Overview:

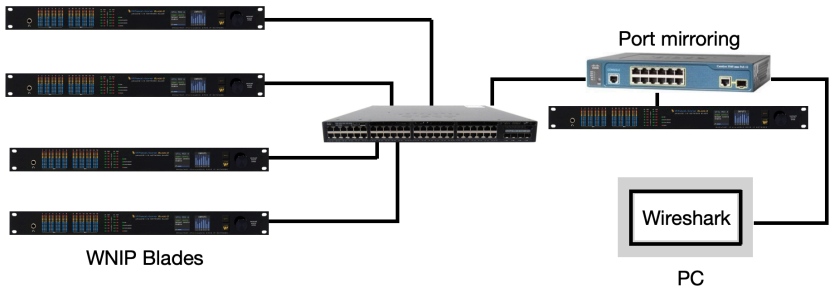
With the advent of the Spectre class of security updates to the Microsoft Windows operating system, the network interfaces on Windows computers have suffered significantly degraded performance.

This issue is widespread, affects many different applications, and is particularly noticeable in environments such as WNIP that use constant low latency, low data count packet streams.

The net result is that Windows PCs that have the Spectre class of updates can no longer process the same volume of audio streams as they were capable of prior to the operating system update. The primary symptom observed is that after the Windows update, audio drop outs will start occurring in streams as more streams are enabled on the PC.

The issue is inherent in the Windows network interface itself and has nothing to do with the operation of the WNIP audio driver and in fact can be observed in PCs that don't even have the WNIP audio driver installed.

Description:



The WNIP system is a high performance, low latency AoIP system. WNIP uses uncompressed (24 bit) audio data with a default .25 ms packet timing. Each WINP audio packet includes 12 samples of 24 bit audio data, resulting in a 48,000 samples per second sample rate / 12 samples per packet = 4000 packets per second per stream.

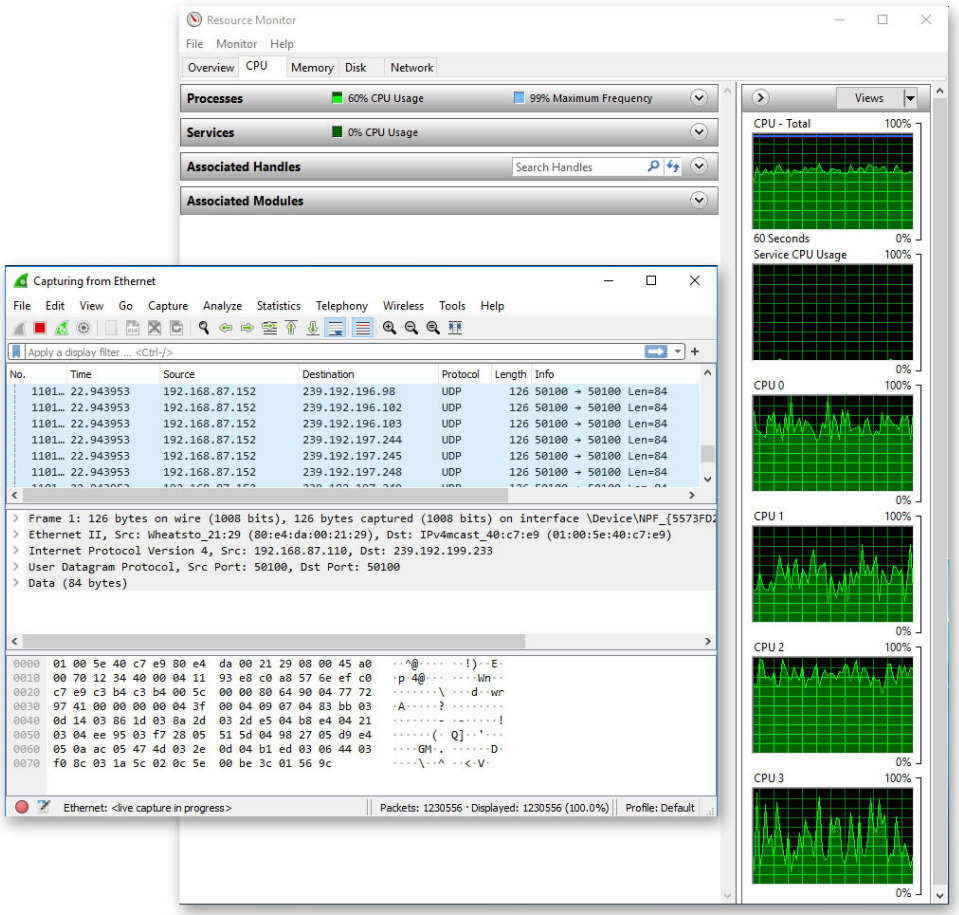
As streams are added, the total packet rate increases by 4000 packets per stream X a maximum of 24 channels = 96,000 packets per second.

