



Importance of New Apple Computers

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Rapidly Changing Scene

- Some information will have changed within the past few days and even hours
- Expect new developments over the next several months

A Short Prologue: Computer Systems I've Worked On

- Alpha Microsystems* (late 1970s → 1990s)
- Various Unix systems (1980s → 2000s)
- Microsoft Windows (~1985 → 2013)
- Apple Computers (~1986 → 2020)



↑
Active
hypertext
links






* Major similarities to DEC PDP/11

Not me in disguise!

No emotional attachment
to any computer system




Short History of Apple CPUs

- 1976 Apple I & II; MOS 6502 
- 1977 Apple III; Synertek 6502B  
- 1985 Macintosh; Motorola 68000 
 - ✓ 68020, 68030 and 68030
- 1994 Macintosh; PowerPC 601 
 - ✓ 603, 604, G3, G4 and G5

History of Apple Hardware (CPUs)

(cont.)

- 2006 Macintosh; Intel x86 
 - ✓ Yonah, Core Penryn, Nehalem, Westmere, Sandy Bridge, Ivy Bridge, Haswell, Broadwell, Skylake, Kaby Lake, Coffee Lake, Ice Lake, Tiger Lake
 - ✓ 2009 Apple dropped support for PowerPC
- 2020 Mac Computers; Apple Silicon





Terminology

- “Apple Silicon” refers to Apple’s proprietary ARM-based hardware
- **Apple Silicon** aka “System* on a Chip” aka “SoC”
- “M1” name of the chip implementing Apple Silicon**

* Not silicon on a chip

** The M1 is a “superset” of the iPhone A14 chip

ARM vs. x86

- ARM uses RISC architecture (Reduced Instruction Set Computing)
 - ✓ Fugaku supercomputer (world's fastest computer) 
- x86 uses CISC architecture (Complex Instruction Set Computing)
 - ✓ Intel-based computers
- ARM focuses on energy efficiency
- x86 focuses on performance
- For more information see   



Project Catalyst*



- Announced June 3, 2019
- Objective: to merge iOS and Mac apps
- Clear signal iPhones and Macs would share a common architecture
 - ✓ x86 (Intel) would be replaced
- Would allow apps to be used interchangeably on all kinds of Apple devices

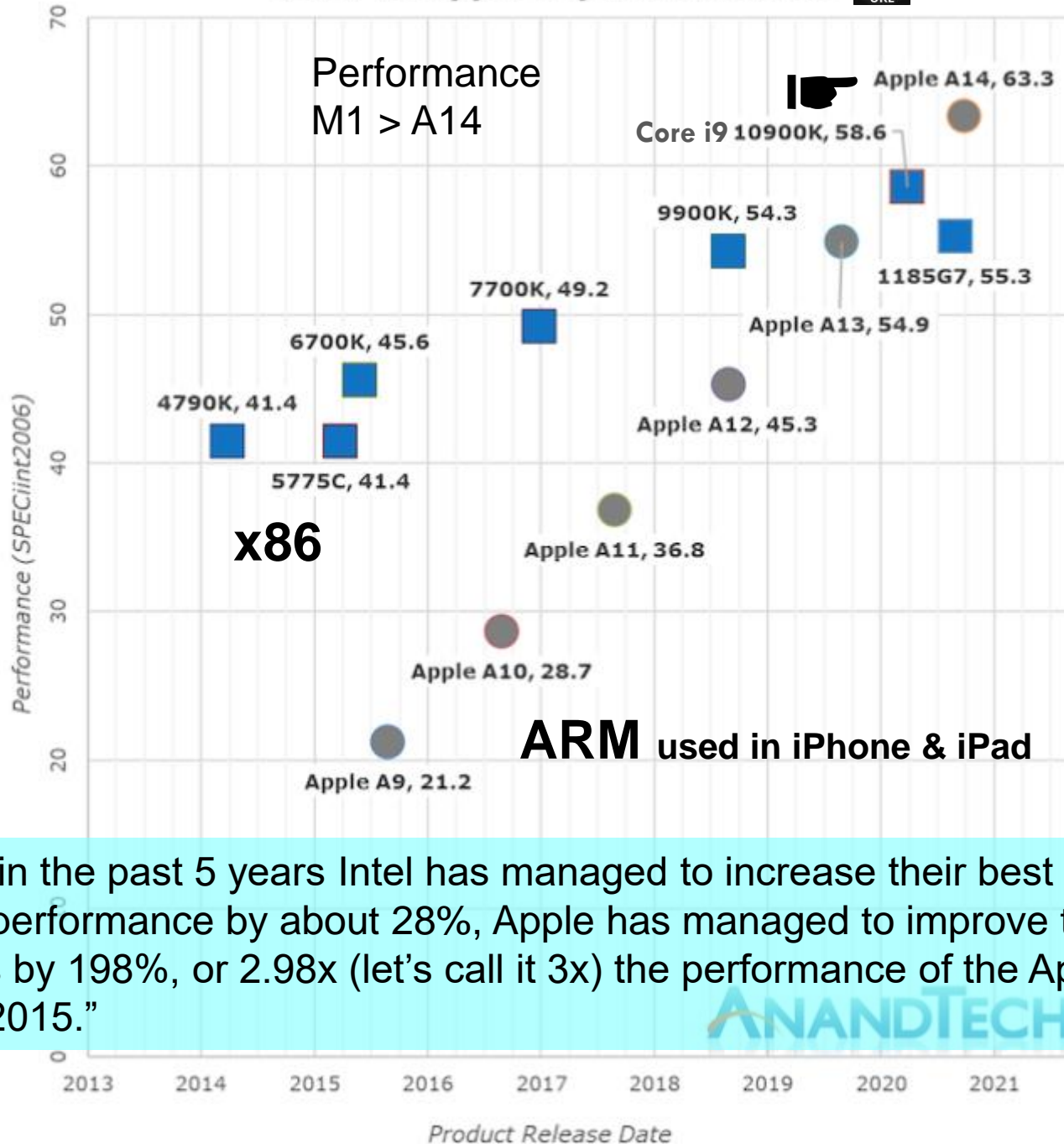
* Previously known as “Project Marzipan”

Worldwide Developers Conference (WWDC)

- June 22, 2020 Apple announced change from Intel to their own hardware 
- See  for the WWDC (1 hr 49 min video*)
- M1 chip is a follow-on to Apple's hardware for the iPhone, iPad and Watch
- Nov 10th Apple Silicon computers on sale
- Nov 13th Apple Silicon computers shipped

* Start at location 1 hr 26 min

Intel vs Apple Top Performance



“Whilst in the past 5 years Intel has managed to increase their best single-thread performance by about 28%, Apple has managed to improve their designs by 198%, or 2.98x (let’s call it 3x) the performance of the Apple A9 of late 2015.”



