

Enterprise Network Architecture with Centralized Data Center

Course: Computer Networks (CSE261)

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Overall Architecture & Core Strategy

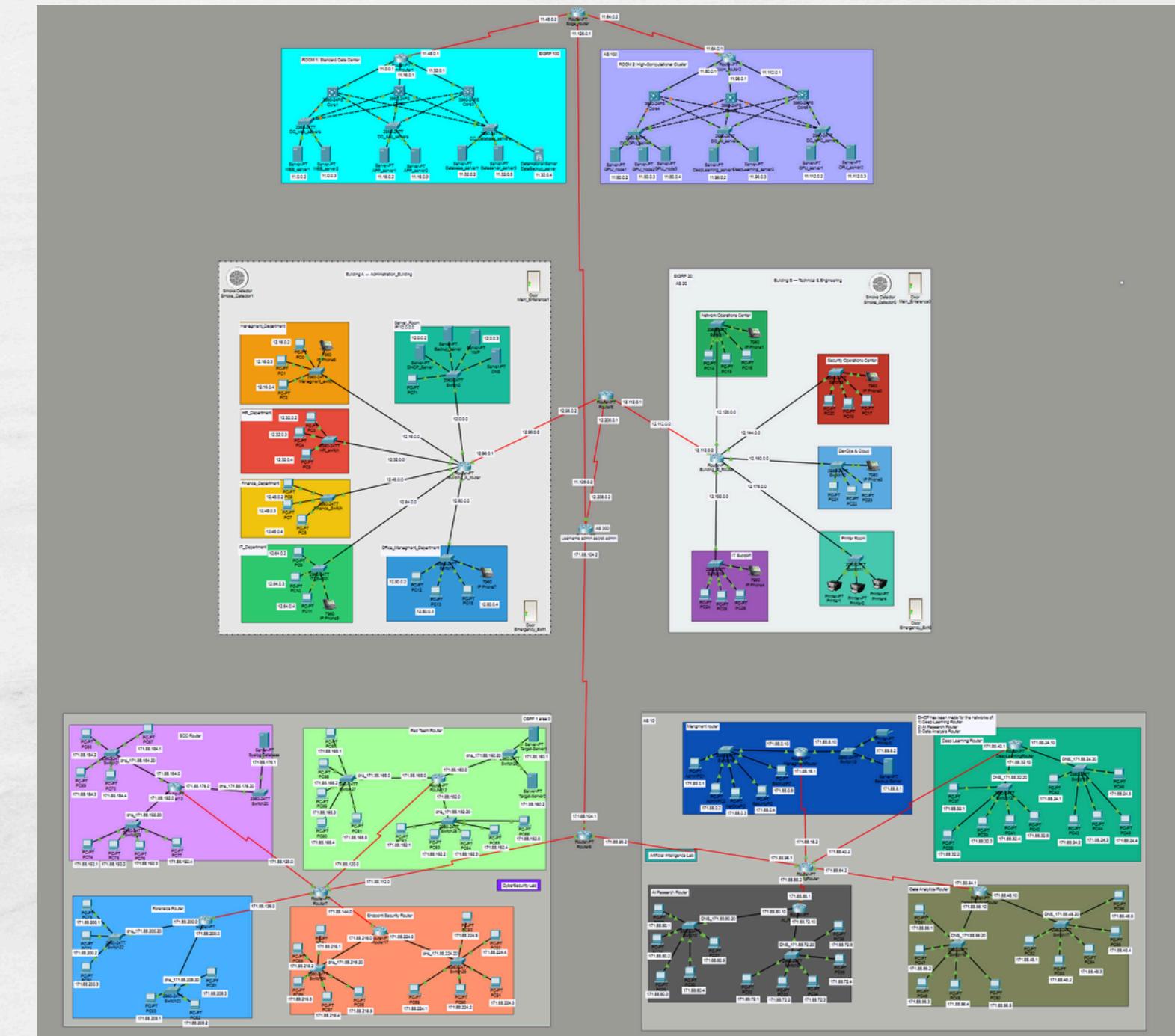
A **data center-centric enterprise network** designed to support corporate services and research environments using real-world design principles.

