Comfort Analytics

Comfort ADR Driver Guide

This documents the Comfort ADR Driver for use on the Niagara platform.

Contents

OpenADR Compatibility

This driver implements an OpenADR Virtual End Node (VEN) and integrates with Open ADR Virtual Top Nodes (VTNs). Its implements the following features:

- OpenADR specification profiles 2.0a and 2.0b.
- The simple HTTP pull model.
- Support for all signal types including custom ones.
- Event and signal level targeting.

Niagara Compatibility

Niagara 4

On Niagara 4, there are two modules. Both will execute on all 4.*n.nnn* version of Niagara:

- comfortAdr-rt.jar – This is required on both stations and engineering tools (Workbench).
- comfortAdr-wb.jar – This is the user interface and is required on the engineering tool (Workbench). If any views (property sheets, managers) of the driver will be accessed through a browser, then this should be installed on the station as well.

Module Installation

Niagara 4

Install comfortAdr-rt.jar and comfortAdr-wb.jar on the computer where Niagara 4 engineering tool (Workbench) will be run. To install, place a copy of the files in the modules directory of your Niagara 4 installation. This is typically C:\Niagara\Niagara-4.n.nnn\modules.

Install the modules on the target station. Using a Niagara 4 Workbench where the modules have already been installed, connect to the station’s platform service. Go to the Software Manager and install comfortAdr-rt and optionally comfortAdr-wb (if any views of the driver will be accessed with a browser).

Licensing

The Comfort ADR Network must be licensed. Licensing is managed on the property sheet of the network object. Unlicensed objects will operate in demo mode for 2 hours. After demo mode expires, the station must be restarted to resume operation, but it is otherwise safe to build a database. The following properties are related to licensing.

- Max Connections – This represents the number of OadrVen2*x* objects being licensed. In other words, the number of OADR VTNs being integrated.
- Product Code – Automatically generated by the driver and is used to generate a license key. This will combine the driver name, host ID and the max connections.
- License Key – Where the key generated for the product code must be entered.

Configure the “Max Connections” property. Then copy the value of the “Product Code” property that is automatically generated. You should highlight the value and copy it by pressing CTRL-C. Send the product code to your Comfort Analytics dealer. They will respond with a text string for you to enter in the “License Key” property.

If the license key is correct, the network will automatically connect and normal driver usage may proceed without restarting the station.

The exact text of the product code and license key are critical. <u>Please try not to send screen shots as it increases the chances for errors.</u> Highlight the text, copy it using CTRL-C and paste into an email.

Features

Signal Types

All signals identified by the OpenADR 2.0n specification are supported. Use point discovery to see all options defined by the specification committee. 2.0a only allows the SIMPLE signal type.

Targeting

Extensive filtering can be employed to route signals to points. Proxy extensions can filter criteria such as:

- Signal names
- Signal types
- Programs (aka market contexts)
- Signal targets such as device types
- Event targets such as groups, resources, device types, locations and more.

Reporting

Telemetry status and usage reports can be made available to the VTN.

Notification

Niagara alerts can routed to alarm recipients as new events are received.

Opt Out

Users can opt out of events by invoking actions on points and event objects.

Certificates

OpenADR 2 specifies certificate usage for security. That doesn't mean official OpenADR certificates are required by all VTNs, this driver allows for HTTP authentication. Check with your VTN provider.

Tridium had a bug which prevented the import of official OpenADR certificates issued by Kyrio. You can download patches for 4.4, 4.7 and 4.8 from (no need to downgrade if you have an equal or higher level for the platCrypto-wb module):

http://comfortanalytics.com/downloads/platCrypto-wb.zip

More information about OpenADR certificates can be found at https://www.openadr.org/cyber-security

VTNs and Certificates

Honeywell

This VTN requires official OpenADR certificates for 2.0b. 2.0a can be used instead if the VTN provider enables it. You will need a user name and password. The user name is also the Ven ID and should be entered into both the Vtn User and Ven Id properties.

IPKeys

This VTN does not require official OpenADR certificates, but it depends on the sophistication of the server provider. It is possible for the VTN provider to sign a Certificate Signing Request for your own certificate.

EPRI

This VTN does not require official OpenADR certificates, but it depends on the sophistication of the server provider. It is possible for the VTN provider to sign a Certificate Signing Request for your own certificate.

Importing an OpenADR Certificate

In general, you will need to create a pem file with the full certificate chain. The following instructions are for using the free utility "KeyStore Explorer" on Windows.

