Part 1 General

1.1 Objective

1.1.1 This document provides deployment standards and design specifications for Building Automation Systems (BAS) integration with Network Equipment at Toronto Metropolitan University. The objective of this design standard is to ensure that the University's communications infrastructure is harmonized between the various applications/protocols as we move towards a unified network.

1.1.2 It shall be mandatory that these standards and specifications, for communications infrastructure related work on the University campus, are adhered to stringently by all Toronto Metropolitan University staff and external contractors.

1.1.3 All work associated with these specifications shall comply with the Canadian Electrical Code (part 1), Ontario Electrical Safety Code (OESC) and the Ontario Building Code.

1.1.4 Network standards are dynamic and constantly changing. Computing and Communication Services (CCS) holds the responsibility for approving changes to these specifications and all parties shall be responsible for acquiring the latest approved copy of these standards for use on any project.

1.1.5 These standards cover the basic requirements for all projects in new and existing buildings.

1.1.6 The department, Communications Services of CCS, Computing and Communications Services is responsible for the communications infrastructure at the University. CCS in consultation with building occupants are to be involved in the design process.

1.1.7 Toronto Metropolitan University appointed designates shall be consulted during the design and construction phases, and must approve all the designs prior to the construction phase. CCS is to be consulted as questions arise during the construction phase.

1.2 General Intent

1.2.1 The general intent of this document is to provide the architect, interior designer, engineers, Network Designer, BAS Designer, BAS Integrator and BAS Contractor the tools necessary to ensure that all Toronto Metropolitan University standard telecommunications requirements are met where it relates to BAS.

1.2.2 Toronto Metropolitan University reserves the right to modify these requirements based on the needs of a particular project, however, the requirements outlined in this document shall represent the initial design requirements for any new project unless advised otherwise by Toronto Metropolitan University.

1.2.3 Where the architect, interior designer, corporate real estate or engineer wish to deviate from the Toronto Metropolitan University Communications Design Standards prior written approval shall be obtained from Toronto Metropolitan University.

1.3 Design Architecture

1.3.1 The objective of BAS is to centralize and simplify building monitoring, control, operation and management. This is done to achieve more efficient building operation at reduced labour and energy costs and provide a safe and comfortable working environment for building occupants'.

1.3.2 The system shall consist of Building System Server, Building Controllers and Local Control Units which includes Primary Equipment Controllers, Secondary Equipment Controllers, etc. as well as CCS's Network Infrastructure.

1.3.3 The intent of this specification is to provide a distributed and networked open Building Automation System, the capability to integrate BACnet, Lonworks and Modbus into a unified system in order to provide flexibility for expansion, maintenance and service of the system over a TCP/IP Network.

1.3.4 While the BAS industry and interested users have tried to establish a common communications protocol that would encourage open networking and development of interoperable products, most BAS protocols are proprietary. Each protocol is different, and not all permit sharing of data and communications between different BAS vendors or may require the use of additional or proprietary converters, bridges, routers, or gateways.

1.3.5 The BAS Integrator needs to verify the interoperability and specific functionality of the products and protocols intended to be used.

1.4 Related Documents

1.4.1 The latest versions of the following codes, standards, and guidelines shall be followed. Bring to CCS' immediate attention where construction documents or conditions differ from requirements in codes, standards, guidelines and specifications.

1.4.2 The following standards:

1. ANSI/TIA-568.0-D Generic Telecommunications Cabling for Customer Premises

2. ANSI/TIA 568.1-D, Commercial Building Telecommunications Cabling Standard

3. ANSI/TIA-568.2-D, Balanced Twisted-Pair Telecommunications Cabling and Components Standards

4. ANSI/TIA -568.3-D, Optical Fiber Cabling Components Standard.

5. ANSI/TIA-568.4-D, Broadband Coaxial Cabling and Components Standard

6. TIA-569-E, Commercial Building Standard for Telecommunications Pathways and Spaces

7. BICSI-003 Information Technology Systems Design and Implementation Best Practices for Educational Institutions and Facilities

8. ANSI/CEA Standard 709.C LonTalk protocol

9. ANSI/ASHRAE Standard 135 BACnet Data Communication Protocol for Building Automation and Control Systems

10. IEC 61158 Industrial communication networks – Fieldbus specifications

11. IEEE 802.3 CSMA/CD (Ethernet – Based) LAN.

12. IEEE 802.3cg 10 Mbit/s Single Twisted Pair Ethernet

1.4.3 The following guidelines:

1. BICSI, Telecommunications Distribution Methods Manual (TDMM)

2. BICSI, Information Transport Systems Installation Methods Manual (ITSIMM)

3. BICSI-003 Information Technology Systems Design and Implementation Best Practices for Educational Institutions and Facilities

