MetaAutomation Sample 3

Installation and Usage

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# Sample Overview

The MetaAutomation Sample 3 is a Visual Studio solution developed with Microsoft Visual Studio Community 2015. It contains 9 projects.

Microsoft Visual Studio Community 2015 is free to download, use and install from the Microsoft web site VisualStudio.com.

The sample is mostly platform-independent; to run the C# code on another platform that is supported by the Mono project for example, remove the Windows Eventing or port the eventing manually to the other platform, and substitute a different XML-based service for Windows Communication Foundation (WCF).

This document concerns setup and run of the sample as downloaded, including the 6 example checks included in the sample.

MetaAutomation samples 1, 2 and 3 demonstrate

* Self-documenting, hierarchical check steps that show pass, fail, or blocked for each check step
* Timeouts for each check step that are configurable in each check artifact used to run the next one

Both MetaAutomation Sample 2 and MetaAutomation Sample 3 demonstrate checks with

* distribution across processes with synchronization within each check
* running any number of checks in parallel
* pure, compact, descriptive check artifacts in a schema-defined grammar of XML

MetaAutomation Sample 3 also demonstrates the scale potential and cross-machine or cross-tier quality-measurement power of MetaAutomation for e.g. measuring quality for an Internet of Things project, by

* using any number (1-N) of machines and configurable users as defined to run the checks

But, installing and configuring MetaAutomation Sample 3 is much more complex than MetaAutomation Sample 1 or MetaAutomation Sample 2; users and filesystem directories must be installed on each machine (e.g. through a domain), a simple XML-based service must be installed and configured on each target machine, and the build must be configured to place binaries in the correct locations and machines.

Learning to work with MetaAutomation Sample 1 first, and then MetaAutomation Sample 2, is recommended as a prerequisite for MetaAutomation Sample 3, because the earlier samples are much simpler to setup and run and all the concepts introduced with the earlier samples are also present in the later ones. Start with MetaAutomation Sample 1, and the tutorial that comes with it.

For more information and diagrams on how this system works, to customize the checks or adapt the infrastructure, and more on how this implements the Atomic Check pattern and works in the bigger setting of the MetaAutomation pattern language, please see the site <http://MetaAutomation.net> and the book on MetaAutomation (2nd Edition). In the 2nd Edition of the book on MetaAutomation, Figure 13.1 is a sequence diagram that shows how MetaAutomation Sample 3 works across multiple tiers.

# Setup

The setup steps are organized with numbers to represent the sections, and numbers to enumerate the steps. Unless there’s a clear reason not to (e.g., you have Visual Studio installed already, or you are working on a non-Windows platform) it’s easiest to follow the steps in order.

## A. Configure Users and Machines

### A1. Choose machines or OS instances

Choose the machines or OS instances you wish to use, including the master machine that will run the primary solution, and target machines to do the check runs. Keep a complete list of these machines because they will be used in some of the following configuration steps.

### A2. Login as the target users on the target machines

Login as the target users on the target machines, to initialize the file system for the users and verify access. This might only be necessary on client operating systems e.g. Windows 10, and this step could be automated with e.g. PowerShell.

For each user on each machine, create a file directory

C:\Users\<user>\Documents\Checks

To hold the binaries that run the checks or check components.

### A3. File Sharing

#### For the check execution files

For each such directory “Checks” created in the last step, share it with read/write permissions to the primary user that will be building and deploying solution components from Visual Studio. The other permissions will work with defaults.

For each target machine or tier in the last step, configure “Advanced Sharing Settings” to turn on “network discovery” and turn on “file and printer sharing.”

From each machine or tier that is involved with the check runs (i.e. both the master machine and the target machine or machines), connect to the file shares on the other machines and enter credentials as needed. Click the check box for “Remember my credentials.” (Note: for many machines, do this with PowerShell; much easier.)

