Operating System
Bull DPS 7000
User Guide
GCOS 7 System Overview

GCOS 7

Software

Subject : This document describes the GCOS 7 system, showing how it fits into the Distributed Computing Model, describing its openness to other systems, and detailing its inherent security features.

Special instructions :

Software supported : This manual is valid for users of GCOS 7-V7.

Date : February 1996

BULL ELECTRONICS ANGERS S.A.
CEDOC
Atelier de Reprographie
331, Avenue Patton
49004 ANGERS Cedex 01
FRANCE

Bull HN Information Systems Inc.
Publication Order Entry
FAX: (508) 294-7411
MA02/423S
Technology Park
Billerica, MA 01821
U.S.A.

47 A2 22UG Rev00

Suggestions and criticisms concerning the form, content, and presentation of this manual are invited. A form is provided at the end of this manual for this purpose.

Preface

SCOPE AND OBJECTIVES

This manual provides a general description of the GCOS 7 operating system for the DPS 7000 range of computers. It describes the system itself and the standard and optional features.

INTENDED READERS

This document is intended for all those who work with the GCOS 7 operating system or who are interested in knowing more about the full range of the system's functionalities.

STRUCTURE OF THIS DOCUMENT

Chapter 1: gives a general introduction and lists the standard and optional features.

Chapter 2: describes how GCOS 7 fits into the Distributed Computing Model

Chapter 3: describes the software components of the system.

Chapter 4: deals with the features of GCOS 7 communications and networks.

Chapter 5: tells you about the databases used with the system.

Chapter 6: describes the sophisticated security features available in GCOS 7.

Chapter 7: describes GCOS 7 as an Information System.

Chapter 8: describes GCOS 7 as a Production System.

Chapter 9: describes GCOS 7 as a Development System.

Chapter 10: tells you about GCOS 7 Solutions.

ASSOCIATED DOCUMENTS

At the end of each chapter a paragraph titled "Further Reading" refers you to the detailed documentation relative to the topics discussed.

Table of Contents

Illustrations

Tables

Figures

1. Introduction to GCOS 7

1.1 GENERAL DESCRIPTION

GCOS 7 is the operating system of the Bull DPS 7000 range. It is characterized in particular by:

- the ability to manage large databases with complete security by means of the TDS transactional monitor.
- a state-of-the-art software engineering offer with openness to the outside world through:
  - its total integration in the Distributed Computing Model,
  - the cooperation of applications in a homogeneous (OSI/DSA) or heterogeneous (TCP/IP) network,
  - partnerships with Independent Software Vendors (ISVs) to offer new market-leading products under GCOS 7.

The GCOS 7 operating system is common to the whole range of DPS 7000 Enterprise Servers. This guarantees that the evolution of sites is totally compatible with software investment (applications, training, etc.).

1.2 GCOS 7 EXMS VERSION V7

This software version supports the segmented-paged architecture present on the DPS 7000/4x5 and DPS 7000/800 series.

The segmented-page architecture can be used to manage large main memories (up to 2 GBytes per GCOS 7 system for a redundant DPS 7000/800 with bi-system facility).

1.2.1 Parallel Multi-Server Architecture

The Parallel Multi-Server Architecture of the DPS 7000 Enterprise TP/DB Server is based on two major technological choices, which are Symmetrical Multiple Parallel Processing and VLSI/CMOS integrated circuit technology.

Symmetrical Multiple Parallel Processing reduces the cost of Enterprise computing by deploying, in parallel, multiple generalized and specialized processors. Multiple processors, multiple servers, and multiple protocols enable the building of the most cost-effective Information System solutions.

Other features of this architecture, such as full redundancy and advanced software techniques, bring a new level of security and high availability to meet the most exacting demands of mission-critical applications.

1.2.2 Symmetrical Multiple Parallel Processing

The DPS 7000/800 High Range of Enterprise TP/DB Servers support up to six generalized processors, up to six specialized processors or a Back-End Server for enhanced application throughput, and up to 64 peripheral processors. The series offers an extremely high level of power (close to double that of the previous series), scalability and flexibility, due to the intensive use of symmetrical multiple parallel processing.

The DPS 7000/800 systems benefit from the new software base GCOS 7 EXMS, which brings efficient management of the new architecture and processors.

Symmetrical multiple parallel processing brings benefits to users in terms of the high power and large number of processors, and through the high degree of flexibility and economy gained by specializing processors for specific tasks and by allocating and deploying processor power where it is most needed.

1.2.3 GCOS 7 Back-End Technology

The GCOS 7 Back-End Server brings significant throughput improvement for Oracle RDBMS-based applications and/or for OPEN 7 client/server applications in production or decision support environments.

The GCOS 7 Back-End Server brings very important advantages:

- there is a large gain in performance/price ratio at minimal cost,
- it is fully compatible with existing applications,
- it requires no extra hardware or software to support it,
- it is fully integrated in the GCOS 7 architecture,
- it is transparent to the user, who sees only the performance benefit.

1.2.4 Continuous Service Features

The DPS 7000/800 series of redundant system

s incorporate a very high degree of resiliency at all levels of the platform: CPU, main memory, power supplies, I/O, and telecommunications.

This resiliency, complemented by the GCOS 7 High Availability software features such as TDS-HA and RDDF 7 (new version 2), contributes to a remarkably high level of Continuous Service.

The DPS 7000/800 models enhance the reputation of GCOS 7 systems for inherently good security and high data integrity. For example, the new integrated Back-up Board can replace a failed CPU.

Both the information capital of the enterprise and the work of users are fully protected.

1.2.5 LAN Communications Servers

An entirely new generation of LAN communications servers offer Fiber Distributed Data Interchange (FDDI) connection capability. FDDI is an industry-standard technology which enables data transfer rates on Local Area Networks of up to 100 Mb/s (compared with the current transfer rate of 10 Mb/s for Ethernet LAN's) and which enables application performance gains of three times or more.

The FDDI LAN capability is an important client/server enabling technology in the context of the Distributed Computing Model.

1.3 GCOS 7 STANDARD AND OPTIONAL FEATURES

The following features are provided either as standard or as options. They are more fully described in other sections of this manual.

- The **CD-DOC Workgroup for** GCOS 7 offers the use of a workgroup installed around a DPS 7000 system to provide GCOS 7 documentation on Compact Disk (CD) for up to ten users' desktop personal computers,

- **ASM7 Disk Storage Manager** includes disk space management facilities:

  - Volume Set Manager.
    Volume sets are "pools" of mass storage media, which accommodate cataloged files. The "pools" may comprise different disk types such as LSS and 1 GB disks, provided that the disks are formatted in FBO (Fixed Block Organization). The ASM7 Disk Storage Manager operates in conjunction with standard GCOS 7 facilities such as the Catalog, Access Rights, and Quota Manager, in order to offer transparency of data location and optimization of disk space.

  - Automated Restore and Save (ARS).
    Automated Restore and Save are provided through file migration services (available with the Disk Storage Manager in extended mode). This facility transfers infrequently used files to secondary media (tape, cartridge) and automatically restores them when they are needed.

- **ASM7 EpochBackup 7,** a client application on GCOS 7, supports the EpochBackup 7 solution consisting of an EpochBackup server located on a DPX/20, with associated libraries. This solution offers two main functions:

  - capability of automated save decisions, and tracking of saves,

  - handling of the DPX/20 libraries and autoloaders used for the save operations.

- **ASM7 File Data Save Manager (FDS7)** is a local-server Automated Storage Management save/archive solution. Its main features are:

  - periodic save and restore of files according to the level of data sensitivity,

  - management of file and data save generations,

  - history of saves and restores:

  - full support of GCOS 7 file organizations,

  - management of tape/cartridge library subsystems or sequential loaders,

- Distributed Operator Facilities (DOF7):

  - **DOF7-PO** (Programmed Operator) option offers programmed operator functions for automating the daily operating tasks (processing of commands, messages and events) on several DPS 7000 systems which are part of an OSI/DSA network.

  - **DOF7-SM** (Script Manager) option offers a user-friendly interface, based on the GCL language, for designing Programmed Operator applications.

- **Large Memory Cache** (LMC) provides efficient management of large memories (up to 1 GByte), enabling improved throughput in production by reducing the number of I/O operations required. LMC is essential for systems equipped with more than 128 MBytes of memory.

- The **I/O Cache Memory** optional feature for DPS 7000/800 systems authorizes the use of the I/O Cache Memory function which offers low-cost memory reserved for the Large Memory Cache.

- The **Mirror Disks** facility provides a high level of data security by permanently maintaining identical copies of two disk volumes.

- The **Migration Facility** allows the migration of user files (code and data) from one set of disk volumes to another, in particular, from VBO (Variable Block Organization) disks to FBO (Fixed Block Organization) disks.

- **Quota Manager** enables efficient, secure management of disk space according to the requirements of the various user projects, thereby stopping excessive monopolizing of this type of system resource.

- The **RDDF7 (Remote Duplicate Data Facility)** optional product provides protection against total or partial destruction of an operating site, for all types of files (UFAS, IDS/II, or ORACLE), by the use of remote backup techniques.

- **TDS-HA** provides High Availability for TDS applications. Its operation is based on real-time back-up techniques, reducing downtime in the event of a serious incident and enabling automatic warm restart for all the users.

- **TPR in C** enables TDS applications (Transaction Processing Routines - TPRs) to be developed and run in the C Language.

- **Standard Development Interfaces (SDI)** provides long-term validity for developments using these primitives to access GCOS 7 services, and reinforces the openness of GCOS 7 to DCM.

- **OPEN 7 Booster** enables applications running in the OPEN 7 environment to gain performance benefits from the X-HRP specialized processors and the Back End Server.

- **UFAS Batch Booster** provides performance enhancement for I/O-intensive batch programs using UFAS sequential and relative files.

- The **Extended Sort** option includes two functions, which are the Large Memory Sort and the Parallel Sort. This last feature is a benefit derived from the DPS 7000 **parallel multi-server architecture**.

- The **GCL Batch facility** option enables a user to submit a non-compiled GCL job in a batch environment.

- The **Extended File Manager** option is intended to support the full operational power and capacity of the DPS 7000/4x0 and 4x5 series, the DPS 7000/500 & 700 series, and the DPS 7000/800 series. The GCOS 7 system limits in terms of file operations are significantly increased.

- **TDS Regulation for** GCOS 7 **DCE RPC** controls the simultaneity level of transactions using the GCOS 7 DCE RPC synchronous mechanism.

Note that several of these and other GCOS 7 features are also available as packaged offers. The packaged offers concern:

- Software Engineering,
- Distributed Operator Facility (DOF7),
- Standard Development Interfaces (SDI),
- System Facility,
- Security,
- Communications.

1.4 DISTRIBUTED COMPUTING MODEL FUNCTIONALITIES

- **Affinity Visual** enables fast and easy development of graphic windowed "facelifting" on PC's accessing DPS 7000 systems, for existing and new GCOS 7 TP/DB applications, with integration of PC commodity tools for local processing.

- **TUXEDO - GCOS 7/TDS CTP Link** enables two-level transactional operation, and two-way Co-operative Transaction Processing (CTP) at "confirm" level between TUXEDO applications running on a DPX system and GCOS 7/TDS applications running on a DPS 7000 system.

- **BusinessObjects** provides end-users with transparent and easy access to ORACLE data on DPS 7000 and/or DPX platforms, and optionally to other data in the DDA environment, using query-building tools and requiring no SQL expertise.

- **CPI-C/XCP2** can be used for inter-communication between co-operating transactions on the same system or on different systems (DPS 7000/GCOS 7 or IBM/MVS). It is now available with the SYNCPOINT function (with the PPC-PI programming interface), which allows consistent, synchronized updates on a distributed database.

- **Data Warehouse 7** provides the ability to extract data from production databases and populate the information database. Data Warehouse management performs the collection of data which supports the management decision-making process.

- **Distributed Data Access (DDA)** is intended for users of decision-making facilities and enables transparent access to data, irrespective of the database technology used, the physical location, and the supporting operating system environment (Bull, IBM, DEC, etc.). All GCOS 7 file organizations, which are ORACLE, UFAS, and IDS/II, can be accessed through DDA.

- **DDA PC7 Gateway** provides easy and ad-hoc access to enterprise information assets, giving users the capability to have direct access to GCOS 7 UFAS and IDS/II data, using PC tools, via a simple GCOS 7 Gateway located on the PC.

- **FlowBus** provides application cooperation using high-level message passing facilities.

- **GCOS 7 Affinity Server** enables GCOS 7 to act as an applications server for PC's configured as Affinity/OpenTeam workstations.

- **GCOS 7 DCE RPC** is a standard Remote Procedure Call, providing GCOS 7 systems with the ability to request services located on other OSF/DCE-conformant servers. The new version 102 introduces a server access mode for GCOS 7 applications and extended TCP/IP support.

- **GCOS 7/EDIWorks Link** EDIWorks Business Server, which runs on DPX/20 platforms, enables GCOS 7 applications to benefit from EDI services through Application Programming Interfaces (API's) using the DCE Remote Procedure Call (RPC) mechanism.

- **GCOS 7/SAS Link** offers functions for decision-making, project planning and management, statistical and mathematical analysis, forecasting and application development. SAS runs on a DPX or other UNIX system, and accesses GCOS 7 data through the GCOS 7/SAS Link.

- **GCOS 7 XTI** (X/OPEN Transport Interface) is an application programmatic interface which support transport-layer applications on GCOS 7 systems, these applications being independent of the underlying communications protocol (TCP/IP or OSI/ISO).

- **/HOST7** is a Client/Server solution enabling Tuxedo client applications running on a DPX system to request services from GCOS 7 TDS servers.

- **ISM/TDS Manager** is an ISM application dedicated to the monitoring and dynamic administration of multiple TDSs on one or more GCOS 7 systems. TDS Manager runs on an ISM server and obtains all the necessary information by communicating through DSA links with the native Agent 7 running on the DPS 7000. TDS Manager brings simplicity, efficiency, and operational cost reductions for sites having production systems based on transactional applications.

- **ISM DBA EXPERT** is a tool for the administration of relational databases in a distributed environment, monitoring ORACLE databases on DPS 7000 and/or DPX systems.

- **MISTRAL** is a powerful Text Information Management System (TIMS), based on Thesaurus capabilities, enabling the collection, management and retrieval of all types of structured or unstructured data, accessible through a multi-criteria query system, optionally with the capability of integrating images. The new version MISTRAL 6.0 is based on a client/server architecture to enable integration into open and distributed solutions, and includes a new PC-based "Windows MISTRAL Query" application.

- **TDS Client-Mode Access to Oracle** provides access from a GCOS 7 / TDS application, running as a client, to an Oracle database located on a DPX/20 system.

- **TDS/IMAGEWorks Classic Link** is a multi-media production system integrating IMAGEWorks documents (on a DPX system) within GCOS 7/TDS applications.

2. GCOS 7 in the Distributed Computing Model

2.1 INTRODUCTION

The challenge in enterprise Information Technology has been to put the resources of the Information System - whether individual, shared by a work group, specific to the enterprise or to several enterprises - on the end-user's desktop.

The Enterprise Information System is presented to users on their workstations as an intuitive, graphic environment, enabling them to access the applications, information and tools which they need.

The Distributed Computing Model supplies the global framework for Bull's response to these enterprise requirements:

- the Model is open because it is based on a number of legally or commonly recognized standards so that Bull systems can work in synergy with each other and with products from other suppliers.
- the Model gives customers total flexibility to build up their own Information System solution using Bull or non-Bull components and interfaces.
- the Model is logically distributed because it offers varying degrees of centralization and decentralization for the data and processing, according to where the applications and services are needed, according to the **client/server** model.
- the Model makes it possible to implement distributed data processing in an evolutionary way. Customers can benefit from the proven advantages of the Bull DPS 7000 Enterprise TP/DB Servers while making use of the possibilities offered by new components of the Model such as graphic workstations, PCs in local area networks or workgroups, UNIX servers, and so on.

For end-users, the Distributed Computing Model gives easy, transparent access to all the applications and enterprise information resources necessary for them to be effective.

For system administrators, the Distributed Computing Model means that the management and administration of information system security is considered as a coherent and integrated whole, regardless of the type of network or platform involved.

For application developers, the Distributed Computing Model means services providing improved productivity and quality in the design and implementation of applications.

The Distributed Computing Model gives the user:

- the best possible performance/price ratio because of the distribution of data and processing onto the components best suited for the task,
- consistency of enterprise data because of the full integration of servers and workstations,
- investment protection because of modular evolution possibilities, and because of standards-based application development and added-value capability,
- unified and easy-to-use presentation on the end-user's desktop, for greater productivity.

2.2 GCOS 7 FUNCTIONALITIES IN THE DISTRIBUTED COMPUTING MODEL

2.2.1 GCOS 7 on DPS 7000 As Transactional Server

TDS (Transaction Driven Subsystem), the transactional monitor of GCOS 7 has:

- high performance levels for the enterprise's mission-critical production applications, in a context involving relational data bases (ORACLE), CODASYL data bases (IDS/II), or traditional files (UFAS),
- the capability of supporting a large number of users: up to 7000 simultaneously active users in an IDS/II database environment, and up to 3500 in an ORACLE relational database environment,
- two-level Transaction Processing, Co-operative Transaction Processing (CTP), and Client/Server Transaction Processing (/HOST 7), between Bull's UNIX systems running Tuxedo and DPS 7000 systems running TDS, in compliance with the X/OPEN standard interface CPI-C,
- transactional intercommunication between GCOS 7/TDS transactional applications, and between GCOS 7/TDS transactional and CICS transactional applications on IBM/MVS systems. According to options purchased, this co-operation is provided either at XCP1 level (compatible with the IBM protocols LU0 (CICS) and LUP (IMS)), or at XCP2 level (compatible with the IBM protocol LU6.2) which guarantees coherence and synchronization in distributed database updating (SYNCPOINT function),
- the added dimension of images, in which a TDS application running on a GCOS 7 system can access the functions of an IMAGEWorks document server located on Bull's UNIX systems, opening the door to new types of multi-media application.

2.2.2 GCOS 7 on DPS 7000 As Enterprise Data Server

In a distributed environment, the GCOS 7 system offers all the functions necessary to manage the enterprise's data, with:

- the possibility of choosing between a relational data organization (ORACLE databases), a CODASYL-type data organization (IDS/II databases) or an organization in classical files (UFAS) whether for production applications and information center requirements,
- the possibility of accessing data transparently on different platforms and with different data organizations. This is accomplished via Distributed Data Access (DDA) architecture, which is based on the Open SQL programmatic interface, compliant with the X/OPEN-SAG norm,
- the possibility of enhancing production data bases with associated image documents (TDS/IMAGEWorks Classic Link),

- numerous solutions giving end users easy access to the data and enabling them to format this data as an aid to decision-making. Among the most prominent are the tools accessing the ORACLE data bases through SQL*Net, FOCUS and its micro-application, BusinessObjects, Windowed Information Link (WIL) in cooperation with the individual tools on the workstation, SAS System in co-operation with Bull's UNIX systems, etc. With the Data Warehouse solutions, data is extracted from the production databases and populated in the information database. Data Warehouse management performs the collection of data to support the management information decision-making process,

- management of textual data, with powerful search capabilities based on inverted file and thesaurus techniques. It is possible to link image documents managed by the IMAGEWorks server to textual documents, with MISTRAL and its micro-application Windows MISTRAL Query,

- the capability of accessing data retrieval and archiving functionalities on a StreamPATH server on UNIX, through the GCOS 7/StreamPATH Link,

- the Automated Storage Management capability (ASM7) which brings a high-level of availability with facilities for a DPS 7000 system and its applications. ASM7 offers high-level Automated Storage Management functions for Mass Storage and Library subsystems on a DPS 7000 system.

2.2.3 GCOS 7 on DPS 7000 As High Security Server

Because it manages the enterprise's mission-critical transactional applications and data, the DPS 7000 Enterprise TP/DB Server offers all the functions necessary for system security and availability:

- mechanisms guaranteeing access security (catalog, access rights, SECUR'ACCESS solution) and data integrity (Before and After Journals, management of concurrent accesses, SYNCPOINT function for updates on distributed databases),

- continuity of service provided by the hardware components' high level of reliability, redundancy of hardware and software components (central processing unit, controllers, multiple access paths to peripherals, Mirror Disks feature, TDS-HA high-availability transactional processing) and remote back-up systems for protection against disaster (the RDDF7 solution),

- access control for applications and checking of user authorizations, based on password/authentication control or on CP8 smart card technology (the SECUR'ACCESS solution). As an option of the SECUR'ACCESS offer, AUDIT7 provides conformity to C2 standard security requirements, bringing a Login function which enhances GCOS 7 security to the C2 level.

2.2.4 GCOS 7 on DPS 7000 As Enterprise Communications Server

To accompany the transactional production applications and the solutions enabling the circulation of information between the host site and the end-user's workstation, the DPS 7000 Enterprise Server also offers solutions for the effective circulation of information between the members of the enterprise or between enterprises, with:

- a document filing and production server (DOAS/DFA7) whose functions can be accessed via micro-applications,
- access to the Fax and Telex functions in cooperation with Bull's UNIX systems,
- an Electronic Data Interchange application, EDIWorks for GCOS 7,
- a telematic server offer which conforms to the French TELETEL norm (Septel).

2.3 STELLA : HIGH-LEVEL GCOS 7 / UNIX INTEROPERABILITY

The Stella offer provides solutions that address the need for enterprises to construct information systems that accommodate the evolution of their legacy applications with new applications in open systems environments. The Stella offer is built on interoperability middleware running on top of a Fast Link between GCOS 7 and Bull's UNIX servers.

Stella Fast Link provides the features and performance of the DPS 7000 multi-server architecture and fast FDDI technology (100 Mbits/sec).

The solutions based on Stella enable benefits to be derived from open systems while capitalizing on existing GCOS 7 environments.

The Stella offer provides information management facilities in an environment where interoperability between GCOS 7 and UNIX grows stronger and closer.

Stella Fast Link is described in the Section "Communications and Networks". Stella Solutions are described in the Section "Solutions".

2.4 GCOS 7 OPENNESS

2.4.1 GCOS 7 Openness to the UNIX World

Users are free to choose between two types of communications architecture enabling cooperation between DPS 7000 systems and systems running under UNIX:

- the OSI/DSA architecture for communication between DPS 7000 systems and Bull's UNIX systems via high-speed Local Area Networks (LANs) and public or private X.25-type networks (WANs). Users can then take advantage of functions such as file transfer, access to GCOS 7 applications in terminal emulation mode from a workstation connected to Bull's UNIX systems, inter-application communication and distributed data base management.

- the de facto standard TCP/IP protocol for communication between systems using this protocol (DPS 7000, DPX, Escala, and other UNIX and non-UNIX systems) via high-speed Local Area Networks (LANs) or private or public X.25-type networks (WANs). The TCP/IP protocol is available on the DPS 7000 through the OPEN 7 services. The user can then take advantage of functions such as file transfer (FTP), access to remote GCOS 7 applications from a workstation connected to a UNIX system (TELNET), management of distributed files (NFS7), X-terminal connection (X/FORM7) and X-station connection (Remote X/FORM7), distributed data bases (ORACLE with SQL*Net).

DPS 7000 - UNIX co-operation gives the user access to the best of both worlds:

- the transactional power, and efficient security and reliable data management capability of GCOS 7 systems,

- the diversity of the applications available for systems under UNIX.

2.4.2 Openness to PC and Workgroup Integration

The ease of use of intelligent workstations, their possibility of graphic user interfaces (GUI), and the market software packages available for them, make them the end user's preferred tool.

Affinity Line is Bull's solution for integrating micro-computers around DPS 7000 servers, other GCOS systems, IBM mainframes or UNIX systems, via Local or Wide Area Networks, thus combining their respective qualities in the most efficient way.

In the market-standard MS-Windows 3 environment, Affinity Line offers:

- automatic connection to the DPS 7000 system,
- terminal emulation on GCOS 7 applications,
- file transfer functions,
- the possibility of multi-sessions,
- the automation of repetitive tasks such as connection to the DPS 7000 host system, activation of a central application or a transfer operation, by writing script files describing the tasks to be performed (AUTOMATOR and USL),
- a programmatic interface (Unified Virtual Terminal Interface) for micro-applications which communicate with the DPS 7000 system independently of the communication links,
- a "face-lifting" or "revamping" function for the central GCOS 7 applications to transform the terminal emulation-type man-machine interface into an MS-Windows-type interface with no modification to the central application (Affinity Visual).

GCOS 7 **Affinity Server** enables GCOS 7 to act as an applications server for PCs configured as Affinity/OpenTeam workstations, directly on the Local Area Network (LAN) supporting the TCP/IP protocol.

OpenTeam is Bull's solution for creating workgroups containing a UNIX Server in a UNIX environment and workstations in an MS-DOS/MS-Windows environment, allowing the sharing of resources and the distribution of the applications through the services of the LAN Manager.

The connection between an OpenTeam workgroup and the DPS 7000 system is implemented via a Local or Wide Area Network. It requires Affinity for OpenTeam for the UNIX workgroup server and the client PCs or BQ330's. It enables:

- an MS-DOS workstation from the work group to access GCOS 7 transactional (TDS) or interactive applications (IOF),
- the workgroup to be seen from the DPS 7000 system as a cluster of terminals,
- the distribution of ORACLE data bases via SQL*Net,
- Unified File Transfer (UFT) between DPS 7000 and other systems,
- the availability of the functions in the Affinity Line offer, as these functions can be integrated in an OpenTeam workgroup.

2.4.3 Openness to Standards

Groupe Bull is a proactive member of standards bodies such as the International Standards Organisation (ISO), X/OPEN and Open Software Foundation (OSF).

Products for DPS 7000 systems in this context include:

- GCOS 7 DCE offer, consisting essentially of the OSF/DCE Remote Procedure Call (RPC), providing GCOS 7 systems with easy and cost-effective access to new distributed services,

- GCOS 7 XTI, the GCOS 7 implementation of the X/OPEN Transport Interface (XTI), supporting transport-layer applications which are independent of the communications protocol (TCP/IP or OSI/ISO),

- FlowBus, which is a solution for message passing between cooperating applications. By enabling applications to communicate with each other in a standard way, FlowBus fulfills a strong requirement of customers, which is to insure cross-platform and cross-application interoperability independently of the network infrastructure and protocols. The FlowBus API is modelled on the X/OPEN TX and X/ATMI standard interfaces and is an extension of the X/OPEN DTP (Distributed Transaction Processing) Model API's.

2.5 ALLIANCE SOLUTIONS

Alliance Solutions are built from GCOS and other Distributed Model components. The Alliance Solutions approach encompasses the following principles :

- solutions are targeted at specific customer needs, while reducing data processing costs and protecting Information System investments,
- solution packs are simple and easy to order, install, configure and use,
- solutions are based on existing Distributed Computing Model building blocks,
- services are associated with the Alliance solutions, to facilitate quick installation and operation,
- solutions are attractively priced, compared with the individual components.

2.6 GCOS 7 SYSTEM MANAGEMENT

2.6.1 GCOS 7 System Administration Features

The following features are offered as part of the GCOS 7 standard offer, either within the GCOS 7 bases or offered as options:

- resource control and optimization (Automatic Resource Manager), management of disk space quotas and analysis of system behavior (System Behavior Reporter),
- Volume set management (VOLSET) operates in conjunction with standard GCOS 7 facilities such as the Catalog, Access Rights, and Quota Manager, in order to offer transparency of data location and optimization of disk space,
- Automated Restore and Save transfers infrequently used files to secondary media (tape, cartridge) and automatically restores them when they are needed.
- remote monitoring of several DPS 7000 systems connected to a primary network (DOF7-OL, DOF7-RM), the connectability of multiple operator consoles dedicated to specialized operator tasks (DOF7-MC), and the possibility of programming automated applications (DOF7-PO/SM),
- administration and monitoring of OSI/DSA telecommunications networks : Network Management Facilities (NMF7),
- ASO (Automated System Operation) solutions, which are usually the subject of Joint Marketing Agreements with partners. These products enhance GCOS 7 with functions such as job scheduling and dispatching, automatic task management, fault and restart management, etc.

