



FlipFactory®

PIPELINE WORKFLOWS

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This
App Note
applies to
versions
6.0 & later



Synopsis

This app note describes how Pipeline and FlipFactory work together to enable a variety of media workflows and how related system and architectural issues affect how workflows should be designed and implemented.

Workflows describe how specific media can be produced from the Pipeline, and ingested into a specific FlipFactory factory (or series of factories) for transcoding to produce media in specific formats. Each workflow includes a system diagram, details about each factory in the workflow, a workflow diagram detailing input, processing, and output, and implementation notes for you to apply to these or similar workflows in your own environment.

Five workflows with wide-ranging requirements and applications are presented:

High-Res Archive Workflow. Produce a single high-resolution file containing one DV, DVCPro, IMX30/40/50 or MPEG2 50Mbps I-Frame only video essences. Formats such as MXF or GXF; MPEG2 or DV files for broadcast servers from Grass Valley, Pinnacle, Leitch, SeaChange, Omneon, Quantel and many others; files for edit systems such as Final Cut Pro, Avid, Adobe, Pinnacle, and more.

Hi-Res Archive and Proxy Workflow. Produce a single high resolution file and one additional file such as a lower resolution file to be placed on a broadcast server, a medium resolution proxy file for off-line editing, or a streaming media file such as Windows media, Flash or MPEG4.

iPod Single Transcode Workflow. Produce a single transcoded file such as MPEG4 for iTunes, an MPEG-2 file for a broadcast server, a Flash file for posting on your web site or a Windows Media file for daily production review.

Broadcast Server Workflow. This Broadcast Server Single-Transcode workflow typifies the majority of factories created in FlipFactory – the factory produces a single file. This factory creates DV (using Direct-convert) from DV output by Pipeline. The factory delivers the file to an Omneon Media Director, along with a dub list Notify.

Multiple File Transcode Workflow. Produce multiple files of differing types, from high resolution to low resolution stream files for the web or mobile.

NOTE

The PipelineWorkflowFactories.zip file on the Pipeline CD and Telestream Web site contains sample FlipFactory factories that you can import (for DV, IMX30, MPEG2). This file is an XML file for importing into your FlipFactory server. When unzipped, it creates the folder structure needed to support these factories. Some modifications to the folders for monitors and destinations will be necessary to implement them in your environment.

See FlipFactory User's Guide, Chapter 5, Using FlipFactory, for details on importing factories. To implement these sample workflows, you may need additional FlipFactory licenses.

System Considerations

Architectural Issues

This section of each workflow is the most critical to understand. It should be read carefully before you purchase a FlipFactory platform or implement this or similar workflows.

In order to design effective Pipeline | FlipFactory workflows and implement them via factory specifications, you should be aware of the subtle workflow nuances that affect the manner in which media flows from Pipeline to FlipFactory. The essential issue to understand is how Pipeline communicates with FlipFactory services: Pipeline connects over Gigabit Ethernet (RTSP/RTP/TCP/UDP) to a FlipFactory server using three independent digital streams transported over separate RTP connections.

- The first stream is a compressed elementary video stream with an essence of DV, DVCPro, IMX30, IMX40, IMX50 or MPEG-2 50I.
- The second stream is up to sixteen uncompressed 16-bit audio streams sampled at 48 KHz.
- The third stream contains control data and metadata. The control data is comprised of status information, error codes and other system data, and the metadata includes time code, closed caption data and other text fields dynamically selected at job submission time.

Due to the unique architecture of the Pipeline-FlipFactory combination, only one FlipFactory direct-convert or transcode process can connect directly to these three real-time Pipeline streams. Utilizing these architectural details, this app note is designed to assist you in the process of designing and implementing efficient factories for virtually any Pipeline-FlipFactory workflow.

FlipFactory Server

Careful consideration should to be taken in specifying a Pipeline | FlipFactory system. Several factors affect the performance of the overall system. These factors consist of the FlipFactory server's processing power (CPU type and speed), the server's RAM speed and size, the server's disk performance (read and write access) and the network connection between all Pipeline devices (SC and Quad) and the FlipFactory server platform.

- Sufficient CPU speed is required for acceptable direct-convert, transcode (decode | encode operations), proxy creation, etc.
- Sufficient disk-write performance is required for simultaneous ingest of multiple streams, up to 60Mbps per stream without failure
- Sufficient RAM speed and size is required to eliminate the need for excessive program read/writes, memory swapping, etc.
- Sufficient network bandwidth (Gigabit Ethernet) is required to handle multiple real-time video streams of up to 60Mbps per stream without failure.

Minimum and recommended system configurations are provided for each sample workflow. If your workflow demands are not known or will change over time, its best to plan for the highest demand workflow possible.

NOTE

If you're planning a combination of workflow types, always configure your FlipFactory server to accommodate each workflow's most demanding requirement.

Organization and Structure

Each of the workflow examples in this app note are organized in the same manner. Each workflow includes the following sections:

Overview. An explanation of the general workflow being accomplished. This explanation briefly describes FlipFactory components including submit methods, media products and their respective destinations, and notification processes that complete the job. This section also includes a system and media transfer diagram to illustrate how the systems are inter-connected and how media flows between the systems.

System Configuration Requirements. This topic explains how the workflow affects the various system components: whether this workflow is CPU intensive, disk I/O intensive, network intensive or any combination thereof. Use this topic to obtain a general sense of what kind of platform performance is required to support this or similar workflows in your environment.

Factory Specifications. Specific details about each factory component (input, process, product, notify, etc.), including detailed workflow diagram for each factory in the workflow, including input, processing, and output details.

Workflow Notes. Detailed notes on the specifics of the overall workflow and of each step, describing the rationale behind the particular structure of the factory elements and how they interact to create the specific workflow.

