Tracking Jobs from Servers and Workflow Applications in Media Production

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Keywords: Media, production, cross-publishing, metadata, workflow, web servers, naming, XML, RDF, scheduling, tracking, CORBA

Abstract

The paper analyses the possibilites and alternatives to track servers, control systems and workflow software used in media production. In the existing systems for global PMS (production management) the collection of the time and event data from the production chain is normally quite laborious. Data senders, in object formats, parsing, databases and powerful software are needed to track, parse, save and report job flow and process behaviour. In our proposed solutions we prefer tracking servers automatically with no permanent data sender modules. Distributed components and object brokers (Java, CORBA) include many useful generic concepts. To keep the PMS overhead and costs on a reasonable level and without sacrificing the scaleability these technologies offer interoperability, persistence and open-system configuration methods. Metadata architectures are standardised under 3W consortium, including resource description (RDF) and markup (XML). This means that the media structures and documents become self-describing and carry their structure andd semantics to any later users, up to the end-users. It is self-evident that any production management becomes easier due to more efficient metadata and well-defined workflow.

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Introduction

In a series of papers [1, 2, 3, 4, 5] we have discussed the methods for media workflow and production management. Today, printed products are made in a more or less static environment. Time and resources are booked for coding the text and image information, then physical pages are designed and output on film and plates. Then a separate printing stage is needed for the production of the ordered copies. In digital printing the printing has been integrated with the prepress without any plates or masters (masterless printing). This enables the splitting of jobs to tailored or profiled versions with variable information mixed with more permanent parts of job content.

The cross-publishing (mainly print+web) has become a must for most publishers and printers. The WWW still is under 5 years old. In the WWW we need dynamic documents to update the contents for the output delivery, e.g. web documents on the socalled push servers. The point is to produce and reuse data in a rapid pace and adapt to changes in the processes and resources. Web site workflows of this type need management, and the research groups talk about workflow management, WFM or WFMS [6, 7].

This is a more dynamic concept of the contemporary production management, PMS [1, 2]. The nature of web publishing is in general different from the conventional or digital print media. This is illustrated in **Fig 1** showing the typical broad product categories plotted against market scope, content focus and updating needs. It is crucial to **all cross-media publishers** to identify these and other differences in markets.

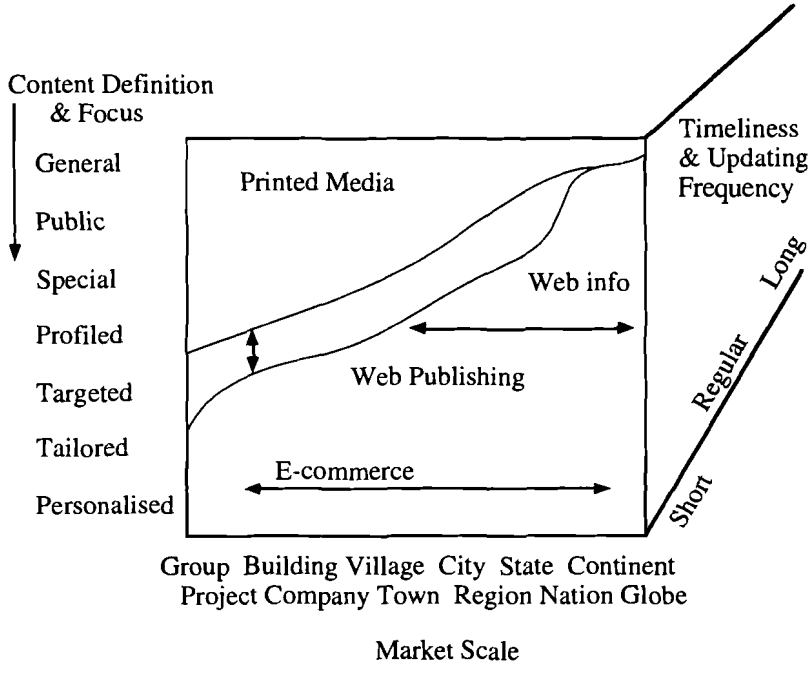

Fig 1 Printed media are stronger in regular or slow timeliness and in moregeneral contents. There are joint markets and cross-publishing opportunitiesin the more specific contents and up to the global market scale. Web publishingand E-commerce require fast and secure transactions and short updating cycles.

