

Extending IFRAtrack for use in General Media Production

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Abstract: The complexity of producing a newspaper is well documented. This process has a very tight schedule involving thousands of elements linked together in a chain of activities. Attempts to supervise this process have been successful using the IFRAtrack recommendation designed for tracking activities in a newspaper environment.

In this paper we extend the IFRAtrack model to the production of television news, a process which is basically very similar to newspaper production. This is a first step towards extending production tracking with IFRAtrack to general media production, such as web publications, commercial printing and radio production.

Introduction

IFRAtrack is a recommendation maintained by IFRA, the international association for newspaper and media technology, for describing how newspaper are produced. Systems implementing the IFRAtrack recommendation have been used for several years and have proven useful tools for increasing effectivity and finding bottlenecks in the production chain (Hedin et al, 1997). So far, IFRAtrack has been a recommendation exclusively for newspaper production, but the concept should be possible to extend to other kinds of production.

With the new XML based version 3.0 of IFRAtrack (Hedin et al, 2000), there is a mechanism for extending the model. This can be used to add new elements, resources and activities to the existing model, but can also be used to describe completely new areas of production tracking.

This paper describes such an extension to the model. The area chosen is TV news production, an area close to newspaper production in that they both are time critical and describe a creative process with tight deadlines, and both produce a new product every day.

Aim

The aim of this paper is to present what we call a product model, an object model and a process model for TV news production, based on the same principles as the IFRAtrack recommendation for newspaper production. We also evaluate whether production tracking in TV news production can have the same benefits as in a newspaper context.

Method

An empirical approach has been taken to gather information about how the actual product in a TV news broadcast is built up. News broadcasts from three different broadcasting companies have been recorded on videotape for one day. These tapes have been analyzed in order to find out which sub-components the news broadcast is composed of, such as pre-recorded material, sub-titles and interviews.

Comparisons have also been made between different broadcasts from the same day and from the same broadcasting company, which can be seen as different editions of the same TV newscast.

The sub-components and the events have been categorized to the same level of detail as for newspapers in IFRAtrack, and been described in two models, which we call the product model and the object model.

To verify the product model it has been checked against news broadcasts not included in the original material, to see if they can be described using the model. The limited amount of data however means it is difficult to draw any general conclusions.

The process model is more complex and perhaps more relevant in a tracking context. The approach for making the process model is as follows: First a visit to a TV company was made to get a basic understanding of the processes involved. Next an expert on the subject from the academic world was interviewed to get a better understanding, after which a draft model was constructed. The model was based on the same principles as the IFRAtrack process model.

Finally the models has been discussed with experts working with the actual production of TV, after which the models have been slightly modified.

Differences Between TV News and Newspapers

One of the main differences between TV news and newspapers from a process point of view is the difference between how the product reaches the consumer. In the newspaper case there is a complex process

involving reproduction and distribution. Tracking these workflows is essential in a complete newspaper tracking system, since it is here the actual extra costs for delays are generated (Stenberg, 1994).

In the TV news case, the distribution process is the process of broadcasting. This process does not affect decisions for how to plan the TV news in the studio, unless the broadcasts are delayed for some reason. The actual transmission through the ether is the responsibility of someone else.

The main difference from a product point of view is that the newspaper has a spatial layout with a non-existent time axis, whereas TV news have a temporal layout with a fixed spatial layout and usually a fixed amount of time available.

The format planning process in a newspaper involves placing a number of departments and/or elements on a number of pages. The format, i.e. the number of pages, can be increased if there are many ads or many news items. The format is also affected by the capacity in the printing press(es), both regarding color possibilities and press speed (Stenberg, 1996)

In TV news, the spatial restrictions are the aspect ratios of the broadcast and the size of a TV screen. The temporal restriction is the length of the program. Since the spatial restrictions are fixed, the only parameter available for planning the format is the length of each news item, and possibly the length of the entire program.

