C H A P T E R 2 0

Network Communications

This chapter presents PC 98 requirements and recommendations for network adapters and related technologies.

Tips for Selecting High-Performance Network Adapters. For PC manufacturers who want to select high-performance components, the following are design features to look for in network adapters:

- Adapter supports bus mastering, especially for use with Pentium Pro processors
- PCI adapter properly supports higher-level PCI commands for intelligent data transfer
- Drivers are tuned for 32-bit performance

Contents

Introduction to NDIS 5.0

The Network Driver Interface Specification (NDIS) 5.0 represents a number of extensions to the interface described in NDIS 3.0 and 4.0. The basic requirements, services, terminology, and architecture of the earlier versions also apply to NDIS 5.0. The new NDIS architecture will be included in Windows 98 and Windows NT 5.0 operating systems.

NDIS 5.0 consists of all functionality defined in NDIS 4.0, plus the following extensions:

- NDIS power management, required for network power management and network wake up.
- Plug and Play, which was previously supported only under Windows 98 but is now also applicable to Windows NT 5.0 network drivers.
- Windows hardware instrumentation support for structured, cross-platform management of NDIS miniports and their associated adapters.
- Simplified network INF format across Windows operating systems, based on the Windows 95 INF format.

  The goal for the new-style INF file format is to enable a single INF file to work on both Windows and Windows NT.
- Deserialized miniport for improved performance on Windows NT multi-processor systems.
- Task-offload mechanisms for tasks such as TCP/IP checksum, PPP compression/encryption, and Fast Packet Forwarding.
- Broadcast media extension, required for broadcast components.
- Connection-oriented NDIS, required for native access to connection-oriented media such as ATM and asymmetric digital subscriber line (ADSL), and WDM support for streaming over connection-oriented media.
- Support for QOS when supported by the media.
- Intermediate driver support, which is required for broadcast components, virtual LANs, LAN emulation over new media (ATM, satellite or broadcast television, and so on), packet scheduling for QOS, and NDIS support over WDM-supported buses such as IEEE 1394.

NDIS Extensions for ATM and QOS. Previously, NDIS primarily supported network interface card driver development and deployment of connectionless network media such as Ethernet, Token Ring, ArcNet, and Fiber Distributed Data Interface (FDDI). NDIS 5.0 extends this interface to provide efficient support for connection-oriented media such as ATM and ISDN, with support for QOS and with isochronous data transfer for media that supports QOS. The new architecture also enables support for streaming of multimedia data such as audio and video over the NDIS media.

Information about the miniport driver model is included in the Windows NT 5.0 DDK.

Note: NDIS 5.0 features are accessible only by using the NDIS miniport driver model and are not supported for full MAC drivers.

System Requirements for Network Communications

This section summarizes the basic hardware design features for network communications devices and the specific features for PC 98.

1. PC system includes network adapter

Consumer PC 98	*Office PC 98*	*Entertainment PC 98*
Recommended	*Required, if no modem*	*Recommended*

It is recognized that OEMs supply PC systems to corporations for networking purposes in situations where the customer will insert network adapters at the end-user site. If the device is present in the system, it must meet the minimum requirements for network adapters defined in this chapter. Office PC 98 systems submitted for testing must include either a network adapter or a modem.

2. PC system includes internal or external ISDN device

Consumer PC 98	*Office PC 98*	*Entertainment PC 98*
Recommended	*Recommended*	*Recommended*

If an ISDN device is present in the system, it must meet the minimum requirements for ISDN devices defined in this chapter. For information about serial ISDN devices, see the “Modems” chapter in Part 4 of this guide.

3. PC system includes cable modem

Consumer PC 98	*Office PC 98*	*Entertainment PC 98*
Optional	*Optional*	*Optional*

Cable modems are not required features for any PC 98 system. Recommendations are provided in this chapter for informational purposes only.

