Getting More From Your Mac

History

R. Scott Granneman & Jans Carton

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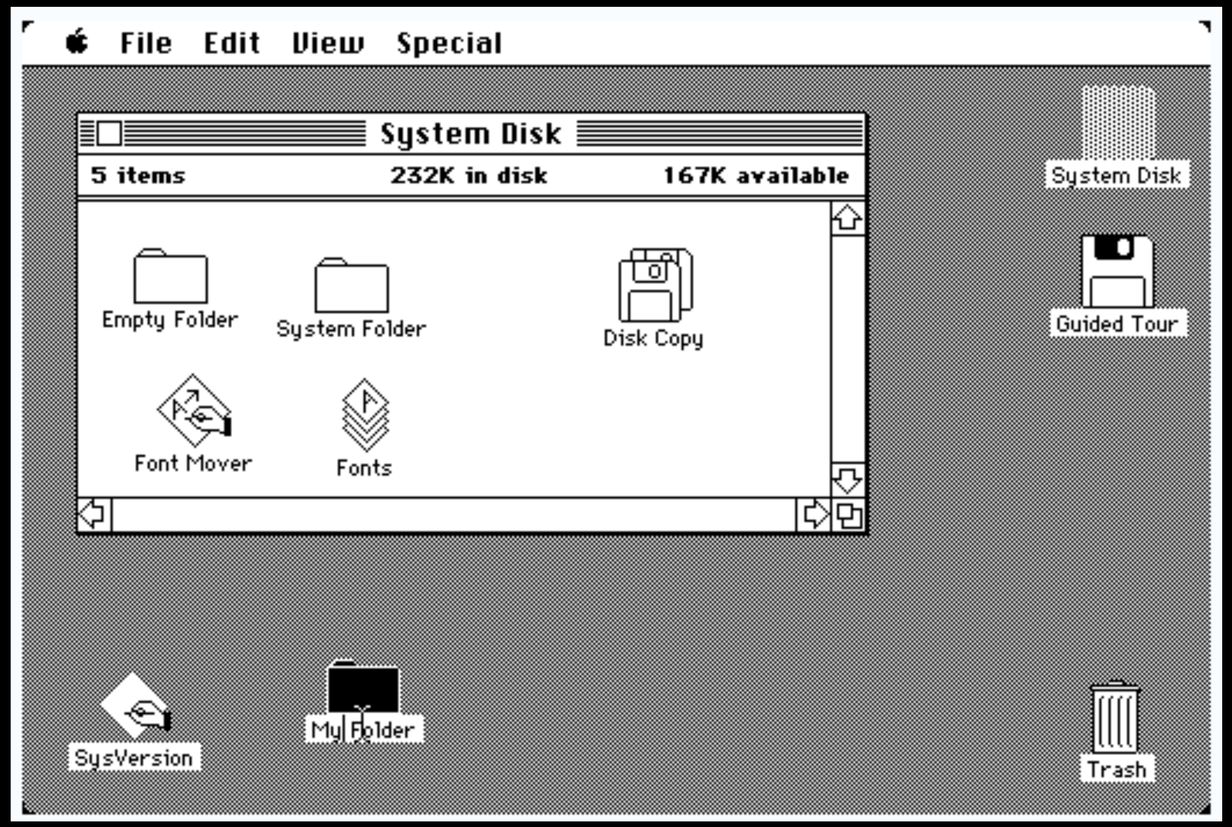
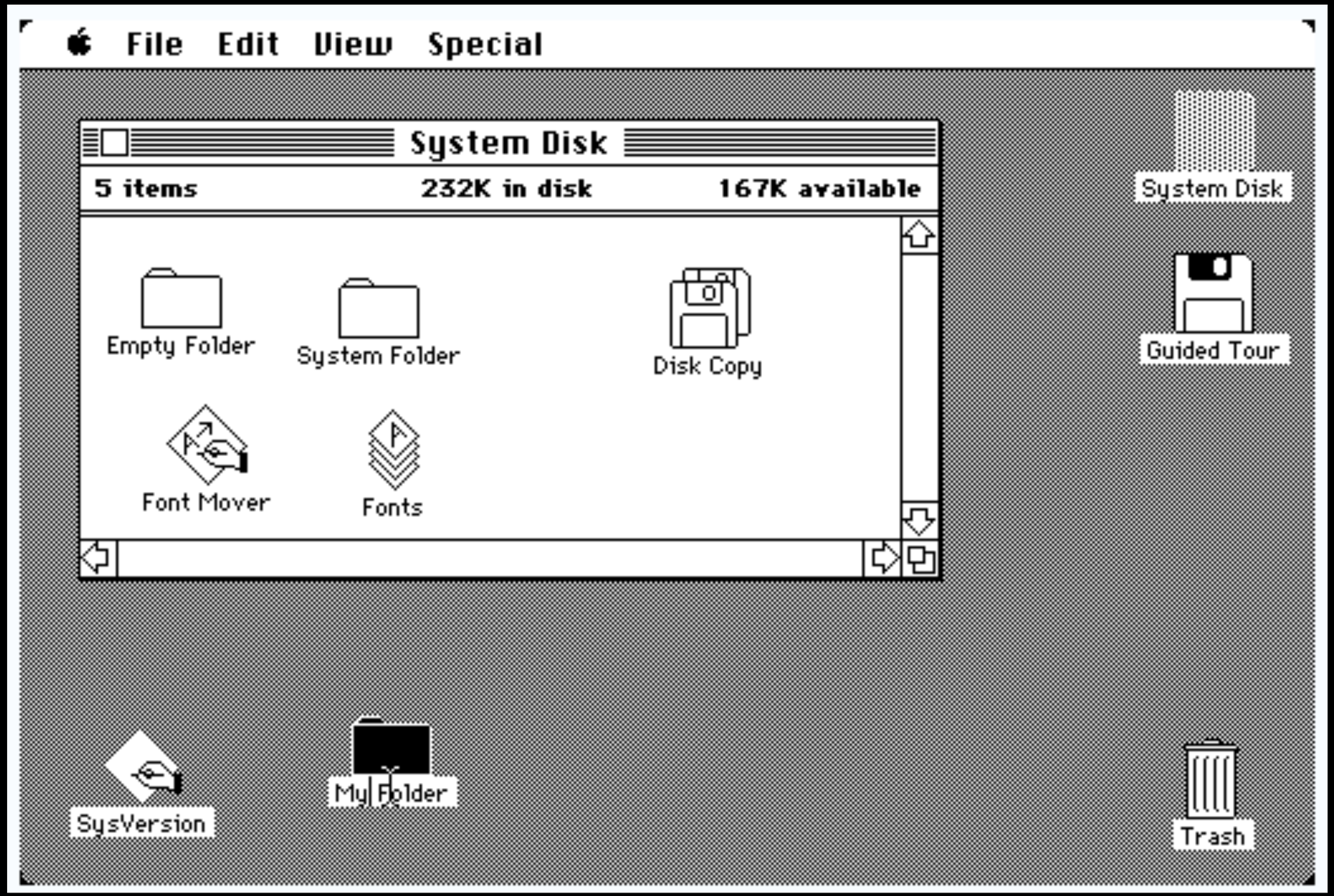
The Mac popularized the *GUI* (Graphical User Interface)

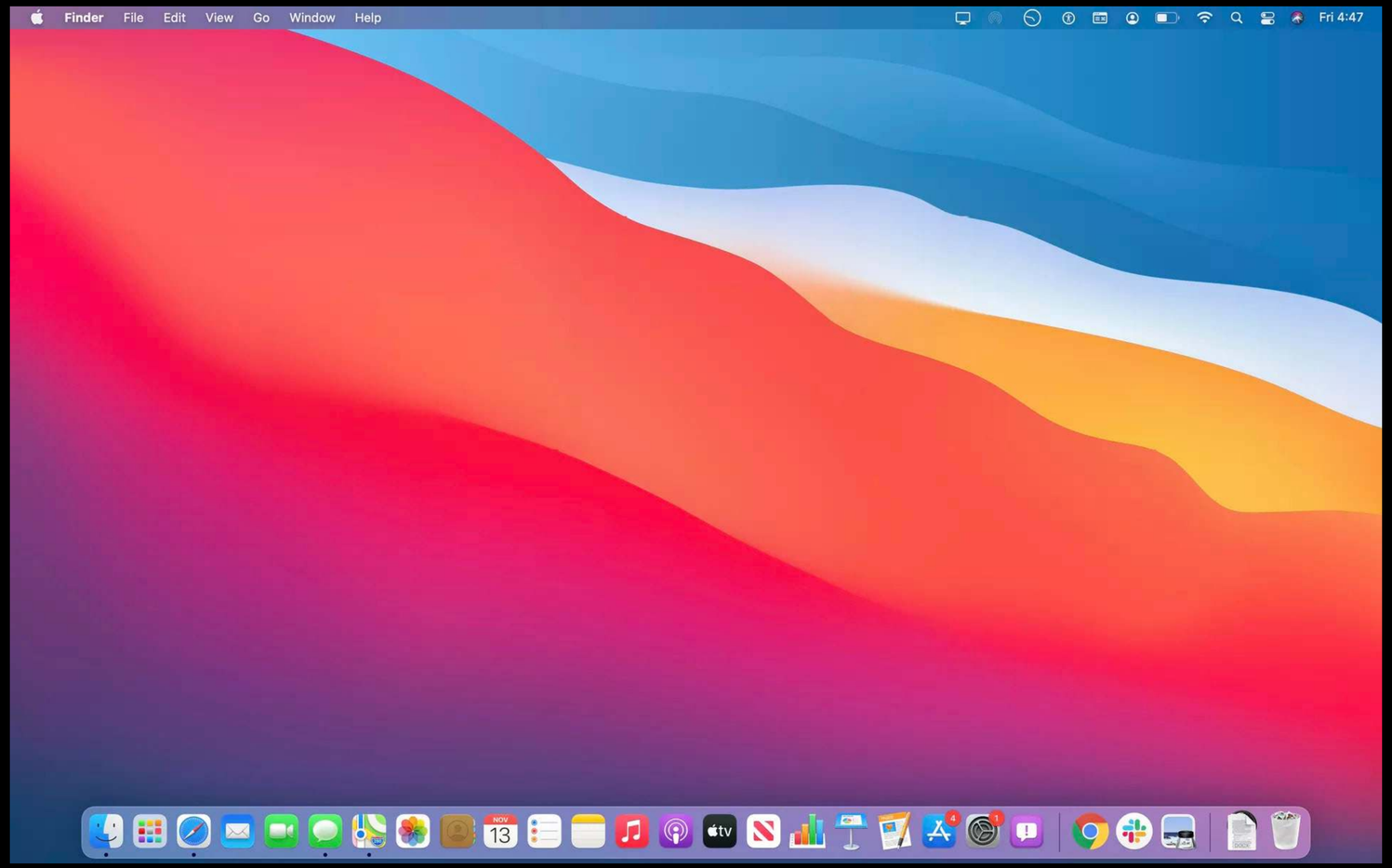
1984–2001: “Classic” Mac OS 1-9

2001–Present: ~~Mac OS X~~ ~~OS X~~ macOS



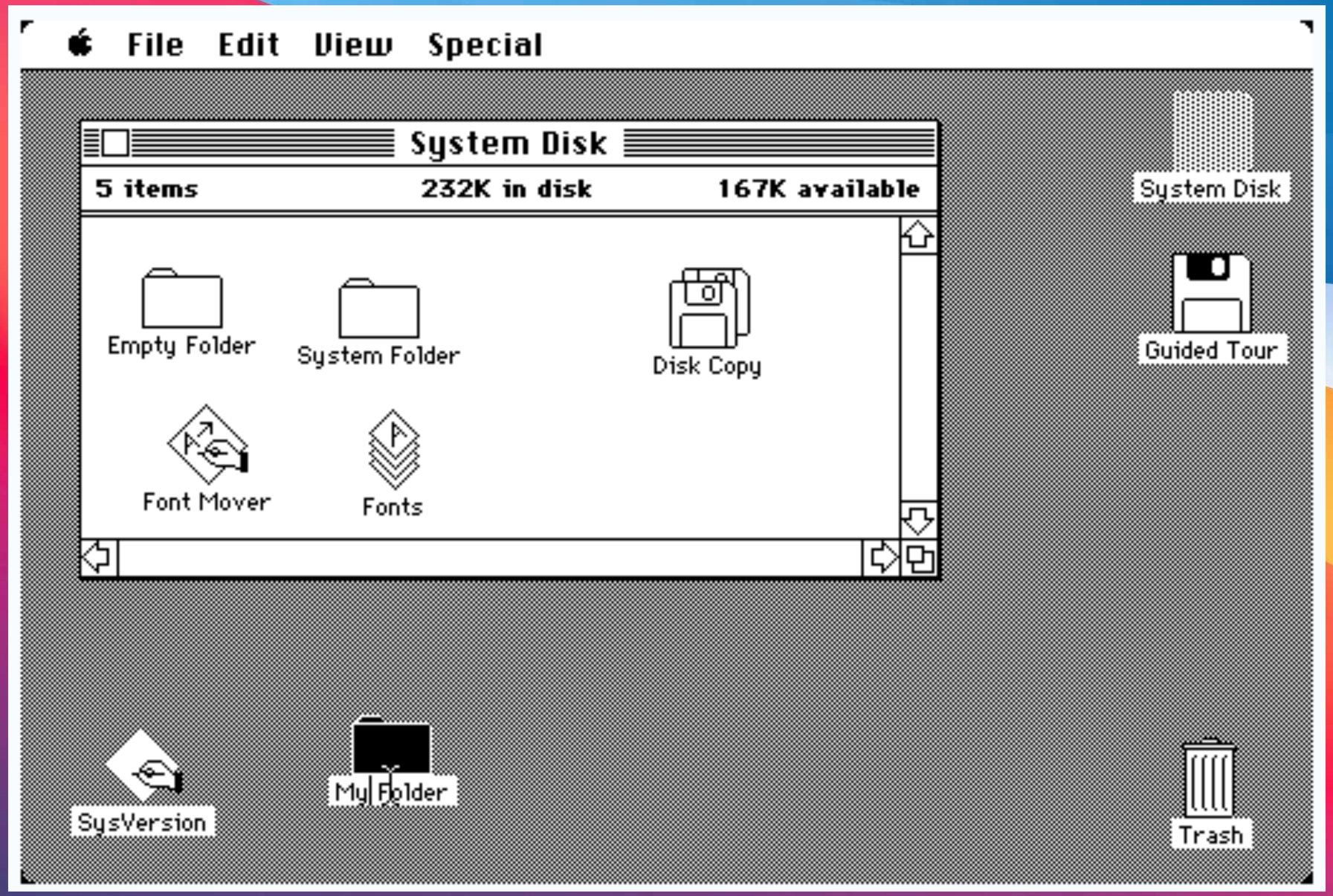
1984: The original Macintosh operating system, with an elegant & advanced GUI, but technically limited in many ways


File Edit View Special
System Disk
5 items
232K in disk
167K available
Empty Folder
System Folder
Disk Copy
Font Mover
Fonts
System Disk
Guided Tour
SysVersion
My Folder
Trash



macOS 11
Big Sur

2001: Mac OS X, a UNIX-based OS, with the attractive, elegant, intuitive Apple GUI running on top of it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System Disk
Guided Tour
SysVersion
My Folder
Trash

A current macOS app icon is 1024×1024 px

That’s huge compared to the original Macintosh screen, which was 512×312 px!

