



CONNECTING
THE WORLD



NF 23

CONNECTING
THE WORLD

Optimising and Troubleshooting Niagara Applications

James Johnson – Tridium

Jason Woollard - Tridium

Sold Out
Show

LIVE AND DANGEROUS

hello

NF
23



ONE NIGHT ONLY

Fairwell
Tour

TRIDIUM

Best Practices



[This Photo](#) by Unknown Author is licensed under [CC BY-SA-NC](#)

- The Niagara Framework provides multiple options to accomplish the same task.
- The best option varies depending on specific customers and requirements.

Why do I need to learn troubleshooting

Planning the rescue
before the mission begins



[This Photo](#) by Unknown Author is licensed under [CC BY](#)

The Six Stages of Debugging

1. That can't happen
2. That doesn't happen on my machine
3. That shouldn't happen
4. Why does that happen?
5. Oh, I see
6. How did that ever work?



What Should You Look For

- CPU usage – evaluate overall and by process if available, overall should be less than 80%.
- Memory – after garbage collection used heap should be less than 75% of max heap.
- Histories – maximum of 6000 for a JACE-8 controller.
- Engine Hogs – insight to what components in the station use the most CPU.
- Spy – more detailed diagnostic information.

Spy

Remote Station | console

- console_backup_230331_1457.txt
- console_backup_230331_1421.txt
- console_backup_230331_1450.txt
- console_backup_230403_1634.txt
- console_backup_230403_1626.txt
- console_backup_230321_1704.txt
- console_backup_230331_1407.txt
- console_backup_230420_1416.txt
- console.txt

Remote Station | platform diagnostics

Platform Diagnostics

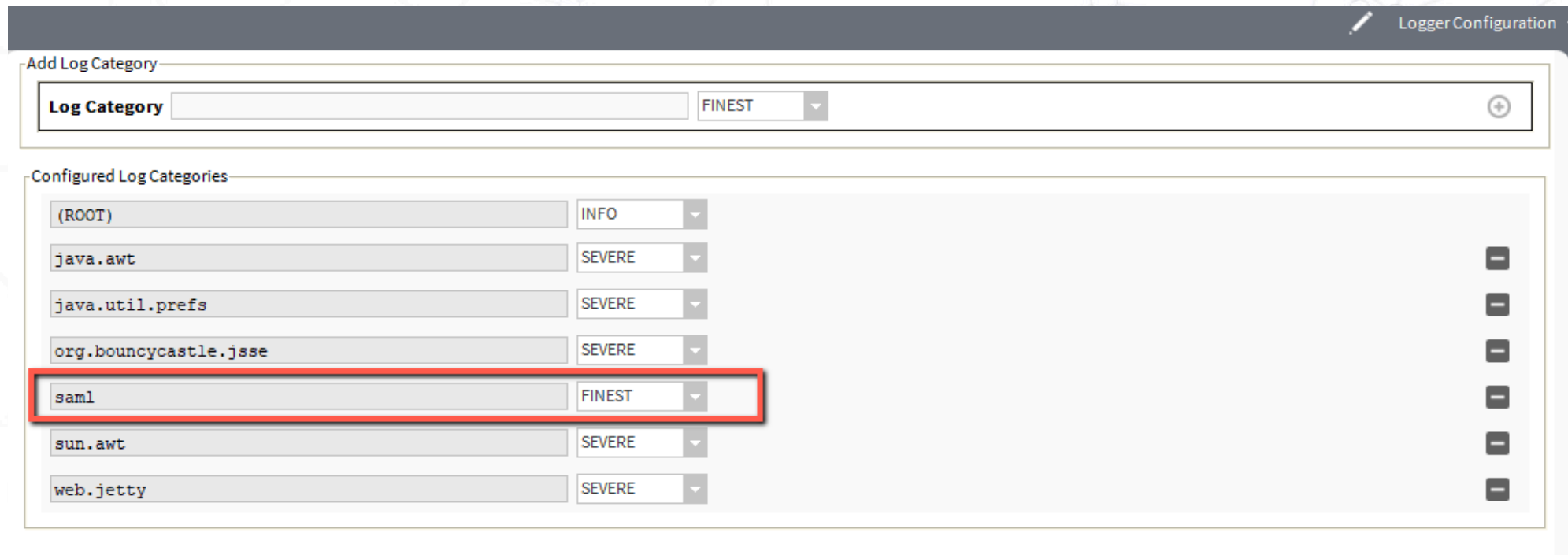
df -k
ifconfig -a
netstat -A
nicinfo
pidin
pidin arg
pidin env
pidin family
pidin fds
pidin in
pidin mem
pidin pmem
pidin times
pidin ttimes
fd usage
flash disk usage
JMX Info

Remote Station | sysManagers

- registryManager
- schemaManager
- licenseManager
- moduleManager
- engineManager
- leaseManager
- serviceManager
- stationManager
- resourceManager
- diagnosticManager
- queryHandlers
- networkInterfaceManager
- scheduleManager
- dataRecoveryManager

Finding More Information

- Adjust logs to different levels for debugging purposes.
- Return to default logger settings when finished.



The screenshot shows a web-based 'Logger Configuration' interface. At the top, there is a header bar with a pencil icon and the text 'Logger Configuration'. Below this is a section titled 'Add Log Category' which contains a text input field labeled 'Log Category' and a dropdown menu currently set to 'FINEST'. Below the 'Add Log Category' section is a table titled 'Configured Log Categories'. The table has two columns: the first column lists log categories and the second column shows their current log level. The categories listed are (ROOT), java.awt, java.util.prefs, org.bouncycastle.jsse, saml, sun.awt, and web.jetty. The log levels for (ROOT), java.awt, java.util.prefs, org.bouncycastle.jsse, sun.awt, and web.jetty are all set to 'SEVERE'. The 'saml' category is highlighted with a red rectangular border, and its log level is set to 'FINEST'. To the right of the table, there are several minus signs in a vertical column, likely for removing categories.

Log Category	Log Level
(ROOT)	INFO
java.awt	SEVERE
java.util.prefs	SEVERE
org.bouncycastle.jsse	SEVERE
saml	FINEST
sun.awt	SEVERE
web.jetty	SEVERE

Tech Support Dos and Don'ts

- Provide Niagara version
- Provide a copy of custom modules
- Explain how to reproduce the issue
- Provide a station backup and bog file passphrase
- Provide application director output with errors, consider performing a thread dump.
- Provide backup console text and spy logs
- Provide client console output for UI type issues
- **Don't provide screen captures of text files**

Troubleshooting Articles

- [Unexpected Restarts](#)
- [Fox Connections](#)
- [BACnet MSTP](#)
- [BACnet Tuning Suggestions](#)
- [Code Signing](#)
- [Tridium Talk – Developer Series](#)

Scenario 1: Bog File Protection

Bog File Protection - Overview

- Sensitive information is encrypted in a bog file.
- Bog files in a backup distribution file or under your Niagara user home are encrypted using a passphrase.
- Bog files in the Niagara daemon user home are encrypted using the host's key ring file.
- A unique key ring file is generated for each Niagara installation on a given host and is locked to that host.

Reversible Encoding Key Source

- **None** – not encrypted, file can be copied to other hosts.

```
: My File System : UserHome : stations : Test : config.bog
<?xml version="1.0" encoding="UTF-8"?>
<bajaObjectGraph version="4.0" reversibleEncodingKeySource="none" F
<p h="c0" c="1" m="b=baja" t="b:Station">
```

- **External** – encrypted using passphrase makes bog file portable, file can be copied to other hosts.

