                  Textual Conventions for Transport Addresses

Status of this Memo

   This document specifies an Internet standards track protocol for the
   Internet community, and requests discussion and suggestions for
   improvements. Please refer to the current edition of the "Internet
   Official Protocol Standards" (STD 1) for the standardization state
   and status of this protocol. Distribution of this memo is unlimited.

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Abstract

   This document introduces a Management Information Base (MIB) module
   that defines textual conventions to represent commonly used
   transport-layer addressing information. The definitions are
   compatible with the concept of TAddress/TDomain pairs introduced by
   the Structure of Management Information version 2 (SMIv2) and support
   the Internet transport protocols over IPv4 and IPv6.

Table of Contents

1. Introduction

   Several MIB modules need to represent transport-layer addresses in a
   generic way. Typical examples are MIBs for application protocols
   that can operate over several different transports or application
   management MIBs that need to model generic communication endpoints.

   The SMIv2 in STD 58, RFC 2579 [RFC2579] defines the textual
   conventions TDomain and TAddress to represent generic transport layer
   endpoints. A generic TAddress value is interpreted in a given
   transport domain which is identified by a TDomain value. The TDomain
   is an object identifier which allows MIB authors to extend the set of
   supported transport domains by providing suitable definitions in
   standardized or enterprise specific MIB modules.

   An initial set of TDomain values and concrete TAddress formats has
   been standardized in STD 62, RFC 3417 [RFC3417]. These definitions
   are however mixed up with SNMP semantics. Furthermore, definitions
   for Internet transport protocols over IPv4 and IPv6 are missing.

   The purpose of this memo is to introduce a set of well-known textual
   conventions to represent commonly used transport-layer addressing
   information which is compatible with the original TDomain and
   TAddress approach and which includes definitions for additional
   Internet transport protocols over IPv4 and IPv6. This memo also
   introduces a new textual convention which enumerates the well-known
   transport domains since such an enumeration provides in many cases
   sufficient flexibility and is more efficient compared to object
   identifiers.

   The key words "MUST", "MUST NOT", "SHOULD", "SHOULD NOT" and "MAY" in
   this document are to be interpreted as described in BCP 14, RFC 2119
   [RFC2119].

2. The Internet-Standard Management Framework

   For a detailed overview of the documents that describe the current
   Internet-Standard Management Framework, please refer to section 7 of
   RFC 3410 [RFC3410].

   Managed objects are accessed via a virtual information store, termed
   the Management Information Base or MIB. MIB objects are generally
   accessed through the Simple Network Management Protocol (SNMP).
   Objects in the MIB are defined using the mechanisms defined in the
   Structure of Management Information (SMI). This memo specifies a MIB
   module that is compliant to the SMIv2, which is described in STD 58,
   RFC 2578 [RFC2578], STD 58, RFC 2579 [RFC2579] and STD 58, RFC 2580
   [RFC2580].

3. Overview

   This MIB module contains definitions for commonly used transport
   layer addressing information. In particular, it provides the
   following definitions:

   1. Textual conventions for generic transport addresses
      (TransportAddress) and generic transport domains
      (TransportDomain).

   2. Object identifier registrations for well-known transport domains.

   3. An enumeration of the well-known transport domains, called a
      transport address type (TransportAddressType).

   4. A set of textual conventions for the address formats used by
      well-known transport domains. The DISPLAY-HINTs are aligned with
      the formats used in URIs [RFC2396], [RFC3291].

   The textual conventions for well-known transport domains support
   scoped Internet addresses. The scope of an Internet address is a
   topological span within which the address may be used as a unique
   identifier for an interface or set of interfaces. A scope zone, or
   simply a zone, is a concrete connected region of topology of a given
   scope. Note that a zone is a particular instance of a topological
   region, whereas a scope is the size of a topological region [SCOPED].
   Since Internet addresses on devices that connect multiple zones are
   not necessarily unique, an additional zone index is needed on these
   devices to select an interface. The textual conventions
   TransportAddressIPv4z and TransportAddressIPv6z are provided to
   support Internet transport addresses that include a zone index. In
   order to support arbitrary combinations of scoped Internet transport
   addresses, MIB authors SHOULD use a separate TransportDomain or
   TransportAddressType objects for each TransportAddress object.

   There are two different ways how new transport domains and textual
   conventions for the address formats used by those new transport
   domains can be defined.

