How to buy a PC

Alan German & Chris Taylor

2023-01-11

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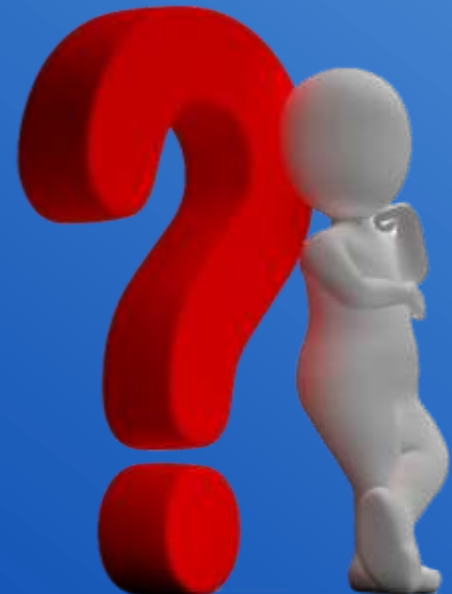
Agenda

- Laptop vs. desktop
- Components
- Printers
- Backup
- Special form-factor computers

Laptop

■ Advantages

- portable
- compact
- low power consumption
- complete
  – monitor, keyboard, trackpad, speakers, webcam, microphone
- *Windows Hello* for authentication
  – often on mid to high-end
    – fingerprint or facial recognition

■ Disadvantages

- more expensive than desktop
- small screen
- cramped keyboard
- less powerful than desktop
- less expandable
- more expensive to expand

Desktop

- ■ Advantages
  - more powerful than laptop
    - – better *bang for the buck*
  - easier & less expensive to expand
  - bigger keyboard & monitor
  - easier to fix

- ■ Disadvantages
  - not portable
  - bigger & heavier
  - more power consumption
  - more to add
    - – keyboard (usually incl.)
    - – mouse (usually incl.)
    - – monitor
    - – speakers
    - – microphone
    - – webcam

Components

- Processor
- Memory
- Disk drives
- Video card
- Optical drive
- Networking
- Ports
- Card reader

Central Processing Unit (CPU)

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- Factors in performance
  - speed
    - faster is better
    - **2x faster processor ≠ 2x faster computer**
  - processing cores
    - more is better
    - more cores can smooth out experience
      - different programs can run on different cores
    - **2x number of cores ≠ 2x faster computer**
  - different **families** from one manufacturer have different performance
  - newer **generations** within a family generally perform better and have more features/capabilities
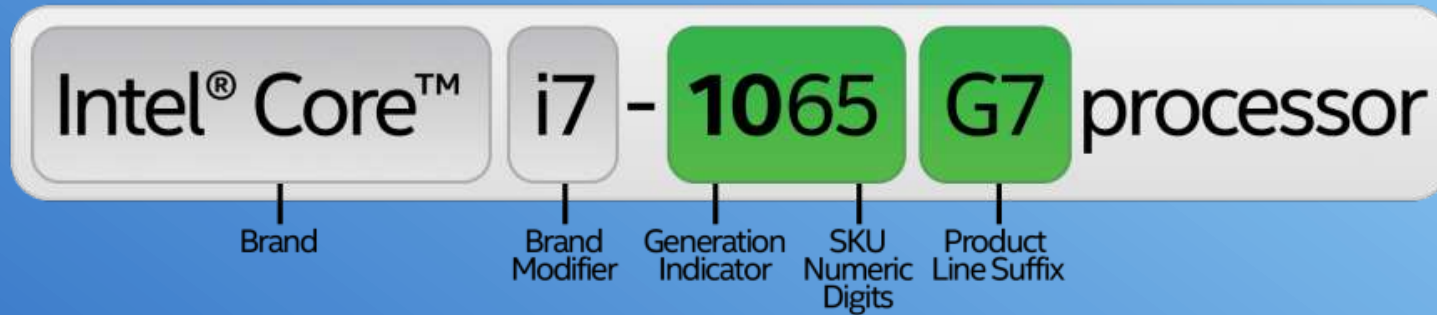
Intel processor families