1.4.4 The following project specifications:

1. 27 05 26 Grounding and Bonding for Communications
2. 27 05 53 Identification for Communications Systems
3. 27 08 10 Optical Fiber Testing and Measurement
4. 27 08 20 Copper Testing
5. 27 11 19 Communications Terminations Blocks and Patch Panels
6. 27 13 23 Communications Optical Fiber Backbone Cabling
7. 27 15 13 Communications Horizontal Copper Cable
8. 27 15 43 Communications Faceplates and Modular Jacks
9. 27 16 19 Communications Patch Cords, Station Cords, and Cross Connect Wire

1.5 Definitions

a) BACnet:
An open communications protocol for building automation and ASHRAE 135 control networks. It is an ASHRAE, ANSI, and ISO standard protocol developed under the auspices of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).

b) FOX:
Tridium's TCP/IP-based protocol used for communication between network level controllers and supervisor servers.

c) LonTalk:
An open communications protocol for building automation and LonWorks control networks. It is a LonMark International, ANSI, and ISO standard protocol originally developed by Echelon Corporation.

d) Low Voltage:
As defined in C22.1 (Canadian Electrical Code Part 1) for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

e) Modbus:
An open communications protocol for building automation and Modbus control networks. It is a standard protocol supported by the Modbus Organization, Inc.

f) Niagara-AX:
A software framework and development environment that solves the challenges associated with building Internet-enabled products, device-to-SupervisorAx applications and distributed Internet-enabled automation systems. Older version, phase-out started in 2015, still compatible with newer version, Niagara.

g) Niagara N4:
A software framework and development environment that solves the challenges associated with building Internet-enabled products, device-to-SupervisorAx applications, and distributed Internet-enabled automation systems. Current version, introduced in 2015, backward compatible with older version, Niagara-AX.

h) TCP/IP:

Short for Transmission Control Protocol/Internet Protocol. A protocol for communication between computers, used as a standard for transmitting data over networks and as the basis for standard Internet protocols.

1.5 Quality Assurance

1.5.1 Toronto Metropolitan University, CCS, will issue a list of IP addresses for all IP devices. It is not acceptable for BAS Contractor to use IP addresses not furnished by CCS.

1.5.2 BACnet products shall be BTL compliant.

1.5.3 Lon products shall be LonMark compliant.

1.5.4 Modbus products shall be fully compliant with the Modbus communication protocol developed by Modicon. Any Modbus product that is not fully compliant with the Modbus communication protocol developed by Modicon, may not be acceptable. Contractor shall guarantee that all Modbus products have error-free, bi-directional read and write communication with any device which utilizes the Modbus communication protocol developed by Modicon. Coordinate other system requirements with CCS.

Part 2 Product

2.1 General

2.1.1 The intent of this specification is to provide a peer-to-peer networked, stand-alone, distributed control system with the capability to integrate the most current ANSI/ASHRAE Standard BACnet, LonWorks technology, MODBUS, existing OPC if applicable, and other existing open and proprietary communication protocols if applicable in one open, interoperable system.

2.1.2 The supplied computer software shall employ component-based technology (OOT) for representation of all data and control devices within the system. In addition, adherence to industry standards including the most current ANSI / ASHRAE™ Standard, BACnet and LonMark to assure interoperability between all system components is required. For each LonWorks device that does not have LonMark certification, the device supplier must provide an XIF file and a resource file for the device. For each BACnet device, the device supplier must provide a PICS document showing the installed device's compliance level. Minimum compliance is Level 3; with the ability to support data read and write functionality. Physical connection of BACnet devices shall be Ethernet (BACnet Ethernet/IP,)

2.1.3 All components and controllers supplied under this Division shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass data shall not be acceptable.

2.1.4 The supplied system must incorporate the ability to access all data using standard Web browsers without requiring proprietary operator interface and configuration programs. An Open Database Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on a supplier-installed server for all database access. Systems requiring proprietary database and user interface programs shall not be acceptable.

2.1.5 A hierarchical topology is required to assure reasonable system response times and to manage the flow and sharing of data without unduly burdening the customer's internal Intranet network. Systems employing a "flat" single tiered architecture shall not be acceptable.

2.1.6 Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces.

2.1.7 All networking equipment required for the Building Automation System shall be provided by CCS unless otherwise noted in the design documents.

2.1.8 It is assumed that the BAS devices do not require Power over Ethernet (POE)

Part 3 Execution

3.1 General

3.1.1 The Building Automation System (BAS) shall be designed, installed, and commissioned in a turnkey fully implemented and operational manner. A BAS System Integrator (supplied by the General Contractor) shall provide an Interface Control Document for integration with CCS.

3.1.2 The BAS Integrator shall submit a network topology diagram that includes the following on all BACnet devices

a) TCP/IP Address

b) MAC Address

c) Device instance number

d) BACnet Port

e) Devices configured for BBMD

f) BACnet routers and subnets

3.1.3 The BAS Integrator shall submit a network topology diagram that includes the following on all LON devices

a) Neuron IDs

b) Routers

3.1.4 BAS Integrator shall use DHCP and DNS for IP communications.
No static IPs or "hardcoded" IP addresses will be accepted.