Version	Code Name	Release	OS Name
10.0	Cheetah	2001	Mac OS X
10.1	Puma	2001	
10.2	Jaguar	2002	
10.3	Panther	2003	
10.4	Tiger	2005	
10.5	Leopard	2007	
10.6	Snow Leopard	2009	

Version	Code Name	Release	OS Name
10.7	Lion	2011	
10.8	Mountain Lion	2012	OS X
10.9	Mavericks	2013	
10.10	Yosemite	2014	
10.11	El Capitan	2015	
10.12	Sierra	2016	macOS
10.13	High Sierra	2017	

Version	Code Name	Release	OS Name
10.14	Mojave	2018	
10.15	Catalina	2019	
11	Big Sur	2020	
12	Monterey	2021	
13	Ventura	2022	
14	Sonoma	2023	
15	Sequoia	2024	

Version	Code Name	Release	OS Name
26	Tahoe	2025	

Version	Code Name	Release	Basis for OS Name
10.0	Cheetah	2001	Big cats ↓
10.1	Puma	2001	
10.2	Jaguar	2002	
10.3	Panther	2003	
10.4	Tiger	2005	
10.5	Leopard	2007	
10.6	Snow Leopard	2009	Refinement of Leopard

Version	Code Name	Release	Basis for OS Name
10.7	Lion	2011	
10.8	Mountain Lion	2012	Refinement of Lion
10.9	Mavericks	2013	California landmarks ↓
10.10	Yosemite	2014	
10.11	El Capitan	2015	Refinement of Yosemite
10.12	Sierra	2016	
10.13	High Sierra	2017	Refinement of Sierra

Version	Code Name	Release	Basis for OS Name
10.14	Mojave	2018	
10.15	Catalina	2019	
11	Big Sur	2020	After 20 years, 11!
12	Monterey	2021	
13	Ventura	2022	
14	Sonoma	2023	
15	Sequoia	2024	

Version	Code Name	Release	Basis for OS Name
26	Tahoe	2025	Number based on year

Version	Code Name	Release	System Font
10.0	Cheetah	2001	Lucida Grande
10.1	Puma	2001	
10.2	Jaguar	2002	
10.3	Panther	2003	
10.4	Tiger	2005	
10.5	Leopard	2007	
10.6	Snow Leopard	2009	

Version	Code Name	Release	System Font
10.7	Lion	2011	
10.8	Mountain Lion	2012	
10.9	Mavericks	2013	
10.10	Yosemite	2014	Helvetica Neue
10.11	El Capitan	2015	San Francisco
10.12	Sierra	2016	
10.13	High Sierra	2017	

Version	Code Name	Release	System Font
10.14	Mojave	2018	
10.15	Catalina	2019	
11	Big Sur	2020	
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Version	Code Name	Release	System Font
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iOS
iPadOS
watchOS
tvOS
macOS
visionOS

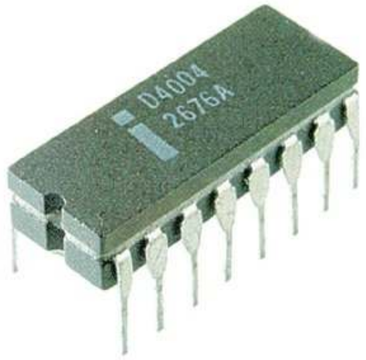
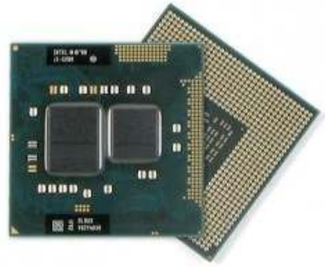
Apple's CPU History

CPU: *Central Processing Unit*

The computer's brains

Interprets instruction & processes data

Consists of millions of integrated circuits, or *transistors*, on a small chip

CPU	Intel 4004	Intel Core i7
Year	1970	2013
Transistors	2250	1.48 billion
Speed	740 kHz	3.5 GHz
		

Manufacturing Process

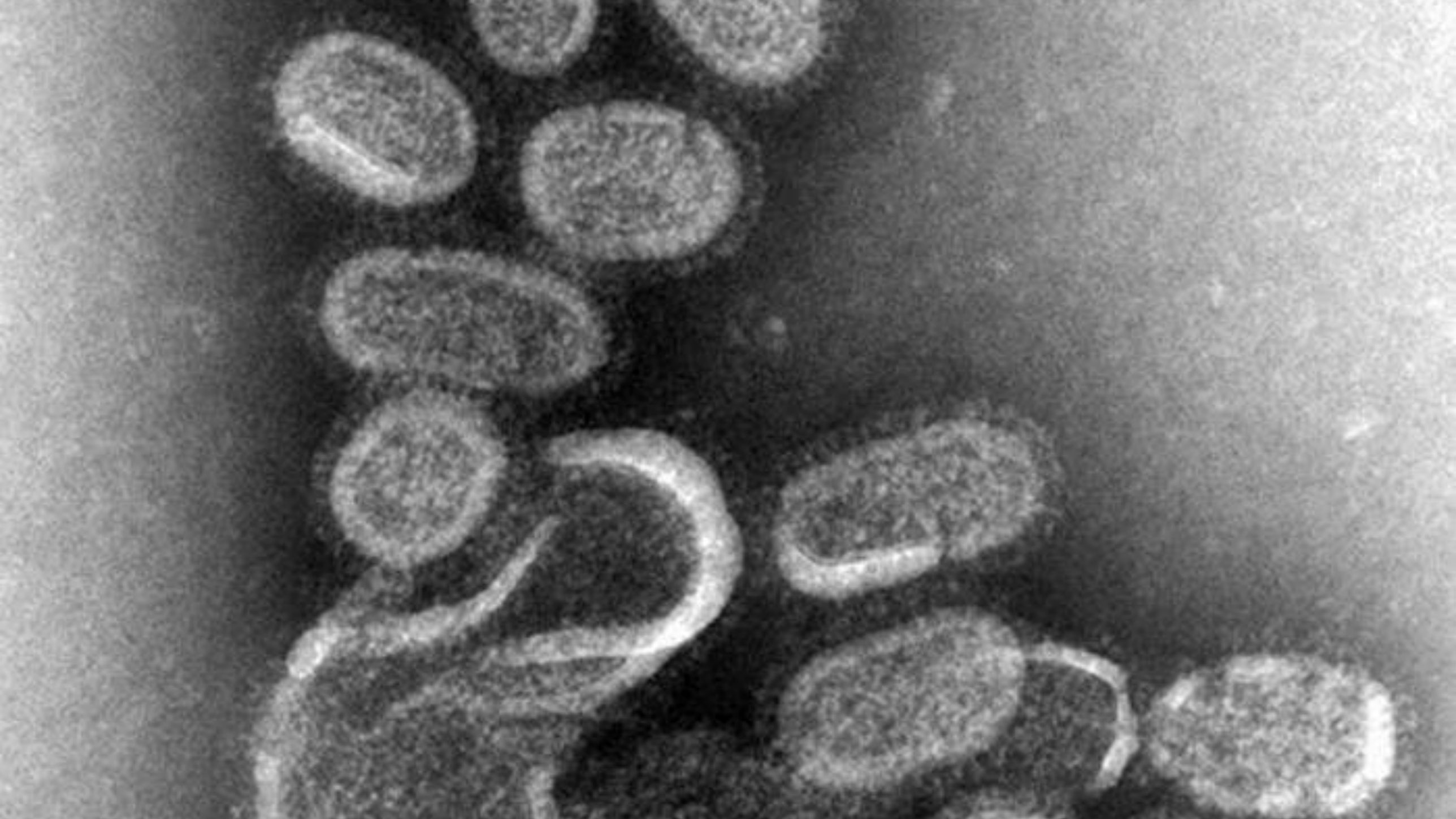
1 meter = 39.37 inches = 1 yard + 3.37 inches

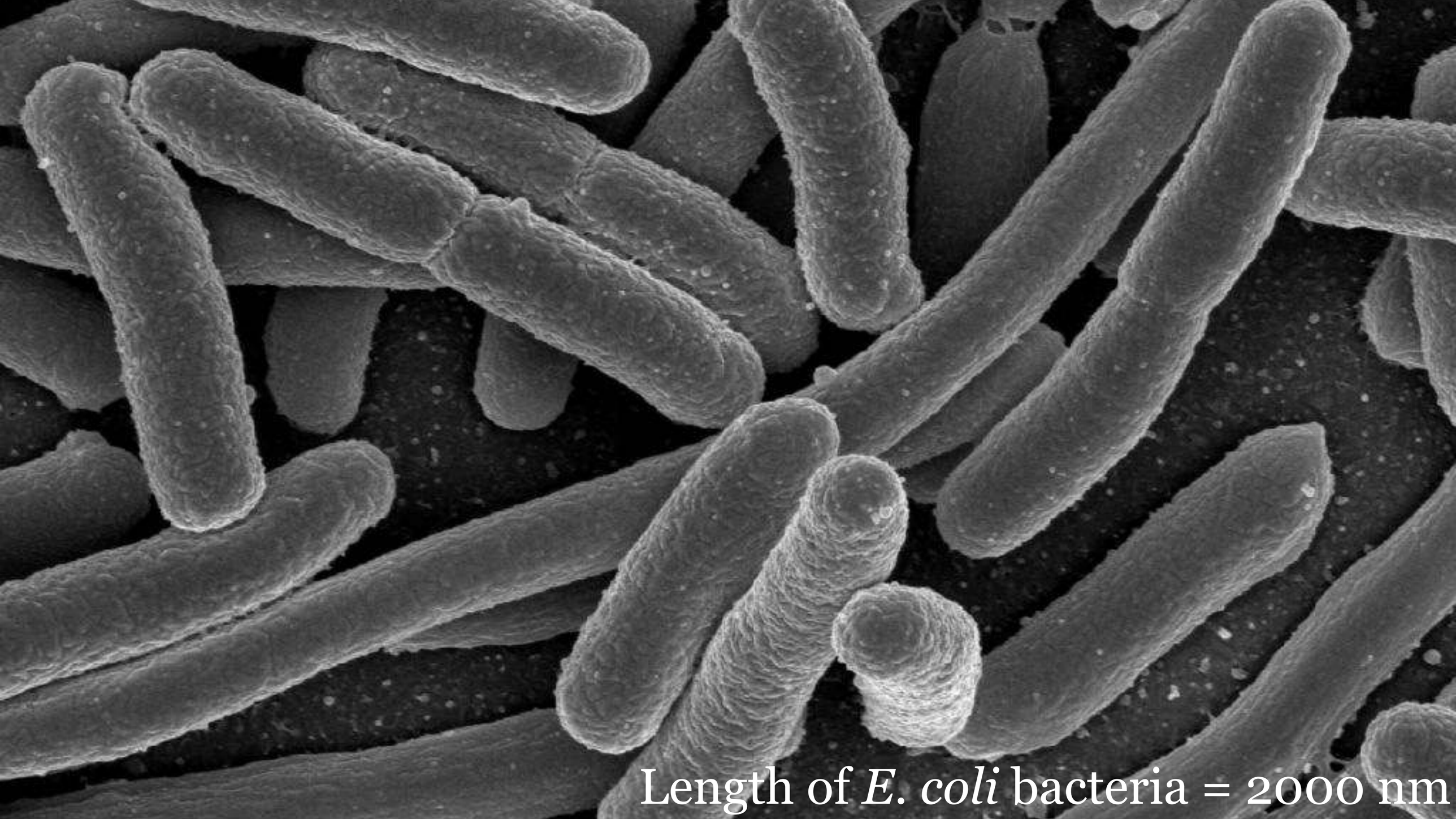
1 meter = 100 cm = 1,000,000,000 nm (*nanometers*)

1 nanometer = 1 billionth of a meter (1×10^{-9} m)

How big is that?

1 water molecule = <1 nm




Length of *E. coli* bacteria = 2000 nm

Width of human hair = 90,000 nm

XL
CAVALIERS
NBA

1994: 600 nm

1995: 350 nm

1998: 250 nm

1999: 180 nm

2000: 130 nm

2002: 90 nm

2006: 65 nm

2008: 45 nm

2010: 32 nm

2012: 22 nm

2014: 14 nm

2016: 10 nm

2018: 7 nm

2020: 5 nm

2022: 3nm

CPU manufacturing processes over time

32 nm of what?

The technical explanation: “The expected half-pitch of a memory cell”

The non-technical explanation: *the distance between transistors*

In the early 2010s, CPUs were using 32 nm & 22 nm processes

.

4 million 32 nm transistors can fit in that period

6 million 22 nm transistors can fit in that period

A 22 nm transistor can switch on & off well over 100 billion times per second

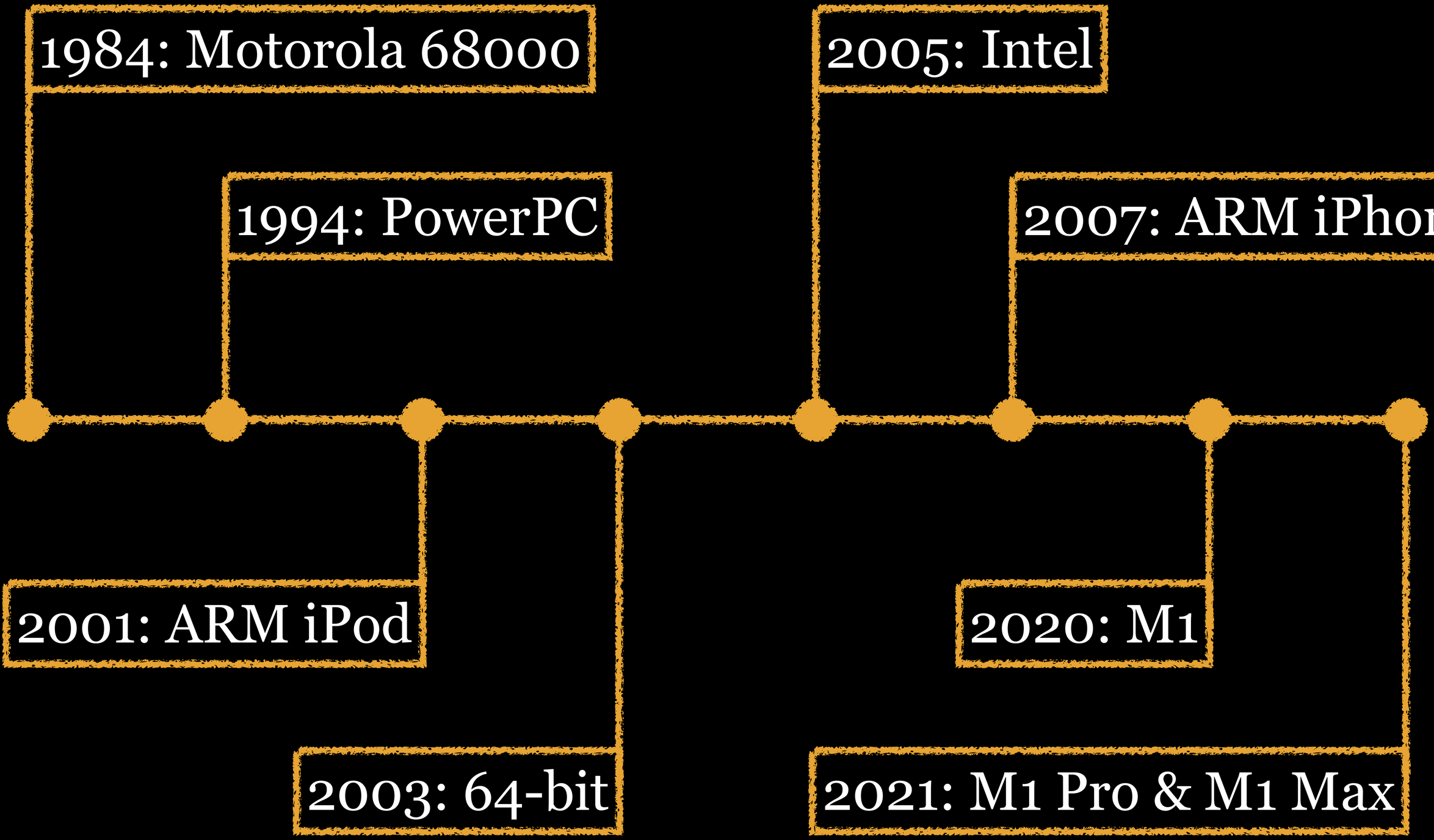
.

