August 19, 2021

BID BULLETIN NO. 1

PROJECT : Supply, Delivery, Installation, Testing, Training and Maintenance of Department of Education Central Office Network Rehabilitation Project

PROJECT NO. : 2021-ICTS3(002)-BII-CB-017

This Bid Bulletin is hereby issued for the information and guidance of all prospective bidders. It shall form an integral part of the bidding documents issued earlier relative to above project.

1. Section I. Invitation to Bid

Provision	Original Provision	Provision, as amended
Item 7	Bids must be duly received by the BAC Secretariat on or before ***10:00 A.M. of August 23, 2021 at Bulwagan ng Karunungan, Ground Floor, Rizal Building, DepEd Complex, Meralco Ave., Pasig City***. **Late bids shall not be accepted.**	Bids must be duly received by the BAC Secretariat on or before ***10:00 A.M. of August 26, 2021 at Bulwagan ng Karunungan, Ground Floor, Rizal Building, DepEd Complex, Meralco Ave., Pasig City***. **Late bids shall not be accepted.**
Item 9	Bid opening shall be on ***August 23, 2021, 10:00 A.M. at Bulwagan ng Karunungan, Ground Floor, Rizal Building, DepEd Complex, Meralco Ave., Pasig City***. Bids will be opened in the presence of the bidders' representatives who choose to attend the activity. In adherence to health protocols and to ensure the safety of everybody, all participants to the submission and opening of bids for the above project are required to present a latest negative result of rapid test/ swab test/ antigen test,	Bid opening shall be on ***August 26, 2021, 10:00 A.M. at Bulwagan ng Karunungan, Ground Floor, Rizal Building, DepEd Complex, Meralco Ave., Pasig City***. Bids will be opened in the presence of the bidders' representatives who choose to attend the activity. In adherence to health protocols and to ensure the safety of everybody, all participants to the submission and opening of bids for the above project are required to present a latest negative result of rapid test/ swab test/ antigen

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	before entering the premises of the Department of Education. Only one (1) representative per bidder will be allowed entry into the premises. **For the purpose of constituting a quorum**, both the physical and virtual presence of the BAC and TWG members shall be considered pursuant to GPPB Resolution No. 09-2020.	test, before entering the premises of the Department of Education. Only one (1) representative per bidder will be allowed entry into the premises. **For the purpose of constituting a quorum**, both the physical and virtual presence of the BAC and TWG members shall be considered pursuant to GPPB Resolution No. 09-2020.

2. Section VII. Technical Specifications

ORIGINAL PROVISION	PROVISION, as amended
FIBER OPTIC & STRUCTURED CABLING MATERIALS	
The proposed Fiber Optic and Structured Cabling must include the following components: a. FOC Multimode mode 6 core FTTH Cable (3,000 Meters) b. FOC single mode 48 core outdoor armored cable (1,000 meters) c. Fiber Panel (ODF 24 Ports loaded w/ coupler and single mode LC pigtail (20 Pieces) d. Fiber Patch cord single mode (LC to LC duplex connector 3m) (100 Pieces) e. Fiber termination box (ODN FTTH loaded w/ 2 LC coupler and pigtail) (60 Pieces) f. 4-PAIR CAT 6 UT Cable 305m/roll (350 rolls) g. 24-Port Patch Panel loaded (50 Pieces) h. Information Outlet (250 Pieces) i. Faceplate Duplex (2-Gang) (80 Pieces) j. Cat 6 Patch cord 1m (200 Pieces) k. Cat 6 Patch cord 2m (200 Pieces) l. Cat 6 Patch cord 3m (200 Pieces) m. IDF Mounted Rack (23 Pieces) n. 72U DATA RACK (MDF) (1 Unit)	The proposed Fiber Optic and Structured Cabling must include the following components: a. FOC **OM4** Multimode mode 6 core ~~FTTH~~ Cable (3,000 Meters) b. FOC **OS1/OS2** single mode 48 core outdoor armored cable (1,000 meters) c. Fiber Panel (ODF 24 Ports loaded w/ coupler and single mode LC pigtail (20 Pieces) d. Fiber Patch cord single mode (LC to LC duplex connector 3m) (100 Pieces) e. ~~Fiber termination box (ODN FTTH loaded w/ 2 LC coupler and pigtail) (60 Pieces)~~ **f. Fiber Patch cord multi-mode OM4 50/125 (LC to LC duplex connector 3m) (100 Pieces)** g. 4-PAIR CAT 6 UT Cable 305m/roll (350 rolls) h. 24-Port Patch Panel loaded (50 Pieces) i. Information Outlet (250 Pieces) j. Faceplate Duplex (2-Gang) (80 Pieces) k. Cat 6 Patch cord 1m (200 Pieces) l. Cat 6 Patch cord 2m (200 Pieces) m. Cat 6 Patch cord 3m (200 Pieces) n. IDF Mounted Rack (23 Pieces) o. ~~72U~~ **42U** DATA RACK (MDF) (1 Unit)
CORE SWITCH (1 UNIT)	
Core Switch (1 Unit)	***Core Switch ~~(1 Unit)~~ (1 Set)***
The switch must support 24 x 1/10 Gigabit SFP+ ports	The switch must support 24 x ~~1/10~~ **10/40** Gigabit SFP+ ports

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The switch must support up to 8 expansion modules	~~The switch must support up to 8 expansion modules~~
The switch must support Ethernet interfaces based on IEEE 802.2 Logical Link Control (LLC), IEEE 802.3 Ethernet, IEEE 802.3ab1000BASE-T, IEEE 802.3ae10 Gigabit Ethernet, IEEE 802.3an10GBASE-T, IEEE 802.3azEnergy Efficient Ethernet (EEE), IEEE 802.3ba40GBASE-X, IEEE 802.3bz2.5GBASE-T and 5GBASE-T, IEEE 802.3x Flow control - full-duplex operation, IEEE 802.3z 1000BASE-X	The switch must support Ethernet interfaces based on ~~IEEE 802.2 Logical Link Control (LLC),~~ IEEE 802.3 Ethernet, IEEE 802.3ab1000BASE-T, IEEE 802.3ae10 Gigabit Ethernet, ~~IEEE 802.3an10GBASE-T, IEEE 802.3azEnergy Efficient Ethernet (EEE), IEEE 802.3ba40GBASE-X, IEEE 802.3bz2.5GBASE-T and 5GBASE-T~~, IEEE 802.3x Flow control - full-duplex operation, IEEE 802.3z 1000BASE-X
The switch must comply to the following Safety Standards: UL60950-1, CAN/CSA-C22.2 No.60950-1-03, EN60950-1, EN60825-1, AS/NZS60950	~~The switch must comply to the following Safety Standards: UL60950-1, CAN/CSA-C22.2 No.60950-1-03, EN60950-1, EN60825-1, AS/NZS60950~~
Performance: a. The switch must have up to 2.6 Terabit of Switching Capacity and forwarding rate of up to 1,905Mpps. b. The switch must support at least 4GB DDR SDRAM with 4GB of Flash Memory c. The switch must support up to 96K of MAC address entries d. The switch must support up to 4K VLANs	***Performance:*** a. The switch must have up to 2.6 Terabit of Switching Capacity and forwarding rate of up to 1,905Mpps. b. The switch must support at least 4GB DDR SDRAM with 4GB of Flash Memory c. The switch must support up to ~~96K~~ **80K** of MAC address entries d. The switch must support up to 4K VLANs
Layer 2 Features: a. The switch must have VLAN support on all ports. b. The switch must support Voice VLAN c. The switch must support LLDP-MED based on ANSI/TIA-1057 d. The switch must support 10KB Jumbo Frames e. The switch must support IEEE 802.1s Multiple Instance Spanning Tree f. The switch must support IEEE 802.1w Rapid Spanning Tree for fast failover in the event of link failure.	***Layer 2 Features:*** a. The switch must have VLAN support on all ports. b. The switch must support Voice VLAN ~~c. The switch must support LLDP-MED based on ANSI/TIA-1057~~ d. The switch must support ~~10KB~~ **9KB** Jumbo Frames e. The switch must support IEEE 802.1s Multiple Instance Spanning Tree f. The switch must support IEEE 802.1w Rapid Spanning Tree for fast failover in the event of link failure.
Layer 3 Features: a. The switch must support Address Resolution Protocol (ARP) based on RFC 826 b. The switch must support Internet Control Message Protocol (ICMP) based on RFC 792 c. The switch must support Bootstrap Protocol (BootP) based on RFC 951	***Layer 3 Features:*** a. The switch must support Address Resolution Protocol (ARP) ~~based on RFC 826~~ b. The switch must support Internet Control Message Protocol (ICMP) ~~based on RFC 792~~ c. The switch must support Bootstrap Protocol (BootP) ~~based on RFC 951~~

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d. The switch must support Routing Information Protocol (RIP and RIPv2) based on RFC 1058 and RFC 2453 e. The switch must support RIPng for IPv6 based on RFC 2080 f. The switch must support Open Shortest Path First (OSPFv2 and OSPFv3 for IPv6) based on RFC 2328 and RFC 2740 g. The switch must support Graceful OSPF Restart based on RFC 3623 h. The switch must support Border Gateway Protocol 4 (BGP-4) based on RFC 4271 i. The switch must support BGP Graceful Restart based on RFC 4724 j. The switch must support BGP Route Flap Damping based on RFC 2439 k. The switch must support BGP Route Reflection based on RFC4456 l. The switch must support Multiprotocol Extensions for BGP-4 based on RFC 2858 m. The switch must support Equal Cost Multipath (ECMP) routing n. The switch must support IP Helper	~~d.~~ The switch must support Routing Information Protocol (RIP and RIPv2) ~~based on RFC 1058 and RFC 2453~~ e. The switch must support RIPng for IPv6 ~~based on RFC 2080~~ f. The switch must support Open Shortest Path First (OSPFv2 and OSPFv3 for IPv6) ~~based on RFC 2328 and RFC 2740~~ g. The switch must support Graceful OSPF Restart ~~based on RFC 3623~~ h. The switch must support Border Gateway Protocol 4 (BGP-4) ~~based on RFC 4271~~ i. The switch must support BGP Graceful Restart ~~based on RFC 4724~~ ~~j.~~ The switch must support BGP Route Flap Damping ~~based on RFC 2439~~ k. The switch must support BGP Route Reflection ~~based on RFC4456~~ l. The switch must support Multiprotocol Extensions for BGP-4 ~~based on RFC 2858~~ m. The switch must support Equal Cost Multipath (ECMP) routing n. The switch must support IP Helper
Resiliency and High Availability Features a. The switch must support Dual Hot-swappable power Supplies b. The switch must support Virtualization Technology to allow multiple switches to be managed as a single virtual chassis. The virtualization technology shall simplifies network operation by eliminating the complexity of Spanning Tree or VRRP. c. The switch must support Long Distance Virtualization Technology to manage multiple switches in different locations as a single virtual chassis. d. The switch must support VRRPv3 (Virtual Router Redundancy Protocol Version 3) for IPv4 and IPv6 based on RFC 5798 e. The switch must support link aggregation IEEE 802.1AX protocol for Static and Dynamic Link Aggregation f. The switch must support link aggregation IEEE 802.1AX protocol	***Resiliency and High Availability Features*** a. The switch must support Dual Hot-swappable power Supplies b. The switch must support Virtualization Technology to allow ~~multiple switches~~ to be managed as a single virtual chassis. The virtualization technology shall simplifies network operation by eliminating the complexity of Spanning Tree or VRRP. ~~c. The switch must support Long Distance Virtualization Technology to manage multiple switches in different locations as a single virtual chassis.~~ d. The switch must support VRRPv3 (Virtual Router Redundancy Protocol Version 3) for IPv4 and IPv6 based on RFC 5798 ~~e. The switch must support link aggregation IEEE 802.1AX protocol for Static and Dynamic Link Aggregation~~ ~~f. The switch must support link aggregation IEEE 802.1AX protocol~~

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for Static and Dynamic Link Aggregation with stack g. The switch must be able to support ring topology with sub 50ms failover for high availability h. The switch must support SuperLoop Protection for network fault resiliency. i. The Ring network must be always up in the event of the Ring Master Switch goes down. (Please elaborate) j. The Switch must support Multiple Ring Networks to be created. k. The Switch must support G.8032 Ethernet Ring Protection which provides standards-based high-speed ring protection, that can be deployed stand-alone or interoperate with other Ring technology. l. The Switch must support Automatic Link-Flap detection and shutdown m. The Switch must support loop protection and thrash limiting mechanism. n. The switch must support Control Plane Prioritization o. The switch must support up to Virtual Routing and Forwarding (VRFlite) Domains	~~for Static and Dynamic Link Aggregation with stack~~ ~~g. The switch must be able to support ring topology with sub 50ms failover for high availability~~ ~~h. The switch must support SuperLoop Protection for network fault resiliency.~~ ~~i. The Ring network must be always up in the event of the Ring Master Switch goes down. (Please elaborate)~~ ~~j. The Switch must support Multiple Ring Networks to be created.~~ k. ~~The Switch must support G.8032 Ethernet Ring Protection which provides standards-based high-speed ring protection, that can be deployed stand-alone or interoperate with other Ring technology.~~ l. The Switch must support Automatic Link-Flap detection and shutdown ~~m. The Switch must support loop protection and thrash limiting mechanism.~~ n. The switch must support Control Plane Prioritization o. The switch must support up to Virtual Routing and Forwarding (VRFlite) Domains
Multicast a. The switch must support IGMP and MLD Snooping Switches based on RFC 4541 b. The switch must support Internet Group Management Protocol v2 (IGMPv2) based on RFC 2236 c. The switch must support IGMPv3 protocol based on RFC 3376 d. The switch must support Multicast Listener Discovery (MLD and MLDv2) for IPv6 based on RFC 2710 and RFC 3810 e. The switch must support PIM Dense Mode (PIM-DM) based on RFC 3973 f. The switch must support PIM Sparse Mode (PIM-SM) based on RFC 4601	***Multicast*** a. The switch must support IGMP and MLD Snooping Switches based on RFC 4541 b. The switch must support Internet Group Management Protocol v2 (IGMPv2) based on RFC 2236 c. The switch must support IGMPv3 protocol based on RFC 3376 d. The switch must support Multicast Listener Discovery (MLD and MLDv2) for IPv6 based on RFC 2710 and RFC 3810 e. ~~The switch must support PIM Dense Mode (PIM-DM) based on RFC 3973~~ f. The switch must support PIM Sparse Mode (PIM-SM) based on RFC 4601
IPv6 a. The switch must support full IPv6 in hardware based on RFC 2460 b. The switch must support Internet Control Message Protocol (ICMPv6)	***IPv6*** a. The switch must support full IPv6 in hardware based on RFC 2460 b. The switch must support Internet Control Message Protocol (ICMPv6)

