Computer Engineering and Intelligent Systems
ISSN 2222-1719 (Paper) ISSN 2222-2863 (Online)
Vol.7, No.8, 2016
www.iiste.org

Metro Area Network Single Link Failure- Fast Spanning Tree Reconnection

Ababakr Ibrahim Rasul
Department of computer Science, Faculty of Science, University of Soran

Abstract
Due to Affordability, ease of maintenance and ubiquity, Ethernet has become a preferred technology to be deployed in to LAN, MAN and WAN networks. Even though Ethernet has being used widely for switched communication it is not meet requirement for Metro Area Networks in terms of network resilience. In this paper, author propose the fast spanning tree re-connection formula, especially for Metro Area Ethernet networks to manage any single link failure, and it has most important feature of fast recovery, backup capacity grantees and ease of fast recovery. If in case of link failure on a spanning tree, a distributed failure recovery protocol is activated to rebuild the broken spanning tree. This is re-connecting the link but not a spanning tree. Author presents the details of the protocol, which including failure notification and forwarding table reconfiguration manual. The Integer linear programming (ILP) is formulated to reconnect-links as it pre-configured. The result of optimization gives the remark of lower implementation cost, fast and effective spanning tree reconnection mechanism can achieve better performance than other resilient technique for Metro Ethernet Networks

INTRODUCTION:

Over the past 3 decades, Local Area network has been dominated by Ethernet technology. Due to Ethernet technologies reliability and speed it's extended to Metro Area Networks and Wide Area Networks. Affordability, ubiquity, easiness in configuration and maintenance, support on different layer 3 technologies, and scalability are some main factors for this preferential status of Ethernet technologies (Ali, 2005).

An Important issue in Metro Area Networks (MANs) is "Failure Handling". One of the main and uncompromised requirements for Metro Area Networks Ethernet is to have fast, reliable and efficient failure handling formula. This failure handling formula or mechanism in MANs should be similar like SONET or more stringent than that. SONET has been used and occupied widely in Metro Area Network's many years in terms of reliability and fast recovery. Even though, the spanning tree protocols used in current Ethernet networks but it cannot satisfy required fast failure recovery. Spanning tree protocols has two limitations they are: spanning tree re-convergence after failure and backward learning on the re-established tree. In case of failure, in both 802.1d Spanning Tree Protocol and 802.1w Rapid Spanning Tree Protocol a new spanning tree is built, but which may take a long time particularly when the failure happens near the root of the tree (IEEE, 802.1d and IEEE, 802.1w). Switching table of each Ethernet switch is flushed and with backward learning a new output port to each destination is determined when the new spanning tree has been established. Due to this, recovery time get increases which result to the traffic flooding in the network. A Single link failure problem in Metro Area Network is common issue and this is not create any major problem in spanning tree so rebuilding spanning tree is unnecessary for this.

The current technology needs fast and efficient spanning tree reconnection mechanism to defend against single link failure in Metro Ethernet Networks. When a link on spanning tree protocol fails in Metro Area Network, this re-connection mechanism should have to act promptly to reconnect failure link additionally this mechanism should ensure that backward learning is avoided by any means. In this research, author tries to give solution for all sort of problem in single link failure in Metro Area Networks.

LITERATURE RIVIEW

An undirected spanning tree gets disconnected by a link failure. If link gets disconnected or failed in spanning tree protocol, it recovers and re-computes itself into another tree. Normally, the convergence time of the original spanning tree algorithm was 30-50 seconds and it reduced later by 802.1d Rapid spanning tree protocol about 10ms or 100ms to few seconds (Pallos, Moldovan, and Lukovski, 2007) depending on various factor such as network topology, port manipulation times, time for failure detection etc. For instance a spanning tree involving ***N*** Ethernet switches then the link is **N**-1 only so number of links in the network is waste. To improve link utilization in the specific network and support for number of spanning trees IEEE standard802.1q and 802.1s had been developed. In this case one or more VLANs can be assigned to a tree. Sousa (2006) says, Each and every tree is identified by specific VLAN in multiple spanning trees. According to Farkas, et al (2005) if link failed it is notified to a central system by either that switch connected to the failed link or the receivers notify to the senders. Then the traffic is redistributed by the source over the remaining spanning trees.