- Launch KeyStore Explorer and drop the private key onto its window. You will be prompted for the password.
- Drop the public certificate onto the same window. This should add data to the existing row.
- Right-click on the entry row in KeyStore Explorer, choose Edit Certificate Chain / Append Certificate. Select the intermediate certificate, it may have _MCA in the name. Keystore Explorer will let you know if it is the incorrect one.
- Right-click on the entry row in KeyStore Explorer, choose Edit Certificate Chain / Append Certificate. Select the root certificate, it may have _RCA in the name.
- Right-click on the entry row in KeyStore Explorer, choose Export / Export Key Pair.
    - Select the PEM format.
    - As of this writing, you must provide a password for the export or Tridium will not be able to import it.
    - Change the name of the .pem file to something useful. If you do not, you can change the alias name when you import it into Tridium.
- Go to Certification Management of your station (/Services/PlatformServices/CertManagerService).
- Press the Import button, select the pem that was just generated and provide the password.

Getting Your Own Certificate Signed

Follow these steps if your VTN provider will sign your own certificate.

- Go to Platform/Certificate Management.
- Create a new certificate for your driver. Except for the actual text such as organization name, you can copy the default “tridium” certificate. You only need to enter the required field and leave everything else at the default setting, **EXCEPT**: set an expiration for 30 years after the “Not Before” timestamp.
- Make a backup of your key pair by selecting it and pressing the Export button. Be sure to select "Export the private key".
- On the User Key Store tab, select your certificate and press the "Generate CSR" button.
- Send the generated .csr file to the signer.
- Import the signed public key .pem file into Niagara in the User Key Store tab. If successful, the yellow icon beside your certificate will turn green.
    - If you do not receive a pem file from the signer, use a utility such as “KeyStore Explorer” or “OpenSSL” to convert it.

Usage

Pre-Configuration Requirements

Before installing and configuring the driver, the following items will be needed.

- Install any necessary certificates or signing responses. See the section on Certificates.
- VTN URL – The server URL
- VTN Type – 2.0a or 2.0b
- User name and password – Only if the server uses http authentication.
- VEN ID – Only required for 2.0a but may be needed if using a user name and password. Uniquely identifies the driver instance with the VTN.

Configuration

1. Install any required certificates. See the Certificates section of this document.
2. Install the module. See the installation section of this document.
3. Open the comfortAdr palette and add a Comfort ADR Network under the /Drivers node of your station.
4. Go to the property sheet of the network object and configure the license. See the licensing section of this document.
5. Double-click the network object to view the device manager. Click the New button to add an OpenAdr2a or OpenAdr2b device object.
6. At the very minimum, configure the VTN address, VEN ID (2.0a only) and certificate alias on the device object.
7. If the VTN address is an HTTPS address, you may need to approve the VTN host at Platform/Certificate Management, Allowed Hosts tab.
8. Add proxy points.
    a. Double-click the Points property on the device to view the point manager and use discovery to see all of the preconfigured points.
    b. VTNs are required to send a SIMPLE signal with every event so this is always a safe choice.

i. It is the only choice for 2.0a. Either choose an Enum or a numeric point. The Enum point will be pre-set to the level Enum (normal, moderate, high and special). If numeric, the values will be 0=normal, 1=moderate, 2=high and 3=special.

c. To route signals to specific points, configure the filtering properties on the proxy extension. Those properties are: Signal Names, Signal Types, Programs, Event Targets and Signal Targets.

d. Each property can be wild carded (match everything), given one value, or given multiple values. If there are multiple values only one has to match the signal. In other words, for any single property, its values are OR'd to match a signal.

e. For a point to match a signal, all of the filtering properties have to match the signal. In other words, all filtering properties are ANDed to match a signal.

9. Add reports.

a. Double-click the Reports property on the device to view the report manager.

b. Two report types are supported, telemetry status and usage.

Troubleshooting

All Issues

- Verify the network is licensed. It will be in fault and the fault cause will say Unlicensed.
- Verify the device is licensed by looking at its property sheet. If max connections is exceeded, the device might be unlicensed even though the network is licensed.
- Verify the module version is the latest. Check the version property on the network property sheet and compare that to the latest version indicated at http://comfortanalytics.com/comfortAdr.html
- Verify your certificate is valid and meets the requirements of your VTN provider.

Cannot Connect to VTN

- First go through "All Issues"
- Check the Fault Cause of the device object.
- Under the Health property of the device, check Last Fail Cause.