   1. The MIB module contained in this memo can be updated and new
      constants for the TransportDomain and the TransportAddressType
      enumeration can be assigned.

   2. Other MIB modules may define additional transport domains and
      associated textual conventions. Such an extension can not update
      the TransportAddressType enumeration.

It is therefore a MIB designers choice whether he uses (a) a more
compact TransportAddressType object with limited extensibility or (b)
a more verbose TransportDomain object which allows arbitrary
extensions in other MIB modules.

The MIB module contained in this memo does NOT define the transport
mappings of any particular protocol. Rather, it defines a set of
common identifiers and textual conventions that are intended to be
used within various transport mappings documents.

3.1 Relationship to Other MIBs

   This section discusses how the definitions provided by the MIB module
   contained in this memo relate to definitions in other MIB modules.

3.1.1 SNMPv2-TC (TAddress, TDomain)

   The SNMPv2-TC MIB module [RFC2579] defines the textual conventions
   TAddress and TDomain to represent generic transport addresses.

   A TAddress is an octet string with a size between 1 and 255 octets.
   Experience has shown that there is sometimes a need to represent
   unknown transport addresses. The MIB module contained in this memo
   therefore introduces a new textual convention TransportAddress which
   is an octet string with a size between 0 and 255 octets and otherwise
   identical semantics. In other words, the sub-type TransportAddress
   (SIZE (1..255)) is identical with the TAddress defined in the
   SNMPv2-TC MIB module [RFC2579].

   This MIB module also introduces a new textual convention
   TransportDomain which is compatible with the TDomain definition so
   that a complete set of definitions is contained in a single MIB
   module. New MIB modules SHOULD use the generic TransportDomain,
   TransportAddressType and TransportAddress definitions defined in this
   memo. Existing MIB modules may be updated to use the definitions
   provided in this memo by replacing TDomain with TransportDomain and
   TAddress with TransportAddress (SIZE (1..255)).

3.1.2 SNMPv2-TM

   The transport domain values defined in the SNMPv2-TM MIB module
   [RFC3417] all contain "snmp" as the prefix in their name and are
   registered under 'snmpDomains' (from RFC 2578 [RFC2578]). They were
   originally intended to describe SNMP transport domains only - but
   they were later also used for non-SNMP transport endpoints. These
   definitions are also incomplete since new transport address domains
   are needed to support (at least) SNMP over UDP over IPv6.

   The transport domain values defined in this memo are independent of
   the protocol running over the transport-layer and SHOULD be used for
   all transport endpoints not carrying SNMP traffic. Programs that
   interpret transport domain values should in addition accept the
   transport domain values defined in the SNMPv2-TM MIB module in order
   to provide interoperability with existing implementations that use
   the SNMP specific transport domain values.

   Transport endpoints which carry SNMP traffic SHOULD continue to use
   the definitions from the SNMPv2-TM MIB module where applicable. They
   SHOULD use the transport domain values defined in this memo for SNMP
   transports not defined in the SNMPv2-TM MIB module, such as SNMP over
   UDP over IPv6. Programs that interpret transport domain values
   should in addition accept all the transport domain values defined in
   this memo in order to provide interoperability in cases where it is
   not possible or desirable to distinguish the protocols running over a
   transport endpoint.

3.1.3 INET-ADDRESS-MIB (InetAddressType, InetAddress)

   The INET-ADDRESS-MIB MIB module [RFC3291] defines the textual
   conventions InetAddressType and InetAddress to represent Internet
   network layer endpoints. Some MIB modules use these textual
   conventions in conjunction with the InetPortNumber textual convention
   to represent Internet transport-layer endpoints. This approach is
   fine as long as a MIB models protocols or applications that are
   specific to the Internet suite of transport protocols. For protocols
   or applications that can potentially use other transport protocols,
   the use of the definitions contained in this memo is more
   appropriate.