4. PC system includes ATM adapter

Consumer PC 98	*Office PC 98*	*Entertainment PC 98*
Optional	*Optional*	*Optional*

ATM adapters are not required features for any PC 98 system. If the device is present in the PC system, it must meet the minimum requirements for ATM adapters defined in this chapter.

5. PC system includes ADSL adapter

Consumer PC 98	*Office PC 98*	*Entertainment PC 98*
Optional	*Optional*	*Optional*

ADSL devices are not required features for any PC 98 system. If the device is present in the PC system, it must meet the minimum requirements for ADSL adapters defined in this chapter.

6. PC system includes satellite or broadcast receiver with NDIS driver

Consumer PC 98	*Office PC 98*	*Entertainment PC 98*
Recommended	*Recommended*	*Recommended*

For information about the PC 98 requirements for supporting a broadcast receiver, which requires NDIS 5.0 support, see the “Video and Broadcast Components” chapter in Part 4 of this guide.

Network Adapter Requirements

This section defines basic PC 98 hardware feature requirements for network adapters. Many of these requirements also apply for other network communications devices described in this chapter.

7. Adapter uses NDIS 5.0 miniport driver

Required

For PC 98, the network adapter driver must support NDIS 5.0 in order to take advantage of new operating system capabilities and must follow the NDIS miniport driver model. A full MAC implementation is not compliant with PC 98 requirements.

If the device is a switched WAN card (for example, ISDN, X.25, or S56), it must have an NDIS WAN miniport driver that supports all TAPI functions as defined for NDIS 5.0 in the Windows NT 5.0 DDK. It must support Windows remote access or other WAN services over WAN media.

8. Full-duplex adapter automatically detects and switches to duplex mode

Required

If the network adapter supports full duplex and if the network switch the adapter is connected to supports full duplex and standard ways of detecting the duplex mode, then the network adapter must be capable of automatically detecting the duplex mode and must use that mode. The goal is to automatically configure this setting without end-user intervention.

9. Adapter automatically senses presence of functional network
Required

The network adapter must be capable of dynamically determining whether it is functionally connected to a link partner such as a hub, switch, or router. If the adapter is on an expansion card not used as a boot device, then the device drivers can determine the presence of the functional link. If it is not functionally connected to a link partner, the miniport driver must provide appropriate NDIS status indication, using support for cable sense in NDIS 5.0.

No time duration is specified for the required detection or status indication.

For information about NDIS status codes and indication mechanisms, see the Microsoft Windows NT 5.0 DDK.

10. Adapter automatically senses transceiver type
Required

Network adapters that support multiple transceivers must be capable of automatically detecting which transceiver type is connected to the network. The network adapter then must automatically use that transceiver. In all cases, the user must not be required to set jumpers or manually enter information to inform the operating system of the transceiver type.

11. Adapter supports quadword buffer alignment for receive and byte buffer alignment for send
Required

Recommended: Byte buffer alignment for all buffers, which imposes fewer limitations on overlying software components.

Buffer alignment refers to the allowed offset addresses (boundaries) where packets can begin. Memory allocated for receive buffers must be quadword-aligned or better (byte-aligned or word-aligned). The send buffer must be capable of handling byte-aligned buffers.

The network adapter must impose minimal buffer-alignment restrictions.

12. Adapter communicates with driver across any bridge
Required

If the adapter uses a bridge, all communications must be free of errors across any bridge, such as a PCI bridge adapter.

13. Adapter supports filtering for 32 multicast addresses, at minimum
Required

Recommended: 128 addresses.

This capability is needed to support new push technology applications such as Microsoft NetShow, Active Desktop, and Internet Explorer 4.0. PC 98 requires a minimum capability for filtering 32 multicast addresses (also known as channels). This number is expected to increase incrementally in coming years. Future requirements will specify filtering for a minimum of 128 addresses.

