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EUROPEAN COMPUTER MANUFACTURERS ASSOCIATION

DATABASES AND NETWORKING

ECMA TR/58

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Brief History

When a number of computer systems are linked together to enable interworking these computer systems are said to be networked. Within a network of computers there may be many applications using databases at various locations. If users on any of these network locations can access any database on the network, these databases are termed networked databases, irrespective of whether these are local or remote databases.

ECMA TC22 (Databases) considered that the structure and design of networked databases were not well known, and decided to prepare an ECMA Technical Report providing tutorial information on this subject. This report, starting from some general modelling considerations and a number of practical examples, arrives at a model for networked databases and draws some conclusions on the implications for the standardisation work of the architecture of networked databases.

Adopted as an ECMA Technical Report by the General Assembly of June 1992.

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1 Scope

This ECMA Technical Report is intended to provide tutorial information on networked databases. It addresses the area of designing, maintaining and controlling networked database systems providing database services to the users of networked databases.

A joint technical committee of the International Organisation for Standardisation and International Electro-technical Commission ((ISO/IEC JTC1) and other forums are currently progressing standards to make networking of databases a reality over the 'Open Systems Interconnection' (OSI) reference model.

These groups address the need to integrate data held in database systems that:

- are supplied by different vendors;
- use different technologies;
- are distributed or logically (if not physically) separated;
- form part of an 'open systems' environment.

Such a database environment encompasses a range of:

- network topologies,
- data distribution,
- couplings of application with data,
- transaction management.

Not all technical solutions are developed yet.

The intent of this ECMA Technical Report is to inform readers who are unfamiliar with databases and networks, and to reach conclusions that could be useful to standardisation groups.

2 Structure

The main clauses of this ECMA Technical Report are clause 4, containing the outline description of reference models for generic distributed or networked data systems; clause 5, exploring a number of possible applications and defining an architectural model in an uniform way; clause 6 presenting the results of the analysis of the data collected in clause 5, and clause 7 describing the model emerging from this work. The implications for the standardisation work are presented in clause 8.

3 Acronyms

ACP	Access control point	CAD	Computer-aided design
CD-ROM	Compact disk read-only memory	DB	Database
DBMS	Database management system	DP	Data processor
IND	Intelligent network database	IR	Information retrieval
OPAC	Online public access catalogue	OSI	Open systems interconnection
PSTN	Public switched telephone network	SQL	Sequential query language
UP	User processor	VLSI	Very large scale integration

4 Modelling concepts

4.1 Introduction

Before considering networked databases let us examine the reference model for a single database environment.

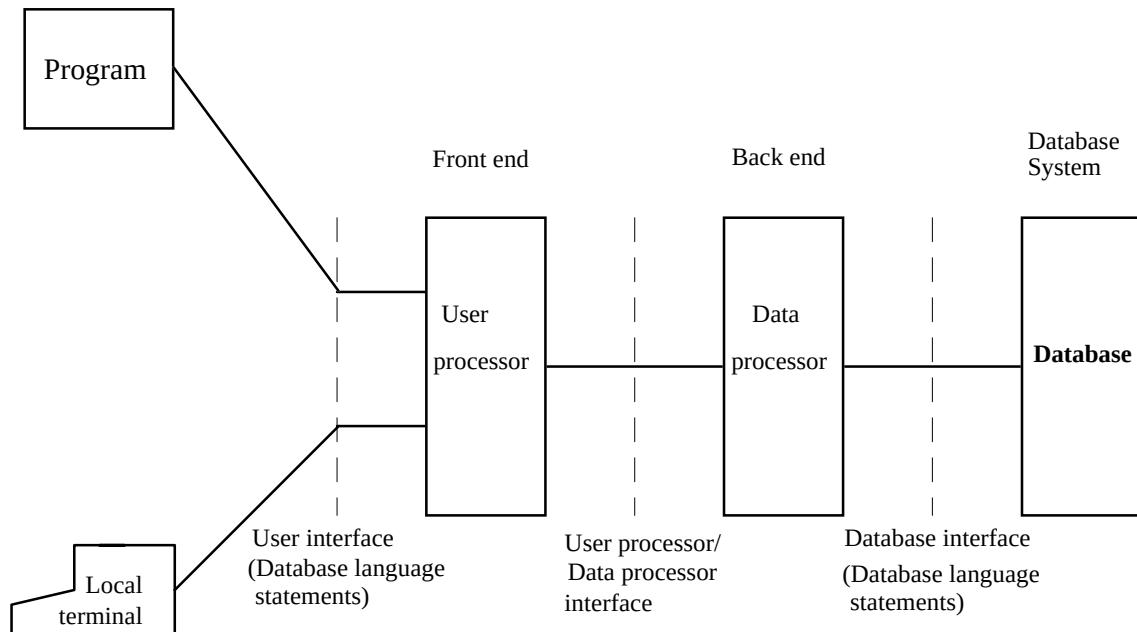


Figure 1 - Single database environment

Note that either a program or a human user may need to access the database. The User Processor (UP) is the front end and the Data Processor (DP) the back end.

In the OSI terminology, UP is referred to as "Client" and DP as "Server".

Database language commands flow across the user interface and the database interface.

In a networked database, in essence each user at a location needs to be able to access any of the databases be they local or remote. Figure 2 shows what is required.

