802.1X and MAB Authentication

Teldat Dm783-I

Legal Notice

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Chapter 1 Introduction

1.1 802.1X Authentication Introduction

Sometimes, access to certain areas on a LAN must be restricted so that only authorized users can reach them. 802.1X authentication (described in the IEEE standard) allows you to control LAN access by defining an authentication and authorization mechanism associated with a connection point to said LAN. This connection point to the LAN is known as a port.

802.1X authentication is used, for example, to allow or deny access to certain segments in a LAN connected through a bridge. If authentication for a device connected to a bridge port fails, then the device is denied access.

Note

802.1X authentication makes sense for point-to-point connections where a single device is connected to a port with authentication. For point-to-multipoint connections, you need to establish a point-to-point logical association to ensure authentication operates correctly. In WLAN interfaces, the 802.11i standard describes how to establish said association in order to use 802.1X authentication.

1.2 MAB Authentication Introduction

Not all devices (e.g., network printers) are compatible with 802.1X authentication. For these devices to use a protected network environment, alternative authentication mechanisms are necessary.

One option is to deactivate 802.1X authentication in the port. However, this leaves the port unprotected and open. Another, slightly more reliable, option is to use MAC Authentication Bypass (MAB). When MAB is configured in a port, it triggers an authentication process with a RADIUS server using the connected device's MAC as the user name and password.

The network administrator must take into account the configuration of the RADUIS server when it comes to MAC address authentication. These addresses can be included as regular users or added to the network's database for verification.

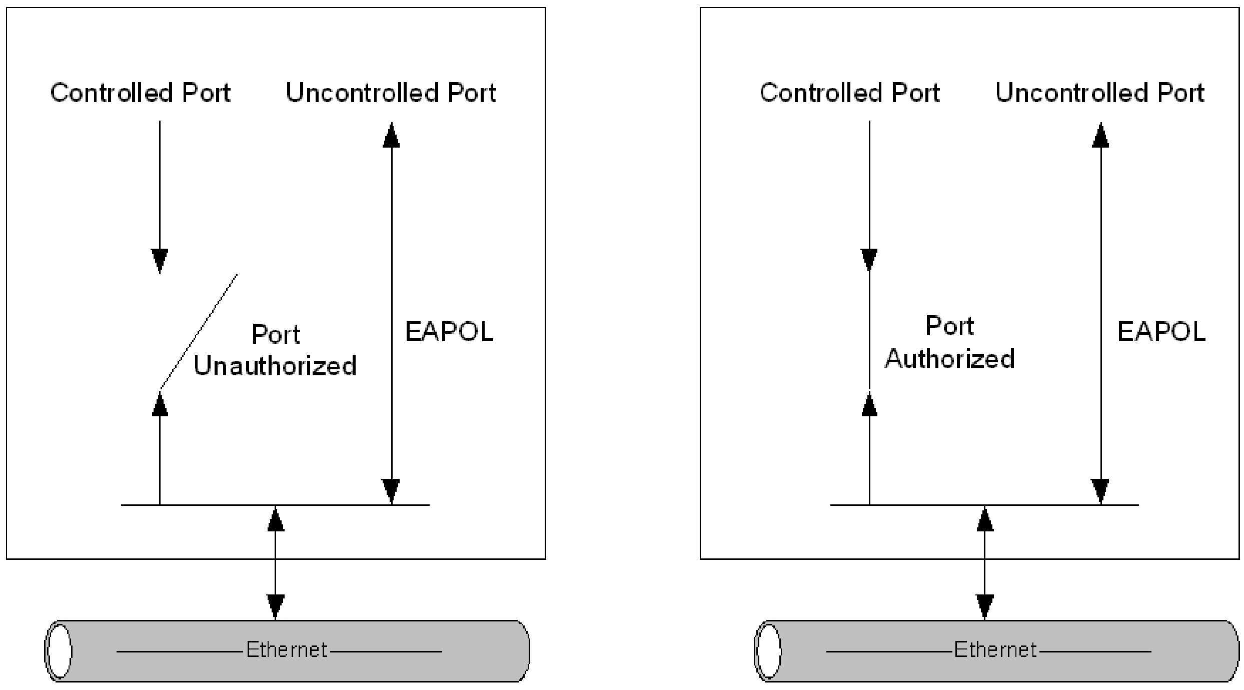
Note

MAB authentication is not available in all switches.

1.3 Controlled and uncontrolled ports

In 802.1X authentication, the physical port connected to a LAN segment is divided into two logical ports: the controlled port and the uncontrolled port. When a port receives a packet, it appears in both the controlled and uncontrolled ports. The controlled port drops all packets when 802.1X authentication has not been carried out. The uncontrolled port allows the access of all packets used for authentication.

As a result, while the authentication process is being carried out, only packets used by said authentication have access. The controlled port is considered open, meaning data flow is not permitted. Only when the authentication process has successfully completed does the controlled port close, allowing normal data flow.



Controlled and uncontrolled port

1.4 802.1X Authentication Elements

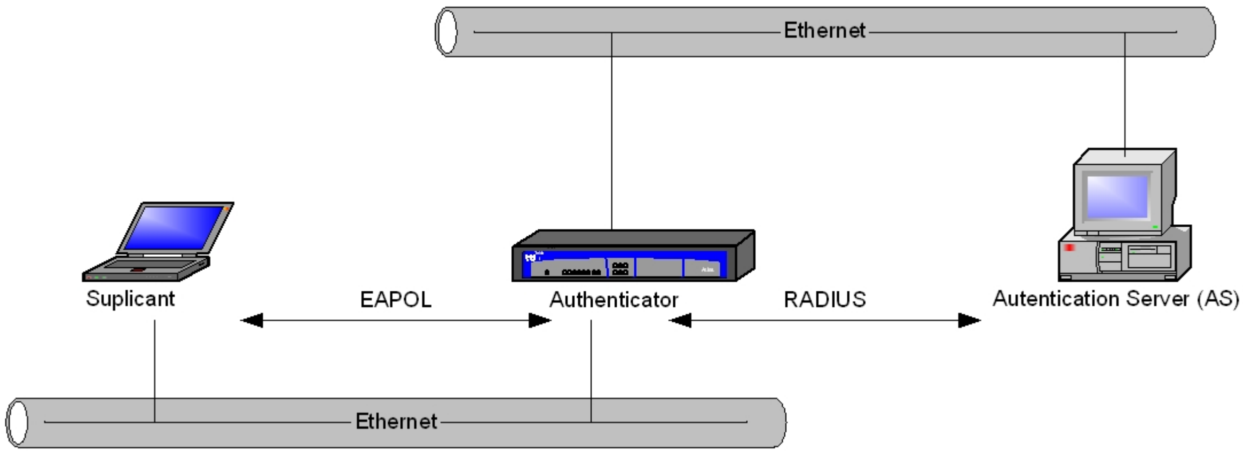
The authentication process is based on the Extensible Authentication Protocol (EAP), described in RFC 3748 together with the use of EAP in LAN networks (wireless or cabled). Said protocol describes EAP encapsulation so that packets can be sent by the LAN. It also creates new types of packets to simplify the use of EAP in LAN networks. The encapsulation defined in the 802.1X standard is known as EAPOL (EAP Over LAN).

In EAP authentication and, by extension, in 802.1X authentication, three components can be found:

- Supplicant: element that wants to access the network.
- Authenticator: element controlling network access. It allows communication between the supplicant and the authentication server.
- Authentication server: element that authenticates the supplicant, deciding if the latter can access the network or not. The authentication server can be the authenticator itself, but it's usually an external element.

The role of each element in the network access process can be easily understood by means of a simple example. Imagine a stranger arrives at the company and wants to enter the building. This is the supplicant. The building's doorman controls the access, allowing people into the building or not. However, he doesn't have the authority to decide who can come in or not. This is the authenticator. When the stranger requests entrance, the doorman calls the person in charge and asks if the visitor can come in. The boss probably asks for data on the visitor. The doorman repeats the boss's questions and relays the answers to the latter. Finally, depending on the responses given, the boss decides whether the visitor can enter or not. The boss is the authentication server.

The following figure shows the elements that make up 802.1X authentication.



802.1X authentication

Note

Although the figure shows RADIUS as the communication protocol between the authenticator and the authentication server, you can use any authentication protocol that transports EAP.

Authentication is carried out between the supplicant and the authentication server. When the supplicant wants to access the network, it triggers the process. The authenticator, through the uncontrolled port, passes the packets exchanged between the supplicant and the authentication server during authentication. Thus, the authenticator acts as the relay for the packets exchanged between the supplicant and the authentication server. The authenticator only looks at the end result: if authentication is successful, the controlled port allows the supplicant to access the network.

Communication between the supplicant and authenticator is carried out using the EAPOL protocol.

For authentication to be carried out safely, the communication channel between the authenticator and the authentication server must be completely secure. There are several options to transfer EAP packets between the authenticator and the authentication server. Radius is one of the most commonly used protocols when it comes to sending EAP packets.

EAP is really a large mixture of authentication protocols. During the authentication phase, the specific EAP protocol to be used is negotiated. Several authentication methods use EAS bases. Some of these are:

- PEAP: Protected EAP.
- EAP-TLS: EAP-Transport Layer Secure.
- EAP-TTLS: EAP-Tunneled Transport Layer Secure.

