Evaluation of Routing Protocols in a Simulated Network

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Problem Statement

The objective is to assess the performance of the distance-vector routing protocol as well as the spanning tree routing protocol within a simulated network environment. The evaluation will focus on factors such as convergence time, scalability, resource utilization, and adaptability to network changes. The objective was achieved through the use of multiple simulated routers, switches, and end devices to form a complex topology, which included various subnets and allowed for the simulation of diverse network scenarios, such as redundant paths, network failures, and port security.

Selection of Simulation Software

Trait	Cisco Packet Tracer	NS3	OPNET
Cost	Free	Free (may have to pay to access special features)	Free (may have to pay to access special features
Availability of References	Plenty of youtube videos provided for Cisco Certification	Some youtube videos and its own website	Mostly from research references
Complexity to Learn	Simple and tutorials Wide selections of hardware devices to implement in different scenarios	More realistic, meaning significantly more things to learn	User friendly, support. Limited explanation resources

What is Routing Info Protocol (RIP)?

- Routing Information Protocol is based on a Distance Vector algorithm like Bellman-Ford.

- Each router will iteratively distribute it's known routing table to their neighbors who will update their routing table if it detects new distances .

- Also has the ability to detect downed links and update their distances to be infinite.

- Simple protocol, Relatively slow, Can only handle small scale networks

RIP Simulations
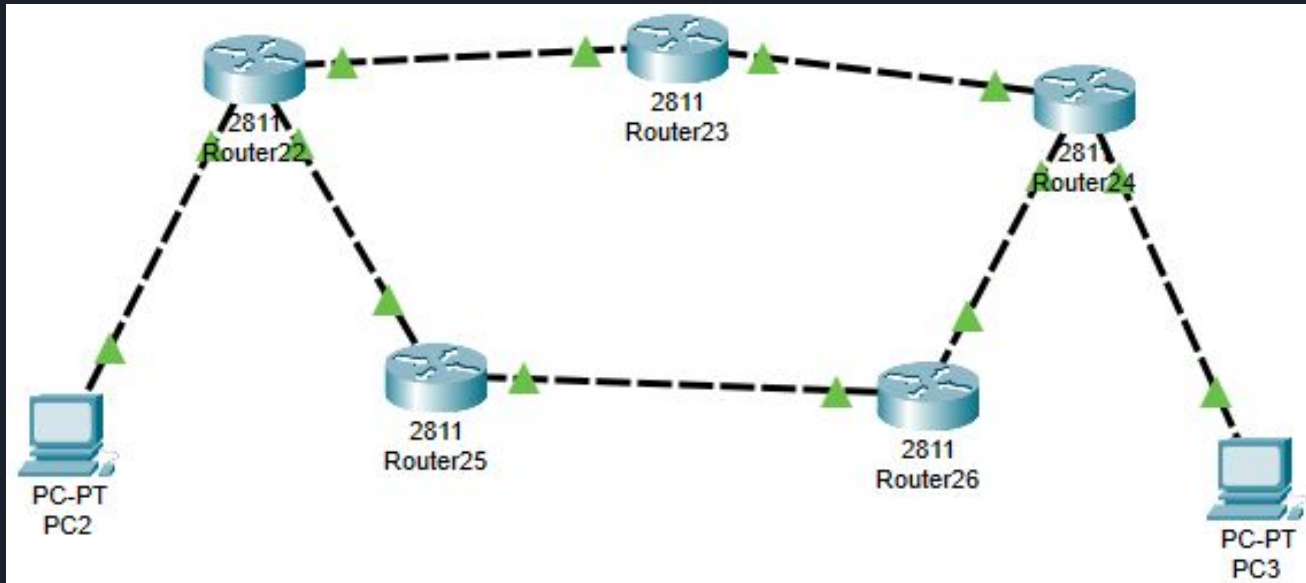
- This network was used as a small scale implementation of a Bellman-Ford algorithm simulation. The sending and receiving of RIP packages between neighboring routers was used to determine the optimal route for communication between PC2 and PC3.

What is Spanning Tree Protocol (STP)?

