All About Apple ARM

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Embarcadero Technologies

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Slides, replay, and more:
blogs.embarcadero.com/all-about-apple-arm-on- the-desktop

Agenda

- Intro to Arm & Apple Silicon
- Comparison with x86
- Running iOS Apps under MacOS
- Using the new Simulator
- Installing and using Windows 11 ARM
- Installed and using Linux **x86** 64-bit
- Deploying to M1 Powered iPad Air
- Demonstrations with Q&A

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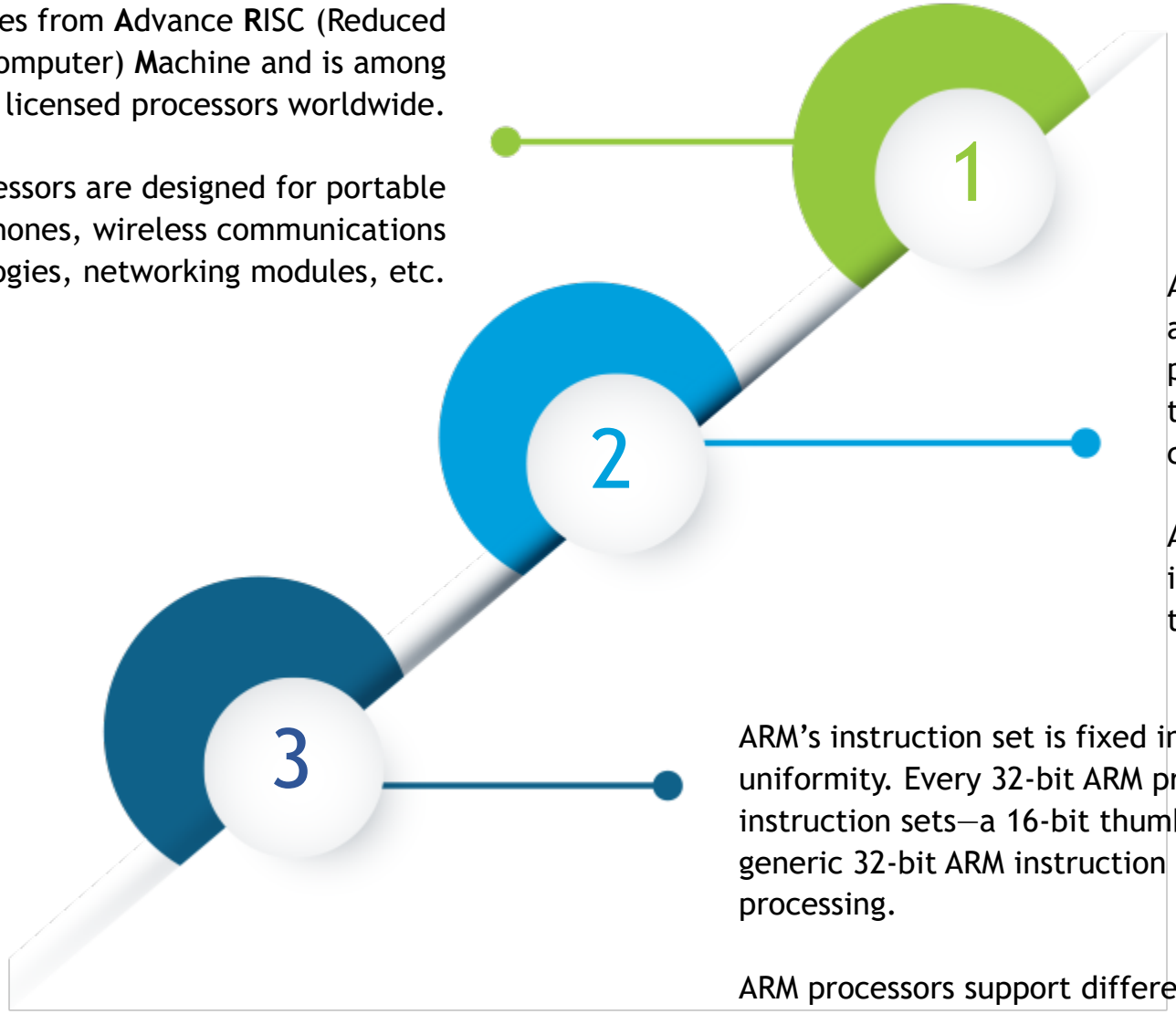
Introduction to ARM

ARM is comes from **A**dvance **R**ISC (Reduced Instruction Set Computer) **M**achine and is among the most licensed processors worldwide.

These processors are designed for portable devices—smartphones, wireless communications technologies, networking modules, etc.



ARM processors are built on a load-and-store type architecture. According to this architecture, data processing is executed only on the data present in the registers and not directly on the memory contents.

As a result, these processors follow data processing instructions that differ from those used for accessing the memory.

ARM's instruction set is fixed in length and follows uniformity. Every 32-bit ARM processor will have instruction sets—a 16-bit thumb instruction set, generic 32-bit ARM instruction set and supports 64bit processing.

ARM processors support different stages of pipelines to accelerate the instructional flow.

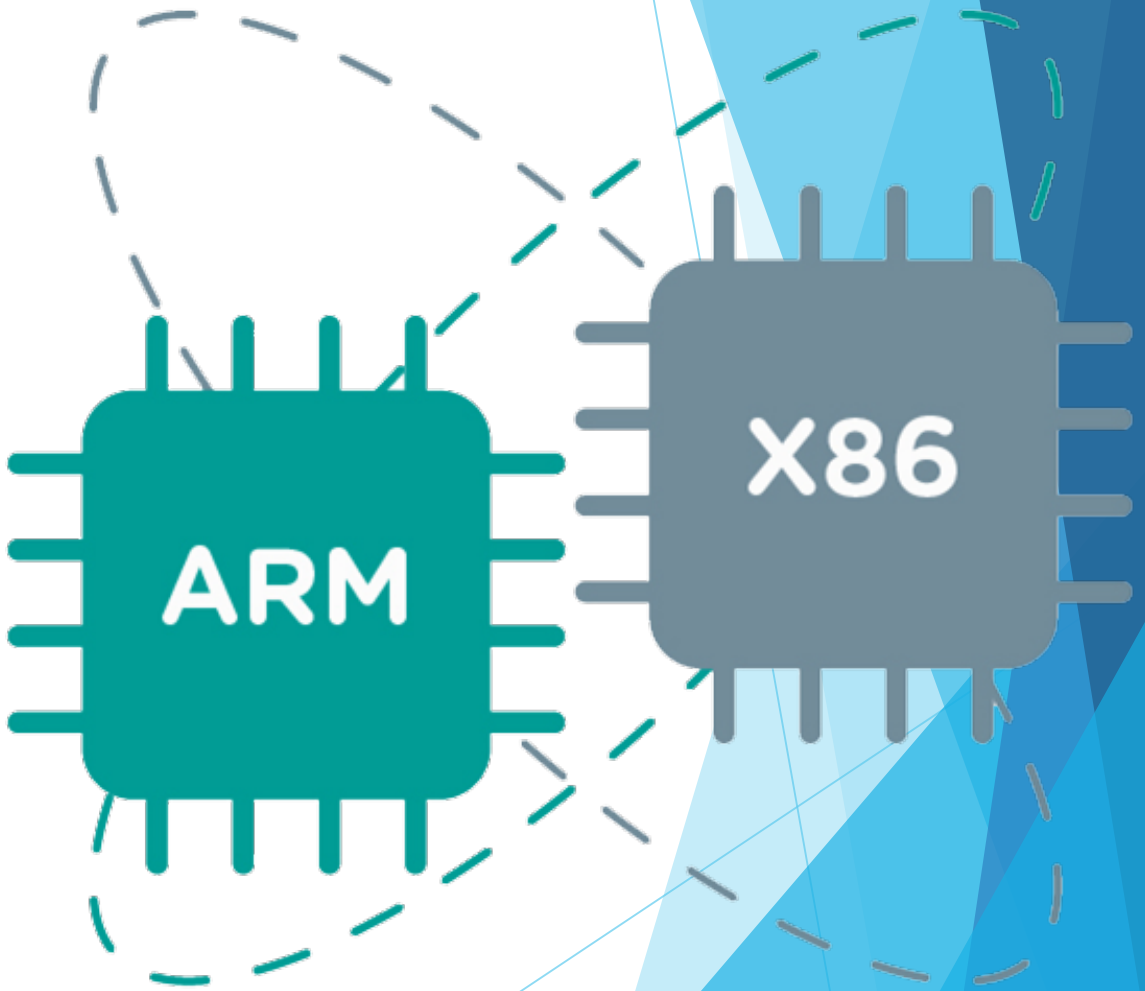
ARM vs x86

Size comparison
between
AMD Ryzen 33300X
and Apple M1 Max

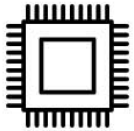
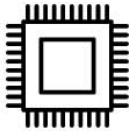
ARM vs x86

Since AMD & Intel are the only manufactures for x86, each CPU is generally considered compatible.

ARM has many manufacturers, and each is customized from a larger specification with many options for specific use cases and scenarios.



ARM versus x86

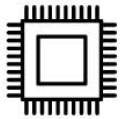
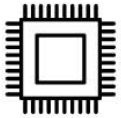
ARM	X86
	
Uses Reduced Instruction Set computing Architecture (RISC).	Uses Complex Instruction Set computing Architecture (CISC).

ARM	X86
	
Executes single instruction per cycle.	Executes complex instruction at a time and it takes more than a cycle.

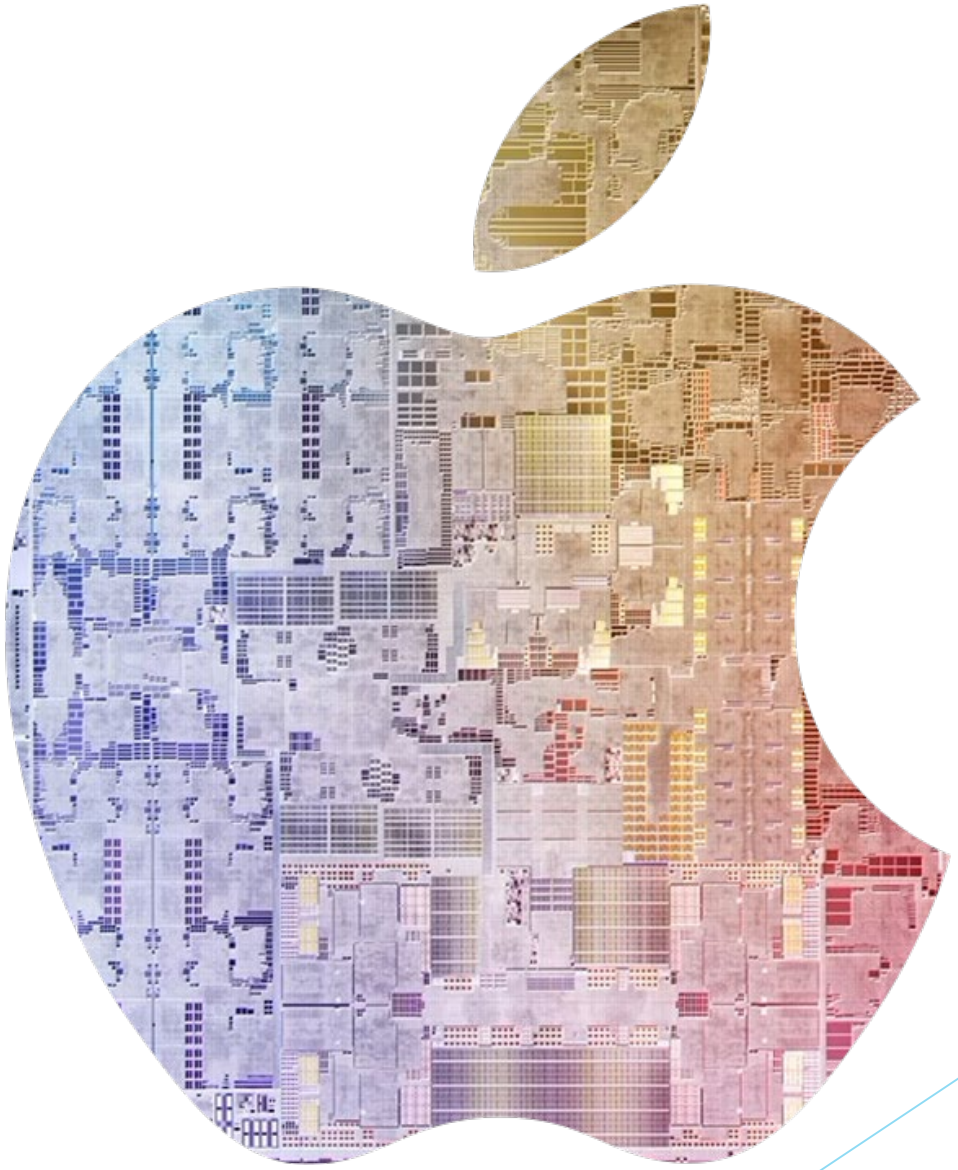
ARM	X86
	
Pipelining of instructions is the unique feature.	Less pipelined.

