INBOUND AND OUTBOUND TRAFFIC CONTROLLING OF MULTI-HOMED AUTONOMOUS SYSTEM

Cokorda Rai Adi Pramartha, Arnoldus Aditya Subiyanto

Network Centric Computing Laboratory

Computer Science Department - Udayana University

cokorda@cs.unud.ac.id,arnolditya@cs.unud.ac.id

Abstract

A multi-homed Autonomous System (AS) usually has two or more BGP border routers connected to the other AS. This border router is the gateway for the AS to connect with other AS. Having more than one gateway is an obstacle for the multi-homed AS when setting their outbound and inbound traffic. The research and observation have been at a multi-homed AS indicating that the BGP Routing Protocol can overcome these obstacles. Multi-homed AS can use the prepend method and set the local_preference attribute to control outbound and inbound traffic.

1. Introduction

The Internet is a collection of thousands and even millions of network nodes in which they exchange their information [1]. At the top level, the Internet is a collection of Autonomous System (AS)[2] - Autonomous System (AS) trade mutually routing tables so that they can communicate each other. An Autonomous System (AS) is a collection of routers working in a similar administrative systems [3]. An AS might consist of a collection of routers using the same or different IGP[1] routing but still within the same administrative system [4]. In other words, people outside the AS can see the AS as an entity. Every AS has a different identification number[5]. This number is given by an organization called the Internet Assigned Number Authority (IANA)[6]. An AS number consists of 16-bit integers, that is 1 to 65,535[7]. AS numberbetween 54,512 to 65,535 is intendedfor personal/private. Therefore this AS number is called the private AS number. While the number 0 and 65,535 are used to control (set forth in RFC 1918).

1.1. Multi-Homed AS

An AS can be classified as a multi-homed AS if the AS has more than one route to get to the other AS[8]. So Multi-homed AS will have more than one border router connected to the other AS border router. Based on the classification system, a multi-homed AS can be divided into 2 types[9], namely:

1. Multi-homed Non Transit AS

An AS can be classified as multi-homed non transit autonomous systems if there is more than one route out to other AS in the AS. This is due to an AS connected to the Internet can be connected to more than one upstream provider. Multi-homed non transit autonomous system cannot be used as a transit route of traffic between the other AS[10]. This is shown inFigure 1, the AS24 cannot be used as a transit route data traffic between the ISP1 and ISP2.

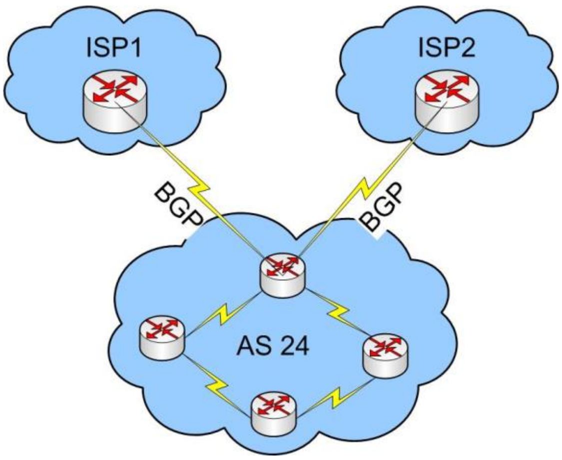

Figure 1Multi-homed non transit AS

2. Multi-homed Transit AS

Just like with multi-homed non transit autonomous systems, multi-homed transit autonomous system has more than one path to another AS network[9]. However, the multi-homed transit autonomous systems can be used as transit route data traffic between theASes. This is indicated byFigure 2, that ISP1 can use AS24 as a transit route to ISP2. A multi-homed transit autonomous system can deliver and share routing information using the Exterior Gateway Protocol (EGP[2])[11].

[1] Interior Gateway Protocol (IGP) is a routing protocol that is used within an autonomous system (AS).