FlipFactory | Pipeline Media Submission Options

FlipFactory is very flexible in its ability to ingest media from Pipeline. You can ingest media into a factory by the following methods:

- Use Pipeline Direct to create an EDL; submit it to an EDL monitor you've added to the factory by dropping the file into the monitor's target folder. For each clip in the EDL, a new job is submitted. FlipFactory controls the Pipeline clip by clip, to generate the media stream in realtime and transmit it to FlipFactory via the LAN for processing.
- Use Pipeline Direct to crash record a TIFO file of DV, DVCPro, IMX, or MPEG2 I-frame video, and submit the TIFO file manually, or submit it via a local or network monitor you've enabled in the factory.
- Use Pipeline Streaming by using the Submit Job window in FlipFactory to stream media directly from your Pipeline in realtime or at a schedule time (crash record, single-clip or EDL list) via the Gigabit LAN to FlipFactory for processing (available in FlipFactory 6.0 and higher).

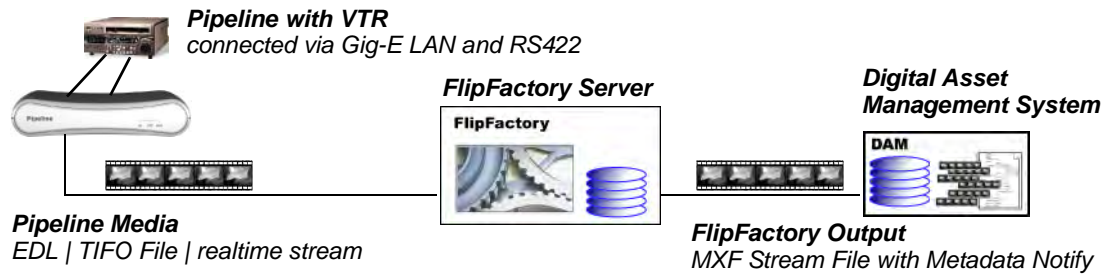
In each workflow in this app note, a specific media submission option is described. However, in most cases, you can freely modify the ingest method to one of these options to suit your workflow requirements.

High-Res Archive Workflow

Overview

This High-Res Archive workflow efficiently creates a high-resolution media file for archival purposes. This workflow employs a factory that re-wraps (*direct-converts*) the Pipeline video essence into the archive file type, delivers the archive file to a Digital Asset Management System and sends a notification containing metadata and media file references to the DAM.

Figure 1. Typical system and media transfer diagram for high-res archive workflow



System Configuration Requirements

Direct-convert factories cause minimal CPU load (because the essence is a direct-convert – it is not decoded and re-encoded) and high disk drive load when writing the media to disk.

System design must take into account the maximum number of simultaneous Pipeline streams. The optimum system design is one that separates the application storage volumes from the media storage volume.

Minimum System: Single, dual-core CPU running at 2.0Ghz with 2GB RAM, and a single 7.2K RPM storage drive. This configuration is suitable for up to two simultaneous streams.

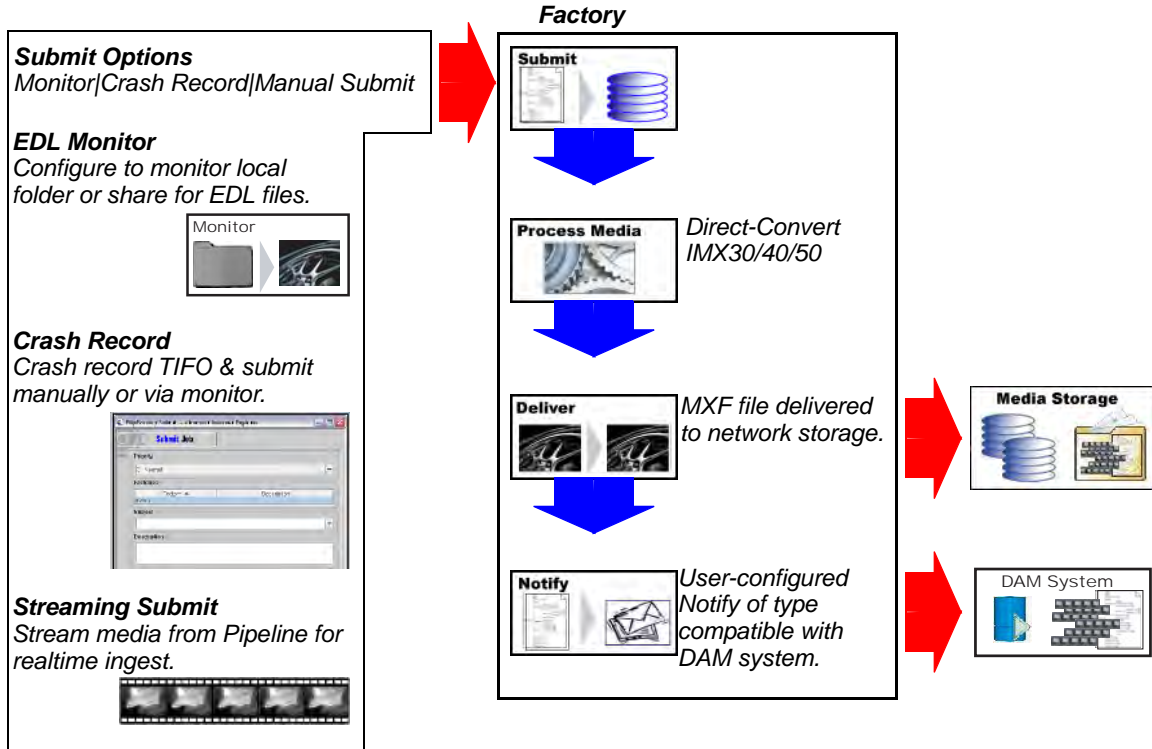
Recommended System: Dual, quad-core CPUs running at 2.33Ghz with 4GB RAM. RAID-1 system software drive array (two drives) and RAID-0 media drive array with at least four (4) 15K RPM drives¹. This configuration is suitable for up to 6 simultaneous IMX40/50/MPEG-2 streams or up to 8 simultaneous DV/DVCPPro/IMX30 streams.