The number of objects involved in TV news production are significantly fewer than in newspaper production. A typical installation of the MWM IFRAtrack compatible tracking system (MWM, 2000) at Göteborgs-Posten daily generates about 1000 trackable objects, not including the elements such as images, text and ads. TV news for one Swedish channel produces about 50 trackable objects every day, not including elements (table 1).

	Aktuellt	ABC	TV4/TV Stockholm
Issue	1	1	1
Edition	2	2	2
Section	10	8	13
NewsItem	31	23	39
Sum	44	34	55

Table 1. Elements for three Swedish news broadcasts, 2001-04-17

The IFRAtrack Model

IFRAtrack is a recommendation maintained by IFRA (Fällström, 1997). It is concerned with tracking objects and their states in a newspaper context. The production tracking consists of registration of events, which changes the states of objects.

The specification covers three areas: Semantics, syntax and message exchange mechanisms. To extend the IFRAtrack model to another context, work must be done to define the semantics of the new context. The syntax only has to be altered to match the semantics and the message exchange mechanism need not be altered at all.

To define the semantics we need to identify the objects we want to track and their attributes. We need to know how they are linked to each other, how the objects are produced in a workflow consisting of a number of workflow steps or activities, and finally we need to know the resources involved in these activities.

Objects need not correspond to a physical object. For example, a positioning object is used to determine the position of an element, and an issue object is used to describe a logical grouping of editions. Objects can be active in several activities, and every object-activity pair can have a dual state consisting of a process state and a schedule state (figure 1).

The semantics in IFRAtrack are defined in three models. The product model describes the completed product, the object model describes all objects, their attributes and their links, and the process model describes the workflow.

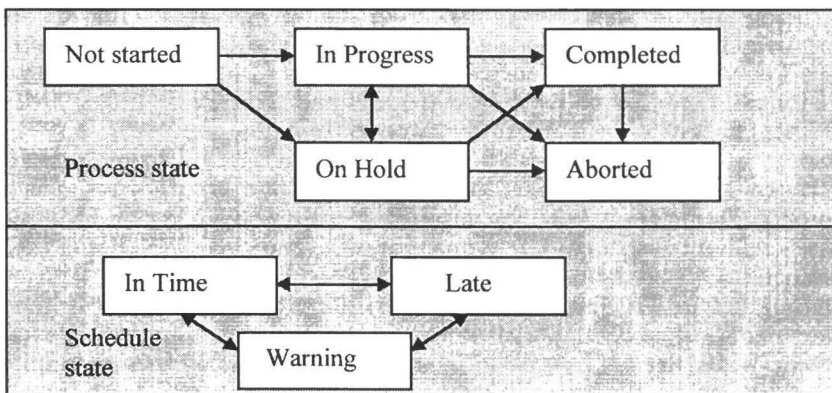


Figure 1. The dual state of trackable objects.

The Product Model

With a product model we want to accomplish two things. First, we want to have a tool for planning purposes, a model for describing the plans for a news broadcast or product. We want to describe which kind of media objects (Hoschka, 1998) are to be displayed, when clips should start and stop, and last but not least to build a structure of elements which we then can track.

Next we want to make a description of the final product. This description should be quite similar to the planned product, but since it is impossible to have control of every second of , for example, an interview, the completed product usually differs from the planned product.

We will show two approaches for describing the product model. One using SMIL (Hoschka, 1998) suitable for describing a completed product, and one using IFRAtrack more suitable for tracking purposes.

The product model is closely related to the object model described later.

A SMIL Based Format for Describing the Product

In the IFRAtrack model there are some possibilities to describe the product structure. The object called a product has a number of pages, each page has a number of attributes such as page number and color, and each page contains a number of elements. Elements can be items such as ads, editorial text or graphics and can have a position on a page. Elements can also contain sub-elements.

The IFRA message format however is mostly for tracking objects and their states, not for describing the current state of one or several objects. Here we make an attempt to use SMIL to describe the product structure, instead of inventing a new format. Two benefits of using SMIL are that the syntax is familiar to many developers and that the resulting SMIL document is easy to read and understand for humans.