14. Adapter is compatible with remote new system setup capabilities if used as boot device
Required

For a PC 98 system that uses a network adapter to support installing the operating system, the network adapter must be compatible with remote new system setup capabilities as defined in the open industry-standard Dynamic Host Configuration Protocol (DHCP). The DHCP provides for dynamic configuration of PCs on TCP/IP networks, as specified in Internet Engineering Task Force (IETF) RFCs 1533, 1534, 1541, and 1542. Trivial File Transfer Protocol (TFTP), Revision 2, supports boot-image download, as specified in IETF RFC 1530.

For Net PC systems and Office PC 98, a network adapter and system BIOS support are required to use the adapter as a boot device, as defined in the "BIOS meets PC 98 requirements for boot support" requirement in the "Basic PC 98" chapter in Part 2 of this guide.

The complete mechanism for remote new system setup is defined in the *Network PC System Design Guidelines*, provided as Appendix E in the References part of this guide.

15. Device Bay network adapter meets PC 98 requirements
Required

Any networking communications device designed as a Device Bay peripheral must interface with either USB, IEEE 1394, or both, and must support relevant USB device class specifications. All Device Bay peripherals must meet the requirements defined in *Device Bay Interface Specification, Version 1.0* or higher.

ISDN Requirements

This section summarizes the design features for ISDN devices.

In this section, “internal ISDN device” refers to the ISDN terminal adapter, which exposes raw access to its B channels using NDIS miniports. NDIS miniports could also be attached to the PC using WDM-supported bus classes such as USB (thereby physically being an external device).

In this section, “ISDN modem” refers to an internal or external ISDN device that exposes itself as a modem controlled by the AT command set. Certain ISDN devices might be attached to the PC internally or externally, exposing serial ports or modems to the system. To Windows operating systems, these devices look like modems, and the operating system can use these devices as modems, provided that the hardware manufacturer has done the work to ensure that these devices look and act like modems. This work includes the following:

- Interpretation of the standard modem AT command set. This can be done either in the ISDN device itself or in a serial port driver. For more information, please refer to the TIA-602 specification, a subset of ITU V.25ter.
- A modem INF file for installing the device and for telling Unimodem which commands to use to control the ISDN device.

This section defines general requirements for ISDN and specific requirements for ISDN terminal adapters. For more information about the requirements for ISDN modems, see the “Modems” chapter in Part 4 of this guide.

For PC 98, ISDN is recommended but not required for high-speed connections. If implemented in a PC 98 system, ISDN must meet the requirements defined in this chapter. For Plug and Play, power management, and driver support requirements, see the “PC 98 Design for Network Communications” section later in this chapter.

16. Internal ISDN device meets PC 98 network adapter requirements
Required

For PC 98, the driver must support NDIS 5.0. Only NDIS 5.0 miniport drivers and INF files are allowed for complete user-friendly installation and operation of the ISDN adapter.

The following requirements must be met, as defined in the “System Requirements for Network Communications” section earlier in this chapter:

- Support NDIS 5.0 using a miniport driver
- Automatically sense whether a cable is connected
- Support quadword buffer alignment or better
- Communicate with a driver across any bridge

17. Internal ISDN device supports synchronous HDLC framing

Required

High-level data link control (HDLC) framing is a standard for sending synchronous data. Other framing methods are allowed if the miniport driver provides simple HDLC framed synchronous PPP packets to NDISWAN using NDIS.

18. Internal ISDN device uses NDIS WAN miniport driver

Required

The device must have an NDIS WAN miniport driver to support Windows remote access over ISDN. For information about NDIS status codes and indication mechanisms, see the Windows NT 5.0 DDK.

19. Internal ISDN device includes connection for analog phone

Recommended

Note: This recommendation applies only in the United States.

Adding an analog (POTS) port to the ISDN device delivers convenience to the small-office/home-office (SOHO) market, allowing customers to use one ISDN line to meet all their telecommuting needs at minimal cost. Many customers in this market don’t want a separate analog phone line for their fax machines, modems, or phone when ISDN can do this with a device that has POTS support.

20. ISDN device supports auto-SPID detection algorithms and standard SPID format

Required

Note: This requirement applies only in the United States.

