Porting COBOL VPLUS and IMAGE Apps to UNIX, Linux or Windows
T145

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Transformix

Investment Protection for MPE/iX Applications Through Application Renovation

http://www.xformix.com/

Introduction and Definitions

- General comments
- Terminology
- Paper subject
- Goal
- Audience
- Presentation focus

Presentation Outline

- *Section I*, ***Introduction and description of what needs to be done to port applications that run in an MPE/iX source environments to target computer operating environments.***
- *Section II*, ***Example of Transport, an MPE Porting and Migration Toolset***
- *Section III*, ***Third-Party Porting Tools***

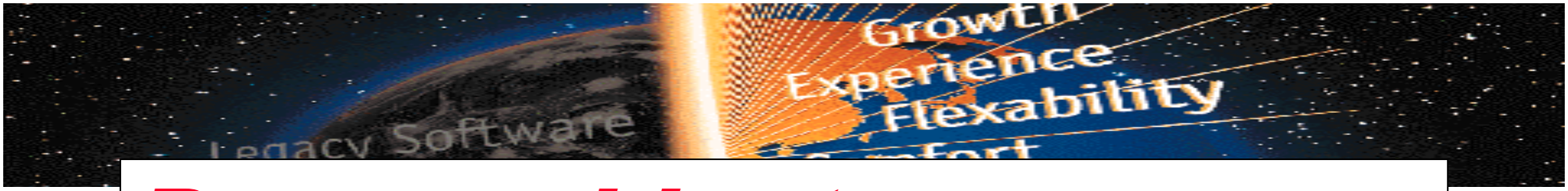
The models developed in Section I will be used as a framework to describe some real-world tools that are available to assist in the porting of HP MPE applications to UNIX and/or NT.

General comments

- **Porting and/or migrating may seem overwhelming at first**
- **With the right planning and the right tools can be least expensive option**

Terminology

- **The terms porting, migrating, converting, reengineering and rearchitecting are sometimes incorrectly used interchangeably.**
- **This can lead to confusion.**



Paper subject

This paper is about porting in the sense that an end-user who is experienced in using the application in the source environment should be able to use the application in the target environment with little or no retraining.
minimal changes to source program logic.

Presentation goal

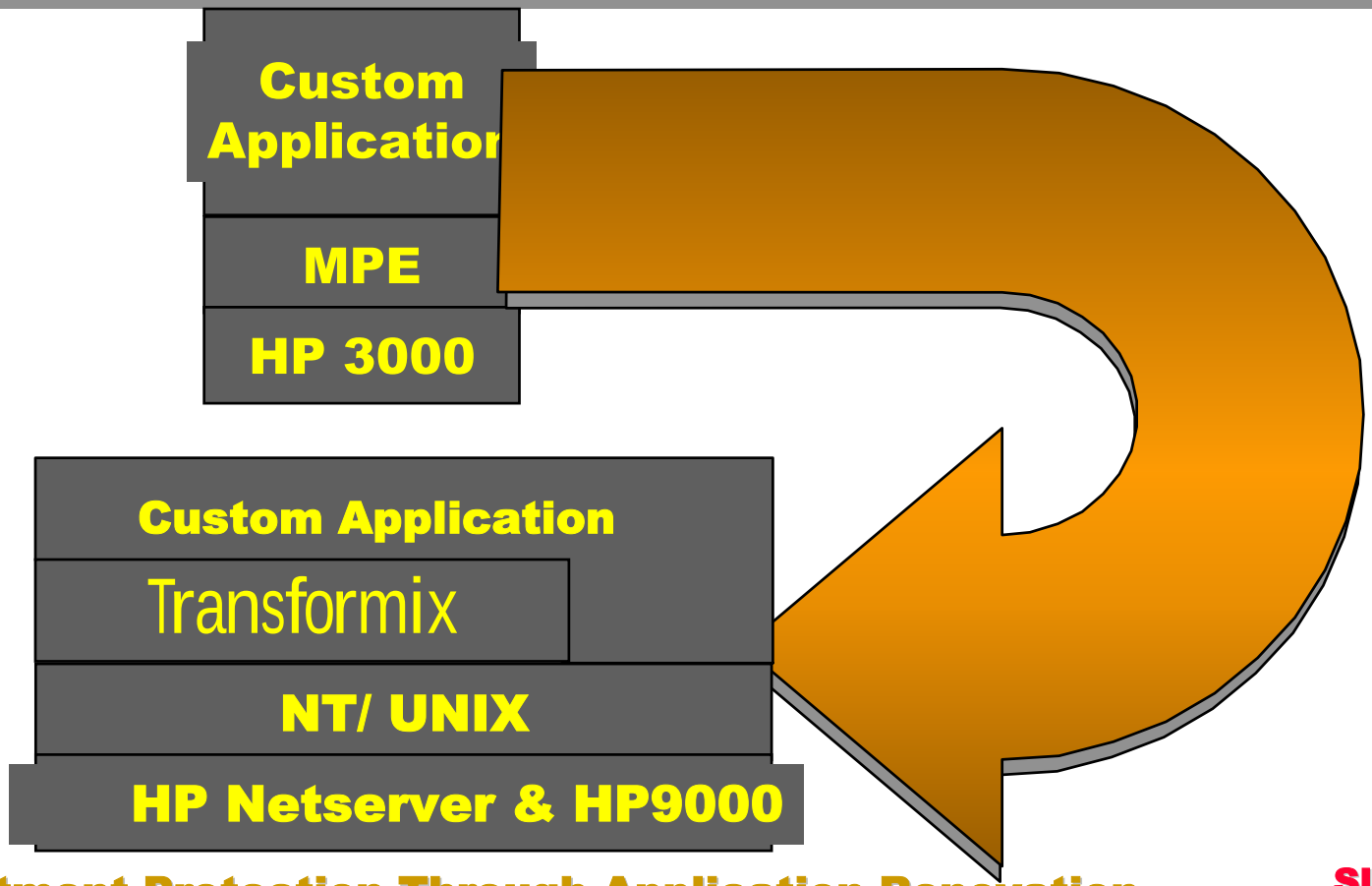
Goal is to provide an understanding of why porting can be challenging and to help the reader understand the key tools and techniques needed to effectively port an application from one computing environment to another.

Transformix Computer Corporation

- **Founded in 1982 as ConAm Corporation evolved into Transformix**
- **Consulting and Systems Integration Services**
  - ***Application Re-engineering***
  - ***HP 3000 Porting and Migrations Tools***
  - ***IT Infrastructure Consulting and Services***
- **Primary focus on Hewlett Packard environments**

The Process

The Successful Migration Achieved through Transformix's Five Step Process



Application Renovation

User Interface Change

GUI

Web User Interface

Web Database Access

SQL Access

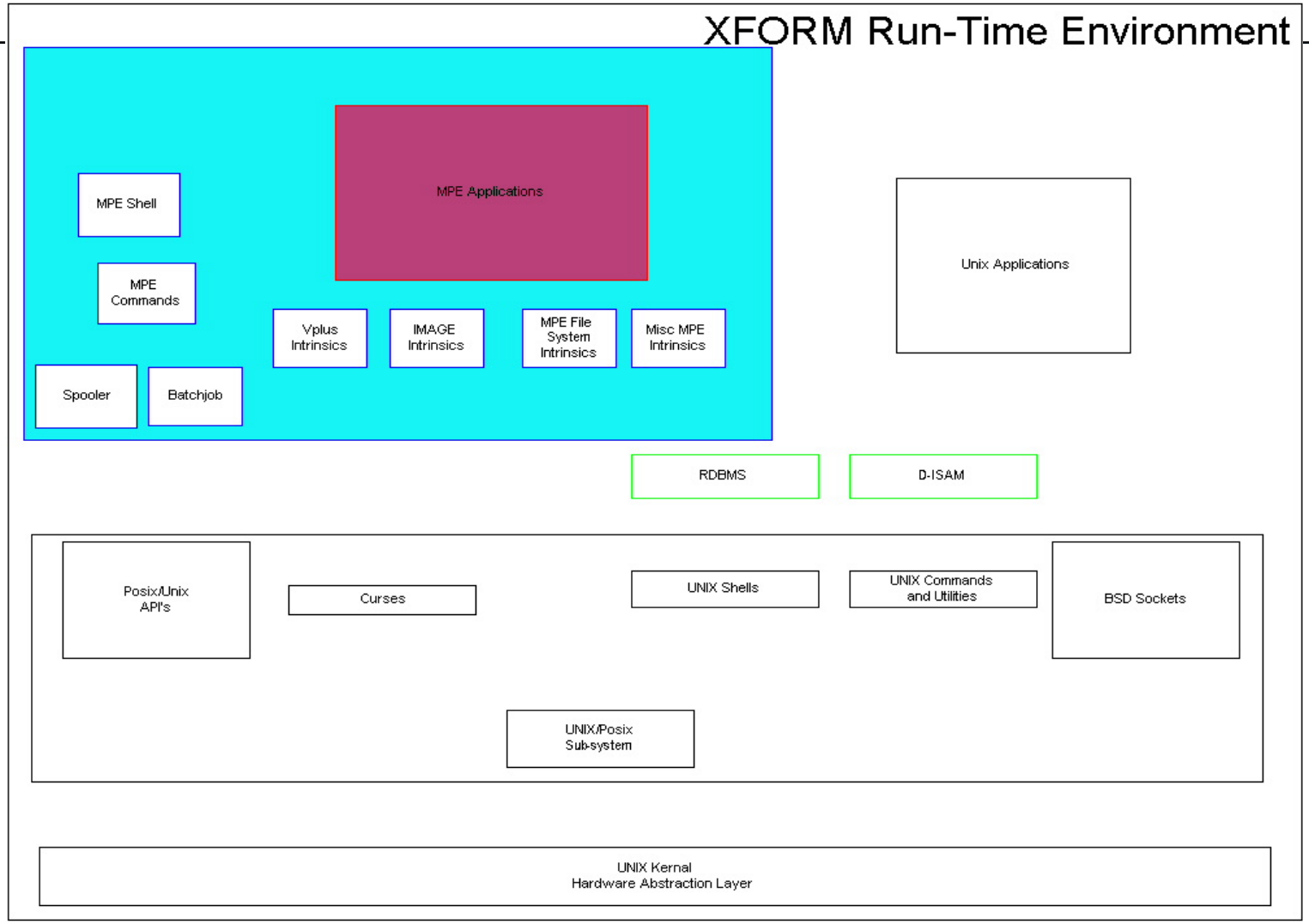
RDBMS

Porting

Translation **- restructuring the code to be compatible with the run-time environment compilers, system calls, etc.**

Emulation **- providing run-time compatibility with the source environment on the target platform by pretending to be the source environment.**

Transport Run-Time Environment



Preserving Legacies: Application Renovation vs. Porting

- ***There is sometimes a need to renovate applications***
- ***There is sometimes a business need to port and migrate***
- ***Applications software is increasingly recognized a valuable asset***

Paper Audience

It is a intended to be a primer directed at a user who has applications software that now runs on the HP MPE operating system who is considering porting that application to either UNIX or NT.