[2]Exterior Gateway Protocol (EGP) is a routing protocol that is used to exchange routing table between autonomous system (AS)

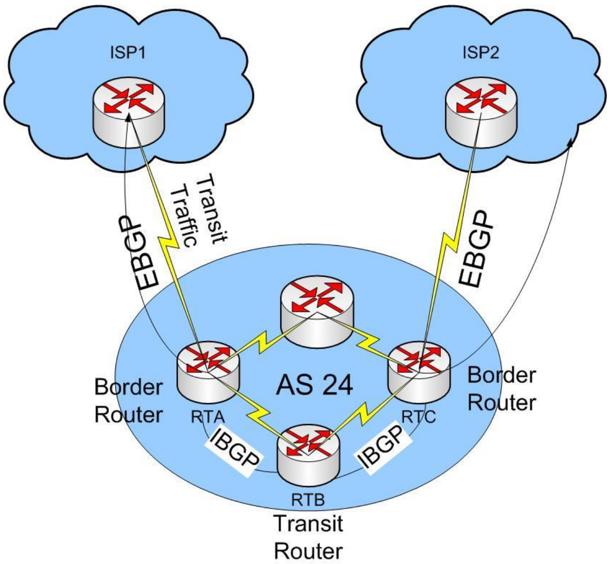

Figure 2Multi-homed transit AS

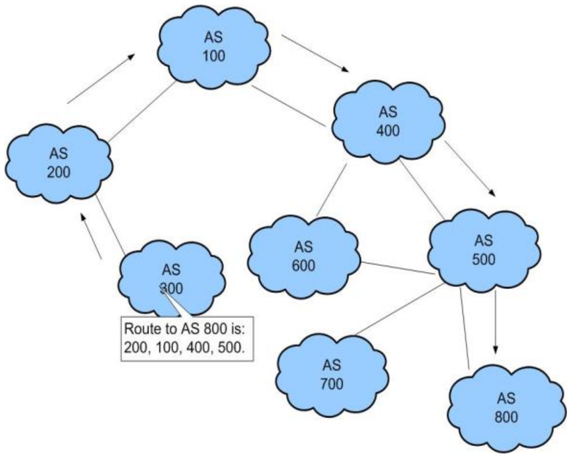

Figure 3BGP Path

1.2. Border Gateway Protocol

Border Gateway Protocol (BGP) is one of the EGP protocol. Nowadays BGP has become an international standard of Exterior Gateway Protocol[12]. BGP is used as a dynamic routing protocol between the AS[8].Served as EGP, BGP protocol is an exchange routing tables between the ASes[13]. Currently BGP has reached version 4. BGP uses TCP[3] port No. 179 in the exchange of routing information. Therefore, the TCP connection between BGP routers must be interconnected before BGP routers can communicate[14]. As a step to avoid the loop path selection, the BGP AS forms a graph from information obtained from other BGP routers. This graph will form pathways that can be taken to achieve a particular network. These pathways are called AS-PATH[15].

When facing the choice of BGP destination with more than one route, by default, BGP will choose the shortest AS PATH[16]. This has led BGP classified as a distance vector protocol[17].

2. Related Work

The present research on inbound and outbound traffic control on a multi-homed AS has already done in a Network Access Point (NAP) in Jakarta. The method described in this paper based on the results of the author's BGP policies observation on the NAP. The method usesprepend and manipulation local_preference attributes have been applied long enough in that NAP. During the application of these methods, they are quite successful in managing inbound and outbound traffic. NAP needs it because the NAP is a multi-homed non transit AS.

3. Prepend

The first thing that will be discussed in this paper is the method to set the inbound traffic on a multi-homed AS. This requires a multi-homed AS, as explained earlier, that the multi-homed AS has more than one gateway. Sometimes administrators need to use the inbound route through one of the upstream than the other upstream. If this

[3]TransmissionControlProtocol (TCP) is one of the core protocols of the Internet Protocol Suite . TCP work with implicit hand-shaking dialogues for guaranteeing reliability, ordering, or data integrity

