

Designing, Cabling and Documenting the Integrated Intelligent Building (IIB)

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WSP | Parsons Brinckerhoff



2017
**BICSI CANADIAN
CONFERENCE & EXHIBITION**
MAY 8-11 • VANCOUVER, BRITISH COLUMBIA, CANADA



An aerial, top-down view of a complex, multi-level building structure under construction. The structure is composed of numerous rectangular concrete slabs and beams, creating a dense, interconnected network. Several thick, curved beams in vibrant colors (orange, blue, and green) are prominent, curving across the structure. Small human figures are scattered throughout the various levels, providing a sense of scale to the massive construction. The overall scene is one of intricate architectural complexity and active construction.

Agenda and Learning Objectives

1. Why build an IIB?

2. What is an IIB?

3. IIB Design Process and Tools

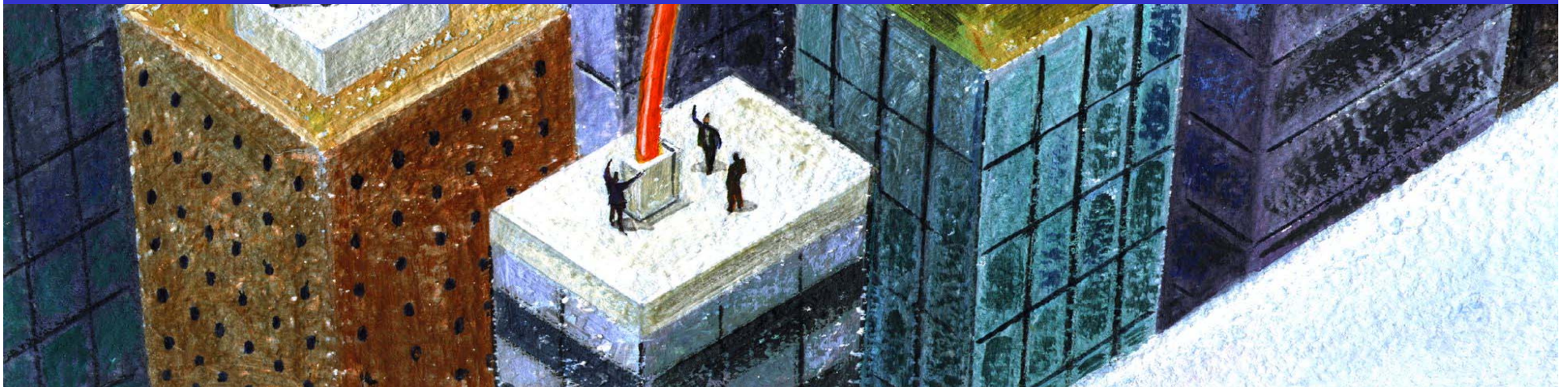
4. Cabling the IIB

5. Documenting IIB Design



Managing Expectations

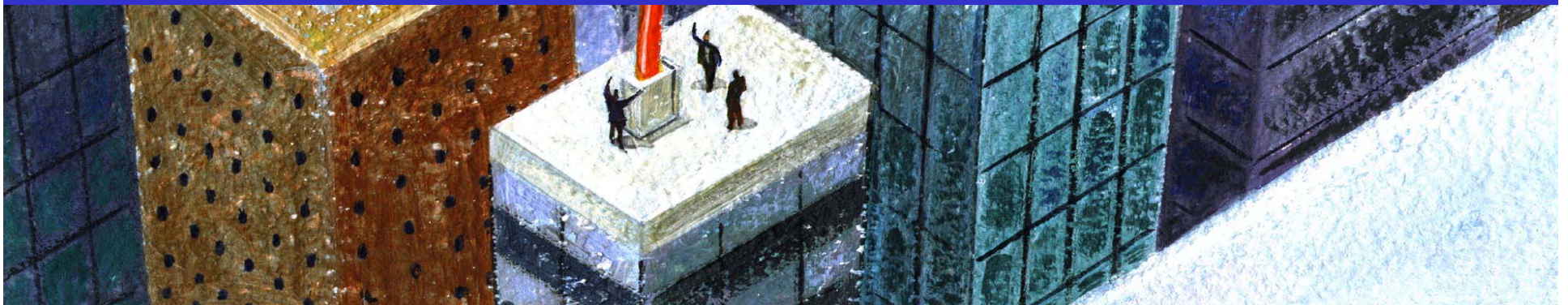
**This will be a 40,000 foot
overview of a complex topic.**





Some Questions

**Is this topic of interest to you?
What type of projects are you doing?
Do you design? Install?
What do you design?**





Part One

1. Why build an IIB?

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Before we begin, let's take a step back in time to review a little history.

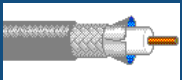


"What's that writin' mean, NI-KE?"

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1984 “smart” building “future-proof” cabling:

- Type 9880 coaxial cable for Ethernet backbone
- Type 9907 coaxial cable for Ethernet to the Desktop
- Type 9296 coaxial cable for IBM dumb terminals



- Dual type 9555 coaxial cable for Wang word processor



- 4, 65, 12, 25-pair telephone cable



- IBM Type-1 Token Ring shielded, twisted-pair cable



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By 1989
Unshielded
Twisted-
Pair (UTP)
cable did it
all.



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And now, Back to the Future



"I've gotta check this out, Doc!"

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What have we learned from the past?

We can't create a future-proof design, but we can design for the *strategic accommodation of change*.

That is, creating a design that will allow the building and its infrastructure be economically modified over time. *This concept is often in conflict with project and construction budgets based on today's needs.*

Sometimes the best investment is empty conduit.

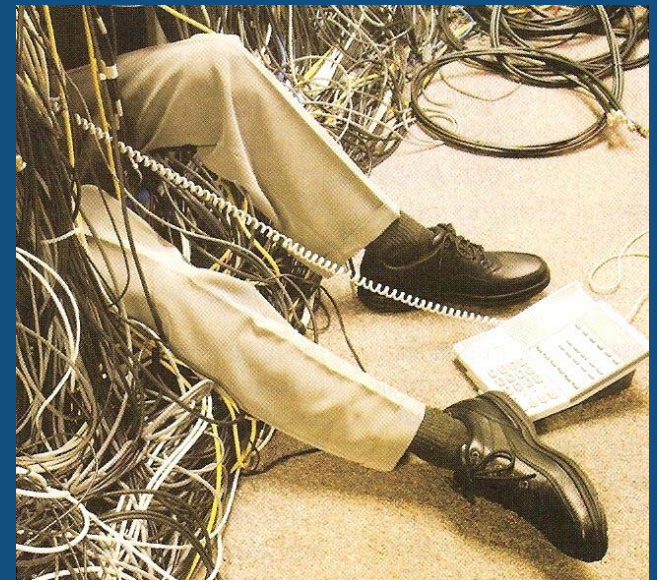
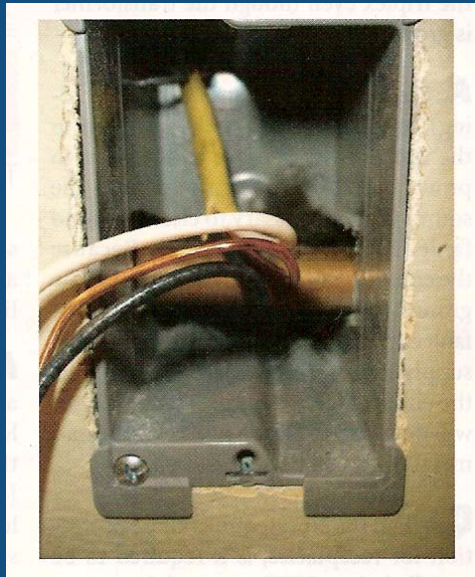
The image depicts a complex, multi-level architectural structure, possibly a futuristic city or a large-scale construction project. The structure is composed of numerous white, rectangular platforms and beams, arranged in a grid-like pattern. The beams are colored in vibrant blue and orange, creating a striking contrast against the white surfaces. Small human figures are scattered throughout the structure, providing a sense of scale and activity. The overall scene is illuminated by bright, natural light, highlighting the intricate details of the architecture.

