

课程代号 WCI - 372

课程标题 Windows Vista 时代的
驱动程序开发

课程内容概述

本讲座将全面介绍在Windows Vista及以后的Windows平台上，如何开发驱动程序以及相关的开发，测试工具，适合有需要的开发、测试团队主管及工程师参加，包括，

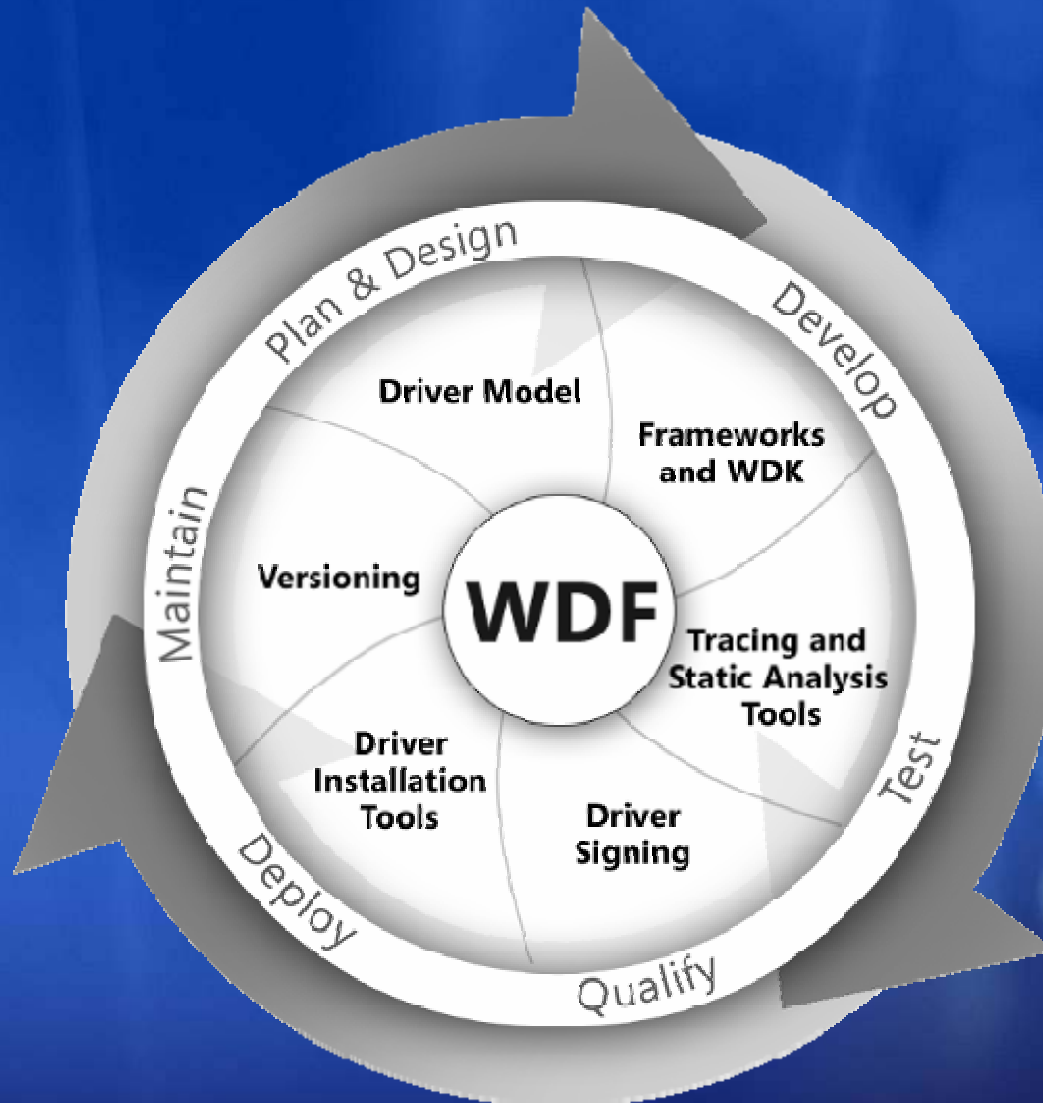
- Vista 时代驱动程序开发介绍 - WDF
- 利用Windows 驱动程序开发包（WDK）工具集来设计、开发、测试、认证、部署驱动程序
- 示例演示

