# 8 Ethernet Model Description

## Background / Operational Description

Ethernet is a bus-based local area network (LAN) technology commonly used in the technical and business communities.

Detailed information about the Ethernet protocol is in the *IEEE 802.3 Standard.*

## Model Scope and Limitations

The Ethernet MAC model provided with OPNET implements the carrier sensing, collision detection, and retransmission mechanisms specified in the *IEEE 802.3, IEEE 8-2.3u, and IEEE 802.3z Standard*. Explicit modeling is performed for all features other than serialization of bit transfers to and from the physical layer. The following list itemizes the features provided in this model:

- FIFO processing of Transmission Requests
- Propagation Delay based on Distance Between Individual Stations
- Carrier Sensing from Physical Layer
- Collision Detection from Physical Layer
- Truncated Binary Exponential Backoff
- Transmission Attempt Limit of 16
- Interframe Gap Timing for Deference
- Jam Sequence Transmission after Collisions
- 802.3 Minimum and Maximum Frame Sizes
- Frame Bursting (1000BaseX Ethernet operating in half-duplex only)
- Full- and half-duplex transmissions

You can configure port-based VLANs on all generic bridge and switch models, and on any vendor-specific models that support this technology. Ethernet link models allow you to simulate point-to-point trunk links; a single trunk link can carry traffic for multiple VLANs as specified by IEEE 802.1q.

To configure a VLAN, set the VLAN Scheme attribute to “Port-based VLAN” on the bridge or switch supporting the VLAN. You can assign VLAN identifiers to specific port numbers in the VLAN Port Configuration Table. (To find a link’s port numbers, use Link Interfaces on the Edit Attributes (Advanced) dialog box.) Note that you can assign only one VLAN identifier to a specific port. However, multiple ports can belong to the same VLAN.

The Ethernet models also support Fast EtherChannel technology. This allows multiple Ethernet point-to-point links to be bundled into one logical full-duplex channel of up to 800 Mbps (for Fast Ethernet) or 8000 Mbps (for Gigabit Ethernet). You can use a Fast EtherChannel or Gigabit EtherChannel link in place of any regular Ethernet link (10BaseT, 100BaseT, or 1000BaseX). EtherChannel links support flow-based balancing of traffic, and are useful for upgrading bottleneck links in Ethernet LAN networks.

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**Note—**You can only use EtherChannel links when Ethernet is running in full-duplex mode.

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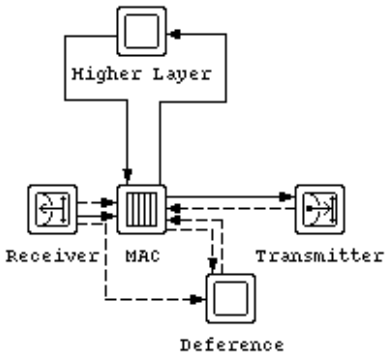
The Ethernet models can be deployed either in a bus (10Base2) or a hub (10BaseT, 100BaseT or fast ethernet, and 1000BaseX or gigabit ethernet) configuration. The following list itemizes the main differences between these two configurations:

- Connections from the MAC processes to the hub are via duplex point-to-point links, as opposed to a bus medium.
- Collision Detection in the hub configuration is handled by the hub, rather than individual MAC processes.
- Deference mechanism is handled by the hub, rather than a separate deference process.
- Ethernet hubs cannot be directly connected to one another. Instead, a bridge must be used to link two or more hubs together.

## Model Architecture

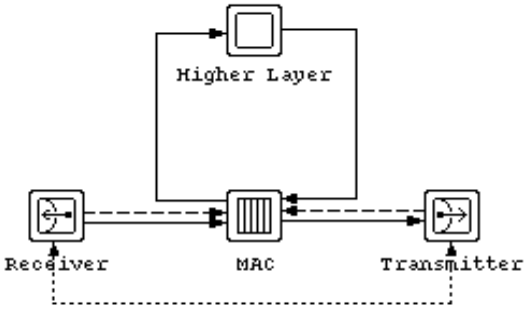
The following diagram illustrates the relevant portions of a typical 10Base2 node model using the process models defined for the Ethernet model suite.