In our previous reports we have pointed out that there are **sources of metadata**, and for the tracking more precisely event data sources, such as servers, databases and applications running on these servers of the production chain. There are directories, logs and the media formats - some of them objects - which create and contain metadata and describe more or less specific workflow information, e.g. :

- Where is this data, file or job and in which process state (location and state)
- What type of content and format, job or other larger entity, for which kind of job/customer
- Why did this file stop on this server or application session (process state)
- When is it supposed to be ready for the next process (import/export prognosis)

• What has happened to this file or job in the earlier processes (throughput history)
• What could be done rapidly to cure a bottleneck or to recover after a failure (remind, alarm)
• The probability that this job will be timely in some named end-server (prognosis for delivery)

The processes of the media production are mostly interactive workstation **sessions** (e.g. page design) or automated file transfer or processing stages, i.e. **batch** processes with fairly predictable throughput time, e.g. RIPing, recorder output or printing. More and more automation will be added to the workflows to support or replace human-driven interactive sessions or operator decisions.

In this paper we develop concepts of more automatic **"lite tracking"** for networked and dynamically changing workflows and media resources which are already used in web publishing and become more common in cross-publishing and digital printing. The distributed objects, ORBs, i.e. the object request brokers, the inter-ORB protocol (IIOP) and multi-database tools make new multi-tier architectures [10] possible and imply new opportunities for the production management and job tracking. The earlier idea or concept [5] of component-based media data management (CMDM) seems to become viable.

Media Production and Metadata sources

There are certain system categories to be used for defining "lite tracking". Each server to be tracked may be acting in a number of ways for the production. Servers are **hosting resources**, such as databases, media stores, design applications, workflows, and control systems (e.g. for presses or mailroom lines) and they may posess certain connectivity features and service levels:

• Database or DB servers are often unmanned web servers delivering data or documents for media jobs, or media stores which may offer open and easy-to-use services to many user groups.
• Design applications, e.g. DTP or web publishing software packages run on smaller web servers or workstations. Interactive sessions are typical to these manned platforms.
• Workflow servers, e.g. the Open™ , used in our earlier experiments [4] as a model workflow, host, control and automate a domain of subservers and output workflows. They guide jobs through production.
• Most control systems have database servers or other high-end servers above the standard field-bus and process control stations of the whole control domain, e.g. an entire plant, mailroom or just one press

• Object brokers use the IIOP and components (e.g. JavaBeans) for a web-wide interoperability . They may also host a large application component store or framework and deliver multi-database services [10].

The idea of the "lite tracking" is to define systems which do some **basic** tracking functions (e.g. find and follow up jobs) and which are automatic, remotely configurable and easy to install. This level of "liteness" is useful if we have a workflow in a number of enterprises (e.g. in extranet), such as a large web site production or a cross-publishing ad delivery through private extranet.

In a more stable, precisely modelled and defined production such as in a newspaper a **legacy GPMS** (global production management system), e.g. with client/server architecture is functional and certainly worth while [12, 13]. IFRA has promoted the development of tracking in newspaper production from 1995 on. Many vendors already support IFRAtrack in their software. The IFRAtrack 2.0 specification (1997) leaves doors open for further development in the direction of ORBs, IIOP and interoperability. The existing messaging solutions listed [13] are DB/SQL inserts, file transfer, TCP/IP socket, with some other options, like e-mail, TCP broadcast and ORBs.

The second inter-system messaging standard CIP3 was compared recently with the IFRAtrack approach by Ray [9]. As he points out these systems (CIP3 and IFRAtrack 2.0) "do not, as yet, directly control the production process". The real inter-system control in the sense of closed controls is no relevant goal eather in batch processing of media "packages" from elements of information to deliverable documents.

