

# USHA MITTAL INSTITUTE OF TECHNOLOGY, SNDT WOMEN'S UNIVERSITY

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## Augmented Reality For Computer Networking

### ARNetExperince

Under Guidance

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Presenter

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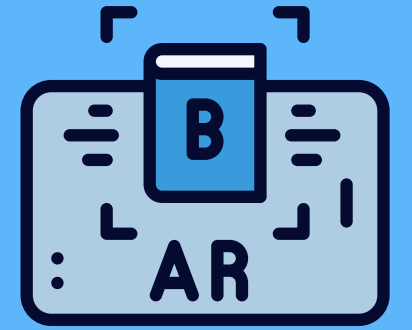
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# Abstract

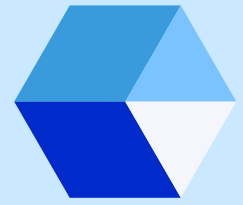
- In recent years, there has been an increasing interest in applying Augmented Reality (AR) to create a unique study of computer networking.
- Our reports consider the factors include the uses, features, and effectiveness of augmented reality in computer networking
- The purpose of this research is to develop augmented reality learning and build application that makes it easier for individual to understand the computer networks.



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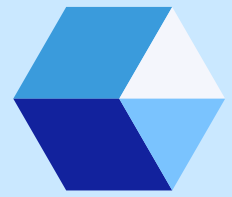
- Introduction
- Problem Statement
- Literature Review
- Existing system
- Proposed system
- Architecture
- Hardware & Software Requirements
- Implementation
- Future Scope
- Conlusion
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# Introduction

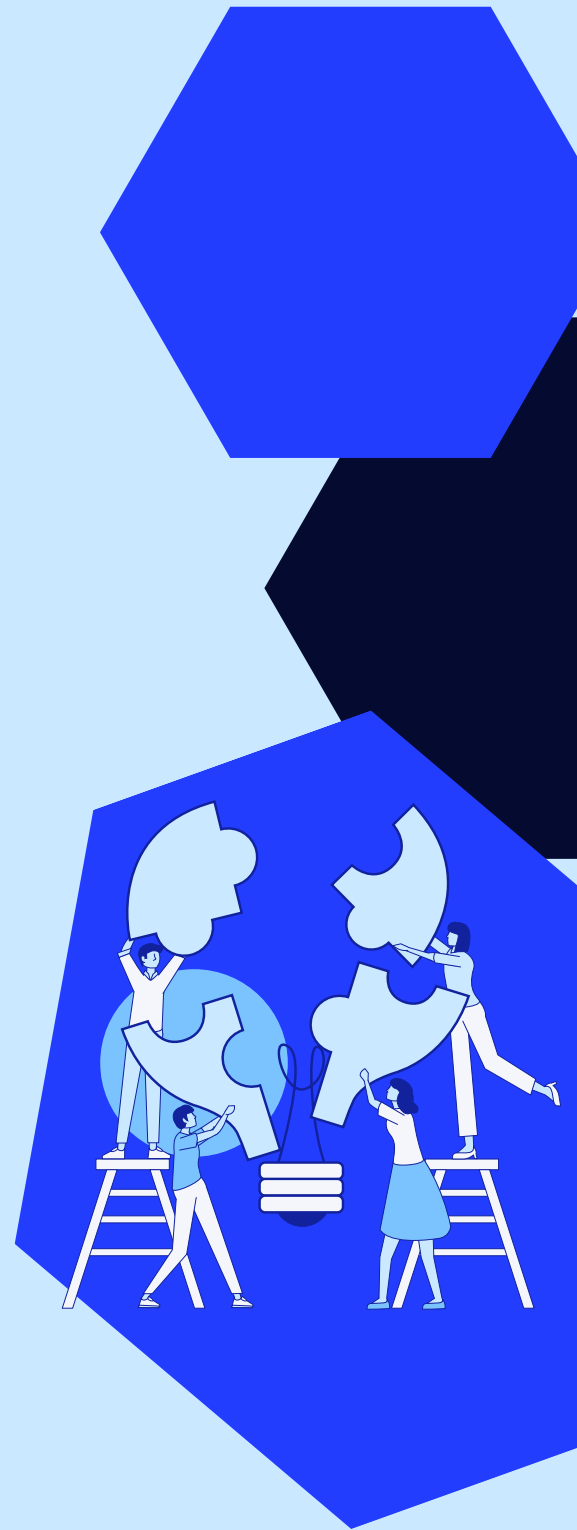
- Augmented Reality (AR) is a technology that combines two-dimensional or three-dimensional virtual objects into a real three-dimensional environment and then projects these virtual objects in real time
- AR technology is user-friendly and can be easily integrated into existing devices, such as smartphones and tablets
- AR can be accessed by anyone with a compatible device,
- characteristics of Augmented Reality:
  1. Augmented Reality combine the real and virtual information.
  2. Augmented Reality is interactive in real world.

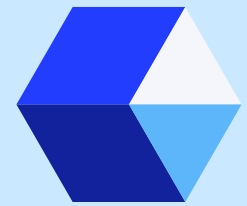




# Problem statement

- The collection of challenges in computer network concepts necessitates a more comprehensive and accessible learning experience.
- Our primary objective is to harness AR's immersive and interactive capabilities to create a more engaging and dynamic learning environment, thus fostering a deeper understanding of computer networks.
- By pursuing this integration, our aim is to empower learners with the knowledge and skills essential for confidently navigating the increasingly interconnected world with enthusiasm and self-assurance.
- Specific computer network concepts pose significant challenges for students due to their inherently abstract nature are Subnetting and IP Addressing, Network Protocols, Routing Algorithms, etc.





