

AUTOMATED WORKFLOW INTEGRATING YOUR BEST-OF-BREED SYSTEMS

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Rapid advances in both broadcast and information technologies have resulted in more frequent replacement of systems in all segments of the broadcast management and operations process. As new systems are installed for planning, content management, and automation - and legacy broadcast equipment replaced with IT-based technology - the need for integration of these “best-of-breed” solutions is essential to achieve the promised ROI from these systems.

In this context, the term “workflow” has entered our broadcast lexicon from its origins in scientific and business processes. If the optimized integration of multiple systems in a broadcast process is the objective, workflow is now the solution. Not surprisingly, as workflow has been introduced to broadcasting, the term has been used in many ways to suit the scope and purpose of the message containing it. Nevertheless, organizing the steps involved in the end-to-end broadcast-related process, and streamlining the movement and exchange of content and metadata among those steps are essential to extracting the value from your best-of-breed systems.

This paper examines the functions required from an automated workflow system, and the technologies available to support them. A sample workflow will be used to illustrate the types of tasks involved in a content management process and the actors (participants) designated to complete them. We will examine the types of tasks required and the required interactions among them. We will describe the role of the “workflow manager”, the capabilities required for directing the workflow based on task outcomes, and the options for required communication among tasks. Through this example, we will describe the process for creating an effective automated workflow. Finally, based on this author’s experience with several large-scale automated workflow deployments, we will outline recommendations for development and installation of automated workflow in a broadcast operation.

WHY AUTOMATE WORKFLOW?

Automated workflow solutions have been deployed for many business and scientific processes since

the early 90’s. One indication of what has been learned through that experience is expressed in this quote from an article by Michael Atherton, a management consultant and workflow expert:

“The idea that we can take a manual process and apply technology to it in a way that reduces costs and increases speed, reliability and accuracy is irresistible. However, this temptation is a significant trap ... implementation requires careful preparation, both in examining the process to be automated and the culture it will invariably change.”

Michael Atherton, Darwin Magazine, September 2002

With those irresistible goals in mind, the objective of this paper is to explore the “careful preparation” required for successful automated workflow.

Certainly “speed, reliability and accuracy” are compelling goals, but they are also somewhat general. In support of the case for using this technology in broadcast operations, I offer the following specific benefits that can accrue from well-designed workflow automation:

- The rules are documented so that manual processes and workflow decisions no longer depend on individual knowledge or interpretation. Creating an automated workflow requires moving the knowledge of a process from the heads of the participants to a structured and documented procedure, independent of any individual.
- Performance can be measured making it easier to find and eliminate bottlenecks. With a well-structured sequence of job statuses, the automated workflow manager can monitor each task and log its completion, providing both real-time job flow information and elapsed time per task for each job. By using additional metadata elements for filtering, these data can readily show the efficiency of tasks in handling different types of jobs. Questions like:

“How long does it take (and how much does it cost) to acquire and prepare a program delivered via conventional satellite feed vs. one delivered via digital file over broadband?”

can be answered with the actual results from a monitored workflow.

- Processes for new requirements can be created based on existing workflows more rapidly and at significantly less cost. From the top down, an end-to-end workflow can be seen as a hierarchy, with higher level processes consisting of a sequence of tasks that are themselves workflows. At lower levels of this tree, workflows are often reusable.

For example, a workflow to create an AAF content file using an MPEG2 file from a video server, timing metadata from the transmission automation system, and rights data from the program management system might find use in several higher-level workflows within production, distribution and asset management.

Reusing proven workflow sequences in this way can significantly reduce the time required to develop, test and deploy new workflows needed to meet new requirements.

These three benefits are among many that can be listed, but in our experience, they have proven to be among the most valuable.

WHAT IS WORKFLOW?

Defining the Terminology

With any new concept for problem solving (in this case, new to broadcasting), an agreement on what we are talking about and the terminology that will be used are prerequisites to productive discussion toward a solution. As is often the case with context-specific terminology, the “new” terms are simply synonyms for generic terms having the same meaning. Therefore, when I tell you that a *workflow* (process) is a sequence of *tasks* (steps) connected by *rules* (decisions), you will understand what I mean.