- Under Station/Config/Services/PlatformService/CertManagerService go to the Allowed Hosts tab and approve the VTN host if it isn't already.
- Invoke the Test Connection Action on the network object to verify the Jaces has proper connectivity. It performs a simple HTTP GET request to any URL and results are printed on application direct.
- Try reaching the VTN address with a browser. If the browser times out, it probably means the address is wrong or the server is down.
    - You can try the event service URL to be even more certain, this should result in an error response from the server.
    - For 2.0a, append "/OpenADR2/Simple/EiEvent to the Vtn Address configured on the property sheet.
    - For 2.0b, append "/OpenADR2/Simple/2.0b/EiEvent to the Vtn Address configured on the property sheet.
- Enable Debug Requests and Debug Responses on the device object and watch application director for anything obvious.

Point Does Not Update For an Event

- First go through "All Issues"
- Verify the device (VEN) object is connected and is {ok}.
- Verify the event object can be found under the Events property of the device.
    - If not, enable debug requests and debug responses on the device object, then invoke the "Refresh Events" action on the device. Look for the event response on application director.
        - If there is a response but the event is missing from the response, then the issue is on the VTN.
        - If the event is in the response, and there is still no corresponding event object, then there is a driver bug.
        - Refresh Events may not work with IPKeys unless the VEN has been given the admin role by the VTN administrator.
- If there is an event object, then the issue may have to do with filtering on the point proxy extension.
    - In the point manager use the New button to create a numeric point and do not configure anything on it. That point should match every event. If that works, then the issue is definitely a filtering issue.

Component Guide

This section documents the properties and actions of the major driver components.

Comfort ADR Network (BCadrNetwork)

This is the root node of the driver. It represents a tree of VEN objects. It manages licensing, threads of execution and the ping monitor.

Properties

- **Enabled** – Set to false to disable the entire driver.
- **Monitor** – The ping monitor is only used to establish sessions with remote VTNs. Consider this the retry rate.
- **Version** – Information about the module installed on the remote station. Can be used to quickly determine what version of the driver is installed.
- **Actual Connections** – The number of VEN device objects already in the subtree.
- **Max Connections** – The number of VEN device objects being licensed.
- **Product Code** – Required by licensing to generate the License Key. See the licensing section of this document.
- **License Key** – Required to unlock this driver. See the licensing section of this document.
- **License Status** – Descriptive text for the license state.

Actions

- **Enable** – A convenience for setting the enabled property to true.
- **Disable** – A convenience for setting the enabled property to false.
- **Test Connection** – This can be used to verify that the Jace can reach remote locations by performing simple HTTP GET requests to any address, it will print results on application director.

OADR VEN 2a (BOadrVen2a)

This is a device object in the Niagara framework, it represents a local Open ADR VEN at specification level 2.0a. The only signal available to a 2.0a VEN is the SIMPLE signal with a level signal type. Either choose an Enum or a numeric point. The Enum point will be pre-set to the level Enum (normal, moderate, high and special). If numeric, the values will be 0=normal, 1=moderate, 2=high and 3=special.

Properties

- **Enabled** – Set to false to disable communications with the VTN.
- **Vtn Address** – This should be the URI/URL to the VTN, excluding all OpenADR path requirements. If the event service of the server is https://host/OpenADR2/Simple/EiEvent then the value of this property should be https://host.
- **Certificate Alias** – This should be the name of the certificate on the User Key Store tab of Certificate Management you wish to use for SSL. Will not be used if the Vtn User property is not empty.
- **Vtn User** – If the server requires user authentication, enter the user name here for basic authentication. Otherwise leave this field blank.
- **Vtn Pass** – Only used if Http User property is not empty.
- **Ven Id** – This will need to be acquired out-of-band and is required to communicate with the VTN.
- **Vtn Id** – Description of the VTN and provided by the VTN.
- **Poll Frequency** – How often to request events from the VTN.
- **State** – The connection state: Disconnected, Connecting, Connected, Disconnecting.
- **Alert New Events** – If true, generates a Niagara alert (an alarm that doesn’t require acknowledgement) when new events are received.
- **Alert Class** – The Niagara alarm class used to route alerts for new events.
- **Points** – The point device extensions. Double-click this object to view the point manager.
- **Events** – The event device extension. Double-click this object to view the event manager.
- **Reports** – The report device extension. Double-click this object to view the report manager.

