TECHNICAL SPECIFICATIONS AND BILLS OF QUANTITIES FOR SUPPLY, INSTALLATION AND COMMISSIONING OF DATA CENTRE, UNIFIED COMMUNICATION NETWORK, AUDIO VISUAL, VIDEO CONFERENCING, QUEUE MANAGEMENT SYSTEM

SUPPLY, INSTALLATIONS AND COMMISSOINING OF DATA CENTRE, UNIFIED COMMUNICATION NETWORK, AUDIO VISUAL, VIDEO CONFERENCING, QUEUE MANAGEMENT SYSTEM

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Preliminaries

SECTION 2

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SECTION 3

Part I – General Specification

PART I

GENERAL SPECIFICATION

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3 PART I - GENERAL SPECIFICATION

3.1 Programme for ICT Installations

The Tenderer shall provide within a stipulated period of acceptance of his tender and award of Contract, a complete programme for the electrical engineering installations to be executed indicating the anticipated commencement and completion dates of the following activities:

(i) Placing of orders for the equipment to be incorporated in the works;

(ii) Shipment of the equipment from country of manufacture;
(iii) Delivery of the equipment to site;
(iv) Installation on site, details for all activities;
(v) Tests on Completion.

Operations shall be commenced when instructed and shall be carried forward to completion with the greatest possible expediency, to the satisfaction of the Architect and the Engineer, in accordance with the Programme. The Contractor's programmes shall be agreed with the Engineer and shall adhere fully to the requirements and timing of the agreed Main Contractor's programme.

3.2 Drawings accompanying the Tender Documents

The Electrical Drawings indicate generally the arrangement of the installations and are for assistance in tendering only. The position of equipment and apparatus shown thereon are approximate only, the exact positions, together with the actual runs of ductwork, trunking and conduit etc., will be agreed upon with the Engineer and the Employer prior to commencement of work. It shall be deemed that the prices entered by the Contractor include for the repositioning, of the various services, to meet the above requirements. No claims will be entertained.

The Contractor shall satisfy himself as to the correctness of all Drawings and measurements particularly the dimensions of the electrical installations. If the Contractor finds any discrepancy in the Drawings or between the Drawings and the Technical Specifications or between the electrical installations and the Drawings, he shall immediately refer the same to the Engineer who will make a ruling on the discrepancy. Figured dimensions shall be taken in preference to the scale mentioned on or attached to any Drawings. Details shown on Drawings shall be read in conjunction with items included in the Technical Specifications.

The Engineer will furnish the Contractor within a reasonable time after the receipt by the Engineer of a written request for the same, any details of which, in the opinion of the Engineer are necessary for the execution of any part of the works. Such a request to be made only within

a reasonable time prior to the execution of such work in order to fulfil the Contract. One copy of the Drawings, details and Technical Specifications shall be kept on the site until the completion of the Contract and the Engineer shall at all reasonable times have access to the same. The Contractor shall return all copies of Drawings and other relevant details to the Engineer on the completion of the Contract.

Additional Drawings will be issued by the Contractor to the Engineer to suit the design requirements of the works. These Drawings being issued either during or after the tender period as may be required or necessary. These Drawings will supplement the details contained within the Technical Specifications and Bills of Quantities and the Tenderer shall be deemed to have taken these into account in his pricing. Where the Contractor can demonstrate that the Drawings relate to new approved or additional items these new or additional items shall be priced to approval in accordance with the Contract rates and prices.

3.3 Contract Working Drawings

The Contractor shall prepare fully detailed Working Drawings for all equipment and accessories required for installation under this section of the Contract. Two copies of each Drawing shall be forwarded to the Engineer for approval and or comments. One copy will be returned stamped "approved" or "not-approved". Where Drawings require further information and/or modifications to meet the comments made by the Engineer they shall be re-submitted, again in duplicate, for approval.

When Drawings have been approved two further copies shall be forwarded to the Engineer, together with copies to the Architect, Site and the Employer.

Drawings, and, where relevant, calculations in respect of the following shall be prepared by the Contractor and submitted to the Services Engineer for his approval commencing within ten (10) days from acceptance of the tender:

(a) Technical literature for all the services;
(b) Shop drawings.

All drawings shall be to scale and fully detailed with all the important dimensions shown and the construction of key components indicated.

During progress of the building works, the Contractor shall make all necessary checks on site to ascertain that the various services can be installed as specified and shown on the approved Drawings.

Where such works cannot be so installed, this must be immediately brought to the notice of the Engineer and Architect prior to the progress of such works.

The Engineer, in conjunction with the Architect and the Employer, will check and return the Drawings submitted for approval within a reasonable period, but in any case not exceeding fourteen (14) days from receipt of the Drawings.

The layouts of plant and equipment are for general guidance only. The Contractor shall assess the requirements and prepare a plant layout for approval within twenty one (21) days, the required liaison being maintained with other specialists, such that an agreed layout is submitted for approval.

3.4 Maintenance Manuals

At the start of the defects liability period, the Contractor shall hand over to the Engineer, four sets of maintenance and operations manuals for each plant and equipment installed. These manuals shall be in English and shall be fully illustrated.

3.5 Builder's Work and Civil Works

Builder's Work and Civil Works that are incidental to this section of the Contract such as cutting of holes in walls and floors, provisions of foundations for the plant and machinery, shall be the responsibility of the Main Contractor. The Contractor shall be fully responsible for the preparation of all such details that relate to such works, the details being subject to approval by the Architect and Engineer prior to submission to the Main Contractor for action. Other items such as fixing of brackets, cables and ductwork and trenching, making good etc. shall be carried out by the Contractor to suit the installation of all the services.

It is the Contractor's sole responsibility to ensure that all holes and chases are in the required position and that any additional ducts, holes and chases necessary for erection of the installations in situ concrete walls, floor slabs etc., are included in the early stages of construction as appropriate.

The Contractor shall furnish the Engineer, Architect and Main Contractor with all the necessary information including position of foundations, brackets and fixings and shall ensure that such works are performed in accordance with available information.

The Contractor shall include in his tender all supports, fixings, plugging of holes in walls, ceilings and floors to facilitate the fixing of the pipework, accessories, and all other portions of the plumbing, drainage and fire fighting installations. Any purpose-made fixing brackets shall also be provided and installed by the Contractor, including escutcheon plates and the like.

The Contractor shall supply and install approved pipework support brackets and hangers. It shall be deemed that prices include for any special requirements and that the Contractor has visited the site during the tender period to ascertain all details.

The Contractor shall pay particular attention to the fixing and alignment of items. All items shall be installed square, true and perpendicular to floors i.e. as shown on Drawings and as may be required at

site to the Engineers approval.

3.6 Commissioning of the ICT Installations

The Contractor shall instruct the Employer's Maintenance Engineer or his representative on the operation and maintenance of the various components forming the electrical installation and shall provide drawings, diagrams and manuals to ensure the Maintenance Engineer or his representative is completely conversant with such installations.

The Contractor shall ensure that the services installations are left in complete safe working order and operating to the satisfaction of the Engineer.

3.7 Regulations and Standards

The Installations must be carried out strictly in accordance with the following documents:

(i) ANSI/TIA/EIA-942 Data Centre Standards
(ii) ISO 27001 Standards
(iii) Relevant International Standards;
(iv) Current Regulations and by-laws of KPLC;
(v) Regulations and by-laws of the Ministry of Energy;
(vi) Nairobi City Council (NCC) By-Laws;
(vii) Current Regulations of Communication Authority of Kenya
(viii) By-laws of the Electricity Regulatory Commission (ERC);
(ix) Current Regulations of Kenya Airports Authority;
(x) Any other duly constituted authorities' regulations having jurisdiction over the Works;
(xi) Water Supply and Sewerage Authority's Regulations;
(xii) The Specification and accompanying documentation and Drawings;

The Contractor shall undertake all modifications demanded by the authorities in order to comply with the regulations, and produce all certificates, if any, for the authorities at no extra charge.

3.8 Quality of Materials

All materials, fittings and accessories are to be new and in accordance with the requirements of the current rules and regulations where such exist, and with the relevant international standards.

Uniformity of type and manufacture of fittings and accessories is to be as far as practicable preserved throughout the whole Works.

Wherever the term 'similar to' is used in these Technical Specifications in reference to any item, the word will be understood to mean type and quality of the equipment and not preference.

Where particular manufacturers only are specified herein no alternative makes will be considered without good reasons.

All materials shall be of good quality, suitable for the purpose specified, and to the approval of the Engineer.

3.9 Workmanship

The Tenderer shall take into consideration, when pricing his tender, that there will be other specialists working alongside him. Any disruptions to the existing services must therefore be kept to a minimum, and in this respect the Contractor shall include in his prices for carrying out Works outside normal working hours as may be directed by the Engineer. No claim will be entertained where abnormal working hours are required to meet this requirement and completion of the works within the specified Contract period.

The Contractor shall be fully responsible for co-ordination of installation of all services. For all services involving ducted wiring, such wiring shall be capable of future addition or maintenance.

The Contractor shall be deemed to have included in his tender prices for relocating switches, terminal points, ductwork, outlets and fixtures in positions and/or locations at least one metre in any direction from the positions indicated on the Drawings. Within these limits no variations in the Contract sum will be made unless the work has already been executed in accordance with previously approved Working Drawings.

Only qualified and certified persons shall be allowed to carry out installation work. The Works shall be performed in a neat and workmanlike manner.

The Contractor shall take every precaution to avoid damage to the existing property including roads, paved walkways, grassed areas, landscaping, cables, drains and other services, and he will be held responsible for and shall make good all such damage at his own expense to the satisfaction of the Engineer.

The Contractor will be responsible for the exact runs and placing of pipework, conduit, boxes, ductwork and accessories that are to be cast in concrete, ceilings, floors, walls, columns and beams, and for the proper fixing of the pipework and accessories to the shuttering and the steel reinforcement work.

Where ductwork is to concealed, the pipes etc shall be in an exact position relative to the finished plaster or such other finishes as may be applied to enable adequate cover to be applied.

Where services are run above the false ceilings the Contractor shall ensure that access to all services is readily available such that future maintenance can be carried out without difficulty. Full details shall be included on the Working Drawings such that the Engineer can give consideration to the Contractor's proposals.

3.10 Setting out of work

The Contractor will be responsible for laying out his work and shall obtain all the necessary information as may be required to carry out the work. Such information shall be obtained sufficiently in advance to avoid any possibility of delay to the Works as a whole.

The Contractor shall be fully responsible, and shall seek, the details of all work being carried out by the various trades on Site, particularly where such trades may interfere with each other, or where co-ordination is necessary. No claims for extra costs will be entertained arising from omissions, oversight, or neglect in this regard.

In advance of the delivery of the plant and equipment, the Contractor shall arrange for the supply of all-necessary foundation bolts, templates, nuts, plates, sleeves, anchorages, etc., as required and as may be directed by the Engineer.

3.11 Erection and checking of work

The Contractor shall provide, and be solely responsible for, all skilled and unskilled labour, tools, lifting tackle and other equipment required for handling of plant and equipment when transporting to Site, within the Site and during erection.

All erection works shall be subject to approval by the Engineer.

All parts shall pass such tests as required by the Engineer to prove compliance with the Contract irrespective of any tests which may already have been carried out at the Manufacturer's Works. In particular all electrical pressure tests made at the Manufacturer's Works shall be repeated at voltages approved by the Engineer.

The Contractor shall supply and install all supports, fixings, brackets and similar items as may be necessary for the completion of the installation of the services as specified and as shown on the Drawings.

3.12 Site performance and acceptance tests

The Contractor shall give notice of the date of the specified tests to be performed on completion of installation. The notice shall be made in writing to the Engineer at least five days to the date of the specified tests. Unless otherwise agreed the tests shall take place within seven days of the stated date or on such day or days as the Engineer shall in writing notify the Contractor in writing. The tests shall be carried out under normal working conditions to the satisfaction of the Engineer and shall extend over such continuous periods as he may direct.

All skilled labour, supervision, apparatus, fuel and instruments required for carrying out the tests will be the responsibility and at the expense of the Contractor. The accuracy of the instruments shall be demonstrated if required. The Contractor shall ensure that test instruments are in good working condition and have been calibrated by an authorised agent.

If any part of the plant or equipment fails to pass the specified tests, further tests of the said part shall, if required by the Engineer, be repeated. The Contractor shall, without delay, put in hand such modifications as found necessary so as to meet the requirements of the Contract and any expense which the Client may have incurred by reason of such further tests shall be deducted from the Contractor's Contract price.

Each completed system within the installation shall be tested as a whole under operating conditions to ensure that each component functions correctly in conjunction with the rest of the system.

3.13 Test records

The Contractor shall make the necessary records of all the tests carried out, and when the tests have been successfully completed he shall provide the Engineer with test records and reports in a format to be agreed.

3.14 Dust, insect and vermin proofing

All equipment, likely to be affected by ingress of dust, shall be effectively dust proofed and vermin proofed where no protection is afforded in its normal manufactured form. All materials

used shall be in general resistant to attack by insects, micro-organisms or other fauna or flora. Materials used for such protection shall be to the approval of the Architect and Engineer.

3.15 Labels

All items of electrical plant, Sub-main distribution boards, etc. shall be neatly and clearly labelled externally with identification marks corresponding with those on Drawings or in Technical Specifications. Final details shall be agreed upon by the Contractor and the Engineer.

Identification labels shall be of laminated plastic material engraved, black on white, with no less than 6mm "Lino" style letters and shall be fixed on or adjacent to all items by means of at least two brass screws or to the approval of the Engineer. Self-adhesive labels shall not be permitted.

All labels/plates shall be in English.

