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Trihedral
A Delta Group Company

Getting Right to the Root of the Problem

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SCADA FEST 2025 ACCELERATE

Advanced Diagnostic Tools

Take a tour of the debugging and diagnostic tools available to you to both troubleshoot issues and pre-emptively avoid problems.

- This talk is not about looking at problems with your plant or process
- It will look at the tools available to help diagnose and help prevent problems with your SCADA system
- Discuss what diagnostics to provide when reporting a problem
- Describe the reasons why we ask for them

Remote Procedure Calls

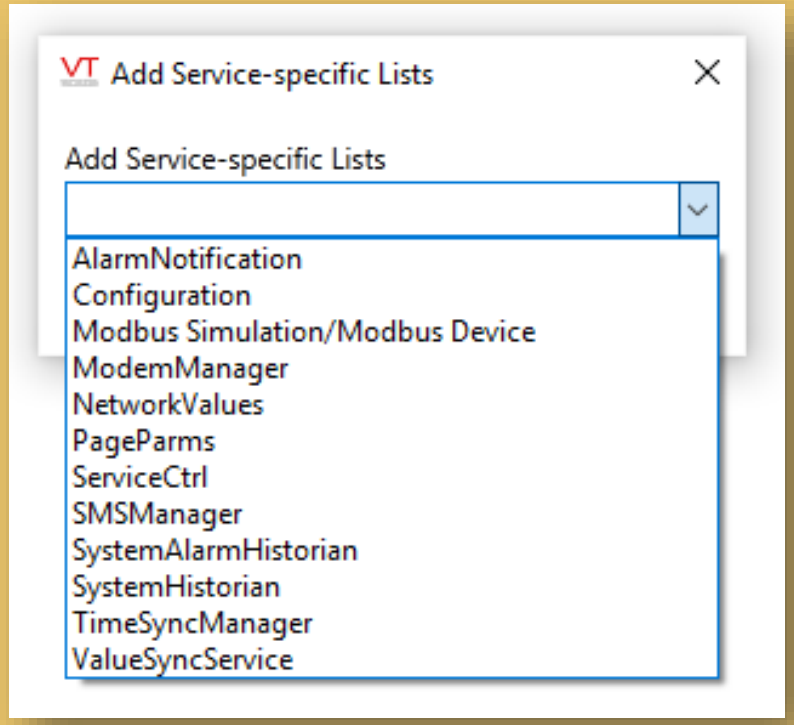
- Remote Procedure Call
- Used to invoke (Call) a piece of code (Procedure) on another machine (Remote)
- Colloquially used to describe the Transfer of Data between VTScada Servers
- An example RPC:

```
SetValue(Station4\Level, 42)
```

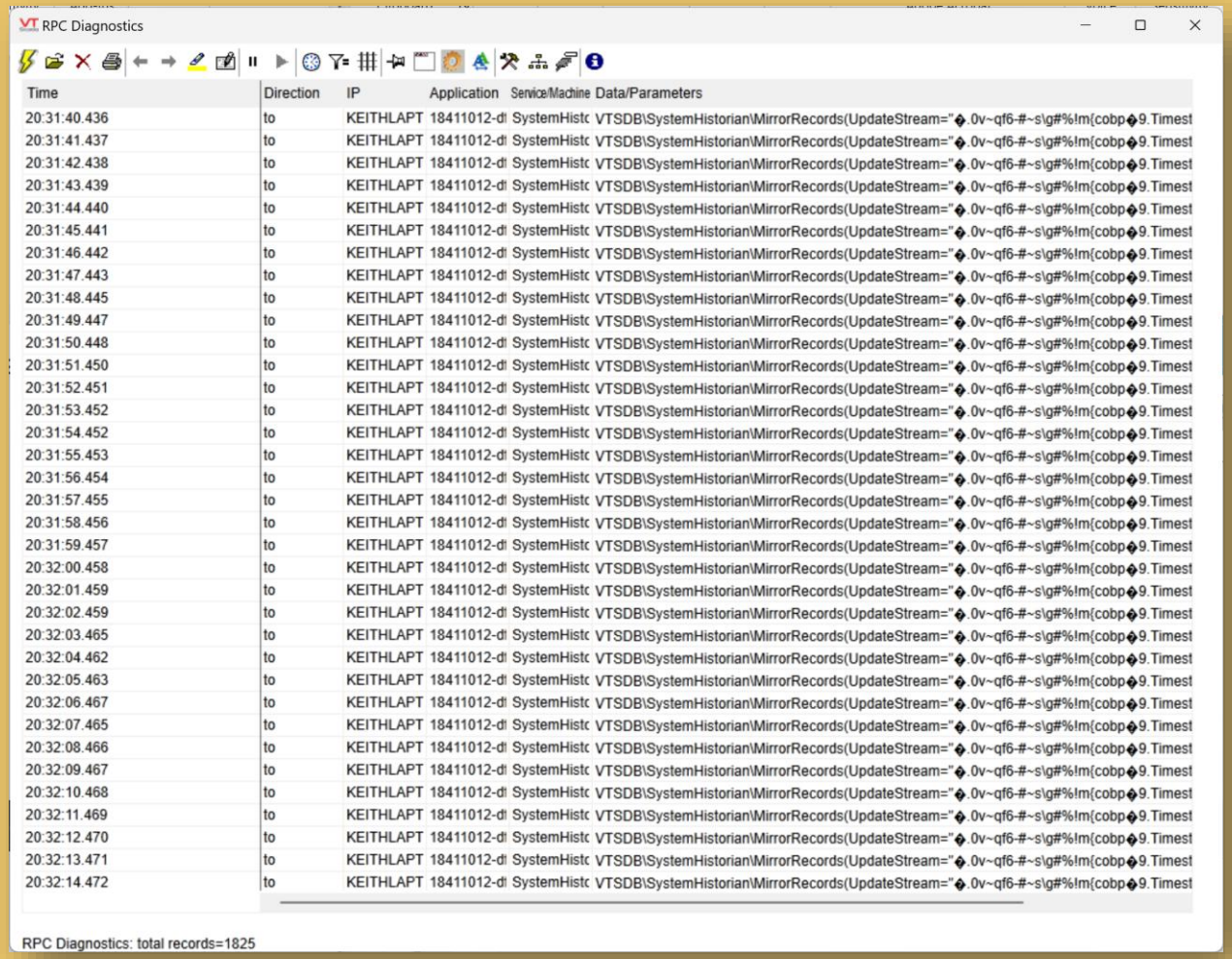
- Called to set variable Level in the Station4 Object to the value 42

