AppleTalk Phase 2
Commonly Asked Questions and Answers

Terminology:

A **network** is a collection of computers joined together so that users can share data and devices. For the purposes of this document, a network is one such collection of computers, separate from any other networks to which it may be connected.

An AppleTalk Phase 1 network supports up to 254 nodes and is identified by a single **network number.**

AppleTalk Phase 2 introduces the concept of an **extended network** which can theoretically support up to 16 million nodes and is identified by either a network number or a **network range** – a range of contiguous numbers, such as 1-10.

An **internet** is a grouping of two or more networks connected by routers. Both AppleTalk Phase 1 and AppleTalk Phase 2 can theoretically support millions of nodes in an internet.

Q.   What does AppleTalk Phase 2 buy me?

A.   AppleTalk Phase 2 adds greater capacity and flexibility to AppleTalk networks.

The principal feature is the ability to address up to 16 million nodes on a single Ethernet or Token Ring extended network. AppleTalk Phase 2 customers can now use EtherTalk on a large Ethernet network without breaking the Ethernet into smaller networks of 254 nodes, as was required in AppleTalk Phase 1. Apple's TokenTalk customers appreciate this feature as well, since both Token Ring and Ethernet support very large single networks when datalink-layer bridges and repeaters are used.

To improve flexibility, more than one zone name can be associated with an AppleTalk Phase 2 network. This is an important feature for customers with extended networks, since a single network can have hundreds of servers on it. By assigning more than one zone name, servers can be placed in different zones, and the user is not confronted with an enormous list of servers when selecting a zone in the Chooser.

Q.   If I'm not concerned with the 254 node per network limitation in AppleTalk Phase 1, should I upgrade anyway?

A.   Yes. AppleTalk Phase 2 also offers features that **significantly** reduce **network traffic.   These features include:**

• **Reduced broadcast traffic:** AppleTalk Phase 2 broadcast packets are sent to multicast addresses instead of the general-purpose Ethernet or Token Ring broadcast address. This means that broadcast packets are only sent to nodes that need to see them, rather than being sent to all Ethernet or all Token Ring nodes.

• **Reduced network traffic caused by routers exchanging routing tables:** The AppleTalk Phase 2 **split horizon** technique reduces the number of redundant routing table entries exchanged by routers. When sending the routing table out a given port, an AppleTalk Phase 2 router omits all entries referring to networks that are reachable from that same port. (The only exception to this rule is that the router does still include information about the network to which the port is directly connected, in case a non-seed router needs that information.) The split horizon technique significantly reduces network traffic, especially on backbone networks with many routers. (See page 25 of the *AppleTalk Phase 2 Protocol Specification* for more information.)

• **Best router selection:** When sending a packet to another network, an AppleTalk Phase 2 non-router node in most cases selects the router which will yield the shortest route, while an AppleTalk Phase 1 node selected the router that was last heard from. (See page 22 of the *AppleTalk Phase 2 Protocol Specification* for more information.)

Q.   Should I upgrade to AppleTalk Phase 2 even if my network is quite small?

A.   Yes. In the future, Apple and 3rd parties will introduce products that assume you have upgraded to AppleTalk Phase 2. Apple will stop shipping products that support AppleTalk Phase 1, for example the AppleTalk Phase 2 Upgrade Utility, and EtherTalk 1.2.

If your network consists of all LocalTalk non-router nodes, then you don't need to do anything. (see next question)

Q.   How do I upgrade to AppleTalk Phase 2?

A.   To upgrade to AppleTalk Phase 2 you should upgrade all your routers and install new EtherTalk 2.0 software on all your EtherTalk nodes. No change is required to LocalTalk non-router nodes. If it's not practical to upgrade all your routers and EtherTalk nodes at once, you can incrementally upgrade them. (See the *AppleTalk Phase 2 Introduction and Upgrade Guide* that ships with the AppleTalk Internet Router for more information.)

Q.   Why aren't extended networks permitted on LocalTalk?

A.   LocalTalk doesn't need extended networks. Apple recommends that you install 32 or less nodes on a single LocalTalk network due to the electrical specifications of the LocalTalk cables. To address more than 32 nodes, you can interconnect multiple LocalTalk networks via routers. Ethernet and Token Ring customers, on the other hand, need extended networks because they have existing networks with hundreds of nodes on them and it may not be practical to break up their large networks into smaller networks connected via routers.

Also, it would be less practical to upgrade LocalTalk users than EtherTalk and TokenTalk users, because the LocalTalk driver is built into the ROM of every Macintosh and LaserWriter, while EtherTalk and TokenTalk are RAM-based drivers.

