

Microsoft

Advantages and Disadvantages of Development with Standardized Operating Systems

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A Quick Introduction

- Microsoft's Strategy:
*Empower people through great software anytime, **anyplace, and on any device.***

Operating Systems

Applications

Developer Tools

Online / MSN

...

Windows xp

Windows CE

eMerging Technologies

General
Embedded

Pocket PC

MS-TV

Automotive



Standardized Operating Systems

- **Fact of Life in the Desktop, Workstation, and Server world**
- **Clear Trend in the Embedded space**
 - **Functionality is migrating from high-end to real-time operating systems**
 - **Retiring 'home built' operating systems in favor of commercial products**
 - **Moving to more functional OSes vs. μ Kernels**

Driven by the Environment

- **Develop more cheaply and rapidly**
- **Solve the problem faster**
- **Build more complex devices**
 - Multi-function
 - Networked or Bus-based architectures
- **Support more complex applications**
 - Internet access
 - Digital media, advanced compression
 - Wireless data
- **Higher level formats and protocols**
 - XML, HTTP, etc.
- **Faster Hardware**



- ✓ Appliance for Internet music and digital media files.
- ✓ Developed in < 6 months.



- ✓ Internet based remote management
- ✓ Credit-card security
- ✓ Graphical User Interface
- ✓ High Reliability

Citroën Xsara

- ✓ Telematics and Internet Access
- ✓ Navigation
- ✓ CD/Radio/Mobile Phone



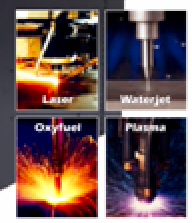
- ✓ Wireless web-browsing
- ✓ Corporate applications
- ✓ Extensive protocol support
- ✓ ~6 months development time



