



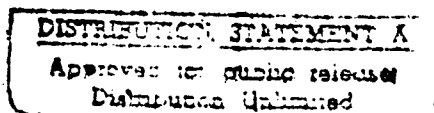
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**Finance Near-Term
Technical Architecture
for the
Defense Information Technology
Services Organization**

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PREFACE

The Finance Near-Term Technical Architecture will provide the integrated guidance, design concepts, and migration strategies that govern the consolidation and evolution of finance and accounting technical infrastructure.

This release of the Architecture , Version 1.1, is based on the previous versions and incorporates the majority of the user supplied comments. This version includes updates to the following sections : Transaction Processing, Video Teleconferencing, Electronic Data Interchange, Operating Systems, Application Programming Languages, Database Management, Data Interchange, and Workstations. Several sections of the architecture not included in this current version will be included in future versions of the architecture as they are completed.

The next version of the Architecture will include updates to Imaging, Security, and Communications.

The architecture will evolve based on comments and feedback from the finance technical and functional integrators, the Defense Information Technology Services Organization (DITSO), and the finance community in general. Please address all comments to:

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TABLE OF CONTENTS

1.0 INTRODUCTION	1
1.1 Background	1
1.2 Purpose	1
1.3 Architecture Approach	2
1.4 Scope of Near-Term Technical Architecture	3
1.5 Document Organization	7
2.0 ARCHITECTURE STRUCTURE	8
2.1 Overview	8
2.2 Support Applications	10
2.2.1 Imaging	11
2.2.2 Transaction Processing	12
2.2.3 Video Teleconferencing	17
2.2.4 Interactive Voice Response	21
2.2.5 Electronic Data Interchange	24
2.2.6 Expert Systems	26
2.2.7 Office Automation	27
2.3 Platform	28
2.3.1 Operating Systems	29
2.3.2 Programming	33
2.3.2.1 Application Program Language	33
2.3.2.2 Computer Aided Software Engineering	37
2.3.3 Network Services	39
2.3.4 Data Base Management	43
2.3.5 Data Interchange	48
2.3.6 Graphics	51
2.3.7 User Interface	52
2.3.8 Security	59
2.3.9 System Management	62
2.3.9.1 Network Management	65
2.3.10 Workstations	66
2.4 Communications	70

1.0 INTRODUCTION

This document describes the support applications, computing platforms, and communications networks needed to provide the technical infrastructure for the finance community. It will be used to guide the evolution of the finance technical infrastructure in support of their specific requirements. System alternatives, economic analysis, detailed migration options, and implementation guidance will be provided in separate documents.

1.1 Background

The current Department of Defense (DoD) finance and accounting technical infrastructure consists largely of stovepipe, single purpose, and inflexible systems which are costly to develop and maintain. There exists over 450 limited purpose systems using a wide variety of computing and communications technology. The use of this large number of systems often contributes to redundant inefficient management of DoD resources.

The existing technical infrastructure fails to provide the centralized management, flexibility, and interoperability required to support new business practices, consolidation efforts, and rapid user access to required information. More importantly, it fails to integrate the multi-IPC/CDA infrastructure which was capitalized into DFAS and does not satisfy regulatory requirements for interoperability.

1.2 Purpose

The Technical Architecture provides the integrated guidance that governs the evolution of the finance and accounting technical infrastructure. It provides the services, standards, design concepts, and migration strategies that will be used to develop a technical infrastructure that conforms to DoD standards and guidelines. The Technical Architecture forms the foundation for introducing and promoting interoperability, portability, and scalability of finance and accounting systems.

Although the eventual goal is a common, cross-functional, standards-based technical infrastructure, the architecture does not drive the finance technical environment directly to open systems compliance. Instead it focuses on a phased migration approach which initially creates the best possible technical infrastructure from existing technology components within the finance and accounting inventory. Opportunities to position for future migration to open systems compliance are exploited wherever possible.

1.3 Architecture Approach

The methodology specified in the DoD Standards-Based Planning Handbook was used to develop this architecture and its supporting documents. The approach includes the following:

- 1. Adopting the DoD Technical Architecture Framework for Information Management as the framework and vision for the Finance Architecture. The Technical Architecture Framework provides the foundation and template for the Finance Architecture.**
- 2. Developing a Finance Baseline which provides information on the current finance technical infrastructure.**
- 3. Define a target architecture.**
- 4. Identifying areas for more in-depth analysis. Teams were formed to look at these areas in more detail using the architecture as an overall integrating mechanism.**
- 5. Providing options, economic analysis and recommendations on migration alternatives to the finance community.**
- 6. Providing implementation guidance to the finance community based on the migration options.**

For more information concerning the basis for adopting this approach please refer to the *DoD Technical Architecture Framework for Information Management* and the *Technical Reference Model for Information Management, Version 3.0*.

1.4 Scope of Near-Term Technical Architecture

This architecture consists of views of the finance technical infrastructure that describe the selection and configuration of components at different points in time. These time frames represent a migration path (Figure 1-1) from legacy systems to migration systems and eventually to objective systems conforming to all applicable DoD standards and guidelines. No explicit dates are given for when the migration occurs. At any given point in time, an individual system may be in any of the three phases. The eventual goal is to move all systems to the objective environment.

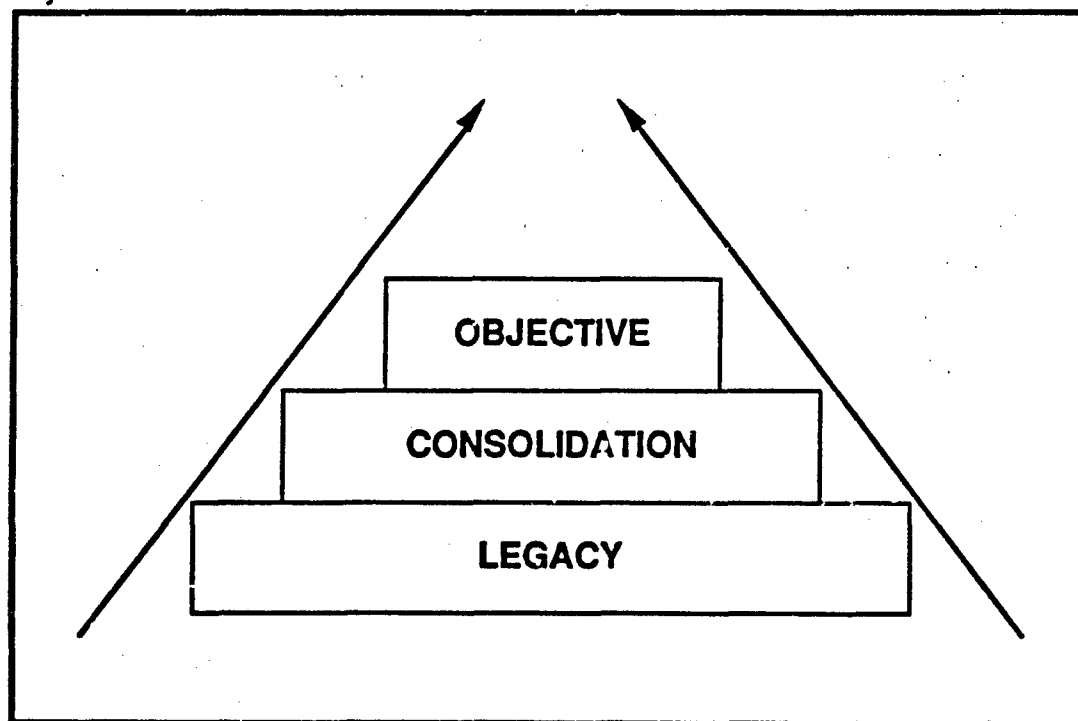


FIGURE 1-1: MIGRATION PATH

In following this migration path, the finance community needs to categorize the support applications, platforms, and communications components to indicate which ones should be considered in making technology investments. By having an explicitly defined set of categories of components, optimal technical decisions can be made at each point within the migration. The technologies and components that define the architecture, either in the current inventory, or where procurement is required, will be placed in one of the following categories (Figure 1-2):

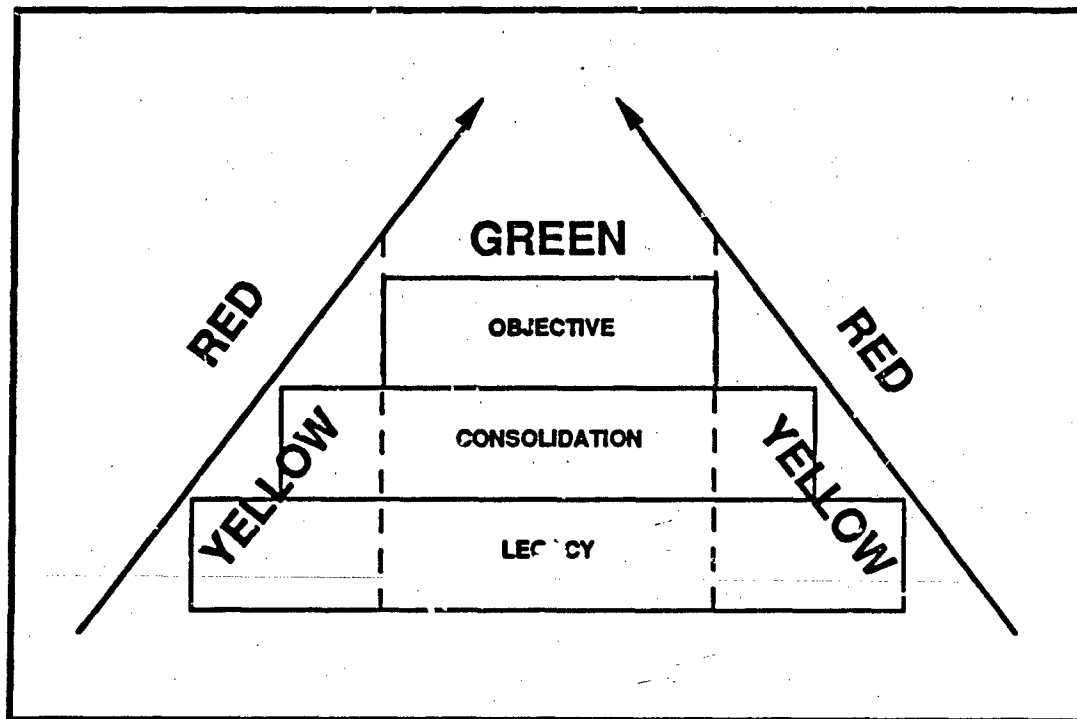


FIGURE 1-2: MIGRATION PATH CATEGORIES

GREEN - contains all those components that conform to applicable DoD standards and guidelines. Every effort should be made to use products in this category unless economic analysis or product availability makes it impossible.

YELLOW - contains all those components that do not meet the applicable DoD standards and guidelines, but represent a choice to achieve technical integration. Yellow components are used because of compelling economic or functional reasons and more closely align with the applicable standards and guidelines. Where possible, this category takes advantage of the current technology inventory to avoid additional capital investment.

RED - contains all those components used by legacy and migration systems that do not follow the desired migration path. It may be required to use some components in this category, but only under exceptional circumstances.

Figure 1-3 shows the migration time frames and relates it to the component categories. In the legacy time frame, red, yellow and green components may exist in individual systems. In the consolidation time frame the move is to eliminate red components. In the objective phase the move is towards systems that use green components to the maximum extent possible.

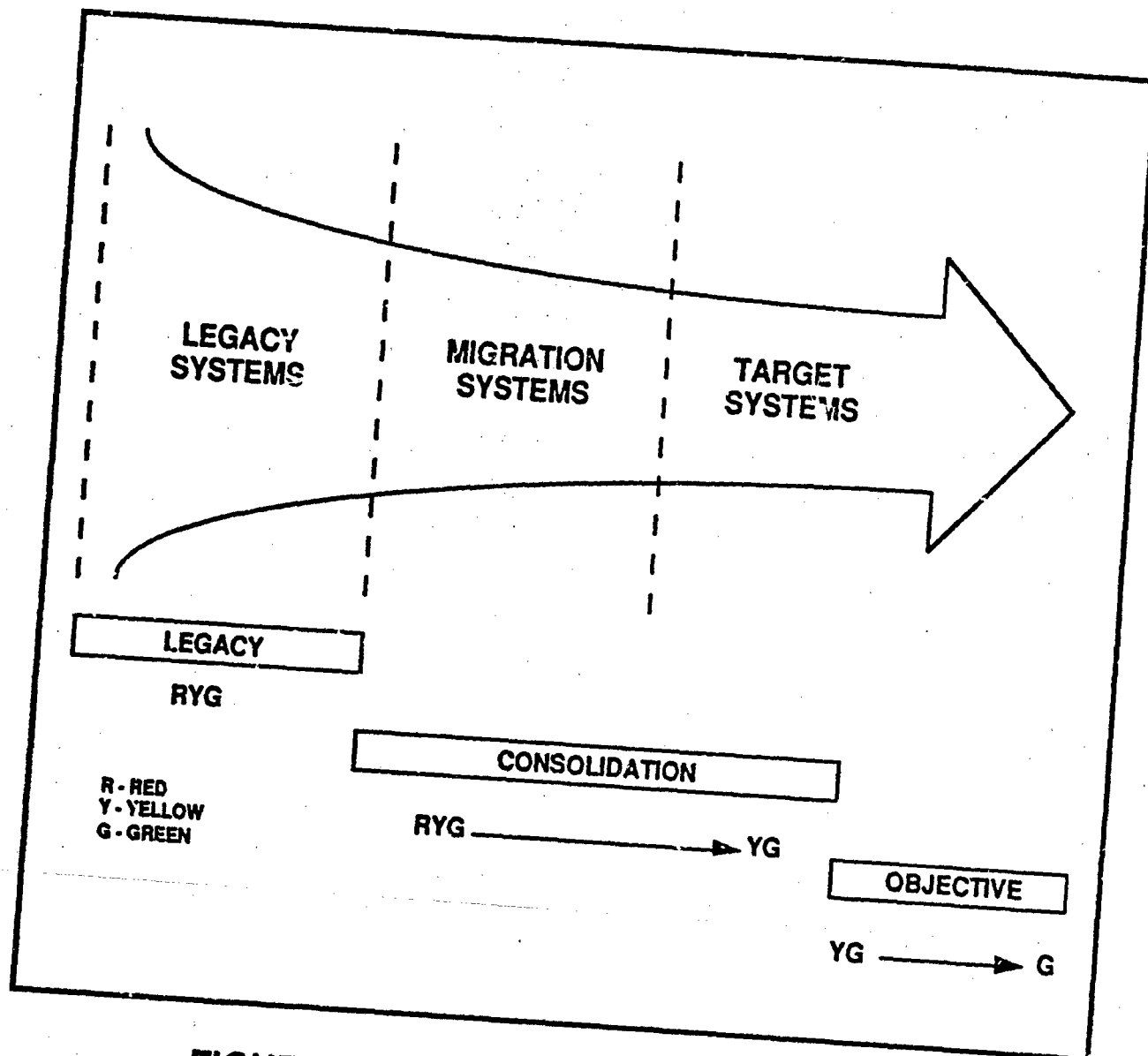


FIGURE 1-3: MIGRATION PATH TIMEFRAMES

1.5 Document Organization

The Finance Near-Term Technical Architecture consists of three chapters and two appendices. Chapter 2 specifies the architecture structure and includes migration analysis and guidance. Chapter 3 provides overall implementation concepts. Definitions and acronyms are in Appendices A and B, respectively.