SMIL stands for Synchronized Markup Integration Language and is a recommendation from W3C for describing multimedia content. Usually, a SMIL document is a complete description of multimedia content with references to the actual media items, much like HTML is used to describe a web page with links to external images. The SMIL document can then be fed as input to a SMIL player to render the result on an output device. In this case we are not interested in displaying the SMIL document on a computer display. We are only interested in the structure of the TV news product we are planning for or that has been broadcast.

The fact that SMIL is an XML based recommendation gives us several advantages over other formats, since we can use the multitude of tools and interfaces for parsing, modifying and generating the XML structure. One possibility, which is not further examined here, would be to use XSLT (Clark, 1999) to automatically do the transformation from a SMIL structure to IFRAtack messages.

Not all elements in SMIL are relevant to our purposes. Since the structure is not meant to be presented directly to an output device such as a SMIL player, the tags for examining the capabilities of the client device such as bandwidth and screen size are meaningless. Links also have no meaning unless the SMIL document is read by the client device.

Elements that are relevant are the various media object elements, like video, audio, text, image and text-stream. Equally important are the <par> and <seq>-tags for describing if media items are to be displayed in parallel or in a sequence. We also use the dur-attribute for describing the duration the media item is to be displayed which allows us to describe the length of different news items which in turn gives us the possibility of planning the entire news broadcast. Finally we use the attribute clip-begin if the element should not start from its intrinsic start.

The spatial description cannot be given using absolute coordinates. This is due to the facts that not all TV-sets have the same size, and not even the same aspect ratios since wide screen TVs became available. The coordinates must instead be given as relative coordinates, i.e. the subtitle region should start 90% from the top, and 10% from the left.

The use of SMIL as described above could be suitable to describe the actual product, but to use it for tracking purposes is more problematic. The main problem is that SMIL is built up around elements, and has no possibilities to describe activities and resources. There is also no clear way to describe the grouping objects such as issues, editions and sections even though such a structure could be built using <seq>-elements.

This means that it would be possible to export a subset of a structure built from IFRAtack messages to a SMIL document, but it would be impossible to do the reverse since a SMIL document only contains a subset of the information that can be generated using IFRAtack.

An example of a SMIL-based structure can be found in Appendix A.

The Object Model

The object model describes the trackable objects and their links to other trackable objects. This can be described in an entity-relationship diagram as in figure 2a and 2b.

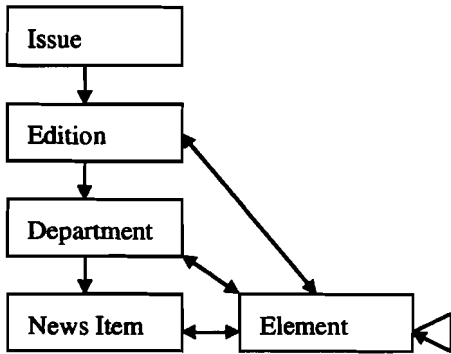


Figure 2a. The object model described in an Entity-Relationship diagram.

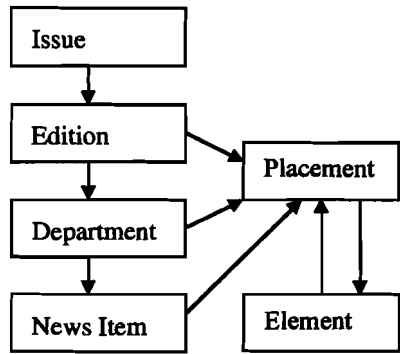


Figure 2b. The same object model described in an Entity-Relationship diagram more easily modeled in IFRatrack.

We use the trackable objects Issue, Edition, Department, NewsItem, Element and Position, which we will use through this paper. The names are chosen to match the corresponding newspaper objects in the IFRatrack model when possible. Their attributes and links are shown in table 2. The attributes are defined in table 3, using the datatypes defined in the XML Schema recommendation (Biron et al, 2001).

