**PRIME Gateway**

Teldat-Dm 823-I

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# Table of Contents

# I  Related Documents

Teldat-Dm 704-I Configuration and Monitoring

Teldat-Dm 772-I Common Configuration Interfaces

# Chapter 1  Introduction

## 1.1  PLC PRIME

In the past few years, some European governments have been passing legislation that forces electrical utilities to provide customers with readings of their electrical consumption.

This new legislation requires that all domestic electricity meters can be remotely managed and include a real-time reading system.These new electricity meters, which will need to be permanently connected to centralized control centers (SCADA), are called smart meters and are now part of the so-called smart grid.

Power Line Communication (PLC) technology is gaining widespread acceptance as one of the preferred technologies for the implementation of smart grids. PLC uses the electricity transmission lines themselves to deploy the telecommunications functionalities. Since the grid itself provides the physical communication channel needed to implement the smart grid concept, there is no need to invest in additional infrastructure.

The PRIME (PowerRline Intelligent Metering Evolution) standard emerged in response to the new Spanish legislation ruling. The aim of PRIME was to create an open, non-proprietary public standard. The PRIME Alliance was created to provide a discussion forum aimed at defining the standard. It brings together the different key players in the electricity distribution industry: distribution companies, meter manufacturers, semiconductor companies, telecommunications companies and research institutions.
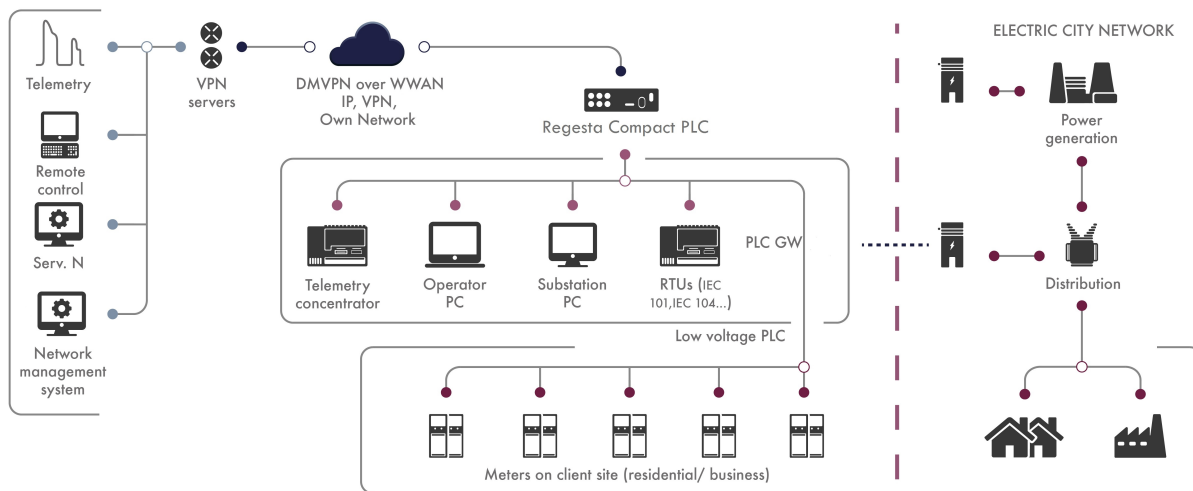


PRIME is based on PLC technology for low voltage electrical networks. It is a PLC system for narrowband data transmission, based on Orthogonal Frequency Division Multiplexing (OFDM). Its main features are:

• Operates on CENELEC A-B-C, FCC and ARIB bands

• OFDM-based technology.

• Several types of digital coding: DBPSK, DQPSK,D8PSK


PRIME defines several layers at the communications layer:
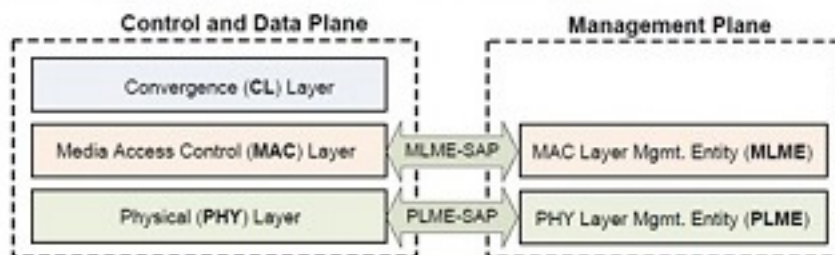


**Convergence layer (CL)**

This layer classifies traffic by associating it with its MAC connection address. This layer performs the mapping of any kind of data traffic and may include header suppression functions. The convergence layer is divided into two sublayers:

• **Common Part Convergence Sublayer (CPCS)**. This provides a set of generic services: Segmentation and Reassembly.

• **Service Specific Convergence Sublayer (SSCS).** This defines the type of communication between the different

subnet nodes. It is responsible for delivering the data exchanged between nodes to the management application layer of the smart grid.

PRIME specifies 4 kinds of SSCS:

- NULL
- IEC-61334-4-32
- IPv4
- IPv6

The PRIME MAC layer provides core MAC functionalities such as:

- Channel access
- Bandwidth allocation
- Connection establishment/maintenance.
- Topology resolution.

This layer provides two interfaces: an interface to the CL named MAC SAP (Service Access Point) and an interface to the Management Plane called MLME (MAC Layer Management Entity) SAP. The first one is mainly used for data transmissions over a PRIME network, while the second is used to externally modify the configuration and the behavior of this layer.

Each node has a universal MAC address - 48 bits (the EUI-48; IEEE Std 802-2001). Each manufacturer assigns this address during the manufacturing process. Said address is used to universally identify a node during network registration. Each subnetwork only has one Base Node, so the EUI-48 of the Base Node identifies its subnetwork uniquely. This EUI-48 is called the Subnetwork Address (SNA).

A Base Node is primarily responsible for setting up and maintaining a subnetwork. In order to execute its task, the Base Node performs the following:

- Beacon transmission at fixed intervals of time
- Promotion and demotion of terminals and switches
- Device registration management
- Connection setup and management
- Channel access arbitration
- Distribution of random sequences to obtain encryption keys
- Multicast group management

Implements the transmission and reception physical layer between neighboring nodes using OFDM technology. It adapts data connection speeds based on the signal.

The PRIME PHY layer is designed to transmit and receive over power lines originally intended for power distribution at 50-60 Hz AC.

Using this medium for communications at higher frequencies poses some technically challenging problems:

- Distribution networks are usually made up of a random variety of conductor types, which translates into loads of different impedances. Such a network has an amplitude and phase response that varies widely with frequency. Furthermore, the channel characteristics can also vary with time as the loads on the network change.
- Interference also affects power lines. Electric appliances with different kind of motors, as well as switching power supplies and halogen lamps, create impulse noises that reduce the reliability of communication signals. The noise is also location-dependent due to attenuation.

Thanks to its combination of approaches, the PRIME PHY layer allows for robust high speed and low cost communications over power lines. This simple yet powerful scheme is based on adaptively modulated Orthogonal Frequency Division Multiplexing (OFDM), along with forward error correction and data interleaving.

The frequency band used depends on local regulations, which ranges from 3 kHz to 500 kHz. Its application is subject to the local regulations in force, e.g., EN 50065 1:2001+A1:2010 in Europe or FCC part 15 in the US.

| Region | Regulator | Freq. Band | Comments |
|--------|-----------|------------|----------|
| Europe | CENELEC | 3-95 KHz<br>95--125 KHz<br>125-140 KHz<br>140-148,5 KHz | A- Energy Providers<br>B- Open for users<br>C- Open for users; regulated CSMA access<br>D- Open for users |
| USA | FCC | 10-490 KHz | |
| Japan | ARIB | 10-145 KHz | |
| China | EPRI | 3-95 KHz<br>3-500 KHz | Not Regulated |

PRIME 1.3 release can operate in the CENELEC-A band only.

Differential modulations are used, with one of three possible constellations: DBPSK, DQPSK or D8PSK. An additive scrambler is used to prevent long sequences of identical bits from arising. Finally, ½ rate convolutional coding and repetition code will be used along with bit interleaving.

The topology generated by a PRIME communications network has a tree structure. There are two kinds of nodes defined by PRIME to develop this structure type:

- BASE NODE
- SERVICE NODE

Communication between the Base node and the Service nodes is carried out in accordance with a master/slave model.

The PRIME Alliance has defined two release of the standard PRIME:

- PRIME 1.3
- PRIME 1.4

The PRIME 1.4 release include some improvements which allow to increase network performance and reliability. Both releases are not compatible, this means that all elements in a PRIME network must have the same PRIME release.

## 1.2  PRIME Base Node

The Base Node (also known as hub or PRIME data hub) represents the center or root of the system, with all communications originating there. Base nodes are usually connected to secondary substations (electrical infrastructures where the voltage is stepped down to lower values). Base nodes are responsible for controlling all dependent subnets, including all the service nodes.

The PRIME Gateway can operate as a Base Node and a Service Node. The most common mode of operation is Base Node.

## 1.3  PRIME Service Node

Each node in a PRIME subnet is called a Service Node. Among other functionalities, service nodes are responsible for implementing the smart meters. In order to cover greater distances and improve performance in the PRIME subnet, service nodes can have two states in the PRIME subnet environment:

- **TERMINAL**: A service node is in TERMINAL state when it is the last device in the PRIME subnet tree structure (that is, no other service node depends on it to gain access to the Base Node).
- **SWITCH**: In certain circumstances, service nodes can be promoted to SWITCH state. When a service node is promoted to SWITCH state, it relays data exchanged between the Base Node and a Service Node connected to the subnet. The service node changes its state in real time, depending on the network conditions (attenuation, noise, etc.). This change in state is dynamic, so it can change back and forth over time.
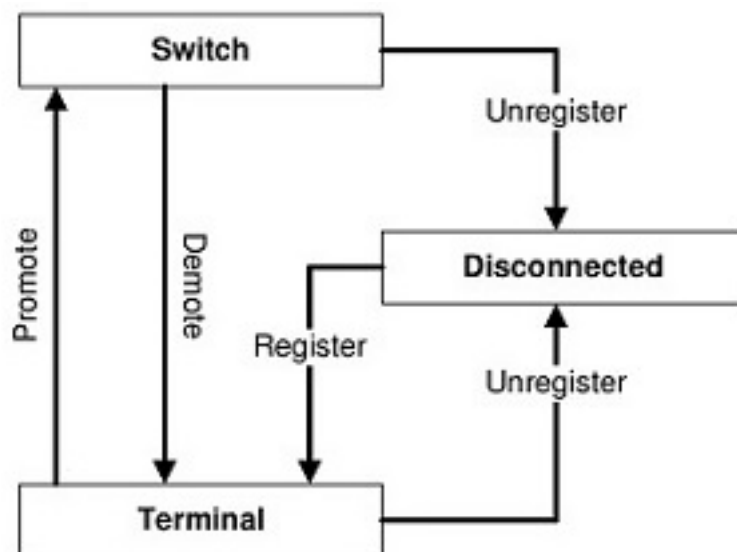
The PRIME Gateway acts as Service Node only to provide IP connection between a Base Node and a PRIME sub-network. That is, the Service Node operates always in SWITCH mode and transfers all PLC PRIME traffic from the local subnet to the Base Node. This functionality mode is known as PHY layer extension or TICKET-65 on PRIME Alliance.

> **Note**
>
> PRIME Gateway as Service Node is not available in all PRIME devices. Please contact our Technical Service for more information on the devices that support this feature.

## 1.4  PRIME topology

PRIME uses the grid to create and maintain the subnet topology. It allows the smart grid to be monitored in real time. A PRIME subnet is mainly used to access the smart meters.

A PRIME subnetwork is a tree with the two types of nodes: a Base Node and several Service Nodes.
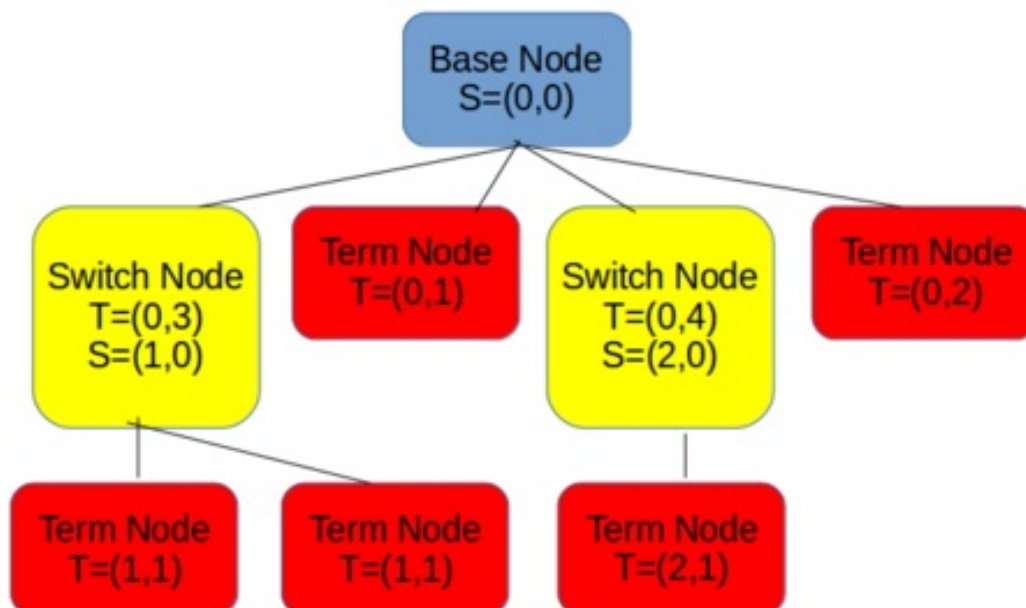


The PRIME Gateway offers a variety of tools that help monitor the subnetwork topology in real time, as well as store changes using events. This information can be accessed through CLI, SNMP or FTP sessions.

## 1.5  DLMS-COSEM over TCP

PRIME has adopted the IEC 62056 suite (DLMS-COSEM) as the preferred choice of application layer for smart grid deployments.

DLMS is a suite of open standards developed and maintained by the DLMS User Association. COSEM is part of the

DLMS protocol stack. DLMS primarily covers two protocols (the Application protocol and the Transport protocol) that define the standard method to model and transfer metered data and other classified functions of the energy meter. These protocols are officially endorsed and registered by the International Electrotechnical Commission (IEC) under IEC 62056.
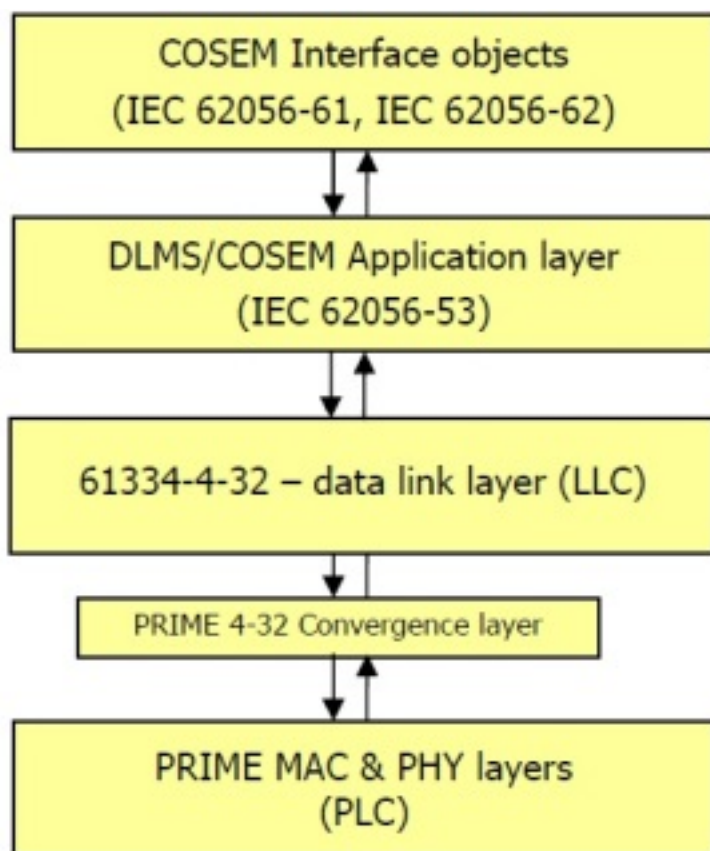


The PRIME Gateway allows the Data Concentrator Unit for Smart Meters to communicate with the meters connected to the PRIME subnetwork on the Base Node. The PRIME Gateway provides transparent access to meters (Service Nodes) through the PRIME Convergence Link Layer (LLC) with IEC-61334-4-32 connections. Connection between the application and the PRIME Gateway is obtained through a TCP/IP session.
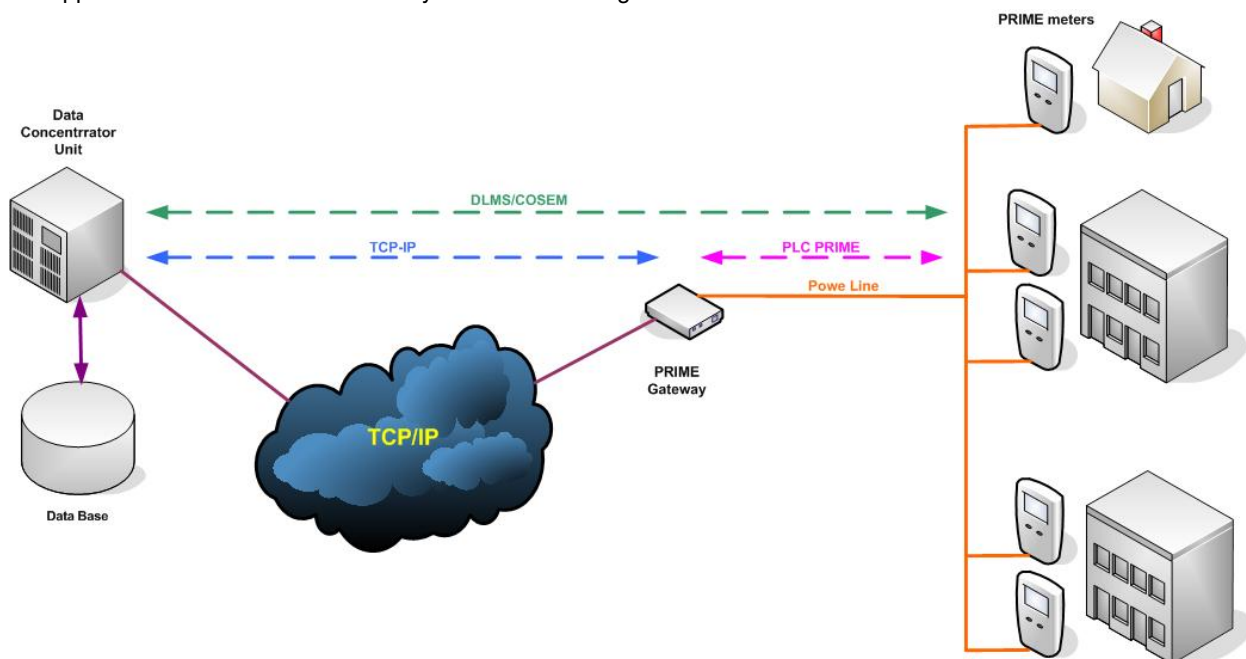


PRIME define DLMS-COSEM over TCP as Ticket#67.

## 1.6  Firmware Upgrade Protocol

When in Base Node mode, the PRIME Gateway can upgrade the firmware of all service nodes connected to the PRIME network. To make this task easier, the Base Node implements the Firmware Upgrade Protocol.

The purpose of the Firmware Upgrade Protocol is to manage firmware upgrade operations in PRIME Base Nodes from any external application, such as Data Concentrators or Network Management Systems. The connection between the Management System and the Base Node is done through a TCP/IP session.

