



BACrest API v1.1

NOTE: Device protocol mappings
are detailed in other documents.

Manual v1.1

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1 Introduction

1.1 The BACrest concept



The **Cimetrics BACrest API** (Application Program Interface) is a **specification** that let's you **read and write data** to device-centric networks using URL-like commands.

The meaning of the word BACrest is **B**uilding **A**utomation **C**ontrol **R**elational **S**tate **T**ransfer. The "REST" part of this name is a well known IT terminology used to describe the architecture used to create the Internet "URL system". Companies such as Google and Amazon used this technology to allow reading and writing to resources on their servers and databases. We have created a version of "REST" that applies to the needs of device-centric networks.

BACrest has been designed to map easily to the most common functions of popular HVAC and Industrial protocols. The set of design choices that we made were based on our desire to create **the simplest yet most powerful data exchange methodology** the integrated Building industry has ever seen.

Some of the powerful characteristics of BACrest are:

- 1) Read and Write commands are simple URL's
- 2) XML or HTML data return
- 3) unlimited scalability
- 4) communications is fully "IT friendly"
- 5) machine to machine compatible
- 6) maps to ANY device-centric protocol
- 7) optional free form text labels
- 8) Data access is fully defined (acts as a firewall)

1.2 Nodes - Attributes - ChildNodes - Paths

Nodes - These are the fundamental data elements which represent everything within the BACrest gateway and ALL of the data within the devices on the device network. Sometimes these are nodes that represent **physical elements** such as analog voltage measurements from sensors, and **virtual elements** such as a metadata within a device.

Attributes - Node have "**attributes**" and attributes have "**values**". Attribute datatypes can be any of the following primitive datatypes:

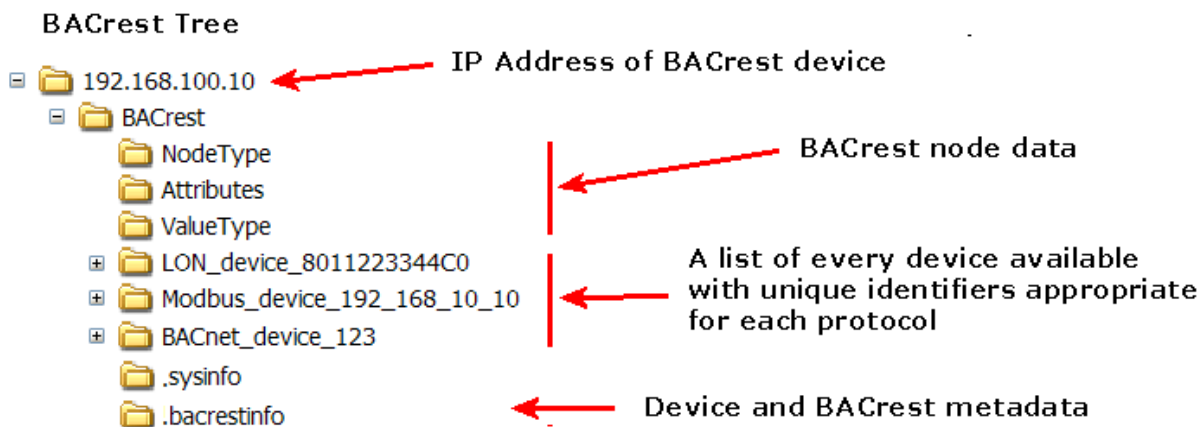
String	Integer
Multistate	Boolean
Date	Time
DateTime	Duration

Nodes that have a value may also have other attributes related to that value, such as minimum, writable, units, etc.

ChildNodes - Nodes that are associated as a "descriptive subset" of a Parent node are called ChildNodes.

Paths - The nodes in BACrest have a "**path**" hierarchy similar to the file hierarchy in your PC's hard drive or the Internet. The hierarchy of nodes is reflected as a hierarchy of identifiers separated by forward slash characters ("/") arranged as a delimited series. These then act as a **Uniform Resource Locator (URL)** which is specifically addressed to the BACrest gateway, and also uniquely identifies a piece of data on the device network.

BACrest nodes can have two identifiers; the "**Default path**" which is created automatically by a BACrest device and is unmutable, and an optional "**Free form path**" which is created by an "administrator" during device configuration. The path hierarchy can be represented as a tree structure like this:



NOTE: The example above represents a gateway with support for three device networks each with one device. Typical BACrest gateways interface to one network with many devices.

The following URL's are examples of paths that are used to read and write data within the system:

<http://192.168.100.10/BACrest>

http://192.168.100.10/BACrest/BACnet_device_123

http://192.168.100.10/BACrest/LON_device_8011223344C0

http://192.168.100.10/BACrest/Modbus_device_192_168_10_10

<http://192.168.100.10/BACrest/.sysinfo>

NOTE 1: All URL's can be appended with "@username:password" for basic security. Advanced security can be done using tradiional SSL or VPN technologies.

1.3 Reading and Writing

Here are examples of how one reads and writes to BACrest nodes. **BACrest command examples**

(READING the exact same sensor): http://10.1.68.2/BACrest/BACnet_device_1409449/binary-input_1

(see NOTE 1) http://10.1.68.2/BACrest/BACnet_device_1409449/binary-input_1/Value (see NOTE 1)

http://10.1.68.2/BACrest/BACnet_device_1409449/binary-input_1@username:password (see NOTE 2)

http://10.1.68.2/BACrest/Occupancy_sensor_1 (see NOTE 3)

http://10.1.68.2/BACrest/ABC_Building/Room_22/Occupancy_sensor_1@username:password (see NOTE 4)

NOTE 1: This is valid when the BACrest installer does not require username and password. The Attribute named "Value" is the default if you do not specify an Attribute.

NOTE 2: This is valid when the BACrest installer has specified that a username and password is required. You can specify the Attribute "Value" if you want, but this is the default so in this case, it is not necessary.

NOTE 3: This is valid when the BACrest installer mapped the free form text "Occupancy_sensor_1" to "BACnet_1409449/binary_input_1" with no security required.

NOTE 4: This is valid when the BACrest installer mapped "ABC_Building/Room_22/Occupancy_sensor_1" to the same sensor with security required.

All of the commands above would return the following XML which (in the case of BACnet) is the appropriate **"Active_Text"** and **"Inactive_Text"** that is contained within the BACnet device (from any manufacturer). The following example text "No people" would have been written into the device during regular facility network setup (not BACrest setup) by the installer.

XML return:

```
<?xml version="1.0" ?>
<BACrest:SetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/BACnet_device_1409449/binary-
input_1</BACrest:NodePath>
  <BACrest:AttributeName>Value</BACrest:AttributeName>
  <BACrest:return>No people</BACrest:return>
</BACrest:SetValue >
```

BACrest command (WRITING to the exact same relay):

http://10.1.68.2/BACrest/BACnet_device_123/binary-output_4/Value/ON (see NOTE 5)

http://10.1.68.2/BACrest/BACnet_device_123/binary-output_4/Value/ON@username:password (see

NOTE 6) http://10.1.68.2/BACrest/Security_system/Value/ON (see NOTE 7)

http://10.1.68.2/BACrest/ABC_Building/Security_System/Value/ON@username:password (see NOTE 8)

NOTE 5: This is valid when the BACrest installer does not require username and password. The Attribute named "Value" must be specified and one of the "PossibleValues" which in this case is "ON" and "OFF".

NOTE 6: This is the same situation as the URL above it, but the BACrest installer has specified that a username and password is required.

NOTE 7: This is valid when the BACrest installer mapped the free form text "Security_system" to "BACnet_123/binary_output_4" with no security required.

NOTE 8: This is valid when the BACrest installer mapped "ABC_Building/Security_system" to the same sensor with security required.