ARM	X86
	
Optimization of performance with Software focused approach.	Hardware approach to optimize performance.

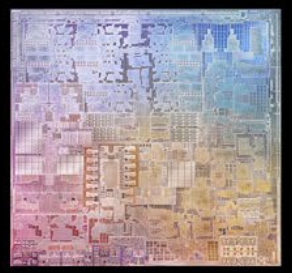
ARM	X86
	
Requires less registers, more memory.	Uses more registers and less memory.

ARM	X86
	
Faster Execution of Instructions reduces time.	Time to execute is more.

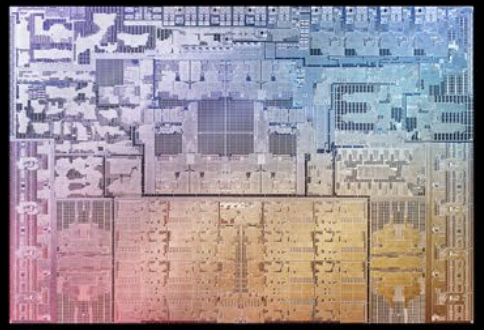
Overview of Apple's ARM Processors



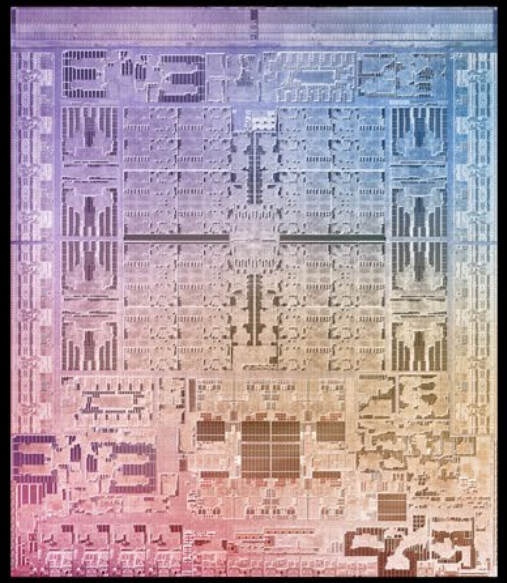
Apple's M1 ARM Silicon Family



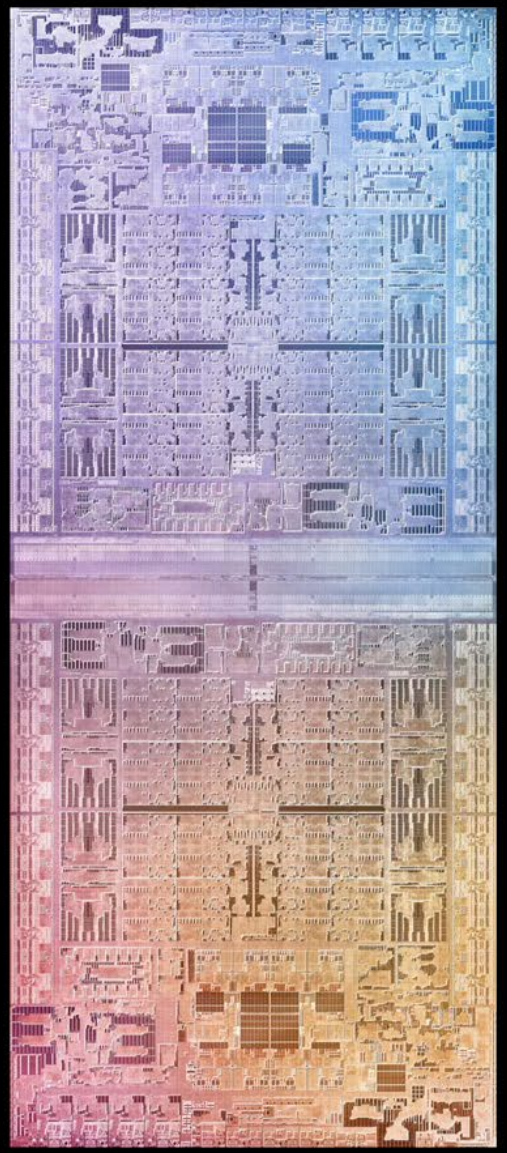
M1



M1 Pro

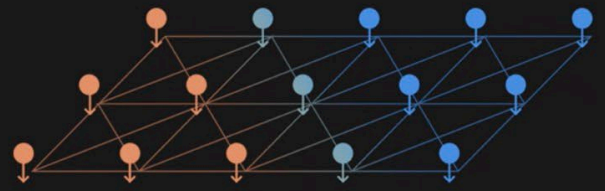


M1 Max



M1 Ultra

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

ProRes
encode and decode

Thunderbolt 4

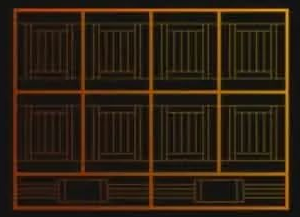
Secure Enclave

Support for two external displays

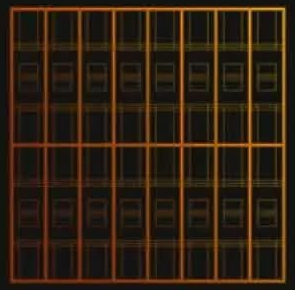
Up to
32GB
Unified memory

33.7 billion
Transistors

M1
PRO



Up to
10-core
CPU



Up to
16-core
GPU

16-core
Neural Engine
11 trillion operations per second

Industry-leading
performance per watt

5 nm process

200GB/s
Memory bandwidth

ProRes
encode and decode

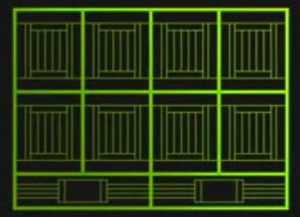
Thunderbolt 4

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

ProRes

Encode and decode

Thunderbolt 4

5 nm process

114 billion

Transistors

Silicon interposer with

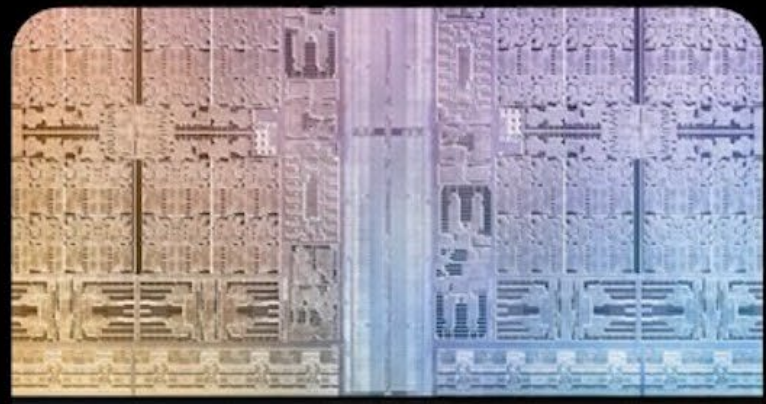
2.5TB/s

interprocessor bandwidth

800GB/s

Memory bandwidth

M1 ULTRA



UltraFusion architecture

Up to

20-core CPU

Up to

64-core GPU

32-core Neural Engine

22 trillion operations per second

Secure Enclave

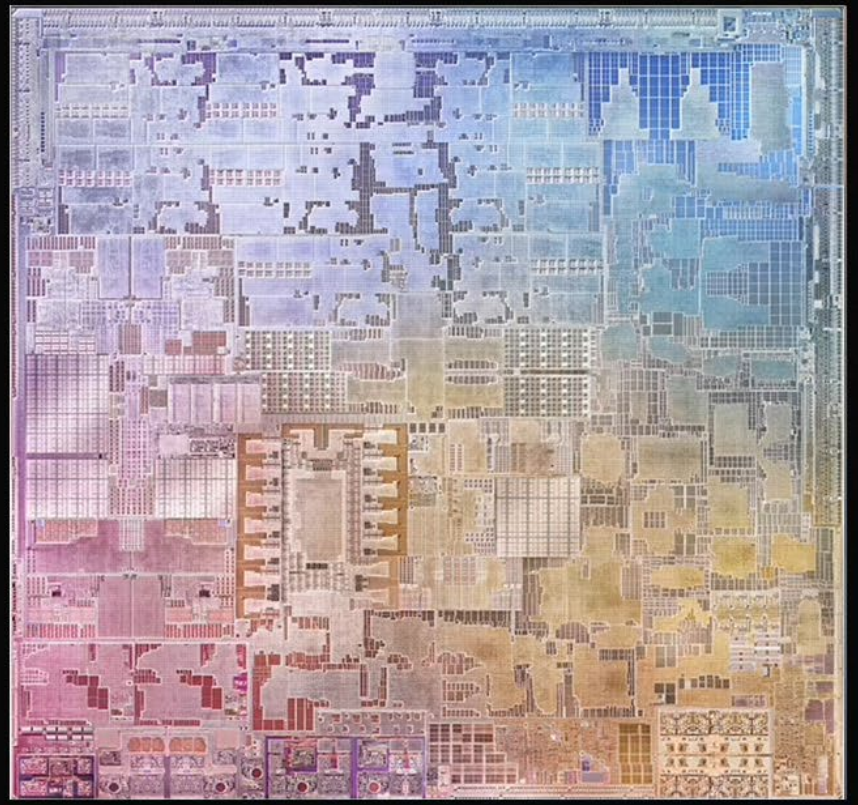
Industry-leading performance per watt

Up to

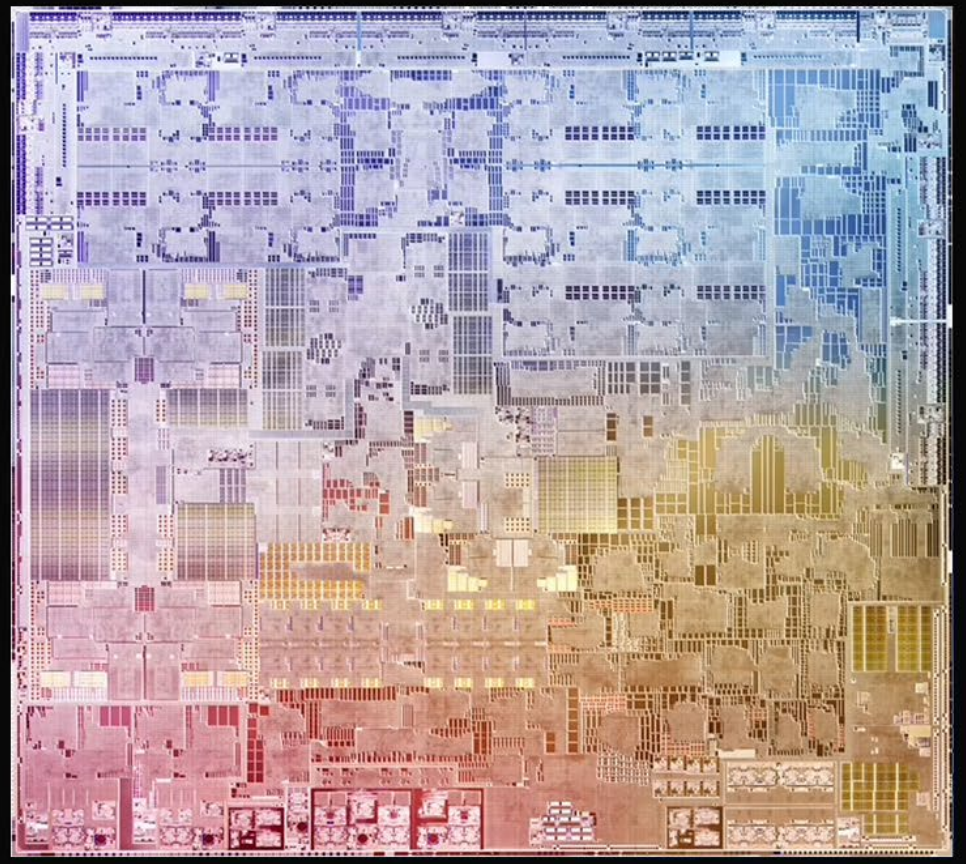
128GB

unified memory

Apple’s M2 Processor



M1



M2

Up to

24GB

LPDDR5 memory

High-performance media engine

40%

Faster Neural Engine

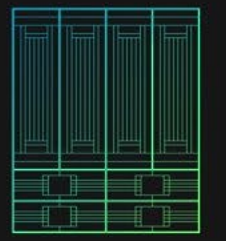
Up to

15.8 trillion

operations per second

16-core Neural Engine

Second-generation 5 nm technology



8-core CPU

Up to

10-core GPU

ProRes

encode and decode

6K external display support

18%

Faster CPU

35%

Faster GPU

Over

20 billion

transistors

Industry-leading performance per watt

50%

More memory bandwidth

100GB/s

Memory bandwidth

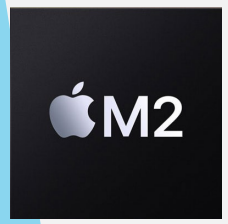
Apple's ARM Silicon Family - Recap

- Apple’s first desktop ARM CPU announced November 10, 2020
- Featured in MacBook Air, Mac mini, MacBook Pro, iMac, and later the iPad Air.
- With 16 billion transistors, four efficiency cores and four performance cores, and eight GPU cores.