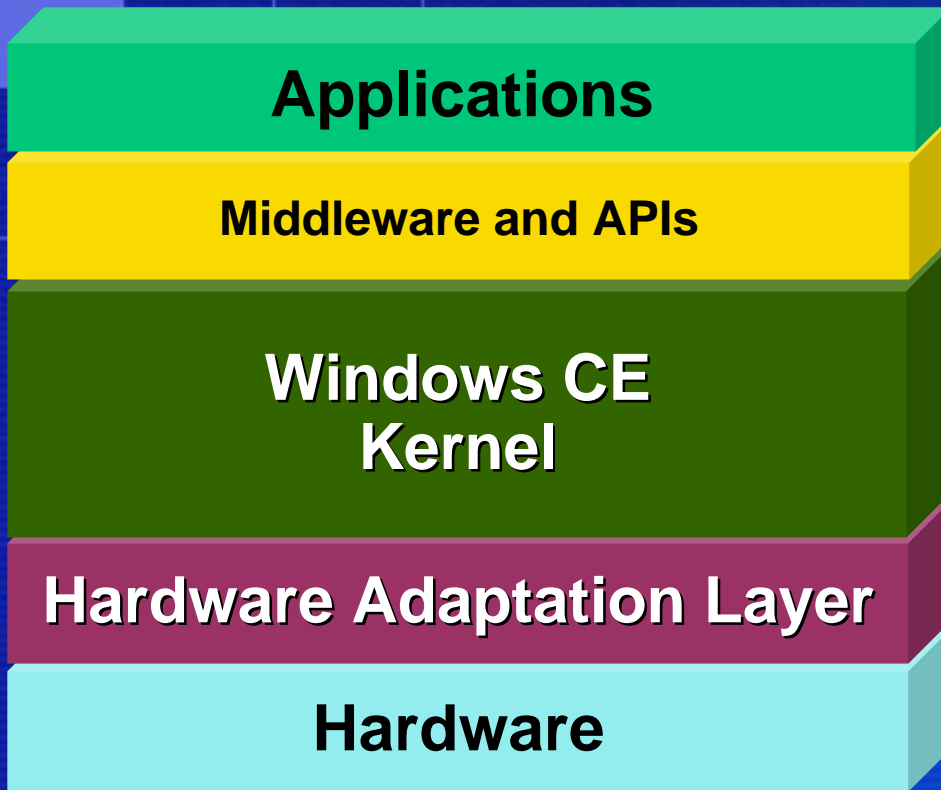
Industrial Control & Robotics



- ✓ Network / Server Appliances



Windows CE Architecture



Examples

Navigation

Real-time position API

