

APPLICATION NOTE

File-Based Live Production

**with the K2 Summit, K2 Dyno Replay System, and
K2 Dyno Production Assistant**

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File-based live production can deliver many advantages to production crews, but leveraging all of the potential benefits is complex. The Grass Valley™ K2 family of solutions gives you the power and simplicity to significantly enhance your live production workflow without added complexity.

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Live Production Enters A New Age



Grass Valley has provided key components for live production for several decades: cameras, switchers, modular products, and routers. Grass Valley is now leveraging its expertise in editing, content management, servers, storage, networking, ingest, playout, and production software to significantly enhance live production workflows using a combination of solutions:

- K2 Summit™ Media Server
- K2 Dyno™ Replay System (consisting of a K2 Dyno Replay Controller and either a K2 Summit or K2 Solo™ media server)
- K2 Dyno Production Assistant (PA)

Two factors make this solution extremely cost-effective for HD productions (and can also be used for SD productions):

- Up/down/crossconversion included as a standard feature, eliminating the need for extra equipment
- Integration of standard IT networking and peripherals keeps connectivity costs down

Workflow Solution

Pre-production, on-air operation, and post-production

In pre-production, the K2 Dyno Replay System supports importing content such as highlights and pre-produced material (promos, bumpers, and teases) across a network or from standard storage devices. Complete metadata layouts can be created offline and imported for consistent content tagging.

During on-air production, the K2 Dyno Replay System provides users with an ergonomic control panel for instant replay. Highlights can be created with searchable and savable metadata for easy reuse. The system can send specific content and continuously transfer material to editors and storage. It is even possible to edit-in-place while media is being recorded by NLEs such as EDIUS® and Final Cut Pro 7.

In post-production, content and metadata can be quickly gathered and transferred across a network or to off-the-shelf removable storage to carry away for later reuse, editing, or archiving.

Optimized Production Tools

Fast and precise control for live production workflows:

- Multiple camera input controls and synchronization permit frame-accurate control
- Immediate playback of all clips with preview, cue, and variable speed
- Shotbox operations with keywords, clip names, or numbers
- Thumbnail icon display, status indicators, drag-and-drop operations, and feedback monitoring for interactive operation
- Instant highlight creation, building of playlist packages with effects, and editing of material
- Enter and retain metadata with logging and keywords, as well as searching for associated metadata

Advanced IT Technologies

Cost-effective integration in production environments:

- Standard Gigabit Ethernet network connectivity with guaranteed bandwidth for IP file transfers
- FTP and CIFS file protocols
- Hot-swappable, redundant SAS internal storage
- USB 2.0 streaming interface
- Connectivity with off-the-shelf removable storage such as USB or NAS devices
- Combined RISC, FPGA, and CPU processing for guaranteed real-time operations
- Combined real-time and embedded operating systems for robust and reliable performance

Live Production Enters A New Age (cont.)

Systems Approach

Media environments such as newsrooms and editing suites have rapidly converted from an analog videotape infrastructure to a newer, digital file-based one.

Many live production facilities have yet to make this transition. Videotape has substantial advantages such as immediacy, transportability, and ubiquitous interoperability.

However, technology has improved and reached a new level of cost-effectiveness that cannot only match the capabilities of videotape, but surpass them with increased efficiencies.

With the K2 media server, Grass Valley was a pioneer of this transition in news and playout applications, where the K2's architecture and infrastructure allowed integration in these environments better than any other server.

The K2 platform approach does not require complex and costly add-on software and hardware components. Instead, the K2 platform provides a host of technologies and features that make it uniquely ideal for the changing needs of production facilities. Unlike systems developed for use with videotape, and for only one type of use, the infrastructure for the K2 is not only more modern, but specifically optimized for file-based production.

K2 Summit

Open Platform

Other servers were designed only as a point product to handle one task. While they have evolved to do that task well, they cannot be used easily in other applications.

Conversely, the K2 media server was created from the beginning to be a platform that could perform a wide range of tasks:

- As clip player for a production switcher
- As the backbone for ingest and playout systems—including a SAN infrastructure, something which others cannot provide

K2 servers can also provide the means for shared production editing and for news production. Being a true platform also means creating versatile, robust APIs that enable a diverse group of third-party developers to create unique solutions.

Not only have other server companies not developed such APIs, some of them discourage developers from providing extensions to their products.

Grass Valley Fusion

Adding more value to Grass Valley products by improving the integration between them. Fusion is all about delivering new functionality that increases operational flexibility by building practical synergies between Grass Valley products when used together.



As more and more companies and their clients transition away from videotape, they require solutions that provide the performance and integration for working in a file-based world. These changing requirements are not just for sports, but also for studios, stadiums, event fly-packs, and any other live production environment.

K2 servers and storage coupled with K2 Dyno Replay Controllers are the best combination for high-performance, tight file integration, and cost-effectiveness for live production.