Now Apple & others use a 3nm process

111 billion 3nm transistors can fit in that period

As manufacturing process decreases, the CPU…

» can pack in more more transistors
» is faster
» is more power efficient


1984: Motorola 68000
1994: PowerPC
2001: ARM iPod
2003: 64-bit
2005: Intel
2007: ARM iPhone
2020: M1
2021: M1 Pro & M1 Max

PowerPC

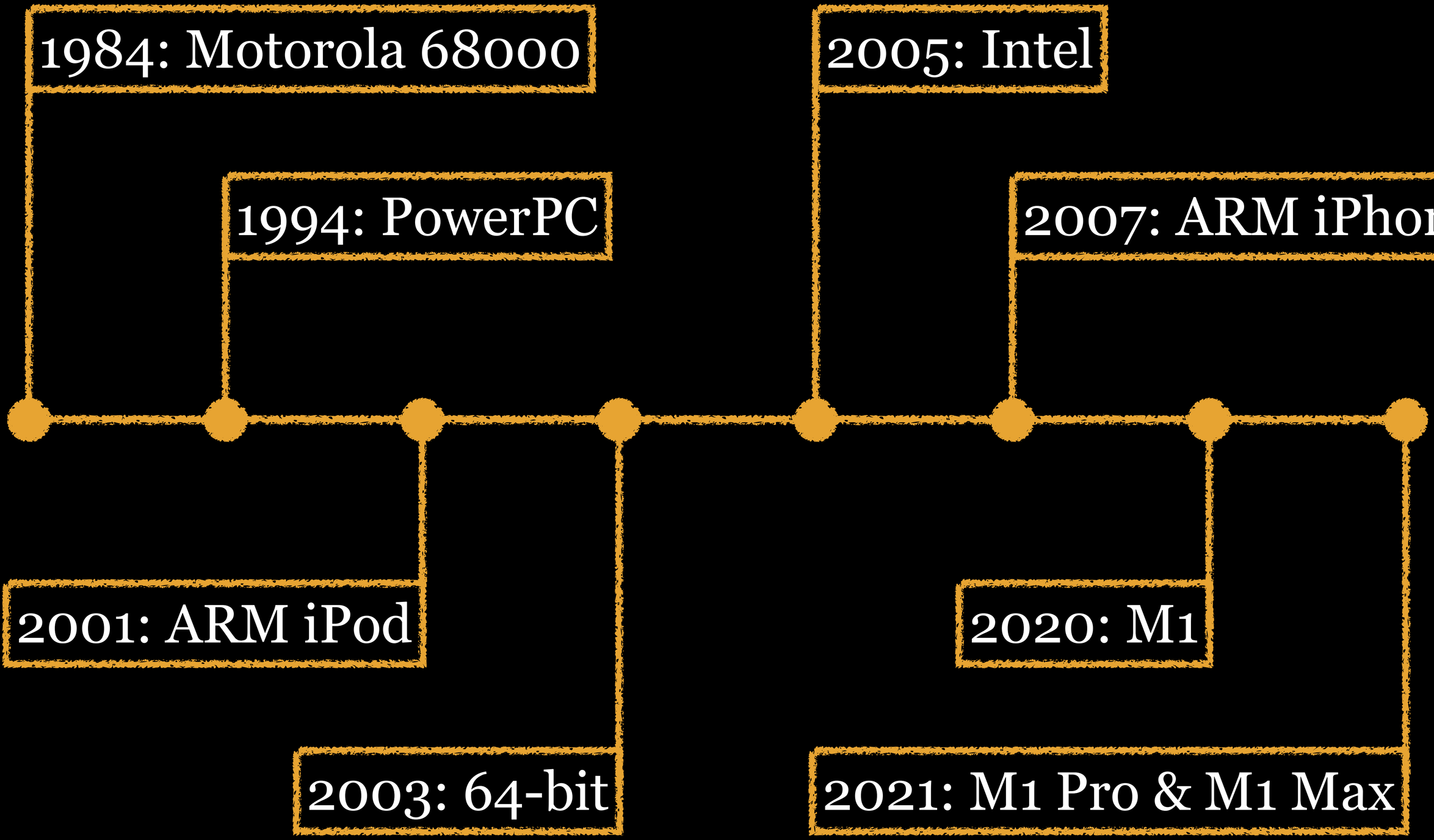
Created by 1991 as an Apple-IBM-Motorola alliance

Tried to counter *WinTel* (Windows + Intel) powerhouse

Used in desktops & laptops, but popular in servers & embedded computers (Microsoft Xbox 360, Ford cars, HP printers)

Most notable success: used in Apple Macs 1994-2006

Now a consortium led by IBM & Freescale Semiconductor (formerly Motorola)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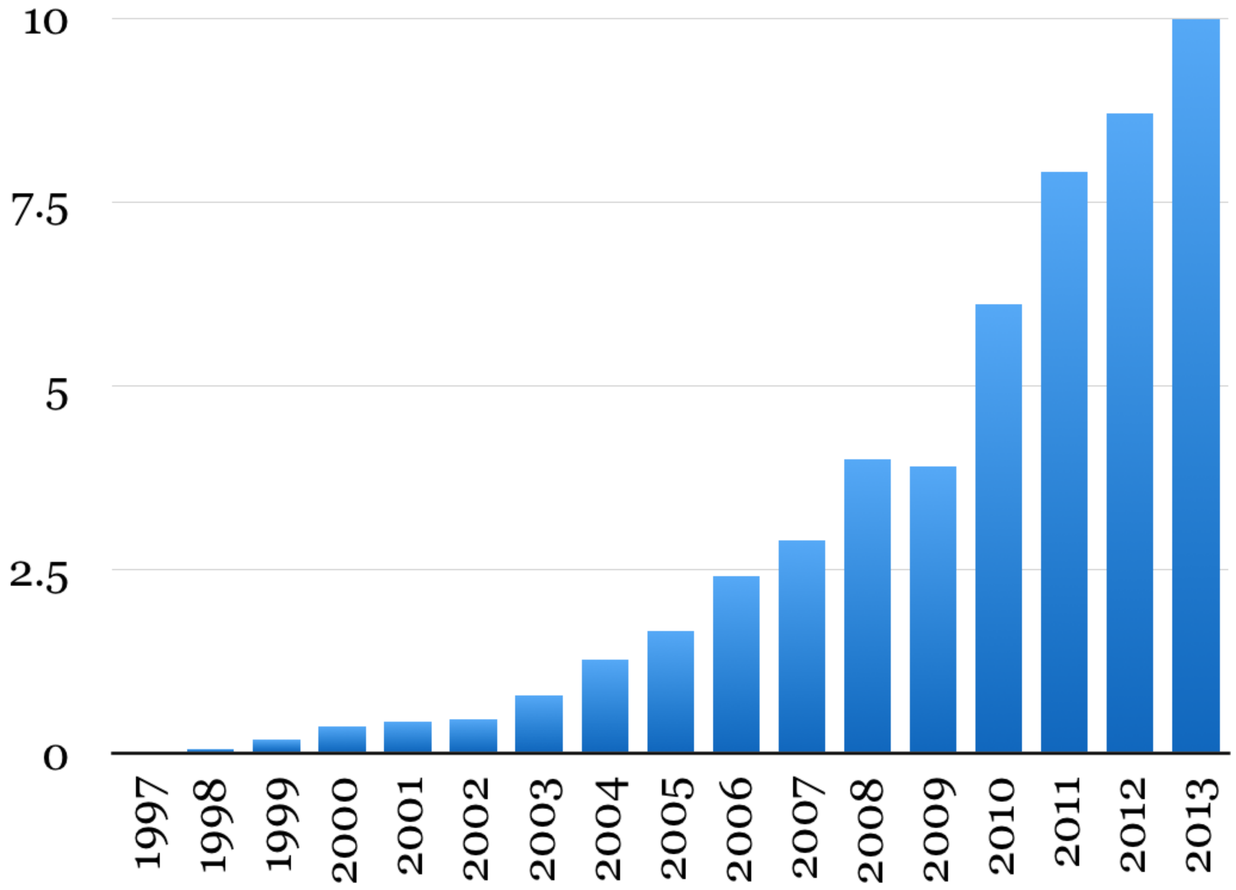
ARM

ARM Holdings

Located in Cambridge, UK

Focuses on low-power, mobile-friendly CPUs for mobile phones, iPad & iPod, Nintendo Game Boy Advance & DS, GPS devices, digital cameras, digital TVs, network devices, & much more



ARM chips manufactured per year, in billions (50 billion total)

99% of smartphones run on ARM CPUs

0% of desktops, laptops, & servers in 2010

By 2026, it’s estimated that ARM will be used on

» 50% of cloud CPUs
» 30% of PCs

ARM licenses its technology to other companies, rather than manufacturing CPUs itself (like Intel & AMD do)

APL0698 339S0207

093FW 1324

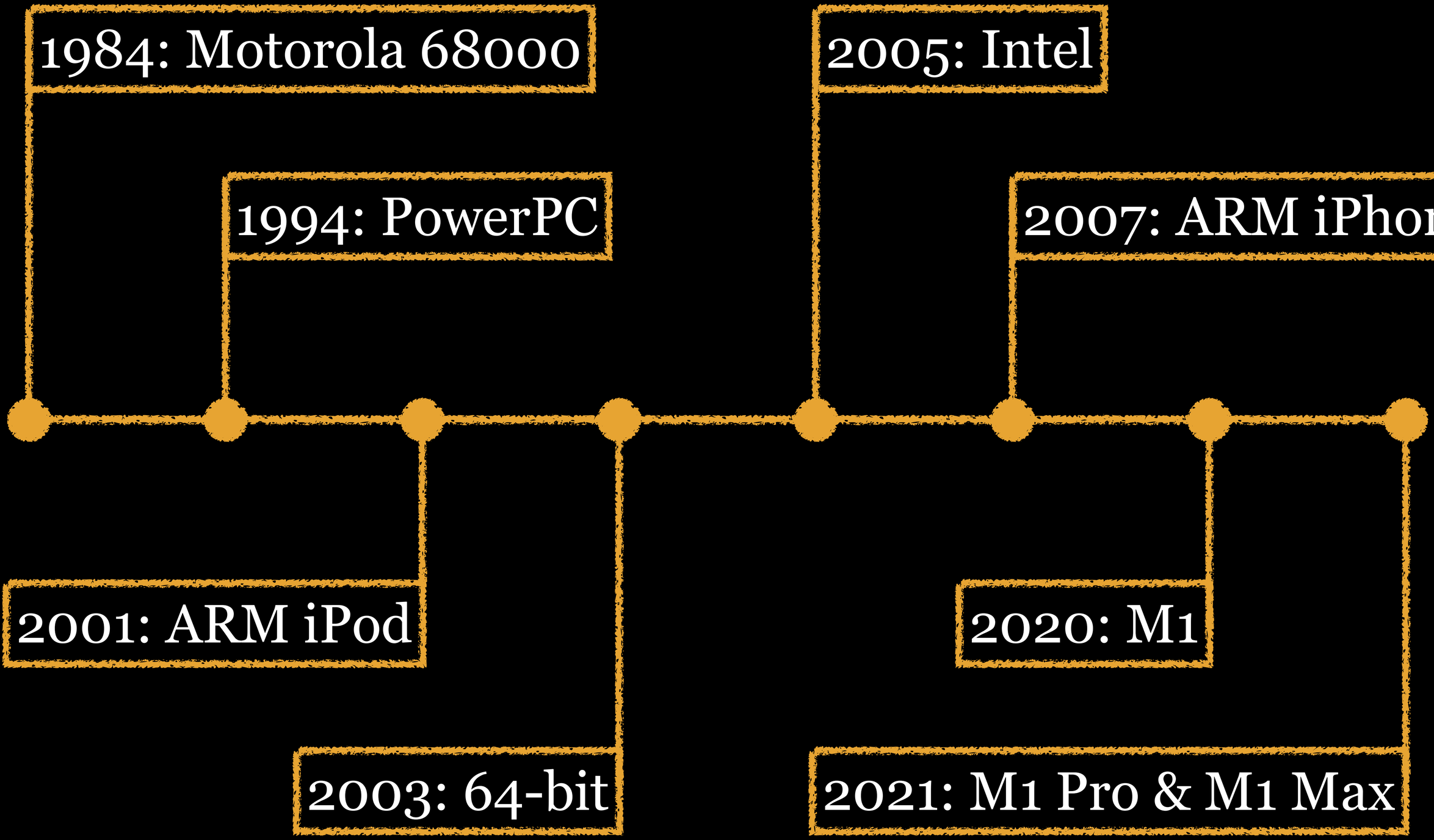
A7

F8164A1PD-GD-F

N6419M1 1334

Apple A7 CPU

» Licensed from ARM
» Designed by Apple
» Manufactured by Samsung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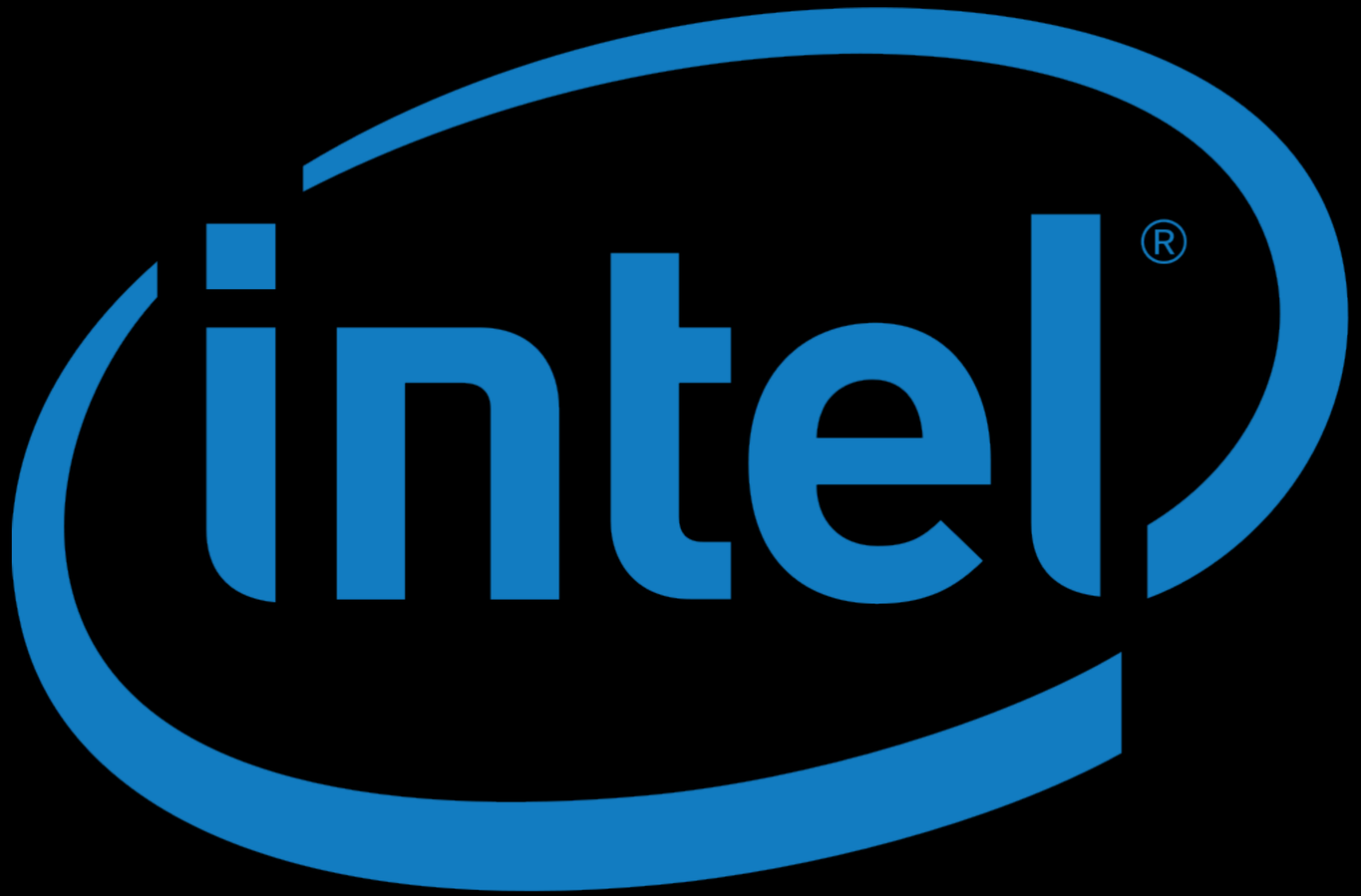
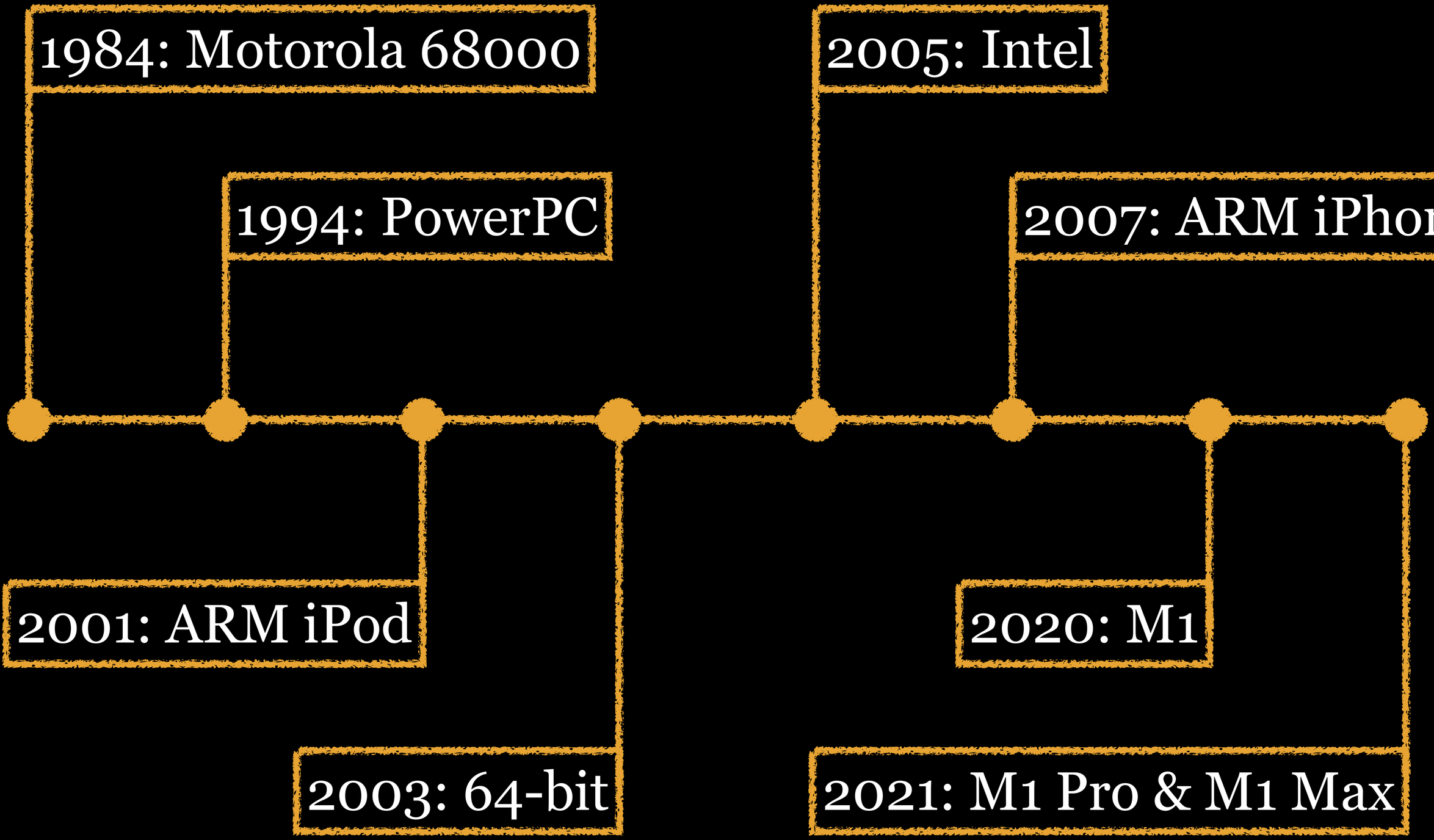