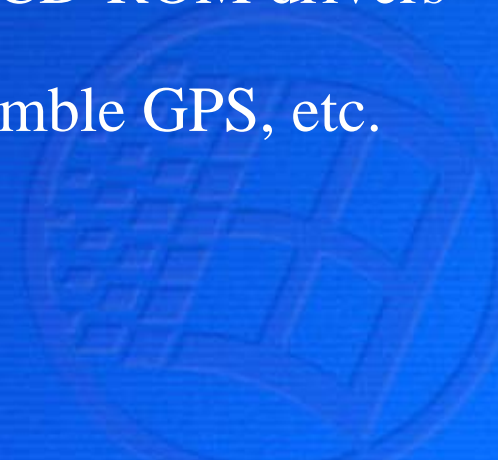
Scheduler

File System

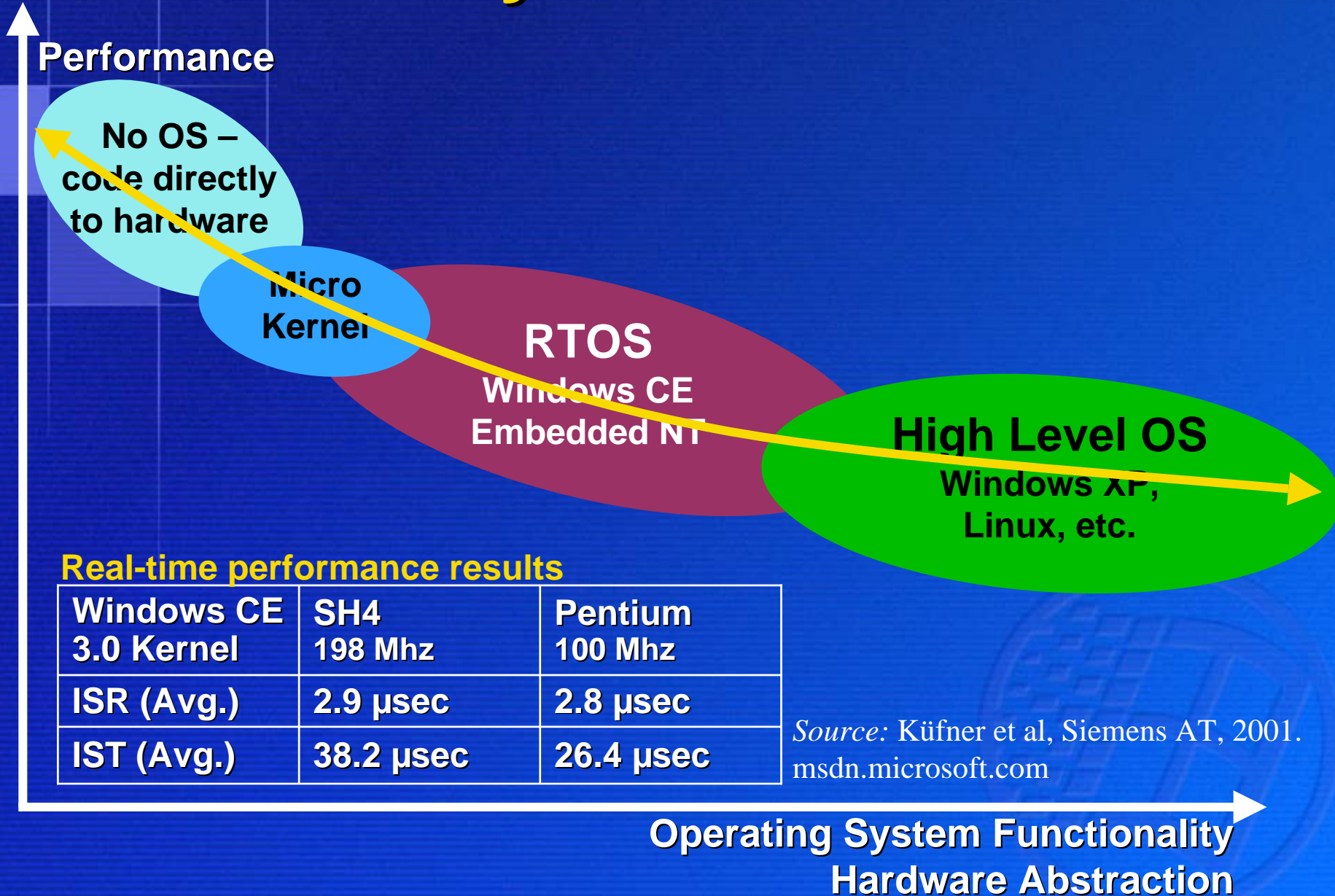
Graphics display subsystem

GPS/Graphics/CD-ROM drivers

SH-4 CPU, Trimble GPS, etc.



