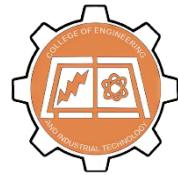




RIZAL TECHNOLOGICAL UNIVERSITY  
College of Engineering, Architecture, and Technology  
Electronics Engineering Department  
City of Mandaluyong



# ITC BUILDING

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# **COMPANY PROFILE**

## Kaizen OptiNet Services

**KAIZEN OPTINET SERVICES**



Kaizen OptiNet Services is a distinguished organization steadfastly dedicated to innovation and excellence. Concentrating on providing reliable connections and seamless communication experiences, the company is firmly grounded in the principles of continuous improvement and the optimization of network infrastructure to ensure peak performance, reliability, and security.

### **Values:**

*Continuous Improvement:* The philosophy of "kaizen" is embraced to facilitate the continuous improvement of our services, processes, and infrastructure.

*Innovation:* We stay ahead of the curve by embracing new technologies and seeking creative solutions to challenges.

*Reliability:* We are committed to providing dependable and consistent connections for our clients.

*Security:* Maintaining optimal security measures for our networks and clients' data is paramount.

*Customer-Centricity:* The company highly emphasizes customer-centricity, whereby clients' needs are given top priority. This is achieved through the provision of

customized solutions and exceptional support, which in turn fosters long-term partnerships.

**Purpose:**

Kaizen OptiNet Services is devoted to providing advanced internet access services enabling individuals, businesses, and communities to thrive, ensuring seamless and effective communication through diverse platforms.

**Mission:**

Our mission is to consistently provide reliable and secure telecommunication network services while continuously improving and optimizing our network architecture to meet the evolving needs of our clients.

**Vision:**

Kaizen OptiNet Services has a vision of a world where individuals can access high-speed, reliable, and secure Internet services, facilitating uninterrupted communication and boundless opportunities for advancement and progress.

**Goal:**

Our goal is to establish a reputable and esteemed position as a leader in the telecommunication network sector while upholding the dedication towards ongoing enhancement and providing unparalleled customer satisfaction.

# **OBJECTIVES**

**General objectives:**

To design a standard-driven telecommunication network within a campus-style structure.

Specifically, the project aims to:

1. Effectively provide the following four distinct services:
  - a) Voice Network: IP Phone
  - b) Data Network: Telecommunication Outlet
  - c) Video Network: IP Camera/CCTV
  - d) Wireless Network: Access Points
2. Demonstrate a standards-compliant network design implementation for the ITC Building at the Rizal Technological University Mandaluyong Campus.
3. Determine the telecommunication requirements of the ITC building:
  - a) Voice (VoIP)
  - b) Data (LAN Internet)
  - c) Video (IP Camera/CCTV)
  - d) Wireless (Access Points)

# **SCOPE**

## **Scope and Delimitation**

The scope of the project is to provide a comprehensive network design exclusively for the ITC building at Rizal Technological University - Mandaluyong Campus. Structured cabling systems, network layout designs, and building layout plans are all included in this proposed project.

The scope of the project is constrained to a maximum bandwidth of approximately 2702 Mbps or 2.8 Gbps and is limited to the utilization of the specified equipment:

- Switches
  - Gigabit Ethernet Switch:
    - 48 Ports - TP-Link 48 Port Gigabit Ethernet Switch
    - 24 Ports - TP-Link 24 Port Gigabit Switch
    - 16 Ports - TP-Link 16 Port Gigabit Switch
    - 8 Ports - TP-Link 8 Port Gigabit Switch
  - PoE Switch: TL-SG2424P, 24-Port Gigabit Smart PoE Switch with 4 Combo SFP Slots
- Router
  - WIFI Router: TP-Link AC4000 Tri-Band WiFi Router (Archer A20)
- Firewall
  - TP-Link ER605 V2 Wired Gigabit VPN Router
- NVR/Video Server and PoE Switch
  - NVR522424-P-4K52
- Computer Setup

- Wireless Access Point
  - TL-WA3001 AX3000 Gigabit Wi-Fi 6 Access Point
- IP-Cameras
  - HIKVISION DS-2CD2046G2-I(U) - Supports FOV from 53° to 103° (Horizontal)
  - Rover Systems RND543UBV - Varifocal Security Camera
- Fiber Optic Distribution Box
- Network Rack
  - Navepoint 9U Open-Frame Server Rack 19"
- Flexible Hose
- CAT 6 UTP Ethernet Lan Cable
- Telecommunication Port
- Telephone
  - FanvilX1SP Enterprise IP Phone
- Raceway
  - PVC Cable Tray 2.0

# **SITE OVERVIEW**

## ITC BUILDING



Figure 1. ITC BUILDING



Figure 2. ITC Building, Rizal Technological University Google Earth Image

Address: Boni Avenue, Barangay Malamig, Mandaluyong City.

Floor Information:

1. The floor plan was created by Kaizen OptiNet Services
2. ITC Building:

Number of floors: 4 Floors

# **DESIGN CONSIDERATIONS**

## COST

To maintain cost-efficiency, we carefully evaluated the cost of each device and equipment used. We made sure to place only the necessary amount of devices and equipment in the building, taking into consideration the specific needs of each room. It is important to note that not all rooms are equipped with these devices, and only the vital rooms have been prioritized for their placement.

## ROOM SELECTION AND CABLING CONSIDERATIONS

The UTP cables were run through the walls for multiple reasons, including space optimization, aesthetics, protection against physical damage, and facilitating easy access to network connections across different rooms or areas of the building. Running the cables inside the walls optimizes the use of space by eliminating the need for visible cables, allowing for greater flexibility in arranging equipment and furniture. This approach creates a safe and uncluttered environment, enhancing the functionality of the space. In addition, running the cables inside the walls provides protection by keeping them safe from physical damage, accidental disconnection, or tampering. The walls act as a barrier, shielding the cables from potential hazards like impacts, the environment, or human interference. This protection is important for maintaining the network infrastructure's durability and reliability. Lastly, running cables through walls allows for easy access to network connections in each room. By routing the cables inside the walls, we can conveniently connect devices in different rooms to the network without the need for visible cables or additional wiring installations.

The building's cable routing system consists of a pipe that connects all floors, allowing the cables to be distributed. These cables are then connected to the main server room. Within the server room, there is a primary switch that serves as a central connection point, linked to the router. This main switch effectively manages the sub switches located on different floors of the building.

Additionally, within the server room, monitoring of CCTV (closed-circuit television) is conducted. This enables surveillance and security measures to be implemented efficiently and effectively, ensuring the safety and protection of the premises.

## CCTV CONSIDERATIONS

In our Design, we have strategically placed the security cameras in areas where human activities are common. Our focus has been on placing cameras at common entry and exit points, as well as in rooms that are vital for campus operations. By positioning the cameras in these key locations, we aim to enhance security measures and deter unauthorized access. The placement of security cameras at entry and exit points helps monitor the flow of individuals entering or leaving the premises, ensuring that only authorized personnel and students have access. This not only helps maintain a secure environment but also serves as a deterrent against potential intrusions or security breaches. Moreover, we have placed cameras in rooms that hold significant importance for campus operations. These areas may include offices, computer labs, equipment storage rooms, or other sensitive spaces. By monitoring these rooms, we can ensure the safety of important resources, maintain accountability, and prevent unauthorized access or tampering.

In choosing the security cameras, we have made the decision to opt for IP cameras. IP cameras, or network cameras, offer benefits such as high-resolution video, remote access capability, scalability, and advanced features. With IP cameras, we can capture clear and detailed footage, access the camera feeds remotely from any location, easily expand the system as needed, and utilize features like motion detection, FOV adjustments and intelligent analytics for enhanced surveillance. For long-range and wide area monitoring, such as hallways and open spaces, we chose cameras with wide FOV and zooming capabilities. These cameras excel at capturing distant subjects and offer adjustable field of view for comprehensive coverage. With zoom functionality, they allow for detailed examination of specific areas or individuals of interest. The combination of a wider FOV and zooming capabilities provides enhanced situational

awareness for effective surveillance. For smaller areas such as offices and wider rooms like laboratories, computer rooms, and entry points such as stairs, we recommend cameras that support a 50-103 degree angle of view (FOV). These cameras strike a balance between coverage and detail, capturing a moderate field of view while still allowing monitoring of specific points of interest within the area.

## **COMPUTERS, SWITCHES, TELCOPORTS AND VoIPs**

We have strategically placed computers in laboratories, offices, and other rooms where essential campus activities are conducted. The placement of computers is specifically prioritized in areas such as computer rooms, laboratories, offices, and other vital rooms. This ensures that students, faculty, and staff have convenient access to computer resources in locations where academic and administrative tasks are carried out effectively. By providing computers in these key areas, we aim to support and enhance the essential activities that take place within them.

The number of computers in each room is based on the expected number of users. In computer rooms and laboratories, it corresponds to the average number of students per section. In offices, a sufficient number of computers are provided for office operations.

We have chosen switches that come with multiple ports, ranging from 6 ports to 48 ports, to provide sufficient connectivity in each room. These switches can support additional devices if necessary. They are specifically installed in rooms where there are four or more computers.

Telco ports with three slots, have been placed in classrooms, offices, and rooms where only a limited number of users require internet connectivity.

VoIPs are placed in office rooms where administrative and clerical tasks are performed, ensuring that staff members have easy access to communication tools for internal and external calls related to their administrative responsibilities.

## **ACCESS POINTS**

Access Points have been placed in areas where campus activities requiring network connectivity are commonly conducted. This includes faculty rooms, the server room, computer rooms, and offices. The placement ensures reliable and efficient Wi-Fi coverage for users. Faculty members can easily access online resources and communicate with colleagues, while the server room benefits from uninterrupted connectivity for effective network management. Computer rooms provide students and faculty with reliable connections for academic tasks, and offices have consistent internet access for administrative operations. Our design prioritizes the placement of Access Points in these areas to support reliable connectivity and enhance productivity in campus activities.

## **STANDARDS AND PROTOCOLS**

### ***TP-Link 16 Port Gigabit Switch / TP-Link 48 Port Gigabit Ethernet Switch***

- IEEE 802.3i, IEEE 802.3u, IEEE 802.3ab, IEEE 802.3x

### ***Cisco SF200-48P 48-Port 10/100 PoE Switch***

- IEEE 802.3, IEEE 802.3u/z/x/ab/ad/af, IEEE 802.1D/Q/p/w/x

### ***TP-Link AC4000 Tri-Band WiFi Router***

- IEE 802.11ac

### ***TP-Link ER605 V2 Wired Gigabit VPN Router***

- IEEE 802.3, 802.3u, 802.3ab, IEEE 802.3x, IEEE 802.1q

### ***Rover Systems RND543UBV***

- IPv4, IGMP, ICMP, ARP, TCP, UDP, DHCP, PPPoE, RTP, RTSP, RTCP, DNS, DDNS, NTP, FTP, UPnP, HTTP, HTTPS, SMTP, 802.1x, SMNP, SSL, QoS

### ***TL-WA3001 AX3000 Gigabit Wi-Fi 6 Access Point***

- IPv4, IPv6

# **BANDWIDTH CALCULATIONS**

## VOICE BANDWIDTH CALCULATIONS

No. of Phone Lines = 15 VOIP Telephones

The form is titled "Lines to VoIP bandwidth Calculator". It has a section for "CODEC" set to "G.711 (PCM) 64 kbps uncompressed". Below it is a "Packet duration" section set to "20 milliseconds (160 samples)". There are two radio buttons: "Voice paths" (selected) with value "15" and "IP bandwidth (kbps)" (selected) with value "1200". At the bottom is a "Calculate" button.

Total Bandwidth for Voice = Using the CODEC G.711 (PCM), typically it requires 64 kbps per call. Also, we must consider the overhead and protocol requirements, such as Real-Time Transport Protocol (RTP). Let us assume that there is an additional 30% for the overhead and protocol requirements, so it must be summed up with the bandwidth requirement.

$$\text{Overhead} = 30\% \times \text{bandwidth for CODEC}$$

$$\text{Overhead} = 0.3 \times 64 \text{ kbps}$$

$$\text{Overhead} = 19.2 \text{ kbps}$$

For the total, we = (Bandwidth per call + Overhead) x Number of simultaneous calls

$$= (64 \text{ kbps} + 19.2 \text{ kbps}) \times 15$$

$$= 1248 \text{ kbps or } 1.248 \text{ Mbps}$$

If there are 15 telephone lines, all running and active simultaneously, we are required to have at least 1.248 Mbps, rounding off its value, we have a total of 2 Mbps for the Voice Bandwidth.

