**Integrated Airport Networking System Architecture**

### Submitted By

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**MINI LAB PROJECT REPORT**

This Report Presented in Partial Fulfillment of the course

**CSE322: Computer Networks Lab in the Computer Science and Engineering Department**

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### DAFFODIL INTERNATIONAL UNIVERSITY

**Dhaka, Bangladesh**

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## DECLARATION

We hereby declare that this lab project has been done by us under the supervision of **Tanvirul Islam**, **Lecturer**, Department of Computer Science and Engineering, Daffodil International University. We also declare that neither this project nor any part of this project has been submitted elsewhere as lab projects.

##### Submitted To:

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## COURSE & PROGRAM OUTCOME

The following course have course outcomes as following:.

Table 1: Course Outcome Statements

|  |  |
| --- | --- |
| **CO’s** | **Statements** |
| CO1 | Able to identify the fundamental technologies for the hardware and software of the internet and their addressing mechanism. |
| CO2 | Able to analyze the conceptual and implementation aspects of network applications and their  use in the application, transport, and data link layer protocols for implementing enterprise networks for different organizations. |
| CO3 | Able to apply the knowledge of the basic binary system to solve subnetting problems and can identify and evaluate the underlying principles of routing algorithms and their related protocols as applied to the Internet. |
| CO4 | Able to describe the components, services, principles, and protocols provided in wireless networks and can categorize different wireless architectures. |

Table 2: Mapping of CO, PO, Blooms, KP and CEP

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **CO** | **PO** | **Blooms** | **KP** | **CEP** |
| CO1 | PO1 | C1, C2 | KP3 | EP1,EP3 |
| CO2 | PO2 | C2 | KP3 | EP1,EP3 |
| CO3 | PO3 | C4, A1 | KP3 | EP1,EP2 |
| CO4 | PO3 | C3, C6, A3,  P3 | KP4 | EP1,EP3 |

The mapping justification of this table is provided in section **4.3.1**, **4.3.2** and **4.3.**

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**The project drive link:** [**Click Here**](https://drive.google.com/file/d/1ed9tm1YjNh237Ez8DAVyTp6y7AUVCD8s/view?usp=drive_link)

**Chapter 1**

# Introduction

This chapter introduces the Integrated Airport Networking System Architecture project, its motivation, objectives, and expected outcomes.

#### Introduction

Modern airports require robust, scalable, and secure networking systems to handle various services including passenger check-in, baggage handling, flight information displays, security systems, and retail operations. This project aims to design an integrated networking architecture for airports using Cisco Packet Tracer to simulate the network infrastructure.

#### Motivation

The motivation behind this project stems from the increasing complexity of airport operations and the need for seamless connectivity between various systems. An efficient network architecture can improve operational efficiency, enhance passenger experience, and ensure security across all airport functions.

#### Objectives

* + 1. To design a scalable and secure network architecture for airports.
    2. To implement the network using Cisco Packet Tracer with routers, switches, and wireless access points.
    3. To ensure seamless connectivity between different airport departments.
    4. To analyze the performance of the network under various conditions.

#### Feasibility Study

Existing airport networks often face challenges such as congestion, security vulnerabilities, and lack of integration between systems. Our solution addresses these issues by proposing a unified architecture that connects all airport services through a reliable network.

#### Gap Analysis

Current systems typically operate in silos with limited interoperability. Our project bridges this gap by creating an integrated network that supports real-time data exchange between all airport services.

#### Project Outcome

The expected outcomes include:

* A functional network design for airports
* Improved communication between airport systems
* Enhanced security measures
* Scalability for future expansions

**Chapter 2**

# Proposed Methodology/Architecture

This chapter presents the network design and methodology for implementing the Integrated Airport Networking System.

