USER MANUAL

FOXMAN-UN

Northbound Interface

Configuration and Operation

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Contents

1 SNMP Interface

1.1 Introduction

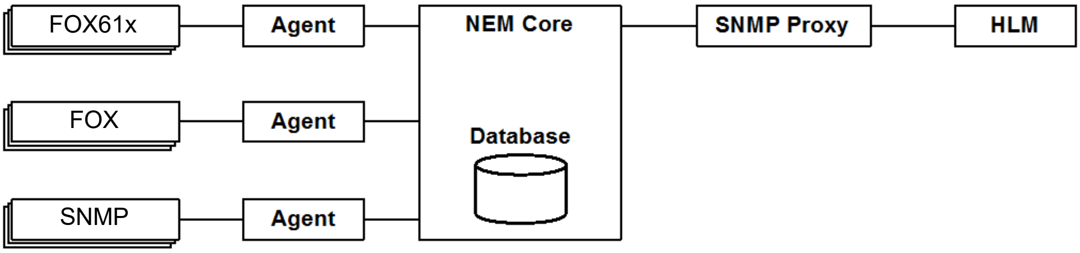
FOXMAN-UN is a Network Management System (NMS) that caters for the management of FOX61x and FOX51x Network Elements (NEs) in a given network. Since the Network Elements types utilize a proprietary interface (thus these NEs are termed foreign devices in the SNMP world), a simple but industry standardized protocol, SNMP, has been implemented in order to integrate these NEs into a heterogeneous network where there may be Higher Order Network Manager(s) in a Network Operational Centre (NOC). This is achieved through the use of an SNMP proxy agent, which acts as an application-gateway on behalf of these foreign devices and is available as a licensed option in FOXMAN-UN. By propagating NE alarms through SNMP, the surveillance of a network can be accomplished via a HLM.

SNMP is one of the most widely used network management protocols and it is supported by most Network Management Systems. The FOXMAN-UN proxy agent uses this protocol to send information to a Higher Level Manager (HLM) in the form of trap messages.

The HLM may use traversal operation, however only read operations against the SNMP proxy agent are supported.

The SNMP agent of FOXMAN-UN supports SNMP V1, V2c, and V3.

1.2 Architecture



Attached to the FOXMAN-UN is an SNMP proxy agent which will be the proxy for all network elements FOXMAN-UN is managing. The proxy agent for FOXMAN-UN is a process that communicates with the FOXMAN-UN database for Fault and Configuration management of FOX61x and FOX51x NEs. Propagation of traps is done over a configurable trap port on the HLM station (the standard SNMP trap port is 162, the default trap port in the «$NEM_HOME/etc/snmpagentd.conf» is set to 10162) using UDP datagrams. For Configuration Management the proxy-agent will listen to a configurable UDP port (the standard SNMP trap is 161, the default request port in the snmpagentd.conf is set to 10161).

The SNMP daemon of FOXMAN-UN implements the Internet Standard SNMP V3. For V1, V2c and V3 the «Get» and «GetNext» request commands are supported. Additionally the «GetBulk» request command is included for V2c and V3.

The FOXMAN-UN database contains the logical objects to be managed and these objects are synchronized with the physical network element by the use of the FOXMAN-UN Element Agents which use a polling based approach to query managed network elements. The SNMP proxy agent will propagate the corresponding SNMP traps when one of the following events occur on the logical Network Element Objects in the FOXMAN-UN database (the Trap Variables are given in the attached MIB):

- When a new alarm is raised on a network element.
- When an outstanding alarm is cleared.
- When an outstanding or cleared alarm is acknowledged.
- When a network element is added to the FOXMAN-UN database
- When an existing network element is deleted from the FOXMAN-UN database.
- When a new unit is added to a network element.

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- When an existing unit in a network element is deleted
- When the name of a network element is modified.
- When the operational state of a network element is modified.
- When the polling status of a network element is modified.

1.3 Installation of the SNMP daemon

The SNMP Proxy agent is installed at the time of installation of the FOXMAN-UN application and is run as a daemon process.

If the option is licensed, the SNMP daemon is started when «nemstart» is executed. It can be started and stopped independently via the commands «snmpstart» and «snmpstop».

After a successful launch of the daemon it sends a standard cold start trap to the HLM running at the server that is specified by the «snmp_hlm_host» variable in the «$NEM_HOME/etc/snmpagentd.conf» file:

The configurable parameters in the «snmpagentd.conf» file applicable to the Proxy Agent and their default values are shown below:

```
######################################################
#
# Configuration parameters for SNMP
#
######################################################
#
# The NEM SNMP agent OID prefix is set to a
# fixed value of: 1.3.6.1.4.1.17268.2818.93
#
snmp_trap_port                  10162      # Remote port where alarms are sent
                                           # Default is: 162

snmp_request_port               10161      # Listening port of the agent
                                           # Default is: 161

#snmp_hlm_host                  XXXX       # HLM host IP address
                                           # Default is: 127.0.0.1
#snmp_no_cards_alarms_table     xxxx       # By enabling (value = enable) this flag
                                           # would set the NBI/FOXMAN-UN to trap only mode
                                           # and HLMs are prevented from accessing
                                           # the FOXMAN-UN ne, card and alarm tables.
                                           # By default it is disabled.
                                           #

#snmp_community                 XXXX       # Community name between agent and HLM
                                           # Default is: public

#snmp_clear_alarm_ack           XXXXXXXX   # Automatic acknowledgment of cleared alarm
                                           # Default is: disable

#snmp_raise_alarm_ack           XXXXXXXX   # Automatic acknowledgment of raised alarm
                                           # Default is: disable

#snmp_send_clear_ack_trap       XXXXXXXX   # Send acknowledge trap when cleared alarm
                                           # acknowledged
                                           # Default is: disable

#snmp_send_raise_ack_trap       XXXXXXXX   # Send acknowledge trap when raised alarm
                                           # acknowledged
```

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```
                                                # Default is: disable

#snmp_hlm_host2                  XXXX           # 2nd HLM host IP address for traps
                                                # Default is: -

#snmp_trap_port2                 XXXX           # Remote port for snmp_hlm_host2
                                                # Default is: 0

#snmp_v3_security                XXXXX          # Turn on SNMPv3 security
                                                # Possible values: enable | disable
                                                # Default: enable

#snmp_v3_userid                  XXXXX          # username setup within SNMPv3 security
                                                # Default is equal to: big_chief

#snmp_v3_auth_protocol           XXX            # The authentication protocol to set for the
snmpv3 user
                                                # Possible values: none | SHA | MD5
                                                # Default: SHA

#snmp_v3_priv_protocol           XXX            # The privacy protocol to set for the snmpv3 user
                                                # Possible values are: none | DES | 3DES
                                                # Default: DES

#snmp_v3_usm_access              XXXXX          # Allow snmpv3 user access USM (user) tables.
                                                # Possible values: enable | disable
                                                # Default: enable

#snmp_trap_version               XX             # Define if send SNMPv1 traps or SNMPv2
Notifications
                                                # Valid values are: 1 (for SNMPv1 traps)
                                                # 2 (for SNMPv2 notifications)
                                                # Default is: 1

#snmp_show_cleared_alarms         disable       # Define if cleared alarms are shown in the
                                                # Northbound SNMP alarm table
                                                # Valid values are:          disable
                                                #                            enable
                                                # Default is: disable

#snmp_alarm_ne_card_batch_size    3             # Define the chunk size of the alarm, ne
                                                # and card traps sent to HLM by NBI
                                                # Default size is: 5
```

1.4 Notes

- The syntax of the octet string describing the equipment reporting the error is determined by the NE family.
    - FOX61x family is «/CCC/PPP (LLL)» where

CCC	is the Card name
PPP	is the subunit (if any)
LLL	is the layer name (if applicable)

e.g. «/unit-9/port-1 (E&M(4-Wire))»

- FOX51x family is «CCC<S>PPP NNN / LLL» where

CCC	is the Card name
S	is the slot number
PPP	is the subunit

NNN is the subunit label (if any)
LLL is the layer name (if applicable)

e.g. «MEGIF <12> 2Mbits-1 to Europe / E12»

− System NE is «III/NNN» where

III is the NE index
NNN is the NE name

e.g. «5/Berlin»

Please note:
Not every alarm follows these syntax rules.

- When writing on a read-write object, the system may reject the request because of a possible semantic incoherence resulting from that operation. If this occurs it raises a «genErr» and does not modify the object.

1.5 The FOXMAN-UN proxy agent

The FOXMAN-UN proxy agent may be started

- manually
- at boot time of the workstation.

When the agent starts it will send a standard SNMP cold start trap to the Higher Layer Manager that has the IP address specified in «snmp_hlm_host». The agent supports a second trap host specified by the parameters «snmp_hlm_host2» (IP address) and «snmp_trap_port2» (remote port number). The SNMP messages are transported using UDP. On receiving the cold start trap the HLM may synchronize itself with the MIB using traversal operation («Get», «GetNext» and «GetBulk» request). The daemon will continue to send traps mentioned in the MIB after the cold start. These are sent in real time and traps are not stored by the agent.

Due to the unreliable nature of UDP, the HLM manager uses the «nemTrapSequenceNumber» as a means of finding lost traps and the HLM should initiate the synchronization process using the traversal operation. This also applies in the case of loss of communication between the HLM and the agent.

To prevent the FOXMAN-UN alarm database from growing too large, automatic acknowledging can be activated. If «snmp_raise_alarm_ack» is enabled, sending a raised alarm trap automatically acknowledges the alarm in the FOXMAN-UN system. If «snmp_clear_alarm_ack» is also enabled, sending a cleared alarm trap automatically acknowledges the clearance and with that moves the alarm from the FOXMAN-UN database to the alarm history. By default the automatic acknowledgment functions are disabled.

When alarms are acknowledged locally by FOXMAN-UN users, corresponding traps can be sent to the SNMP interface. The parameters «snmp_send_raise_ack_trap» and «snmp_send_clear_ack_trap» control these functions. By default they are disabled.

The «TimeTicks» in this implementation is the number of seconds since 00:00 January 1, 1970.

1.6 Security

Please note:
SNMP v3 is the default for GET and traps. If you want to use SNMP v1 or v2 you need to change the related parameter settings (`snmp_trap_version` and `snmp_v1v2_support`) in /opt/nem/etc/snmpagentd.conf. For more information also see the related parameter definition in [1KHW002414] FOXMAN-UN under Linux - User Manual and application details given in [1KHW029203] FOXMAN-UN HLM SNMPv3 Integration - Application Note.

- SNMP V3 (default, recommended)

  If required v3 security can be disabled via the parameter «snmp_v3_security», however it is not recommended to do that. One SNMP V3 user including authentication and privacy protocol can be set up via the «snmpagentd.conf» file using the parameters «snmp_v3_userid», «snmp_v3_auth_protocol» and «snmp_v3_priv_protocol» (see 1.3 "Installation of the SNMP daemon").

Additional users can be created by the initial user if he is given access to the USM and VACM tables via the parameter «snmp_v3_usm_access».

- SNMP V1 & V2c (not recommended)

  The community field («snmp_community») of a read request is set to «public» by default. This string can be changed by editing the «snmpagentd.conf» file. Refer to 1.3 "Installation of the SNMP daemon" for more details on the SNMP part of the configuration file.

1.7 Traps & notifications

The FOXMAN-UN proxy agent may send SNMP V1 or SNMP V2c notifications. To configure which type of traps are sent, the parameter «snmp_trap_version» can be set. Setting the parameter to «1» will ensure the agent sends SNMP V1 traps, and setting it to «2» will indicate that SNMP V2c notifications must be sent.

The «nemTrapSequenceNumber» is incremented each time the proxy agent sends a trap. The proxy agent sends the alarm in response to a change of events in the database. The SNMP agent is not responsible for resending lost traps due to communication failure between the two entities. In such an event the «nemTrapSequenceNumber» variable is used to ascertain if traps have been lost by the Higher Level Manager (HLM).

1.8 SNMP MIB

1.8.1 General

The current FOXMAN-UN MIB file for system release R18 can be downloaded from Hitachi Energy Publisher (https://publisher.hitachienergy.com/documents). Its ID is 7ABA145730.

1.8.2 ASN.1 description

```
FOXMAN-UN-MIB DEFINITIONS ::= BEGIN
-- Revision 12    Replaces all previous versions.
--               Applies for FOXMAN-UN Release R17A onwards