#### For the MetaAutomationService service files

On each target machine or tier that is involved with the check runs, create a new directory:

C:\inetpub\wwwroot\MetaAutomationService

Turn on sharing for the MetaAutomationService directory.

Using advanced sharing, add “Full Control” permissions for the custom user of step A2 above to the MetaAutomationService directory.

If using anonymous access for HTTP services in a network for these services, share the directory out to everyone with read permissions.

### A4. Install Windows components

On each target and on the master machine, In the Control Panel, start the configuration tool “Turn Windows features on or off.”

Check boxes to enable the following features:

1. .NET Framework 4.6 Advanced Services -> ASP.NET 4.6
2. .NET Framework 4.6 Advanced Services -> WCF Services -> HTTP Activation
3. Internet Information Services -> FTP Server -> FTP Service
4. Internet Information Services -> Web Management Tools -> IIS Management Console
5. Internet Information Services -> Web Management Tools -> IIS Management Scripts and Tools
6. Internet Information Services -> Web Management Tools -> IIS Management Service
7. Internet Information Services -> World Wide Web Services -> Application Development Features -> .NET Extensibility 4.6
8. Internet Information Services -> World Wide Web Services -> Application Development Features -> ASP.NET 4.6
9. Internet Information Services -> World Wide Web Services -> Application Development Features -> ISAPI Extensions
10. Internet Information Services -> World Wide Web Services -> Application Development Features -> ISAPI Filters
11. Internet Information Services -> World Wide Web Services -> Common HTTP Features -> Default Document
12. Internet Information Services -> World Wide Web Services -> Common HTTP Features -> HTTP Errors
13. Internet Information Services -> World Wide Web Services -> Health and Diagnostics -> HTTP Logging
14. Internet Information Services -> World Wide Web Services -> Health and Diagnostics -> Logging Tools
15. Internet Information Services -> World Wide Web Services -> Health and Diagnostics -> Request Monitor
16. Internet Information Services -> World Wide Web Services -> Security -> Request Filtering
17. Internet Information Services -> World Wide Web Services -> Security -> Windows Authentication
18. Windows PowerShell 2.0 -> Windows PowerShell 2.0 Engine

These configuration steps can also be automated with PowerShell.

## B. Configure Eventing

### B1. Start Event Viewer

Run Event Viewer to ensure that it is available on the master and on each target machine.

### B2. Create the MetaAutomationService event listener on each machine

On the master machine and on each target machine, run a PowerShell shell as admin, and run this script in the shell:

[system.Diagnostics.EventLog]::CreateEventSource("MetaAutomationService", "MetaAutomationService")

Debug builds of MetaAutomation use the Windows Event log for improved visibility into what it’s doing, e.g. with errors and XML communications. This is a very important tool to use in case of configuration difficulty.

### B3. Verify Event Viewer

Restart Event Viewer and look at the hierarchy:

Event Viewer (local) -> Applications and Services Logs

Ensure that the MetaAutomation Service event listener is created on each machine in the “Applications and Services Logs” group.

In this event listener, events are shown for the master and target machines communicating with each other with valid XML documents to carry the detailed instructions needed to run the various check components. This is a very useful tool to see what’s going on, e.g., if something in the system is not behaving as expected.

## C. Create Services

### C1. Use IIS Manager to create the necessary services and thread pools

As an admin user, start Internet Information Services (IIS) Manager.