Paper focus

- **Third-generation languages such as COBOL, FORTRAN or C.**
- **The 4GL many of the same issues only less so.**
- **Particularly true when the 4GL vendor supports both the source and target environments.**

Section I:

The Porting and Migration Challenge

Porting and Migration Introduction

- Introduction
- The Porting and Migration Challenge
- Downsizing As Part of Your Information Technology Strategy
- One Step At a Time
- Selecting the Right Applications

Understanding the Landscape: Overview of Requirements for a Migration Toolset (Transport)

- ***Execution (Runtime) Sub-Environment***
- ***The User (Operations) Sub-Environment***
- ***The Development Sub-Environment***
- ***The Administration Sub-Environment***

General Porting Design Objectives

- **General Porting Design Objectives**
  For all sub-environments of the mpa environment the following are our objectives:
- ***They are complementary and should not interact in a way other way than is consistent with normal behavior on the MPE/iX operating system,***
- ***Any used UNIX or NT device or other feature should be left in state that is consistent with how a native program would leave it and therefore it should be accessible for the rest of the UNIX or NT system,***
- ***No other UNIX or NT operation should be disturbed or impacted other than what is expected, i.e. no unwanted side effects are allowed,***
- ***In any situation where the needs of MPE and those of UNIX or NT conflict to the point where the functioning of UNIX or NT might be impaired, the requirements of the UNIX or NT environment take precedence***
- ***any features not specified within MPE operating system should be made to conform to the POSIX and other standards on which UNIX or NT platform is based.***

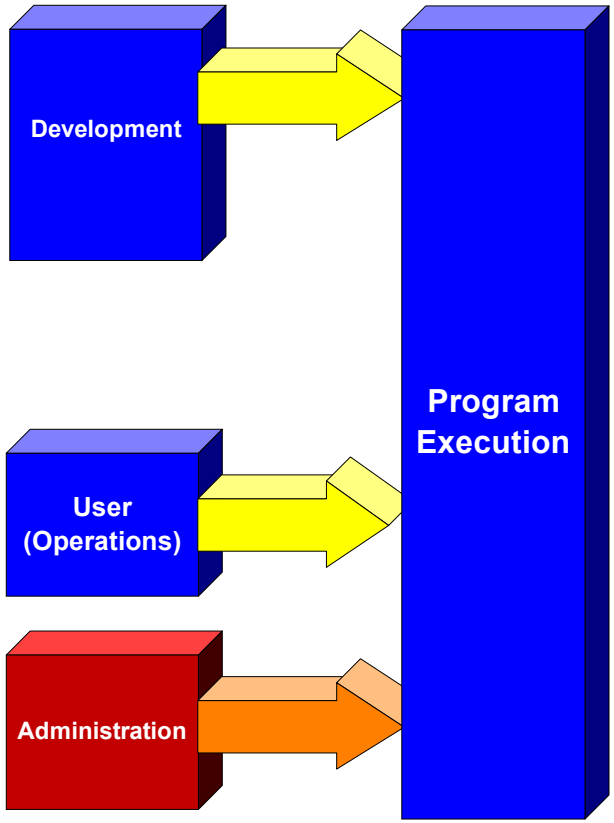
General Porting Steps

- **Analyze Source Environment -The first goal of porting is to first identify what features are provided to programs, programmers and computer users in the source MPE environment.**

- **Determine Target Environment Requirements -The next step is to somehow make the source and target versions of the application sources behave the same from an end-user and an executing program point of view.**

    - ***One way to do this is to find either exact or functionally compatible replacement functions in the target environment.***
    - ***A second way to make the source and target versions compatible is to translate from one to the other.***

Computing Environment Anatomy



Execution (Runtime) Sub-Environment

User Interface The runtime (screens)

- VPlus
- Non-HP Screen Handler
- Direct I/O to Screens
- GUI

Data Management

- MPE Flat Files
- KSAM
- IMAGE Clone
- SQL Access

Transaction Management

Operating System Interfaces

- The File System
- System Information
- Process Management
- User Information
- Program Information
- Interprocess Communication
- Process Synchronization
- Miscellaneous OS Interfaces

The User (Operations) Sub-Environment

Files and Data

- MPE File Usage
- Directories
- Tape Files

Commands

- Commands
- Command Files
- UDC's
- Jobs and Job Files

Operations Control

- Production Scheduling
- Output Spooling

Utilities

- Sort/Merge
- Editors
- Mail

The Development Sub-Environment

Editing

3rd GL Compiling

- FORTRAN
- ANSI/C

4GL Development

Linking Programs

The Administration Sub-Environment

- Backup
- Security

Elements of a Porting Tool Chest

Emulation Tools

- System Calls - Intrinsics
- Command Interpreter
- JCL
- Vplus
- Data Management Calls – IMAGE, KSAM and Flat Files

Translation Tools

- Translation Tools
- Language Differences
- Custom Translators
- Required Skills

File and Data Conversion Tools

- File and Data Conversion Tools
- Set up a Link to the HP 3000
- Interface between UNIX and MPE

MPE/UNIX/NT Interoperability

- SAMBA
- NFS
- Telnet
- ODBC
- JDBC
- Client/Server

Required Skills

- Systems Software, Hardware and Infrastructure
- Compilers
- Job Management
- Networking
- Terminal Interfaces

Project Management and Methods

- Project Management and Methods
- Required Skills

Professional Services

- Professional Services
- Required Skills
- Document Changes

Opportunities for Incompatibility

- **VPlus,**
- **TurboIMAGE and**
- **MPE Intrinsics**
- **All unique, proprietary aspects of MPE.**

Transformix Methodology for Matching Source to Target

Goal of Methodology

Our goal is to create a checklist of functions needed in UNIX and/or NT that will allow our originally MPE-based applications to run on the target environment with little or no modification.

Porting Data Management Sources

Transferring Sequential Files

- Transferring Sequential Files
- Preparing the File Transfer
- MPE Unique File Types
- UNIX File Names

- File Transfer Methods
- TCP/IP File Transfer Protocol
- DDS
- Diskette
- Tape
- DLT

Migrating TURBOIMAGE

- Migrating TURBOIMAGE
- HP Eloquence
- Relational Databases
- Database Definitions
- Table Definitions
- View Definitions
- Index Definitions
- Procedure Definitions

Converting and Transferring TURBOIMAGE Databases

- **Bridges or gateways**
- **Unload/Reload**

KSAM Files

- Transferring KSAM Files
- Loading the KSAM Data into Your Unix System

Porting User Access and System Management Pieces

Terminal Access

- Terminal Access
- Functions Supported
- Functions Not Supported
- VPlus
- Non-VPlus
- GUI

Batch Jobs

- Batch Jobs
- Setting Up a Batch Queue
- Change the Application Code to Produce Script Commands
- Job Scheduling Systems
- Transformix Job Scheduler for UNIX
- UNIX Cron Facility

Printing

- Printing
- Print Transaction Started on a Printer
- Level
- Writing to the Spooler

Programming Language Porting and Migration Methdology

Migrating COBOL Programs

- Source Language and Compiler Considerations
- COBOL Migration Restrictions
- VPLUS Migration Restrictions
- Setting Up the COBOL Run-Time System
- Compiling COBOL Programs

- Problems Encountered
- Database and SQL Differences
- Restrictions
- Precompiler
- Testing Your Application
- COBOL Source Level Debugger
- COBOL Program Caching

Migrating FORTRAN Programs

- Source Language and Compiler Considerations
- FORTRAN Migration Restrictions
- VPlus Migration Restrictions
- Setting Up the FORTRAN Run-Time System

- Compiling FORTRAN Programs
- Problems Encountered
- Database and SQL Differences
- Restrictions
- Precompiler
- Testing Your Application
- Execution Diagnostic Facility

Migrating C/XL Programs

- Source Language and Compiler Considerations
- C/XL Migration Restrictions
- VPlus Migration Restrictions
- Setting Up the C/XL Run-Time System

- Compiling C/XL Programs
- Problems Encountered
- Restrictions
- Precompiler
- Testing Your Application
- Execution Diagnostic Facility

Migrating SPL Programs

- Source Language and Compiler Considerations
- SPL Migration Restrictions
- VPlus Migration Restrictions

- SPLASH Compiler Options
- Compiling SPL Programs
- Problems Encountered
- Restrictions
- Precompiler
- Testing Your Application
- Execution Diagnostic Facility

Migrating PASCAL Programs

- Source Language and Compiler Considerations
- PASCAL Migration Restrictions
- VPlus Migration Restrictions

- Setting Up the PASCAL Run-Time System
- Compiling PASCAL Programs
- Problems Encountered
- Precompiler
- Testing Your Application
- Execution Diagnostic Facility

Migrating 4GL Programs

- **Source Language and Compiler Considerations**
- **SPEEDWARE AND POWERHOUSE Migration Restrictions**
- **Screens Migration Restrictions**

- **Setting Up the SPEEDWARE AND POWERHOUSE Run-Time System**
- **Compiling SPEEDWARE AND POWERHOUSE Programs**
- **Problems Encountered**
- **Database and SQL Differences**

  Restrictions
- **Precompiler**
- **Testing Your Application**
- **Execution Diagnostic Facility**

Migrating RPG Programs

- Source Language and Compiler Considerations
- RPG II Migration Restrictions
- VPlus Migration Restriction
- Setting Up the RPG II Run-Time System

