Avid NEXIS®

Network and Switch Guide

October 2018

Legal Notices

Product specifications are subject to change without notice and do not represent a commitment on the part of Avid Technology, Inc.

This product is subject to the terms and conditions of a software license agreement provided with the software. The product may only be used in accordance with the license agreement.

This product may be protected by one or more U.S. and non-U.S patents. Details are available at www.avid.com/patents.

This document is protected under copyright law. An authorized licensee of Avid NEXIS may reproduce this publication for the licensee's own use in learning how to use the software. This document may not be reproduced or distributed, in whole or in part, for commercial purposes, such as selling copies of this document or providing support or educational services to others. This document is supplied as a guide for Avid NEXIS. Reasonable care has been taken in preparing the information it contains. However, this document may contain omissions, technical inaccuracies, or typographical errors. Avid Technology, Inc. does not accept responsibility of any kind for customers' losses due to the use of this document. Product specifications are subject to change without notice.

Copyright © 2018 Avid Technology, Inc. and its licensors. All rights reserved.

The following disclaimer is required by Sam Leffler and Silicon Graphics, Inc. for the use of their TIFF library:

Copyright © 1988–1997 Sam Leffler
Copyright © 1991–1997 Silicon Graphics, Inc.

Permission to use, copy, modify, distribute, and sell this software [i.e., the TIFF library] and its documentation for any purpose is hereby granted without fee, provided that (i) the above copyright notices and this permission notice appear in all copies of the software and related documentation, and (ii) the names of Sam Leffler and Silicon Graphics may not be used in any advertising or publicity relating to the software without the specific, prior written permission of Sam Leffler and Silicon Graphics.

THE SOFTWARE IS PROVIDED "AS-IS" AND WITHOUT WARRANTY OF ANY KIND, EXPRESS, IMPLIED OR OTHERWISE, INCLUDING WITHOUT LIMITATION, ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

IN NO EVENT SHALL SAM LEFFLER OR SILICON GRAPHICS BE LIABLE FOR ANY SPECIAL, INCIDENTAL, INDIRECT OR CONSEQUENTIAL DAMAGES OF ANY KIND, OR ANY DAMAGES WHATSOEVER RESULTING FROM LOSS OF USE, DATA OR PROFITS, WHETHER OR NOT ADVISED OF THE POSSIBILITY OF DAMAGE, AND ON ANY THEORY OF LIABILITY, ARISING OUT OF OR IN CONNECTION WITH THE USE OR PERFORMANCE OF THIS SOFTWARE.

The following disclaimer is required by the Independent JPEG Group:

This software is based in part on the work of the Independent JPEG Group.

This Software may contain components licensed under the following conditions:

Copyright (c) 1989 The Regents of the University of California. All rights reserved.

Redistribution and use in source and binary forms are permitted provided that the above copyright notice and this paragraph are duplicated in all such forms and that any documentation, advertising materials, and other materials related to such distribution and use acknowledge that the software was developed by the University of California, Berkeley. The name of the University may not be used to endorse or promote products derived from this software without specific prior written permission. THIS SOFTWARE IS PROVIDED ``AS IS'' AND WITHOUT ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, WITHOUT LIMITATION, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Copyright (C) 1989, 1991 by Jef Poskanzer.

Permission to use, copy, modify, and distribute this software and its documentation for any purpose and without fee is hereby granted, provided that the above copyright notice appear in all copies and that both that copyright notice and this permission notice appear in supporting documentation. This software is provided "as is" without express or implied warranty.

Copyright 1995, Trinity College Computing Center. Written by David Chappell.

Permission to use, copy, modify, and distribute this software and its documentation for any purpose and without fee is hereby granted, provided that the above copyright notice appear in all copies and that both that copyright notice and this permission notice appear in supporting documentation. This software is provided "as is" without express or implied warranty.

Copyright 1996 Daniel Dardailler.

Permission to use, copy, modify, distribute, and sell this software for any purpose is hereby granted without fee, provided that the above copyright notice appear in all copies and that both that copyright notice and this permission notice appear in supporting documentation, and that the name of Daniel Dardailler not be used in advertising or publicity pertaining to distribution of the software without specific, written prior permission. Daniel Dardailler makes no representations about the suitability of this software for any purpose. It is provided "as is" without express or implied warranty.

Modifications Copyright 1999 Matt Koss, under the same license as above.

Copyright (c) 1991 by AT&T.

Permission to use, copy, modify, and distribute this software for any purpose without fee is hereby granted, provided that this entire notice is included in all copies of any software which is or includes a copy or modification of this software and in all copies of the supporting documentation for such software.

THIS SOFTWARE IS BEING PROVIDED "AS IS", WITHOUT ANY EXPRESS OR IMPLIED WARRANTY. IN PARTICULAR, NEITHER THE AUTHOR NOR AT&T MAKES ANY REPRESENTATION OR WARRANTY OF ANY KIND CONCERNING THE MERCHANTABILITY OF THIS SOFTWARE OR ITS FITNESS FOR ANY PARTICULAR PURPOSE.

This product includes software developed by the University of California, Berkeley and its contributors.

Contents

Using This Guide

This document describes switch setup information for the Avid NEXIS® shared storage networks. Your network might not contain certain topologies that are covered in the documentation. The Avid network and switches are tuned for high-speed and high-capacity shared storage primarily for Avid editing workstations and servers that manage media.

Symbols and Conventions

Avid documentation uses the following symbols and conventions:

Symbol or Convention	Meaning or Action
📖	A note provides important related information, reminders, recommendations, and strong suggestions.
⚠	A caution means that a specific action you take could cause harm to your computer or cause you to lose data.
⚡	A warning describes an action that could cause you physical harm. Follow the guidelines in this document or on the unit itself when handling electrical equipment.
>	This symbol indicates menu commands (and subcommands) in the order you select them. For example, File > Import means to open the File menu and then select the Import command.
▸	This symbol indicates a single-step procedure. Multiple arrows in a list indicate that you perform one of the actions listed.
(Windows) or (Macintosh)	This text indicates that the information applies only to the specified operating system, either Windows or Macintosh OS X.
Bold font	Bold font is primarily used in task instructions to identify user interface items and keyboard sequences.
Italic font	Italic font is used to emphasize certain words and to indicate variables.
`Courier Bold font`	Courier Bold font identifies text that you type.
Ctrl+key or mouse action	Press and hold the first key while you press the last key or perform the mouse action. For example, Command+Option+C or Ctrl+drag.

If You Need Help

If you are having trouble using your Avid product:

1. Retry the action, carefully following the instructions given for that task in this guide. It is especially important to check each step of your workflow.

2. Check the latest information that might have become available after the documentation was published.

Always check online for the most up-to-date release notes or ReadMe because the online version is updated whenever new information becomes available. To view the online versions, visit the Knowledge Base at www.avid.com/support.

3. Check the documentation that came with your Avid application or your hardware for maintenance or hardware-related issues.

4. Visit the online Knowledge Base at www.avid.com/US/support. Online services are available 24 hours per day, 7 days per week. Search this online Knowledge Base to find answers, to view error messages, to access troubleshooting tips, to download updates, and to read or join online message-board discussions.

Accessing the Online Documentation

The Avid online documentation contains all the product documentation in PDF format. You can access the documentation from the Knowledge Base site specific to your release. Download and install Acrobat Reader before you access the PDF documentation.