1.5 EAPOL Frames

1.5.1 Ethernet type and destination address

EAPOL frames are Ethernet frames that use 0x888E. As a rule, EAPOL frames go to a special destination address (known as PAE group address) that takes value 01-80-C2-00-00-03. Only in point-to-multipoint environments is the device's MAC address used as the packet destination address.

1.5.2 Types of frames

There are five types of frames:

(1) EAP-Packet: EAP frames encapsulated in Ethernet format.

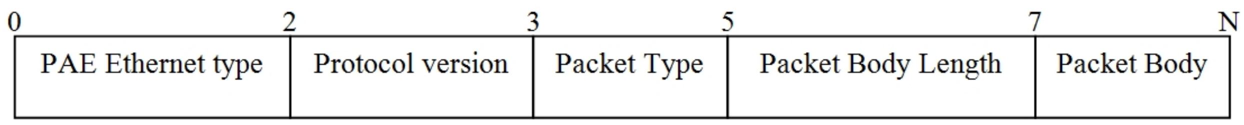
(2) EAPOL-Start: frame used by the supplicant to start the authentication process.

(3) EAPOL-Logoff: frame used by the supplicant to tell the authenticator to abandon the session.

(4) EAPOL-Key: frames used to send information on the keys.

(5) EAPOL-Encapsulated-ASF-Alert: ASF alert frames (Alerting Standards Forum). These allow ASF frames to pass through an unauthorized port.

1.5.3 Frame format



PAE Ethernet type: 0x888E.

Protocol version: The current version is 2 (defined in the 802.1X-2004 standard).

Packet Type: EAP-Packet (0), EAPOL-Start (1), EAPOL-Logoff (2), EAPOL-Key (3) or EAPOL-Encapsulated-ASF-Alert (4).

Packet Body Length: data length in bytes. A value equal to zero indicates there is no further data.

Packet Body: data. Depending on the type of packet, the data is interpreted in a different way. E.g. an EAP-Packet contains an EAP packet.

1.5.4 Authentication Process

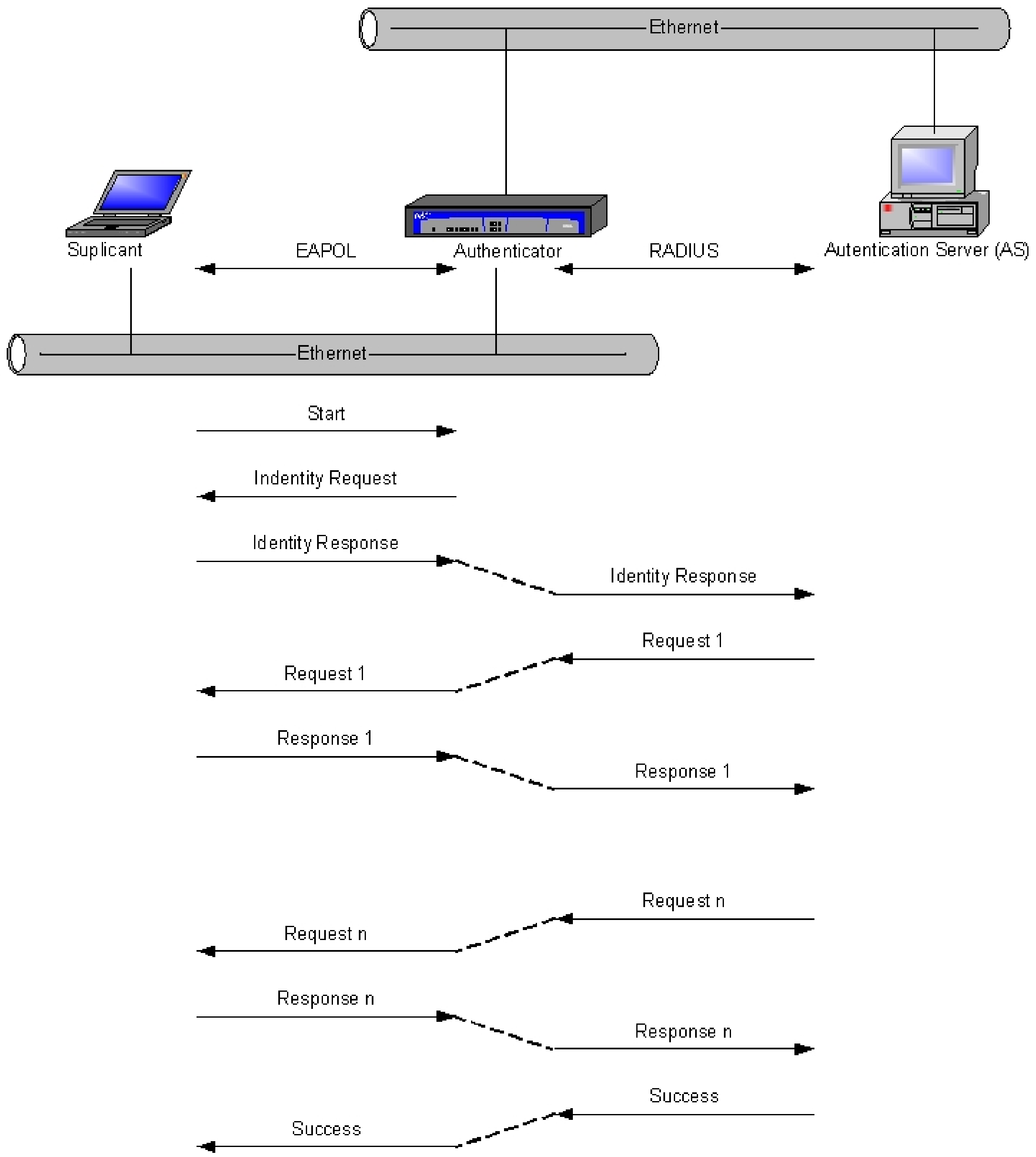
The authentication process is as follows: when the authenticator detects an element connected to a port configured with 802.1X authentication, authentication starts. To do this, an EAP identity request frame is sent.

Note

The authentication process can also be started by the supplicant through an EAPOL-Start frame. The authenticator then sends an identity request frame as a response to said frame.

At this point an EAP dialog between the supplicant and the authentication server is established, with the authenticator serving as a simple frame translator. The EAP dialog is basically a process where the authentication server sends EAP Request packets and the supplicant replies with EAP Response packets. When EAP authentication ends, the authentication server either sends an EAP Success packet or an EAP Fail packet. The packet is read by the authenticator, who then grants or refuses access to the controlled port.

The following figure shows the authentication process.



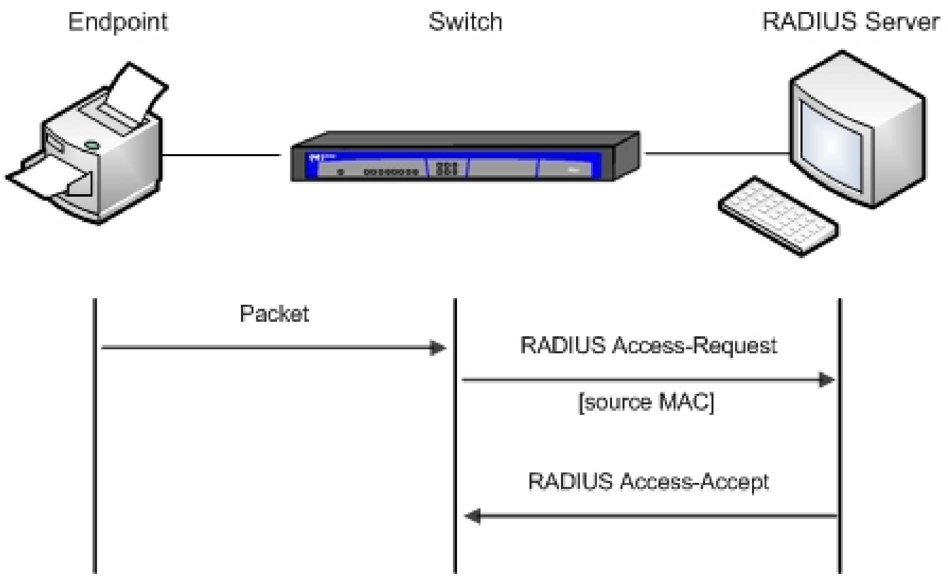
802.1X authentication process

1.6 MAB authentication elements

The basis of the authentication process is the Remote Authentication Dial In User Service (RADIUS) protocol, described in the RFC 2865 standard. The RADIUS protocol is an authentication and authorization protocol on network access. For further information, please see manual *Teldat-Dm 733-I* "*Radius Protocol*" .

There are three components in MAB authentication:

- Terminal: device that wants to access the network.
- Switch: element that controls network access.
- RADIUS Server: element that authenticates the terminal, granting access to the network or not.



MAB authentication

The switch begins the MAB authentication process by opening the port to accept a single packet through which the terminal's MAC address is learned. Once the switch has learned the MAC address, it begins to exchange messages with the RADIUS server.

1.7 RADIUS packet for MAB authentication

The RADIUS Access-Request packet the switch generates for the MAB authentication must include the terminal's MAC address in three attributes:

- Attribute 1 (Username)
- Attribute 2 (Password)
- Attribute 31 (Calling-Station-Id)

Although the MAC address is the same in each attribute, the address format is different. This is important, as the different RADIUS servers can use different attributes to validate the MAC address. Some RADIUS servers can only focus on Attribute 31 (Calling-Station-Id), while others verify the user and the password in Attributes 1 and 2.

