

Windows Driver Design Overview

主講人：虞台文

1

Content

- Windows History
- Components of a Driver Package
- Steps in Driver Development
- System Components for Driver Writers

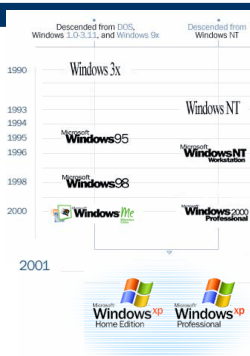
2

Windows Driver Design Overview

Windows History

3

Windows History



4

1985: Windows 1.0



- A **milestone product** – it allowed PC users to switch from the MS-DOS® method of typing commands at the C prompt (C:\) to **using a mouse** to point and click their way through functions, such as **starting applications**, in the operating system.
- Allowed users to **switch between several programs** – without requiring them to quit and restart individual applications.
- Included a set of **desktop applications**, including the MS-DOS file management program, a calendar, card file, notepad, calculator, clock, and telecommunications programs, which helped users manage **day-to-day activities**.

5

1987: Windows 2.0

- Took advantage of the improved processing speed of the **Intel 286 processor**, expanded memory, and inter-application communication capabilities using **Dynamic Data Exchange (DDE)**.
- Windows 2.0 featured support for the **VGA graphics standard**, and also allowed users to **overlap windows**, control screen layout, and use keyboard combinations to move rapidly through Windows operations.
- Many developers started **writing their first Window-based applications for Windows 2.x**.
- Following the release of Windows 2.0 was Windows/386 2.03, which took advantage of the protected mode and extended memory capabilities of the Intel 386 processor.

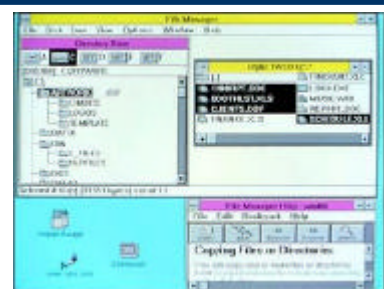
6

1990: Windows 3.0

- Microsoft's first mainstream computing platform offered **32-bit performance**, advanced graphics, and **full support** of the more powerful **Intel 386 processor**.
- Offered a wide range of new features and capabilities, including:
 - Program Manager**, **File Manager**, and **Print Manager**.
 - A completely rewritten **application development environment** with modular **virtual device drivers (VxDs)**, native support for applications running in extended memory, and fully pre-emptive MS-DOS multitasking.
 - An improved set of **Windows icons**.
- The release of a completely new **Windows software development kit (SDK)**, which helped software developers focus more on writing applications and less on writing device drivers.
- Widespread acceptance among third-party hardware and software developers helped fuel the success of Windows 3.0.

7

1990: Windows 3.0



Windows 3.0 featured a new File Manager

8

1993: Windows for Workgroups 3.11

- ⚡ A superset of Windows 3.1, Windows for Workgroups 3.11 added **peer-to-peer workgroup** and **domain networking support**. For the first time, Windows PCs were natively network-aware and became an integral part of the emerging client/server computing evolution.
- ⚡ Windows for Workgroups was used in local area networks (LANs) and on stand-alone PCs and laptop computers. It added features of special interest to corporate users, such as centralized configuration and security, significantly improved support for Novell NetWare networks, and remote access service (RAS).
- ⚡ Windows for Workgroups also offered the performance benefits of **Microsoft's new 32-bit file system**.

9

1993: Windows NT 3.1

- ⚡ The new operating system began with version 3.1 in order to **maintain consistency with Windows 3.1**, which at the time was a well-established operating system for both home and business users.
- ⚡ Windows NT was **geared toward business users** and was initially available in both a **desktop (workstation) version** and a server version called **Windows NT Advanced Server**. The desktop version was well received by developers because of its security, stability, and rich Microsoft Win32® application programming interface (API) – a combination that made it easier to support powerful programs.

13

1993: Windows NT 3.1

- ⚡ The release to manufacturing of Microsoft Windows NT® on July 27, 1993, marked an important milestone for Microsoft.
- ⚡ It completed a project Microsoft began in the late 1980s to **build an advanced new operating system from scratch**.
- ⚡ "Windows NT represents nothing less than a **fundamental change** in the way that companies can address their **business computing requirements**," Microsoft Chairman **Bill Gates** said at its release.

