

Monitoring Ethernet Traffic with Tolomatic ACS & Managed Switch

N-Tra

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1. Introduction

This procedure will show how to connect to a managed network switch using port mirroring to monitor the Ethernet/ IP transactions between a PLC controller device and the Tolomatic's Ethernet/IP enabled ACS drive. This may be used to help troubleshoot undesirable behaviors, or check the health of the network.

NOTE: Your PC Network Protection Firewall must be DISABLED for proper operation.

2. Equipment

- Tolomatic ACS Drive with Ethernet/IP
- PLC with Ethernet/IP (Allen Bradley ControlLogix L3X)
- N-TRON 708TX Switch
- Windows PC (64-BIT Windows 7)
- Ethernet cable
- (Optional) 2nd PC (64-BIT Windows 7)



Figure 1: System Overview, make connections as shown in diagram above



3. Software

- WIRESHARK Network Protocol Analyzer (V1.10.0)
- Web Browser (Internet Explorer 9)
- PLC software (RSLogix 5000)

4. Definitions

PORT MIRRORING – A mirroring port is a specific port on a managed switch that is setup to receive copies of Ethernet frames from any other port or combination of ports.

5. Procedure

First, connect the PC to the switch with the Ethernet cable. It is recommended to disable any other network connections such as wireless connections.

6. Change IP Address

Next, change IP Address of the PC to be on the same network as the N-TRON switch. This is done under the Windows Start Menu -> Control Panel, select Network and Sharing Center, select Local Area Connection.



Figure 2: Network and Sharing Center Window



Click Properties to edit connection configuration.

Seneral			
Connection			
IPv4 Connectivity: No	o Internet access		\wedge
IPv6 Connectivity: No	o network access		
Media State:	Enabled		
Duration:	04:08:38		
Speed:	100.0 Mbps		
Details			$\backslash \cdot /$
			\sim
Activity			
	20 m l 2	\land	>
Sent —	Received		
april 1	100000000		
Bytes: 4,824,368	25,135,080	\langle / \rangle	
Properties Diagno	ose		
	Close		

Click Internet Protocol Version 4 (TCP/IPv4) to highlight, then click Properties.

🔋 Local Area Connection Properties				
Networking				
Connect using:				
Proadoom Net Vireme Gigabit Ethemet				
<u>Configure</u>				
Client for Microsoft Networks				
BooS Packet Scheduler Ele and Printer Sharing for Microsoft Networks				
Broadcont Advanced Server Program Driver				
Internet Protocol Version 6 (TCP/IPV6) Internet Protocol Version 4 (TCP/IPV4)				
Link-Dayer Topology Discovery Mapper I/O Driver Link-Layer Topology Discovery Responder				
Install Uninstall Properties				
Description				
Transmission Control Protocol/Internet Protocol. The default wide area network protocol that provides communication across diverse interconnected networks.				
OK Cancel				

Figure 4: Entering Properties of TCP/IPv4



Select the radio button Use the Following IP Address and enter the IP Address, Subnet mask, and Default gateway so the PC will be on the same network as the switch. See the following example. The last numbers in the PC IP address must be unique numbers on the network.

Internet Protocol Version 4 (TCP/	IPv4) Properties	
General		
You can get IP settings assigned this capability. Otherwise, you no for the appropriate IP settings.	automatically if your network support eed to ask your network administrator	or
Obtain an IP address auton	natically	
Use the following IP addres	s:	
IP address:	192.168.0.121	
Subnet mask:	255.255.255.0	
Default gateway:	192.168.0.1	
Obtain DNS server address	automatically	
• Use the following DNS serve	er addresses:	
Preferred DNS server:	• •	
Alternate DNS server:		
Validate settings upon exit	Ad <u>v</u> ancet,	
	OK Can	ince
Figure 5: Setting the PC Networ	k IP address	

7. Network JP Addresses

Here are the configurations for the network devices used in this example:

	N-TRON switch	PLC	ACS drive	PC
IP address	192.168.0.201	192.168.0.1	192.168.0.100	192.168.0.121
Subnet mask	255.255.255.0	255.255.255.0	255.255.255.0	255.255.255.0
Default gateway	192.168.0.1	192.168.0.1	192.168.0.1	192.168.0.1
N-TRON Port	NA	PORT 8	PORT 1	PORT 7

Note: Some of the screenshots in this example were acquired during the initial configuration of the switch for the network. The switch default IP address was 192.168.1.201 and was later changed to 192.168.0.201 after being configured for this network. For this example it should be assumed that the later address is used.



8. Connecting to the Switch

Now that the PC has the correct IP address for this network, open a web browser to begin connecting to the switch. In the browser's address bar, type http:// plus the IP address of the switch, it should look like this: http://192.168.1.201.

