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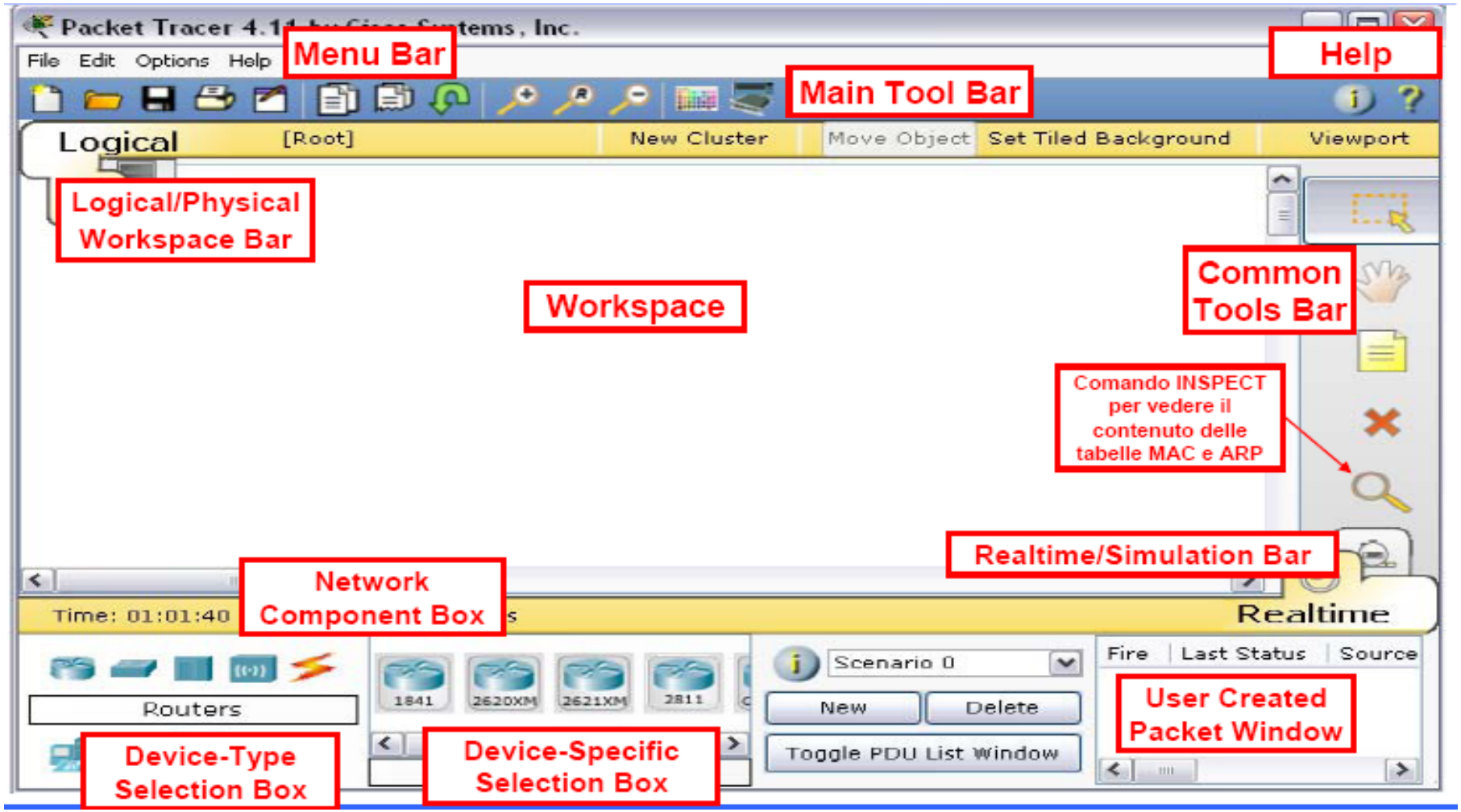
Packet Tracer and initial router configuration

Packet Tracer (1/2)

- **Packet Tracer?**
  - Cisco Packet Tracer is a software able to emulate CISCO networking devices.
- **Packet Tracer features:**
  - Allows to create network topologies with Cisco devices and generic device.
  - Emulate the Command Line Interface (CLI) of the Cisco IOS (a subset of functions).
  - Allows to configure, using the CLI (or the GUI), the network devices so that to check the correctness of a network configuration .
  - Dynamically evaluate the device state and the traffic packets exchanged into the network.

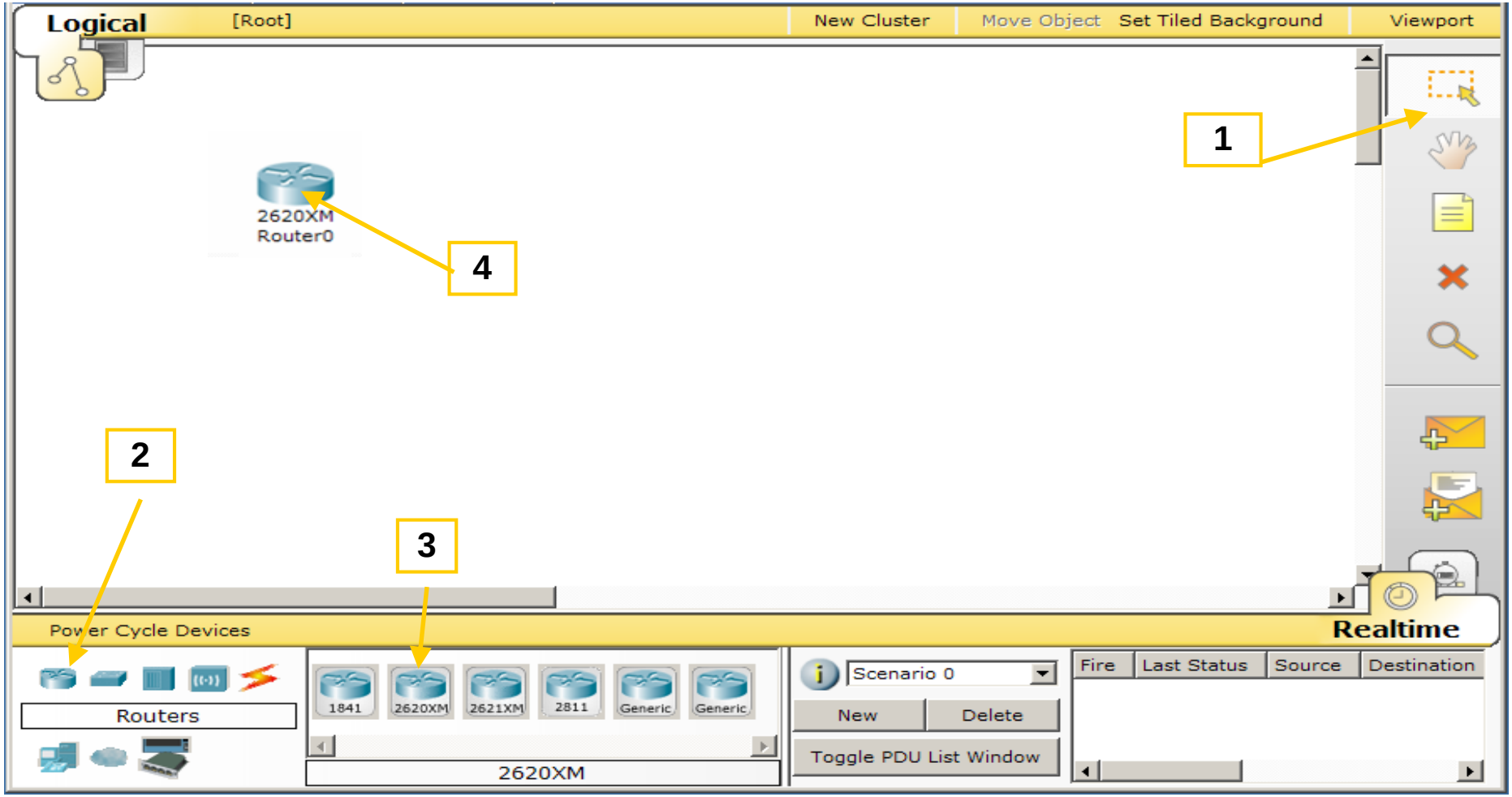
Packet Tracer (2/2)