## **DATA BANDWIDTH CALCULATIONS**

No. of Users/Computer = 225

Bandwidth per Computer = 4 Mbps

Total Bandwidth for Data = (225 users) (4) = 900 Mbps

## **ACCESS POINT BANDWIDTH CALCULATIONS**

No. of Access Point = 15 (Suppose 20 devices are connected in every AP)

Bandwidth per Access Point = 100 Mbps

Bandwidth per Device = 6 Mbps

Overall Bandwidth for Access Point = 1800 Mbps

## **OVERALL BANDWIDTH COMPUTATION**

For the overall bandwidth computation, it is the sum of all the Bandwidth in the school premises, the formula below is followed:

Overall Bandwidth = Voice Bandwidth + Data Bandwidth + Access Point Bandwidth

$$\text{Overall Bandwidth} = 2 \text{ Mbps} + 900 \text{ Mbps} + 1800 \text{ Mbps} = 2702 \text{ Mbps}$$

<b>SERVICES</b>	<b>BANDWIDTH</b>
Voice	2 Mbps
Data	900 Mbps
Access Point	1800 Mbps
<b>Overall Bandwidth</b>	<b>2702 Mbps or 2.8 Gbps</b>

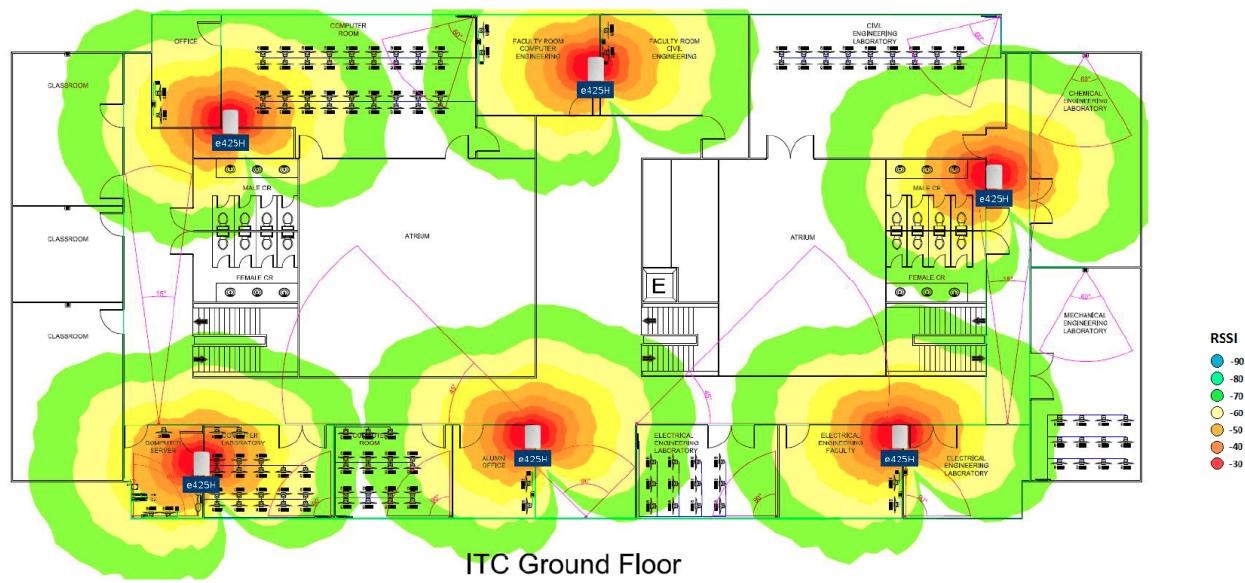
## **CONSIDERATIONS**

Since we are once again switching to online learning for the remaining days of the semester, the bandwidth usage will be concentrated on faculties, where the professors usually will conduct their teaching sessions. There will be a lot of video streaming in google classroom, zoom, etc. According to high-speed internet, a good video conferencing bandwidth will be around 3 Mbps.

For our Data Bandwidth, we had a total of 194 computers, and assumed that there are extra computers, a total of 225 computers. For the VOIP Bandwidth, we rounded off the 1.248 Mbps into 2 Mbps for excess bandwidth. As for the Access Point Bandwidth, we are giving off 6 Mbps per device for both wired and wireless devices.

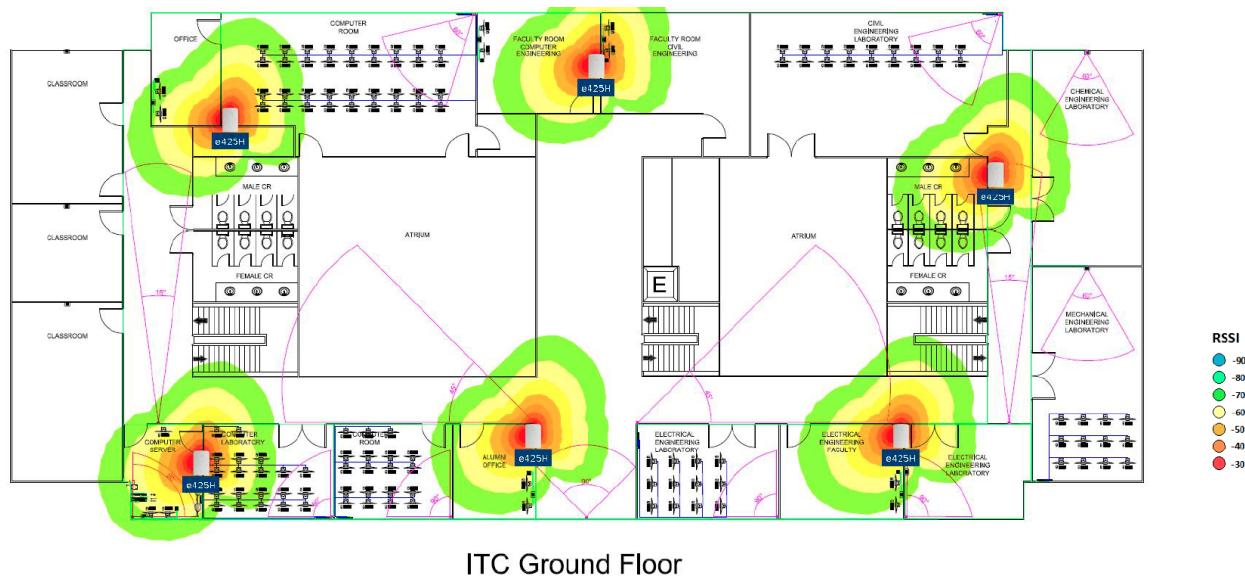
Overall, summing those bandwidths up, we have 2.7Gbps, and rounded it up for 2.8 Gbps for a much safer bandwidth since internet with higher bandwidth, or speed, gives you a faster and better experience over Internet with lower bandwidth. We did not go up to 2.9 Gbps or 3.0 Gbps since the trade off it offers is costly, for us, the safest bandwidth is 2.8 Gbps.

Floor Plan: Ground Floor - 2.4GHz Band



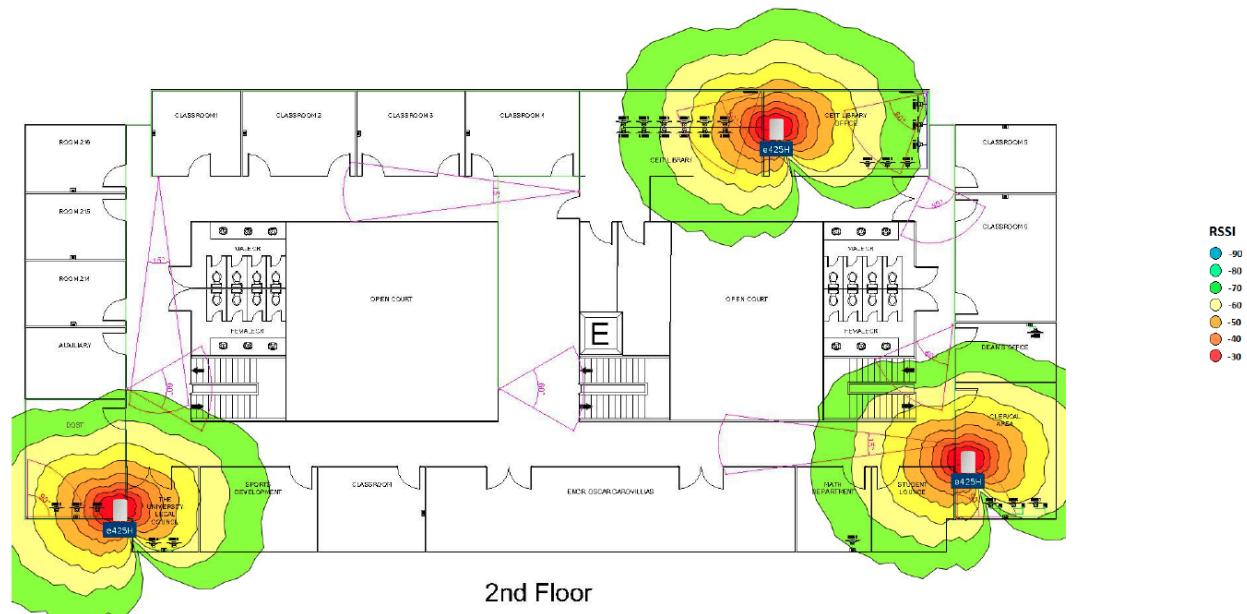
ITC Ground Floor

Floor Plan: Ground Floor - 5GHz Band

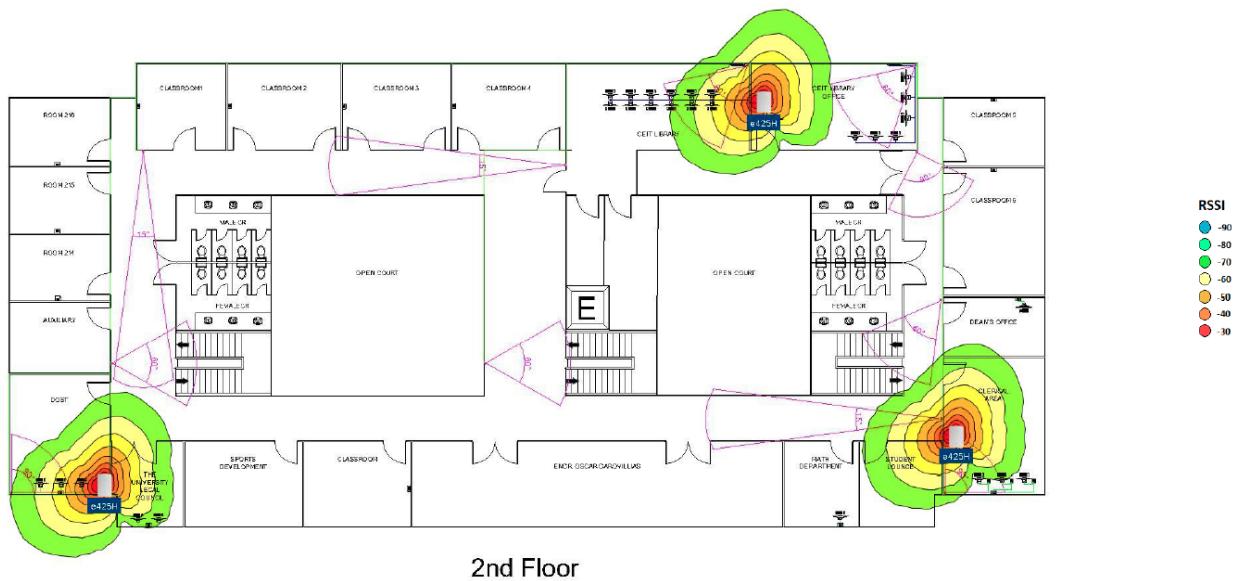


ITC Ground Floor

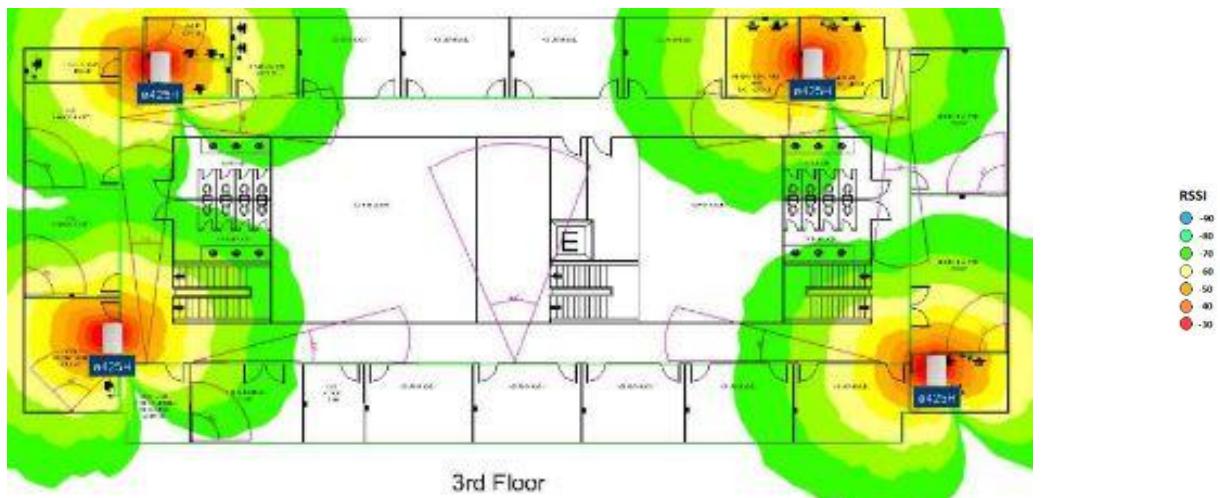
Floor Plan: 2nd Floor Heat Map Final - 2.4GHz Band