ISDN drivers must support auto-SPID detection algorithms as defined by NIUF in *1997 Version of National ISDN Basic Rate Interface Terminal Equipment Generic Guidelines*. This capability eliminates the need for the end user to enter the SPIDs.

ISDN drivers also must support the standard SPID format, which is useful when auto-SPID is not available.

21. ISDN driver supports switch detection

Recommended

The driver can attempt to determine the switch type based on the directory number, or it can use other proprietary solutions to determine the switch type. This enhances the Plug and Play experience for users.

22. ISDN driver supports unattended installation, with limitations
Required

ISDN devices must be capable of being installed without user intervention. The exception is specific ISDN parameters, which must be acquired from the equipment being connected to. Dependent parameters include SPIDs and switch-type IDs.

Notice that it is a PC 98 requirement for the device to support auto-SPID detection algorithms. If these algorithms are also supported on the equipment being connected to, only the switch type should have to be entered during installation of ISDN hardware if it cannot be detected automatically.

23. ISDN device includes built-in NT-1
Recommended

Note: This recommendation applies only in the United States.

NT-1 (network terminator) splits the duplexed transmit and receive signals from the ISDN line into separate transmit and receive components. An ISDN device with a built-in NT-1 can connect directly to the ISDN line. However, doing so prevents other devices from being attached to the ISDN line (only one NT-1 can be connected to an ISDN line).

Cable Modem Recommendations

Cable modems are neither required nor recommended for PC 98. The recommendations provided in this section are for informational purposes only.

Cable modems connected to a PC are one component in a system that cable-television operators use to deliver high-speed cable data services (HSCDS) to customers. HSCDS provides two-way services: Data flows downstream from the cable operator's head end and upstream from the customer's PC.

Ideally, two-way HSCDS is delivered over 450-MHz and 550-MHz hybrid fiber-coax (HFC) cable-television distribution networks. Most current cable-television distribution networks in the United States are 300-MHz, 350-MHz, and 400-MHz coax branch and tree networks.

Currently, the typical cable modems used on customer premises are external to the PC, with their own power supply. These cable modems are essentially IP routers. The cable modem's upstream connection is either a standard F-coax interface or an ATM interface. The cable modem connection to the PC uses a 10BaseT interface (RJ45) to connect a twisted pair to a standard Ethernet network adapter. For the next several years, it is expected that external cable modems will be included as part of the HSCDS service by the cable operator, much like set-top boxes. In light of that, along with the absence of standards for cable modems, few PC vendors are expected to bundle cable-modem hardware with their systems.

PC platform vendors can build PCs that are capable of using external cable modems by including a standard Ethernet network adapter in their PC systems. The PC platform should also have pre-installed Microsoft TCP/IP software.

HSCDS upstream data flow can be implemented on the predominant 300-MHz, 350-MHz, and 400-MHz coax branch and tree cable-television distribution networks by using telephone circuits for the upstream channel. This is a design alternative used today to accomplish HSCDS field trials with existing cable-television networks until more HFC networks are built.

There are a great number of design issues for cable operators as they upgrade their cable-television distribution networks to HFC and begin to deliver HSCDS. Even operators who have existing HFC networks must add equipment to that network in order to begin offering HSCDS. The speed at which cable-television operators resolve these issues will determine the requirements for cable modems in homes and businesses in the next two years. Although HSCDS is only in trials today, a majority of the cable operators in the United States are working on business plans for delivering HSCDS within the next two years.

PC platform makers must track the rate at which cable-television operators are resolving these issues and must track the best methods. The key cable-modem design issues for PC platform makers are cost and standards.

Some cable-modem vendors plan to implement the new IEEE 802.14 protocol when it becomes available. It should be well-suited to the distances, data rates, and physical-plant scenarios for HSCDS on cable-television distribution networks.

If implemented under Windows or Windows NT, a cable modem should support PC 98 network adapter requirements, including Plug and Play, power management, and driver support.

