Tridium OpenADR Service

User Manual

Revision 1.6

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Introduction

This document describes the Niagara 4 OpenADR Service (OadrService) and its subcomponents. OadrService implements the OpenADR Virtual End Node (VEN) which is used to communicate with the OpenADR Virtual Top Node (VTN). Although a VEN can behave as the VTN in certain interactions as shown in Figure 1 below the Niagara 4 OadrService only implements the VEN functionality.

There is always a one-to-one relationship between a VEN to a VTN so typically only one OadrService is installed in the Niagara Station. The OadrService requires a Tridium license to operate and when deployed in a Niagara Station becomes a communication endpoint that represents one or more logical resources (shedable loads, endpoint equipment, meters, etc.). The OadrService is a communication mechanism only and does not define how resources are assigned to events and signals from the VTN.

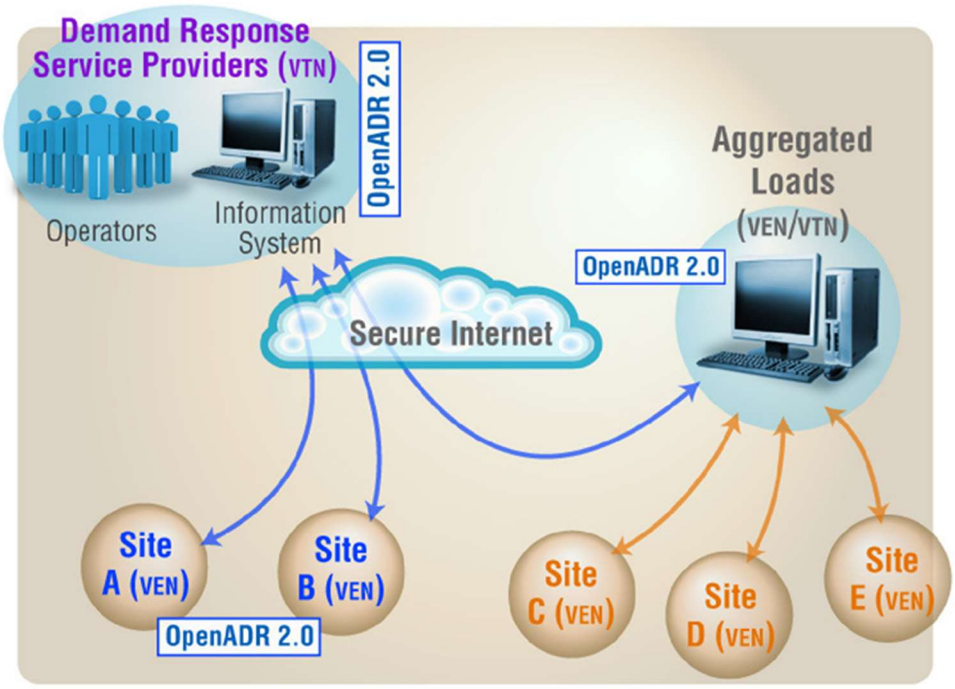

Figure 1

The OadrService implements the following features defined by the OpenADR Specification:

- Profile 2.0a of the OpenADR specification
- Profile 2.0b of the OpenADR specification
- Simple HTTP pull model with polling
- EiEvent Service
- EiReport Service

- EiRegisterParty Service
- EiOpt Service
- Signal Types SIMPLE, ELECTRICITY PRICE, LOAD DISPATCH, and others defined in Table 1 of the OPenADR 2.0b Profile Specification v1.1. Custom Signal Types are also supported
- Standard Security Level

OadrService Certification

- Niagara OadrService is certified as OpenADR 2.0a and OpenADR 2.0b compliant service.

OadrService Security Architecture and Certificate Types

Niagara OadrService implements the OpenADR 2.0 'Standard' security level. The 'Standard' security level uses TLS 1.2 for establishing secure communication channels between a VEN and a VTN. OadrService uses the Public Key Infrastructure (PKI) certificates to provide VEN security services like authentication, confidentiality, and integrity.

The following parameters will be used for certificates:
- RSA – 2048 bit key
- Certificate Type – X.509v3

The following parameters will be used for transport layer:

- Transport Layer Security – TLS 1.2
- Cipher Suite – RSA – TLS_RSA_WITH_AES128_CBC_SHA256

Certificate Fingerprints

VENs must facilitate registration by providing a 'certificate fingerprint' which can be easily transmitted out-of-band to the VTN.

The certificate fingerprint will be generated as follows:

1. Perform a SHA-256 hash on the bytes of the DER-encoded client certificate.
2. Take the last 10 bytes (from the 32-byte SHA-256 hash), represented as pairs of hexadecimal digits, separated by the colon character.

Niagara 4 Module Installation

Niagara OadrService is distributed as a single module named openAdr-rt.jar. Install this module on the computer where Niagara Workbench will be run by copying openAdr-rt.jar to the modules folder.

If running the station on a remote PC or JACE, use Workbench to install the module to the target station. Refer to the Niagara 4 documentation on details steps on how to do this.

Restart Workbench and the Station after installing the module.

OadrService Niagara License

Niagara OadrService requires a valid Niagara 4 license. The license includes the number of VEN objects that can be configured in the station.

Niagara License Feature Name: openADR with an attribute of VEN.limit specifying number of VENs allowed in the Station.

OpenADR Certificate Generation and Configuration – Generating Certificate with Niagara

OpenADR secure connections (https) require the use of certificates. These certificates must be created and signed with the cooperation of the owners of your VTN. You may generate your VEN's certificate using Niagara.

1. Open your N4 Supervisor station's Certificate Management Service. At the bottom of the User Key Store tab, click New.
2. Fill out the form for your VEN's new certificate. Make sure to include the Common Name, which can be either the IP address or the hostname of the VEN. Some environments also require a Subject Alternate Name.
3. Click OK to generate the certificate.
4. After the certificate has been generated, select it and then click Cert Request. Save the resulting .csr file to a convenient location.
5. Send the .csr file to your VTN provider for signing. They should send you a .pem file in return, along with a password for the file.
6. When you have received the signed .pem file, open the Supervisor's Certificate Management Service again and this time click Import. Locate the .pem file from the VTN and import it. You may have to enter the file's password.
7. After the import has been completed, the yellow icon beside your VEN certificate's alias should turn into a green shield icon.

8. Your VTN should also have sent you a .pem file that is their root or intermediate Certificate Authority's public key. You can import this into your User Trust Store by opening Certificate Manager Service and then changing the tab to User Trust Store, then clicking Import. This will enable your Supervisor station to recognize and trust communications from the VTN.

If you are using Canvas Cloud VTN, you will need to know your certificate's fingerprint. There are two ways to identify the certificate's fingerprint. The easiest way is to double-click on the certificate in the Certificate Management Service and copy the SHA Fingerprint from the popup window. It should be 20 character pairs separated by colons. If you would prefer, you can use OpenSSL to get the fingerprint as follows:

1. In your station's Certificate Management Service, select your certificate and click Export.
2. Leave the box for exporting the certificate's private key unchecked. We will only need to export the public key.
3. Export the certificate's public key to a convenient location in your file system.
4. Download OpenSSL from the Internet.
5. Add the bin directory of your OpenSSL installation to your PC's system environment variables path.
6. Open a command prompt window as Administrator and use the "cd" command to move to the location of your certificate's public key.
7. Run the following command, replacing "certificatename.pem" and "certificatename.der" with the name of the .pem file you just exported (and its counterpart .der file.)
   openssl x509 -outform der -in certificatename.pem -out certificatename.der
8. This should create a version of the .pem file that is of type .der. Then run the following command:
   openssl x509 -in openadrcertchain.der -noout -fingerprint
9. The result of that command should be your certificate's SHA fingerprint. It should be 20 character pairs separated by colons.

OpenADR Certificate Generation and Configuration – Certificate from Kyrio.com

If you are using Canvas Cloud VTN, your test certificate may come from a third party such as Kyrio.com. Certificates and the private key must be assembled into a single pem file to import them into the Niagara Stations User Key Store. Steps to install the assembled pem file are listed below:

1. Coordinate with the VTN operator to get the client and CA intermediate and root certificates. These certificates are typically provided by Kyrio.com in a single zip file.