Intel 11th Gen Tiger Lake (10 nm)



**CPU
only**

Apple M1 (5 nm)



Advanced power management

High-efficiency CPU cores
4

High-performance CPU cores
4

Secure Enclave

Low-power video playback

Neural Engine
16 cores

High-bandwidth caches

Advanced display engine



High-performance GPU
7 or 8 cores

HDR imaging

Cryptography acceleration

HDR video processor

High-performance video editing

Gen 4 PCI Express

High-performance unified memory
8 or 16 GB

Always-on processor

Thunderbolt / USB 4 controller

Performance controller

Machine learning accelerators

High-quality image signal processor

Low-power design

High-performance NVMe storage

High-efficiency audio processor

Advanced silicon packaging




Enough M1 details

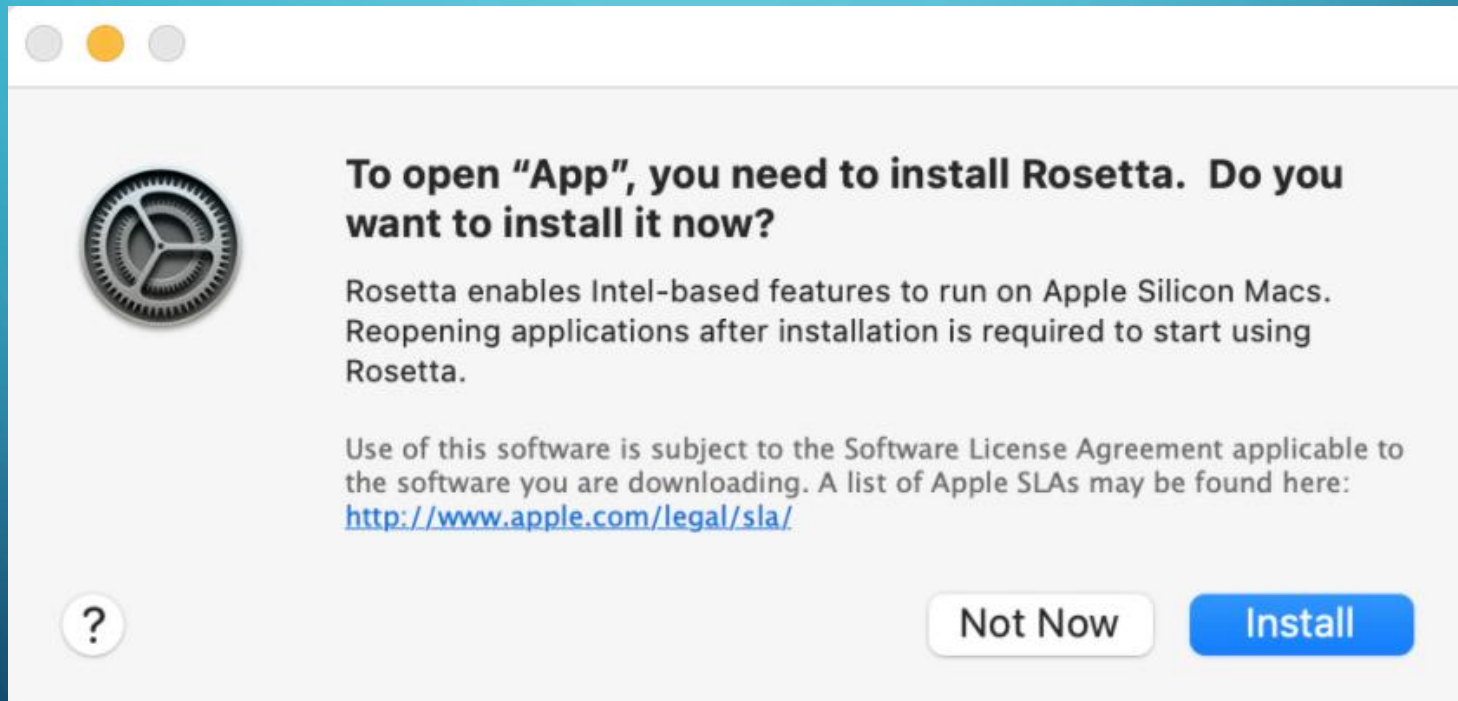
Rosetta 2*

- A translation app that allows users to run apps on Apple Silicon that contain x86 instructions (64-bit)
- Inevitably some apps will not translate well
- Translated Intel-based apps generally run slower than native apps
- 2006 Original Rosetta allowed PowerPC apps to run on Intel-based Macs
- Apple regards Rosetta 2 as a temporary solution

* Rosetta 2 is not a simulator or emulator; it translates x86 instructions to ARM instructions

