



The Loop-Back Mode

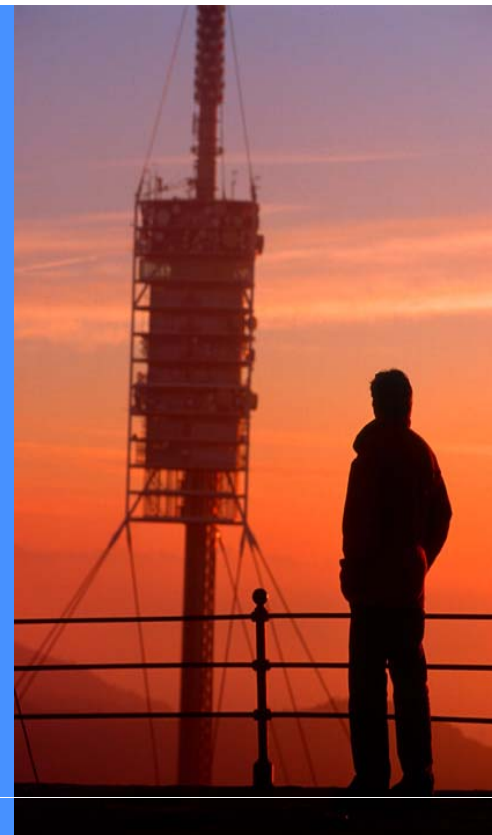


Loops are quite common when testing. A technician can test a link before bringing it into service. The technician loops the traffic in the far end back to the tester and analyses the signal to detect potential problems after the traffic has crossed the network.

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by Francisco J. Hens

Testing the World's Networks



TrendCommunications

INTRODUCTION

One of the main features of (switched) Ethernet is the bridging mechanism. Unlike in IP, ATM or MPLS, in Ethernet, managing the switching tables is part of the forwarding plane. Thanks to the *bridging mechanism*, Ethernet is “plug and play”; most of the times it does not require any special configuration. This has become one of the most important advantages of Ethernet.

However, bridging has some inconveniences as well, the most important of them being that network topologies with loops are not allowed. Special protocols, like the *Spanning Tree Protocol (STP)*, have been developed to prevent loops in switched Ethernet networks.

Loops are quite common when testing. A technician can test a link before bringing it into service. The technician loops the traffic in the far end back to the tester and analyses the signal to detect potential problems after the traffic has crossed the network (see Figure 1). In technologies such as SDH or PDH, the loop is made up of a cable connecting a transmitting port to a receiving port in the destination. In Ethernet this is not possible.

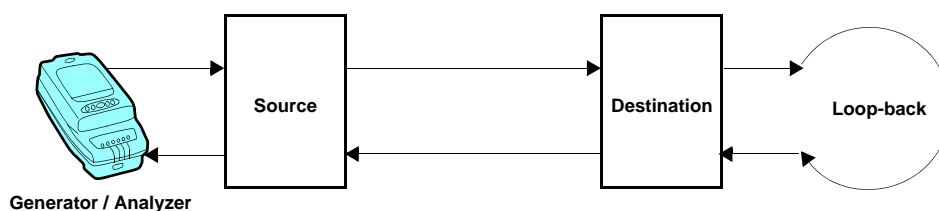


Figure 1 A typical measurement carried out by testing staff before bringing a link into service

ETHERNET AND LOOPS

When a frame enters an Ethernet bridge or switch, the destination MAC address is checked:

- If the address is found in the switching table, the frame is sent to the corresponding output interface.
- If the address is not found, the frame is broadcast to all the interfaces except to the incoming one.

The source MAC address is also checked for every incoming frame:

- If the address is not found in the switching table, it is stored in the table and associated to the incoming interface. This prevents

broadcasting when the same address is found in the destination field of other frames.

- If the address is found in the switching table, no action is needed.

Problems arise when two ports are looped by a cable in the switch. In this case, what happens is that a frame with the same source MAC address arrives from two different ports (see Figure 2). If the STP protocol is not configured, the switch cannot solve the situation and it stops working correctly. When the STP is enabled, one of the conflicting links is declared out of service for user traffic.