The protocol used to exchange the messages between the Base Node and the Management System is a custom simple binary protocol. When the application wants to start a Firmware Upgrade process, it establishes a TCP/IP connection with the FUP port configured in the Base Node. This connection remains open until the process is completed.
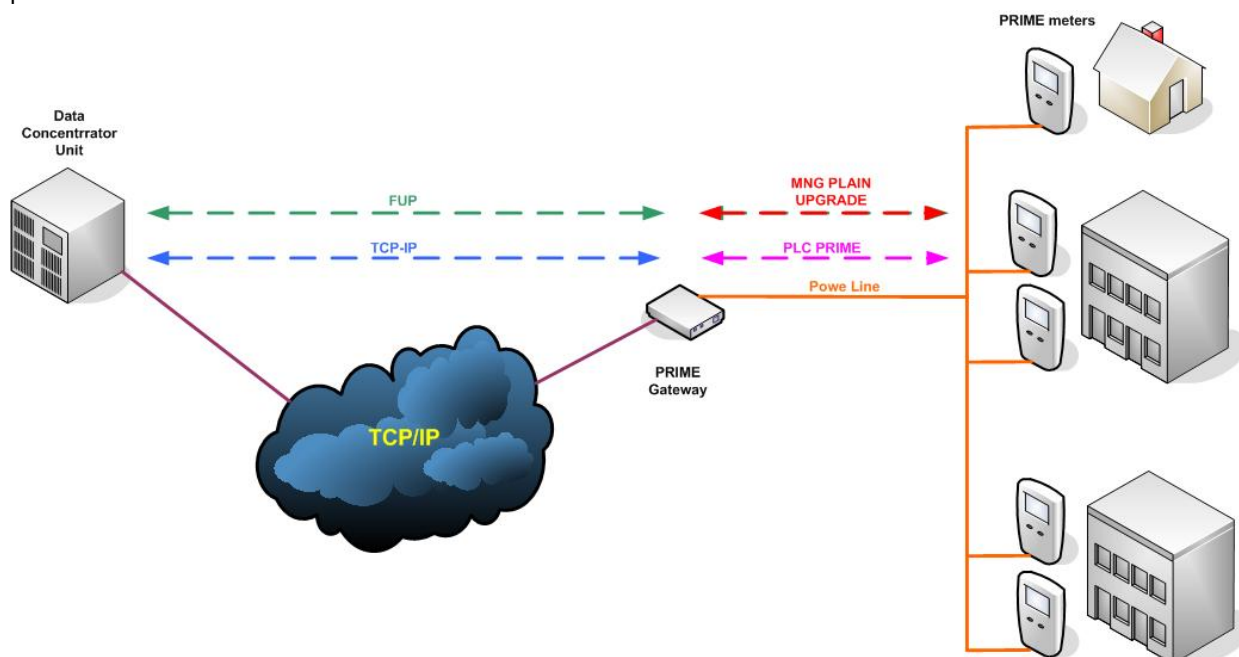


The Firmware Upgrade Protocol defines a set of messages that enable the configuration and firmware updating of Service Nodes.

The Service Nodes to upgrade are selected based on a list which includes the PRIME MAC address of selected Nodes. This list is sent to the Base Node in a FUP command.

The most important features of the Firmware Upgrade mechanism are the following

• Ability to work in unicast and multicast.
• May change the size of data packets depending on channel conditions.
• Ability to request basic information from the Service Nodes at any time (such as device model, firmware version, etc.).
• Can be canceled at any time.
• Can check the integrity of the downloaded FW once reception is complete.
• The new firmware is executed in the Service Nodes only when commanded to do so.
• Ability to reject the new firmware after a "test" period and switch to the former version.

In environments where a Firmware Upgrade Protocol application is not available, the PRIME Gateway implements a way to initiate and cancel a limited FUP process.

The FUP command in the monitoring menu helps trigger a local FUP process. See *FUP* on page 30 under the monitoring menu.

For more information on FUP implementation, please contact our support department.


## 1.7  PHY Layer Extension feature

The PHY Layer Extension is a feature designed to increase the number of Service Nodes that a Base Node can control in a Multi-transformer Secondary Substation scenario.

Generally speaking, in secondary substations with multiple transformers (and where low voltage lines are independent of each other), there is not enough power transfer of PRIME PLC signal between low voltage busbars. Service Nodes that are electrically connected to a different transformer to the one the Base Node is connected to are not able to communicate properly. For them to behave well in a PRIME network, a Base Node will need to be installed for each transformer.

Thanks to the PHY layer extension feature, installing several Base Nodes in a substation with multiple transformers

is not necessary.

For it to work, a repeater must be installed in each of the additional busbars found on the secondary transformers. The repeater reproduces Base Node messages addressed to any Service Node connected to the secondary bus-bars. This repeater can be found in a special Service Node known as an Auxiliary Node.

From the point of view of the PRIME PLC network, the Auxiliary Node always behaves as a PRIME SWITCH. It always registers in the Base Node as a SWITCH. The PHY layer communication between the Base Node and the Auxiliary Node is carried out through UDP/IP datagrams.

The following image depicts a scenario where a Base Node is able to manage the Service Nodes connected to two different transformers in a substation.
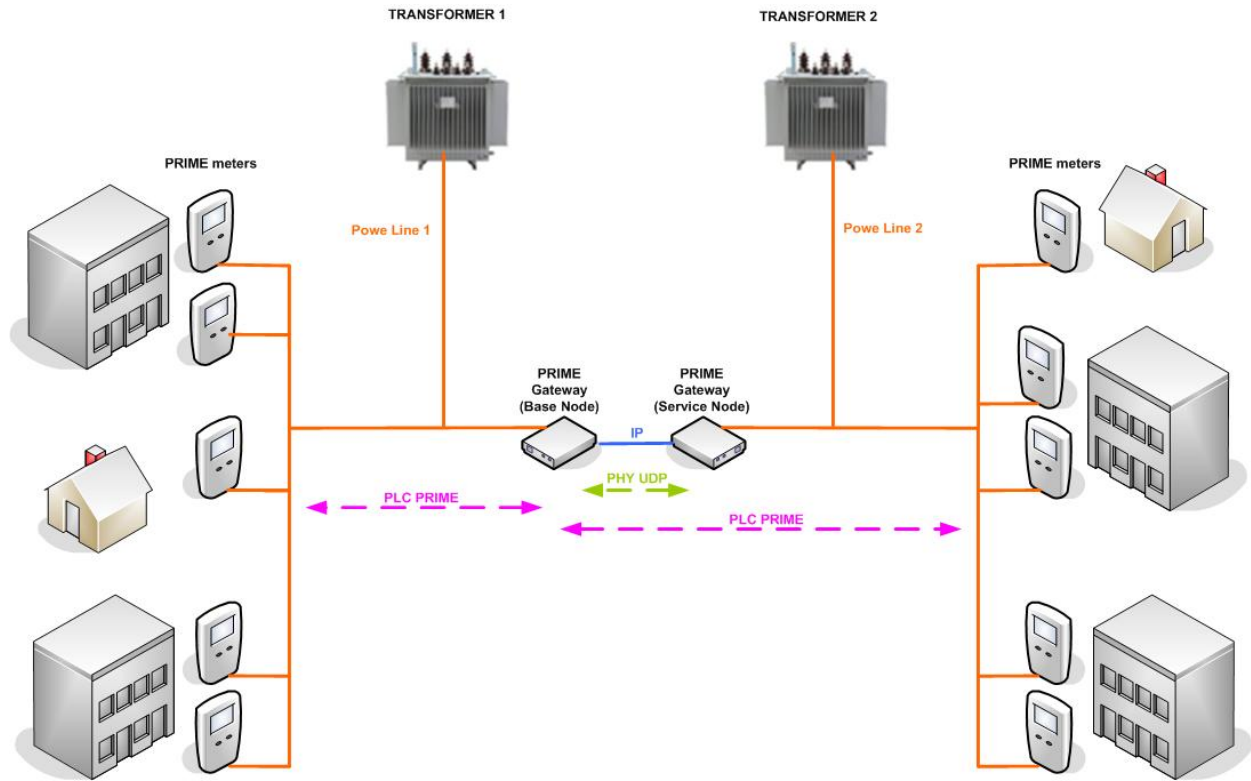


The PRIME Gateway, in Base Node mode, may connect to several Service Nodes that work as Auxiliary Nodes.

The PRIME Gateway, in Service Node mode, is able to work as an Auxiliary Node.

The PHY layer extension for the Multi-transformer Secondary Substation feature is also known as Ticket#65.

> ☞ **Note**
>
> The PHY Layer Extension feature is not available in all PRIME devices. Please contact our Technical Service for more information on the devices that support this feature.

## 1.8  PRIME Sniffer

From the PRIME Node, the PRIME Gateway can monitor the PRIME packets in the PLC network transfered between connected nodes.

The Sniffer protocol has been developed to monitor data traffic on power line networks. This tool focuses on the PRIME (versions 1.3 and 1.4) protocol. The PRIME Gateway snoops the power line to catch the PRIME packets at the PHY layer. The PRIME Gateway will send the packet sent over the network through a TCP/IP connection. The sniffer tool can be used to:

• Analyze network problems
• Gather network statistics and report on them
• Monitor network usage
• Debug network protocols
• Improve network understanding

Sniffer frames contain the received PDU and some extra information related to the PHY layer, which is included in

the header part:

- Sniffer frame version: 2 bytes
- Sniffer type version
- Modulation scheme of the received frame
- Length of the PDU in PHY symbols
- PRIME-defined measurement of the SNR
- Channel in which the frame has been received
- TimeStart/TimeEnd: high precision internal counter to measure the length (time) of the PDUs in hundredths of microseconds
- RSSI in dBuV
- CRC flag to indicate if the PLC frame has a valid CRC.
- Length of the PDU in bytes

The Sniffer data can be sent to a Sniffer application or a TCP server controlled by SNMP commands.

The information gathered from the PRIME Sniffer Protocol by the PRIME Gateway can be sent through a TCP session to a Sniffer application. The Sniffer application must open the TCP session to the Gateway.

The Gateway supports several SNMP commands allowing TCP transfer of Sniffer data. For SNMP Sniffer control, the Gatway opens a TCP session in a TCP sever configured by SNMP.

The format of sniffer data varies depending on the transfer method. For Sniffer applications, the data format is the one used with the Microchip PLC Sniffer tool. For SNMP commands, the data format is the one described in *Sniffer format for SNMP managed TCP sessions* on page 63.

## 1.9  SNMP management

PRIME gateway devices support the SNMP management protocol. To fully manage the PRIME network, the PRIME Gateway includes a SNMP MIB for the PRIME interface.

The PRIME MIB may be loaded from teldat-mon-interf-prime-mib.mib

This MIB may provide the following information about the PRIME network:

- Network uptime.
- Statistics about the number of terminals, number of switches, switching levels, nodes per levels, a list of active connections and their type.
- Periodic statistical information. Integrated values for a period defined by three superframes duration (approx. 1 minute). Periodic information for 60 periods and the global accumulated value for:
  - Number of topology changes: Promotion, demotions, registrations and deregistrations.
  - Coverage: ALIVE messages successful, Total ALIVE messages.
  - Availability.
- Instantaneous "image" of the subnetwork topology. Table including all Service Nodes connected to the network and some relevant parameters.
- PLC channel occupation. Integrated values for a period defined by three superframes (approx. 1 minute). Periodic information for 60 periods and the global accumulated value for:
  - PHY level: CFP, SCP and ERROR packets.
  - MAC level: Beacons, Control and Data packets.

Several commands stemming from the SNMP protocol can make the Gateway start a TCP session in order to transfer specific information. When enabled, the PRIME Gateway sends selected information to a SNMP-configured TCP server. The following session types can be handled through SNMP commands:

- Topology events in real time.
- PRIME PHY layer sniffer. It sends information about the PLC messages exchanged between Nodes, as well as the PLC PHY PDU.

*Sniffer format for SNMP managed TCP sessions* on page 63 describes what the data format is for this kind of transfers.

# Chapter 2  Configuration

## 2.1  Getting the PRIME Interface

The PRIME Interface is the configuration menu where all configuration options for the PRIME Gateway can be set.

To access the PRIME interface configuration menu, first access the general configuration menu. From there, access the PRIME interface.

```
Config>list devices

Interface          Connector      Type of interface
ethernet0/0        EXP/SWITCH     SOFTETH Switch Ethernet
prime0/0           PLC-PW         PRIME interface
cellular1/0        SLOT1          AT SOFTUSB COM
cellular1/1        SLOT1          SOFTNIC Interface
direct-ip1         ---            Generic DirectIP encapsulation
Config>
```

In this example, the PRIME interface appears as prime0/0.

PRIME configuration commands must be entered in the configuration menu associated with the PRIME interface (*PRIME-primeX/Y Config>*). To access this menu, enter the **NETWORK primeX/Y** command from the general configuration menu (*Config>*).

```
Config>network prime0/0

-- PRIME Interface Configuration --
PRIME-prime0/0 Config>
```

> **Note**
>
> The PRIME interface is only available in some devices and a license could be necessary to enable it.
> Please contact our Technical Service for more information on the devices that support this feature.

## 2.2  Configuration Commands for the PRIME Gateway

PRIME configuration commands must be entered in the configuration menu associated with the PRIME interface (*PRIME-primeX/Y Config>*). To access this menu, enter the **NETWORK primeX/Y** command from the general configuration menu (*Config>*).

```
Config>network prime0/0

-- PRIME Interface Configuration --
PRIME-prime0/0 Config>
```

Once you have accessed the PRIME configuration menu, you can use the commands below:

```
PRIME-prime0/0 Config>?
  bandwidth            Intended bandwidth, in kilobits per second (kbps)
  bn-channel           BN Frequency channel operation
  description          Enter interface description
  fup-port             Configure TCP local port for Firmware Upgrade
                       Prot.(FUP)
  iflinkup-down-traps  Enable ifLinkUp and ifLinkDown traps
  input-low            Set low water mark for input buffers
  list                 List configuration
  local-ip             Configure local IP address
  local-port           Configure TCP local port(remote)
  no                   Negate a command or set its defaults
  node-mode            Configure the type of operational PRIME node (BASE or
                       SERVICE)
  output-fair          Set fair share value for output buffers
  phy-layer-extension  Configure parameters for PHY layer extension over UDP
  plc-signal           Enable/disable PLC signal
```

```
prime-release        Configure the PRIME standard release
shutdown             Change state to administratively down
sniffer              Configure Sniffer parameters
topology             Configure parameters to manage topology files
trace-level          Configure debugging trace level bit mask
update               Update a level indicator
vrf                  Configure link to VRF
exit
PRIME-prime0/0 Config>
```

| Command | Function |
|---|---|
| BANDWIDTH | This is a global command. For more information, please refer to "Dm 772-I Common Configuration Interfaces". |
| BN-CHANNEL | Specifies the frequency channel used by BN to establish the PLC PRIME network. |
| DESCRIPTION | This is a global command. For more information, please refer to "Dm 772-I Common Configuration Interfaces". |
| FUP-PORT | Specifies the local TCP port to establish "listen", used for the incoming connections from Firmware Upgrade application to perform FUP (Firmware Upgrade Protocol) over Service Nodes. |
| INPUT-LOW | This is a global command. For more information, please refer to "Dm 772-I Common Configuration Interfaces". |
| LIST | Shows a list of main configuration parameters. |
| LOCAL-IP | Specifies the local IP address for all TCP/UDP data connections related to the PRIME Gateway. |
| LOCAL-PORT | Specifies the local TCP port to establish "listen", used for the incoming connections from Data Concentrator. |
| NO | Clears a configuration parameter or sets its default value. |
| NODE-MODE | Specifies the type of operational PRIME node in the device. The device can operate as a BASE or SERVICE Node. |
| OUTPUT-FAIR | This is a global command. For more information, please refer to "Dm 772-I Common Configuration Interfaces". |
| PHY-LAYER-EXTENSION | Sets the configuration parameters related to the "PHY layer extension over UDP" feature, known as Ticket#65. This feature helps deploy the PRIME network through an IP connection. |
| PLC-SIGNAL | Allows the PLC signal to transmit, from an internal PRIME Base Node, over the power line. This command also enables/disables the Base Node functionality. |
| PRIME-RELEASE | Specifies the PRIME technology used by BN to establish the PLC PRIME network. PRIME 1.3 or PRIME 1.4 can be selected. |
| SHUTDOWN | This is a global command. For more information, please refer to "Dm 772-I Common Configuration Interfaces". |
| SNIFFER | Sets the configuration parameters related to the Sniffer feature. This feature allows for the monitoring of PLC data activity at the physical layer level. |
| TOPOLOGY | Sets the configuration parameters to monitor topological changes. This feature allows files that include topological changes to be created in the PLC network. |
| TRACE-LEVEL | Allows several types of traces related to PRIME interface processes to be enabled. |
| UPDATE | This is a global command. For more information, please refer to "Dm 772-I Common Configuration Interfaces". |
| VRF | Establishes a link to a configured VRF. |
| EXIT | Exits the PRIME configuration menu. |

## 2.2.1  BN-CHANNEL

This parameter configures the frequency channel used by the BN to build the PRIME network. All SNs connected to the network must be able to detect or configure the frequency selected. This functionally only affects PRIME 1.4 operation. The frequency used for each channel is defined under PRIME 1.4 specifications.

It accepts values ranging from 1 to 8. The default value is 1.

*Syntax:*

```
PRIME-primeX/Y Config>bn-channel ?
```

```
 <1..8>    Channel number
```

*Example:*

```
PRIME-prime0/0 Config>bn-channel 5
PRIME-prime0/0 Config>
```

> **Note**
>
> - This command is not necessary when in Service Node mode.
>
> - This command is not necessary when the PRIME 1.3 release is configured. In such cases, the command is ignored and channel 1 is used.
>
> - BN channel selection is not available in all PRIME devices. Some devices only support channel 1. Please contact our Technical Service for more information on the devices that support this feature.

**Command history:**

| Release | Modification |
|---|---|
| 11.01.08 | The "bn-channel" command was introduced as of version 11.01.08. |

## 2.2.2  FUP-PORT

This parameter configures the local listening TCP port for incoming TCP sessions from a Firmware Upgrade Protocol (FUP) remote application. This port provides the input path needed to access the FUP on the PRIME Gateway. FUP performs firmware updates on Service Nodes connected to the PRIME network that can be accessed by the Gateway. FUP is designed to carry out easier and faster firmware updates of Service Nodes.

It accepts values ranging from 1 to 65535. Default is 502.

*Syntax:*

```
PRIME-primeX/Y Config>fup-port ?
 <0..65535>    Enter local TCP port value for FUP
```

*Example:*

```
PRIME-prime0/0 Config>fup-port 3452
PRIME-prime0/0 Config>
```

> **Note**
>
> - There is no need for this command when Service Node mode is configured.

**Command history:**

| Release | Modification |
|---|---|
| 11.00.06, 11.01.02 | New command added. |

## 2.2.3  LIST

Lists the current values of the main configuration parameters.

*Syntax:*

```
PRIME-primeX/Y Config>list
```

*Example:*

```
PRIME-prime0/0 Config>list
PRIME node type        : BASE-NODE
PRIME standard release  : 1.3
PLC signal             : Enabled
Frequency channel      : 1
Local IP address       : 0.0.0.0
Local TCP port         : 502
VRF tag                : <main>
```

```
FUP TCP local port      : 21400

Topology Parameters:
 File management         : Enabled
 FTP server ip address   : 192.168.212.33
 FTP server port         : 21
 File send time          : 60 seconds
 File max lines          : 100
 File FTP remote path     : prime
 File name prefix        : topology
 FTP connection user     : admin
 FTP connection password : hdsudx

PHY layer extension over UDP parameters:
 PHY layer extension     : Enabled
 UDP local port          : 4567
 Remote slaves SN info:
  SN ID name     : REMOTE
   UDP port      : 40038
   IP address    : 192.168.213.165

Sniffer Parameters:
 Sniffer control         : Enabled
 Local port              : 24300
 Max. connection time    : 0

Debug trace level: 0x1080

PRIME-prime0/0 Config>
```

This command shows values for the following parameters:

- MODE-NODE

- PRIME-RELEASE

- PLC-SIGNAL

- BN-CHANNEL

- LOCAL-IP

- LOCAL-PORT

- VRF

- FUP-PORT

- TOPOLOGY MONITORING PARAMETERS

- PHY-LAYER-EXTENSION PARAMETERS

- SNIFFER PARAMETERS

- TRACE-LEVEL

**Command history:**

| Release | Modification |
| --- | --- |
| 11.00.06, 11.01.02 | New command added. |
| 11.01.08 | The "update" option has been added as of version 11.01.08. |

### 2.2.4  LOCAL-IP

This parameter helps configure the local IP address. For incoming TCP sessions, the destination IP sent by the originator of the TCP session is compared to the local IP address. The session is rejected if the addresses don't match. For outgoing TCP sessions, this value is sent as a local IP address when establishing the TCP session.