# Literature Review

- **"AUGMENTED REALITY FOR MOBILE-BASED COMPUTER NETWORK LEARNING INTERACTIONS": -**

1. This research paper focuses on marker recognition for rendering 3D computer network hardware objects in AR applications. If a marker is recognized, it is used as a trigger to render and replicate digital objects, particularly those related to 3D Computer Network Hardware

- **"DEVELOPMENT OF INTERACTIVE LEARNING MEDIA IN COMPUTER NETWORK USING AUGMENTED REALITY TECHNOLOGY" :-**

1. This research discusses the development of learning media Augmented reality of computer network installation.
2. The purpose of this research is to develop augmented reality learning media and build media that makes it easier for students to understand the process of installing computer networks that becomes an alternative as a learning media.



- **"DEVELOPMENT AND EVALUATION OF AUGMENTED REALITY LEARNING CONTENT FOR PNEUMATIC FLOW: CASE STUDY ON BRAKE OPERATING UNIT OF RAILWAY VEHICLE" (8 MAY 2023):**

1. AR content was designed to train maintenance staff on the pneumatic flow of railway vehicle BOU using SLMVC and CEPC algorithms.
2. The AR content is practical, convenient, and not limited by time and space, making it a valuable tool for maintenance education in railway operating organizations.

- **MERGE CUBE AS A NEW TEACHING TOOL FOR AUGMENTED REALITY" :-**

1. This research project aims to create an open-source Unity 3D environment for Android devices, intended for hospitalized children. The project will focus on solar systems, world monuments, and marine animals, with two entertainment parts.



# AR vs VR vs Mixed Reality vs Web AR

FEATURE	AUGMENTED REALITY (AR)	VIRTUAL REALITY (VR)	MIXED REALITY (MR)	WEB-BASED AR
DEFINITION	Integrates digital content with the real world in real-time.	Creates a completely immersive, artificial environment.	Blends the physical and digital worlds, allowing interaction with both.	Augmented reality experiences accessible through a web browser using frameworks like Model-Viewer.
INTERACTION	Enhances real-world environments by overlaying digital information.	Provides a fully immersive, computer-generated environment.	Allows users to interact with both digital and physical elements.	Interaction typically involves overlaying 3D models onto the real world in the browser.
HARDWARE REQUIREMENTS	Typically uses devices like smartphones, tablets, or AR glasses.	Requires dedicated VR headsets like Oculus Rift or HTC Vive.	Utilizes devices like Microsoft HoloLens or Magic Leap glasses.	Accessible through devices with web browsers, such as smartphones or tablets.





# AR vs VR vs Mixed Reality vs Web AR

FEATURE	AUGMENTED REALITY (AR)	VIRTUAL REALITY (VR)	MIXED REALITY (MR)	WEB-BASED AR
IMMERSIVENESS	Enhances the real-world experience but allows users to stay connected with the environment.	Offers a highly immersive experience by blocking out the real world.	Merges digital and physical elements, providing a varying level of immersion.	Provides a less immersive experience compared to dedicated AR or VR devices but brings 3D models into the real world.
EXAMPLES	Pokémon Go, Snapchat filters.	Oculus Rift, HTC Vive.	Microsoft HoloLens, Magic Leap.	Web AR applications using Model-Viewer, Three.js, A-Frame.
USE CASES	Navigation, gaming, education.	Gaming, simulations, virtual tours.	Training, design visualization, remote collaboration.	Product visualization, interactive marketing campaigns, showcasing 3D models in the real world.



# AR vs VR vs Mixed Reality vs Web AR

FEATURE	AUGMENTED REALITY (AR)	VIRTUAL REALITY (VR)	MIXED REALITY (MR)	WEB-BASED AR
DEVELOPMENT ENVIRONMENT	ARKit (iOS), ARCore (Android), Unity.	Unity, Unreal Engine.	Unity, Unreal Engine, Microsoft Mixed Reality Toolkit.	Web AR frameworks like Model-Viewer, Three.js, A-Frame.
ACCESSIBILITY	Generally more accessible with widespread use of smartphones.	Requires specific VR hardware, limiting accessibility.	Accessibility depends on dedicated MR devices.	Widely accessible through common web-enabled devices with modern browsers.



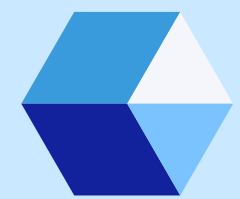
# Marker vs Marker-less AR

FEATURE	MARKER-BASED AR	MARKERLESS AR
DEFINITION	Relies on identifiable markers or images in the real world to trigger augmented content.	Does not require specific markers; content is overlaid on the environment without predefined markers.
MARKER TYPES	Requires distinct markers, often in the form of QR codes, images, or physical objects.	Does not rely on specific markers; the system tracks features in the environment, such as natural patterns or objects.
TRACKING METHOD	Utilizes marker tracking algorithms to determine the position and orientation of markers in real-time.	Relies on computer vision techniques to track and analyze the features of the environment, such as SLAM (Simultaneous Localization and Mapping).
EXAMPLES	AR applications using QR codes as markers.	AR applications using SLAM technology, like ARKit (iOS) and ARCore (Android). Model-Viewer integrated into websites for markerless AR experiences.



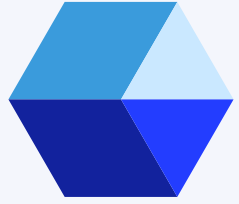
# Marker vs Marker-less AR

FEATURE	MARKER-BASED AR	MARKERLESS AR
SETUP COMPLEXITY	Generally simpler to set up since it requires placing predefined markers in the environment.	Setup can be more complex as it involves creating robust algorithms for tracking features in various environments.
ENVIRONMENT ADAPTABILITY	Well-suited for controlled environments where markers can be placed or embedded.	More adaptable to diverse environments as it doesn't rely on predefined markers, making it suitable for dynamic or changing surroundings.
APPLICATION AREAS	Commonly used in marketing, gaming, and educational applications where markers can be strategically placed.	Widely used in navigation, gaming, industrial applications, and scenarios where flexibility and adaptability to different environments are crucial.
ADVANTAGES	Simple setup, precise tracking when markers are in view.	More flexible in varied environments, no need for specific markers, offers a more natural AR experience.