RPC Services

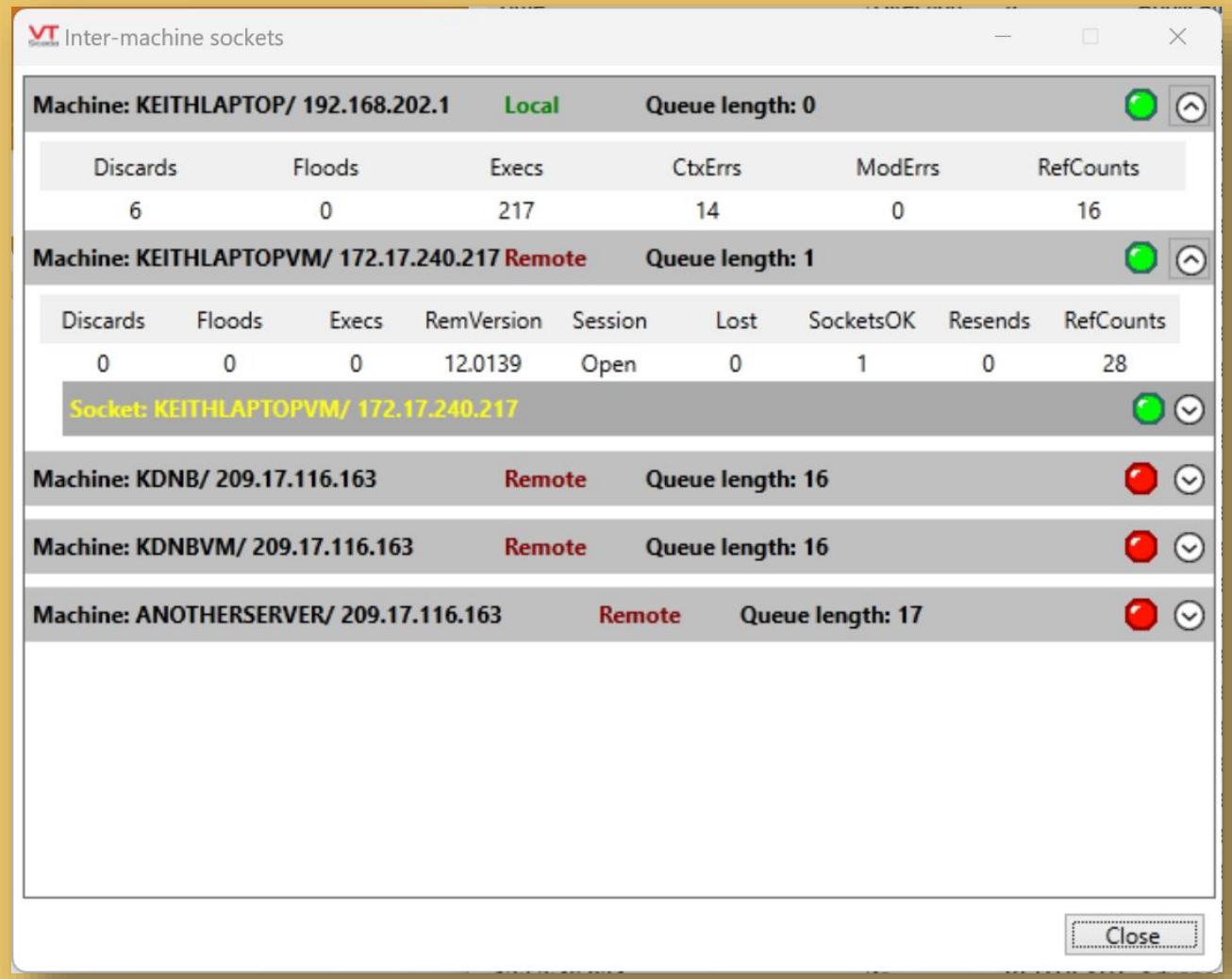
- VTScada split into different Services
- Used to keep data Synchronised across machines
  - Services Synchronise bi-directionally
    - `GetClientChanges`
    - `GetServerChanges`
- Each Service runs independently
- Each Service can have its own Server List
- RPC Manager is responsible for overseeing all the RPC Services
- Drivers can specify Driver List parameter



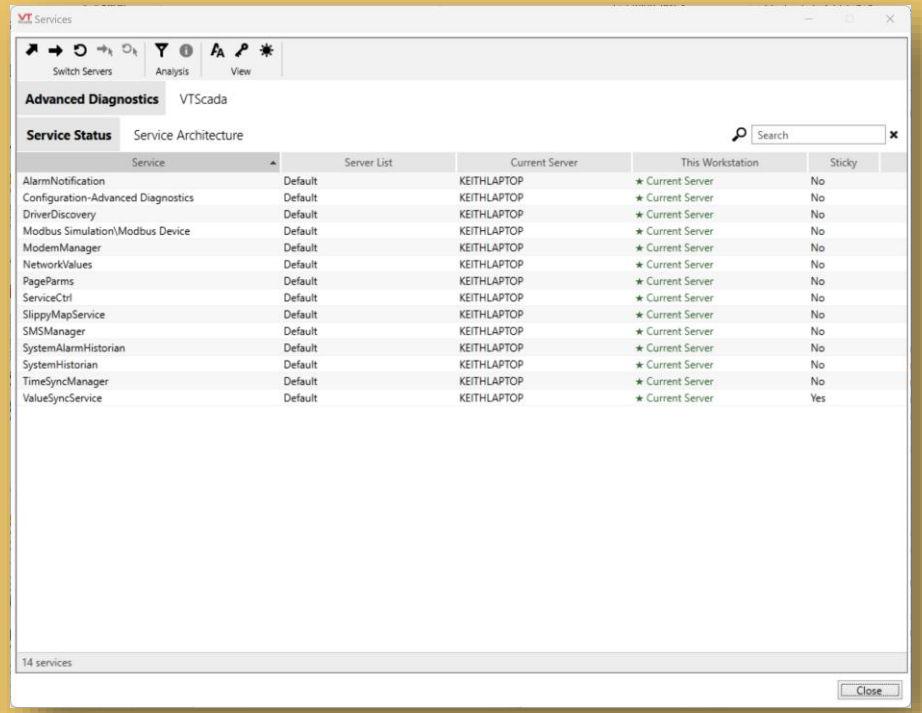
RPC Diagnostics – Viewing VTScada to VTScada communications

