Some BACnet devices include two sets of screw terminals, one for incoming and one for outgoing wires. But usually there is a single pair so the daisy chain must be created by twisting incoming and outgoing wire ends rattail fashion and capturing the twist in the corresponding screw terminal for the network. Be sure not to expose too much bare twisted wire so that adjacent wires don’t short, or use crimp sleeves.

The shield wire should enter the wire cabinet and shields should also be daisy-chained together and then taped or covered. In some cases devices have “empty” screw terminals where shields can be landed. It is VERY IMPORTANT to assure that shields are connected to ground at only one location along the bus! Typically MS/TP networks will have a single router or large controller in addition to many small devices. It can be convenient to use the router/controller as the single grounding point and as an end node at one extreme of the network or the other.

### Termination, Loading and Biasing

Electrically, MS/TP uses a type of signaling known as EIA-485. With EIA-485, devices use a single twisted pair which carries a differential voltage relative to a shared ground. Each node uses a *transceiver* that consists of a differential receiver and differential driver whose legs are connected together on the “plus” and “minus” sides. When the node is “listening” the driver TxEnable is deasserted putting the driver into a high impedance tri-state mode. When the node needs to transmit, the driver TxEnable is asserted, applying the Tx state to the differential bus. This means that only one driver can be asserted at any time.
MS/TP specifies the use of 510Ω resistors for end point biasing.

Unfortunately there is some difference of opinion within the industry regarding whether network biasing is the best approach to use. The standard indicates a strong preference for network biasing, but allows an alternative called local biasing. With local biasing each node has biasing resistors but the values are much larger. The larger values provide less bias so the effect is localized to the node itself, and also less power is required to be sourced by the node’s power supply. MS/TP specifies values of 47KΩ for these types of biasing resistors.

The EIA-485 standard models each transceiver as an idealized 12KΩ impedance (load) and specifies that each driver shall be required to source no more than 60mA. This works out to 32 unit loads. A lot has changed since the EIA-485 standard was created and today there are transceivers designed with higher impedance (½, ¼, and even 1/8 load). Under some circumstances we can take advantage of this and have more than 32 devices on a segment.

MS/TP allows the total length of the twisted pair bus to be up to 4000 feet (1200m) using datarates from 9600, 19200, 38400, 57600 or 76800 bps. At 115200 bps the length must be degraded to 3280 feet (1000m).

The standard also requires that both extreme ends of the network bus shall have 120Ω termination resistors across the receiver:

Termination is important over longer distances and higher speeds to eliminate reflections.

When there is an active driver asserted the voltage differential is reliably held in the 0 or 1 state by the driver. However when all drivers are tri-state (all deasserted) the differential floats at an indeterminate level. This can cause undesirable effects including random transitions that receivers can interpret as valid data bits. To help overcome these effects, BACnet MS/TP specifies the use of active biasing. The extreme end nodes of the network bus are enhanced to include pullup and pulldown biasing resistors. The values chosen for these resistors must be small enough to provide more than 200mV of voltage drop across each receiver, and large enough that they do not exceed the driver’s ability to overcome the bias which would prevent transmitting data.

Since the standard allows both types of biasing philosophy there is always the possibility that a given MS/TP segment may include a mixture of types. For network segments containing 32 or fewer nodes that is not a problem. However, when you want to have the same MS/TP segment include more than 32 nodes, the biasing philosophy becomes very important.

The opinions expressed here are those of the author and do not necessarily represent the position of BACnet International, or any of the organizations with which the author is affiliated.
Although the mathematics is somewhat complicated, it boils down to some simple rules.

- If there are any locally biased (47K) nodes on the segment, the segment is limited to 32 or fewer nodes unless repeaters are used.

- If all of the nodes use partial-load transceivers, e.g. all ¼ load, and network biasing is used, then you can extend the total number of nodes based on load. For example all ¼ load transceivers can have up to 128 nodes without repeaters.

Repeaters are special devices that include two or more sets of EIA-485 transceivers. Data incoming to one set causes the other set(s) to retransmit the same data with low latency (delay). Repeaters are bidirectional so there is some logic within them that determines which side is transmitting at any given time and enables/disables the EIA-485 drivers accordingly.