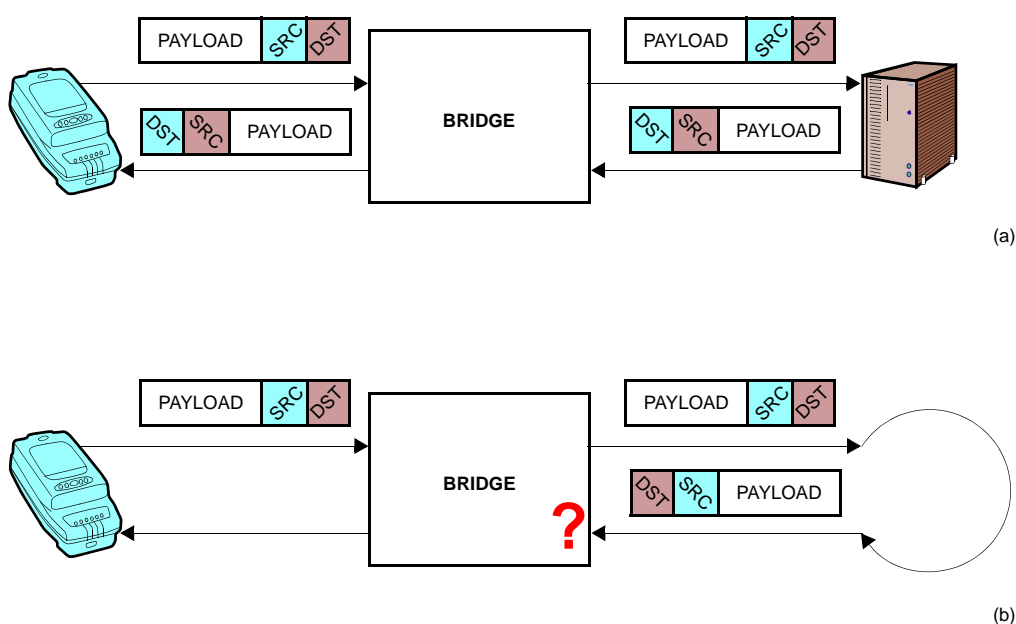


Figure 2

Ethernet switches and bridges do not know what to do when they receive MAC frames with the same source address from two or more different ports. (a) All ports in the bridge receive frames from the devices attached to them. (b) The looped port receives frames from a device that is attached to a different interface. This generates a conflict in the bridge.

UPPER LAYER LOOP-BACK MODES

Aurora Tango Gigabit Ethernet is a tester with a full set of functions to help in the installation and maintenance of Ethernet links and services operating at 10/100/1000 Mbit/s.

Aurora Tango can be configured in different loop-back modes. The simplest mode is the physical "wire" loop, but more sophisticated loop-

back modes are possible for end-to-end tests in bridged and routed networks (see Figure 3).

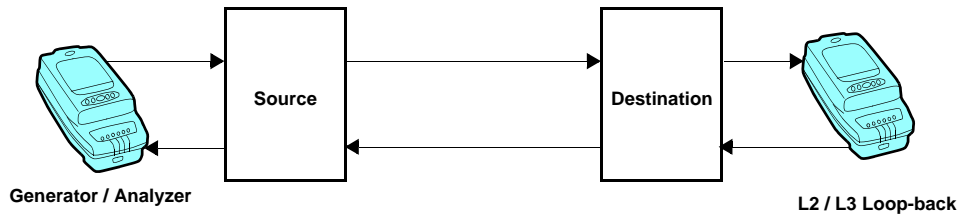


Figure 3 Test performed with Aurora Tango Gigabit Ethernet. The first tester is configured in “End-point” mode to generate and analyse test traffic. The second tester is set to “Loop-back” mode to forward traffic back to the origin.

Altogether, there are four different loop-back modes in the Aurora Tango Gigabit Ethernet (see Figure 4):