4. Definitions

TRANSPORT-ADDRESS-MIB DEFINITIONS ::= BEGIN

IMPORTS
    MODULE-IDENTITY, OBJECT-IDENTITY, mib-2   FROM SNMPv2-SMI
    TEXTUAL-CONVENTION   FROM SNMPv2-TC;

transportAddressMIB MODULE-IDENTITY
    LAST-UPDATED "200211010000Z"
    ORGANIZATION
        "IETF Operations and Management Area"
    CONTACT-INFO
        "Juergen Schoenwaelder (Editor)
         TU Braunschweig
         Bueltenweg 74/75
         38106 Braunschweig, Germany

```
         Phone: +49 531 391-3289
         EMail: schoenw@ibr.cs.tu-bs.de

         Send comments to <mibs@ops.ietf.org>."
    DESCRIPTION
        "This MIB module provides commonly used transport
         address definitions.

         Copyright (C) The Internet Society (2002). This version of
         this MIB module is part of RFC 3419; see the RFC itself for
         full legal notices."

    -- Revision log

    REVISION     "200211010000Z"
    DESCRIPTION
        "Initial version, published as RFC 3419."
    ::= { mib-2 100 }


transportDomains OBJECT IDENTIFIER ::= { transportAddressMIB 1 }

transportDomainUdpIpv4 OBJECT-IDENTITY
    STATUS       current
    DESCRIPTION
        "The UDP over IPv4 transport domain.  The corresponding
         transport address is of type TransportAddressIPv4 for
         global IPv4 addresses."
    ::= { transportDomains 1 }

transportDomainUdpIpv6 OBJECT-IDENTITY
    STATUS       current
    DESCRIPTION
        "The UDP over IPv6 transport domain.  The corresponding
         transport address is of type TransportAddressIPv6 for
         global IPv6 addresses."
    ::= { transportDomains 2 }

transportDomainUdpIpv4z OBJECT-IDENTITY
    STATUS       current
    DESCRIPTION
        "The UDP over IPv4 transport domain.  The corresponding
         transport address is of type TransportAddressIPv4z for
         scoped IPv4 addresses with a zone index."
    ::= { transportDomains 3 }

transportDomainUdpIpv6z OBJECT-IDENTITY
    STATUS       current
```

```
     DESCRIPTION
         "The UDP over IPv6 transport domain.  The corresponding
          transport address is of type TransportAddressIPv6z for
          scoped IPv6 addresses with a zone index."
     ::= { transportDomains 4 }

transportDomainTcpIpv4 OBJECT-IDENTITY
     STATUS       current
     DESCRIPTION
         "The TCP over IPv4 transport domain.  The corresponding
          transport address is of type TransportAddressIPv4 for
          global IPv4 addresses."
     ::= { transportDomains 5 }

transportDomainTcpIpv6 OBJECT-IDENTITY
     STATUS       current
     DESCRIPTION
         "The TCP over IPv6 transport domain.  The corresponding
          transport address is of type TransportAddressIPv6 for
          global IPv6 addresses."
     ::= { transportDomains 6 }

transportDomainTcpIpv4z OBJECT-IDENTITY
     STATUS       current
     DESCRIPTION
         "The TCP over IPv4 transport domain.  The corresponding
          transport address is of type TransportAddressIPv4z for
          scoped IPv4 addresses with a zone index."
     ::= { transportDomains 7 }

transportDomainTcpIpv6z OBJECT-IDENTITY
     STATUS       current
     DESCRIPTION
         "The TCP over IPv6 transport domain.  The corresponding
          transport address is of type TransportAddressIPv6z for
          scoped IPv6 addresses with a zone index."
     ::= { transportDomains 8 }

transportDomainSctpIpv4 OBJECT-IDENTITY
     STATUS       current
     DESCRIPTION
         "The SCTP over IPv4 transport domain.  The corresponding
          transport address is of type TransportAddressIPv4 for
          global IPv4 addresses. This transport domain usually
          represents the primary address on multihomed SCTP
          endpoints."
     ::= { transportDomains 9 }
```

```
transportDomainSctpIpv6 OBJECT-IDENTITY
    STATUS       current
    DESCRIPTION
        "The SCTP over IPv6 transport domain.  The corresponding
         transport address is of type TransportAddressIPv6 for
         global IPv6 addresses. This transport domain usually
         represents the primary address on multihomed SCTP
         endpoints."
    ::= { transportDomains 10 }

transportDomainSctpIpv4z OBJECT-IDENTITY
    STATUS       current
    DESCRIPTION
        "The SCTP over IPv4 transport domain.  The corresponding
         transport address is of type TransportAddressIPv4z for
         scoped IPv4 addresses with a zone index. This transport
         domain usually represents the primary address on
         multihomed SCTP endpoints."
    ::= { transportDomains 11 }

transportDomainSctpIpv6z OBJECT-IDENTITY
    STATUS       current
    DESCRIPTION
        "The SCTP over IPv6 transport domain.  The corresponding
         transport address is of type TransportAddressIPv6z for
         scoped IPv6 addresses with a zone index. This transport
         domain usually represents the primary address on
         multihomed SCTP endpoints."
    ::= { transportDomains 12 }

transportDomainLocal OBJECT-IDENTITY
    STATUS       current
    DESCRIPTION
        "The Posix Local IPC transport domain. The corresponding
         transport address is of type TransportAddressLocal.

         The Posix Local IPC transport domain incorporates the
         well-known UNIX domain sockets."
    ::= { transportDomains 13 }

transportDomainUdpDns OBJECT-IDENTITY
    STATUS       current
    DESCRIPTION
        "The UDP transport domain using fully qualified domain
         names. The corresponding transport address is of type
         TransportAddressDns."
    ::= { transportDomains 14 }
```