- October 18, 2021, M1 Pro in 16- and 14-inch MacBook Pro.
- Two efficiency cores, up to eight performance cores, and up to 16 GPU cores.
- 16 Neural Engine cores, a 32 GB unified RAM with almost 200 GB/sec. memory bandwidth, and over 32 billion transistors.

- The M1 Max is a bigger version of the M1 Pro. Two efficiency cores, eight performance cores, up to 32 GPU cores, 16 Neural Engine cores, and up to 64 GB unified RAM and 400 GB/sec. memory bandwidth.
- Announced on October 18, 2021, the M1 Max is equipped with Mac Studio and MacBook Pro.

- Rolled out on March 8, 2022, an M1 Ultra chip is made from fusing two M1 Max chips.
- Optional upgrade for the Mac Studio
- Up to 128 GB unified RAM that comes with a solid 800 GB/sec. memory bandwidth.



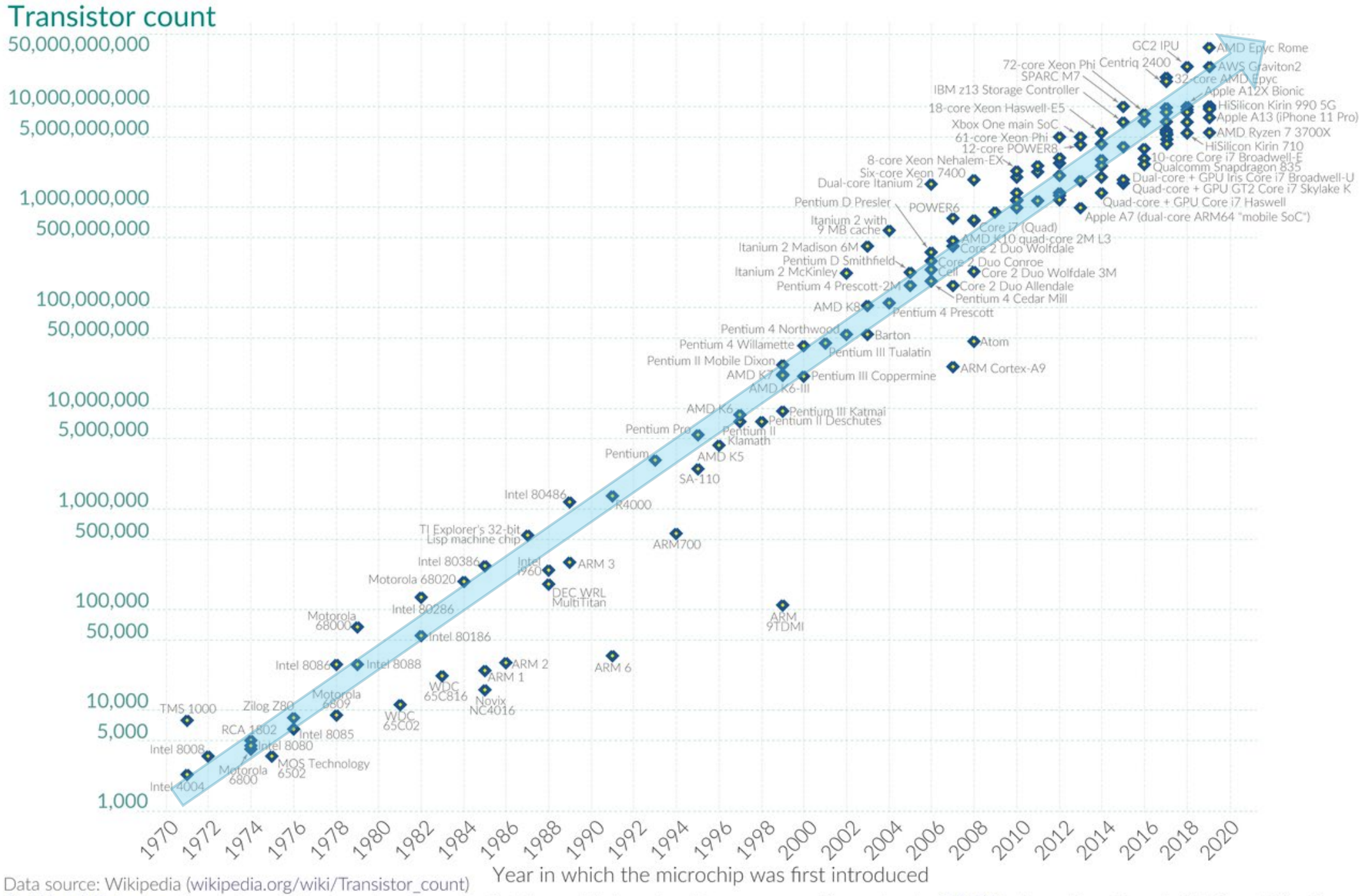
- Rolled out on June 6, 2022, the M2 chip powers the MacBook Air and the 13-inch MacBook Pro.
- Based on improved 5-nm technology.
- The chip houses over 20 billion transistors and can include up to 24 GB of RAM and 2TB of storage.
- The M2 chip has four efficiency & four performance cores and includes up to 10 GPU cores.

Moore's Law

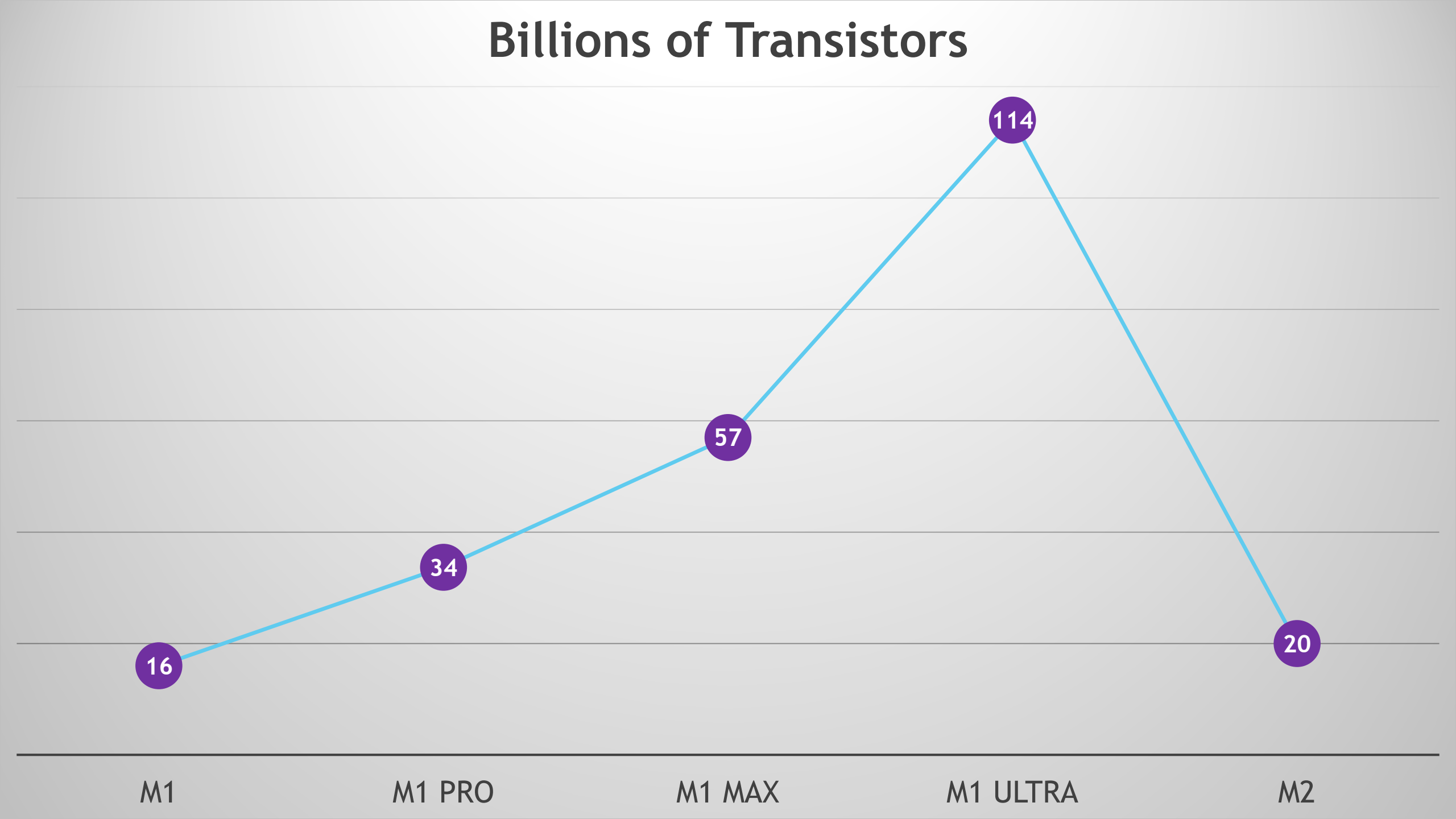
Plot of MOS transistor counts for micro-processors against dates of introduction. The curve shows counts doubling every two years.

Data isn't published for all chips. Number is only one measure of chip complexity.

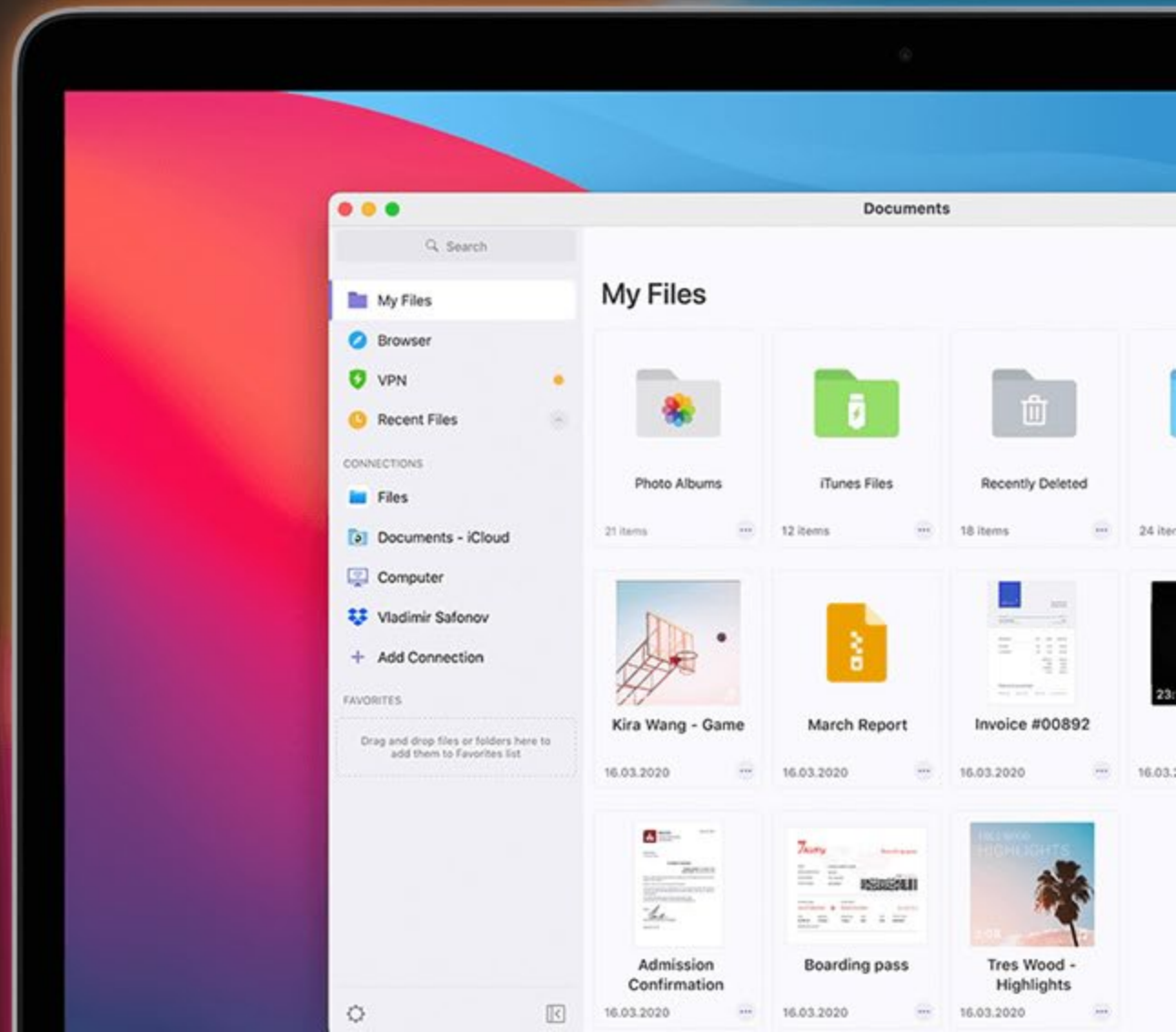
Sources
https://w.wiki/5rau
https://w.wiki/5rat



Data source: Wikipedia (wikipedia.org/wiki/Transistor_count)
OurWorldinData.org – Research and data to make progress against the world's largest problems.