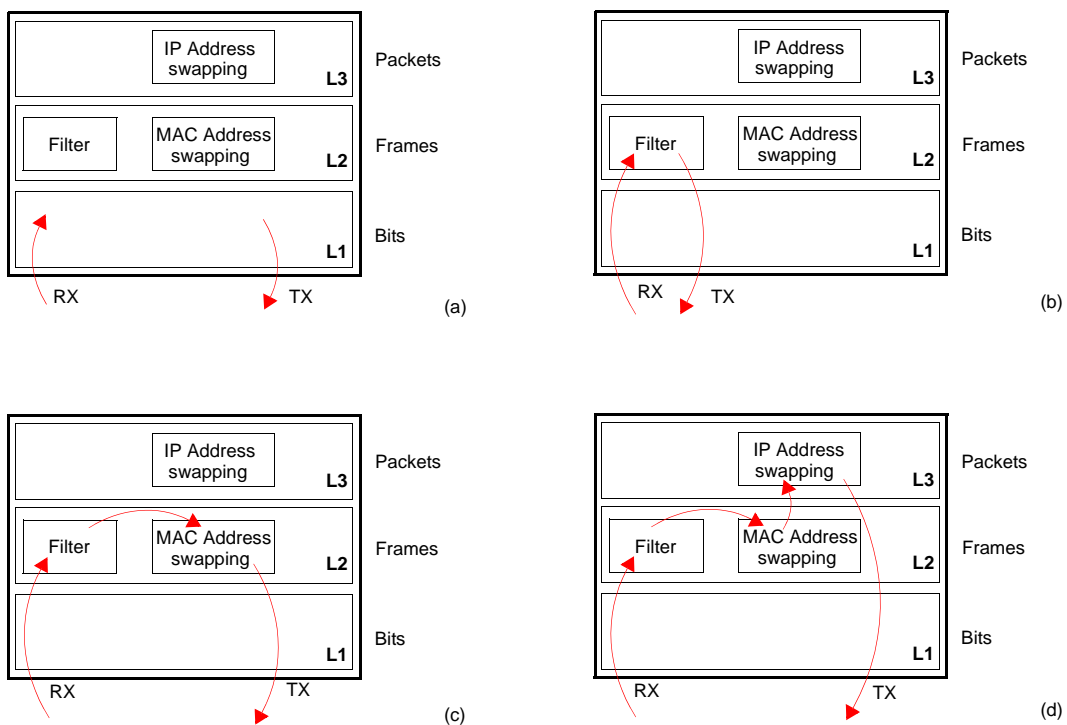


Figure 4 The loop-back operation modes of Aurora Tango Gigabit Ethernet: (a) “Wire” loop-back. (b) “Frame” loop-back. (c) “L2” loop-back. (d) “L3” loop-back.

- a. The “*Wire*” loop-back loops all the incoming data back to the origin bit by bit. It is a physical layer loop-back similar to a wire connection between the transmitter and the receiver of the interface where Aurora Tango is connected.
- b. The “*Frame*” loop-back reads the contents of the frame before looping it

back to the origin. This feature makes it possible to filter the incoming data: for example, one could only loop frames with a specified source or destination MAC address, or those that belong to a particular VLAN.

- c. The “L2” loop-back mode is designed for bridged networks. It swaps source and destination addresses before looping back the frames. Thanks to MAC address swapping, any conflict in the intermediate switches / bridges is avoided. In this mode it is also possible to perform filtering operations.
- d. The “L3” loop-back mode is similar to the “L2” loop-back, except that it also swaps source and origin IP addresses before looping the frames back. This is the operation mode to choose for loop-back in routed networks with IP routers on the path between the Generator / Analyser test set and the loop-back tester (Figure 5).