### Requirement Analysis & Design Specification

#### Overview

The airport network will connect various departments including:

* Public Free WiFI
* Administrator
* Custom & Immigration
* Medical Unit
* Air Traffic Control
* Operation control &
* Controlroom
* Checking
* IT
* Maintenance & Engineering

##### Proposed Methodology/System Design

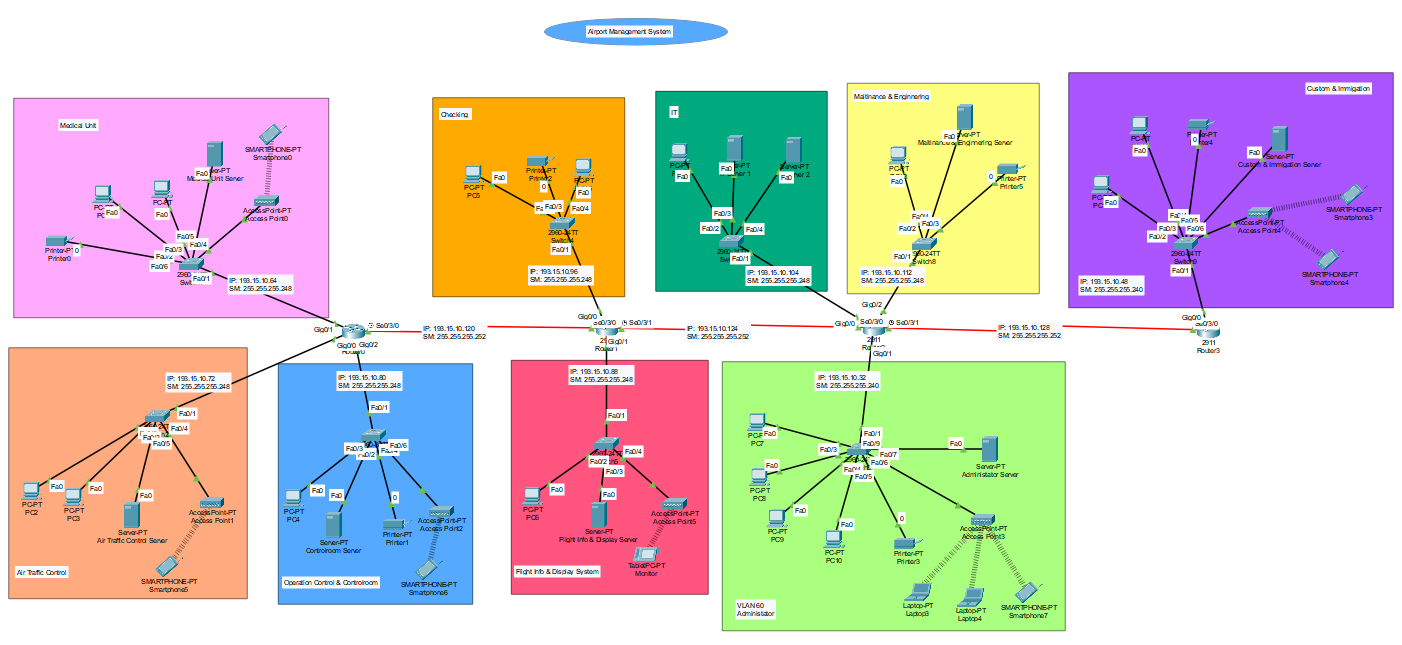
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Figure 2.1: Airport Network Architecture

The architecture includes:

* + - * 4 routers for interconnecting different zones
      * 1 wireless router for passenger and staff Wi-Fi access
      * Multiple switches for departmental connectivity
      * VLANs for security
      * DHCP (Dynamic Host Configuration Protocol) for Dynamic IP Address Assignment
      * OSPF (Open Shortest Path First) for Dynamic Routing
      * Servers for central management

#### VLAN Configuration:

#### To improve network security and performance, we implemented VLANs (Virtual Local Area Networks) to logically segment the network into different departments. Each department is assigned its own VLAN. The VLANs help in isolating traffic between departments, thus preventing unauthorized access and reducing network congestion.