Actions

- **Enable** – A convenience for setting the enabled property to true.
- **Disable** – A convenience for setting the enabled property to false.
- **Refresh Events** – Force a refresh of all events. In the 2.0a VEN this is the same as polling.

OADR VEN 2b (BOadrVen2b)

This is a device object in the Niagara framework, it represents a local Open ADR VEN at specification level 2.0b.

Properties

- **Enabled** – Set to false to disable communications with the VTN.
- **Address** – The URL to the VTN, excluding OpenADR path elements. If the event service of the server is https://host/OpenADR2/Simple/2.0b/EiEvent then the value of this property should be https://host.
- **Certificate Alias** – This should be the name of the certificate on the User Key Store tab of Certificate Management you wish to use for SSL. Will not be used if the Vtn User property is not empty.
- **Vtn User** – If the server requires user authentication, enter the user name here for basic authentication. Otherwise leave this field blank.
- **Vtn Pass** – Only used if Http User property is not empty.
- **Ven Id** – This is required to communicate with the VTN, but will be automatically acquired by the driver.
- **Vtn Id** – Description of the VTN and provided by the VTN.
- **Registration Id** – The session ID assigned to the VEN by the VTN.
- **Poll Frequency** – How often to request events from the VTN. This value is provided by the VTN.
- **State** – The connection state: Disconnected, Connecting, Connected, Disconnecting.
- **Alert New Events** – If true, generates a Niagara alert (an alarm that doesn’t require acknowledgement) when new events are received.
- **Alert Class** – The Niagara alarm class used to route alerts for new events.
- **Points** – The point device extensions. Double-click this object to view the point manager.
- **Events** – The event device extension. Double-click this object to view the event manager.

Actions

- **Enable** – A convenience for setting the enabled property to true.
- **Disable** – A convenience for setting the enabled property to false.
- **Reconnect** – Reregisters with the VTN, refreshes all events.

- **Refresh Events** – Force a refresh of all events. In the 2.0a VEN this is the same as polling.

Point Proxy Extensions (BCadrProxyExt)

Proxy extensions convert event signals into point values that can be used in station logic. They provide several properties designed to route signals to specific points.

For a signal to match the proxy extension, all of the following properties must match it, and its parent event: Signal Names, Signal Types, Programs, Event Targets and Signal Targets.

When no signal is active the point value will be null except during the ramp period. During ramp, the point will be the value of the payload of the first interval. This can be disabled with the “Use First Interval For Ramp” property.

Properties

- **Enabled** – Only sets the point status to disabled. The point will still be updated for matching events.
- **Device Facets** – The driver constantly updates the device facets based on information contained in the signals from the VTN. You should only edit the facets on the control point. If the point facets have no units, the driver will set those as well.
- **Signal Names** – Use the * asterisk to match all signals. Otherwise, use a comma separated list of signal names to match. If there are multiple values, only one has to match. Use discovery to set this to a specific value.
- **Signal Types** – Use the * asterisk to match all types. Otherwise, use a comma separated list of signal types to match. If there are multiple values, only one has to match. Use discovery to set this to a specific value.
- **Programs** – Use the * asterisk to match all programs (AKA market contexts). Otherwise, use a comma separated list of programs to match. If there are multiple values, only one has to match. This cannot be set by discovery and specific values must be acquired out-of-band.
- **Event Targets** – Zero or more event level targets to match. Zero targets matches all events. If there are multiple values, only one has to match.
- **Signal Targets** – Zero or more signal level targets to match. Zero targets matches all signals. If there are multiple values, only one has to match.
- **Signal** – Ord to the most relevant signal. In order of priority they are: current, next or previous.
- **Event ID** – The event ID of the signal indicated by the Signal property.
- **Ramp Start** – If the event indicated by the Event ID has a ramp period, this will have the time the ramp period starts taking into account any randomization built into the event. This will be null if the event has no ramp period.

- **Event Start** – Start time of the event indicated by Event ID. If the event is configured for randomization, this will reflect the randomized offset.
- **Event End** – End time of the event indicated by Event ID. If the event is configured for randomization, this will reflect the randomized offset.
- **Recovery End** – If the event indicated by the Event ID has a recovery period, this will have the time the recovery period end taking into account any randomization built into the event. This will be null if the event has not ramp period.
- **Event State** – Idle (no other state applies), Far, Near, Ramp, Active, Recovery, Completed, Opt Out, Cancelled. If there is a ramp time associated with the event, Near will be replaced with Ramp.
- **Next Interval Start** – Start time of the next interval of the current or upcoming event.
- **Next Interval Value** – Payload of the next interval indicated by the Next Interval Start.
- **Test Event** – True when the event is a test.