Factory Specifications

- Input – Pipeline EDL monitor (for EDL files) or use other submit options
- Product – Process MXF Stream using the D-10 MPEG2 Direct-Convert codec
- Destination – Deliver to User-configured for Digital Access Management system's store
- Notification – User-configured notification of type that is compatible with your DAM system

1. The FlipFactory default temporary media store must be set to use the RAID-0 media storage volume.

Figure 2. High-Res Archive Workflow Factory Processes



Workflow Notes

You can build a workflow of this type by creating a factory with an EDL monitor. A Pipeline EDL monitor requires Pipeline and Codec selection, and a local folder or share to monitor for new EDL files you'll place there for processing.

In this example, the factory is ingesting Pipeline's compressed video essence directly, compressing the audio streams into their appropriate format and wrapping them in an MXF wrapper. Specifically, this factory wraps IMX 3/040/50 video essences and eight channels of audio to produce an MXF Stream D-10 OP1A file containing IMX video using the Direct-convert codec.

The resulting file is delivered to the DAM's store, which includes the file's UNC path and other details, in an XML file (or other format/structure as required by DAM).

Destination and Notification configuration is site-dependent. Choose the destination (SAN or network folder, for example) and MDML File Sample, XSL Transform, Dub List, or other Notification to suit your specific workflow requirements and your DAM system.

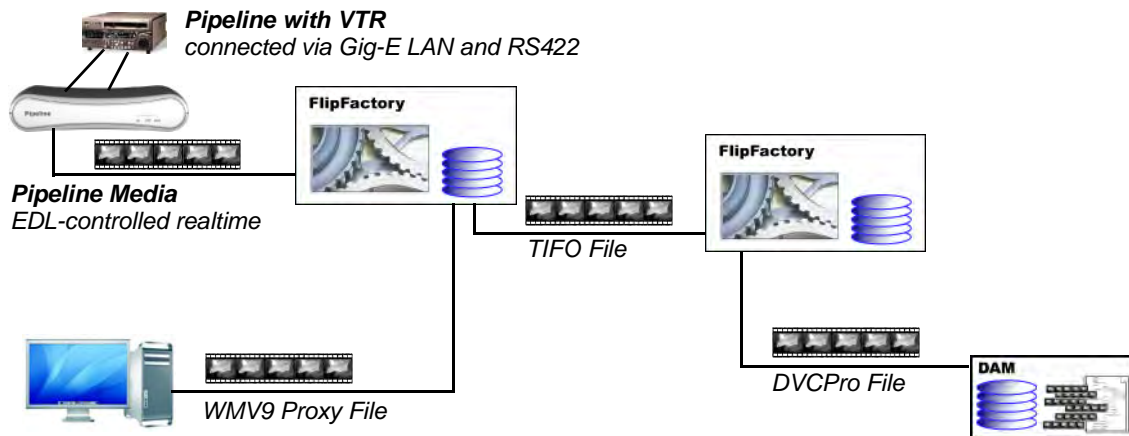
Hi-Res Archive and Proxy Workflow

Overview

This Hi-Res Archive with Proxy workflow has two factories. The factories create a high-res DVCPro archive file, plus a Windows Media 9 proxy with embedded time code for off-line editing.

Factory #1 produces the WMV9 proxy and delivers it to an editor's workstation. Factory #1 also produces a TIFO file from the Duplicate Original product as an intermediate media file for factory #2. The TIFO file is automatically forwarded and submitted to factory #2. Factory #2 direct-converts the TIFO file into DVCPPro and delivers it to an archive SAN.

Figure 3. Typical system and media transfer diagram for high-res archive and proxy workflow



System Configuration Requirements

This two-factory system has a moderate CPU impact on the server due to realtime ingest, decoding and encoding processes, and high disk drive load when writing the media to disk.

System requirements for this type of workflow are similar to those in High-Res Archive workflow, but with more detail paid to the number and speed of the CPUs. Proxy generation can consume ten times (or more) CPU cycles than a Direct Convert operation.

Minimum System: Single, dual-core CPU running at 2.0Ghz with 2GB RAM, one 7.2K RPM storage drive. This configuration is suitable for one stream.

Recommended System: Dual, quad-core CPUs running at 2.33Ghz with 4GB RAM. RAID-1 system software drive array (two drives) and RAID-0 media drive array with at least four 15K RPM drives¹. This configuration is suitable for up to 4 simultaneous IMX40/50/MPEG-2 streams or up to 6 simultaneous DV/DVCPPro/IMX30 streams.