# Marker vs Marker-less AR

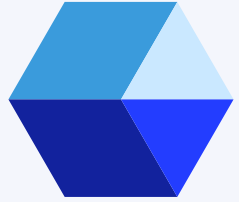
FEATURE	MARKER-BASED AR	MARKERLESS AR
CHALLENGES	Limited adaptability to dynamic or changing environments, dependency on markers.	Complex algorithms, potential tracking issues in less structured environments.
ENVIRONMENT ADAPTABILITY	Well-suited for controlled environments where markers can be placed or embedded.	More adaptable to diverse environments as it doesn't rely on predefined markers, making it suitable for dynamic or changing surroundings.
DEVELOPMENT TOOLS/Frameworks	Vuforia, ARToolkit.	ARKit (iOS), ARCore (Android), Wikitude. Model-Viewer, Three.js, A-Frame for creating markerless AR experiences.



# Existing System vs Proposed System

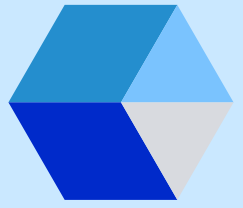
ASPECT	EXISTING SYSTEM	PROPOSED SYSTEM
FOCUS OF SYSTEM	Marker recognition for rendering 3D computer network hardware objects in AR applications.	Enhancing education and understanding of networking concepts using AR technology.
3D MODELS	Renders 3D computer network hardware objects based on marker recognition.	Creates realistic 3D models of routers, switches, servers, and endpoints without relying solely on markers.
SIMULATIONS	Limited focus on marker-triggered 3D object rendering.	Develops AR simulations displaying network traffic flows, packets, and data transfer processes for an immersive learning experience.
LEARNING CONTENT	Learning content primarily focused on marker-triggered 3D objects in the context of computer network hardware.	Comprehensive learning content covering network traffic patterns, protocols, and interactive tools for packet tracing, routing, and switching.
APPLICATION SCOPE	Focuses on computer network hardware only.	Expands application scope to cover a broader range of networking concepts and scenarios.