The ORBs and IIOP are future standards for interoperability for web publishing and other media. ORBs connect the distributed components, component-based applications and frameworks on a higher level of openness. There are no real obstacles to develop component based media data management (CMDM) as proposed already in our earlier report [5]. This means that the media design applications and their management tools, such as tracking, scheduling and PMS reporting software will be componentized for more efficient interoperability. CORBA and Java components are open methods to support the media functions in networked production and in dynamic media workflow applications [10, 11, 20]. In web publishing this is already happening with some examples mentioned before [5] and in this paper.

Basic-level Tracking

In tracking jobs from servers we may use various **depths of intrusion** to copy continuous metadata, e.g. time windows, from the directories or logs (the server or application logs). In tracking we have to decide which events, processes and jobs are tracked. We also have to define the precision (element, page, document, job) of tracking, where to save the data, parse and report on it. The environment to be tracked needs to be defined and the tracker customized for the product/workflow/intranet in question.

The servers and workstations are mostly IP addressed. In an Internet web link you may have: After the service (e.g. www or FTP) the domain name, the data type (after the slash, e.g. html), and then finally the **resource**, i.e. document description. In print media documents are normally less public. In our previous prototype **Tracker Server** we showed how to copy time frames of process event data from the log of a "model application" - in our case the press frontend called Open™ of Luminous running on a Mac - and collect it in the Tracker Server into its Master Log [4]. In fact, this Java Application tracker/collector is able to track any common server with IP address on TCP/IP-based virtual LANs and on WWW. We also pointed out that this kind of Tracker Server could feed formatted raw data to a proprietary global PMS, e.g. using IFRAtrack messaging and SQL database. To use it in a GPMS connected manner we need to convert the Master Log data and event names to the event and resource naming of the GPMS system in question.

The main value of the idea of a system-neutral Tracker Server [4] was that it can track jobs on any server and collect the data to be saved centrally and in a neutral way. The only extra configuration work is to authorize the Java application to read and copy directory or log data within the setup domain of servers of the workflow in question and access the log files of the applications. Another limitation is that the Java Applications, which are server-side codes, **are not** distributed components and do not posess the same level of interoperability than components, e.g. JavaBeans or Enterprise JavaBeans, the EJBs, which are server-side components.

Metadata- and content-wise the simpliest way of tracking is to answer the question where is this file or job now. Another level is to track the recent history of all the job files based on some naming hierarchy of the elements of the media job. There may be a company-wide naming convention based on a rough physical division of the product into its elements. Then jobs are divided in e.g. (..., element, page, press sheet, book, ...) corresponding the same precision which is used for job

tickets and cost accounting. A more comprehensive method is the product-model-based naming, such as that used in the IFRAtrack 2.0 [13]. Then the solution may be more generic but for a specific media product concept such as newspaper production. We continue the discussion of metadata, naming and entity objects in the next chapter.

In servers the directories list the files by file names. The event log files of the server or application may include more useful metadata. Some more integrated file formats include relevant metadata. However, in general, the metadata in the tracking data sources - as listed above - is **non-standard**. Some common log formats exist and software exists, e.g. WebTrends, IPnet Watcher, FlashStats and OpenView [8] to track web servers in relation to e.g.: Network monitoring and traffic analysis, web server management, log file analysis and website link analysis.

In environments, such as less standard application specific logs and platform specific directories, it maybe difficult to find a generic solution on **how to lite-track** processes and events in a very comprehensive manner, say with defined process states, product model naming and precise real-time needs. Tracking must be focused on the central processes and on the main components of the key products. Almost anything can be tracked but we have to limit ourselves to the most relevant factors of the workflow.

Instability of the Production

Media production is dealing with complex product structures and with considerable instability as regards the media products and production resources. Tracking jobs in an **instable media and resource** environment we have to use flexible and automatic tools and make some precision compromises. The problem of platform heterogeneity is also there though the web standards help to deal with it.

In a large **cross-publishing corporation** there are tens of database, DTP and design applications for pagination and web site design. They are connected in intranets and extranets to produce documents and deliverable job files for print, print-on-demand and web publishing. These applications run always on heterogeneous platforms, mostly Unix, Windows and Mac, and on VLAN and web/http (i.e. Internet, intra/extranet). The job contents, resources, processes (especially design) and workflows are instable in many ways both in minutes, days and weeks:

• **Jobs contain** both reusable and routine material but also unidentified or difficult files, analog material like paper, films or video, and various versions of formats often not supported by some applications.