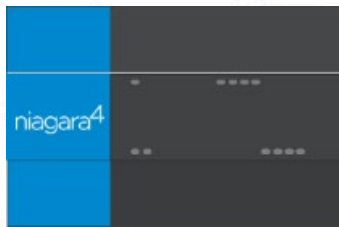
```
: My File System : UserHome : stations : Bldg1F1 : config.bog
<?xml version="1.0" encoding="UTF-8"?>
<bajaObjectGraph version='4.0' reversibleEncodingKeySource='external' FIPSE
<p h='2' c='1' m='b=baja' t='b:Station'>
<n n="stationName" v="Bldg1F1"/>
```

- **Keyring** – encrypted using node locked key ring file, must use station copier or backup dist to make portable.

```
: C: : ProgramData : Niagara4.13 : tridium : stations : Bldg1F1 : config.bog
<?xml version="1.0" encoding="UTF-8"?>
<bajaObjectGraph version='4.0' reversibleEncodingKeySource='keyring' FIPSEnabled='fal
<p h='2' c='1' m='b=baja' t='b:Station'>
```


Bog File Protection - Workflow

- Bog file on the remote station is encrypted using the host's key ring file.
- Station copier and backup functions decrypt the bog file using the key ring on the host and re-encrypt the bog file using the host's passphrase prior to transfer



Station Copier or Backup Dist



Host Passphrase = **MySecret27#**
Bog encrypted by host's key ring

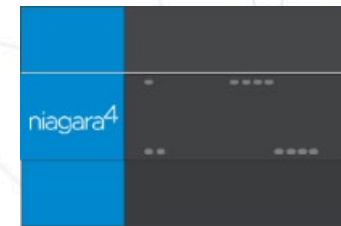
Host Passphrase = Niagara4Rocks
Bog encrypted by passphrase **MySecret27#**

Bog File Protection - Workflow

- Bog file and host passphrases don't match.
- Station copier and commissioning wizard functions prompt the user to provide the bog file passphrase to decrypt the bog file from the client and re-encrypt using the host's key ring.



Station Copier or Commissioning Wizard



Host Passphrase = Niagara4Rocks
Bog encrypted by passphrase = **MySecret27#**

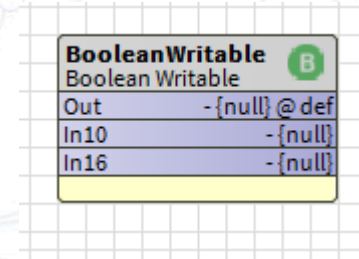
Host Passphrase = PigsFly@82
Bog encrypted by **host's key ring**



Scenario 2: Using the Poll Scheduler to improve performance

Getting Straight to the Point...

- The Control Points used in strategy / wiresheet logic have a **null** Proxy Extension
- Support extensions:
 - HistoryExt
 - AlarmExt
 - DiscreteTotalizerExt
 - ...



BooleanWritable (Boolean Writable)

Facets trueText=true,falseText=false >> ⌚ ▾

▶ Proxy Ext	null
Out	- {null} @ def
In1	- {null}
In2	- {null} ▾
In3	- {null} ▾
In4	- {null} ▾
In5	- {null} ▾

The Proxy Point is, one that...

- Has an **Proxy Ext** appropriate to its parent driver
- With driver specific properties e.g.
 - **Address** details

N Fuel Level (Numeric Writable)

Facets units=L,precision=1 L,min=-inf L,max=+inf L >> ⌚

Proxy Ext Modbus Client Numeric Proxy Ext

Status {ok}

Fault Cause

Enabled ☒ true

Device Facets units=L,precision=1 L,min=-inf L,max=+inf L >> ⌚

Conversion Default

Tuning Policy Name Default Policy

Read Value 101.0 L {ok}

Write Value 101.0 L {ok} @ def

Poll Frequency Normal

Data Address Modbus 40001

Absolute Address Modbus 40001

Data Source Point Poll

Reg Type Holding

Data Type Integer Type

Out 101.0 L {ok} @ def

In1 - {null}

In2 - {null}

BACnet example...

- Has an **Proxy Ext** appropriate to its parent driver
- With driver specific properties e.g.
 - **Address** details

The screenshot shows a configuration window for a BACnet device. An orange arrow points from the text 'Has an Proxy Ext appropriate to its parent driver' to the 'Proxy Ext (Bacnet Boolean Proxy Ext)' header. A green box highlights the 'Tuning Policy Name' dropdown, which is set to 'Default Policy'. Another orange arrow points from the text 'With driver specific properties e.g. Address details' to a group of properties including 'Object Id', 'Property Id', 'Property Array Index', 'Data Type', 'Read Status', and 'Write Status', which are enclosed in an orange rounded rectangle.

Proxy Ext (Bacnet Boolean Proxy Ext)	
Status	{ok}
Fault Cause	
Enabled	<input checked="" type="radio"/> true
Device Facets	trueText=true,falseText=false,priPV=false >> ⌚
Conversion	Default
Tuning Policy Name	Default Policy
Read Value	false {ok}
Write Value	- {null} @ def
Object Id	Binary Value 200
Property Id	Present Value
Property Array Index	-1
Data Type	ENUMERATED
Read Status	Polled
Write Status	Writable

What is a Tuning Policy?

- Found under the **Network**
- Min Write
 - “Throttles” writes
- Max Write
 - Re-writes to “Forgetful” Devices
- {stale}
 - Indicates delay / congestion
- BACnet is a special case!
 - Poll Frequency; COV settings

Tuning Policies		Tuning Policy Map	
Default Policy		Tuning Policy	
Forgetful Devices		Tuning Policy	
Min Write Time	00001h 00m 00s	[0 ms - +inf]	
Max Write Time	00000h 00m 00s	[0 ms - +inf]	
Write On Start	● true		
Write On Up	● true		
Write On Enabled	● true		
Stale Time	00000h 00m 00s	[0 ms - +inf]	
Throttled Devices		Tuning Policy	
Min Write Time	00000h 00m 00s	[0 ms - +inf]	
Max Write Time	00001h 00m 00s	[0 ms - +inf]	
Write On Start	● false		
Write On Up	● false		
Write On Enabled	● true		
Stale Time	00000h 01m 00s	[0 ms - +inf]	
Poll Scheduler		Basic Poll Scheduler	

What is a Poll Scheduler?

