Accessing the WAN – Chapter 8
Objectives

- Establish a network baseline
- Describe troubleshooting methodologies and troubleshooting tools
- Describe the common issues that occur during WAN implementation
- Troubleshoot enterprise network implementation issues
Establish a Network Baseline

- Explain the importance of network documentation

### Documenting Your Network

<table>
<thead>
<tr>
<th>Device Name, Model</th>
<th>Interface Name</th>
<th>MAC Address</th>
<th>IP Address/Subnet Mask</th>
<th>IP Routing Protocol(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1, Cisco 2611XM</td>
<td>fa0/0</td>
<td>0007.8580.a159</td>
<td>192.168.10.1 /24</td>
<td>EIGRP 10</td>
</tr>
<tr>
<td></td>
<td>fa0/1</td>
<td>0007.8580.a160</td>
<td>192.168.11.1 /24</td>
<td>EIGRP 10</td>
</tr>
<tr>
<td></td>
<td>s0/0/0</td>
<td>--- ---</td>
<td>10.1.1.1/30</td>
<td>OSPF</td>
</tr>
<tr>
<td></td>
<td>s0/0/1</td>
<td>--- ---</td>
<td>Not Connected</td>
<td></td>
</tr>
<tr>
<td>R2, Cisco 2611XM</td>
<td>fa0/0</td>
<td>0007.8580.a159</td>
<td>192.168.20.1 /24</td>
<td>EIGRP 10</td>
</tr>
</tbody>
</table>

### Switch Name, Model, Management IP Address

<table>
<thead>
<tr>
<th>Port Name, Speed, Duplex, STP State, Port Fast, Trunk Status, Ether Channel, VLANs, Key</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1, Cisco WS-C3550-24-SMI, 192.168.10.2 /24</td>
</tr>
<tr>
<td>fa0/1 100 Auto Fwd No On L2 1 Connects to R1</td>
</tr>
<tr>
<td>fa0/2 100 Auto Fwd No On L2 1 Connects to PC1</td>
</tr>
<tr>
<td>fa0/3</td>
</tr>
<tr>
<td>fa0/4</td>
</tr>
</tbody>
</table>
Establish a Network Baseline

- Describe the stages of the network documentation process
Establish a Network Baseline

- Explain the purpose for measuring normal network performance when creating a baseline

Why Is Establishing a Network Baseline Important?

- How does the network perform during a normal or average day?
- Where are the most errors occurring?
- What alert thresholds should be set for the devices that need to be monitored?
- Can the network meet the identified policies?
- What part of the network is most heavily used?
- What part of the network is least used?

The network baseline determines the "personality" of a network under normal conditions.
Establish a Network Baseline

- Describe the steps for establishing a network baseline
Describe Troubleshooting Methodologies and Troubleshooting Tools

- Explain why a systematic method is the generally the best approach to troubleshooting

A General Approach to Troubleshooting

Rocket Scientist Approach
(Theorist)

Caveman Approach
(Brute Force)

A Systematic Approach is Best
Describe Troubleshooting Methodologies and Troubleshooting Tools

- Describe how layered models, such as the OSI reference model or TCP/IP model, are used for troubleshooting

OSI Versus TCP/IP Layered Models

OSI

7 Application
6 Presentation
5 Session
4 Transport
3 Network
2 Data Link
1 Physical

TCP/IP

Application
Transport
Internet
Network Access

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Describe Troubleshooting Methodologies and Troubleshooting Tools

- Describe the three stages of the general troubleshooting process

General Troubleshooting Process

Stage 1
Gather symptoms

Stage 2
Isolate the problem

Stage 3
Correct the problem

If another problem arises as a result of the correction
Describe Troubleshooting Methodologies and Troubleshooting Tools

- Describe the three main methods for troubleshooting network problems
Describe Troubleshooting Methodologies and Troubleshooting Tools

- Describe the stages for gathering symptoms for troubleshooting a network problem

![Diagram showing stages of troubleshooting](image-url)
Describe Troubleshooting Methodologies and Troubleshooting Tools

- Describe the types of software and hardware tools that are commonly used when troubleshooting networks.
Describe the Common Issues that Occur During WAN Implementation

- Describe the fundamentals in WAN design and communication

WAN Technologies operate at the lower 3 layers of the OSI Model.
Describe the Common Issues that Occur During WAN Implementation

- Describe the steps for designing or modifying a WAN
Describe the Common Issues that Occur During WAN Implementation