Avid Training Services

Avid makes lifelong learning, career advancement, and personal development easy and convenient. Avid understands that the knowledge you need to differentiate yourself is always changing, and Avid continually updates course content and offers new training delivery methods that accommodate your pressured and competitive work environment.

For information on courses/schedules, training centers, certifications, courseware, and books, please visit www.avid.com/support and follow the Training links, or call Avid Sales at 800-949-AVID (800-949-2843).

1 **Qualified and Approved Switches for Avid NEXIS**

This document provides Avid NEXIS Administrators with a single reference regarding the implementation, configuration and troubleshooting of Avid® qualified, approved, and architecturally capable Ethernet switches for use as the Avid Production Network (APN) switch for the following Avid platforms:

•   Avid NEXIS | PRO (1 x 10GbE)

•   Avid NEXIS | E2 (2 x 10GbE per Controller)

•   Avid NEXIS | E2 SSD (2 x 40GbE per Controller)

•   Avid NEXIS | E4 (2 x 10GbE per Controller)

•   Avid NEXIS | E5 (2 x 40GbE per Controller)

•   Avid NEXIS | E5 NL (2 x 10GbE per Controller)

•   Avid NEXIS | SDA (2 x 10GbE per Controller)

📖   *You cannot mix an Avid NEXIS | PRO in the same shared storage system as an Avid NEXIS E-Series Engine or an Avid NEXIS | SDA.*

Avid has the following designations for Ethernet switches that can provide suitable performance for Avid NEXIS storage:

•   Qualified

    Fully qualified for a broad range of applications. Qualified switches are typically part of the Avid engineering and test labs and part of ongoing testing.

•   Approved

    Approved for deployment as detailed in the Avid ISIS / NEXIS & Media Central Network Requirements Document. (Approved switches are typically tested at a customer site as part of a specific commissioning engagement.)

All of the listed switches support using the 802.3ad Link Aggregation Control Protocol (802.1ax), which is supported on any Avid NEXIS E-Series Engine and the Avid NEXIS | SDA running Avid NEXIS v7.0 or higher. The Avid NEXIS | PRO does not support using LACP.

Refer to the switch vendor's documentation for specifics.

The switches in each table are listed in alphabetical order. If a switch cannot connect directly to an Avid NEXIS system it can still be used as a down-linked (subordinate) edge switch.

Qualified Switches and Options

Switch Model and Avid Part Number if applicable	Avid NEXIS Models	Minimum Firmware or Network OS[a]	Description and Approved Blades, and Avid Part Number if applicable
Cisco Catalyst 4500-X (Layers 2 and 3) Cisco 32-port switch: Avid P/N 9935-65891-xx Cisco 16-port switch: Avid P/N 9935-71898-xx	E2, E4, E5 NL, PRO	ROM: 15.0(1R)SG6 (and later[a]) IOS: 03.04.02.SG (and later[a])	16 or 32 dual-speed 1Gb (SFP) or 10Gb (SFP+) ports
Cisco Nexus 9372-PX and PXE (SFP+ based)	E2, E4, E5, E2 SSD, E5 NL, PRO	7.0 (3) I1 (3)	All 9372 switches have 6 x 40GbE QSFP+ ports plus 48 x 1/10GbE ports
Cisco Nexus 9372-TX and TXE (RJ-45 based)	All		
Cisco Nexus 9372 PX and PXE, and TX and TXE (40GbE), with the Cisco 40GBASE-CR4 Passive Copper cable (QSFP-H40G-CU5M)	E5, E2 SSD		
Cisco Nexus 93180YC-EX, Cisco Nexus 93180YC-FX	All	BIOS: 07.59 NXOS: 7.0(3)14(2)	48 x 1/10/25-Gbps fiber ports and 6 x 40/100-Gbps Quad Small Form-Factor Pluggable 28 (QSFP28) ports
Cisco Nexus 93180LC-EX	All	BIOS: 05.19 NXOS: 7.0(3)16(1)	Up to 32 x 40/50-Gbps QSFP+ ports OR 18 x 100-Gbps QSFP28 ports
Cisco Nexus 93108TC-EX, Cisco Nexus 93108TC-FX	All		48 x 100M/1/10GBASE-T ports and 6 x 40/100-Gbps QSFP28 ports
Cisco Nexus 9348GC-FXP	All		48 x 1G RJ45 4 x 1/10/25G SFP 2 x 40/100G QSFP28
Dell Networking N2024 Avid P/N: 7080-30085-00	E2, E4, PRO	6.3.0.18 and later	24 x 1Gb (RJ45) 2 x 10Gb SFP+ ports Avid-supplied switch includes 2-port 10Gb SFP+ module
Dell Networking N3024 Avid P/N: 9935-65890-xx	E2, E4, E5 NL, PRO	6.3.0.18 and later	24 x 1Gb (RJ45) 2 x 1Gb SFP ports 2 x 10Gb SFP+ ports 1 slot for 2-port 10Gb SFP+ or 10GBASE-T module

Switch Model and Avid Part Number if applicable	Avid NEXIS Models	Minimum Firmware or Network OS[a]	Description and Approved Blades, and Avid Part Number if applicable
Dell Networking N3048 Avid P/N: 9935-65892-xx	E2, E4, E5 NL, PRO	6.3.0.18 and later	48 x 1Gb (RJ45), 2 x 1Gb SFP ports, 2 x 10Gb SFP+ ports 1 slot for 2-port 10Gb SFP+ or 10GBASE-T module Avid-supplied switch includes 2-port 10Gb SFP+ module
Dell Networking S4048-ON Avid P/N: 7080-35019-00	All	9.8 or later	48 dual-speed 1/10GbE (SFP+) ports and six 40GbE (QSFP+) uplinks (totaling 72 10GbE ports with breakout cables) with OS support *The Dell S4048 switch supports a mix of 10Gb SFP+ (optical) and 10GBASE-T (copper) connection types. However there are minimum firmware requirements and restrictions on how many 10GBASE-T devices are supported, and in which locations. Consult your Dell documentation for more information.*
Dell S4048T-ON, with one of the components listed for the Dell S4048-ON	E2, E4, PRO	9.8(0.0P5)	48 x 10Gb/1Gb/100Mb (RJ45)
	E5, E2 SSD		6 x 40Gb QSFP+

a. Later firmware/operating system versions should be acceptable but are not tested by Avid.

Approved Switches and Options

In addition to the approved switches listed here, you can also use any switch considered architecturally capable, meaning they have been stress tested by the switch vendor in coordination with Avid and subject to an Avid specific test plan (see Avid NEXIS Switch Infrastructure for details).

