

Vijeo Citect 2015 Run as a Windows Service

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Make the most of your energy



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Introduction

This white paper describes how to set up the **Vijeo Citect™ 2015** or **CitectSCADA 2015** product to run as a Windows service. We will refer to the product **Vijeo Citect 2015** for the remainder of the white paper.

Historically the Citect product has not natively supported the ability to run as a Windows service. With the release of Vijeo Citect 2015, it is now possible to run Citect as a Windows service. This feature is now supported for Vijeo Citect 2015 (v7.50) as per scenarios documented in this white paper.

The ability to run as a Windows service is crucial for many applications where the server provides runtime and historical data to clients. For these applications, a service interruption cannot be tolerated. Normally an application that only supports stand-alone program operation is forced to shut down when a log out occurs on the host machine.

When run as a Windows service, the application can continue to supply data across user log in sessions. This allows the application to run unattended with no user account required to be logged into the Server. The application can also be started automatically at system power on, minimising downtime in the event of a system reboot or unexpected issue. There are also security benefits as well as efficiency improvements by not having to have a user logged in to the operating system. Access to the server can then be restricted and locked down to suit specific security requirements.

In summary, the main benefits to run as a Windows service are:

- Efficient use of resources
- Increased security
- High availability
- True client/server architecture

This white paper goes through the detailed instructions to implement this feature, including step-by-step examples. Any limitations with this solution will also be discussed and explored with the most effective approach to be taken, with a view for securing your system and providing a robust outcome.

Audience

The content of this white paper is targeted towards SCADA engineers, systems integrators and individuals with intermediate to advanced level of knowledge using Citect. In addition to this requirement, some level of IT experience would be advantageous. Users who want to run the Vijeo Citect 2015 application as a Windows service should refer to this white paper.

Prerequisites

Before continuing with the setup, it is recommended to review the prerequisites:

- Windows Server® 2008 R2 SP1 / 2012 R2
(also works on Windows 7 SP1 / 8.1 but server operating systems are recommended)
- Vijeo Citect 2015 (v7.50) / CitectSCADA 2015 (v7.50) or higher

In addition to the above requirements, it is recommended that you only attempt to run as a Windows service in the final stage of system delivery. It is recommended to use a 'Runtime Only' installation and your project compiled and ready to run.



Setting up Vijeo Citect 2015
to run as a Windows service

Server Isolation

System and service processes run on Session 0, with user processes run on Session 1 or 2. This means that system/service and user processes are isolated. If a service or application is compromised, it doesn't necessarily mean the entire system is compromised and hence vulnerable. Applications that run as a Windows service with the minimum privileges required will also restrict any attacker actions.

There are some drawbacks that need to be considered when an application is run on Session 0:

- Services can't display a user interface (UI) on the desktop
- No shared resources between services

These limitations can be overcome through alternate methods or approaches. This is beyond the scope of this white paper, but further reading material can be found on the Microsoft website.

See the Microsoft PowerPoint on session isolation for further details: <http://bit.ly/18YWRX5>

OPC Server (optional)

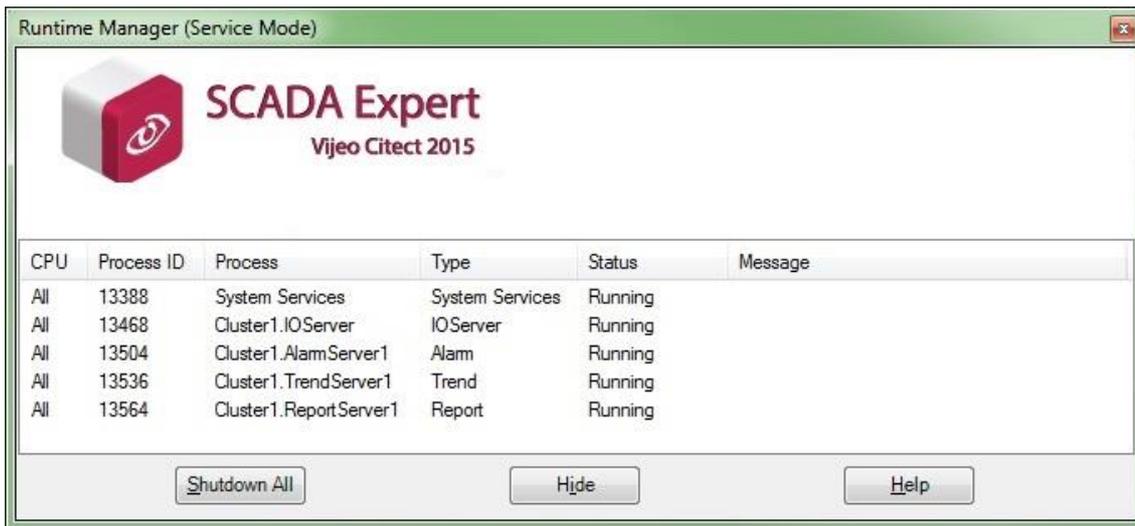
The following section is optional and only relevant for systems configured to run with OPC Servers for data access. OPC servers in operation on the machine can also be configured to run as a Windows service so they can be linked to the Vijeo Citect 2015 service that is created during installation. Please consult the individual OPC Server product documentation for further details on how to configure the application to run as a Windows service.