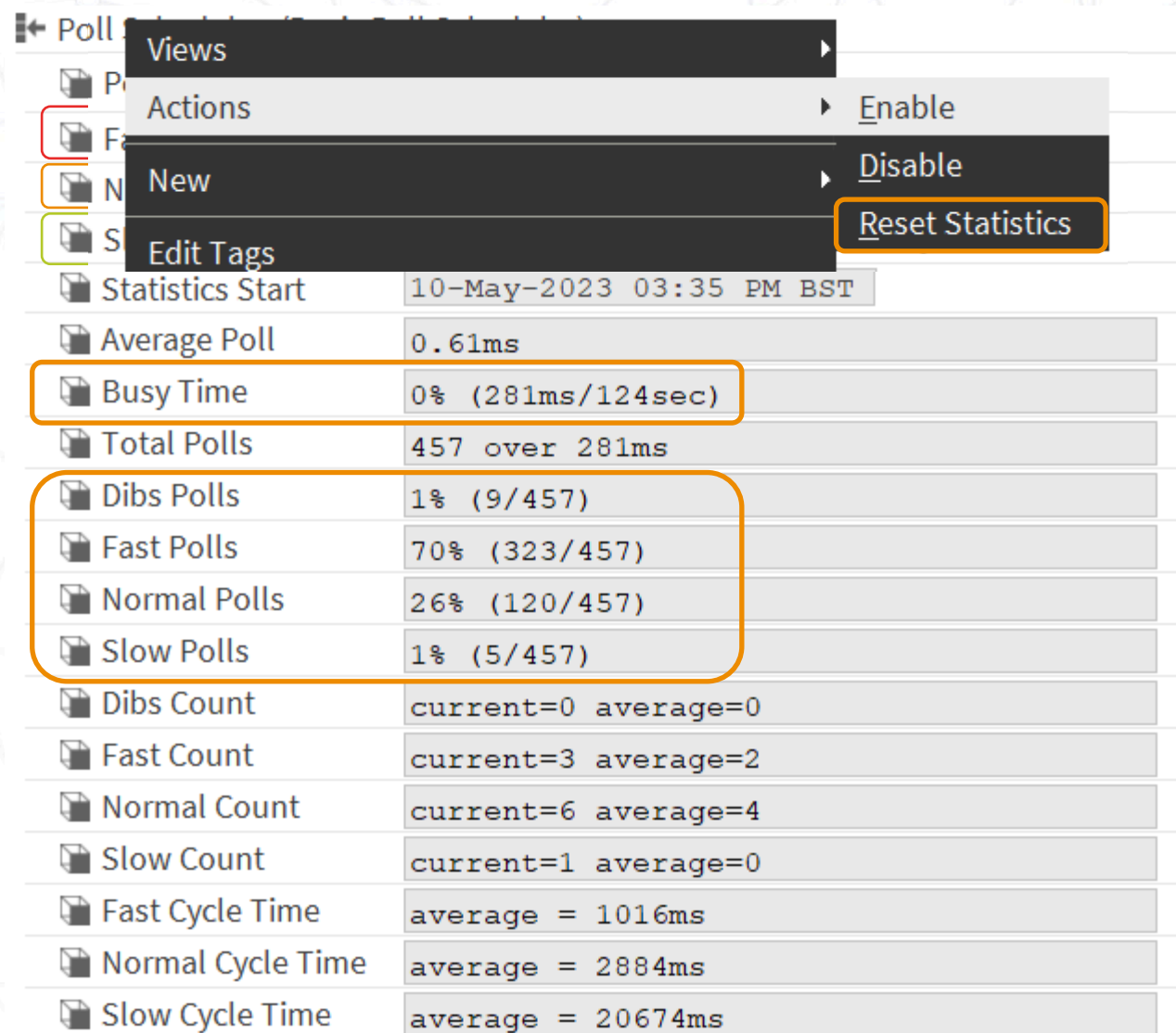
- The Poll Scheduler has

- Fast
- Normal
- Slow

- Target busy < 80%

- Right click

- Reset Statistics



The screenshot shows the Poll Scheduler interface. A right-click context menu is open over the 'Poll' header, with options: Views, Actions, New, and Edit Tags. The 'Actions' menu is further expanded, showing 'Enable', 'Disable', and 'Reset Statistics' (highlighted with an orange border). Below the menu is a table of statistics. The 'Busy Time' row is highlighted with an orange border. The 'Polls' section (Dibs Polls, Fast Polls, Normal Polls, Slow Polls) is also highlighted with an orange border.

Statistics Start	10-May-2023 03:35 PM BST
Average Poll	0.61ms
Busy Time	0% (281ms/124sec)
Total Polls	457 over 281ms
Dibs Polls	1% (9/457)
Fast Polls	70% (323/457)
Normal Polls	26% (120/457)
Slow Polls	1% (5/457)
Dibs Count	current=0 average=0
Fast Count	current=3 average=2
Normal Count	current=6 average=4
Slow Count	current=1 average=0
Fast Cycle Time	average = 1016ms
Normal Cycle Time	average = 2884ms
Slow Cycle Time	average = 20674ms



Where is the Poll Scheduler?

- Mostly, found under the **Network**
- Individual proxyExt has Fast/Normal/Slow
- ...Unless using
 - **BACnet**: each Trunk (IP; MS/TP; SC) has a **Poll Service**
 - Fast / Normal / Slow rate can vary by MT/TP trunk for example
 - **OPC UA**: each Device has it's own Poll Scheduler
- Community developed drivers may vary

Match Points to Policies & Poll Rates

Fast

Normal

Slow

Database

Name	Out	Absolute Address
N Fuel Select	1.0 {ok} @ def	modbus:40001
N Fuel Level	101.0 L {ok} @ def	modbus:40002
N Load Percent	42.0 % {ok} @ def	decimal:3
N Runtime	54646.0 hr {ok} @ def	decimal:4
N Last Start Time	65535 s {ok} @ def	decimal:5
N RPM	100.0 rpm {ok} @ def	decimal:6
N Voltage	240.0 V {ok} @ def	decimal:7
N Rated Wattage	5000.0 W {ok} @ def	decimal:8
N Oil Temperature	65.0 °C {ok} @ def	decimal:9
N Exhaust Temperature	59.0 °C {ok} @ def	decimal:10

Not always simple e.g. Fuel Level **should** change slowly? 

How do I know this is a problem?

- {stale} points
 - An as yet unfulfilled read request, or “untrustworthy value”
 - Indicates a **congested** network / device
 - Not updated **since** the read request was **sent**
 - “Stale time” **interval** drives this
- Slow loading graphics
- Ping fails
 - {down} Devices
- Read Fails
 - Points in {fault}
- Queue Full Exceptions
 - = point qty
- Timeouts
 - Serial or IP

App Dir

Application Director Tips

- Stream To File
 - Capture rare or extremely verbose errors
 - Easily share, or search with text editor
- Output Dialog
 - Keep on second monitor
- Dump Threads
 - Debug hanging behaviour

Application Director

Connected to localhost

Name	Type	Status	Details
encrypted	station	Idle	fox=n/a,foxs=n/a,http=n/a,https=n/a
Jace	station	Idle	fox=n/a,foxs=n/a,http=n/a,https=n/a
modbusSlave	station	Running	fox=n/a,foxs=4919,http=n/a,https=n/a
nf23	station	Running	fox=n/a,foxs=4918,http=n/a,https=443
Supervisor	station	Idle	fox=n/a,foxs=n/a,http=n/a,https=n/a
unencrypted	station	Idle	fox=n/a,foxs=4911,http=n/a,https=443

```
Tag = -1
Modbus Device Address = 1
Modbus Function Code = 3
Modbus Data Starting Address = 9
Modbus Number of Data Points = 1
Raw Bytes = 226100000006010300090001
FINE [12:44:01 11-May-23 BST] [ModbusTcpNetwork] **** Received m
FINE [12:44:01 11-May-23 BST] [ModbusTcpNetwork] Poll <Voltage (
FINE [12:44:01 11-May-23 BST] [ModbusTcpNetwork] Voltage>>> BMod
FINE [12:44:01 11-May-23 BST] [ModbusTcpNetwork] **** ModbusTcp
Tag = -1
Modbus Device Address = 1
Modbus Function Code = 3
Modbus Data Starting Address = 7
Modbus Number of Data Points = 1
Raw Bytes = 226200000006010300070001
FINE [12:44:01 11-May-23 BST] [ModbusTcpNetwork] **** Received m
FINE [12:44:01 11-May-23 BST] [ModbusTcpNetwork] Poll <Fuel Leve
FINE [12:44:01 11-May-23 BST] [ModbusTcpNetwork] Fuel$20Level>>>
FINE [12:44:01 11-May-23 BST] [ModbusTcpNetwork] **** ModbusTcp
Tag = -1
Modbus Device Address = 1
Modbus Function Code = 3
Modbus Data Starting Address = 1
Modbus Number of Data Points = 1
Raw Bytes = 226300000006010300010001
FINE [12:44:01 11-May-23 BST] [ModbusTcpNetwork] **** Received m
```

```
Output for station nf23 on localhost

Tag = -1
Modbus Device Address = 1
Modbus Function Code = 3
Modbus Data Starting Address = 0
Modbus Number of Data Points = 1
Raw Bytes = 21b700000006010300000001
FINE [12:43:21 11-May-23 BST] [ModbusTcpNetwork] **** Received message: 010302
FINE [12:43:21 11-May-23 BST] [ModbusTcpNetwork] Poll <Oil Temperature (decima
FINE [12:43:21 11-May-23 BST] [ModbusTcpNetwork] Oil$20Temperature>>> BModbusC
FINE [12:43:21 11-May-23 BST] [ModbusTcpNetwork] **** ModbusTcp Send Bytes [de
Tag = -1
Modbus Device Address = 1
Modbus Function Code = 3
Modbus Data Starting Address = 9
Modbus Number of Data Points = 1
Raw Bytes = 21b800000006010300090001
FINE [12:43:21 11-May-23 BST] [ModbusTcpNetwork] **** Received message: 010302
FINE [12:43:21 11-May-23 BST] [ModbusTcpNetwork] Poll <Voltage (decimal:7)>>
```

