1: EXTENDING Wi-Fi

by Francis Chao
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for over 40 years

TuCSon COMPUTER SOCIETY

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“Meeting Notes”

SUMMARY

You can extend Wi-Fi to increase coverage area for computers, tablets, cell phones, televisions, or cameras that are connected to the existing Wi-Fi routers in your home or business.

TOPICS

- Wi-Fi Extenders
- Wi-fi Mesh
- Wi-Fi Backhaul Options
- Wi-Fi Adapters
- Wi-Fi Troubleshooting

INTERNET PROVIDER'S GATEWAY BOX

(ASUS) (MESH) ROUTER #1

STEEL STAIRWELL & METAL FURNITURE

MY OFFICE AREA IN THE SOUTH SIDE OF THE HOUSE LACKS RELIABLE Wi-Fi COVERAGE

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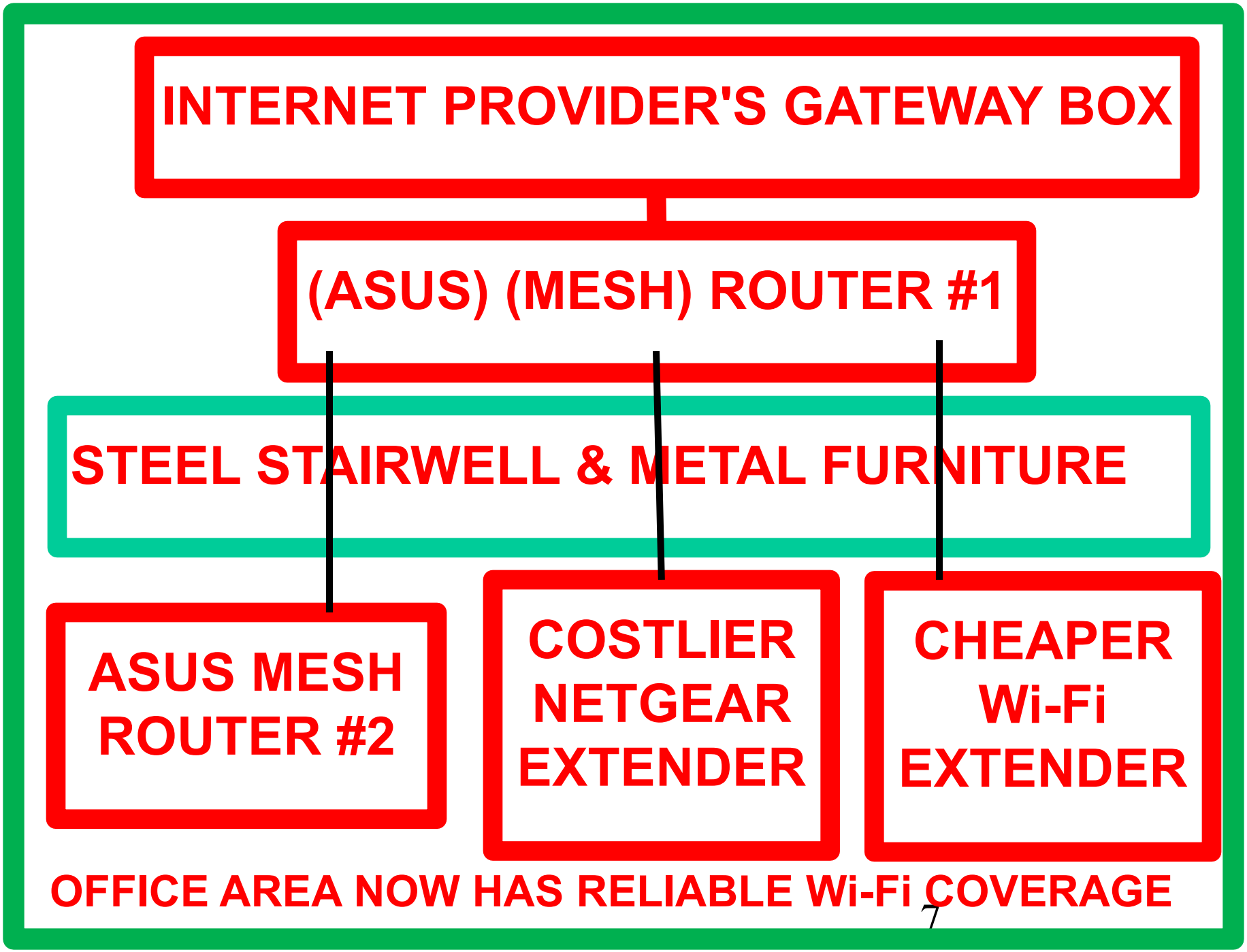
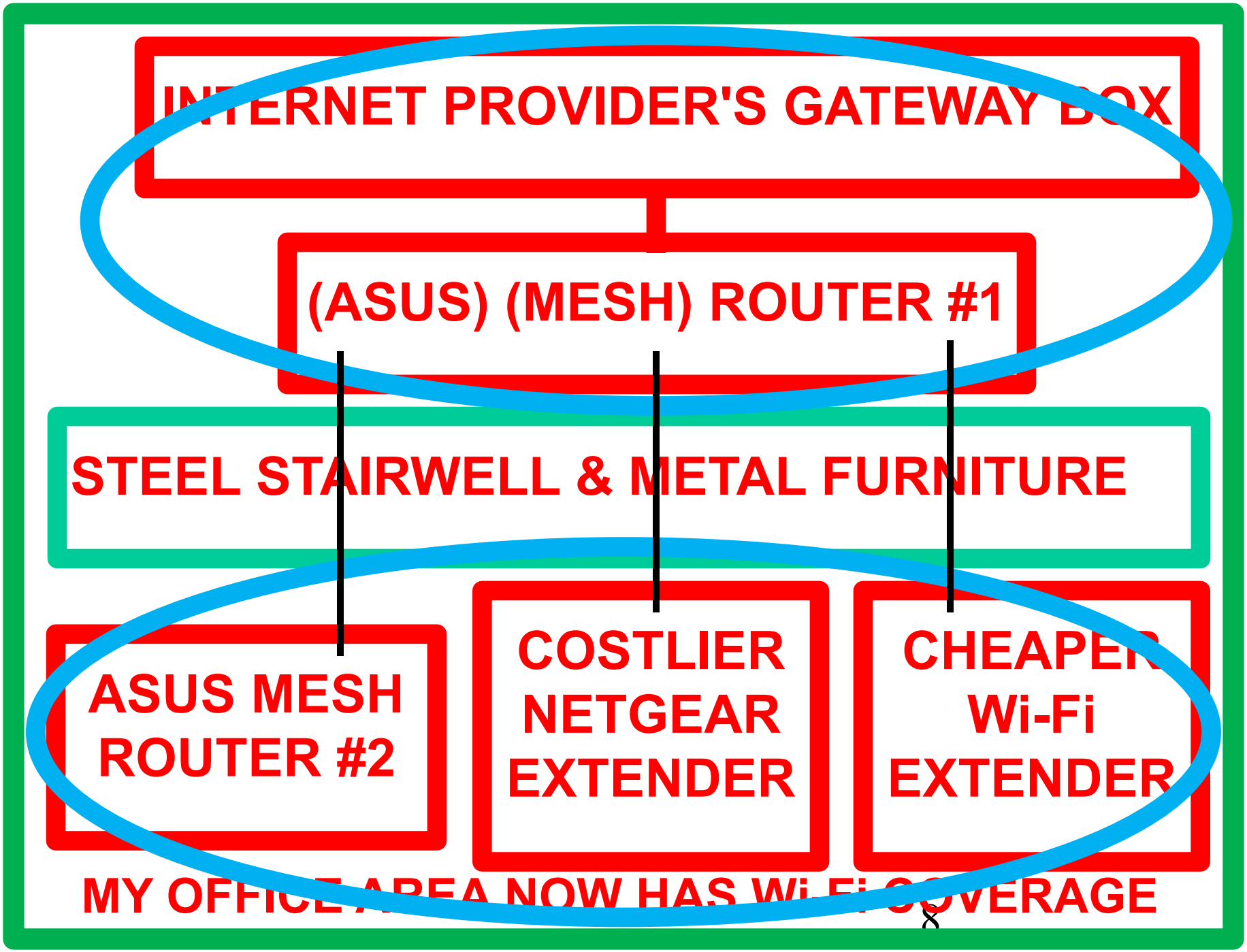

INTERNET PROVIDER'S GATEWAY BOX
(ASUS) (MESH) ROUTER #1
STEEL STAIRWELL & METAL FURNITURE
ASUS MESH ROUTER #2
COSTLIER NETGEAR EXTENDER
CHEAPER Wi-Fi EXTENDER
OFFICE AREA NOW HAS RELIABLE Wi-Fi COVERAGE


INTERNET PROVIDER'S GATEWAY BOX
(ASUS) (MESH) ROUTER #1
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COSTLIER NETGEAR EXTENDER
CHEAPER Wi-Fi EXTENDER
MY OFFICE AREA NOW HAS Wi-Fi COVERAGE

OPTIONS FOR EXTENDING Wi-Fi

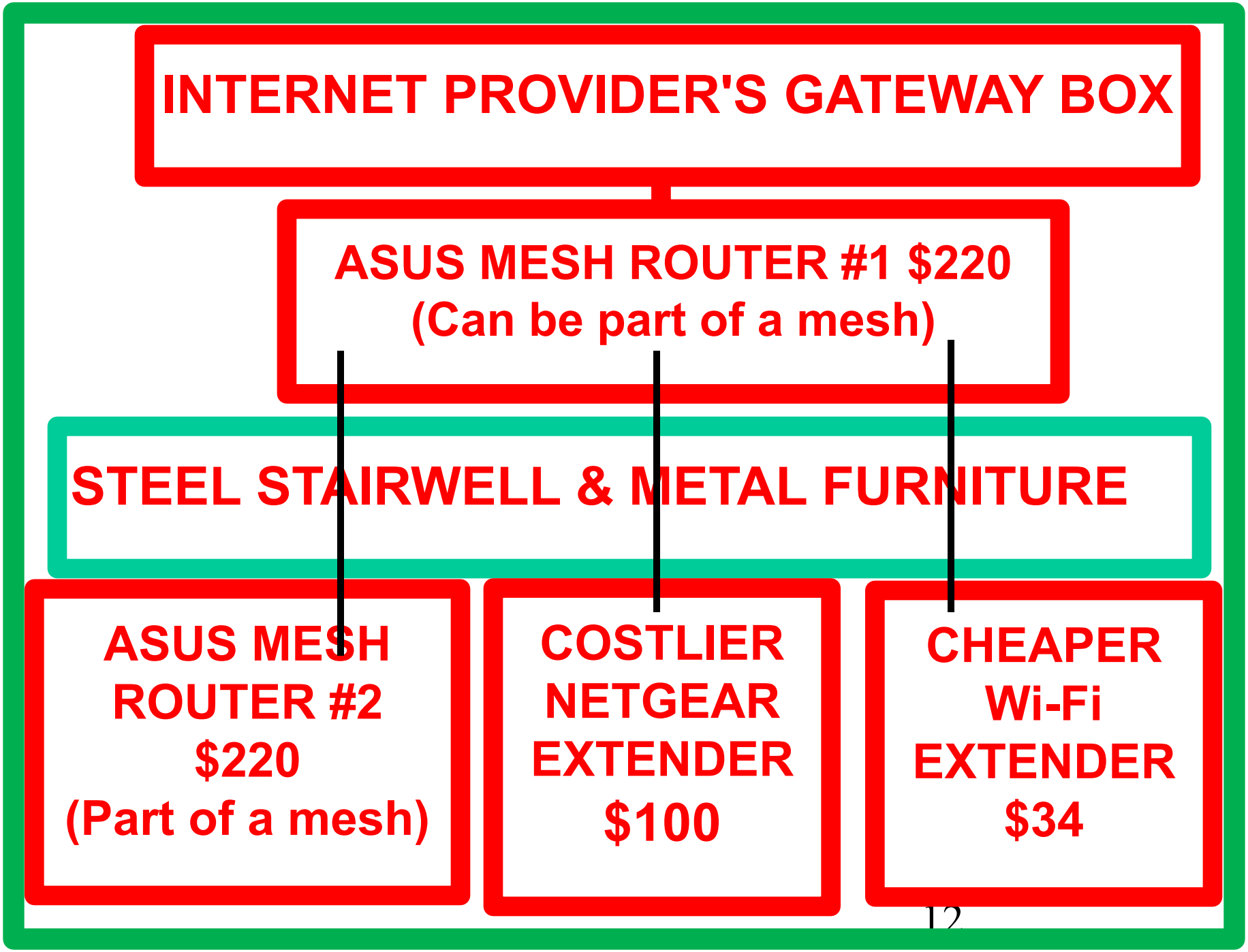
- The vertical black lines represent the connections between the router in the North side of the house and the South side of the house.
- These connections are called **backhaul connections**.
- Backhaul connections can be either wireless or wired.

