**Portable Systems Group**

**NT OS Base Product Contents**

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*Original Draft 0.0, September 19, 1990*
*Revision 0.1, September 25, 1990*
*Revision 0.2, October 2, 1990*
*Revision 0.3, October 15, 1990*
*Revision 0.4, October 18, 1990*
*Revision 0.5, October 30, 1990*
*Revision 0.6, November 27, 1990*

## 1. Introduction

This document describes the NT Base group deliverables for the **NT OS** for four product releases:

o   beta testing SDK kit for RISC and 486

o   retail product for MIPS and 486 workstation (includes retail SDK kit).

o   retail product for RISC, uniprocessor 486, and 486 mutliprocessor servers

o   retail product for 486 workstation which includes MVDM and Win-16 support.

Note that 386 workstations will be supported (B6 stepping and above), but they will not have kernel support for correcting  the deficiencies in i386 memory management.  This deficiency manifests itself by allowing one thread to change the page protection on a page to read-only and having another thread (which is executing a kernel service) write to that page.  The 486 has hardware support to honor page protections in kernel mode.

The Base group is responsible for those portions of **NT OS** which do not include networking or windowing, for example, device drivers, files systems, scheduler, loader.

## 2. Internal development workstation

Allows self-hosting of NT on an NT workstation.  This includes CMD.EXE, compiler, assembler, linker, SLM, editor (MEP), redirector, and other tools.

As the windowing environment will still be under development, a stopgap character mode window driver will be developed which will allow the VGA on the 386/486 and frame buffer on JAZZ to appear as an ANSI terminal device.  This allows character based applications to operate using the graphics device as an output device.  The ANSI terminal emulation will be incorporated into the Windows environment for the SDK release.  This support is described in the document titled _NT Console Interface Specification_.

### 3. Beta testing SDK kit (includes DDK)

The beta testing SDK kit contains the basic features of **NT OS** to allow ISVs and OEMs to begin developing applications and device drivers targeted specifically at Win-32 and/or NT.

### 3.1 API Sets

The following API sets are provided (including necessary header files for C language):

Win-32 Base API - provides the 32-bit interface for integrating with the base operating system.  These APIs are described in the document titled *Win32 Base APIs* and are designed as a logical extension to the Windows 3.0 Base APIs thereby allowing a straightforward conversion of software developed for Windows 3.0.  This same API set is offered on the 32-bit version of Windows.

NT Native API - this is the underlying API set for NT.  It is currently undecided if this API set is formally documented, though certain features may be provided through an "NT Extension" API set.  One such feature which would improve server based applications is asynchronous I/O.  *Issue: if the NT API set is provided, documentation must exist.*

Device Drivers - this is the "public executive" (device helper) API set exposed by NT kernel mode components.  The User Ed group is developing documentation for device driver developers.  The **NT Design Workbook** specifies the device driver model and interface in documents titled *NT OS Driver Model Specification* and *NT OS I/O System Specification*.

### 3.2 Subsystems

The **NT OS** base provides a number of subsystems which act as servers for various applications.  Subsystems operate as user mode processes but may have amplified privileges beyond the client application.  This allows subsystems to manage global state, open key files, and manage critical resources on behalf of its clients.

The following subsystems exist in the **NT OS** base:

o   Session Manager - provides a mechanism to start processes executing images which were developed for a different API environment then the current process.  For example, a POSIX application can "exec" an image which was developed with the  OS/2 API set.  The session manager is describes in a document titled *NT OS Session Management and Control*.

o   Security

o   Local Security Authority - maintains security policy information, including list of privileged users, audit control, and security domain membership. This is described in a document titled *NT OS Local Security Specification*.

o   Security Account Manager - maintains user and group account information as described in the document *NT OS Security Account Manager Protected Server (SAM)*.

o   Loader - provides mechanism for locating DLLs, translating symbol names to executable images, and other DLL related functions.

o   Windows Base  - provide mechanism for maintaining shared state between window processes and groups.  The functionality provided by this subsystem may be moved to the subsystem which provides windows graphic support.

o   Debug - provides dispatching of debug events.  This subsystem is described in the document titled *NT OS Debug Architecture*.

*Issue: Is DOS emulation required on the RISC/PC? How about Win-16 emulation?*

## 3.3 File Systems

o   FAT - supports the FAT file format.  This allows floppy disks to be exchanged between NT and DOS.  The overall file system design is described in the document titled *NT File System Design Note*.

o   HPFS - supports the HPFS file format as defined by OS/2 v1.21.

o   NTFS - supports the NT native fully recoverable file system.  This file system provides enhanced data integrity features to provide basic support for transactions.  The NTFS is described in the document titled *NT Recoverable File System Specification.*

o   CD-ROM - supports the ISO CD-ROM file format.

o   NPFS - supports named pipes.  The named pipe file system is described in the document titled *NT Named Pipe File Specification*.

o   BOOT - supports multiple boot partitions and allows new file formats to be bootable as described in the *NT Boot Architecture*.

