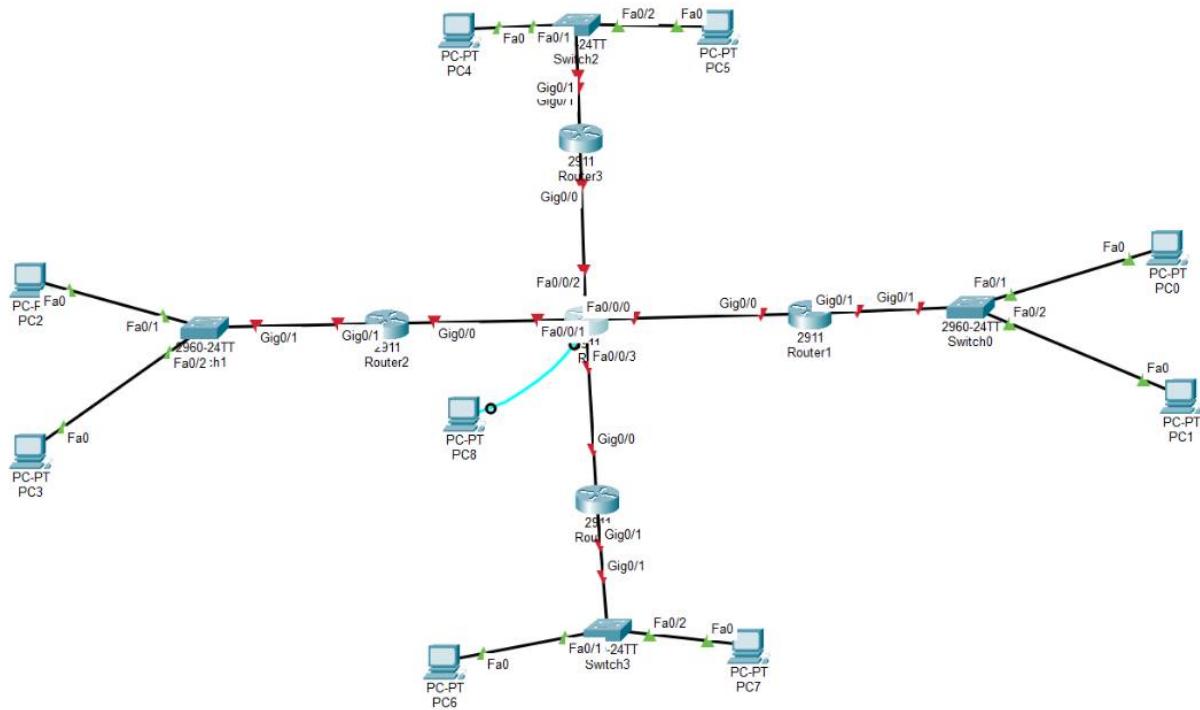


Network Learn



PC8

Physical Config Desktop Programming Attributes

Terminal X

```

agree to comply with applicable laws and regulations. If you are unable
to comply with U.S. and local laws, return this product immediately.

A summary of U.S. laws governing Cisco cryptographic products may be found at:
http://www.cisco.com/wwl/export/crypto/tool/stqrg.html

If you require further assistance please contact us by sending email to
export@cisco.com.

Cisco CISCO2911/K9 (revision 1.0) with 491520K/32768K bytes of memory.
Processor board ID FTX152400KS
4 FastEthernet interface(s)
3 Gigabit Ethernet interfaces
DRAM configuration is 64 bits wide with parity disabled.
255K bytes of non-volatile configuration memory.
249856K bytes of ATA System CompactFlash 0 (Read/Write)

--- System Configuration Dialog ---

Would you like to enter the initial configuration dialog? [yes/no]:
%LINK-5-CHANGED: Interface FastEthernet0/0/0, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/0/1, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/0/2, changed state to up
%LINK-5-CHANGED: Interface FastEthernet0/0/3, changed state to up

% Please answer 'yes' or 'no'.
Would you like to enter the initial configuration dialog? [yes/no]: n

Press RETURN to get started!

Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#hostname R1
R1(config)#int f0/0/0
R1(config-if)#ip addr 10.0.0.1 255.255.255.252
^
% Invalid input detected at '^' marker.

R1(config-if)#ip ?
  access-group  Specify access control for packets
  arp          Configure ARP features
  dhcp         Configure DHCP parameters for this interface
R1(config-if)#ip addr ?
% Unrecognized command
R1(config-if)#ip address?
% Unrecognized command
R1(config-if)#