The primary goal is to employ more than one spanning tree; each associated and identified with a unique VLAN in order to achieve a speedy recovery from the link failures. Fast recovery refers to the forwarding

of packets alongside an alternate path from the switch that is connected to the failed link. By switching the traffic o an alternate path, it would imply the changing VLAN tag in the packet which in turn means employing a different spanning tree for routing. When a link failure occurs, the intermediate switch would select a VLAN identifier that is higher than the failed one (Huynh, Mohapatra, 2007) . It ought to be noted that the papers do not quantify the number of spanning trees which in theory is necessary to guarantee a recovery from a single link failure. In order to achieve load balancing and failure recovery, Link disjoint spanning trees have been proposed (Qiu, Gurussamy, and Chua, 20011). The spanning tree is constructed in a such a way that it ensures that no two undirected link is common to both trees. The link-disjoint guarantees recovery from a single link failure and this could be classed as a primary use. It is important to be four edge connected in a network to obtain two link-disjoint spanning trees (Mirjalily, et al 2009). On the contrary it is quite possible to compute two independent rooted-linked spanning trees. A popular approach for distributing traffic across different paths is the use of multiple spanning trees, each identified with the help of a unique VLAN tag. There have been works in the past that have dealt with issues concerning tolerance and bandwidth guarantee. Inspire of the schemes ability to quickly reconnect it is not clear as to how the packets at the switch could be reconnected till at time a new tree is set up. In such circumstances, there would be a). Packet losses and b) potentially control message being exchanged.

In this paper, the definition of a guaranteed fast recovery when a link failure has occurred is the ability of the switches to quickly forward the packets without the necessity to inform other switches of a failure. Thus it is limited only by detection time.

The primary focus on this paper is concentrated on providing guaranteed recovery from a single link failure in Ethernet networks. To best of author knowledge and belief, this is the very first work that provides process that guarantees a purely local and quick recovery from a single link failure in Ethernet network that are two edges connected. Moreover there are efforts to develop multiple schemes that would assist in achieving this goal.

It is suggested that by modifying STP and RSTP, a guaranteed protection could be obtained in Metro Ethernet. During the normal operation traffic is transmitted on the master tree. According to Paradmaraj and Nair (2008), builds a master tree and a set of sub trees for each node. The sub tree replaces a part of master tree when a link failure occurs. The re-convergence of master tree is usually avoided. This however does not address the issue of a guaranteed backup capacity provisioning o carry affected traffic. In order to provide a guaranteed protection to the traffic in Metro Ethernet, a tool for RSTP optimization is introduced (Kern,2007). Multiple Spanning Tree protocol (MSTP) including Viking and FHP has been proposed in order to achieve optimal network resource utilization, fast resilience mechanisms based on IEEE802.1s. To enable the restoration of traffic, a local restoration mechanism based on multiple spanning trees is proposed by changing Ethernet frames' Virtual LAN (VLAN) in local Ethernet switch. The prerequisite for changing frames' VLAN ID is a high speed processor in Ethernet switch. This dramatically increases the cost. It must be noted that VLAN switching is not supported in most Ethernet switches.

RESEARCH METHODOLOGIES, TOOLS AND TECHNIQUE:

The main purpose of this section is to identify different research tools, techniques, and research approaches that can be used to satisfying above defined objectives. From above objective it is possible to have different research tools and techniques for each. To get best results, it is compulsory to choose most appropriate set of research approach, tools and techniques as primary and as a secondary/alternative. Secondary approaches or alternative approaches are used in case of primary research method fails.

To reach the research objectives, author need to implement the fast spanning tree re connection mechanism into Ethernet switched network. As previously mentioned, This Fast spanning tree reconnection mechanism is kind of tool which helps to re connect failure link with pre-configuring and it gives failure notification table and alternate output port table to each switch. Significantly, it avoids backward learning. Mainly this mechanism uses network resources efficiently.

RESEARCH APPROACH:

In this research work, the author has chosen experimental approach, hence it is deductive approach. Generally, deductive research method derived some particular subject from any general subject but it ends with systematic hypothesis proposal starting from general theory. To testify the hypothesis characteristics the observations or experiments are conducted.