intel

World’s largest CPU company

Roughly 80% market share in PC CPUs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2020-06-22: Apple announces Mac switch to M1

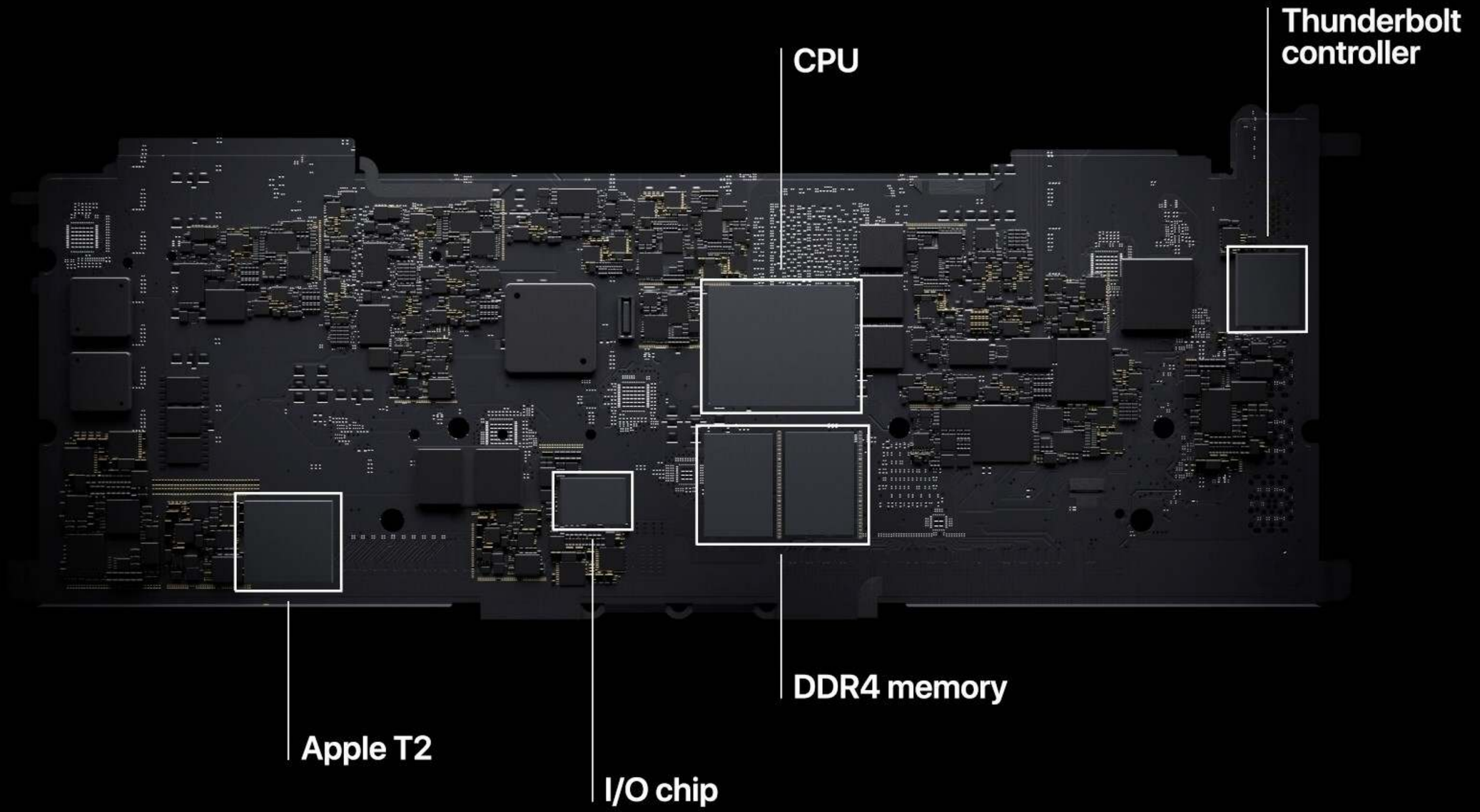
2020-11-10: M1 inside new MacBook Air, 13" MacBook Pro, & Mac mini

2021-04-20: M1 inside 24" iMac, & 11" & 12.9" iPad Pro

2021-10-18: M1 Pro & M1 Max inside MacBook Pro 14" & 16"

M1

Apple: “The transition to Apple silicon will take about two years to complete”


Thunderbolt controller
CPU
DDR4 memory
Apple T2
I/O chip

Why the movement towards SoCs?

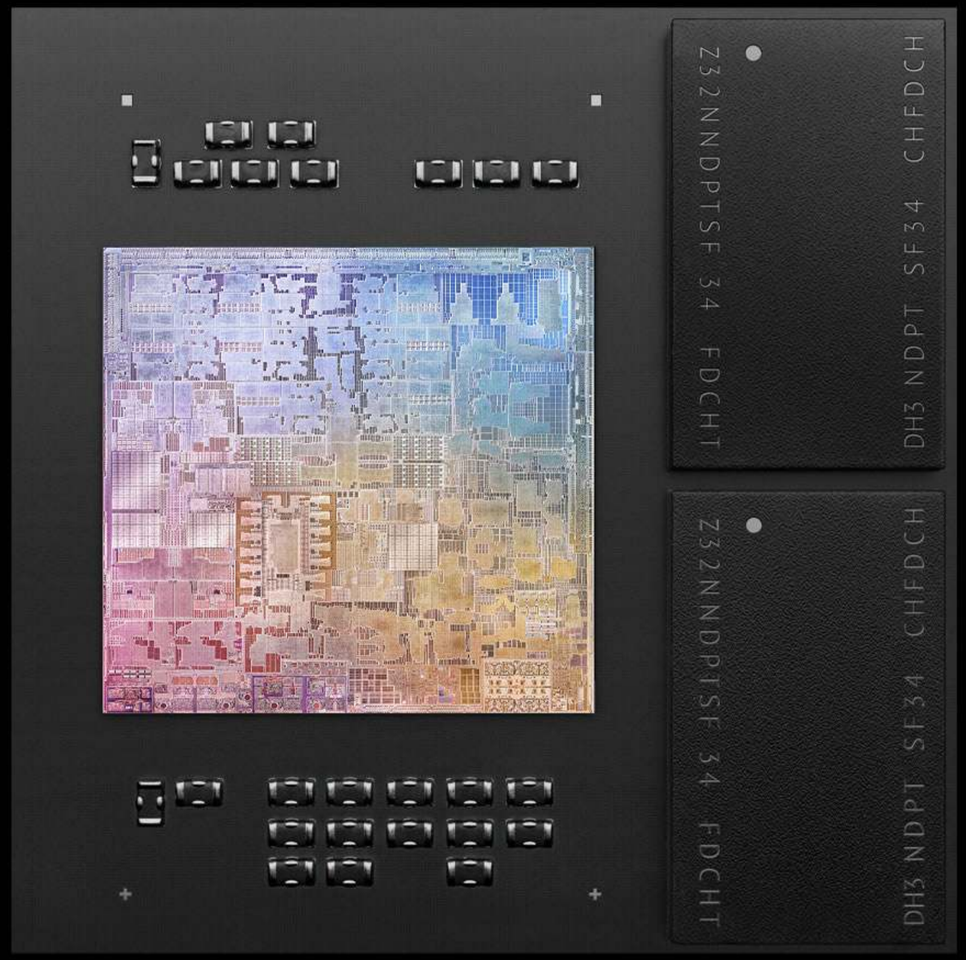
Needed for smartphones: saves space, ↓ power, & ↑ batteries

Expertise developed from mobile can be applied to desktops & laptops as well

“A system on a chip (SoC; es-oh-SEE or sock) is an integrated circuit (also known as a ‘chip’) that integrates all or most components of a computer or other electronic system. These components almost always include a central processing unit (CPU), memory, input/output ports and secondary storage, often alongside other components such as radio modems and a graphics processing unit (GPU) — all on a single substrate or microchip.” —Wikipedia

“It features the world’s fastest CPU core in low-power silicon, the world’s best CPU performance per watt, the world’s fastest integrated graphics in a personal computer…

…up to 3.5× faster CPU performance, up to 6× faster GPU performance, and up to 15× faster machine learning, all while enabling battery life up to 2× longer than previous-generation Macs” —Apple, November 10, 2020



1st PC chip built using 5-nanometer process technology

16 billion transistors

5 nanometer process

Machine learning accelerators

16-core Neural Engine

11 trillion operations per second

Thunderbolt / USB 4 controller

Media encode and decode engines

M1

16 billion transistors

Up to 8-core GPU

8-core CPU

Advanced image signal processor

Secure Enclave

Unified memory architecture

Industry-leading performance per watt

Advanced power management
High-efficiency CPU cores
High-performance CPU cores
Low-power video playback
Neural Engine
High-bandwidth caches
Advanced display engine
M1
High-performance GPU
Advanced silicon packaging
Cryptography acceleration
Always-on processor
High-performance video editing
High-performance unified memory
Performance controller
Machine learning accelerators
High-quality image signal processor
Low-power design
High-performance storage
High-efficiency audio processor
Secure Enclave

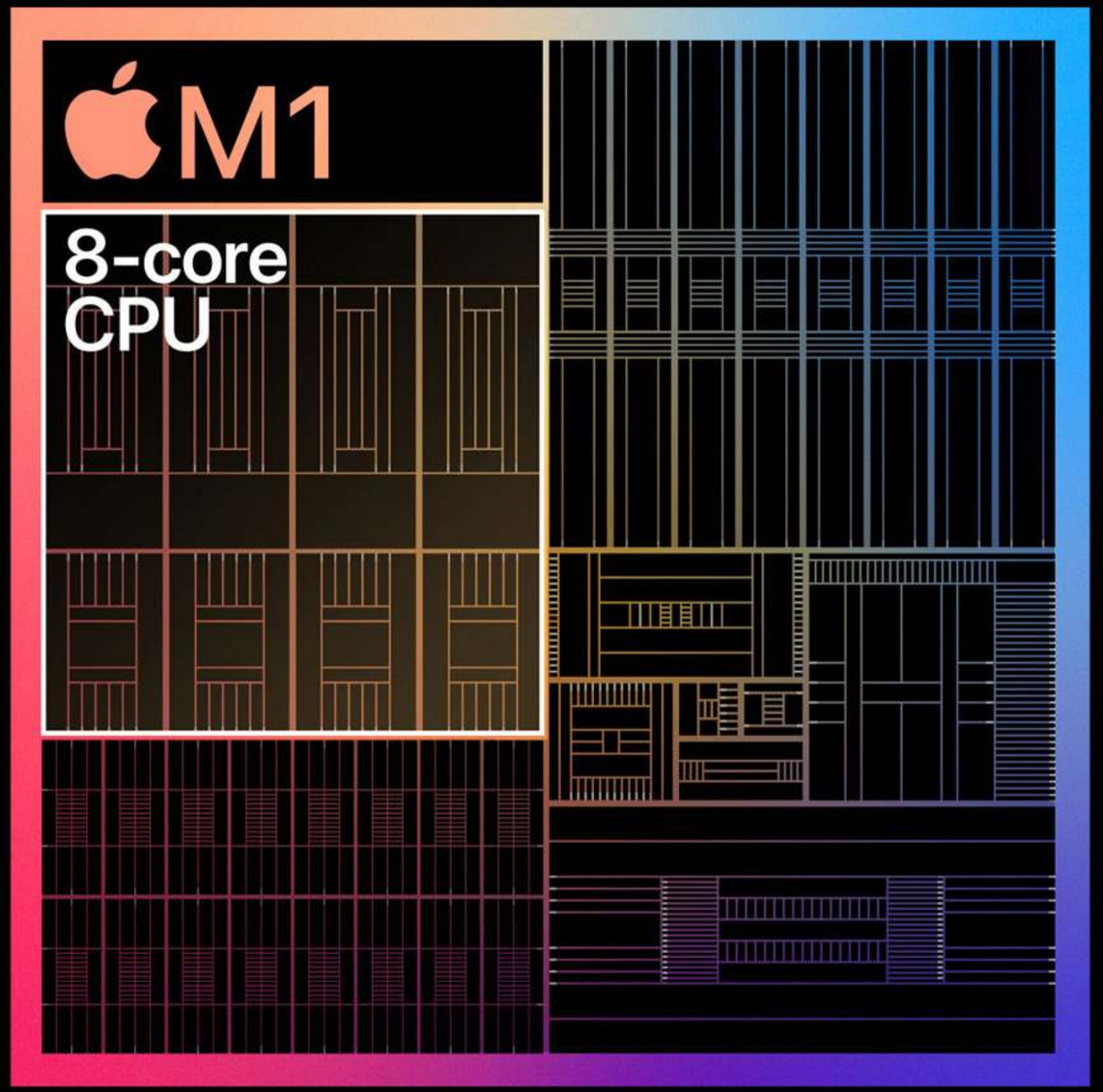
8-core CPU

The highest-performance CPU we've ever built.