OPTIONS FOR EXTENDING Wi-Fi (continued)

- For your home or business, you only need to have one of these three options for extending the coverage of a wireless Wi-Fi network:

OPTIONS FOR EXTENDING Wi-Fi (continued)

- With each increased-cost option, you get better penetration through walls and obstructions and greater Internet & local network speeds:

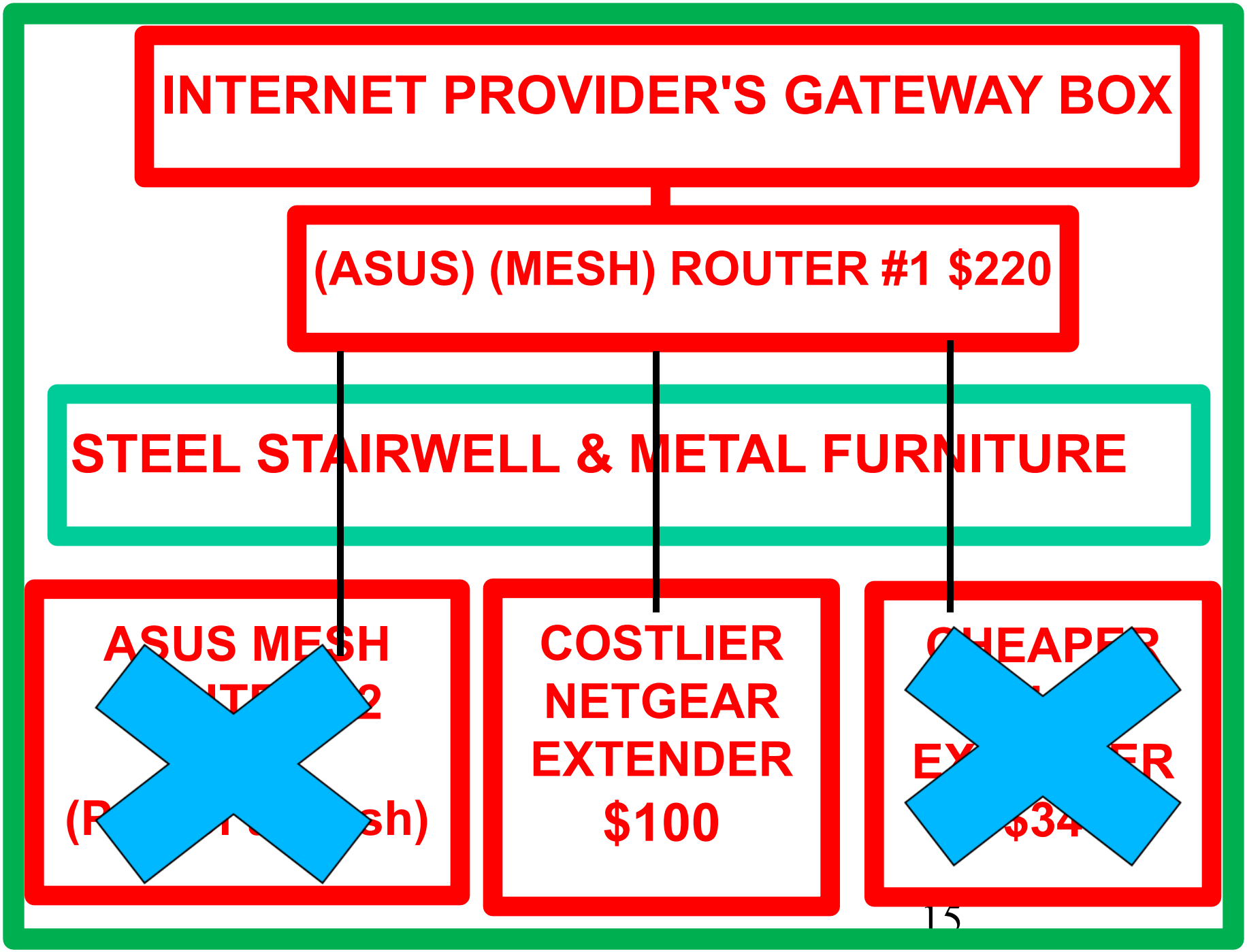

INTERNET PROVIDER'S GATEWAY BOX
ASUS MESH ROUTER #1 $220
(Can be part of a mesh)
STEEL STAIRWELL & METAL FURNITURE
ASUS MESH ROUTER #2 $220 (Part of a mesh)
COSTLIER NETGEAR EXTENDER $100
CHEAPER Wi-Fi EXTENDER $34

OPTIONS FOR EXTENDING Wi-Fi (continued)

- The vertical black lines represent the connections between the router in the North side of the house and the equipment on the South side of the house.

OPTIONS FOR EXTENDING Wi-Fi (continued)

- These connections are called **backhaul connections**.
- Backhaul connections can be either wireless or wired.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ASUS MESH
COSTLIER
NETGEAR
EXTENDER
$100

INTERNET PROVIDER'S GATEWAY BOX

(ASUS) (MESH) ROUTER #1 $220

STEEL STAIRWELL & METAL FURNITURE

ASUS MESH

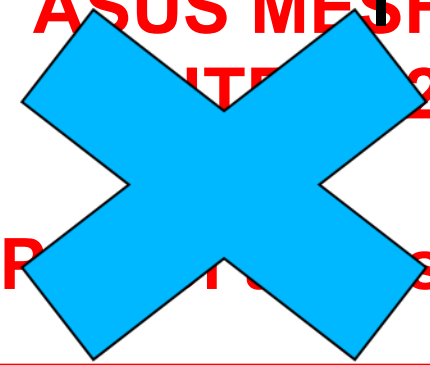
(R sh)

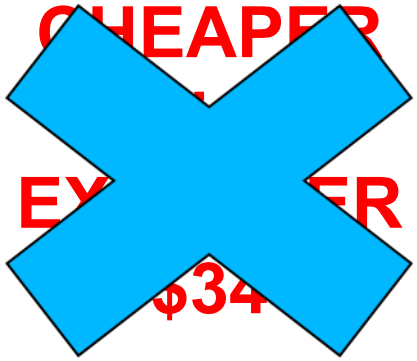
COSTLIER NETGEAR EXTENDER $100

CHEAPER

EX ER

$34





COSTLIER EXTENDER CONFIGURATION DETAILS

- For the cheap extender option and the costly extender option, I do not need a mesh-capable router at the North end of the house:

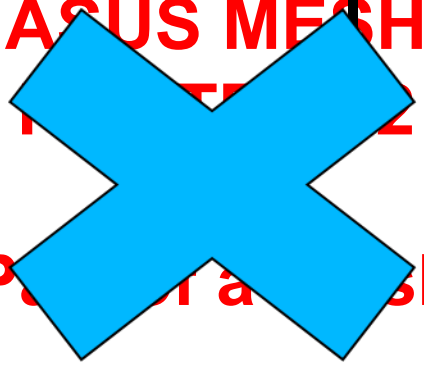
INTERNET PROVIDER'S GATEWAY BOX

(ASUS) (MESH) ROUTER #1 $220

STEEL STAIRWELL & METAL FURNITURE

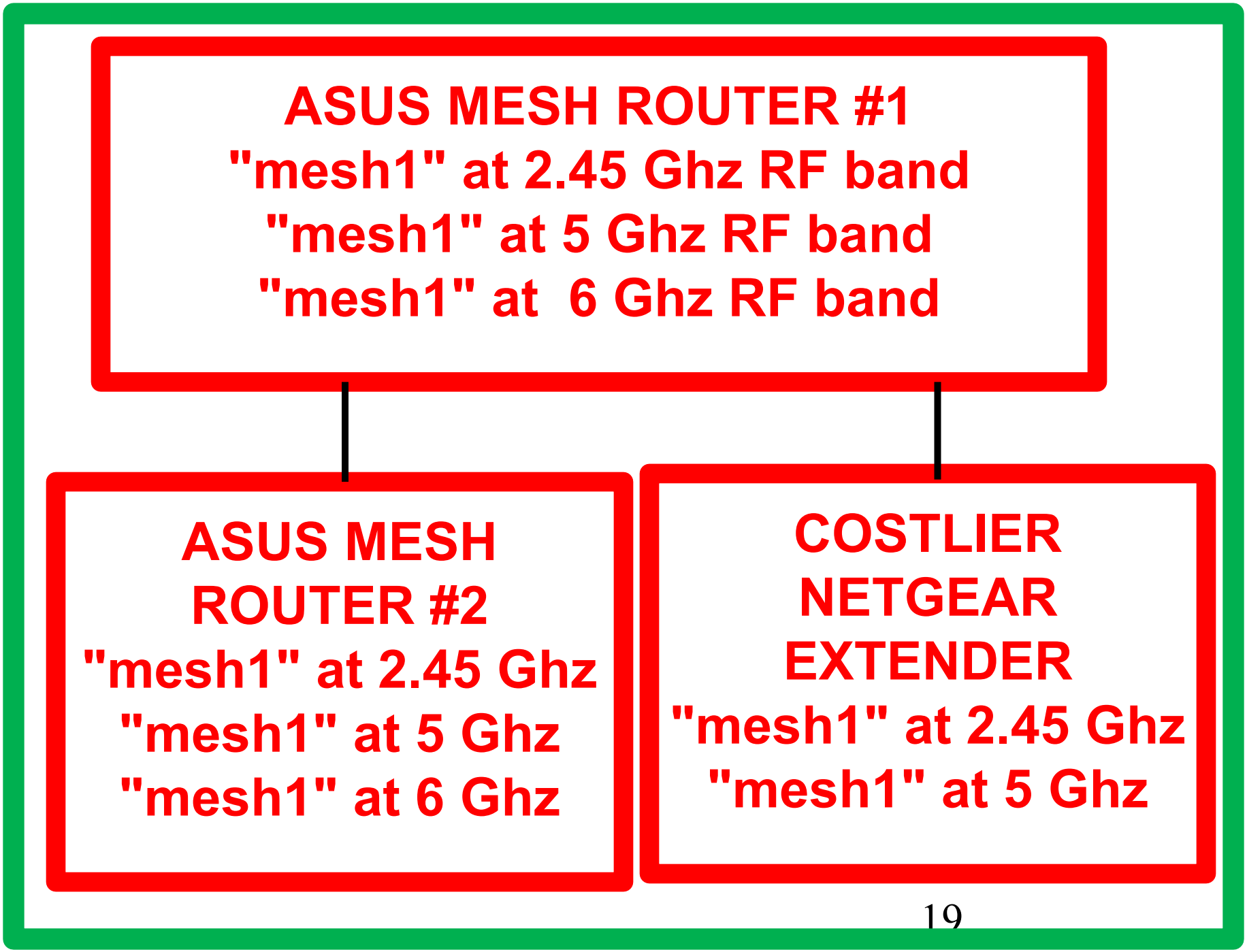
ASUS MESH

(P a Mesh)