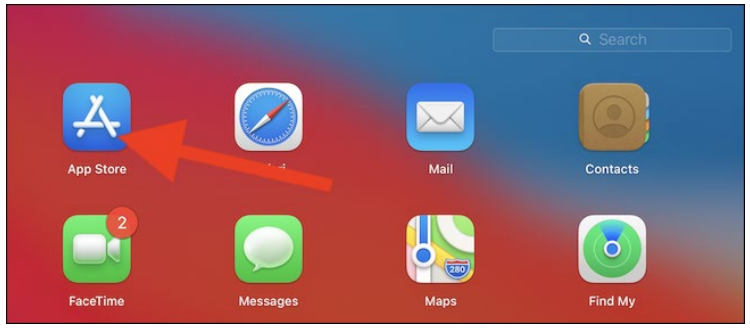

Billions of Transistors
16
34
57
114
20
M1
M1 PRO
M1 MAX
M1 ULTRA
M2

How to run iOS apps on Mac

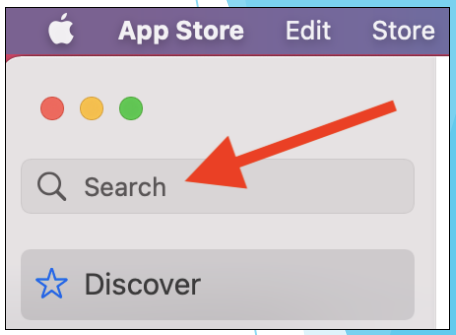


How to Run iOS Apps on macOS?

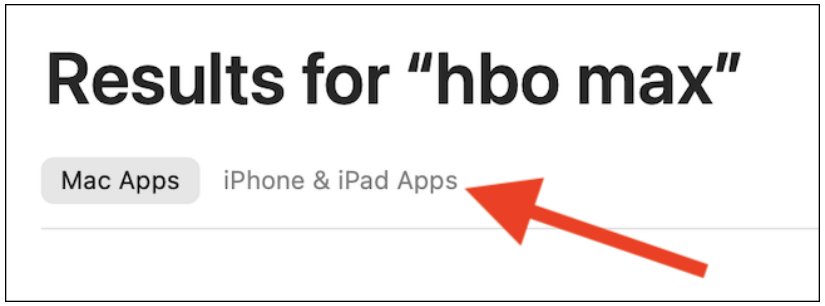
Start by clicking on the Launchpad icon found on your computer's dock.



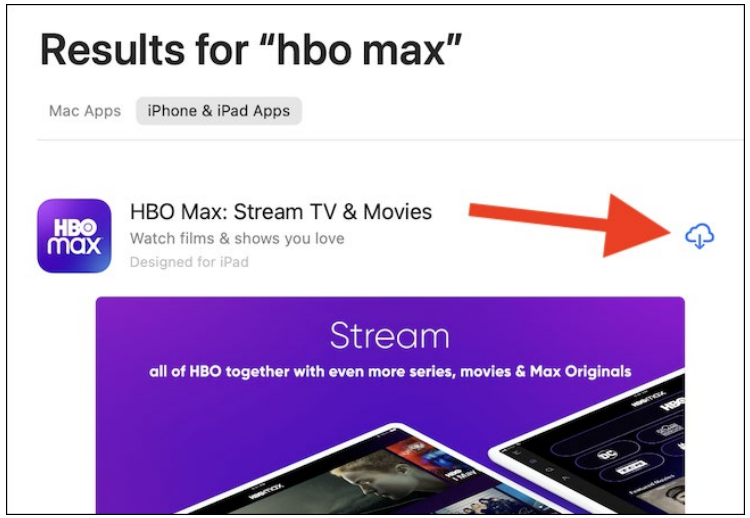
Next, click on the "App Store" button. If you can't find it, use the search bar found at the top of the bat to locate the app.



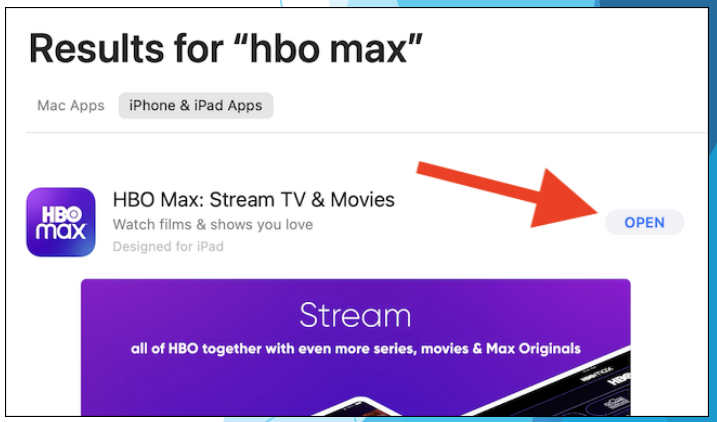
You can now enter the iPhone or iPad app's name **(HBO MAX)** into the search bar found in the top-left corner of the window.



You won't immediately see the app you're looking for—this is because the App Store defaults to only showing Mac apps. Click on the "iPhone & iPad Apps" listing to switch views.



Click the "Get" or Download button (which looks like a cloud icon) to start the download process.



Once the iPhone or iPad app is installed on your Mac, select the "Open" button. The app will open in its own window and run like any other application developed for your Mac.

New ARM Based iOS Simulators

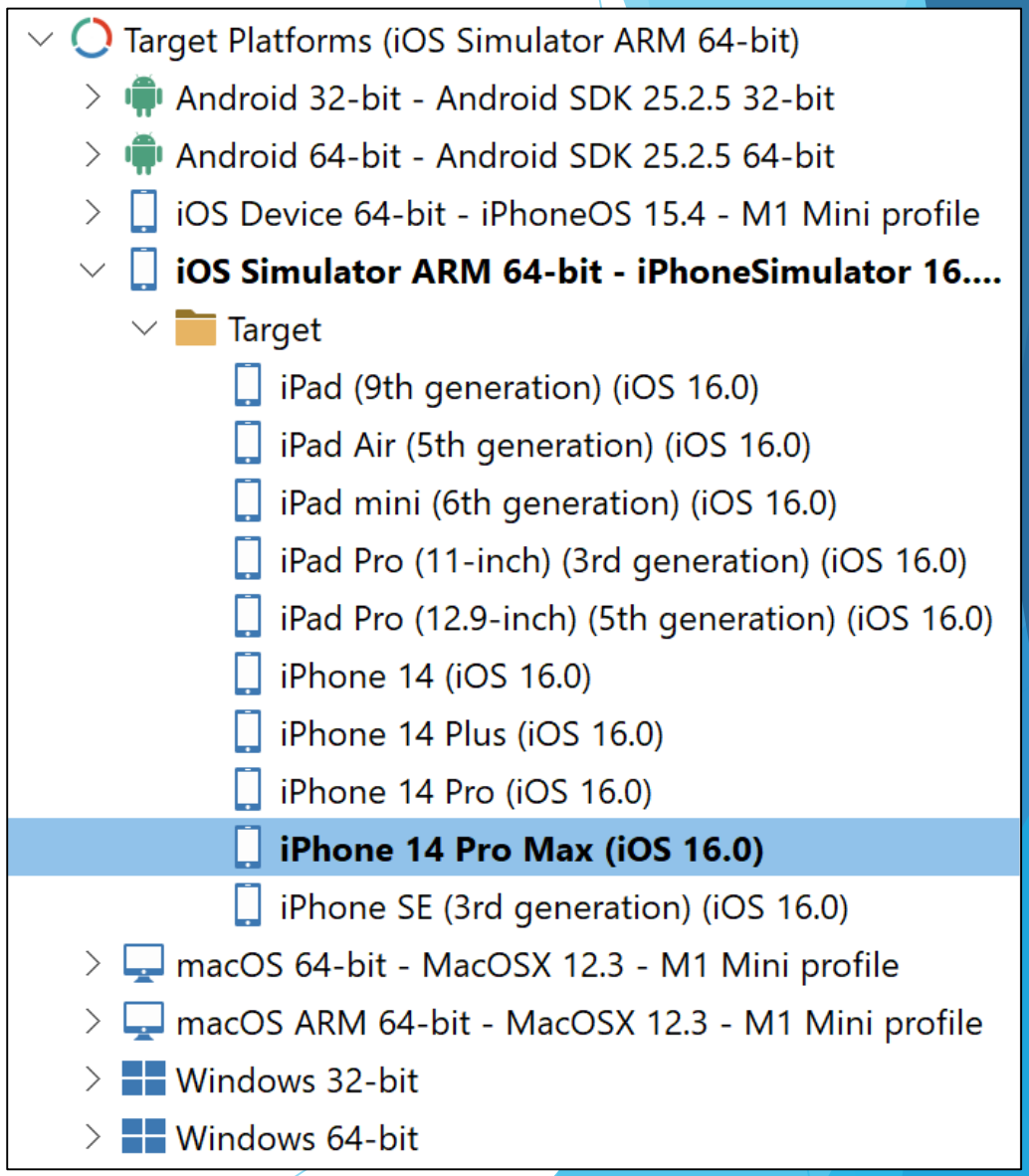
ARM-Based iOS Simulators

Use Simulator to:

- Interact with your apps on different devices.
- Use your pointer and keyboard.
- Prototype and debug your apps.
- Optimize your graphics.
- Test your apps.

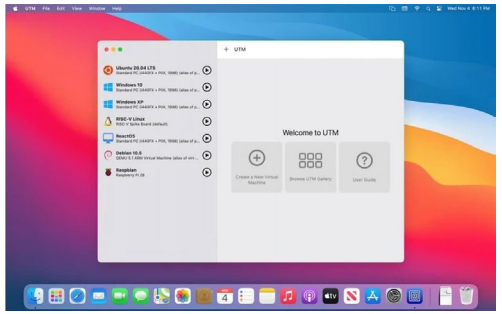
New in latest Simulator and Delphi 11.2

- Previous simulators ran x86 compiled apps.
- Latest simulator uses ARM compiled apps.
- Delphi 11.2 supports the iOS Simulator on ARM MacOS



Comparing Virtualization Stacks

Comparing Virtualization Stacks



UTM

- An open-source virtual machine environment.
- UTM supports both virtualization and *emulation*
- Emulation allows x86_64 architectures on ARM.

Parallels Desktop

- Parallels was the first to support Apple ARM processor
- Supports running ARM architecture operating systems including Windows, Linux, and MacOS.
- No plans for Emulation.