[Note: This version does not include all sections of Chapter 2 and the Appendices. These will be included in future versions.]

2.0 ARCHITECTURE STRUCTURE

2.1 Overview

The architecture structure provides the basic concepts that will govern the evolution of the Finance Technical Infrastructure. This structure defines the layers of the Finance Technical Architecture, the common services provided by each of the layers, the relationships between the layers and establishes the rules for how they are interconnected.

A more general discussion of the concepts of architectural layers, services, and components^o can be found in the *DoD Technical Architecture Framework for Information Management, Volume 2, Architecture Guidelines and Design Concepts*.

The Finance Technical Architecture Structure is comprised of three layers, support applications, platforms, and communications, each layer providing specialized services.

- o Support application services provide services that are not available as platform services. These applications are implemented primarily in software and include applications such as E-Mail, word processors, and spreadsheets.
- o Platform layer services provide the common information processing and communications functions required by the Finance and Accounting functional area. A platform is made up of a processor, peripherals, and software that implements platform layer services. The platform also includes communications network services that are provided to applications through an Application Program Interface (API).

o Communications layer services provide end-to-end communications among platforms. These services are provided to platforms through an External Environment Interface (EEI). The communication layer includes communications devices such as routers and gateways and the software required to implement communications services.

While the Finance Technical Architectural structure does not include the framework for organizing and defining the interrelationships of data, it does provide the services needed to manage, format, and exchange data.

2.2 Support Applications

Support Applications are generic applications that provide common communication and information processing services to users and other applications. Support applications supplement the services offered by the platform to satisfy general functional needs. In some cases, support applications provide common services, such as word processing, not offered by the platform. In other cases, such as E-Mail, support applications coordinate the use of platform services and present them to users and other applications in an organized, easy to use manner.

Support applications simplify the computing and communications environment for mission area applications and users by insulating them from the technical details of the computing and communications infrastructure. This insulation also promotes: the portability of users and mission area applications; the integration of new technology into existing environments; and, the distribution of platform services based on functional requirements and processing efficiency.

This initial section on support applications has been limited to those support applications identified through DFAS functional requirements as near term priorities. The description of each support applications includes a brief summary of the existing baseline capability if one exists. Migration analysis and guidance is provided to support both the near term finance and accounting consolidation efforts as well as long range DoD objectives to establish an open distributed computing environment. Each section also includes a list of applicable standards.

2.2.1 Imaging

To be provided in Version 2.0

2.2.2 Transaction Processing

2.2.2.1 Current Transaction Processing Environment

The current DoD transaction processing environment is characterized by batch and interactive query and update transactions against data managed by a DBMS or a file system. The interactive transactions are primarily managed by teleprocessing (TP) monitors associated with a specific data base usually in a one to one relationship. Complex queries and batch updates are typically processed during non-peak hours. There is little sharing of data or integration between systems, and users requiring data from more than one data base are required to logon to separate systems. The following list shows the diversity of the TP monitors associated with the legacy and migration systems.

2.2.2.2 Analysis and Guidance

The long range objective of the DoD is to establish a distributed computing environment where transaction processing services are used to support transparent access to distributed processes and databases anywhere in the network. In this environment, a single transaction processor, or multiple transaction processors capable of interoperating, will: manage access to all of the available processes and databases; will be capable of interaction with diverse application and platform services on multiple hardware and software platforms; be accessible from all nodes in the DoD computing and communication infrastructure; be able to manage the invocation of any combination of local and remote processes; and, be compliant with open system standards.

During the consolidation phase, the migration to the objective transaction processing environment will proceed along two paths. The first path will be to standardize on no more than three TP monitors from the migration system baseline. One each to support the existing migration applications in the IBM, UNISYS, and Data General environments.

During the consolidation phase, the common mainframe TP monitors will not be required to meet the standards set forth in the *DoD Technical Architecture Framework for Information Management*. Once the consolidation phase is accomplished, there will be a concerted effort to migrate transaction management away from proprietary environments. If there is a continued need for a mainframe TP monitors, they will be required to support the distributed transaction processing standards that are currently emerging, so that they can accept transactions from application processes and transaction managers that are distributed to other platforms.

The second path, which can occur simultaneously with the first, involves the establishment of the objective transaction processing environment. The first step will be to standardize on a transaction manager (processor) targeted for the objective POSIX environment that meets the requirements set forth in the *DoD Technical Architecture Framework for Information Management* and the applicable standards listed in section 2.2.2.3.

A key distinction between the traditional TP monitor environment and the objective transaction processing environment lies in the way they handle the three main pieces of transaction processing; transaction management, resource management (typically data), and communications. In the traditional TP monitor environment, the TP monitor is tightly coupled with a database manager and the underlying communications necessary to support remote users. In the objective transaction processing environment there is a separation of the management of transactions from the management of resources (data) and the communications required to support them. This separation of function promotes the establishment of a distributed computing environment where transaction processing functions can be isolated and distributed to appropriate locations, and users can be anywhere in the network. As the objective transaction matures it is imperative that these boundaries be maintained.

During the consolidation phase, an initial implementation of the standard transaction manager can be used to direct queries to DBMSs managing redundant copies of migration application data that have been downloaded

to POSIX compliant platforms. As new applications are developed, or as migration application processes are re-engineered to access and update data managed in a POSIX compliant environment, the standard transaction manager can be used to control their transactions.

Interoperability between the objective transaction manager environment and the mainframe TP monitors can be established to support distributed users and processes that need real-time access to data managed by mainframe migration application DBMSs. This interoperability will be provided with an interface that conforms to the mainframe protocols.

Over time, as different resource managers (file servers, LBMS, application servers, etc) are established on the network, the standard transaction manager can be used to route work to the appropriate server and begin to control the flow of transactions in a distributed transaction processing environment. Figure 2-1 provides the migration path for transaction processing.

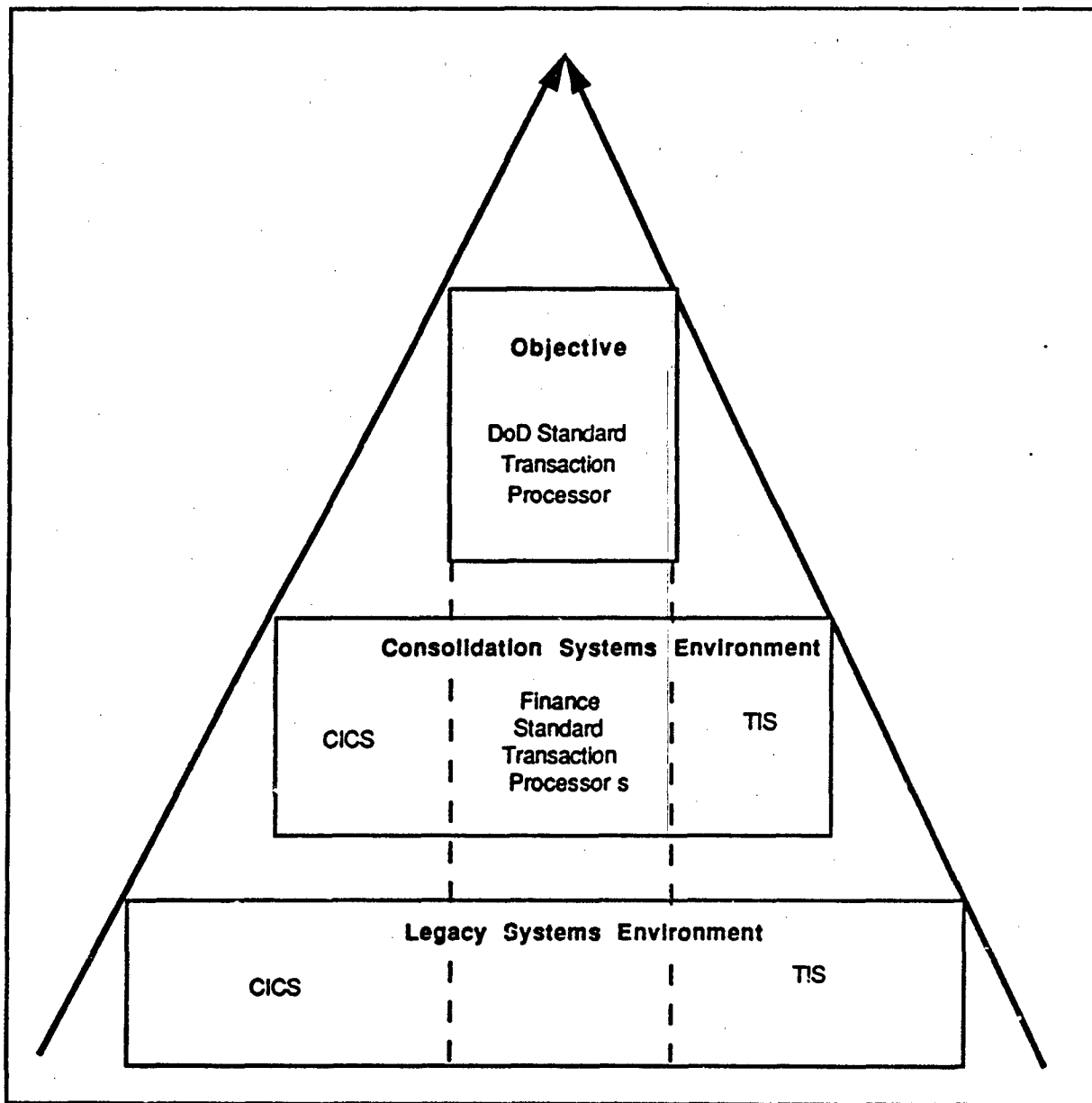


FIGURE 2-1: TRANSACTION PROCESSING MIGRATION PATH

2.2.2.3 Applicable Standards

The following standards apply to transaction processing:

- POSIX 1003.11 - Transaction Processing
- ISO TP - International Standards Organization Transaction Processing
- X/Open XA - a standard interface between relational DBMSs and transaction processing systems.
- X/Open TM

2.2.3 Video Teleconferencing

2.2.3.1 Current Video Teleconferencing Environment

DFAS is currently implementing a video teleconferencing capability (VTC) at the following locations:

- **HQ DITSO, Denver, CO**
- **HQ DFAS, Arlington, VA**
- **Columbus Center, Columbus, OH**
- **Cleveland Center, Cleveland, OH**
- **Indianapolis Center, Indianapolis, IN**
- **Kansas City Center, Kansas City, MO**
- **Denver Center, Denver, CO**
- **Cleveland Center Satellite at Pensacola, FL**

In addition, the existing VTC system at Denver will be upgraded and replicated at Pensacola.

The HQ DITSO location is a GSA/FTS 2000 Network A subscriber. This permits the HQ DITSO node to dial, via switched service, directly to the Director of Defense Information (DDI) at the Pentagon, the DISA/CIM node in Vienna, VA, and the DISA Multipoint Control Unit at DISA Headquarters. Connection to the DISA Multipoint Control Unit permits both multipoint and point-to-point conferencing with existing DISA Video Conferencing subscribers at HQ DISA in Arlington, VA, Virginia Square in Arlington, VA, and Isaac Newton Square in Reston, VA.

Currently, video teleconferencing services are available for over 110 rooms which can confer with other users in either a point-to-point or multipoint mode. Users of these services include the Navy, Army, Air Forces, the Strategic Defense Initiatives Organization (SDIO), and Forces Command, along with major defense contractors and other Government agencies. Gateways to Sprint's Meeting Channel and AT&T's Accunet Reserved Digital Services allow for meetings with other national and international facilities connected to these networks.

2.2.3.2 Analysis and Guidance

Video teleconferencing is a means of communicating between two or more groups of individuals in different locations using interactive video and audio to provide the equivalent of a face-to-face meeting. Video teleconferencing is implemented by a variety of methods: customized video teleconferencing rooms with specialized acoustics and lighting; smaller roll-about conference room systems; and PC-based desktop video teleconferencing workstations.

Each method satisfies a different set of requirements, has its strengths and weaknesses, and provide varying degrees of video and audio quality. Facilities are connected by either dedicated digital lines and/or switched digital services. Standard communication interfaces include ISDN, using both the Basic Rate Interface (BRI) and the Primary Rate Interface (PRI). Most systems are connected through dedicated digital lines running at speeds between 56 Kbps and 1.544 Mbps (the maximum provided by T1 circuitry.) Standard communication interfaces include T1, fractional T1, T3, and switched 56 Kbps services. **NOTE: 56Kbps is not recommended for video teleconferencing because of insufficient bandwidth.** Many of these conferences occur between only two rooms, while others are connected through a Multipoint Control Unit (MCU) to allow for more than two sites to confer at a time.

Outside of the standard video and audio capability, additional features which can be available include:

- FAX - documents can be faxed during a conference.
- Graphics - Photos, graphs, color slides, etc., can be captured by a special camera and transmitted during a conference.
- PC Images - PC graphs, documents, and mainframe computer sessions can be transmitted during a conference.