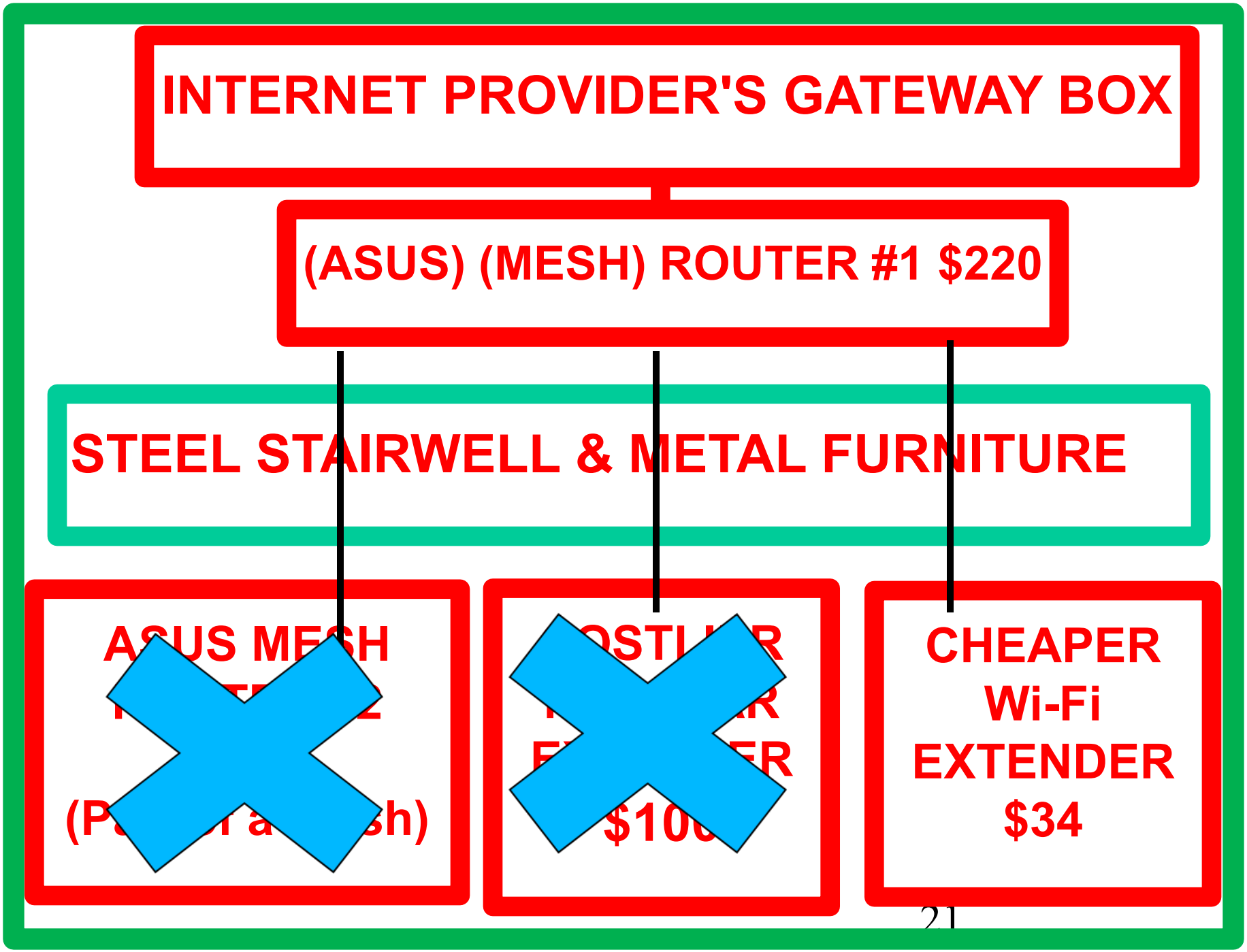
COSTLIER
NETGEAR
EXTENDER
$100

$34


ASUS MESH ROUTER #1
"mesh1" at 2.45 Ghz RF band
"mesh1" at 5 Ghz RF band
"mesh1" at 6 Ghz RF band
ASUS MESH ROUTER #2
"mesh1" at 2.45 Ghz
"mesh1" at 5 Ghz
"mesh1" at 6 Ghz
COSTLIER NETGEAR EXTENDER
"mesh1" at 2.45 Ghz
"mesh1" at 5 Ghz

COSTLIER EXTENDER CONFIGURATION DETAILS (continued)

- https://www.amazon.com/dp/B0DMBXDY75?ref_=ppx_hzsearch_conn_dt_b_fed_asin_title_1&th=1
- This Wi-Fi extender has a Gigabit Ethernet port so it is fast enough if your Internet provider is providing you with upload and/or download speeds greater than 100 Megabits per second.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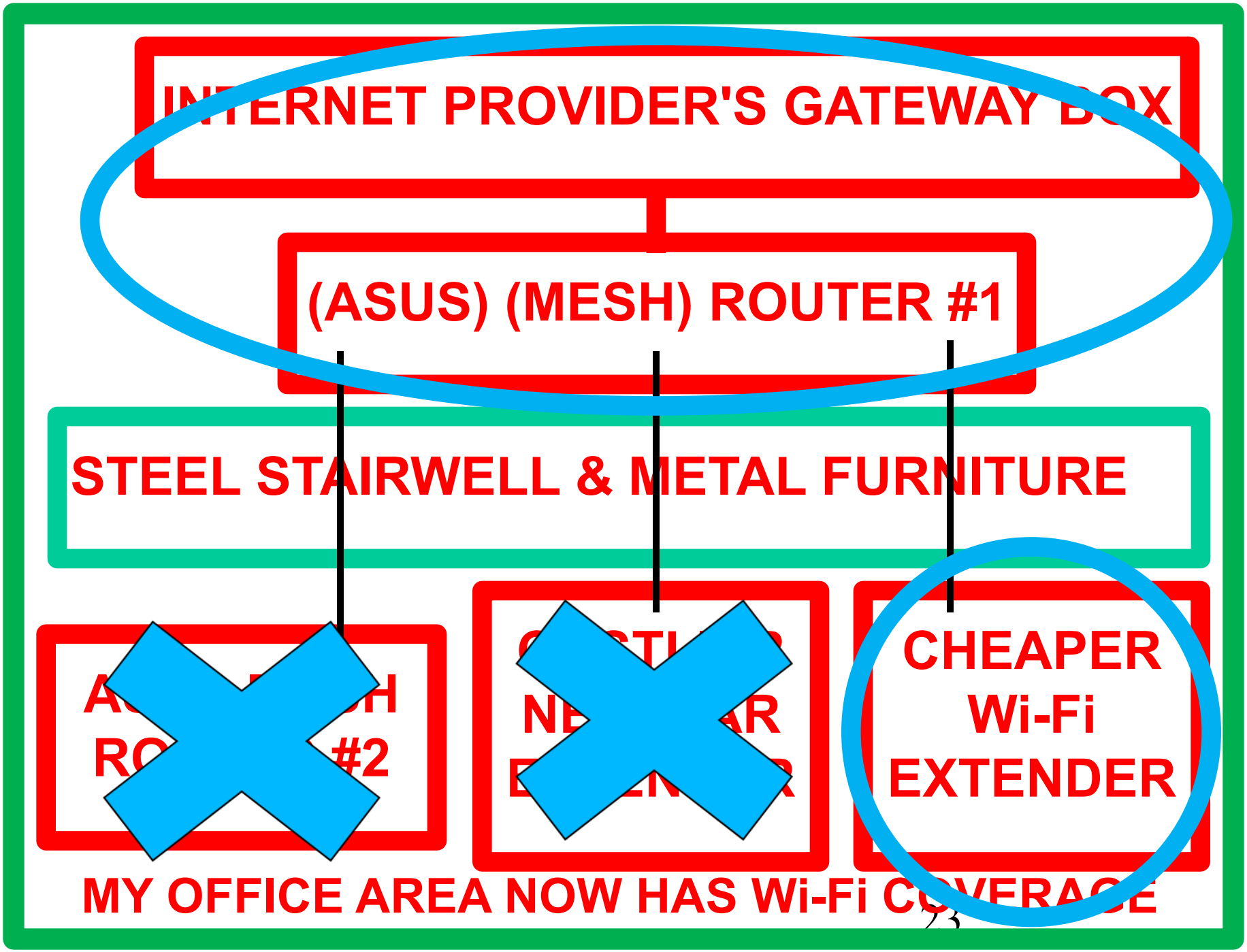
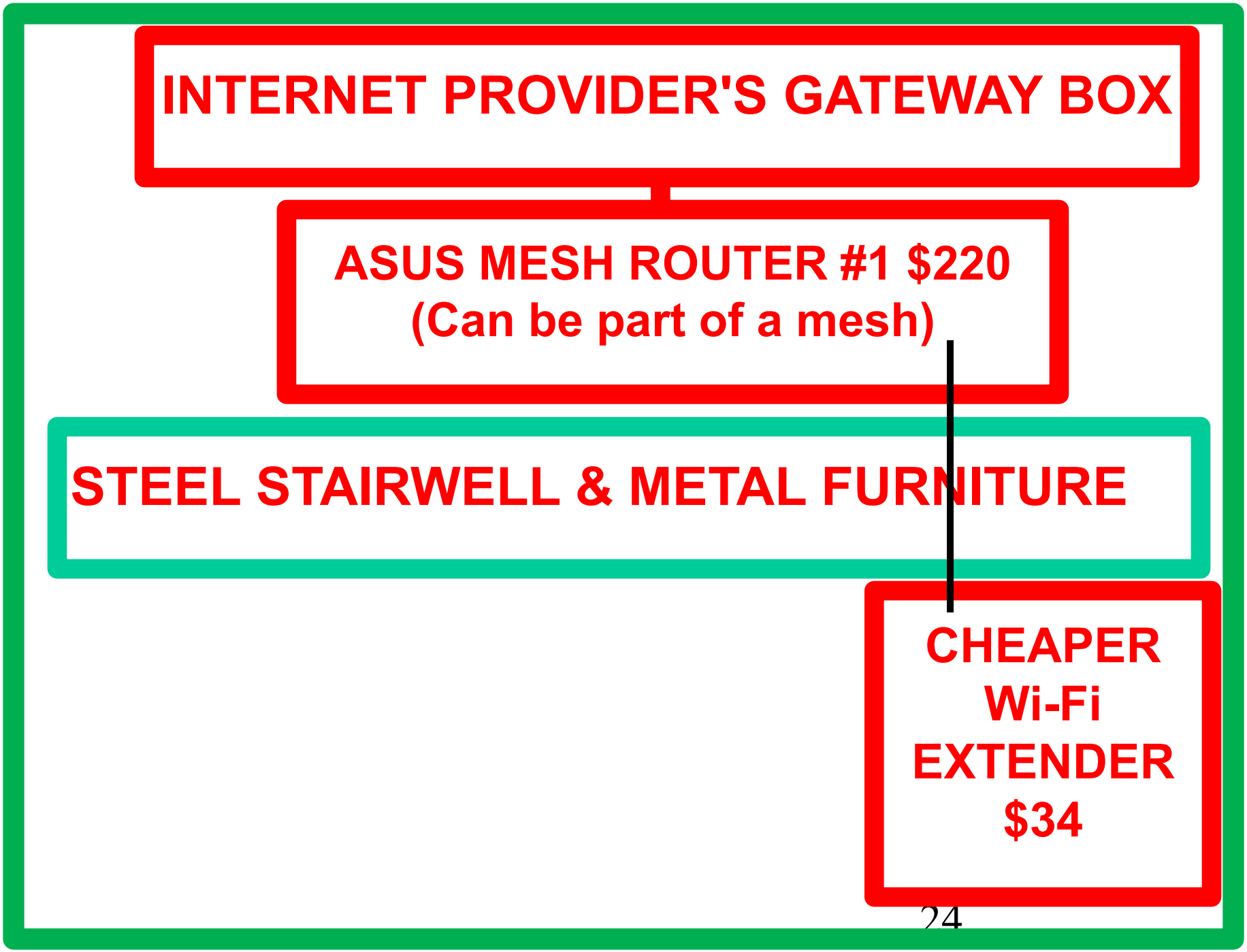
(ASUS) (MESH) ROUTER #1 $220
STEEL STAIRWELL & METAL FURNITURE
CHEAPER
Wi-Fi
EXTENDER
$34

CHEAPER EXTENDER CONFIGURATION DETAILS

- https://www.amazon.com/dp/B0D5YR7HKF?ref_=ppx_hzsearch_conn_dt_b_fed_asin_title_3
- This Wi-Fi extender is adequate if your Internet provider is providing you with upload and download speeds below 100 Megabits per second because it only has a "Fast Ethernet" port


INTERNET PROVIDER'S GATEWAY BOX
(ASUS) (MESH) ROUTER #1
STEEL STAIRWELL & METAL FURNITURE
CHEAPER
Wi-Fi
EXTENDER
MY OFFICE AREA NOW HAS Wi-Fi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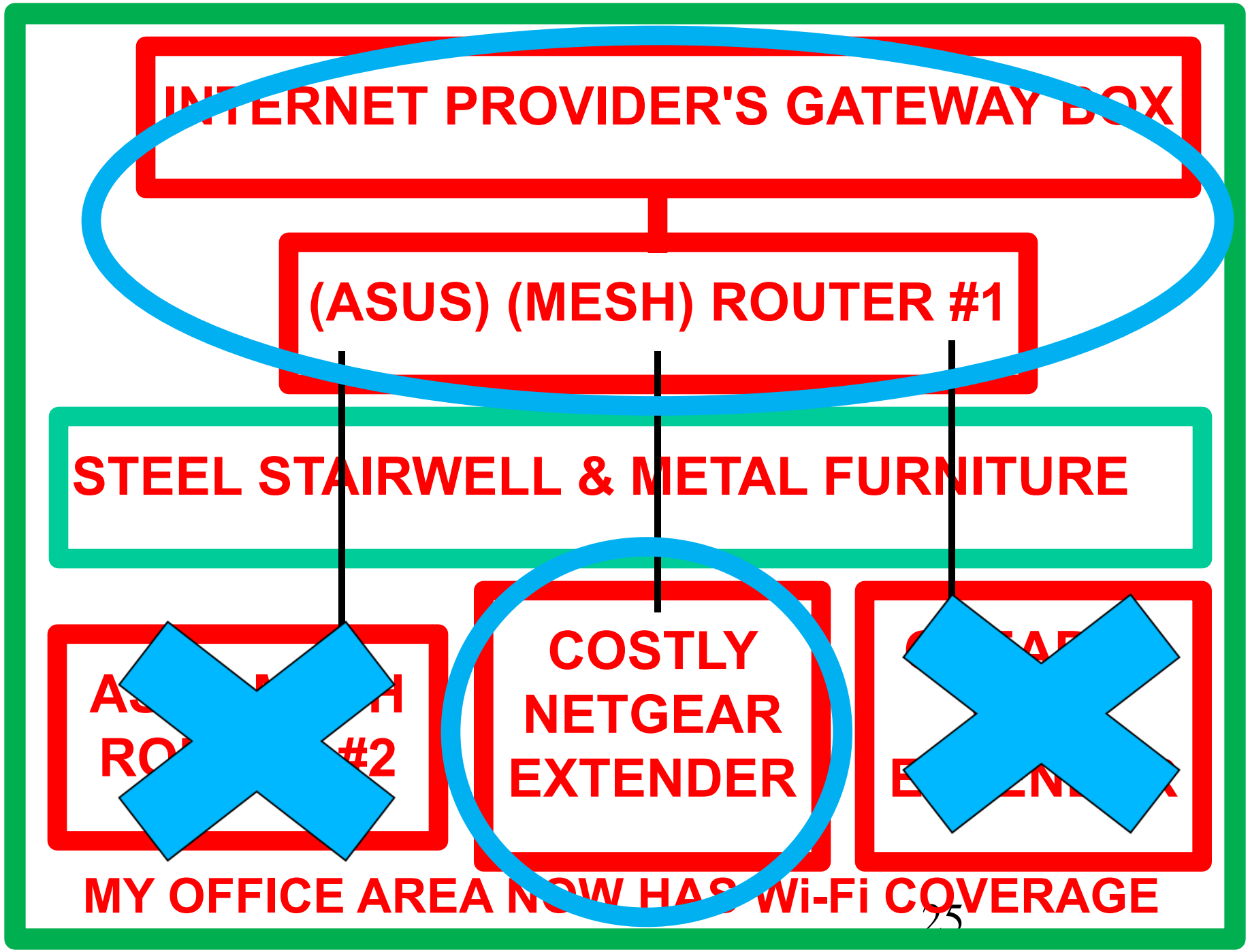