Windows Driver Foundation

Current Windows Driver Models

Device/Driver Classes	Current Model
Display Adapters	Video port
Storage Adapters (SCSI & ATA)	Scsiport, Storport, ATAport,
Network Adapters	NDIS
Video Capture	AvStream
Audio Adapters	AVStream, PortCls
File System filters	FS Mini filter
Printers	UniDrv
Scanners,Cameras	WIA
PCI, PC Card, generic filter drivers	WDM
Modems, Cable Modem	WDM & NDIS WDM
Biometric Devices	WDM
Smart Card Devices	WDM
Keyboard/Mouse Filters	WDM
Legacy Devices (Serial, Parallel)	WDM
Portable Media Players	WMDM
UPnP & Network Connected Devices, Cell Phones	No support
USB, 1394, Bluetooth, SD devices	WDM (kernel), no support (user)
Others	WDM

Windows Driver Foundation- 体验

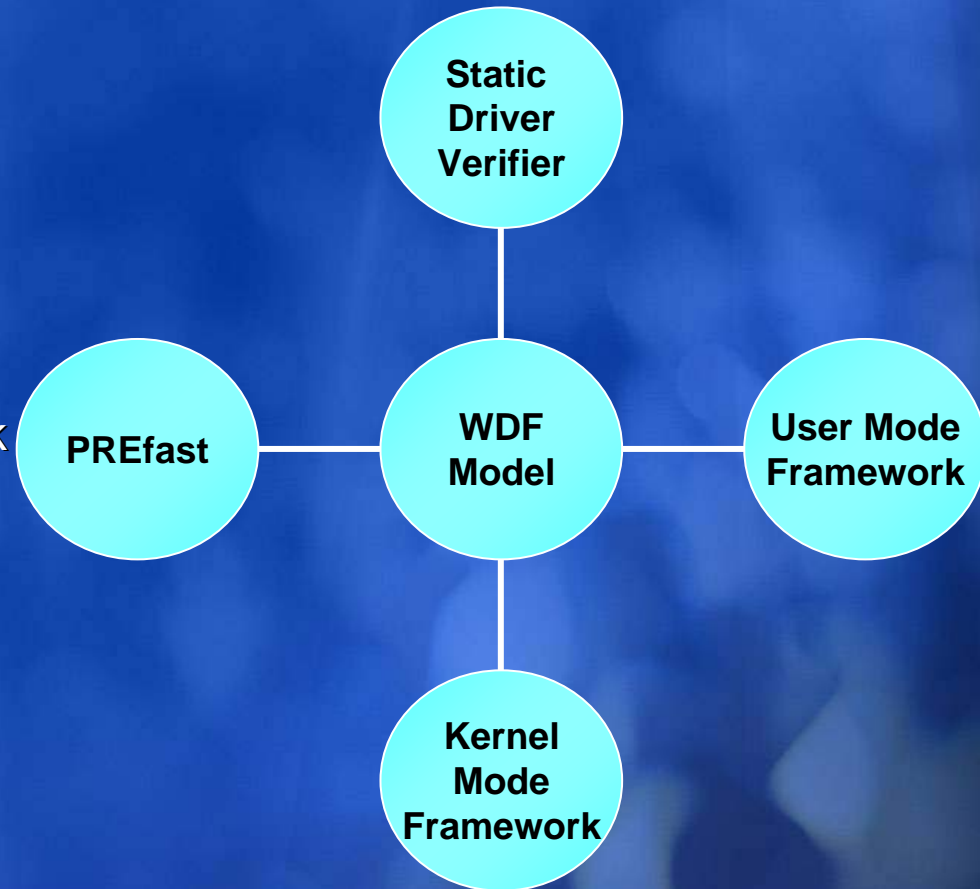


关于WDF

- Windows Driver Foundation (WDF) 是WDM的继任
 - 新的Kernel Mode and User Mode driver frameworks – KMDF and UMDF
- 将影响到驱动开发的整个生命周期
 - 开发工具包 (Driver kit)
 - 测试工具集 (Test tools)
 - 安装工具 (Installation tools)