OFS Service

The configuration of OFS to run as a Windows service is only required if the OFSOPC driver is configured within a project. It is necessary to configure OFS to run as a Windows service for a number of reasons. If OFS is launched by Vijeo Citect 2015 when run as a Windows service and you attempt to launch the OFS application or connect to OFS using a logged in user, it will launch another instance of OFS.exe as the interactive user account in a different session. It is recommended that only a single OFS.exe instance be in operation across all sessions, and accessible by both services and interactive users. Please consult the OFS user documentation for further details regarding the OFS service and DCOM configuration.

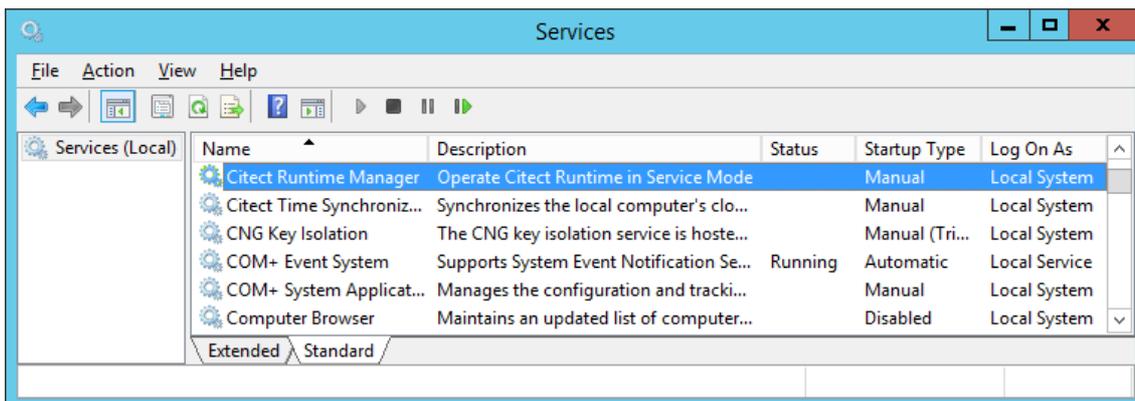
Citect Runtime Manager

Citect Runtime Manager is used to manage the Vijeo Citect 2015 processes and also acts as the service manager. The Citect Runtime Manager can now run in a new mode, referred to as 'Service Mode' which is clearly indicated in the title bar of the Runtime Manager (UI).



Installation

On installation of Vijeo Citect 2015 a service is automatically created. By default the service 'Status' is stopped, the 'Startup Type' is set to Manual and the 'Log On As' is set to the Local System account.



Service Dependency

Once the installation is complete and the Citect Runtime Manager service has been created, it may be necessary to configure dependencies between another service. In the following example, the FlexNet Licensing Service is used for product licensing, so it will need to be the first service to be started. The Citect Runtime Manager will have a dependency on the FlexNet Licensing Service to acquire a valid license.



There are a couple of different options available to configure the dependency illustrated above. The first option is to use the Service Controller configuration command. The second option is to manually configure dependency using the registry editor (**regedit.exe**).

Option 1: Service Controller Command

The Service Controller configuration command (**sc config**) can be used to modify the service entries in the registry and in the Service Control Manager settings.

To configure the required dependency using the Service Controller configuration command, first launch a command prompt with Administrator privilege. Then create a dependency of the FlexNet License Service service to start before the Citect Runtime Manager service by entering the following command:

```
sc config "Citect Runtime Manager" depend= "FlexNet Licensing Service"
```

Please note it is important to insert a space character after the **depend=** parameter. It is also necessary to enclose any service names in quotes which include spaces in their name.