- Core (i3, i5, i7, i9)
  - mainstream to high-end
    - higher numbers better performance & additional features
    - i5 & i7 probably best option for most people
- Pentium, Celeron
  - budget line
    - lower performance than Core
    - for those who are trying to save the most money
- Xeon
  - high-end servers & workstations

https://www.intel.ca/content/www/ca/en/processors/processor-numbers.html

Decoding Intel Core

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Intel® Core™ i7 - 1065 **G7** processor

Brand | Brand Modifier | Generation Indicator | SKU Numeric Digits | Product Line Suffix

Suffix	Meaning	Suffix	Meaning
G1-G7	Graphics level (processors with new integrated graphics technology only)	K	Unlocked
E	Embedded	S	Special edition
F	Requires discrete graphics	T	Power-optimized lifestyle
G	Includes discrete graphics on package	U	Mobile power efficient
H	High performance optimized for mobile	Y	Mobile extremely low power
HK	High performance optimized for mobile, unlocked	X/XE	Unlocked, High End
HQ	High performance optimized for mobile, quad core	B	Ball Grid Array (BGA)

Decoding Intel Pentium & Celeron

https://www.intel.ca/content/www/ca/en/processors/processor-numbers.html
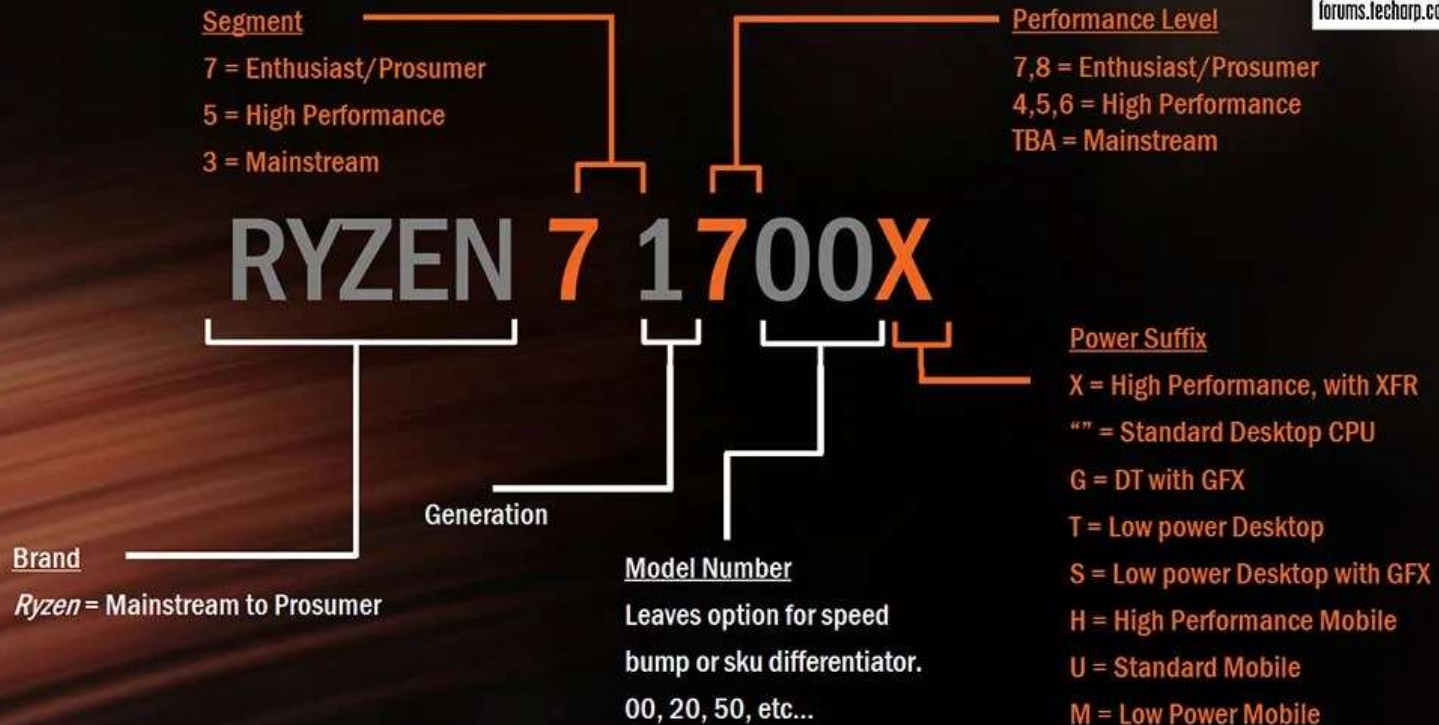
AMD families

