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Using public communication services for archaeological applications

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1.1 Introduction and motivation

The quantity of information collected in various scientific disciplines has become really enormous and completely confusing, resulting in one of the most unpleasant effects in scientific work. Information on possibly closely related topics is stored at different sites, usually unaccessible from remote locations.

Although this is becoming a common problem, archaeology and related disciplines particularly suffer from this type of unintentional 'information hiding'. Reports, even on important excavations, are very often published in newsletters or journals of only regional circulation. As a result, scientific work in this area is frequently slowed down or even blocked.

On the other hand, a large number of different communication networks now bridge the continents. These networks include the 'classic' ones like phone, telex or facsimile, but also public or private data communication networks. As a matter of fact public data networks, especially, provide a very effective means of overcoming the rather frustrating situation outlined above.

Currently, data networking is globally migrating towards OSI (Open Systems Interconnection). OSI stands for a set of standard communication protocols and service definitions intended to provide for (technically) unrestricted communication in a completely heterogeneous environment. OSI standards are currently under development at the International Standards Organisation (ISO) in the framework of the OSI Reference Model (OSI/RM) (International Standards Organisation 1984).

For the scenario envisaged in this paper two OSI services are of particular interest: the electronic mail service Message Handling System (MHS) and the Directory Service (DS). Whereas the first offers a fast, worldwide exchange of electronic letters, the second provides for services analogous to the 'White Pages' and the 'Yellow Pages' of the telephone service.

We propose to use public communication services provided by PTTs or equivalent national organisations to make distributed information accessible. In particular, we propose to use the Directory Service in conjunction with public electronic mail systems as a basis of information exchange and storage.

With this approach we take into consideration two major conditions:

- MHS and DS will soon be available (more or less) worldwide.
- Using, accessing and maintaining the directory data base will be cheap.

These points, together with some technical features which are very attractive for archaeological applications, make these systems, especially the DS, really promising tools for the support of research work.

Our basic idea is twofold: first, we want to stress the prospective benefits of the use of public communication services for archaeological applications. We propose to use the directory's globally distributed data base managed by various institutions and universities. This will provide easy access to archaeological information stored, for example, at university institutes, specialist journals and appropriate departments. Additionally, MHS may be used for interpersonal communication, group communication and bulletin boards. Relevant information may include excavation reports, scientific papers or any other form of documentation. Second, we will give an example how archaeological information may easily be mapped on the information structure of the directory, thus providing standardised access to this information.

The remainder of the paper is structured as follows:

Section 1.2 summarizes state-of-the-art in retrieving archaeological information (from a very personal view, admittedly). Section 1.3 briefly introduces the technical details of the Message Handling and Directory services, respectively. A heirarchical model of a broad range of archaeological information is presented in section1.4. In section 1.5 we describe two additional features which may turn out to be quite advantageous. Finally, section 1.6 sketches a scenario of how use of public communication services might be organised and managed, and how archaeological research may benefit it.

1.2 Retrieving archaeological information today — a nuisance

Publications in archaeology and related fields may, unfortunately, very often be characterised by

big delays Years may pass between an excavation and its publication.

inaccessibility Much information is published only in some internal reports. That which is published in journals, v ery often suffers from a

very regional circulation Although the phenomenon is very well known, it can be illustrated by a rather impressive example: excavations have been undertaken beneath Cologne Cathedral since 1948. These excavations are '...the best published scientific excavation in Germany since World War 2' (Doppefeld & Weyres 1980). But: most of the results have only been published in the 'Kölner Domblatt', a newsletter with a circulation of about 4,000, very few copies of which are available at public libraries.

Compiling relevant information today is a real problem, for archaeologists as well as for all other people. However, in archaeology — and related disciplines — things seem to be especially fustrating. This is mainly due to the fact that there is no real international platform for publication: whereas in computer science, for example, there are a huge number of international journals and conferences providing a broad basis for information exchange. There are almost no comparable opportunities for archaeologists.