Q.   Even though extended networks aren't implemented for LocalTalk, *routers* **on LocalTalk must be upgraded to AppleTalk Phase 2. Why is this?**

A.   LocalTalk routers must be upgraded in order to talk to AppleTalk Phase 2 LocalTalk/EtherTalk or LocalTalk/TokenTalk routers on their network. If all routers aren't upgraded, then the AppleTalk Phase 2 Upgrade Utility must be used. (see the next question.)

Another reason to upgrade LocalTalk routers is that AppleTalk Phase 2 LocalTalk routers generate less traffic than AppleTalk Phase 1 LocalTalk routers because they use the split horizon technique.

Also, Apple and third parties will introduce future network applications that assume you have upgraded all your routers.

Q.   What does the AppleTalk Phase 2 Upgrade Utility do?

A.   The AppleTalk Phase 2 Upgrade Utility translates packets that the AppleTalk Internet Router sends to other routers from AppleTalk Phase 2 packets into AppleTalk Phase 1 packets when an AppleTalk Phase 1 router still exists on a network. The Upgrade Utility translates outgoing Routing Table Maintenance Protocol, Zone Information Protocol, and Name Binding Protocol packets. (No translation is necessary on *incoming* AppleTalk Phase 1 packets because the AppleTalk Internet Router can understand those packets, even without the Upgrade Utility.)

The Upgrade Utility is necessary when customers haven't had the chance to upgrade all their routers to AppleTalk Phase 2 compliant routers.

When the Upgrade Utility is used, network ranges and multiple zone names per network cannot be used *anywhere on the internet*. This is a good reason to migrate your network to full AppleTalk Phase 2 capability and remove the Upgrade Utility as soon as possible.

Q.   If I have both LocalTalk and EtherTalk 2.0 users on my internet, do I need to run the Upgrade Utility? If I have both EtherTalk 1.0 and EtherTalk 2.0 nodes on my network, do I need to run the Upgrade Utility?

A.   No and No. The Upgrade Utility is only necessary when you have a mixture of AppleTalk Phase 1 and AppleTalk Phase 2 *routers* on a network. LocalTalk and EtherTalk 2.0 nodes can communicate through the AppleTalk Internet Router without running the Upgrade Utility.

To make sure EtherTalk 1.0 and 2.0 nodes can communicate, you can run both EtherTalk 1.0 and 2.0 software on a router. The router will accept packets from 1.0 nodes and send them to 2.0 nodes on the same Ethernet network. (The router only needs to have one EtherTalk card installed.) Note that this causes increased traffic on the Ethernet network because packets are being resent. You should only use this solution temporarily while incrementally upgrading EtherTalk nodes.

Q.   Is it even possible to install AppleTalk Phase 2 on a non-router LocalTalk node?

A.   Yes. To install AppleTalk Phase 2 on a LocalTalk node, install EtherTalk 2.0 or TokenTalk 2.0 software, (even if no EtherTalk or TokenTalk card is present). This installation puts a new AppleTalk file (version 53) in the System Folder as well as some new resources in the System File of the LocalTalk node. When the node starts up, it loads the new resources into RAM and uses them instead of the LocalTalk driver in ROM. (You may discard the EtherTalk or TokenTalk file in your System Folder.)

Note that System 7.0 will ship with an AppleTalk Phase 2 file in the System Folder and AppleTalk Phase 2 resources already installed into the System File.

Q.   Does the LocalTalk user get any advantages from running the RAM-based AppleTalk Phase 2 driver?

A.   Currently only minor advantages. Although the LocalTalk user does not get any of the better known AppleTalk Phase 2 features, such as extended networks or best router selection, the LocalTalk user does get two other features. (**Note: EtherTalk 2.0 and TokenTalk 2.0 users get these features too.**)

• **Name Binding Protocol wildcard support:** The AppleTalk Phase 2 implementation of the Name Binding Protocol supports the ability to look for object or type names using the "≈" wildcard character, meaning "look for a match of zero or more characters". For example, "≈abc" matches "abc," xabc," "xxabc," etc. "abc≈" matches "abcx," "abcxxxx," etc.

• **AppleTalk Transaction Protocol enhancement:** Though no changes were necessary to the AppleTalk Transaction Protocol to support the architectural changes in AppleTalk Phase 2, flexibility was added to the Apple Talk Transaction Protocol Exactly Once service. In AppleTalk Phase 2, the sender of a transaction request can tell the responder how long to wait before purging the request from his list of recently received transaction requests. Developers of higher-level protocols and applications will find that this flexibility improves performance of their software, especially in very large AppleTalk networks.

