**Last Update: 6/30/18**

RS5 Validation Guide

**Summary:** This document provides implementation steps to implement and test the Precision Time Protocol client on Windows 10 and Server 2019.

This guide should be accompanied by the Software Timestamping and Time Accuracy Validation guides found here: <https://github.com/Microsoft/SDN/tree/master/FeatureGuide>

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# Overview

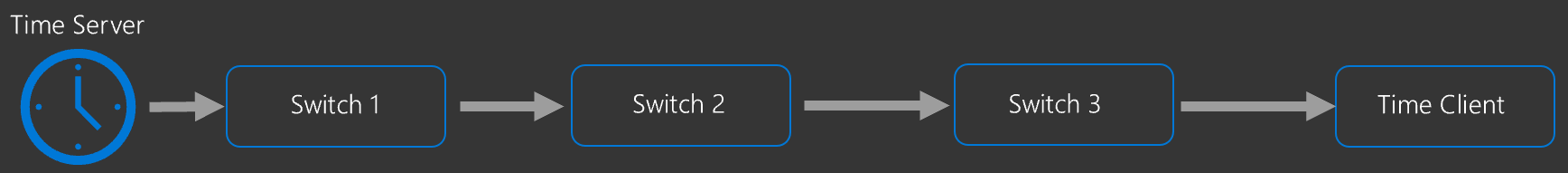
Many sectors require accurate time. The financial sector requires accurate time so that transactions are properly timestamped to 50ms, 1ms or even 100µs accuracy. Windows Server 2019 and the corresponding Windows 10 release continues to improve Windows’ accuracy by leveraging a new time synchronization client protocol, Precision Time Protocol.

# Description

Think back to the last thunderstorm you saw  – Did you see lightning and hear thunder at the same time?  Unless you’re very close to the storm, you’ll likely detect an audible delay after you’ve seen the lightning.  How much of an audible delay are you experiencing?  The delay is not based strictly on the speed of sound and your distance from the storm.  It's also affected by buildings or other influences that introduce additional acoustic delay.  If you want to know just how close to the storm you are, you'd have to consider all the influences.

[](https://msdnshared.blob.core.windows.net/media/2018/06/tstorm.png)

Likewise, there is delay (latency) introduced in the timing packets being passed from the time server across the network.  If that delay is not accounted for, or if it is not symmetric (equal in both directions – to and from the client), then it becomes increasingly difficult for the client to properly apply the time stamp sent from the time server.

[](https://msdnshared.blob.core.windows.net/media/2018/06/TIme2Client.png)

Network Time Protocol (NTP) has long been the primary time synchronization method for Windows but unfortunately, NTP does not have a solution to this problem; NTP assumes that the round-trip delay introduced by the network is symmetric.

Precision Time Protocol ([IEEE 1588v2](https://standards.ieee.org/findstds/standard/1588-2008.html)) enables network devices to add the latency introduced by each network device into the timing measurements thereby providing a far more accurate time sample to the endpoint (Windows Server 2019 or Windows 10, host or virtual machine).

Precision Time Protocol is not for everyone; due to the network configuration requirements, NTP will continue to be supported (and default) protocol.  However, for customers with the highest of accuracy requirements, you can drive towards even higher accuracy systems using our inbox PTP Client in Windows Server 2019.

Operating System Requirements

Software timestamping is currently supported only on Windows Server 2019 and Windows 10 (v1809). This feature is available on current Insider builds.

# Troubleshooting and Feedback

Please submit an issue at: <https://github.com/Microsoft/SDN/issues> and add the [Time](https://github.com/microsoft/sdn/issues?q=is%3Aissue+is%3Aopen+label%3Atime) tag

# Test Activities

Below are the activities included to validate this feature:

1. Configure the PTP Client Provider
2. Activity 2

# Activities

## Activity 1: Configure the System for High Accuracy

PTP is intended for the highest accuracy time. As such you should also configure your system for high accuracy prior to proceeding. The high accuracy settings and configuration can be found here: [Link](https://docs.microsoft.com/en-us/windows-server/networking/windows-time-service/configuring-systems-for-high-accuracy?tabs=MinPollInterval)

## Activity 2: Configure the PTP Client

This activity will help you configure the Windows PTP Client to communicate with your third-party PTP Time server.

First, configure the following registry keys. We’ll disable the other client providers to avoid confusion.