The following recommendations should be considered for cable modems implemented in PC 98 systems:

- **Provide platform support for external cable modems.** Plan to support external cable modems by supplying a low-cost Ethernet network adapter as part of a PC until a low-cost internal cable modem becomes available.
- **Provide an Ethernet card solution for cable modems.** PC platform makers providing a standard Ethernet card to connect to an external cable modem can contribute today to a low-cost solution at the user’s end for HSCDS service.
- **Participate in developing standards for cable modems.** Microsoft encourages cable-modem vendors to contact Microsoft about the devices they are designing. Microsoft wants to work with the cable-television industry in establishing standards for the use of cable modems in HSCDS delivery networks.

ATM Adapter Requirements

The NDIS 5.0 extensions provide kernel-mode NDIS 5.0 client drivers with direct access to connection-oriented media such as ATM. The new architecture for Windows and Windows NT extends native ATM support to Windows Sockets 2.0 (WinSock) and DirectShow-based applications by providing system-level components that map the applicable WinSock and DirectShow APIs to NDIS 5.0, extending direct ATM access to user-mode applications.

If ATM is included in a PC 98 system or is specifically designed for Windows or Windows NT, it must meet the requirements outlined in this chapter. For basic requirements for Plug and Play, power management, and driver support, see the "PC 98 Design for Network Communications" section later in this chapter. For more details about the following requirements, please refer to Section 3, "ATM Layer Specification," in *ATM User-Network Interface Specification, Version 3.1*.

24. ATM adapter meets PC 98 network adapter requirements
Required

The following requirements must be met as defined in the "System Requirements for Network Communications" section earlier in this chapter:

- Support NDIS 5.0 using a miniport driver
- Automatically sense whether a network cable is connected
- Support quadword buffer alignment or better
- Communicate with a driver across any bridge

25. ATM adapter supports a minimum number of active connections
Required

The VPI (Virtual Path Identifier) and VCI (Virtual Channel Identifier) ranges supported by the adapter affect the maximum number of simultaneous connections supported on a system.

This affects the applicability of the adapter to ATM applications such as LAN emulation, where at least one dedicated VC is created between each pair of communicating ATM hosts.

System type	Simultaneous connections
Client	64 or more
Server	2048 or more

A sample driver is provided in the Windows NT DDK to guide developers in properly supporting resources to meet this requirement.

26. ATM adapter supports all service types defined by the ATM Forum

Recommended

The ATM adapter should support the constant bit rate (CBR), variable bit rate (VBR), available bit rate (ABR), and unspecified bit rate (UBR) service types as defined by the ATM Forum.

27. ATM adapter supports a minimum number of simultaneously active rt-VBR/nrt-VBR/CBR connections

Required

Support for at least two simultaneously active rt-VBR/nrt-VBR/CBR connections is required for basic applications, such as LAN Emulation (where "rt" stands for real time and "nrt" stands for non-real time). The two simultaneous active connections can be any combination of two from the three service types: rt-VBR, nrt-VBR, and CBR.

Support for additional CBR/rt-VBR connections is required for ATM adapters that support multimedia or other traffic that demands QOS. These are listed in the following table.

System type	Simultaneous active rt-VBR/nrt-VBR/CBR connections
Client	6
Server	500

28. ATM adapter supports traffic shaping

Required

The ATM adapter must support and enforce all the traffic-shaping rules specified for each service type it supports, including CBR, VBR, ABR, and UBR. For example, this includes enforcement of peak cell rate on a UBR virtual circuit.

If the ATM adapter is connected to residential broadband networks—either directly or using external devices such as an ADSL modem or cable modem—there are additional traffic shaping requirements that restrict the total transmission rate of all active virtual circuits not to exceed the upstream bandwidth of the residential broadband network.

To support these types of connections with possibly limited throughput or asymmetric speeds, the adapter must enforce traffic shaping of all (aggregated) ATM traffic on the line, based on maximum line rate and peak cell rate (PCR) for outgoing traffic. This rate normally will be read from the adapter and reported to NDIS. However, a new requirement is that NDIS must also be able to write a lower rate back to the adapter, which shall then shape the aggregate of all ATM traffic to this indicated PCR.