IMPORTS
    DisplayString,
    TEXTUAL-CONVENTION
        FROM SNMPv2-TC

    AGENT-CAPABILITIES,
    OBJECT-GROUP,
    NOTIFICATION-GROUP,
    MODULE-COMPLIANCE
        FROM SNMPv2-CONF

    utilityCommProducts
        FROM ABB-ROOT-MIB

    MODULE-IDENTITY,
    OBJECT-TYPE,
    NOTIFICATION-TYPE,
    Gauge32,
    Integer32,
```

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```
    Counter32,
    IpAddress,
    Unsigned32,
    enterprises
        FROM SNMPv2-SMI;


-- This module defines the object used by the SNMP NBI agent
-- of FOXMAN-UN R17A - SMIv2
unemMIB MODULE-IDENTITY
    LAST-UPDATED "202406061400Z"      -- June 6, 2024 14:00:00 PM
    ORGANIZATION "Hitachi Energy Ltd"
    CONTACT-INFO
    "
  Hitachi Energy Ltd.
    Bruggerstr. 72,
    CH-5400 Baden
    Switzerland
    Tel.+41 43 550 04 52
    E-mail: communication.networks@hitachienergy.com
    www.hitachienergy.com
    "
    DESCRIPTION
                        "MIB of FOXMAN-UN SNMP North Bound Interface"

    REVISION
        "202406061400Z"  -- June 6, 2024 14:00:00 PM
    DESCRIPTION
        "Add neAlarmSeverity to NEEntry and
        neAlarmSeverityModified notification"
    REVISION
        "202007021600Z"  -- Jul 2, 2020 16:00:00 PM
    DESCRIPTION
        "Use FOX brand names"
    REVISION
        "201909171400Z"  -- Sept 17, 2019 14:00:00 PM
    DESCRIPTION
        "Fix errors reported by smilint 0.4.8"
    REVISION    "201712151400Z"      -- Dec 15, 2017 14:00:00 PM
    DESCRIPTION
        "Set under ABB root OID"
    REVISION    "201401211400Z"      -- Januray 21, 2014 14:00:00 PM
    DESCRIPTION
        "Released with UNEM R9C, added support for additional
         family logicalfamily(8) and two additional neTypes
         milegate2200(23) and servicene(24)"
    REVISION    "201103201400Z"      -- March 20, 2011 14:00:00 PM
    DESCRIPTION
        "Released with UNEM R8CSP4, changed various OBJECT-TYPES from
         INTEGER to Gauge32 for a more standard definition"
    REVISION    "201009211400Z"      -- September 21, 2010 14:00:00 PM
    DESCRIPTION
        "Released with UNEM R8CSP3, added support for additional
         family xmlrpcfamily(7) and three additional neTypes
         milegate2510(20), milegate2310(21) and xmlrpcdevice(22)"
    REVISION    "201005281400Z"      -- May 28, 2010 14:00:00 PM
    DESCRIPTION
        "Released with UNEM R8CSP2, added support for additional
         neType: milegate2011(19)"
    REVISION    "200902191400Z"      -- February 19, 2009 14:00:00 PM
    DESCRIPTION
        "Released with UNEM R8C, added support for additional
         neType: milegate2300(18)"
    REVISION    "200707051400Z"      -- July 5, 2007 14:00:00 PM
    DESCRIPTION
        "Released with UNEM R8B, added support for additional family
         snmpfamily(5) and neType: snmpdevice(16)"
    REVISION    "200606141400Z"      -- June 14, 2006 14:00:00 PM
    DESCRIPTION
        "Initial revision UNEM R8 SMIv2 MIB"

    -- 1.3.6.1.4.1.17268.2818.93
    ::= { unem 100 }

unem          OBJECT IDENTIFIER ::= { utilityCommProducts 93 }
release1       OBJECT IDENTIFIER ::= { unem 1 }
trap-object    OBJECT IDENTIFIER ::= { release1 1 }
ne            OBJECT IDENTIFIER ::= { release1 2 }
card          OBJECT IDENTIFIER ::= { release1 3 }
alarm         OBJECT IDENTIFIER ::= { release1 4 }
notification   OBJECT IDENTIFIER ::= { release1 0 }


-- textual conventions

NemTime ::=
             Gauge32
    -- This data type is used to model the time_t datatype in the C
    -- lib. It contains the number of seconds since 00:00 01-01-1970
    -- GMT.

-- Object Types

-- Trap Objects group

-- Note: Although these objects can be accessed using the GET-
-- REQUEST and the GET-NEXT-REQUEST, the value returned by this
-- method correspond to those set by the latest trap sent which
-- can be different to the latest trap received by the HLM

unemTrapSequenceNumber OBJECT-TYPE
             SYNTAX            Gauge32
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
            "Each trap sent to the defined address are given a
             sequence number."
    ::= { trap-object 4 }

-- Traps in FOXMAN-UN 3.00: these traps are intended to replace
-- the FOXMAN-UN 2.00 traps. Configuration information of the FOXMAN-UN
-- will let the user choose between the old- or new-fashioned
-- traps

alarmRaisedTrap NOTIFICATION-TYPE
    OBJECTS {    unemTrapSequenceNumber,
           alarmNEfamily,
           alarmNE,
           alarmId,
           alarmCardSlot,
           alarmLayer,
           alarmSubUnit,
           alarmStatus,
           alarmSeverity,
           alarmEventType,
           alarmText,
           alarmOnTime,
           alarmOffTime,        -- value is undefined
           alarmAckOnStatus,
           alarmAckOnTime,
           alarmAckOffStatus,    -- value is 'not_acknowledged'
           alarmAckOffTime,      -- value is undefined
           alarmIntermittency,
           alarmIntermittentPeriod,
           alarmNEName,
           alarmLocation}
    STATUS      current
    DESCRIPTION
        "Trap sent when a new Alarm is raised."
    ::= {notification 3}

alarmAckedTrap NOTIFICATION-TYPE
    OBJECTS {    unemTrapSequenceNumber,
           alarmNEfamily,
           alarmNE,
           alarmId,
           alarmCardSlot,
           alarmLayer,
           alarmSubUnit,
           alarmStatus,
           alarmSeverity,
           alarmEventType,
           alarmText,
           alarmOnTime,
           alarmOffTime,
           alarmAckOnStatus,
           alarmAckOnTime,
           alarmAckOffStatus,
           alarmAckOffTime,
           alarmIntermittency,
           alarmIntermittentPeriod,
           alarmNEName,
           alarmLocation}
    STATUS      current
    DESCRIPTION
            "Trap sent when an alarm is acknowledged."
    ::= {notification 4}

alarmClearedTrap NOTIFICATION-TYPE
    OBJECTS {    unemTrapSequenceNumber,
           alarmNEfamily,
           alarmNE,
           alarmId,
           alarmCardSlot,
           alarmLayer,
           alarmSubUnit,
           alarmStatus,          -- value is 'cleared'
           alarmSeverity,
           alarmEventType,
           alarmText,
           alarmOnTime,
           alarmOffTime,
           alarmAckOnStatus,
           alarmAckOnTime,
           alarmAckOffStatus,
           alarmAckOffTime,
           alarmIntermittency,
           alarmIntermittentPeriod,
           alarmNEName,
           alarmLocation}
 STATUS      current
 DESCRIPTION
            "Trap sent when an alarm is cleared."
    ::= {notification 5}

neAdded NOTIFICATION-TYPE
    OBJECTS {     unemTrapSequenceNumber,
           neFamily,
           neIndex,
           neName,
           neUNEMAddress,
           neType,
           neOperationalState,
           nePollingStatus,
           neAlarmSeverity}
    STATUS      current
    DESCRIPTION
            "A UMUX Network Element has been added to the
             Agent Database."
    ::= {notification 6}

neDeleted NOTIFICATION-TYPE
    OBJECTS {     unemTrapSequenceNumber,
           neFamily,
           neIndex,
           neName,
           neUNEMAddress,
           neType,
           neOperationalState,
           nePollingStatus,
           neAlarmSeverity}
    STATUS      current
    DESCRIPTION
            "A UMUX Network Element has been deleted from the
            Agent Database."
    ::= {notification 7}

neNameModified NOTIFICATION-TYPE
    OBJECTS {     unemTrapSequenceNumber,
           neFamily,
           neIndex,
           neName,
           neUNEMAddress,
           neType,
           neOperationalState,
           nePollingStatus}
```

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```
    STATUS      current
    DESCRIPTION
            "Name of Network Element has been modified."
    ::= {notification 8}

neOpStatModified NOTIFICATION-TYPE
    OBJECTS {    unemTrapSequenceNumber,
          neFamily,
          neIndex,
          neOperationalState,
          neName,
          neUNEMAddress,
          neType,
          nePollingStatus}
    STATUS      current
    DESCRIPTION
            "Operational state of the NE has been modified."
    ::= {notification 9}

nePollStatModified NOTIFICATION-TYPE
    OBJECTS {    unemTrapSequenceNumber,
          neFamily,
          neIndex,
          nePollingStatus,
          neName,
          neUNEMAddress,
          neType,
          neOperationalState}
    STATUS      current
    DESCRIPTION
            "Polling status of the NE has been modified."
    ::= {notification 10}

cardAdded NOTIFICATION-TYPE
    OBJECTS {    unemTrapSequenceNumber,
          cardNEfamily,
          cardNE,
          cardSlot,
          cardName,
          cardIdentifier,
          cardSwVersion,
          cardNEName}
    STATUS      current
    DESCRIPTION
            "A card has been added to a Network Element."
    ::= {notification 11}

cardDeleted NOTIFICATION-TYPE
    OBJECTS {    unemTrapSequenceNumber,
          cardNEfamily,
          cardNE,
          cardSlot,
          cardName,
          cardIdentifier,
          cardSwVersion,
          cardNEName}
    STATUS      current
    DESCRIPTION
            "A card has been deleted from an Network Element."
```

```
       ::= {notification 12}

   neAlarmSeverityModified NOTIFICATION-TYPE
       OBJECTS {     unemTrapSequenceNumber,
               neFamily,
               neIndex,
               nePollingStatus,
               neName,
               neUNEMAddress,
               neType,
               neAlarmSeverity}
       STATUS       current
       DESCRIPTION
                 "Alarm State of the NE has been modified."
       ::= {notification 13}

neNumber OBJECT-TYPE
                 SYNTAX Gauge32
       MAX-ACCESS read-only
       STATUS current
       DESCRIPTION
             "Number of entries in neTable"
       ::= { ne 2 }

cardNumber OBJECT-TYPE
                 SYNTAX Gauge32
       MAX-ACCESS read-only
       STATUS current
       DESCRIPTION
             "Number of entries in cardTable"
       ::= { card 2 }


-- Network Element Group

neTable OBJECT-TYPE
       SYNTAX SEQUENCE OF NEEntry
       MAX-ACCESS not-accessible
       STATUS current
       DESCRIPTION
                 "This FOXMAN-UN's table of network elements"
       ::= { ne 1 }

neEntry OBJECT-TYPE
       SYNTAX NEEntry
       MAX-ACCESS not-accessible
       STATUS current
       DESCRIPTION
                 "Each entry contains some basic informations about
                  the network element."
       INDEX {        neFamily,
                 neIndex }
       ::= { neTable 1 }

NEEntry ::=
       SEQUENCE {
             neFamily
                 INTEGER,
             neIndex
```

```
                INTEGER,
            neName
                DisplayString,
            neUNEMAddress
                OCTET STRING,
            neType
                INTEGER,
            neOperationalState
                INTEGER,
            nePollingStatus
                INTEGER,
            neAlarmSeverity
                INTEGER

        }

    neFamily OBJECT-TYPE
        SYNTAX INTEGER {
                foxUxfamily(1),
                foreign(2),
                fox5xfamily(3),
                system(4),
                fox6xfamily(5),
                snmpfamily(6),
                xmlrpcfamily(7),
                logicalfamily(8)
        }
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION
                "The NE Family identifies the kind of Network Element"
        ::= { neEntry 1 }

    neIndex OBJECT-TYPE                    -- This correspond to the last number
        SYNTAX INTEGER  (0..2147483647)  -- of the logical object ID in the DB.
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION
                "The index uniquely identifies the network element"
        ::= { neEntry 2 }

    neName OBJECT-TYPE
        SYNTAX DisplayString
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION
                "This is the name of network element. It can change
                 during the lifetime of the network element."
        ::= { neEntry 3 }

