BACnet® Best Practices:

Realizing The Benefits of Interoperability

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Presented By
David Fisher
PolarSoft® Inc.

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Moderator Edward Sullivan is editor of Building Operating Management magazine. He has more than 15 years of experience covering facility issues.

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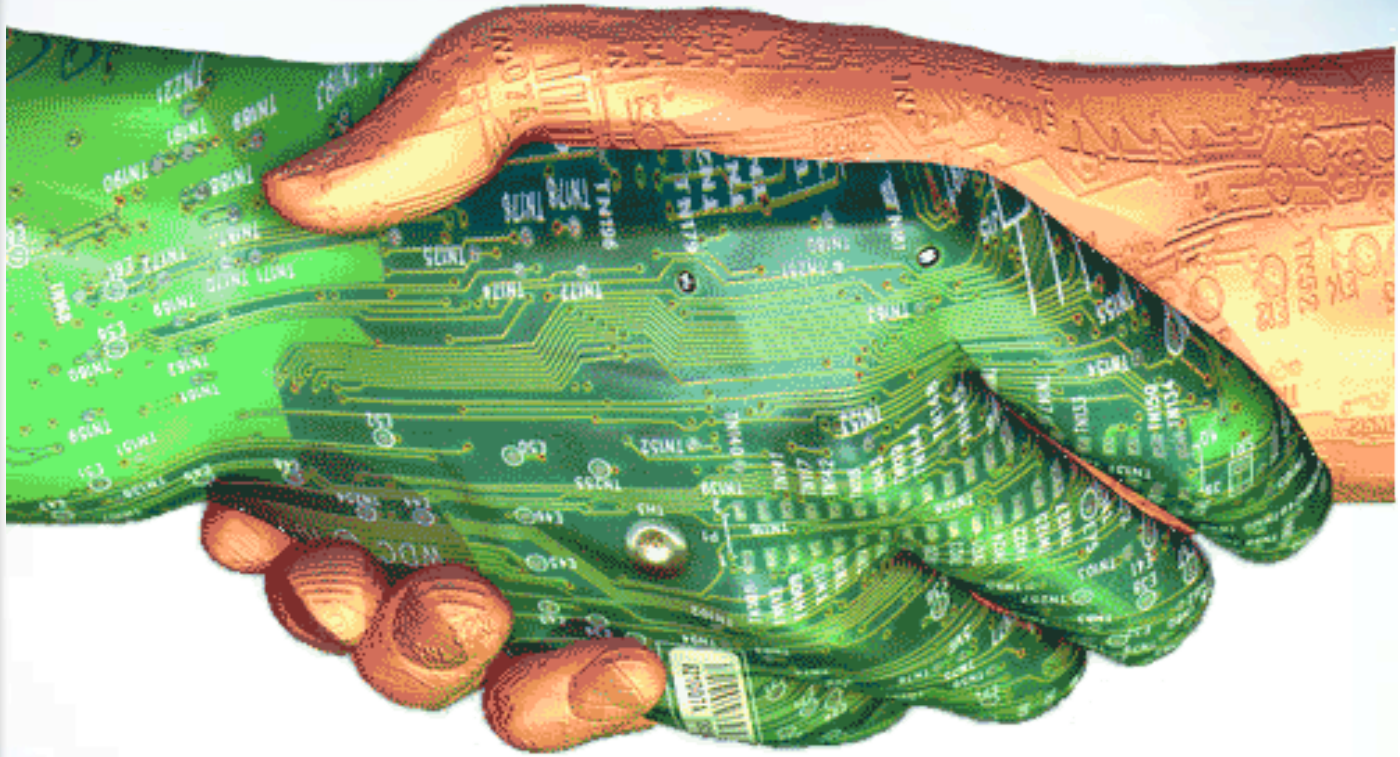
Interoperability –
What is it and What isn't it?
Focus on ASHRAE
BACnet Standard Protocol



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Today's Presentation is by

David Fisher

of PolarSoft® Inc.

David Fisher attended Carnegie-Mellon University where he studied Computer Science and Artificial Intelligence. He was a charter voting member of ASHRAE's SPC 135P and has been very active in the development of the BACnet® Standard since its inception over 20 years ago. Fisher has over 35 years experience in building automation, communications networks, real-time software, human-interface design and distributed direct digital control systems.

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We had buildings all over the map that couldn't communicate with each other. So we talked to Alerton.

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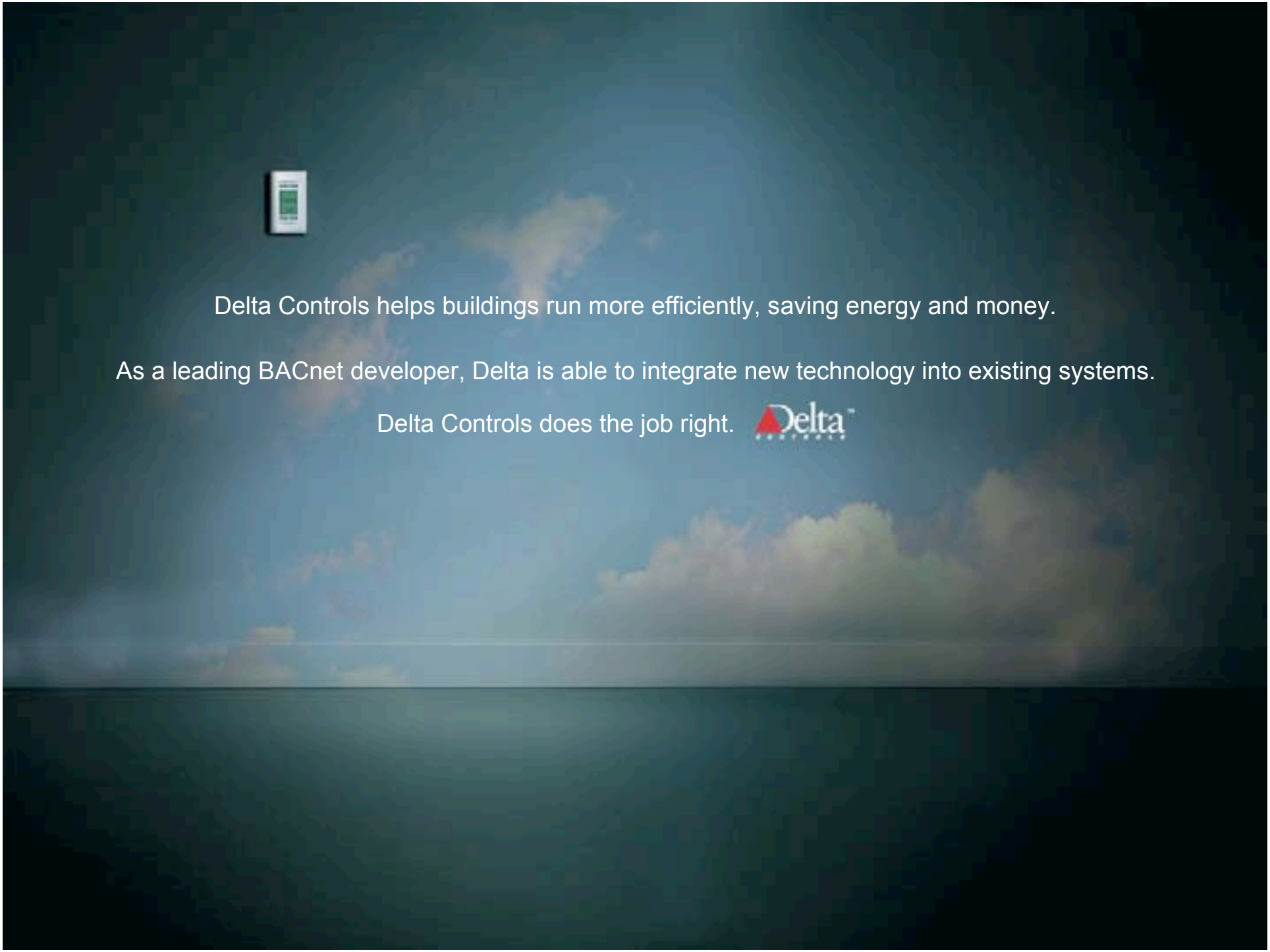
ALERTON®
We make buildings work.


