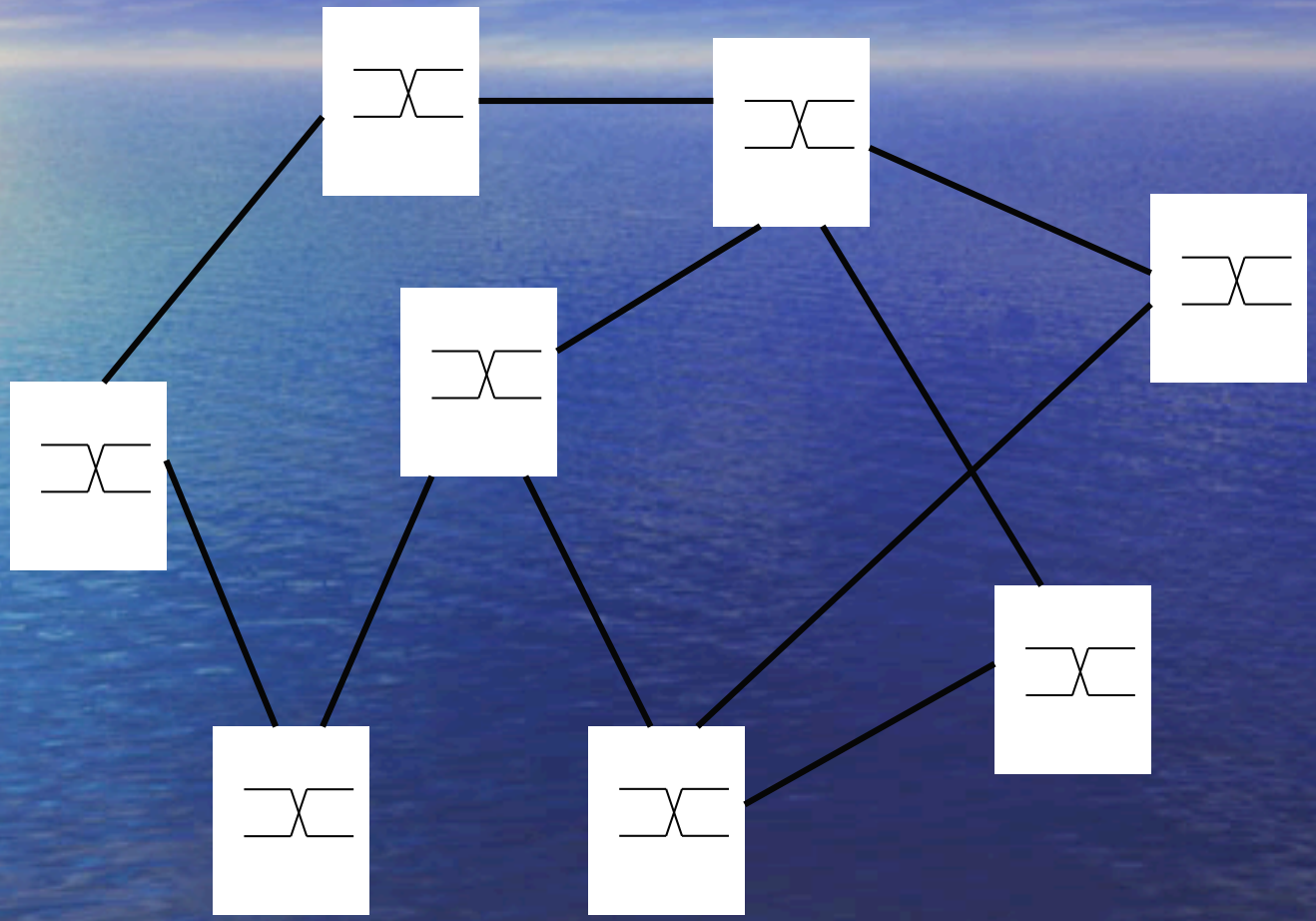
DDoS Abnormalities



Concept for Reducing Energy Usage



Issues to be Tackled (1) Technical

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- How do we collect the required measurement data?
  - Dealing with data rates
  - Dealing with volume
  - Dealing with location
- How do we store and access the data?
  - Dealing with volume
- What forms of processing should be used?
  - To extract maximum value
  - At the lowest cost

Issues to be Tackled (2) Legal

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- Data Security
  - Must be anonymous
  - Yet contain sufficient richness
  - And processing must be manageable
- Access
  - Legal Agreements
  - Acceptable use defined for all parties

Issues to be Tackled (3) Financial

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- Financial
- Funding the Research
  - Instrumenting a network
  - Developing the mechanisms and algorithms
- Making a Business case
  - Upfront costs
  - Savings on security/management/fault detection/energy efficiency
  - Overall Savings

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Conclusions

- Network Performance Measurement Reuse could answer many of the problems facing communication networks today.
- MUST be holistic to achieve maximum benefits.