• **Human experts and software** are developed. Intended or abrupt changes occur. Disturbances and faults occur even when they are least expected. Software versions and instability alone are a major source of low process and product quality. Multi-platform packages and neutral formats work less perfectly in some of the many platforms.

• **Processes and sessions** along the workflow are changed, and not only improved. Some processes are out of the responsibility of the main contractor, e.g. incoming contents, native file choices, network operator services, system support and maintenance functions.

• **Workflow** must be changed for **new types of jobs** or for less permanent or back-up situations.

Almost the same degree of instability prevails in medium and small media companies but in smaller scale.
There are no clear signs of decrease in the trend of increasing complexity and instability - both intended and deliberate - in the media production environments.

Scheduling jobs and tracking documents

Java applets, applications and components (Java Beans) are natural tools for managing tracking over more dynamic media production environments such as those of a cross-publishing company. The job ticket and in general early enough points of defining metadata must be possible. **Job preplanning** and job tickets are natural stages to define the jobs in terms of the naming, possible structure (XML metadata), and approximate scheduling - even if this happens in the office of the customer on extranet. In some cases the target times are relatively easy to evaluate based on some earlier experience of similar jobs. It is important to define these target times for the jobs before they enter the other process stages.

In lite tracking the scheduling data and track data are processed in a similar way. The preplanning of jobs produces adequate job metadata. In the case that there is a separate workflow system for job initiation the scheduling module is working on the same platform to extract the necessary target-time data. Active components for tracking and scheduling push data upstream to the tracking server in a presetable pace. The server sofware expresses the series of events in a brief and easy-to-read views through the production managers´ output pages on their browsers.

The IIOP-based connectivity offers many advantages in media production control as compared with http level intranet. The definiton of the tracked workflow is separated of the work of production management as most other administartion work. This happens on the tracker server through control panels with specific design to support the tracking coordination. In **Fig 2** we illustrate some of the system requirements.

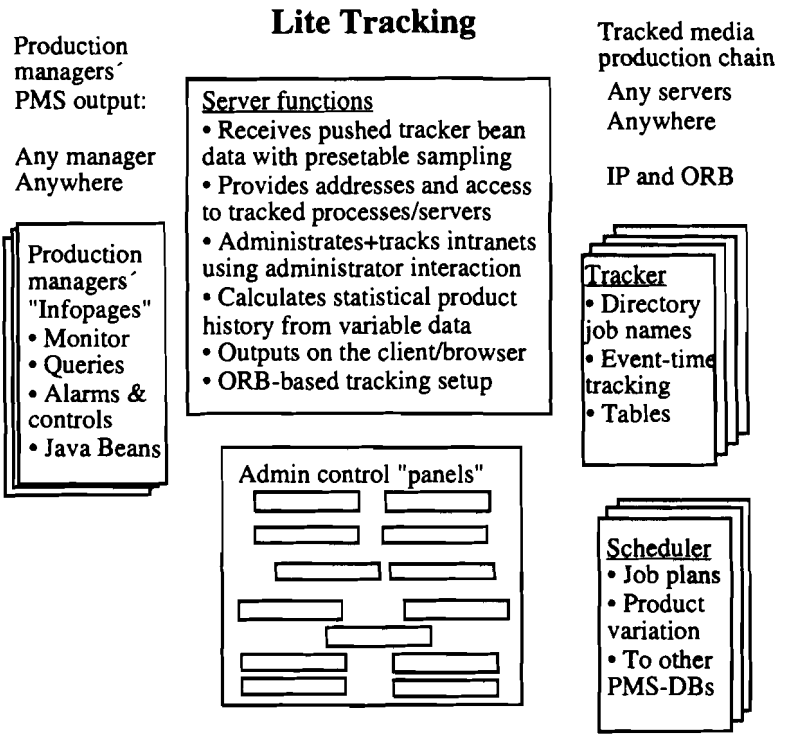

Fig 2 The principle and system requirements of the "lite tracking" from one server :Java Beans components, ORB and IIOP messaging, server for the administration functions,easy configured and installed, presetable tracking variables (granularity, servers, sampling,sources), client-end and tracker components are automatic and do not interfere with any other applications.