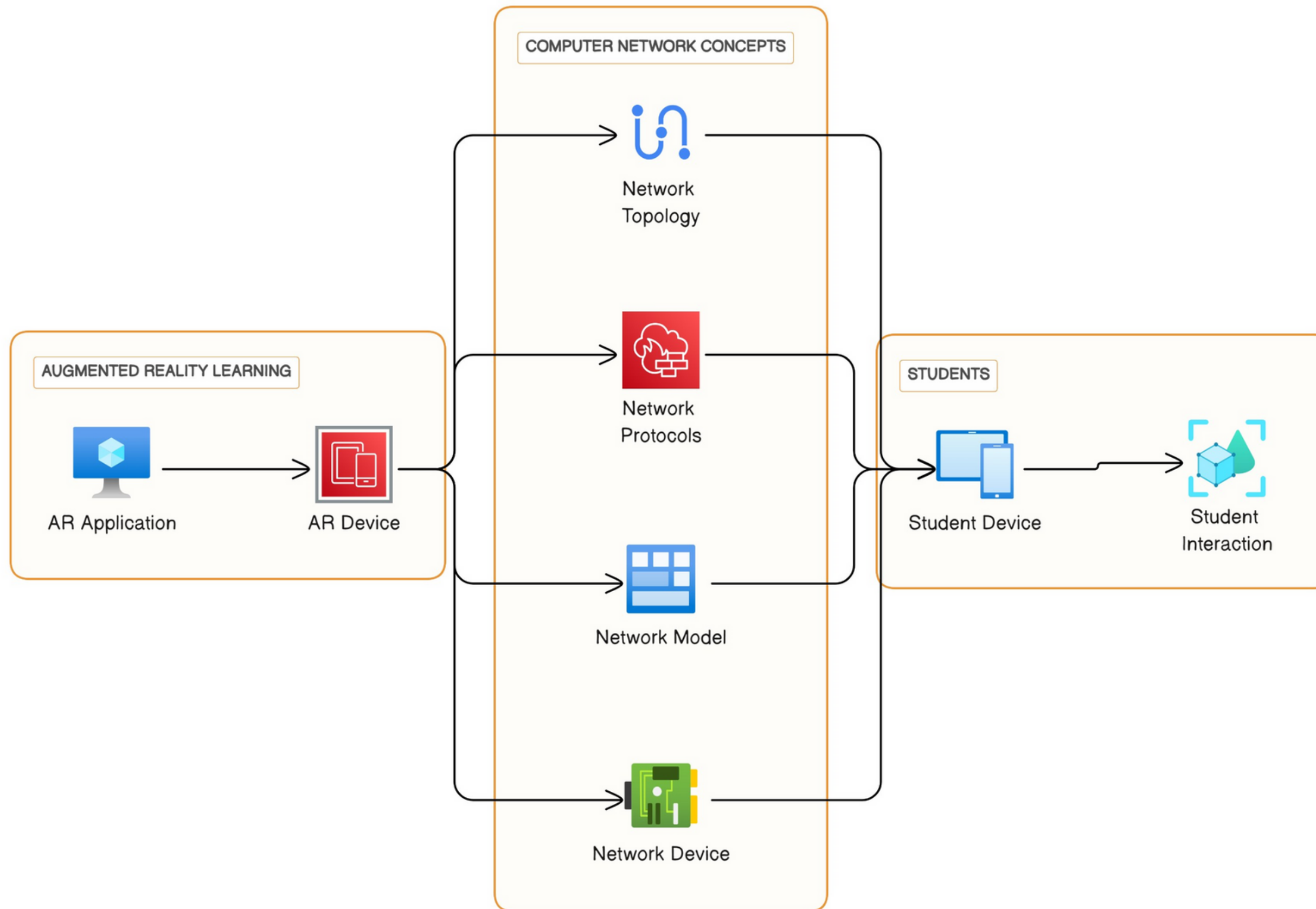


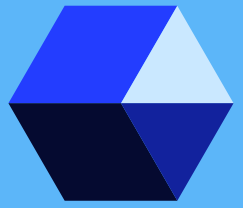
# Existing System vs Proposed System

ASPECT	EXISTING SYSTEM	PROPOSED SYSTEM
PRACTICAL APPLICATION	No specific mention of practical applications or hands-on experiences.	Practical and interactive learning through AR simulations for analyzing network traffic patterns and understanding routing and switching.
MAINTENANCE EDUCATION	Not applicable to maintenance education in railway operating organizations.	Not limited by time and space, the proposed system offers practical AR content for maintenance education in the field of computer networks.
TEACHING TOOLS	Not explicitly focused on creating new teaching tools.	Introduces new teaching tools using AR, such as realistic 3D models and interactive simulations, enhancing the learning experience.
TARGET AUDIENCE	Primarily focused on computer network hardware learning.	Expands the target audience to students seeking a deeper understanding of networking concepts through AR.
CONTENT VARIETY	Limited to marker-triggered 3D objects related to computer network hardware.	Diversifies content with simulations covering various networking aspects, offering a broader educational experience.