Delta Controls helps buildings run more efficiently, saving energy and money.
As a leading BACnet developer, Delta is able to integrate new technology into existing systems.
Delta Controls does the job right.
Delta

BACnet-based Interoperability:

- Increase energy efficiency
- Reduce operations and maintenance costs

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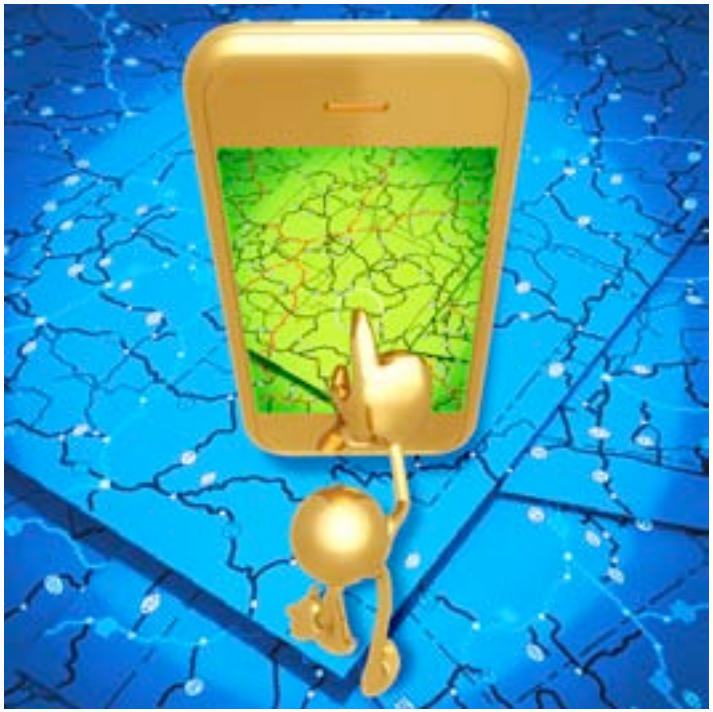
Today's goal is to provide:

A clear picture of what interoperability means

Greater understanding of Best Practices in the implementation of the ASHRAE/BACnet Standard



Implementation roadmap to minimize cost and maximize flexibility

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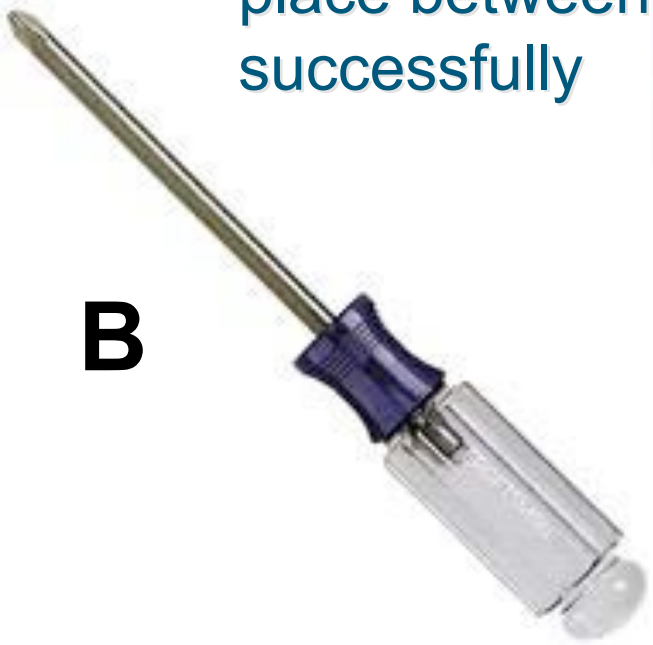
INTEROPERABILITY

"Interoperability" has specific meaning in context of building and facilities systems and infrastructure

A



B

We have specific interactions in mind that we expect to take place between them successfully

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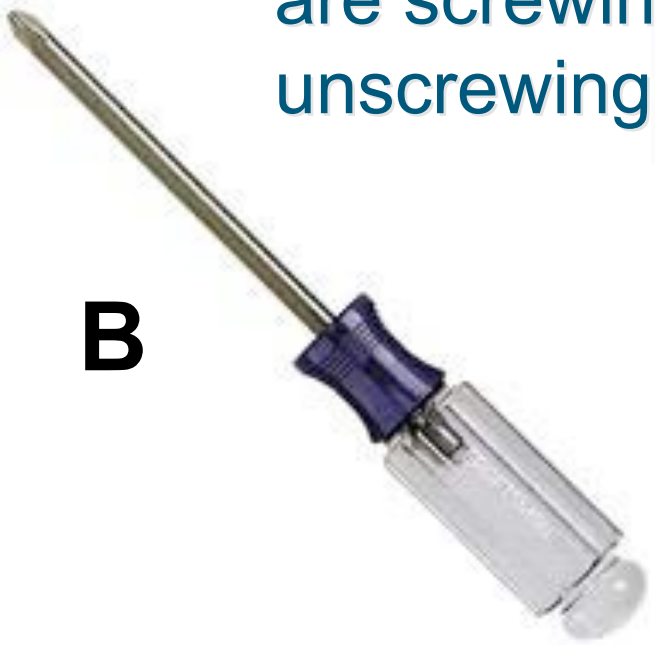
INTEROPERABILITY

- Screw A ***interoperates*** with screwdriver B
- The ***interoperations*** are screwing and unscrewing

A



B

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INTEROPERABILITY

Interoperations have limitations

- Limitation: Screwdriver B can interoperate with both A and C, but not with D
  - Accept limitation or get more screwdrivers