1. Find and launch the IIS Manager
2. Create the MetaAutomationService site
   1. On the left, open up the machine name server node and select “Sites”
   2. At top of the main “Sites” window in the middle of the tool window, right-click on the “Sites” folder icon and select “add website…”
   3. Name the Site “MetaAutomationService”
   4. Pick a port number if needed to avoid collisions with existing sites, OR remove the existing sites. For port 80, for example, there might be a collision with the default site; you can use port 80, but the existing default site (that also uses port 80) must be removed. Note the port number because it will be needed for later configuration steps.
   5. Set the directory created in step 2 above as the path
   6. Set the host name as the machine name
   7. OK to save settings
3. To run the checks as your custom user rather than the identity you’re using for Visual Studio …
   1. Select “Application Pools” at left, to show the list of application pools in the center
   2. Right-click on the MetaAutomationService application pool, and pick “Advanced Settings”
   3. In the “Process Model” property group, click on “Identity” and click the “…” to open the “Application Pool Identity” dialog
   4. Select the “Custom account” radio button
   5. click the “Set…” button to open the “Set Credentials” dialog
   6. Set the credentials to your target user of step A2 above
   7. OK to close the dialogs and return focus to the IIS Manager
4. In IIS Authentication, enable Anonymous Authentication for the service
   1. Open the “Sites” node at left
   2. Select the MetaAutomationService site
   3. Open the node in the middle for IIS -> Authentication…
   4. Select the row for “Anonymous Authentication” and click “Enable” at right
   5. Select the row for “ASP.NET Impersonation” and click “Disable” at right
   6. Select the row for “Forms Authentication” and click “Disable” at right
   7. Select the row for “Windows Authentication” and click “Disable” at right
5. In IIS Logging, change the schedule to “Hourly.”
   1. Select the MetaAutomationService site at left
   2. Open the IIS -> Logging control at center
   3. Under “Log File rollover,” set Schedule to “Hourly.”
   4. Based on your team situation using the MetaAutomation sample, consider clicking the “Use local time for file naming and rollover” check box.
   5. Click “Apply” at right

### C2. Open ports as needed

Use the Windows Firewall tool to enable inbound rules to open ports as needed for incoming HTTP requests to the services on each machine. If using port 80, it might not be necessary to make any changes.

## D. Load and Configure the Solution in Visual Studio

### D1. Install VS 2015

If you don’t have a version of Visual Studio 2015, install the latest free version:

1. Browse to this page <https://www.visualstudio.com/en-us/products/visual-studio-community-vs.aspx>
2. Select “Download Community 2015” or a newer version
3. Verify that it’s published by Microsoft, and Select “Run”
4. In the installer, choose the “Typical” or “Default” installation
5. Proceed with the installation

### D2. Load MetaAutomation Sample 3 solution

The MetaAutomation Sample 3 is available as a zip file here:

<http://metaautomation.net>

Click the “Samples” tab, download the solution and un-compress it to the file system in your workspace. Ensure that there are no spaces in the absolute workspace path, because that can confuse the post-build file copy steps that are included in some of the projects in the MetaAutomation Sample 3 solution.

Note: you might get post-build file-copy errors at this point, but the binaries of the solution should all build correctly.

### D5. Configure post-build binary copies

Post-build binary copies are needed for the CheckProcess process running on each machine and for each user. For each project that needs post-build files copied, edit the project properties with Build Events -> Post-build event command line window.

The following project files must be copied for each target machine and for each user’s file system. By convention, the file copy target location for the machine and user is:

\\<TARGETMACHINE>\Users\<USERNAME>\Documents\Checks

For the MetaAutomationBaseMtLibrary project, copy the target DLL (and the corresponding PDB, for debug information).

For the MetaAutomationClientMtLibrary, copy the target DLL (and the corresponding PDB, for debug information).

For the MetaAutomationClientMt, copy the target DLL (and the corresponding PDB, for debug information).

For the CheckMethods project, copy the target DLL (and the corresponding PDB, for debug information).

For the CheckProcess project, copy the target CheckProcess.EXE and the corresponding config file (and the corresponding PDB, for debug information).

Build the entire solution to test the file copy settings, and make corrections as needed.