All of the commands above would return the following XML which (in the case of BACnet) is the appropriate "**Active_Text**" and "**Inactive_Text**" that is contained within the BACnet device (from any manufacturer). The following example text "ON" would have been written into the device during regular facility network setup (not BACrest setup) by the installer.

XML return:

```
<?xml version="1.0" ?>
<BACrest:SetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/ABC_Building/Security_system</BACrest:NodePath>
  <BACrest:AttributeName>Value</BACrest:AttributeName>
  <BACrest:return>ON</BACrest:return>
</BACrest:SetValue >
```

1.4 Free form text URL's

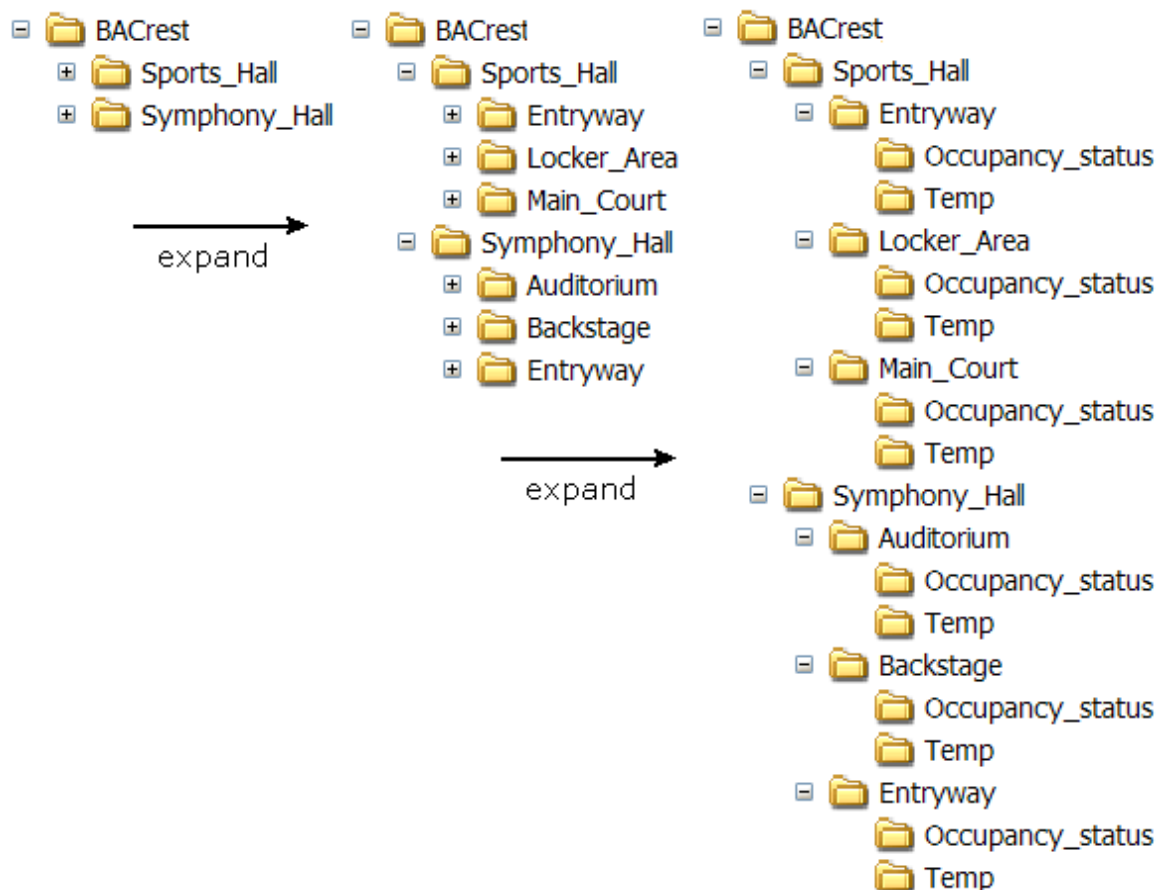
In all BACrest gateways (or dedicated function BACrest devices), the installation person can define simple names for the protocol specific paths. **A free form text path is a "link"** to a default device path (such as BACnet_device_123/analog-output_1). You can make these free form links in two ways:

No hierarchy references - This means that you do not use forward slash ("/"). So all references are thought of as being in the same tree. Examples of these are replacing with ".../Toms_Office_Temp" , and ".../Karens_Office_Temp", and ".../Security_Lights".

Hierarchical references - When you use a forward slash ("/"), you create hierarchical groupings. You may freely choose how many levels are within this hierarchy. This can be used to create logical control group labels such as **building name/location name/function** . The commands and hierarchy would then look like this:

http://10.1.68.2/BACrest/Symphony_Hall/Backstage/Occupancy_status

Here is an example of a three level hierarchy which use this technique:



Here are some examples of the URL's that one would use to read and write data from this system:

READ Examples

http://10.1.68.2/BACrest/Sports_Hall/Entryway/Temp

http://10.1.68.2/BACrest/Symphony_Hall/Backstage/Occupancy_status

http://10.1.68.2/BACrest/Symphony_Hall/Auditorium/Temp

WRITE Examples

http://10.1.68.2/BACrest/Sports_Hall/Entryway/Temp/Value/70

http://10.1.68.2/BACrest/Symphony_Hall/Auditorium/Temp/Value/72

NOTE 1: All URL's can be appended with "@username:password" for basic security. Advanced security can be done using traditional SSL or VPN technologies.

NOTE 2: In theory, any number of links can be created to the same default path, however, some BACrest devices choose to place a limit of one free form text link per default path to save memory within the device.

1.5 Node Control List (NCL)

A Node Control List is a file which an installer creates to **define EXACTLY what data is allowed to be accessed** using the BACrest gateway. In other words, this **acts just like a "firewall"** between the device network and the outside world.

The NCL is created using a **Cimetrics software program** that lets you define the following:

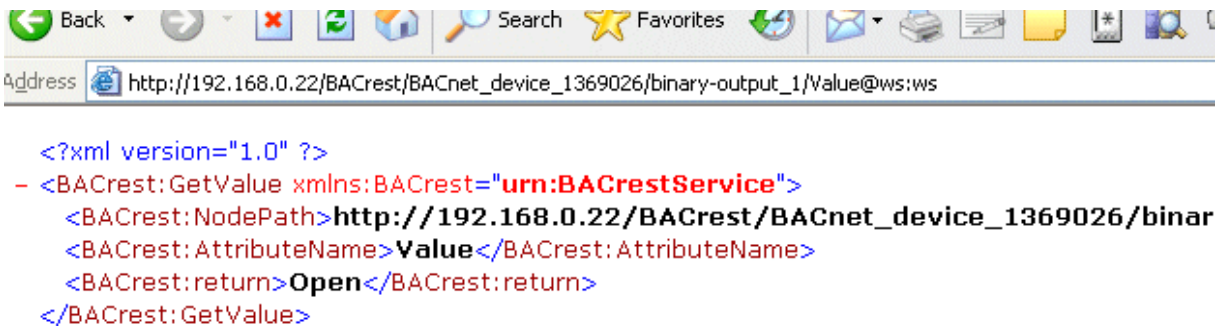
- Nodes that are allowed to be accessed via BACrest (default paths)
- "free-form text" paths to any of these nodes
- Read or read/write characteristics for each of these nodes
- Optional system and installer metadata

As of this writing, we have two software tools; an advanced BACnet discovery and node selection program and a universal mapping tool for any device-centric protocol which let's you entered the "allowed" nodes into an Excel spreadsheet. **Please contact Cimetrics for the latest NCL creator tools.**

1.6 Data returns (XML or HTML)

When you send a read or write command to a BACrest device, data is sent back to you (a "return"). The two returns that we support are XML and HTML.

