

# Measuring Bandwidth Usage

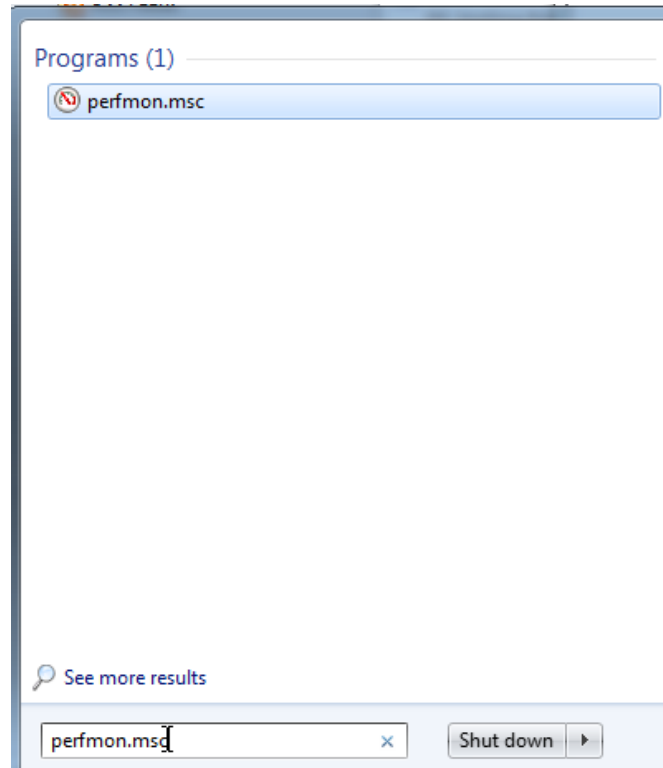
On the 2013 FRC Field (and at home when the DAP-1522 is configured using the FRC Bridge Configuration Utility) each team is limited to 7Mb/s of network traffic (see the [FMS Whitepaper](#) for more details). The FMS Whitepaper provides information on determining the bandwidth usage of the Axis camera, but some teams may wish to measure their overall bandwidth consumption. This document details how to make that measurement.

## Measuring Bandwidth Using the Performance Monitor (Win 7 only)

Windows 7 contains a built-in tool called the Performance Monitor that can be used to monitor the bandwidth usage over a network interface.

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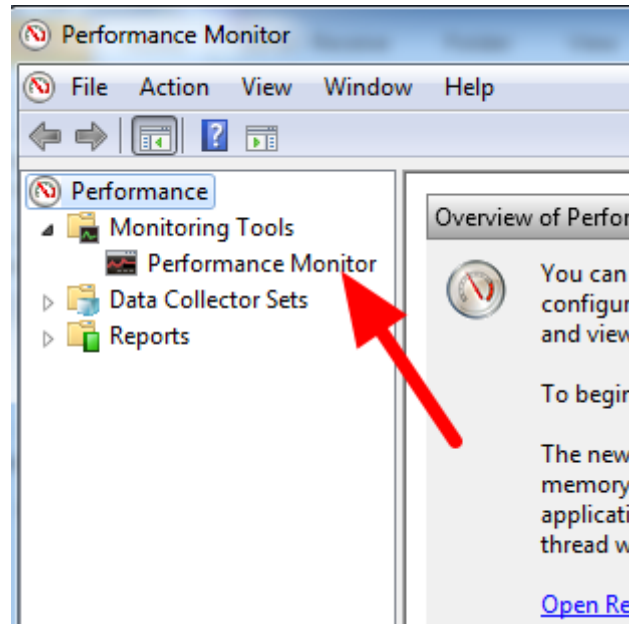
## Launching the Performance Monitor



Click **Start** and in the search box, type **perfmon.msc** and press Enter.