3.1.5 The BAS Integrator shall request from CCS all required primary port TCP/IP network configuration settings via standard RFI. The BAS Integrator shall not assign any of the following configuration settings without CCS approval.

1) Domain name

2) Host name

3) Station Name

3.1.6 CCS Network is a VLAN TCP/IP network.

3.1.7 The BAS Integrator shall identify the TCP/UDP ports used by the BAS protocols/ applications

3.2 Labour

3.2.1 The BAS Contractor shall provide only skilled, trained tradesmen experienced in the installation of a certified installation. Sub-contractors, if used, must be approved by the University before the commencement of the project.

3.3 Installation

3.3.1 Adequate space and provisions shall be left for removal of components and servicing of equipment, with minimum inconvenience to the operation of systems.

3.4 Quality Control

3.4.1 All CAT5E/CAT6/6A cabling links in the BAS installation shall be tested for the following, in accordance with the field test specifications defined in ANSI/TIA-568.2-D "Commercial Balanced Twisted-Pair Telecommunications Cabling and Components Standard".

3.4.2 All fiber optic cabling cabling links in the BAS installation shall be tested for the following, in accordance with the field test specifications defined in ANSI/TIA-568.0-D "Generic Telecommunications Cabling for Customer Premises"

3.5 Coordination

3.5.1 Work causing noise, dust and/or odour shall be performed during evenings and/or weekends to prevent disturbance to the operation of the University's or surrounding businesses. Work shall be performed at agreed times and in coordination with each party. All damages caused for work performed not in compliance with this item shall be the responsibility of the BAS Contractor.

3.5.2 BAS Contractor shall coordinate with Toronto Metropolitan University to ensure the protection of the active LAN Hardware from dust and debris.

3.6 Site Conditions

3.6.1 The BAS Contractor is responsible for maintaining a clean work environment and is responsible for the removal of all debris on a daily basis. Debris and removed materials shall be disposed of in conformance with all local by laws and regulations. Failing to comply and after reasonable time and written notice the General Contractor reserves the right to hire cleaners to complete the cleaning and back charge the BAS Contractor.

3.6.2 All materials and installation throughout the project will remain the responsibility of the BAS Contractor until final completion for the project is accepted by the University. Damages to any item installed shall be replaced or repaired by the BAS Contractor to provide a complete final installation at no additional cost to the University.

3.7 Safety

3.7.1 The BAS Contractor shall adhere to all safety laws, rules and regulations issued by the authorities having jurisdiction, General Contractor, Project Manager and the University.

3.7.2 At all times maintain clear fire exits, emergency routes and access to emergency equipment including fire hose cabinets, fire extinguishers and stand pipe connections.

3.7.3 Smoking and combustion of any materials is strictly prohibited on all sites.

3.7.4 Provide protection as required by the authorities having jurisdiction to all employees for work performed in typically inaccessible or concealed spaces.

3.8 Site Adjustments

3.8.1 Portions of the project may be at any time identified in writing to be "On Hold". Work in these areas shall not be started, continued or completed until further direction is received. No additional cost shall be accepted by the University for areas put on hold.

3.9 Substitutions

3.9.1 Substitution of any product shall be prior approved in writing by only TMU CCS.

3.9.2 The procedure for substitution approval will include the written submission by the BAS Contractor including the following:

.1 Original specified product

.2 Proposed product being substituted

.3 Reason for substitution

.4 Shop drawings indicating all technical specifications

.5 Financial advantage

.6 Schedule delivery date

.7 Written approval from certifying system manufacturer

3.9.3 Based on the review of the information requested above, the University reserves the right to reject any proposed substitution without delay or cost to the project or the University.

3.10 Material Handling

3.10.1 The BAS Contractor is responsible for the delivery of all materials to site and transportation to the work place in accordance with all safety regulations and procedures.

3.10.2 Make arrangements and schedule all hoisting with Building Management and the General Contractor.

3.10.3 Provide and be responsible for lockable storage for all tools and material required to complete the installation through the duration of the project. Once the project is complete remove all tools and excess materials within 2 business days.

3.10.4 The University and its representatives shall in no way be held liable for any missing material, equipment or tools required to complete the installation.

3.11 Cutting, Patching and Repairing

3.11.1 It is the responsibility of the BAS Contractor to perform all cutting, patching and repair related to the BAS work including any penetrations through walls or floors.

3.12 Firestopping

3.12.1 The BAS Contractor is required to properly fire-stop any penetrations through fire barriers utilized for the placement of BAS cabling. Provide fire resistant intumescent materials to restore fire ratings to wall, floor, or ceiling penetrations according to local, provincial and national codes.

3.12.2 Fire stop systems shall meet the requirements of ULC Standard CAN/ULC-S115.

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