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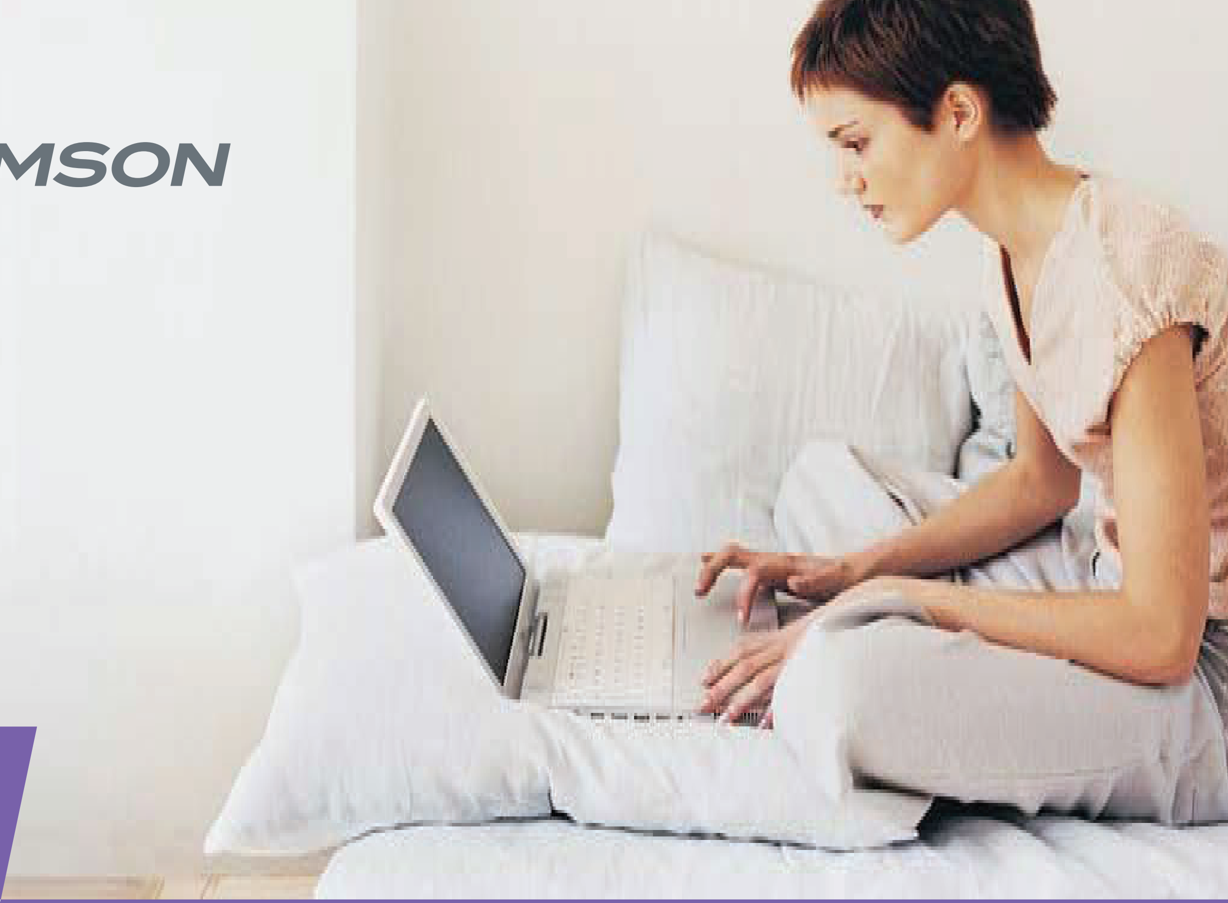
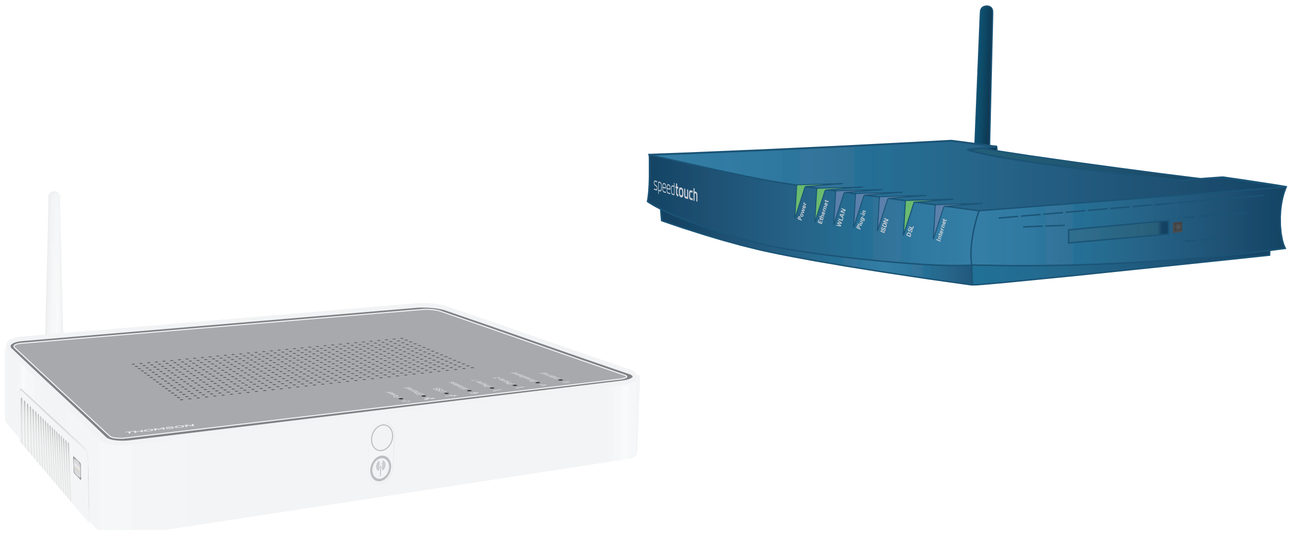


Thomson Gateway



VLAN Configuration Guide

R7.4 and higher

Thomson Gateway

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R7.4 and higher

Document Information

Status: v1.0 (March 2008)
Reference: E-DOC-CTC-20080229-0001
Short Title: Config Guide: VLAN R7.4 and higher

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Used Symbols

A *note* provides additional information about a topic.

A *caution* warns you about potential problems or specific precautions that need to be taken.

Terminology

Generally, the Thomson Gateway356 will be referred to as Wireless USB Adaptor in this VLAN Configuration Guide.

Typographical Conventions

Following typographical convention is used throughout this manual:

- Sample text indicates a hyperlink to a Web site.

  Example: For more information, visit us at www.thomson-broadband.com.
- Sample text indicates an internal cross-reference.

  Example: If you want to know more about guide, see "1 Introduction" on page 7".
- ***Sample text*** indicates an important content-related word.

  Example: To enter the network, you ***must*** authenticate yourself.
- **Sample text** indicates a GUI element (commands on menus and buttons, dialog box elements, file names, paths and folders).

  Example: On the **File** menu, click **Open** to open a file.

Documentation and software updates

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About this VLAN Configuration Guide

Overview

First, this VLAN Configuration Guide shortly lists the VLAN features of the Thomson Gateway and the relevant standards. Some background information on several VLAN-related concepts is also provided. Next, this document describes the configuration of each VLAN feature on the Thomson Gateway in detail. CLI (Command Line Interface) commands are used for the configuration.

This document is structured as follows:

1 Introduction

Introduction

Virtual Local Area Networks, commonly known as VLANs, are the subject of this document. In this chapter, we shortly list the VLAN features that are supported by the Thomson Gateway, the relevant standards and related documents.