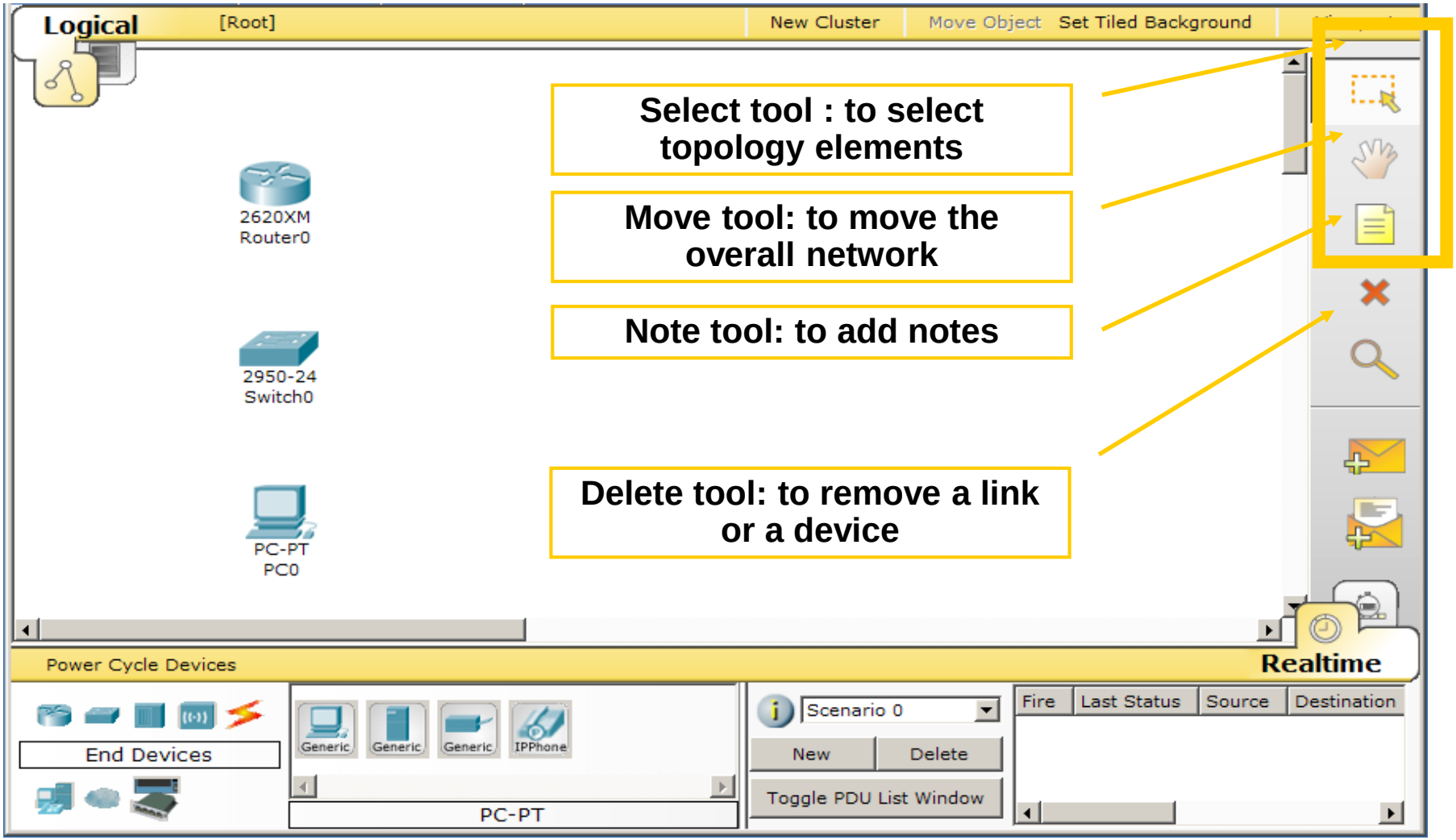
Topology and available devices

- **It is possible**
  - To start from an existing topology
    - open -> Reference_Topologies
  - Or to create your own network
- **It is possible to use**
  - Cisco network devices with specific hardware features
  - Customize generic devices

How to insert a device



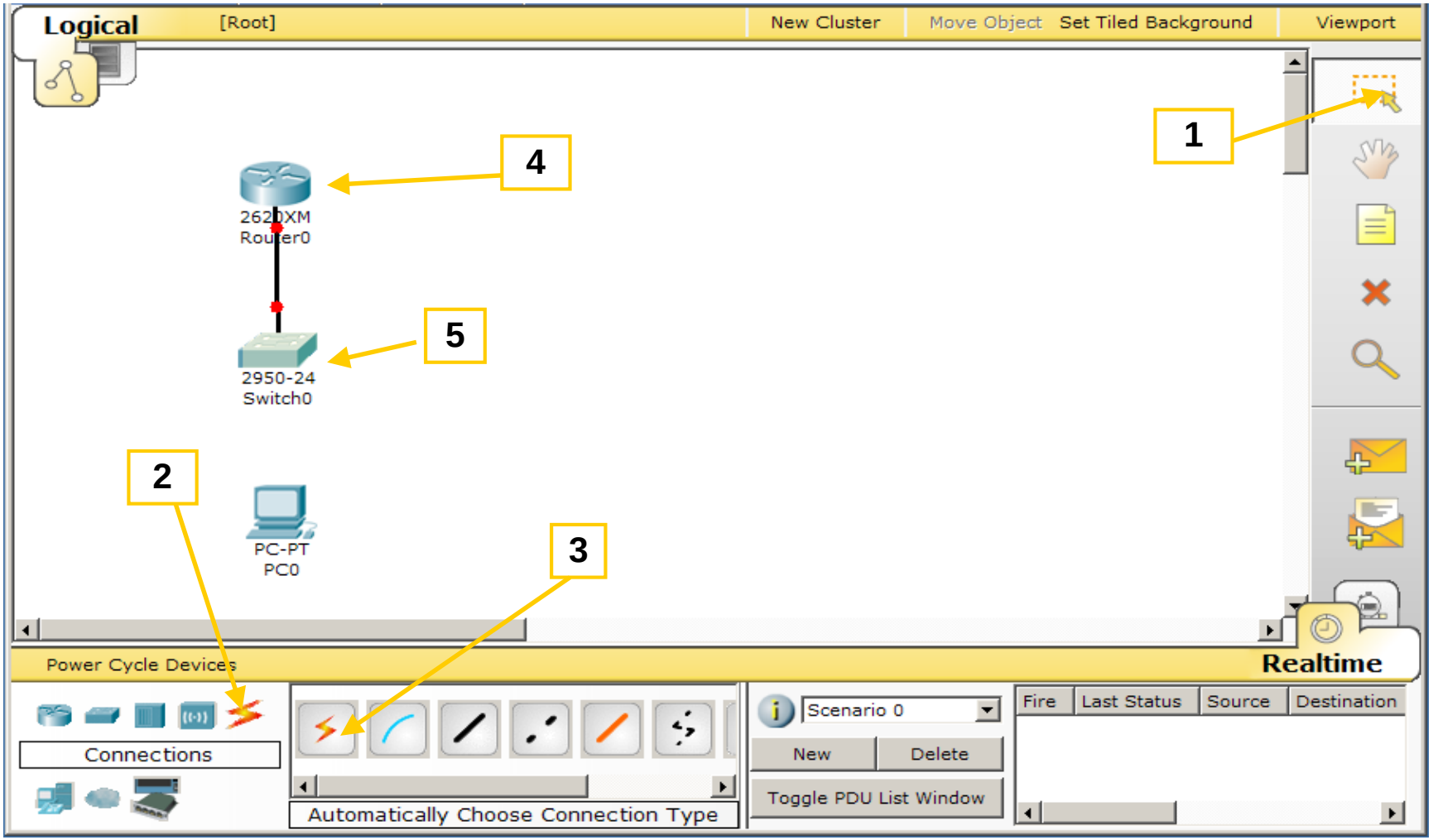
The Common Tools Bar



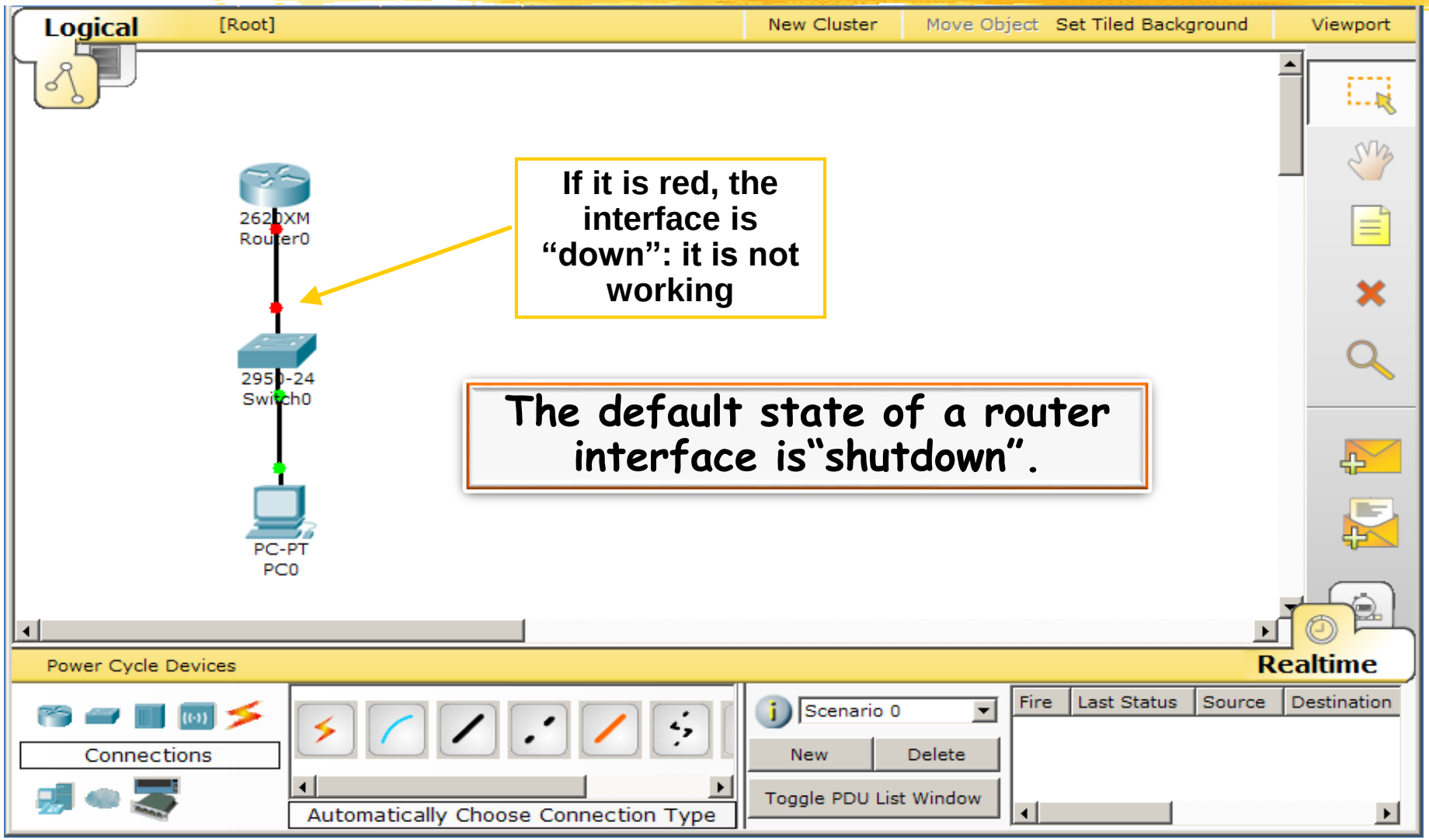
Connecting devices

- To connect two network devices, it is needed to select:
  - An adequate physical medium (wired/wireless cable)
  - The proper interfaces
- It is also possible to use the smart connection mode:
  - Packet Tracer selects on itself the cable and the interfaces to be connected