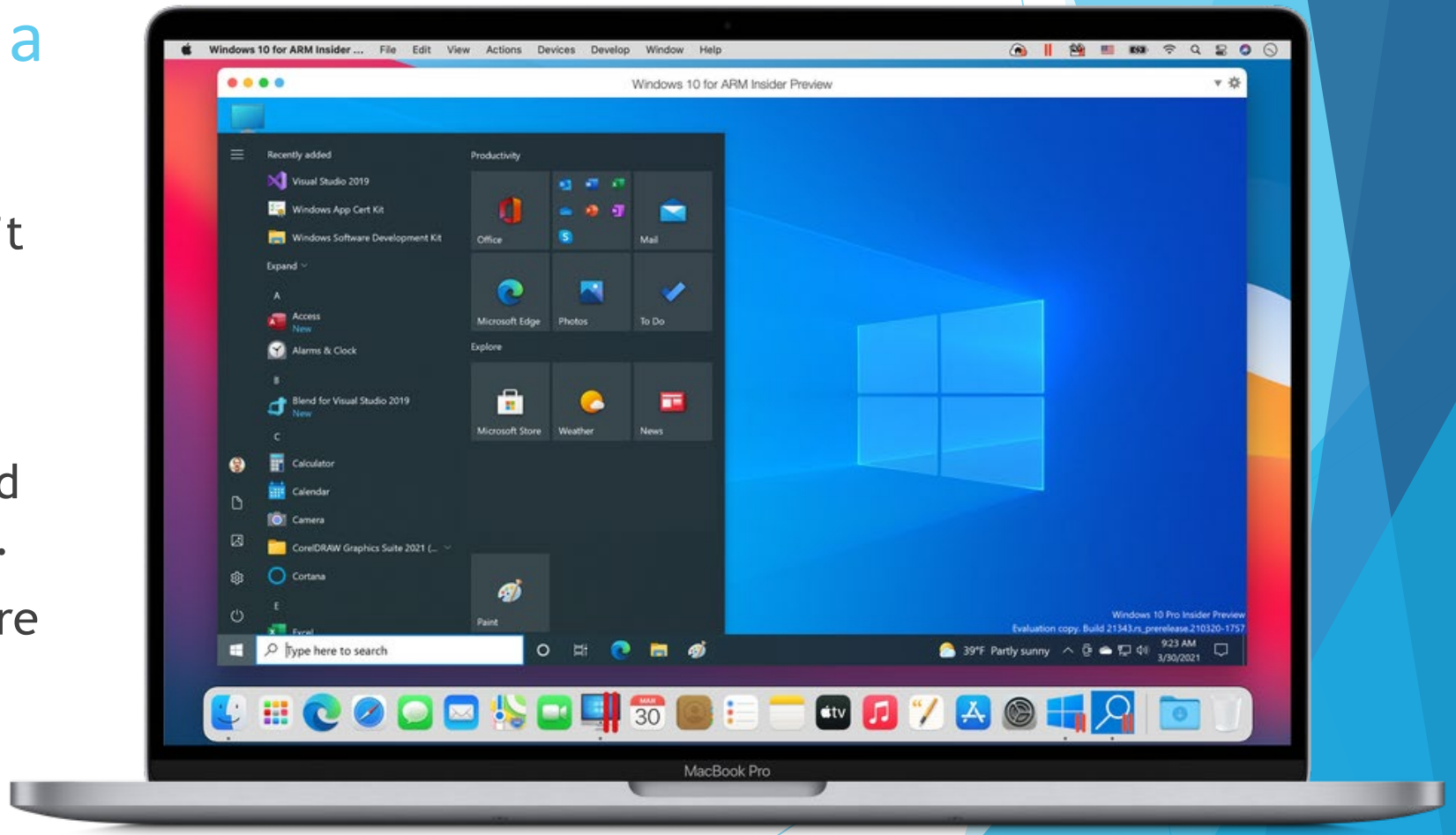
VMware Fusion

- ARM support still in Tech Preview
- VMware Fusion Public Tech Preview 22H2
- Release 2022-09-22
- No plans for Emulation.

Parallels™

Installing and Running Windows 11 ARM in a VM on Apple ARM

- Windows on Apple ARM isn't *officially* supported, but seems to work.
- Microsoft includes compatibility for 32-bit and 64-bit x86 binaries on ARM.
- The only issues I've seen are programs that explicitly check CPU architecture.



Installation Assistant

About Macs with M Series Chip

Your Mac computer is powered by the **Apple M series chip** that is built on the **ARM** architecture. This new platform has the following limitations:

- Existing virtual machines created on **Intel-based** Mac computers cannot work on Macs with the M series chip.
- It is not possible to create a new virtual machine using an Intel x86-based operating system installer.

On such Mac computers, Parallels Desktop uses a new virtualization engine. To create a virtual machine, you need a **VHDX** or **ISO** image with an **ARM-based** operating system.

?

Learn more about using Parallels Desktop on Macs with the M series chip

Continue

Installation Assistant

Just click

Create New

Get Windows 11
from Microsoft

VHDX

Install Windows
or another OS
from a DVD or image file

Free Systems

Also...

inux

Download
Fedora Linux

Download
Debian GNU/Linux

Download
Kali Linux

Download
macOS

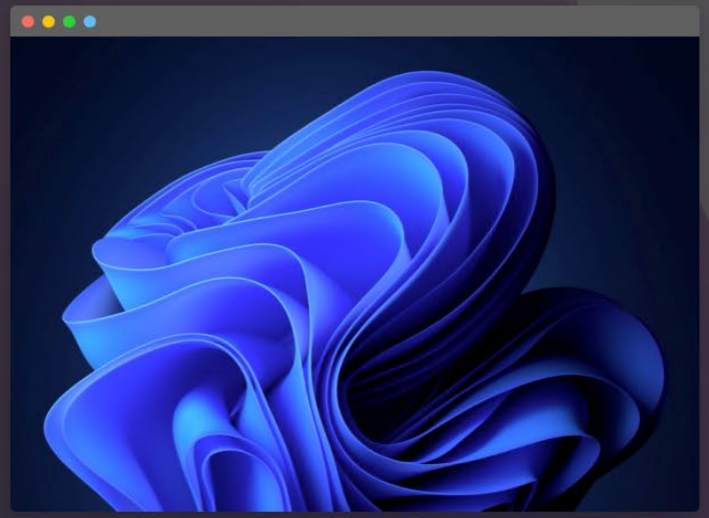
?

Open...

Continue

Installation Assistant

Download and Install Windows 11



To work with Windows applications, first you need to install Windows on your Mac. Use this assistant to install Windows 11. If you already have Windows installed or want to use another operating system, skip this step.

Windows 11 Home will be installed.

Change Edition

?

Choose Edition...

Back

Install Windows

Installation Assistant

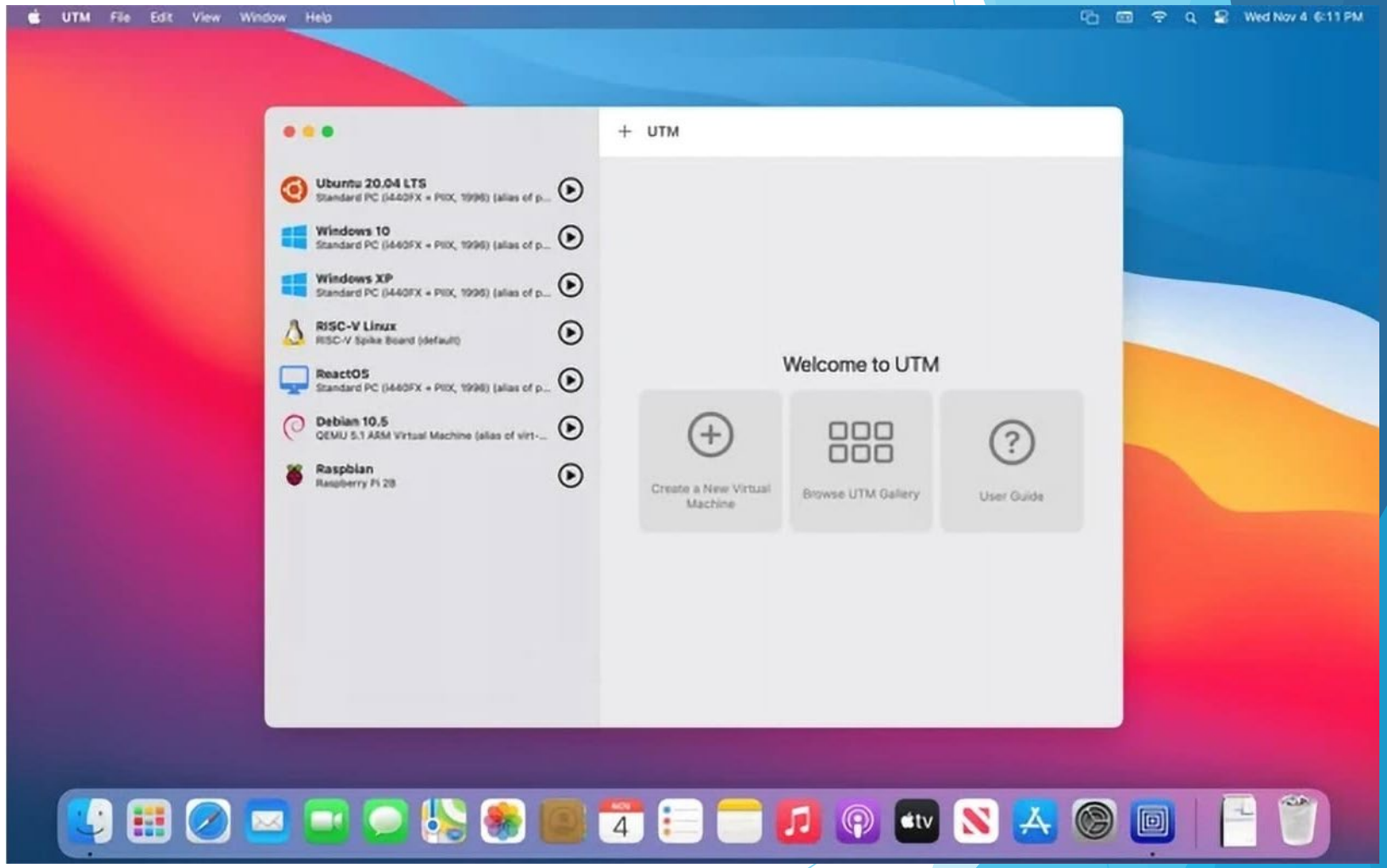
Downloading Windows 11

Installation will start automatically. While you wait, explore what you can accomplish with Parallels Desktop for Mac.

133.7 MB of 3.99 GB (23.3 MB/sec) - 3 minutes remaining

Cancel Pause

Installing and Running 64-bit Linux x86 with UTM



Installing and Running 64-bit Linux x86 in a UTM VM

When you are installing an OS with a different architecture than the host you need Emulation.

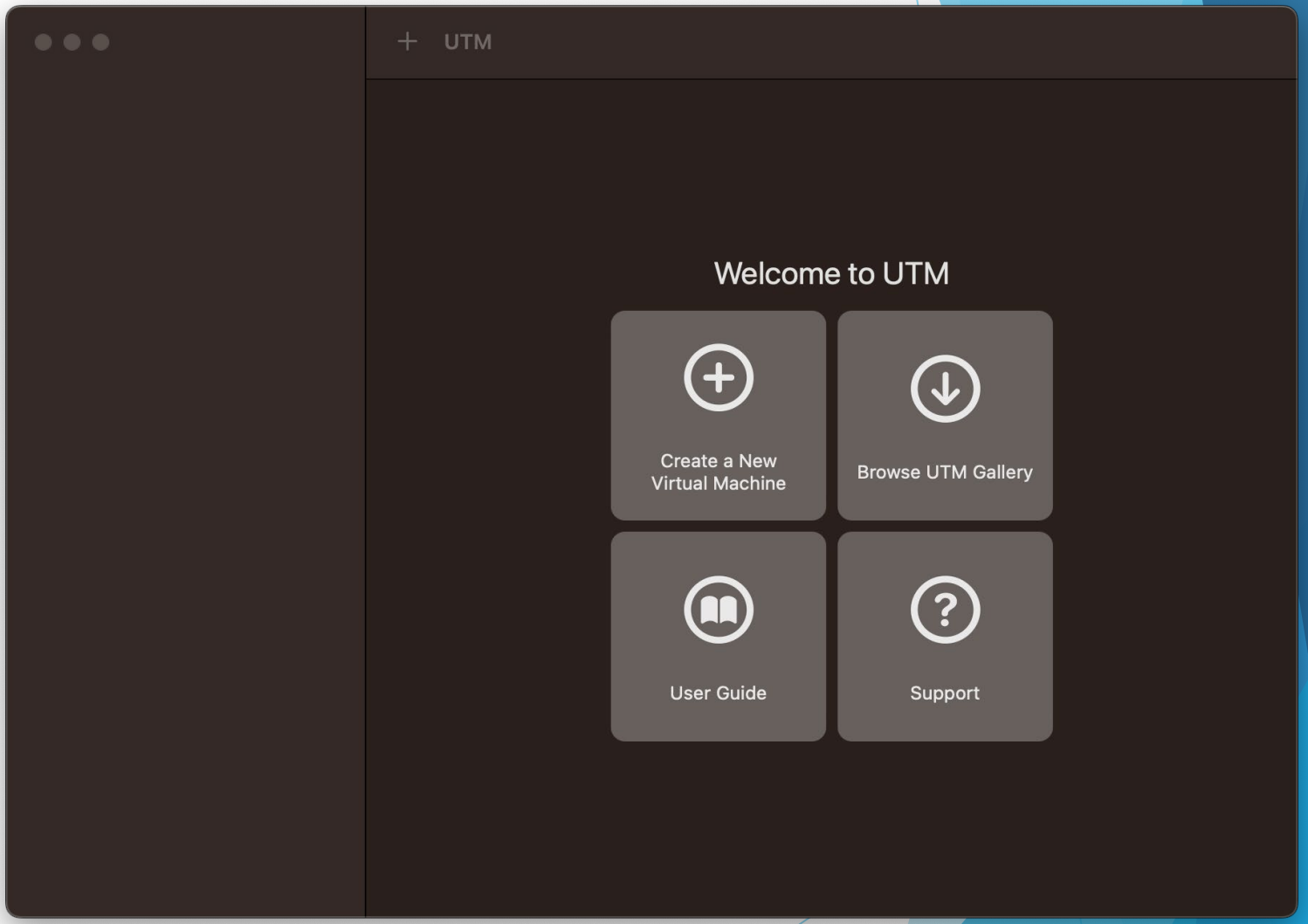
That is where UTM comes in. It uses Qemu to provide emulation.

