WHITE PAPER

EditShare in Education: Deployment and Networking Recommendations

EditShare®

Introduction

EditShare collaborative video storage and media asset management solutions can be found in media labs at hundreds of colleges and universities the world over – from the Americas to Europe, from Africa to the Middle and Far East.

Our EFS storage and Flow media asset management (MAM) products enable dozens or hundreds of students, faculty members, and media staff to work directly and collaboratively off central storage for "in place" video editing and audio mixing, graphics and video effects design, video effects rendering, and much more.

In the Americas, where college sports are hugely popular, EditShare installations are often shared between communications and athletics programs on opposite sides of a large campus.

This document discusses some general networking requirements and deployment suggestions for EditShare systems.

EditShare Filesystem: NAS, Not SAN

EditShare's EFS systems have a scale-out network-attached storage (NAS) design, where all physical components – EFS filesystem metadata nodes, EFS storage nodes, and Flow MAM servers – are connected to the ethernet network by 10, 40, or 100 Gigabit Ethernet. Workstations will most often be connected by 1 or 10 Gigabit ethernet but sometimes need 40 Gigabit connections for working in real time with video streams that have a data rate of 1 to 2 Gigabytes per second or more (uncompressed 4K or 8K video, for example). Fiber channel and InfiniBand interconnects are not part of an EditShare system.

Network Planning Recommendations

The physical network that contains the EditShare servers and multimedia production workstations must provide high throughput and very low latency. Video and audio files are not typically copied onto student or faculty workstations but instead are edited or mixed "in place:" The video or audio editing application will stream files in real time from the EditShare shared storage system, so the flow of data must be fast and uninterrupted.

Anything that delays ethernet packet reception – such as performing packet inspection within a switch or traversing firewalls between the EditShare servers and the workstations – should be avoided. They often introduce extra latency to network data flows that can severely degrade the video or audio editing experience.

For best results, consider these network planning recommendations:

- Use high speed switches that are optimized for multimedia workflows. (Officially qualified switches are discussed later in this document.)
- Use Cat. 6 cabling or better for 1000BASE-T and 10GBASE-T interconnects. (Note that 10GBASE-T requires Cat. 6A cabling for runs longer than 55 meters and the runs should not exceed 100 meters.)
- Use appropriate fiber optic ethernet transceivers and cabling according to the switch's hardware interface (SFP+, QSFP+, and so on), the length of the cable run (short-range MMF, long-range SMF, multi-fiber ribbon cable, and many variations), and the patch panel and wall jack terminations (most commonly LC, SC, or MPO).
- Plan a permanent hostname and IP address for each EditShare server. Using DHCP to automatically configure the servers' network interfaces according to their MAC addresses is possible, but you must ensure that permanent DHCP leases are properly configured and that the servers' IP addresses are removed from the DHCP pool. (Generally, EditShare recommends that servers' IP addresses and hostnames not be changed after a system is commissioned. If this becomes necessary, contact EditShare technical support beforehand.)
- Ideally, the EditShare servers and the workstations that will connect to them should be in the same IPv4 network. If workstations must be in a separate network from the EditShare servers, then appropriate routing must be configured. Routing can increase the latency of packets being forwarded to their destination, so the sustained throughput of video and audio streams may be decreased as a result. (Also note that Flow MAM servers and client applications rely on IP broadcasts as part of their automatic discovery mechanism. If the Flow servers and the workstations are to be in separate broadcast domains, manual configuration of the auto-discovery mechanism will be required.)
- EditShare servers will be specified with either one-port or two-port network interface cards (NICs) depending on customer requirements for throughput and fault tolerance. Servers that have two-port cards can easily be configured to use link aggregation (LAG), which provides higher network throughput, load balancing among the two links, and tolerance to the failure of one of the links. (This is also known as "bonding" or "teaming.") LACP is the most common LAG method used by EditShare systems but other options are available if a customer's network infrastructure does not support LACP.

- With servers that have two-port NICs, it is possible to implement a "no single point of failure" (no SPOF) network design by utilizing switches that support multi-chassis link aggregation (MLAG). In such a design, two or more switches will be configured as a fault-tolerant MLAG group and a server with a two-port NIC will have its two ports connected to two independent switches.