- Ryzen (3, 5, 7, 9, Threadripper)
  - mainstream to high-end
  - competes with Intel Core
- Athlon
  - entry-level
  - competes with Intel Pentium & Celeron
- Epyc
  - high-end server & workstations
  - competes with Intel Xeon

https://en.wikipedia.org/wiki/List_of_AMD_processors

Decoding AMD Ryzen

Comparing CPUs

■ Hard enough comparing within a manufacturer's line

- **Intel 8-core Core-i7 10700K @ 3.8 GHz**

  Fewer cores, higher level, older generation, running faster

  vs

- **Intel 14-core Core-i5 13600KF @ 3.5 GHz**

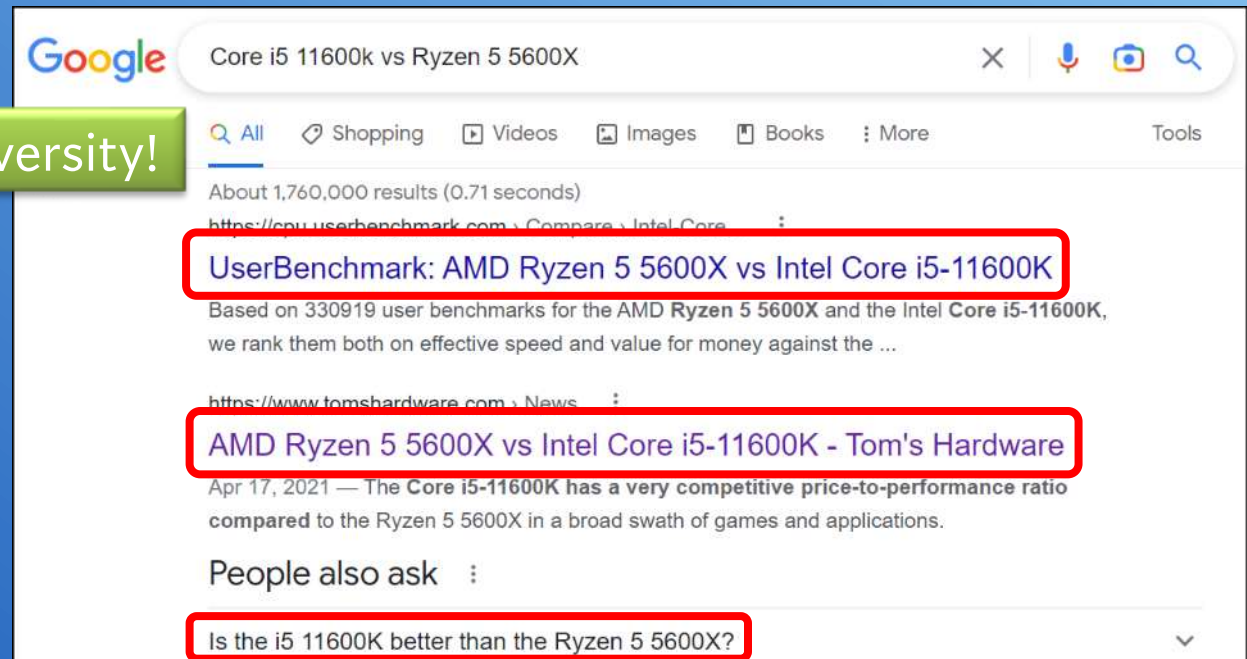 More cores, lower level, newer generation, running slower

Comparing CPUs

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- Let alone across manufacturers

Intel 6-core Core i5 11600KF @3.9 GHz
 or
AMD 6-core Ryzen 5 5600X @ 3.7 GHz

Go to Google University!