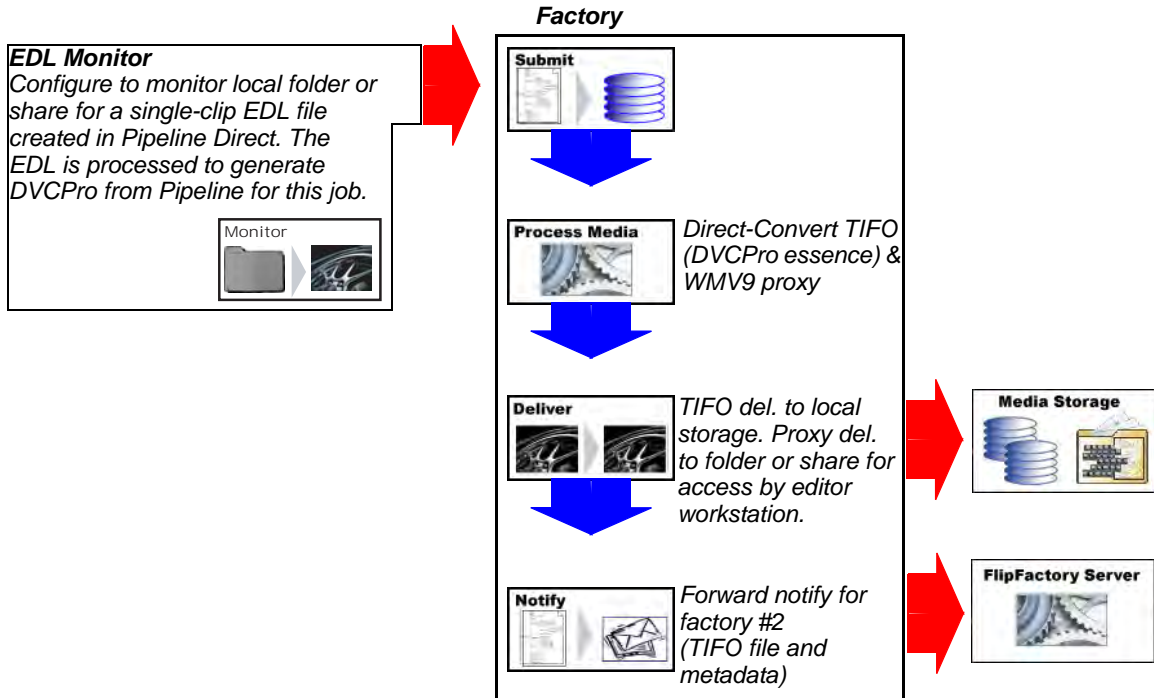
Factory No. 1 Specifications

- Input – EDL list, processed by EDL Monitor to encode & deliver DVCPPro video in realtime.
- Product #1 – Duplicate Original (TIFO file with DVCPPro video essence) and WMV proxy file
- Duplicate Original Destination – None – without a specific destination, FlipFactory automatically delivers it to the default store in FlipFactory.

1. The FlipFactory default temporary media store must be set to use the RAID-0 media storage volume.

- WMV Proxy file Destination – User-configured destination to required location
- Notification – Forward to Factory #2 for further processing

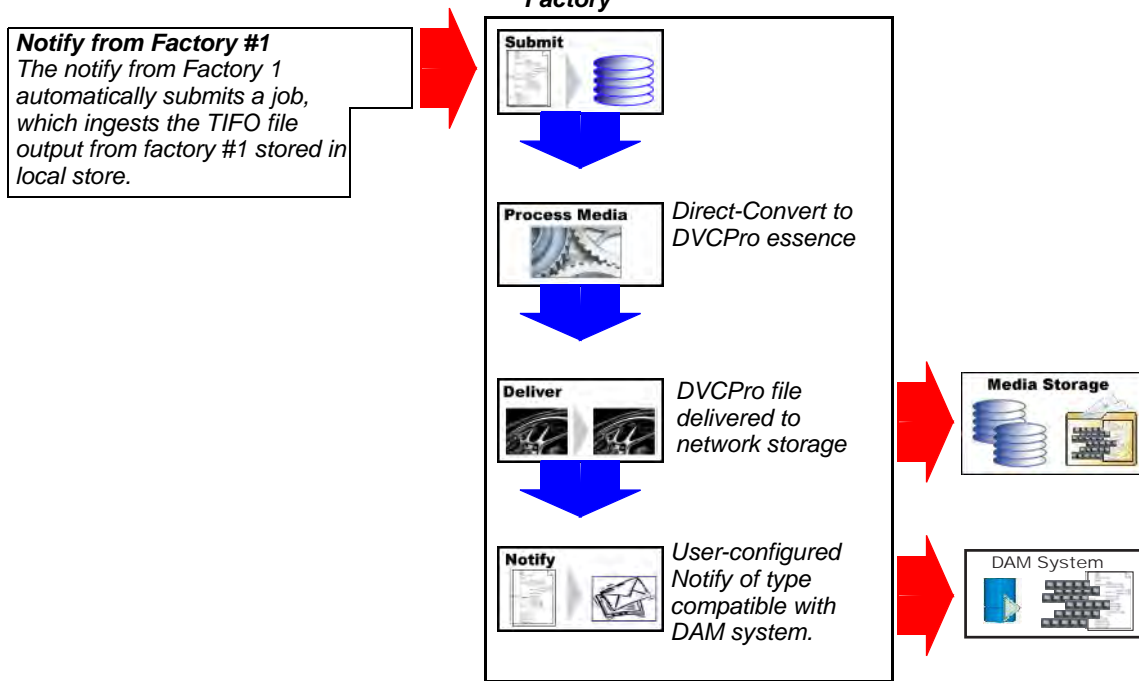
Figure 4. High-Res Archive and Proxy Workflow – Factory No. 1



Factory No. 2 Specifications

- Input – Automatic job submission via Factory #1 Notify: TIFO file with DVCPPro essence.
- Product – DVCPPro via direct-convert codec
- Destination – User-configured destination to the Digital Access Management system's store
- Notification – User-configured DAM system notification

Figure 5. High-Res Archive and Proxy Workflow – Factory No. 2



Workflow Notes

This workflow is designed with two factories. Because FlipFactory can produce an additional product in a single pass when producing a TIFO file, the first factory has been designed to efficiently produce the proxy file with negligible impact on the FlipFactory server.

Direct-convert factories can also be used to create any format you need (using compatible input essence), with minimal CPU cycles, from DV, DVCPPro, IMX30/40/50 or MPEG2 50Mbps I-Frame video essences.

(Submission options are discussed in the Hi-Res Archive workflow. The options are valid in this workflow as well as the others in this app note, and won't be repeated.)