Dump Threads Pause Output Clear Output Close

- ☒ Auto-Start
- ☒ Restart on Failure
- Start
- Stop
- Restart
- Reboot
- Kill
- Dump Threads
- Save Bog
- Verify Software
- Clear Output
- Pause Output
- Output Dialog
- Stream To File
- Output Settings

Application Director - Life Goals

```
INFO [09:26:33 09-May-23 BST][sys] Saving station...
INFO [09:26:33 09-May-23 BST][sys] Saved C:\ProgramData\Niagara4.13\tridium\stations\nf23\config.bog (110ms)
INFO [09:47:28 09-May-23 BST][fox] Closed: b7e7548033af8d3183e8e4941b90deab79fb93879bad1a4245f73198763afa0c <- 7fc846a0f2717950684ff8
INFO [10:26:33 09-May-23 BST][sys] Saving station...
INFO [10:26:33 09-May-23 BST][sys] Saved C:\ProgramData\Niagara4.13\tridium\stations\nf23\config.bog (234ms)
INFO [11:26:33 09-May-23 BST][sys] Saving station...
INFO [11:26:34 09-May-23 BST][sys] Saved C:\ProgramData\Niagara4.13\tridium\stations\nf23\config.bog (141ms)
INFO [12:26:34 09-May-23 BST][sys] Saving station...
INFO [12:26:34 09-May-23 BST][sys] Saved C:\ProgramData\Niagara4.13\tridium\stations\nf23\config.bog (93ms)
INFO [13:26:34 09-May-23 BST][sys] Saving station...
INFO [13:26:34 09-May-23 BST][sys] Saved C:\ProgramData\Niagara4.13\tridium\stations\nf23\config.bog (109ms)
INFO [14:26:34 09-May-23 BST][sys] Saving station...
INFO [14:26:35 09-May-23 BST][sys] Saved C:\ProgramData\Niagara4.13\tridium\stations\nf23\config.bog (219ms)
INFO [15:26:35 09-May-23 BST][sys] Saving station...
INFO [15:26:35 09-May-23 BST][sys] Saved C:\ProgramData\Niagara4.13\tridium\stations\nf23\config.bog (109ms)
INFO [16:26:35 09-May-23 BST][sys] Saving station...
INFO [16:26:36 09-May-23 BST][sys] Saved C:\ProgramData\Niagara4.13\tridium\stations\nf23\config.bog (547ms)
INFO [17:26:35 09-May-23 BST][sys] Saving station...
INFO [17:26:36 09-May-23 BST][sys] Saved C:\ProgramData\Niagara4.13\tridium\stations\nf23\config.bog (1
INFO [18:26:36 09-May-23 BST][sys] Saving station...
INFO [18:26:36 09-May-23 BST][sys] Saved C:\ProgramData\Niagara4.13\tridium\stations\nf23\config.bog (1
INFO [19:26:36 09-May-23 BST][sys] Saving station...
INFO [19:26:36 09-May-23 BST][sys] Saved C:\ProgramData\Niagara4.13\tridium\stations\nf23\config.bog (2
INFO [20:26:36 09-May-23 BST][sys] Saving station...
INFO [20:26:37 09-May-23 BST][sys] Saved C:\ProgramData\Niagara4.13\tridium\stations\nf23\config.bog (1
```



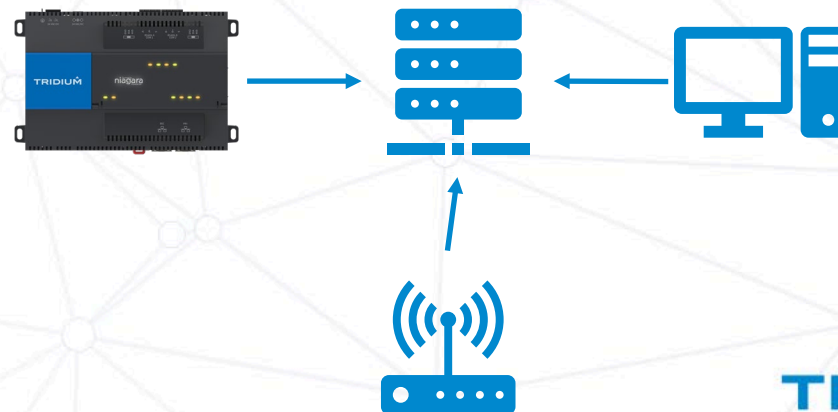
Syslog – new for 4.13

- Use this to win friends in IT
 - Switches, Routers, Servers...
 - Central location / archive
 - Smart log analysis tools
- See also:
 - SNMP
 - Monitoring by IT
 - LDAP / Active Directory
 - Integrate with domain user accounts

Property Sheet

SyslogPlatformService (Syslog Platform Service)

Platform Service Description	Syslog Configuration
Enabled	<input type="radio"/> false
Transport Protocol	TCP
Server Host	localhost
Server Port	1514 [1 - 65535]
Message Type	BSD
Client Alias And Password	syslog
Platform Log Enabled	<input checked="" type="radio"/> true
Station Log Enabled	<input checked="" type="radio"/> true
Workbench Log Enabled	<input checked="" type="radio"/> true
Station Audit Enabled	<input checked="" type="radio"/> true
Security Audit Enabled	<input checked="" type="radio"/> true
Facility	local0
Queue Size	1000
Log Level	INFO
Station Server Status	{ down }
Queue Full Percent Station	0.00 [0.00 - 100.00]
Platform Server Status	{ down }
Queue Full Percent Platform	0.00 [0.00 - 100.00]
Syslog Server Connection Alarm Support	Platform Alarm Support
Syslog Message Queue Alarm Support	Platform Alarm Support