Tasks in the workflow are performed by *actors*. These actors can be *people* or *resources they control* - such as operators, workstations, edit suites, or departments - or *resources controlled by systems* - such as software applications, services or broadcast equipment.

Tasks, on the other hand, can be categorized into three types:

Tasks can be...	Meaning they are done by ...
Manual	People (an operator, workstation or department)
Automatic	Systems (software, equipment), without human intervention.
Auto-Assisted	Jointly by a system and people. Typically, an auto-assisted task uses a system to gather and present information to an operator in preparation for manual action.

From the description of a workflow as “a sequence of tasks connected by rules”, it is fair to conclude that this sequence is not fixed. In other words, the order of tasks can vary based on the rules. Therefore, what we are really talking about here is *automated workflow*, and in that case, a question that comes immediately to mind is “Who’s in control?”.

In fact, an automated workflow normally requires a controlling process referred to as a *Workflow Manager*. This is a software application designed to oversee the sequence and initiation of workflow tasks. I say “normally requires” because in a small workflow with few tasks and simple rules, it is possible to have each task evaluate its own result and initiate the next task without a separate controlling application. However, this technique has obvious and severe limitations as a general approach to workflow automation.

The last element in this primer on workflow terminology is the *job* (transaction). The job is the “target” of the workflow tasks. In the context of broadcast operations, an example of a job is a piece of content moving through a process to prepare it for transmission.

AUTOMATED WORKFLOW

The Workflow Manager

As suggested by the earlier description, the Workflow Manager acts as an “event engine” to drive the execution of tasks in the workflow. This can be a reasonably simple piece of software needing no detailed knowledge of specific task methods and objectives, but only knowing the possible results of each task, the applicable rules for using these results to decide which task is next. The Workflow Manager should also have some IT functionality for housekeeping, setup and communication.

Therefore, the Workflow Manager requires only three basic capabilities. Listed here with simple examples of each, they are:

The Workflow Manager must...	For example...
Test task results	If the program failed compliance review, return it to Programming.
Initiate new tasks	Add an entry to the job queue for the Dubbing Service.
Perform IT operations	Copy a file of metadata to a work area, such as a shared folder, for use in the next manual operation.

These functions can be viewed as tasks in their own right, and in this respect, the Workflow Manager is one of the actors in the workflow, in fact it is lead actor.

With this concept of a Workflow Manager in mind, a solution provider (aka software vendor) offering an “automated workflow system” usually provides a software application with this functionality including the ability to communicate with their other products, with systems from other vendors, or both. We’ll have more to say about this communication a bit later.

COMPONENTS OF THE WORKFLOW

Tasks, Rules and Actors

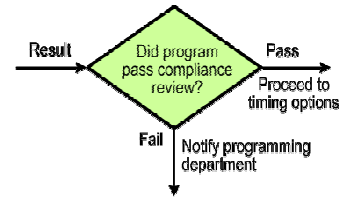
Returning to the topic of terminology, the best way to explain what we mean by *tasks*, *rules* and *actors* in a workflow is by example. Using content management in a broadcast facility as the context, examples of these workflow components are easy to list:

Tasks are the things that need to be done, such as:

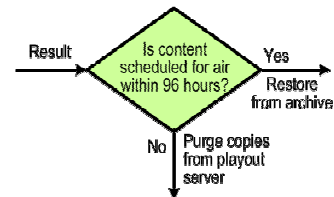
- Dub a tape to a video server clip
- Transcode a content file to “house format”
- Create a Windows Media proxy
- Archive a video server clip
- Produce a promo for a program
- Record a daily program feed
- Copy a content file to a playout server
- Review a program for standards compliance
- Get preparation instructions for a multi-segment program
- Copy a content file to the disaster recovery site archive

Knowing the tasks, examples of associated *rules* come readily to mind -

Here’s a rule:



and here’s another:

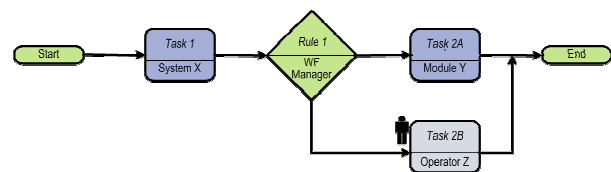


As mentioned earlier, depending on the category of a task, *actors* can be people or systems:

- Dubbing operator
- File transfer service
- Transcode service
- Proxy encoder
- Archive manager
- Edit suite
- Satellite record system
- Caching module
- Compliance reviewer
- Programming department

WORKFLOW DESIGN

Connecting the Dots: *The Workflow Diagram*



The *workflow diagram* is a tool for designing and documenting a workflow. The Workflow Manager normally provides a user interface (GUI) to create and maintain workflow diagrams, enter rules, and define procedures for tasks that will be performed directly by the Workflow Manager.