2. The OpenADR certificate bundle from Kyrio.com will typically include five files:
   - OpenADR_RSA_MCA_Cert.pem
   - OpenADR_RSA_RCA_Cert.pem
   - RSA_VEN_cert.pem
   - RSA_VEN_privkey.pem
   - RSA_VEN_cert_Fingerprint.txt

   Note that there may be other timestamp data in the name of the files listed above.
3. After following below steps once, the certificate is imported into niagara then send the fingerprints from niagara certificate management->user key store to the VTN operator so the VEN can be registered with the VTN.
4. Create a new (blank file) in a plain text editor like Notepad. Name it "openADRCertChain.pem"
5. Copy the entire contents of the *_privkey.pem file into the openADRCertChain.pem file.
6. Copy the entire contents of the *_cert.pem file below the *_privkey.pem file contents in the openADRCertChain.pem file.
7. Copy the entire contents of the *_MCA_Cert.pem at the end of the openADRCertChain.pem file.
8. Copy the entire contents of the *_RCA_Cert.pem at the end of the openADRCertChain.pem file.
9. Save the openADRCertChain.pem file. This is the file that will be imported to the Niagara User Key Store. Note that the order of the contents of this file are important and the file must be assembled in the order listed above. Sample assembled file is shown below.

```
-----BEGIN RSA PRIVATE KEY-----
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-----END CERTIFICATE-----

10. Using Niagara 4 Workbench open the CertificateManagerService for your station: /Config/Services/PlatformServices/CertManagerService.
11. Press the Import button in the User KeyStore tab and select the openADRCertChain.pem file assembled above.
12. If the assembled certificate does not import into the Niagara User Key Store and generates the exception shown below you will need to remove the pass phrase from the RSA private key by using tools such as openssl.

13. To remove the pass phrase from the *_privkey.pem file run the following openssl command:

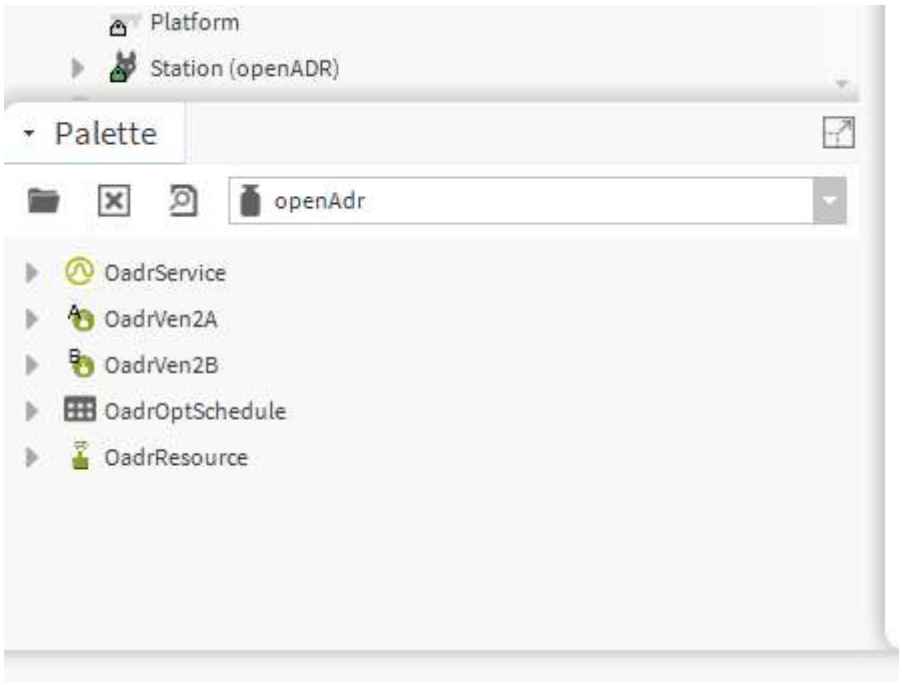
    openssl rsa -in *_privkey.pem -out *_privkeyOut.pem

    Note: Enter the full filename for the input and output key files.
14. Reassemble the openADRCertChain with the newly generated *_privkeyOut.pem and import into the Niagara User Key Store.

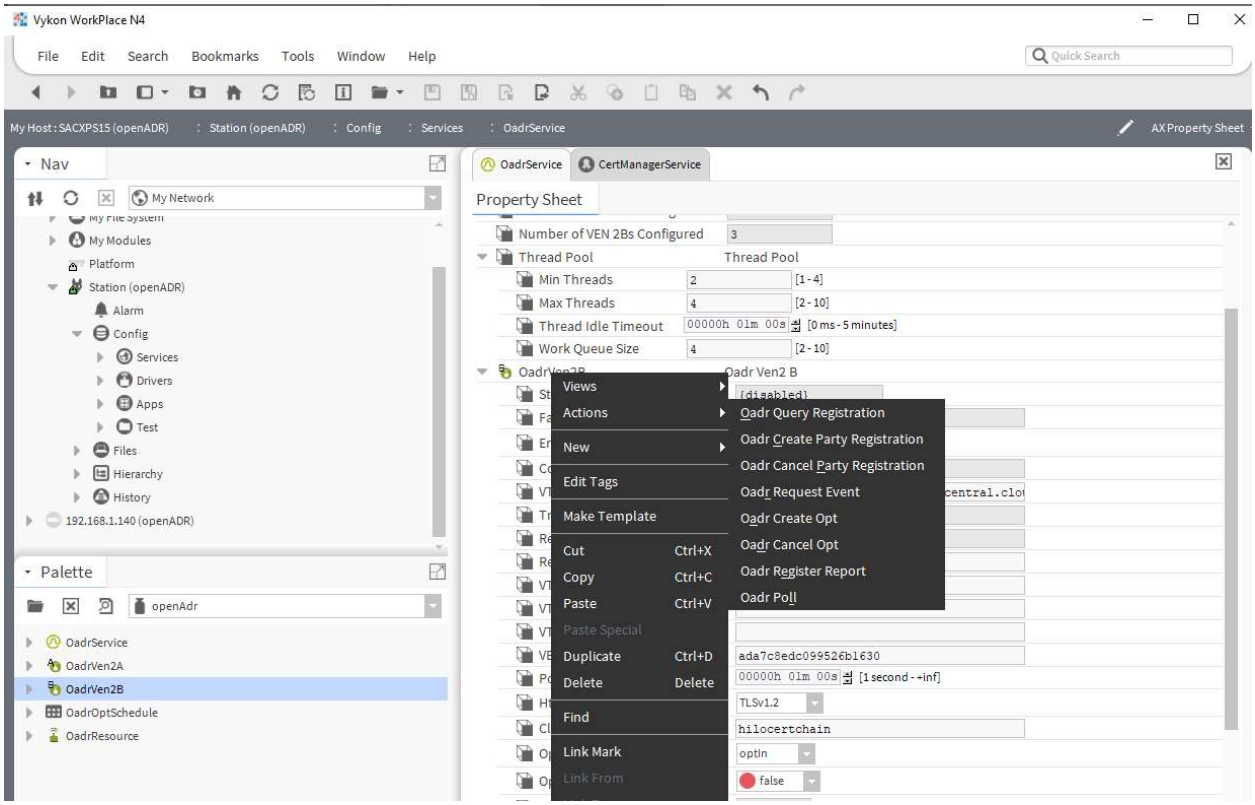
Installing and Configuring OadrService in the Niagara 4 Station

This section describes the steps required to configure the OadrService in the Station.

1. Install the openAdr-rt.jar in the Station. See the Niagara 4 module Installation section above.
2. Install the VEN Client Certificate if using secure communications with the VTN. See the Importing OpenADR Certificate into Niagara section above.
3. Start Workbench and open the openAdr palette. The palette contains the objects shown in the screenshot below:



4. Connect to the Station and expand the Nav tree to expose the /Config/Services object.
5. Drag the OadrService object from the Palette and drop it on the /Config/Services object in the Station.
6. The OadrService object manages the lifecycle and licenses for the VEN objects configured under it. Only one OadrService object is allowed in the Station.
7. If the license is valid then the Status property of the OadrService object will have a value of {ok} and the number of VENs Licensed will be displayed as well. Details of the properties of the OadrService are described under the OadrService Components.
8. Drag the OadrVen2A or OadrVen2B object from the Palette and drop it on the OadrService object.
9. If the License is valid and the number of VENs licensed limit has not been exceeded than the OadrVen can be configured to connect to the VTN.
10. Configure the VTN URL property of the OadrVen object. This is provided by the VTN operator.
11. If the VTN URL starts with https (secure connection) then configure the Https Min Protocol property to TLSv1.2 and the Client Certificate Alias to the certificate chain Alias, you imported to the User Key Store.
12. Right-click on the OadrVen object and invoke the “Oadr Create Party Registration” Action.



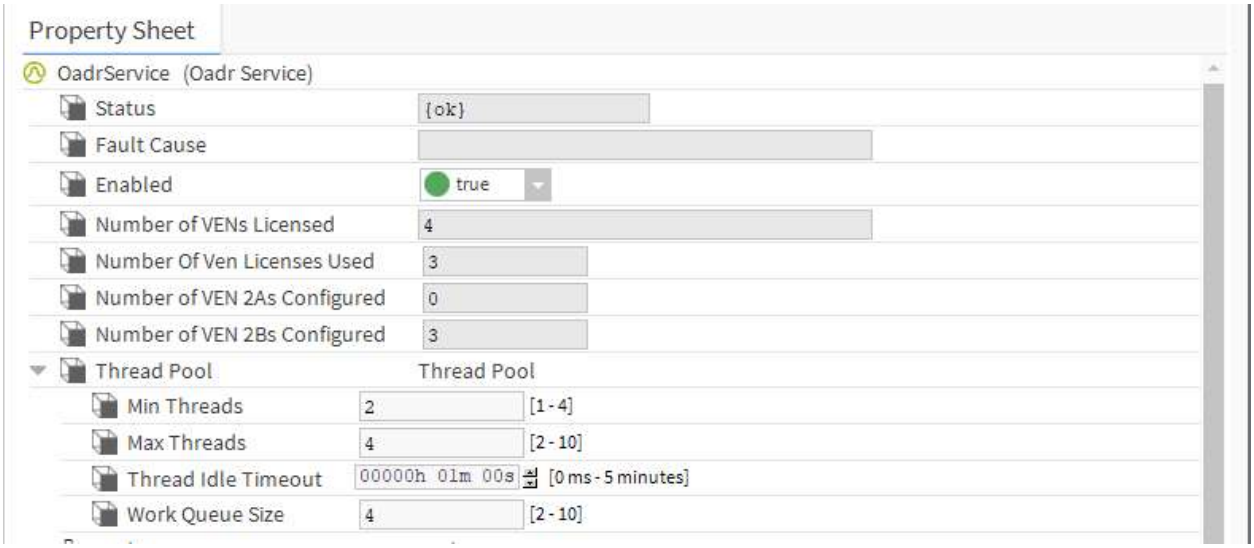
13. If the VTN address starts with https, you may need to approve the VTN host at the /Config/Services/PlatformServices/CertMangerService Allowed Hosts tab for the first time you try to access the VTN URL and then invoke the Oadr Create Party Registration Action again after approving the VTN Host.