## 3.4 Device Drivers

Device drivers provide the necessary logic to bind the I/O functions to a physical device.  **NT OS** supplies the proper mechanisms to allow drivers to be loaded either at system initialization or later once the system is operational.

3.4.1 MIPS R4000 PC drivers:

o   floppy as described in the document _NT Floppy Driver Specification_.

o   SCSI driver with support for disk, CD-rom and tape as described in _NT SCSI Design Note_.

o   serial - western digital part (2 serial, 1 parallel port), supports modems, printers, basic serial devices as described in the _NT Serial Driver Specification._

o   parallel - western digital part, supports printers and basic parallel devices as described in the _NT Parallel Driver Specification_.

o   video - frame buffer as described in _NT Screen Device Driver Design Note._

o   keyboard as described in _NT Keyboard Device Driver Design Note._

o   mouse - in port as described in _NT Mouse Device Driver Design Note._

o   sound

o   EISA support - verification driver to show that EISA functions properly.

3.4.2 Intel 486/MP and uni-processor drivers:

o   floppy as described in the document _NT Floppy Driver Specification_.

o   SCSI driver with support for disk, CD-rom and tape as described in _NT SCSI Design Note_.

o   disk - ST506 EDSI driver as described in the _NT EDSI Driver Specification._

o   serial - Intel 8250 part supports modems, printers, basic serial devices as described in the _NT Serial Driver Specification._

o   parallel  supports printers and basic parallel devices as described in the _NT Parallel Driver Specification._.

o   video - frame buffer as described in _NT Screen Device Driver Design Note._

o   keyboard as described in _NT Keyboard Device Driver Design Note._

o   mouse - in port and serial variants as described in _NT Mouse Device Driver Design Note._

o   EISA support - verification driver to show that EISA functions properly

o   MCA support - verification driver to show that MCA functions properly

## 3.5 Fault tolerance

For systems with battery backed up memory, power fail recovery is supported. This support involves saving volatile hardware registers and caches into RAM during loss of power and restoring the system state when power is regained. At restoration time, all drivers requesting powerfail notification are notified and any I/O operations in progress are restarted by the drivers.

## 3.6 Language support

3.7 MIPS support

o   C compiler for MIPS (from either MS or MIPS)

o   MIPS assembler for R4000 (only runs on RISC/PC)

o   Linker for R4000 (provided by NT/Base group)

o   Debugger similar to symdeb

o   Kernel debugger for device driver ISV's (requires separate host machine, currently running OS/2)

o   C Run time libraries for Win-32 applications

o   Cross development tools for 486 development:

   o   C6.0 compiler

   o   MASM Assembler

   o   Linker for 486 modules. Current plan is for the NT native linker to support both MIPS and 486 OMFs (Object Module Formats).

## 3.8 Intel 486 support

o   C6.0 compiler

o   MASM Assembler

o   Linker for 486 modules.

o   Debugger similar to symdeb

o   Kernel debugger for device driver ISV's (requires host machine, currently OS/2).

*Issue: the kernel debugger should be ported to the Win-32 environment at a minimum and possibly to the Win-16 environment.  Porting to the Win-16 environment provides the least disruption to the target audience.*

o   C Run time libraries for Win-32 applications

## 3.9 Hardware booting support

The following platforms are being utilized for development and/or testing and as such hardware booting support and configuration will be provided.

o   Power PC/RISC (Jazz)

o   Compaq Deskpro-486 (EISA)

For 386 environments, Intel 387 floating point emulation is provided for system without 387 coprocessors.

## 3.10 Installation / Setup

The beta SDK release will have minimal installation / setup support.  This includes support for building a bootable system from a floppy disk kit and copying the appropriate SDK header files and utilities to the hard disk.

## 3.11 Performance utilities

The beta SDK will have basic performance utilities.

o   profiler - provides mechanism to obtain a time sampled PC histogram.  The profiler is implemented like a debugger; no changes are required to the application to enable profiling.  The profiler operates in its own address space and creates profiling objects on behalf of the process being profiled.  When the process completes, the profiler closes the profile objects and analyzes the collected data.  The beta SDK version of the profiler will not be GUI based.  The profiler fucntionality is not currently documented.

o   show system information - shows the current resource usage, active processes, active threads, etc. within the system.  The show system functionality is not currently documented.

