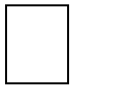
New Technical Notes

Macintosh



Developer Support

AppleTalk: The Rest of the Story

Networking **M.NW.AppleTalk2**

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This Technical Note discusses the new features of AppleTalk available for system software version 7.0 and AppleTalk version 57. The new features include support for the Flagship Naming Service and the AppleTalk Multiple Node Architecture. We present the Multiple Node Architecture and discuss the new calls available to applications. We also discuss the impact of the new architecture on AppleTalk Device files (ADEVs), and the changes necessary to make them multinode compatible. In addition, we discuss the Flagship Naming Service, along with the new AppleTalk Transitions. The new transitions notify a process of changes to the Flagship name, network cable range, router status, and processor speed.

Changes since April 1992: Reordered subjects according to the order of the AppleTalk version in which the feature was first implemented. Added a table of contents to make it easier to find material. Added a discussion on Multivendor ADEV Architecture, the .TOKN driver interface, plus information on making AppleTalk drivers compatible with virtual memory under system software version 7.0.x. Added a description of the change to the .ENET interface presented by the Apple SONIC based Ethernet drivers. Added socket listener sample code. Added AppleTalk version list.

Introduction

This Technical Note discusses the updates, modifications, and clarifications to a number of facets of the lower levels of AppleTalk Phase 2 since the release of *Inside Macintosh* Volume VI. Topics range from discussion of the new Datagram Delivery Protocol (DDP) layer calls to the AppleTalk Multiple Node Architecture to a discussion at the driver level of the new Multivendor ADEV Architecture. Most of the information presented here concerns AppleTalk version 56 and 57; however, additional material is presented to answer commonly asked questions relating to all versions of AppleTalk. Each major section indicates the revision of AppleTalk where the functionality is first supported where applicable.

Note that this Tech Note differs from previous revisions in that the subjects have been reordered. The topics are presented according to the order of the AppleTalk version in which the feature was first implemented. You can find new topics and modifications to this Tech Note by looking for material set off by change bars in the margins.

The first section in this Note, “The 'atkv' Gestalt Selector,” discusses the new Gestalt selector 'atkv', which provides version information when AppleTalk is available.

The next section, “Sample Socket Listener,” presents a sample socket listener, including initialization code to assist high-level language programmers. There socket listener comments describe in detail the basic functions of packet handling at the data link layer.

The next section, “The AppleTalk Transition Queue,” discusses the AppleTalk Transition Queue including its support for the Flagship Naming Service, AppleTalk Remote Access, and changes to processor speed that can affect LocalTalk and other processes dependent on processor speed. Included is Pascal source code for checking whether the Phase 2 LAP Manager exists to support the Transition Queue mechanism, plus sample Transition Queue handlers written in both C and Pascal.

The section “Multivendor ADEV Architecture” presents the Multivendor ADEV Architecture, which allows for Ethernet and token ring cards from multiple vendors to be installed on the same system. Included is a description of the functionality of the new driver shells for Ethernet and token ring, plus a description of the .TOKN interface required for compatibility with the new ADEV Architecture.

The section, “Driver Considerations for Virtual Memory,” shows how to modify driver code for compatibility with system software version 7.0 virtual memory.

The section “Ethernet NB and Macintosh Quadra Built-in Software Interface Change” presents a change to the .ENET interface that resulted from the implementation of the SONIC Network Interface Controller on the Ethernet NB Card and in the Macintosh Quadra computer’s built-in

Ethernet. The change concerns the EGetInfo function, which now returns additional network information for Apple Ethernet products based on the SONIC chip.

The section “AppleTalk Multiple Node Architecture” discusses the new program interfaces to the AppleTalk Multiple Node Architecture. The new architecture was developed to support multiple node capability on the Macintosh computer, which allows the Macintosh to present itself as separate entities, or unique nodes on the network. The AppleTalk Remote Access program uses multinode capability to implement Remote Access functionality. This section presents the Datagram Delivery Protocol (DDP) interface for multinode AppleTalk for applications to take advantage of this new functionality. This Note, however, does not discuss the Remote Access program.

The section, “New for AppleTalk ADEVs,” presents the changes required of an ADEV’s `'atlk'` code resource for compatibility with the AppleTalk Multinode Architecture. While we recommend that developers of Ethernet and token ring network hardware conform to the specifications of the Multivendor ADEV Architecture, this information is presented for those developers of network products for which Apple does not supply an ADEV.

The final section, “AppleTalk Version Information,” lists the various versions of AppleTalk, and the new products that require the support of the AppleTalk version.

Where Can I Get the Latest Version of AppleTalk?

For testing purposes, the latest version of AppleTalk and related software is available on the latest *Developer CD Series* disc, on AppleLink on the Developer Services Bulletin Board, and on the Internet through anonymous FTP to ftp.apple.com (130.43.2.3). It can be installed by using the Network Software Installer.

The 'atkv' Gestalt Selector

The `'atkv'` Gestalt selector is available beginning with AppleTalk version 56 to provide more complete version information regarding AppleTalk, and as an alternative to the existing `'atlk'` Gestalt selector. Beginning with AppleTalk version 54, the `'atlk'` Gestalt selector was available to provide basic version information. The `'atlk'` selector is not available when AppleTalk is turned off in the Chooser. It is important to note that the information between the two resources is provided in a different manner. Calling Gestalt with the `'atlk'` selector provides the major revision version information in the low-order byte of the function result. Calling Gestalt with the `'atkv'` selector provides the version information in a manner similar to the `'vers'` resource. The format of the `LONGINT` result is as follows:

```
byte;                                   /* Major revision */
byte;                                   /* Minor revision */
byte         development = 0x20,        /* Release stage  */
             alpha = 0x40,
             beta = 0x60,
             final = 0x80, /* or */ release = 0x80;
byte;                                   /* Nonfinal release # */
```

For example, passing the `'atkv'` selector in a Gestalt call under AppleTalk version 57 gives the following `LONGINT` result: `0x39008000`.

Note: With the release of the System 7 Tuner product, AppleTalk will not be loaded at startup, if prior to the previous shutdown AppleTalk was turned off in the Chooser. Under this circumstance, the `'atkv'` selector is not available. If the `'atkv'` selector is not available under System 7, this is an indicator that AppleTalk cannot be turned on without doing so in the Chooser and rebooting the system.

Sample Socket Listener

The preferred AppleTalk calls presented in *Inside Macintosh* Volume V, page 513, do not include a preferred style call for `DDPRead`. As a result developers are faced with the prospect of writing their socket listeners and using the `POpenSkt` function when upgrading their programs. *Inside Macintosh* Volume II, page 324, presents an overview of how socket listeners should function. *Inside Macintosh* states that socket listeners, as well as protocol handlers, need to be written in assembly code, since parameters are passed in registers. To assist high-level programmers with

implementing a socket listener, the generic listener code is provided. The following code demonstrates how to do the following:

- buffer multiple packets
- return DDP/LAP header information that has already been read into the Read Header Area (RHA) by DDP
- calculate and compare the packet checksum when a packet uses a long DDP header, and includes the checksum value

Some of the things that the listener sample does not do, which you might wish to implement, are the following:

- Check the DDP type and ignore any packets that don't match the desired type(s) that you're interested in.
- Check the source node ID and ignore any packets that don't come from the desired node(s).
- If the socket listener is used by more than one socket, it could route the packets differently based on the socket number found in D0.
- The socket listener does not handle the implementation of a completion routine to be executed when the packet is processed.

The example listener code includes an initialization routine which the listener client uses to notify the listener code of the "available" and "used" buffer queues. A high-level procedure is provided to demonstrate the initialization of the listener, and the use of the socket listener.

Socket Listener Review

The reader is advised to refer to *Inside Macintosh* Volume II, pages 324 to 330, for a description of protocol handlers, socket listeners, and data reception in the AppleTalk Manager over LocalTalk. The same architecture applies to AppleTalk on Ethernet and token ring. With the advent of AppleTalk Phase 2, the size of the Read Header Area (RHA) has been expanded to accommodate the long DDP header.

After every `ReadPacket` or `ReadRest` call, the listener code must check the Z (Zero) condition code for errors. If an error is detected from `ReadPacket`, the code must not call `ReadRest`.

It is the responsibility of the socket listener code to check for the existence of the DDP checksum. In contrast with the Frame Check Sequence which the hardware uses to verify frame, the DDP checksum is implemented in extended DDP headers to verify that the packet data is not corrupted by memory or data bus errors within routers on the internet. If the checksum has been entered, then the socket listener code must calculate the checksum after the

packet has been read in, and compare the computed value with the passed checksum value. The sample listener code demonstrates this check and calculation of the checksum. The listener code sets a flag which the program can check to determine whether the checksum matched or not.

The record structure presented in this sample returns the DDP type, destination node ID, source address in `AddrBlock` format, the hop count, the size of the packet, a flag to indicate whether a checksum error occurred, followed by the actual datagram. The record structure can be extended to return additional information, such as the tick count at the time the socket handler was called.

Timing Considerations for LocalTalk

If LocalTalk is being used, your socket listener has less than 95 microseconds (best case) to read more data with a `ReadPacket` or `ReadRest` call. If you need more time, you might consider

reading another three bytes into the RHA to buy another 95 microseconds. Remember that the RHA may only have eight bytes still available.

Register Usage

When the socket listener is called, the registers will be set up as follows:

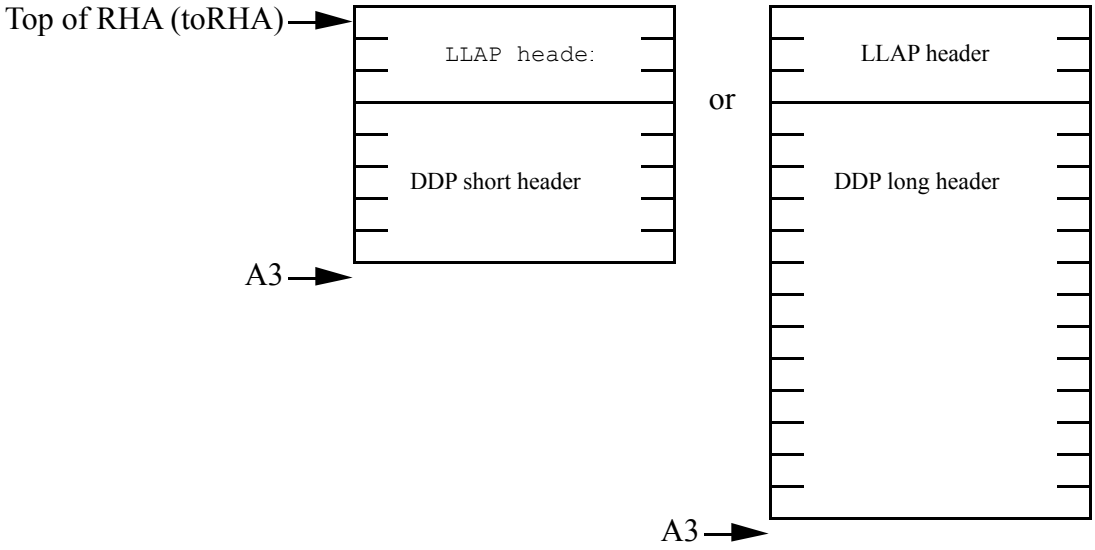
Register(s)	Contents
A0-A1	SCC addresses used by MPP
A2	Pointer to MPP's local variables
A3	Pointer to next free byte in RHA
A4	Pointer to ReadPacket {JSR (A4)} and ReadRest {JSR 2(A4)} jump table
D0	This packet's destination socket number
D1	Number of bytes left to read in packet

- Registers D0, D2, and D3 can be used freely throughout the socket listener. A6, and D4 to D7 must be preserved.

- From entry to socket listener until ReadRest is called:
  The A5 register can be used.
  Registers A0-A2, A4, and D1 must be preserved.

- From ReadRest until exit from socket listener:
  The A5 register must be preserved.
  Registers A0-A3 and D0-D3 are free to use.

You should assume only eight bytes are still available in the RHA for your use. The RHA will contain one of the following:



Socket Listener Overview

The sample socket listener utilizes two standard Operating System (OS) queues (see *Inside Macintosh* II-372), a free queue of available buffers which the listener uses to fill with incoming datagrams. The second linked list is a used queue of buffers which the listener has processed, but

have not been processed by the listener client. The SL_InitSktListener routine is called to pass the listener the pointers to the two OS queues.

When the listener is called to process a packet, the listener checks whether there is an available buffer record in the free queue by checking that qHead element of the free queue is not nil. If so, then the listener sets register A3 to point to the buffer_data element of the record and calls the ReadRest routine. If there is no available buffer record, the packet is ignored by calling ReadRest with a buffer size value of 0. Maybe the next time a packet is handled, a buffer will be available. If an error occurs during the ReadRest function, then the listener simply returns to the caller.

If the packet is successfully read, the listener processes the header information. The header information has been stored by the hardware driver in the MPP local variable space pointed to in register A2. The listener code fills in the hop count field of the packet buffer record and determines the packet length. The listener then figures out whether it is dealing with a short or extended DDP header and fills in the remaining fields of the packet buffer. A check is made to determine whether the checksum field of the DDP header is non-zero. If the field is non-zero, the value is passed to the SL_DoChkSum function to verify that the resulting checksum is zero. If the resulting checksum is non-zero, the buffer_CheckSum field is set to ckSumErr, -3103, otherwise the field is set to noErr. Finally, the listener Enqueues the packet buffer into the used queue and Dequeues it from the free queue before returning to the caller.

The calling program periodically checks the QHead element of the used queue. When QHead is no longer nil, a packet is available for processing. The program processes the packet buffer. When finished, the packet buffer is Enqueued into the free queue and Dequeued from the used queue. The program might then check for additional packets in the used queue and process them in the same manner.

The program needs to define a sufficient number of packet buffers so that the listener has buffers available in the free queue between times when the program checks the used queue and processes incoming packets.

