

Advances in USB Technology for Wireless Products

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Wireless Japan

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Overview

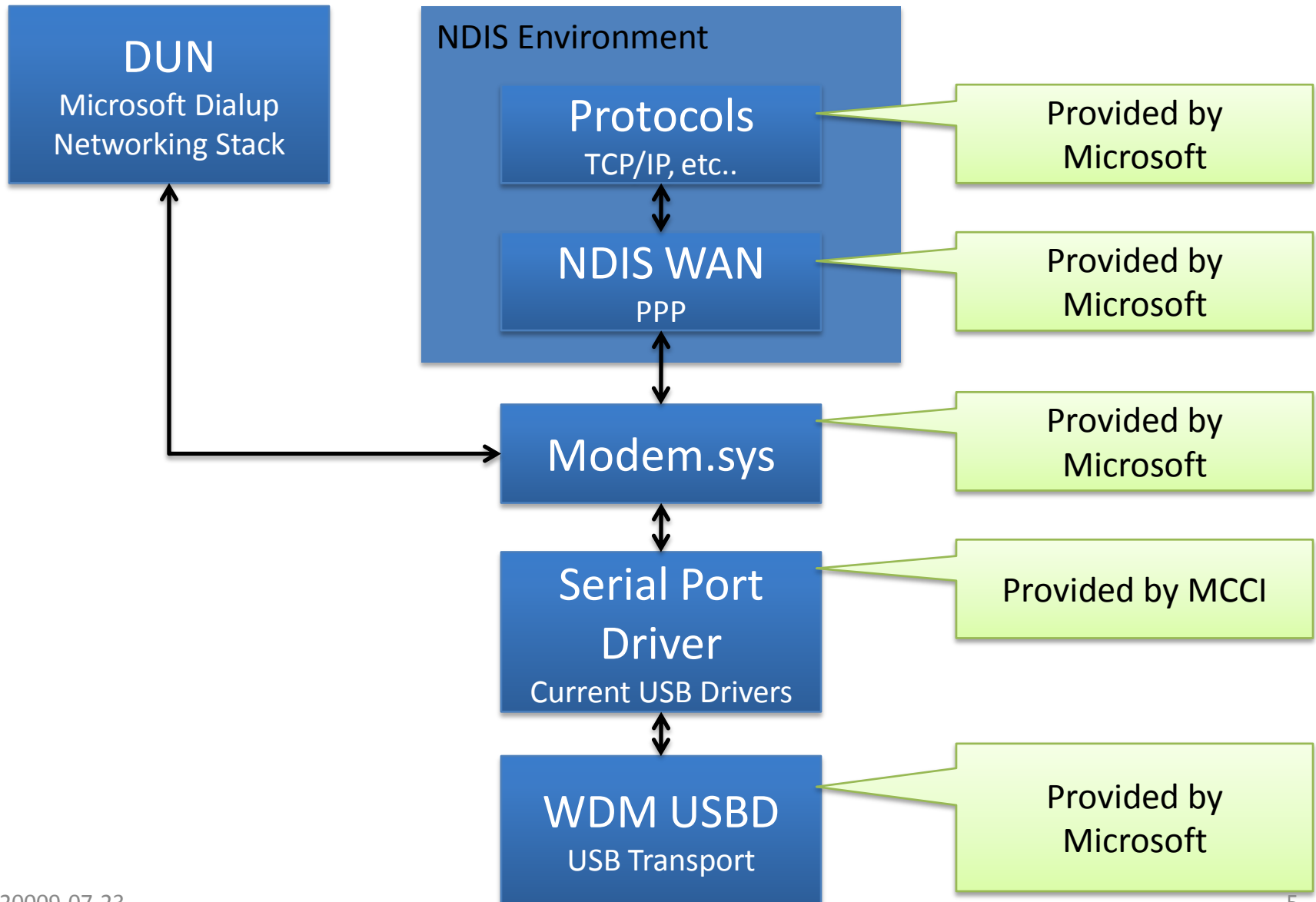
- Network Connectivity
- Windows 7 Mobile Broadband Networking
- Other important trends
 - Handover drivers
 - Video over USB

