              Management Information Base for Frame Relay DTEs

Status of this Memo

   This RFC specifies an IAB standards track protocol for the Internet
   community, and requests discussion and suggestions for improvements.
   Please refer to the current edition of the "IAB Official Protocol
   Standards" for the standardization state and status of this protocol.
   Distribution of this memo is unlimited.

Abstract

   This memo defines a portion of the Management Information Base (MIB)
   for use with network management protocols in TCP/IP-based internets.
   In particular, it defines objects for managing Frame Relay.

Table of Contents

1. The Network Management Framework

    The Internet-standard Network Management Framework consists of three
    components. They are:

    RFC 1155 which defines the SMI, the mechanisms used for describing
    and naming objects for the purpose of management. RFC 1212 defines a
    more concise description mechanism, which is wholly consistent with
    the SMI.

    RFC 1156 which defines MIB-I, the core set of managed objects for the
    Internet suite of protocols. RFC 1213 defines MIB-II, an evolution
    of MIB-I based on implementation experience and new operational
    requirements.

    RFC 1157 which defines the SNMP, the protocol used for network access
    to managed objects.

    The Framework permits new objects to be defined for the purpose of
    experimentation and evaluation.

2. Objects

    Managed objects are accessed via a virtual information store, termed
    the Management Information Base or MIB. Objects in the MIB are
    defined using the subset of Abstract Syntax Notation One (ASN.1) [7]
    defined in the SMI. In particular, each object has a name, a syntax,
    and an encoding. The name is an object identifier, an
    administratively assigned name, which specifies an object type. The
    object type together with an object instance serves to uniquely
    identify a specific instantiation of the object. For human
    convenience, we often use a textual string, termed the OBJECT
    DESCRIPTOR, to also refer to the object type.

    The syntax of an object type defines the abstract data structure
    corresponding to that object type. The ASN.1 language is used for
    this purpose. However, the SMI [3] purposely restricts the ASN.1
    constructs which may be used. These restrictions are explicitly made
    for simplicity.

    The encoding of an object type is simply how that object type is
    represented using the object type's syntax. Implicitly tied to the
    notion of an object type's syntax and encoding is how the object type
    is represented when being transmitted on the network.

    The SMI specifies the use of the basic encoding rules of ASN.1 [8],
    subject to the additional requirements imposed by the SNMP.

2.1. Format of Definitions

   Section 4 contains contains the specification of all object types
   contained in this MIB module. The object types are defined using the
   conventions defined in the SMI, as amended by the extensions
   specified in [9,10].

3. Overview

3.1. Frame Relay Operational Model

   For the purposes of understanding this document, Frame Relay is
   viewed as a multi-access media, not as a group of point-to-point
   connections. This model proposes that Frame Relay is a single
   interface to the network (physical connection) with many destinations
   or neighbors (virtual connections). This view enables a network
   manager the ability to group all virtual connections with their
   corresponding physical connection thereby allowing simpler
   diagnostics and trouble shooting.

3.2. Textual Conventions

   Several new data types are introduced as a textual convention in this
   MIB document. These textual conventions enhance the readability of
   the specification and can ease comparison with other specifications
   if appropriate. It should be noted that the introduction of the
   these textual conventions has no effect on either the syntax nor the
   semantics of any managed objects. The use of these is merely an
   artifact of the explanatory method used. Objects defined in terms of
   one of these methods are always encoded by means of the rules that
   define the primitive type. Hence, no changes to the SMI or the SNMP
   are necessary to accommodate these textual conventions which are
   adopted merely for the convenience of readers and writers in pursuit
   of the elusive goal of clear, concise, and unambiguous MIB documents.

   The new data types are Index and DLCI. Index refers to the range
   1..ifNumber, and is used to establish the correspondence between
   ifEntries and Frame Relay Interfaces. DLCI refers to the range
   0..DLCINumber, and is used to refer to the valid Data Link Connection
   Indices. DLCINumber is, by definition, the largest possible DLCI
   value possible under the configured Q.922 Address Format.

3.3. Structure of MIB

   The MIB is composed of three groups, one defining the Data Link
   Connection Management Interface (DLCMI), one describing the Circuits,
   and a third describing errors.

   During normal operation, Frame Relay virtual circuits will be added,
   deleted and change availability. The occurrence of such changes is
   of interest to the network manager and therefore, one trap is
   defined, intended to be corollary to the SNMP "Link Up" and "Link
   Down" traps.