Part One

2. What is an IIB?

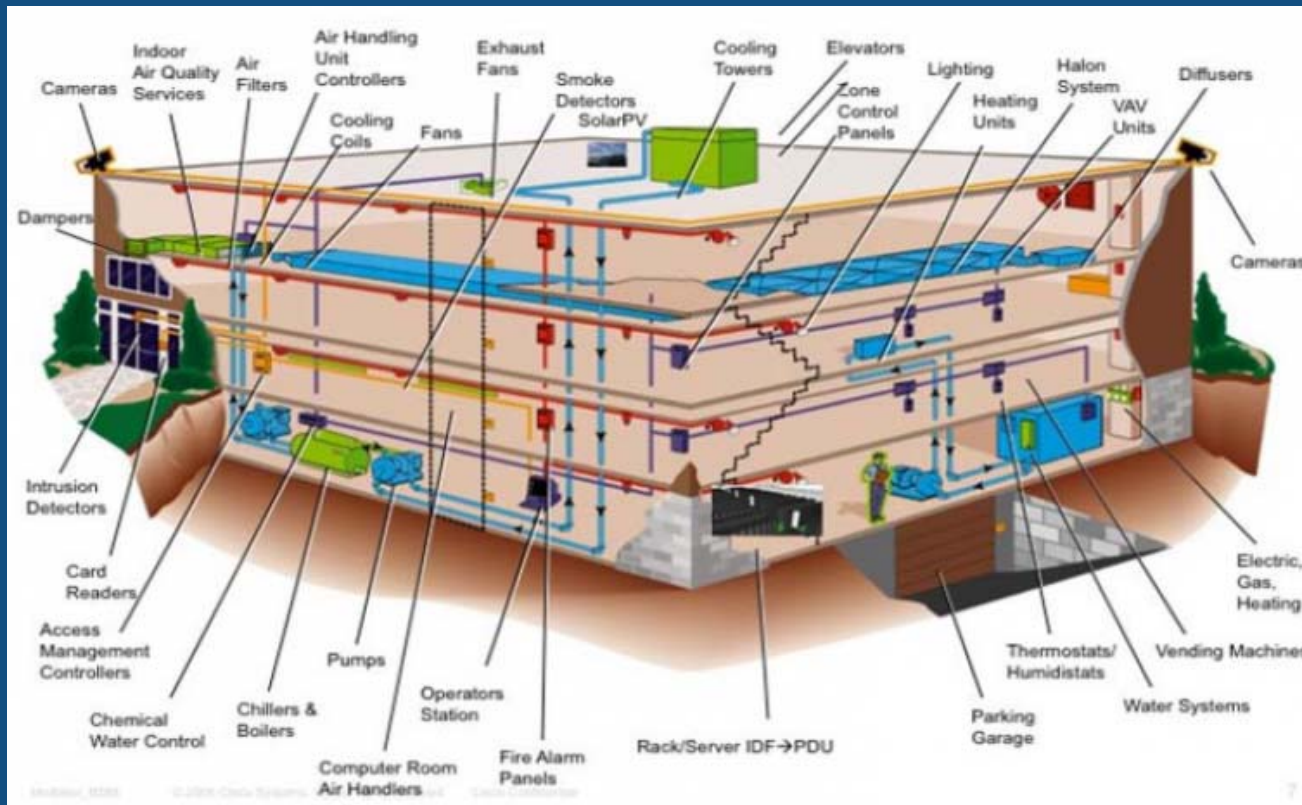
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What is an IIB?
or
What problems does an IIB solve?



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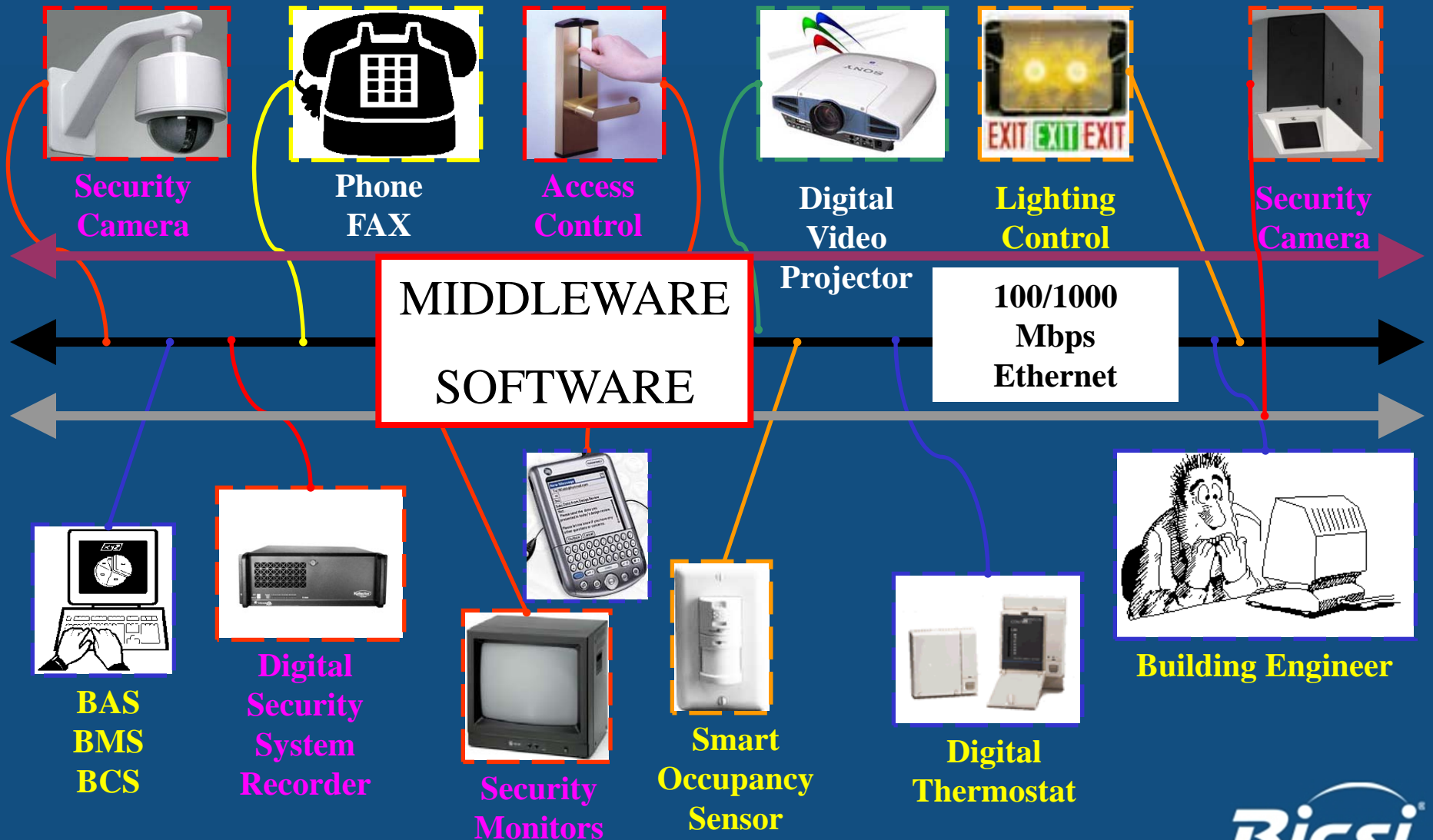
Today, almost all buildings are “smart”.