Functionality vs. Performance

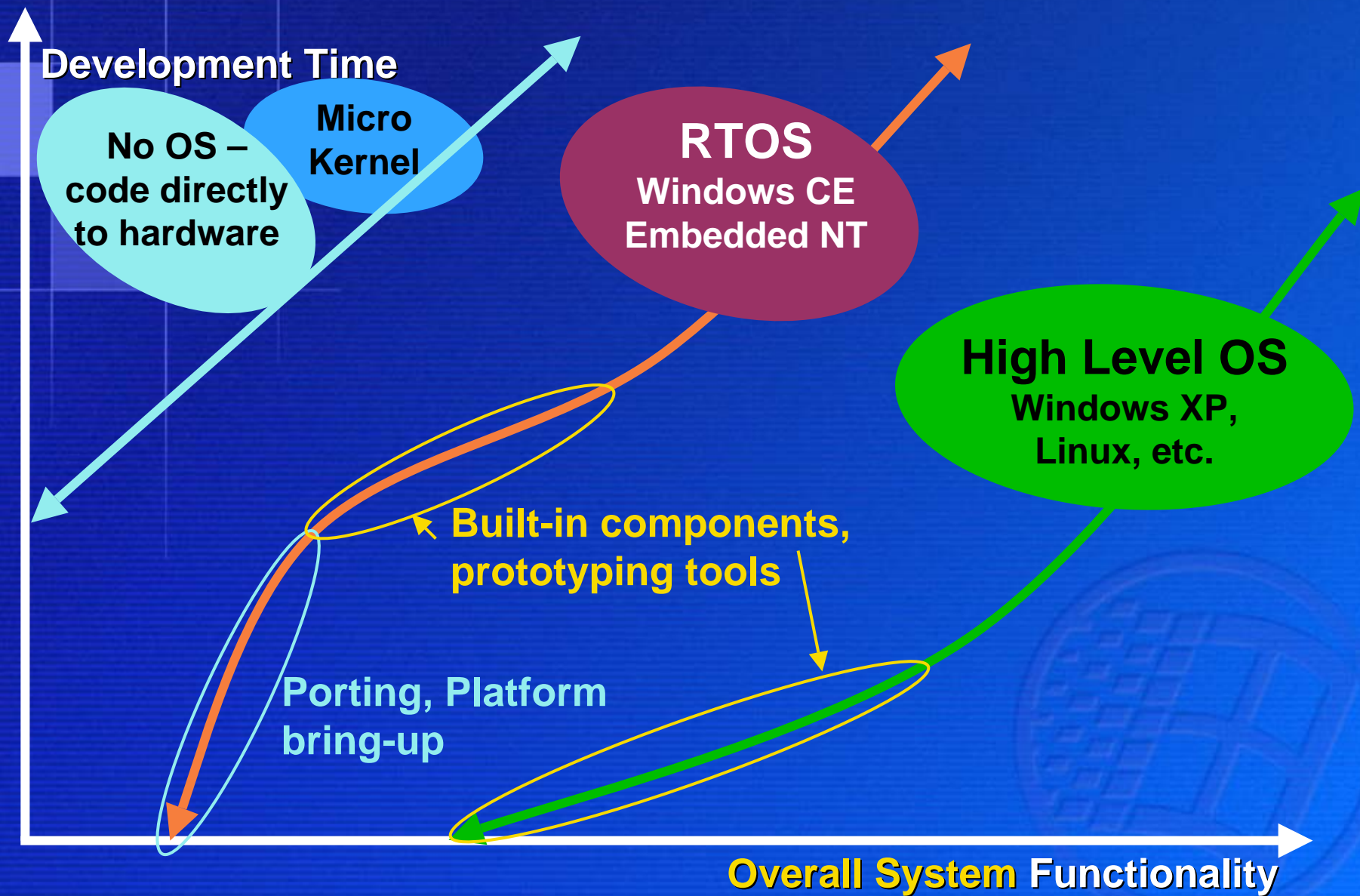


Real-time performance results

Windows CE 3.0 Kernel	SH4 198 Mhz	Pentium 100 Mhz
ISR (Avg.)	2.9 μ sec	2.8 μ sec
IST (Avg.)	38.2 μ sec	26.4 μ sec