What's more, almost no bibliographic data bases, which are for instance available for all natural sciences, are provided (at least as far as the authors know).[1]

This situation may lead to considerable delays for scientific work, since it may be necessary to do a lot of travelling just to compile the relevant information required to continue research work.

1.3 Some inevitable technical details: message handling and the directory — a (very) short introduction

Within this section we will briefly describe basic Message Handling System (MHS) and Directory System (DS) models and services. It is intended to provide a very condensed overview of the subject; just to introduce it to the reader. Those who have a deeper interest in MHS's and the directory's functionality should, for example, refer to Craigie 1988 or Jakobs 1989.

Roughly speaking, the MHS's major task is message-transport oriented, whereas the DS deals with supplementary naming and management issues.

1.3.1 Message handling system

The X.400 MHS recommendations (CCI 1988b) describe a vendor-independent electronic messaging system. MHS may be characterised as a stored-and-forward architecture (cf. Fig. 1.1). The recommendations specify a general MHS model as well as related services and protocols. In the near future, MHS will allow worldwide exchange of interpersonal messages in a rather simple and effective way.

Fig. 1.1 shows the basic MHS model. The (human) user accesses the Message Transfer System (MTS) via his private User Agent (UA). A message is routed in a store-and-forward manner from MTA to MTA until it reaches its final destination MTA. It may now be stored in a Message Store (MS) associated with the recipients UA.

Basically, a message is made up of two parts: an Envelope and the Contents (cf. Fig. 1.2). The envelope carries information required by the system like, for example — on 'real' envelopes — source address (the sender) and destination address (the addressee). The contents is the piece of information to be delivered.

Discussing MHS we will have to pay attention to the directory service as well. The DS is supposed to considerably enhance user-friendliness of MHS. That is, in addition to the quite elementary services of MHS more sophisticated naming facilities, information services (yellow pages) as well as mechanisms supporting group communication are provided.

1.3.2 The directory

The CCITT X.500 Directory Service (CCI 1988a) provides information about, and a uniform naming scheme for, a network's resources (including e.g. hosts, processes, devices and human users). In terms of the DS, these resources usually are referred to as Objects. A non-ambiguous name is assigned to every object. In general, a DS has to provide three types of service:

- name → information. For example, an objects name may be mapped on its network address.
- name → set of names. A set of objects is identified by one single name.
- information → set of names. This service establishes a 'Yellow Pages' function.

Usually, the DS is described as a highly distributed Client-Server System. This may be characterised by a typically small number of hosts (the servers, the Directory System Agents (DSA)) providing callable services to the other hosts of the system (the clients, the Directory User Agents (DUA)).

A name is assigned to every object. This name is called Relative Distinguished Name (RDN). Every RDN is non-ambiguous relative to its immediate superior. The sequence of RDNs of an object plus those of its superiors forms the Distinguished Name (DN) of this object. The DN is globally unambiguous. The directory also provides for one kind of alternative name, called Aliases.

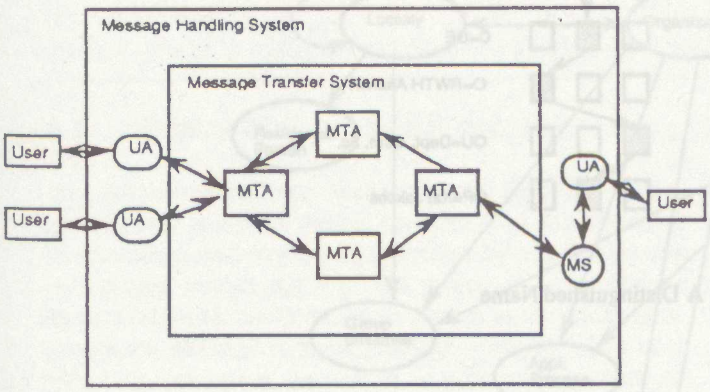
Every object is represented by an Entry, all the entries forms the Directory Information Base (DIB). An object's name and the information stored in an entry are composed of Attributes.