```

Top

I have a situation
 I connected a 2911 router to 4 other 2911 routers through fast ethernet ports (added "HWIC-4ESW" module to the router.) now the router configuration commands are not working why so?

Excellent question  — this is a **very common CCNA-level confusion**, and understanding this properly will make you strong in interviews.

You added a **HWIC-4ESW module** to a **2911 router**, and now **ip address** is not working under **fa0/0/0**. Let's break this down properly.

1 Core Concept Explanation

When you add **HWIC-4ESW** to a Cisco 2911 router, the ports you get are **Layer 2 switch ports**, NOT Layer 3 routed interfaces.

That means:

- They behave like **switch ports**
- Not like normal router interfaces
- So you cannot assign **ip address** directly on them

That's why when you typed:

```
arduino
R1(config-if)#ip address 10.0.0.1 255.255.255.252
```

You got:

```
css
% Invalid input detected
```

Because that interface is **Layer 2**, not Layer 3.

2 Supporting Concepts (Very Important)

◆ Normal Router Interface (Layer 3)

Example:

```
nginx
interface gig0/0
  ip address 10.0.0.1 255.255.255.252
```

These interfaces:

- Route traffic
- Have IP addresses
- Participate in routing protocols

◆ HWIC-4ESW Interface

This module adds:

- fa0/0/0
- fa0/0/1
- fa0/0/2
- fa0/0/3

But these are:

- ✓ Switch ports
- ✓ Layer 2
- ✓ Support **switchport** commands
- ✗ Do NOT support **ip address**

When you typed **ip ?**, notice what it showed:

```
pgsql

access-group
arp
dhcp
```

No **address** option.

That confirms it is **Layer 2 switch interface**.

3 Real-World Enterprise Scenario

Imagine this situation:

A branch office buys a 2911 router and adds HWIC-4ESW to reduce cost.

Instead of buying:

- 1 Router
- 1 Switch

They combine both into one device.

So:

- HWIC ports = Access switch ports for PCs
- Main Gigabit interfaces = Routed uplinks to WAN

This is cost-effective design.

But if you try to use those HWIC ports as routed WAN links between routers, it won't work unless you configure VLAN + SVI.

4 How to Fix It (Two Possible Designs)

✓ Option 1: Use Router Gigabit Interfaces for Router-to-Router Links

Best practice:

Use:

```
Gig0/0
Gig0/1
```

For inter-router connections.

Because those are Layer 3 routed interfaces.

✓ Option 2: Use VLAN + SVI (Router Switch Module Design)

If you insist on using HWIC-4ESW ports, you must:

Step 1 - Assign ports to VLAN

```
kotlin

interface fa0/0/0
switchport access vlan 10
no shutdown
```

Step 2 - Create SVI

```
nginx

interface vlan 10
ip address 10.0.0.1 255.255.255.252
no shutdown
```

Now the IP is assigned on the VLAN interface, not the physical port.

This is exactly how Layer 2 switches work.

5 Why Cisco Designed It This Way

Because:

- Routers forward at Layer 3
- Switch modules forward at Layer 2
- Cisco didn't want mixing of switching and routing logic at hardware level

It separates:

- Data plane switching
 - Routing engine
-

6 What Happens If Misconfigured?

If you:

- Assign VLAN
- But forget to create `interface vlan`
- Or forget `no shutdown`

Then:

- Interface will stay down
- No routing
- No ARP resolution
- Ping fails

Common beginner mistake:

Thinking HWIC ports are routed ports.