Google | Core i5 11600k vs Ryzen 5 5600X

Q All   🏷 Shopping   ▶ Videos   🖼 Images   📖 Books   ⋮ More   Tools

About 1,760,000 results (0.71 seconds)

https://cpu.userbenchmark.com › Compare › Intel-Core

UserBenchmark: AMD Ryzen 5 5600X vs Intel Core i5-11600K
Based on 330919 user benchmarks for the AMD **Ryzen 5 5600X** and the Intel **Core i5-11600K**, we rank them both on effective speed and value for money against the ...

https://www.tomshardware.com › News

AMD Ryzen 5 5600X vs Intel Core i5-11600K - Tom's Hardware
Apr 17, 2021 — The **Core i5-11600K has a very competitive price-to-performance ratio compared** to the Ryzen 5 5600X in a broad swath of games and applications.

People also ask   ⋮

Is the i5 11600K better than the Ryzen 5 5600X?

...or https://nanoreview.net/en/cpu-compare

Intel Core i7 10700K vs Intel Core i5 13600KF

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📊 Benchmarks
Comparing the performance of CPUs in benchmarks

Cinebench R23 (Single-Core)
Core i7 10700K	1309
Core i5 13600K +52%	1991

Cinebench R23 (Multi-Core)
Core i7 10700K	12637
Core i5 13600K +84%	23196

Passmark CPU (Single-Core)
Core i7 10700K	3062
Core i5 13600K +36%	4174

Passmark CPU (Multi-Core)
Core i7 10700K	
Core i5 13600K +99%	

Geekbench 5 (Single-Core)
Core i7 10700K	1369
Core i5 13600K +47%	2009

Geekbench 5 (Multi-Core)
Core i7 10700K	
Core i5 13600K +86%	

◐ Key Differences
What are the key differences between 13600K and 10700K

Advantages of Intel Core i5 13600K

➕ Newer - released 2-years and 5-months later

➕ Around 43.8 GB/s (96%) higher theoretical memory bandwidth

➕ Has 6 more physical cores

➕ Newer PCI Express version – 5.0

➕ Has 8 MB larger L3 cache size

➕ 46% faster in a single-core Geekbench v5 test - 2015 vs 1381 points

➕ More modern manufacturing process – 10 versus 14 nanometers

https://nanoreview.net/en/cpu-compare

Intel Core i5 11600KF vs AMD Ryzen 5 5600X

Review

General overview and comparison of the processors

Single-Core Performance
Performance in single-threaded apps and benchmarks

Core i5 11600KF	74
Ryzen 5 5600X	73

Performance
Measure performance when all cores are involved

Core i5 11600KF	43
Ryzen 5 5600X	46

Power Efficiency
The efficiency score of electricity consumption

Core i5 11600KF	55
Ryzen 5 5600X	66

NanoReview Final Score
Generic CPU rating

Core i5 11600KF	
Ryzen 5 5600X	

Key Differences

What are the key differences between 5600X and 11600KF

Advantages of Intel Core i5 11600KF

- Newer - released 5-months later
- 7% higher Turbo Boost frequency (4.9 GHz vs 4.6 GHz)
- Around 2.32 GB/s (5%) higher theoretical memory bandwidth

Advantages of AMD Ryzen 5 5600X

- Has 20 MB larger L3 cache size
- More modern manufacturing process – 7 versus 14 nanometers
- Consumes up to 48% less energy than the Core i5 11600KF – 65 vs 125 Watt

https://nanoreview.net/en/cpu-compare

Processor cost as portion of computer

	Model	Retail price
AMD	Ryzen 5 4500 6-Core	$170
	Ryzen 9 7950X 16-Core	$750
	Ryzen PRO 5995WX Threadripper • 64 cores, 4.5 Ghz, 32 MB L2 cache, 256 MB L3 cache	**$9000**
Intel	Core i5, 10400, 6-Core	$210
	Core i7-12700K, 12 cores	$500
	Core i9-13900K, 24 cores	$800

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Memory requirements
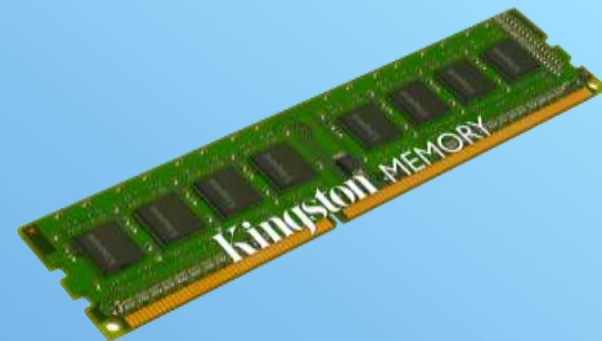
■ Windows 7, 8, 10 remained pretty similar