29. ATM adapter supports external clocking
Required

Recommended: ATM adapter supports both internal and external (default) clocking.

Usually adapters can derive their transmit clocks from the switch's Sonet frames (external clocking). Internal clocking is useful for diagnostics (connect Tx to Rx, and so on).

30. ATM adapter supports OAM
Recommended

Operation and maintenance (OAM) is needed for diagnostics.

This capability is recommended for Client systems, but is required for a Server system (layers F1–F5).

31. ATM adapter supports buffer chaining (Tx + Rx)
Recommended

This feature is needed for large packets.

This capability is recommended for Client systems, but is required for a Server system.

ADSL Requirements

New support is provided in the Windows and Windows NT operating systems for ADSL adapters, which provide a faster method for moving data over regular phone lines.

It is recommended that manufacturers participate in developing standards for this technology. For example, review the white paper, *An Interoperable End-to-End Broadband Service Architecture over ADSL Systems*, which discusses end-to-end service interoperability over ATM over ADSL. This paper, available at http://www.microsoft.com/isp/supercomm, was jointly developed by leading ADSL vendors.

32. ADSL device meets PC 98 network adapter requirements
Required

For PC 98, the driver must support NDIS 5.0. It is also recommended that the manufacturer participate in developing standards for ATM solutions.

33. ATM/ADSL solution is implemented
Recommended

Refer to ATM Adapter requirements for ATM specific requirements if an ATM/ADSL solution is implemented.

34. ADSL device supports RADSL
Recommended

On a rate adaptive digital subscriber line (RADSL), the downstream and upstream data rates are independently set either by an automatic adaptive algorithm or by manual selection.

RADSL provides the capability to optimize the transmission speed and performance over a range of telephone-line loop distances. Adaptive channel equalization ensures more robust performance in the presence of channel impairments and narrow-band interference.

This also helps telephone companies to provision RADSL access on their existing networks. RADSL products can be provisioned on many telephone lines without costly and time-consuming network upgrades.

PC 98 Design for Network Communications

This section summarizes requirements related to the PC 98 design initiatives defined in Part 1 of this guide.

Plug and Play and Bus Design for Network Communications

The items in this section are PC 98 requirements for Plug and Play capabilities.

35. Each device has a unique Plug and Play device ID
Required

For a system-board device, there must be a Plug and Play device-specific ID.

Each bus-specific device must provide Plug and Play device IDs in the manner required for the bus it uses, as defined in Part 3 of this guide. For example, a PCI device must comply with PCI 2.1 requirements and also must provide a Subsystem ID and Subsystem Vendor ID as defined in the “PCI” chapter in Part 3 of this guide.

36. Automatic resource assignment and dynamic disable capabilities are supported

Required

The system must be capable of automatically assigning, disabling, and relocating the resources used by this device as necessary using the method required for the related bus class. When an end user changes this device or adds it to the system, setting resource assignments must not require changing jumpers or switches on either the adapter or the system board. In the event of an irreconcilable conflict with other devices on the system, the system must be able to disable the device to prevent the system from stalling.

37. Plug and Play capabilities support multiple adapters

Required

For network communications devices, the Plug and Play IDs and resource support must be sufficient to automatically support the addition of multiple network communications devices to the system. This is true for the same and differing types of network communications devices.

38. All resource settings are reported in the user interface

Required

All resource settings must be viewable in Device Manager and in adapter properties dialog boxes. All resource settings that can be changed by the user must be changed using the standard Windows user interface, not by way of INI files or other setting files.

Power Management for Network Communications

This section summarizes the specific power management requirements for network communications devices.

39. Device complies with device class power management reference specification

Required

The *Network Device Class Power Management Reference Specification, Version 1.0* or higher, provides definitions of the OnNow device power states (D0–D3) for network adapters. The specification also covers device functionality expected in each power state and the possible wake-up event definitions for the class.

