

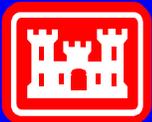
BACnet® Technology Update

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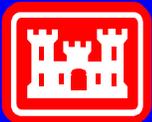
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Terminology

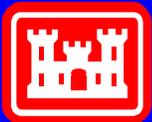
- **BACnet**[®] is 'Building Automation and Control Network'
 - Standard data communications protocol developed by ASHRAE
- BACnet Manufacturers Association (**BMA**)
 - Formed in Jan 2000 to encourage the successful use of BACnet in building automation and control systems, through interoperability and compliance testing, educational programs, and promotional activities
- BACnet Testing Laboratories (**BTL**[®])
 - Part of BMA, offers a product testing and listing program for products that have BACnet capability



Terminology

- **"Native" BACnet** implies that the devices only speak and understand BACnet. The devices may be interconnected using any of the approved LAN technologies (Ethernet, ARCNET, MS/TP, LonTalk, BACnet/IP)

<http://www.bacnet.org/Tutorial/HMN-Overview/sld026.htm>



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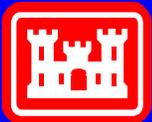
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Terminology

- **BIBB**: BACnet Interoperability Building Block
 - Based on **objects** and **services**
 - Collection of one or more **services** that function to define the interoperational capabilities of a BACnet device
 - Certain BIBBs may also be predicated on the support of certain, otherwise optional, BACnet **objects** or **properties**
 - BIBBs may also constrain allowable values of specific **properties** or **service** parameters

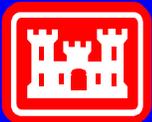
<http://www.aamatrix.com/bacnet/bacnetdefinitions.shtml>



Terminology

- **Services** are client-server messages
 - Alarm & Event
 - File Access
 - Object Access
 - Remote Device Management
 - Virtual Terminal

<http://www.bacnet.org/Tutorial/HMN-Overview/sld023.htm>



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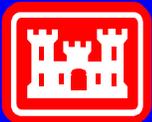
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Terminology

- **Object**

- Represents data in a defined data structure. Each object has a set of **properties** and a group of functions that can be applied to them.
- BACnet defines objects to represent control system data
- BACnet objects can represent information about a physical input or output, a file or a logical grouping of data that performs some function (a setpoint or schedule, for example)
- By prescribing an object-model method to represent all control system data, BACnet facilitates interoperability and extensibility.
- 23 different **object types** (AI, BO, averaging, schedule, etc.)

<http://www.aamatrix.com/bacnet/bacnetdefinitions.shtml>



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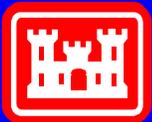
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Terminology

- **Property**
 - A characteristic or parameter of an **Object**
 - Properties of a file object in BACnet, for example, may include file size, type, and modification date
 - In BACnet, certain properties of an object may be required, while others may be optional

<http://www.aamatrix.com/bacnet/bacnetdefinitions.shtml>



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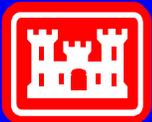
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Terminology

- **Device Profile**

- Basically a named collection of **BIBBs**
- Annex L defines 6 standard profiles that describe typical collections of BACnet capability in terms of the **BIBBs** that might be supported by each profile
 - B-OWS Operator Workstation
 - B-BC Building controller
 - B-AAC Advanced application controller
 - B-ASC Application specific controller
 - B-SA Smart actuator
 - B-SS Smart Sensor (not shown at BTL site)



Terminology

- **PICS**: Protocol Implementation Conformance Statement
 - Manufacturer supplied document (spec sheet)
 - Identifies all portions & options of BACnet implemented in a device
- **PICS content**:
 - a) Vendor & device description
 - b) **BIBBs** supported by the device (see Annex K)
 - c) **Device Profile** to which the device conforms, if any (see Annex L)
 - d) All non-standard **application services** that are supported along with an indication for each service of whether the device can initiate the service request, respond to a service request, or both
 - e) List of all standard and proprietary **object** types that are supported
 - f) For each **object** type supported,
 1. any optional **properties** that are supported,
 2. which **properties** can be written-to using BACnet **services**,
 3. if the objects can be dynamically created or deleted using BACnet **services**,
 4. any restrictions on the range of data values for **properties**.
 - g) Supported data link layer option options, both real & virtual. (See Annexes H and J).
 - h) Whether segmented requests and segmented responses are supported



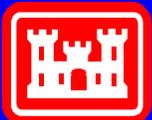
BACnet Status

Not Ready. Don't use it.
High risk of problems

Specifications not available.

Implementation methodology/guidance not available.

Useful criteria available in approximately 1 year.