The following table shows the MAC address format for each attribute.

RADIUS Attribute	**Format**	**Example**
1 (Username)	12 hexadecimal digits, all lower case and without punctuation.	0019f910dec8
2 (Password)	This is the same format as the user but encrypted.	065836c1f1069758e6206f8096a24463
31 (Calling-Station-Id)	6 groups of 2 hexadecimal digits, all upper case and separated by hyphens.	00-19-F9-10-DE-C8

Given that the MAB authentication uses the MAC address as user and password, make sure the RADIUS server can differentiate between MAB petitions and other types of petitions for network access. This allows you to prevent other clients from trying to use the MAC address as a valid credential. To uniquely identify a MAB petition, use Attribute 6 (Service-Type) with a value of 10 (Call-Check) in the RADIUS Access-Request message.

1.7.1 Processing authentication

Authentication begins when the switch receives a packet in a port configured with MAB authentication. A RADIUS Access-Request message is then sent to the RADIUS server. It includes the terminal's MAC address in the three attributes indicated above.

At this point, a dialog between the switch and the RADIUS server is created.

- If the MAC address is valid, the RADIUS server responds with a RADIUS Access-Accept message. This message indicates the switch must allow the terminal to access the network.
- If the MAC address isn't valid (or doesn't have permission to access the network), the RADIUS server responds with a RADIUS Access-Reject message. This message indicates that the switch cannot allow the terminal to access the network.

Chapter 2 Configuring the 802.1X and MAB Authentication

2.1 Using 802.1X authentication in Teldat devices

802.1X authentication can be configured in the following interfaces:

- Ethernet interfaces. This can act as authenticator or supplicant.
- Ethernet interfaces with switch. It's possible to configure 802.1X authentication in each switch port. This feature is not available for all switches. Only the authenticator is supported in these interfaces.
- WLAN interfaces. 802.1X authentication in these interfaces does not follow the same configuration system as the rest of the interfaces. For further information on 802.1X authentication configuration in WLAN interfaces, please see manual *Teldat-Dm 771-I "Wireless LAN Interface"* .

Note

From here onwards, this manual shall focus on 802.1X authentication in Ethernet interfaces.

For 802.1X authentication to operate in an Ethernet interface or port, it must be globally enabled and not simply configured in the corresponding menu.

2.2 Using MAB authentication in Teldat devices

MAB authentication can be configured in the following interfaces:

- Ethernet interfaces with switch. It's possible to configure MAB authentication per switch port.

MAB authentication is configured by accessing a *dot1X* configuration menu for each switch port.

Note

This feature is not available for all switches.

2.3 802.1X Authentication Configuration Menus

802.1X authentication is configured in the interface or port configuration menu. On top of this option, a global menu allows parameters that are common to all ports using 802.1X authentication to be configured.

2.3.1 Accessing the global configuration menu

To access 802.1X authentication global configuration, run **protocol dot1x** (general configuration menu).

```
*config
Config>protocol dot1x
-- 802.1X User Config --
dot1X config>
```

2.3.2 Accessing the configuration menu for an Ethernet interface

To access the 802.1X authentication configuration menu for an Ethernet interface, run **dot1x** (interface configuration menu).

```
*config
Config>network ethernet0/0
-- Ethernet Interface User Configuration --
ethernet0/0 config>dot1x
-- 802.1X User Config --
ethernet0/0 dot1X config>
```

2.3.3 Accessing the configuration menu for a one switch port

To access the 802.1X authentication configuration menu for a one-switch port internally connected to an Ethernet interface, run **port <n-port> dot1x** (switch configuration menu).

```
*config
Config>network ethernet1/0
-- Ethernet Interface User Configuration --
ethernet1/0 config>repeater
-- Repeater User Config --
ethernet1/0 repeater config>port 1 dot1X
-- 802.1X User Config --
ethernet1/0 (port 1) dot1X config>
```

Note

The configuration commands for a one-switch port are a subset of the configuration commands for an Ethernet interface. When detailing the different commands, those unavailable to a switch port are pointed out.

2.4 Global Configuration Commands

This section summarizes the 802.1X authentication global configuration commands for all devices.

The following table shows the 802.1X authentication global configuration commands. These are further explained in the following sections.

Command	Function
? (HELP)	Displays the configuration commands or their options.
NO	Configures parameters with their default values.
SYSTEM-AUTH-CONTROL	Globally enables 802.1X authentication in the device.
EXIT	Exits the 802.1X authentication global configuration menu.

2.4.1 ? (HELP)

Displays the configuration commands and their options.

2.4.2 NO

Sets parameters at their default value or deletes the configuration.

Syntax:

```
dot1X config>no ?
  system-auth-control     Globally enables 802.1X
```

Example:

Globally disables 802.1X authentication in the device.

```
dot1X config>no system-auth-control
```

2.4.3 SYSTEM-AUTH-CONTROL

Globally enables 802.1X authentication in the device.

Syntax:

```
dot1X config>system-auth-control
```

802.1X authentication is globally disabled by default.

Note

For 802.1X authentication to run in Ethernet ports, you need to globally enable it in the device. This command does not affect 802.1X authentication operations in WLAN interfaces.

2.4.4 EXIT

Exits the 802.1X authentication global configuration menu.

Syntax:

```
dot1X config>exit
```

2.5 Per Port Configuration Commands

This section summarizes the different configuration commands for 802.1X authentication and MAB authentication per port.

The following table shows the 802.1X authentication configuration commands per port. These are further explained in the following paragraphs.

Command	**Function**
? (HELP)	Displays the configuration commands and their options.
AUTHENTICATOR	Configures the authenticator parameters.
NO	Configures parameters with their default values.
PAE	Configures the authenticator or supplicant mode.
SUPPLICANT	Configures the supplicant parameters.
EXIT	Exits the 802.1X authentication configuration menu for a port.

2.5.1 ? (HELP)

Displays the available commands and their options.

2.5.2 AUTHENTICATOR

Configures the authenticator parameters.

Syntax:

```
ethernet0/0 dot1X config>authenticator
        authentication           Set AAA authentication options
               dot1x <list name>    AAA list name to use for 802.1X
        controlled-directions    802.1X controlled directions
               both                 Both (In and Out) packet flows controlled by
                                    802.1X
               in                   Only In packets controlled by 802.1X
        key-transmit             Enables key transmission
        port-control             Port control
               auto                 Port status controlled by 802.1X
               force-authorized     Port forced to authorized
               force-unauthorized   Port forced to unauthorized
        quiet-period <period>    Time between authentications
        reauth-max <value>       Reauthentication attempts permitted before the port
                                 becomes Unauthorized
        reauth-period <period>   Time between reauthentications
        reauthentication         Enables reauthentication
        server-timeout <period>  Server timeout
```

2.5.2.1 AUTHENTICATOR AUTHENTICATION

Configures authentication parameters.

AUTHENTICATOR AUTHENTICATION DOT1X

Configures the method list that needs to be used for 802.1X authentication. Method lists are defined using the AAA feature. For more information on how to configure it, please see Teldat manual *Dm800-I AAA feature*.

Command history:

Release	Modification
11.01.05	This command was introduced as of version 11.01.05.

AUTHENTICATOR AUTHENTICATION ORDER

Configures the authentication order. When more than one authentication method is defined, use this command to specify the order in which the different authentication methods are tried. Current available authentication methods are MAB and 802.1X. By default, 802.1X is tried before MAB.

If one authentication method succeeds, the user is granted access. If it fails, the next authentication method is tried.

Command history:

Release	Modification
11.01.09	This command was introduced as of version 11.01.09.

AUTHENTICATOR AUTHENTICATION PRIORITY

Configures the authentication priority. When more than one authentication method is defined, use this command to specify the priority of the different authentication methods available. Currently, these are MAB and 802.1X. By default, 802.1X has a higher priority than MAB.

This command only makes sense when MAB and 802.1X are configured as authentication methods and the user wants MAB to be tried first (order *mab dot1x*). If an EAPOL-Start packet is received, 802.1X authentication will be carried out whenever the priority is set to *dot1x mab*. On the other hand, if priority is set to *mab dot1x*, 802.1X authentication won't be carried out until MAB fails.

Command history:

Release	Modification
11.01.09	This command was introduced as of version 11.01.09.

2.5.2.2 AUTHENTICATOR CONTROLLED-DIRECTIONS

Configures the direction of the data controlled through 802.1X authentication. If the controlled port is not authorized, data flow is not permitted. This parameter defines whether the data flow is controlled in both directions or only at input.

Note

This command is not available for switch ports.

AUTHENTICATOR CONTROLLED-DIRECTIONS BOTH

802.1X authentication controls the data flow in both directions. Data cannot be sent or received through a controlled port until the 802.1X authentication has placed the port in an authorized state.

AUTHENTICATOR CONTROLLED-DIRECTIONS IN

802.1X authentication controls the data flow in the entry. If the controlled port is in an unauthorized state, it does not receive data. However, it does allow data to exit.

By default, 802.1X authentication controls data flow in both directions (*authenticator controlled-directions both*).

2.5.2.3 AUTHENTICATOR KEY-TRANSMIT

Allows key transmission as part of the 802.1X authentication process.

Key transmission is allowed by default.