Q.   Will new machines have AppleTalk Phase 2 built into their ROM?

A.   Yes. The Macintosh IIfx, for example, already has AppleTalk Phase 2 in ROM. Macintosh IIfx users can take advantage of the features mentioned in the last question without installing any new software.

Q.   What's the difference between EtherTalk 1.0 and 2.0?

A.   EtherTalk 2.0 supports AppleTalk Phase 2. Also, EtherTalk 1.0 and 2.0 use different packet formats.

EtherTalk 1.0 packets are in the Ethernet format, as defined by the original developers of Ethernet: Xerox, Intel, and Digital Equipment Corporation.

An EtherTalk 1.0 packet looks like:

Ethernet Destination	6 bytes	
Ethernet Source	6 bytes	
Ethernet type	2 bytes	809B for data
		80F3 for AARP
AppleTalk data	maximum 603 bytes	
Padding if needed	(minimum Ethernet packet is 60 bytes)	

EtherTalk 2.0 packets are in the format defined by the 802.3 committee of the Institute of Electrical and Electronics Engineers (IEEE.)

An EtherTalk 2.0 packet looks like:

802.3 Destination	6 bytes	
802.3 Source	6 bytes	
802.2 LLC length	2 bytes	
802.2 Header		
802.2 LLC DSAP	1 byte	always $AA
802.2 LLC SSAP	1 byte	always $AA
802.2 Control	1 byte	always $03
SNAP Header	5 bytes	00000080F3 for AARP
		080007809B for data
AppleTalk data	maximum 599 bytes	
	note: DDP long header is required for data	
Padding if needed	(minimum Ethernet packet is 60 bytes)	

Note: TokenTalk 2.0 packets look the same as EtherTalk 2.0 packets.

Q.   We've all heard that AppleTalk Phase 2 supports 16 million nodes. However we've also heard such numbers as 1024 networks, 255 zones, etc. What are the actual AppleTalk Phase 2 architectural limitations?

A.   The AppleTalk Phase 2 architecture supports 16 million nodes in an internet or in a single network. Theoretically, all 16 million nodes can be on one single Ethernet or Token Ring network with just one router present for the purpose of defining the network range. Even if no router is present, a single network can support approximately 65,000 nodes because a special network range of 254 numbers is reserved for a network with no routers.

In most cases the 16 million nodes will be in multiple networks connected via routers, however. The AppleTalk Phase 2 architecture supports approximately 65,000 networks in an internet.

The AppleTalk Phase 2 architecture specifies that 255 zone names can be associated with any one Ethernet or Token Ring network.   Hence the number of zones in a full internet could be 255 times 65,000 or approximately 16 million.

Q.   Are these AppleTalk Phase 2 architectural numbers actually practical?

A.   Probably not. A customer should follow guidelines in the Ethernet and Token Ring specifications for actual number of nodes per network and internet.

Due to memory constraints, router manufacturers must impose stricter limitations on the number of networks and zone names.

The AppleTalk Internet Router can support 1024 networks in an internet. Each network can be an extended network identified by a network range. If there are more than 1024 networks, the AppleTalk Internet Router will report a "routing table overflow" error. Though it's unlikely that most customers will encounter this limitation, if they do encounter it, they should reconfigure their internet to reduce the number of networks.

The AppleTalk Internet Router can support 256 zone names in an internet. If there are more zones than this, than the router's Zone Information Table overflows. Though it's unlikely that most customers will encounter this limitation, if they do encounter it, then they should consolidate their zones.

Q.   This Q&A document has been great, but if I'd like more details, what else should I read?

A.   We recommend the following reading material:

Inside AppleTalk (book published by Addison-Wesley Publishing Company and available from APDA or computer bookstores. The 2nd edition, due to ship in May 1990, will include information on AppleTalk Phase 2.)

AppleTalk Phase 2 Protocol Specification: An Addendum to Inside AppleTalk (APDA document - not necessary if you have 2nd edition of Inside AppleTalk.)

AppleTalk Phase 2 Introduction and Upgrade Guide (ships with the AppleTalk Internet Router product)

Macintosh Technical Note #250 from Apple Developer Technical Support (available on AppleLink)

Macintosh AppleTalk Connections Programmer's Guide (APDA document)

Apple Support Readiness LANMinds training binder (Apple employees only)

Tech Info Library on AppleLink (search on AppleTalk Phase 2 to see answers given to relevant questions by Apple support engineers)