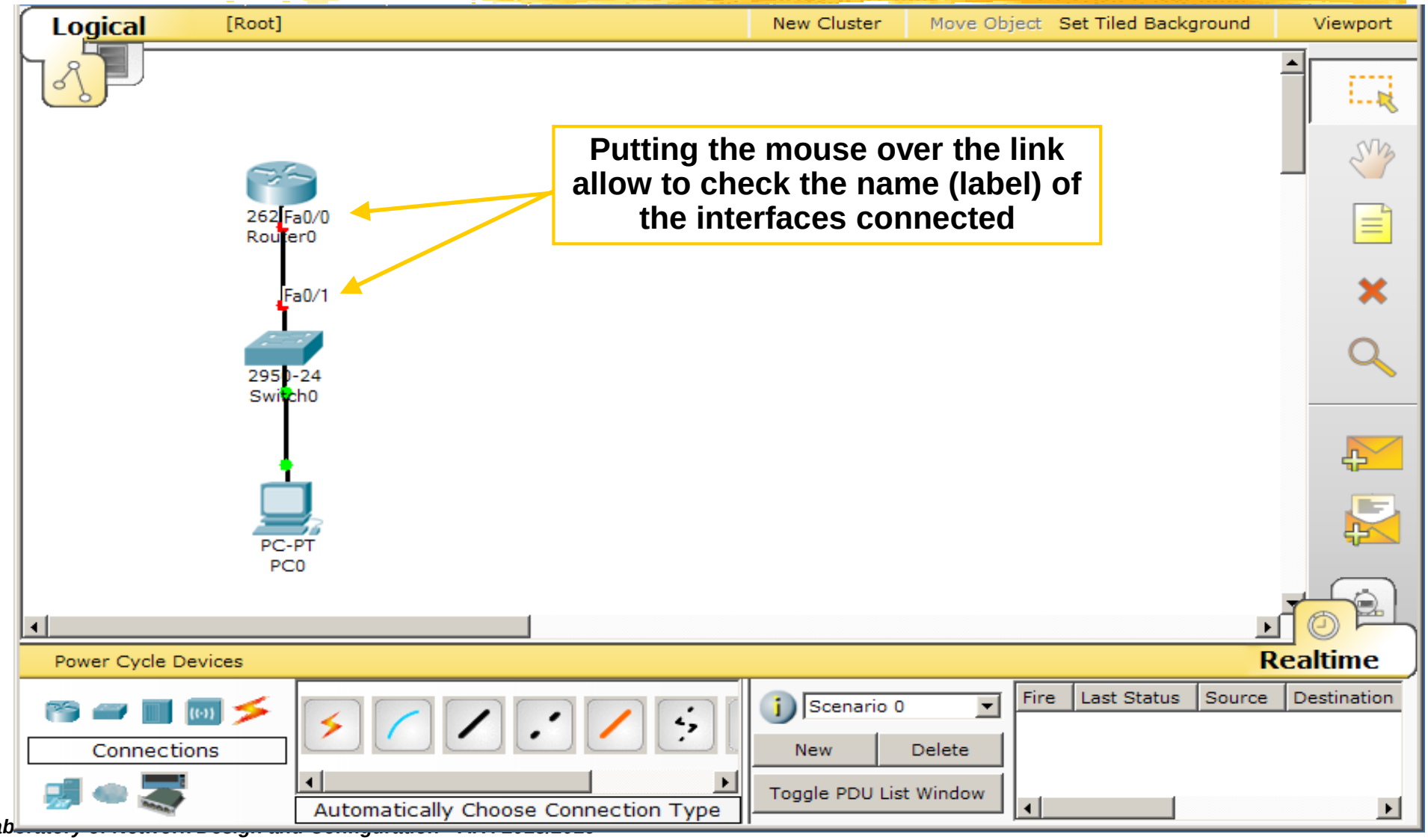
The Smart Connection mode



Port Status


Logical
[Root]
New Cluster
Move Object
Set Tiled Background
Viewport
2620XM
Router0
2950-24
Switch0
PC-PT
PC0
If it is red, the interface is "down": it is not working
The default state of a router interface is"shutdown".
Power Cycle Devices
Realtime
Connections
Automatically Choose Connection Type
Scenario 0
New
Delete
Toggle PDU List Window
Fire
Last Status
Source
Destination

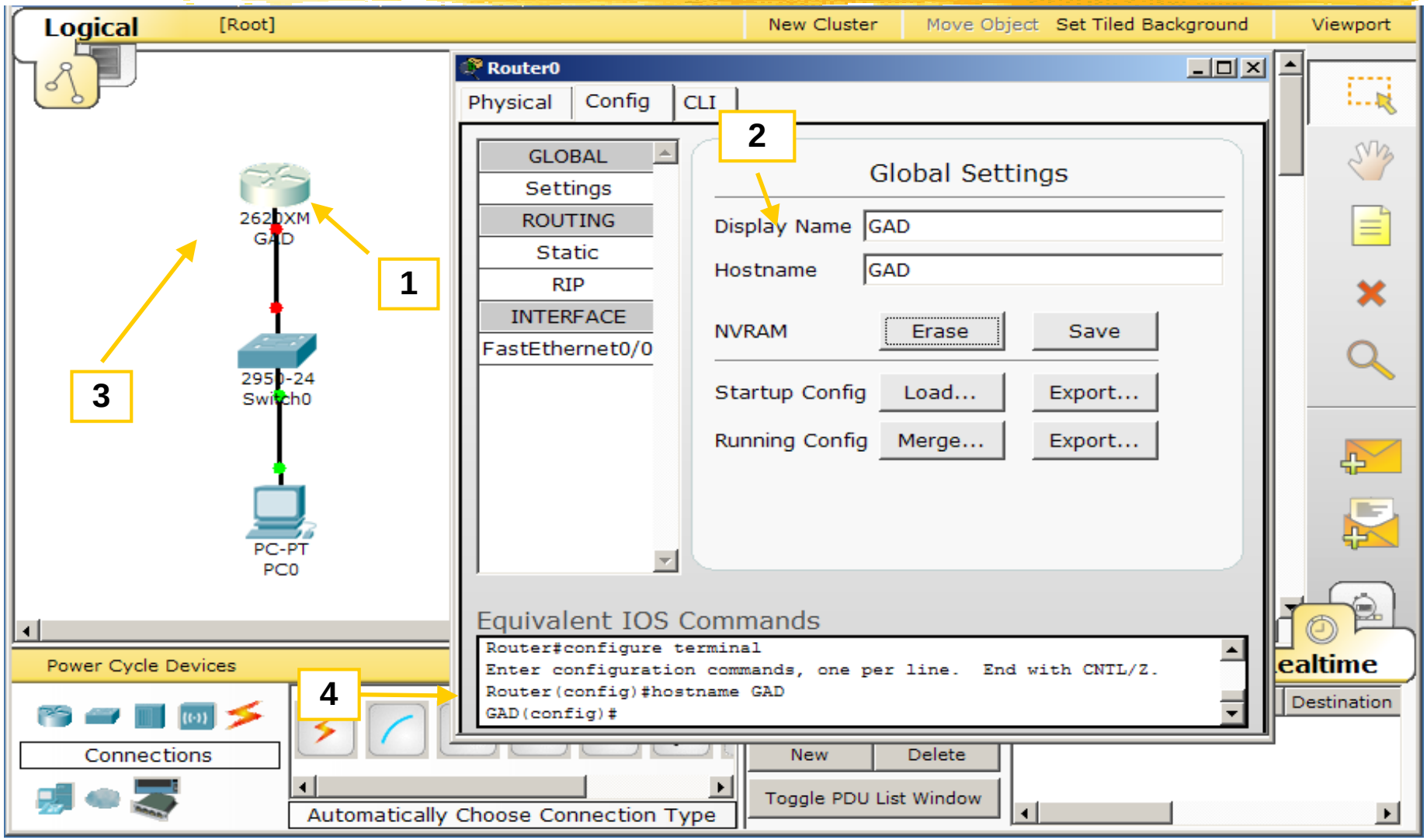
Port Labels


Logical
[Root]
New Cluster
Move Object
Set Tiled Background
Viewport
Putting the mouse over the link allow to check the name (label) of the interfaces connected
Fa0/0
Fa0/1
PC-PT
PC0
Power Cycle Devices
Realtime
Connections
Automatically Choose Connection Type
Scenario 0
New
Delete
Toggle PDU List Window
Fire
Last Status
Source
Destination