7 Troubleshooting Approach (Real NOC Method)

If IP command fails:

Step 1

```
kotlin
show ip interface brief
```

Check if interface is listed as L3.

Step 2

```
arduino
show running-config interface fa0/0/0
```

If you see `switchport`, it's Layer 2.

Step 3

```
sql
show vlan
```

Check VLAN assignment.

Step 4

```
kotlin
show ip interface brief
```

Check if VLAN interface exists.

8 Technical Interview Questions

Q1: Why can't we assign IP address to HWIC-4ESW interface?

Because it is a Layer 2 switchport, not a routed Layer 3 interface.

Q2: How do you make HWIC-4ESW port route traffic?

By assigning it to a VLAN and configuring an SVI.

Q3: What is difference between switchport and routed port?

Switchport = Layer 2
No switchport = Layer 3

Q4: What happens if SVI is down?

If no active port in VLAN, SVI stays down.

9 CCNA Exam-Style MCQs

MCQ 1

A network engineer installs a HWIC-4ESW module on a Cisco 2911 router. The `ip address` command is unavailable under `fa0/0/0`. Why?

- A. The interface is shutdown
- B. The router IOS is outdated
- C. The interface is Layer 2
- D. The subnet mask is incorrect

✓ Answer: C

Explanation: HWIC-4ESW provides Layer 2 switch ports.

MCQ 2

To assign an IP address when using HWIC-4ESW module, where should the IP be configured?

- A. On the FastEthernet interface
- B. On VLAN interface
- C. On loopback interface
- D. On auxiliary interface

 **Answer: B**

MCQ 3

What command converts a switchport into a routed port?

- A. `ip routing`
- B. `switchport routed`
- C. `no switchport`
- D. `encapsulation dot1q`

 **Answer: C**

MCQ 4

Which interface type on a 2911 router supports direct IP address configuration?

- A. HWIC-4ESW FastEthernet
- B. VLAN interface
- C. GigabitEthernet
- D. Line VTY

 **Answer: C**

10 How to Explain in Interview (HR Ready)

"When we add a HWIC-4ESW module to a 2911 router, the added interfaces behave as Layer 2 switch ports. Therefore, we cannot assign an IP address directly on them. To route traffic, we must configure a VLAN and assign the IP address on the corresponding SVI interface. Alternatively, we should use the router's native Gigabit interfaces for Layer 3 routing."

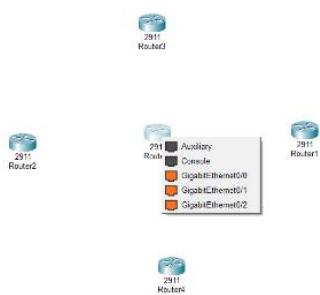
🔥 TL;DR

- HWIC-4ESW ports are **Layer 2 switchports**
- You cannot use `ip address` directly
- Use VLAN + SVI for routing

- Or use normal Gigabit interfaces
- Very common CCNA trick question

If you want, next I can explain:

👉 Difference between Router, Layer 3 Switch, and Router with Switch Module (very important for placements).



I need to connect 4 routers to a 2911 router and what's the way to do it?
I need only layer 3 connection and not any layer 2 connection as we seen now!

Perfect 👍 now this is a proper network design question.

You want:

- One **2911 router in center**
- Connect **4 other 2911 routers**
- Only **Layer 3 connectivity**
- No switch module
- No VLAN
- Pure routed links

Let's design this properly like an enterprise WAN setup.

1 Core Concept Explanation

A router interface is **Layer 3 by default** (unless it's a switch module).

To connect 4 routers to one 2911 router using Layer 3 only, you need:

- 4 physical Layer 3 interfaces on the central router
- Each connection must be:
 - Routed interface

- Point-to-point subnet
- Unique /30 or /31 network

Since each router-to-router link is a separate broadcast domain, each needs its own subnet.

2 Supporting Foundation

◆ Why /30 or /31?

When connecting router-to-router:

You only need **2 usable IPs**

Example:

Network	Usable IPs	Broadcast
10.0.0.0/30	.1 and .2	.3

This is efficient IP usage.