- Compiling RPG II Programs
- Problems Encountered
- Database and SQL Differences
- Restrictions
- Precompiler
- Testing Your Application
- Execution Diagnostic Facility

Migrating BASIC And Business BASIC Programs

- Source Language and Compiler Considerations
- BASIC AND BUSINESS BASIC Migration Restrictions
- VPLUS Migration Restrictions

- Setting Up the BASIC AND BUSINESS BASIC Run-Time System
- Compiling BASIC AND BUSINESS BASIC Programs
- Problems Encountered
- Database and SQL Differences
- Restrictions
- Precompiler
- Testing Your Application
- Execution Diagnostic Facility

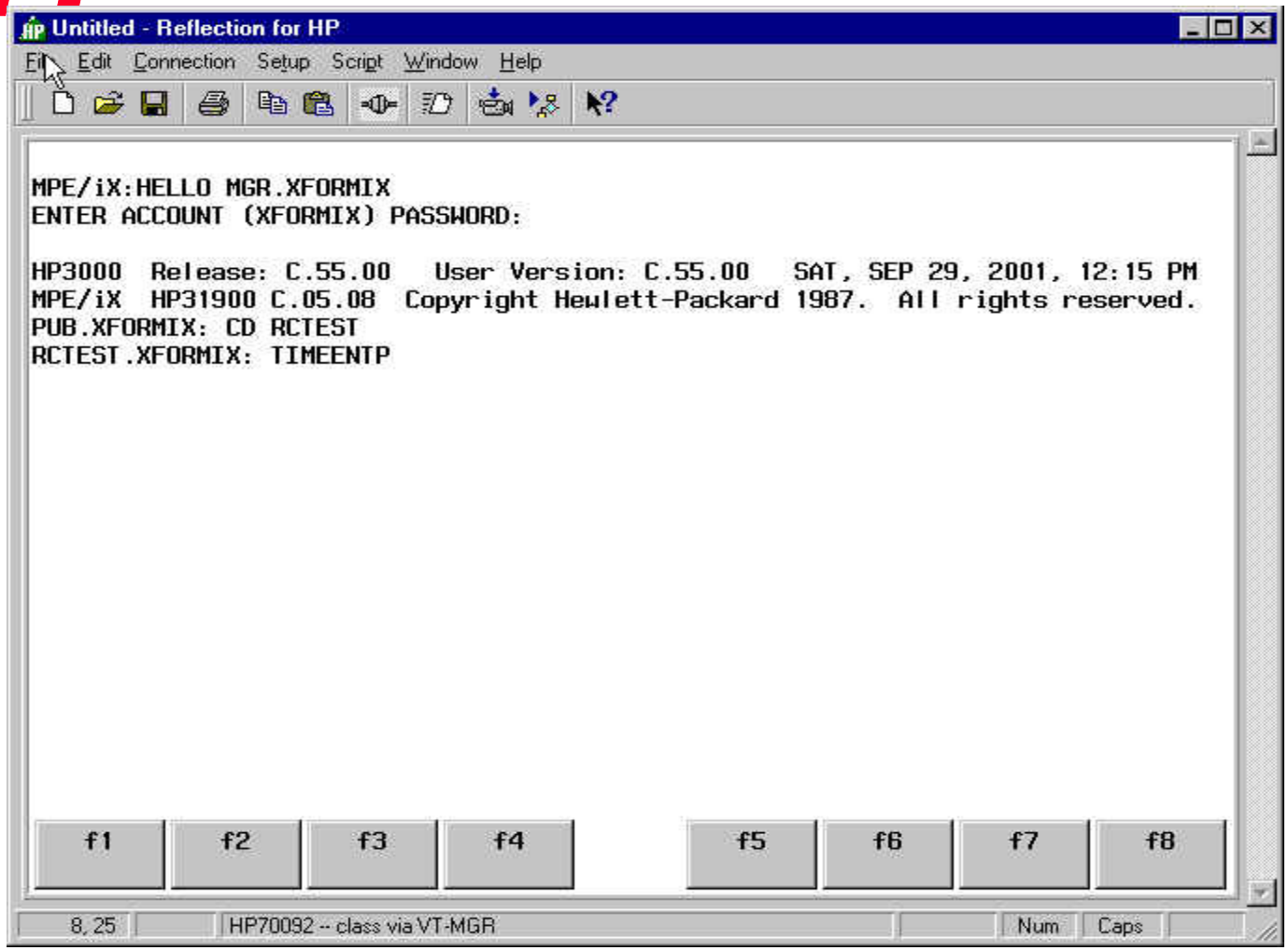
Migrating Other Language Programs

- Source Language and Compiler Considerations
- OTHER LANGUAGES Migration Restrictions

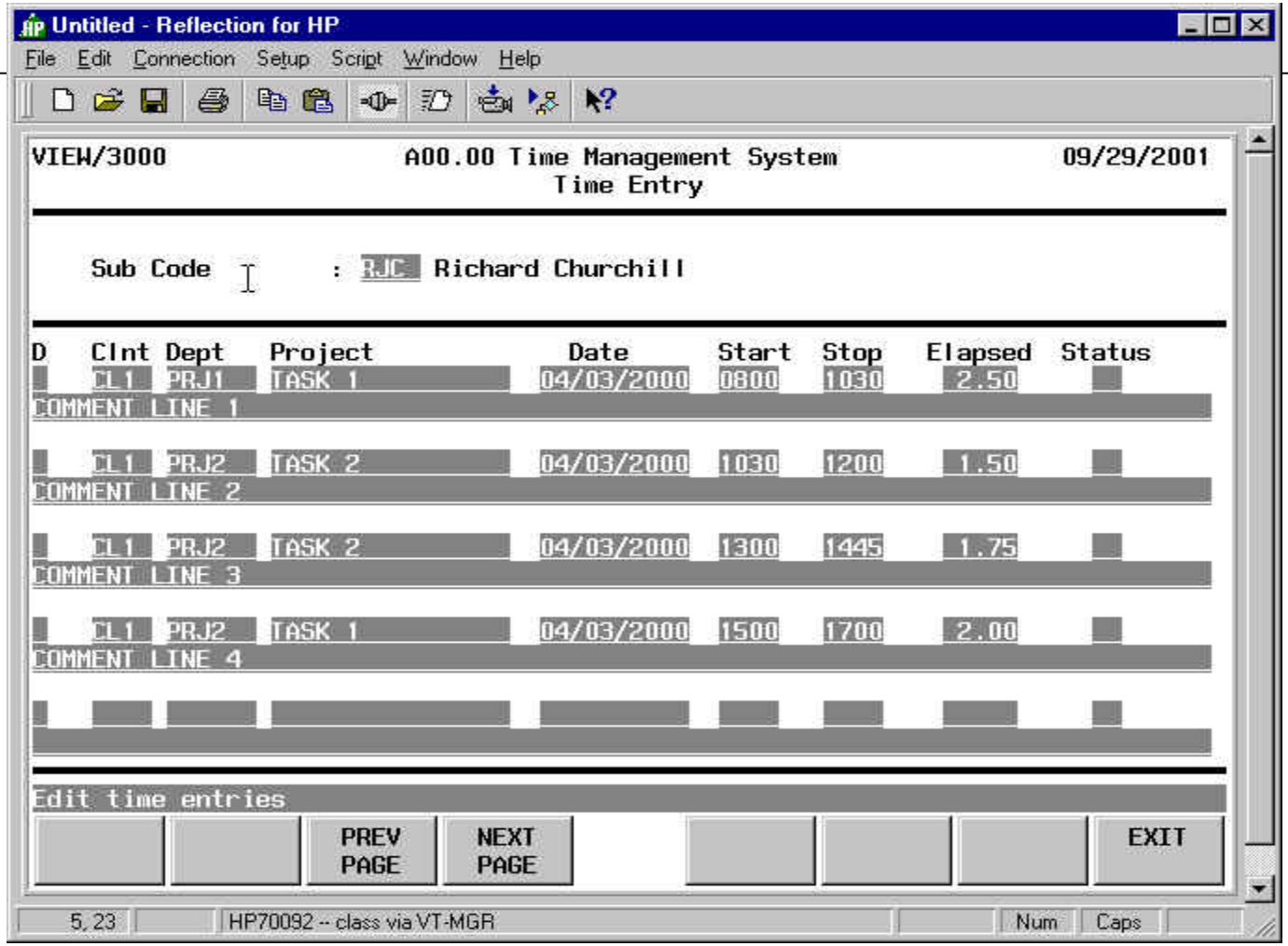
- VPLUS Migration Restrictions
- Translation Options

