IP Redundancy and Load Balancing With Gateway Load Balancing Protocol

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Abstract : Call centers are a fast growing industry whereby it sees millions of turnover in terms of profit. As the industry grows, the need to improvise their network to ensure smooth traffic increases in order to generate more profit. Most call centers which are based in Asia have customers from Europe. Hence, the providence of high availability, redundancy and business continuity is of utmost importance. The implementation of GLBP in this network seeks to do exactly that. This will be achieved because its implementation creates a good fail over, applies virtual routers, implements virtual gateway and load balancing to prevent network congestion and ensure smooth operation. GLBP will overcome the existing problems that call centers face. Its efficacy will be entirely demonstrated using GNS3 network simulator; existing problems will be simulated and compared with GLBP network. Thus, the aim of this research paper can be defended.

Keywords : GLBP, GNS3, VVRP, HSRP, network

I. Introduction

Gateway load balancing protocol is a Cisco proprietary protocol created in 2005 which allows automatic selections, the usage of multiple available gateway simultaneously and also automatic fail over between those gateways. Multiple routers share the load of frames that, from client perspective, are single to a single default gateway address [HYPERLINK \l "CIS1" 1]. Many organizations are not able to invest much into their network infrastructure due to financial factors and this can lead to a lack of growth in their ICT management. [2] This research paper will be a discussion on how this network protocol can be used to improvise their existing network. This protocol can be really useful in a call center environment as it provides the redundancy and high availability needed by a continuously (24 hours, 7 days a week) operating call center. This project will provide better understanding for network engineers and n administrators on how this protocol can be used to improve existing network or its usage in future planning. Its implementation is relatively moderate in terms of complexity as no additional devices are needed. Existing enterprise level devices which are already present in the call center environment should be sufficient as this is based solely on configuration.

 Since call centers are an important business in current days, it is important for them to be able to run a network which is reliable and provides excellent fail overs in times of single point outages. GLBP enables network resources to be fully utilized without the administrative burden of configuring and managing multiple groups of default gateways configuration. This differentiates GLBP from HSRP and VVRP. [3] GLBP would be able to shed light on the current reliability, load balancing and redundancy issues faced by call centers in order to sustain business continuity.

This paper will highlight the advantages of GLBP which can be utilized in a call center environment to improve their current need and meet their business requirement.

II.   LITERATURE REVIEW

High availability is an important factor in call center environment as multiple requests will be sent over for retrieval of customer information at all times and this generates high traffic load. High availability comes into play here by providing fast access and keeping the network load at a balanced level to ensure call center representatives attend to their customers on time. Cisco has defined high availability as the capability to meet the target of the business, namely 99.9%. [4] In other words this means that high availability leads to business continuity as it works in alignment with the company's objectives. High availability leads to smooth operation and it enables the system administrator to manage more servers with lesser efforts [5].

Network failure can occur due to many possible reasons and the most commonly known factors are due to faulty cables and also misconfiguration of the network. The process of troubleshooting and looking for the errors have become expensive, hence even the slightest nonchalance can risk the production to stop and economically financially burdening outages. The using of redundant real time networking has the boon of a separate router cable. Redundancy provides an

excellent failover in the event of outages or network failure if any node in the network fails. **Ошибка! Источник ссылки не найден.** will demonstrate how redundancy works with GLBP protocol. When one of the routers in the network fails, the other available routers from the same GLBP group will take over the task of the failed router automatically and this gives network engineers to work on the failed router with minimal downtime.
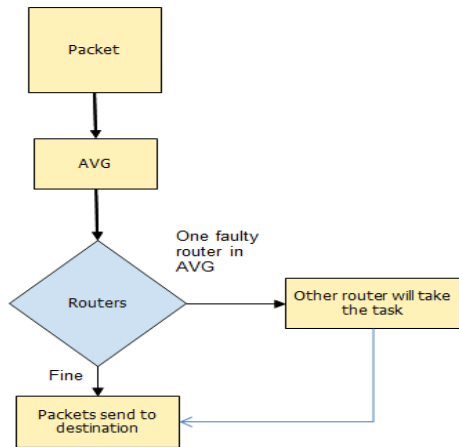
Fig 1: GLBP flowchart