Network Design

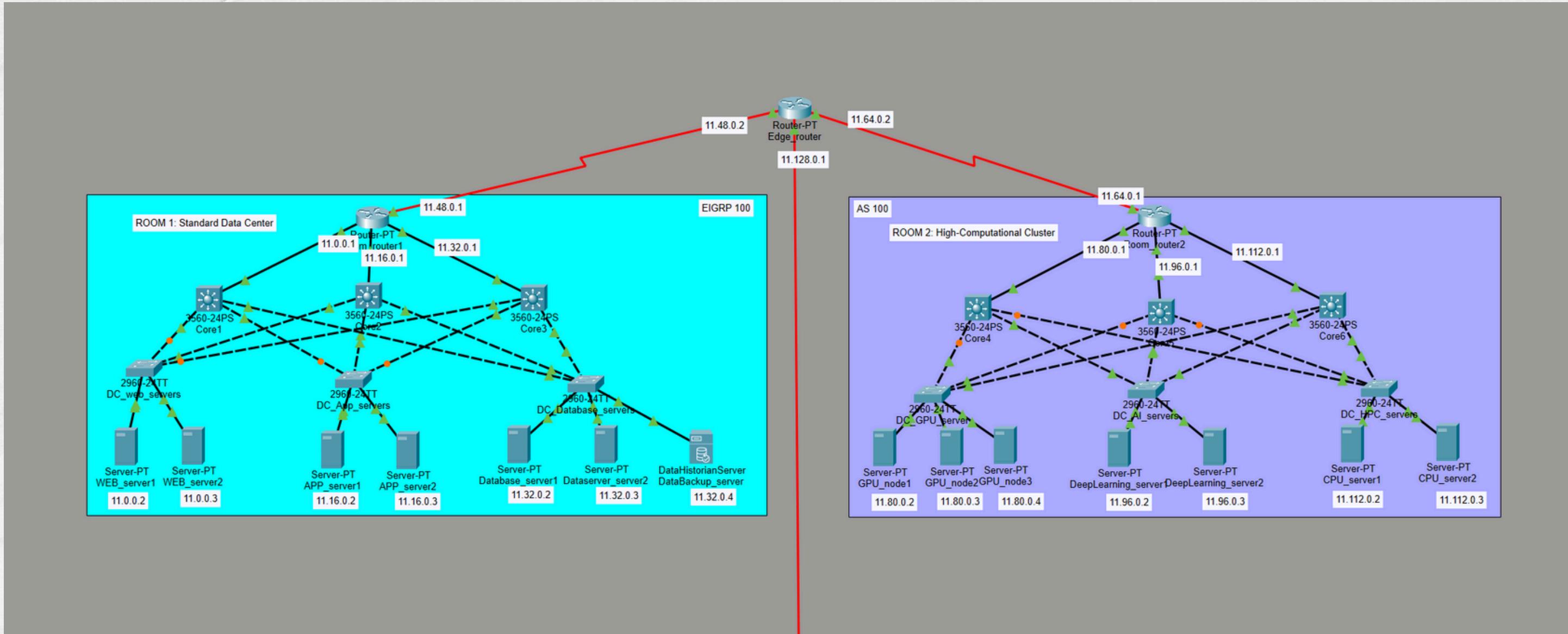
- Data Center as the central backbone and service core
- Independent domains (Corporate & Labs) connected via BGP
- Spine–leaf topology for high availability and low latency

Routing Protocols

- BGP: Inter-domain connectivity
- EIGRP: Corporate Campus
- OSPF: Research & Cyber Labs
- RIP: Internal Data Center routing



Core Data Center Architecture



Core Data Center Architecture

Spine-Leaf Topology:

- Two-tier design ensures scalability and efficient east–west traffic, ideal for AI and HPC workloads.

High Availability:

- Redundant paths between Spine and Leaf switches eliminate bottlenecks and improve reliability.

Segmentation:

- Room 1 (Standard): Web & application servers for DevOps and cloud testing
- Room 2 (High-Performance): HPC clusters, GPU farms, and AI research servers

Routing & Connectivity

- RIP: Simple internal routing inside the Data Center
- BGP: Policy-based routing to Corporate Campus and Research Labs