RESEARCH DATA:

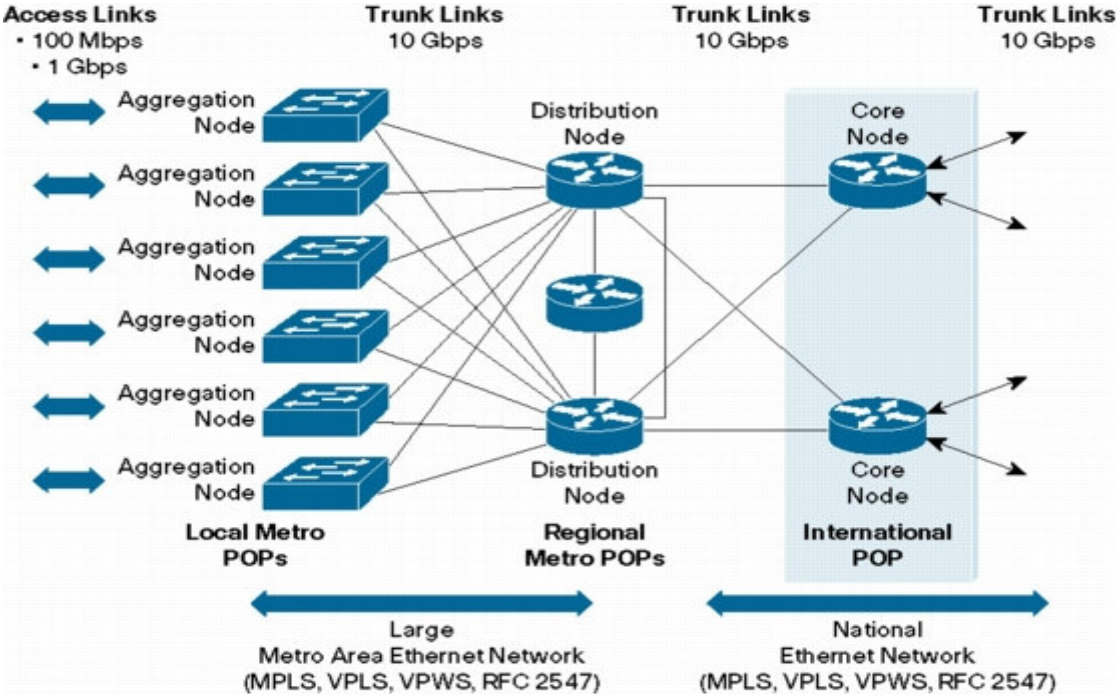
For this research both qualitative data and quantitative data can be taken to account. Spanning Tree Protocols plays important role in small and medium business environment in recent years. So for this research other can collect data from real network. The data can be taken as a two part one is before and after implement this fast

spanning tree re-converge and re-connect mechanism. Then it can be compared and drawn to result in various aspects. For some factor author will use previous research work and that result to compare with this present research.

REARCH METHOD:

As mentioned in previous section this research work is based on an experimental method. To get good result and prove its outcome, it's mandatory to set up a real network environment. To collect real data, either can implement this mechanism into real network or model network. Due to data privacy, it is quite difficult to implement into real network, so author has chosen to set up model network in Lab with enough end-devices and intermediate devices.

MODEL NETWORK DIAGRAM:



CRITICAL EVALUATION AND REFLECTION OF OUTCOME AND PROCESS:

The main reason of this section is to identify the contribution of this research topic to the current literature and expected results after successful completion of this research work.

EXPECTED OUTCOES:

- ✓ This mechanism has to protect spanning tree link failure in Metro Area Networks.
- ✓ After link failure re-convergence and re-built time should be low as possible.

POSSIBLE OUTCOME:

- ✓ Spanning tree structure is kept as same after failure.
- ✓ It creates failure notification table.
- ✓ It creates alternative output port table on each switch.
- ✓ Avoid the backward learning.

CONCLUSION:

Research proposal for failure link spanning tree reconnection is presented with clear and articulation of narrow focused research question, aim and objectives. Consequences From this research proposal are to give deep insight knowledge about spanning tree link failure and reconnection mechanism requirement. So after tested in lab environment with different circumstances, en it can be used in real time. This research is not included recovery mechanism when link has failed. In a future we can add this feature to optimize this research further.

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