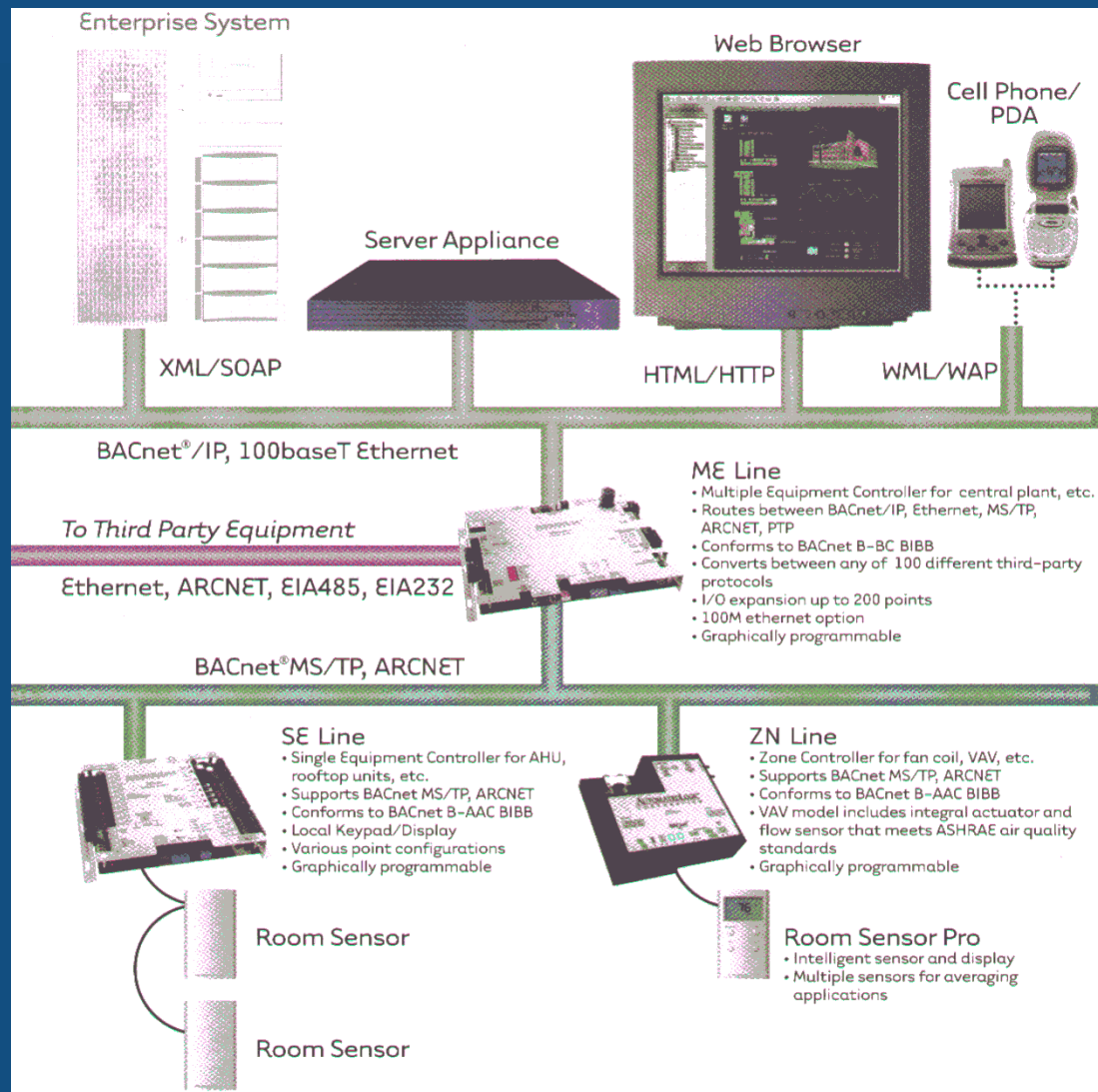
What makes them intelligent?



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Self-Powered Sensors Communicate Building Defects



Monday, 23 March 2015

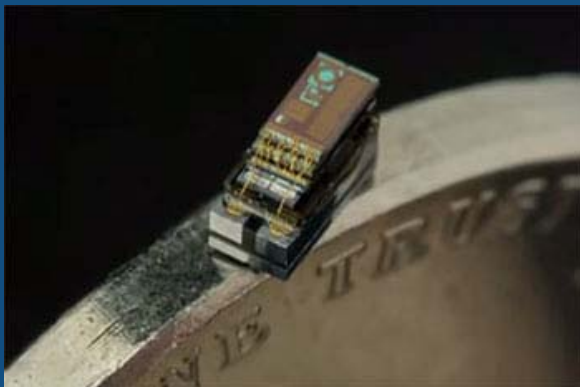
Michigan State University researchers have developed a technology that allows sensing, communication, and diagnostic computing — all within the building material of a structure.

Using energy harvested from the structure itself, the "substrate computing" system features sensors that continuously monitor and report on the building's integrity.

"Adoption of such monitoring has previously been limited because of the frequency of battery replacement for battery-powered sensors," said Subir Biswas, professor of electrical and computer engineering, "as well as the need for a separate communication subsystem usually involving radio frequency sensor networks."