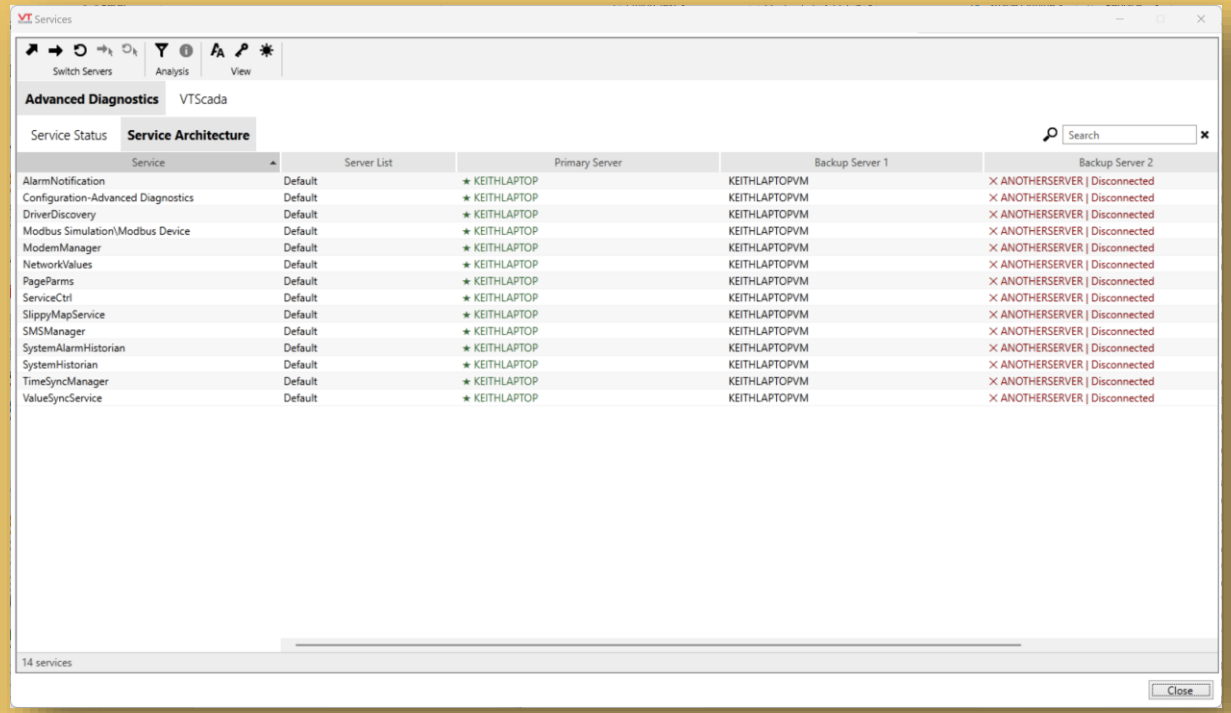


Viewing Communications connections between VTScada Servers



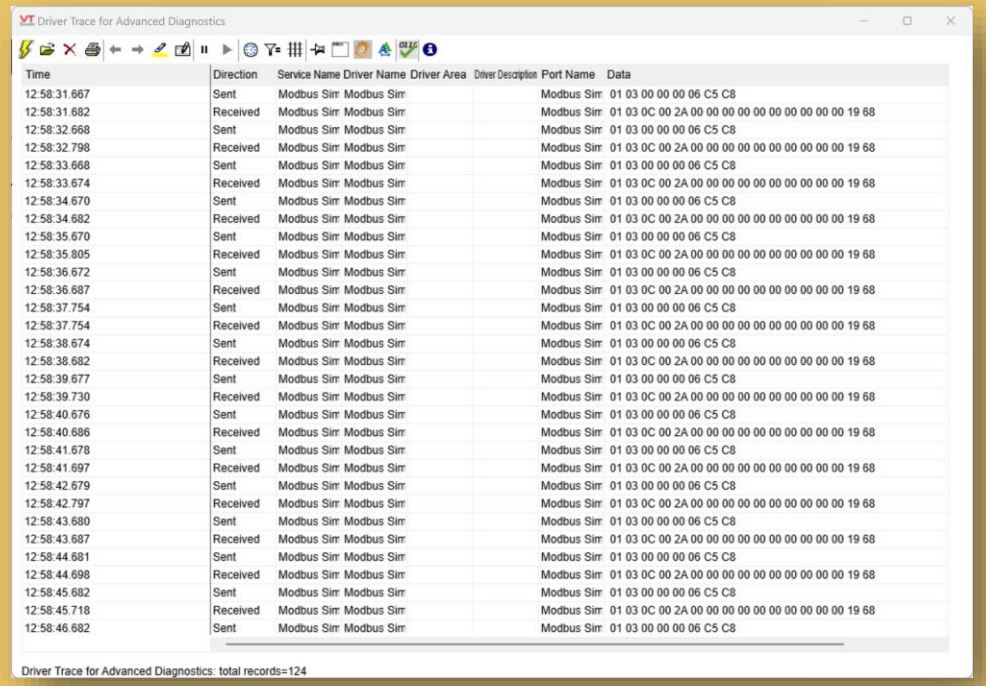
Viewing the Status of RPC Services





Viewing Driver Communications

- Selecting Communications traffic
- Logs to VTSCADA\TraceFiles (database)



RPC Timings Application

- This application is included with VTScada, but you may need to add it to the VAM
- When run Queries VTScada RPCManager Server to retrieve Statistics
- The IP shown may not be the IP address expected
- Q Delay – the time for a message to propagate the RPC Queue on the local machine
- Average, Best and Worst round-trip times shown
- Tolerance – Link Tolerance section of Setup.ini
- Used to handle the differing response times from one workstation to another, which is often experienced due to CPU loading, but mostly due to link throughput limitations

