

Distributed Sampling for On-line SLA Assessment

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Outline

- 1 Introduction
- 2 Network Parameter Acquisition System
- 3 Static Traffic Sampling
- 4 Evaluation
- 5 Conclusions and Future Work

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Evolution

- Content Oriented Internet
 - New user demands
 - More services
- New traffic profiles
 - Real-time traffic
 - Peer-to-peer
- Constraints on network metrics
 - Latency
 - Jitter
 - Packet Losses



New Requirements

- Operators need to monitor the network status
 - Detect congestion
 - Detect SLA violations
 - Take actions when required
 - Users should not notice potential problems
- Customers want guaranties about the network quality
 - Even if they have to pay
- Standardization Bodies push new recommendations for SLA assessment (ETSI EG 202 057-4)



Objectives

- Design a distributed infrastructure
 - Traffic monitoring of network metrics
 - SLA Assessment
 - On-line usage (real-time)
- Scalable system
 - Intra-domain reporting



Outline

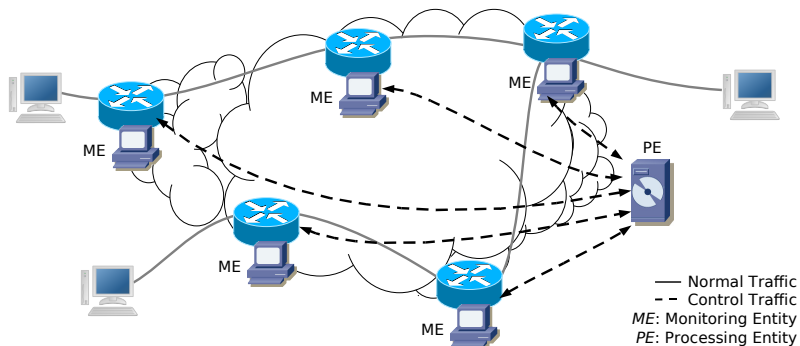
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Basics

- Distributed system for on-line QoS reporting
- Compute the most important metrics
 - One-Way Delay
 - Inter Packet Delay Variation
 - Packet Loss Ratio
- Reduced latency on the reporting

Intra-Domain Scenario



Entities

- *Monitoring Entity (ME)*
 - Technology Independent Collection point
 - Extracts relevant traffic information
 - Timestamp
 - Packet Size
 - *Packet Identifier*
 - *Flow Identifier*
- *Processing Entity (PE)*
 - Matches packet information among ME
 - Extracts final network metrics
 - Logs or informs about the results



Identifiers

- Flow Identifier
 - Src and Dst Address
 - Src and Dst Ports
 - Protocol

- Packet Identifier
 - Total Length
 - Datagram ID
 - TCP Window (for retransmissions)
 - 27 Bytes of the payload

Issues of the proposal

- Per packet reporting is too expensive in resources
 - Control traffic of $\sim 18\%$ of the total
- Also it does not scale
 - The PE has too much information to analyze
- We need ways of easing this
 - **Traffic Sampling**



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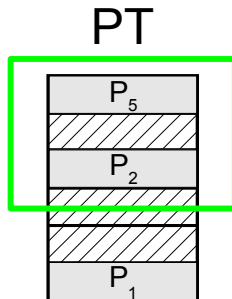
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Requirements

- Reduce the PE overhead by sending less packet information
- How to guaranty that all the ME collect the same packets
 - Hash sampling
- We need information about all the flows under analysis
- Efficient in computational requirements

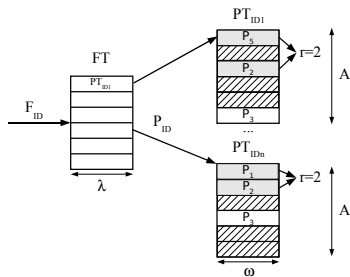
Hash Sampling

- All the packets treated equally
- Some flows might get sampled out
- **Not suitable for our requirements**



Structure of the solution

- Two level hash table
- We should avoid too many collisions
- The size of the hash tables determine the memory requirements
- Hash table flushing interval



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Testbed

- 12 Testbed across Europe (IST-EuQoS)
- 5 Different countries
- Overlay network over Gêant
- ~ 520 tests with different traffic rates
 - 64Kbps low rate flows
 - 1Mbps big packets
 - 1.5Mbps small packets high rate

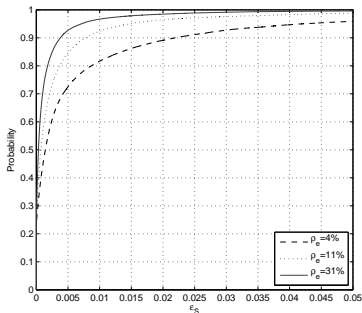
Methodology

- Capture the full trace
- Apply the sampling off-line (proof of concept)
- Compare the sampled results with the perfect knowledge
- Estimate the error

- $t = 175ms$
- $A = 1297$

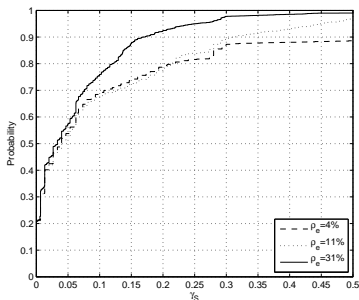
One-Way Delay Results

- Good Accuracy even for low sampling rates
- Normally OWD do not change abruptly
- Few packets are representative of the whole set per bin



Packet Loss Ratio Results

- BAD Accuracy even for high sampling rates
- Caused by the amount of collected packets per bin
 - Low rate flows can have at much 3 packets per bin



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Conclusions

- System for on-line SLA assessment
- Basis for a solid intra-domain metric reporting framework
- Efficient intra-domain reporting solution

Future Work

- Enhance the platform to support inter-domain scenarios
- Other sampling methodologies (Dynamic Sampling)

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