Autonomic Networking Use Case for Distributed Detection of SLA Violations

draft-irtf-nmrg-autonomic-sla-violation-detection-04

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Outline

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Introduction

- Critical networked services expected to operate respecting associated Service Level Agreements (SLAs)
  - To ensure that SLAs are not being violated → constantly monitoring of service levels at the network layer
- Active measurement mechanisms
  - Better accuracy and privacy than passive ones
  - Detection of end-to-end network performance problems
- IP Performance Metrics (IPPM) WG active mechanisms
  - One-Way Active Measurement Protocol (OWAMP) [RFC4656]
  - Two-Way Active Measurement Protocol (TWAMP) [RFC5357]
  - Cisco Service Level Assurance Protocol (SLA) [RFC6812]
- Measurement probes distributed along the network to inject synthetic traffic and deliver the SLA metrics

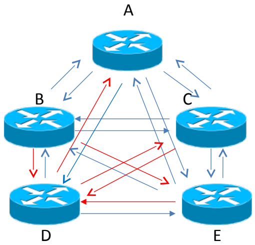
Problem Statement

- Activation of active measurement sessions → expensive in terms of resource consumption
- Required resources → function of the # of measured destinations
- Better monitoring coverage → more sessions
  - Monitor all connections is too expensive → combinatorial explosion
  - Fast reactions required to reconfigure sessions if critical flows are too short in time and dynamic in terms of traversing network paths

Problem Statement

Best practice

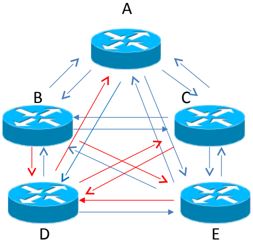
- Distribution of the available measurement sessions along the network considering human administrator expertise
- Collection of measurement and traffic information to infer which are the best destinations to activate sessions



	A	B	C	D	E
A		5	6	4	7
B	5		7	12	10
C	6	7		13	7
D	15	12	13		8
E	1	3	5	14	

Problem Statement

- Too difficult and labor intensive
- Inefficient considering fast changing network environments
- # of detections constrained by the # of available sessions



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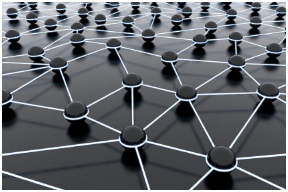
E	1	3	5	14	

Problem Statement

- Embedded management SW → deployment control of active measurement mechanisms
    - Network device vendors → utilization to avoid devices starvation (e.g., due to configuration errors and lack of experience from human administrators)
- Lack of enhancements in scalability and efficiency
- Resources and knowledge about the network infrastructure not shared by network devices



Benefits of an Autonomic Solution

- Focus → complete solution to steer the process of measurement probe activation
- Design goals
  - Efficient
  - Reliable
  - Secure
  - Minimal human intervention
- Components for the implementation of measurement probe activation
  - Algorithms
  - Protocols
  - Metrics
  - Technologies

Benefits of an Autonomic Solution

Features

1. Optimization of resource consumption and avoidance of resource starvation on the network devices
   - Better efficiency in the measurement session activation decisions
   - Sharing of measurement results
2. Increase on the # of detected SLA violations
   - Better network coverage
3. Decrease on the time necessary to detect SLA violations
   - Adaptivity features of an autonomic loop → capturing network dynamics faster than an human administrator
4. Reduction on the workload of human administrators
   - At least to avoid their need to perform operational tasks

Intended User and Administrator Experience

- AN solution → to avoid the human intervention in the distributed detection of SLA violations
- SLA monitoring performed by less experienced human administrators
- Some information necessary from the human administrator
  - E.g., SLOs (regarding the SLA being monitored) provided by the human administrator
- Configuration and bootstrapping of network devices → minimal for the human administrator
  - E.g., information about the address of a solution-enabled device
  - Exchange of configuration data among the devices themselves

Analysis of Parameters and Information Involved

Device Based Self-Knowledge and Decision

- Each device → self-knowledge about local SLA monitoring
  - E.g., SLOs, historical measurement data
- AN decision on devices about the measurement session activation algorithm

Interaction with other devices

- Network devices → info sharing about SL results
  - Increase the # of detected SLA violations and their speed
- Definition of network devices that exchange measurement data → creation of a new topology
- Different approaches for topology definition
  - E.g., correlated peers (local relevancy of remote results)
  - Bootstrapping → known endpoints neighbours as initial seed

Comparison with current solutions

- No standardized solution for distributed autonomic detection of SLA violations
- Current solutions usually restricted to ad hoc scripts running on a per node fashion to automate some administrator's actions
- Some proposals for passive probe activation (e.g., DECON and CSAMP), but without the focus on autonomic features
- Barford *et al.* (INFOCOM 2009) → Detection and localization of links which cause anomalies along a network path
- Nobre *et al.* (CNSM 2012, ICC 2013, AINA 2014) → Utilization of P2P technology embedded in network devices to improve probe activation decisions using autonomic loops

Related IETF Work

Large-Scale Measurement of Broadband Performance (LMAP) WG

- AN solution relevant for LMAP → SLA violation screening
- Solution to decrease the workload of human administrators in service providers → probably highly desirable

IP Flow Information Export (IPFIX) WG

- AN solution extension for passive measurement probes (i.e., metering exporters)
- Flow information used in the decision making of probe activation

Application Layer Traffic Optimization (ALTO) Working Group

- Definition of the topology regarding the network devices which exchange measurement data

Security Considerations

Possible Approaches

- Bootstrapping of a new device → homenet approach [draft-behringer-homenet-trust-bootstrap]
- Measurement data exchange → signed and encrypted among devices
  - Sensible information about network infrastructures

Possible Attacks

- Denial of service (DoS) attacks → activation of more local probe than the available resources allow
- Results could be forged by a device (attacker) in order to this device be considered peer of a specific device (target) → to gain information about a network infrastructure

Updates and Outlook

Revision 04

- Minor revisions
  - Mostly updates on references

Outlook

- Minor revisions
  - Bootstrapping of a new device → anima approach

WGLC?

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Thanks for your attention! Questions?