Ethernet Switch Choices

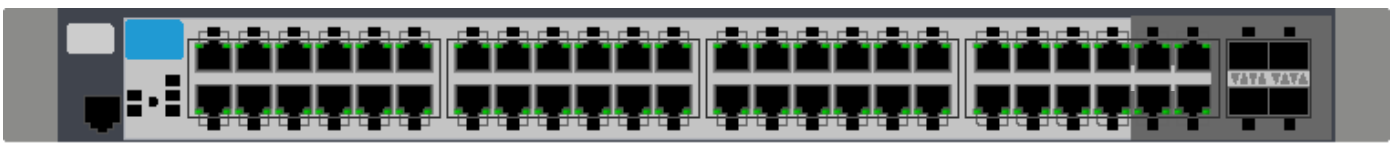
For any workgroup with more than a few users or more than one server, at least one ethernet switch will be required in the EditShare system to provide the connections between the servers and the workstations. Larger installations with very many workstations and servers or those requiring no single point of failure in the network infrastructure will require multiple switches or modular switches that have built-in redundancy.

These are some of the aspects to consider:

- How many media workstations will be deployed now and in the near future, and how many switch ports will they require?
- How many servers will be deployed now and in the near future, and how many ports will they require?
- Will the network support 10 gigabit or 40 gigabit ethernet connections to the servers?
- Will the servers have one-port or two-port NICs (which would allow the use of link aggregation)?
- What is the required shared storage throughput and network throughput to support the expected editing workflows? Consider the connections between the shared storage servers and the switches and between the switches and the workstations.
- If the EditShare system will be at the center of a network topology that branches into one or more distribution points, what levels of throughput and resilience are needed for the cross-campus connections?
- What level of fault tolerance is required within the switches themselves (redundant power supplies, fan modules, and so on)?

Qualified Ethernet Switches

EditShare has invested significant resources in researching, testing and developing standard configurations for a variety of ethernet switches. Currently, we offer qualified switches from Arista, Mellanox, HPE and Netgear. These switches are widely deployed at major film and television studios around the world, and excel at high throughput, low latency performance. In addition, for each qualified switch, we offer a complete set of compatible accessories, including SFP+ and QSFP+ transceivers and cables.



Including qualified and properly configured network switches with your new EditShare system is an easy way to ensure that the system performs as specified. Therefore, in most circumstances, EditShare will

recommend a turnkey package that includes qualified switches. Before your system is shipped, all system elements, including the switches, will be assembled, updated, configured, and tested for correct operation.

EditShare will recommend one or more of the following switches as part of a bundled solution. The specific switch selection will depend on the networking infrastructure, the workstations employed, and the potential future growth of the system.

Deploying EditShare Systems with Existing Switches

EditShare recognizes that many IT organizations have preferred switch vendors and may have already standardized their switch deployments throughout a campus. If an EditShare system is to be deployed onto an existing network infrastructure that uses switches or switch configurations that have not been qualified by EditShare, we recommend considering these suggestions:

- Streaming high bitrate video and audio over the network usually benefits from a higher maximum transmission unit (MTU). Ethernet packets larger than 1500 bytes are often referred to as "jumbo frames." Configure the EditShare servers, multimedia production workstations, and the switch ports that the servers and workstations are connected to to use jumbo frame. An MTU of 9000 bytes is typical and supported by most switches and NICs.

Vendor & Model	Ports	Recommended Usage
Arista 7050X series	1 Gb and 10 Gb auto-sensing ports for workstations and servers, 40 Gb ports for servers or uplink, HA MLAG is possible	Classroom access ports or server access ports, well suited for HA systems
HPE FlexFabric 5940 series	1 Gb and 10 Gb auto-sensing ports for workstations and servers, 40 Gb ports for servers or uplink	Classroom access ports or server access ports
Mellanox SN2000 series	10 Gb, 25 Gb, 40 Gb, 50 Gb, and 100 Gb options for workstations and servers, HA MLAG is possible	Classroom access ports or server access ports, well suited for HA systems
Netgear GS series	10 Gb connections for a single server or uplink to another 10 Gb switch 1 Gb ports for workstations	Small installations or classroom access ports
Netgear XS series	1 Gb and 10 Gb auto-sensing ports for workstations and servers, no HA features	Classroom access ports or server access ports for small systems
Netgear M4300 series	1 Gb and 10 Gb auto-sensing ports for workstations and servers, HA stacking is possible	Classroom access ports or server access ports

