

Portable Systems Group

NT OS/2 Product Description and Implementation Plan

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1. Executive Summary

NT OS/2, here referred to simply as **NT**, is a new operating system product being developed by **Microsoft** which is portable and supports the Windows 32-bit base system APIs, graphical user interface, and window management software.

This document describes implementation plans for the **NT** operating system and contains product descriptions, projected release dates, an overall schedule, a summary of the work items to be performed, and a list of external dependencies.

Development on **NT** actually began approximately two years ago and has progressed to the point where significant system functionality is operational on both 386/486 and MIPS RISC platforms.

In addition to the development of the **NT** operating system, **Microsoft** is also developing a reference implementation for RISC PCs based on the MIPS R4000 microprocessor chip. This hardware architecture will be the main target for the first **NT** product release.

The development and product releases of **NT** will be phased such that new markets are addressed first, followed by high end server markets, and finally the general workstation market.

NT is aimed at the high end of **Microsoft's** systems business and, when running on an 386/486 platform, will share a binary compatible 32-bit programming interface with the low end implementation of the Windows 32-bit operating system environment based on DOS and an extension of Windows 3.0.

On RISC systems, **NT** will provide source level compatibility with the 386/486 versions of the Windows 32-bit operating system environment, and binary compatibility with other RISC systems of the same architecture.

Typically **NT** will service markets requiring larger memories and higher performance (e.g., greater than 4mb and RISC performance levels), whereas the low end system will service markets requiring smaller memories, lower performance, and x86 binary compatibility (e.g, less than 4mb of memory and up to 486 performance).

Currently four major product releases are planned, although it is likely that one of more of these releases will be combined.

The first release of NT is planned as a workstation product that will provide a strong competitor to UN*X based workstations. It will provide the Windows 32-bit operating system environment, a POSIX compliant execution environment, high integrity, robustness, security, and be network enabled as both a client and a server. The primary target for this release is a MIPS based RISC PC, although a 386/486 system will also be developed in parallel and be ready for deployment.

|A major issue that needs to get resolved is whether DOS and/or Windows 16-bit emulation needs to be provided on the RISC platform. Another issue relates to whether the 1003.2 tools need to be delivered with the POSIX environment./

The second release of NT is planned as a scalable performance server product and adds multiprocessor support for 486 systems, LanMan 3.0 functionality, an extensive set of network device drivers, and the full services needed to replace OS/2 1.x as the primary **Microsoft** server platform. Its main marketing goal is to provide strong competitor with Novell for server based systems.

The third release of NT adds full support for 386/486 workstations and includes DOS emulation, Windows 16-bit emulation, OS/2 32-bit Base APIs, and certified C2 security. It will provide a full PC workstation environment.

The fourth release of NT adds support for multiprocessor RISC servers. This release will most likely be combined with the second release if hardware is available for testing and evaluation.

In addition to the planned product releases, an OAK, DDK, SDK, and source porting kit will be available at the appropriate times.

2. Overall Goals

The overall long term goals for the NT project are to:

- o Provide **Microsoft** with a high end Windows 32-bit operating system that is portable, secure, and provides the base technology to compete with UN*X on the desktop, Novell in the network, and provides the advanced features necessary to implement "information at your finger tips".
- o Provide **Microsoft** with a reference implementation of a RISC platform based on the MIPS R4000 microprocessor chip that can be used to facilitate the establishment of standards for the implementation of RISC PCs and servers.

- o Deliver on the above two goals by providing a series of product releases that build functionality, let **Microsoft** address new markets, and provide strong compatibility ties to existing and future low end products.

The specific development goals for NT are:

- o Portability - NT will be written in C and will be portable to RISC, the 386/486, and other architectures. A typical port to a new architecture should take no longer than six calendar months.
- o Security - NT will be designed to have pervasive security and will be capable of attaining the "B" levels of security as defined by the U.S. government. Initially it will be certified at the C2 level.
- o Compatibility - NT will provide a high degree of compatibility with other **Microsoft** systems.
 - Window 32-bit Environment - Binary compatibility with the low end implementation of 32-bit Windows environment will be provided when running on a 386/486 system. On RISC platforms, source level compatibility with 386/486 systems will be provided and binary compatibility with other RISC platforms of the same architecture.
 - OS/2 32-bit Base APIs - Binary compatibility will be provided with the OS/2 2.0 32-bit Base APIs when running on a 386/486 platform. On RISC platforms source level compatibility will be provided.

|OS/2 32-bit Base API binary compatibility is predicated on IBM accepting and implementing all of the NT OS/2 DCRs that were implemented in Cruiser. This includes the image format, structured exception handling, alignment of arguments, and changes to the semantics of muxwait.|
 - DOS and Windows 16-bit Environment - Binary compatibility with DOS and 16-bit Windows will be provided when running on a 386/486 system. On RISC platforms, these capabilities will be provided via software emulation of the 8086 instruction set.

|It is not clear how extensive these capabilities will be. The simplest and most straight forward approach is to only run "clean" APPs that do not

make arcane use of hardware resources. If all APPS have to be executed without change, then this goal becomes more difficult to achieve. Another question is whether network services need to be available to 16-bit environments.