2.6.2 Integrated System Management (ISM)

2.6.2.1 ISM Structure and Functions

The central component of the administration facilities of the Distributed Computing Model is Integrated System Management (ISM), a global management system for enterprise-wide distributed computing. ISM is based on the OSI/ISO Reference Model and Management Framework, and complies with the alarm classification specification of the OSI NMForum model. ISM provides administration and management facilities for the resources of the enterprise in the areas of systems, networking, and DCM distributed applications.

ISM provides comprehensive, modular, and flexible management solutions for GCOS 7 (and GCOS 8 and UNIX) customers as well as for medium and large DCM solution users.

It protects your investments by offering a strategic management platform based on de facto or emerging standards and boosts the performance of Information Systems by providing the appropriate tools. It reduces operational costs, and increases the quality of service and responsiveness.

The basic structures and functionalities of ISM are as follows:

- integrated architecture providing a homogeneous view of heterogeneous worlds (TCP/IP, OSI/DSA, etc.),
- management application independency from the underlying protocols and system architectures,
- a comprehensive development platform for management applications with a versatile portfolio of tool-kits and management API's,
- the CM-API (Common Management API) programmatic interface, Bull's contribution to OSF/DME, which is a standard low-level programmatic interface for developing Management Services.

The ISM Framework has an extended management architecture for co-operation of several ISM managers, and features for data export to external spreadsheets. ISM Data Exchange is a tool which enables the administrator to select and export data from an ISM object or group to a flat file for further processing. The ISM Development Toolkit offers new tools such as the SML debugger, SNMP and CMIP agent development tool kits.

Other main functions are as follows:

- network management capabilities: covering WAN's, and the support of OSI as well as OSI/DSA networks, and interoperability with other NMForum-compliant management platforms. For TCP/IP LAN's, there is an automatic network "discovery" function which enables a TCP/IP network configuration to be drawn with an appropriate map for use by the ISM Monitor. Finally, ISM offers generic support for LIN/LAN equipment, and in-depth support for the LinkBuilder 4/10 hubs and the NETBuilder family of bridges and routers.
- PC/Workgroup Management capabilities: resource monitoring of active servers, of the connected PC's, and of the active NetBIOS applications of selected PC's. In addition, the new Software Delivery function enables the downloading and automatic installation of PC applications.
- system management capabilities: Console management facilities for multiple platforms running under different operating systems (any GCOS system, UNIX and Datanet), System Monitoring facilities for global monitoring and remote tracking of several systems, and ORACLE database supervisory and performance monitoring applications.
- enhanced ISM Framework and generic applications:
  - New centralized configurator,
  - Improved graphical user interface,
  - Scripts to automate administrative operations,
  - Remote alarm forwarding,
- new ISM Server models: 100, 390 and 690,
- an extended application portfolio to manage:

  - UNIX systems,
  - Workgroups,
  - OSI/DSA, SNMP and OSI networks,
  - LIN/LAN equipment,
- enhanced existing administrative applications,
- management of new resources:
  - BOS/TP distributed OLTP
  - EpochBackup storage systems

2.6.3 Principle ISM Functionalities for GCOS 7 Users

ISM Pilot

This ISM application concentrates and automates, on a single administrative ISM Server, the console operator dialog originating from multiple heterogeneous systems. Features are:

- script facility, which is a key feature for automating systems in complex situations, by providing message correlation,
- log file functions (Archiving, Reading, Exporting, Printing, etc.) and Filter printing functions,
- integration of the Pilot Alarm mechanism with the ISM Alarm generic application, enabling alarms to be received from systems without an agent (SNMP, DSAC, etc.),
- ISM Pilot self-management through the generation of console-like messages triggering Pilot automation mechanisms,
- extended communication links (PAD X.25, PAD Ethernet, Telnet).

ISM/TDS Manager

This ISM application is dedicated to the monitoring and dynamic administration of multiple TDSs on one or more GCOS 7 systems. TDS Manager runs on an ISM server and obtains all the necessary information by communicating through DSA links with the native Agent 7 running on the DPS 7000.

ISM DBA Expert

This application provides versatile tools for advanced management of Oracle databases installed on GCOS 7, DPX/2, DPX/20 and Escala systems. Tasks performed include installation and configuration, security, integrity, and performance. This application is intended for database administrators.

ISM DB Monitor

This application provides global monitoring of multiple Oracle7 databases installed on GCOS 7, DPX/2, DPX/20 and Escala systems, and enables ISM to display information on the status of Oracle servers, sites, hosts and SQL*Net gateways. This application is intended for database operators.

ISM STATDSA

This application, resulting from a third-party cooperation, provides two sets of facilities:

- an efficient network traffic analyser tracking the performance of the various components and highlighting potential bottlenecks,
- a comprehensive set of tools processing historical data for trend analysis and capacity planning.

Versatile graphical displays and reports can be realized from the analyzed data with the help of outstandingly performant tools.

ISM DNS/CNS Explorer

This specific ISM application enables the user to browse a running NAD configuration (Datanet or CNP7) and to monitor its behaviour. The main functions are:

- display DSAC NAD monitor objects and associated mappings and also the Datanet/CNP7 configuration
- display the Datanet/CNP7 object status through a matrix display.

ISM Workgroup Monitor

This specific ISM application provides the management of Netware 3.1x servers and of their associated MS-DOS PCs. The following information is handled:

- PC Hardware and Software inventory,
- threshold alarm configuration,
- user and memory accounting,
- waiting queue management.

The Novell Netware workgroup PCs can be downloaded by the ISM Software Distribution application from a DPX/20 system.

Note: GCOS 7/DPS 7000/800 customers are offered a bundled ISM Server with the ISM Pilot console management application with their system deliveries.

2.7 GCOS 7 APPLICATION DEVELOPMENT

2.7.1 Application Development Features

The GCOS 7 operating system offers, either bundled in the base or optionally, a number of software products enabling the development and debugging of production applications.

In particular, the SINDIA 7 Integrated Dialog System is a Software Engineering facility. that provides a method and a set of tools for developing transactional applications which run in a GCOS 7/TDS remote processing environment.

See the section *GCOS 7 Development Systems* for further details.

Additionally, GCOS 7 customers have at their disposal a large choice of CASE (Computer-Aided Software Engineering) tools, such as PACBASE, DELTA, MANTIS, and others, which are also available on other or non-platforms, and which help to produce highly portable applications. These CASE products provide developers with integrated powerful PC-based tools for maximizing programmer ergonomy and productivity. The detailed description of these products is outside the scope of this document, since they are the subject of JMA (Joint Marketing Agreements) between Groupe Bull and its partners (for example, Andersen Consulting, CINCOM, CGI, etc.).

2.7.2 Client/Server Application Development

The paragraphs below are intended to give an overview statement about current and future products in this domain. Not all products quoted are immediately available at the time of publication.

2.7.2.1 CASE Solutions

These solutions are supplied in the following ways :

- either in the form of a family of products covering the totality of the development cycle, which concerns Integrated CASE solutions,
- or in the form of integration of various tools addressing the different phases of the development cycle and which communicate development data between them.

Integrated CASE solutions

This offer is based on the strategy of our partner CGI:

- the family of products PACBASE/CS (PACDESIGN, PACBENCH, etc.) bring new functionalities for the development of client/server applications which dialog via the CPI-C interface,
- the new product PAC/CS enabling the development of object-oriented PC applications.

and CGI cooperate at the Engineering and Marketing levels in order to guarantee the longevity of their agreements and to enable GCOS 7 customer to benefit from all the new functions available in the field of client/server application development.

Solutions for integration of CASE components

These solutions are based on CASE components which address different phases of the development cycle (analysis, design, etc.) and which communicate by the medium of ISD (Integrated System Development), a TRANSTAR offer, described in the preceding paragraph.

The main features of ISD are the following :

- a dictionary of application development data based on Portable Common Tools Environment (PCTE) technology and associated tools,
- a Neutral Information Model (NIM) which is independent of the methods and development tools used,
- an Exchange Server for development data and a series of bridges for the tools,
- existing bridges for tools such as Bachman/Analyst, Oracle's CDE CASE*Dictionary, Intersolv's Excelerator, Texas Instruments' IEF, KnowledgeWare's ADW and IEW, CGI's PACLAN/X, Powersoft's PowerBuilder, etc.,
- the openness to accommodate additional bridges as needed.

2.7.2.2 Rapid Application Development (RAD) tools

These tools address client/server functions at application level, or second-generation C/S, for enterprise applications with a large number of users.

Enterprise Server Procedure

On the PC side, the support of ODBC Level 2 is implemented by an extension of the product DDA/ODBC. On the GCOS 7 side, the support of ODBC Level 2 is implemented by the ESP (Enterprise Server Procedure) module.

The functions provided by ESP are as follows :

- an application may call, on a PC or an Escala system, and in a transparent way through "Execute Procedure"-type queries, application services supplied by GCOS 7/TDS which perform the processing, **access and updates** of data,
- a function for query routing,
- a function for converting the parameters for call and return-of-call,
- a function for managing the catalog of application services in order to make them available to the RAD tools used for the development of client applications which call these services.

RAD Tools

The RAD tools available in a client/server context based on ESP are the following :

- Visual Basic (Microsoft)
- PowerBuilder (Powersoft)
- NS-DK (NAT Systems).

2.7.2.3 PC Development Tools for GCOS 7

Complementing the solutions described above, PC-based tools such as GDT-PC7 (GDT Software) provide functionalities that improve productivity for developments targeted at GCOS 7 platforms.

GDT-PC7 is a tool which enables the development and maintenance of COBOL code for GCOS 7 applications. It is based on the Micro-FOCUS COBOL/2 compiler. It offers on a PC all the features required to :

- update COBOL code,
- test COBOL code, whether this code was generated by a CASE tool or not, by emulating the specifics of the GCOS 7 production environment, such as TDS, Batch, FORMS, and IDS/II.

3. GCOS 7 Software Components

3.1 STANDARD FEATURES

The following features are integrated as standard in the GCOS 7 bases.

3.1.1 Transaction Driven Subsystem (TDS)

The TDS (Transaction Driven System) transactional monitor is a conversational system whose function is to process exchanges between the user of a terminal or workstation and a DPS 7000 system operating under GCOS 7.

It enables rapid development of optimized multi-task transactional production applications since the TDS monitor itself manages:

- assignment of the system resources to the application,
- synchronization of the simultaneous processing of several applications,
- sharing for reading and updating of the UFAS files and the IDS/II or ORACLE databases common to several applications executed simultaneously, thus ensuring data integrity,
- the restart mechanisms to be implemented in the event of a malfunction or failure, in order to protect users against loss of information when application processing is resumed.

The applications (transaction processing routines - TPRs) are written either in COBOL or in C language (languages also used to program batch processing applications). No additional programming skills are required to develop TPRs.

One interesting feature of the TDS monitor is the possibility it gives batch programs of connecting to it as if they were terminals. This is the concept of pseudo-terminals.

TDS is an integral part of the GCOS 7 EXMS bases.

3.1.2 Multi Volume Backing Store

This GCOS 7 function enables the virtual memory (backing store) to be spread over several disks (currently up to 64 disks).

This spreading achieves a better distribution of Input/Output operations, leading to improved performance when the load on the system disk is heavy.

The backing store files can be installed on all the types of disk supported by GCOS 7.

3.1.3 UFAS Cache

The UFAS Cache function is available for batch as well as for transactional applications. It enables the UFAS access method to handle the growing requirements in terms of file access, as a result of new addressing and management modes for the UFAS files and buffers. The effect of this is to reduce the number of physical Input-Output operations necessary for a given task.

3.1.4 Large Memory Cache (LMC)

The aim of the LMC product is to improve application performance levels (batch - IOF - TDS) and the system processing capacity. Its operation is based on storing blocks of data in the main memory, in a special cache memory area, before they undergo Input-Output processing, which also leads to a reduction in the number of I/O operations necessary for a task.

You have the flexibility to define the files (system or user) to be allocated as desired to the Large Memory Cache (LMC). The files are no longer cached by default, and may be allocated temporarily (by DEFINE) or permanently (by CATALOG) to the LMC. Besides this ease-of-use feature, an automatic regulation mechanism dynamically *excludes* infrequently accessed files from the LMC, thus minimizing the global CPU consumption requirement, and dynamically *includes* frequently accessed files.

3.1.5 System Behavior Reporter (SBR) - Basic Mode

The GCOS 7 facility for analyzing the use of the system resources (SBR) enables the use of the hardware and software resources to be monitored effectively during operation.

It complements the GCOS 7 accounting mechanisms and can be used to optimize performance for a chain or for the whole system.

SBR is executed in two desynchronized phases:

- information gathering phase,
- analysis phase.

The information gathering phase takes place during operation. It can be implemented and stopped at any time without disturbing operation. The information is stored in a file.

The analysis phase reads the file created during the information gathering phase, analyzes the information gathered and generates tables and statistics on the use of the resources.

3.1.6 General Access Control (GAC)

GCOS 7 enables various types of jobs to be executed in parallel: batch, transactional, and interactive. To implement such a system with full security, GCOS 7 includes a function called GAC (General Access Control).

This function provides:

- simultaneous access in update mode to the same files/databases from all the types of application managed by GCOS 7.
- guarantee of consistency of the data stored in conventional files or in databases.

To achieve this consistency and to avoid interfering with the system performance, GAC uses selective locking of data. This allows several simultaneous accesses to the same data as long as no application tries to modify them.

If modification is attempted, the application wishing to do so receives an "exclusive" right of access to the data to be modified.

The length of time that a data item will be locked is defined during analysis of the application (definition of the commitment unit).

GAC is capable of managing:

- abnormal locking duration,
- deadlock situations.

GAC is not designed to manage concurrent accesses in configurations of coupled systems.

3.1.7 Generalized Terminal Writer (GTWriter)

GTWriter is a GCOS 7 product that provides a function for writing outputs on user terminals.

The end-user visibility is the same as for the standard SYSOUT functionality.

The main features are as follows:

- up to 3000 terminals supported, of any GCOS 7 terminal type,
- ISL-connected printers supported,
- static printer sharing by several GCOS 7 systems connected to the same ISL,
- centralized network administrator functionality,
- access from TDS, BATCH and IOF,
- set of GCL operator commands,
- restart capability at page level after a fault,
- remote loading of character fonts, page backgrounds, etc.
- security and privacy of printouts,
- rerouting of printouts from GTWriter to the system printer or a "remote batch" workstation.

The latest version of GTWriter provides the following enhancements:

- increase in number of FORM's supported (from 100 to 255),
- adaptation to Distributed Printing Facility (DPF) offer,
- enhancement of performance for NIPSON non-impact printer connection on ISL, support of interface with new models, compatibility with EASYPRINT new version ,
- compatibility with the SECUR'ACCESS security solution.

3.1.8 Automatic Resource Manager (ARM)

ARM has three objectives:

- to distribute resources among the various dimensions according to the relative importance assigned to each and according to its load.
- to control the use of resources in each dimension, according to what has been assigned to them and each job's authorization parameters.
- to optimize the distribution of resources in line with the overall system load and the job profiles.

ARM automatically regulates, controls and allocates system resources (memory and CPU) among the various TDS, IOF and BATCH applications, according to the overall load on the system and the profile of the jobs being executed (priority, consumption attained, thresholds, etc.).

ARM guarantees resources for IOF and TDS applications in priority.

ARM provides answers to the following problems:

- automatic detection and prevention of system overloads,
- automatic adjustment of the number of jobs being executed,
- prevention of starvation of the low-priority jobs,
- isolation and restriction of resource-hungry jobs, etc.

ARM is reserved for the system administrator, and its GCL menus make it user-friendly and easy to use.

The ARM feature in GCOS 7 extends the dimension concept beyond the memory aspects, encompassing the CPU, the level of multi-programming, reinforced protection of the resources necessary for good performance in a given activity, and the capability of creating personalized dimensions.

These functionalities are triggered by the parameters attached to the dimension in which the task involved is executed.

The main advantages of this facility are:

- the ability to spread several interactive users over several different dimensions.
- the possibility of automatically re-assigning unused resources if the load on the system is not heavy.
- the possibility of isolating certain tasks which may disturb operation of the system (heavy I/O requirements, for example).

3.1.9 Quota Manager

On all configurations, and particularly on large configurations, there is a trend towards:

- increased number of users
- growing proportion of interactive applications
- increasing disk capacity
- increasing number of disks supported
- progressive disappearance of removable disks and replacement with fixed disks.

Until now, it was difficult to control the use of disk space because any user had the right to create a file on any public volume as long as the space was available, without being identified (unless the file was cataloged). This could lead to over-dimensioned files that were rarely used (and sometimes unused or forgotten), allocated without any plan and without any identifiable owner.

Quota Manager offers the system administrator a means of measuring and limiting the consumption of secondary storage on disk.

This facility, which supports all types of operation (IOF, BATCH, TDS), is aimed above all at interactive systems for which the frequency of operations on the disk space (file creation, extension and deletion) is higher.

Use of this facility is optional and selective: as soon as the product has been installed on the site, the system administrator can activate or disable it. If it is activated, it can be restricted to some of the volumes and some of the projects.

This facility is user-friendly: the GCL commands for managing the quotas are accessible under IOF in the MAINTAIN_QUOTA domain.

The Quota Manager provides the following functions:

- accounting of the disk space consumed per project
- control of the disk space consumed per project:
  - auditing, restriction and correction,
  - control of the distribution of files over all the volumes and restriction of certain projects to certain disks, within the limits defined.
  - guaranteed disk space for each project.

The quota is defined at project level (all the users in a project share a certain "quota"). The quota is the maximum amount of "accounted space" that a project can allocate in secondary storage. The accounted space is made up of the set of volumes controlled by the quota manager.

Two types of resources are managed:

- temporary space, consisting of all the resident disks where the temporary files can be located.
- permanent space, consisting of the set of "public protected" disks subject to quota management.

Using this basis, four types of quota can be defined per project:

- the temporary space consumed by all the jobs executed for this project,
- the temporary space consumed by each job,
- the permanent space consumed by the project as a whole,
- the permanent space consumed by the project on each volume in a pre-defined list.

3.1.10 Front-End Processor Support (FEPS)

The FEPS component is a GCOS 7 service which manages the interface with the Datanet telecommunications processor connected to the DPS 7000 system.

It contains two modules:

- a transport module which provides real-time functions during the exchange of data between a DPS 7000 and a Datanet.
- an administration module which, among other features, generates the software and records the statistics gathered by the Bull Datanet in the GCOS 7 system files.

3.1.11 TNS

TNS is a unique server that handles communications over one or several ISL controllers, allowing communications over one or several ISL cables. There is only one occurrence of TNS in a DPS 7000 system. TNS manages all connections with other systems either directly or through CNP7. The TNS configuration parameters are specified at network generation.

3.1.12 OCS

OCS is a communications driver for the FCP7 integrated controller. OCS is a single driver job managing several server occurrences. There is one server occurrence for each FCP7 in a DPS 7000 system. OCS manages all connections through FCP7 with the FDDI network. OCS also performs administrative functions such as LOAD and DUMP for FCP7. The OCS configuration parameters are specified at network generation.

3.1.13 VCAM

VCAM is a communications module which handles the functions dealing with the session layer (connections between local or remote applications using ISO ISO/DSA or DSA protocols and addressing). Starting and terminating this communications module is synchronized with those of GCOS 7 itself. But only local connections can be done while no communications session is active.

3.1.14 Mirror Disks

Mirror Disks provides a very high availability and integrity of data. This product can be used to protect all sorts of user data.

Its operation is based on permanently maintaining identical copies on two disk volumes. If one of the disks fails, the volume involved is automatically disabled and the customer's processing continues using the other "surviving" volume.

When the failed disk has been repaired or replaced, the data on the surviving disk can be copied onto a new disk.

The Mirror Disk facility is totally transparent to the application, and the users only have to choose the disks to be mirrored and take the appropriate action should a fault occur.

3.1.15 Unattended Operation (DOF7-OL)

GCOS 7 offers the possibility of having no operator directly on the machine through the use of a remote console. It allows silent initialization and automatic restarting of the system. In the absence of an operator, the messages are recorded in the system log file (SYS.LOGC) and are repeated on the console.

3.2 OPTIONAL FEATURES

3.2.1 CD-DOC Workgroup for GCOS 7

A workgroup installed around a DPS 7000 system can access GCOS 7 documentation on CD for multiple users. A copy of the GCOS 7 CD-DOC product is a prerequisite for the CD-DOC Workgroup for GCOS 7 offer.

This offer comprises the following items:

- an application and installation guide,
- an application to enable the sharing of DPS 7000/GCOS 7 documentation through the workgroups: Windows 3.11 for Workgroup, Novell 3.12, LAN Manager,
- a license to authorize the use of GCOS 7 CD-DOC by two simultaneous users among a maximum of ten possible users.

The required PC hardware configuration (also valid for the PC's which contain the CD-DOC) is:

- Bull ZDS AT or compatible 80486, with at least 8 MBytes of RAM, 30 MBytes free on hard disk, VGA graphics colour monitor, Microsoft compatible mouse, CD player, ISO 9660 standard.
- Laser printer (Postscript or HPGL) is recommended.
- Software: MS-DOS 5 or later, MS-Windows 3.1 or later.
- Workgroup: you must provide the LAN hardware and software necessary to support the required number of CD-DOC users planned. Bull offers consulting services and additional networking products and services.

3.2.2 High Availability TDS (TDS-HA)

The TDS-HA (High Availability) product is an option of the TDS Monitor and is complementary to the basic TDS offer. TDS-HA works on the principle of a main TDS, accessing the production files, being followed in real time by a back-up TDS, which runs on another processor. If a hardware or software fault affects the main TDS, the back-up TDS takes over responsibility for the applications, and restarts the processing. The back-up environment contains both the means for detecting faults and the mechanisms for automatically starting up the back-up TDS.

The operation of TDS-HA is based on a configuration with coupled systems or with bi-system mode, sharing the disk volumes containing the TDS files and the program environment. The two systems are seen by the user as a single DPS 7000 system, because of the DSA backup correspondent function.

It is also possible (and very simple) for the operator to switch operation voluntarily over to the back-up system, for maintenance purposes for example.

From the end-user's point of view, any interruption of processing on a TDS-HA system is practically invisible, and resembles a "warm restart" of TDS:

- all the sessions protected by TDS-HA are reconnected,
- journalized files are recovered immediately,
- the transactions are automatically restarted from the last commitment point.

TDS-HA provides a dimension of continuous service and comfort to users for whom the cost of system unavailability is prohibitive.

3.2.3 Extended Sort

This feature gives considerable performance enhancement for applications using the Sort function. It comprises two features: the Large Memory Sort and the Parallel Sort.

The Large Memory Sort operates by enlarging the size of memory attributed to this function. It provides:

- accelerated read/write of user files for sorting, by means of a multi-block read/write function,
- increase in available memory size from 512 KB (now) to 64 MB in mono-process and 1 GB in multi-process (up to 32 processes).

Performance gains vary widely according to the volume of the sort, the application, the memory available, and other factors., but a typical improvement in sort time is of the order of 30%.

For the Parallel Sort, the end-user chooses the number of processes to be attributed to the sort task, which will use the memory size indicated in the job control language or by the sort command.

Extended Sort enhances performance in three ways:

- accelerated read/write of user files for sorting, by means of a multi-block read/write function,
- increase in available memory size from 512 KB (prior to V7) to 64 MB if parallel feature is not used, or to 1 GB if parallel feature is used,
- parallel sorting: the sort task is divided into several sorts which are executed simultaneously, which will reduce elapsed times,

Note: The **Limited New Sort** feature, which is integrated as standard in the GCOS 7 EXMS base, provides a limited performance improvement for sort functions.

3.2.4 UFAS Batch Booster

This performance improvement option is complementary to the UFAS Cache and Large Memory Cache standard features described above.

This feature provides improved I/O performance when accessing UFAS data files, by reducing the number of exchanges required for a given operation. It applies to UFAS sequential and relative files.

An enhancement from TS7254 further increases performance due to a new process of blocking/unblocking of records in sequential access, and a new process of read/write of buffers containing UFAS records.

3.2.5 GCOS 7 Bi-system Support

With GCOS 7 EXMS, it is possible to partition any system in the DPS 7000/800 redundant series into two subsets, each with its own GCOS 7 operating system. This bi-system operation supports the following operating modes:

- running two different GCOS 7 EXMS versions (version n and version n+1) in order to facilitate the switchover to the new technical status,
- executing high-availability transactional processing (TDS-HA) by operating the two GCOS 7 systems in parallel,
- or, isolating a specific activity from any interference in order to insure the stability of the response times or the security of this activity.

3.2.6 Coupled Systems

This product enables disk space to be shared dynamically between two DPS 7000 systems under GCOS 7. The two systems do not need to have equal power or the same configuration.

Dynamic sharing of the disk space means that access to the files and data bases can be totally or partially shared between two systems, if certain rules of use are followed.

If there is a fault on one system, the shared resources remain available on the other system.

The system disk cannot be shared between two systems.

This product is not necessary if only static sharing of peripherals between two DPS 7000 systems is required.

3.2.7 Control Tool and System Measurement (CTSM)

This module brings together several software products capable of effectively monitoring the use of the hardware and software resources being operated or tested.

It contains the facility for analyzing the use of the system resources (SBR) and the transactional and interactive load simulator (TILS).

System Behavior Reporter (SBR)

SBR is an effective tool for monitoring the use of hardware and software resources during operation, and optimizing performance levels for a chain or for the whole system by detecting any bottlenecks.

SBR is executed in two desynchronized phases:

- information gathering phase,
- analysis phase.

The information gathering phase takes place during operation. It can be implemented and stopped at any time without interfering with operation. The data is stored in a file.

The analysis phase reads the file created during the information gathering phase, reads the data it contains and generates tables and statistics on the use of the resources.

The basic version of SBR is integrated in GCOS 7. An extended version is available to give a more thorough analysis of the system.

Transactional and Interactive Load Simulator (TILS)

TILS can be used to test and assess existing transactional and/or interactive application programs before effective installation of the terminals, or to debug a new transactional and/or interactive application without disturbing applications which are already operational.

TILS thus leads to savings on hardware and human resources.

TILS can also be used to simulate a heavy transactional and interactive load. This can be used, usually with the help of the SBR, to study the behavior of the system in future conditions of use and also to discover any potential bottlenecks with full security.

TILS can be installed on the machine where the applications used are run, or on a remote machine.

3.2.8 GCL Batch Facility

The GCL Batch facility enables a user to submit a non-compiled GCL job from any environment for execution in a batch environment. This means that users can benefit from the full functionalities of GCL for their batch operations, with correspondingly greater flexibility.

3.2.9 Extended File Manager

Extended File Manager is designed to support the full operational power and capacity of the DPS 7000/4x0 and 4x5 series, the DPS 7000/500 & 700 series, and the DPS 7000/800 series. GCOS 7 system limits in terms of file operations are significantly increased.

The Extended File Manager is particularly beneficial for customers wishing to assemble a large number of applications on a system without reprogramming them. Cases in point are companies being merged or recentralized, or planning large migration/evolutions, or simply requiring the creation of a large number of small files.

3.2.10 I/O Cache Memory

The I/O Cache Memory, available on all DPS 7000/800 redundant and non-redundant models, provides a cache for processing input/output operations. This cache cannot be used for other purposes. The use of the I/O Cache Memory is controlled by the software option "I/O Cache Memory Support".

The I/O Cache Memory comprises, in hardware terms, an integer number of memory modules which are dedicated to the Large Memory Cache (LMC). This memory is fully compatible with other GCOS 7 standard system functions such as the Automatic Resource Manager, System Behavior Reporter, etc.

The maximum size of the I/O Cache Memory on is 1024 MBytes on DPS 7000/800 redundant systems, and 256 MBytes on DPS 7000/800S non-redundant systems. The I/O Cache Memory product consists of a module of 256 MBytes.