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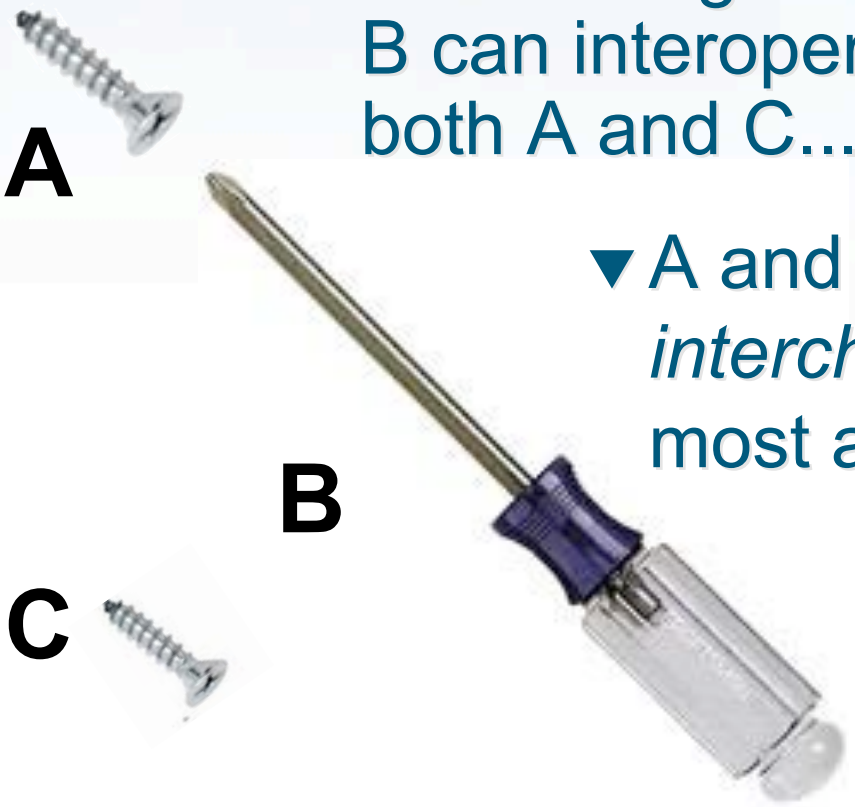
Interchangeability

- Interchangeability is not interoperability
  - Even though Screwdriver B can interoperate with both A and C...
    - A and C are NOT *interchangeable* for most applications



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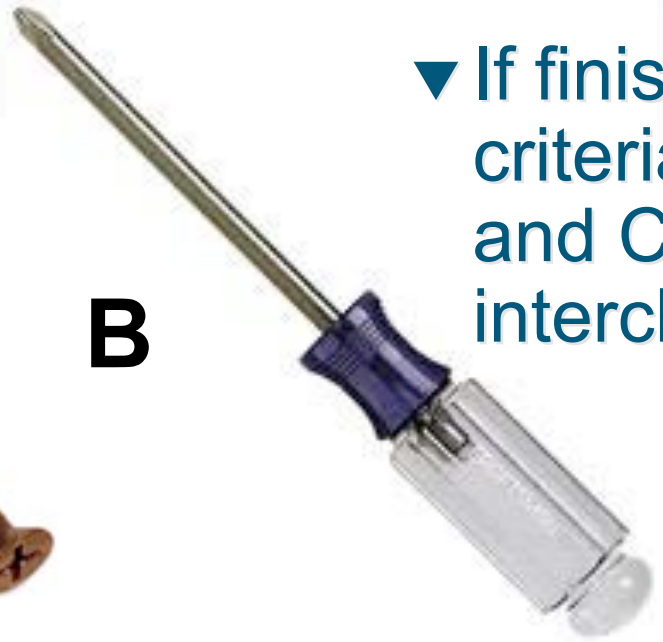
Interchangeability

- Interchangeability is always based on *criteria*
  - If size is the criteria, then A and C are interchangeable
  - If finish is the criteria then A and C are NOT interchangeable

A



B

C

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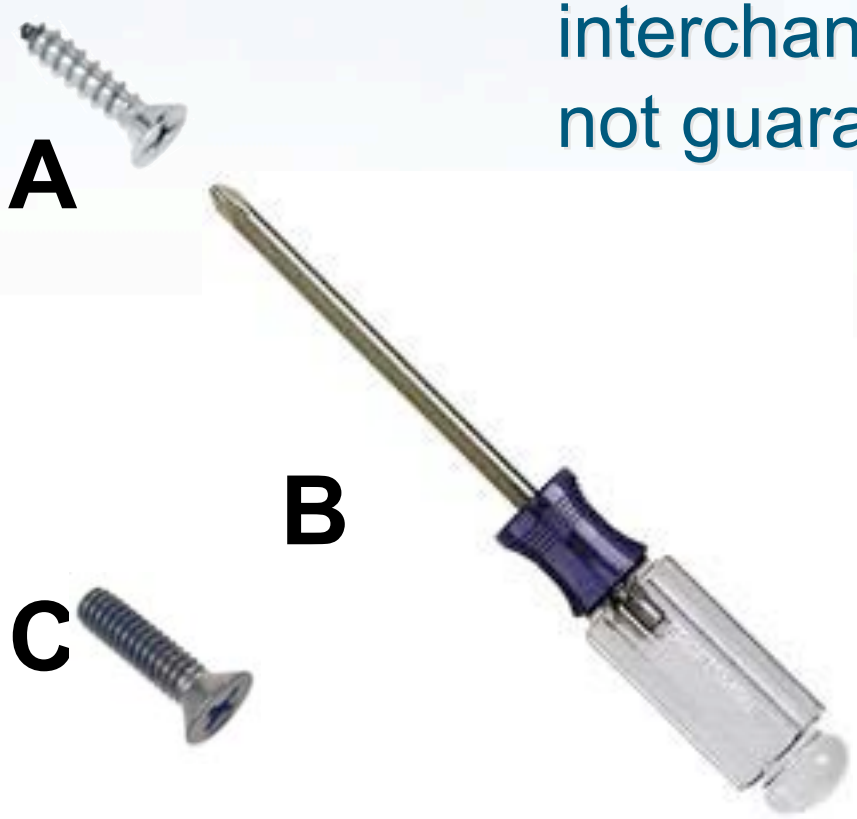
Interchangeability

- Even when interoperability is exactly the same, interchangeability is not guaranteed