3.16 Specialist manufacturers

Where specialists are not nominated by the Employer, the Contractor shall appoint specialist manufacturers and suitable specialists for any sections of the Works described herein in which he is not himself an experienced, recognized and approved specialist.

The Tenderer shall, on submission of his tender, indicate the names of all proposed specialist manufacturers and specialists, together with the precise sections of the Works for which each will be responsible. The Contractor may be required to seek alternative manufacturers or Contractors or to accept specialists nominated by the Employer; it shall be deemed that the prices entered in the tender include for this requirement. For plant and equipment supplied by suppliers other than the Contractor, the Contractor will be required to furnish an agreement between himself and the supplier stating that he is authorised by the supplier to deal in the plant and equipment and that he is authorised to stock the necessary spare parts or that the Employer will be authorised to revert to the supplier in the event of breakdown of the plant or equipment.

The Contractor shall allow in his prices for phasing his work to meet the requirements of the other specialists, and for varying his programme or otherwise, to comply with the erection programme of such specialist. No additional costs will be allowed to the Contractor for any disruptions to his programme, or otherwise, in his compliance with the above requirements.

3.17 Interference with the existing Works

The Contractor shall not interfere in any way with any existing works whether the property of the Employer or of a third party and whether the position of such works is indicated to the Contractor by the Engineer or not. The exception being where such interference is specifically described as part of the Works either in the Contract or in any instruction from the Engineer.

3.18 Protection of Works

The Contractor shall carefully protect from injury by weather all Work and materials which may be affected thereby and allow in his prices for all dams, pumping, shoring, temporary drains, sumps etc. necessary for the purpose. The Contractor shall clear away and make good at his own cost to the satisfaction of the Engineer all damage caused thereby.

3.19 Sundries

The necessary holding down bolts, supporting brackets and templates, guards and screens, locks, piping, conduits, lamps and other requisite sundries whether specified in detail or not shall be provided, under the Contract and it shall be deemed that the Contractor's prices, rates and the like include for all such items.

3.20 Schedules of technical data

Where included in the Tender Documents, all Tenderers shall complete Schedules of technical data; otherwise the Tender may not receive full consideration, and will be liable to rejection.

3.21 Copies of orders

Copies of all orders for major items of plant, equipment and materials places with suppliers shall be provided in triplicate to the Engineer.

SECTION 4

Part II – Particular Specification

PART II

PARTICULAR SPECIFICATIONS FOR

SUPPLY, INSTALLATIONS AND COMMISSOINING OF DATA CENTRE, UNIFIED COMMUNICATION NETWORK, AUDIO VISUAL, VIDEO CONFERENCING, QUEUE MANAGEMENT SYSTEM

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PART 2 - PARTICULAR SPECIFICATION

4.1 Extent of installation

The Contractor shall carry out all the necessary works for successful installation of the equipment's and infrastructure as described and set out in this section of the Technical Specification, Bills of Quantities, other sections of the equipment documents and accompanying Drawings in accordance with the General and Standard Practice herewith.

The Works, the major elements of which are scheduled below, includes **"but is not limited to"** supply of all labour, material, equipment and components necessary for complete installation and setting out work in respect of the entire infrastructure and services requirements within the proposed development and rendering it in complete working condition in respect of but not limited to the following installations:

New Installations: Supply, Installation, testing and commissioning of the following installations to the satisfaction of the Services Engineer:

- Modular data center;
- Active network;
- Unified communication;
- Open DNS
- Perimeter Security Tools and systems – Firewall;
- Server & Software;
- Office 365 + End Point Security;
- Monitoring tools solution;
- Audio Visual system;
- Video conferencing system;
- Queue management system.
- Access Control and Security Solution;

In general, the installations shall be concealed in heavy gauge PVC conduits except in areas where surface installation is necessary. In such cases, installation will be carried out in trunking, galvanized steel conduit or cable trays (by others) as indicated on the Drawings.

4.2 Modular Data Centre

The modular data centre facilities include the power supply and distribution system, cooling system, cabinet system, monitoring system and Fire suppression system. This chapter describes the functional requirements for the equipment. Bidders are to provide compliance response to each category.

- **Certification Requirements**

No	Features	Minimum Requirements	Bidder's Response
1.	**Supplier certification requirements**	• The supplier must be certified by the following certification systems and provide the certificates: • Computer Information System Integration Qualification Certificate (Class 1) • ISO 9001/TL9000 • ISO 14001 • ISO IEC_27001 • OHSAS 18001	
	Testing equipment requirements	• The supplier should have state-authorized labs that have been certified by the following organizations and provide the certificates: • State-level lab accreditation organization: CNAS, A2LA • Industrial or national appointed accreditation or certification organizations: ISTA, FCC, IC, VCCI • Third-party test and certification organizations: UL, MET, CETECOM, ITS, TUV RH, TUV PS	
	Product certification requirements	• Air conditioner: CE, SASO certificates obtained; RoHS, REACH, reports obtained • Battery cabinet: CE, RoHS, REACH, certificates obtained • Converged cabinet: CE, RoHS, REACH, SASO certificates obtained	

- **Installation and Environment Requirements**

No	Features	Minimum Requirements	Bidder's Response
1.	**Environmental adaptability requirements**	• The modular data center should apply to the outdoor environment with the air temperature range of –20°C to +45°C, the relative humidity range of 5% to 95%, and the altitude range of 0 m to 4000 m.	
	Power supply requirements	• The equipment room should provide the redundant power supplies of 400/415 V AC, 50 & 60 Hz, 3Ph+N+PE.	
	Installation requirements	• The module should support single-row deployment to efficiently use the equipment room space and can be installed on the concrete floor or ESD floor. • Floor height requirements; The modular data center can be installed without a raised floor and meets the requirements for the 2.6 m net height	

- **Overall Modular Requirements**

The data centre uses the modular architecture design and features the cold aisle containment. A single module should integrate the cabinet system, power supply and distribution system, cooling system, management system, and generic cabling system. The module provides space for up to eight cabinets. Each cabinet has the maximum rated power of 7 kW, and the total IT load is 15 kW at most.

No	Features	Minimum Requirements	Bidder's Response
1.	Modular Requirements	Tier requirement: Uptime Tier2 Surge protection level: CLASS II/C, In 20kA, Imax 40kA, 8/20 μs Waterproof and dustproof level: IP20 Certification requirement: Main components should be CE certified. Configuration requirement: aisle containment, rack-mounted variable-frequency air conditioner, easy maintenance, less footprint, high integration, and high energy efficiency Rack-mounted UPS in N+1 mode. Installation and maintenance requirement: The module can be installed on the concrete floor (raised floor not required) in a building and can be maintained from the front and rear. Backup time requirement: 30 min backup time is supported. Battery deployment mode requirement: The battery rack can be deployed outside the module. Cooling mode: Air cooled rack-mounted air conditioners are supported. Monitoring function: A single module can be remotely monitored over the web user interface (WebUI). Alarms can be sent by the short message service (SMS). The mobile APP can be used for mobile operation and maintenance (O&M).	

		Cabling mode: Cables can be routed from the top or bottom. Containment flexibility requirement: Cold aisle containment can be used. Computational fluid dynamics (CFD) simulation report: The supplier should provide the CFD heat analysis and simulation report to optimize the system design. Modular design: Modular design is adopted for power distribution equipment, UPS, monitoring equipment, and air conditioner indoor units to facilitate maintenance. Environment adaptability requirement: The deployment space should meet the requirement for 2.6 m net floor height. To guarantee high quality delivering, the vender should acquire the service certification from OEM factory and evidence should be provided.	

- **Active Network**

a. Edge Firewall

NO	Features	Minimum Requirements	Bidder's Response
1.	**Gigabit Ethernet Interface**	• provides 8 Gigabit Ethernet interfaces,80GB SSD	
	Stateful inspection throughput (multiprotocol)	• 500 Mbps	
	Maximum 3DES/AES VPN throughput	• 175 Mbps	
	Virtual interfaces (VLANs)	• 50	
	High Availability	• high availability to help ensure business continuity	
	Memory	• 8 GB	

	Power (AC or DC)	• AC	
	IPSEC VPN	• supports up to 100 IPsec VPN peers, 50,000 concurrent connections and 1 Gbps throughput.	
	Integrated policy management over multiple security functions	• Configures firewall access, application control, threat prevention, URL filtering, and advanced malware protection settings in a single policy • Eases policy administration, reduces errors, and promotes consistency • Enables a single policy to be deployed to multiple security solutions	
	Application visibility and control	• Further reduces threats to your network with precise control of more than 4000 commercial applications • Uses the open-source standard Open App ID for detailed identification and control over custom applications	
	Reporting	• Provides the visibility you need through customizable dashboards with custom and template-based reports • Delivers comprehensive alerts and reports for both general and focused information • Displays event and contextual information in hyperlinked tables, graphs, and charts for easy-to-use analysis • Monitors network behavior and performance to identify anomalies and maintain system health	
	Security	• Intrusion Prevention, Application and Visibility, Malware Protection and URL Filtering capability.	
	Quantity	• Two Firewalls for high availability to cater for Business Continuity	

b. Core Switch

No	Features	Minimum Requirements	Bidder's Response
1.	Interfaces	• 16-port 10Gig switch	
	Switching capacity	• Up to 240 Gbps	
	Forwarding rate	• Up to 360 Mpps	
	DRAM	• 16 G	
	Chassis with 2 power supplies and built-In fan	• 23.6 lb (10.7 kg)	
	Operating	• 32° to 104°F (0° to 40°C)	
	Memory	• Has a 4-core x86, 2.4-GHz CPU, 16-GB DDR4 memory, and 16-GB internal storage.	
	Forwarding rate	• Up to 360 Mpps	
	Total number of MAC addresses	• Up to 64,000*	
	QoS ACL scale	• Up to 18000*	
	VLAN IDs	• 4000	
	Jumbo frame	• 9198 bytes	
	Altitude	• Operation up to 13,000 feet at 40°C	

c. Access Switch

NO	Features	Minimum Requirements	Bidder's Response
1.	Total 10/100/1000 or Multigigabit copper ports	• 48-port PoE+	
	Default AC power supply Available PoE power	• 715W AC • 437W	

	Switching capacity	• 256 Gbps on 48-port Gigabit Ethernet model	
	Stacking bandwidth	• 480 Gbps	
	Total number of MAC addresses	• 32,000	
	Packet buffer per SKU	• 16 MB buffer for 24- or 48-port Gigabit Ethernet models	
	Jumbo frames	• 9198 bytes	
	Layer 3 Features	• Switch should have Layer 3 features	
	Intent based and SD Access Feature	• The switches should support SD Access	
	Quantity	• Seven in number	

d. Wireless Controller

NO	**Features**	**Minimum Requirements**	**Bidder's Response**
1.	**Technology**	• Multigigabit Ethernet technology to support next-generation 802.11ac Wave 2 deployments using existing cabling infrastructure.	
	Scalability and performance	Optimized to enable 802.11ac Wave 2 next-generation networks, supporting: • 4-Gbps throughput • 150 access points • 3000 clients • 1x Multigigabit Ethernet interface (up to 5 Gigabit Ethernet), + 4x 1 Gigabit Ethernet • 4096 VLANs	
	Flexibility and ease of deployment	• Only 10-in. (25-cm) depth to fit nicely in reduced-depth cabinet or desktop deployments • Quiet and fanless operation for cabinet or desktop (up to 86°F [30°C] ambient) deployment. The fans are used by the controller only under certain conditions • For quick and easy deployment, access points can be connected directly to the controller via two Power Over Ethernet (PoE) ports	

	RF management	• Proactively identifies and mitigates signal interference for better performance	
	Comprehensive end-to-end security	• Offers Control and Provisioning of Wireless Access Points (CAPWAP)-compliant Datagram Transport Layer Security (DTLS) encryption on the control plane between access points and controllers across remote WAN links • Management frame protection detects malicious users and alerts network administrators • Rogue detection for Payment Card Industry (PCI) compliance • Rogue access point detection and detection of denial-of-service attacks	

e. Access Point

NO	**Features**	**Minimum Requirements**	**Bidder's Response**
1.	**Technology**	• delivers new 802.11ac Wave 2 standard • 802.11ac Beamforming • 20-, 40-, 80, 160-MHz channels • PHY data rates up to 5.2 Gbps • Packet aggregation: A-MPDU (Tx/Rx), A-MSDU (Tx/Rx) • 802.11 DFS • 1024 MB DRAM • 256 MB flash	
	Antenna	• provides internal antenna and E regulatory domain.	
	MIMO	• 4x4 MU-MIMO with three spatial streams	

- **Unified Communication telephony**

  a. **Systems Requirement**

NO	Features	Minimum Requirements	Bidder's Response
1.	Technology	• Technology is DDR4 SDRAM	
	Processor	• 1 processor(s) installed • 2 processor(s) supported	
	RAM	• 48GB installed RAM •	
	Memory	• 13MB installed cache • 300GB Hot-swap hard drive	
	Size	• 1U Rackmount	
	Apps	• Supports four collaboration application options plus one for provisioning in a single virtualized server platform	
	Maximum number of users	• 1000	
	Number of devices supported	• 1200	

b. IP Phone

1.	**User IP phone Features**	• Delivers advanced IP Telephony features and crystal clear wideband audio performance to deliver an easy-to-use, full-featured voice communications experience on-premises and hosted infrastructure platforms and third party hosted call control. • User Experience Enhancing Collaboration • Two-lines deliver more efficient call handling • High-resolution graphical grayscale display makes viewing easier • Dedicated fixed keys* ease communications for increased productivity • Built-in speakerphone supports hands-free communications • Wideband audio enhances clarity with the handset, speaker, or a headset • Simple, Cost-Effective Administration • Key features to ease and reduce costs of administration include: • Flexible deployment options with Cisco on-premises, hosted, and Webex Calling. • Cisco Expressway supports remote worker single sign-on access without a VPN client • Power over Ethernet (PoE) Class 1 and Cisco EnergyWise lowers energy	