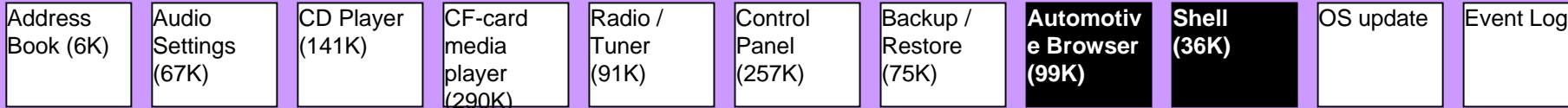
Source: Kufner et al, Siemens AT, 2001.
msdn.microsoft.com

Functionality vs. Dev Effort

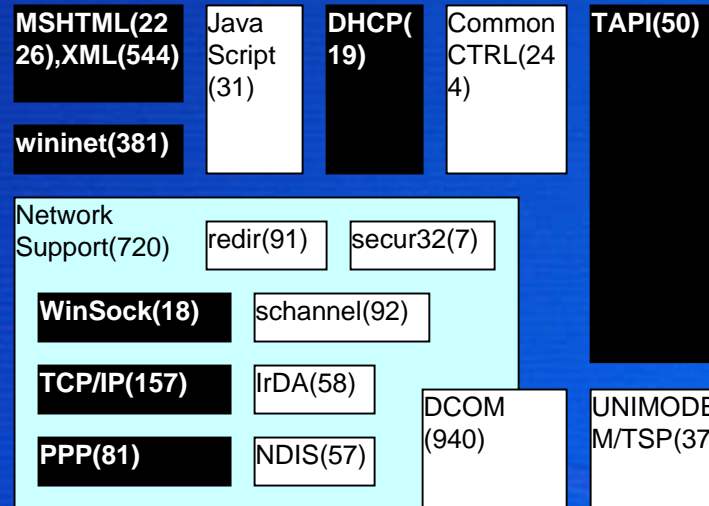
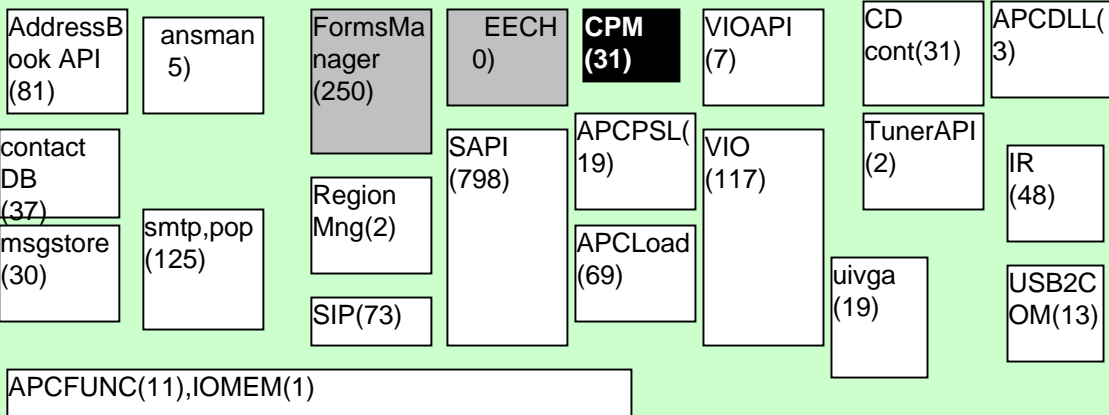