Trace VTScada Actions Application

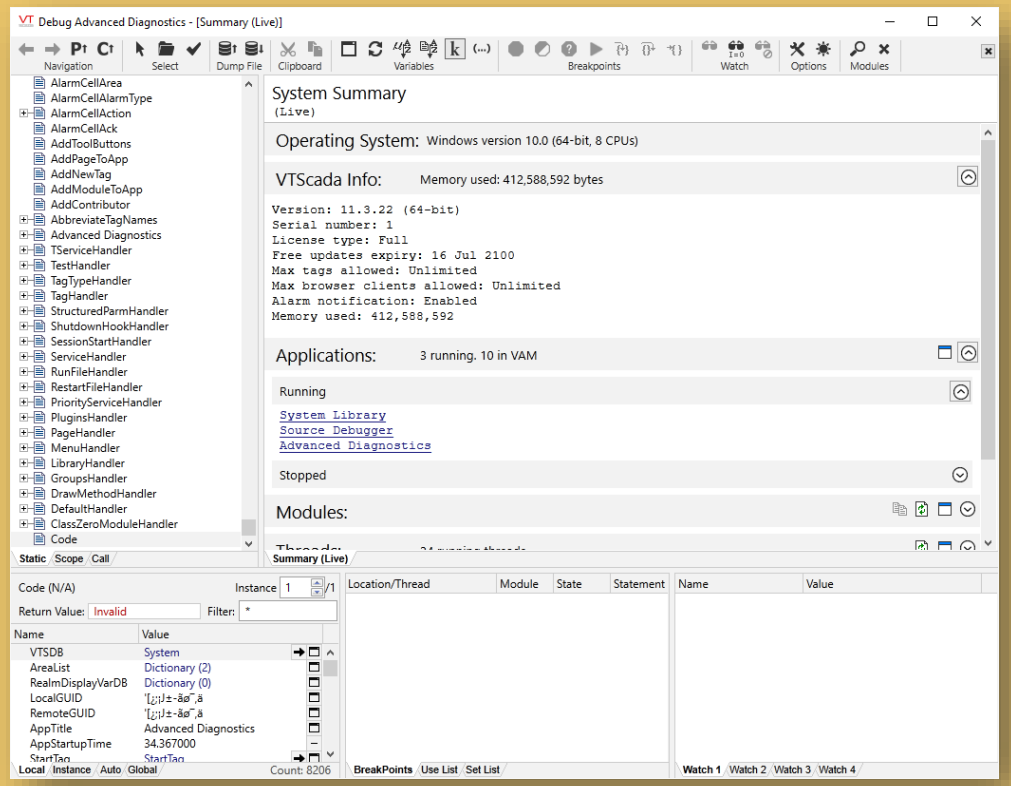
- This application is included VTScada, but you may need to add it to the VAM
- Writes data about selected actions to a text file named, "VTSTrace.txt“
- Additionally, VTScada traces all actions to disk, storing the data in a separate text file named, "VTSTraceAll.txt".
- Records in RAM - the number of trace actions saved to RAM prior to being written to the VTSTrace.txt file
- The Start/Stop button enables you to start and stop the tracing

- Located in the Data\TwilioLogs\
- Timestamped Rolling Log Files


```
"Parameters": null,
  "Body": {
    "VoiceUrl": "http:\/\/######:########@0445ba83.ngrok.io:80\/Twilio\/TELECOM\/Twilio\/Answer",
    "StatusCallback": "http:\/\/######:########@0445ba83.ngrok.io:80\/Twilio\/TELECOM\/Twilio\/Status",
    "FallbackUrl": "http:\/\/######:########@0445ba83.ngrok.io:80\/Twilio\/TELECOM\/Twilio\/Error",
    "VoiceMethod": "POST",
    "SmsUrl": "http:\/\/######:########@0445ba83.ngrok.io:80\/Twilio\/TELECOM\/Twilio\/SMSMessage",
    "SmsMethod": "POST",
    "SmsFallbackUrl": "http:\/\/######:########@0445ba83.ngrok.io:80\/Twilio\/TELECOM\/Twilio\/SMSError",
    "SmsFallbackMethod": "POST",
    "ApiVersion": "2010-04-01",
    "StatusCallbackEvent": [
      "initiated",
      "ringing",
      "answered",
      "completed"
    ]
},
```

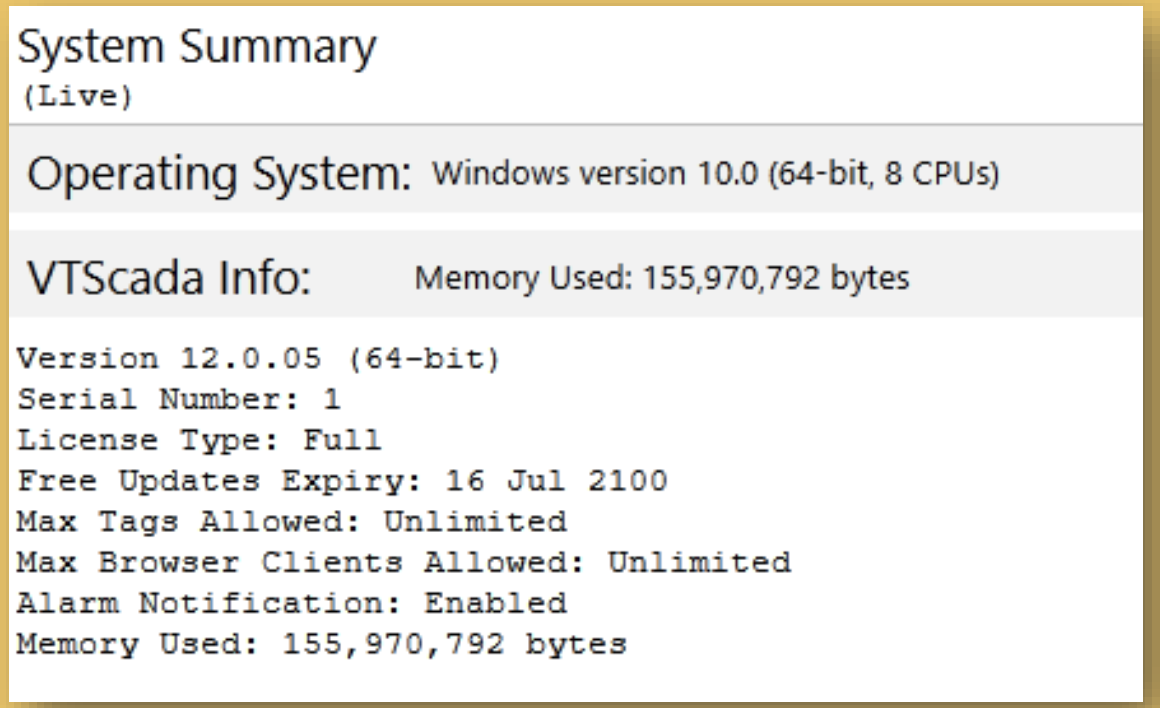
The Source Debugger
Viewing the code, variables and more

- Shipped with every VTScada Installation
- For Advanced Users only (not aimed at end users)
- Complex but useful



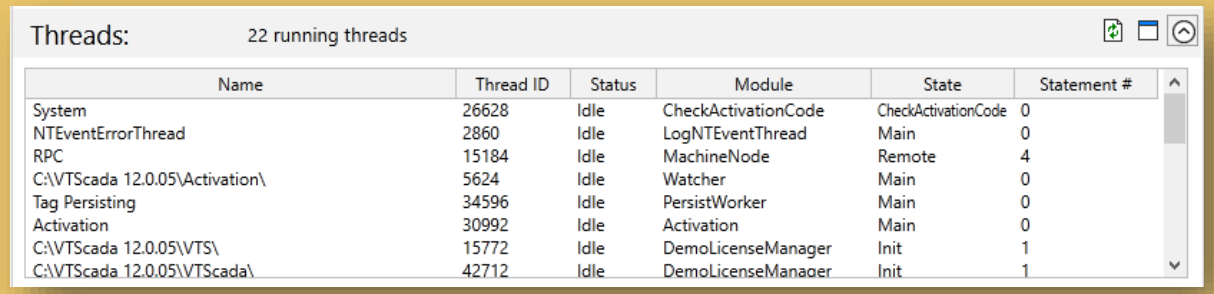
Source Debugger Application – Summary Tab

