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Automatic Network Congestion Relief in GeneRic Autonomic Signaling Protocol (GRASP)

draft-han-anima-grasp-congestion-relief-00

Abstract

This draft defines a method for automatic congestion relief using the Grasp protocol. In operator networks, in response to network failures such as fiber optic cable faults and optical module malfunctions, network devices can automatically respond and achieve real-time self-healing, thereby ensuring the stable operation of the network.

Status of This Memo

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1. Introduction

1.1. Overview

GeneRic Autonomic Signaling Protocol (GRASP) [RFC8990] is intended to be used for Service Announcement, Discovery and Selection especially in network or for network services intended to be deployable without dependencies against centralized "server" entities, such as fully autonomous networks or Autonomous Service Agents (ASA).

To support these goals, GRASP provides a hop-by-hop network wide flooding of announcement or discover messages reliably and secured and without looping messages. This flooding is achieved with a per-hop GRASP agent responsible for per-hop flooding of GRASP messages.

Automatic Network Congestion Relief is introduced by [I-D.zhao-anima-automatic-congestion-relief]. The ntwork congestion caused by fiber optic failures becoming a common issue for operators. It requires dedicated staff to perform daily traffic inspections and manually adjust configurations on an hourly basis, which significantly increases the difficulty of network maintenance.

This draft introduces an automatic congestion relief mechanism based on intelligent traffic analysis and auto-regulation. In the event of congestion caused by fiber optic failures, it can intelligently respond to congestion and initiate real-time self-healing processes, solving the network congestion and maintenance challenges faced by operators due to fiber optic failures, and ensuring the stable operation of the network.

The mechanism in this document enables the Automatic Network Congestion Relief through GRASP.

2. Conventions and Definitions

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 RFC2119 [RFC8174] when, and only when, they appear in all capitals, as shown here.

3. Approach of Automatic Network Congestion Relief

This second-level congestion relief mechanism is automated through the intelligent module within the device. Leveraging intelligent traffic analysis, it precisely calculates the volume of traffic requiring redistribution. Subsequently, it redirects this traffic to paired devices via inter-device protocol announcements and the automatic adjustment of routing priorities.

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Figure 1: Mechanism Framework Description

4. GRASP Requirements and Specification

This sections describes how to utilize GRASP protocol to realize the autonomic congestion relief mechanism.

4.1. GRASP Requirements

4.1.1. New GRASP Option: Congestion Monitoring

A new Option is defined within the GRASP protocol to carry congestion status information transmitted between Autonomous Service Agent (ASA) nodes. As an example, a node MAY periodically transmit messages that include its local congestion metrics, such as queue length and bandwidth utilization to adjacent nodes.

4.1.2. New GRASP Option: Bandwidth Allocation

Leveraging the negotiation mechanism inherent to the GRASP protocol, network nodes are able to negotiate the allocation of bandwidth resources. Upon the occurrence of network congestion, nodes SHALL renegotiate the bandwidth allocation scheme, reduce the bandwidth consumption of non-critical traffic flows, and release additional resources to be allocated to critical traffic flows.

4.1.3. ASA capability: Autonomous Decision for Congestion Relief

Nodes independently determine whether to trigger the congestion relief mechanism based on the congestion status they locally monitor and the congestion information received from peer nodes. For instance, if a node’s queue length or bandwidth utilization exceeds a predefined threshold, the congestion resolution process is automatically initiated.

By leveraging the distributed nature of the GRASP protocol, all nodes within the network are enabled to participate in the congestion resolution decision-making process. Each node makes optimal decisions based on its local information and the global network information it obtains, thereby achieving end-to-end congestion resolution across the entire network.

4.2. GRASP Specification

TBD.

5. Security Considerations

TBD.

6. IANA Considerations

TBD.

7. References

7.1. Normative References

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