In **Fig 3** the multi-tier arhitecture of the ORB/IIOP is presented to point out the fundamental differences between http and IIOP messaging though we must remember thet they will work parallel in most cases. ORBs and CORBA will also mean the possibility of "network computing" but in the media production the advantages of distributed components and interoperability are enormous.

• Media elements become classes on entity objects and they are widely distributed and self-describing.

• XML will help metadata to become more proactive and not only in relation to its logical and physical structure but also in relation to the web resources and to the entire knowledge environment in media.

• Specific identifiers, such as the Digital Object Identifier, DOI [22], promoted by publishers, may exist on any hierarchical level of the elements.

• Generic media processes may become more persistent business objects and process objects in many families of applications instead of being limited to one legacy framework or object model

• Metadata is more adequate and systematic. XML may become a glue between the content structures and object models as proposed already by 3WC

In Fig 2 we have illustrated some system requirements for the lite tracking from one server to any other production servers. Tracking and scheduling modules produce target-time data and tracked-time data which is then collected to the central application for reporting. Reporting modules are in the client interfaces to be opened anywhere - e.g. in the production intranet or in the supplier/customer extranet.

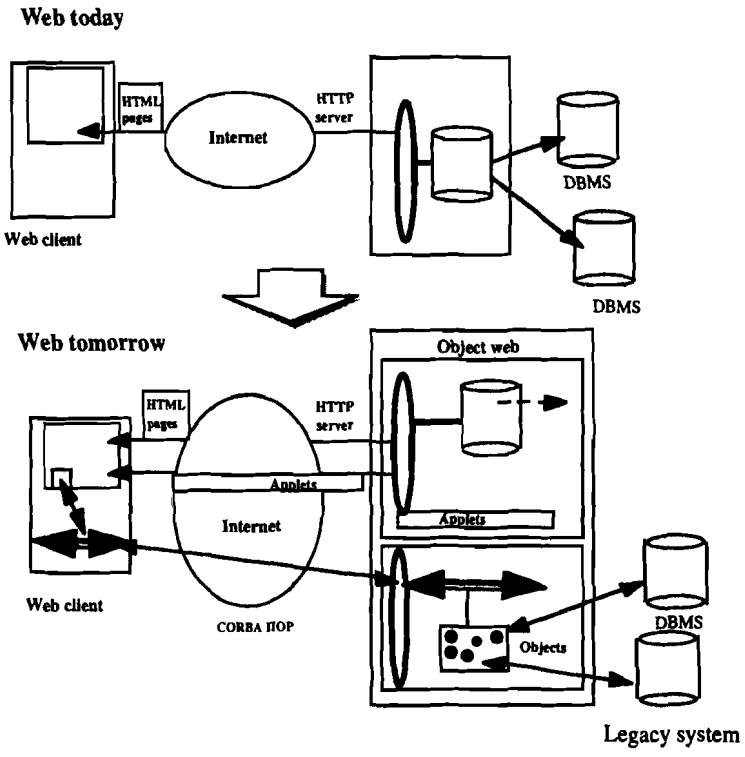

Fig 3. The future object web.

Here, we are not proposing a fully functional system but merely a leading principle which many vendors can use. We have also listed some early examples [5] and continue to do so in this paper. For several categories of distributed computing applications we find already highly functional and tested products:

• Middleware and office software exists from several companies such as Lotus (eSuite), Corel (several products), Digital Harbor (WAV) and Jstream [5]. These may become useful software for at least web publishing. Corel is also active in the network computer market.

• Tracking and similar management features exist as componentized applications. There are several new products. One of the best examples is the Webmethods : http://www.webmethods.com

Workflow is Redefined

The problems **of using metadata**, as the tracking and PMS application must do, are connected to the lack of metadata, to its non-standard formats and to the arbitrary workflow definition. We must mention the few approaches which may change this rather hopeless situation. OMG (www.omg.org), developing CORBA Object Technologies, has given a new RFP [6] and this will lead to a new common facility under the CORBA framework and CORBAfacilities Architecture, namely the Workflow Management Facility. Additionally metadata architectures [17] are developed rapidly as discussed in the next chapter. The CORBA common facilities [10] are **interfaces** for end-user-oriented facilites to be applied in most common application domains or frameworks, e.g. those for web or print publishing.