## 3.12 Development utilities

CMD.EXE - command interpreter (ported from OS/2) provides basic
    commands (dir, ren, del, etc) and batch script capability.
format - format disks, supports FAT format for floppy, HPFS, FAT, and NTFS
    for hard disks.
chkdsk - check disk, checks disk for consistent file structure and bad blocks
chmode - allows protection on file to be changed
diskcopy - sector based floppy disk copy
diskcomp - sector based disk comparison
du - disk usage by directory
ech - echo string
fcom - compare files (both text and binary)
fcopy - general purpose file/directory copy
fdel - general purpose file/directory deletion
fview - extensible file viewer, views text files, objects, images, etc.
ls - list directory contents
nmake - program maintenance utility
ppr - remote print
qgrep - search for strings in files
sort - sort file contents base on keys
timer - simple execution timer
touch - change file time stamps
walk - walk a directory tree applying command to files and directories
where - locate files in a directory tree
ync - single character batch file prompts (yes, no, continue)
editor (MEP) which utilizes WinHelp

## 3.13 Internal Development Utilities (not shipped with SDK)

cp - copy file to file or files to directory
delnode - delete directory tree
exp - remove deleted files
mv - rename files and directories
rm - make files deleted
slm - source control maintenance facility
t - terminal emulator
undel - undelete deleted files
upd - timestamp based file copy
updrn - timestamp base file copy for directories
xcopy - copy file and directory tree

## 4. Retail Product for RISC/PC (includes an SDK)

The retail product for RISC/PC includes the final version of the components provided in the beta SDK release plus installation/setup features, POSIX compliance and security at the C2 level.

### 4.1 API Sets

Same as beta SDK with addition of POSIX support.

POSIX 1003.1 API - provides the POSIX compliant APIs.  These APIs are defined by the *IEEE 1003.1 POSIX specification.*  The APIs supported are the minimum set required for to obtain POSIX certification, i.e., none of the optional APIs will be supported.

### 4.2 Subsystems

Same as Beta SDK with the addition of POSIX.

   o   POSIX - provides support for all processes executing the POSIX API set.

### 4.3 Device Drivers

Same as beta SDK.

### 4.4 File Systems

Same as beta SDK.

### 4.5 Fault tolerance

Same as beta SDK.

### 4.6 Language support

Same as beta SDK plus the addition of C run time libraries for POSIX applications.

### 4.7 Hardware booting support

Same as beta SDK.

### 4.8 Installation / Setup

Complete installation / setup support including configuration management.  The documentation for installation and system management is currently under development.

o   Architecture dependent kernel routines

o   System configuration / configuration management

o   System management

   o   Error log reporting mechanism.  This is a character mode application that allows error log reports to be generated based on error type, time, and device type.  For example, list all Fatal errors on device Harddisk0 between Jan 1 1990 12:00 and Jan 1 1990 18:00.

   o   System crash dump and analysis utility.  This provides a mechanism to dump the contents of physical memory to a file on the disk in the case of a system crash.  When the system is rebooted, the analysis utility allows the cause of the crash to be analyzed.  In severe cases, crash dump contents may be copied to floppy or tape and sent to product support specialists for analysis.

   o   File backup on SCSI tape.  This utility provides the ability to backup and restore complete volumes or selected files onto tape.

   *Issue: does this need to be SYTRON compatible to provide the ability to read files written on an OS/2 system? How about just supporting TAR format??*

o   Application installation - provides a mechanism to install application software on an NT system.

o   National Language Support (NLS) - provides a mechanism for tailoring an NT system to a specific language environment.

o   Shutdown - allow orderly shutdown of the system as a reasonable alternative to Ctrl-Alt-Del.  The shutdown mechanism flushes file caches, terminates network connects, and does an orderly shutdown of the system.

## 4.9 Security

**NT OS** provides security features to allow the base operating system to be certified at the C2 level (discretionary access control) for the first product release, and eventually at the B1 level.  In order to gain certifications certain features and utilities must be present in the system to allow the detection and analysis of break-in attempts and suspected attempts.  In addition, a mechanism must be provided to allow users to display and manipulate security information on objects, most notably files.

The following components are provided to support security:

<u>User Interface:</u>

> User Account Manager - This utility is based upon the LAN Manager 3.0 User Account Manager utility.  It includes minor extensions to support administration of Security Account Manager concepts that don't exist in LAN Manager.

> Local Security Manager - This utility allows the security parameters of each NT system to be administered.  This is a new utility with no corresponding LAN Manager functionality.  This utility will utilize the Local Security Manager DLL described below.

> Win32 Logon User Interface - This is the user interface presented at logon time.  It collects the user name and password and prevents password stealing by unauthorized processes.  This UI is projected by the Win32 logon process described below.

> Win32 File Browser extensions - The Win32 File Browser will be extended to support security by:
>
> > - Displaying security of files and directories upon request.
> >
> > - Allow modification of file and directory protection and auditing requirements (using the Object Security editor DLL described below).
> >
> > - Allow modification of file and directory owner values.