- Describe the considerations for analyzing WAN traffic

<table>
<thead>
<tr>
<th>Traffic Types</th>
<th>Latency</th>
<th>Jitter</th>
<th>Bandwidth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voice</td>
<td>Low</td>
<td>Low</td>
<td>Medium</td>
</tr>
<tr>
<td>Transaction data</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
</tr>
<tr>
<td>Messaging (e-mail)</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>File transfer</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Batch data</td>
<td>High</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Network management</td>
<td>High</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Videoconferencing</td>
<td>Low</td>
<td>Low</td>
<td>High</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Traffic Characteristics</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connectivity and volume flows</td>
<td>Where does this traffic flow and how much traffic flows there?</td>
</tr>
<tr>
<td>Client/server data</td>
<td>What kind of traffic flows between the client and server?</td>
</tr>
<tr>
<td>Latency tolerance, including length and variability</td>
<td>Can the users tolerate delays? How much and how often?</td>
</tr>
<tr>
<td>Network availability tolerance</td>
<td>How critical is network availability to the users of this LAN? Can they tolerate WAN outages or would their work grind to a halt?</td>
</tr>
<tr>
<td>Error-rate tolerance</td>
<td>Is this noisy traffic?</td>
</tr>
</tbody>
</table>
Describe the Common Issues that Occur During WAN Implementation

- Describe the considerations for designing a WAN topology
Describe the Common Issues that Occur During WAN Implementation

- Describe common WAN implementation issues
Describe the Common Issues that Occur During WAN Implementation

- Describe the recommended steps for troubleshooting a WAN

Case Study: Troubleshooting from an ISPs Perspective

Ask the Customer:
- What, if anything, has changed since before you started seeing this problem?
- Have you power cycled (turned off and back on; re-booted) the router, switch, PC, server? Would you be willing to do it again while I stay on the phone with you?
- Has there been a power outage, lightening strike, or a power brown out in your area recently?
- Do you have up-to-date virus software on your PCs?

Also:
- Ask customers to fax or e-mail you their network diagram.
- Help customers to isolate the different parts of the Internet.
Troubleshoot Enterprise Network Implementation Issues

- Explain how network diagrams are used for troubleshooting
Troubleshoot Enterprise Network Implementation Issues

- Describe how to troubleshoot network problems occurring at the physical layer

Troubleshooting Layer 1 Problems

1. Check for bad cables or connections
2. Check if correct cable standard has been used
3. Check if devices have been cabled incorrectly
4. Verify proper interface configurations
5. Check operating statistics, and data error rates
Troubleshoot Enterprise Network Implementation Issues

- Describe how to troubleshoot network problems occurring at the data link layer

Problem: R2 encapsulation was incorrectly configured as HDLC

```
R2#show interfaces serial 0/0/0
Serial0/0/0 is up, line protocol is up
    Hardware is GT96K Serial
    Internet address is 10.1.1.2/30
    MTU 1500 bytes, BW 128 Kbit, DLY 20000 usec,
    reliability 255/255, txload 1/255, rxload 1/255
    Encapsulation HDLC, loopback not set
```

Step 1: Check that the appropriate encapsulation is in use at both ends.
Troubleshoot Enterprise Network Implementation Issues

- Describe how to troubleshoot network problems occurring at the network layer

Troubleshooting Layer 3 Problems

1. Check for Network Topology Changes
2. Check for Equipment and Connectivity Problems
3. Check Routing Neighbor Relationships
4. Check for Topology Database Issues
5. Check for Routing Table Issues
Troubleshoot Enterprise Network Implementation Issues

- Describe how to troubleshoot network problems occurring at the transport layer

Symptoms of Transport Layer Problems

- Intermittent network problems
- Security problems
- Address translation problems
- Problems with specific traffic types

Common NAT Issues

- Interoperability Issues
- Incorrect Static NAT
- Improperly Configured NAT Timers
Troubleshoot Enterprise Network Implementation Issues

- Describe how to troubleshoot network problems occurring in the application layers

Troubleshooting Application Layer Problems

1. Ping the Default Gateway
2. Verify End-to-End Connectivity
3. Verify ACL and NAT Operation
4. Troubleshoot Upper Layer Protocol Connectivity

Correcting Application Layer Problems

1. Make a backup
2. Make only one change at a time
3. Undo changes not resulting in success
4. Evaluate and document the results of the change
5. Re-evaluate plan or seek a second opinion
6. Problem Solved? (Yes/No)
7. Document successful resolution
Summary

- **Network Baseline**
  How a network is expected to perform under normal conditions

- **Network documentation should include:**
  - Network configuration table
  - End-system configuration table
  - Network topology diagram

- **Planning for the 1\textsuperscript{st} baseline**
  - Determine what type of data to collect
  - Identify devices and ports of interest
  - Determine baseline duration
Summary

- 3 stages of the troubleshooting process
  - Gather symptoms
  - Isolate problem
  - Correct problem

- 3 main methods for troubleshooting a network
  - Bottom up
  - Top down
  - Divide & conquer
Summary

- **Software troubleshooting tools**
  - Cisco view
  - Solar winds
  - HP Open view

- **Hardware troubleshooting tools**
  - Network analysis mode
  - Digital multi-meters
  - Cable testers
  - Network analyzer
Summary

- Common WAN implementation issues include
  - QoS
  - Reliability
  - Security
  - Latency
  - Confidentiality
  - Public or Private

- Using a layered approach to troubleshooting aids in isolating and solving the problem