Object / relation	Attributes	Links
Issue	Name, Date	Edition (1:N)
Edition	Name, DateTime, Duration	Issue (N:1), Department (1:N), Placement (1:N)
Department	Name, Duration, Description	Edition (N:1), NewsItem (1:N), Placement (1:N)
NewsItem	Name, Duration, Description	Department (N:1), Placement (1:N)
Element	Name, Type, Duration, Clip-Begin, Location, Description	Placement (1:N), Placement (N:1)
Placement	Start, Stop, Region	Edition (N:1), Department (N:1), NewsItem (N:1), Element (N:1), Element (1:N)

Table 2. The objects, their attributes and their links.

Attribute	Datatype	Example
Name	String	SVT1_2001-04-06
Date	Date	2001-04-06
DateTime	DateTime	2001-04-06T00:11:00.00+2
Duration	Duration	PT1M30S
Description	String	An interview with Alan Greenspan
Type	String	Video
Location	AnyURI	http://videosever/4711
Start	Time	00:00:00.00
Stop	Time	00:00:30.00
Clip-Begin	Time	00:00:15.00
Region	String	Subtitle_Region

Table 3. The object attributes and their datatypes (Biron et al 2001)

- Issue: The top-level object, which is a logical grouping of a number of editions. Example: CNN 2001-04-06
- Edition: A logical grouping of Departments, with a startTime attribute. Example: CNN 2001-04-06:19.00.00
- Department: A logical grouping of NewsItems. Example: Weather
- NewsItem: One piece of news with a common theme. Example: Budget.
- Element: One part of a NewsItem, or sub-part of another Element, e.g. an interview, a pre-recorded video, subtitles, graphics, stock-tickers.
- Placement: The position in time and space of an element, usually relative to its parent object.

The Placement object is used to describe the following relationships.

- Edition <-> Element: An element can be associated with an edition, either a part of the edition or the whole edition. An example of such a relationship is the logo of the TV channel, which can be seen throughout the entire news broadcast.
- Department <-> Element: An element can also be associated with a section. An example is a stock-ticker that is only present during the financial department. The Start and Stop attributes are given relative to the start of the Department.
- News item <-> Element: A news item is a sequence of elements, such as studio interviews, videos and studio introductions to the news item. The Start and Stop attributes are given relative to the start of the News item.
- Finally, an element can be composed of several sub-elements. These are placed on the super-element. A pre-recorded video can consist of, for example, the video, a separate sound channel and subtitles.

This relationship is valid mainly for pre-recorded material, which can be seen as one complete unit from a planning/product point of view, but which still contains of several sub-elements that must be created from a process point of view. The Start and Stop attributes are given relative to the start of the parent Element .

The Process Model

The process model describes the steps involved in creating TV news. In the IFRAtack models, objects go through one or several workflows consisting of one or several workflow steps or activities. These activities differ for different kinds of objects, and also differ for different production sites. It is therefore impossible to make a complete description of these activities, but we have tried to include the most common activities. Production-site specific, or more detailed activities can be added as extensions, which is possible with version 3.0 of IFRAtack (Hedin et al, 2000).

The main activities in the workflow are:

- Planning
- Creation
- Off-line Editing
- On-line Editing
- Disk transfer (optional)

Of these, the Creation activity is described more fully in the Creation sub-workflow. This contains the following activities:

- Script-creation
- Production

For a graphical representation of these activities, see Appendix D.

Planning is the process of defining an issue, its editions, departments, news items and possibly elements it/they will contain. The result is a spatial-temporal plan for the placements of these objects. This plan can, of course, be modified later.

Creation is the creative part when the actual element-content is produced. See the Creation sub-workflow for a more detailed description.

Off-line Editing is the activity of merging elements to produce a completed news item, or part thereof. It does not include the on-line editing performed by the on-line editor during the actual broadcast. Off-line Editing can be either linear or non-linear, where linear editing means

the editing must be done sequentially and if anything must be added earlier in the sequence everything after that point must be re-done. This is usual when editing raw tapes. Non-linear means random access to the elements are allowed, such as when the elements are stored on a hard-disk.