### D6. Edit the project config files

So the different components can talk to each other, the web.config file must be edited for the MetaAutomationService, and the App.config files for the CheckProcess project and the CheckLauncher project. For each of these three .config files, in the xml path /Configuration/system.serviceModel/client/, there must be an “endpoint” element for each target machine with the following XML attributes:

1. Address of the service, depending on how the services were configured in step C1 above, e.g. address="<http://MACHINENAME:62978/MetaAutomationService.svc>"
2. Binding of the endpoint: binding="basicHttpBinding"
3. Binding configuration: bindingConfiguration="BasicHttpBinding\_IMetaAutomationService"
4. Contract: contract="IMetaAutomationService"
5. Name of the endpoint. The name of the endpoint must be identical to the machine or OS instance name, but in all UPPER-CASE CHARACTERS.

### D7. Create the publish profiles for MetaAutomationService

In Visual Studio, for the MetaAutomation Sample 3 solution, edit or create a publish profile for the local machine and every target machine.

1. In Solution Explorer view, right-click over the project MetaAutomationService and select “Publish…” to open the “Publish Web” dialog
2. Click the “Profile” button
3. Drop the “Profile” listbox to check the existing profiles, if any.
4. To delete or rename profiles, use the “Manage Profiles…” button.
5. To add profiles, select “Custom” publish target, drop the listbox and select “<New Custom Profile…>”
6. Use publish method “File System” mode
7. Target location: \\<servername>\MetaAutomationService
8. Use “Debug” configuration
9. Under “File Publish Options”
   1. Check “Delete all existing files prior to publish.”
   2. Check “Precompile during publishing.”

### D8. Build the entire solution

### D9. Deploy MetaAutomationService to each target machine

Right-click on the MetaAutomationService project in the Solution Explorer of Visual Studio, choose “Publish…” and select the publishing profile for your target machine. The output of the publish operation should include “Publish: 1 succeeded, …”

Publish to all target machines, including the current (origin) machine.

## E. Run Example Check 1 (the default)

### E1. Build

Do a complete build first, to ensure that all 9 projects in the solution are built, the binaries distributed to the various machines, and the service successfully deployed to the master machine and all target machines..

### E2. Configure the last-run check artifact to drive the next check run

In Visual Studio, in the Solution Explorer window for solution MetaAutomation Sample 3, right-click on the solution and select “Open Folder in File Explorer.”

Find the Artifacts folder in the same window, and inside it, the file CheckMap.xml. Open the file to view and edit. This is the CheckMap that points to the current artifact file for any check; this is important because the current artifact file for any check also has the information required to run the check next time. See the below table for more details on this point.

As downloaded, the sample solution has only one example check enabled, “Example 1.” In this element “Check,” find the named values for “DirectoryName” and “CurrentCheckRunArtifact.”

In the File Explorer window, drill down through the “Artifacts” folder and then the folder of the “DirectoryName” of the enabled example check. This should be “Example\_1\_SimpleOneTierCheck.” In that folder, find the file with the name that is the “CurrentCheckRunArtifact.” It’s expected to be the file “CheckRunArtifact\_Original.xml” in case the example check has not yet run to completion.

Open the artifact file in your favorite text editor, e.g., Visual Studio. Changes might be necessary for the following child elements of element “CheckRunData.”

|  |  |
| --- | --- |
| **In the DataElement element with Name attribute of this value…** | **Set the Value attribute to this** |
| PathAndFileToRunner | On the target machine (destination machine, where the check will be executed) this is the absolute path to the location of CheckProcess.exe. Depending on where the exe is placed in post-build steps and the user, this value might need to be changed. |
| OriginMachine | The current machine name or OS instance name, IN ALL CAPS. |
| DestinationMachine | The machine on which the check will be executed, or in the case of a multi-tier check, the least dependent part of the check, IN ALL CAPS. |
| CheckClientUser | The current user that launches the check with CheckLauncher.exe. This may be the same user as above in step A2. |
| CheckMethodName | The name of the method that is executed in CheckMethods.dll. See the CheckMethods project in Solution Explorer, and open the source file for the example check, to find this method. |
| CheckMethodGuid | The GUID of the method, as specified with the CheckMethodAttribute instance for the method. |
| ThreadPoolUserName | The user name of the identity that executes the MetaAutomationService through the threadpool. This may be the same user as above in step A2. |
| CheckTimeOutMilliseconds | Timeout for the entire check. For the default example check, 10000 ms is probably enough. |
| CheckLibraryAssembly | This specifies the assembly to load to look for the check to execute. This probably does not need to be changed. |

Verify and edit as needed, save changes, and hit F5 to run in a debug session.