So which philosophy is “better?” Because of the ubiquity of partial-load transceivers, and the generally cost-sensitive nature of MS/TP devices, the BACnet standard leans toward the use of two point network biasing which allows devices to exploit the additional device possibilities without requiring repeaters. On the other hand, advocates of the 47K philosophy argue that their approach is easier to remember and apply because all nodes are the same and repeater cost is only incurred in larger population network segments. They would also argue that repeater cost is similar to the cost of dual end point biasing, if implemented as a separate device accessory. The other camp would argue that a slight increase in power supply capacity would allow any node to fill the role of end point biasing source. Suffice it to say that there is no clear consensus on a best approach even after 15 years as a standard and many millions of installed nodes.

Non-isolated Power
A typical microcomputer-based controller device that implements MS/TP has several important parts. We will greatly oversimplify this view with the block diagram to the right.

The Microcomputer, memory, Input/Output (I/O) and EIA-485 components share access to a power supply circuit that provides appropriate voltage(s) to all of the individual components. Of particular interest is that the ground reference for the entire device is the same as the power supply ground.

This is important to remember because it’s one of the things that make the two-wire EIA-485 concept work. Recall that the differential voltage signal in EIA-485 is referenced to a ground return path. In this case it’s clear that this ground is the same as the power supply ground for the transceiver and also for the whole device.
Isolated Power

Clearly it would be desirable to design the EIA-485 circuits in a way that would reduce or eliminate transient intrusion into the sensitive internals of the microcomputer(s) and their memory, I/O and communications components. In some kinds of MS/TP devices, such as variable frequency drives (VFDs), the motor control circuits themselves can be a source for disruptive transients. In those cases it is more than desirable, it’s necessary. This is usually accomplished by isolating the power supply for the EIA-485 components (or disruptive I/O components or both) from the power supply used for other internals. This greatly simplified diagram shows how this works:

The EIA-485 standard specifies a wide range of +12 to -7 volts relative to the reference ground. Modern transceivers have protection built-in that shuts down the transceiver if these voltages are exceeded. Many designs use microfuses and extremely fast switching transorbs for protection also. But even with these measures it is still possible to actually damage some transceivers with sufficiently large transients. When there are two or more devices on the same network, both of which use isolated power, if their isolated ground references...
The BACnet Device ID

Steve Karg, Senior Engineer, Watt Stopper

The BACnet Device ID is a commonly misunderstood term and value by newcomers to BACnet. Its purpose is often misunderstood. This is perhaps because many developers come to BACnet from other protocols which do not have the extra complexity of an address resolution protocol.

The term “Device ID” is short for Device Identifier, and is shorthand for the Instance Number portion of the BACnet Device object Object_Identifier property. The Device ID is a non-volatile value that is chosen and configured by someone at the site where the BACnet product is installed. The Device ID is used for resolution of network layer addresses into application layer addresses, commonly referred to as “binding”.

Objects

BACnet uses objects to represent physical inputs, outputs, values, and processes. These objects provide a framework for BACnet messages to access and manipulate the properties of these objects. How the objects map to the real values or physical points used in the device is what each vendor gets to choose when they develop a BACnet product. The quantity of each type of object in a BACnet product is also something that the vendor will choose. The exception for choice in the quantity of objects is the Device object.

Every BACnet device has one, and only one, Device object. However, a gateway device could represent multiple devices by having each device appear as if they were behind a virtual router.

Mixed Networks

Sometimes it is necessary or desirable to have a mixed network that incorporates some number of non-isolated MS/TP devices and some number of isolated ones. The issue is how to reconcile the ground reference used by the isolated devices (through the third common wire) and the implied Earth ground used by the non-isolated devices. The answer is that the common third wire is tied to the Earth ground through a current-limiting 100Ω resistor.

Summary

MS/TP can provide low cost reliable operation under a wide range of conditions. However, careful planning for new construction and diligent research when retrofitting existing networks is essential to reap to benefits that MS/TP has to offer. Biasing, loading and wiring become particularly important in any mixed device network segment. Failure to take these factors into account is the number one cause of field issues with MS/TP, and also the easiest to prevent using best practices.

are not tied together then it is possible for the two “floating” references to be at different levels, thus their combined voltage range can easily push outside of the design spec during transients. As a result, the 135-2010 BACnet standard introduced new guidelines governing best practice for MS/TP. Under the new standard, it is strongly recommended that isolated devices have their isolated ground references tied together through a third wire.