Installing Rosetta 2

- You might be asked to install Rosetta 2 in order to open an x86 app 




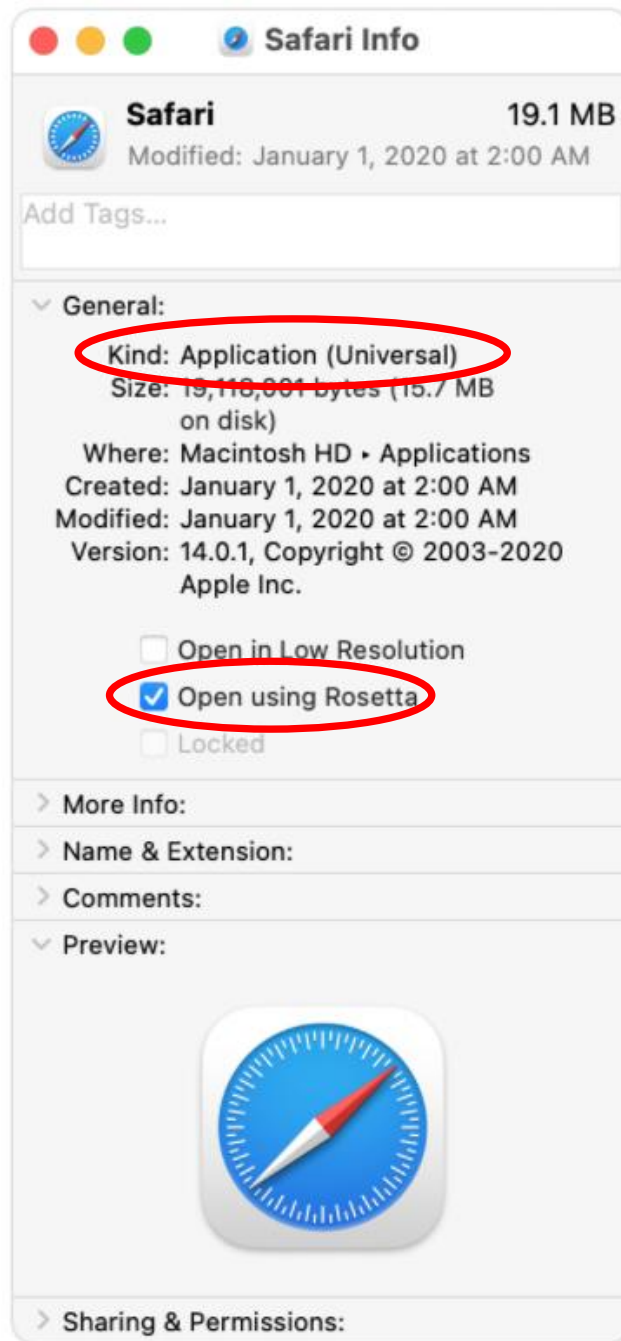
How Rosetta 2 Works

- If an app contains only Intel (x86) instructions...
 - ✓ macOS automatically launches Rosetta 2
 - ✓ when translation finishes the system launches the translated executable

Info Function

Left-click
[select] “Get Info”

How to tell which apps
are optimized for M1
Apple Silicon see 



Universal binary

Contains two versions
of compiled code

One version runs natively on
Apple Silicon



The other version runs natively
on Intel-based Macs

At runtime, the system
automatically chooses
which version to run

I'm enthralled...
Move on!



macOS **11**.0.1 (Big Sur)

- macOS 10: from 2001 to 2020
- macOS 11: released November 12, 2020
- Big Sur runs on Apple Silicon and Intel Macs
- Inevitably something won't work! (wait for 11.0.2)
- **CAUTION:** A number of MacBook Pro* owners are reporting the Big Sur update is bricking their machines 
- Presumably there a fix available, see 

* Late 2013 and mid 2014 models—other models?


macOS Big Sur 11.0.1 (cont.)

- There are reports of problems connecting with Bluetooth 
✓ And a suggested fix... 

macOS Big Sur 11.0.1 (cont.)

- Design refresh—Mac interface more like iPad and iPhone
- New Control Center
- Maps improvement
- Revamped Messages app
- Built-in language translator for Safari
- Is Big Sur a dramatic change? **Sort of...**

Microsoft 365 on Apple Silicon




- Currently runs natively on Intel Macs under macOS Big Sur*
- x86 version runs on Apple Silicon via Rosetta 2 
 - ✓ Takes ~20 seconds first time used and after each update for translation
 - ✓ Subsequently will run “without delay”... maybe
- Native Apple Silicon version expected early 2021

* Also as a beta native release for Apple Silicon


Adobe Products on Apple Silicon

- Photoshop for Apple Silicon Macs available November 17th (native version, beta test)
- Photoshop x86 via Rosetta 2—but not officially supported by Adobe
- Native versions for all (?) Adobe software on Apple Silicon coming in 2021

Running iOS Apps on Apple Silicon

- iPad and iPhone apps will run natively on Apple Silicon 
- Google and Facebook won't offer their iOS apps on Apple Silicon (maybe?) see 
- Some iOS apps won't work on Apple Silicon
- What is the impact of a missing touch screen on the M1 Macs?
- How to run any iOS app on Apple Silicon 

Which iOS Apps Run on Apple Silicon?

- See  for iOS apps that run on Apple Silicon (natively or translated via Rosetta 2)
- For example...



NATIVE M1 SUPPORT ✓ ROSETTA 2 ONLY ✗ NOT WORKING

ALL APPS DESIGN MUSIC WEB BROWSERS DEVELOPERS VIDEO PRODUCTION PHOTOS FINANCE PRODUC >







+ REQUEST AN APP

Application	Developer	Apple silicon optimized	Rosetta 2	M1 Supported version	Last update ↓
> Skype	Microsoft	✗	✓		November 25, 2020
Microsoft Remote Desktop	Microsoft	✗	✓	-	November 23, 2020
Microsoft teams	Microsoft	✗	✓	-	November 21, 2020
VSCode	Microsoft	⚠	✓	1.52.0-exploration+	November 19, 2020
Microsoft Edge	Microsoft	✗	✓	-	November 17, 2020
Office 2019	Microsoft	✓	✓	16.44.20111100 beta+	November 16, 2020
Office 365	Microsoft	✓	✓	16.44.20111100 beta+	November 16, 2020
OpenJDK	Microsoft	✓	✓	16-ea+10-macOS-aarch64	November 11, 2020
.NET	Microsoft	✗	✓	6.0+ soon	November 9, 2020