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Interoperability

- Some devices interoperate better than others for the same interoperations

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Interoperability

- Even when standard objects are used, interoperability is not guaranteed

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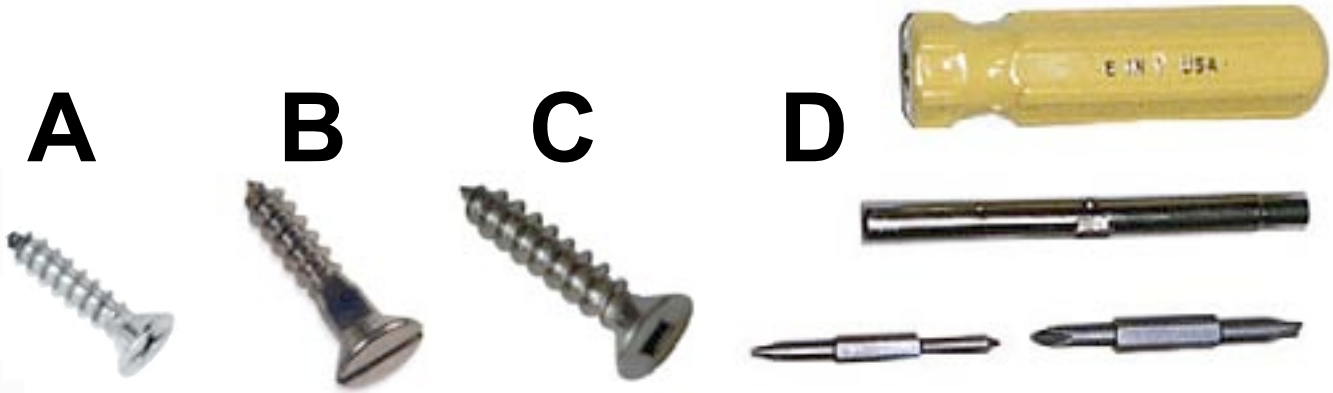
Interoperability

- Interoperability is not a "yes" or "no" thing
- We want a collection of possible interactions that mostly or completely overlap
- Some devices have a broader range of interoperability than others



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Proprietary vs. Interoperable

What Does This All Mean?

Should you invest in systems intended to be interoperable or proprietary by nature?

Proprietary systems aren't necessarily designed to NOT work with anything else

But interoperable systems ARE designed to work with other interoperable systems

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Proprietary vs. Interoperable

Pitfalls of choosing a proprietary system over an interoperable system

- Proprietary architecture locks in single vendor for replacement or expansion
- Risk of supply disappearing or costly upgrades
- No procurement flexibility
- Choices for maintenance, service & training are limited
- Lack of competition can lead to poor service

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Proprietary vs. Interoperable

Pitfalls of choosing a proprietary system over an interoperable system

- Locked-in to one vendor
- Can't expand except with one vendor
- Procurement inflexibility
- Specialized training limitations and expense
- Obsolescence of technology
- No third-party tools, services, expertise

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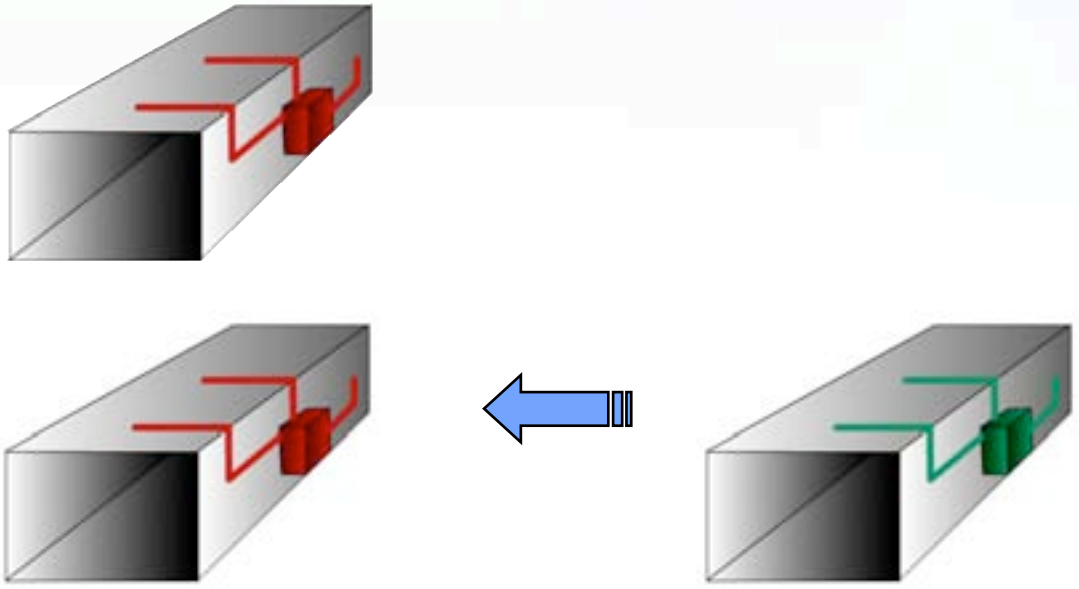
Interoperability Benefits

- Interoperability is beneficial even if components aren't interchangeable
- Interchangeability isn't always the issue
- Often, replacements are needed to do a particular thing even though they aren't identical

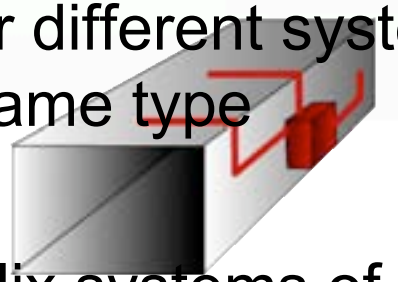


Interoperability Benefits

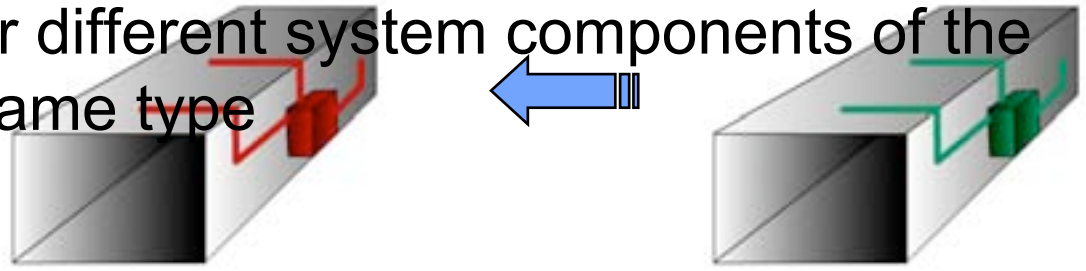
▼ Procurement Flexibility

Flexibility to partially expand and intermix building automation components without replacing entire system

Mix systems of different function & type or different system components of the same type



Mix systems of different function & type or different system components of the same type