XML return:



The screenshot shows a web browser window with the address bar containing the URL: `http://192.168.0.22/BACrest/BACnet_device_1369026/binary-output_1/Value@ws:ws`. The main content area displays the following XML response:

```
<?xml version="1.0" ?>
- <BACrest:GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://192.168.0.22/BACrest/BACnet_device_1369026/binar
  <BACrest:AttributeName>Value</BACrest:AttributeName>
  <BACrest:return>Open</BACrest:return>
</BACrest:GetValue>
```

NOTE: ws:ws is the default username:password in the Cimetrics Eplus products.

You can also specify a browser friendly HTML return by adding the **transform=true** option. This return is an example of the **inherent discovery** mechanism in BACrest. You can discover EVERY node just by clicking on HTML links.

HTML return:



The screenshot shows a web browser window with the address bar containing the URL: `http://192.168.0.22/BACrest/BACnet_device_1369026/binary-output_1/Value?transform=true@ws:ws`. The main content area displays the following HTML response:

Cimetrics BACrest HTML Example page

BACrest command

http://192.168.0.22/BACrest/BACnet_device_1369026/binary-output_1/Value

Node Path

http://192.168.0.22/BACrest/BACnet_device_1369026/binary-output_1

Attribute name

Value

Return value

Open

1.7 Inherent discovery

The ability to discover all characteristics of the device network is a powerful feature of the BACrest technology. By starting with the [http://\[IP Address\]/BACrest](http://[IP Address]/BACrest) command, you will get all information concerning the root node. By following the ChildNodes, you are able to discover all characteristics of the available device nodes.

BACrest command:

<http://10.1.68.2/BACrest>

XML return:

```
<?xml version="1.0" ?>
<BACrest:GetValue xmlns:BACrest="urn:BACrestService">
<BACrest: NodeContent xmlns:BACrest="urn:BACrestService" xmlns:xlink="http://www.w3.org/1999/xlink">
  <BACrest:Attribute xlink:href="http://10.1.68.2/BACrest/NodeType" />
  <BACrest:ChildNode xlink:href="http://10.1.68.2/BACrest/Attributes" />
  <BACrest:ChildNode xlink:href="http://10.1.68.2/BACrest/ValueType" />
  <BACrest:ChildNode xlink:href="http://10.1.68.2/BACrest/BACnet_device_1409449" />
  <BACrest:ChildNode xlink:href="http://10.1.68.2/BACrest/.sysinfo" />
  <BACrest:ChildNode xlink:href="http://10.1.68.2/BACrest/.bacrestinfo" />
</BACrest:NodeContent>
```

NOTE: Attributes describe the "BACrest" node. ChildNodes are nodes that have more information inside of them.

====

What nodes does BACnet_device_1409449 have ?

BACrest command:

http://10.1.68.2/BACrest/BACnet_device_1409449

XML return:

```
<?xml version="1.0" ?>
<BACrest:GetValue xmlns:BACrest="urn:BACrestService">
<BACrest:NodeContent>
  <BACrest:Attribute xlink:href="http://10.1.74.1/BACrest/BACnet_device_1369026/NodeType@ws:ws"/>
  <BACrest:Attribute
xlink:href="http://10.1.74.1/BACrest/BACnet_device_1369026/NodeSubtype@ws:ws"/>
  <BACrest:Attribute xlink:href="http://10.1.74.1/BACrest/BACnet_device_1369026/Attributes@ws:ws"/>
  <BACrest:Attribute xlink:href="http://10.1.74.1/BACrest/BACnet_device_1369026/ValueType@ws:ws"/>
  <BACrest:Attribute xlink:href="http://10.1.74.1/BACrest/BACnet_device_1369026/Children@ws:ws"/>
  <BACrest:Attribute xlink:href="http://10.1.74.1/BACrest/BACnet_device_1369026/Description@ws:ws"/>
  <BACrest:Attribute
xlink:href="http://10.1.74.1/BACrest/BACnet_device_1369026/DisplayName@ws:ws"/>
  <BACrest:Attribute
xlink:href="http://10.1.74.1/BACrest/BACnet_device_1369026/HasDynamicChildren@ws:ws"/>
  <BACrest:Attribute
xlink:href="http://10.1.74.1/BACrest/BACnet_device_1369026/InstanceNumber@ws:ws"/>
  <BACrest:Attribute xlink:href="http://10.1.74.1/BACrest/BACnet_device_1369026/vendor-
name@ws:ws"/>
  <BACrest:Attribute xlink:href="http://10.1.74.1/BACrest/BACnet_device_1369026/model-
name@ws:ws"/>
  <BACrest:Attribute xlink:href="http://10.1.74.1/BACrest/BACnet_device_1369026/software-
version@ws:ws"/>
  <BACrest:Attribute xlink:href="http://10.1.74.1/BACrest/BACnet_device_1369026/vendor-id@ws:ws"/>
  <BACrest:Attribute xlink:href="http://10.1.74.1/BACrest/BACnet_device_1369026/database-
version@ws:ws"/>
  <BACrest:ChildNode xlink:href="http://10.1.74.1/BACrest/BACnet_device_1369026/binary-
input_1@ws:ws"/>
  <BACrest:ChildNode xlink:href="http://10.1.74.1/BACrest/BACnet_device_1369026/binary-
```

```

    input_2@ws:ws"/>
    <BACrest:ChildNode xlink:href="http://10.1.74.1/BACrest/BACnet_device_1369026/binary-
    output_1@ws:ws"/>
    <BACrest:ChildNode xlink:href="http://10.1.74.1/BACrest/BACnet_device_1369026/binary-
    output_2@ws:ws"/>
    <BACrest:ChildNode xlink:href="http://10.1.74.1/BACrest/BACnet_device_1369026/binary-
    output_3@ws:ws"/>
    <BACrest:ChildNode xlink:href="http://10.1.74.1/BACrest/BACnet_device_1369026/binary-
    output_4@ws:ws"/>
    <BACrest:ChildNode xlink:href="http://10.1.74.1/BACrest/BACnet_device_1369026/binary-
    output_5@ws:ws"/>
    <BACrest:ChildNode xlink:href="http://10.1.74.1/BACrest/BACnet_device_1369026/binary-
    output_6@ws:ws"/>
  </BACrest:NodeContent>

```

====

What data is available for binary-output_1 ?

BACrest command:

http://10.1.68.2/BACrest/BACnet_device_1409449/binary-output_1

XML return:

```

<?xml version="1.0" ?>
<BACrest:GetValue xmlns:BACrest="urn:BACrestService">
<BACrest:NodeContent xmlns:BACrest="urn:BACrestService" xmlns:xlink="http://www.w3.org/1999/xlink">
  <BACrest:Attribute xlink:href="http://10.1.68.2/BACrest/BACnet_device_1409449/NodeType />
  <BACrest:Attribute xlink:href="http://10.1.68.2/BACrest/BACnet_device_1409449/NodesubType />
  <BACrest:Attribute xlink:href="http://10.1.68.2/BACrest/BACnet_device_1409449/Attributes />
  <BACrest:Attribute xlink:href="http://10.1.68.2/BACrest/BACnet_device_1409449/ValueType />
  <BACrest:Attribute xlink:href="http://10.1.68.2/BACrest/BACnet_device_1409449/Value />
  <BACrest:Attribute xlink:href="http://10.1.68.2/BACrest/BACnet_device_1409449/Writable />
  <BACrest:Attribute xlink:href="http://10.1.68.2/BACrest/BACnet_device_1409449/Description />
  <BACrest:Attribute xlink:href="http://10.1.68.2/BACrest/BACnet_device_1409449/DisplayName />
  <BACrest:Attribute xlink:href="http://10.1.68.2/BACrest/BACnet_device_1409449/PossibleValues />
  <BACrest:Attribute xlink:href="http://10.1.68.2/BACrest/BACnet_device_1409449/WritableValues />
  <BACrest:Attribute xlink:href="http://10.1.68.2/BACrest/BACnet_device_1409449/InstanceNumber />
  <BACrest:Attribute xlink:href="http://10.1.68.2/BACrest/BACnet_device_1409449/DeviceType />
  <BACrest:Attribute xlink:href="http://10.1.68.2/BACrest/BACnet_device_1409449/Polarity />
</BACrest:NodeContent>

```

====

What are valid entries for the Value attribute in binary-output_1 ?