Socket Listener Assembler Code

```
;_____________________________________________________________________________
;
; Socket Listener Sample
;
; 3/92 Jim Luther,  Apple DTS
;
; ©1992 Apple Computer, Inc.
;_____________________________________________________________________________

   INCLUDE    'QuickEqu.a'
   INCLUDE    'ToolEqu.a'
   INCLUDE    'SysEqu.a'
   INCLUDE    'Traps.a'
   INCLUDE    'ATalkEqu.a'
   INCLUDE    'SysErr.a'

;
;
; Record Types
;
;_____________________________________________________________________________

QHdr                    RECORD    0
qFlags                  DS.W      1
```

```
qHead                DS.L      1
qTail                DS.L      1
                     ENDR

PacketBuffer         RECORD    0
qLink                DS.L      1
qType                DS.W      1
buffer_Type          DS.W      1            ; DDP Type
buffer_NodeID        DS.W      1            ; Destination node
buffer_Address       DS.L      1            ; Source address in AddrBlock format
buffer_Hops          DS.W      1            ; Hop count
buffer_ActCount      DS.W      1            ; length of DDP datagram
buffer_CheckSum      DS.W      1            ; Chksum error returned here (cksumErr or noErr)
buffer_Data          DS.B      ddpMaxData   ; the DDP datagram
                     ENDR

;_____________________________________________________________________________
;
; Local Variables
;
;_____________________________________________________________________________

SL_Locals    PROC
       ENTRY free_queue,used_queue,current_qelem

free_queue        DC.L    0        ; pointer to freeQ QHdr - initialized by InitSktListener
used_queue        DC.L    0        ; pointer to usedQ QHdr - initialized by InitSktListener
current_qelem     DC.L    0        ; pointer to current PacketBuffer record
                                   ; initialized by InitSktListener, then
                                   ; set by socket listener after every packet.
                                   ; NIL if no buffer is available.
   ENDP

;_____________________________________________________________________________
;
; SL_DoChksum - accumulate ongoing checksum (from Inside Macintosh)
;
;    Input:
;     D1 (word) = number of bytes to checksum
;     D3 (word) = current checksum
;     A1 points to the bytes to checksum
;
;    Return:
;     D0 is modified
;     D3 (word) = accumulated checksum
;_____________________________________________________________________________

SL_DoChksum    PROC
   CLR.W      D0                    ; Clear high byte
   SUBQ.W     #1,D1                 ; Decrement count for DBRA
ChksumLoop:
   MOVE.B     (A1)+,D0              ; read a byte into D0
   ADD.W      D0,D3                 ; accumulate checksum
   ROL.W      #1,D3                 ; rotate left one bit
   DBRA       D1,ChksumLoop         ; loop if more bytes
   RTS
   ENDP

;_____________________________________________________________________________
;
; SL_TheListener
;
;_____________________________________________________________________________

;_____________________________________________________________________________
;
```

```
; SL_TheListner - process packets received at the designated socket
;
;    Input:
;     D0 (byte) = packet's destination socket number
;     D1 (word) = number of bytes left to read in packet
;     A0 points to the bytes to checksum
;     A1 points to the bytes to checksum
;     A2 points to MPP's local variables
;     A3 points to next free byte in Read Header Area
;     A4 points to ReadPacket and ReadRest jump table
;
;    Return:
;     D0 is modified
;     D3 (word) = accumulated checksum
;_____________________________________________________________________

SL_TheListener  PROC    EXPORT

   WITH    PacketBuffer

; get pointer to current PacketBuffer

GetBuffer:
   LEA       current_qelem,A3              ; get the pointer to the PacketBuffer to use
   MOVE.L    (A3),A3
   MOVE.L    A3,D0                         ; if no PacketBuffer
   BEQ.S     NoBuffer                      ; then ignore packet

; read rest of packet into PacketBuffer.datagramData

   MOVE.L    D1,D3                         ; read rest of packet
   LEA       buffer_data(A3),A3            ; A3 = ^bufferData
   JSR       2(A4)                         ; ReadRest
   BEQ.S     ProcessPacket                 ; If no error, continue
   BRA       RcvRTS                        ; there was an error, so ignore packet

; No buffer; ignore the packet

NoBuffer      CLR D3                         ; Set to ignore packet (buffer size = 0)
   JSR       2(A4)                         ; ReadRest
   BRA       GetNextBuffer                 ; We missed this packet, but maybe there
                                           ; will be a buffer for the next packet…

; Process the packet you just read in.
; ReadRest has been called so registers A0-A3 and D0-D3 are free to use.
; We'll use registers this way:
PktBuff         EQU    A0        ; the current PacketBuffer
MPPLocals       EQU    A2        ; pointer to MPP's local variables (still set up
                                ;  from entry to socket listener)
HopCount        EQU    D0        ; used to get the hop count
DatagramLength  EQU    D1        ; used to determine the datagram length
SourceNetAddr   EQU    D2        ; used to build the source network address

ProcessPacket:
   LEA        current_qelem,PktBuff          ; PktBuff = current_qelem
   MOVE.L     (PktBuff),PktBuff

; do everything that's common to both long and short DDP headers

; first, clear buffer_Type and buffer_NodeID to ensure their high bytes are 0

   CLR.W      buffer_Type(PktBuff)           ; clear buffer_Type
   CLR.W      buffer_NodeID(PktBuff)         ; clear buffer_NodeID

; clear SourceNetAddr to prepare to build network address
```

```
   MOVEQ      #0,SourceNetAddr              ; build the network address in SourceNetAddr

; get the hop count
   MOVE.W     toRHA+lapHdSz+ddpLength(MPPLocals),HopCount ; Get hop/length field
   ANDI.W     #DDPHopsMask,HopCount         ; Mask off the hop count bits
   LSR.W      #2,HopCount                   ; shift hop count into low bits of high byte
   LSR.W      #8,HopCount                   ; shift hop count into low byte
   MOVE.W     HopCount,buffer_Hops(PktBuff) ; and move it into the PacketBuffer

; get the packet length (including the DDP header)
   MOVE.W     toRHA+lapHdSz+ddpLength(MPPLocals),DatagramLength ; Get length field
   ANDI.W     #ddpLenMask,DatagramLength    ; Mask off the hop count bits

; now, find out if the DDP header is long or short

   MOVE.B     toRHA+lapType(MPPLocals),D3   ; Get LAP type
   CMPI.B     #shortDDP,D3                  ; is this a long or short DDP header?
   BEQ.S      IsShortHdr                    ; skip if short DDP header

; it's a long DDP header

   MOVE.B     toRHA+lapHdSz+ddpType(MPPLocals),buffer_Type+1(PktBuff) ; get DDP type

   MOVE.B     toRHA+lapHdSz+ddpDstNode(MPPLocals),buffer_NodeID+1(PktBuff)
                                            ; get destination node from LAP header

   MOVE.L     toRHA+lapHdSz+ddpSrcNet(MPPLocals),SourceNetAddr
                                            ; source network in hi word
                                            ; source node in lo byte
   LSL.W      #8,SourceNetAddr              ; shift source node up to high byte of low word
                                            ; get source socket from DDP header
   MOVE.B     toRHA+lapHdSz+ddpSrcSkt(MPPLocals),SourceNetAddr

   SUB.W      #ddpType+1,DatagramLength     ; DatagramLength = number of bytes in datagram
   BRA.S      MoveToBuffer

; checksum time…
   TST.W      toRHA+lapHdSz+ddpChecksum(MPPLocals) ;Does packet have checksum?
   BEQ.S      noChecksum

; Calculate checksum over DDP header
   MOVE.L     DatagramLength,-(SP)          ; save DatagramLength (D1)

   CLR        D3                            ; set checksum to zero
   MOVEQ      #ddphSzLong-ddpDstNet,D1      ; D1 = length of header part to checksum
                                            ; pointer to dest network number in DDP header
   LEA        toRHA+lapHdSz+ddpDstNet(MPPLocals),A1
   JSR        SL_DoChksum                   ; checksum of DDP header part
                                            ; (D3 holds accumulated checksum)

; Calculate checksum over data portion (if any)

   MOVE.L     buffer_Data(PktBuff),A1       ; pointer to datagram
   MOVE.L     (SP)+,DatagramLength          ; restore DatagramLength (D1)
   MOVE.L     DatagramLength,-(SP)          ; save DatagramLength (D1)
                                            ;  before calling SL_DoChksum
   BEQ.S      TestChecksum                  ; don't checksum datagram if its length = 0
   JSR        SL_DoChksum                   ; checksum of DDP datagram part
                                            ; (D3 holds accumulated checksum)

TestChecksum:
   MOVE.L     (SP)+,DatagramLength          ; restore DatagramLength (D1)

; Now make sure the checksum is OK.

   TST.W      D3                            ; is the calculated value zero?
```

```
   BNE.S      NotZero                         ; no -- go and use it
   SUBQ.W     #1,D3                           ; it is 0; make it -1

NotZero:
   CMP.W      toRHA+lapHdSz+ddpChecksum(MPPLocals),D3
   BNE.S      ChecksumErr                     ; Bad checksum
   MOVE.W     #0,buffer_CheckSum(A0)          ; no errors
   BRA.S      noChecksum
ChecksumErr:
   MOVE.W     #ckSumErr,buffer_CheckSum(PktBuff) ; checksum error

noChecksum:
   BRA.S      MoveToBuffer


; it's a short DDP header

IsShortHdr:
   MOVE.B     toRHA+lapHdSz+sddpType(MPPLocals),buffer_Type+1(PktBuff) ; get DDP type
   MOVE.B     toRHA+lapDstAdr(MPPLocals),buffer_NodeID+1(PktBuff)
                                              ; get destination node from LAP header
   MOVE.B     toRHA+lapSrcAdr(MPPLocals),SourceNetAddr ; get source node from LAP header
   LSL.W      #8,SourceNetAddr                ; shift src node up to high byte of low word
   MOVE.B     toRHA+lapHdSz+sddpSrcSkt(MPPLocals),SourceNetAddr
                                              ; get source socket from short DDP header
   SUB.W      #sddpType+1,DatagramLength      ; DatagramLength = number of bytes in datagram

MoveToBuffer:
   MOVE.L     SourceNetAddr,buffer_Address(PktBuff)
                                              ;move source network address into PacketBuffer
   MOVE.W     DatagramLength,buffer_ActCount(PktBuff)
                                              ; move datagram length into PacketBuffer


; Now that we're done with the PacketBuffer, enqueue it into the usedQ and get
; another buffer from the freeQ for the next packet.

   LEA        used_queue,A1                   ; A1 = ^used_queue
   MOVE.L     (A1),A1                         ; A1 = used_queue (pointer to usedQ)
   _Enqueue                                   ; put the PacketBuffer in the usedQ

GetNextBuffer:
   LEA        free_queue,A1                   ; A1 = ^free_queue
   MOVE.L     (A1),A1                         ; A1 = free_queue (pointer to freeQ)
   LEA        current_qelem, A0               ; copy freeQ.qHead into current_qelem
   MOVE.L     qHead(A1),(A0)
   MOVEA.L    qHead(A1),A0                    ; A0 = freeQ.qHead
   _Dequeue

RcvRTS:
   RTS                                        ; return to caller
   ENDP

;_____________________________________________________________________
; Function SL_InitSktListener(freeQ, usedQ: QHdrPtr): OSErr
;
;

SL_InitSktListener PROC EXPORT

StackFrame     RECORD    {A6Link},DECR     ; build a stack frame record
Result1        DS.W      1                 ; function's result returned to caller
ParamBegin     EQU       *                 ; start parameters after this point
freeQ          DS.L      1                 ; freeQ parameter
usedQ          DS.L      1                 ; usedQ parameter
ParamSize      EQU       ParamBegin-*      ; size of all the passed parameters
```

```
RetAddr         DS.L      1                ; placeholder for return address
A6Link          DS.L      1                ; placeholder for A6 link
LocalSize       EQU       *                ; size of all the local variables
                ENDR

   WITH         StackFrame,QHdr            ; use these record types

   LINK         A6,#LocalSize              ; allocate our local stack frame

; copy the queue header pointers into our local storage for use in the listener

   LEA          used_queue,A0              ; copy usedQ into used_queue
   MOVE.L       usedQ(A6),(A0)

   LEA          free_queue,A0              ; copy freeQ into free_queue
   MOVE.L       freeQ(A6),(A0)

; dequeue the first buffer record from freeQ and set current_qelem to it

   MOVEA.L      freeQ(A6),A1               ; A1 = ^freeQ
   LEA          current_qelem, A0          ; copy freeQ.qHead into current_qelem
   MOVE.L       qHead(A1),(A0)
   MOVEA.L      qHead(A1),A0               ; A0 = freeQ.qHead
   _Dequeue
   MOVE.W       D0,Result1(A6)             ; Return status

@1  UNLK         A6                         ; destroy the link
   MOVEA.L      (SP)+,A0                   ; pull off the return address
   ADDA.L       #ParamSize,SP              ; strip all of the caller's parameters
   JMP          (A0)                       ; return to the caller
   ENDP

   END                                     ; end of this source file
```

Initializing the Socket Listener

To initialize the socket listener, define the free and used queue `QHdr` variables. You'll need to define a PacketBuffer structure to match the record structure defined in the socket listener code. If you add any new fields, then you need to modify the `PacketBuffer` structure defined in the listener code. In the sample below, an array of 10 `PacketBuffers` is declared. Initialize the buffer packets, then queue them into the free queue using the `_Enqueue` trap. Call `SL_InitSktListener` and pass the addresses of the `QHdr` variable for the free and used queues. The following Pascal code demonstrates this process:

```
USES MEMTYPES, QUICKDRAW, OSINTF, APPLETALK;

CONST
 ddpMaxData = 586;
TYPE
   PacketBuffer = RECORD
       qLink: QElemPtr;
       qType: Integer;
       buffer_Type: Integer;
       buffer_NodeID: Integer;
       buffer_Address: AddrBlock;
       buffer_Hops: Integer;
       buffer_ActCount: Integer;
       buffer_CheckSum: OSErr;
       buffer_Data: ARRAY[1..ddpMaxData] OF SignedByte;
   END;

VAR
```

```
   freeQ, usedQ: QHdr;
   Buffers: ARRAY[1..10] OF PacketBuffer;


PROCEDURE SL_TheListener;
External;

FUNCTION SL_InitSktListener (freeQ, usedQ: QHdrPtr): OSErr;
External;

PROCEDURE SetUpSocketListener;
   VAR
       err: OSErr;
       i: Integer;

   BEGIN
       freeQ.QHead := NIL;                 { initialize to nil to indicate empty queue }
       freeQ.QTail := NIL;                 { initialize to nil to indicate end of queue }

       usedQ.QHead := NIL;                 { initialize to nil to indicate empty queue }
       usedQ.QTail := NIL;                 { initialize to nil to indicate end of queue }

       FOR i := 1 TO 10 DO
           Enqueue(@Buffers[i], @freeQ);

       err := SL_InitSktListener(@freeQ, @usedQ);
       IF err <> noErr THEN
           BEGIN
               { Perform error processing here }
           END;
   END;
```

For C Programmer's the initialization code is as follows

```
#include    <types.h>
#include    <appletalk.h>
#include    <OSUtils.h>
#include    <stdio.h>

#define ddpMaxData   586

typedef struct {
   QElemPtr    qLink;
   short       qType;
   short       buffer_type;        /* DDP Type */
   short       buffer_NodeID;      /* Destination Node */
   AddrBlock   buffer_Address;     /* Source Address in AddrBlock format */
   short       buffer_Hops;        /* Hop count */
   short       buffer_ActCount;    /* length of DDP datagram */
   OSErr       buffer_CheckSum;    /* Checksum returned here */
   char        buffer_Data[ddpMaxData]; /* the DDP datagram */
} PacketBuffer;

QHdr          freeQ, usedQ;
PacketBuffer  buffers[10];


extern void SL_THELISTENER();

extern pascal OSErr SL_INITSKTLISTENER (freeQ, usedQ: QHdrPtr): OSErr;

void SetUpSocketListener()
{
```

```
    OSErr  err;
    short  i;

    freeQ.QHead = nil;              /* initialize to nil to indicate empty queue */
    freeQ.QTail = nil;              /* initialize to nil to indicate end of queue */

    usedQ.QHead = nil;              /* initialize to nil to indicate empty queue */
    usedQ.QTail = nil;              /* initialize to nil to indicate end of queue */

    for (i = 0; i < 10; i++)
        Enqueue((QElemPtr)&buffers[i], &freeQ);

    err = SL_INITSKTLISTENER (&freeQ, &usedQ);
    if (err != noErr) {
        /* perform error processing here */
    }
}
```