Multiple Applications

Fast, easy, and cost-effective live event production

Stadiums, sports production centers, government organizations, educational institutions, and live event producers can take advantage of capabilities for fast and precise recording and playback during live-to-air productions.

Live-to-disk applications, such as serial programming, game shows, reality shows, avail themselves to collaborative solutions for efficient multi-camera input, pre and post editing.

The lower cost of combined HD/SD production enables a large number of users with a greater set of advanced capabilities to produce sophisticated and complex content.

Fusion is not a specific product, but it is a new way of working, a new way of thinking about design from a systems and operational point of view rather than about individual product development. It could be a simple one-to-one link that improves usability of products working together or it could be the implementation of system wide protocols.

What makes Fusion possible is the common design platform which Grass Valley is rolling out across all its products and systems.

For example, Fusion brings together the operation of the K2 Summit/K2 Solo media servers with Kayenne Video Production Center switcher, allowing to use K2 as a clip player totally controlled from the Kayenne.



K2 Summit (cont.)

Architecture

The K2 Dyno Replay System incorporates a number of new technologies. Other products have not kept up with pertinent technology trends.

K2 Summit and the K2 Dyno Replay Controller utilize:

- Embedded Windows and real-time operating systems
- System software on CompactFlash
- Multiple USB and Gigabit Ethernet connections
- The latest Intel processors, RISC, and FPGA processors

With the K2 Dyno Replay System, users have a clear choice of which architecture will support their future needs, such as 1080p formats.

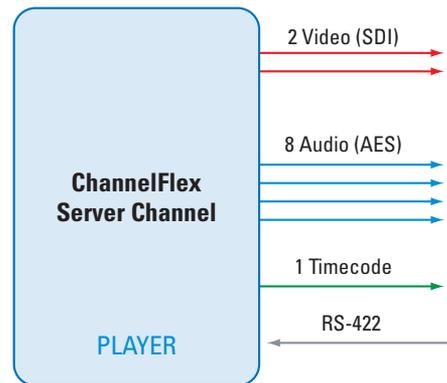
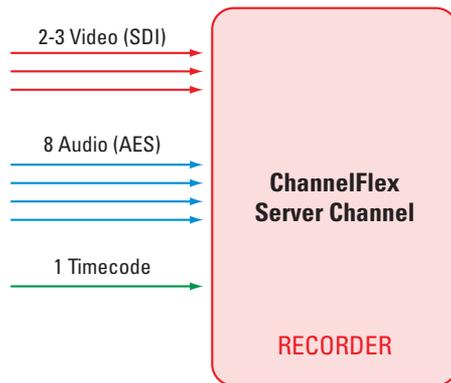
ChannelFlex

Many existing systems are locked into specific configurations. K2 media servers offer a single flexible software option that supports many different types of uses.

The ChannelFlex™ software option provides the unique ability to assign up to three video streams to a single recording channel and up to two video streams to a playback channel. It increases the input count to configurations such as 4-in and 2-out. This option also provides a 6-in and 1-out configuration with effects.

The four channels of K2 Summit (or the two channels of K2 Solo) are fully independent from each other. ChannelFlex can be activated for recording/playing several streams on a single channel, according to the selected mode: multi-camera, video+key, super slow-motion, or 3D.

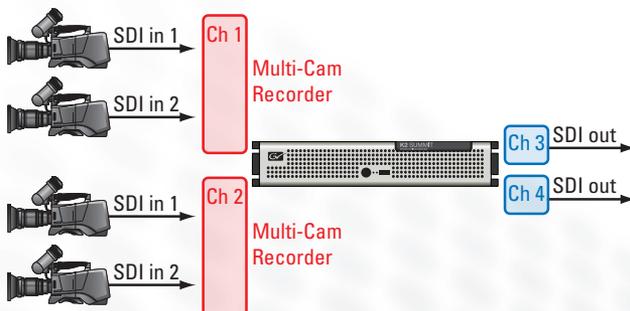
ChannelFlex thus allows matching channel count to your real needs while optimizing configuration and cost.



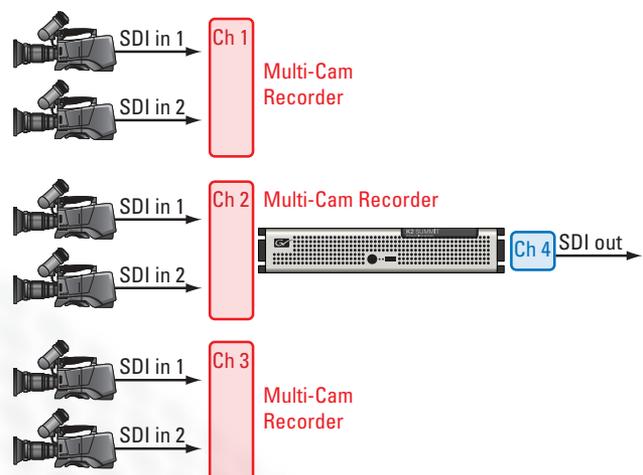
Multi-Cam

In Multi-Camera mode, ChannelFlex allows configuration of a 4-channel K2 Summit with:

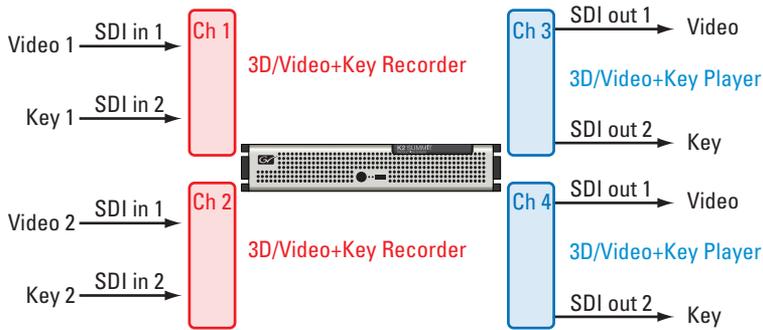
4 in + 2 out:



6 in + 1 out:

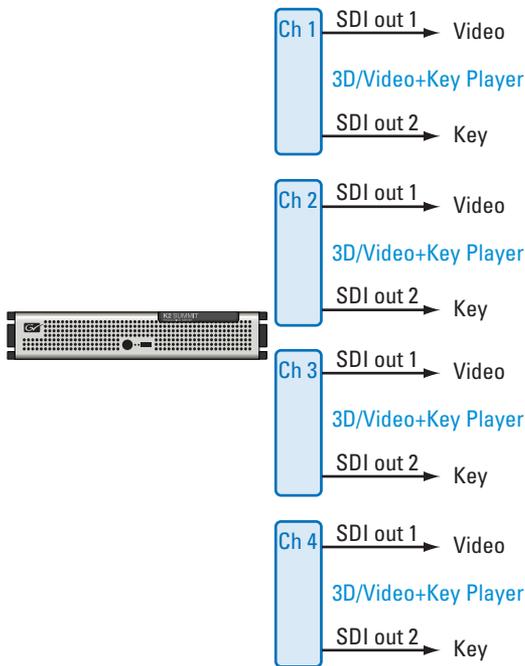


K2 Summit (cont.)

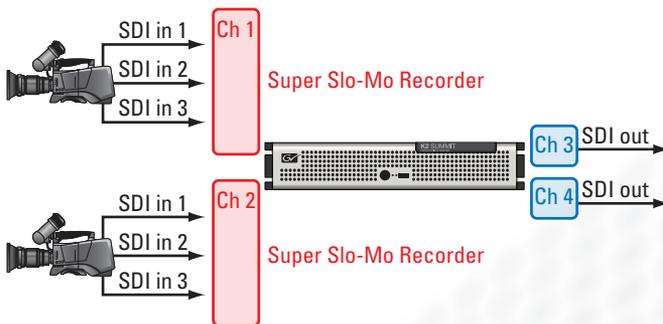


Video + Key

In Video + Key mode, the K2 Summit can synchronously record a video stream and its key signal on a single channel.



The same mode also allows playing a video stream and its signal, on a single channel, in sync.



Super Slow-Motion

In Super Slo-Mo Recorder mode, ChannelFlex allows 2X or 3X video streams provided by high-speed cameras (like the LDK 8300) to be recorded on a single channel.

Images from these two or three video stream phases are then multiplexed during the recording process to make up a single clip.

This clip is then readable via a standard K2 server channel. With the K2 Dyno Replay Controller, control of the playback speed includes great slow-motion replays with extreme precision.

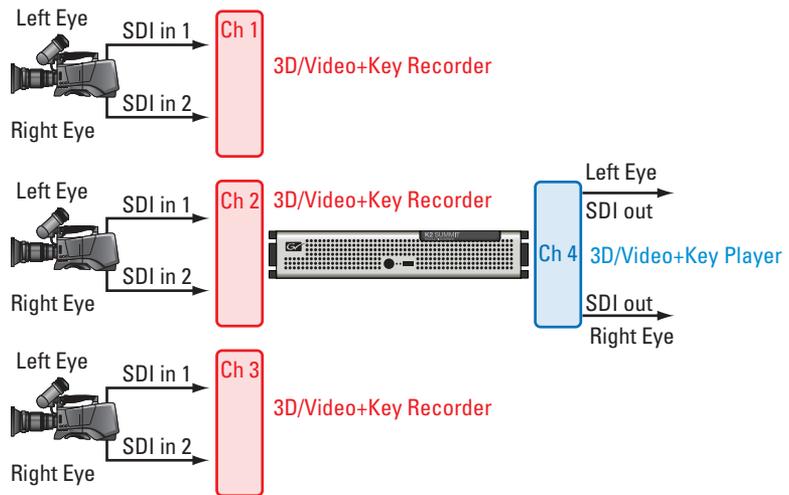
K2 Summit (cont.)

