

What's Good and Bad about Routers and Why Would I Want One (Do I already have one?!)

Gabe Goldberg

gabe@gabegold.com

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What's a Router and Why Would I want One?

- What's a Router?
- Surprise, you have one – I hope!
 - Survey: Who's used router admin functions? Updated firmware?
- Isn't combo modem/router better than two gadgets? (No)
- Setup/Security/Administration
- How should I choose a router?
- Why is my router so complex?
- Why is my router so slow?
- Why can't my router reach everywhere in my house?
- Can I trust my router or public routers?

What's a Router and Why Would I want One? (Cont)

- Can I set/forget my router? (No)
- Don't forget your router
- How to fix <something>?
- Can guests use my router?
- Is my smartphone a router?
- Case study: replace router to greatly increase speeds
- Sample routers
- References
- Unknown unknowns converted to known unknowns?
- Router setup demo and Q&A

What's a Router?

- First interface to outside world is modem
 - Converts ISP cable/fiber/satellite to Ethernet
- Router provides several functions
 - Multiple Ethernet ports (creates LAN)
 - Wi-Fi signal
 - Cloaking connected devices from Internet
 - Protection against intrusion
 - Optionally, attached storage/printers/etc.

Surprise, You Have One – I Hope

- If you don't, you're at risk from attacks!
 - Don't plug any devices directly into modem
- Isn't that box from my ISP a router?
 - If you have a device with Wi-Fi, yes
 - It may not be best quality
 - It may not handle newest Wi-Fi protocols
 - You may not fully control it
 - It may provide free Wi-Fi to neighborhood

Isn't Combo Modem/Router Good Idea? (No)

- Separate modem/router lets you control
 - Configure router as you like
 - Replace router when you like
 - Update router firmware when you like
 - Secure router as you like
- ISP router may include public side
 - May degrade your speed/security
- Buy, don't rent, devices

Setup/Security/Administration

- Added line of defense, “firewall”
- Print full manual, not just “Quick Start”
- Set for security – verify/change defaults
 - Change/cloak SSID (network name)
 - Set strong router password; no WAN access
 - Set strong network password/passphrase
 - Strong protocol (WPA2, not WEP; WPA3 next)
 - Enable MAC filtering (maybe)
 - I’ve never used router vendor’s PC software

Setup/Security/Administration (Continued)

- Be skeptical about cloud management
 - Privacy/security/reliability/access
- Risks: E.g., VPNFilter malware
- Protect growing Internet of Things (IoT)
 - Cameras, doorbells, home automation...)
 - Secure “things” (passwords, on guest network)
 - Beware devices tunneling through router
 - Be skeptical of apps needed
 - Garage door opener online – no thanks

How Should I Choose a Router?

- Aren't all routers the same? No.
- Complex decision, but just a router
- Vendors come and go (e.g., Apple)
- Plan current/future needs
- Price/performance/function/reviews
- Protocols 80211.ac, -n, -b, g, Wi-Fi 6, etc.
- Support/recommendations/brand/design
- Query manufacturer for missing details

Why Is My Router So Complex?

- It's a powerful computer!
- It must meet diverse people's needs
- It performs many simultaneous functions
- It runs 24/7 and protects you
- Standards/functions/expectations evolve
- Maybe replace OS (OpenWRT, DD-WRT)
 - Advanced functions, likely not needed

Why Is My Router So Slow?

- Are you sure your router is slowing things?
- Is it slower than usual, are you impatient?
- Speed test wired and wireless devices
 - If equally and unusually slow, contact ISP
- What might have caused slowdown?
 - Router moved? Antenna jostled?
 - Other devices hogging bandwidth?
 - Interference (cellphone, microwave, neighbor)
 - Device config change (ensure correct band)

My Router Is Still Slow

- Run speed test, interference monitor app
- Verify router/device settings
- Verify cabling
- Verify on correct network (not neighbor's!)
- Explore alternative router channels
 - Maybe override automatic selection
 - Default channel 1 can be crowded

My Router Is STILL Slow

- Change DNS settings (Google's, etc.)
- Setting alternate DNS is simple change
- Quick update: change router DNS settings
 - Affects all network clients/devices
 - No action needed at end devices
- Improves performance/security for sites explicitly visited plus all links from them
- <https://www.grc.com/dns/benchmark.htm>
- Thanks, Mark Mabee, for DNS slides!

Free & Public DNS Servers

Provider	Primary DNS Server	Secondary DNS Server
Quad9	9.9.9.9	149.112.112.112
Level3	209.244.0.3	209.244.0.4
Verisign	64.6.64.6	64.6.65.6
Google	8.8.8.8	8.8.4.4
DNS.WATCH	84.200.69.80	84.200.70.40
Comodo Secure DNS	8.26.56.26	8.20.247.20
OpenDNS Home	208.67.222.222	208.67.220.220
Norton ConnectSafe	199.85.126.10	199.85.127.10
GreenTeamDNS	81.218.119.11	209.88.198.133
SafeDNS	195.46.39.39	195.46.39.40

Free & Public DNS Servers

Provider	Primary DNS Server	Secondary DNS Server
OpenNIC	23.94.60.240	128.52.130.209
SmartViper	208.76.50.50	208.76.51.51
Dyn	216.146.35.35	216.146.36.36
FreeDNS	37.235.1.174	37.235.1.177
Alternate DNS	198.101.242.72	23.253.163.53
Yandex.DNS	77.88.8.8	77.88.8.1
UncensoredDNS	91.239.100.100	89.233.43.71
Hurricane Electric	74.82.42.42	
puntCAT	109.69.8.51	

Why Can't My Router Reach Everywhere In the House?