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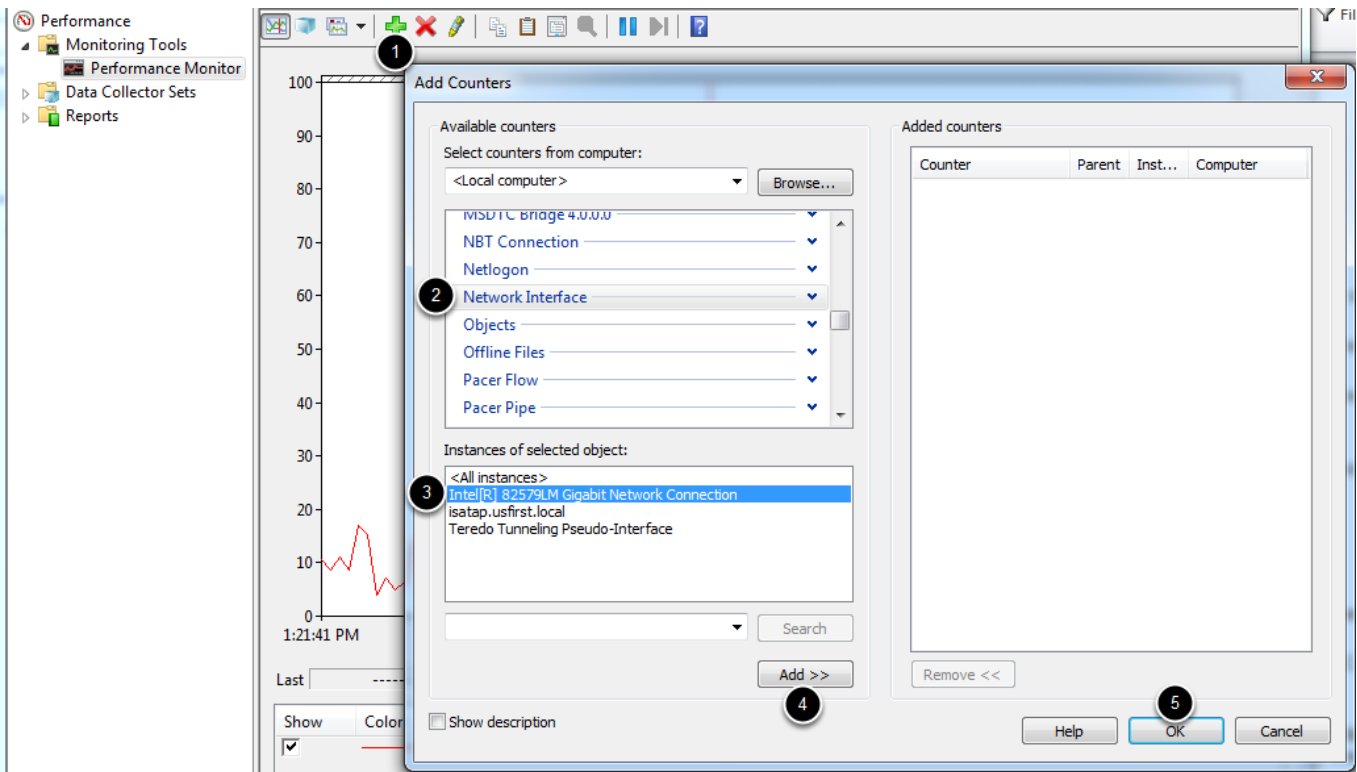
## Open Real-Time Monitor



In the left pane, click Performance Monitor to display the real-time monitor.

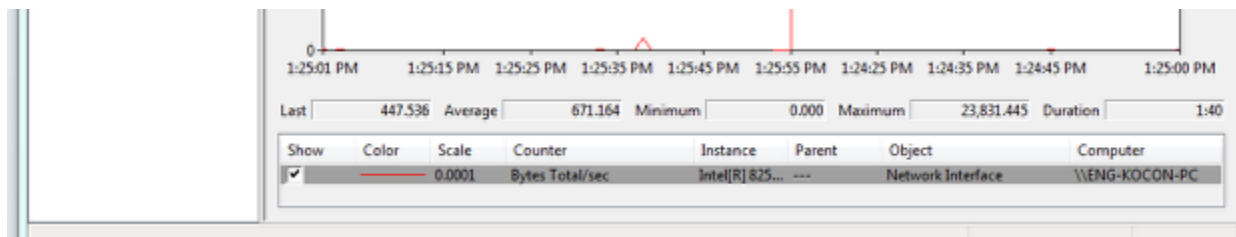
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## Add Network Counter