Section II: Example of a Porting and Migration Toolset

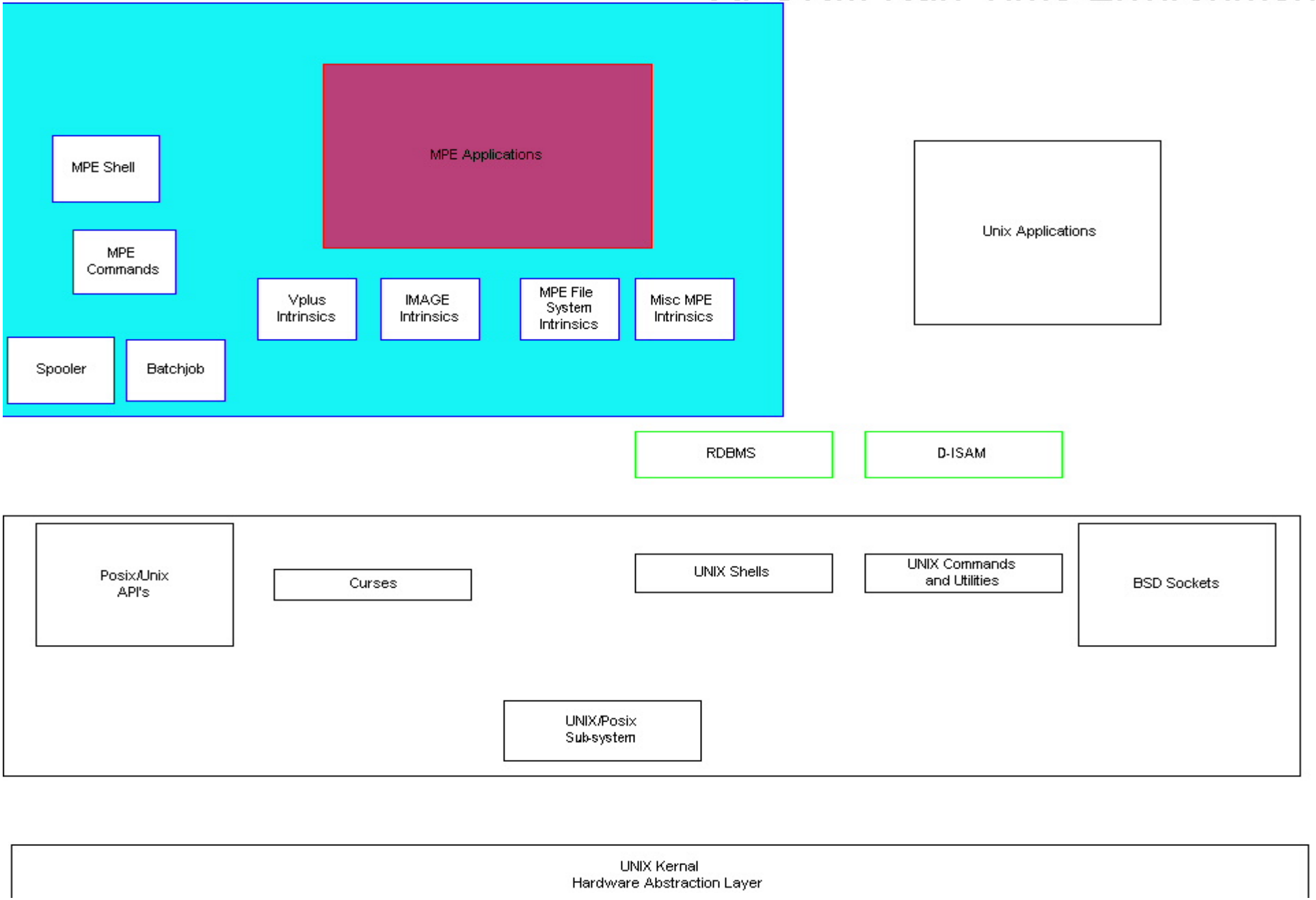
Logon MPE and Run Application



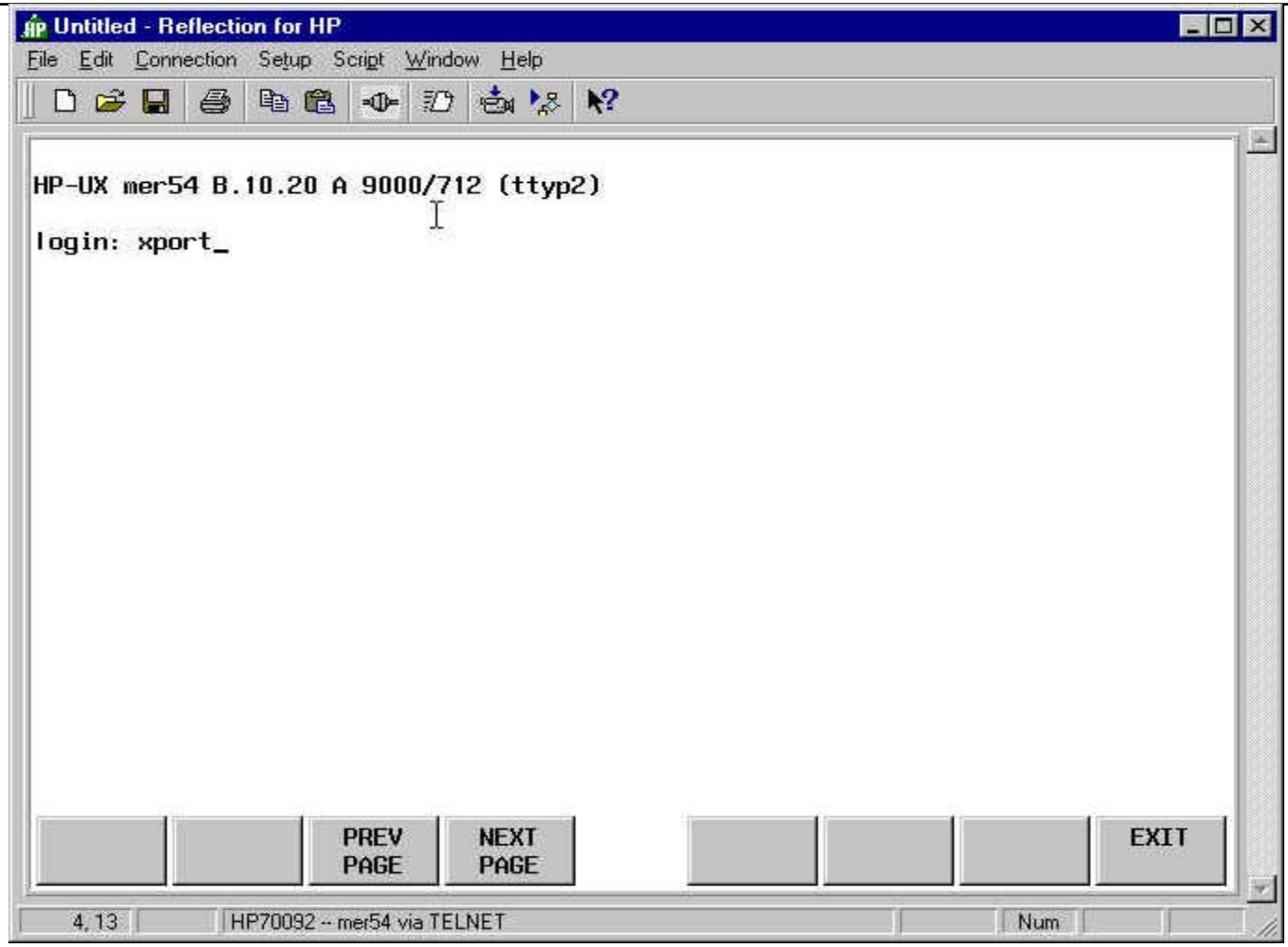
Vplus Form


Untitled - Reflection for HP
File Edit Connection Setup Script Window Help
VIEW/3000 A00.00 Time Management System 09/29/2001
Time Entry
Sub Code : RJC Richard Churchill
D Clnt Dept Project Date Start Stop Elapsed Status
CL1 PRJ1 TASK 1 04/03/2000 0800 1030 2.50
COMMENT LINE 1
CL1 PRJ2 TASK 2 04/03/2000 1030 1200 1.50
COMMENT LINE 2
CL1 PRJ2 TASK 2 04/03/2000 1300 1445 1.75
COMMENT LINE 3
CL1 PRJ2 TASK 1 04/03/2000 1500 1700 2.00
COMMENT LINE 4
Edit time entries
PREV PAGE
NEXT PAGE
EXIT
5, 23
HP70092 -- class via VT-MGR
Num
Caps

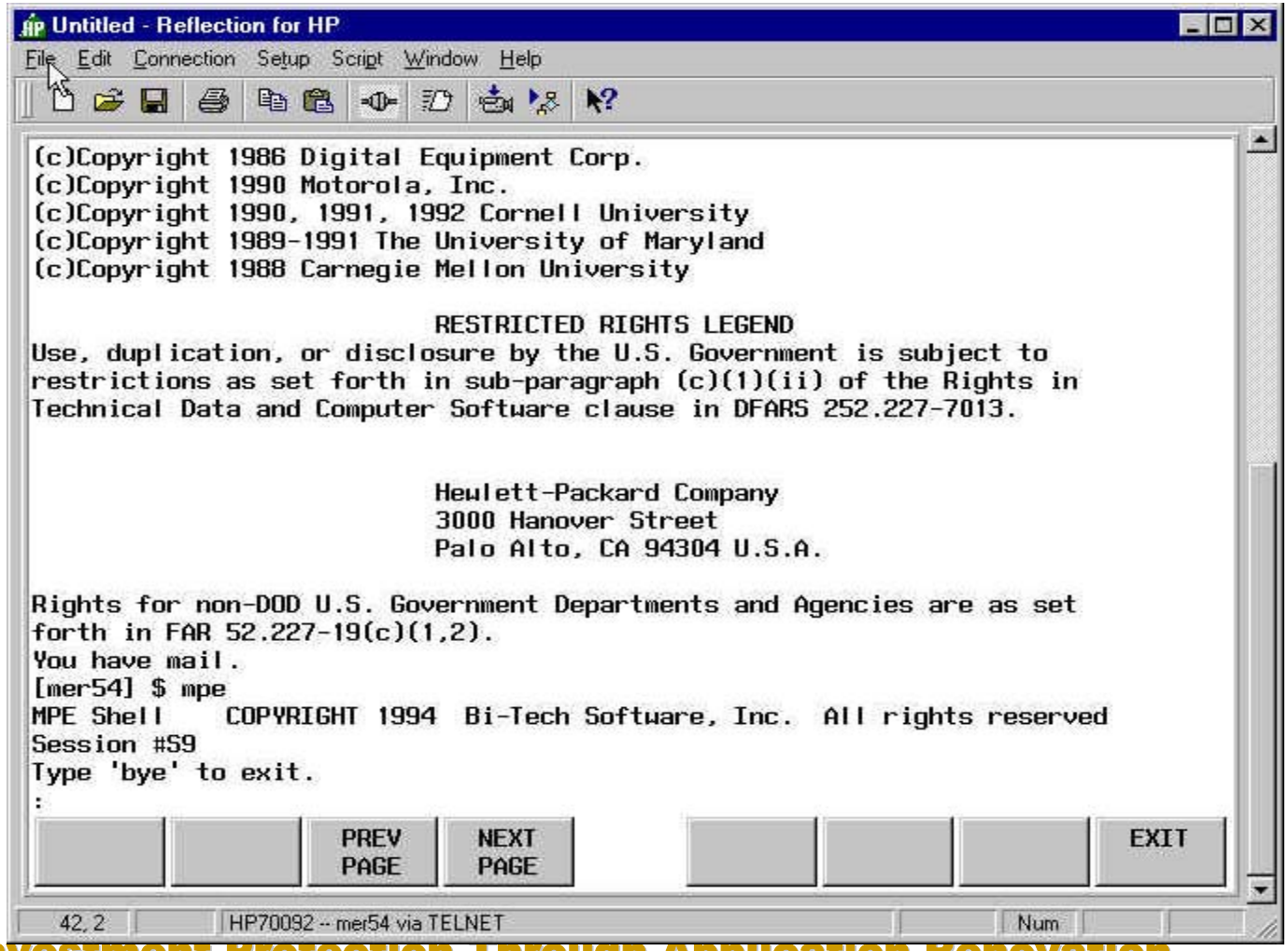
XFORM Run-Time Environmen



Unix Login


Untitled - Reflection for HP
File Edit Connection Setup Script Window Help
HP-UX mer54 B.10.20 A 9000/712 (ttyp2)
login: xport_
PREV PAGE
NEXT PAGE
EXIT
4, 13
HP70092 -- mer54 via TELNET
Num