3.2.11 ASM7 Disk Storage Manager

The Disk Storage Manager of ASM7 includes space management facilities (Volset and Automated Restore and Save) for Volume Sets, which are "pools" of mass storage media. Two modes of operation are available, Basic and Extended :

Basic mode manages a single Volume Set (VOLSET). This mode offers transparency of data location and optimization of disk space, with the following features:

- mass storage disk media grouped in one set of volumes :
- optimized and automated space allocation in a set, using several media if required,
- dynamic file extension within a set, using several media if required,
- disk space consumption reporting.

Extended mode manages multiple Volume Sets. It includes the Storage Management functions provided by the Full Volume Set (Full VOLSET) options, and file migration services provided by the Automated Restore and Save (ARS) feature.

Full VOLSET Functions

Full VOLSET provides transparency of data location and enhancement of disk space management. Mass storage disk media are grouped in Volume Sets related to the use of Catalog Access rights and the Full VOLSET functions:

- several volume sets,
- set dedicated to GCOS 7 project,
- dynamic link between Project and Volume Set, with a set dedicated to a GCOS 7 project,
- optimized and automated space allocation in a set, using several media if necessary,
- dynamic file extension within a set, using several media if necessary,
- disk space consumption reporting.

Automated Restore and Save (ARS)

Automated Storage Management is enhanced by the Automated Restore and Save (ARS) feature, providing hierarchical storage management functions. Automated Restore and Save transfers infrequently used files to secondary media (tape, cartridge) and automatically restores them when they are needed.

3.2.12 ASM7 EpochBackup 7

The **ASM7 EpochBackup** solution consists of an EpochBackup server located on a DPX/20, with associated libraries, and a client software component called EpochBackup 7 which runs on GCOS 7. The DPS 7000, as a client, communicates with the EpochBackup server on DPX/20 via OPEN 7 and an Ethernet or FDDI LAN. The EpochBackup 7 client software runs on any system supporting GCOS 7 TS7254 or later. The ASM7 EpochBackup solution offers two main functions:

- automated save decisions, and tracking of saves,
- handling of the DPX/20 libraries and autoloaders used for the save operations.

The EpochBackup server on DPX/20 can also handle explicit orders for saves and restores, received from the EpochBackup 7 client software.

The ASM7 EpochBackup solution provides the following services for cataloged files:

- periodic saves according to the level of data sensitivity and the required level of data availability:
  - the set of files to be saved (complete or incremental saves) is declared in EpochBackup, together with the save rules (based on time), and these saves are then automatically triggered from EpochBackup,
  - EpochBackup 7 can also explicitly request a save operation from the EpochBackup server, the command being forwarded to EpochBackup 7 through a GCL command,
- history of save and restore operations performed by EpochBackup.
- explicit restore requests from EpochBackup 7, the command being forwarded to EpochBackup 7 through a GCL command.
- handling of cartridge libraries by the EpochBackup server:
  - storing of the contents of the cartridges,
  - production of labels in a specific format for EpochBackup server,
- handling of the storage location of the save media,
- allocation of the media for save operations.

3.2.13 ASM7 File Data Save Manager

ASM7 File Data Save Manager (FDS7) is a local-server Automated Storage Management save/archival solution. FDS7 runs on any GCOS 7 version (AP/HPS/EXMS) from TS6152 or later. Its main features are the following:

- periodic save and restore of files according to the level of data sensitivity,
- management of file and data save generations,
- history of saves and restores:
  - through FDS7 utilities,
  - through GCOS 7 utilities (VOLSAVE, FILSAVE, FILDUPLI), provided that the coresponding commands are updated to include FDS7 probes,
- full support of GCOS 7 file organizations,
- management of tape/cartridge library subsystems or sequential loaders:
  - recording the contents of the tapes/cartridges,
  - production of the label,
  - handling of the storage location of the save media,
  - allocation of the media for save operations.

3.2.14 CTL ACS4400 Support for VM Server

CTL ACS4400 Support is the software component of the Cartridge Tape Library (CTL) offer. This product manages the IBM VM server of the ACS4400 and PowderHorn CTL libraries.

3.2.15 CTL ACS4400 Support for UNIX Server

CTL ACS4400 Support is the software component of the Cartridge Tape Library (CTL) offer. This product manages the UNIX server of the ACS4400 and PowderHorn CTL libraries.

Two GCOS 7 systems can share the same UNIX server.

3.2.16 CTL WOLF Support for UNIX Server

The WolfCreek library is offered with a UNIX server (DPX/20 model) and the associated software ACSLS release 4.0.b.

One server model is available for managing up to four WolfCreek library LSM's (and also for ACS4400 and PowderHorn libraries at a later date): CTLC011-Q400.

To support the UNIX server under GCOS 7, a library support software must also be ordered.

Two GCOS 7 systems can share the same UNIX server.

3.2.17 Multi-console Operation (DOF7-MC)

With GCOS 7, it is possible to have several GCOS 7 consoles on a system. Each console can therefore be dedicated to a specialized operator, and the messages associated with the operator's specialty are directed to this console. All the messages and commands sent or received by the various operators are archived in the same file if required for analysis. The DOF7-MC function allows dynamic reconfiguration of the consoles if one console becomes unavailable.

3.2.18 Multiplexed Remote Operation (DOF7-RM)

This application can be used to control several interconnected DPS 7000 systems in an OSI/DSA primary network via the console of one of the DPS 7000 systems.

With DOF7-RM, the operator can select, at a given time, the DPS 7000 system from which to control the other DPS 7000 systems.

The operator can choose the messages to be received (filtered or not).

It is possible to have several DOF7-RM facilities simultaneously in the same network.

3.2.19 Operation by Programmed Operator (DOF7-PO/SM)

DOF7-PO (Programmed Operator) and DOF7-SM (Script Manager) are two new additions to the DOF7 family:

- DOF7-PO enables extensive automation of the functions which are traditionally implemented by the operator (commands, messages, management of events), by enabling the development of "programmed operator" applications,
- DOF7-PO run-time package enables the DOF7-PO function to be separated into a development component and an execution component. This possibility reduces the cost for customers using DOF7-PO on multiple sites.
- DOF7-SM includes the same functionalities as DOF7-PO but with a very simple user interface, based on the GCL language, which enables the automatization of operator functions through the use of scripts. When an event occurs, these scripts initiate the execution of programmed GCL procedures which perform the required processing for the event.

These two products can be used, with different levels of coverage, to automate the management of several DPS 7000 systems and the resources of the network that interconnects them.

The DOF7-PO runtime package is also offered as a separate product.

The main functions which can be implemented by an application are as follows:

- submission and automatic control of jobs,
- output report management,
- supervision of the transactional applications,
- control and regulation of system resource consumption,
- management of events caused by the system,
- control of services such as Time-out and Remote Maintenance,
- management of OSI/DSA networks, receiving the network events in real time.

4. Communications and Networks

GCOS 7 communications facilities range from a simple connection that allows a user to work with a DPS 7000 from his own terminal, to complex facilities that enable a number of different computer systems to exchange information.

Communications (or "telecommunications" -- the terms are interchangeable in GCOS 7) sometimes seems to be a complicated subject, mainly because it uses a special vocabulary, with many abbreviations and acronyms.

The following paragraphs explain some of these key terms and the concepts behind them, and the remainder of this section treats them in more detail.

4.1 FEATURES OF GCOS 7-V7 COMMUNICATIONS

The main features of the GCOS 7-V7 communications package are:

- Full support of DSA and ISO/DSA Network,
- Full and native support of OSI Network,
- Full support of TCP/IP Network,
- Direct access to an Ethernet Local Network,
- Direct access to an FDDI Network,
- Direct support of the DIWS ("Dsa/Iso WorkStation") alias STID ("Station de Travail Iso/Dsa") which is a station executing DSA applications on the OSI session,
- Availability of OSI session programmatic interface,
- Availability of GXTI programmatic interface (GCOS 7 X/OPEN Transport Interface),
- Support of LU6.2 connections (XCP2 module) through the DSA-SNA Gateway or directly towards other XCP2 implementations (for example, CPI-C/OSI on DPX).
- Full support of previous functionalities (XCP1, MCS ...).

4.2 DPS 7000 COMMUNICATIONS ARCHITECTURE

The DPS 7000 communications environment may require one or several Front-End Processors (FEP) to manage terminals and/or to access networks. Since terminals are managed by the FEP, they are not declared in the DPS 7000 network generation but instead, they are declared in the *system generation* (SYSGEN) of the FEP itself.

Two types of FEP are available:

- **CNP7** which is either integrated in or extended to the DPS 7000.
- **Datanet** which is connected to the DPS 7000 over a PSI channel.

The DPS 7000 communications environment may also use the **ISL** controller to directly access other systems and communications processors located on this ISL in conformance with Ethernet standard ISO 8802.3.

The DPS 7000 communications environment may also use the **FCP7** controller to directly access other systems and communications processors via an FDDI link in conformance with FDDI standard ISO 9314.

The main advantages of such communications links (ISL and FCP7) are:

- increased communication speed (10 Mb/s for Ethernet or 100 Mb/s for FDDI),
- increased data flow,
- and increased transmission security.

DPS 7000 communications are handled by software modules named communication servers, as described below.

Figure 4-1 shows the architecture of GCOS 7 communications.

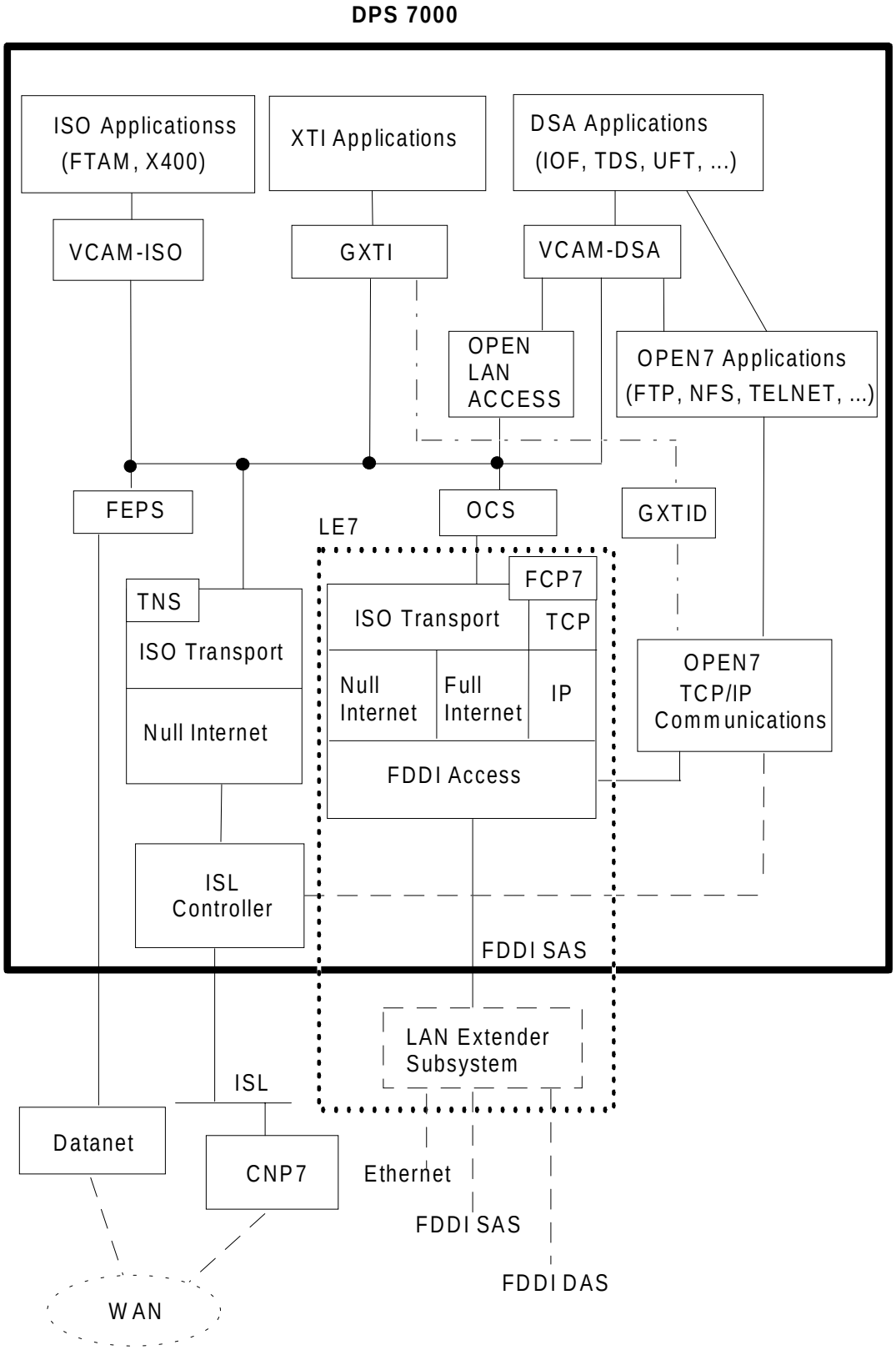


Figure 4-1. DPS 7000 Communications Architecture

4.2.1 Datanet and CNP7

The DPS 7000 can connect to the network through:

- a Datanet via the **FEPS** server module and a PSI channel
- a CNP7 via the **TNS** server and a controller accessing the ISL by means of an Ethernet link

The controller is one of the following:

- the SPA (DPS 7000/2xx/3xx),
- the MPC (DPS 7/1x07/10x7/5x0/7x0x),
- the LNM (DPS 7000/Ax),
- the LNI (DPS 7000/4xx),
- the FIA (Fast ISL Access) option in the DPS 7000/5xx /7xx /8xx.

There is one controller board per physical attachment of the DPS 7000 to an ISL cable.

4.2.2 ISL Controller

The ISL controller also allows the DPS 7000 to connect directly over an Ethernet link to another DPS 7000, another DSA, ISO/DSA or TCP/IP system.

The ISL complies with IEEE 802.3 and ISO 8802.3 (Ethernet) specifications.

These connections are managed by the **TNS** server.

4.2.3 FCP7 Controller

FCP7 is a FDDI controller located in the DPS 7000 cabinet.

OCS Driver

FCP7 interfaces with the DPS 7000 via the **OCS** driver through an MB2 (Multibus 2) and connects to an FDDI network by means of an FDDI SAS link.

FCP7 handles the four first layers of DSA and OSI communications (transport, network, link and physical layers) and TCP/IP layers.

Optical Loopback Plug

Each FCP7 controller is delivered with an optical loopback plug already mounted. This plug is used during OLTD tests. The plug also serves as an anti-dust protector when the controller is not attached (to a fiber optic cable).

Address Label

Each FCP7 controller has a stick-on label on which its MAC address can be written. This address is not related to the controller's serial number. FCP7 MAC addresses are in the range 08 00 38 10 00 00 to 08 00 38 10 0F FF. Once the MAC address has been assigned, it should be written on the label. The label is then stuck on the appropriate DPS 7000 rack (in which the FCP7 is placed).

4.2.4 MainWay 2000

In addition to the FCP7, **MainWay 2000** provides

- the LAN Extender Subsystem allowing a maximum configuration of five FDDI SAS links, eight Ethernet 802.3 ports, and one FDDI DAS link,
- WAN processors for access to Wide Area Networks.

4.3 COMMUNICATIONS SERVERS

The main communications functions are handled by communications servers which are implemented as independent subsystems.

The communication servers are:

- **TNS**, a unique server that handles communications over one or several ISL controllers, allowing communications over one or several ISL cables. There is only one occurrence of TNS in a DPS 7000 system. TNS manages all connections with other systems either directly or through CNP7. The TNS configuration parameters are specified at network generation.

- **FEPS**, a server that handles the dialog with a Datanet through 1 or 2 PSI channels. There is one occurrence of FEPS in a DPS 7000 system for each Datanet attached. In the case of a bi-PSI link towards a single Datanet, only one PSI channel is managed by the FEPS occurrence at a time, the other occurrence being backup. FEPS manages the two PSI links so that it automatically, restarts in a transparent way on the other PSI when the first fails. Each FEPS occurrence must be defined at network generation.

- **OCS**, a communications driver for the FCP7 integrated controller. OCS is a single driver job managing several server occurrences. There is one server occurrence for each FCP7 in a DPS 7000 system. OCS manages all connections through FCP7 with the FDDI network. OCS also performs administrative functions such as LOAD and DUMP for FCP7. The OCS configuration parameters are specified at network generation.

- **FECM**, a server that performs administrative functions such as LOAD, DUMP or SYSGEN for the Datanet and the CNP7. It does not need to be configured and an occurrence of FECM is dynamically created when a Datanet or a CNP7 is to be administered.

- **RAEH**, a unique server that handles administrative sessions between DSA systems for the purpose of exchanging commands/responses or event notifications.

- **QMON**, a unique server that manages queues accessed by applications using the MCS communications interface.

4.4 COMMUNICATIONS MODULES

4.4.1 VCAM

VCAM is a communications module which handles the functions dealing with the session layer (connections between local or remote applications using ISO ISO/DSA or DSA protocols and addressing). Starting and terminating this communications module is synchronized with those of GCOS 7 itself. But only local connections can be done while no communications session is active.

4.4.2 OPEN LAN ACCESS 7

OPEN LAN ACCESS 7 is a communications module which handles the protocol and/or address conversion from DSA to ISO. This mechanism allows DSA applications such as IOF, TDS, UFT to work with applications located in an ISO/DSA workstation (DIWS). Use of OPEN LAN ACCESS 7 is defined in network generation.

4.4.3 GXTI

GCOS 7 X/OPEN Transport Interface (GXTI) is the implementation on DPS 7000 of the X/OPEN Transport Interface.

GXTI is a programmatic interface that allows a GCOS 7 application to access a remote application through ISO transport or TCP or UDP transport.

It supplies a unique communication interface:

- with remote applications through the ISO transport located in the FCP7 via OCS,
- with remote applications through the ISO transport located in a Datanet via FEPS,
- with remote applications through the ISO transport located in a CNP7 via TNS,
- with remote applications through the TCP or UDP transport located in the FCP7 via OCS,
- with remote applications through the TCP or UDP transport located in the OPEN 7 subsystem. Note that access to TCP/UDP from FCP7 and OPEN7 are mutually exclusive in the sense that one cannot establish connections from TCP to OPEN7 and to FCP7, but both can be launched simultaneously. In such a case, FCP7 has priority. If the GXTID daemon under OPEN7 is launched before FCP7, FCP7 stops GXTID to force the connections to pass via FCP7. If FCP7 is launched before OPEN7 (and therefore before GXTID), FCP7 has priority.

4.4.4 GCOS 7 DCE RPC

GCOS 7 DCE RPC is the client mechanism on Bull DPS 7000 which supports GCOS 7 requests to OSD/DCE distributed services on a Bull DPX/20 server. This allows GCOS 7 applications to use services available on UNI• or any system conforming to OSF/DCE.

Figure 4-2 shows GCOS 7 DCE RPC architecture.

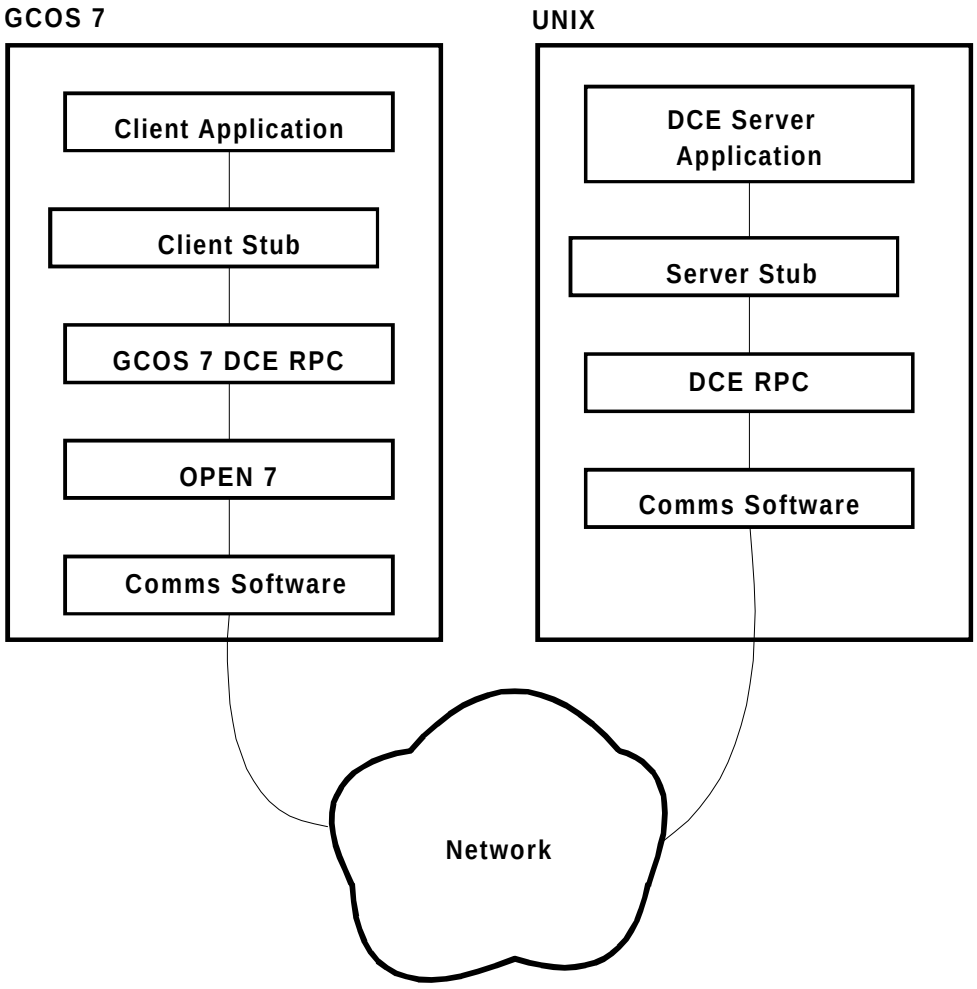


Figure 4-2. GCOS 7 DCE RPC

4.4.5 DSA Gateways to SNA

OSF (Open Systems Facility) allows the conversion of SNA protocols to their DSA equivalents and vice versa. OSF executes in the Datanet which front-ends the other processor. The transition of data between the DPS 7000 and the other processor is not restricted solely to the transport layer.

4.5 NETWORK CONFIGURATION

Under GCOS 7, the generation utility used for the network configurations is NETGEN (NETwork GENerator). NETGEN is described in the manual *Network Generation*.

The FCP7 is configured each time its OCS server is started. This configuration process loads the necessary parameters for ISO/DSA, ISO and TCP/IP stacks of the FCP7. The FCP7 configuration is described in the manual *Network Generation*.

The Datanet and the CNP7 need to be configured through their own configuration tools. These tools are described in the Datanet or CNP7 manuals.

Network configurations directives for DPS 7000 and its FEPs are statically generated by their respective configurators from descriptive information entered by the network (or system) administrator.

4.6 GCOS 7 APPLICATIONS

GCOS 7 standard applications are treated elsewhere in some detail, and are summarized here from a communications viewpoint.

4.6.1 IOF

The Interactive Operator Facility is the overall software link between the user at his terminal and GCOS 7 in a DPS 7000. With regard to communications, it also allows the user to:

- create, update, and delete source files or members containing data, language instructions, processor commands, or GCL statements
- start and control batch jobs, MCS applications, and other communications services such as TDS
- scan and receive output reports from jobs submitted
- execute interactively any application, utility, or processor

4.6.2 TDS

The Transaction Driven Subsystem schedules, initiates, and monitors transactions written in the form of sharable TPRs (Transactional Processing Routines). GCOS 7 communications facilities are used in transmitting data and messages during operation of the TDS, and also for generating the executive and preparing the TPRs.

TDS runs as a job step which provides the interface for connections, disconnections, and data exchanges between the TPRs and VCAM.

4.6.3 MICROFIT 7

This is an application that allows the user of a microcomputer to connect to applications in the DPS 7000, and to transfer files between the DPS 7000 and the microcomputer.The microcomputer may be either

- a Bull Micral or compatible machine operating in:
  - asynchronous mode by emulating a VIP7800, or in
  - synchronous mode with an ATLANTIS card (SCOM, UCOM, or XCOM) by emulating a DKU7107 terminal.
- a QUESTAR 400 operating in synchronous mode by emulating a DKU7007.

4.6.4 UFT

Unified File Transfer enables a DPS 7000 to transfer a file in interactive or batch mode to or from another DPS 7000, or a DPS 7, DPS 6, DPS 8, QUESTAR 400, DPX 2030/5000(SPS 7/9), DPX 2020 (QUESTAR 700), or an IBM site. In this last case, OSF (the Open Systems Facility) permits conversion of DSA to SNA protocol.

4.6.5 DJP

Distributed Job Processing enables a user at a DPS 7000 site to submit a job for execution at a remote DPS 7000 site, or to execute a job submitted by a remote DPS 7000 or DPS 6 operating as a departmentalized station. It also allows outputs to be presented at a remote DPS 7000 or DPS 6. Like UFT, DJP uses the RFA (Remote File Access) protocol.

4.6.6 FORMS

A form is a format for presenting data on the screen in such a way as to make data easy for the user to work with, with no regard to the format of that data inside the computer. A form usually contains both fixed and variable fields, and may be defined by the user himself via the MAINTAIN_FORM (MNFORM) utility. Forms are widely used by other applications noted here, and follow the same communications pattern as the application itself.

4.6.7 GTWRITER

The Generalized Terminal Writer allows a SYSOUT report to be printed on any hard-copy terminal in the network. It can be used under IOF, TDS, and batch. With TDS, a transaction can be initiated at one terminal and the results printed out at another terminal. GTWRITER can also be used with all OPEN 7 applications, such FTP, Telnet, X/Form, NFS, Affinity on OPEN 7, etc.

4.7 STELLA FAST LINK

Stella Fast Link comprises a set of communications products and UNIX and GCOS hardware and software components, combined to provide interoperability between GCOS and UNIX, and offering the advantages of performance enhancement, "Load & Go" installability, and maintenance.

The Stella Fast Link consists of :

- GCOS 7 and Escala basic communication hardware :
  - FDDI Communications Processor 7 (FCP 7),
  - FDDI communications hardware on the Escala side.
- GCOS 7 and Escala basic communication software :
  - OSI/DSA Plug,
  - OPEN 7 and TCP/IP.

4.8 USER PROGRAMMATIC INTERFACE

The User Programmatic Interface is a set of tools that make it easy for the user to run his own applications. It includes the Message Control System (MCS), the VCAM-ISO interface, the XCP1 protocol, and the Administrative Utilities Programmatic Interface.

4.8.1 MCS

The Message Control System allows a user-written application running on a DPS 7000 to exchange messages with one or more terminals. The messages transmitted to a terminal are usually stored in a queue and delivered when the terminal becomes available. Similarly, messages received from a terminal are stored in a queue and read by the application when it is ready to receive them.

MCS manages the message queues in memory and on disk, recovers the disk queues after an incident, and synchronizes and maintains communications between MCS applications within the same system.

The two main components of MCS are:

- MAM (Message Access Method), which is a set of sharable queue control procedures, and
- QMON (Queue Monitor), the communications server that interfaces VCAM session control procedures with MAM queue control procedures.

4.8.2 VCAM-ISO Interface

The VCAM-ISO Programmatic Interface allows applications to exchange data and information over an ISO network; they dialog through a set of system primitives using the protocol and services of the ISO session.

The ISO network is configured at system level where the ISO transport is accessed through ATS (Applicative Transport Service), which is an application that runs on the Datanet. When a DPS 7000 uses an ISO session, the ISO transport layer is accessed in such a way as to appear to be a DSA session.

The interface provides the following facilities:

- Administering the connection by defining the objects required to establish the session
- Session handling when opening and accepting the session, and when closing the session
- Dialog control when normal data, requests, and control information is sent from and received by the correspondents
- Error management for information recovery.