BACrest command:

http://10.1.68.2/BACrest/BACnet_device_1409449/binary-output_1/PossibleValues

XML return:

```

<?xml version="1.0" ?>
<BACrest:GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.74.1/BACrest/BACnet_device_1369026/binary-
  output_1</BACrest:NodePath>
  <BACrest:AttributeName>PossibleValues</BACrest:AttributeName>
  <BACrest:return>Closed;Open</BACrest:return>
</BACrest:GetValue>

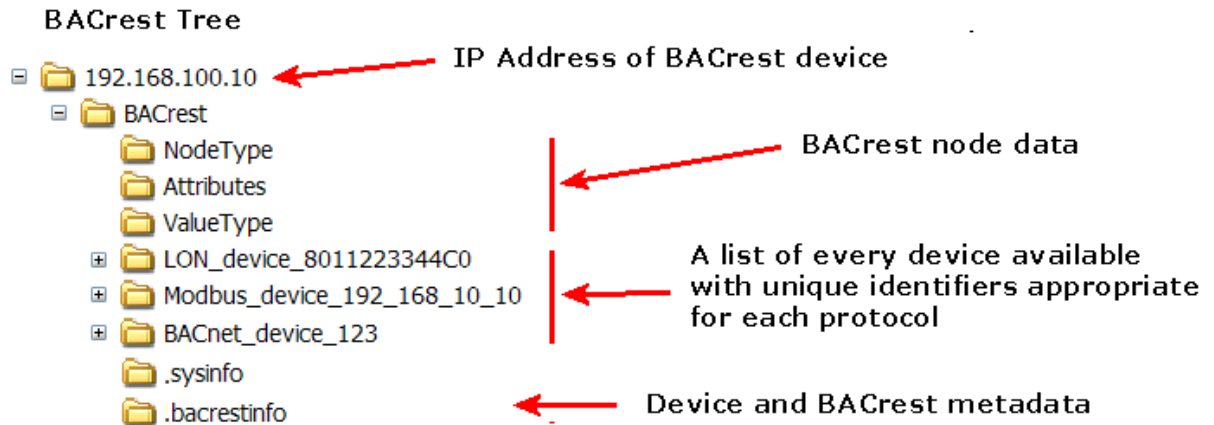
```

====

2 The BACrest Data Model

2.1 Data Model Overview

The principle elements of BACrest are:



- simple "URL- like" paths
- read/write access to ANY device-centric networks
- information is contained within "nodes"
- the root node ([IP Address]/BACrest) has children but no parent
- nodes are arranged as a hierarchy (similar to a hard disk file structure)
- all other nodes have a single parent and may have children
- the information within a node is exposed as attributes
- device-centric paths may have "free form text" URL's which link to them
- returns are formatted as XML or HTML (using XSLT transform)
- optional return modifiers

3 Attributes

3.1 Attribute Overview

An attribute is a single aspect or quality of a node, such as its value or its units or its writability. Every node exposes a collection of attributes. Some attributes are always available for all nodes, and some are conditionally available based on the value of other attributes.

In BACrest v1.0, the supported node attributes are:

	BACrest Attribute	Presence
1	NodeType	required for every node
2	NodeSubtype	optional
3	Attributes	required for every node
4	ValueType	required for every node
5	Value	required if ValueType is not "None"
6	Writable	required if ValueType is not "None"
7	Description	optional
8	DisplayName	optional
9	Resolution	optional
10	Maximum	optional
11	Minimum	optional
12	Units	required if ValueType is "Real" or "Integer"
13	PossibleValues	required if ValueType is "Multistate" or "Boolean"
14	WritableValues	required if ValueType is "Multistate" or "Boolean" and Writable is "true"
15	InstanceNumber	required if Node represents a BACnet device or BACnet object or BACnet property
16	DeviceType	optional
17	Polarity	optional
18	Scale	optional
19	vendor-name	required for BACrest system node

	BACrest Attribute	Presence
20	model-name	required for BACrest system node
21	software-version	required for BACrest system node
22	vendor-id-tvpe	required for BACrest system node
23	vendor-id	required for BACrest system node
24	protocol-support	required for BACrest system node
25	datalink-support	required for BACrest system node
26	bacrest-version	required for BACrest system node
27	ncl-file-name	required for BACrest system node
28	net-file-version	required for BACrest system node
29	installer-company	required for BACrest system node
30	installer-name	required for BACrest system node
31	installer-email	required for BACrest system node
32	installer-!If	required for BACrest system node
33	database-version	required if Node represents a BACnet device
34	svstem-comments	required for BACrest system node
35	HasDvynamicChildren	optional
36	Children	required if node has one or more child nodes
37	HasHistory	required if ValueType is not "None"

3.2 1 - NodeType

This attribute indicates the general classification of a node. BACrest v1.0 supports the following values: "Device" (a physical device), and "Point" (a single data point representing a physical input or output of a control or monitoring device)

Attribute location: In a device on the target network.

BACrest command example 1:

http://10.1.68.2/BACrest/BACnet_device_1409449/binary-output_1/NodeType@username:password

XML return 1:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/BACnet_device_1409449/binary-
  output_1</BACrest:NodePath>
  <BACrest:AttributeName>NodeType</BACrest:AttributeName>
  <BACrest:return>Point</BACrest:return>
</BACrest: GetValue>
```

BACrest command example 2:

http://10.1.68.2/BACrest/Modbus_device_192_168_10_10/coil_1/NodeType@username:password

XML return 2:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/Modbus_192_168_10_10/coil_1</BACrest:No
  dePath>
  <BACrest:AttributeName>NodeType</BACrest:AttributeName>
  <BACrest:return>Point</BACrest:return>
</BACrest: GetValue>
```

3.3 2 - NodeSubType

This optional attribute is a string of printable characters whose content is not restricted. The manufacturer or administrator may have entered further information about this data point.

Attribute location: In a device on the target network.

BACrest command example 1:

http://10.1.68.2/BACrest/BACnet_device_1409449/binary-output_1/NodesubType@username:password

XML return 1:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/BACnet_device_1409449/binary-
output_1</BACrest:NodePath>
  <BACrest:AttributeName>NodeSubType</BACrest:AttributeName>
  <BACrest:return>binary output</BACrest:return>
</BACrest:GetValue>
```

BACrest command example 2:

http://10.1.68.2/BACrest/Modbus_device_4/NodeSubType@username:password

XML return 2:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/Modbus_device_4</BACrest:NodePath>
  <BACrest:AttributeName>NodeSubType</BACrest:AttributeName>
  <BACrest:return>Modbus device</BACrest:return>
</BACrest: GetValue>
```

3.4 3 - Attributes

This A list of the actual set of attributes that are available for a particular node depends on the "ValueType" and can be obtained by reading the "Attributes" attribute.