On-line Editing is the activity of on-line producing the TV news broadcast. It includes sub-activities such as starting the right pre-recorded elements at the right time and choosing which of the studio cameras to use. Another possible term is broadcasting. The input is the plan for the edition, the sections, the pre-recorded elements and the elements produced on-line, such as interviews. The output is the stream of elements viewed by the viewers, which is equivalent to the final product or edition. On-line editing is always, by nature, linear.

Script-creation is a sub-activity of the Creation activity. It includes writing a manuscript for a news item or an element. The output can be a number of elements, which are created in this sub-activity rather than in the Planning activity. These elements can then become input to the Script-creation sub-activity to produce a script for each of these elements and so on. The final output is a set of elements, which will later be produced.

The Production sub-activity is where the raw material is created, based on the manuscript. It can include tasks such as recording video, audio, subtitles and creating graphics. If a finer granularity is wanted it is possible to divide this activity into further sub-activities by making a site-specific extension.

Disk transfer is an optional but often desirable activity, which includes transferring elements to disk on a media server. It is optional only because there are some cases when there is no time to do this transfer, and the element is, for example, played directly from a videotape recorder.

Extending the IFRA Message Format for TV News

The IFRA Message Format, IMF, is divided into two parts. The first part covers the message exchange mechanism and the framework for how to describe a generic workflow. The second part contains all objects, attributes, links, activities and resources used in a particular context.

To extend the IMF for TV news production we keep the first part, but write a new second part for describing all objects, attributes, links, activities and resources specific for TV news production. The extension is done using the mechanisms permitted in the XML Schema specifications (Biron et al, 2001), (Thompson, 2001). The complete XML schema can be

found in Appendix B, and an example message can be found in Appendix C.

Discussion, Conclusion and Future Work

An important question is of course if there are any benefits to gain by implementing a computer system for tracking TV news using this model.

There are a number of reason why production tracking for TV news might not be as successful as for newspapers.

- There are no reproduction and distribution activities, and therefore virtually no delay-costs.
- There are few semi-automated workflows, like plate-making, ripping and recording, in TV news production, which make systematic sub-optimizations less likely.
- Significantly fewer number of elements to track, makes the need for a computerized tracking system less obvious.

On the other hand there are some reasons which makes TV news tracking much easier than newspaper tracking.

- A less complex product, like TV news, is easier to track.
- There are probably fewer systems that need to be adapted to supply the IFRAtrack messages needed.
- The development goes towards completely digital workflows, which are easier to track than physical workflows.

We have also examined SMIL as a possible alternative to IFRAtrack to describe a product. We concluded that SMIL could be useful to describe the finished product, but could not be used for the actual tracking. It would however be relatively simple to export at least a sub-part of a structure built up from IFRAtrack messages to a SMIL structure.

This paper shows it is possible to extend the IFRAtrack recommendation to other media production environments. The next step is to investigate other media production environments, such as web publishing, where production tracking can be more useful.

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Appendix A: Example of an edition described using SMIL syntax

```
<smil>
  <head>
    <meta name="author" content="John Smith" />
    <meta name="title" content="Aktuell-2001-04-08:19.30" />
    <layout>
      <root-layout width="40cm" height="30cm" />
      <region id="subtitles" bottom="10%" left="10%"
        width="75%" height="10%" z-index="2" />
      <region id="graphics" top="10%" left="70%"
        width="30%" height="80%" z-index="1" />
    </layout>
  </head>
  <body>
    <seq>
      <par id="intro" dur="6s">
        <video src="http://videomixer/output1/" />
        <audio src="http://soundserver/intro.wav" />
        <image src="http://images/intro.tiff" region="graphics" />
      </par>
      <seq id="headlines" dur="15s">
        <par id="stockmarketheadline" dur="6s">
          <image src="http://images/stockmarket.jpg" />
          <audio src="http://soundmixer/output1/" />
          <text src="http://text/stockmarketheadline.txt"
            region="subtitles" />
        </par>
        <par id="miseryheadline" dur="9s">
          <video src="http://videoserver/misery.mpg" />
          <audio src="http://soundmixer/output1/" />
          <text src="http://text/miseryheadline.txt"
            region="subtitles" />
        </par>
      </seq>
      <seq id="stockmarket" dur="200s">
        <par dur="30s">
          <video src="http://videomixer/output1/" />
          <audio src="http://soundmixer/output3/" />
        </par>
        <video src="http://videoserver/stocks.mpg" dur="50s"
          desc="6 % fall on NASDAQ yesterday" />
        <par dur="120s">
          <video src="http://videomixer/output2/"
            desc="interview with Alan Greenspan" />
          <audio src="http://soundmixer/output2/" />
        </par>
      </seq>
    </body>
  </smil>
```