4.8.3 XCP1 Protocol

Extended Communications Protocol Level 1 permits communication between different TDS applications or between a TDS application and an IMS. If the communication is TDS-to-TDS, the session established between the user and the principal system can be extended to other systems, in relay fashion.

XCP1 enables the user to recover messages and to avoid duplication of messages when retransmission occurs on recovery.

The interface is implemented by a set of COBOL procedures.

4.8.4 XCP2 Protocol

Extended Communications Protocol Level 2 is a set of rules and procedures that provide a means for programs to communicate with each other. In particular XCP2 makes it possible for transactions running under GCOS 7 to exchange information with programs running on IBM systems supporting LU6.2 protocol.

4.8.5 GCOS 7 DCE RPC

The GCOS 7 DCE RPC (GXRPC) interface is a mechanism that enables a GCOS 7 program to call a subroutine on a remote X/OPEN machine as if it were local.

4.8.6 AUPI

The Administrative Utilities Programmatic Interface allows the user to process administrative data transmitted by systems that support the DSA200 (AEP1) or DSA300 (AEP2) protocols.

AUPI enables the user to obtain information on events, statistics, or results of command execution from systems supporting the AEP1 and AEP2 protocols, and to issue commands conforming to the AEP2 protocol for monitoring network operations.

AUPI simplifies complex AEP encoding techniques used by DSA systems by providing a high-level view of this protocol, and permits user-defined applications or utilities to be independent of changes in the structure of the AEP protocol.

AUPI conforms to DSA standards, hence utilities can usually be transported from one system to another.

4.9 TUNING AND MAINTENANCE TOOLS

The following tuning and maintenance tools enable the system or network administrator to evaluate and improve the performance of communications activities.

4.9.1 BNSE

The **Basic Network Session Exerciser** (BNSE) establishes sessions and transfers data between two DPS 7000s without interfering with normal network traffic. Each side interprets precoded test procedures and executes session control interface commands.

4.9.2 VIDSA 7

VIDSA 7 (Video DSA) is an interactive, menu-driven utility that enables the adminsitrator to visualize a part or the whole of the DPS 7000 network and to gather statistics on the function of the node(s).

4.9.3 LFA 7

The **Log File Analyzer 7** (LFA 7)is a batch utility for analyzing administrative traffic in the form of AEP records sent from participating nodes in the DPS 7000 network.

4.9.4 CPDS

The **Communications Processor Dump Scanner** (CPDS) is an interactive utility for analyzing a dump of the memory image of the front-end processor.

4.10 FURTHER READING

For more information on communications, see the following manuals:

Simple Generation Guide Using FPG 7 ..... 39 A2 46DM
DNS V4 Documentaion Directory..... 39 A4 27DN
CNS7-A2 Documentation Directory 39 A4 30DN
Network Administration Utilities..... 47 A2 10UC
Remote Facilities DPS 6 to DPS 7..... 47 A2 11UC
Unified File Transfer (UFT) User's Guide..... 47 A2 13UC
Distributed Job Processing (DJP) User's Guide 47 A2 14UC
MICROFIT 7 User's Guide..... 47 A2 20UC
VCAM-ISO Reference Manual, Part One - Description 47 A2 60UC
VCAM-ISO Reference Manual, Part Two - Primitives..... 47 A2 61UC
VCAM-ISO User's Guide..... 47 A2 62UC
Getting Started With Telecommunications..... 47 A2 70UC
Networks Overview & Concepts 47 A2 92UC
Network Generation 47 A2 93UC
Network User Guide..... 47 A2 94UC
DSAC User's Guide..... 47 A2 75UC
AUPI User's Guide 47 A2 76UC
DOF7-PO User's Guide 47 A2 80UC
Structured Records (OMH Format) Part 1 - Commands..... 47 A2 81UC
Structured Records (OMH Format) Part 2 - Messages..... 47 A2 82UC
Structured Records (DSAC Format) 47 A2 83UC
Generalized Terminal Writer User's Guide 47 A2 55UU
GCOS 7 XTI.....47 A2 64AC
GCOS 7 XTI Name ServiceI 47 A2 69UC
GCOS 7 DCE RPC Overview 40 A4 61CF
DCE RPC on GCOS 7 Administrator Guide.....40 A2 62 CF
DCE RPC on GCOS 7 User's Guide.....40 A2 63 CF
MainWay Migration Guide.....39 A2 70RA
MainWay Overview 39 A2 72RA
MainWay System Generation Guide.....39 A2 74RA
MainWay NGL Reference Manual 39 A2 75RA
MainWay Configuration Application Guide.....39 A2 81RA
MainWay NOI Operator Manual.....39 A2 86RA
MainWay Terminal Management 39 A2 91RA

5. Databases

5.1 THE ORACLE RELATIONAL DATABASE MANAGEMENT SYSTEM

ORACLE is a relational database management system. It consists of a kernel, called the ORACLE RDBMS, plus a set of processors and utilities for application development, network communication, and decision support.

As a GCOS 7 application integrated into the GCOS 7 architecture, ORACLE provides an environment which is particularly suited to the data management of small or medium production and development systems.

Users of an ORACLE database fall into three main categories:

- end-users who run applications
- programmers who create applications which access the database
- administrators who control and monitor the use of the database (and are responsible for setting it up).

ORACLE can be used in interactive, batch, and TDS environments. In the interactive environment, the ORACLE processors and utilities are executed using dedicated GCOS Command Language (GCL) commands. In batch, they are executed using Job Control Language (JCL) commands.

GCOS 7 also offers ORACLE users the following additional features:

- ORACLE processors and utilities are presented via standard GCOS 7 menus.
- ORACLE has its own concurrent access and integrity mechanisms, and so does not use the GCOS 7 Before and After Journals.

Table 5-1. A Sample ORACLE Database Table

NAME	JOB	HIRE DATE
SMITH	CLERK	FRI 22 DEC 1995
JONES	MANAGER	THU 06 APR 1995
SCOTT	ANALYST	FRI 09 DEC 1994
ADAMS	CLERK	WED 11 JAN 1995
FORD	ANALYST	THU 01 DEC 1994

5.1.1 ORACLE7.1

The version of ORACLE which is now available under GCOS 7 is called Oracle7.1.

This version enhances its distributed capability with new data replication features, significantly reducing the coding required to develop several classes of distributed applications.

Oracle7.1 enables users to extend the SQL language with application-specific stored PL/SQL procedures. These procedures can be referenced in SQL expressions as if they were built-in functions in the SELECT list and the WHERE clause. The ability to reference user-defined functions in SQL enables users to encapsulate application logic within the database server, without exposing the system to integrity problems caused by linked-in "user exits".

Oracle7.1 allows multiple triggers of the same type on a single table.

In addition, stored PL/SQL procedures can call packaged procedures to execute dynamic SQL statements where the text of the statement is not known until runtime. This enables users to develop more flexible and general purpose procedures.

Oracle7.1 enables database administrators to place table space in read-only mode, which saves time and reduces costs. Administrators whose databases contain large amounts of static data can save time because read-only table spaces require no backup or recovery.

Parallel Query Option

The Parallel Query Option is specifically designed to respond to performance requirements when queries are submitted on very large databases.

The Parallel Query Option speeds up the execution of most SQL operations against large tables, including table scans, joins, sorts, set operations and aggregations. Database administrators or developers can use configuration options and SQL hints to enable them to control query decomposition and parallel execution.

Parallel Data Loading

The Parallel Query option enables multiple sessions running SQL*Loader using the fast bulk load "direct path" capability to load data into the same table.

Parallel Index Creation

The Parallel Query option enables indexes to be created in parallel, reducing the elapsed time required for initial database loading and reconfiguration of indexes on large tables. The Parallel Query Option automatically executes the CREATE INDEX command in parallel across multiple processes, using parallel table scans and parallel sorts.

Parallel Recovery Database

The recovery of the database can be processed in parallel, with large time savings.

5.1.2 Associated ORACLE Products

SQL*Plus is the ORACLE command language. It is a superset of the relational data sublanguage SQL. SQL (pronounced "sequel") was developed and defined by IBM Research and has become a standard language for relational database management systems.

SQL*Plus is designed to be easy to write and to read. It is powerful enough to meet the needs of both experienced users and new users who are just learning ORACLE.

The **Oracle/Pro*COBOL** pre-compiler enables the fast compilation of programs.

The **Oracle SQL *Net UVTI Driver** (Unified Virtual Terminal Interface) Driver on GCOS 7 gives access to an ORACLE database on a Bull DPS 7000 from a PC running MS-Windows 3 applications.

ORACLE7 DISTRIBUTED (Option)

Oracle7.1 with the Distributed Option significantly enhances the performance of distributed queries.

A single SQL statement can reference data stored in multiple physical databases, as if the data were all local. A single transaction can transparently reference data stored at multiple sites. The Oracle peer-to-peer distributed architecture provides complete location transparency to users and application programmers, and avoids the problems of a central "star" server which constitute a severe performance bottleneck in other systems.

Users and applications can execute SQL statements that update local or remote data without knowledge of the data location. Stored procedures and triggers can access local and remote data equally easily, for retrieval update.

The integrity of distributed update transactions is automatically ensured with a robust, transparent two-phase commit mechanism, so that the databases on all sites are either committed or rolled back together.

Many applications have a need for some distributed transactions, and the two-phase commit capability provides a building block for other distributed data strategies such as data replication. Multi-site transactions are committed by means of the standard SQL COMMIT statement.

ORACLE7 PROCEDURAL (Option)

This option consists of three functions:

- stored procedures and functions, whereby procedures commonly used by several users can be stored, executed, and maintained within the database, rather than in each application,
- database triggers, which are activated upon events such as INSERT, UPDATE, DELETE, etc.
- alerts, which are part of the warning system, alerting the user to critical data changes via calls from an application to a stored procedure.

ORACLE Pro*C

This product is a pre-compiler for introducing SQL instructions into C programs in order to access an ORACLE database when they are executed, in batch or IOF.

SQL*Net Synchronous Driver

This is an additional SQL*Net module, which enables ORACLE connection between a DPS 7000 system and ZDS (or compatible) PCs on a secondary network via a synchronous link.

SQL*Net DSA Driver

This is an additional SQL*Net module, which enables ORACLE connections distributed between the following elements, linked by an OSI/DSA primary network:

- several DPS 7000 systems on Ethernet LAN or X.25 WAN,
- DPS 7000 and ZDS (or compatible) on Ethernet LAN with the ESA card,
- DPS 7000 and Bull DPX on Ethernet LAN or X.25 WAN.

SQL*Net TCP/IP Driver

This is an additional SQL*Net module, which enables ORACLE connections distributed between the following elements, linked by a TCP/IP network:

- several DPS 7000 systems on Ethernet LAN or X.25 WAN,
- DPS 7000 and Bull DPX on Ethernet LAN or X.25 WAN,
- DPS 7000 and ZDS (or compatible) with the 3COM card.

SQL*Net GXTI

SQL*Net GXTI is an option of SQL*Net V2 (which is a prerequisite), enabling use of applications based on the XTI transport-level standard interface.

TDS Client-Mode Access

The TDS Client-Mode Access (CMA) solution enables a TDS application on a DPS 7000 system to access an Oracle database on a Bull DPX/20 server in client mode. This CMA solution is capable of operating either in OSI/DSA networking with SQL*Net V1 protocol, or in TCP/IP networking with SQL*Net V2 protocol. The TCP/IP protocol adapter supplied by SQL*Net V2 requires the SQL*Net GXTI and the GCOS 7 XTI products.

Two variants of the TDS Client-Mode Access solution are available:

- Client-Mode Access for TDS solution applies to Oracle databases located on the DPX/20 only,
- Client-Mode Access for TDS/Oracle solution applies to Oracle databases located on the DPS 7000 or the DPX/20.

These variants are shown in Figure 5-1.

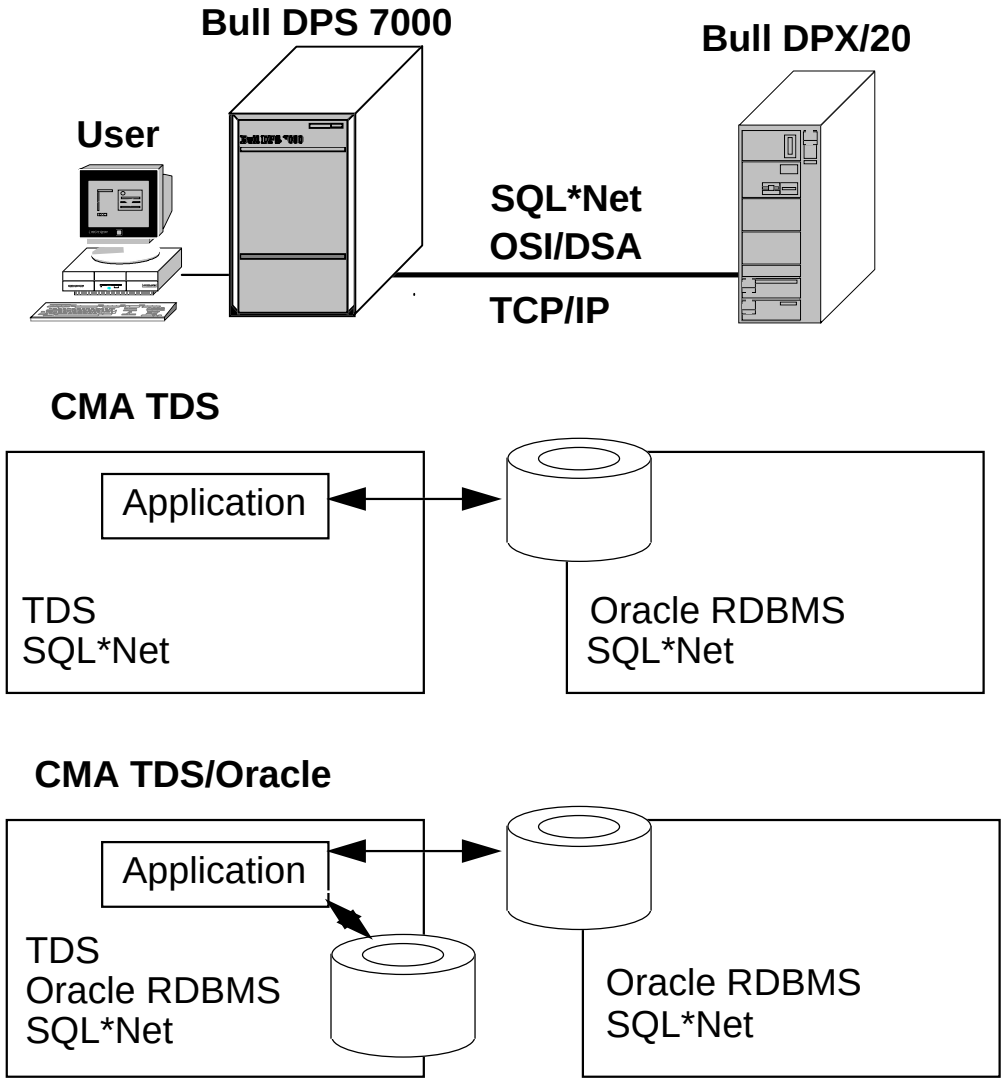


Figure 5-1. TDS Client-Mode Access Solutions

DBA EXPERT

DBA EXPERT is a tool for the administration of relational data bases in a distributed environment. It enables ORACLE data bases located on one or more DPS 7000 and/or DPX platforms to be managed from the same workstation, which is a DPX/20. This tool uses an ergonomic graphic interface with OSF/Motif presentation. The current version of this tool is DBA EXPERT V2.

The principal administration functions are the following:

- browsing in the ORACLE catalog,
- monitoring of space and performance levels,
- management of space through graphical display of occupation of various objects (tables, resources, etc.),
- management of performance levels through programmed monitoring,
- management of security (ORACLE user rights),
- script for deferred administration.

5.2 INTEGRATED DATA STORE II (IDS/II)

IDS/II is a sophisticated database management system that allows users to create, access, and maintain an integrated database. It is ideal for large production systems. There are two versions of IDS/II: an older version, called simply "IDS/II", and a new, more powerful version called "Full IDS/II".

Full IDS/II is shown in functional block diagram form in Figure 5-2. The earlier IDS/II does not use subschemas and has no index.

A schema is a logical map of the data structure; a subschema is a sub-map that can be handled independently.

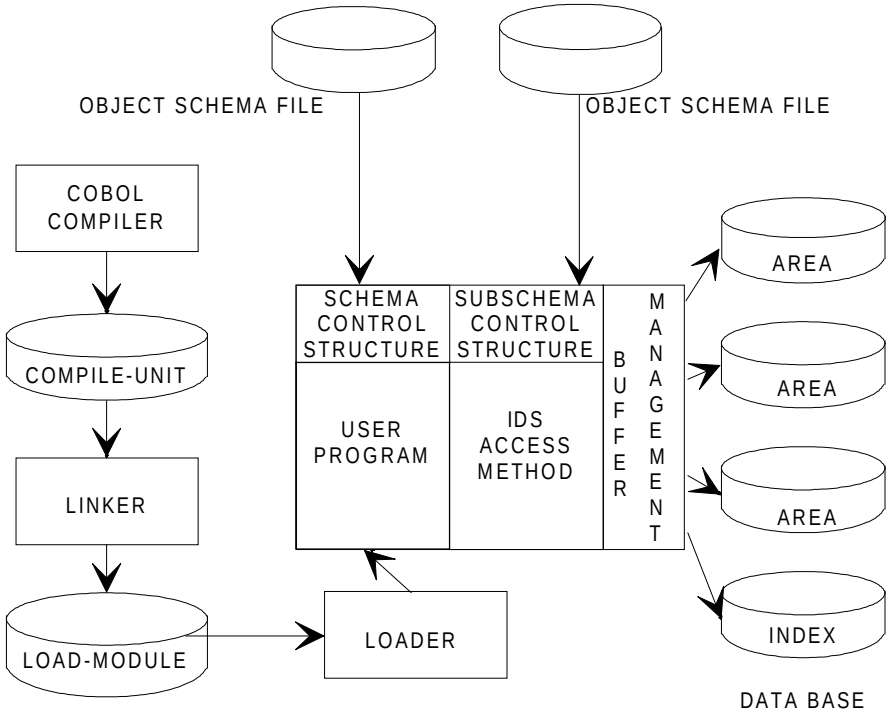


Figure 5-2. Full IDS/II

The **Database Administrator (DBA)** decides how to distribute records among the various database areas. A number of techniques are available, as described in the IDS/II documentation.

The organization of the database is specified via **Device/Media Control Language** (DMCL).

IDS/II provides a set of monitoring tools to examine database performance and show the real-time state of the database.

5.3 THE IQS RELATIONAL INFORMATION SYSTEM

IQS can be described as an "information generator".

It makes use of the standard GCOS 7 facilities while offering a sophisticated set of development tools. Information can be extracted from large databases and worked on locally.

IQS has two powerful languages:

- Query for writing programs quickly and easily.
- IQS Command Language which gets fast answers to ad-hoc requirements without programming.

In addition to its own report generator and macro compiler, IQS allows dynamic access to major GCOS 7 software tools. This permits, for example, form generation and text editing from within the IQS processor. Such facilities make IQS an ideal tool for applications developers needing to build rapid prototypes.

All levels of user can get results from IQS.

End-users can work on parts of the corporate database via their own user views; their requirements are built in so that they see the data in the way they need to see it. Views also eliminate data redundancy and duplication.

Systems developers can use the Query language to program general purpose applications, use forms to build throwaway prototypes, scripts to automate complex, cumbersome, and frequently-used command sequences, and the extended Format/report processor to develop and tailor complex presentation frameworks for output data.

The IQS Processor is shown as a block diagram in Figure 5-3.

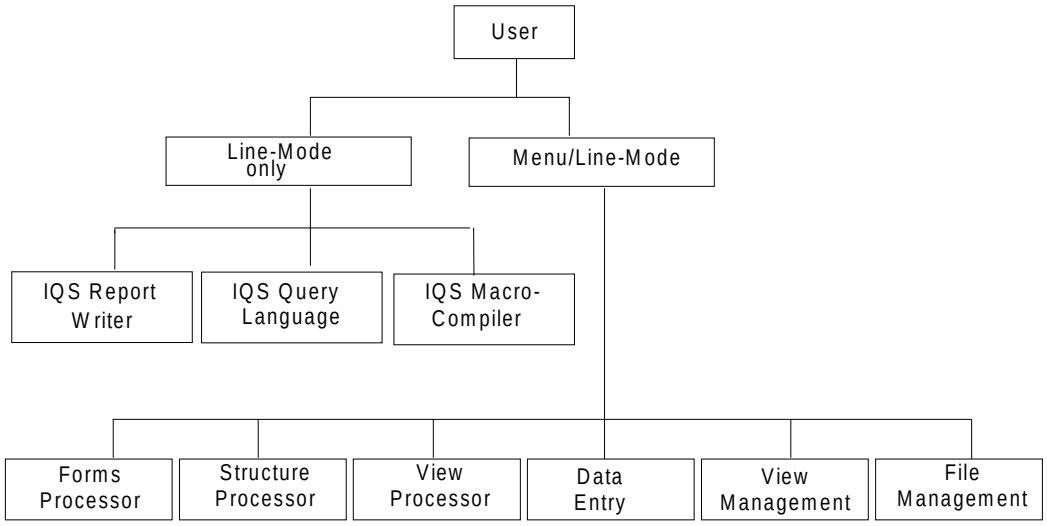


Figure 5-3. Overview of the IQS Processor

IQS-LINK is a facility which converts IQS files to either SYLK or DIF format.

WIL 7 enables you to transfer files to a microcomputer, and then convert them into most available file formats for micros. You can run system applications, like IQS, concurrently with micro applications, and can switch between them.

Queries are data access programs written in the IQS Query Language. They can be written to allow programmers to:

- retrieve, sort, and display information
- create, update, and delete information
- extract data into files.

The **IQS Report Generator** includes a set of procedural commands for creating customized printed reports. The reports are written, compiled, and saved using IQS commands in the same way as queries and macros. A request to display a report on the screen or on paper can come from a query or an IQS command.

IQS provides an interface between query applications and applications created under the **Transaction Driven Subsystem** (TDS). IQS queries and TDS transaction processing routines (TPRs) can call one another, and TDS applications can access IQS views.

This facility is described in more detail in the *IQS/TDS User's Guide*.

5.4 FURTHER READING

The most important manuals in the IDS/II manual set are:

IDS/II Reference Manual *47 A2 11UD*
IDS/II User's Guide *47 A2 12UD*
Full IDS/II Reference Manual, Volume 1 ..... *47 A2 05UD*
Full IDS/II Reference Manual, Volume 2 ..... *47 A2 06UD*
Full IDS/II User's Guide *47 A2 07UD*
IDS/II Administrator's Guide *47 A2 13UD*
Database Reorganization Utility User's Guide *47 A2 15UD*
DBA Expert User's Guide *86 A2 78AS*
Setting-up and Managing DBA Expert Sessions *86 A2 AJ00*

IQS-V4 has a documentation set of 13 manuals including:

IQS Quick Tour *47 A2 71UR*
Getting Started With IQS-*V4* *47 A2 72UR*
IQS-V4 Programmer's Guide *47 A2 79UR*

An extensive set of manuals is available. Some of these manuals are GCOS 7-specific, while the others contain general information for the use of ORACLE V6.

The manuals specific to GCOS 7 are:

ORACLE7 Documentation Catalog *47 A2 10UR*
ORACLE-V6 Installation Guide *47 A2 01UR*
ORACLE-V6 Guide to Processors and Utilities *47 A2 02UR*
IDS/II to ORACLE-V5/V6 Load Facility User's Guide,..... *47 A2 06UR*
SQL*Net V1With ORACLE7 ..... 47 A2 13UR
ORACLE7/TDS User's Guide *47 A2 14UR*
*SQL *Net UVTI Driver for MS-Windows* *47 A2 AJ25*

There are also manual sets for SQL*Plus and SQL*Forms, the programmatic interfaces, and SQL.

6. GCOS 7 Security

6.1 SECURITY LEVELS

The following levels of security exist in GCOS 7:

- Basic GCOS 7 functions (for example, checking access rights to files)
- GCOS 7 associated with a complementary product such as SECUR'ACCESS (for example, identification and authentication using smart cards)
- A GCOS 7 product such as AUDIT 7 (for example, using AUDIT 7 to supply imputation functions)
- An application "cooperating" with GCOS 7 (for example, a TDS application that includes checks on access rights to individual records of a file).

Figure 6-1 shows how terminals and remote systems must pass through a sequence of controls to access the system, the application, and the data.

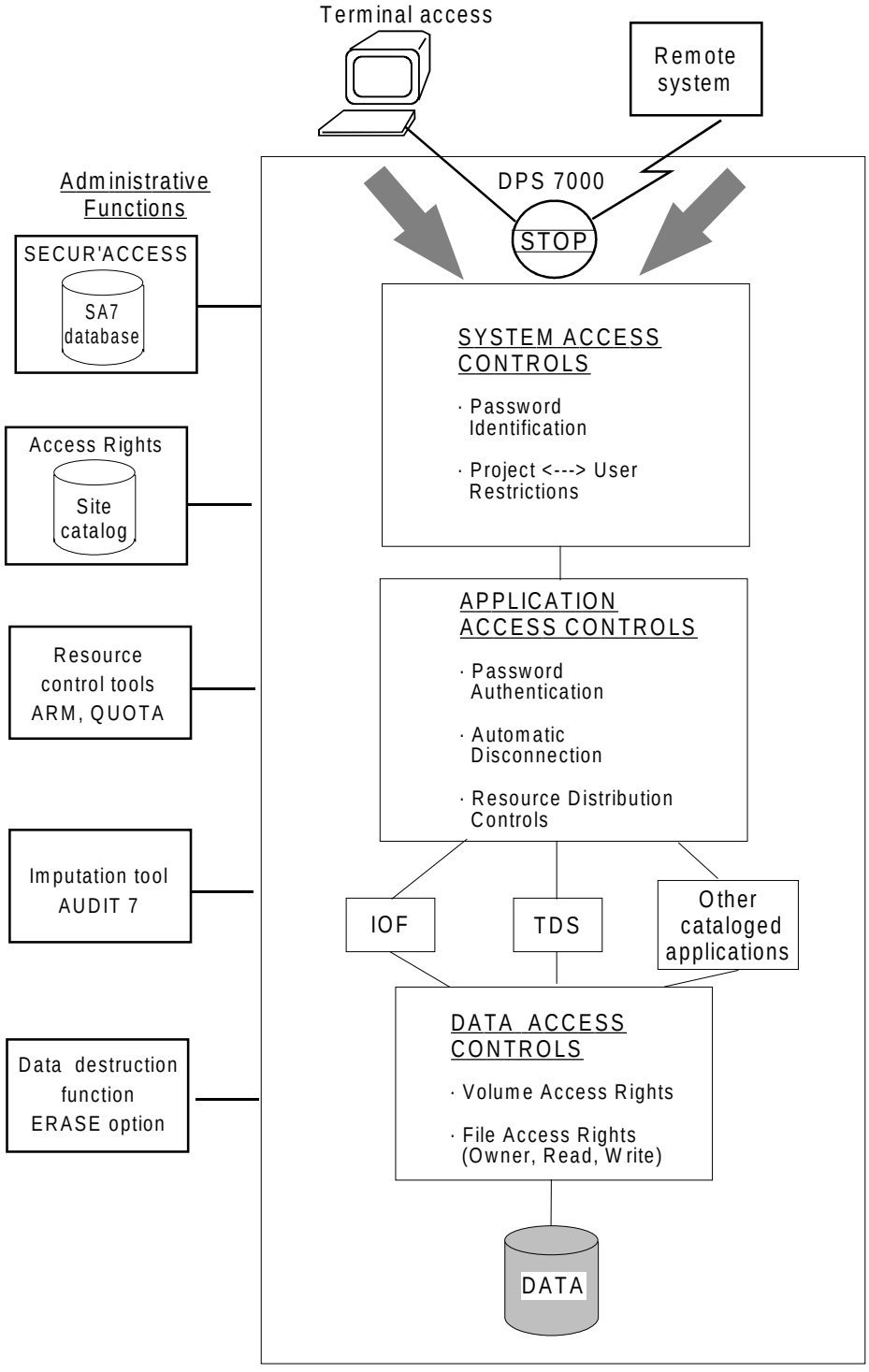


Figure 6-1. Overview of GCOS 7 Security Functions

6.1.1 Identification and Authentication of IOF and TDS Users

Identification and authentication are basic security functions used for access checks and audits. They are essential functions for guaranteeing the security of an operating system.