The relationships between objects in a network is usually hierarchical. Thus, the DIB will be structured in a 'tree-shaped' way. This tree is called Directory Information Tree (DIT). Information about objects is stored in the DIT. Every DSA holds data about a subset of objects known by other DSAs (to provide for distributed operations).

The directory's Schema specifies the structure of the DIT, defines Object Classes (e.g. Country, Organisation), Attribute Types (e.g. country name or telephone number) and Attribute Syntaxes (e.g. printable string or numeric string) permitted. The schema is composed form a number of subschemas each valid within one particular Administrative Authority.

The possibility of defining new subschemas is of specific interest for our problem. Every area of application may define subschemas tailored for their very specific needs. We will come back to that point in section 1.4.

[1] A data base named MONUDOC does provide information on preservation of historical monuments , but focusses on impairments caused by environmental influences.



UA = User Agent, MS — Message Store
MTA = Message Transfer system

Figure 1.1: MHS Model

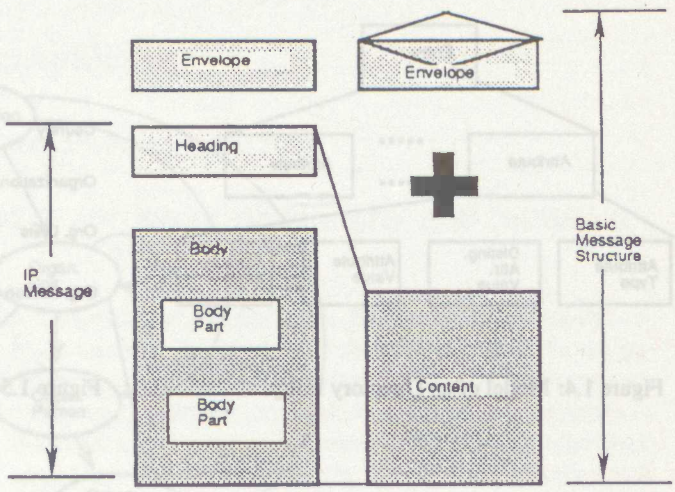
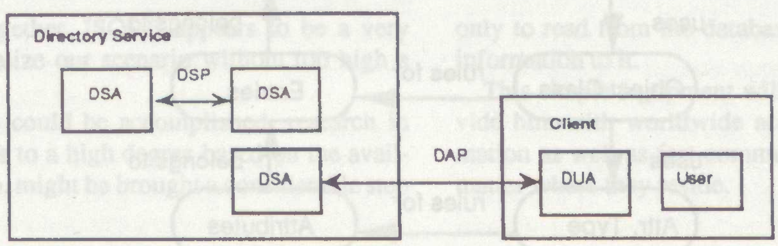


Figure 1.2: Message Structure



DSP = Directory Service Protocol, DAP = Directory Access Protocol

Figure 1.3: Directory Model

1.4 Modeling archaeological information

Like every scientific discipline archaeology has to deal with different types of data. However, hierarchical interdependencies between these data may be identified. For example *burial ground → grave → burial object* or the scheme *region → period → type of finding place.* You may easily identify a whole set of such hierarchical interdependencies, temporally, spatially or possibly genealogically.

At each level of this hierarchy additional information will have to be assigned to the respective objects. This may for instance include information of regional peculiarities, let's say some specific pottery type, or a detailed (verbal and graphic) description of an amphora. Additionally, references to relevant literature might be included.

Hierarchical relations makes applying the directory for information retrival look reasonable. The only thing that remains to be done is to specify new object classes and new attribute types. The directory standard provides appropriate mechanisms. In terms of the directory, such modifications will result in a new Subschema, valid for one, possibly more system agents. That is, this new subschema will have to be applied for those DSAs holding archaeological information.

1.5 Two additional benefits

Besides the possibility of simply mapping archaeological information onto the directory information tree, there are two more possibly very interesting features that should be mentioned: Distribution Lists and Bulletin Boards.