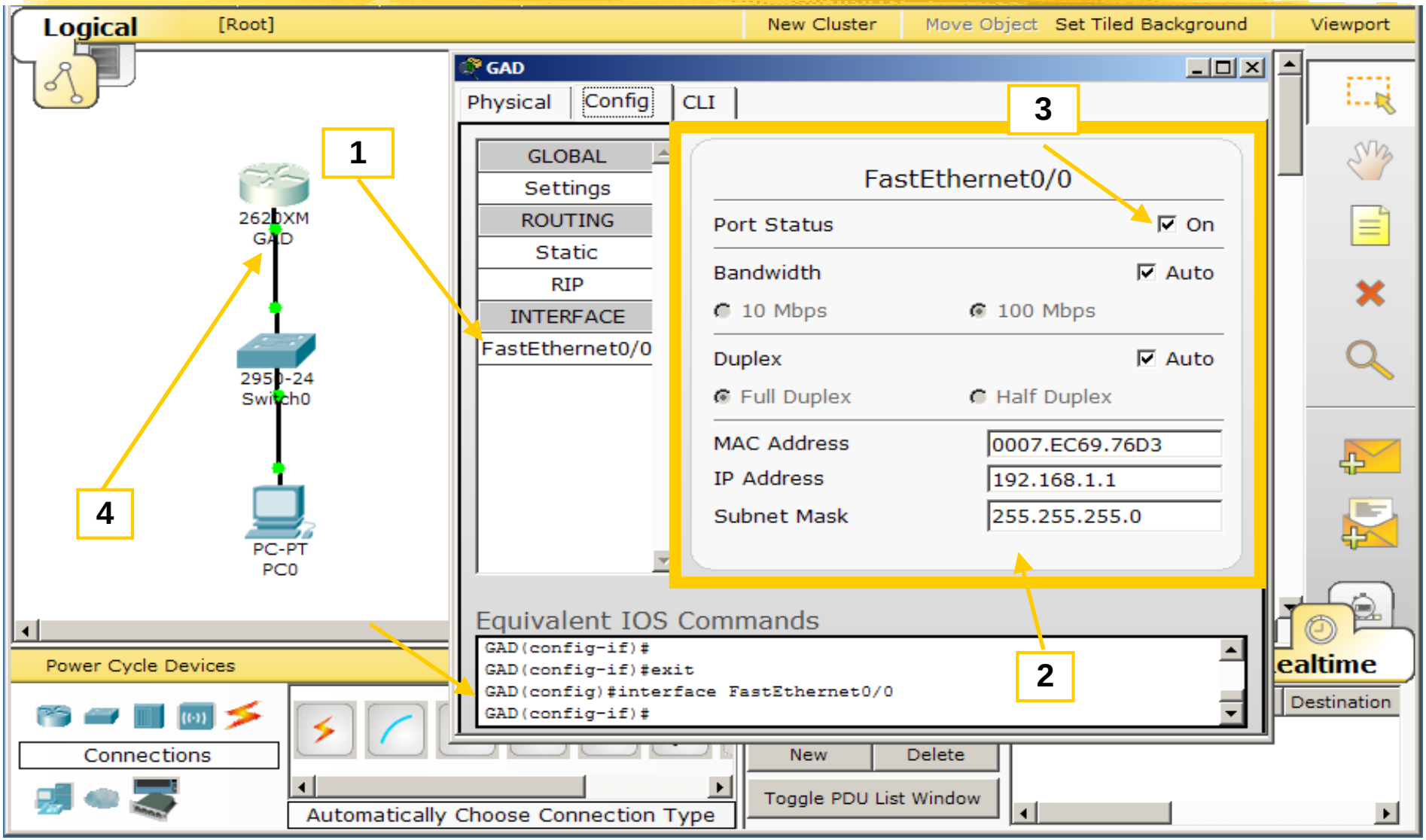
Configuring a device

- Packet Tracer provides a set of basic configuration commands to be performed by means of the graphical interface (GUI- Grafic User Interface).
- On the bottom, the list of commands to be used for the CLI is shown.