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- Fully compatible with Apple silicon (M1)
- Not working
- Initial support or Beta with issues/crashes reported

Microsoft Windows on Apple Silicon

- Boot Camp will not be available on Apple Silicon  
- Parallels virtualization doesn't work on Apple Silicon—expected in the future 
- Same with VMware's Fusion 
- Windows 10 sort of runs with QEMU virtualizer 
- What about Windows 10/ARM* on Apple Silicon? **It's up to Microsoft** 



* Microsoft runs Windows 10 on ARM on their Surface Pro X using their SQ1 and SQ2 CPUs co-developed with Qualcomm



Linux on Apple Silicon

- ARM based distros of Linux will not boot up natively on Apple Silicon 
- Not an issue for most users

Web Browsers on Apple Silicon


- Apple Safari—available
- Chrome—available 
- Firefox—available 
- Microsoft Edge—soon 
- Opera—probably soon

MacBook Air 
Power. It's in the Air.



Three New M1 Macs



MacBook Pro 13" 
All systems Pro.

Mac mini 
New guts. More glory.



Announced November 10th

MacBook Air

Apple M1 Chip with 8-Core CPU and 7-Core GPU
256GB Storage

Apple M1 chip with 8-core CPU, 7-core GPU, and 16-core Neural Engine

8GB unified memory (16GB available)

256GB SSD storage¹ (Up to 2 TB)

Retina display with True Tone

Magic Keyboard

Touch ID

Force Touch trackpad

Two Thunderbolt / USB 4 ports

\$999 → \$1,999

Prices dependent on amount of memory and size of SSD

Apple M1 Chip with 8-Core CPU and 8-Core GPU
512GB Storage

Apple M1 chip with 8-core CPU, 8-core GPU, and 16-core Neural Engine

8GB unified memory (16GB available)

512GB SSD storage¹ (Up to 2 TB)

Retina display with True Tone

Magic Keyboard


Touch ID

Force Touch trackpad

Two Thunderbolt / USB 4 ports

\$1,249 → \$2,049

Fanless

**CPU clock speed
might be reduced** 

MacBook Pro 13”

Apple M1 Chip with 8-Core CPU and 8-Core GPU

256GB Storage

Apple M1 chip with 8-core CPU, 8-core GPU, and 16-core Neural Engine

8GB unified memory (16GB available)

256GB SSD storage¹ (Up to 2 TB)

13-inch Retina display with True Tone

Magic Keyboard

Touch Bar and Touch ID

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\$1,299 → \$2,299

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Force Touch trackpad

Two Thunderbolt / USB 4 ports

\$1,499 → \$2,299

Prices dependent on amount of memory and size of SSD

Controversial Touch Bar in place of function keys

Mac mini

Apple M1 Chip with 8-Core CPU and 8-Core GPU 256GB Storage

Apple M1 chip with 8-core CPU, 8-core GPU, and 16-core Neural Engine

8GB unified memory (16GB available)

256GB SSD storage¹ (Up to 2 TB)

Gigabit Ethernet

\$699 → \$1,699

Apple M1 Chip with 8-Core CPU and 8-Core GPU 512GB Storage

Apple M1 chip with 8-core CPU, 8-core GPU, and 16-core Neural Engine

8GB unified memory (16GB available)

512GB SSD storage¹ (Up to 2 TB)

Gigabit Ethernet

\$899 → \$1,699

Prices dependent on amount of memory and size of SSD

It is also necessary to purchase a keyboard, mouse and monitor

Apple Computer Family






	13-inch MacBook Pro (M1)	Mac mini (Core i3, 2018)	Mac mini (Core i7, 2018)	15-inch MacBook Pro (Core i7, 2018)	15-inch MacBook Pro (Core i9, 2018)	16-inch MacBook Pro (Core i9, 2019)	Mac Pro (2019)
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Processor	Apple M1	Core i3	Core i7	Intel Core i7	Core i9	Core i9	Xeon W-3223
Cores	8	4	6	6	6	8	8
Clock Speed	3.2GHz	3.6GHz	3.2GHz	2.6GHz	2.9GHz	2.4GHz	3.5GHz
macOS version	11.0.1	11.0 Beta	11.0.1	10.15.7	11.0.1	10.15.7	11.0.1
Memory	16GB	8GB	8GB	32GB	32GB	32GB	384GB
Graphics	Apple M1 8-core	Intel UHD Graphics 630	Intel UHD Graphics 630	AMD Radeon Pro 560X 4GB, Intel UHD Graphics 630	AMD Radeon Pro 560X 4GB, Intel UHD Graphics 630	AMD Radeon Pro 5500M 8GB, Intel HD Graphics 630	AMD Radeon Pro 580X 8GB

Apple's Claims for M1 Computers

- “The world’s best CPU performance per watt”
- “The world’s fastest integrated graphics”
- “...world’s fastest CPU core in low-power silicon”
- “M1 is faster than the chips in 98 percent of PC laptops sold in the past year”
- “As a result, M1 delivers up to...”
 - ✓ “3.5x faster CPU performance”
 - ✓ “6x faster GPU”
 - ✓ “15x faster machine learning”
- “Blazing-fast, on-device machine learning”