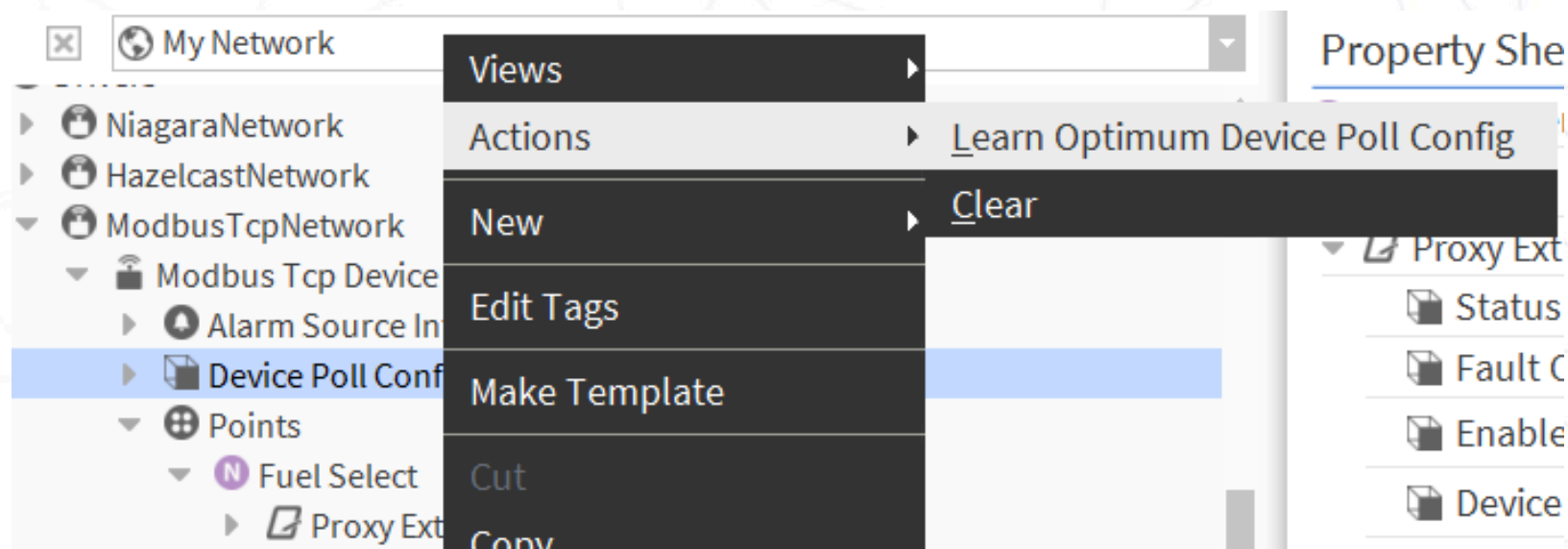


Get back to the Point(s)

- Does Niagara do anything to help me here?
- The subscription model ✓
 - Basically means – don't read something unless you need to!
- When is a point subscribed then?
 - Viewed (px graphics, wiresheet etc.)
 - Monitored for alarm or history
 - Onward linked in control strategy

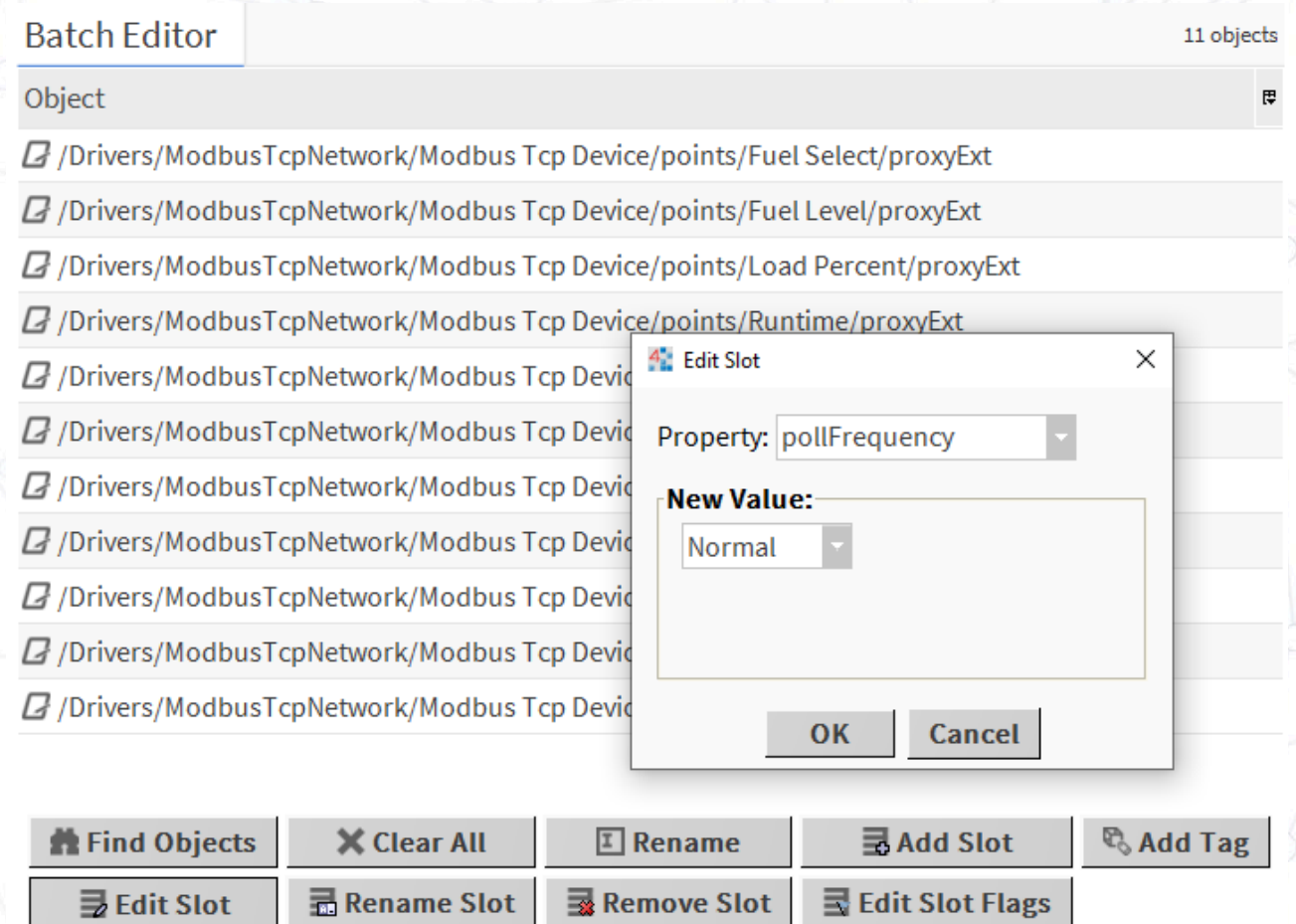
Improve Modbus Efficiency

- After points have been added to a Modbus Device
- Use this action to poll consecutive registers



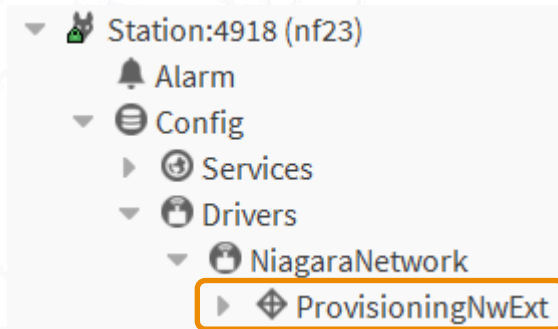
Use the Program Service for many Devices

- Bulk changes of points
 - Search below the Network for **driver:ProxyExt**
 - Edit Slot button
- Can also stagger History Collection this way
 - Although On-Demand history mitigates the need now