Network Connectivity

Current Situation

- All networking data is connected as if by a legacy analog modem.
- This requires use of PPP for encoding the data.
 - Imposes a large impact on the handset for high data rates.
- Also requires use of AT commands for control of the connection.
- NDIS can't use AT commands while the connection is active.
 - This means NDIS can get very little information about the status of an active connection.
- Unimodem must be used to place the call.
 - This means the user must manually activate the connection. “Always-on” scenario is not possible.

Current “Modem Architecture”



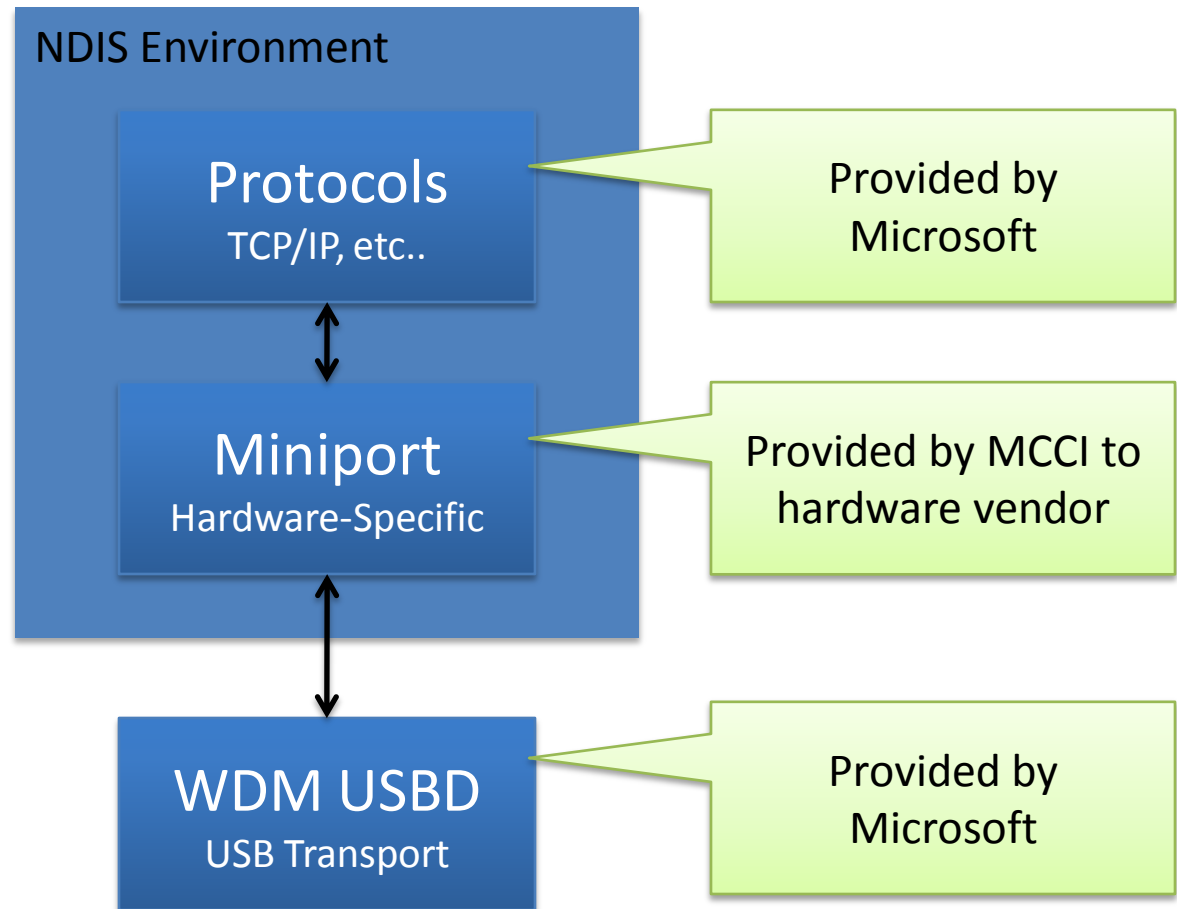
Industry Migration

- Because of limitations of the serial port model, the industry is moving to a “Network Model” architecture.
- In this architecture, the PC views the handset as an Ethernet-like device, not as a modem-like device.
- At high data rates, the handset benefits by not having to do PPP encapsulation/de-encapsulation.
- The user benefits because Ethernet / WiFi have very good support in modern operating systems
- Every vendor is using USB with NDIS, but there are still a number of important differences in the actual implementations. Different vendors are taking slightly different paths.

NDIS Technical Overview

- NDIS stands for “Network Driver Interface Specification.”
 - [http://technet.microsoft.com/en-us/library/cc758715\(WS.10\).aspx](http://technet.microsoft.com/en-us/library/cc758715(WS.10).aspx)
- NDIS is a Windows kernel API, and defines how Windows interacts with networking device drivers.
- NDIS itself is independent of the underlying hardware and bus.
- A hardware-specific driver converts NDIS requests into hardware-specific commands.

NDIS Architecture for next generation Wireless Devices



Key software components

- Two things must be shipped by the vendor:
 - Connection Manager / Dialer application
 - Replacement of the Microsoft Dial-up Networking application
 - Choices are:
 - Write your own
 - Use the Windows 7 MBN infrastructure
 - Most people need to support XP and Vista, so they need to write their own anyway.
 - Low-level hardware-specific miniport driver
 - Manages the conversion from NDIS to USB