These “procedures” are often specified by a high-level scripting language that can be used to perform IT operations such as checking or updating database records, copying files, or sending messages. Some examples of typical Workflow Manager scripting

languages are SQL, Java, and Visual Basic, but the choices are certainly not limited to those three.

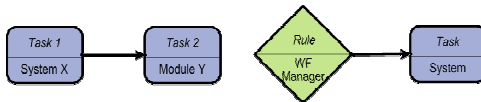
Keeping in mind the last benefit for workflow automation mentioned above (i.e. “processes for new requirements can be created based on existing workflows”) and the concept of a workflow hierarchy, workflow diagrams can be drawn at multiple levels. For higher-level workflows, such as end-to-end processes, the “tasks” are often entire, lower-level workflows which can be used in several such processes.

WORKFLOW COMMUNICATION

Powering the Workflow

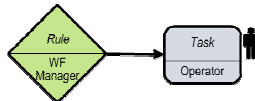
Communication among the actors is the power that drives automated workflow. With the wide range of possible actors, more than one technology is usually required to support this workflow communication. Since inter-actor communication is provided by the Workflow Manager, the full range of IT methods can be made available to accommodate the capabilities or limitations of different actors.

For *automatic* tasks that require system-to-system or rule-to-system (i.e. Workflow Manager to system) communication, some typical methods include:



- IP messaging: Web Services (XML/SOAP), CSF
- Database tables: Task queues, status elements, triggers
- File exchanges: Plain text, XML files
- Distributed objects: .NET, J2EE, DCOM, CORBA

For *manual* tasks requiring communication to people as actors, methods are often familiar ones like:



- Work orders via email forms, attachments or task lists
- URLs to generated HTML documents
- Operator alerts via IM or pop-ups

A WORKFLOW EXAMPLE

Process: Prepare Content for Air

To understand the integration of the workflow components we have been discussing, let's walk through the creation of a simple workflow for a content management process. Here's our requirement:

New content arrives via tape, satellite feed or digital file. A workflow is required to prepare the content for on-air use by the transmission automation system.

In planning this workflow, the requirements to consider include:

- Assignment of house identification
- Archiving of master copy
- Creation of proxy
- Frame-accurate timing
- Program segmentation
- Promo production
- Standards compliance review

This simple, high-level process description defines the scope of our workflow and provides a roadmap for its design.

Next: Order the Tasks & Identify the Actors

From the requirements above, the next step in design is to name and describe the specific tasks, their assigned actors, and the interdependencies among them. A simple table can be used to organize this information:

Step	Task	Applies to	Actor / Department	Must follow
1	Transcode to House Format	All	Transcode Module	-
2	Create Proxy	All	Proxy Encode Module	1
3	Copy to Archive	All	Archive Manager	1
4	Assign House ID	All	Workflow Manager	-
5	Time Content or Segments	All	Media Workstation / Operations	2
6	Produce Promo	Promo Dept	Edit Suite / Production	1
7	Compliance Review	All Programs	Proxy Viewer / Programming	5,6
8	Mark as Ready-for-Air	All	Workflow Manager	7

In this table the column *Applies To* specifies which jobs require each step or who is responsible for deciding which jobs require the step. *Must follow*

indicates steps that must be completed as a prerequisite for each step.