This applies to all TCP connections linked to the PRIME Gateway. That is, the DLMS/COSEM Data Concentrator and Sniffer.

A value of 0.0.0.0 indicates that this parameter is not used. The router automatically assigns the IP address used for outgoing sessions.

The default value is: 0.0.0.0.

*Syntax:*

```
PRIME-primeX/Y Config>local-ip ?
  <a.b.c.d>    Ipv4 format
```

*Examples:*

```
PRIME-prime0/0 Config>local-ip 192.168.1.123
PRIME-prime0/0 Config>
```

> **Note**
> • The local IP Address must be one of the addresses configured on the router for any addressable interface (i.e., Ethernet, PPP, loopback, etc.).

**Command history:**

| Release | Modification |
|---|---|
| 11.00.06, 11.01.02 | New command added. |

### 2.2.5  LOCAL-PORT

This parameter configures the local listening TCP port for incoming TCP sessions from the DLMS-COSEM Data Concentrator (DC). The DC must establish TCP sessions with the port configured for this parameter. The latter accepts values ranging from 1 to 65535. Default is 502.

*Syntax:*

```
PRIME-prime0/0 Config>local-port ?
  <0..65535>    Enter local TCP port value
```

> **Note**
> • When configuring the local TCP port, make sure you do not configure the same TCP port in two different functionalities.

*Examples:*

```
PRIME-prime0/0 Config>local-port 502
PRIME-prime0/0 Config>
```

**Command history:**

| Release | Modification |
|---|---|
| 11.00.06, 11.01.02 | New command added. |

### 2.2.6  NO

This command clears a configuration parameter or sets its default value.

*Syntax:*

```
GPS-Apps Config>no <command>
```

*Example:*

```
PRIME-prime0/0 Config>no ?
  bandwidth            Intended bandwidth, in kilobits per second (kbps)
  description          Enter interface description
  iflinkup-down-traps  Enable ifLinkUp and ifLinkDown traps
  input-low            Set low water mark for input buffers
```

```
  output-fair        Set fair share value for output buffers
  shutdown           Change state to administratively down
  update             Update a level indicator
  vrf                Configure link to VRF
PRIME-prime0/0 Config> no vrf
```

**Command history:**

| Release | Modification |
|---|---|
| 11.00.06, 11.01.02 | New command added. |
| 11.01.08 | The "update" option has been added as of version 11.01.08. |

### 2.2.7  NODE-MODE

This command helps set the role for the PRIME Gateway on the PRIME network. The two possible roles are Base Node and Service Node.

The most commonly used mode for the PRIME Gateway on a PRIME network is Base Node mode. It provides access to all Service Nodes connected to the network.

Service Node mode is intended to be used as a PLC PRIME switch on the PHY layer extension feature (Ticket#65). This mode provides access to all Service Nodes connected to a power line, but links the PRIME PHY layer to a Base Node through an IP/UDP connection.

The default mode is Base Node.

*Syntax:*

```
PRIME-primeX/Y Config>node-mode ?
  base-node       Set PRIME BN mode
  service-node    Set PRIME SN mode
```

*Example:*

Enable the PRIME Gateway to send PLC signal.

```
PRIME-prime0/0 Config>node-mode base-node
```

> **Note**
> • Enabling some configuration and monitoring commands is not necessary under Service Node mode.
> • Operation under Service Node mode is not available in all PRIME devices. Please contact our Technical Service for more information on the devices that support this feature.

**Command history:**

| Release | Modification |
|---|---|
| 11.00.06, 11.01.02 | New command added. |
| 11.01.08 | Note added for Service Node mode operation. |

### 2.2.8  PHY-LAYER-EXTENSION

The PRIME Gateway includes a feature that makes it possible to deploy the PRIME network through a power line that is not directly connected to the Base Node. This feature is known as PRIME PHY layer extension or Ticket#65.

To do this, you must add a Service Node to the network that supports the PHY layer extension feature.

Communication between the Base Node and the Service Node for the expansion of the PRIME PHY layer is performed through UDP/IP datagrams.

The PRIME Gateway can operate as Base Node or Service Node. Both operation modes support the PRIME PHY layer extension feature.

Immediately after registering on the Base Node, the PRIME Gateway in Service Node mode becomes a SWITCH. The Service Node acts as a repeater for PHY PLC messages sent from the Base Node over the power line where it is connected.

PHY-LAYER-EXTENSION commands help configure the parameters to establish PRIME PHY connectivity between a Base Node and several Service Nodes via an IP connection.

*Syntax:*

```
PRIME-primeX/Y Config>phy-layer-extension ?
  control          Enable/disable PHY layer extension feature
  local-udp-port   Configure local UDP port
  no               Negate a command or set its defaults
  remote-sn        Name for remote SN included in PHY layer extension
```

Data messages for PHY layer extension are exchanged through UDP/IP datagrams.

> **Note**
> * For PHY-LAYER-EXTENSION to operate properly, the communication delays between the BN and the SNs must have low latency (< 1 msec.). We recommend using an Ethernet LAN connection.
> * PHY-LAYER-EXTENSION operation is not available in all PRIME devices. Please contact our Technical Service for more information on the devices that support this feature.

**Command history:**

| Release | Modification |
| --- | --- |
| 11.00.06, 11.01.02 | New command added. |
| 11.01.08 | Notes added. |

### 2.2.8.1  CONTROL

This parameter enables/disables the PRIME PHY layer extension feature. When the disable option is configured, any attempt to establish a TCP session is rejected.

It is disabled by default.

*Syntax:*

```
PRIME-primeX/Y Config>phy-layer-extension control ?
  enable     Enable PHY layer extension feature
  disable    Disable PHY layer extension feature
```

*Example:*

This example shows how to configure the control option:

```
PRIME-prime0/0 Config>phy-layer-extension control enable
PRIME-prime0/0 Config>
```

> **Note**
> * For the "PHY layer extension" to work, *control* must be enabled on the Base Node and the Service Nodes.

**Command history:**

| Release | Modification |
| --- | --- |
| 11.00.06, 11.01.02 | New command added. |

### 2.2.8.2  LOCAL-UDP-PORT

This parameter helps configure the local UDP port to receive any incoming UDP datagrams that contain the PHY layer information. This UDP port is the one the PHY layer extension feature has as UDP listen.

The local UDP port must be configured in the Base Node and Service Nodes that are part of a PHY layer extension.

*Syntax:*

```
PRIME-primeX/Y Config>phy-layer-extension local-udp-port ?
  <0..65535>    Configure local UDP port
```

*Example:*

This example shows how to configure the local UDP port:

```
PRIME-prime0/0 Config>phy-layer-extension local-udp-port 5678
PRIME-prime0/0 Config>
```

> ☞ **Note**
> • When configuring the local UDP port, make sure you do not configure the same port in two different functionalities.

**Command history:**

| Release | Modification |
|---|---|
| 11.00.06, 11.01.02 | New command added. |

### 2.2.8.3  NO

This command clears a configuration parameter or sets its default value.

*Syntax:*

```
PRIME-primeX/Y Config>phy-layer-extension no ?
  remote-sn    Name for remote SN entry
```

*Example:*

This example shows how to remove a remote SN:

```
PRIME-prime0/0 Config>phy-layer-extension no remote-sn REMOTE
PRIME-prime0/0 Config>
```

**Command history:**

| Release | Modification |
|---|---|
| 11.00.06, 11.01.02 | New command added. |

### 2.2.8.4  REMOTE-SN

This command helps create and modify the necessary parameters to send UDP datagrams to the associated nodes. Since it may be necessary to access multiple nodes, this command creates records to configure parameters that grant access to each remote node.

In Base Node mode, when the PHY layer extension feature is enabled, the PRIME Gateway can access several Service Nodes via UDP. The commands listed in this section configure the parameters that are necessary to send data to those Service Nodes via UDP/IP. The Base Node sends all datagrams to the registered Service Nodes.

In Service Node mode, only the associated Base Node may be accessed. The commands listed in this paragraph section configure the parameters needed to send data to the Base Node via UDP/IP. The Service Node sends all datagrams to its associated Base Node only. Its access parameters must be included in the only configurable record for this mode.

To configure the parameters for several Service Nodes, a record must be created for each one. Records are created automatically when the first command is added.

To erase a record for a node, please use the "NO" command.

*Syntax:*

```
PRIME-primeX/Y Config>phy-layer-extension remote-sn ?
  <1..20 chars>    Name for remote SN entry
PRIME-primeX/Y Config>phy-layer-extension remote-sn <rec-name> ?
  remote-udp-port    Configure remote UDP port
  remote-ip-addr     Configure remote IP address
```

*Example:*

```
PRIME-prime0/0 Config>phy-layer-extension remote-sn RECORD remote-udp-port 4354
```

**Command history:**

| Release | Modification |
|---|---|
| 11.00.06, 11.01.02 | New command added. |

### 2.2.8.4.1  REMOTE-UDP-PORT

This parameter configures the remote UDP port in the record. The node will then send the outgoing UDP datagrams that include the PHY layer information to the node's remote UDP port.

*Syntax:*

```
PRIME-primeX/Y Config>phy-layer-extension remote-sn <rec-name> remote-udp-port ?
  <0..65535>    Configure remote UDP port
```

*Example:*

This example shows how to configure the remote UDP port:

```
PRIME-prime0/0 Config>phy-layer-extension remote-sn REMOTE remote-udp-port 43434
PRIME-prime0/0 Config>
```

> **Note**
> • When configuring the local UDP port, make sure you do not configure the same port in two different functionalities.

**Command history:**

| Release | Modification |
|---|---|
| 11.00.06, 11.01.02 | New command added. |

### 2.2.8.4.2  REMOTE-IP-ADDR

This parameter configures the remote IP address that appears in the record. The node will then send the outgoing UDP datagrams that include the PHY layer information to the node's configured IP address.

*Syntax:*

```
PRIME-primeX/Y Config>phy-layer-extension remote-sn <rec-name> remote-ip-addr ?
  <a.b.c.d>    Ipv4 format
```

*Example:*

This example shows how to configure the remote IP address:

```
PRIME-prime0/0 Config>phy-layer-extension remote-sn REMOTE remote-ip-addr 192.168.21.56
PRIME-prime0/0 Config>
```

**Command history:**

| Release | Modification |
|---|---|
| 11.00.06, 11.01.02 | New command added. |

## 2.2.9  PLC-SIGNAL

This command enables/disables the sending of PLC signals from the PRIME Gateway. When this option is "disabled", the PRIME Gateway functionality is completely deactivated. For the PRIME Gateway to work, it is essential that this command is entered in the configuration. The PLC signal is disabled by default.

*Syntax:*

```
PRIME-primeX/Y Config>plc-signal ?
  enable     Enable PLC signal
  disable    Disable PLC signal
```

*Example:*

Enable the PRIME Gateway to send PLC signal.

```
PRIME-prime0/0 Config>plc-signal enable
```

> **Note**
> • While the PLC signal is disabled, the PRIME Gateway functionality will remain in an inoperative state.

**Command history:**

| Release | Modification |
|---|---|
| 11.00.06, 11.01.02 | New command added. |

## 2.2.10  PRIME-RELEASE

This command configures the PRIME release of standard PRIME that is operative in the PLC network. PRIME 1.3 and PRIME 1.4 are configurable. The PRIME GW operates in the configured release automatically, load a FW it is not necessary. PRIME 1.3 and PRIME 1.4 don't allow inter interoperability. The PRIME GW creates a PLC network according to PRIME release, this means all Services Nodes connected to the network must be able to operate under the configured release. The default value for PRIME-RELEASE is 1.3.

*Syntax:*

```
PRIME-primeX/Y Config>prime-release ?
  1.3    Set PRIME 1.3 standard operation
  1.4    Set PRIME 1.4 standard operation
```

*Example:*

This example shows how to configure PRIME 1.4 release.

```
PRIME-prime0/0 Config>prime-release 1.4
```

> **Note**
> • The PRIME-RELEASE command is not available in all PRIME devices. Please contact our Technical Service for more information on the devices that support this feature.
>
> • Devices that don't support the PRIME-RELEASE command can operate under PRIME 1.3 or PRIME 1.4, depending on the firmware installed. These devices, however, cannot automatically change the PRIME release.

**Command history:**

| Release | Modification |
|---|---|
| 11.01.08 | The "prime-release" command was introduced as of version 11.01.08. |

## 2.2.11  SNIFFER

The PRIME Gateway can act as a sniffer of PLC PRIME traffic. The information collected by the PRIME Gateway can be sent through a TCP session to a Sniffer application.

SNIFFER commands help configure the parameter that grants remote access to the Sniffer data. These commands provide the configuration options to allow access by a proprietary application. For more info about proprietary applications, please contact your dealer.

> **Note**
> SNMP-specific commands, which are independent of the *Sniffer* command, can also provide access to Sniffer data.

*Syntax:*

```
PRIME-prime0/0 Config>sniffer ?
  local-tcp-port      Configure local TCP port
```

```
connection-time       Configure TCP session max. connection time
control               Enable/disable Sniffer access
```

The Sniffer application accesses data through incoming TCP sessions.

**Command history:**

| Release | Modification |
|---|---|
| 11.00.06, 11.01.02 | New command added. |

### 2.2.11.1  LOCAL-TCP-PORT

This parameter helps configure the local TCP port for incoming Sniffer TCP sessions. This TCP port is the one the Sniffer feature has as TCP listen.

*Syntax:*

```
PRIME-primeX/Y Config>sniffer local-tcp-port ?
  <0..65535>    Configure local TCP port
```

*Example:*

This example shows how to configure the local TCP port:

```
PRIME-prime0/0 Config>sniffer local-tcp-port 3245
PRIME-prime0/0 Config>
```

> **Note**
> • When configuring the local TCP port, make sure you do not configure the same TCP port in two different functionalities.

**Command history:**

| Release | Modification |
|---|---|
| 11.00.06, 11.01.02 | New command added. |

### 2.2.11.2  CONNECTION-TIME

This parameter configures the maximum time a Sniffer TCP session will be active. When the configured time expires, the Sniffer TCP session will end.

The value configured is in minutes and can range from 0 to 65535. Value 0 disables the connection time functionality. The default value is 0.

*Syntax:*

```
PRIME-primeX/Y Config>sniffer connection-time ?
  <0..65535>    Connection time value in minutes
```

*Example:*

This example shows how to configure the connection time:

```
PRIME-prime0/0 Config>sniffer connection-time 30
PRIME-prime0/0 Config>
```

**Command history:**

| Release | Modification |
|---|---|
| 11.00.06, 11.01.02 | New command added. |

### 2.2.11.3  CONTROL

This parameter enables/disables the Sniffer TCP access feature. When the disable option is configured, any attempt to establish a TCP session is rejected.

It is disabled by default.

*Syntax:*

```
PRIME-prime0/0 Config>sniffer control ?
  enable    Enable sniffer access
  disable   Disable sniffer access
```

*Example:*

This example shows how to configure the control option:

```
PRIME-prime0/0 Config>sniffer control enable
PRIME-prime0/0 Config>
```

> **Note**
>
> • *Control* must be enabled for the Sniffer feature to work.

**Command history:**

| Release | Modification |
|---------|--------------|
| 11.00.06, 11.01.02 | New command added. |

### 2.2.12 TOPOLOGY

The PRIME Gateway can collect, in real time, topological data of the PRIME network associated with the Base Node. This information contains all state change events in the Service Nodes of PLC networks and is stored in files that can be sent to a server via FTP.

The main purpose of the TOPOLOGY feature is to keep the information about the state of all network Service Nodes updated in a management server. Changes in data are updated periodically, based on the time configured. If, between two periods of file saving, the number of stored events reaches the number configured on "file-max-lines parameter", the file will be updated too.

The file name will have the following format:

prefix_yyyymmdd_hhmmss.csv

The meaning of each field is the following:

• prefix: configured file prefix. All files include the same prefix.

• yyyy: year when file sending starts.

• mm: month when file sending starts.

• dd: day when file sending starts.

• hh: hour when file sending starts.

• mm: minute when file sending starts.

• ss: second when file sending starts.

The Gateway will send as many files as needed until the functionality is disabled.

If file sending fails, the Gateway will try again after 10 minutes. It will try 5 times before discarding the file.

When this functionality is enabled, the Gateway generates a special file every 24 hours which contains the Service Nodes currently registered on the Base Node.

While the functionality is enabled, files will not be sent if there are no changes in the PLC network topology .

Topological data can be shown through a monitoring CLI tool. See the monitoring section for more information.

The TOPOLOGY commands configure the parameters to enable, collect and send topological data.

*Syntax:*

```
PRIME-prime0/0 Config>topology ?
  enable             Enable topology files generation and FTP send
  disable            Disable topology files generation and FTP send
  ftp-server-ip      Configure the IP address for the topology FTP server
  ftp-server-port    Configure the TCP port for the topology FTP server
```

```
file-max-lines      Configure the max number of topology changes(lines)
                    included in file
file-time           Configure the time between sending two consecutive
                    files
file-path           Configure remote FTP server path to put topology file
file-prefix         Configure prefix for the topology files name
ftp-cnx-user        Configure username for FTP connection
ftp-cnx-password    Configure password for FTP connection
no                  Negate a command or set its defaults
```

The format of the topological data file is defined in ANNEX B.

**Command history:**

| Release | Modification |
|---------|--------------|
| 11.00.06, 11.01.02 | New command added. |

### 2.2.12.1  ENABLE

This parameter enables the topology functionality. This means that, if there are Service Nodes registered on the PLC network, the sending of files starts and CLI topology monitoring is updated.

When this functionality is enabled, the Gateway generates a special file every 24 hours which contains the Service Nodes currently registered on the Base Node.

It is disabled by default.

*Syntax:*

```
PRIME-prime0/0 Config>topology enable ?
  <cr>
```

*Example:*

This example shows how to enable the "Topology" functionality:

```
PRIME-prime0/0 Config>topology enable
PRIME-prime0/0 Config>
```

**Command history:**

| Release | Modification |
|---------|--------------|
| 11.00.06, 11.01.02 | New command added. |

### 2.2.12.2  DISABLE

This parameter disables the topology functionality. This means that the sending of files ends and CLI topology monitoring is not updated.

When the functionality is disabled, a topology file that includes stored changes is sent to the FTP server.

It is disabled by default.

*Syntax:*

```
PRIME-prime0/0 Config>topology disable ?
  <cr>
```

*Example:*

This example shows how to disable the "Topology" functionality:

```
PRIME-prime0/0 Config>topology disable
PRIME-prime0/0 Config>
```

**Command history:**

| Release | Modification |
|---------|--------------|
| 11.00.06, 11.01.02 | New command added. |

### 2.2.12.3  FTP-SERVER-IP

This parameter configures the IP address of the topology server. For the FTP topology functionality to work properly, this parameter must be configured.

*Syntax:*

```
PRIME-prime0/0 Config>topology ftp-server-ip ?
  <a.b.c.d>    Configure the IP address for the topology FTP server
```

*Examples:*

```
PRIME-prime0/0 Config>topology ftp-server-ip 192.168.1.24
PRIME-prime0/0 Config>
```

**Command history:**

| Release | Modification |
|---|---|
| 11.00.06, 11.01.02 | New command added. |

### 2.2.12.4  FTP-SERVER-PORT

This parameter configures the TCP port in the topology server. For the FTP topology functionality to work properly, this parameter must be configured.

*Syntax:*

```
PRIME-prime0/0 Config>topology ftp-server-port ?
  <0..65535>    Configure the TCP port for the topology FTP server
```

*Examples:*

```
PRIME-prime0/0 Config>topology ftp-server-port 1234
PRIME-prime0/0 Config>
```

**Command history:**

| Release | Modification |
|---|---|
| 11.00.06, 11.01.02 | New command added. |

### 2.2.12.5  FILE-MAX-LINES

This parameter configures the maximum number of topology changes to include in an FTP file (lines). This means that, when the number of topology changes stored in the Gateway reaches the configured number, a topology file is generated and the process to send it via FTP is triggered.

This parameter can take values ranging from 1 to 4000. The default value is 1000.