- Telephone bridges - These devices can be used to tie outside phone conversations into an active video teleconference.

The customized video teleconferencing room has been the main form of videoconferencing throughout the 1980's. These rooms, costing up to \$1 million per site, must be specifically designed and engineered to provide the best audio and video performance for an effective conference. They are usually connected by T1 or fractional T1 dedicated communication lines. Faxes, telephone bridges, multiple camera shots, PC and overhead graphics, as well as customized control panels can be included in the room package and help to contribute to a successful conference.

Roll-about cabinet systems have been introduced in the last few years and have become very popular because of their lower cost (between \$20,000 and \$150,000) and their ability to be used in a variety of areas. With the improvements in audio and video technology, perfect room acoustics and lighting are no longer required to provide quality meetings. The cabinets usually come with video monitors and can include such features as fax.

Desktop video conferencing, implemented using PC-based multimedia systems, is the most recently developed method to provide video teleconferencing. These systems, costing between \$5,000 and \$7,000, are connected via communication services provided either by an ISDN or a switched 53 Kbps network. These facilities allow the users to communicate face-to-face in a window on their PCs and to exchange PC-type data such as spreadsheets, documents, and graphics. Most existing LANS can not adequately support VTC due to the high bandwidth required. The advent of higher bandwidth LANS, implemented using Fiber Distributed Data Interface (FDDI) or Asynchronous Transfer Mode (ATM) technology, along with future improvements in video compression algorithms, should allow for VTC on LANS to become more common place.

The type of facility selected during the consolidation and objective plan phases will be determined by user requirements and budget constraints.

2.2.3.3 Applicable Standards.

The DoD standard for compressed digital video teleconferencing is MIL-STD-188-121. This standard is still in development and awaits testing and publishing. Final approval and testing is expected in early 1994. Meanwhile, DoD facilities should comply with CCITT international standards. The current overall standard for VTC is CCITT H.320.

Standards referenced include:

- H.320 Overall standard the involves other standards
- H.221 Frame Structure and Signalling
- H.230 Control and Indication Signals
- H.231 Multipoint Control Units for Audiovisual Systems
- H.242 Establishing Communications
- H.261 Coding of the Video Signal
- G.711 Narrow band (3KHz) speech at 64 Kbps
- G.722 Wideband (7KHz) speech at 64 Kbps

2.2.4 Interactive Voice Response

2.2.4.1 Current Environment

Interactive Voice Response (IVR) is a new technology which allows service members direct access to general information about retirement or military pay operations or specific information concerning their individual account. Selected data fields for each account holder reside on the Interactive Voice Response System (IVRS) mini-computer. Account holders receive a Personal Identification Number (PIN) which, in combination with their Social Security Number, give them access to the data in the IVRS through any touch-tone phone. The system also allows account holders to leave or receive voice messages. Using a telephone keypad as a terminal, the user can extract, input, or manipulate data stored on the computer. The definition of IVR is expanded to include the use of speech recognition as the input device to the voice response unit (VRU) which converts the digital information to voice (analog) and speaks it back to the caller. Speech recognition provides users, who do not have access to a touch-tone telephone, the ability to speak into a telephone to input and retrieve information from a computer.

IVR greatly increases the productivity and capabilities of the customer service divisions by enabling a reduced staff to handle all incoming inquiries.. Additionally, it will provide interconnectivity, expansion capability, and be able to interface with other advanced technologies such as Electronic Data Interchange (EDI). Routine calls will be processed by the IVR equipment, using its round-the-clock automated response capability. Callers will be able to get answers to routine questions about their accounts by pressing buttons on their touch-tone telephones, without the intervention of customer service agents. The interface with EDI can provide copies of W-2s or Leave and Earning Statements to customers without the intervention of DFAS employees.

2.2.4.2 Analysis & Guidance

The IVR must be completely controllable from a remote location by means of dial-up modem. Application development and maintenance must be available remotely. System monitoring and administrative management must also be remotely accessible. The IVR system should function without the need for on-site administration. The system is being developed in conjunction with the DFAS Strategic Transition Plan 23-2 "Interactive Voice Response System" (STP 23-2) and Strategic Transition Plan 4-1-1 "Defense Retired and Annuitant Pay System" (STP 4-1-1). The requirements for the system are:

- o The IVR system will be interfaced to the DFAS-CL LAN and mainframe networks via IEEE 802.5 LAN protocols and 3270 terminal emulation software. The system must interface with the IBM 370/90 architecture and current telephone hardware configuration (GSA controlled CENTREX using an AT&T 5ESS switch) and all major telecommunications vendors' current Automatic Call Distributor (ACD) products/services.
- o Software to develop IVR applications must be capable of interacting with live host applications to facilitate rapid development. IVR software must be menu driven for script development. No changes to host applications must be required to run the IVR application.
- o Voice recognition must be provided for all 72 lines. Spoken vocabulary must include the numbers "zero" through "nine", "Yes", and "No".
- o The IVR must be capable of 72 simultaneous on-line host sessions. Shared host connections for multiple incoming lines is not acceptable.

- o Each IVR line must be capable of interfacing with a fax module which can generate fax messages directly from host application reports, from host information combined with disk-based graphic forms, or from information stored directly on the IVR disks.

- o Access to the IVR maintenance and system administration functions must be password protected.

2.2.4.3 APPLICABLE STANDARDS

There are no standards documented for IVR technology at this time.

2.2.5 Electronic Data Interchange

Electronic Data Interchange (EDI) is the electronic exchange of business transactions formatted in accordance with a public standard. While there are many different issues involved in establishing an EDI capability, two of the key technical elements include standardizing the formats of business transactions and standardizing the communications between business partners.

2.2.5.1 Current Environment

EDI is being used at some locations to support Electronic Funds Transfer with the banking industry however, the majority of the business transactions in the current Finance and Accounting environment are still being conducted via paper. Those finance applications that do support the electronic exchange of business transactions do not conform to a public standard such as X12 or EDIFACT. As a result, these applications require DoD business partners to format business transactions differently. In addition, a wide variety of communication methods are being used, once again requiring DoD business partners to support many different communication methods.

2.2.5.2 Analysis and Guidance

The objective EDI environment is a single interface where all business transactions are formatted into X12 or EDIFACT and are transmitted in accordance with X.435, the emerging standard that merges X.400 and EDI.

The primary goal for the consolidation phase is to put an EDI support application in place that can manage an orderly migration from the existing non-standard, mostly paper environment, to the objective environment. To minimize impact on existing migration and legacy applications, this support application will shield mission area applications from both formatting and communications details. EDI support applications will accept transactions from mission applications

and invoke the platform formatting service that will put the transaction into the appropriate EDI format (see Section 2.3.5). When EDI transactions are received from DoD business partners, the EDI support application will invoke the platform formatting service to take it out of EDI format. Communications between the mission application and the EDI support application and between the EDI support application and the platform service will be via will defined Application Program Interfaces (APIs). The EDI support application will also manage the archival/retrieval of these electronic transactions.

Initially, the EDI support application will be required to support a wide variety of communication media, including paper, SMTP, FTP, RJE, and asynchronous communications. The EDI support application will choose the appropriate communication media required to transmit the transaction to a specific business partner. The migration to the objective environment will occur over time and it will be dictated by both emerging technology and the capability of DoD business partners to support EDI. Until the objective environment is achieved, the support application will need to support most of the above communication media.

2.2.5.3 Applicable Standards

There are no international, national, or Federal standards that apply to EDI support applications. The emerging standards in this area all apply to platform services, which are addressed in section 2.3.5 Data Interchange. The Information Exchange System (INX) is currently being used in the finance and accounting community as an electronic invoicing prototype. This system satisfies most of the above criteria for support applications and is in the DoD Reuse Library. The INX system and other potential EDI support applications, including the system being developed as part of the DoD Electronic Commerce Program, need to be evaluated as to which best satisfies the EDI support application requirements for finance and accounting.

2.2.6 Expert Systems

2.2.6.1 Current Expert Systems Environment

DFAS has developed, and put into operation, several expert systems based on artificial intelligence concepts. These systems were developed by functional knowledge engineers as well as domain experts. VP-Expert and 1st-Class are the selected PC software tools running on an IBM compatible hardware platform. These systems support the Survivor Benefit Plan, Social Security Offset Plan, Employee Leave Policy, Former Spouse Survivor Benefit Plan, Basic Allowance for Quarters (BAQ) for Secondary Dependency, and PC Diagnostics. DFAS is pursuing the development and implementation in both the PC and mainframe environments.

2.2.6.2 Analysis and Guidance

Analysis and guidance will be provided in a future version.

2.2.7 Office Automation

To be provided a future version.

2.3 Platform

The platform provides common processing and communications services as identified by the *Technical Reference Model for Information Management*, the *DoD Technical Architecture Framework* and the *POSIX Open Systems Environment Guide*. These services are provided to users, mission area applications, and support applications and are satisfied through a combination of hardware and software.

Platform hardware includes a processor and all devices external to the processor required to support users, external data storage, and data interchange. External devices include, among others, CRTs, keyboards, mice, floppy disks, and disk drives. Hardware specific to communications is also considered to be an external device, but these devices are covered under communications.

Platform software implements platform services and includes the Application Program Interface (API) that allows applications to invoke platform services as well as the External Environment Interface (EEI) that enables communication between the platform and external devices.

The initial version of this section contains a discussion of the platform services deemed to be the most critical to the finance and accounting community. Each of the discussions includes a brief summary of the existing baseline environment. Migration analysis and guidance is provided to support both the near term finance and accounting consolidation efforts as well as long range DoD objectives to establish an open distributed computing environment. Each section also includes a list of applicable standards.

2.3.1 Operating Systems

2.3.1.1 Current Operating System Environment

The operating systems for the current legacy and migration systems are as follows:

Legacy Systems

Migration Systems

NAVSCIPS	MVS-XA	DCPS	MVS-XA
NAFCPS	MVS		OS1100
JUMPS-JSS	MVS-XA	DJMS	MVS-XA, MPE/V
MCARS	MVS-XA		
DRAS-NRPS	MVS-XA	DRAS	MVS-XA
AFAPS	MVS-XA		
DTPS-ATOS	MS DOS	DTPS	DG/UX
IATS	MS DOS		
TRIPS	MS-DOS		
DTRS-TIPS	UNISYS	DTRS	OS1100
MOCAS	MVS-XA	MOCAS	MVS-XA
AFDARS	MVS	DDMS	MVS-XA
APCAPS	MVS	DRMS	MVS-XA

2.3.1.2 Analysis and Guidance

The long range DoD objective for operating systems is compliance with the POSIX suite of standards as defined in FIPS PUB 151-1. POSIX compliant operating systems provide a set of common services which can

be used to improve application portability and interoperability. Any POSIX compliant operating system that meets the information processing requirements of the finance and accounting community is acceptable.

The objective for mainframe operating systems during consolidation is to minimize legacy system diversity and establish a stable baseline. This can be accomplished by selecting operating systems from the existing legacy baseline. The near-term goal should be standardization on proprietary operating systems given their dominance in the existing baseline.

The most prevalent mainframe operating system in the current installed base of migration systems is MVS and, therefore, is selected as the preferred operating system for standardization during the consolidation phase. This includes MVS-XA and MVS-ESA. During consolidation the advantages of continuing to use the current MVS-based systems outweigh any movement towards POSIX due to the current investment in MVS and compatible hardware and, the re-engineering effort required to transition the current environment to POSIX. By standardizing on MVS, the migration systems applications will be able to execute and share resources at multiple processing locations.

OS1100, DG/US, and MVP/E are also placed in the yellow category during consolidation. These operating systems represent a significant current investment in the finance community and the effort required to re-engineer these to the standard OS be prohibitive in the near-term.

UNIX Non-POSIX operating systems are placed in the yellow category for the consolidation phase since these provide the functionality required to implement the client/server approach and provide a transition path to POSIX

In the microcomputing environment, DOS is the near term choice. It is the prevalent operating system, is an enabling technology during the consolidation phase, and offers a large variety of commercial-off-the-shelf (COTS) software products.

Figure 2-2 provides the migration path for operating systems.