Supported VLAN features

Thomson Gateway devices support following VLAN features:

- *Creation of VLANs* on the Thomson Gateway
- *VLAN features of the Ethernet bridge*
  - VLAN learning constraints for dynamic entries
  - Creation of static entries with VLANs
  - VLAN awareness of the bridge
  - Tagged and untagged VLAN membership of bridge ports
  - Port VID of a bridge port
  - Acceptance of only VLAN-tagged frames
  - Ingress filtering of VLAN-tagged frames
  - Dynamic VLAN membership
  - Unknown VID policy
  - Extra tagging (stacked VLANs)
- *VLAN features of the logical Ethernet interfaces*
  - WAN-side VLAN tagging
  - Support of VLAN routing on the Thomson Gateway

Standards compliancy

Thomson Gateway devices are compliant with following standards, which are relevant to Ethernet, Ethernet bridging, VLAN bridging, VLAN user priorities and stacked VLANs:

- *IEEE Std 802.3 - 2000*: Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications.
- *IEEE Std 802.1D - 2004*: IEEE standard for local and metropolitan area networks - Media Access Control (MAC) bridges.
- *IEEE Std 802.1Q - 1998*: IEEE standard for local and metropolitan area networks - Virtual bridged local area networks.
- *IEEE Std 802.1p*: Traffic Class Expediting and Dynamic Multicast Filtering. This standard is merged into 802.1D-2004.
- *IEEE Std 802.1ad - 2005*: IEEE standard for local and metropolitan area networks - Virtual bridged local area networks - Amendment 4: Provider bridges.

Related documents

Other Layer 2 related features, such as Ethernet and Ethernet QoS, are described in other documents. See the “Ethernet Configuration Guide” and the “Ethernet QoS Configuration Guide” for more information.

1| Introduction

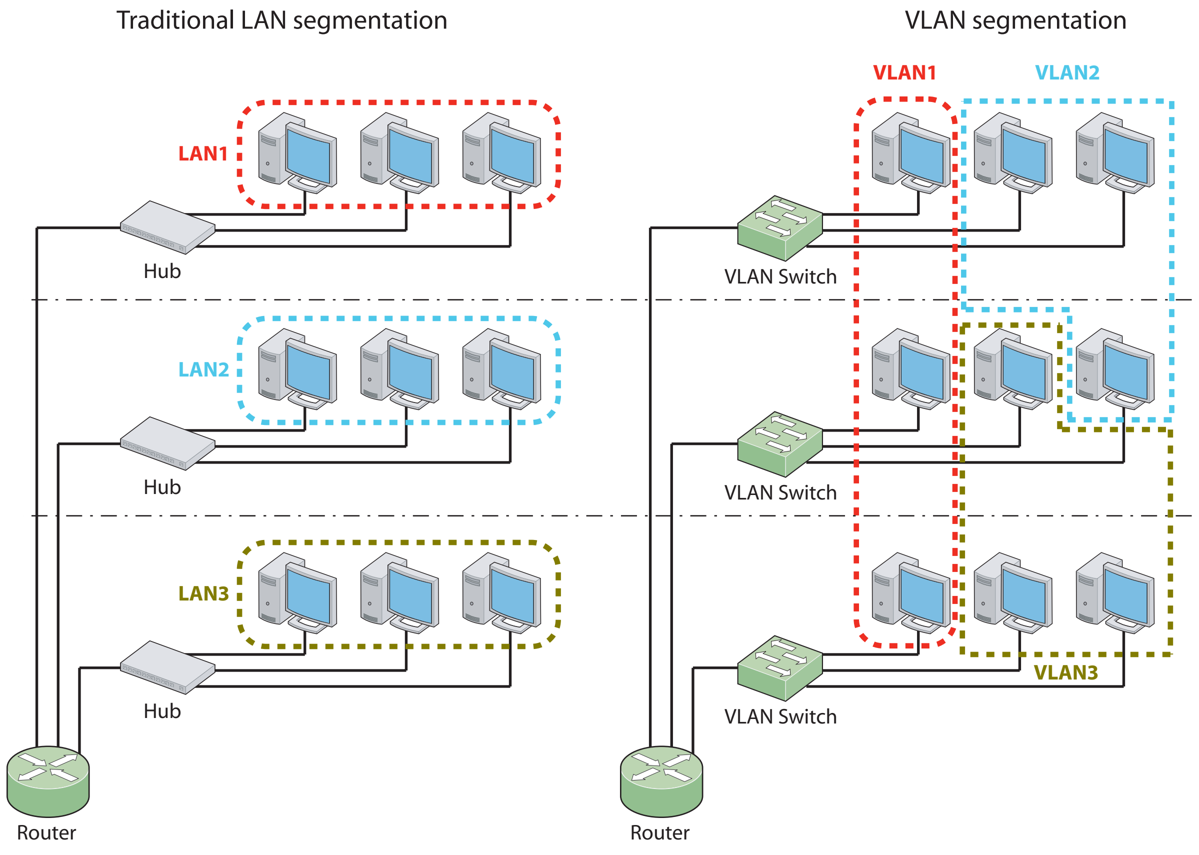
2 VLAN Overview

What is a VLAN?

A VLAN is a Layer 2 method of creating independent logical networks within a single physical network. Hosts in the same VLAN behave as if they are connected to the same LAN segment, even though they may be physically connected to different LAN segments.

The primary use of VLANs is to split large switched networks, which are large broadcast domains. While traditional LAN segmentation adds routers to the network to split a broadcast domain, VLAN segmentation adds VLAN-aware switches. Routers are only needed to communicate between two VLANs.

Following illustration shows the difference between traditional physical LAN segmentation and logical VLAN segmentation:



Advantages of using VLANs

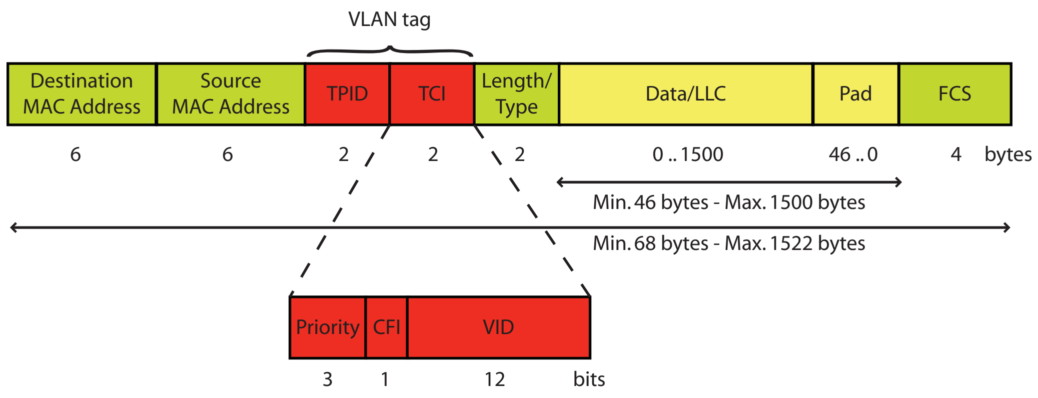
The use of VLANs is very popular in today's networks, because VLANs offer several advantages:

- *Increased performance*:
  - VLANs increase the number of broadcast domains but reduce the size of each broadcast domain. As this limits broadcast storms, multicast traffic, chatty protocols and so on, overall network traffic is reduced.
  - VLAN-aware switches add no substantial latency compared to routers, as the amount of routing (Layer 3 forwarding) is reduced.
  - Snooping is limited, which increases the network security.