Load balancing plays an essential feature as lack of it can lead to poor performance and network congestion which will bring down the whole network. Load Balancing enables multiplayer switch which can share the network load among the devices. As the network load being shared among the network devices, this would help to boost high availability and effective utilization of the network resources. This feature would optimize business continuity and also meet the service level agreement. [6]

III.   CURRENT CHALLENGES

Architecting a network has become more challenging as it has to be business friendly in terms of cost, sustainability and availability. The figure 2 below is the summary of the challenges faced.
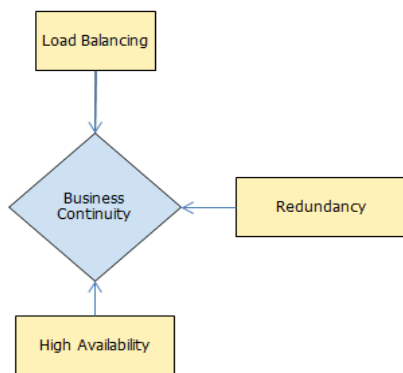
Fig 2: Challenges in network

Since call centers are an import asset for an organization it is important to make sure their network environment would be able to bear the enormous number of requests every minute at all times. High availability is essential because downtimes can cause a business as customers may decide to transfer their service to another reliable service provider which provides them higher availability. The next generation network mostly depends on a single network with a 100% reliability and availability in traffic flow. This can be maintained by enabling high availability mechanism with the usage of multiple devices so that high availability can be achieved. It is also need to addressed that 100% availability cannot be achieved by conventional methods [7]. Hence, the current major challenge faced by call centers are having a high availability network and sustaining a healthy network without any downtime with business consequences.

Providing Redundancy for IT resources especially in a call center environment is essential because loss of data or inability to retrieve data due to network outage can make huge impacts on their business especially in the financial aspect. Despite this fact, many call centers still face problems in converting to a redundant network due to the reasons such as higher operating cost, high complexity in terms of management and maintenance of the infrastructure as well as unpredictable solutions since testing network redundancy requires essential equipment and resources.

IV.   Technological Operation

The technological operation is a part of the design and implementation of a network which can ensure high availability through an efficient network management. Nowadays, businesses depend on a secured and a highly available network that serves that able to serve wide area a multiple domains. [8] The maintenance of high availability in networks is based on fault management, performance management, inventory management, availability monitoring and accounting.

There are two types of redundant protocol which are standard base and proprietary. The standard base provides a slower recovery time compared to the proprietary. In redundancy sometimes there are overlapping features and functionality of the redundancy protocols, but in most of the applications a hybrid protocol is used as it is generally used. [9]

The two most common standard based redundancy protocols are link aggregation and rapid spanning tree protocol. Link aggregation provides multiple path links in virtual link. An example would be a link where there is up to eight established links between two locations. If 100-Megabits connections are placed there, it will be become 800-Megabits. However, rapid

spanning tree protocol uses an algorithm methodology whereby the path used for primary communication is the most redundant. It works best in mesh topology which has multiple redundant protocols.

Proprietary protocol consists of ring protocol and redundant coupling. Ring protocol is highly scalable and a single ring can consist up to 200 switches which can lead to faster recovery in times of outage. It provides high availability redundancy. However, redundant coupling can be used in ring topology where proprietary or standard based are used as it will enable redundant link between rings.