INTERNET PROVIDER'S GATEWAY BOX
(ASUS) (MESH) ROUTER #1
STEEL STAIRWELL & METAL FURNITURE
COSTLY
NETGEAR
EXTENDER
MY OFFICE AREA NOW HAS Wi-Fi COVERAGE

CHEAP EXTENDER CONFIGURATION DETAILS (continued)

- For the cheap extender option, user equipment that is located at the South end of the house will display both "WiFi pro_531EFC"
- and
- "WiFi pro_531EFC-5G"

(ASUS) (MESH) ROUTER #1
"mesh1" at 2.45 Ghz RF band
"mesh1" at 5 Ghz RF band
"mesh1" at 6 Ghz RF band

STEEL STAIRWELL & METAL FURNITURE

CHEAPER Wi-Fi EXTENDER
"WiFi pro_531EFC" at 2.45 Ghz
"WiFi pro_531EFC-5G" at 5 Ghz

CHEAP EXTENDER CONFIGURATION DETAILS (continued)

- For the cheap extender option, user equipment that is located at the South end of the house will display both "WiFi pro_531EFC"
- and
- "WiFi pro_531EFC-5G"

CHEAP EXTENDER CONFIGURATION DETAILS (configuration)

- For the cheap extender option, user equipment that is located at the North end of the house will display "mesh1" because any item of user equipment can only display a case-sensitive SSID only once.

CHEAP EXTENDER CONFIGURATION DETAILS (continued)

- For the cheap extender option, user equipment that is located at the South end of the house will display both "WiFi pro_531EFC"
- and
- "WiFi pro_531EFC-5G"

"USER EQUIPMENT" (=UE) VIEWPOINT

- In the Wi-Fi standards, the term "User Equipment" refers to any computer, tablet, cell phone, camera, refrigerator, or television that is used to connect to a Wi-Fi router or a Wi-Fi extender.

"USER EQUIPMENT" (=UE) VIEWPOINT (continued)

- In a mesh system of routers, every transmitter-receiver on a Wi-Fi router and on a Wi-Fi extender will broadcast the same exact case-sensitive "Service Set Identifier" (SSID) unless you configure the specific transmitter-receiver to not to do so.

"USER EQUIPMENT" (=UE) VIEWPOINT (continued)

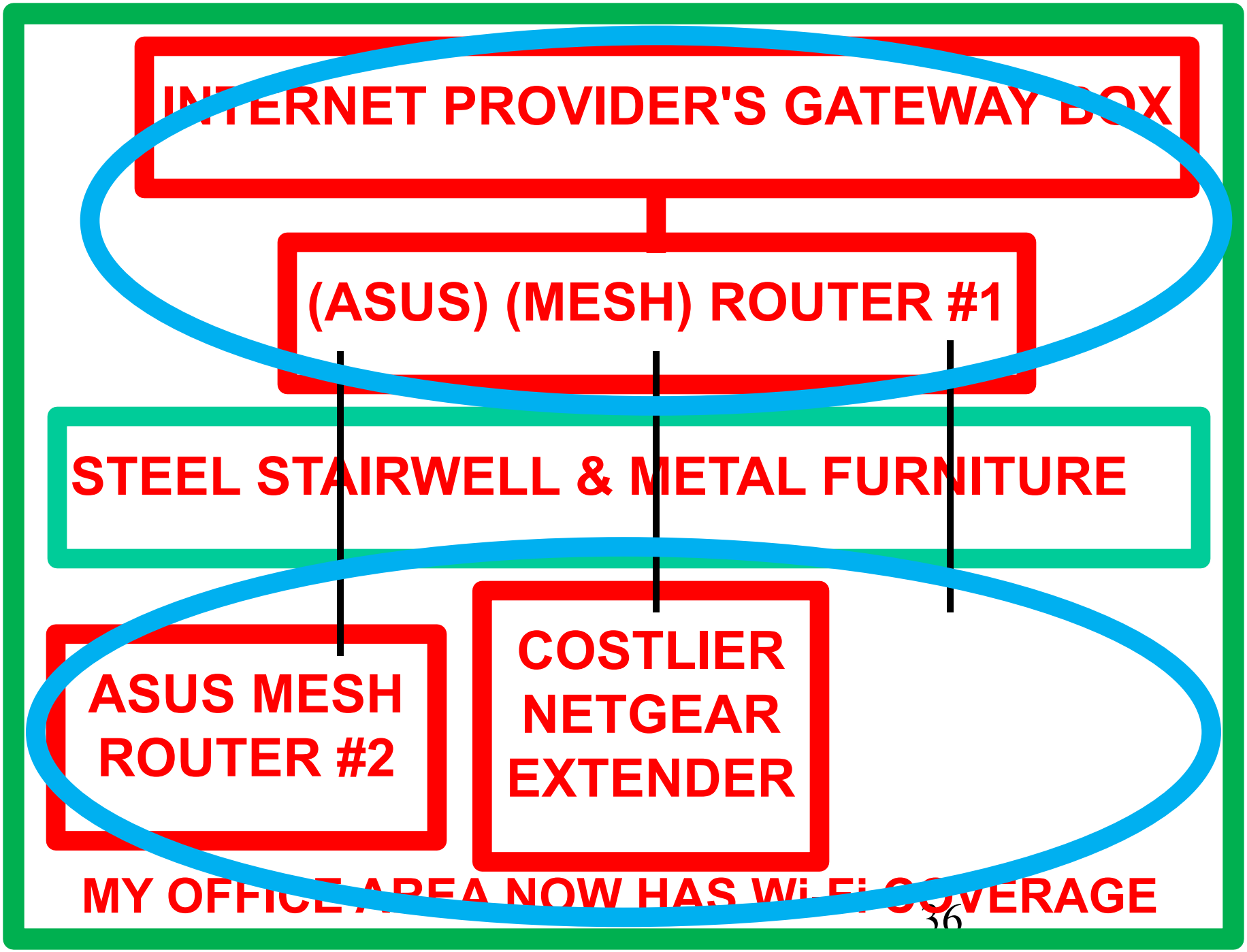
- SSIDs are case sensitive so "mesh1", "Mesh1, "mEsh1", "meSh1" and "mesH1" would be seen as separate SSIDs by your user equipment.

"USER EQUIPMENT" (=UE) VIEWPOINT (continued)

- When you use a UE device (a computer, a tablet, a cell phone, a smart TV, or a Wi-Fi camera) to look at available wireless Wi-Fi networks, any single SSID that is displayed can represent 1 to n number of Wi-Fi transmitter receivers in 1 to n number of physical Wi-Fi routers and Wi-Fi extenders

"USER EQUIPMENT" (=UE) VIEWPOINT (continued)

- All devices broadcasting with transmitter-receivers identifying as as an SSID of "mesh1" in my example: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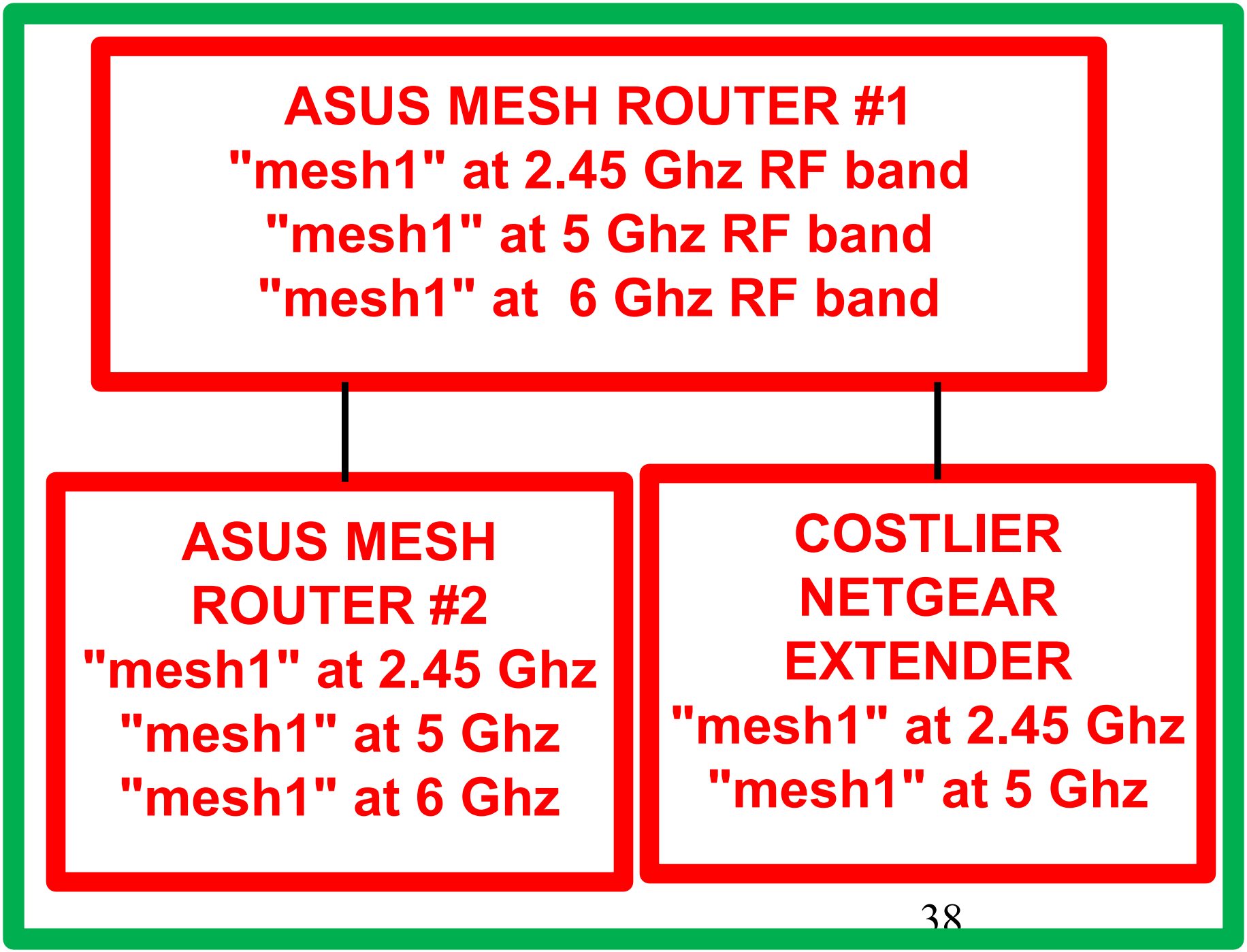
STEEL STAIRWELL & METAL FURNITURE
ASUS MESH ROUTER #2
COSTLIER NETGEAR EXTENDER
MY OFFICE AREA NOW HAS Wi-Fi COVERAGE

"USER EQUIPMENT" (=UE) VIEWPOINT (continued)