Using the Socket Listener

The socket listener is set in use with the `POpenSkt` function, or with the more specific `POpenATPSkt` function. The program then periodically checks the `usedQ.QHead` value to determine whether the socket listener has processed a packet. If so, the packet is processed, `Dequeued` from the used queue, and `Enqueued` into the free queue. It's also possible for the same socket listener to be used by separate processes in the program. If so, then program must scan the list for the desired packet(s). Note that if multiple packets are expected, it is possible that the program may process the first packet before the listener processes the second packet. The program needs to be designed to check the `usedQ.QHead` value later for the additional packets.

```
TYPE
    PacketBuffer = RECORD
        qLink: QElemPtr;
        qType: Integer;
        buffer_Type: Integer;
        buffer_NodeID: Integer;
        buffer_Address: AddrBlock;
        buffer_Hops: Integer;
        buffer_ActCount: Integer;
        buffer_CheckSum: OSErr;
        buffer_Data: ARRAY[1..ddpMaxData] OF SignedByte;
    END;

    PacketPtr = ^PacketBuffer;

VAR
    freeQ, usedQ: QHdr;
    bufPtr : PacketPtr;
    .
    .
    .

    WHILE (usedQ.QHead <> nil) DO              { check if packet available for processing }
        BEGIN
            bufPtr := PacketPtr(usedQ.QHead);  { get the packet ptr }
            IF (Dequeue(QElemPtr(bufPtr), @usedQ) <> noErr) THEN
                BEGIN

                    { Process the packet information }

                    Enqueue(QElemPtr(bufPtr), @freeQ); { requeue the packet buffer for use. }
                END
```

```
            ELSE
                BEGIN
                    { error occurred dequeueing packet - perform error processing here }
                END;
        END;
```

For C Programmers, the socket listener code is used as follows:

```
typedef struct {
   QElemPtr    qLink;
   short       qType;
   short       buffer_type;        /* DDP Type */
   short       buffer_NodeID;      /* Destination Node */
   AddrBlock   buffer_Address;     /* Source Address in AddrBlock format */
   short       buffer_Hops;        /* Hop count */
   short       buffer_ActCount;    /* length of DDP datagram */
   OSErr       buffer_CheckSum;    /* Checksum returned here */
   char        buffer_Data[ddpMaxData]; /* the DDP datagram */
} PacketBuffer;

typedef PacketBuffer *PacketPtr;

QHdr       freeQ, usedQ;
PacketPtr  bufPtr;
   .
   .
   .

   while (usedQ.QHead != nil) {               /* check if packet available for processing */
       bufPtr = (PacketPtr)usedQ.QHead;       /* get the packet ptr */
       if (Dequeue(QElemPtr(bufPtr), &usedQ) == noErr {

           { Process the packet information }

           Enqueue(QElemPtr(bufPtr), &freeQ);  /* requeue the packet buffer for use. */
       }
       else {

           /* error occurred dequeueing packet - perform error processing here */
       }
   }
```

The AppleTalk Transition Queue

The AppleTalk Transition Queue keeps applications and other resident processes on the Macintosh informed of AppleTalk events, such as the opening and closing of AppleTalk drivers, or changes to the Flagship name (to be discussed later in this Note). A comprehensive discussion of the AppleTalk Transition Queue is presented in *Inside Macintosh* Volume VI, Chapter 32. New to the AppleTalk Transition Queue are messages regarding the Flagship Naming Service, the AppleTalk Multiple Node Architecture (also to be discussed later in this Note), changes to processor speed that may affect LocalTalk timers, and a transition to indicate change of the network cable range.

Later in this section is a sample Transition Queue procedure in both C and Pascal which includes the known transition selectors. There is also a sample Pascal source for determining whether the LAP Manager version 53 or later exists. Calling `LAPAddATQ` for AppleTalk

versions 52 and earlier will result in a system crash since the LAP Manager is not implemented prior to AppleTalk version 53. The Boolean function, `LAPMgrExists`, should be used instead of checking the low-memory global `LAPMgrPtr, $0B18`.

Calling the AppleTalk Transition Queue

System software version 7.0 requires the use of the MPW version 3.2 interface files and libraries. The AppleTalk interface presents two new routines for calling all processes in the AppleTalk Transition Queue. Rather than use parameter block control calls as described in M.NW.AppleTalk2Mac, use the ATEvent procedure or the ATPreFlightEvent function to send transition notification to all queue elements. These procedures are discussed in *Inside Macintosh* Volume VI, Chapter 32.

Note: You can call the ATEvent and ATPreFlightEvent routines only at virtual memory safe time. See the Memory Management chapter of *Inside Macintosh* Volume VI, Chapter 28, for information on virtual memory.

Standard AppleTalk Transition Constants

Use the following constants for the standard AppleTalk transitions:

```
CONST   ATTransOpen                = 0;  {open transition }
        ATTransClose               = 2;  {prepare-to-close transition }
        ATTransClosePrep           = 3;  {permission-to-close transition }
        ATTransCancelClose         = 4;  {cancel-close transition }
        ATTransNetworkTransition   = 5;  {.MPP Network ADEV Transition }
        ATTransNameChangeTellTask  = 6;  {change-Flagship-name transition }
        ATTransNameChangeAskTask   = 7;  {permission-to-change-Flagship-name transition }
        ATTransCancelNameChange    = 8;  {cancel-change-Flagship-name transition }
        ATTransCableChange         = 'rnge' {cable range change transition }
        ATTransSpeedChange         = 'sped' {change in cpu speed }
```

The following information concerns the new transitions from `ATTransNetworkTransition` through `ATTransSpeedChange`.

The Flagship Naming Service

System software version 7.0 allows the user to enter a personalized name by which her system will be published when connected to an AppleTalk network. The System 'STR ' resource ID –16413 is used to hold this name. The name (listed as Macintosh Name) can be up to 31 characters in length and can be set using the Sharing Setup Control Panel Device (cdev). This resource is different from the Chooser name, System 'STR ' resource ID –16096. When providing network services for a workstation, the Flagship name should be used so that the user can personalize his workstation name while maintaining the use of the Chooser name for server connection identification. It's important to note that the Flagship name resource is available only from system software version 7.0. **DTS recommends that applications not change either of these 'STR ' resources.**

Applications taking advantage of this feature should place an entry in the AppleTalk Transition Queue to stay informed as to changes to this name. Three new transitions have been defined to communicate Flagship name changes between applications and other resident processes. Support for the Flagship Naming Service Transitions is provided starting from AppleTalk version 56. Note that AppleTalk version 56 can be installed on pre-7.0 systems; however, the Flagship Naming Service is available only from System 7.0 and later.

The ATTransNameChangeAskTask Transition

From Assembly language, the stack upon calling looks as follows:

```
ATQEvent            RECORD   0
ReturnAddr          DS.L     1      ; address of caller
```

```
theEvent            DS.L     1      ; = 7; ID of ATTransNameChangeAskTask transaction
aqe                 DS.L     1      ; pointer to task record
infoPtr             DS.L     1      ; pointer to NameChangeInfo parameter block
                    ENDR
```

The `NameChangeInfo` record block is as follows

```
NameChangeInfoPtr: ^NameChangeInfo;
NameChangeInfo  = RECORD
                    newObjStr:      Str32;          {new Flagship name to change to }
                    name:           StringPtr;      {ptr to location to place ptr to process }
                                                    {name }
                  END;
```

The `ATTransChangeNameAskTask` is issued under system software version 7.0 to inform Flagship clients that a process wants to change the Flagship name. Each AppleTalk Transition Queue element that processes the `ATTransChangeNameAskTask` can inspect the `NameChangeInfoPtr^.newObjStr` to determine the new Flagship name. If you deny the request, you must set the `NameChangeInfoPtr^.name` pointer with a pointer to a Pascal string buffer containing the name of your application **or** to the nil pointer. The AppleTalk Transition Queue process returns this pointer. The requesting application can display a dialog notifying the user of the name of the application that refused the change request.

While processing this event, you can make synchronous calls to the Name-Binding Protocol (NBP) to attempt to register your entity under the new name. It is recommended that you register an entity using the new Flagship name while handling the `ATTransChangeNameAskTask` event. You should not deregister an older entity at this point. Your routine must return a function result of 0 in the D0 register, indicating that it accepts the request to change the Flagship name, or a nonzero value, indicating that it denies the request.

Warning: DTS does not recommend that you change the Flagship name. The Sharing Setup cdev does not handle this event and the Macintosh name will not be updated to reflect this change if the cdev is open.

The ATTransNameChangeTellTask Transition

From Assembly language, the stack upon calling looks as follows:

```
ATQEvent        RECORD  0
ReturnAddr      DS.L    1       ; address of caller
theEvent        DS.L    1       ; = 6; ID of ATTransNameChangeTellTask transaction
aqe             DS.L    1       ; pointer to task record
infoPtr         DS.L    1       ; pointer to the new Flagship name
                ENDR
```

A process uses ATEvent to send the `ATTransNameChangeTellTask` to notify AppleTalk Transition Queue clients that the Flagship name is being changed. The LAP Manager then calls every routine in the AppleTalk Transition Queue that the Flagship name is being changed.

When the AppleTalk Manager calls your routine with a `ATTransNameChangeTellTask` transition, the third item on the stack is a pointer to a Pascal string of the new Flagship name to be registered. Your process should deregister any entities under the old Flagship name at this time. You can make synchronous calls to NBP to deregister an entity. Return a result of 0 in the D0 register.

Note: When the AppleTalk Manager calls your process with a TellTask transition (that is, with a routine selector of `ATTransNameChangeTellTask`), you cannot prevent the Flagship name from being changed.

To send notification that your process intends to change the Flagship name, use the ATEvent function described above. Pass `ATTransNameChangeTellTask` as the event parameter and a pointer to the new Flagship name (Pascal string) as the infoPtr parameter.

The ATTransCancelNameChange Transition

From Assembly language, the stack upon calling looks as follows:

```
ATQEvent          RECORD  0
ReturnAddr        DS.L    1      ; address of caller
theEvent          DS.L    1      ; = 8; ID of ATTransCancelNameChange transaction
aqe               DS.L    1      ; pointer to task record
                  ENDR
```

The `ATTransCancelNameChange` transition complements the ATTransNameChangeAskTask transition. Processes that acknowledged an `ATTransNameChangeAskTask` transition will be sent the `ATTransCancelNameChange` transition if a later process disallows the change of Flagship name. Your process should deregister any NBP entities registered during the `ATTransNameChangeAskTask` transition. You can make synchronous calls to NBP to deregister an entity. Return a result of 0 in the D0 register.

System 7.0 Sharing Setup cdev / Flagship Naming Service Interaction:

The Flagship Naming Service is a new system service built into System 7. It is used to publish the workstation using the Flagship name. The Flagship Naming Service implements an AppleTalk Transition Queue element to respond to changes in the Flagship name. For example, the Sharing Setup cdev can be used to reset the Flagship name. When a new Macintosh (Flagship) name is entered in Sharing Setup, Sharing Setup sends an `ATTransNameChangeAskTask` message to the AppleTalk Transition Queue to request permission to change the Flagship name. The Flagship Naming Service receives the `ATTransNameChangeAskTask` transition and registers the new name under the type "Workstation" on the local network. Sharing Setup follows with the `ATTransNameChangeTellTask` to notify AppleTalk Transition Queue clients that a change in Flagship name will occur. The Flagship Naming Service responds by deregistering the workstation under the old Flagship name.

If an error occurs from the NBPRegister call, Flagship Naming Service returns a nonzero error (the error returned from NBPRegister) and a pointer to its name in the `NameChangeInfoPtr^.Name` field. Note that the Workstation name is still registered under the previous Flagship name at this point.

AppleTalk Remote Access Network Transition Event

AppleTalk Remote Access allows you to establish an AppleTalk connection between two Macintosh computers over standard telephone lines. If the Macintosh you dial-in to is on an AppleTalk network, such as LocalTalk or Ethernet, your Macintosh becomes, effectively, a node on that network. You are then able to use all the services on the new network. Given this new capability, it is important that services running on your Macintosh be notified when new AppleTalk connections are established and broken. For this reason, the ATTransNetworkTransition event has been added to AppleTalk version 57. With version 57 present, this event can be expected in system software version 6.0.4 or later.

Internally, both the AppleTalk Session Protocol (ASP) and the AppleTalk Data Stream Protocol (ADSP) have been modified to respond to this transition event. When a disconnect transition event is detected, these drivers close down sessions on the remote side of the connection.

The ATTransNetworkTransition Transition

From Assembly language, the stack upon calling looks as follows:

```
ATQEvent          RECORD  0
ReturnAddr        DS.L    1      ; address of caller
theEvent          DS.L    1      ; = 5; ID of ATTransNetworkTransition
aqe               DS.L    1      ; pointer to task record
infoPtr           DS.L    1      ; pointer to the TNetworkTransition record
                  ENDR
```

The `TNetworkTransition` record block is passed as follows:

```
TNetworkTransition RECORD  0
private           DS.L    1      ;   pointer   used   internally   by   AppleTalk   Remote   Access
netValidProc      DS.L    1      ; pointer to the network validate procedure
newConnectivity   DS.B    1      ; true = new connectivity, false = loss of connectivity
                  ENDR
```

Network Transition Event for AppleTalk Remote Access

Network Transition events are generated by AppleTalk Remote Access to inform AppleTalk Transition Queue applications and resident processes that network connectivity has changed. The type of change is indicated by the `NetTransPtr^.newConnectivity` flag. If this flag is true, a connection to a new internet has taken place. In this case, all network addresses will be returned as reachable. If the `newConnectivity` flag is false, certain networks are no longer reachable. Since AppleTalk Remote Access is connection based, it has knowledge of where a specific network exists. AppleTalk Remote Access can take advantage of that knowledge during a disconnect to inform AppleTalk Transition Queue clients that a network is no longer reachable. This information can be used by clients to age out connections immediately rather than waiting a potentially long period of time before discovering that the other end is no longer responding.

When AppleTalk Remote Access is disconnecting, it passes a network validation hook in the TNetworkTransition record, `NetTransPtr^.netValidProc`. A client can use the validation hook to ask AppleTalk Remote Access whether a specific network is still reachable. If the network is still reachable, the validate function will return true. A client can then continue to check other networks of interest until the status of each one has been determined. After a client has finished checking networks, control returns to AppleTalk Remote Access where the next AppleTalk Transition Queue client is called.