After the update, this packet rate will put a heavy workload on the PC network interface and cause it to start losing packets, resulting in the audio drop outs you can hear. The degree to which this occurs is dependent on the ability of the particular PC and network interface to ingest these packets, with lower power PCs more susceptible to the problem.

An experiment was devised to quantify this issue, using a PC with the Windows operating system updated. No audio drivers were installed on the PC and no applications were running other than Wireshark network analysis. The PC was connected to a WNIP audio system which allowed us to control the number of audio streams directed to the PC network interface and hence ingested by Wireshark via a switch with port mirroring. The Blade connected to this switch could request the streams needed and due to the port mirroring on the switch they would also appear at the PC.

Results:

After running this experiment, data was taken from the PC using the performance monitor capabilities of the Task Manager utility in Windows. These results are shown here, indicating that the CPU on this PC is running at near 100% utilization just ingesting the network packets from the audio streams. This with no audio drivers and no applications other than Wireshark running. It was noted that just moving the mouse would create enough extra CPU usage to reach 100%.



Work Around:

Since clearly under the updated Windows operating system the issue is the workload required to ingest these packets, any mitigation efforts would involve reducing this workload. We have come up with 3 strategies that can be used.

1). First the obvious one; roll back the Windows OS to pre- Spectre release versions. This is will be effective but of course will lose the security benefits that the newer OS includes. For PCs that have no exposure to the Internet, this may be a viable approach, but is not advisable for general purpose PCs that have Internet connections.

2) Secondly, lower the number of packet streams ingested by the PC. Many users do not realize that if the PC simply has a connection to an audio source it will be forced to ingest the stream packets, even if it is not in use or has no audio content. Frequently connections are left in place which are not actually in use. Making connections only to streams actually in use will reduce the packet ingest workload.

3) Thirdly, reduce the number of packets ingested by changing the stream packet timing. In order to comply with the AES67 AoIP standards, WNIP provides a mechanism to selectively create audio streams with 1ms packet timing. By using 1ms streams, The PC has additional time available to ingest the audio data in a packet before the next packet needs to be read. With 1ms packet timing each stream has 48 samples per packet (4 times as much as .25ms streams) yielding 48,000 samples per second / 48 samples per packet = 1,000 packets per second. Yes the total number of samples is the same, but the Windows OS is more efficient using the relaxed packet rate.

There are two components to this strategy. First, enable 1ms packet streams by selecting the desired source stream in Navigator and checking the “enable 1ms translation” box on the signals of interest.

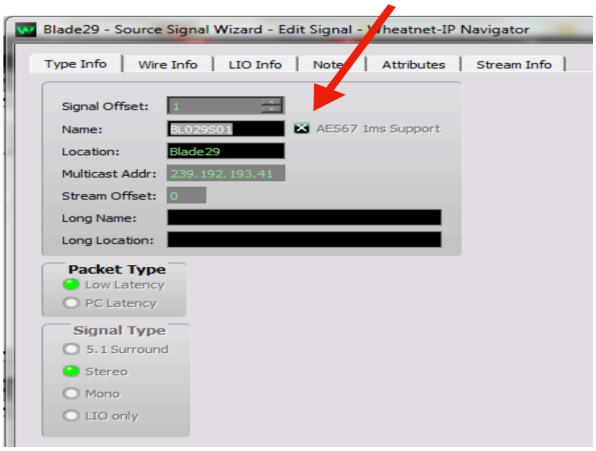
1) Launch the Navigator configuration software and connect to the WNIP system if not already running.

2) Select the desired audio source stream by right-clicking on its name in the crosspoint grid.

3) Choose the “Modify Signal” drop down menu item.

4) Proceed to the Blade admin Tab and click on the “AES67 1ms Support” check box. This process will create a duplicate audio stream of the desired source but with 1ms packet timing. The original .25ms stream will still be available for live, low latency applications.