The sample implementation opens a command-line window to show the output of running the check or checks specified in the check map file CheckMap.xml.

The artifacts of the check run(s) are new versions of the check run artifact file(s). The file CheckMap.xml is updated at check run completion(s) to point to the new versions of the artifact file(s). To see results of the runs, open the new artifact files. Optionally, put the XSL file in the “ReferenceDocuments” folder, called CheckRunArtifact.XSL, in the same folder as the artifact file, then open it in a standard web browser to see a simple human-friendly presentation of the data of the artifact.

The check that is enabled by default does a minimal demonstration of self-documenting, hierarchical check steps.

## Running the other example checks

This example check is enabled by default. To disable it, comment out the “Check” element in XML in the map file that represents this check.

Each un-commented “Check” element in the map file is enabled, and will run a different example check. All the enabled example checks will run in parallel in different processes on target (destination) machines on launch of the CheckLauncher executable.

### Example check 2

Un-comment the “Check” element in the map file for Example\_2\_CheckOfWebPageBuiltToFailRandomly to enable this check, and refer to the above table to configure the last-run artifact file as needed.

This check requests a page of the MetaAutomation.net web site, but the page is deliberately built to fail 80% of the time. There are 5 possible behaviors of this page, based on the time of page request. Only one behavior passes the check, and the others fail, to demonstrate how a check can report the failure.

### Example check 3

Un-comment the “Check” element in the map file for Example\_3\_TwoTierCheckOfFileSystem to enable this check, and refer to the above table to configure the last-run artifact file as needed.

For this check, there is one more step needed: configure the file share used.

In the last-run artifact file, see the element “CheckCustomData,” and child element DataElement with name “TestFileNameAndPath.” Edit this value to point to the file share to use.

See the name “DestinationMachine” and notice that it occurs twice for this check: once in a child element of “CheckRunData” element, and once in a child element of the “SubCheckData” element. The first name/value pair designates where the less dependent part of this check runs, and the second designates where the more dependent part of this check (or, “sub-check”) runs. The two locations here can be the same machine or different machines.

If the two machines for the two parts of the check are the same as each other (whether or not they are the same as the machine that runs CheckLauncher.exe) the file share could be, e.g., “C:\temp\TestFile.txt.” The directory needs to exist before check run, but the file can exist or not.

If the two machines for the two parts of the check are different, then the “TestFileNameAndPath” needs to point to a file share that is accessible by the same path from both places.

This check demonstrates a minimal behavioral check that requires driving check steps in two different operating system processes, tiers, machines or OS instances.

### Example check 4

Un-comment the “Check” element in the map file for Example\_4\_DeeplyNestedCrossProcessCheck to enable this check.

This check demonstrates how a check can have an arbitrarily complex hierarchical structure of check steps across an arbitrarily complex set of operating system processes. MetaAutomation Sample 3 demonstrates (using a WCF service) that these processes can happen across any number of systems, given that each of these systems can run a simple XML-based service.

### Example check 5

Un-comment the “Check” element in the map file for Example\_5\_StaticFailureIndicatedInArtifact\_DebugBuildOnly to enable this check.

This check will only work with a DEBUG build of the MetaAutomation sample system. It demonstrates a hard-coded failure in a check to aid with debugging and demonstrate how failures are handled in multi-tiered checks.

### Example check 6

Un-comment the “Check” element in the map file for Example\_6\_RollingFailureIndicatedInArtifact\_DebugBuildOnly to enable this check.