*Syntax:*

```
PRIME-prime0/0 Config>topology file-max-lines ?
  <1..4000>    Lines number
```

*Example:*

This example shows how to configure the maximum lines parameter:

```
PRIME-prime0/0 Config>topology file-max-lines 500
PRIME-prime0/0 Config>
```

**Command history:**

| Release | Modification |
|---|---|
| 11.00.06, 11.01.02 | New command added. |

### 2.2.12.6  FILE-TIME

This parameter configures the time to save the topology file. The value configured is the time between two consecutive file-saving actions. When a file is saved, the previous file is removed and the information must be updated in the server.

Time is configured in seconds. This parameter can take values ranging from 10 to 65535. The default value is 1800.

*Syntax:*

```
PRIME-prime0/0 Config>topology file-time ?
  <10..65535>    Time in seconds
```

*Example:*

This example shows how to configure the file time parameter:

```
PRIME-prime0/0 Config>topology file-time 1800
PRIME-prime0/0 Config>
```

**Command history:**

| Release | Modification |
|---|---|
| 11.00.06, 11.01.02 | New command added. |

### 2.2.12.7  FILE-PATH

This parameter is linked to the path where topology files will be saved on the remote FTP server. The path to the destination directory on the server may be defined using this command.

The path name must be a text string ranging from 1 to 12 characters.

*Syntax:*

```
PRIME-prime0/0 Config>topology file-path ?
  <1..12 chars>    Path name
```

*Example:*

This example shows how to configure the file path parameter:

```
PRIME-prime0/0 Config>topology file-path topology
PRIME-prime0/0 Config>
```

In this example, the destination file path will be:

**/topology/**prime_20160612_142254.csv

**Command history:**

| Release | Modification |
|---|---|
| 11.00.06, 11.01.02 | New command added. |

### 2.2.12.8  FILE-PREFIX

This parameter has to do with the name of the files to be sent to the remote FTP server.

The first characters for the topology files name may be defined using this command. All topology files generated automatically by the Gateway will have, in the first characters of their name, the characters configured in this command.

The prefix name must be a text string ranging from 1 to 20 characters.

*Syntax:*

```
PRIME-prime0/0 Config>topology file-prefix ?
  <1..20 chars>    Prefix for file name
```

*Example:*

This example shows how to configure the file prefix parameter:

```
PRIME-prime0/0 Config>topology file-prefix prime
PRIME-prime0/0 Config>
```

In this example, the destination path for the file will be:

/topology/**prime**_20160612_142254.csv

**Command history:**

| Release | Modification |
|---|---|
| 11.00.06, 11.01.02 | New command added. |

### 2.2.12.9 FTP-CNX-USER

This command configures the authentication parameters needed in order to access the remote FTP server (which is where the topology files have to be saved).

This command configures the user name that grants access to the FTP server.

The path name must be a text string ranging from 1 to 12 characters.

*Syntax:*

```
PRIME-prime0/0 Config>topology ftp-cnx-user ?
  <1..12 chars>    Username
```

*Example:*

This example shows how to configure the FTP user parameter:

```
PRIME-prime0/0 Config>topology ftp-cnx-user admin
PRIME-prime0/0 Config>
```

**Command history:**

| Release | Modification |
|---|---|
| 11.00.06, 11.01.02 | New command added. |

### 2.2.12.10 FTP-CNX-PASSWORD

This command configures the authentication parameters to access the remote FTP server (which is where the topology files have to be saved).

This command configures the password that grants access to the FTP server.

The path name must be a text string ranging from 1 to 12 characters.

*Syntax:*

```
PRIME-prime0/0 Config>topology ftp-cnx-password ?
  <1..12 chars>    Password
```

*Example:*

This example shows how to configure the FTP user parameter:

```
PRIME-prime0/0 Config>topology ftp-cnx-password hsdudx
PRIME-prime0/0 Config>
```

**Command history:**

| Release | Modification |
|---|---|
| 11.00.06, 11.01.02 | New command added. |

### 2.2.12.11  NO

This command clears a configuration parameter or sets its default value.

*Syntax:*

```
PRIME-primeX/Y Config>topology no ?
  ftp-server-ip      Configure the IP address for the topology FTP server
  ftp-server-port    Configure the TCP port for the topology FTP server
  file-max-lines     Configure the max number of topology changes(lines)
                     included in file
  file-time          Configure the time between sending two consecutives
                     files
  file-path          Configure remote FTP server path to put topology file
  file-prefix        Configure prefix for the topology files name
  ftp-cnx-user       Configure username for FTP connection
  ftp-cnx-password   Configure password for FTP connection
```

*Example:*

This example shows how to delete the FTP connection password:

```
PRIME-prime0/0 Config>topology no ftp-cnx-password
PRIME-prime0/0 Config>
```

**Command history:**

| Release | Modification |
| --- | --- |
| 11.01.08 | The "no" command was introduced as of version 11.01.08. |

### 2.2.13  TRACE-LEVEL

This command enables/disables the debugging of traces in the PRIME Gateway and selects their level.

The following types of traces can be enabled:

- MNG_FSM: Enables traces for the management of the state machine for PRIME (0x0001)
- TK67: Enables DLMS overt TCP(Ticket#67) traces (0x0002)
- TPOLOGY: Enables topology management traces (0x0004)
- TPL_FILE: Enables traces related to the topology files management process (0x0008)
- FTP_PUT: Enables FTP topology transfer files traces (0x0010)
- SN_VER: Enables traces to monitor the process of obtaining firmware versions for Service Nodes (0x0020)
- FUP: Enables traces to monitor the Firmware Upgrade Protocol (0x0040)
- TK65: Enables traces to monitor the PHY layer extension (Ticket#65) process (0x0080)
- USI: Enables traces to monitor PLC modem communication (0x0100)
- USI_DAT: Enables traces to analyze all PLC modem data (0x0200)
- API_DAT: Enables traces to analyze PRIME API data of the PLC modem (0x0400)
- SNIF_DAT: Enables traces to analyze SNIFFER data (0x0800)
- TK65_DAT: Enables traces to analyze the PHY layer extension (Ticket#65) data (0x1000)
- SNIFFER: Enables SNIFFER management traces (0x2000)
- PLC modem debug report traces (0x4000)

Different types of traces can be activated simultaneously by means of an OR operation that uses the desired trace values. These values are in HEX format. To disable all traces, use the 0x0000 value.

*Syntax:*

```
PRIME-prime0/0 Config>trace-level ?
  <hex 0..ffff>    Trace level bit mask: MNG_FSM(0x0001) TK67(0x0002)
                   TPOLOGY(0x0004) TPL_FILE(0x0008) FTP_PUT(0x0010)
                   SN_VER(0x0020) FUP(0x0040) TK65(0x0080) USI(0x0100)
                   USI_DAT(0x0200) API_DAT(0x0400) SNIF_DAT(0x0800)
                   TK65_DAT(0x1000) SNIFFER(0x2000) PLC_DBG(0x4000)
```

*Example:*

```
PRIME-prime0/0 Config>trace-level 0802
PRIME-prime0/0 Config>
```

**Command history:**

| Release | Modification |
| --- | --- |
| 11.00.06, 11.01.02 | New command added. |
| 11.00.07, 11.01.03 | New option added. (PLC_DBG(0x4000)) |

## 2.2.14  VRF

This command allows you to select the VRF to which the PLC PRIME interface that is being configured belongs.

*Syntax:*

```
PRIME-prime0/0 Config>vrf
  <1..32 chars>    VPN Routing/Forwarding instance name
```

*Example:*

```
PRIME-prime0/0 Config>vrf NODEQ
PRIME-prime0/0 Config>
```

**Command history:**

| Release | Modification |
| --- | --- |
| 11.00.06, 11.01.02 | New command added. |

# Chapter 3  Monitoring

## 3.1  Accessing the interface monitoring

To access the PRIME interface monitoring menu, you first need to access the general monitoring menu. From there, please access the PRIME interface.

The "configuration" command lets you obtain a list of available interfaces, among other things.

```
+configuration

Teldat's Router, Regesta-Smart-PLC S/N: 914P/00101
SWL:BASE PLC_2000SN UART USB_INTERNAL
Profile: none
ID:  Regesta-Smart-PLC

Boot ROM release:
 BIOS CODE VERSION: 01.07  Nov 25 2019 13:26:09 L0

System Info:
PCB:0x411 Regesta-Smart-PLC SYS:0x000B REV:0x2
CLKs: CPU=500 FBS1=250 FBS2=250 DDR(clk)=250 LBUS=250
Watchdog:Enabled
Cache:ON Write-Back
Time Base: frequency = 250000 KHz period = 4.000 ns
CPU temperature: 43 C
BOARD temperature: 31 C

Software release: 11.01.08 Nov 22 2019 08:56:37
Compiled by    integrator on ares.id.teldat.com
Loaded from primary partition

Hostname:                     Active user:
Date:  Saturday, 01/01/00    Time: 02:13:57
Router uptime: 2h13m27s

Name      Protocol
IP        Internet Protocol
IP6       IPv6
ARP       Address Resolution Protocol
CFM       Connectivity Fault Management
ASRT      Adaptive Source Routing Transparent Enhanced Bridge
DLS       Data Link Switching
dot1X     Extensible Authentication Protocol Over LAN
RIP       Route Information Protocol
OSPF      Open SPF-Based Routing Protocol
BGP       BGP
BFD       Bidirectional Forwarding Detection
NHRP      Next Hop Resolution Protocol
DHCP      Dynamic Host Configuration Protocol
L2TP      L2TP
SNMP      SNMP
IGMP      Internet Group Management Protocol
PIM       Protocol Independent Multicast
MSDP      Multicast Source Discovery Protocol
GW104     Gateway IEC 104/101
SIP       SIP
H323      H323
NOE       UA/NOE
SCCP      SCCP
RPNG      RIPng
OSPFv3    OSPFv3
DHCPv6    DHCPv6

9 interfaces:
```

```
Connector       Interface           MAC/Data-Link       Status
SFP-WAN         ethernet0/0         Ethernet/IEEE 802.3  Up
LAN             ethernet0/1         Ethernet/IEEE 802.3  Testing
PLC-PW          prime0/0            PRIME interface      Up
SERIAL1         uart1/0             AHDLC                Testing
SERIAL2         uart1/1             AHDLC                Testing
ANT1            cellular1/0         Async serial line    Down
ANT1            cellular1/1         NIC interface        Down
ANT1            cellular1/2         NIC interface        Down
---             direct-ip1          DirectIP interface   Down


SNMP OperStatus:
Interface           OperStatus
ethernet0/0         Up
ethernet0/1         Down
prime0/0            Up
uart1/0             Down
uart1/1             Down
cellular1/0         Down
cellular1/1         Down
cellular1/2         Down
direct-ip1          Lower layer down


Hardware Encryption Engine: LTQ-DEU xRX200 Family, Revision 5
Cellular Driver Version:


WLAN Driver Version: 9.5.0.35.1


+
```

The PRIME interface appears as prime0/0 in this example, therefore:

```
+network prime0/0

-- PRIME Console --

PRIME-prime0/0+
```

## 3.2  Interface monitoring

This section describes the monitoring commands for the PRIME interface.

The monitoring commands are as follows:

```
PRIME-prime0/0+?
  clear             Initialize statistics
  fup               Statistics for FW Upgrade Prot.(FUP) monitoring
                    connection
  list              Display monitoring information
  reset             PRIME module hardware reset control
  upgrade-firmware  PRIME module firmware upgrade
  exit
PRIME-prime0/0+
```

Once you have accessed the PRIME monitoring menu, you can enter the commands below:

| Command | Function |
|---|---|
| *CLEAR* | Sets the statistics counter to its reset state. |
| *FUP* | Shows Firmware Upgrade Protocol (FUP) process evolution. |
| *LIST* | Displays the PLC PRIME monitoring information. |
| *RESET* | Performs a PLC PRIME module reset. |
| *UPGRADE-FIRMWARE* | Upgrades the firmware of the PLC PRIME module. |
| *EXIT* | Returns to the previous menu. |

### 3.2.1 CLEAR STATISTICS

Deletes the interface statistics that correspond to the packets and bytes exchanged by the PRIME interface.

*Syntax:*

```
PRIME-prime0/0+clear statistics ?
  <cr>
```

*Example:*

```
PRIME-prime0/0+clear statistics
PRIME-prime0/0+
```

**Command history:**

| Release | Modification |
|---------|--------------|
| 11.00.06, 11.01.02 | New command added. |

### 3.2.2 FUP

The Firmware Upgrade Protocol (FUP) is designed to upgrade the Service Nodes that are connected to the Base Node in the PRIME local network. FUP is defined to launch and control the firmware upgrade by a remote application, through a TCP session.

In environments where FUP is not available, this command helps launch and cancel a limited FUP process.

*Syntax:*

```
PRIME-prime0/0+fup ?
  cancel    Cancel FUP process in progress
  set       Set FUP parameters
  start     Starts FUP process for added SNs
```

> **Note**
>
> • This command is not necessary when the PRIME Gateway is configured in Service Node mode.

**Command history:**

| Release | Modification |
|---------|--------------|
| 11.00.06, 11.01.02 | New command added. |
| 11.01.08 | The "set" command option was added as of version 11.01.08. |

#### 3.2.2.1 CANCEL

The CANCEL command ends the running FUP session. This command cancels a session initiated by an FUP remote application or by the FUP START local console command.

*Syntax:*

```
PRIME-prime0/0+fup cancel ?
  <cr>
```

*Example:*

```
PRIME-prime0/0+fup cancel
PRIME-prime0/0+
```

**Command history:**

| Release | Modification |
|---------|--------------|
| 11.00.06, 11.01.02 | New command added. |

### 3.2.2.2 SET

The SET command allows you to configure several parameters that are necessary for the FUP session. These parameters must be set before a session is initiated. The command option only works when the FUP START local console command is responsible for launching the FUP session.

*Syntax:*

```
PRIME-prime0/0+fup set ?
  signature-length      Signature length for signed FW (For PRIME 1.4 only)
  signature-algorithm   Algorithm type for signed FW (For PRIME 1.4 only)
```

**Command history:**

| Release | Modification |
|---------|--------------|
| 11.01.08 | The "set" command was introduced as of version 11.01.08. |

#### 3.2.2.2.1 SIGNATURE-LENGTH

The SIGNATURE-LENGTH command allows you to configure the length of the signature for a specific FW. PRIME version 1.4 defines an encrypted signature to allow the FW to be used for Service Nodes. This signature may use several types of encryption and may be of variable length.

This parameter must be configured before the FW is sent to the Service Nodes. That is, the command must be set before a FUP session is initiated. It is only valid when the FUP START local console command launches the FUP session.

This parameter must only be configured for Service Nodes that use PRIME version 1.4 and when the algorithm used is not NONE.

The FW algorithm and its length are defined by the Service Node manufacturer, who is responsible for providing these parameters.

*Syntax:*

```
PRIME-prime0/0+fup set signature-length ?
  <0..255>   Signature length
```

*Example:*

```
PRIME-prime0/0+fup set signature-length 8
PRIME-prime0/0+
```

**Command history:**

| Release | Modification |
|---------|--------------|
| 11.01.08 | The "signature-length" command was introduced as of version 11.01.08. |

#### 3.2.2.2.2 SIGNATURE-ALGORITHM

The SIGNATURE-ALGORITHM command allows you to configure the algorithm used to decrypt the signature for a specific FW. PRIME version 1.4 defines an encrypted signature to allow the FW to be used for Service Nodes. This signature may use several types of encryption and may be of variable length.

This parameter must be configured before the FW is sent to the Service Nodes. That is, the command must be set before a FUP session is initiated. It is only valid when the FUP START local console command is responsible for launching the FUP session.

This parameter must only be configured for Service Nodes that use PRIME version 1.4 and when the algorithm used is not NONE.

The FW algorithm and its length are defined by the Service Node manufacturer, who is responsible for providing these parameters.

The following signature types are allowed:

- NONE. FW does not include an encrypted signature.

- RSA. FW includes an encrypted signature (with RS3072 algorithm).

- ECDSA. FW includes an encrypted signature (with ECDSA256 algorithm).

*Syntax:*

```
PRIME-prime0/0+fup set signature-algorithm ?
  none     None algorithm, not signed FW
  RSA      RSA3072 algorithm, for signed FW
  ECDSA    ECDSA256 algorithm, for signed FW
```

*Example:*

```
PRIME-prime0/0+fup set signature-algorithm RSA
PRIME-prime0/0+
```

**Command history:**

| Release | Modification |
|---|---|
| 11.01.08 | The "signature-algorithm" command was introduced as of version 11.01.08. |

### 3.2.2.3  START

The START command initiates a local FUP session for multiple Service Nodes. Up to 14 Service Nodes may be up-graded using this command.

A new session cannot be started while one is in progress.

The LIST FUP monitoring command displays information about a running process or the last finished process. This command may be used to monitor the FUP process.

*Syntax:*

```
PRIME-prime0/0+fup start ?
  <1..256 chars>    SNs MAC list separated by semicolon:
                    00:A0:26:00:01:FF;00:A0:26:00:01:32
```

*Example:*

```
PRIME-prime0/0+fup start 40:40:22:68:D4:01;40:40:22:68:D4:04
Reading upgrading file from /MEM/FW_NM_PRIME_V2203, 69760 bytes
PRIME-prime0/0+
```

To launch an FUP process, follow these steps:

- Obtain the upgraded software.
- Transfer the Service Node software to the PRIME Gateway through FTP.
- Launch the FUP process over the desired Service Nodes.

**Command history:**

| Release | Modification |
|---|---|
| 11.00.06, 11.01.02 | New command added. |

#### 3.2.2.3.1  Obtain Service Node firmware

To upgrade Service Node firmware, you must obtain the loading file for the Service Nodes that need upgrading. Similarly, you also need information about the type and version of Service Node installed to determine which firmware versions are compatible.

The user may obtain firmware for several Service Node models, together with the possible versions for each, from Service Node manufacturers. Please contact your Service Node provider and give them all the information about your Service Node. Information about the current firmware version can be found on the PRIME Gateway monitoring console.

*Example:*

```
PRIME-prime0/0+list topology firmware-sn

 Service NodeS FW VERSION LIST:
 ----------------------------
```

```
State     MAC               SERIAL/NUMBER     FW VERSION
--------  ----------------  ----------------  ----------------
terminal  40:40:22:68:D4:07 ZIV0040424455     9.2.0.3.4403
terminal  40:40:22:68:D4:06 ZIV0040424454     9.2.0.3.4403
terminal  40:40:22:70:58:AC ZIV0040917164     9.2.0.3.4403
terminal  40:40:22:70:58:AD ZIV0040917165     9.2.0.3.4403
terminal  40:40:22:68:D4:08 ZIV0040424456     9.2.0.3.4403
terminal  40:40:22:68:D4:05 ZIV0040424453     9.2.0.3.4403
terminal  40:40:22:70:58:AE ZIV0040917166     9.2.0.3.4403
terminal  00:80:E1:34:E1:5F LGZ0031458326     00-2403t
switch    00:80:E1:34:E1:AF LGZ0031458327     00-2403t
terminal  40:40:22:68:D4:01 ZIV0040424449     2.2.0.3.4403
terminal  40:40:22:68:D4:04 ZIV0040424452     2.2.0.3.4403
terminal  40:40:22:68:D4:02 ZIV0040424450     9.2.0.3.4403
terminal  00:80:E1:2F:9A:AC CIR0141604122     00-2201a
terminal  00:80:E1:2F:B0:87 CIR0141604121     00-2201a
switch    00:A0:26:92:00:0D                   01.03.10.02-A-S


Total listed SN: 15



PRIME-prime0/0+
```

### 3.2.2.3.2  Transfer Service Node firmware

When it comes to upgrading device software or loading firmware for internal devices, the PRIME Gateway has an FTP server it can transfer files to.

This server is only accessible if the device has initiated correctly (application executed).

The firmware of the Service Nodes to be upgraded using the FUP command must be uploaded to PRIME Gateway through FTP before the FUP process starts. Only one firmware can be loaded at a time (meaning that only the Service Nodes that are compatible with this firmware will be upgraded).

Follow these steps to upgrade:

(1)   Save the upgrade file in a directory that belongs to the device from which you are going to launch the FTP session.