3D

Using ChannelFlex, a K2 Summit or K2 Solo can combine left-eye and right-eye streams on a single channel.

A K2 Summit-based system can then operate in 2x2 or 3x1 configurations and K2 Solo in a 2x1 configuration.

In 3D production, ChannelFlex halves the number of required channels while other systems require the use of one channel for each of the left-eye and right-eye streams, so that a typical high-end system from another provider has no more capability than a low-cost K2 Solo-based system.



Networking

Networking on other systems can be expensive and not IT-friendly. With older architectures, other systems do not offer the QOS-managed, guaranteed-bandwidth networking of the K2 platform.

K2 Summit comes standard with four connectors for Gigabit Ethernet with separate networks for control and IP file transfers. K2 systems offer higher bandwidth specifications than other systems.

Storage

K2 Summit clients, as standalone devices, use eight of the latest, high-performance 450 and 600 GB 15K SAS drives, striped and mirrored for redundancy. Other systems use lower-performance, lower-capacity drives with less redundancy.

K2 Summit and K2 Solo also have the option for solid state drives—others do not.

All the drives in K2 Summit are individually hot-swappable from the front of the unit unlike systems from other manufacturers, which require taking out the entire disk tray to perform any service or to replace even a single drive.

SAN Systems

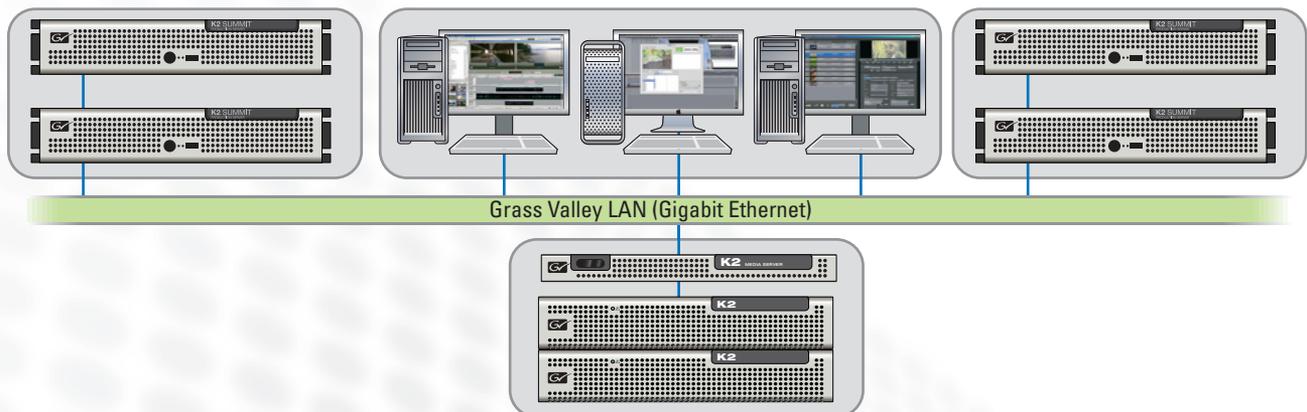
K2 Summit can also be used in a true SAN configuration, a capability others cannot provide.

The main advantage of a SAN is to offer shared resources such as highlights and playlists, along with a flexible number of inputs/outputs with full shared access (each controller can access any record channel).

The K2 SAN architecture can also connect editing stations for editing-in-place while ensuring bandwidth control for simultaneous FTP file transfers and real-time read/write access for K2 Summit clients.

The K2 SAN architecture is also scalable, allowing expansion of the initial system over time to increase:

- The number of channels
- The storage capacity
- The FTP bandwidth
- The number of editing stations



K2 Summit (cont.)

Compression Formats

To maximize interoperability, K2 Summit offers a wide array of compression formats:

- DVCAM
- DVCPRO 50
- DVCPRO HD
- MPEG IMX
- XDCAM HD
- XDCAM EX
- AVC-Intra

Other systems often use non-mainstream or proprietary codecs. These codec choices make it more difficult to exchange content to be used by other systems.

File Import/Export

To ensure optimum integration with third-party systems without requiring additional and costly interfaces, K2 Summit uses common formats and has standard wrapping and unwrapping of essence files using MXF, GXF, or MOV.



Because format support and removable storage is restrictive, files from other suppliers' products are not easy to use with third-party systems. Often extra hardware and software components must be purchased to exchange material.

Editing

The K2 platform architecture provides easy integration with editing systems such as Grass Valley EDIUS or Aurora™ Production Suite, without any additional resources (software options, transcoders, etc.).