14. If communication is successful, the Registration State property will change to “registered” and the Registration Id property will be filled in along with the VTN Id and VEN Id properties.
15. If the VEN Enabled property is set to true and Status property is {ok}, the VEN will start polling the VTN at the Poll Frequency the VTN has requested.
16. You can turn the station log for the openAdr.service and openAdr.Message to ALL to see the detailed messages that are exchanged between the VEN and the VTN. This is good practice during the initial configuration of the VEN and can provide insight into any issues that may be preventing successful communications.

OadrService Components

This section describes the main components that make up the OadrService and their properties.

OadrService

The OadrService object manages the lifecycle and licenses for the VEN objects configured under it. Only one OadrService object is allowed in the Station.

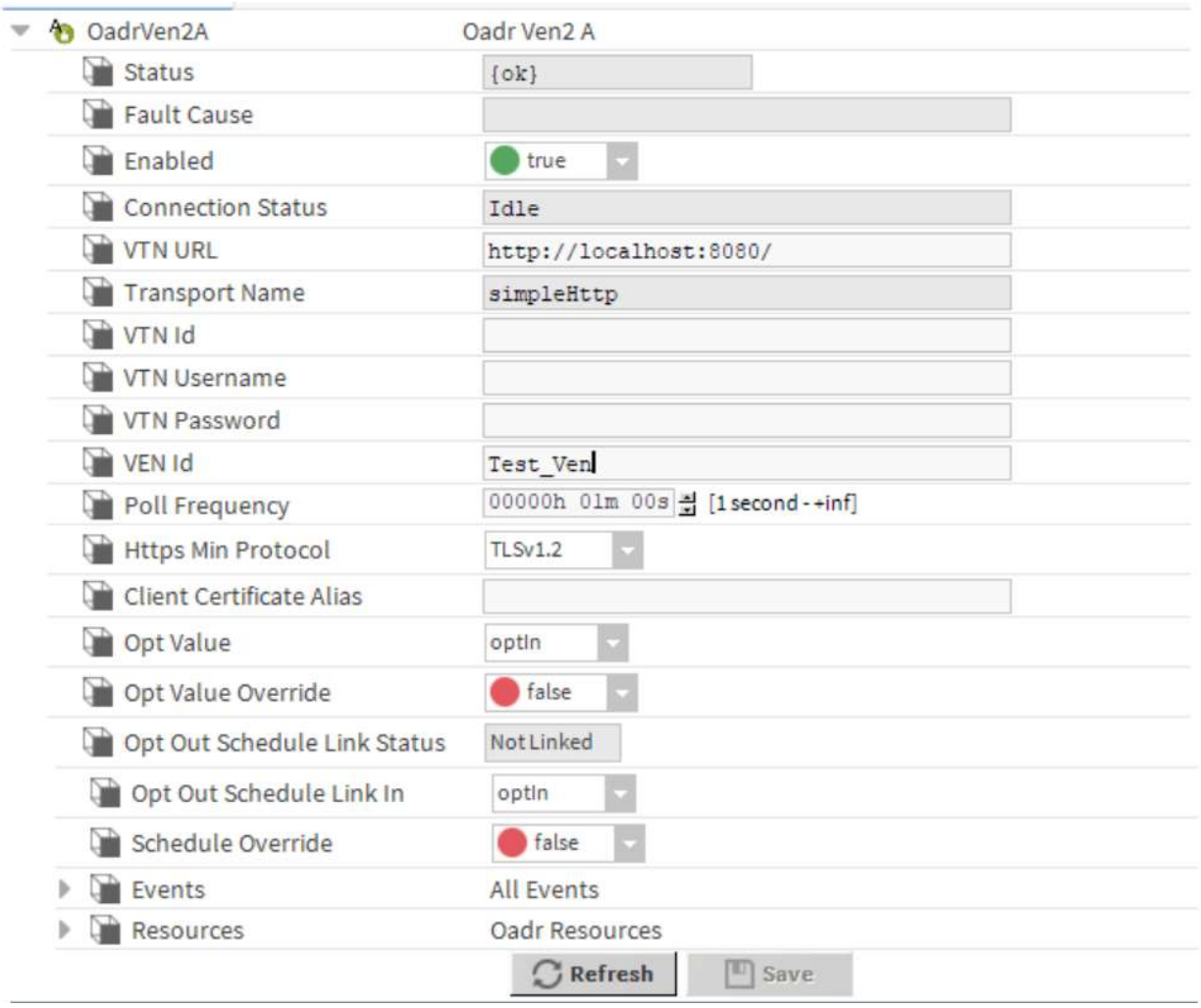


Properties of this component are listed below:

- Status: Text message showing status of this object. {ok} or error message.
- Fault Cause: Text message showing reason for fault.
- Enabled: Set to false to disable the OadrService.
- Number of VENs Licensed: Shows the VEN.limit quantity in the license file. This is how many VEN objects you can have in this station.
- Number of Ven Licenses Used: Shows the current number of VEN objects configured in the Station.
- Number of VEN 2As Configured: Shows how many VEN2A objects have been configured in the Station.
- Number of VEN 2Bs Configured: Shows how many VEN2B objects have been configured in the Station.
- Thread Pool: OadrService maintains a pool of Threads that the VENs can use to perform tasks such as communications without using the main engine thread.
- Thread Pool/Min Threads: Minimum number of threads the pool maintains all the time.
- Thread Pool/Max Threads: Maximum number of threads the pool can instantiate.
- Thread Pool/Thread Idle Timeout: Threads above Minimum thread count will be terminated if idle for this timeout period.
- Thread Pool/Work Queue Size: Threads are queued for execution. This is the number of threads that can be in queue or they will be blocked until a slot opens in the queue.

OadrVen2A

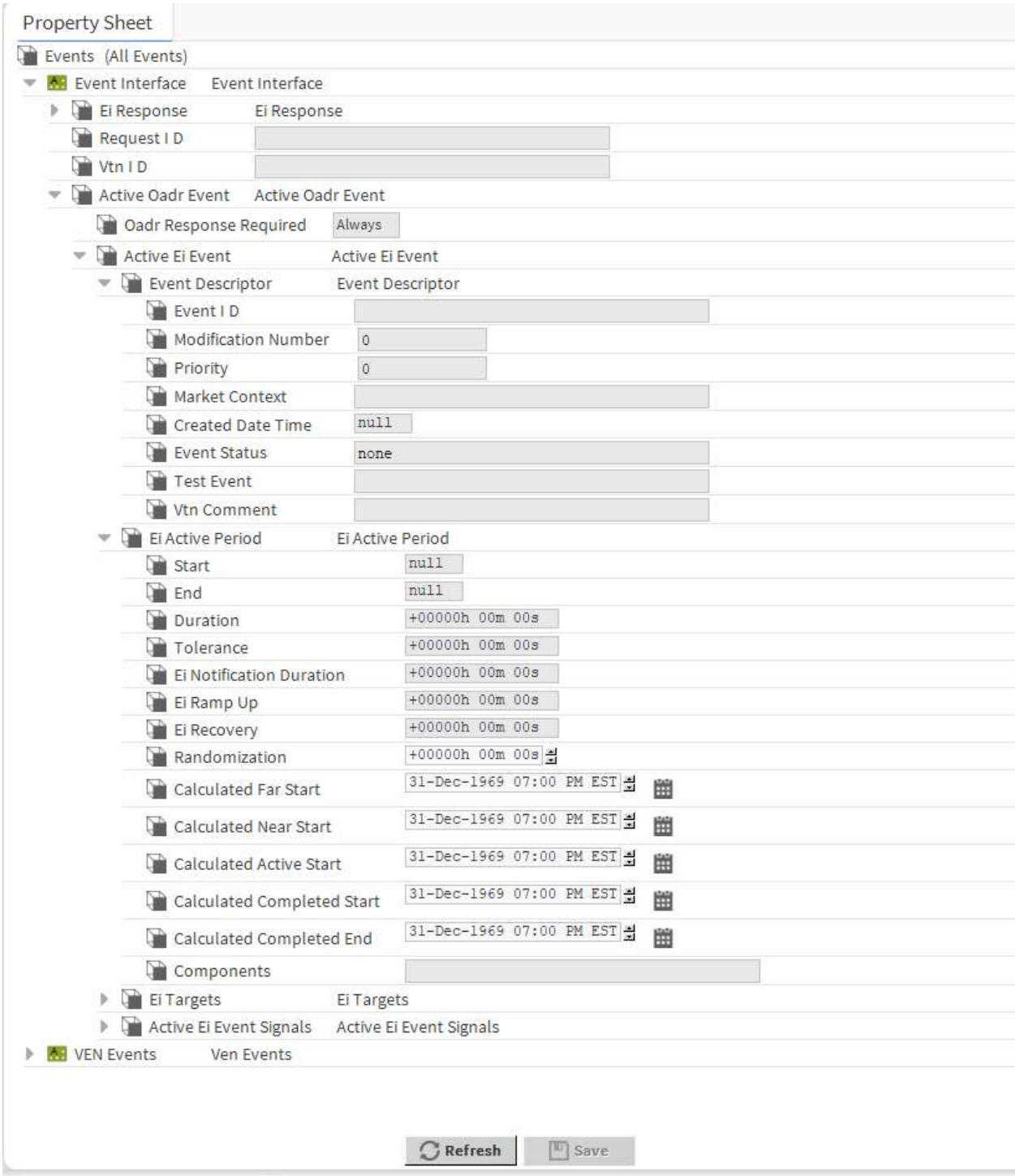
The OadrVen2A object represents the OpenADR 2.0A VEN in the Niagara Station. VEN objects can only exist under the OadrService.



Properties of this component are listed below:

- Status: Text message showing status of this object. {ok} or error message.
- Fault Cause: Text message showing reason for fault.
- Enabled: Set to false to disable the VEN polling.
- Connection Status: Shows communication status.
- VTN URL: VTN Endpoint. This URL should not include the OpenADR URIs (/OpenAdr2/Simple/EiEvent for example). Required for VTN communications.
- Transport Name: Only “simpleHttp” is supported by this VEN.
- VTN Id: Provided by the VTN operator.
- VTN Username: Leave blank unless VTN requires user authentication (not typical).
- VTN Password: Leave blank unless Username is filled in (not typical).

- VEN Id: Provided by the VTN operator after out-of-band registration. Required for VTN communications.
- Poll Frequency: Interval at which the VEN will poll for Events from the VTN.
- Https Min Protocol: TLSv1.2 is the current requirement for OpenADR 2.0.
- Client Certificate Alias: Fill in with the Alias of the OpenADR certificate Chain imported into the Niagara User Key Store.
- Opt Value: VEN level opt value. Defaults to optIn.
- Opt Value Override: If set to true then the Opt Value will be used without any further Opt calculation. Refer to the Event Workflow section on details about this property.
- Opt Out Schedule Link Status: Shows if an OadrOptSchedule is linked to this VEN.
- Opt Out Schedule Link In: Property of the VEN where the OadrOptSchedule should be linked to. Shows current Opt value of the linked in schedule.
- Schedule Override: If true ignore the OadrOptSchedule in calculating the opt value. Refer to the Event Workflow section on details about this property.
- Events: This node contains the Event Interface and the Ven Events objects. The Event Interface node is “static” and contains all the properties of an Event. VEN Events node contains a list of Events that have been sent to this VEN. Properties of the Event Interface node are filled in with the properties of the current “active event from the VEN Event list of events.