The information the network validation hook returns is valid only if a client has just been called as a result of a transition. A client can validate networks only when she has been called to handle a Network Transition event. Note that the Network Transition event can be called as the result of an interrupt, so a client should obey all of the normal conventions involved with being called at this time (for example, don't make calls that move memory and don't make *synchronous* Preferred AppleTalk calls).

To check a network number for validity the client uses the network validate procedure to call AppleTalk Remote Access. This call is defined using C calling conventions as follows:

```
pascal long netValidProc(TNetworkTransition *thetrans, unsigned long theAddress);
```

```
thetrans    -->  Pass in the TNetworkTransition record given to you when your
                 transition handler was called.

theAddress  -->  This is the network address you want checked. The format of
                 theAddress is the same as AddrBlock as defined in Inside
                 Macintosh II, page 281:

                 Bytes 2 & 3 (High Word) - Network Number
                 Byte 1 - Node Number
                 Byte 0 (Low Byte) - Socket Number
```

Result codes	true	network is still reachable
	false	network is no longer reachable

AppleTalk Transition Queue handlers written in Pascal must implement glue code to use the netValidProc.

Cable Range Change Transition Event

The Cable Range Transition, `ATTransCableChange`, event informs AppleTalk Transition Queue processes that the cable range for the current network has changed. This can occur when a router is first seen, when the last router ages out, or when an RTMP broadcast packet is first received with a cable range that is different from the current range. The `ATTransCableChange` event is implemented beginning with AppleTalk version 57. Most applications should not need to process this event. With version 57 present, this event can be expected in system software version 6.0.4 and later.

The ATTransCableChange Transition

From Assembly language, the stack upon calling looks as follows:

```
ATQEvent          RECORD  0
ReturnAddr        DS.L    1      ; address of caller
theEvent          DS.L    1      ; = 'rnge'; ID of ATTransCableChange
aqe               DS.L    1      ; pointer to task record
infoPtr           DS.L    1      ; pointer to the TNetworkTransition record
                  ENDR
```

The `TNewCRTrans` record block is passed as follows:

```
TNewCRTrans       RECORD  0
newCableLo        DS.W    1      ; the new Cable Lo received from RTMP
newCableHi        DS.W    1      ; the new Cable Hi received from RTMP
                  ENDR
```

The cable range is a range of network numbers starting from the lowest network number through the highest network number defined by a seed router for a network. All node addresses acquired on a network must have a network number within the defined cable range. For nonextended networks, the lowest and the highest network numbers are the same. If the cable range on the network changes, for example, if the router on the network goes down, the Cable Range Change event will be issued with the parameters described earlier in this Technical Note.

After receiving the event, a multinode application should use the new cable range to check if all the multinodes it obtained prior to the event are still valid. For the invalid multinodes, the application should issue the .MPP `RemoveNode` control call to get rid of invalid nodes. The .MPP `AddNode` control call can be issued immediately after removing invalid nodes to obtain new valid multinodes

in the new cable range. This Cable Range Change Transition event will be issued only during system task time.

The Speed Change Transition Event

The `ATTransSpeedChange` Transition event is defined for applications that change CPU speed without rebooting, to notify time-dependent processes that such change has taken place. Such speed change occurs when altering the cache states on the 68030 or 68040 CPUs, or with third- party accelerator cards that allow speed changes on the fly via a cdev. Any process that alters the effective CPU speed should use the `ATEvent` to notify processes of this change. Issue the `ATTransSpeedChange` event **only** at `SystemTask` time! Any process that depends on changes to the CPU speed should watch for this event. The Speed Change Transition event is issued only during system task time.

One time-dependent code module is LocalTalk, whose low-level timer values must be recalculated when the CPU speed changes. Note that altering the cache state on the 68030 does not affect LocalTalk; however doing so on the 68040 does affect LocalTalk timers. This event must be sent by any application that toggles caching on the 68040 processor on the fly. If the cache is toggled and LocalTalk is not notified, a loss of network connection will result if LocalTalk is the current network connection. Note that only LocalTalk implemented in AppleTalk version 57 or later recognizes the Speed Change Transition event. Contact Apple Software Licensing for licensing AppleTalk version 57.

Regarding LocalTalk on the Macintosh Plus, the timing values are hard-coded in ROM regardless of the CPU speed. Vendors of accelerators for Macintosh Plus computers should contact DTS for information on how to make LocalTalk work for you.

The ATTransSpeedChange Transition

From Assembly language, the stack upon calling looks as follows:

```
ATQEvent          RECORD  0
ReturnAddr        DS.L    1      ; address of caller
theEvent          DS.L    1      ; = 'sped'; ID of ATTransSpeedChange
aqe               DS.L    1      ; pointer to task record
                  ENDR
```

To notify LocalTalk that a change in processor speed has taken place, use the `ATEvent` procedure. Pass `ATTransSpeedChange` as the `event` parameter and a nil pointer as the `infoPtr` parameter. This event must be issued only at system task time. The `ATEvent` procedure is implemented as a glue routine in MPW 3.2 or greater. The following line of code demonstrates notification of the `ATTransSpeedChange` event.

```
    ATEvent (ATTransSpeedChange, nil);
```

Sample Pascal Source to LAPMgrExists Function

It is important to check whether the LAP Manager exists before making LAP Manager calls like `LAPAddATQ`. The LAP Manager is implemented beginning with AppleTalk version 53. Rather than check the low-memory global `LAPMgrPtr`, it is preferable to check for its existence from a higher level. The following Pascal source demonstrates this technique:

```
FUNCTION GestaltAvailable: Boolean;
CONST
```

```
    _Gestalt = $A1AD;
BEGIN
    GestaltAvailable := TrapAvailable(_Gestalt);
    { TrapAvailable is documented in Inside Macintosh Volume VI, page 3-8 }
END;


FUNCTION AppleTalkVersion: Integer;
CONST
    versionRequested = 1; { version of SysEnvRec }
VAR
    refNum: INTEGER;
    world: SysEnvRec;
    attrib: LONGINT;
BEGIN
    AppleTalkVersion := 0; { default to no AppleTalk }
    IF OpenDriver('.MPP', refNum) = noErr THEN { open the AppleTalk driver }
        IF GestaltAvailable THEN
        BEGIN
            IF (Gestalt(gestaltAppleTalkVersion, attrib) = noErr) THEN
                AppleTalkVersion := BAND(attrib, $000000FF);
        END
        ELSE   { Gestalt or gestaltAppleTalkVersion selector isn't available. }
            IF SysEnvirons(versionRequested, world) = noErr THEN
                AppleTalkVersion := world.atDrvrVersNum;
END;


FUNCTION LAPMgrExists: Boolean;
BEGIN
    { AppleTalk phase 2 is in AppleTalk version 53 and later }
    LAPMgrExists := (AppleTalkVersion >= 53);
END;
```

Sample AppleTalk Transition Queue Function

A sample AppleTalk Transition Queue function has been implemented in both C and Pascal. These samples have been submitted as snippet code to appear on the *Developer CD Series* disc. Since Transition Queue handlers are called with a C-style stack frame, the Pascal sample includes the necessary C glue.

Sample AppleTalk Transition Queue Function in C

The following is a sample AppleTalk Transition Queue handler for C programmers. To place the handler in the AppleTalk Transition Queue, define a structure of type `myATQEntry` in the main body of the application. Assign the SampleTransQueue function to the `myATQEntry.CallAddr` field. Use the `LAPAddATQ` function to add the handler to the AppleTalk Transition Queue. Remember to remove the handler with the `LAPRmvATQ` function before quitting the application.

Warning: The System 7 Tuner extension will not load AppleTalk resources if it detects that AppleTalk is off at boot time. Remember to check the result from the `LAPAddATQ` function to determine whether the handler was installed successfully.

The following code was written with MPW C v3.2:

```
/*------------------------------------------------------------------------
 file: TransQueue.h
------------------------------------------------------------------------*/

#include <AppleTalk.h>

/*
*  Transition Queue routines are designed with C calling conventions in mind.
*  They are passed parameters with a C-style stack and return values are expected
*  to be in register D0.
*/

#define ATTransOpen              0      /* .MPP just opened */
#define ATTransClose                2         /* .MPP is closing */
#define ATTransClosePrep            3         /* OK for .MPP to close? */
#define ATTransCancelClose       4      /* .MPP close was canceled */
#define ATTransNetworkTransition 5      /* .MPP Network ADEV transition */
#define ATTransNameChangeTellTask 6     /* Flagship name is changing */
#define ATTransNameChangeAskTask 7      /* OK to change Flagship name */
#define ATTransCancelNameChange     8         /* Flagship name change was canceled */
#define ATTransCableChange       'rnge' /* Cable Range Change has occurred */
#define ATTransSpeedChange       'sped' /* Change in processor speed has occurred */

/*------------------------------------------------------------------------
       NBP Name Change Info record
------------------------------------------------------------------------*/
typedef struct NameChangeInfo {
   Str32  newObjStr;    /* new NBP name */
   Ptr name;         /* Ptr to location to place a pointer to Pascal string of */
                        /* name of process that NAK'd the event */
}
   NameChangeInfo, *NameChangePtr, **NameChangeHdl;

/*------------------------------------------------------------------------
       Network Transition Info Record
------------------------------------------------------------------------*/

typedef struct TNetworkTransition {
   Ptr    private;         /* pointer to private structure */
   ProcPtr   netValidProc;    /* pointer to network validation procedure */
   Boolean   newConnectivity; /* true = new connection */
                              /* false = loss of connection */

}
   TNetworkTransition , *TNetworkTransitionPtr, **TNetworkTransitionHdl;

typedef   pascal long   (*NetworkTransitionProcPtr)(TNetworkTransitionPtr netTrans, \
                  unsigned long theNet);

/*------------------------------------------------------------------------
       Cable Range Transition Info Record
------------------------------------------------------------------------*/
typedef struct TNewCRTrans {
   short  newCableLo;   /* the new Cable Lo received from RTMP */
   short  newCableHi;   /* the new Cable Hi received from RTMP */
}
   TNewCRTrans , *TNewCRTransPtr, **TNewCRTransHdl;

/*------------------------------------------------------------------------
       AppleTalk Transition Queue Element
------------------------------------------------------------------------*/
typedef struct   myATQEntry {
   Ptr    qLink;     /* -> next queue element */
   short     qType;     /* unused */
```

```
    ProcPtr   CallAddr; /* -> transition procedure */
    Ptr    globs;    /* -> to user defined globals */
}
    myATQEntry, *myATQEntryPtr, **myATQEntryHdl;


/*-----------------------------------------------------------------------
 file: TransQueue.c
-----------------------------------------------------------------------*/

#include <Memory.h>
#include <AppleTalk.h>
#include "TransQueue.h"

long SampleTransQueue(long selector, myATQEntry *q, void *p)
{
    long                    returnVal = 0; /* return 0 for unrecognized events */
    NameChangePtr           myNameChangePtr;
    TNewCRTransPtr          myTNewCRTransPtr;
    TNetworkTransitionPtr   myTNetworkTransitionPtr;
    NetworkTransitionProcPtr   myNTProcPtr;
    StringPtr               newNamePtr;
    long                    checkThisNet;
    char                    **t;
    short                   myCableLo, myCableHi;


    /*
     * This is the dispatch part of the routine. We'll check the selector passed into
     * the task; its location is 4 bytes off the stack (selector).
     */
    switch(selector) {
        case ATTransOpen:
            /*
             *  Someone has opened the .MPP driver. This is where one would reset the
             *  application to its usual network state (that is, you could register your
             *  NBP name here). Always return 0.
             */
            break;

        case ATTransClose:
            /*
             *  When this routine is called, .MPP is going to shut down no matter what we
             *  do. Handle that type of situation here (that is, one could remove an NBP
             *  name and close down all sessions); 'p' will be nil. Return 0
             *  to indicate no error.
             */
            break;

        case ATTransClosePrep:
            /*
             *  This event gives us the chance to deny the closing of AppleTalk if we
             *  want. Returning a value of 0 means it's OK to close; nonzero
             *  indicates we'd rather not close at this time.
             *
             *  With this event, the parameter 'p' actually means something. 'p' in
             *  this event is a pointer to an address that can hold a pointer to a
             *  string of our choosing. This string indicates to the user which task
             *  would rather not close. If you don't want AppleTalk to close, but you
             *  don't have a name to stick in there, you MUST place a nil value in
             *  there instead.
             *
             *  (We're doing this all locally to this case because it's C and we can, so
             *  there.)
             */
            newNamePtr = (StringPtr)NewPtr(sizeof(Str32));
```

```
    /*
     *  Assume Ptr allocation successful.
     */

    newNamePtr = "\pBanana Mail"; /* This will either be an Ax reference or PC
     *  relative depending on compiler and options. */

    /*
     *  Get a new reference to the address we were passed (in a form we can use).
     */
    t = (char **) p;
    /*
     *  Place the address of our string into the address we were passed.
     */
    *t = (char *)newNamePtr;

    /*
     *  Return a nonzero value so that AppleTalk knows we'd rather not close.
     */
    returnVal = 1;
    break;

case ATTransCancelClose:
    /*
     *  Just kidding, we didn't really want to cancel that AppleTalk closing
     *  after all. Reset all your network activities that you have disabled
 *  here (if any). In our case, we'll just fall through. 'p' will be nil.
     */
    break;

case ATTransNetworkTransition:
    /*
     *  A Remote AppleTalk connection has been made or broken.
     *  'p' is a pointer to a TNetworkTransition record.
     *   Always return 0.
     */
    myTNetworkTransitionPtr = (TNetworkTransitionPtr)p;
    /*
     *  Check newConnectivity element to determine whether
     *  Remote Access is coming up or going down.
     */
    if (myTNetworkTransitionPtr->newConnectivity) {
        /*
         * Have a new connection
         */
    }
    else {
        /*
         * Determine which network addresses need to be validated
         * and assign the value to checkThisNet.
         */
        checkThisNet = 0x1234FD80;  /* network 0x1234, node 0xFD, socket 0x80 */
        myNTProcPtr = (NetworkTransitionProcPtr)myTNetworkTransitionPtr->netValidProc;
        if ((*myNTProcPtr)(myTNetworkTransitionPtr, checkThisNet)) {
            /*
             * Network is still valid.
             */
        }
        else {
            /*
             * Network is no longer valid.
             */
        }
    }
    break;
```

```
case ATTransNameChangeTellTask:
    /*
     *  Someone is changing the Flagship name and there is nothing we can do.
     *  The parameter 'p' is a pointer to a Pascal-style string that holds the new
     *  Flagship name.
     */
    newNamePtr = (StringPtr) p;

    /*
     *  You should deregister any previously registered NBP entries under the
     *  'old' Flagship name. Always return 0.
     */
    break;

case ATTransNameChangeAskTask:
    /*
     *  Someone is messing with the Flagship name.
     *  With this event, the parameter 'p' actually means something. 'p' is
     *  a pointer to a NameChangeInfo record. The newObjStr field contains the
     *  new Flagship name. Try to register a new entity using the new Flagship name.
     *  Returning a value of 0 means it's OK to change the Flagship name.
     */
    myNameChangePtr = (NameChangePtr)p;

    /*
     *  If the NBPRegister is unsuccessful, return the error. You must also set
     *  p->name pointer with a pointer to a Pascal-style string of the process
     *  name.
     */
    break;

case ATTransCancelNameChange:
    /*
     *  Just kidding, we didn't really want to change that name after
     *  all. Remove new NBP entry registered under the ATTransNameChangeAskTask
     *  Transition. In our case,  we'll just fall through. 'p' will be nil. Remember
     *  to return 0.
     */
    break;

case ATTransCableChange:
    /*
     *  The cable range for the network has changed. The pointer 'p' points
     *  to a structure with the new network range. (TNewCRTransPtr)p->newCableLo
     *  is the lowest value of the new network range. (TNewCRTransPtr)p->newCableHi
     *  is the highest value of the new network range. After handling this event,
     *  always return 0.
     */
    myTNewCRTransPtr = (TNewCRTransPtr)p;
    myCableLo = myTNewCRTransPtr->newCableLo;
    myCableHi = myTNewCRTransPtr->newCableHi;
    break;

case ATTransSpeedChange:
    /*
     *  The processor speed has changed. Only LocalTalk responds to this event.
     *  We demonstrate this event for completeness only.
     *  Always return 0.
     */
    break;

default:
    /*
     *  For future Transition Queue events (and yes, Virginia, there will be more).
     */
```

```
            break;
    } /* end of switch */

    /*
     * return value in register D0
     */
    return returnVal;
}
```

Sample AppleTalk Transition Queue Function in Pascal

The following is a sample AppleTalk Transition Queue handler for Pascal programmers. AppleTalk Transition Queue handlers are passed parameters using the C parameter passing convention. In addition, the 4-byte function result must be returned in register D0. To meet this requirement, a C procedure is used to call the handler, then to place the 4-byte result into register D0. The stub procedure listing follows the handler.