Up to

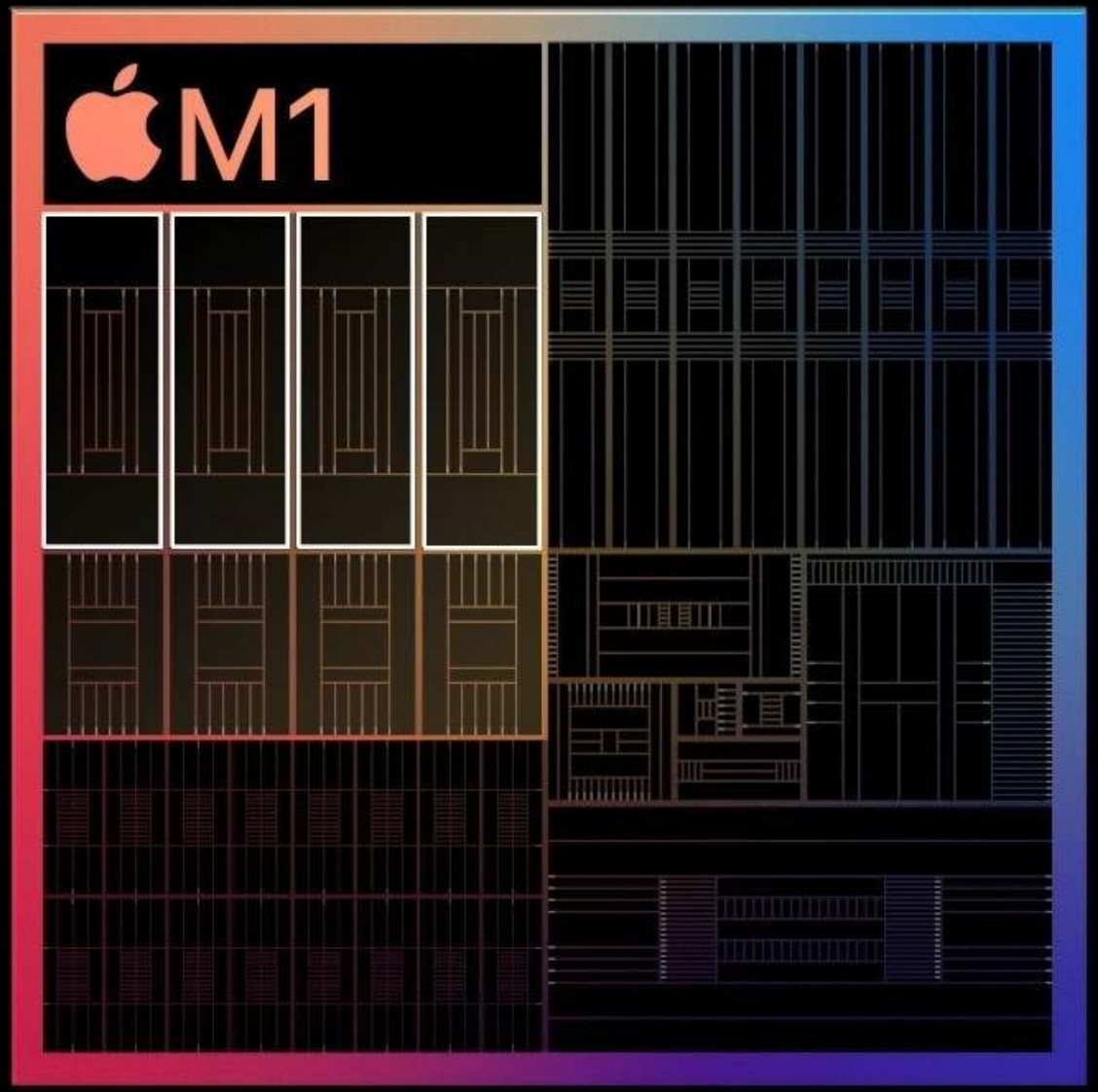
3.5x

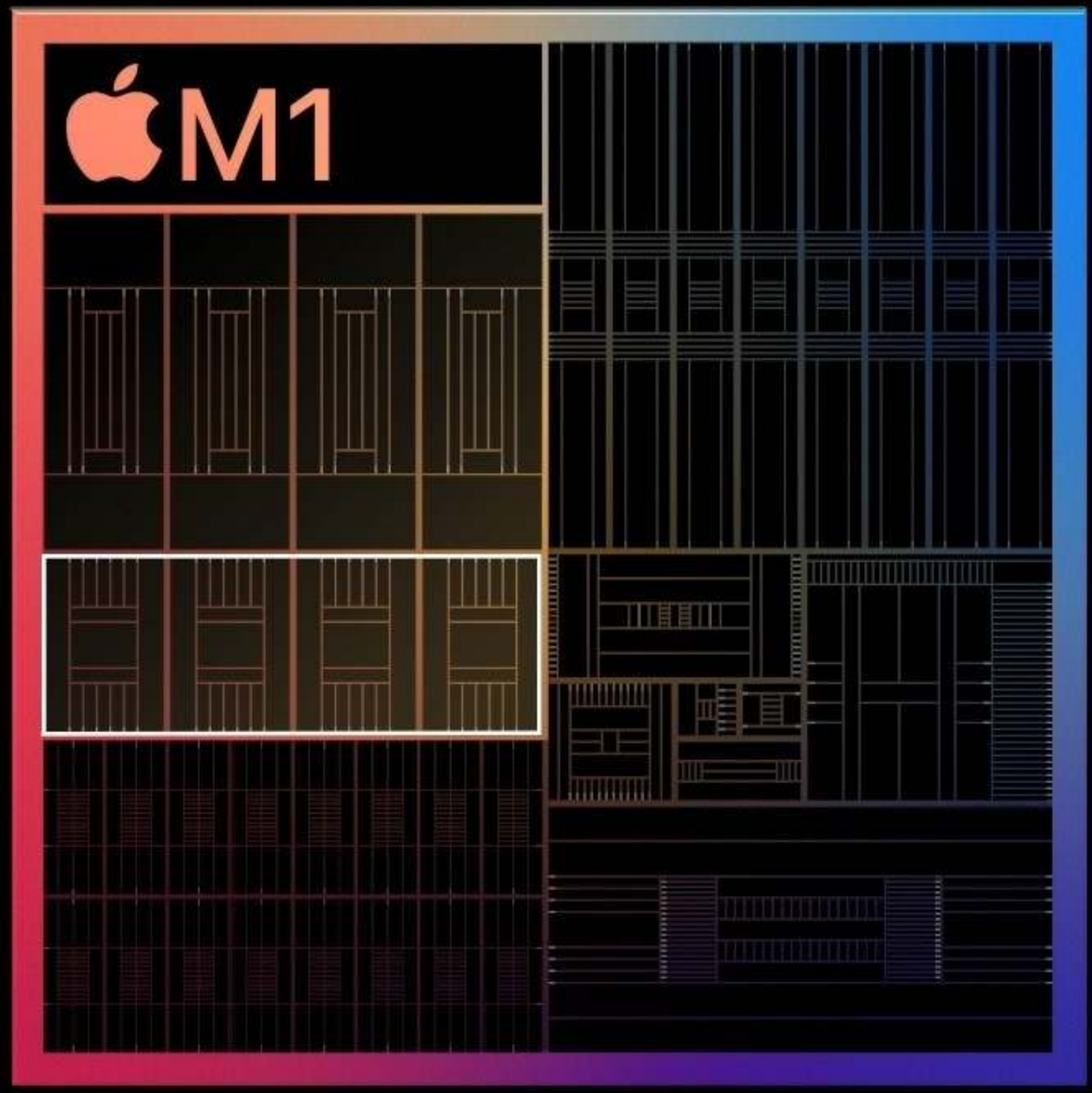
faster CPU performance[1]



4 high-performance cores

Ultra-wide execution architecture
192KB instruction cache
128KB data cache
Shared 12MB L2 cache