happens, then the administrator can use the prepend methods. Prepend is a method to which the administrator add the AS-PATH line using his own number[18]. In other words, I will use an example of case. Supposed an AS with an AS number 100 has two upstream (e.g.AS number 200 and 300) to connect to the Internet. AS 100 has 192.168.1.0/24 network prefix. AS 100 requires the AS administrator for inbound traffic through the AS 200. This can be overcome by using prepend or often called AS-PATH Prepending. Thenthe AS administrator must add the AS 100-PATH on AS 300 to 100 100 100. As a result, BGP routers on the Internet will see the path through the AS-PATH AS 300 to AS 100 which is 2 PATH longer than AS 200. The number of the administrators who must add their prepend to the AS must be adjusted to best-path or paths between the other upstream. If the path to AS 300 is shorter than the AS 200, then the administrator must add more prepend the AS 300 so that AS-PATH is longer than AS 200. To see the AS-PATH,the administrators can use the tools provided by several research institutions on the Internet such as: http://us.nett.net/support/looking-glass/. Prepend method has several advantages, one of them is by not adding large of routing tables [19]. This is due to information about the PATH will not be stored in routing tables. Another benefit is that when other routes to the AS which are not in the prepend fail/break, so BGP will automatically choose to use prepend path.

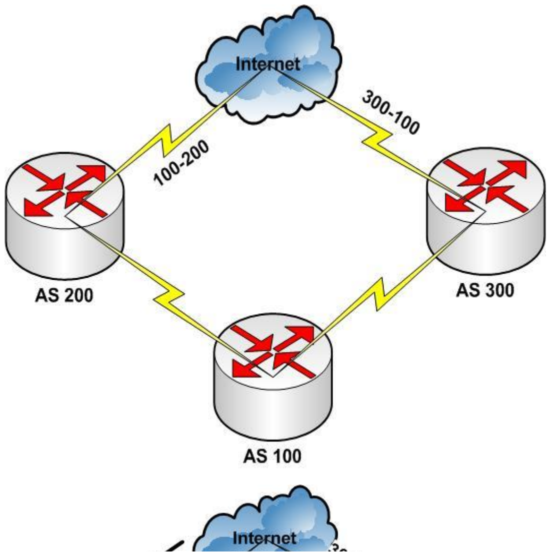

Figure 4Example of Case non Prepend

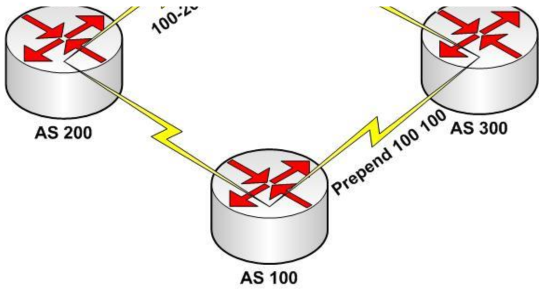

Figure 5Example of Case Prepend

Besides being used to determine the inbound path, prepend also be used in a multi-homed AS which wants to do load-balancing[20]. This is needed when the AS PATH through an upstream shorter than the other upstream. This of course causes the data packets from the Internet will always be delivered by the shortest PATH. Therefore it is necessary to prepend AS-PATH on the shorter upstream AS, so the AS long-PATH is balanced with the other upstream. Administrators can only prepend the AS number in addition to his AS number.

4. Local_Preference

Local_preference is an attribute in the BGP routing protocol[14]. Local_preference shows the value to the closest router. The greater value of local_preference attribute indicates the closer neighboring BGP router. BGP routers always choose the path through a router that has the largest local_preference value. These characteristics can be used to regulate outbound traffic by the administrator. Local_preference value at BGP routers can be modified in accordance with the needs of multi-homed AS. If administrators need to use outbound traffic through one of the only AS upstream, the administrator can provide attribute values on the router upstream local_preference he wants. Because of these characteristics of the existing routing protocols BGP, the BGP router will choose for the upstream path having a greater value local_preference earlier. Thus, the administrator can set up outbound traffic on multi-homed AS in accordance with the needs of the existing system.