10

1993: Windows NT 3.1

- ⚡ Windows NT was a strategic platform that could **integrate client/server applications with existing Windows-based desktop applications**, or function as a technical workstation to run high-end engineering or scientific applications.

14

1993: Windows NT 3.1

- ⚡ Windows NT was the first Windows operating system to combine support for **high-end client/server business applications** with the industry's leading personal productivity applications.
- ⚡ The operating system broke new ground in security, operating system power, performance, desktop scalability, and reliability with a range of key new features. These included a **pre-emptive multitasking scheduler** for Windows-based applications, **integrated networking**, **domain server security**, OS/2 and POSIX subsystems, support for **multiple processor architectures**, and the **NTFS file system**.

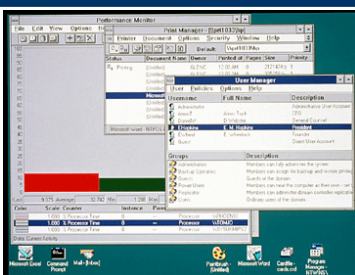
11

1993: Windows NT Workstation 3.5

- ⚡ Windows NT Workstation 3.5 supported the **OpenGL** graphics standard, which helped power high-end applications for software development, engineering, financial analysis, scientific, and business-critical tasks.
- ⚡ The Windows NT Workstation 3.5 release provided the highest degree of protection yet for critical business applications and data. The product also offered 32-bit performance improvements, better application support, including support for **NetWare file and print servers**, and **improved productivity features**, such as **the capability to give files 255-character names**.

15

1993: Windows NT 3.1



Windows NT 3.1 contained overlapping windows and other features similar to Windows 3.1

12

1995: Windows 95

- ⚡ Windows 95 was the successor to Microsoft's three existing general-purpose desktop operating systems—Windows 3.1, Windows for Workgroups, and MS-DOS.
- ⚡ Windows 95 included an integrated 32-bit TCP/IP stack for built-in **Internet support**, **dial-up networking**, and **new Plug and Play capabilities** that made it easy for users to install hardware and software.
- ⚡ The 32-bit operating system also offered **enhanced multimedia capabilities**, more powerful features for **mobile computing**, and **integrated networking**.
- ⚡ In order to keep memory requirements to a minimum, it did not include support for such features as system-level security or Unicode, which came later.

16



1996: Windows NT Workstation 4.0

- ⚡ This upgrade to Microsoft's business desktop operating system brought increased **ease of use and simplified management**, higher network throughput, and a complete set of tools for developing and managing intranets.
- ⚡ Windows NT Workstation 4.0 included the popular **Windows 95 user interface** and improved networking support, providing secure, easy access to the Internet and corporate intranets.
- ⚡ In October 1998, Microsoft announced that Windows NT would no longer carry the initials "NT," and that **the next major version of the operating system would be called Windows 2000**.

17

2000: Windows 2000 Professional

- ⚡ Windows 2000 Professional was the **upgrade to Windows NT Workstation 4.0**, but it was more than just that. Windows 2000 Professional was designed to replace Windows 95, Windows 98, and Windows NT Workstation 4.0 on all business desktops and laptops. Built on top of the proven Windows NT Workstation 4.0 code base, Windows 2000 added major improvements in reliability, ease of use, Internet compatibility, and support for mobile computing.
- ⚡ Windows 2000 Professional also made hardware installation much easier than it was with Windows NT Workstation 4.0 by **adding support for a wide variety of new Plug and Play hardware**, including advanced networking and wireless products, USB devices, IEEE 1394 devices, and infrared devices.

21

1998: Windows 98

- ⚡ Windows 98 was the upgrade to Windows 95. Described as an operating system that **"Works Better, Plays Better,"** Windows 98 was **the first version of Windows designed specifically for consumers**.
- ⚡ Windows 98 enabled users to find PC- or Internet-based information easily, it opened and closed applications more quickly, and it included support for **reading DVD discs** and connecting to **universal serial bus (USB) devices**.