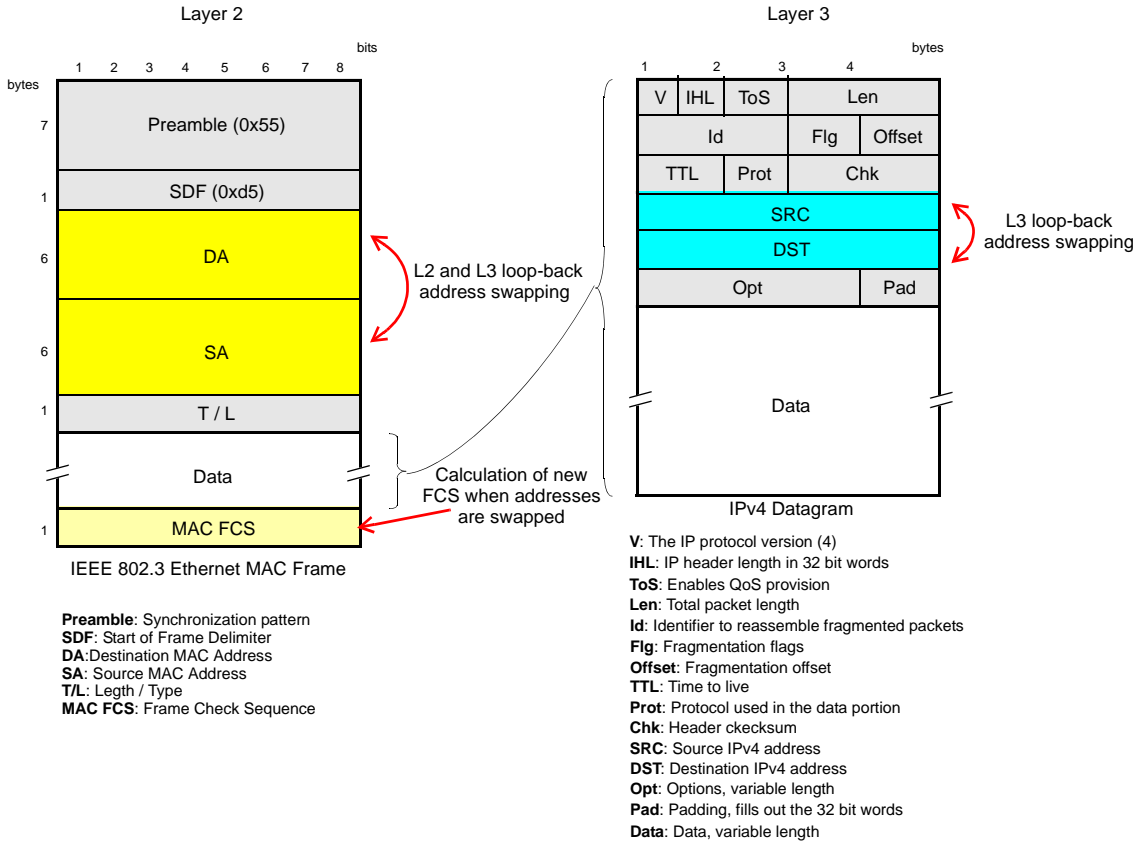


Figure 5 Address swapping in Ethernet frames and IP datagrams when L2 or L3 loop-back mode is used in Aurora Tango

CONCLUSIONS

Unlike the legacy transmission technologies, such as SDH or PDH, Ethernet does not allow physical “wire” loops. Before looping back a frame, it is necessary to swap source and destination MAC addresses, or a conflict will arise in the intermediate switches / bridges.

Aurora Tango Gigabit Ethernet is a test set for 10/100/1000 Gbit/s that includes several different loop-back modes (see Figure 6). These modes enable end-to-end testing of Ethernet and Gigabit Ethernet without generating conflicts in the intermediate network elements.

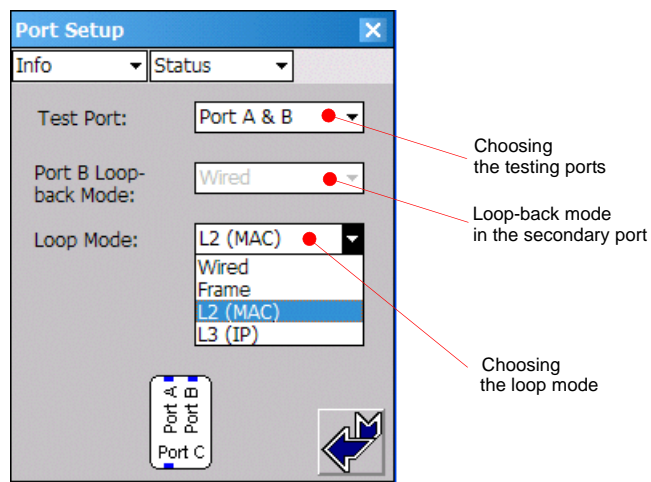


Figure 6

The port configuration screen of Aurora Tango Gigabit Ethernet



Trend Communications Ltd.
Whitebrook Park
Lower Cookham Rd.
Maidenhead, Berkshire
SL6 8XY - UK

TrendCommunications

Americas: +1 256 461 0790

China: +86 10 8518 3141

Deutschland: +49 (0) 8932 3009-0

España: +34 93 300 3313

France: +33 01 69 35 54 70

India: +91 11 25554161

UK: +44 (0) 1628 503529

web: www.trendcomms.com

mail: infoline@trendcomms.com



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