Switch Model and Avid Part Number if applicable	Avid NEXIS Models	Minimum Firmware or Network OS[a]	Description and Approved Blades, and Avid Part Number if applicable
Arista Networks 7150S-24 (10GbE only)	E2, E4, E5 NL, PRO		24-Port SFP+
Arista Networks 7150S-52 (10GbE only)	E2, E4, E5 NL		52-Port SFP+
Arista Networks 7280SE-64	All	4.14.7M or 4.16.7M	48x1/10GbE and 4 x 10/40GbE
Arista Networks 7280SR	E2, E4, E5 NL, PRO		48-port SFP+ and 6-port QSFP100

Switch Model and Avid Part Number if applicable	Avid NEXIS Models	Minimum Firmware or Network OS[a]	Description and Approved Blades, and Avid Part Number if applicable
Cisco Nexus 7000 series[b] (Layers 2 and 3)	E2, E4, E5 NL, PRO	BIOS 3.19.0 (and later[a]) Kickstart 4.2(4) (and later[a]) System 4.2(4) (and later[a]) CMP BIOS 02.01.05 (and later[a]) CMP Image 4.2(1) (and later[a])	48 port 10Gb/1Gb module (optical) N7K-F248XP-25E 24 port 10Gb module (optical) N7K-M224XP-23L 48 port 1Gb copper N25-C2248TP-E-1GE
Dell Networking N4032	E2, E4, E5 NL, PRO		24 x 10GbE RJ45 auto-sensing (10Gb/1Gb/100Mb) fixed ports 1 x hot swap expansion module bay
Dell Networking N4032F	E2, E4, E5 NL, PRO		24 x 10GbE SFP+ (10Gb/1Gb) fixed ports 1x hot swap expansion module bay
NETGEAR XS716T	E2, E4, PRO	6.6.1.7	16 x 10GBase-T + 2 x shared 10 Gigabit SFP+
NETGEAR XS728T	E2, E4, PRO		24 x 10G copper + 4 x dedicated 10Gb SFP+ ports

a. Later firmware/operating system versions should be acceptable but are not tested by Avid.
b. The Cisco Nexus 7000 series can be configured to meet a wide variety of combinations of 1, 10, and 40 Gb Ethernet connections. Depending on the base unit, there are from 4 to 18 slots that allow for supervisor modules and up to 16 I/O modules offering a variety of ports (including SFP+ with XL option).

Legacy Switches and Options

The switches listed here are either end-of-life or no longer commercially available. However, if you have one, you can still use it with the indicated Avid NEXIS models.

Switch Model and Avid Part Number if applicable	Avid NEXIS Models	Minimum Firmware or Network OS[a]	Description and Approved Blades, and Avid Part Number if applicable
Arista Networks 7048	E2, E4, PRO	4.8.6	NA
Cisco Catalyst 4900M (Layers 2 and 3) Avid P/N: 7010-30323-xx	E2, E4, E5 NL, PRO	Rommon 12.2(44r)SG (and later[a]) IOS: 12.2 (46)SG (and later[a])	20 x 1 Gb (RJ-45), WS-X4920-GB-RJ45 and/or • 4 x 10Gb (X2/SC)WS-X4904-10GE • 8 x 10Gb (X2/SC)
Cisco Catalyst 4948E (Layers 2 and 3) Avid P/N: 7010-30322-xx	E2, E4, E5 NL, PRO	Rommon: 12.2(44r)SG8 (and later[a]) IOS: 12.2 (54)SG (and later[a])	48 x 1Gb (RJ45) 4 x 10Gb (SFP+/LC)

Switch Model and Avid Part Number if applicable	Avid NEXIS Models	Minimum Firmware or Network OS[a]	Description and Approved Blades, and Avid Part Number if applicable
Cisco Catalyst 4948-10GE (Layers 2 and 3)	E2, E4, E5 NL, PRO	Rommon: 12.2(31r)SGA (and later[a]) IOS: 12.2 (25) EWA8 (and later[a])	48 x 1Gb (RJ45) 2 x 10Gb (X2/SC)
Cisco Nexus 7000 (switch is Approved but the listed options are legacy)			48 x 1Gb module (copper) N7K-M148GT-11 32 x 10Gb module (optical) N7K-M132XP-12 (only 8 supported running simultaneously due to 4 to 1 over-subscription) N7K-M108x2
Dell S4810	E2, E4, E5 NL, PRO	FTOS 8.3.7.0 (and later)	48 x 1Gb SFP or 10 Gb SFP+
	E5, E2 SSD		4 x 40Gb
Dell 4820T	E2, E4, E5 NL, PRO		48 x 100Mbps/1Gbps/10Gbps (RJ45)
	E5, E2 SSD		4 x 40Gb
Dell S60	E2, E4, E5 NL, SDA, PRO	FTOS 8.3.3.4 (and later)	48 x 1Gb (RJ-45) Two slots for 10 Gb SFP+ or 24Gb stacking modules Two 10Gb SFP+ ports per module (SFP+/LC)
NETGEAR XS712T	PRO	6.1.0.34 or later	12 x 1/10Gb RJ45 (Copper) or 2 x 10Gb SFP+ plus 10 x 1/10Gb RJ45 (ports 11 and 12 are dual-purpose; can be used either as SFP+ or RJ45)

a. Later firmware/operating system versions should be acceptable but are not tested by Avid.

Supported Switch Options

When purchased through Avid, many switches come with Avid-supported components such as NICs and transceivers. The following table lists the components preinstalled in switches purchased through Avid, and the options you can purchase separately for your switches.

Vendor/Model	Model/Description/Avid-Supplied Options	Avid Part Number
Cisco C4500-X	1000Base-T SFP+	7070-30589-00
	8 port 10GigE module	7030-65533-00

Vendor/Model	Model/Description/Avid-Supplied Options	Avid Part Number
Cisco C4900M	20 port 1GbE copper module, p/n WS-X4920-GB-RJ45	N/A
	4 X 10 GbE port add-in module for 4900M base unit	
	10GBASE-SR 850nm X2 Module/Single Transceiver, Cisco p/n X2-10GB-SR	
	10GBASE-LR 1310nm X2 Module/Single Transceiver, Cisco p/n X2-10GB-LR	
	SC connector	
	X2 = Cisco X2-10GB-SR for MMF X2 = Cisco X2-10GB-LR for SMF	
Cisco 4948E, C4500-X	10 GbE optical SFP+ 850 nm laser compatible with 50 micron MMF cable; 300 meters maximum distance. Cisco p/n SFP-10G-SR=	
	The minimum cable length for -LR and -SR transceivers is 2 meters.	
Dell Networking S4048	GP-SFP2-1T single 1GigE RJ45 Copper transceiver (407-BBTS)	7070-35076-00
Dell Networking N2024, N3024, N3048, S4048-ON	10GigE, SFP+, single, transceiver, SR, 850nm	7070-30026-01
Dell Networking N2024, N3024, N3048, S4048-ON	10GigE, SFP+. single transceiver, LR, 1310nm	7070-30331-01
Dell Networking N3024/3048	SFP 1000Base-Sx 850nm. 1GbE optical transceiver	7070-30584-00
	SFP+ (SR) 850 nm	7070-30582-00
	SFP+ (LR) 1300 nm	7070-30583-00
Dell Networking S4048-ON	QSFP+ SR Optic, 40GbE (100-150m)	7070-35041-00
Dell Networking N3000	Spare SFP+ 2-port 10GbE module (spare, no optics, no cables)	7030-65530-00
NETGEAR XS712T, XS716T	AXM761-10000S: 10GBase-SR short-range SFP+ LC transceiver module	
	AXC761-10000S: 10GSFP+ Cu (passive) cable with SFP+ connectors on both ends, 1m (3.3 ft)	
	AXC763-10000S: 10GSFP+ Cu (passive) cable with SFP+ connectors on both ends, 3m (9.8 ft)	

Connecting the Engine to a Switch

To connect the Avid NEXIS to a switch, you will need one or two transceivers or direct attach (Twinax) cables per Controller (if using redundant Controllers), depending on whether you are using link aggregation.