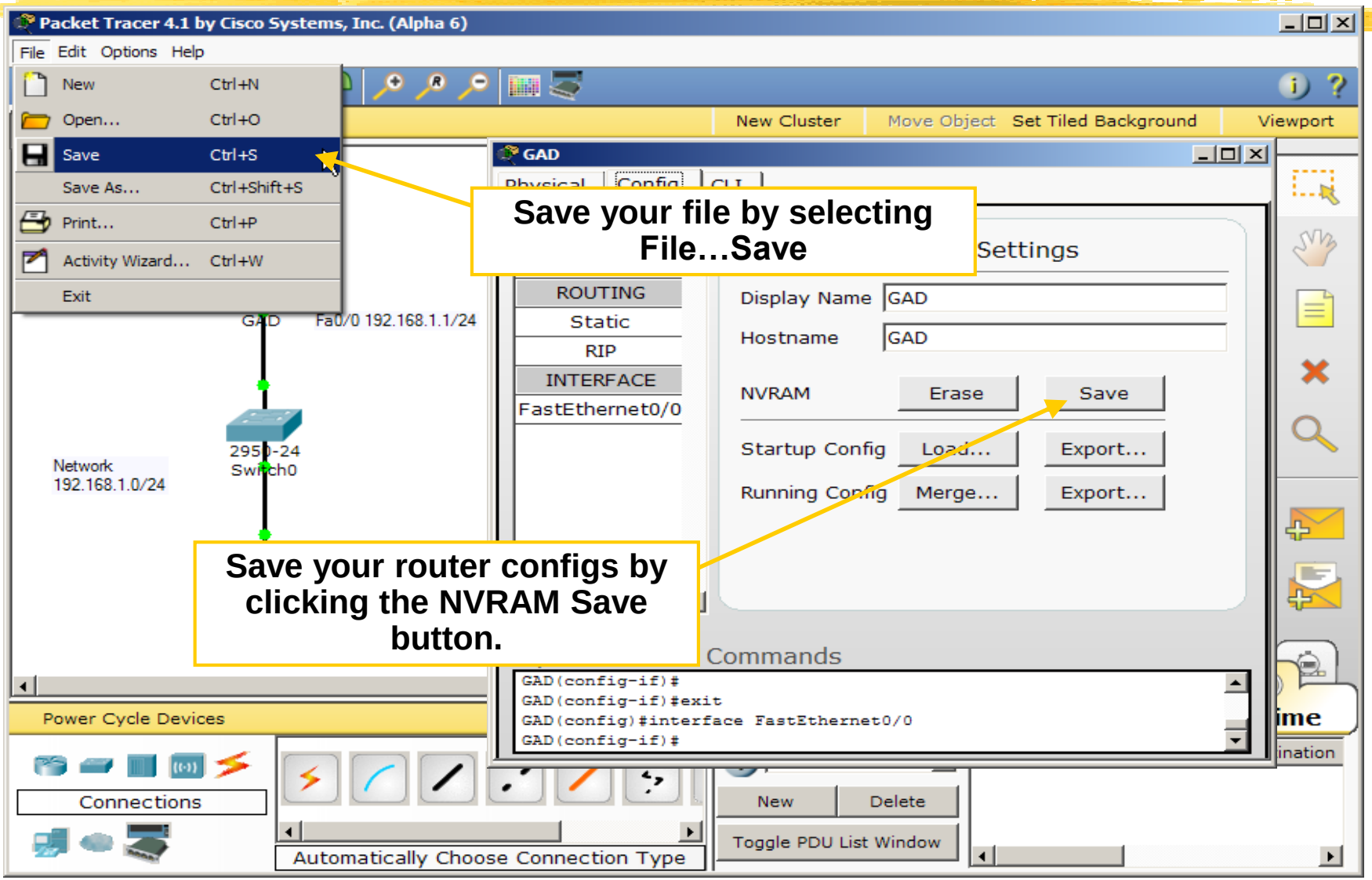
Configuring the Router Hostname



Router FastEthernet Interface



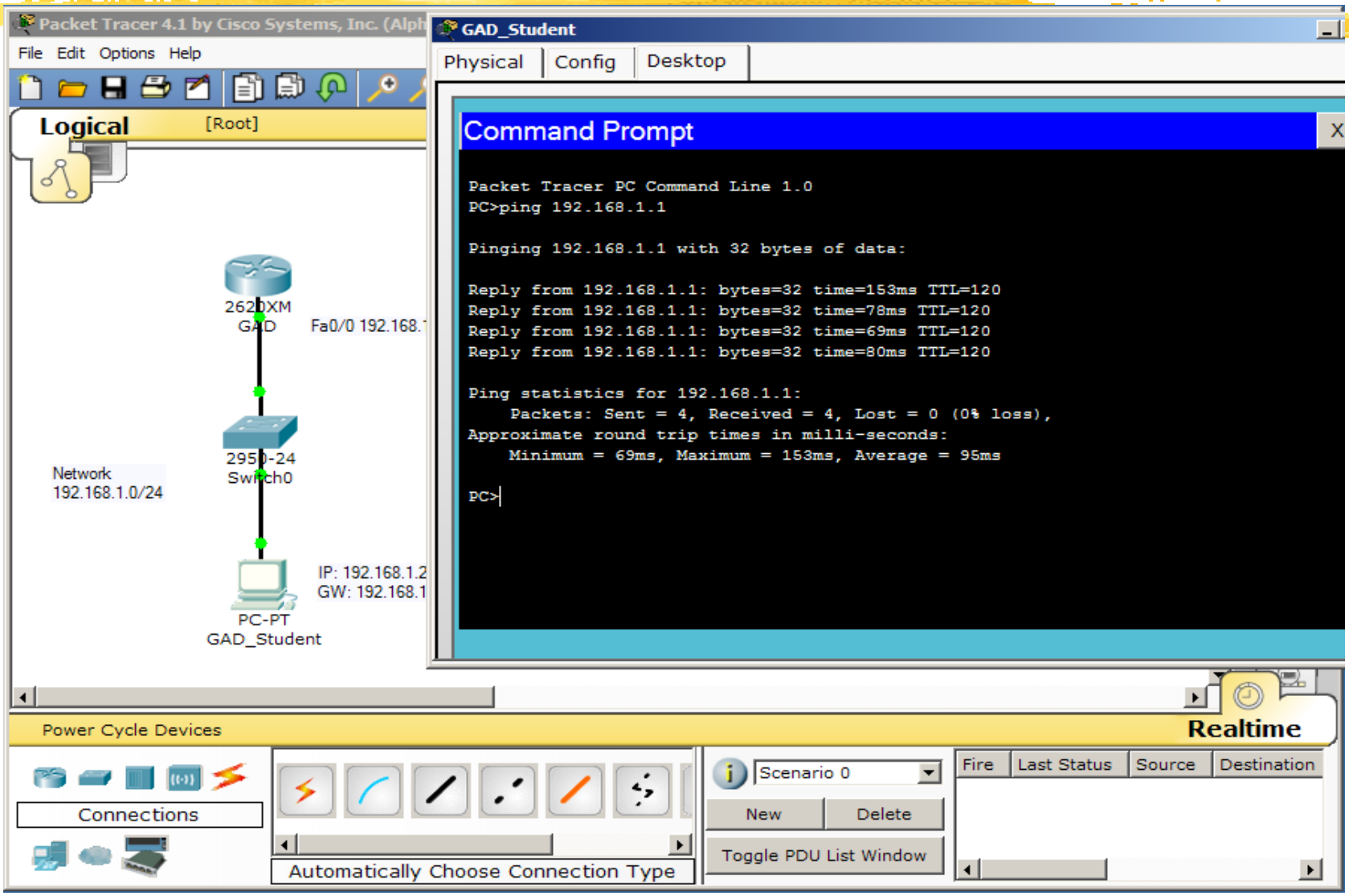
Saving the configuration



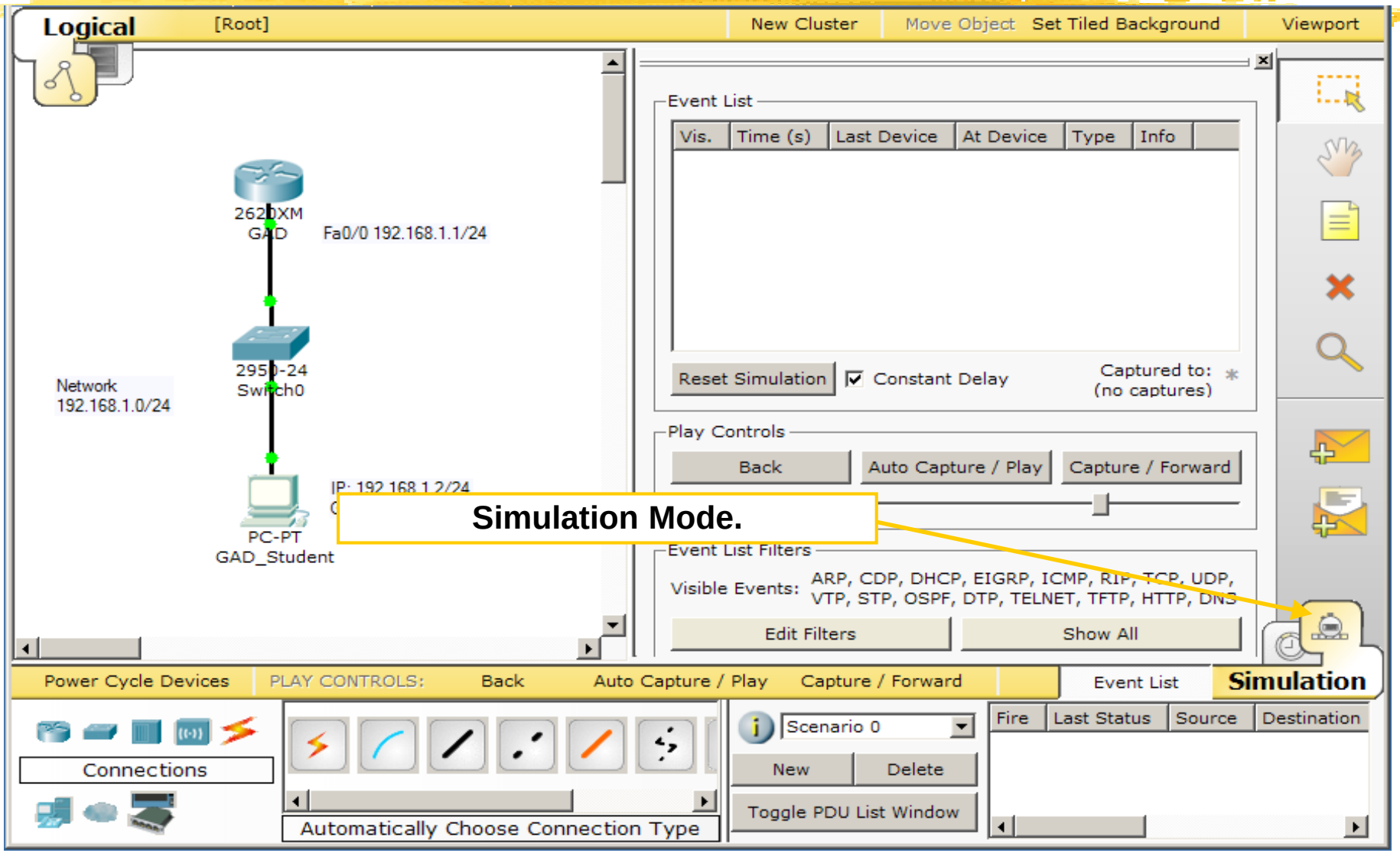
How to check the connectivity

- Realtime Mode: using the CLI of a router/PC and performing a ping (like in the real world….).
- Simulation Mode: it is possible to follow the packets crossing all network devices in their path