Event Interface can be used to link the Ramp Up and Recovery times, etc. to the station logic. The properties of this object will be updated automatically with the properties of the current Event at the beginning of its Notification time (Calculated Far Start time) and reset to nulls at the end of the Recovery period

(Calculated Completed End time). Refer to Figure 2 below for the time intervals of an event.

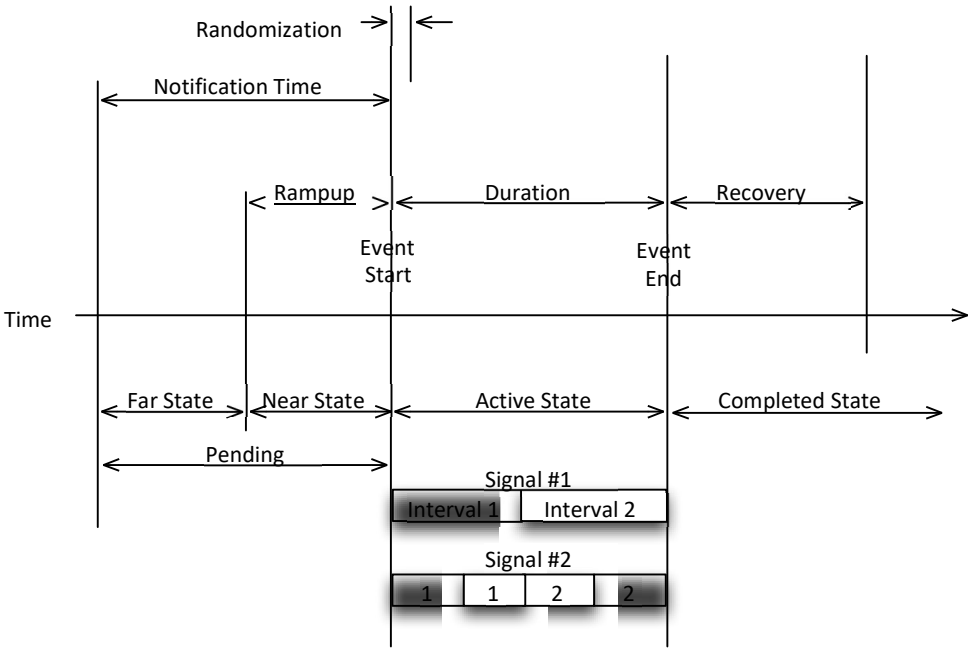
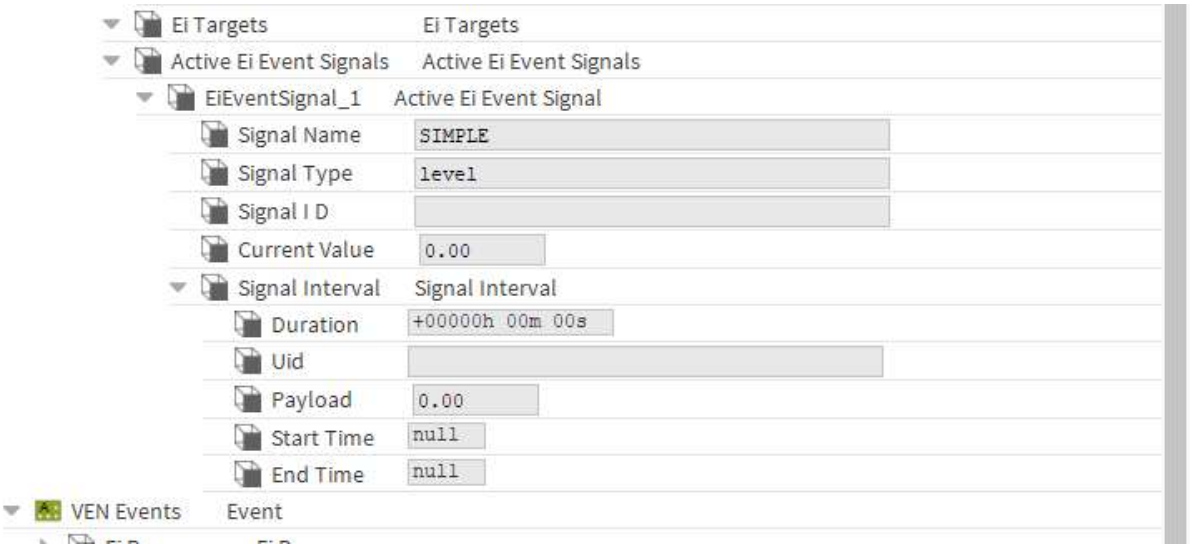


Figure 2 Time intervals of an event

Signal Filter objects can be configured under the Active Ei Event Signals node of the Event Interface object to configure specific Signals (Level, Electricity Price, etc.) that need to be linked to other station objects to drive displays or logic. Standard or Custom Signals can be configured by invoking the appropriate Action on the Active Ei Event Signals node of the Event Interface object.



If the Signals for the Active Event match the “Signal Name” property of the Signal Filter object then the rest of the Signal Filter properties will be set to the Signal

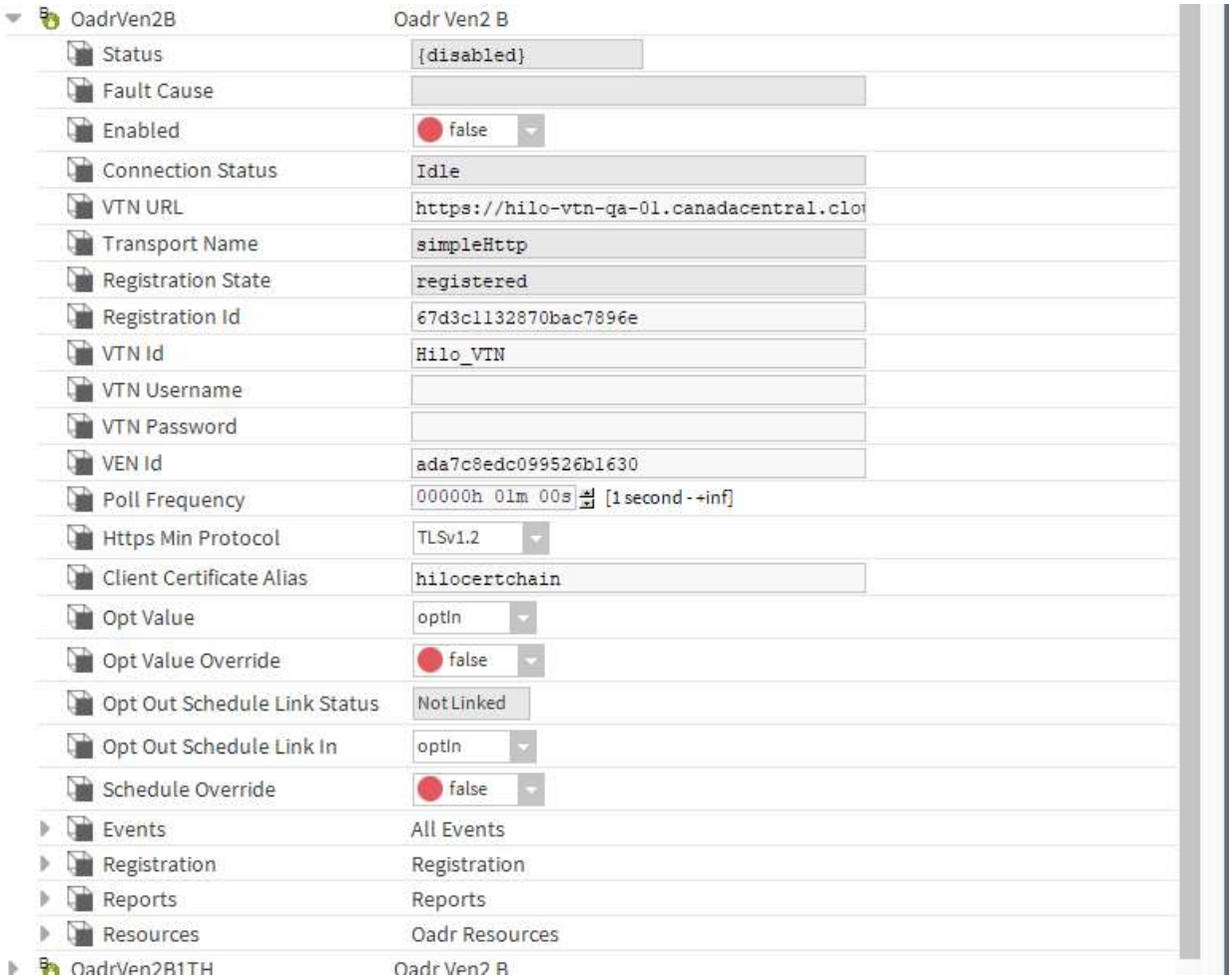
values. If the “Signal Name” does not match, then the properties of the Signal Filter object will remain ‘null’.

Actions

- Oadr Request Event: This action is used to request events from the VTN. If the OadrVen2A object’s Enabled property is set to true, this action is executed at the polling frequency to request events from the VTN. This action can also be invoked manually to request events immediately.

OadrVen2B

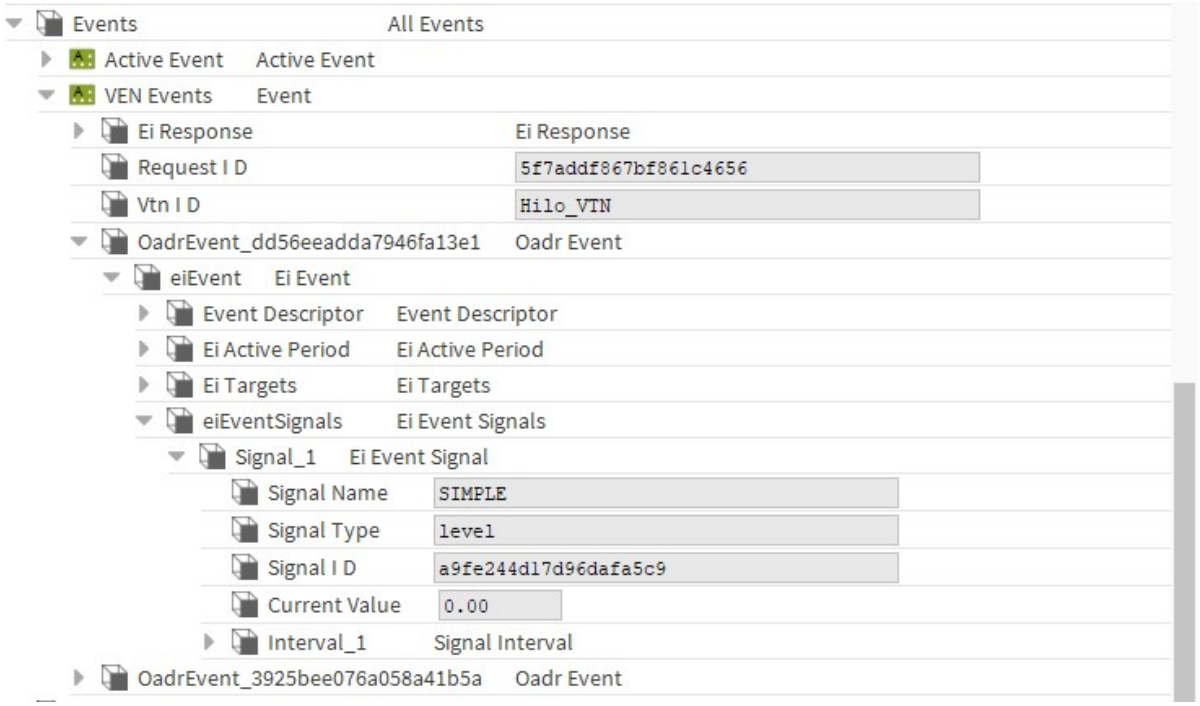
The OadrVen2B object represents the OpenADR 2.0B VEN in the Niagara Station. VEN objects can only exist under the OadrService.



Properties of this component are listed below:

- Status: Text message showing status of this object. {ok} or error message.
- Fault Cause: Text message showing reason for fault.

- Enabled: Set to false to disable the VEN polling.
- Connection Status: Shows communication status.
- VTN URL: VTN Endpoint. This URL should not include the OpenADR URIs (/OpenAdr2/Simple/EiEvent for example). Required for VTN communications.
- Transport Name: Only "simpleHttp" is supported by this VEN.
- Registration State: Shows "unregistered" or "registered". Must be in the registered state for polling the VTN. Automatically configured after successful invocation of the "Oadr Create Party Registration" Action.
- Registration Id: Automatically filled in after invoking the "Oadr Create Party Registration" Action. Can also be provided by the VTN operator after out-of-band registration. Required for VTN communications.
- VTN Id: Automatically filled in after invoking the "Oadr Create Party Registration" Action. Can also be provided by the VTN operator after out-of-band registration.
- VTN Username: Leave blank unless VTN requires user authentication (not typical).
- VTN Password: Leave blank unless Username is filled in (not typical).
- VEN Id: Automatically filled in after invoking the "Oadr Create Party Registration" Action. Can also be provided by the VTN operator after out-of-band registration.
- Poll Frequency: Interval at which the VEN will invoke the "Oadr Poll" Action to get updates from the VTN. The polling interval is set to the Polling Frequency requested by the VTN during registration. This interval can be manually set to a value slower than the poll frequency requested by the VTN but not any faster.
- Https Min Protocol: TLSv1.2 is the current requirement for OpenADR 2.0.
- Client Certificate Alias: Fill in with the Alias of the OpenADR certificate Chain imported into the Niagara User Key Store.
- Opt Value: VEN level opt value. Defaults to optIn.
- Opt Value Override: If set to true then the Opt Value will be used without any further Opt calculation. Refer to the Event Workflow section on details about this property.
- Opt Out Schedule Link Status: Shows if an OadrOptSchedule is linked to this VEN.
- Opt Out Schedule Link In: Property of the VEN where the OadrOptSchedule should be linked to. Shows current Opt value of the linked in schedule.
- Schedule Override: If true ignore the OadrOptSchedule in calculating the opt value. Refer to the Event Workflow section on details about this property.