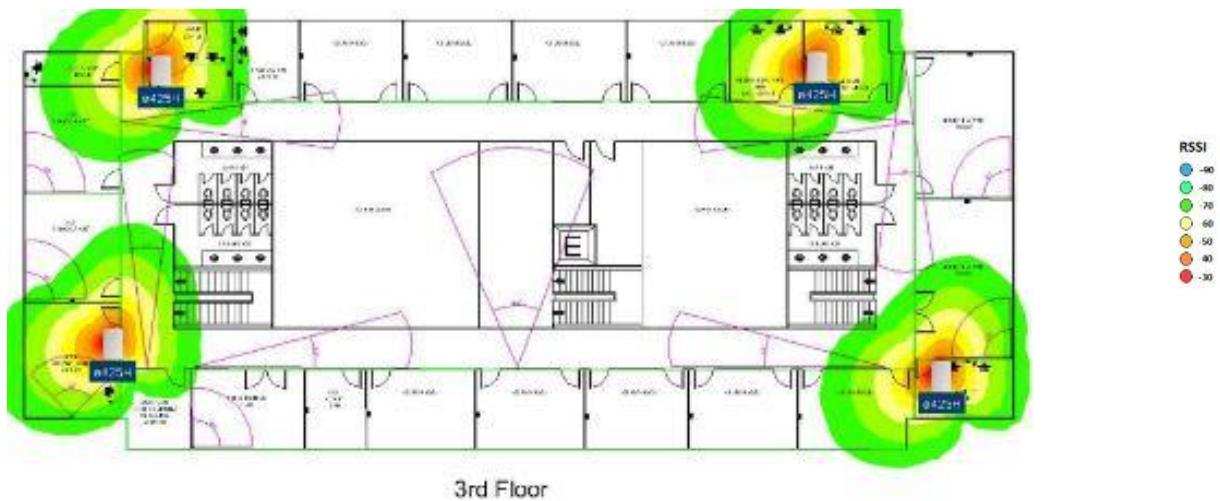
Floor Plan: 2nd Floor Heat Map Final - 5GHz Band



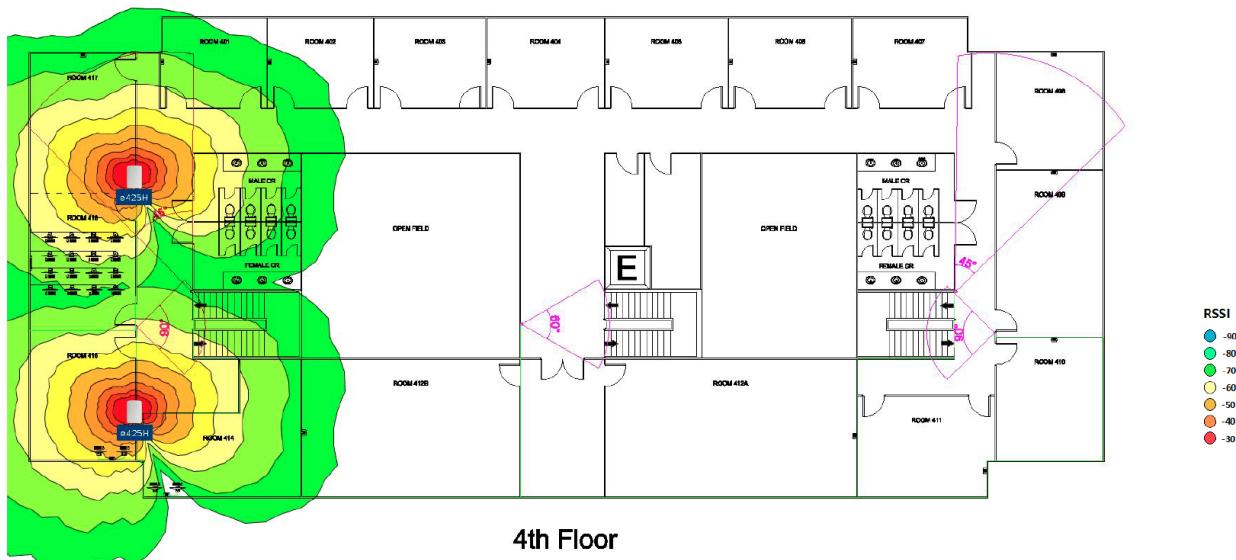
Floor Plan: 3rd Floor - 2.4GHz Band



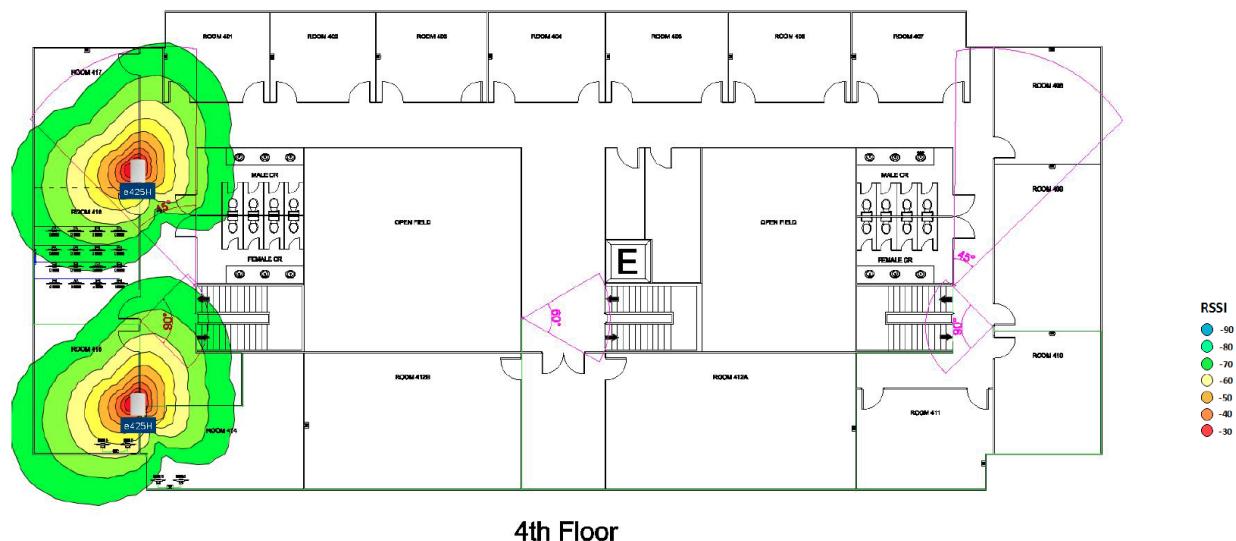
Floor Plan: 3rd Floor - 5GHz Band



Floor Plan: ITC 4th Floor - 2.4GHz Band



Floor Plan: ITC 4th Floor - 5GHz Band



# **IP ADDRESSING**

Virtual local area networks (VLANS) were employed, with VLANs being assigned to certain services, to implement network segmentation. The protocol for Dynamic Host Configuration (DHCP) protocol will be used to obtain IP addresses for hosts. On servers and networking equipment, it will be static. Both IP address range coverage and VLAN segmentation are discussed.

IP Addressing computations:

To get the number of host per subnet (x), the formula used was::

$$x = 2^{32-n} - 2$$

Where:

x = number of host/subnet

n = subnet mask

To get the number of usable IP addresses we need to subtract 2. The minus 2 represents the network address and broadcast address.

## CIDR Network reference:

CIDR	SUBNET MASK	WILDCARD MASK	# OF IP ADDRESSES	# OF USABLE IP ADDRESSES
/32	255.255.255.255	0.0.0.0	1	1
/31	255.255.255.254	0.0.0.1	2	2*
/30	255.255.255.252	0.0.0.3	4	2
/29	255.255.255.248	0.0.0.7	8	6
/28	255.255.255.240	0.0.0.15	16	14
/27	255.255.255.224	0.0.0.31	32	30
/26	255.255.255.192	0.0.0.63	64	62
/25	255.255.255.128	0.0.0.127	128	126
/24	255.255.255.0	0.0.0.255	256	254
/23	255.255.254.0	0.0.1.255	512	510
/22	255.255.252.0	0.0.3.255	1,024	1,022
/21	255.255.248.0	0.0.7.255	2,048	2,046
/20	255.255.240.0	0.0.15.255	4,096	4,094
/19	255.255.224.0	0.0.31.255	8,192	8,190
/18	255.255.192.0	0.0.63.255	16,384	16,382
/17	255.255.128.0	0.0.127.255	32,768	32,766
/16	255.255.0.0	0.0.255.255	65,536	65,534
/15	255.254.0.0	0.1.255.255	131,072	131,070
/14	255.252.0.0	0.3.255.255	262,144	262,142
/13	255.248.0.0	0.7.255.255	524,288	524,286
/12	255.240.0.0	0.15.255.255	1,048,576	1,048,574
/11	255.224.0.0	0.31.255.255	2,097,152	2,097,150
/10	255.192.0.0	0.63.255.255	4,194,304	4,194,302
/9	255.128.0.0	0.127.255.255	8,388,608	8,388,606
/8	255.0.0.0	0.255.255.255	16,777,216	16,777,214
/7	254.0.0.0	1.255.255.255	33,554,432	33,554,430
/6	252.0.0.0	3.255.255.255	67,108,864	67,108,862
/5	248.0.0.0	7.255.255.255	134,217,728	134,217,726
/4	240.0.0.0	15.255.255.255	268,435,456	268,435,454
/3	224.0.0.0	31.255.255.255	536,870,912	536,870,910
/2	192.0.0.0	63.255.255.255	1,073,741,824	1,073,741,822
/1	128.0.0.0	127.255.255.255	2,147,483,648	2,147,483,646
/0	0.0.0.0	255.255.255.255	4,294,967,296	4,294,967,294

IP and VLAN Deployment									
Service	VLAN ID	No. of user	VLAN name	CIDR	Subnet Address	Subnet Mask	Available Address/Subnet	Broadcast Address	Valid Host Address
PCs	10	194	Data	/24	172.16.0.0/24	255.255.255.0	254	172.16.0.255	172.16.0.1 - 172.16.0.254
IPCs	30	44	Video	/26	172.16.1.0/26	255.255.255.192	62	172.16.1.63	172.16.1.1-172.16.1.62
WAPs	40	9	Wireless	/28	172.16.2.0/28	255.255.255.240	16	172.16.2.15	172.16.2.1 - 172.16.3.14
VoIPs	50	11	Voice	/28	172.16.3.0/28	255.255.255.240	16	172.16.3.15	172.16.3.1 - 172.16.3.14

DATA	
Network Address	172.16.0.0
Usable Host IP Range	172.16.0.1 - 172.16.0.254
Broadcast Address	172.16.0.255
Total Number of Hosts	256
Valid Host Address	254
Subnet Mask	255.255.255.0
Wildcard Mask	0.0.0.255
Binary Subnet Mask	11111111.11111111. 11111111.00000000
IP Class	C
CIDR Notation	/24
IP Type	PRIVATE
Short	172.16.0.0/24

IP Addresses for the PCs (DATA)						
VLAN ID	VLAN NAME	DEPARTMENT	ACTUAL HOST	PREFIX	TOTAL NO. OF HOST IN VLAN	CLIENT ADDRESS
11	1st Floor Classroom & Laboratory	Civil Engineering Laboratory	18	/25	117	172.16.0.1 - 172.16.0.118
		Electrical Engineering Laboratory	12			
		Mechanical Engineering Laboratory	12			
		Computer Laboratory	20			
		Computer Room 1	36			
		Computer Room 2	19			
12	Faculty Room	Faculty Room Computer Engineering	2	/28	8	172.16.0.119 - 172.16.0.126
		Faculty Room Civil Engineering	2			
		Electrical Engineering Faculty	2			
		Faculty Room	2			