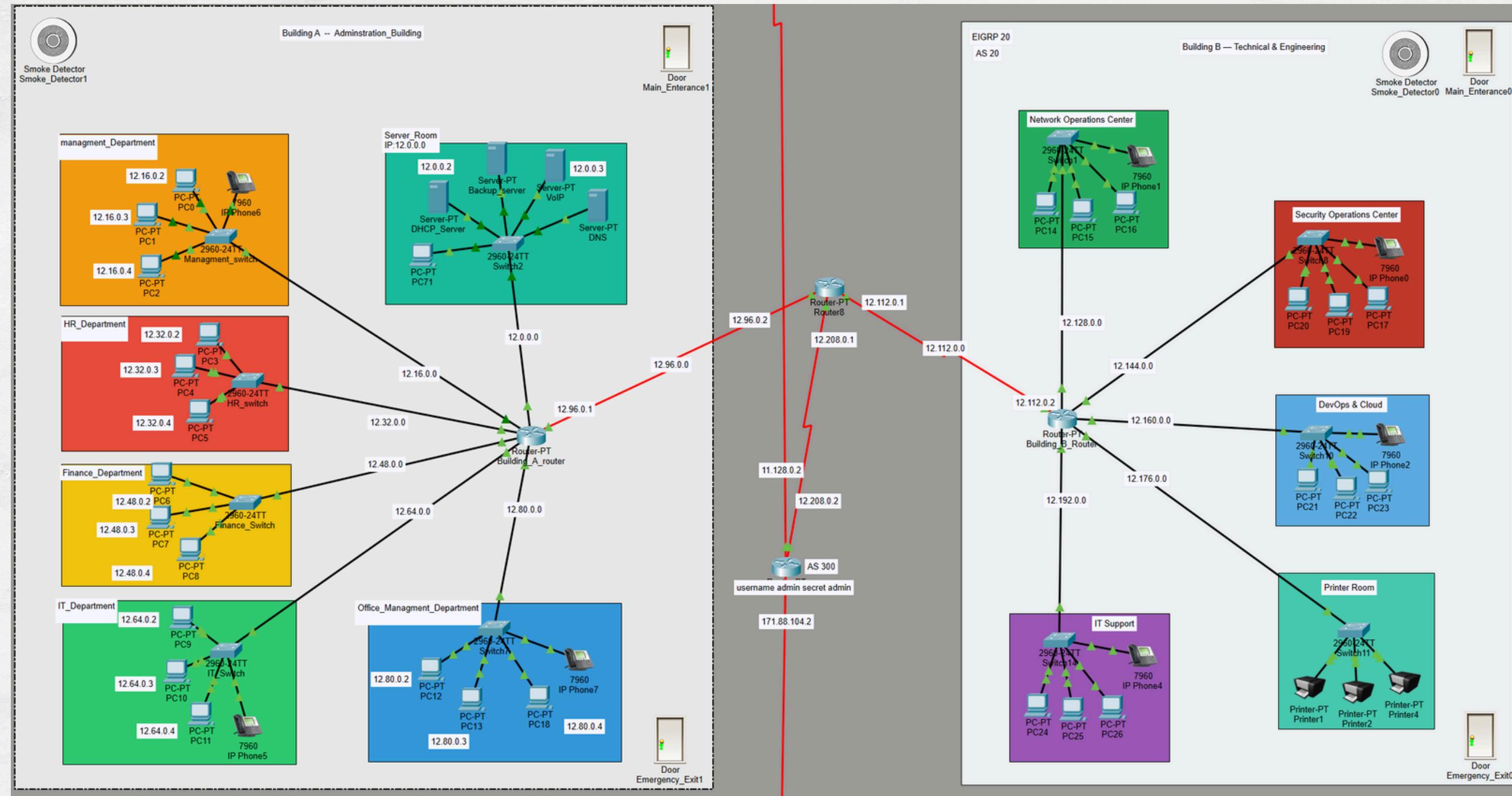
Data Center Subnetting (11.0.0.0/8)

- Subnetting Strategy: Borrowed 4 bits to support multiple networks
- Subnet Mask: /12 (255.240.0.0)
- Examples:
 - 11.0.0.0 – 11.15.255.255 → General services
 - 11.80.0.0 – 11.95.255.255 → High-compute clusters
 - 11.112.0.0 – 11.127.255.255 → HPC server segments



Campus Buildings Architecture & Security

Building A – Administration | Building B – Technical



Campus Buildings Architecture & Security

Building A – Administration | Building B – Technical

Topology & Routing

- EIGRP: Fast internal routing and rapid convergence
- Redundancy: Multiple links between layers ensure high availability
- Three-Tier Design: Core → Distribution → Access for modularity

Building Roles

- Building A – Administration: Management, HR, Finance, Server Room, IT Support
- Building B – Technical: NOC, SOC, DevOps & Cloud teams, local IT Support
- Supports separation of business and technical operations