Attribute location: In a device on the target network. **BACrest command**

example 1:

http://10.1.68.2/BACrest/BACnet_device_1409449/Attributes@username:password

XML return 1:

XML return 1:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
<BACrest:NodePath>http://10.1.68.2/BACrest/BACnet_device_1409449</BACrest:NodePath>
<BACrest:AttributeName>Attributes</BACrest:AttributeName>
<BACrest:return>NodeType;NodeSubType;ValueType;Attributes;Description;DisplayName;InstanceNumber;software-version;vendor-name;model-name;vendor-id</BACrest:return>
</BACrest: GetValue>
```

BACrest command example 2:

http://10.1.68.2/BACrest/Modbus_2/Attributes@username:password

XML return 2:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
<BACrest:NodePath>http://10.1.68.2/BACrest/Modbus_device_2</BACrest:NodePath>
<BACrest:AttributeName>Attributes</BACrest:AttributeName>
<BACrest:return>NodeType;NodeSubType;Attributes;ValueType;InstanceNumber</BACrest:retu
rn>
</BACrest: GetValue>
```

3.5 4 - ValueType

This attribute indicates the datatype of the Value attribute and attributes restricting the Value attribute.

Attribute location: In a device on the target network.

BACrest command example 1:

http://10.1.68.2/BACrest/BACnet_device_1409449/binary-output_1/ValueType@username:password

XML return 1:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/BACnet_device_1409449/binary-
output_1</BACrest:NodePath>
  <BACrest:AttributeName>ValueType</BACrest:AttributeName>
  <BACrest:return>Boolean</BACrest:return>
</BACrest: GetValue>
```

Possible values are:

None: Used when the node does not have a value.

String: Character string values that are intended to be human readable.

OctetString: Arbitrary binary data that is typically not human readable.

Real: A floating point value, for example 75.6.

Integer: Values that are expressed in whole numbers, for example, 1234.

Multistate: A value that is a choice from a set of named states, for example, {"high", "medium", "low"}.

Boolean: A choice between exactly two named states, such as "active" and "inactive", one of which is considered true and the other false. A "New value" for the "Boolean" nodes must be one of the "WritableValues" attributes or be the "SWITCH" string.

Date: Values that are calendar dates.

Time: A time of day.

DateTime: An exact moment in time, specifying both a date and a time.

Duration: A time span, such as "5 seconds."

3.6 5 - Value

This attribute represents the value of the node. The datatype of this attribute is indicated by the ValueType attribute. The Value attribute is present if and only if the value of the ValueType attribute is not "None".

Attribute location: In a device on the target network.

BACrest command example 1:

http://10.1.68.2/BACrest/BACnet_device_1409449/analog-input_1/Value@username:password

or

http://10.1.68.2/BACrest/BACnet_device_1409449/analog-input_1@username:password

XML return 1:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/BACnet_device_1409449/analog-
input_1</BACrest:NodePath>
  <BACrest:AttributeName>Value</BACrest:AttributeName>
  <BACrest:return>32.4</BACrest:return>
</BACrest: GetValue>
```

BACrest command example 2:

http://10.1.68.2/BACrest/Modbus_device_192_168_10_10/holding-register_4/Value@username:password

or

http://10.1.68.2/BACrest/Modbus_device_192_168_10_10/holding-register_4@username:password

XML return 2:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/Modbus_device_192_168_10_10/holding-
register_4</BACrest:NodePath>
  <BACrest:AttributeName>Value</BACrest:AttributeName>
  <BACrest:return>133</BACrest:return>
</BACrest: GetValue>
```

3.7 6 - Writable

This attribute indicates whether the Value attribute is writable by a BACrest command. This attribute is available if and only if the Value attribute is present.

Attribute location: In a device on the target network.

BACrest command example:

http://10.1.68.2/BACrest/BACnet_device_1409449/analog-input_1/Writable@username:password

XML return:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/BACnet_device_1409449/analog-
input_1</BACrest:NodePath>
  <BACrest:AttributeName>Writable</BACrest:AttributeName>
  <BACrest:return>false</BACrest:return>
</BACrest: GetValue>
```


3.8 7 - Description

This attribute is a string of printable characters whose content is not restricted.

Attribute location: In a device on the target network.

BACrest command example:

http://10.1.68.2/BACrest/BACnet_device_1409449/analog-input_1/Description@username:password

XML return:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/BACnet_device_1409449/analog-
input_1</BACrest:NodePath>
  <BACrest:AttributeName>Description</BACrest:AttributeName>
  <BACrest:return>ABC Building roof temp sensor</BACrest:return>
</BACrest: GetValue>
```

3.9 8 - DisplayName

This attribute is a string of printable characters whose content is not restricted. It is used to provide a short (10-30 character) descriptive name or title. This would typically be entered by the administrator during installation setup.

Attribute location: In a device on the target network.

BACrest command example:

http://10.1.68.2/BACrest/BACnet_device_1409449/analog-input_1/DisplayName@username:password

XML return:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/BACnet_device_1409449/analog-
input_1</BACrest:NodePath>
  <BACrest:AttributeName>DisplayName</BACrest:AttributeName>
  <BACrest:return>Outside Air Temperature</BACrest:return>
</BACrest: GetValue>
```

3.10 9 - Resolution

This attribute indicates the smallest change that can be represented in the value of the Value attribute.

Attribute location: In a device on the target network.

BACrest command example:

http://10.1.68.2/BACrest/BACnet_device_1409449/binary-output_1/Resolution@username:password

XML return:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/BACnet_device_1409449/analog-
input_1</BACrest:NodePath>
  <BACrest:AttributeName>Resolution</BACrest:AttributeName>
  <BACrest:return>0.097965</BACrest:return>
</BACrest: GetValue>
```

3.11 10 - Maximum

This attribute indicates the maximum value of the Value attribute.

Attribute location: In a device on the target network.

BACrest command example:

http://10.1.68.2/BACrest/BACnet_device_1409449/analog-output_1/Maximum@username:password

XML return:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/BACnet_device_1409449/analog-
output_1</BACrest:NodePath>
  <BACrest:AttributeName>Maximum</BACrest:AttributeName>
  <BACrest:return>100</BACrest:return>
</BACrest: GetValue>
```

3.12 11 - Minimum

This attribute indicates the minimum value of the Value attribute.

Attribute location: In a device on the target network.

BACrest command example:

http://10.1.68.2/BACrest/BACnet_device_1409449/analog-output_1/Minimum@username:password

XML return:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/BACnet_device_1409449/analog-
output_1</BACrest:NodePath>
  <BACrest:AttributeName>Minimum</BACrest:AttributeName>
  <BACrest:return>0</BACrest:return>
</BACrest: GetValue>
```

3.13 12 - Units

This attribute defines the engineering units for the Value attribute of the node. If the ValueType is "Real" or "Integer", then this attribute is required to be present, but may have the value of "no-units". This attribute may not always be available for other values of the ValueType attribute.

Attribute location: In a device on the target network.

BACrest command example:

http://10.1.68.2/BACrest/BACnet_device_1409449/analog-input_1/Units@username:password

XML return:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/BACnet_device_1409449/analog-
output_1</BACrest:NodePath>
  <BACrest:AttributeName>Units</BACrest:AttributeName>
  <BACrest:return>Volts</BACrest:return>
</BACrest: GetValue>
```

3.14 13 - PossibleValues

This attribute contains all of the possible string values for the Value attribute of a node whose ValueType is equal to "Multistate" or "Boolean". For nodes that have a ValueType attribute equal to "Boolean", the first entry in the array corresponds to "true", and the second entry corresponds to "false".

Attribute location: In a device on the target network.