2.3.1.3 Applicable Standards

The following standards apply to Operating Systems:

- o IEEE P1003.1 - 1990 (ISO/IEC 9943-1:1990) - Portable Operating System Interface for computer environments: POSIX
- o FIPS 151-1 - POSIX
- o FIPS 151-2 - POSIX
- o IEEE P1003.2 - Shell and Utilities
- o IEEE P1003.4 - Real Time Extensions
- o IEEE P1003.6 - Security
- o GNMP/MIL-STD-2045-3800 - System Management

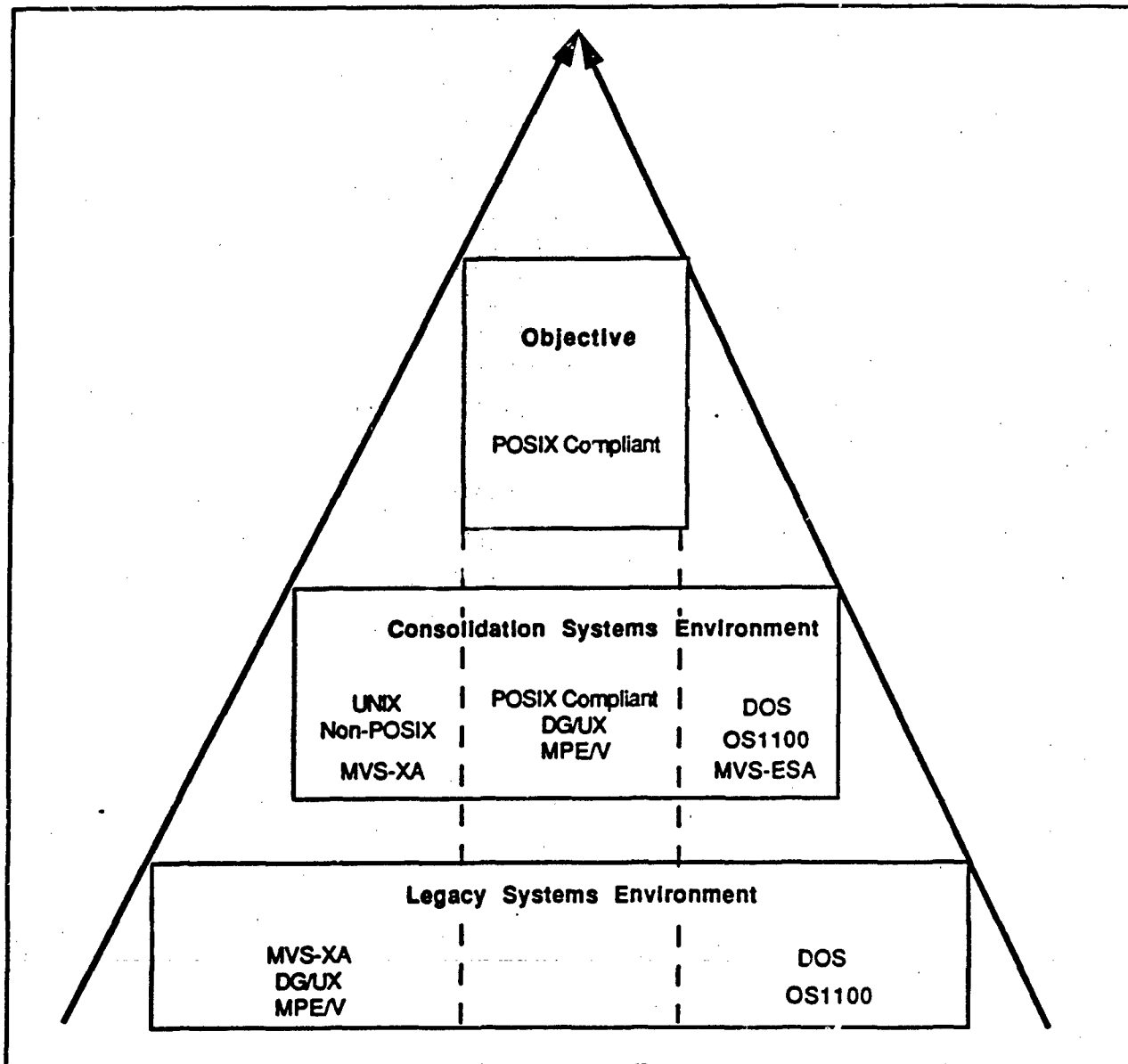


FIGURE 2-2: OPERATING SYSTEM MIGRATION PATH

2.3.2 Programming

2.3.2.1 Application Program Language

2.3.2.1.1 Current Application Programming Language Environment

Application programming languages for the current legacy and migration systems are as follows:

Legacy Systems

Migration Systems

NAVSC:PS	COBOL	DCPS	COBOL
NAFCPS	COBOL		
JUMPS-JSS	COBOL	DJMS	COBOL
MCARS	ALC, COBOL, NATURAL, Easytrieve		
DRAS-NRPS	COBOL, Easytrieve	DRAS	COBOL
AFAPS	ADSO, COBOL, Easytrieve		
DTPS - ATOS Clipper		DTPS	'C', PROGRESS (4GL)
IATS	BASIC		
DTRS-TIPS	COBOL	DTRS	COBOL
MCCAS	COBOL, MANTIS (4GL)	MOCAS	COBOL, MANTIS (4GL)
AFDARS	ADSO, COBOL	DDMS	COBOL
APCAPS	COBOL	DRMS	COBOL

2.3.2.2.2 Analysis and Guidance

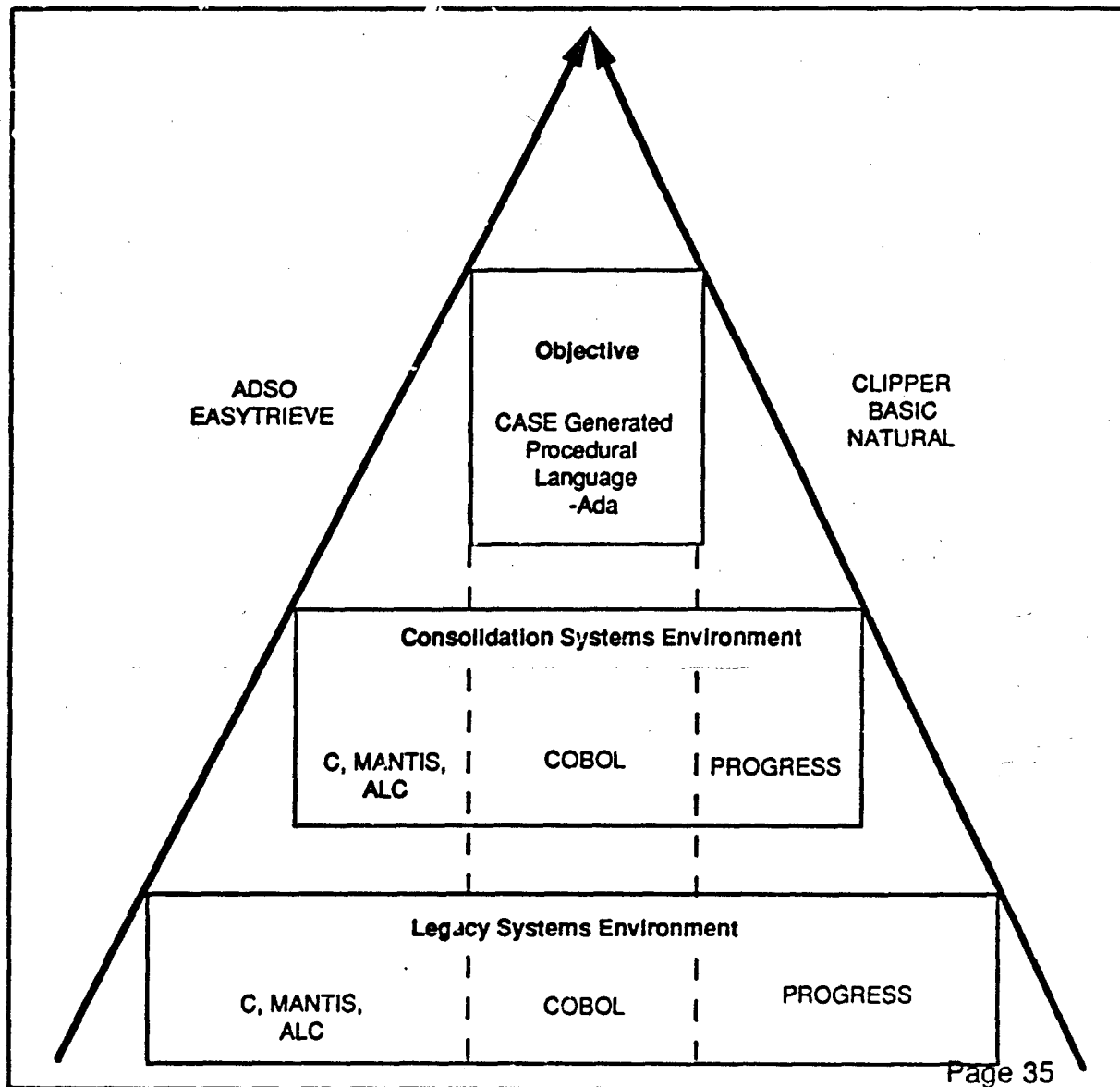
The objective application programming language is a standard Computer-Aided Software Engineering (CASE) tool generated procedural language. Where feasible, Ada is required by DoD policy.

The objective for application programming languages during consolidation is to minimize diversity and establish a stable baseline. COBOL is the prevalent language in the current installed migration baseline and is therefore the selection for standardization (green category) during the consolidation phase. The applications should be re-engineered, where economically feasible, to standardize to the same version of COBOL85. Language extensions, if used, will be modularized in order to facilitate portability. Language extensions will not be allowed in re-engineered or newly developed code. CASE tools that generate COBOL are commercially available and should be used when modifying the legacy systems.

Finance and accounting systems that upgrade their operating systems from MVS-XA to MVS-ESA will have to migrate to COBOL85 with COBOL89 addendum in accordance with FIPS-PUB 21-3.

ANSI 'C' is placed in the yellow category because of its use in the installed base of application systems and its status as a FIPS standard. Fourth-generation languages such as Mantis and Progress are included in the yellow category and possibly the green category for personal level customization only. ALC is acceptable in the yellow category because of its machine level and efficiency characteristics. ALC should be used only when necessary and will be modularized to facilitate modification or removal. ALC will not be allowed in any re-engineered or newly developed mission application software.

Figure 2-3 provides the migration path for application programming languages. Languages listed in the red category in Figure 2-3 do not represent a significant portion of the installed baseline and are not aligned with any national or international standards. During the consolidation phase an attempt should be made to convert these languages to ones listed in the yellow or green categories. However, where processing efficiency dictates the use of one of these languages or where they satisfy a unique requirement, continued use is acceptable



Page 35

**FIGURE 2-3: APPLICATION PROGRAMMING LANGUAGES
MIGRATION PATH**

2.3.2.1.3 Applicable Standards

The following standards apply to the Application Programming Languages:

- o ANSI 2.23-1985 - COBOL
- o ANSI X2.23A-1989 - COBOL
- o FIPS 021-3 - COBOL
- o ANSI X2.159-1989 - 'C' Language
- o FIPS 160 - 'C' Language
- o POSIX P1003.16 - 'C' Language
- o ANSI/MIL-STD-1815A-1983 - Ada
- o FIPS 119 - Ada
- o POSIX P1003.5 - Ada

2.3.2.2 Computer Aided Software Engineering

2.3.2.2.1 Current CASE Environment

The current CASE environment consists of multiple non-integrated tools to provide system development methodologies, data repositories, system re-engineering and reverse engineering.

2.3.2.2.2 Analysis and Guidance

The long range DoD objective is for a standard I-CASE tool/environment utilizing the Open System Development (OSD) technology to provide a common system development methodology across all functional areas. This standard CASE environment will provide the tools for data repositories, system re-engineering and reverse engineering, and system and software life-cycle management.

During the consolidation phase, and until the DoD standard I-CASE tool is available, the objective will be to move from the many different tools currently in use and standardize on a single tool, PACBASE.

PACBASE is a suite of repository-based I-CASE tools that support the finance and accounting community during the consolidation phase. It will provide a standard procedural language; support the required re-engineering and reverse engineering; and, support the development and maintenance of logical metadata repositories.

2.3.2.2.3 Applicable Standards

There are no established standards for CASE tools/environments at this time.

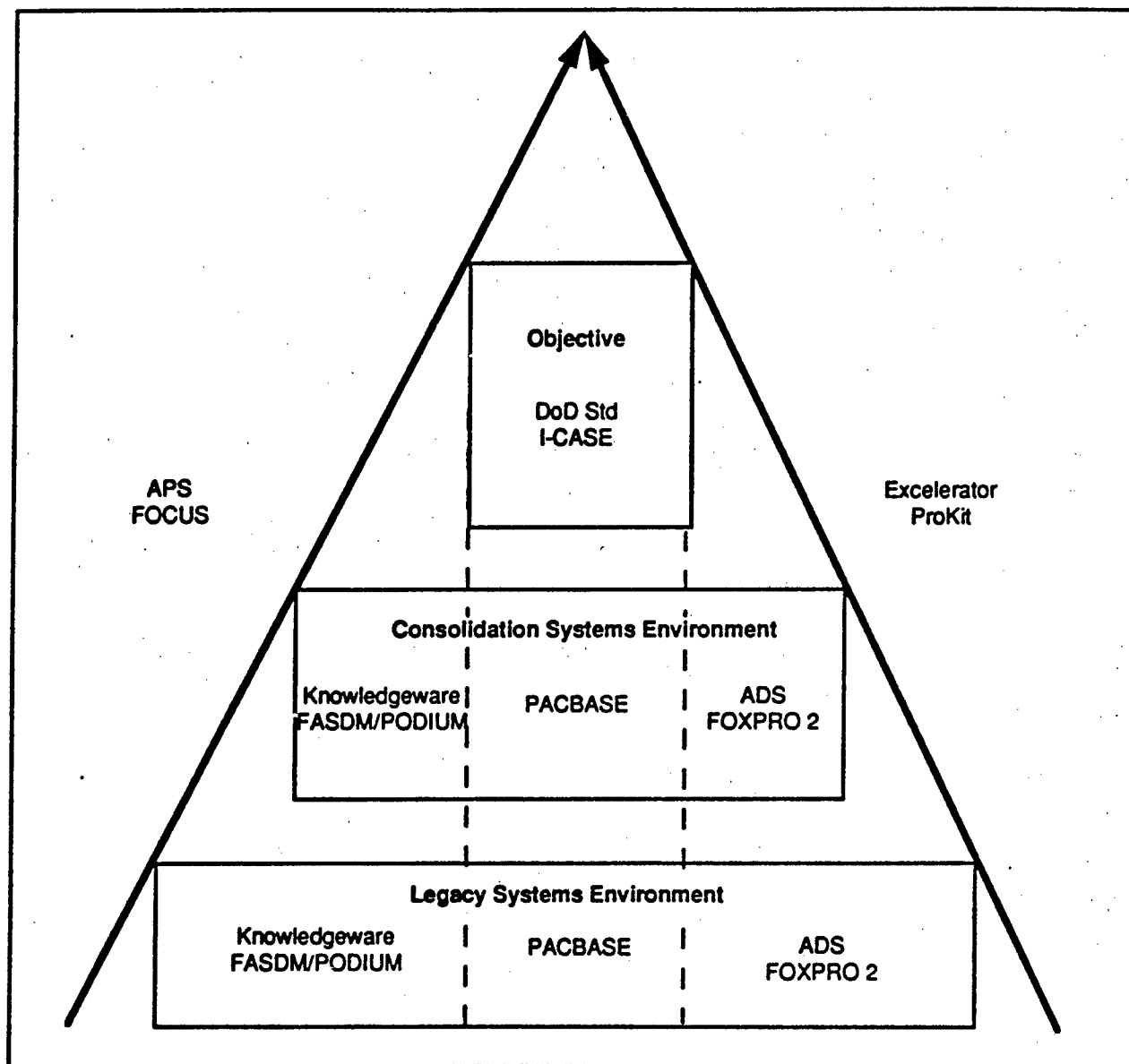


FIGURE 2-4: CASE MIGRATION PATH

2.3.3 Network Services

2.3.3.1 Current Network Services Environment

The current legacy financial Network Services environment is unknown. Additional information is required to obtain a better understanding of the DFAS Network Services environment. Limited information available to date indicates a large percentage of the current communications environment is an IBM System Network Architecture. For the purpose of preparing the analysis and guidance section, typical IBM SNA type services have been assumed.