- ***Topological independence***: the use of VLANs allows non-physical grouping of nodes that share similar resources. This results in the creation of logical networks, independent of the physical location of the involved nodes. Hardware requirements are reduced, as networks can be separated logically instead of physically.
- ***Ease of administration***: the management efforts to create (logical) networks are reduced:
  - Nodes can easily change their VLAN membership.
  - Network topology changes, for example a host moving to another location, no longer require hardware changes but can be done via software.
- ***Cost-effectiveness is improved***: less routers, which are costly, are needed and VLAN-aware switches are used instead. Routers are only needed to communicate between two VLANs.
- ***Additional features***: the VLAN user priority allows Layer 2 traffic separation.

VLAN-tagged frame format

In order to support VLANs, the Ethernet frame format is extended with a VLAN tag, indicated in red in the following illustration:

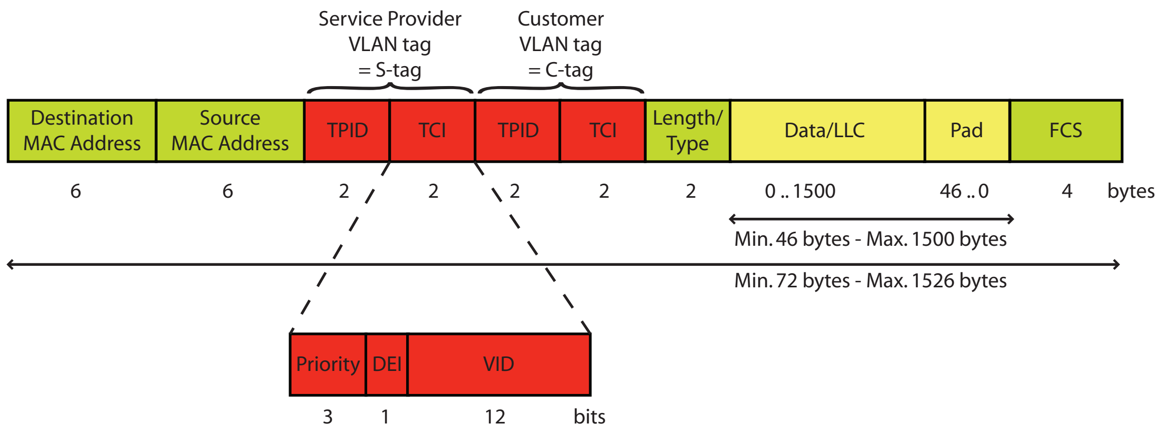


A VLAN tag consists of following fields:

- ***Tag Protocol Identifier (TPID)***: this field is located at the same place as the Length/Type field of untagged frames. The value of the field is always equal to 0x8100, which indicates that the frame is tagged and that the original Length/Type field is located after the VLAN tag.
- ***Tag Control Information (TCI)***:
  - ***User Priority Field***: this field indicates the 802.1p user priority.
  - ***Canonical Format Indicator (CFI)***
  - ***VLAN Identifier (VID)***: this field identifies the VLAN to which the frame belongs.

Stacked VLAN frame format

VLAN stacking means that a frame contains two VLAN tags. An example of a stacked VLAN frame format is shown in the following illustration:



An S-tag can be distinguished from a C-tag as follows:

- The value of the TPID field of an S-tag is set to 0x88a8.
- An S-tag contains a DEI (Drop Eligible Indicator) field instead of a CFI field.

2| VLAN Overview

3 Creating VLANs on the Thomson Gateway

Introduction

This chapter describes the creation of new VLANs on the Thomson Gateway. As soon as a VLAN is created, it can be used for:

- VLAN bridging by the Ethernet bridge.
- WAN-side VLAN tagging by logical Ethernet interfaces.
- VLAN routing.

The CLI commands explained in this chapter belong to the command group **`:eth vlan`**.

Creating a new VLAN

To create a new VLAN, use the command **`:eth vlan add`**.

Two parameters must be specified:

- ***Name***: the name of the new VLAN.
- ***Vid (VLAN identifier)***: the VID of the new VLAN.

  This VID corresponds to the value of the VID field of VLAN-tagged frames that belong to this VLAN. As this VID field has a size of 12 bits, the VID can be a number within the range from 0 through 4095. However, following VIDs are reserved and can not be used to create a new VLAN:

  - 0: this value indicates that the VLAN tag contains only user priority information and no VID.
  - 1: this value indicates the default VID. This value is already in use by the default VLAN on the bridge.
  - 4095: this value is reserved.

Optionally, following parameter can be specified:

- ***Addrule***: this parameter indicates whether the default VLAN learning constraint is used. If the parameter is not specified, the parameter is enabled.
  - If the parameter is ***enabled***, the default VLAN learning constraint is used. This means that Shared VLAN Learning (SVL) is being used between the new VLAN and the default VLAN.
  - If the parameter is ***disabled***, a separate filtering database is created for the new VLAN and Independent VLAN Learning (IVL) is being used implicitly.

It is recommended to disable this parameter when creating a new VLAN. In this case, the same MAC address can be used in different VLANs. No MAC address conflicts occur when different VLANs are connected to the same device (for example a router at the WAN side).

For more information on the configuration of VLAN learning constraints, see "4.1 VLAN Learning Constraints" on page 12.

For example, to create a data, video and voice VLAN, execute following commands:

```
=>:eth vlan add name=data vid=2
=>:eth vlan add name=video vid=3 addrule=enabled
=>:eth vlan add name=voice vid=4 addrule=disabled
```

Listing all VLANs

To list all VLANs that were created in the previous example, execute following command:

```
=>:eth vlan list
Vid      Name
---      ----
1        default
2        data
3        video
4        voice
```

The number of active VLANs is the number of VLANs that are in use at a certain moment. The maximum number of active VLANs that the bridge can support at any time is 15, including the VLANs that are already created by default.

Deleting a VLAN

To delete a specific VLAN, use the command **:eth vlan delete**.

One parameter must be specified:

- ***Name***: the name of the VLAN to be deleted.

For example, to delete the voice VLAN, execute following command:

```
=>:eth vlan delete name=voice
=>:eth vlan list
Vid      Name
---      ----
1        default
2        data
3        video
```

You cannot delete the ***default VLAN*** (VID=1).

Even if one or more bridge ports are member of the deleted VLAN, the VLAN is deleted without warning. Each affected bridge port becomes untagged member of the default VLAN.

Flushing all VLANs

To delete all VLANs at once, execute following command:

```
=>:eth vlan flush
=>:eth vlan list
Vid      Name
---      ----
1        default
```

You cannot flush the ***default VLAN*** (VID=1).

Even if one or more bridge ports are member of the flushed VLANs, the VLANs are deleted without warning. All bridge ports become untagged members of the default VLAN.

4 Ethernet Bridge and VLANs

Introduction

This chapter describes the VLAN features of the Ethernet bridge in detail. These VLAN features can be grouped as follows:

- *Ethernet bridge*:
  - The learning process is extended with the use of VLAN learning constraints.
  - Static entries can be configured per VLAN or for all VLANs.
  - VLAN awareness of the bridge.
- *Ethernet bridge ports*:
  - Tagged and untagged VLAN membership of the bridge ports.
  - Control of unexpected incoming frames on a bridge port.
- *Advanced VLAN features*:
  - Dynamic VLAN membership.
  - Unknown VID policy.
  - Extra tagging.

Overview

This chapter is structured as follows:

4.1 VLAN Learning Constraints

Introduction

The supported self-learning VLAN bridge functionality operates according to IEEE 802.1Q. This learning process creates the ***dynamic entries*** in the filtering data base(s) of the Ethernet bridge.