40. Device supports wake-up events
Required

This requirement applies specifically to Ethernet and Token Ring adapters. The *Network Device Class Power Management Reference Specification* does not support ATM and ISDN adapters.

The system must be capable of being awakened from a lower power state based on network events specified by the local networking software. This capability yields the result that any standard Windows network access—such as connections to shared drives and WinSock connections, as well as focused service and management applications—has the capability to wake machines in lower power states.

For PC 98, support is required for peer-to-peer networking, personal web servers, and other transparent networking applications. Wake-up capabilities must be based on pattern matching, which is a method of filtering, in addition to the normal address filtering that occurs when the system is fully on.

Implementation details are described in the "Network Wake-up Frames" and "Network Wake-up Frame Details" sections of *Network Device Class Power Management Reference Specification, Version 1.0* or higher.

Device Drivers and Installation for Network Communications

This section summarizes requirements for network communications device drivers, in addition to the requirements for using an NDIS 5.0 miniport driver as defined in the "System Requirements for Network Communications" section earlier in this chapter.

41. Device drivers and installation meet PC 98 requirements
Required

The manufacturer does not need to supply a driver if a PC 98-compliant driver provided with the operating system can be used. If the manufacturer supplies a driver, the requirements for the device drivers and installation are defined in the "Basic PC 98" chapter in Part 2 of this guide. The basic requirements include driver support for unattended installation and Help file support if special driver parameters are used.

For exceptions to unattended installation requirements for ISDN adapters, see the "ISDN Requirements" section earlier in this chapter.

For information about NDIS status codes and indication mechanisms, see the Microsoft Windows NT 5.0 DDK.

42. Driver supports promiscuous mode

Required

This ensures that the adapter can be used with Microsoft Network Monitor Agent. This requirement applies only to LAN (non-switched) media.

Notice that, by default, promiscuous mode is not turned on. Configuring promiscuous mode should be possible only by using the Microsoft Network Monitor Agent or another similar administrative application.

43. Driver works correctly with Microsoft network clients and protocols

Required

This includes the 32-bit Microsoft client and NetWare-compatible clients provided with Windows, whether connected to a Windows NT-based server, a Novell NetWare 3.*x* or 4.*x* server, or a Windows-based peer server. In all cases, this includes connections using Microsoft TCP/IP, IPX/SPX-compatible protocol, and NetBEUI.

44. NDIS miniport driver does not make operating system–specific kernel calls

Required

A miniport driver that follows the NDIS 5.0 specification must not make operating system–specific calls. A correct driver makes calls only to the NDIS library. The NDIS library provides all the functions a driver needs or should use. This results in binary compatibility of the driver between Windows and Windows NT.

NDIS conformance must be validated over a single network connection and multiple connections. For Windows NT, this must be validated on a multiprocessor system as part of PC 98 testing.

45. NDIS 5.0 driver uses new INF format

Required

For NDIS 5.0 drivers (which are required for Windows NT 5.0), all network components must use the new-style INF format, which is based on the Windows 95 INF format. For information, see the Windows NT 5.0 DDK.

Note: For Windows NT 5.0, there will be no legacy INF support and no satisfactory upgrade option for OEM components created for Windows NT 4.0.

Network Communications References

The following represents some of the references, services, and tools available to help build hardware that is optimized to work with Windows operating systems.