Windows Driver Foundation

- WDF 是迈向理想的驱动模式的关键一步
- WDF包括
 - 一个模型 (Model)
 - 多个框架 (frameworks)
 - Kernel Mode Framework
 - User Mode Framework
 - Verification Tools
 - Static Driver Verifier
 - PREfast for Drivers



Windows Driver Foundation: 模型

- 一个概念化模型覆盖所有部份 (用户态和核心态) 驱动
- 模型意味着:
 - Object model, object hierarchies, state machines
 - Does not refer to DDIs, data structures etc.
- 注意一个框架结构 (framework) 可能仅仅实现整体模型的一部分
 - e.g., User mode framework will not implement support for Interrupts
- 提供深入和丰富的功能 (不象 WDM)
 - Intelligent defaulting
- 允许使用不同的编成语言实现 (C, C++)
- 允许使用静态分析工具验证代码
- 使用 UMDF (user mode driver framework) 提供驱动程序隔离

Kernel Mode Driver Framework

- 以前被称为“Windows Driver Framework”
- 在核心态实现WDF模型
- 作为WDM之上的库的形式存在
- 支持Windows 2000及以后的版本
- 基于对象（Object based）
- ‘C’ 语言实现
- 支持
 - PNP and Power
 - WMI
 - DMA
 - Requests and Queue
 - IO targets

User Mode Driver Framework

- 在用户态实现WDF模型
- 支持：
 - PnP/PM, Asynchronous I/O, layering
- 不支持：
 - Interrupts, DMA, access to hardware registers, client address space etc.
- 实现语言：
 - C++
- 符合Windows I/O 模型
 - Naming, security, discovery APIs remain the same
- 应用程序使用 Win32 APIs
- 防止驱动崩溃引发的Windows系统崩溃（蓝屏）
- 核心态驱动不能位于用户态驱动的堆栈上
- 在Vista和XP上支持，(2007)在Longhorn和Windows 2003上支持

WDF 设备支持范围: Longhorn (Vista)

Device Class / Driver Model	KMDF	UMDF	SDV	PFD
Modem, CD ROM devices, Keyboard, Mouse	Yes	No	Yes	Yes
SCSI – StorPort	No	No	No	Yes
Display cards	No	No	No	Yes
Ethernet devices	No	No	No	Yes
DSL/Cable Modems	Yes	No	No	Yes
Video Capture devices (Webcams)	No	No	No	Yes
Anti-virus filters	No	No	Yes	Yes
Digital cameras/portable media players/cell phones/PDAs etc	No	Yes	No	Yes
Printers	No	No	No	Yes
Scanners	No	No	No	Yes



2006 中国

案例分析: PCIDRV 范例

Metric	WDM	WDF	Comments
Line Count	13147	7271	Explicit registration of granular event callbacks add to the line count
LOC devoted to PnP/PM	7991	1795	Almost 6000 lines of code is eliminated
Locks	8	3	This is the most important stat. This explains the complexity
State variables devoted to PnP/PM	30	0	This explains that there are fewer paths in the driver and thus less testing and complexity

- 本示例程序针对 Intel E100B NIC 网卡. 原型是一个WDM模型的网卡驱动.