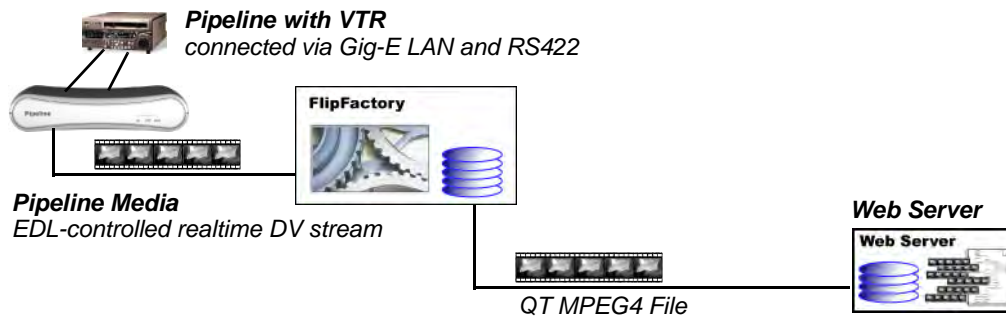
iPod Single-Transcode Workflow

Overview

This iPod Single-Transcode workflow has a single factory and one product. This factory creates an iTunes-compatible QuickTime MPEG4 file from any media essence you send from Pipeline (DV recommended). The factory delivers the file to a Web server, along with an associated XML metadata file for Podcast publication.

The Local + Metadata monitor can be used for submitting TIFO files, or TIFO files and associated XML files with external metadata.

Figure 6. Typical system and media transfer diagram for iPod workflow



System Configuration Requirements

This factory has a high CPU impact on the server during realtime ingest, decoding and encoding processes to produce small-frame size media, and light disk drive load when writing media to disk.

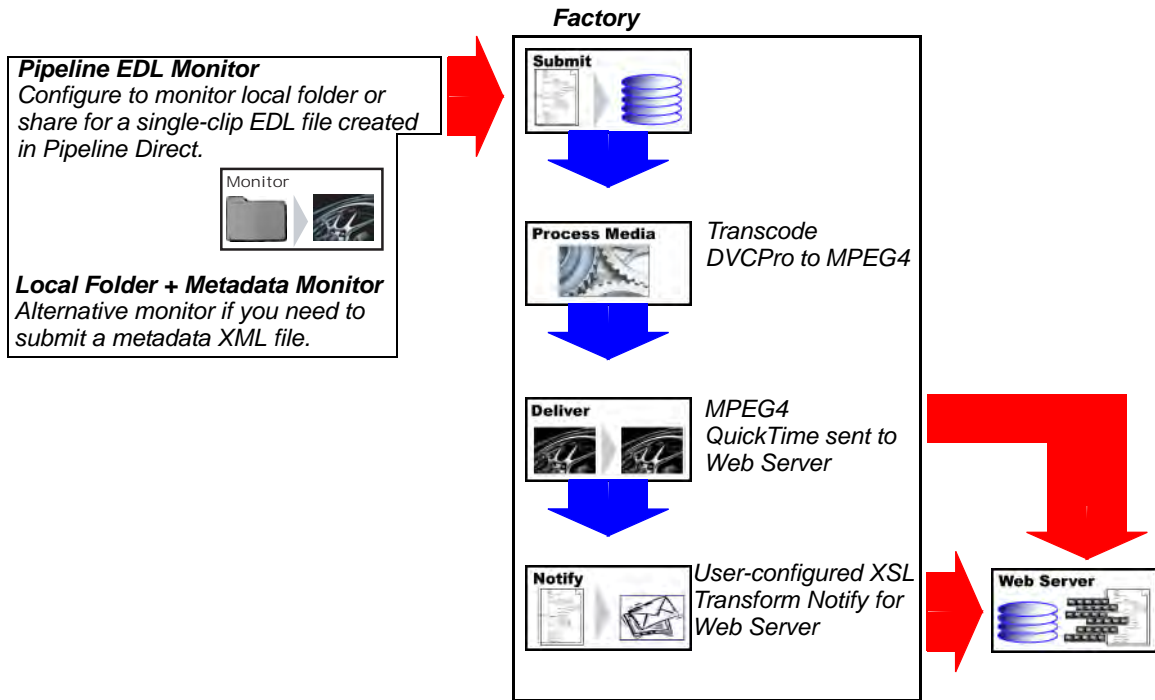
Minimum System: Single, dual-core CPU running at 2.0Ghz with 2GB RAM or better. This configuration is suitable for up to two simultaneous streams.

Recommended System: Dual, quad-core CPUs running at 2.0Ghz with 4GB RAM or better. RAID disk arrays are recommended but not required. This configuration is suitable for up to 5 simultaneous streams.

Factory Specifications

- Input – TIFO file with DVCPPro essence.
- Product – iTunes compatible QuickTime MPEG4
- Destination – Network location; a directory on a Web server
- Notification – XML metadata

Figure 7. iPod Single-Transcode Workflow



Workflow Notes

With this workflow, you can create an iPod-compatible MPEG4 file by enabling the iPod 320 x 240 movie codec in your Product. The file is delivered to the Web server's shared network folder. You can set up delivery via a WebDAV | FTP Server | Web Server (Local) | Samba Network Folder Destination, and configure the Web server directory where your media is published.

Also included in this factory is the creation of iTunes compatible metadata, delivered via an XSL Transform Notify, including a filename pattern, stylesheet, & Web server destination. The suggested notification can be used when you submit an XML metadata file. It is configured by you to suit your specific workflow requirements. For details on configuring the XSL Transform notification, see online Help in the FlipFactory console, and the FlipFactory User's Guide.