	Conference Phone Features	• Superior wide band acoustics with the first two-element speaker in a conference phone; this feature allows the phone to capture the full voice spectrum without having to compromise with a single-element speaker • Expanded room coverage with support for daisy chaining two units • Support for optional DECT wireless extension microphone: sold separately • Session Initiation Protocol (SIP) signaling • Device authentication and signaling encryption using Transport Layer Security (TLS) with Advanced Encryption	

c. **Voice Gateway Router**

NO	Features	Minimum Requirements	Bidder's Response
1.	**Aggregate Throughput**	• 50 Mbps to 100 Mbps	
	Total onboard WAN or LAN 10/100/1000 ports	• 2 •	
	RJ-45-based ports	• 2	
	SFP-based ports	• 1	
	NIM (Network Interface	• 1	
	Memory	• 4 GB (default) / 8 GB (maximum)	
	Aggregate Throughput (Performance License)	• 100 to 300 Mbps	
	License	• Unified Communication License	
	Channel	• 256-channel DSP module	
	Card	• 4-port Network Interface Module - FXO (Universal)	

- **Open DNS**

a. Rack Server

NO	Features	Minimum Requirements	Bidder's Response
1.	**Storage**	• 20 TB Storage	
	Socket	• High-density 2-socket rack server that delivers industry-leading performance and efficiency for a wide range of workloads, including virtualization, collaboration, and bare-metal applications.	
	Rack Unit	• 1-Rack-Unit (1RU) form factor	
	Technology	• It incorporates the Intel® Xeon® Scalable processors, supporting up to 20 percent more cores per socket, twice the memory capacity, 20 percent greater storage density, and five times more PCIe NVMe Solid-State Disks (SSDs) compared to the previous generation of servers.	
	Processor	• Processor; 1.7 GHz 3104/85W 6C/8.25MB Cache/DDR4 2133MHz on each server •	
	Memory	• Memory; 16GB DDR4-2666-MHz RDIMM/PC4-21300/single rank/x4/1.2v on each server	
	SAS/SATA HDD	• 2 TB 12G SAS 7.2K RPM SFF HDD , ten in number for each server.	
	VMWare	• VMware vSphere 6 Standard (1 CPU), 1-yr, Support Required	
	RAID Controller	• 12G Modular RAID controller with 2GB cache	
	OS	• Windows Server Datacenter2012 R2 x64 Eng 1pk DSP OEI DVD	

- **Perimeter security and Display tools**

No	Features	Minimum Requirements	Bidder's Response
1.	Video standards and protocols	• H.261, H.263, H.264 AVC, H.264 High Profile, H.264 SVC, RTV • H.239/BFCP for content sharing • H.263 & H.264 Video error concealment	
	Video input	• 1 x HDCI • 1 x HDMI 1.3 • 1 x VGA	
	Video out	• 2 x HDMI 1.3 One HDMI output enabled standard, second output enabled with optional license key	
	Output	• HD (1920 x 1080i) • HD (1920 x 1080p) • WSXGA+ (1680 x 1050) • SXGA+ (1400 x 1050) • SXGA (1280 x 1024) • HD (1280 x 720p) • XGA (1024 x 768) • VGA (640 x 480)	
	Content frame rate	• Content frame rate 5–60 fps (up to 1080p resolution at 60 fps) • • • Content Sharing Polycom® People+Content™ IP and Polycom Pano app support • VbSS content in Microsoft environments	

	Interoperability	Microsoft Lync and Skype for Business certification, including Skype for Business Online / Office 365 IBM® Sametime™ support Zoom Meetings interoperability BlueJeans Cloud Services Interoperability Microsoft® Office Communications Server integration Microsoft® ICE support	
	Security	Media Encryption (H.323, SIP): AES-128, AES-256 • Authenticated access to admin menus, web interface, and telnet API • H.235.6 support • FIPS 140-2 Validated Cryptography (Validation Certificate #1747) • PKI/Certificate Management: SSL 3.0, TLS 1.0, 1.1, 1.2 Self-signed and CA-signed certificate support CRL and OCSP-based certificate revocation checking • Network intrusion detection system Local account password policy configuration • Security profiles • Web UI/SNMP Whitelists • Local account and login port lockout • API via Telnet and secure SSH interfaces	

4.3 Monitoring

- **Network Performance Monitoring**

Functionality	Solution description	Compliant? Yes/No
▪ Solution to monitor and alert and alert on health on network nodes. ▪ Provide compliance reports and provide remediation as recommended. ▪ Provide reports on availability and performance of network nodes. ▪ Reports from solution should be customizable. ▪ Solution to provide statistical network performance baselines. ▪ Solution should provide Critical path hop-by-hop analysis for on premise,		

hybrid, and cloud services. ▪ Solutions should be able to Cross-stack network data correlation for acceleration of problem identification ▪ Capability to manage and monitor wireless nodes. ▪ Collect and report on inventory from network nodes		

- **Server and Application Monitoring**

▪ Solution to manage applications running in the cloud ▪ Provide capability to monitor Internal and External performance of websites. ▪ Provide performance counters of virtual environment ▪ Provide performance statistics of servers as well as capacity planning features of hardware ▪ Provide application dependency mapping features ▪ Provide for self-healing features of server applications ▪ Provide capacity planning and performance of virtual environment servers and virtual machine sprawl control. ▪ Provide capability to monitor VDI environment with statistics on performance and configuration management capabilities, alerting, remediation, and chargeback automation ▪ Collect and report on inventory from server nodes ▪ Monitor application stack issues that may affect the application performance in storage environments ▪ Capable of providing complete visibility of Office 365 environment, with management and reporting tool		

- **Help Desk Solution**

▪ Solution should Simplify and streamline IT help desk processes from service request creation to resolution		

▪ Solution should Automate ticketing management with rule-based routing and escalation, real-time tracking, and alerts ▪ Solution should provide automated IT asset management for tracking and managing the lifecycle of hardware and software assets ▪ Offers built-in knowledge base for self-resolution of issues, and automation of change management. ▪ The solution should have the ability to be integrated with the Network Performance and Server and Application Monitors.		

4.4 Queue Management system

Minimum Requirements	Compliance Yes/No	Comments
Ticket Dispenser Ticket Dispenser: The Queue Management system should come with a ticket dispenser unit to facilitate for customers to take a ticket Multiple categories/reason for visiting: Customers should be able to select more than 1 reason for visiting the branch at the touch of a button in the ticket dispensing unit. The Kiosk should be capable of running promotional media contents when it is not serving any customer service requests. In case of automated process flows where the customer journey from one counter to another is known for a completion of a service, the system should be capable of automatically routing customer accordingly for providing service efficiency. The Kiosk screen contents should be managed from a central location for easy dissemination into the branches. The services priorities and its changes should be centrally manageable. Run adverts on Ticket Dispenser: Screen-saver mode on the Ticket Dispenser/ QMS Customer interface should show eye-catching, dynamic promotional media to captivate the audience. The system should have the capability to change the promotional media remotely Processor System Operating System: Android OS, V4.04 (ICS) CPU: Dual Core 1.0 GHz Power Requirement Power Input: ~100-240v (AC) 50/60 Hz Power Consumption: 100 Watt Display Display Type: 17 inches TFT, 16.1M colors		

Resolution: 1280 x 1024 pixels (96ppi) Touch Screen: Capacitive Touch Screen 3M Branch Mechanical Dimensions: 1400 (H) x 478 (L) x 480 (W) mm (without packaging) 16500 (H) X 673 (L) X 600 (W) mm (with packaging) Material: Metal		
Main Screen Display Unit: The system to provide a Screen Display Unit that will display current ticket number to be served along with respective service counter in large font. The service should be flexible enough to be used with an existing LCD or Plasma TV with PC. Along with the ticket numbers the display screen should also display client advertisements on one portion of the screen.		
Counter Display Unit: Counter display unit must be capable of displaying ticket numbers, counter numbers, directional information and also promotional messaging. The CDU directs waiting customers to the right counter and can also be used to convey short instructional messages. The CDU should be flexible enough to be Wall mounted, desk fixed or suspended from the ceiling. Should be activated when the service representative hits the next button. When the counter is inactive, CDU displays “CLOSED” or any other customized message.		
Agent Interface This software should have the following features: Should be a web based interface Employee logs in through username and password. Employee calls for next customer through a mouse click The software also shows statistical data about queues and customers. The software shows employee		

performance as easy-to-read color indicators showing the employee performance compared to average and target performance. The employee can transfer the customer to another service queue. The transfers should be available to be a service queue change or a counter change. The transfer reason should be marked so the next calling Teller (Employee) is able to understand why the customer is being routed to him/her. The employee can send a customer to a "wait status" and call him again from the wait status. The employee can chat with the branch manager though the software. It should be possible to add tags/comments or additional information eg Names, tel phone number etc for a customer to be viewed by the Teller (Employee) later or while transferring the customer to another counter. The Teller (Employee) should be able to random call a customer from the waiting queues in order to serve the customer superseding the usual queue calling sequence. The system should enable the Teller to allocate the total service time into various sub-services and mark them accordingly for evaluating his/her overall efficiency. The system should provide Tellers a leverage to perform backend activities apart from their designated customer service duties such as performing back office functions and taking breaks. The system should have an effective alert mechanism for updating the Teller if they are sitting idle for too long or has a customer in wait for too long. The system should provide auto logging off facilities in case the Teller forgets to shut off his logged in session. The system should be able to repeat the customer calling sound automatically so that incase a customer misses a calling sound, they can respond to the		

second call. The system should allow Tellers to mark a customer as a no show in case he/she fails to respond to multiple sound calls for reaching at a particular counter.		
Reporting software Should be a web based application accessible on any browser Enables branch manager to monitor, control and configure the branch. Viewing the status of each counter such as: Which employee is working on which counter? What the employee stats are such as logged in time, idle time, total customer service time and backend activity (breaks) time? Which customer is being served on which counter including customer data. The time since the customer has been called for service. Any moment the service time on a certain counter exceeds a certain limit (pre-configured for each service), the system provides an alert to the branch manager (the counter appears in a different color). The branch manager can send and receive messages from employees (chatting) The branch manager is able to view statistics about the current status of the branch including number of waiting customers for each service. The branch manager is able to view the list of waiting customers and can transfer them to other services by assessing the branch workload and efficiency stats. The branch manager can assign services to counters or tellers, and these changes must be reflected on the fly. View various performance reports and dashboards about employees and the branch as a whole. It is mobile & Tablet responsive, adjusted to any type of screen size. Manager is able to create his/her own		

dashboards components. Manager should be able to change the Service Quality percentage dynamically. Manager is able to filter a ticket, a teller, a customer name, etc and only such filter should be shown on the dashboard. Manager is able to change the priority calling and calling profile of tellers on the fly without having to restart the system.		
Training The offered solution should include Administration training covering the following topics: Customization and Integration Installation, operation & Troubleshooting Documentation The offered solution should include a soft copy of Administrator and User Guides provided on CD's.		
Warranty and Support The offered system should include one year warranty and support from the date of final acceptance for each branch.		

SECTION 5

Bill Of Quantities

A. General Instructions

B. Particular Instructions for Pricing of Items in the Bills of Quantities

C. Bill of Quantities

A. General Instructions

5.1 Detailed requirements - Smart Small Modular Data Centre Solution

5.1.1 Overview

This document is provided by KPPF to illustrate the technical specifications for the modular data centre project. It provides guidelines for interested bidders to compile the project technical proposal and offer a quotation. In the technical proposal, interested bidders must specify and address each technology and project requirement specified in this document.

Interested bidders must keep all internal documents and technical documents and information provided by KPPF confidential.

5.1.2 Project Background

The following table analyses the data centre requirements in the project.

No.	IT Service Requirement Item	Power Input	IT Cabinet/Rack (Set)	UPS Configuration	Air Conditioner Configuration	IT Load (kW)
1	DC Sizing	Dual inputs	4	N +1	N +1	20
	Total:	Dual inputs	4	N +1	N +1	20

5.1.3 Related Standards

The products (including software and hardware) provided by the Bidder must comply with technical standards, which include but are not limited to the following:

1. Code for design of electronic information system room (GB50174-2008)
2. Code for construction and acceptance of electronic information system room (GB50462-2008)
3. ISO27001/ ISO20000
4. ASHARE TC9.9 2009
5. Information security technology - Disaster recovery specifications for information systems (2007)
6. Standard for design of intelligent building (GB/T50314-2006)
7. Code for acceptance of quality of *intelligent* building (GB 50339-2003)
8. Code for design of electric power supply systems (GB50052-95)
9. Low voltage distribution design specifications (GB50054-95)
10. Code for engineering acceptance of generic cabling system (GB 50312-2007)
11. Code for engineering design of generic cabling system (GB 50311-2007)
12. *Communication* chamber electrostatic protective general rules (YD/T754-95)
13. Regulations for electromagnetic radiation *protection* (GB8702-88)

14. Installation engineering standard for surge protection and grounding (322-1998)
15. Code for acceptance of construction quality of electrical installation in building (GB 50303-2002)
16. Code for *fire* protection design of buildings (GB 50016-2006)
17. Code for design of heating ventilation and *air* conditioning (GB50019-2003)
18. Code for acceptance of construction quality of ventilation and air conditioning works (GB50243-2002)
19. Code for *fire* protection design of tall buildings (GB50045-2005)
20. Code for electrical design of civil buildings (JGJ16-2008)
21. Generic code for electronic computer site (GB/T2887-2000)

If the equipment provided by the Bidder does not comply with the preceding standards, The Bidder should point out the non-compliance items and propose the commitment and deadline for compliance, and is responsible for version upgrades. If no industry standards are applicable to the new functions or equipment provided by The Bidder, the manufacturer' standards shall prevail.