- Provides specific information about the Operating System
- VTScada Information
  - Version
  - Serial Number
  - Licence Type Maintenance Expiry
  - Tag Limit
  - Thin Client Limits
  - Alarm Notification status
  - Memory Used



Using the Source Debugger to examine VTScada Threads

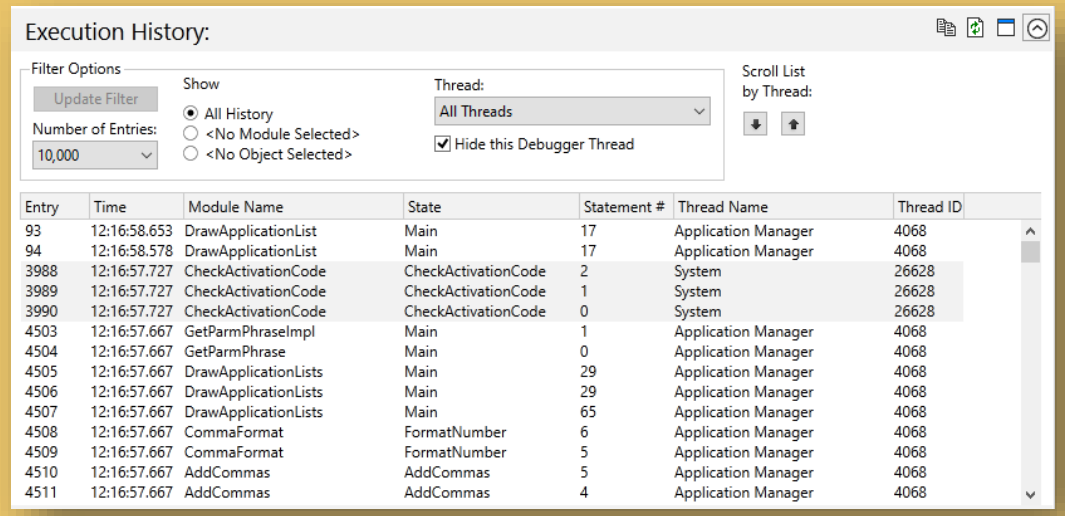
- List Threads
- Refresh button shows a live view of Thread Execution
- Module, State and Statement show exactly where code execution is running
- Double Click to navigate Source Debugger to source code line



Name	Thread ID	Status	Module	State	Statement #
System	26628	Idle	CheckActivationCode	CheckActivationCode	0
NTEventErrorThread	2860	Idle	LogNTEventThread	Main	0
RPC	15184	Idle	MachineNode	Remote	4
C:\VTScada 12.0.05\Activation\	5624	Idle	Watcher	Main	0
Tag Persisting	34596	Idle	PersistWorker	Main	0
Activation	30992	Idle	Activation	Main	0
C:\VTScada 12.0.05\VTS\	15772	Idle	DemoLicenseManager	Init	1
C:\VTScada 12.0.05\VTScada\	42712	Idle	DemoLicenseManager	Init	1

Source Debugger – Execution History

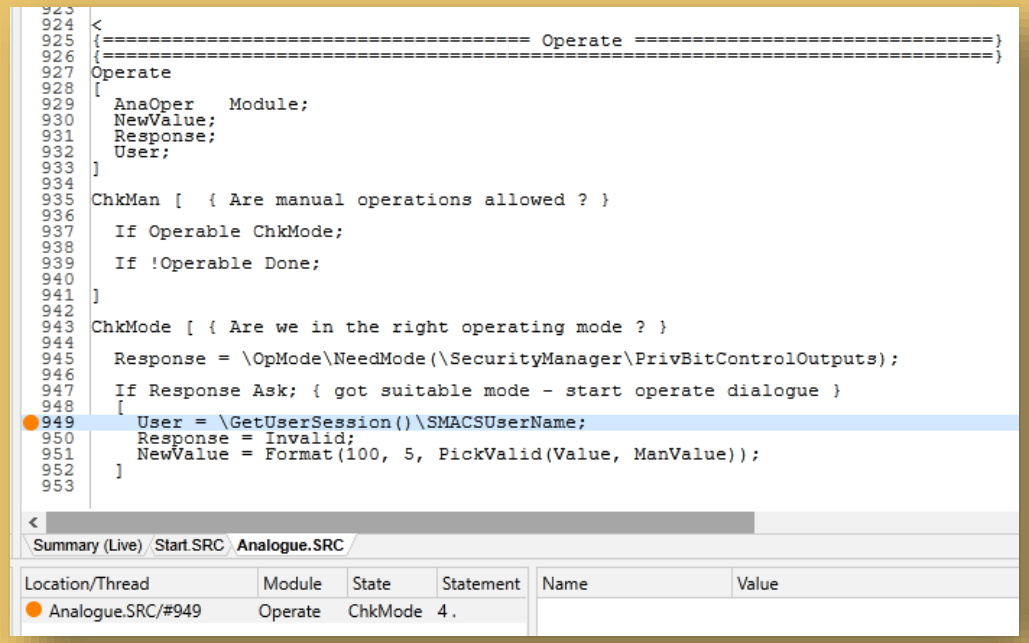
- Shows the 10,000, 100,000 or 1,000,000 history of execution
- Only displays the active threads which have executed any code within the sample period
- Can filter by Thread to aid viewing
- Double Click to navigate Source Debugger to source code line



Entry	Time	Module Name	State	Statement #	Thread Name	Thread ID
93	12:16:58.653	DrawApplicationList	Main	17	Application Manager	4068
94	12:16:58.578	DrawApplicationList	Main	17	Application Manager	4068
3988	12:16:57.727	CheckActivationCode	CheckActivationCode	2	System	26628
3989	12:16:57.727	CheckActivationCode	CheckActivationCode	1	System	26628
3990	12:16:57.727	CheckActivationCode	CheckActivationCode	0	System	26628
4503	12:16:57.667	GetParmPhraseImpl	Main	1	Application Manager	4068
4504	12:16:57.667	GetParmPhrase	Main	0	Application Manager	4068
4505	12:16:57.667	DrawApplicationLists	Main	29	Application Manager	4068
4506	12:16:57.667	DrawApplicationLists	Main	29	Application Manager	4068
4507	12:16:57.667	DrawApplicationLists	Main	65	Application Manager	4068
4508	12:16:57.667	CommaFormat	FormatNumber	6	Application Manager	4068
4509	12:16:57.667	CommaFormat	FormatNumber	5	Application Manager	4068
4510	12:16:57.667	AddCommas	AddCommas	5	Application Manager	4068
4511	12:16:57.667	AddCommas	AddCommas	4	Application Manager	4068