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based on RFC 4443 c. The switch must support IPv6 Stateless Address Autoconfiguration based on RFC 4862 d. The switch must support IPv4 and IPv6 Dual Stack e. The switch must support DHCPv6 Relay f. The switch must support NTPv6	based on RFC 4443 c. The switch must support IPv6 Stateless Address Autoconfiguration based on RFC 4862 d. The switch must support IPv4 and IPv6 Dual Stack e. The switch must support DHCPv6 Relay f. ~~The switch must support NTPv6~~
Quality of Service (QoS) a. The switch must support IEEE 802.1p Classification and priority tagging b. The switch must support DiffServ based on RFC 2475 c. The switch must support DiffServ precedence for 8 queues per port based on RFC 2474 d. The switch must support Single- Rate Three-Color Marker based on RFC 2697 e. The switch must support Two-Rate Three-Color Marker based on RFC 2698 f. The switch must support limiting bandwidth per port to 64Kbps g. The switch must support Strict Priority Scheduling and Weighted Round Robin. h. The switch must support policy based QoS i. The switch must support policy-based Storm Protection	***Quality of Service (QoS)*** a. The switch must support IEEE 802.1p Classification and priority tagging b. The switch must support DiffServ based on RFC 2475 c. The switch must support DiffServ precedence for 8 queues per port based on RFC 2474 ~~d. The switch must support Single- Rate Three-Color Marker based on RFC 2697~~ ~~e. The switch must support Two-Rate Three-Color Marker based on RFC 2698~~ ~~f. The switch must support limiting bandwidth per port to 64Kbps~~ ~~g. The switch must support Strict Priority Scheduling and Weighted Round Robin.~~ h. The switch must support policy based QoS i. The switch must support policy-based Storm Protection
Management a. The switch must support Out-of-band 10/100/1000T Management port b. The switch must support USB port c. The switch must support Eco-friendly Mode d. The switch must support built in Management Framework to provide the network with backup, recovery and firmware upgrade management without the need of any additional hardware modules or software. (Please Elaborate and provide documentations) e. The switch GUI has a built-in network management system that includes a network map that displays	***Management*** a. The switch must support Out-of-band 10/100/1000T Management port b. The switch must support USB port ~~c. The switch must support Eco-friendly Mode~~ d. The switch must support built in Management Framework to provide the network with backup, recovery and firmware upgrade management without the need of any additional hardware modules or software. ~~(Please Elaborate and provide documentations)~~ e. The switch GUI has a built-in network management system that includes a network map that displays

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details of centrally managed devices (wired and wireless) and other third-party devices.	details of centrally managed devices (wired and wireless) and other third-party devices.
f. The switch must support Find Me feature to provide a visual way of identifying the switch for maintenance.	f. The switch must support Find Me feature to provide a visual way of identifying the switch for maintenance.
g. The Network must support the ability to centrally manage switches over the WAN network for device backup, zero touch network node recovery and Centralized firmware upgrades with rolling reboots feature	g. The Network must support the ability to centrally manage switches over the WAN network for device backup, zero touch network node recovery and Centralized firmware upgrades with rolling reboots feature
h. The Switch must support Built in Text Editor	~~h. The Switch must support Built in Text Editor~~
i. The Switch must support Built-in Self-Test	i. The Switch must support Built-in Self-Test
j. The Switch must support Event-based triggers and scripting	~~j. The Switch must support Event-based triggers and scripting~~
k. The Switch must support ping polling for IPv4 and IPv6	k. The Switch must support ping polling for IPv4 and IPv6
l. The switch must support Simple Network Time Protocol (SNTP) and Network Time Protocol (NTP) version 4 based on RFC 4330 and RFC 5905.	l. The switch must support Simple Network Time Protocol (SNTP) and Network Time Protocol (NTP) version 4 ~~based on RFC 4330 and RFC 5905.~~
m. The switch must support SNMPv1/2c/3.	m. The switch must support SNMPv1/2c/3.
n. The switch must support sFlow based on RFC 3176	~~n. The switch must support sFlow based on RFC 3176~~
o. The switch must support RMON (Groups 1, 2,3 and 9) based on RFC 2819	o. The switch must support RMON (Groups 1, 2,3 and 9) based on RFC 2819
p. The switch must support Industry Standard Command Line Interface (CLI) which is similar to Cisco IOS and must support Web-based Graphical User Interface (GUI)	p. The switch must support Industry Standard Command Line Interface (CLI) which is similar to Cisco IOS and must support Web-based Graphical User Interface (GUI)
q. The switch must support the following management interface: Console, telnet and SSH.	q. The switch must support the following management interface: Console, telnet and SSH.
r. The switch must support Syslog based on RFC 3164	r. The switch must support Syslog based on RFC 3164
s. The switch must support ICMP Router Discovery Protocol based on RFC 1256 and Energy Efficient Ethernet based on IEEE 802.3az	s. The switch must support ICMP Router Discovery Protocol based on RFC 1256 and Energy Efficient Ethernet based on IEEE 802.3az
t. The switch must support full environmental monitoring of PSUs, fans, temperature and internal voltages.	t. The switch must support full environmental monitoring of PSUs, fans, temperature and internal voltages.
u. The switch must have operational indicator light(s) for each port.	u. The switch must have operational indicator light(s) for each port.
v. The switch must be Software Defined Networking (SDN) ready and will	v. The switch must be Software Defined Networking (SDN) ready and will

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support OpenFlow v1.3 or similar programmable network protocol w. The switch must support Upstream Forwarding Only (UFO) for secure multi-user deployment. x. The switch must support UDLD to prevent traffic from being sent across a bad link by blocking the ports at both ends of the link in the event that either the individual transmitter or receiver for that connection fails y. The switch must support configurable ACLs for management traffic z. The switch must support Active Fiber Monitoring that prevents eavesdropping on fiber communications by monitoring received optical power. If an intrusion is detected, the link can be automatically shut down, or an operator alert can be sent	support OpenFlow v1.3 or similar programmable network protocol w. ~~The switch must support Upstream Forwarding Only (UFO) for secure multi-user deployment~~. x. The switch must support UDLD to prevent traffic from being sent across a bad link by blocking the ports at both ends of the link in the event that either the individual transmitter or receiver for that connection fails y. The switch must support configurable ACLs for management traffic ~~z. The switch must support Active Fiber Monitoring that prevents eavesdropping on fiber communications by monitoring received optical power. If an intrusion is detected, the link can be automatically shut down, or an operator alert can be sent~~
POWER OVER ETHERNET (POE) SWITCHES	
The switch must support Ethernet interfaces based on IEEE 802.3, IEEE 802.3u, IEEE 802.3z, IEEE 802.3ab and IEEE 802.3ae	The switch must support Ethernet interfaces based on IEEE 802.3, IEEE 802.3u, IEEE 802.3z, IEEE 802.3ab and ~~IEEE 802.3ae~~
The switch must comply to the following Safety Standards: UL60950-1, CAN/CSA- C22.2 , No. 60950-1-03, EN60950-1, EN60825-1, AS/NZS 60950.1	The switch must comply to the following Safety Standards: UL60950-1, ~~CAN/CSA- C22.2 , No. 60950-1-03~~, EN60950-1, ~~EN60825-1, AS/NZS 60950.1~~
Performance a. The switch must have up to 140 Gbps of Switching Capacity and forwarding rate of up to 104.16Mpps. b. The switch must support at least 512MB of memory with 64MB of Flash Memory c. The switch must support stacking bandwidth of 40Gbps between Switches (Virtual or Enhanced Stacking Not Accepted) d. The switch must support up to 16K of MAC address entries e. The switch must support up to 2K of IPv4 routes f. The switch must support up to 4K VLANs	***Performance*** a. The switch must have up to ~~140 Gbps~~ **200 Gbps** of Switching Capacity and forwarding rate of up to ~~104.16Mpps~~ **200Mpps**. b. The switch must support at least ~~512MB~~ **2GB** of memory with ~~64MB~~ **2GB** of Flash Memory c. The switch must support stacking bandwidth of ~~40Gbps~~ **100Gbps** between Switches (~~Virtual or Enhanced Stacking Not Accepted~~) d. The switch must support up to 16K of MAC address entries e. The switch must support up to 2K of IPv4 routes f. The switch must support up to 4K VLANs
Layer 2 Features a. The switch must support VLAN on all ports.	***Layer 2 Features*** a. The switch must support VLAN on all ports.

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b. The switch must support Voice VLAN c. The switch must support LLDP-MED based on ANSI/TIA-1057 d. The switch must support 13KB Jumbo Frames e. The switch must support IEEE 802.1Q Multiple Instance Spanning Tree f. The switch must support IEEE 802.1D Rapid Spanning Tree for fast failover in the event of link failure.	b. The switch must support Voice VLAN ~~c. The switch must support LLDP-MED based on ANSI/TIA-1057~~ d. The switch must support ~~13KB~~ **9K** Jumbo Frames e. The switch must support IEEE 802.1Q Multiple Instance Spanning Tree f. The switch must support IEEE 802.1D Rapid Spanning Tree for fast failover in the event of link failure.
Resiliency and High Availability Features a. The switch must support Virtualization Technology to allow multiple switches to be managed as a single virtual chassis. The virtualization technology shall simplify network operation by eliminating the complexity of Spanning Tree or VRRP. (Virtual and Enhanced Stacking Not Accepted) b. The switch must support link aggregation IEEE 802.1AX protocol for Static and Dynamic Link Aggregation c. The switch must support link aggregation across stack. d. The switch must be able to support ring topology with sub 50ms failover for high availability. (STP protocol Not Accepted) e. The Ring network must be always up in the event of the Ring Master Switch goes down. (Please elaborate) f. The Switch must support Multiple Ring Networks to be created. g. The Switch must support Automatic Link-Flap detection and shutdown h. The Switch must support loop protection mechanism i. The switch must support Control Plane Prioritization j. The switch must have PVST+ compatibility mode.	***Resiliency and High Availability Features*** a. The switch must support Virtualization Technology to allow ~~multiple~~ switches to be managed as a single virtual chassis. The virtualization technology shall simplify network operation by eliminating the complexity of Spanning Tree or VRRP. ~~(Virtual and Enhanced Stacking Not Accepted)~~ ~~b. The switch must support link aggregation IEEE 802.1AX protocol for Static and Dynamic Link Aggregation~~ c. The switch must support link aggregation across stack. ~~d. The switch must be able to support ring topology with sub 50ms failover for high availability. (STP protocol Not Accepted)~~ ~~e. The Ring network must be always up in the event of the Ring Master Switch goes down. (Please elaborate)~~ ~~f. The Switch must support Multiple Ring Networks to be created.~~ g. The Switch must support Automatic Link-Flap detection and shutdown h. The Switch must support loop protection mechanism ~~i. The switch must support Control Plane Prioritization~~ ~~j.~~ The switch must have PVST+ compatibility mode.
Multicast a. The switch must support IGMP and MLD Snooping b. The switch must support Internet Group Management Protocol v2 (IGMPv2) based on RFC 2236 c. The switch must support IGMPv3 protocol based on RFC 3376	***Multicast*** a. The switch must support IGMP ~~and MLD~~ Snooping b. The switch must support Internet Group Management Protocol v2 (IGMPv2) ~~based on RFC 2236~~ c. The switch must support IGMPv3 protocol ~~based on RFC 3376~~

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IPv6	***IPv6***
a. The switch must support full IPv6 in hardware based on RFC 2460 b. The switch must support Internet Control Message Protocol (ICMPv6) based on RFC 4443 c. The switch must support IPv6 Stateless Address Autoconfiguration based on RFC 4862 d. The switch must support IPv4 and IPv6 Dual Stack e. The switch must support DHCPv6 Relay f. The switch must support NTPv6	a. The switch must support full IPv6 in hardware based on RFC 2460 b. The switch must support Internet Control Message Protocol (ICMPv6) ~~based on RFC 4443~~ c. The switch must support IPv6 Stateless Address Autoconfiguration based on RFC 4862 d. The switch must support IPv4 and IPv6 Dual Stack e. The switch must support DHCPv6 Relay ~~f. The switch must support NTPv6~~
Quality of Service (QoS)	***Quality of Service (QoS)***
a. The switch must support IEEE 802.1p Classification and priority tagging b. The switch must support DiffServ based on RFC 2475 c. The switch must support DiffServ precedence for 8 queues per port based on RFC 2474 d. The switch must support SingleRate Three-Color Marker based on RFC 2697 e. The switch must support Two-Rate Three-Color Marker based on RFC 2698 f. The switch must support limiting bandwidth per port to 64Kbps g. The switch must support Strict Priority Scheduling and Weighted Round Robin. h. The switch must support policy based QoS i. The switch must support policybased Storm Protection	a. The switch must support IEEE 802.1p Classification and priority tagging b. The switch must support DiffServ based on RFC 2475 c. The switch must support DiffServ precedence for 8 queues per port based on RFC 2474 ~~d. The switch must support SingleRate Three-Color Marker based on RFC 2697~~ ~~e. The switch must support Two-Rate Three-Color Marker based on RFC 2698~~ ~~f. The switch must support limiting bandwidth per port to 64Kbps~~ ~~g. The switch must support Strict Priority Scheduling and Weighted Round Robin.~~ h. The switch must support policy based QoS i. The switch must support policybased Storm Protection
Security	***Security***
a. The switch must support wire rate Access Control List based on L2/L3/L4 criteria b. The switch must support DHCP Snooping, IP Source Guard and Dynamic ARP Inspection c. The switch must support RADIUS and RADIUS Accounting based on RFC 2865 and RFC 2866 d. The switch must support IEEE 802.1X Port Based Network Access Control e. The switch must support SSLv2	a. The switch must support wire rate Access Control List based on L2/L3/L4 criteria b. The switch must support DHCP Snooping, IP Source Guard and Dynamic ARP Inspection c. The switch must support RADIUS and RADIUS Accounting based on RFC 2865 and RFC 2866 d. The switch must support IEEE 802.1X Port Based Network Access Control e. The switch must support SSLv2