- My iPhone shows only one "mesh1" even though it see's all transmitter-receivers identifying as as an SSID of "mesh1"
- Even though my iPhone sees all transmitter-receivers identifying as an SSD of "mesh1", my iPhone will only let me connect to the transmitter-receiver that has the strongest radio signal.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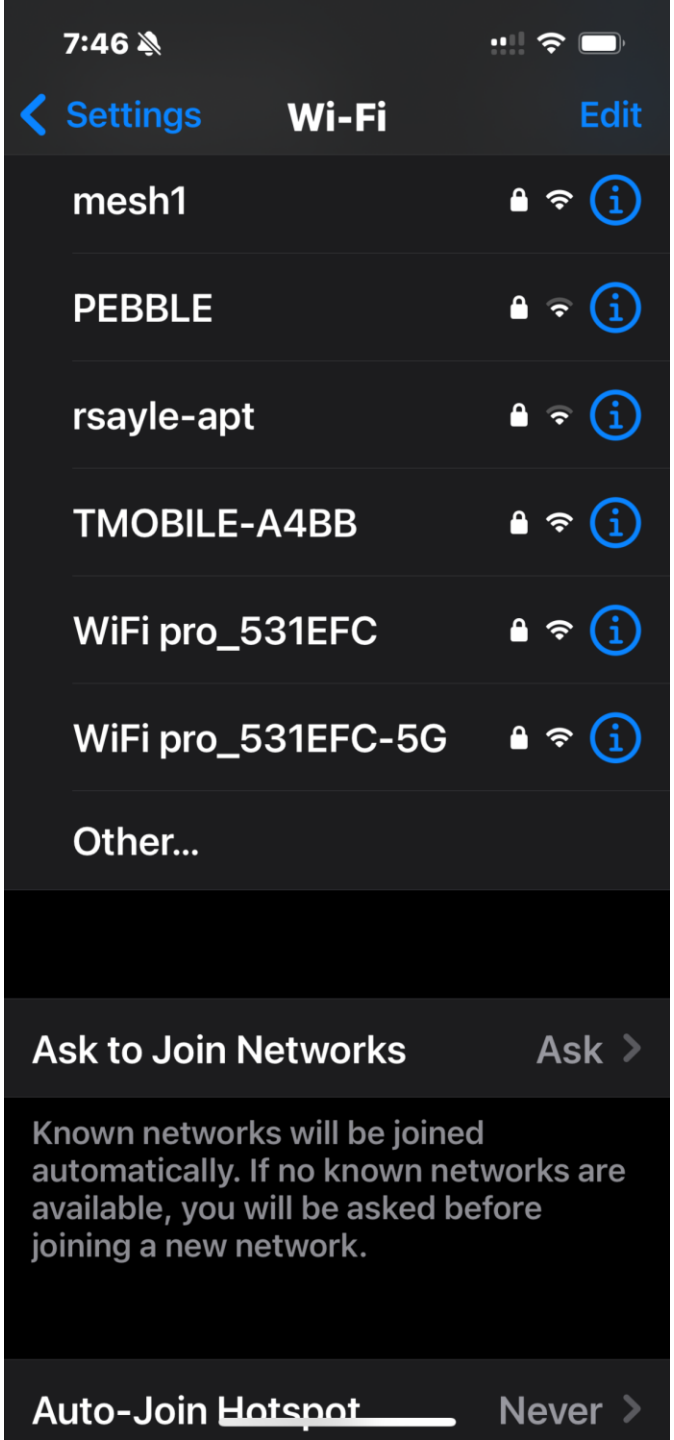
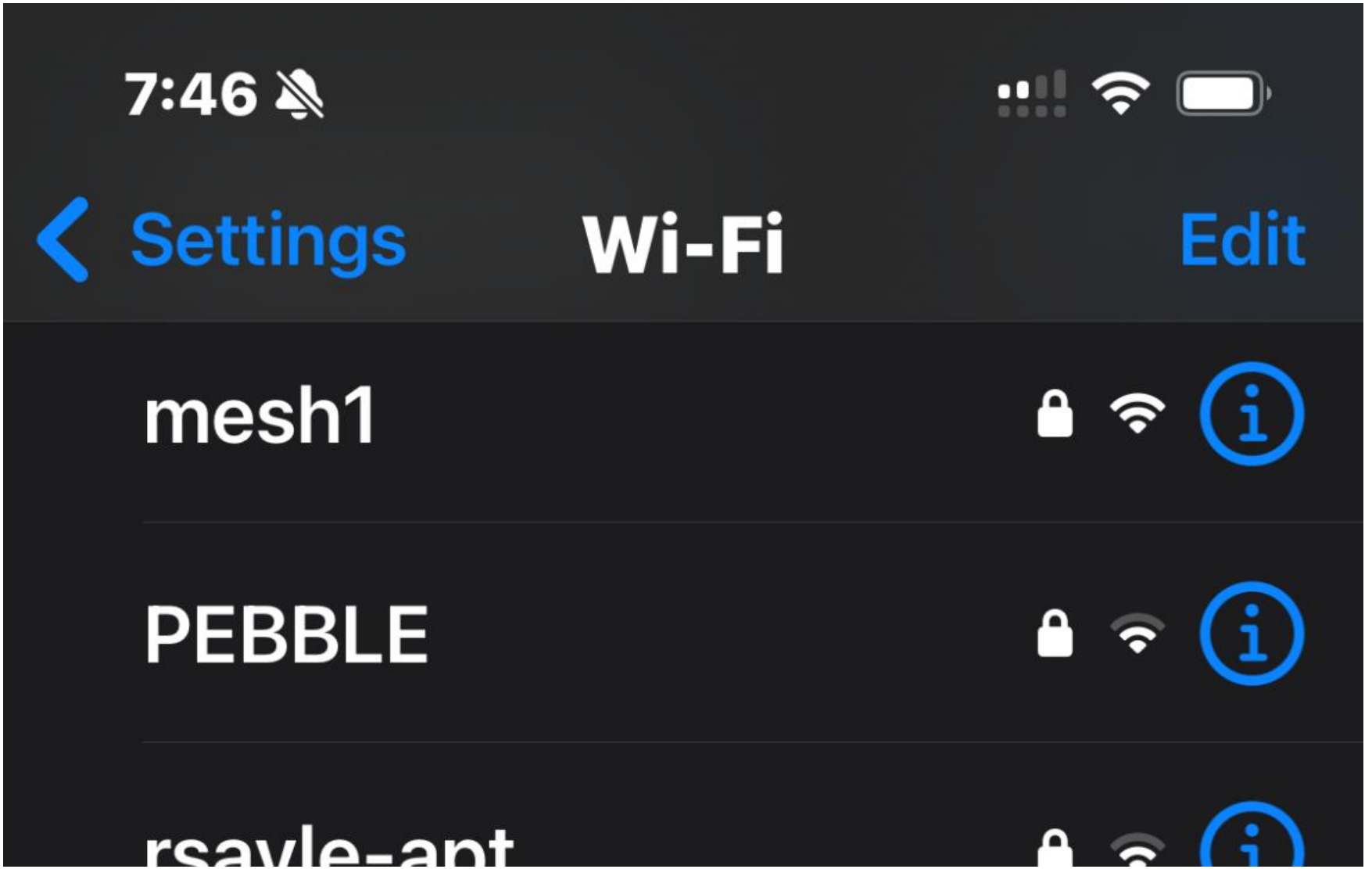
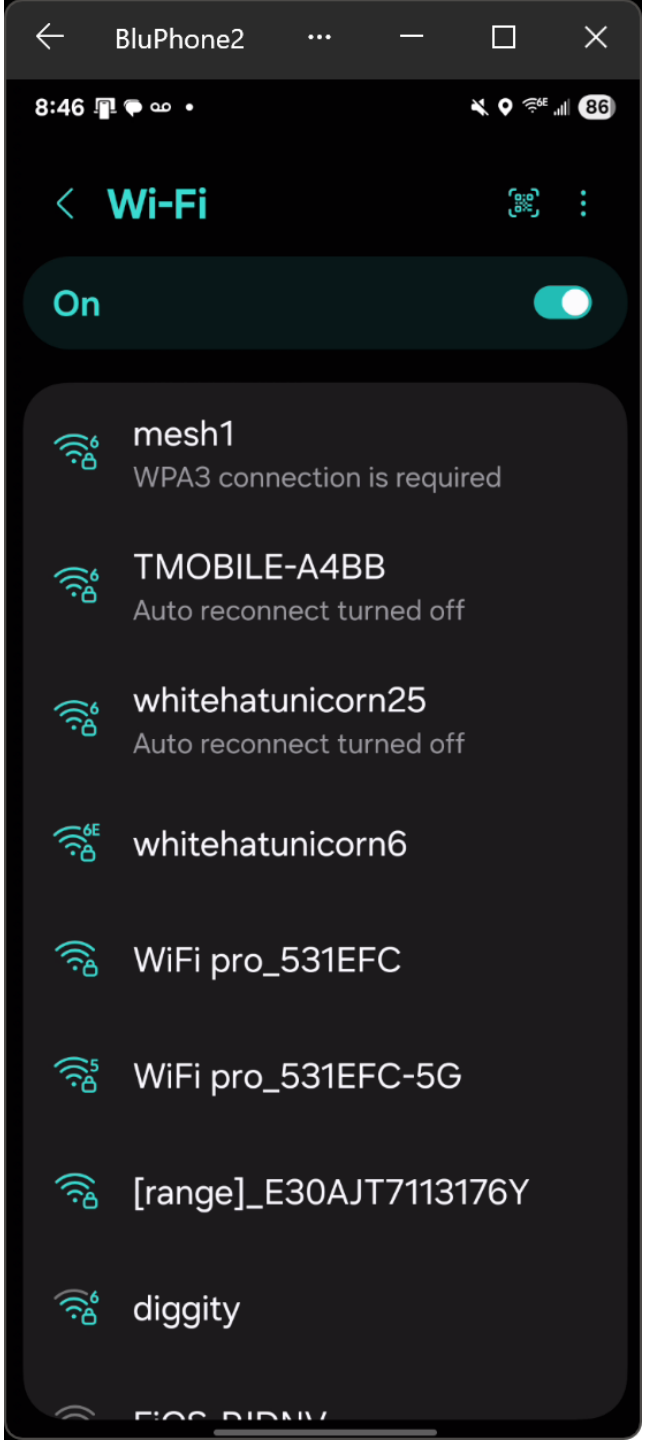
"mesh1" at 2.45 Ghz RF band
"mesh1" at 5 Ghz RF band
"mesh1" at 6 Ghz RF band
ASUS MESH ROUTER #2
"mesh1" at 2.45 Ghz
"mesh1" at 5 Ghz
"mesh1" at 6 Ghz
COSTLIER NETGEAR EXTENDER
"mesh1" at 2.45 Ghz
"mesh1" at 5 Ghz

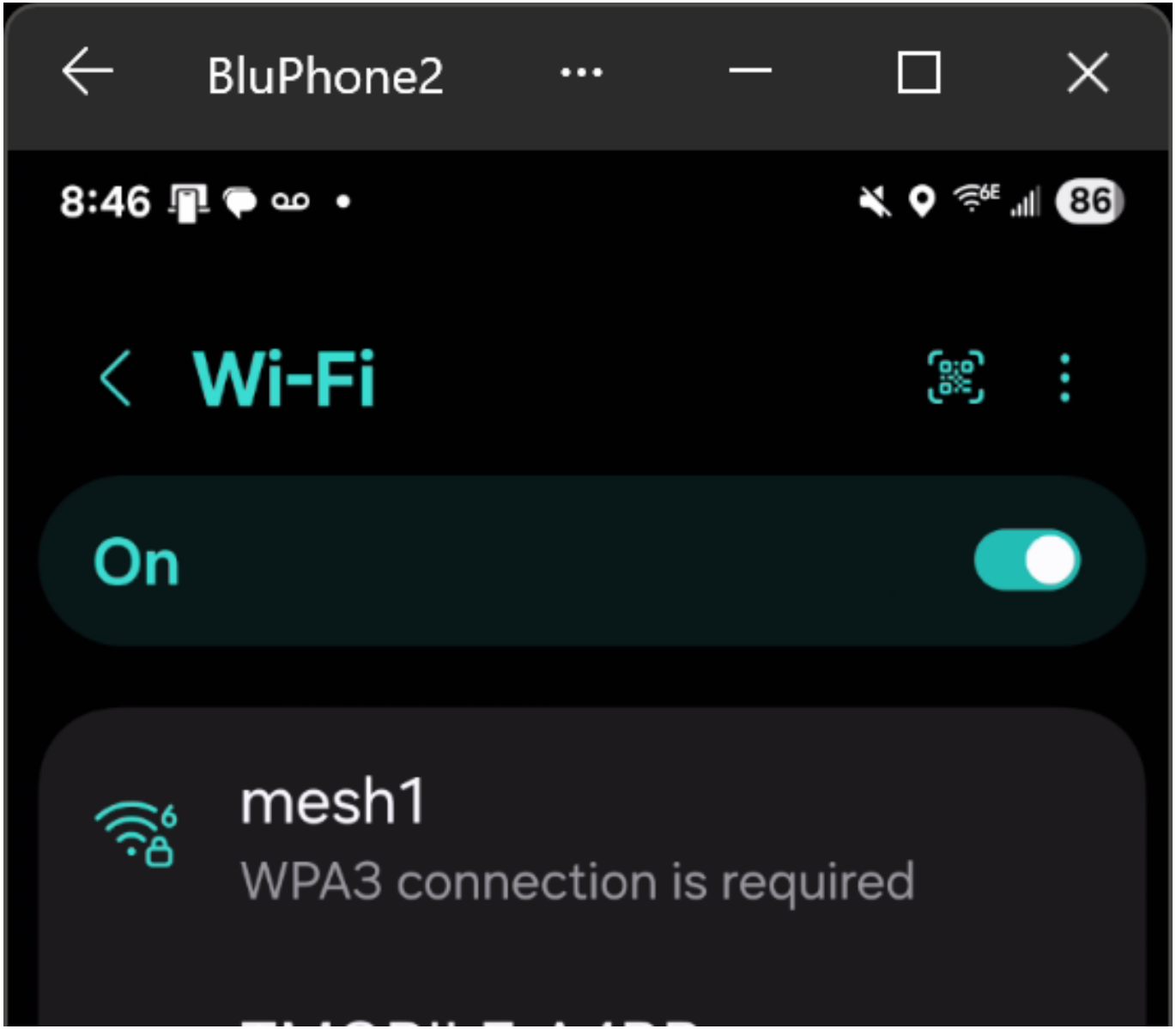

7:46
Settings
Wi-Fi
Edit
mesh1
PEBBLE
rsayle-apt
TMOBILE-A4BB
WiFi pro_531EFC
WiFi pro_531EFC-5G
Other...
Ask to Join Networks
Ask
Known networks will be joined automatically. If no known networks are available, you will be asked before joining a new network.
Auto-Join Hotspot
Never