The CLI commands explained in this section belong to the command group **`:eth bridge rule`**.

Multiple filtering data bases

The Ethernet bridge supports multiple filtering data bases. Each filtering data base can be shared by multiple VLANs.

VLAN learning constraints

The VLAN learning constraints used by the learning process determine which dynamic entries are created in which filtering data bases.

Following VLAN learning constraints exist:

- ***Shared VLAN Learning (SVL)***: only one filtering data base is supported, shared by all VLANs. This means that if an individual MAC address is learned in one VLAN, that learned information can be used in forwarding decisions taken for that address by all other VLANs.

  In this case, only one entry for a specific MAC address can exist. The same MAC address can not be forwarded differently in different VLANs.
- ***Independent VLAN Learning (IVL)***: multiple filtering data bases are supported and each data base is used by only one VLAN. This means that if an individual MAC address is learned in one VLAN, that learned information is only used in forwarding decisions taken for that address by that VLAN.

  In this case, the same MAC address can be used in different VLANs, as each filtering data base can contain an entry for that MAC address. This way, the Thomson Gateway can be connected to the same device via different connections.
- ***Shared VLAN Learning/Independent VLAN Learning (SVL/IVL)***: this is a combination of SVL and IVL.

Creating a new VLAN learning constraint

To create a new VLAN learning constraint, use the command **`:eth bridge rule add`**.

Following two parameters must be specified:

- *Type*: the type of the VLAN learning constraint. This type can be set to:
  - Shared
  - Independent
- *Vlan*: the VLAN to which the constraint belongs.

Depending on the selected type, one of the following parameters must be specified:

- *Vlan2*: if the type is set to ***shared***, this parameter indicates a second VLAN. As a result, Shared VLAN Learning is used between the VLANs identified by the pair of VLANs (Vlan and Vlan2).
- *Isi*: if the type is set to ***independent***, this parameter indicates the Independent Set Identifier (ISI). The ISI is a number within the range from 0 through 32. As a result, Independent VLAN Learning is used between all VLANs with the same ISI.

For example, create VLAN learning constraints so that Shared VLAN Learning is used between the default, data and video VLANs and Independent VLAN Learning is used between the video and voice VLAN:

```
=>:eth bridge rule add type=shared vlan=data vlan2=default
=>:eth bridge rule add type=shared vlan=video vlan2=default
=>:eth bridge rule add type=independent vlan=video isi=0
=>:eth bridge rule add type=independent vlan=voice isi=0
```

Be careful during the creation of VLAN learning constraints, as inconsistencies are not always reported by the Thomson Gateway.

Listing all VLAN learning constraints

To list all VLAN learning constraints, execute following command:

```
=>:eth bridge rule list
Index     Type         VLAN                               Parameter
-----     ----         ----                               ---------
1         shared       data                               Shared with VLAN: default
2         shared       video                              Shared with VLAN: default
3         independent  video                              Independent set identifier: 0
4         independent  voice                              Independent set identifier: 0
```

If the list has no entry for a specific VLAN, Independent VLAN learning (IVL) is being used implicitly.

Deleting a VLAN learning constraint

To delete a VLAN learning constraint, use the command **`:eth bridge rule delete`**.

One parameter must be specified:

- *Index*: this parameter indicates the index of the VLAN learning constraint to be deleted.

For example, delete the first two VLAN learning constraints as follows:

```
=>:eth bridge rule delete index=1
=>:eth bridge rule delete index=2
=>:eth bridge rule list
Index     Type         VLAN                               Parameter
-----     ----         ----                               ---------
3         independent  video                              Independent set identifier: 0
4         independent  voice                              Independent set identifier: 0
```

Before deleting a constraint, list all VLAN learning constraints to obtain the correct index of the constraint to be deleted.

Flushing all VLAN learning constraints

To delete all VLAN learning constraints at once, execute following command:

```
=>:eth bridge rule flush
=>:eth bridge rule list
Index     Type         VLAN                               Parameter
-----     ----         ----                               ---------
```

4.2 Static Entries with VLANs

Introduction

A ***static entry*** is defined as an entry that has not been obtained through the learning process. This section describes the configuration of static entries in combination with VLANs.

Creating static entries

To create a static entry, use the command **:eth bridge macadd**.

Optionally, the parameter **vlan** can be specified:

- ***If a VLAN is specified***, one entry for that particular VLAN is added to the filtering database:

```
=>:eth bridge macadd hwaddr=00:00:00:00:00:01 intf=ethport1 vlan=default
=>:eth bridge macadd hwaddr=00:00:00:00:00:01 intf=ethport3 vlan=video
```

- ***If no VLAN is specified***, an entry for each VLAN is added to the filtering database:

```
=>:eth bridge macadd hwaddr=00:00:00:00:00:02 intf=ethport2
```

On the assumption that only a default and video VLAN exist, the resulting filtering database looks as follows:

```
=>:eth bridge maclist
00:00:00:00:00:01 -- static, default, ethport1
00:00:00:00:00:01 -- static, video, ethport3
00:00:00:00:00:02 -- static, default, ethport2
00:00:00:00:00:02 -- static, video, ethport2
00:14:7f:01:dc:9e -- permanent, default
...
```

Deleting static entries

To delete a static entry, use the command **:eth bridge macdelete**.

Optionally, the parameter **vlan** can be specified:

- ***If the entry was created for a specific VLAN***, that VLAN must be specified when removing the entry from the filtering database:

```
=>:eth bridge macdelete hwaddr=00:00:00:00:00:01
Failed to delete MAC address from database.
=>:eth bridge macdelete hwaddr=00:00:00:00:00:01 vlan=default
=>:eth bridge macdelete hwaddr=00:00:00:00:00:01 vlan=video
```

- ***If the entry was created for all VLANs***, no VLAN must be specified when removing the entries from the filtering database:

```
=>:eth bridge macdelete hwaddr=00:00:00:00:00:02 vlan=video
Failed to delete MAC address from database.
=>:eth bridge macdelete hwaddr=00:00:00:00:00:02
```

The resulting filtering database looks as follows:

```
=>:eth bridge maclist
00:14:7f:01:dc:9e -- permanent, default
...
```

4.3 VLAN Awareness

What is VLAN awareness?

VLAN awareness of the bridge indicates whether the bridge interprets the VLAN tags of received frames:

- If the bridge is ***VLAN aware***, the bridge recognizes VLAN-tagged frames and interprets the VLAN tags. The VLAN tag of a received frame identifies the VLAN to which the frame belong. The bridge forwards this VLAN-tagged frame only to bridge ports configured as an explicit member of the same VLAN.
- If the bridge is ***non-VLAN aware***, the bridge does not interpret the VLAN tags.

Configuring VLAN awareness

By default, the bridge is non-VLAN aware.

To make the bridge VLAN aware, execute following command:

```
=>:eth bridge config vlan=enabled
```

To check the VLAN awareness of the bridge, execute following command:

```
=>:eth bridge config
Ageing : 300
Filter : no_WAN_broadcast
VLAN   : enabled
IPQoS precedence map for TOS:
    IP priority    QoS internal class
        0                4
        1                7
        2                9
        3                11
        4                13
        5                14
        6                15
        7                15
```

If the bridge is non-VLAN aware, you must disable *all* VLAN-related parameters of the bridge ports (port VLAN membership, ingressfiltering, acceptvlanonly and so on) to avoid unexpected behaviour. Whenever any VLAN configuration is used, VLAN awareness must be enabled.

4.4 Port VLAN Membership

Introduction

Each bridge port can be member of one or more VLANs. A bridge port can only be member of a VLAN if this VLAN already exists on the bridge.