**Note**: Modify the following entry "10.10.10.10 10.10.10.11" as a space-separated list of your PTP grandmasters

|  |  |  |
| --- | --- | --- |
| **Root Key** | HKLM\SYSTEM\CurrentControlSet\Services\W32Time\TimeProviders\PtpClient | |
| **Type** | **Name** | **Value** |
| REG\_SZ | PtpMasters | "10.10.10.10 10.10.10.11" |
| REG\_DWORD | Enabled | 1 |
| REG\_DWORD | InputProvider | 1 |
| REG\_SZ | DllName | "c:\windows\system32\ptpprov.dll" |
| REG\_DWORD | DelayPollInterval | 0x3e80 |
| REG\_DWORD | AnnounceInterval | 0x0fa0 |
| **Root Key** | HKLM\SYSTEM\CurrentControlSet\Services\W32Time\TimeProviders\NtpClient | |
| REG\_DWORD | Enabled | 0 |
| **Root Key** | HKLM\SYSTEM\CurrentControlSet\Services\W32Time\TimeProviders\VMICTimeProvider | |
| REG\_DWORD | Enabled | 0 |

Next, restart the Windows Time Service

**Note:** See <https://github.com/Microsoft/SDN/tree/master/Time/PTP> for some simple automation help of these settings.

## Activity 2: Configure the Firewall

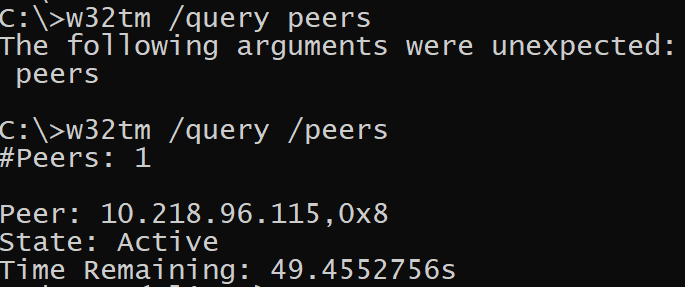
Create the following Firewall rules to allow the PTP Client to communicate with the time server.

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **Direction** | **Protocol** | **LocalPort** |
| PTP Event In | In | UDP | 319 |
| PTP Event Out | Out | UDP | 319 |
| PTP General In | In | UDP | 320 |
| PTP General Out | Out | UDP | 320 |

**Note:** See <https://github.com/Microsoft/SDN/tree/master/Time/PTP> for some simple automation help of these settings.

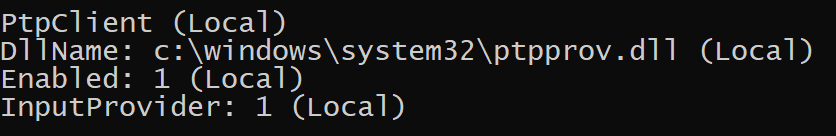
## Activity 3: Verify PTP Provider Configuration

1. Verify that the necessary Time Source has been properly configured



1. Verify that the PTP Time Provider is loaded and enabled by running the command **w32tm /query /configuration**

Each loaded provider will have an entry under the **[TimeProviders]** section. The **Enabled** property will be 1 if it is enabled.



1. Now attempt a resynchronization using the **w32tm /resync**
2. Now verify that the system is synchronizing with the PTP Source Server

**w32tm /query /status /verbose**

*Leap Indicator: 0(no warning)*

***Stratum: 3*** *(secondary reference - syncd by (S)NTP)*

*Precision: -23 (119.209ns per tick)*

*Root Delay: 0.0006638s*

*Root Dispersion: 0.0100020s*

*ReferenceId:* ***0x4D505450 (source IP:  77.80.84.80)*** *– This indicates PTP*

*Last Successful Sync Time: 5/1/2018 7:10:46 PM*

***Source: 10.11.12.1    – This indicates your specific PTP Server***

*Poll Interval: 6 (64s)*

*Phase Offset: 0.0368311s*

*ClockRate: 0.0156250s*

*State Machine: 1 (Hold)*

*Time Source Flags: 0 (None)*

*Server Role: 0 (None)*

***Last Sync Error: 0 (The command completed successfully.)    – This indicates your last sync was successful***

*Time since Last Good Sync Time: 2.8389207s*

In the output above, the Reference ID ***0x4D505450 (source IP:  77.80.84.80)*** indicates that the PTP Provider is in use. If you don’t see this, then a non-disabled PTP provider you may not have disabled the other providers.

Note: Why 0x4D505450? This is the ASCII Conversion for “MPTP” (Microsoft PTP)