1. Click the green plus near the top of the screen to add a counter
2. In the top left pane, locate and click on **Network Interface** to select it
3. In the bottom left pane, locate the desired network interface (or use All instances to monitor all interfaces)
4. Click **Add>>** to add the counter to the right pane.
5. Click **OK** to add the counters to the graph.

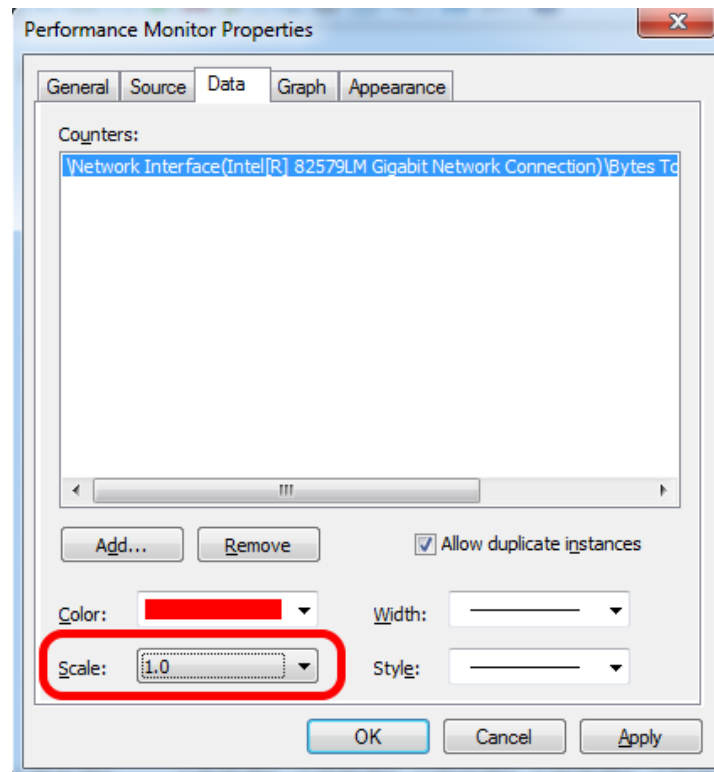
## Remove extra counters



In the bottom pane, select each counter other than **Bytes Total/sec** and press the **Delete** key. The **Bytes Total/sec** entry should be the only entry remaining in the pane.

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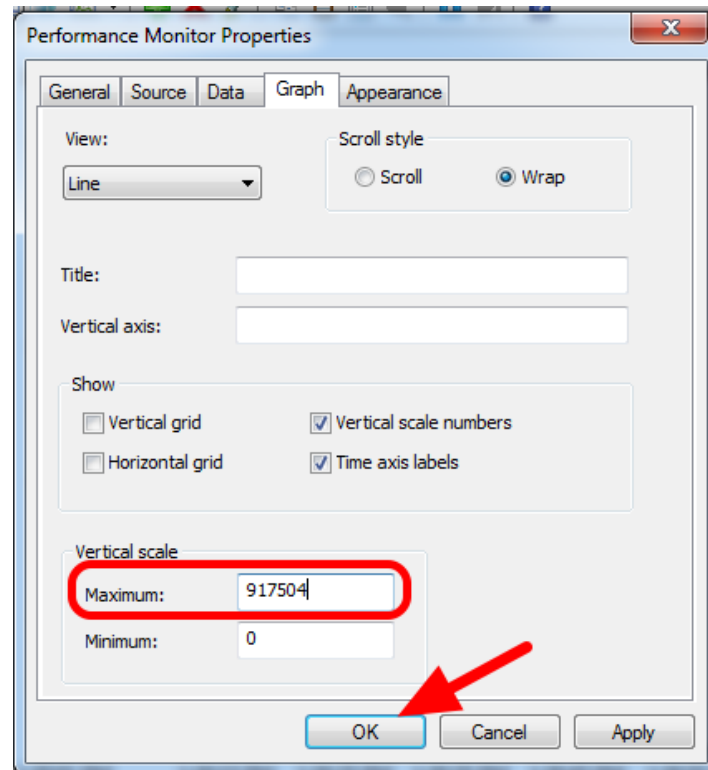
## Configure Data Properties