4. Definitions

      RFC1315-MIB DEFINITIONS ::= BEGIN

      IMPORTS
              OBJECT-TYPE
                      FROM RFC-1212
              transmission
                      FROM RFC1213-MIB
              TimeTicks
                      FROM RFC-1155
              TRAP-TYPE
                      FROM RFC-1215;

      -- Frame Relay DTE MIB

      frame-relay   OBJECT IDENTIFIER ::= { transmission 32 }

      --
      --   the range of ifIndex
      --
      Index ::= INTEGER   -- 1..ifNumber

      --
      --   the range of a Data Link Connection Identifier
      --
      DLCI ::= INTEGER   -- 0..DLCINumber

      -- Data Link Connection Management Interface

      --   The variables that configure the DLC Management Interface.

      frDlcmiTable OBJECT-TYPE
          SYNTAX   SEQUENCE OF FrDlcmiEntry
          ACCESS   not-accessible
          STATUS   mandatory
          DESCRIPTION
            "The Parameters for the Data Link Connection Management
            Interface for the frame relay service on this
            interface."
          REFERENCE

```
             "Draft American National Standard T1.617-1991, Annex D"
         ::= { frame-relay 1 }

         frDlcmiEntry OBJECT-TYPE
             SYNTAX   FrDlcmiEntry
             ACCESS   not-accessible
             STATUS   mandatory
             DESCRIPTION
                 "The Parameters for a particular Data Link Con-
                 nection Management Interface."
             INDEX { frDlcmiIfIndex }
             ::= { frDlcmiTable 1 }

         FrDlcmiEntry ::=
             SEQUENCE {
                 frDlcmiIfIndex
                     Index,
                 frDlcmiState
                     INTEGER,
                 frDlcmiAddress
                     INTEGER,
                 frDlcmiAddressLen
                     INTEGER,
                 frDlcmiPollingInterval
                     INTEGER,
                 frDlcmiFullEnquiryInterval
                     INTEGER,
                 frDlcmiErrorThreshold
                     INTEGER,
                 frDlcmiMonitoredEvents
                     INTEGER,
                 frDlcmiMaxSupportedVCs
                     INTEGER,
                 frDlcmiMulticast
                     INTEGER
         }



         frDlcmiIfIndex OBJECT-TYPE
             SYNTAX   Index
             ACCESS   read-only
             STATUS   mandatory
             DESCRIPTION
                 "The ifIndex value of the  corresponding  ifEn-
                 try."
             ::= { frDlcmiEntry 1 }
```

```
        frDlcmiState OBJECT-TYPE
            SYNTAX INTEGER {
                noLmiConfigured (1),
                lmiRev1         (2),
                ansiT1-617-D    (3),   -- ANSI T1.617 Annex D
                ansiT1-617-B    (4)    -- ANSI T1.617 Annex B
            }
            ACCESS   read-write
            STATUS   mandatory
            DESCRIPTION
                "This variable states which Data  Link  Connec-
                tion Management scheme is active (and by impli-
                cation, what DLCI it uses) on the  Frame  Relay
                interface."
          REFERENCE
                "Draft American National Standard T1.617-1991"
            ::= { frDlcmiEntry 2 }



        frDlcmiAddress OBJECT-TYPE
            SYNTAX       INTEGER {
                        q921            (1),  -- 13 bit DLCI
                        q922March90     (2),  -- 11 bit DLCI
                        q922November90 (3),  -- 10 bit DLCI
                        q922            (4)   -- Final Standard
            }
            ACCESS   read-write
            STATUS   mandatory
            DESCRIPTION
                "This variable states which address  format  is
                in use on the Frame Relay interface."
            ::= { frDlcmiEntry 3 }


        frDlcmiAddressLen OBJECT-TYPE
            SYNTAX   INTEGER {
                        two-octets (2),
                        three-octets (3),
                        four-octets (4)
            }
            ACCESS   read-write
            STATUS   mandatory
            DESCRIPTION
                "This variable states which address  length  in
                octets.  In the case of Q922 format, the length
                indicates the entire length of the address  in-
                cluding the control portion."
```

```
                ::= { frDlcmiEntry 4 }



        frDlcmiPollingInterval OBJECT-TYPE
            SYNTAX   INTEGER (5..30)
            ACCESS   read-write
            STATUS   mandatory
            DESCRIPTION
               "This is the number of seconds between  succes-
               sive status enquiry messages."
            REFERENCE
               "Draft American National  Standard  T1.617-1991,
               Section D.7 Timer T391."
           DEFVAL { 10 }
           ::= { frDlcmiEntry 5 }


        frDlcmiFullEnquiryInterval OBJECT-TYPE
            SYNTAX   INTEGER (1..255)
            ACCESS   read-write
            STATUS   mandatory
            DESCRIPTION
               "Number of status enquiry intervals  that  pass