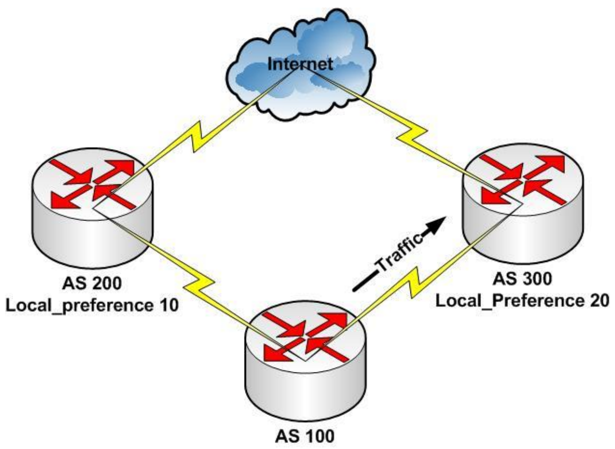

Figure 6Example of Case Local_Preference

5. Conclusions

In this paper, we explain the methods that can be used to manage inbound and outbound traffic on a multi-homed AS. The method presented is done on the router using BGP routing protocol. Prepend Method or also known as AS-PATH prepending can be used to manage inbound traffic. While to regulate outbound traffic, it can be done by modifying the attribute values of local_preference border router upstream from the AS. We found this method while doing an observation in a NAP company. The method described in this paper has been applied by that NAP Company to manage its inbound and outbound traffic

6. References

1. Clough, B.M.B., *FCS Data Communication and Networking L4*. 2009: Pearson South Africa.

2. Das, V.V., J. Stephen, and Y. Chaba, *Computer Networks and Information Technologies: Second International Conference on Advances in Communication, Network, and Computing, CNC 2011, Bangalore, India, March 10-11, 2011. Proceedings*. 2011: Springer.

3. Newman, M.E.J., *Networks: an introduction*. 2010: Oxford University Press.

4. Hanrahan, H., *Network convergence: services, applications, transport, and operations support*. 2007: John Wiley & Sons Ltd.

5. Dooley, K. and I.J. Brown, *Cisco IOS cookbook*. 2007: O'Reilly.

6. Meersman, R., Z. Tari, and H.M. Herrero, *On the move to meaningful internet systems 2006: OTM 2006 workshops: OTM Confederated International Workshops and Posters, AWeSOMe, CAMS, COMINF, IS, KSinBIT, MIOS-CIAO, MONET, OnToContent, ORM, PerSys, OTM Academy Doctoral Consortium, RDDS, SWWS, and SeBGIS 2006, Montpellier, France, October 29 -*

November 3, 2006 ; proceedings. 2006: Springer.

7. Lammle, T., S. Odom, and K. Wallace, *CCNP routing study guide*. 2001: Sybex.

8. Medhi, D. and K. Ramasamy, *Network routing: algorithms, protocols, and architectures*. 2007: Elsevier/Morgan Kaufmann.

9. Forouzan, B.A. and S.C. Fegan, *TCP/IP protocol suite*. 2006: McGraw-Hill.

10. Hakhoe, H.T. and I.C. Society, *Journal of communications and networks*. 2008: AIEI Korean Institute of Communication Sciences (KICS).

11. Philcox, J., *Solaris 9 network administrator*. 2003: Que.

12. Electrical, I.o., et al., *IEEE International Conference on Communications*. 2001: Institute of Electrical and Electronics Engineers.

13. Zhang, R. and M. Bartell, *BGP design and implementation*. 2004: Cisco Press.

14. Garrett, A. and I. Juniper Networks, *JUNOS cookbook*. 2006: O'Reilly.

15. Beijnum, I., *BGP*. 2002: O'Reilly.

16. Schluting, C., *Network Ninja*. 2008: Lulu.com.

17. Rhee, M.Y., *Internet security: cryptographic principles, algorithms and protocols*. 2003: J. Wiley.

18. Lucas, M., *Cisco Routers for the Desperate: Router and Switch Management, the Easy Way*. 2009: No Starch Press.

19. Stiller, B., *From QoS provisioning to QoS charging: third COST 263 International Workshop on Quality of Future Internet Services, QofIS 2002 and second International Workshop on Internet Charging and QoS Technologies, ICQT 2002, Zurich, Switzerland, October 16-18, 2002 : proceedings*. 2002: Springer.

20. Communications, A.f.C.M.S.I.G.o.D. and U. Association, *Proceedings of the 2004 ACM SIGCOMM Internet Measurement Conference: IMC 2004, Taormina, Sicily, Italy, October 25-27, 2004*. 2004: ACM Press.