2.5.2.4 AUTHENTICATOR Mode

Configures the authentication mode in the port.

Note

This command is only available for switch ports.

AUTHENTICATOR MODE MAB

Enables MAC Authentication Bypass as the authentic mode in the port.

Default is MAB disabled.

2.5.2.5 AUTHENTICATOR PORT-CONTROL

Configures port control through 802.1X authentication. Port status can be set to authorized or not authorized, or can be configured so that the status reflects the 802.1X authentication results.

AUTHENTICATOR PORT-CONTROL AUTO

Port status and control relies on normal 802.1X authentication operations. If 802.1X authentication is not satisfactorily completed, said port is not authorized.

Note

On top of configuring this port so that 802.1X authentication is carried out, you must also globally enable 802.1X authentication (**system-auth-control-global** configuration menu)

AUTHENTICATOR PORT-CONTROL FORCE-AUTHORIZED

Forces port authorization without executing authentication. Devices connected to this port have network access.

AUTHENTICATOR PORT-CONTROL FORCE-UNAUTHORIZED

Forces port deauthorization. Devices connected to this port do not have network access.

The port status is given via 802.1X authentication (**authenticator port-control auto**) by default.

2.5.2.6 AUTHENTICATOR QUIET-PERIOD

When the authenticator cannot authenticate a supplicant, it waits for the configured time (set using this parameter) to time out before retrying the authentication process.

Syntax:

```
ethernetx/x dot1X config>authenticator quiet-period ?
  <0..655535>    Value in the specified range
```

By default, 60 seconds elapse between authentication attempts.

2.5.2.7 AUTHENTICATOR REAUTH-MAX

Configures the maximum number of possible reauthentications without the port switching to an unauthorized state. If the authenticator exceeds the number of reauthentications set by this parameter, the controlled port is unauthorized before new authentication efforts can be attempted.

Syntax:

```
ethernetx/x dot1X config>authenticator reauth-max ?
  <1..255>    Value in the specified range
```

By default, two authentication attempts can be made before the port becomes unauthorized.

Note

This command is not available for some switches.

Command history:

Release	Modification
11.01.08	This command was made available to some switches as of version 11.01.08.

2.5.2.8 AUTHENTICATOR REAUTH-PERIOD

Configures the time between reauthorizations. Where reauthorizations are permitted, this parameter indicates how often reauthentication from the supplicant should be forced.

Syntax:

```
ethernetx/x dot1X config>authenticator reauth-period ?
  <1..65535>    Value in the specified range
```

A one-hour (3600 seconds) interval between reauthentications is set by default.

Note

This command is not available for some switches.

Command history:

Release	Modification
11.01.08	This command was made available to some switches as of version 11.01.08.

2.5.2.9 AUTHENTICATOR REAUTHENTICATION

Allows reauthentications. Once a port is authorized, this forces reauthorization each time the time period indicated in the **authenticator reauth-period** parameter times out.

It is disabled by default.

Note

This command is not available for some switches.

Release	Modification
11.01.08	This command was made available to some switches as of version 11.01.08.

2.5.2.10 AUTHENTICATOR SERVER-TIMEOUT

Configures the timer used to detect lack of response in communications between the authenticator and the authentication server.

Syntax:

```
ethernetx/x dot1X config>authenticator server-timeout ?
  <1..65535>    Value in the specified range
```

The default value is 30 seconds. If, after sending a packet to the authentication server, a response has not been received within this period, a timeout is considered to have occurred and appropriate actions are taken.

2.5.3 NO

Sets parameters at their default values or deletes the configuration.

Syntax:

```
ethernetx/x dot1X config>no
       authenticator
               controlled-directions    802.1X controlled directions
               key-transmit             Enables key transmission
               mode                     Authentication mode
               port-control             Port control
               quiet-period             Time between authentications
```

```
                reauth-max              Reauthentication attempts permitted before
                                        the port becomes Unauthorized
                reauth-period           Time between reauthentications
                reauthentication        Enables reauthentication
                server-timeout          Server timeout
        pae                             Configure Port Access Entity (PAE)
        supplicant
                auth-period             802.1x supplicant state machine authPeriod
                ca-cert                 Trusted CA certificate
                eap-method              Configure EAP method
                held-period             802.1x supplicant state machine heldPeriod
                max-start               802.1x supplicant state machine maxStart
                password                Supplicant authentication password
                start-period            802.1x supplicant state machine startPeriod
                user-cert               User certificate
                username                Supplicant identity configuration
```

Example:

Configuration for the default time period between reauthentications.

```
ethernet0/0 dot1X config>no authenticator reauth-period
```

2.5.4 PAE

Configures the behavior mode as either authenticator or supplicant.

Syntax:

```
ethernet0/0 dot1X config>pae
  authenticator                       Authenticator Port Access Entity (PAE)
  supplicant                          Supplicant Port Access Entity (PAE)
```

Default is authenticator.

Note

This command is not available for switch ports.

2.5.5 SUPPLICANT

Configures the supplicant parameters.

Syntax:

```
ethernet0/0 dot1X config>supplicant
        auth-period     802.1x supplicant state machine authPeriod
        ca-cert         Trusted CA certificate
        ca-cert-inner   Inner method trusted CA certificate
        eap-method      Configure EAP method
           peap            Use PEAP method
               eap-mschapv2    Use EAP-MSCHAPV2 inner method
               eap-md5         Use EAP-MD5 inner method
               eap-gtc         Use EAP-GTC inner method
               eap-otp         Use EAP-OTP inner method
           tls             Use TLS method
           ttls            Use TTLS method
               eap-mschapv2    Use EAP-MSCHAPV2 inner method
               eap-md5         Use EAP-MD5 inner method
               eap-gtc         Use EAP-GTC inner method
               eap-otp         Use EAP-OTP inner method
               eap-tls         Use EAP-TLS inner method
               mschapv2        Use MSCHAPV2 inner method
               mschap          Use MSCHAP inner method
               chap            Use CHAP inner method
               pap             Use PAP inner method
        held-period     802.1x supplicant state machine heldPeriod
        max-start       802.1x supplicant state machine maxStart
        password        Supplicant authentication password
        start-period    802.1x supplicant state machine startPeriod
        user-cert       User certificate
        user-cert-inner Inner method user certificate
        username        Supplicant identity configuration
```

Note

These commands are not available for switch ports.

2.5.5.1 SUPPLICANT AUTH-PERIOD

Time period during which the supplicant waits for a request from the authenticator before assuming the authentication process has failed.

Syntax:

```
ethernetx/x dot1X config> supplicant auth-period ?
  <1..65535>    Value in the specified range
```

By default, 30 seconds must go by before authentication is considered to have failed.

2.5.5.2 SUPPLICANT CA-CERT

Configures the certificate belonging to the trusted certifier to check the validity of the certificate the authenticator sends when triggering 802.1x sessions. If this command is executed in the dynamic configuration, the certificate must be preloaded in the device.

If you don’t configure the trusted certifier authority’s certificate, authenticator certificate validity is not executed. However, authentication still can be satisfactorily fulfilled even if security is lower (since the authenticity of the server cannot be verified). Confidentiality between the device and the authenticator is guaranteed as the data is encrypted.

To load a certificate in device base64, execute **certificate <certname> base64** (ipsec certificates menu) and enter said certificate. For further information, please see the section on *Certificates* in manual *Teldat Dm739-I "IPSEC"*.

Syntax:

```
ethernetx/x dot1X config> supplicant ca-cert ?
  <word>    Text
```

2.5.5.3 SUPPLICANT CA-CERT-INNER

Configures the certifier authority's certificate used in the internal session when TTLS/TLS is used. Said certificate is used to check the validity of the information the authenticator sends. The certificate must be preloaded in the device if you execute this command in the dynamic configuration. Where you don’t configure this parameter, the certificate used is configured through **supplicant ca-cert**.

If you don’t configure a certifier authority certificate, authenticator certificate validity is not executed. However, authentication can terminate satisfactorily even if security is lower (since the authenticity of the server cannot be verified). Nevertheless, confidentiality between the device and the authenticator is guaranteed as the data is encrypted.

To load a certificate in base64 in the device, execute **certificate <certname> base64** (ipsec certificates menu) and enter the certificate. For further information, please see the section on *Certificates* under manual *Teldat-Dm 739-I "IPSEC"*.

Syntax:

```
ethernetx/x dot1X config> supplicant ca-cert-inner ?
  <word>    Text
```

2.5.5.4 SUPPLICANT EAP-METHOD

Configures the EAP method the supplicant uses in the authentication process. If this is not configured, all supported methods are allowed. The authenticator must choose which method to use.

SUPPLICANT EAP-METHOD PEAP

Configures the use of the Protected Extensible Authentication Protocol (PEAP) in the authentication process. PEAP is a safe method to transmit authentication information. This requires a certificate in the authentication server that can be verified by the client, provided a certifier authority is configured (**supplicant ca-cert**). An SSL/TLS encrypted tunnel is created to transmit the authentication data. Optionally, you can specify an internal authentication method for the PEAP. If none is configured, all are supported. The internal methods need a user and password to be configured (**supplicant username** and **supplicant password** commands).

