Project Part 4: Wireless and Wide Area Networking

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Introduction

Arroyo Shoes wants to utilize Wi-Fi inside and outside the headquarters. They also want high-speed connectivity with built-in redundancy for wide area network (WAN) connections between the headquarters and distribution centers. This paper will provide a description and diagram for the new wireless LAN (WLAN) for the headquartes that will serve as the model for distribution centers and provide a description for WAN connections to the distribution centers with built-in redundancy.

Location of Access Points

For location points of every access point, coverage and capacity need to be sufficient for both inside and outside the headquarters. Coverage is the attempt to provide the same level of signal strength to all network nodes (Solomon & Kim, 2021, p. 313). Capacity is the number of nodes and amount of shared bandwidth available to each node (Solomon & Kim, 2021, p. 313). For indoors, this is going to be the busiest part of the network, so it’s going to be the most important part for ensuring capacity and coverage for all users. Access points are going to be located within each department, which are sales, IT, accounting, and marketing. I want to ensure that each subnetwork gets its own dedicated bandwidth for each access point on the WLAN, which will help prevent over saturation on the network (Solomon & Kim, 2021, p.288).

Since multiple APs will be used, overlapping may occur and cause crosstalk (Solomon & Kim, 2021, p. 315). Crosstalk is interference that can cause errors or noise caused by transmissions at frequencies close to the active channel (Solomon & Kim, 2021, p. 315). To prevent crosstalk, each overlapping AP will be set on a different

channel so users can still roam on their AP without interference (Solomon & Kim, 2021, p. 314).

Signal Strength

Wireless networks follow a set of standards referred to as 802.11x (Solomon & Kim, 2021, p. 314). Each standard has its own frequency, range, and speed (Black Box, 2022). Access points are one of many wireless devices that must follow these standards, so it's best to use specific standards based on the environment that APs reside in to solve distance issues and satisfy speed requirements (Solomon & Kim, 2021, p. 317).

For the indoor access points, range isn't much of a necessity because of the smaller and more compacted departments that each use their own access point, so in this case the 802.11ac standard will work (Black Box, 2022). The 802.11ac standard operates at both 2.4 and 5 GHz, has a speed up to 1300 mbps, and supports a distance of 46 meters indoors and 92 meters outdoors, which sounds perfect for high-speed connections indoors with a great amount of coverage (Black Box, 2022). Indoor access points will use unidirectional antennas to prevent signals from travelling outside and limit coverage to indoor users only (Solomon & Kim, 2021, p. 318).

For outdoors, APs will use the 802.11n standard. This standard operates at both 2.4 and 5 GHz, has a speed up to 600 mbps, and supports a distance up to 250 meters (Black Box, 2022). This provides a lot of coverage with necessary speed with greater resistance to interference coming from outside sources (Black Box, 2022). Outdoor access points will use omnidirectional antennas because of their placement in a central

point outdoors and to provide enough coverage for Wi-Fi outside (Solomon & Kim, 2021, p. 318).

Number of Users

A WLAN's capacity is dependent on how capable its APs are (Solomon & Kim, 2021, p. 315). Bandwidth is being shared by each node at the same time for each AP on the network (Solomon & Kim, 2021, p. 315). APs can fluctuate their capacity based on the load, type, and amount of data that's being transmitted (Solomon & Kim, 2021, p. 315). When it comes to AP placement, each department will have one AP because each department will have at least 20 nodes transmitting and receiving data at the same time. 20 is a general rule for how many nodes should be connected to an AP based on the mix of traffic (Solomon & Kim, 2021, p. 315).

AP Management

Access points are managed using a wireless LAN controller (WLC) (Solomon & Kim, 2021, p. 280). WLAN controllers aggregate the APs into a cohesive WLAN infrastructure (Solomon & Kim, 2021, p. 280). They can also monitor network traffic loads and bandwidth (Solomon & Kim, 2021, p. 280). As shown in the logical topology, the WLAN controller also has a backup. In the event of primary WLC failure, the backup WLC will be used as a failover (Cisco Certified Expert, 2022). Once the primary WLC is back online, control will then be returned to the primary WLC (Cisco Certified Expert, 2022). This will provide redundancy for WLAN management (Cisco Certified Expert, 2022).