#### VLAN Configuration CLI (Cisco Example):

#### vlan 10

#### name Medical\_Unit

#### exit

#### vlan 20

#### name Air\_Traffic

#### exit

#### vlan 30

#### name Controlroom

#### exit

#### VLAN 10: Medical\_Unit

#### VLAN 20: Air\_Traffic

#### VLAN 30: Controlroom

Once the VLANs are created, assign them to specific interfaces on switches:

name Medical\_Unit

interface range fa0/2-6

switchport access vlan 10

switchport mode access

exit

#### DHCP Configuration:

#### To simplify the management of IP addresses for devices, DHCP is configured on the router. This ensures that devices are dynamically assigned IP addresses when they connect to the network, eliminating the need for manual IP assignment.

#### DHCP Configuration CLI (Cisco Example):

#### ip dhcp pool administration

#### network 193.15.10.32 255.255.255.240

#### default-router 193.15.10.33

#### exit

#### Administration Pool: Dynamically assigns IPs in the range 193.15.10.33 to 193.15.10.46.

#### OSPF Configuration:

**OSPF** (Open Shortest Path First) is used to dynamically route traffic between VLANs, ensuring optimal path selection and redundancy. This allows the network to adapt to changes and failures automatically.

**OSPF Configuration CLI (Cisco Example):**

router ospf 1

network 193.15.10.88 0.0.0.7 area 1

network 193.15.20.96 0.0.0.7 area 1

exit

#### Network Command: Advertises the specified networks to OSPF.

#### Area 1: Defines the OSPF area to which the network belongs.

#### IP Addressing Scheme

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Department | Network Address | Subnet Mask | Host Address Range | Broadcast Address |
| Public Free WiFI | 193.15.10.0 | 255.255.255.224 | 193.15.10.1-  193.15.10.30 | 193.15.10.31 |
| Administator | 193.15.10.32 | 255.255.255.240 | 193.15.10.33-  193.15.10.46 | 193.15.10.47 |
| Custom & Immigation | 193.15.10.48 | 255.255.255.240 | 193.15.10.49-  193.15.10.62 | 193.15.10.63 |
| Medical Unit | 193.15.10.64 | 255.255.255.248 | 193.15.10.65-  193.15.10.70 | 193.15.10.71 |
| Air Traffic Control | 193.15.10.72 | 255.255.255.248 | 193.15.10.73-  193.15.10.86 | 193.15.10.87 |
| Operation control &  Controlroom | 193.15.10.88 | 255.255.255.248 | 193.15.10.89-  193.15.10.94 | 193.15.10.95 |
| Checking | 193.15.10.96 | 255.255.255.248 | 193.15.10.97-  193.15.10.102 | 193.15.10.103 |
| IT | 193.15.10.104 | 255.255.255.248 | 193.15.10.105-  193.15.10.110 | 193.15.10.111 |
| Maitinance & Enginnering | 193.15.10.112 | 255.255.255.248 | 193.15.10.113-  193.15.10.118 | 193.15.10.119 |

##### UI Design

The network management interface will provide:

* + - * Real-time monitoring of all connected devices
      * Traffic analysis tools
      * Security alerts and notifications
      * Configuration management

##### Overall Project Plan

The project will be implemented in phases:

1. Requirement gathering and analysis
2. Network design using Cisco Packet Tracer
3. Simulation and testing
4. Performance analysis
5. Documentation and reporting

**Chapter 3**

# Implementation and Results

This chapter details the implementation process and presents the results of our network simulation.

#### Implementation

#### VLAN Configuration:

#### The VLANs were created on the core switches using the CLI commands mentioned above. Each department was assigned its own VLAN to ensure that the communication between departments remains isolated, improving security and reducing unnecessary traffic on the network.

#### DHCP Configuration:

#### The DHCP pools were configured to dynamically assign IP addresses to devices in the network. The configuration included setting the IP address ranges, default router, DNS server, and lease time. This allows devices such as computers, smartphones, and tablets to automatically obtain an IP address upon connecting to the network.

#### OSPF Configuration:

#### OSPF was implemented to ensure efficient and resilient routing within the network. By configuring OSPF on the routers, the network ensures that the routing paths are dynamically adjusted based on real-time network conditions, thus ensuring the network remains optimal and resilient to link failures.