To connect the Storage Controller(s) to one or more switches:

1. Insert a supported transceiver module or cable into the left port on each Controller if not using LACP, or both ports, if using LACP.
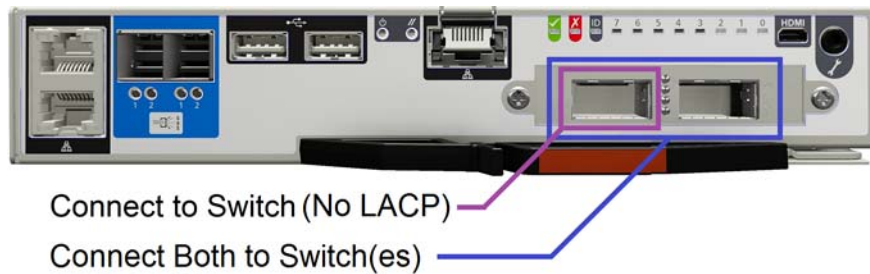
2. Insert the appropriate cables into the modules.
3. Connect the other end of the cables to the appropriate ports on your switch or switches.

Flow Control in Avid Production Networks

If you are experiencing poor read performance even when using tools like Avid PathDiag or Avid Benchmark Utility, check the switch port to see if the client is sending a large number of Pause frames. These are usually reported as "Throttles" in the input statistics for the interface on most switches, but can also be reported as "802.3x Pause Frames."

If this occurs, check whether the switch port is configured to honor Rx Flow Control (make sure FlowControl Rx is enabled). If not, enable Rx Flow Control and reset the port or client to see if the issues persist. If they do, contact Avid.

Flow control is enabled by default on all the currently supported switches (except Dell S4048-ON).

Enabling Flow Control on the Dell S4048-ON

By default, Flow Control is disabled on the Dell Networking switch S4048-ON. To use this switch in an Avid NEXIS environment, you must enable Flow Control. Consult the Dell Networking switch documentation for information on how to log into the switch, then enter these commands:

To enable Flow Control on the Dell S4048-ON:

1. S4048#**configure**
2. S4048(conf)#**int range tengigabitethernet 1/1 - 1/48**
3. S4048(conf-if-range-te-1/1-1/48)#**flowcontrol rx on tx off**
4. S4048(conf-if-range-te-1/1-1/48)#**exit**
5. S4048(conf)#**int range fortyGigE 1/49 - 1/54**
6. S4048(conf-if-range-fo-1/49-1/54)#**flowcontrol rx on tx off**
7. S4048(conf-if-range-fo-1/49-1/54)#**exit**
8. S4048(conf)#**exit**
9. S4048#**exit**

Configuring Switches for LACP

In Avid NEXIS v7.0 and higher, the Engines and Avid NEXIS | SDA support enabling LACP on the Ethernet ports on the Controllers. See the *Avid NEXIS Administration Guide* for more information on enabling LACP on the Controllers.

⚠ **Before enabling LACP on the Engines or Avid NEXIS | SDA, make sure both Ethernet ports on the Controllers are connected to one or more switches that support using link aggregation groups (LAGs).**

Switch vendors refer to this feature using different terminology:

Vendor	Terminology
Arista, Dell N-Series	Multi-chassis link aggregation (MLAG)
Dell S-Series	Virtual Link Trunking (VLT)
Cisco Nexus	Virtual PortChannel (vPC)
Cisco Catalyst	Virtual Switching System (VSS)
NETGEAR	*Not supported*

Consult your switch vendor documentation for steps on how to enable or configure link aggregation on your switches.

Configuring LACP (MLAG) on an Arista Switch

The following instructions apply to an Arista switch that has no other link aggregation or VLAN settings configured, and is provided for reference only. For more detailed information, consult your Arista documentation.

To configure LACP (MLAG) on an Arista switch:

1. Create a port channel:

   ```
   <switchhostname>(config)# int port-Channel <port-Channel number>
   ```

2. Add the port channel to the correct VLAN:

   ```
   <switchhostname>(config)#switchport access <vlan number>
   ```

3. Add the ports for the port channel to the correct VLAN:

   ```
   <switchhostname>(config)#int Ethernet <port number>
   <switchhostname>(config)#switchport access <vlan number>
   ```

4. Assign the ports that belong to the port channel:

   ```
   <switchhostname>(config)#int Ethernet <port number>
   <switchhostname>(config)#channel-group <port-Channel #> mode active
   ```

5. Set LACP to fast rate:

   ```
   <switchhostname>(config)#int Ethernet <port number>
   <switchhostname>(config)# lacp rate fast
   ```

Configuring LACP (vPC) on a Cisco Switch

The following instructions apply to a Cisco switch that has no other link aggregation or VLAN settings configured, and is provided for reference only. For more detailed information, consult your Cisco documentation.

To configure LACP (vPC) on a Cisco switch:

1. Create a port channel:

   ```
   <switchhostname>(config)# int port-Channel <port-Channel number>
   ```

2. Add the port channel to the correct VLAN:

   ```
   <switchhostname>(config)#switchport access <vlan number>
   ```

3. Add the ports for the port channel to the correct VLAN:

   ```
   <switchhostname>(config)#int Ethernet 1/<port number>
   ```

   ```
   <switchhostname>(config)#switchport access <vlan number>
   ```

4. Assign the ports that belong to the port channel:

   ```
   <switchhostname>(config)#int Ethernet 1/<port number>
   ```

   ```
   <switchhostname>(config)#channel-group <port-Channel #> mode active
   ```

5. Set LACP to fast rate:

   ```
   <switchhostname>(config)#int Ethernet 1/<port number>
   ```

   ```
   <switchhostname>(config)# lacp rate fast
   ```

Configuring LACP (MLAG) on a Dell Networking S4810 Switch

This procedure describes how to group links into port channels and use the port channel interface to send and receive traffic from the Avid NEXIS. If the Engine or Avid NEXIS | SDA has two Controllers, the ports on each Controller must be in a separate port channel.

In this example, ports 0/28 and 0/34 are connected to the 10GbE ports on the Controller in the Avid NEXIS Engine.

To configure LACP (MLAG) on a Dell S4810:

1. Identify an unused port channel. (The Dell S4810 supports up to 128 port channels).

   ```
   S4810>show interfaces port-channel brief

   Codes: L - LACP Port-channel

       LAG   Mode  Status        Uptime        Ports
       1     L3    down          00:00:00
       2     L3    down          00:00:00
   L   103   L2L3  up            1d14h34m      Te 0/43    (Up)
   ```

   Ports channels 1, 2, and 103 are being used, but 102 is available.