1997 Version of National ISDN Basic Rate Interface Terminal Equipment Generic Guidelines, Document Number SR-3888
Phone: (800) 521-2673 (North America)
(908) 699-5800 (Outside North America)
http://www.bellcore.com

ATM User-Network Interface Specification, Version 3.1
Prentice Hall, 1995
ISBN 0-13-393828-X

Device Bay Interface Specification, Version 1.0
http://www.device-bay.org

Network Device Class Power Management Reference Specification, Version 1.0
http://www.microsoft.com/hwdev/onnow.htm

High-Speed Cable Data Service (HSCDS) Request for Proposals (RFP)
Cable Television Laboratories, Inc.
400 Centennial Parkway
Louisville, CO 80027
http://www.cablelabs.com

An Interoperable End-to-End Broadband Service Architecture over ADSL System
http://www.microsoft.com/isp/supercomm/ (click the “High Speed Access” link in the frame on the left, then scroll down to the bottom of the frame on the right)

NDIS and Windows networking white papers
http://www.microsoft.com/ntserver/communications/

USB specifications
Phone: (503) 264-0590
Fax: (503) 693-7975
http://www.usb.org

Windows 95 and Windows NT DDKs
MSDN Professional membership
Includes NDIS specifications, driver requirements, and Plug and Play support.

Checklist for Network Communications

If a recommended feature is implemented, it must meet the PC 98 requirements for that feature as defined in this document.

Consumer PC 98	Office PC 98	Entertainment PC 98
1. PC system includes network adapter		
Recommended	*Required, if no modem*	*Recommended*
2. PC system includes internal or external ISDN device		
Recommended	*Recommended*	*Recommended*
3. PC system includes cable modem		
Optional	*Optional*	*Optional*
4. PC system includes ATM adapter		
Optional	*Optional*	*Optional*
5. PC system includes ADSL adapter		
Optional	*Optional*	*Optional*
6. PC system includes satellite or broadcast receiver with NDIS driver		
Recommended	*Recommended*	*Recommended*
7. Adapter uses NDIS 5.0 miniport driver		
Required		
8. Full-duplex adapter automatically detects and switches to duplex mode		
Required		
9. Adapter automatically senses presence of functional network		
Required		
10. Adapter automatically senses transceiver type		
Required		
11. Adapter supports quadword buffer alignment for receive and byte buffer alignment for send		
Required		
12. Adapter communicates with driver across any bridge		
Required		
13. Adapter supports filtering for 32 multicast addresses, at minimum		
Required		
14. Adapter is compatible with remote new system setup capabilities if used as boot device		
Required		
15. Device Bay network adapter meets PC 98 requirements		
Required		
16. Internal ISDN device meets PC 98 network adapter requirements		
Required		
17. Internal ISDN device supports synchronous HDLC framing		
Required		
18. Internal ISDN device uses NDIS WAN miniport driver		
Required		

19. Internal ISDN device includes connection for analog phone
Recommended

20. ISDN device supports auto-SPID detection algorithms and standard SPID format
Required

21. ISDN driver supports switch detection
Recommended

22. ISDN driver supports unattended installation, with limitations
Required

23. ISDN device includes built-in NT-1
Recommended

24. ATM adapter meets PC 98 network adapter requirements
Required

25. ATM adapter supports a minimum number of active connections
Required

26. ATM adapter supports all service types defined by the ATM Forum
Recommended

27. ATM adapter supports a minimum number of simultaneously active rt-VBR/nrt-VBR/CBR connections
Required

28. ATM adapter supports traffic shaping
Required

29. ATM adapter supports external clocking
Required

30. ATM adapter supports OAM
Recommended

31. ATM adapter supports buffer chaining (Tx + Rx)
Recommended

32. ADSL device meets PC 98 network adapter requirements
Required

33. ATM/ADSL solution is implemented
Recommended

34. ADSL device supports RADSL
Recommended

35. Each device has a unique Plug and Play device ID
Required

36. Automatic resource assignment and dynamic disable capabilities are supported
Required

37. Plug and Play capabilities support multiple adapters
Required

38. All resource settings are reported in the user interface
Required

39. Device complies with device class power management reference specification
Required

40. Device supports wake-up events
Required

41. Device drivers and installation meet PC 98 requirements
Required

42. Driver supports promiscuous mode
Required

43. Driver works correctly with Microsoft network clients and protocols
Required

44. NDIS miniport driver does not make operating system–specific kernel calls
Required

45. NDIS 5.0 driver uses new INF format
Required