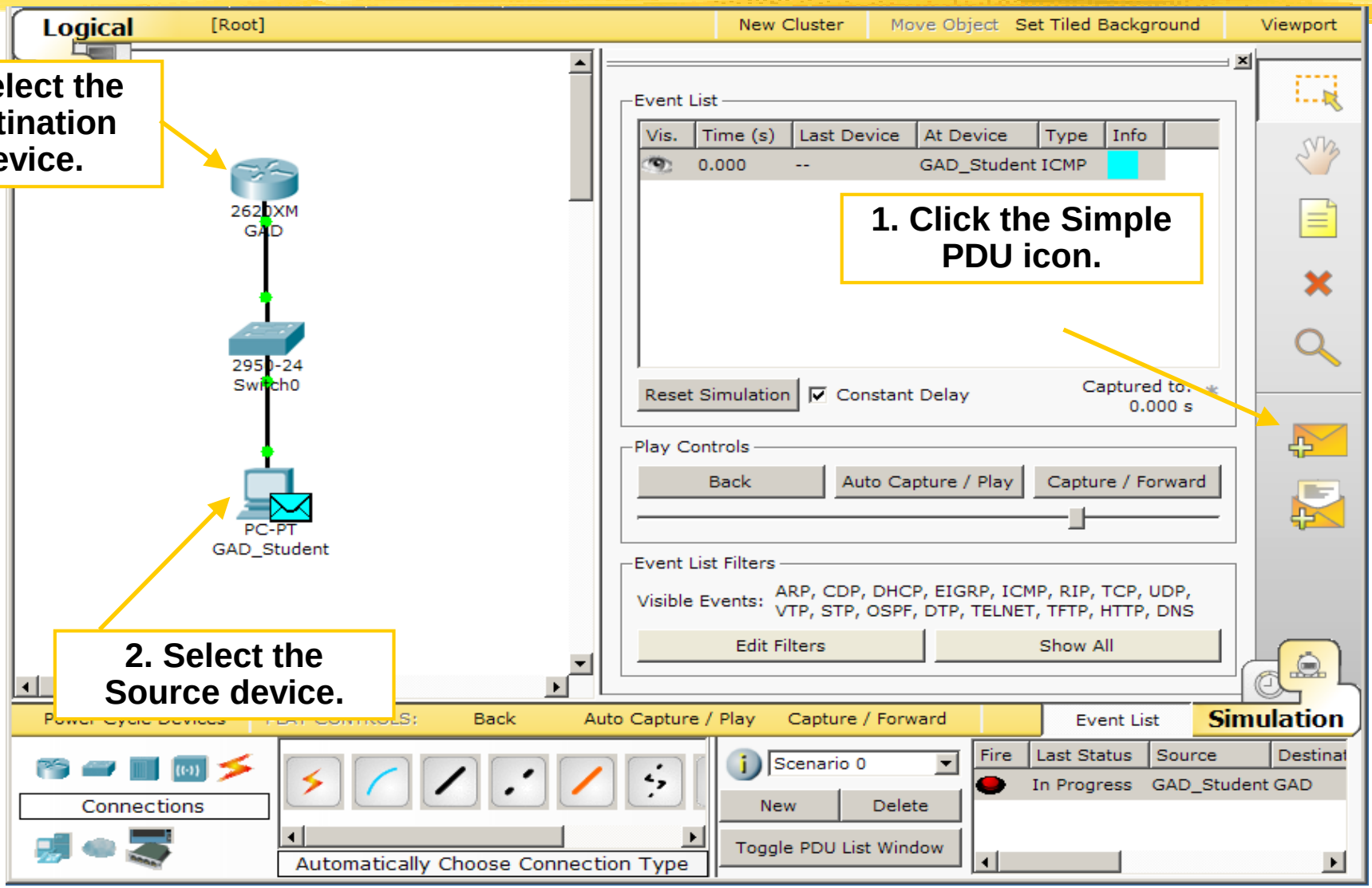
Ping from a PC



Simulation Mode



Creating a PDU

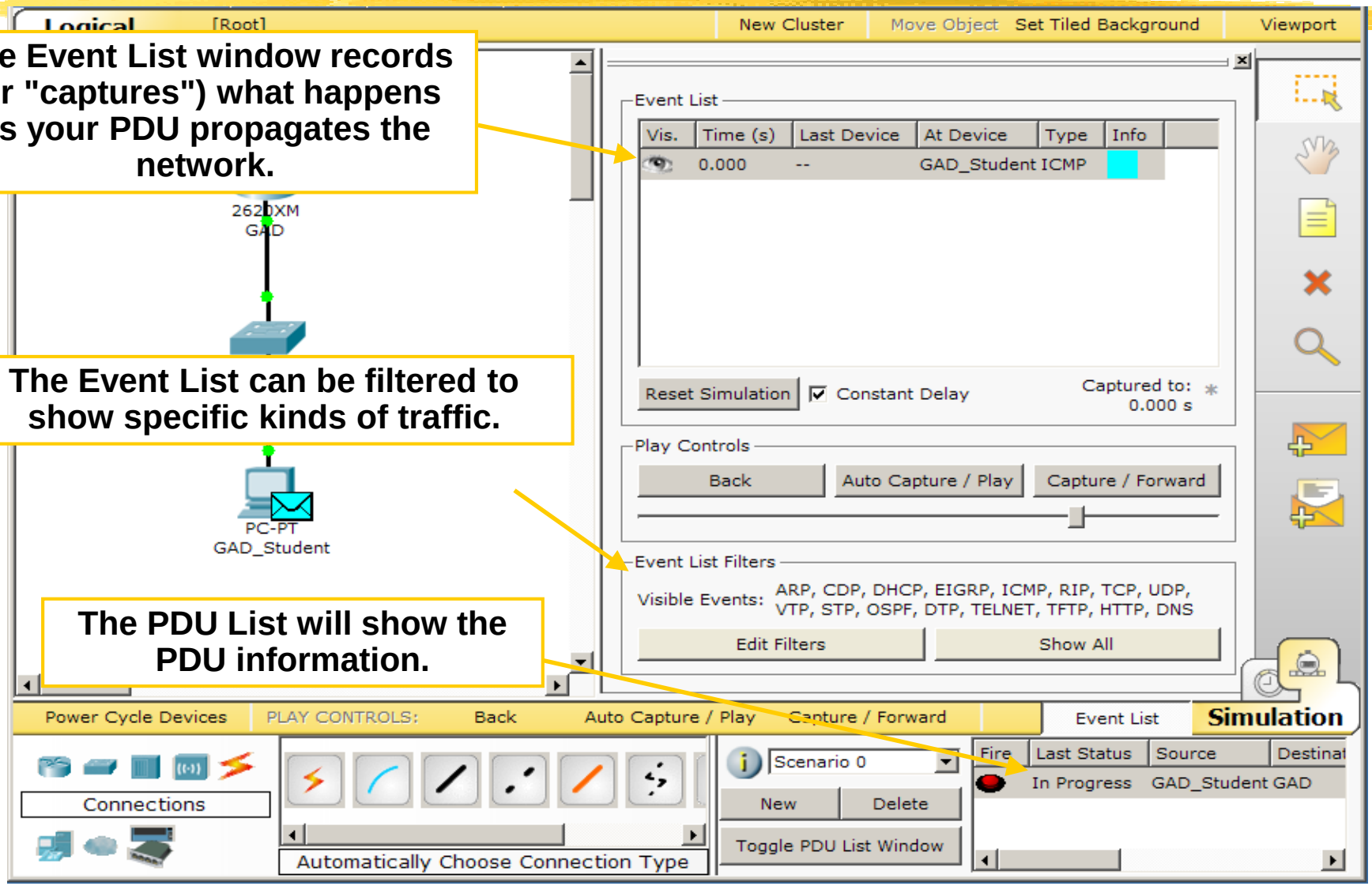


Event List

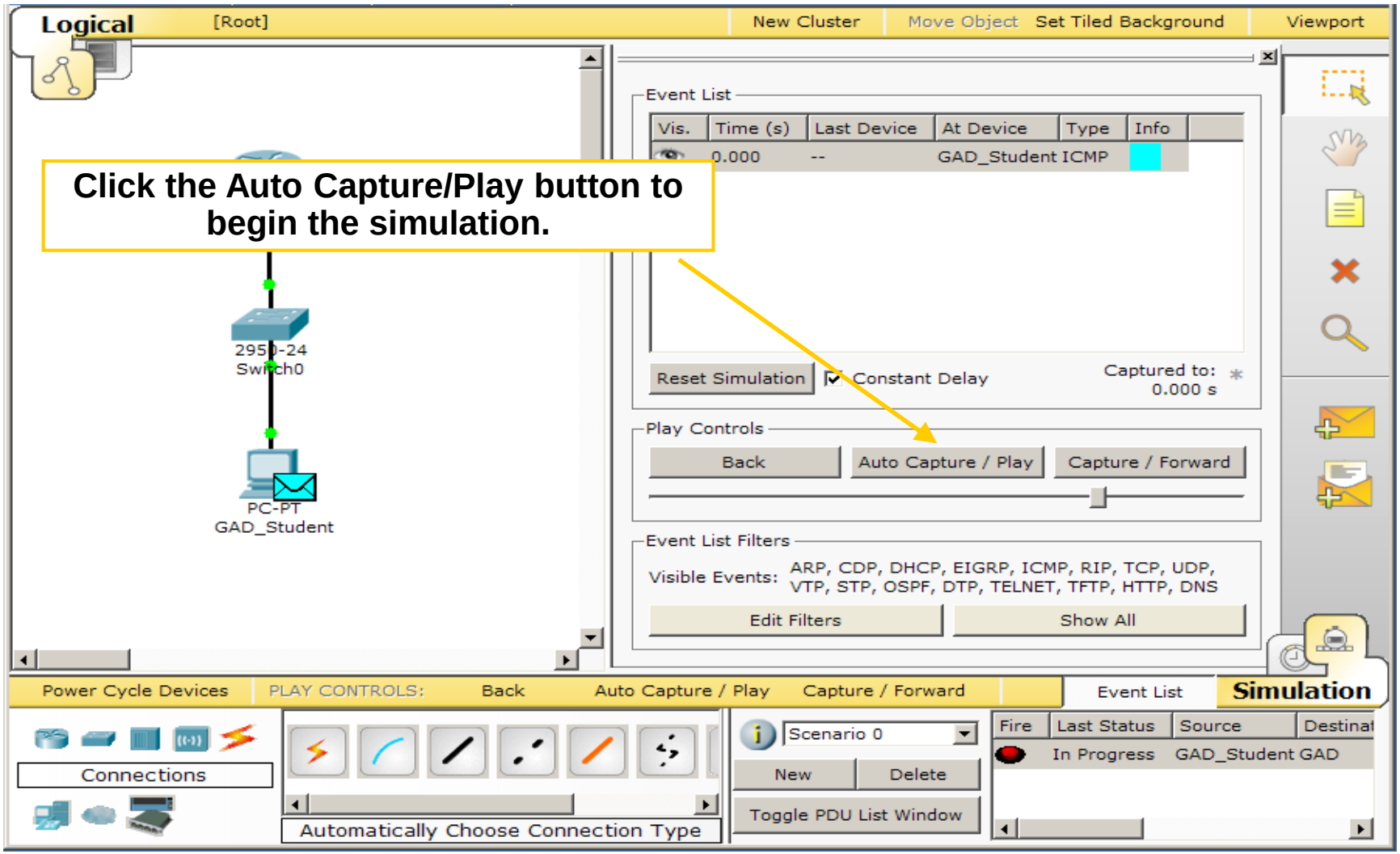
The Event List window records (or "captures") what happens as your PDU propagates the network.

The Event List can be filtered to show specific kinds of traffic.

The PDU List will show the PDU information.