(It also supports x86 VMs on iOS…)

- Install UTM from mac.getutm.app
- Download ISO of 64-bit x86 Linux
- Create New Virtual Machine
- Select Emulate & Linux
- Load Linux ISO
- Specify 2 or more CPU Cores
- At Summary select Open VM Settings
- Under System enable Force Multicore
- Under QEMU enabled Balloon Device

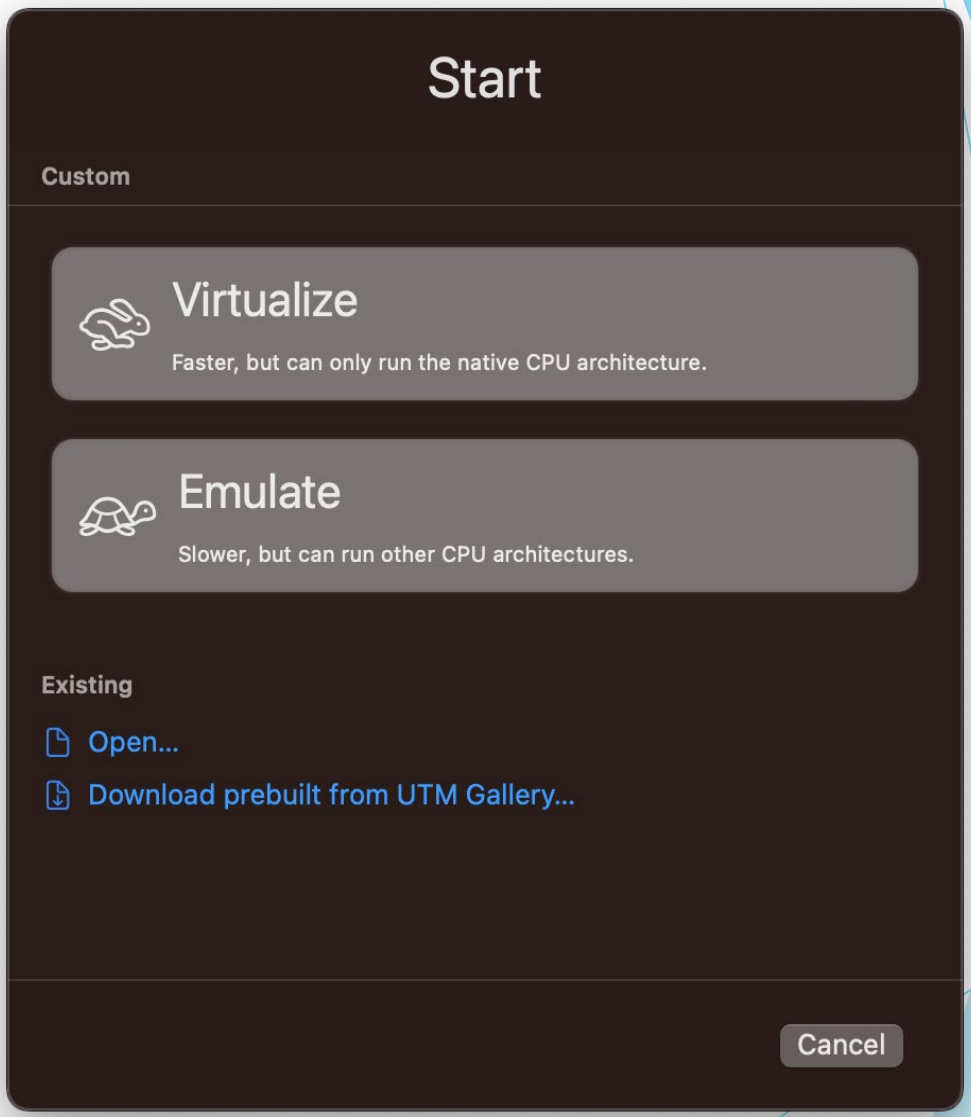
UTM Welcome Screen

Select Create New Virtual Machine



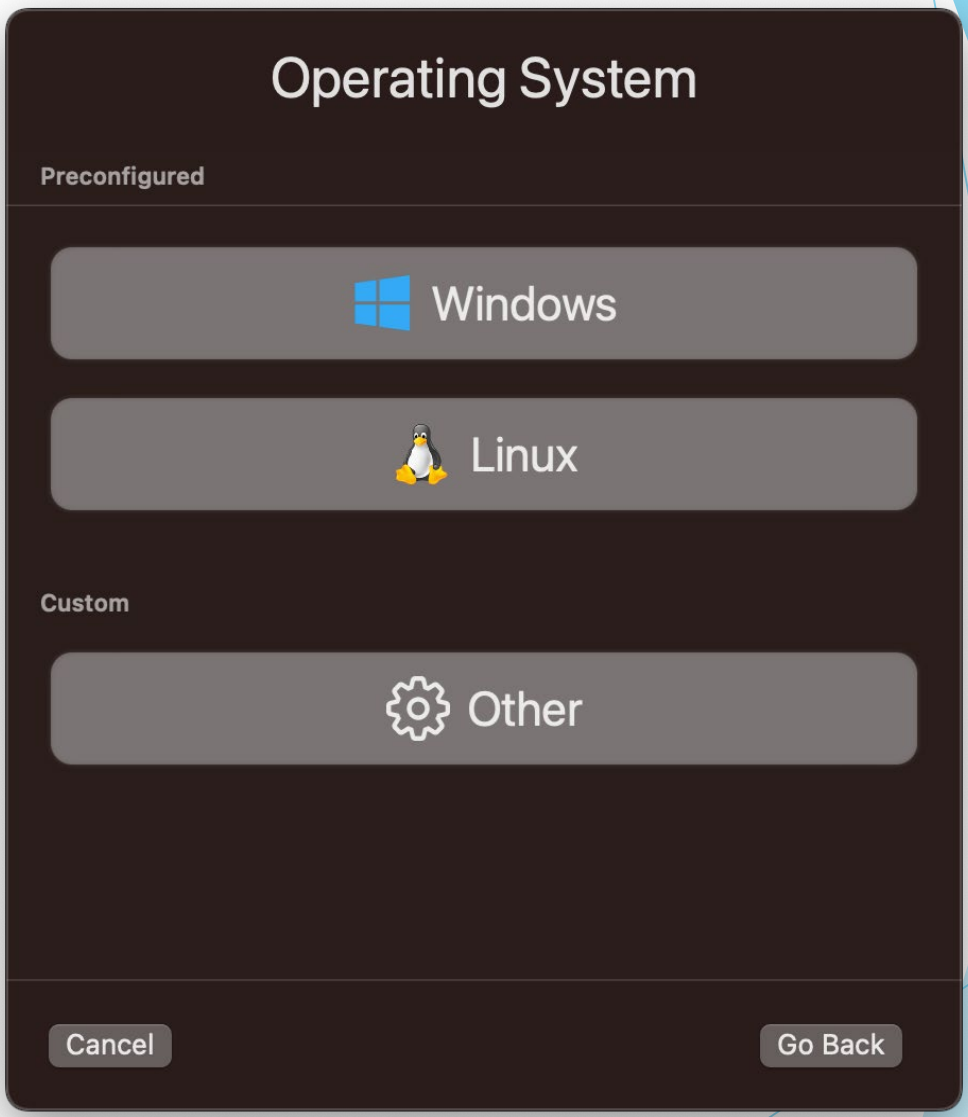
Virtualize vs Emulate

Since x86 ISO doesn't match the ARM hardware we need to choose Emulate.