WAN Redundancy

A connection is needed for connection to and from both the headquarters and distribution centers. The best approach to maximize the redundancy for the WAN is to use a dual multi-homed connection (Noworatzky, 2019). A dual multi-homed connection provides two connections to each distribution center using two links and two edge devices (Noworatzky, 2019). If one link ends up failing, connection will not be lost because the link is duplicated (Noworatzky, 2019). Having the distribution center's independent of each other means that if one network goes down, the connection is still maintained (Noworatzky, 2019).

Conclusion

The Arroyo Shoes organization needed a WLAN for the headquarters to use as a model for their distribution centers, along with a WAN connection to and from the distribution centers. This paper includes the implementation of a WLAN on the current network with considerations for access points and redundancy methods of WLAN controllers. This paper also presents an approach to WAN connectivity between the headquarters and distribution centers, along with redundancy options in case the main connection goes down.

References

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Noworatzky, D. (2019, September 18). *How to ensure business continuity through WAN redundancy*. TeleDynamics Think Tank. https://info.teledynamics.com/blog/how-to-ensure-business-continuity-through-wan-redundancy

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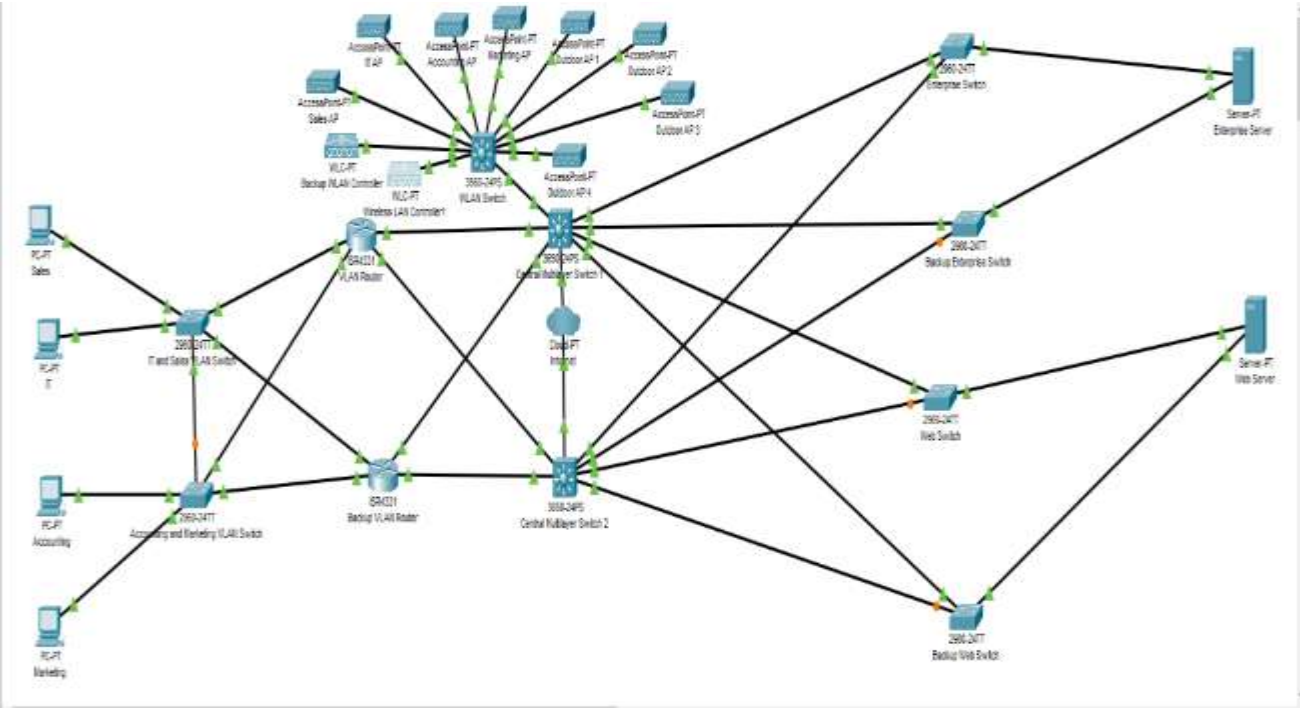
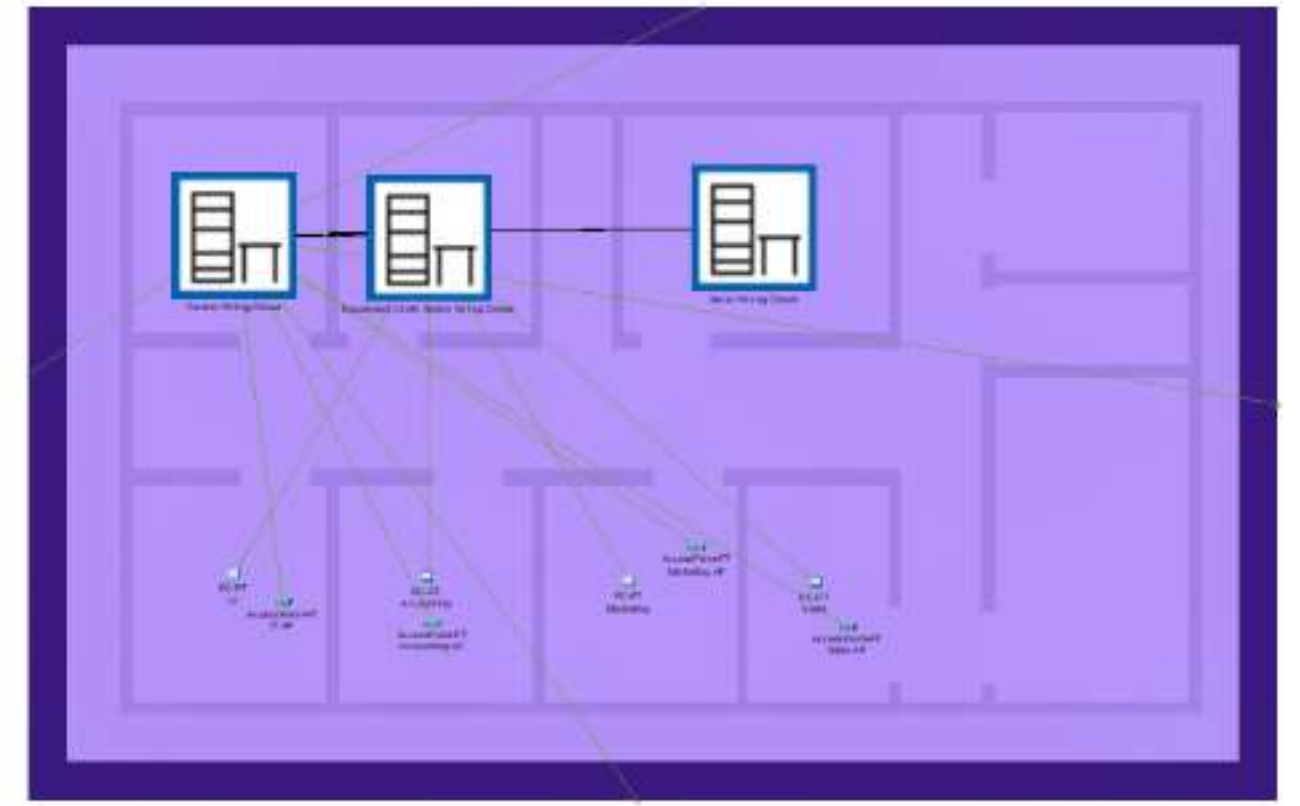
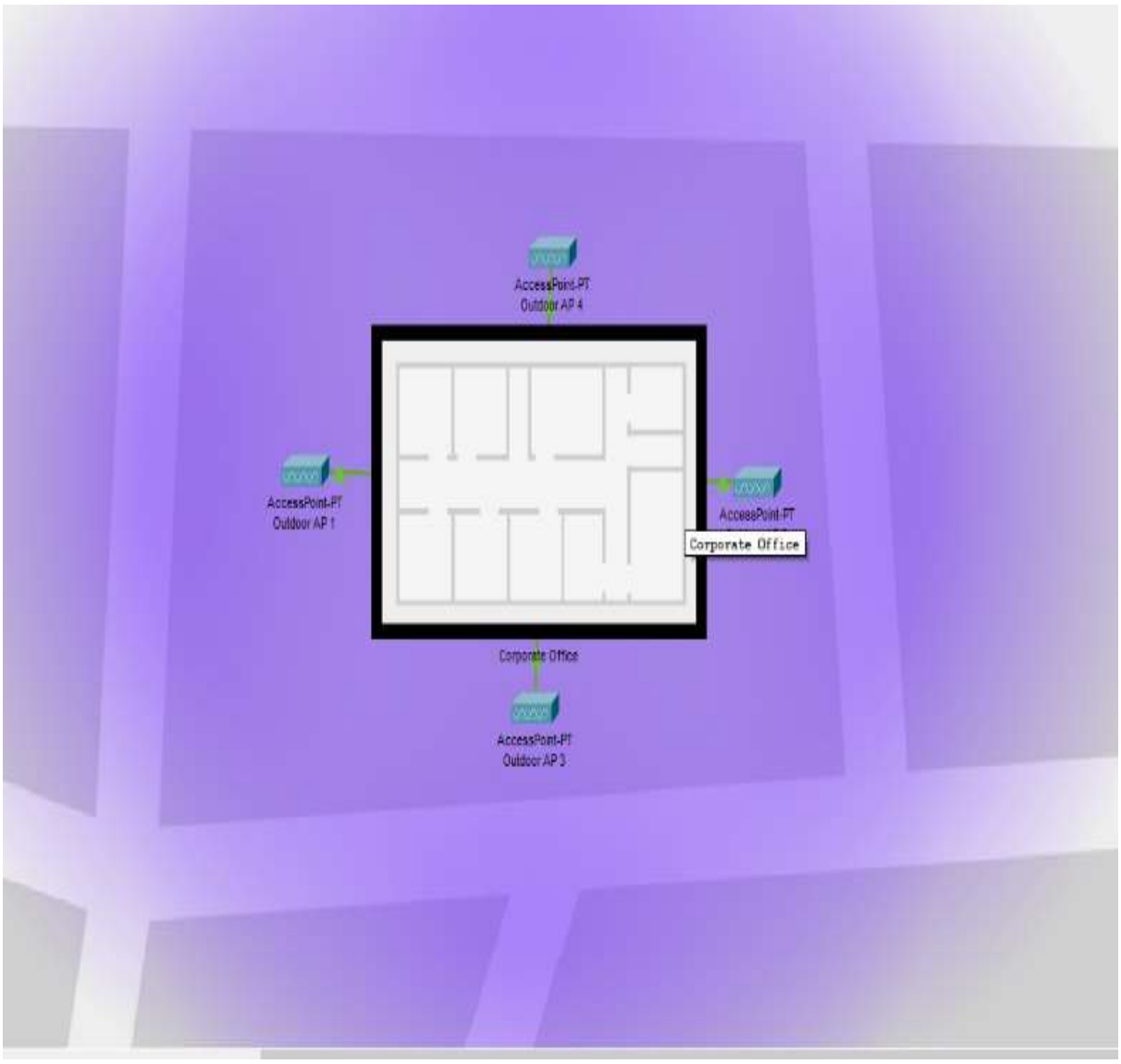
Appendix A: Network Diagram






AccessPoint-PT
Outdoor AP 4
AccessPoint-PT
Outdoor AP 1
AccessPoint-PT
Corporate Office
Corporate Office
AccessPoint-PT
Outdoor AP 3