To place the handler in the AppleTalk Transition Queue, define a structure of type myATQEntry in the main body of the application. Assign the `CallTransQueue` C procedure to the `myATQEntry.CallAddr` field. Use the `LAPAddATQ` function to add the handler to the AppleTalk Transition Queue. Remember to remove the handler with the `LAPRmvATQ` function before quitting the application.

Warning: The System 7 Tuner extension will not load AppleTalk resources if it detects that AppleTalk is off at boot time. Remember to check the result from the `LAPAddATQ` function to determine whether the handler was installed successfully.

The following code was written with MPW Pascal and C v3.2:

```
{*************************************************************************
 file: TransQueue.p
*************************************************************************}

UNIT TransQueue;

INTERFACE

USES MemTypes, QuickDraw, OSIntF, AppleTalk;

CONST
(*  Comment the following 4 constants since they are already defined in the AppleTalk unit.
   ATTransOpen                 =   0;  { .MPP is opening }
   ATTransClose                =   2;  { .MPP is closing }
   ATTransClosePrep            =   3;  { OK for .MPP to close? }
   ATTransCancelClose          =   4;  { .MPP close was canceled }
*)
   ATTransNetworkTransition    =   5;  { .MPP Network ADEV transition }
   ATTransNameChangeTellTask   =   6;  { Flagship name is changing }
   ATTransNameChangeAskTask    =   7;  { OK to change Flagship name }
   ATTransCancelNameChange     =   8;  { Flagship name change was canceled. }
   ATTransCableChange          =   'rnge'; { Cable Range Change has occurred. }
   ATTransSpeedChange          =   'sped'; { Change in processor speed has occurred. }

{-------------------------------------------------------------------
       NBP Name Change Info record
-------------------------------------------------------------------}

TYPE

NameChangeInfo = RECORD
   newObjStr : Str32;      { new NBP name }
```

```
   name      : Ptr;       { Ptr to location to place a pointer to Pascal string of }
                          { name of process that NAK'd the event }
   END;
NameChangePtr = ^NameChangeInfo;
NameChangeHdl = ^NameChangePtr;

{-------------------------------------------------------------------------
      Network Transition Info Record
-------------------------------------------------------------------------}

TNetworkTransition = RECORD
   private      : Ptr;       { pointer to private structure }
   netValidProc : ProcPtr;   { pointer to network validation procedure }
   newConnectivity : Boolean; { true = new connection, }
                             { false = loss of connection }
   END;

TNetworkTransitionPtr = ^TNetworkTransition;
TNetworkTransitionHdl = ^TNetworkTransitionPtr;

{ The netValidProc procedure has the following C interface. Note the }
{ CallNetValidProc C function, which follows. The C Glue routine allows the Pascal }
{ handler to make the call to the netValidProc function. }

{
typedef pascal long (*NetworkTransitionProcPtr)(TNetworkTransitionPtr netTrans, \
                  unsigned long theNet);
}
{-------------------------------------------------------------------------
      Cable Range Transition Info Record
-------------------------------------------------------------------------}
TNewCRTrans = RECORD
   newCableLo   : INTEGER;   { the new Cable Lo received from RTMP }
   newCableHi   : INTEGER;   { the new Cable Hi received from RTMP }
   END;
TNewCRTransPtr = ^TNewCRTrans;
TNewCRTransHdl = ^TNewCRTransPtr;

{-------------------------------------------------------------------------
      AppleTalk Transition Queue Element
-------------------------------------------------------------------------}
myATQEntry = RECORD
   qlink     : Ptr;       { -> next queue element }
   qType     : INTEGER;   { unused }
   CallAddr  : ProcPtr;   { -> transition procedure }
   globs     : Ptr;       { -> to user defined globals }
   END;
myATQEntryPtr = ^myATQEntry;
myATQEntryHdl = ^myATQEntryPtr;


{---------------- Prototypes --------------------}

FUNCTION SampleTransQueue (selector :LONGINT; q :myATQEntryPtr;  p :Ptr) : LONGINT;
{
*  Transition Queue routines are designed with C calling conventions in mind.
*  They are passed parameters with a C-style stack and return values are expected
*  to be in register D0. Note that the CallTransQueue C glue routine is used
*  to reverse the C-style stack to Pascal style before calling the handler. The
*  procedure CallTransQueue follows this listing. To install this Trans Queue
*  handler, assign CallTransQueue to the CallAddr field, NOT SampleTransQueue.
}

FUNCTION CallNetValidProc(p : ProcPtr; netTrans : TNetworkTransitionPtr;
                        theNet : LONGINT) : LONGINT;
{
```

```
*  CallNetValidProc is used to call the netValidProc passed in the TNetworkTransition
*  record. Since Pascal cannot call the ProcPtr directly, a C glue routine is
*  used. This routine is defined following this listing.
}


IMPLEMENTATION

FUNCTION SampleTransQueue (selector :LONGINT; q :myATQEntryPtr;  p :Ptr) : LONGINT;

VAR
   returnVal               : LONGINT;
   myNameChgPtr            : NameChangePtr;
   myTNewCRTransPtr        : TNewCRTransPtr;
   myTNetworkTransitionPtr : TNetworkTransitionPtr;
   newNamePtr              : StringPtr;
   processNameHdl          : StringHandle;
   myCableLo, myCableHi       : INTEGER;
   shortSelector           : INTEGER;
   checkThisNet            : LONGINT;


BEGIN
   returnVal := 0;               { return 0 for unrecognized events )
   {
    *  This is the dispatch part of the routine. We'll check the selector passed into
    *  the task; its location is 4 bytes off the stack (selector).
    }
   IF ((selector <= ATTransCancelNameChange) AND (selector >= ATTransOpen)) THEN
   {
    *  Check whether a numeric selector is being used whose known values are between
    *  8 and 0 so that we can implement a CASE statement with an INTEGER var.
    }
   BEGIN
      shortSelector := selector;
      CASE shortSelector OF
         ATTransOpen:
         BEGIN
            {
             *  Someone has opened the .MPP driver. This is where one would reset the
             *  application to its usual network state (that is, you could register your
             *  NBP name here). Always return 0.
             }
         END;

         ATTransClose:
         BEGIN
            {
             *  When this routine is called, .MPP is going to shut down no matter what we
             *  do. Handle that type of situation here (that is, one could remove an NBP
             *  name and close down all sessions). 'p' will be nil. Return 0 to
             *  indicate no error.
             }
         END;

         ATTransClosePrep:
         BEGIN
            {
             *  This event gives us the chance to deny the closing of AppleTalk IF we
             *  want. Returning a value of 0 means it's OK to close; nonzero
             *  indicates we'd rather not close at this time.
             *
             *  With this event, the parameter 'p' actually means something. 'p' in
             *  this event is a pointer to an address that can hold a pointer to a
             *  string of our choosing. This string indicates to the user which task
             *  would rather not close. If you don't want AppleTalk to close, but you
```

```
     *  don't have a name to stick in there,  you MUST place a nil value in
     *  there instead.
     }

    {
     *  Get a new reference to the address we were passed (in a form we can use).
     *  (We're doing this all locally to this case because we can, so
     *  there.)
     }
    processNameHdl := StringHandle(NewHandle(sizeof(Str32)));

    {
     *  Place the address of our string into the address we were passed.
     }
     := 'Banana Mail';
    Ptr(p) := Ptr(processNameHdl);

    {
     *  Return a nonzero value so that AppleTalk knows we'd rather not close.
     }
    returnVal := 1;
END;

ATTransCancelClose:
BEGIN
    {
     *  Just kidding, we didn't really want to cancel that AppleTalk closing
     *  after all. Reset all your network activities that you have disabled here
     *  (IF any). In our case, we'll just fall through. 'p' will be nil.
     }
END;

ATTransNetworkTransition:
BEGIN
    {
     *  A Remote AppleTalk connection has been made or broken.
     *  'p' is a pointer to a TNetworkTransition record.
     *   Always return 0.
     }
    myTNetworkTransitionPtr := TNetworkTransitionPtr(p);
    {
     *  Check newConnectivity element to determine whether
     *  Remote Access is coming up or going down.
     }
    if (myTNetworkTransitionPtr^.newConnectivity) THEN
    BEGIN
        {
         * Have a new connection.
         }
    END
    ELSE
    BEGIN
        {
         * Determine which network addresses need to be validated
         * and assign the value to checkThisNet.
         }
        checkThisNet = $1234FD80;  /* network $1234, node $FD, socket $80 */
        if (CallNetValidProc(myTNetworkTransitionPtr^.netValidProc,
               myTNetworkTransitionPtr, checkThisNet) <> 0) THEN
        BEGIN
            {
             * Network is still valid.
             }
        END
        ELSE
        BEGIN
```

```
                {
                 * Network is no longer valid.
                 }
            END;
        END;
    END;

    ATTransNameChangeTellTask:
    BEGIN
        {
         *  Someone is changing the Flagship name and there is nothing we can do.
         *  The parameter 'p' is a pointer to a Pascal-style string that holds the new
         *  Flagship name.
        }
        newNamePtr := StringPtr (p);

        {
         *  You should deregister any previously registered NBP entries under the
         *  'old' Flagship name. Always return 0.
         }
    END;

    ATTransNameChangeAskTask:
    BEGIN
        {
         *  Someone is messing with the Flagship name.
         *  With this event, the parameter 'p' actually means something. 'p' is
         *  a pointer to a NameChangeInfo record. The newObjStr field contains the
         *  new Flagship name. Try to register a new entity using the new Flagship
         *  name. Returning a value of 0 means it's OK to change the Flagship name.
         }
        myNameChgPtr := NameChangePtr (p);

        {
         *  If the NBPRegister is unsuccessful, return the error. You must also set
         *  p->name pointer with a pointer to a string of the process name.
         }
    END;

    ATTransCancelNameChange:
    BEGIN
        {
         *  Just kidding, we didn't really want to cancel that name change after
         *  all. Remove new NBP entry registered under the
         *  ATTransNameChangeAskTask Transition. 'p' will be nil.
         *  Remember to return 0.
         }
    END;

    OTHERWISE
        returnVal := 0;
        {
         *  Just in case some other numeric selector is implemented.
         }
  END; { CASE }
END
ELSE IF (ResType(selector) = ATTransCableChange) THEN
BEGIN
  {
   *  The cable range for the network has changed. The pointer 'p' points
   *  to a structure with the new network range. (TNewCRTransPtr)p->newCableLo
   *  is the lowest value of the new network range. (TNewCRTransPtr)p->newCableHi
   *  is the highest value of the new network range. After handling this event,
   *  always return 0.
   }
  myTNewCRTransPtr := TNewCRTransPtr(p);
```

```
       myCableLo := myTNewCRTransPtr^.newCableLo;
       myCableHi := myTNewCRTransPtr^.newCableHi;
       returnVal := 0;
    END
    ELSE IF (ResType(selector) = ATTransSpeedChange) THEN
    BEGIN
       {
        *  The processor speed has changed. Only LocalTalk responds to this event.
        *  We demonstrate this event for completeness only.
        *  Always return 0.
        }
        returnVal := 0;
    END; { IF }

    SampleTransQueue := returnVal;
END;

FUNCTION CallNetValidProc(p : ProcPtr; netTrans : TNetworkTransitionPtr;
                          theNet : LONGINT) : LONGINT; EXTERNAL;

END. { of UNIT }


/**************************************************************************
 file: CGlue.c
**************************************************************************/
#include <AppleTalk.h>

/*------------------------------------------------------------------------
       Network Transition Info Record
------------------------------------------------------------------------*/

typedef struct TNetworkTransition {
    Ptr    private;         /* pointer to private structure */
    ProcPtr   netValidProc;    /* pointer to network validation procedure */
    Boolean   newConnectivity; /* true = new connection, */
                               /* false = loss of connection */

}
    TNetworkTransition , *TNetworkTransitionPtr, **TNetworkTransitionHdl;

typedef   pascal long   (*NetworkTransitionProcPtr)(TNetworkTransitionPtr netTrans, \
                  unsigned long theNet);

/*------------------------------------------------------------------------
       AppleTalk Transition Queue Element
------------------------------------------------------------------------*/
typedef struct   myATQEntry {
    Ptr    qLink;     /* -> next queue element */
    short     qType;     /* unused */
    ProcPtr   CallAddr; /* -> transition procedure */
    Ptr    globs;     /* -> to user defined globals */
}
    myATQEntry, *myATQEntryPtr, **myATQEntryHdl;

/*------------------------------------------------------------------------
       Prototypes
------------------------------------------------------------------------*/
pascal long  SampleTransQueue (long selector, myATQEntry *q, void *p);
long CALLTRANSQUEUE(long selector, myATQEntry *q, void *p);
/* Capitalize CALLTRANSQUEUE so that linker can match this entry with */
/* the Pascal call. */
pascal long CallNetValidProc(ProcPtr p, TNetworkTransitionPtr netTrans, long theNet);


long CALLTRANSQUEUE(long selector, myATQEntry *q, void *p)
```

```
/* CallTransQueue sets up the Pascal stack for the SampleTransQueue handler, */
/* then puts the result into D0. */
{
    return(SampleTransQueue(selector, q, p));
}

pascal long CallNetValidProc(ProcPtr p, TNetworkTransitionPtr netTrans, long theNet)
/* CallNetValidProc is used to call the netValidProc pointed to by ProcPtr p. */
{
    NetworkTransitionProcPtr   myNTProcPtr;

    myNTProcPtr = (NetworkTransitionProcPtr)p;
    return ((*myNTProcPtr)(netTrans, theNet));
}
```

Multivendor ADEV Architecture

With the release of AppleTalk version 56, Apple implemented the Multivendor ADEV Architecture. Under the original architecture with versions of AppleTalk prior to 56, using EtherTalk or TokenTalk on Macintosh II class machines permitted only one brand of NuBus card where multiple Ethernet or token ring connections were desired. Furthermore, there was no support for a configuration of a NuBus slot device and a “slotless” device, such as a SCSI Ethernet connection.