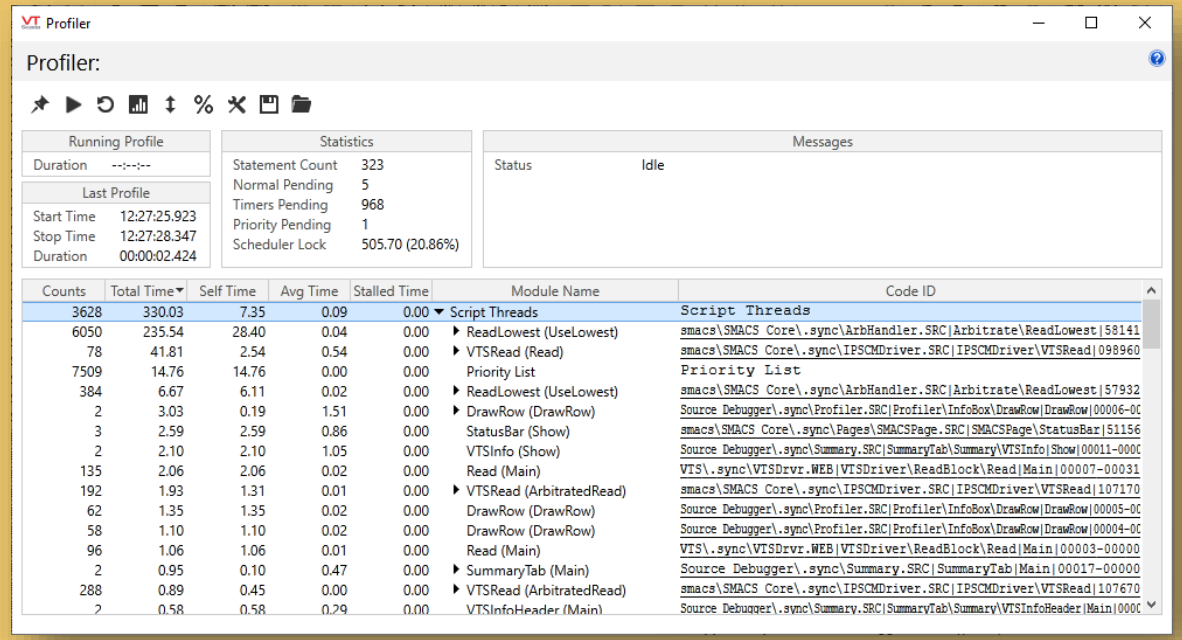
VTScada Script Code Statement Numbering

- Each statement in VTScada is assigned a unique Statement Number
- Statements are Numbered in Steady State first top to bottom (excluding scripts)
- Then each statement in a script is numbered top to bottom
- Placing a breakpoint will reveal the Statement Number of a line of code



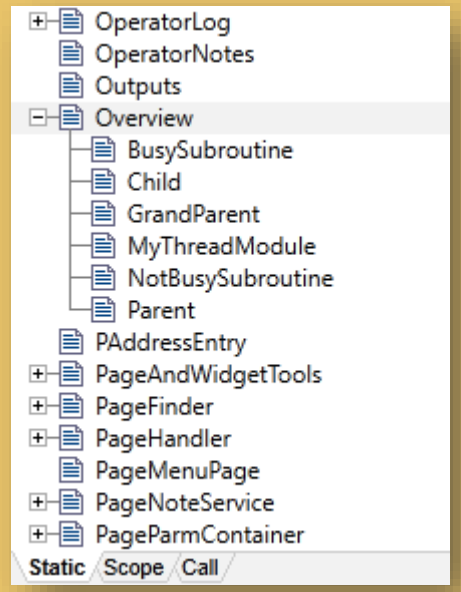
Using the Source Debugger to Profile VTScada Execution

- Running the Profile
- Flipping the Tree
- Time vs Percentage
- Statistics
- CodeID and linking to Source Code
- Save and Load Profiles

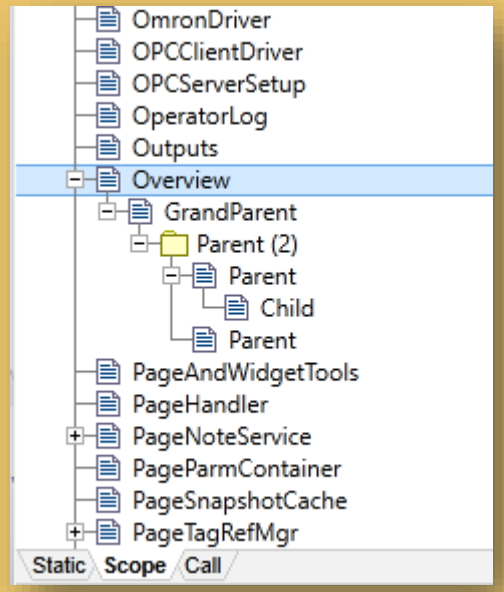


Navigating the Source Debugger Module Trees

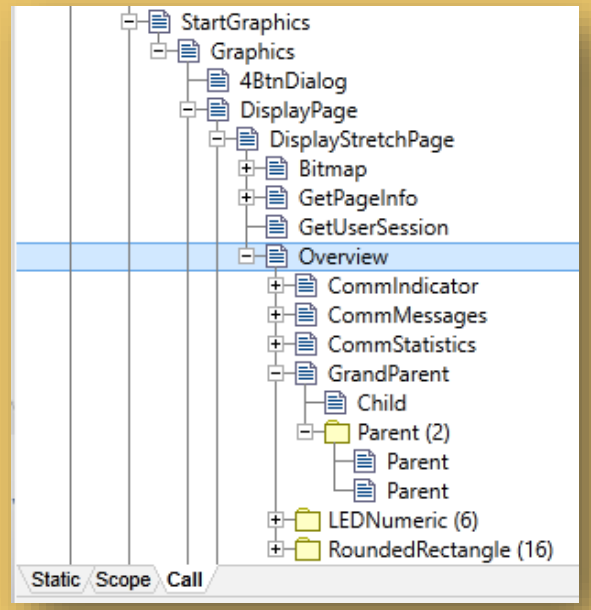
- Three different views of the Module Tree, Static, Scope and Call tree