2.3.3.2 Analysis and Guidance

The long range DoD objective for network services is compliance with the Government Open Systems Interconnection Profile (GOSIP). DoD has mandated GOSIP use in all computer communications procurements. The GOSIP protocols provide interoperability among applications in a heterogeneous network, while the GOSIP Application Programming Interfaces (APIs) provide portability of applications across heterogeneous platforms in a network. GOSIP is therefore placed in the green category.

In the consolidation phase, network services will be provided by multiple protocol stacks. SNA, TCP/IP, GOSIP and proprietary protocols are currently used in the finance and accounting community to provide network services. The goals for consolidation are: elimination of proprietary protocols, minimizing diversity by standardizing on existing standards, and providing a single protocol stack for each processing environment.

In the mainframe environment, SNA is most commonly used to provide network services. In the consolidation phase SNA is placed in the yellow category. During consolidation the advantages of using SNA outweigh any movement towards GOSIP due to: the use of SNA at most finance and accounting mainframe sites; the industry de facto standardization of SNA; the hardware/software availability of SNA products; and the management

products that exist for SNA environments. By standardizing on SNA and reducing the number of protocols, the transition to GOSIP in the mainframe environment will be less complicated.

In the minicomputer/server and workstation environments, TCP/IP is placed in the yellow category and should be used during the consolidation phase. Wherever possible GOSIP compliant products should be used. Due to the relative immaturity of GOSIP standards and products, TCP/IP products can be used in the near-term. The TCP/IP protocols provide services similar to GOSIP and are open standards. If TCP/IP is used, the network services calls should use a standard interface which can be linked to GOSIP network services when they are available.

Figure 2-5 provides the migration path for network services.

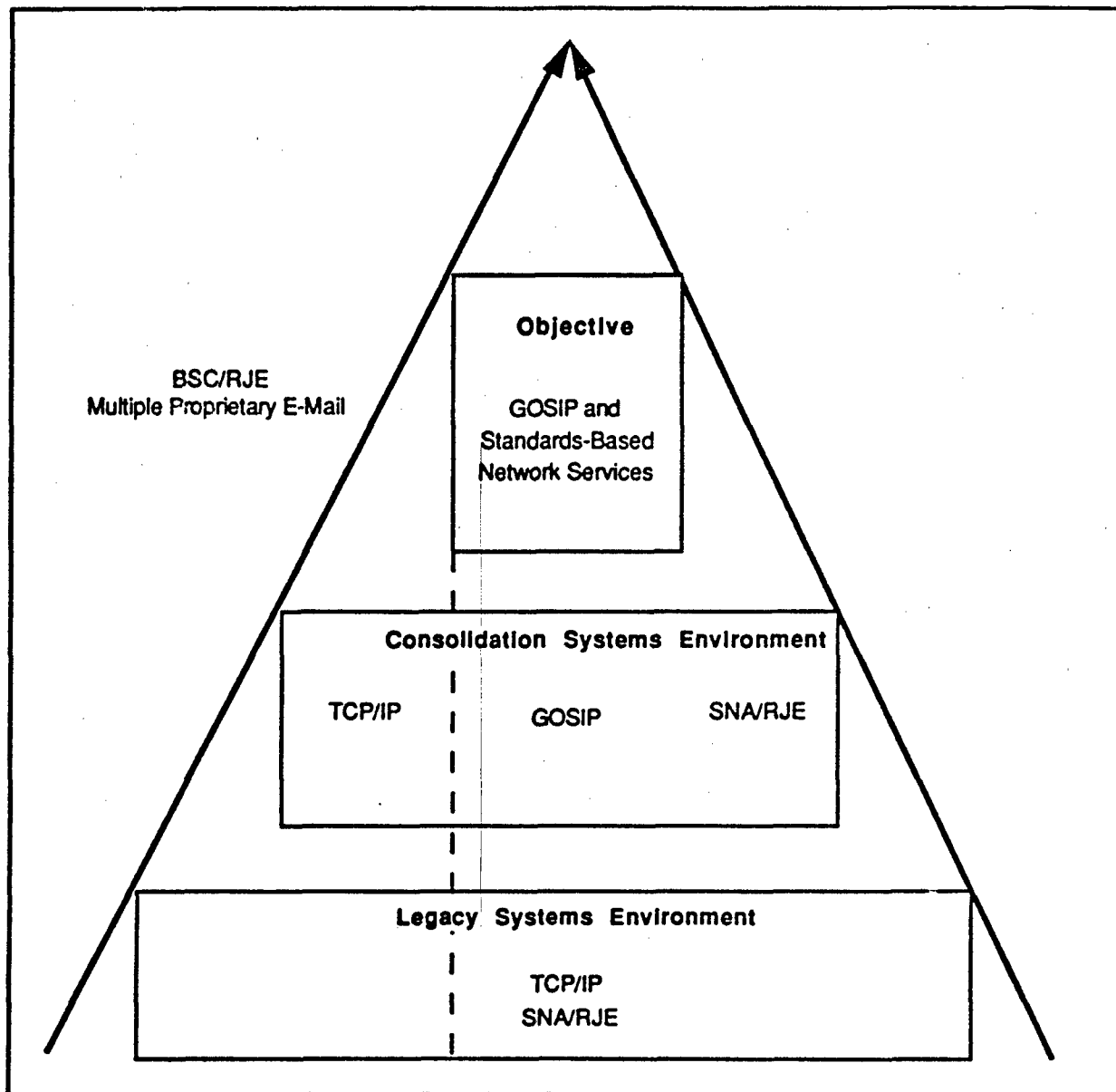


FIGURE 2-5: NETWORK SERVICES MIGRATION PATH

2.3.3.3 Applicable Standards

- o **Government Open Systems Interconnection Profile (GOSIP)**
- o **NIST Specification Pub 500-163**
- o **POSIX 1003.8 Networking**
- o **POSIX 1003.12 Protocol Independent Interfaces**
- o **POSIX 1003.17 Directory Services API**
- o **ISO Remote Procedure Call (RPC)**
- o **X/Open Application Program Interface Association (XAPIA)**
- o **CCITT X.400**
- o **CCITT X.500, The Directory, Overview of Concepts, Models, and Services**
- o **Open Document Architecture Office Document**
- o **Interchange Format (ODA/ODIF)**
- o **OSF Distributed Computing Environment (DCE)**
 - **Andrew File System (AFS)**
- o **UNIX International (UI) Open Network Computing (ONC)**
 - **Network File System (NFS)**

2.3.4 Data Base Management

2.3.4.1 Current Data Base Management System Environment

The existing DBMS environment consists of a mixture of different mainframe DBMS products, PC based DBMSs, and file management capabilities provided by the operating system. The mainframe DBMSs provide a capability for applications to access data through a Structured Query Language (SQL) interface but few of the applications use this capability. The end users are frequently supported through the use of query capabilities provided through proprietary, non-standard fourth generation languages (4GLs) such as Easytrieve, ADSO, and Natural. These queries are made against production databases, and large queries are frequently handled as batch jobs during non-peak processing times.

Data Base Management Systems (DBMSs) for the current legacy and migration systems are as follows:

Legacy Systems

Migration Systems

NAVCIPS NAFCPS	CA-IDMS/R TBD	DCPS	DATACOM DB
JUMPS-JSS MCARS	IDMS ADABAS	DJMS	DB2, IMAGE, DMS 1100
DRAS-NRPS AFAPS	IDMS IDMS	DRAS	IDMS/R
DTPS-ATOS IATS TRIPS	TBD TBD TBD	DTPS	DBASE IV, PROGRESS/R
DTRS-TIPS	DMS 1100	DTRS	ORACLE

MOCAS	TIS	MOCAS	TIS (SUPRA)
AFDARS	IDMS/R	DDMS	TBD
APCAPS	TIS,	DRMS	SUPRA-II

2.3.4.2 Analysis and Guidance

The long range objective for database management systems is a standards-based DBMS environment where subject databases provide information to applications and users regardless of location or function. This standards-based environment will be based on relational database technology with access provided through the Structured Query Language (SQL). Remote database access will be supported in compliance with the Remote Database Access (RDA) standard. Users and applications will be provided transparent access to data that will be distributed across multiple hardware and software platforms located at various nodes in the DoD network. Access will be controlled through a centralized data dictionary/directory which will serve as a repository of metadata.

During the consolidation phase the primary objective for database management is to minimize diversity in the migration system environment, through evolution to a SQL compliant relational DBMS environment. An attempt should be made to standardize on one or two relational DBMSs at each of the three tiers; mainframe, mini, and PC. A DBMS that runs on multiple tiers and platforms, supports existing DBMS standards, and has an announced migration path to support emerging DBMS standards, is the best choice.

As licenses expire for existing migration system DBMSs, acquisitions should attempt to procure a DBMS from the standard suite. New acquisitions and new developments will require SQL compliance. Major enhancements to existing migration systems should use standard SQL with a controlled use of proprietary extensions. Where possible, existing migration applications should be re-engineered for compliance with SQL.

End-user query capabilities should be supported through redundant copies of migration system data. Where real-time currency of information is not imperative, this redundant data could be distributed to minis and PCs. This would allow end-users additional capability to massage the information without impacting corporate migration systems or data. Finance and accounting subject data bases should be introduced during the consolidation phase. These databases will be populated with data replicated from migration system DBMSs and they will be SQL compliant. Initially, to minimize the impact on the consolidation process and existing migration systems, these databases will provide query only management information system capabilities. Over time, create, delete, and update capabilities will be added.

Once the finance and accounting consolidations are accomplished, migration systems can be re-engineered and new systems can be developed to access and update data managed by the subject databases. Over time, all database access will be directed to the subject databases, and the migration databases will be phased out. To minimize the impact on existing migration applications, the use of middleware tools that intercept existing database access calls and translate them into the standard SQL calls expected by the subject database may be employed. New systems will conform to the SQL standard Application Programming Interface (API). As the standards for distributed transaction processing mature and commercial products become available, the database management environment will be integrated into the objective transaction processing environment (see Section 2.2.2). Figure 2-6 provides the migration path for data base management systems.

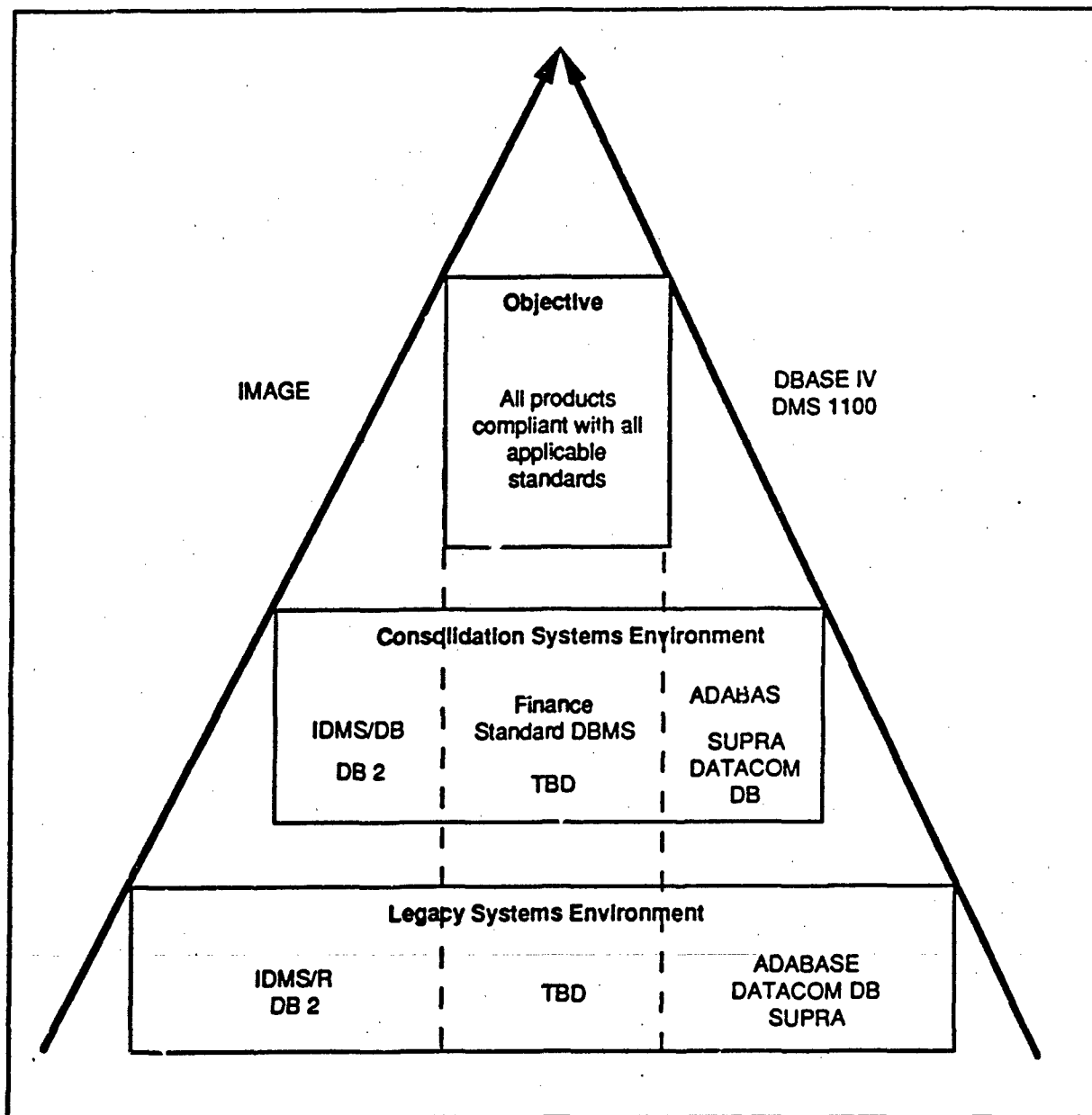


FIGURE 2-6: DATA BASE MANAGEMENT MIGRATION PATH

2.3.4.3 Applicable Standards

The following standards apply to Database Management Systems:

- o **FIPS PUB 127-1 - Database Language SQL**

- ANSI X2.135-1989 - SQL**

- ANSI X2.168-1989 - Embedded SQL**

- o **FIPS PUB 156 - Information Resource Dictionary Standard - IRDS**

- ANSI X2.138-1988 - IRDS Specification**

- ANSI X2.195-1991 - Import/Export Format**

- o **SQL Ada Module Extensions - Same**

- o **Emerging Standards**

- Remote Data Access - RDA**

- Scheme Manipulation**

- Dynamic SQL**

- Exception Handling**

- Enhanced Integrity Constraints**

- Transaction Management**

- Data Administration**

2.3.5 Data Interchange

Data interchange services provide specialized support for the interchange of data between applications on the same or different platforms. Data interchange services include the capability to exchange documents, graphics, technical drawings, and standard business transactions.