#### Performance Analysis

* **VLAN Performance:**  
  Reduced broadcast traffic and enhanced security by isolating department communications.
* **DHCP Performance:**  
  Automated IP address assignment, reducing administrative effort and configuration errors.
* **OSPF Performance:**  
  Improved routing efficiency and fault tolerance by dynamically recalculating optimal paths during network failures.

#### Results and Discussion

The implemented network successfully:

1. Connected all airport departments
2. Maintained secure communication channels
3. Handled simulated passenger traffic efficiently
4. Demonstrated scalability for future expansions

**Chapter 4**

# Engineering Standards and Mapping

This chapter discusses the engineering standards and mapping of course outcomes.

### Impact on Society, Environment and Sustainability

#### Impact on Life

Improved airport networks enhance passenger experience and operational efficiency.

#### Impact on Society & Environment

Reduces paper usage through digital systems and improves overall travel experience.

#### Ethical Aspects

Ensures data privacy and secure handling of passenger information.

#### Sustainability Plan

The design allows for energy-efficient operations and future upgrades without complete overhaul.

### Project Management and Team Work

The project was completed over [duration] with team members handling different aspects:

* Network design
* Simulation implementation
* Documentation
* Testing and validation

### Complex Engineering Problem

#### Mapping of Program Outcome

|  |  |
| --- | --- |
| **PO's** | **Justification** |
| **PO1** | Applied knowledge of computing and mathematics |
| **PO2** | Problem analysis and solution design |
| **PO3** | Designed and implemented a complex network system |

#### Complex Problem Solving

The project addressed:

* + - * Network scalability
      * Security challenges
      * Real-time performance requirements

**Table 4.2: Mapping with Complex Problem Solving**

|  |  |  |
| --- | --- | --- |
| **CEP Attribute** | **Project Justification** | **Check (**✓**)** |
| **EP1: Depth of**  **Analysis** | Demonstrated through subnetting, routing protocols  (OSPF/EIGRP), and VLAN design in Cisco Packet Tracer. | ✓ |
| **EP2: Conflicting Requirements** | Balanced trade-offs between security (ACLs/firewalls), scalability (modular design), and real-time performance (QoS for flight  systems). | ✓ |
| **EP3: Stakeholder**  **Involvement** | Addressed needs of passengers (Wi-Fi), airport staff (reliable  LAN), and security teams (isolated VLANs). | ✓ |
| **EP4: Applicable Codes** | Complied with IEEE 802.11 (Wi-Fi), TCP/IP standards, and Cisco best practices. | ✓ |
| **EP5: Interdependence** | Integrated subsystems (baggage handling, flight info displays) with centralized network management. | ✓ |

#### Engineering Activities

**Included:**

* + - * **Network design**
      * **Protocol configuration**
      * **Performance optimization**
      * **Security implementation**

|  |  |  |
| --- | --- | --- |
| **Engineering Activity** | **Project Implementation** | **Check (**✓**)** |
| **EA1: Range of Resources** | Used Cisco Packet Tracer, physical router emulation, and Wireshark for traffic analysis. | ✓ |
| **EA2: Level of Interaction** | Team collaboration (design, testing) and stakeholder feedback (hypothetical airport IT team). | ✓ |
| **EA3: Innovation** | Custom VLAN segmentation for security zones and dynamic routing for fault tolerance. | ✓ |
| **EA4: Societal/Environmental Impact** | Reduced paper use (digital boarding), energy-efficient network design. | ✓ |
| **EA5: Familiarity** | Applied classroom knowledge (subnetting, routing  protocols) to real-world airport context. | ✓ |

**Chapter 5**

# Conclusion

#### Summary

The project successfully designed and simulated an integrated airport networking system that addresses current challenges in airport operations.

#### Limitation

The simulation doesn't account for physical infrastructure challenges and real-world environmental factors.

#### Future Work

Future enhancements could include:

* + - IoT integration for smart airport features
    - Advanced security measures
    - Cloud integration for distributed systems

#### References

* Cisco Networking Academy Materials
* Jon Kleinberg and Eva Tardos. *Algorithm Design*. Pearson Education India, 2006.
* “Enterprise Networking Design,” Cisco Documentation
* IEEE Research on Airport Communication System