> The Win32 Shell will allow a user to establish security *personas* and to modify the user's active security persona.  This will allow the user to perform actions such as changing default protection or enabling and disabling privileges.

> Some aspects of installation will deal with establishing the customer's mode of operation (secure or non-secure) and collecting security parameters, if running securely.  A secure system may also have to convert a LAN Manager UAS database to a Security Account Manager database.

> Some aspects of configuration control will deal with the security attributes associated with components of the configured system.  For example, protected subsystems, such as the NT Session Manager, may be assigned privileges to be run with.

<u>Runtime Library & Client Stubs:</u>

Runtime Library routines will be included for the manipulation of security data structures, such as access control lists.

Client RPC stubs will be included for Security Account Manager services, making the security Account Manager a network-wide service. This allows administration of security accounts from remote nodes.

Client RPC stubs will be included for Local Security Authority services, making the Local Security Authority a network-wide service. This allows administration of individual system security from remote nodes.

Executable Images And DLLs:

Security Account Manager protected subsystem image (sam.exe). This image is run as a native NT protected subsystem. It services user/group account administration requests, as well as user authentication requests. This image will only be run on Domain Controller nodes.

Local Security Authority protected subsystem (lsa.exe). This image is run as a native NT protected subsystem. This image is responsible or maintaining and enforcing all security policy for an individual system, such as what audit messages to generate. This protected subsystem will be active on each NT system.

Win32 Logon Process (w32logon.exe). This image is responsible for monitoring Win32 for logon requests, and processing them when received. It prevents Trojan programs from stealing user passwords. This is a customer modifiable or replaceable module and we will ship the source code for this module. This image will be active on each NT system.

Local Security Manager DLL (lsm.dll). This DLL provides Win32 user Interface screens for administering the local system security. This is implemented as a DLL to allow this functionality to be activated from a number of related UI utilities (such as the security account administrator).

Object Security Editor DLL (objsec.dll). This DLL provides object protection viewing and modification capabilities. It is implemented as a DLL to allow a standard view of object security to be used anyplace it is needed. For example, the file browser will use this DLL for file and directory protection modification and the Security Account Manager will use this DLL for user and group account protection modification.

## 4.10 Performance utilities

Same as beta SDK with a GUI interface to show system information utility.

## 4.11 Development utilities

Same as beta SDK with the addition of UI enhancements to some utilities and the user debugger.

## 5. Retail Product for Servers (RISC, 486 and 486MP)

The retail product for servers includes the retail product components provided in the above product in addition to a more robust networking environment.

### 5.1 API Sets

Same as RISC workstation product.

### 5.2 Subsystems

Same as RISC workstation product.

### 5.3 File Systems

Same as RISC workstation product.

### 5.4 Device Drivers

Same as retail product (both MIPS and 486).

### 5.5 Fault tolerance

o   Disk Mirror - allows files mirroring of disk image on another disk(s) block for block.  While this is implemented as a layered driver, it is listed under file systems.

o   UPS - uninterruptable power systems support

o   Dual controller support ??

### 5.6 Language support

Same as RISC workstation product with the addition of C++ support.

### 5.7 Hardware booting support

The following platforms are being utilized for development and/or testing and as such hardware booting support and configuration will be provided.

o   Power PC/RISC (Jazz)

o   Power PC/486 with EISA bus

o   Power PC/486 with MCA bus

o   Compaq Deskpro 486

o   IBM PS/2 Model 90

o   Power MP/486 - to be determined.

## 5.8 Installation / Setup

Same installation / setup features provided in the RISC workstation product plus the addition of:

o   Disk mirroring management

o   Logical volume management - allows multiple disks to be configured such that they appear as a single drive.

## 5.9 Security

More network based security?  remote admin?

## 5.10 Performance utilities

network performance things?

## 5.11 Development utilities

Same as RISC workstation product.

## 6. Retail Product for 486 workstations

The retail product for 486 workstations provides the support for running Windows 16-bit applications and DOS applications as well as support for 32-bit OS/2 non PM base (i.e., server) applications.

### 6.1 API Sets

Same as server product.

### 6.2 Subsystems

Same as server product plus the addition of:

- o MVDM subsystem

- o Windows 16-bit subsystem

- o OS/2 subsystem

### 6.3 File Systems

Same as server product.

### 6.4 Device Drivers

Same as server product.

### 6.5 Fault tolerance

Same as server product.

### 6.6 Language support

Same as server product.

### 6.7 Intel 486 support

Same as server product.

### 5.8 Hardware booting support

Same as server product.

## 6.8 Installation / Setup

Same installation / setup features provided in the server product plus the addition of:

- o MVDM installation

- o Windows 16-bit installation

- o OS/2 Subsystem installation

## 6.9 Security

Same as server product.

## 6.10 Performance utilities

Same as server product.

## 6.11 Development utilities

Same as server product.