2.3.5.1 Current Environment

There are very few operational data interchange platform services in the existing finance and accounting environment. Some of the existing financial applications support Electronic Funds Transfer, but, for the most part this is being accomplished within the financial applications, instead of being handled as a separate platform service. This mode of operation requires that the application be modified each time that the standard formats change or as a new format is introduced.

2.3.5.2 Analysis and Guidance

The objective environment for data interchange platform services is one which supports graphics data formats and descriptions as well as data format and data description protocols for all of the emerging ODA, EDI, and CALS standards. The objective environment will provide these services on a POSIX compliant platform.

During the consolidation phase, data interchange platform services will include the capability to support standard EDI transactions. COTS translation software will be used to translate flat files into and out of EDI standard transaction formats. Initially, this translation will occur on a mid-tier UNIX platform. The invocation of translation services will be managed by an EDI support application.

As Graphical User Interfaces (GUIs) are introduced in the finance and accounting community, graphics data formats and descriptions will be supported. Platform services to provide the necessary graphics

formatting will be introduced in both the user workstation and mid-tier UNIX/POSIX platforms.

2.3.5.3 Applicable Standards

ISO 8613:1989 - Office Document Architecture/Office Document Interchange Format/Office Document Language (ODA/ODIF/ODL)

FIPS PUB 152 - Standard Generalized Markup Language (SGML)

FIPS PUB 128 - Computer Graphics Metafile (CGM)

FIPS PUB 150 and ODA Raster Document Application Profile Raster Graphics Representation in Binary Format

Initial Graphics Exchange Specification (IGES)

FIPS PUB 161 - ASC X12

FIPS PUB 161 - EDIFACT

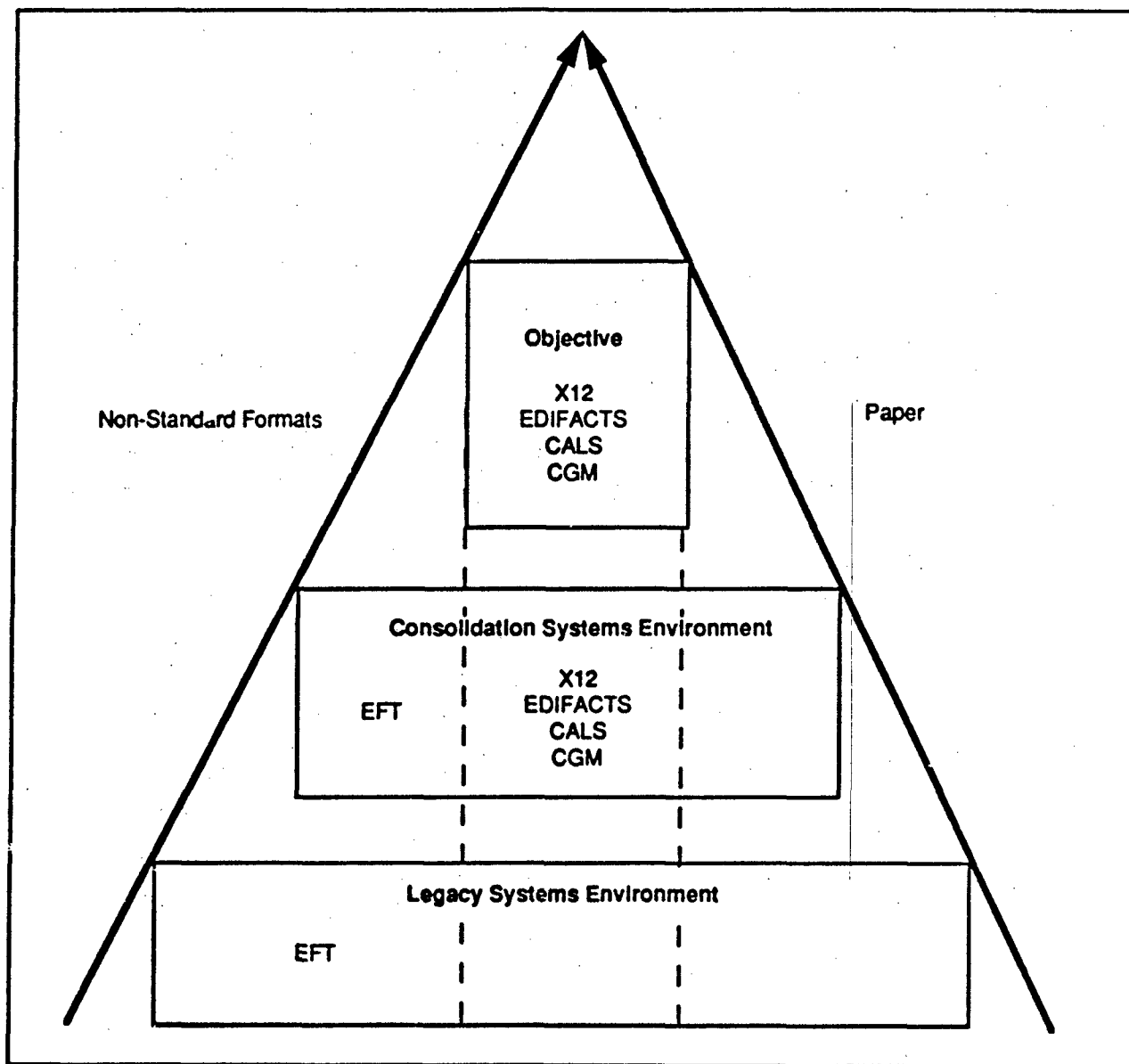


FIGURE 2-7: DATA INTERCHANGE MIGRATION PATH

2.3.6 Graphics

To be included in a future version along with Figure 2-8.

2.3.7 User Interface

2.3.7.1 Current User Interface Environment

Specific information on the user interfaces in the legacy environment has not been collected and analyzed to the extent that details can be presented here. However, through reviewing the documented data on the existing hardware and software in this environment, accurate descriptions of the user interface environment in the Finance community may be presented with a large degree of confidence.

The largest population of user interface in the Finance community is the 3270-type character-based interface. This interface is common among the database and transaction processing systems associated with mainframe financial applications.

These interfaces were developed so that character-based menu options can be chosen or processing is initiated from a command line prompt. There is no intelligence required by these terminals for this type of processing; hence, 3270-type terminals prevail in the DoD Finance community.

The microcomputer applications do not use a graphical user interface where multiple windows are available concurrently in accessing the Finance application; however, the applications may have a combination of "pop-up" windowing capability as well as character-based menu-driven process initiation.

Where there are microcomputers or PCs used for access to the mainframe Finance application, 3270-type terminal emulation packages have been installed. These packages are generally TSRs (terminate and stay resident) that can be toggled via "hot" keys established in the program setup. In the Finance community where there is a concurrent windowing capability on a microcomputer, but the application access is via 3270-type emulation, users are currently opening a window to the

terminal emulation program and accessing the mainframe based application.

Other character-based terminals such as VT100s are also used in the current legacy environment for access to the Finance applications. At least one of the systems in the finance consolidation environment is using UNISYS systems and there are at least two consolidation finance systems that are microcomputer DOS-based applications.

The legacy system and the migration system environment are:

<u>Legacy Systems</u>		<u>Migration Systems</u>	
NAVSCIPS	3270	DCPS	3270
NAFCPS	3270		
JUMPS-JSS	3270	DJMS	3270
MCARS	3270		
DRAS-NRPS	3270	DRAS	3270
AFAPS	3270		
DTPS-ATOS	PC Based	DTPS	PC Windowing System
IATS	PC Based		
TRIPS	PC Based		
DTRS-TIPS	Other Non-3270 Character based	DTRS	Other Non-3270 Character based
MOCAS	3270	MOCAS	3270
AFDARS	3270	DDMS	3270
APCAPS	3270	DRMS	3270

2.3.7.2 Analysis and Guidance

DoD is moving toward user interface services following the guidelines in the *DoD Human Computer Interface Style Guide, Version 1.0*. Objectives of user interface services are based on the POSIX Open Systems Environment (P1003.0) sections on Windowing System Services, Character-Based User Interface Services, and User Command Interface Services and FIPS Pub 158 (MIT X Window System).

The future should include the evolution of applications that have a single look and feel, a single log-on to the system, multi-media capabilities, manipulation of icons to process tasks, and human portability; that is, the ability to log on from any location and become productive. These topics are covered extensively in the *DoD Human Computer Interface Style Guide* and in the *DoD Technical Architecture Framework for Information Management, Volume 2*. A user interface style guide specific to the Financial community, that is based on DoD overall direction, will be developed to provide guidance on future development of financial applications.

In the consolidation system environment where 3270-type terminals are most heavily used, the guidance will be to stay with that architecture, but to evolve toward the more open, user friendly interfaces outlined in DoD directives.

As the legacy systems are consolidated, every attempt should be made to standardize the front-end interface so that there is a common "look and feel" among the financial community systems. One option is that there will be modifications to the character-based menu and command-line screen formats that are currently implemented as user interfaces to the Finance systems so that users of the consolidation systems will be presented with similar application interfaces. Another option is that the systems are consolidated with no new development made to the screen presentation formats, other than what is necessary due to the consolidation process. What is considered to be the most cost effective solution while achieving the highest degree of standardization and

usability across the Finance applications should be the approach.

During consolidation, COTS software products that allow the creation of graphical user interface presentation formats or "false fronts" can be used with 3270-type terminal applications. This will allow Finance users to achieve familiarity with icon-based processing and is a move in the direction of being able to create common "look and feel" interfaces. For the current objective systems, host-based application presentation screens should not be heavily modified, other than for the purposes of consolidation, and microcomputer applications can be developed as a front end to the host Finance system. This microcomputer application will present a common "look and feel" to the user, but will serve as a collection point for data that will then be transmitted to the host application for processing. This interface to the host application will be transparent to the Finance user.

Further analysis pertaining to the cost effectiveness and efficiency of either of these solutions will be performed. Certainly, many alternatives exist that need to be explored in more detail. Knowledge of other functional area (i.e., Human Resources, Medical, etc.) user interfaces will be important so that in the objective environment, standardization of user interfaces across all of these functional areas will be achieved. The Finance systems objective with regard to user interfaces is well documented. The Finance systems need to work with the installed base of technology through consolidation. There should be no further development of Finance applications that are restricted only to 3270-type presentation formats. The systems need to have a standard user interface style. Once the standard is implemented, movement can be made toward providing Finance users with at least some of the user interface capabilities that will be implemented as part of the DoD interface objective. Once consolidation is completed, efforts to re-engineer the systems should be made to create the objective system environment.

The migration path of the current Finance environment as it pertains to user interfaces will be a standard presentation of character-based screens and menus on 3270-type terminals or microcomputers emulating a

3270-type terminal. A Finance User Interface Style Guide will establish the standards and guidelines that are to be adhered to as the migration and consolidation of Finance systems progresses. Most all of the consolidation systems are mainframe, MVS, Cobol based systems that use transaction processing facilities. These systems have traditionally used dumb terminals.

There is not going to be a quick movement toward a graphical user interface for the Finance systems. A graphical user interface should only be developed where it is applicable; that is, when it provides identifiable benefits. Therefore, the approach should be to standardize the configuration of the user interface for the Finance systems according to presentation (i.e., screen layout, command-line options, etc.) guidelines.

The consolidated systems will evolve toward the DoD objective for all of the Finance initiatives undertaken in the Technical Architecture. As the direction of the workstation, client/server, and communications initiatives - which are all closely tied to the user interface initiative - are defined in more detail, movement toward graphical user interfaces and open standards will be facilitated. Figure 2-9 provides the migration path for user interface.