Identification

In GCOS 7, access rights are given to projects, which are groups of users who perform the same tasks or who use the same information; all jobs are submitted by a user through a project.

A person who logs on to the system has the double identifier: Project.User

Authentication

There are three possible levels of authentication before accessing IOF or TDS services. These levels are given below in increasing order of security:

- Authentication of a GCOS 7 user without SECUR'ACCESS (GCOS 7 non-secure mode)
- Authentication of a GCOS 7 user with SECUR'ACCESS but without a CP8 smart card (GCOS 7 in secure mode with a password)
- Authentication of a GCOS 7 user with SECUR'ACCESS and with a CP8 smart card (GCOS 7 in secure mode with a CP8 card)

6.1.2 SECUR'ACCESS Authentication Without CP8 Smart Card

This authentication mode uses the mechanism of "advanced" password verification, in which the following checks exist:

- limiting the number of wrong entries accepted
- forcing the use of a complex password
- forcing the renewal of a password
- periodic re-authentication of the user's identity

The level of security in this authentication mode is relatively high and can be improved on only with an additional checking system such as a smart card reader. (See next paragraph.)

The degree of security offered by this mechanism depends on the values given to security parameters by site administrators (number of wrong entries accepted, minimum length of passwords).

6.1.3 SECUR'ACCESS Authentication With CP8 Smart Card

This authentication mode combines the mechanism of verifying an "advanced" password, as described in the previous paragraph, with the use of a CP8 smart card. Possession of a CP8 card provides supplementary authentication of a user's identity and supplementary security when connecting to a network. The equivalent of the password used in this authentication mode is not directly transmitted on the telecommunication line and cannot , therefore, be discovered.

Apart from the specific requirements of the CP8 reader, the use, administration and installation of this mode of authentication remain the same as in the previous paragraph (Authentication with SECUR'ACCESS, but without a CP8 Smart Card).

6.2 TYPES OF ACCESS CHECKS IN GCOS 7

Summary of Access Checking Functions

Function Checked	Aim	Person Responsible
Access to cataloged applications	To check on access rights to IOF, TDS, DJP, UFT applications	IOF SYSADMIN administrator
Access to transactions (authority mask)	To check on access rights within a TDS application	- IOF SYSADMIN administrator - TDS master operator
Access through SECUR'ACCESS control points	To check access to files in IOF, batch jobs, UFT, DJP - but not, usually, in TDS	- SECUR'ACCESS security administrator - SECUR'ACCESS delegate administrator - Developer of an application with built-in security checks
Access to files	To check access rights of a user sending a batch job	- IOF SYSADMIN administrator - IOF end user
Access to memory resources and CPU, using ARM	To check access to resources in IOF, batch jobs, TDS	IOF SYSADMIN administrator
Access to GCL commands	To check access to GCL commands in IOF or batch jobs	- IOF SYSADMIN administrator - Developer of the GCL command

6.3 PREVENTION OF OBJECT REUSE

Summary of Functions that Prevent Object Reuse

Function	Aim	Person Responsible
Prevent the reuse of an object in a TDS application	To delete information no longer necessary to a TDS application	Developer of an application with built-in in security checks
Prevent the reuse of an object in a disk file	To delete information contained in a disk file that is no longer necessary	- IOF SYSADMIN administrator - IOF end user
Prevent the reuse of a disk volume Prevent the reuse of a tape file or volume	To delete information contained in a disk volume, or in a tape file/volume, that is no longer necessary	- IOF SYSADMIN administrator - IOF main operator

6.4 IMPUTATION AND AUDITING OF GCOS 7 EVENTS

The auditing tool AUDIT 7 is described in this paragraph. Its use is complemented by the tracing (magnetic or paper) of events such as dialogs on the main console, the system configuration report, or application source programs.

A description of AUDIT 7 can be found in the *AUDIT 7 Administrator's Manual.*

Summary of Imputation and Auditing Functions

Function	Aim	Person Responsible
Imputation	To collect and record security-related events	IOF AUDIT 7 administrator
Auditing	To analyse events recorded during the imputation phase	IOF AUDIT 7 administrator

6.5 FURTHER READING

For more information on security, see the following manuals:

Manual	**Order Number**
GCOS 7 Guide to Logical Security	*47 A2 17UG*
AUDIT 7 Reference Manual	*47 A2 40US*

7. GCOS 7 Information System

7.1 ELEMENTS OF THE INFORMATION SYSTEM

The GCOS 7 Information system comprises the following elements:

- ORACLE7
- Integrated Query System (IQS)
- Integrated Data Store II (IDS/II)
- Data Warehouse
- Information-Link
- Affinity Line
- Disk and Filing Application (DFA7)
- Mistral
- Distributed Data Access

The Information System offer based on the ORACLE RDBMS, IDS/II, and IQS is described in the Section "Databases".

7.1.1 Data Warehouse 7

The Data Warehouse 7 solution is based on the Data Warehouse 7 products running on DPS 7000 and Escala or DPX/20.

A Data Warehouse is defined by the type and manner of data stored in it. In general, data is extracted from the production databases and is populated in the information database.

Data Warehouse management performs the collecting of data which supports management's information decision-making process. This data is characterized as follows :

- subject-oriented (marketing, customer support, etc.),
- integrated (all necessary data fields from multiple sources),
- time-variant (snapshot of legacy data),
- non-volatile (Data Warehouse operates in read-only environments).

The GCOS 7 Data Warehouse approach covers all data extract operations and insures consistency of decision support data across the enterprise.

The Data Warehouse 7 solution is built on Focus technology supplied by Information Builders Inc. (IBI), with whom Bull has a Joint Marketing Agreement.

A complementary Data Warehouse 7 solution, running on DPS 7000 and PC platforms, is described in the “Alliance Solutions” section.

Data Warehouse is an important facility for customerts:

- with applications using IDS/II, UFAS or Oracle databases in production environments,
- who want to use data intensively with three or four PCs, for decision support purposes,
- who wish to transfer, remodel and coordinate data from GCOS 7 to UNIX environments.

The Data Warehouse 7 solution is available on :

- DPS 7000/4x0 and DPS 7000/500 & 700 systems supporting GCOS 7 HPS,
- DPS 7000/4x5 and DPS 7000/800 platforms supporting GCOS 7 EXMS.

Data Warehouse 7 provides three main functionalities, as shown in Figure 7-1:

- data extraction,
- warehouse management,
- PC-based administration.

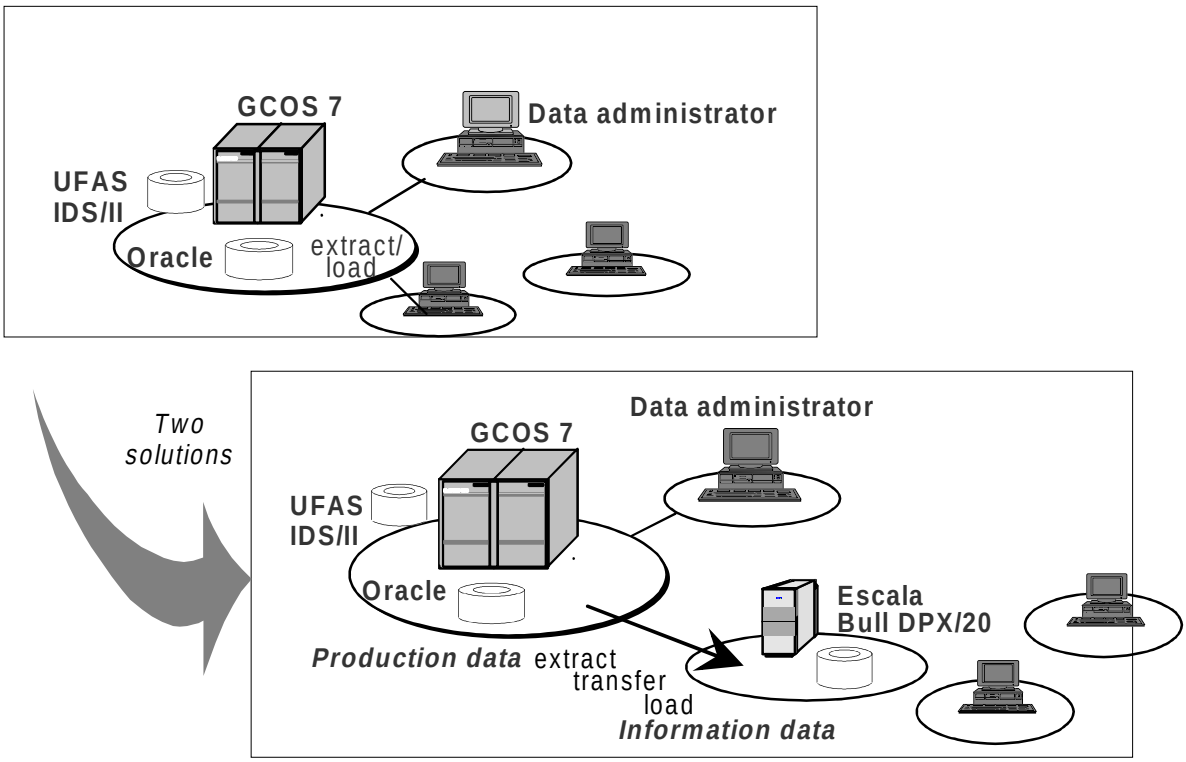


Figure 7-1. Data Warehouse 7 for GCOS 7 - Overview

7.1.1.1 Data extraction

This function comprises data extraction operations from UFAS files and Oracle or IDS/II databases, and any join operations between these databases.

The data extract function is a logical operation performed on GCOS 7 data. It covers all data transformation and remodeling functions and prepares data for use by the Decision Support database.

7.1.1.2 Warehouse Management

This function comprises the managing and scheduling of data extraction and migration. It can support data mapping, filtering, and transformation. It manages all information about the location and form of data and the required extraction operation.

It covers optimization of the extraction process as well as the decision database. It can provide, from request logs, information on how data is extracted and accessed.

7.1.1.3 PC-based Administration

The Data Warehouse Administrator uses Windows-based software to administer Data Warehouse processes. The administrator can define, modify, or start data warehouse queries, or schedule them for later execution. The administrator also can continue to allocate resources to the Data Warehouse operations and defer execution.

The PC-based software works in client/server mode, based on GCOS 7 and DPX/20 or Escala platforms.

7.1.1.4 Components

The Data Warehouse 7 solution for GCOS 7 is built of the following components :

- Data Warehouse for DPS 7000 :
  - Report Writer,
  - FSO (Focus Server Option),
  - Dialog Manager,
  - PC Data Export.
- Data Warehouse for PC platform :
  - Focus for Windows.
- Data Warehouse for UNIX platform :
  - Report Writer,
  - Modify Transaction,
  - Dialog Manager,
  - PC Data Export.

7.1.2 INFORMATION-LINK

INFORMATION-LINK is a product of the micro-to-mainframe type operating with DPS 7000 systems and Bull Questar 400 or ZDS (or compatible) PCs. It provides a high level of ergonomics for communication between the workstation and the DPS 7000 system.

INFORMATION-LINK provides the following functions:

- "push-button" connection to applications on the DPS 7000 system, using pre-defined menus, and activation of local applications on the workstation,
- exchange of data between the software packages on the workstation and the GCOS 7 data bases (IDS/II, UFAS, ORACLE),
- automatic chaining of the functions available for pre-programming repetitive operations in "submission files".

The host component of INFORMATION-LINK is part of the GCOS 7 EXMS bases.

7.1.3 AFFINITY LINE

Affinity Line is Bull's solution for integrating micro-computers around DPS 7000 servers, other GCOS systems, IBM mainframes or UNIX systems, via Local or Wide Area Networks, thus combining their respective qualities in the best possible way.

In the market-standard MS-Windows 3 environment, Affinity Line provides:

- automatic connection to the DPS 7000 system,
- terminal emulation on GCOS 7 applications,
- the file transfer function,
- the possibility of multi-sessions,
- the automation of repetitive tasks such as connection to the DPS 7000 host system, activation of a central application or a transfer operation, by writing script files describing the tasks to be performed (AUTOMATOR and USL),
- a programmatic interface (Unified Virtual Terminal Interface) for micro-applications which communicate with the DPS 7000 system independently of the communication links,
- a "face-lifting" or "revamping" function for the central GCOS 7 applications to transform the terminal emulation-type man-machine interface into an MS-Windows-type interface, with no modification to the central application (Affinity Visual).

7.1.3.1 GCOS 7 Affinity Server

GCOS 7 Affinity Server enables GCOS 7 to take the part of an applications server for PC's configured as Affinity/OpenTeam workstations and connected directly to the Ethernet LAN running TCP/IP protocol.

This offer is built on a Client/Server architecture with a client component (Front-End) supplied by the Affinity V2 OPEN 7 PC/Client software on PC, and a server component (Back-End) ported on GCOS 7/OPEN 7, and offering PC management functions in emulation mode and functions supporting communications with GCOS 7 applications.

7.1.3.2 Affinity Line/WIL (Windowed Information Link)

WIL is a product of the micro-to-mainframe type running on ZDS (or compatible) PCs, and offering end-users a workstation which:

- operates in an MS-Windows (version 2 or 3) environment
- integrates all the functions of Information and Communication Solutions distributed between GCOS 7 and PCs.

Affinity/WIL provides the following functions:

- administration of access to GCOS 7,
- automatic connection to GCOS 7,
- "push-button"activation of GCOS 7 applications with multi-session emulation,
- exchange of data between MS-DOS PC and GCOS 7 (ORACLE, IDS/II, UFAS),
- conversion of the data,
- integration of MS-DOS applications and cooperating MS-DOS/GCOS 7 applications (for example, MICROLIB, MICROPOST).

The host component of WIL is part of the GCOS 7 EXMS bases.

7.1.4 Desk and Filing Application (DFA7)

DFA7, an office and archiving application, is a software package operating in the GCOS 7 transactional environment (TDS).

DFA7 enables word processing, electronic mail, filing/archiving and document search functions to be integrated into existing applications.

DFA7 offers the following functions:

- document production
- mass mailing
- archiving, document search
- sending, recording, filing and follow-up of mail
- access to the distributed mail system (DMS7)
- diary
- a programmatic interface allowing access to the functions of DFA7 from transactional applications.

DFA7 supports all the terminal types authorized by FORMS and MINITEL Videotex terminals (French TELETEL norm).

7.1.5 MISTRAL

MISTRAL is a powerful Text Information Management System (TIMS) based on thesaurus capabilities and easily adaptable to all types of documents: scientific, legal, industrial, etc. The information managed by MISTRAL may be bibliographical, full text or factual data. MISTRAL is designed for managing large document bases (millions of documents) and for simultaneous consultation by a large number of users.

MISTRAL implements powerful indexing and search functions based on techniques involving inverted files, thesauri and lexicons.

MISTRAL document entry facilities are implemented via PC/MISTRAL Document Entry, in the MS-Windows 3 environment. This micro-application features links with word processing software (Word for Windows) and integration with IMAGEWorks.

PC/MISTRAL Query V2 is a micro-application running on PCs under MS-DOS in an MS-Windows 3 environment, which offers end-users an ergonomic graphic interface for access to MISTRAL search functions and display of MISTRAL documents.

MISTRAL offers the possibility of associating documents from the document base with image documents managed by the IMAGEWorks server on DPX systems.

This MISTRAL/TDS interface option provides an interface which enables user applications operating in a transactional GCOS 7/TDS environment to access the MISTRAL search functions.

MISTRAL 6.0 provides the following additional features:

- handling of large and very large document bases,
- bases structured in domains,
- open and/or closed lexicons,
- powerful thesaurus processing,
- complete multi-criteria and full-text retrieval capabilities (boolean requests, jokers, proximity searches, words belonging to the same sentence or paragraph, etc.),
- various display and printing utilities,
- flexible macro-language facilitating routine searches,
- query form definition tool helping the administrator to build a query framework for inexperienced or casual users,
- various security levels,
- transactional processing capabilities through access to GCOS 7/TDS applications.

In addition, MISTRAL 6.0 has a new client/server architecture using the TCP/IP protocol and a complete set of API functions available for PC's and DPX/20 platforms:

- connexion and service functions,
- lexicon and thesaurus consultation functions,
- document query functions,
- displaying and printing the search results,
- document base update and indexing functions.

7.1.6 Distributed Data Access (DDA)

The GCOS 7/DDA offer consists of two main components:

- the GCOS 7 DDA Manager, which runs on a DPS 7000 server (all models supporting GCOS 7 AP, GCOS 6 HPS and GCOS 7 EXMS Version V7),
- the DDA GCOS 7 Gateway, which runs on a DPX/2 server (all models supporting B.O.S. 02.01.8x) or a DPX/20 Server (all models supporting B.O.S./X 3.2.5 or AIX 3.2.5 Set4).

These two different servers communicate through the OSI/DSA communication protocol in a full client/server relationship.

The DPS 7000/GCOS 7 platform acts as a Database Server within the global DDA offer, which offers the following capabilities:

- access to databases as shown in Figure 7-2:

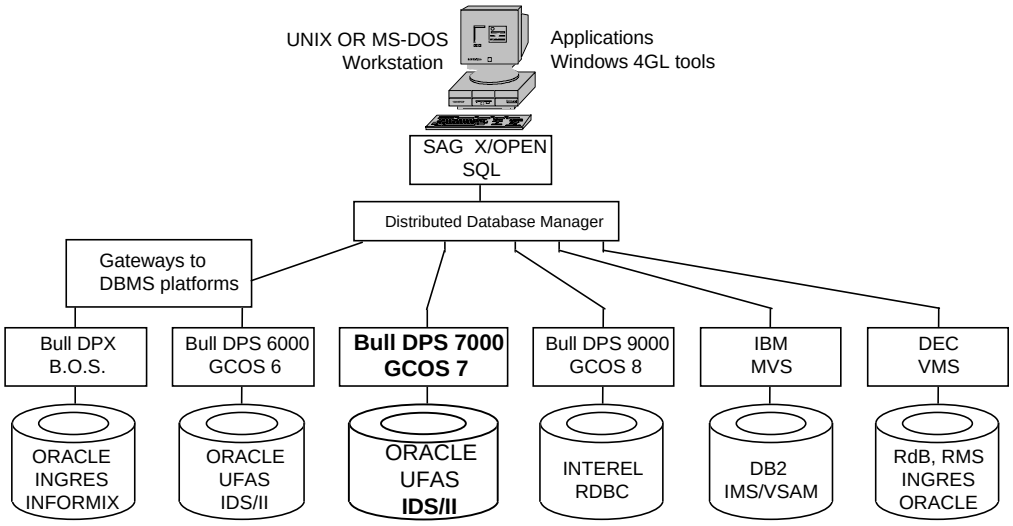


Figure 7-2. DDA Database Access

- end-user tools:

  - BusinessObjects 3.0 which provides the end-user with an object oriented view of data, eliminating any need to know SQL or data structures,

  - Ingres character-based and graphical tools,

  - PC off-the-shelf software through DDA/ODBC (Open Data Base Connectivity) which provides a seamless integration with Bull's DDA Gateways and Distributed Data Manager. The tools are: Microsoft's Access, Excel and Visual Basic, Powersoft's PowerBuilder and Lotus Notes.

7.1.6.1 Access to ORACLE Databases

Access to distributed GCOS 7 ORACLE databases is provided by the standard ORACLE SQL*Net mechanism, via the ORACLE gateway on the DPX/2 or DPX/20 Server.

7.1.6.2 Access to UFAS and IDS/II Databases

The GCOS 7 Distributed Data Manager completes the DDA solution with relational access to GCOS 7 non-relational databases, namely UFAS and IDS/II. This access is characterised by:

- support of the DDA exchange protocol: the OpenSQL and the Generalized Common Architecture (GCA) of Ingres,

- support of the Bull OpenSQL in Read Mode,

- full coexistence with the native data managers, i.e. the ability for GCOS 7 data to be independently and concurrently accessed in both retrieval and update modes by native UFAS and IDS/II local applications.

7.1.6.3 DDA Manager Functionalities

The GCOS 7 Distributed Data Access Manager offer comprises:

Model Generator
This is an administration utility which is a GCOS 7 load module. Its function is to build and maintain the "relational models"; which are basic relational views of a set of UFAS files or an IDS/II database.

Each IDS/II database is represented as a separate model; and a given model cannot describe both UFAS files and IDS/II databases.

IDS/II V40 and Full IDS/II with secondary indexes are supported. Full IDS/II subschemas are replaced by relational views.

SQL Data Server
This is a GCOS 7 application which is a dedicated TDS. Its function is to handle requests issued from several DDA users and to have them executed concurrently.

An SQL Data server can serve several IDS/II and UFAS models simultaneously. IDS/II databases are statically assigned to the TDS server in the usual way. The constraint of IDS/II-TDS which prevents different IDS/II versions from running under the same TDS must be respected.

SQL Processor
This is a set of GCOS 7 services, which are packaged in the SQL Data Server. Their function is to analyze and execute an SQL command on UFAS or IDS/II data which is described by a relational model.

Gateway
This is a UNIX Server. Its function is to convert DDA communication and data protocols from/to SQL Data Server protocols. This gateway is adapted from the DDA-Oracle gateway.

UNIX/GCOS 7 Communication Package
This is a two-level TP interface, which runs on UNIX in VIP7800 emulation. It is based on the OTM (Standard ISO/DSA) service.

7.1.6.4 GCOS 7/DDA PC Gateway

The GCOS 7/DDA PC Gateway enables ODBC-compliant PC-based tools to access GCOS 7 UFAS or IDS/II data in read-only OPEN SQL mode. At a given time, the request from the PC tool can access one Relational Model representing one IDS/II database or a group of UFAS files.

The gateway is shown in Figure 7-3:

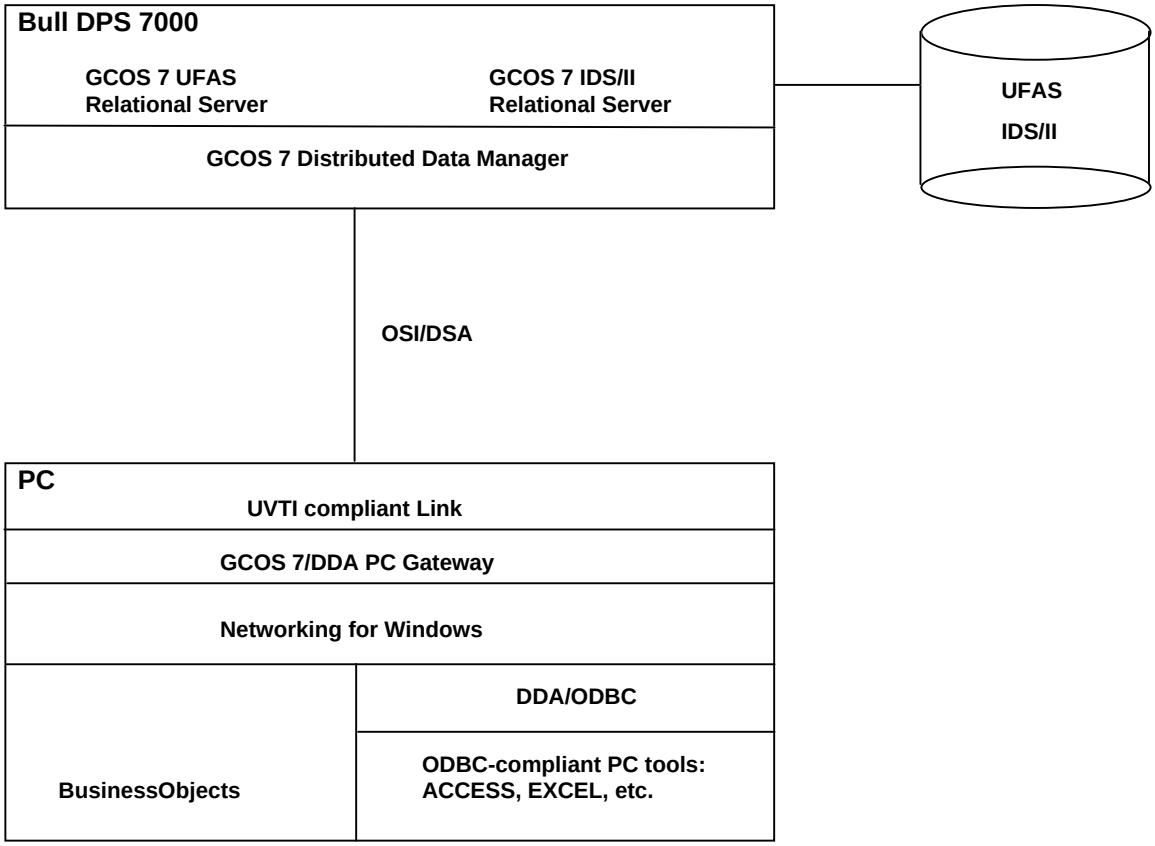


Figure 7-3. GCOS 7/DDA PC Gateway

BusinessObjects 3.0 is also available within this environment, but the Batch Option is not supported because it requires the full DDA product with the Distributed Data Manager (DDM) on DPX/20.

8. GCOS 7 Production System

8.1 ELEMENTS OF THE PRODUCTION SYSTEM

The GCOS 7 Production system comprises the following elements:

- TDS
- TDS-HA
- TDS/IMAGEWorks Link
- GCOS 7/StreamPATH Link
- GCOS 7/EDIWorks Link
- Distributed Transactional Processing (XCP1)
- Cooperative Transactional Processing (CPI-C/XCP2)
- Open Software/TP to GCOS 7/TDS Link
- /HOST7
- Affinity Visual
- Database Manager (DBM)
- ORACLE7
- GCOS 7 DCE RPC
- Flow Bus
- SECUR'ACCESS
- AUDIT 7
- RDDF7

The TDS (Transaction Driven System) transactional monitor and TDS-HA (High Availability) are described in the Section "GCOS 7 Software Components".

SECUR'ACCESS and AUDIT 7 are described in the Section "GCOS 7 Security".

ORACLE7 is described in the Section "Databases".

8.1.1 TDS/IMAGEWorks Link

The TDS/IMAGEWorks Link adds an image dimension to mission-critical applications in the context of:

- a DPS 7000 Enterprise TP/DB server,
- IMAGEWorks, the Electronic Document Management System (EDMS) solution,
- OpenTeam workgroup,
- Affinity Line PC's,
- CPI-C protocol,

and integrating them into the Distributed Computing Model framework.

The TDS/IMAGEWorks Link provides GCOS 7/TDS applications, which are TPR's written in COBOL or C, with Application Programming Interfaces (API's) that provide access to IMAGEWorks services. These API's are divided into two sets:

- one set which enables PC end-users to manipulate documents
- one set which directly links GCOS 7/TDS with the IMAGEWorks server in order to automate additional services.

8.1.1.1 APIs for TDS/IMAGEWorks Link via PC

These APIs enable a PC end-user with MS-Windows 3, connected to a GCOS 7/TDS application via WIL, to:

- automate links between between images/documents and GCOS 7 databases
- display IMAGEWorks folders and documents (images, texts, files of MS-Windows applications)
- digitize a document with a scanner connected to a PC,
- store a local PC document in the IMAGEWorks server,
- edit an IMAGEWorks document (annotate, add a new portion, update it, etc.)