MPE Shell


Untitled - Reflection for HP
File Edit Connection Setup Script Window Help
(c)Copyright 1986 Digital Equipment Corp.
(c)Copyright 1990 Motorola, Inc.
(c)Copyright 1990, 1991, 1992 Cornell University
(c)Copyright 1989-1991 The University of Maryland
(c)Copyright 1988 Carnegie Mellon University
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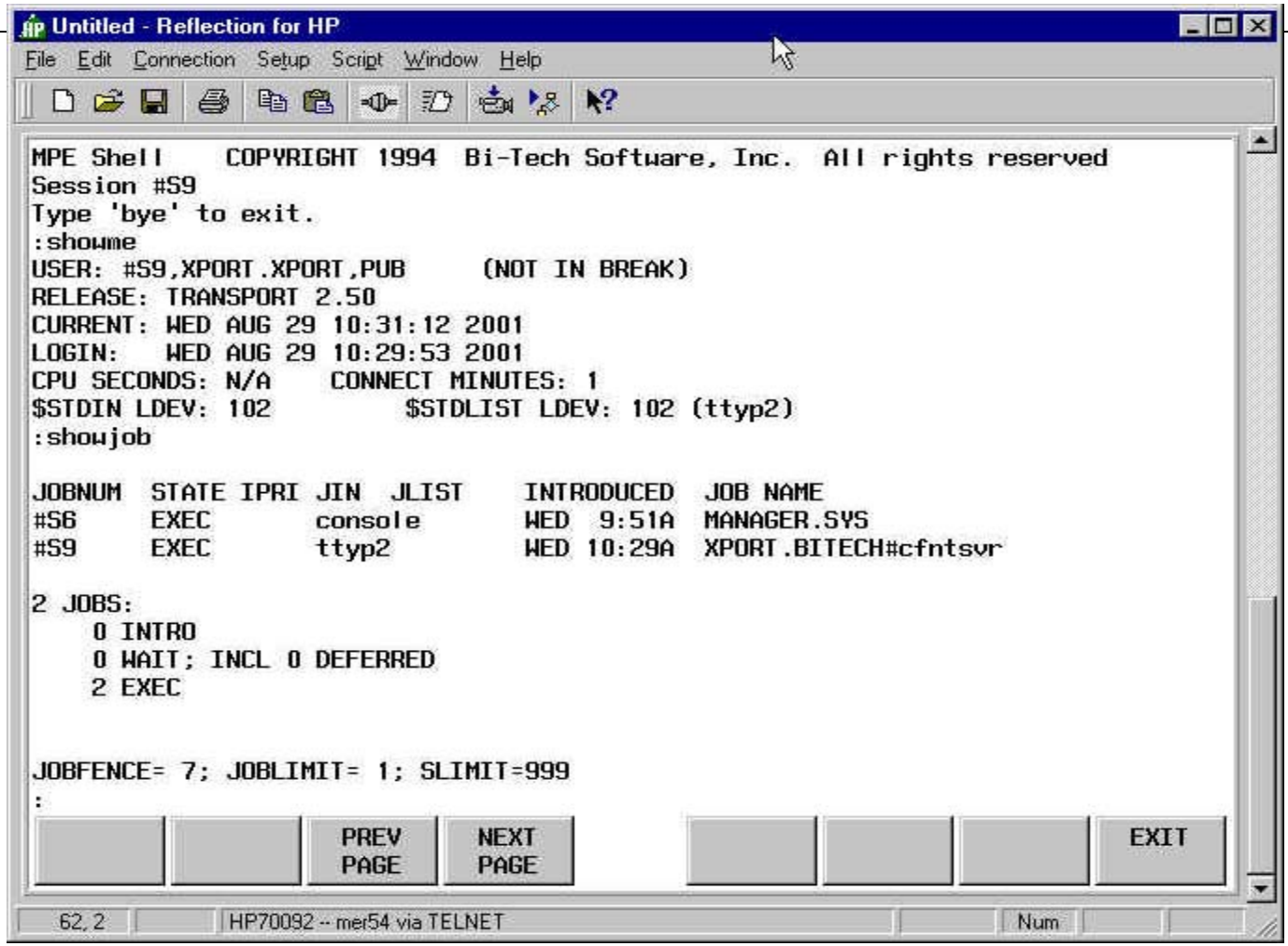
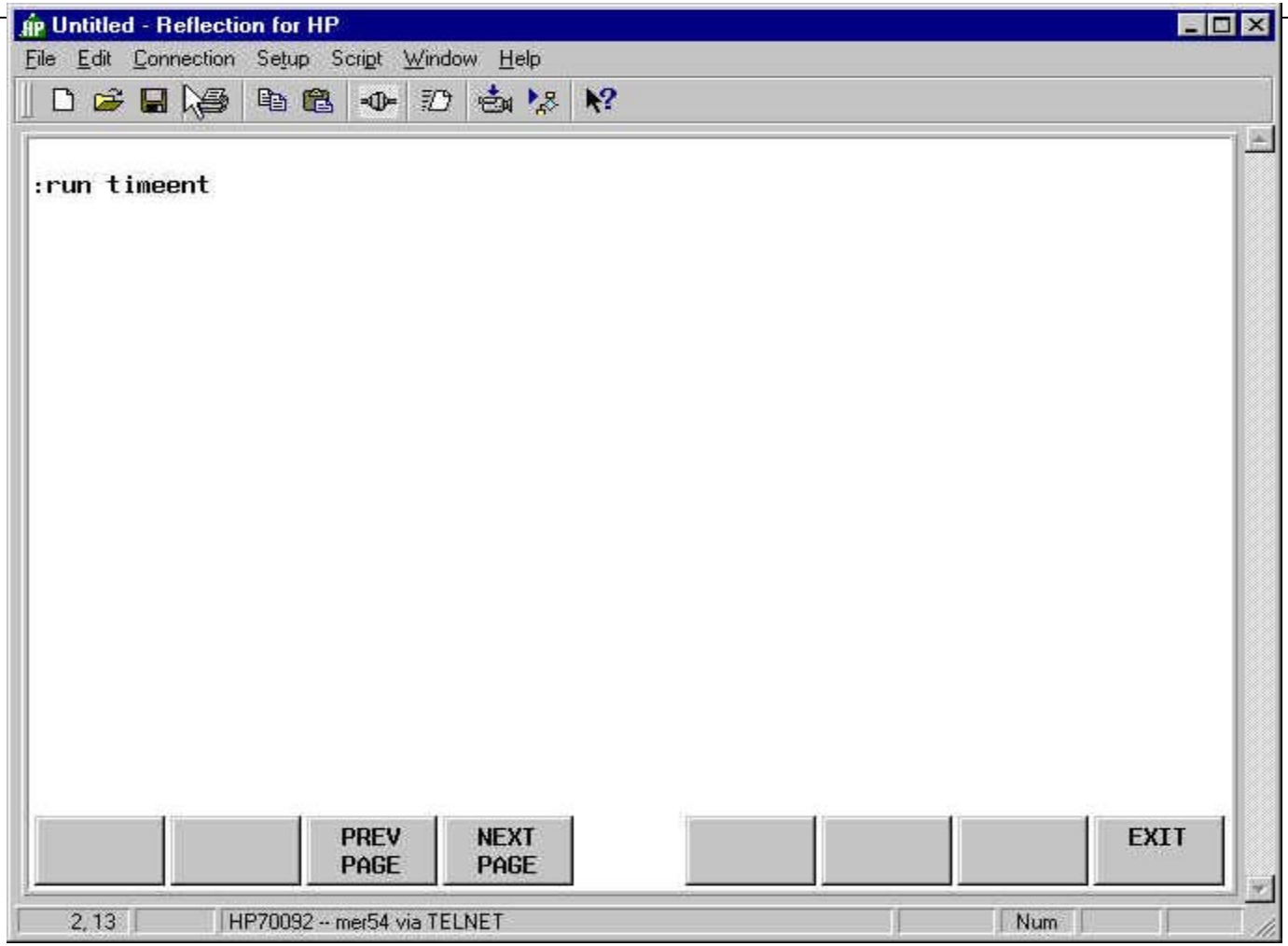
3000 Hanover Street
Palo Alto, CA 94304 U.S.A.
Rights for non-DOD U.S. Government Departments and Agencies are as set
forth in FAR 52.227-19(c)(1,2).
You have mail.
[mer54] $ mpe
MPE Shell COPYRIGHT 1994 Bi-Tech Software, Inc. All rights reserved
Session #S9
Type 'bye' to exit.
:
PREV PAGE
NEXT PAGE
EXIT
42, 2
HP70092 -- mer54 via TELNET
Num