The switch's login page should appear. Enter the correct Username and Password for the switch, the default login here was "admin".



Figure 7: Switch General Configuration Screen



9. Logical View - Port Assignment

The N-TRON server provides a view of the ports that are connected and in use. Click on Logical View and a diagram of the switch appears with ports highlighted in green (Figure 7) to show they are in use. In this example port 1 is the ACS drive, port 5 is the PC connecting to the switch, port 8 is the PLC, and port 7 is a second PC used to read the port mirroring.





10. Enable Port Mirroring

To enable port mirroring, click on Ports -> Mirroring to bring up the port mirroring configuration view. Click Modify to enter a new configuration. Under Source Ports, select all of the ports to be copied to the destination port. In this example port 8 (PLC) RX and TX are selected. Select the desired destination port; this is the port the PC will be plugged into to for mirroring; here port 7 is used. Do not use the same port as the PC is plugged into for the mirroring port, select an open port. Select Enable next to Mirror Status. Click Update to update the settings.



Figure 9: Port Mirroring Configuration View





Save the configuration, click Config on the left, then Save:



Figure 10: Configuration Save Screen

Next, unplug the PC from the current port location and plug it into the mirroring port.





11. Monitoring with WIRESHARK

NOTE: Your PC Network Protection Firewall must be DISABLED for the correct network to appear in Wireshark.

Open the WIRESHARK program. Select Local Area Connection and click Start.

The Wireshark Network Analyzer [Wireshark 1.10.0 (SVN Rev 49790 from	/trunk-1.10)]	
the Fait Them To Pabrine Buside Structure Lesburgh Tools		
Filter:	Expression Clear Apply Save	
WIRESHARK The World's Most Popula Version 1.10.0 (SVN Rev 49790 ft	• Network Protocol Analyzer om /trunk-1.10)	
Capture	Files	Online
Interface List	Open	Website
Dive list of the capture interfaces	Open a previously captured file	It fat the projects vectore
fraction account becaut	Open Recent	User's Guide
Start		The User's Guide (local version, if installed)
Choose one or more interfaces to capture from, then Start	Sample Captures	Security
27) Wretess Network Connection 20		Concerning an and a securely as possible
Capture Options		
Start a capture with detailed options		
Capture Help		
A How to Capture		
Step by step to a successful capture setup		
Network Media		
Specific information for capturing on:		
Ethernet WLANL_		
eady to load or capture No Packets		Profile: Default
😚 # 🛍 🔚 🛛 🧭 🗷 🖷 😨		🗸 😽 👬 😘 😺 🕲 🛱 🖗 🖓 🕈
Saure 11. WIDECUADY Ctarture C		
Igure II: WIKESMARK Startup St	reen	

Figure 11 shows what the network traffic looks like with these devices running. Both the ACS drive and PLC IP addresses are logged with the transactions. Each line can be expanded to show more details and data to help in troubleshooting the network.