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- Is this the future of an IIB?
- Every light bulb, light switch, power outlet, VAV box, valve, lockset, and thermostat connected to the a network?
- IPv6 offers 2^{128} or 3.4×10^{38} IP addresses
340,282,366,920,938,463,463,374,607,431,768,211,456



World's tiniest computer:
Michigan Micro Mote (M³)

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That's Equal To

- 40,000 IP addresses for every atom on the surface of the surface of the earth
- 655,570,793,348,866,943,898,599 IP addresses for every square meter on the surface of the earth



Part Two

3. IIB Design Process and Tools

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Designing the IIB

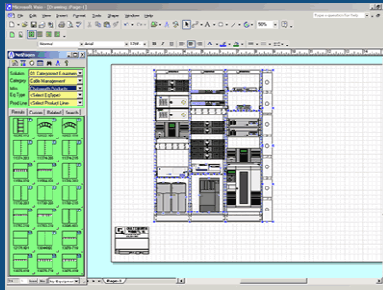


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The Evolution of Design Tools

Specialty Design Tools



2D/3D CAD

2D Manual Drafting



Building Information Model

4D/5D Modeling



BIM Revit Resources

Bradley's data-rich Revit family components meet or exceed Autodesk's standards for visual content (coarse, medium and fine views) and parametric metadata. When applicable, files contain LEED credit information, shared parameters, materials and finish MasterFormat titles and numbers, ADA compliance, and more. All in a single ZIP file along with related .txt files and/or README file.

Visit our new Blog at bradleybim.com to get even more up-to-date BIM initiative! Follow our Blog to receive update emails, join Revit with other users, and much more!

Autodesk Revit software is required to view files. For optimum performance you have the latest update for your release.

AV-Series Aerovate Lavatory Systems	Emergency Fixtures	Express Lavatory Systems
Faucets	Frequency Lavatory Systems	OmniDecks
Lenox Lockers	Mills Partitions	Multi-Point Lavatories
Patient Care Products	SafeCare Literature Resistant	Security Fixtures

3-Part Specs & Tech Data Sheets

BRADLEY BIM INFO

- > List of Updates
- > Bradley Material Catalogs
- > Bradley BIM Blog!
- > Sign up for the Quarterly BIKI Newsletter

Let us know how these files perform, or to request something you don't see

GENERAL BIM INFO

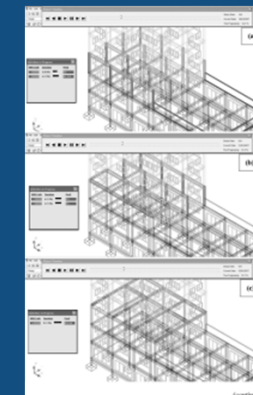
- > BIM for Government Projects

REVIT FAMILIES BY DIVISION:

- > Division 10
- > Division 22

PRODUCT INFO

- > Request Product Literature
- > Technical Data Listing
- > 3 Part Specifications

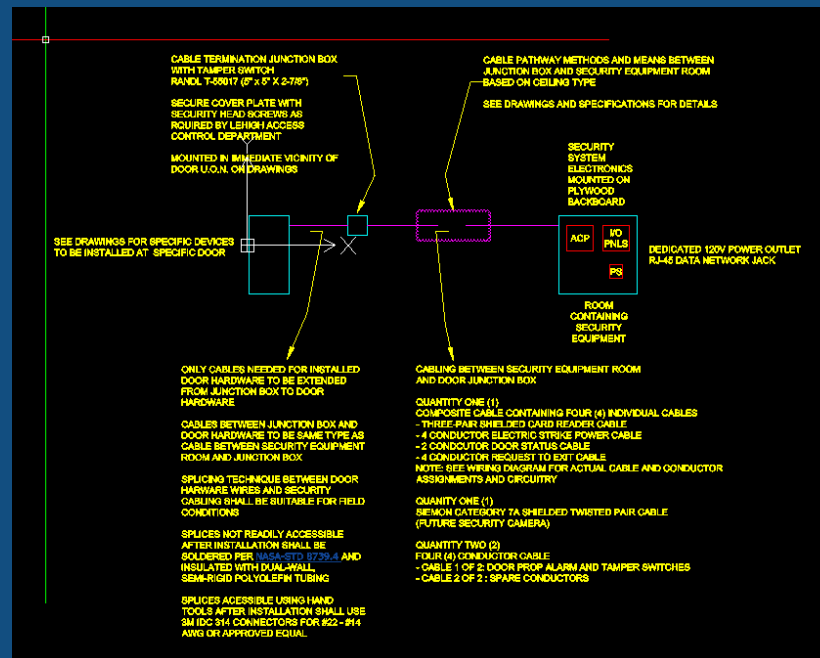


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Bonus Slide

Free full-function equivalent of AutoCAD
For Windows, Mac and Linux

www.3ds.com/products-services/draftsight/overview/



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The Building Information Model

3D Design

- Architect designs central model
- Design team members copy model
 - Structural, electrical, plumbing ...
- What to model? (e.g., conduits > 2")
 - Level of object detail
- Models updated and synchronized
- Collisions detected
- Subs prefabricate assemblies

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Bonus Slide

How to get a free Revit viewer

1. Download 30 day trial version of Revit
2. After 30 days, Revit will stop working
3. Revit viewer will continue to work

<http://www.smarterarchitect.com/revit-viewer/>



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The Building Information Model

BIM Design and Database

- Family of objects
 - Walls, piping, equipment
 - Levels of detail
 - Standardization of field names
 - Format of data

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The Building Information Model

LEVEL of DEVELOPMENT

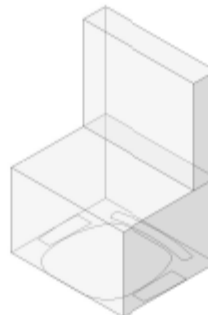
LOD 100

LOD 200

LOD 300

LOD 400

LOD 500



Concept (Presentation)

Design Development

Documentation

Construction

Facilities Management

DESCRIPTION:
Office Chair
Arms, Wheels
WIDTH:

DEPTH:

HEIGHT:

MANUFACTURER:
Herman Miller, Inc.
MODEL:
Mirra
LOD:
100

DESCRIPTION:
Office Chair
Arms, Wheels
WIDTH:
700
DEPTH:
450
HEIGHT:
1100
MANUFACTURER:
Herman Miller, Inc.
MODEL:
Mirra
LOD:
200

DESCRIPTION:
Office Chair
Arms, Wheels
WIDTH:
700
DEPTH:
450
HEIGHT:
1100
MANUFACTURER:
Herman Miller, Inc.
MODEL:
Mirra
LOD:
300

DESCRIPTION:
Office Chair
Arms, Wheels
WIDTH:
685
DEPTH:
430
HEIGHT:
1085
MANUFACTURER:
Herman Miller, Inc
MODEL:
Mirra
LOD:
400