- Avoid store-and-forward switching, which forces a switch to buffer an entire packet and inspect it before forwarding it. Such buffering adds latency to the transmission of the packets, usually resulting in dropped video frames or audio samples.
- Avoid the use of security features that can introduce latency (such as deep packet inspection) within the network segments that contain the EditShare servers and the media production workstation.
- Be aware of the switches' hardware or software limitations:
    - The number of ports within a group or across the entire switch that are allowed to operate at their fastest advertised speed may be limited. (Switches that have no such restriction are often called non-blocking, wire-speed, or line-speed switches.)
    - The total number of LAGs allowed within a group of ports or within the whole switch configuration may be limited.
- If you are planning a highly available (HA) EFS system, which will include two EFS metadata nodes, consider how IGMP is managed on your network. The two HA EFS metadata nodes rely on IGMP group multicasts as part of their HA software management system. Some switches have IGMP snooping enabled by default, and if such a switch cannot contact an IGMP snooping querier elsewhere on the network, then it will stop forwarding multicast packets between the two HA EFS metadata nodes, resulting in failure of the HA software management system.

Accessing EditShare Systems from Outside the Campus

Increasingly, the media and entertainment industry relies on content producers and editors being able to work on projects from outside of a typical production or post-production facility, so it is not surprising that many university professors expect to teach the relevant techniques and workflows to their students. Network throughput and connectivity needs can vary greatly depending on the workflow being used and the video and audio formats chosen for a project. For example, low resolution or "proxy quality" video streams often have data rates as low as 500 kilobytes to 1 or 2 megabytes per second, whereas compressed high quality HD streams can have data rates from about 8 to 60 megabytes per second, and uncompressed HD and 4K streams can have data rates of hundreds or thousands of megabytes per second per. These points must be considered when students or faculty are expecting to work on projects from outside the school campus.

The following is a list of techniques that can be used to meet the remote access needs of the users of the EditShare system. They are not all exclusive of each other; depending on your users' specific needs, some may be used together.

- VPN: Provide a VPN that is routable to the IPv4 network that contains the EditShare system. Users can login to the EditShare client software after connecting to the VPN.
- Remote desktop: Provide workstations that can be controlled remotely in the IPv4 network that contains the EditShare system. This can be accomplished through the use of Microsoft Remote Desktop Services, VNC, Teradici, TeamViewer, or other similar technologies.
- AirFlow and Flow Story: The Flow MAM system offers two options for remote access and typically needs nothing more than support for proxy data rates. AirFlow is a web browser-based client that allows

users to search the media asset database, modify asset metadata, view proxy versions of video assets, organize content, and complete basic cuts only editing tasks. Flow Story is a desktop non-linear editing application (NLE) that provides more sophisticated video editing features than AirFlow and offers editing project interchange with other popular NLEs. One of the unique features of Flow Story is that it supports remote timeline editing with proxy files.

Depending on the remote access technique that is chosen, adjustments to your firewall rules or routing may be necessary.