Example – Web Browser

Applications



CE for Automotive Core OS



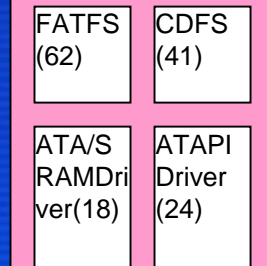
Coredll(348)



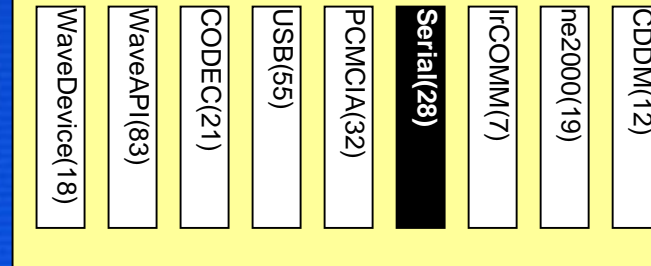
DirectX



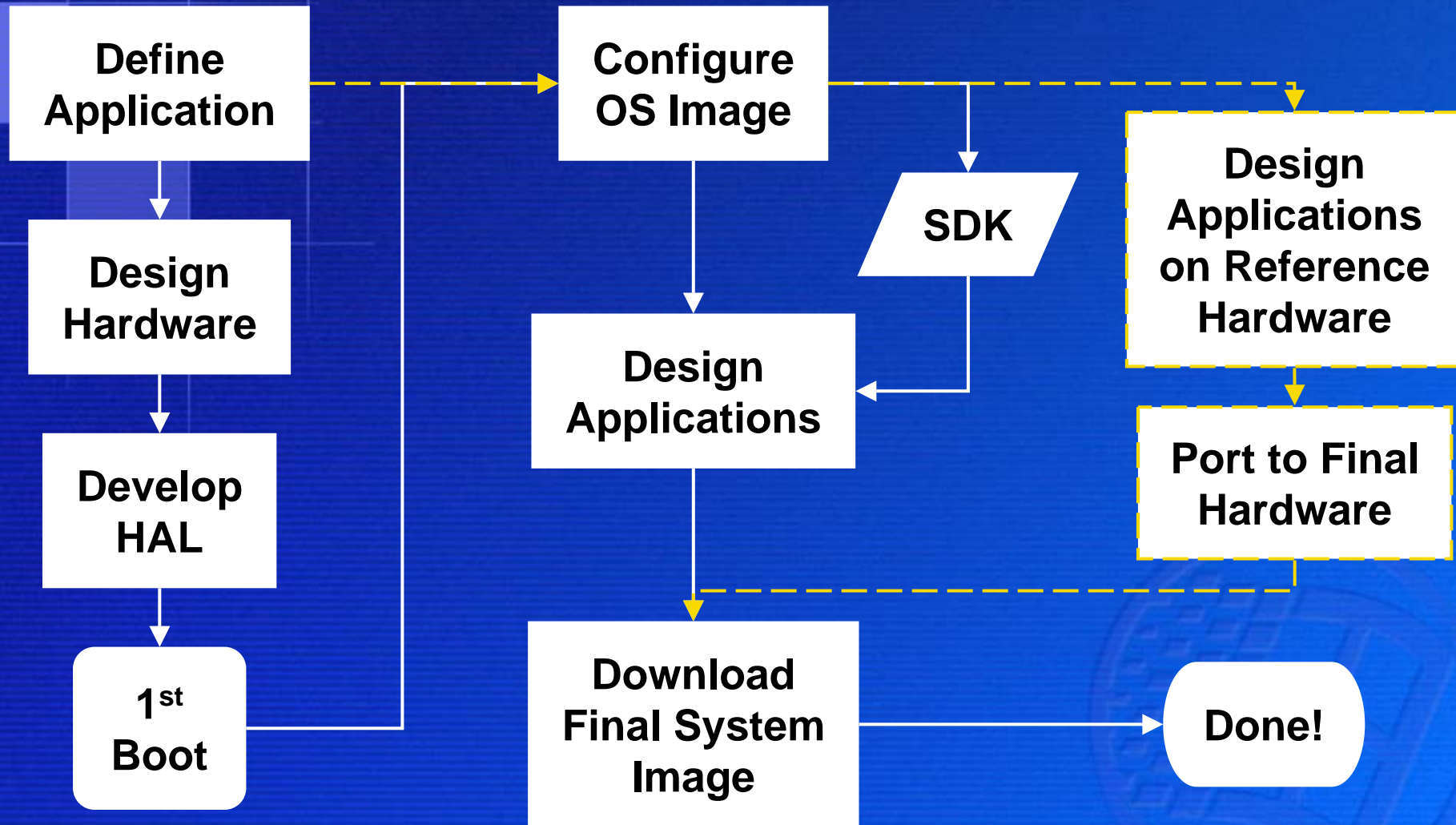
File System()166



Device Manager()17



Development Cycle



Reference Hardware

- Pre-built HALs and images for common CPU boards
 - Partner with silicon vendors
- Jump-start application development
- Jump-start peripheral driver development



Summary

No OS Micro Kernel	Real-time OS (WinCE)	High Level OS (WinXP, Linux)
<ul style="list-style-type: none">● Highest possible performance● Long development time for complex solutions● Hardest to use	<ul style="list-style-type: none">● Excellent performance for many apps● Reduced solution development time● Hardware abstraction● Usable with some training	<ul style="list-style-type: none">● Not necessarily real-time performance● Lowest development time● Richest development environment● Hardware abstraction● Easiest to use

Conclusions

- **Many solutions today are “complex”**
 - **Networking**
 - **High-level formats and protocols**
 - **User Interface**
- **Commercial RTOSes –**
 - **Performance suitable for many applications**
 - **Features “migrating” from High Level OSes speed solution development**
 - **Opportunity to ‘jump start’ development**

Advantages and Disadvantages

Standard

- **Advantages**
 - Reduced development time and cost
 - Greater hardware abstraction
 - Community
- **Disadvantages**
 - Performance
 - Porting effort
 - Not 100% to *your* specs

Custom Development

- **Advantages**
 - Highest possible performance
 - Custom built to your specs
- **Disadvantages**
 - Higher development time and cost
 - Hard to upgrade to newer hardware, standards

What's the best choice for your application?