The CLI commands explained in this section belong to the command group **`:eth bridge vlan`**.

Tagged and untagged membership

A bridge port can be tagged or untagged member of a VLAN:

- ***Tagged member***: if the bridge port is tagged member of a VLAN, the VLAN header of received VLAN-tagged frames is not stripped off when the frames are sent out on the bridge port. As a result, all frames transmitted by the bridge port are tagged frames.
- ***Untagged member***: if the bridge port is untagged member of a VLAN, the VLAN header of received VLAN-tagged frames is stripped off when the frames are sent out on the bridge port. As a result, all frames transmitted by the bridge port are untagged frames.

Rules for bridge ports

If you want to change the VLAN membership of a bridge port, you must take following rules into account:

- A bridge port must be ***untagged*** member of ***at least 1*** VLAN.
- A bridge port can be ***untagged*** member of ***1 or more*** VLANs.
- A bridge port can be ***tagged*** member of ***0 or more*** VLANs.
- A bridge port can ***never*** be tagged ***and*** untagged member of the same VLAN.

Rules for the OBC

If you want to change the VLAN membership of the OBC, you must take following rules into account:

- The OBC can be member of all available VLANs supported by the bridge.
- The OBC can be ***untagged*** member of ***maximum one*** VLAN.
- The OBC must be member of the default VLAN.

Be careful when modifying the VLAN membership of the OBC, as violations of these rules are not always reported by the Thomson Gateway.

Listing VLAN memberships

To display all port VLAN memberships, execute following command:

```
=>:eth bridge vlan iflist
Vid      Name            Bridge interfaces (* = untagged)
---      ----            --------------------------------
1        default         OBC*, ethport1*, ethport2*, ethport3*, ethport4*, WLAN*
2        data
```

Bridge ports that are ***untagged*** member of a VLAN are indicated by an ***asterisk*** in the list.

Adding ports to a VLAN

To make a bridge port member of a VLAN, use the command **:eth bridge vlan ifadd**.

Two parameters must be specified:

- *Name*: the name of the VLAN.
- *Intf*: the name of the bridge port.

Optionally, the following parameter can be specified:

- *Untagged*: this parameter indicates whether the bridge port is tagged or untagged member of that VLAN. If the parameter is not specified, the parameter is disabled in case of the OBC and is enabled in case of all other bridge ports.
  - If the parameter is ***enabled***, the bridge port is untagged member of the VLAN.
  - If the parameter is ***disabled***, the bridge port is tagged member of the VLAN.

```
=>:eth bridge vlan iflist
Vid      Name           Bridge interfaces (* = untagged)
---      ----           --------------------------------
1        default        OBC*, ethport1*, ethport2*, ethport3*, ethport4*, WLAN*
2        data
=>:eth bridge vlan ifadd name=data intf=OBC
=>:eth bridge vlan ifadd name=data intf=ethport1
=>:eth bridge vlan ifadd name=data intf=ethport2 untagged=disabled
=>:eth bridge vlan iflist
Vid      Name           Bridge interfaces (* = untagged)
---      ----           --------------------------------
1        default        OBC*, ethport1*, ethport2*, ethport3*, ethport4*, WLAN*
2        data           OBC, ethport1*,ethport2
```

Removing ports from a VLAN

To remove a bridge port from a VLAN, use the command **:eth bridge vlan ifdelete**.

Two parameters must be specified:

- *Name*: the name of the VLAN.
- *Intf*: the name of the bridge port.

```
=>:eth bridge vlan iflist
Vid      Name           Bridge interfaces (* = untagged)
---      ----           --------------------------------
1        default        OBC*, ethport1*, ethport2*, ethport3*, ethport4*, WLAN*
2        data           OBC, ethport1*,ethport2
=>:eth bridge vlan ifdelete name=data intf=ethport2
=>:eth bridge vlan iflist
Vid      Name           Bridge interfaces (* = untagged)
---      ----           --------------------------------
1        default        OBC*, ethport1*, ethport2*, ethport3*, ethport4*, WLAN*
2        data           OBC, ethport1*
```

Modifying VLAN membership

To modify the configuration of a bridge port that is member of a VLAN, execute the command **`:eth bridge vlan ifconfig`**.

Three parameters must be specified:

- ***Name***: the name of the VLAN.
- ***Intf***: the name of the bridge port.
- ***Untagged***: this parameter indicates whether the bridge port is tagged or untagged member of that VLAN.
  - If the parameter is ***enabled***, the bridge port is untagged member of the VLAN.
  - If the parameter is ***disabled***, the bridge port is tagged member of the VLAN.

```
=>:eth bridge vlan iflist
Vid       Name            Bridge interfaces (* = untagged)
---       ----            --------------------------------
1         default         OBC*, ethport1*, ethport2*, ethport3*, ethport4*, WLAN*
2         data            OBC, ethport1*
=>:eth bridge vlan ifconfig name=data intf=ethport1 untagged=disabled
=>:eth bridge vlan iflist
Vid       Name            Bridge interfaces (* = untagged)
---       ----            --------------------------------
1         default         OBC*, ethport1*, ethport2*, ethport3*, ethport4*, WLAN*
2         data            OBC, ethport1
```

The only parameter that can be modified with this command is the parameter ***untagged***. The specified bridge port must already be member of the specified VLAN.

4.5 Optional Incoming Traffic Validation

Introduction

The Ethernet bridge can be configured to explicitly control the handling of ***unexpected frames*** coming in on any of its bridge ports. Unexpected frames are for example untagged frames or tagged frames coming in on an incorrect bridge port.

Following concepts can be used to control unexpected frames:

- Port VID (PVID)
- Acceptable frame types
- Ingress filtering

Each of these concepts is configurable per bridge port using the command **`:eth bridge ifconfig`**.

Port VID (PVID)

Each bridge port is configured with the **`vlan`** parameter, also referred to as the port VID (PVID). All ***untagged and priority-tagged*** (VID = 0) frames received on that port are handled as if they belong to that VLAN.

The PVID must be a VLAN of which the bridge port is ***untagged member***, as it is not possible to be tagged and untagged member of the same VLAN. This parameter is mandatory and this is the main reason why each bridge port has to be untagged member of at least one VLAN.

By default, the PVID of a bridge port is the default VLAN. To modify this configuration, execute following command:

```
=>:eth bridge ifconfig intf=ethport1 vlan=video
```

As the OBC is untagged member of maximum one VLAN (the default VLAN) and the PVID must be a VLAN of which the port is untagged member, the PVID of the OBC is always the default VLAN.

Be careful when modifying the PVID of a bridge port. A violation of the rule that the bridge port must be untagged member of the PVID VLAN is not always reported by the Thomson Gateway.

Acceptable frame types

Each bridge port can be configured with the **`acceptvlanonly`** parameter. This parameter is used to check the ***frame format*** of ingress traffic:

- If the parameter is ***disabled***, both VLAN-tagged and non VLAN-tagged frames (i.e. untagged or priority-tagged frames) are allowed on the port. Non VLAN-tagged frames are mapped to the VLAN that corresponds with the PVID.
- If the parameter is ***enabled***, only VLAN-tagged frames are allowed. Non VLAN-tagged frames are dropped.