◆ How Many Interfaces Does 2911 Have?

Default 2911 has:

- GigabitEthernet0/0
- GigabitEthernet0/1
- GigabitEthernet0/2

Only 3 Layer 3 interfaces by default.

You need 4.

So you have 3 options.

3 Real Enterprise Scenario

Imagine:

You are designing a hub-and-spoke topology.

Central Router = HQ

Other 4 routers = Branch offices

Each branch connects to HQ via point-to-point WAN link.

Design must:

- Avoid Layer 2
- Use routed links

- Allow routing protocol or static routing

4 How To Do It (Best Practical Methods)

✓ OPTION 1 (Best Practice): Add Layer 3 HWIC Module

Install:

- HWIC-2T (Serial module)
- NIM-2GE (Extra Gigabit ports)
- Any Layer 3 expansion module

This gives extra routed interfaces.

This is how real enterprise routers scale.

✓ OPTION 2: Use Gigabit + Subinterfaces (If Physical Ports Limited)

You can use one physical interface and create subinterfaces:

```
nginx

interface g0/0.1
encapsulation dot1Q 10
ip address 10.0.0.1 255.255.255.252
```

But ! This requires Layer 2 trunking — which you said you don't want.

So skip this.

✓ OPTION 3: Use External Layer 3 Switch (Realistic Design)

Central router connects to L3 switch.

Switch creates 4 routed ports:

```
nginx

interface g0/1
no switchport
ip address 10.0.0.1 255.255.255.252
```

But again, you asked router-only.

✓ Correct Clean Design For You

Since each router has 3 Gig interfaces:

Make central router use:

- G0/0 → Router1
- G0/1 → Router2
- G0/2 → Router3

For 4th router:

Install additional Layer 3 interface module.

There is no other clean Layer 3-only way.

5 Step-by-Step Configuration (Pure L3)

Example IP Plan:

Link	Network	Central Router	Branch Router
R1	10.0.0.0/30	10.0.0.1	10.0.0.2
R2	10.0.0.4/30	10.0.0.5	10.0.0.6
R3	10.0.0.8/30	10.0.0.9	10.0.0.10
R4	10.0.0.12/30	10.0.0.13	10.0.0.14

On Central Router

```
kotlin
interface g0/0
ip address 10.0
```

wait.

I need to ask you the following questions

1. Which Router Series is used commonly in the Real-Time ? (in companies - which router is the industry standard???) (eg-> Cisco 2911 series, Cisco 1941 Series etc...)
2. Which among the Best Practical methods is industry-standard method to be followed?
3. I did not find the NIM port to add extra in the 2911 series - but I could find the HWIC-2T port, but my question is - connecting two ports on Gigabit Ethernet and 2 ports on Serial connectivity - doesn't that make it odd???- will there be any significant difference in connectivity???

Very good. Now you're thinking like a network engineer, not just doing Packet Tracer labs.

Let's answer each question properly from **real industry perspective**, not lab perspective.

1 Which Router Series Is Used Commonly in Real-Time?

First important thing:

👉 **Cisco 2911, 1941, 2900 series are almost legacy now.**

They are mostly seen in:

- Old branch offices
 - Lab environments
 - Training setups
 - Small legacy deployments
-

◆ **What Is Industry Standard Today?**

In modern enterprise networks, commonly used Cisco router families are:

 **Cisco ISR 4000 Series (Most Common in Enterprise)**

Examples:

- ISR 4321
- ISR 4331
- ISR 4351
- ISR 4431

These are:

- Branch routers
- WAN edge routers
- VPN termination routers
- SD-WAN capable

These are very common in:

- Corporate branch networks
 - Banks
 - Retail chains
 - Manufacturing companies
-

 **For Large Enterprise / Data Center Edge**

- Cisco ASR 1000 Series
- Cisco Catalyst 8000 Edge

Used in:

- ISP edge

- Enterprise WAN edge
 - Large HQ
-

⚠ Important Reality

In many companies today:

- Traditional routers are being replaced by **L3 switches**
- Especially inside campus networks

Routing is done by:

- Catalyst 9300
 - Catalyst 9500
 - Nexus switches (data center)
-

🔥 So Interview-Ready Answer

"In modern enterprise networks, Cisco ISR 4000 series routers are commonly used for branch and WAN edge deployments, while Layer 3 switches like Catalyst 9000 series are widely used for campus routing. Older models like 2911 are mostly found in legacy environments or labs."