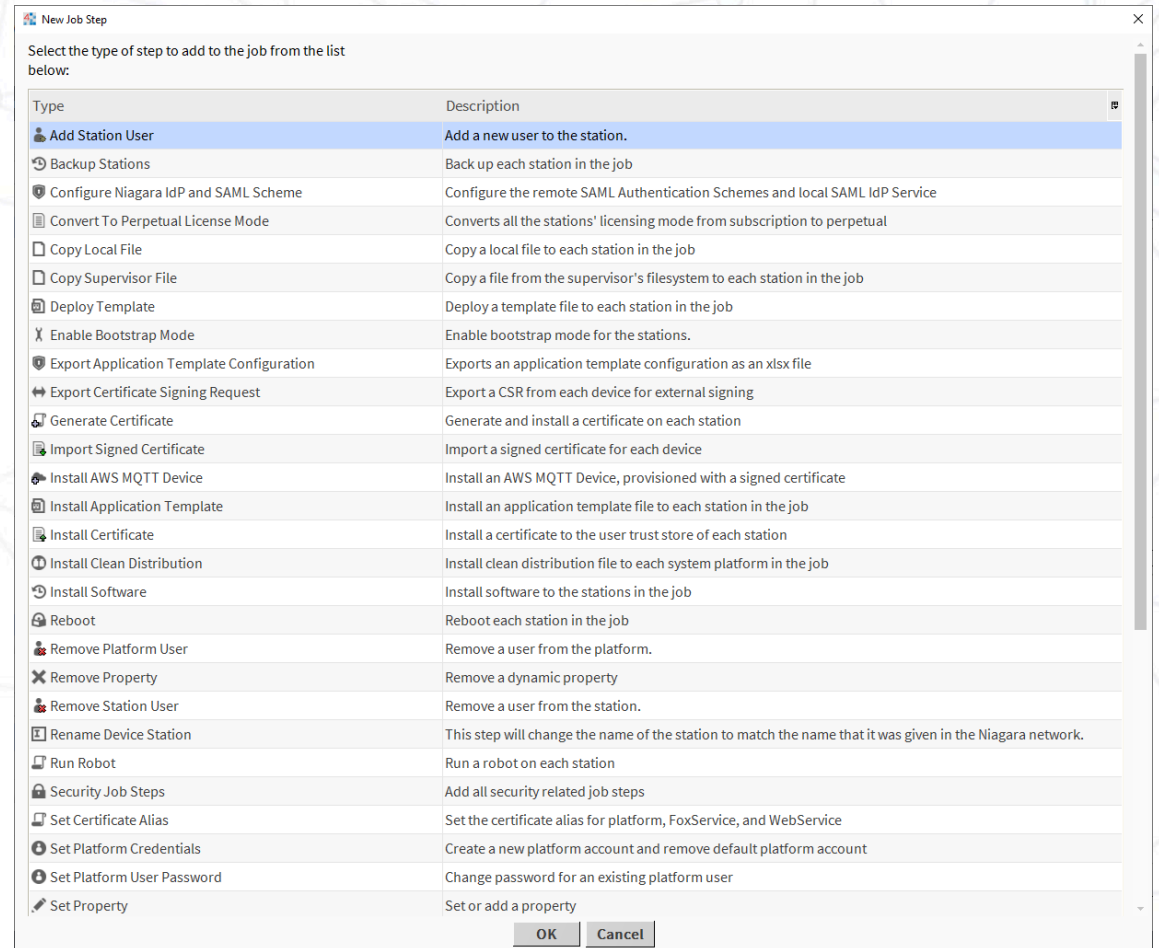


Provisioning – for lots of controllers!

- For lots of controllers



- Push out a template with Poll Frequency changes
- Also, schedule backups



Scenario 3: Broken Schedule Import or Export

Missing Schedule Import Scenario

- Supervisor has a Niagara schedule export, but subordinate station does not have a reciprocal Niagara schedule import.
- Exception thrown every 5 minutes in application director, BNiagaraScheduleExport Execution Time..

```
SEVERE [11:14:56 08-May-23 EDT][niagaraDriver] schedule
com.tridium.fox.session.ServerException: java.lang.IllegalArgumentException: Subordinate schedule not found for supervisor id: slot:/GlobalSchedules/WeeklySchedule
at com.tridium.fox.sys.LocalizableExceptionTranslator.messageToException(LocalizableExceptionTranslator.java:102)
at com.tridium.fox.session.FoxSession.sendSync(FoxSession.java:1167)
at com.tridium.fox.sys.BFoxConnection.sendSync(BFoxConnection.java:545)
at com.tridium.fox.sys.BFoxChannel.sendSync(BFoxChannel.java:395)
at com.tridium.nd.schedule.BNiagaraScheduleDeviceExt.send(BNiagaraScheduleDeviceExt.java:290)
at com.tridium.nd.schedule.BNiagaraScheduleExport.doExecute(BNiagaraScheduleExport.java:91)
at auto.com.tridium.nd.schedule.BNiagaraScheduleExport.invoke(AutoGenerated)
at com.tridium.sys.schema.ComponentSlotMap.invoke(ComponentSlotMap.java:1909)
at com.tridium.sys.engine.EngineUtil.doInvoke(EngineUtil.java:62)
at javax.baja.sys.BComponent.doInvoke(BComponent.java:1268)
at javax.baja.util.Invocation.run(Invocation.java:47)
at com.tridium.nd.BStationWorker$StationWork.run(BStationWorker.java:261)
at javax.baja.util.ThreadPoolWorker$WorkerThread.run(ThreadPoolWorker.java:290)

SEVERE [11:14:56 08-May-23 EDT][niagaraDriver] Request:
schedule.export=m:{
  supervisor=b:5195[<?xml version="1.0" encoding="..."]
  supervisorId=s:slot:/GlobalSchedules/WeeklySchedule
}
```

Schedule Export Configuration Scenario

- Supervisor has a Niagara schedule export and subordinate station has a reciprocal Niagara schedule import.
- Schedule in supervisor has been renamed, moved or deleted causing Unresolved Exception.
- Exception thrown if the subordinate station's schedule import descriptor executes.

```
SEVERE [11:45:28 08-May-23 EDT][niagaraDriver] Error receiving msg: /Drivers/NiagaraNetwork/Jace/schedules
javax.baja.naming.UnresolvedException: /GlobalSchedules/ConferenceRoomSchedule
    at javax.baja.naming.BSlotScheme.doResolve(BSlotScheme.java:289)
    at javax.baja.naming.BSlotScheme.resolve(BSlotScheme.java:95)
    at javax.baja.naming.BOrdScheme.resolve(BOrdScheme.java:124)
    at javax.baja.naming.BOrd.resolve(BOrd.java:290)
    at javax.baja.naming.BOrd.resolve(BOrd.java:254)
    at javax.baja.naming.BOrd.resolve(BOrd.java:234)
    at com.tridium.nd.schedule.BScheduleChannel.process(BScheduleChannel.java:138)
    at com.tridium.fox.sys.BFoxConnection.process(BFoxConnection.java:470)
    at com.tridium.fox.session.SessionDispatcher.dispatch(SessionDispatcher.java:92)
    at com.tridium.fox.session.SessionDispatcher.run(SessionDispatcher.java:68)
    at java.lang.Thread.run(Thread.java:750)
```

How To Find The Culprit

- Exception may not specify the slot path of the component causing the exception.
- Stack trace indicates the Java class of the component.

```
at com.tridium.nd.schedule.BNiagaraScheduleExport.doExecute(BNiagaraScheduleExport.java:91)
```

- BQL query used to find the BNiagaraScheduleExport components with a fault status

: Config : Drivers : NiagaraNetwork : bql:select slotPath, supervisorId from niagaraDriver:NiagaraScheduleExport where status.isFault=true

Slot Path	Supervisor Id
slot:/Drivers/NiagaraNetwork/VykonProJace/schedules/WeeklyScheduleExport	slot:/GlobalSchedules/WeeklySchedule
slot:/Drivers/NiagaraNetwork/VykonProJace/schedules/GymScheduleExport	slot:/GlobalSchedules/GymSchedule