18

2001: Windows XP

- ⚡ Windows XP is a unifying leap forward for desktop operating systems. With the release of Windows XP Home Edition and Windows XP Professional in October 2001, Microsoft **succeeded in merging its two Windows operating system lines for consumers and businesses**, uniting them around the Windows NT and Windows 2000 code base.
- ⚡ With Windows XP, **consumers and home users now have performance, stability, and security that business users benefited from in Windows 2000**.
- ⚡ Windows XP also includes the broad base of application and hardware compatibility of Windows 98 and Windows Me, while adding new tech-support technology, a fresh user interface, and many other improvements that make it easier to use for a broad range of tasks.

22

1999: Windows 98 Second Edition

- ⚡ Microsoft Windows 98 SE, as it was often abbreviated, was an incremental update to Windows 98. It offered consumers a variety of new and **enhanced hardware compatibility and Internet-related features**.
- ⚡ Windows 98 SE delivered an improved online experience with **Internet Explorer 5** browser software and Microsoft **Windows NetMeeting® version 3.0** conferencing software.
- ⚡ It also included Microsoft **DirectX® API 6.1**, which delivered a variety of Windows multimedia improvements, and offered home networking capabilities through Internet connection sharing (ICS).
- ⚡ Windows 98 SE was also Microsoft's first consumer operating system capable of **using device drivers that also worked with the Windows NT business operating system**.

19

2001: Windows XP

- ⚡ Windows XP is available in two main versions, **Windows XP Professional** and **Windows XP Home Edition**, as well as a 64-bit edition, **Windows XP 64-Bit Edition**, for power users with workstations that use the **Intel Itanium 64-bit processor**.

23

2000: Windows Millennium Edition (Windows Me)

- ⚡ Windows Me offered consumers numerous music, video, and home networking enhancements and reliability improvements.
- ⚡ **System Restore** let users roll back their PC software configuration to a date or time before a problem occurred. **Windows Movie Maker** provided users with the tools to digitally edit, save, and share home videos. Microsoft Windows **Media™ Player 7** technologies allowed users to easily find, organize, and play digital media.
- ⚡ Windows Me was **the last Microsoft operating system to be based on the Windows 95 kernel**.
- ⚡ Microsoft announced that **all future operating system products would be based on the Windows NT and Windows 2000 kernel**.

20

2001: Windows XP Professional

- ⚡ Windows XP Professional benefits from the long track record of Microsoft Windows NT technology: **superior operating system performance, including preemptive multitasking, fault tolerance, and system memory protection**.
- ⚡ Windows XP Professional also offers a redesigned interface and includes features for business and advanced home computing, including **Remote Desktop, encrypting file system, system restore and advanced networking features**. It also offers numerous key enhancements such as wireless 802.1x networking support, Windows Messenger, Remote Assistance, and the System Restore feature.

24

Windows Driver Design Overview

Steps in Driver Development

33

Steps in Driver Development

- ⚡ Step 1: Understand Driver and Operating System Basics
- ⚡ Step 2: Determine Device-Specific Driver Requirements
- ⚡ Step 3: Make Driver Design Decisions
 - you should decide which Windows operating systems and hardware platforms your driver will run on, and whether you can modify an existing sample or legacy driver or instead should start from scratch.
- ⚡ Step 4: Build, Test, and Debug the Driver
- ⚡ Step 5: Provide an Installation Package
- ⚡ Step 6: Distribute the Driver

34

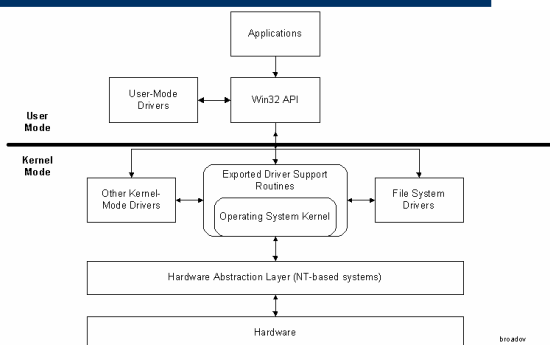
Windows Driver Design Overview

System Components for Driver Writers

35

The operating system includes kernel-mode components and user-mode components.