8.1.1.2 API's for TDS/IMAGEWorks Link via DPX/20

These APIs enable a GCOS 7/TDS application to benefit from the features of IMAGEWorks Folder Management services, for example, to:

- create, delete, copy, move a folder
- create, delete, copy, move, archive a document
- read/store the attributes of a document or a folder
- retrieve a document with multi-criteria
- list the documents contained in a folder or a subfolder.

These functions are used to insure automatic database consistency between GCOS 7 applications and IMAGEWorks document attributes. It is not necessary for the end user to index his data twice (once for transactional applications and once for document indexing and storage). With this guarantee of database consistency, the DPS 7000/GCOS 7 system and the IMAGEWorks server can be used separately or together.

8.1.2 GCOS 7/StreamPATH Link

In the context of archival needs in the COLD (Computer Output on Laser Disk) market, StreamPATH provides archiving of information produced by Enterprise Servers, replacing obsolete methods such as microfilm. Retrieving archived data from a workstation/terminal through a transactional application, without microfilm manipulation, is a far superior method and gives a fast return on investment.

This product makes optical archiving attainable from DPS 7000 workstations/terminals running transactional applications for retrieval operations. The archiving mechanism can be automated.

StreamPATH provides large data centre operations with a safe archival mechanism for purging alphanumeric data records and reports off overloaded Enterprise Servers. Information such as SPOOL/SYSOUT files, outdated accounting reports, general ledgers, account statements, insurance benefit reports, telemetry data etc., are indexed and off-loaded onto optical media. StreamPATH retrieves the data and offers flexible search capabilities. StreamPATH is thus an attractive incentive to replace intrusive Computer Output to Microfilm (COM) processes or paper listing archival.

StreamPATH can be devoted to applications processing characters only or can be used by applications requiring the association of single images to character records. StreamPATH keeps a huge volume of information "nearly on line":

- on-line for pre-mounted optical disk media,
- nearly on-line for optical disk media put in robotic slots: an additional access time (from 5 to 17 seconds) is required for robotic-driven mounting operations.

8.1.3 GCOS 7/EDIWorks Link

The EDIWorks Business Server, which runs on DPX/20 platforms, enables GCOS 7 applications to benefit from EDI services through Application Programming Interfaces (API's) using the DCE Remote Procedure Call (RPC) mechanism. This functionality is an example of the capability for GCOS 7 applications to access UNIX-based services through the standard OSF/DCE mechanism, in the context of the Distributed Computing Model.

The services offered by the EDIWorks Business Server are the following:

- translation service with the support of ANSI X/12 and EDIFACT syntaxes (other syntaxes are supported depending on specific needs),
- mapping service to map message structures with application file formats,
- multi-communication service,
  - value-added networks: IBM IN (OFTP/X.25), GEISCO (OFTP/X.25),
  - file fransfers: PeSIT (X.25), ETEBAC (X.25), OFTP(X.25),
  - X.400 message handling systems: P1/P2 (TEDIS, TEDECO, ALLEGRO, BRIO protocols), ATLAS 400 (440, TEDIS, TEDECO, ALLEGRO, and BRIO protocols),
- message management (send and receive),
- administration services,
  - configuration of the server,
  - management of the trading partner database,
  - archive function,
  - start and stop of the server,
  - view functions (statistics and status of the server),
- audit-log file to store events used for billing, error diagnosis and statistics,
- track file to maintain all status information related to the messages to be sent or received,
- API server for local/remote DPX/20 applications and for remote GCOS 7 applications.

8.1.4 Distributed Transactional Processing (XCP1)

This functionality enables transactional applications to be distributed on several DPS 7000 systems in a DSA network.

With the programming facilities associated with the XCP1 protocol, it is possible for a TDS transaction to activate a second transaction executed on a different DPS 7000 system.

Synchronization between the databases manipulated by the TDS is not managed by the protocol and must be handled by the user application.

XCP1 provides the mechanisms necessary to control correct transmission of the dialog between two TDS subsystems.

In the event of a fault, XCP1 executes an automatic restart of the dialog.

8.1.5 Cooperative Transactional Processing (CPI-C/XCP2)

This product corresponds to an inter-application communication protocol, applicable in the context of interchange taking place either between two DPS 7000s, or between a DPS 7000/GCOS 7 platform and an IBM/MVS platform. The initiator of the communication may be on either of the platforms.

CPI-C stands for "Common Programmatic Interface for Communication", and XCP2 means "eXtended Communication Protocol level 2". CPI-C/XCP2 is compatible with the market-standard LU6.2 protocol (whereas XCP1 is compatible with IBM's LU0 and LUP (IMS) protocols).

CPI-C/XCP2 offers two different functionalities:

- it contains a set of procedures enabling transactional applications running under GCOS 7 to co-operate, by exchanging messages, with the applications executed on systems handling the XCP2 protocol.

- it offers services via two programmatic interfaces: PPC-PI (Program-to-Program Communication Programmatic Interface), and CPI-C (X/OPEN norm). The PPC-PI interface, compatible with IBM's APPC/CICS, integrates the very important SYNCPOINT function, allowing "distributed execution" between the co-operating transactions, which guarantees synchronized and consistent updating of the distributed databases.

8.1.6 Open Software/TP to GCOS 7/TDS Link (CTP)

This product provides access to transactional GCOS 7 applications on a DPS 7000 system from a DPX system running BOS/TP:

- routing of the transactions to the remote GCOS 7 databases,
- two-level transaction processing with the local data base and routing of the transactions to the remote GCOS 7 data bases,
- Co-operative Transaction Processing (CTP) between GCOS 7, IBM and UNIX systems (XCP2 or LU6.2 confirm level),
- links provided by the OSI/DSA WAN networks and Ethernet LANs for communication between BOS/TP and GCOS 7/TDS via UNIX STID-PASS-THROUGH,
- multi-platform software engineering facilities enabling the development of distributed applications,
- use of the CPI-C programmatic interface by the BOS/TP application to cooperate with GCOS 7/TDS.

Theproduct enables the integration of the enterprise's information system (transactional GCOS 7 applications) into a unified view from a DPX, while preserving customer's investments in GCOS 7 applications.

8.2 /HOST7

The /HOST 7 offer provides BOS/TP client applications with the ability to request services (transaction execution) from a GCOS 7/TDS server. This offer fully integrates GCOS 7/TDS as a Server in the Client/Server based BOS/TP architecture and is a building block of Distributed Computing Model solutions.

/HOST 7 is supported on the BOS/TP side by DPX/2 200/300 platforms running BOS V2 Set7 software, or by DPX/20 platforms running AIX software.

/HOST 7 enables the development of BOS/TP servers to execute (or request services execution) under the GCOS 7/TDS monitor (i.e. a non-UNIX platform). Thus, BOS/TP client processes can request services available on GCOS 7 Enterprise Servers.

The /HOST 7 product consists of Native Gateway Servers running on the BOS/TP platform (DPX/2 and DPX/20) which communicate with TDS Gateway Servers running on the GCOS 7/TDS platform using the XCP2 protocol, and provide:

- communication between GCOS 7/TDS and BOS/TP application
- automatic data format translation between GCOS 7/TDS and BOS/TP.

With /HOST 7, the monitoring capability of BOS/TP is exported to the GCOS 7 world. Statistics can be obtained on the TDS Gateway Server giving information on transactions requested, status of current and completed transactions, data types exchanged between BOS/TP and GCOS 7/TDS applications, and so on.

/HOST 7 enables the development of BOS/TP servers that execute (or request the execution of) services under the GCOS 7/TDS monitor . Thus BOS/TP processes can request, as clients, services available on GCOS 7 Enterprise servers.

The GCOS 7/TDS application "sees" BOS/TP messages through the same programmatic interface as for a terminal, and the BOS/TP application uses standard BOS/TP verbs to request a transaction execution from the GCOS 7/TDS Server. This cooperation link is completely transparent to both GCOS 7/TDS and BOS/TP application programmers. Obviously, both ends must agree upon the data structures to be exchanged.

The BOS/TP programmer is responsible for writing Clients and Servers and for building Native Gateway Servers, configured as normal BOS/TP servers. The GCOS 7/TDS programmer is responsible for writing GCOS 7/TDS transactions to be requested by BOS/TP applications.

The BOS/TP administrator is responsible for :

- installation, generation and configuration of BOS/TP and supporting services
- installation of /HOST

The GCOS 7 administrator is responsible for :

- generation of XCP2 links
- generation of TDS gateways, and optionally, preparation of the TDS gateway server administrative file.

TDS-HA (High Availability) configurations are supported, but the link must be re-established manually upon failure. Global transactions are not supported, and rollback and commitment processing must be handled locally.

8.2.1 AFFINITY VISUAL

This product provides "facelifting" for DPS 7000 TDS applications designed for traditional character-mode terminals, providing the benefits of the Graphic User Interface on the screen of the workstation. End-users can enjoy the comfort and productivity advantages of a "point and click" interface for their application, while at the same time, it is not necessary to modify the code of the application.

8.2.2 Database Manager

This product is used to manage, maintain, and control an IDS/II database. It contains the following modules:

- the integrated "IDS/II" database manager,
- the DBUTILITY tool for creating, administering, controlling, maintaining, and validating IDS/II databases. This utility works in a batch processing environment or in an interactive environment.
- the DBDIALOG tool for dialog in interactive mode with a database directly using COBOL verbs (DML) relative to the IDS/II data bases.
- the DBREORG utility.

The integrated IDS/II database manager releases the user from the management of data access (physical storage of the data, management of the relations between the data, etc.), which makes independence of the programs and the data possible.

To achieve this independence, the integrated data base manager includes the languages of all DBMSs:

- the Data Description Language (DDL) used to describe the entities and the data constituting them, as well as the relations between the various entities,
- the Data Manipulation Language (DML) inserted into COBOL programs can be used to perform data transfers between the program and the data base.

In an application program, DML and COBOL are closely integrated so that no inputs or outputs from one language to the other are necessary.

The integrated data base manager (IDS/II) can be used for the access of data from all types of applications managed by GCOS 7:

- batch application programs,
- transactional applications,
- interactive applications,

as well as with the use of IQS, the GCOS 7 query language.

The integrated data base manager complies with the standardization recommendations by the CODASYL Data Base Task Group (DBTG).

The IDS/II data base benefits from the same data security mechanisms as the other GCOS 7 data organizations (catalog, journalization, GAC).

IDS/II is an option of GCOS 7 EXMS.

8.2.3 GCOS 7 DCE RPC

GCOS 7 DCE RPC is a Client-only mechanism supporting GCOS 7 requests to OSF/DCE distributed basic services and distributed application services,

DCE RPC/Ally provides GCOS 7 gateway access to OSF/DCE distributed services on the local DPX/20 server.

There is an ISL LAN (Ethernet TCP/IP) link between the GCOS 7 system and the local UNIX server.

This facility provides GCOS 7 systems with easy and cost-effective access to UNIX-based services. The associated functions required to support a fully distributed environment and used by the GCOS 7 DCE RPC mechanisms can be provided by a local UNIX server referred to as the DCE RPC/Ally.

The facility provides an environment to develop and validate new OSF/DCE distributed applications services.

A key component of OSF/DCE is the RPC (Remote Procedure Call) facility, which brings the traditional local procedure call to a distributed computing environment. The RPC enables a program not only to call a procedure from a remote server but also to export an Application Programmatic Interface (API) from a server to a client system.

The products composing this offer can be used in two modes.

1. **Static binding**. The client requesting the distributed services has direct knowledge of which server it needs and how to access it. In this mode, only the GCOS 7 DCE RPC function is required and not the DCE RPC/Ally function.

2. **Dynamic binding**. The client does not know where the server is located and gets the information from the Directory Service through the DCE RPC/Ally gateway interface on DPX/20 server. In this mode, both the GCOS 7 DCE RPC and the DCE RPC/Ally functions are required.

The latest version 102 of the GCOS 7 DCE RPC offer provides the following additional features :

- Server access mode to batch services implemented on GCOS 7, from OSF/DCE clients running on OSF/DCE-compliant systems,

- Extended support of the TCP/IP communication protocol.

Server access mode enables GCOS 7 batch applications to act as servers for OSF/DCE clients running on OSF/DCE-compliant systems with the following restrictions:

- the GCOS 7 OSF/DCE Server cannot register in the CDS (Cell Directory Services) directory, so binding between the clients and the GCOS 7 server application is static,

- server access mode is supported only in the GCOS 7 batch environment. This means that the RPC dialog (server primitives) between the GCOS 7 server application and the OSF/DCE clients is implemented in a batch server job. The service requested by the OSF/DCE clients may be implemented either :

- in the same batch server job,
- or in a process running in a transactional or interactive environment which communicates with the batch server job (acting as a relay) through a communication protocol such as CAM.

- the invoked GCOS 7 transaction has the following characteristics :
  - mono-exchange (no dialog),
  - line mode.

Extended support of the TCP/IP communication protocol for GCOS 7 DCE RPC covers the following cases :

- the RPC link on TCP/IP Ethernet via OPEN 7 and the ISL Ethernet adapter,
- the RPC link on TCP/IP Ethernet via OPEN 7 and the FCP 7/MainWay Ethernet adapter,
- the RPC link on TCP/IP FDDI via OPEN 7 and the FCP 7/MainWay FDDI adapter.

8.2.4 FlowBus

FlowBus creates a scalable, flexible and highly manageable environment for inter-application communication that enables gradual renovation of an Information System. By enabling applications to communicate with each other in a standard way, FlowBus insures cross-platform and cross-application interoperability independently of the network infrastructure and protocols. Figure 8-1 shows an overview of FlowBus.

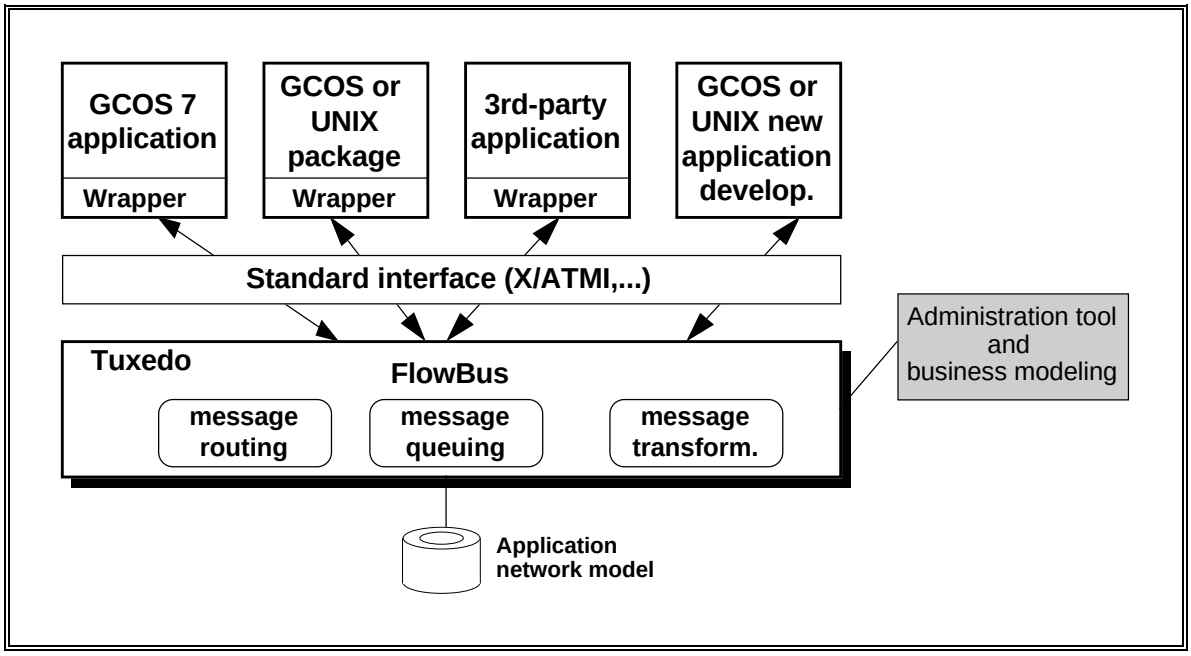


Figure 8-1. Overview of FlowBus

A key strength of FlowBus is that it can accommodate incompatible modes of function (batch or transactional), and data formats that do not match. Applications can cooperate by exchanging messages, with no concern for the identity of the recipient application.

To accommodate different modes of function and message formats between applications, message queueing and message transformation mechanisms are provided by FlowBus.

FlowBus provides two external interfaces :

- an API enabling applications to access the FlowBus message service,
- an administrator graphical interface, through which FlowBus is configured with the necessary rules for message routing, queuing and transformation, combining applications to create appropriate business procedures.

Applications can be developed or adapted independently. Once they have been adapted to use the FlowBus API, it is simple to combine and recombine applications to respond to changing business needs by reconfiguring FlowBus without modifying the applications.

FlowBus creates a scalable, flexible and highly manageable environment for inter-application communication that enables customers to gradually renovate their Information System. By enabling applications to communicate with each other in a standard way, FlowBus insures cross-platform and cross-application interoperability independently of the network infrastructure and protocols.

FlowBus is a set of services built upon the Tuxedo System and therefore benefits from all Tuxedo features such as the scalability brought by the distribution over several UNIX servers and the queueing mechanisms.

The components of FlowBus are :

- a message Routing Service,
- a message Transformation Service,
- a message Queueing Service,
- an Administrative/Configuration application and its graphical interface,
- the API libraries available on UNIX servers and GCOS mainframes.

8.2.5 RDDF7 Remote Duplicate Data Facility

RDDF7 (Remote Duplicate Data Facility) is a remote back-up facility enabling operation to be restarted securely and quickly on a back-up site in the event of a major accident on the operating site. The DPS 7000 system production is protected by preventive duplication of the production database on a back-up DPS 7000 system.

The main functions of the RDDF7 are as follows:

- remote journal archiving for ORACLE , IDS/II and/or UFAS files on a remote back-up system,
- an asynchronous transfer mode providing better End User efficiency, with:
  - lower dependency between primary and secondary systems,
  - shorter reponse times for users,
- automatic restart of the remote back-up system in the event of a network failure,
- continuous remote database journalization for remote archiving or mirroring,
- smooth switchover of operation onto a back-up system, if the event is foreseeable,
- short elapsed time for restart on the remote back-up center in the event of disaster or an unforeseeable occurrence,

Integrity of the database is guaranteed without loss of data in the event of recovery on the back-up center, when the synchronous remote transfer method is used.

Figure 8.2 shows the RDDF7 Remote Duplicate Data Facility:

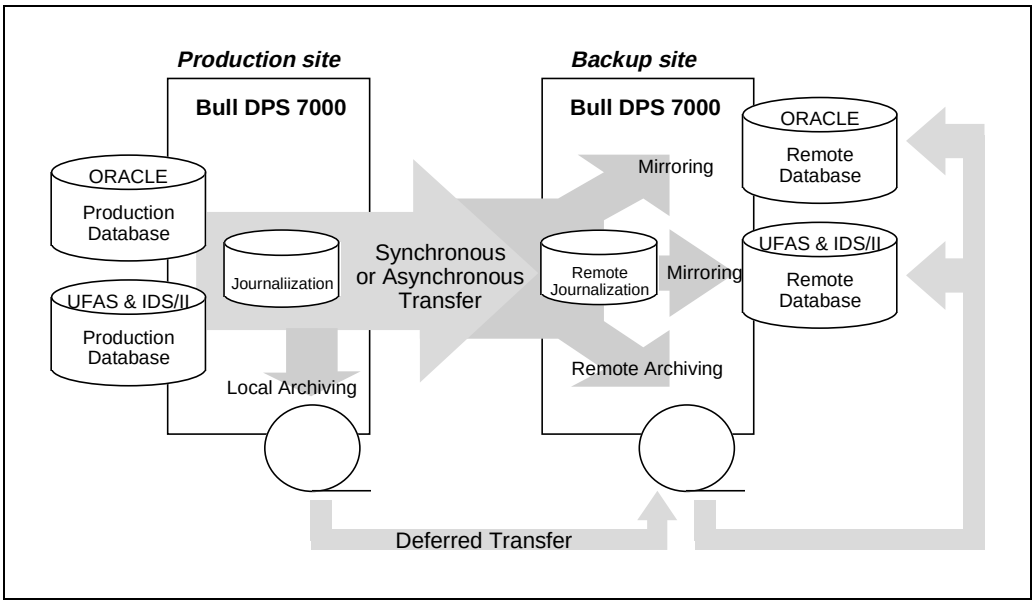


Figure 8-2. RDDF7 Remote Duplicate Data Facility

9. GCOS 7 Development System

9.1 ELEMENTS OF THE DEVELOPMENT SYSTEM

The GCOS 7 Development system comprises the following elements:

- Full Screen Editor (FSE)
- Interactive Development Facilities (IDF)
- Program Checkout Facility (IPCF and TPCF)
- COBOL85
- FORTRAN77
- GCOS 7 Programming Language (GPL)
- PASCAL
- C LANGUAGE
- MACPROC
- SINDIA 7

9.1.1 Full Screen Editor (FSE)

The full-screen editor is a text editor included in GCOS 7 for creating and maintaining library members simply and easily, in full-screen mode.

FSE operates with the help of menus, prompts and help texts.

As well as the classical text editor commands (creation, modification, etc.), FSE possesses specific commands to facilitate the maintenance of library members, such as:

- dynamic selection of libraries,
- copy of a library member into another library,
- etc.

Users have a choice between two options, if the text lines to be viewed are longer than the display possibilities on the terminal:

- wrap-around option
- option of display using a "window" which can be moved in all four directions.

In library update mode, FSE provides a large number of pre-defined requests facilitating the users' work.

9.1.2 Interactive Development Facilities (IDF)

Interactive Development Facilities (IDF) is a product which works in an interactive environment under GCOS 7, and enables the system administrator:

- to control access to the information contained in the files, according to the needs of the various users of the system (catalog),
- to manage the files and volumes (Interactive Utilities),
- to construct well-defined domains of activity for the various users of the system, using the "Command Management" facility.

The command manager is a processor working in incremental mode whose use can be guided by menus, with help facilities for the user.

It offers the following functions:

- the possibility of grouping system commands and user commands by domain of activity, for example, salary processing, inventory management processing, accounts processing (in other words, the possibility of creating an environment),
- the possibility of creating and managing links between the environments and the catalog; this means attaching an environment to one or more users and customizing the domains of activity.

9.1.3 Program Checkout Facility (IPCF and TPCF)

This product is an interactive processor for effective debugging in symbolic addressing mode of programs written in C, COBOL, FORTRAN and GPL. Two versions of the product are available: IPCF for debugging IOF programs, and TPCF for debugging TDS programs.

The following main functions are provided:

- stop on address,
- display or modification of the content of one or more variables,
- modification of the processing sequence,
- etc.

A menu system, with help concerning the commands, is available to programmers for use of the product (this is part of the interactive GCOS 7 facilities).

9.1.4 COBOL85

The COBOL language processor under GCOS 7 offers the following features:

- a powerful and standardized COBOL language which corresponds to the COBOL85 standard recommendations, concerning notably:
  - structured programming,
  - communication between programs,
  - data manipulation.
- possibilities of compatibility with GCOS 8 systems (packed decimal DPS8, ACCEPT, DISPLAY).
- a report generation module (Report Writer).
- a telecommunications support module.
- a module that takes into account the data manipulation language (DML).
- support of intrinsic functions.

This language is used by programmers to perform data transfers between their program and a database (IDS/II). COBOL 85 has the following advantages:

- it automatically segments the program that it generates,
- it provides full diagnosis of any errors,
- it generates complete detailed output reports,
- it contains a module that handles dynamic correction of the user programs,
- it can work in batch or interactive processing mode,
- it generates programs in interactive mode.

9.1.5 FORTRAN77

The FORTRAN language processor under GCOS 7 handles a powerful and standardized FORTRAN language which complies with all the ANSI 77 recommendations and corresponds to the requirements of modern scientific programmers.

This language enables the power of the GCOS 7 software and the high performance of the DPS 7000's hardware/firmware to be used to the full. As well as the functions defined by the ANSI 77 norm, FORTRAN77 contains several extensions to these functions:

- dynamic creation of permanent or temporary files,
- sequential read and write of records of up to 4MBytes on virtualized files,
- direct reading and writing on virtualized files.

With FORTRAN77, there is the possibility of writing applications in a modular way (package).

The FORTRAN77 language processor can be used in the batch processing environment or the interactive environment and corrections are applied to applications dynamically.

There is an interface for developing graphic applications.

A mathematical library is made available to users of the FORTRAN77 language.

9.1.6 GCOS 7 Programming Language (GPL)

The GPL language processor under GCOS 7 can be used to generate programs written in the GPL language.

This is a PL/1-type language which can be used for writing system software, with the potential of a high-level language. It is made up of:

- a set of instructions that complies with the ANSI 76 norms,
- extensions which are specific to GCOS 7.

GPL users have direct access to the functions of GCOS 7:

- task management,
- data and file management (dynamic assignment),
- segment management,
- interface with interactive operator facility (IOF), etc.

This processor can be used in a batch processing or interactive environment.

9.1.7 PASCAL

The PASCAL language processor under GCOS 7 handles three levels of language:

- the PASCAL language specified by the ISO 7185 norm (including the adjustable table parameters). This level of language can be used to describe applications that are portable onto various types of machines using PASCAL.
- the PASCAL SOL language which contains specifications that complement the ISO norm. It can be used for separate compilation (sub-programs), calling procedures written in another language (GPL, FORTRAN77, etc.), dynamic assignment of the files and access to relative files (direct). It facilitates the inclusion of text (equivalent of COPY in COBOL). Applications written in PASCAL SOL are portable onto all machines using PASCAL SOL.
- the GCOS 7 PASCAL language which provides a certain number of additional facilities, for example: manipulation of chains (a specific feature of the PASCAL language processor under GCOS 7).

The PASCAL language processor can be used in a batch or interactive environment and can generate applications operating in an interactive environment.

A mathematical library is provided to users of the PASCAL language.

9.1.8 C Language

The C language is a very versatile language which is suitable for a wide range of applications.

C is a structured language in which flow control is insured by a system of nested loops. It provides a wide variety of data structures and a powerful set of operators.

The C language, like COBOL85, can be used for the development and running of Transaction Processing Routines (TPRs).

The C language on DPS 7000 systems complies with the description defined by Kernighan and Ritchie. It conforms to the "full ANSI" recommendations for this language.

9.1.9 MACPROC

MACPROC (macro processor) is a facility which can be used to:

- parameterize programs using means which more powerful than those provided by the programming languages themselves (above all the generics of the code),
- specify and implement interfaces between software functions, whether written in the same language or not,
- generate test combinations (programs and data) automatically.

9.1.10 SINDIA 7

The SINDIA 7 Integrated Dialog System is a Software Engineering facility. SINDIA 7 provides a method and a set of tools for developing transactional applications which run in a GCOS 7/TDS remote processing environment.

Based on a conception which aims to break down the dialog into a set of elementary processing routines, the facilities proposed in SINDIA 7 can be used to:

- analyze applications,
- define transactions,
- define the environment (screen forms, messages, etc.),
- implement a model application,
- generate skeletons of transaction programs (TPRs),
- generate analysis and maintenance dossiers automatically,
- facilitate application maintenance.

SINDIA 7 is equipped with a dictionary that centralizes the management of the development objects: screen forms, labels, structures, help, scenarii, COBOL copy, etc.

The SINDIA 7 dictionary can be used to improve:

- the quality of the applications (centralization and consistency of the data)
- development productivity (re-usability of the objects in the dictionary, generation of the code corresponding to the transactional chaining)
- maintenance productivity (cross references and impact analysis)

SINDIA 7 can easily be inserted into the existing organization as it respects COBOL coding and releases developers from the programming process under TDS.

SINDIA 7 can be used to develop applications:

- accessing all the data organizations in GCOS 7: UFAS, IDS/II, ORACLE,
- accessed from VIP and DKU-type terminals, IBM3270-type terminals, the MINITEL and ZDS (or compatible) PCs in the appropriate terminal emulation mode.