5.1.4 Work Division

The main Contractor shall build DC equipment room, including the floors, ceilings, partitions, inner wall and column surfaces, doors, windows, and other necessary materials.

1. The bidder shall purchase, install, and integrate the UPS's, air conditioners, power distribution equipment, cabinets, cabling cabinets, battery cabinets, and monitoring equipment inside the equipment room module, which are included in the project quotation. KPPF shall purchase the power distribution equipment to be deployed outside the equipment room module, which is excluded from the quotation.
2. The Bidder shall provide clean agent fire extinguishing system
3. The Bidder shall integrate into KPPF power distribution equipment

5.2 Power Supply and Distribution System Requirements

5.2.1 Overview

Electrical engineering is fundamental to an equipment room. The power supply and distribution system should be highly reliable. Key factors include safety, reliability, and maintainability of the power supply and distribution system. Power intended for the computer system and communication system must pass through the UPS. The design load for the power distribution cables and cabinets as well as the corresponding circuits must meet the peak power usage requirements. Power cables and signal cables in the equipment room should be routed along separated cable troughs. The power supply and distribution system for a small data centre is composed of the power distribution box, UPS, battery, and rack power distribution unit (RPDU).

5.2.2 Design Scope

The design scope for this phase of the project is power distribution in the KPPF equipment room module.

UPS power supply and distribution system design

Power supply and distribution for the air conditioning system

The power for equipment except the preceding items and outside the equipment room is not considered in this phase.

The power supply and distribution system should use the N+1 architecture and meet the tier 1 or tier 2 requirements or GB 50174 class C requirements. The 400/415 V AC, 50/60 Hz, 3Ph+N+PE power distribution solution is supported.

5.2.3 UPS

The UPS provides uninterruptible power for IT loads in the small data center by means of batteries when the external primary power supply fails.

The UPS for the small data center must meet the following requirements:

The UPS whose rated capacity is 20 kVA, can be installed in the 19-inch rack, and occupies only 3 U heights.

The UPS rated input voltage is 400/415 V, 50/60 Hz, 3Ph+N+PE.

Wide input voltage range: 138–485 V AC

The UPS provides high efficiency up to 95% in online mode.

The UPS has strong overload capacity and continues running for 60s when overloaded by 125%.

The UPS provides RS485 communications port for easily monitoring its parameters and status.

Category	Item	20 kVA
Input	Input voltage range	80–280 V AC, single-phase When the voltage is 80–176 V AC, the load power is linearly derated to 40%–100%. 138–485 V AC, three-phase When the voltage is 138–305 V AC, the load power is linearly derated to 40%–100%.
	Rated input voltage	AC/ 400 V AC /415 V AC (three-phase)
	Input frequency range	40–70 Hz
Output	Rated capacity	20 kVA
	Rated voltage	400/ 415 V AC; three-phase output; a voltage system can be selected by setting a voltage level over the LCD.
	Power factor	0.9
	Max. efficiency	95%
	Overload capacity	In normal mode, when the UPS is overloaded to a range between 105% and 125%, the UPS transfers to the bypass mode in 5

Category	Item	20 kVA
		minutes if the bypass is normal or disconnects the power output if the bypass is abnormal. In normal mode, when the UPS is overloaded to a range between 125% and 150%, the UPS transfers to the bypass mode in 1 minute if the bypass is normal or disconnects the power output if the bypass is abnormal. In normal mode, when the UPS is overloaded to more than 150%, the UPS transfers to the bypass mode in 0.1 second if the bypass is normal, or disconnects the power output if the bypass is abnormal.
Structure	Dimensions (H x W x D)	130 mm x 430 mm x 757 mm
	Installation mode	Rack-mounted
	Surge protection	IEC/EN60240-2 IEC/EN61000-4-5 YD/T1095-2000 YD/T944-2007 The AC input meets class D surge protection requirements (differential mode and common mode: 5 kA, 8/20 μs).
Environment	Port type	Dry contact/USB/Modbus/SNMP
	Operating temperature	0–40°C
	Relative humidity	0%–95% RH (non-condensing)
	Altitude	< 1000 m (derated when the altitude is between 1000 m and 4000 m. For derating data, refer to the IEC62040-3.)
	Storage and transportation temperature	–40°C to +70°C (battery pack: –20°C to +40°C)

5.2.4 Power Distribution Box

Type of power distribution equipment: ATSE power distribution module, UPS input and output power distribution module, indicator power distribution module

Installation mode: rack-mounted

Electrical performance

The power distribution box contains the UPS input, UPS output, UPS maintenance bypass switch, and surge protection switch. The 6 U high power distribution module should provide at least 14 IT outputs.

The class C SPD is deployed in standard configuration. A surge protection switch should be installed before the SPD, and a micro switch with the surge protection switch or SPD fault indicator should be used to remotely monitor the SPD status.

Application environment

Operating temperature: 0°C to +40°C

Operating humidity: ≤ 95% RH

Operating altitude: 2000 meters without derating

5.2.5 RPDU

Electrical performance

Single-phase 230 V AC input voltage, 50/60 Hz

Single-phase of the RPDU

Input: junction box input or standard IEC60309 three-core plug input

Output: C13/C19 standard socket, circuit breaker protection supported by the RPDU of 32 A or higher current

Application environment

Operating temperature: 0°C to +40°C

Operating humidity: ≤ 95% RH

Operating altitude: 2000 meters without derating

Item	Specifications
Input voltage range	176–264 V AC
Input voltage	230 V AC
Input current	32 A
Number of inputs	Single
Output power distribution specifications	20 x C13 + 4 x C19
Dimensions (L x W x D)	1732 mm x 50 mm x 44.5 mm
Net weight	2.49 kg

5.3 Cooling System Requirements

5.3.1 Technical Requirements for In-row Precision Air Conditioners

The air conditioners should feature efficient cooling, effective energy saving, high reliability, wide working conditions, wide power range, high compatibility, intelligent monitoring, and easy maintenance.

5.3.2 High Energy Efficiency

Name brand DC inverter compressors with high energy efficiency can achieve 20%–100% steeples speed adjustment to provide cooling capacity on demand, thereby greatly reducing energy consumption.

Six EC fans in the indoor unit use the horizontal air supply mode for racks. 30%–100% steeples fan speed adjustment is supported, which enables precise control over the supply air temperature and direction, thereby reducing energy consumption.

Optimal system configurations and efficient refrigeration coil pipes ensure efficient heat exchange.

The variable-frequency temperature control algorithm enables quick response to load changes and precise temperature control to conserve energy.

Fans support variable-frequency start, which lowers the start current and prevents shock on the power grid and other electrified equipment.

A wet film humidifier consumes more than 90% less energy than a conventional humidifier because energy consumption of a wet film humidifier comes only from the water pump.

The air conditioners are connected over FE ports and networked through the MAC protocol bus to achieve teamwork control, which effectively saves energy.

5.3.3 High Reliability

The DC variable-frequency air conditioner greatly reduces the number of startup and shutdown times, reducing component failures and extending the lifespan of key components.

The electronic expansion valve is used, allowing rapid and precise adjustment of the refrigerant volume based on the temperature and humidity requirements and improving system stability. A backup power module is provided to close the electronic expansion valve when the system experiences a power failure.

The Positive Temperature Coefficient (PTC) electric heater provides dual protection functions: automatic reset and auto-recovery disabling.

The air conditioner is designed for non-condensation at low loads to maintain the humidity in cold aisles below 80% at low loads (10% load at least) in a high-humidity environment.

The air conditioner features 6 kV surge protection design, providing high surge protection reliability.

5.3.4 High Compatibility

The air conditioner can be rack-mounted, which considerably decreases the cooling system footprint as it occupies only 11 U high space.

Both the refrigerant pipes and water pipes can be routed from the top or bottom.

Heating and humidification functions are optional.

5.3.5 Wide Power Range

Adaptability to multiple power systems:

System supply voltage 220–240 V AC, L+N+PE, 50 Hz

Voltage range: 198–264 V AC

Frequency range: 47–53 Hz

5.3.6 Intelligent Monitoring

Users can monitor and configure parameters for the cooling system on the monitoring unit.

5.3.7 Easy Installation and Maintenance

The air conditioner can be easily inserted into a cabinet, facilitating installation.

End face sealing stop valves are reserved for the ports on the indoor and outdoor units. The welding-free design achieves fast maintenance and no ignition is required.

The 6 kg refrigerant is delivered with the equipment, which meets the requirements of 30 m pipes. The prefilled refrigerant oil meets the requirements of 60 m pipes.

Remote parameter setting and remote inspection are supported, reducing service costs.

Key components support front and rear maintenance. The entire air conditioner can be easily replaced without extra maintenance space. During the maintenance and replacement of an air conditioner, other air conditioners are not affected.

The control unit can be pulled out for maintenance. The power module, auxiliary source module, and main control module above it can be quickly removed and inserted for maintenance, greatly reducing O&M time and difficulty.

Environmental Requirements for In-row Precision Air Conditioners

Item	Specifications
Indoor unit operating temperature	0–45°C
Indoor unit operating humidity	5%–95% RH (non-condensing)
Outdoor unit operating temperature	–20°C to +45°C
Storage temperature	Without refrigerant: –40°C to +70°C With refrigerant: –40°C to +55°C
Storage humidity	5%–95% RH (non-condensing)
Altitude	0–4000 m (derated when the altitude is greater than 1000 m)

5.3.8 Installation Requirements for In-row Precision Air Conditioners

Installation Mode	Rack-Mounted
Height difference between indoor and outdoor units	If the outdoor unit is placed higher than the indoor unit, the vertical distance between them should be less than or equal to 20 meters. If the indoor unit is placed higher than the outdoor unit, the vertical distance between them should be less than or equal to 5 meters.
Maximum equivalent length of the one-way pipe	60 m
Thermal insulation foam thickness	≥ 13 mm
Water drainage	The distance between the upper drainage of the water pump and the cabinet installation floor should not exceed 4 meters.

5.3.9 Main Technical Specifications for In-row Precision Air Conditioners

The following table lists the main technical specifications for air conditioners.

Air conditioner technical specifications

Specifications	11 kW
Indoor fan type	EC fan
Total cooling capacity	≥ 11 kW
Sensible cooling capacity	≥ 11 kW
Sensible heat ratio	1
Air volume	≥ 2600 m^3/h
Indoor unit installation mode	Rack-mounted
Outdoor unit installation mode	Wall/floor-mounted
Heating capacity (optional)	≥ 3kW

NOTE

The cooling capacity is measured at the indoor inlet air temperature 37.8°C, relative humidity 20%, and condensing temperature 35°C.

5.4 Cabinet System Requirements

5.4.1 Aisle Containment System

The depth of a contained aisle should be no more than 250 mm.

Hot aisle: The front door is a single-swing double-layered glass door that prevents condensation.

Cold aisle: The front door is a perforated door.

5.4.2 Cabinet System

Cabinets are necessary facilities in a data centre. They provide an appropriate operating environment for accommodating and interconnecting equipment.

The cabinets must provide the following features:

The ventilation rate of the perforated door is greater than or equal to 70%.

Two power distribution units (PDUs) can be vertically installed at the rear of the cabinet.

The position of each U is marked on the vertical mounting bars.

The front and rear doors are locked and can be unlocked only with dedicated keys.

The total depth of the cabinet and aisle is 1350 mm at most.

Item	Technical Specifications
Dimensions (H x W x D)	IT cabinet: 2000 mm x 600 mm x 1350 mm Battery cabinet (deployed inside the aisle containment): 2000 mm x 600 mm x

Item	Technical Specifications
	1350 mm Battery cabinet (deployed outside the aisle containment): 2000 mm x 600 mm x 1100 mm/1200 mm Network cabinet: 2000 mm x 600 mm/800 mm x 1350 mm
Color	Black
Material	High-intensity class A carbon cold rolled steel sheet and zinc-coated steel sheet
Air channel	Front and rear air channels
Installation space	Each cabinet provides 42 U available space. The distance between the front and rear mounting bars can be adjusted by a step of 25 mm. Positions for vertically installing two PDU2000s are provided at the rear of the cabinet.
Installation mode	Installed on a concrete or raised floor
Static load	1500 kg
Dynamic load	1000 kg
Protection level	IP20

5.5 . MONITORING AND MANAGEMENT SYSTEM

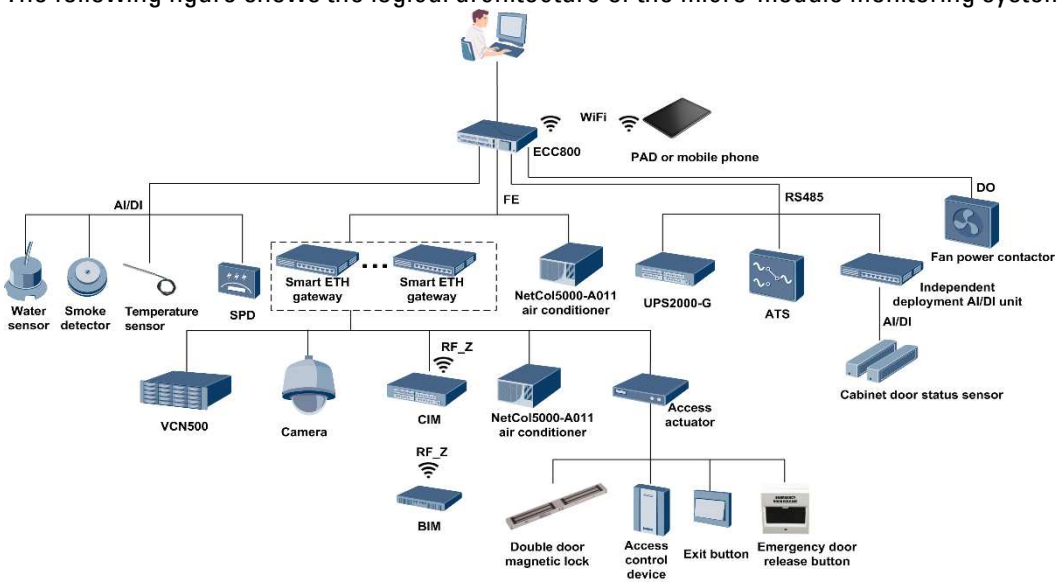
Monitoring System for a Single Micro-Module

5.5.1 System Overview

Each micro-module should provide a general environment and power monitoring interface to constantly monitor equipment such as the power supply and distribution devices, UPS, air conditioners, temperature and humidity sensors, water sensors, smoke detectors, video surveillance devices, and access control devices inside the module. If a component fault or parameter error is detected, alarms are generated in diverse modes such as color, email, SMS, and audio. Historical data and alarm events are recorded. All monitoring information is reported to the management platform through a standard northbound SNMP interface. Users can query device information in real time using the pad APP or mobile phone APP, enabling mobile operation and maintenance. To ensure unified planning, management, and commissioning of the micro-module, make ensure that the micro-module monitoring system is of the same brand as the micro-module.