Press **Ctrl+Q** to bring up the Properties window. Click on the dropdown next to **Scale** and select **1.0**. Then click on the **Graph** tab.

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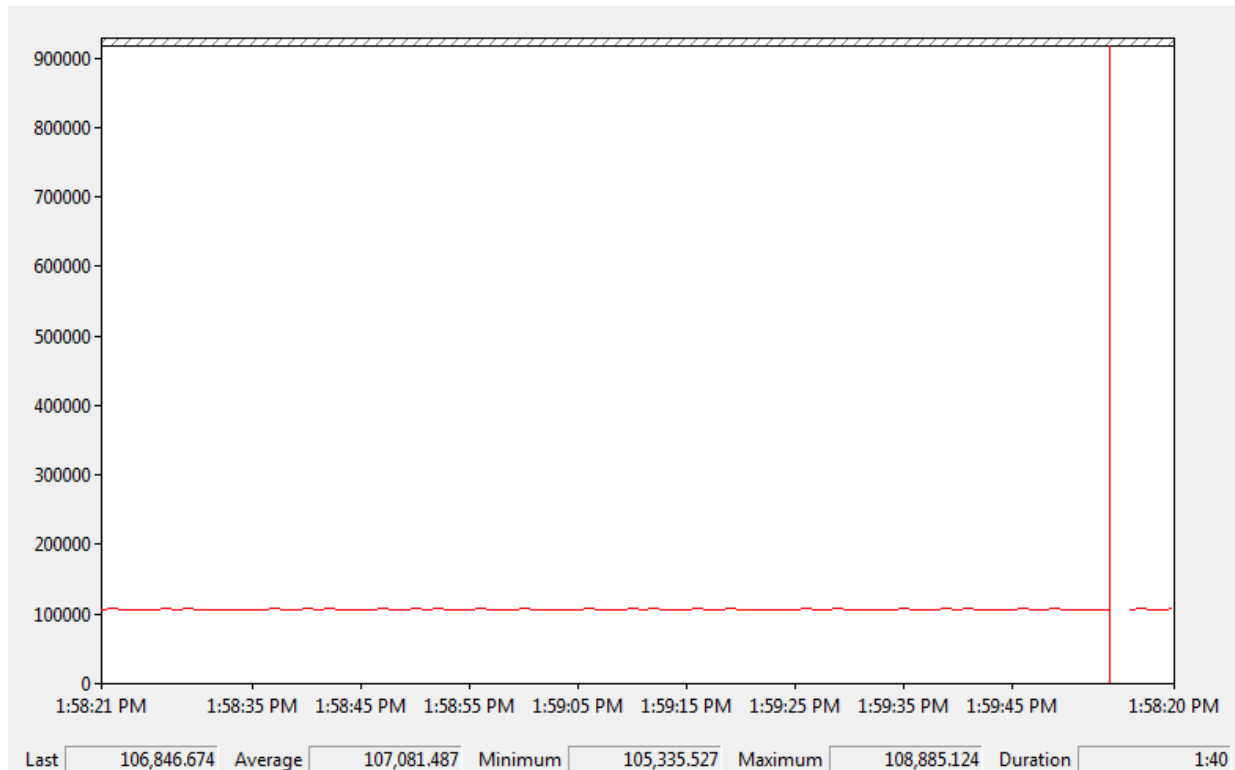
## Configure Graph Properties



In the **Maximum Box** under **Vertical Scale** enter 917504 (this is 7Megabits converted to Bytes). If desired, turn on the horizontal grid by checking the box. The click **OK** to close the dialog.