SINDIA 7 enables the development time for a transactional application to be halved on average.

10. GCOS 7 Solutions

10.1 ALLIANCE SOLUTIONS

Alliance Solutions are distributed client/server solutions for Enterprise Information Processing, built on components of Bull's Distributed Computing Model (the framework for evolving the information infrastructure in line with changing business requirements).

Alliance Solutions are based on interoperability between Enterprise Servers and open systems.

Bull has assembled, qualified and delivered these solutions as packs that meet specific customer needs. The work required to integrate and implement a distributed solution is already done.

Alliance Solution Packs are the guarantee for the customer of predictable results in a defined hardware and software environment. They are fast and easy to implement, thanks to a services offer included in the package.

The Alliance Solutions offer for GCOS 7 comprise the following **domains**:

- management,
- data access,
- printing.

Within each domain, there are one or several solution packs tailored for specific needs.

10.1.1 MANAGEMENT 7

Management 7 is built on the Integrated System Management (ISM) offer, a key building block of the Distributed Computing Model. ISM provides the services to manage and maintain a consistent environment for all functions throughout the network.

Management 7 consists of a single package which is built on the following ISM Server 390 configuration:

- ISM Server 390 (Bull DPX/20 150, AIX, ISM Executive and generic applications),
- asynchronous link to GCOS 7 through RTC or X.25/PAD access,
- extended hardware and software configurability for the ISM Server (available in the standard ISM catalog)

Management 7 includes an integrated services package for fast deployment of the pack.

In addition, the pack includes the following specific ISM administrative applications:

- ISM Pilot, a console management/automation application
- DSAC Agent Integrator, a network management application for OSI/DSA networks (DSA Administration and Control).

The ISM Pilot application supports the consoles of GCOS 7, GCOS 8, Datanet and UNIX systems. ISM Pilot provides two main functions:

- system console automation capabilities, incorporating message filtering, automatic answer and alarm management,
- concentration of system console messages, enabling centralized and consistent management of heterogeneous systems, from a remote console.

The DSAC Agent Integrator application provides two main functions:

- network administrative traffic monitoring, incorporating message filtering, logging and alarm management,
- concentration of multiple communication processors, enabling centralized and consistent remote console management of these processors.

10.1.2 DATA ACCESS 7

Both the TCP/IP and OSI/DSA environment packs are aimed at boosting PC-based Decision Support around **installed** GCOS 7 Oracle databases.

On the PC side, the BusinessObjects offer is the ideal tool for these packs. BusinessObjects works in the MS-Windows 3 environment and offers an intuitive point-and-click interface that enables end-users to query data in a flexible ad-hoc manner.

On the Bull DPS 7000 side, the the Data Access packs encompass Bull's SQL*Net components and some software prerequisites that are required to make GCOS 7 Oracle databases accessible from PC's. Appropriate services are included in the packs to insure successful implementation of the solution.

Note: Alliance Solution Data Access packs require GCOS 7 ORACLE RDBMS , and are not available for DPS 7000/400 systems running only the bundled ORACLE RDBMS.

Figures 10-1 to 10-4 show four possible architectures for Data Access 7.

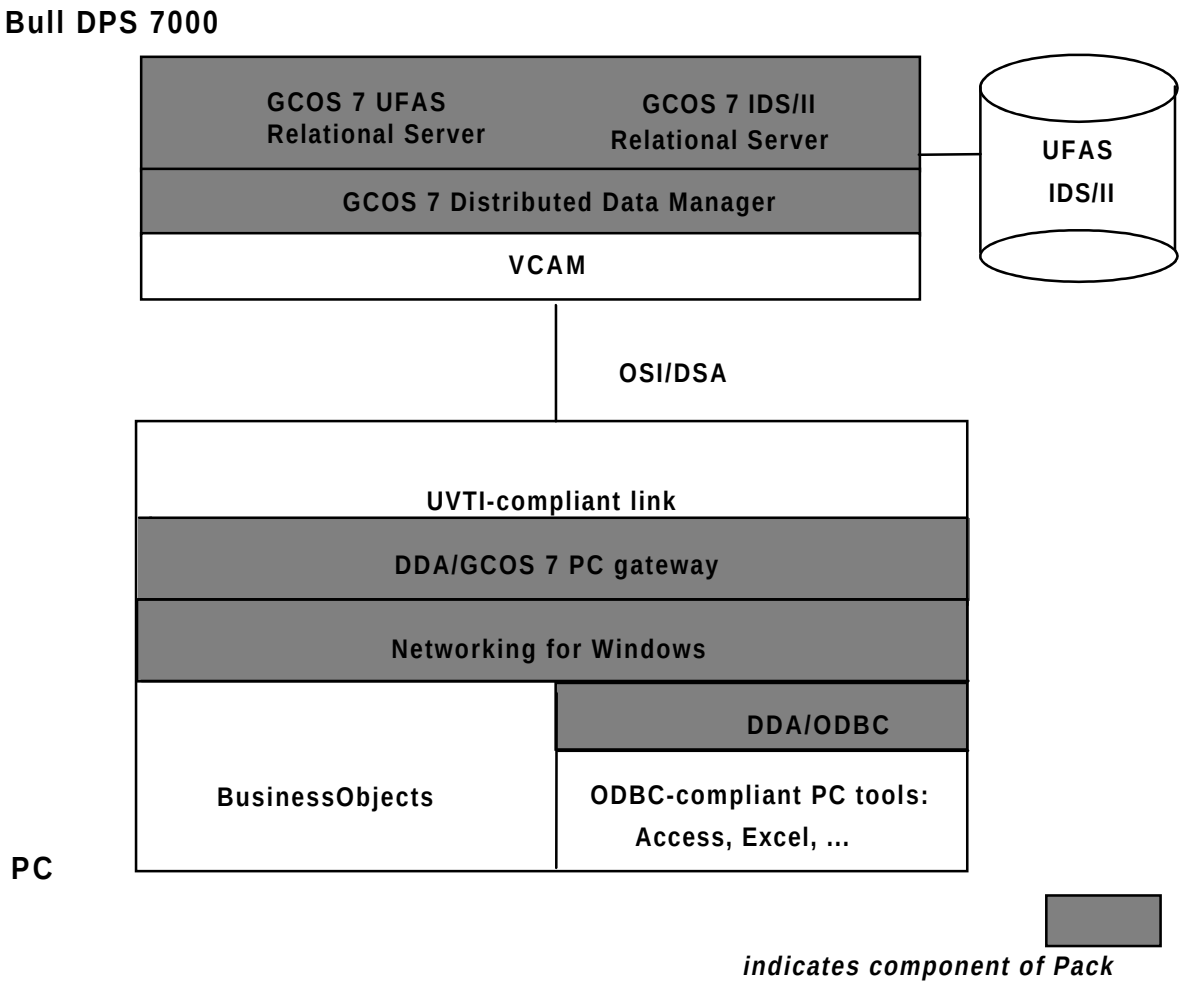


Figure 10-1. Data Access 7 Architecture - Example 1

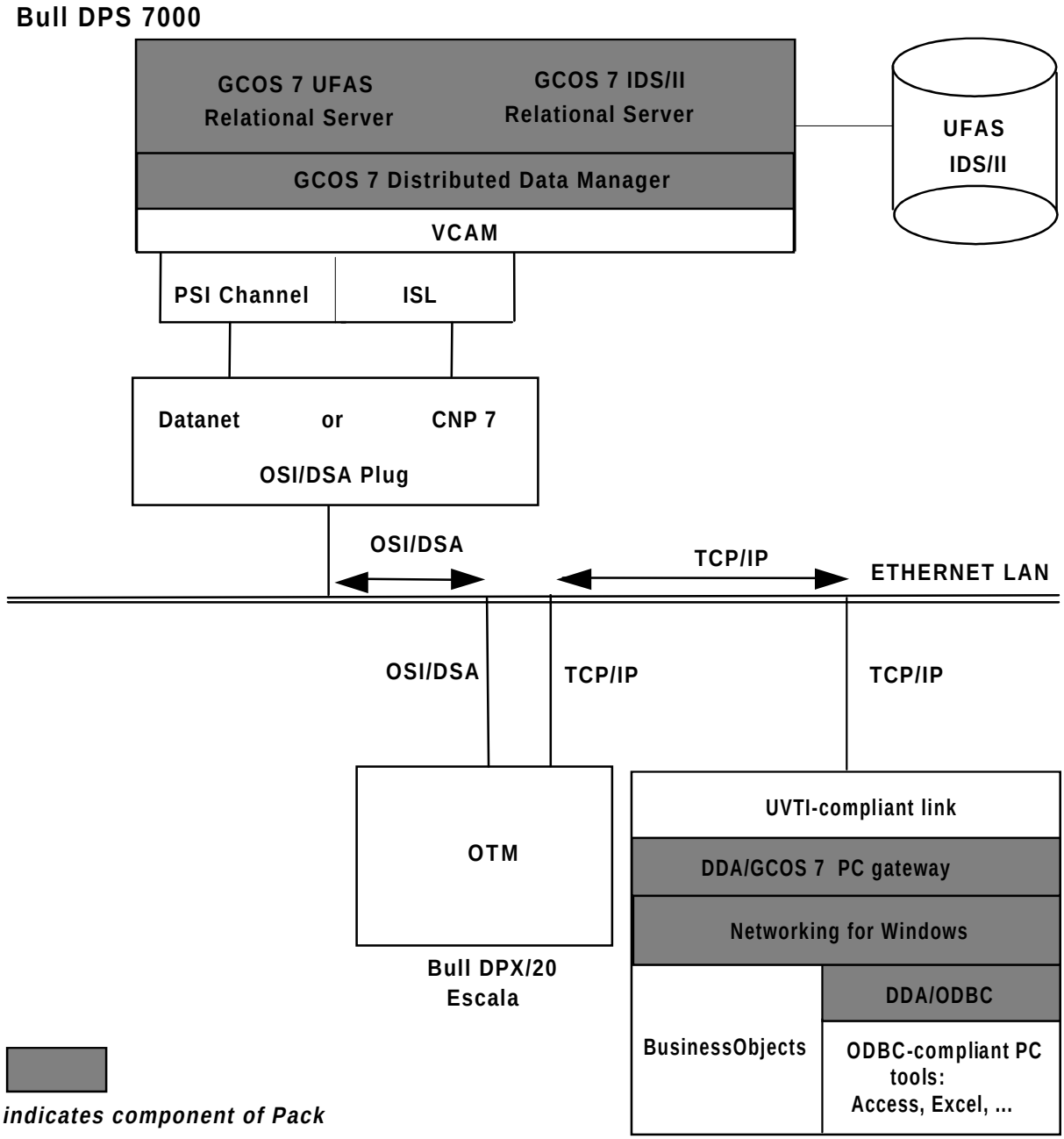


Figure 10-2. Data Access 7 Architecture - Example 2

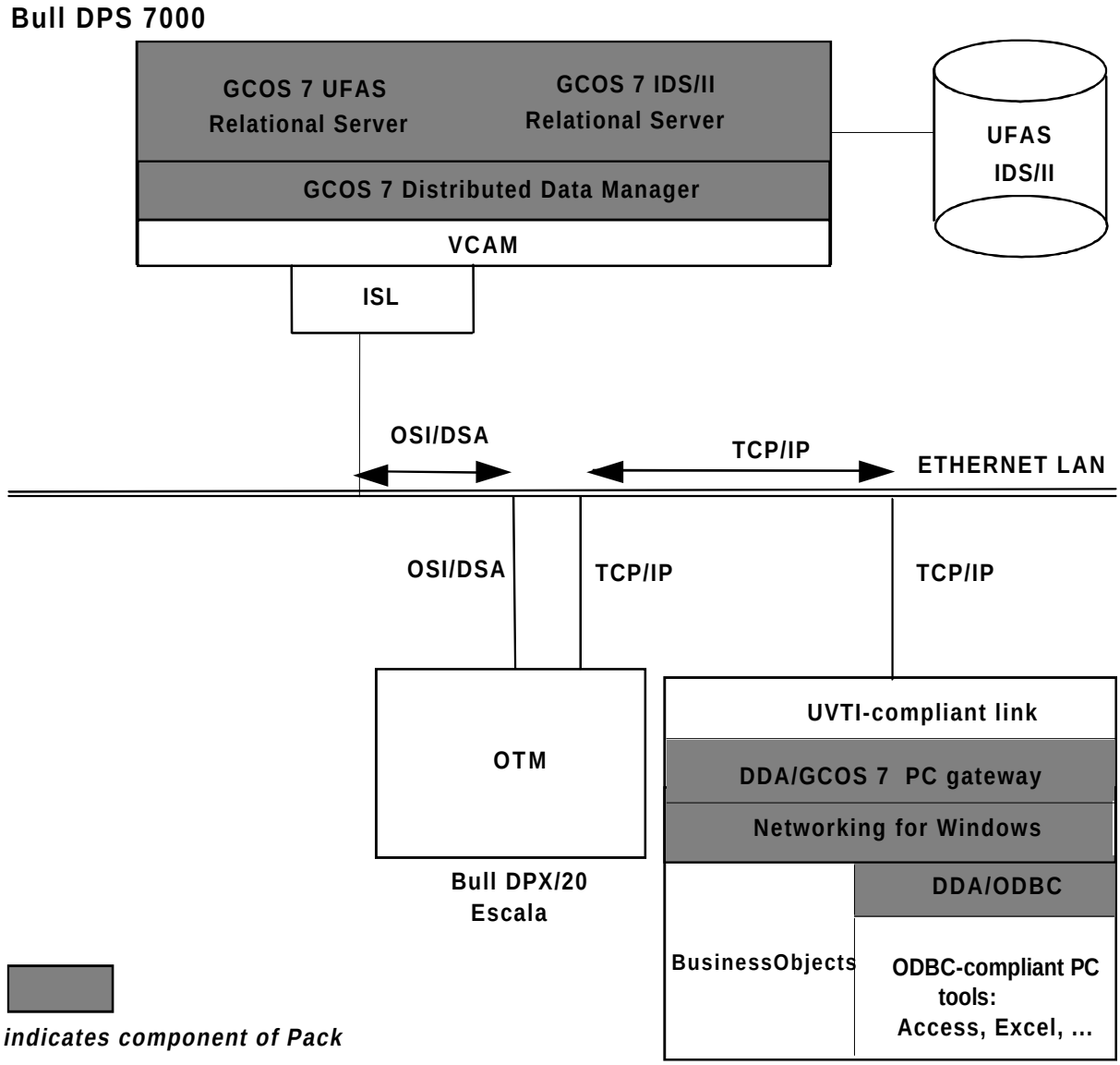


Figure 10-3. Data Access 7 Architecture - Example 3

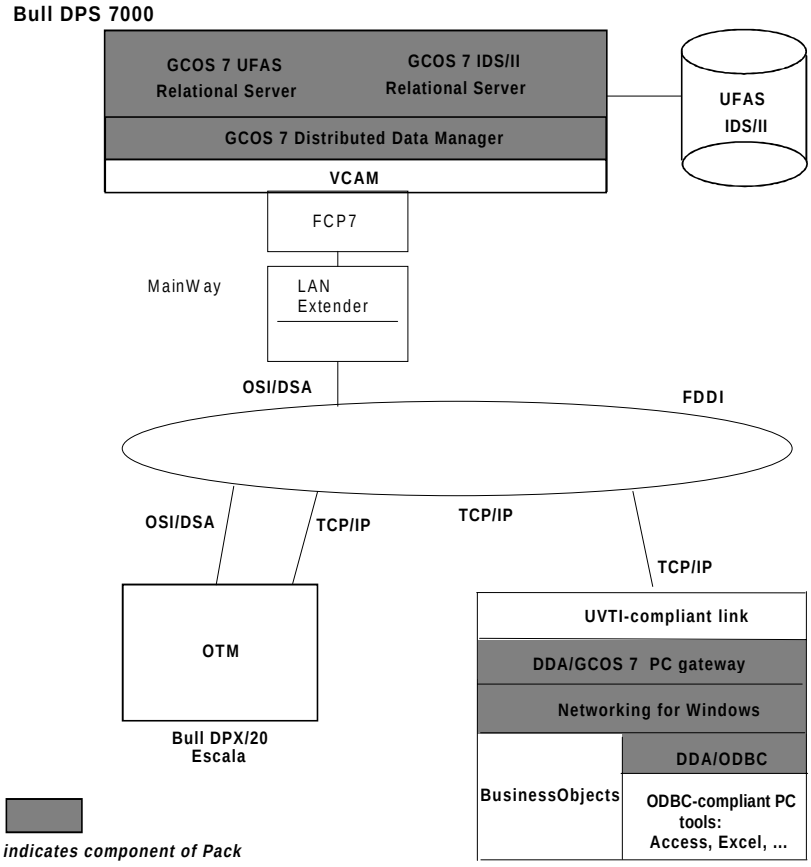


Figure 10-4. Data Access 7 Architecture - Example 4

10.1.3 PRINT 7

The Alliance Solution Print 7 is based on Distributed Printing Facility (DPF) V1.1 with the DSA Listener gateway access from GCOS 7. Print 7 provides users with:

- direct access to a DPF distributed realm from one or several GCOS 7 systems, or
- printing system services for multiple GCOS 7 systems.

Print 7 complements the standard offer which provides access to DPF from GCOS 7 applications currently written to use DSA networked printers. Print 7 is a simplified, rapidly operable and more attractively priced way of providing access to DPF from GCOS 7 systems.

Print 7 is built on the latest version of the GCOS 7 DSA Listener product, which provides gateway access from GCOS 7 to Distributed Printing Facility V1.1 standard facilities.

DPF V1.1 is a modern Client/Server print manager, accommodating a large array of printers distributed on a TCP/IP network (or OpenTeam or Novell Netware workgroup).

GCOS 7 DSA Listener Gateway access to DPF V1.1 is offered on Bull DPX/2 and Bull DPX/20 platforms connected to GCOS 7 through an OSI/DSA link.

GCOS 7 GTWriter reports (or SYSOUT reports redirected to GTWriter through the "GTWriter Writer") can be submitted to DPF for remote printing. Applications are not impacted, and the GTWriter sees a DSA Listener like an intelligent remote DSA printer.

A DSA Listener can be statically configured for GTWriter, and GTWriter can send print parameters to a DSA Listener, to dynamically override the static configuration for the current output. This feature gives greater flexibility for the distribution, personalization and enrichment of the output sent to DPF through the DSA Listener.

Figure 10-5 shows a typical print configuration using Print 7.

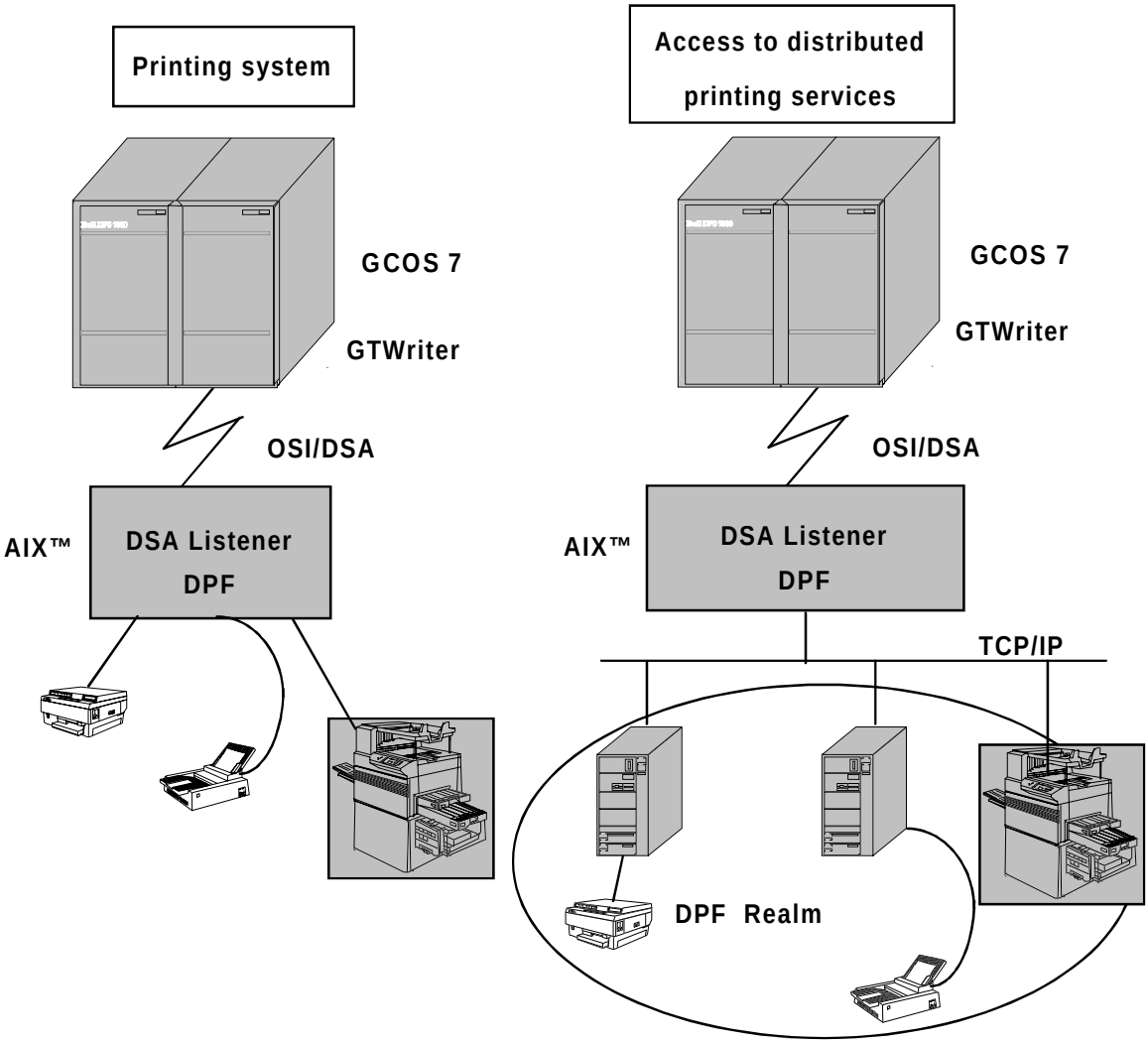


Figure 10-5. PRINT 7 Configuration

10.1.4 Other Alliance Solutions

Packs are also available for EpochBackup 7 and Data Warehouse 7. These products are described in the Sections "GCOS 7 Software Components" and "GCOS 7 Information System" respectively.

10.2 STELLA SOLUTIONS

The Stella environment, bringing a progressive strengthening of GCOS 7-UNIX cooperation, is based on a GCOS - Escala interoperability platform. It includes a large set of communication and interoperability middleware services, running on both the GCOS 7 and Escala systems. It is based on a performant GCOS 7-UNIX FDDI physical link, with the associated attachments required for the GCOS 7 and Escala systems, and supporting market leading communication protocols.

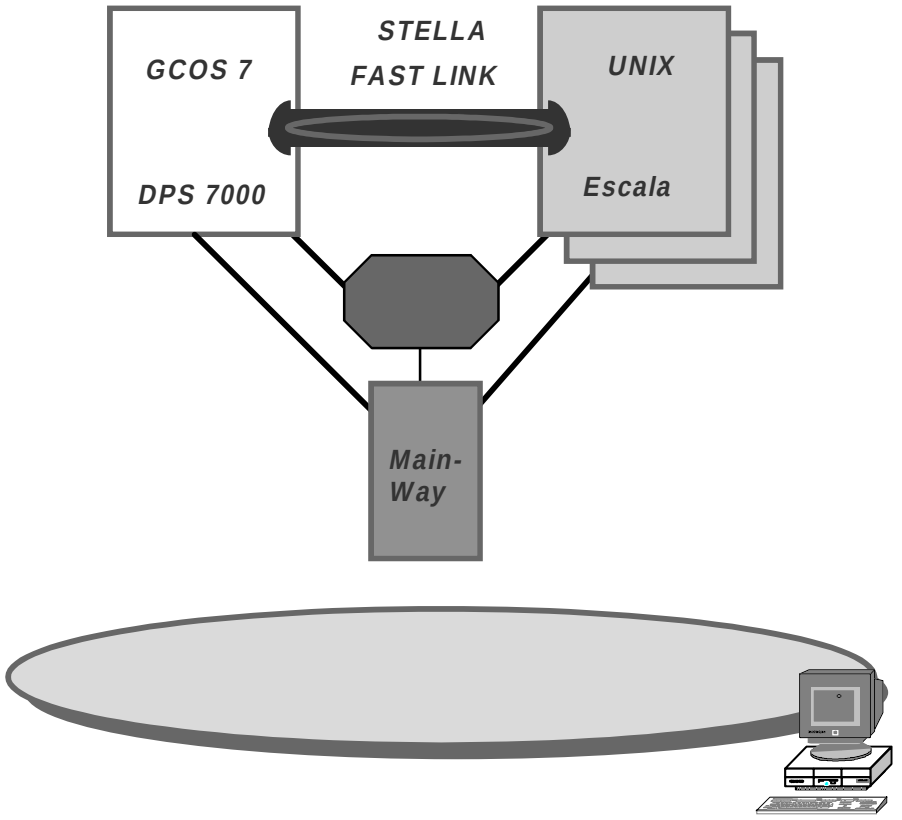


Figure 10-6. Stella Fast Link

Stella solutions are composed of the Stella Fast Link and Stella functions.

Stella Fast Link is a high-performance hardware/software interoperability link which connects GCOS 7 and Escala systems. It provides high throughput between servers, with the performance of FDDI (100 Mbits/second nominal bandwidth).

Stella functions enable application developers and operations personnel to derive benefit from open systems while capitalizing on their existing GCOS 7 environment. Stella provides functions for the distribution of data and processing, for example, the distribution of data in a production environment.

Stella solutions are managed, qualified, delivered, installed and supported as a GCOS 7 technical status, in order to fully answer the requirements for performance, resiliency, security and "Load & Go" features.

"Load & Go" means that these products are prevalidated by Bull's skilled development teams, so that the quality of Stella is equivalent to that of a single operating system. Bull's

System Integration capability provides a first level of mainframe disciplines (security, robustness, maintainability, etc.) across a distributed GCOS - UNIX environment.

10.2.1 Cooperative Transaction Processing 7

The **Cooperative Transaction Processing 7** (TP7) Stella solution is based on the two transactional monitors Tuxedo System V4.2.2 and GCOS 7/TDS.

The Tuxedo System V4.2.2 is a flexible, efficient platform which supports customer-developed applications or VAR business packages in a Distributed Transactional Environment. The Tuxedo System runs on Bull's UNIX platforms (Escala). The different links provided by Cooperative Transaction Processing 7 provide a flexible integration of GCOS 7/TDS with Tuxedo System transactional applications.

The Cooperative TP7 Stella solution is available on Bull DPS 7000/4x5 and Bull DPS 7000/800 platforms supporting GCOS 7 EXMS V7 TS 7254 and on Escala platforms supporting AIX 4.1 and Tuxedo System V4.2.2.

The solution can be supported by the Stella Fast Link which interconnects the Bull DPS 7000 and the Escala systems via a dedicated FDDI SAS (Single Attachment Station) link. This link is highly recommended.

Three types of transactional cooperation between GCOS 7/TDS and AIX/Tuxedo are available in the Cooperative TP7 offer :

- Two-Level Transaction Processing (2LTP)
  Enables a Tuxedo System transaction to be seen from a GCOS 7/TDS server as a dumb terminal. No modification is needed to TDS transactions.

- Cooperative Transaction Processing (CTP)
  Enables the development of a symmetrical peer-to-peer communication between GCOS 7/TDS and the Tuxedo System**.** This link is based on the CPI-C API and XCP2 protocol.