- Distributions lists provide an effective basis for cooperative work; a predefined group of recipients (let's say a number of colleagues sharing the same research interests) may simply be addressed via just one logical group name. It is foreseeable that cooperative work of geographically separated partners will increase drastically. Obviously, this will require a sophisticated supporting communication system. Thus, mechanisms supporting group communication will become of major interest.
- Bulletin boards, though not yet directly supported by MHS, may serve as a platform for international discussions on various topics and as medium for quick dissemination of information. For instance, today's largest data network, uucp, provides a wide variety of so called 'newsgroups' on topics including all aspects of computer science (naturally), but also history and social cultural issues. The German PTT's public mailbox system 'Telebox' for instance provides for

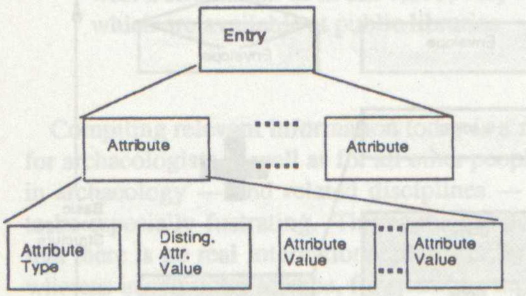


Figure 1.4: Model of an Directory Entry

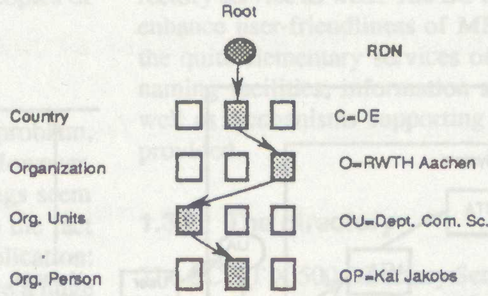


Figure 1.5: A Distinguished Name

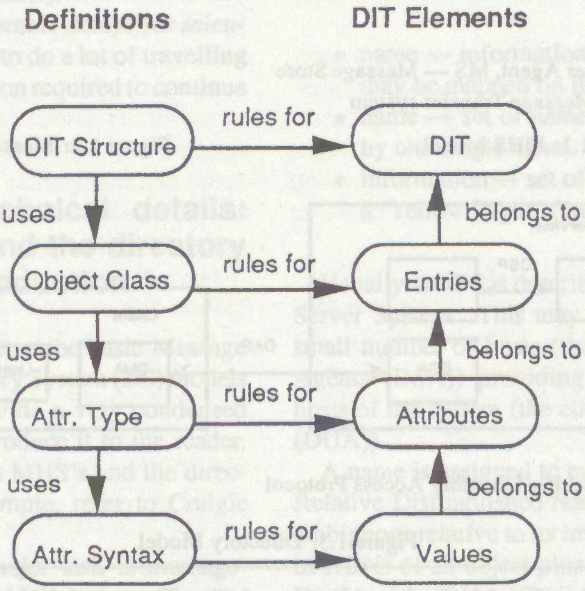


Figure 1.6: The Directory Schema

a similar service. So why not establish newsgroups on archaeology or related subjects?

1.6 Making use of public communication services — a scenario

Finally, we briefly want to outline a scenario whereby archaeological research may benefit from using the (public) directory and (public) electronic messaging systems.

Directory system agents may be operated at a number of research institutes or universities. The user accesses the system via public data networks, providing (relatively) cheap and reliable access. Of course, every user is responsible for keeping the information base up-to-date by submitting information to the system and storing it accordingly.

The different directory system agents (DSAs) are interconnected via public links and may be accessed either directly or via a message handling agent. DSAs are installed at a number of university computing centres where staff should be available to install, run and maintain the software.

The only prerequisities required to access this 'archaeological network' would be a personal computer, access to a public network (e.g. via modem or acoustic coupler) and the MHS/DS software necessary to access the network. Things may be that simple since a 'normal' user will usually only need the respective user-agent software already available for personal computers.