BACrest command example:

http://10.1.68.2/BACrest/BACnet_device_1409449/binary-output_1/PossibleValues@username:password

XML return:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/BACnet_device_1409449/analog-
  output_1</BACrest:NodePath>
  <BACrest:AttributeName>PossibleValues</BACrest:AttributeName>
  <BACrest:return>Open;Closed</BACrest:return>
</BACrest: GetValue>
```

3.15 14 - WritableValues

This attribute contains all of the string values that may be written to the Value attribute of a node whose ValueType is equal to "Multistate" or "Boolean".

Attribute location: In a device on the target network.

BACrest command example:

http://10.1.68.2/BACrest/BACnet_device_1409449/analog-output_1/WritableValues@username:password

XML return:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/BACnet_device_1409449/analog-
output_1</BACrest:NodePath>
  <BACrest:AttributeName>WritableValues</BACrest:AttributeName>
  <BACrest:return>Value</BACrest:return>
</BACrest: GetValue>
```


3.16 15 - InstanceNumber

This attribute contains the number for a device or object. This type of command becomes valuable when you create queries such as "get ALL instance numbers".

Attribute location: In a device on the target network. **BACrest command example:**

http://10.1.68.2/BACrest/BACnet_device_1409449/InstanceNumber@username:password

XML return:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/BACnet_device_1409449</BACrest:NodePath
  >
  <BACrest:AttributeName>InstanceNumber</BACrest:AttributeName>
  <BACrest:return>1409449</BACrest:return>
</BACrest: GetValue>
```

3.17 16 - DeviceType

This attribute contains the number for a device or object. This type of command becomes valuable when you create queries such as "get ALL instance numbers".

Attribute location: In a device on the target network.

BACrest command example:

http://10.1.68.2/BACrest/BACnet_device_1409449/analog-input_1/DeviceType@username:password

XML return:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/BACnet_device_1409449/analog-
input_1</BACrest:NodePath>
  <BACrest:AttributeName>DeviceType</BACrest:AttributeName>
  <BACrest:return>10k type 2 sensor</BACrest:return>
</BACrest: GetValue>
```

3.18 17 - Polarity

This attribute contains information concerning the value property being positive or negative polarity.

Attribute location: In a device on the target network.

BACrest command example:

http://10.1.68.2/BACrest/BACnet_device_1409449/analog-output_1/Polarity@username:password

XML return:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/BACnet_device_1409449/analog-
output_1</BACrest:NodePath>
  <BACrest:AttributeName>Polarity</BACrest:AttributeName>
  <BACrest:return>true</BACrest:return>
</BACrest: GetValue>
```

3.19 18 - Scale

This attribute contains information concerning the scale factor of the value property.

Attribute location: In a device on the target network. **BACrest command example:**

http://10.1.68.2/BACrest/BACnet_device_1409449/accumulator_1/Scale@username:password

XML return:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/BACnet_device_1409449/accumulator_1</BACrest:NodePath>
  <BACrest:AttributeName>Scale</BACrest:AttributeName>
  <BACrest:return>1.2</BACrest:return>
</BACrest: GetValue>
```

3.20 19 - vendor-name

This attribute contains name of the manufacturer of a device.

Attribute location: In both the BACrest gateway and devices on the target network.

BACrest command example:

To get the vendor-name for the BACrest gateway,

<http://10.1.68.2/BACrest/.sysinfo/.BACrest/vendor-name@username:password>

To get the vendor name for a device on the target network,

http://10.1.68.2/BACrest/BACnet_device_24/vendor-name@username:password

Example XML return:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/BACnet_device_24/vendor-
name</BACrest:NodePath>
  <BACrest:AttributeName>vendor-name</BACrest:AttributeName>
  <BACrest:return>Cimetrics</BACrest:return>
</BACrest: GetValue>
```

3.21 20 - model-name

This attribute contains manufacturers formal name of the device.

Attribute location: In both the BACrest gateway and devices on the target network.

BACrest command example:

To get the model name for the BACrest gateway,

<http://10.1.68.2/BACrest/.sysinfo/.BACrest/model-name@username:password>

To get the model name for a device on the target network,

http://10.1.68.2/BACrest/BACnet_device_24/model-name@username:password

Example XML return:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/BACnet_device_24/model-
name</BACrest:NodePath>
  <BACrest:AttributeName>model-name</BACrest:AttributeName>
  <BACrest:return>B6040 - BACnet/IP to 6 Relays and 2 Inputs</BACrest:return>
</BACrest: GetValue>
```

3.22 21 - software-version

This attribute contains manufacturers formal name of the device.

Attribute location: In both the BACrest gateway and devices on the target network.

BACrest command example:

To get the software version of the BACrest gateway,

<http://10.1.68.2/BACrest/.sysinfo/.BACrest/software-version@username:password>

To get the software version of a device on the target network,

http://10.1.68.2/BACrest/BACnet_device_24/software-version@username:password

Example XML return:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/BACnet_device_24/software-
version</BACrest:NodePath>
  <BACrest:AttributeName>software-version</BACrest:AttributeName>
  <BACrest:return>1.0</BACrest:return>
</BACrest: GetValue>
```

3.23 22 - vendor-id-type

This identifies the protocol organization that the "vendor-id" represents.

Attribute location: In the BACrest gateway only.

BACrest command example:

To get the vendor-id-type for the BACrest gateway,

<http://10.1.68.2/BACrest/.sysinfo/.bacrest/vendor-id-type@username:password>

XML return:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/.sysinfo/.bacrest</BACrest:NodePath>
  <BACrest:AttributeName>vendor-id-type</BACrest:AttributeName>
  <BACrest:return>Modbus</BACrest:return>
</BACrest: GetValue>
```

IMPORTANT: A "period" is used in the ".sysinfo/.bacrest" to indicate unique metadata contained within the BACrest gateway.

3.24 23 - vendor-id

This is the identification number assigned by a formal organization representing a particular protocol. This identifies what company manufactured the device.

Attribute location: In both the BACrest gateway and devices on the target network.

BACrest command example:

To get the vendor-id for the BACrest gateway,

<http://10.1.68.2/BACrest/.sysinfo/.bacrest/vendor-id@username:password>

To get the vendor name for a device on the target network,

http://10.1.68.2/BACrest/BACnet_device_23/vendor-id@username:password

Example XML return:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/.sysinfo/.bacrest</BACrest:NodePath>
  <BACrest:AttributeName>vendor-id</BACrest:AttributeName>
  <BACrest:return>24</BACrest:return>
</BACrest: GetValue>
```

IMPORTANT: A "period" is used in the ".sysinfo/.bacrest" to indicate unique metadata contained within the BACrest gateway.

3.25 24 - protocol-support

This will list the protocol on the target network that is supported by the BACrest gateway. If the BACrest device is a dedicated function device and not a gateway, this will return "no device network".

NOTE: This is listing the protocols that BACrest has the ability to communicate with. For example, Cimetrix makes a product with relays that can be controller by BACnet/IP or BACnet Web Services or BACrest. The BACrest commands are able to control the relays but have no connection to the other protocols. Therefore, these devices should return "no device network". If this device could also direct commands to devices on the BACnet/IP network then the return would be "BACnet network"

Attribute location: In the BACrest gateway only.

BACrest command example:

<http://10.1.68.2/BACrest/.sysinfo/.bacrest/protocol-supported@username:password>

XML return:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/.sysinfo/.bacrest</BACrest:NodePath>
  <BACrest:AttributeName>protocol-supported</BACrest:AttributeName>
  <BACrest:return>BACnet</BACrest:return>
</BACrest: GetValue>
```

Valid return values are:

- BACnet-IP
- MS-TP
- LONtalk
- Modbus
- EtherNet-IP
- X10
- Insteon
- proprietary
- no device network
- multiple device networks
- Other

3.26 25 - datalink-support

This will list the data-link for the target network supported by the BACrest gateway. This should match with the protocol-support attribute so if the protocol-support return said "BACnet" and the datalink-support attribute returns "TCP-IP" then this is "BACnet/IP".