               before  issuance  of a full status enquiry mes-
               sage."
            REFERENCE
               "Draft American National  Standard  T1.617-1991,
               Section D.7 Counter N391."
           DEFVAL { 6 }
           ::= { frDlcmiEntry 6 }



        frDlcmiErrorThreshold OBJECT-TYPE
            SYNTAX   INTEGER (1..10)
            ACCESS   read-write
            STATUS   mandatory
            DESCRIPTION
               "This  is  the  maximum  number  of  unanswered
               Status Enquiries the equipment shall accept be-
               fore declaring the interface down."
            REFERENCE
               "Draft American National  Standard  T1.617-1991,
               Section D.5.1 Counter N392."
           DEFVAL { 3 }
           ::= { frDlcmiEntry 7 }
```

```
        frDlcmiMonitoredEvents OBJECT-TYPE
            SYNTAX   INTEGER (1..10)
            ACCESS   read-write
            STATUS   mandatory
            DESCRIPTION
               "This is the number of status polling intervals
               over which the error threshold is counted.  For
               example, if within 'MonitoredEvents' number  of
               events  the  station  receives 'ErrorThreshold'
               number of errors, the interface  is  marked  as
               down."
            REFERENCE
               "Draft American National  Standard  T1.617-1991,
               Section D.5.2 Counter N393."
           DEFVAL { 4 }
           ::= { frDlcmiEntry 8 }



        frDlcmiMaxSupportedVCs OBJECT-TYPE
            SYNTAX   INTEGER
            ACCESS   read-write
            STATUS   mandatory
            DESCRIPTION
               "The maximum number of Virtual Circuits allowed
               for  this  interface.   Usually dictated by the
               Frame Relay network.

               In response to a SET, if a value less than zero
               or  higher  than the agent's maximal capability
               is configured, the agent  should  respond  bad-
               Value"
            ::= { frDlcmiEntry 9 }


        frDlcmiMulticast OBJECT-TYPE
            SYNTAX   INTEGER {
                       nonBroadcast (1),
                       broadcast (2)
                       }
            ACCESS   read-write
            STATUS   mandatory
            DESCRIPTION
               "This indicates whether the Frame Relay  inter-
               face is using a multicast service."
            ::= { frDlcmiEntry 10 }
```

```
     -- A Frame Relay service is a multiplexing service.  Data
     -- Link Connection Identifiers enumerate virtual circuits
     -- (permanent or dynamic) which are layered onto the underlying
     -- circuit, represented by ifEntry.  Therefore, each of the entries
     -- in the Standard MIB's Interface Table with an IfType of
     -- Frame Relay represents a Q.922 interface.  Zero or more
     -- virtual circuits are layered onto this interface and provide
     -- interconnection with various remote destinations.
     -- Each such virtual circuit is represented by an entry in the
     -- circuit table.

     --   Circuit Table

     -- The table describing the use of the DLCIs attached to
     -- each Frame Relay Interface.

     frCircuitTable OBJECT-TYPE
         SYNTAX   SEQUENCE OF FrCircuitEntry
         ACCESS   not-accessible
         STATUS   mandatory
         DESCRIPTION
           "A table containing information about specific Data
           Link Connection Identifiers and corresponding virtual
           circuits."
         ::= { frame-relay 2 }

         frCircuitEntry OBJECT-TYPE
             SYNTAX   FrCircuitEntry
             ACCESS   not-accessible
             STATUS   mandatory
             DESCRIPTION
                "The information regarding a single  Data  Link
                Connection Identifier."
             INDEX { frCircuitIfIndex, frCircuitDlci }
             ::= { frCircuitTable 1 }


         FrCircuitEntry ::=
             SEQUENCE {
                 frCircuitIfIndex
                     Index,
                 frCircuitDlci
                     DLCI,
                 frCircuitState
                     INTEGER,
                 frCircuitReceivedFECNs
                     Counter,
                 frCircuitReceivedBECNs
```

```
                Counter,
            frCircuitSentFrames
                Counter,
            frCircuitSentOctets
                Counter,
            frCircuitReceivedFrames
                Counter,
            frCircuitReceivedOctets
                Counter,
            frCircuitCreationTime
                TimeTicks,
            frCircuitLastTimeChange
                TimeTicks,
            frCircuitCommittedBurst
                INTEGER,
            frCircuitExcessBurst
                INTEGER,
            frCircuitThroughput
                INTEGER
        }


        frCircuitIfIndex OBJECT-TYPE
            SYNTAX   Index
            ACCESS   read-only
            STATUS   mandatory
            DESCRIPTION
              "The ifIndex Value of the ifEntry this  virtual