    neUNEMAddress OBJECT-TYPE
        SYNTAX OCTET STRING
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION
                "This is a string describing the physical address
                 of the network element.(See section 4.2)"
        ::= { neEntry 4 }
```

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```
neType OBJECT-TYPE
    SYNTAX INTEGER {
        foxU(0),        -- System FOX U.
        foxUM(1),       -- System FOX U-M.
        foxUMe(2),      -- System FOX U-M e.
        colt2(3),       -- System COLT.
        lecar(4),       -- desktop Leca
        tunor(5),       -- desktop Tunor
        fox514(6),      -- System FOX 515.
        fox515(7),      -- System FOX 515.
        foreign(8),     -- Foreign object. (neFamily is set to foreign in that case)
        -- fox512(8),   System FOX 512. (neFamily is set to fox515family in that case)
        colt-e(9),      -- System COLT-E.
        colt-ec(10),    -- System COLT-EC.
        snmpdevice(16),  -- SNMP managed NE.
        fox615(20),     -- System FOX 615.
        fox612(21),     -- System FOX 612.
        xmlrpcdevice(22),  -- XMLRPC managed NE.
        fox611(23),     -- System FOX 611.
        servicene(24),     -- Service NE.
        system(25)      -- special value
    }
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
            "These are the types of the network elements. The
             FOREIGN(8) is associated with the foreign(2) family
             of NEs, foxU(0), foxUM(1), foxUMe(2),
             and COLT2(3) are associated with the
             foxUfamily(1) family of NEs and the fox514(6),
             fox512(8), COLT_E(9), COLT_EC(10), and
             fox515(7) are associated with the
             fox515family(3) family of NEs. The fox615(12),
             fox612(18), fox615(20) and fox612(21) are associated
             with the fox61xfamily (5) family. The snmpdevice(16)
             is associated with the snmpfamily(6) group of NEs.
             The xmlrpcdevice(22) is associated with the
             xmlrpcfamily(7) group of NEs"
    ::= { neEntry 5 }

neOperationalState OBJECT-TYPE
    SYNTAX INTEGER {
            notConfigured(49),
            normal(50),
            notSameConfigId(51),
            unmanageable(52)
    }
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
            "This object describes the state of the network
             element.When no upload of the Network Element
             has been done, its in the notConfigured state;
             if the configuration of the network element
             differs from the one in the proxy agent Database
             the network element is in the notSameConfigId
             state; if the proxy agent cannot communicate with
             the network element, it is in the unmanageable
             state; otherwise the Network Element is in the
```

```
                normal(50) state."
    ::= { neEntry 6 }

nePollingStatus OBJECT-TYPE
    SYNTAX INTEGER {
                enabled(1),
                disabled(2)
    }
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
                "This object indicates if the network element is
                 currently being polled for alarms. If the element
                 notifies changes in alarms, then the polling is said
                 to be enabled."
    ::= { neEntry 7 }

neAlarmSeverity OBJECT-TYPE
    SYNTAX INTEGER {
        critical(0),
        major(1),
        minor(2),
        warning(3),
        indeterminate(4),
        off(5)
    }
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
                "The max level of severity of the network element alarms."
    ::= { neEntry 8}

-- Card Group

cardTable OBJECT-TYPE
    SYNTAX SEQUENCE OF CardEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
                "This FOXMAN-UN's table of cards. Indexed by network
                 element (family and number) and slot number."
    ::= { card 1 }

cardEntry OBJECT-TYPE
    SYNTAX CardEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
                "Each entry contains the basic information about the
                 card in the given slot. If the slot is empty, the
                 corresponding card object does not exists."
    INDEX   {     cardNEfamily,
                cardNE,
                cardSlot }
    ::= { cardTable 1 }

CardEntry ::=
    SEQUENCE {
        cardNEfamily
```

```
                INTEGER,
            cardNE
                INTEGER,
            cardSlot
                INTEGER,
            cardName
                DisplayString,
            cardIdentifier
                DisplayString,
            cardSwVersion
                DisplayString,
            cardNEName
                DisplayString
        }

    cardNEfamily OBJECT-TYPE
        SYNTAX INTEGER {
                foxUfamily(1),
                foreign(2),
                fox515family(3),
                system(4),
                fox61xfamily(5),
                snmpfamily(6),
                xmlrpcfamily(7),
                logicalfamily(8)
        }
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION
                "The family of the network element containing the
                 card."
        ::= { cardEntry 1 }

    cardNE OBJECT-TYPE
        SYNTAX INTEGER (0..2147483647)
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION
                "The identifier of the network element containing the
                 card which is unique within a family of network
                 elements."
        ::= { cardEntry 2 }

    cardSlot OBJECT-TYPE
        SYNTAX INTEGER (1..21)
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION
                "The slot number where the card is, in the subrack."
        ::= { cardEntry 3 }

    cardName OBJECT-TYPE
        SYNTAX DisplayString
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION
                "A string giving the name of the card."

        ::= { cardEntry 4 }
```

```
cardIdentifier OBJECT-TYPE
    SYNTAX DisplayString
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
      "A string identifying the Hardware characteristics
       of the card."
    ::= { cardEntry 5 }


cardSwVersion OBJECT-TYPE
    SYNTAX DisplayString
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
            "The version of the firmware of the card."
    ::= { cardEntry 6 }

cardNEName OBJECT-TYPE
    SYNTAX DisplayString
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
            "The name of the network element containing the
             card. It can change
             during the lifetime of the network element."
    ::= { cardEntry 7 }


-- Alarm Group

alarmTable OBJECT-TYPE
    SYNTAX SEQUENCE OF AlarmEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
            "This is the FOXMAN-UN's table of alarms. Indexed by
            network element (neFamily and neIndex) and alarm
            number."
    ::= { alarm 1 }

alarmEntry OBJECT-TYPE
    SYNTAX AlarmEntry
    MAX-ACCESS not-accessible
    STATUS current
    DESCRIPTION
            "Each entry contains information about an alarm."
    INDEX   {     alarmNEfamily,
            alarmNE,
            alarmId }
    ::= { alarmTable 1 }

AlarmEntry ::=
    SEQUENCE {
        alarmNEfamily
            INTEGER,
        alarmNE
            INTEGER,
        alarmId
            INTEGER,
        alarmCardSlot
            INTEGER,
        alarmLayer
            INTEGER,
        alarmSubUnit
            INTEGER,
        alarmStatus
            INTEGER,
        alarmSeverity
            INTEGER,
        alarmEventType
            INTEGER,
        alarmText
            DisplayString,
        alarmOnTime
            NemTime,
        alarmOffTime
            NemTime,
        alarmAckOnStatus
            INTEGER,
        alarmAckOnTime
            NemTime,
        alarmAckOffStatus
            INTEGER,
        alarmAckOffTime
            NemTime,
        alarmIntermittency
            INTEGER,
        alarmIntermittentPeriod
            INTEGER,
        alarmNEName
            DisplayString,
        alarmLocation
            DisplayString
    }

alarmNEfamily OBJECT-TYPE
    SYNTAX INTEGER {
            umux1300family(1),
            foreign(2),
            umux1500family(3),
            system(4),
            fox6xfamily(5),
            snmpfamily(6),
            xmlrpcfamily(7),
            logicalfamily(8)
    }
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
            "The family of the network element which has the
             alarm."
    ::= { alarmEntry 1 }

alarmNE OBJECT-TYPE
    SYNTAX INTEGER (0..2147483647)
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
            "The ID of the network element which has the alarm.
            The ID is unique within a family of NEs."
    ::= { alarmEntry 2 }

alarmId OBJECT-TYPE
    SYNTAX INTEGER (0..2147483647)
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
        "The identifier of an alarm. It is unique for each
         network element."
    ::= { alarmEntry 3 }

alarmCardSlot OBJECT-TYPE
        SYNTAX INTEGER (1..21)
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION
            "The slot number where the alarm occured."
    ::= { alarmEntry 4 }

alarmLayer OBJECT-TYPE
        SYNTAX INTEGER (0..255)
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION
            "The layer number of the alarm"
    ::= { alarmEntry 5 }

alarmSubUnit OBJECT-TYPE
        SYNTAX INTEGER (0..255)
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION
            "The Sub-Unit Where the alarm occured."
    ::= { alarmEntry 6 }

alarmStatus OBJECT-TYPE
    SYNTAX INTEGER {
        outstanding(0),
        cleared(1)
    }
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
            "alarmStatus indicates if the alarm is active, or
            if a previously active alarm has been cleared"
    ::= { alarmEntry 7}

alarmSeverity OBJECT-TYPE
    SYNTAX INTEGER {
        critical(0),
        major(1),
        minor(2),
        warning(3),
        indeterminate(4),
        off(5)
```

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```
    }
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
            "The level of severity of the alarm."
    ::= { alarmEntry 8}

alarmEventType OBJECT-TYPE
    SYNTAX INTEGER {
        communicationAlarm(0),
        equipmentAlarm(1),
        environmentalAlarm(2),
        processingErrorAlarm(3),
        qualityOfServiceAlarm(4)
    }
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
            "The type of service to which the alarm is related."
    ::= { alarmEntry 9}

alarmText OBJECT-TYPE
    SYNTAX DisplayString
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
            "The text describing the alarm."
    ::= { alarmEntry 10 }

alarmOnTime OBJECT-TYPE
    SYNTAX NemTime
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
            "The time the alarm alarm was activated."
    ::= { alarmEntry 11 }

alarmOffTime OBJECT-TYPE
    SYNTAX NemTime
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
            "The time the alarm was cleared."
    ::= { alarmEntry 12 }

alarmAckOnStatus OBJECT-TYPE
    SYNTAX INTEGER {
        not-acknowledged(0),
        acknowledged(1)
    }
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
            "Indicates if the activation of the alarm has been
            acknowledged"
    ::= { alarmEntry 13 }

alarmAckOnTime OBJECT-TYPE
    SYNTAX NemTime
```

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```
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
            "The time when the activation of the alarm has been
             acknowledged. This object has no valid value if the
             alarm is not acknowledged."
    ::= { alarmEntry 14 }

alarmAckOffStatus OBJECT-TYPE
    SYNTAX INTEGER {
        not-acknowledged(0),
        acknowledged(1)
    }
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
            "Indicates if the clearing of the alarm has been
            acknowledged
            stopped."
    ::= { alarmEntry 15 }

alarmAckOffTime OBJECT-TYPE
    SYNTAX NemTime
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
            "The time when the clearing of the alarm has been
             acknowledged. This object has no valid value if the
             alarm is not acknowledged."
    ::= { alarmEntry 16 }

alarmIntermittency OBJECT-TYPE
    SYNTAX INTEGER {
        off(0),
        on(1)
    }
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
            "Is the alarm is an intermittent alarm."
    ::= { alarmEntry 17 }

alarmIntermittentPeriod OBJECT-TYPE
    SYNTAX INTEGER (0..65535)
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
            "The time that should elapse between two raising of
             intermittent alarms; they are considered
             as two separate alarms. If this is not an
             intermittent alarm, this object has no valid value."
    ::= { alarmEntry 18 }

alarmNEName OBJECT-TYPE
    SYNTAX DisplayString
    MAX-ACCESS read-only
    STATUS current
    DESCRIPTION
            "The name of the network element which has the
```

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```
                alarm. It can change
                during the lifetime of the network element."
        ::= { alarmEntry 19 }

alarmLocation OBJECT-TYPE
        SYNTAX DisplayString
        MAX-ACCESS read-only
        STATUS current
        DESCRIPTION
                "The location of the alarm."
        ::= { alarmEntry 20 }


--
-- conformance groups
--
unemMIBConformance OBJECT IDENTIFIER ::= { release1 5 }
unemMIBCompliances OBJECT IDENTIFIER ::= { unemMIBConformance 1 }
unemMIBGroups      OBJECT IDENTIFIER ::= { unemMIBConformance 2 }

unemMIBCompliance MODULE-COMPLIANCE
          STATUS current
          DESCRIPTION "The compliance statement for SNMPv2 entities which implement FOXMAN-
UN v1"
          MODULE -- this module
          MANDATORY-GROUPS {unemMIBGroup }
          ::= { unemMIBCompliances 1 }


unemMIBGroup OBJECT-GROUP
OBJECTS     { unemTrapSequenceNumber,
          neFamily,
          neIndex,
          neName,
          neUNEMAddress,
          neType,
          neOperationalState,
          nePollingStatus,
          neAlarmSeverity,
          neNumber,
          cardNumber,
          cardNEfamily,
          cardNE,
          cardSlot,
          cardName,
          cardIdentifier,
          cardSwVersion,
          cardNEName,
          alarmNEfamily,
          alarmNE,
          alarmId,
          alarmCardSlot,
          alarmLayer,
          alarmSubUnit,
          alarmStatus,
          alarmSeverity,
          alarmEventType,
          alarmText,
          alarmOnTime,
```

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```
            alarmOffTime,
            alarmAckOnStatus,
            alarmAckOnTime,
            alarmAckOffStatus,
            alarmAckOffTime,
            alarmIntermittency,
            alarmIntermittentPeriod,
            alarmNEName,
            alarmLocation
           }
STATUS      current
DESCRIPTION "The current unem V1 group of objects providing for management of FOXMAN-UN"
::= { unemMIBGroups 1 }


unemTrapGroup NOTIFICATION-GROUP
     NOTIFICATIONS { alarmRaisedTrap,
              alarmAckedTrap,
              alarmClearedTrap,
              neAdded,
              neDeleted,
              neNameModified,
              neOpStatModified,
              nePollStatModified,
              cardAdded,
              cardDeleted,
              neAlarmSeverityModified }
     STATUS current
     DESCRIPTION ""
     ::= { unemMIBGroups 2 }

END
```

1.9 SNMP Northbound Interface (NBI) Trap only mode

In the default installation, the NBI loads all NE, CARD and ALARM tables in memory from the database (eventually duplicating or making local copies in the memory). The main purpose of loading these tables is to provide the walking access and sending traps to HLMs. A sample snmpwalk result for neTable is shown in Figures 1 and 2.

However, with FOXMAN-UN supporting 25K nodes, the size of the database grows and loading time of these tables would become very large and may lead to freezing or crashing of the system. Likewise, 90% of HLMs do not intend to walk these tables and are only interested in receiving traps corresponding to addition, deletion, change of state of NE & CARD units and for current or newly raised alarms.

Hence, starting R9B, it is possible to set the “trap only” mode for NBI. This mode does not load the tables in the memory or allow HLM walking access on the tables but will only send traps to HLMs.