Subnetting

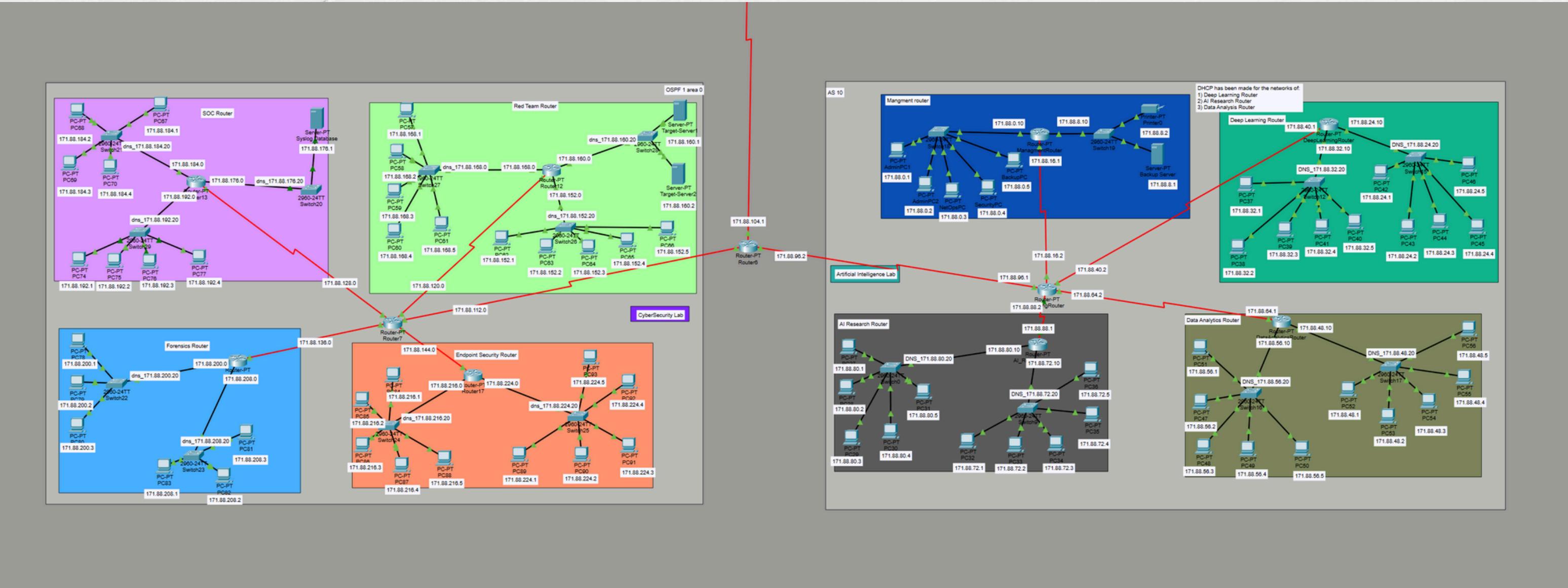
- Network: 12.0.0.0/8
- 16 subnets (/12) for all departments
- Simple allocation per department (e.g., Management, HR, Finance, IT, DevOps)

ACLs

- **Building A → B:**
 - Management: full access
 - HR & Finance: limited access
 - IT Support: IT only
 - Shared services allowed
- **Building B → A:**
 - SOC: Server Room access
 - DevOps: DNS & VoIP only
 - Finance: protected
 - Return traffic allowed



Research & Cybersecurity Labs



Research & Cybersecurity Labs

Labs Roles

- **Lab 1 – AI Research:** Focused on AI development, testing, and HPC-based simulations
- **Lab 2 – Cybersecurity Lab:** High-security lab for cybersecurity research and threat analysis

Purpose:

- Leverages HPC resources in the Data Center
- Designed for secure, isolated, high-performance operations

Routing & Connectivity

- OSPF Multi-Area Routing:
- Efficiently handles 29 subnets/interfaces
- Keeps routing tables small and network scalable
- BGP Edge Connectivity:
- Labs access corporate resources in a controlled manner

Lab Subnetting (171.88.0.0/16)

- Subnets: 29 → borrowed 5 bits → /21 mask
- Increment: 8 in the 3rd octet (e.g., 171.88.0.0, 171.88.8.0, 171.88.16.0)
- Reference: Full Lab Subnet Document



Project Cost Analysis & Resource Allocation

1. Networking Infrastructure (All Cisco)

- Edge/Core Routers (18 units): \$12,600
- Multi-Layer Switches 3560 (6 units): \$38,400
- Access Switches 2960 (35 units): \$56,000

2. High-Performance & End-User Computing

- HPC AI Servers (5 units): \$2,500,000
- Enterprise Servers (9 units): \$6,200
- Cisco IP Phones & Endpoints: \$43,150

3. Connectivity & Physical Layer

- Fiber & Ethernet Cabling: \$5,770

4. Financial Summary

- Total Investment: **\$2,662,120**
- Design Philosophy: Standardized Cisco ecosystem to maximize uptime & security, and support high-performance research