By using the K2 FCP Connect plug-in, you can integrate multiple Final Cut Pro 7 systems with K2 servers and storage.

These editing systems can be configured to:

- Directly access the media stored on the SAN (edit-in-place)
- Transfer files between the server and the edit stations

The great benefit of the edit-in-place model is the ability to edit material while it is being recorded (growing files), and therefore save valuable time when building sophisticated production packages.

Agile Playback

A primary feature of the K2 media server family is the ability to play back-to-back clips of different resolutions, aspect ratios, and compression formats.

This is important because even though an event is recorded in a single format, the production may need to include archival material or content from other sources.

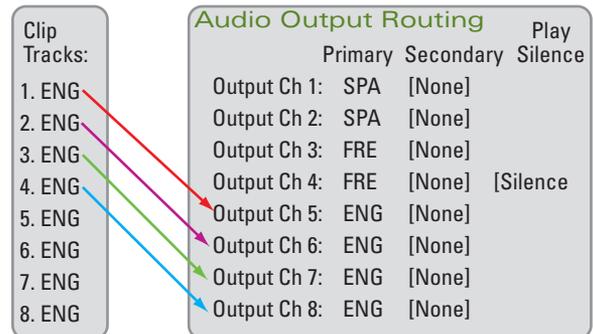
There may not be time for transcodes or conversions. Other systems do not offer the diversity of conversion capabilities for attributes such as aspect ratio management on a clip-by-clip basis.

All K2 media servers are easily re-configured on a channel-by-channel basis using our AppCenter configuration software tool. Other systems must change the entire system from one format to another, and these changes require a reboot of the system.

Audio

K2 Summit has 16 embedded audio tracks per channel in addition to eight discrete audio tracks per channel.

Optionally, each K2 Summit SDI stream can support up to 16 audio tracks per video channel, but each video can support up to 32 audio tracks, and the mapping between tracks and outputs can be static or dynamic.



K2 has additional audio tools not found on other systems, including adjustable audio timing delay, audio click filter, and audio gain adjustments that can be saved as clip data.



K2 Summit (cont.)

Multiviewer Monitoring

K2 Summit and K2 Solo both include a nicely integrated VGA multiviewer output providing display of all inputs and outputs of the server without requiring SDI monitors. The multiviewer also offers a variety of on-screen data (including audio levels) that can be selected and positioned.



K2 Summit and K2 Solo also come standard with a main SDI output ("on-air") and a secondary SDI output for monitoring purposes which also includes the same display of on-screen data.



Form Factor

For easy installation in limited spaces, K2 Summit and K2 Solo are an economical 2 RU each, while other systems can be 4, 5, or 6 RU in size.

As many mobile operators share resources, it is a challenge to move other systems from one OB van to another. They also take up more space that is at a premium in many situations.



Serviceability

K2 Summit has easy serviceability with thumbscrews, and major components that slide in and out. Other systems require a great deal of disassembly to replace failed parts and must be taken out of the rack.

K2 Dyno Replay System

From its inception, the K2 Dyno Replay Controller was always intended to be more than a simple replay controller.



Ease of Use

Reliance on outdated interface implementations only appeals to dedicated technicians who have invested extensive time and training to master a particular product.

The K2 Dyno Replay Controller has been designed with experienced operators to ensure an intuitive approach and limit training to a minimum.

The K2 Dyno Replay Controller provides colored buttons, a Windows UI using colors, and a touchscreen on the control panel.

The panel can be augmented with a keyboard, a mouse, and a separate VGA interface output.

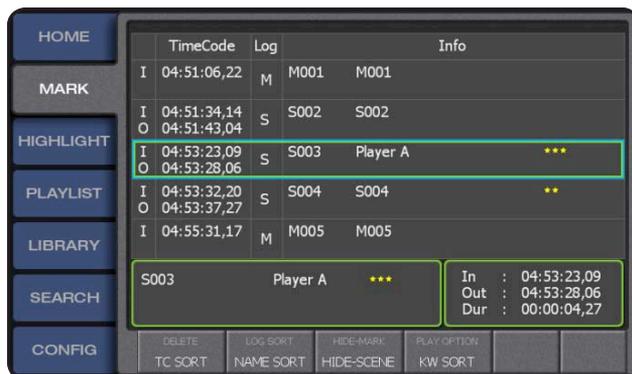
User data includes text for items such as clips and metadata rather than just a series of numbers.

The K2 Dyno Replay Controller is purposely designed to appeal to a wider range of users who may not be technicians but who understand the nuances of a particular event and can more easily use their creative abilities to enhance a production.

Clips, Highlights, and Playlists

On-the-fly clip marking during recording, in/out point trimming, best shot selection, ratings—all of these operations only require a few keystrokes.

Playlist creation and editing is also very intuitive with a choice between keystrokes and touchscreen.