transportDomainTcpDns OBJECT-IDENTITY
    STATUS   current
    DESCRIPTION
        "The TCP transport domain using fully qualified domain
         names. The corresponding transport address is of type
         TransportAddressDns."
    ::= { transportDomains 15 }

transportDomainSctpDns OBJECT-IDENTITY
    STATUS   current
    DESCRIPTION
        "The SCTP transport domain using fully qualified domain
         names. The corresponding transport address is of type
         TransportAddressDns."
    ::= { transportDomains 16 }

TransportDomain ::= TEXTUAL-CONVENTION
    STATUS   current
    DESCRIPTION
        "A value that represents a transport domain.

         Some possible values, such as transportDomainUdpIpv4, are
         defined in this module. Other possible values can be
         defined in other MIB modules."
    SYNTAX   OBJECT IDENTIFIER

--
-- The enumerated values of the textual convention below should
-- be identical to the last sub-identifier of the OID registered
-- for the same domain.
--

TransportAddressType ::= TEXTUAL-CONVENTION
    STATUS   current
    DESCRIPTION
        "A value that represents a transport domain. This is the
         enumerated version of the transport domain registrations
         in this MIB module. The enumerated values have the
         following meaning:

         unknown(0)   unknown transport address type
         udpIpv4(1)   transportDomainUdpIpv4
         udpIpv6(2)   transportDomainUdpIpv6
         udpIpv4z(3)   transportDomainUdpIpv4z
         udpIpv6z(4)   transportDomainUdpIpv6z
         tcpIpv4(5)   transportDomainTcpIpv4
         tcpIpv6(6)   transportDomainTcpIpv6
         tcpIpv4z(7)   transportDomainTcpIpv4z

```
        tcpIpv6z(8)     transportDomainTcpIpv6z
        sctpIpv4(9)     transportDomainSctpIpv4
        sctpIpv6(10)    transportDomainSctpIpv6
        sctpIpv4z(11)   transportDomainSctpIpv4z
        sctpIpv6z(12)   transportDomainSctpIpv6z
        local(13)       transportDomainLocal
        udpDns(14)      transportDomainUdpDns
        tcpDns(15)      transportDomainTcpDns
        sctpDns(16)     transportDomainSctpDns

        This textual convention can be used to represent transport
        domains in situations where a syntax of TransportDomain is
        unwieldy (for example, when used as an index).

        The usage of this textual convention implies that additional
        transport domains can only be supported by updating this MIB
        module. This extensibility restriction does not apply for the
        TransportDomain textual convention which allows MIB authors
        to define additional transport domains independently in
        other MIB modules."
    SYNTAX        INTEGER {
                unknown(0),
                udpIpv4(1),
                udpIpv6(2),
                udpIpv4z(3),
                udpIpv6z(4),
                tcpIpv4(5),
                tcpIpv6(6),
                tcpIpv4z(7),
                tcpIpv6z(8),
                sctpIpv4(9),
                sctpIpv6(10),
                sctpIpv4z(11),
                sctpIpv6z(12),
                local(13),
                udpDns(14),
                tcpDns(15),
                sctpDns(16)
            }

TransportAddress ::= TEXTUAL-CONVENTION
    STATUS        current
    DESCRIPTION
        "Denotes a generic transport address.

        A TransportAddress value is always interpreted within the
        context of a TransportAddressType or TransportDomain value.
        Every usage of the TransportAddress textual convention MUST
```

          specify the TransportAddressType or TransportDomain object
          which provides the context. Furthermore, MIB authors SHOULD
          define a separate TransportAddressType or TransportDomain
          object for each TransportAddress object. It is suggested that
          the TransportAddressType or TransportDomain is logically
          registered before the object(s) which use the
          TransportAddress textual convention if they appear in the
          same logical row.