7:46
Settings
Wi-Fi
Edit
mesh1
PEBBLE
rsayle-apt

"USER EQUIPMENT" (=UE) VIEWPOINT (continued)

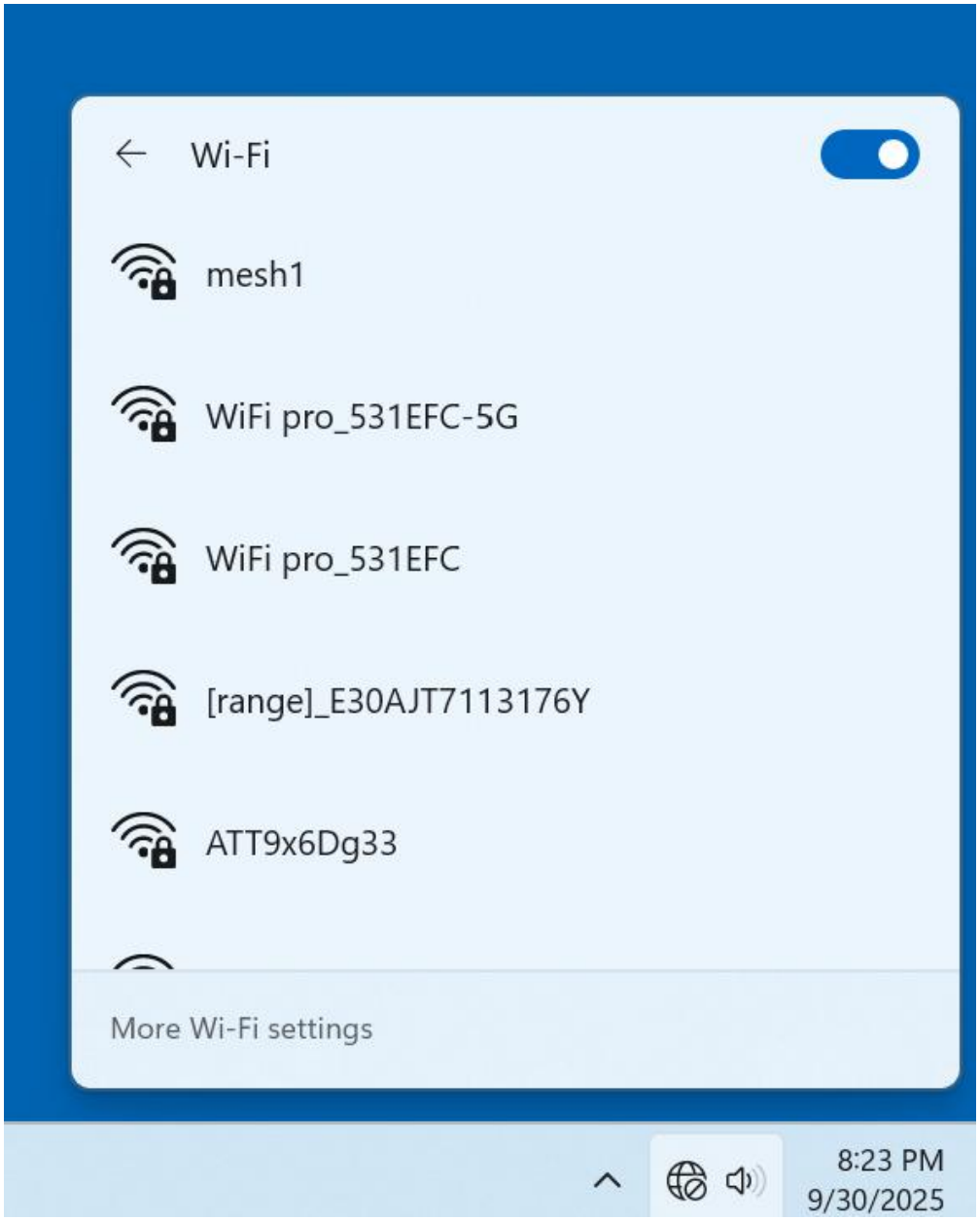
- My Samsung cell phone shows only one "mesh1" even though it see's all transmitter-receivers identifying as as an SSID of "mesh1".
  Even if my Samsung cell phone sees all transmitter-receivers identifying as an SSD of "mesh1", my iPhone will only let me connect to the transmitter-receiver that has the strongest radio signal.

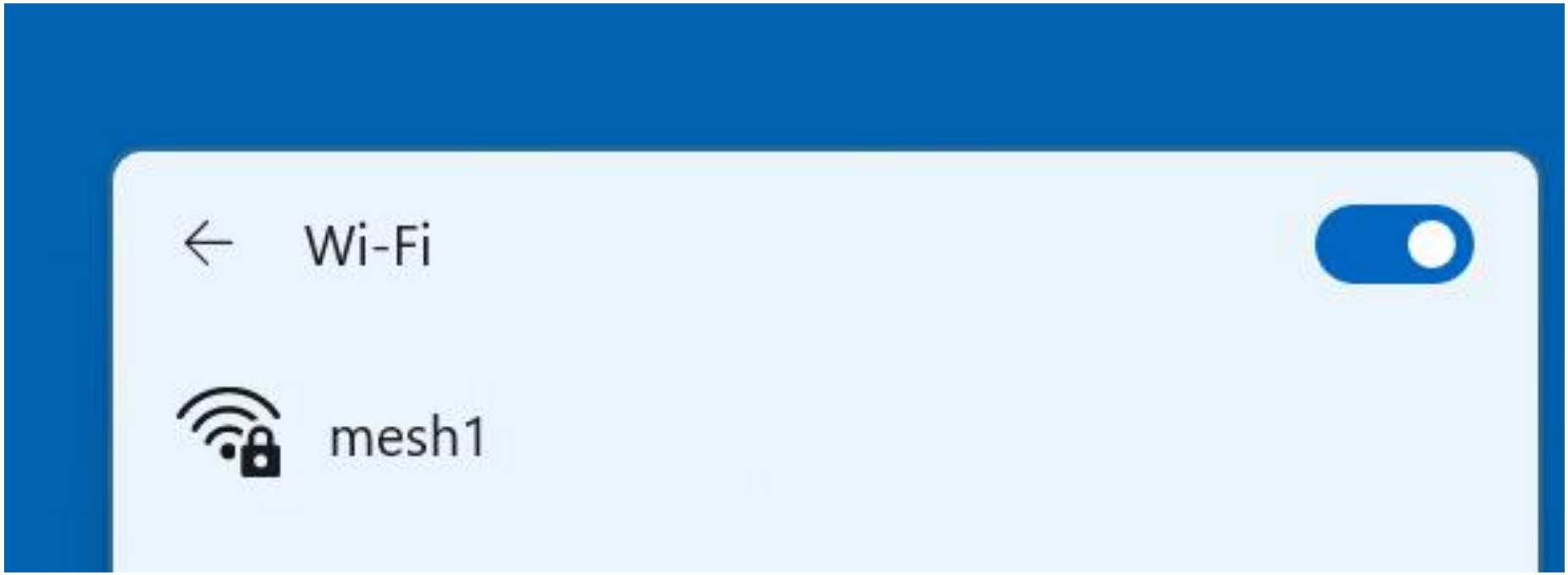

BluPhone2
8:46
86
Wi-Fi
On
mesh1
WPA3 connection is required
TMOBILE-A4BB
Auto reconnect turned off
whitehatunicorn25
Auto reconnect turned off
whitehatunicorn6
WiFi pro_531EFC
WiFi pro_531EFC-5G
[range]_E30AJT7113176Y
diggity


BluPhone2
8:46
86
Wi-Fi
On
mesh1
WPA3 connection is required

"USER EQUIPMENT" (=UE) VIEWPOINT (continued)

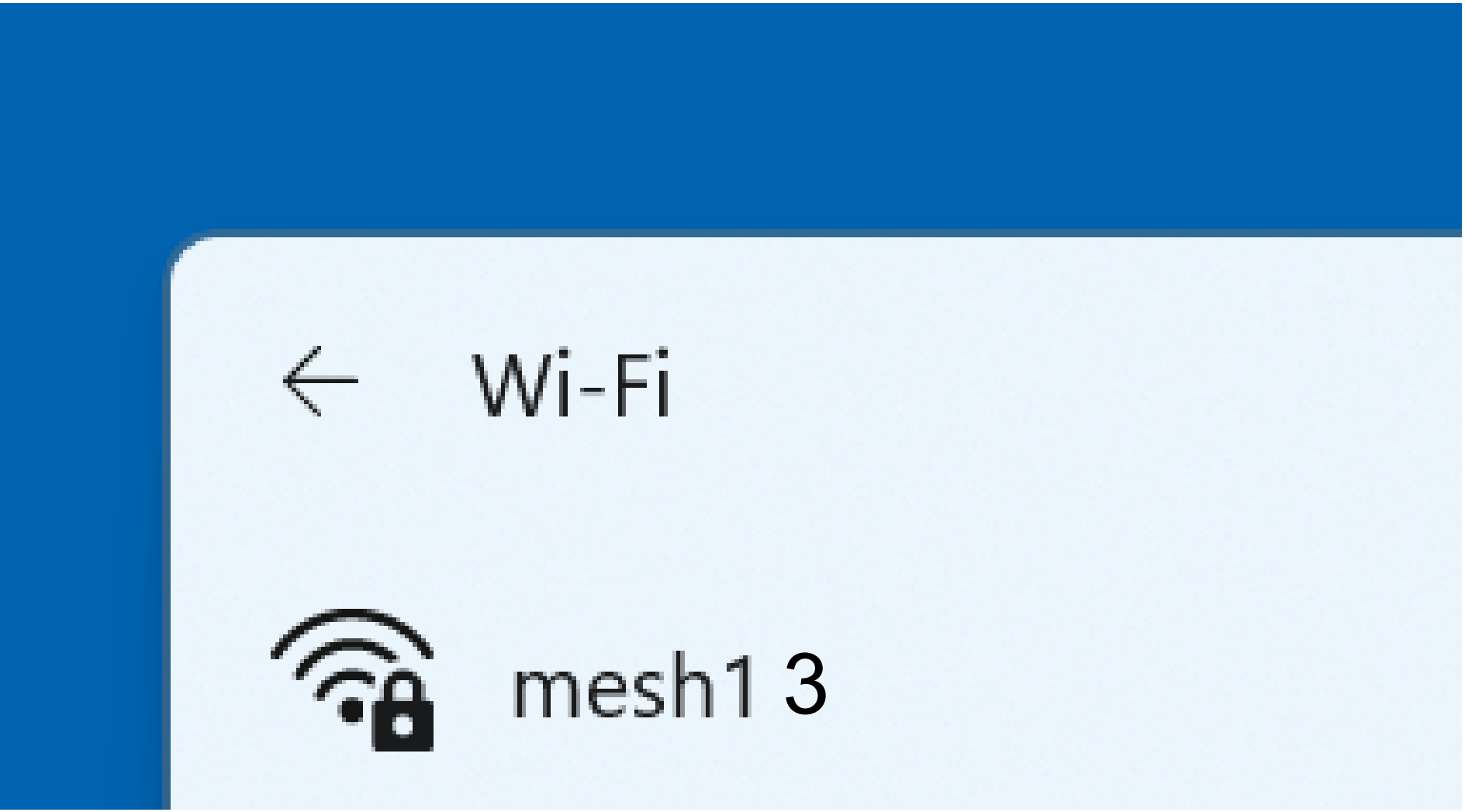
- My Windows 11 computer shows only one "mesh1" even though it see's all transmitter-receivers identifying as as an SSID of "mesh1".
  Even if my Windows 11 computer sees all transmitter-receivers identifying as an SSD of "mesh1", my iPhone will only let me connect to the transmitter-receiver that has the strongest radio signal.