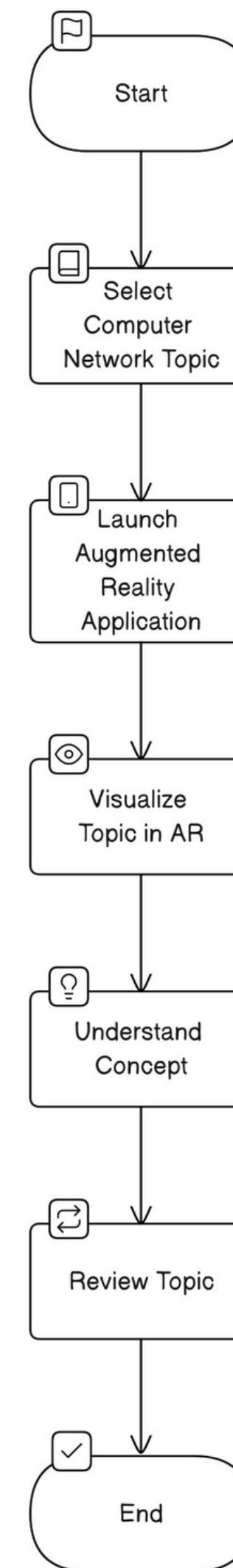


# Architecture

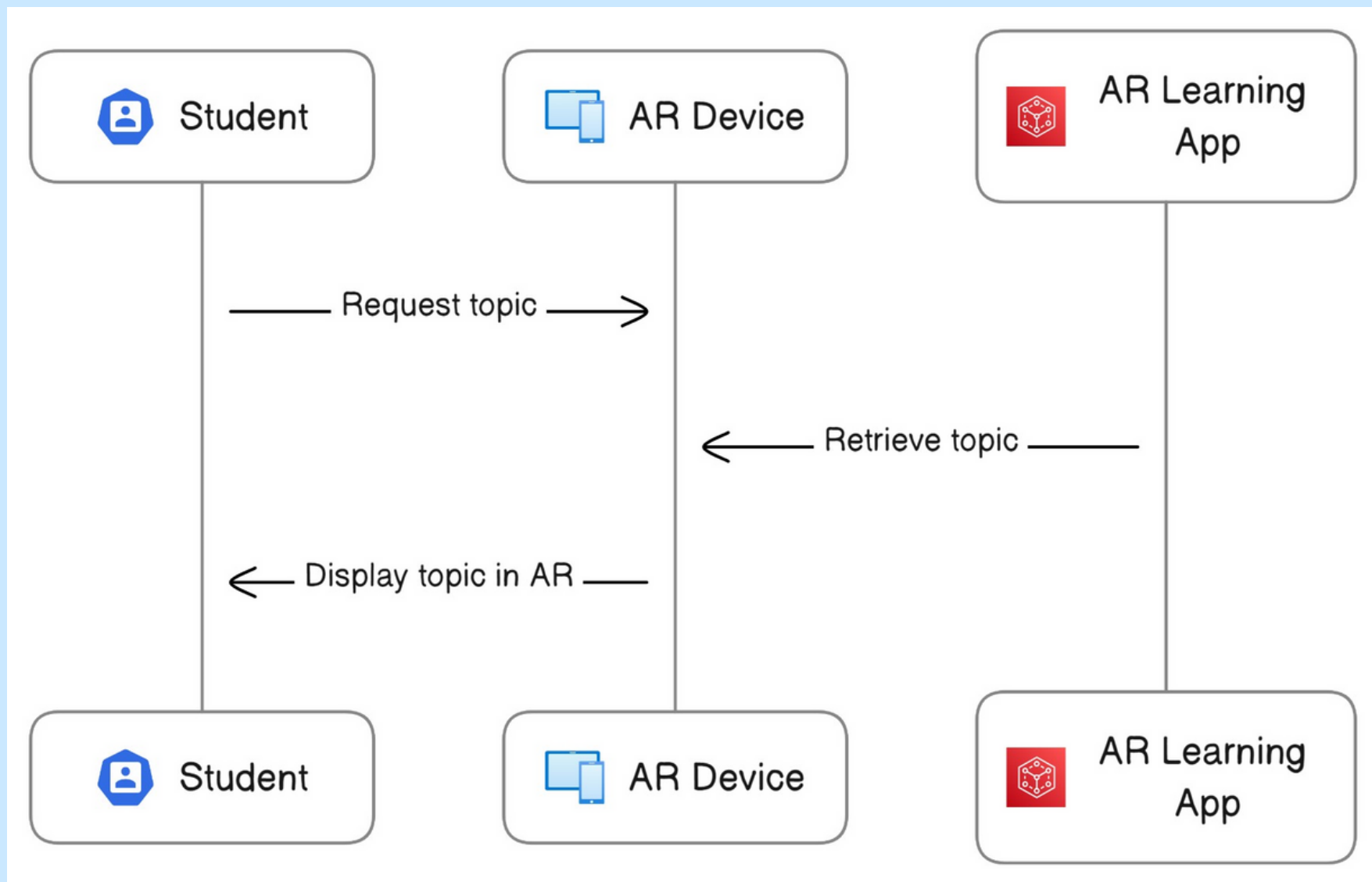




# Flowchart Diagram of AR for Computer Networking



# Sequence Diagram



# Software Used



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## Software

Visual Studio Code

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## External files

