Prepared by the Winnipeg Construction Association, and intended as a guideline to increase awareness of recommended industry practice

BEST PRACTICE: DESIGN OF NETWORKED EQUIPMENT IN BUILDING CONSTRUCTION

The purpose of this Best Practice document is to provide the construction industry (owners, architects, engineers, consultants, and contractors) guidance on the best way to integrate building management systems and related network equipment.

KEY ROLES/ DEFINITIONS IN THIS BEST PRACTICE DOCUMENT:

Network(ed) Equipment

- Active equipment including, but not limited to servers, switches, hubs, routers, bridges, access points.
- Devices and components from various manufactures to various control building management systems, such as security, audio, visual, lighting, etc.

Infrastructure

- Fiber or copper wiring for the backbone and the horizontal wiring.
- Connecting hardware including racks, patch panels, connectors, devices.
- Hard wired as well as wireless systems (Wi-Fi, Mesh, Bluetooth, RFID).

Master Integrator (MI)

- Functions as a subject matter expert/sub-consultant/designer for the IT architecture, bringing together a wide array of network equipment from various manufacturers to accomplish the goal of creating a unified, functioning system that meets the needs of the client.
- Dedicated to the operating technology (OT) system in the building on new construction or retrofits.
- Provides specific guidance in the following:
    - Understanding of network building blocks topologies, architectures, bandwidth, quality of service, security, remote management, and general networking standards to ensure the IT Infrastructure will support the network driven devices.
    - Operation of Sub-Systems (e.g. lighting, AV, security etc) to select systems to meet the building's performance and feature requirements.
    - Communication and network protocols specific to the systems being deployed in the building.
    - Integration of multiple subsystems, by providing a control layer or dashboard to manage and monitor multiple sub-systems.

- Current networking standards and network security to protect the networks, devices and data from unauthorized access or criminal use and the practice of ensuring confidentiality, integrity, and availability of information.

- Fluent in a variety of disciplines including:
  - Control systems
  - Electrical systems
  - Mechanical systems
  - Information Technology / Information Systems
  - Software applications and data management
  - Network/IT/Application Security
  - Visualization

If the MI participates in sales and represents a company that can design/supply/install, they must also separate themselves from their proprietary products to best serve the owner's needs.

WHY EARLY DESIGN OF NETWORK REQUIREMENTS IS NEEDED

The notion of best practices for smart building system integration and interoperability should be undertaken with the aim of providing an exceptional occupant experience, with innovative technology that is sustainable and intelligent while using minimal resources (energy).

Modern buildings utilize a variety of networked equipment to provide audio, visual, IT and control systems. These networks of highly specialized building systems including but not limited to lighting, HVAC, AV, Mechanical Control Systems, Security, Communications, and Control Layering. The successful integration of these networks requires early consideration in the design process for modern buildings or retrofits.

Incorporating the networked equipment requirements early in the design stage will provide many benefits to all participants in a project, especially the owner, designers, consultants, and contractors, such as:

1. Obtain a better understanding of the owner's full vision and desired performance.
2. Early interdisciplinary conversations to ensure either; all networked equipment requirements can be met with the other systems' design, are compatible with existing infrastructure, or there is sufficient building service capacity to support the new equipment being integrated.
3. Incorporate future expansion capability available at time of design.
4. Include required equipment in the early-stage cost-estimates to maintain a comprehensive budget.
5. Ensure the best possible outcome in concert with the owner, IT administrator, architect, consulting engineer(s) and general contractor to ensure desired functionality, maintenance, performance budget, construction efficiencies, project schedule, and ultimately construction costs are met.

BEST PRACTICE FOR THE DESIGN OF NETWORKED EQUIPMENT IN BUILDING CONSTRUCTION

The purpose of this table is to demonstrate the importance early engagement of a Master Integrator to bring a project together from start to finish. This applies to projects large and small. Like any other industry, it is more cost effective to assess client needs, conceptualize, consult, plan, design, integrate and implement a project through early engagement

rather than 're-doing' portions or adding scope late in a project due to poor planning.

The importance of early coordination between modern suppliers of advanced systems that interact with each other is paramount. For example, a control system will need to interact with a lighting system or possibly with an HVAC or an Audio Visual, system and so on. Some or all of these systems may exist on a shared network and be delivered by different suppliers. Gaps due to early sequential coordination will result in exponentially higher costs to correct (4-10x more) and quite possibly a result that does not meet the performance and feature desired by the owner.

Stage	Action	Benefit
Conceptual Design	Include budget for Master Integrator (MI) 's design service,	Engaging the MI for a fee and/or as part of any general accepted design development process will provide recommendations that are timely, un-biased and cost-efficient.
	Preliminary discussion on desired network equipment requirements.	Ensuring project program and client needs are highlighted. Ensuring functionality, divisional coordination and responsibilities are met.
Design	Meet with all stakeholders to discuss the objective of the building/space. Considerations include: 1. What level of integration is desired (e.g., mechanical systems, specialty systems, metering, lighting, load shedding, smoke control, shades, security, etc)? 2. Is there a desire to only monitor specific points versus control and monitor? 3. Is the owner happy with their existing building controls? 4. Is the owner looking for an open system? 5. Will maintenance and operations be contracted out or performed by internal staff?	Understanding the client's needs and/or project program will help establish a full 360-degree view of system complexities, available options, and their integrations. Helping to determine if: ▸ Open source (3rd Party) designed software systems are an option, compared to closed and/or proprietary systems and their limiting factors. ▸ The project site/location have high quality utility available. E.g., dirty power and low-grade internet infrastructure (coaxal, fiber or satellite). ▸ Options for local versus outsourced system and software maintenance. ▸ Review of contracts and service agreements after systems are commissioned. ▸ Ensure networked system delivers customer expectations and requirements.

Stage	Action	Benefit
	6. Is there an operation and maintenance budget?	
	Discuss new business models enabled by the Internet of Things (IoT) that may enhance the building control system objectives/benefits.	Leading edge. Future proofing
	Include early conversations with other sectors. For example: door hardware specialists, furniture suppliers, lighting suppliers, window covering suppliers, A/V suppliers, etc.	Understanding detailed needs early on will help prevent potentially complex fixes in the latter stages of construction.
	Develop network design including network equipment requirements, drawings, and specifications.	Ensure interoperability of the control system. Required for the installation of the network equipment and may include, but not be limited to block, riser and wiring diagrams, equipment rack elevations, etc.
Construction	Ensure cooperation between trades.	Although various Trade Definitions outline the supply, installation and commissioning of their products, there is no one entity usually specified who has the overall responsibility to integrate them into a single, working system. Components that can/should be integrated include: ▸ Doors (access hardware) ▸ Electrical (lighting, fire alarm, CCTV, A/V, security, card access, network hardware, voice/data, generators) ▸ Mechanical (equipment/temperature controls, sprinkler)

Stage	Action	Benefit
		▸ Elevators ▸ Blinds and Window Coverings ▸ Furniture ▸ Glass/Window Assemblies
	Develop As Built Drawings.	Required for the maintenance of the network equipment and should include, but not be limited to block, riser and wiring diagrams, equipment rack elevations, etc.
	Meet with in-house IT department and facility managers/maintenance to discuss system deployment, training on system integration and documentation and cybersecurity.	Ensure programs in place for scheduling and outsourcing if needed.
Maintenance	Budgets established.	On-going system integration support.