Appendix B: XML Schema extending IFRAtack for TV news

```
<?xml version="1.0" encoding="UTF-8" ?>
<schema xmlns="http://www.w3.org/2001/XMLSchema"
  xmlns:imf="http://www.ifra.com/imf/3.0"
  xmlns:tv="http://www.gt.kth.se/tvimf/1.0"
  targetNamespace="http://www.gt.kth.se/tvimf/1.0">

  <!-- objects -->
  <element name="Issue" type="imf:AbstractObjectType"
    substitutionGroup="imf:abstract_object" />
  <element name="Edition" type="imf:AbstractObjectType"
    substitutionGroup="imf:abstract_object" />
  <element name="Section" type="imf:AbstractObjectType"
    substitutionGroup="imf:abstract_object" />
  <element name="NewsItem" type="imf:AbstractObjectType"
    substitutionGroup="imf:abstract_object" />
  <element name="Element" type="imf:AbstractObjectType"
    substitutionGroup="imf:abstract_object" />
  <element name="Position" type="imf:AbstractObjectType"
    substitutionGroup="imf:abstract_object" />

  <!-- attributes -->
  <element name="Location" type="anyURI"
    substitutionGroup="imf:abstract_attribute" />
  <element name="Duration" type="duration"
    substitutionGroup="imf:abstract_attribute" />
  <element name="DateTime" type="dateTime"
    substitutionGroup="imf:abstract_attribute" />
  <element name="Date" type="date"
    substitutionGroup="imf:abstract_attribute" />
  <element name="Description" type="string"
    substitutionGroup="imf:abstract_attribute" />
  <element name="Start" type="time"
    substitutionGroup="imf:abstract_attribute" />
  <element name="Stop" type="time"
    substitutionGroup="imf:abstract_attribute" />
  <element name="Region" type="string"
    substitutionGroup="imf:abstract_attribute" />
  <element name="Type" type="string"
    substitutionGroup="imf:abstract_attribute" />
  <element name="Name" type="string"
    substitutionGroup="imf:abstract_attribute" />
```

```

<!-- links -->
<element name="EditionsLink"      type="imf:AbstractLinkType"
      substitutionGroup="imf:abstract_link"/>
<element name="DepartmentsLink"  type="imf:AbstractLinkType"
      substitutionGroup="imf:abstract_link"/>
<element name="NewsItemsLink"    type="imf:AbstractLinkType"
      substitutionGroup="imf:abstract_link"/>
<element name="ElementsLink"     type="imf:AbstractLinkType"
      substitutionGroup="imf:abstract_link"/>
<element name="PlacementsLink"   type="imf:AbstractLinkType"
      substitutionGroup="imf:abstract_link"/>

<!-- activities -->
<element name="Planning"         type="imf:AbstractActivityType"
      substitutionGroup="imf:abstract_activity"/>
<element name="Creation"        type="imf:AbstractActivityType"
      substitutionGroup="imf:abstract_activity"/>
<element name="DiskTransfer"     type="imf:AbstractActivityType"
      substitutionGroup="imf:abstract_activity"/>
<element name="OfflineEditing"   type="imf:AbstractActivityType"
      substitutionGroup="imf:abstract_activity"/>
<element name="OnlineEditing"   type="imf:AbstractActivityType"
      substitutionGroup="imf:abstract_activity"/>
<element name="ScriptCreation"   type="imf:AbstractActivityType"
      substitutionGroup="imf:abstract_activity"/>
<element name="Production"      type="imf:AbstractActivityType"
      substitutionGroup="imf:abstract_activity"/>

<!-- resources (should most likely be extended -->
<element name="Employee"        type="imf:AbstractResourceType"
      substitutionGroup="imf:abstract_resource"/>
<element name="Producer"        type="imf:AbstractResourceType"
      substitutionGroup="imf:abstract_resource"/>

</schema>