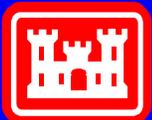
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BACnet Criteria – Status

- Navy has lead
- Navy draft spec developed - July 05
 - Navy sent to industry for review
- Navy developing plan/report - Sep 05
 - One or more UFGS? One or more UFCs?
 - UFC content
 - Drawing needs? Edit & use (existing) LONWORKS drawings?
- CERL met with 7 BACnet vendors, BMA, and BTL
 - Mostly very productive cooperation
 - Several vendors actively helping with criteria (Points Schedule)



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UFGS = Unified Facilities Guide Spec
UFC = Unified Facilities Criteria

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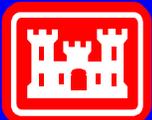
UFGS / UFC Packaging

One or more UFGS? One option: “5 specs”

- LONWORKS only (UFGS-15951 and UFGS-13801)
- BACnet only (UFGS 15955 and 13xxx ???)
- Controls only (UFGS-15xxx)
 - Sensors/actuators, execution, sequences

One or more UFCs? One option: “3 UFCs”

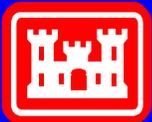
- LONWORKS UFC
- BACnet UFC
- Controls UFC



UFGS = Unified Facilities Guide Spec
UFC = Unified Facilities Criteria

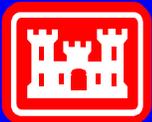
Specifying BACnet Data

- Need method to specify BACnet data to be shared/exchanged over network
 - To meet project application requirements and to ensure interoperability and thus functional requirements
 - It largely comes down to device **properties**
 - Leave it up to the Contractor and you'll get what you deserve
- Can't assume devices will contain needed **properties**...
- **BIBBs & device profiles** do not sufficiently describe actual application data shared over the network, and
- **Objects** have so many **properties** (both optional & required), it may not be practical to show all on a 'Points' drawing



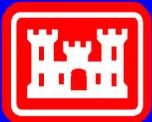
Managing Network Data

- Unlike LONWORKS, BACnet neither specifies nor requires a std database/image of network. Each vendor has/uses own.
- Interoperability achieved (in part) through ‘**discovery**’ process
- **Discovery**: Vendor uses their tool (software) to query network & uses that info to create a vendor specific database
- ‘**Discovery**’ not conceptually bad, but in application has limitations:
 - Not all devices can be ‘discovered’. (MSTP **slave devices**)
 - Brute force method is required to query/discover **slave devices**
 - Not all needed objects/properties will necessarily exist in ‘discovered’ devices



Cross-Network Device Configuration

- Vendors may use protocols other than BACnet for device configuration
 - These protocols may not be supported by the entire multi-vendor network (from OWS to the end device)
 - Device configuration may require physical access to the device (can't do it over the network)
 - Therefore, this is a problem with multi-vendor BACnet systems
- Example... 3rd party BACnet Building Controller (B-BC) functioning as a router from Ethernet to MSTP likely will not pass another vendor's non-BACnet device configuration communications

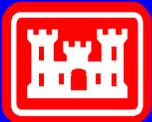


Conformance Testing & BTL Listing

- Device testing more rigorous than LONWORKS 'certification' process
- Testing for 5 classes of **device profiles**.
- OWS conformance testing not ready. 1 year to go.
- Vendors seem to prefer spec 'BTL Listing' requirement

Network Security

- Same "Networthiness" challenge as LONWORKS
- Need to get vendors up to speed



OWS = Operator Workstation

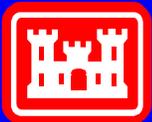
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Other Issues/Lessons Learned

- **PICS** defines how a vendor's device implements BACnet
 - As important as a data specification sheets when reviewing a submittal for BACnet components/systems
- **XML**
 - ASHRAE is defining XML applications for BACnet
 - Web interface to automation & control systems
 - Not ready. Wait and see.
- Use [Annex J](#) of the BACnet standard. [Annex H](#) routers are old technology and not compatible.



XML = eXtensible Markup Language

LONWORKS (ANSI 709)

- Certification process available and in progress
- Many devices available
 - Not all encompassing
- Application specific controllers are common
- Single platform/tool for device configuration possible
- Flat architecture w/single media
- Less defined supv. functions
 - Fewer options/functionality
 - Alms/scheduling/trends
- Standard database/mgmt available (UFGS reqmt)
- Easier to understand/specify
- Can be proprietary

BACnet

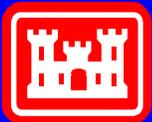
- Conformance testing process available but incomplete
- Fewer devices available
 - Not all encompassing
- Programmable controllers seem more common
- Multiple vendor-specific tools required for device configuration
- Hierarchical architecture/media
- More defined supv. functions
 - More options/functionality
 - Alms/scheduling/trends
- Proprietary databases/mgmt
- Kinda tough to understand/specify
- Can be proprietary

Army Energy Strategy & Campaign Plan

- Eliminate energy waste in existing facilities
- Increase energy efficiency in new construction and renovations
- Reduce dependence on fossil fuels
- Conserve water resources
- Improve energy security

DDC/UMCS is necessary to support these goals!

<http://hqda-energypolicy.pnl.gov/programs/plan.asp>



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BACnet Summary

- BACnet is not ready for implementation
 - Specifications not ready
 - Implementation methodology/guidance not available
- Develop some in-house expertise / familiarity now
- Be prepared to hire/procure a Systems Integrator whether you adopt BACnet or LONWORKS (recommend: IDIQ)
- Probably not wise to implement BACnet *and* LONWORKS
- CERL recommends LONWORKS, but recognizes potential of BACnet and wants to see it implemented intelligently