Modify the «`$NEM_HOME/etc/snmpagentd.conf`» file as follows:

- Set `snmp_no_cards_tables` to «`enable`»

  This parameter enables/disables the trap only mode. Default is set to «`disable`»

  If this is set to “disable”,

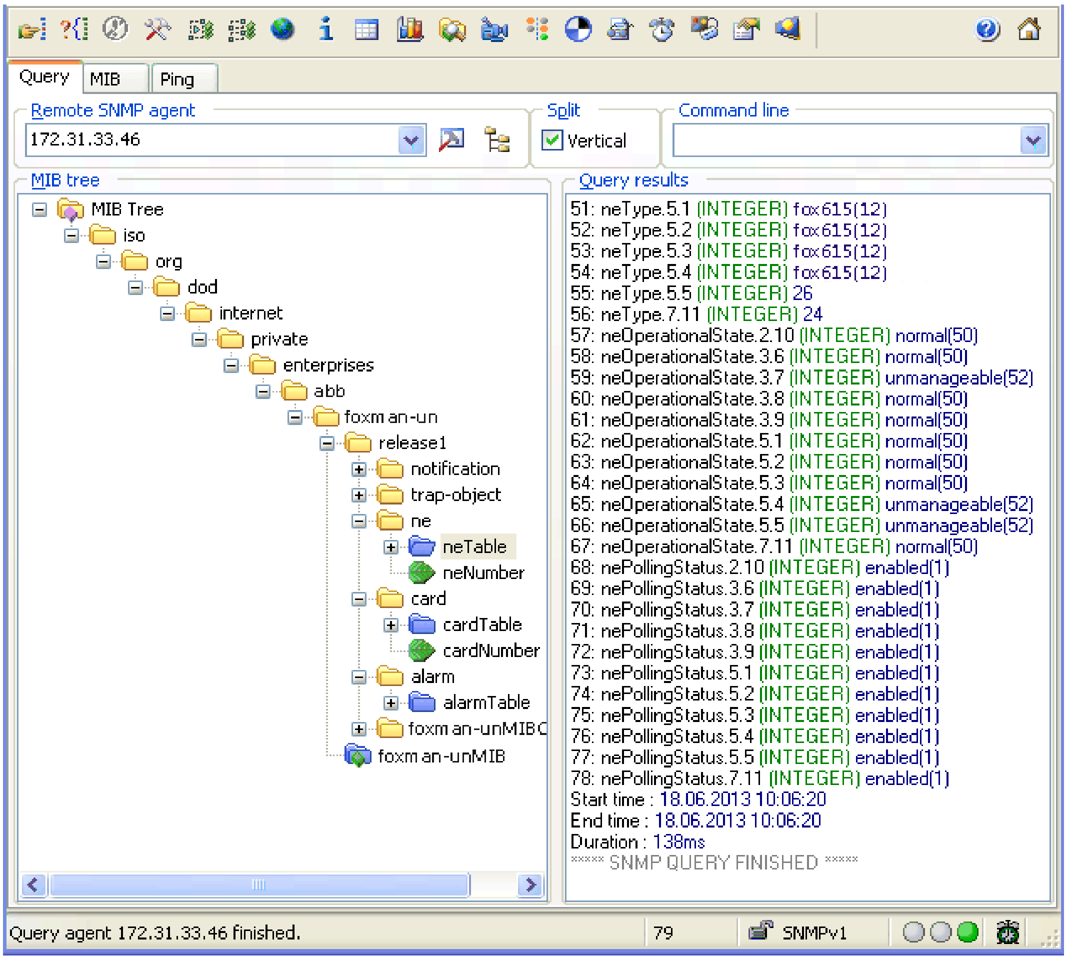
  - the SNMP NBI loads all NE, Card and Alarm tables in memory from database
  - allows walkthrough of the tables

  If this is set to “enable”,

  - the NBI is set to “trap only” mode

  - does not allow walkthrough of the tables
  - will only send traps to HLM
  - no table will be loaded into the memory from the database during the startup of the NBI daemon
- Add the parameter and value `snmp_alarm_ne_card_batch_size 50`

  It sets the chunk size of the traps sent by the NBI. Default is set to 5.



Remote SNMP agent: 172.31.33.46

Split: ☑ Vertical

Command line:

```
51: neType.5.1 (INTEGER) fox615(12)
52: neType.5.2 (INTEGER) fox615(12)
53: neType.5.3 (INTEGER) fox615(12)
54: neType.5.4 (INTEGER) fox615(12)
55: neType.5.5 (INTEGER) 26
56: neType.7.11 (INTEGER) 24
57: neOperationalState.2.10 (INTEGER) normal(50)
58: neOperationalState.3.6 (INTEGER) normal(50)
59: neOperationalState.3.7 (INTEGER) unmanageable(52)
60: neOperationalState.3.8 (INTEGER) normal(50)
61: neOperationalState.3.9 (INTEGER) normal(50)
62: neOperationalState.5.1 (INTEGER) normal(50)
63: neOperationalState.5.2 (INTEGER) normal(50)
64: neOperationalState.5.3 (INTEGER) normal(50)
65: neOperationalState.5.4 (INTEGER) unmanageable(52)
66: neOperationalState.5.5 (INTEGER) unmanageable(52)
67: neOperationalState.7.11 (INTEGER) normal(50)
68: nePollingStatus.2.10 (INTEGER) enabled(1)
69: nePollingStatus.3.6 (INTEGER) enabled(1)
70: nePollingStatus.3.7 (INTEGER) enabled(1)
71: nePollingStatus.3.8 (INTEGER) enabled(1)
72: nePollingStatus.3.9 (INTEGER) enabled(1)
73: nePollingStatus.5.1 (INTEGER) enabled(1)
74: nePollingStatus.5.2 (INTEGER) enabled(1)
75: nePollingStatus.5.3 (INTEGER) enabled(1)
76: nePollingStatus.5.4 (INTEGER) enabled(1)
77: nePollingStatus.5.5 (INTEGER) enabled(1)
78: nePollingStatus.7.11 (INTEGER) enabled(1)
Start time : 18.06.2013 10:06:20
End time : 18.06.2013 10:06:20
Duration : 138ms
***** SNMP QUERY FINISHED *****
```

```
Query agent 172.31.33.46 finished.    79    SNMPv1
```

Figure 1: FOXMAN-UN MIB Tree and neTable walk

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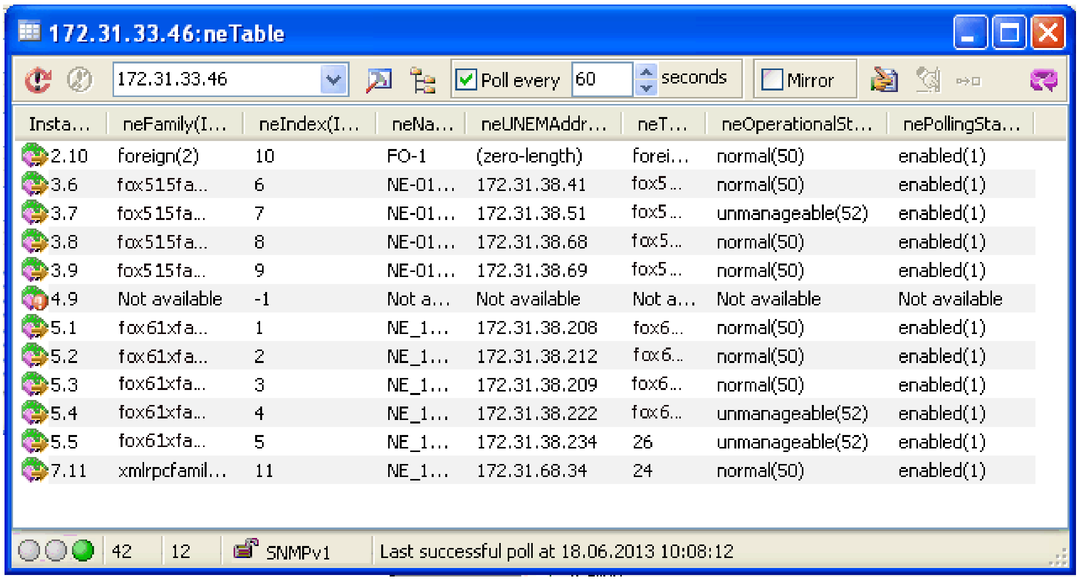


172.31.33.46:neTable

172.31.33.46 ☑ Poll every 60 seconds □ Mirror

Insta...	neFamily(I...	neIndex(I...	neNa...	neUNEMAddr...	neT...	neOperationalSt...	nePollingSta...
2.10	foreign(2)	10	FO-1	(zero-length)	forei...	normal(50)	enabled(1)
3.6	fox515fa...	6	NE-01...	172.31.38.41	fox5...	normal(50)	enabled(1)
3.7	fox515fa...	7	NE-01...	172.31.38.51	fox5...	unmanageable(52)	enabled(1)
3.8	fox515fa...	8	NE-01...	172.31.38.68	fox5...	normal(50)	enabled(1)
3.9	fox515fa...	9	NE-01...	172.31.38.69	fox5...	normal(50)	enabled(1)
4.9	Not available	-1	Not a...	Not available	Not a...	Not available	Not available
5.1	fox61xfa...	1	NE_1...	172.31.38.208	fox6...	normal(50)	enabled(1)
5.2	fox61xfa...	2	NE_1...	172.31.38.212	fox6...	normal(50)	enabled(1)
5.3	fox61xfa...	3	NE_1...	172.31.38.209	fox6...	normal(50)	enabled(1)
5.4	fox61xfa...	4	NE_1...	172.31.38.222	fox6...	unmanageable(52)	enabled(1)
5.5	fox61xfa...	5	NE_1...	172.31.38.234	26	unmanageable(52)	enabled(1)
7.11	xmlrpcfamil...	11	NE_1...	172.31.68.34	24	normal(50)	enabled(1)

42 | 12 | SNMPv1 | Last successful poll at 18.06.2013 10:08:12

Figure 2: neTable walk

Set command can be issued on the NE, CARD and ALARM tables to specify sending all or only part of the traps.

The syntax for sending the set command is shown below:

snmpset [COMMON OPTIONS] OID TYPE VALUE [OID TYPE VALUE]

- The specific OIDs are listed below:
  - NE: 1.3.6.1.4.1.17268.2818.93.1.2.1.1.2.4.0
  - CARD:1.3.6.1.4.1.17268.2818.93.1.3.1.1.3.4.0
  - ALARM:1.3.6.1.4.1.17268.2818.93.1.4.1.1.4.4.0
- the possible TYPE/VALUE are:
  - i (Integer) -1: will trigger all traps corresponding to every entry in the respective tables
  - i (Integer) NeId: will trigger only traps corresponding to the specified ne in the respective tables.

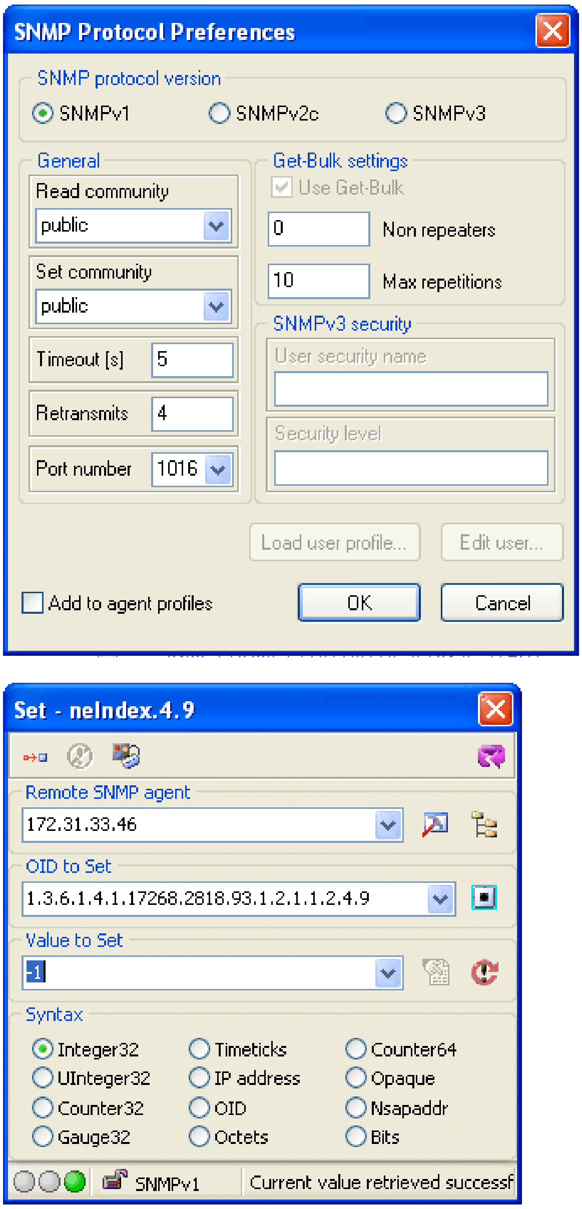
Please note:

Verify the configuration of «$NEM_HOME/etc/snmpagentd.conf» for the following parameters:

- `snmp_trap_port` (HLM port, where traps are received)
- `snmp_hlm_host` (HLM host IP address)
- `snmp_request_port` (listening port of the proxy agent)

Sample set command for the neTable:

- via a mib browser:



SNMP Protocol Preferences

SNMP protocol version: ● SNMPv1 ○ SNMPv2c ○ SNMPv3

General

Read community: public

Set community: public

Timeout [s]: 5

Retransmits: 4

Port number: 1016

Get-Bulk settings

☑ Use Get-Bulk

Non repeaters: 0

Max repetitions: 10

SNMPv3 security

User security name:

Security level:

□ Add to agent profiles

Set - neIndex.4.9

Remote SNMP agent: 172.31.33.46

OID to Set: 1.3.6.1.4.1.17268.2818.93.1.2.1.1.2.4.9

Value to Set: -1

Syntax: ● Integer32 ○ UInteger32 ○ Counter32 ○ Gauge32 ○ Timeticks ○ IP address ○ OID ○ Octets ○ Counter64 ○ Opaque ○ Nsapaddr ○ Bits

SNMPv1 Current value retrieved successf

Figure 3: snmpset via mib browser

- or via command line (if using Linux, the net-snmp rpms should be installed)

snmpset -v 1 -c public $1:10161 1.3.6.1.4.1.17268.2818.93.1.2.1.1.2.4.0 i -1

Where:

[COMMON OPTIONS]:

-c public : set the community string

-v1 : specifies SNMP version to use

Agent/[OID]:

$1:10161 : specifies the IP address and listening port of the FOXMAN-UN proxy agent (e.g. 172.31.33.46:10161)

1.3.6.1.4.1.17268.2818.93.1.2.1.1.2.4.0: Hitachi Energy FOXMAN-UN neTable OID

`[TYPE/VALUE]:`

i -1: specifies the value for ‘NeId’. if the field is set to ‘-1’ it would trigger all the ne traps. If this is set to a specific ‘NeId’, it would trigger only the ne traps for this particular network element.