As Ethernet comes built in on next-generation CPUs, this clearly presents a problem for customers wishing to mix Ethernet controller brands on the same CPU. The Multivendor Architecture presents a common interface through which basic AppleTalk services are provided. The new architecture simplifies software development whereas AppleTalk engineering provides the ADEV file, and the developer provides the hardware level driver software for Ethernet and token ring. By following the new architecture, Ethernet and token ring hardware cards will be compatible as new services are provided by AppleTalk (for example, AppleTalk Remote Access and MacTCP).

AppleTalk version 56 and later is compatible with system software version 6.0.4 unless specifically stated otherwise in the release notes.

Original Limitations

The original product allowed only one type of NuBus Ethernet or token ring controller or one “slotless” controller. This Multivendor ADEV Architecture deals only with the restriction of differing NuBus controllers. It does not address the mutual exclusion of slot and slotless devices, nor does it address the singularity of slotless devices.

NuBus slot Ethernet or token ring controller hardware is recognized by the original product through a series of Slot Manager `SNextTypesRsrc` calls. Any NuBus device that is in the *network* category and has a type classification of *Ethernet /token ring* is considered a NuBus slot controller device. Whenever such a device is found in a NuBus slot, the user can select it as

the current AppleTalk network connection, or it can be used as a port in a Internet Router configuration.

When the AppleTalk network system uses this connection, an _Open, IMMED trap call is made with an *ioNamePtr* -> ".ENET/.TOKN", and the *ioSlot* field set to the slot containing the card. Since only one driver resource can be installed in the system with this name, only one type of Ethernet or token ring card was supported under the original architecture.

.ENET Driver Shell

System software version 7.0 and later (and Network Software Installers system software version 1.1 and later) is packaged with the .ENET driver shell that will support multiple NuBus Ethernet controllers. The sole function of this driver is to locate the appropriate driver resource for the particular device selected, and transfer control to the open routine for that driver. It accomplishes this in the following fashion:

- Obtains the *Board ID* from the board sResource information for the given slot
- Uses `_GetResource` to obtain a resource of type 'enet' with the id equal to the *Board ID* from the system file. If the resource is present, proceeds to use it as the driver code resource as defined below, otherwise attempts to load the driver from the slot resources in the ROM of the slot device. If neither code resource is found, returns an open error.
- Detaches the newly loaded resource
- Modifies the device control entry for the current `_Open call` with information from the loaded driver code (address to the driver)
- Obtains the address of the open routine from the driver header information
- JSRs to the open routine of the loaded driver
- If the open is successful, returns, otherwise recovers the handle for the loaded driver and disposes of it

This very simple technique allows developers to quickly repackage driver resources by simply changing the resource type and ID.

Built-in Ethernet on newer CPUs makes use of the board sResource list for slot zero, which should be present on all CPUs. These systems also have the Ethernet device sResource lists, and also have the .ENET driver in the sResources as well.

The Easy Install process supplied on the Network Software Installer version 1.1 and later, and on the system software installers for 7.0 and later, install the driver shell when it recognizes that an Apple EtherTalk NB or Ethernet NB (or other Ethernet board with Board ID 8) is installed in the system.

.TOKN Driver Shell

The .TOKN driver shell is currently available from Apple Software Licensing (SW.LICENSE) for licensing. The driver and Multivendor TokenTalk ADEV are being packaged beginning with system software version 7.0.1 and AppleTalk products that require AppleTalk version 57 or later. The operation of the .TOKN driver shell is similar to the .ENET driver shell. In place of searching for and loading the 'enet' resource, a 'tokn' resource will be used instead. The new driver will affect all developers whose .TOKN drivers get replaced by the driver shell.

.TOKN Driver Basics

The following guidelines describe the minimum requirements for developers of token ring products for the Macintosh to be compatible with the TokenTalk Phase 2 driver software. MacDTS strongly recommends that all developers of token ring products implement the basic functionality described below. By following these guidelines, the product will be compatible with AppleTalk Remote Access, MacTCP, and future releases of AppleTalk and related products.

The .TOKN driver is similar to the structure of the .ENET driver as described in Appendix B, “Macintosh Ethernet Driver Details” in the *Macintosh AppleTalk Connections Programmer’s Guide* (Final Draft 2, November 11, 1989) and more recently in *Inside Macintosh* Volume VI, page 32-88. These documents describe the expected functionality of the .ENET driver. The .TOKN driver

interface that you design can be a superset of the functionality discussed here. The following are some additional guidelines and exceptions to consider:

• The driver can obtain the slot number from the DCE entry `dCtlSlot`.

• The driver need only support `EAttach` protocol type 0. Return an error on other protocol types.

• Implement the add and delete functional address in place of the `EAddMulti` and `EDelMulti` commands.

• Implement the `ESetGeneral` call to return a result of noErr.

• Implement source routing support if the driver is to support the source routing bridges.

• On `EWrite` call:

The first buffer in the WDS contains a 802.3 MAC header (6-byte destination address + 6-byte source address + 2-byte length field). The 6-byte destination address is the only important field to the driver. The source address and the length fields are not used for token ring media. The header is 14 bytes in length.

The second buffer in the WDS contains the LLC header and the SNAP header. This buffer is 8 bytes in length.

The remainder of the WDS is the user data.

• On Receive:

Build a 14-byte 802.3 MAC header somewhere in the memory. Have register A0 point to one byte after the length field.

Calculate the packet length (LLC header + SNAP header + data). Place the length in register D1.W. Also place the computed length into the length field of the 802.3 MAC header (this length does not include the source routing and 802.5 fields). Have register A3 point to the beginning of the LLC header. Place the address of the `ReadPacket` routine into register A4. Disable the interrupt. Call the protocol handler or use `DeferUserFn` as described below. Enable the interrupt.

Driver Considerations for Virtual Memory

With the release of system software version 7.0 and the virtual memory option, it is critical for driver software to protect against the possibility of a double page fault. Since driver software runs at interrupt time, a non-virtual memory compatible packet processing routine could cause a page fault while the Macintosh is already processing a page fault. To protect against this possibility, the `DeferUserFn` is provided to allow interrupt service routines to defer code, which might cause a page fault, until a safe time. The following guidelines will help make your driver code compatible with virtual memory.

• In the Open routine, use Gestalt to test for the presence of virtual memory, and whether it's on. If so, set a flag in your `dctlstorage` that you can reference later.

• If virtual memory is enabled, always use `DeferUserFn` to defer the delivery of your packet data to your clients. This is necessary to protect against page faults at interrupt time when your

client reads data into her own (probably unlocked) memory. In addition, do not touch any memory that is not locked down (in the virtual memory sense, not the Memory Manager sense) while processing your interrupts.

• Set the `VMImmuneBit` to keep the system from locking down memory (bit 0 at offset `dCtlFlags` + 1). If the `VMImmuneBit` isn't set, the system locks the user's parameter block. In contrast, the user's buffers remain unlocked unless locked by the application. As a result, it is necessary to assume that the buffers are unlocked, and to use `DeferUserFn` accordingly. Having the system lock the parameter block results in a noticeable performance hit. The solution to this problem is to set the `VMImmuneBit`, and to be careful to "touch" the parameter block only when it is "safe" to do so. One time when it might be "unsafe" is in a completion routine. Therefore, use `DeferUserFn` .

The `VMImmune` bit is not currently found in the MPW headers. Add the following line somewhere at the beginning of your driver code:

```
VMImmuneBit     EQU     0
```

Somewhere in the beginning of your code, assuming that the driver is now virtual memory-aware, add the following line:

```
BSET  #VMImmuneBit,dCtlFlags+1(A1)  ; set the bit
```

Warning: Do not assume that DeferUserFn will always successfully queue your packet- handling routine. Check the return result. Under specific situations, the Defer-Function Queue can become full. If the return result is cannotDeferErr exit the slot interrupt routine with a result of zero to indicate that the interrupt could not be serviced.

Limiting DeferUserFn Calls

Your interrupt service routine can reduce the number of calls to `DeferUserFn` depending on the Network Interface Controller (NIC) being used. With the SONIC and other NICs, incoming packets are queued. An ISR for such a NIC can be designed to process not only the packet that generated the interrupt, but also successive packets. As a result, the ISR can be designed to set a "deferred function" flag to indicate that the service routine has been queued, then process all packets that it finds in the card's queue. When the service routine has completed, it can then reset the deferred function flag. If the ISR is reentered, it can check whether the deferred function flag is set. If so, simply exit with a nonzero result in register D0 to indicate that the packet was processed.

Using this algorithm, it is important to reset the NIC's interrupt service register each time the ISR determines that a packet will be processed by a previously deferred function. If the register is not cleared, the card will remain in a constant state of interrupt, and the deferred function will never get a chance to execute.

Implementing DeferUserFn

The question may arise as to where to implement the `DeferUserFn` The following approach is one possible suggestion for devices that are not able to empty the NIC's packet RAM all at once, and which implement a circular buffer or linked buffer list. Define an entry point where the ISR begins processing the packet from the card. At this entry point, there may be some code to check whether a packet transmission is under way and to perform a cleanup. There may also be code here to check whether the buffer has become overrun and to reset the NIC according to manufacturer's guidelines. The driver code would copy the header into the RHA (Read Header Area), identify the

protocol handler and set up register A4 with a pointer to the ReadPacket routine, then call the handler. Upon completion, the ISR might check whether additional packets have been received, if applicable. A flowchart of the deferred function process is as follows:

```
myDeferedFunction()
{
   If transmit complete
       do final cleanup of packet transmission

   If buffer overrun
       Reset the NIC according to manufacturer's guidelines

   while(received packets are waiting in adapter ram)
   {
       process packet
       call protocol handler
   }
}
```

On entry to the ISR, see whether virtual memory is active by checking the flag set by the open routine. Perform whatever processing is necessary, then pass `DeferUserFn`, the entry point described above, if virtual memory is active. If virtual memory is inactive, branch to the entry point and process the packet.

SONIC Based Ethernet Driver Software Interface Change

With the introduction of SONIC based Ethernet controllers, a modification was implemented into the Ethernet driver software to return additional information available from the SONIC chip network statistics counters. This section describes the format of the information returned by an `EGetInfo` call when the current network connection is through an Ethernet NB Card, an Ethernet LC Card, or through the built-in Ethernet available on the Macintosh Quadra 700/900/950.

EGetInfo Changes

The `EGetInfo` call can return up to 60 additional bytes of new information making the maximum number of bytes returned 78. As with the Apple EtherTalk NB Card (Apple/3Com card), the first 6 bytes returned contain the card's Ethernet address. The remaining bytes that are returned contain information different from that returned with the Apple EtherTalk NB Card.

The next 12 bytes (offset 6–17) returned contain NO information but are always returned zero filled for compatibility. The remaining 60 bytes returned contain SONIC chip network statistic counters. The counters are listed below in the following table with the decimal and hexadecimal offsets given from the start of the return buffer. Note that the offset of the first item in the return buffer, the Ethernet address, is at offset 0.

Byte offset:(start at 0)			Description
18	($12)	-	Frames transmitted OK
22	($16)	-	Single collision frames
26	($1A)	-	Multiple collision frames
30	($1E)	-	Collision frames
34	($22)	-	Frames with deferred transmission
38	($26)	-	Late collision
42	($2A)	-	Excessive collisions
46	($2E)	-	Excessive deferrals
50	($32)	-	Internal MAC transmit error
54	($36)	-	Frames received OK
58	($3A)	-	Multicast frames received OK
62	($3E)	-	Broadcast frames received OK
66	($42)	-	Frame check sequence errors
70	($46)	-	Alignment errors
74	($4A)	-	Frames lost due to internal MAC receive error

Distinguishing Apple's SONIC-Based Ethernet Systems

When making the `EGetInfo` call, it is important to pass the correct size buffer. The control call will only fill in the buffer with the number of bytes specified in the `eBuffSize` field. Unless it is already known that the active Ethernet card is the Apple (3Com) EtherTalk NB Card, it is recommended that you pass a buffer large enough to accommodate the additional information returned by the driver for the SONIC chip. One method to distinguish the Apple (3Com) EtherTalk NB Card from Apple's SONIC-based systems, is to fill the 78-byte buffer with a byte pattern like 0xFF. For the Apple EtherTalk NB Card, the last 60 bytes of the buffer will still be filled with the byte pattern. For Apple's SONIC-based systems, the last 60 bytes of the buffer will NOT all contain the byte pattern.

AppleTalk Multiple Node Architecture

Supporting multiple node addresses on a single machine connected to AppleTalk is a feature that has been created to support software applications such as AppleTalk Remote Access. Its implementation is general enough to be used by other applications as well.

Note: AppleTalk version 57 or later is required to support the AppleTalk Multiple Node Architecture. Version 57 is compatible with system software version 6.0.4 and later. If you implement multinode functionality into your program you should also plan to include AppleTalk version 57 with your product. Contact Apple's Software Licensing department (see end of this Note) for information on licensing AppleTalk.

What Is It?

Multiple Node AppleTalk provides network node addresses that are in addition to the normal (user node) DDP address assigned when AppleTalk is opened. These additional addresses have different characteristics from those of the user node address. They are not connected to the protocol stack above the data link layer. When an application acquires a multinode, the application has to supply a receive routine through which AppleTalk will deliver broadcasts and packets directed to that multinode address.

The number of multinode addresses that can be supported on one single machine is determined by a static limit imposed by the AppleTalk ADEV itself (for example, EtherTalk). The limit is currently 253 nodes for Apple's implementation of EtherTalk ($0, $FF, and $FE being invalid node addresses) and 254 for LocalTalk ($0 and $FF being invalid node addresses). The number of receive routines that .MPP supports is determined by the static limit of 256. If all of the multiple nodes acquired need to have unique receive routines, then only a maximum of 256 nodes can be acquired, even if the ADEV provides support for more than 256 nodes. .MPP will support the lesser of either the maximum of 256 receive routines, or the node limit imposed by the ADEV.

Outbound DDP packets can be created with a user-specified **source network, node,** and **socket** (normally equal to a multinode address) with the new Network Write call. With this capability and the packet reception rules described above, a single machine can effectively become several nodes on a network. The **user** node continues to function as it always has.