          The value of a TransportAddress object must always be
          consistent with the value of the associated
          TransportAddressType or TransportDomain object. Attempts
          to set a TransportAddress object to a value which is
          inconsistent with the associated TransportAddressType or
          TransportDomain must fail with an inconsistentValue error.

          When this textual convention is used as a syntax of an
          index object, there may be issues with the limit of 128
          sub-identifiers specified in SMIv2, STD 58. In this case,
          the OBJECT-TYPE declaration MUST include a 'SIZE' clause
          to limit the number of potential instance sub-identifiers."
     SYNTAX   OCTET STRING (SIZE (0..255))

TransportAddressIPv4 ::= TEXTUAL-CONVENTION
     DISPLAY-HINT "1d.1d.1d.1d:2d"
     STATUS   current
     DESCRIPTION
         "Represents a transport address consisting of an IPv4
          address and a port number (as used for example by UDP,
          TCP and SCTP):

            octets   contents   encoding
             1-4   IPv4 address   network-byte order
             5-6   port number   network-byte order

          This textual convention SHOULD NOT be used directly in object
          definitions since it restricts addresses to a specific format.
          However, if it is used, it MAY be used either on its own or
          in conjunction with TransportAddressType or TransportDomain
          as a pair."
     SYNTAX   OCTET STRING (SIZE (6))

TransportAddressIPv6 ::= TEXTUAL-CONVENTION
     DISPLAY-HINT "0a[2x:2x:2x:2x:2x:2x:2x:2x]0a:2d"
     STATUS   current
     DESCRIPTION
         "Represents a transport address consisting of an IPv6
          address and a port number (as used for example by UDP,

          TCP and SCTP):

             octets   contents   encoding
              1-16   IPv6 address   network-byte order
              17-18   port number   network-byte order

          This textual convention SHOULD NOT be used directly in object
          definitions since it restricts addresses to a specific format.
          However, if it is used, it MAY be used either on its own or
          in conjunction with TransportAddressType or TransportDomain
          as a pair."
     SYNTAX   OCTET STRING (SIZE (18))

TransportAddressIPv4z ::= TEXTUAL-CONVENTION
     DISPLAY-HINT "1d.1d.1d.1d%4d:2d"
     STATUS   current
     DESCRIPTION
          "Represents a transport address consisting of an IPv4
          address, a zone index and a port number (as used for
          example by UDP, TCP and SCTP):

             octets   contents   encoding
              1-4   IPv4 address   network-byte order
              5-8   zone index   network-byte order
              9-10   port number   network-byte order

          This textual convention SHOULD NOT be used directly in object
          definitions since it restricts addresses to a specific format.
          However, if it is used, it MAY be used either on its own or
          in conjunction with TransportAddressType or TransportDomain
          as a pair."
     SYNTAX   OCTET STRING (SIZE (10))

TransportAddressIPv6z ::= TEXTUAL-CONVENTION
     DISPLAY-HINT "0a[2x:2x:2x:2x:2x:2x:2x:2x%4d]0a:2d"
     STATUS   current
     DESCRIPTION
          "Represents a transport address consisting of an IPv6
          address, a zone index and a port number (as used for
          example by UDP, TCP and SCTP):

             octets   contents   encoding
              1-16   IPv6 address   network-byte order
              17-20   zone index   network-byte order
              21-22   port number   network-byte order

          This textual convention SHOULD NOT be used directly in object
          definitions since it restricts addresses to a specific format.

           However, if it is used, it MAY be used either on its own or
           in conjunction with TransportAddressType or TransportDomain
           as a pair."
       SYNTAX   OCTET STRING (SIZE (22))

TransportAddressLocal ::= TEXTUAL-CONVENTION
       DISPLAY-HINT "1a"
       STATUS   current
       DESCRIPTION
           "Represents a POSIX Local IPC transport address:

             octets   contents   encoding
              all   POSIX Local IPC address   string

           The Posix Local IPC transport domain subsumes UNIX domain
           sockets.