Capturing from Local Area Connection	shark 1.100 (SVN Rev 49790 from	/trunk-110		
Ele Edit View Go Capture Analyze Sta	tistics Telephony Tools Intel	mals Help		
O O A T A B A X B	Q + / 0 7 1 =			
Filter	V	Expression .	. Clear Apply Save	
No. Time Source	Destination	Protocol	easth lafa	
21077 358.459780 N-7. 0.74:00 65	spann og-tree-(for	STP	60 RST. Root = 32768/0/00:07:af:7a:bd:81 Cost = 0 Port = 0x5005	
21973 958.920066 192.163.0.181	192.168 0.255	BROWSEE	231 Browser Election Request	
7.074 959.420652 N-Tron_7. bd:85	Spanning-ree-iter-	STP	60 RST. Root = 32768/0/00:07:af:7a:bd:81 Cost = 0 Port = 0x8005	
21075 959.920129 192.168.0.101	192.168.0.255	NENS	110 Registration NB TOLNT<1d>	
210/6 /00.415595 Tron_/aibdr	Testecast_01:01:00	0.05	242 Ethernet II	
21077 - 00.480200 N- P. 01_73:00:03	TRUCTOR MAT / 11-01-0	Dell'zz	00 KS1, KOOC = 32708/0/0010/1411/4100181 COSC = 0 FORC = 0X8003	
21079 949, 538646 N-Tron hibd:80	TPu1ec. 1 01:01 00	0x8874	242 Ethernet II	
21050 960 595705 N-Tron_7a 0d150	Avelocast AL 201:00	0x8574	242 Ethernet II	
1081 960. 0 5613 N-Tron_7ath 180	In decast_01:01:00	0x8874	242 Ethernet 11	
21082 960.670019192.168.0.181	192, 168. 0. 255	NBNS	110 Registration NB TOLNT<1d>	
210,1 960,71869, N-Tron_7a:bd:8	IPvincast_01:01:00	0x8874	242 Ethernet II	
21054 360.778695 A Tron_7aibdist	IPvincast_01:01:00	0x8874	242 Ethernet II	
21085 960 120005 102 105 0 181	100 168 0 255	UX5574	110 Registration NR TOUNTalds	
21087 961 a 1496 N-Tron 70 00141	astroing-Trees (for	STR	60 R57, Root = 32168/0/00:07:af:2a:bd:81, Cost = 0, Rort = 0x8005	
21088 962.170088 192.165.0.181	192.168.0.255	NENS	110 Registration NB TOLNT<1d>	
21059 962.500620 Tron_7a:bd:55	Spanning-tree-(for-	STP	60 RST, Root = 32765/0/00:07:af:7a:bd:81 Cost = 0 Fort = 0x8005	
21090 962.920251 192.468.0.151	192.168.0.255	NENS	110 Registration NB <01><02>_MSBROWSE_<02><01>	
21091 963.510889 N-Tron_7atbd185	spanning-tree-(for-	- STP	60 RST. ROOT = 32768/0/00:07:af:7a:bd:81 Cost = 0 Port = 0x8005	0
21092 963.670144 192.168.0.181	192.168.0.255	NENS	110 Registration NB <01><02>MSBROWSE<02><01>	
 Frame 15479: 242 bytes on wire Ethernet II, Src: N-Tron_7a:bd: Destination: IPv4mcast_01:01: Source: N-Tron_7a:bd:80 (00:0 Type: Unknown (0x8874) Data (228 bytes) 	(1936 bits), 242 bytes 80 (00:07:af:7a:bd:80) 00 (01:00:5e:01:01:00) 77:af:7a:bd:80)	captured DST: I	d (1936 bits) on interface 0 Pv4mcast_01:01:00 (01:00:5e:01:01:00)	
0000 01 00 54 01 01 00 00 07 af 0010 01 00 00 00 00 00 00 00 00 00 00 0010 00 00 00 00 00 00 00 00 00 00 00 0010 00 00 00 00 00 00 00 00 00 00 00 0010 00 00 00 00 00 00 00 00 00 00 00 0010 00 00 00 00 00 00 00 00 00 00 00 0010 00 00 00 00 00 00 00 00 00 00 00 00	7a bd 80 88 74 03 00 54 58 00 00 00 00 00 00 00 00 00 00 00 00 40 11 00 02 00 64 00 00 00 00 00 00 00 00 00 00 00 00 00	···^···		
Elecal Area Connection: < live capture in pro	og Packets: 21116 - Displayed: 2	1116 (100.05	N2	Profile: Default

Figure 12: WIRESHARK Network Traffic



For more information about what the logged data means, please refer to WIRESHARK help documentation and Ethernet IP standards.

When finished, plug the PC back into an open port and disable the port mirroring function on the switch.