2 Which Method Is Industry Standard for Connecting Multiple Routers?

You asked earlier about connecting 4 routers to one central router.

Let's break real industry practice.

♦ In Real Enterprise, We DON'T Do:

- Serial connections (except in very old WAN links)
 - Random mixing of modules
 - Improvised designs
-

✓ Industry Standard Approach

♦ Hub-and-Spoke WAN (Modern)

Central router (HQ) connects to:

- MPLS cloud
- Internet

- SD-WAN overlay

Branches connect via:

- MPLS
- IPsec VPN
- SD-WAN

Not directly router-to-router via Ethernet cables.

◆ If It's Internal Campus Routing

We use:

- Layer 3 switch as core
 - Routed uplinks
 - /31 or /30 point-to-point links
 - OSPF or EIGRP
-

🏆 Correct Industry Method

If you need multiple routed links:

- 👉 Use router with sufficient routed interfaces
- 👉 Or use Layer 3 switch with routed ports
- 👉 Use dynamic routing protocol (OSPF mostly)

Serial interfaces are rarely used now unless:

- MPLS provider handoff
 - Legacy WAN circuits
-

3 Mixing Gigabit and Serial – Is That Odd?

Excellent question. This shows architectural thinking.

Short answer:

- 👉 It is not wrong
 - 👉 But it represents different physical technologies
-

◆ Technical Difference

Feature	GigabitEthernet	Serial
Speed	1 Gbps	2 Mbps – 100 Mbps typical
Encapsulation	Ethernet	HDLC / PPP

Feature	GigabitEthernet	Serial
Clocking	Auto	DCE/DTE required
Modern Use	LAN/WAN	Legacy WAN

◆ Does It Affect Layer 3?

At Layer 3:

No major difference.

Routing protocols:

- OSPF
- EIGRP
- Static routing

Work the same.

But:

- Serial has lower bandwidth
- OSPF cost calculation changes
- Throughput differs

◆ Real Enterprise Scenario

Imagine:

HQ router has:

- Gig0/0 → LAN
- Gig0/1 → Internet
- Serial0/0/0 → MPLS WAN

That's totally normal in older deployments.

It's not odd.

But today, most WAN links are Ethernet-based.

⚠ Why You Didn't See NIM on 2911

Because:

- 2911 is older generation
- Uses EHWIC slots

- NIM modules belong to ISR 4000 series

Packet Tracer doesn't simulate full hardware ecosystem either.

Interview-Style Questions You Might Face

Q1:

Is mixing serial and gigabit interfaces wrong?

Answer:

No. They represent different physical media but operate similarly at Layer 3.

Q2:

Why are serial links rare today?

Because modern WAN services provide Ethernet handoffs and higher bandwidth.

Q3:

What is replacing traditional WAN routers?

SD-WAN edge devices and L3 switches.

How To Explain This Confidently

"In modern enterprise networks, Cisco ISR 4000 series routers are commonly used for WAN edge deployments, while Layer 3 switches handle campus routing. Mixing serial and Gigabit interfaces is technically valid at Layer 3, but serial links are largely legacy, as modern WAN connectivity is Ethernet-based."

TL;DR

- 2911 is mostly legacy
 - ISR 4000 series is modern enterprise standard
 - L3 switches handle most campus routing
 - Mixing serial + gigabit is not wrong
 - Serial is legacy WAN technology
 - Modern WAN is Ethernet-based
-

If you want, I can now explain:

- 👉 How real enterprise hub-and-spoke WAN topology looks
- 👉 OR how SD-WAN changed everything

👉 OR how to design proper routed core network for placements 🚀