The snapshot below shows the alarm traps received by HLM, when the value is set to specific NeId (NeIndex), e.g. 11.

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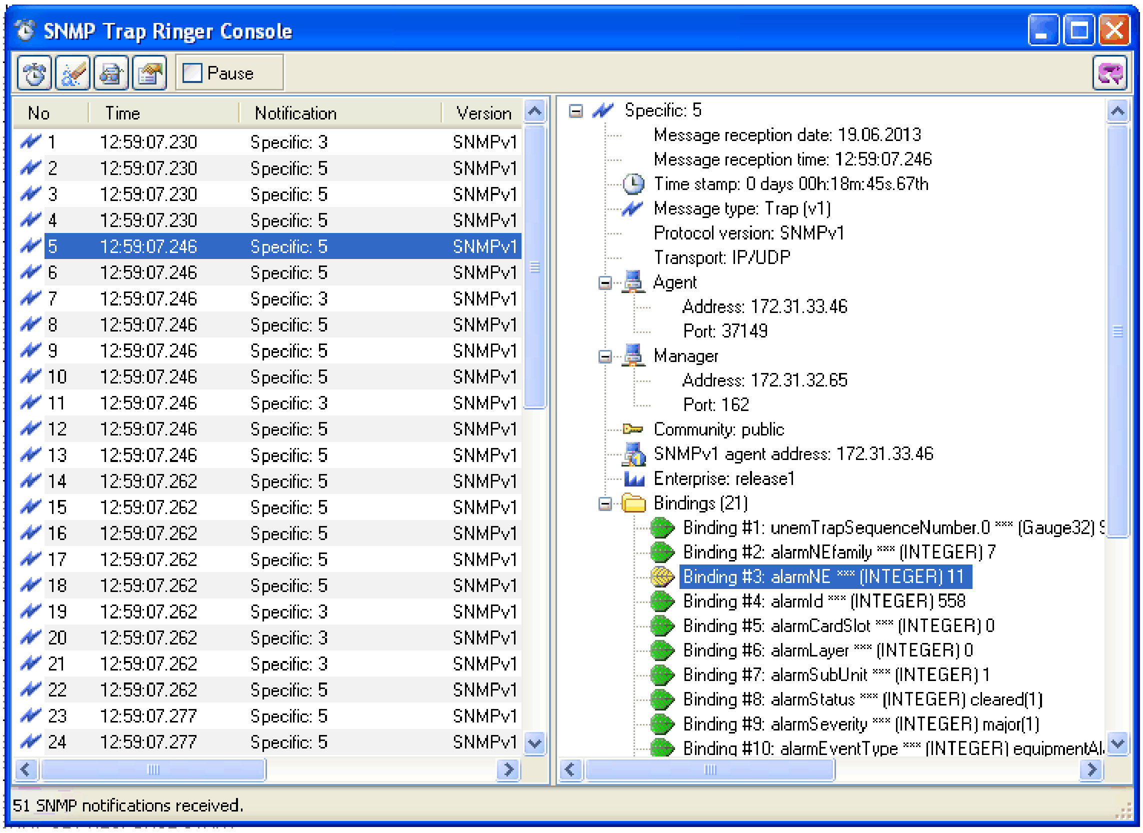

No	Time	Notification	Version
1	12:59:07.230	Specific: 3	SNMPv1
2	12:59:07.230	Specific: 5	SNMPv1
3	12:59:07.230	Specific: 5	SNMPv1
4	12:59:07.230	Specific: 5	SNMPv1
5	12:59:07.246	Specific: 5	SNMPv1
6	12:59:07.246	Specific: 5	SNMPv1
7	12:59:07.246	Specific: 3	SNMPv1
8	12:59:07.246	Specific: 5	SNMPv1
9	12:59:07.246	Specific: 5	SNMPv1
10	12:59:07.246	Specific: 5	SNMPv1
11	12:59:07.246	Specific: 3	SNMPv1
12	12:59:07.246	Specific: 5	SNMPv1
13	12:59:07.246	Specific: 5	SNMPv1
14	12:59:07.262	Specific: 5	SNMPv1
15	12:59:07.262	Specific: 5	SNMPv1
16	12:59:07.262	Specific: 5	SNMPv1
17	12:59:07.262	Specific: 5	SNMPv1
18	12:59:07.262	Specific: 5	SNMPv1
19	12:59:07.262	Specific: 3	SNMPv1
20	12:59:07.262	Specific: 3	SNMPv1
21	12:59:07.262	Specific: 3	SNMPv1
22	12:59:07.262	Specific: 5	SNMPv1
23	12:59:07.277	Specific: 5	SNMPv1
24	12:59:07.277	Specific: 5	SNMPv1

```
Specific: 5
    Message reception date: 19.06.2013
    Message reception time: 12:59:07.246
    Time stamp: 0 days 00h:18m:45s.67th
    Message type: Trap (v1)
    Protocol version: SNMPv1
    Transport: IP/UDP
    Agent
        Address: 172.31.33.46
        Port: 37149
    Manager
        Address: 172.31.32.65
        Port: 162
    Community: public
    SNMPv1 agent address: 172.31.33.46
    Enterprise: release1
    Bindings (21)
        Binding #1: unemTrapSequenceNumber.0 *** (Gauge32)
        Binding #2: alarmNEfamily *** (INTEGER) 7
        Binding #3: alarmNE *** (INTEGER) 11
        Binding #4: alarmId *** (INTEGER) 558
        Binding #5: alarmCardSlot *** (INTEGER) 0
        Binding #6: alarmLayer *** (INTEGER) 0
        Binding #7: alarmSubUnit *** (INTEGER) 1
        Binding #8: alarmStatus *** (INTEGER) cleared(1)
        Binding #9: alarmSeverity *** (INTEGER) major(1)
        Binding #10: alarmEventType *** (INTEGER) equipmentAl
```

51 SNMP notifications received.

Figure 4: Traps received, value set to ‘NeId’ 11

When using the snmpset command with NeIndex -1 to generate traps from neTable,alarmTable, alarm traps for all NEs should be returned.

Example:

```
[nemsec@nemsrv ~]$ snmpset -v 2c -c public 172.31.41.82:10161 SNMPv2-SMI::enterprises.17268.2818.93.1.4.1.1.10.1.33.2 i -1
SNMPv2-SMI::enterprises.17268.2818.93.1.4.1.1.10.1.33.2 = INTEGER: -1
```

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2 SSH tunneling for northbound IF

2.1 General

This section describes how to set up SSH secured Northbound Interface (NBI) CLI sessions.

On the FOXMAN-UN core system, you need to create a local user account (in this example we will use «nbicli» as the user name). Initially provide this account a login-shell like bash, csh, etc, a valid home-directory, and a valid password.

The purpose of this account is to enable a secure authentication between the systems and enable a secure transmission for FOXMAN-UN NBI CLI telnet sessions.

```
ssh-keygen -N '' -t dsa -f ~/.ssh/nbicliclient.id_dsa
```

2.2 SSH preparations

On the client system where you will run the CLI telnet sessions from, do the following:

Generate a keypair without passphrase:

```
ssh-keygen -N '' -t dsa -f ~/.ssh/nbicliclient.id_dsa
```

The public key will then be generated in the file:

```
~/.ssh/nbicliclient.id_dsa.pub
```

This file has to be transferred somehow to the FOXMAN-UN core system into the previously generated account (named “nbicli” in this example). The contents of the file above have to be added to the file containing the normally authorized keys.

The easiest and most secure way to do this is:

```
cat ~/.ssh/nbicliclient.id_dsa.pub | \ssh nbicli@foxman-unHost.dns.dom \ "( cat >> .ssh/
authorized_keys && \chmod 600 .ssh/authorized_key )"
```

You will be prompted for the password for the account: nbicli.

The file authorized_keys has the correct permissions now.

In order to enable SSH access to the FOXMAN-UN core host without having to type a pass-phrase ensure to always use the generated local private key (see the –i option below):

```
~/.ssh/nbicliclient.id_dsa
```

The connection can be tested without a password prompt by entering the following command:

```
ssh -i ~/.ssh/nbicliclient.id_dsa nbicli@foxman-unHost.dns.dom
```

2.3 Running CLI sessions

In order to connect to:

- the FOXMAN-UN inventory northbound interface (default port 2500) type:

```
ssh -i ~/.ssh/nbicliclient.id_dsa nbicli@foxman-unHost.dns.dom telnet foxman-
unHost.dns.dom 2500
```

- the FOXMAN-UN ECLIP northbound interface (default port 2600) type:

```
ssh -i ~/.ssh/nbicliclient.id_dsa nbicli@foxman-unHost.dns.dom telnet foxman-
unHost.dns.dom 2600
```

- the FOXMAN-UN linetest_cli northbound interface (default port 2700) type:

```
ssh -i ~/.ssh/nbicliclient.id_dsa nbicli@foxman-unHost.dns.dom telnet foxman-
unHost.dns.dom 2700
```

Alternatively you also could setup an SSH tunnel with port forwarding:

```
ssh -i ~/.ssh/nbicliclient.id_dsa \
-L2500:foxman-unHost.dns.dom:2500 \
-L2600:foxman-unHost.dns.dom:2600 \
-L2700:foxman-unHost.dns.dom:2700 \
nbicli@foxman-unHost.dns.dom
```

Please note:

The -L options that are not required can be omitted when entering the above command.

In the command shown above the backslash is used to connect several lines to one command line.

As long as this SSH session is kept open the NBI CLI ports are tunneled between the FOXMAN-UN core host and your client host and you can connect as follows:

- FOXMAN-UN inventory northbound interface:

```
telnet localhost 2500
```

- FOXMAN-UN ECLIP northbound interface:

```
telnet localhost 2600
```

- FOXMAN-UN linetest_cli northbound interface:

```
telnet localhost 2700
```

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3 ECLI Proxy (ECLIP)

3.1 General

3.1.1 Introduction

FOXMAN-UN provides Embedded CLI Proxy (Proxy), a CLI based northbound interface between FOXMAN-UN and the customer's OSS. ECLIP supports direct connection to the ECLI interface of an FOX61x control unit, such as CESM1, CESM2, CESM3.

ECLIP provides access for several OSS clients to all FOX61x NEs of a FOXMAN-UN domain via the ECLI commands.

3.1.2 Block Diagram

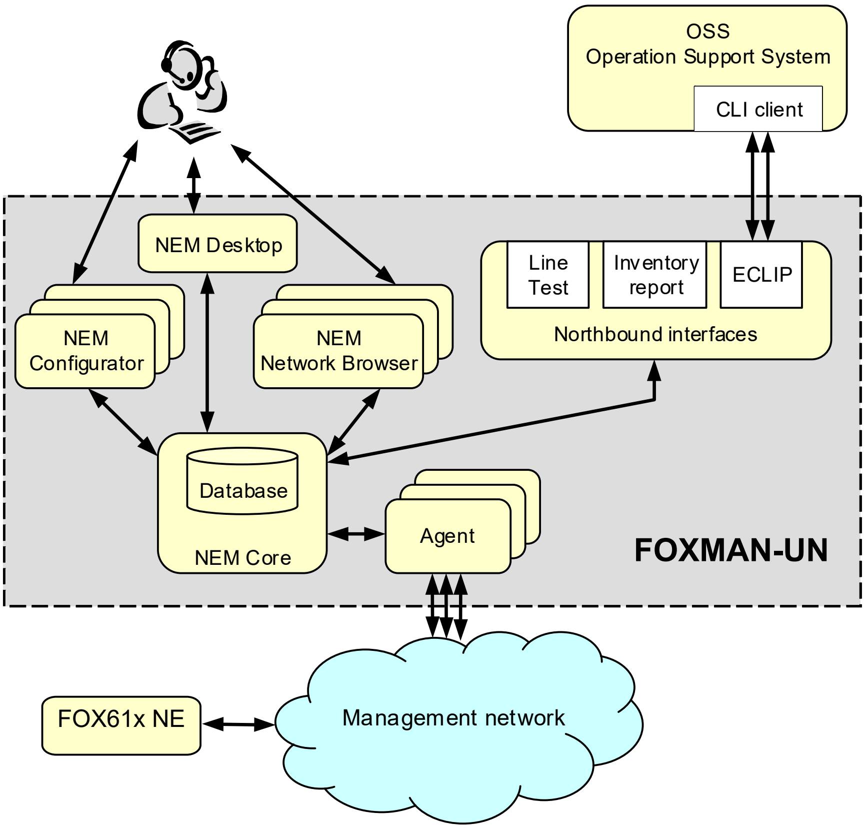

Figure 5: ECLIP Block Diagram

3.1.3 ECLI proxy manager

The ECLI proxy manager is started and terminated as part of the FOXMAN-UN core process package. The ECLIP frontend starts up a Telnet TCP server listening on the port 2600. The maximal number of ECLI proxy sessions is restricted to 100 OSS clients. This can be changed at startup by setting the "nbi_eclip_max_number_of_sessions" in $NEM_HOME/etc/nbcli.conf file.

The ECLIP frontend opens a Database session to check if a certain NE is in the domain access of the OSS client.