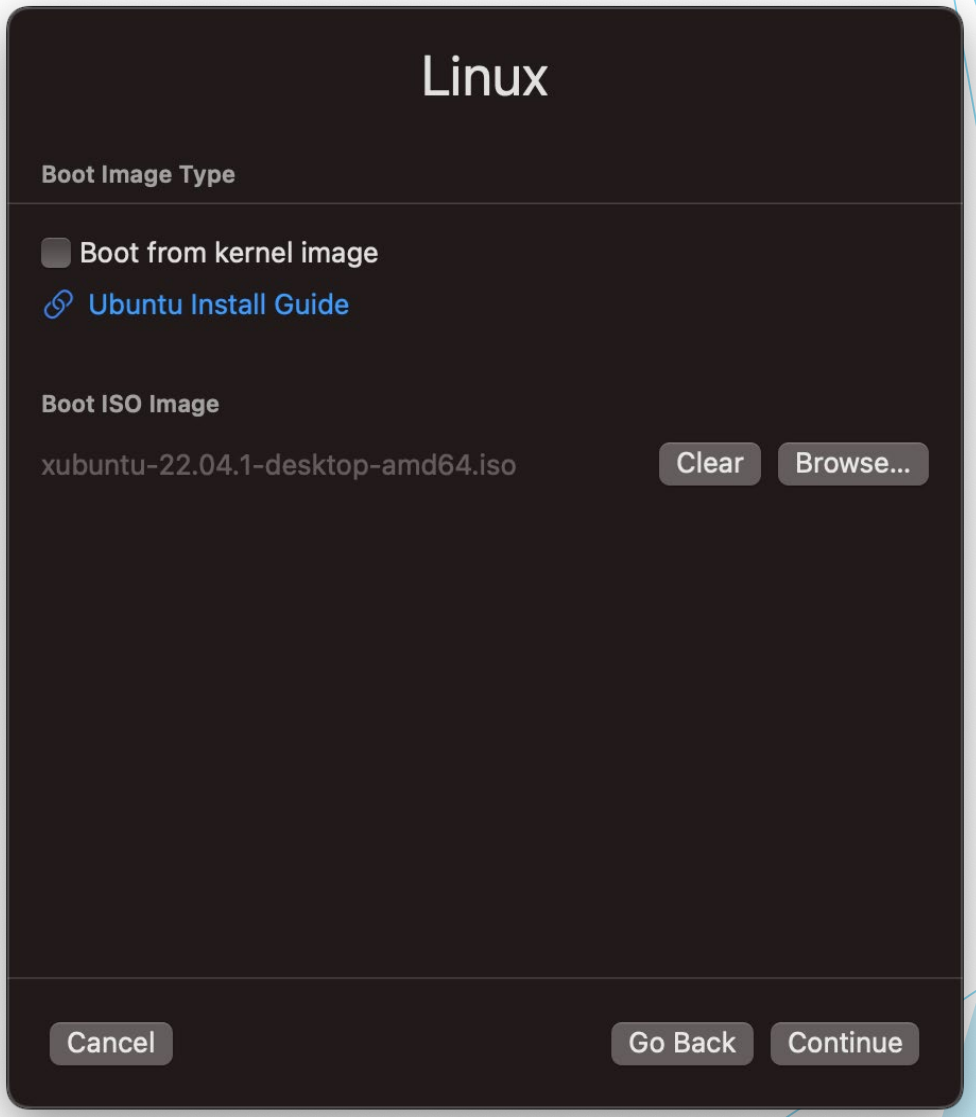
Operating System

We are installing Linux



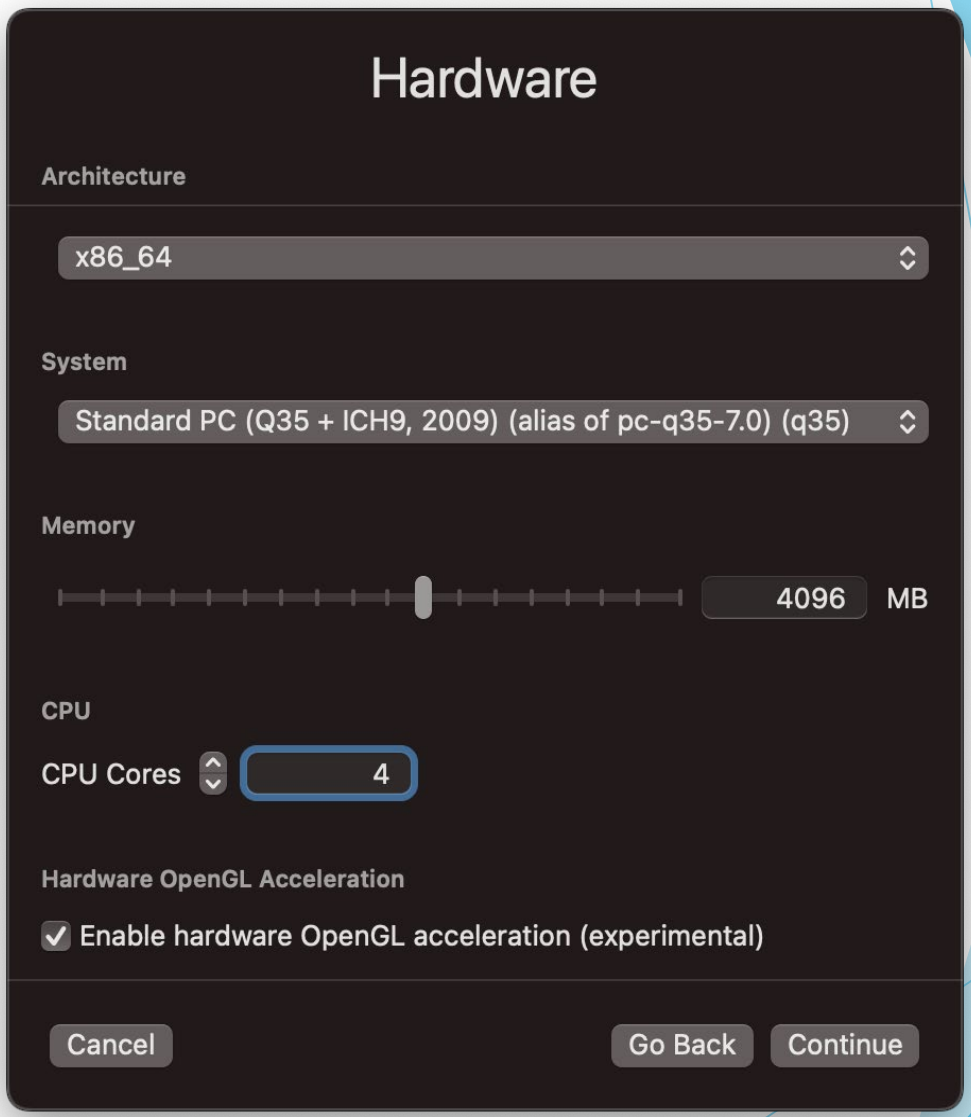
Select ISO

Browse to the ISO you downloaded.



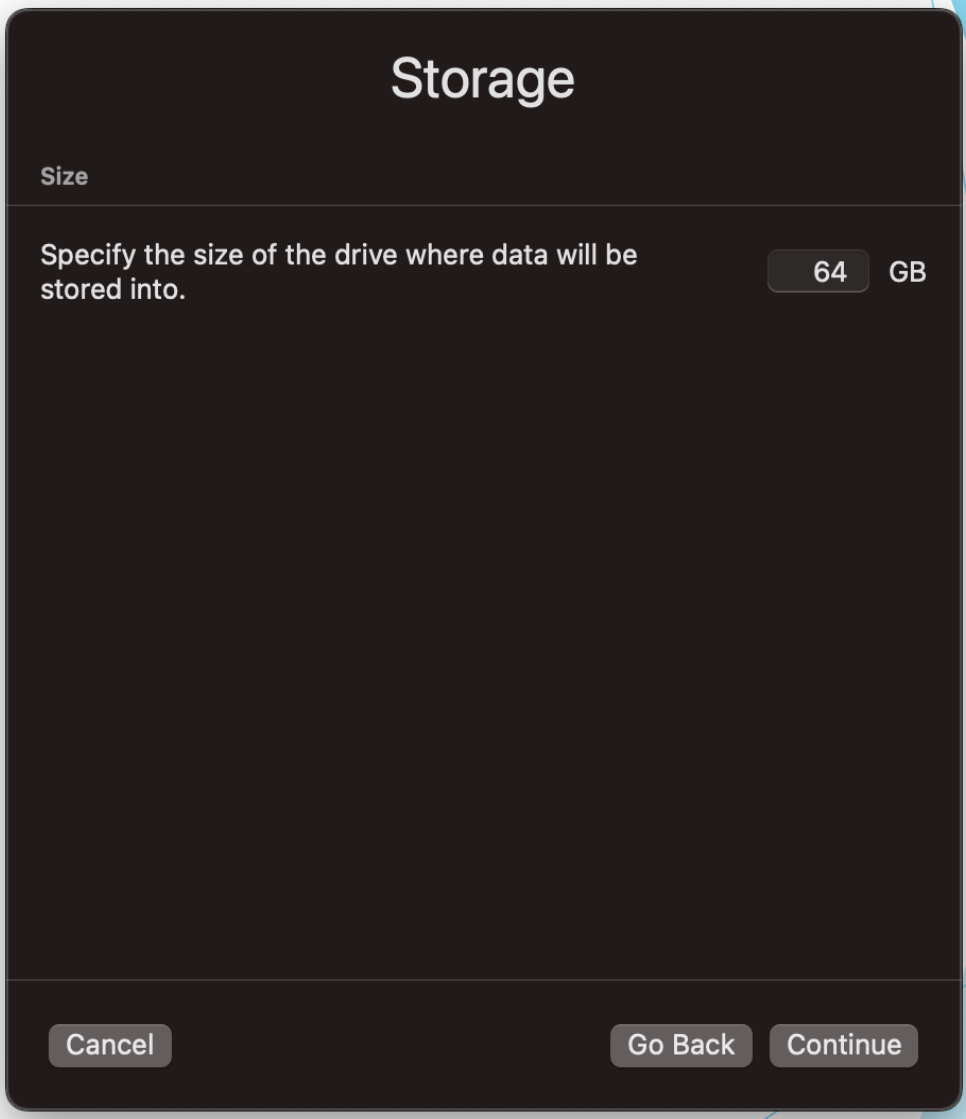
Hardware

- 2+ CPU Cores
- Optionally enable OpenGL Hardware acceleration
- Optionally change RAM – 4 GB is default



Storage

- Optionally change storage from the 64 GB default.
- Storage is allocated dynamically, so this is really only the upper limit.
- My install took 15 GB.

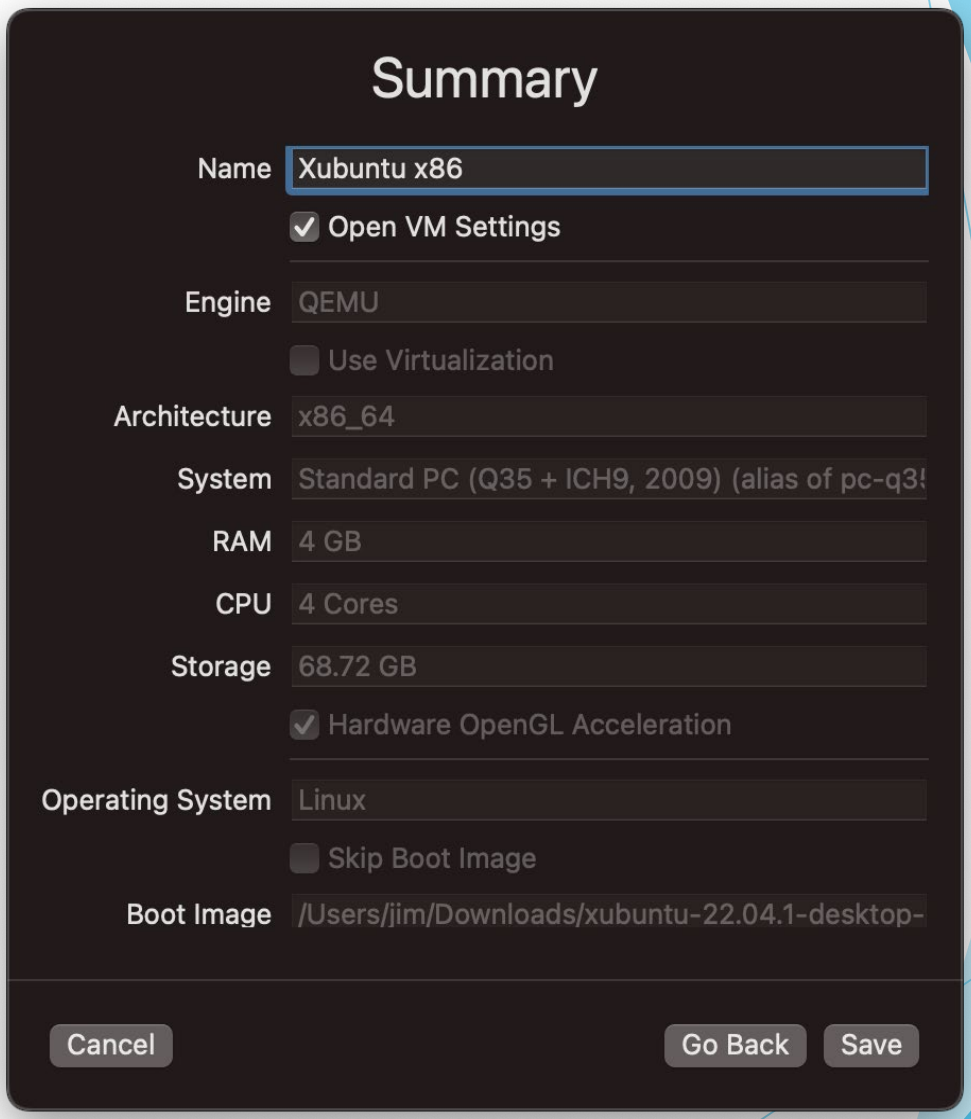


Shared Directory

- Optionally specify a shared directory between the VM and host.