Syntax:

```
ethernetx/x dot1X config> supplicant eap-method peap
               <cr>
               eap-mschapv2    Use EAP-MSCHAPV2 inner method
               eap-md5         Use EAP-MD5 inner method
               eap-gtc         Use EAP-GTC inner method
               eap-otp         Use EAP-OTP inner method
```

SUPPLICANT EAP-METHOD TLS

Configures the use of TLS in the authentication process. This is a safe method based on mutual authentication between certificates, which is carried out when a TLS session is established. This requires a certificate in the authentication server that can be verified by the client, provided a certifier authority is configured (**supplicant ca-cert**). In addition, this method needs a user certificate to be configured with a private password to identify the device. Said certificate is configured by running **supplicant user-cert**.

Syntax:

```
ethernetx/x dot1X config> supplicant eap-method tls
```

SUPPLICANT EAP-METHOD TTLS

Configures the use of Tunneled Transport Layer Security (TTLS) in the authentication process. This is a safe method similar to PEAP and only requires a certificate in the server that can be verified by the client, provided a certifier authority is configured (**supplicant ca-cert**). A TLS tunnel is established to exchange authentication data. Optionally, you can specify an internal authentication method for the TTLS. If none is configured, all are supported. All internal methods, except for **eap-tls**, need a user and password to be configured (**supplicant username** and **supplicant password** commands).The **eap-tls** method requires a certificate to be configured with a private password (**supplicant user-cert-inner)**.

Syntax:

```
ethernetx/x dot1X config> supplicant eap-method ttls ?
               <cr>
               eap-mschapv2    Use EAP-MSCHAPV2 inner method
               eap-md5         Use EAP-MD5 inner method
               eap-gtc         Use EAP-GTC inner method
               eap-otp         Use EAP-OTP inner method
               eap-tls         Use EAP-TLS inner method
               mschapv2        Use MSCHAPV2 inner method
               mschap          Use MSCHAP inner method
               chap            Use CHAP inner method
               pap             Use PAP inner method
```

2.5.5.5 SUPPLICANT HELD-PERIOD

Time the supplicant state machine waits before retrying authentication when the authentication process has not finalized.

Syntax:

```
ethernetx/x dot1X config> supplicant held-period ?
  <1..65535>    Value in the specified range
```

Default is 60 seconds between retries.

2.5.5.6 SUPPLICANT MAX-START

Configures the maximum number of petition retries to start authentication (EAPOL-Start) before assuming authentication has failed.

Syntax:

```
ethernetx/x dot1X config> supplicant max-start ?
  <1..65535>    Value in the specified range
```

Default is 3 EAPOL-Starts sent.

2.5.5.7 SUPPLICANT PASSWORD

Configures the password to use in the authentication process.

SUPPLICANT PASSWORD PLAIN

Lets you enter the password in plain text. To enter the password in clear, run **supplicant password plain**.

Syntax:

```
ethernetx/x dot1X config> supplicant password plain ?
  <word>    Text
```

SUPPLICANT PASSWORD CIPHERED

Lets you enter the password in encrypted form. The password is encrypted and saved by running **supplicant password ciphered**.

Syntax:

```
ethernetx/x dot1X config>supplicant password ciphered ?
  <word>    Text
```

Example:

```
ethernet0/0 dot1X config$supplicant password plain secret
ethernet0/0 dot1X config$
ethernet0/0 dot1X config$show config
        supplicant password ciphered 0x6E90D5292F478EB6
ethernet0/0 dot1X config$
```

2.5.5.8 SUPPLICANT START-PERIOD

Time the supplicant state machine waits before trying to send the authentication start petition (EAPOL-Start) again when a response from the authenticator hasn't been received.

Syntax:

```
ethernetx/x dot1X config> supplicant start-period ?
  <1..65535>    Value in the specified range
```

Default is 30 seconds between retries.

2.5.5.9 SUPPLICANT USER-CERT

Configures the certificate used by the device when it authenticates through TLS. Said certificate must be preloaded in the device and have an associated private password.

To generate a private password and load the signed certificate in the device, please see the section on *Certificates* found in manual *Teldat-Dm 739-I "IPSEC"*.

Syntax:

```
ethernetx/x dot1X config>supplicant user-cert ?
  <word>    Text
```

2.5.5.10 SUPPLICANT USER-CERT-INNER

Configures the certificate used by the device in the internal session when TTLS/TLS is being used. Said certificate must be preloaded in the device and be associated to a private password.

To generate a private password and load the signed certificate in the device, please see the section on *Certificates* found in manual *Teldat-Dm 739-I "IPSEC"*.

If you don't configure this parameter, the certificate used is configured by running **supplicant user-cert**.

Syntax:

```
ethernetx/x dot1X config>supplicant user-cert-inner ?
  <word>    Text
```

2.5.5.11 SUPPLICANT USERNAME

Configures the user name for the authentication process.

Syntax:

```
ethernetx/x dot1X config> supplicant username ?
  <word>    Text
```

2.5.6 EXIT

Exits the 802.1X authentication configuration menu in a port.

Syntax:

```
ethernetx/x dot1X config>exit
```

Chapter 3 802.1X Authentication Monitoring

3.1 802.1X Authentication Monitoring Menus

This is very similar to configuration, with a global monitoring menu and a menu associated to each Ethernet port.

3.1.1 Accessing the global monitoring menu

To access 802.1X authentication global monitoring, run **protocol dot1x** (general monitoring menu).

```
*monitor
Console Operator
+protocol dot1x
--  802.1X Console  --
dot1X+
```

3.1.2 Accessing the monitoring menu for an Ethernet interface

To access the 802.1X authentication monitoring menu for an Ethernet interface, run **dot1x** (interface monitoring menu).

```
*monitor
Console Operator
+net ethernet0/0
--  Ethernet Console  --
ethernet0/0 ETH+dot1x
--  802.1X Console  --
ethernet0/0 DOT1X+
```

3.1.3 Accessing the monitoring menu for a one switch port

To access the 802.1X authentication monitoring menu for a one-switch port internally connected to an Ethernet interface, run **dot1x <n-port>** (switch monitoring menu).

```
*monitor
Console Operator
+net ethernet1/0
--  Ethernet Console  --
ethernet1/0 ETH+repeater
-- Repeater Monitoring Console --
ethernet1/0 Repeater+dot1x 1
--  802.1X Console  --
ethernet1/0 (port 1) DOT1X+
```

Note

The monitoring commands for a switch port are a subset of monitoring commands for an Ethernet interface. When the various commands are detailed, those unavailable for a switch port are indicated.

3.2 Global Monitoring Commands

This section summarizes the different monitoring commands for 802.1X authentication for all devices.

The following table summarizes the 802.1X authentication global monitoring commands. These are further explained in the following sections.

Command	Function
? (HELP)	Displays the configuration commands and their options.
SHOW	Displays information relative to 802.1X authentication.
SUPPLICANT	Monitoring the supplicant.
EXIT	Exits the 802.1X authentication global monitoring menu.

3.2.1 ? (HELP)

Displays the available commands and their options.

3.2.2 SHOW

Displays information relative to 802.1X authentication.

Syntax:

```
dot1X+show
  system    system monitoring
        configuration    system configuration
```

SHOW SYSTEM CONFIGURATION

Displays information for each Ethernet port that supports 802.1X authentication, for the EAPOL version being executed and the role the port can take: supplicant, authenticator or both. It also displays the state of the **SystemAuthControl** variable and shows whether 802.1X authentication is globally enabled in the device.

Example:

```
dot1X+show system configuration
SystemAuthControl: Enabled
      Interface        Port   EAPOL Version    PAE Capabilities
--------------------   ----   -------------    ----------------
ethernet0/0            1                  2    Authenticator
ethernet0/1            1                  2    Authenticator
ethernet1/0            1                  2    Authenticator
ethernet1/0            2                  2    Authenticator
ethernet1/0            3                  2    Authenticator
ethernet1/0            4                  2    Authenticator
dot1X+
```

3.2.3 SUPPLICANT

Supplicant monitoring commands.

Syntax:

```
dot1X+ supplicant ?
  trace-level    Set supplicant trace level
```

SUPPLICANT TRACE-LEVEL

Configures the debugging level for the supplicant's authentication process. Debugging traces are displayed through the DOT1X.026 event. Values between 0 and 5 are allowed, with 5 being the level where the most debugging traces are displayed. Default is 3.

Syntax:

```
dot1X+ supplicant trace-level ?
  <0..5>    Value in the specified range
```

3.2.4 EXIT

Exits the 802.1X authentication global monitoring menu.

Syntax:

```
dot1X+exit
```

3.3 Per Port Monitoring Commands

This section summarizes the different monitoring commands for 802.1X authentication per port.

The following table summarizes the 802.1X authentication monitoring commands per port. These are further explained in the following sections.

Command	Function
? (HELP)	Displays the monitoring commands and their options.
MAB *REAUTHENTICATE*	Forces MAB reauthentication.
REAUTHENTICATE	Forces reauthentication.
SHOW AUTHENTICATOR	Displays information relative to the authenticator.
SHOW SUPPLICANT	Displays information relative to the supplicant.
EXIT	Exits the 802.1X authentication monitoring menu for a port.

3.3.1 ? (HELP)

Displays the available monitoring commands and their options.

3.3.2 MAB REAUTHENTICATE

Forces reauthentication when MAC Access Bypass (MAB) is used. It deletes all authorized MACs from the switch address table so that a new authentication takes place.

Syntax:

```
ethernet0/0 (port 1) DOT1X+mab reauthenticate
```

Release	Modification
11.01.08	The "*MAB reauthenticate*" command was introduced as of version 11.01.08.