		Office	2			
		Alumni Office	2			
		CEIT Library Office	6			
		DEAN's Office	1			
		DOOR Office	4			
		Physical Plan Development Office	2			
		ECE Department Office	3			
		Infrastructure and Mgt. Office	2			
13	Offices	Room 416	16	/27	22	172.16.0.127 - 172.16.0.148
		Room 415	2			
		Room 414	2			
14	Classroom	Computer Server	3	/29	3	172.16.0.169 - 172.16.0.171
15		CEIT Library	12			
16		Clerical Area	3			
17	Math Department	Math Department	1	/30	1	172.16.0.187
18		The University Legal Council	2			
19	DOST	DOST	3	/29	3	172.16.0.190 - 172.16.0.192
20	ECE Stock Room	ECE Stock Room	1	/29	1	172.16.0.193
21	Evaluation Center	Evaluation Center	2	/29	2	172.16.0.194 - 172.16.0.195

VIDEO	
Network Address	172.16.1.0
Usable Host IP Range	172.16.1.1 - 172.16.1.62
Broadcast Address	172.16.1.63
Total Number of Hosts	64
Valid Host Address	62
Subnet Mask	255.255.255.192
Wildcard Mask	0.0.0.63
Binary Subnet Mask	11111111.11111111. 11111111.11000000
IP Class	C
CIDR Notation	/26
IP Type	PRIVATE
Short	172.16.1.0/26

IP Addresses for the IPCs (VIDEO)	
<b>First Floor</b>	
IPCam-001	172.16.1.1
IPCam-002	172.16.1.2
IPCam-003	172.16.1.3
IPCam-004	172.16.1.4
IPCam-005	172.16.1.5
IPCam-006	172.16.1.6
IPCam-007	172.16.1.7
IPCam-008	172.16.1.8
IPCam-009	172.16.1.9
IPCam-010	172.16.1.10
IPCam-011	172.16.1.11
IPCam-012	172.16.1.12
IPCam-013	172.16.1.13
IPCam-014	172.16.1.14
<b>Ground Floor</b>	
IPCam-015	172.16.1.15
IPCam-016	172.16.1.16
IPCam-017	172.16.1.17
IPCam-018	172.16.1.18
IPCam-019	172.16.1.19
IPCam-020	172.16.1.20
IPCam-021	172.16.1.21
IPCam-022	172.16.1.22
IPCam-023	172.16.1.23
IPCam-024	172.16.1.24
IPCam-025	172.16.1.25
<b>Third Floor</b>	
IPCam-026	172.16.1.26
IPCam-027	172.16.1.27
IPCam-028	172.16.1.28
IPCam-029	172.16.1.29
IPCam-030	172.16.1.30
IPCam-031	172.16.1.31
IPCam-032	172.16.1.32
IPCam-033	172.16.1.33
IPCam-034	172.16.1.34
IPCam-035	172.16.1.35
IPCam-036	172.16.1.36
IPCam-037	172.16.1.37
IPCam-038	172.16.1.38
IPCam-039	172.16.1.39
<b>Fourth Floor</b>	
IPCam-040	172.16.1.40
IPCam-041	172.16.1.41
IPCam-042	172.16.1.42
IPCam-043	172.16.1.43
IPCam-044	172.16.1.44

# **EQUIPMENT**

## Switches

### Gigabit Ethernet Switch



*TP-Link 48 Port Gigabit Ethernet Switch, Plug and Play, Sturdy Metal with Shielded Ports, Rackmount, Traffic Optimization, Unmanaged (TL-SG1048)*

### Specifications:

Features:	
<ul style="list-style-type: none"><li>• Innovative energy-efficient technology saves power up to 18%</li><li>• 100% Data filtering rate eliminates all error packets</li><li>• Supports IEEE 802.3x flow control for Full Duplex mode and backpressure for Half Duplex mode</li><li>• Non-blocking switching architecture forwards and filters packets at full wire-speed for maximum throughput</li><li>• 96Gbps Switching Capacity</li><li>• Auto MDI/MDIX eliminates the need for crossover cables</li><li>• Supports MAC address auto-learning and auto-aging</li><li>• Support the port N-Way Auto-Negotiation, Store and Forward.</li><li>• Compact size design for desktops, Rackmountable</li><li>• Plug and Play design simplifies installation</li></ul>	
Hardware Features	
Standards and Protocols	IEEE 802.3i, IEEE 802.3u, IEEE 802.3ab , IEEE 802.3x
Interface	48 10/100/1000Mbps RJ45 Ports (Auto Negotiation/Auto MDI/MDIX)
Network Media	<ul style="list-style-type: none"><li>• 10BASE-T: UTP category 3, 4, 5 cable (maximum 100m)</li><li>• 100BASE-TX/1000BASE-T: UTP category 5, 5e or above cable</li></ul>

	(maximum 100m)
<b>Fan Quantity</b>	2
<b>Dimensions ( W x D x H )</b>	17.32 x 8.7 x 1.73 in.(440 x 220 x 44 mm) 19-inch Rack mount Steel Case, 1U Height
<b>Power Consumption</b>	Maximum: 29.8W (220V/50Hz)
<b>Performance</b>	
<b>Bandwidth/Backplane</b>	96 Gbps
<b>Packet Forwarding Rate</b>	71.4 Mpps
<b>MAC Address Table</b>	8K
<b>Buffer Memory</b>	16 MB
<b>Jumbo Frame</b>	10KB
<b>Green Technology</b>	Innovative energy-efficient technology saves power up to 18%
<b>Transfer Method</b>	Store-and-Forward
<b>Others</b>	
<b>Certification</b>	CE, FCC, RoHS
<b>Package Contents</b>	<ul style="list-style-type: none"> <li>• Switch</li> <li>• Power Cord</li> <li>• Installation Guide</li> <li>• Rackmount Kit</li> <li>• Rubber Feet</li> </ul>
<b>System Requirements</b>	Microsoft Windows XP, Vista or Windows 7/8, MAC OS, NetWare, UNIX or Linux
<b>Environment</b>	<ul style="list-style-type: none"> <li>• Operating Temperature: 0°C~40°C (32°F~104°F),</li> <li>• Storage Temperature: -40°C~70°C (-40°F~158°F)</li> <li>• Operating Humidity: 10%~90% non-condensing,</li> <li>• Storage Humidity: 5%~90% non-condensing</li> </ul>
<b>Price</b>	PHP 15,990
Link: <a href="#">TP-Link TL-SG1048 48-Port Gigabit Rackmount Switch   Shopee Philippines</a>	



*TP-Link 24 Port Gigabit Switch, Easy Smart Managed, Plug & Play, Desktop/Rackmount, Sturdy Metal w/ Shielded Ports, Support QoS, Vlan, IGMP & LAG (TL-SG1024D)*

## Specifications:

### Features:

- Innovative energy-efficient technology saves power up to 25%
- Supports IEEE 802.3x flow control for Full Duplex mode and backpressure for Half Duplex mode
- Non-blocking switching architecture that forwards and filters packets at full wire-speed for maximum throughput
- 48Gbps Switching Capacity
- 10K Jumbo frame improves the performance of large data transfers
- Auto-MDI/MDIX eliminates the need for crossover cables
- Supports MAC address auto-learning and auto-aging
- Store and forward Switching scheme
- Auto-negotiation ports provide smart integration between 10Mbps, 100Mbps and 1000Mbps hardware.
- Desktop and Rack-mountable design
- Plug and Play design simplifies installation

### Hardware Features

<b>Standards and Protocols</b>	IEEE 802.3i, IEEE 802.3u, IEEE 802.3ab , IEEE 802.3x
<b>Interface</b>	24 10/100/1000Mbps RJ45 Ports (Auto Negotiation/Auto MDI/MDIX)
<b>Network Media</b>	<ul style="list-style-type: none"> <li>● 10BASE-T: UTP category 3, 4, 5 cable (maximum 100m)</li> <li>● 100BASE-TX/1000BASE-T: UTP category 5, 5e or above cable (maximum 100m)</li> </ul>
<b>Fan Quantity</b>	Fanless

<b>Dimensions ( W x D x H )</b>	11.6 x 7.1 x 1.7 in. (294 x 180 x 44 mm)
<b>Power Supply</b>	100-240VAC, 50/60Hz
<b>Power Consumption</b>	Maximum: 14.6W (220V/50Hz)
<b>Performance</b>	
<b>Switching Capacity</b>	48 Gbps
<b>Packet Forwarding Rate</b>	35.7 Mpps
<b>MAC Address Table</b>	8K
<b>Packet Buffer Memory</b>	2 MB
<b>Jumbo Frame</b>	10KB
<b>Green Technology</b>	Innovative energy-efficient technology saves power up to 25%
<b>Transfer Method</b>	Store-and-Forward
<b>Others</b>	
<b>Certification</b>	CE, FCC, RoHS
<b>Package Contents</b>	<ul style="list-style-type: none"> <li>• Switch</li> <li>• Power Cord</li> <li>• Installation Guide</li> <li>• Rackmount kit</li> <li>• Rubber Feet</li> </ul>
<b>System Requirements</b>	Microsoft Windows 8, 7,Vista, XP or MAC OS, NetWare, UNIX or Linux
<b>Environment</b>	<ul style="list-style-type: none"> <li>• Operating Temperature: 0°C~40°C (32°F~104°F),</li> <li>• Storage Temperature: -40°C~70°C (-40°F~158°F)</li> <li>• Operating Humidity: 10%~90% non-condensing,</li> <li>• Storage Humidity: 5%~90% non-condensing</li> </ul>
<b>Price</b>	PHP 5,290
<p><b>Link:</b> <a href="#">TP-Link TL-SG1024D 24-Port Gigabit Desktop/Rackmount Switch   Shopee Philippines</a></p>	



*TP-Link 16 Port Gigabit Switch, Easy Smart Managed Plug & Play, Desktop/Rackmount Sturdy Metal w/ Shielded Ports, Support QoS, Vlan, IGMP & Link Aggregation (TL-SG1016D)*

## Specifications:

### Features:

- Innovative energy-efficient technology saves power up to 15%
- Supports IEEE 802.3x flow control for Full Duplex mode and backpressure for Half Duplex mode
- Non-blocking switching architecture that forwards and filters packets at full wire-speed for maximum throughput
- 32Gbps Switching Capacity
- 10K Jumbo frame improves performance of large data transfers
- Auto-MDI/MDIX eliminates the need for crossover cables
- Supports MAC address auto-learning and auto-aging
- Store and forward Switching scheme
- Auto-negotiation ports provide smart integration between 10Mbps, 100Mbps and 1000Mbps hardware.
- Plug and Play design simplifies installation

Hardware Features	
<b>Standard and Protocols</b>	IEEE 802.3i, IEEE 802.3u, IEEE 802.3ab , IEEE 802.3x
<b>Interface</b>	16 10/100/1000Mbps RJ45 Ports (Auto Negotiation/Auto MDI/MDIX)
<b>Network Media</b>	<ul style="list-style-type: none"> <li>● 10BASE-T: UTP category 3, 4, 5 cable (maximum 100m)</li> <li>● 100BASE-TX/1000BASE-T: UTP category 5, 5e or above cable (maximum 100m)</li> </ul>
<b>Fan Quantity</b>	Fanless

<b>Dimensions ( W x D x H )</b>	11.6 x 7.1 x 1.7 in. (294 x 180 x 44 mm)
<b>Power Supply</b>	100-200VAC, 50/60Hz
<b>Power Consumption</b>	Maximum: 13.3 W (220V/50Hz)
<b>Performance</b>	
<b>Switching Capacity</b>	32 Gbps
<b>Packet Forwarding Rate</b>	23.8 Mpps
<b>MAC Address Table</b>	8k
<b>Packet Buffer Memory</b>	2 MB
<b>Jumbo Frame</b>	10KB
<b>Green Technology</b>	Innovative energy-efficient technology saves power up to 15%
<b>Transfer Method</b>	Store-and-Forward
<b>Others</b>	
<b>Certification</b>	CE, FCC, RoHS
<b>Package Contents</b>	<ul style="list-style-type: none"> <li>● Switch</li> <li>● Power Cord</li> <li>● Installation Guide</li> <li>● Rackmount kit</li> <li>● Rubber Feet</li> </ul>
<b>System Requirements</b>	Microsoft Windows 8, 7, Vista, XP or MAC OS, NetWare, UNIX or Linux
<b>Environment</b>	<ul style="list-style-type: none"> <li>● Operating Temperature: 0°C~40°C (32°F~104°F),</li> <li>● Storage Temperature: -40°C~70°C (-40°F~158°F)</li> <li>● Operating Humidity: 10%~90% non-condensing,</li> <li>● Storage Humidity: 5%~90% non-condensing</li> </ul>
<b>Price</b>	PHP 3,290.00
Link: <a href="#">TP-Link TL-SG1016D 16-Port Gigabit Switch   Shopee Philippines</a>	