Static –
As declared



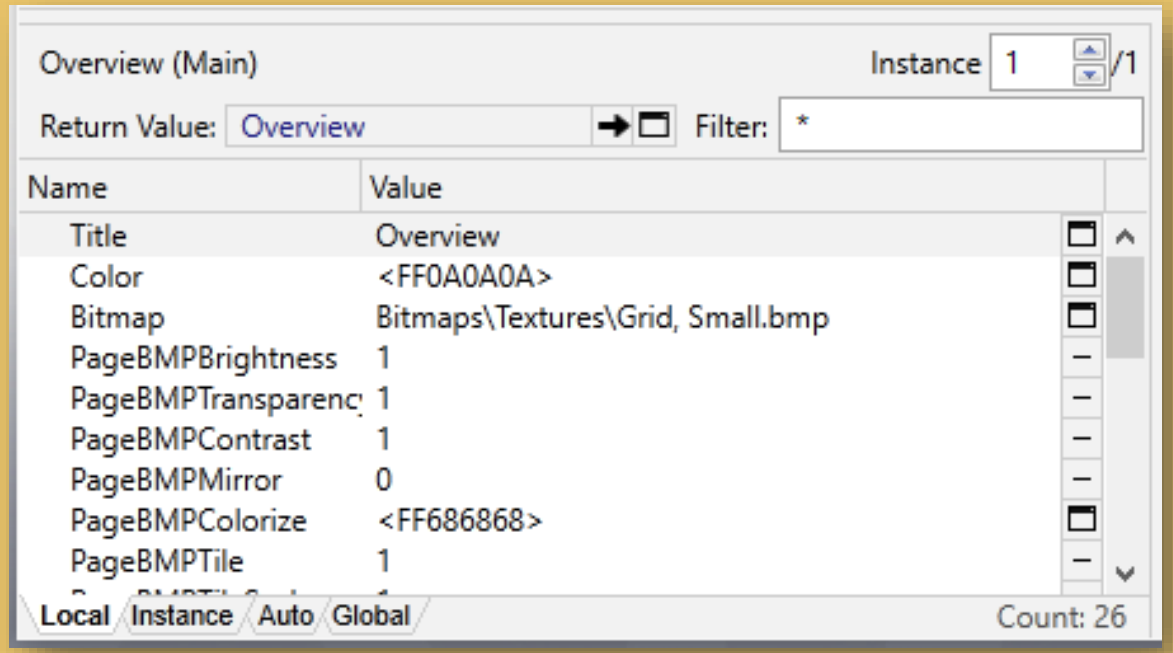
Scope –
Resolve Variables



Call –
Module Lifetime

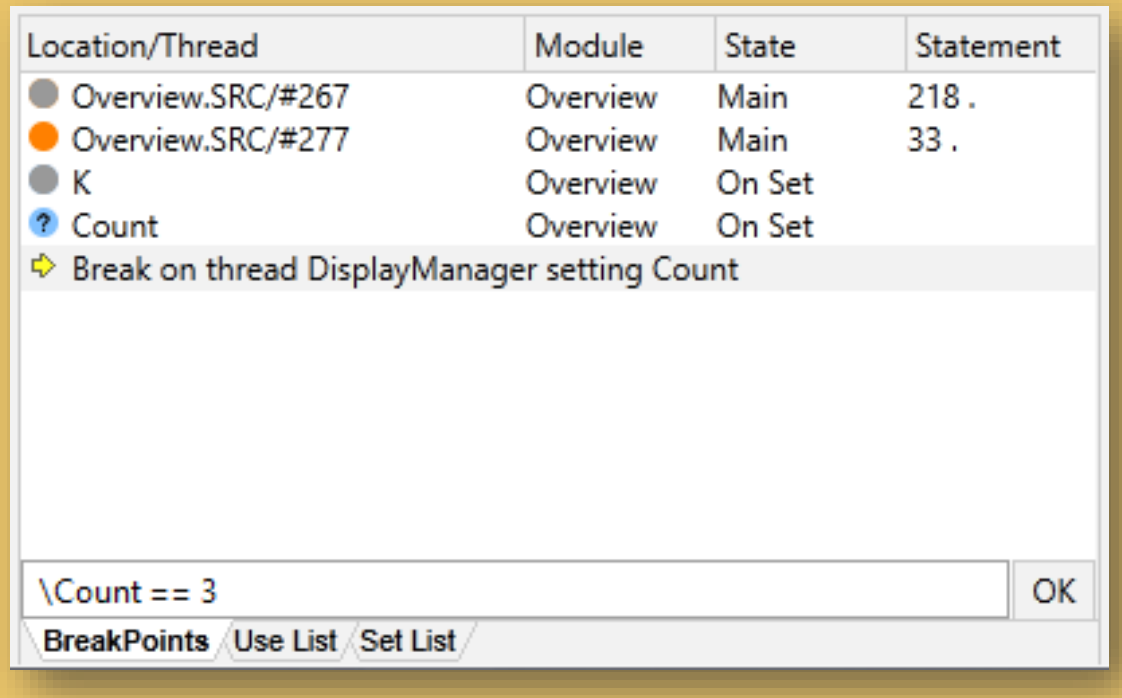
Inspecting Variables using the Source Debugger Variable Window

- Module Name & Current State
- Number of Instances
- Return Value
- Filter
- Local / Instance / Auto / Global
- Variable Count
- Variable Name and Value (Editable)