Although it is possible to do this with a separate wire, the best practice is to use (or retrofit with) shielded twisted triple which is also called 1.5 pair. When daisy-chaining the segment into a device cabinet, the common wire is landed on each isolated ground terminal. The drain daisy-chains through cabinets but is only grounded at one point.

MS/TP can provide low cost reliable operation under a wide range of conditions. However, careful planning for new construction and diligent research when retrofitting existing networks is essential to reap to benefits that MS/TP has to offer. Biasing, loading and wiring become particularly important in any mixed device network segment. Failure to take these factors into account is the number one cause of field issues with MS/TP, and also the easiest to prevent using best practices.
Device ID Value

The BACnet standard tells us that “each object within a single BACnet Device shall have a unique value for the Object_Identifier property.” It also says “…the system-wide unique Object_Identifier of the BACnet Device…”. The standard specifies that the instance number range is 22-bits: 0-4194303. It also states that “No object shall have an Object_Identifier with an instance number of 4194303.”

The only method to make a system-wide unique Device ID from 0 to 4194302 is to have this value configurable at the building site where the BACnet product is installed. This can be accomplished in a variety of ways, from a user interface on the product to simply allowing the Device object Object_Identifier property to be writable using the BACnet WriteProperty service. This Device ID, which must be unique system wide, provides a mechanism for referencing every Device in the control system network.

Device Address Binding

But why do we even need a Device ID when each device has a MAC (Media Access Control) address? An Ethernet MAC address is large (6 bytes) enough to be unique across a large building network, but an MS/TP MAC address is too small to be used in any building that requires more than 127 devices. BACnet devices can use a variety of datalink and physical layer interfaces, and utilize a BACnet router to pass messages between the interfaces. The router (network layer) must also be accounted for when communicating between BACnet devices located on different interfaces.

BACnet uses a type of address resolution protocol based on a Device ID query broadcast (Who-Is service) to the network to find a specific device. The device reply (I-Am) will contain information about the route and include the MAC address. Having an address resolution protocol is useful if a device fails and is replaced as it can simply be re-numbered to the failed Device ID. It is also useful in systems where the MAC address may change (i.e. BACnet/IP and DHCP service). The address resolution protocol is needed when routers are utilized in the network to join various datalink and physical network segments.

After discovery, the Device ID can now be associated with this MAC address and route. This data will be used as the unicast address in the majority of BACnet messages, including ReadProperty, WriteProperty, and DeviceCommunicationControl, that are directed to that Device ID.

Properties

Each BACnet object contains a number of properties. Some of the properties are required to exist in the object, such as Object_Identifier, Object_Name, and Object_Type properties. Some properties are optional and may be supported by the vendor if that device needs that property, or if the vendor chooses to implement a feature that mandates that an optional property be supported by that object. Some properties are proprietary, or non-standard. A proprietary property is often a property that is needed by the vendor for specific object functionality, but is not defined by the standard set of properties for that object in the BACnet standard. Some properties are read-only. Some properties are writable.

Object Identifiers

The Object_Identifier property, which is required in every BACnet object, is useful for uniquely referencing each object in a device. The Object_Identifier is made of two pieces of data: an object type, and an object instance number.

There are many numbers used in the BACnet protocol to communicate information on the network. Most of these numbers are prescribed and defined in the standard. Object types can be any of the BACnet standard object types and are enumerated from 0 to 127, or they can be a non-standard type numbered from 128 to 1023. As an example, a Device object type is enumerated as 8. The vendor of a device can choose which types of objects are used in a device.

The object instance numbers can range from 0 to 4194302. The vendor can choose which object instance numbers are used for each object. The exception to this is the object instance number for the Device object, which can be chosen initially by the vendor, but must be configurable and survive power and controller resets (non-volatile).
2. Identify four major areas where building automation can contribute to each of the four areas.

Learning Objectives
1. Enumerate the criteria used to select "The Best In Show" Award.
2. What is and is not a BACnet Success Story
3. Why submit your BACnet Success Story

Abstract
A review of some of the most compelling BACnet Success Stories submitted to date including contenders for this year’s "The Best in Show Award." Project reviews will identify the unique challenges and solutions and how BACnet as the key to success. Where available all contributing firms, consultants, integrators, contractors and manufacturers will be identified.