When OSS client starts a session, the client needs to authenticate itself. To this purpose the FOXMAN-UN user name and password are queried interactively. If the authentication succeeds, the OSS client gains access to FOX61x NEs that are part of his access domain. After three unsuccessful attempts the client session is terminated.

When the ECLIP is shut down, all open backend sessions will be closed and the connections to the FOX61x will be disconnected.

3.1.4 Syntax

All the commands of the ECLI can be executed. While the OSS client is connected to a FOX61x NE, the commands can directly pass through to the ECLI without filtering.

When ECLI proxy session is started, the user can choose from a set of commands. The available commands are:

- co[nnect]: <NE-IPAddr> <UserClass>
  establishes a connection to the ECLI
- h[elp]: shows a help list
- st[at]: shows the statistics of the response times.
- re[set]: resets the statistics of the response times.
- qu[it]: quit the session

3.1.4.1 Connect

The different user classes are “information”, “maintenance”, “manager”, “sessionmanager”. If the client tries to connect to an ECLI, the proxy session checks first if the NE is in the access domain of the client. If the check passes, the connection to the ECLI will be established. If not an error message will appear. The ECLI proxy session is restricted to connect to one NE at a time.

If the OSS client tries to connect as “information”, the client needs to have the read to NE access right. If the client connects as “maintenance”, “manager” or “sessionmanager”, the client needs to have read and update to NE access rights.

Please note:
The remote authentication is not supported.

3.1.4.2 Help

The help command differs if the client is connected to an ECLI or if the client is not connected.

If the client is connected to an ECLI, the help text of the ECLI is shown.

If the OSS client is not connected to an ECLI, the following text is shown:

You are not connected to a network element. The command-set is restricted
while not connected. Available commands are:

```
co[nnect] <NE-IpAddr> <UserClass> -- connect to a network element
  qu[it]                 -- quit this program (session will
                                    be closed)
  h[elp]                            -- show these lines
  st[at]                            -- show statistics
  re[set]                           -- reset statistics
Network element user classes are:
"information", "maintenance", "manager", "sessionmanager", "softwaremanager"

If not sure, use "information".

Example for connect-command:   co 172.30.2.176 information
```

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3.1.4.3 Stat

ECLIP measures the response time and maintain statistic. It measures the time since the ECLIP backend gets the command from the client until the response is send back to it.

The response time statistic is maintained in six different time intervals as shown in the sample below. The statistic is maintained for all clients together and it is maintained until an OSS client resets it or the ECLIP is shut down.

```
> stat
Statistics:
 <1s: 31, <3s: 0, <5s: 0, <10s: 0, <20s: 0, >20s: 0
Total success request: 31
Total failed request: 0
```

3.1.4.4 Quit the session

The command will close the proxy session. If there is an open connection to an ECLI, the connection will be aborted and the proxy session will be closed as shown below:

```
> quit
> Connection closed by foreign host
```

i **Please note:**
ECLIP accepts `disconnect` and `exit` for legacy compatibility reasons.

3.1.5 FOXMAN-UN Pre-requisites

3.1.5.1 License

The ECLIP is a license key controlled option. The command `lslicense` returns a list of activated options.

The following line shows whether CLI northbound interface is licensed:

CLI northbound interface : yes

This key is shared with other northbound interfaces.

3.1.5.2 Configurations

This section describes the configuration parameters of the FOXMAN-UN which are directly related to the ECLIP interface. These parameters are set in the file $NEM_HOME/etc/nbcli.conf

```
# NBI CLI northbound interface
# ===========================

# ECLI proxy configuration
# =======================

# ECLI proxy OSS-Port
# -------------------
# Configures the tcp listen port of the ECLI proxy daemon
# default set to 2600
#nbi_eclip_oss_port              2600

# ECLI proxy maximum of sessions
# -----------------------------
# Defines the maximum number of ECLI proxy sessions
# default set to 100
#nbi_eclip_max_number_of_sessions       100

# ECLI proxy protocol
# -----------------
# Defines the protocol
# Valid values are "telnet", "ssh". Default is "telnet"
#nbi_eclip_protocol            telnet
```

Additional information regarding the CLI syntax:

nbi_eclip_protocol

Defines the backend connection protocol for an ECLI. This telnet or ssh client establishes a connection to the ECLI, sends commands and receives the response. There is no difference in the use of the ECLI proxy if the customer starts the ECLIP with telnet or ssh as backend protocol.

3.1.5.3 Sample Connection to an ECLI

```
$ telnet <nemhost> 2600
Trying <nemhost>
Connected to <nemhost>
Escape character is `^]'.
NEM ECLI northbound interface

Login: <nem_user>
Password: <nem_user password>

> co <NE-IpAddr> <UserClass>

--===### CLI Release R2A21, Build 2019-08-22 ###===---
/> help

commands
--------

cd                   -- Change to specified node address and/or MF
pwd                  -- Show current address
ls                   -- Show infos for current address
show                 -- Show settings
mode                 -- Configure operation modes
ftpserver            -- Configure the (s)ftp-server settings
upload               -- Upload a file (filename) from the NE into the (s)ftp server (serverpath)
download             -- Download a file (serverpath/filename) from the (s)ftp server into the
NE
get                  -- Get property values from the node
set                  -- Define property values and send them to the node
help                 -- Show CLI operation help
exit                 -- Exit CLI session

/> cd /unit-11/port-1/main
/unit-11/port-1/main> ls
General
  Prop: Labels rw
  Prop: AlarmStatus r-
AdminAndOperStatus
  Prop: AdministrativeStatus rw
  Prop: OperationalStatus r-
/unit-11/port-1/main> get OperationalStatus
                \ # OperationalStatus
Up              \ # State
```

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4 Inventory report interface

4.1 General

4.1.1 Introduction

FOXMAN-UN provides a command line interface (CLI) to its inventory database which can be accessed via a socket connection, e.g. a telnet session.

i

Please note:
SSH tunneling can be used for this connection as described in section 2 "SSH tunneling for northbound IF".

4.1.1.1 Inventory report

The inventory CLI allows an OSS to retrieve inventory data on a NE, unit, port, service and config level from the inventory data stored in the FOXMAN-UN database. The data can be delivered in XML format.

Inventory reports can be requested either unscheduled or scheduled. An unscheduled report results in a single response containing the requested data. A scheduled report delivers an immediate response confirming the request and a subsequent notification which contains the requested data.

4.1.1.2 Inventory change notification

Additionally requests can be made for notification of inventory changes. Such a request must be registered with the report server by the CLI client. A request for a registration can be made for an unscheduled or a scheduled response.

A request stays valid till it is deregistered by the client, or till the session is closed.

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4.1.2 Block diagram

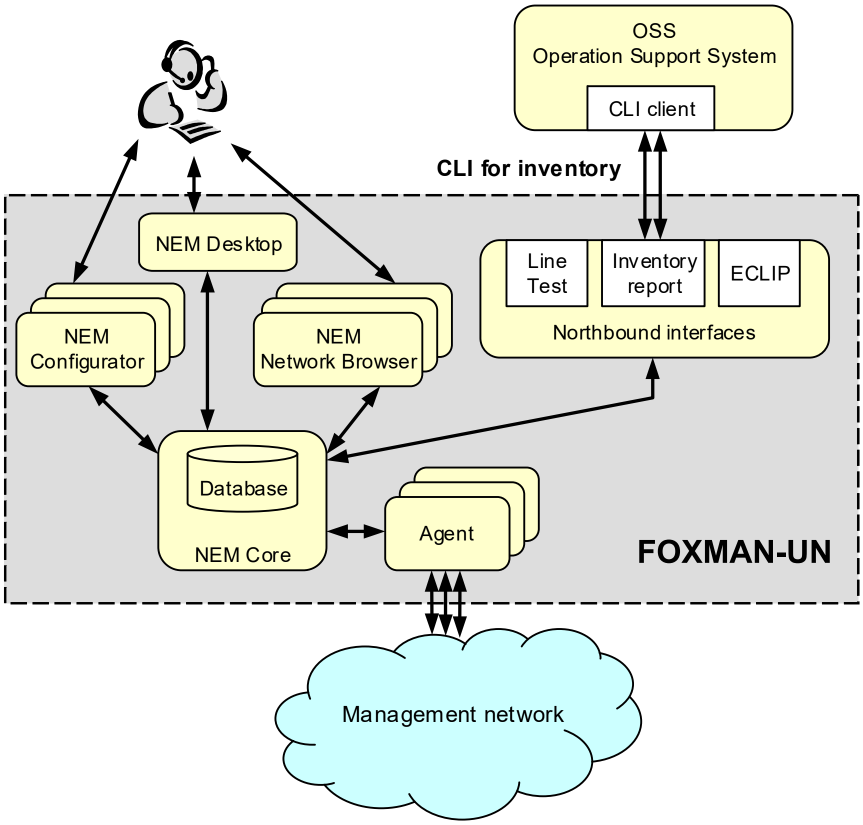

Figure 6: Inventory Report Interface Block Diagram

4.1.3 Protocol

The CLI uses a text TCP socket based protocol that can be accessed e.g. via the «telnet» command. End of line characters are UNIX based. There is no encryption implemented over the socket connection. The default socket is 2500.

On connection to the CLI server, the client first receives a login query for user name and password. An error message «wrong username or password!» is sent if the authentication fails.

The maximum number of concurrent connections to the CLI server is by default configured as 5.

i

Please note:
No session timeout is implemented in the CLI. The CLI connection is closed

→ when the «quit» command is issued

→ when the socket is closed on the client side

→ when the FOXMAN-UN core is stopped.

4.1.4 Syntax

4.1.4.1 Inventory report unscheduled

Format of the request for an unscheduled inventory data retrieval:

inventory getReport async <msgID> <reportType> [<address>] [<filter>] [<reportFormat>]

msgID	The «message identifier» is a number issued by the user. This number is returned by the report server in its response.

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reportType	Possible values are NE | Unit | Port | Service | Config
address (optional)	Refer to 4.1.4.6 "Equipment addressing".
filter (optional)	Refer to 4.1.4.7 "Filters".
reportFormat (optional)	Possible values are xml | csv (Default: xml)

Format for the response of the report server to an unscheduled inventory data request:

```
inventory getReportResponse async <msgID> <errorCode> <datastream>
```

msgID	Message identifier of the corresponding request.
errorCode	Refer to 4.1.5 "Error codes".
datastream	Inventory data as requested.

4.1.4.2 Inventory report scheduled

Format of the request for a scheduled inventory data retrieval:

```
inventory getReport async <msgID> scheduled <reportType> [<address>] [<filter>] [<reportFormat>]
```

msgID	The «message identifier» is a number issued by the user. This number is returned by the report server in its response.
reportType	Possible values are NE | Unit | Port | Service | Config
address (optional)	Refer to 4.1.4.6 "Equipment addressing".
filter (optional)	Refer to 4.1.4.7 "Filters".
reportFormat (optional)	Possible values are xml | csv (Default: xml)

Format of the immediate response to a request for a scheduled inventory data retrieval:

```
inventory getReportResponse async <msgID> scheduled <scheduleID> <errorCode>
```

msgID	Message identifier of the corresponding request.
scheduleID	Schedule identifier assigned by the report server to be included in the subsequent response containing the requested inventory data.
errorCode	Refer to 4.1.5 "Error codes".

Format of the scheduled response containing the requested inventory data:

```
inventory notification schedule <scheduleID> <errorCode> <datastream>
```

scheduleID	Schedule identifier as announced in the immediate response.
errorCode	Refer to 4.1.5 "Error codes".
datastream	Inventory data as requested.

4.1.4.3 Inventory change registration unscheduled

Format of the request for the registration of an inventory change notification with unscheduled response:

inventory registerGetReport async <msgID> <reportType> [<address>] [<filter>] [<reportFormat>]

msgID	The «message identifier» is a number issued by the user. This number is returned by the report server in its response.
reportType	Possible values are NE | Unit | Service
address (optional)	Refer to 4.1.4.6 "Equipment addressing".
filter (optional)	Refer to 4.1.4.7 "Filters".
reportFormat (optional)	Possible values are xml | csv (Default: xml)

Format of the immediate response to a registration request:

inventory registerGetReportResponse async <msgID> <errorCode> <regID> <datastream>

msgID	Message identifier of the corresponding request.
regID	Registration identifier assigned by the report server to this registration. This identifier will be quoted in all future notifications of inventory changes.
errorCode	Refer to 4.1.5 "Error codes".
datastream	Inventory data as requested.

Format of the notification caused by an inventory change:

inventory notification registration <regID> <reportNotificationType> <datastream>

regID	Registration identifier assigned by the report server to this registration.
reportNotificationType	The following types are generated: NECreation | NEDeletion | UnitCreation | UnitDeletion | ServiceCreation | ServiceDeletion
datastream	For notifications of the type «Creation»: Inventory data as requested. For notifications of the type «Deletion»: Address of the deleted inventory item.

4.1.4.4 Inventory change registration scheduled

Format for the registration of an inventory change notification with scheduled response:

inventory registerGetReport async <msgID> scheduled <reportType> [<address>] [<filter>] [<reportFormat>]

msgID	The «message identifier» is a number issued by the user. This number is returned by the report server in its response.
reportType	Possible values are NE | Unit | Service
address (optional)	Refer to 4.1.4.6 "Equipment addressing".
filter (optional)	Refer to 4.1.4.7 "Filters".
reportFormat (optional)	Possible values are xml | csv (Default: xml)

Format of the immediate response to the registration request:

inventory registerGetReportResponse async <msgID> scheduled <scheduleID> <errorCode>

msgID	Message identifier of the corresponding request.