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f. The switch must support SSHv2 based on RFC 4251 g. The switch must support Tri-Authentication based on MAC. Web and IEEE 802.1X h. The switch must support TACACS+ Accounting and Authentication i. The switch must support Private VLANs j. The switch must support Dynamic VLAN Assignment k. The switch must support Network Access Control l. The switch must support DHCPv4 based on RFC 2131 m. The switch must support DHCPv6 based on RFC 3315 n. The switch must support DHCP Relay Agent Information Option based on RFC 3046.	f. The switch must support SSHv2 based on RFC 4251 g. The switch must support Tri-Authentication based on MAC. Web and IEEE 802.1X h. The switch must support TACACS+ Accounting and Authentication i. The switch must support Private VLANs j. The switch must support Dynamic VLAN Assignment k. The switch must support Network Access Control l. The switch must support DHCPv4 based on RFC 2131 m. The switch must support DHCPv6 based on RFC 3315 ~~n. The switch must support DHCP Relay Agent Information Option based on RFC 3046.~~
Management a. The switch must support USB Slot b. The switch must support Eco-friendly Mode c. The switch must support built-in Management Framework to provide the network with backup, recovery and firmware upgrade management without the need of any additional hardware modules or software. (Please Elaborate and provide documentations) d. The switch must support Optical DDM for real time monitoring of transceiver according to SFF-8472 specifications e. The Switch must support Built in Text Editor f. The Switch must support Event-based triggers and scripting g. The Switch must support ping polling for IPv4 and IPv6 h. The switch must support Simple Network Time Protocol (SNTP) and Network Time Protocol (NTP) version 4 based on RFC 4330 and RFC 5905. i. The switch must support SNMPv1/2c/3. j. The switch must support RMON (Groups 1, 2,3 and 9) based on RFC 2819 k. The switch must support Industry Standard Command Line Interface (CLI) which is similar to Cisco IOS	***Management*** a. The switch must support USB Slot ~~b. The switch must support Eco-friendly Mode~~ ~~c. The switch must support built-in Management Framework to provide the network with backup, recovery and firmware upgrade management without the need of any additional hardware modules or software. (Please Elaborate and provide documentations)~~ ~~d. The switch must support Optical DDM for real time monitoring of transceiver according to SFF-8472 specifications~~ ~~e. The Switch must support Built in Text Editor~~ ~~f. The Switch must support Event-based triggers and scripting~~ g. The Switch must support ping polling for IPv4 and IPv6 h. The switch must support Simple Network Time Protocol (SNTP) and Network Time Protocol (NTP) version 4 based on RFC 4330 and RFC 5905. i. The switch must support SNMPv1/2c/3. j. The switch must support RMON ~~(Groups 1, 2,3 and 9) based on RFC 2819~~ k. The switch must support Industry Standard Command Line Interface (CLI) which is similar to Cisco IOS

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l. The switch must support Web-based Graphical User Interface (GUI) m. The switch must support the following management interface: Console, telnet and SSH. n. The switch must support Syslog based on RFC 3164 o. The switch must support ICMP Router Discovery Protocol based on RFC 1256. p. The switch must support Energy Efficient Ethernet based on IEEE 802.3az q. The switch must support full environmental monitoring of PSUs, fans, temperature and internal voltages. r. The switch must have operational indicator light(s) for each port. s. The proposed switch must be managed by a single network monitoring system t. The proposed networking solution must be of the same brand for ease of management	l. The switch must support Web-based Graphical User Interface (GUI) m. The switch must support the following management interface: Console, telnet and SSH. n. The switch must support Syslog based on RFC 3164 o. The switch must support ICMP Router Discovery Protocol based on RFC 1256. ~~p. The switch must support Energy Efficient Ethernet based on IEEE 802.3az~~ q. The switch must support full environmental monitoring of PSUs, fans, temperature and internal voltages. r. The switch must have operational indicator light(s) for each port. s. The proposed switch must be managed by a single network monitoring system t. The proposed networking solution must be of the same brand for ease of management
Distribution Switch	
Distribution Switch (5 Units)	Distribution Switch (5 ~~Units~~ **Sets**)
The switch can support up to 24x Combo SFP port	The switch can support ~~up to 24x Combo SFP port~~ **at least 24 SFP+ (10GB) Ports and 2 x 40GB QSFP+ (40GB) Ports**
The switch can support up to 4 ports SFP+ The Switch can support up to 2 port QSFP+	The switch can support ~~up to 4 ports SFP+~~ **at least 24 ports SFP+** The Switch can support up to 2 port QSFP+
The switch must support the following transceivers: - XFP - SFP - SFP+ - QSFP+	The switch must support the following transceivers: ~~- XFP~~ - SFP - SFP+ - QSFP+
The switch must comply to the following Safety Standards: UL60950-1, CAN/CSA- C22.2 , No. 60950-1-03, EN60950-1, EN60825-1, AS/NZS 60950.1	The switch must comply to the following Safety Standards: UL60950-1, ~~CAN/CSA- C22.2 , No. 60950-1-03~~, EN60950-1, ~~EN60825-1, AS/NZS 60950.1~~
Performance a. The switch must have up to 288 Gbps of Switching Capacity and forwarding rate of up to 214Mpps. b. The switch must support at least 2GB of memory with 256MB of Flash Memory	***Performance*** a. The switch must have up to ~~288 Gbps~~ **400 Gbps** of Switching Capacity and forwarding rate of up to ~~214Mpps~~ **300Mpps**. b. The switch must support at least ~~2GB~~ **4GB** of memory with ~~256MB~~ **4GB** of Flash Memory

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c. The switch must support stacking bandwidth of up to 160Gbps between Switches d. The switch must support up to 64K of MAC address entries e. The switch must support up to 4K VLANs	c. ~~The switch must support stacking bandwidth of up to 160Gbps between Switches~~ d. The switch must support up to 64K of MAC address entries e. The switch must support up to 4K VLANs
Layer 2 Features a. The switch must have VLAN support on all ports. b. The switch must support Voice VLAN c. The switch must support LLDP-MED based on ANSI/TIA-1057 d. The switch must support 13KB Jumbo Frames e. The switch must support IEEE 802.1s Multiple Instance Spanning Tree f. The switch must support IEEE 802.1w Rapid Spanning Tree for fast failover in the event of link failure.	***Layer 2 Features*** a. The switch must have VLAN support on all ports. b. The switch must support Voice VLAN ~~c. The switch must support LLDP-MED based on ANSI/TIA-1057~~ d. The switch must support ~~13KB~~ **9KB** Jumbo Frames e. The switch must support IEEE 802.1s Multiple Instance Spanning Tree f. The switch must support IEEE 802.1w Rapid Spanning Tree for fast failover in the event of link failure.
Resiliency and High Availability Features a. The switch must support Dual Hot-swappable power Supplies b. The switch must support Virtualization Technology to allow multiple switches to be managed as a single virtual chassis. The virtualization technology shall simplify network operation by eliminating the complexity of Spanning Tree or VRRP. c. The switch must support VRRPv3 (Virtual Router Redundancy Protocol Version 3) for IPv4 and IPv6 based on RFC 5798 d. The switch must support link aggregation IEEE 802.1AX protocol for Static and Dynamic Link Aggregation e. The switch must support link aggregation across stack. f. The switch must be able to support ring topology with sub 50ms failover for high availability g. The switch must support SuperLoop Protection for network fault resiliency. h. The Ring network must be always up in the event of the Ring Master Switch goes down. (Please elaborate)	***Resiliency and High Availability Features*** a. The switch must support Dual Hot-swappable power Supplies b. The switch must support Virtualization Technology to allow multiple switches to be managed as a single virtual chassis. The virtualization technology shall simplify network operation by eliminating the complexity of Spanning Tree or VRRP. c. The switch must support VRRPv3 (Virtual Router Redundancy Protocol Version 3) for IPv4 and IPv6 based on RFC 5798 ~~d. The switch must support link aggregation IEEE 802.1AX protocol for Static and Dynamic Link Aggregation~~ e. The switch must support link aggregation across stack. ~~f. The switch must be able to support ring topology with sub 50ms failover for high availability~~ ~~g. The switch must support SuperLoop Protection for network fault resiliency.~~ ~~h. The Ring network must be always up in the event of the Ring Master Switch goes down. (Please elaborate)~~

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i. The Switch must support Multiple Ring Networks to be created. j. The Switch must support G.8032 Ethernet Ring Protection which provides standards-based high-speed ring protection, that can be deployed stand-alone or interoperate with other Ring technology. k. The Switch must support Automatic Link-Flap detection and shutdown l. The Switch must support loop protection mechanism m. The switch must support Control Plane Prioritization n. The switch must support diagnostic for copper cables to be able to know the status or faults that might exists in either the connected cable or in its terminations	~~i. The Switch must support Multiple Ring Networks to be created.~~ ~~j. The Switch must support G.8032 Ethernet Ring Protection which provides standards-based high-speed ring protection, that can be deployed stand-alone or interoperate with other Ring technology.~~ k. The Switch must support Automatic Link-Flap detection and shutdown l. The Switch must support loop protection mechanism m. The switch must support Control Plane Prioritization n. The switch must support diagnostic for copper cables to be able to know the status or faults that might exists in either the connected cable or in its terminations
Multicast a. The switch must support IGMP and MLD Snooping Switches based on RFC 4541 b. The switch must support Internet Group Management Protocol v2 (IGMPv2) based on RFC 2236 c. The switch must supportIGMPv3 protocol based on RFC 3376 d. The switch must support Multicast Listener Discovery (MLD and MLDv2) for IPv6 based on RFC 2710 and RFC 3810 e. The switch must support PIM Dense Mode (PIM-DM) based on RFC 3973 f. The switch must support PIM Sparse Mode (PIM-SM) based on RFC 4601	***Multicast*** a. The switch must support IGMP and MLD Snooping Switches based on RFC 4541 b. The switch must support Internet Group Management Protocol v2 (IGMPv2) based on RFC 2236 c. The switch must supportIGMPv3 protocol based on RFC 3376 d. The switch must support Multicast Listener Discovery (MLD and MLDv2) for IPv6 based on RFC 2710 and RFC 3810 ~~e. The switch must support PIM Dense Mode (PIM-DM) based on RFC 3973~~ f. The switch must support PIM Sparse Mode (PIM-SM) based on RFC 4601
IPv6 a. The switch must support full IPv6 in hardware based on RFC 2460 b. The switch must support Internet Control Message Protocol (ICMPv6) based on RFC 4443 c. The switch must support IPv6 Stateless Address Autoconfiguration based on RFC 4862 d. The switch must support IPv4 and IPv6 Dual Stack e. The switch must support DHCPv6 Relay f. The switch must support NTPv6	***IPv6*** a. The switch must support full IPv6 in hardware based on RFC 2460 b. The switch must support Internet Control Message Protocol (ICMPv6) based on RFC 4443 c. The switch must support IPv6 Stateless Address Autoconfiguration based on RFC 4862 d. The switch must support IPv4 and IPv6 Dual Stack e. The switch must support DHCPv6 Relay ~~f. The switch must support NTPv6~~
Quality of Service (QoS)	***Quality of Service (QoS)***

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a. The switch must support IEEE 802.1p Classification and priority tagging b. The switch must support DiffServ based on RFC 2475 c. The switch must support DiffServ precedence for 8 queues per port based on RFC 2474 d. The switch must support Single- Rate Three-Color Marker based on RFC 2697 e. The switch must support Two-Rate Three-Color Marker based on RFC 2698 f. The switch must support limiting bandwidth per port to 64Kbps g. The switch must support Strict Priority Scheduling and Weighted Round Robin. h. The switch must support policy based QoS i. The switch must support policy-based Storm Protection	a. The switch must support IEEE 802.1p Classification and priority tagging b. The switch must support DiffServ based on RFC 2475 c. The switch must support DiffServ precedence for 8 queues per port based on RFC 2474 ~~d. The switch must support Single- Rate Three-Color Marker based on RFC 2697~~ ~~e. The switch must support Two-Rate Three-Color Marker based on RFC 2698~~ ~~f. The switch must support limiting bandwidth per port to 64Kbps~~ ~~g. The switch must support Strict Priority Scheduling and Weighted Round Robin.~~ h. The switch must support policy based QoS i. The switch must support policy-based Storm Protection
Security a. The switch must support wire rate Access Control List based on L3/L4 criteria b. The switch must support DHCP Snooping, IP Source Guard and Dynamic ARP Inspection c. The switch must support RADIUS and RADIUS Accounting based on RFC 2865 and RFC 2866 d. The switch must support IEEE802.1X Port Based Network Access Control e. The switch must supportSSLv2and SSLv3 f. The switch must support SSHv2 based on RFC 4251 g. The switch must support Tri-Authentication based on MAC. Web and IEEE 802.1X h. The switch must support MAC address filtering and MAC address lockdown i. The switch must support Private VLANs j. The switch must support Dynamic VLAN Assignment k. The switch must support Network Access Control l. The switch must support Local Radius Server	***Security*** a. The switch must support wire rate Access Control List based on L3/L4 criteria b. The switch must support DHCP Snooping, IP Source Guard and Dynamic ARP Inspection c. The switch must support RADIUS and RADIUS Accounting based on RFC 2865 and RFC 2866 d. The switch must support IEEE802.1X Port Based Network Access Control e. The switch must supportSSLv2and SSLv3 f. The switch must support SSHv2 based on RFC 4251 g. The switch must support Tri-Authentication based on MAC. Web and IEEE 802.1X h. The switch must support MAC address filtering and MAC address lockdown i. The switch must support Private VLANs j. The switch must support Dynamic VLAN Assignment k. The switch must support Network Access Control l. The switch must support Local Radius Server