4 high-efficiency cores

Wide execution architecture

128KB instruction cache

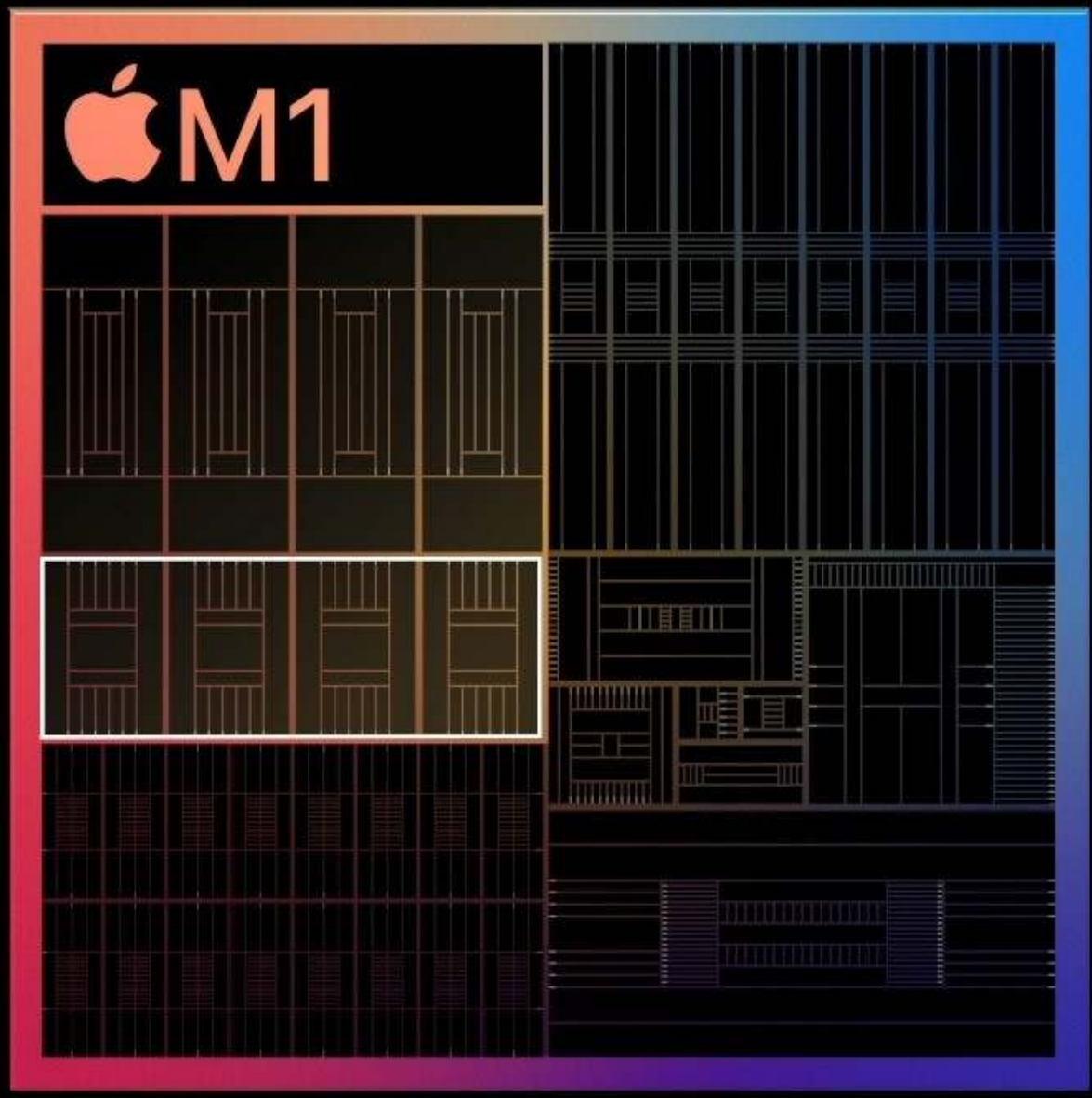
64KB data cache

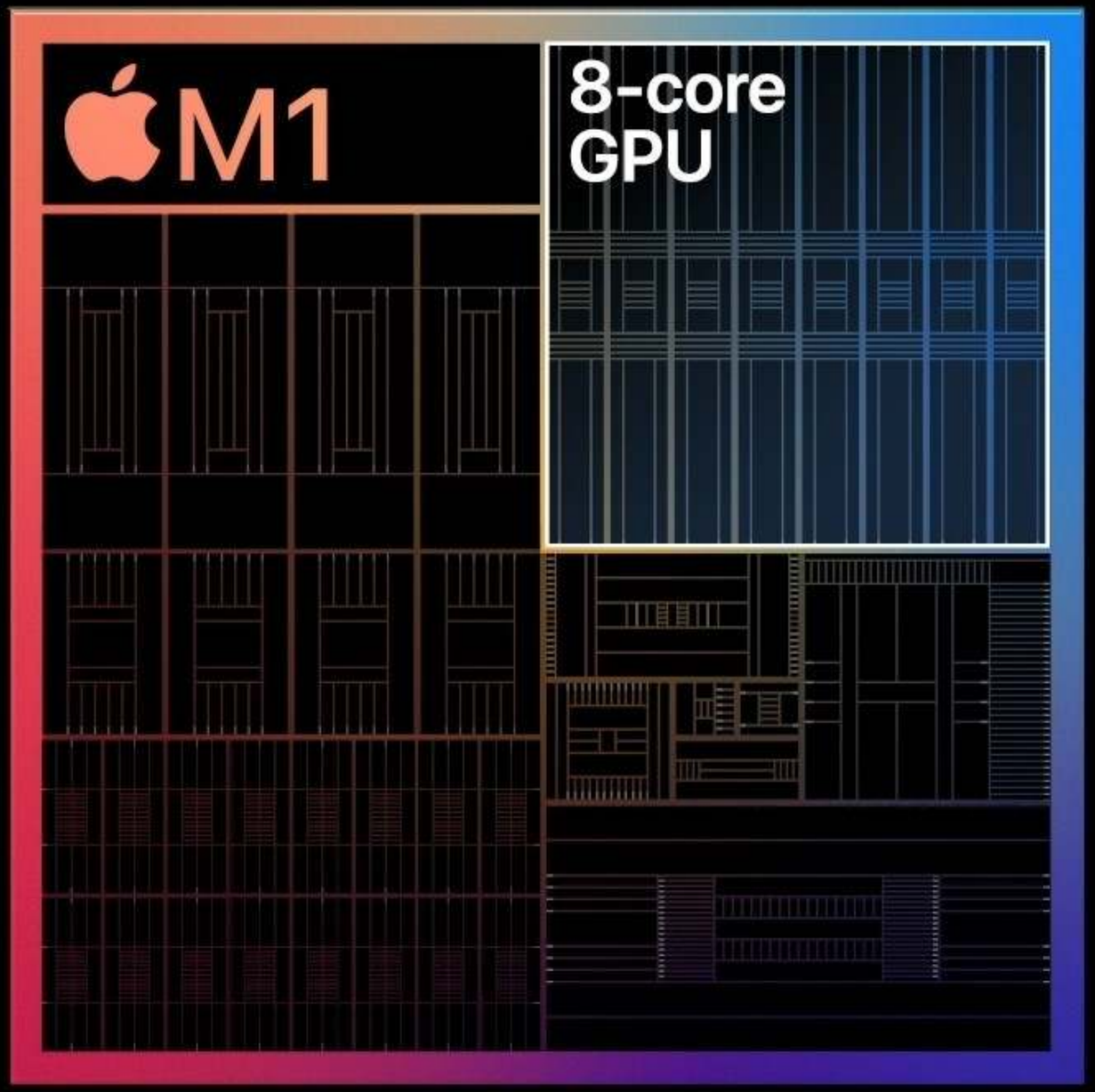
Shared 4MB L2 cache

1/10th of power

For “lightweight, everyday tasks” like email or web browsing at 1/10th the power

Can work together with 4 high-performance cores





Up to 8 cores

128 execution units

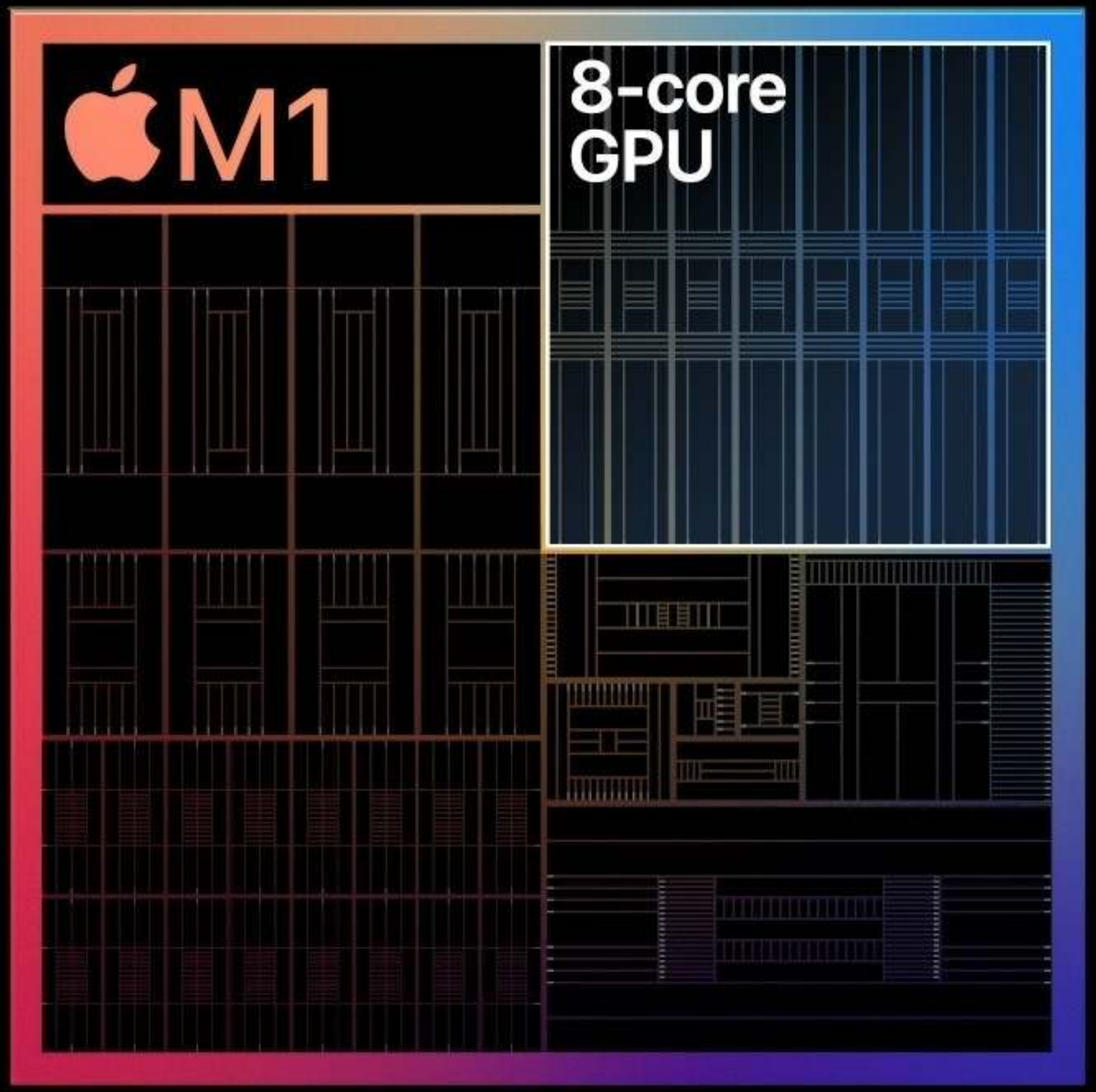
Up to 24,576 concurrent threads

2.6 teraflops

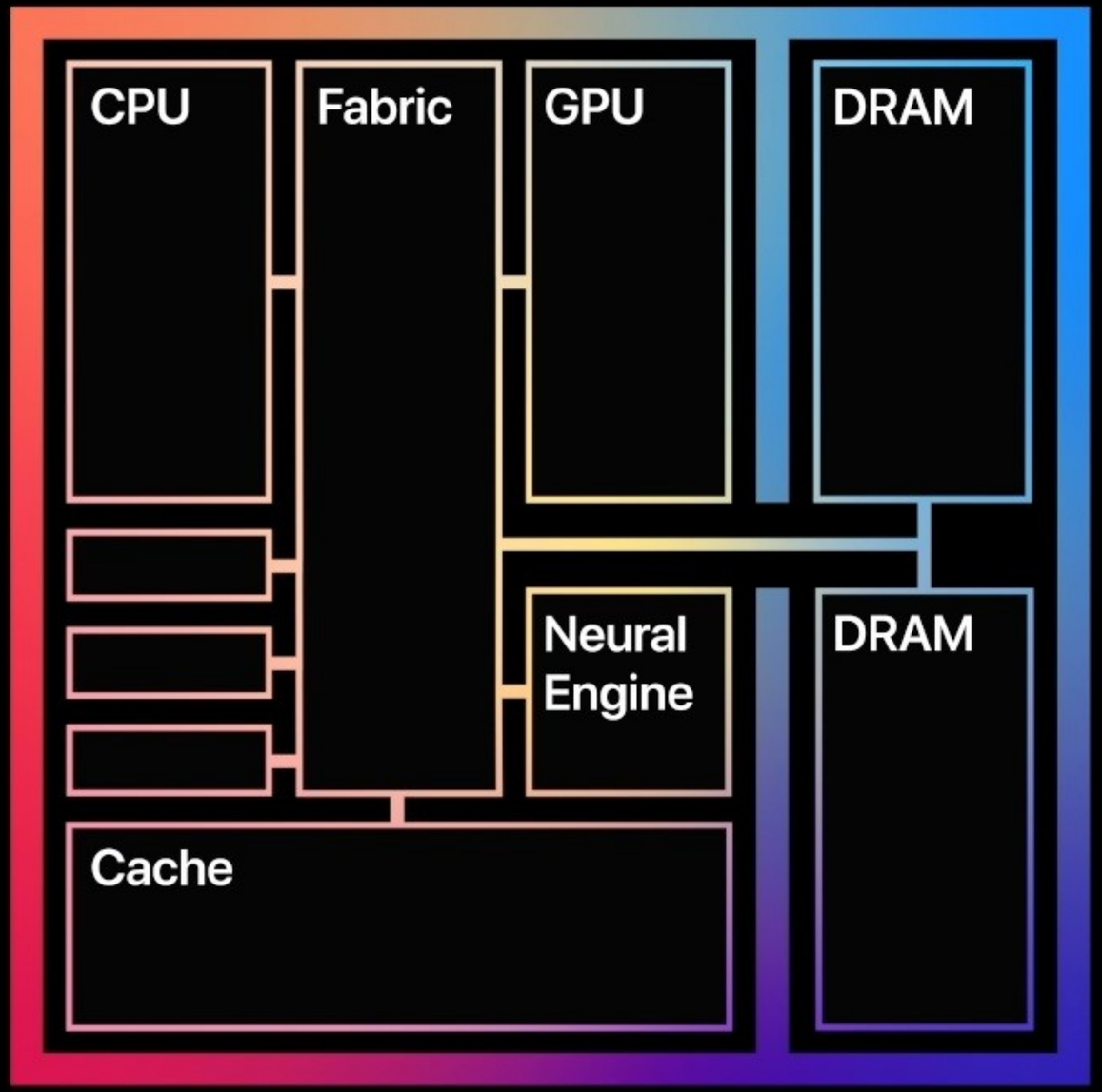
82 gigatexels/second

41 gigapixels/second

“World’s fastest integrated graphics in a personal computer”



Designed to “handle extremely demanding tasks with ease, from smooth playback of multiple 4K video streams to rendering complex 3D scenes”

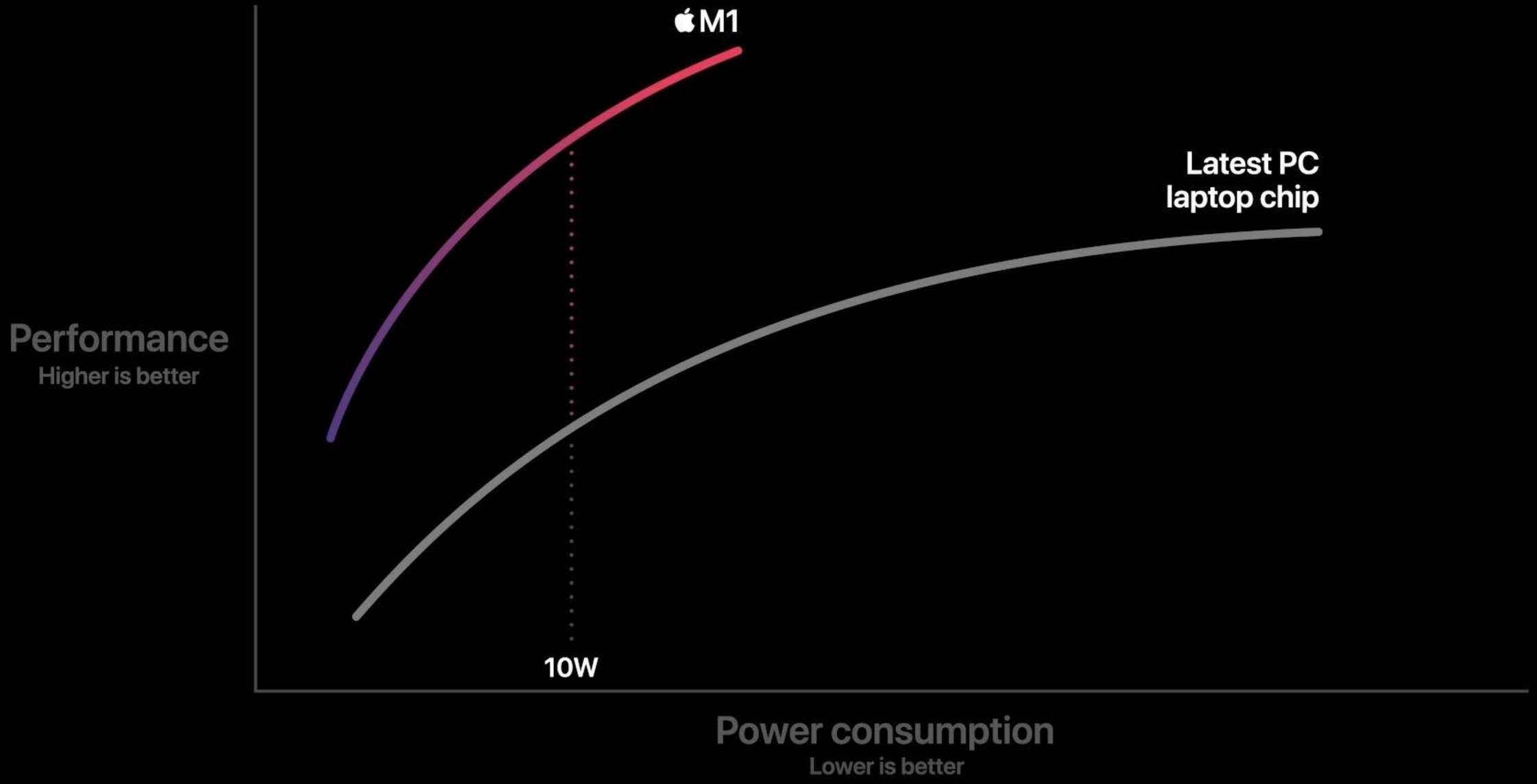


Unified memory architecture

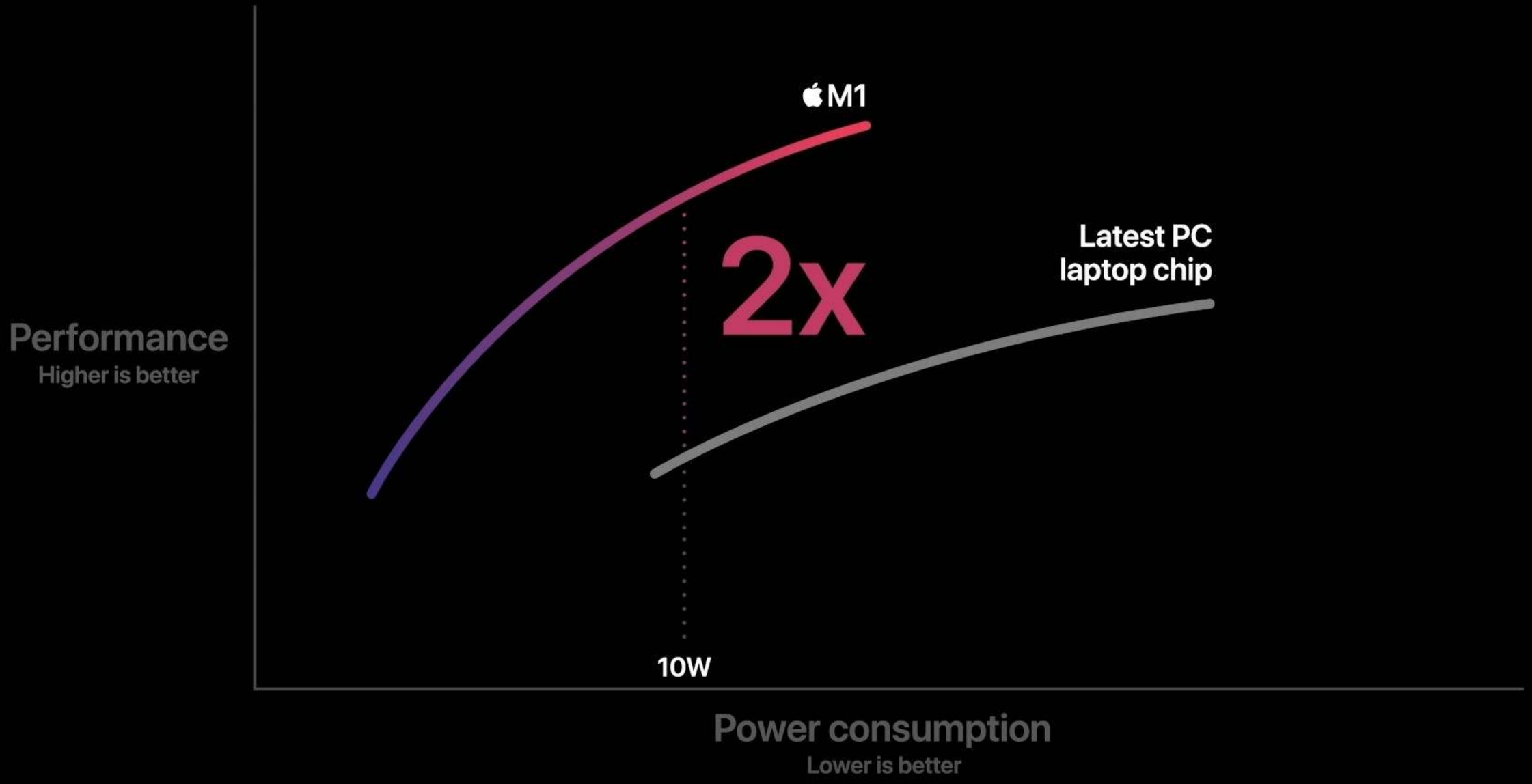
High bandwidth, low latency
Apple-designed package
Accessible to entire SoC

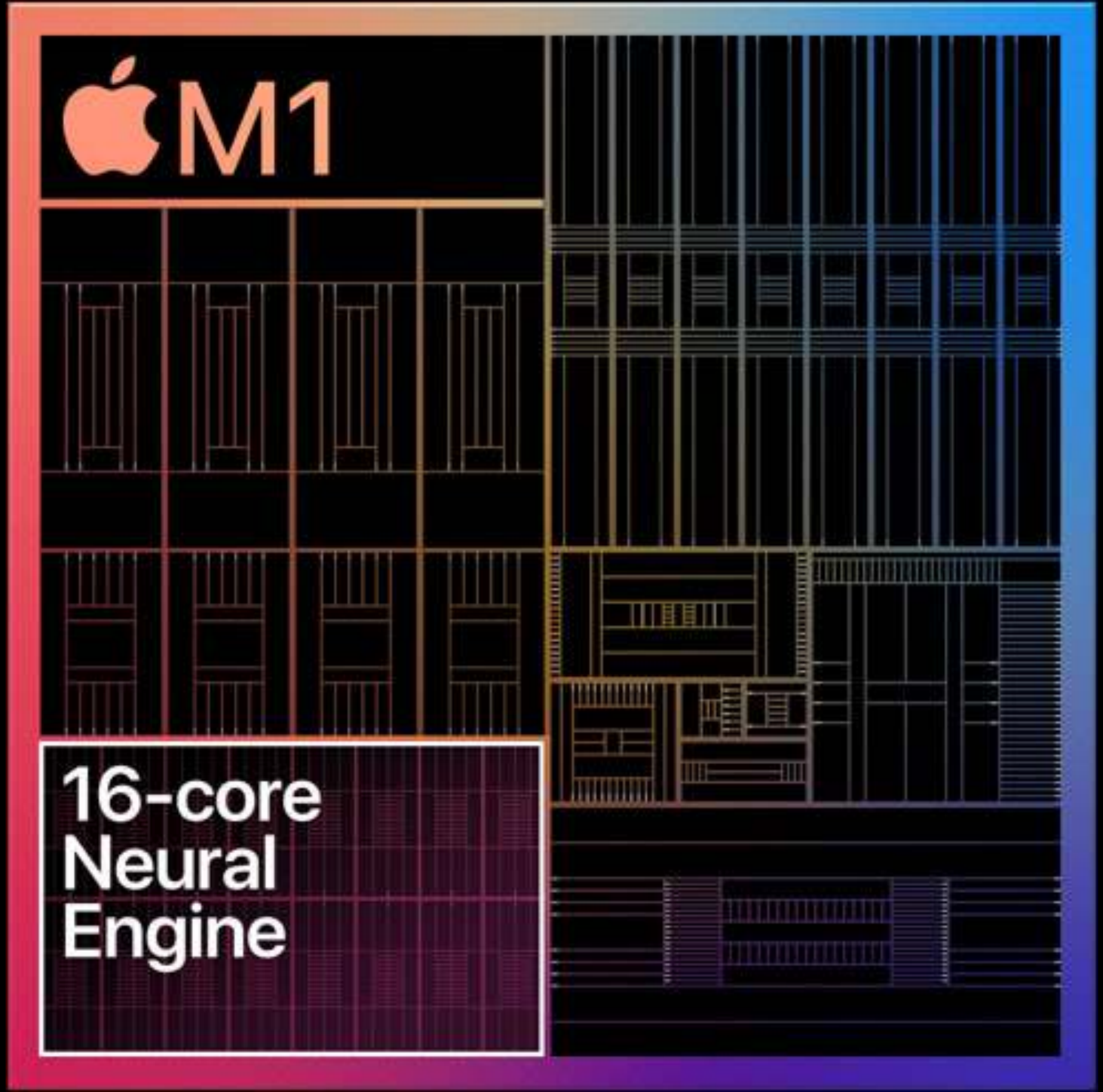
Benefits of UMA: All technologies in M1 SoC can access the same data without copying it between multiple pools of memory, improving performance & efficiency

CPU Performance vs. Power



GPU Performance vs. Power




M1
16-core
Neural
Engine

“The future of machine learning is at the ‘edge,’ which refers to the edge of computing networks, as opposed to centralized computing.