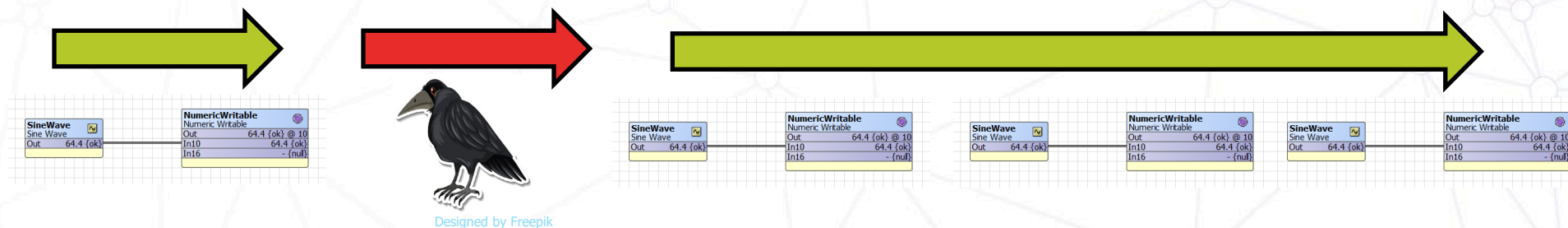
Fixing the Issue

- Recreate the Niagara schedule import in the subordinate station.
- If no longer required, delete the Niagara schedule export in the supervisor.
- Update the properties on the Niagara schedule export in the supervisor or Niagara schedule import in the subordinate station.

Scenario 4: Engine Watchdog Timeout

What is the Engine Thread?

- Control Points - Updating **Out** value
 - plus Alarm Ext, History Ext



- Triggers



Daily (Time Trigger)

Trigger Mode: Daily

Time Of Day: 02:00:00 AM BST

Randomization: +00000h 00m 00s

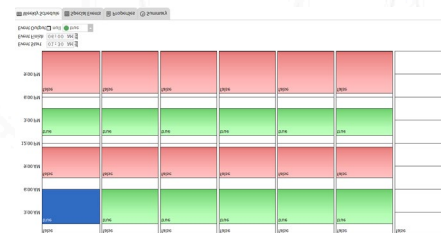
Days Of Week: ☒ Sun ☒ Mon ☒ Tue ☒ Wed ☒ Thu ☒ Fri ☒ Sat

Last Trigger: null

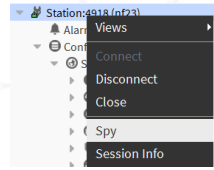
Next Trigger: 12-May-2023 02:00 AM BST



- Schedules



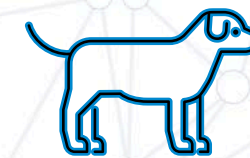
Engine Hogs



Remote Station | sysManagers | engineManager | hogs

Engine Hogs					
Rank	Component	Type	Total Time	Total Count	Avg time
0	/Engine\$20Thread\$20Falling\$20Apart/The\$20Hand\$20That\$20Feeds	control:BooleanWritable	5766ms [5.766 seconds]	104531	55 us
1	/Engine\$20Thread\$20Falling\$20Apart/Bite	kitControl:MultiVibrator	4674ms [4.674 seconds]	104530	44 us
2	/Engine\$20Thread\$20Falling\$20Apart/NumericWritable	control:NumericWritable	2668ms [2.668 seconds]	52280	51 us
3	/Drivers/ModbusTcpNetwork/Modbus\$20Tcp\$20Device/points/Fuel\$20Level	control:NumericWritable	2529ms [2.529 seconds]	54643	46 us
4	/Engine\$20Thread\$20Falling\$20Apart/SineWave	kitControl:SineWave	1858ms [1.858 seconds]	52278	35 us
5	/Drivers/ModbusTcpNetwork/Modbus\$20Tcp\$20Device/points/Fuel\$20Select	control:NumericWritable	232ms [232 ms]	5716	40 us
6	/Drivers/ModbusTcpNetwork/Modbus\$20Tcp\$20Device/points/Oil\$20Temperature	control:NumericWritable	228ms [228 ms]	5715	39 us
7	/Drivers/ModbusTcpNetwork/Modbus\$20Tcp\$20Device/points/RPM	control:NumericWritable	75ms [75 ms]	2007	37 us
8	/Drivers/ModbusTcpNetwork/Modbus\$20Tcp\$20Device/points/Load\$20Percent	control:NumericWritable	44ms [44 ms]	1145	38 us
9	/Drivers/ModbusTcpNetwork/Modbus\$20Tcp\$20Device/points/Voltage	control:NumericWritable	44ms [44 ms]	1145	38 us
10	/Drivers/ModbusTcpNetwork/Modbus\$20Tcp\$20Device/points/Exhaust\$20Temperature	control:NumericWritable	43ms [43 ms]	1145	37 us
11	/Drivers/ModbusTcpNetwork/Modbus\$20Tcp\$20Device/points/Runtime	control:NumericWritable	42ms [42 ms]	1146	37 us
12	/Drivers/ModbusTcpNetwork/Modbus\$20Tcp\$20Device/points/Rated\$20Wattage	control:NumericWritable	41ms [41 ms]	1145	36 us
13	/Services/SecurityService/certificates/default/expiry	nss:CertificateExpiryPoint	11ms [11 ms]	19	583 us
14	/Drivers/ModbusTcpNetwork/Modbus\$20Tcp\$20Device/points/Last\$20Start\$20Time	control:NumericWritable	7ms [7 ms]	192	38 us
15	/Drivers/HazelcastNetwork/HazelcastDevice/points/redFlags	control:StringWritable	2ms [2 ms]	3	856 us
16	/Drivers/HazelcastNetwork/HazelcastDevice/points/ITalkToTheWind	control:StringWritable	0ms [0 ms]	3	262 us
17	/Drivers/BacnetNetwork/BacnetDevice/points/BooleanWritable	control:BooleanWritable	0ms [0 ms]	2	314 us

What is a Watchdog Timeout?



- If the Engine Thread is **unresponsive** an Engine Watchdog Timeout occurs at the specified interval:

- **Policy**

- Reboot
 - Controllers only
- Terminate
- Log Only (debugging)

Platform Service Container Plugin

Java VM Vendor	Oracle Corporation
Java VM Version	25.371-b11
OS Name	Windows 10
OS Arch	amd64
OS Version	10.0
Platform Daemon Port	3011
Platform Daemon TLS Port	5011
Locale	en_GB
System Time	20:30
Date	09-May-2023
Time Zone	Europe/London (+0/+1)
Engine Watchdog Policy	Terminate
Engine Watchdog Timeout	00000h 03m [0 ms - +inf]
Enable Station Auto-Save	<input checked="" type="checkbox"/> Enable
Station Auto-Save Frequency	00001h 00m [1 minute - +inf]
Station Auto-Save Versions to Keep	3 [1 - 10]

Why did it happen?



- **Spy > Console** (to view archived logs)

ENGINE WATCHDOG TIMEOUT STACK DUMP @ Tue May 25 22:56:30 CDT 2022

...