           This textual convention SHOULD NOT be used directly in object
           definitions since it restricts addresses to a specific format.
           However, if it is used, it MAY be used either on its own or
           in conjunction with TransportAddressType or TransportDomain
           as a pair.

           When this textual convention is used as a syntax of an
           index object, there may be issues with the limit of 128
           sub-identifiers specified in SMIv2, STD 58. In this case,
           the OBJECT-TYPE declaration MUST include a 'SIZE' clause
           to limit the number of potential instance sub-identifiers."
       REFERENCE
           "Protocol Independent Interfaces (IEEE POSIX 1003.1g)"
       SYNTAX   OCTET STRING (SIZE (1..255))

TransportAddressDns ::= TEXTUAL-CONVENTION
       DISPLAY-HINT "1a"
       STATUS   current
       DESCRIPTION
           "Represents a DNS domain name followed by a colon ':'
            (ASCII character 0x3A) and a port number in ASCII.
            The name SHOULD be fully qualified whenever possible.

            Values of this textual convention are not directly useable as
            transport-layer addressing information, and require runtime
            resolution. As such, applications that write them must be
            prepared for handling errors if such values are not
            supported, or cannot be resolved (if resolution occurs at the
            time of the management operation).

            The DESCRIPTION clause of TransportAddress objects that may

             have TransportAddressDns values must fully describe how (and
             when) such names are to be resolved to IP addresses and vice
             versa.

             This textual convention SHOULD NOT be used directly in object
             definitions since it restricts addresses to a specific format.
             However, if it is used, it MAY be used either on its own or
             in conjunction with TransportAddressType or TransportDomain
             as a pair.

             When this textual convention is used as a syntax of an
             index object, there may be issues with the limit of 128
             sub-identifiers specified in SMIv2, STD 58. In this case,
             the OBJECT-TYPE declaration MUST include a 'SIZE' clause
             to limit the number of potential instance sub-identifiers."
         SYNTAX   OCTET STRING (SIZE (1..255))

   END

   5. Examples

      This section shows some examples how transport addresses are encoded
      and rendered using some of the transport address definitions.

   Description: Unspecified IPv4 address on port 80.
   Encoding (hex):   000000000050
   Display: 0.0.0.0:80

   Description: Global IPv4 address on port 80.
   Encoding (hex):   86A922010050
   Display: 134.169.34.1:80

   Description: Unspecified IPv6 address on port 80.
   Encoding (hex):   0000000000000000000000000000000000050
   Display: [0:0:0:0:0:0:0:0]:80

   Description: Global IPv6 address on port 80.
   Encoding (hex):   108000000000000000080800200C417A0050
   Display: [1080:0:0:0:8:800:200C:417A]:80

   Description: Link-local IPv6 address with zone-index 42 on port 80.
   Encoding (hex):   FE80000000000000000100000000020000000002A0050
   Display: [FE80:0:0:0:1:0:0:200%42]:80

   Description: Posix Local IPC address (UNIX domain).
   Encoding (hex):   2F7661722F6167656E74782F6D6173746572
   Display: /var/agentx/master

Description: Fully qualified domain name on port 80.
Encoding (hex):   7777772E6578616D706C652E6E65743A3830
Display: www.example.net:80

6. Security Considerations

   The MIB module contained in this memo does not define any management
   objects. Instead, it defines a set of textual conventions which may
   be used by other MIB modules to define management objects.

   Meaningful security considerations can only be written for MIB
   modules that define concrete management objects. This document has
   therefore no impact on the security of the Internet.

7. Acknowledgments

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   "IPv6MIB" design team. The authors would like to thank Mark Ellison,
   Brian Haberman, Mike Heard, Glenn Mansfield Keeni, Erik Nordmark,
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Authors' Addresses

   Mike Daniele
   Consultant
   19 Pinewood Rd
   Hudson, NH   03051
   USA

   Phone: +1 603 883-6365
   EMail: md@world.std.com

   Juergen Schoenwaelder
   TU Braunschweig
   Bueltenweg 74/75
   38106 Braunschweig
   Germany

   Phone: +49 531 391-3289
   EMail: schoenw@ibr.cs.tu-bs.de