DESCRIPTION:
Office Chair
Arms, Wheels
WIDTH:
685
DEPTH:
430
HEIGHT:
1085
MANUFACTURER:
Herman Miller, Inc
MODEL:
Mirra
PURCHASE DATE:
01/02/2013

(Only data in red is useable)

practicalBIM.net © 2013

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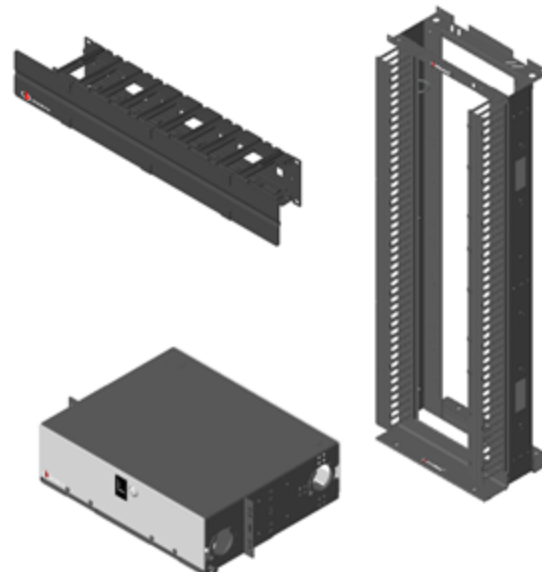
The Building Information Model

BIM (Building Information Modeling) Download Center for Network Infrastructure Hardware Models

Network Racks, Cabinets, Enclosures, Patch Panels and more in Revit, DWF, AutoCAD 3-D and ACIS 3-D formats

Building Information Modeling (BIM) uses multi-dimensional, spatial models that incorporate detailed product information for the building components. BIM offers many benefits such as improved integration of the design process and identification and avoidance of potential spatial interferences.

To support our partners using BIM initiatives, Siemon provides a growing library BIM models of our network racks, cabinets, cable management and other network infrastructure products. These models are provided in multiple formats (Revit, DWF, AutoCAD 3-D, ACIS 3-D) for optimal compatibility with today's leading BIM software programs including Autodesk® Revit® and Bentley® MicroStation.





Part Three



4. Cabling the IIB



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A high-performance copper, fiber optic and wireless communications network is considered the enabling technology for an Integrated Intelligent Building

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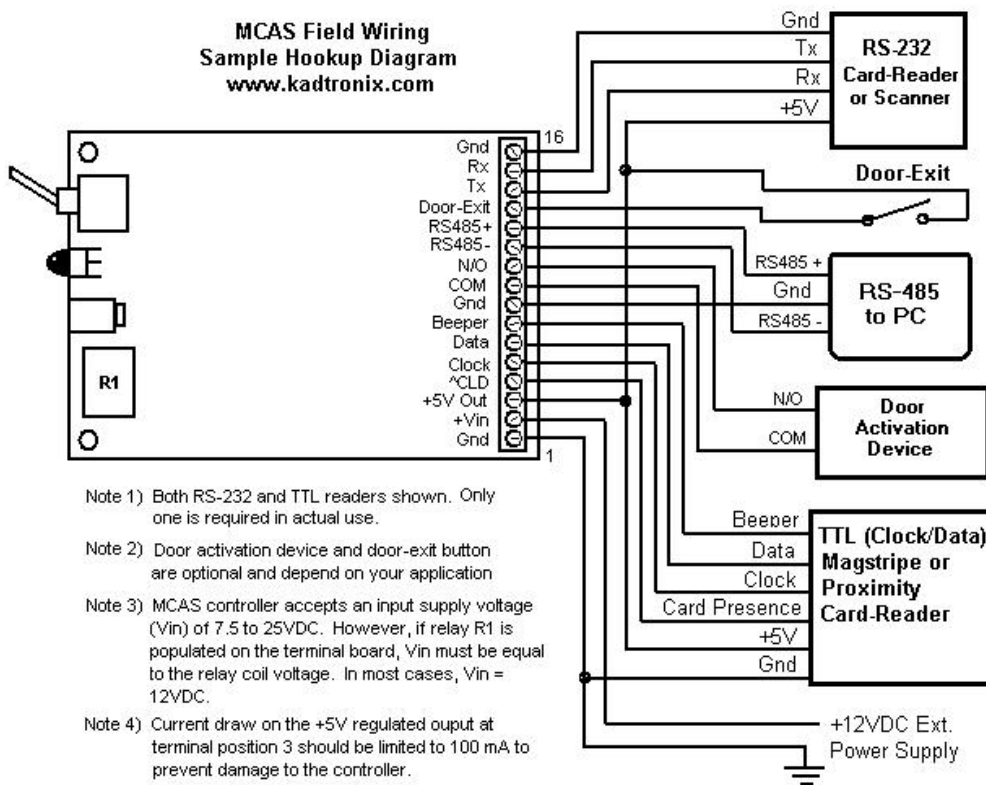
One cable system capable of supporting:

- Legacy Voice, Video, Data
- BACnet, LonWorks, ARCnet, PROFINET
- MODBUS
- Ethernet IEEE 802.3
- Digital serial data transmission
 - (RS 232, 422, 423, 485)
- Analog data transmission
 - 0-20 and 4-20 milliamp process control
 - 0-10 volt process control

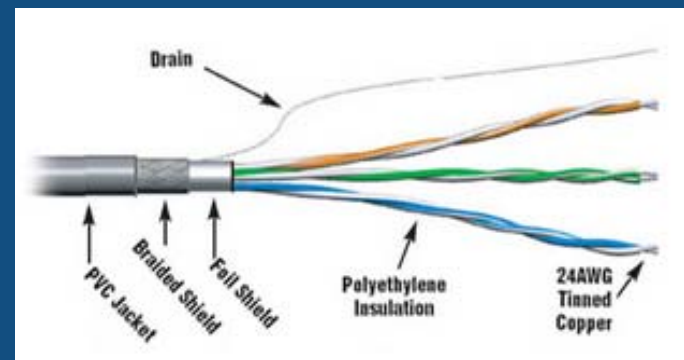


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MCAS Field Wiring
Sample Hookup Diagram
www.kadtronix.com



- Note 1) Both RS-232 and TTL readers shown. Only one is required in actual use.
- Note 2) Door activation device and door-exit button are optional and depend on your application
- Note 3) MCAS controller accepts an input supply voltage (Vin) of 7.5 to 25VDC. However, if relay R1 is populated on the terminal board, Vin must be equal to the relay coil voltage. In most cases, Vin = 12VDC.
- Note 4) Current draw on the +5V regulated output at terminal position 3 should be limited to 100 mA to prevent damage to the controller.



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Industrial (aka hardened) Ethernet switches are designed to operate over an extended temperature in unconditioned environments (e.g., -40°C to -75°C) without cooling fans



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How will this effect me?