Content Management

As program producers move to a file-based workflow, being able to manage material and enhance it for reuse is increasingly important.

With the K2 Dyno Replay Controller, users can create metadata layouts offline in advance to tag information such as names and relevant event action types. This metadata can be easily distributed and imported as XML data on a USB drive.

Clips can be given text names and text metadata can be added during the event along with ratings and icons.

All metadata created can be saved with the associated content and used from session to session or system to system.

Content can be aggregated into different bins and sent to removable storage or network destinations.

With other systems, the entire function of content management is both weak and cumbersome as they were developed prior to producers' needs and have not kept up with technological developments.

For users needing advanced content management for live production, please see the K2 Dyno Production Assistant section.

Removable Storage

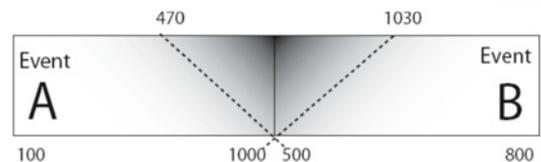


Other manufacturers' products use expensive options to take away material to be used with other production systems. These proprietary implementations only work with their own products.

The K2 Dyno Replay Controller has both USB and Gigabit Ethernet connectivity so that standard, off-the-shelf IT storage devices can be used.

Mix/Effects

Channel counts on systems are not always as they first appear.



When playing out with effects such as dissolves and fades, the K2 Dyno Replay System can handle these as a single channel on each of the server's output channels.

For example, a replay on one channel and a playlist on another channel can both include effects.

K2 Dyno Production Assistant



K2 Dyno Production Assistant (PA) is a software platform for managing content for live event productions.

Content from multiple K2 Dyno Replay Controllers, K2 production clients, and other K2 storage systems can be reviewed, modified, and transferred in an easy and intuitive manner.

Therefore, while K2 Dyno PA can add enhanced capabilities when integrated with K2 Dyno Replay Controller systems, it can be also used for other live production tasks when the replay controllers are not used or available.

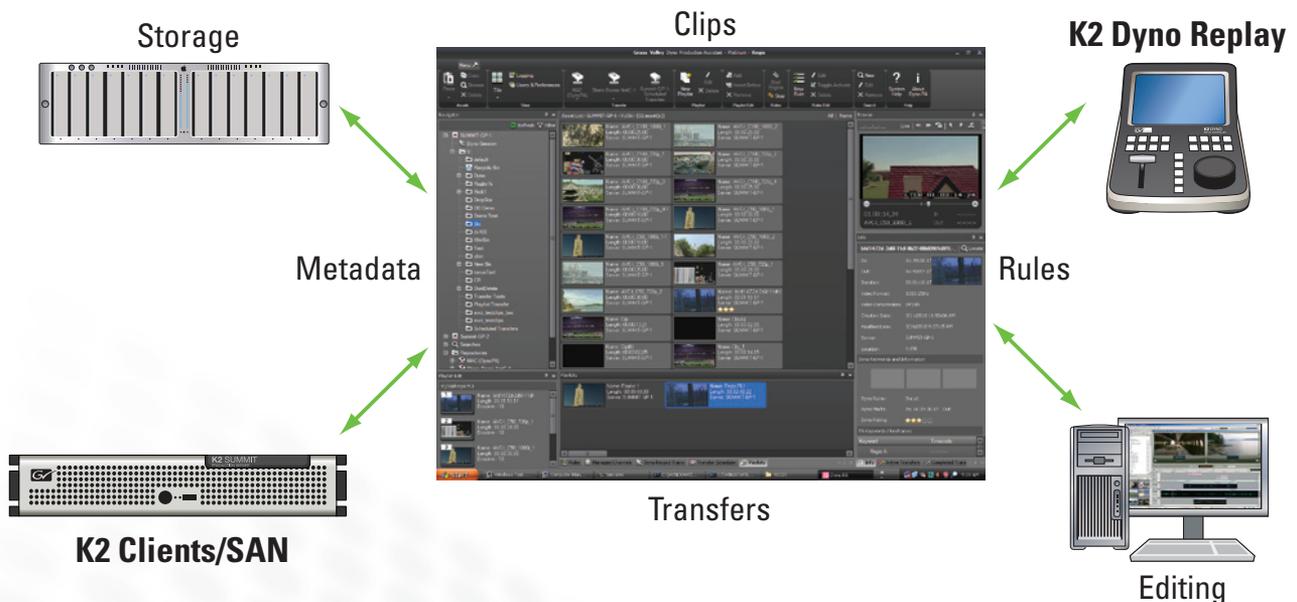
As with the K2 Dyno Replay Controller, the K2 Dyno PA's software is intuitive and easy to use. The focus is on production roles rather than having an operator tied to a particular device. In this way, production companies can draw from a wider pool of production personnel. This flexibility permits a more diverse, or smaller number of personnel to perform required tasks which are vital for the production of every size event.