In this configuration, equipped with a Pipeline EDL monitor, the factory is controlling the Pipeline via a VTR based on clip timecodes in the EDL you submitted, and ingesting Pipeline's output by decoding and re-encoding the media to produce the MPEG4 file. Any Pipeline essence can be used as input; DV will probably produce acceptable results in the fastest processing time.

If you want to submit a TIFO file and an optional XML file with external metadata, add a Local Folder + Metadata monitor. By default, this monitor does not wait for XML files, so you can use it to submit the TIFO file.

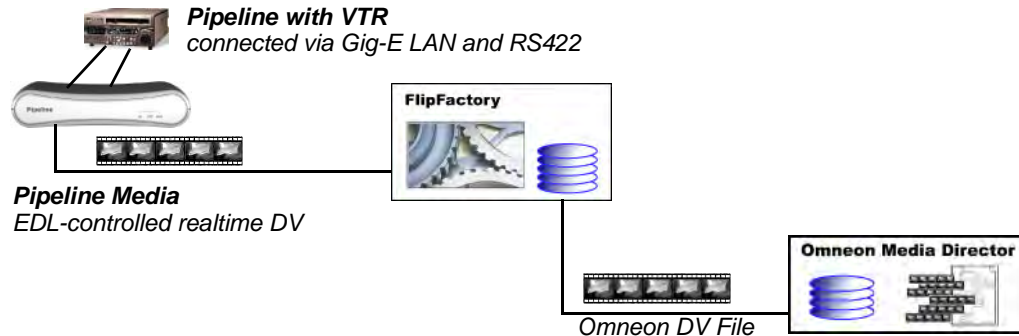
The product in this example factory can be modified to create any type of file format required.

Broadcast Server Single-Transcode Workflow

Overview

This workflow typifies the majority of factories created in FlipFactory – it produces a single file. This factory creates DV (using Direct-convert) from DV output by Pipeline. The factory delivers the file to an Omneon Media Director, along with a dub list Notify.

Figure 8. Typical system and media transfer diagram for broadcast server workflow



System Configuration Requirements

This factory has a moderate CPU impact on the server due to realtime ingest, decoding and encoding processes, and moderate disk drive load when writing the media to disk.

Direct-convert factories cause minimal CPU load (because the essence is a direct-convert – it is not decoded and re-encoded) and high disk drive load when writing the media to disk.

System design must take into account the maximum number of simultaneous Pipeline streams. The optimum system design is one that separates the application volumes from the media volume.

The system should have a two-drive RAID-1 volume for the system OS and FlipFactory software, and a three-drive (or higher) RAID-1 array for media storage.

Minimum System: Single, dual-core CPU running at 2.0Ghz with 2GB RAM, and a single 7.2K RPM storage drive. This configuration is suitable for up to two simultaneous streams.

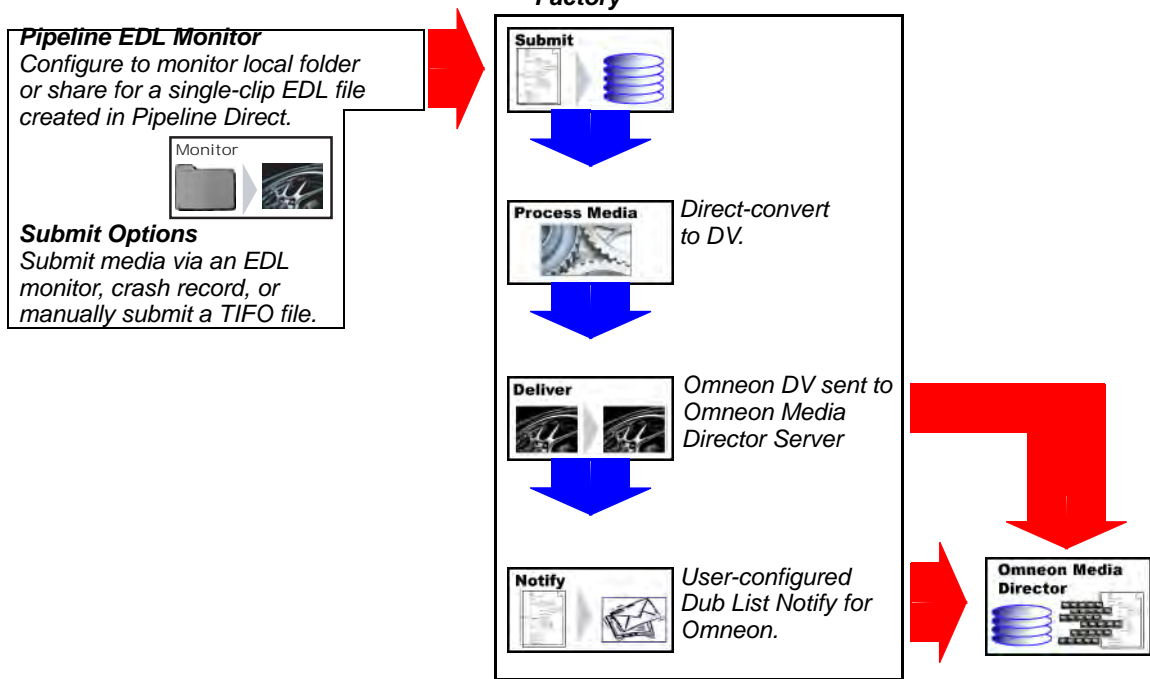
Recommended System: Dual, quad-core CPUs running at 2.33Ghz with 4GB RAM. RAID-1 system software drive array (two drives) and RAID-0 media drive array with at least four (4) 15K RPM drives¹. This configuration is suitable for up to 6 simultaneous IMX40/50/MPEG-2 streams or up to 8 simultaneous DV/DVCP/IMX30 streams.