Reviewers' Comments

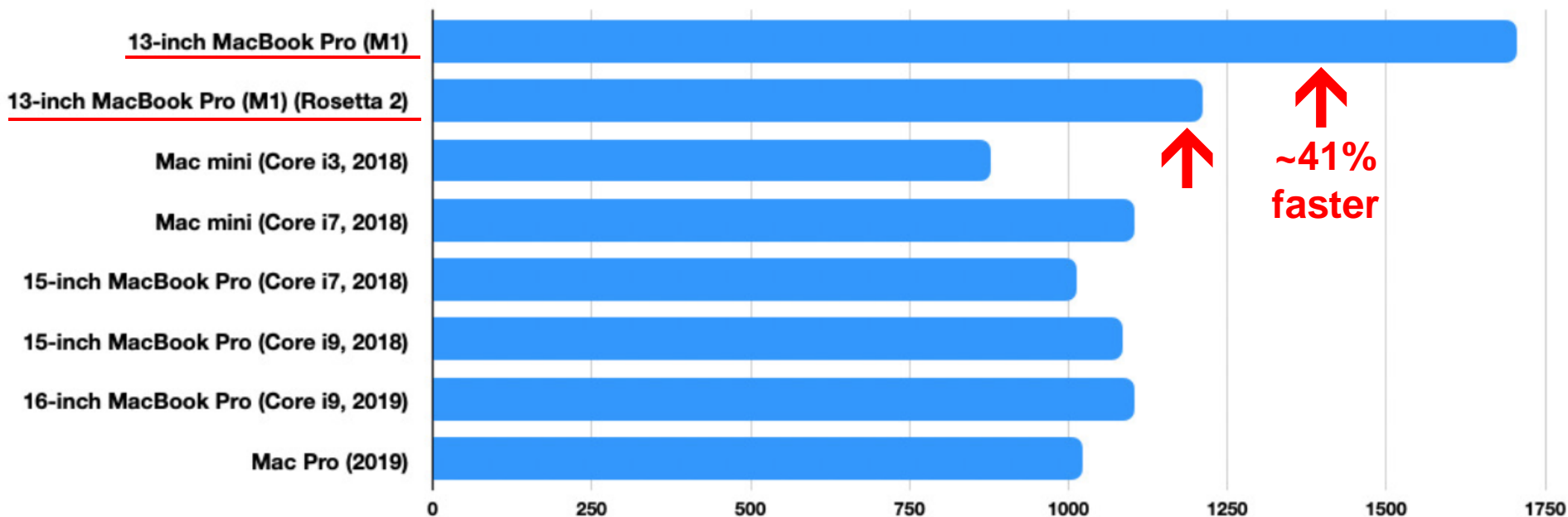
- “The new MacBook Air with Apple’s M1 chip is a triumph” 
- “M1 makes the Air (MacBook) sing” 
- “Apple’s M1 chip redefines what an ultraportable can be” 
- “Overall, Apple hit it out of the park with the M1” 
- “Apple MacBook Pro 13” M1 Review—why you might want to pass” 

Benchmark Tests

- Useful for comparing systems
- Indicative of performance, however...
- True performance—your applications running correctly and quickly
- **Uncertainty whether all the following benchmark software runs natively on Apple Silicon or via Rosetta 2**

Native vs. M1 MacBook Pro Translated via Rosetta 2

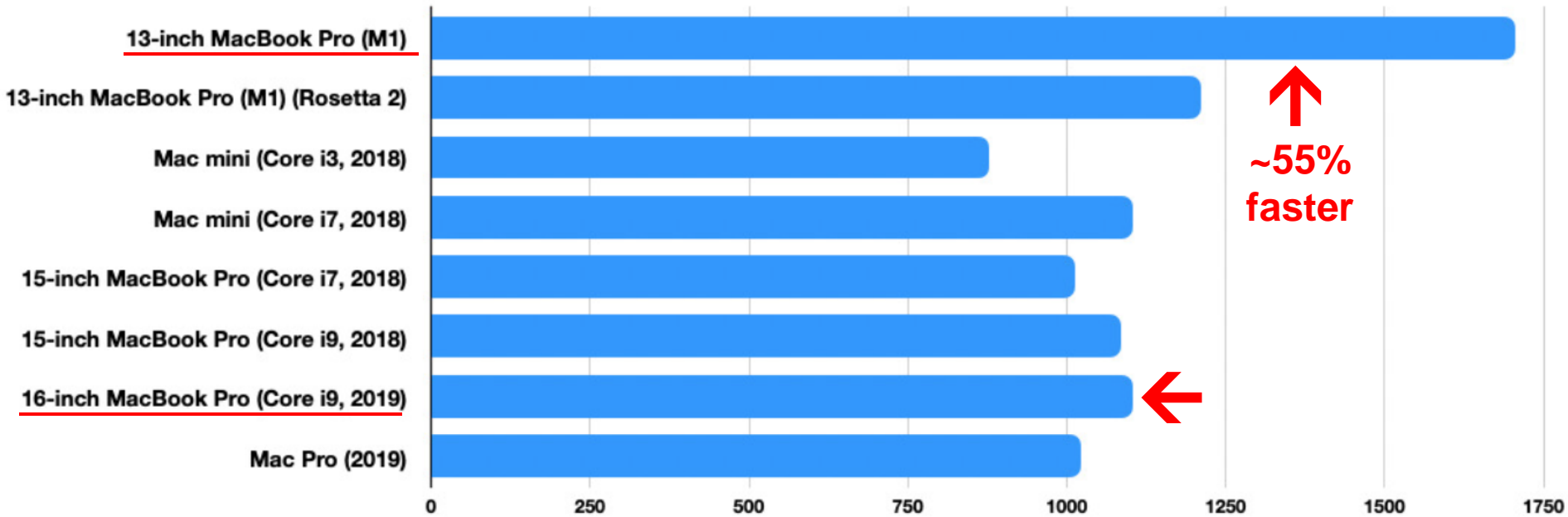
Geekbench Single-Core 
URL 



Geekbench is a cross-platform processor benchmark with a scoring system That separates single-core and multi-core performance and workloads that Simulate real-world scenarios. 
URL 