              circuit is layered onto."
          ::= { frCircuitEntry 1 }


        frCircuitDlci OBJECT-TYPE
            SYNTAX   DLCI
            ACCESS   read-only
            STATUS   mandatory
            DESCRIPTION
              "The Data Link Connection Identifier  for  this
              virtual circuit."
           REFERENCE
              "Draft American National  Standard  T1.618-1991,
              Section 3.3.6"
          ::= { frCircuitEntry 2 }
```

```
        frCircuitState OBJECT-TYPE
            SYNTAX   INTEGER {
                        invalid (1),
                        active (2),
                        inactive (3)
                    }
            ACCESS   read-write
            STATUS   mandatory
            DESCRIPTION
               "Indicates whether the particular virtual  cir-
               cuit  is operational.  In the absence of a Data
               Link Connection Management  Interface,  virtual
               circuit   entries  (rows) may be created by set-
               ting virtual  circuit  state  to  'active',  or
               deleted by changing Circuit state to 'invalid'.
               Whether or not the row actually  disappears  is
               left  to the implementation, so this object may
               actually read as 'invalid' for  some  arbitrary
               length  of  time.   It is also legal to set the
               state of a virtual  circuit  to  'inactive'  to
               temporarily disable a given circuit."
           DEFVAL { active }
           ::= { frCircuitEntry 3 }


       frCircuitReceivedFECNs OBJECT-TYPE
           SYNTAX   Counter
           ACCESS   read-only
           STATUS   mandatory
           DESCRIPTION
              "Number of frames received from the network in-
              dicating  forward  congestion since the virtual
              circuit was created."
           REFERENCE
              "Draft American National  Standard  T1.618-1991,
              Section 3.3.3"
          ::= { frCircuitEntry 4 }



       frCircuitReceivedBECNs OBJECT-TYPE
           SYNTAX   Counter
           ACCESS   read-only
           STATUS   mandatory
           DESCRIPTION
              "Number of frames received from the network in-
              dicating  backward congestion since the virtual
              circuit was created."
```

```
    REFERENCE
       "Draft American National  Standard  T1.618-1991,
        Section 3.3.4"
     ::= { frCircuitEntry 5 }



frCircuitSentFrames OBJECT-TYPE
    SYNTAX   Counter
    ACCESS   read-only
    STATUS   mandatory
    DESCRIPTION
       "The number of frames sent  from  this  virtual
        circuit since it was created."
     ::= { frCircuitEntry 6 }



frCircuitSentOctets OBJECT-TYPE
    SYNTAX   Counter
    ACCESS   read-only
    STATUS   mandatory
    DESCRIPTION
       "The number of octets sent  from  this  virtual
        circuit since it was created."
     ::= { frCircuitEntry 7 }



frCircuitReceivedFrames OBJECT-TYPE
    SYNTAX   Counter
    ACCESS   read-only
    STATUS   mandatory
    DESCRIPTION
       "Number of frames received  over  this  virtual
        circuit since it was created."
     ::= { frCircuitEntry 8 }



frCircuitReceivedOctets OBJECT-TYPE
    SYNTAX   Counter
    ACCESS   read-only
    STATUS   mandatory
    DESCRIPTION
       "Number of octets received  over  this  virtual
        circuit since it was created."
     ::= { frCircuitEntry 9 }
```

```
        frCircuitCreationTime OBJECT-TYPE
            SYNTAX   TimeTicks
            ACCESS   read-only
            STATUS   mandatory
            DESCRIPTION
                "The value of sysUpTime when the  virtual  cir-
                cuit was created, whether by the Data Link Con-
                nection Management Interface  or  by  a  SetRe-
                quest."
           ::= { frCircuitEntry 10 }



        frCircuitLastTimeChange OBJECT-TYPE
            SYNTAX   TimeTicks
            ACCESS   read-only
            STATUS   mandatory
            DESCRIPTION
                "The value of sysUpTime when last there  was  a
                change in the virtual circuit state"
           ::= { frCircuitEntry 11 }



        frCircuitCommittedBurst OBJECT-TYPE
            SYNTAX   INTEGER
            ACCESS   read-write
            STATUS   mandatory
            DESCRIPTION
                "This variable indicates the maximum amount  of
                data,  in  bits,  that  the  network  agrees to
                transfer under normal  conditions,  during  the
                measurement interval."
             REFERENCE
                "Draft American National  Standard  T1.617-1991,
                Section 6.5.19"
           DEFVAL   { 0 }  -- the default indicates no commitment
           ::= { frCircuitEntry 12 }



        frCircuitExcessBurst OBJECT-TYPE
            SYNTAX   INTEGER
            ACCESS   read-write
            STATUS   mandatory
            DESCRIPTION
                "This variable indicates the maximum amount  of
                uncommitted data bits that the network will at-
```