If such a scenario became reality, it would also quite helpful on the spot at excavations: DS/MHS user agent software running on portable PCs might assist in identifying a find or in obtaining information on related finds.

By the way, the ISODE (ISO Development Environment) software package provides communication software compatible to ISO standards running on top of either X.25 or TCP/IP. *Inter alia* the package includes MHS software in line with the 1988 MHS version and the QUIPU directory service, a full X.500 implementation (excluding strong authentication). The package is now broadly accepted and widely used.

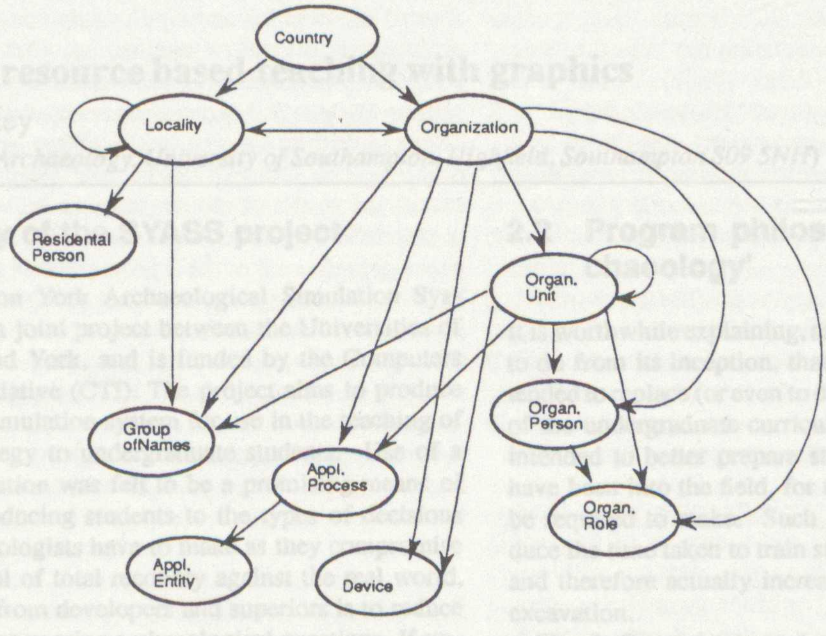


Figure 1.7: The Suggested DIT

Putting all this together, ISODE appears to be a very promising tool to realize our scenario without too high a financial overhead.

If such a scenario could be accomplished, research in archaeology, which is to a high degree based on the availability of information, might be brought a considerable step forward.

1.7 Some final remarks and conclusion

The problem of retrieving relevant information is well known and frustrating. This holds especially for archaeology and related disciplines. To remedy this matter, we propose to adopt public communication services as a platform for both information retrival and exchange. The directory service may easily be employed for the first task, the latter may be achieved using electronic mail services. We have pointed out functional advantages as well as the financial ones.

Our scenario comprises a highly distributed data base, installed and maintained, for example, at universities and accessible by everyone all over the world. It is foreseeable that everyone who is able to afford a PC will be able not only to read from the database, but also to add additional information to it.

This simple equipment will (in the ideal case) then provide him with worldwide access to archaeological information as well as fast communication with colleagues, no matter where they reside.

Bibliography

CCI 1988a. *The Directory*. Recommendation Series X.500. International Telegraph and Telephone Consultative Committee.

CCI 1988b. *Message Handling Systems*. Recommendation Series X.400. International Telegraph and Telephone Consultative Committee.

CRAIGIE, J. 1988. "X.400 (88) — A Tutorial", *Computer Networks and ISDN Systems*, 16: 153–60.

DOPPEFELD, O. & W. WEYRES 1980. *Die Ausgrabungen im Dom zu Köln*. Mainz.

INTERNATIONAL STANDARDS ORGANISATION 1984. *ISO IS 7498, Open Systems Interconnection — Basic Reference Model*.

JAKOBS, K. 1989. "ISO's Directory Proposal — Evolution, Current Status and Future Problems", *Canadian Journal of Information Sciences*, 64 (1).