- File Systems - Binary compatible on-disk structures will be provided for the FAT, HPFS, and CD-ROM file systems on both 386/486 and RISC platforms.
- Network - LanMan compatible protocols, redirector, server, and network services will be provided.
- o Multiprocessors - NT will support symmetric multiprocessing and provide scalable performance on 486 and RISC based platforms.
- o POSIX - NT will provide a POSIX compliant IEEE 1003.1 (FIPS 151-1) POSIX execution environment for deployment in the government marketplace.
- o Virtual Memory - NT will provide support for a 32-bit flat addressed virtual environment with demand paging, mapped files, and asynchronous I/O.

The 486 and RISC PC platforms will be fully supported by NT and will provide a robust and high integrity system. The deficiencies in the 386 memory management architecture, however, will not be fully masked and will result in a 386 based system that is less secure and does not exhibit the same level of integrity and robustness as the 486 and RISC systems. In actual practice this should not be a concern and only represents an exposure in a system under malicious attack.

|386 platforms must contain an i386 B6 stepping or above to be supported. Earlier steppings will not be supported and an attempt to boot on such a platform will be rejected by the NT system with an appropriate error message.

3. Major Milestones, Implementation Strategy, and Overall Schedule

Several major milestones are planned on the road to a the first release of an NT product. These milestones lead through a progression of functionality and will increase confidence that the implementation is proceeding according to plan.

Currently NT boots and executes user programs on both 386/486 and MIPS R3000 based DECstation 5000s. However, the network software is not complete, the complete set of development tools are not in place, the implementation of the Windows 32-bit

base system APIs, graphical user interface, and window management environment are just beginning, and the system is not capable of supporting its own development. In addition, the Jazz hardware is not yet available for software development.

The first major milestone is the finalization of the implementation plan, product descriptions, and development schedule. This is expected to occur before the end of the year with the first draft completed by **November 30, 1990**.

The main implementation strategy for NT is to provide a self hosted development environment on NT as quickly as possible. This will provide more testing, force the focus to a stable system that supports its own development, and provide a viable system for ISV and hardware OEM development.

Self hosting will first occur on the 386/486 and be followed shortly thereafter on the Jazz MIPS hardware. The initial self hosted development environment will support network connections to the source code server, character mode development tools, and will require an additional machine for mail and producing word documents.

The target date for self hosting on 386/486 systems is **March 26, 1991** and the target date for the Jazz MIPS system is **April 25, 1991**.

Self hosting with character mode tools will be followed by a windows environment that supports an ANSI terminal window. This will allow the windowing and graphical user interface software to be combined into the system that is running on each developer's desktop.

The target date for a self hosted system on both the 386/486 and Jazz MIPS platforms using the windowing environment is ????.

The next major milestone is a Beta Test SDK that contains a full Windows 32-bit environment on both 386/486 and Jazz platforms. The target date for the Beta Test SDK is ????.

It is envisioned that two major updates to the beta-test SDK will be required before the first real product release. These updates will occur at approximately 3 month intervals.

The target for the first product release is ????.

4. Self Hosted Development Environment

The self hosted development system provides for the development of NT on NT. There are three self hosted system milestones described below.

4.1. ANSI Terminal Based 386/486 Self Hosted System

The 386/486 self hosted system will occur first and will contain following tools and components:

1. A completely functional NT base system with virtual memory, multithreading, process management, image/DLL loader, file system support (FAT and HPFS), and disk driver (ST506).
2. Support for the Windows 32-bit base system API minus the named pipe, sound, and registration APIs.
3. ANSI terminal support for character mode APPs in the keyboard, mouse, and display drivers.
4. A complete C runtime library that uses the Windows 32-bit base system APIs.
5. A command interpreter (CMD.EXE) and the Z-Tools.
6. The source language maintenance utility (SLM).
7. A full screen editor (MEP).
8. The make utility (NMAKE).
9. A native profile utility.
10. A linker that produces executable images and DLLs.
11. An object module conversion utility to convert from the **Microsoft** x86 object format to the COFF format(CVTOMF).
12. The NT system build utility (BUILD.EXE).
13. A LanMan redirector that is capable of communicating with and accessing files and printing on a LanMan 2.0 server.