               tempt to deliver over the measurement interval.

               By default, if not configured when creating the
               entry, the Excess Information Burst Size is set
               to the value of ifSpeed."
            REFERENCE
               "Draft American National Standard T1.617-1991,
               Section 6.5.19"
                    ::= { frCircuitEntry 13 }

         frCircuitThroughput OBJECT-TYPE
             SYNTAX   INTEGER
             ACCESS   read-write
             STATUS   mandatory
             DESCRIPTION
               "Throughput is the average number of 'Frame Re-
               lay Information Field' bits transferred per
               second across a user network interface in one
               direction, measured over the measurement inter-
               val.

               If the configured committed burst rate and
               throughput are both non-zero, the measurement
               interval
               T=frCircuitCommittedBurst/frCircuitThroughput.

               If the configured committed burst rate and
               throughput are both zero, the measurement in-
               terval
                       T=frCircuitExcessBurst/ifSpeed."
             REFERENCE
               "Draft American National Standard T1.617-1991,
               Section 6.5.19"
           DEFVAL {0} -- the default value of Throughput is
                       -- "no commitment".
           ::= { frCircuitEntry 14 }

     -- Error Table

     -- The table describing errors encountered on each Frame
     -- Relay Interface.

     frErrTable OBJECT-TYPE
         SYNTAX   SEQUENCE OF FrErrEntry
         ACCESS   not-accessible

```
         STATUS   mandatory
         DESCRIPTION
           "A table containing information about Errors on the
           Frame Relay interface."
        ::= { frame-relay 3 }

        frErrEntry OBJECT-TYPE
            SYNTAX   FrErrEntry
            ACCESS   not-accessible
            STATUS   mandatory
            DESCRIPTION
                "The error information for a single frame relay
                interface."
            INDEX { frErrIfIndex }
            ::= { frErrTable 1 }



        FrErrEntry ::=
            SEQUENCE {
                frErrIfIndex
                    Index,
                frErrType
                    INTEGER,
                frErrData
                    OCTET STRING,
                frErrTime
                    TimeTicks
        }



        frErrIfIndex OBJECT-TYPE
            SYNTAX   Index
            ACCESS   read-only
            STATUS   mandatory
            DESCRIPTION
              "The ifIndex Value of the  corresponding  ifEn-
              try."
            ::= { frErrEntry 1 }



        frErrType OBJECT-TYPE
            SYNTAX   INTEGER {
                        unknownError(1),
                        receiveShort(2),
                        receiveLong(3),
```

```
                    illegalDLCI(4),
                    unknownDLCI(5),
                    dlcmiProtoErr(6),
                    dlcmiUnknownIE(7),
                    dlcmiSequenceErr(8),
                    dlcmiUnknownRpt(9),
                    noErrorSinceReset(10)
                }
        ACCESS   read-only
        STATUS   mandatory
        DESCRIPTION
           "The type of error that was last seen  on  this
           interface."
        ::= { frErrEntry 2 }



    frErrData OBJECT-TYPE
        SYNTAX   OCTET STRING
        ACCESS   read-only
        STATUS   mandatory
        DESCRIPTION
           "An octet string containing as much of the  er-
           ror  packet as possible.  As a minimum, it must
           contain the Q.922 Address or  as  much  as  was
           delivered.   It is desirable to include all in-
           formation up to the PDU."
        ::= { frErrEntry 3 }



    frErrTime OBJECT-TYPE
        SYNTAX   TimeTicks
        ACCESS   read-only
        STATUS   mandatory
        DESCRIPTION
           "The value of sysUpTime at which the error  was
           detected."
        ::= { frErrEntry 4 }


    -- Frame Relay Globals

    frame-relay-globals OBJECT IDENTIFIER ::= { frame-relay 4 }

    frTrapState OBJECT-TYPE
        SYNTAX   INTEGER { enabled(1), disabled(2) }
        ACCESS   read-write
```

```
            STATUS   mandatory
            DESCRIPTION
               "This variable  indicates  whether  the  system
               produces the frDLCIStatusChange trap."
            DEFVAL { disabled }
            ::= { frame-relay-globals 1 }


        -- Data Link Connection Management Interface Related Traps

        frDLCIStatusChange TRAP-TYPE
            ENTERPRISE frame-relay
            VARIABLES  { frCircuitIfIndex, frCircuitDlci, frCircuitState }
            DESCRIPTION
               "This trap indicates that the indicated Virtual
               Circuit  has changed state.  It has either been
               created or invalidated, or has toggled  between
               the active and inactive states."
            ::= 1

    END
```