M1 MacBook Pro vs. Intel 16" MacBook Pro Apple Silicon vs. Intel

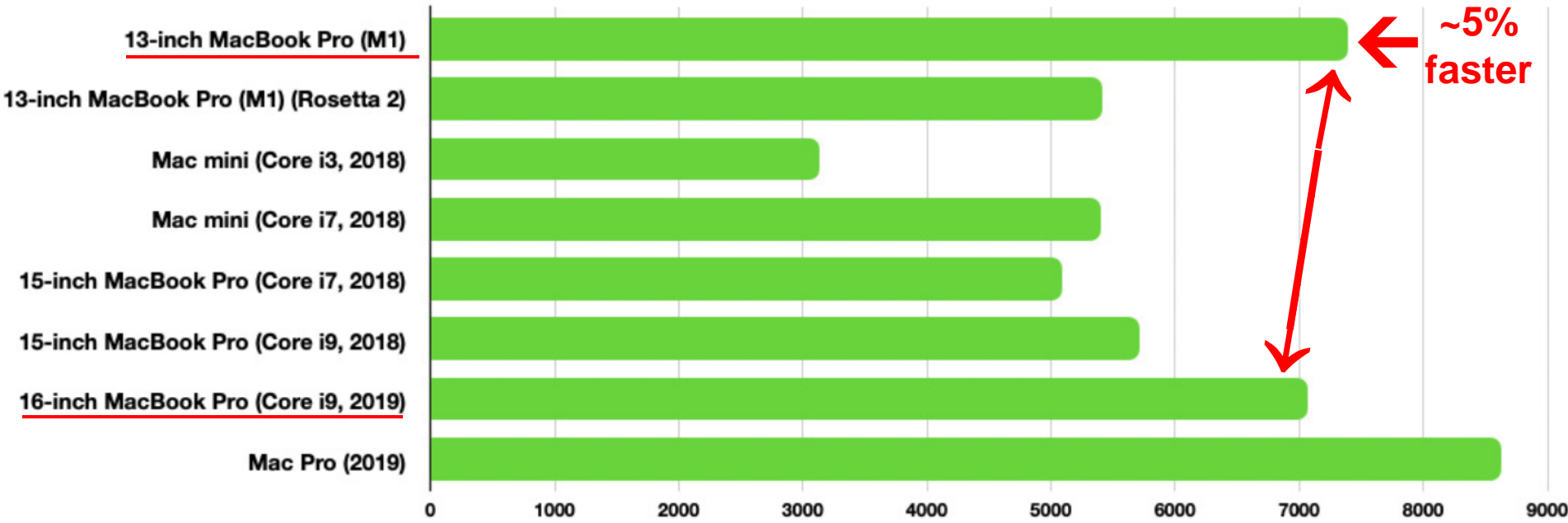
Geekbench Single-Core  [URL](#)



M1 MacBook Pro vs. Intel MacBook Pro 16"