- Events: This node contains the Event Interface and the Ven Events objects. The Event Interface node is "static" and contains all the properties of an Event. VEN Events node contains a list of Events that have been sent to this VEN. Properties of the Event Interface node are filled in with the properties of the current "active" event from the VEN Event list of events.



Event Interface can be used to link the Ramp Up and Recovery times, etc. to the station logic. The properties of this object will be updated automatically with the properties of the current Event at the beginning of its Notification time. Refer to Figure 2 below for the time intervals of an event.

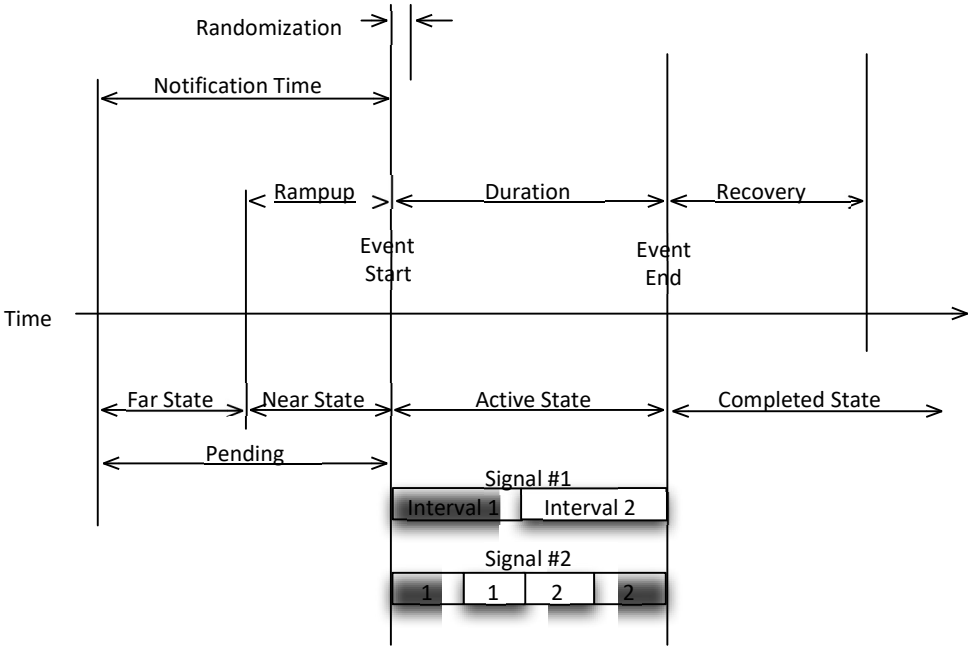
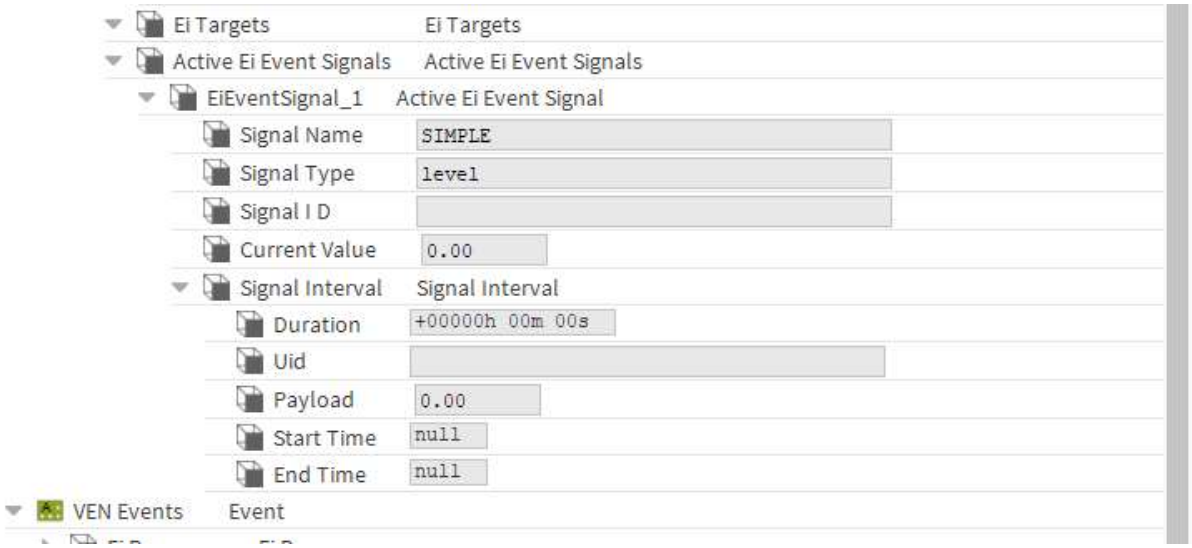


Figure 2 Time intervals of an event

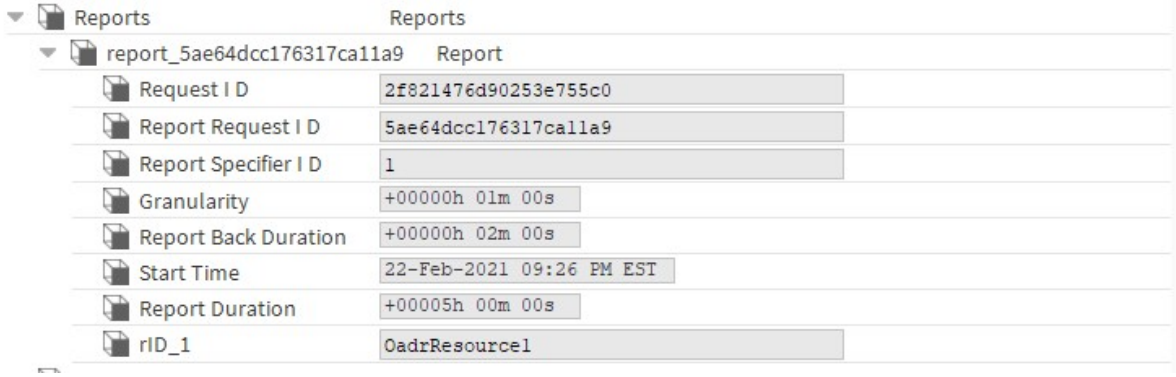
Signal Filter objects can be configured under the Active Ei Event Signals node of the Event Interface object to configure specific Signals (Level, Electricity Price, etc.) that need to be linked to other station objects to drive displays or logic. Standard or Custom Signals can be configured by invoking the appropriate Action on the Active Ei Event Signals node of the Active Event object.



If the Signals for the Active Event match the “Signal Name” property of the Signal Filter object then the rest of the Signal Filter properties will be set to the Signal values. If the “Signal Name” does not match, then the properties of the Signal Filter object will remain ‘null’.

OadrVen2B object has one Action called “Oadr Poll”, if its Enabled property is set to true, it is executed at the polling frequency. This action can also be invoked manually to request events immediately.

- Registration: This node contains the properties of the registration message used to register the VEN. The properties will be filled in automatically once the VEN has been registered with the VTN by invoking the “Oadr Create Party Registration” Action on the OadrVen2B object.
- Reports: This node contains the list of reports that have been requested by the VTN.



- Resources: This node contains the list of OadrResource objects that have been configured for this OadrVen2B object.

Actions

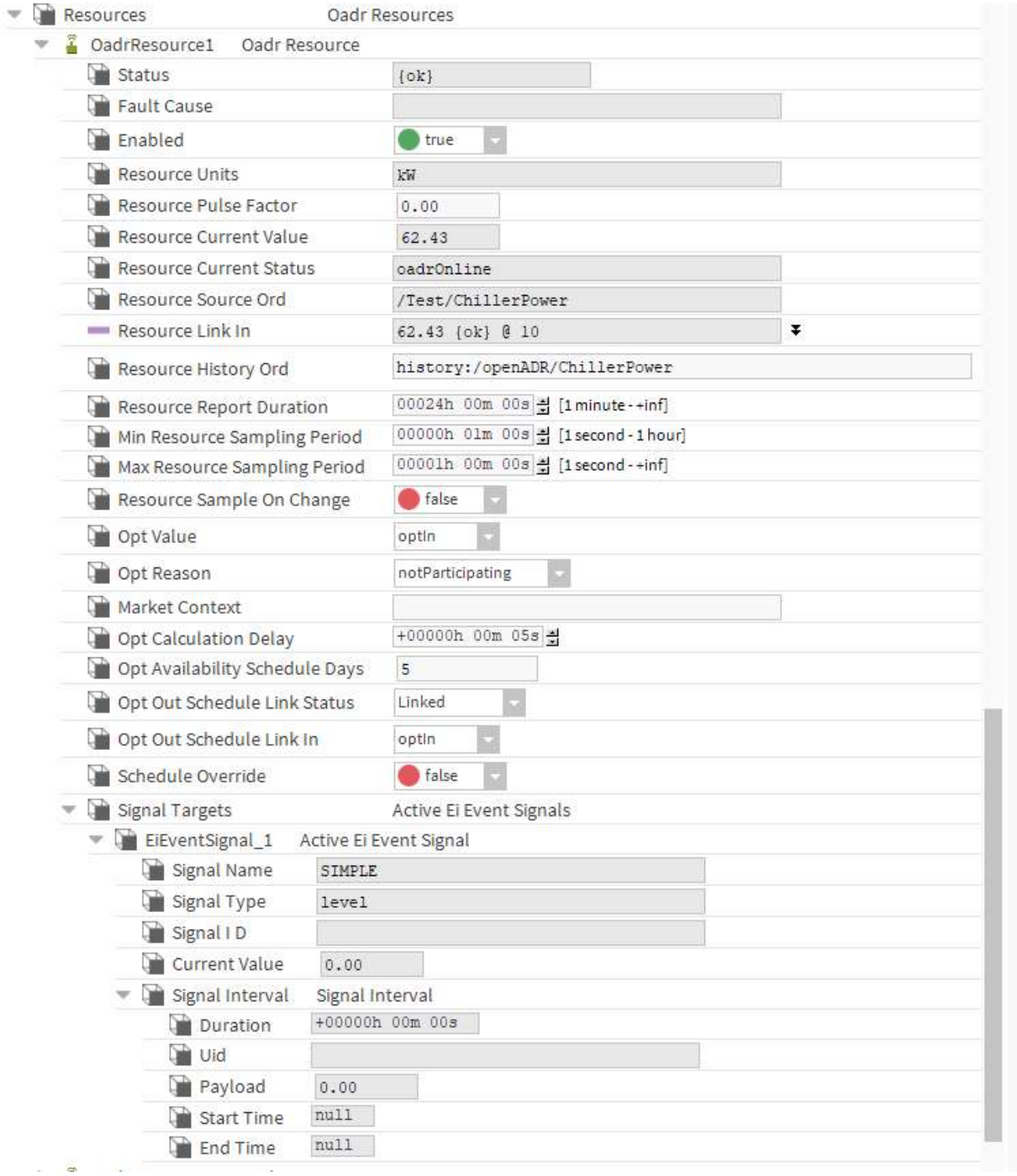
- Oadr Query Registration: This action is used to query the VTN to determine what profiles, transports, and extensions it may support. Note that the VEN will need to be configured out of band with the address of the VTN to initiate the query. The response to the query can be viewed in the debug console of the station to see the profiles, transports, etc. supported by the VTN.
- Oadr Create Party Registration: This action is used to register the VEN with the VTN. Note that the VEN will need to be configured out of band with the address of the VTN to initiate the query. VEN object properties Registration State, Registration Id, and VTN Id are configured after successful invocation of this Action. The Registration object properties will also be configured after successful invocation of this action.
- Oadr Cancel Party Registration: This action is used to cancel an active VEN registration.
- Self Cancel Party Registration: This action is used to cancel VEN registration without communicating to the VEN. The Registered state property of the VEN object is set to unregistered. This Action is only used for testing purposes and should not be invoked under normal operating conditions.
- Oadr Request Event: This action is used to request events from the VTN. If the VEN object's Enabled property is set to true, this action can be invoked manually to request events immediately.
- Oadr Register Report: This action is used to register the reports capabilities of the VEN. This Action is automatically invoked during the Registration process. This action can also be invoked manually to Register Reports if Resource object configuration of the station is changed. Note that after the Register Report Action is invoked the Request Events Action is automatically invoked as well.
- Oadr Poll: This action is used to poll for messages (events, re-registration,reports etc.) from the VTN. If the VEN object's Enabled property is set to true, this action is executed at the polling frequency to request messages from the VTN. This action can also be invoked manually to request messages from the VTN immediately.

OadrResource

