Infrastructure Challenges and Solutions for IoT and Intelligent Building Integration

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Yesterday ...
History Repeats Itself... Yesterday...

Pre-standards & Proprietary Systems

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Today... Integrated Cabling
Fiber and copper for integrated applications
Tomorrow ... Segmented networks?
Additional applications. Same infrastructure?
Agenda

IoT and Intelligent Buildings...

- Trends & Challenges
- Design Considerations
- Standards Update
- Solutions in Practice: Case Study

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What is IoT?

The Internet of Things is a network of uniquely identifiable endpoints (or “things”) that contain embedded technology to sense, collect, communicate and, exchange data locally or with external environments, without human interaction, affecting our daily life.
Evolution of Communication through IoT

Human to Human

Device to Human

Human to Device

Device to Device

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What is an Intelligent Building?

An Intelligent Building is a building that integrates technology and process to create a facility that is safer, more comfortable and productive for its occupants, and more operationally efficient for its owners.

Source: Intelligent Buildings Institute
Applications in Building Networks

- Wireless Access Point
- Data Outlets
- IP Phones
- Security Cameras
- Occupancy Sensors
- Sound Masking
- Intelligent LED Lighting
- Access Control
- Climate Sensors
- Climate Sensors

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Connected World Trends

Building Networks
- Intelligent Buildings
- Data & Power Convergence
- Building Wireless

Data Centers
- Cloud vs. Building Enterprise
- Micro Data Centers
- Control/DCIM

Fog Computing and IoT Gateways
Infrastructure Challenges

Building Networks
- IoT and PoE
- Trade Convergence
- Increased Mobility Demands

Data Centers
- Increased Density Demands
- Availability, Latency, and Bandwidth
- Power from Data Centers
- Security and IAM

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Infrastructure to support the evolution to IoT

CONVERGENCE OF
POWER, LIGHT AND DATA
OVER THE SAME INFRASTRUCTURE

PoE

IoT ENABLEMENT INFRASTRUCTURE

IoT DEVICES

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Network Architecture Selection

Centralized

Hybrid

Decentralized
Centralized Approach

TRANSFERRING INFORMATION TO THE DATA CENTER

IoT DEVICES

STORAGE, ANALYZING, AND AUCTIONING

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Hybrid Solution

- PoE Lighting
- PoE Light Switch
- CCTV Camera
- Network Jacks
- Wireless Access Points
- Twisted Pair
- AC Power

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PoE Design Considerations

IoT Application
- Power/Data Requirement
- Distance
- Centralized/Decentralized Deployment

Structured Cabling
- Cable Type
- Connectivity
- Performance
- Heat Dissipation
- Voltage Drop

Physical Infrastructure
- Security
- Network Protection
- Zone Cabling Distribution
- Power and Cooling

COST

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Power-over-Ethernet Standards

IP Phones 802.11n Wireless IP Camera

UP TO 15.4 WATTS STANDARD: IEEE 802.3af, TYPE 1 (2002), 2-PAIR POE
Power-over-Ethernet Standards

UP TO 15.4 WATTS  STANDARD: IEEE 802.3af, TYPE 1 (2002), 2-PAIR POE

UP TO 30 WATTS  STANDARD: IEEE 802.3at TYPE 2 (2009), 2-PAIR POE+

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Power-over-Ethernet Proposed Standards
New Applications Are Using IP Protocols and PoE

Thin Clients  Laptop PC  Point of Sale  Outdoor PTE Camera  Nurse Call

UP TO 60 WATTS
STANDARD: CISCO PROPRIETARY (2011), 4-PAIR UPOE;
PROPOSED IEEE 802.3at TYPE 3 (2016-2017), 4-PAIR POE
Power-over-Ethernet Proposed Standards
New Applications Are Using IP Protocols and PoE

- Thin Clients
- Laptop PC
- Point of Sale
- Outdoor PTE Camera
- Nurse Call

**UP TO 60 WATTS**
STANDARD: CISCO PROPRIETARY (2011), 4-PAIR UPOE;
PROPOSED IEEE 802.3bt TYPE 3 (2016-2017), 4-PAIR POE

- Flat Panel TV
- Desktop PC
- Digital Signage/Kiosk
- High Power Wireless

**UP TO 90 WATTS**
STANDARD: POWER OVER HDBASE-T (2011), 4-PAIR POH;
PROPOSED IEEE 802.3bt TYPE 4 (2016-2017), 4-PAIR POE

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Power and Data Requirements by Application