Active Directory Integration

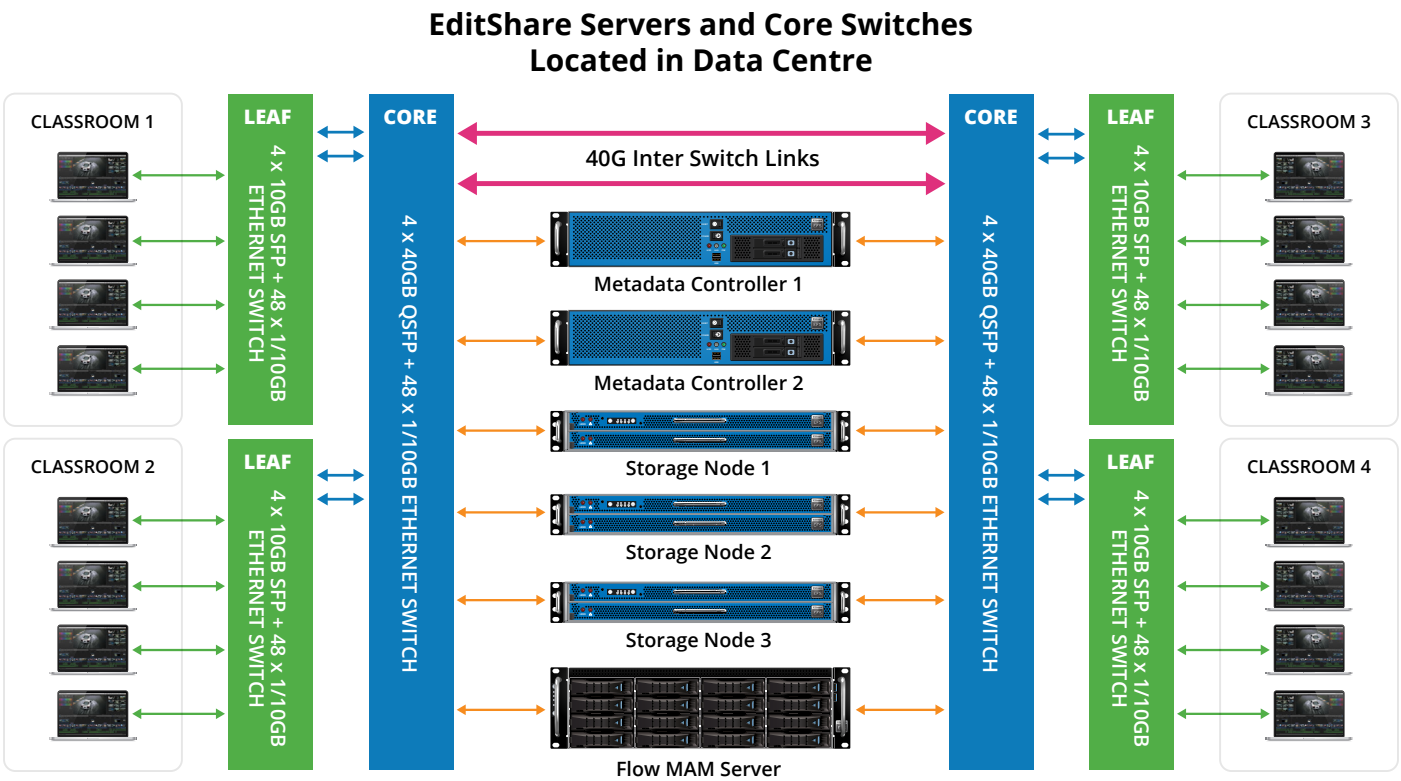
EditShare servers can join a Windows domain that is provided by Windows Server 2008r2, Windows Server 2012, or Windows Server 2016 domain controllers running Active Directory (AD) Domain Services. When this feature is enabled, the EditShare system will be configured to automatically import user accounts from a specified AD security group. The members of the group will be allowed to access the EditShare system using their AD user account credentials. Likewise, access to the EditShare system can be revoked by removing a user account from the security group. Additionally, the EditShare Storage client software can utilize Active Directory's authentication token system to provide a single-sign-on (SSO) user experience: After a user logs in to a workstation that is in the AD domain, he is not required to enter his credentials again to login to the client software or to connect to shared volumes.

User accounts that are imported from AD into the EditShare system can be further subdivided by utilizing grouping features of the EditShare Storage management system. For example, the EditShare system may

be configured to obtain user accounts from the AD security group named "Main Campus Students" and then those accounts can be separated into groups such as "Film Editing 101," "Audio Mixing 201," and so on. Access to shared volumes can then be easily managed by group rather than by individual user accounts.

When configuring an EditShare system to integrate with Active Directory, consider these recommendations:

- EditShare Storage servers (filesystem metadata and storage nodes) regularly query Active Directory's LDAP service for information about the security group that provides the user accounts and about the user accounts themselves. Therefore, it is important that the EditShare servers be able to consistently connect to the AD domain controllers. High latency or packet loss between the EditShare system and the domain controllers can result in slow logins to the EditShare Storage client software and difficulty managing the shared volumes.
- EditShare's current implementation of AD integration is capable of importing user accounts from only one security group. It does not support importing user accounts from multiple groups nor inheritance of user accounts from nested groups.*
- The EditShare Flow client software can utilize the same user accounts as the Storage client software, but Flow does not currently support SSO. Therefore, a user must enter his AD credentials when logging in.*



*These limitations are planned to be addressed in future EditShare software releases.

Physical Installation Recommendations

All EditShare servers are rack-mountable in four-post cabinets* and include sliding rails. The rails can be mounted on square-hole or tapped-hole vertical posts, and the distance between the front and rear posts must be between 28" and 36.5" (varies by server model).

Servers should be located in a space with adequate cooling, ventilation, and sound isolation, ideally a server room or IDF closet that is close to the media lab, media production facility, or sports venue. They can also be installed in a central campus data center that has appropriate fiber ethernet connections to distribution switches closer to the multimedia production workstations.

*Two-post installation is not recommended.

Summary

With over 3000 installations worldwide, including hundreds in prominent higher education applications, EditShare has the expertise to help you choose the best solution for your media infrastructure. Visit our website to learn how EditShare provides colleges and universities with media storage, content management and file-based workflow solutions that mirror real-life production workflows.