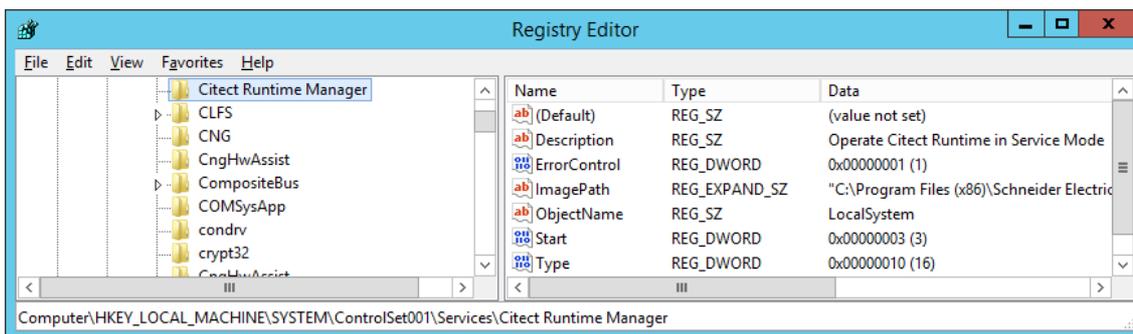
Option 2: Registry Editor

Before making changes to the registry, it is recommended to backup the appropriate registry section.

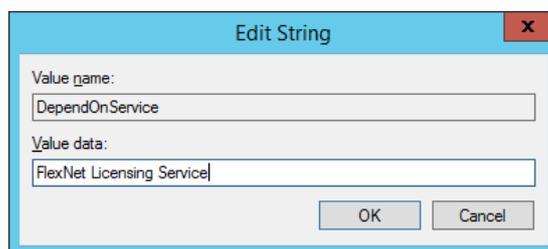
Locate the services section in the Windows registry:

HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet001\Services

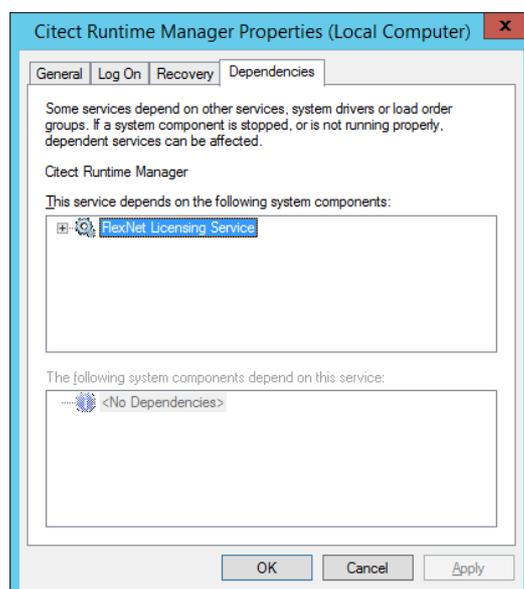
Locate the Citect Runtime Manager service in the list. Select the Citect Runtime Manager folder and right click on the white space where the other parameters are shown. Select New -> String Value:



Type in the name DependOnService, then edit the String Value and enter "FlexNet Licensing Service":



The service dependency configuration is now complete and can be confirmed by inspecting the Windows Services Manager Console.



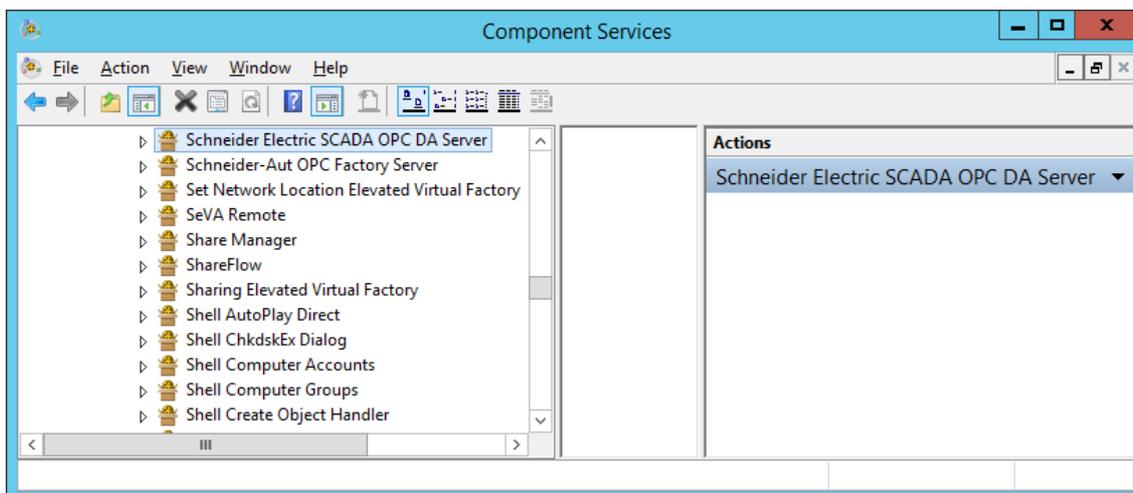
SCADA OPC Server (optional)