*TP-Link 8 Port Gigabit Switch, Easy Smart Managed Plug & Play, Desktop/Rackmount Sturdy Metal w/ Shielded Ports, Support QoS, VLAN, IGMP & Link Aggregation (TL-SG108S)*

### Specifications:

<b>Brand</b>	TP-Link
<b>Number of Ports</b>	8
<b>Included Components</b>	Installation Guide, Power Adapter, TL-SG108S, Rubber Feet
<b>Compatible Devices</b>	Desktop
<b>Switch Type</b>	Metal

### About this item:

- Full Gigabit Connection - 8× 10/100/1000Mbps RJ45 Ports expand network capacity and provide stable gigabit speed
- Plug and Play - A plug-and-play design makes for easy deployment, no technician needed. Auto-negotiation on each port senses the link speed of a network device and intelligently adjusts to ensure full compatibility and optimal performance
- Advanced Software Features - Prioritize your traffic and guarantee high-quality of video or voice data transmission with Port-based 802.1p/DSCP QoS and IGMP Snooping
- Flexible Design - Durable metal casing and desktop/wall-mounting design are well-suited for different environments
- TP-Link Secured Protection - Backed by our industry-leading limited lifetime warranty and 24/7 technical support, you can work with confidence

<b>Price</b>	PHP 1,570
<b>Link:</b> <a href="#">TP-Link TL-SG108 8-Port Gigabit Desktop Switch   Shopee Philippines</a>	

## WIFI Router



*TP-Link AC4000 Tri-Band WiFi Router (Archer A20) -MU-MIMO, VPN Server, 1.8GHz CPU, Gigabit Ports, Beamforming, Link Aggregation*

### Specifications:

<b>Brand</b>	TP-Link
<b>Model</b>	Archer A20
<b>Special Feature</b>	Homecare
<b>Frequency Band Class</b>	Tri-Band
<b>Wireless Communication Standard</b>	802.11ac
<b>Compatible Devices</b>	Gaming Console, Personal Computer, Smart Television
<b>Frequency</b>	5 GHz
<b>Recommended Uses For Product</b>	Security

<b>Included Components</b>	Router body, power supply, Ethernet Cable
<b>Connectivity Technology</b>	Wi-Fi Built In, Ethernet, Wi-Fi Ready
<b>About this item:</b>	
	<ul style="list-style-type: none"> <li>• Tri Band Wireless Internet Router for 4K video, streaming and gaming with incredible high-speed, 1625 Mbps on both 5 GHz bands and 750 Mbps on 2.4 GHz band</li> <li>• Archer A20 V3 with Powerful 1.8 GHz 64-bit CPU, three co-processors and 512 MB of RAM powers your home network. Works as a great gaming router.</li> <li>• Eliminate buffering with MU-MIMO technology letting you connect more devices simultaneously. Multiple requests and accelerate loading Times.</li> <li>• Range boost technology enables far reaching Wi-Fi for long range coverage throughout the Home. Supported Operating Systems: OS Independent Up to Windows 10, Mac OS 10.12 and Linux</li> <li>• Advanced security: Protect your network and connected devices with a free lifetime subscription to TP-Link HomeCare featuring next-level antivirus, robust parental controls, and QoS.</li> <li>• Gigabit Wired Speeds-1 WAN and 4 LAN gigabit ports bring wired speeds to the maximum and Link Aggregation even doubles it to 2 Gbps.</li> <li>• Works with all internet service providers, such as AT&amp;T, Verizon, Xfinity, Spectrum, RCN, Cox, CenturyLink, Frontier, etc.( a modem is required for most internet service providers)</li> </ul>
<b>Price</b>	
	USD 59.99 or PHP. 3,366.76
Link: <a href="https://www.amazon.com/TP-Link-AC4000-Smart-WiFi-Router/dp/B084HLB7LJ">https://www.amazon.com/TP-Link-AC4000-Smart-WiFi-Router/dp/B084HLB7LJ</a>	

## Firewall



*TP-Link ER605 V2 Wired Gigabit VPN Router, Up to 3 WAN Ethernet Ports + 1 USB WAN, SPI Firewall SMB Router, Omada SDN Integrated, Load Balance, Lightning Protection*

### Specifications:

<b>Brand</b>	TP-Link
<b>Model Name</b>	ER605
<b>Special Feature</b>	WPS
<b>Frequency Band Class</b>	Single-Band
<b>Compatible Devices</b>	Personal Computer
<b>Frequency</b>	5 GHz
<b>Included Components</b>	Gigabit VPN Router ER605, Power Adapter, RJ45 Ethernet Cable, Quick Installation Guide
<b>Connectivity Technology</b>	Ethernet

### About this item:

- Five Gigabit Ports - 1 Gigabit WAN Port + 2 Gigabit WAN/LAN Ports + 2 Gigabit LAN Port. Up to 3 WAN ports optimize bandwidth usage through one device.
- One USB WAN Port - Mobile broadband via 4G/3G modem is supported for WAN backup by connecting to the USB port.
- Integrated into Omada SDN - Omada's Software Defined Networking (SDN) platform integrates network devices including gateways, access points & switches with multiple control options offered – Omada Hardware controller, Omada Software Controller or Omada Cloud-based controller, Standalone mode also applies.
- Cloud Access& SDN Compatibility - Remote Cloud access and Omada app enables centralized cloud management of the whole network from different sites – all controlled

from a single interface anywhere, anytime.

- Abundant Security Features - Advanced firewall policies, DoS defense, IP/MAC/URL filtering, speed test, and more security functions protect your network and data.
- Highly Secure VPN - Supports up to 20× LAN-to-LAN IPsec, 16× OpenVPN, 16× L2TP, and 16× PPTP VPN connections.
- Limited Lifetime Protection - Backed by our industry-leading limited lifetime protection and free 24/7 technical support, you can work with confidence.
- Security - SPI Firewall, VPN Pass-through, FTP/H.323/PPTP/SIP/IPsec ALG, DoS Defence, Ping of Death, and Local Management. Standards and Protocols IEEE 802.3, 802.3u, 802.3ab, IEEE 802.3x, IEEE 802.1q

<b>Price</b>	PHP 2,390
Link : <a href="#">TP-Link ER605 Omada Gigabit VPN Router   Shopee Philippines</a>	

## NVR / Video Recorder and PoE Switch



*NVR5224-24-P-4KS2 - 24 Channel 1U 2HDDs 24PoE 4K & H.265 Pro Network Video Recorder*

<b>PoE</b>	24 ports (IEEE802.3af/at)
<b>Access Channel</b>	24
<b>Network Bandwidth</b>	320 Mbps for access, 320 Mbps for storage and 320 Mbps for forwarding
<b>Resolution</b>	12MP, 8MP, 6MP, 5MP, 4MP, 3MP, 1080p, 1.3MP, 720p, D1, and more
<b>Video Output</b>	HDMI1: 3840 × 2160; 1920 × 1080; 1280 × 1024; 1280 × 720 VGA1: 1920 × 1080; 1280 × 1024; 1280 × 720
<b>Multi-screen Display</b>	1/4/8/9/16/25
<b>Decoding Capability</b>	16-channel@1080P (30 fps)
<b>Third Party Camera Access</b>	Panasonic, Sony, Samsung, Axis, Pelco, Arecont, ONVIF, Canon and more
<b>HDD</b>	2 SATA III ports, up to 10 TB for a single HDD. The maximum HDD capacity varies with environment temperature

<b>Network</b>	1 RJ-45 10/100/1000 Mbps self-adaptive Ethernet port
<b>Storage Method</b>	Local HDD and network
<b>Price</b>	PHP 22,714.97
<b>Link</b>	<a href="https://www.router-switch.com/nvr5224-24p-4ks2.html">https://www.router-switch.com/nvr5224-24p-4ks2.html</a>

## IP- Cameras

### Varifocal Security Camera



RND543UBV

<b>Brand</b>	Rover Systems
<b>Model Name</b>	RND543UBV
<b>Sensor</b>	1/2.8" 2MP Progressive Scan, CMOS
<b>Lens</b>	4.5-148.5mm, AF automatic focusing and motorized lens
<b>Digital Zoom</b>	x16
<b>Optical Zoom</b>	x33
<b>Field of View</b>	Angle of View (H): 76.8°-2.1° Angle of View (V): 38.4°-1.2° Angle of View (O): 94.46°-2.48°
<b>Shutter</b>	Auto/Manual, Shutter Time: 1s-1/100000s
<b>Minimum Illumination</b>	Colour 0.001 Lux (F1.5, AGC ON); 0 Lux with IR
<b>Iris</b>	F1.5-F4.0
<b>Day/Night</b>	IR-cut filter with auto switch (ICR)
<b>IR Range</b>	Up to 150m (492ft)
<b>Video Compression</b>	H.265+, H.265, H.264, MJPEG
<b>Frame Rate and Resolution</b>	Mainstream 2MP (1920x1080): Max 30 fps; Sub Stream 2MP (1920x1080): Max. 30 fps; Third Stream D1 (720x576): Max. 30 fps

<b>Protocols</b>	IPv4, IGMP, ICMP, ARP, TCP, UDP, DHCP, PPPoE, RTP, RTSP, RTCP, DNS, DDNS, NTP, FTP, UPnP, HTTP, HTTPS, SMTP, 802.1x, SMNP, SSL, QoS
<b>Pan Range</b>	360°
<b>Pan Speed</b>	0.1°/s - 300°/s; Preset Speed 200°/s
<b>Tilt Range</b>	-15° - +90° (auto reverse)
<b>Tilt Speed</b>	0.1°-80°/s; Preset Speed 80°/s
<b>Number of Presets</b>	1024
<b>Patrol</b>	Preset Patrol, Route Patrol, Recorded Patrol
<b>Interface</b>	Audio I/O: 1 Input: impedance 1 kΩ±10%; amplitude 2V [p-p], 1 Output: impedance 600Ω; amplitude 2V [p-p] Alarm I/O: 2/1 Network: 1 RJ45 10M/100M Base-TX Ethernet
<b>Power</b>	DC12V±25%, PoE (PSE Required), Power Consumption: 16-30W
<b>Dimensions</b>	220mmx369mm (8.7"x14.5")
<b>Weight</b>	3 Kg
<b>Working Environment</b>	-40°C - +65°C(-40°F - 149°F), Humidity: 10%-90%
<b>Product Features:</b> Up to 2 Megapixel (1920x1080) resolution;	
<ul style="list-style-type: none"> <li>● 33x Optical Zoom;</li> <li>● Low light illumination;</li> <li>● Fifth-generation infrared technology, Smart IR, more than 150m (492ft) IR Distance;</li> <li>● IR anti-reflection window to increase the infrared transmittance;</li> <li>● Optical glass window with higher light transmittance;</li> <li>● EIS (Electronic Image Stabilization);</li> <li>● H.265+, H.265, H.264, MJPEG;</li> <li>● Embedded smart algorithm;</li> <li>● Customized OSD;</li> <li>● ONVIF Conformance;</li> <li>● Intelligent temperature control technology;</li> <li>● More effective heat dissipation system;</li> <li>● 6 KV surge protection designed for network interface;</li> <li>● Ingress Protection: IP66</li> </ul>	
<b>Price</b>	PHP. 6,860
<b>Link:</b> <a href="https://shopee.ph/Rover-Systems-2MP-1080P-E-Series-IP-Dome-Varifocal-CCTV-Camera-Indoor-Security-Camera-8000-ESeries">https://shopee.ph/Rover-Systems-2MP-1080P-E-Series-IP-Dome-Varifocal-CCTV-Camera-Indoor-Security-Camera-8000-ESeries</a>	

**53° - 103° FOV**



*DS-2CD2046G2-I(U)*

**Specifications:**

<b>Brand</b>	HIKVISION
<b>Model Name</b>	DS-2CD2046G2-I(U)
<b>CAMERA</b>	
<b>Image Sensors</b>	1/3" Progressive Scan CMOS
<b>Max. Resolution</b>	2688 × 1520
<b>Min. Illumination</b>	Color: 0.003 Lux @ (F1.4, AGC ON), B/W: 0 Lux with IR
<b>Shutter Time</b>	1/3 s to 1/100,000 s
<b>Day &amp; Night</b>	IR cut filter
<b>Angle Adjustment</b>	Pan: 0° to 360°, tilt: 0° to 90°, rotate: 0° to 360°
<b>LENS</b>	
<b>Lens Type</b>	Fixed focal lens, 2.8, 4, and 6 mm
<b>Iris Type</b>	Fixed
<b>Focal Length &amp; FOV</b>	<ul style="list-style-type: none"><li>• 2.8 mm, horizontal FOV: 103°, vertical FOV: 55°, diagonal FOV: 123°</li><li>• 4 mm, horizontal FOV: 83°, vertical FOV: 45°, diagonal FOV: 98°</li><li>• 6 mm, horizontal FOV: 53°, vertical FOV: 29°, diagonal FOV: 62°</li></ul>
<b>Aperture</b>	F1.4
<b>ILLUMINATOR</b>	