Many live event productions face tight budget constraints, while at the same time there is an increased need to quickly re-package and re-use event content. K2 Dyno PA is a solution that can perform background tasks and offer various interfaces to review, log, modify, augment, transfer, and package content in a unified manner, so the job gets done faster.

K2 Dyno PA is based on a software services platform. The software platform is deployed on a PC platform with Gigabit Ethernet connectivity.

The system is completely scalable for virtually any number of ingest/replay channels, content destinations, and production staff. The underlying infrastructure for recording, storing, and replay is provided by K2 production clients.

The platform can support scenarios where a single user client provides a global point of control, as well as where multiple clients are deployed to directors, media managers, or editors with individual workspace layouts tailored to their specific needs.

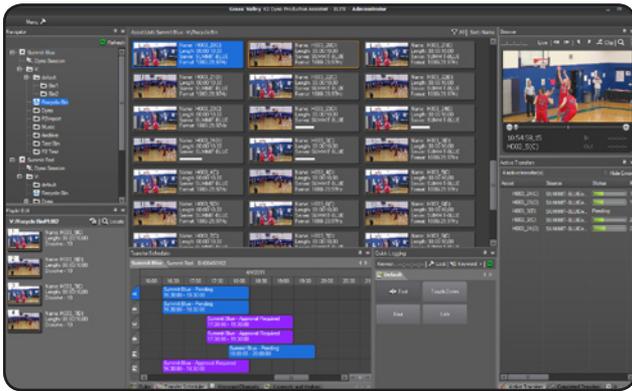


K2 Dyno Production Assistant (cont.)

Ease of Use

Rather than only appealing to dedicated technicians who have spent extensive training time to master a system, K2 Dyno PA provides modern interfaces using standard keyboard and mouse operations for use by creative production staff. With intuitive tools, metadata becomes an integral part of the entire production process.

K2 Dyno PA content management is purposely designed so that users who are familiar with common business applications will be comfortable completing production tasks. The end result is that any level of production can be done with greater efficiencies while benefiting from a more polished look and feel both during and after an event.



K2 Dyno PA features:

- Toolbar for quick access to all functions
- Explorer for viewing, navigating, filtering, and searching
- Lists with text and thumbnails to display content
- Playlist creator and manager
- Logging, adding, and modifying metadata
- Controls for server ingest and playout channels
- Rules creation of background tasks
- Content sharing of all material on the network
- Export and transfer of content to destinations including editors

Advanced Content Management

As productions move more and more to file-based workflows, being able to manage material and enhance it for re-use is increasingly important.

By providing an intuitive toolset, metadata becomes an integral part of the entire production process during and after an event. Users can create metadata layouts off-line in advance of a production to tag content later during the production.

Metadata layouts can be easily distributed and imported as a simple XML file to all replay systems. Content can be logged and metadata can quickly be added during a production.

Metadata from K2 Dyno Replay Controllers can be searched on and appended. All metadata created can be saved along with the content and used from session-to-session or system-to-system.

K2 Dyno PA can direct assets to specified storage destinations. Content can be aggregated and transferred to fixed network locations or removable media to be used for post-production or archive. It is also possible to schedule transfers at set times. With K2 Dyno PA, organizing and managing media is made simple.

In addition, K2 Dyno PA can create new media by reviewing and sub-clipping existing highlights, or defining new highlights from incoming recordings. K2 Dyno PA can also assemble material as playlists ready for playout.



K2 Dyno Production Assistant (cont.)

Scalability

Unlike other systems, K2 Dyno PA can be installed on a single workstation or deployed over a client/server architecture. This flexibility allows it to be used by several operators according to the number of connected servers, channels, replay controllers, edit station, and storage systems.

K2 Dyno PA permits grouping of K2 server storage within a single and unique workspace. Any number of K2 clients can be combined into streamlined user workspaces. And any number of channels can be controlled and grouped in an easy to use manner.

Editor Integration

Edit systems such as Grass Valley EDIUS, Apple Final Cut Pro 7, and Avid Media Composer can be networked to K2 clients, and files transferred.



Grass Valley and Apple editors can also be configured to directly edit-in-place growing files. Metadata can also be sent to EDIUS and Final Cut Pro 7 and interchanged to use when searching in edit workstations for material.

As the K2 platform provides file wrapping of MXF and MOV, the content can easily be shared with systems such as editors and archives, with no special equipment or processes.