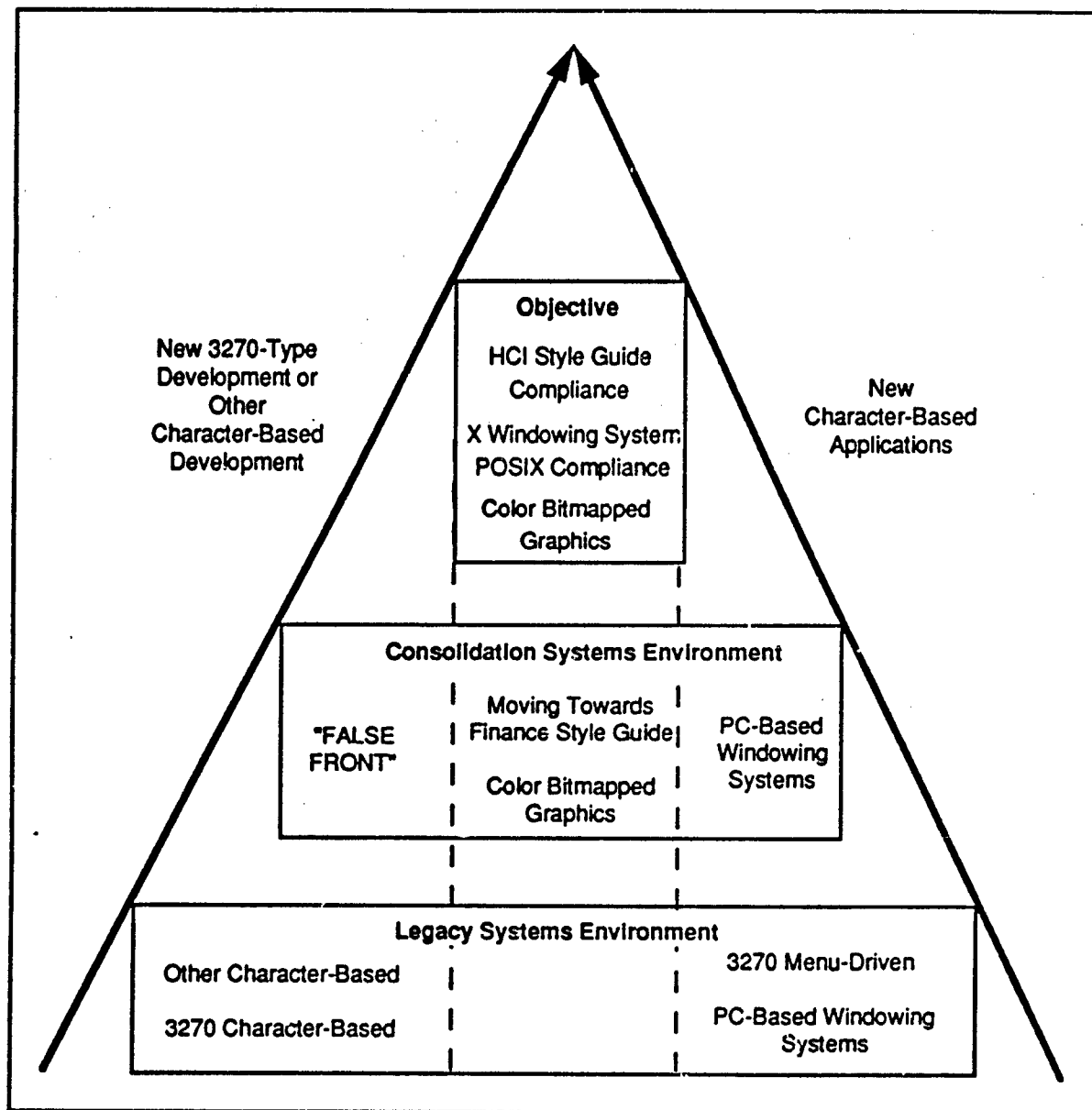


FIGURE 2-9: USER INTERFACE MIGRATION PATH

2.3.7.3 Applicable Standards

The following standards and guidelines apply to user interfaces:

- o P1003 - Guide to the POSIX Open Systems Environment, , (Sections on Windowing System Services, Character-Based User Interface Services, and User Command Interface Services)
- o FIPS 158 - User Interface Component of Applications Portability Profile
- o Federal Law 508 - Americans With Disability Act
- o DoD Human Computer Interface Style Guide
- o Finance Style Guide - To Be Developed

2.3.8 Security

2.3.8.1 Current Security Environment

Mainframe based legacy systems have been protected at a C2 Level of Trust by a number of software based security packages affording protection to data accessed primarily by dumb terminals. Information about systems running on distributed minicomputers and personal computers is not available at this time.

2.3.8.2 Analysis and Guidance

There will be a continuing requirement to maintain a C2 Level of Trust for Finance information systems running at the mainframe sites and at field activities. As the Information Processing Centers become more standardized during migration system consolidation, a single software package running on the mainframes should be selected and used by all of the IPCs.

As local area networks and intelligent terminals become more prevalent in Finance user work areas, additional measures beyond the mainframe security package must be taken to maintain adequate security. Multilevel security must be put into place in a network environment. The access to data that interconnected networks will provide also increases the risk of unauthorized access to that data. A client-server architecture will likely become much more prevalent in the Finance community. New systems development must be undertaken with a clear idea of how security will be afforded to dispersed databases in the client-server environment. The DODIIS Network Security for Information Exchange (DNSIX) Interface Specifications should be considered to provide a minimum set of security services/protocols required for compartmented mode networking.

Diskless workstations should be considered for the primary user workstation as a means of providing an additional level of security. A diskless workstation has no removable data storage media and may not have any non volatile local storage installed. The diskless configuration makes the information system much less susceptible to the introduction of viruses that can alter, destroy or deny access to critical data. It also makes unauthorized removal of data from the system much harder to accomplish if there are no floppy drives installed.

2.3.8.3 Applicable Standards

The following standards and guidelines apply to security:

- o DoD 5200.28-STD - DoD Trusted Computer Systems Evaluation Criteria
- o POSIX P1003.6 - POSIX Security Interface
- o ISO 7498-2 - OSI Reference Model
- o DRS-2600-5502-87 Compartmented Mode Workstation(CMW)
- o DDS-2600-6243-91, Version 1 - CMW Evaluation Criteria
- o DDS-2600-6216-91 - CMW Labeling: Encoding Format
- o DDS-2600-6215-91 - CMW Labeling: Source Code and User Interface Guidelines

2.3.8.1 Digital Signature

2.3.8.1.1 Current Digital Signature Environment

The full extent of use of digital signatures in the legacy environment is unknown at this time. Rudimentary forms of digital signatures are being used by some systems for access control to data. Additional information is required to obtain a better understanding of the use of digital signatures by DFAS.

2.3.8.1.2 Analysis and Guidance

The digital signature is designed to provide proof of a document sender's identity and that the contents of the document have not been altered. It can be of great use in the Finance community for authentication of funds transfer, invoking of contracts and many other uses. The National Institute of Standards and the National Security Agency are currently working on developing a digital security standard that can be used throughout the federal government.

The digital signature is comprised of a signer's public and private key, a hashing algorithm, and public and secret parameters assigned to each message sent by the signer. It can be used for electronic mail, negotiations, software protection, data protection and smart cards. As the use of smart cards increases for identification purposes in the Department of Defense, the use of secure digital signatures becomes very important. New system design should investigate the use of digital signatures where feasible to protect the integrity of financial transactions.

2.3.8.1.3 Applicable Standards

To be provided in next version.

2.3.9 System Management

2.3.9.1 Current System Management Environment

Detailed information on network management and configuration management in the legacy environment has not been collected and analyzed. Data on operating systems and hardware is available in the Technical Reference Model for Information Management, the DoD Technical Architecture Framework, and the POSIX Open Systems Environment Guide. But no details of how these systems are managed are known at this time. Most likely they are initiated individually, or are part of a unique scheduling process that may or may not be useful for all financial area users.

System management capabilities are the tools, technologies and procedures that manage the technical resources used to deliver information technology. System management facilitates the use of and changes to technical resources that deliver information services. Configuration management is a function of systems management responsibilities for controlling and coordinating resources falling into categories such as software, communications, data, hardware etc.

Most of the tools and technologies that compose system management capabilities currently in use are application software products also known as system software or executive software. Traditionally, these capabilities were provided by IBM and the relatively few other vendors providing mainframe processing systems. By their nature (one processor, one location, one point of control, one vendor), the capabilities are simple to manage. In contrast, Finance area near-term technical architecture, including client/server, has many more elements, locations, and potential points of control. As the consolidation systems evolve toward the DoD objective, the delivery of information services will continue to get more and more complex. As the systems become more complex, so will managing them. System management capabilities procured from various sources will have to be integrated over the entire network.

When appropriate systems management capabilities are in place, the technical resources will become available to the service user through a "single image." That is, it will be transparent to the person who is using the service that he or she is working with several different computing resources. They will appear to be on the computer he or she is working with. Today for any of these systems to work, the user must be logged on to the system that is running it. Theoretically a finance area user needing to get all 13 applications would need 13 different logon IDs.

2.3.9.2 Analysis and Guidance

All migration systems are running under MVS, MS-DOS, or UNISYS. All IPCs should be under change control for all OS software changes and managed from a single point. When the system administrator changes the configuration, all applications impacted by the change should be identified. Software releases should be managed by defining a class for them. When an attribute in the releases is changed, the control point should initiate a process to distribute the software to all recipients so that they may change their object to reflect the new release.

Each new release of the application software must be under formal control, and explicitly identified as to which release of the system software it can work under.

All restart processes either must be standard or well documented.

Communications use and products are unknown, but VTAM and/or SNA must be under the same change control process as the operating system software.

As the legacy systems are consolidated, an attempt should be made to adopt distributed architecture as a means of integrating existing heterogeneous components. For instance, the application end users should be supported by workstations connected by LAN. Geographically separated groups might be connected by LAN bridge. The application running on the workstation should interact with source of data running on mini or mainframe computers. In order to support groups of people involved in a common activity, workstation based applications should communicate with each other over this network. Action taken by one person that effect the work of others should be propagated through the network of application.

The consolidation systems will have one user interface process per user. This will allow the system configuration to allocate a unique profile, which will customize the interface based on the user's job. Automatic log-in and log-out may be implemented by associating log-in and log-out script files with each user interface, thereby making the process transparent to the operator. Security will be implemented through the use of access control files. These files will be designed to contain the names of the objects that are to be protected, the names of the users who may access system objects, and the type of access each user is allowed. The system administrator will be the only class of user allowed to update these files to establish user profiles and access privileges. An audit trail within these files will be automatically kept on the access attempts and activities of each user.

2.3.9.3 Applicable Standards

The following standards and guidelines apply to system management.

- o System Management Component - NIST Planned FIPS PUB on Government Network Management Profile (GNMP) and Draft Military Standard 2045-38000
- o Government Open System Interconnect Profile (GOSIP Version 2.0) FIPS PUB 146-1
- o Kernel Operations Component - Portable Operating System Interface for Computer Environments (POSIX.1) FIPS PUB 151-1
- o ISO IS 7498-2, Information Processing Systems - OSI Reference Model - Part 2

2.3.9.1 Network Management

To be provided in a future version.

2.3.10 Workstations

2.3.10.1 Current Workstation Environment

The current workstation environment within the finance community is comprised primarily of 3270-type terminals with a small number of non-3270 character-based terminals and stand-alone PCs.

Workstations for the current legacy and migration systems are:

Legacy Systems

NAVSCIPS 3270
NAFCPS 3270

JUMPS-JSS 3270
MCARS 3270

DRAS-NRPS 3270
AFAPS 3270

DTPS-ATOS PC
IATS PC
TRIPS PC

DTRS-TIPS Character-based

MOCAS 3270

AFDARS 3270

APCAPS 3270

Migration Systems

DCPS 3270 or PC

DJMS 3270 or PC

DRAS 3270 or PC

DTPS PC

DTRS Character-based, PC

MOCAS 3270 or PC

DDMS 3270 or PC

DRMS 3270

2.3.10.2 Analysis and Guidance

The DoD long range objective is to move towards easy-to-use, flexible, and scalable end-user computing devices (i.e., workstations). The goal is a single multi-function workstation on each desktop that provides all functional capabilities required by the user. The workstation will be multi-tasking, provide the required platform services in accordance with the standards specified in this Chapter, and have sufficient performance characteristics to support one of the client/server processing models specified in Volume 2 of the Technical Architecture Framework for Information Management.

A single workstation will not be mandated for use in the Finance community. Instead a family of workstations that satisfy the technical requirements will be available to system developers. The workstation chosen for individual use will depend on functional requirements and the client/server processing environment. The possible workstation options include: Personal Computers (PCs), X-terminals, and high-performance workstations. The workstation options and possible uses are described below.

PCs - The PC is the most commonly used and readily available workstation. Its is capable of supporting the services required by finance end-user computing devices. Standard PC configurations will be the most common workstation solution in the Finance community. It should be noted that PCs can be configured with X Windows software that enables them to act as X-terminals.

X-terminals - A X-terminal is essentially a smart terminal that only handles presentation management. It lacks such features as high speed disk controllers, large caches, and memory management units. X-terminal hardware and software are optimized for running the X-protocol and therefore focus on network communications, graphics performance and graphical user interface enhancements.

High-performance workstations - High-performance workstations provide users with increased desktop computing capabilities. For stand-alone applications that require high-horsepower computing, these workstations must be used. Possible applications include simulation, modeling, and computer-aided software engineering.

Each of these workstation options can be implemented in configurations with and without disks (both fixed and removable). Diskless workstations can be used when accessing distributed databases, using corporate data, primary application is entry and validation of data, primary application is office automation, user access and virus protection are of paramount concern. Diskless workstations should not be used when autonomy is paramount or when communications support is limited or unreliable.

During the consolidation phase 3270 and character based terminals should not be procured. In environments where 3270 terminals are needed to interoperate with legacy systems, one of the three workstation configurations mentioned above should be used (with the addition of 3270 emulation software). When replacing 3270 terminals and existing workstations that do not meet the long range objectives, one of the three configurations should be used.

Figure 2-10 provides the migration path for workstations.