Wi-Fi
mesh1
WiFi pro_531EFC-5G
WiFi pro_531EFC
[range]_E30AJT7113176Y
ATT9x6Dg33
More Wi-Fi settings
8:23 PM
9/30/2025


Wi-Fi
mesh1

"USER EQUIPMENT" (=UE) VIEWPOINT (continued)

- Windows 11 and Windows 10 sometimes shows a
  space <number>
  after the actual SSIDs that it detects. Please ignore this oddity as explained at https://learn.microsoft.com/en-us/answers/questions/4020055/why-is-there-a-number-after-the-wifi-im-connected


Wi-Fi
mesh1 3

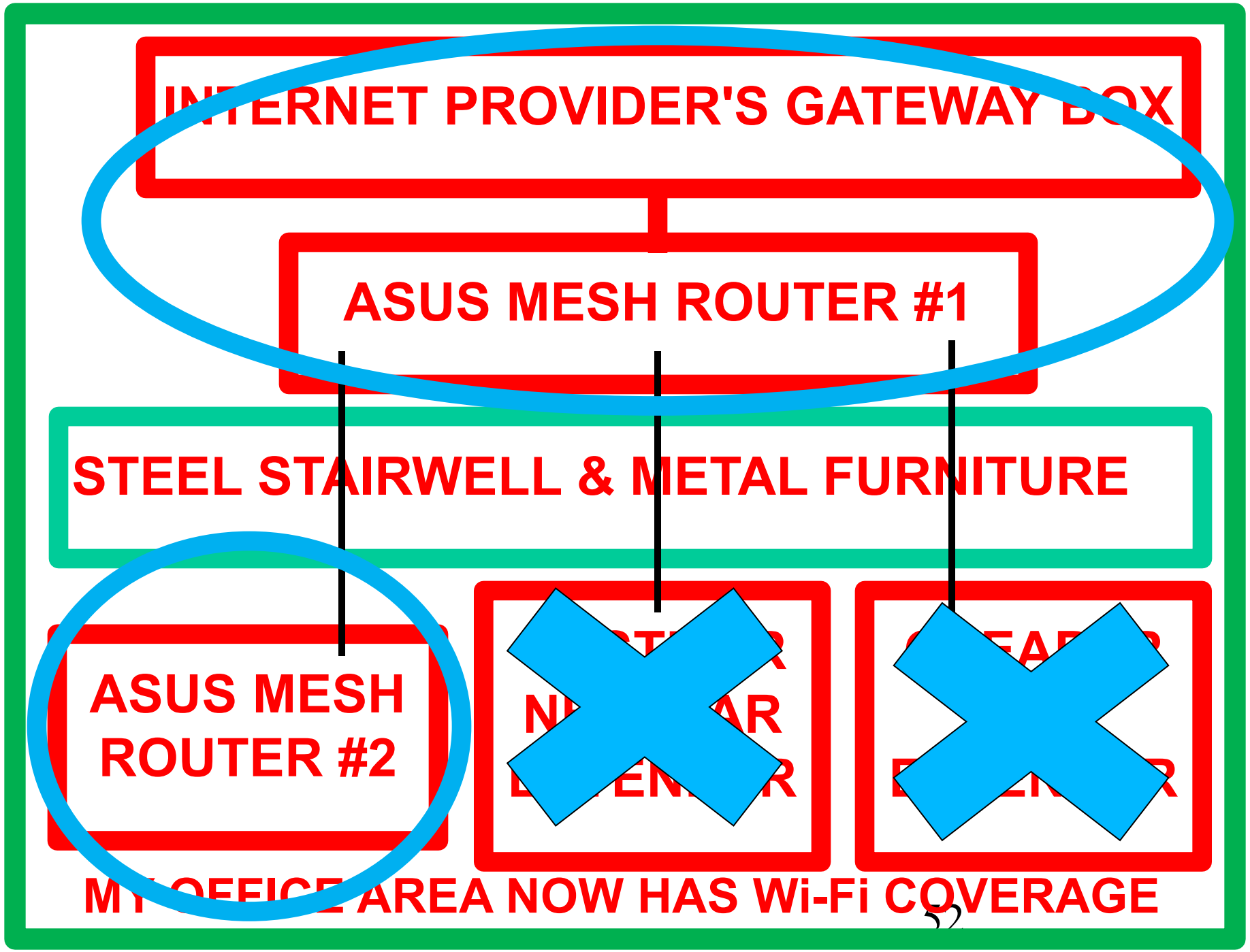

Wi-Fi
mesh1 3

"USER EQUIPMENT" (=UE) VIEWPOINT (continued)

- The actual SSIDs that are being detected are the charactors to the left of the space <number>

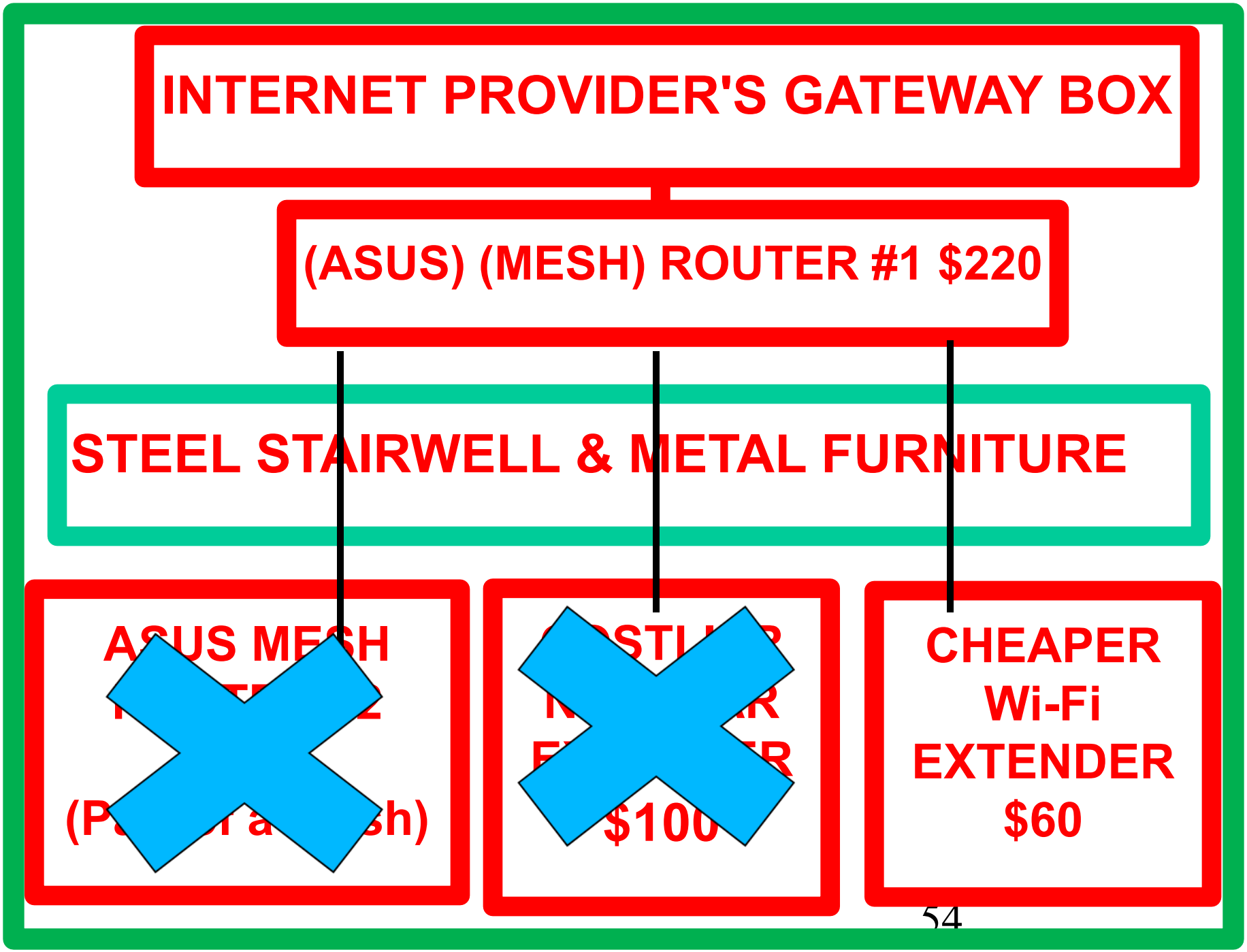
"USER EQUIPMENT" VIEWPOINT (continued)

- For the mesh option, I need to have a mesh-capable router at both the North end of the house and the South end of the house
and both routers have to belong to the same "mesh" system which, in practice", means that both routers have to belong to the same mesh group of the same manufacturer:


INTERNET PROVIDER'S GATEWAY BOX
ASUS MESH ROUTER #1
STEEL STAIRWELL & METAL FURNITURE
ASUS MESH ROUTER #2
MY OFFICE AREA NOW HAS Wi-Fi COVERAGE

TWO MODES OF OPERATION FOR MOST Wi-Fi EXTENDERS

- Repeater mode
- Access Point mode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(ASUS) (MESH) ROUTER #1 $220
STEEL STAIRWELL & METAL FURNITURE
CHEAPER
Wi-Fi
EXTENDER
$60

INTERNET PROVIDER'S GATEWAY BOX

(ASUS) (MESH) ROUTER #1 $220

STEEL STAIRWELL & METAL FURNITURE

ASUS MESH
[illegible]2
(R[illegible]sh)

COSTLIER
NETGEAR
EXTENDER
$100

[illegible]HEAPER
E[illegible]ER
$60[illegible]

TWO MODES OF OPERATION FOR MOST Wi-Fi EXTENDERS (continued)

- Repeater mode
  reduces Internet download and upload speeds down to 20 to 40 percent of the source signals that are being repeated
- Access Point mode
  does not reduce Internet download and upload speeds by much but requires Ethernet or Ethernet equivalent to connect the Wi-Fi extender to the existing router

Repeater Mode: As a wireless signal extender

A. Extend your Wi-Fi signal without using any cables to reduce wiring troubles.

B. Extend your Wi-Fi signal with a cable, connect your device and extender stably.

Repeater Mode: As a wireless signal extender

A. Extend your Wi-Fi signal without using any cables to reduce wiring troubles.

B. Extend your Wi-Fi signal with a cable, connect your device and extender stably.

Repeater Mode: As a wireless signal extender

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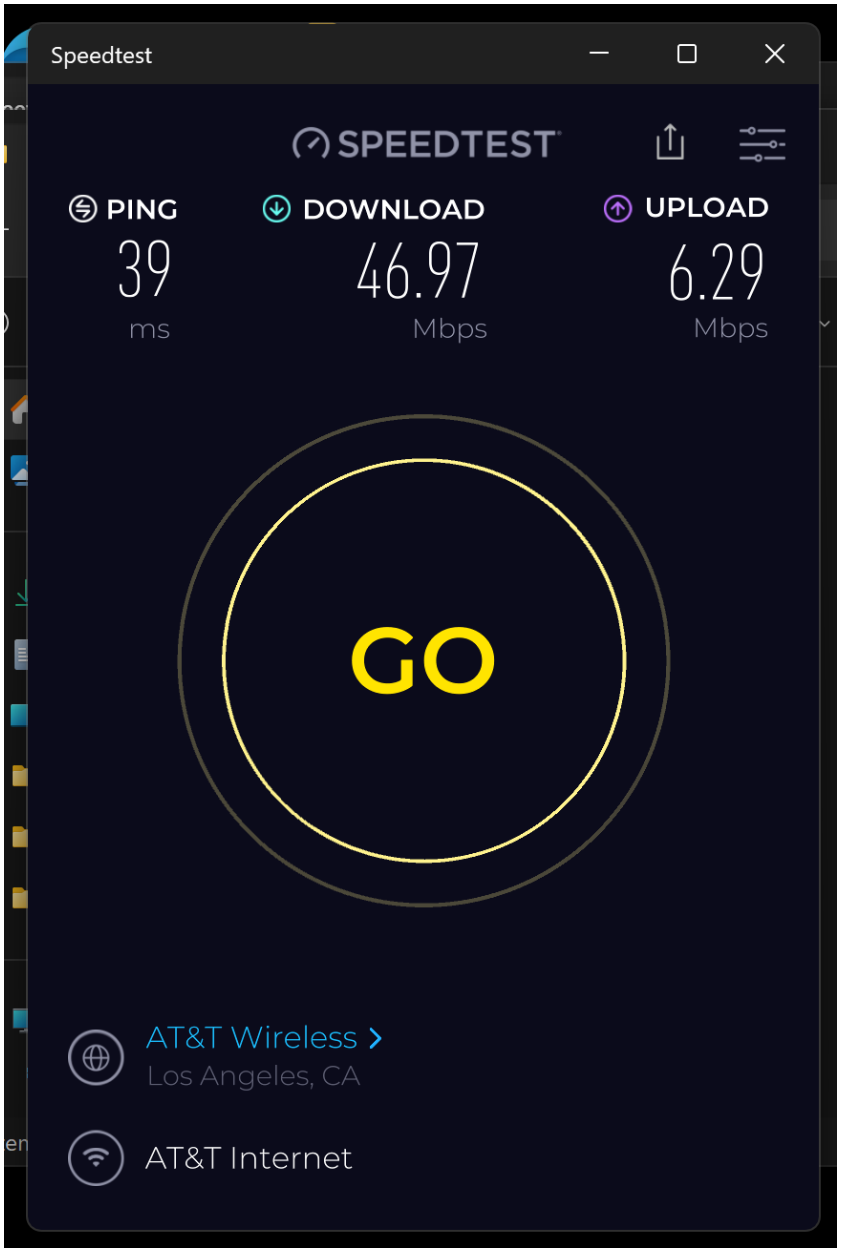
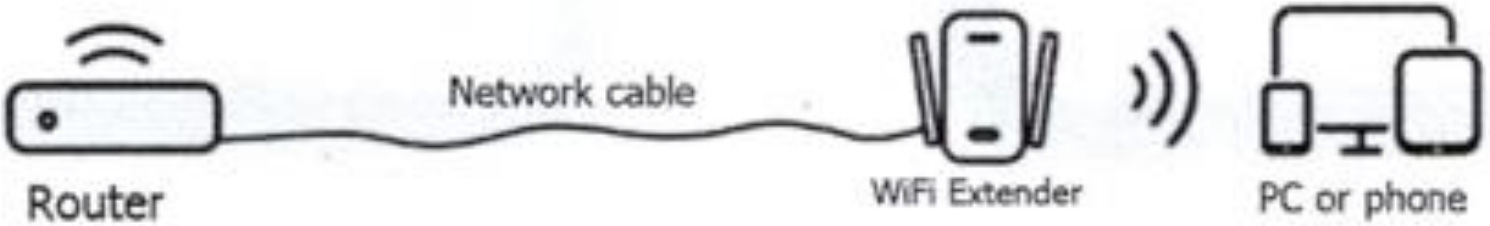