The OadrResource object represents one or more loads that are managed by this VEN. These are the interface objects to be linked to the rest of the station objects and logic. OadrResource objects can only exist under the Resources node of the OadrVen2B object.SI need to add the standard or custom signals under the Signal Target property of resource object using appropriate action.

When VEN receives any event from VTN it gets added under VEN Events node .When event goes to far state then properties of Active interface node gets populated with that specific VEN Event. Once the event goes to active state then signal payload values get updated under Event interface - > Active Ei Event Signal as well as under targeted resource's Active Ei Event Signal. When event's completed start time is reached signal payload under the Event interface - > Active Ei Event Signal as well as under targeted resource's Active Ei Event Signal gets cleared.

Please note that only targeted resources signal payload gets updated.



Properties of this component are listed below:

- Status: Text message showing status of this object. {ok} or error message.
- Fault Cause: Text message showing reason for fault.
- Enabled: Set to false to disable the VEN polling.
- Resource Units: Units derived from the units of the linked in resource. Units must be configured for the Reports to work. Only Power (Watts) or Energy (Watt-Hours) are the allowed Resources.

- Resource Pulse Factor: Enter the pulse factor if this resource is a pulse counter.
- Resource Current Value: Current value of the linked in resource object.
- Resource Current Status: oadrOnline or manualOverride based on the linked in resource priority array value. If priority array value is 8 (user override) or less, then the resource is in manualOverride. If the priority array is higher than 9 then the linked in resource is oadrOnline. These values are used in the Telemetry Status Report.
- Resource Source Ord: Derived from the Resource Link in property.
- Resource Link in: Property to link a Numeric point representing the power or energy used by this resource.
- Resource History Ord: Standard Niagara History associated with the resource linked in. Must be Numeric values representing power or energy.
- Resource Report Duration: Maximum reporting period available for Telemetry Usage or Status reports for this resource.
- Min Resource Sampling Period: Minimum sampling period this resource can be configured to provide data for the Telemetry Usage and Status reports.
- Max Resource Sampling Period: Maximum sampling period this resource can be configured to provide data for the Telemetry Usage and Status reports.
- Resource Sample On Change: If set to true this resource supports COV sampling for the Telemetry Usage and Status reports.
- Opt Value: Opt value for this resource. Refer to the Event Workflow topic for details on this property.
- Opt Reason: select the reason for opting out for this resource when sending the resource opt schedule to the VTN.
- Market Context: If blank this resource participates in all Market Contexts, otherwise this resource participates only if the Event Market Context matches the Market Context listed here.
- Opt Calculation Delay: Delay in calculating the Opt schedule for this resource after the Event has targeted this resource to allow the station logic to influence the Opt schedule if needed.
- Opt Availability Schedule Days: Number of days since today to generate the “vavailability” schedule for this resource.
- Opt Out Schedule Link Status: Shows if an OadrOptSchedule is linked to this Resource.
- Opt Out Schedule Link In: Property of the Resource where the OadrOptSchedule should be linked to. Shows current Opt value of the linked in schedule.
- Schedule Override: If true ignore the OadrOptSchedule in calculating the opt value. Refer to the Event Workflow section on details about this property.
- Signal Targets: Invoke the “Add Standard Signal Targets” or “Add Custom Signal Targets” on this property to configure the signal targets that this resource participates in. If the Event Signal matches the signal configured here its

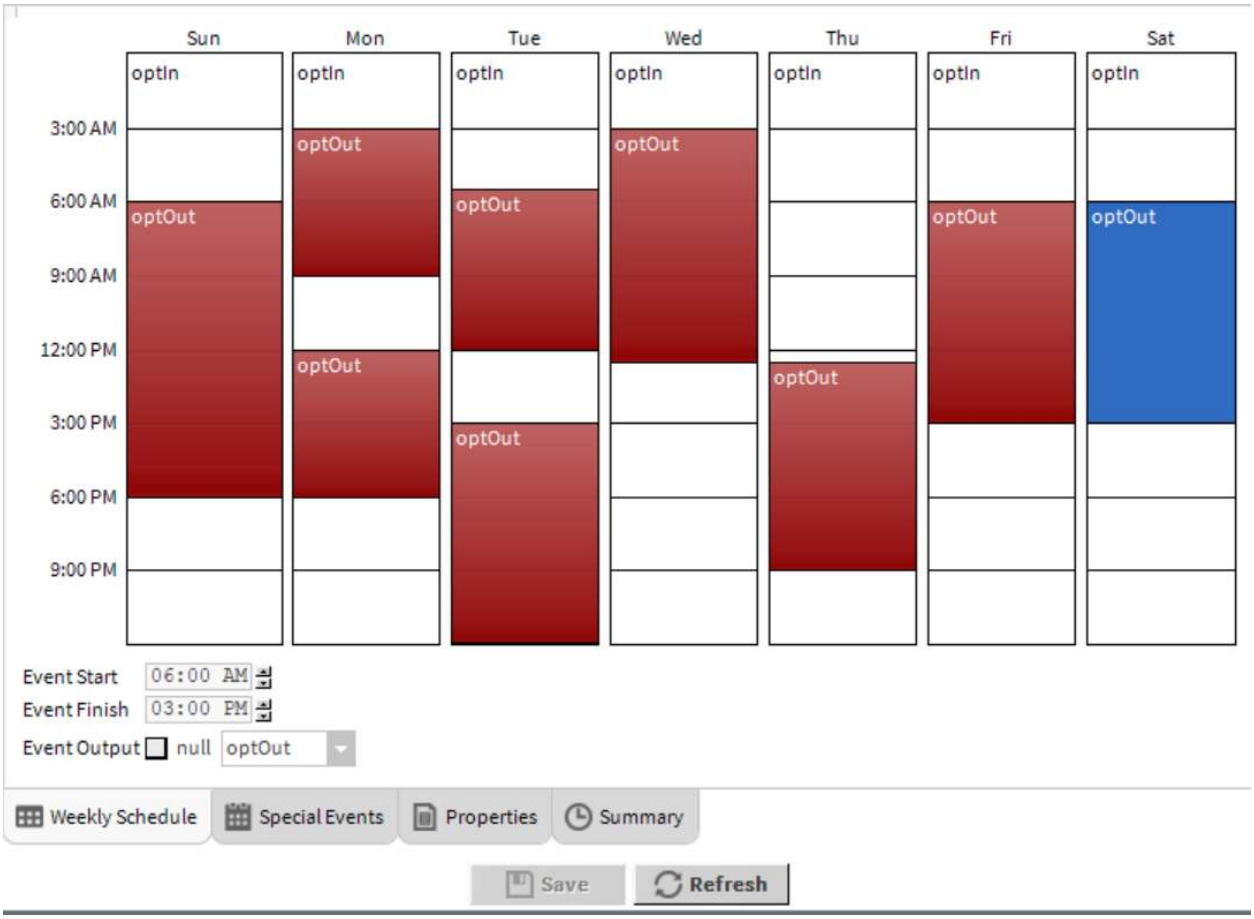
properties will be mapped to Resource signal properties when the signal interval is active.

Actions

- Update Resource: This action is used to update the Signal Targets properties of the Resource object. This Action is triggered automatically based on the Events and their states in the station and should not be invoked manually under normal operating conditions.