<b>IR Range</b>	Up to 40 m
<b>VIDEO</b>	
<b>Max Resolution</b>	60 Hz, 30 fps (2688 × 1520, 1920 × 1080, 1280 × 720)
<b>IMAGE</b>	
<b>Day/Night Switch:</b>	<b>Day/Night Switch:</b> Day, Night, Auto, Schedule
<b>WDR</b>	120 dB
<b>SNR</b>	≥ 52 dB
<b>Image Enhancement</b>	BLC, HLC, 3D DNR
<b>INTERFACE</b>	
<b>Ethernet Interface:</b>	1 RJ45 10 M/100 M self-adaptive Ethernet port
<b>On-Board Storage:</b>	Built-in micro SD/SDHC/SDXC slot, up to 512 GB
<b>NETWORK</b>	
<b>Simultaneous Live View</b>	Up to 6 channels
<b>Price</b>	USD 122.99 or PHP. 6,899.12
<b>Link:</b>	
<a href="https://www.hikdistribution.com/products/4-mp-acusense-strobe-light-and-audible-warning-fixed-mini-bullet-network-camera-hikvision-ds-2cd2046g2-iu-sl">https://www.hikdistribution.com/products/4-mp-acusense-strobe-light-and-audible-warning-fixed-mini-bullet-network-camera-hikvision-ds-2cd2046g2-iu-sl</a>	

## Wireless Access Point (WAP)

TL-WA3001 AX3000 Gigabit Wi-Fi 6 Access Point



Hardware Features	
Interface	1 Gigabit Port (Supports Passive PoE)
Antenna Type	4 Fixed High Performance Antennas
Button	Power On/Off Button, WPS Button, Reset Button
External Power Supply	48V/0.5A
Dimensions ( W x D x H )	9.4×6.5×1.7 in (240×165×43.6mm)
Wireless Features	
Signal Rate	2402 Mbps at 5 GHz, 574 Mbps at 2.4 GHz
Transmit Power	FCC: <23dBm(2.4GHz), <22dBm(5GHz)

<b>Software Features</b>	
<b>Quality of Service</b>	WMM
<b>DHCP</b>	Server, DHCP Client List
<b>Protocols</b>	IPv4, IPv6
<b>Others</b>	
<b>Package Contents</b>	Wireless Access Point TL-WA3001 Power Adapter RJ45 Ethernet Cable Quick Installation Guide PoE Power Injector
<b>Price</b>	PHP. 3,920.00
<b>Link</b>	<a href="https://www.amazon.com/TP-Link-TL-WA3001-WiFi-AX3000-Wireless-Gigabit-Access-Point-Desktop-Wi-Fi-Bridge-HE160-Beamforming-Supports-Multi-SSID-Client-Range-Extender-Mode">Amazon.com: TP-Link TL-WA3001 WiFi 6 AX3000 Wireless Gigabit Access Point   Desktop Wi-Fi Bridge   HE160 &amp; Beamforming   Supports Multi-SSID/Client/Range Extender Mode</a>

## Wireless AP Controller



*TL-SG2424P, 24-Port Gigabit Smart PoE Switch with 4 Combo SFP Slots*

### Specifications:

Overview:	
<ul style="list-style-type: none"><li>Supports 24 802.3at/af-compliant POE+ ports with a total power supply of 180W</li><li>Integrated security strategy including 802.1Q VLAN, Port Security and Storm control help protect LAN area investment</li><li>L2/L3/L4 QoS and IGMP snooping optimize voice and video applications</li><li>WEB/CLI managed modes, SNMP, RMON bring abundant management features</li></ul>	
HARDWARE FEATURES	
<b>Standards and Protocols</b>	<ul style="list-style-type: none"><li>IEEE 802.3i, IEEE 802.3u, IEEE 802.3ab, IEEE 802.3z, IEEE 802.3ad,</li><li>IEEE 802.3x, IEEE 802.1d, IEEE 802.1s, IEEE 802.1w, IEEE 802.1q,</li><li>IEEE 802.1p</li></ul>
<b>Interface</b>	<ul style="list-style-type: none"><li>24 10/100/1000Mbps RJ45 Ports</li><li>(Auto Negotiation/Auto MDI/MDIX)</li><li>4 Combo 100/1000Mbps SFP Slots</li></ul>
<b>Network Media</b>	<ul style="list-style-type: none"><li>10BASE-T: UTP category 3, 4, 5 cable (maximum 100m)</li><li>100BASE-TX/1000Base-T: UTP category 5, 5e or above cable (maximum 100m)</li><li>1000BASE-X: MMF, SMF</li></ul>
<b>Fan Quantity</b>	3
<b>Power Supply</b>	100~240VAC, 50/60Hz
<b>Power Consumption</b>	Maximum (PoE on): 216W (220V/50Hz) Maximum (PoE off): 36W (220V/50Hz)

<b>PoE+ Ports(RJ45)</b>	Standard: 802.3at/af compliant PoE+ Ports: 24 Ports Power Supply: 180W
<b>Dimensions ( W x D x H )</b>	17.32*13*1.73 in.(440*330*44 mm)
<b>PERFORMANCE</b>	
<b>Bandwidth/Backplane</b>	48Gbps
<b>Packet Forwarding Rate</b>	35.7Mpps
<b>MAC Address Table</b>	8K
<b>Jumbo Frame</b>	10240 Bytes
<b>SOFTWARE FEATURES</b>	
<b>Quality of Service</b>	<ul style="list-style-type: none"> <li>Support 802.1p CoS/DSCP priority</li> <li>Support 4 priority queues</li> <li>Queue scheduling: SP, WRR, SP+WRR</li> <li>Port/Flow- based Rate Limiting</li> <li>Voice VLAN</li> </ul>
<b>L2 Features</b>	<ul style="list-style-type: none"> <li>IGMP Snooping V1/V2/V3</li> <li>802.3ad LACP (Up to 6 aggregation groups, containing 4 ports per group)</li> <li>Spanning Tree STP/RSTP/MSTP</li> <li>LLDP, LLDP-Med</li> <li>BPDU Filtering/Guard</li> <li>TC/Root Protect</li> <li>Loop back detection</li> <li>802.3x Flow Control</li> </ul>
<b>VLAN</b>	Supports up to 512 VLANs simultaneously (out of 4K VLAN IDs)
<b>Access Control List</b>	<ul style="list-style-type: none"> <li>L2~L4 package filtering based on source and destination MAC address,</li> <li>IP address, TCP/UDP ports</li> <li>Time Range Based</li> </ul>
<b>Security</b>	<ul style="list-style-type: none"> <li>SSH v1/v2</li> <li>SSL v2/v3/TLSv1</li> <li>Port Security</li> <li>Broadcast/Multicast/Unknown-unicast Storm Control</li> </ul>
<b>Management</b>	<ul style="list-style-type: none"> <li>Web-based GUI and CLI management</li> <li>SNMP v1/v2c/v3,compatible with</li> </ul>

	<ul style="list-style-type: none"> <li>• public MIBs and TP-LINK private MIBs</li> <li>• RMON (1, 2, 3, 9 groups)</li> <li>• DHCP/BOOTP Client,DHCP Filtering</li> <li>• CPU Monitoring</li> <li>• Port Mirroring</li> <li>• Time Setting: SNTP</li> <li>• Firmware Upgrade: TFTP &amp; Web</li> <li>• System Diagnose: VCT</li> <li>• SYSLOG &amp; Public MIBS</li> </ul>
<b>OTHERS</b>	
<b>Certification</b>	CE, FCC, RoHS
<b>Package Contents</b>	<ul style="list-style-type: none"> <li>• Switch</li> <li>• Power Cord</li> <li>• Quick Installation Guide</li> <li>• Resource CD</li> <li>• Rackmount Kit</li> <li>• Rubber Feet</li> </ul>
<b>System Requirements</b>	Microsoft® Windows® 98SE, NT, 2000, XP, Vista™, Windows 7 or Windows 8, MAC® OS, NetWare®, UNIX® or Linux.
<b>Environment</b>	<ul style="list-style-type: none"> <li>• Operating Temperature: 0°C~40°C (32°F~104°F);</li> <li>• Storage Temperature: -40°C~70°C (-40°F~158°F)</li> <li>• Operating Humidity: 10%~90% non-condensing</li> <li>• Storage Humidity: 5%~90% non-condensing</li> </ul>
<b>Price</b>	PHP 16,698.20
Link: <a href="https://www.amazon.com/TP-Link-24-Port-Gigabit-Ethernet-Smart-PoE-Switch-with-4-Combo-SFP-Slots-TL-SG2424P-Black/dp/B00KJZDQWU">Amazon.com: TP-Link 24-Port Gigabit Ethernet Smart PoE Switch with 4-Combo SFP Slots (TL-SG2424P),Black</a>	

## Fiber Optic Distribution Box



The Mini Fiber Distribution Hub (FDH) 3000 is specifically designed to address the unique density requirements commonly found in multi-dwelling units (MDUs) and in rural fiber deployments.

The Mini FDH 3000 provides maximum density termination capacity of eight feeder fibers and 72 distribution fibers and includes spliced or MPO connections for distribution and feeder ports.

### FEATURES:

- Universal wall/pole bracket shipped with unit
- Accommodates up to 4 plug-and-play (PNP) splitters
- High density sliding pack circuit access
- Supports 12 to 72 fiber terminations
- The same Mini FDH will serve both indoor and outdoor applications
- Integrated splicing and MPO connection configurations available
- Parking-Lot storage for 32 fibers
- Sealed bottom cable entry
- Small footprint (HxWxD): 19" x 13" x 8" takes up less space on poles and walls
- Uses the same splitter as all other OSP products

Link:

<https://www.tvcinc.com/fiber-cable-connectivity/mini-fiber-distribution-hub-fdh-3000/>

Price: PHP. 23,540.00

## Network Rack

NavePoint 9U Open-Frame Server Rack for 19" IT Network Equipment



Brand	<b>NavePoint</b>
Color	<b>Black</b>
Dimensions	<b>19.5 x 20 x 18 inches</b>
Material	<b>Alloy Steel</b>
Compatible Devices	<b>Servers</b>
<b>About this item:</b>	
<ul style="list-style-type: none"><li>• Durable: 9U rack is made of high-quality 1.5mm cold-rolled steel with black powder coating. Max weight capacity 55 Lbs</li><li>• Easy Access: Easy access to equipment and cables with the open frame rack and dual-hinged front swing gate that opens 180 degrees</li><li>• Space-Efficient: Use free-standing network cabinet or wall mount to maximize the use of available space</li><li>• Ventilation: Open frame rack promotes passive cooling of networking gears and AV components</li><li>• Compliances &amp; Assembly: CE, EIA/ECA-310-E Easy to install, hardware and lock keys are included</li></ul>	
<b>Price:</b> PHP 5,100.00	
<b>Link:</b> <a href="https://www.amazon.com/NavePoint-Open-Frame-Server-Rack/dp/B00KJLWVQY">Amazon.com: NavePoint 9U Open-Frame Server Rack for 19" IT Network Equipment &amp; A/V Devices Free Standing or Wall Mount with 180 Degrees Gate Swing, Black : Electronics</a>	

## **Flexible Hose**



Sizes: Available in  $\frac{1}{2}$ " and  $\frac{3}{4}$ "

Price: PHP. 315 - 600 / 50 or 100 meters

Link:

[https://shopee.ph/Flexible-Hose-ORANGE-1-2-X50M-3-4-X50M-i.69820221.8090739501?sp\\_atk=20cb6ba4-5b7c-41fe-ac6e-3570dc363f87&xptdk=20cb6ba4-5b7c-41fe-ac6e-3570dc363f87](https://shopee.ph/Flexible-Hose-ORANGE-1-2-X50M-3-4-X50M-i.69820221.8090739501?sp_atk=20cb6ba4-5b7c-41fe-ac6e-3570dc363f87&xptdk=20cb6ba4-5b7c-41fe-ac6e-3570dc363f87)

## CAT 6 UTP Ethernet Lan Cable



## CAT6 Outdoor UTP Lan Cable

- 23AWG with 4 pairs copper
- HDPE Insulation
- PVC + PE Jacket
- High Performance Network Cable
- Can be used indoor and Outdoor
- Waterproof Cable
- 305m
- Thicker Outer layer, VERY GOOD for Outdoor Purposes.