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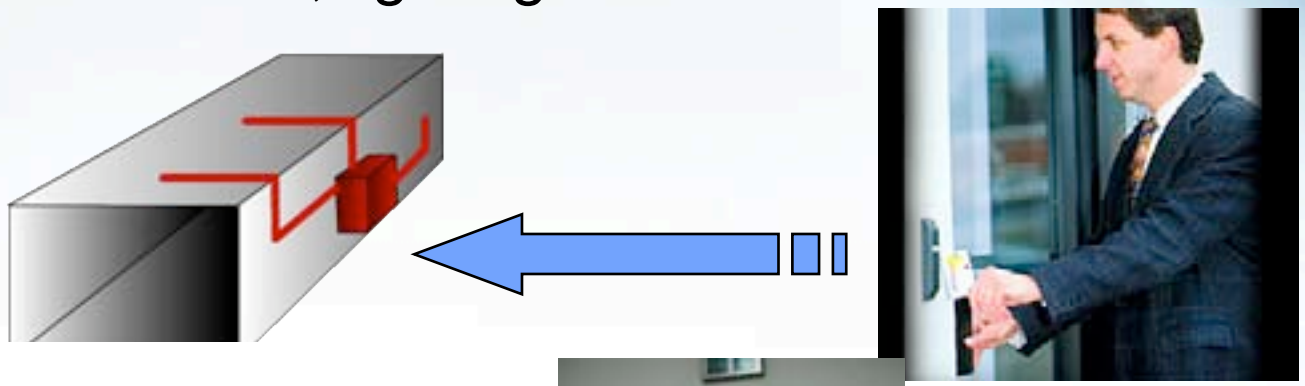
Interoperability Benefits

- Integration and Cooperative Interoperation

Example: Access card reader integrates elevators, lighting & HVAC control



Ability to achieve integration and cooperation between systems & components historically thought of as separate

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Interoperability Benefits

- Protection from “lock-in” and proprietary technology

Future-proofing your investment

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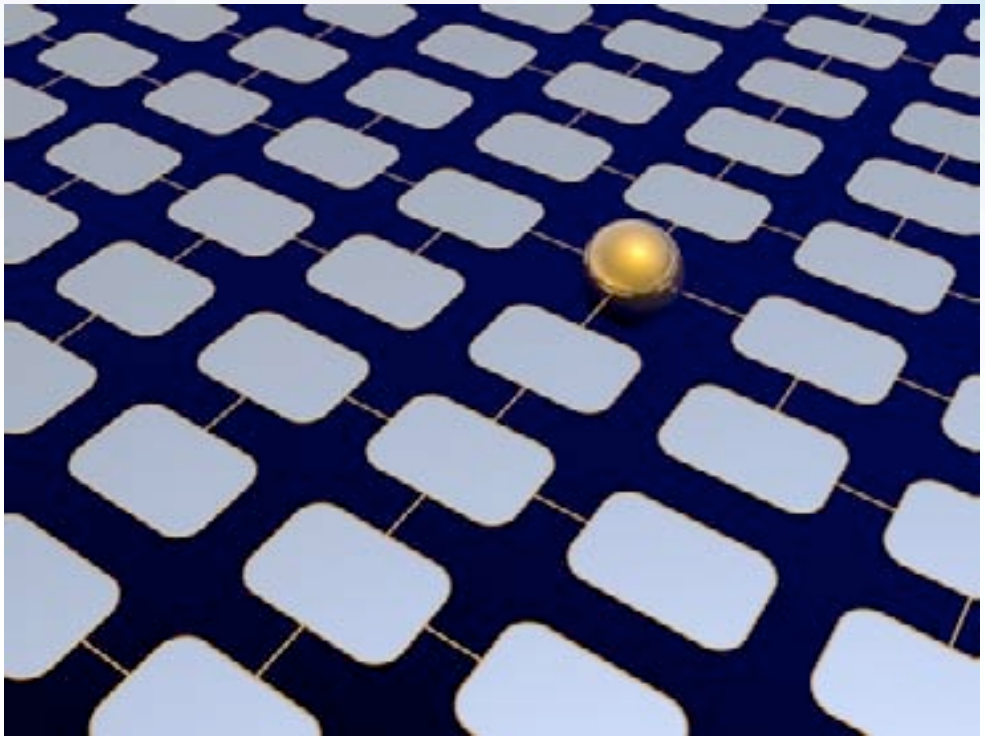
Challenges

There is no boilerplate solution assuring the kind of interoperability you want — There is no litmus test for BACnet!



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Challenges

Most problems are traced to a few root causes:

- Inadequate or imprecise specification of interoperable requirements
- Weak or non-conforming BACnet implementations
- Qualification of vendors
- Clear responsibilities

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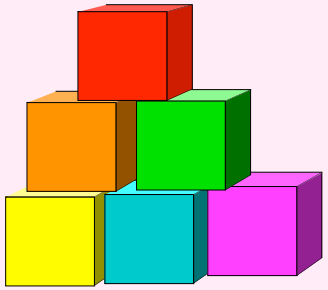
BACnet Interoperability

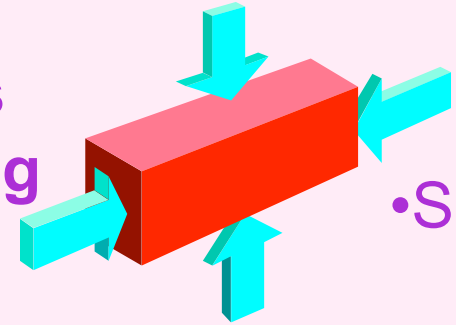
Divides the problem into three distinct areas and defines methods and standards for implementation

Representing Information



•Objects

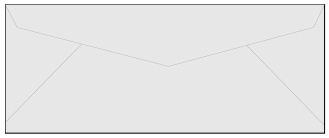
Making Requests and Interoperating



•Services

Application Language

Transport System



•LANs
•Internetworking

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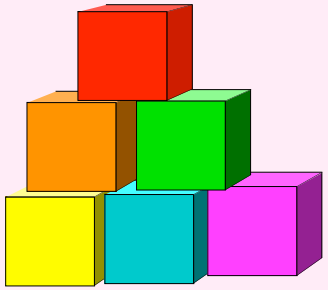
BACnet Interoperability

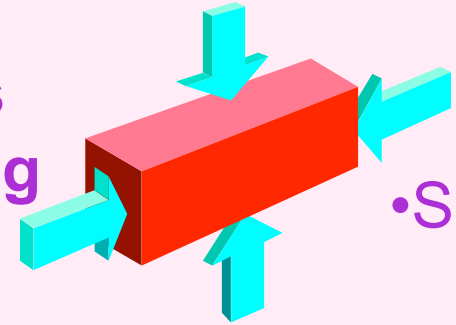
Device information is modeled in one or more information Objects

Representing Information



•**Objects**

Making Requests and Interoperating



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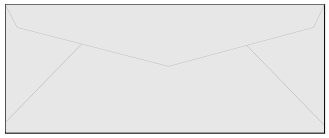

•LANs
•Internetworking

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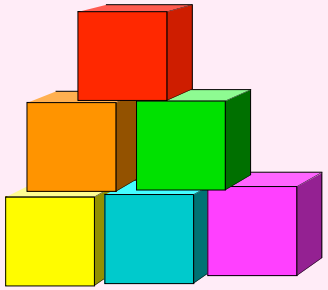
BACnet Interoperability