(2)   Connect to the FTP server (default is user **root** and no password).

(3)   Configure the binary mode through the **bin** command.

(4)   Transfer the file containing the firmware using the  **put myfmwr.zzz** command. The .bin and .img file extensions are not allowed. Rename file extensions if necessary.

(5)   Once the transfer is complete, disconnect using the **bye** command.

```
C:\tmp>ftp 172.24.79.12
Conectado a 172.24.79.12.
220 FTP server ready, 1 active clients of 1 simultaneous clients allowed.
Name (172.24.79.12:(none)): root
331 User name accepted, need password.
Password:
230 User login complete.
ftp> bin

200 TYPE is set to IMAGE.
ftp> hash
Hash mark printing on (1024 bytes/hash mark).
ftp> put myfmwr.zzz

200 PORT is set to IP ADDR = 172.24.51.96  PORT = 5001
150 Data connection open, file transfer in process...
############################################################################
226 STOR completed, 69760 bytes processed, data connection is closed.
ftp: 69760 bytes sent in 0,04 secs 1550.22 kB/s.
ftp> bye
230 Goodbye.

C:\tmp>
```

The transferred file is stored in the volatile memory (i.e., it will disappear once the device is restarted).

### 3.2.2.3.3  FUP process

Once this is done:

(1)  Configure FUP parameter with the SET commands if necessary.

(2)  Execute FUP START to start loading. If you have not preloaded the upgrade file in RAM, you will receive an error message.

```
PRIME-prime0/0+fup start 40:40:22:68:D4:01;40:40:22:68:D4:04

Reading upgrading file from /MEM/FW_NM_PRIME_V2203, 69760 bytes
PRIME-prime0/0+
```

(3)  The FUP process can take several hours depending on the number of Service Nodes to load and on the PRIME network requirements.

(4)  The firmware upgrade ends when the processing status goes to IDLE. You can monitor how the FUP process progresses through the LIST FUP monitoring command:

```
PRIME-prime0/0+list fup

---- PRIME FUP MONITORING COMMUNICATION ------

---- PLC STATISTICS ------
 Process status                   : UPGRADING(3)
 FUP control process status       : RUNNING(11)
 Bytes received from PLC          : 618
 Packets received from PLC        : 152
 Bytes received from PLC discarded : 0
 Packets received from PLC discard.: 0
 Packets sent to PLC              : 150
 Retransmitted packets to PLC     : 4

---- TCP DATA STATISTICS ------
 Bytes sent to TCP                : 0
 Bytes received from TCP          : 0
 Packets sent                     : 0
 Packets received                 : 0
 Error packets received           : 0
 Error bytes received             : 0
 Errors or congestion detected    : 0

---- TCP CONNECTION STATISTICS ------
 Connection status                : DISCONN.(2)
 TCP listen port                  : 21400
 Opened sessions                  : 0
 Disconnects received             : 0
 Disconnects transmitted          : 0

---- TCP SESSIONS INFO ------
   STATE    REMOTE IP ADDR. REM.PORT  ESTABLISH TIME    ORIG.
 --------- --------------- -------- ---------------- ------
 ESTAB     192.168.213.157 60448    14:27:13 11/12/16 remote

 FUP CURRENT SESSION CONFIGURATION:
 --------------------------------
  FW image CRC         : 0x07c63cbc
  FW image length      : 69760
  Page size            : 64
  Reflash mode         : Unicast
  Seg. unicast timeout : 3600
  Packet time          : 0
  Sending process timeout: 18000
  Switches delay execut. : Disabled[0]
  Activation timeout    : 600

 SN INCLUDED IN LAST FU PROCESS:
 --------------------------------
```

```
    Process elapsed time: 81
      MAC                ROLE      LEV.  STATE         STATUS        PROGRESS

     ----------------- --------- ----- ------------ ------------ -----------
      40:40:22:68:D4:04 TERMINAL      0 UPGRADING    RECEIVING     712/1090
      40:40:22:68:D4:01 TERMINAL      0 UPGRADING    RECEIVING       0/1090


      Total listed SN: 2



    PRIME-prime0/0+
```

(5)   When FUP ends, you can check whether the correct firmware version has been loaded in each Service Node through the LIST TOPOLOGY FIRMWARE-SN command.

```
    PRIME-prime0/0+list topology firmware-sn

      Service NodeS FW VERSION LIST:
      ----------------------------
      State    MAC               SERIAL/NUMBER    FW VERSION
      -------- ----------------- ---------------- -----------------
      terminal 40:40:22:68:D4:07 ZIV0040424455    9.2.0.3.4403
      terminal 40:40:22:68:D4:06 ZIV0040424454    9.2.0.3.4403
      terminal 40:40:22:70:58:AC ZIV0040917164    9.2.0.3.4403
      terminal 40:40:22:70:58:AD ZIV0040917165    9.2.0.3.4403
      terminal 40:40:22:68:D4:08 ZIV0040424456    9.2.0.3.4403
      terminal 40:40:22:68:D4:05 ZIV0040424453    9.2.0.3.4403
      terminal 40:40:22:70:58:AE ZIV0040917166    9.2.0.3.4403
      terminal 00:80:E1:34:E1:5F LGZ0031458326    00-2403t
      switch   00:80:E1:34:E1:AF LGZ0031458327    00-2403t
      terminal 40:40:22:68:D4:01 ZIV0040424449    2.2.0.3.4403
      terminal 40:40:22:68:D4:04 ZIV0040424452    2.2.0.3.4403
      terminal 40:40:22:68:D4:02 ZIV0040424450    9.2.0.3.4403
      terminal 00:80:E1:2F:9A:AC CIR0141604122    00-2201a
      terminal 00:80:E1:2F:B0:87 CIR0141604121    00-2201a
      switch   00:A0:26:92:00:0D                  01.03.10.02-A-S

    Total listed SN: 15



    PRIME-prime0/0+
```

## 3.2.3  LIST

This command helps monitor several PRIME interface functionalities:

- IEC 61334-4-32 active connections.
- Service Node availability statistics.
- PRIME network channel occupation.
- Data Concentrator TCP connection
- Firmware Upgrade Protocol (FUP) information
- Global PRIME status connection
- PLC modem debug report
- PHY layer extension feature information
- Sniffer protocol connection
- Topological information

*Syntax:*

```
PRIME-prime0/0+list ?
  432-connections       List IEC 61334-4-32 active connections
  availability          PRIME SN availability statistics
  channel-occupation    PRIME network channel occupation
  dc-communication      Statistics for PRIME data connection
  fup                   FUP(Firmware Upgrade Protocol) control options
  global                Global PRIME interface statistics
  modem-debug-report    PLC modem debug report
```

```
phy-layer-extension    Statistics for PHY layer extension over UDP monitoring
                       connection
sniffer                Statistics for Sniffer monitoring connection
topology               PRIME network topology monitoring
```

**Command history:**

| Release | Modification |
|---|---|
| 11.00.06, 11.01.02 | New command added. |
| 11.00.07, 11.01.03 | New command (*modem-debug-report*) added. |

### 3.2.3.1 432-CONNECTIONS

The *432-connections* option displays the list of PRIME Service Nodes that have an active data connection to the Base Node. The command displays all 432 connections or a specific number thereof.

*Syntax:*

```
PRIME-prime0/0+list 432-connections ?
  <1..749>    Max. number of 432 connections to display
  <cr>        Display all 432 connections
```

*Example:*

This example shows a list of several Service Nodes with an active IEC 61334-4-32 data connection:

```
PRIME-prime0/0+list 432-connections

 IEC 61334-4-32 ACTIVE CONNECTIONS:
 ---------------------------------
 ADDRESS        SERIAL/NUMBER    MAC
 ------------- ---------------- -----------------
  1009(0x03f1)    ZIV0040917166 40:40:22:70:58:AE
  1015(0x03f7)    ZIV0040917164 40:40:22:70:58:AC
  1007(0x03ef)    ZIV0040424455 40:40:22:68:D4:07
  1004(0x03ec)    ZIV0040424450 40:40:22:68:D4:02
  1008(0x03f0)    LGZ0031458326 00:80:E1:34:E1:5F
  1012(0x03f4)    LGZ0031458327 00:80:E1:34:E1:AF
  1006(0x03ee)    CIR0141604122 00:80:E1:2F:9A:AC
  1013(0x03f5)    ZIV0040917165 40:40:22:70:58:AD
  1014(0x03f6)    ZIV0040424454 40:40:22:68:D4:06
  1011(0x03f3)    ZIV0040424453 40:40:22:68:D4:05
  1001(0x03e9)    ZIV0040424452 40:40:22:68:D4:04
  1010(0x03f2)    ZIV0040424456 40:40:22:68:D4:08
  1005(0x03ed)    ZIV0040424449 40:40:22:68:D4:01
  1003(0x03eb)    CIR0141604121 00:80:E1:2F:B0:87

Total listed SN: 14

PRIME-prime0/0+
```

> **Note**
>
> • This command is not necessary when the PRIME Gateway is configured in Service Node mode.

**Command history:**

| Release | Modification |
|---|---|
| 11.00.06, 11.01.02 | New command added. |
| 11.01.08 | Address hex format added. |

### 3.2.3.2  AVAILABILITY

The availability command shows the quality and stability of the PRIME network. It is a list that includes statistical information on several key network parameters.

The Gateway integrates the statistical values for each period defined by three superframes (duration: ~1 minute).

The Gateway keeps the information for 60 periods (180 superframes). On top of this, the node also saves the accumulated values generated since the last network reset. The first listed element is the accumulated value, the second is the last period, the third is the period before that and so on.

The statistical information is displayed in a table with 61 rows and 9 columns. The first row (it. acc) shows the accumulated value since Base Node initialization or reset.

The availability parameters listed are the following:

- It.: Item listed (the first is the accumulated value) based on their period. The periods are listed from most to least recent.

- Promo.: Number of promotions that have occurred during the period.

- Demot.: Number of demotions that have occurred during the period.

- Reg.: Number of registrations that have occurred during the period.

- Unreg.: Number of unregistrations that have occurred during the period.

- Suc Alv.: Number of success alive sequences that have occurred during the period.

- Tot Alv.: Total number of live sequences sent during the period.

- Avail.: Average availability.

    The accumulated value (first value in the table) is calculated as the average availability of the different nodes registered (at least once in that period) in the subnetwork. The accumulated value (row 1) will take into account every data registered since the last reset.

    Period availability (from it.values 0 to -59) is calculated as the average availability of the different nodes registered, at least once, in the subnetwork.

- num.SN: Number of Service Nodes detected in the period, used when calculating availability.

This information can also be obtained by means of the SNMP protocol.

*Syntax:*

```
PRIME-prime0/0+list availability ?
  <cr>
```

*Example:*

This example shows the availability statistics for the Gateway:

```
PRIME-prime0/0+list availability

 It. Promo. Demot. Reg.   Unreg. Suc.Alv Tot.Alv Avail. nun.SN
 --- ------ ------ ------ ------ ------- ------- ------ ------
 Acc      2      0     30     27   11825   10983  99.50     11
   0      0      0      0      0       7       7 100.00     11
  -1      0      0      0      0       8       8 100.00     11
  -2      0      0      0      0      12      11 100.00     11
  -3      0      0      0      0      10       9 100.00     11
  -4      0      0      1      0      11       7  97.27     11
  -5      0      0      0      0      10       9 100.00     10
  -6      0      0      0      0      10       9 100.00     10
  -7      0      0      0      1       7       7 100.00     10
  -8      0      0      0      2      11       9  93.18     11
  -9      0      0      0      0       7       7 100.00     11
 -10      0      0      0      0       9       9 100.00     11
 -11      0      0      0      0       9       9 100.00     11
 -12      0      0      0      0      13      10 100.00     11
 -13      0      0      0      0       8       8 100.00     11
 -14      0      0      0      0       9       8 100.00     11
 -15      0      0      0      0       8       7 100.00     11
```

```
-16       0       0       0       0      12      11 100.00      11
-17       0       0       0       0      10       8 100.00      11
-18       0       0       0       0       7       7 100.00      11
-19       0       0       0       0       9       9 100.00      11
-20       0       0       0       0      12      10 100.00      11
-21       0       0       0       0       6       6 100.00      11
-22       0       0       0       0      13       9 100.00      11
-23       0       0       0       0       7       7 100.00      11
-24       0       0       0       0      10      10 100.00      11
-25       0       0       0       0      11      10 100.00      11
-26       0       0       0       0       9       8 100.00      11
-27       0       0       0       0       8       8 100.00      11
-28       0       0       0       0      10       8 100.00      11
-29       0       0       0       0       9       9 100.00      11
-30       0       0       0       0      13      10 100.00      11
-31       0       0       0       0       6       6 100.00      11
-32       0       0       0       0       9       9 100.00      11
-33       0       0       0       0      10       9 100.00      11
-34       0       0       0       0       8       7 100.00      11
-35       0       0       0       0      10      10 100.00      11
-36       0       0       0       0      10       9 100.00      11
-37       0       0       0       0       7       7 100.00      11
-38       0       0       1       0      17      10  94.54      11
-39       0       0       0       0       8       8 100.00      10
-40       0       0       0       1      11       9 100.00      10
-41       0       0       0       1       7       7  92.12      11
-42       0       0       0       0       8       8 100.00      11
-43       0       0       0       0      12       9 100.00      11
-44       0       0       0       0       8       8 100.00      11
-45       0       0       0       0      10      10 100.00      11
-46       0       0       0       0       8       7 100.00      11
-47       0       0       0       0      10       9 100.00      11
-48       0       0       0       0      10       9 100.00      11
-49       0       0       0       0      11       9 100.00      11
-50       0       0       0       0       7       7 100.00      11
-51       0       0       0       0      10      10 100.00      11
-52       0       0       0       0       9       8 100.00      11
-53       0       0       0       0      11       9 100.00      11
-54       0       0       0       0       8       8 100.00      11
-55       0       0       0       0       9       9 100.00      11
-56       0       0       0       0       9       9 100.00      11
-57       0       0       0       0       9       8 100.00      11
-58       0       0       0       0      10       9 100.00      11
-59       0       0       0       0       9       9 100.00      11


PRIME-prime0/0+
```

**Command history:**

| Release | Modification |
|---|---|
| 11.00.06, 11.01.02 | New command added. |

### 3.2.3.3  CHANNEL-OCCUPATION

The channel-occupation command shows the data flow performance in the PLC network. It is a list of statistical information on several key network parameters.

Two separate options can be introduced to obtain data at PHY and MAC levels:

The PRIME Gateway supports several commands to obtain channel occupation data at PHY and MAC levels:

*Syntax:*

```
PRIME-prime0/0+list channel-occupation ?
 mac-layer    Display MAC layer channel occupation
```

```
     phy-layer    Display PHY layer channel occupation
```

**Command history:**

| Release | Modification |
|---------|--------------|
| 11.00.06, 11.01.02 | New command added. |

### 3.2.3.3.1 MAC-LAYER

This command displays the PLC PRIME network occupation at the MAC level.

The Gateway integrates the statistical values of each period, defined by three superframes (~1 minute).

The Gateway keeps the information for 60 periods (180 superframes). On top of this, the node also saves the accumulated values generated since the last network reset. The first listed element is the accumulated value, the second is the last period, the third is the period before that and so on.

The statistical information is displayed in a table with 61 rows and 10 columns. The first row (it. acc) includes the accumulated value since the Base Node has been running or reset.

The MAC layer channel occupation parameters listed are:

- It.: Item listed (the first is the accumulated value) based on their period. The periods are listed from most to least recent.

- Beacons: Number of beacon packets transmitted.

- CTR Tx pk: Number of control packets transmitted.

- CTR Tx tm: Channel time occupation of control packets transmitted (ms).

- CTR Rx pk: Number of control packets received.

- CTR Rx tm: Channel time occupation of control packets received (ms).

- DAT Tx pk : Number of data packets transmitted.

- DAT Tx tm: Channel time occupation of data packets transmitted (ms).

- DAT Rx pk: Number of data packets received.

- DAT Rx tm: Channel time occupation of data packets received (ms).

*Syntax:*

```
PRIME-prime0/0+list channel-occupation phy-layer ?
 <cr>
```

*Example:*

This example shows channel occupation at the MAC layer:

```
PRIME-prime0/0+list channel-occupation mac-layer

MAC layer occupation information:
It. Beacons   CTR Tx pk CTR Tx tm  CTR Rx pk CTR Rx tm  DAT Tx pk DAT Tx tm  DAT Rx pk DAT Rx tm
--- --------- --------- ---------- --------- ---------- --------- ---------- --------- ----------
Acc   1348434    359810    4535381    268924    3757485    395651    4779749    325493    4310162
  0       194        42        534        37        533        66        777        52        746
 -1       194        44        562        33        453        67        788        54        724
 -2       194        42        528        35        483        63        750        52        694
 -3       194        39        510        33        429        64        761        52        642
 -4       194        52        635        41        541        72        834        58        736
 -5       192        33        444        29        393        63        750        49        649
 -6       194        50        610        39        499        62        742        52        654
 -7       194        43        548        34        444        65        769        52        666
 -8       194        46        572        39        515        65        772        52        666
 -9       194        46        572        37        509        66        777        53        709
-10       194        42        534        36        474        66        777        52        690
-11       192        46        572        37        501        63        750        52        694
-12       194        41        526        35        487        63        750        52        694
-13       194        43        542        36        494        65        769        53        709
```

```
-14      194      49      599      39      499      66      780      52      662
-15      194      39      510      32      422      66      777      53      669
-16      194      50      613      41      549      67      788      53      669
-17      194      38      502      30      416      68      793      54      724
-18      194      39      507      32      442      65      772      53      709
-19      194      46      578      38      528      64      758      52      694
-20      194      50      607      40      546      65      766      53      709
-21      194      47      586      38      504      70      815      54      716
-22      194      35      466      32      418      65      772      50      620
-23      194      42      534      36      466      66      780      52      666
-24      196      45      564      38      496      64      758      52      674
-25      194      44      550      36      502      65      772      52      694
-26      194      42      534      32      434      62      742      52      694
-27      194      40      524      34      468      65      766      52      694
-28      194      57      672      45      601      62      742      52      694
-29      194      34      458      29      397      68      796      54      724
-30      194      44      550      36      474      63      750      52      694
-31      194      41      532      35      459      64      758      52      674
-32      194      39      504      33      457      65      766      52      694
-33      194      45      564      38      484      64      758      54      684
-34      194      44      550      37      505      65      772      52      694
-35      194      46      572      38      492      63      750      52      638
-36      194      42      534      35      479      64      758      52      694
-37      194      44      553      36      466      67      782      53      681
-38      194      43      542      36      486      65      766      52      702
-39      192      46      572      39      535      69      807      53      709
-40      194      51      624      38      512      67      791      54      724
-41      194      44      556      35      459      78      888      59      735
-42      194      39      498      34      440      62      742      48      606
-43      194      41      532      34      452      67      785      54      680
-44      195      43      542      36      494      65      766      52      694
-45      195      50      610      40      538      64      758      52      694
-46      194      40      518      33      429      67      785      54      680
-47      194      43      542      37      477      62      742      52      674
-48      194      50      616      40      546      65      766      52      694
-49      194      41      526      35      463      83      946      61      809
-50      194      34      452      30      412      59      744      46      604
-51      194      45      567      37      485      64      758      52      654
-52      194      48      594      39      531      67      788      53      709
-53      194      43      542      37      505      64      758      52      694
-54      194      45      558      38      484      65      766      52      646
-55      194      48      594      38      505      68      796      53      685
-56      194      46      572      38      525      67      785      53      685
-57      194      36      480      30      408      65      769      53      709
-58      194      43      542      37      473      64      758      52      662


PRIME-prime0/0+
```

**Command history:**

| Release | Modification |
| --- | --- |
| 11.00.06, 11.01.02 | New command added. |

### 3.2.3.3.2  PHY-LAYER

This command displays the PLC PRIME network occupation at the MAC level.

The Gateway integrates the statistical values of each period, defined by three superframes (~1 minute).

The Gateway keeps the information for 60 periods (180 superframes). On top of this, the node also saves the accumulated values generated since the last network reset. The first listed element is the accumulated value, the second is the last period, the third is the period before that and so on.

The statistical information is displayed in a table with 61 rows and 7 columns. The first row (it. acc) includes the accumulated value since the Base Node has been running or reset.