5.5.2 System Architecture

The following figure shows the logical architecture of the micro-module monitoring system.



5.5.3 Monitoring Function Description

Temperature and humidity monitoring: detects the ambient temperature and humidity inside the module.

1. Water leakage monitoring: detects water leakage in areas where there are sources of water inside the module.
2. Smoke monitoring: detects smoke inside the module.
3. Precision air conditioner monitoring: comprehensively diagnoses the running status of air conditioners in real time and monitors the running status and parameters of air conditioner components such as the compressor, fan, heater, humidifier, dehumidifier, and air filter.
4. Video surveillance: uses 2-megapixel high-definition cameras equipped with SD cards
5. Door access monitoring: has access right management, access event record, and alarm record functions.

5.5.5 Specifications Requirements for Key Hardware

Data collector

Item	Specifications
Power input	Operating voltage: 85–300 V AC (rated voltage: 200–240 V AC or 100–120 V AC) Operating frequency: 45–66 Hz (rated frequency: 50 Hz or 60 Hz) Input current: 6.7 A
Power output	Output voltage: 42–58 V DC (rated voltage: 53.5 V DC) Output power of a single power supply: 1000 W (176–300 V AC); 470 W (linear derating at 85–175 V AC) Output current: 14 A
System memory	512M
Solid state disk	2 GB and 128 MB of storage space
FE port expansion	Two WAN ports, two LAN ports, and 10/100M communications rate
RS485 serial port expansion	Four RS485 ports reserved; with the default communications rate of 9600 bit/s Each port providing 12 V DC power with the rated current of 450 mA
AI/DI expansion (RJ45)	Six AI/DI ports used for connecting to sensors such as smoke detectors, water sensors, and temperature sensors Each port providing 12 V DC power with the rated current of 85 mA
DO expansion (RJ45)	Two expansion dry contacts with the contact point capacity of 20 W, maximum withstand voltage of 60 V DC, and rated current of 0.5 A Two active DO ports with the output voltage of 12 V DC and output current of 450 mA
Wireless communication	Wireless communication that complies with IEEE802.15.4
3G	Provide a SIM card slot; support 3G communication
USB	General USB port
SD card	One micro-SD card
Buttons	SW: wireless network pairing button Default: restoring the default IP address

Pad

The controller pad (9.6 inches at least) supports wireless access to the data center facility management system. The APP can be used to monitor the data center equipment and environment parameters in real time. The pad for the micro-module uses a capacitive screen and supports multi-touch control

5.6 Detailed Technical Requirements Active Network and Unified Communication Network

5.6.1 Edge Firewalls

The Edge firewall is a network security system that monitors and controls incoming and outgoing network traffic based on predetermined security rules at the perimeter level. A firewall typically establishes a barrier between a trusted internal network and untrusted external network, such as the Internet.

The Edge Firewall should provide comprehensive protection from known and advanced threats, including protection against targeted and persistent malware attacks

The edge firewall also provides site-to-site and remote access VPN and advanced clustering provide highly secure, high-performance access and high availability to help ensure business continuity.

Granular Application Visibility and Control (AVC) functionality of the firewall supports more than 4,000 application-layer and risk-based controls that can launch tailored intrusion prevention system (IPS) threat detection policies to optimize security effectiveness.

The edge firewall provides highly effective threat prevention and full contextual awareness of users, infrastructure, applications, and content to detect multi-vector threats and automate defense response.

Reputation- and category-based URL filtering offer comprehensive alerting and control over suspicious web traffic and enforce policies on hundreds of millions of URLs in more than 80 categories.

The edge firewall includes the Intrusion Prevention, Application and Visibility, Malware Protection and URL Filtering capability.

5.6.2 Core Switch

A core switch is a high-capacity switch generally positioned within the backbone or physical core of a network. Core switches serve as the gateway to a wide area network (WAN) or the Internet - they provide the final aggregation point for the network and allow multiple aggregation modules to work together.

Has a 4-core x86, 2.4-GHz CPU, 16-GB DDR4 memory, and 16-GB internal storage. Supports full programmability and serviceability deliver unmatched table scale (MAC/route/ACL) and buffering for enterprise applications. Includes non-blocking 40 and 100 Gigabit Ethernet Quad Small Form-Factor Pluggable (QSFP+, QSFP28) and 1, 10 and 25 Gigabit Ethernet Small Form-Factor Pluggable Plus (SFP/SFP+/SFP28) switches with granular port densities that fit diverse campus needs.

Unified Access™ Data Plane (UADP) Application-Specific Integrated Circuit (ASIC) ready for next-generation technologies with its programmable pipeline, micro engine capabilities, and template-based, configurable allocation of Layer 2 and Layer 3 forwarding, Access Control Lists (ACLs), and Quality-of-Service (QoS) entries

Intel® 2.4-GHz x86 CPU with up to 120 GB of USB 3.0 or up to 960 GB of SATA SSD storage for container-based application hosting

Platinum-rated AC/DC power supplies

Up to 512,000 Flexible NetFlow (FNF) entries in hardware

Up to 36 MB of unified buffer per ASIC

Up to 212,000 routing entries (IPv4/IPv6) for high-end campus core and aggregation deployments

IPv6 support in hardware, providing wire-rate forwarding for IPv6 networks

IEEE 802.1ba AV Bridging (AVB) built in to provide a better AV experience through improved time synchronization and QoS

Precision Time Protocol (PTP; IEEE 1588v2) provides accurate clock synchronization with sub-microsecond accuracy, making it suitable for distribution and synchronization of time and frequency over the network

Dual-stack support for IPv4/IPv6 and dynamic hardware forwarding table allocations, for ease of IPv4-to-IPv6 migration

Scalable routing (IPv4, IPv6, and multicast) tables and Layer 2 tables

IOS® XE Software, a modern operating system for the enterprise with support for model-driven programmability, on-box Python scripting, streaming telemetry, container-based application hosting, and patching for critical bug fixes. The OS also has built-in defenses to protect against runtime attacks

StackWise Virtual technology, a network system virtualization technology that increases operational efficiency and boosts nonstop communications and scaled system bandwidth

Encrypted Traffic Analytics (ETA): You benefit from the power of machine learning to identify and take actions toward threats or anomalies in your network, including malware detection in encrypted traffic and distributed anomaly detection. Additionally, ETA is able to detect vulnerable implementations in encrypted traffic

Support for AES-256 with the powerful MACsec 256-bit encryption algorithm available on all models

Trustworthy systems: Secure Unique Device Identification (SUDI) support for Plug and Play, enabling tamper-proof device identity capability, which secures zero-touch provisioning by allowing your device to show a certificate to the server to be able to get onto your network

5.6.3 Access Switches

Access switch is the only one that directly interacts with end-user devices. Because an access network switch connects the majority of devices to the network, it normally has the highest port density of all switch types. In spite of the high port count, access switch usually provides the lowest throughput per port.

The Access Switch has the highest-density stacking bandwidth solution with the most flexible uplink architecture and a UADP 2.0 Application-Specific Integrated Circuit (ASIC) with programmable pipeline and microengine capabilities, along with template-based, configurable allocation of Layer 2 and Layer 3 forwarding, Access Control Lists (ACLs), and Quality of Service (QoS) entries

It also has an x86 CPU complex with 8-GB memory, and 16 GB of flash and external USB 3.0 SSD pluggable storage slot (delivering 120GB of storage with an option SSD drive) to host containers with a USB 2.0 slot to load system images and set configurations

The Access switch has a switching platform built for security, IoT, mobility, and cloud.

Up to 480 Gbps of local stackable switching bandwidth

Flexible and dense uplink offerings with 1G, Multigigabit, 10G, 25G, and 40G

Flexible downlink options with 1G and Multigigabit links

Intelligent Power Management with StackPower technology, providing power stacking among members for power redundancy

Line-rate, hardware-based Flexible NetFlow (FNF), delivering flow collection of up to 64,000 flows

IPv6 support in hardware, providing wire-rate forwarding for IPv6 networks

Dual-stack support for IPv4/IPv6 and dynamic hardware forwarding table allocations, for ease of IPv4-to-IPv6 migration

Policy-based automation from edge to cloud

Simplified segmentation and micro-segmentation, with predictable performance and scalability

Automation through the Cisco Application Policy Infrastructure Controller Enterprise Module (APIC-EM)

Policy handled through the Cisco Identity Services Engine (ISE)

Network assurance provided through the Network Data Platform

Faster launch of new business services and significantly improved issue resolution time

Encrypted Traffic Analytics (ETA): You benefit from the power of machine learning to identify and take actions toward threats or anomalies in your network, including malware detection in encrypted traffic (without decryption) and distributed anomaly detection

Support for AES-256 with the powerful MACsec 256-bit encryption algorithm available on all models

Trustworthy systems: Hardware anchored Secure Boot and Secure Unique Device Identification (SUDI) support for Plug and Play, to verify the identity of the hardware and software

5.6.4 Unified Communication -Telephony

The Unified Communication system Supports four collaboration application options plus one for provisioning in a single virtualized server platform; maximum capacity of 1000 users, 1200 devices, and 100 contact centre agents. Ideal for medium-scale end-to-end collaboration deployments. gives employees a full range of collaboration tools: premium voice, video, messaging, instant messaging and presence, conferencing, video conferencing, contact centre services, mobility capabilities is purpose-built for companies with 25 to 1000 employees. use virtualization technology, designed for performance and density over a wide range of company sizes and business workloads, 2 processor(s) supported;

5.6.5 IP Phone

An IP phone, also called a VoIP phone, is a phone that uses internet protocol, rather than the circuit-switched PSTN. An IP phone connects through an Ethernet cable, rather than a phone jack, to the internet, where is connects to the IP address of either the VoIP provider or the hosted PBX provider. From a user's perspective, it works just like a traditional phone, but better.

The User and Reception IP Phone should have the following features;

- Delivers advanced IP Telephony features and crystal clear wideband audio performance to deliver an easy-to-use, full-featured voice communications experience on-premises and hosted infrastructure platforms and third party hosted call control.
- User Experience Enhancing Collaboration
- Two-lines deliver more efficient call handling
- High-resolution graphical grayscale display makes viewing easier
- Dedicated fixed keys* ease communications for increased productivity
- Built-in speakerphone supports hands-free communications
- Wideband audio enhances clarity with the handset, speaker, or a headset
- Simple, Cost-Effective Administration
- Key features to ease and reduce costs of administration include:
- Flexible deployment options with Cisco on-premises, hosted, and Webex Calling.
- Cisco Expressway supports remote worker single sign-on access without a VPN client
- Power over Ethernet (PoE) Class 1 and Cisco EnergyWise lowers energy costs
- Integrated IEEE 10/100 switch reduces installation costs and footprint at the desk

The Conference Phone should have the following features;

- Superior wideband acoustics with the first two-element speaker in a conference phone; this feature allows the phone to capture the full voice spectrum without having to compromise with a single-element speaker
- Expanded room coverage with support for daisy chaining two units
- Support for optional DECT wireless extension microphone: sold separately
- Session Initiation Protocol (SIP) signaling
- Device authentication and signaling encryption using Transport Layer Security (TLS) with Advanced Encryption Standard 128 (AES-128)

5.6.6 Voice Gateway Router

A **VoIP gateway** is a piece of hardware with the standard purpose of converting TDM telephony traffic from the PSTN into digital packets IP packets for transport over an IP network (such as your LAN). A VoIP gateway can also convert digital IP packets into TDM telephony traffic for transport across the PSTN (Publicly Switched Telephone Network).

The Router should deliver advanced VOIP services to the small enterprise branch environment integrates 2 dual mode Gigabit Ethernet ports and PVDM4 DSP for voice and video services, two network modules, one integrated services card slot, 4GB DDR3 Dream and 4 GB flash memory delivers 50Mbps throughput by default, with pay-as-you-grow performance, you can increase forwarding capacity to 100Mbps when needed, so the platform performance growth with your business, you only pay for the performance you need.