The following steps should be followed if you require the Vijeo Citect 2015 OPC DA Server to run as a Windows service. It is necessary to configure DCOM settings for the 'Schneider Electric SCADA OPC DA Server' to operate correctly.

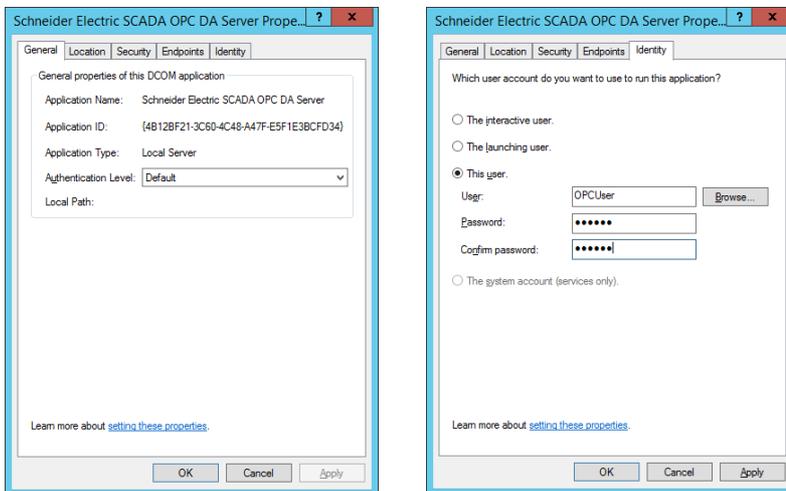
It is necessary to create a Windows User account which can be used in the DCOM configuration as well as the log on user to run the service.

Using the principle of least privilege the user account "OPCUser" is created. It has the minimum privilege required to perform its assigned task. The "OPCUser" user is based on the standard user account which has limited privilege to run applications only. It cannot make system changes.

Launch **DCOMCNFG** using an Administrator account. Expand the tree view in the Console Root -> Computers -> My Computer -> DCOM Config and locate the "Schneider Electric SCADA OPC DA Server" item, then right click and select properties:



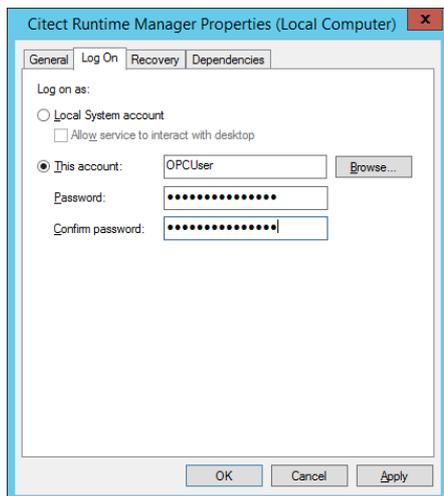
In the **Identity** tab, select “This user” and enter the username and password of the “OPCUser” account which will run the application.



Click OK.

Next launch the Services Management Console and select the ‘Citect Runtime Manager’ service. Right click on the service and select properties.

Go to the **Log On** tab and select ‘This account:’. Enter the username and password of the ‘OPCUser’ account.