5. Acknowledgements

   This document was produced by the IP Over Large Public Data Networks
   (IPLPDN) Working Group.

   The following people provided additional comments and suggestions:
   Art Berggreen of Advanced Computer Communications, and Jim Philippou
   of Xyplex Communications.

6. References

   [1] Cerf, V., "IAB Recommendations for the Development of Internet
       Network Management Standards", RFC 1052, NRI, April 1988.

   [2] Cerf, V., "Report of the Second Ad Hoc Network Management Review
       Group", RFC 1109, NRI, August 1989.

   [3] Rose M., and K. McCloghrie, "Structure and Identification of
       Management Information for TCP/IP-based internets", RFC 1155,
       Performance Systems International, Hughes LAN Systems, May 1990.

   [4] McCloghrie K., and M. Rose, "Management Information Base for
       Network Management of TCP/IP-based internets", RFC 1156, Hughes
       LAN Systems, Performance Systems International, May 1990.

   [5] Case, J., Fedor, M., Schoffstall, M., and J. Davin, "Simple
       Network Management Protocol", RFC 1157, SNMP Research,
       Performance Systems International, Performance Systems
       International, MIT Laboratory for Computer Science, May 1990.

   [6] McCloghrie K., and M. Rose, Editors, "Management Information Base
       for Network Management of TCP/IP-based internets", RFC 1213,
       Performance Systems International, March 1991.

   [7] Information processing systems - Open Systems Interconnection -
       Specification of Abstract Syntax Notation One (ASN.1),
       International Organization for Standardization, International
       Standard 8824, December 1987.

   [8] Information processing systems - Open Systems Interconnection -
       Specification of Basic Encoding Rules for Abstract Notation One
       (ASN.1), International Organization for Standardization,
       International Standard 8825, December 1987.

   [9] Rose, M., and K. McCloghrie, Editors, "Concise MIB Definitions",
       RFC 1212, Performance Systems International, Hughes LAN Systems,
       March 1991.

  [10] Rose, M., Editor, "A Convention for Defining Traps for use with
       the SNMP", RFC 1215, Performance Systems International, March
       1991.

7. Security Considerations

    Security issues are not discussed in this memo.

8. Authors' Addresses

Caralyn Brown
Wellfleet Communications, Inc.
15 Crosby Drive
Bedford, Massachusetts 01730

Phone: (617) 275-2400
EMail: cbrown@wellfleet.com

Fred Baker
Advanced Computer Communications
315 Bollay Drive
Sannta Barbara, California 93117

Phone: (805) 685-4455
EMail: fbaker@acc.com

Charles Carvalho
Advanced Computer Communications
315 Bollay Drive
Sannta Barbara, California 93117

Phone: (805) 685-4455
EMail: charles@acc.com