Matt Tucker

tuckmn1@student.op.ac.nz

Abstract

This document outlines the WAN design for our companies’ network. It includes evidence of choices made, and configuration files for each device.

Phase 2 WAN Design and implementation

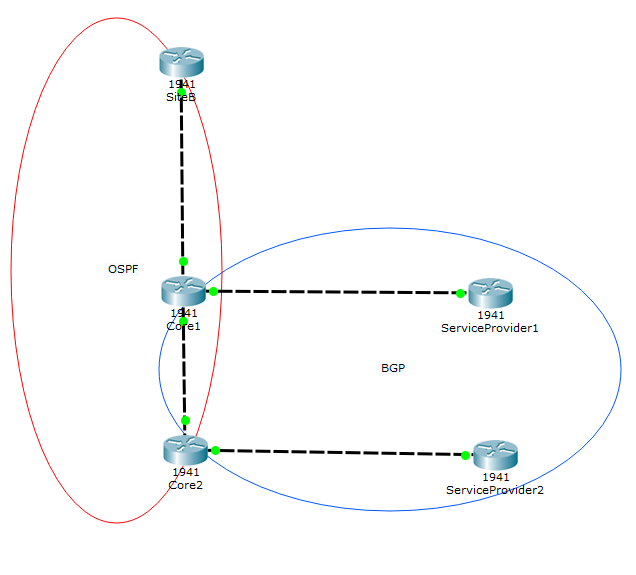
Matt Tucker

# Overview

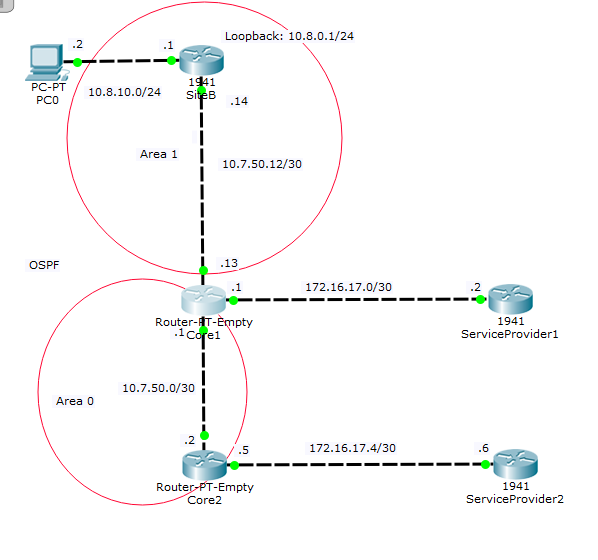
This document outlines the WAN design for our companies’ network. It includes evidence of choices made, and configuration files for each device.

Please refer to Phase One document for the LAN design of the head office.

# Head Office & Site B Physical Topology



# Logical Topology



# BGP Topology

# 

To stop head office being a transit AS, we apply a route map to both Core 1 and Core 2, that matches on AS-PATH of nothing. If it is a match we advertise the route. If not, the routers have learnt the route from an external AS so will not advertise to other AS’s.

Core 2 prepends 2 more 65007 to AS-PATH so that incoming packets prefer to go via Core 1.

Core 2 has a local preference of 100 (default). Core 1 has a local preference of 200, making it the preferred choice for outgoing packets.

Secondary Path for Incoming and Outgoing packets to ISP

Primary Path for Incoming and Outgoing packets to ISP

# OSPF

Open Shortest Path First (OSPF) will be configured between the gateway routers, distribution switches, and the dark fibre link to Site B. OSPF offers faster convergence and scales to larger network implementations than the older protocol RIP. It is a link state routing protocol that was developed as a replacement for the distance vector routing protocol offered by RIP. RIP uses hop-count as the only metric, which can quickly become problematic, whereas OSPF looks at a number of factor when deciding the best route to take (OSPF Fundamental, 2017). These factors can be customised by the network administration for greater control over network paths.

We will implement multi-area OSPF between the head office and Site B. This will reduce the number of link state advertisements (LSA) flooding the network. The ABR will generate a network summary (type 3 LSA), to send into both areas (Balchunas, 2007). Core 1 router will act as the Area Border Router (ABR). Core 1 will also be the DR by setting the ip ospf priority on all internal interfaces to 5. Core 1 has been chosen as the DR because it is the ABR and the priority connection to the service provider.

Splitting the Head Office and Site B into two different areas has the following benefits:

* Smaller routing table, as networks can be advertised as a summary.
* Smaller Link State Database (LSDB), as routers only need to know their area.
* Reduced SPF algorithm calculations, as an ABR only needs to run the SPF algorithm when there is a change an associated area.