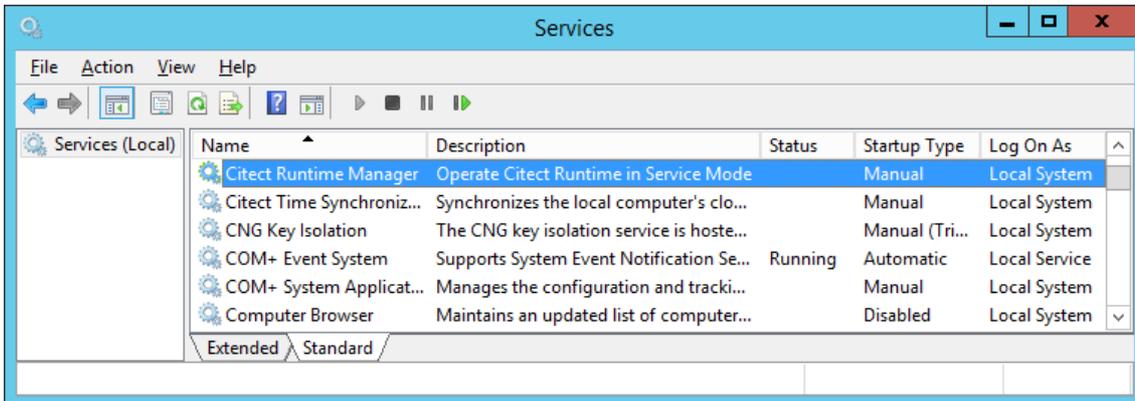


Click OK to close the window. Close the Services Management Console.

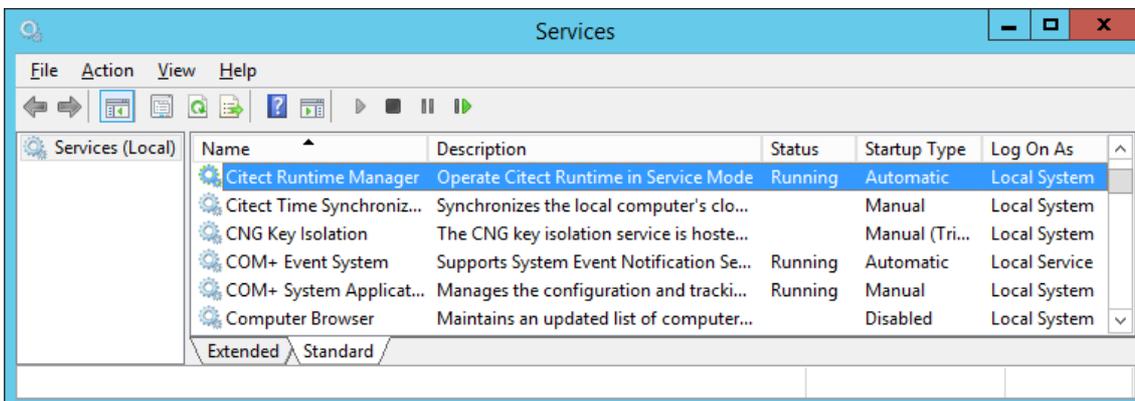
Restart the server for the changes to take effect.

Windows Service

The Citect Runtime Manager service should now be configured. It should be noted that the service is run as **Local System** account on Session 0. When an application is run in Session 0 it is not possible to raise this session to the active desktop to interact with it. It will remain hidden. See the section **Display UI** for further details on how to setup an interactive client session.



In order to have Vijeo Citect 2015 launch at startup of Windows, make sure that the “Startup Type” is set to “Automatic” then reboot the machine to allow Vijeo Citect 2015 to run as a Windows service. Alternatively, you can simply right click on the ‘Citect Runtime Manager’ service, and select ‘Start’ to run Vijeo Citect 2015 without rebooting the machine.



It is now possible to log in and log off without disrupting or stopping the Citect system.

Note: Before Citect 2015 SP1 Patch 5, when running CitectSCADA as a service, there was no way to specify the use of an alternate Citect.ini file. Command line arguments are provided to services by specifying them as start parameters in the services console. However, this change does not persist, so it is a once only operation. To persist command line arguments for a service, you can either use the SC Config command line tool to set the BinPath of a service to contain the arguments, or you can directly modify the ImagePath field for the service under HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\services in the registry to contain the arguments. CitectSCADA now supports this modification to the "CitectSCADA Runtime Manager" service, and it can be used to specify the path to an alternate Citect.ini file to be used through the /I command line argument. See example below to set specific INI file when running Citect as a service on a Windows Server 2012 R2 Operating system.:

First install Citect 2015 SP1 Patch 5 or above and then modify Windows registry key below using *RegEdit.exe*:

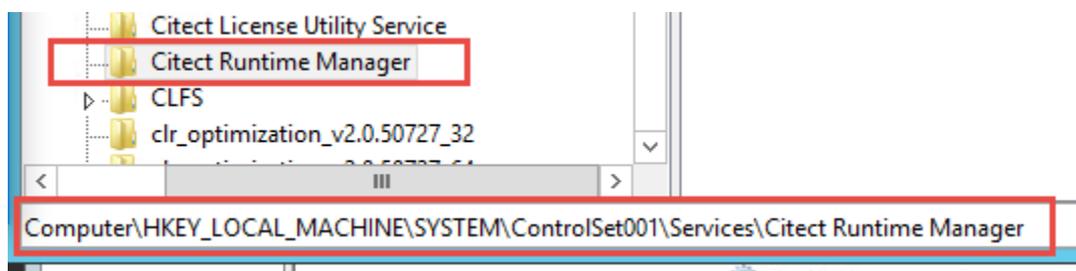
Key:

HKEY_LOCAL_MACHINE\SYSTEM\ControlSet001\services\Citect Runtime Manager\ImagePath

Value:

"C:\Program Files (x86)\Schneider Electric\Vijeo Citect 7.50\Bin\SE.SCADA.RuntimeManager.BackEndService.exe" /I"C:\ProgramData\Schneider Electric\Vijeo Citect 7.50\Config\Service.INI"

Where Service.ini is a specific INI file for running Citect as a service.



Name	Type	Data
(Default)	REG_SZ	(value not set)
Description	REG_SZ	Operate Citect Runtime in Service Mode
DisplayName	REG_SZ	Citect Runtime Manager
ErrorControl	REG_DWORD	0x00000001 (1)
ImagePath	REG_EXPAND_SZ	"C:\Program Files (x86)\Schneider Electric\Vijeo Citect 7.50\Bin\SE.SCADA.RuntimeManager.BackEndService.exe" /I"C:\ProgramData\Schneider Electric\Vijeo Citect 7.50\Config\Service.INI"
ObjectName	REG_SZ	.\testservice
ServiceSidType	REG_DWORD	0x00000001 (1)
Start	REG_DWORD	0x00000003 (3)
Type	REG_DWORD	0x00000010 (16)

Client UI (optional)

In previous releases of Citect, it was necessary to provide an additional client license if the Client UI was required on the same machine when run as a Windows service. In Vijeo Citect 2015, this is no longer the case. The ability to run a Client UI is provided in addition to the Citect processes that run as a Windows service.

To launch an additional Client UI on the machine there are several options.

Option 1: Citect Explorer

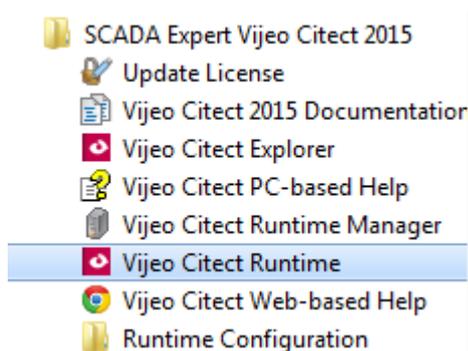
Simply click the Run icon found in the Citect Explorer ribbon:



This will launch the Client UI.

Option 2: Windows Start Menu

Simply start Vijeo Citect Runtime from the Windows Start Menu.



Option 3: Windows Shortcut

Create a windows shortcut with location set to "C:\Program Files (x86)\Schneider Electric\Vijeo Citect 7.50\Bin\Citect32.exe"



It is also possible to launch the Client UI and load a specific citect.ini file. This may be required if you need to launch specific startup cicode in the Vijeo Citect Client process with UI capabilities, which is different to the server processes which run as a Windows service. To modify which citect.ini file is loaded add the /i switch with the full path to the file. An example would be:

"C:\Program Files (x86)\Schneider Electric\Vijeo Citect 7.50\Bin\Citect32.exe" /i"C:\Custom Citect Config\citect.ini"

Monitoring Citect

An effective way to get detailed diagnostics and status of the running system is to use the following Cicode functions:

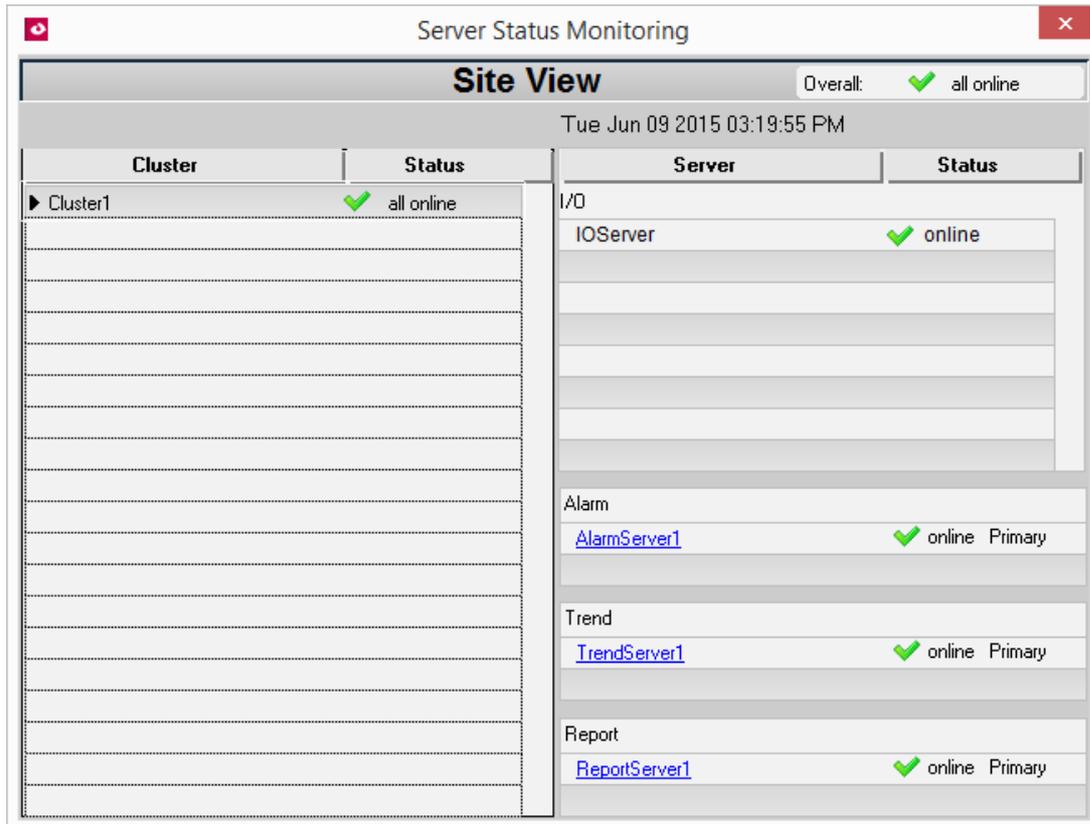
ServerGetProperty (sServer, sProperty, sCluster)

The ServerGetProperty function can only be called for Alarm, Report and Trend types. It will not work for other Server types (I/O Server, OPC DA, EWS).

ServerInfo (sName, iType, sCluster)

The ServerInfo function only works for Alarm, Trend, Report and I/O Server types. It will not work for other Server types (OPC DA, EWS).

The Example project has Cicode and graphics pages pre-configured which can be re-used to monitor the server status in your system.



Controlling Citect

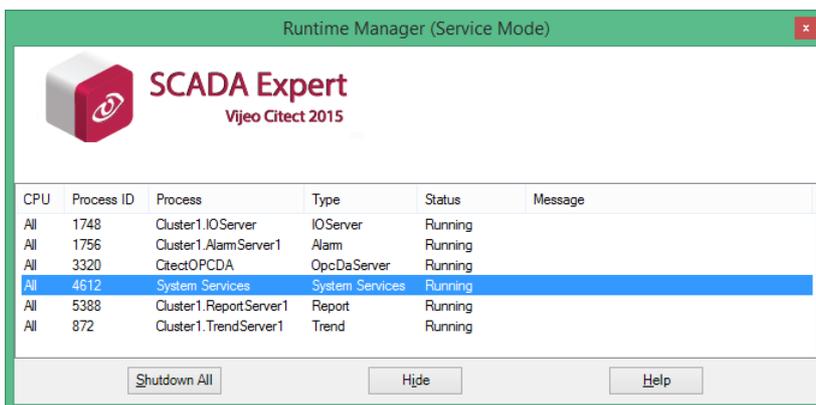
There are a number of options available to manage and control the Citect server processes that run as a Windows service. The Runtime Manager (UI) and Cicode can be used to control the Citect server processes.

Runtime Manager (UI)

The preferred method is to use the Runtime Manager (UI), but this is only available when logged onto the local computer running the service. When you launch Runtime Manager (UI) from Citect Explorer, you will see clear indication that Vijeo Citect 2015 is run as a Windows service by the title '(Service Mode)'. A number of useful controls are available - Start, Stop, Restart, Reload and Dump Kernel, when you right click on an individual process.