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## Viewing Bandwidth Usage



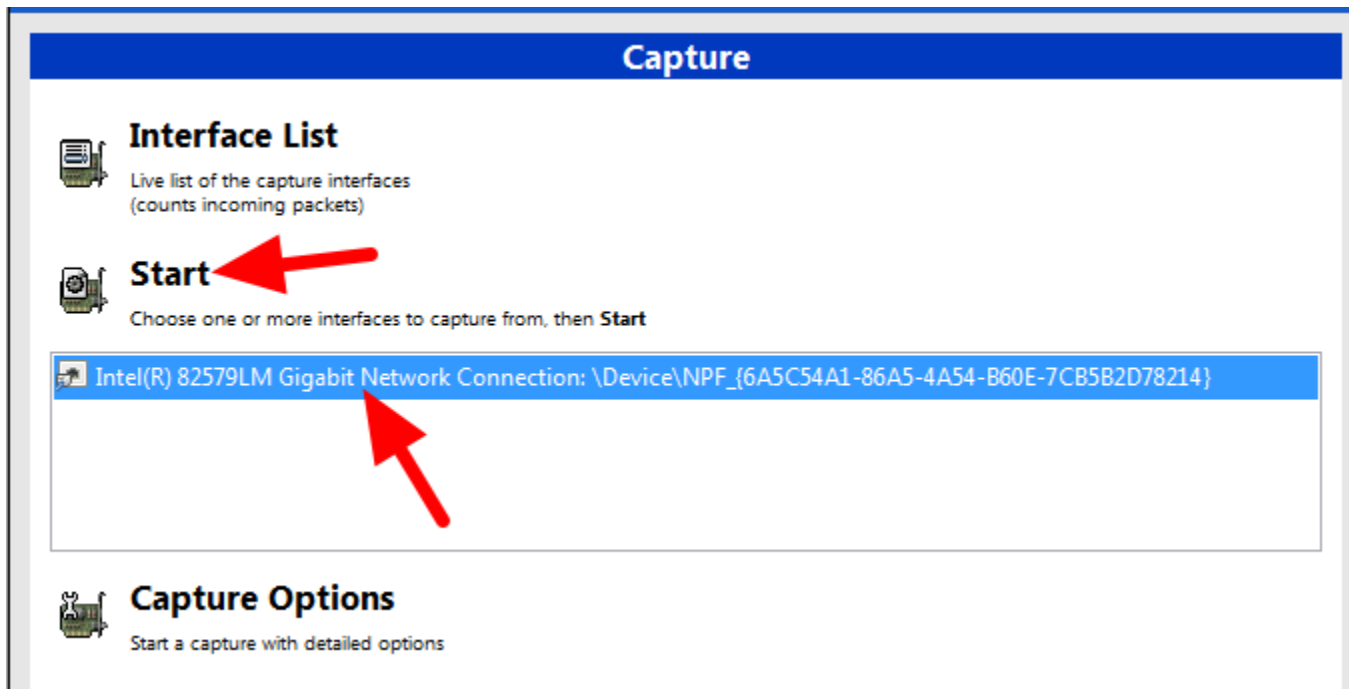
You may now connect to your robot as normal over the selected interface (if you haven't done so already). The graph will show the total bandwidth usage of the connection, with the bandwidth cap at the top of the graph. The Last, Average, Min and Max values are also displayed at the bottom of the graph. Note that these values are in Bytes/Second meaning the cap is 917,504. With just the Driver Station open you should see a flat line at ~100000 Bytes/Second.

## Measuring Bandwidth Usage using Wireshark

If you are not using Windows 7, you will need to install a 3rd party program to monitor bandwidth usage. One program that can be used for this purpose is Wireshark. [Download](#) and install the latest version of Wireshark for your version of Windows. After installation is complete, locate and open Wireshark. Connect your computer to your robot, open the Driver Station and any Dashboard or custom programs you may be using.