5.6.7 Wireless Controller

The Wireless Controller provides centralized control, management, and troubleshooting for small to medium-sized enterprises and branch offices.

It offers flexibility to support multiple deployment modes in the same controller—a centralized mode for campus environments, FlexConnect® mode for lean branches managed over the WAN, and a mesh (bridge) mode for deployments in which full Ethernet cabling is unavailable.

real-time communications between access points

optimized for 802.11ac Wave 2 performance, high scale, and enhanced system uptime.

Intent-driven programmability and streaming telemetry.

Quiet operation, with a small form factor and compact design ideal for space-constrained deployments, providing flexibility without compromising on features.

Subsecond access point and client failover for uninterrupted application availability.

Extraordinary visibility into application traffic, using Application Visibility and Control (AVC), the technology that includes the Network-Based Application Recognition 2 (NBAR2) engine, with Deep Packet Inspection (DPI) capability. An embedded wireless Bring-Your-Own-Device (BYOD) policy classification engine that allows classification of client devices and application of user group policies.

Guest access and Bonjour and Chromecast services in centralized deployments.

Software-defined segmentation with TrustSec® technology, reducing Access Control List (ACL) maintenance, complexity, and overhead.

Integrated CleanAir® technology, providing the industry's only self-healing and self-optimizing wireless network.

A simplified GUI wizard for quick setup and intuitive dashboards for monitoring and troubleshooting.

5.6.8 Video Conference Solution

Video conferencing is the technology that allows you to hold meetings with several correspondents who are located in different places while seeing and talking to them in real time. It is different from simple video calling, which is normally one-to-one video communication.

The intangible benefits of video conferencing include more efficient meetings with the exchange of non-verbal communications and a stronger sense of community among business contacts, both within and between companies, as well as with customers. On a personal level, the face-to-face connection adds non-verbal communication to the exchange and allows participants to develop a stronger sense of familiarity with individuals they may never actually meet in person.

The video conferencing system should be certified with Skype for Business and Office 365, making it easy to connect without changing the way you work. The Skype interface is instantly familiar for an intuitive experience that needs no training.

The conference solution should support 1080p60 video resolution, adding a new level of clarity and realism to your business communications. Content can be sent and received in up to 1080p60 quality,

and it's easy to share using the HDMI or VGA connections or wirelessly from your laptop or mobile device.

The conference camera should deliver excellent 1080p image quality and is optimized for smaller groups. In many smaller rooms participants sit closer to the camera, which can make it difficult to capture everyone in view. The camera should feature a powerful optical zoom and optional wide-angle lens to overcome these challenges, along with an advanced sensor that captures incredible detail and brilliant image quality.

5.6.9 Access Point

In computer networking, a wireless access point (WAP), or more generally just access point (AP), is a networking hardware device that allows other Wi-Fi devices to connect to a wired network. The AP usually connects to a router (via a wired network) as a standalone device, but it can also be an integral component of the router itself. An AP is differentiated from a hotspot, which is the physical location where Wi-Fi access to a WLAN is available.

The access points go beyond getting ready for the new standard, providing the ultimate in flexibility and versatility.

For large enterprise organizations that rely on Wi-Fi to engage with customers, the AP should be intelligent enough to make decisions based on end-device activities and usage. This automation allows you to devote time to other pressing matters, secure in the knowledge that your Wi-Fi network is performing to its utmost potential.

The Access Point should have the following features;

- delivers new 802.11ac Wave 2 standard
- 802.11ac Beamforming
- 20-, 40-, 80, 160-MHz channels
- PHY data rates up to 5.2 Gbps
- Packet aggregation: A-MPDU (Tx/Rx), A-MSDU (Tx/Rx)
- 802.11 DFS
- 1024 MB DRAM
- 256 MB flash
- provides internal antenna and E regulatory domain.
- 4x4 MU-MIMO with three spatial streams

5.6.10 Rack Server

The Rack Server is among the most versatile general-purpose enterprise infrastructure and application servers in the industry. It is a high-density 2-socket rack server that delivers industry-leading performance and efficiency for a wide range of workloads, including virtualization, collaboration, and bare-metal applications. The Rack Servers can be deployed as standalone servers. The Cisco server extends the capabilities of the UCS portfolio in a 1-Rack-Unit (1RU) form factor. It incorporates the Intel® Xeon® Scalable processors, supporting up to 20 percent more cores per socket, twice the memory capacity, 20 percent greater storage density, and five times more PCIe NVMe Solid-State Disks (SSDs) compared to the previous generation of servers. These improvements deliver significant performance and efficiency gains that will improve your application performance.

The C220 M5 delivers outstanding levels of expandability and performance in a compact package, with:

- Latest Intel Xeon Scalable CPUs with up to 28 cores per socket
- Up to 24 DDR4 DIMMs for improved performance
- Up to 10 Small-Form-Factor (SFF) 2.5-inch drives or 4 Large-Form-Factor (LFF) 3.5-inch drives (77 TB storage capacity with all NVMe PCIe SSDs)
- Support for 12-Gbps SAS modular RAID controller in a dedicated slot, leaving the remaining PCIe Generation 3.0 slots available for other expansion cards
- Modular LAN-On-Motherboard (mLOM) slot that can be used to install a Cisco UCS Virtual Interface Card (VIC) without consuming a PCIe slot
- Dual embedded Intel x550 10GBASE-T LAN-On-Motherboard (LOM) ports

5.7 AUDIO VISUAL SYSTEM

a) Provide a **detailed proposed technical solution for the AV system** of the building.

b) Supply, install, test and commission AV and meeting room booking system to the building in accordance with the specifications.

c) Configure and set up the AV system to integrate with other related systems in the building.

d) Provide the test results, warranty certificate, reports and as installed drawings

PARTICULAR SPECIFICATIONS FOR CABLING

a. Introduction

The project comprises the supply and installation of a structured telecommunications cabling system.
A backbone network shall be installed within the building. Not all IP-based services will run on the different physical networks. These services include:

- Corporate network
- Customs network
- Tenant network
- Voice traffic (IP phones)
- Wireless network
- Access control system.
- Security system

The detail design shall consider a cost-effective installation, allowing multi-use of physical layers where appropriate. To ensure data security between the different services, Virtual networks or VLANs will be configured. All access VLANs will be routed by core switches however; physical network infrastructure will be shared.

b. Regulations

This design shall comply with the latest revisions and amendments as at the date of submission of the following:

- Relevant British Standards
- The Electronic Power Act
- The Communications Commission of Kenya (CCK)
- Kenya Bureau of Standards
- Institute of Electronic and Electrical Engineers (IEEE)
- The Asynchronous Transfer Mode (ATM)
- The International Standards Organisation (ISO)
- Institution of Electrical Engineers (I.E.E) Wiring Regulations
- Current recommendation of CCITT and CC1R

- ANSI/TIA/EIA

c. Labelling of cables, faceplates and interconnecting hardware

- Horizontal and backbone cables shall be labelled at each end. The cable or its label shall be marked with its identifier.
- A unique identifier shall be marked on each faceplate to identify it as connecting hardware.
- Each port in the faceplate shall be labelled with its identifier.
- A unique identifier shall be marked on each piece of connecting hardware to identify it as connecting hardware.
- Each port on the connecting hardware shall be labelled with its identifier.

d. Working drawings

A full set of all the working drawing shall be supplied by the contractor to the engineer for approval showing the locations of and identifiers for:

- All Horizontal cable routing and terminations.
- All Telecommunications outlets/connectors
- All Backbone cable routing and terminations

e. Records

All records shall be created by the installation contractor and turned over to the engineer at the completion of work. The format shall be computer based and both soft copies and hard copies shall be part of the As-built package.

The minimum requirements include:

- Cable records must contain the identifier, cable type, length termination positions at ends, manufacturer, and part number.
- Connecting hardware records must contain the identifier, type of hardware and the amount of positions.
- Connecting hardware positions records must contain the identifier, type of position, and the cable identifier attached to it.
- Test documentation on all cable types shall be included as part of the As-built package.

f. Reports

All reports shall be generated from the computer-based programme used to create the records above. These reports should include but not limited to: -

- Cable reports
- Cross-Connect Reports
- Connecting Hardware Reports

g. Testing

Testing of cable channels shall be performed prior to system hand-over.

- **Copper testing**

All UTP/SeTP horizontal cables and backbone cables whose length does not exceeding 90M (295 ft) shall be tested according to ANSI/TIA/EIA-TSB-67 for wire map, attenuation, length, NEXT (Near End Crosstalk Loss), and SeTP shall have an additional test for shield continuity. NEXT testing shall be done in both directions

- **Fibre optic testing**

Fibre horizontal and backbone cables shall be 100% tested for length, polarity, and attenuation at 850MM or 1300MM for 62.5/125-micron cable in at least one direction. Length shall be tested using an OTDR. The warranty offered shall be for link and/or channel coverage for horizontal and backbone cables. The testing performed shall be done in accordance with the type of warranty required.

h. Workmanship

All work shall be done in a workman like fashion of the highest standards and in accordance with best practices in the telecommunications industry. All equipment and materials are to be installed in a neat and secure manner, while cables are to be properly dressed.

i. Installer qualifications and training

The installer shall be fully conversant and capable in the cabling of low voltage applications such as, but not limited to data voice and imaging network systems. The installer shall at minimum possess the following qualifications: -

- Personnel trained and certified in the design/installation of structured cabling system.
- Personnel trained and certified in fibre optic cabling, splicing, termination and testing techniques. Shall show proof of current certification.

j. System warranty

A Twenty-Year System Warranty for the structured cabling system shall be provided for covering applications and components on all passive telecommunications equipment and cables.

k. Technical requirements

The system offered and quoted shall incorporate all features and facilities listed in this specification. The structured cabling system shall consist of the following sub-systems: -

- Horizontal Sub-System
- Work Area Sub-System
- Backbone System
- Equipment Sub-System

The system shall support telephony and low voltage networks associated with analogue and digital voice, data, local area networks (LAN) and imaging applications.

l. Horizontal cabling

The Horizontal Sub-System is the porting of the telecommunications cabling system that extends from the work area telecommunications outlet/connector to the floor distributor in the wiring closet. It consists of the telecommunications outlet/connector, horizontal cables, and that portion of the cross-connect in the telecommunications closet serving the horizontal cable. Each floor of the building shall be served by its own horizontal sub-system.

m. Cable types

All UTP/SeTP cables shall conform to ANSI/TIA/EIA-568-A Commercial Building Telecommunications Cabling Standard and ISO/IEC 11801 (International) generic cabling for customer premises standard. The following cable specifications shall also be met by the cable manufacturer for copper 4 pair UTP/SCTP category 6 cables.

UTP cables shall: -

- be 100 Ω 4-pair, category 6 cable
- be appropriate for the environment in which it is installed
- Meet the requirements of ANS/TIA/EIA-568-A and ISO/IEC11801 meet the same transmission requirements of UTP as specified in ANSI/TIA/EIA-568-A and ISO 9001 and 9002 Certified Manufacturer.
- Be categorised using power sum testing and meet the hybrid cable requirements for use in horizontal cabling.

n. Cable routing

All horizontal cables, regardless of media type, shall not exceed 90M (295 ft) from the telecommunications outlet in the work area to the floor distributor located in the Telecommunications cabinet. The combined length of jumpers, or patch cords and equipment cables in the telecommunications closet and the work area should not exceed 10M (33 ft).

Two horizontal cables shall be routed to each work area. Both the horizontal cables connected to a telecommunication outlet shall be 4-pair, 100 Ω Category 6, unshielded twisted-pair (UTP)/ Screen twisted-pair SeTP.

Horizontal pathways shall be installed or selected such that the minimum bend radius of horizontal cables is kept within manufacturer specifications both during and after installation.

In open ceiling cabling, cable supports shall be provided by means that are structurally independent of the suspended ceiling, its frame work, or supports. These supports shall be spaced no more than 1.5 M (5 ft) apart.

Telecommunications pathways, spacers and metallic cables which run parallel with electric power or lighting shall be installed with a minimum clearance of 50MM (2 in). 4-pair UTP cables shall be run using a star topology from the telecommunications closet on each floor to every individual telecommunications outlet. All cables routes shall be approved by the Engineer prior to installation of the cabling.

The contractor shall observe the bending radius and pulling strength requirements of the 4-pair UTP/SeTP cable during handling and installation.

Each run of UTP/SeTP cable between horizontal of the cross-connect in the telecommunications closet and the telecommunications outlet shall not contain splices.

In the telecommunications closet where cable trays or cable racking area used, the contractor shall provide appropriate means of cable management such as reusable colour odd hook and loop cable managers (cable ties) to create a neat appearance.

In a false ceiling environment, a minimum of 3 inches (75MM) shall be observed between the cable supports and the false ceiling. Continuous conduit runs installed by the contractor should not exceed 30.5m (100 ft) or contain more than two (2) 90-degree bends without utilising appropriately-sized pull boxes.

o. Work area

This section outlines specifications for the work areas equipment cords (patch cords) and telecommunications outlets at the users work area. The connection between the telecommunications outlet and the user equipment (computer/telephone) shall be achieved by means of this subsystem.

i. Work area equipment cords

The work area equipment cords shall meet or exceed the following criteria:

a) Copper modular equipment cords: category 6 patch cords

Category 6 modular equipment cords shall: -

- Be round and consist of eight insulated 24 AWG, stranded copper conductors, arranged in four colour-coded twisted pairs within a flame-retardant jacket.
- Be equipped with modular 8-position (RJ-45 style) plugs on both ends, wired straight-through with standards compliant wiring.