.glb (Graphics Library  
Binary)

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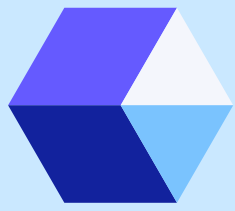
## Technology

HTML, CSS, JavaScript,  
Model-Viewer, Bootstrap

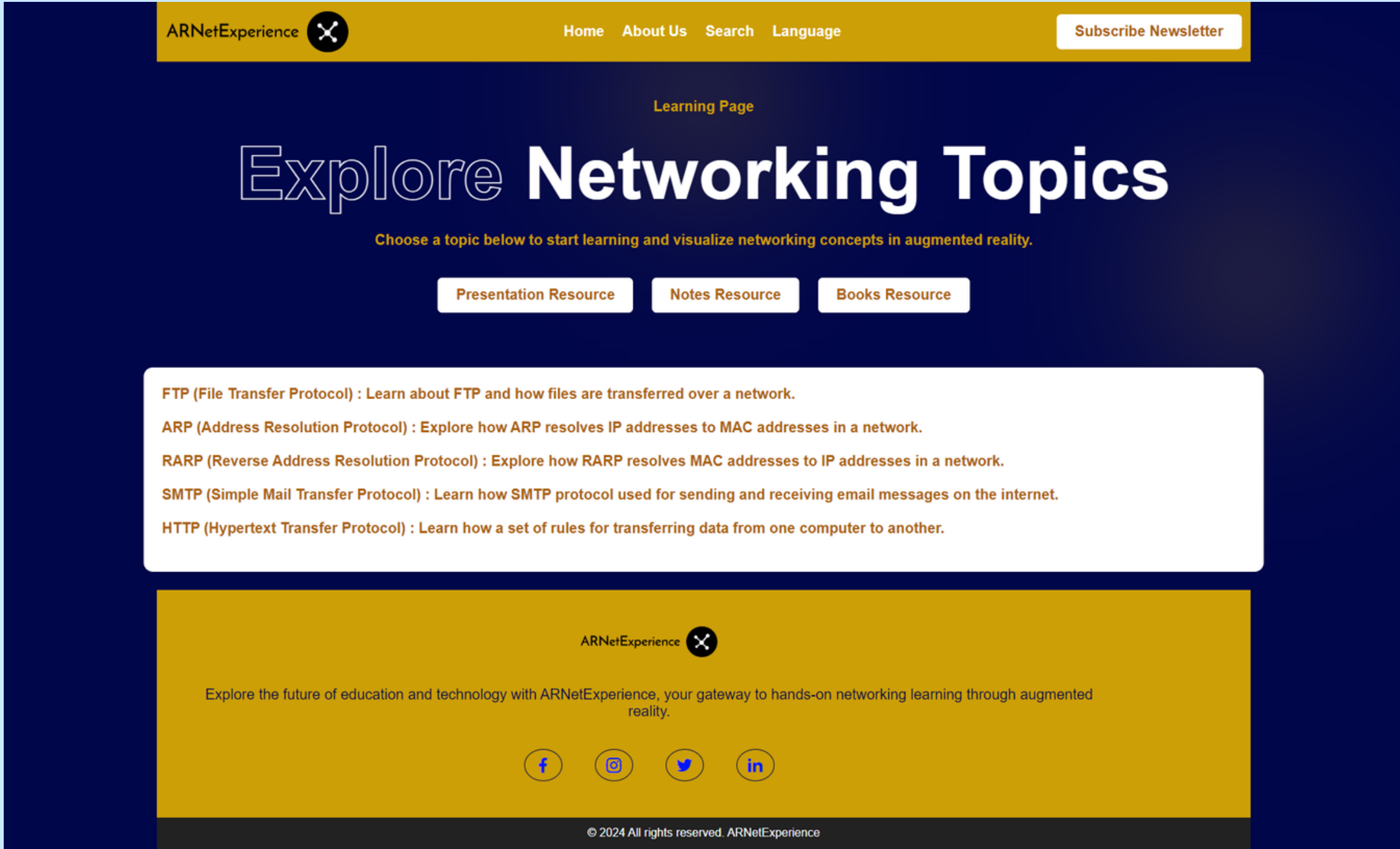
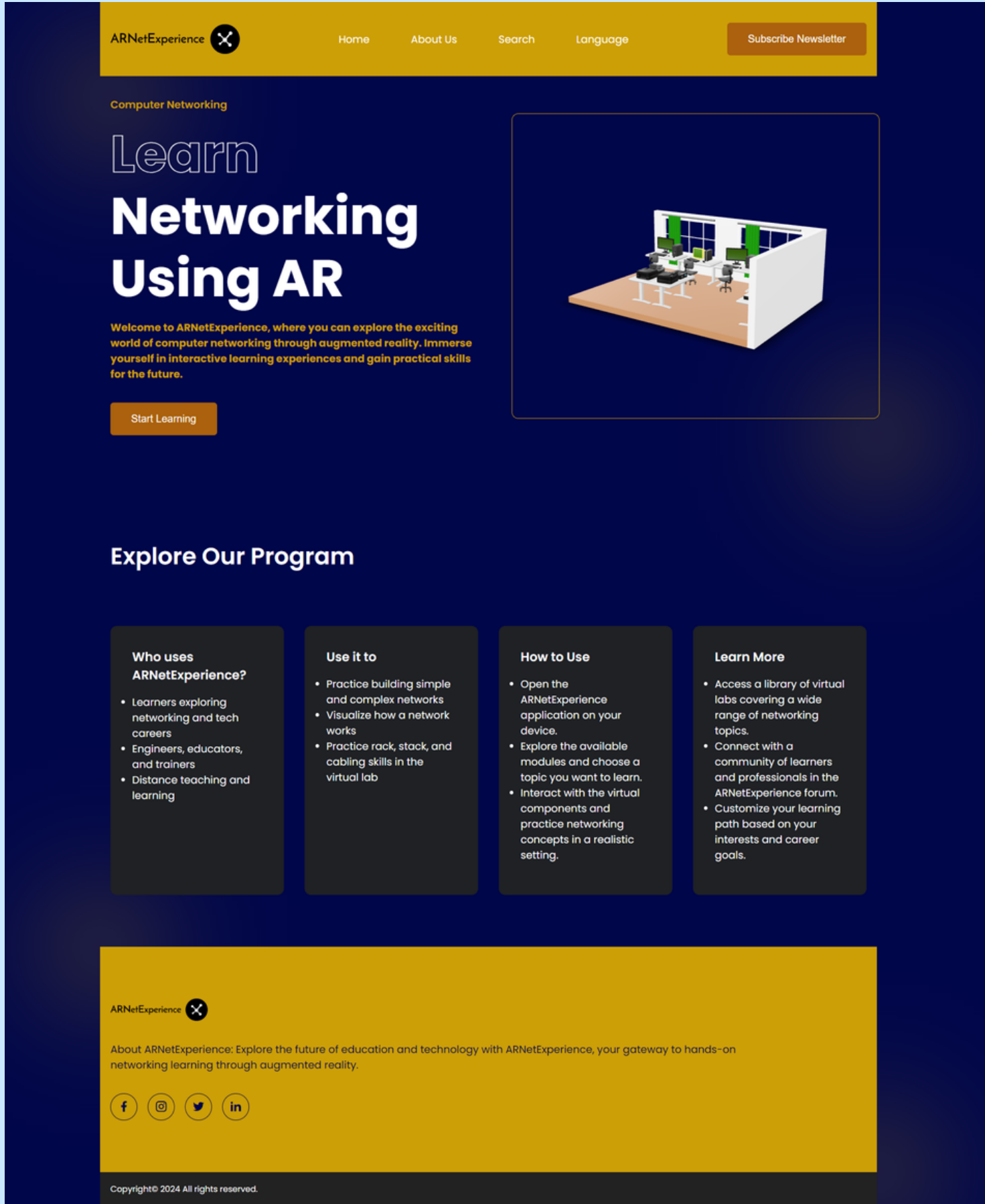
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## Documentation