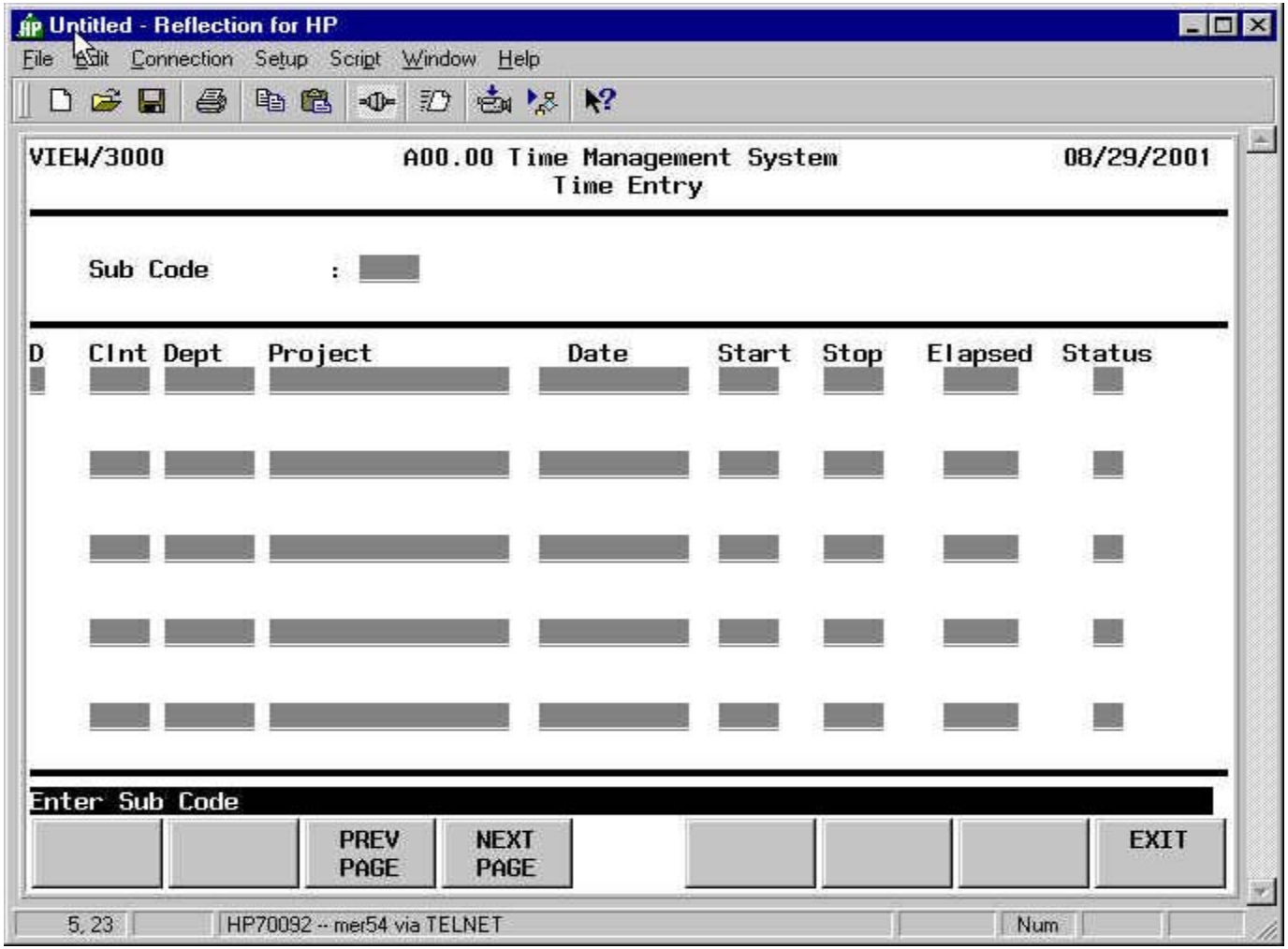
MPE Commands



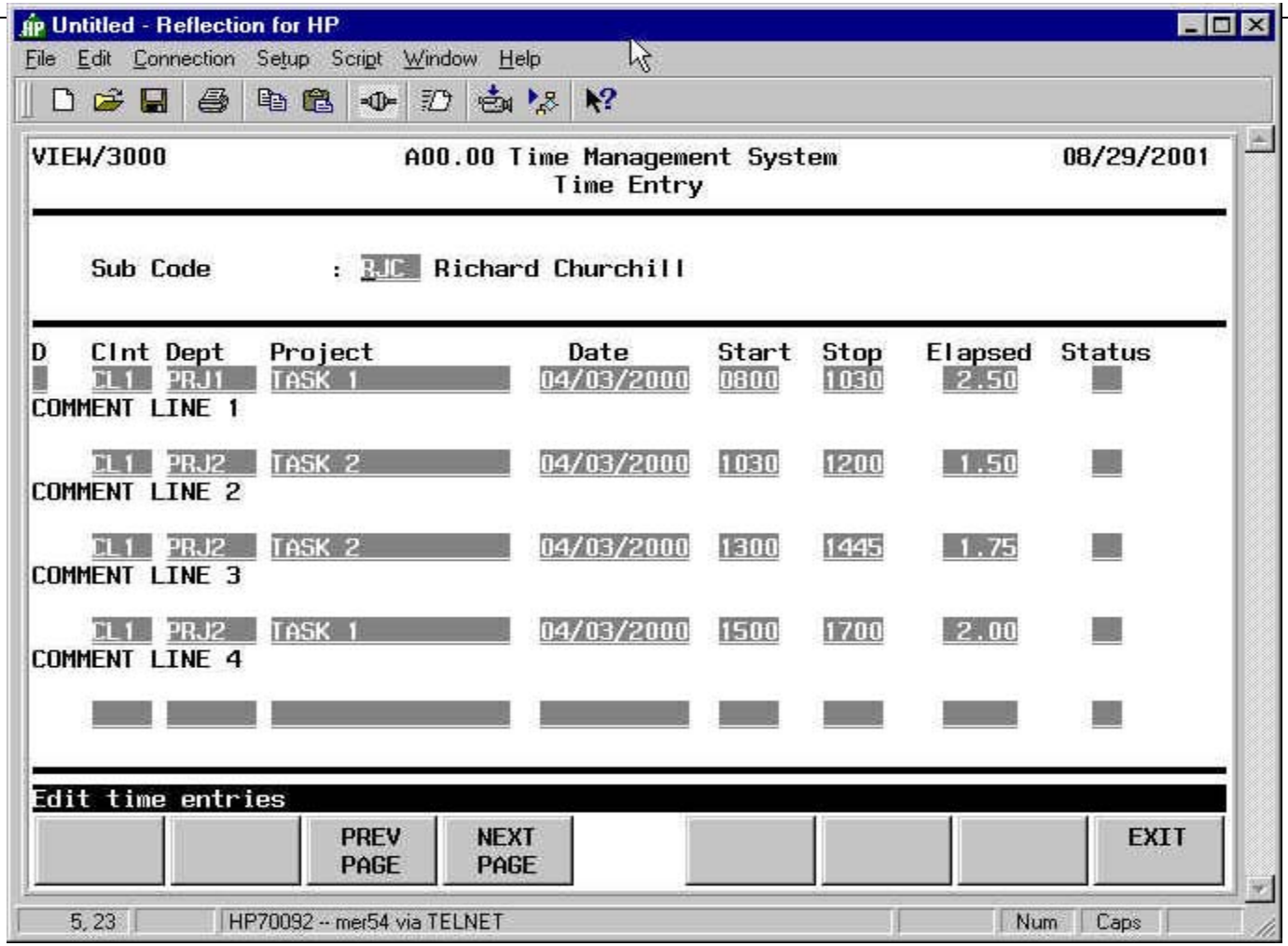
Run Application



Application First Screen



Data Entry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PREV PAGE
NEXT PAGE
EXIT
5, 23
HP70092 -- mer54 via TELNET
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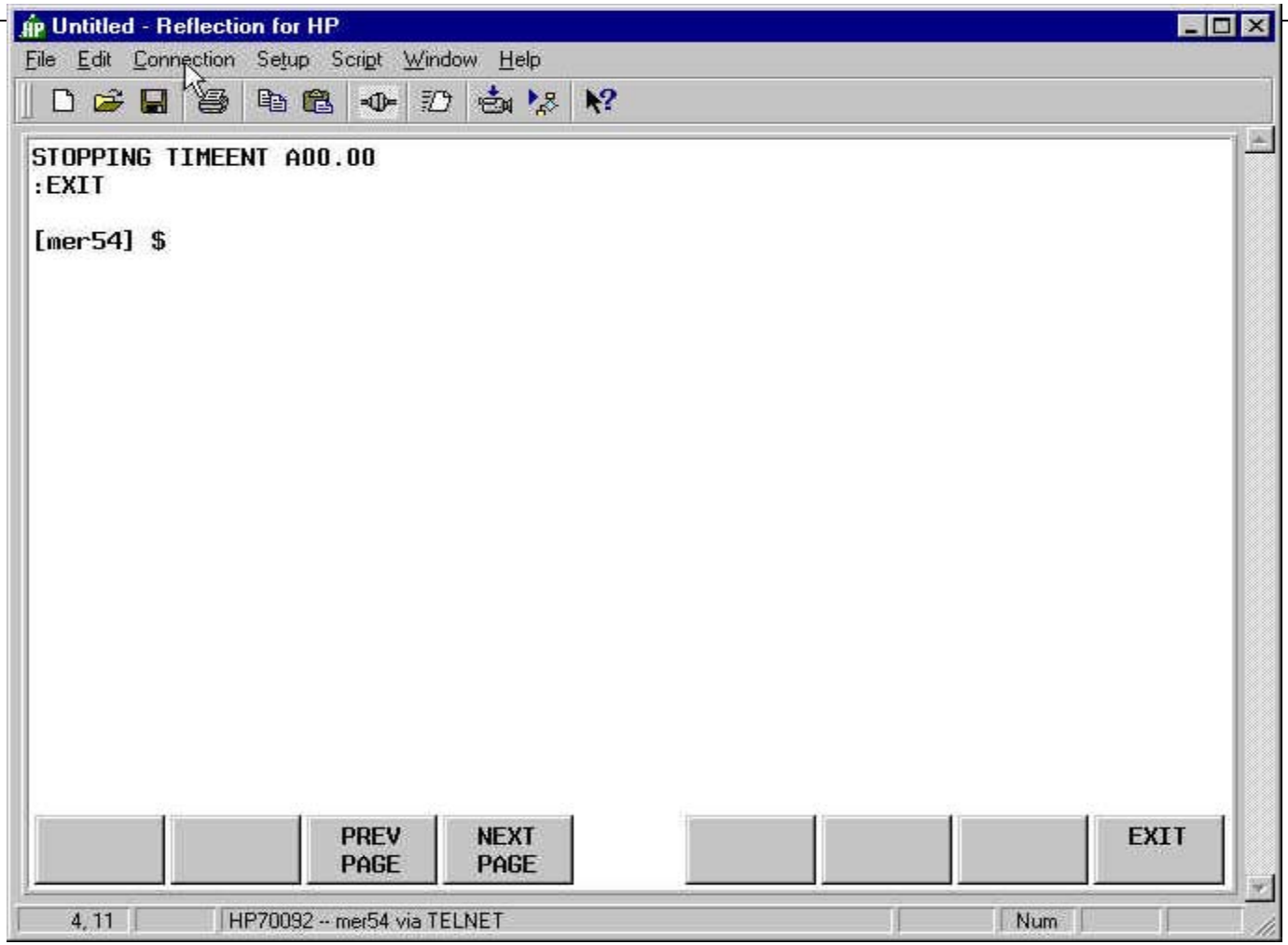
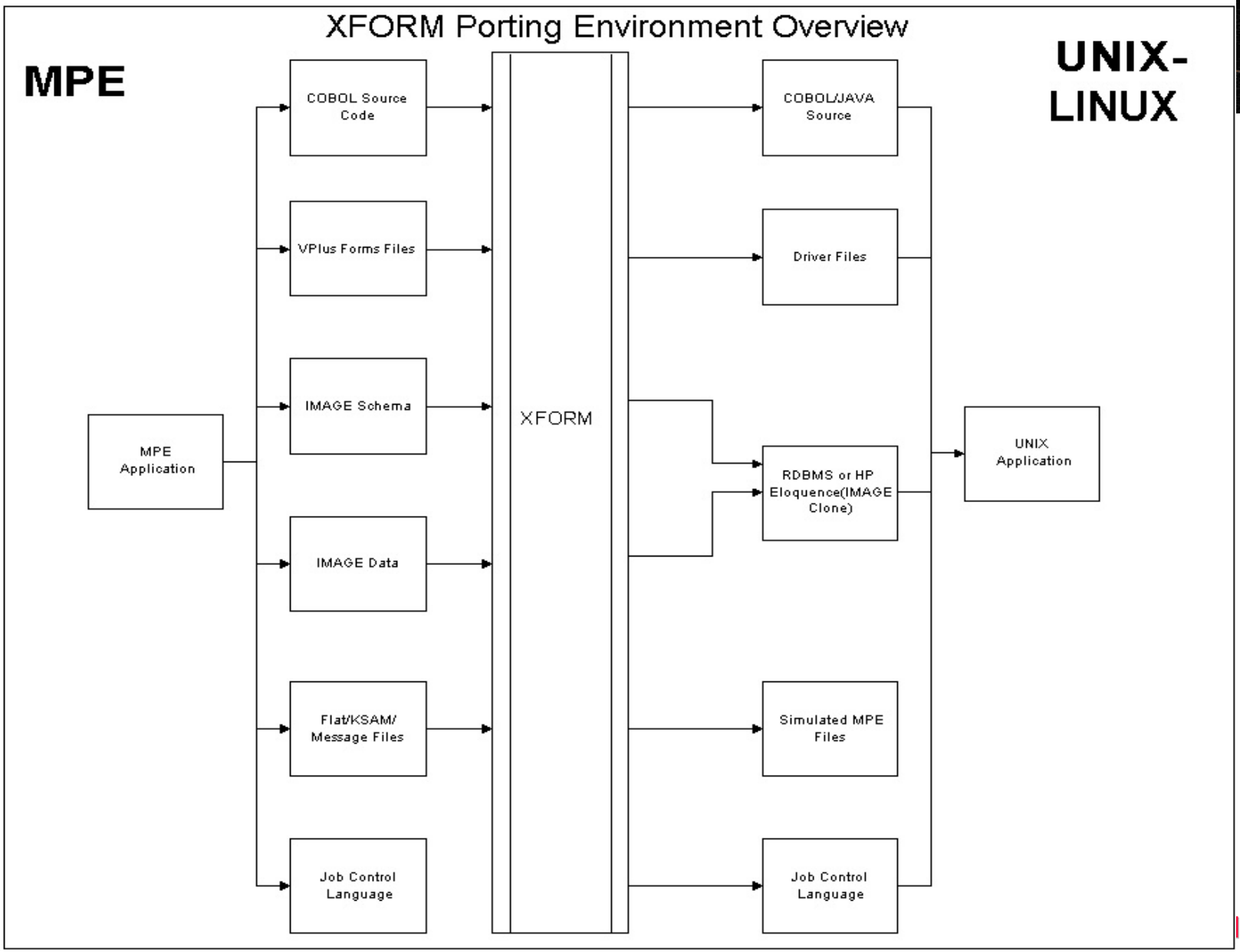
Caps

Exit Transport MPE Shell




XFORM Porting Environment Overview
MPE
UNIX-
LINUX
COBOL Source Code
VPlus Forms Files
IMAGE Schema
IMAGE Data
Flat/KSAM/ Message Files
Job Control Language
MPE Application
XFORM
COBOL/JAVA Source
Driver Files
RDBMS or HP Eloquence(IMAGE Clone)
Simulated MPE Files
Job Control Language
UNIX Application

Porting Process Steps Overview

- Migrate COBOL Copy Libraries
- Migrate COBOL SL/XL programs.
- Migrate COBOL (non SL/XL) programs.
- Migrate VPLUS forms files
- Migrate IMAGE databases.
- Migrate IMAGE data
- Migrate ASCII Flat Files.
- Migrate BINARY Flat Files.
- Migrate Error Catalogs.
- Build Message (MSG) Files (if required).

"Process" Commands

- Type XCOBOL to convert COBOL
- Type XVIEW to convert VFORM files
- Type XMACRO to expand Macros within Cobol files/libraries

Utilities

- Type XCOPY to copy filesets
- Type XSCAN to scan a fileset for a particular string
- Type XPURGE to purge filesets

HP3000 Transport Support Files

- **Used by XCOBOL during the migration process.**
  - ***DONTPORT.README.UNIX - names of the programs/files, which are not to be ported.***
  - ***INTRINSI.README.UNIX - list of the intrinsics, their status and parameters which are currently supported by Transport.***
  - ***Reserved.README.UNIX - the reserved word list which is used during the conversion process to determine the end of parameters etc.***

HP3000 Transport Support Files

- ***LPNAMES.README.UNIX - list of available printer device filenames (mnemonics) that are used in the SELECT statements of the application being migrated.***
- ***Notes.Pub.UNIX -any errors which are encountered during the XCOBOL process are returned to this file.***

UNIX Transport Utilities

- Tar - used to read/write to tape.
- MPE - 'front end' to command intrinsics to allow supported MPE commands.
- Dbutil - indicates activity on the Informix database created.

UNIX Transport Utilities

- Makecat - convert a migrated MPE file into a catalog.
- Xsql - invokes the SQL interface.
- Remlabel - send files to other applications outside the Transport environment. It is used to remove file labels from the beginning of a file.

Primary Resource Porting Groups

- Migration of COBOL code, copy libraries and error catalogs
- Migration of IMAGE schemas and data
- Migration of VPLUS forms files
- Migration of supporting flat files