■ Windows 11 pretty much doubled

	Windows 8 & 10	Windows 11
Minimum	2 GB	4 GB
Okay	4 GB	8 GB
Best	8 GB or more	12 – 16 GB or more

Minimum: if on a strict budget & very light computing

Okay: web browsing, word processing, light gaming

Best: video editing, advanced photo editing, many apps open at once, advanced computing

Storage (internal)

■ Laptops

- vast majority have a single Solid State Drive (SSD)
    - <$400 budget PCs to >$3,000 powerhouses
- typically 128 GB SSD to 1 TB SSD
    - avoid 128 GB

■ Desktop

- most have an SSD
- Budget PCs might have modest sized SSD (128 GB) and a larger HDD (1 TB or larger)
- higher-end will have good sized SSD (512 GB or larger) and an HDD (1 TB or larger)

Storage (external)

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- Great for:
  - backup
  - adding storage (most useful for desktops)
- Capacity
  - 2 TB to 20 TB
- Portable drives
  - capacity 1 TB to 5 TB
  - no power supply required
    – very useful for offsite backup
- Solid State Drives (SSD)
  - capacity 500 GB to 2 TB

Storage (external)

- ■ Really inexpensive but normally not huge capacities (~4-256 GB)
- ■ Can be a "no-cost" option e.g. reuse camera SD card
- ■ Uses:
  - • Limited file backup (laptops - space-saving nano-USB and SD cards)
  - • Portable file transfer medium
  - • Bootable OS and utilities (reusable)

Backups

- **Image backups**
  - high-capacity USB drives
    - disk images can be large
    - multiple full backups need space
  - archive of many/large files (e.g. digital photos.)
- **File and folder synchronization**
  - "Active" folders
  - frequently updated
  - real-time backup
  - file versioning

File History is on

Copy files from: Libraries, Desktop, Contacts, and Favorites

Copy files to: 64GBnano (G:)
52.2 GB free of 57.2 GB

Files last copied on 11/28/2022 9:06 PM.
Run now
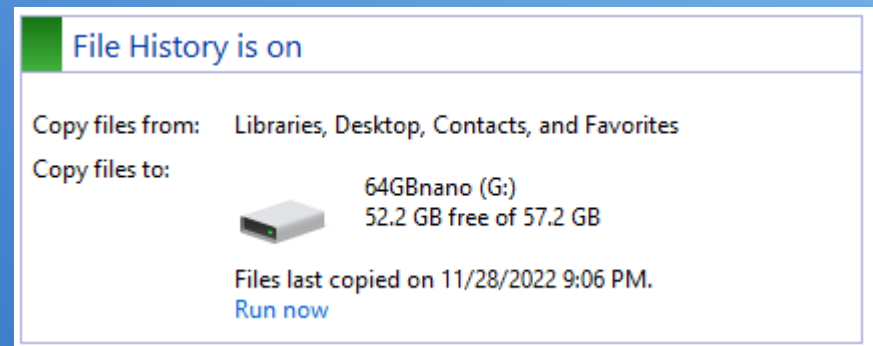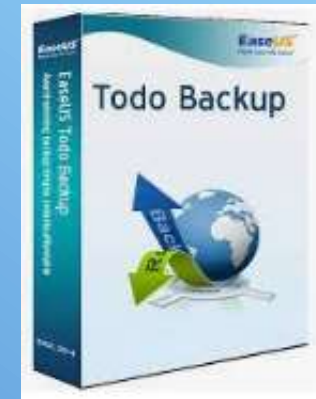
Video/graphics card

■ Integrated graphics
- uses part of the computer's memory (RAM)
- cost savings
- appropriate for general computer use

■ Dedicated/discrete graphics card
- dedicated on-board memory (typically 2-8 GB)
- more expensive
- may be *required* for advanced video editing/photo editing/gaming
  - check software for system requirements
- think you need a dedicated graphics card?
  - research it!