3.3.3 REAUTHENTICATE

Forces reauthentication. Applicable in authenticator and supplicant mode. If authentication is in progress, reauthentication does not occur until the current authentication is complete.

Syntax:

```
ethernet0/0 dot1X+reauthenticate
```

Note

This command is not available for some switches.

Release	Modification
11.01.08	The "*Reauthenticate*" command was made available for some switches as of version 11.01.08.

3.3.4 SHOW AUTHENTICATOR

Displays information relative to the authenticator.

Syntax:

```
dot1X+show authenticator
  auth-methods           authenticator authentication methods
  configuration          authenticator configuration
  diagnostics            authenticator diagnostics
  session-statistics     authenticator session statistics
  statistics             authenticator statistics
```

SHOW AUTHENTICATOR AUTH-METHODS

Displays information about the current authentication methods available.

Example:

```
ethernet0/0 (port 3) DOT1X+show authenticator auth-methods
MAB: enabled
802.1X  session control block: 07a40620
Current method: MAB
```

```
method: 802.1X
        priority: 1
method: MAB
        priority: 2
```

The following information is shown:

- *MAB*: MAB status, enabled or disabled.
- *802.1X session control block*: address of the 802.1X control block, to be internally used by Teldat.
- *Current method*: current authentication method used
- List of authentication methods configured for a given port and their priority. A lower value means higher priority.

Release	Modification
11.01.09	This command was introduced as of version 11.01.09.

SHOW AUTHENTICATOR CONFIGURATION

Displays information relative to the configuration of the authenticator associated to an Ethernet port.

Example:

```
ethernet0/0 DOT1X+show authenticator configuration
Interface: ethernet0/0 (port 1)
Authenticator PAE state : FORCE_AUTH
Backend Authentication state : AUTH_INITIALIZE
AdminControlledDirections: Both
OperControlledDirection: Both
AuthControlledPortControl: ForcrAuthorized
AuthControlledPortStatus: Authorized
quietPeriod: 60
serverTimeout: 30
reAuthPeriod: 3600
reAuthEnabled: Disabled
KeyTransmissionEnabled: Yes
ethernet0/0 DOT1X+
```

The following information is shown:

- *Interface*: information on the interface and port.
- *Authenticator PAE state* : status of the states machine associated to the authenticator communication with the supplicant.
- *Backend Authentication state* : status of the states machine associated to the authenticator communication with the authentication server.
- *AdminControlledDirections*: configuration of directions controlled by 802.1X authentication: incoming packets (In) or incoming and outgoing (Both).
- *OperControlledDirections*: indicates the directions controlled by 802.1X authentication. Normally, this value matches the configured value. However, the execution of the state machines can make this parameter take a value of *Both* when the configured value is *In*.
- *AuthControlledPortControl*: port control configuration through 802.1X authentication. The values allowed are *ForceAuthorized* if the port is always authorized without having to perform 802.1X authentication, *ForceUnauthorized* if the port is always unauthorized without carrying out 802.1X authentication and *Auto* if the port status is determined by 802.1X authentication.
- *AuthControlledPortStatus*: port status, *Authorized* or *Unauthorized*.
- *quietPeriod*: value configured for this variable: this is the time period the authenticator must wait before retrying the authentication process in cases where there is an error.
- *serverTimeout*: value configured for this variable: time period used to wait for a response from the authentication server before deciding there is no response.
- *reAuthPeriod*: time between reauthentications.
- *reAuthEnabled*: indicates if authentication is enabled or not.
- *KeyTransmissionEnabled* : indicates if key transmission is enabled or not.

Note

These statistics do not update correctly for switch ports.

SHOW AUTHENTICATOR DIAGNOSTICS

Displays useful information on authenticator operations. This information refers to the state machines defined in the 802.1X standard. You need to have some training on state machines to be able to interpret the results correctly.

Example:

```
ethernet0/0 DOT1X+show authenticator diagnostics
Interface: ethernet0/0 (port 1)
authEntersConnecting: 0
authEapLogoffsWhileConnecting: 0
authEntersAuthenticating: 0
authAuthSuccessWhileAuthenticating: 0
authAuthTimeoutsWhileAuthenticating: 0
authAuthFailWhileAuthenticating: 0
authAuthEapStartsWhileAuthenticating: 0
authAuthEapLogoffWhileAuthenticating: 0
authAuthReauthWhileAuthenticating: 0
authAuthEapStartsWhileAuthenticated: 0
authAuthEapLogoffWhileAuthenticated: 0
backendResponses: 0
backendAccessChallenges: 0
backendOtherRequestsToSupplicant: 0
backendAuthSuccesses: 0
backendAuthFails: 0
ethernet0/0 DOT1X+
```

The following information is displayed:

- *Interface*: information on the interface and port.
- *authEntersConnecting*: Number of times the states machine switches to a *CONNECTING* state from any other state.
- *authEapLogoffsWhileConnecting*: Number of times the states machine switches from CONNECTING to *DISCONNECTED* after receiving an EAPOL-Logoff message.
- *authEntersAuthenticating*: Number of times the states machine switches from *CONNECTING* to *AUTHENTICATING* after receiving an EAPOL-Response/Identity message.
- *authAuthSuccessWhileAuthenticating*: Number of times the states machine switches from *AUTHENTICATING* to *AUTHENTICATED* after a successful authentication.
- *authAuthTimeoutsWhileAuthenticating*: Number of times the states machine switches from *AUTHENTICATING* to *ABORTING* after a timeout in authentication.
- *authAuthFailWhileAuthenticating*: Number of times the states machine switches from *AUTHENTICATING* to *HELD* after a failed authentication.
- *authAuthEapStartsWhileAuthenticating*: Number of times the states machine switches from *AUTHENTICATING* to *ABORTING* after receiving an EAPOL-Start message.
- *authAuthEapLogoffWhileAuthenticating*: Number of times the states machine switches from *AUTHENTICATING* to *ABORTING* after receiving an EAPOL-Logoff message.
- *authAuthReauthWhileAuthenticating*: Number of times the states machine switches from *AUTHENTICATED* to *RESTART* after a reauthentication request.
- *authAuthEapStartsWhileAuthenticated*: Number of times the states machine passes from an *AUTHENTICATED* state to *CONNECTING* after receiving an EAPOL-Start message.
- *authAuthEapLogoffWhileAuthenticated*: Number of times the states machine switches from *AUTHENTICATED* to *DISCONNECTED* after receiving an EAPOL-Logoff message.
- *backendResponses*: Number of times the first response from the supplicant is sent to the communication layer with the authentication server.
- *backendAccessChallenges*: Number of times that the first request is received from the authentication server after the first response from the supplicant.
- *backendOtherRequestsToSupplicant*: Number of times an EAP-Request packet is sent after sending the first packet to the supplicant.
- *backendAuthSuccesses*: Number of times a success indication is received from the authentication server.
- *backendAuthFails*: Number of times an authentication failure indication is received from the authentication server.

SHOW AUTHENTICATOR SESSION-STATISTICS

Displays the statistics for the current session. When the port is unauthorized, the statistics correspond to the last session established.

Example:

```
ethernet0/0 DOT1X+show authenticator session-statistics
Interface: ethernet0/0 (port 1)
Session Octets Received: 33548
Session Octets Transmitted: 22
Session Frames Received: 332
Session Frames Transmitted: 1
Session Identifier: ethernet0/0-port1-session1
Session Authentication Method: Remote Authentication Server
Session Time: 15s
Session Terminate Cause: Not Terminated Yet
Session User Name: Sampledot1x
```

The following information is displayed:

- *Interface*: information on the interface and port.
- *Session Octets Received*: number of octets received in the current session.
- *Session Octets Transmitted* : number of octets transmitted in the current session.
- *Session Frames Received*: number of frames received in the current session.
- *Session Frames Transmitted* : number of frames transmitted in the current session.
- *Session Identifier*: Session identifier for this authenticator.
- *Session Authentication Method*: authentication method used. This can be local (Local Authentication Server) or remote (Remote Authentication Server).
- *Session Time*: session duration in seconds.
- *Session Terminate Cause* : possible causes are:

  Supplicant Logoff: an EAPOL-Logoff packet has been received from the supplicant.

  Port Failure: an error has occurred in the port (authentication error, interface down, etc).

  Supplicant Restart: an EAPOL-Start packet has been received from the supplicant.

  Reauthentication Failure: a failure has occurred when reauthenticating the supplicant.

  Port Control forced to unauthorized: the port state has been forcibly changed to unauthorized.

  Port re-initialization: the port has been re-initialized.

  Port Administratively Disabled: the port is administratively inoperative.

  Not Terminated Yet: the session is still active.
- *Session User Name*: supplicant identity.