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m. The switch must support DHCPv4 based on RFC 2131 n. The switch must support DHCPv6 based on RFC 3315 o. The switch must support DHCP Relay Agent Information Option based on RFC 3046. p. The switch must support Black Hole Routing q. The switch must support DoS attack blocking and virus throttling	m. The switch must support DHCPv4 based on RFC 2131 n. The switch must support DHCPv6 based on RFC 3315 o. The switch must support DHCP Relay Agent Information Option based on RFC 3046. p. The switch must support Black Hole Routing ~~q. The switch must support DoS attack blocking and virus throttling~~
Management a. The switch must support Out-of-band 10/100/1000T Management port b. The switch must support USB port c. The switch must support Eco-friendly Mode d. The switch must support built in Management Framework to provide the network with backup, recovery and firmware upgrade management without the need of any additional hardware modules or software. (Please Elaborate and provide documentations) e. The switch must support Find Me feature to provide a visual way of identifying the switch for maintenance. f. The Network must support the ability to centrally manage switches over the WAN network for device backup, zero touch network node recovery and Centralized firmware upgrades with rolling reboots feature g. The Switch must support Built in Text Editor and Built-in Self-Test h. The Switch must support Event-based triggers and scripting i. The Switch must support ping polling for IPv4 and IPv6 j. The switch must support Simple Network Time Protocol (SNTP) and Network Time Protocol (NTP) version 4 based on RFC 4330 and RFC 5905. k. The switch must support SNMPv1/2c/3. l. The switch must support sFlow based on RFC 3176 m. The switch must support RMON (Groups 1, 2,3 and 9) based on RFC 2819	***Management*** a. The switch must support Out-of-band 10/100/1000T Management port b. The switch must support USB port ~~c. The switch must support Eco-friendly Mode~~ ~~d. The switch must support built in Management Framework to provide the network with backup, recovery and firmware upgrade management without the need of any additional hardware modules or software. (Please Elaborate and provide documentations)~~ ~~e. The switch must support Find Me feature to provide a visual way of identifying the switch for maintenance.~~ f. The Network must support the ability to centrally manage switches over the WAN network for device backup, zero touch network node recovery and Centralized firmware upgrades with rolling reboots feature ~~g. The Switch must support Built in Text Editor and Built-in Self-Test~~ h. The Switch must support Event-based triggers and scripting i. The Switch must support ping polling for IPv4 and IPv6 j. The switch must support Simple Network Time Protocol (SNTP) and Network Time Protocol (NTP) version 4 based on RFC 4330 and RFC 5905. k. The switch must support SNMPv1/2c/3. ~~l. The switch must support sFlow based on RFC 3176~~ m. The switch must support RMON ~~(Groups 1, 2,3 and 9) based on RFC 2819~~

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n. The switch must support Industry Standard Command Line Interface (CLI) which is similar to Cisco IOS, and support Web-based Graphical User Interface (GUI) o. The switch must support the following management interface: Console, telnet and SSH. p. The switch must support Syslog based on RFC 3164, and ICMP Router Discovery Protocol based on RFC 1256. q. The switch must support Energy Efficient Ethernet based on IEEE 802.3az r. The switch must support full environmental monitoring of PSUs, fans, temperature and internal voltages. s. The switch must have operational indicator light(s) for each port. t. The switch must be Software Defined Networking (SDN) ready and will support OpenFlow v1.3 or similar programmable network protocol u. The switch must support Upstream Forwarding Only (UFO) for secure multi-user deployment v. The switch must support UDLD to prevent traffic from being sent across a bad link by blocking the ports at both ends of the link in the event that either the individual transmitter or receiver for that connection fails w. The switch must support configurable ACLs for management traffic x. The switch must support Active Fiber Monitoring that prevents eavesdropping on fiber communications by monitoring received optical power. If an intrusion is detected, the link can be automatically shut down, or an operator alert can be sent	n. The switch must support Industry Standard Command Line Interface (CLI) which is similar to Cisco IOS, and support Web-based Graphical User Interface (GUI) o. The switch must support the following management interface: Console, telnet and SSH. p. The switch must support Syslog based on RFC 3164, and ICMP Router Discovery Protocol based on RFC 1256. ~~q. The switch must support Energy Efficient Ethernet based on IEEE 802.3az~~ r. The switch must support full environmental monitoring of PSUs, fans, temperature and internal voltages. s. The switch must have operational indicator light(s) for each port. t. The switch must be Software Defined Networking (SDN) ready and will support OpenFlow v1.3 or similar programmable network protocol ~~u. The switch must support Upstream Forwarding Only (UFO) for secure multi-user deployment~~ v. The switch must support UDLD to prevent traffic from being sent across a bad link by blocking the ports at both ends of the link in the event that either the individual transmitter or receiver for that connection fails w. The switch must support configurable ACLs for management traffic ~~x. The switch must support Active Fiber Monitoring that prevents eavesdropping on fiber communications by monitoring received optical power. If an intrusion is detected, the link can be automatically shut down, or an operator alert can be sent~~
Access Points	
The proposed solution must support all mandatory and several optional 802.11ax features, which include uplink and downlink OFDMA with up to 37	The proposed solution must support all mandatory and several optional 802.11ax features, which include uplink and downlink OFDMA ~~with up to 37~~

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resource units, uplink and downlink multi-user MIMO (MU-MIMO).	~~resource units~~, uplink and downlink multi-user MIMO (MU-MIMO).
The proposed solution must be ideal for high density environments, such as schools, retail branches, hotels, and enterprise offices.	The proposed solution must be ideal for high density environments~~, such as schools, retail branches, hotels, and enterprise offices.~~
The proposed solution must support an integrated Bluetooth Low-Energy (BLE) and Zigbee radio, as well as a USB port for maximum flexibility, providing secure and reliable connectivity for IOT devices and for implementing location services	The proposed solution must support an integrated Bluetooth Low-Energy (BLE) and ~~Zigbee radio~~, as well as a USB port for maximum flexibility, providing secure and reliable connectivity for IOT devices and for implementing location services
The proposed solution must have an uplink Ethernet port (E0): • Supports up to 2.5/5 Gbps with NBase-T and IEEE 802.3bz Ethernet compatibility. • Backwards compatible with 100/1000Base-T.	The proposed solution must have an uplink Ethernet port ~~(E0)~~: • Supports up to 2.5~~/5~~ Gbps with NBase-T and IEEE 802.3bz Ethernet compatibility. • Backwards compatible with ~~100/~~1000Base-T.
The proposed solution must have a built-in Bluetooth Low-Energy (BLE) and Zigbee radio—Enables a wide range of IOT use cases, such as asset tracking and mobile engagement.	The proposed solution must have a built-in Bluetooth Low-Energy (BLE) ~~and Zigbee radio~~ —Enables a wide range of IOT use cases, such as asset tracking and mobile engagement.
Must be able continuously monitor and report its actual power consumption and optionally make autonomous decisions to disable certain capabilities based on the amount of power available to the unit. Software-configurable to disable capabilities in specified order of priority. The feature applies when the unit is powered by an 802.3af POE source.	Must be able continuously monitor and report its actual power consumption and optionally make autonomous decisions to disable certain capabilities based on the amount of power available to the unit. ~~Software-configurable to disable capabilities in specified order of priority. The feature applies when the unit is powered by an 802.3af POE source.~~
The proposed solution must have the following specifications: • AP type—Indoor, dual radio, 5 GHz 802.11ax 4x4 MIMO, and 2.4 GHz 802.11ax 4x4 MIMO • 5 GHz radio: • Four spatial stream Single User (SU) MIMO for up to 2.4 Gbps wireless data rate to individual 4SS HE80 or 2SS HE160 802.11ax client devices (maximum). • Four spatial stream Multi User (MU) MIMO for up to 2.4 Gbps wireless data rate to up to four 1SS or two 2SS HE80 802.11ax MU-MIMO capable client devices simultaneously (typical). • 2.4 GHz radio: • Four spatial stream Single User (SU) MIMO for up to 1.150 Gbps wireless	The proposed solution must have the following specifications: • AP type—Indoor, dual radio, 5 GHz 802.11ax 4x4 MIMO, and 2.4 GHz 802.11ax 4x4 MIMO • 5 GHz radio: • Four spatial stream Single User (SU) MIMO for up to 2.4 Gbps wireless data rate to individual 4SS HE80 or 2SS HE160 802.11ax client devices (maximum). • Four spatial stream Multi User (MU) MIMO for up to 2.4 Gbps wireless data rate to up to four 1SS or two 2SS HE80 802.11ax MU-MIMO capable client devices simultaneously (typical). • 2.4 GHz radio: • Four spatial stream Single User (SU) MIMO for up to 1.150 Gbps wireless

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data rate to individual 4SS HE40 or 2SS HE40 802.11ax MUMIMO capable client devices simultaneously (typical). • Support for up to 1024 associated client devices per radio and up to 16 BSSIDs per radio • Supported frequency bands (country-specific restrictions apply): • 2.400 to 2.4835 GHz • 5.150 to 5.250 GHz • 5.250 to 5.350 GHz • 5.470 to 5.725 GHz • 5.725 to 5.850 GHz • Available channels— Dependent on configured regulatory domain. • Dynamic frequency selection (DFS) optimizes the use of available RF spectrum. • Supported radio technologies: • 802.11b: Direct-sequence spread-spectrum (DSSS) • 802.11a/g/n/ac: Orthogonal frequency-division multiplexing (OFDM) • 802.11ax: Orthogonal frequency-division multiple access (OFDMA) with up to 37 resource units (for an 80 MHz channel) • Supported modulation types: • 802.11b: BPSK, QPSK, CCK • 802.11a/g/n: BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM (proprietary extension) • 802.11ac: BPSK, QPSK, 16- QAM, 64-QAM, 256-QAM, 1024-QAM (proprietary extension) • 802.11ax: BPSK, QPSK, 16- QAM, 64-QAM, 256-QAM, 1024-QAM • 802.11n high-throughput (HT) support: HT20/40 • 802.11ac very high throughput (VHT) support: VHT20/40/80/160 • 802.11ax high efficiency (HE) support: HE20/40/80/160 • Supported data rates (Mbps): • 802.11b: 1, 2, 5.5, 11 • 802.11a/g: 6, 9, 12, 18, 24, 36, 48, 54 • 802.11n (5 GHz): 6.5 to 600 (MCS0 to MVC31, HT20 to HT40)	data rate to individual 4SS HE40 or 2SS HE40 802.11ax MUMIMO capable client devices simultaneously (typical). • Support for up to 1024 associated client devices per radio and up to 16 BSSIDs per radio • Supported frequency bands (country-specific restrictions apply): • 2.400 to 2.4835 GHz • 5.150 to 5.250 GHz • 5.250 to 5.350 GHz • 5.470 to 5.725 GHz • 5.725 to 5.850 GHz • Available channels— Dependent on configured regulatory domain. • Dynamic frequency selection (DFS) optimizes the use of available RF spectrum. • Supported radio technologies: • 802.11b: Direct-sequence spread-spectrum (DSSS) • 802.11a/g/n/ac: Orthogonal frequency-division multiplexing (OFDM) • 802.11ax: Orthogonal frequency-division multiple access (OFDMA) with up to 37 resource units (for an 80 MHz channel) • Supported modulation types: • 802.11b: BPSK, QPSK, CCK • 802.11a/g/n: BPSK, QPSK, 16-QAM, 64-QAM, 256-QAM (proprietary extension) • 802.11ac: BPSK, QPSK, 16- QAM, 64-QAM, 256-QAM, 1024-QAM (proprietary extension) • 802.11ax: BPSK, QPSK, 16- QAM, 64-QAM, 256-QAM, 1024-QAM • 802.11n high-throughput (HT) support: HT20/40 • 802.11ac very high throughput (VHT) support: VHT20/40/80/160 • 802.11ax high efficiency (HE) support: HE20/40/80/160 • Supported data rates (Mbps): • 802.11b: 1, 2, 5.5, 11 • 802.11a/g: 6, 9, 12, 18, 24, 36, 48, 54 • 802.11n (5 GHz): 6.5 to 600 (MCS0 to MVC31, HT20 to HT40)