When discussing about the naming we have earlier mentioned [5] also the more basic CORBA Object Services which include services, such as Naming, Events, LifeCycle, Persistent Object, Relationships to mention only the five first ones which are likely to be used in the naming contexts of distributed-component-based programs or applications. Some of these object services are obligatory components of the commercial ORBs.

It is self-evident that the naming inside a private tracking application can be very specific and internal but the metadata objects, e.g. formatted tracking/reporting messages, may have something to do with more standard and basic Object Services which guarantee the interoperability of the components. The CORBA interoperability and compliant ORBs are based on the IIOP , the Internet Inter-ORB Protocol, a TCP/IP mapping of the General IOP.

The bridges between CORBA and other frameworks, i.e. non-CORBA-compliant legacy ORBs, use the Environment-Specific IOPs (ESIOP) of which the one for the DCE-based systems (DCE-ESIOP) is ready and well known. Many other, than DCE middleware systems [21], are going to use the ESIOP protocol to build gateways to the genuine CORBA systems, as soon as it will become necessary.

This ORB and interoperability promise is new but it means more open systems and functional interfaces between them. The future web must iteroperate on all levels. It will also lead to **the reuse** of information and components, i.e. applications, entity objects and process objects. Distributed applications need much **less system support** in media production [14, 19].

CommerceNet is a large consortium for developing workflow and business processes of the I-commerce.

As was pointed out by Tenenbaum [14] of CommerceNet, transactions, security, payments and business processes will be based on CORBA-compliant technologies. Above the network (e.g. TCP/IP and http/HTML) we need component middleware architecture with IIOP, a commerce interface layer, i.e. the eCo ORB and Systems as proposed by the CommerceNet consortium, and specific systems for the so-called **vertical market**, e.g. retail, financial, publishing/media, travel, hardware and others. All eCo system services will be network accessible objects "which respond both to agents using CBL commands over IIOP and to browsers using http/HTML" [14].

In total OMG [6] and CommerceNet [14] have redefined the workflow concepts and put them in a correct perspective of the developing web transactions and distributes components markets. This is a logical continuation to what was the vision of Orfali et alii [10 and 11]. Many leading vendors have their own product family definition based on roughly the same concepts [19]. The dynamic workflow is a **process object** in the future Object Web and in the commercial frameworks of media business objects, to use the terminology of distributed components [10, 11] and EJB [20].

More han 20 vendors and orgaisations are developing of the socalled Simple Workflow Access Protocol (SWAP) which allows customers to use software components from multiple vendors to build workgroup and process automation systems on their intranets [23]. SWAP is a consequence of earlier OMG workflow standard work [6]. IBM has an earlier framework development called San Francisco Framework [19] while it is actively participating OMG and SWAP organisations. This is typical to many big companies.

The actual product data management concepts, i.e. the PDM systems, may be too heavy for the small- or medium-scale media production but the Manufacturing Workgroup of OMG proposes that the CORBA framework will be applied. Even the large PDM systems will benefit from the dynamic workflow features of the CORBA framework [24].

Metadata and Naming

The naming of content elements and jobs in the private enterprise must remain a separate product specific problem. There may however be possibilities to connect and relate these with more generic naming

conventions. It may also be possible to develop vertical-market generic naming for some regular product structures as was made in the IFRAtrack [13].

The resource description, as proposed in the RDF and XML metadata approaches [17], will be a future key for the self-descriptive potential of the web documents and resources. In **Fig 4** we illustrate how the document naming works in the web documents. The nature of print media is different and more static, but their raw material, such as ready files of formatted information may become linked or imported parts of web resources and in this role they have to be compatible and fulfil the same metadata requirements as media elements in general.