2. Enter the switch's global configuration mode and check whether the port has a VLAN configured:

   ```
   S4810>enable
   ```

11

```
S4810#show vlan
Codes: * - Default VLAN, G - GVRP VLANs, R - Remote Port Mirroring VLANs, P
- Primary, C - Community, I - Isolated
        O - Openflow
Q: U - Untagged, T - Tagged
   x - Dot1x untagged, X - Dot1x tagged
   o - OpenFlow untagged, O - OpenFlow tagged
   G - GVRP tagged, M - Vlan-stack, H - VSN tagged
   i - Internal untagged, I - Internal tagged, v - VLT untagged, V - VLT
tagged


    NUM     Status     Description                      Q Ports
*   1       Inactive                                    U Fo 0/60
    10      Active                                      U Po11(Te 0/42,44)
                                                        U Te 0/19,21,26
    11      Active                                      U Po22()
                                                        U Te 0/46
    20      Active                                      U Po21(Te 0/43,45)
    21      Active                                      U Te 0/47
    42      Active                                      U Te 0/0-6,8-9,12-
18,20,22-25,27-41
                                                        U Fo 0/48,52
    43      Inactive                                    U Te 0/10-11
                                                        U Fo 0/56
    3647    Active                                      U Te 0/7
```

S4810#configure

```
S4810(conf)#
```

3. Determine whether the port has a VLAN configuration:

4. If the port has a VLAN configuration, remove it:

   S4810(conf)#interface vlan 169

   S4810(conf-if-vl-169)#no untagged tengigabitethernet 0/28

   S4810(conf-if-vl-169)#exit

   S4810(conf)#

5. If the port is in another LAG, unconfigure it:

   S4810(conf)#interface tengigabitethernet 0/28

   S4810(conf-if-te-0/28)#port-channel-protocol lacp

   S4810(conf-if-te-0/28-lacp)#no port-channel

   S4810(conf-if-te-0/28-lacp)#exit

   S4810(conf-if-te-0/28)#exit

   S4810(conf)#

6. Unconfigure the port and enable LACP on it:

```
S4810(conf)#interface tengigabitethernet 0/28
S4810(conf-if-te-0/28)#no shutdown
S4810(conf-if-te-0/28)#no spanning-tree 0 portfast
S4810(conf-if-te-0/28)#no spanning-tree
S4810(conf-if-te-0/28)#no switchport
S4810(conf-if-te-0/28)#show config
S4810(conf-if-te-0/28)#port-channel-protocol lacp
S4810(conf-if-te-0/28-lacp)#port-channel 102 mode active
S4810(conf-if-te-0/28-lacp)#exit
S4810(conf-if-te-0/28)#exit
```

7. Repeat steps 3 through 5 for the second port.

8. Configure the port channel:

```
S4810(conf)#interface port-channel 102
S4810(conf-if-po-102)#switchport
S4810 (conf-if-po-102)#lacp long-timeout
S4810(conf-if-po-102)#exit
```

9. If there was a VLAN previously, add the port channel to the VLAN:

```
S4810(conf)#interface vlan 169
S4810(conf-if-vl-169)#untagged port-channel 169
S4810(conf-if-vl-169)#exit
```

10. To configure LACP for another Controller, create a new port channel.

11. Verify that links 0/28 and 0/34 are now part of a port channel with LACP enabled (note the L in the first column of output):

```
S4810>show interfaces port-channel brief

Codes: L - LACP Port-channel

    LAG  Mode  Status       Uptime      Ports

    1    L3    down         00:00:00

    2    L3    down         00:00:00

L   102  L2L3  up           1d16h27m    Te 0/28    (Up)

                                        Te 0/34    (Up)

L   103  L2L3  up           1d16h27m    Te 0/43    (Up)
```

12. Verify that the VLAN now has PO102:

```
S4810>show vlan id 1

Codes: * - Default VLAN, G - GVRP VLANs, R - Remote Port Mirroring VLANs,
P - Primary, C - Community, I - Isolated

        O - Openflow
Q: U - Untagged, T - Tagged

   x - Dot1x untagged, X - Dot1x tagged

   o - OpenFlow untagged, O - OpenFlow tagged

   G - GVRP tagged, M - Vlan-stack

   i - Internal untagged, I - Internal tagged, v - VLT untagged,
       V - VLT tagged

   NUM    Status   Description                       Q Ports
*  1      Active                                     U Po10()

                                                     U Po43()

                                                     U Po48()

                                                     U Po66(Te 1/1-1/2)

                                                     U Po77()
```

Network Considerations

Carefully plan for space, environmental, and power requirements for your Avid hardware. This section contains topics related to setting up your Avid network environment.

Computer Names

A hostname must comply with RFC 952 and RFC 1123 standards. For example, you cannot use an underscore in a hostname. For more information, see the Microsoft Knowledge Base article "Naming Conventions in Active Directory for Computers, Domains, Sites, and OUs."

Verify Entries on the DNS Server

Make sure that you correct any errors in DNS entries for name to IP resolution. The Avid network can become sluggish and unstable if there are incorrect entries in the DNS server for any of the computers in the Interplay environment. Symptoms include excessive CPU usage by the Interplay Framework Lookup service and Interplay Diagnostics. The tree view in the Interplay Service Configuration or Health Monitor may also fail to populate if there are incorrect DNS entries.

Configure the DNS Server to Support Reverse Lookup

Make sure that the DNS server is configured to support Reverse Lookups. If not, Interplay Framework cannot resolve IP addresses to host names. Symptoms include; tree views fail to populate in the Interplay Service Configuration, Interplay Diagnostics, and Health Monitor.

Non-DNS Environments

In a non-DNS environment you must configure a host file on all systems, including Avid Low Res Encode systems. This is necessary so that the Interplay Framework can list the systems in its client applications such as the Interplay Service Configuration or Health Monitor.

Computers with Multiple Network Interfaces

Computers that have multiple network interfaces in use must be entered in DNS so that all IP addresses have the same hostname.

If you have multiple network interfaces on a computer and one is not used, use the Device Manager to disable the interface. Otherwise, the computer might have problems communicating with the Interplay Framework. If multiple network interfaces are used, adjust the binding order and local specific routes to ensure the intended operation. Use the Advance setting in the Network adapter properties to change the priority order on the network interfaces.

Configuring an Avid Shared Storage System

On an Avid Production Network, to support clients that are not routed, you must configure a Layer 3 switch to route between subnetworks.

Know Where Your Subnets Are on the Network

Create a system diagram that identifies the subnets on your Avid network environment. Avid recommends you use Classless Inter-Domain Routing (CIDR) IP ranges of contiguous addresses instead of non-contiguous ranges VLAN 16, 17, 18, 19.

Time Synchronization

If you already have a system in place to maintain Time Sync on your network, you can continue to use that system. Avid Interplay provides the Interplay Framework Time Synchronization service to perform the same task. Avid has created a detailed guide on synchronizing many Avid products. Search for "A Guide to Time Synchronisation for Avid Interplay Systems" posted on the Avid Knowledge Base at www.avid.com/US/support.

The Avid Time Synchronization Service enables time synchronization between different machines in a workgroup. The Time Synchronization Service can operate in either Master mode or Slave mode. In Master mode, the service retrieves a reference time from a configured time source and redistributes it to the Slave services within the workgroup. The time source can be the local PC clock, an NTP server, or a timecode card installed in a server, such as the CaptureManager server. In Slave mode, the Time Synchronization Service listens for time notifications from the workgroup and (optionally) sets the local PC clock to match.

It is important to use only one time synchronism mechanism to set the local PC clocks in the Interplay environment. If a Time Synchronization Slave service is configured to set the local PC clock and it detects that some other mechanism (such as Windows 32 Time Services) changes the local clock, then the Time Sync Slave service will disable itself to avoid the local clock from jumping back and forth. The Time Sync slave will also post a Warning in the Health Monitor.

2 Supported Network Components and Cables

The cables and components described in this section pertain to Avid Engines and switches used in the Avid workgroup environments. Use these guidelines when connecting your clients and workstations to the workgroup.