Price: PHP. 1,890.00 / 305 meter

Link:

[https://shopee.ph/COMLINK-CAT6-Quality-Outdoor-UTP-Ethernet-LAN-Cable-305m-i.199191933.5633217700?sp\\_atk=3470af1e-7718-4133-a7d3-3883ed8e5631&xptdk=3470af1e-7718-4133-a7d3-3883ed8e5631](https://shopee.ph/COMLINK-CAT6-Quality-Outdoor-UTP-Ethernet-LAN-Cable-305m-i.199191933.5633217700?sp_atk=3470af1e-7718-4133-a7d3-3883ed8e5631&xptdk=3470af1e-7718-4133-a7d3-3883ed8e5631)

## Telecommunication Port



Color	White
Port	RJ45 / LANx4
RJ45 Version	CAT 6
Type	Female to Female
Size	86x86mm
Panel Material	Flame Retardant Plastic
Screw Hole Distance	60mm
Price: PHP 245.52	

## Telephone



FANVILX1SP ENTERPRISE IP PHONE

### Overview

- 2 SIP lines, 3-way conference, SIP hotspot
- 1000 local phonebook, caller ID, call hold, call transfer
- 128x48 Dot-matrix display
- HD audio on speakerphone and handset
- Support EHS wireless headset
- Dual Fast ports, integrated PoE
- Stand with 2 adjustable angles of 45 and 50 degrees
- Compatible with major platforms: Asterisk, BroadSoft, 3CX, Metaswitch, Elastix
- Price: ₦3,150.00

### Specifications

<b>Generic</b>	<ol style="list-style-type: none"><li>1. 2 SIP Lines</li><li>2. HD Voice</li><li>3. PoE Enabled (Only X1SP)</li><li>4. 128x48 Dot-matrix display screen</li><li>5. Handset / Hands-free / Headset mode</li><li>6. Desktop Stand / Wall-mounted (need an additional wall hanging parts)</li><li>7. Optional External Power Supply</li></ol>
<b>Call Features</b>	<ol style="list-style-type: none"><li>1. Call out / Answer / Reject</li><li>2. Mute / Unmute (Microphone)</li></ol>

	<ul style="list-style-type: none"> <li>3. Call Hold / Resume</li> <li>4. Call Waiting</li> <li>5. Intercom</li> <li>6. Caller ID Display</li> <li>7. Speed Dial</li> <li>8. Anonymous Call (Hide Caller ID)</li> <li>9. Call Forward (Always/Busy/No Answer)</li> <li>10. Call Transfer (Attended/Unattended)</li> <li>11. Call Parking/Pick-up (Depending on server)</li> <li>12. Redial</li> <li>13. Do-Not-Disturb</li> <li>14. Auto-Answering</li> <li>15. Voice Message (With server)</li> <li>16. 3-way Conference</li> </ul>
<b>Phone Features</b>	<ul style="list-style-type: none"> <li>1. Local Phonebook (1000 entries)</li> <li>2. Remote Phonebook (XML/LDAP, 1000 entries)</li> <li>3. Call logs (In/Out/Missed, 600 entries)</li> <li>4. Black/White List Call Filter</li> <li>5. Voice Message Waiting Indication (VMWI)</li> <li>6. Programmable DSS/Soft keys</li> <li>7. Network Time Synchronization</li> <li>8. Support Plantronics wireless headset (Through Plantronics APD-80 EHS Cable)</li> <li>9. Support Jabra wireless headset (Through Fanvil EHS20 EHS Cable)</li> <li>10. Support Recording (Through Server)</li> <li>11. uaCSTA</li> <li>12. Action URL / Active URI</li> </ul>
<b>Audio</b>	<ul style="list-style-type: none"> <li>1. HD Voice Microphone/Speaker (Handset/Hands-free, 0 ~ 7KHz Frequency Response)</li> <li>2. Wideband ADC/DAC 16KHz Sampling</li> <li>3. Narrowband Codec: G.711a/u, G.723.1, G.726-32K, G.729AB, AMR, iLBC</li> <li>4. Wideband Codec: G.722, AMR-WB, Opus</li> <li>5. Full-duplex Acoustic Echo Canceller (AEC)</li> <li>6. Voice Activity Detection (VAD) / Comfort Noise Generation (CNG) / Background Noise Estimation (BNE) / Noise Reduction (NR)</li> <li>7. Packet Loss Concealment (PLC)</li> <li>8. Dynamic Adaptive Jitter Buffer up to 300ms</li> <li>9. DTMF: In-band, Out-of-Band – DTMF-Relay (RFC2833) / SIP INFO</li> </ul>

<b>Networking</b>	<ol style="list-style-type: none"> <li>1. Physical: 10/100/1000 Mbps Ethernet, dual bridged port for PC bypass</li> <li>2. IP Mode: IPv4/IPv6/IPv4&amp;IPv6</li> <li>3. IP Configuration: Static / DHCP / PPPoE</li> <li>4. Network Access Control: 802.1x</li> <li>5. VPN: L2TP / OpenVPN</li> <li>6. VLAN</li> <li>7. LLDP</li> <li>8. QoS</li> <li>9. RTCP-XR(RFC3611),VQ-RTCPXR(RFC6035)</li> </ol>
<b>Protocols</b>	<ol style="list-style-type: none"> <li>1. SIP2.0 over UDP/TCP/TLS</li> <li>2. RTP/RTCP/SRTP</li> <li>3. STUN</li> <li>4. DHCP</li> <li>5. IPv6</li> <li>6. LLDP</li> <li>7. PPPoE</li> <li>8. 802.1x</li> <li>9. L2TP</li> <li>10. OpenVPN</li> <li>11. SNTP</li> <li>12. FTP/TFTP</li> <li>13. HTTP/HTTPS</li> <li>14. TR-069</li> </ol>
<b>Deployment &amp; Maintenance</b>	<ol style="list-style-type: none"> <li>1. Auto-Provisioning via FTP/TFTP/HTTP/HTTPS/DHCP OPT66/SIP PNP/TR-069</li> <li>2. Web Management Portal</li> <li>3. Web-based Packet Dump</li> <li>4. Configuration Export / Import</li> <li>5. Phonebook Import/Export</li> <li>6. Firmware Upgrade</li> <li>7. Syslog</li> </ol>
<b>Physical Specifications</b>	<ol style="list-style-type: none"> <li>1. Main LCD x1: 128x48 Dot-matrix screen with backlight</li> <li>2. Keypad: 34 keys, including</li> <li>3. 4 Soft-keys</li> <li>4. 9 Function keys (Hold/Transfer/Conference/Phonebook/MWI/He adset/Redial)</li> <li>5. 2 Line keys (With LED Indicator Light)</li> </ol>

	<p>6. 6. 4 Navigation keys      7. 1 OK key      8. 12 Standard Phone Digits keys      9. 3 Volume Control keys (Up/Down/Mute (Microphone))      10. 1 Hands-free key      11. HD Handset (RJ9) x1      12. Standard RJ9 Handset Wire x1      13. 1.5M CAT5 Ethernet Cable x1      14. Back Rack x1      15. Status Indicator Light x1 (Red)      16. RJ9 Port x2: Handset x1, Headset x1      17. RJ45 Port x2: Network x1, PC x1 (Bridged to Network)      18. Safety Keyhole x1      19. DC Power Input: 5V/0.6A      20. Power Consumption: Idle 0.9~1.65W, Peak 1.8~2.95W      21. Working Temperature: 0~45°C      22. Working Humidity: 10~95%</p>
Link	<a href="https://s.lazada.com.ph/s.hKf3E">https://s.lazada.com.ph/s.hKf3E</a>

## Computer Setup



CPU: Intel Core i5-11400F

GPU: Integrated Graphics (e.g., Intel UHD Graphics 730) - Included with CPU

RAM: 8GB DDR4

Storage: 256GB SSD

Monitor: 23.8-inch Full HD LED

Keyboard and Mouse: Basic USB Keyboard and Mouse Combo

Operating System: Windows 10 (Education License) - (included with educational licensing)

Estimated Price per Computer: PHP. 25,000.00

## Raceway



*PVC Cable Tray/Duct Slotted 2.0 Meter Length 30 x 30mm/50 x 50mm/80 x 80mm*

<b>Size</b>	<b>50x50cm</b>
<b>Price</b>	<b>PHP 300.00</b>
Link: <a href="#">Raceway   Lazada Philippines</a>	