Load balancing can be achieved using hardware as well. Hardware such as Barracuda and F5 can perform load balancing using the same technique as GLBP. The technique used is as following:

- User connects to the internet and submits a request
- DNS server involved and also user would be connected to a specific assigned IP address.
- User connects to load balancer
- Load balancer makes the decision on which server to be assigned depending on the load. It also changes the destination IP so that the server would match the selected host.
- Once connection is accepted by the server, it responds to the source client through its default route.
  - Load balance captures the packets returned from the host and it makes changes in the source IP so that it will match with the server IP and port before the packets being forwarded to the client.
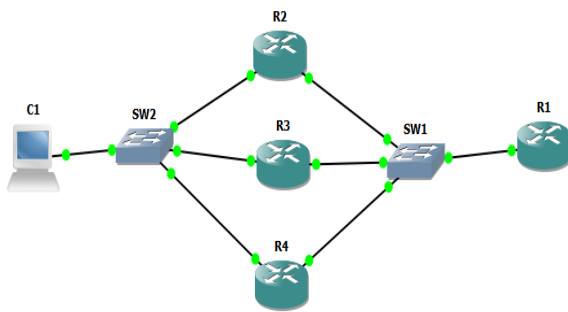- Host will then receive the packet and display its contents

Figure 3: GLBP network

Figure 3 above explains further how GLBP works in terms of the load balancing and IP redundancy. Figure 3 above shows a GLBP network in a call center environment. Router2, Router3, Router4 can be configured with a virtual gateway IP so that one gateway IP will be used to send all the traffic. These three routers can be configured to perform load balancing by using

the default round-robin or weighted configuration. Weighted protocol can be used to make one router the primary router and the rest as backups. For example we can configure Router1 as primary and the Router2 and Router3 as backup but that does not mean Router2 and Router3 does not function till Router1 goes down. Router1 can be configured to take 50% of the traffic, Router2 30% and Router3 20%. If any of the routers fail, by default the other two routers will perform load balancing automatically.

HSRP and VVRP works based on the same principle. VVRP can determine its role based on priority. The master is the device with the highest priority, it forward packets to outside network and the device with the lowest priority which act as a backup. [10] However, VVRP has limitation as the configuration would not be enabled in management interface, configuration of more than one first hop redundancy protocol on the same interface, BFD for VVRP can only be configured between two routers. [11]

V.   RESEARCH METHODOLOGY

Research Methodology is a systematic way to solve a problem. It is the science of studying how research should be carried out. Essentially, it is the procedure by which researchers go about their work of describing, explaining and predicting phenomenon. It is also defined as the study of methods by which knowledge is gained. Its aim is to give the work plan of the research. Table 1 provides a summary on how research should be done the right way.

Table 1: Research Methodology Summary [12]

Research Dimension	Explanatory Sequential Design
Research Methodology	Mixed Mode (Quantitative Generalizability + Qualitative Reasoning)

Research Validation	1. Content Validity
	   - Domain Distribution
	   - Language
	   - Depth
	   - Jargon
	
	2. Concurrent Validity
	   - Focus group
	
	3. Construct Validity
	   - Lecturer
	   - Industry Peer
	   - Industry Experts

Research Methods	Phase 1 : Literature Review Phase 2 : Simulation Testing

GNS3 software has been determined to be the appropriate tool to demonstrate GLBP protocol as it can provide real call center network environment simulated in it with all the needed network devices from all access layers. GNS3 also allows real Cisco IOS to be downloaded hence providing a real time experience

GN3 simulation software is used in this paper in order to imitate a call center environment with all the basic core devices. We will simulate two separate network protocol environment which is HSRP and also GLBP. GNS3 allows both protocols to be configured within its software environment.

We operated using IP multi cast diagram. Hence, all messaging protocol can operate over a different multicasting LAN technology that supports multicast. Each GLBP has a single MAC address assigned to it. The MAC address in virtual router is used as source in all periodic GLBP sent by master router to enable bridge learning in extended LAN.

A network with HSRP protocol will be configured simulating the network environment of a call center. Packets will be sent through the network in order to replicate a problem. These problems are like load balancing, failover when it comes to network using a single line and IP redundancy. Those problems can lead to congestion and eventually bring down a whole network.

GLBP network protocol is the solution as it provides business continuity with its extended features. GLBP provides load balancing, fail over and IP redundancy which will keep the network healthy even if one router goes down. On the other hand it also provides an excellent disaster recovery plan. GLBP provides redundancy for IP network, ensuring that user traffic immediately and transparently recovers from the first hop router failure. These features provide GLBP with a high availability and keep the network alive even if one router fails. GLBP also provides load balancing over multiple routers using a single virtual gateway and multiple virtual MAC addresses. Each host configured with the same virtual IP address, and all routers in the virtual router group participate in the forwarding of the packet process.