Kernel Mode/User Mode 驱动模型比较

- 什么时候KMDF
 - DMA, Interrupt, requires use of non paged pool, strict timing requirements
 - Access to hardware
- 什么时候 UMDF
 - Software drivers, drivers that just need PNP and IO support
 - Devices on protocol bus (USB-based “Hello Kitty device”)

Feature	KMDF	UMDF
PnP/PM	Yes	Yes
Async I/O	Yes	Yes
Filter support	Yes	Yes
Recovery from failure	No	Yes
Languages	C	C++
Interrupts, DMA etc	Yes	No
Driver Installation	Yes	Yes

相关的驱动开发测试工具

- Static Analysis and Verification of Drivers
 - preFast
 - SDV
- Driver Verifier
 - <http://www.microsoft.com/whdc/DevTools/tools/vistaverifier.mspx>.
 - Design Preview Agreement required
- Driver Test Manager
 - WCI 270/271 – Vista 时代PC/提高硬件驱动质量
- Windows Vista徽标测试 ctcwhql@microsoft.com

The WDK 工具集

- 一个完整的驱动程序工程化解决方案



完整解决方案 - engineering



Signing Tools

Build Lab

Static Analysis Tools

Build Environments



Docs

Windows Driver Framework

Development Team

Samples



Docs

Test Lab

Driver Test Manager

Driver Verifier

Driver Test Framework

Winqual Integration

Signing Tools

Release Team

WDK 文档和范例程序

- 更容易发现所需信息
- 改进的索引、搜索和导航
- 一站式购物
 - DDK, IFS and HCT docs integrated into one doc set
 - Samples are **searchable**
 - Search **multiple** external documentation such as MSDN online and Codezone communities



Windows Vista 编译环境

- 包括创建驱动程序所需的工具，库和头文件
- 新加入的工具：
 - PREfast for drivers
 - Static Driver Verifier (SDV)
 - DIFx tools
 - Windows Driver Framework
 - Windows Driver Test Framework



头文件版本化 (Versioning)

- 用一套头文件编译Windows2000以后不同Windows版本的驱动
- 更容易使用新版系统的高级功能
- 易于发现不同OS间头文件的变化
- 包括用户态和核心态的头文件



Windows Driver Foundation

- 简化驱动的开发
 - Replaces complex boilerplate with frameworks
 - Plug and play and power management abstracted via frameworks
 - Simplifies creating secure and stable drivers
- 快速开发驱动



Windows Driver Foundation

- 通过UMDF可以将部分驱动程序放到用户态运行
- WDF的头文件和库包含在WDK编译环境中
- KMDF和UMDF 范例程序可以在WDK 帮助文件中发现



静态分析工具

- 使得早期发现复杂和难于发现的驱动程序错误成为可能
 - Reduce development time
 - Create more stable and secure drivers
 - Reduce test time
 - Identify critical issues pre-release
- 包括在WDK的工具
 - PREfast for Drivers
 - Static Driver Verifier (SDV)
- 使用 Driver Test Manager (DTM) 自动调用这些工具



Driver Verifier

- 探测更多的错误类型
 - IRP Dispatch
 - Inconsistent MDL structures
 - User-mode addresses and other malformed structures
 - Synch objects in pageable memory
- 易于使用
 - Enable/disable Verifier without rebooting
 - More flexible Low Resource Simulation behavior



Driver Test Manager

- 基于微软用于Windows测试的自动化测试架构
- 对于所有的Windows硬件徽标认证是必需的测试平台



Driver Test Manager

- 改进测试效率
 - Parallel execution
 - Automated scheduling and execution of tests
 - Integrated OS deployment tools
- 集成化测试
 - Use additional Microsoft QA tests
 - Mix and match Logo, Microsoft QA and **your** tests to create a custom test pass
 - Automate tasks such as building drivers, running static analysis and deploying Windows



Driver Test Manager

- 快速容易的客户端安装
- 远程管理
 - Create tests
 - Schedule tests
 - Deploy operating systems to clients
 - Review results
- 更方便的协作特性
 - Easily export tests for use in other labs
 - Export multiple results and logs to a single CAB
 - View exported results in a light-weight viewer



Driver Test Framework

- 开发驱动测试的框架结构
- DTF对于驱动测试如同WDF对于驱动开发一样
- 简化测试开发
 - Enable test developers to focus on device specifics
 - Write better tests in less time
 - Create tests that work across multiple devices and device classes



