

1. CHARACTERIZING THE EXISTING INTERNETWORK

Review Questions

1. What is a flat network? Why does it pose challenges for a network designer?
2. Why is it important to characterize a network's logical topology and not just its physical topology? What information does a logical topology illustrate that might be missed with just a physical topology?

Design Scenario

The city of Mapleland, Oregon, which owns and operates its own power utility, built a fiber-optic network to monitor power meters at residents' homes. The network is called Mapleland Fiber Network (MFN). Because MFN had more capacity than was needed to monitor meters, the city expanded its services to offer access to the network for city businesses. The businesses use the network to communicate with each other and to access the Internet. At the MFN headend, which is located with the city government offices, three routers and WAN links connect to the Internet for use by the city. The businesses on MFN also use these routers to reach the Internet.

In addition to the business service, MFN also offers cable modem service to homes. A cable modem router at the MFN headend connects to the fiber-optic network. In the city neighborhoods, hybrid fiber-coax nodes bring coax cabling to each street and into the homes for cable modem Internet access.

The MFN backbone consists of a fiber-optic Gigabit Ethernet network that runs through the city in a ring topology. The fiber-optic ring connects the hybrid fiber-coax nodes that bring coax cabling to each neighborhood. Also connected to the ring are six data routers.

Each router links one or more Mapleland businesses to MFN via simple point-to-point connections. At the business, the fiber-optic network enters the building and connects to a media converter. A UTP cable connects to the media converter and typically to a 100-Mbps Ethernet switch. The switch links the business's computers and servers in a star topology via UTP cabling.

Questions

1. Mapleland is considering expanding the MFN to include wireless access for its residences.
What additional investigation will you do to prepare for a citywide wireless network?
2. What security concerns do you have for the wireless network?

2. CHARACTERIZING NETWORK TRAFFIC

Review Questions

1. Why is it important to explore traffic behavior when designing a network? What problems could arise if you don't understand traffic behavior when you build a new network or upgrade a network?

Design Scenario

Genome4U is a scientific research project at a large university in the United States. Genome4U has recently started a large-scale project to sequence the genomes of 100,000 volunteers with a goal of creating a set of publicly accessible databases with human genomic, trait, and medical data.

The project's founder, a brilliant man with many talents and interests, tells you that the public databases will provide information to the world's scientific community in general, not just those interested in medical research. Genome4U is trying not to prejudge how the data will be used because there may be opportunities for interconnections and correlations that computers can find that people might have missed. The founder envisions clusters of servers that will be accessible by researchers all over the world. The databases will be used by end users to study their own genetic heritage, with the help of their doctors and genetic counselors. In addition, the data will be used by computer scientists, mathematicians, physicists, social scientists, and other researchers.

The genome for a single human consists of complementary DNA strands wound together in a double helix. The strands hold 6 billion base pairs of nucleotides connected by hydrogen bonds. To store the research data, 1 byte of capacity is used for each base pair. As a result, 6 GB of data capacity is

needed to store the genetic information of just one person. The project plans to use network-attached storage (NAS) clusters.

In addition to genetic information, the project will ask volunteers to provide detailed information about their traits so that researchers can find correlations between traits and genes. Volunteers will also provide their medical records. Storage will be required for these data sets and the raw nucleotide data.

You have been hired as a network design consultant to help the Genome4U project.

Questions

1. List the major user communities.
2. List the major data stores and the user communities for each data store.
3. Characterize the network traffic in terms of flow, load, behavior, and QoS requirements.
4. What additional questions would you ask Genome4U's founder about this project? Whom besides the founder would you talk to and what questions would you ask them?