New equipment, new terminology

New cable types

New methods and means, new
temperature extremes

Multiple stakeholder coordination

More documentation



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Intelligent Building Cabling Standard

- ANSI/TIA Standard 862-A

*Building Automation Systems Cabling
Standard for Commercial Buildings*

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ANSI/TIA Standard 862-B is still in committee

- Technical issues to be resolved
- Nomenclature changes

Proposed name change from

“Building Automation Systems Cabling Standard for Commercial Buildings”

To

“Intelligent Building Systems Cabling Standard”

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Pros and Cons of integrated cabling:

Pros: Vendor, application and protocol independent; avoids redundant design efforts; decreases construction costs (13% to 30% most frequently quoted numbers for BAS, BCS, BMS cabling); reduces life-cycle operational costs; and creates optimal ratio of active-to-spare cables.

Cons: Requires more coordination, knowledge of multiple systems and willingness of vendors to support cable plant.

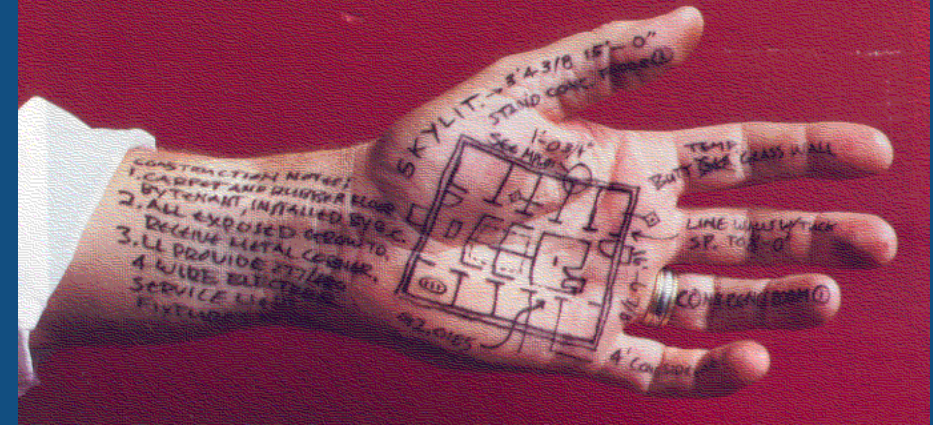
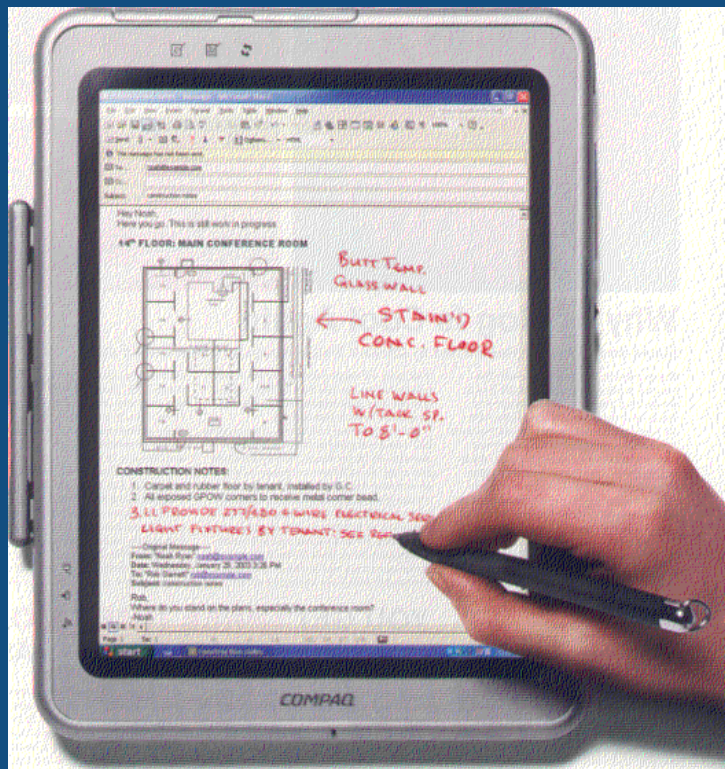


Part Four

5. Documenting IIB Design

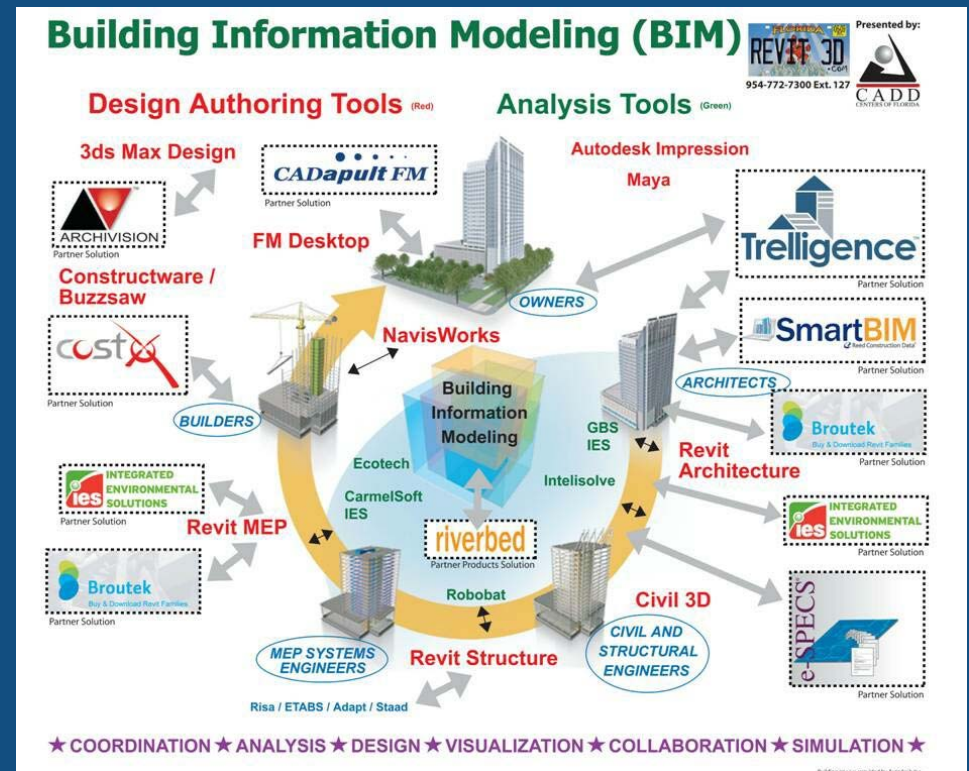
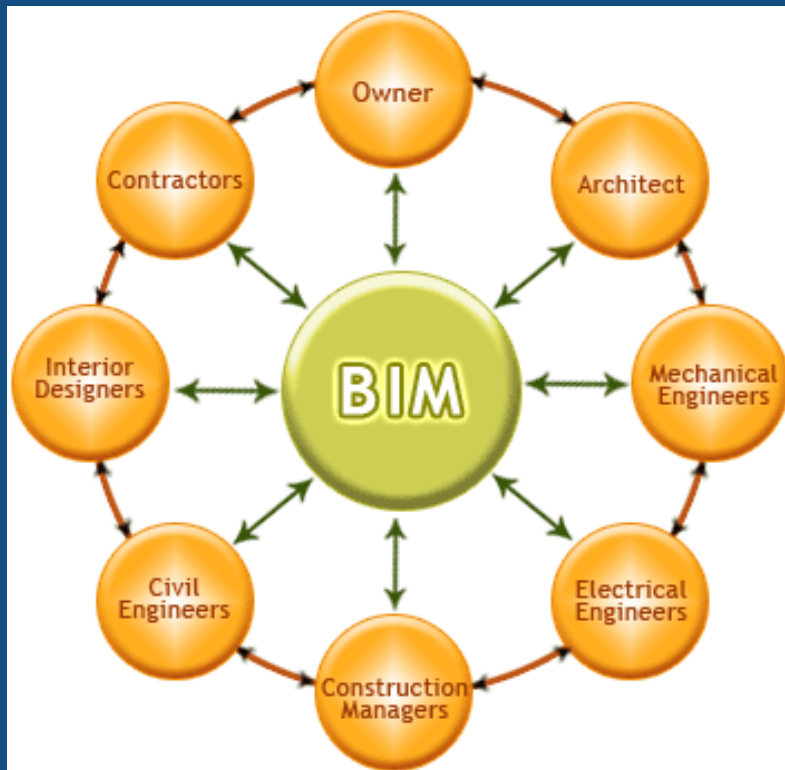
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How do we document an IIB?