By default, the parameter is disabled. To enable this parameter, execute following command:

```
=>:eth bridge ifconfig intf=ethport1 acceptvlanonly=enabled
```

Ingress filtering

Each bridge port can be configured with the **`ingressfiltering`** parameter. This parameter is used to check the ***VID*** of VLAN-tagged ingress traffic. This parameter decides whether a received frame is allowed or dropped by the port:

- If the parameter is ***disabled***, both VLAN-tagged and non VLAN-tagged frames (i.e. untagged or priority-tagged frames) are allowed on the port. Of course, these frames will only be sent out on interfaces that are member of the correct VLAN.
- If the parameter is ***enabled***, VLAN-tagged frames are dropped if the receive port is not member of the VID. VLAN-tagged frames are only allowed if the receive port is member of the VID. Non-VLAN tagged frames are mapped to the VLAN that corresponds with the PVID.

By default, the parameter is disabled. To enable this parameter, execute following command:

```
=>:eth bridge ifconfig intf=ethport1 ingressfiltering=enabled
```

Parameter status information

To obtain information on the status of the parameters that are described in this section, list the bridge port configuration as follows:

```
=>:eth bridge iflist intf=ethport1
ethport1  : dest : ethif1
           Connection State: connected   Retry: 10
           Priority Tagging: NA (destination switch interface)
           Port: ethport1       PortNr: 1          PortState: forwarding  Interface: up
           Multicast filter: disabled              Dynamic VLAN    : disabled
           WAN              : disabled
           IGMP snooping    : enabled
           Transparent Prio: disabled
           BPDU Filtering   : disabled
           Extra Tagging    : none
           VLAN: Default VLAN: default   Ingressfiltering: disabled   Acceptvlanonly: disabled
           VLAN: Priority: disabled  IP Prec: disabled  Priority: 0
           Regeneration table: 0 1 2 3 4 5 6 7
           RX bytes: 49421      frames: 14
           TX bytes: 10512      frames: 22          dropframes: 0
```

4.6 Dynamic VLAN Membership

Introduction

The basic idea of the dynamic VLAN (dynVLAN) membership feature is to assign VLANs to specific MAC addresses rather than to bridge ports. When a device with such a MAC address is connected to a bridge port, that port is dynamically added to the correct VLAN.

The dynVLAN membership feature uses two tables:

- *DynVLAN membership table*: this table contains the mapping between MAC addresses and VLANs.
- *List of active entries*: this table also contains information on the used bridge port.

The CLI commands explained in this section belong to the command group **:eth bridge dynvlan**.

General configuration of the bridge

Before using the dynVLAN membership feature, make following preparations:

- *VLAN awareness of the bridge*: extra VLANs will be created in addition to the default VLAN on the bridge. Hence, the bridge should be VLAN aware.

  By default, the bridge is non-VLAN aware. To make the bridge VLAN aware, execute following command:

```
=>:eth bridge config vlan=enabled
```

For more information on VLAN awareness, see "4.3 VLAN Awareness" on page 16

- *VLANs on the bridge*: as MAC addresses are assigned to VLANs, at least one new VLAN must be created in addition to the default VLAN:

```
=>:eth vlan add name=data vid=2
=>:eth vlan list
Vid       Name
---       ----
1         default
2         data
```

DynVLAN membership checking

DynVLAN membership checking can be enabled per bridge port using the command **:eth bridge ifconfig** and the parameter **dynvlan**.

If this parameter is enabled, the bridge port:

- Checks the source MAC address of an incoming frame,
- Looks for an entry for that MAC address in the dynVLAN membership table,
- Updates the list of active entries if the MAC address was found in the dynVLAN membership table: it creates an entry or refreshes an existing entry.

By default, dynVLAN membership checking for a bridge port is disabled. To enable this feature, execute following command:

```
=>:eth bridge ifconfig intf=ethport2 dynvlan=enabled
=>:eth bridge iflist intf=ethport2
ethport1 : dest : ethif2
        Connection State: connected   Retry: 10
        Priority Tagging: NA (destination switch interface)
        Port: ethport2       PortNr: 2          PortState: forwarding  Interface: up
        Multicast filter: disabled              Dynamic VLAN   : enabled
        WAN             : disabled
        IGMP snooping   : enabled
        Transparent Prio: disabled
        BPDU Filtering  : disabled
        Extra Tagging   : none
        VLAN: Default VLAN: default  Ingressfiltering: disabled  Acceptvlanonly: disabled
        VLAN: Priority: disabled  IP Prec: disabled  Priority: 0
        Regeneration table: 0 1 2 3 4 5 6 7
        RX bytes: 60626      frames: 129
        TX bytes: 37510      frames: 1            dropframes: 0
```

Creating a dynVLAN membership entry

To create a new entry in the dynVLAN membership table, use the command **`:eth bridge dynvlan add`**.

Following parameters must be specified:

- *Hwaddr*: this parameter indicates the MAC address to be assigned to a VLAN.
- *Vlan*: this parameter indicates to which VLAN the MAC address must be assigned.

Optionally, two other parameters can be specified:

- *Id*: the value of this parameter uniquely identifies the entry in the dynVLAN membership table. The value must be within the range from 0 through 100000.
- *Remvlan*: the VLAN that will be removed from the bridge port.

```
=>:eth bridge dynvlan add hwaddr=00:19:b9:2d:0f:c1 vlan=data id=50
```

The use of the parameter **`remvlan`** is limited: the parameter is used for all entries or for none of the entries.

The MAC addresses of the devices are stored in the dynVLAN membership table. A maximum of four devices can simultaneously make use of dynamic VLANs.

Lifetime of active entries

Each entry in the list of active entries has a timer that indicates the remaining lifetime of the entry. Every time the bridge port receives a frame with the same MAC address as the entry, the timer is refreshed. When the timer expires, the entry is removed from the list of active entries.

The initial value of the timer, expressed in seconds, is the same for all entries. This value is located within the range from 0 through 100000 s. By default, the parameter is set to 90 s. This timeout value can be modified with following command:

```
=>:eth bridge dynvlan config timeout=100
=>:eth bridge dynvlan config
Timeout 100
```

Listing dynVLAN membership information

To list the entries of the ***dynVLAN membership table***, execute following command:

```
=>:eth bridge dynvlan list
ID                    MAC Address          VLAN       RemVLAN    (* = dynamic)
--                    -----------          ---------- ----------
50                    00:19:b9:2d:0f:c1    data       (none)
```

When a device with a MAC address from the table is connected to the bridge, an entry is added to the list of active entries. To display information on the ***active MAC entries*** and their timeout, execute following command:

```
=>:eth bridge dynvlan actlist
Index    ID       MAC Address          VLAN             Interface        Timeout
50       0        00:19:b9:2d:0f:c1    data             ethport3         92
```

Deleting dynVLAN membership entries

To remove ***a specific entry*** from the dynVLAN membership table, execute the command **`:eth bridge dynvlan delete`**.

Following parameter must be specified:

- ***Id***: this parameter identifies the entry to be deleted.

```
=>:eth bridge dynvlan list
ID                    MAC Address          VLAN       RemVLAN    (* = dynamic)
--                    -----------          ---------- ----------
50                    00:19:b9:2d:0f:c1    data       (none)
=>:eth bridge dynvlan delete id=50
=>:eth bridge dynvlan list
ID                    MAC Address          VLAN       RemVLAN    (* = dynamic)
--                    -----------          ---------- ----------
```

Before you delete an entry, list all entries to obtain the correct identifier of the entry to be deleted.

To remove ***all entries*** from the dynVLAN membership table, execute following command:

```
=>:eth bridge dynvlan list
ID                    MAC Address          VLAN       RemVLAN    (* = dynamic)
--                    -----------          ---------- ----------
50                    00:19:b9:2d:0f:c1    data       (none)
=>:eth bridge dynvlan flush
=>:eth bridge dynvlan list
ID                    MAC Address          VLAN       RemVLAN    (* = dynamic)
--                    -----------          ---------- ----------
```

Applications

The Flexiport mechanism is based on the dynVLAN membership mechanism. If the Flexiport mechanism is used in combination with dynamic MAC addresses, even more than four devices can make use of Flexiport.