The PHY layer channel occupation parameters listed are:

- It.: Item listed (the first is the accumulated value) based on their period. Periods are listed from most to least recent.

- CFP pkts: Number of CFP packets transmitted or received.

- CFP time: Channel time occupation of CFP packets transmitted or received (ms).

- SCP pkts: Number of SCP packets transmitted or received.

- SCP time: Channel time occupation of SCP packets transmitted or received (ms).

- ERR pkts: Number of error packets received.

- ERR time: Channel time occupation of error packets received (ms).

*Syntax:*

```
PRIME-prime0/0+list channel-occupation phy-layer ?
  <cr>
```

*Example:*

This example shows channel occupation at the PHY layer:

```
PRIME-prime0/0+list channel-occupation phy-layer

 PHY PLC channel occupation information:
 It. CFP pkts   CFP time   SCP pkts   SCP time   ERR pkts   Err time
 --- ---------- ---------- ---------- ---------- ---------- ----------
 Acc         0          0    1350477   17390372       1182      22298
   0         0          0        219       2741          0          0
  -1         0          0        186       2376          0          0
  -2         0          0        188       2412          0          0
  -3         0          0        197       2590          0          0
  -4         0          0        198       2527          0          0
  -5         0          0        192       2455          2         30
  -6         0          0        188       2342          0          0
  -7         0          0        223       2746          0          0
  -8         0          0        174       2236          2         30
  -9         0          0        203       2505          0          0
 -10         0          0        194       2427          0          0
 -11         0          0        202       2525          0          0
 -12         0          0        202       2567          0          0
 -13         0          0        196       2475          0          0
 -14         0          0        198       2517          0          0
 -15         0          0        191       2457          0          0
 -16         0          0        197       2514          0          0
 -17         0          0        206       2540          0          0
 -18         0          0        190       2378          0          0
 -19         0          0        211       2619          0          0
 -20         0          0        190       2435          0          0
 -21         0          0        189       2430          2         38
 -22         0          0        200       2558          0          0
 -23         0          0        208       2628          0          0
 -24         0          0        209       2621          0          0
 -25         0          0        182       2276          0          0
 -26         0          0        196       2446          0          0
 -27         0          0        199       2492          0          0
 -28         0          0        197       2518          0          0
 -29         0          0        188       2404          0          0
 -30         0          0        191       2452          0          0
 -31         0          0        216       2709          2         30
 -32         0          0        185       2375          0          0
 -33         0          0        195       2468          0          0
 -34         0          0        192       2423          0          0
 -35         0          0        189       2421          0          0
 -36         0          0        201       2490          2         22
 -37         0          0        198       2521          2         38
 -38         0          0        199       2452          0          0
```

```
-39          0          0          193       2465          0          0
-40          0          0          200       2482          0          0
-41          0          0          196       2496          0          0
-42          0          0          207       2623          0          0
-43          0          0          210       2651          0          0
-44          0          0          216       2638          0          0
-45          0          0          183       2286          0          0
-46          0          0          196       2449          0          0
-47          0          0          196       2496          0          0
-48          0          0          206       2600          0          0
-49          0          0          194       2412          0          0
-50          0          0          194       2435          0          0
-51          0          0          207       2622          0          0
-52          0          0          220       2744          2          30
-53          0          0          169       2212          0          0
-54          0          0          198       2464          2          38
-55          0          0          207       2622          2          30
-56          0          0          196       2499          0          0
-57          0          0          200       2454          0          0
-58          0          0          207       2580          0          0
-59          0          0          204       2567          0          0


PRIME-prime0/0+
```

**Command history:**

| Release | Modification |
|---------|--------------|
| 11.00.06, 11.01.02 | New command added. |

### 3.2.3.4  DC-COMMUNICATION

The DC-COMMUNICATION list option displays information on the communication between the PRIME Gateway and the DLMS/COSEM Data Concentrator. This communication is also known as "DLMS over TCP" or TICKET-67.

The PRIME Gateway keeps two communications: one to the Data Concentrator via TCP session and another to the internal PLC PRIME module.

The list command option shows, separately, information for each data communication path and information about current TCP active connections (whenever they are established).

Enabling this command makes no sense when PRIME Gateway is configured as Service Node, since a direct connection between the Data Concentrator and the Service Node is not possible in this mode.

*Syntax:*

```
PRIME-primeX/Y+list dc-communication
```

*Example:*

This example shows the statistics and connection state of an established Data Concentrator session:

```
PRIME-prime0/0+list dc-communication

---- PRIME DATA TO DC COMMUNICATION ------

---- PLC STATISTICS ------
Data protocol                    : TICKET-67
Connection status                : CON(3)
Connection drops                 : 0
Bytes received from PLC          : 14331
Packets received from PLC        : 312
Bytes sent to PLC                : 12937
Packets sent to PLC              : 290
Bytes received from PLC discarded : 422
Packets received from PLC discard.: 38
PLC 4-32 communication:
 - Data packets sent             : 289
```

```
 - Data packets confirmed OK     : 288
 - Data packets confirmed ERROR  : 0
 - Data packets not confirmed    : 0
 - Data packets retransmissions  : 0
 - Tx Data packets queued        : 1
 - Release packets sent          : 1
 - Release/Joint packts confirmed : 1
 - Release packets not confirmed  : 0
 - Release packets retransmissions: 0


---- TCP DATA STATISTICS ------
 Bytes sent to TCP                : 14287
 Bytes received from TCP          : 13604
 Packets sent                     : 310
 Packets received                 : 403
 Error packets received           : 0
 Error bytes received             : 0
 Errors or congestion detected    : 0

---- TCP CONNECTION STATISTICS ------
 TCP listen port                  : 502
 Opened sessions                  : 2
 Current sessions                 : 1
 Max simultaneous sessions        : 1
 Disconnects received             : 1
 Disconnects transmitted          : 0


---- TCP SESSIONS INFO ------
   STATE    REMOTE IP ADDR. REM.PORT  ESTABLISH TIME    ORIG.
 --------- --------------- -------- ---------------- ------
 ESTAB     192.168.213.157 48560     09:34:32 19/11/25 remote


PRIME-prime0/0+
```

> **Note**
>
> • This command is not necessary when the PRIME Gateway is configured in Service Node mode.

**Command history:**

| Release | Modification |
|---------|--------------|
| 11.00.06, 11.01.02 | New command added. |
| 11.01.08 | 4-32 connection statistics added. |

### 3.2.3.5  FUP

The FUP option displays statistical information on the Firmware Upgrade Protocol (FUP) process. When FUP is running, this command displays information about the current process. If the FUP process is not running but was previously executed, this command shows information on the last process executed.

The PRIME Gateway keeps two communications: one to the FUP application via a TCP session and another to the internal PLC PRIME modem.

The list command option shows, separately, information for each data communication path and information about current TCP active connections (whenever they are established).

Enabling this command makes no sense when PRIME Gateway is configured as Service Node, since a direct connection between the FUP application and the Service Node is not possible in this mode.

*Syntax:*

```
PRIME-primeX/Y+list fup
```

*Example:*

This example shows the statistics and connection state of an established FUP session, as well as the status of the
Service Nodes involved in the process:

```
PRIME-prime0/0+list fup

---- PRIME FUP MONITORING COMMUNICATION ------

---- PLC STATISTICS ------
 Process status                 : UPGRADING(3)
 FUP control process status     : RUNNING(11)
 Bytes received from PLC         : 618
 Packets received from PLC       : 152
 Bytes received from PLC discarded : 0
 Packets received from PLC discard.: 0
 Packets sent to PLC             : 150
 Retransmitted packets to PLC    : 4

---- TCP DATA STATISTICS ------
 Bytes sent to TCP              : 0
 Bytes received from TCP        : 0
 Packets sent                   : 0
 Packets received               : 0
 Error packets received         : 0
 Error bytes received           : 0
 Errors or congestion detected  : 0

---- TCP CONNECTION STATISTICS ------
 Connection status              : DISCONN.(2)
 TCP listen port                : 21400
 Opened sessions                : 0
 Disconnects received           : 0
 Disconnects transmitted        : 0

---- TCP SESSIONS INFO ------
   STATE    REMOTE IP ADDR. REM.PORT  ESTABLISH TIME    ORIG.
 --------- --------------- -------- ---------------- ------
 ESTAB     192.168.213.157 60448    14:27:13 11/12/16 remote

 FUP CURRENT SESSION CONFIGURATION:
 --------------------------------
  FW image CRC          : 0x07c63cbc
  FW image length       : 69760
  Page size             : 64
  Reflash mode          : Unicast
  Seg. unicast timeout  : 3600
  Packet time           : 0
  Sending process timeout: 18000
  Switches delay execut. : Disabled[0]
  Activation timeout     : 600

 FUP CURRENT SESSION STATISTICS:
 --------------------------------
  Num. Tx unicast data packets  : 0
  Num. Tx multicast data packets: 1132
  Num. Tx STATUS packets        : 6
  Num. Rx STATUS packets        : 19
  Num. Tx MISS packets          : 14
  Num. Rx MISS packets          : 7
  Num. Tx CONTROL packets       : 15
  Num. Rx CONTROL packets       : 16

 SN INCLUDED IN LAST FU PROCESS:
 ------------------------------
 Process elapsed time: 81
  MAC             ROLE      LEV. STATE       STATUS      PROGRESS
  --------------- --------- ----- ----------- ------------ -----------
```

```
 40:40:22:68:D4:04 TERMINAL       0 UPGRADING    RECEIVING       712/1090
 40:40:22:68:D4:01 TERMINAL       0 UPGRADING    RECEIVING         0/1090


 Total listed SN: 2



PRIME-prime0/0+
```

The following FUP parameters are listed:

- Process status: indicates the status of the global FUP process. This status value is reported to the remote FUP application when required. The status can take the following values:
  - (a) IDLE
  - (b) RECEIVING
  - (c) RELEASING
  - (d) UPGRADING
  - (e) ACTIVATING SWITCHES

- FUP control process status: indicates the status of the FUP process at the PRIME PLC level. The status can take the following values:
  - (a) STOPPED
  - (b) RUNNING

- PLC statistics: displays several counters on the data exchanged with the PRIME modem.

- TCP data statistics: displays several counters on the data exchanged with the FUP application through a TCP session.

- TCP connection statistics: displays several counters related to the TCP sessions used by the FUP application to connect to the PRIME Gateway. It also displays, if active, some relevant information about the TCP session.

- FUP current session configuration: displays the configuration parameters received from the FUP application to perform the process. When the process is launched from the local console, the configuration parameters are always the same. This information is only displayed if the FUP process is running or said process has been previously executed.

- FUP current session statistics: displays statistical information of messages related to the FUP process exchanged in the PLC network. Listed message types are those defined by the PRIME standard for the FUP process.

- Service Node included in last FUP process: displays information related to the FUP process for each Service Node. The information reported is as follows:
  - (a) MAC: MAC address for the Service Node involved in the FUP process.
  - (b) ROLE: Service Node role in PRIME network: SWITCH or TERMINAL.
  - (c) LEV: level on PRIME network topology for Service Node.
  - (d) STATE: indicates the state of the FUP process for each Service Node. This status value is reported to the remote FUP application when required. It can take the following values: IDLE, CONFIGURED, UPGRADING, UPGRADED, KILLED, ERROR, TIMEOUT, REJECTED and ABORTED.
  - (e) STATUS: indicates the status of the FUP process for each Service Node. This value represents the status of the FUP received from the Service Node, in accordance with the PRIME standard. It can take following values: IDLE, RECEIVING, COMPLETE, COUNTDOWN and UPGRADE.
  - (f) PROGRESS: displays the firmware packets transferred, and the total packets to be transferred, to each Service Node.

> **Note**
>
> - There is no need for this command when the PRIME Gateway is configured in Service Node mode.

**Command history:**

| Release | Modification |
|---|---|
| 11.00.06, 11.01.02 | New command added. |

### 3.2.3.6  PHY-LAYER-EXTENSION

The PHY-LAYER-EXTENSION list option displays information related to the PRIME PHY layer extension over UDP (Ticket#65). Through this command, the state of the PHY layer extension communication can be monitored.

The PHY layer extension feature is operative for the Base Node and Service Node modes.

In Base Node mode, when the PHY layer extension feature is enabled, the PRIME Gateway can access several Service Nodes over UDP. The Base Node sends all datagrams to the Service Nodes that have a record.

In Service Node mode, only one access to the associated Base Node is allowed. The Service Node sends all datagrams to its associated Base Node.

When it comes to the PHY layer extension feature, the PRIME Gateway keeps two communication types: one to its peer/s node/s via UDP datagrams, and another one to the internal PLC PRIME modem.

The list command option shows, separately, information for each data communication path and information about the current UDP status.

*Syntax:*

```
PRIME-primeX/Y+list phy-layer-extension
```

*Example:*

This example shows statistics and the connection state for the PHY layer extension feature:

```
PRIME-prime0/0+list phy-layer-extension


---- PRIME PHY LAYER EXTENSION OVER UDP ------
 Configuration option            : ENABLED(1)
 Connection status               : CONNECT.(3)
 UDP local listen port           : 4567
 Remote SN connection data:
  SN ID name     : REMOTE
    UDP port   : 40038
    IP address : 192.168.213.165



---- PLC STATISTICS ------
 Bytes received from PLC           : 35330344
 Packets received from PLC         : 1378325
 Bytes sent to PLC                 : 14454584
 Packets sent to PLC               : 520709
 Bytes received from PLC discarded : 0
 Packets received from PLC discard.: 0



---- UDP STATISTICS ------
 Bytes sent to UDP                 : 35330362
 Bytes received from UDP           : 14454584
 Packets sent                      : 1378325
 Packets received                  : 520709
 Error packets received            : 0
 Error bytes received              : 0
 Errors or congestion detected     : 0
PRIME-prime0/0+
```

The meaning of the parameters listed is as follows:

• PHY layer extension over UDP. Display the configuration and status that define UDP communications:

  **Configuration option:** Indicates whether the PHY layer extension feature is enabled.

  **Connection status:** Indicates if the PHY layer extension feature is running.

  **UDP local listen port:** Displays active listening UDP port to receive incoming datagrams from the remote node/s.

  **Remote SN connection data:** Displays remote node/s UDP configuration, to send outgoing datagrams to the remote node/s. The configured parameters for each remote node are: NAME, UDP port and IP address. For Service Node mode, only one remote Base Node can appear. For Base Node mode, several remote Service Nodes may appear.

- PLC Statistics: displays several counters on the data exchanged with the PRIME modem.
- UDP statistics: displays several counters on the data exchanged with the peer/s node/s through UDP datagrams.

> **Note**
>
> - The PHY-LAYER-EXTENSION operation is not available in all PRIME devices. Please contact our Technical Service for more information on the devices that support this feature.

**Command history:**

| Release | Modification |
| --- | --- |
| 11.00.06, 11.01.02 | New command added. |

### 3.2.3.7 MODEM-DEBUG-REPORT

The MODEM-DEBUG-REPORT list option displays debugging information linked to the PLC PRIME internal module. This information is usually intended for internal debugging purposes, as it may contain code errors or debugging results. This command also shows information about PLC RAM memory and PLC ZCD (Zero Cross Detector) sensor.

It shows the RAM memory size of the PLC modem and the result of its initial test.

The ZCD sensor generates a square signal, the command shows the time for each level (high and low). The sum of the high an low times should be around 20000 microseconds.

*Syntax:*

```
PRIME-primeX/Y+list modem-debug-report
```

*Example:*

This example shows the outcome of the MODEM-DEBUG-REPORT command:

```
PRIME-prime0/0+ list modem-debug-report

Zero Cross Sensor info:
 - High time:   10576 uSec
 - Low time :    9327 uSec

External SRAM test:
 - Test result:     OK
 - Detected size:   8192 KBytes

Item Date       Time     Debug code
---- ---------- -------- ----------
   1 2019/11/25 09:30:42 0x99da8df2
   2 2019/11/25 09:30:42 0x06f908fb
   3 2019/11/25 09:30:42 0xebff5254
   4 2019/11/25 09:30:42 0x778b6e7f
   5 2019/11/25 09:30:42 0xafe3471b
   6 2019/11/25 09:30:42 0x42d51e5b
   7 2019/11/25 09:30:42 0x09b5b4b6
   8 2019/11/25 09:30:42 0x81245c25
   9 2019/11/25 09:30:42 0x19424c58
  10 2019/11/25 09:30:42 0x5d5bdfbc
  11 2019/11/25 09:30:42 0xd80c0d83
  12 2019/11/25 09:30:42 0xb9b0b9d1
  13 2019/11/25 09:30:42 0x65e9fb14
  14 2019/11/25 09:30:42 0x3916998f
  15 2019/11/25 09:30:42 0x5a435353
  16 2019/11/25 09:30:42 0x00002950
  17 2019/11/25 09:30:42 0x0000246f
  18 2019/11/25 09:30:42 0x5a435345
  19 2019/11/25 09:30:42 0x45525453
  20 2019/11/25 09:30:42 0x00000001
  21 2019/11/25 09:30:42 0x00000000
  22 2019/11/25 09:30:42 0x00800000
  23 2019/11/25 09:30:42 0x45525445
```

```
PRIME-prime0/0+
```

**Command history:**

| Release | Modification |
| --- | --- |
| 11.00.07, 11.01.03 | New command added. |
| 11.01.08 | ZCD and SRAM information added. |

### 3.2.3.8  GLOBAL

The GLOBAL list option displays information relative to the PLC PRIME internal module. Through this command, the state of the PLC module can be monitored.

This command shows the operation mode: Service Node or Base Node.

It also shows current BN frequency channel in use.

For the PRIME module to operate properly, the PRIME MANAGEMENT COMMUNICATION status and the "Interface state" must be up.

This command shows the PRIME firmware version for the PLC module. The PRIME Gateway loads the appropriate firmware depending on the configured operation mode (Base or Service Node) or PRIME release (PRIME 1.3 or PRIME 1.4).

*Syntax:*

```
PRIME-primeX/Y+list global
```

*Example:*

This example shows the GLOBAL command results:

```
PRIME-prime0/0+list global

 Node operation mode : BASE NODE
 Frequency Channel   : 1
 Interface State     : UP(4)
 PLC firmware version : 01.03.10.04-B-F


------ PRIME INTERFACE STATISTICS -----
 Bytes sent to PLC              : 147926
 Bytes received from PLC        : 4707974
 Packets sent to PLC            : 3071
 Packets received from PLC      : 74173
 CRC/LRC error packets PLC      : 0
 Start frame char errors        : 1
 Length error packets           : 0
 Errors or congestion detected  : 0



---- PRIME MANAGEMENT COMMUNICATION ------
 Status                         : UP(16)
 Connection drops               : 0
 Management packets received    : 407
 Management packets sent        : 250
 Network status events received : 2308
 Alive status events received   : 2279
 PLC modem resets performed     : 0


PRIME-prime0/0+
```

**Command history:**

| Release | Modification |
| --- | --- |
| 11.00.06, 11.01.02 | New command added. |

| Release | Modification |
|---------|--------------|
| 11.01.08 | New information added. |

### 3.2.3.9  SNIFFER

The SNIFFER list option displays information relative to the PLC PRIME Sniffer protocol. Through this command, the Sniffer's communication state can be monitored.

The purpose of this command is to monitor the PRIME Sniffer connections and communication.

When it comes to the PRIME Sniffer protocol, the PRIME Gateway keeps two communications: one to the Sniffer Application via a TCP session, and another one to the internal PLC PRIME module.

Sniffer may be accessed by a Sniffer application, through an incoming TCP session, or by the SNMP protocol through an outgoing TCP session. Only one session is allowed. An SNMP session has priority over a Sniffer application session. If Sniffer is enabled and the Gateway receives an SNMP session request, the Sniffer session will be dropped.

This command shows whether the session established is SNMP.

The list command option shows, separately, information for each data communication path and information about current TCP active connections (whenever they are established).