Laptop dedicated graphics card

Desktop dedicated graphics card

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Video ports

- Modern computers typically have HDMI and/or DisplayPort (DP)
- Both can transfer video and audio signals
- HDMI is often used to connect a PC to a monitor, TV, projector, game console, TV set-top box, etc.
- DP used mostly for PC/monitor

https://opcug.ca/qa_recordings/20221130_PowerPoint.pdf

VGA & DVI – legacy ports

VGA

DVI

HDMI & DisplayPort – uses

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	HDMI	DisplayPort
Monitor	**Yes**	**Yes**
Computer	**Yes**	**Yes**
TV	**Yes**	No
Projector	**Yes**	No
Game console	**Yes**	No
Blu-ray player	**Yes**	No
Streaming device	**Yes**	No
Cable box	**Yes**	No

https://www.rtings.com/monitor/learn/hdmi-vs-displayport

HDMI/DP capabilities & release dates

	HDMI 1.4 Jun 2009	HDMI 2.0 Sep 2013	HDMI 2.1 Jan 2017	DP 1.2 Jan 2010	DP 1.3 Sep 2014	DP 1.4 Mar 2016	DP 2.0 Jun 2019
1080p @120Hz	✓	✓	✓	✓	✓	✓	✓
1440p @30Hz	✓	✓	✓	✓	✓	✓	✓
1440p @60Hz	✗	✓	✓	✓	✓	✓	✓
4k @30Hz	✓	✓	✓	✓	✓	✓	✓
4k @60Hz	✗	✓	✓	✓	✓	✓	✓
4k @120Hz	✗	✗	✓	✗	✓	✓	✓
8k @30Hz	✗	✗	✓	✗	✓	✓	✓
8k @60Hz	✗	✗	✓	✗	✗	✓	✓
8k @120Hz	✗	✗	✓	✗	✗	✗	✓
HDR	✗	✓	✓	✗	✗	✓	✓

Converting video ports

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HDMI to DisplayPort

HDMI splitter

DisplayPort splitter

Type-C to HDMI

Type-C to DisplayPort

Type-C to DisplayPort splitter

Multi-monitor

- Ability to output to multiple displays
  - mirror display or extend desktop
  - almost all laptops
    - built-in display and one external monitor through a port
  - many desktops
    - often 3 or more possible displays
  - extend to more displays through splitter
- Connection to external display varies
  - modern ports: HDMI, DisplayPort
  - legacy ports: DVI, VGA
- Some laptops have Miracast for wireless connection to display

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Webcams

- Laptops almost always have a webcam
- Desktops very rarely have a webcam
- Easily added to
  - desktop
    or
  - laptop
    - if you don't like the included one

Webcams

- Common resolutions
  - 1280 x 720 pixels (720p - HD)
  - 1920 x 1080 pixels (1080p - full HD)
  - 3840 x 2160 pixel (4K - UHD)
    - probably overkill for vast majority
- Frame rates
  - 30 fps to 120 fps
  - higher frame rate give less jerky look when there is movement
  - higher fps = lower resolution (usually)

Webcams

- Field of view
  - 60 degrees
    - good for single person
  - 78 degrees
    - good for two people
  - 90 degrees
    - good for a group
- Autofocus
  - almost all webcams
  - faster autofocus and better subject selection on higher-end webcams

Webcams

- Built-in microphone
  - almost all webcams have at least one microphone
  - dual microphones: more natural sound
  - for best sound, consider a headset
- Privacy shutters
  - ensure video only presented when you want
  - piece of cardboard & tape?