4.7 Unknown VID Policy

Introduction

If the bridge receives a VLAN-tagged frame and no bridge port is member of the same VLAN as the frame, the frame contains an ***unknown VID***. The bridge can be configured with an unknown VID policy that defines how frames with such an unknown VID are handled.

The CLI commands explained in this section belong to the command group **`:eth bridge unknownvlan`**.

What is the unknown VID policy?

Without the unknown VID policy, a VLAN aware bridge operates as follows: when the bridge receives a VLAN-tagged frame, this frame is only forwarded to ports that are configured as an explicit member of the same VLAN as the frame. When the bridge receives a VLAN-tagged frame with an unknown VID, the frame is ***dropped*** by the bridge.

The unknown VID policy feature supports an extra flood policy to flood frames with an unknown VID to a set of bridge ports. To this end, these ports must be a member of the ***unknown VLAN***.

General configuration of the bridge

Before using the unknown VID policy feature, make following preparations:

- *VLAN awareness of the bridge*: the bridge must be able to interpret the VLAN tags of received frames. Hence, the bridge must be VLAN aware.

  By default, the bridge is non-VLAN aware. To make the bridge VLAN aware, execute following command:

```
=>:eth bridge config vlan=enabled
```

For more information on VLAN awareness, see “4.3 VLAN Awareness” on page 16

Adding a port to the unknown VLAN

To add a bridge port to the unknown VLAN, use the command **`:eth bridge unknownvlan ifadd`**.

The following parameter must be specified:

- *Intf*: the name of the bridge port.

Optionally, two parameters can be specified:

- *Brname*: the name of the bridge instance. If the parameter is not specified, the default bridge instance is used.
- *Untagged*: this parameter indicates whether the bridge port is tagged or untagged member of the unknown VLAN. If the parameter is not specified, the parameter is enabled.
  - If this parameter is ***enabled***, the VLAN header of VLAN-tagged frames is stripped off when the frames are sent out on the bridge port.
  - If this parameter is ***disabled***, the VLAN header of VLAN-tagged frames is not stripped off when the frames are sent out on the bridge port. As a result, the frames preserve their (unknown) VID.

```
=>:eth bridge unknownvlan ifadd intf=ethport1
=>:eth bridge unknownvlan ifadd intf=ethport2 untagged=disabled
```

Some hardware limitations exist in case of Thomson Gateway devices with an Ethernet switch. The unknown VID policy feature works fine in following cases:

- No switch ports are a member of the unknown VLAN.
- All switch ports are a member of the unknown VLAN.

Other scenarios can not be handled due to hardware restrictions.

Listing unknown VLAN membership

To display information on the unknown VLAN membership of the bridge ports, execute following command:

```
=>:eth bridge unknownvlan iflist
      Bridge       Interface     Untagged
--------------------------------------
      bridge        ethport1          yes
      bridge        ethport2           no
```

Removing a port from the unknown VLAN

To remove a bridge port from the unknown VLAN, use the command **`:eth bridge unknownvlan ifdelete`**.

Only one parameter must be specified:

- ***Intf***: the name of the bridge port.

Optionally, the bridge instance can be specified:

- ***Brname***: the name of the bridge instance. If the parameter is not specified, the default bridge instance is used.

```
=>:eth bridge unknownvlan iflist
      Bridge       Interface     Untagged
--------------------------------------
      bridge        ethport1          yes
      bridge        ethport2           no
=>:eth bridge unknownvlan ifdelete intf=ethport2
=>:eth bridge unknownvlan iflist
      Bridge       Interface     Untagged
--------------------------------------
      bridge        ethport1          yes
```

Modifying unknown VLAN membership

To modify the configuration of a bridge port that is already member of the unknown VLAN, execute the command **`:eth bridge unknownvlan ifconfig`**.

Only one parameter must be specified:

- ***Intf***: the name of the bridge port.

Optionally, other parameters can be specified:

- ***Brname***: the name of the bridge instance. If the parameter is not specified, the default bridge instance is used.

- *Untagged*: this parameter indicates whether the bridge port is tagged or untagged member of the unknown VLAN. If the parameter is not specified, the parameter is enabled.

```
=>:eth bridge unknownvlan iflist
      Bridge       Interface     Untagged
--------------------------------------
      bridge        ethport1          yes
=>:eth bridge unknownvlan ifconfig intf=ethport1 untagged=disabled
=>:eth bridge unknownvlan iflist
      Bridge       Interface     Untagged
--------------------------------------
      bridge        ethport1           no
```

Applications

An important application of the unknown VID policy is the ***transparent VLAN trunking scenario***. In this scenario, all ingress frames with an unknown or unconfigured VID are sent to or from the WAN-side “trunk” port in a transparent way.

4.8 Extra Tagging (Stacked VLANs)

Introduction

The CLI commands explained in this section belong to the command group **:eth bridge xtratag**.

What is VLAN stacking?

VLAN stacking means that a frame contains two VLAN tags:

- An ***inner VID***, also referred to as the local VID.
- An ***outer VID***, also referred to as the WAN-side VID.

General configuration of the bridge

Before using the unknown VID policy feature, make following preparations:

- ***VLAN awareness of the bridge***: the bridge must be able to interpret the VLAN tags of received frames. Hence, the bridge must be VLAN aware.

  By default, the bridge is non-VLAN aware. To make the bridge VLAN aware, execute following command:

```
=>:eth bridge config vlan=enabled
```

For more information on VLAN awareness, see "4.3 VLAN Awareness" on page 16

Extra tagging mode

Each bridge port can be configured with an ***extra tagging mode***.

By default, the extra tagging mode is set to none. To change the mode, execute the command **:eth bridge ifconfig** and specify the value of the parameter **xtratagging**.

The parameter can have one of the following values:

- ***None***: the extra tagging feature is not used.
- ***C-vlan***: the extra tagging feature is used. When a frame is sent out on the bridge port, two tags are added: an inner C-tag with the inner VID and an outer C-tag with the outer VID.
- ***S-vlan***: the extra tagging feature is used. When a frame is sent out on the bridge port, two tags are added: an inner C-tag with the inner VID and an outer S-tag with the outer VID.

```
=>:eth bridge ifconfig intf=eth_data xtratagging=c-vlan
=>:eth bridge iflist intf=eth_data
eth_data  : dest : atm_data
           Connection State: connected   Retry: 10
           Priority Tagging: Disabled
           Port: wan0           PortNr: 6          PortState: forwarding  Interface: unknown
           Multicast filter: disabled              Dynamic VLAN     : disabled
           WAN              : enabled
           IGMP snooping    : enabled
           Transparent Prio: disabled
           BPDU Filtering   : disabled
           Extra Tagging    : c-vlan
           VLAN: Default VLAN: default  Ingressfiltering: disabled  Acceptvlanonly: disabled
           VLAN: Priority: disabled  IP Prec: disabled  Priority: 0
           Regeneration table: 0 1 2 3 4 5 6 7
           RX bytes: 0          frames: 0
           TX bytes: 0          frames: 0            dropframes: 0
```

Adding a VID translation entry

If a bridge port receives a VLAN-tagged frame, the ***VID translation table*** indicates the VID value of the corresponding outer VID.

An entry can be added to the VID translation table using the command **`:eth bridge xtratag add`**.