Our Head Office site is going to act as our backbone area, or Area 0. Site B will be Area 1. To further reduce the flooding on LSA’s we are making Site B a stub area. This will stop Area 1 receiving Type 4 and 5 LSA’s (Balchunas, 2007). This is appropriate as there is only a single point of entry to and from the area, and no ASBR inside the area (Lesson 3 Stub Areas, 2017). The ABR will automatically advertise the default route (with a cost metric of 1) into the stub area.

Using another router as the ABR was considered, however it was determined that due to a relatively low number of employees, a single router acting as the ABR, and part of the Head Office network, would easily meet our requirements.

OSPFv4 is being used in our network as we are using IPv4 as our IP protocol. A further advantage of OSPF is that MD5 can be implemented, to improve network security. This means that routers will only accept OSPF updates from peers with the same pre-shared password.

# BGP

## What is BGP?

Border Gateway Protocol (BGP) is an exterior routing protocol. It allows routers to send packets to router in different networks / Autonomous Systems (AS) (Understanding BGP, 2017). BGP uses TCP as the transport protocol, on port 179 (BGP Case Studies, 2008). This allows BGP routers to peer with other BGP routers that are more than one hop away.

Before BGP routers can exchange routing information, the routers must become BGP neighbours/peers. Once a BGP peer is established, the peer initially exchange full BGP routing tables (Balchunas, 2007). After this, the peers send incremental updates as the routing table changes (BGP Case Studies, 2008). All BGP neighbours keep the same version number of the BGP table, which increments whenever the routing information changes (BGP Case Studies, 2008).

Internal BGP is when routers are peers within the same autonomous system. External BGP is where routers are peered from different AS’s. In our network, we will use internal BGP to peer the two core routers to each other, and external BGP to peer the core routers to the ISP routers.

## Head Office Setup

Our Head Office Site is connected to every other site in our company (excluding Site B), using BGP into an MPLS service provider network. The aim is to be able to see each remote site in our route table, and advertise Site B and Head Office network to the other sites.

As we have two connections to our service provider, but want only 1 of those connections to be used for both incoming and outgoing traffic, we need to apply some BGP policy. The secondary link must be able to take over in the case of an outage.

Core 1’s link to the service provider is the primary link that will be used for incoming and outgoing traffic. In order to make Core 1 the preferred link for outgoing traffic, we have decided to set the default local-preference of Core 1 to be 200. This is greater than the default local-preference of Core 2 (100), so Core 1 will be used for all outgoing traffic (Balchunas, 2007).

To make Core 1 the primary path for incoming traffic, we need to use AS-PATH prepending on Core 2. This will make Core 2 be the least preferred option when deciding whether to send traffic to Core 1 or 2. To do this we created a route map, and matched any as-path that originated in the Head Office network. We then prepended two more instances of the AS 65007 to all outgoing traffic.

We do not want the Head Office site to be a transit site for any of other sites. In order to stop this happening, we have chosen to only advertise networks that originate in the Head Office AS. We do this by creating a route map on both Core 1 & 2 that matches an as-path access list. This access list uses a regular expression to check that the as-path contains nothing (therefore originating locally). The route map denies by default any other paths that may want to be advertised.

# Work Log

29/09/17 – Started researching BGP. (2hrs)

3/10/17 – Drew a physical and logical network schema out by hand. Created more available networks where required. Started building example network in packet tracer. (2hrs)

5/10/17 – 12/10/17 – Began documentation. Took screen shots of topologies. Started writing down router config for the network. Completed further research. (6hrs)

13/10/17 – Consulted with Michael about implementing BGP and to resolve some OSPF issues. Continued with documentation.

15/10/17 – Continued with documentation. (1hr)

22/10/17 – Tested BGP config in VIRL. – Will need to do again as config file didn’t push to github. (4hrs)

25/10/17 – Continued with documentation. Getting references written down correctly. Looked into OSPF stub areas and implemented it in my network design. (3hr)

# References

BGP Case Studies. (2008). *Cisco*. Retrieved from: https://www.cisco.com/c/en/us/support/docs/ip/border-gateway-protocol-bgp/26634-bgp-toc.html#howbgpwork

Understanding BGP. (2017). *Juniper Networks*. Retrieved From: https://www.juniper.net/documentation/en\_US/junos/topics/concept/bgp-routing-overview.html

OSPF Fundamental. (2017). *Computer Networking Notes****.*** Retrieved From: https://www.computernetworkingnotes.com/ccna-study-guide/ospf-fundamental-terminology-explained.html

Balchunas, A. (2007). *Open Shortest Path First v1.31*. Retrieved From: http://www.routeralley.com/guides/ospf.pdf

Balchunas, A. (2007). *Border Gateway Protocol v2.01*. Retrieved From: http://www.routeralley.com/guides/bgp.pdf

Lesson 3 Stub Areas. (2017). *IN723*. Retrieved From: Otago Polytechnic I: Drive.