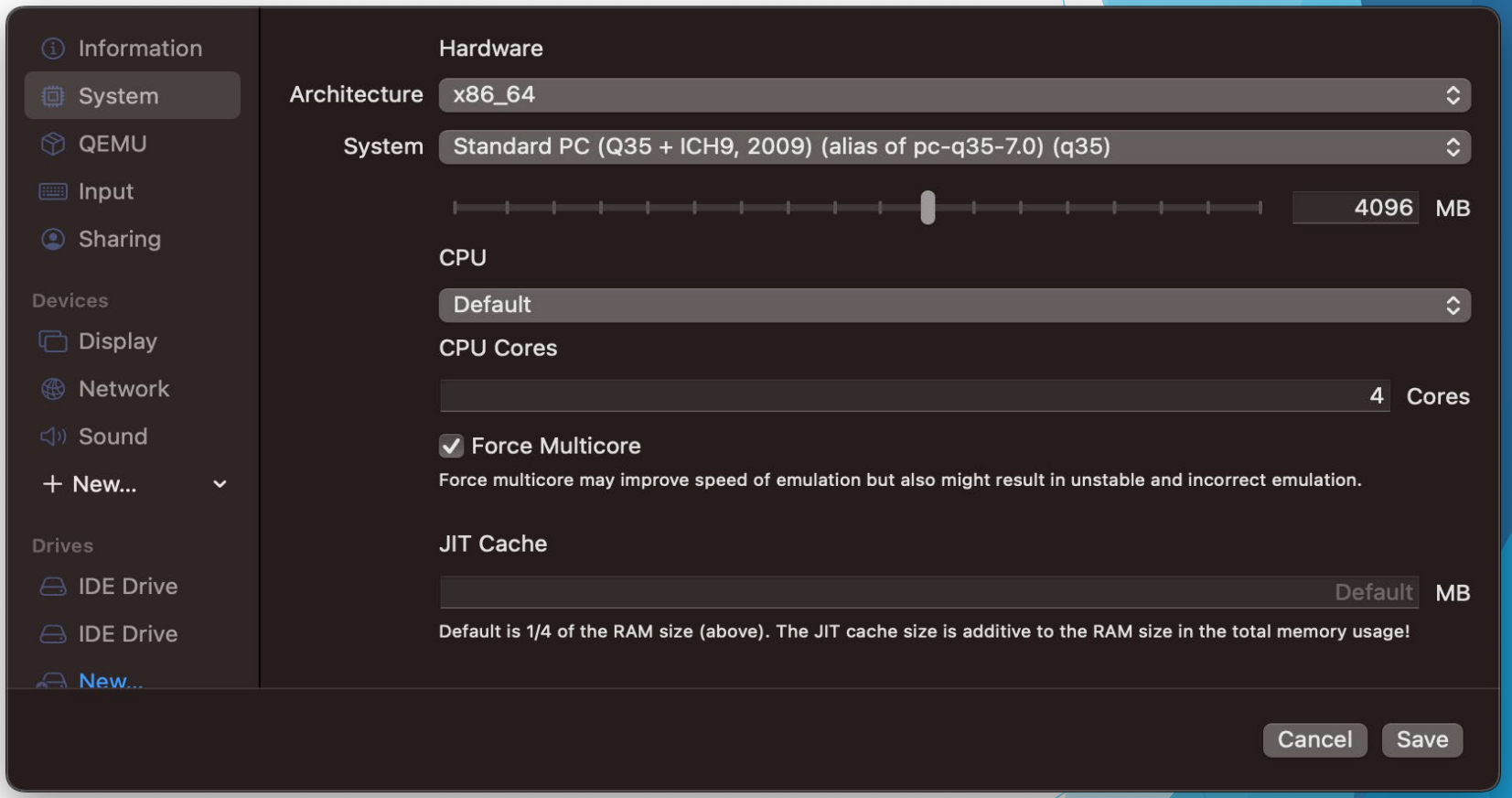
Summary

- Give your VM and Name
- Select *Open VM Settings*



System Settings

- Enable *Force Multicore*

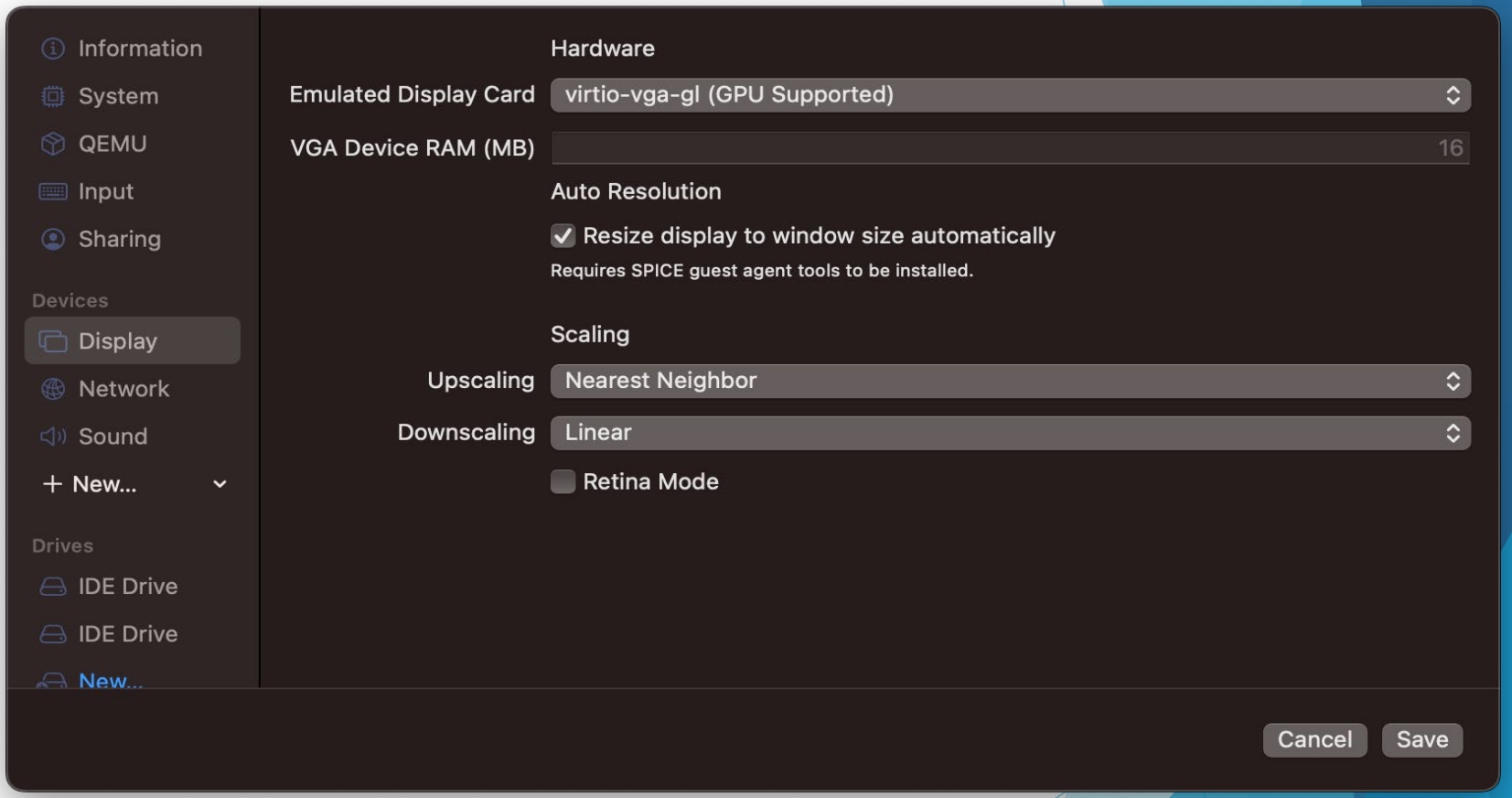


QEMU Settings

- Enable Balloon Device – This allows VM memory to allocate dynamically.

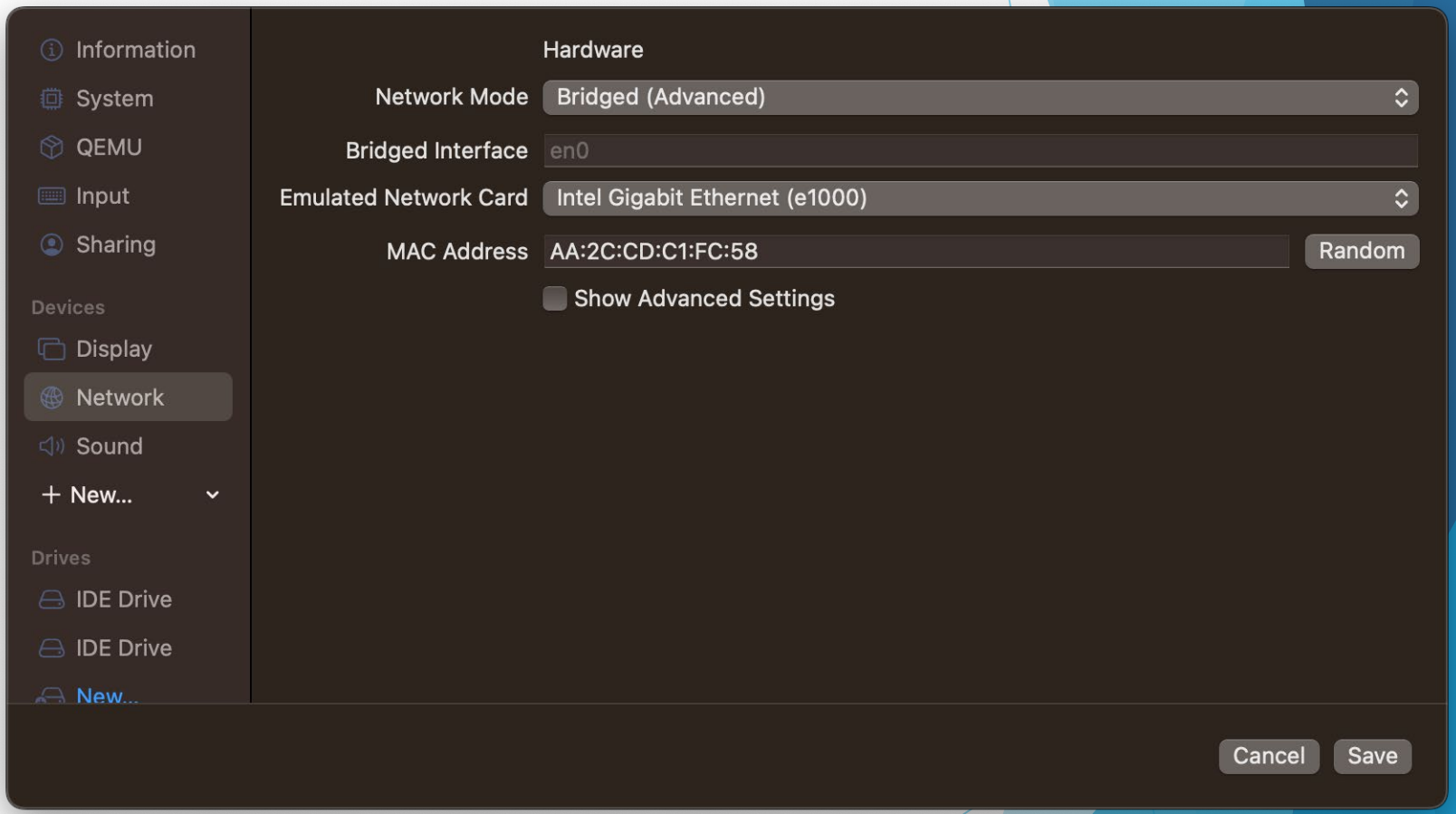
Display

- This is where you can turn GPU support on or off.
- On: Virtigo-vga-gl (GPU Supported)
- Off: Virtigo-vga



Network

- The network defaults to Shared, which is host only. Works fine for any local VMs too.
- Change it to Bridged to access the VM from the local network.



Ubuntu

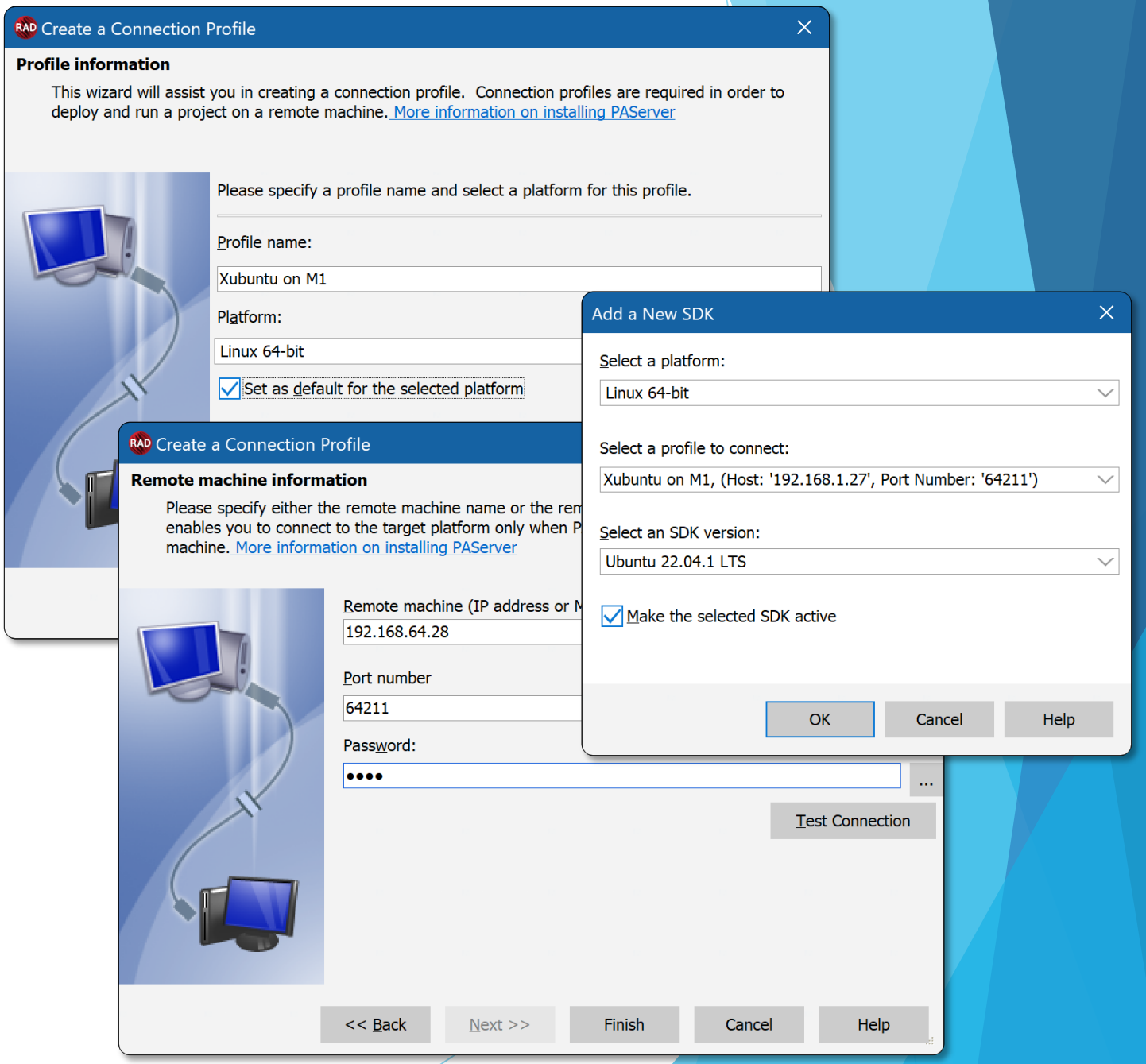
ubuntu.com/desktop/flavours

After Install for Ubuntu/Debian Linux

- Update APT
  - `sudo apt update`
  - `sudo apt install ubuntu-desktop`
  - `sudo reboot`
- Enable Clipboard and Directory sharing
  - `sudo apt install spice-vdagent`
  - `sudo apt install spice-webdavd`
- Setup for Delphi embt.co/Ubuntu4Delphi22
  - `sudo apt install curl`
  - `curl -L https://embt.co/SetupUbuntu4Delphi22 | bash`

Connecting from Delphi

- Run PA Server in Linux
- Use the [I] command to get the IP address
- Provide the IP Address in SDK Manager



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