```

Appendix C: Sample IFRAtrack message for TV news

```
<?xml version="1.0"?>
<imf xmlns="http://www.ifra.com/imf/3.0"
  xmlns:tv="http://www.gt.kth.se/tvimf/1.0"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  xsi:schemaLocation="http://www.gt.kth.se/tvimf/1.0
    http://datan.gt.kth.se/1.1/tv-taga.xsd
    http://www.ifra.com/imf/3.0
    http://datan.gt.kth.se/1.1/imf-base.xsd">

  <head>
    <version>3.0</version>
    <source supplier="TV_Unlimited" application="TVTool"/>
    <time>2001-04-06T00:11:00.00+2</time>
  </head>
  <body>
    <object action="modify">
      <tv:Element/>
      <object_uid>
        <local_id>20010406_4711</local_id>
      </object_uid>
      <activities>
        <activity>
          <tv:Planning>completed</tv:Planning>
          <resource>
            <tv:Producer/>
            <object_uid>
              <local_id>Mr Smith</local_id>
            </object_uid>
          </resource>
        </activity>
      </activities>
      <attributes>
        <tv:Duration>PT1M30S</tv:Duration>
        <tv:Name>Alan_Greenspan</tv:Name>
        <tv:Location>http://mediaserver/4711/</tv:Location>
      </attributes>
    </object>
  </body>
</imf>
```


Appendix D: The process model

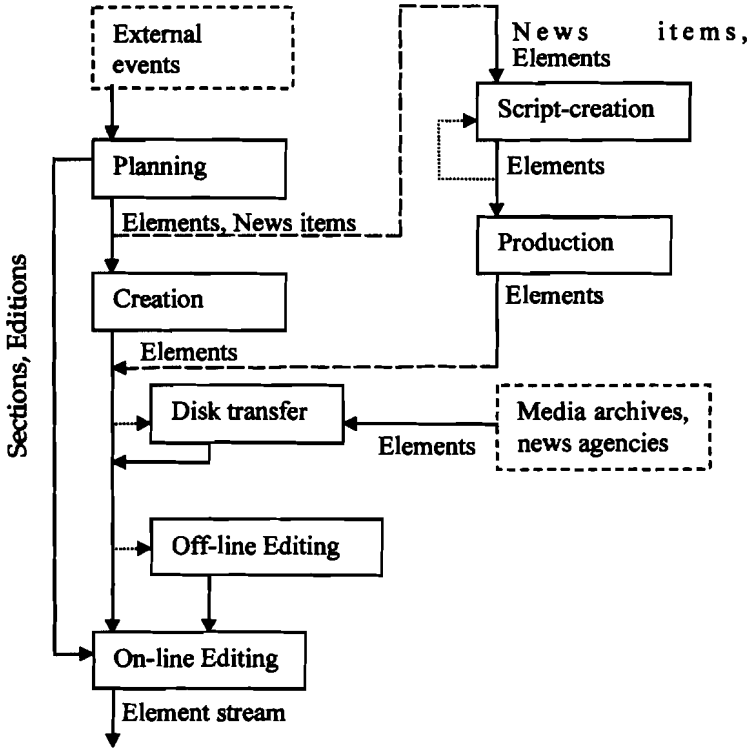


Figure 2. The main production workflow, with the creation sub-workflow to the right.