Supported Network Interface Cards

Avid sells or supports the following network interface cards (NICs) for use in client systems that will connect to an Avid NEXIS system.

For NICs suitable for VM deployments, also see Interplay Virtualization Best Practices.

Avid Part Number	Description
(N/A)	ATTO TLNQ 3401/3402 for 40G Mac clients
	ATTO FFRM-NQ 41/42 for 40G Windows clients
(N/A)	ATTO FF-NS12, NT12 (with Avid NEXIS v6.0 and higher)
(N/A)	ATTO NS-3101/3102 2 x 10 Gb optical TB3 NIC
	• Windows clients: Use driver version 1.0.21, available from ATTO
	• Mac OS clients: Use driver version 1.10, available from ATTO
7030-72023-00	ATTO TLNS 2102 D01 Thunderbolt™ 2 to 10Gb Ethernet (SFP LC Optical) w/(2) SFP module, LP Desktop
7030-72024-00	ATTO TLNT 2102 D01 Thunderbolt 2 to 10Gb Ethernet (RJ45 Copper), Desktop, LP
7030-72028-00	ATTO TLNS 2101 D00 Thunderbolt 2 (2-port) to 10GbE (1-Port, Optical)
(N/A)	Intel I350 1GigE and 2x1GigE LC fiber optic and RJ-45 copper (with Avid NEXIS v6.0 and higher)
(N/A)	Intel Converged Ethernet X540-T2 1GigE, 2x1GigE, 10GigE, and 2x10GigE RJ-45 copper (with Avid NEXIS v6.0 and higher)
(N/A)	Intel Converged Ethernet X520-T2 1GigE, 2x1GigE, 10GigE, and 2x10GigE LC fiber optic and RJ-45 copper (with Avid NEXIS v6.0 and higher)
(N/A)	Intel Converged Ethernet X710 2 x 10GigE SFP+ (with Avid NEXIS v6.0 and higher)
7030-30346-01	Intel QUAD PORT Ethernet NIC i340 for ISIS 5500 direct attach clients
7070-30007-01	10GB SFP+ LR TRANSCEIVER, 1310 NM for Myricom 10G NIC
7010-30241-01	Myricom 10G-PCIE-8B-S+E 10GBE NIC, with 850nM Short Range (SR) optical transceiver

Avid Part Number	Description
(N/A)	Sonnet 10G Solo 10GBaseT 1 x 10 Gb NIC
	Download the driver from www.sonnettech.com

1G, 10G, 40G Transceivers and Direct Attach Cables

Avid sells the following cables and transceivers.

Avid Part Number	Description
10GbE SFP+ Optical Transceivers	
9900-65632-00	Optical 10Gbps transceiver. 10GbE Ethernet SFP+ LC 300m range, SR 850nm wavelength (Default for 10G optical short range)
9900-65652-00	Optical 10Gbps transceiver. 10GbE Ethernet SFP+ LC 10km range, LR 1310nm wavelength
7070-30026-01	Dell Networking: 10GigE, SFP+, single, transceiver, SR, 850nm (for Dell N2024, N3024, N3048, S4048-ON)
7070-30331-01	Dell Networking: 10GigE, SFP+. single transceiver, LR, 1310nm (for Dell N2024, N3024, N3048, S4048-ON)
7070-30583-00	Dell N2000/N3000 SFP+ 10G transceiver LR (1310 nm)
7070-30329-01	10 GbE optical SFP+ for Cisco 4948E & C4500-X switches. 850 nm laser compatible with 50 micron MMF cable; 300 meters maximum distance.
	Cisco Product Number SFP-10G-SR=
10GbE SFP+ Direct Attach Cables (Twinax)	
7070-30615-01	Dell Direct Attach 10G Cable. Copper 10GbE SFP+ twinax cable, 1 meter
7070-30615-03	Dell Direct Attach 10G Cable. Copper 10GbE SFP+ twinax cable, 3 meter
7070-30358-01	Cisco 10G SFP+ direct attach cable (twinax) 1 meter
7070-30358-03	Cisco 10G SFP+ direct attach cable (twinax) 3 meter
7070-30358-05	Cisco 10G SFP+ direct attach cable (twinax) 5 meter
40GbE SFP+ Direct Attach Cables (Twinax)	
7070-35071-03	Avid NEXIS 40GbE QSFP passive copper cable, 3m (Mellanox MC2210128-003)
7070-35071-05	Avid NEXIS 40GbE QSFP passive copper cable, 5m (Mellanox MC2210126-005)
7070-35040-03	Dell 40G QSFP+ Direct Attach Cable 3m
7070-35040-05	Dell 40G QSFP+ Direct Attach Cable 5m
1GbE SFP Copper & Optical Transceivers	
7070-35076-00	Dell Networking GP-SFP2-1T single 1GigE RJ45 Copper transceiver (407-BBTS) for Dell S4048
7070-30584-00	Dell N3000 SFP 1000Base-Sx 850nm. 1GbE optical transceiver for Dell N3024/3048

Avid Part Number	Description
7070-30589-00	Cisco C4500-X 1000Base-T SFP+
Miscellaneous	
9900-65653-00	Spare QSFP to SFP+ adapter (QSA) for Avid NEXIS	PRO and E5 NL controller 10 Gigabit Ethernet interface

Patch Cables

When planning your cable routes, make sure your cables cannot be damaged by traffic or moving objects. The network interface ports in Avid NEXIS systems work with any cable supported by the vendor for their switches. For convenience, Avid sells the following cables.

If you need run your cables greater distances, call Avid Customer Support for supported cable and accessory information. For cable connections, see the Avid Setup Guide for your product.

Avid Part Number	Connection Type	Description	Purpose
7070-03056-01	Gigabit Ethernet (Cat5-E) RJ45 connector Up to 100 Meters maximum, subject to EIA/TIA recommendations and limitations. The minimum 1 Gb cable length for Avid network products is 6 feet or 2 meters.	3 meter copper Cat5-E Gigabit Ethernet cable, RJ-45 connectors	Connects: • Avid NEXIS management port to a laptop
7070-03056-15		5 meter copper Cat5-E Gigabit Ethernet cable, RJ-45 connectors	• Clients to 1 or 10 Gb ports • Avid Interplay servers to shared storage networks
7070-03056-25		8 meter copper Cat5-E Gigabit Ethernet cable, RJ-45 connectors	• Avid AirSpeed capture and playback servers to shared storage networks

Avid Part Number	Connection Type	Description	Purpose

3m, LC/LC: 7070-03117-01
 	
5m, LC/LC: 7070-03117-05
 	
10m, LC/LC: 7070-03117-10
 	
3m, SC/LC: 7070-03104-01
 	
5m, SC/LC: 7070-03104-05
 	
10m, SC/LC: 7070-03104-10
 	
3m, SC/SC: 7070-03055-01
	Optical for 10GbE	Optical multi-mode cable for 10 Gigabit Ethernet, LC connectors
		
		• OM1 (62.5/125) —
		
		  - 1 Gb Ethernet, 275 meters (SX)
		  - 10 Gb Ethernet, 33 meters (SR)
		
		• OM2 (50/125) —
		
		  - 1 Gb Ethernet, 550 meters (SX)
		  - 10 Gb Ethernet, 82 meters (SR)
		
		• OM3 (50/125) —
		
		  - 1 Gb Ethernet, 550 meters (SX)
		  - 10 Gb Ethernet, 300 meters (SR)
		
		• OM4 (50/125) —
		
		  - 1 Gb Ethernet, 1000 meters (SX)
		  - 10 Gb Ethernet, 400 meters (SR)
			Connects:
			
			• 1 Gb switch port to 1 Gb client
			
			  - Windows – Intel Pro 1000 PF
			  - Macintosh – Small Tree PEG2F
			
			• 10 Gb port of switch to optical 10 Gb port on the Avid NEXIS Engine.
			