This check will only work with a DEBUG build of the MetaAutomation sample system. It demonstrates rolling failures in a check to aid with debugging, and failure handing in a multi-tiered check.

## Iterative Runs for Test and Debugging

In the CheckLauncher project, class LaunchAsynchronousChecks, see the local variable

const int IterateCount = 1;

This determines how many times the checks referenced in the file CheckMap.xml are run. This can be set to any number and is useful to set to a higher number for repeated runs of the Debug rolling failures example check.

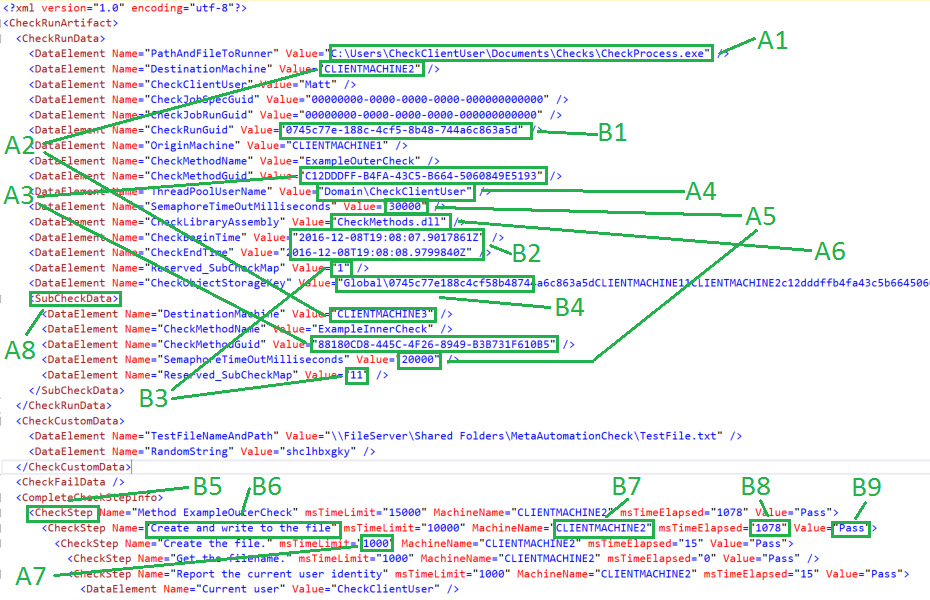
### Outputs from a Successful Run

Look in the directory where you edited the file CheckRunArtifact\_Original.xml. There is now a new file called CheckRunArtifact\_<GUID>.xml. Open up this file to see the result of the run.

The file CheckMap.xml now points to this file, and doesn’t know about the CheckRunArtifact.Original.xml. To make changes to the check run, edit the new file; it is the new reference for running the check.

### Using the Artifact XML to Drive Checks and Read Results

Here is the form of the XML artifact from example check 3 from MetaAutomation Sample 3, which shows a basic file system check spanning up to three tiers, machines or OS instances, one for launching the check, one for creating and writing a file, and one for reading and verifying the file. The text in various shades of red and blue are as seen in the Visual Studio text editor, with default colorization settings, and the green annotations are added to this graphic to correspond to the notes below:



### A. Entries in the XML artifact that drive the check

For this sample implementation, these values are set by editing the XML with a text editor, if they need to be set or changed.

For an adapted or more complete implementation of the patterns of MetaAutomation, these values might be set by the automation infrastructure outside of the scope of the actual check runs.

#### A1. PathAndFileToRunner

A relative path is used here, and is determined by the name of the EXE used to establish the new process for running a check or subcheck.

#### A2. DestinationMachine

#### A3. CheckMethodGuid

This GUID determines the method in the CheckMethods assembly that is executed to begin the check. In C# code, the GUID is set with the CheckMethodAttribute class of the MetaAutomationClientSpLibrary.