In a centralized machine learning network, users send data to a server, which makes a prediction, and sends that back to the user. This is slower, more expensive, less reliable, and less secure than edge computing, where predictions are made directly on the user’s device.” —Frederik Bussler

“…capable of 11 trillion operations per second, the Neural Engine in M1 enables up to 15x faster machine learning performance. In fact, the entire M1 chip is designed to excel at machine learning, with ML accelerators in the CPU and a powerful GPU, so tasks like video analysis, voice recognition, and image processing will have a level of performance never seen before on the Mac.” —Apple, November 10, 2020

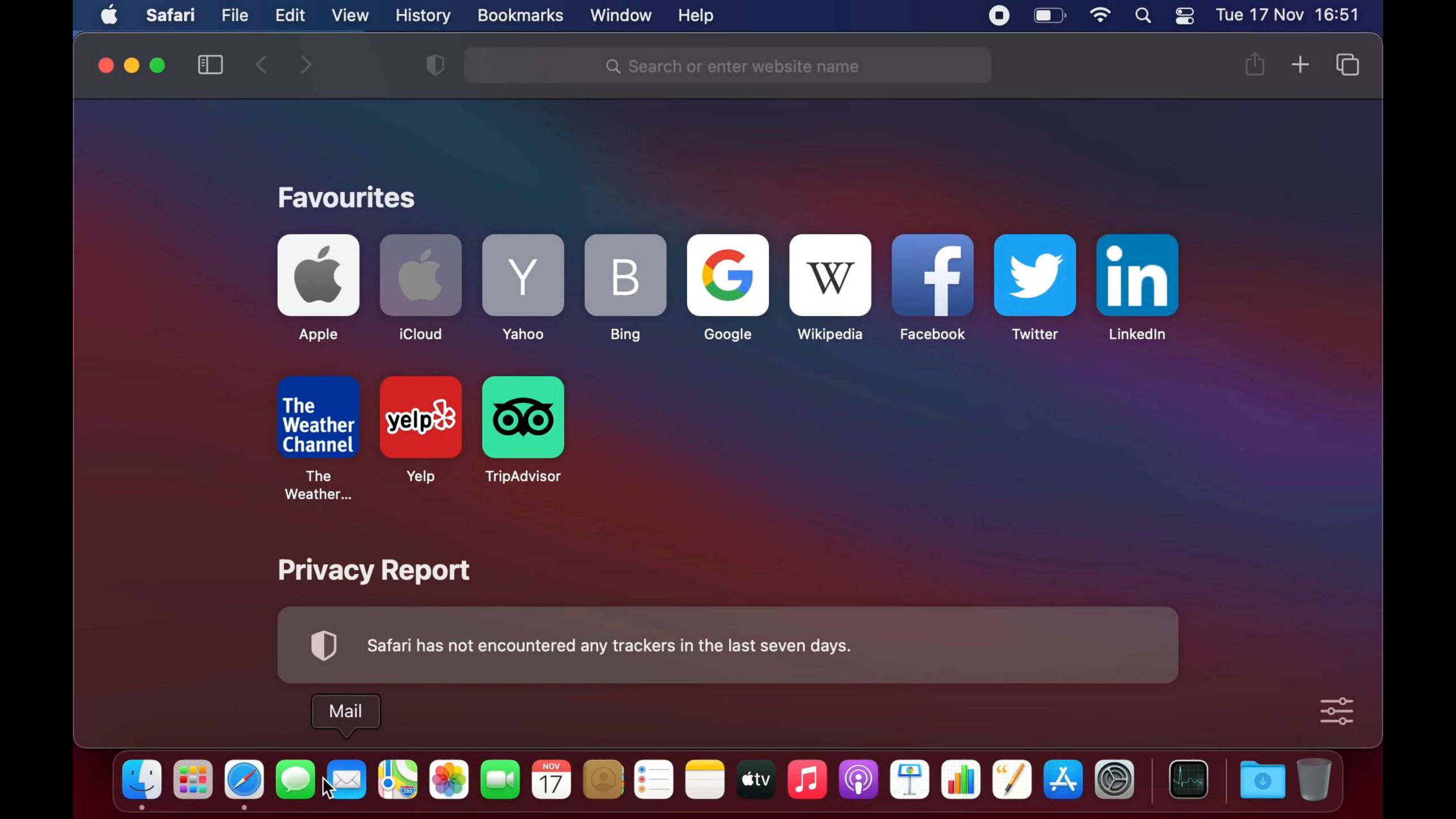
What does the Neural Engine do?

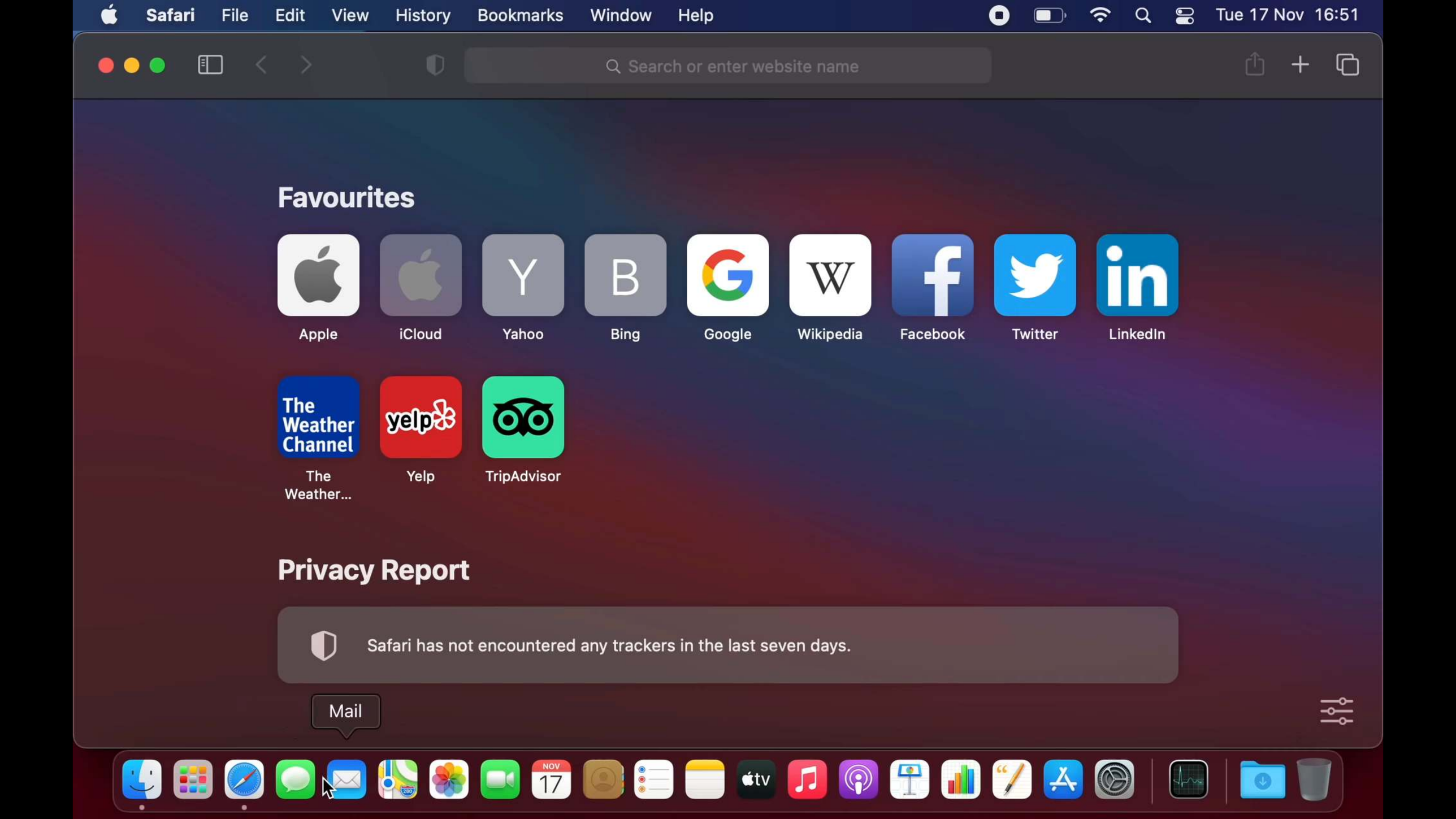
“Final Cut Pro can intelligently frame a clip in a fraction of the time. Pixelmator Pro can magically increase sharpness and detail at incredible speeds.” —Apple

The Neural Engine can be used for: video analysis • voice & facial recognition • artificial intelligence • *computational photography* • recognizing objects in photos • identifying purposes of words in sentences for dictation • create captions on the fly for videos • *Night mode* to capture photos in low-light environments • augmented reality • *deep fusion*: snap a picture & the best pixels from 8 bursts are combined into 1 image • sleep tracking • translation • identify background sounds • handwriting recognition • *palm rejection* for Apple Pencil • virtual assistant response voices

Faster than 98%
of PC laptops

Let’s see what happens when you try to open 18 default apps on an M1 MacBook Air…


Safari File Edit View History Bookmarks Window Help
Tue 17 Nov 16:51
Search or enter website name
Favourites
Apple
iCloud
Yahoo
Bing
Google
Wikipedia
Facebook
Twitter
LinkedIn
The Weather...
Yelp
TripAdvisor
Privacy Report
Safari has not encountered any trackers in the last seven days.
Mail


Safari File Edit View History Bookmarks Window Help
Tue 17 Nov 16:51
Search or enter website name
Favourites
Apple
iCloud
Yahoo
Bing
Google
Wikipedia
Facebook
Twitter
LinkedIn
The Weather...
Yelp
TripAdvisor
Privacy Report
Safari has not encountered any trackers in the last seven days.
Mail

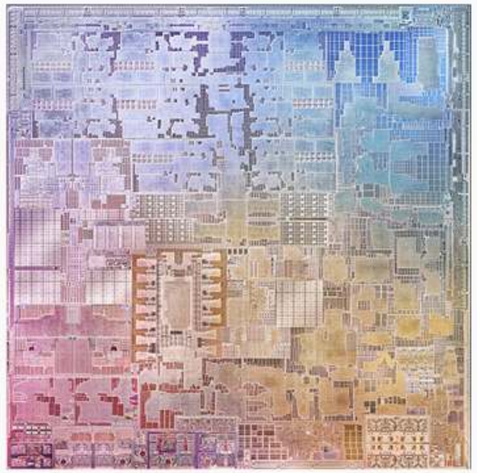
Battery life is outstanding

M1 MacBook Pro 13"
17 hours wireless web browsing
20 hours movie playback

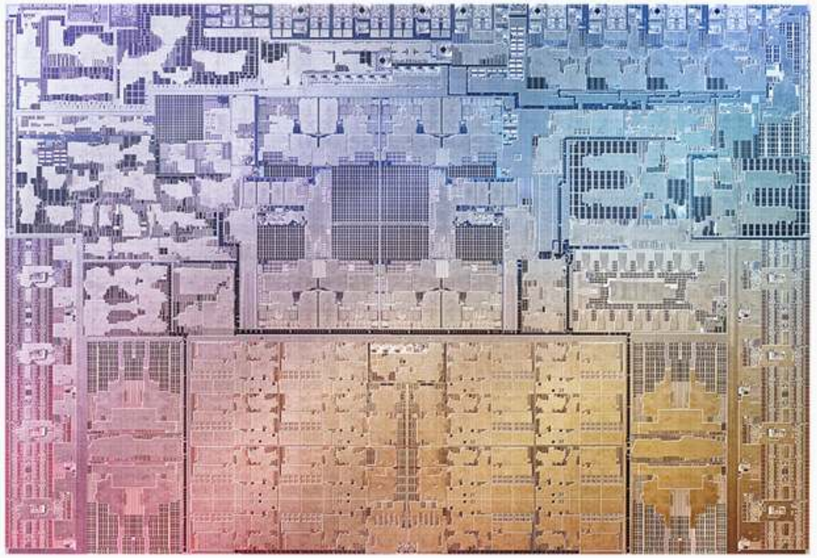
M1 MacBook Air
15 hours wireless web browsing
18 hours movie playback