Dual microphones

Privacy shutter

Webcams

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- ■ Mount
  - • almost all can be mounted on monitor
  - • some can be mounted on mini-tripod
- ■ Software controls
  - • higher-end webcams
  - • control zoom, pan, tilt, brightness, contrast, auto-focus, white balance
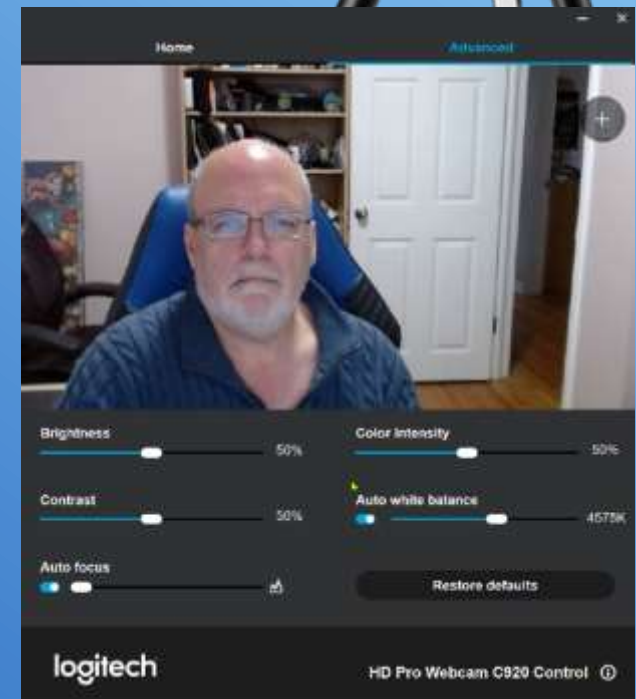
Optical drive

- Rarely needed
- DVD burner on most desktops
- DVD burner on some larger laptops
- External USB optical drives available

USB Ports

■ Universal Serial Bus

■ Generally 1 – 8 ports

■ Front and rear (desktops)

■ Limited on 'thin' laptops and tablets

■ Data transfer and power delivery

■ Multiple flavours

• USB 2.0 480 Mbps 2.5 W

• USB 3.x   5-20 Gbps 4.5-15 W

• USB 4.0   40-80 Gbps

• USB PD   100-240 W

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Card readers

- Mostly useful for digital cameras & some smart phones
- Some laptops and many desktops
- Laptops limited in formats (normally SD)
- Desktops more likely to support other formats
- Inexpensive USB card readers available

Desktop networking

- Wired gigabit Ethernet
- Some desktops
  - Wireless WiFi 5 (802.11ac) or WiFi 6 (802.11 ax)

Laptop networking

- Wireless WiFi 5 (802.11ac) or WiFi 6 (802.11 ax)
- Some laptops (larger or gaming)
  - wired gigabit Ethernet

Wireless standards

Generation	IEEE Standard	Maximum Linkrate (Mbit/s)	Adopted	Radio Frequency (GHz)
Wi-Fi 7	802.11be	1376 to 46120	(2024)	2.4/5/6
Wi-Fi 6E	802.11ax	574 to 9608[1]	2020	2.4/5/6
Wi-Fi 6			2019	2.4/5
Wi-Fi 5	802.11ac	433 to 6933	2014	5[2]
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

*: (Wi-Fi 0, 1, 2, 3, are unbranded common usage.[3][4])

https://en.wikipedia.org/wiki/IEEE_802.11ac-2013

Printers

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Inkjet

- Inexpensive hardware
- Expensive ink
- Good to excellent quality
- Print at least weekly
  - prevent clogged print head

Laser

- Moderately priced hardware
- Relatively inexpensive toner
- Very good to excellent quality
- Colour pretty expensive

Special form factor computers

- Thin-and-light (ex-Ultrabook)
- Convertible / Hybrid
- All-in-one
- Tablet
- Chromebook
- Gaming
- Single Board Computers

Thin and Light

■ High performance

■ Expensive

■ Powerful (processor, memory)

■ SSD

■ WiFi & (sometimes) wired networking

■ 1-3 USB ports, video out, web cam

■ Card reader (sometimes)

■ Battery life generally good

Convertible / Hybrid

- Can be used as laptop or tablet
- Touchscreen
- Keyboard removable or flips over
- Somewhat more expensive than regular laptop

All in one

- **Essentially a big laptop**
  - all of the disadvantages of a desktop
    - large, not portable
    - must be plugged in
  - all of the disadvantages of a laptop
    - confined space (heat, difficulty upgrading)
    - higher cost
- **Niche product**

Tablet

- Usually Android rather than Windows
  - but there are some Windows tablets (e.g. Surface, Slate)
- Great for consuming information
- Not so great for creating information
- Keyboard and mouse among most
  popular accessories
  - but doesn't that
    make it a laptop?