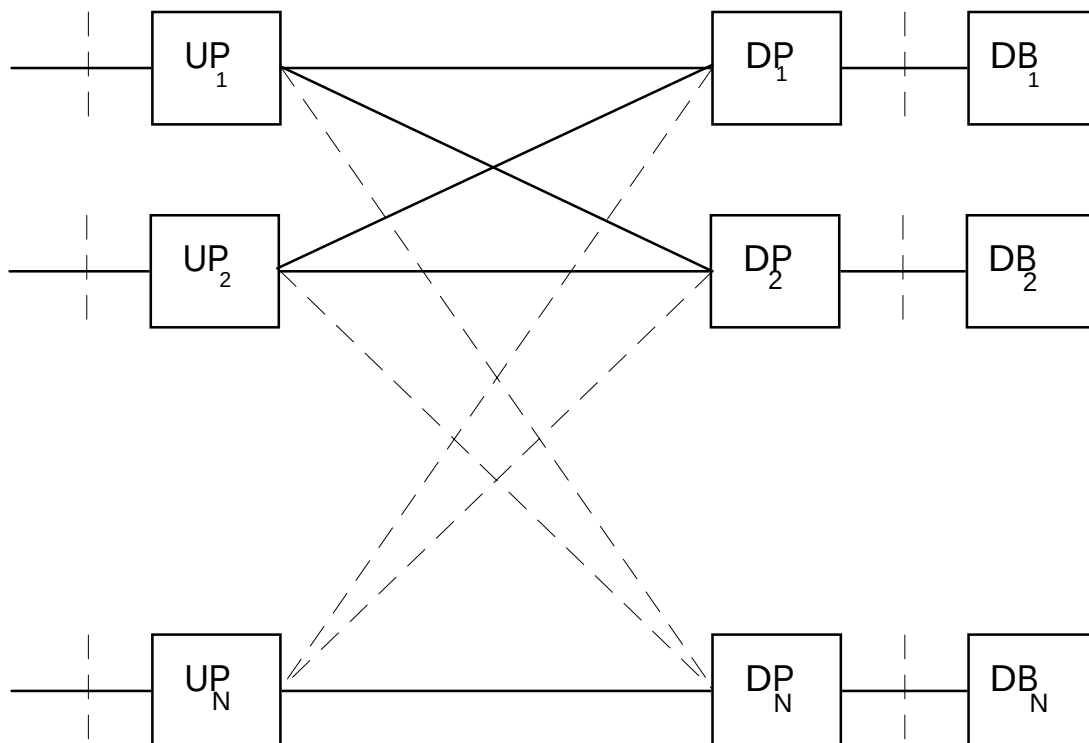


Figure 2 - Networked database environment

The figure can be reduced to the following diagram, which highlights the communication networks.

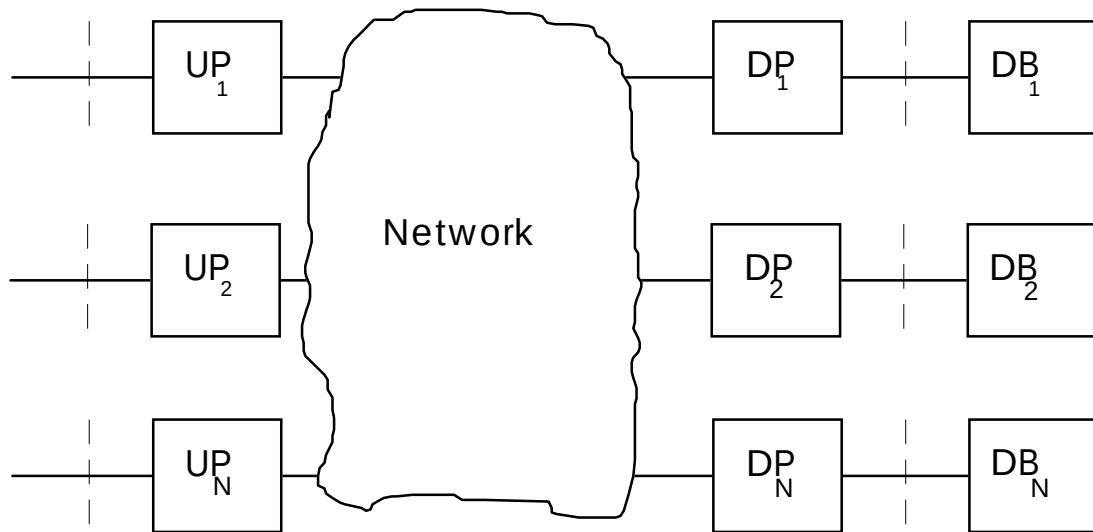


Figure 3 - Networked database environment - alternate representation

4.2 Definitions

Some of the terms used in this ECMA Technical Report are explained below.

4.2.1 Common query language

The language used to define the data held in databases, such as SQL. It is often referred to as the query language.

4.2.2 Common schema

A schema is the design of a database and when this design is common for the whole organisation it is referred to as the common schema.

4.2.3 Data consistency

Integrity of the data held in an organisation's database resource.

4.2.4 Directory

The addressing information for the databases within the system.

4.2.5 Query decomposition

The order in which operations are carried out for a given transaction.

4.2.6 Query optimisation

The way a transaction is carried out, to make the whole operation as efficient as possible.

4.2.7 Replication

The duplication of the data used for achieving better availability of data to the user at various locations.

4.2.8 Routing

The way communication paths are utilised in the course of the transaction.

4.3 Components

Four different reference architecture are identified in a paper prepared by Mr. J.A. Larson - (Four Reference Architectures for Distributed Database Management Systems, Computer Standards and Interfaces, North Holland Pub. Co. vol. 8, 1988/89, pp.209-221). These are discussed in detail in 4.4 to 4.7, a summary is given in table 1.