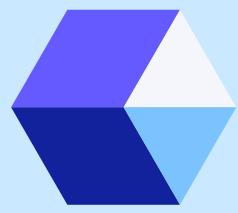
Latex (Overleaf)



# Output | ARNetExperience Home Page





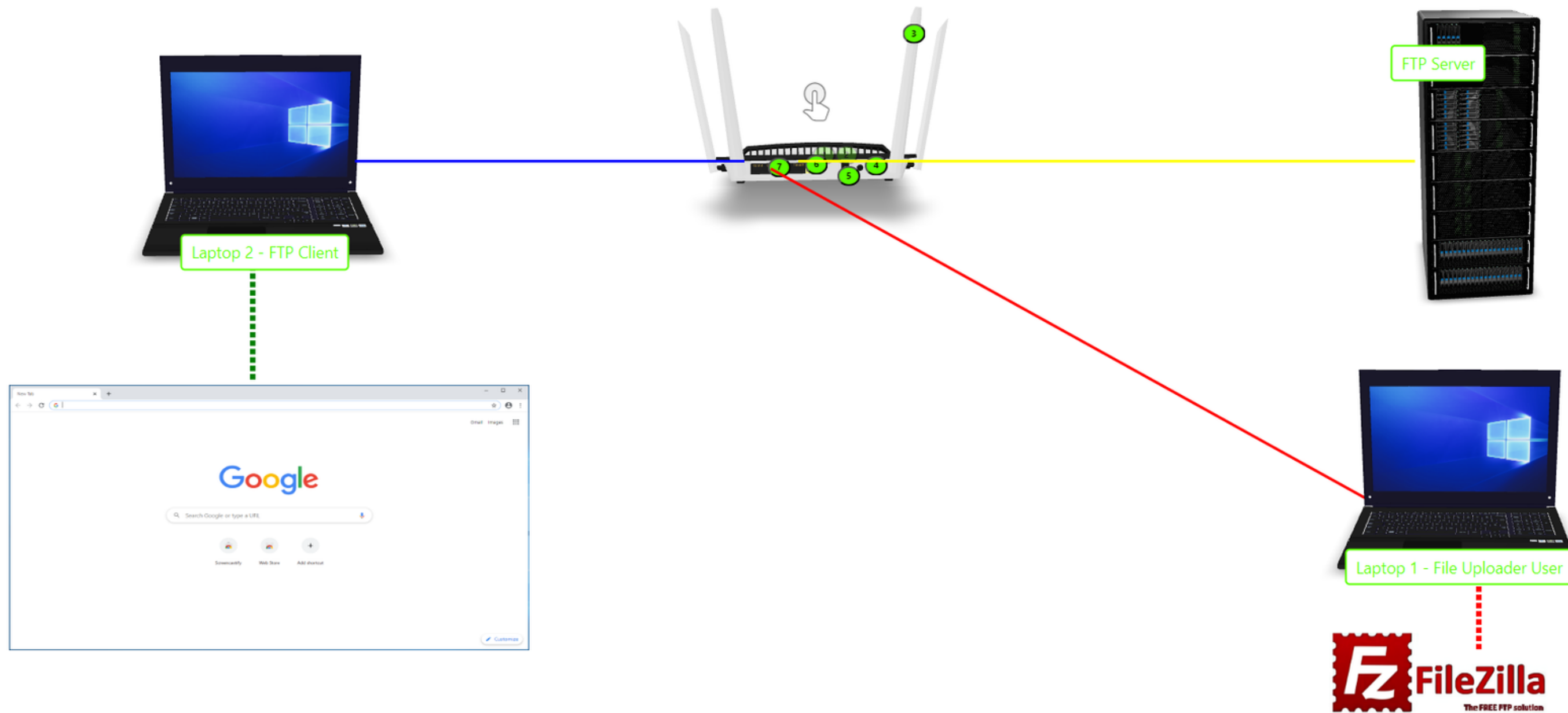


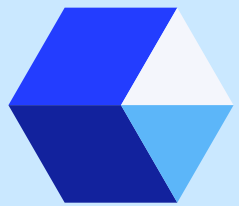
# Output | File Transfer Protocol

## File Transfer Protocol (FTP)

About FTP

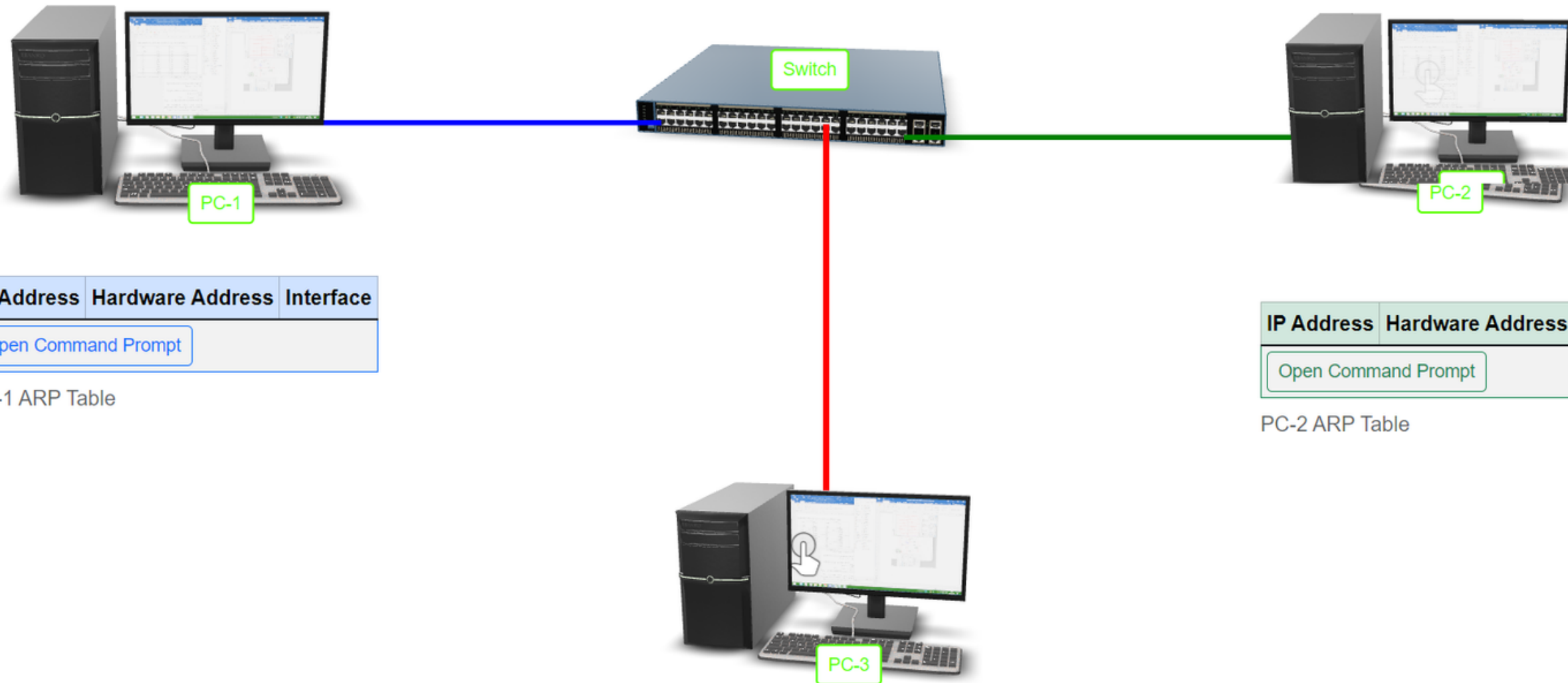
How To Use FTP





# Output | ARP

## Address Resolution Protocol (ARP)

[About ARP](#)[How To Use ARP](#)