 - Has to interact with the phone firmware
 - A variety of USB protocols are available

Protocol Comparison

Protocol	MCCI Support Available Now?	Protocol good for device?	Open Standard?	Recommended by MCCI for adoption in new designs?	Host-Side Support (either in-box or MCCI)
ECM	✓	✗	✓	✗	Windows by MCCI, Mac OS X by Apple, Linux part of recent kernel.
ENCM	✓	✓	✓	✓	Windows by MCCI. Mac OS X and Linux under development by MCCI and others
NCM	✓	✓	*	*	Waiting for spec to be published
EEM	✓	✗	✓	*	Windows by MCCI, Mac OS X by Apple, Linux not available.
RNDIS	✓	✗	✗	✗	Windows by Microsoft, Mac OS X not available, Linux support questionable.
RMNet	✓	*	✗	*	Windows by MCCI, Mac OS X not available, Linux may support.

NCM Status

- Specification has been submitted to the USB-IF board of directors.
- The BoD has put the standard in a 45 day review process by the USB core companies.
- Review process scheduled to end early August.

ENCM Status

- MCCI and STE have decided to publish the ENCM specification as an open standard.
- ENCM products have been built, and it has been demonstrated to meet the goals of high throughput with low device overhead.
- Can be used freely in new device and host designs.
- Another revision will be published based on the experience gained in first-round implementations.

RNDIS and NDIS

- NDIS is a Windows driver architecture, not a USB protocol.
- RNDIS is a USB protocol that comes with a Microsoft driver, for Windows operating systems.
- RNDIS stands for “Remote NDIS”
 - Optimized for host PC benefit
 - Very heavy on device-side
- USB protocol is proprietary, owned by Microsoft.

RNDIS Status

- Nobody is using it for data communications. Very limited use reported in WinCE cell-phones. No known use in other consumer products.
- Nokia found that using RNDIS, performance was limited to 20-40Mbit/s on their platform. This was CPU limited.
- STE found that RNDIS throughput was approx 100Mbit/s. CDC ECM throughput was approx same as RNDIS. Host (PC) was struggling but not CPU limited.
- All NCM member companies reported stability problems with RNDIS at LTE speeds.
- Even if Microsoft fixes these issues in Win7, or Win8, they won't release updated drivers for WinXP or earlier.