Glue Code For Multinode Control Calls

The following files are provided for C and Pascal programmers to implement the new multinode calls presented in this Tech Note. First, for C programmers:

```
/*------------------------------------------------------------------------
 file: MultiNode.c
------------------------------------------------------------------------*/

#include <Types.h>
#include <Devices.h>
#include <OSUtils.h>
#include <AppleTalk.h>

enum {

/*  MultiNode .MPP csCodes */

   netWrite = 261,                 /* Send packet through multinode */
   addNode = 262,                  /* Request a multinode */
   removeNode = 263,               /* Remove multinode */
};

typedef struct {
   MPPATPHeader
       char filler1;
       unsigned char checkSumFlag;     /* perform checksum on datagram */
       Ptr wdsPointer;                 /* Ptr to write-data structure */
       char filler2[2];
       union {
           AddrBlock reqNodeAddr;      /* preferred address requested */
           AddrBlock nodeAddr;         /* node address to be deleted */
              } MNaddrs;
       AddrBlock actNodeAddr;          /* actual node address acquired */
       Ptr recvRoutine;                /* address of packet receive routine */
       short reqCableLo;               /* preferred network range for the */
       short reqCableHi;               /*  node being acquired */
       char reserved[70];
} MNParamBlock;

typedef MNParamBlock*MNParmBlkPtr;
```

```
#ifdef __cplusplus
extern "C" {
#endif
pascal OSErr MNAddNode(MNParmBlkPtr thePBptr,Boolean async);
pascal OSErr MNRemoveNode(MNParmBlkPtr thePBptr,Boolean async);
pascal OSErr MNNetWrite(MNParmBlkPtr thePBptr,Boolean async);
```

```
#ifdef __cplusplus
}
#endif

pascal OSErr MNAddNode(MNParmBlkPtr thePBptr,Boolean async)
{
       thePBptr->csCode = addNode;
       thePBptr->ioRefNum = mppUnitNum;
       return (PBControl((ParmBlkPtr)thePBptr, async));
}

pascal OSErr MNRemoveNode(MNParmBlkPtr thePBptr,Boolean async)
{
       thePBptr->csCode = removeNode;
       thePBptr->ioRefNum = mppUnitNum;
       return (PBControl((ParmBlkPtr)thePBptr, async));
}

pascal OSErr MNNetWrite(MNParmBlkPtr thePBptr,Boolean async)
{
       thePBptr->csCode = netWrite;
       thePBptr->ioRefNum = mppUnitNum;
       return (PBControl((ParmBlkPtr)thePBptr, async));
}
```

Now for Pascal Programmers:

```
UNIT MultiNode;
INTERFACE

USES
       MemTypes, QuickDraw, OSIntf, AppleTalk;

CONST

{    MultiNode .MPP csCodes }

   netWrite = 261;                { Send packet through multinode }
   addNode = 262;                 { Request a multinode }
   removeNode = 263;              { Remove multinode }

TYPE
MNParmType = (AddNodeParm,RemoveNodeParm);

MNParamBlock = PACKED RECORD
   qLink: QElemPtr;                  {next queue entry}
   qType: INTEGER;                   {queue type}
   ioTrap: INTEGER;                  {routine trap}
   ioCmdAddr: Ptr;                   {routine address}
   ioCompletion: ProcPtr;            {completion routine}
   ioResult: OSErr;                  {result code}
   ioNamePtr: StringPtr;             {->filename}
   ioVRefNum: INTEGER;               {volume reference or drive number}
   ioRefNum: INTEGER;                {driver reference number}
   csCode: INTEGER;                  {call command code AUTOMATICALLY set}
       filler1: Byte;
       checkSumFlag: Byte;            { perform checksum on datagram }
       wdsPointer: Ptr;               { Ptr to write-data structure }
       filler2: INTEGER;
       CASE MNParmType of
         AddNodeParm:
          (reqNodeAddr: AddrBlock;    { preferred address requested }
          actNodeAddr: AddrBlock;    { actual node address acquired }
          recvRoutine: ProcPtr;      { address of packet receive routine }
          reqCableLo: INTEGER;       { preferred network range for the }
```

```
          reqCableHi: INTEGER;       {  node being acquired }
          reserved: PACKED ARRAY [1..70] of Byte);
     RemoveNodeParm:
            (nodeAddr: AddrBlock);  { node address to be deleted }
   END;

MNParmBlkPtr = ^MNParamBlock;

FUNCTION MNAddNode(thePBptr: MNParmBlkPtr; async: BOOLEAN): OSErr;
FUNCTION MNRemoveNode(thePBptr: MNParmBlkPtr; async: BOOLEAN): OSErr;
FUNCTION MNNetWrite(thePBptr: MNParmBlkPtr; async: BOOLEAN): OSErr;

IMPLEMENTATION

FUNCTION MNAddNode(thePBptr: MNParmBlkPtr; async: BOOLEAN): OSErr;
BEGIN
       thePBptr^.csCode := addNode;
       thePBptr^.ioRefNum := mppUnitNum;
       MNAddNode := PBControl(ParmBlkPtr(thePBptr), async);
END;

FUNCTION MNRemoveNode(thePBptr: MNParmBlkPtr; async: BOOLEAN): OSErr;
BEGIN
       thePBptr^.csCode := removeNode;
       thePBptr^.ioRefNum := mppUnitNum;
       MNRemoveNode := PBControl(ParmBlkPtr(thePBptr), async);
END;

FUNCTION MNNetWrite(thePBptr: MNParmBlkPtr; async: BOOLEAN): OSErr;
BEGIN
       thePBptr^.csCode := netWrite;
       thePBptr^.ioRefNum := mppUnitNum;
       MNNetWrite := PBControl(ParmBlkPtr(thePBptr), async);
END;

END.
```

Things You Need to Know When Writing a Multinode Application

Two new .MPP driver control calls have been added to allow multinode applications to add and remove multinodes.

AddNode (csCode=262)

A user can request an extra node using a control call to the .MPP driver after it has opened. Only one node is acquired through each call.

```
Parameter Block:
       -->    24     ioRefNum     short         ; driver ref. number
       -->    26     csCode       short         ; always = AddNode (262)
       -->    36     reqNodeAddr  AddrBlock     ; the preferred address requested
                                                 ; by the user.
       <--    40     actNodeAddr  AddrBlock     ; actual node address acquired.
       -->    44     recvRoutine  long          ; address of the receive routine for MPP
                                        ; to call during packet delivery.
       -->    48     reqCableLo   short         ; the preferred range for the
       -->    50     reqCableHi   short         ; node being acquired.
       -->    52     reserved[70] char          ; 70 reserved bytes

AddrBlock:
       aNet          short                      ; network #
       aNode         unsigned char              ; node #
       aSocket       unsigned char              ; should be zero for this call.
```

The AddNode call must be made as an IMMEDIATE control call at system task time. The .MPP driver will try to acquire the requested node address. The result code will be returned in the ioResult field in the parameter block. The result code –1021 indicates that the .MPP driver was unable to continue with the AddNode call because of the current state of .MPP. The caller should retry the AddNode call (the retry can be issued immediately after the AddNode call failed with –1021) until a node address is successfully attained or another error is returned.

If the requested node address is zero, invalid, or already taken by another machine on the network, a random node address will be generated by the .MPP driver. The parameters reqCableLo and reqCableHi will be used only if there is no router on the network and all the node addresses in the network number specified in NetHint (the last used network number stored in parameter RAM) are taken up.

In this case, the .MPP driver tries to acquire a node address from the network range as specified by reqCableLo and reqCableHi. The network range is defined by the seed router on a network. If a specific cable range is not important to the application, set the reqCableLo and reqCableHi fields to zero. The recvRoutine is an address of a routine in the application to receive broadcasts and directed packets for the corresponding multinode.

Possible Error Codes:

```
noErr               0           ; success
tryAddNodeAgainErr  -1021       ; .MPP was not able to add node, try again.
MNNotSupported      -1022       ; Multinode is not supported by
                                ; the current ADEV.
noMoreMultiNodes    -1023       ; no node address is available on
                                ; the network.
```

RemoveNode (csCode=263)

This call removes a multinode address and must be made at system task time. Removal of the user node is not allowed.

```
Parameter Block:
      -->    24     ioRefNum     word          ; driver ref. number
      -->    26     csCode       word          ; always = RemoveNode (263)
      -->    36     NodeAddr     AddrBlock     ; node address to be deleted.
```

Possible Error Codes:

```
noErr        0           ; success
paramErr     -50         ; bad parameter passed
```

Receiving Packets

Broadcast packets are delivered to both the user's node and the multinodes on every machine. If several multinodes are acquired with the same recvRoutine address, the recvRoutine, listening for these multinodes, will be called only once in the case of a broadcast packet.

Multinode receive handlers should determine the number of bytes already read into the Read Header Area (RHA) by subtracting the beginning address of the RHA from the value in A3 (see *Inside Macintosh* Volume II, page 326, for a description of the Read Header Area). A3 points past the last byte read in the RHA. The offset of RHA from the top of the .MPP variables is defined by the equate ToRHA in the MPW include file ATalkEqu.a. The receive handler is expected to call

`ReadRest` to read in the rest of the packet. In the case of LocalTalk, ReadRest should be done as soon as possible to avoid loss of the packet. Register A4 contains the pointer to the `ReadPacket` and `ReadRest` routines in the ADEV.

To read in the rest of the packet,

```
JSR    2(A4)
```

On entry:

`A3`	pointer to a buffer to hold the bytes
`D3`	size of the buffer (word), which can be zero to throw away packet

On exit:

`D0`	modified
`D1`	modified
`D2`	preserved
`D3`	Equals zero if requested number of bytes was read; is less than zero if packet was –D3 bytes too large to fit in buffer and was truncated; is greater than zero if D3 bytes were not read (packet is smaller than buffer)
`A0`	preserved
`A1`	preserved
`A2`	preserved
`A3`	pointer to 1 byte after the last byte read

For more information about `ReadPacket` and `ReadRest`, refer to the *Inside Macintosh* Volume II, page 327.

A user can determine if a link is extended by using the `GetAppleTalkInfo` control call. The `Configuration` field returned by this call is a 32-bit word that describes the AppleTalk configuration. Bit number 15 (0 is LSB) is on if the link in use is extended. Refer to *Inside Macintosh* Volume VI, page 32-15.

Sending Datagrams Through Multinodes

To send packets through multinodes, use the new .MPP control call, `NetWrite. NetWrite` allows the owner of the multinode to specify a **source network, node,** and **socket** from which to send a datagram.

NetWrite (csCode=261)

```
Parameter Block:
      -->    26     csCode       word         ; always NetWrite (261)
      -->    29     checkSumFlag byte         ; checksum flag
      -->    30     wdsPointer   pointer      ; write data structure
```

Possible Error Codes:

```
      noErr        0            ; success
      ddpLenErr    -92          ; datagram length too big
      noBridgeErr  -93          ; no router found
      excessCollsns-95          ; excessive collisions on write
```

This call is very similar to the `WriteDDP` call. The key differences are as follows:

- The source socket is not specified in the parameter block. Instead it is specified along with the source network number and source node address in the DDP header pointed to by the write-data structure (WDS). Furthermore, the socket need not be opened. Refer to *Inside Macintosh* Volume II, page 310, for a description of the write-data structure. It is important to note that the caller needs to fill in the WDS with the source network, source node, and source socket values. .MPP does not set these values for the NetWrite call.

- The `checkSumFlag` field has a slightly different meaning. If true (nonzero), then the checksum for the datagram will be calculated prior to transmission and placed into the DDP header of the packet. If false (zero), then the **checksum field is left alone** in the DDP header portion of the packet. Thus if a checksum is already present, it is passed along unmodified. For example, the AppleTalk Remote Access program sets this field to zero, since remote packets that it passes to the .MPP driver already have valid checksum fields. Finally, if the application desires no checksum, the checksum field in the DDP header in the WDS header must be set to zero.

Datagrams sent with this call are *always sent using a long DDP header*. Refer to *Inside AppleTalk*, second edition, page 4-16, for a description of the DDP header. Even if the destination node is on the same LocalTalk network, a long DDP datagram is used so that the source information can be specified. The LAP header source node field will always be equal to the user node address (sysLapAddr), regardless of the source node address in the DDP header.

AppleTalk Remote Access Network Number Remapping

Network applications should be careful not to pass network numbers as data in a network transaction. AppleTalk Remote Access performs limited network number remapping. If network numbers are passed as data, they will not get remapped. AppleTalk Remote Access recognizes network numbers in the DDP header and among the various standard protocol packets, NBP, ZIP, RTMP, and so on.

Is There a Router on the Network?

Do not assume that there are no routers on the network if your network number is zero. With AppleTalk Remote Access, you can be on network zero and be connected to a remote network. Network applications should use the `GetZoneList` or the `GetBridgeAddress` calls to determine if there is a router on the network.

New for AppleTalk ADEVs

First, a word from our sponsors: The information in this section is provided to assist ADEV developers in updating their products for compatibility with AppleTalk Remote Access. If you are a Ethernet or token ring developer, MacDTS strongly urges that you consider following the Multivendor ADEV Architecture described earlier. For developers of Fiber Data Distribution Interface (FDDI) network interface cards, please contact Apple Software Licensing for information on licensing the new FDDI Phase 2 ADEV and Driver shell.

Several new calls have been implemented into the .MPP driver for AppleTalk version 57. Two calls, `AOpen` and `AClose`, were built into AppleTalk version 54 and later, and are also documented here. These calls notified the ADEV of changes in the status of the .MPP driver. For AppleTalk version 57, three new calls, `AAddNode`, `ADelNode`, and `AGetNodeRef`, plus a change to the `AGetInfo` call, were implemented to support the Multiple Node Architecture.

EtherTalk Phase 2, version 2.3, and TokenTalk phase 2, version 2.4, drivers support the new Multiple Node Architecture. Both drivers and AppleTalk version 57 are available through the Network Software Installer, version 1.1. As mentioned previously, AppleTalk version 57 and these drivers are compatible with system software version 6.0.4 and later. Note that the AppleTalk Remote Access product includes the EtherTalk Phase 2, version 2.3 driver, but *not* the multinode-compatible TokenTalk Phase 2, version 2.4, driver. Token ring developers, who license TokenTalk Phase 2, version 2.2 and earlier, should contact Apple's Software Licensing department.

The following information describes changes to the ADEV that are required for multinode compatibility. This information is of specific importance to developers of custom ADEVs. The ADEV can be expected to function under version 6.0.4 and later. A version 3 ADEV **must** be used with AppleTalk version 57 or later. Developers of custom ADEVs will want to contact Software Licensing to license AppleTalk version 57.

For compatibility with Multinode AppleTalk, the 'atlk' resource of an ADEV must be modified to respond to these calls as described below. To determine whether an ADEV is multinode compatible, the .MPP driver makes an AGetInfo call to determine whether the ADEV version is 3 or later. Any ADEVs responding with a version of 3 or later must be prepared to respond to the new calls: `AAddNode`, `ADelNode`, and `AGetNodeRef`. See the *Macintosh AppleTalk Connections Programmer's Guide* for more information about writing an AppleTalk ADEV.