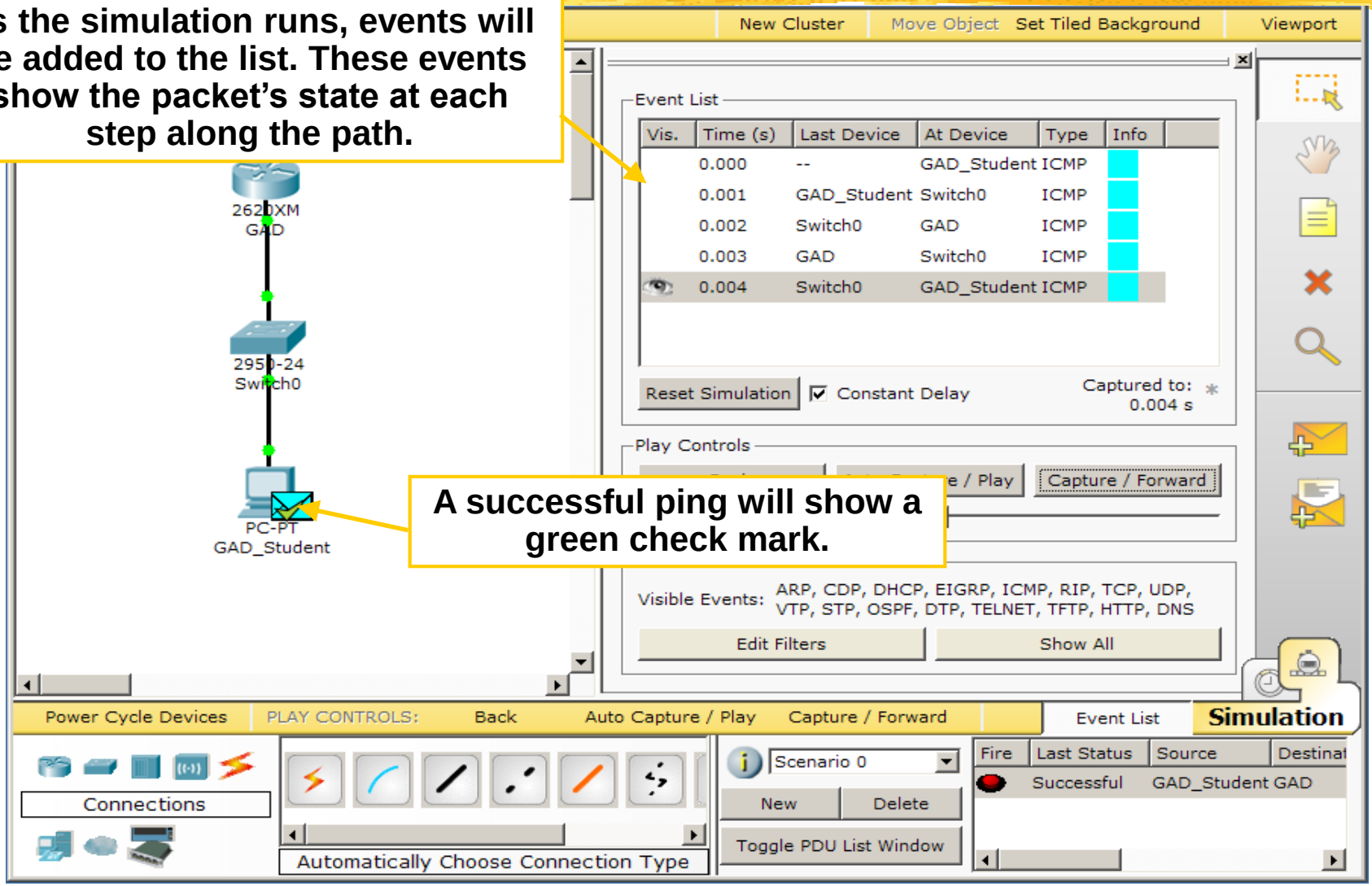


Playing the Simulation



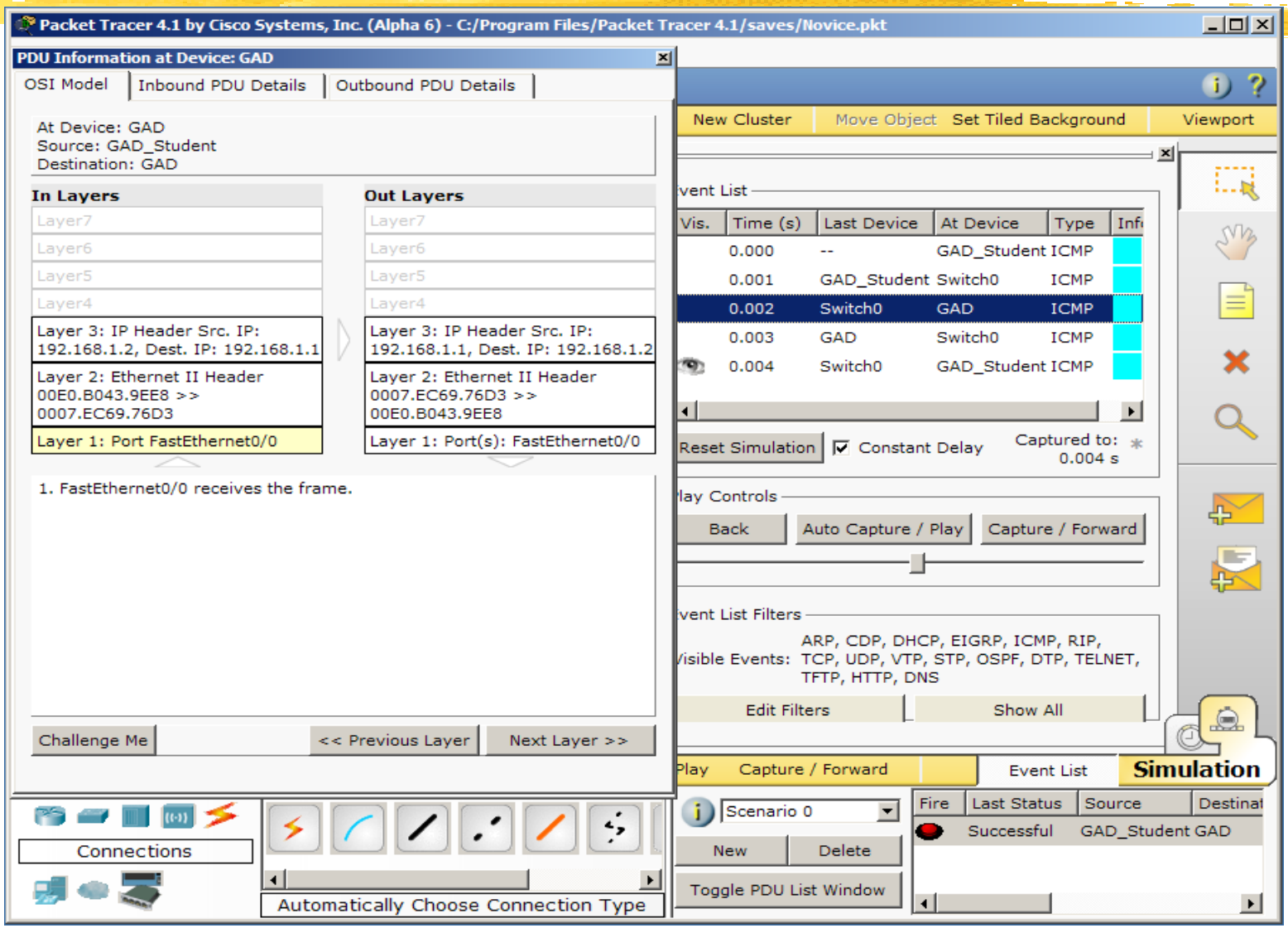
Results

As the simulation runs, events will be added to the list. These events show the packet's state at each step along the path.



A successful ping will show a green check mark.

PDU Information



Configuring a Cisco Router

CLI (1/2)

- To configure a router/switch we need to learn how the Command Line Interface (CLI) is organized
- How to reach the CLI?
  - Console Session
  - Telnet Session

CLI (2/3)

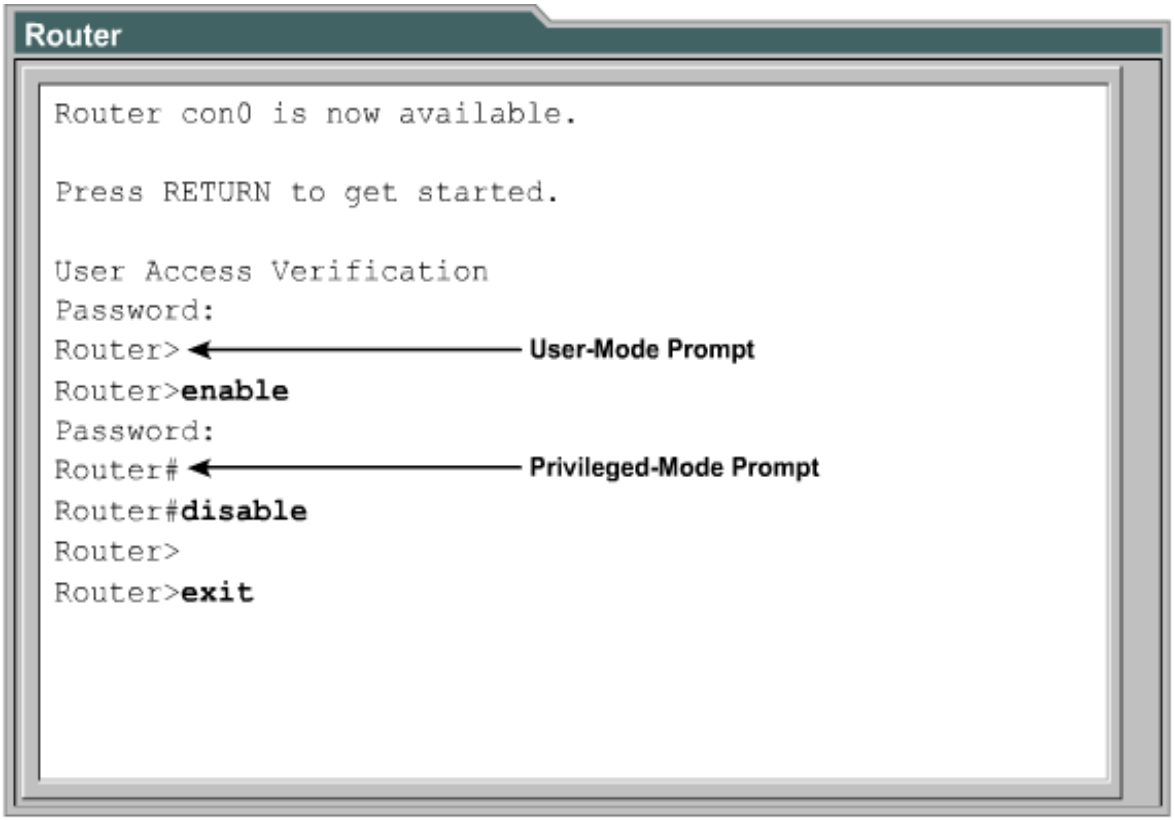
- **Il CLI has a hierarchical structure**
  - Different modes with different configuration levels
    - User EXEC mode
    - Privileged EXEC mode or enable mode
    - Global Configuration mode

CLI (3/3)

- **The User EXEC only allows for basic monitoring functions ("view only" mode)**
  - It is not possible to perform configuration actions
  - It is identified by the prompt ">".
- **The Privileged EXEC mode allows for more operational functions**
  - It is possible to secure with a password
  - It is identified by the prompt "#"
- **To move form User mode to Privileged mode**
  - "enable" command

Moving among modes

- To come back to Privileged mode from global configuration: "exit" or "Ctrl-Z"



Configuration mode

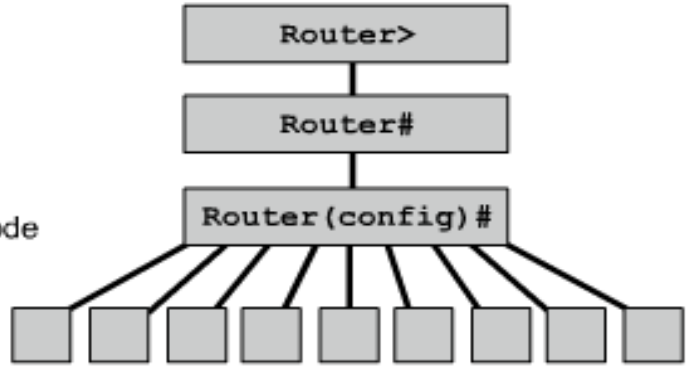
- The global configuration mode allows to perform configuration commands
- To move from the Privileged mode to the Global Configuration one:

```
Router#configure terminal
Router(config)#
```

- From the Global Configuration mode it is possible to configure: interfaces, routing protocols, etc..