Implications of Moving to NDIS

- Benefits of using NDIS all come from the upper edge integration with Windows.
- No matter how you implement NDIS, you get the same benefits on Windows.
- To get all the improvements, you must choose an appropriate USB protocol, and upgrade both the device and host drivers to support this.
- Must manage compatibility issues.

Compatibility Issues

- Must support older Windows platforms
- Must support non-Windows and embedded host platforms, too
- “Always-on” sometimes can’t be used
 - User preferences, operator requirements, regulatory requirements, etc.
 - “Always-on” roaming can be very expensive
- Software for operator-support shops must continue to work with any new devices
- Legacy applications must continue to work with any new architecture.
- Must consider international compatibility over life of product

Windows 7 Mobile Broadband Networking (MBN)

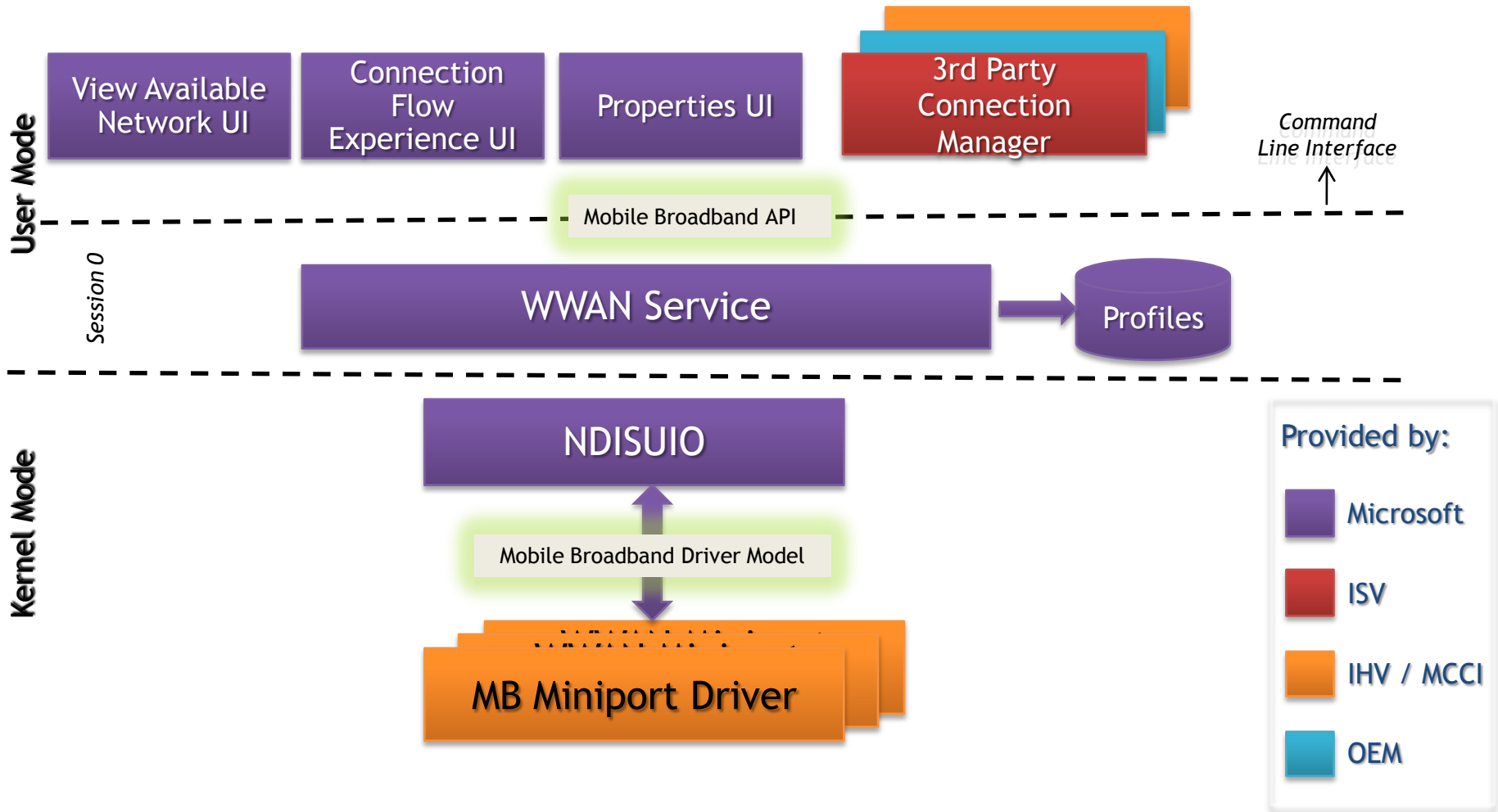
2009 Mobile Broadband Trends

- Netbooks (Net PC):
 - Heavy usage of mobile broadband
 - FY09 estimate at 21.2M total units (Lehman, 2009)
- Mobile Operator Distribution Channel:
 - Represents 20 –25 % of total volume of Netbooks in FY10
- Growth of 3G Network:
 - 51% YoY US Mobile Broadband subscriber growth (IDC, 2008)
- Declining cost of 3G embedded modules
 - 96% CAGR for PC with internal modems (ABI, 2009)

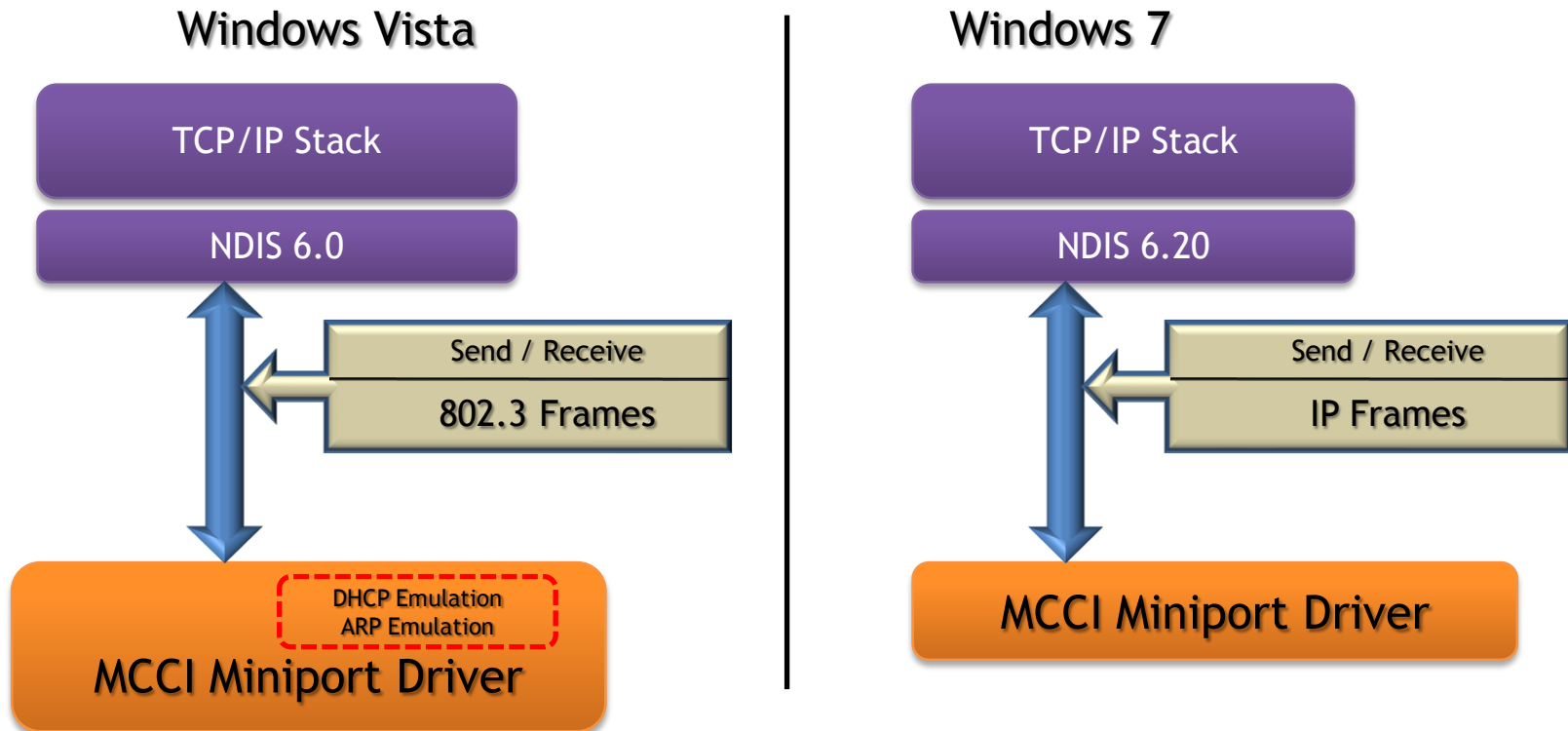
What Is New in Windows 7?