- Use modular plugs which exceed FCC 47-part 68 subpart F and IEC 603-7 specifications and have 50 microinches of gold plating over nickel contracts.
- Maintain shield continuity through the modular plug shield not via the contracts when screened (SeTP) cords are used.
- Modular cords shall include a moulded strain relief boot.
- be available in any custom length and standard length of 0.9, 1.5, 2.1, 4.5, 6, 7.6 metres
-

Electrical Specifications

- Have a DC resistance per lead 9.38Ω/100 mm maximum
- Have a mutual capacitance 17 split (86) maximum
- Have a characteristic impedance: 100Ω 15% from 1 to 100 Mhz.
- be 100% transmission tested with laboratory gas network analysers for proper performance up to 100mhz.Vendor shall guarantee cords are compatible with category 6 links.
- be UL VERIFIED for TIA/EIA category 6 electrical performance
- be UL LISTED 1863
- be made by an ISO 9001 and 9002 Certified Manufacturer
- be constructed of high impact flame-retardant the thermoplastic

b) Telecommunications outlets (high density)

All high-density telecommunications outlets for 100 Ω 22.26 AWG copper cable shall: -

- be available in black, white, grey, ivory and light ivory
- be 8 position/8-conductor with coherent pairing of IDC pins
- have available a gravity feed (45 degree angled) design
- provide universal application/multi-vendor support
- support industry standards for T568A or T568B wiring options on each individual outlet
- allow installation from the front or rear of the faceplate and allow for the jack to pass through the faceplate without re-termination
- beside-stackable for high density solutions
- allow termination without the use of special termination tools
- be available in a screened version for 100Ω SeTP cable
- be a protective, hinged or flexible door to protect the outlet from dust and other airborne contaminants
- provide colour-coded, slide-icons available for circuit identification
- be constructed of high impact, flame retarded thermoplastic
- have, as an option, an outlet which can be mounted into an IEC 603-7 complaint opening (keystone)
- be UL VERIFIED for TIA/EIA Category 6 electrical performance

- be UL listed 1863 and CUL C22.2 approved
- have Austel "C-Tick" A96/0399
- Made by an ISO 9001 and 9002 Certified Manufacturer

ii. Faceplates

All faceplates shall:-

- be applicable to both fibre and copper applications
- have write on designation labels for circuit identification together with a clear plastic cover.
- be available in single gang and double gang configurations
- have optional modular furniture adapters available
- have stainless steel options available
- be made by ISO 9001 and 9002 Certified Manufacturer.

a) Telecommunications outlets (surface mount) low profile outlets

All Surface Mount Information Outlets for 100 Ω 22-26, AWG shall: -

- utilise compliant pin technology 110 style insulation displacement connectors (IDC) and allow the use of a 4-pair impact tool
- allow for a minimum of 200 re-terminations without signal degradation below standards compliance limit
- have solid state construction for transmission performance
- utilise reactance balance pair technology to address data circuit applications upto 100 mhz
- comply with ECCC FR 47 part 68 subpart F and ICE 603-7 specifications and have 50 microinches of gold plating over ticket contracts
- provide universal application multi-vendor support
- support industry standards for T568A or T568B wiring options
- allow removal from the front when mounted in place
- be available in single port, modular increments
- be UL VERIFIED for TIA/EIA category 6 electrical performance
- be UL LISTED 1863 and CSA C22.2 approved
- be made by an ISO 9001 and 9002 Certified Manufacturer.

b) Surface mount boxes

All low profile, surface mount boxes, used for mounting surface mount information outlets shall:-

- be available in 1-, 2-, 4-, or 6- port versions

- be built-in cable management for both fibre and copper applications
- be available in black, white, grey, ivory and light ivory
- have at least three sides with breakouts and an opening in the base for cable or trunking (raceway) entry
- provide for an optional spring-loaded shutter door for added protection from dust and other airborne contaminants
- have a designed area for printed or adhesive labels for circuit identification
- have optional magnets which can be internally mounted
- have colour-coded, snap in icons for circuit identification size
- 1-port box shall not exceed 61.8mm width, 44.6mm length and 27.9mm height
- 2-port box shall not exceed 70.6mm width 66.3mm length and 27.9mm height
- 4-port box shall not exceed 90.6mm width, 11.55mm length and 27.9mm height
- 6-port box shall not exceed 101.6mm width, 165.1mm length and 27.9mm height
- be made by an ISO 9001 and 9002 Certified Manufacturer.

c) Multimedia telecommunications outlet housings

All Multimedia/ multi-user information outlets shall:

- be surface mounted
- be capable of housing SC and ST type connectors for fibre and/or 8 position/8 conductor modular jacks for 100Ω UTP/SeTP cable
- accommodate hybrid adapter units for ST to SC or SC to ST connections
- be capable of integrating fibre, UTP/SeTP, coax shield (STP) connectivity outlets
- be capable of accommodating up to 12 port of mixed media (fibre, UTP/SeTP, coax or shield STP outlets simultaneously or up to 24 ports for fibre only applications
- be capable of accommodating a splice try for fibre terminations
- have a hide way labelling system compliant with TIA/EIA - 606 administrative standard
- allow for securing cover with screw for additional security
- have rear cable access and at least four sides breakouts for cable/trunking (raceway) entry with strain relief points
- have storage capacity for at least 1 meter of fibre and 305mm for UTP slack storage, while maintaining minimum bends radius requirements
- have a removal fibre management tray that allows copper and fibre slack to be stored separately
- allow information outlets to pass through openings before and after termination
- have optional magnets which can be internally mounted

- have a low-profile design
- Be made by an ISO 9001 and 9002 Certified Manufacturer.

p. Telecommunications closets

The Telecommunication closet is a floor serving facility. The Floor Distributor links the horizontal sub-system and the backbone subsystem together. The Floor Distributor shall consist of rack mounted wiring blocks or panels for termination of copper cables and rack mount interconnect centres for fibre management panels/trays for the termination of optical fibres.

The telecommunications closet shall be sized to accommodate telecommunications equipment, cable terminations and associated cross-connect.

Communication grounding/earthing and bonding shall be in accordance with Applicable codes and regulations.

It is recommended that the requirements of IEC 1000-5-2 ANSIT/TIA/EIA-607, or both be observed through the entire cabling system.

The telecommunications closet shall not be shared with building services that may interfere with the telecommunications systems or be used for custodial services.

q. Copper termination patch panels (utp/setp)

The termination panels shall support category 6 applications and facilitate cross-connection and inter-connection using modular patch cords. The panels shall be sized to fit an EIA standard 19 inch relay rack.

i. Modular patch panel

The panel shall:-

- be made of block anodised aluminium in 16-, 24-, 28-, 32-, 48-, 64- and 96-port configurations
- have cut outs to fit the variety of information outlets used at the work area, supporting UTP, SeTP and ST fibre adapters, as well as coaxial applications
- have cut outs which allow terminated jacks to pass through the panel for easy rearrangement
- be available in two sizes for each port quality to allow for custom administration of the network
- be changeable ports which are removed from the front of the panel to allow custom configuration or modification to the panel
- be available with no ports to act as a filler between rack hard ward and equipment

- have port identification numbers provide on both the front and the rear of the panel
- have mounting slots compatible with ANS/EIA-310
- accept 110-style patch plugs as a means of termination
- electrical specifications
- be consistent with the electrical specifications of the work area outlets specified in sections 4.1. 33.2.1 And 4.3.2.2 above be made by an ISO 9001 and 9002 Certified Manufacturer.

ii. Modular patch panel (high density)

The panel shall:

- be made of black, light weight, high strength brushed aluminium in 24-, 48-port configuration
- have openings to fit the variety of information outlets ousted in the work area-supporting UTP, SeTP and ST fibre adapters, as well as coaxial applications,
- Each opening can handle four or six jack modules
- have openings which allow terminated jacks to pass through panel for easy rearrangement
- have port identification numbers on both the front and rear of the panel
- provide for proper termination and grounding/earthing of 100Ω SeTP cable
- Accommodate at least 24 ports for each rack mount space (1rms) = 44.5mm (1.75in.)
- be available with an integrated rear management bar
- be provided with self-adhesive, clear label holders and white designation labels
- be available with no ports to act as a filter between rack hardware and equipment
- have mounting slots compatible with ANSI/EIA-310

Electrical specifications:

- be consistent with the electrical specifications of the work area outlets specified
- Be made by an ISO 9001 and 9002 Certified Manufacturer.

r. Fibre optic interconnect centres, panels and trays

All interconnect trays (units) shall provide cross-connect, inter-connect, splicing capabilities and contain cable management for supporting and routing the fibre cables/jumpers.

i. Rack-mounted, high density fibre interconnect centre

- be available in white or black and occupy no more than four rack mount spaces 4 rms = 177.8mm (7.00 in.) and accommodate up to 72 ST or 144 SC fibres using snap-in pre-loaded adapter plates
- accommodate hybrid adapter bezel for ST to SC or SC to St connections
- have fibre cable managers to effectively store fibre cable slack and comply with fibre bend radius requirements
- have six port fibre adapter plates which allow for colour coding connectors
- have fibre adapter plates with snap-in installation and one-finger removal
- have lockable front and rear transparent doors that have spring release hinges for removal
- accommodate stackable splice trays which manage a total of 72 splices
- have an adapter plate mounting bracket which slides out to the front and to the rear of the unit for increased access
- have cable access points for fibre jumpers entering and exiting the unit with rotating grommets to facilitate cable loading and to minimise micro bending stress
- have anchor points for fibre cables (s) entering the unit
- have labelling which meets or exceed ANSI/TIA/EIA-606 requirements and also be laser printable
- be able to mount to a standard 19 inch cabinet
- be UL LISTED 1863 and CUL C22.2 approved
- Be made by an ISO 9001 and 9002 Certified Manufacturer.

ii. Rack-mounted, low profile fibre connect panel

The low fibre connect panel shall:

- Not be bigger than one rack mount space and accommodate up to -32SC or ST adapters;
- Accommodate hybrid adapter bezels for ST to SC or SC to ST connections;
- Be provided with strain relief lugs for the fibre cable entering the unit from the slide or back.

s. Patch cords

Where applicable, the contractor shall supply patch cords (factory assembled plug ended jumpers) for patch panel and terminal blocks.

i. RJ-45 – RJ-45 Patch cords: category 6

Category 6 modular patch/equipment cords shall:

- be round and consist of eight insulated 24AWG, stranded copper conductors, arranged in four colour-coded twisted pairs within a flame-retardant jacket
- be equipped with modular 8 position (RJ-45 style) plugs on both ends, wired straight-through with standards compliant wiring
- use modular plugs which exceed ECC CFR 47 part 68 subpart F and IEC 603-7 specifications and have 50 micro inches of gold plating over nickel contracts
- shall maintain shield continuity through the modular plug shield not via te contracts when screened (SeTP) cords are used
- modular cords should include a moulded strain relief boot
- be available in standard lengths of 1.5 and 3meters

Electrical specifications

- have a DC resistance per lend: 9.38Ω/100m maximum
- have a mutual capacitance: 17.5 pF/ft (5.6pF/m) maximum
- have a characteristic impedance: 100Ω 15% from 1 to 100mhz
- be 100% transmission tested with laboratory grade network analysers for proper Category 6 links
- be UL VERIFIED for TIA/EIA Category 6 electrical performance
- be UL LISTED 1863
- be made by an ISO 9001 and 9002 Certified Manufacturer.

ii. Fibre equipment/patch cords (jumpers)

The fibre equipment patch cords shall:-

- be available in standard lengths of 1, 3 and 5 meters
- custom lengths shall also be available and shall meet or exceed standards as defined in ANSI/TIA/EIA-568-A and ISO/IEC 11801
- utilise simplex or duplex fibre cable that is 62.5/125 MICRON multimode, OFNR riser grade and meets the requirements of UL 1666
- attention shall not exceed 3.5 bB/km @350mm wavelength of 1.0 Db/km @1300mm
- cable packet colour shall be orange. The connectors shall be SC or ST in accordance with TIA/EIA-568-A and must include a ceramic ferrule
- ST connectors must have a metal coupling nut
- terminated connectors shall exhibit a maximum insertion loss of 0.75dB with an average of 0.50 dB when tested at either 850mm or 1300mm wavelengths
- be made by an ISO 9001 and 9002 Certified Manufacturer
- be UL 166 approved

iii. Single mode fibre patch cords

All single mode fibre optic patch cords shall:-

- be either simplex or duplex OFNR riser grade cable, with attenuation at wavelength 1310mm being 1.0 dB/km and at wavelength 1550mm 1.0dB/km
- have a yellow jacket
- be terminated with ceramic tip connectors in either the standards based SC or ST style. These connectors shall have a maximum attenuation of 0.5dB and a minimum return loss of 40dB
- be made by an ISO 9001 and 9002 Certified Manufacturer
- be UL 1666 approved

t. Standard floor distribution frame

For rack mounted installations in a telecommunications closet the installer shall use a 19in x 7ft rack. The rack shall:

- have 76mm by 152mm vertical cable channels as side rails
- have channels capable of utilising and re-locating up to ten re-usable hook and loop cable managers
- have ten high capacity cable managers provided for the front of the rack which can be used for horizontal or vertical cable management and easily twist and lock into place without the use of screws or tools
- have standard ANSI/EIA-310-C mounting holes and cable routing openings in the front, rear and size of the channels
- be made of aluminium with a black finish and utilise black grommets for unused cable openings
- have two optional vertical cable management channels 153mm (6in.) x 2.1mm (7ft) and 76mm (3in.) x 2.1m (7ft) which can be located between racks. The channel shall include cable retainers which can be hinged left or right and be located in any position along the channel
- have floor mounting holes and a ground lug for 0.6 gauge ground cable provided
- be made by an ISO 9001 and 9002 Certified Manufacturer.

u. Wall mounting brackets

Wall brackets shall:-

- be constructed as a single piece

- be available in 2,3,4 and 6 rack mount spaces, but be designed in 1 rms increments to accept 1 rms panels
- be hinged on one side with standard ANSI/EIA-310-C mounting holes
- mount standard 19 inch patch panels
- mount with the hinge to the right or the left
- be able to mount to a standard 19 inch rack
- have a cable access hole in the rear support
- be 150mm (6 in.) deep
- be made by an ISO 9001 and 9002 Certified Manufacturer

v. Backbone cabling

These are cables connecting closet to closet or closet to the equipment room within the building. The following cables are allowed for use in as backbone: 4 pair 100 Ω unshielded/screened twisted-pair. 100Ω UTP multi-pair copper cables and 62.5/125 micron multimode Optical fibre cables. The cable shall support voice, data and imaging applications. The bending radius and pulling strength requirements of all backbone cables shall be observed during handing and installation.