14. A NetBeui transport.
15. The CFRONT C++ preprocessor.
16. An Etherlink II NDIS driver.
17. A 386/486 C compiler with structured exception handling.
18. A 386/486 assembler.
19. A 386/486 user mode debugger.
20. An OS/2 hosted 386/486 kernel debugger.

The **NT** group will deliver all of these components except the last four items which will be delivered by the **Microsoft** Languages group.

|A schedule commmitment is required from the languages group for support of an NT OS/2 hosted 386/486 C compiler, 386/486 assembler, and 386/486 user mode debugger. |

Four people from the **NT** group will be responsible for pulling together the actual system and verifying its operation over a 6-8 week period. These people are tentatively identified as Bryanwi, Stever, Garyki, and Davidtr. Kylesh from the testing group will be the offical build resource and will be responsible for maintaining the build and maintenance trees.

People developing the MIPS self hosted system will not be able to switch their development environment to the 386/486 **NT** system since they will have to be able to continue to compile on the DECstation 5000 systems which are accessed using TCP/IP.

The target data for the self hosted 386/486 system is **March 26, 1991**.

|A complete set of Windows 32-bit base system API tests should be operatioinal to check out this system. What other tests should be available? |

|A complete set of network aware file tests should be available. |

|File system and file server stress tests should be available. |

|Are there any doucmentation requirements? |

Documentation will be required for installation and a description of the features that are, and are not, available in the various utilities.

4.2. ANSI Terminal Based MIPS Self Hosted System

The MIPS self hosted system implementation will proceed in parallel with the 386/486 self hosted system support but will not occur until after the 386/486 version. It will contain the following additional tools and components:

1. A port of the NT base system from the DECstation 5000 to the R3000 based Jazz system. This requires a new set of device drivers for the SCSI and floppy disks and an update to the original i860 bootstrap code.
2. A port of the NT base system from the R3000 based Jazz system to the R4000 base Jazz system. This requires a rewrite of the trap handling code, an update to the memory management code, and an update to the interlocked operations.
3. ANSI terminal support for character mode APPs in the keyboard, mouse, and display drivers.
4. A port and verification of all the above development utilities and tools to the MIPS environment. This includes the 386/486 C compiler and 386/486 assembler.
5. The MIPS C compiler with structured exception handling.
6. The MIPS assembler.
7. A MIPS user mode debugger.
8. An OS/2 hosted MIPS kernel debugger.
9. A Sonic chip NDIS driver.
10. A port and verification of the redirector and NetBeui transport.

The NT group will deliver all of these components except the 386/486 C compiler, 386/486 assembler, the MIPS user mode debugger, and the OS/2 hosted MIPS kernel debugger which are being delivered by the **Microsoft** Languages Group.

|A schedule commitment is required from the languages group for support of an NT OS/2 hosted 386/486 C compiler, 386/486 assembler, and a MIPS user mode debugger. |

Four people from the NT group will be responsible for pulling together the actual system and verifying its operation over a 6-8 week period. These people are tentatively identified as Markl, Davegi, Tomm, and Larryo. Kylesh from the testing group will be the official build resource and will be responsible for maintaining the build and maintenance trees.

The target data for the self hosted MIPS system is **April 25, 1991**.

Meeting the target date assumes that a MIPS compiler will be available on the DECstation 5000 by **December 1, 1990** that fully supports structured exception handling and a Microsoft C compatible packed pragma.

Meeting the target date also assumes that the R3000 based Jazz hardware will be available for use by the NT software group by **December 1, 1990** and that the R4000 based Jazz system will be available by **February 1, 1991**.

|We will have to decide how to split the source tree for multiple targets within one architecture. Currently this is done via conditional compilation, but the differences between the R3000 and R4000 based Jazz system will be too great to use this methodology. |

|A ported set of Windows 32-bit base system API tests should be available for testing this system. What other tests should be available? |

|A complete set of network aware file tests should be available. |

|File system and file server stress tests should be available. |

4.3. Windows Based Self Hosted 386/486 and MIPS System

The windows based self hosted system adds Windows support for an ANSI terminal window and allows the phase over from the interim ANSI terminal capabilities to a fully windowed system. This system will be supported on both 386/486 and MIPS platforms and will form the development environment for the components and capabilities needed for the Beta Test SDK system.

The Windows based self hosted system will contain the following additional capabilities and components:

1. ANSI terminal support in a window.
2. The GDI subset required for window support.
3. The user window manager.
4. The program manager in the shell.
5. Kernel and DDI level device drivers for the Jazz and 386/486 display, keyboard, and mouse that have the interim ANSI terminal support removed.
6. The resource compiler.

|What other tools and capabilities are needed?|

*|What is the debugging environment for windows apps? Is it 3.1 compatible?
Does it require a separate terminal?|*

*|The 32-bit thunks kit would help the development of Windows 32-bit APPs
before the full windowing environment is available.|*

The target date for the self hosted windows system is **May 1, 1991**.