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scheduleID	Schedule identifier assigned by the report server to be included in the subsequent responses containing the requested inventory change data. In this case the scheduleID serves also as identifier of the registration.
errorCode	Refer to 4.1.5 "Error codes".

Format of the scheduled response to the registration request:

inventory notification schedule <scheduleID> <errorCode> <data stream>

scheduleID	Schedule identifier as announced in the immediate response.
errorCode	Refer to 4.1.5 "Error codes".
datastream	Inventory data as requested.

Format of the notification caused by an inventory change:

inventory notification registration <scheduleID> <reportNotificationType> <data stream>

scheduleID	Schedule identifier assigned by the report server to this registration.
reportNotificationType	The following types are generated: NECreation | NEDeletion | UnitCreation | UnitDeletion | ServiceCreation | ServiceDeletion
datastream	For notifications of the type «Creation»: Inventory data as requested. For notifications of the type «Deletion»: Address of the deleted inventory item.

4.1.4.5 Inventory change deregistration

Format for the deletion of an existing registration, for both unscheduled and scheduled requests:

inventory unregister async <msgID> <regID>
inventory unregister async <msgID> <scheduleID>

msgID	The «message identifier» is a number issued by the user. This number is returned by the report server in its response.
regID /scheduleID	Identifier of the registration to be deleted.

Format of the response to a deregistration:

inventory unregisterResponse async <msgID> <errorCode>

msgID	Message identifier of the corresponding deregistration request.
errorCode	Refer to 4.1.5 "Error codes".

4.1.4.6 Equipment addressing

Addressing can be used to select appropriate NEs for a report.

The format for the optional item `[<address>]` is as follows:

NEIDList (NEAddress, ...) |
NETypeList (NEType, ...)

NEAddress	For FOX61x, FOX515/512, SNMP devices /<IPAddress> for FOX-U / FOX-U/M /<IPAddress>:<Port>:<HDLCAddress>
NEType	Available NE types are (case sensitive) FOX615 | FOX612 | FOX611 | FOX515 | FOX512 | FOX-U | FOX-U/M

Not specifying an address results in a report containing the inventory data of all NEs in the managed network.

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4.1.4.7 Filters

In addition to using the address to select appropriate objects for a report, an optional filter can be set. The format for a filter is

Filter (<filterDefinition>)

«filterDefinition» is a boolean expression. Logical operators are «and» and «or». The following operators for comparisons can be used:

=	equal
!=	not equal
<	smaller than (not applicable for strings)
<=	smaller or equal than (not applicable for strings)
>	greater than (not applicable for strings)
>=	greater or equal than (not applicable for strings)

Strings containing special characters must be enclosed by double quotes.

Alphanumeric types can contain the characters a-z, A-Z, 0-9, the special characters , . ; : as well as space.

In strings, asterisk (*) can be used as a wildcard in the filter definitions.

Available filter items depend on the requested report type. The names of the filter items are case sensitive.

Filter items for a **NE** report:

Filter item	xml item	Data type	Comment
neId	neId	Numeric	Internal NE identifier
networkId	networkId	Numeric	Internal agent identifier
accessType	accessType 1)	Numeric	1)
name	name	Alphanumeric	NE name
tag	tag	Alphanumeric	NE tag
location	location	Alphanumeric	NE location
additionalText	additionalText	Alphanumeric	NE operator message
type	type 2)	Numeric	NE type 2)
ipAddress	ipAddress	Numeric	NE IP address in full decimal
isPollingOn	isPollingOn 3)	Boolean	3)
hdlcAddress	hdlcAddress	Numeric	
hdlcRouterType	hdlcRouterType	Numeric	4)
dialUpNumber	dialUpNumber	Alphanumeric	
gatewayIPAddress	gatewayIPAddress	Numeric	
gatewayTCPPort	gatewayTCPPort	Numeric	
currentConfigId	currentConfigId	Alphanumeric	
oldConfigId	not part of report	Alphanumeric	
state	not part of report	Numeric	Management status 5)
additionalInfo	not part of report	Alphanumeric	not suitable for filtering

1) Valid values are:

0 = Permanent	4 = EOC
1 = RemotePermanent	5 = ATU
2 = DirectPTP	6 = Q1

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3 = ModemPTP

2) Valid values are:

0 = FOX-U	10 = COLT_EC
1 = FOX-U/M	12 = FOX615
2 = FOX-U/E	16 = SNMPType
3 = COLT2	18 = FOX612
4 = DESKTOP	20 = FOX615
5 = N/A	21 = FOX612
6 = N/A	
7 = FOX515	
8 = FOX512	
9 = COLT_E	

3) Valid values are:

0 = false	1 = true

4) Valid values are:

0 = SerialRouter	1 = FOX515

5) Valid values are:

0 = NotConfigured	2 = DifferentConf
1 = NotManageable	3 = Manageable

Filter items for a **Unit** report:

Filter item	xml item	Data type	Comment
unitId	id	Numeric	Internal unit identifier
neId	neId	Numeric	Internal NE identifier
slot	slotId	Numeric	Slot number
layer	layerId	Alphanumeric	
subunit	subUnitId	Numeric	Internal subunit identifier
cfgName	cfgName	Alphanumeric	
cfgIdentity	cfgIdentity	Alphanumeric	
cfgDescription	cfgDescription	Alphanumeric	
hwName	hwName	Alphanumeric	Hardware name
hwIdentity	hwIdentity	Alphanumeric	Hardware identity
hwVersion	hwVersion	Alphanumeric	Hardware version
hwKey	hwKey	Alphanumeric	Hardware key
swName	swName	Alphanumeric	Software name
swVersion	swVersion	Alphanumeric	Software version
boardId	boardId	Numeric	Board identity
supplierPN	supplierPN	Alphanumeric	Supplier part number
manufacturerID	manufacturerID	Alphanumeric	Manufacturer identifier
manufacturerSN	manufacturerSN	Alphanumeric	Manufacturer serial number

Filter item	xml item	Data type	Comment
manufacturerPN	manufacturerPN	Alphanumeric	Manufacturer part number
deliveryDate	deliveryDate	Alphanumeric	e.g. «06W24»
blName	blName	Alphanumeric	Bootloader name
blVersion	blVersion	Alphanumeric	Bootloader version
customerID	customerID	Alphanumeric	Customer identifier
customerPN	customerPN	Alphanumeric	Customer part number
nofPorts	nofPorts	Numeric	Number of ports
supplierBuildState	supplierBuildState	Alphanumeric	
manufacturerBuildState	manufacturerBuildState	Alphanumeric	
layerName	layerName	Alphanumeric	
status	configStatus	Alphanumeric	SW DL configuration status
immediateSoftware	immediateSW	Alphanumeric	
scheduledSoftware	scheduledSW	Alphanumeric	
installTime	installTime	Numeric	
compilationDate	compileDate	Numeric	
lastInventoryCollectTime	not in report	Numeric	
additionalInfo	not in report	Alphanumeric	not suitable for filtering

Filter items for a **Port** report:

Filter item	xml item	Data type	Comment
ttpId	id	Numeric	Internal port identifier
neId	neId	Numeric	Internal NE identifier
slot	slotId	Numeric	
subSlot	subSlot	Numeric	
portNumber	portNumber	Numeric	
portTTPId	portTTPId	Numeric	
unitType	unitName	Alphanumeric	
label	label	Alphanumeric	
layerRate	layerRate	Alphanumeric	1)
nbOf64k	nbOf64k	Alphanumeric	Number of 64k
isActive	isActive	Boolean	2)
allocatedBandwidth	allocatedBW	Numeric	
totalBandwidth	totalBW	Numeric	
configState	configState	Alphanumeric	
adminState	adminState	Alphanumeric	
hasCASProcessing	not in report	Boolean	2)
supportCASInLastTS	not in report	Boolean	2)
ttpPortType	not in report	Numeric	3)
sector	not in report	Numeric	
mode	not in report	Numeric	
needProtectionWithSameChannel	not in report	Boolean	2)
canProtectionInSNCPI	not in report	Boolean	2)
retrieveProtectionSupported	not in report	Boolean	2)
connectionType	not in report	Numeric	4)
connectedChannelsMustMatch	not in report	Boolean	2)

Filter item	xml item	Data type	Comment
additionalInfo	not in report	Alphanumeric	

1) Valid values are:

UndefinedRate	STM1 PMS	ADSL Line
P0_nc	STM4 PMS	E-SHDSL
E0	STM16 PMS	Clock Distribution
E12	O22	Ethernet
E22	Unknown	CSMACD Ethernet
E31	E-DSL	E-VDSL
E32		

2) Valid values are:

0 = false	1 = true

3) Valid values are:

0 = ExternalOpticalPort	4 = InternalFixedLink
1 = ExternalElectricalPort	5 = InternalFloatingLink
2 = InternalSectionPort	6 = ExternalSFPPort
3 = InternalLogicalPort	7 = Radioport-Minilink

4) Valid values are:

0 = NoConnection	4 = AggregateConnection
1 = FixedConnection	5 = OnBoardFullConnection
2 = FullConnection	6 = OnBoardAccessConnection
3 = AccessConnection	7 = OnBoardAggregateConnection

Filter items for a **Service** report:

Filter item	xml item	Data type	Comment
neId	neId	Numeric	Internal NE identifier

Filter items for a FOX51x **Config** report:

Filter item	xml item	Data type	Comment
neId	neId	Numeric	Internal NE identifier
networkId	networkId	Numeric	Internal agent identifier
accessType	accessType 1)	Numeric	1)
name	name	Alphanumeric	NE name
tag	tag	Alphanumeric	NE tag
type	type 2)	Numeric	NE type 2)
isPollingOn	isPollingOn 3)	Boolean	3)

1) Valid values are:

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0 = Permanent	4 = EOC
1 = RemotePermanent	5 = ATU
2 = DirectPTP	6 = Q1
3 = ModemPTP	

2) Valid values are:

0 = FOX-U	7 = FOX515
1 = FOX-U/M	8 = FOX512
2 = FOX-U/E	9 = COLT_E
3 = COLT2	10 = COLT_EC

3) Valid values are:

0 = false	1 = true

Example for a NE report filter that delivers a report of all NEs assigned to the agents with the networkId 1 and 3:

filter (networkId=1 and networkId=3)

4.1.5 Error codes

The following error codes can be generated by the interface:

0	STATUS_OK
1	GENERAL_FAILURE
2	CORBA_EXCEPTION
3	FOXMAN-UN_EXCEPTION
4	UNKNOWN_EXCEPTION
5	PROCESS_REPORT_REQUEST_FAILED
6	UNREGISTER_FAILED
7	UNREGISTER_ID_DOES_NOT_EXIST
8	PROCESSING_FAILURE_EXCEPTION
9	PROCESSING_FAILURE_CORBA_EXCEPTION
10	PROCESSING_FAILURE_UNKNOWN_EXCEPTION
11	NE_FILTER_MISMATCH
12	OPEN_OUTPUT_FILE_FAILED
13	BAD_OUTPUT_FILE_FORMAT
14	ACCESSCONTROLLMGR_MISSING
15	OPEN_INPUT_FILE_FAILED
16	DB_FAILURE
17	SHUTDOWN_IMMINENT
18	NOT_IMPLEMENTED
19	NOT_YET_IMPLEMENTED

4.1.6 Examples

NE report for the two NEs with IP address 192.168.165.63 and 172.30.48.69.

```
inventory getReport async 1 NE NEIDList (/192.168.165.63, /172.30.48.69 )
```

NE report for all NEs of the type SNMP:

```
inventory getReport async 1 NE NETypeList ( SNMP )
```

Unit report of all units in the NE with IP address 192.168.165.63 (address) in the slots 2 to 10 (filter):

```
inventory getReport async 1 Unit NEIDList (/192.168.165.63) Filter (slot >= 2 and slot <= 10)
```

Registration request for a notification of all unit changes in all NEs of the type FOX515:

```
inventory registergetreport async 1 Unit NETypeList (FOX515)
```

4.2 FOXMAN-UN prerequisites

4.2.1 License

The inventory report interface is a license key controlled option. The command `lslicense` returns a list of the activated options.

The following line shows whether the inventory report interface is licensed:

```
CLI northbound interfaces      : yes
```

This key is shared with the other northbound interfaces.

If the inventory report interface is not licensed, an attempt to connect to the socket results in an error message, e.g. for a telnet session:

```
[nemadmin@nemsrv ~]$ telnet nemsrv 2500
Trying 172.31.33.231...
telnet: connect to address 172.31.33.231: Connection refused
telnet: Unable to connect to remote host: Connection refused
[nemadmin@nemsrv ~]$Authentication
```

The authentication process is based on the Login/Password CLI prompt. The authentication is successful if the Login/Password is valid according to the system authentication (PAM) and the user is registered as a valid user in the FOXMAN-UN, i.e. added via the FOXMAN-UN configuration application.

Access to all or part of the NEs in the managed network can be configured using FOXMAN-UN security. For details refer to 1KHW002412 FOXMAN-UN NEM Help System.

4.2.2 Character set

The FOXMAN-UN inventory report interface expects the character set ISO 8859-1 from the OSS side.

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5 POTS and DSL line test interface

5.1 General

5.1.1 Introduction

Please note:
SSH tunneling can be used for this connection as described in 2 "SSH tunneling for northbound IF".