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• 802.11ac: 6.5 to 3,467 (MCS0 to MCS9, NSS = 1 to 4, VHT20 to VHT160) • 802.11ax (2.4 GHz): 3.6 to 1,147 (MCS0 to MCS11, NSS = 1 to 2, HE20 to HE40) • 802.11ax (5 GHz): 3.6 to 2,402 (MCS0 to MCS11, NSS = 1 to 4, HE20 to HE160) • 802.11n/ac packet aggregation: A-MPDU, A-MS • Transmit power— Configurable in increments of 0.5 dBm. • Maximum (aggregate, conducted total) transmit power (limited by local regulatory requirements): • 2.4 GHz band: +21 dBm (18 dBm per chain) • 5 GHz band: +24 dBm (18 dBm per chain) • Note that conducted transmit power levels exclude antenna gain. For total (EIRP) transmit power, add antenna gain. • Advanced Cellular Coexistence (ACC) minimizes the impact of interference from cellular networks; Maximum ratio combining (MRC) for improved receiver performance. • Cyclic delay/shift diversity (CDD/CSD) for improved downlink RF performance; Space-time block coding (STBC) for increased range and improved reception. • Low-density parity check (LDPC) for high-efficiency error correction and increased throughput. • Transmit beamforming (TxBF) for increased signal reliability and range. • 802.11ax Target Wait Time (TWT) to support low-power client devices. • Four integrated dual-band downtilt omni-directional antennas for 4x4 MIMO with peak antenna gain of 3.5 dBi in 2.4 GHz and 5.4 dBi in 5 GHz. Built-in antennas are optimized for horizontal ceiling mounted orientation of the AP. The downtilt angle for maximum gain is roughly 30 degrees. Combining the patterns of each of the antennas of the MIMO radios, the peak gain of the effective per-antenna pattern is 1.9 dBi in 2.4 GHz and 3.5 dBi in 5 GHz	• 802.11ac: 6.5 to 3,467 (MCS0 to MCS9, NSS = 1 to 4, VHT20 to VHT160) • 802.11ax (2.4 GHz): 3.6 to 1,147 (MCS0 to MCS11, NSS = 1 to 2, HE20 to HE40) • 802.11ax (5 GHz): 3.6 to 2,402 (MCS0 to MCS11, NSS = 1 to 4, HE20 to HE160) • 802.11n/ac packet aggregation: A-MPDU, A-MS • Transmit power— Configurable ~~in increments of 0.5 dBm.~~ • Maximum (aggregate, conducted total) transmit power (limited by local regulatory requirements): • 2.4 GHz band: +21 dBm ~~(18 dBm per chain)~~ • 5 GHz band: +24 dBm ~~(18 dBm per chain)~~ • Note that conducted transmit power levels exclude antenna gain. For total (EIRP) transmit power, add antenna gain. • ~~Advanced Cellular Coexistence (ACC) minimizes the impact of interference from cellular networks; Maximum ratio combining (MRC) for improved receiver performance.~~ • Cyclic delay/shift diversity (CDD/CSD) for improved downlink RF performance; ~~Space-time block coding (STBC) for increased range and improved reception.~~ • ~~Low-density parity check (LDPC) for high-efficiency error correction and increased throughput.~~ • Transmit beamforming (TxBF) for increased signal reliability and range. • 802.11ax Target Wait Time (TWT) to support low-power client devices. • Four integrated dual-band downtilt omni-directional antennas for 4x4 MIMO with peak antenna gain of 3.5 dBi in 2.4 GHz and ~~5.4~~ 5.0 dBi in 5 GHz. Built-in antennas are optimized for horizontal ceiling mounted orientation of the AP. ~~The downtilt angle for maximum gain is roughly 30 degrees. Combining the patterns of each of the antennas of the MIMO radios, the peak gain of the effective per-antenna pattern is 1.9 dBi in 2.4 GHz and 3.5 dBi in 5 GHz~~

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• E0, E1—HPE SmartRate port (RJ-45, maximum negotiated speed 2.5 Gbps): • Auto-sensing link speed (100/1000/2500/5000BASET) and MDI/MDX • 2.5 and 5.0 Gbps speed complies with NBase-T and 802.3bz specifications • USB 2.0 host interface (Type A connector): Capable of sourcing up to 1A/5W to an attached device • Bluetooth Low Energy (BLE5.0) and Zigbee (802.15.4) radio: • BLE—Up to 8 dBm transmit power (class 1) and -95 dBm receive sensitivity • Zigbee—Up to 8 dBm transmit power and -99 dBm receive sensitivity • Visual indictors (two multicolor LEDs)—For System and Radio status • Reset button—Factory reset, LED mode control (normal/off) • Serial console interface (proprietary, micro-B USB physical jack) • Kensington security slot • Reliability • Mean Time Between Failure (MTBF)—995,000 hours (114 years) at +25 C operating temperature. • Regulatory Compliance • FCC/ISED • CE Marked • RED Directive 2014/53/EU • EMC Directive 2014/30/EU • Low Voltage Directive 2014/35/EU • UL/IEC/EN 60950 • EN 60601-1-1, EN60601-1-2	• ~~E0, E1—HPE SmartRate port (RJ-45, maximum negotiated speed 2.5 Gbps):~~ **Ethernet Port** • Auto-sensing link speed (~~100~~/1000/2500/~~5000~~BASET) and MDI/MDX • 2.5 **Gbps** ~~and 5.0 Gbps~~ speed complies with NBase-T and 802.3bz specifications • USB 2.0 host interface (Type A connector): ~~Capable of sourcing up to 1A/5W to an attached device~~ • Bluetooth Low Energy (BLE5.0) and Zigbee (802.15.4) radio: • ~~BLE—Up to 8 dBm transmit power (class 1) and -95 dBm receive sensitivity~~ • ~~Zigbee—Up to 8 dBm transmit power and -99 dBm receive sensitivity~~ • Visual indictors (two multicolor LEDs)—For System and Radio status • Reset button—Factory reset, LED mode control (normal/off) • Serial console interface ~~(proprietary, micro-B USB physical jack)~~ • Kensington security slot • Reliability • Mean Time Between Failure (MTBF)—~~995,000 hours (114 years) at +25 C operating temperature.~~ **at least 200,000 hours** • Regulatory Compliance • FCC/ISED • CE Marked • ~~RED Directive 2014/53/EU~~ • ~~EMC Directive 2014/30/EU~~ • ~~Low Voltage Directive 2014/35/EU~~ • UL/IEC/EN 60950 • EN 60601-1-1, EN60601-1-2
EMPLOYEE AND GUEST MANAGEMENT SYSTEM (2 UNITS)	
The solution must be an easy-to-deploy hardware or virtual appliance platform that utilizes identity based policies to secure network access and includes an integrated set of capabilities bundled under one policy platform: a. Full AAA server – RADIUS and TACACS+ b. Automatic device profiling and the ability to use profiled information for access authorization	The solution must be an easy-to-deploy hardware or virtual appliance platform that utilizes identity based policies to secure network access and includes an integrated set of capabilities bundled under one policy platform: a. Full AAA server – RADIUS and TACACS+ b. Automatic device profiling and the ability to use profiled information for access authorization

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c. Built-in guest management and device/user onboarding d. Web based management interface with Dashboard e. Reporting and analysis with custom data filters f. Data repository for user, device, transaction information g. Rich policies using identity, device, health, or conditional elements h. Deployment and implementation tools. i. Support SSO SAML for GUI and Guest portal integration. j. Integration with leading MDM provider such as MobileIron, AirWatch, Maas360, ZenPrise, SOTI to extract endpoint information k. Integration with Palo Alto Networks Firewall to provide context base information	c. Built-in guest management and device/user onboarding d. Web based management interface with Dashboard e. Reporting and analysis with custom data filters f. Data repository for user, device, transaction information g. Rich policies using identity, device, health, or conditional elements h. Deployment and implementation tools. i. Support SSO SAML for GUI and Guest portal integration. j. Integration with leading MDM provider such as ~~MobileIron, AirWatch, Maas360, ZenPrise, SOTI~~ to extract endpoint information k. Integration with Palo Alto Networks Firewall to provide context base information
Support single sign-on (SSO) and Aruba Auto Sign-On support via SAML v2.0.	Support single sign-on (SSO) ~~and Aruba Auto Sign-On support via SAML v2.0.~~
Support the following RFC standards: 2246, 2248, 2548, 2759, 2865, 2866, 2869, 2882, 3079, 3576, 3579, 3580, 3748, 4017, 4137, 4849, 4851, 5216, 528, 7030	Support the following RFC standards: 2246, 2248, 2548, 2759, 2865, 2866, 2869, 2882, 3079, 3576, 3579, 3580, 3748, 4017, 4137, 4849, 4851, 5216, ~~528,~~ 7030
Support the following profiling methods: DHCP, TCP, MAC OUI, ClearPass Onboard, SNMP, Cisco device sensor	Support the following profiling methods: DHCP, TCP, MAC OUI, ~~ClearPass Onboard,~~ SNMP, ~~Cisco~~ device sensor
Appliance a. Single platform approach that combines AAA, NAC, BYOD, MAM and Guest Access by incorporating identity, health, physical/device information, and conditional elements into one set of policies. b. Must have ability to scale to up to 5,000 devices per appliance or 80 virtual appliance (Both VMware and Hyper V). c. Solution must be Agnostic to existing wired, wireless and VPN network in place today. d. Appliance must be pre-built and ready to be imported (OVF) into VMware virtualization environment (building from ISO not acceptable). e. Shell protected by CLI providing configuration for base appliance settings.	***Appliance*** a. Single platform approach that combines AAA, NAC, BYOD, MAM and Guest Access by incorporating identity, health, physical/device information, and conditional elements into one set of policies. b. Must have ability to scale to ~~up to~~ 5,000 devices per appliance or ~~80~~ virtual appliance (~~Both~~ VMware ~~and Hyper V~~). c. Solution must be Agnostic to existing wired, wireless and VPN network in place today. d. Appliance must be pre-built and ready to be imported (OVF) into VMware virtualization environment (building from ISO not acceptable). e. Shell protected by CLI providing configuration for base appliance settings.

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f. Appliance must provide disk or file encryption. g. Ability to mix and match virtual and hardware appliances in one deployment. h. Platform must be deployable in an out-of-band model and support for clustering with N+1 redundancy model. i. Flexibility to operate all features/functions on any appliance in the cluster. j. Hardware platform must be running on hardened operating system	~~f. Appliance must provide disk or file encryption.~~ g. Ability to mix and match virtual and hardware appliances in one deployment. h. Platform must be deployable in an out-of-band model and support for clustering with N+1 redundancy model. i. Flexibility to operate all features/functions on any appliance in the cluster. j. Hardware platform must be running on hardened operating system
Bring Your Own Devices (BYOD) a. Self-service workflow built on an industry leading platform. Supports popular smart devices as well as traditional computing platform b. Unique portal pages based on devices type – iOS, Android. c. Ability to support revocation of devices. d. Correlation of user, device, and authentication information for easier troubleshooting, tracking etc. – provides high level of visibility into what devices are on the network and associated with what users. e. Automated onboarding of devices to enable secure access via self-serve portal allowing for the configuration of 802.1x supplicants, device enrolment and provisioning. f. Ability to integrate with Active Directory so users that are approved for BYOD may be authenticated via identity and/or device attributes. g. OPTIONAL Cloud based, endpoint configuration tool for streamlining the configuration of 802.1X supplicants for laptops or handheld devices (smartphones, pads, etc.) and guiding the end-user onto the network for the first time. h. Support for Windows, Mac, iOS (iPhones, iPads, etc.) and Android devices.	***Bring Your Own Devices (BYOD)*** a. Self-service workflow built on an industry leading platform. Supports popular smart devices as well as traditional computing platform ~~b. Unique portal pages based on devices type – iOS, Android.~~ c. Ability to support revocation of devices. d. Correlation of user, device, and authentication information for easier troubleshooting, tracking etc. – provides high level of visibility into what devices are on the network and associated with what users. e. Automated onboarding of devices to enable secure access via self-serve portal allowing for the configuration of 802.1x supplicants, device enrolment and provisioning. f. Ability to integrate with Active Directory so users that are approved for BYOD may be authenticated via identity and/or device attributes. ~~g. OPTIONAL Cloud based, endpoint configuration tool for streamlining the configuration of 802.1X supplicants for laptops or handheld devices (smartphones, pads, etc.) and guiding the end-user onto the network for the first time.~~ h. Support for Windows, Mac, iOS (iPhones, iPads, etc.) and Android devices.
Controller (1 Unit)	
Controller (1 Unit)	***Controller (~~1~~ 2 Units)***
The proposed solution must have a newly installed controllers automatically synchronized with the already existing	~~The proposed solution must have a newly installed controllers automatically synchronized with the already existing~~

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controller(s), without requiring a separate network management server.	~~controller(s), without requiring a separate network management server.~~
The proposed solution must support the following certifications: a. Wi-Fi Alliance certified (802.11a/b/g/n/d/h/ac, WPATM b. Personal, WPATM Enterprise, WPA2TM Personal, WPA2TM c. Enterprise, WMMTM, WMM Power Save) d. FIPS 140-2 validated (when operated in FIPS mode) e. Common Criteria EAL-2 f. RSA certified g. Polycom/Spectralink VIEW certified h. USGv6 firewall	The proposed solution must support the following certifications: a. Wi-Fi Alliance certified (802.11a/b/g/n/d/h/ac, WPATM b. Personal, WPATM Enterprise, WPA2TM Personal, WPA2TM c. Enterprise, WMMTM, WMM Power Save) d. FIPS 140-2 validated (when operated in FIPS mode) e. Common Criteria EAL-2 f. RSA certified ~~g. Polycom/Spectralink VIEW certified~~ ~~h. USGv6 firewall~~
The proposed solution must support up to 12 controllers in one cluster, Controller Clustering enables a seamless experience across giant campuses, in the event of failure or significant crowd density	The proposed solution must ~~support up to 12 controllers in one cluster, Controller Clustering enables a seamless experience across giant campuses, in the event of failure or significant crowd density~~ **be a cluster in Active Standby Mode**
The proposed solution must support ability to dynamically update individual service modules (AppRF, AirGroup, ARM, AirMatch, NBAPI, UCM, WebCC and IP classification) that are residing on the Mobility Master, without requiring an entire system reboot	The proposed solution must support ability to dynamically update individual service modules ~~(AppRF, AirGroup, ARM, AirMatch, NBAPI, UCM, WebCC and IP classification) that are residing on the Mobility Master~~, without requiring an entire system reboot
The proposed solution must allow the Department to have visibility into non-RF metrics (RADIUS, DHCP and DNS server) which not only gives them end-to-end visibility into a wireless user experience, but also provides them with the ability to foresee connectivity issues before users are even impacted. In addition to looking at real traffic flowing through the network, Clarity also enables WLAN administrators to simulate traffic to identify service outages and performance issues before users experience them. This proactive workflow can either be on-demand or scheduled across thousands of locations	~~The proposed solution must allow the Department to have visibility into non-RF metrics (RADIUS, DHCP and DNS server) which not only gives them end-to-end visibility into a wireless user experience, but also provides them with the ability to foresee connectivity issues before users are even impacted.~~ ~~In addition to looking at real traffic flowing through the network, Clarity also enables WLAN administrators to simulate traffic to identify service outages and performance issues before users experience them. This proactive workflow can either be on-demand or scheduled across thousands of locations~~
Wireless LAN controller a. Support up to 256 APs. b. Support over 8192 number of concurrent connected wireless clients.	***Wireless LAN controller*** a. Support up to 256 APs. b. Support over ~~8192~~ **10,000** number of concurrent connected wireless clients.