Attribute location: In the BACrest gateway only. **BACrest command example:**

<http://10.1.68.2/BACrest/.sysinfo/.bacrest/datalink-support@username:password>

XML return:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/.sysinfo/.bacrest</BACrest:NodePath>
  <BACrest:AttributeName>datalink-support</BACrest:AttributeName>
  <BACrest:return>TCP-IP</BACrest:return>
</BACrest: GetValue>
```

Valid return values are:

- TCP-IP
- Ethernet only
- MS/TP
- RS485
- RS232
- powerline
- powerline-wireless
- free topology
- twisted pair
- wireless
- none
- multiple
- Other

IMPORTANT: A "period" is used in the ".sysinfo/.bacrest" to indicate unique metadata contained within the BACrest gateway.

3.27 26 - bacrest-version

This is the revision number of the BACrest implementation. If you try a command that you fully expect to work, you might want to check this and make sure that your BACrest command conforms to the capabilities of the BACrest features loaded into the gateway.

Attribute location: In the BACrest gateway only. **BACrest command**

example: <http://10.1.68.2/BACrest/.sysinfo/.bacrest/bacrest-version@username:password>

XML return:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/.sysinfo/.bacrest</BACrest:NodePath>
  <BACrest:AttributeName>bacrest-version</BACrest:AttributeName>
  <BACrest:return>1.1</BACrest:return>
</BACrest: GetValue>
```

IMPORTANT: A "period" is used in the ".sysinfo/.bacrest" to indicate unique metadata contained within the BACrest gateway.

3.28 27 - ncl-file-name

The expression "ncl" stands for "**N**ode **C**ontrol **L**ist". The Node Control List is a file which one creates using a Cimetrics software program that lets you define exactly what device network Nodes (sometimes called points) are to be made accessible to the "outside world" via Web Services or BACrest.

The Node Control List is a complete list of the following issues:

- Nodes that are allowed to be accessed via BACrest
- The technical or "free-form text" paths to these nodes
- Read or read/write characteristics for each of these nodes
- Optional system and installer information

This information is stored in a file in *.asn format and is then downloaded to the BACrest gateway.

Attribute location: In the BACrest gateway only.

BACrest command example:

<http://10.1.68.2/BACrest/.sysinfo/.bacrest/ncl-file-name@username:password>

XML return:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/.sysinfo/.bacrest</BACrest:NodePath>
  <BACrest:AttributeName>ncl-file-name</BACrest:AttributeName>
  <BACrest:return>1.1</BACrest:return>
</BACrest: GetValue>
```

3.29 28 - ncl-file-version

The expression "ncl" stands for "**N**ode **C**ontrol **L**ist". The Node Control List is a file which one creates using a Cimetrics software program that lets you define exactly what device network Nodes (sometimes called points) are to be made accessible to the "outside world" via Web Services or BACrest.

This would tell you what revision this file is inside the BACrest gateway.

Attribute location: In the BACrest gateway only.

BACrest command example:

<http://10.1.68.2/BACrest/.sysinfo/.bacrest/ncl-file-version@username:password>

XML return:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/.sysinfo/.bacrest</BACrest:NodePath>
  <BACrest:AttributeName>ncl-file-version</BACrest:AttributeName>
  <BACrest:return>1.1</BACrest:return>
</BACrest: GetValue>
```

3.30 29 - installer-company

This gives you an opportunity to enter the name of the company that setup the BACrest gateway.

Attribute location: In the BACrest gateway only.

BACrest command example:

<http://10.1.68.2/BACrest/.sysinfo/.bacest/installer-company@username:password>

XML return:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/.sysinfo/.bacest</BACrest:NodePath>
  <BACrest:AttributeName>installer-company</BACrest:AttributeName>
  <BACrest:return>Bond Buildings, Inc.</BACrest:return>
</BACrest: GetValue>
```

3.31 30 - installer-name

This gives you an opportunity to enter the name of the person that setup the BACrest gateway.

Attribute location: In the BACrest gateway only. **BACrest command**

example: <http://10.1.68.2/BACrest/.sysinfo/.bacrest/installer-name@username:password>

XML return:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/.sysinfo/.bacrest</BACrest:NodePath>
  <BACrest:AttributeName>installer-name</BACrest:AttributeName>
  <BACrest:return>James Bond</BACrest:return>
</BACrest: GetValue>
```


3.32 31 - installer-email

This gives you an opportunity to enter the email of the person that setup the BACrest gateway.

Attribute location: In the BACrest gateway only. **BACrest command**

example: <http://10.1.68.2/BACrest/.sysinfo/.bacrest/installer-email@username:password>

XML return:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/.sysinfo/.bacrest</BACrest:NodePath>
  <BACrest:AttributeName>installer-email</BACrest:AttributeName>
  <BACrest:return>james@building-guys.com</BACrest:return>
</BACrest: GetValue>
```

3.33 32 - installer-tlf

This gives you an opportunity to enter the telephone number of the person that setup the BACrest gateway.

Attribute location: In the BACrest gateway only. **BACrest command**

example: <http://10.1.68.2/BACrest/.sysinfo/.bacrest/installer-tlf@username:password>

XML return:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/.sysinfo/.bacrest</BACrest:NodePath>
  <BACrest:AttributeName>installer-tlf</BACrest:AttributeName>
  <BACrest:return>800-123-4567</BACrest:return>
</BACrest: GetValue>
```

3.34 33 - database-version

This is used to note the revision level of a devices database.

Attribute location: In a device on the target network.

BACrest command example:

http://10.1.68.2/BACrest/BACnet_device_1409449/database-version@username:password

XML return:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest_device_1409449</BACrest:NodePath>
  <BACrest:AttributeName>database-version</BACrest:AttributeName>
  <BACrest:return>1.4</BACrest:return>
</BACrest: GetValue>
```

3.35 34 - system-comments

This gives you an opportunity to enter any comments of interest to BACrest users. This might cover issues like baud rates, or physical location of equipment, or installation date, or ?

Attribute location: In the BACrest gateway only.

BACrest command example:

<http://10.1.68.2/BACrest/.sysinfo/.bacrest/system-comments@username:password>

XML return:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>http://10.1.68.2/BACrest/.sysinfo/.bacrest</BACrest:NodePath>
  <BACrest:AttributeName>system-comments</BACrest:AttributeName>
  <BACrest:return>The gateway is located in equipment cabinet #2 in the Thomas building and
  was installed on Jan 14, 2006</BACrest:return>
</BACrest: GetValue>
```

3.36 35 - HasDynamicChildren

3.37 36 - Children

3.38 37 - HasHistory

4 URL Options

4.1 Option Overview

BACrest URL's allow options that give further command details or modifies the values returned.

Individual options are specified in string form as simply "option-name" or "option-name=option-value". For example, "readback", or "precision=3". When multiple options are combined into a single string, they are separated by a semicolon, such as "readback;precision=3". White space is allowed in string DataTypes. The option-value is not constrained with the exception that it may not contain a semicolon.

The '=' character and option-value may be omitted for boolean options. If a boolean option name is present without an option-value, then it assumes the value "true". Options with a default value of "true" will have to be explicitly set to "false". If an option-name is specified more than once in the string, the last one takes precedence.

Name	Data Type	Default if Not Specified
readback	boolean	true
errorString	string	default error return
errorPrefix.....	string	empty string
precision.....	nonNegativeInteger ...	as in device (max 6)
priority.....	multistate	medium
transform.....	boolean	false

=== Examples:

http://192.168.0.22/BACrest/device_92345/analog-output_1/value/active/?readback=false@username:password

http://192.168.0.22/BACrest/device_92345/analog-input_1?precision=3@username:password

4.2 readback

This option defaults to "true" which means that there will be an XML/SOAP return when you read or write to a device. Add "readback=false" if you DO NOT want a return after you do a read or write.

readback=true (default)
readback=false

BACrest command example:

http://10.1.68.2/BACrest/BACnet_device_1409449/binary-output_1/Value/Active?readback=false@username:password

XML return:

...no return...