5) Repeat this process for any other streams intended to be ingested on the WindowsPC.



Note: if this selection is greyed out and unavailable, that means either the signal is currently connected or the resources for this function have not been allocated. Enable these resources here on any available Blade not using Utility Mixers.

Once the 1ms streams have been created they will be available for the Windows PC. To use them, download and install a copy of version 3.7.5 of the WNIP audio driver from this link.

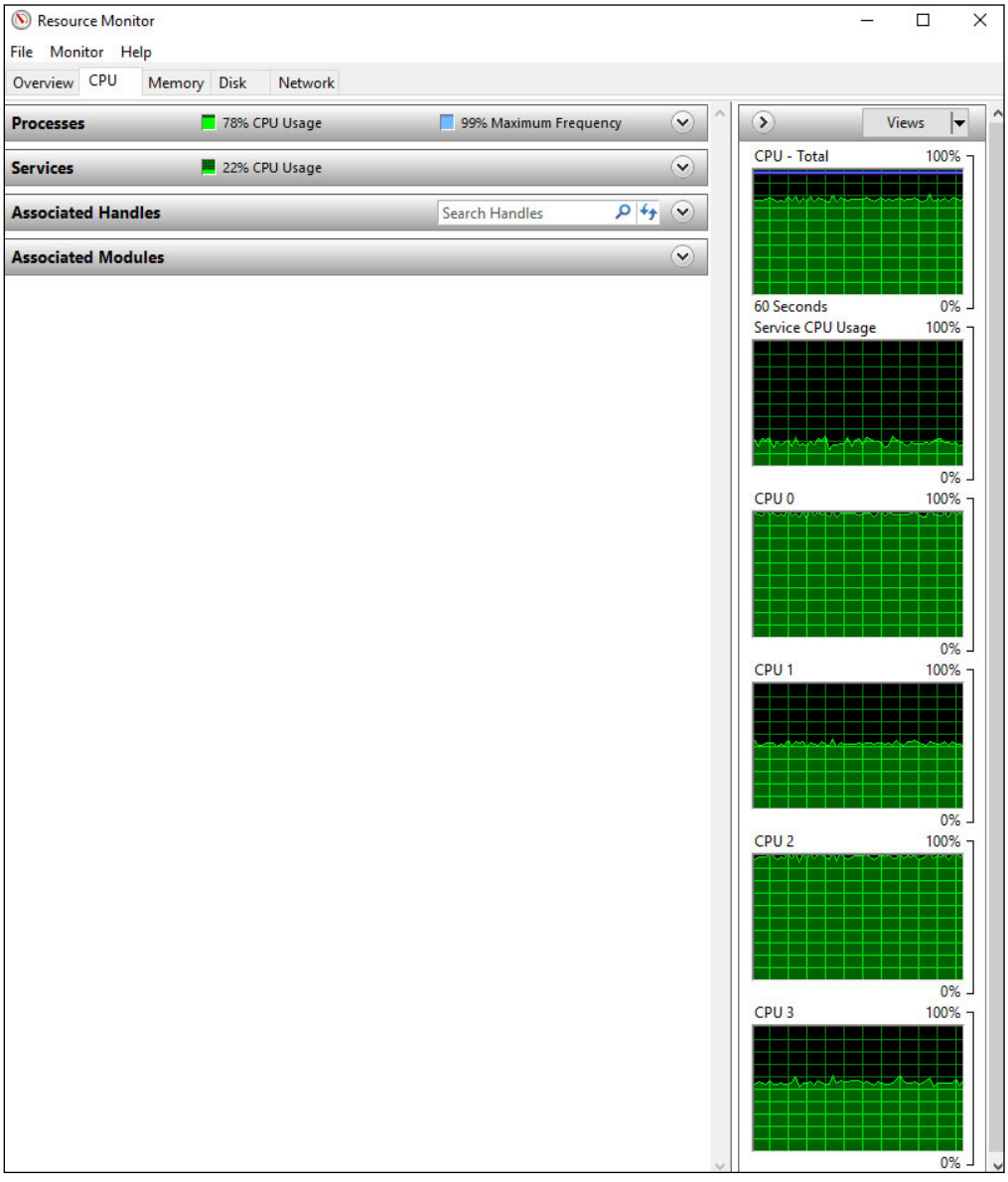
https://wheatstone.box.com/s/y4rjota8lovq8j8dq3p5f1wvq4tq71u1 (WDM)

https://wheatstone.box.com/s/knq1d6sizkjhakoaf48a2iz6rjweqy85 (ASIO)