VI.   BUSINESS ADVANTAGES

Business advantages are an important aspect when architecting an enterprise network because it is the backbone of the company in terms of managing the business. This is has been described in figure 4.
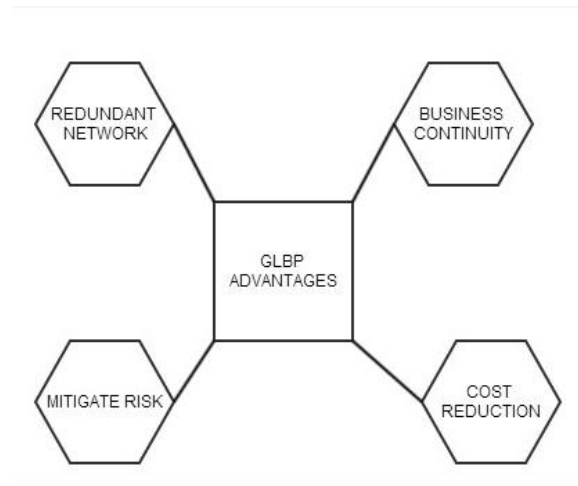

Figure 4: Business Advantages

A network with a high availability and up time brings many advantages to the business. Nowadays, requirement of a network uptime is about 99.999%. This is also referred to as the five 9s of network availability. If the network has a strict requirement then it would have 99.9999999% or also known as the 9s availability. [13] That raises many questions about the service level agreements when it comes to network. This is because by business perceptions, a smooth operation can lead to continuity and low running cost in the long term. Reliability and high availability in a network will prevent frequent migration and maintenance in call center environment and will lead to lower running cost and business continuity.

The presence of network redundancy in call centers can lead to increase in performance and production. This can assist the organization in convincing their outsourcing clients to stay with them or bring in more projects to the organization which is one of the objectives of call center outsourcing.

Any organization that requires consistently available access to the internet should consider using multiple ISP connections into the network. [14] The usage of multiple ISP providers will increase the uptime on the network connectivity. This would enable key call center environment needs like VPN access and voice traffic to be up at maximum uptime. This can be achieved by primary line and backup lines which uses different ISP for each line.

Constant flowing of business can help in reducing the risk of substandard service provision to the clients as availability is provided at optimum level even if one of the devices fails. The organizations retain their ability to sustain their business without breaching their service level agreements. Load balancing offers a lot of benefit to sustain business continuity and following should address the advantages:-

- Load balancing allows traffic to be shared among devices hence preventing a single device from being burdened.

These feature enable maximum uptime as network congestion are prevented and preventing from a single point network failure.

- It also provides failsafe as it automatically routes the packets to the different node if a node fails and keeps the network alive and constant.
- Load balancing provides short response time due to the quick response from the network's end. This enables tasks to be completed quickly.

VII.   CONCLUSION

Even though HSRP seems to provide redundancy and load balancing, GLBP seems to perform load balancing and fail over more efficiently than HSRP.

HSRP and GLBP both allow clients using one virtual default gateway in order to provide redundancy and fail over. Even though it is a single gateway but it points to two to four routers at the core level and all is making use of the default gateway. However, HSRP only allows forwarding to one router at a time while GLBP allows load sharing across all the routers in the GLBP group evenly. In a call center environment which requires efficient traffic and resource management this would be a great technological solution.

This will be really useful for call center environment as it could make data transferring, connection and communication effortless and would be much more reliable. In terms of assurance of a non-failure networking, this would be reliable.

Thus this brings us back to business perception on how this configuration can help businesses function efficiently. By providing higher availability efficient transfer of data can be expected as transfer of data always have been an issue in large scale networks. Efficient transfer of data also indirectly leads to efficient usage of network resources as there would be minimal network hogging and also easier administration. In the long run it leads to a financial boon as a reliable network requires lesser financial aid as less money will be spent on replacing or upgrading the network frequently.

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