Presenter
Michael R. Wilson, Business Development Manager, OEMCtrl / Marketing Chair, BACnet International, OEMCtrl

3. Describe one or more ways that building automation contributes to building sustainability. For each of these areas, common building challenges and solutions and how BACnet as the key to success will be identified. Also, an integrators, contractors and manufacturers will be identified.

Learning Objectives
1. Define "building sustainability" and "building automation."
2. List the characteristics of well designed BACnet interfaces. BACnet is the protocol of choice for this task. The presentation will outline how to design and specify BACnet-based BASs from the initial concept, then through the design and LEED process, the construction phase, the commissioning process and finally the operational phase. The presentation will touch on specifying BACnet in the SmartGrid environment. Mr. Wichenko will also offer tips and tricks when specifying Energy Dashboards normally used by Senior Management.

Learning Objectives
1. Outline the benefits of a BACnet-based design model to Facility Owners and Managers.
2. List the characteristics of well designed BACnet interfaces for boilers, chillers, meters, etc by equipment suppliers.
3. Specify on board BACnet controls from equipment suppliers in a simple and understandable manner.
4. Identify clear lines of responsibility for installation, wiring, programming, graphics and commissioning BACnet interfaces or on a BACnet Electrical and other equipment to avoid Change Orders.
5. Explain how the BACnet-based Networked Controls design model assists with compliance to LEED and SmartGrid Interoperability.

Abstract
Free LEED Credits with every BACnet connected VFD

Abstract
Both LEED New Construction and LEED Existing Buildings have Credits available for Energy Management and Verification. This session will cover how to obtain "free" LEED Credits by connecting your VFDs to the BACnet system.

Learning Objectives
1. LEED Energy and Atmosphere Sections will be explained and discussed.
2. Learn how to obtain Credits under Section 5 - Energy Management - BACnet Success Story
3. Learn that up to three LEED Credits are available by using the BACnet information available from your VFDs.

Abstract
When Interoperability Isn't

Abstract
We will describe various hurdles to achieving interoperability on a multi-vendor control project. What is the best cost effective or technically savvy approach.

Learning Objectives
1. Understand the goals of interoperability.
2. Become aware of common hurdles related to interoperability.
3. Determine actions that can be taken to avoid such problems on multi-vendor projects.

Abstract
Which Points Should I Use and Why?

Abstract
Modern Variable Frequency Drives (VFDs) have 80 or more points (BACnet. Objects) available for monitoring and control over the BACnet system. Do I need to monitor all 80 points? Which points should I use and why? This paper will discuss which points are important for basic energy savings and control strategies and also give examples of more advanced usage of the points available. Finally, recommendations for the end-user and consultant will be presented.

Learning Objectives
1. What BACnet points are available from VFDs?
2. Which points are important to monitor and why?

Abstract
Building Sustainability through Building Automation

Abstract
This session describes four primary areas of achieving sustainability. For each of these areas, common building automation strategies and tactics are discussed. Also, an exemplary case study for each area is summarized.

Learning Objectives
1. Define "building sustainability" and "building automation."
2. Identify four major areas where building automation can influence building sustainability.
3. Describe one or more ways that building automation contributes to each of the four areas.
4. Explain what they can do to ensure a greater level of building sustainability on their next project.

Presenter
Ben Dorney, Vice President of Marketing, KMC Controls

Learning Objectives
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3. Why submit your BACnet Success Story

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Learning Objectives
1. What BACnet points are available from VFDs?
2. Which points are important to monitor and why?
In January 2010, addendum 135-2008w was published, defining 12 new BACnet value object types. Why did the BACnet Committee add so many new object types and how would someone use these to solve building automation problems?

BACnet provides powerful extension mechanisms vendors may use to extend and supplement the standard objects and services. One can add properties to the standard object types and can create new object types if the standard ones do not match the needs of the product under development.

The problem with the extension mechanism is that not enough vendors have provided full support for interoperating with extensions implemented by others. This leads to either more work during the engineering phase or a lack of interoperability on special features that products provide.

The extension mechanism has also gained a bad reputation because vendor-defined objects and properties are labeled “proprietary” by the BACnet standard. This leads to the belief that the extended objects and properties are not interoperable. This only occurs because vendors do not implement full support for the generic extension mechanism defined in the standard.