Apple Silicon vs. Intel

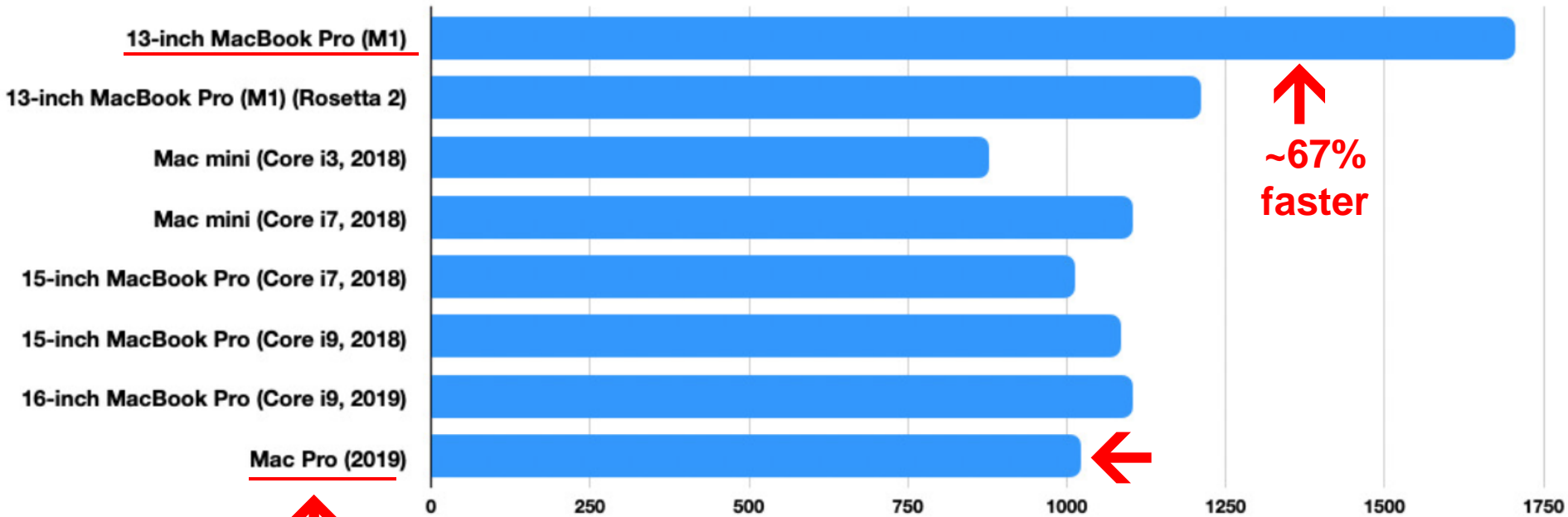
Geekbench Multi-Core 



M1 MacBook Pro vs. Intel Mac Pro

Apple Silicon vs. Intel

Geekbench Single-Core 



↑
~67%
faster



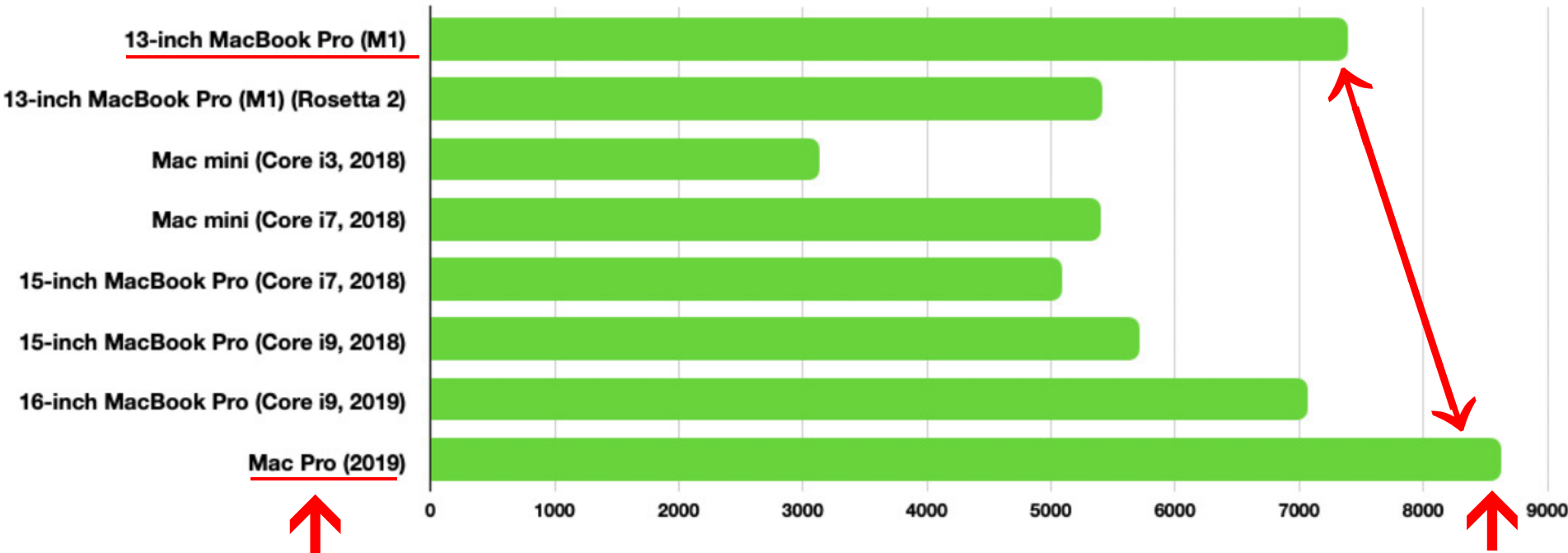
Xeon W-3223 8-core 3.5 GHz
AMD Radeon Pro 580X 8 GB GPU
384 GB RAM ~\$18,000

\$6,000 → \$54,000

M1 MacBook Pro vs. Intel Mac Pro

Apple Silicon vs. Intel

Geekbench Multi-Core 



Xeon W-3223 8-core 3.5 GHz
AMD Radeon Pro 580X 8 GB GPU
384 GB RAM ~\$18,000

\$6,000 → \$54,000

~16%
faster



Compared to Windows

Geekbench 5



Handbrake video transcoding

PugetBench Photoshop

Windows

M1 MacBook Air

5,962

9:15

653

M1 MacBook Pro SoC

5,925

7:44

649

Dell XPS 13 (Tiger Lake)

5,319

18:22

588

Asus ZenBook 13 (Tiger Lake)

5,084

17:51

743

Intel MacBook Air 2020

2,738

27:10

n/a

Intel MacBook Pro (13-inch, 2020)

4,399

12:43

569

Higher is better

Lower is better

Lower is better



Compared to Windows

Geekbench 5

Handbrake video transcoding



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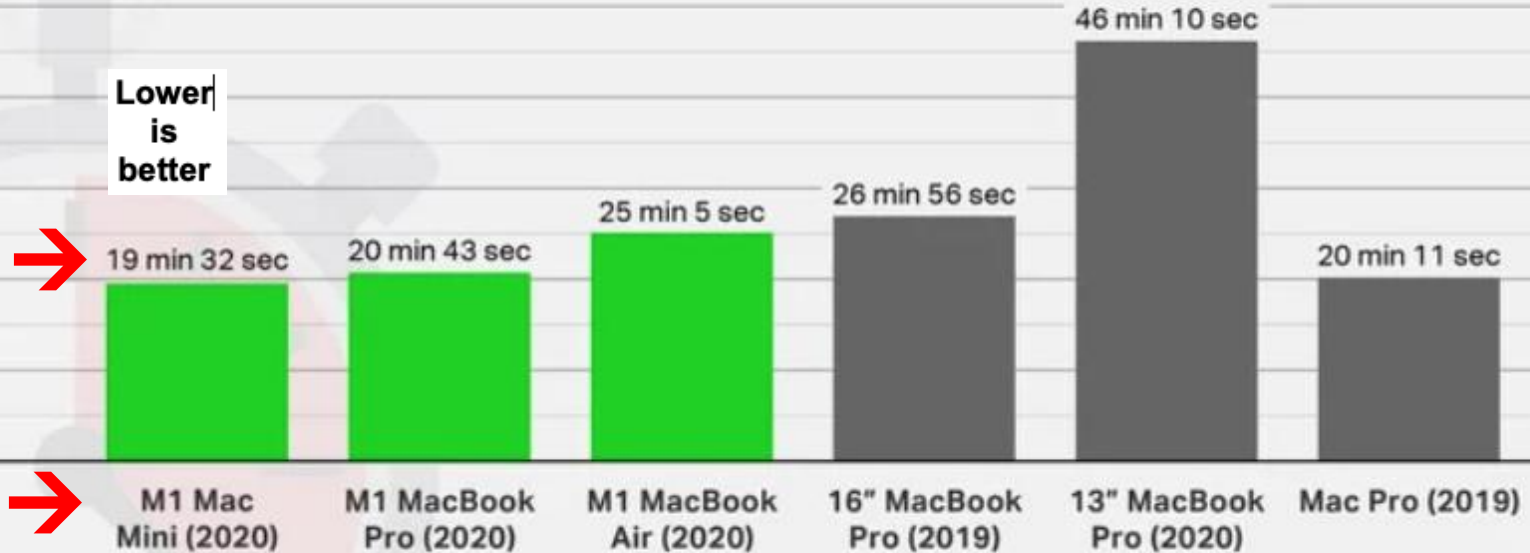
Lower is better

Lower is better

WebKit compile time



Comparing Apple Silicon and Intel Mac Computers



Apple Silicon—M1



Apple/Intel



Photoshop—Stress Tests^a

- M1^b 13” MacBook Pro
- 8 GB RAM
- 256 GB SSD
- 8 Core GPU
- \$1,300



VS.