5. Beta Test SDK

The Beta Test SDK will be a formally packaged system that is distributed to a selected set of ISVs and hardware OEMs wishing to develop device drivers. It will be supported on a selected 486 platform and the Jazz MIPS platform.

It will contain preliminary installation and configuration management software.

Windows based version of user debugger.

DDK and device driver writers guide.

NDIS driver writers guide.

6. Product Descriptions

This following sections contain a detailed description of the various product releases and schedules.

6.1. Power PC Workstation Release

6.1.1 Deliverables

This section contains a description of the deliverables.

6.1.2 Base System

6.1.3 Windows

6.1.4 Network

6.1.5 Schedule

This section section contains the schedule for major milestones.

6.1.6 Dependencies

This section contains the dependencies on other groups.

User-Ed, Testing, Languages, Lan, Windows-32.

6.1.7 Issues

This section contains any issues that need to be called out.

6.2. Multiprocessor Server Release

6.2.1 Deliverables

This section contains a description of the deliverables.

6.2.2 Base System

6.2.3 Windows

6.2.4 Network

6.2.5 Schedule

This section section contains the schedule for major milestones.

6.2.6 Dependencies

This section contains the dependencies on other groups.

User-Ed, Testing, Languages, Lan, Windows-32.

6.2.7 Issues

This section contains any issues that need to be called out.

6.3. Full Workstation Release

6.3.1 Deliverables

This section contains a description of the deliverables.

6.3.2 Base System

6.3.3 Windows

6.3.4 Network

6.3.5 Schedule

This section section contains the schedule for major milestones.

6.3.6 Dependencies

This section contains the dependencies on other groups.

User-Ed, Testing, Languages, Lan, Windows-32.

6.3.7 Issues

This section contains any issues that need to be called out.

7. Product/Major Milestone Descriptions and Schedules

The development strategy that is being followed is to

The next major milestone in the development of NT OS/2 will be the ability of the operating system to host its own development. This is planned to be operational on both the x86 and the MIPS RISC PC in Q1'91.

This milestone will be followed by a beta quality field test SDK that will be available on the MIPS RISC PC and Compaq 486 systems in Q3'91.

The first retail product will be a MIPS RISC PC that supports the Windows 32-bit APIs, is network enabled, provides a robust and secure operating environment, and is capable of competing with UN*X systems. A secondary goal for this product is the support for Compaq 486 systems. The target date for this product is Q1'92.

The second retail product is aimed at providing a robust and secure platform for scalable performance LanMan servers. This release will support multi-processor 486 systems (possibly also MIPS RISC multi-processor systems as well) and will support all the network services and NDIS drivers necessary to compete with Novell on 386 and 486 systems. The target date for this product is H2'92.

The third retail product is aimed at providing a full workstation capability for 368 and 486 systems that is certifiably secure, contains support for DOS and Windows 16-bit applications, and also supports the OS/2 32-bit base system APIs. The target date for this product is sometime in 93.

What products have an OAK? DDK?

8. Project Goals

9. Dependencies

The NT operating system products are dependent on several groups to provide necessary components for the various product releases.

9.1. Languages Group

The NT effort is dependent on the languages group to deliver the necessary programming tools for the 386, 486, and MIPS platforms to support self hosted development.

Programming tools to be supplied by the languages group are split into two groups; those required for 386 and 486 development, and those required for MIPS development. All tools must be ported to the NT environment and run under the NT operating system.

The following is a list of the 386 and 486 tools to be delivered by the languages group:

76. C compiler with structured exception handling.
77. x86 Assembler.
78. Linker capable of producing NT format images.
79. User debugger capable of supporting multi-thread debugging.
80. Kernel debugger capable of supporting multi-processor debugging.

The following is a list of the MIPS tools to be delivered by the languages group:

81. User debugger capable of supporting multi-thread debugging.
82. Kernel debugger capable of supporting multi-processor debugging.

The languages group is also planning to deliver a C compiler for MIPS that supports structured exception handling. However, this compiler will not be available for use in time to support the self hosting of NT development. Therefore, the MIPS C compiler, which also supports structured exception handling, is being ported to the NT environment as a backup.

A linker capable of linking MIPS object modules into an executable image will be provided by the NT Base System group.

The MIPS assembler is being ported to the NT OS/2 environment to support self hosting and product development in assembly language.

C++?? C++ seh??

9.2. LanMan Group

Lan group for UI components, RPC stub compiler and runtime, TCP/IP transport and utilities.

9.3. Testing Group

Testing group for ??

9.4. User Ed Group

NT system services manual - who does?

Driver writers course?

NDIS driver writers course.

Where will the documentation for the MIPS compiler and assembler come from? Who will do?

10. Hardware Plans