Devices ask each other to perform Services

Representing Information



- Objects

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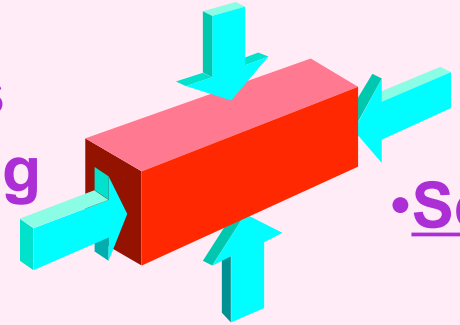

- **Services**

Application Language

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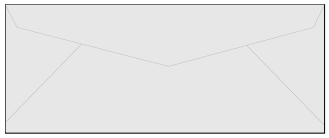

- LANs
- Internetworking

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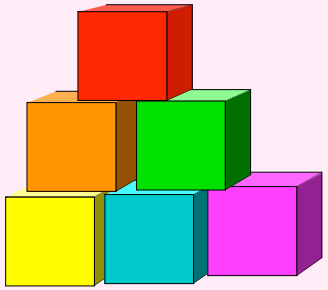
BACnet Interoperability

Objects and Services model is the Language of BACnet devices

Representing Information



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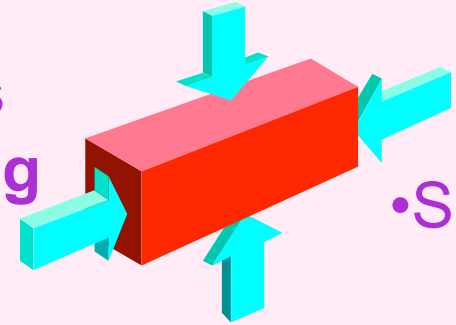

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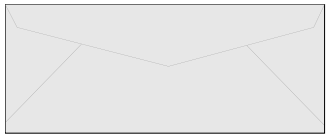

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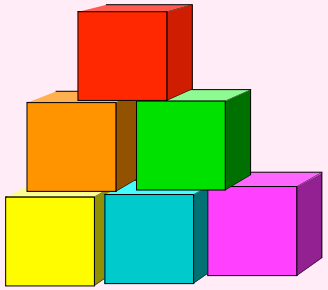
BACnet Interoperability

Multiple types of Transport Systems allow designers to choose the most cost-effective method for an application.

Representing Information



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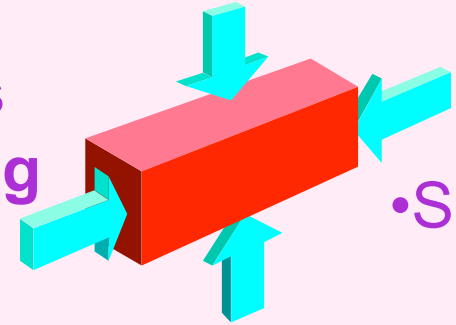

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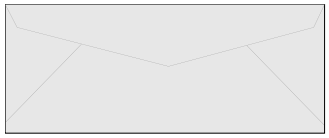

- LANs
- Internetworking

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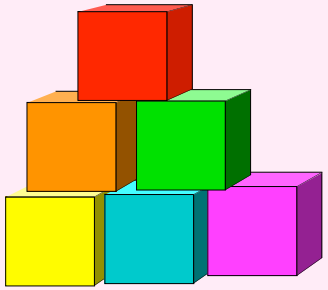
BACnet Interoperability

Flexible and scalable internetworking scheme allows large BACnet networks

Representing Information



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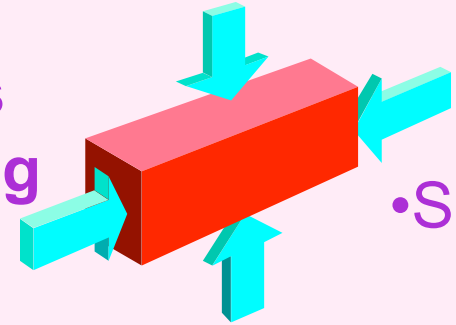

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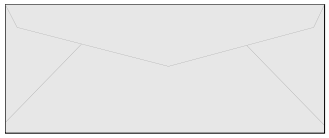

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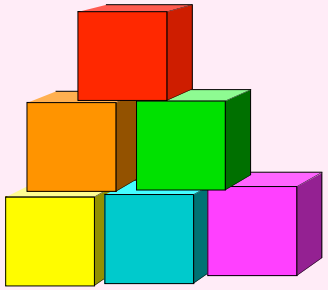
BACnet Interoperability

Allows multiple types of transport mechanisms but the message contents are the same language

Representing Information



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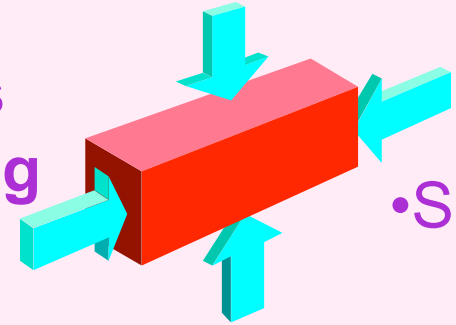

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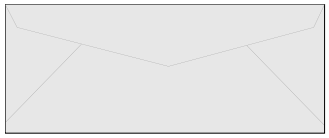

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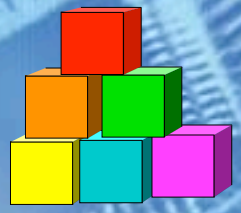
Objects



BACnet defines 25 standard object types.

- Binary Input
- Binary Output
- Binary Value
- Analog Input
- Analog Output
- Analog Value
- Averaging
- Pulse Converter
- Accumulator
- Multi-state Input
- Multi-state Output
- Multi-state Value
- Loop
- Calendar
- Notification Class
- Command
- LifeSafetyZone
- File
- Program
- Schedule
- Trend Log
- Group
- Event Enrollment
- Device
- LifeSafetyPoint

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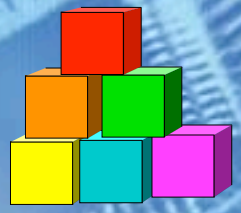
Objects



These standard objects represent much of the functionality in building automation and control systems

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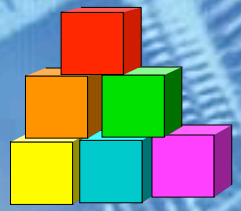
Objects



18 new object types expanding into Access Control, Lighting and other areas have been proposed

- Binary Input
- Binary Output
- Binary Value
- Analog Input
- Analog Output
- Analog Value
- Averaging
- Pulse Converter
- Accumulator
- Multi-state Input
- Multi-state Output
- Multi-state Value
- Loop
- Calendar
- Notification Class
- Command
- LifeSafetyZone
- File
- Program
- Schedule
- Trend Log
- Group
- Event Enrollment
- Device
- LifeSafetyPoint