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c. Support up to 12 Gbps of stateful firewall throughput. d. Support over 128,000 million concurrent active firewall sessions e. Support solid state drives for maximum reliability and uptime. f. Support 2 x 10Gbase-X (SFP+) ports and 4 x 1G Combo (Copper and Fiber)	c. ~~Support up to 12 Gbps of stateful firewall throughput.~~ d. ~~Support over 128,000 million concurrent active firewall sessions~~ e. ~~Support solid state drives for maximum reliability and uptime.~~ f. Support 2 x 10Gbase-X (SFP+) ports and 4 x 1G Combo (Copper and Fiber)
Network Services a. The system must support internal routing, bridging and spanning tree capabilities across its ports within the centralized switch/controller in order to enable ease of deployment and scalability. b. Source NAT and destination NAT must be available for private address use. c. Interfaces on the switch/controller must be able to be set for DHCP in order to operate where static IP addressing is not available. d. An internal DHCP server for ease of deployment and scalability must be available and must be able to redistribute dynamically learned information such as DNS, WINS, and local DNS suffix entries in the DHCP response. e. Support GRE and IPSEC tunnels between controllers and other GRE/IPSEC termination devices in order to enable secure site-to-site connections without requiring external hardware. f. WLAN infrastructure should support multiple VLAN assignments to a single SSID in an effort to ease the pain in VLAN subnet sizing management. WLAN infrastructure should automatically distribute mobile devices to different VLANs. g. Support wireless devices that print and share media that leverage UpnP®, DLNA®, AirPrint and AirPlay® technology. Also provides QoS and policy enforcement to control resource sharing based on group, user, role, time and location, included: ● Enables users to discover network services across IP subnet boundaries in wireless and wired networks. ● Allow users to access conference	***Network Services*** a. The system must support internal routing, bridging and spanning tree capabilities across its ports within the centralized switch/controller in order to enable ease of deployment and scalability. b. ~~Source NAT and destination NAT must be available for private address use.~~ c. Interfaces on the switch/controller must be able to be set for DHCP in order to operate where static IP addressing is not available. d. An internal DHCP server for ease of deployment and scalability must be available and must be able to redistribute dynamically learned information such as DNS, WINS, and local DNS suffix entries in the DHCP response. e. ~~Support GRE and IPSEC tunnels between controllers and other GRE/IPSEC termination devices in order to enable secure site-to-site connections without requiring external hardware.~~ f. ~~WLAN infrastructure should support multiple VLAN assignments to a single SSID in an effort to ease the pain in VLAN subnet sizing management. WLAN infrastructure should automatically distribute mobile devices to different VLANs.~~ g. ~~Support wireless devices that print and share media that leverage UpnP®, DLNA®, AirPrint and AirPlay® technology. Also provides QoS and policy enforcement to control resource sharing based on group, user, role, time and location, included:~~ ~~● Enables users to discover network services across IP subnet boundaries in wireless and wired networks.~~ ~~● Allow users to access conference~~

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room Apple TVs during presentations using group-based access privileges. ● Identifies AirPrint-enabled printers and enables user access based on location. ● Teachers can project to an Apple TV in a classroom using a laptop or iPad, while student access is prevented. ● Students get exclusive access to Apple TVs in their dorm rooms based on personal access privileges, while access by other residents is not allowed.	~~room Apple TVs during presentations using group-based access privileges.~~ ~~● Identifies AirPrint-enabled printers and enables user access based on location.~~ ~~● Teachers can project to an Apple TV in a classroom using a laptop or iPad, while student access is prevented.~~ ~~● Students get exclusive access to Apple TVs in their dorm rooms based on personal access privileges, while access by other residents is not allowed.~~
h. Support enterprise-grade adaptive WLANs to automatically manages all RF parameters to achieve maximum performance, included: ● Support 802.11ac VHT20, VHT40 and VHT80 – manages spectrum for all 802.11ac networks. ● Support 802.11n HT20 and HT40 – manages spectrum for all 802.11n networks. ● Client band steering – keeps dual-band clients on optimal RF band. ● Self-healing around failed Aps – automatically adjust power levels to compensate for failed Aps. ● Airtime fairness – manages client access to the air resources. Can be configured to provide fair access or to deliver preferred access to clients that connect using the latest 802.11 standard. ● RF spectrum load-balancing – evenly distributes clients across available channels. ● Single-channel coordinated access – ensures optimal performance even with nearby Aps on the same channel. ● RF planning – automatic pre-deployment modeling, planning and placement of Aps and RF monitors based on capacity, coverage and security requirements. ● Coverage hole and interference detection – detects clients that cannot associate due to coverage gaps. ● Timer-based AP access control – shuts off Aps outside of defined operating hours. ● Remote wireless packet capture – remotely captures raw 802.11 frames and streams to protocol analyzer.	~~h. Support enterprise-grade adaptive WLANs to automatically manages all RF parameters to achieve maximum performance, included:~~ ~~● Support 802.11ac VHT20, VHT40 and VHT80 – manages spectrum for all 802.11ac networks.~~ ~~● Support 802.11n HT20 and HT40 – manages spectrum for all 802.11n networks.~~ ~~● Client band steering – keeps dual-band clients on optimal RF band.~~ ~~● Self-healing around failed Aps – automatically adjust power levels to compensate for failed Aps.~~ ~~● Airtime fairness – manages client access to the air resources. Can be configured to provide fair access or to deliver preferred access to clients that connect using the latest 802.11 standard.~~ ~~● RF spectrum load-balancing – evenly distributes clients across available channels.~~ ~~● Single-channel coordinated access – ensures optimal performance even with nearby Aps on the same channel.~~ ~~● RF planning – automatic pre-deployment modeling, planning and placement of Aps and RF monitors based on capacity, coverage and security requirements.~~ ~~● Coverage hole and interference detection – detects clients that cannot associate due to coverage gaps.~~ ~~● Timer-based AP access control – shuts off Aps outside of defined operating hours.~~ ~~● Remote wireless packet capture – remotely captures raw 802.11 frames and streams to protocol analyzer.~~

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● Plug-ins for third-party analysis tools – Wireshark, OmniPeek, AirMagnet. ● Rogue AP detection and containment – Detects unauthorized Aps and automatically shuts them down. ● Real-time location tracking and monitoring – enhanced with optional Aruba ALE solution. ● Location tracking API for external integration – compatible with many retail analytics solution.	~~● Plug-ins for third-party analysis tools – Wireshark, OmniPeek, AirMagnet.~~ ~~● Rogue AP detection and containment – Detects unauthorized Aps and automatically shuts them down.~~ ~~● Real-time location tracking and monitoring – enhanced with optional Aruba ALE solution.~~ ~~● Location tracking API for external integration – compatible with many retail analytics solution.~~
i. Support controller high availability to minimize downtime in the unlikely event of a mobility controller failure, with the following deployment models and features: ● Active/active (1:1) – each Mobility Controller typically serves 50% of its rated capacity. The first acts as a standby for Aps served by second controller and vice-versa. If a controller fails, its Aps failover to the other controller, ensuring high-availability to all Aps. ● Active/standby (1+1) – one Mobility Controller terminates all the Aps, while the other controller acts as a standby if the primary controller goes down, Aps move to standby controller. ● N+1 – multiple active Mobility Controllers are backed-up by a single standby controller. ● AP establish simultaneous communication channel with both active and standby Mobility Controller – instantaneous failover to redundant Mobility Controller when the first controller fails. ● During a failover, the Aps do not turn their radios off and on – SSID always available. ● The solution works across layer 3 network – no special topology needed. ● Client state sync – Credentials are cached, eliminating need to re-authenticate and overload RADIUS server. ● N+1 oversubscription – simplifies configuration and reduces number of Mobility Controller needed.	i. ~~Support controller high availability to minimize downtime in the unlikely event of a mobility controller failure, with the following deployment models and features:~~ ~~● Active/active (1:1) – each Mobility Controller typically serves 50% of its rated capacity. The first acts as a standby for Aps served by second controller and vice-versa. If a controller fails, its Aps failover to the other controller, ensuring high-availability to all Aps.~~ ~~● Active/standby (1+1) – one Mobility Controller terminates all the Aps, while the other controller acts as a standby if the primary controller goes down, Aps move to standby controller.~~ ~~● N+1 – multiple active Mobility Controllers are backed-up by a single standby controller.~~ ~~● AP establish simultaneous communication channel with both active and standby Mobility Controller – instantaneous failover to redundant Mobility Controller when the first controller fails.~~ ~~● During a failover, the Aps do not turn their radios off and on – SSID always available.~~ ~~● The solution works across layer 3 network – no special topology needed.~~ ~~● Client state sync – Credentials are cached, eliminating need to re-authenticate and overload RADIUS server.~~ ~~● N+1 oversubscription – simplifies configuration and reduces number of Mobility Controller needed.~~

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NETWORK MONITORING SYSTEM (UNLIMITED NODES)	
NETWORK MONITORING SYSTEM (UNLIMITED NODES)	**NETWORK MONITORING SYSTEM (~~UNLIMITED~~ 250 NODE LICENSE)**
DATA Center Upgrading (Stand Alone FDAS with Notification)	
DATA Center Upgrading (Stand Alone FDAS with Notification)	**DATA Center Upgrading (Stand Alone ~~FDAS~~ Fire and Smoke Detector and Alarm ~~with Notification~~) (1 Unit)**
SMART DATA CABINET	
A. Cabinet Systems Colling with 4 Racks and Single UPS System a. SDC, 600mm IT rack for 42Ux600Wx1400D,120Pcs CAT6 cables entry, intelligent lock, RDU-THD b. Cable duct300mm width c. Cable duct600mm width, for 600mm width IT Rack & PMC d. PMC Rack 600mm, PMC18, ITA2 20kVA UPS (long backup) UPS standalone, intelligent lock, Fan controller, RDU501, 1x CRV4 DX power cables, max support 2+9 e. Indoor unit DX, 60Hz, intelligent lock, electrical reheat & electrode humidifier, with condenser pump, top piping, with CRAC HMI in rear door f. Outdoor unit, for 25KW50/60Hz, environment temperature:20~40°C g. Adjustable rail kit h. External battery cabinet, 2U i. RP2V2006 MPS switched PDU 32A, C13*18+C19*6, 5M length input cable j. 4G Modem for SMS notification k. Testing & Commissioning, Smart Row Configuration 1+4, within business hours ***B. Fire Suppression System*** **a.** FSS with Point detectors: Novec1230 suppression for 1.5m **b.** 2.2 FSS with Point detectors: Novec1230 suppression for 3.0m3 **c.** Rackmount Kit **d.** In-country training and onsite installation (Services - Mandatory Per System) ***C. Electrical System Works w/ Materials and Rough-ins*** **D.** ***Mechanical System Works w/ Materials and Rough- ins***	***A. Cabinet Systems Colling with 4 Racks and Single UPS System*** a. SDC, 600mm IT rack for 42Ux600Wx1400D,120Pcs CAT6 cables entry, intelligent lock, RDU-THD b. Cable duct300mm width c. Cable duct600mm width, for 600mm width IT Rack & PMC d. PMC Rack 600mm, PMC18, ITA2 20kVA UPS (~~long backup~~ **30 mins backup time**) UPS standalone, intelligent lock, Fan controller, RDU501, 1x CRV4 DX power cables, max support 2+9 e. Indoor unit DX, 60Hz, intelligent lock, electrical reheat & electrode humidifier, with condenser pump, top piping, with CRAC HMI in rear door f. Outdoor unit, for 25KW50/60Hz, environment temperature:20~40°C g. Adjustable rail kit h. External battery cabinet, 2U i. RP2V2006 MPS switched PDU 32A, C13*18+C19*6, 5M length input cable j. 4G Modem for SMS notification k. Testing & Commissioning, Smart Row Configuration 1+4, within business hours ***B. Fire Suppression System*** **a.** FSS with Point detectors: Novec1230 suppression for 1.5m **b.** 2.2 FSS with Point detectors: Novec1230 suppression for 3.0m3 **c.** Rackmount Kit **d.** In-country training and onsite installation (Services - Mandatory Per System) ***C. Electrical System Works w/ Materials and Rough-ins*** **D.** ***Mechanical System Works w/ Materials and Rough- ins***