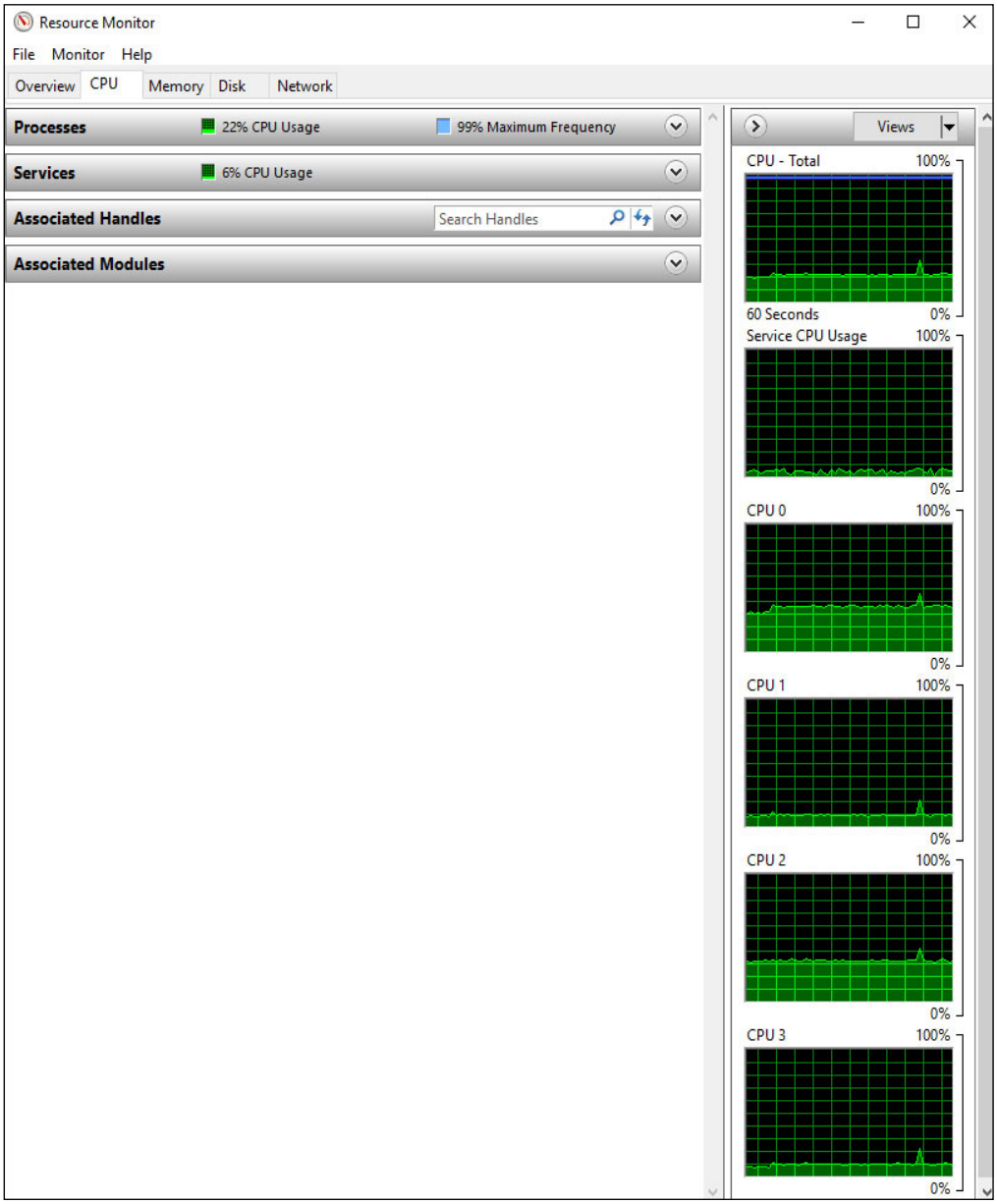
This version of the audio driver has been modified to automatically choose the 1ms version of a source stream if it is available.

Results:

By using 1ms streams for ingest in Windows PCs running the Spectre class of Operating System updates, significant performance improvements have been found as shown below.



Windows PC with .25 ms streams



Same Windows PC with 1ms streams