Factory Specifications

- Input – DV realtime stream
- Product – Omneon using DV Direct-Convert codec
- Destination – Omneon MediaDirector
- Notification – Dub List Notify

1. The FlipFactory default temporary media store must be set to use the RAID-0 media storage volume.

Figure 9. Broadcast Server Single-Transcode Workflow



Workflow Notes

With this workflow, you create an Omneon file using the DV direct-convert codec and deliver it to the Omneon MediaDirector's SAN.

This configuration is equipped with a Pipeline EDL monitor, where the factory is controlling the Pipeline via a VTR based on clip timecodes in the EDL you submitted, and ingesting Pipeline's DV output for direct-conversion to the DV file.

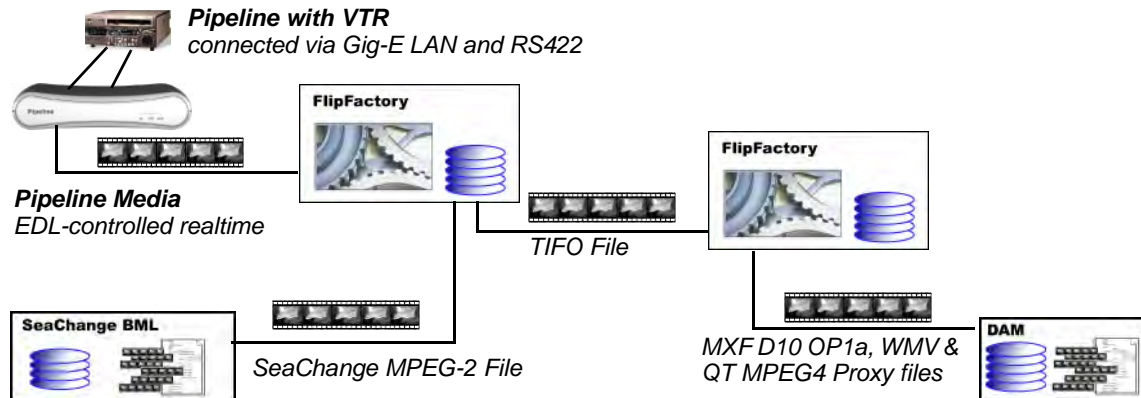
The suggested Notification is Dub List notification, set up with a user-selectable filename pattern, stylesheet, and destination for your Omneon Media Director. For details on configuring the Dub List Notification, see the online Help in the FlipFactory console, and the FlipFactory User's Guide.

Multi-File Transcode Workflow

Overview

This multiple file transcoding workflow is another example of a two-factory workflow; this one creates two hi-res files and three low-res proxy files from the DVCPro source.

Figure 10. Typical system and media transfer diagram for multi-file transcode workflow



System Configuration Requirements

This dual-factory configuration has high server CPU impact due to realtime ingest, decoding and MPEG2 encoding processes, and high disk drive load when writing the media to disk.

This type of workflow requires multiple, fast CPUs and drive arrays configured to handle a large volume of transcoding and writing large, high-bitrate media files to a media disk array.

Minimum System: Dual, dual-core CPU running at 2.0Ghz with 2GB RAM, one (or more) 7.2K RPM storage drive(s). This configuration is suitable for one stream.

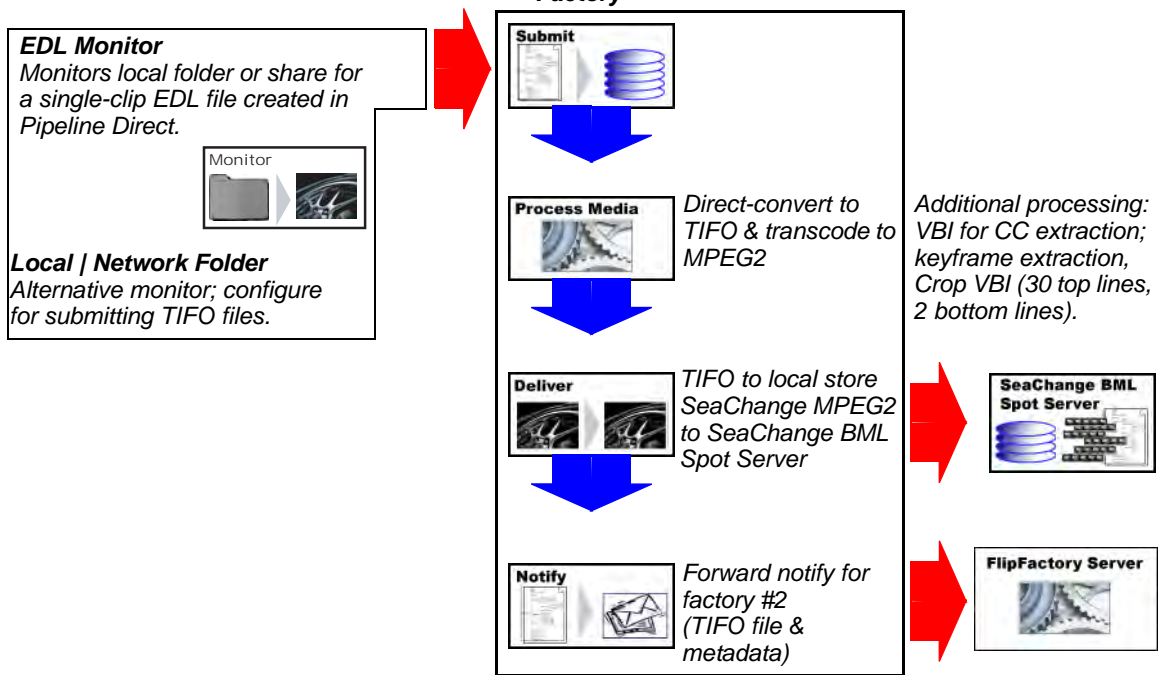
Recommended System: Dual, quad-core CPUs running at 2.33Ghz with 4GB RAM. RAID-1 system software drive array (two drives) and RAID-0 media drive array with at least four 15K RPM drives¹. This configuration is suitable for up to 3 simultaneous IMX40/50/MPEG-2 streams or up to 5 simultaneous DV/DVCPro/IMX30 streams.