5.1.1.1 POTS line test

The POTS units SUBH<X>, SUPC<X>, and SUPM<X> contain a line test functionality which can be configured via the UCST, or the FOXCST, respectively:

- Specify a scheduled («Cyclic») line test for a SUBH<X> unit
- Specify a line test for the SUPC<X> or SUPM<X> unit
- Select the available line test measurements («Criteria») for the unit

UCST or FOXCST then allow the following:

- Retrieve the results of the most recently executed line test («Get») and view them («Details»)
- Execute a line test immediately («Test»)

These last two functions can also be performed via the northbound CLI interface for POTS line tests. The available commands allow retrieving the measurement values of the most recent line test for a particular SUBH<X>, SUPC<X>, and SUPM<X> port, or execute an immediate line test on a SUBH<X>, SUPC<X>, and SUPM<X> unit with the configured set of measurement types with subsequent automatic retrieval of the resulting measurement values.

The CLI syntax allows opening a communication channel via the FOXMAN-UN core to the NE containing the SUBH<X>, SUPC<X>, or SUPM<X> unit.

Please note:
The POTS line test interface does not allow changing the line test configuration. This can only be done via the UCST or via the FOXCST, respectively.

5.1.1.2 DSL line test

The same CLI syntax allows retrieving the signal to noise ratios (near end and far end) of FOX-51x DSL units (LECA2, LECAF, LESA8, LESI8, SLIM1, SLIM2, SLID1, SLID2, STIC1, STIC2).

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5.1.2 Block diagram

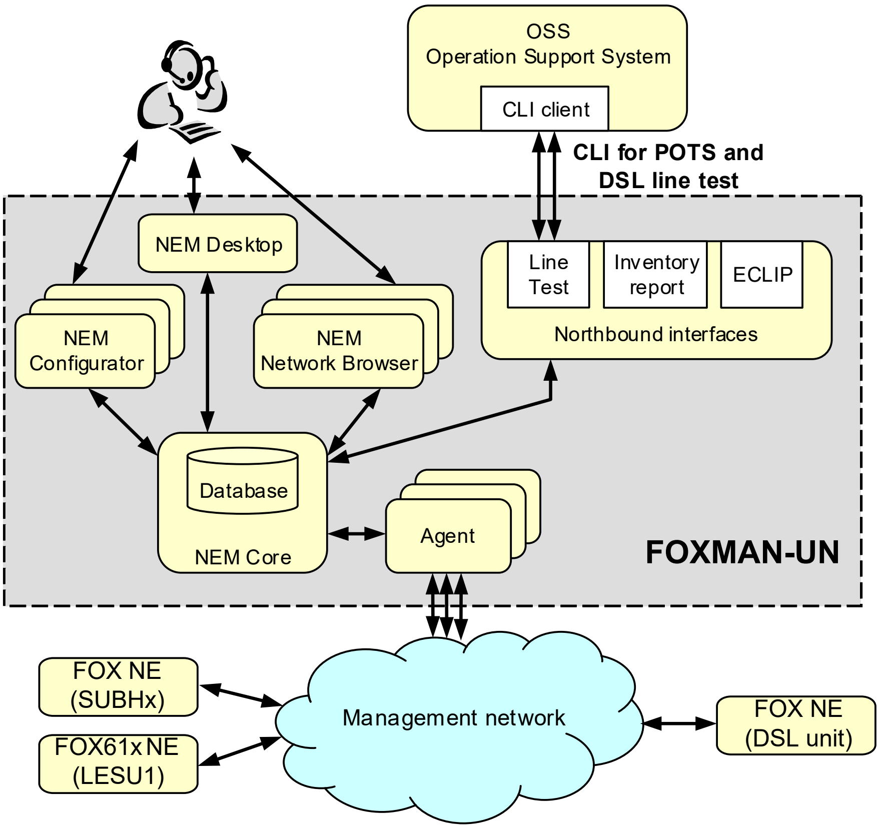

Figure 7: POTS and DSL Line Test Block Diagram

5.1.3 Protocol

The CLI uses a text TCP socket based protocol that can be accessed via the «telnet» command. End of line characters are UNIX based. There is no encryption implemented over the socket connection. The default socket is 2700.

On connection to the CLI server, the client first receives a login query for user name and password. An error message «wrong username or password!» is sent if the authentication fails.

The maximum number of concurrent connections to the CLI sever is by default configured as 5. Only a single connection can be made to any NE.

Please note:
No session timeout is implemented in the CLI. The CLI connection is closed

→ when the «quit» command is issued

→ when the socket is closed on the client side

→ when the FOXMAN-UN core is stopped.

5.1.4 Syntax

CLI for line test supports two commands:

- «getlastresult» retrieves the results of the most recently executed line test of a specific SUBH<X>, SUPC<X>, or SUPM<X> port or the near and far end noise margins of DSL units.
- «execute» triggers an immediate line test on a specific SUBH<X> unit and then retrieves the measurement values for the specified criteria.

The commands have the following format:

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oam linetest asynch <msgId> <type> <command> <criteria> <address>

<msgId>	msgId (message identity) is an integer provided by the client. The server does not interpret it; it simply returns it in its response.
<type>	Two types are available: **pots | dsl**
<command>	Two commands are available: **getlastresult | execute** «execute» is only possible together with the type «pots».
<criteria>	all or a single one of the available criteria can be specified: **all | isolation | foreign_voltage | capacity | noise_ratio** Only the criteria activated in the configuration of the unit can be retrieved. For the type «dsl» the entry in «criteria» has no meaning, but must be specified.
<address>	POTS, FOX51x: An active subunit of a SUBH<X> unit must be specified. **/<NE IP address>/<slot>/<subunit>** POTS, FOX61x: An active port of a SUPMx unit must be specified. **/<NE IP address>/unit-<x>/port-<y>** VoIP, FOX61x: An active Termination ID/subscriber# must be specified: COSI1: **/gwIPAddr-<GW IP address>/subsNo-<subscriber#>** POTS, FOX61x: An active port of a LESU1 unit must be specified. **/<NE IP address>/unit-<x>/port-<y>** VoIP, FOX61x: An active Termination ID/subscriber# must be specified: COSI1: **/gwIPAddr-<GW IP address>/subsNo-<subscriber#>** DSL: An active subunit of a DSL unit must be specified. **/<NE IP address>/<slot>/<subunit>**

Examples for FOX51x units:

```
oam linetest asynch 1 pots getlastresult all /192.168.21.21/8/1
oam linetest asynch 1 pots execute all /192.168.21.21/8/1
oam linetest asynch 1 dsl getlastresult all /192.168.21.21/12/1
```

Examples for FOX61x units:

```
oam linetest asynch 1 pots getlastresult all /192.168.24.31/unit-6/port-1
oam linetest asynch 1 pots execute all /192.168.24.31/ unit-6/port-1
```

The syntax for the immediate answer to a request using correct syntax is as follows:

```
oam linetestResponse asynch <msgId> [<errorcode>] [<optional error text>]
```

If the immediate response does not contain an error indication, it will be followed by a time stamp and the requested line test data.

The command to terminate a CLI session is:

```
quit
```

Below are two sample sessions using the «telnet» command. The socket number is taken from the entry in the nbcli.conf file. Grey background is used to indicate the data transmitted from the TCP client to the server. Responses from the server have no background.

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POTS line test for a FOX51x POTS unit:

```
$ telnet localhost $(${NEM_HOME}/bin/private/getvar nbi_clilinetest_oss_port)
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.
NEM linetest_cli northbound interface

Login: ^Cusername
Password: ^Cpassword
Logged
oam linetest asynch 1 pots getlastresult all /192.168.21.21/8/1
oam linetestResponse asynch 1
timestamp:1163894444
status:Passed
Resistance a-b,Passed,> 800 [kOhm]
Isolation a-GND,Passed,> 200 [kOhm]
Isolation b-GND,Passed,> 200 [kOhm]
Foreign DC Voltage a-b,Passed,0 [V]
Foreign DC Voltage a-GND,Passed,1 [V]
Foreign DC Voltage b-GND,Passed,0 [V]
Foreign AC Voltage a-b,Passed,0 [V]
Foreign AC Voltage a-GND,Passed,0 [V]
Foreign AC Voltage b-GND,Passed,0 [V]
Capacitance a-b,Passed,0.00 [µF]
Capacitance a-GND,Passed,0.03 [µF]
Capacitance b-GND,Passed,0.03 [µF]
Noise,Passed,< -40 [dBm]
ok
```

DSL line test for a FOX51x DSL unit:

```
$ telnet localhost $(${NEM_HOME}/bin/private/getvar nbi_clilinetest_oss_port)
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.
NEM linetest_cli northbound interface

Login: ^Cusername
Password: ^Cpassword
Logged
oam linetest asynch 1 dsl getlastresult all /192.168.21.21/12/1
oam linetestResponse asynch 1
timestamp:1163894721
status:Passed
Noise Margin Near,Passed,14 [dB]
Noise Margin Far,Passed,11 [dB]
ok
```

5.1.5 Errors

5.1.5.1 Syntax errors

A «syntax error» message is sent If the request is badly formatted:

```
oam linetest asynch
syntax error
```

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5.1.5.2 Error codes

The following error codes are used:

1	An HDLC address has been provided, this is not supported.
2	This error code is followed by a text message explaining the type of error.
3	This is a severe error. Please contact the Hitachi Energy customer support.
4	No match found for the IP address provided. Check the address.
5	Several matches found for the IP address provided. Check the address.

5.1.5.3 Examples

Invalid node address:

```
oam linetest asynch 1 pots execute all /192.168.21.255/8/1
oam linetestResponse asynch 1 4
```

Empty slot specified:

```
oam linetest asynch 1 pots execute all /192.168.21.21/35/1
oam linetestResponse asynch 1
oam linetestResponse asynch 1 2 No unit found in specified slot.
```

Unmanageable node:

```
oam linetest asynch 1 pots execute all /192.168.21.21/8/1
oam linetestResponse asynch 1
oam linetestResponse asynch 1 2 Failed to retrieve line test counters: Telnet : No route to host, check the network part of the address
```

Maximum number of sessions reached:

```
$ telnet localhost 2700
Trying 127.0.0.1…
Connected to localhost.
Escape character is ‘^]’.
Max number of connections reached Connection closed by foreign host.
$
```

Specified slot does not contain SUBHx, IPSMG or DSL unit:

```
oam linetestResponse asynch 1 2 Line test not supported or no subunits activated
```

Specified POTS subunit is not active / does not exist:

```
oam linetestResponse asynch 1 2 Failed to retrieve line test counters
```

Specified DSL subunit is not active / does not exist:

```
oam linetestResponse asynch 1 2 Failed to retrieve SNR
```

«dsl» specified for SUBHx unit or «pots» specified for DSL unit:

```
oam linetestResponse asynch 1 2 Invalid type
```

5.2 FOXMAN-UN prerequisites

5.2.1 License

The POTS line test interface is a license key controlled option. The command `lslicense` returns a list of the activated options.

The following line shows whether the POTS line test interface is licensed:

```
CLI northbound interfaces     : yes
```

This key is shared with the other northbound interfaces.

If the subscriber line test interface is not licensed, an attempt to connect to the socket results in an error message, e.g. for a telnet session:

```
[nemadmin@nemsrv ~]$ telnet nemsrv 2700
Trying 172.31.33.231…
telnet: connect to address 172.31.33.231: Connection refused
telnet: Unable to connect to remote host: Connection refused
[nemadmin@nemsrv ~]$
```

5.2.2 Authentication

The authentication process is based on the Login/Password CLI prompt. The authentication is successful if the Login/Password is valid according to the system authentication (PAM) and the user is registered as a valid user in the FOXMAN-UN, i.e. added via the FOXMAN-UN configuration application.

5.2.3 Character set

The FOXMAN-UN POTS line test interface expects the character set ISO 8859-1 from the OSS side.

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6 Bibliography / referenced documents

6.1 Product manuals

Ref.	Document
[1KHW002414]	FOXMAN-UN under Linux - User Manual
[1KHW002412]	FOXMAN-UN Help - User Manual
[1KHW002416]	FOXMAN-UN Networking Package - User Manual
[1KHW002426]	FOXMAN-UN Installation - User Manual
[1KHW002499]	FOXMAN-UN Release Note
[1KHW029018]	FOXMAN-UN SNMP Southbound Interface - Application Note
[1KHW029012]	FOXMAN-UN in Firewalled Environment - Application Note
[1KHW029097]	FOXMAN-UN Main/Standby Solution - User Manual
[1KHW029203]	FOXMAN-UN HLM SNMPv3 Integration - Application Note

6.2 Document History

Table 1: Document History

Document ID	FOXMAN-UN Release	Rev	Date	Changes since previous version
1KHW002427	R16A	A	2022-09-09	Version published for R16A. Minor editorial changes only.
1KHW002427	R16A	B	2022-12-08	Updated version for R16A; - Added reference to application note [1KHW029203] in section 1.6 Security (on page 7). - Added document history.
1KHW002427	R16B	A	2023-02-27	Updated version for R16B. Minor editorial changes only.
1KHW002427	R17A	A	2024-09-11	Updated version for R17A. Replaced MIB contents in section 1.8.2 with added NE alarm status declarations.
1KHW002427	R18	A	June 2025	Updated version for R18. Example added at the end of section 1.9 related to alarm traps.

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Hitachi Energy Ltd
Bruggerstrasse 72
5400 Baden - Switzerland

Phone: please refer to https://www.hitachienergy.com/contact-us/Customer-Connect-Center
(Customer Connect Center)
Email: communication.networks@hitachienergy.com

www.hitachienergy.com/communication-networks

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