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IP-PBX	
A. ***IPBX Main System***	**A.** ***IPBX Main System (1 Unit)***
B. ***Operator Phone***	**B.** ***Operator Phone (1 Unit)***
C. ***IP PHONES***	**C.** ***IP PHONES (110 Units)***
D. UPS	***D. UPS (1 Unit)***
E. Smart-UPS	***E. Smart-UPS (22 Units)***
F. ***VHF Radio Integration Specification***	**F.** ***VHF Radio Integration Specification (1 Unit)***
IP BASED PAGING SYSTEM HARDWARE	
a. Ceiling Speaker 6" cone type, 6W(100V), Sensitivity: 90 dB (1 W, 1 m) (500 Hz - 5 kHz, pink noise), Freq. response: 65 Hz - 18 kHz (peak -20 dB) b. Multi-functional Amplier with 5 zones, 4 audio inout for bgm, Rated power: 240 watts,Freq. response: 50Hz – 16kHz, Output Connection: Speaker output, Direct speaker line output,Line output,Recording output, Preamplifier output. c. Remote Microphone(unidirectional mic) connect to vm-2240, Freq. response: 100-20, S/N ratio: 60dB or more d. Playback-only Voice Announcing board, Freq. response: 20 - 20,000 Hz (44.1 kHz sampling) 20 - 14,000 Hz (32 kHz sampling), Distortion: Under 0.3 % (44.1 kHz, recording method: Extremely High) e. 4 channels: 500 W × 4 (100 V line M4 screw terminal, Class D Amp, Freq. response: 50 Hz - 20 kHz (-3 dB), S/N Ratio: 100 dB (A-weighted) f. 30 Watts Tared input, Wide Range Weatherproof Speaker(outdoor), Sensitivity: 98 dB (1 W, 1 m), Freq. Response: 120 - 15,000 Hz, Horizantal Directivity: Constant directivity horn 90 ◌° (±45 ◌° horizontal from front axis), 93 dB or more (1 W, 1 m), 3 kHz at ±45, Bracket already included g. Line Transformer converts unbalanced to balance h. Mobilisation and Demobilisation i. Hardware and Consumable Materials j. Engineering Services	a. **(205 Units)** Ceiling Speaker 6" cone type, 6W(100V), Sensitivity: 90 dB (1 W, 1 m) (500 Hz - 5 kHz, pink noise), Freq. response: 65 Hz - 18 kHz (peak -20 dB) b. Multi-functional Amplier with 5 zones, 4 audio inout for bgm, Rated power: 240 watts,Freq. response: 50Hz – 16kHz, Output Connection: Speaker output, Direct speaker line output,Line output,Recording output, Preamplifier output. c. **(2 Units)** Remote Microphone(unidirectional mic) connect to vm-2240, Freq. response: 100-20, S/N ratio: 60dB or more d. Playback-only Voice Announcing board, Freq. response: 20 - 20,000 Hz (44.1 kHz sampling) 20 - 14,000 Hz (32 kHz sampling), Distortion: Under 0.3 % (44.1 kHz, recording method: Extremely High) e. 4 channels: 500 W × 4 (100 V line M4 screw terminal, Class D Amp, Freq. response: 50 Hz - 20 kHz (-3 dB), S/N Ratio: 100 dB (A-weighted) f. **(3 Units)** 30 Watts Tared input, Wide Range Weatherproof Speaker(outdoor), Sensitivity: 98 dB (1 W, 1 m), Freq. Response: 120 - 15,000 Hz, Horizantal Directivity: Constant directivity horn 90 ◌° (±45 ◌° horizontal from front axis), 93 dB or more (1 W, 1 m), 3 kHz at ±45, Bracket already included g. Line Transformer converts unbalanced to balance h. Mobilisation and Demobilisation i. Hardware and Consumable Materials j. Engineering Services
SMART-UPS 3000VA LCD RM 2U 230V	
SMART-UPS 3000VA LCD RM 2U 230V	***SMART-UPS 3000VA LCD RM 2U 230V (8 Units)***

3. Please see Appendix "A" for the Fiber Optic Cabling Single Line Diagram 1

Room M-511, 5th Floor, Mabini Building, DepEd Complex, Meralco Avenue, Pasig City 1600
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4. **Please see Appendix "B" for the Fiber Optic Cabling Single Line Diagram 2**
5. **Please see Appendix "C" for the Network Switch Single Line Diagram**
6. **Please see Appendix "D" for the IP-PBX and Portable Radio Integration Diagram**
7. **Please see Appendix "E" for the IP-PBX and IP Paging System Interconnection Line Diagram**

All other provisions not herein modified shall remain in full force and effect.

For your information and guidance.

Atty. REVSEE A. ESCOBEDO
Undersecretary and Chairperson

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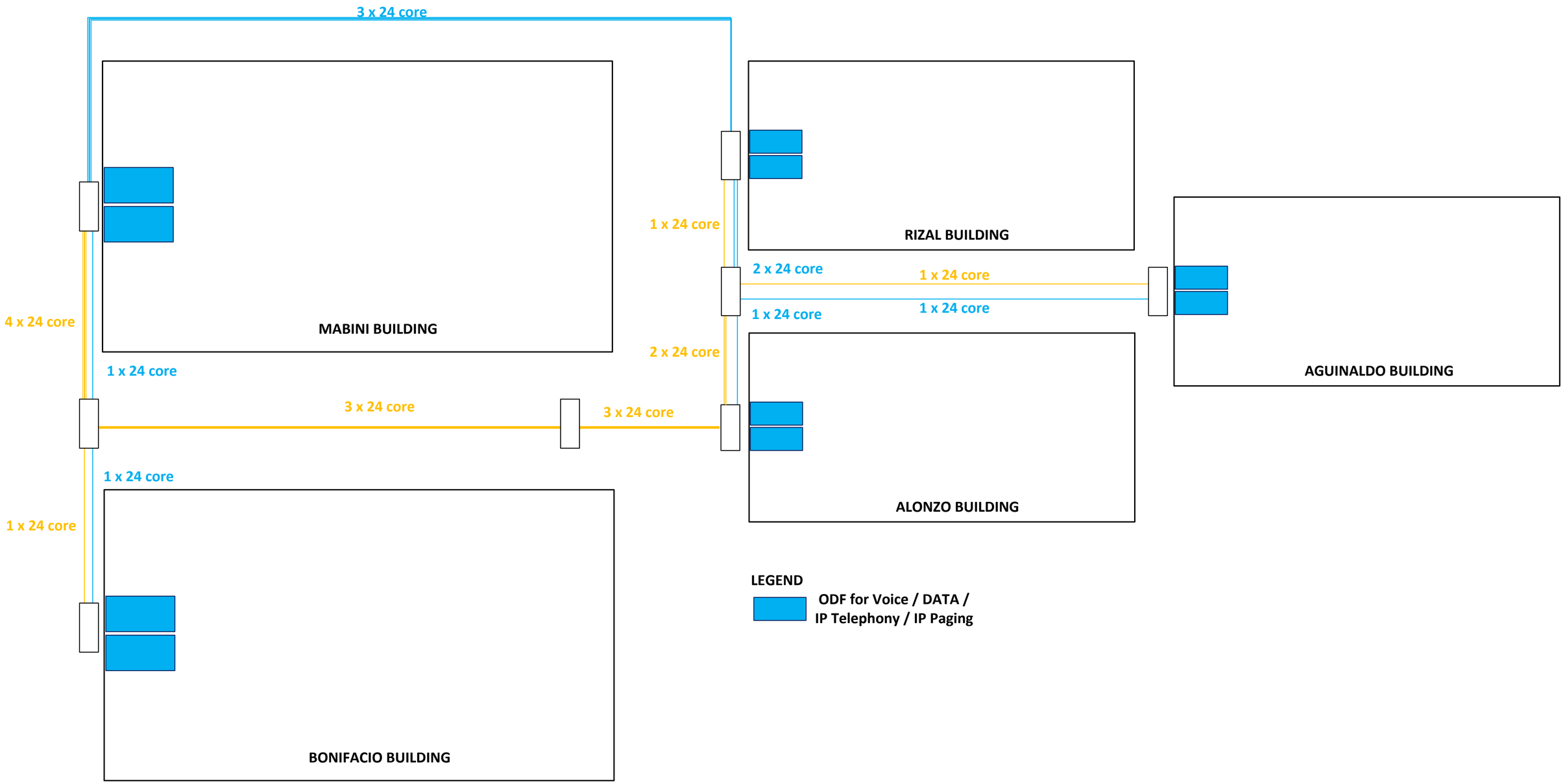
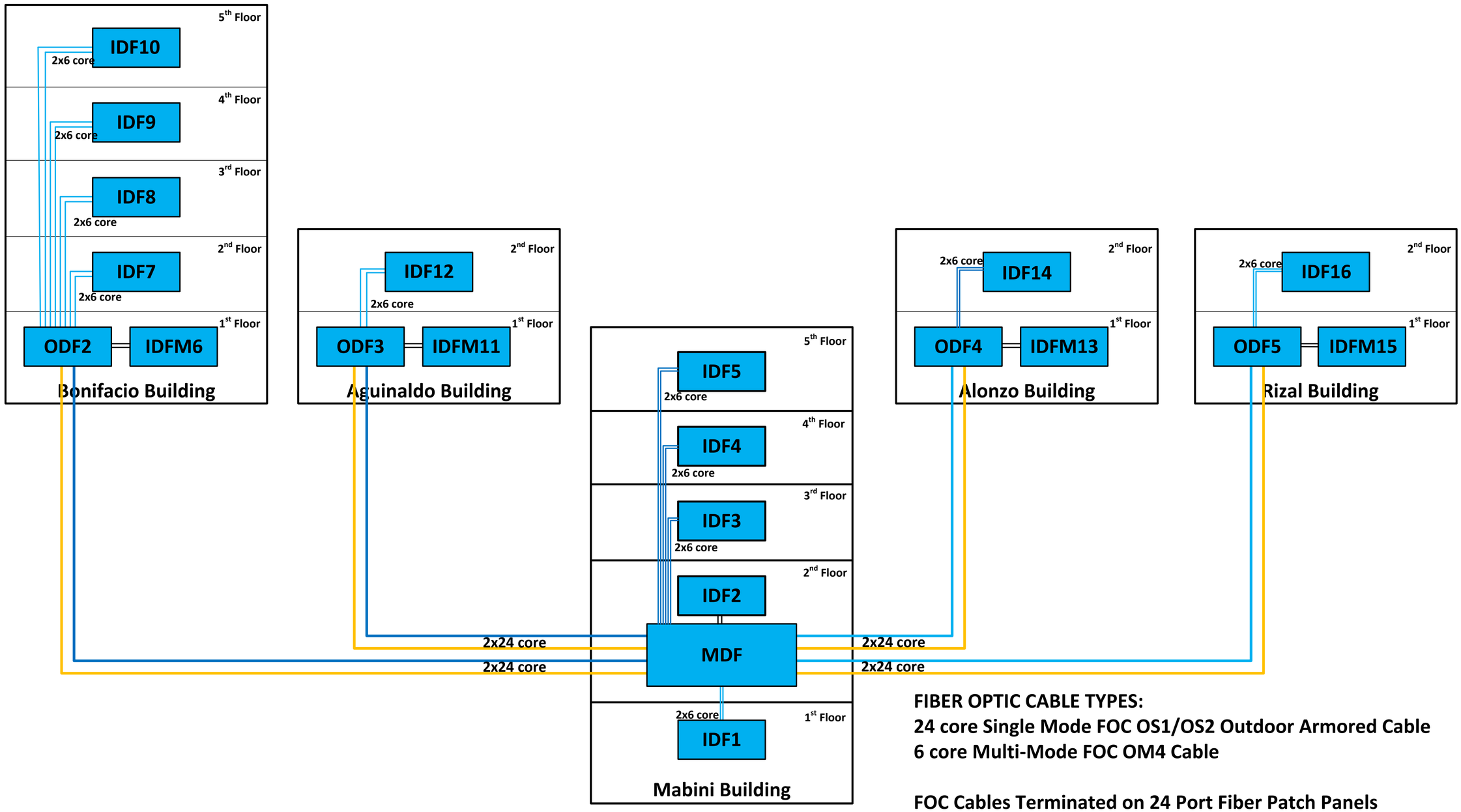


FIBER OPTIC CABLING SINGLE LINE DIAGRAM

	PROJECT	PREPARED BY	REVIEWED BY	APPROVED BY	
DepED DEPARTMENT OF EDUCATION	SUPPLY, DELIVERY, INSTALLATION, TESTING, TRAINING AND MAINTENANCE OF DEPARTMENT OF EDUCATION CENTRAL OFFICE NETWORK REHABILITATION	SEAN MICHAEL ANGELO E. BRUCAL	ENGR. OFELIA L. ALGO	ABRAM Y.C ABANIL	1/5
	LOCATION	COMPUTER PROGRAMMER II	INFORMATION TECHNOLOGY OFFICER III CHIEF, TECHNOLOGY INFRASTRUCTURE DIVISION	DIRECTOR IV	
	DEPED COMPLEX, MERALCO AVENUE, PASIG CITY				