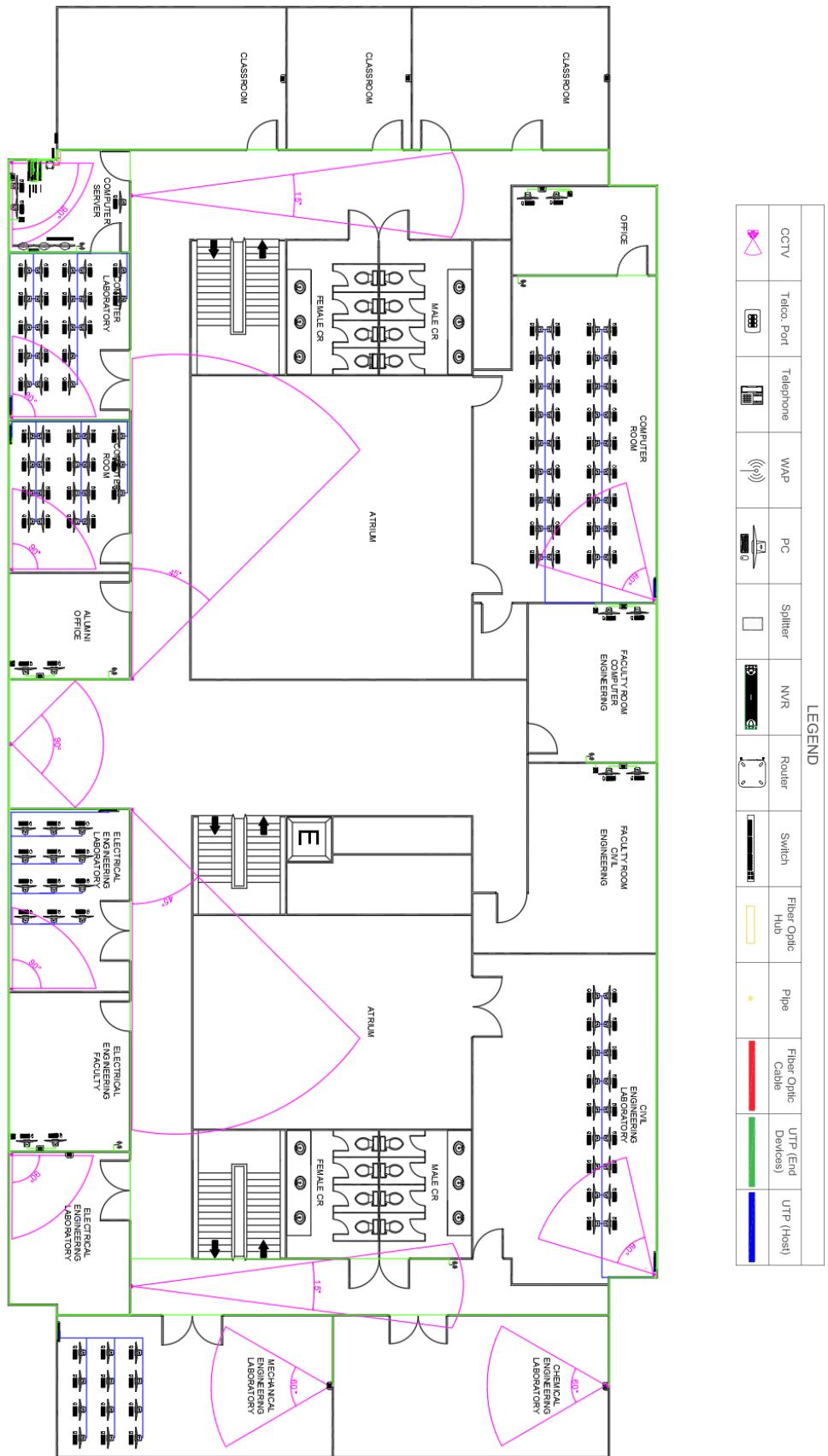
# **BILL OF MATERIALS**

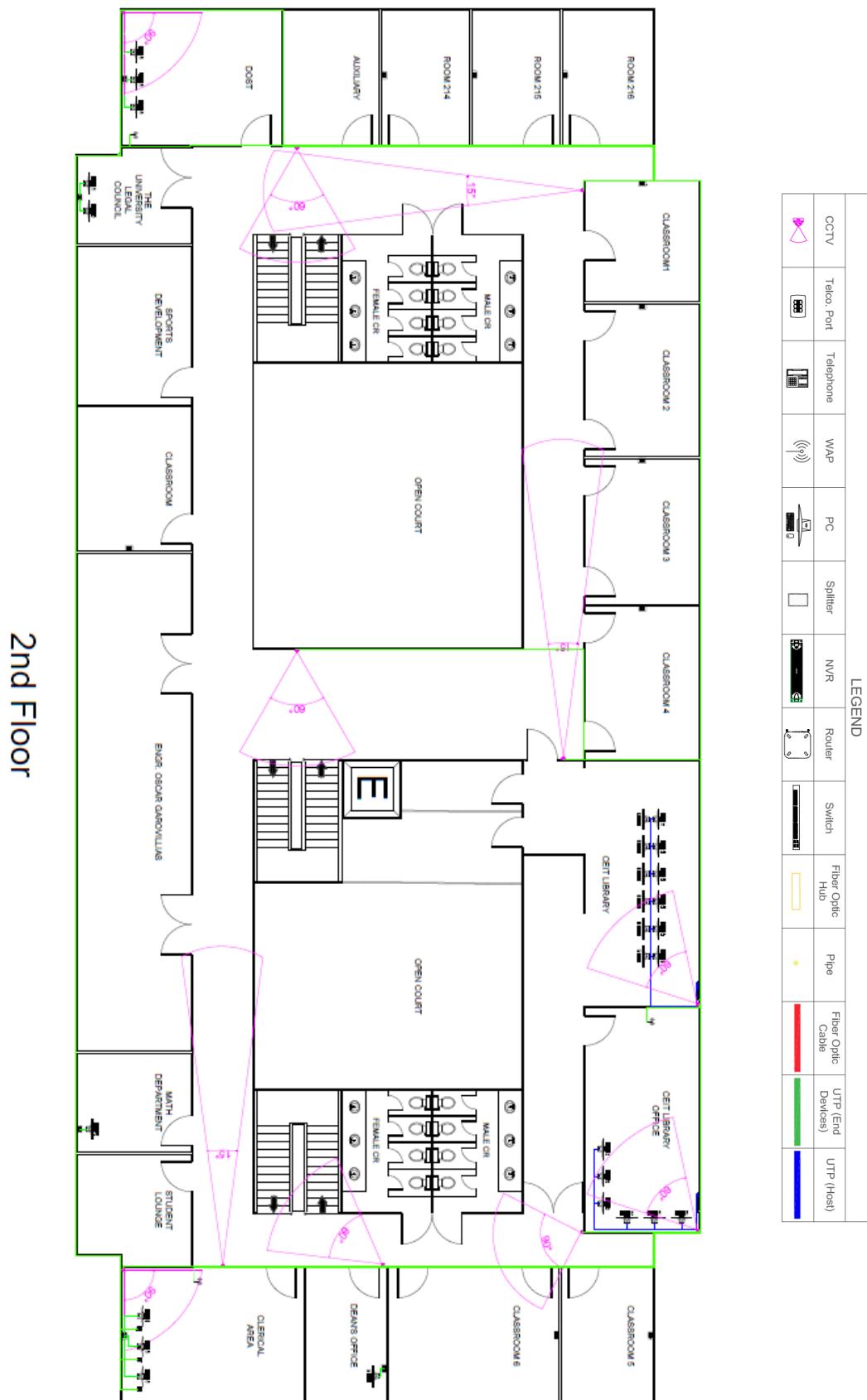
## **Bill of Materials:**

<b>Product</b>	<b>Quantity</b>	<b>Price (Php)</b>	<b>Total</b>
<b>TP - Link 48 Port Gigabit Switch</b>	1	15,990.00	15,990.00
<b>TP - Link 24 Port Gigabit Switch</b>	5	5,290.00	26,450.00
<b>TP - Link 16 Port Gigabit Switch</b>	3	3,290.00	9,870.00
<b>TP - Link 8 Port GigaBit Switch</b>	1	1,570.00	1,570.00
<b>TL-SG2424P 24 Port Gigabit PoE Switch</b>	2	16,698.20	33,396.40
<b>NVR522424-P-4KS2</b>	2	22,714.97	45,429.94
<b>FANVIL X1SP</b>	15	3,150.00	47,250.00
<b>DS-2CD2046G2-I(U)</b>	16	6,899.12	110,385.92
<b>RND543UBV</b>	28	6,860.00	192,080.00
<b>TP-Link ER605 V2</b>	1	2,390.00	2,390.00
<b>TP-Link AC4000</b>	1	3,366.76	3,366.76
<b>Computer Setup</b>	194	25,000.00	4,850,000.00
<b>TL-WA3001</b>	15	3,920.00	58,800.00
<b>UTP Cable</b>	10	1,890.00/305m	18,900.00
<b>Telecommunication Port</b>	67	245.52	16,449.84
<b>NavePoint 9U Open-Frame Server Rack</b>	1	5,100.00	5,100.00
<b>Mini Fiber Distribution Hub 3000</b>	1	23,540.00	23,540.00
<b>Flexible hose</b>	8	300.00 - 600.00	2,400.00 - 4,800.00
<b>Raceway</b>	35	282.54/2m	9,888.90
			<b>5,470,857.76</b>

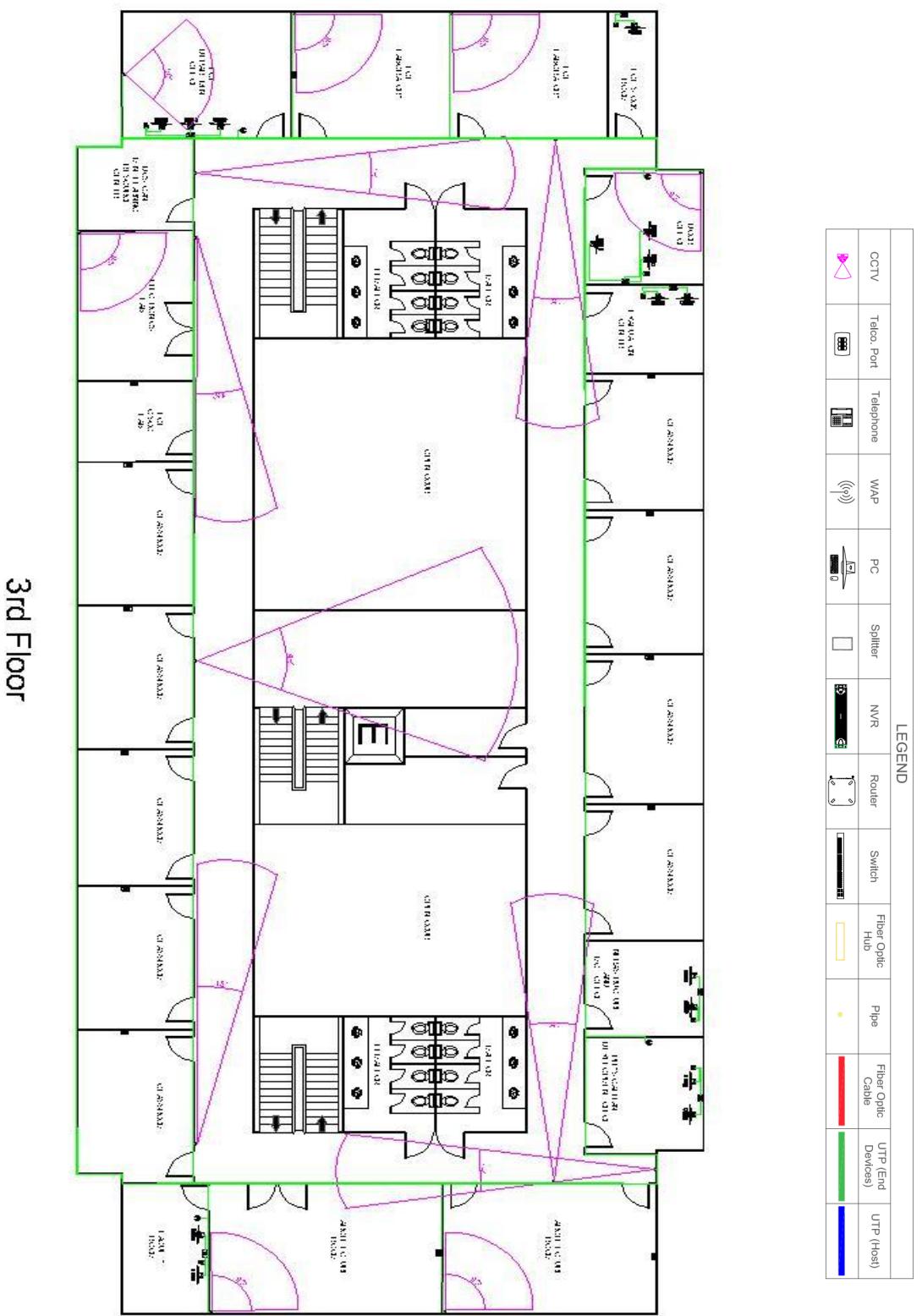
# LAYOUT

## ITC Ground Floor



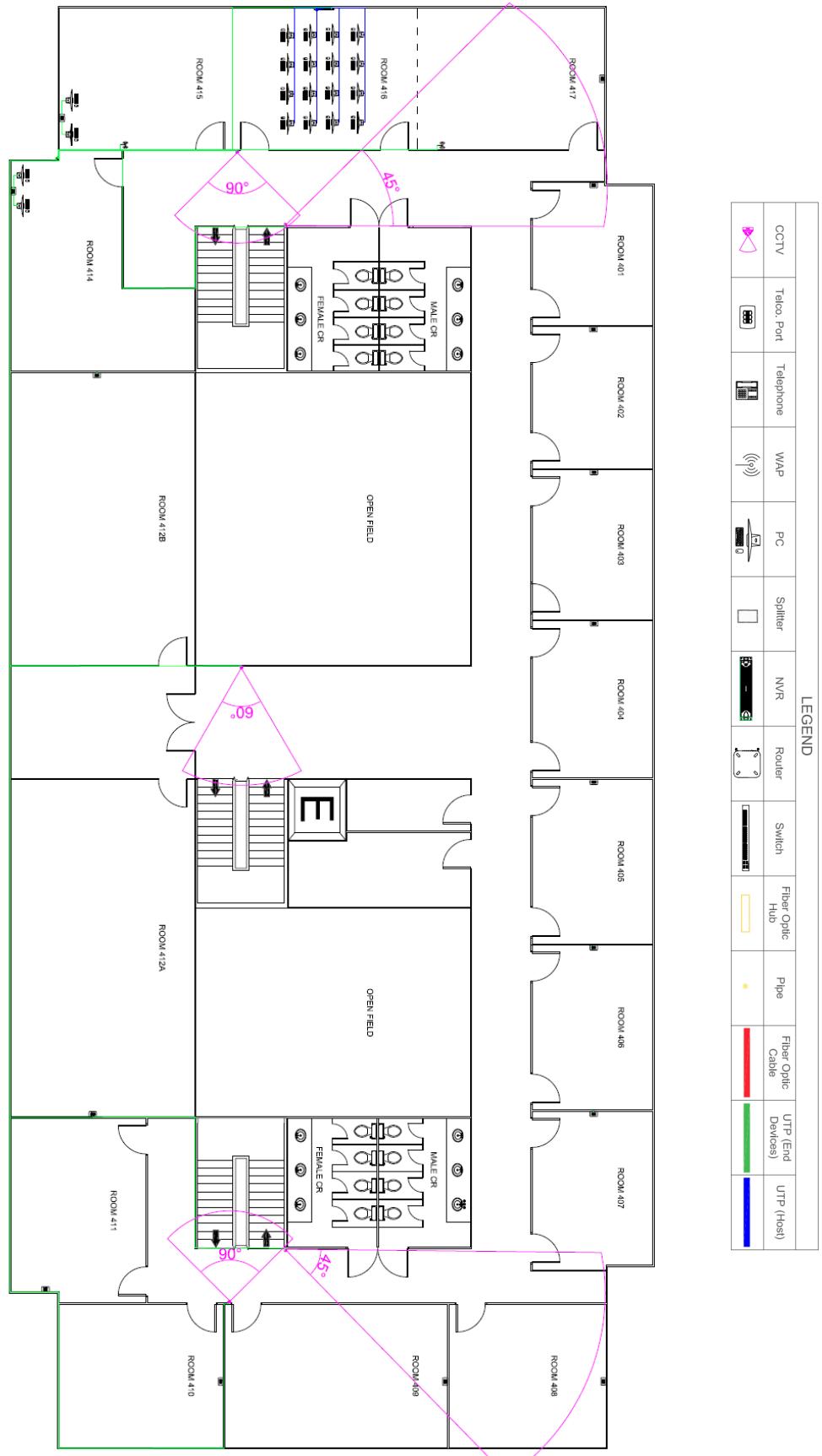


2nd Floor



3rd Floor

## 4th Floor



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