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The Design Database

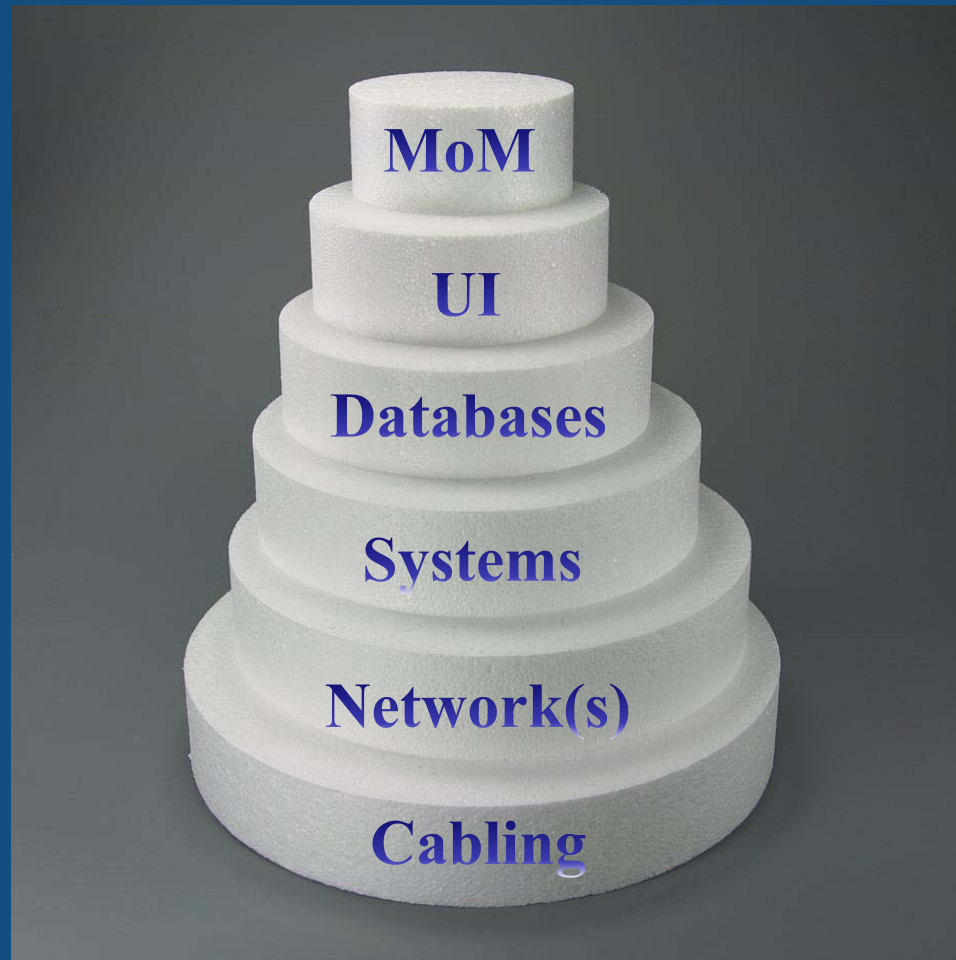


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IIB Layer Model

**MoM:
Manager
of
Managers**

**UI:
User
Interface**



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Data Exchange

Spreadsheet

Database

Comma Separated File

AutoCAD block attributes

BIM file (shared data)

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BIM: How Will As-Builts Be Delivered?

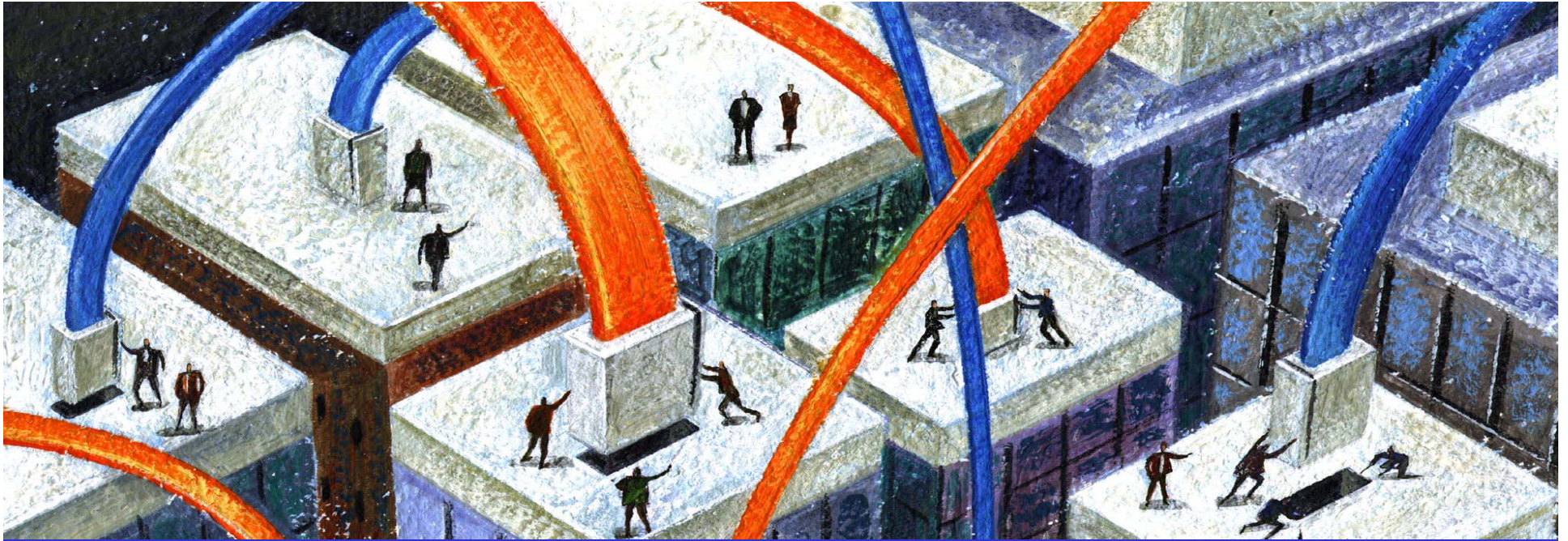
Who delivers the BIM model?