- One of the primary goals of the spanning tree protocol is to keep Ethernet networks free of loops.
- Network performance is improved by assisting packets in reaching their destination without overloading the system.
- By essentially blocking the loop-causing port and re-enabling it in the event that the initial route fails, it prevents loops.

Rapid Spanning Tree Simulations
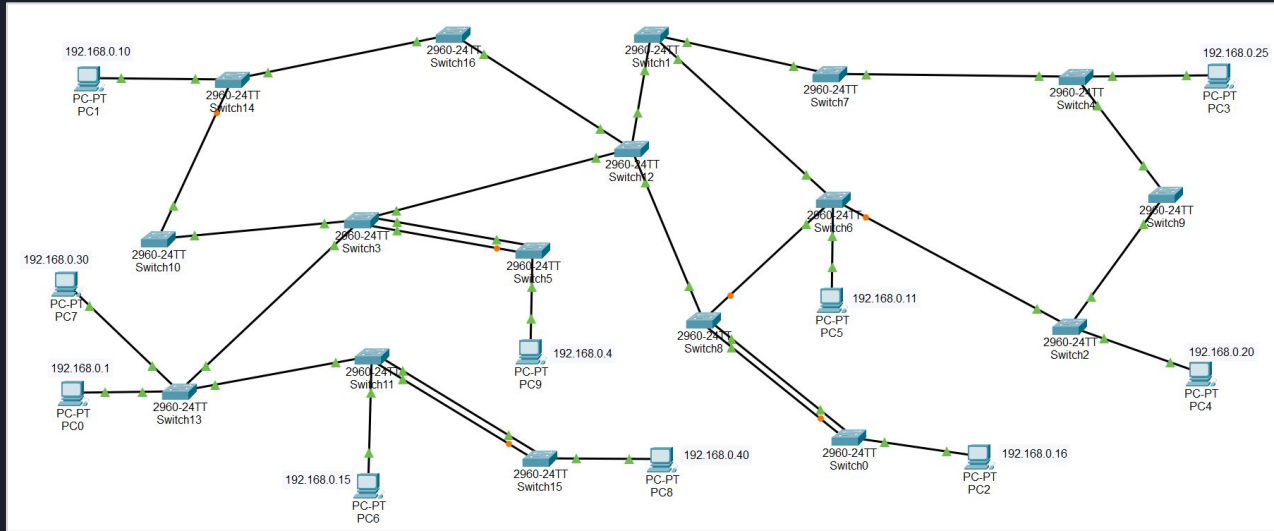
- A network where Spanning Tree Protocol (STP) and Rapid Spanning Tree Protocol (RSTP) are used together to reduce time convergence, network failure and increase security.

RIP Results

- The message sent from one end device to another and the response back were visible and recorded in the events list with a timestamp.

- The RIP packages that were repeatedly being sent from each of the routers to their respective neighbors were visible and recorded in the events list with a timestamp.

- While pinging one end device from another the route the packets are tracked and displayed. In the case of a change in the network, the new optimal route is also able to be displayed once the connection is re-established.

- The administrative distance from RIP at any given router was a low number, meaning that the route was more accurate and that RIP is the favored protocol.

Spanning Tree Results

- RSTP has smaller convergence time as compared to STP.
- In a large network many root bridges may be formed which affects the network. To overcome this, choose only one switch as the root-bridge.
- Even when STP and RSTP are implemented in the same network the difference in the convergence time still exists.
- In smaller network, the amount of time taken to receive the reply when a link goes down is almost same, however in large network each device takes different time.
- When port guard is turned on only the end devices like PC, laptops are able to send data on the network thus protecting the network against misconfigurations or any intentional attempts to introduce new switches into the network.

Lessons Learned

- Even what appeared to be the simplest software has somewhat of a learning curve.

- CPT is mostly for simple network verification and learning.

- There were limitations with Cisco Packet Tracer in terms of finding applicable metrics

- Some limitations from simulating our design with Cisco Packet Tracer are that we don't account for environmental factors that can affect wireless communication and all of our simulations are 2-dimensional

Thank you!

Any Questions?