- Client/server Transaction Processing (/HOST 7)
  This feature enables the Tuxedo System transaction to be a client of a GCOS 7/TDS server transaction, through a transparent connection**.** GCOS 7/TDS is a fully integrated server in the Tuxedo client/server architecture.

Figure 10-6 shows an overview of Cooperative Transaction Processing 7.

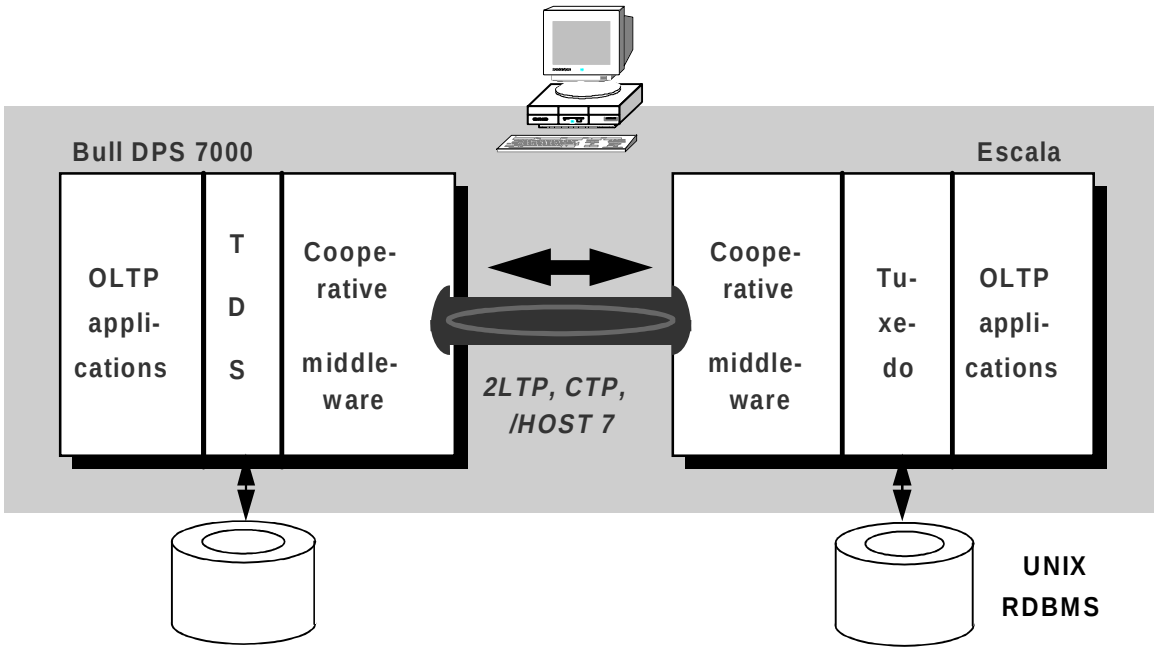


Figure 10-7. Cooperative Transaction Processing 7 - Overview

10.2.2 Electronic Data Interchange (EDI 7)

The EDIWorks Business Server running on Bull DPX/20 and Escala platforms enables GCOS 7 applications to benefit from EDI services through API's relying on the DCE RPC mechanism. This capability is an example of the Bull Distributed Computing Model deployment, with GCOS 7 applications using UNIX-based services through the standard OSF/DCE mechanism.

The EDI 7 Stella solution is available on all Bull DPS 7000 platforms supporting GCOS 7 EXMS V7 TS 7254 or later, and on Escala platforms under AIX 4.1.

The EDI 7 Stella solution operates in conjunction with EDIWorks Business Server V2.01.

The solution can be supported by the Stella Fast Link which interconnects the Bull DPS 7000 and the Escala systems via a dedicated FDDI SAS (Single Attachment Station) link. This link is highly recommended.

The functionalities and services offered by the EDIWorks Business Server are the following :

- translation service, with the support of ANSI X/12 and EDIFACT syntaxes; other syntaxes can be supported depending on specific needs,
- mapping service, to map messages structures with application file formats,

- multi-communication services :
  - value added networks: IBM IN (OFTP/X25), GEISCO (OFTP/X25),
  - file transfers: PeSIT (X.25), ETEBAC (X.25), OFTP(X.25),
  - X.400 Message Handling Systems : P1/P2 (TEDIS, TEDECO, ALLEGRO, BRIO protocols), ATLAS 400 (440, TEDIS and TEDECO protocols),
- message management, send and receive,
- administration services :
  - server configuration,
  - management of trading partners database,
  - archive function,
  - start and stop server,
  - view functions (statistics and status of the Server),
- audit log file to store events used for billing, error diagnosis and statistics,
- track file to maintain all status information related to the messages to be sent or received,
- API server for local/remote Bull DPX/20 or Escala applications and for remote GCOS 7 applications.

Figure 10-7 shows an overview of the EDI 7 Stella solution.

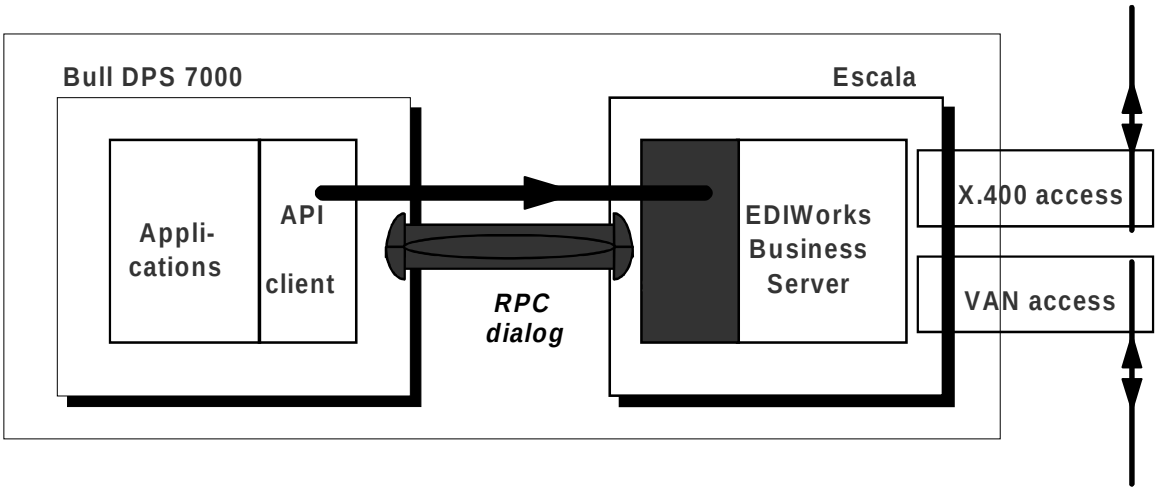


Figure 10-8. Electronic Data Interchange (EDI 7)

10.2.3 Other Stella Solutions

Stella Solutions cover the following products and their environments:

Stella Fast Link	See "Communications and Networks"
Data Warehouse 7	See "GCOS 7 Information System"
Oracle7 (Client Mode Access)	See "Databases"
FlowBus	See "GCOS 7 Production System"
GCOS 7 DCE RPC	See "GCOS 7 Production System"

Glossary

The glossary defines many of the terms encountered in this overview of the GCOS 7 system.

If a word is in **bold** type, this indicates that it is the subject of a specific entry in this glossary.

Affinity

See **Micro-to-Mainframe Links**.

Batch

Users working in the batch **environment** submit work to the operating system in the form of an input stream. An input stream contains one or more job descriptions. Each job description is made up of Job Control Language (**JCL**) or GCOS 7 Command Language (**GCL**) statements, and defines a job to be run for a given user.

Historically, the input stream was usually read in from cards, but now the most common way for users to submit a batch job is to create it first as a disk file, and then run it using a command input from the **IOF** environment.

Binary Object (BIN) Library

See **Library**.

Catalog

A catalog is a special permanent file where information is kept about **files**, volumes and other cataloged objects such as directories, generations and user information. As part of the installation process for a GCOS 7 system, two catalogs are set up:

- the System Catalog, which contains the cataloged files supplied with the system. (These files have the prefix SYS. as part of the file name).
- the Site Catalog, under which are cataloged the system startup files, and information about user **projects**. (Files cataloged here have the prefix SITE. as part of their name).

In addition, users can create their own private catalogs which may or may not be cataloged in the Site Catalog. A private catalog can contain objects which belong to only one project. This project is said to be the owner of the catalog.

The owner of the System Catalog and the Site Catalog is the SYSADMIN project.

A representation of a catalog is given in Figure g-1 below.

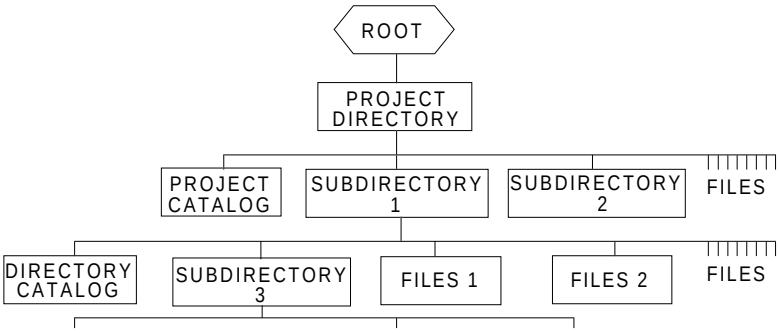


Figure g-1. A Representation of a Catalog

Communications

Generally speaking, DPS 7000 systems are not used as stand-alone systems, able to call upon only their own data processing resources. They are now almost always joined together in networks, which may be "homogeneous" (containing only GCOS 7 systems), or "heterogeneous" (containing other systems such as GCOS 8, etc.). The distribution of processing resources over a network makes economic sense, and reduces both the impact of failures and the duplication of effort.

In a physical sense, a network is a combination of interconnected hardware and software for moving information between points where it can be generated, processed or stored. The interconnections include computer channels, telephone lines, microwave links, satellite links, and coaxial cables.

In a more abstract sense, the term "network" refers to a configuration of data processing products such as processors, controllers, and terminals, established and operated for the purpose of information exchange or data processing. The communication between the different elements of the network is ensured by a public network.

The Distributed Systems Architecture (DSA) is the facility which enables you to see the network and its data in an ordered, logical way. It is a set of rules and protocols that permit the transfer of data across a communications network.

GCOS 7 has an extensive set of communications facilities to handle data transport between the different elements of the network. These facilities include the **IOF** and **TDS environments**, and the **remote facilities** described below. The interface that users have with these facilities is provided by the Virtual Communications Access Method (VCAM).

A representation of a network is given in Figure g-2.

Communications and networks are described in Section 4.

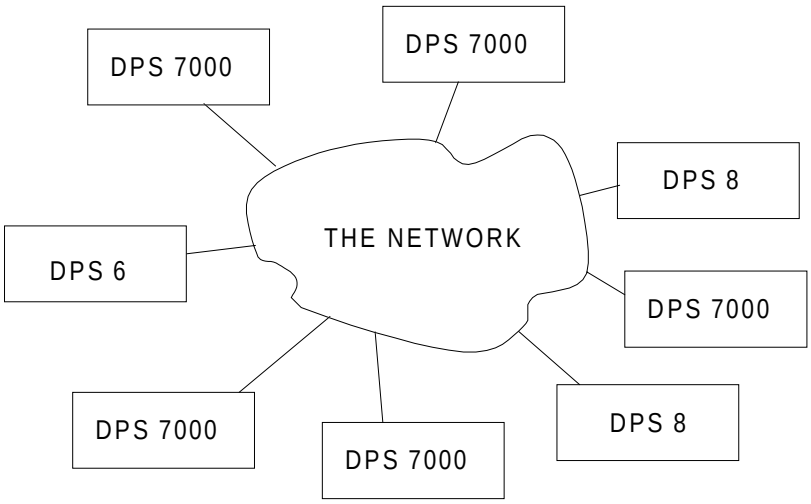


Figure g-2. Representation of a Network

Compile Unit (CU) Library

See **Library**.

Database

GCOS 7 offers two distinct database management systems: **IDS/II** and **ORACLE**. In addition, the **IQS** relational system can be used to develop databases from a combination of IDS/II and UFAS **files**.

Distributed Job Processing (DJP)

See **Remote Facilities**.

Distributed Systems Architecture (DSA)

See **Communications**.

Environment

With GCOS 7 you have three possible operating environments:

- **IOF** (Interactive Operation Facility)
- **TDS** (Transaction Driven System)
- **Batch**.

Your environment determines how you enter work to the operating system, and access its facilities. The three environments are shown in Figure g-3.

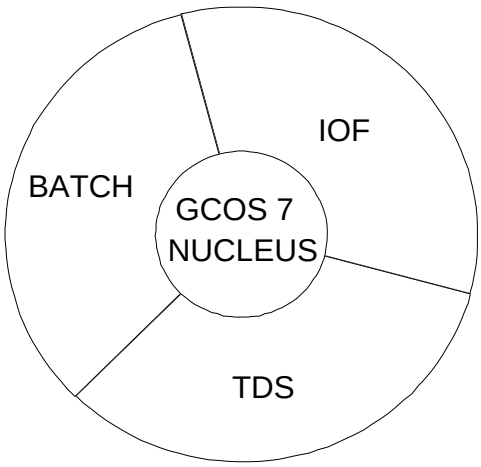


Figure g-3. The GCOS 7 User Environments

File

A file is a collection of related records, held on disk or other magnetic media. GCOS 7 supports a number of file organizations, including:

- sequential files, in which records are accessed sequentially
- indexed sequential files, in which records are accessed either sequentially, or via a primary key and up to 15 secondary keys
- relative files, in which records are accessed by record number (these are sometimes called direct or random files)
- linked queued files or **library** files, which are logically divided into subfiles or members.

File Access Method

File access methods constitute the interface between logical data management and the physical device on which the file is recorded. Each file access method is a set of routines which provide facilities for creating and managing files. There are three access methods available to users of GCOS 7:

- UFAS (Unified File Access System), which supports all record-based file organizations
- Linked-Queued, for **library** files only.
- **IDS/II**

IDS/II is a sophisticated database management system that allows users to create, access, and maintain an integrated database. It is ideal for large production systems. There are two versions of IDS/II: an older version, called simply "IDS/II", and a new, more powerful version called "Full IDS/II".

GCL

GCL (GCOS 7 Command Language) is the command language used to communicate with the system when working interactively or to submit jobs in a batch environment.

GCL commands are used to request that the system carry out activities such as executing a program, copying a **file**, or cancelling the execution of a **batch** job. Commands can be entered at the terminal under **IOF**, stored in a file for multiple execution, or compiled into procedures which are given names by GCL's command management function.

GCL commands perform operations on such objects as files, libraries, and **catalogs**; user profiles, **batch** jobs, and programs. They are mainly used to:

- create and execute programs that control user-written or system applications,
- manage files,
- define new commands,
- execute and test programs,
- observe and change some system values,
- secure objects against unauthorized use.

The main features of GCL are listed below:

- Many kinds of user **profile** can be defined, from novice user to complete expert.
- Specific operating environments can be provided for each user. This means that users can access only commands which are necessary for their own processing requirements.
- **Menus**, **prompts**, **parameters screens**, and **Help Texts** are available to present commands in a user-friendly form. This means that GCL is particularly well suited to novice or casual users.
- There is a programming capacity to develop new commands or to automate common processing sequences.

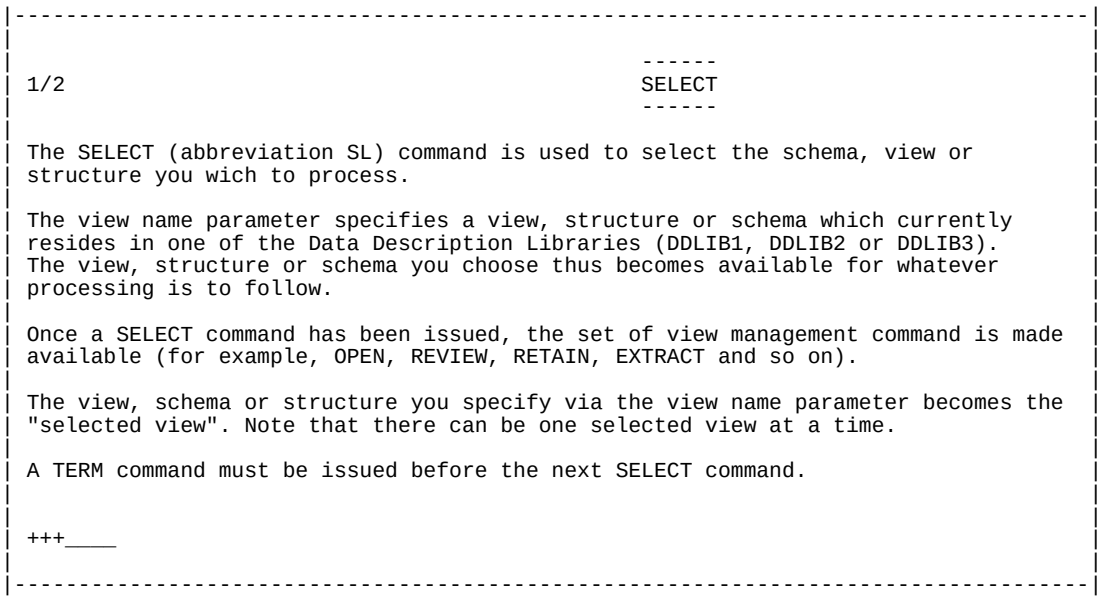
Help Text

A Help Text is an explanatory text which is available on-line to help you to make better use of the system or to understand a particular concept. Help Texts are available for all commands and parameters, keywords, **menus**, **prompts**, and operating contexts. There are also Tutorial texts, which give brief explanations on selected topics.

You can call up a Help Text by entering a question mark before a command name (for example, ?PRINT) or instead of a parameter value. Since the system knows the context in which each particular user is operating, the text displayed is specific to this context.

Help Texts can in theory support 10 different languages. If a requested text is not available in a particular language, the English version is displayed instead. A set of standard Help Texts is supplied with every GCOS 7 system, and users can write their own Help Texts, to cope with any situation.

An example of a Help Text is given below:



IDS/II

IDS/II is a network-type **database**. Such databases are characterized by the way they associate relationships between sets of data by using pointers rather than embedded keys.

The fundamental concepts are those of a record type and a record set.

A record type can be an owner of other records, or be owned by other records (that is, a member), or can be both.

Sets define the relationship between record types in a one-to-one, one-to-many, or a many-to-many relationship.

It is sets which enable you to navigate around the network. Data is retrieved one record at a time in order for the pointer chain to be followed.

IDS/II provides interfaces with **IQS**, **TDS**, and **ORACLE**.

INFORMATION-LINK

See **Micro-to-Mainframe Links**.

IOF

IOF stands for Interactive Operation Facility. This is the GCOS 7 time-sharing **environment** which allows many users to access GCOS 7 processors simultaneously and to use the GCOS 7 Command Language (**GCL**) from a terminal or workstation. There are sub-environments within the IOF environment.

IQS

IQS is a relational information system. It can use the combined power of **IDS/II databases** and UFAS **files** to form virtual databases of its own. Data is perceived as views which conform to the way users wish to see it.

IQS incorporates both a procedural programming language and a powerful end-user oriented command language. It also provides a set of tools which enables you to access existing GCOS 7 data without needing to set up a separate database.

IQS provides interfaces with IDS/II and **TDS**.

JCL

JCL is the Job Control Language of GCOS 7. Its main purpose is to enable the user to run **batch** jobs written in one of the standard languages of GCOS 7.

A job is the basic unit of work that is input to the GCOS 7 system. Jobs can be submitted either:

- from a local terminal or a remote terminal connected to a DPS 7000 host (interactive input), or
- as part of an input stream on disk (**batch** input).

Library

A library is a disk-based **file**. A file contains one or more subfiles, also known as members, each of which is identified by a unique name within the library.

There are five types of library:

- Source Language (SL) libraries, whose members contain a series of source lines such as uncompiled source programs, **JCL** command files, documents, and other readable texts.
- Compile Unit (CU) libraries, whose members are compiled but as yet unlinked source programs.
- Load Module (LM) libraries, whose members are linked programs which are ready to be executed.
- Sharable Module (SM) libraries, whose members are sharable modules. Sharable modules are executable load modules which can be shared by several users. **TDS** transactions use SM libraries, as do most GCOS 7 system programs.
- Binary Object (BIN) libraries, whose members are mainly system programs or GCL procedures.

System libraries are supplied with the GCOS 7 system, and user libraries can be created at the System Administrator's discretion.

An example of a system library is the system load module library, SYS.HLMLIB.

User libraries can be created according to the particular requirements of a **project**. For example, a project might have one library for all source COBOL programs, another for all compiled FORTRAN programs, etc.

Load Module (LM) Library

See **Library**.

Menu

A GCOS 7 menu is a list of commands presented so that the user can select a command simply by typing in the number that corresponds to it.

Menus may be spread over more than one screen. You can step forward or backward through a menu, screen by screen, or access a screen directly by its reference..

Menus can be an invaluable aid to novice users, and to more experienced users when using unfamiliar commands, but users who are accustomed to working with **GCL** commands may find this interface unnecessary, and can suppress the use of menus or limit their use to times of need only.

An example of a menu is given below:

```
|-------------------------------------------------------------------------|
|                                                                         |
| 1/6                            VIEW MGT                                 |
|                                                                         |
| 1  ENTRY                      DE   Initiate an entry session            |
| 2  FILE                       FL   Set the current work file            |
|                                                                         |
| 4  EXTRACT                    XT   Extract data into a file set as current  |
| 5  OPEN                       OP   Open the areas of a view or schema   |
| 6  PRINT                      PR   Print the records of the current view    |
| 7  RETAIN                     RT   Retain items and occurrences to be kept  |
| 8  REVIEW                     RV   Review the current view or file      |
| 9  STATISTICS                 ST   Elabore statistics on the current data   |
| 10 WRITE                      WR   Save the current data in a work file     |
|                                                                         |
| 12 ASSIGN                    ASG   Assign a logical file to a real file     |
| 13 MERGE                      MG   Merge several work files together    |
| 14 SORT                      SRT   Sort a work file                     |
|                                                                         |
|                                                                -->:___  |
| -:_____________________________________________________________________ |
| -:_____________________________________________________________________ |
|                                                                         |
|-------------------------------------------------------------------------|
```

MICROFIT 7

See **Micro-to-Mainframe Links**.

Micro-to-Mainframe Links

A number of applications are available to enable the DPS 7000 to communicate (both ways) with microcomputers. Such applications are called micro-to-mainframe links.

MICROFIT 7 is an application which enables **files** to be transferred between the DPS 7000 and the microcomputer, and allows microcomputer users to connect to applications running on the DPS 7000.

INFORMATION-LINK is an application package that allows users working on a micro-computer to run applications on a host DPS 7000, and to transfer files between the two machines. Users can run GCOS 7 applications, like **IQS**, concurrently with micro-computer applications, and can switch between them.

Micro-to-mainframe links generally require additional special components on the micro-computer side to enable it to dialog with the DPS 7000. MICRALINK and MIMIC are two such components. MICRALINK supports synchronous transmission while MIMIC supports asynchronous transmission.

AFFINITY consists of a group of integrated services for PC users, and includes terminal emulators, communication facilities, and micro applications that communicate with applications on a GCOS 7 system as well as on BOS systems. Affinity includes an environment for implementing applications locally on a PC that can access a GCOS 7 system as well as IBM and UNIX systems.

OPEN TEAM is the workgroup server software for a network of PCs using LAN Manager/UNIX for print and file services. It provides the connectivity for PCs to Bull and IBM mainframes via a UNIX server. WIL 7 provides access to GCOS 7 applications. PC/Mistral-link provides access to document databases on DPS 7000.

Figure g-4 represents a micro-to-mainframe link application.

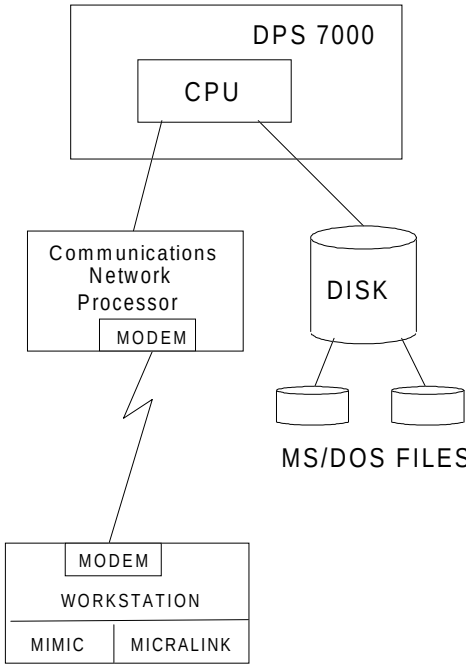


Figure g-4. Micro-to-Mainframe Link Application

Network

See **Communications**.

Open Team

See **Micro-to-Mainframe Links**.

ORACLE

ORACLE is a relational **database** management system. Such databases are perceived externally as a collection of tables which are made up of rows and columns.

Data held in this way is simpler to access than data held in network-type systems since you are not concerned with the way data is stored.

ORACLE supports the industry standard relational data sublanguage, SQL, which can be used directly or embedded in a C, COBOL, or FORTRAN program.

ORACLE provides interfaces with **IDS/II** and **TDS**.

The ORACLE product consists of an integrated set of processors and utilities.

Parameter Screen

Parameter screens are closely related to **menus**. A screen applies to a particular command, and presents the parameters associated with it, together with their default values. You can then change the parameter values if required, before executing the command.

Pass Through

See **Remote Facilities**.

Private Catalog

See **Catalog**.

Project

To log on to GCOS 7, you must belong to a project. Projects are a means of controlling access rights. A user can access a certain file or command only if his or her project allows access to it.

All users have a default project, (stored in the user profile), in which they are automatically placed when they log on, but any user can work under several projects, with different access rights, as determined by the System Administrator.

Prompt

A prompt is a message output by the system as an indication that it is ready to accept some kind of input from the user. What form this message takes, and what type of input is expected, depends on the current **environment**.

In the **IOF** environment, the prompt is usually a single letter which indicates at what level the user is working. For example, when you log on, you enter GCOS 7 at system level, which is shown by the prompt S:. If you then activate a processor, the prompt changes to another letter according to the processor chosen. Within the processor, the prompt may change again, more than once, depending on the function selected. The response to such a one-letter prompt is normally a **GCL** command, but it may be text of some kind.

In the **TDS** environment, prompts tend to be specific requests, according to the transaction being run. You must then respond with a specific answer.

Remote Facilities

At certain times, a given system in a computer network may have a greater workload than usual, while other systems are more available. Using the GCOS 7 remote facilities, it is possible to equalize the workloads of the systems in the network by transferring certain jobs to be executed on remote sites instead of at the local site, and also transferring files between sites.

In this way, all the processing resources of the network are available to the user, who sees all remote resources as if they were on his/her own site.

The GCOS 7 remote facilities are:

- the Distributed Job Processing facility (DJP) for submitting jobs between DPS 7000s, and the Remote **Batch** facility (RBF 6) for submitting jobs from a DPS 6 to a DPS 7000
- the Unified File Transfer facility (UFT) for transferring files between DPS 7000 and other systems in the network, and the File Transfer facility (FTF 6) for transferring files between a DPS 6 and a DPS 7000
- the Pass Through facility to connect from one DPS 7000 system to another.

Site Catalog

See **Catalog**.

Sharable Module (SM) Library

See **Library**.

Source Language (SL) Library

See **Library**.

System Catalog

See **Catalog**.

TDS

TDS stands for Transaction Driven Subsystem, a GCOS 7 facility that allows users to create and run transactional applications. A transactional application accepts information input from a terminal, processes it, and returns an answer to the same terminal. Examples of transactional applications include banking, stock control, and reservation systems.

UFAS

See **File Access Method**.

Unified File Transfer (UFT)

See **Remote Facilities**.

Virtual Communications Access Method (VCAM)

See **Communications**.

Index

E

F

G

H

I

J

L

M

N

O

P

Q

R

S

T

U

V

X