Chromebook

- Laptop running Google's ChromeOS
- Inexpensive
  - usually
- Low performance devices to quite capable
- Online focus (browser-based apps)
  - but can do a lot offline
- Limited lifetime for OS
  - (5-8 years following release)

Gaming

- High performance
  - especially for graphics
- Falcon Northwest Talon
  - AMD Ryzen 9 7950X
  - 16 cores, 32 threads, 5.76 GHz
  - 64GB DDR5-5600
  - 2 TB SSD
  - Nvidia GeForce RTX 4090
    - video card alone worth $3,000
  - 12 USB ports
  - US $6,989

CONS

PC EDITORS' CHOICE

— May require a second mortgage

Single Board Computers (SBC)

- Raspberry Pi, BeagleBoard
- Inexpensive (Raspberry Pi Zero, $5)
- ARM, x86, RISC-V
- Linux
- Low power consumption
- HDMI, Wi-Fi
- General-purpose input/output (GPIO)
- Specific applications
- Learn programming (Python)
- Experimentation (Robots)
- NAS, media server

Narrowing the field

Get a good idea of the features
- you absolutely need
- nice to have

Look for makes/models that have those features

Lots of reviews available

PC

40 YEARS

The Best Laptops for 2022

HP Pavilion Plus 14

Best Laptop for Most Buyers

PC EDITORS' CHOICE
PCMAG.COM

●●●●○ 4.0 Excellent

Why We Picked It

This is, simply put, one of the best deals for a Windows laptop right now. To qualify as the best pick for *most* shoppers, a laptop needs an affordable starting price, quick parts, premium build quality, and ideally (for those with bigger budgets) room to scale up when ordering. The Pavilion Plus 14 delivers all of those at a sub-$800 starting price, with a thin design, very capable processor choices, and an option to jump up to a high-res, 90Hz OLED display without breaking the bank.

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Thurrott™

HP Pavilion Plus 14 Review

Posted on August 8, 2022 by **Paul Thurrott** in Hardware, Mobile, Windows 11

Recommendations and conclusions

HP got so much right with the Pavilion Plus 14, and its hard to argue with the price. But its terrible battery life and stupefying amount of crapware could be problematic. If you can live with those flaws, you'll love the PC's 16:10 display—which can be had in OLED if you prefer that—impressive performance, webcam, and Windows Hello capabilities. And you may even get some value out of HP's bundled apps, as some of them are truly useful. At the end of the day, that's the Pavilion sacrifice: you can save a lot of money if you can live with a few issues. And I suspect that many people will be happy to make this compromise.

Pros

- Incredible value
- Gorgeous 16:10 display
- Impressive performance
- Very good integrated webcam
- Windows Hello fingerprint and webcam

Cons

- Inexcusable amount of crapware
- Middling battery life
- Curiously large 90-watt power adapter
- Touchpad can be a bit sensitive
- Somewhat pedestrian design

Summary

- Narrow choice to laptop or desktop
- Identify **your** computing needs
  - light-duty vs. high-power
    - will determine factors such as CPU and RAM
  - ports you need for video & USB
    - hub or conversion cable can often take care of these needs
- Most users don't need separate graphics card
  - on-board graphics sufficient unless
    - **high-end** video/photo editing, gaming
- Make provision for backups
  - external storage & software
- Ask friends (& OPCUG members!)
- Consult reviews

Don't forget :

Next Q&A Jan 18th
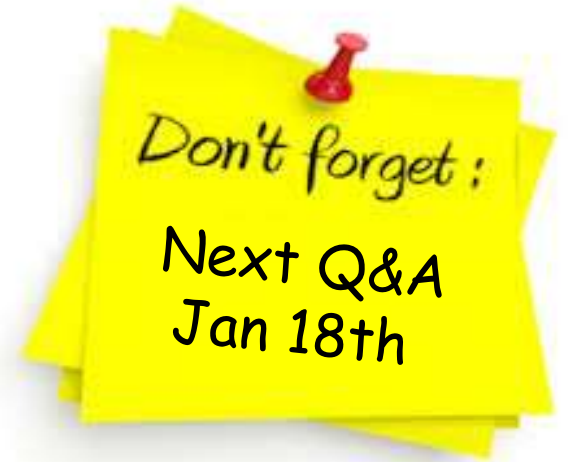
Send your questions, answers, and topics you wish to share to:

SuggestionBox@opcug.ca