Driver Test Framework

- 与DTM集成
- 头文件和库包括于WDK编译环境
- 许多DTM徽标测试时构建于DTF之上



Winqual 集成

- 更容易的测试流程
 - Automated selection of tests based on device capabilities
 - Logo Wizard walks you through the process
 - Status indicator keeps you up to date
- 更容易的测试结果提交
 - Automated errata and contingency filtering eliminates uncertainty and improves efficiency
 - Packaging specifically for the simplified Winqual reduces manual processing time
 - Programmatic collection of data eliminates common errors and ensure a successful submission



签名工具

- Authenticode 签名工具被包括在WDK之中
 - Create your own certificates
 - Create your own catalogs
 - Sign your own driver catalogs
- 被 DMI 信任
 - Required to stop install popup
- 被KMCS信任
 - Required to load in Vista x64



驱动安装 (DIFx) 工具

- 简化的驱动部署
- 客户简化驱动安装
- Add on to your app installer to install drivers
- DIFx 工具包含于WDK编译环境中



Header Versioning

- Windows Vista Build Environment Refactoring
http://download.microsoft.com/download/f/0/5/f05a42ce-575b-4c60-82d6-208d3754b2d6/WDK_BE-Refactoring.ppt
- Header Versioning white paper
<http://www.microsoft.com/whdc/driver/WDK/headers.mspx>

Windows Driver Foundation

- Windows Driver Foundation Beta
<http://www.microsoft.com/whdc/driver/wdf/beta.mspx>
- Previous conference content
 - Windows Driver Foundation introduction
http://download.microsoft.com/download/f/0/5/f05a42ce-575b-4c60-82d6-208d3754b2d6/WDK_BE-Refactoring.ppt
 - How to port a WDM driver to WDF
http://download.microsoft.com/download/f/0/5/f05a42ce-575b-4c60-82d6-208d3754b2d6/WDK_BE-Refactoring.ppt
 - How to develop a KMDF driver
http://download.microsoft.com/download/f/0/5/f05a42ce-575b-4c60-82d6-208d3754b2d6/WDK_BE-Refactoring.ppt

DTM Resources

- WDK Docs via DTM Studio
- Support:

China:

CTCWHQL @ microsoft.com

US:

DTMSUPP@microsoft.com

Signing Tools

- White paper titled “Digital Signatures for Kernel Modules on x64-based Systems Running Windows Vista”
<http://www.microsoft.com/whdc/system/platform/64bit/kmsigning.mspx>
- 64 bit and kernel mode
http://www.microsoft.com/whdc/driver/kernel/64bit_chklist.mspx
- Windows Vista Logo requirements
<http://www.microsoft.com/whdc/winlogo/hwrequirements.mspx>

Winqual Integration

- Draft Logo program requirements
<http://www.microsoft.com/whdc/driver/wdf/beta.mspx>
- Windows Hardware and Driver Central newsletter
<http://www.microsoft.com/whdc/newsreq.mspx>

Driver Install (DIFx) Tools

- Driver Install info on the web
<http://www.microsoft.com/whdc/driver/install/default.mspx>
- Driver Install Frameworks tools download
<http://www.microsoft.com/whdc/driver/install/DIFxtls.mspx>

其他资源

- Web Resources
 - Windows Driver and Hardware Central
<http://www.microsoft.com/whdc/default.mspx>
 - WDK Page <http://www.microsoft.com/whdc/driver/wdk/default.mspx>
- “Introduction to the Windows Driver Foundation: Kernel Mode Driver Foundation” Peter Viscarola (A ‘how to’ book for writing Windows Vista drivers) by OSR Press.
September 2005 <http://www.osr.com/wdfbook.htm>

与本次主题有关的Session和活动

- WCI 270 – Windows Vista 时代的PC
- WCI 271 - Vista时代的硬件设备质量认证和持续改善



填反馈表

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