File-Based Interoperability

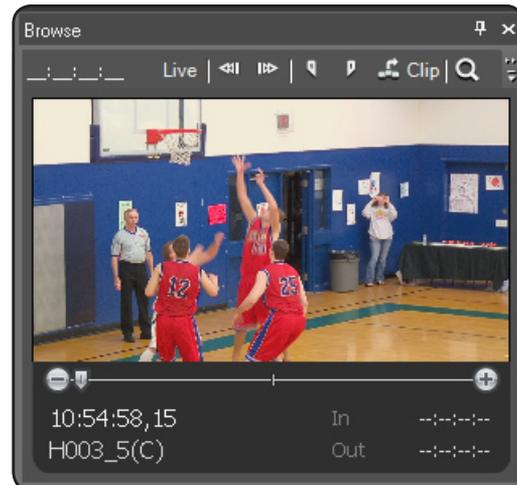
The K2 clients offer QOS-managed, guaranteed-bandwidth networking that K2 Dyno PA takes advantage of when performing file transfers in the background while production operations are occurring.

This includes a rules engine for moving content between servers and to network storage locations, as well as standard off-the-shelf removable USB and NAS storage devices.

Users can create a library of rules and select which ones to use for a particular event.

The use of standard IT technologies makes providing true file-based production simple.

Files sent in and out use standard file wrappers such as MXF and QuickTime/MOV. All networking and file transfers are accomplished with no additional software and hardware components needed.



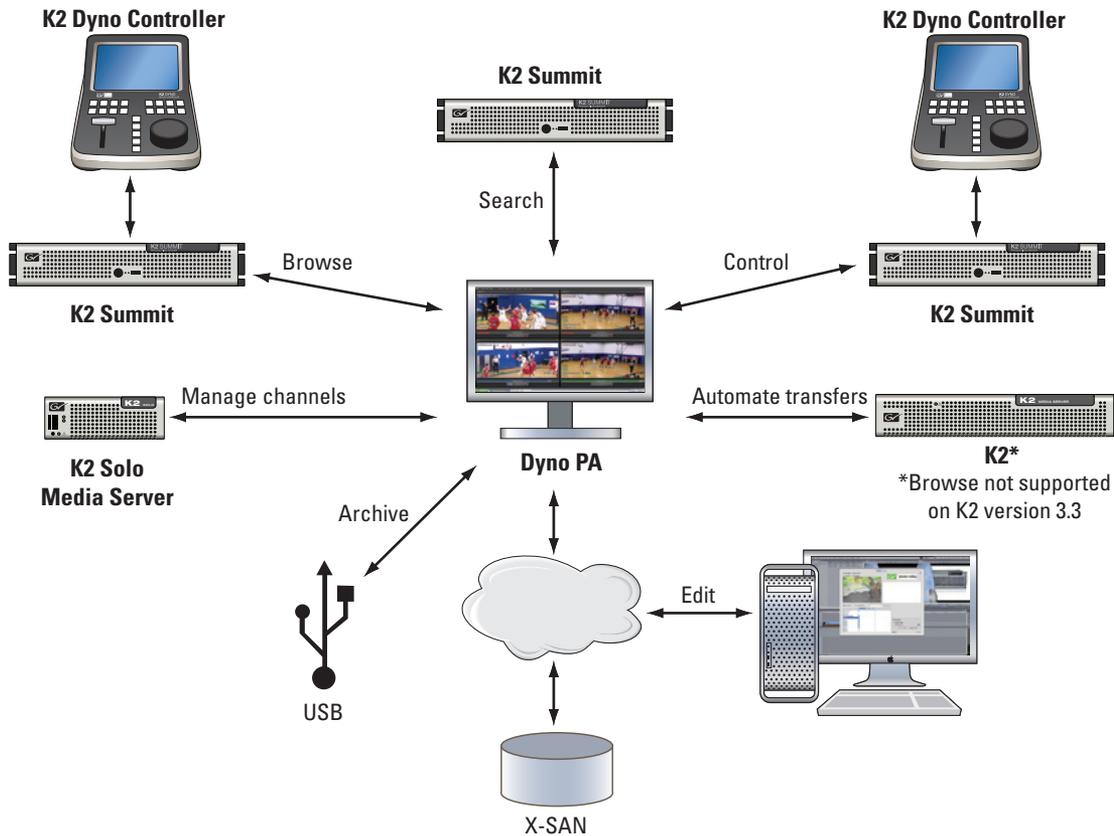
K2 Dyno Production Assistant (cont.)

System Integration

Integration of a K2 Dyno PA does not require any modification to the system's video network.

K2 Dyno PA is based on the standard Gigabit Ethernet connectivity of the K2 platform and includes all tools to copy/move content between servers, network storage, removable storage, and editors.

K2 Dyno PA runs on standard PC platforms, including laptops for clients' seats, and is compatible with Windows XP/7.



Conclusion

As you have seen, file-based live production delivers many advantages to production crews, but leveraging all the benefits that it provides are complex. The Grass Valley K2 family of solutions gives you the power and simplicity to significantly enhance your live production workflow without added complexity.

To learn more about Grass Valley K2 file-based live production solutions, visit www.grassvalley.com/products/servers.

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