"**Nre:Engine**" #16 daemon prio=5 os_prio=0 tid=0x000000001c42e800 nid=0x7860 waiting on condition
[0x000000001b58f000]

java.lang.Thread.State: TIMED_WAITING (sleeping)

at java.lang.Thread.sleep(Native Method)

at **Prog_f89acc5065c8476daf91e7aefcc1f459**.onExecute(Prog_f89acc5065c8476daf91e7aefcc1f459.java:54)

at **com.tridium.program.BProgram**.doExecute(BProgram.java:146)

at auto.com_tridium_program_BProgram.invoke(AutoGenerated)

at com.tridium.sys.schema.Component

at com.tridium.sys.engine.EngineUtil.d

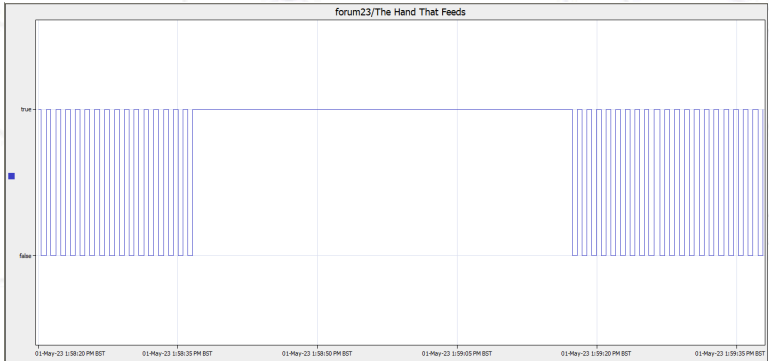
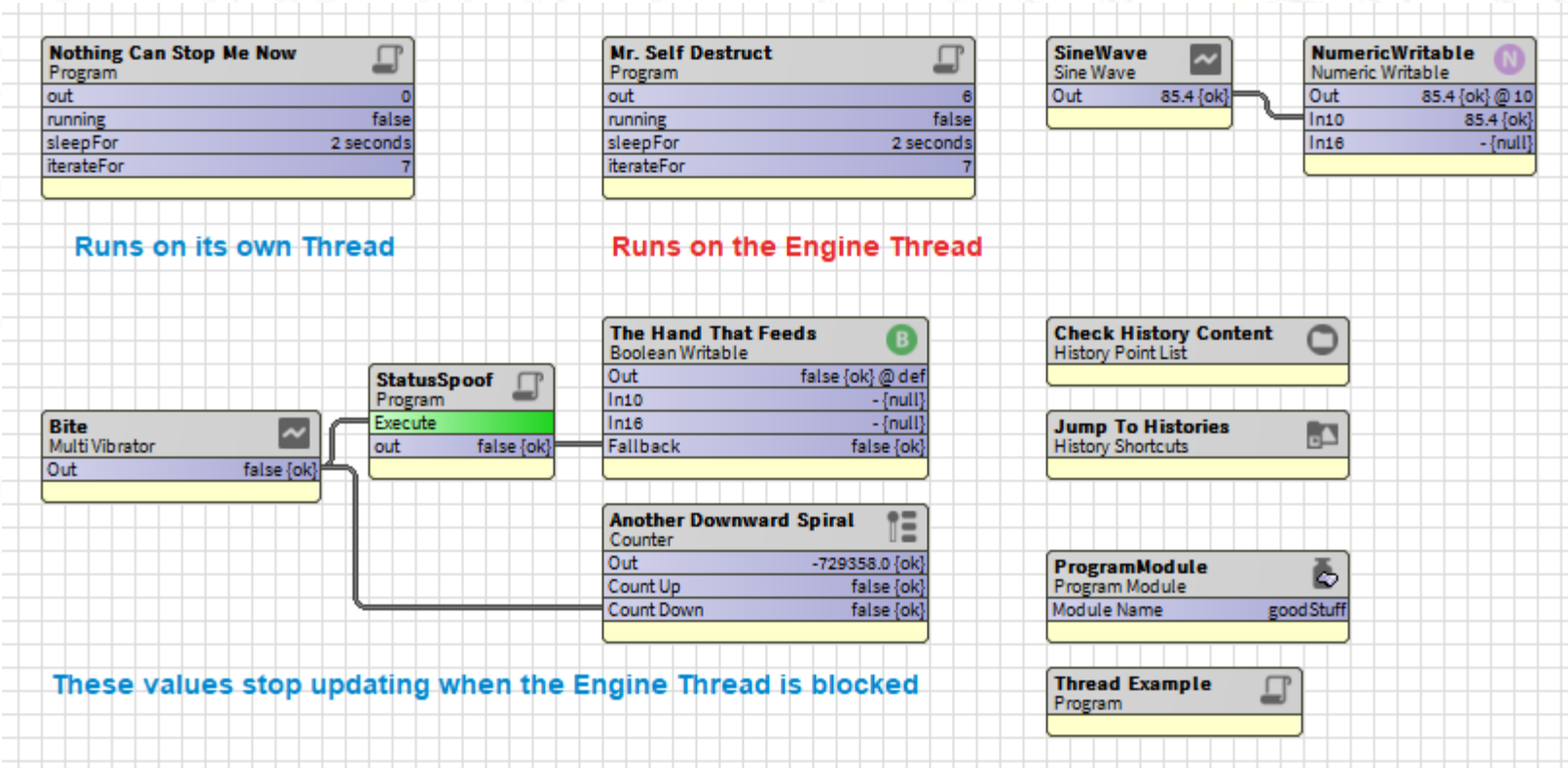
at com.tridium.sys.engine.EngineMana

at com.tridium.sys.engine.EngineMana

at com.tridium.sys.engine.EngineMana

```
INFO [21:42:24 08-Jun-21 UTC][stationRegistry] station va51tr21c startup complete
WARNING [13:33:37 11-Jun-21 UTC][stationRegistry] station va51tr21c ENGINE LOCKUP DETECTED
WARNING [13:33:52 11-Jun-21 UTC][stationRegistry] station va51tr21c ENGINE WATCHDOG - KILLING VM
INFO [13:33:52 11-Jun-21 UTC][stationRegistry] killing station va51tr21c
INFO [13:33:53 11-Jun-21 UTC][stationRegistry] station va51tr21c exited with status -119
SEVERE [13:33:53 11-Jun-21 UTC][stationRegistry] station va51tr21c failed, rc = -119
INFO [13:33:53 11-Jun-21 UTC][stationRegistry] station va51tr21c restarting
INFO [13:33:53 11-Jun-21 UTC][stationRegistry] station va51tr21c watchdog thread started [tid = 52]
INFO [13:33:53 11-Jun-21 UTC][stationRegistry] station va51tr21c starting
INFO [13:36:08 11-Jun-21 UTC][stationRegistry] station va51tr21c startup complete
```

Demonstrating a blocked Engine Thread:



Finally...

- System Monitor Service

- Pro-active Logging and Alarming for critical metrics:

- CPU
- Memory

- Added 4.4

SystemMonitorService (System Monitor Service)

Status	{ok}
Fault Cause	
Enabled	<input checked="" type="checkbox"/> true
Last System Check Time	12-May-2023 12:15 PM BST
System Check Time Trigger	15 minutes {Sun Mon Tue Wed ...}
Platform Monitor	Platform Monitor
System Memory Monitor	System Memory Monitor
Heap Memory Monitor	Heap Memory Monitor
Metaspace Memory Monitor	Meta Space Memory Monitor
Loaded Classes Monitor	Loaded Classes Monitor
CPU Idle Cycles Monitor	Idle C P U Monitor
CPU Used Cycles Monitor	Used C P U Monitor

Status {ok}

Last Alarm Message

Last Alarm Time null

Alarm Source Info Alarm Source Info

Generate Alarm ☒ true

Log C P U To History ☐ false

Cpu History Config Interval: irregular, Record Type: ...

Application To Monitor station.exe

Last Interval 1579 ms

Last Interval Percent 0.01 % [0.00 - 100.00]

Since Start Percent 0.01 % [0.00 - 100.00]



Remember:

- Use station copier or backup dist to copy config.bog from daemon home
- Put points in appropriate polling buckets
- Use BQL to find culprits
- Provide stack trace and Niagara version
- Check nre:Engine in console (via Spy) if you experience an Engine Watchdog Timeout
- Contacting support? Please try to share the text version of any error include the version number 🙏

Questions