Note: The ability to launch the kernel window is not available when run in service mode.

See the **Diagnostics** section for further details.



Cicode

The following Cicode functions can also be used to control the Vijeo Citect server processes.

ServerReload (sServerName, sCluster, bSync)

Server reload works on the following components: Alarm, Trend, Report.

ServerRestart (sServerName, sCluster)

Restart works on the following components: Alarm, Trend, Report, I/O.

Shutdown (sDestination, sProject, iMode, sCluster, bCallEvent)

Shutdown works on the following components: Alarm, Trend, Report, I/O, OPC DA.

The Shutdown function will only work on Citect nodes which have [Shutdown]ShutdownIgnore=0.

The default value is 1.

Services Manager

The Windows Services Manager Console allows you to manage individual services installed on the operating system. The following controls can be used on the Citect Runtime Manager service:

- Start
- Stop
- Restart

The Pause and Resume control modes are not supported by Vijeo Citect 2015 and the Citect Runtime Manager service.

A shortcut to the Windows Services Manager Console can be added to the engineering tools page in the project. Set the following command on a button:

Exec ("cmd /c services.msc")

Diagnostics

Since it is not possible to directly access the kernel window for individual component processes, it may be necessary to access diagnostics information through alternative methods. The following options should be explored and used as appropriate for the individual system requirements.

Event Viewer

The Application Event Log is a useful source of information. The Citect Runtime Manager service will log any unexpected interruptions here. To access the event viewer go to **Control Panel -> System and Security -> Administrator Tools -> Event Viewer**.

Log Files

Diagnostic information is also available to view in the log files automatically created by each component. The syslog.dat, debug.log, parameters.log each have useful information which aids in diagnosing any unexpected interruptions that are experienced.

Kernel Dump

The majority of information contained in the Kernel can be obtained through performing a kernel dump. The kernel dump is simply a text file which can be opened with a text editor. The Runtime Manager (UI) can be used to create a kernel dump for any specific process. Simply right click on the process and select 'Dump Kernel'. The log file can then be found in the Log folder on the local machine.

Remote Kernel Dump

The kernel dump Cicode function is only supported on the Alarm, Trend, Report, I/O and OPC DA components. To perform a kernel dump on a remote server process, run the following Cicode command from a button or other calling function:

ServerRPC("<servername>","DumpKernel","0x8000, ^"^^", 1, "<clustname>")

Where '<servername>' and '<clustname>' are set according to the project configuration.

Conclusion

In closing, there are some important points to consider before proceeding to run Vijeo Citect 2015 as a Windows service:

- The 'Citect Runtime Manager' service will run in Session 0 under the **Local System** account (by default) which is not able to interact with the desktop.
- When Vijeo Citect 2015 is run as a Windows service under the **Local System**, it may not have access to network resources. For example UNC file shares, printer access and other resources may be unavailable. If these resources are required, the service must be run under a user account with the required privilege, for example the **Network Service** account. It is recommended that the principle of least privilege be applied when setting up this user account and the service.
- The OPC DA Server service requires DCOM configuration to enable connectivity to local OPC Clients.
- There is no kernel window access to components run as a Windows service. A kernel window is only available for the Client UI process. An alternative approach to access kernel information is to perform a dump of the kernel and access the log file created.
- One full license is required on each Server to run the Citect Runtime Manager service (which will manage and run the Vijeo Citect 2015 server processes). It also provides the ability to run one local Client UI without the need for additional licenses.
- There are no Cicode functions available to control or manage the OPC DA Server or EWS Server. The log files found in the log folder should be utilized if any unexpected interruptions occur.
- When setting up Vijeo Citect 2015 to run as a Windows service, it is recommended to update any project deployment procedures. Care needs to be taken to not inadvertently make changes to the running system (for example, accidentally modifying the project making it "uncompiled"). It is highly recommended to have a 'Runtime Only' installation on server machines.
- Vijeo Citect 2015 does not support pause or resume modes when issued from the Windows Services Manager Console.
- 'Citect Runtime Manager' (**RuntimeManager.exe**) is the preferred method to control individual Vijeo Citect server processes. The title bar will indicate clearly when run in 'Service Mode'.

Efficiency, increased security and high availability are just some of the values delivered when Vijeo Citect 2015 is run as a Windows service.

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