- Oadr Create Opt: This action is used to generate and send the vavailability schedule of this resource to the VTN. This action can be invoked manually or based on station logic. If resource's schedule override property is true or if no schedule is connected to resource then it sends full day schedule with opt value as resource's opt value else it sends all schedule time slots with duration for connected schedule.
- Oadr Cancel Opt: This action is used to cancel the Opt Schedule for this Resource.

OadrOptSchedule

The OadrOptSchedule object is used to create the optOut schedule for the VEN or individual Resources configured in the station. This schedule is also used to generate the "vavailability" schedule of a resource that is sent to the VTN using the EiOpt service.

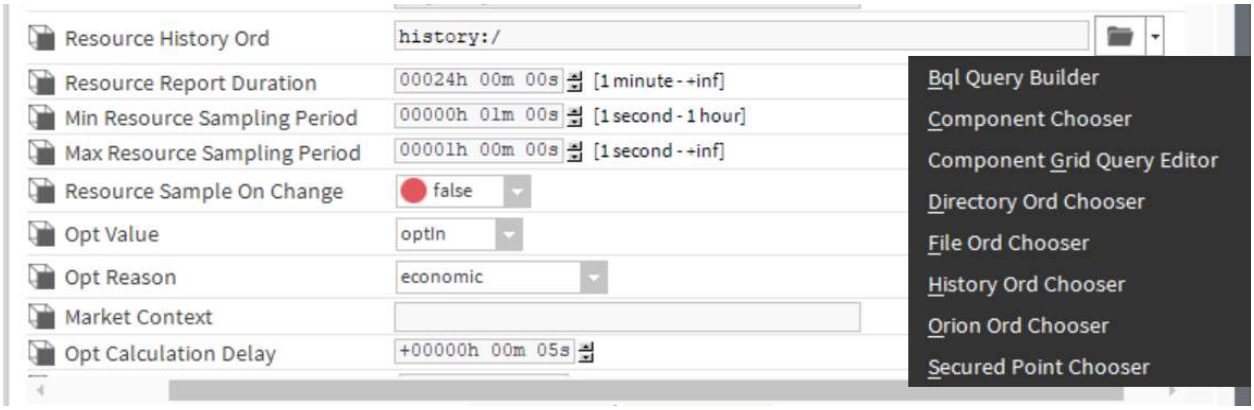

Sun
Mon
Tue
Wed
Thu
Fri
Sat
optIn
3:00 AM
6:00 AM
9:00 AM
12:00 PM
3:00 PM
6:00 PM
9:00 PM
optOut
Event Start
06:00 AM
Event Finish
03:00 PM
Event Output
null
optOut
Weekly Schedule
Special Events
Properties
Summary
Save
Refresh

Reports

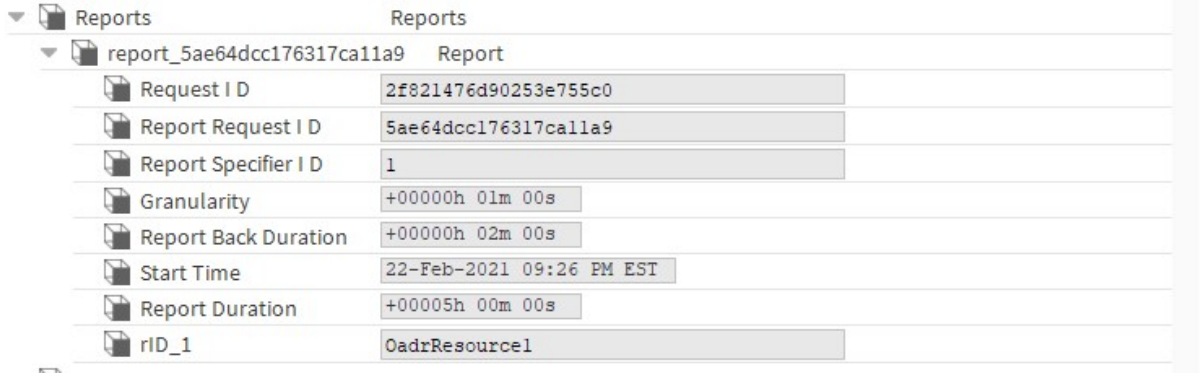
Niagara VEN supports 3 types of reports.

1) Telemetry Usage
2) Telemetry Status
3) History Usage

Once VTN request for report, then VEN sends the report details to VTN.
VTN can request only registered reports from VEN, So VEN has to register the reports first. Report registration automatically happens during create party registration of VEN.
If user adds any new resources after the registration process then user need to invoke action “Oadr Register Report” on VEN to register report.
In order to register the history usage report user first need to select the history ord using the property “Resource History Ord” as shown in below snapshot.



Reports node contains the list of reports that have been requested by the VTN.



Event Workflow

Niagara VEN calculates the opt value for an event based on the following properties:

a) VEN "Opt Out Schedule" opt value
b) VEN Resources opt value

Scenario 1: Events are sent to the VEN and the "Ei Target->Resources" property is blank. This means that ***all*** resources have been targeted and should be processed as described below.

1. Events are added to the "All Events" node of the VEN.
2. If the VEN "Opt Value Override" is true then the VEN's "Opt Value" will be used as the published value for the events and no further processing of any resources will take place.
3. If there is no Opt Out schedule linked into the "Opt Out Schedule Link In" property of the VEN or the schedule is linked in, but the "Schedule Override" value is set to true then all resources under this VEN will be processed as described below to calculate the published opt value for this event.
4. If there is an Opt Out schedule linked into the "Opt Out Schedule Link In" property of the VEN then it will be processed between the calculated start and end times of the event. If any period of the event falls within the linked in schedules opt out time the opt value for this event will be published as "optOut" and no further processing of any resources will take place.
5. If the "Opt Out" schedule linked in to the VEN calculates to "optIn" or If there is no Opt Out schedule linked into the "Opt Out Schedule Link In" property of the VEN or the schedule is linked in but the "Schedule Override" value is set to true, then all active resources under this VEN (resource status value is "{ok}") will be processed to see if any of the resources opt value calculation result is "optOut" during the event's active time. If all the participating resources (targeted, marketContext and signal match) calculate to "optIn" for the duration of the event, then the opt value for this event will be published as "optIn". If on the other hand any of the resource's calculations evaluate to Opt Out the opt value for the event will still be published as "optIn". The availability schedule of resources that are Opt Out can be sent to the VTN by invoking the "Oadr Create Opt" action on the Resource object. This action can be invoked asynchronously at any time the VEN wants to inform the VTN about its resource availability.
6. Note that if the "Market Context" property of the Resource is blank then it participates in all markets. If the "Market Context" property has a comma separated list of market contexts, then this resource will only participate in the events that

have a market context that matches at least one of the market contexts in the resource's list of market contexts.