- 16” MacBook Pro
- 64 GB RAM
- 1 TB SSD
- AMD Radeon Pro 5500 GPU
- Core i9 2.4-5.0 GHz CPU
- \$4,000

^a Large files and operations requiring extensive CPU & GPU operations

^b Apple Silicon


Photoshop Tests—Native Apple Silicon vs. Intel

Test	M1—SoC (Rosetta 2) ^a	M1—SoC (Native) ^a	Intel Core i9 ^a
1	22	14 	15
2	69	43 	103
3	36	25	15
4	68	49	12
5	229	329	98
6	71	55	41

^a Time in seconds; lower is better

Photoshop Tests—Native Apple Silicon vs. Rosetta 2



Test	M1—SoC (Rosetta 2) ^a	M1—SoC (Native) ^a	Intel Core i9 ^a
1	22	14	15
2	69	43	103
3	36	25	15
4	68	49	12
5	Surprise! 229 	329	98
6	71	55	41

^a Time in seconds; lower is better

Conclusions—Photoshop on Apple Silicon

- For most people, the least powerful Apple Silicon MacBooks are adequate for light to moderate use of Photoshop
- Photoshop on future higher-end Apple Silicon MacBooks will perform better
- Photoshop on Apple Silicon iMacs likely to be exceptionally fast



Numbers!
Numbers!
Numbers!
Enough!

Battery Life

- The time until charging is needed, not how many years the battery will last
- Current Apple Intel MacBooks—10 hours
- For M1 laptops Apple claims...
 - ✓ MacBook Air—18 hours running video
 - ✓ MacBook Pro 13"—20 hours running video

Battery Life

WebKit Compile Battery Remaining



Remaining Battery Capacity After Compilations (Intel vs. Apple Silicon)

{ Intel

M1 MacBook Pro (2020)

91.00%

16" MacBook Pro (2019)

61.00%

13" MacBook Pro 2.3GHz i7/32GB (2020)

24.00%

M1 MacBook Air (2020)

91.00%

0.00%

25.00%

50.00%


75.00%



Higher is better



Conclusions About M1 Laptops

- Current Apple Silicon Macs are the lowest level (least powerful) Apple Silicon computers
- Consumer grade computers—not professional grade 
- Nevertheless, they are remarkably powerful
- *More powerful computers are coming in 2021 and 2022*

Conclusions About M1 Laptops (cont.)

- The MacBook Air is more than adequate for most people doing...
 - ✓ E-mail, calendar, contacts, etc.
 - ✓ Document preparation
 - ✓ Surfing the Web
- M1 MacBook Pro 13-inch would be a better choice for CPU/GPU intensive programs—only light to moderate duty

Criticisms of the M1 Laptops



- “Same old shell wrapped around some new guts”
- No touch screen or pen support
- Limited choice of RAM (8 or 16 GB)
- Only two Thunderbolt USB 4 ports
- Thermal CPU throttling on MacBook Air
- No face ID*
- Boot Camp no longer supported**

* Has touch ID

** Parallels, VMware, etc. will probably run in the future and perhaps an ARM version of Microsoft Windows

Questions

- How long will Apple support Intel x86 systems?
- What about drivers for 3rd party hardware (printers, scanners, keyboards, mice, etc.)?
- Will anti-malware software be available?
 - ✓ Running via Rosetta 2 translation? (problematic)
 - ✓ Running natively on Apple Silicon?
- Will VPN software be available?

Questions (cont.)

- Will Microsoft develop an SoC like Apple's architecture in its approach to ARM*?
- What will Intel**, AMD and Nvidia do in response to Apple Silicon?
- Does the SoC architecture lend itself to the server market? Intel has ~94% of the market

* Windows RT from 2012 was an ARM implementation
The current Surface Pro X runs with an ARM CPU

** Intel welcomes AMD and ARM competition (Greg Bryant, Intel CEO)



Thoughts on Buying an Intel Based Mac

- Continued Apple Intel support uncertain
- Performance of Apple Silicon Macs likely to be considerably superior to Intel machines
- If you must buy an Intel Mac, buy a used machine to minimize depreciation
 - ✓ Residual value of Intel Macs is likely to decline at an unusually fast rate

When to Buy an Apple Silicon Mac



- Unless your Mac has died, wait 4-6 months
- If new to Apple computers, wait...
- Be sure your essential apps run on Apple Silicon
- If your essential apps run via Rosetta 2 translation, check reviews for performance
- If your apps require CPU/GPU intensive processing wait for the Apple Silicon iMacs
- Probably none of us will need the Apple Silicon Mac Pro

Two Appropriate “Yogisms”





- “It’s tough to make predictions, especially about the future!”
- “The future ain’t what is used to be!”

* Uttered by that great philosopher Yogi Berra

My Prognostications (keep Yogi in mind!)

- Apple's introduction of Apple Silicon Macs will have a profound impact on computer industry
- Few individual users are likely to switch from Windows computers to Apple Silicon
 - ✓ Most individuals find switching difficult and painful
 - ✓ Several other factors...

Additional References

- Apple Silicon/M1: 
- Apple Air M1: 
- Apple Pro 13-inch M1: 
- Apple Mini M1: 

The End

A large black and white spotted dog, possibly a Great Dane, is standing and looking down at a small, light-colored puppy sitting on the ground. The dog has a black collar with a buckle. The puppy is looking up at the dog.

All done!

Finished?