SHOW AUTHENTICATOR STATISTICS

Displays authenticator statistics

Example:

```
ethernet0/0 DOT1X+show authenticator statistics
Interface: ethernet0/0 (port 1)
EAPOL frames received: 0
EAPOL frames transmitted: 1
EAPOL Start frames received: 0
EAPOL Logoff frames received: 0
EAP Resp/Id frames received: 0
EAP Response frames received: 0
EAP Initial Request frames transmitted: 0
EAP Request frames transmitted: 0
Invalid EAPOL frames received: 0
EAP length error frames received: 0
Last EAPOL frame version: 0
```

The following information is displayed:

- *Interface*: information on the interface and port.
- *EAPOL frames received*: Number of valid EAPOL frames received.
- *EAPOL frames transmitted*: Number of EAPOL frames transmitted.
- *EAPOL Start frames received*: Number of *EAPOL-Start* frames received.
- *EAPOL Logoff frames received*: Number of *EAPOL-Logoff* frames received.
- *EAP Resp/Id frames received*: Number of *EAP-Response/Identity* frames received.
- *EAP Response frames received*: Number of *EAP-Response* frames different from the *EAP-Response/Identity* received.
- *EAP Initial Request frames transmitted*: Number of *EAP Initial Request* frames transmitted.
- *EAP Request frames transmitted*: Number of *EAP-Request* frames different from the *EAP Initial Request* transmitted.
- *Invalid EAPOL frames received*: Number of EAPOL frames received with an unknown frame type.
- *EAP length error frames received*: Number of EAPOL frames received with an error in the field indicating packet body length.
- *Last EAPOL frame version*: Protocol version indicated in the latest EAPOL frame received.

3.3.5 SHOW SUPPLICANT

Displays information relative to the supplicant.

Syntax:

```
dot1X+ show supplicant ?
  statistics    Supplicant statistics
  status        Supplicant configuration
```

SHOW SUPPLICANT STATISTICS

Displays supplicant statistics.

Example:

```
ethernet0/0 DOT1X+ show supplicant statistics
dot1xSuppEapolFramesRx: 3
dot1xSuppEapolFramesTx: 7
dot1xSuppEapolStartFramesTx: 5
dot1xSuppEapolLogoffFramesTx: 0
dot1xSuppEapolRespFramesTx: 2
dot1xSuppEapolReqIdFramesRx: 2
dot1xSuppEapolReqFramesRx: 0
dot1xSuppInvalidEapolFramesRx: 1
dot1xSuppEapLengthErrorFramesRx: 0
dot1xSuppLastEapolFrameVersion: 2
dot1xSuppLastEapolFrameSource: 00:a0:26:46:2f:d9
```

The following information is displayed:

- dot1xSuppEapolFramesRx: Number of EAPOL frames received.
- dot1xSuppEapolFramesTx: Number of EAPOL frames transmitted.
- dot1xSuppEapolStartFramesTx: Number of *EAPOL-Start* frames transmitted.
- dot1xSuppEapolLogoffFramesTx: Number of *EAPOL-Logoff* frames transmitted.
- dot1xSuppEapolRespFramesTx: Number of *EAP-Response* frames transmitted.
- dot1xSuppEapolReqIdFramesRx: Number of *EAP-Request/Identity* frames received.
- dot1xSuppEapolReqFramesRx: Number of *EAP-Response* frames received.
- dot1xSuppInvalidEapolFramesRx: Number of invalid EAPOL frames received.
- dot1xSuppEapLengthErrorFramesRx: Number of EAPOL frames received with a length error.
- dot1xSuppLastEapolFrameVersion: Version of the last EAPOL frame received.
- dot1xSuppLastEapolFrameSourc: Source MAC address of the last EAPOL frame received.

SHOW SUPPLICANT STATUS

Displays the status of the supplicant.

Example:

```
ethernet0/0 DOT1X+ show supplicant status
Supplicant PAE state: AUTHENTICATED
suppPortStatus: Authorized
heldPeriod: 60
authPeriod: 30
startPeriod: 30
maxStart: 3
portControl: Auto
Supplicant Backend state: IDLE
EAP state: SUCCESS
selectedMethod: 13 (EAP-TLS)
reqMethod: 0
methodState: DONE
decision: UNCOND_SUCC
ClientTimeout: 60
```

The following information is displayed:

- Supplicant PAE state: state of the supplicant's state machine.
- suppPortStatus: state of the port (i.e. *Authorized* or *Unauthorized*).
- heldPeriod: amount of time the supplicant's state machine waits before retrying the authentication when the authentication process has not completed.
- authPeriod: amount of time the supplicant's state machine waits for a request from the authenticator before assuming the authentication process has failed.
- startPeriod: amount of time the supplicant's state machine waits before retrying to send the authentication start request (EAPOL-Start) when it doesn't receive a response from the authenticator.
- maxStart: configures the maximum number of authentication start requests (EAPOL-Start) to be sent before assuming authentication has failed.
- portControl: state of port control.
- Supplicant Backend state: state of the supplicant's Backend state machine.
- EAP state: state of the EAP transaction.
- selectedMethod: EAP authentication method selected.
- reqMethod: method received in the current EAP petition.
- methodState: state of the authentication method.
- decision: authentication method results.
- ClientTimeout: amount of time spent before assuming an EAP authentication process has timed out.

Note

These commands are not available for switch ports.

3.3.6 EXIT

Exits the 802.1X authentication monitoring menu in a port.

Syntax:

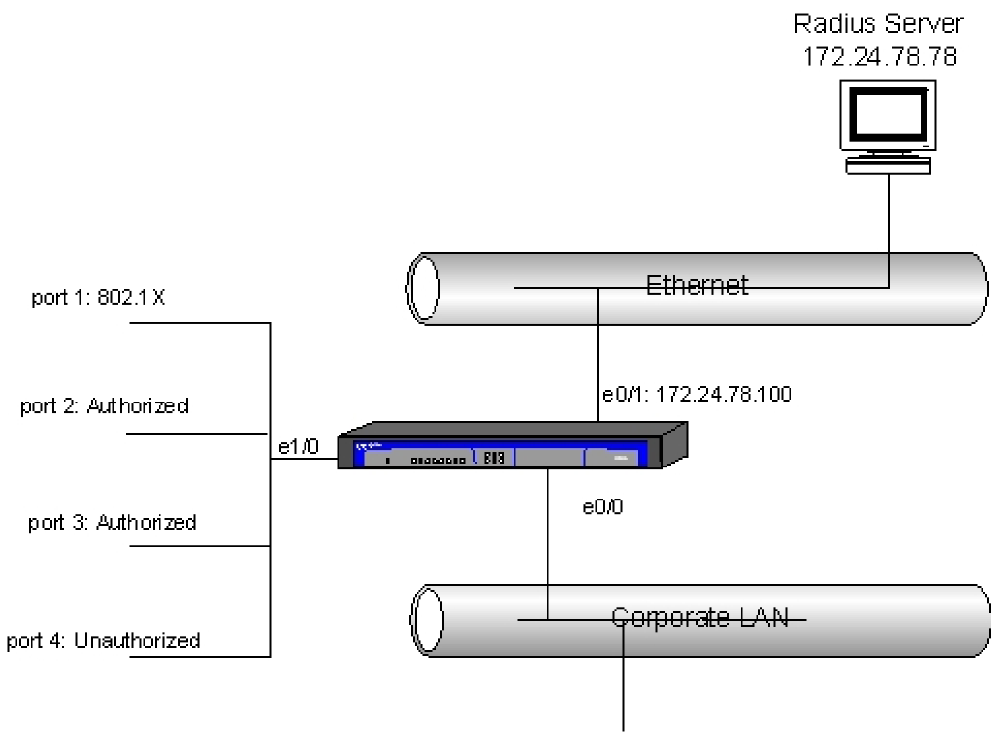
```
ethernet0/0 DOT1X+exit
```

Chapter 4 Configuration Examples

4.1 802.1X Authentication in a port

In the following example, we're going to explain the steps required to configure 802.1X authentication in a one-switch port.

4.1.1 Scenario



802.1X authentication

In the scenario shown in the figure, we have a corporate LAN connected to the ethernet0/0 interface. To access this LAN, use the switch found in the device. We want all devices connected to port 1 to execute 802.1X authentication before gaining access to the corporate LAN. Devices connected to ports 2 and 3 have direct access to the corporate LAN without having to authenticate, while access to the corporate LAN from the remaining switch ports is denied.

4.1.2 Globally configuring 802.1X authentication

First, globally enable 802.1X authentication in the device.

```
*config
Config>protocol dot1x
-- 802.1X User Config --
dot1X config>system-auth-control
```

4.1.3 Configuring 802.1X authentication in Ethernet ports

The Ethernet0/0 interface, to which the corporate LAN is connected to, does not execute 802.1X authentication. Consequently, the status is forced to authorize access.

```
Config>net ethernet0/0
-- Ethernet Interface User Configuration --
ethernet0/0 config>dot1x
-- 802.1X User Config --
ethernet0/0 dot1X config>authenticator port-control force-authorized
```

In the switch, port 1 executes 802.1X authentication, ports 2 and 3 are authorized and the rest of the ports are unauthorized.

```
Config>net ethernet1/0
```

```
-- Ethernet Interface User Configuration --
ethernet1/0 config>repeater
-- Repeater User Config --
ethernet1/0 repeater config>port 1 dot1X
-- 802.1X User Config --
ethernet1/0 (port 1) dot1X config>authenticator port-control auto
ethernet1/0 (port 1) dot1X config>exit
ethernet1/0 repeater config>port 2 dot1X
-- 802.1X User Config --
ethernet1/0 (port 2) dot1X config>authenticator port-control force-authorized
ethernet1/0 (port 2) dot1X config>exit
ethernet1/0 repeater config>port 3 dot1X
-- 802.1X User Config --
ethernet1/0 (port 3) dot1X config>authenticator port-control force-authorized
ethernet1/0 (port 3) dot1X config>exit
ethernet1/0 repeater config>port 4 dot1X
-- 802.1X User Config --
ethernet1/0 (port 4) dot1X config>authenticator port-control force-authorized
ethernet1/0 (port 4) dot1X config>exit
```

4.1.4 Configuring Radius

Finally, configure access to the Radius server. For further information on Radius configuration, please see manual *Teldat-Dm 733-I "Radius Protocol"* .