Scenario 2: Events are sent to the VEN and the "Ei Target" property has a comma separated list of resources that are targeted by this event. "Market Context" is blank so participate in all Market Contexts.

1. Events are added to the "All Events" node of the VEN.
2. If the VEN "Opt Value Override" is true then the VEN's "Opt Value" will be used as the published value for the events and no further processing of any resources will take place
3. If there is no Opt Out schedule linked into the "Opt Out Schedule Link In" property of the VEN or the schedule is linked in, but the "Schedule Override" value is set to true then the VEN "Opt Value" property will be used as the opt value for this event and all resources under this VEN will be processed as described below to calculate the published opt value for this event.
4. If there is an Opt Out schedule linked into the "Opt Out Schedule Link In" property of the VEN then it will be processed between the calculated start and end times of the event. If any period of the event falls within the linked in schedules opt out time the opt value for this event will be published as "optOut" and no further processing of any resources will take place.
5. If the "Opt Out" schedule linked in to the VEN calculates to "optIn" or If there is no Opt Out schedule linked into the "Opt Out Schedule Link In" property of the VEN or the schedule is linked in but the "Schedule Override" value is set to true, then all active resources under this VEN (resource status value is "{ok}") will be processed to see if any of the resources opt value calculation result is "optOut" during the event's active time. If all the participating resources (targeted, marketContext and signal match) calculate to "optIn" for the duration of the event, then the opt value for this event will be published as "optIn". If on the other hand any of the resource's calculations evaluate to Opt Out the opt value for the event will still be published as "optIn". The availability schedule of resources that are Opt Out can be sent to the VTN by invoking the "Oadr Create Opt" action on the Resource object. This action can be invoked asynchronously at any time the VEN wants to inform the VTN about its resource availability.
6. Note that if the "Market Context" property of the Resource is blank then it participates in all markets. If the "Market Context" property has a comma separated list of market contexts, then this resource will only participate in the events that have a market context that matches at least one of the market contexts in the resource's list of market contexts.

Since many property values can affect the Opt schedule calculation the following table can be used as guide to determine the final Opt Value sent to the VTN.

Opt Calculation Table:

VEN Opt Value Override	VEN Schedule Linked	VEN Schedule Override	RESOURCE Schedule Linked	RESOURCE Schedule Override	Response
TRUE	NA	NA	NA	NA	VEN's Opt Value
FALSE	TRUE	TRUE	TRUE	TRUE	As per event target either all or only targeted RESOURCE objects will be evaluated as below. If event targets all resource then if any RESOURCE is OptIn then the Event response will be OptIn . If all resources OptOut then event response will be OptOut. If event targets only specific resources then if any targeted RESOURCE is OptIn then the Event response will be OptIn . If all targeted resources OptOut then event response will be OptOut. Below statement specifies how individual resource opt value is calculated. Specific RESOURCE Opt value will be set for that resource.
FALSE	TRUE	TRUE	TRUE	FALSE	As per event target either all or only targeted RESOURCE objects will be evaluated. Below statement specifies how individual resource opt value is calculated. Specific RESOURCE Opt value will be set as per evaluation of linked in opt out schedule for specific resource.
FALSE	TRUE	TRUE	FALSE	NA	As per event target either all or only targeted RESOURCE objects will be evaluated. Below statement specifies how individual resource opt value is calculated. Specific RESOURCE Opt value will be set for that resource.
FALSE	TRUE	FALSE			Evaluation of VEN schedule.

					If VEN Schedule calculates to OptOut then it sends “OptOut” value to VTN. Else if VEN Schedule calculates to “Opt In” then as per event target either all or only targeted RESOURCE objects will be evaluated.
FALSE	FALSE	NA			As per event target either all or only targeted RESOURCE objects will be evaluated.