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End Goals

Best practices to keep in mind when planning a new or expanded BACnet system:

- Leverage interoperable technology
- Emphasize common elements
- Flexible procurement, Eliminate “lock-in”
- Only buy the interoperability you need

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Best Practices

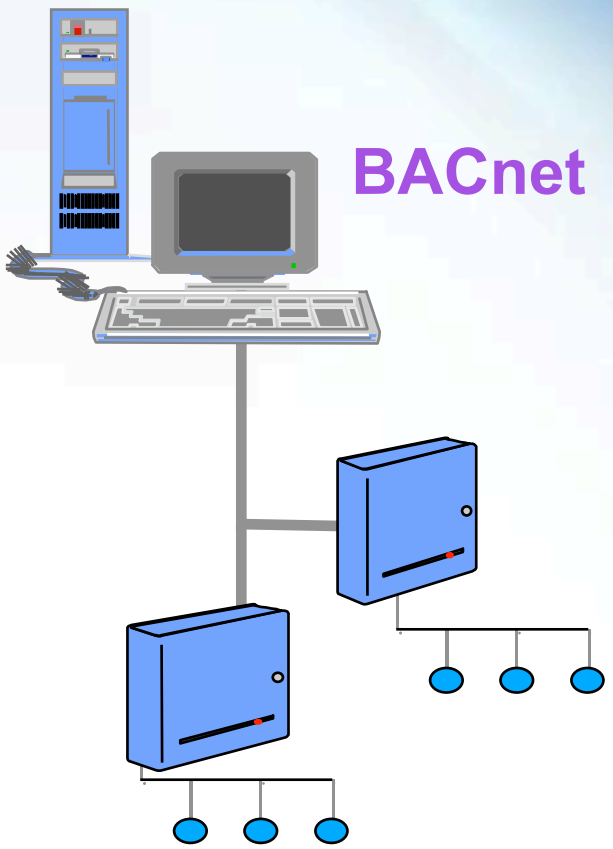
Native BACnet Devices:

Minimize cost by using control systems, mechanical equipment and subsystems based on BACnet at core level

Have no intrinsic premium cost!

Provide greatest flexibility in replacement, procurement and interoperability

Avoid the pitfalls of proprietary systems



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Best Practices

BACnet Clients

Training advantages: common BACnet ideas are applicable across vendors' equipment

Well Documented Non-standard Objects

- AHU object
- Chiller object
- etc.

Standard Objects

- AI, AO, AV
- BI,BO,BV
- MSI,MSO,MSV
- etc.

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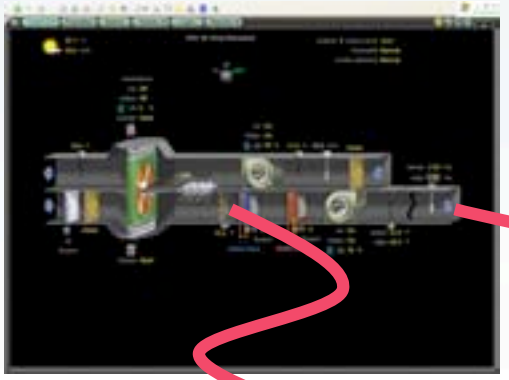
Best Practices

BACnet Clients

Proprietary extensions should be transparently documented and easily accessible



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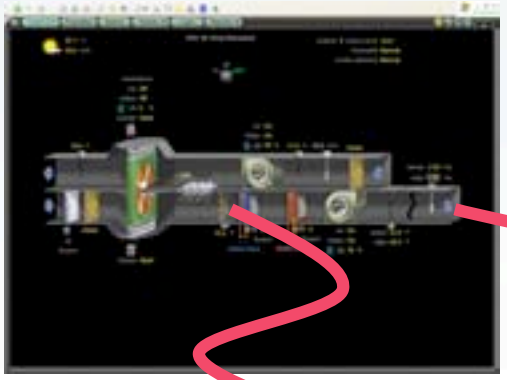
Best Practices

BACnet Clients

Don't build around too rigid or simplistic BACnet clients



Well Documented Non-standard Objects

- AHU object
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- etc.

Standard Objects

- AI, AO, AV
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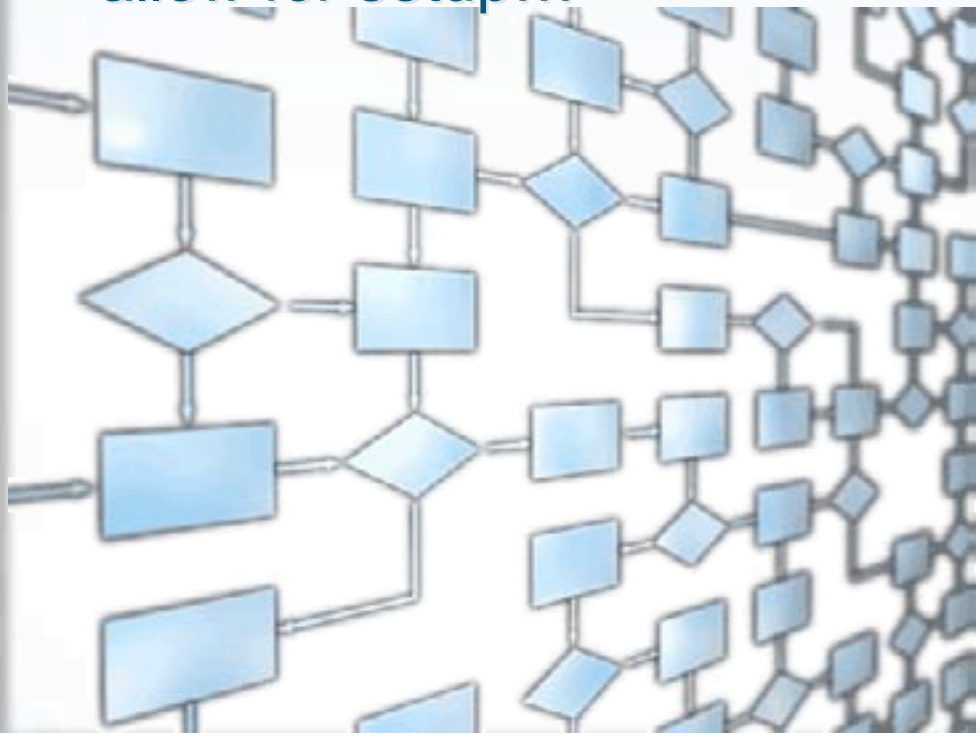
- etc.