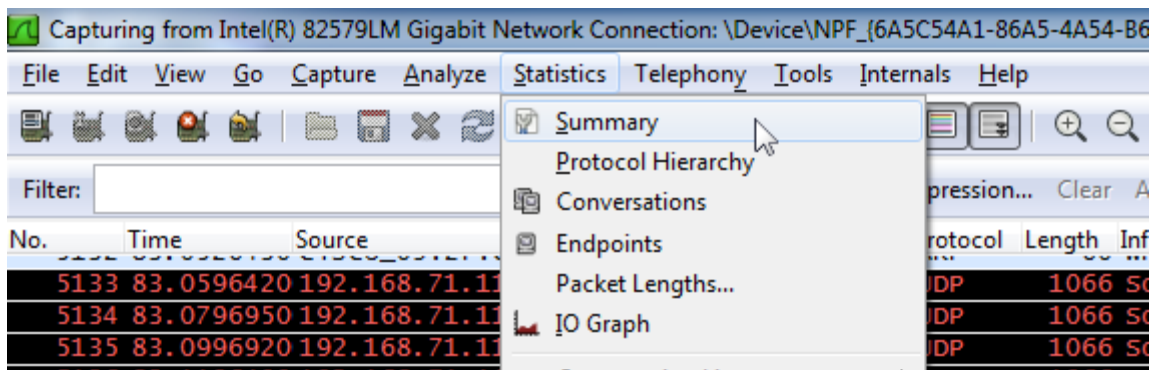
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## Select the interface and Start capture



In the Wireshark program on the left side, select the interface you are using to connect to the robot and click **Start**.

## Open Statistics Summary

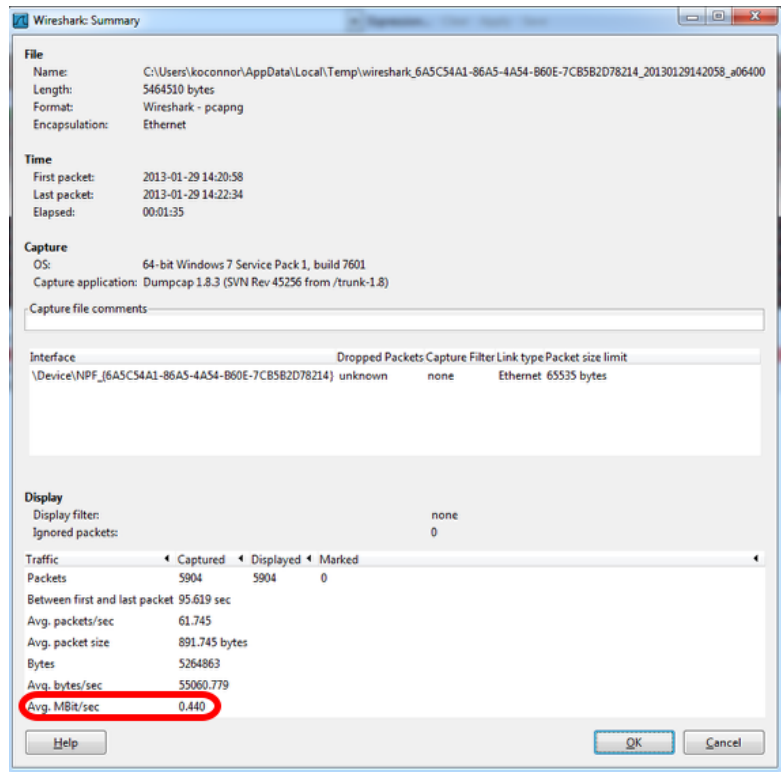


Let the capture run for at least 1 minute, then click **Statistics>>Summary**.



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## View Bandwidth Usage



Average bandwidth usage, in Megabits/Second is displayed near the bottom of the summary window. The bandwidth cap on the field is 7 Megabits/second.