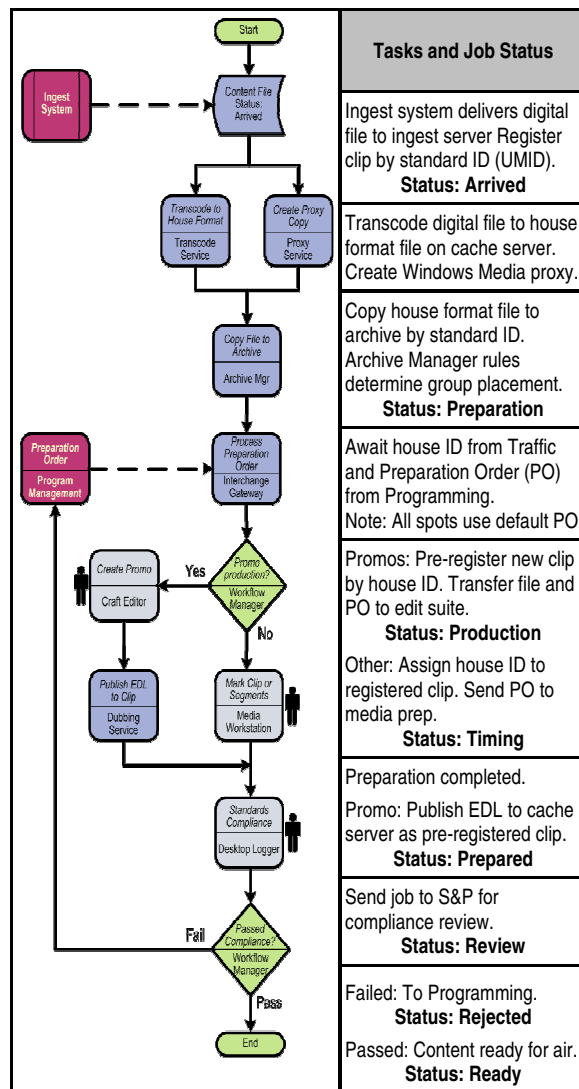
Next: Build the Workflow

From the simple task list above,, the detailed workflow can be created using workflow diagramming and scripting language tools provided by the Workflow Manager or other software utilities.

An important part of the workflow task sequence is a corresponding series of changes to a *job status* attribute maintained by the Workflow Manager. This record of each job’s progress (i.e. status changes) through the workflow – with associated time stamps – can be used to track individual jobs, gather statistics on the volume of jobs in different categories (e.g. programs, movies, spots, promos, etc), and analyze the performance of the workflow over a volume of jobs (i.e. identify bottlenecks).

This part of workflow development (diagramming and scripting) can be a time consuming process and requires in-depth knowledge of the system actors and manual procedures that will be followed. This work falls somewhere between systems analysis and software development, and requires considerable expertise. It is also the process that benefits most from the re-use of proven task sequences from other workflows.

The following table is a high-level representation of a workflow design. In an actual design this workflow table would reference detailed scripts for each rule and Workflow Manager task.



DEPLOYING WORKFLOW AUTOMATION

Lessons from the Field

Based on experience with the successful deployment of three large workflow solutions using these methods within the past eighteen months, we have compiled a list of practices that have worked well and pitfalls to avoid. Among these are the following recommendations:

- Define all your requirements first. Think about the functions needed and the users involved, not the technology required.
- Try not to focus on the end-to-end solution too early. Concentrate on one process (workflow) at a time.
- Begin with proven standard workflows or samples from your solution provider. It’s better to modify a

process that works, than to start from scratch.
Why?

- Past experience highlights pitfalls and reduces risk.
- Workflows that have been QA-tested and are in use can be deployed faster, and with better available support.
- Workflow development is time consuming and expensive.
- Keep each process (workflow) simple, logical and modular. If a workflow is too complex, users will have difficulty operating it and will hesitate to support the expansion of workflow automation.
- Check progress often during development and installation. Workflow problems can snowball, so get issues on the table for resolution ASAP.

WORKFLOW AUTOMATION OUTLOOK

As broadcasters continue to be faced with the rapid deployment of new technologies like HDTV, and delivery options such as mobile devices and Internet, maintaining an efficient and cost-effective operation will demand more from the systems they purchase. The perceived benefits of a single- or few-vendor end-to-end solution are outweighed by the superior capabilities of products from specialist companies. Getting the value from these best-of-breed solutions demands customized integration but based on standard IT technologies.

This is the value of well-designed workflow automation.

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