Actions

- **Opt Out** – Sets the optIn property on the signal/event indicated by the Signal property. Will have no effect for past events. This action will also be added to the parent point.
- **Opt Out** – Sets the optIn property on the signal/event indicated by the Signal property. Will have no effect for past events. This action will also be added to the parent point.

Event Objects (BCadrEvent)

These represent events transmitted from the VTN to the VEN object. The can be found under the "Events" property of the VEN object. They will contain one or more children signal objects.

Properties

- **Event Id** – VTN generated.
- **Event State** – Locally managed event state machine: Idle (no other state applies), Far, Near, Ramp, Active, Recovery, Completed, Opt Out, Cancelled. If there is a ramp time associated with the event, Near will be replaced with Ramp.
- **Opt In** – True until the Opt Out action is invoked.
- **Start** – When the event becomes active. Note that if there is a tolerance, all timing of the event will be offset somewhere between 0 and the tolerance amount.
- **Duration** – How long the event remains active. If this is zero, the event will remain active until canceled or Opt Out is invoked.
- **Ramp** – Time before the start that equipment should be ramping in preparation of the event. Proxy points will use the start value as the value during a ramp period (but that can be disabled). This should be negotiated out-of-band and not a surprise.
- **Recovery** – Time after the event ends that equipment should resume normal operation. It doesn't make much sense, it's just a spec item.
- **Tolerance** – To prevent many VENs from taking action at the same time. All event times will be offset somewhere between 0 and this value.
- **Program** – From the VTN.
- **Priority** – From the VTN.
- **Test Event** – From the VTN. Identifies test events.
- **Created** – Timestamp of when the event was created in the Niagara station.
- **Modification Number** – From the VTN.
- **Modification Reason** – From the VTN.
- **Vtn Comment** – From the VTN.
- **Targets** – Event level targets from the VTN.

Signal Objects (BCadrSignal)

An event can have multiple signals such as pricing and load setpoints. These can be found under the event objects and they will contain one or more child interval objects.

Properties

- **Signal Id** – From the VTN.
- **Signal Name** – A well-defined name such as ELECTRICITY_PRICE.
- **Signal Type** – Further refinement of the signal name such a delta, level, multiplier…
- **Targets** – Signal level targets. The only type of signal level targets allowed by the specification are called endDeviceAssest which is also referred to as device class.
- **Unit** – Units of the payload contained in the child intervals. These will be applied to the device facets of the proxy extension. If there are no units in the parent point, they will be set in the point facets as well.

Interval Objects (BCadrInterval)

As a child of a signal object, it defines a payload value (point value) and a duration. 2.0a signals can only have a single interval, but 2.0b signals can have many.

Properties

- **Uid** – From the VTN.
- **Duration** – How long the interval is in effect.
- **Payload** – The value during the interval.

Telemetry Status Report (BTelemetryStatusReport)

These can be created by double-clicking the reports device extension on BOadrVen2b, then click the new button.

This buffers real time values and periodically reports them back to the VTN. The minimal sample interval is one minute and the max in one hour. The maximum buffer is one hour.

Properties

- **Source** – Ord to the data source, which should be a numeric control point.
- **Program** – Optional, the program of the report.
- **Signal Type** – Further refinement of the signal name such a delta, level, multiplier…
- **Resource** – Represent the target type of the resource.
- **Facets** – If the source does not have power units, then the units must be supplied here.

Actions

- **Refresh** – After adding a new report object, invoking this will register the report with the VTN. Otherwise, simply reconnect the Ven object.

Telemetry Usage Report (BTelemetryUsageReport)

These can be created by double-clicking the reports device extension on BOadrVen2b, then click the new button.

This buffers real time values and periodically reports them back to the VTN. The minimal sample interval is one minute and the max in one hour. The maximum buffer is one hour.

Properties

- **Source** – Ord to the data source, which should be a numeric control point.
- **Program** – Optional, the program of the report.
- **Signal Type** – Further refinement of the signal name such a delta, level, multiplier…
- **Resource** – Represent the target type of the resource.
- **Facets** – If the source does not have energy or power units, then the units must be supplied here. If the source is a pulse count, the pulse value should be defined here as “pulseCount”.

Actions

- **Refresh** – After adding a new report object, invoking this will register the report with the VTN. Otherwise, simply reconnect the Ven object.