			• 10 Gb Client to 10 Gb Switch port
			
			• 10 Gb Ethernet switch to 10 Gb Ethernet Switch

The maximum length for optical Ethernet cables is limited by the core diameter (measured in microns) and modal bandwidth (in units of MHz*km).

Avid supports multi-mode fiber (MMF) cable using 850 nm transceivers (1000BASE-SX short distances). For specifications see the ISO 11801 structured cabling document.

Avid supports single-mode fiber cable using 1310 nm transceivers (long distances)

⚠ **When connecting to the 10 Gb port, make sure that:**
– The cable has the required modal bandwidth for the distance of the run.
– All multimode cables between a switch port and the other end of the cable run are of the same diameter (for example, 50/125 um or 62.5/125 um).

⚡ **Single mode transceivers are a Class 1 laser product per IEC 60825-1 Amendment 2(2001) and IEC 60825-2 1997. Operating this product in a manner inconsistent with intended usage and specification may result in hazardous radiation exposure.**

Avid Part Number	Connection Type	Description	Purpose
N/A		Cisco 93xx: QSFP-4SFP10G-CU (0.5m, 1m, 2m, 3m, 4m, 5m)	
7070-30581-00	Interswitch connection (stacking)	Dell N3000 Stacking cable 0.5m	

3 Client Network Adapter Reference

This chapter describes the default settings for Windows clients that are set automatically by the Avid NEXIS Client software, and the values set by the OS or the Myricom driver for Mac clients.

This chapter also includes the procedure to change the settings if necessary.

The Avid Client installer and Client Manager do not check for or change any network adapter settings on Linux systems.

1-Gb Network Adapter Settings for Windows

When you install the client software and each time you start the Client Manager, especially on Windows clients, some network adapter settings are checked and changed automatically if necessary. The following settings for Windows clients are provided for reference.

1-Gb Network Adapters

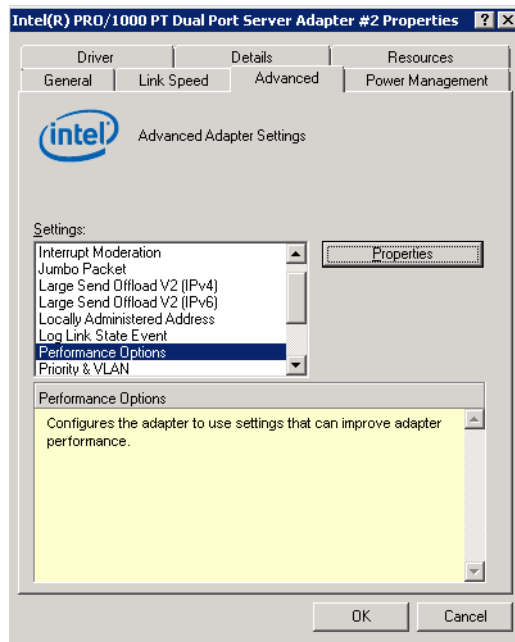| Option	Setting
Receive Buffers	1024
Transmit Buffers	1024

Modifying the 1-Gb Network Adapter Settings (Windows)

Under normal circumstances, you do not have to change the network adapter settings. The Client Manager installer checks for specific hardware platforms (Intel and Myricom) and makes changes only to those.

For other adapters, you can change the settings manually. The following procedure is provided for reference.

To access the network port properties:

1. Click Start and type `devmgmt.msc` in the Search text box.

   If using Windows 8, you can get to the Search text box by pressing the Windows key on your keyboard and start typing on the Windows 8 desktop.

   The Device Manager dialog window opens.

2. Double-click the Network adapters category to expand the list.

3. Right-click the first PRO/1000 network port and select Properties.

4. Click the Advanced tab.

5. Click Performance Options in the Setting list, then click Properties.
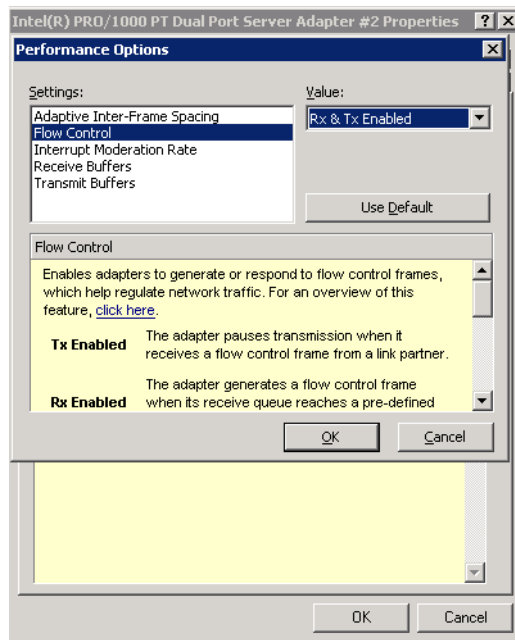
   a.   Click Flow Control and set the Value to Rx&Tx Enabled.

   b.   Click Interrupt Moderation Rate and set the Value to Enabled.

   c.   Click Interrupt Throttling Rate and set the Value to Adaptive.

   d.   Make sure that the Receive Buffers Value is set to 1024.

   e.   Make sure that the Transmit Buffers Value is set to 1024.

   f.   Click OK to close the Performance Options.

6. Click the Power Management tab.
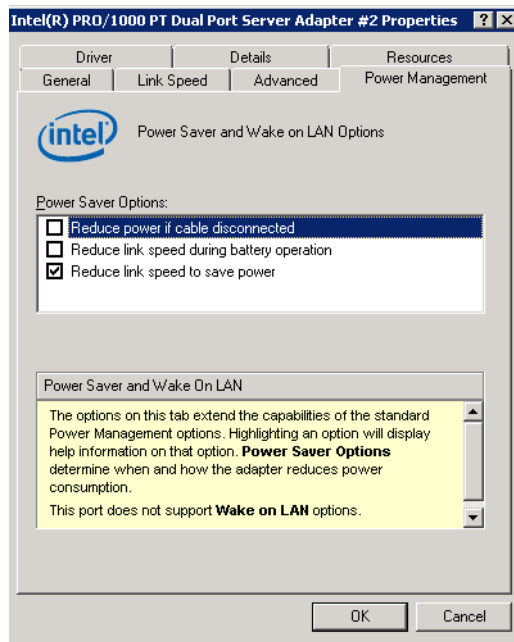
    a.   Deselect the "Reduce power if cable disconnected" power saving option.

    b.   Deselect the "Reduce link speed during standby" power saving option.

7. Click OK to close the Server Adapter Properties dialog box.

8. (Option) If this is a dual port network adapter, repeat steps 3 through 7 to configure the second Intel PRO/1000 port.