Commissioning

BACnet mechanisms facilitate setup –

but the standard doesn't solve every commissioning issue

RESULT: There are no standard BACnet mechanisms required by every device to allow for setup…



…and there is no standard BACnet programming language

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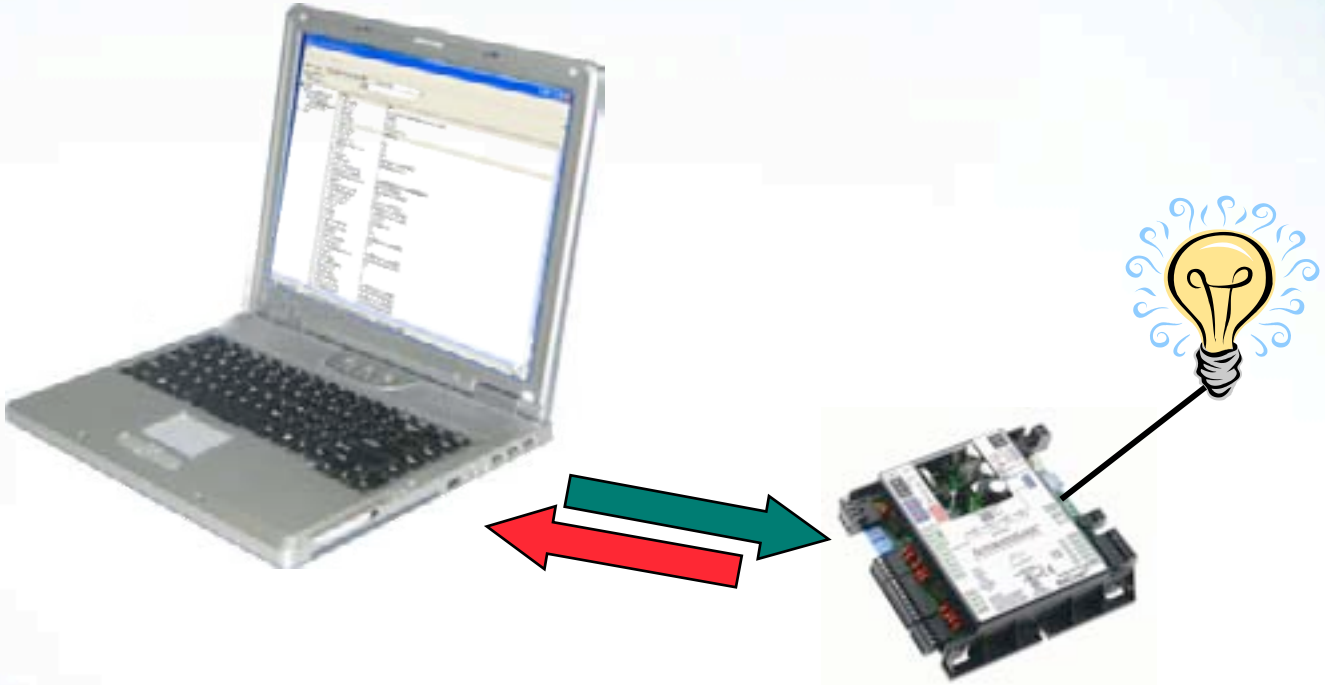
Commissioning

IMPORTANT:

Who is responsible for software setup?

Who provides required software?



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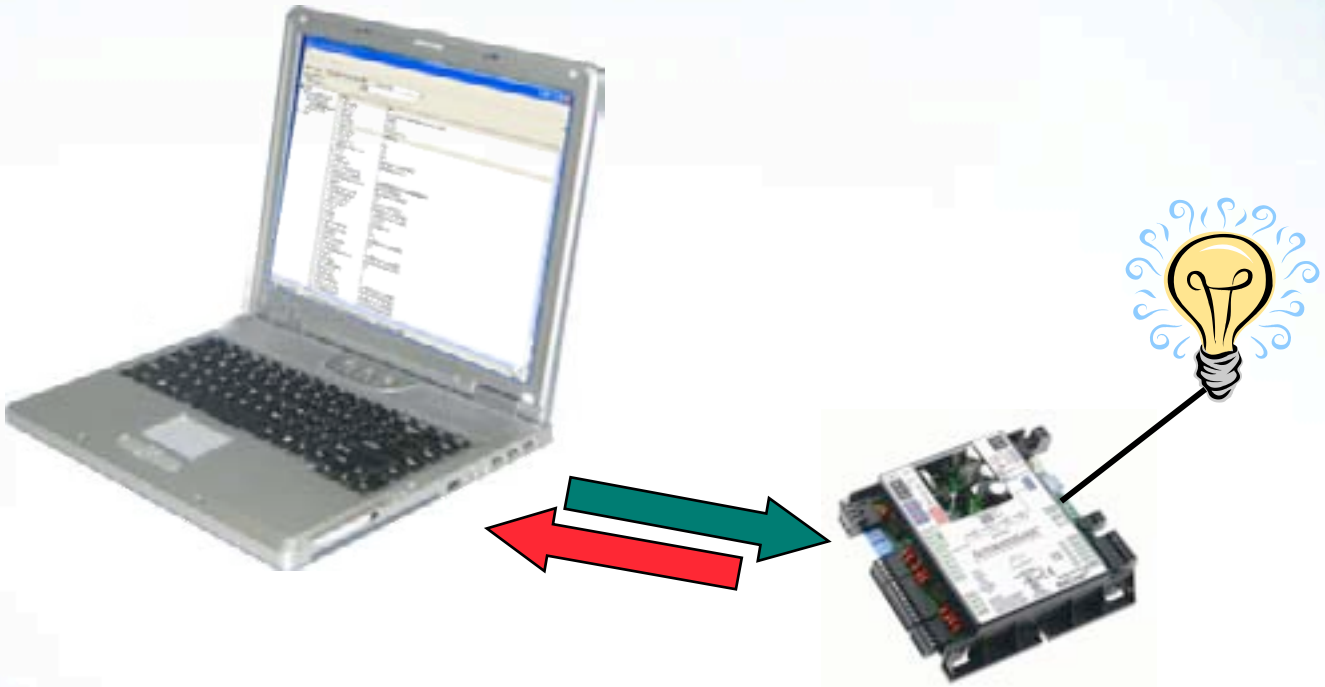
Commissioning

- Object property-based setup
- Proprietary tools when necessary
- Documentation is key!



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BACnet Testing

- BACnet Testing Laboratory (BTL)
  - A not-for-profit company
  - Test according to ASHRAE 135.1
  - Additional Test Criteria based on BTL-WG member input
  - Fee-based Listing

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BACnet Testing

- BTL Benefits:
  - Uniform evaluation criteria
  - Interoperability measurement (to extent of test accuracy)
  - Assured vendor commitment to BACnet standard

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Managing a BACnet System

BACnet Workstation Software

Vendor A Tools

Vendor B Tools

Third Party Tools

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For More Information

- www.polarsoft.biz/learning.html
  PolarSoft's BACnet Learning Center
- www.bacnet.org
  Unofficial BACnet Committee website at Cornell University
- www.bacnetassociation.org
  BACnet International trade association

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Thank You!

This concludes the webinar.

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