Operating-System Components

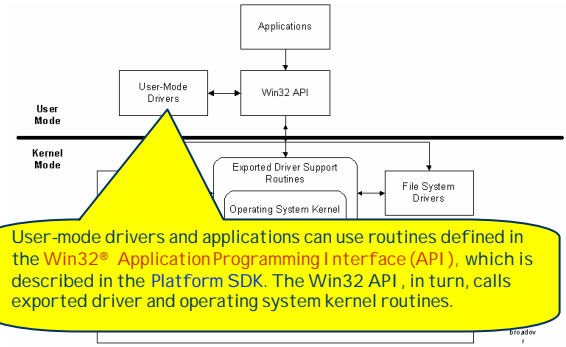


36

The operating system includes kernel-mode components and user-mode components.

User-Mode Drivers

37



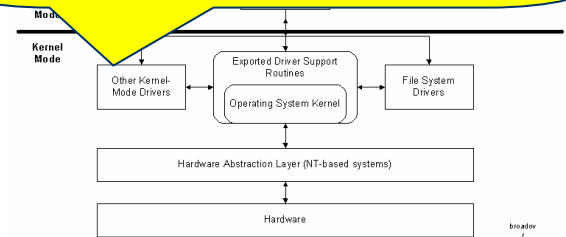
The operating system includes kernel-mode components and user-mode components.

Kernel-Mode Drivers

Kernel-mode drivers can use support routines that are defined and exported by various components of the operating system kernel.

These routines support I/O, configuration, Plug and Play, power management, memory management, and numerous other operating system features.

38



The operating system includes kernel-mode components and user-mode components.

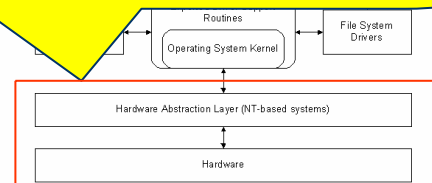
Hardware Abstraction Layer

The NT-based operating system's kernel is designed to be portable and hardware-independent, and thus is layered on top of the hardware abstraction layer (HAL).

The HAL provides hardware-dependent features.

Windows 98/Me does not support this level of hardware independence.

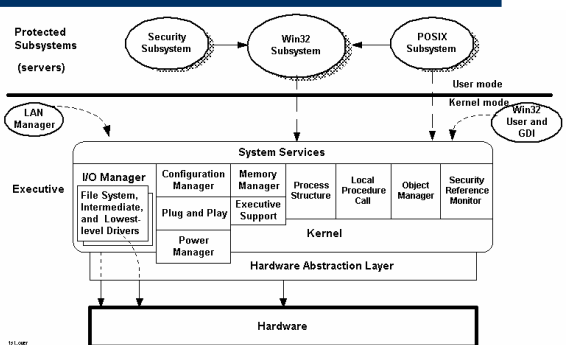
39



The operating system includes kernel-mode components and user-mode components.

Major Internal Components of the NT-based Operating System

40



Device Drivers vs. File System Drivers

- Device Drivers
 - provides I/O services for an underlying device
 - E.g., IEEE1394 **bus driver**, a video **class driver** that manages streaming input data for a variety of video devices, a video **miniclass driver** that communicates with the class driver to support a specific video device, and a **filter driver** that filters the streaming data.
 - Some device drivers – particularly those for audio, video, and print devices – run in user mode, but most run in kernel mode.
- File System Drivers
 - Handles I/O independent of any underlying physical device
 - E.g., FAT, NTFS, CDFS file systems
 - Developing using (*Installable File Systems Kit*) IFS www.microsoft.com/ddk/ifskit.

41

Windows Driver Model (WDM)

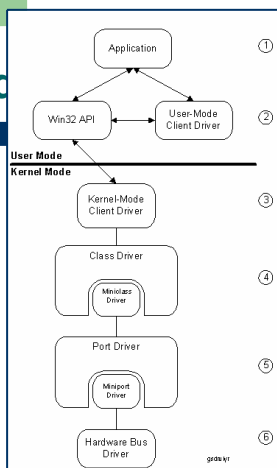
- Any kernel-mode device driver that conforms to the Windows Driver Model (WDM) is considered a WDM driver.
 - Include `wdm.h`, not `ntddk.h`.
 - Be designed as a **bus driver**, a **function driver**, or a **filter driver**, and attached onto the Device Stacks.
 - Support **Plug and Play**.
 - Support **Power Management**.
 - Support **Windows Management Instrumentation (WMI)**.

42

Layered Driver Architecture

43

Layered Driver Architecture



44

Layered Driver Architecture