**Figure 8-1 Node Model Structure Surrounding Ethernet**



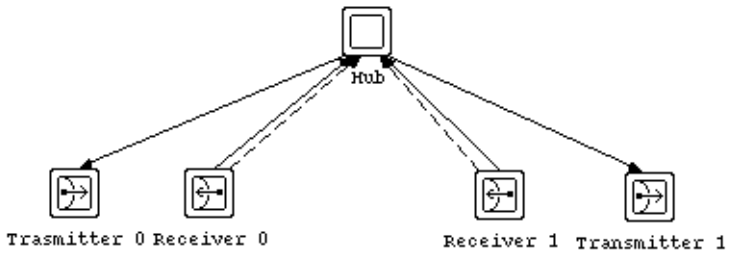

The following diagram illustrates the relevant portions of a typical node model.

**Figure 8-2 Node Model Structure Surrounding Ethernet Hub**



The following diagram illustrates the relevant portions of a typical hub node model.

**Figure 8-3 Node Model Structure Surrounding Ethernet Hub**




## Process Models

The following table enumerates the process models used by the Ethernet model suite. Additional details on these process models are provided in subsequent sections.

**Table 8-1 Ethernet Process Models (Part 1 of 2)**

| name | location | summary |
|---|---|---|
| eth_defer_v2 | Deference Module | Performs carrier sensing and computes the deference variable. |
| eth_gen_v2 | Higher Layer Module | Provides a simple example of higher-layer interfacing with the Ethernet MAC protocol. The process generates packets to the other stations on the LAN. |
| ethernet_hub_v2 | Hub Module | Implements the Ethernet hub functions such as collision detection. |

**Table 8-1 Ethernet Process Models (Part 2 of 2)**

| name | location | summary |
|---|---|---|
| ethernet_mac_v2 | MAC Module | Performs media access control for the Ethernet interface in a 10BaseT, 100BaseT, or 1000BaseX configuration. The module can operate in either half or full duplex mode, and if operating at gigabit ethernet speed, can have frame bursting either enabled or disabled. |
| eth_mac_v2 | MAC Module | Performs media access control for the Ethernet interface in a 10Base2 configuration. |
| eth_sink_v2 | Higher Layer Module | Provides a simple example of higher-layer interfacing with the Ethernet MAC protocol. The process simply discards arriving packets. |
| **End of Table 8-1** | | |

# Model Interfaces

## Packet Formats

The following table enumerates the packet formats used in the Ethernet model suite.

**Table 8-2 Ethernet Packet Formats**

| name | description |
|---|---|
| ethernet | Represents the Ethernet packet format. This packet format allows for the encapsulation of higher level protocol data and carries control fields such as destination and source address, and protocol type. In addition, the frame check sequence (FCS) and preamble components of transmissions are modeled as fields of the packet. |
| **End of Table 8-2** | |

## ICI Formats

The following table enumerates the interface control information (**ICI**) formats used in the Ethernet model suite.

**Table 8-3 Ethernet ICI Formats**

| name | description |
|---|---|
| eth_mac_ind | Used in conjunction with packet transfers from eth_mac_v2 (or ethernet_mac_v2) to the higher layers. The attributes carried in this ICI specify the destination address (normally that of this station), the address of the sending station, and the type of higher level protocol used, respectively. |
| mac_req | Used in conjunction with packet transfers to eth_mac_v2 (or ethernet_mac_v2). It carries the destination address of the node to which the packet is being transmitted. The higher level protocol type may also be passed in this ICI, but it is not currently used by MAC processes. |
| **End of Table 8-3** | |

## Ethernet Addressing

Each MAC entity has a physical address, specified by the “station_address” attribute of the eth_mac_v2 (and ethernet_mac_v2) process models.When using these models in conjunction with the Spanning Tree Bridge models, the Ethernet addresses must be unique for the entire OPNET network to support correct bridge address learning. The addresses can be automatically assigned to meet this requirement.