4.3 errorString

This option specifies the string to be returned for errors rather than the default format. Changing the error string may simplify client calculations or presentations. For example, if the client requires "-1" to be returned for errors to aid in some numerical calculations, it would specify a service option of "errorString=-1". If the client is filling a report and wants blank strings returned for errors, it would specify a service option of "errorString=".

errorString=<string>

BACrest command example:

http://10.1.68.2/BACrest/BACnet_device_1409449/binary-output_1/Value/Active?errorString=-1@username:password

Example error return:

```
<?xml version="1.0" ?>
<BACrest:GetValue xmlns:BACrest="urn:BACrestService">
<BACrest:NodePath>device_9222345</BACrest:NodePath>
<BACrest:AttributeName />
<BACrest:return>-1</BACrest:return>
</BACrest:GetValue>
```

4.4 errorPrefix

This option specifies the string to be returned in front of the default format. Changing the error prefix may be desired if the default format could possibly conflict with a real value. Whereas the errorString service option is intended to define the entire contents of the error string, the errorPrefix merely prefixes the default format to allow clients to get the original error information in addition to a customized prefix. If both errorString and errorPrefix are specified, the resultant error string is the errorPrefix followed by the errorString.

errorPrefix=<string> BACrest command example:

http://10.1.68.2/BACrest/BACnet_device_1409449/binary-output_1/Value/Active?errorPrefix=ERROR@username:password

Example error return:

```
<?xml version="1.0" ?>
<BACrest:GetValue xmlns:BACrest="urn:BACrestService">
<BACrest:NodePath>device_9222345</BACrest:NodePath>
<BACrest:AttributeName />
<BACrest:return>ERROR? 9 Node Not Found</BACrest:return>
</BACrest:GetValue>
```

4.5 precision

This option defaults to the actual value within the device with no processing up to a maximum precision of 6 numbers after the decimal. If you would like to change a return of "123.456732" into "123.4", then add the option "precision=1" to the BACrest URL.

precision=<non-negativeInteger> BACrest command

example:

http://10.1.68.2/BACrest/BACnet_device_1409449/analog-input_1/Value?precision=1@username:password

XML return:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>BACnet_device_1409449/analog-input_1</BACrest:NodePath>
  <BACrest:AttributeName>Value</BACrest:AttributeName>
  <BACrest:return>32.4</BACrest:return>
</BACrest: GetValue>
```

BACrest command example:

http://10.1.68.2/BACrest/BACnet_device_1409449/analog-input_1/Value?precision=3@username:password

XML return:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>BACnet_device_1409449/analog-input_1</BACrest:NodePath>
  <BACrest:AttributeName>Value</BACrest:AttributeName>
  <BACrest:return>32.428</BACrest:return>
</BACrest: GetValue>
```

4.6 priority

This option allows the inclusion of device protocols which use **the concept of WRITE priorities**. This concept solves the problem where several "control devices" need to control the same point and one need the ability to understand which control command is the most important

For example, there might be a local wall switch that controls a lamp, with a master workstation which can turn off this lamp at night, and a security system which can over-ride both of these control settings if there is an alarm.

So, in that case the local wall switch and the master workstation could use the "low" priority when the security system could use the "high" priority in their command requests.

The installer of the BACrest gateway is in charge of setting up the specific priority level that gets written to the target network, but a BACrest URL can write to a maximum of three levels. How to use these priorities is installation specific so please consult the BACrest gateway installer if you do not know what priority should be used.

priority=<low>
priority=<med>
priority=<high>

BACrest command example: This defaults to priority=low

http://10.1.68.2/BACrest/BACnet_device_1409449/analog-output_1/Value/33@username:password

The following performs the same action but sets the command to priority=high

http://10.1.68.2/BACrest/BACnet_device_1409449/analog-output_1/Value/33?priority=high@username:password

XML return:

```
<?xml version="1.0"?>
<BACrest: GetValue xmlns:BACrest="urn:BACrestService">
  <BACrest:NodePath>BACnet_device_1409449/analog-input_1</BACrest:NodePath>
  <BACrest:AttributeName>Value</BACrest:AttributeName>
  <BACrest:return>33</BACrest:return>
</BACrest: GetValue>
```

To clear a value in a given priority level the "null" should be used as a value in the "write" request for any object:

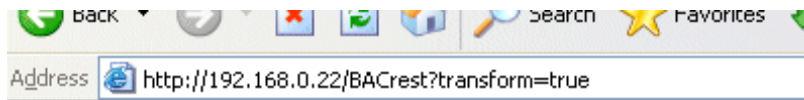
http://10.1.68.2/BACrest/BACnet_device_1409449/analog-output_1/Value/null?priority=high@username:password

4.7 transform

In BACrest v1.0, we have included a sample HTML transform which enables "clickable" links to nodes so that one can perform an easy discovery of all available nodes. This HTML display is an **EXAMPLE** display that helps your understanding of the power of BACrest.

NOTE: This HTML return is generated using a technology called XSLT (**Extensible Stylesheet Language Transformation**), These are "style sheets" that change the xml return into another format. BACrest v1.0 offers **ONE** XSLT template but future versions will allow a user to specify customized XSLT transform templates to fit multiple applications.

The BACrest v1.0 HTML example return looks like this:



Cimetrics BACrest HTML Example page

BACrest command

<http://192.168.0.22/BACrest>

Attributes

[NodeType](#)

[Attributes](#)

[ValueType](#)

[Children](#)

Child nodes

[BACnet_device_1369026](#)

NOTE 1: All URL's can be appended with "@username:password" for basic security. Advanced security can be done using tradiional SSL or VPN technologies.

5 BACrest Default Return Errors

5.1 Error Overview

For maximum interoperability with a wide range of clients, BACrest does not return complex (constructed) datatypes by returning both valid data and errors in the same result string.

The default error string encoding is "**? error-number error-message**". More specifically, the string is composed of: a question mark character, followed by a single space character, followed by a standardized error number defined in the following table, in decimal form, followed by a single space character, followed by the error message.

The default error encoding can be overridden by the client with the "errorString" service option.

Example return

```
<?xml version="1.0" ?>
<BACrest:GetValue xmlns:BACrest="urn:BACrestService">
<BACrest:NodePath>device_9222345</BACrest:NodePath>
<BACrest:AttributeName />
<BACrest:return>? 9 Node Not Found</BACrest:return>
</BACrest:GetValue>
```

5.2 Error Codes

The default error string encoding is "? **error-number error-message**".

Error Number	Error Message
0	Unspecified Error
1	Not Authenticated
2	Not Authorized
3	Bad Options Syntax
4	Option Not Supported
5	Bad Option Value Farnat
6	Option Out of Range
7	reserved
8	Bad Path Syntax
9	Node Not Found
10	Attribute Not Found
11	Illegal Attribute
12	Bad Value Format
13	Value Out of Range
14	reserved
15	Not Writable
16	Write Failed
17	reserved
18	reserved
19	reserved
20	reserved
21	reserved
22	reserved
23	reserved
24	reserved
25	No Communications
26	Readback Failed

6 Device Protocol Mappings

BACrest to protocol "x" mappings are **detailed in separate documents**. The list of mappings that are either completed or available soon are:

- **BACnet**
- **LONmark**
- **Modbus**
- **EtherNet/IP**

Contact Cimetrics at products@cimetrics.com for the latest mappings.

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Governing Law

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8 Cimetrics Information

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