IP Address	Hardware Address	Interface
Open Command Prompt		

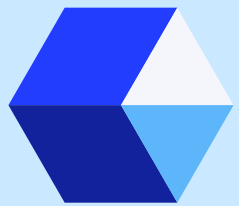
PC-1 ARP Table

IP Address	Hardware Address	Interface
Open Command Prompt		

PC-2 ARP Table

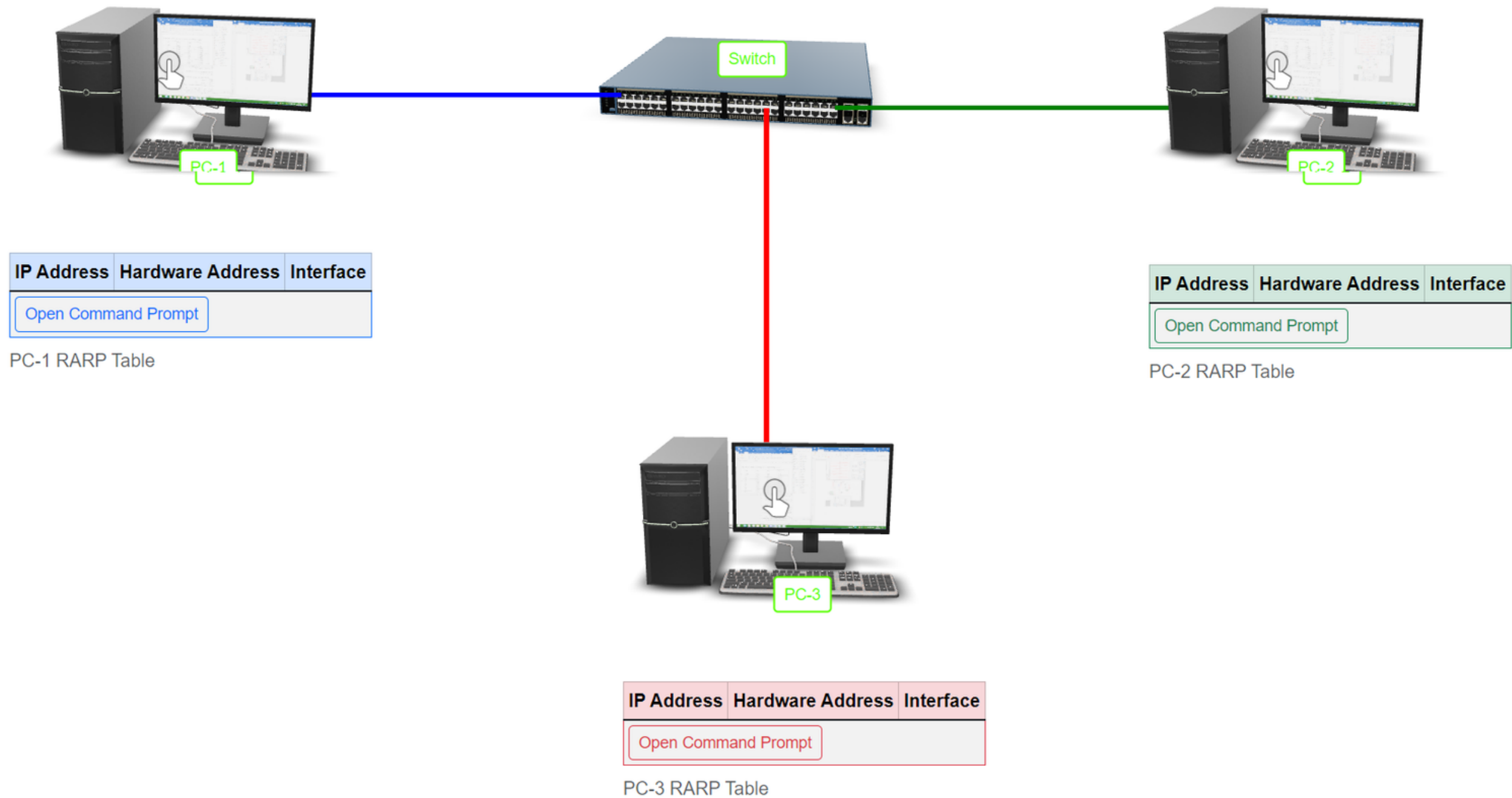
IP Address	Hardware Address	Interface
Open Command Prompt		

PC-3 ARP Table



# Output | RARP

## Reverse Address Resolution Protocol (RARP)

[About RARP](#)[How To Use RARP](#)



# Future scope

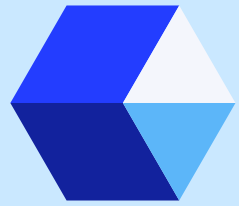


## GAMIFIED LEARNING:

- Objective: Boost engagement via gamification.
- Features: Quizzes, challenges, and rewards integrated into learning.
- Progress Tracking: Monitor achievements for ongoing improvement.

## RESOURCE LIBRARIES:

- Extensive library including AR-enhanced textbooks, tutorials, videos, and reference materials.
- Structured Access: Resources categorized by networking topics and skill levels.
- Personalized Learning.



# Conclusion

- **AR-Powered Learning:** The application leverages Augmented Reality (AR) to create an innovative learning experience.
- **Alignment with Network Concepts:** It closely aligns learning content with computer networks for relevance.
- **Real-World Integration:** AR is used to seamlessly blend real and virtual worlds, displaying network devices within the physical environment.
- **Interactive Learning:** The application emphasizes interactivity, making it engaging and practical for learners.
- **Comprehensive Learning:** The application offers concise, essential information, enhancing the understanding of network concepts while creating an immersive educational experience using technology.







# Refernces



- Overleaf Documentation
- Creatly Website for creating diagrams
- Paint Tool for resizing the images
- Canva
- Model Viewer Documentation
- Github for Files Management
- IEEE Research Papers
- Sketchfab



*Thank You*