*Syntax:*

```
PRIME-primeX/Y+list sniffer
```

*Example:*

This example shows statistics and the connection state of a Sniffer session established:

```
PRIME-prime0/0+list sniffer


---- PRIME SNIFFER MONITORING COMMUNICATION ------

---- PLC STATISTICS ------
 Connection status               : CONNECT.(5)
 SNMP Sniffer Tx Data            : DISABLED
 SNMP Topology Tx Data           : DISABLED
 SNMP Sniffer Tx Optional Data   : DISABLED
 Sniffer listen port for ext. tool : ENABLED
 Bytes received from PLC          : 18201
 Packets received from PLC        : 309
 Bytes sent to PLC               : 0
 Packets sent to PLC             : 0
 Bytes received from PLC discarded : 0
 Packets received from PLC discard.: 0



---- TCP DATA STATISTICS ------
 Bytes sent to TCP               : 20167
 Bytes received from TCP         : 0
 Packets sent                    : 311
 Packets received                : 0
 Error packets received          : 0
 Error bytes received            : 0
 Errors or congestion detected   : 0

---- TCP CONNECTION STATISTICS ------
 TCP listen port                 : 3333
 Opened sessions                 : 1
 Disconnects received            : 0
 Disconnects transmitted         : 0



---- TCP SESSIONS INFO ------
   STATE    REMOTE IP ADDR. REM.PORT  ESTABLISH TIME    ORIG.
 --------- --------------- -------- ---------------- ------
 ESTAB      192.168.212.33  58027     09:45:18 20/06/16 remote
```

```
PRIME-prime0/0+
```

**Command history:**

| Release | Modification |
|---------|-------------|
| 11.00.06, 11.01.02 | New command added. |

### 3.2.3.10  TOPOLOGY

The TOPOLOGY list option displays information on the topology of the PLC PRIME active network. The PRIME Gateway supports several commands related to PRIME network topology:

- List of firmware versions of Service Nodes.
- Statistics for topology files sent through FTP.
- Network change events stored while waiting to be saved in a topology file.
- Topological structure of the network.

*Syntax:*

```
PRIME-prime0/0+list topology ?
  firmware-sn      Displays the last firmware version for each SNs detected.
  ftp-statistics   Displays the statistics of sending the topology files
                   through FTP
  net-events       Display Network topology Events stored
  sn-devices       Display topology for SN devices detected
```

**Command history:**

| Release | Modification |
|---------|-------------|
| 11.00.06, 11.01.02 | New command added. |

#### 3.2.3.10.1  FIRMWARE-SN

The FIRMWARE-SN list option lists the PRIME Service Nodes that have an active data connection to the Base Node and, where obtained, their firmware versions. The command displays information on all connected Service Nodes, or on a specific number thereof.

This command displays the following fields:

- STATE: Indicates the Service Node's state (SWITCH or TERMINAL).
- MAC: Indicates the Service Node's MAC address.
- SERIAL/NUMBER: Indicates the Service Node's serial number.
- FW VERSION: Indicates the Service Node's PRIME firmware version.

*Syntax:*

```
PRIME-prime0/0+list topology firmware-sn ?
  <1..749>   Max. number of SN to display
  <cr>       Display all SN stored
```

*Example:*

This example shows a list of several Service Nodes with their PRIME firmware version:

```
PRIME-prime0/0+list topology firmware-sn

 Service NodeS FW VERSION LIST:
 ----------------------------
 State    MAC                SERIAL/NUMBER     FW VERSION
 -------- ---------------- ---------------- -----------------
 terminal 40:40:22:68:D4:03 ZIV0040424451     2.2.0.3.4559
 terminal 40:40:22:68:D4:07 ZIV0040424455     9.2.0.3.4403
 terminal 40:40:22:68:D4:06 ZIV0040424454     9.2.0.3.4403
 terminal 40:40:22:70:58:AC ZIV0040917164     9.2.0.3.4403
 terminal 40:40:22:70:58:AD ZIV0040917165     9.2.0.3.4403
```

```
terminal 40:40:22:68:D4:08 ZIV0040424456     9.2.0.3.4403
terminal 40:40:22:68:D4:05 ZIV0040424453     9.2.0.3.4403
terminal 40:40:22:70:58:AE ZIV0040917166     9.2.0.3.4403
terminal 00:80:E1:34:E1:5F LGZ0031458326     00-2403t
switch   00:80:E1:34:E1:AF LGZ0031458327     00-2403t
terminal 40:40:22:68:D4:01 ZIV0040424449     2.2.0.3.4403
terminal 40:40:22:68:D4:04 ZIV0040424452     2.2.0.3.4403
terminal 40:40:22:68:D4:02 ZIV0040424450     9.2.0.3.4403
terminal 00:80:E1:2F:9A:AC CIR0141604122     00-2201a
terminal 00:80:E1:2F:B0:87 CIR0141604121     00-2201a
switch   00:A0:26:92:00:0D                    01.03.10.02-A-S


Total listed SN: 16



PRIME-prime0/0+
```

> **Note**
> • There is no need for this command when the PRIME Gateway is configured in Service Node mode.

**Command history:**

| Release | Modification |
|---------|--------------|
| 11.00.06, 11.01.02 | New command added. |
| 11.01.06 | The "firmware-sn" command was previously misspelled ("firware-sn") and, from now on, is shown correctly. |

### 3.2.3.10.2  FTP-STATISTICS

This command displays detailed status and statistical information on FTP transfers of topology files.

The information obtained using this command can help detect some problems related to FTP server communication.

*Syntax:*

```
PRIME-prime0/0+list topology ftp-statistics ?
  <cr>
```

*Example:*

```
PRIME-prime0/0+list topology ftp-statistics

Active configuration parameters:
 File management        : Enabled
 FTP server ip address  : 192.168.212.33
 FTP server port        : 21
 File send time         : 60 seconds
 File max lines         : 100
 File FTP remote path    : prime
 File name prefix       : topology
 FTP connection user    : admin
 FTP connection password : hsdudx

File transfer statistics:
 File trans. in progress : NOT
 File in progress name  :
 Waiting for Retransm.   : NOT
 Retrans. remaining tries: 0
 Num. success transfers  : 2
 Last success file       : topology_20160720_102553.csv
 Num. of failed transfers: 114
 Last failed file        : topology_20160720_090816.csv
 Last failure error cause: 0x02 (Connection error)


PRIME-prime0/0+
```

> **Note**
> • There is no need for this command when the PRIME Gateway is configured in Service Node mode.

**Command history:**

| Release | Modification |
|---------|--------------|
| 11.00.06, 11.01.02 | New command added. |

### 3.2.3.10.3  NET-EVENTS

The TOPOLOGY NET-EVENTS list option displays the state changes in events waiting to be saved in a topology event file.

The current events showed will be stored in a topology event file when file timeout occurs.

This command may show all pending events or a specific number thereof.

*Syntax:*

```
PRIME-prime0/0+list topology net-events ?
  <1..3999>    Number of Events to display
  <cr>         Display all Events stored
```

*Example:*

This example shows a list of changes in the state of an event:

```
PRIME-prime0/0+list topology net-events

Item Date       Time     SN MAC            Father MAC        SN State     Q   BN_MAC
---- ---------- -------- ----------------- ----------------- ------------ --- -----------------
   1 2019/11/24 08:17:26 00:80:E1:34:E1:5F 00:A0:26:8C:00:15 switch       98  00:A0:26:8C:00:15
   2 2019/11/24 08:19:50 40:40:22:70:58:AE 00:A0:26:8C:00:15 terminal     97  00:A0:26:8C:00:15
   3 2019/11/24 08:23:12 40:40:22:70:58:AD 00:A0:26:8C:00:15 terminal     98  00:A0:26:8C:00:15
   4 2019/11/24 08:23:12 40:40:22:70:58:AE 00:A0:26:8C:00:15 switch       97  00:A0:26:8C:00:15
   5 2019/11/24 08:23:52 40:40:22:70:58:AC 40:40:22:70:58:AE terminal     99  00:A0:26:8C:00:15
   6 2019/11/24 08:24:13 40:40:22:68:D4:05 00:A0:26:8C:00:15 disconn.     96  00:A0:26:8C:00:15
   7 2019/11/24 08:28:12 00:80:E1:34:E1:5F 00:A0:26:8C:00:15 terminal     97  00:A0:26:8C:00:15
   8 2019/11/24 08:28:43 40:40:22:70:58:AC 40:40:22:70:58:AE disconn.     99  00:A0:26:8C:00:15

PRIME-prime0/0+
```

> **Note**
> • There is no need for this command when the PRIME Gateway is configured in Service Node mode.

**Command history:**

| Release | Modification |
|---------|--------------|
| 11.00.06, 11.01.02 | New command added. |

### 3.2.3.10.4  SN-DEVICES

The TOPOLOGY SN-DEVICES list option displays the topological structure of all Service Nodes registered, at one point, in the PRIME Gateway.

The list of Nodes is organized by levels, based on the number of switches that a Service Node has in the path to access the Base Node.

This command may show all Service Nodes or a specific number thereof.

For the Service Node mode operation, this command only shows the Base Node itself and the nodes that depend on it and are operating as SWITCH. The information for this operation mode is minimal.

*Syntax:*

```
PRIME-prime0/0+list topology sn-devices ?
  <1..749>    Max. number of SN to display
  <cr>        Display all SN stored
```

*Example:*

In the following example, the command executed on a PRIME Gateway configured as Base Node, shows a topological list of Service Nodes:

```
PRIME-prime0/0+list topology sn-devices

 BASE NODE Info:
 ---------------
 State        MAC              CHANNEL LNID   DISC UP-TIME     CNX-TIME
 ------------ ---------------- ------- ------ ---- ----------- -----------
 Running      00:A0:26:96:00:06      1 0x0000    0    1:49:11     1:49:11

 SERVICE NODES network topology:
 -----------------------------
 NETWORK LEVEL: 0
 State    MAC              LNID   SID  LSID Qlt TxALV RxALV ALV-T DISC UP-TIME     %    CNX-TIME
 -------- ---------------- ------ ---- ---- --- ----- ----- ----- ---- ----------- ---- -----------
 terminal 00:80:E1:2F:B0:87 0x1778 0x00 0xff  97   311   302   256    0    1:46:13 97.2    1:46:13
 switch   40:40:22:68:D4:08 0x1777 0x00 0x06  96   314   304   256    0    1:47:05 98.0    1:47:05
 switch   40:40:22:70:58:AD 0x1774 0x00 0x04  98   311   307   256    0    1:47:15 98.2    1:47:15
 terminal 40:40:22:68:D4:02 0x1773 0x00 0xff  96   318   306   256    0    1:47:28 98.4    1:47:28
 terminal 00:80:E1:34:E1:5F 0x1771 0x00 0xff  98   317   313   256    0    1:49:09 100     1:49:09

 NETWORK LEVEL: 1
 State    MAC              LNID   SID  LSID Qlt TxALV RxALV ALV-T DISC UP-TIME     %    CNX-TIME
 -------- ---------------- ------ ---- ---- --- ----- ----- ----- ---- ----------- ---- -----------
 terminal 40:40:22:68:D4:07 0x177b 0x06 0xff  80   312   250   256    0    1:34:09 86.2    1:34:09
 terminal 40:40:22:70:58:AC 0x177a 0x06 0xff  80   310   251   256    0    1:34:10 86.2    1:34:10
 terminal 00:80:E1:2F:9A:AC 0x1779 0x06 0xff  83   312   261   256    0    1:37:19 89.1    1:37:19
 terminal 40:40:22:70:58:AE 0x1775 0x04 0xff  77   340   263   256    0    1:40:02 91.6    1:40:02
 terminal 00:80:E1:34:E1:AF 0x1772 0x06 0xff  87   308   270   256    1    1:39:06 90.7    1:32:16
 terminal 40:40:22:68:D4:06 0x1776 0x04 0xff  83   345   288   256    1    1:45:49 96.9    1:33:36


Total listed SN: 11
 Terminals:  9
 Switches:   2
 Disconnec.: 0

PRIME-prime0/0+
```

In the following example, the command executed on a PRIME Gateway configured as Service Node, shows a topological list of Service Nodes operating in SWITCH mode. The switch on level 0 represents the current PRIME Gateway:

```
PRIME-prime0/0+list topology sn-devices

 BASE NODE Info:
 ---------------
 State        MAC              LNID   DISC UP-TIME     CNX-TIME
 ------------ ---------------- ------ ---- ----------- -----------
 Connected    00:A0:26:92:00:09 0x0000    0   119:38:39   119:38:39

 Service NodeS network topology:
 -----------------------------
 NETWORK LEVEL: 0
 State    MAC              LNID   SID  LSID DISC UP-TIME     CNX-TIME
 -------- ---------------- ------ ---- ---- ---- ----------- -----------
 switch   00:A0:26:92:00:0D 0x37ac 0x00 0x01    0   119:38:40   119:38:40

 NETWORK LEVEL: 1
 State    LSID %    CNX-TIME
```

```
 -------- ---- ---- -----------
 switch   0x0f 58.7    70:14:07


Total listed SN: 2

PRIME-prime0/0+
```

Each field has the following meaning:

- **STATE:** Current state for a specific node. Service Nodes can have the following states: terminal, switch or disconnect. The Base Node can take the following states: stopped or running.
- **MAC**: Node MAC (Medium Access Control) address.
- **CHANNEL**: Frequency channel operation (for BN only).
- **LNID**: Local Node Identifier in PRIME network
- *SID*: Switch Identifier where the Service Node is connected. The value of this field is 0x00 for Service Nodes that are directly connected to the Base Node.
- **LSID**: Local Switch Identifier, identifies a Switch on Service Nodes that have a SWITCH role.
- **Qlt**: Quality, represents a correlation between the alive frames transmitted and received. Expressed in %.
- **TxALV**: Alive frames transmitted.
- **RxALV**: Alive answer frames received.
- **ALV-T**: Amount of time in seconds that the system waits for an ALV answer message before assuming that the Service Node has been unregistered by the Base Node. Can take the following values: 32, 64, 128, 256, 512, 1024, 2048, 4096.
- **DISC**: Number of disconnections detected at the MAC layer level.
- **UP-TIME**: Total amount of time that the Node is in a connected state (Terminal or Switch).
- **%**: UP-TIME percentage regarding Base Node UP-TIME.
- **CNX-TIME**: Amount of time that the Node remains in a connected state (Terminal or Switch) in the current active connection. This time is 00:00:00 if the connection is not active.

**Command history:**

| Release | Modification |
| --- | --- |
| 11.00.06, 11.01.02 | New command added. |

### 3.2.4  RESET

The RESET command performs a hardware reset of the PLC PRIME module. This means that the PLC module can be reset without having to reset the whole router.

The RESET command controls the hardware reset signal in the PLC module. This way, the PLC module can be completely disabled or restarted.

To restart the PLC module, please enter the RESET ON command followed by the RESET OFF one.

To disable the PLC module, enter the RESET ON command only.

*Syntax:*

```
PRIME-primeX/Y+reset ?
  off    Deactivate hardware reset
  on     Activate hardware reset
```

*Example:*

```
PRIME-prime0/0+reset on
Are you sure to activate HW reset to PLC(Yes/No)? Y

    PLC modem in reset state

PRIME-prime0/0+
PRIME-prime0/0+reset off

    PLC modem activated
```

```
PRIME-prime0/0+
```

**Command history:**

| Release | Modification |
| --- | --- |
| 11.00.06, 11.01.02 | New command added. |

## 3.2.5  UPGRADE-FIRMWARE

The UPGRADE-FIRMWARE command is used to change the firmware version that is running in the internal PLC PRIME module. The PLC PRIME module firmware is independent of the one running on the PRIME Gateway. That is, it has two separate firmwares.

See *Upgrading PRIME Firmware* on page 56 for more detailed information.

*Syntax:*

```
PRIME-primeX/Y+upgrade-firmware [yes]
```

• optional parameter **yes** allows the device to run an operation without prompting the user to confirm first. If this parameter is set to **yes**, no such confirmation is required. If not, the device prompts the user for confirmation.

*Example:*

```
PRIME-prime0/0+upgrade-firmware
Upgrade file release detected: 01.03.10.02-A-M


Are you sure to upgrade the module(Yes/No)? y

Upgrade in progress
        Progress: End.............: 100%
        Upgrade successful
PRIME-prime0/0+
```

> **Note**
>
> • There is no need for this command when the PRIME Gateway is configured in Service Node mode.

**Command history:**

| Release | Modification |
| --- | --- |
| 11.00.06, 11.01.02 | New command added. |
| 11.01.06 | The "[yes]" option was added as of version 11.01.06 |

# Chapter 4  Upgrading PRIME Firmware

## 4.1  Introduction

Given the ongoing optimization of PLC PRIME technology, upgrading the PLC module must be possible in order to offer the latest available features.

PRIME interfaces are equipped with a mechanism for PLC PRIME firmware upgrading.

Simply follow these steps:

• Obtain the upgraded software.
• Transfer the software to the device through FTP.
• Load it in the PLC PRIME module.

## 4.2  Procedure

### 4.2.1  Obtaining the upgrade

To carry out firmware upgrading, you need the loading file that matches the module that requires upgrading. Similarly, you also need information on the type and version of the installed module to determine which firmware versions are compatible.

The user may obtain firmware for various models of PLC modules, as well as the possible versions for each, from our Technical Service. Please contact our Technical Service and give them all the information on the module. This information can be found on the device monitoring console. There are several firmware versions for the PRIME module in base to device model: Base Node to support 30 Service Nodes, Base Node to support 150 Service Nodes, Base Node to support 750 Service Nodes, Base Node to support 2000 Service Nodes, Service Nodes compatible with PRIME version 1.36, compatible with PRIME version 1.4, etc.

*Example:*

```
+configuration

Teldat's Router, Regesta-Smart-PLC S/N: 914P/00101
SWL:BASE PLC_2000SN UART USB_INTERNAL
Profile: none
ID:  Regesta-Smart-PLC

Boot ROM release:
 BIOS CODE VERSION: 01.07  Nov 25 2019 13:26:09 L0

System Info:
PCB:0x411 Regesta-Smart-PLC SYS:0x000B REV:0x2
CLKs: CPU=500 FBS1=250 FBS2=250 DDR(clk)=250 LBUS=250
Watchdog:Enabled
Cache:ON Write-Back
Time Base: frequency = 250000 KHz period = 4.000 ns
CPU temperature: 43 C
BOARD temperature: 31 C

Software release: 11.01.08 Nov 22 2019 08:56:37
Compiled by    integrator on ares.id.teldat.com
Loaded from primary partition

Hostname:                   Active user:
Date:  Saturday, 01/01/00    Time: 02:13:57
Router uptime: 2h13m27s

Name     Protocol
IP       Internet Protocol
IP6      IPv6
ARP      Address Resolution Protocol
CFM      Connectivity Fault Management
```

```
ASRT      Adaptive Source Routing Transparent Enhanced Bridge
DLS       Data Link Switching
dot1X     Extensible Authentication Protocol Over LAN
RIP       Route Information Protocol
OSPF      Open SPF-Based Routing Protocol
BGP       BGP
BFD       Bidirectional Forwarding Detection
NHRP      Next Hop Resolution Protocol
DHCP      Dynamic Host Configuration Protocol
L2TP      L2TP
SNMP      SNMP
IGMP      Internet Group Management Protocol
PIM       Protocol Independent Multicast
MSDP      Multicast Source Discovery Protocol
GW104     Gateway IEC 104/101
SIP       SIP
H323      H323
NOE       UA/NOE
SCCP      SCCP
RPNG      RIPng
OSPFv3    OSPFv3
DHCPv6    DHCPv6

9 interfaces:
Connector     Interface          MAC/Data-Link      Status
SFP-WAN       ethernet0/0        Ethernet/IEEE 802.3  Up
LAN           ethernet0/1        Ethernet/IEEE 802.3  Testing
PLC-PW        prime0/0           PRIME interface    Up
SERIAL1       uart1/0            AHDLC              Testing
SERIAL2       uart1/1            AHDLC              Testing
ANT1          cellular1/0        Async serial line  Down
ANT1          cellular1/1        NIC interface      Down
ANT1          cellular1/2        NIC interface      Down
---           direct-ip1         DirectIP interface  Down

SNMP OperStatus:
Interface          OperStatus
ethernet0/0        Up
ethernet0/1        Down
prime0/0           Up
uart1/0            Down
uart1/1            Down
cellular1/0        Down
cellular1/1        Down
cellular1/2        Down
direct-ip1         Lower layer down

Hardware Encryption Engine: LTQ-DEU xRX200 Family, Revision 5
Cellular Driver Version:

WLAN Driver Version: 9.5.0.35.1
```

Depending of the model, the PRIME Gateway should always have several firmwares loaded on its disk.