In contrast, when a vendor implements all of a product’s functionality using a collection of basic BACnet objects (analog, binary and multi-state inputs, outputs and values) instead of adding extension objects and properties, there is usually full interoperability between products. In these implementations, each interesting piece of data in a product is placed in one of the basic BACnet object types.

This common approach to product development has not escaped the notice of the BACnet Committee. On the contrary, the committee recognized the situation and recently made changes to the standard that will make it easier to ensure data can be expressed in basic object types.

The New Value Objects
The addition of value object types for most of the basic BACnet data types allows products to hold in standard objects almost any basic data value. The new object types added in addendum 135-2008w are:

- Integer Value, Positive Integer Value, Large Analog Value
- Date Value, Time Value, DateTime Value
- Date Pattern Value, Time Pattern Value, DateTime Pattern Value
- CharacterString Value
- BitStringValue
- OctetStringValue

The new value object types have been defined with a minimum number of required properties. Each requires the three properties required of all objects (Object_Identifier, Object_Type, and Object_Name) plus Present_Value and Status_Flags. The numeric value object types also require the Units property. This design choice by the BACnet committee minimizes the overhead for simple data values stored in these new value objects.

Although a primary motivation for these new object types was to provide small-footprint data values they are not just simple data values. Most of the new object types also include optional support for intrinsic reporting, command prioritization, and some have support for change of value reporting.

Numeric Value Objects
There are three new numeric value object types added into the standard: Integer Value, Positive Integer Value and Large Analog Value.

In the past, device designers had the choice between an Analog Value and a Multi-State Value object for numeric data. The Analog Value object, the most commonly used object type for numeric data values, has an IEEE 784 single precision floating point Present_Value. This datatype (which has a range ±1038.53 and provides 6 significant digits) suffers from 2 problems:

1. it does not work well for precise integer calculations, and
2. it does not provide sufficient precision for certain applications (e.g. power metering).
The Multi-State object type, while intended for modeling discrete states, can be used to represent positive integer values but there are 2 significant issues with using it for a generic integer data type. The Multi-State Value object cannot hold the value 0, and it is required to have a character string description for each of its – potentially many – values.

The new Integer Value and Positive Integer Value object types allow for proper representation of integer data values. They do not suffer from the calculation issues of the Analog Value object, nor do they suffer either of the problems noted with Multi-State Value objects. While the new integer value types theoretically have an unbounded value range, BACnet devices commonly limit internal integer and positive integer values to 32 bits which provide the ranges shown in **Range A** below.

The new Large Analog Value object type provides better value range and precision that the existing Analog Value object type. The ranges and precisions of the two analog value object types are shown below in **Range B**. This greater range and greater accuracy will be useful in many applications.

---

**Date and Time Objects**

The new date and time object types come in two main classes: specific date / time values and date / time patterns.

The pattern values differ from the specific date / time value in that they can contain unspecified values. Unspecified values available in BACnet date and times are listed in the chart to the right.

The pattern values allow the specification of a recurring date or time. Significantly simpler than a Schedule object a device might use these date / time pattern objects for indicating simple scheduling (that relies on a single rule instead of the set of complex rules contained in a Schedule object).

The non-pattern date / time objects will be useful for devices that need to record when an action is going to occur. If the time that an action is to be executed is not governed by a schedule but rather by a calculation, these objects provide an excellent location for indicating when the action is expected to next occur. For example, a device might use a Date/Time Value object to indicate the next transition to or from daylight savings time.

---

**Range A:**

<table>
<thead>
<tr>
<th>Object Type</th>
<th>Value Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integer Value</td>
<td>-2147483648 .. 2147483647</td>
</tr>
<tr>
<td>Positive Integer Value</td>
<td>0 .. 4294967295</td>
</tr>
<tr>
<td>Analog Value</td>
<td>-9999999 .. 9999999 (accurate integer range)</td>
</tr>
</tbody>
</table>

**Range B:**

<table>
<thead>
<tr>
<th>Object Type</th>
<th>Value Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog Value</td>
<td>± ~1038.53 with 6 significant digits</td>
</tr>
<tr>
<td>Large Analog Value</td>
<td>± ~10308.3 with 15 significant digits</td>
</tr>
</tbody>
</table>