Translation Overall Structure

- Cleansing of MPE source files or data files on HP 3000.
- Transfer of the cleansed files from the MPE to the UNIX environment.
- Recompilation of the migrated code or reformatting and translation of data under the UNIX environment.

COBOL Porting

- Migration of Copy Libraries to UNIX
- Migration of COBOL (non-SL/XL) programs to UNIX
- Migration of COBOL SL/XL programs to UNIX

IMAGE Migration

- Migration of IMAGE Schemas to UNIX
- Migration of IMAGE data to UNIX

Migration of Files

- Migration of ASCII Flat Files to UNIX
- Migration of BINARY Flat Files to UNIX
- Migration of Error Catalogs to UNIX
- KSAM File Migration
- Message File Implementation

KSAM File Migration

- Use binary file migration for KSAM FILES
- Migrate index and data as separate files

Message File Implementation

- 'data' does not need to be migrated to UNIX.
- Created from either within the MPE Shell or from the UNIX prompt.
- To create a Message file from within the MPE Shell, enter:
  - ***BUILD [filename];[file characteristics];MSG***

Run-Time Environment Utilities

- XPORTRC
- BATCHJOB
- ILOCK
- MPESPOOLER

BATCHJOB

- Transport provides a daemon named 'batchjob' to facilitate background processing in the same manner as MPE. The format of the command is:

  batchjob [-d] [-c console] [-q] [-l limit] [-g tmpgroup] [-p printcommand] [-f fence]

MPESPOOLER

- Transport provides a daemon named 'mpespooler' to facilitate spooler processing in the same manner as MPE. This daemon should be launched via the 'etc/rc' script

Commands supported by 'mpespooler'

- SHOWOUT
- OUTFENCE num[;DEV=device name]
- STARTSPOOL <device name>
- STOPSPOOL <device name>
- ALTSPOOLFILE
- DELETESPOOLFILE
- MPELP [-p priority] [-d device name] [-n copies] filename

Section III:

Third-Party Porting Tools

Code Restructuring

- ***Using Common Compilers***
  Using Similar Compilers
  Using 4th Generation Languages
  Hardware Architecture Migration Issues

- **Tools-Based Migration**
  Emulation
  Translation (i.e. BASIC to C)

- **Professional Migration Services**

Introduction

- **Run-Time Library and System Services Emulation**
- **Description of an MPE to HP-UX and NT Porting Toolset**
  - ***The Execution Sub-Environment***
  - ***The User (Operations) Sub-Environment***
  - ***The Development Sub-Environment***
  - ***The Administration Sub-Environment***
  - ***Detailed Description of Porting Tool***
  - ***Requirements and Examples***

Run-Time Library and System Services Emulation

Description of an MPE to HP-UX and NT Porting Toolset

- The Execution Sub-Environment
  The User (Operations) Sub-Environment
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  The Administration Sub-Environment