(1) Access the Radius configuration menu:

```
Config>feature radius
-- RADIUS User Configuration --
RADIUS config>
```

(2) Configure the Radius server address:

```
RADIUS config>primary-address 172.24.78.78
RADIUS config>
```

(3) Configure the key for the Radius server:

```
RADIUS config>primary-secret whatever
RADIUS config>
```

(4) Enable Radius:

```
RADIUS config>enable radius
RADIUS enabled
RADIUS config>
```

(5) Exit the Radius configuration menu:

```
RADIUS config>exit
Config>
```

(6) Configure the IP address in the ethernet0/1 interface to access the Radius server:

```
Config>net ethernet0/1
-- Ethernet Interface User Configuration --
ethernet0/1 config>ip address 172.24.78.100 255.255.0.0
```

4.1.5 Complete configuration

The full configuration is shown below:

```
   log-command-errors
   no configuration
;
   network ethernet0/0
; -- Ethernet Interface User Configuration --
      dot1x
; -- 802.1X User Config --
         authenticator port-control force-authorized
      exit
;
   exit
```

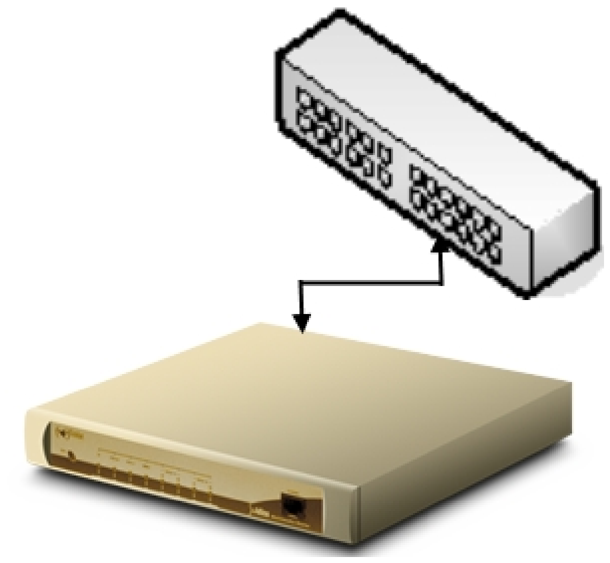
```
;
   network ethernet0/1
; -- Ethernet Interface User Configuration --
      ip address 172.24.78.100 255.255.0.0
;
   exit
;
   network ethernet1/0
; -- Ethernet Interface User Configuration --
      repeater
; -- Repeater User Config --
         port 2 dot1X
; -- 802.1X User Config --
            authenticator port-control force-authorized
         exit
;
         port 3 dot1X
; -- 802.1X User Config --
            authenticator port-control force-authorized
         exit
;
         port 4 dot1X
; -- 802.1X User Config --
            authenticator port-control force-unauthorized
         exit
;
      exit
;
   exit
;
   protocol dot1X
; -- 802.1X User Config --
      system-auth-control
   exit
;
   feature radius
; -- RADIUS User Configuration --
      primary-address 172.24.78.78
      primary-secret whatever
      enable radius
   exit
;
   dump-command-errors
   end
```

4.2 802.1X Supplicant in an Ethernet interface

In this example, we are going to describe the configuration for an 802.1X supplicant in an Ethernet port.

4.2.1 Scenario

The router’s ethernet0/0 interface is connected to a switch with 802.1X authentication enabled. This means authentication is mandatory before traffic can be transmitted through the port. We don’t want the router to have certificates, so we won’t use EAP-TLS authentication, and the validity of the server certificate won't be checked. Additionally, we don’t want to specify any particular method. Consequently, the authentication server can choose whatever it wants.



Scenario

4.2.2 802.1X supplicant: Global configuration

First, globally enable 802.1X authentication in the device.

```
*config
Config>protocol dot1x
-- 802.1X User Config --
dot1X config>system-auth-control
```

4.2.3 Configuring the 802.1X supplication in the Ethernet port

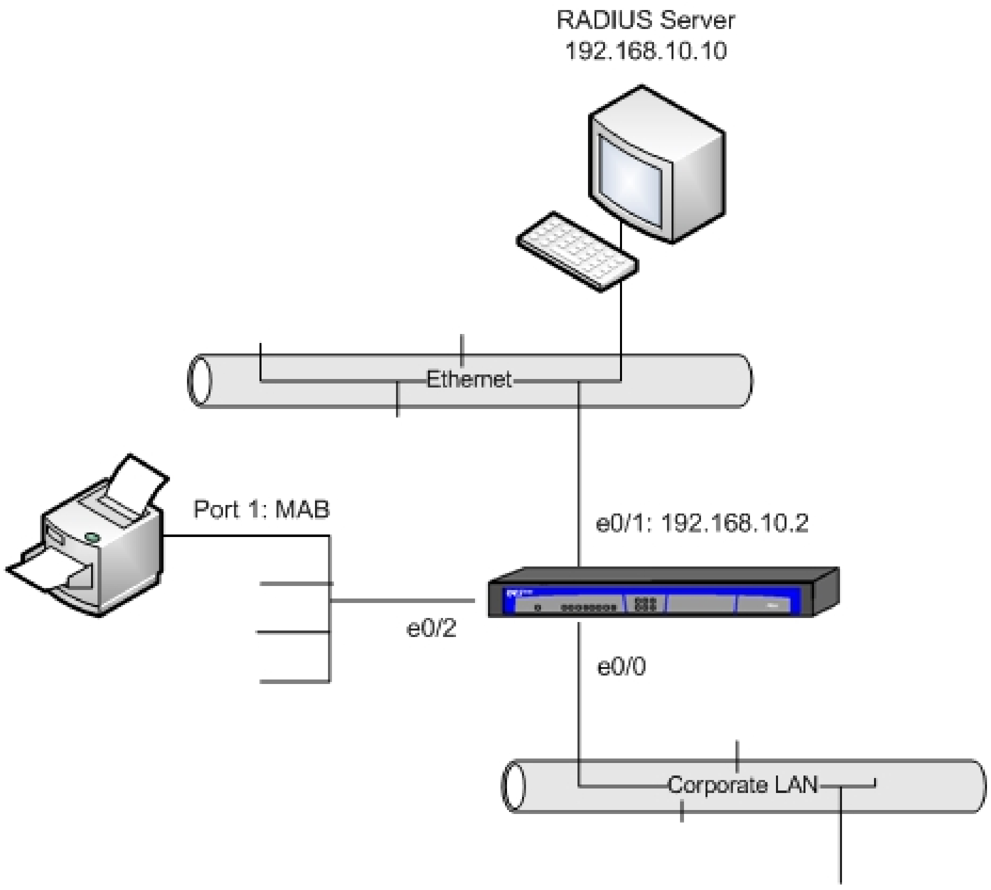
Configure the supplicant mode, the user and the password in the ethernet0/0 interface.

```
Config$network ethernet0/0
-- Ethernet Interface User Configuration --
ethernet0/0 config$dot1x
-- 802.1X User Config --
ethernet0/0 dot1x config$ pae supplicant
ethernet0/0 dot1x config$ supplicant username sample
ethernet0/0 dot1x config$ supplicant password plain secret
ethernet0/0 dot1x config$ show config
; -- 802.1X User Config --
         pae supplicant
         supplicant username sample
         supplicant password ciphered 0x6E90D5292F478EB6
ethernet0/0 dot1x config$
```

4.3 MAB Authentication in a port

In this example, we are going to detail the steps required to configure MAB authentication in a switch port.

4.3.1 Scenario



Scenario

In the scenario displayed in the figure, we have a corporate LAN connected to the ethernet0/0 interface. To access this LAN, use the switch in the device. We want the devices connected to port 1 to execute MAB authentication before gaining access to the corporate LAN. However, devices connected to the remaining switch ports have direct access to said LAN without having to authenticate.

4.3.2 Configuring MAB authentication

```
   log-command-errors
   no configuration
;
   network ethernet0/2
; -- Ethernet Interface User Configuration --
;
      repeater-switch
; -- Switch User Config --
         port 1 dot1X
; -- 802.1X User Config --
            authenticator mode mab
         exit
;
      exit
;
   exit
;
;
   network ethernet0/1
; -- Ethernet Interface User Configuration --
      ip address 192.168.10.2 255.255.255.0
;
   exit
;
;
   feature radius
; -- RADIUS User Configuration --
      primary-address 192.168.10.10
      primary-secret whatever
      enable radius
   exit
;
   dump-command-errors
   end
```

Chapter 5 Annex

5.1 Third Party Software

A WPA Supplicant code is used for the 802.1X supplicant.

The WPA Supplicant license can be seen below:

WPA Supplicant

When it comes to TLS negotiation, CIT uses the OpenSSL library code.

Please see a copy of the OpenSSL license below:

The OpenSSL toolkit remains under a dual license, i.e. both the conditions of the OpenSSL License and the original SSLeay license apply to the toolkit. The actual license texts can be found below.