

Technical Report

COMP-3670

Computer Networks

CISCO Networking Academy Project

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*Submitted to:*

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1. **Introduction**

Cisco Packet Tracer is a powerful network simulation tool that allows you to practice networking, the Internet of Things (IoT), and cybersecurity. Packet tracer provides valuable hands-on experience by simulating real-world network configurations and connections within the comfort of your devices. The course is available through the Cisco Networking Academy and is free for all users regardless of their expertise upon registration. After registering, users can begin downloading from the Cisco Network Academy’s official website. Once installed, users have free reign over how they want the networks built from scratch, pre-built sample networks, or complete lab assignments from the resources attached in each module.

A screenshot of a computer

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1. ***Technological Details***
2. **Logical and Physical Modes**

The Packet Tracer features two primary modes, Simulation Mode and Physical Mode, each offering a different perspective from the user's standpoint.

* **Logical Mode:** This Mode allows users to create and manage a rational view of their network, configure devices, track data packets across the network, and analyze individual data packets to better understand network protocols and practices.

A diagram of a smart power grid switch

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* **Physical Mode:** This Mode allows the user to simulate through a virtual lab to configure the physical setup of a network, configure cables, and set up devices within the network layout. This Mode helps users translate their logical configurations into a physical space that mirrors a real-world network setup.

A diagram of a network

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A computer hardware and a computer

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1. **Realtime and Simulation Modes**

Cisco Packet Tracer features two primary modes of operation: Realtime and Simulation Modes. These modes are essential for monitoring, troubleshooting, and managing networks. Each Mode offers users distinct features and allows them to experience their network behavior and patterns.

### Realtime Mode

**Realtime Mode:** This Mode provides users with a network environment where they can communicate just as they would in a real-world environment. In this Mode, the network operates in Realtime, with data packets being sent, retrieved, and modified as they would in Realtime without any modifications and delays. This Mode is used best when the user wishes to connect to the network configuration and get to know precisely how the data packet is being processed. The system clock on the bottom left shows how long the network has been active and running. Users will immediately get feedback and issues as soon as the network operates.

A computer screen shot of a computer network

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* **Simulation Mode**

**Simulation Mode:** This Mode offers a more flexible and detailed view of how data packets flow through the network. It allows users to slow down, pause, and fast-forward the movements of each packet between devices. Through the network protocol, users can track down specific packets, such as TCP, UDP, HTML, HTTP, etc. This provides insight into how the data is processed and fetched throughout the process.

A computer screen shot of a computer

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Realtime and Simulation modes offer users a distinct identity in how they operate and are important tools in The Packet Tracer for different uses and purposes. In comparison, Realtime Mode provides users with instant feedback and surrounds users with real-world networks on their operation with continuous network configuration. Simulation Mode helps process troubleshooting networks and analyze individual packet behaviors and protocols. Both modes allow users to understand how the networks work and troubleshoot, which is an essential tool in today’s tech jobs market.

1. **Device and Network Management Menu**

Users can add devices on the bottom left, such as laptops, PCs, printers, routers, etc., and connect them using cables and links however they prefer, giving them endless flexibility on how to configure network connections. The Packet Tracer allows users to select, delete, inspect, and resize for easy access and troubleshooting. The menu on the top left will enable users to open new and existing network files, with options to save or discard them depending on the user’s preference. Overall, this menu bar is very user-friendly and gives users complete freedom over what they wish to facilitate.

A computer screen shot of a diagram

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1. **Device Configuration Tabs**

Packet Tracer offers a wide range of tabs that are accessible by clicking on each device with detailed configuration and identical of that in the real world. They are:

**Physical Tab:** Allows users to interact with the physical setting of each device with port specifications and connections.

A screenshot of a computer

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**Config Tab:** This tab provides users with user friendly configurations on device parameters and protocols in graphical terms.

A screenshot of a computer

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**Desktop Tab:** This tab provides users with tools such as web browser, pc wireless, IP configuration, terminal etc.., providing a carbon copy of the real-world devices.

A screenshot of a computer

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**Attributes Tab:** This tab provides users with devices’ attributes such as MTBF, cost, power source, rack units and wattage.

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**Programming Tab:** This tab allows users to program and code inside devices such as laptops and PCs.

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**Service Tab:** Tab which allows a server to be configured with common server processes such as HTTP, DHCP, DNS, etc.

A screenshot of a computer

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**III. *Experience***

My journey with Cisco Packet Tracer was eventful and packed with valuable lessons and experience. As a student who is interested in computers and actively pursuing a major in Computer Science, Cisco Packet Tracer has provided me with network configurations, concepts and protocols all in the comfort of my laptop. With only registration needed to be in this course without any additional cost, it is highly accessible to everyone enthusiastic about computer networks, including me.