Summary

- User EXEC mode
- Privileged EXEC mode
- Global configuration mode
- Specific configuration modes



Configuration Mode	Prompt
Interface	`Router(config-if)#`
Subinterface	`Router(config-subif)#`
Controller	`Router(config-controller)#`
Map-list	`Router(config-map-list)#`
Map-class	`Router(config-map-class)#`
Line	`Router(config-line)#`
Router	`Router(config-router)#`
IPX-router	`Router(config-ipx-router)#`
Route-map	`Router(config-route-map)#`

CLI Help

- The Question Mark (?) is used to list the set of available commands
  - After "—More—" other commands
  - "Enter" to see line by line
  - "Space" to see the whole next page
- It is possible to cut off a word ("ena" instead of enable)
- "Ctrl-P" o "Up Arrow" to recall the last commands
- The ^ symbol show the wrong command part

Router name

- Each route has a nome (Router is the default name)

- TO assign a different name:
  - From Global configuration mode

```
Router(config)#hostname Tokyo
Tokyo(config)#
```

Securing router access (1/4)

- It is possible to configure a password for router access
- The password can be defined for different access ways:
  1. Console port
  2. Telnet access, referred to as Virtual Terminal Line (vty) in the CLI
  3. Privileged EXEC mode

Securing router access (2/4)

- Password for the console port:

```
Router(config)#line console 0
Router(config-line)#password <password>
Router(config-line)#login
```

- Password for the telnet access (virtual terminal line):

```
Router(config)#line vty 0 4
Router(config-line)#password <password>
Router(config-line)#login
```

Securing router access (3/4)

- Two possibilities to configure a password for the Privileged mode:

1. "**enable password**" command

```
Router(config)#enable password <password>
```

   - The password is shown (not encrypted) in the configuration files (more later when introducing commands "show running-config" o "show startup-config")
   - It is possible to encrypt the password (all the passwords) using the command:

```
Router(config)#service password-encryption
```

Securing router access (4/4)

2. "**enable secret**" command

```
Router(config)#enable secret <password>
```

- The algorithm used by the *enable secret* command is more robust than the one used by the *service password-encryption* command

The "show" command (1/2)

- It is used to provide information about router features (both hardware and software)
- It is available both in the User EXEC and Privileged EXEC modes (with different information provided)
- Esempi:
  - **"show interfaces"** – statistics about interfaces
  - **"show controllers serial"** – hardware level information about interfaces
  - **"show clock"** – router clock
  - **"show hosts"** – list of devices (hostname and IP address) known by the router

The "show" command (2/2)

- "**show users**" – users connected to the router
- "**show history**" – list of commands used in the past
- "**show flash**" – information about flash memory and available IOS image files
- "**show version**" – hardware level features of the router and running IOS
- "**show ARP**" – ARP table of the router
- "**show protocol**" – Layer 3 protocols configured at router level and at interface level
- "**show startup-configuration**" – startup configuration file (saved into the NVRAM)
- "**show running-configuration**" – running configuration file (saved into the RAM)

The configuration files (1/2)

- The *running-config* file stores the actual configuration of the router
- The *startup-config* file stores the last configuration saved (that will be loaded on router re-start)
- To save the actual configuration in the NVRAM:

```
Router# copy running-config startup-config
```

The configuration files (2/2)

- If a command accepted by the router was not the one to be used it is possible to come back:
  - Execute "*no command name*"
- If all the commands executed from router startup must be removed from the configuration:
  - Reload the startup configuration file from NVRAM

```
Router# copy startup-config running-config
```

Serial interface configuration (1/2)

```
Router(config)#interface serial 0/0

Router(config-if)#ip address <ip address>
<netmask>
Router(config-if)#clock rate 56000
Router(config-if)#no shutdown
```

- The serial interfaces require a clock for synchronization purposes
- All un router interfaces are "physically down" (powered off): the powering up command is "no shutdown"

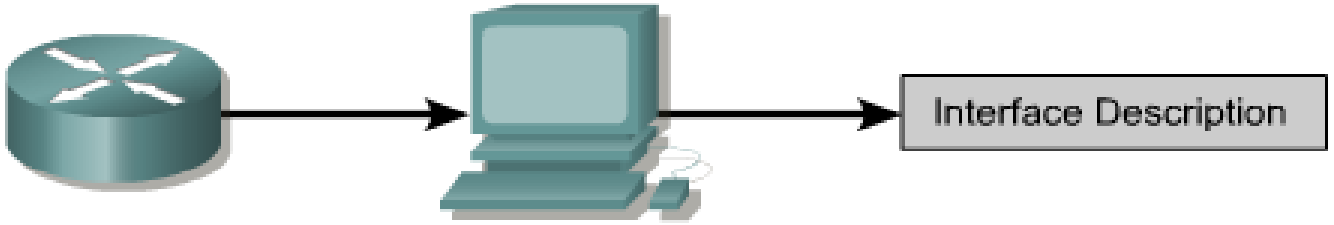
Ethernet interface configuration

- Similar to the serial interface one.
- No need to configure a clock

Router

```
Router(config)#interface e0
Router(config-if)#ip address 183.8.126.2 255.255.255.128
Router(config-if)#no shutdown
```

Interface description (2/2)




```
Tokyo(config)#interface e 0

Tokyo(config-if)#description Engineering LAN, Bldg. 18
```

Static routing

Static routing and dynamic routing (1/2)

- The routing table of a router can be updated in two different ways:
  - Using information exchanged with different routers (Dynamic routing – Routing protocols);
  - By means of configuration commands executed by the network administrator (Static Routing)

Static routing and dynamic routing (2/2)

- The static routing is not scalable:
  - A static route must be configured manually;
  - In the case of a topology change, the network administrator must modify the proper static routes;
  - It has an high management complexity in case of big networks.
- Usually both static and dynamic routing are used

Static route configuration

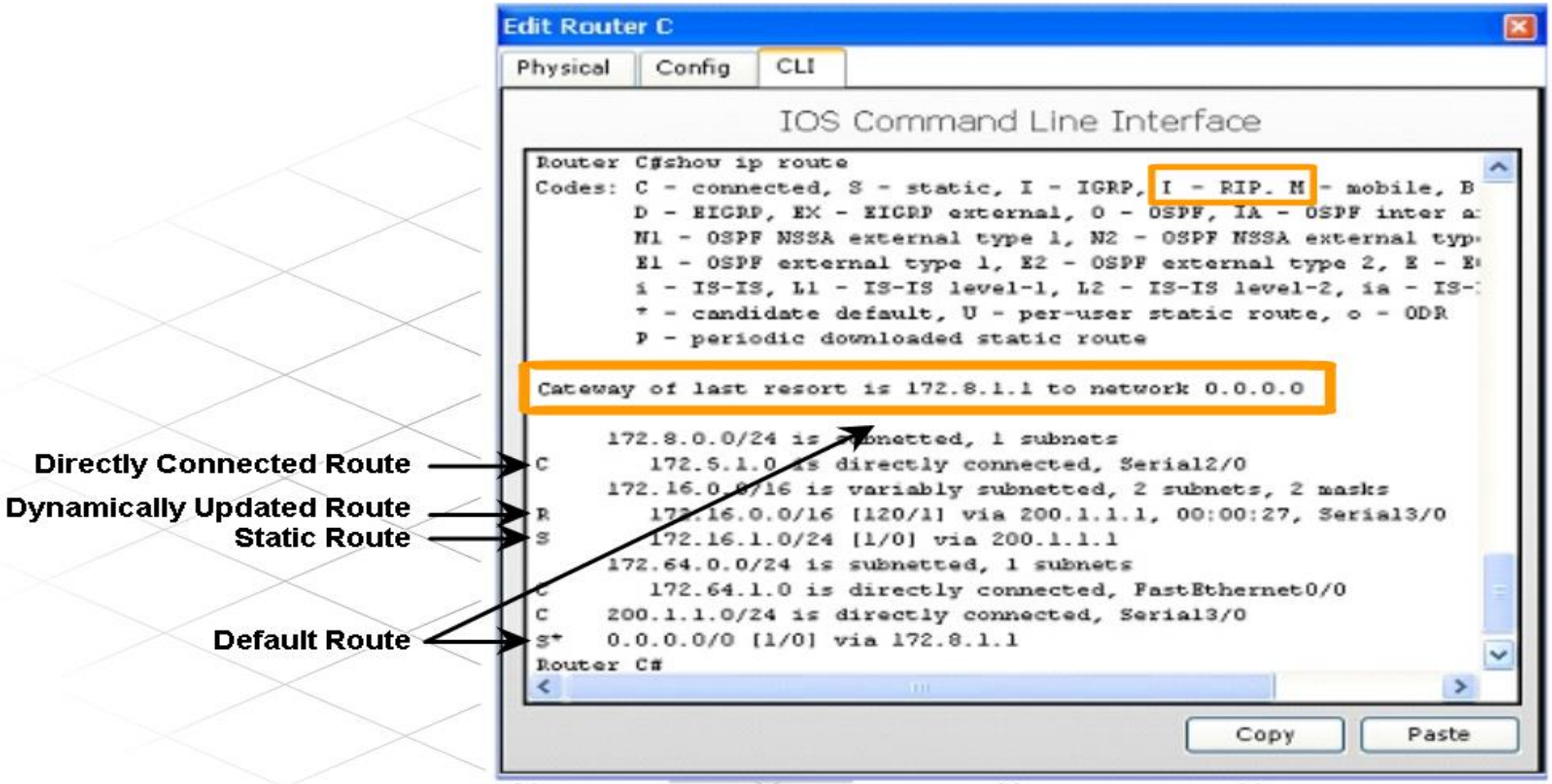
- The command to configure a static route is

```
R1(config)#ip route Dest_IP_Add  SubNet_Mask A/B
```

- Two options for the forwarding part:
  - Option A: the output interface (it is possible only in the case of a point-to-point link)
  - Option B: the next-hop router IP address
- The default route can be configured statically:

```
ip route 0.0.0.0 0.0.0.0 A/B
```

Routing table (1/2)



Routing table (2/2)

- The rows (route) of a routing table have different sources:
  - Directly connected routes (C)
  - Statics routes (S,S*)
  - Dynamic Routes (RIP→R, OSPF→O, etc…)
- The administrative distance is a measure of the route reliability (depends on the source)
- To check reachability: **ping** and **traceroute**