M1
PRO

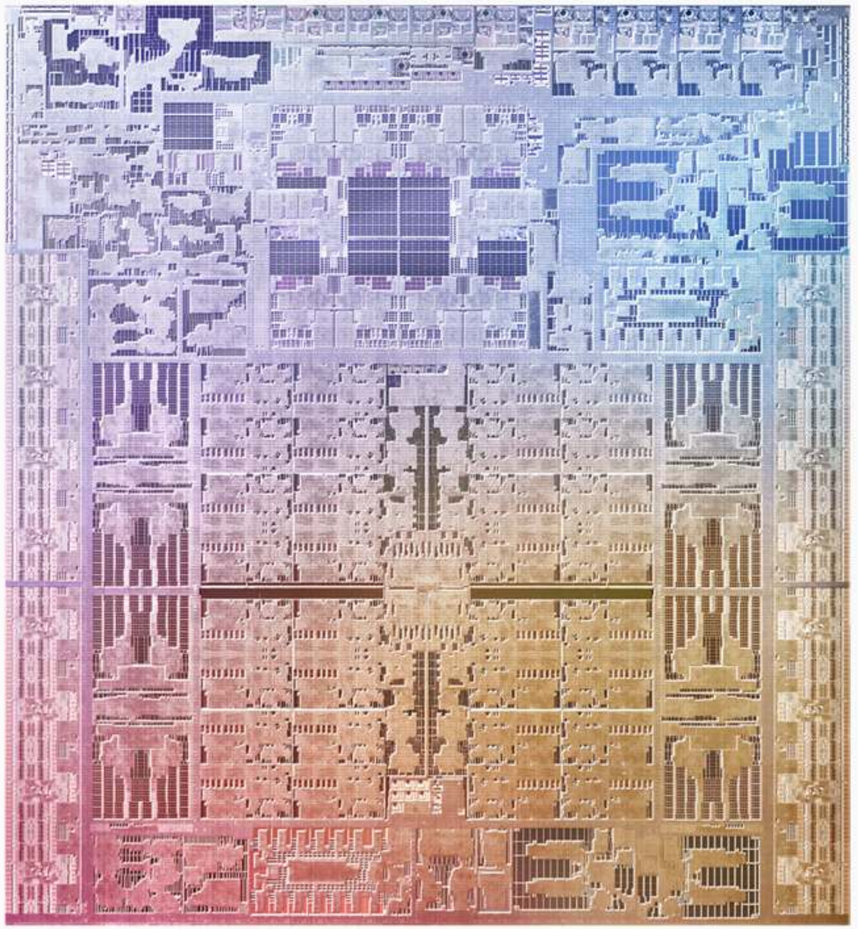
M1
MAX



M1



M1 Pro



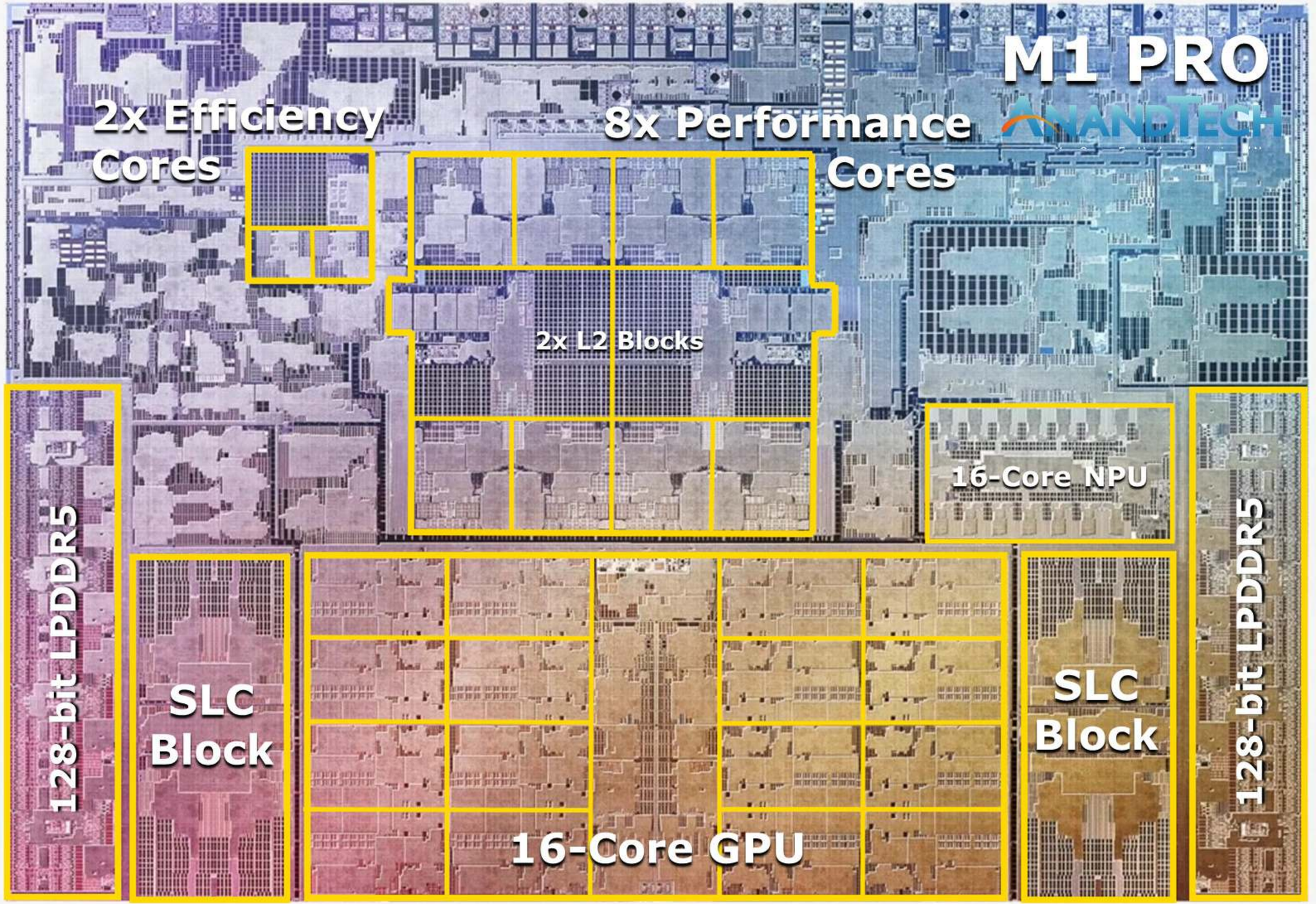
M1 Max

CL4 NZNM DB71 CLZLM

Z58NNCTJGK 19 VDAKJ

CL4 NZNM DB71 CLZLM

Z58NNCTJGK 19 VDAKJ


M1 PRO
ANANDTECH
2x Efficiency Cores
8x Performance Cores
2x L2 Blocks
16-Core NPU
128-bit LPDDR5
SLC Block
16-Core GPU
SLC Block
128-bit LPDDR5

ProRes

encode and decode

Thunderbolt 4

Secure Enclave

Support for two external displays

Up to

32GB

Unified memory

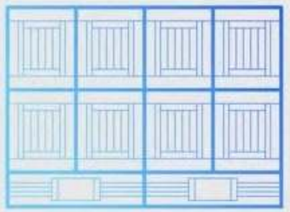
33.7 billion

Transistors

16-core

Neural Engine

11 trillion operations per second



Up to

10-core

CPU

Up to

16-core

GPU

Industry-leading performance per watt

5 nm process

200GB/s

Memory bandwidth

SM1SRCB ZM87 KMEIGL

T13NNPCRNV10 MJMCL

SM1SRCB ZM87 KMEIGL

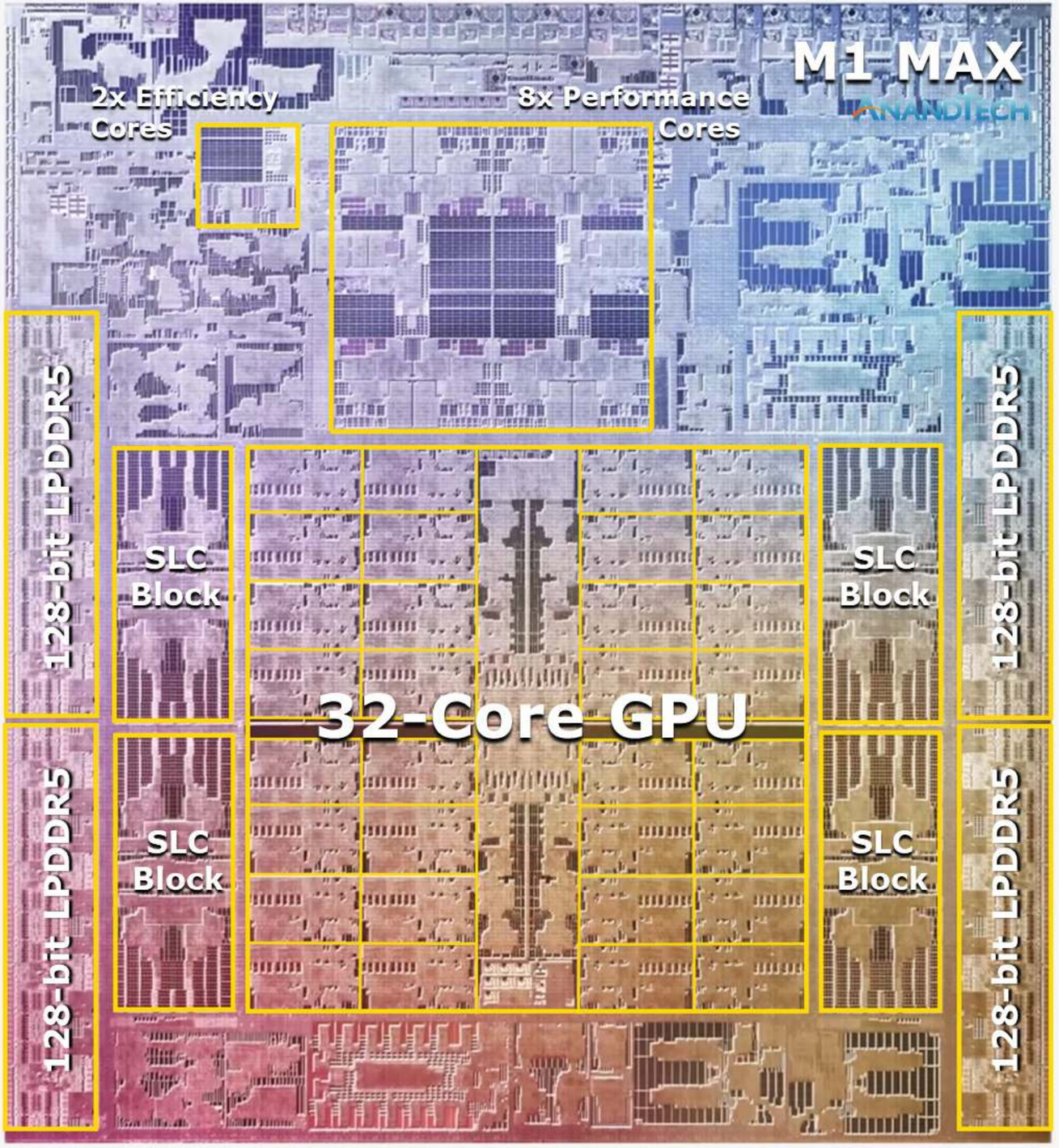
T13NNPCRNV10 MJMCL

SM1SRCB ZM87 KMEIGL

T13NNPCRNV10 MJMCL

SM1SRCB ZM87 KMEIGL

T13NNPCRNV10 MJMCL


M1 MAX
ANANDTECH
2x Efficiency Cores
8x Performance Cores
128-bit LPDDR5
128-bit LPDDR5
SLC Block
SLC Block
32-Core GPU
SLC Block
SLC Block
128-bit LPDDR5
128-bit LPDDR5

ProRes

encode and decode

Thunderbolt 4

Secure Enclave

Support for four external displays

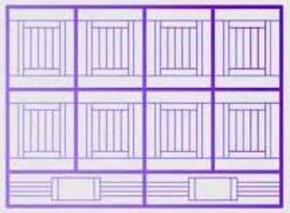
Up to

64GB

Unified memory

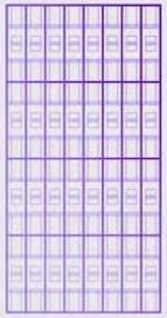
57 billion

Transistors



10-core

CPU



Up to

32-core

GPU

16-core

Neural Engine

11 trillion operations per second

Industry-leading performance per watt

5 nm process

400GB/s

Memory bandwidth

Johny Srouji, Senior Vice President, Hardware Technologies

Reviewers

“The M1 chips make laptops as powerful as some of the fastest desktops on the market yet so efficient that their battery life beats that of just about any other laptop. …

The result is something like the difference between a muscle car and a Tesla. The muscle car achieves high speeds with a huge engine that burns a lot of gasoline. The Tesla can hit even higher speeds while consuming less power because its electric motor is inherently more efficient than a gas engine. For years, Intel was making muscle cars; Apple’s big innovation was to build the Tesla of computer chips.” —Farhad Manjoo, *The New York Times*

“I’ll just cut to the chase — for content creation and creative work*, these are the most powerful laptops we’ve ever seen.” —Monica Chin, The Verge

* But not really for gaming, as she makes clear

“But … when I tell you these laptops are next level, I mean that because the real world performance and the real world capabilities of these laptops is dramatically better than they have any business doing. … I haven’t been able to say something’s truly next level in a really long time, but these are. It’s one of my favorite products of the year, to be honest.” —Marques Brownlee

“We expected large performance jumps, but we didn’t expect the [*sic*] some of the monstrous increases that the new chips are able to achieve. … [T]he M1 Pro & Max … achieve performance figures that simply weren’t even considered possible in a laptop chip. The chips here aren’t only able to outclass any competitor laptop design, but also competes against the best desktop systems out there, you’d have to bring out server-class hardware to get ahead of the M1 Max — it’s just generally absurd. (con't.)

“What’s clearer, is that the new GPU does allow immense leaps in performance for content creation and productivity workloads which rely on GPU acceleration. … The combination of raw performance, unique acceleration, as well as sheer power efficiency, is something that you just cannot find in any other platform right now, likely making the new MacBook Pro’s not just the best laptops, but outright the very best devices for the task.” —AnandTech

“The 16-inch MacBook Pro with the M1 Pro is the longest lasting laptop I’ve ever tested in my career as a hardware reviewer, like period. I got 16 hours of continuous use with the 16-inch M1 Pro model. I was jumping between a dozen-ish Chrome tabs, using a couple apps like Slack and Spotify, and often running Zoom calls and YouTube videos over that and I have never seen a laptop last this long.” —Monica Chin, The Verge

Developers

YETI

YETI

Staff Software Engineer at Twitter

Staff Engineer at Reddit; compared to 2019 i9 32GB MBP

Mahyar McDonald
@mahyarm8
All active iOS Engineers at Uber are getting upgraded to 16" M1 Max MacBook Pros with 64GB of RAM, which includes new hires! Looking forward to a faster machine.
2:39 PM · Nov 1, 2021 · Twitter Web App
78 Retweets
39 Quote Tweets
805 Likes

Uber

Development Manager at Shopify

CEO of Shopify

MacBook Air

Apple still has to release an M1 Mac Pro

(Supposedly) based on M1 Max, but with 2 dies instead of 1

$$$

Options

M1 Pro (10-core CPU & 16-core GPU) or
M1 Max (10-core CPU & 24- or 32-core GPU)

16, 32, or 64GB unified memory

1, 2, 4, or 8TB SSD storage

8-Core M1 Pro CPU

14-Core GPU

16GB Unified Memory

512GB SSD Storage

14" Liquid Retina XDR display

3 Thunderbolt 4 ports, HDMI port, SDXC card slot, MagSafe 3 port

$1,999

10-Core M1 Pro CPU

16-Core GPU

16GB Unified Memory

1TB SSD Storage

14" Liquid Retina XDR display

3 Thunderbolt 4 ports, HDMI port, SDXC card slot, MagSafe 3 port

$2,499

10-Core M1 Pro CPU	10-Core M1 Pro CPU	10-Core M1 Max CPU
16-Core GPU	16-Core GPU	32-Core GPU
16GB Unified Memory	16GB Unified Memory	32GB Unified Memory
512GB SSD Storage	1TB SSD Storage	1TB SSD Storage
16" Liquid Retina XDR display	16" Liquid Retina XDR display	16" Liquid Retina XDR display
3 Thunderbolt 4 ports, HDMI port, SDXC card slot, MagSafe 3 port	3 Thunderbolt 4 ports, HDMI port, SDXC card slot, MagSafe 3 port	3 Thunderbolt 4 ports, HDMI port, SDXC card slot, MagSafe 3 port
$2,499	$2,699	$3,499

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Oct 18, 2021

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Oct 18, 2021

Thank you!

scott@granneman.com
granneman.com
@scottgranneman@mastodon.social

Getting More From Your Mac

History

R. Scott Granneman & Jans Carton

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Changelog

2025-07-09 2.6: Updated info re: Sequoia & Tahoe; updated theme to Granneman 1.14; minor fixes & corrections

Changelog

2023-10-06 2.5: Updated name of new macOS to Sonoma; added image comparing modern macOS app icon to original Macintosh screen resolution; added visionOS to list

2022-07-22 2.4: Added info re Tech Specs

2022-03-08 2.3: Added new sections on *Apple's CPU History*, *M1*, & *M1 Pro & M1 Max*

Changelog

2021-06-07 2.2: Updated name of new macOS 12 Monterey

2021-06-05 2.1: Fixed minor formatting errors

2021-03-31 2.0: Created presentation using slides from the original Getting More From Your Mac & Granneman 1.7

Changelog

2021-03-23 1.8: Added how to copy & move files in Finder with key commands; added *Installing Software* section

2020-06-23 1.7: Added section *Get Info, Get Summary Info, & Show Inspector*; add info re: macOS 11 Big Sur; added slide listing all Apple operating systems

2019-08-16 1.6: Added Catalina for 10.15; added note that --- is not an em dash

Changelog

2017-09-20 1.5: Combined naming charts in *History*; fixed minor formatting issues; added Thank You, Scott (⌘⇧/) to *Basic Key Commands*; added Terminal commands for disclosure buttons; added Show the Finder location of a file from a dialog box; added screenshot of Finder sidebar; added command for QuickLook slideshow; added Special Info in Finder; updated Mac prices for 2019; fixed QuickLook slides

Changelog

2018-08-19 1.4: Added *File Info & Actions* section under Finder with Contextual Menus, Get Info, & Inspector; added HoudahSpot under Spotlight; added commands to open all disclosure boxes & Show Details for printing; added *File Management* section with New Folder with Selection; applied Granneman 1.4 theme; fixed minor formatting issues; added Sidebar under Components; more info on built-in security; added ⌘^D in addition to triple-click for data detectors

Changelog

2017-09-06 1.3: Fixed formatting; in *History* & added High Sierra; in *Key Commands*, added Alfred for clipboard; added slides re: holding down ⌥ in *Open & Save*; made deleting clearer in *Movement*; added slide about drop shadows in screenshots; added huge amount about Path Finder; added slides re: Finder renaming files; added lots of examples of Spotlight searches (RIP David Bowie); added New File Menu; added `duration:`, `date:`, & much more to Spotlight

Changelog

2016-10-11 1.2: Changed Lazy is Good image; spread Automation throughout the deck; renamed *Things You're Not Doing Right* to *Finder* & added lots more; added *Spotlight* section; changed *menulets* to *status menus*; added *Quick Look*

2016-10-07 1.1: Changed theme; fixed formatting; added & changed a lot; new stuff on Finder, Printing, Key Commands, System Preferences, Tabs; added *Computer Rules* section; lots of fixes

2016-03-13 1.0: First version

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Questions? Email scott@granneman.com