Speedtest
SPEEDTEST
PING
39
ms
DOWNLOAD
46.97
Mbps
UPLOAD
6.29
Mbps
GO
AT&T Wireless
Los Angeles, CA
AT&T Internet

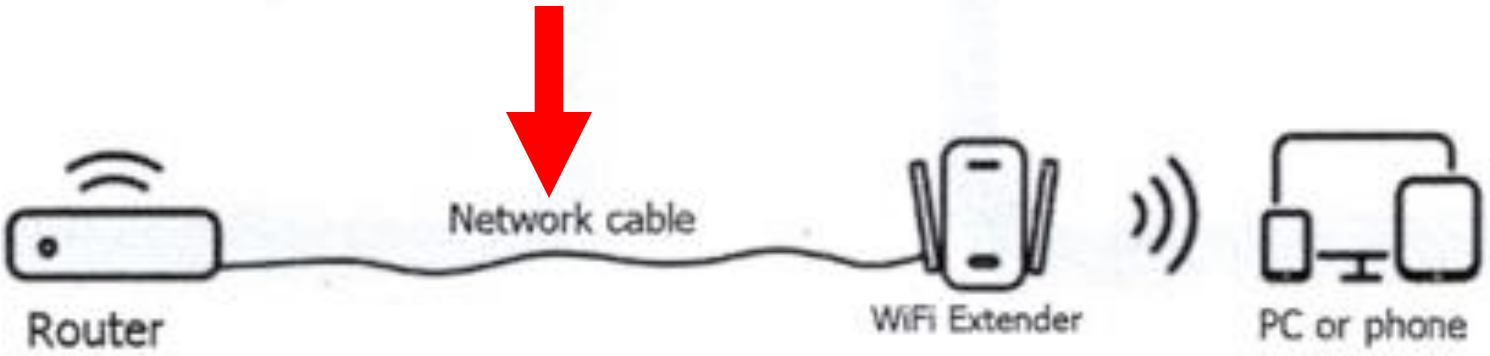
AP Mode: As a wired signal extender (access point)

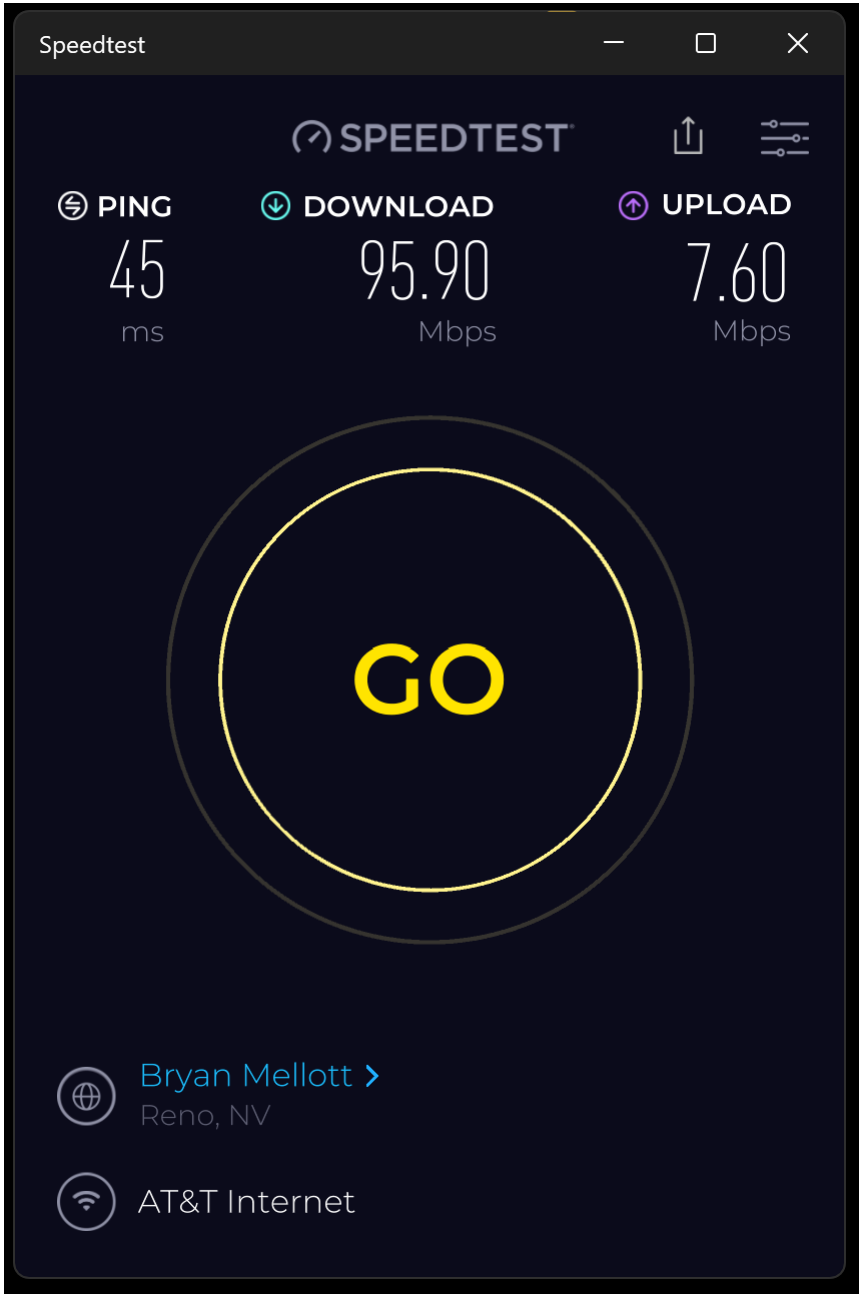
Get better WiFi speed by connecting the router and the extender with network cable in the poor WiFi signal area.



AP Mode: As a wired signal extender (access point)

Get better WiFi speed by connecting the router and the extender with network cable in the poor WiFi signal area.




Speedtest
SPEEDTEST
PING
45
ms
DOWNLOAD
95.90
Mbps
UPLOAD
7.60
Mbps
GO
Bryan Mellott
Reno, NV
AT&T Internet

REQUIREMENTS FOR Wi-Fi EXTENDERS (continued)

- In "Repeater Mode", a 100 Megabits per second Ethernet port on a Wi-Fi extender will bottleneck the download and upload speeds of an Internet provider that is providing Internet speeds faster than 100 Megabits per second, if you are using the Ethernet port to connect to a downstream computer, tablet, or camera.

Repeater Mode: As a wireless signal extender

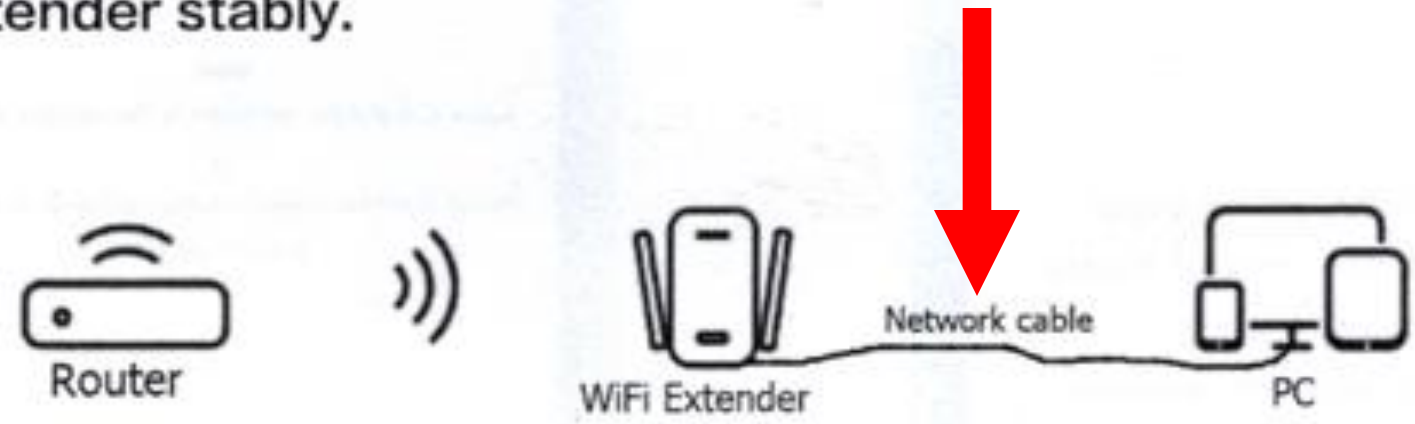
A. Extend your Wi-Fi signal without using any cables to reduce wiring troubles.

B. Extend your Wi-Fi signal with a cable, connect your device and extender stably.

Repeater Mode: As a wireless signal extender

A. Extend your Wi-Fi signal without using any cables to reduce wiring troubles.

B. Extend your Wi-Fi signal with a cable, connect your device and extender stably.

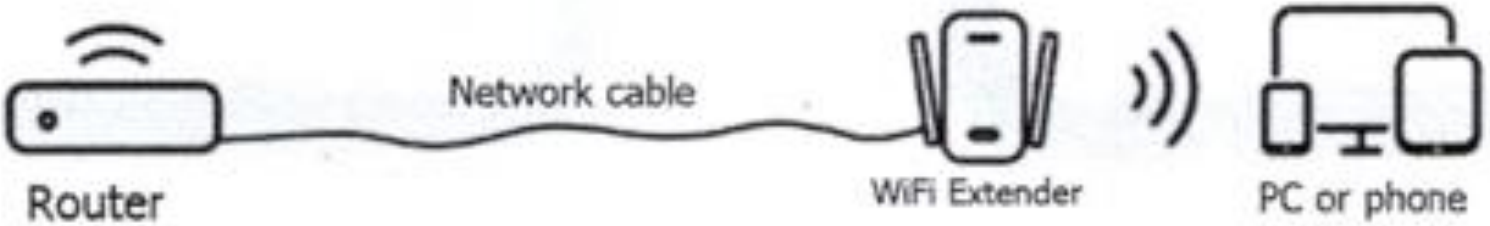


REQUIREMENTS FOR Wi-Fi EXTENDERS (continued)

- In "Access Point Mode", a 100 Megabits per second Ethernet port on a Wi-Fi extender will bottleneck the download and upload speeds of an Internet provider that is providing Internet speeds faster than 100 Megabits per second, since the Ethernet port is used to connect the Wi-Fi extender to the existing router in "Access Point Mode".

AP Mode: As a wired signal extender (access point)

Get better WiFi speed by connecting the router and the extender with network cable in the poor WiFi signal area.



Wi-Fi Generations

Generation	IEEE Standard	Maximum Linkrate (Mbit/s)	Adopted	Radio Frequency (GHz)
Wi-Fi 7	**802.11be**	721 to 46120	2024	2.4/5/6
Wi-Fi 6E	802.11ax	600 to 9608	2020	2.4/5/6
Wi-Fi 6	802.11ax	600 to 9608	2019	2.4/5
Wi-Fi 5	802.11ac	433 to 6933	2014	5
Wi-Fi 4	802.11n	72 to 600	2008	2.4/5
(Wi-Fi 3)*	802.11g	6 to 54	2003	2.4
(Wi-Fi 2)*	802.11a	6 to 54	1999	5
(Wi-Fi 1)*	802.11b	1 to 11	1999	2.4
(Wi-Fi 0)*	802.11	1 to 2	1997	2.4