#### A4. ThreadPoolUserName

#### A5. SemaphoreTimeoutMilliseconds

Global operating system semaphores are used to synchronize checks with subchecks, and these have timeouts defined. If a semaphore times out, the check might end with no artifact record of the check run, so judicious use of the check step timeouts is recommended. See item A5 below.

#### A6. CheckLibraryAssembly

For this simple sample, the check code all lives in this one assembly, so the name of the assembly is specified here.

#### A7. CheckStep msTimeLimit

These values determine the timeout for a check step, including all child steps that run as part of that step.

This value is set for any existing check step for a check. If the check steps change or are initialized at first run of a given check, the msTimeLimit will default to the value determined by the MetaAutomation libraries (currently 30,000 milliseconds i.e. 30 seconds).

For check steps that do not change as a result of the check run, the msTimeLimit attribute values will persist to the next check run in the XML.

See entry B3 below for more information on the lifecycle of the CheckStep elements.

#### A8. SubCheckData

This is how a subcheck is defined, i.e. a portion of the check that would run in a different operating system process. These may be nested or defined in peer sequence. The CheckMethodGuid (see item A2) defines what code is run in the new process.

### B. Entries that are determined by the check code and the engine during a check run

#### B1. CheckRunGuid

This uniquely describes a run of a check.

#### B2. CheckBeginTime and CheckEndTime

These values are determined by the run of the check.

#### B3. SubCheckMap

You may ignore this element.

#### B4. CheckObjectStorageKey

You may ignore this element.

#### B5. CheckStep elements and hierarchy

CheckStep elements describe the step hierarchy of a repeatable check.

Before the first run of a given check, the element CompleteCheckStepInfo would have no child elements at all. The artifact that results from the check run will show the CheckStep elements to reflect the steps of the check, following from the code and other elements of the check.

If the steps of a check change, that is detected by the engine during the first run of the check in which the changed steps occur, and the new or changed steps are reflected in the artifact of the check run.

#### B6. CheckStep Name

The name of the check step is determined by the C# code. The names are hard-coded and therefore stable and unchanging, the better to support analysis on the data that is created by the check runs.

#### B7. MachineName

This is the machine or tier on which the check step was executed.

#### B8. CheckStep msTimeElapsed

The elapsed time is determined by the check run. The time includes the running time for all child steps as well.

#### B9. CheckStep Value

These values describe the result of a given step in the check run: Pass, Fail, or Blocked.

A result of “Fail” for a given check step propagates up through ancestor steps.

A result of “Blocked” means that the check step was not executed at all due to an earlier failure.

## Troubleshooting

Each machine or OS instance that is running the checks must be able to find all of the other machines. If this isn’t working, the following checklist might help:

1. If intra-machine communication fails, check the firewall inbound rules to see if traffic is blocked for any of the machines for the port number that the local service install uses.
2. If intra-machine communication fails, check that DNS allows all of the machines to find each other. Try “ping” from the command line. If this fails, run “ipconfig /renew” from the command line on the affected machines.
3. If intra-machine communication fails, check the firewall outbound rules to ensure that the traffic is allowed for the port number(s) needed.
4. To simplify the rules and configurations, if port 80 is not needed for anything else e.g. a web site served by the machines, try standardizing all of the ports to 80. You could also standardize the ports to 8080 or any other number that is known to not conflict with other services.
5. If the debugging session continues for more than 10 seconds while the console window continues to report queries for the results for the process, try forcing a debugger attach: In project CheckProcess, class CheckProcessMain.cs, un-comment the 5 lines of code that check Debugger.IsAttached and sleep. Set a breakpoint after this loop. Rebuild all, then start debug, and attach the debugger to process CheckProcess.exe.
6. If the check run times out with no informative output to the console, for a debug build, check the event viewer for the OS instance(s) used. Look for the “MetaAutomationService” events in the “Applications and Services Logs” group.
7. If the MetaAutomation Sample 3 Visual Studio solution does not load the web service project, verify that the binding for the local IIS service includes both “localhost” and the machine name for the web service.