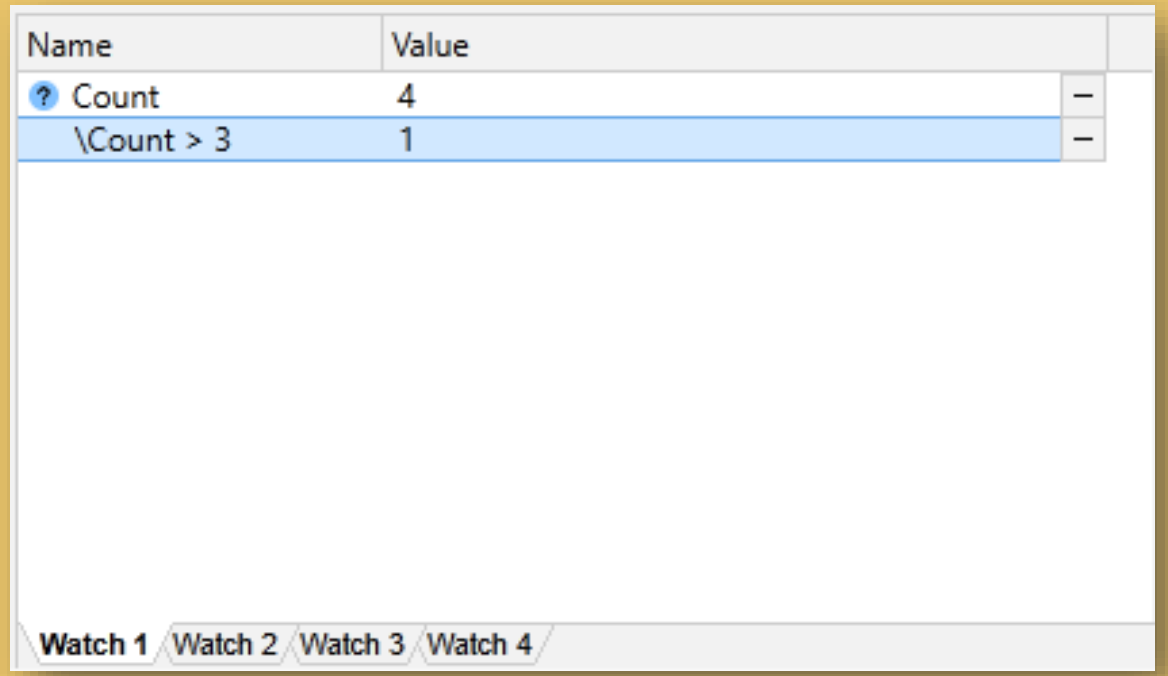
Source Debugger – The Breakpoints Window

- Breakpoints Place and disable
- Stepping through Code
- Variable Breakpoints
- Conditional Breakpoints
- Use List and Set List
- Module State and Statement
- NEW! Step Out



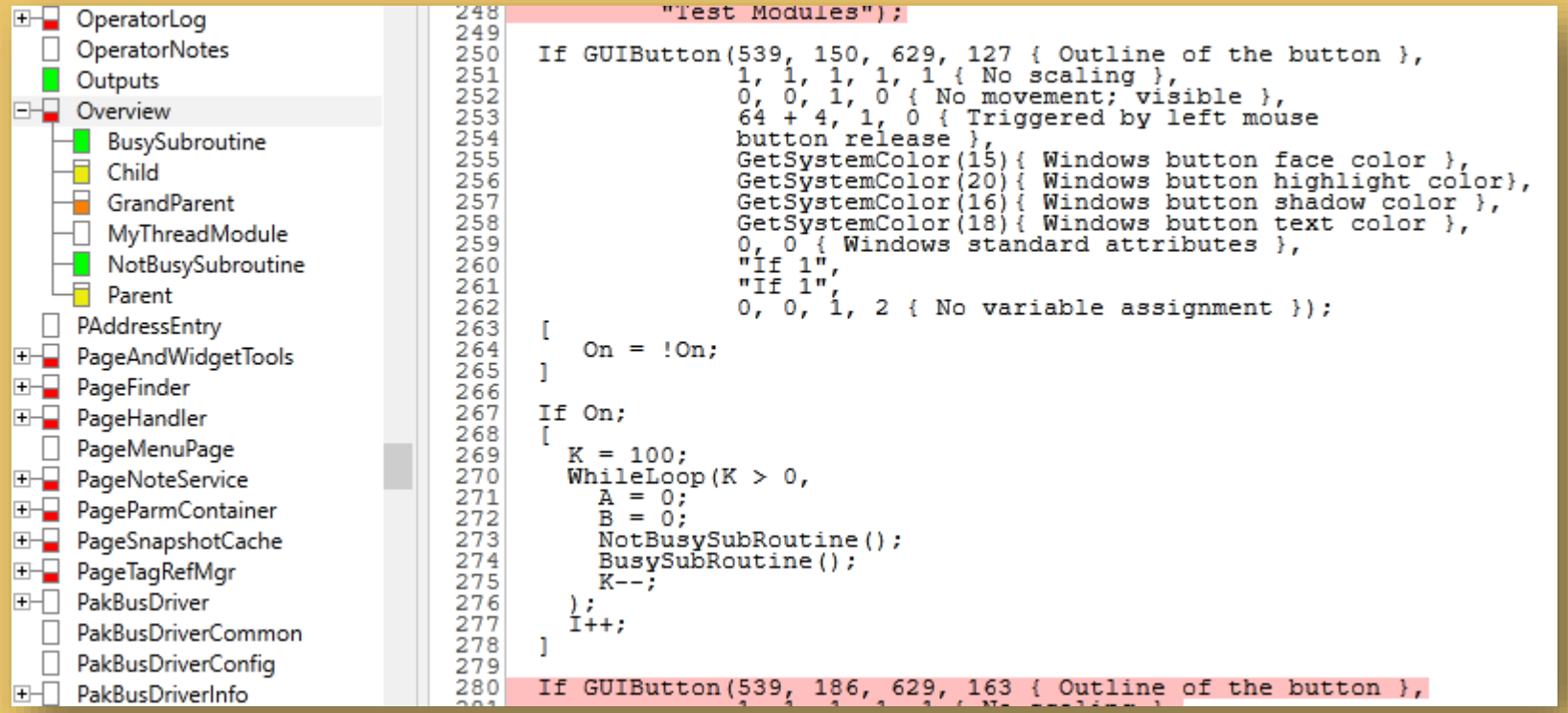
Source Debugger – The Watch Window

- Add a Variable Watch
- Adding a Watch Expression
- Multiple Watch Tabs
- NEW! Script Statement Calls



Source Debugger – Code Coverage

- Enable code coverage to see what code has executed



Dump Files

- Warning – creating a dump file will halt all system activity
- Often called a crash dump (Win32 system debugger, Dr Watson, may be configured to produce a file after an unrecoverable program error)
- UserDump in the VTScada\DumpTools directory
- Right Click on the VTS.EXE process in Task Manager
- By default stores dumps in %appdata%\local\Temp\VTS.DMP
- Click on the Create Dump File icon on the Source Debugger Window
- Allows path to be specified

Getting the most from Technical Support

- You can **NEVER** provide too much information!
- Dump files zipped and uploaded to FTP site (ftp://ftp.trihedral.com)
- Traces from both client and server (when working with a RPC issue)
- Information, Version Number, Operating System, 64bit / 32bit
- Information to reproduce
- A changeset of the application
- User name and password for admin level access to the application

Thank you for attending this session!

- Fill out the 2-question feedback survey via the App! Whova
- Especially if you need a Continuing Education Credit or Professional Development Hours certificate.
- Don’t have the app, fill out the paper form included in your conference kit and hand into Natashia.

SAVE THE DATE!

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