- Simple connection experience for Mobile Broadband
 - Similar to WLAN, VPN and Dial-up
- Driver Model for Mobile Broadband Devices
- Mobile Broadband APIs
- Logo Program for MB Devices

Win7 Mobile Broadband Platform



NDIS 6.20 – Data Path



Windows 7 MCCI Miniport Drivers for Mobile Broadband can

- Take advantage of raw IP support in send/receive path
- Eliminate DHCP and ARP spoofing in miniport drivers

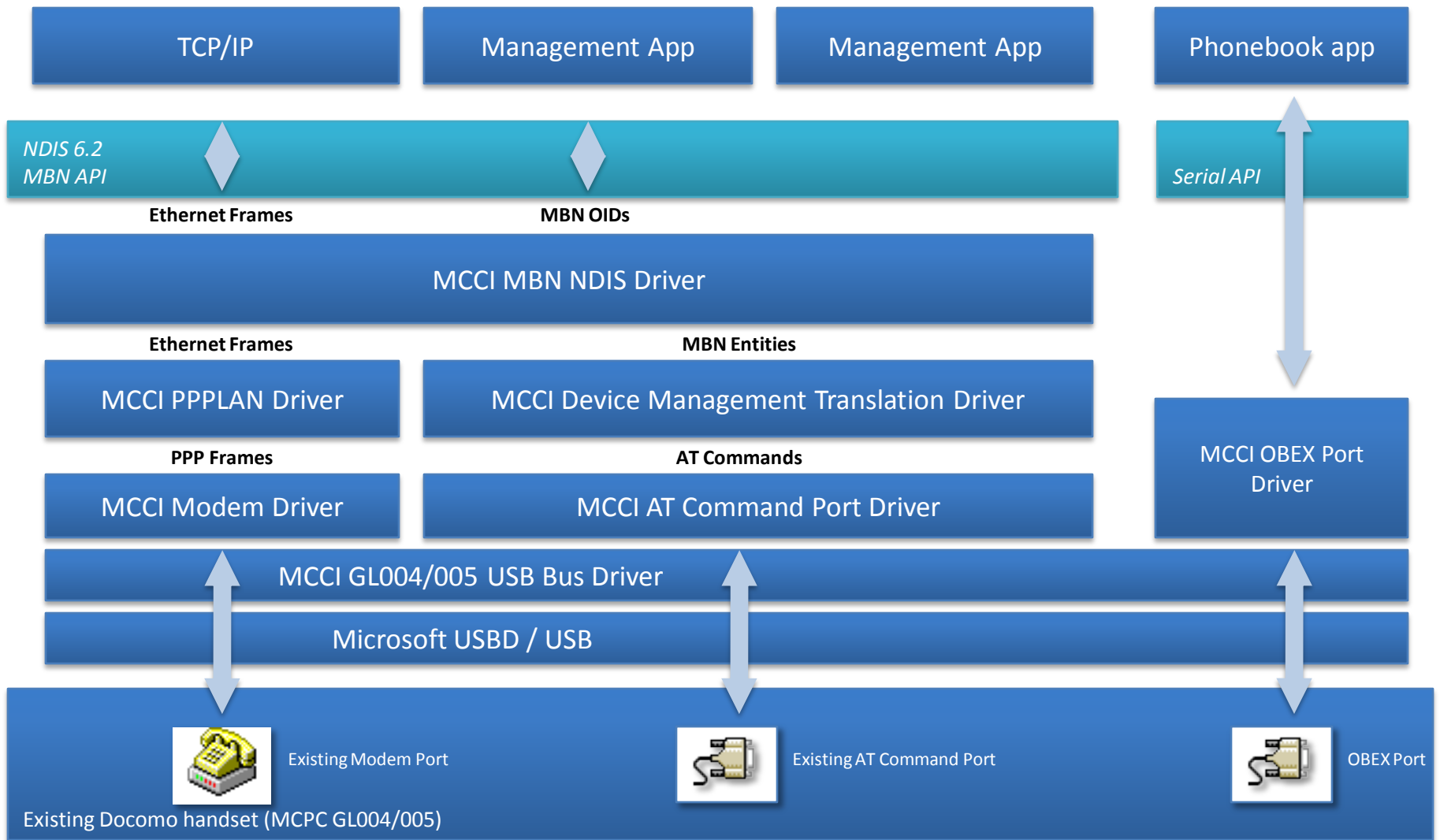
Supporting Legacy Devices

- The majority of today's handsets have only USB modem support (AT commands)
- Vendors and operators may want to use Win 7's connection manager framework without reengineering the handset platform
- MCCI has a software product that will work without changing the handset at all....

PPPLAN

- Provides the benefits of the NDIS “Network Model” architecture to users with PPP-based devices.
 - Can work with Windows 7 connection manager
 - Can allow multiple connection managers to operate simultaneously
 - Can support the “Always-on” usage scenario
 - Supports earlier versions of Windows, either as Always-on or with dialup networking
 - No legacy problems, because device is unmodified
 - May be very useful as an interim solution during migration to a complete Network Model architecture.

MCCI PPPLAN Solution for MBN



Other Important Trends

Hand-over Drivers

- Multi-radio platforms the norm for 4G
 - One radio for legacy network (UMTS, CDMA-200)
 - One radio for LTE or WiMax
- Separate basebands
- On USB, appear as two different devices
- MCCI has Windows handover drivers that integrate the two devices into a single logical network device
- User enjoys continuous access to best available network

USB UICC

- Smart cards and SIM cards have ever-increasing capabilities
- Switching to Interchip USB for higher speed, more functionality
- MCCI's USB DataPump host stack fully supports Interchip USB and multifunction UICC cards
 - small memory footprint
 - zero copy architecture
 - easy to embed in any product firmware stack
- MCCI's USB DataPump device stack is ideal for use in prototyping and implementing the UICC firmware

Video over USB

- Mobile devices have small displays, but often contain the content the user wants to display
- A new device class will allow mobile devices to transfer the content to display devices without doing all the rendering in the device
- With USB OTG, can charge at the same time!
- USB 3.0 is fast enough to run HD Video uncompressed

Thank You!