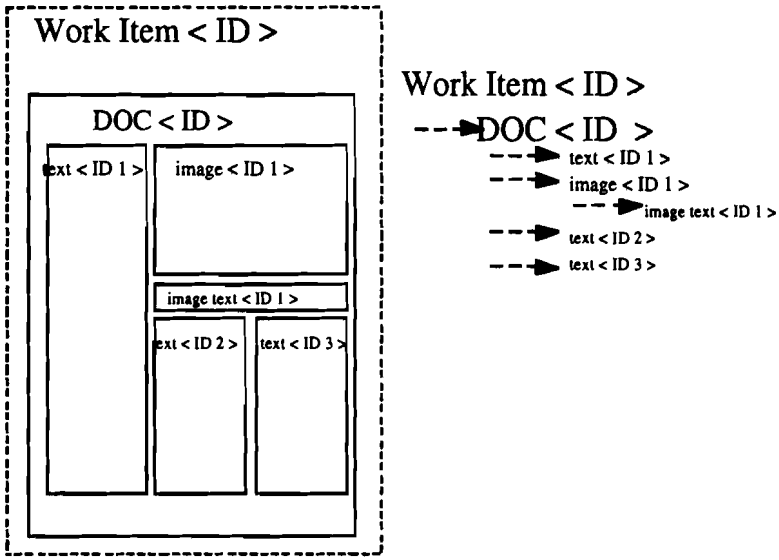

Fig 4 Digital objecti descriptions (DOC <ID >, image <ID >, imagetext < ID >, text < ID >) are subclasses of work Item < ID >. They identify the components and the logical structure of the document.

As shown by the first official documents of the RDF and XML [17] and by the first products using the XML potential the development of this area is in its infancy. However, we can already anticipate how

naming will be more efficient and hierarchical both on the URI level and in the inner parts of the documents.

RDF will bring the object technology in the naming of web contents and resources. The XML documents also have the view selection capability: Users may switch between different views of the same content.

Metadata such as XML will make the web more aware of all the entity components but also of the web audiences, i.e. systems and human users, purpose of the elements, data types (e.g. datasets, databases, metamodels, maps, images, video) and granularity or semantic formalities.

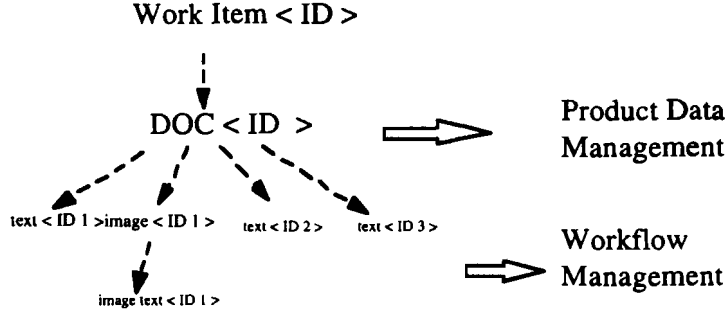

Fig 5. The same document structure in tree format as in Fig. 4. It reveals the relatioship between the XML/RDF based digital object description and both Product Data Management and the Workflow Management. Each identified object is separately tracked.

XML provides a generic method **to code logical structures in metadata** for the content files and documents. It does it in a more flexible way than it predecessor the SGML from year 1986. The XML makes the same, i.e. structure capturing, for the content than database makes for data.

Conclusions

The original straight-forward concept of workflow is **redefined** by several players - vendors and organisations - of the Object Web. The production of modern media for web or cross-publishing (web+print) will require more self-describing elements (i.e. digital objects, not only static pages) and a dynamic workflow. The workflow must be a part of the process object frameworks and comply CORBA.

Product data management will be easily integrated in the workflow systems. XML documents and RDF descriptions of the elements are new system-neutral tools and do not exclude any private naming conventions. We have mentioned IFRAtrack and DOI as vertical-market examples of more specific naming.

As regards to the messaging in tracking and PMS the component-based systems will be tracked by component trackers which do not require any loading or installation routines. Scheduling and dead-line setting seem to become easy to include in the document tagging.

In this paper we continue to develop the concept the tracking and present some new "lite tracking principles". We would like to be more concrete with some examples of how it works in a real media companies, and in fact, we are very close to this stage. In a couple of classified projects VTT IT will test these concepts during this year. The results, shared with customer companies, will be reported later.

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