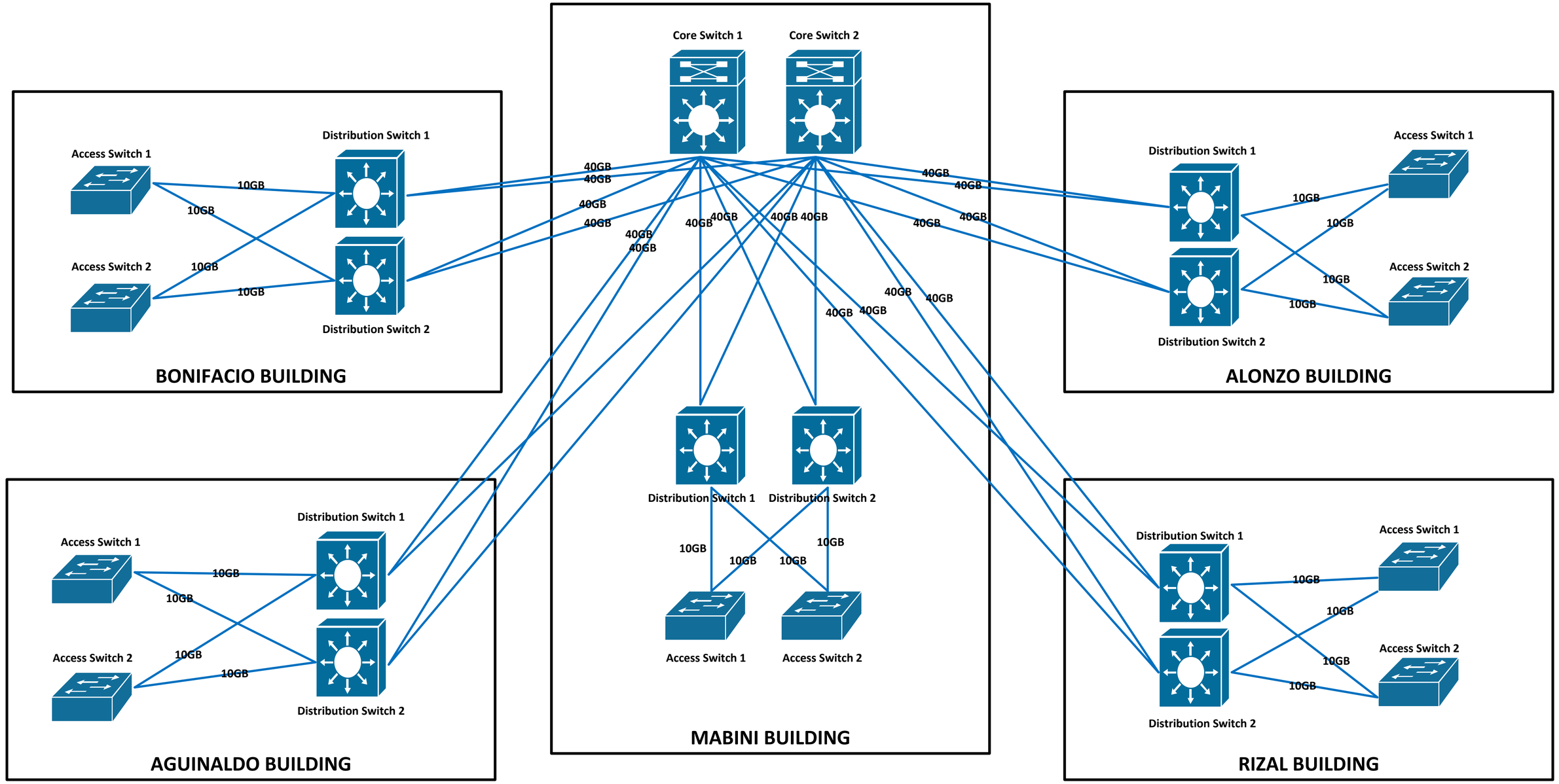


FIBER OPTIC CABLE TYPES:
24 core Single Mode FOC OS1/OS2 Outdoor Armored Cable
6 core Multi-Mode FOC OM4 Cable

FOC Cables Terminated on 24 Port Fiber Patch Panels

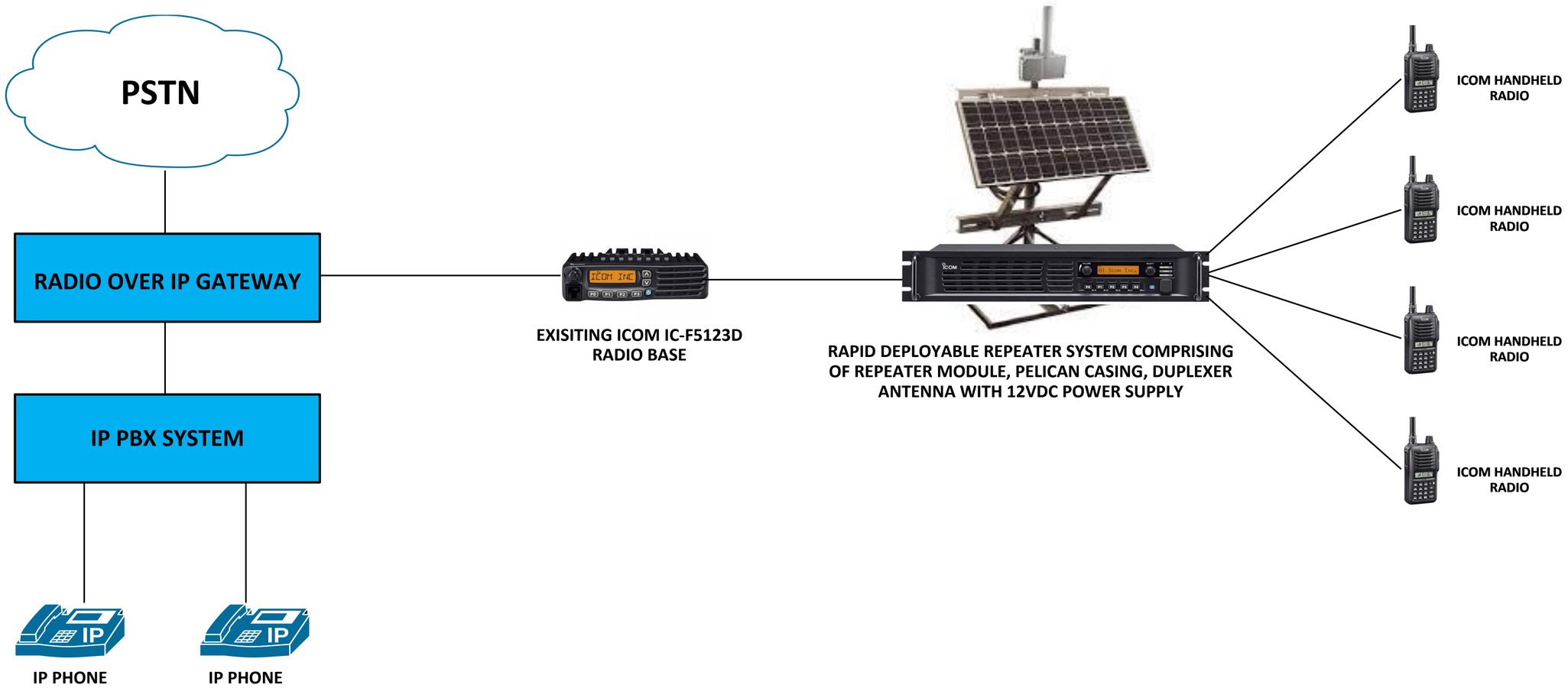
FIBER OPTIC CABLING SINGLE LINE DIAGRAM

	PROJECT	PREPARED BY	REVIEWED BY	APPROVED BY	
DepED DEPARTMENT OF EDUCATION	SUPPLY, DELIVERY, INSTALLATION, TESTING, TRAINING AND MAINTENANCE OF DEPARTMENT OF EDUCATION CENTRAL OFFICE NETWORK REHABILITATION	SEAN MICHAEL ANGELO E. BRUCAL	ENGR. OFELIA L. ALGO	ABRAM Y.C ABANIL	2/5
	LOCATION	COMPUTER PROGRAMMER II	INFORMATION TECHNOLOGY OFFICER III CHIEF, TECHNOLOGY INFRASTRUCTURE DIVISION	DIRECTOR IV	
	DEPED COMPLEX, MERALCO AVENUE, PASIG CITY				



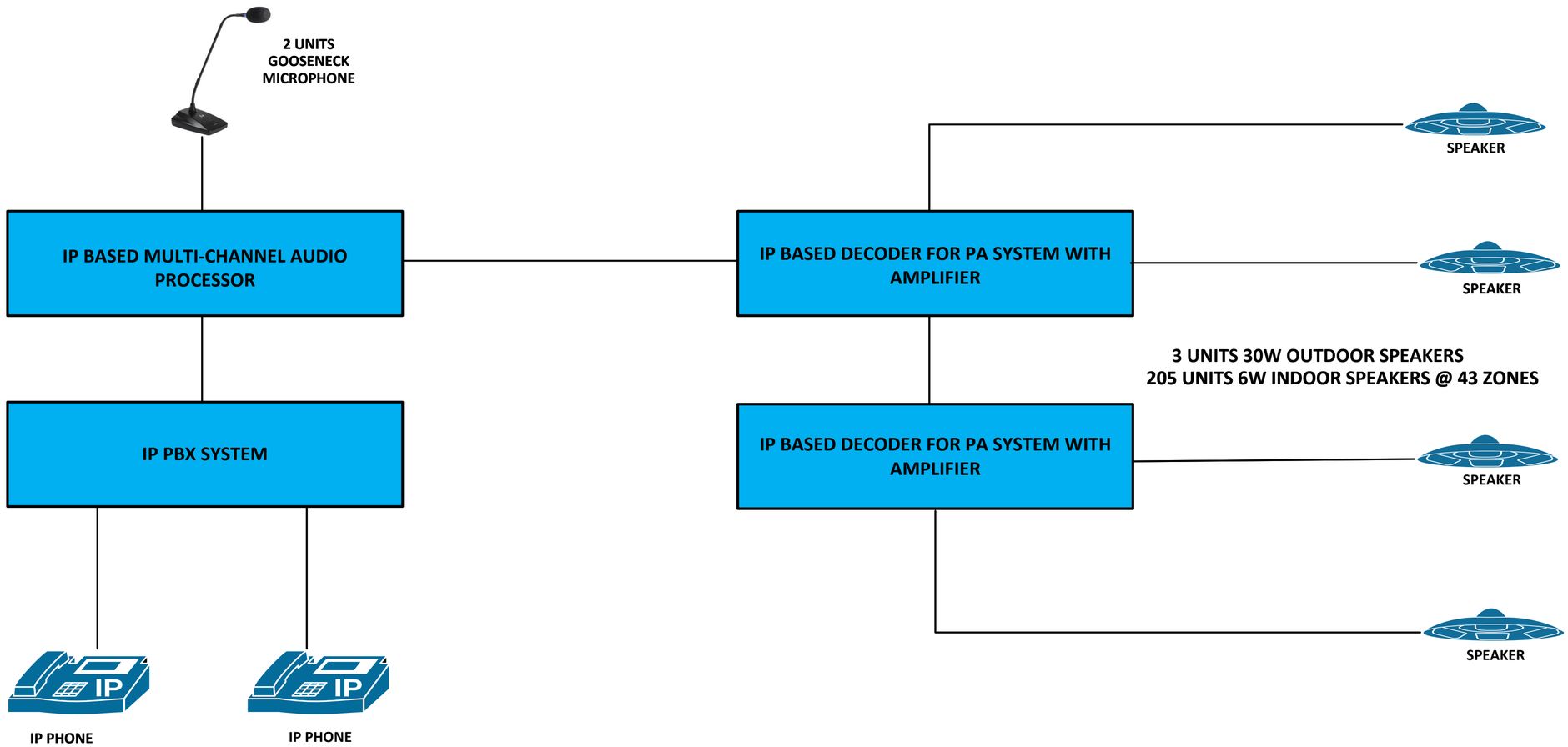
NETWORK SWITCH SINGLE LINE DIAGRAM

	PROJECT	PREPARED BY	REVIEWED BY	APPROVED BY	
DepED DEPARTMENT OF EDUCATION	SUPPLY, DELIVERY, INSTALLATION, TESTING, TRAINING AND MAINTENANCE OF DEPARTMENT OF EDUCATION CENTRAL OFFICE NETWORK REHABILITATION	SEAN MICHAEL ANGELO E. BRUCAL	ENGR. OFELIA L. ALGO	ABRAM Y.C ABANIL	3/5
	LOCATION	COMPUTER PROGRAMMER II	INFORMATION TECHNOLOGY OFFICER III CHIEF, TECHNOLOGY INFRASTRUCTURE DIVISION	DIRECTOR IV	
	DEPED COMPLEX, MERALCO AVENUE, PASIG CITY				



IP-PBX AND PORTABLE RADIO INTEGRATION DIAGRAM

	PROJECT	PREPARED BY	REVIEWED BY	APPROVED BY	
DepED DEPARTMENT OF EDUCATION	SUPPLY, DELIVERY, INSTALLATION, TESTING, TRAINING AND MAINTENANCE OF DEPARTMENT OF EDUCATION CENTRAL OFFICE NETWORK REHABILITATION	SEAN MICHAEL ANGELO E. BRUCAL	ENGR. OFELIA L. ALGO	ABRAM Y.C ABANIL	4/5
	LOCATION DEPED COMPLEX, MERALCO AVENUE, PASIG CITY	COMPUTER PROGRAMMER II	INFORMATION TECHNOLOGY OFFICER III CHIEF, TECHNOLOGY INFRASTRUCTURE DIVISION	DIRECTOR IV	



IP-PBX AND IP PAGING SYSTEM INTERCONNECTION LINE DIAGRAM

DepED DEPARTMENT OF EDUCATION

PROJECT	PREPARED BY	REVIEWED BY	APPROVED BY	
SUPPLY, DELIVERY, INSTALLATION, TESTING, TRAINING AND MAINTENANCE OF DEPARTMENT OF EDUCATION CENTRAL OFFICE NETWORK REHABILITATION	SEAN MICHAEL ANGELO E. BRUCAL	ENGR. OFELIA L. ALGO	ABRAM Y.C ABANIL	5/5
LOCATION DEPED COMPLEX, MERALCO AVENUE, PASIG CITY	COMPUTER PROGRAMMER II	INFORMATION TECHNOLOGY OFFICER III CHIEF, TECHNOLOGY INFRASTRUCTURE DIVISION	DIRECTOR IV	