Detailed Description of Porting Tool Requirements and Examples

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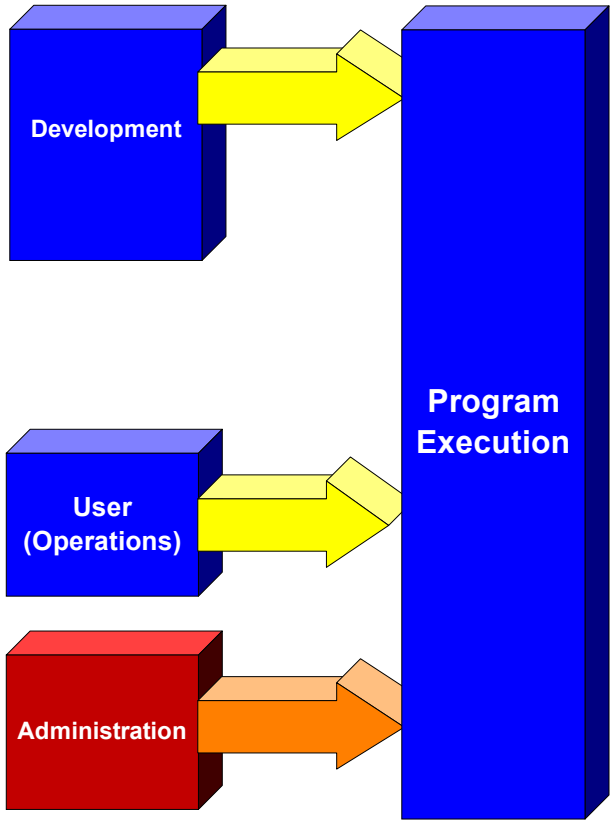

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Commands

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- Mail

The Development Sub-Environment

Editing

3rd GL Compiling

- FORTRAN
- ANSI/C

4GL Development

Linking Programs

The Administration Sub-Environment

Backup

Security

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Transport/RT - API Solutions

Transport/RT - MPE like System Services for UNIX & NT

- Transport MPE like Intrinsic Calls
- MPE Full Device Control
- MPE to UNIX Device & Filename Mapping

Step 3 - API's for NT & UNIX

Replacement of MPE API's

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Transport/ViewEmulator - ***API Solutions***

Transport/ViewEmulator - MPE like VPlus for UNIX & NT

- **Identical programming interface as VPlus**
- **Identical functionality as Vplus**
- **Full HP compatible terminal or terminal emulator required for most apps**
- **Full HP 3000 forms functionality**
- **Adaptable to emulate HP VPlus Library functionality**
- **Full HP 3000 MPE FMS API implementation**

Step 3 - API's for NT & UNIX

Replacement of MPE API's

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Transport/Shell - API Solutions

Transport/Shell MPE like shell for UNIX & NT

- User Shell & Application Shells
- COPY, RENAME, DELETE, BATCH & PRINT etc.
- MPE commands for UNIX and NT
- MPE file spec to UNIX file spec translation
- Integrated RMS, CI interface

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Transport/JSP Solutions

Transport/JSP - MPE like BATCH & PRINT spooler

- Use of Batchjob batch spooling and job management
- Use of MPE Spool for print spooling

Step 3 - API's for NT & UNIX

Replacement of MPE API's

Transformix

Transport/ReFace - API Solutions

Transport/ReFace - VPlus GUI for UNIX & NT

- Identical interface as VPlus
- Identical functionality as VPlus
- Needs HP 3000 style terminal capability list
- Extended keyboard required for most apps
- Client Server ReFace for Windows + Extensions

Transformix

Transport/RMS - API Solutions

Transport/RMS - MPE like RMS for UNIX & NT

- **RELATIVE RECORD, SEQUENTIAL, KEYED**
- **Transport/RMS is KSAM Compatibility Available**
- **No need for file re-organize**
- **NT, UNIX & MPE record locking compliant**
- **Uses either IBM/Informix C-ISAM or Bytedesigns D-ISAM**
- **Separate Index & Data files**
- **Full MPE RMS return status codes**

Transformix

HP-Eloquence - API Solutions

HP Eloquence - MPE like IMAGE for UNIX & NT

- Identical record access services to TurboIMAGE
- Functionally Compatible with TurboIMAGE
- Balances B+ tree, very fast record access
- No need for file re-organize
- NT, UNIX & MPE record locking compliant
- Remote NT client / server file systems
- Separate Index & Data files
- Full MPE IMAGE return status codes
- ODBC Available
- Different API from TurboIMAGE

Transformix

Transport/MPE Extension - API Solutions

HP Eloquence Add-on for UNIX & NT

- Implements IMAGE API for HP Eloquence
- Needed because to maintain HP Eloquence installed base compatibility
- Not an HP product
- Platform independent

Porting Tools

Services Solutions

Project Management

Assessment ***In-house Migration*** ***Complete Migration***

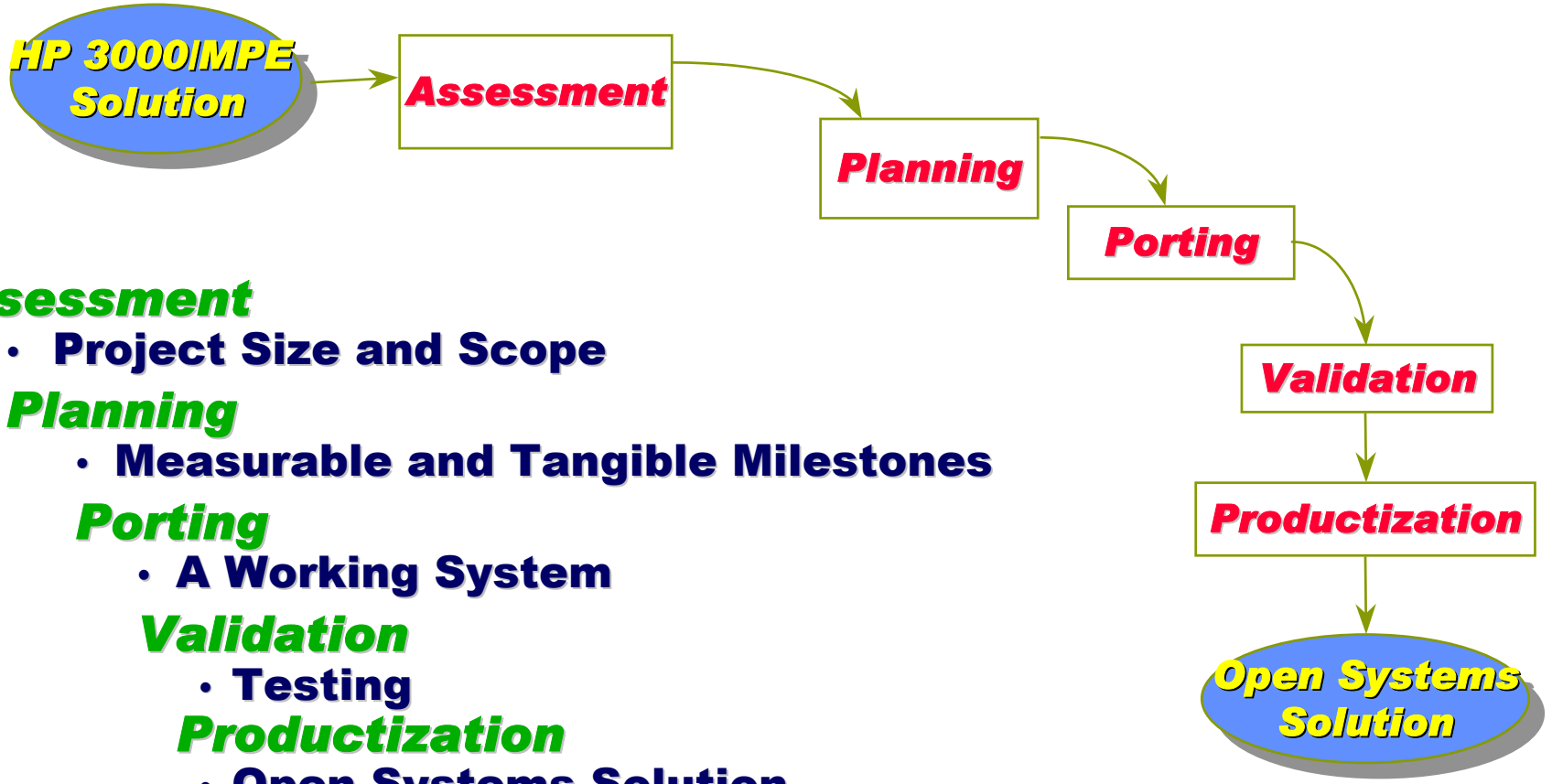
Tool Sets for UNIX and NT

Transport/RT ***MPE like System Services***
Transport/RMS ***MPE like RMS***
Transport/CL ***MPE like Commands (CL)***
Transport/ViewEmulator ***VPlus replacement***
Transport/ReFace ***GUI VPlus***
HP-Eloquence ***TurboIMAGE Clone***
Transport/ODBC ***ODBC for Eloquence***
Transport/DB ***IMAGE to RDBMS***

Transport/COBOL ***Convert HP 3000 COBOL to ANSI***
Transport/BASIC ***MPE BASIC Compiler & C***
Transport/FPT ***Convert HP 3000 FORTRAN to ANSI***
Transport/Cpp ***Convert HP 3000 to ANSI C***
Transport/ViewEmulator ***VPlus to NT Client***
Editor Qedit ***Robelle Qedit***
Job Management ***Batchjob***
Spool Management ***MPESpool***

The Process

The Process



Assessment
- Project Size and Scope

Planning
- Measurable and Tangible Milestones

Porting
- A Working System

Validation
- Testing

Productization
- Open Systems Solution

Strategy Recommendation

Most Desirable Path To Rehost MPE Applications

- Migrate to target computer with minimal changes
- Get system operational as soon as possible
- Postpone User Interface changes until system is on target platform
- Postpone file system and IMAGE/RDBMS changes until system has been ported
- Reduce migration complexity

Conclusions

Rehosting is practical if done in small steps

Tools are available to help you port applications to UNIX or NT with few changes use them

The most difficult aspects of migrations are testing and project management be realistic about those tasks and hire help if you need it