The desired architecture for a multinode-compatible ADEV is such that it delivers incoming packets to the LAP Manager along with an address reference number, AddrRefNum. The LAP Manager uses the AddrRefNum to locate the correct receive routine to process the packet. For broadcast packets, the LAP Manager handles multiple deliveries of the packet to each multinode receive routine.

The .MPP driver for AppleTalk version 57 supports the new control call to add and remove multinodes, along with the network write call that allows the specification of the source address. .MPP includes a modification in its write function to check for one multinode sending to another. .MPP supports inter-multinode transmission within the same machine. For example, the user node may want to send a packet to a multinode within the same system.

AGetInfo (D0=3)

The AGetInfo call should be modified to return the maximum number of **AppleTalk** nodes that can be provided by the atlk. This limit will be used by .MPP to control the number of multinodes that can be added on a single machine. The new interface is as follows:

Call: D1 (word) length (in bytes) of reply buffer

	A1 ->	Pointer to GetInfo record buffer
Return:	A1 ->	Pointer to GetInfo record
	D0	nonzero if error (buffer is too small)

```
      AGetInfoRec = RECORD
<--   version:            INTEGER;     { version of ADEV, set to three (3) }
<--   length:             INTEGER;     { length of this record in bytes }
<--   speed:              LongInt;     { speed of link in bits/sec }
<--   BandWidth:          Byte;        { link speed weight factor }
<--   reserved:           Byte;        { set to zero }
<--   reserved:           Byte;        { set to zero }
<--   reserved:           Byte;        { set to zero }
<--   flags:              Byte;        { see below }
<--   linkAddrSize:       Byte;        { of link addr in bytes }
```

```
<--    linkAddress:        ARRAY[0..5] OF Byte;
<--    maxnodes:           INTEGER;
       END;

       flags: bit 7 = 1 if this is an extended AppleTalk, else 0
              bit 6 = 1 if the link is used for a router-only connection (reserved
                     for half-routing)
              bit 5 through 0 reserved, = 0
```

maxnodes is the total number of nodes (user node and multinodes) the ADEV supports. If a version 3 ADEV does not support multinodes, it must return 0 or 1 in the maxnodes field in AGetInfoRec and the ADEV will not be called to acquire multinodes. The version 3 ADEV will be called by .MPP in one of the following two ways to acquire the user node:

- If the ADEV returns a value of 0 in maxnodes, .MPP will issue Lap Write calls to the ADEV with D0 set to $FF indicating that ENQs should be sent to acquire the user node. .MPP is responsible for retries of ENQs to make sure no other nodes on the network already have this address. This was the method .MPP used to acquire the user node before multinodes were introduced. This method of sending ENQs must be available, even though the new AAddNode call is provided, to allow older versions of AppleTalk to function properly with a version 3 ADEV.
- If the ADEV returns a value of 1 in maxnodes, the new AAddNode function will be called by .MPP to acquire the user node.

For values of maxnode greater than 1, the new AAddNode function will be called by .MPP to acquire the additional multinodes.

AAddNode (D0=9)

This is a **new** call which is used to request the acquisition of an AppleTalk node address. It is called by the .MPP driver during the execution of the AddNode control call mentioned earlier. The ADEV is responsible for retrying enough ENQs to make sure no other nodes on the network already have the address. .MPP makes this call only during system task time.

Call:	A0->	Pointer to parameter block
Return:	D0	= zero if address was acquired successfully
		≠ zero if no more addresses can be acquired

```
       atlkPBRec           Record csParam
-->    NetAddr             DS.L   1      ; offset 0x1C  24-bit node address to acquire
-->    NumTrys             DS.W   1      ; offset 0x20  # of tries for address
-->    DRVRPtr             DS.L   1      ; offset 0x22  ptr to .MPP vars
-->    PortUsePtr          DS.L   1      ; offset 0x26  ptr to port use byte
-->    AddrRefNum          DS.W   1      ; offset 0x2A  address ref number used by .MPP
                           EndR
```

The offset values describe the location of the fields from the beginning of the parameter block pointed to by A0. atlkPBRec is the standard parameter block record header for a _Control call. The field NetAddr is the 24-bit AppleTalk node address that should be acquired. The node number is in the least significant byte 0 of NetAddr. The network number is in bytes 1 and 2 of NetAddr; byte 3 is unused. NumTrys is the number of tries the atlk should send AARP probes on non-

LocalTalk networks to verify that the address is not in use by another entity. On LocalTalk networks, `NumTrys` x 32 number of ENQs will be sent to verify an address.

DRVRPtr and PortUsePtr are normally passed when the atlk is called to perform a write function. For ADEVs that support multinodes, AppleTalk calls the new AAddNode function rather than the write function in the ADEV to send ENQs to acquire nodes. However, the values DRVRPtr and PortUsePtr are still required for the ADEV to function properly and are passed to the AAddNode call. AddrRefNum is a reference number passed in by .MPP. The ADEV must store each reference number with its corresponding multinode address. The use of the reference number is described in the following two sections.

For multinode-compatible ADEVs, .MPP issues the first AAddNode call to acquire the user node. The AddrRefNum associated with the user node must be 0xFFFF. It is important to assign 0xFFFF as the AddrRefNum of the user node, and to disregard the AddrRefNum passed by .MPP for the user node. See the discussion at the end of the ADelNode description.

ADelNode (D0=10)

This is a **new** call which is used to remove an AppleTalk node address. It can be called by the .MPP driver to process the RemoveNode control call mentioned earlier.

Call: A0-> Pointer to parameter block
NetAddr contains the node address to be deleted
Return: D0 = zero if address is removed successfully
≠ zero if address does not exist
atlkPBRec.AddrRefNum = AddrRefNum to be used by .MPP if the operation is successful

```
        atlkPBRec           Record csParam
-->     NetAddr             DS.L   1      ; offset 0x1C  24-bit node address to remove
<--     AddrRefNum          DS.W   1      ; offset 0x2A  AddrRefNum passed in by AAddNode
                                          ;              on return
                            EndR
```

The field NetAddr is the 24-bit AppleTalk node address that should be removed. As with the AAddNode selector, the node number is in the least significant byte 0 of NetAddr. The network number is in bytes 1 and 2 of NetAddr; byte 3 is unused. The address reference number, AddrRefNum, associated with the NetAddr, must be returned to .MPP in order for .MPP to clean up its data structures for the removed node address.

As mentioned above, a value of 0xFFFF must be returned to .MPP after deleting the user node. When the AppleTalk connection is started up for the first time on an extended network, the ADEV can expect to process an AAddNode request followed shortly by an ADelNode request. This results from the implementation of the provisional node address for the purpose of talking with the router to determine the valid network number range to which the node is connected. After obtaining the network range, .MPP issues the ADelNode call to delete the provisional node. The next ADelNode call will be to acquire the unique node ID for the user node. As mentioned previously, .MPP can pass a value different from 0xFFFF for the user node. The user node is acquired before any multinode. The ADEV needs to keep track of the number of AAddNode and ADelNode calls issued to determine whether the user node is being acquired. Refer to *Inside AppleTalk*, second edition, page 4-8, for additional information.

AGetNodeRef (D0=11)

This is a **new** call which is used by .MPP to find out if a multinode address exists on the current ADEV. This call is currently used by .MPP to check if a write should be looped back to one of the

other nodes on the machine (the packet does not actually need to be sent through the network) or should be sent to the ADEV for transmission.

Call:	A0->	Pointer to parameter block
Return:	D0->	= zero if address does not exist on this machine ≠ zero if address exists on this machine `atlkPBRec.AddrRefNum = AddrRefNum` (corresponding to the node address) if the operation is successful

```
      atlkPBRec          Record csParam
-->   NetAddr            DS.L   1      ; offset 0x1C  24-bit node address to remove
<--   AddrRefNum         DS.W   1      ; offset 0x2A  AddrRefNum passed in by AAddNode
                                       ;              on return
                         EndR
```

The field `NetAddr` is the 24-bit AppleTalk node address whose AddrRefNum is requested. The node number is in the least significant byte 0 of `NetAddr`. The network number is in bytes 1 and 2 of `NetAddr`; byte 3 is unused. The address reference number, `AddrRefNum`, associated with the `NetAddr`, must be returned to .MPP. Remember to return 0xFFFF as the `AddrRefNum` for the user node.

AOpen (D0=7)

Call:

```
      -->   D4.B        current port number
```

ADEVs should expect the `AOpen` call whenever the .MPP driver is being opened. This is a good time for the ADEV to register multicast addresses with the link layer or register a Transition Queue handler. After this call is completed, .MPP is ready to receive packets. If the ADEV does not process this message, simply return, `RTN` with a `ControlErr`.

Note that `AOpen` is not specific to the Multinode Architecture.

AClose (D0=8)

`AClose` is called only when .MPP is being closed (for example, .MPP is closed when the “inactive” option is selected in the Chooser or when the user switches links in network cdev). The ADEV can use this event to deregister any multicast addresses with the link layer or remove an existing Transition Queue handler. After this `AClose` call is completed, the ADEV should not defend for any node addresses until .MPP reopens and acquires new node addresses. If the ADEV does not process this message, simply return, RTN with a `ControlErr`.

Note that `AClose` is not specific to the Multinode Architecture.

For comparison, descriptions of `AInstall` and `AShutDown` are documented as follows:

AInstall (D0=1)

Call:

```
      -->   D1.L = value from PRAM (slot, ID, unused, atlk resource ID)
      <--   D1.L = high 3 bytes for parameter RAM returned by the ADEV,
      if no error
      <--   D0.W = error code
```

The AInstall call is made before .MPP is opened either during boot time or when the user switches links in network cdev. This call is made during system task time so that the ADEV is allowed to allocate memory, make file system calls, or load resources and so on. Note: AOpen call will be made during .MPP opens.

AShutDown (D0=2)

ADEVs should expect the AShutDown call to be made when the user switches links in the Network cdev. The network cdev closes .MPP, which causes the AClose call to be made before the cdev issues the AShutDown call. Note: the AShutDown call is always made during system task time; therefore, deleting memory, unloading resources, and file system calls can be done at this time.

Receiving Packets

The address reference number (AddrRefNum) associated with each node address must be passed to .MPP when delivering packets upward. When making the LAP Manager call LReadDispatch to deliver packets to AppleTalk, the ADEV must fill the high word of D2 in with the address reference number, corresponding to the packet's destination address (LAP node address in the LocalTalk case and DDP address in the non-LocalTalk case). There are a few special cases:

- In the case of broadcasts and packets directed to the user node, $FFFF (word) should be used as the address reference number.
- On non-LocalTalk networks, packets with DDP destination addresses matching neither the user node address nor any of the multinode addresses should still be delivered to the LAP Manager so that the router can forward the packet on to the appropriate network. In this case, the high word of D2 should be filled in with the address reference number, $FFFE, to indicate to MPP that this packet is not for any of the nodes on the machine in the case of a router running on a machine on an extended network.
- On LocalTalk networks, the ADEV looks only at the LAP address; therefore, if the LAP address is not the user node, one of the multinodes, or a broadcast, the packet should be thrown away.

Defending Multinode Addresses

Both LocalTalk (RTS and CTS) and non-LocalTalk (AARP) ADEVs have to be modified to defend not only for the user node address but also for

any active multinode addresses.

AppleTalk Version Information

The following table is presented to assist AppleTalk developers in understanding which versions of AppleTalk are required by the various AppleTalk products. This list does not identify the individual bug fixes associated with each release of AppleTalk.

AppleTalk Version	.MPP Version	.ATP Version	Apple Products Using That Version
19	19	19	Macintosh Plus ROM
48	48	46	Macintosh SE ROM Macintosh Classic ROM
48.1	48	46	AppleShare File Server v1.0
49	49	49	Macintosh II ROM Macintosh IIcx ROM Macintosh SE/30
50	50	49	AppleShare File Server v1.1
51	51	51	AppleShare Print Server v2.0
52	52	52	AppleShare File Server v2.0 Macintosh IIx ROM Macintosh IIci ROM Macintosh Portable ROM PowerBook 100 ROM

Phase 1 drivers

AppleTalk Version	.MPP Version	.ATP Version	Apple Products Using That Version
53	53	53	AppleTalk Phase 2 products AppleTalk Internet Router v2.0 Apple EtherTalk NB Card 2.0 Apple TokenTalk NB Card 2.0
54	54	54	Macintosh IIfx Macintosh LC Macintosh LC II Macintosh IIsi
55	55	55	Apple Ethernet LC Card (for Macintosh LC)
56	56	56	System 7 Macintosh Classic II PowerBook 140 PowerBook 170 Quadra 700 Quadra 900 Quadra 950
57.0.1	57.0.1	57.0.1	AppleTalk Remote Access Apple TokenRing 4/16 NB Card Apple Ethernet NB Card
57.0.3	57.0.3	57.0.3	Apple Ethernet LC Card (for Macintosh LC II)
57.0.4	57.0.4	57.0.4	MacTCP Token Ring Extension v1.0

Phase 2 drivers

Some interesting notes:

- .MPP and .ATP driver versions weren't always the same in versions of AppleTalk before version 51. The .MPP driver version is the AppleTalk version number.
- The Phase 1 RAM-based drivers (versions 49 through 52) were supplied as file that could be drag-installed (that is, the installation consisted of dropping them into the System Folder).
- The Phase 2 RAM-based drivers (versions 53 through 57) must be installed by an Installer script that will install the various system pieces (files, resources, and so on) needed to load and support these new drivers; these versions cannot be drag-installed.
- AppleTalk version 56 or greater includes the .DSP driver (ADSP). Starting with version 56, the .DSP driver version is the same as the AppleTalk version.

Apple software products that require the Phase 2 RAM-based drivers must be installed using the Installer program. Apple supplies an Installer script that will copy all files and system resources needed. Apple licenses the source to an Installer script that you can use if you license AppleTalk to ship with your products.

Contacting Apple Software Licensing

Software Licensing can be reached as follows:

Software Licensing
Apple Computer, Inc.
20525 Mariani Avenue, M/S 38-I
Cupertino, CA 95014
MCI: 312-5360
AppleLink: SW.LICENSE
Internet: SW.LICENSE@AppleLink.Apple.com
(408)974-4667

Further Reference:

- *Inside AppleTalk,* Second Edition, Addison-Wesley
- *Inside Macintosh*, Volume II, *The AppleTalk Manager*, Addison-Wesley
- *Inside Macintosh*, Volume V, *The AppleTalk Manager*, Addison-Wesley
- *Inside Macintosh*, Volume VI, *The AppleTalk Manager*, Addison-Wesley
- *Macintosh AppleTalk Connections Programmer's Guide*, Final Draft 2, Apple Computer, Inc. (M7056/A)
- *AppleTalk Phase 2 Protocol Specification*, Apple Computer, Inc. (C0144LL/A)
- *AppleTalk Remote Access Developer's Toolkit,* Apple Computer, Inc. (R0128LL/A)
- M.NW.AppleTalk2Mac