To create an entry, three parameters must be specified:

- ***Intf***: the name of the bridge port.
- ***Innervid***: the inner VID. This parameter can be set to:
  - A ***number*** within the range from 1 through 4094.
  - ***All***, indicating that any inner VID is translated to the specified outer VID.
- ***Outervid***: the outer VID. This parameter can be set to:
  - A ***number*** within the range from 1 through 4094.
  - ***Notag***, indicating that no outer VLAN tag is added.
  - ***Transparent***, indicating that the outer VID is set to the inner VID.

In addition, if the bridge port is not a member of the default bridge instance, the following parameter must be specified:

- ***Brname***: the name of the bridge instance to which the bridge port belongs. If this parameter is not specified, the default bridge instance is selected.

```
=>:eth bridge xtratag add intf=eth_data innervid=2 outervid=5
=>:eth bridge xtratag add intf=eth_data innervid=3 outervid=4
```

Entries can ***not*** be added for bridge ports with the extra tagging mode ***none***.

Per bridge port, not more than ***four*** entries can be added to the VID translation table.

Listing the VID translation table

To display all entries of the VID translation table, execute following command:

```
=>:eth bridge xtratag list
      Bridge        Interface     Inner VID     Outer VID
------------------------------------------------------
      bridge         eth_data             2             5
      bridge         eth_data             3             4
```

Configuring a VID translation entry

An entry of the VID translation table can be modified using the command **`:eth bridge xtratag config`**.

The entry is identified by the bridge port and the inner VID. The configured outer VID of this entry can be modified. As a result, three parameters must be specified:

- ***Intf***: the name of the bridge port.
- ***Innervid***: the inner VID.
- ***Outervid***: the new outer VID. This parameter can be set to:
  - A ***number*** within the range from 1 through 4094.
  - ***Notag***, indicating that no outer VLAN tag is added.
  - ***Transparent***, indicating that the outer VID is set to the inner VID.

In addition, if the bridge port is not a member of the default bridge instance, following parameter must be specified:

- ***Brname***: the name of the bridge instance to which the bridge port belongs. If this parameter is not specified, the default bridge instance is selected.

```
=>:eth bridge xtratag config intf=eth_data innervid=2 outervid=transparent
=>:eth bridge xtratag list
      Bridge        Interface     Inner VID     Outer VID
------------------------------------------------------
      bridge         eth_data             2   transparent
      bridge         eth_data             3             4
```

Deleting a VID translation entry

To delete an entry of the VID translation table, execute the command **`:eth bridge xtratag delete`**.

Two parameters must be specified to define the entry to be deleted:

- ***Intf***: the name of the bridge port.
- ***Innervid***: the inner VID.

In addition, if the bridge port is not a member of the default bridge instance, the following parameter must be specified:

- ***Brname***: the name of the bridge instance to which the bridge port belongs. If this parameter is not specified, the default bridge instance is selected.

```
=>:eth bridge xtratag list
      Bridge       Interface    Inner VID    Outer VID
------------------------------------------------------
      bridge        eth_data            2  transparent
      bridge        eth_data            3            4
=>:eth bridge xtratag delete intf=eth_data innervid=2
=>:eth bridge xtratag list
      Bridge       Interface    Inner VID    Outer VID
------------------------------------------------------
      bridge        eth_data            3            4
```

Flushing all VID translation entries

To delete the entries of the VID translation table all at once, execute following command:

```
=>:eth bridge xtratag list
      Bridge       Interface    Inner VID    Outer VID
------------------------------------------------------
      bridge        eth_data            2  transparent
      bridge        eth_data            3            4
=>:eth bridge xtratag flush
=>:eth bridge xtratag list
      Bridge       Interface    Inner VID    Outer VID
------------------------------------------------------
```

Applications

Following scenarios are based on the extra tagging feature:

- ***Stacked VLAN tunnelling or Q-in-Q tunnelling*** is supported by unconditionally adding an extra S-tag to a C-tagged frame.
- ***VID translation***: if the bridge port is untagged member of the VLAN with the inner VID, the outgoing frame has only one VLAN tag with the outer VID. The inner VID is thus translated into the outer VID.

5 Logical Ethernet Interfaces and VLANs

Introduction

Logical Ethernet interfaces can be configured to support following VLAN features:

- ***VLAN tagging*** of traffic at the WAN-side
- Support of ***VLAN routing*** on the Thomson Gateway

VLAN tagging parameter

A logical Ethernet interface can be assigned to a VLAN using the **`vlan`** parameter of the **`:eth ifconfig`** command.

- If the parameter is set to the ***default VLAN***, the logical Ethernet interface transmits untagged frames. By default, the interface is assigned to the default VLAN.
- If the parameter is set to ***another VLAN***, the frames transmitted by the logical Ethernet interface are tagged with the specified VLAN.

```
=>:eth ifconfig intf=eth_video vlan=video
=>:eth iflist intf=eth_video
eth_video       : Dest: eth_total
                  Connection State: not-connected  Retry: 10
                  WAN: Enabled
                  Priority Tagging: Disabled
                  PortNr: (unassigned)
                  VLAN: video
```

5.1 WAN-side VLAN Tagging

Introduction

In order to support WAN-side VLAN tagging, logical Ethernet interfaces are stacked on top of each other. Several logical Ethernet interfaces with different VLANs (tagged) are created on top of a single logical Ethernet interface with the default VLAN (untagged).

Configuring WAN-side VLAN tagging

To configure WAN-side VLAN tagging, execute following steps:

1 Create the necessary VLANs:

```
=>:eth vlan add name=video vid=2
=>:eth vlan add name=voice vid=3
```

2 Create a first logical Ethernet interface:

```
=>:eth ifadd intf=eth_total
=>:eth ifconfig intf=eth_total dest=atm_total wan=enabled
=>:eth ifattach intf=eth_total
```

3 On top of this interface, configure several logical Ethernet interfaces that support VLAN tagging:

```
=>:eth ifadd intf=eth_video
=>:eth ifconfig intf=eth_video dest=eth_total wan=enabled vlan=video
=>:eth ifattach intf=eth_video

=>:eth ifadd intf=eth_voice
=>:eth ifconfig intf=eth_voice dest=eth_total wan=enabled vlan=voice
=>:eth ifattach intf=eth_voice
```

5.2 VLAN Routing on the Thomson Gateway

Introduction

VLAN bridging does not allow communication between two VLANs: the bridge forwards a frame that belongs to a specific VLAN only to bridge ports that are member of the same VLAN.

VLAN routing is needed to communicate between two VLANs. To this end, the router on the Thomson Gateway must be member of both VLANs.

Configuring VLAN routing

To configure WAN-side VLAN tagging, execute following steps:

1 Make the bridge VLAN aware:

```
=>:eth bridge config vlan=enabled
```

2 Create the necessary VLAN(s):

```
=>:eth vlan add name=video vid=2
```

3 Make the OBC tagged member of the new VLAN(s):

```
=>:eth bridge vlan ifadd intf=OBC name=video untagged=disabled
```

4 For each new VLAN, create a ***logical Ethernet interface***. Configure this interface with the bridge as destination and associate the interface with the VID of the correct VLAN:

```
=>:eth ifadd intf=eth_video
=>:eth ifconfig intf=eth_video dest=bridge vlan=video
=>:eth ifattach intf=eth_video
```

5 On top of each logical Ethernet interface, create a new IP interface. These IP interfaces are connected to the router:

```
=>:ip ifadd intf=ip_video dest=eth_video
=>:ip ifattach intf=ip_video
```

The resulting configuration of the Thomson Gateway can be used to configure several VLAN routed scenarios. To this end, some additional steps are necessary: the IP interfaces must be configured with IP addresses, the necessary routes must be added to the router, and so on.

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