2.3.10.3 Applicable Standards

The following standards apply to workstations:

- o TBD

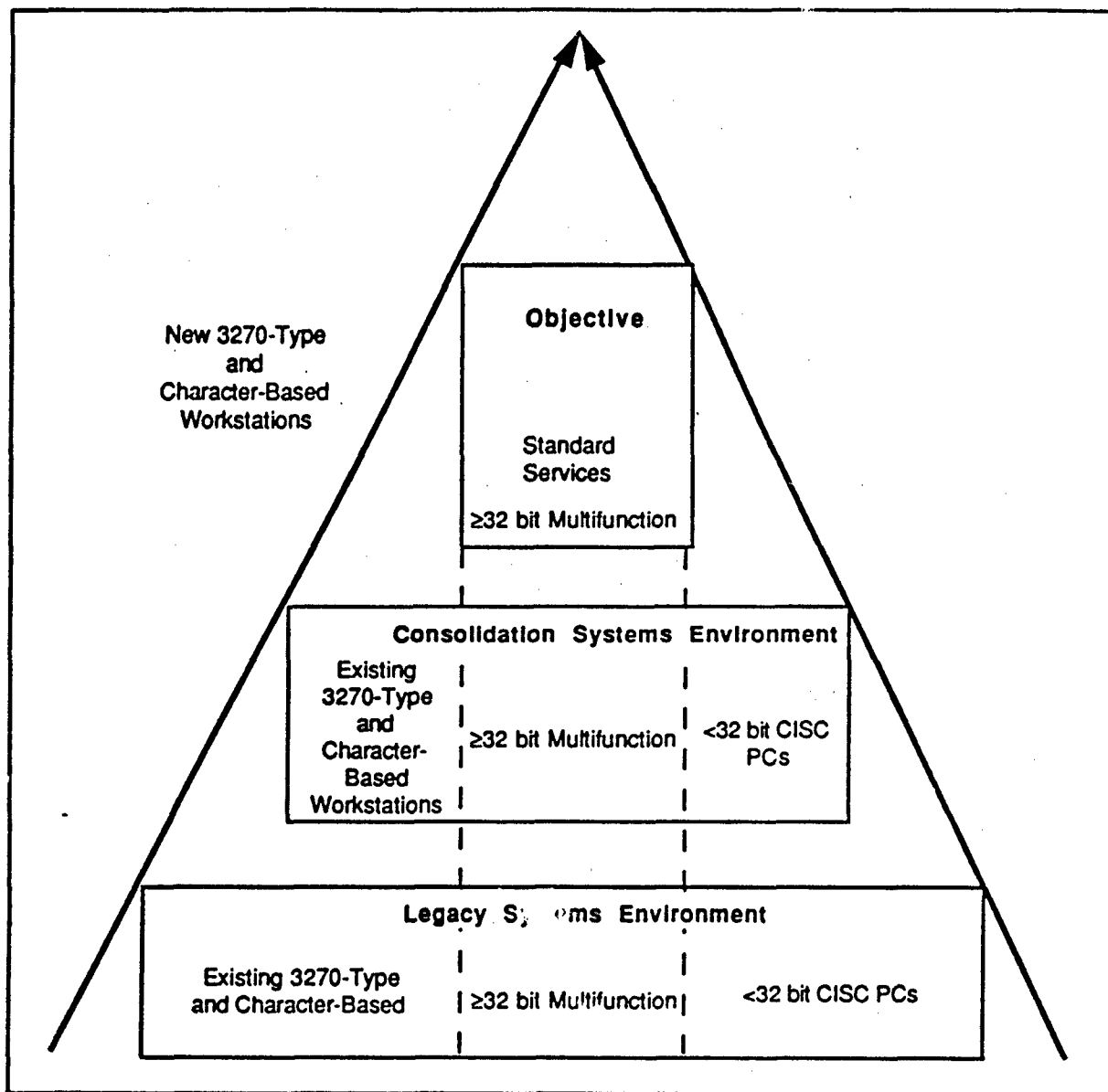


FIGURE 2-10: WORKSTATION MIGRATION PATH

2.4 Communications

This section defines the communications layer of the Finance Technical Architecture. The communications layer provides services that enable information exchange between end-devices distributed world-wide and supports the exchange of different types of information including: data, voice, and imagery. End devices include platforms, video teleconferencing devices, telephones, facsimile machines, and sensing devices. The communications layer services combined with the network services provided by the platform layer form that part of the system which transfers information. This section will discuss the hardware and software required to provide communications services to the Defense Finance and Accounting System (DFAS) in the near-term and include a brief characterization of the existing baseline capability if one exists. Migration analysis and guidance is provided to support both the near term finance and accounting consolidation efforts as well as long range DoD objectives to establish an open distributed computing environment.

2.4.1 Current Communications Environment

The current Communications legacy environment is primarily an IBM Systems Network Architecture (SNA) consisting of mostly 3270 terminals or PCs emulating 3270 terminals. The Wide Area Network (WAN) consists of three levels: the Defense Data Network (DDN), IDNX Smart Mux, and a router based TCP/IP network. The overall communications infrastructure currently consists of one primary transport level, therefore the communications structure is labeled "Flat."

Additional information is required in order to obtain a better understanding of the financial legacy Communications environment.

Communications for the current legacy and migration systems are as follows:

<u>Legacy Systems</u>		<u>Migration Systems</u>	
NAVSCIPS	SNA Protocols	DCPS	SNA Protocols
NAFCPS	SNA Protocols		
JUMPS-JSS	SNA Protocols	DJMS	SNA Protocols
MCARS	SNA Protocols		
DRAS-NRPS	SNA Protocols	DRAS	SNA Protocols
AFAPS	SNA Protocols		
DTPS-ATOS	TBD	DTPS	TBD
IATS	TBD		
TRIPS	TBD		
DTRS-TIPS	UNISYS Protocols	DTRS	TBD
MOCAS	SNA Protocols	MOCAS	SNA Protocols
AFDARS	SNA Protocols	DDMS	SNA Protocols
APCAPS	TBD	DRMS	TBD

2.4.2 Analysis and Guidance

The DoD objective environment for Communications is to move toward an open systems architecture that conforms to GOSIP. Additionally, the DoD has defined the communications infrastructure to consist of three transport levels: Local, Regional, and Global. Analysis and guidance for the three transport levels are presented below.

2.4.2.1 Local

The "Local" architecture should include fundamental standards or guidelines for the following:

- o Physical Wiring**
- o Premises Distribution**
- o Local Area Networks**

A common configuration is recommended for both voice and data for premises distribution systems. Common cabling plants should be considered for data, voice, and video services to each end-user location. Given the large percentage of existing 3270-type terminals, it may not be cost effective to rewire at the premises distribution level. If LAN-attached PC devices replace the 3270-type terminals, then recommendations and guidelines should be established for all new implementations.

LANs should be used to provide access to all desired network services. Adherence to corporate security guidelines and naming standards is required. LAN components should provide management capability such as Simple Network Management Protocol (SNMP). Operating systems should be standards based and servers should be scalable. Access to other communications networks should be provided using communication gateways. Bridges should be used to interconnect LAN segments that are located within the same work group or building.

2.4.2.2 Regional

The "Regional" architecture should include fundamental standards or guidelines for the following:

- o Campus Area Network (CAN)
- o Metropolitan Area Network (MAN)
- o Wide Area Network (WAN)

CAN and MAN operating systems should be standards-based. Servers should be scalable. Routers should be used to interconnect LANs and CANs by the services provided by a WAN. Bridges and repeaters can be used within a local work group or site. The router's protocol should be based on open standards to ensure that all routers will interoperate.

TCP/IP should be used at the transport and network layer protocol suite. Open Shortest Path First (OSPF) protocol should be used by the TCP/IP routers. Intermediate System-Intermediate System (IS-IS), End System-Intermediate System (ES-IS) and End System-End System (ES-ES) routing protocols should be used on OSI-based networks.

Multi-protocol routers should be considered for specific traffic requirements. Bridges and repeaters should not be used for LAN interconnection over a Wide Area Network (WAN).

Analysis and guidance for WAN components of the Regional transport level are covered in the "Global" section below.

2.4.2.3 Global

WANs should use end-to-end digital transmission facilities based on open international standards and incorporating the appropriate combination of public and private facilities.

The DoD has mandated that OSI specifications, as defined by GOSIP, be supported on all Government contracts. TCP/IP provides limited capability compared to OSI, but is a stable protocol that is widely supported by vendors and is generally interoperable between different vendors. Interfaces, translation packages, and emulation packages are frequently used to circumvent incompatibility problems. Proprietary protocols are unlikely to disappear even with the emergence of OSI because proprietary protocols, built to support the specific characteristics of a vendor's components, are often much faster and more manageable within that vendor's components than generic, standard protocols.

Proprietary networks should not be used to transport open protocols (i.e., TCP/IP should not be transmitted over an SNA network). TCP/IP gateways should be used to interconnect disparate LANs. Figure 2-11 provides the migration path for communications.

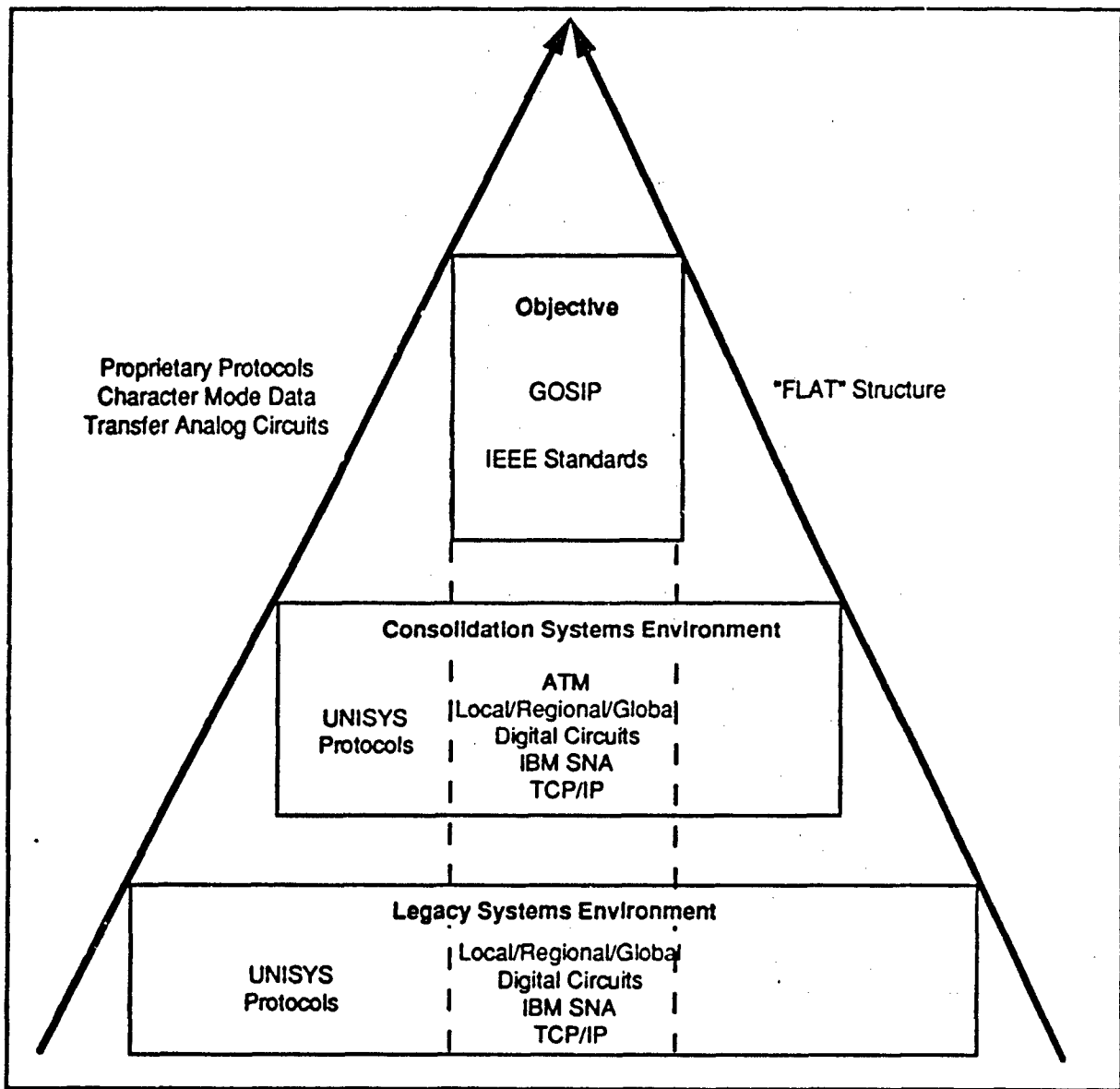


FIGURE 2-11: COMMUNICATIONS MIGRATION PATH

2.4.2.4 Analysis and Guidance Summary

Communications components for current environment and recommended environment are as follows:

Current Environment

3270 Coaxial Cable Runs,
Coaxial-wired LANs

3270 terminal or PC with
emulation adapter

Proprietary Network
Operating System

Non-IEEE802 Series LAN

Non-GOSIP compliant LANs

WAN LAN bridges

Proprietary protocols

Proprietary network transporting
Open Systems protocols

Analog circuits

Flat communications structure
Varied network management

2.4.3 Applicable Standards

Recommended Environment

Unshielded Twisted Pair (UTP),
Shielded Twisted Pair (STP)
for noisy environments,
or Fiber Optic (FO)

LAN-attached PC and 3270
gateway

Non-Proprietary Network
Operating System

IEEE802 Series LAN

GOSIP compliant LANs

WAN LAN routers

Standards based protocols

Open Systems transporting
Proprietary & OSI network
protocols

Digital circuits

Local/Regional/Global structure
Standards-based network
management

2.4.3.1 Local

- o Government Open Systems Interconnection Profile (GOSIP)
- o NIST Specification Pub 500-163
- o ISO 8802/3, IEEE 802.3 Ethernet
- o ISO 8802/4, IEEE 80 Token Bus
- o ISO 8802/5, IEEE 802.5 Token-Ring
- o ANSI X3T9.5 Fiber Distributed Data Interface (FDDI)
- o ANSI FDDI II
- o Copper Distributed Data Interface (CDDI) [future]
- o Defense Data Network (DDN) RFC-xxx
- o Transmission Control Protocol / Internet Protocol TCP/IP)

2.4.3.2 Regional

- o ISO 8802/3, IEEE 802.3 Ethernet
- o ISO 8802/5, IEEE 802.5 (16Mbps only) Token-Ring
- o IEEE 802.6 Distributed Queue Dual Bus (DQDB) [future]
- o ANSI X3T9.5 FDDI
- o ANSI FDDI II
- o CDDI [future]

- o Open Shortest Path First (OSPF)
- o OSI Intermediate System-Intermediate System (IS-IS,
- o OSI End System-Intermediate System (ES-IS)
- o OSI End System-End System (ES-ES)
- o OSI Integrated IS-IS [future]

Applicable Standards for Wide Area Network (WAN) components of the Regional environment are covered in the section "Global" below.

2.4.3.3 Global

- o GOSIP
- o T1, T3, DS-3, Fractional T1
- o Switched Digital Data Service (SW/DDS)
- o Asynchronous Transfer Mode (ATM)
- o Integrated Services Digital Network (ISDN)/
- o Basic Rate Interface (BRI)
- o Primary Rate Interface (PRI)
- o Broadband Integrated Services Digital Network (BISDN)
- o CCITT X.25 Interface between DTE and DCE for Terminals
- o Operating in Packet Mode and Connected to Public
- o Domain Networks by Dedicated Circuits.

o Synchronous Optical Network (SONET)

o ANSI T1.606 Frame Relay

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