---

**Unspecified Date Values**

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>unspecified</td>
<td>Can be used in any of the date fields and is used to match to any valid value.</td>
</tr>
<tr>
<td>even months</td>
<td>Matches to even months (February, April, etc.)</td>
</tr>
<tr>
<td>odd months</td>
<td>Matches to odd months (January, March, etc.)</td>
</tr>
<tr>
<td>last day of the month</td>
<td>Matches the last day of the month.</td>
</tr>
<tr>
<td>even days</td>
<td>Matches even days of the month.</td>
</tr>
<tr>
<td>odd days</td>
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</tr>
</tbody>
</table>

**Unspecified Time Values**

<table>
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<th>Value</th>
<th>Description</th>
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<tbody>
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<td>unspecified</td>
<td>Can be used in any of the time fields and is used to match to any valid value.</td>
</tr>
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</table>

---

**CharacterString Object**

Before the addition of the new object types, if a product needed a string value and the product was restricted to using standard properties, the only choice the product had for character string values was to use a standard property, such as Description, outside of its intended purpose.

The new character string object type solves this problem. Some expected use cases for the CharacterString object type are: provide access to the text for small displays and annunciator panels; provide textual diagnostic data.

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**BitString Object**

The BitString Value allows a device to have a related set of Boolean values. The Present_Value of the object contains multiple Boolean values that are read and written together. The same information could be modeled with multiple Binary Value objects. A product designer will need to choose which is better for their use case, a set of Binary Values allowing each to be independently written to, or a BitString Value which provides a more compact representation and indicates some form of logical relationship between the values.
OctetString Object

The OctetString Value will mostly likely be the least used of the new object types as the data value of the object will not be as easily understood as that of other types. Given that the data value is an arbitrary sequence of bytes, the value of the object will remain somewhat proprietary. While they can be used interoperably for control, it is more likely that these will be used for diagnostic purposes showing the detail of internal items within a controller or providing a raw configuration item. For example, a BACnet gateway might provide an OctetString Value object for displaying the content of recently sent or received messages on the “other side” of the gateway.

Looking Forward

As mentioned previously, interoperability is more commonly achieved when a collection of basic objects is used in place of a complex proprietary object. The downside is that the relationships between the data values can be lost when an object is broken up into its constituent parts.

To solve the logical grouping problem, the Structured View object can be used. Instead of implementing a proprietary object type, basic BACnet objects are used, one for each data value, and the Structured View object is used to collect all of the data values together into a single grouping.

The benefit of this approach is twofold:

- those devices that understand the Structured View based model can determine the semantics of individual basic BACnet objects, and
- those devices that do not have knowledge of the models can still easily consume the data because the data values reside in known object types (basic value objects).

As of this writing (April 2012), the BACnet Committee’s proposed direction for modeling standard complex systems is in an Advisory Public Review. The feedback from the public will drive the ultimate direction that the BACnet standard takes. Regardless, these new objects are in the standard and are available for product designers to use to design better solutions to the problems found in building automation.
Introduction to the BACnet Discovery Tool
Discover and Verify Communication with MS/TP Devices
by Bill Greer, Contemporary Controls

Contemporary Controls has developed a vendor-neutral BACnet Discovery Tool (BDT) to determine if a BACnet router is successfully communicating to attached devices. As part of Contemporary Controls’ ongoing mission to simplify the use of BACnet, the BDT is available as a free download from the Contemporary Controls website.

BDT is a BACnet/IP application for Windows® that is easy to install and use. It is an excellent means for discovering and verifying communication with MS/TP devices that are being accessed through BACnet/IP routers such as those available from Contemporary Controls: the BASRT-B DIN-rail mounted BACnet/IP-to-MS/TP router — or its portable counterpart, the BASRT-B. At Contemporary Controls, we use BDT with equipment from different BACnet vendors to prove our routers operate with different equipment configurations.

BDT has proved to be very popular — as one satisfied user reports:

After downloading BDT from Contemporary Controls, unzip its file set to any location on your host PC hard drive (be sure to keep all the files together at the chosen location). The file set will include an instruction sheet in PDF format and the following four files:

- bacnet-stack.dll
- BDT 2.03.00.exe
- msvc71d.dll
- msvc71d.dll

If you are not using Windows 7, double-click on the BDT2.03.00.exe file to launch BDT. But if you are using Windows 7, right click the file name, choose to “Run as Administrator” and click “Yes” in the dialog that appears — otherwise, BDT will not function properly.