Factory #1 Specifications

- Input – DVCPro realtime stream ingested from Pipeline under control of VTR via EDL
- Product #1 – Duplicate Original (TIFO file with IMX video essence)
- Destination – Automatic delivery to FlipFactory's default location for ingest by Factory #2
- Product #2 – SeaChange 6Mbps MPEG-2 file
- Destination – SeaChange BML spot server
- Notification – Forward to Factory #2 for further processing

1. The FlipFactory default temporary media store must be set to use the RAID-0 media storage volume.

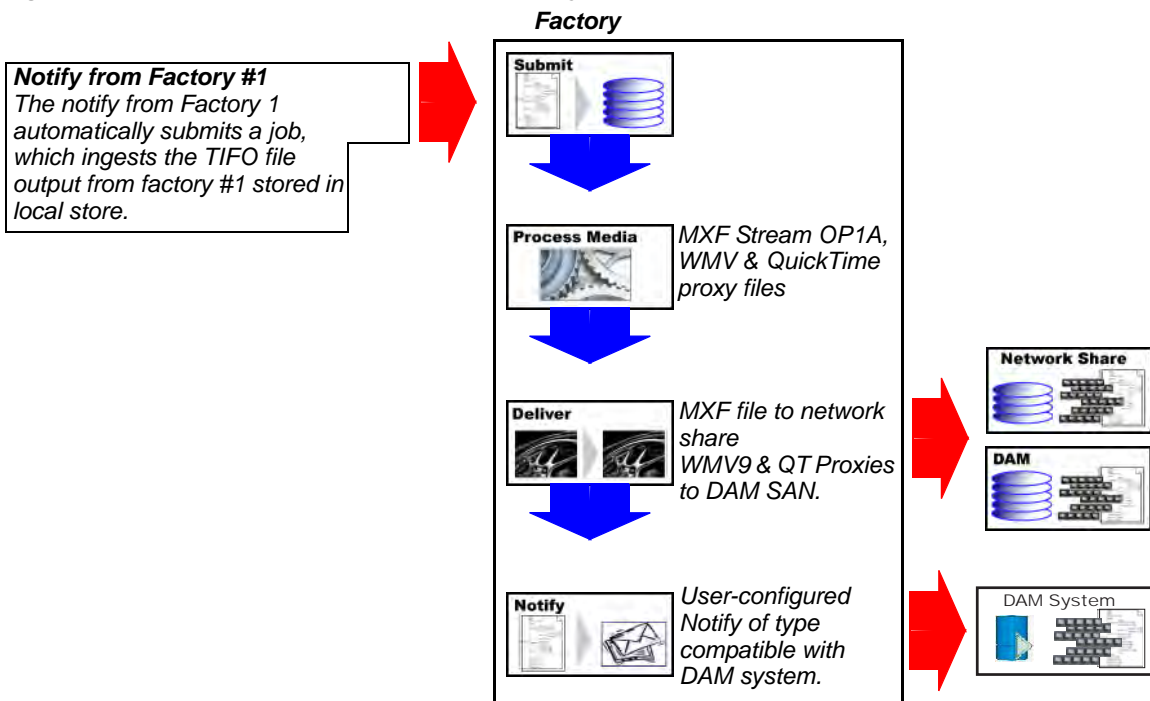
Figure 11. Multi-File Transcode Workflow – Factory No. 1



Factory #2 Specifications

- Product #1 – MXF D-10 OP1A direct-convert
- Destination –Network destination to the DAM SAN
- Product #2 – WMV9 proxy with time code
- Destination –Network destination to the DAM SAN
- Notification – User-configured DAM system notification
- Product #3 – QT MPEG4 proxy with time code
- Destination – Network destination to the DAM SAN
- Notification – User-configured DAM system notification

Figure 12. Multi-File Transcode Workflow – Factory No. 2



Workflow Notes

In this 2-factory workflow, factory #1 creates the TIFO file and a SeaChange MPEG-2 file, which is delivered to a SeaChange BMS/BMC server. The TIFO file is forwarded to factory #2, which ingests and direct-converts it to an MXF D-10 OP1a, then transcodes it into WMV and QuickTime proxy files.

This factory's Notify updates a DAM database with paths to media files. Process/Analyze tools provide metadata (keyframes and time code). A Notify is sent to the automation server.

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FlipFactory has been designed for professionals skilled in the art of digital media transformation and workflow automation, to facilitate the automation of complex media operations and workflow that require a multitude of input and output media formats, delivery to numerous types of media devices and file systems, and notification of media systems including broadcast automation systems and media asset management systems.

The FlipFactory architecture and user interface is designed to provide maximum flexibility in the setup and configuration of these complex media transformations and workflow. In providing this high degree of flexibility, it is possible for media transformation and workflow processes to be configured that are impractical, likely to result in unexpected or unintended results, or beyond the limits of FlipFactory to perform satisfactorily. Additionally, FlipFactory may be executed on a platform that lacks the performance or capacity to perform the media transformations and workflow you've configured, which is your responsibility to specify. Telestream has chosen to implement FlipFactory to provide the greatest flexibility without limiting its functionality to only those transformations and workflow that are known with certainty to be within its performance capabilities, including those limits imposed by the platform upon which you have installed FlipFactory.

Therefore, you acknowledge that you may create transformations and workflow that are impractical or beyond your FlipFactory installation's limits, and Telestream does not warrant that each transformation or workflow you specify or use will complete without error.

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