Appendix - 1 12. Additional screen captures: Capturing from Local Area Connection [Wireshark 1.10.0 (SVN Rev 49790 from /trunk-1.10) Elle Edit Yiew Go Capture Analyze Statistics Telephony Tools Internals Help ● ● # ■ # = # # # # = 4 + + + + = 7 ± | = = 0,0,0,0 | # 2 5 5 % | # · Expression... Clear Apply Save Filter Protocol Length Info ENIP 90 Connection: ENIP 98 Connection: ENIP 98 Connection: Source Imme Source 47562 1655, 6579 192, 168, 0, 100 47562 1655, 67105 192, 168, 0, 100 47564 1655, 7021192, 168, 0, 100 47564 1655, 7021192, 168, 0, 10 47566 1655, 7024192, 168, 0, 10 47566 1655, 7024192, 168, 0, 10 47566 1655, 7024192, 168, 0, 10 47566 1655, 7068192, 126, 0, 11 47566 1655, 7068192, 126, 0, 11 47566 1655, 70849192, 166, 0, 11 47570 1655, 80181192, 166, 0, 10 47571 1655, 80181192, 166, 0, 10 47572 1655, 80739192, 166, 0, 11 47571 1655, 80739192, 166, 0, 11 47572 1655, 80739192, 166, 0, 11 47574 1655, 80739192, 166, 0, 11 47574 1655, 90127, 112, 166, 0, 10 47575 1655, 90127, 112, 166, 0, 10 47576 1655, 90127, 112, 166, 0, 10 47576 1655, 90127, 112, 166, 0, 10 47576 1655, 90127, 112, 166, 0, 10 47576 1655, 01365, 112, 112, 166, 0, 11 47586 47562 1655.65979 192.168.0.100 192.168.0.1 ID=0x014FCC01, SE0=0000058370 192.168.0.100 192.168.0.100 ID=0x7EA60002, SEQ=0000097781 ID=0x7EA60002, SEQ=0000097782 192.168.0.1 ENIP 90 Connection: ID=0x014FCC01. SEQ-00000583 $\begin{array}{c} 192, 168, 0, 100\\ 192, 168, 0, 10\\ 192, 168, 0, 10\\ 192, 168, 0, 100\\ 100, 100\\ 100$ 192.168.0.100 ENIP 98 Connection: ID=0x7EA60002 SEQ=0000 00097783 ENIP 90 Connection: ID-0x014FCC01. SEC ENIP 98 Connection: ID-0x7EA60002 097784 SEC ENIP 98 Connection: ID-0x7EA60002. 0097785 98 Connection: 90 Connection: 98 Connection: 98 Connection: 90 Connection: 90 Connection: 98 Connection: ENIP ID 0x014FCC01, 058373 ENIP ID OX7EA6 =0x7EA60002, =0x014FCC01, =0x7EA60002, =0x014FCC01, 15837 197 ID SEC IC 097790 058376 097791 097792 1D-017EA60002, 1D-0X01FCC01, 1D-0X7EA0002, 1D-0X7EA0002, 1D-0X7EA6002, 1D-0X7EA6002, 058377 97793 Connection: Connection: ID-0x014FCC0 ID-0x7EA6000 ENIP 90 8378 192,168.0.100 ENIP 98 01410601 192.168.0.1 ENIP 90 Connection 95 Connection ID-0x 05832 192.168.0.100 47587 1656.15169 192.168.0.1 ENIP OX7EA 09779 Frame 22211: 98 bytes on wire (764 bits), 98 bytes captured (7 Ethernet 11, Src: Rockwell_56:07:81 (00:00:bc:56:07:81), Dst: 1 © Destination: Microchi_92:f4:1b (00:04:a3:92:f4:1b) © Source: Rockwell_56:07:81 (00:00:bc:56:07:81) Type: IP (0x0800) on interface 0 92:f4:1b (00:04:a3:92:f4: bits) rochi ۲ Packets 47085 - Displayed 475 on (ip.dst), 4 bytes Profile Default Figure 13: Port traffic without port mirroring RSLogix 5000 - ACSEIP (1769-L23 1 20 121 - 0 - X Elle Edit Yiew Search Logis Hel W 10 - 9 x 7 14 7 A Laco Contraction No Decision Ren Run . No Forces NoEdt 0 X XX A BE A er:1 (1769-L23E-Q81 Ethernet Port 20.11) - 23 MainProgram • 7. sculed Prog on Module Into Port Configuration Port Diagnostics Description 192.168.0 1 PAddet Domain Name 21 = 1 NET_ NET_ NET_ Sed_L Sed_0 Sed_0 Sed_0 Address on General Tab) funt Mate Host Name: atter 255.255.255.0 Select Port Speed Usage Type Alas For Base Tag Data Type Address 0.0 0.0 Current Port Speed: 100 Mbps Base 0 0 0 0 Select Dyplex: Current Duplex Full Dupl (Dhanges to Port Speed and Duplex require module reset.) Secondary DNS Server Address 0 0.0.0 Full Dupley Enable BOOTP Enable DUCP (DHCP must be configured to I Enable DUS I Enable DUS I Auto Negotiate Port Speed and Duplex Read/Write Scope External Acce. 100 d address.] ompact ogid 5323E-QB1 System 1769-123E-QB1 ACSEIP 1769-123E-QB1 Ethemat Port LocalE Style Decinal Rghesh Set Constant Ethernet 1769-L23E-Q81 Ethernet Por ETHERNET-MODULE ACS24: OK. Cancel Acoly Help Status: Running Data COURSES OF THE STORE CompactBus Local + ToloOutputsFull.Move Select Decimal SINT ToloOutputsFull Target_0_Position ToloOutputsFull Target_0_Velocity Float REAL [1] Embedded IQ16F Discrete [2] Embedded OE16 Discrete REAL 50.0 Float ToloOutputsFull Target_0_Accel 100.0 Float REAL ToloOutputsFull Target_0_Decel ToloOutputsFull Target_0_Force REAL Float 100. Flost 100.0 + ToloOutputsFull Motion_Type Decima SINT + ToloOutputsFull Output 160000_0001 DINT · · Monitor Tags (Edit Tags / 1. 1. a

Figure 14: IP address configuration in RSLogix5000









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