When you attempt to open BDT, Windows may warn you that the file has no valid digital signature. It is safe to ignore this warning and proceed.

Before initiating any BDT activity, you should determine the scope of what you wish to accomplish. The first thing to consider is whether or not your BACnet internetwork crosses IP subnets — and is therefore using a BACnet/IP Broadcast Management Device (BBMD). If a BBMD is present, you may wish to use it to examine more of the BACnet internetwork than just your local subnet. You can do this by using the BDT’s Foreign Device function properly.

NOTE: When you click on the Set BBMD button, registration is completed.

Setting the BBMD, if needed. In the BBMD Address field, enter the IP address of the BBMD with which you wish to register. (You do not specify a subnet mask — this is determined by other equipment in the network.) In some larger networks with several subnets, there may be multiple BBMDs. In such cases, you would normally register with the central BBMD and thus access the entire BACnet internetwork. You could perform FDR with a non-central BBMD on a specific subnet, but you may not know the extent to which the various BBMDs are sharing information — and you might not access the devices that you need to contact. Targeting the central BBMD is almost always the best option. When you click on the Set BBMD button, registration is completed.

Using the Search function. After setting the BBMD (if needed) and with your host PC attached to the network of interest, click the Search button — not the Scan button, which should only be used after a search has built a database of objects. As the Search function runs, it transmits BACnet Who-Is messages and a progress bar appears. NOTE: BDT sends a BACnet/IP Who-Is — not a BACnet/IP Broadcast Management Device (BBMD). If a BBMD is present, you may wish to use it to examine more of the BACnet internetwork than just your local subnet. You can do this by using the BDT’s Foreign Device function properly.

Each 1-Am response identifies the:

- the Device Instance number of the responding device
- the Device Name of the device
- the IP Address and UDP Port number through which the device was contacted
- and (for MS/TP master devices) the MS/TP Network number and MS/TP MAC Address

Each piece of equipment producing an 1-Am response could be simply a BACnet/IP device — or it could be a BACnet/IP to BACnet MS/TP router acting as an intermediary for devices on the MS/TP side. If the reported Device Instance is that of an MS/TP device, then the MS/TP Network and MAC information will complete the line.

To investigate the objects contained by any discovered device, double-click that device’s line in the discovered device list. A new window will appear (the pop-up in Figure 1 below) and display a list of the discovered objects within the selected device. Also, the number of discovered objects will be reported in the Objects field. BDT can support up to 1000 devices and each device can have up to 2000 objects.

BDT 2.03 has become one of the BACnet applications I have begun to rely on when discovering BACnet devices and objects. For a quick snapshot of networks and the MAC addresses of the controllers on them is as easy as one click, and the support of BBMD to connect to remote sites is a great feature. The ability to scan the present values of all supported BACnet objects in discovered devices and the ability to write to the present value (at selectable priority levels) of certain objects make BDT 2.03 one of the most user-friendly downloadable BACnet applications on the web.

FIGURE 1: DISCOVERED OBJECTS LIST

Previous

JUMP TO ARTICLE

Next
Executing the Search function creates an object database that is used by the Scan function. Clicking the Scan button opens a window where you will see a bar indicating the progress in Building Object — that is, creating a scan list of objects extracted from the object database. As the list is built, the current Device and its Object are identified in their respective fields.

After the scan object list has been built, the scan proceeds as shown in Figure 3. As the list is scanned, the current Device and its Object being scanned are identified in their respective fields. If an object fails to report its data, BDT retries the data acquisition four times before registering an error and moving on to the next object. These two fields — Errors and Retries — are incremented without reset for as long as the scan proceeds. You can also Pause the scan, if needed.

When scanning for present-values, BDT will display the currently read values. When all objects have been read, BDT will start displaying again — at the first line. Because present-values will appear in the same place in the display, current values can be viewed by scrolling the list up or down. If a present-value cannot be read, an error statement will occupy a line in the list.

When you are finished with scanning, click the OK button to terminate the scan. When you are finished with the BDT, close all of its windows.

To download BDT, go to www.ccontrols.com/bdt.
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