- High Data
  - Low Power
    - Category 6
    - Category 6a
- Low Data
  - Low Power
    - Category 5e
- High Data
  - High Power
    - Category 6a
- Low Data
  - High Power
    - Category 5e
    - Category 6
References for Supporting Power over Twisted Pair

NEC 2017 Handbook
- Cable Ratings and Markings for Safety
- Ampacity Table for Bundles

TIA TSB-184
- Copper Cable Installation Requirements for PoE
- Bundle Size & Max. Temperature rise (+15°C)
- De-rating of cable

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Additional Infrastructure Planning Challenges

- System design/integration: application specific vs. structured cabling
- Pathways
- Telecom rooms: size & layout
- Outlets: facilities connections vs. telecom outlets ("user" administered)
New Standards Addressing Infrastructure Challenges

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TIA-862-B Structured Cabling for Intelligent Building Infrastructure – System Layout
TIA-862-B Structured Cabling for Intelligent Building Infrastructure - Device termination

Max 90 M (295 ft)

Balanced twisted pair cable

Zone Cabling

HCP

Equipment outlet

Coverage area

Equipment cord

Device termination

Distributor A

Max 90 M (295 ft)

Balanced twisted pair cable

Distributor A

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BICSI (Draft) 033

Purpose:
Best practices for integrating diverse applications on the ICT network

Publication Target Date: 2017
Applications & Main Chapters

• Communications Infrastructure (Topology, Cabling, Pathways)
• Design Considerations (Power, Data, Zone Cabling)
• Building Monitoring Systems (BAS, Utility)
• Unique Building Systems (Lighting, Digital Signage, Vertical Transportation, Sound Systems, ESS)
• System/Network Integration
Planning Telecom Rooms

- Allow for additional systems and cabling
- Segmenting systems from core network
- Allow for future racks and systems

Source: BICSI-004 Healthcare Standard
Device Terminations (BICSI 005 & 033)
Unique coverage areas – application dependent

Source: BICSI 005 ESS and Draft 033
Key Elements in Planning the Infrastructure

Performance  Time  Space  Experience  Sustainability

CONNECTED INFRASTRUCTURE

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Key Questions for ICT Infrastructure Planning

- What applications will be going on the core network (Ethernet/IP-based) and what applications will be on separate networks?
- How many will utilize PoE and how much wattage will be required?
- Will the network and applications utilize a centralized or decentralized topology – or a hybrid?
- Where are the devices located (distance & location)?
The Sinclair Hotel Fort Worth
A Marriott Autograph Collection Hotel
Case Study

Farukh Aslam
CEO, Sinclair Holdings LLC
Developer/Owner/Operator

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Driving Factors

• Technology drives Customer Satisfaction and Repeat Business
  – HSIA, Room Automation, Scene Control

• Low Voltage Lowers Construction Costs
  – Faster Installation

• IP Enables Systems Integration and Better Management
  – More Energy Efficient
  – Granular Energy Measurement Tools

• Future Proof the Building
  – Long Term Owner/Operator
Approach to Technical Disruption: Crawl, Walk, Run

Crawl Phase:
Office Small POC
- Simple Network
- Touch/Feel Products
- Evaluate Network Power and Control
- Define Quick Installation needs
  - Quick Connect Plugs and Cabling
- Define/Refine Lighting Products
Approach to Technical Disruption: Crawl, Walk, Run

Walk Phase:

Sanger Office Building Deployment (Adjacent to future Sinclair Hotel)

- Phase 1: Deploy Floors 5-7
- Phase 2: Deploy Ground Level Retail Space
Approach to Technical Disruption: Crawl, Walk, Run

Run Phase:
Sinclair Hotel

- In Room Digital Ceiling:
  - Lighting
  - Automated Window Blinds
  - Automated Curtain Motors
- Hallway Lighting
- Exterior RGB Accents
The Digital Building Infrastructure

Centralized Approach: Office Bldg.

- Terra Bridge Project Management & Installation
- IDF: Cisco 3850 Network Switches
- Estelles T-Bar Lights
- Lighting VLAN
- NuLEDs LED Controls & Software

Decentralized Approach: Hotel

- Terra Bridge Project Management & Installation
- IDF: Cisco 2960 Aggregation Switch
- In Each Guest Room:
  - Cisco Digital Building Ceiling Switch
  - Estelles Light Fixtures
  - NuLEDs LED Controls & Software
  - And/or Somfy Motors

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Summary

- Technical Innovation Lowers Cost Structure (CapEx/OpEx)
- Better Experiences lead to higher Occupancy and Customer Satisfaction
- Low Voltage/PoE is Future Proof Building Infrastructure
Thank you.

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