9. Restart the client system.

10-Gb Network Adapter Settings for Windows (Myricom)

The Avid NEXIS Client software for Windows clients sets the Myricom driver settings automatically. The following table provides the Myricom 10-Gb network adapter settings as a reference.

Myricom 10-Gb Network Settings

Option	Setting
Flow Control	On
Interrupt Coalescing Delay	2
Receive Buffers	2048
MTU	1500
Receive Side Scaling (RSS)	Disabled

Under normal circumstances, you do not have to change the network adapter settings. The Client installer checks for specific hardware platforms (Intel and Myricom) and makes changes only to those.

For other adapters, you can change the settings manually. The following procedure is provided for reference.
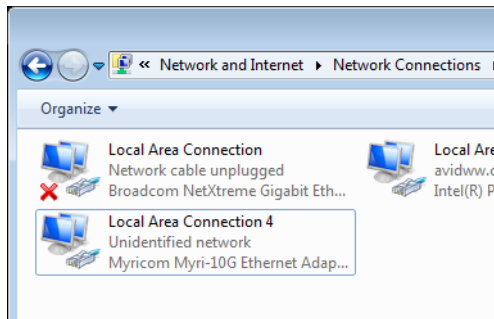
To configure the 10-Gb Myricom network adapter in Windows clients:

1. Click Start and type `ncpa.cpl` in the Search text box.
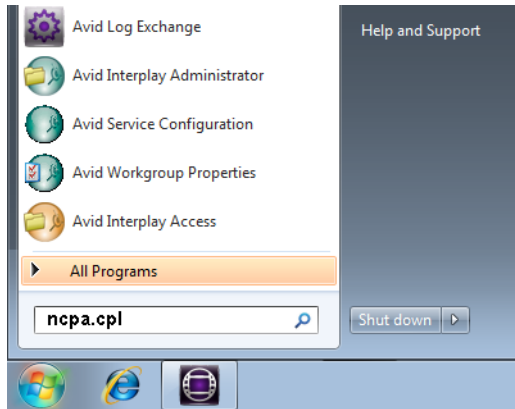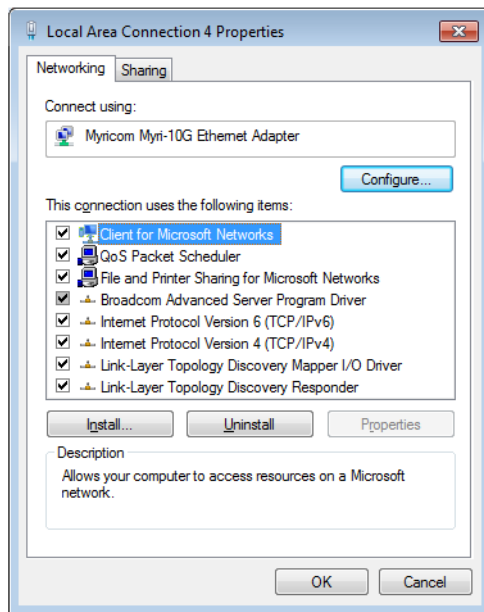

   (On Windows 8, open the Search text box by pressing the Windows key on your keyboard and start typing on the Windows 8 desktop.)
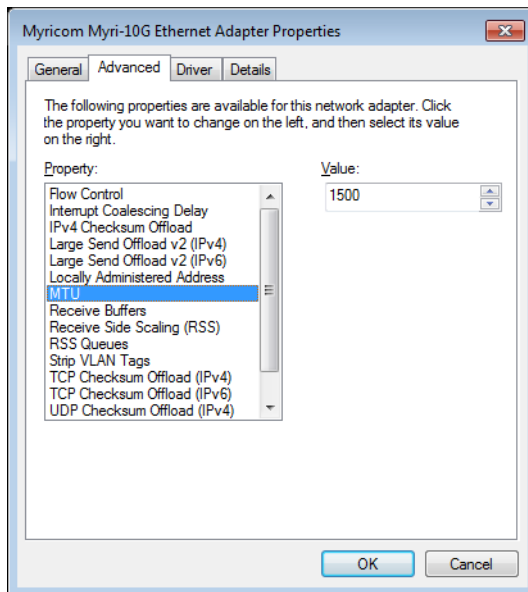
2. Right-click on the Myricom adapter and select Properties.

3. Click Configure.

4. Click the Advanced tab.

5. Click OK.

After changing the Myricom adapter settings, restart your client system.

Network Settings for Mac (Myricom)

On 1 Gb Mac clients, the OS sets the MTU value appropriately. On 10-Gb Mac clients, the Myricom driver supplied by Avid sets the MTU value appropriately. For reference, the network settings are provided in the following table.

If you download and install the driver directly from Myricom (CSPi), turn off Jumbo Frames for 10-Gb clients.

Myricom 10-Gb Network Settings

Option	Setting
Configure	Manually
Speed	Autoselect
Duplex	Full - Duplex, Flow-Control
MTU	Standard (1500)

40-Gb Network Settings for Windows (ATTO)

For the ATTO FFRM-NQ 41/42 NIC for 40G Windows clients, the Receive Buffer parameter is changed from 512 (default) to 2048.

4 Requirements

The Avid hardware components are fully rack-mountable. They are compatible with any standard 19-inch video racks using either NEMA or EIA mounting-hole layouts.

Electrical Requirements

Consider installing a separately derived power system for your Avid shared storage hardware. This ensures that you can control the hardware grounding, with all grounds brought to a single point, and that uncontrolled equipment, such as coffee makers or floor polishers, cannot be plugged into the same power source as the Avid shared storage hardware.

If you do not create a separately derived power system, make sure the power outlets are from the same distribution panel. This helps prevent the occurrence of ground loops that can be caused by plugging equipment into power sources with different ground potentials.

If you run more than one power line because you have more than one UPS, make sure the power lines come from the same distribution panel.

Have all the electrical work at your site done by a licensed electrician. All the electrical changes must meet country, state, and local electrical codes.

As you choose the location for your Avid shared storage hardware, keep these electrical requirements in mind:

- Make sure there is adequate, dedicated power for the UPSs that are part of your Avid shared storage workgroup.

Avid recommends the use of UPSs, appropriately sized for your Avid shared storage workgroup, or conditioned power in your computer room environment. This provides protection against sudden power surges or losses that could cause you to lose files or experience data corruption.

- Make sure your location is away from major electrical equipment such as motors, air conditioners, or elevators.
- Make sure the location is not subject to electrostatic buildup.
- Plug only your Avid hardware into the power strips. Do not plug in coffee makers, radios, lights, or other non-Avid devices.

The following table shows the electrical specifications for the Avid qualified and approved switches. Make sure your site meets these specifications.

Environmental Requirements

The Avid NEXIS and Interplay hardware and switches are intended for use computer-room environments. They are not intended for use on top of desks or in open office environments. When you select a location, make sure that the location meets the following requirements:

- A sturdy, level floor, not subject to vibration.

- Away from high-traffic areas.

- Clean and free from dust, smoke, or other airborne contaminants.

- No significant temperature changes. Choose a location where the temperature does not vary more than 18°F (7.78°C) per hour.

- No significant humidity changes. A location with approximately 40 percent humidity can prevent problems stemming from electrostatic discharge.

- Adequate space in front of and behind the rack. You must be able to connect cables and service parts of your hardware. It also needs adequate airflow for cooling.