The first chapter gave me a solid introduction to Packet Tracer and helped lay the groundwork for understanding networking. It explained various file types like .pka, .pkt, and .pksz, each with specific functions. I frequently worked with .pka files, which contain instructions and scored activities, while .pkt files are used to save custom networks without scoring. I first encountered .pksz files during the Logical and Physical Mode Exploration activity, which provided hints to guide me through challenges. This chapter also covered cable and port configuration, allowing me to build simple networks and easily switch between logical and physical views. The hint system was especially helpful when I got stuck, improving both my problem-solving and troubleshooting skills. Overall, this hands-on experience strengthened my understanding of networking concepts.

Chapter 2 provided connecting devices using wireless connections, such as mounted cables and structured cablings, to help organize small office layouts. I enjoyed this part of the chapter, where I got to monitor my network using a network controller. Realtime and Simulation modes were helpful as I got to experience what each type does. Simulation mode lets me create and capture Packet Data Units to check the network’s connectivity. In contrast, Realtime mode shows continuous network configurations, but in Simulation mode, time can be slowed or stopped depending on the users’ preference. Personally, I liked Realtime mode because it feels natural and authentic to experience in real-time. Network Controllers enable centralized monitoring and configuration of multiple devices via a single GUI, accessed through a browser connected to the controller's IP address.

In Chapter 3, Internet of Things (Iot) was introduced, and I was intrigued by learning about how sensors and actuators communicate through a Home Gateway. It was mind blowing to see me trying to control these devices portably and remotely, while simultaneously configuring network management. I also explored how programming with Python allows me to control environmental settings in virtual spaces, making the process of creating new IoT devices engaging and hands-on. This chapter also made me understand how different spaces such as cities, buildings and environments behave in environments. The complexity of each device’s specifications was in-depth and thought out and it made me appreciate this chapter more.

Overall, my experience with Cisco Packet Tracer was a success, and I will incorporate this tool into my progress with computer science. With these new skills, I feel more confident in tackling future challenges in my computer science journey, and I'm motivated to keep learning and expanding my knowledge.

**IV. *Summary***

Cisco Packet Tracer is a user-friendly tool, yet it explains how the network system works in depth and is demonstrated throughout the course. It is highly recommended for beginners and professionals alike, offering valuable lessons regardless of users’ expertise. It covers different topics with care and in-depth, with each chapter offering users challenges with pre-lab activities to challenge themselves.

Cisco Packet Tracer operates with two primary modes, Logical and Physical Modes and Realtime and Simulation Modes for monitoring network connections and configurations. Logical Mode allows users to configure devices and manage a network’s layout, focusing on how data packets move across the network. Physical Mode lets users simulate the physical setup of networks, arranging devices and cables in a real-world style environment. Realtime Mode runs the network as it would in real life, providing immediate feedback. Simulation Mode allows users to slow down or pause data flow for deeper analysis and troubleshooting. File types in Packet Tracer also include. pka for scoring activities with instructions, .pkt for saving networks without scoring, and .pksz, which provides for media assets and scripts with guided hints. There are also multiple device configuration tabs for users to browse through; Physical, Config, Attributes, Service, Programming, and Desktop, each with unique characteristics and features.

Activities in Cisco Packet Tracer were challenging yet rewarding after each correct attempt. They are essential in enhancing the users’ understanding of the materials of computer networks and practical skills. Some key activities include Logical and Physical Mode exploration, Creating a simple network, and programming IoT devices with Python. In Logical and Physical Mode exploration, we were given the basics and understanding of how a different mode works or when it’s suitable to prefer to use a mode and vice versa. In Create a Simple Network Activity, we were tasked to build a network system from scratch, using appropriate devices such as laptops, PCs, and routers and connecting them with wired and wireless links. Configuring IP addresses, subnet masks, and default gateways was essential in ensuring proper communication between devices. This hands-on task emphasized the importance of accurate configuration and each device's role within a network. In Programming IoT devices with Python, users were tasked to explore programming within the IoT environment. Sensors and actuators play a role in connecting them through a home gateway. Python scripts were written to let sensors detect, such as lights turning on my human movement. These activities require careful planning and strategic thinking from the users, which, in turn, helps users innovate and operate better network systems.

Gaining experience and expertise is crucial in today’s competitive job market, and Cisco Packet Tracer has equipped me with the essential tools to succeed. Through hands-on activities and practical applications, I have developed a solid understanding of networking concepts, IoT integration, and device configuration. The skills I have acquired will not only enhance my technical abilities but also prepare me to tackle real-world challenges in the field of networking. With Cisco Packet Tracer, I feel confident and ready to pursue my career goals in technology.

**V. *Course Badge of Completion:***

A certificate of completion with a logo

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**VI. References:**

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Ciscoapprovedmemorycom. “UNLOCK THE BENEFITS OF CISCO PACKET TRACER: A Guide to Its Advantages and Disadvantages.” *Ciscoapprovedmemory.Com*, 17 Feb. 2023, ciscoapprovedmemory.com/packet-tracer/cisco-packet-tracer/.