Building Backbone subsystem shall act as the convergence point for all the telecommunications closets. It shall consist of the backbone transmission media between the telecommunications closets and the server room. The building shall be connected to the incoming telecommunications services through the core routing switch located in the server room.

w. Installation

i. Site survey

Prior to placing any cable pathways or cable, the contractor shall survey the site to determine job conditions will not impose any obstructions that would interfere with the safe satisfactory placement of the cables and to arrange the removal of any obstructions with the Engineer accordingly.

ii. Cable pathways

Pathways shall be designed and installed to meet Applicable Local and National Building and Electrical Codes or Regulations.

Ground/Earth and bonding of pathways shall comply with applicable codes and regulations.

Pathways shall not have exposed sharp edges that may come into contract with telecommunications cables.

The number of cables placed in a pathway shall not exceed manufacture specifications, nor will the geometric shape of a cable be affected.

Pathways shall not be located in elevator shafts.

iii. Cable routes and clearances

Horizontal distribution cables shall not be exposed in the work area or other locations with public access.

Cables routed in a suspended ceiling shall not be draped across the ceiling tiles. Cable supports shall be mounted a minimum of 75mm above the ceiling grid supporting tiles.

Cables supports in a suspended ceiling shall be structurally independent of the suspended ceiling, its framework or support and not be spaced more than 1.5m apart.

The installations of telecommunications cabling shall maintain a minimum clearance of 3m from power cables in excess of 180 Vrms.

No telecommunications cross connects shall be physically located within 6m of electrical distribution panels, step down devices or transformers which carry voltages in excess of 480 Vrms.

Minimum separation of 50mm (2ft) shall be provided in areas where power or electric light circuits which are equal to or less than 480 Vrms and telecommunications cabling coexist.

iv. Work area termination

All UTP/SeTP cables wired to the telecommunications outlet/connector shall have 4-pair terminated in eight-position, not keyed modular outlets in the work area. All pairs shall be terminated.

The telecommunications outlet/connector shall be securely mounted at planned locations.

The height of the telecommunications faceplates shall be next to a device unless otherwise specified.

The maximum cable pulling tensions shall not exceed manufacturer's specifications.
The maximum cable bend radius shall not exceed the manufacturer's specifications.

In spaces with UTP/SeTP cable termination, the maximum bending radius for 4-pair cable shall not exceed four times outside diameter of the cable and ten times for multi-pair cable. This shall be done unless this violates manufacturer specifications.

During the actual installation, bend radius on 4-pair cable shall not exceed eight times the outside diameter of the cable and ten times for multi-pair cable. This shall be done unless this violates manufacturer specifications.

v. Slack

In the work area, a minimum of 300mm shall be left for UTP/SeTP, while 1000m shall be left for fibre cables.
In telecommunications closets a minimum of 3m of slack shall be left for all cables. This slack must be neatly managed on trays or other support types.

x. Infrastructure management

An intelligent infrastructure management system shall be installed for the system. The system shall have a windows-based interface. The proposed system should be able to track and log all the changes undertaken on the system in the operational phase.

y. Network control equipment

- Active devices used at the LAN edge shall have 24 or 48 ports for connection to the horizontal cabling.
- Active devices shall be rack mounted.
- Active devices for horizontal cabling shall support auto sensing 10/100mbps and backbone cabling at 1000mbps.
- Active devices used at aggregation layer of LAN shall support IP routing.
- Active devices used at the LAN edge must be stackable and shall attach to the backbone cabling at 1000mbps.
- Where more than one active device is required to satisfactorily serve the floor data outlets distribution requirements they shall be stacked using interface operating at the backbone speed.

z. Ethernet floor edge switches

- The edge switch connecting to the backbone must include at least two ports of 1000 Base X Gigabit Ethernet with GBIC support, QOS, Multiple queues with weighted round robin (WRR) scheduling and layer 3 switching and routing of IP, IPX and IP multicast traffic.
- The switch in the set up should give 10/100/1000MBPS at the desktop.
- Should support at least 16,000 MAC Addresses
- The switch should be adequate to cater for the total number of data points.
- Advanced IP Switching
- Stackable to up to 8 units
- Up to 8 queues per port with prioritisation
- At least 9.5 MB throughput
- Redundant power supply
- Support for up to 512 Virtual router interface
- At least 16K MAC Table
- Support Centralised management via SNMP

a. Ethernet core routing switches

The following are the minimum requirements for the core routing switch:

- The Backbone switch should provide minimum (10/100/1000/10000) of 12 ports of IEEE802.32 1000 Base X.
- Be able to run industrial standard IP multi cast at wire speed.
- Chassis should support a minimum of 8 Slots
- Non-blocking integrated layer 2/3/4 switching performance.
- Multi-layer IOS software services with IP routing, advanced QOS, traffic management and comprehensive security.
- Shall be rack mounted in standard rack/cabinets.
- Shall have a redundant power supply for each edge switch connecting to the backbone.
- Shall support standard security features.
- Up to 8 queues per port with prioritisation
- At least 9.5 MB throughput
- Redundant power supply
- Support for up to 512 Virtual router interface
- At least 16K MAC Table
- At least 4096 VLANS support
- Dual power supply
- MPLS Packet Switching

b. DTU'S

Type:	HDSL
Max Data Transfer Rate:	2Mbps
Mode of Operation:	DCE
Connector:	DB37
Interface Cable:	DB37-DB15

a. Router Specifications

Memory: 256MB expandable to 512MB

Flash Memory: 64MB

Interfaces: 2 x Fast Ethernet LAN Ports

1 x Serial WAN Port

Auxiliary Port

Console Port

Expansion Slots: 1 Network Module Slot

Software: Latest Software release

Installation: Standard 19" Rack Mount Kit

b. Network cabinets

- The cabinet shall be metallic with front clear glass and of good finish and conveniently accessible by technical personnel for maintenance.
- Power to the cabinet shall be switched off/on from within the cabinets. Proper power socket cables to be supplied within the cabinet.
- The cabinets to be used in this installation shall conform to ANSI/TIA/EIA-568B with forced cooling and their location shall be determined on site.
- Support small factor pluggable (SFP) and industry leading density up to 240 of IEEE 8033 for 1000 Base-SX ports per system.

B. Particular Instructions For Pricing of Items in the Bills of Quantities

9.1 General Directions

(a) The Bills of Quantities are to be read in conjunction with the Conditions of Contract, the Technical Specification, the Data Schedules and the Drawings for details of the description, quality, tests and strengths of materials to be used and the workmanship, conditions, obligations, liabilities described in the Conditions of Contract, the Specification, the Data Schedules and the Bills of Quantities including all overhead charges and profit and carrying out of the Works shall be deemed to be spread over and included in the prices and sums in this Bill of Quantities.

(b) Each item which the Tenderer proposes to supply shall be priced by Tenderer with the exception of the item for which Provisional Sums have been allowed. The Tenderer shall insert in the appropriate column against each item allocated in Kenya Shillings (Kshs.) as required by him and payments shall be made according to this allocation in the event of a contract.

If the Tenderer omits to price any item in the Bills of Quantities then the cost of such items will be held to be spread over and included in the prices given for other items of work.

(c) The rate entered against each item **shall be inclusive** of all duties, customs and excise charges. A separate section is included for **VAT** at the summary page.

(d) The Total of Tender for the electrical services shall be carried to the Main Summary section 6.

The Total of Tender for the electrical services shall include for the design, manufacture, inspection and testing, packing for shipment, insurance, customs, dues, delivery to site, unloading, and all other charges, complete erection, testing, setting to work, finishing, painting, maintenance for a period of six calendar months and the instruction period all to the satisfaction of the Engineer, of the items of Plant described or implied within the Specification and shown on the Drawings.

(e) Provisional Sums may be expended in part, in whole or totally deleted from the Contract. The Tenderer shall take this into consideration when pricing the tender as no claims for loss of profit, etc will be entertained.

It shall be deemed that the contractor has included for all requirements contained within the Specification, Drawings, Data Schedules and Bills of Quantities.

(f) For information and to assist the contractor in pricing the Bills of Quantities and the Schedule of Rates, the following Scope of Contract have been included, these details having formed part of the Main Tender Documents.

(g) Irrespective of the requirements contained within the East African Standard method of Measurement it shall be deemed that the contractor has included all requirements contained within the Specification, Drawings, Schedules and Bills of Quantities.

(h) It shall be the responsibility of the Tenderer to ensure that his prices include for all items necessary to complete the installation whether or not the items have been specifically identified within the Bills of Quantities. The Tenderer's prices shall include for all nuts, bolts, washers, fixings, supports and the like as necessary.

SECTION 6

ICT Installations

Main Summary

ITEM	DESCRIPTION	AMOUNT(KSHS)
	SUMMARY PAGE FOR ICT INSTALLATIONS	
	SUB - CONTRACT PRELIMINARIES	-
A	INCOMING FIBER OPTIC CABLE & GENERAL ITEMS	
B	MODULAR DATA CENTRE	
C	QUEUE MANAGEMENT SYSTEM	
D	VIDEO CONFERENCING SOLUTION	
E	AUDIO VISUAL SYSTEM	
F	MONITORING SYSTEM	
G	ACCESS CONTROL & SECURITY SYSTEM INSTALLATION	
	TOTAL AMOUNT FOR ICT INSTALLATIONS INCLUSIVE VAT	

SECTION 7

Data Schedules

DATA SCHEDULE A - GENERAL

Item	Description	Manufacturer	Name of Local Agent	Delivery to Site in weeks
1	Modular data centre			
2	Active network			
3	Unified communication			
4	Open DNS			
5	Server & software			
6	Perimeter Security Tools &system firewalls.			
7	Queue management equipment			
8	Audio visual equipment			
9	Video conferencing equipment			
10	Security system installations			
11	Any other items to be listed below or on an attached sheet			

DATA SCHEDULE B – SPECIAL TOOLS

The Tenderer shall list hereunder his recommended list of tools for the plant supplied under this contract. The list shall be priced individually. A Provisional Sum is to be included in the Schedule of Prices.

Item No.	Description	Amount in Kshs.
1	Modular data centre	
2	Audio visual system	
3	Video conferencing system	
4	Data management equipment	
	To be listed below	

Note: Tenderer to submit details of tools for which prices have been entered

Total for Special Tools Kshs._____

DATA SCHEDULE C – SPARE PARTS

The Tenderer shall list hereunder his recommended list of spares covering a period of one year for the plant supplied under this Contract. The list shall be priced individually. A Provisional Sum is to be included in the Schedule of Prices.

Item No.	Description	Amount Kshs.
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Total for Spare Parts Kshs.

Note: Tenderer to submit details of spare parts for which prices have been entered.

DATA SCHEDULE D – CONTRACTORS

If the whole of the equipment is not to be manufactured at the Tenderer's own works, he shall give the names and addresses of the firms to whom various items will be sub-contracted.

	Item	Name and Address of Contractor
1.	_____	_____
2.	_____	_____
3.	_____	_____
4.	_____	_____
5.	_____	_____
6.	_____	_____
7.	_____	_____

DATA SCHEDULE E – MANUFACTURERS, PLACES OF ASSEMBLY, TESTING AND INSPECTION

Item	Manufacturer	Place of Manufacture	Place of Inspection and Testing
1	Modular data centre		
2	Audio visual system		
3	Video conferencing system		
4	Queue management system		
5	Security system installation		

DATA SCHEDULE F – DELIVERIES

The times to be entered below are the periods in weeks from the date of acceptance of the Tender in the event of a Contract.

In the column headed "Method of Shipping", the Tenderer is to state whether items are to be shipped by sea or air and road or rail and whether as general cargo, in containers, etc. Each item of plant, equipment or materials shall be entered.

Item	Time of Despatch Ex-Works	Shipping Route From	To	Method of Shipping	Time of Arrival on Site

SECTION 8

Drawings

SCHEDULE OF TENDER DRAWINGS

The following drawings are issued for tendering purposes

J189/E-01 - SCHEDULE OF DRAWINGS AND LEGEND OF SYMBOLS LAYOUT

J189/E-02 - THIRD FLOOR – POWER & DATA LAYOUT

J189/E-03 - FOURTH FLOOR - POWER & DATA LAYOUT

J189/E-04 - FIFTH FLOOR - POWER & DATA LAYOUT

J189/E-05 - THIRD FLOOR – CCTV & ACCESS CONTROL LAYOUT

J189/E-06 - FOURTH FLOOR - CCTV & ACCESS CONTROL LAYOUT

J189/E-07 - FIFTH FLOOR - CCTV & ACCESS CONTROL LAYOUT

J189/E-08 - DATA CENTRE ROOM ELECTRICAL LAYOUT

J189/E-09 - UTILITY ROOM ELECTRICAL LAYOUT