Architect?

Each trade?

Who is responsible for the accuracy?

Does it need to interface to a facilities or property management system?



Emerging Technologies



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**High-density
Wireless Access Point
16 radios each with its
own antenna
1,000 users
1 GB Ethernet**

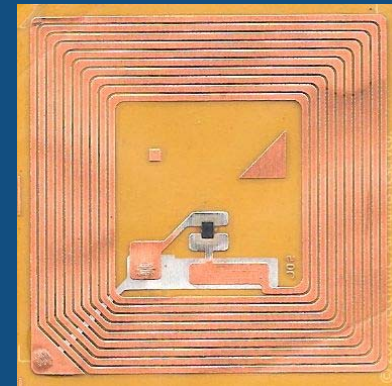


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900 MHz Wireless Modem



RFID Tags



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Powering the IIB - No Batteries Required

VIBRATIONAL PARASITES

The typical building never stops shaking. Air conditioners, heaters and even computer fans vibrate the walls, floors and ceilings. University of California, Berkeley, researchers are working on tiny wireless devices that scavenge this continual buzz as a source of power. The devices attach to surfaces throughout a building to monitor conditions such as airflow and temperature, and contain transceivers that send data to a central computer that can adjust the climate.

Better than batteries because it doesn't run down, and more practical than wall wiring, the device's power scavenger uses a piezoelectric material and a weight attached to a springy cantilever (*photo*) to convert mechanical pressure into electricity. Berkeley mechanical engineering graduate student Shad Roundy has built quarter-sized scavengers that generate 70 to 80 microwatts—enough to run a sensor and transceiver—and aims to demonstrate more-powerful devices by year-end.

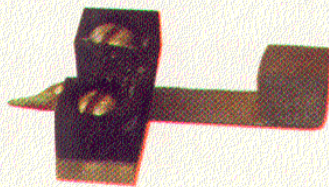


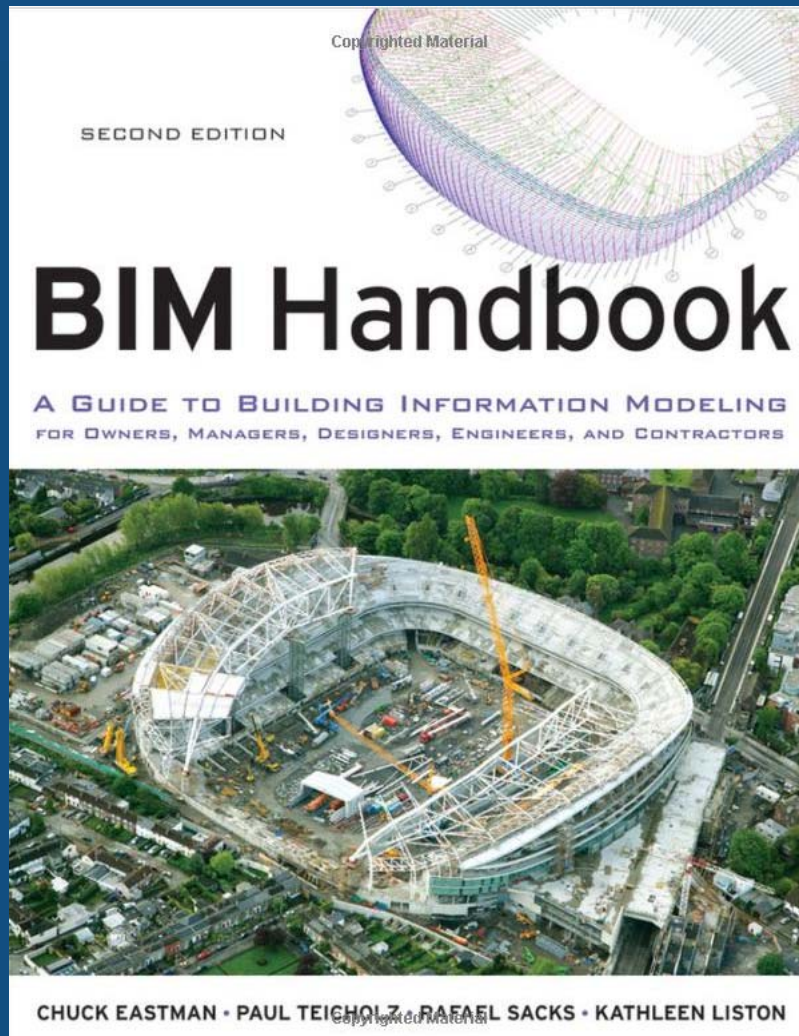
Fig. 3. The LTC3588-1 employs a high-efficiency buck converter to harvest ambient vibrational energy via piezoelectric transducers, and then convert it to a well-regulated output for use by other components.



To Learn More



The Integrated Intelligent Building



Hardcover: 648 pages

Publisher: Wiley; 2 edition (April 19, 2011)

Language: English

ISBN-10: 0470541377

ISBN-13: 978-0470541371

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Audiovisual Control and Signal Processing Equipment Manufacturers

AMX

www.amx.com

Crestron

www.crestron.com

Extron

www.extron.com

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Related Publications

Building Design + Construction Magazine

www.bdcnetwork.com

Engineered Systems

www.esmagazine.com

American School & University

www.asumag.com www.schooldesign.com

Healthcare Management Technology

www.healthmgttech.com

Medical Construction & Design

www.mcdmag.com

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Related Publications

Security Magazine

www.securitymagazine.com

Security Sales & Integration

www.securitysales.com

Mission Critical Data Center and Emergency Backup Solutions

www.missioncriticalmagazine.com

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Related Publications

Digital Signage

www.avnetwork.com

Commercial Integrator

www.commercialintegrator.com

Sound & Video Contractor

www.svconline.com

AV Technology

www.avnetwork.com

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Organizations

Council on Tall Buildings and Urban Habitat

www.ctbuh.org/

The Whole Building Design Guide

www.wbdg.org/

Sustainable Buildings Industry Council

www.sbicouncil.org/

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Organizations

Continental Automated Building Association (CABA)

www.caba.org

Smart Buildings Institute

www.smartbuildingsinstitute.org

Automated Buildings On-Line Magazine

www.automatedbuildings.com/

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Questions?

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Vanderweil Engineers
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