For example Regesta Compact PLC must include two firmwares: one for Service Node mode and one for Base Node mode. For Regesta Smart PLC must also include two firmwares: one for Base Node operation with PRIME 1.3 release and one for Base Node operation with PRIME 1.4 release.

When an upgrade process is performed, the PRIME Gateway loads the firmware according to the configured node mode or PRIME release. Therefore, before launching an upgrade process, care must be taken to ensure that the firmware to be upgraded is appropriate for the selected node mode or PRIME release.

Some license limits may cause an error in the upgrade process. For example, to upgrade the firmware of a Base Node that supports 2000 Service Nodes, the device must include the license to support 2000 Service Nodes.

Through the firmware version, you can identify the specific type to which it belongs. The last digit identifies the type of node and, in the case of a Base Node, the number of Service Nodes supported. The following examples show how the firmware versions are named:

- Firmware version for a Base Node mode supporting up to 30 Service Nodes (for Regesta Compact PLC only): 01.03.10.02-A-L

  The "-L" character indicates that the firmware is for these type of Base Nodes.

- Firmware version for a Base Node mode supporting up to 150 Service Nodes (for Regesta Smart PLC only): 01.03.10.02-A-R

  The "-R" character indicates that the firmware is for these type of Base Nodes.

- Firmware version for a Base Node mode supporting up to 750 Service Nodes(for Regesta Comact PLC only): 01.03.10.02-A-M

  The "-M" character indicates that the firmware is for this type of Base Node. Note that this firmware version requires the PRIME Gateway to include the corresponding license.

- Firmware version for a Base Node mode supporting up to 2000 Service Nodes(for Regesta Smart PLC only): 01.03.10.04-B-F

  The "-F" character indicates that the firmware is for this type of Base Node. Note that this firmware version requires the PRIME Gateway to include the corresponding license.

- Firmware version for Service Node mode: 01.03.10.02-A-S

  The "-S" character indicates that the firmware is for this Service Node type.

The file containing the new module firmware has a *.BFW extension.


## 4.2.2  Transferring to the device

When it comes to upgrading the device software or loading firmware for internal devices, users have an FTP server they can transfer files to. This server is only accessible if the device has started up correctly (application executed).

Follow these steps to upgrade:

(1)   Load the upgrade file in a directory of the device where you are going to launch the FTP session.

(2)   To carry out upgrading, your device needs enough memory space to store the file.
         For further information, please see Teldat manual .

(3)   Connect to the device's FTP server (**default is** user **root** and no password).

(4)   Configure the binary mode through the **bin** command.

(5)   Transfer the file containing the firmware using the  **put myfmwr.bfw** command.

(6)   Once the transfer is complete, save the file in the system's disc using the  **quote site savebuffer** command.

(7)   Once saving is complete, disconnect using the **bye** command.

```
C:\tmp> ftp 192.168.213.152
Connected to 192.168.213.152.
220 FTP server ready, 1 active clients of 4 simultaneous clients allowed.
Name (192.168.213.152): root
331 User name accepted, need password.
Password:
230 User login complete.
ftp> has
Hash mark printing on (1024 bytes/hash mark).
ftp> bin
200 TYPE is set to IMAGE.
ftp> put myfmwr.bfw
local: myfmwr.bfw remote: myfmwr.bfw
200 PORT is set to IP ADDR = 192.168.212.7  PORT = 49677
150 Data connection open, checked file transfer in process...
############################################################################################
226 STOR completed, 100352 bytes processed, data connection is closed.
100352 bytes sent in 0.06 secs (1629.3 kB/s)
ftp> quote site savebuffer
200 SAVEBUFFER completed O.K.
ftp> bye
221 Goodbye.
C:\tmp>
```

### 4.2.3 Upgrading the module

(1) In order for the module to update as described in the chapter on monitoring, access the PRIME interface (**primeX/Y**) monitoring menu.

(2) Execute the **upgrade-firmware** command to start loading. If you have not preloaded the upgrade file in the system's disc, you will receive an error message.

```
PRIME-prime0/0+upgrade-firmware
Upgrade file release detected: 01.03.10.02-A-M


Are you sure to upgrade the module(Yes/No)? y


Upgrade in progress
        Progress: End..............: 100%
        Upgrade successful
PRIME-prime0/0+
```

(3) Wait until the process is complete. During said process, indications and messages appear to show the progress and state of the upgrading.

> **Note**
>
> Do not, under any circumstances, switch off or restart the device during this process.

> **Note**
>
> This process can take tens of seconds.

(4) Check this is the correct version through the interface **list** command.

*Example:*

```
PRIME-prime0/0+list global

 Node operation mode : BASE NODE
 Frequency Channel    : 1
 Interface State      : UP(4)
 PLC firmware version : 01.03.10.04-A-F


------ PRIME INTERFACE STATISTICS -----
Bytes sent to PLC                : 53541
Bytes received from PLC          : 62097
Packets sent to PLC              : 1131
Packets received from PLC        : 2500
CRC/LRC error packets PLC        : 0
Errors or congestion detected    : 0



---- PRIME MANAGEMENT COMMUNICATION ------
Status                           : UP(9)
Connection drops                 : 0
Management packets received      : 182
Management packets sent          : 0
Network status events received   : 234
Alive status events received     : 223
PLC modem resets performed       : 0

PRIME-prime0/0+
PRIME-prime0/0+
PRIME-prime0/0+
PRIME-prime0/0+upgrade-firmware
 Upgrade file release detected:  01.03.10.04-B-F


Are you sure to upgrade the module(Yes/No)? y


Upgrade in progress
        Progress: End..............: 100%
```

```
        Upgrade successful

PRIME-prime0/0+
PRIME-prime0/0+list global

 Node operation mode : BASE NODE
 Frequency Channel   : 1
 Interface State : UP(4)
 PLC firmware version :  01.03.10.02-B-M

------ PRIME INTERFACE STATISTICS -----
Bytes sent to PLC               : 53541
Bytes received from PLC         : 62097
Packets sent to PLC             : 1131
Packets received from PLC       : 2500
CRC/LRC error packets PLC       : 0
Errors or congestion detected   : 0



---- PRIME MANAGEMENT COMMUNICATION ------
Status                          : UP(9)
Connection drops                : 0
Management packets received     : 182
Management packets sent         : 0
Network status events received  : 234
Alive status events received    : 223
PLC modem resets performed      : 0

PRIME-prime0/0+
```

> **Note**
>
> Progress information presented on the router console can differ from that shown in this example.

# Chapter 5  Examples

## 5.1  PRIME basic with Sniffer enabled

In this example, a basic configuration example for a PRIME Gateway associated with the Sniffer feature is shown. This example shows a configuration for devices that support the PRIME interface, as used typically in utilities.

The following configuration elements are set:

(1)  Cellular interface connection, through a "direct-ip" interface.

(2)  Ethernet connection.

(3)  IP basic routing for access through cellular interface.

(4)  The PRIME interface configuration (including configuration to access Sniffer data through an incoming TCP session, launched from an external application). The topology files sent through the FTP feature are included too.

   • Base Node Mode.

   • PLC signal enabled.

   • Configuration to access Sniffer data through an incoming TCP session, launched from an external application

   • Topology files sent through the FTP feature.

   • PHY layer extension.

```
   log-command-errors
   no configuration
   set inactivity-timer disabled
   add device direct-ip 1
   set data-link at cellular1/0
   set data-link nic cellular1/1
   global-profiles dial
; -- Dial Profiles Configuration --
     profile OPERATOR default
     profile OPERATOR dialout
     profile OPERATOR 3gpp-apn operator.com
;
   exit
;
;
   network ethernet0/0
; -- Ethernet Interface User Configuration --
     ip address 192.168.1.123 255.255.0.0
;
;
   network prime0/0
; -- PRIME Interface Configuration --
     plc-signal enable
     sniffer local-tcp-port 3333
     sniffer control enable
     topology ftp-server-ip 1.1.1.1
     topology ftp-server-port 1234
     topology file-time 1200
     topology file-max-lines 1000
     topology file-path topology
     topology file-prefix prime
     topology ftp-cnx-user admin
     topology ftp-cnx-password hsdudx
     topology enable
   exit
;
   network cellular1/0
; -- Interface AT. Configuration  --
     coverage-timer 10
     no register-denied-reset
     pin ciphered 0xC8155E104D247110
;
```

```
      network mode automatic
      network domain cs+ps
   exit
;
;
   network direct-ip1
; -- Generic Direct IP Encapsulation User Configuration --
      ip address dhcp-negotiated
;
      base-interface
; -- Base Interface Configuration --
         base-interface cellular1/1 link
         base-interface cellular1/1 profile OPERATOR
;
      exit
;
      direct-ip
; -- Direct IP encapsulator user configuration --
         address dhcp
         authentication sent-user EKCIDR ciphered-pwd 0x34CF78A8952A56D5
      exit
;
   exit
;
;
;
   protocol ip
; -- Internet protocol user configuration --
      route 0.0.0.0 0.0.0.0 direct-ip1
;
      rule 1 local-ip direct-ip1 remote-ip any
      rule 1 napt translation
;
      no icmp-redirects
   exit
;
;
;
;
;
   feature ntp
; -- NTP Protocol user configuration --
      protocol
      peer address 1 130.206.0.1
   exit
;
   dump-command-errors
   end
```

# Chapter 6  Annex A. SNMP data formats

Several commands can be triggered using the SNMP protocol and force the Gateway to start some session transfers.This annex describes the data format for these transfers.

## 6.1  Sniffer format for SNMP managed TCP sessions

The PRIME Gateway may activate the sniffer protocol option through SNMP. This Sniffer data format is used for outgoing TCP sessions and for requests made through SNMP commands.

For this purpose, the following objects are available for read-write operations.

- Enable Sniffer – Integer (0 or 1)
- Enable Sniffer Optional Fields – Integer (0 or 1)
- Destination Address – IPAddress
- Destination Port – Integer32

When the PRIME Gateway receives a "1" value for the Enable Sniffer object, it activates the Sniffer option (sending every MAC PDU encapsulated in TCP to the destination address-port indicated by the corresponding objects). If the Enable Sniffer Optional Fields object is also set to 1, the information will include optional fields.

This command is compatible with an SNMP topology session, meaning both can be activated at the same time. Both share the destination Address and Port.

The protocol used to transmit the sniffed traffic is a custom simple binary protocol encoded in Big Endian. The protocol encapsulates messages that have a fixed message format. The header is shared with the Topology protocol. The basic message has the following format:

| 4 bytes | 1 byte | "Length" byte |
|---|---|---|
| **Length** | **Type** | **Payload** |

The meaning of the foregoing fields is as follows:

- **Length**: is the length of the payload. Messages are encoded sequentially and multiplexed using this length.
- **Type**: is the type of message. There are currently 3 types of messages: MAC PDU, reception and transmission, and topology.

The types of messages that can be carried now are the following:

| Message Type | Identifier |
|---|---|
| **MAC_TX** | 0 |
| **MAC_RX** | 1 |
| **TOPOLOGY** | 2 |

For MAC_TX and MAC_RX messages, the payload will have the following format:

| 4 bytes | 5 bytes | 2 bytes | 2 byte | Length | -- |
|---|---|---|---|---|---|
| **Time Counter** | **Date and Time** | **PHY INFO** | **Length** | **PDU** | **Optional Fields** |

- **Time Counter:** is a time counter of 10 microseconds that overflows every 12 hours approximately.
- **Date and Time**: number of seconds since 00:00 (midnight) 1 January, 1970 GMT.
- **PHY Info**:

| Bits | Type | Description |
|---|---|---|
| 15 | Optional Fields | 1 if optional fields are present, 0 otherwise |
| 14 | Interface | 1 if PLC, 0 other. If 0, SNR, Power and Encoding are not valid |
| 10-13 | Reserved | |

| 7-9 | Encoding | PDU encoding: |
|---|---|---|
| | | 0: D8PSK |
| | | 1: DQPSK |
| | | 2: D8PSK |
| | | 4: DBPSK_CC |
| | | 5: DQPSK_CC |
| | | 6: D8PSK_CC |
| 4-6 | SNR | Signal to Noise ratio in which this message was received (only reception) as defined in the PRIME standard: |
| | | 0: # 0 dB |
| | | 1: # 3 dB |
| | | 2: # 6 dB |
| | | 3: # 9 dB |
| | | 4: # 12 dB |
| | | 5: # 15 dB |
| | | 6: # 18 dB |
| | | 7: > 18 dB |
| 0-3 | Power | For RX: Reception power in which this message was received (only reception) as defined in PRIME: |
| | | 0: # 70 dBuV |
| | | 1: # 72 dBuV |
| | | 2: # 74 dBuV |
| | | ..... |
| | | 15: > 98 dBuV |
| | | For TX: |
| | | 0: Maximal output level (MOL) |
| | | 1: MOL -3 dB |
| | | 2: MOL -6 dB |
| | | ..... |
| | | 7: MOL -21 dB |

- **Length**: the length of the PDU payload.
- **PDU**: the MAC PDU buffer.
- **Optional fields**: optional information for each MAC PDU. This field can contain several fields with the following format.

| 1 byte | 1 byte | Field length |
|---|---|---|
| FIELD ID | FIELD LENGTH | DATA |

The following are some pre-defined optional fields:

| Field ID | Length | Type | Description |
|---|---|---|---|
| 0 | 4 | PHY Rx details | Signal to Noise ratio in which this message was received |

| | | | |
|---|---|---|---|
| | | | in 0.1 dB steps. Reception power in which this message was received (only reception) in 0.1 dBuV steps |
| 1 | * | IFACE | Text representation of the interface through which this message was received/transmitted: e.g: plc1, plc3 |
| 2 | 6 | EUI-48 | MAC Address of the Service Node used for PDU transmission (if uplink) and destination (if downlink). |
| 3 | 4 | Duration | The duration of the PDU in 10s of microseconds. |
| 255 | * | Vendor Specific | Content of this field is vendor specific. The first two bytes in data shall contain the AppVendorId. Vendors should follow a similar field structure (entering the Field Id, Length and Data inside the Vendor Specific field). |

## 6.2  Topology format for SNMP managed TCP sessions

The PRIME Gateway may activate a topology protocol option through SNMP. This topology data format is used for outgoing TCP sessions and for requests made through SNMP commands.

For this purpose, the following objects are available for read/write operations.

- Enable Topology – Integer (0 or 1)
- Destination Address – IPAddress
- Destination Port – Integer32

When the PRIME Gateway receives a "1" value for the Enable Topology object, it activates the topology option sending every topology change encapsulated in TCP to the destination-address port indicated by the corresponding objects.

This command is compatible with an SNMP Sniffer protocol session, meaning both can be activated at same time. Both share the destination Address and Port.

The protocol used to transmit the sniffed traffic is a custom simple binary protocol encoded in Big Endian. The protocol encapsulates messages that have a fixed message format. The header is shared with the Sniffer protocol. The basic message has the following format:

| 4 bytes | 1 byte | "Length" byte |
|---|---|---|
| **Length** | **Type** | **Payload** |

The meaning of the foregoing fields is as follows:

- **Length**: is the length of the payload. Messages are encoded sequentially and multiplexed using this length.
- **Type**: is the type of message. There are currently 3 types of messages: MAC PDU, reception and transmission, and topology.

The types of messages that can be carried now are the following:

| Message Type | Identifier |
|---|---|
| **MAC_TX** | **0** |
| **MAC_RX** | **1** |
| **TOPOLOGY** | **2** |

For TOPOLOGY messages, the payload will have the following format:

| 4 bytes | 5 bytes | 6 bytes | 1 byte | 2 bytes | 1 byte | 1 byte |
|---|---|---|---|---|---|---|
| **Time Counter** | **Date and Time** | **EUI-48** | **SID** | **LNID** | **STATE** | **SSID** |

- **Time Counter:** is a time counter of 10 microseconds that overflows approximately every 12 hours.
- **Date and Time**: number of seconds since 00:00 (midnight) 1 January, 1970 GMT.
- **EUI-48**: MAC Address of the Service Node.
- **SID**: Switch Identifier of the parent. 0 if directly connected to the Base Node.
- **LNID**: LNID of the Service Node.
- **STATE** : State of the Service Node as defined in the PRIME Specification:

    **0**: Disconnected

    **1**: Terminal

    **2**: Switch

    **3**: Base
- **SSID**: Switch Identifier if the Service Node is in Switch mode.

# Chapter 7  Annex B. Topology file

The PRIME Gateway can collect, in real time, topological data belonging to the PRIME network associated with the Base Node. This information is stored in files that can be sent to a server via FTP. These files contain the changes in state of the Service Nodes that are part of the PLC network.

This annex shows the format used to store topological events in the file.

## 7.1  File format

The topology event file is made up of a text file that includes several fields separated by semicolons.

The following fields shall be listed in order:

(a)  Date and Time: **yyyy/mm/dd hh:mm:ss** (note there is a blank space between date and time)
(b)  Semicolon
(c)  MAC address of Service Node
(d)  Semicolon
(e)  MAC address of Father Node (Switch or Base Node)
(f)  Semicolon
(g)  State of Service Node (disconnected, terminal or switch )
(h)  Semicolon
(i)  Connection quality (i.e., the percentage of success in keeping *alive* messages for the Service Node).
(j)  Semicolon
(k)  MAC address of the Base Node to which the Service Node is connected.

The following is an example of a topology file:

2013/02/05 10:28:56;40:40:22:29:14:73;40:40:22:01:9f:f0;disconnected;0;40:40:22:01:9f:f0

2013/02/05 10:28:58;40:40:22:29:14:73;40:40:22:01:9f:f0;terminal;0;40:40:22:01:9f:f0

2013/02/05 10:28:59;40:40:22:29:14:97;40:40:22:01:9f:f0;disconnected;0;40:40:22:01:9f:f0

2013/02/05 10:28:59;40:40:22:29:14:97;40:40:22:01:9f:f0;terminal;0;40:40:22:01:9f:f0

2013/02/05 10:28:59;40:40:22:3a:87:2d;40:40:22:01:9f:f0;disconnected;0;40:40:22:01:9f:f0

2013/02/05 10:28:59;40:40:22:3a:87:2d;40:40:22:01:9f:f0;terminal;0;40:40:22:01:9f:f0

2013/02/05 10:29:00;40:40:22:3a:8b:ed;40:40:22:01:9f:f0;disconnected;0;40:40:22:01:9f:f0

2013/02/05 10:29:00;40:40:22:3a:8b:ed;40:40:22:01:9f:f0;terminal;0;40:40:22:01:9f:f0

2013/02/05 10:29:14;40:40:22:29:14:73;40:40:22:01:9f:f0;switch;98;40:40:22:01:9f:f0

2013/02/05 10:29:15;40:40:22:29:14:97;40:40:22:01:9f:f0;terminal;98;40:40:22:01:9f:f0

2013/02/05 10:29:15;40:40:22:3a:87:2d;40:40:22:01:9f:f0;terminal;98;40:40:22:01:9f:f0

2013/02/05 10:29:16;40:40:22:3a:8b:ed;40:40:22:01:9f:f0;terminal;98;40:40:22:01:9f:f0

2013/02/05 10:29:30;40:40:22:29:14:73;40:40:22:01:9f:f0;terminal;100;40:40:22:01:9f:f0

2013/02/05 10:29:31;40:40:22:29:14:97;40:40:22:01:9f:f0;terminal;100;40:40:22:01:9f:f0

2013/02/05 10:29:32;40:40:22:3a:8b:ed;40:40:22:01:9f:f0;terminal;100;40:40:22:01:9f:f0

2013/02/05 10:29:51;40:40:22:3a:87:2d;40:40:22:01:9f:f0; switch;75;40:40:22:01:9f:f0

2013/02/05 10:30:02;40:40:22:29:14:73;40:40:22:01:9f:f0;terminal;99;40:40:22:01:9f:f0

2013/02/05 10:30:03;40:40:22:29:14:97; 40:40:22:3a:87:2d;terminal;99;40:40:22:01:9f:f0

2013/02/05 10:30:04;40:40:22:3a:8b:ed;40:40:22:01:9f:f0;terminal;99;40:40:22:01:9f:f0