- Obstacles! (Walls, floors, distance)
- Evaluate router placement (high, central)
- Consider...
 - Router extender(s)
 - Mesh network (next slide)
- Understand router frequencies (2.4/5GHz)
 - Slower/farther vs. faster/nearer

My Router Still Can't Reach Everywhere (Continued)

- Mesh network (Cox Panoramic Wi-Fi?)
 - Read Amazon/other reviews
 - Devices collaborate to expand connectivity
 - Expensive
 - Generally proprietary internal protocols
 - Vendors: Eero, Linksys Velop (from Apple, resembles Apple's Airport Extreme), Netgear, Ubiquiti, Asus, etc.

Can I Trust...

- My router?
 - Trust but verify
 - Monitor devices connecting
 - Set problem/anomaly alerts if available
- Public routers?
 - Yes, maybe, cautiously; with current antivirus
 - Via VPN (virtual private network) -- restrictions
 - Be alert/sensible; restrict activities to HTTPS
 - Use smartphone private network

Can I Set/Forget My Router? (No)

- “Routers rot” – consumer grade; heat/dust
- Designed by committee
- Not always consumer friendly
- Upgrade protocol/speed/security/range
- When you replace, retain working router
- May need to tweak for IoT
- I didn’t cover QoS, IPv4/6, MIMO, MU-MIMO, software defined network, etc.

Don't Forget Your Router

- Access configuration controls via browser
 - Vendor-specific process, see manual
 - IP address (192.168.1.1) or URL (vendor.com)
 - Requires userid/password
- Update software (twice/yearly?)
 - Simple: button in configuration or download
- Replace router for improved security(?)

ASUS RT-AC66U Logout Reboot English

Operation Mode: **Wireless router** Firmware Version: **3.0.0.4.382_50470**
 SSID: **Plover24 Plover2** App

Quick Internet Setup

General

Network Map

Guest Network

Traffic Manager

Parental Controls

USB Application

AiCloud 2.0

Advanced Settings

Wireless

LAN

WAN

IPv6

VPN

Firewall

Administration

System Log

Network Tools

Internet status:
Connected
WAN IP: 68.110.171.16
DNS: 80

Security level:
WPA2-Personal

System Status

2.4GHz **5GHz** **Status**

Network Name (SSID)
WWWW

Authentication Method
WPA2-Personal

WPA Encryption
AES

WPA-P SK key
.....

Apply

LAN IP
192.168.1.1

PIN code
94499513

LAN MAC address
AC:22:0B:D0:5A:C0

Wireless 5GHz MAC address
AC:22:0B:D0:5A:C4

Clients: 8

View List

USB 2.0
Kingston DataT

USB 2.0
No Device

[Help & Support](#) [Manual](#) | [Utility](#) | [Product Registration](#) [FAQ](#)

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How To Fix <something>?

- Ensure problem is with router
 - Examine router setup for problems
 - Try multiple devices
 - If some work, turn Wi-Fi off/on failing device
 - Can network see device? Device see router?
 - Check devices connected for interference
- Reset network
 - Unplug modem, router, device; wait
 - Plug in modem (wait), router (wait), device

How To Fix? (Continued)

- Router/device renew IP address lease
- Is it reproducible?
- Describe problem precisely to customer support (NOT just “it doesn’t work!”)
 - Be patient (“deceptive”); they’re script driven
 - May have to live with it (e.g., I toggle Wi-Fi)
 - Factory Reset button – also give/dispose
 - Back up settings!
 - Check modem diags/log (e.g., 192.168.100.1)

Can Guests Use My Router?

- Most routers provide multiple networks
- Define one for guest use
- Use different passwords for each
- Don't use router password for networks
- Keep SSID/passwords handy but safe
- Perhaps change guest password after use

Is My Smartphone a Router?

- Many smartphones can provide Wi-Fi
- ...or via Bluetooth on shared account
- May need cellular carrier action
- Access can be automatic for devices on same cloud account (e.g., Apple)
- Secure access with password
- Devices can rapidly consume data plan

Case Study: Replace Router

- Mentioned this presentation to friend
- Wi-Fi and Ethernet connections slow
- Tinker with settings, realize router is old
- Research current routers (next slide!)
- Suggest Linksys EA6350 AC1200, \$80
- Purchase, install (simple!)
- Ethernet 6x speed, Wi-Fi 12x speed!

Sample Routers

- Linksys EA6350 AC1200 (\$80, now)
- ASUS RT-AC66U (\$167, 2013)



References

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- Best wireless routers according to PC Mag.com
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Mesh References

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