

All About Apple ARM

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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



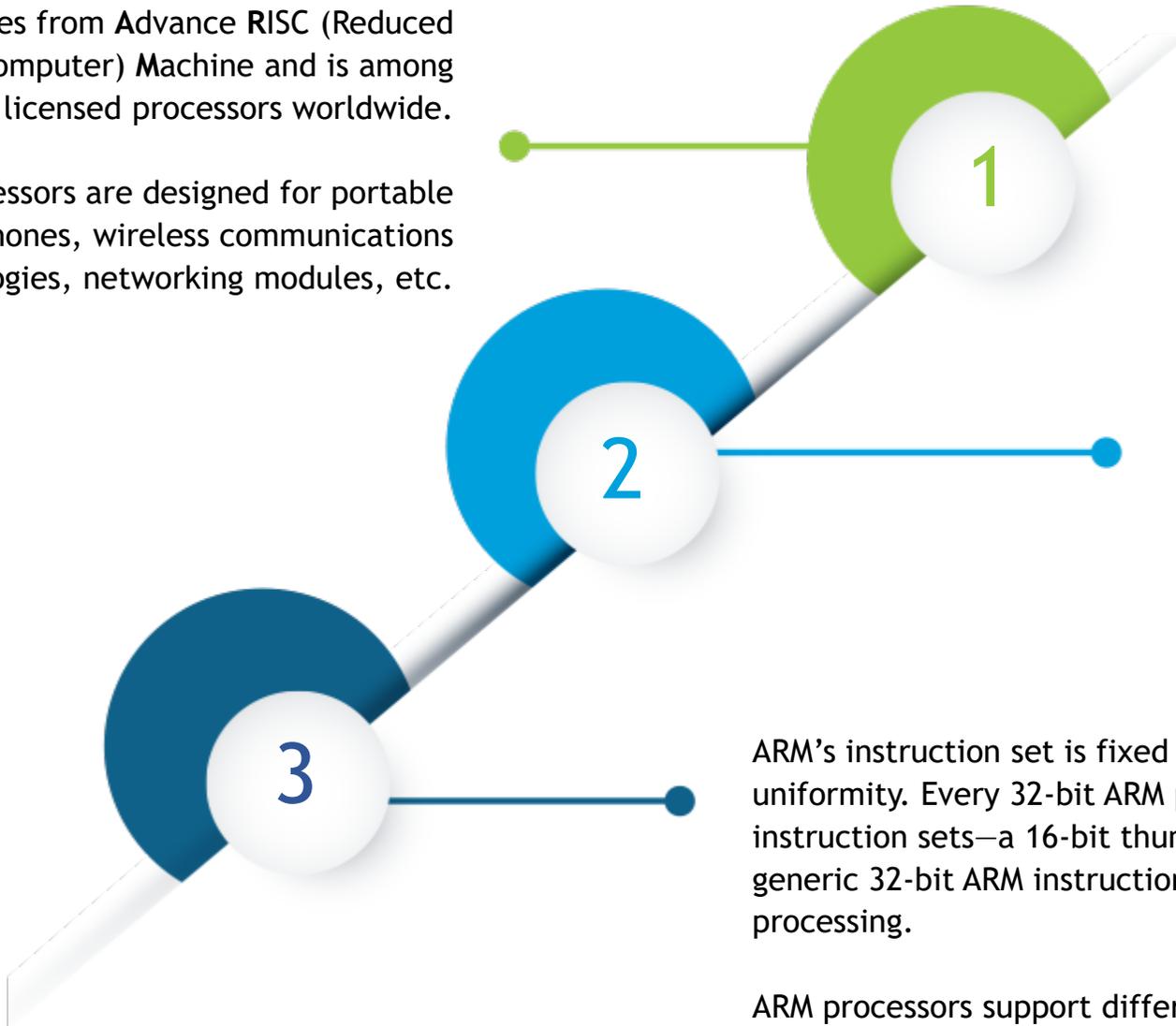
Slides, replay, and more:

blogs.embarcadero.com/all-about-apple-arm-on-the-desktop

Introduction to ARM

ARM is comes from Advance RISC (Reduced Instruction Set Computer) Machine 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.

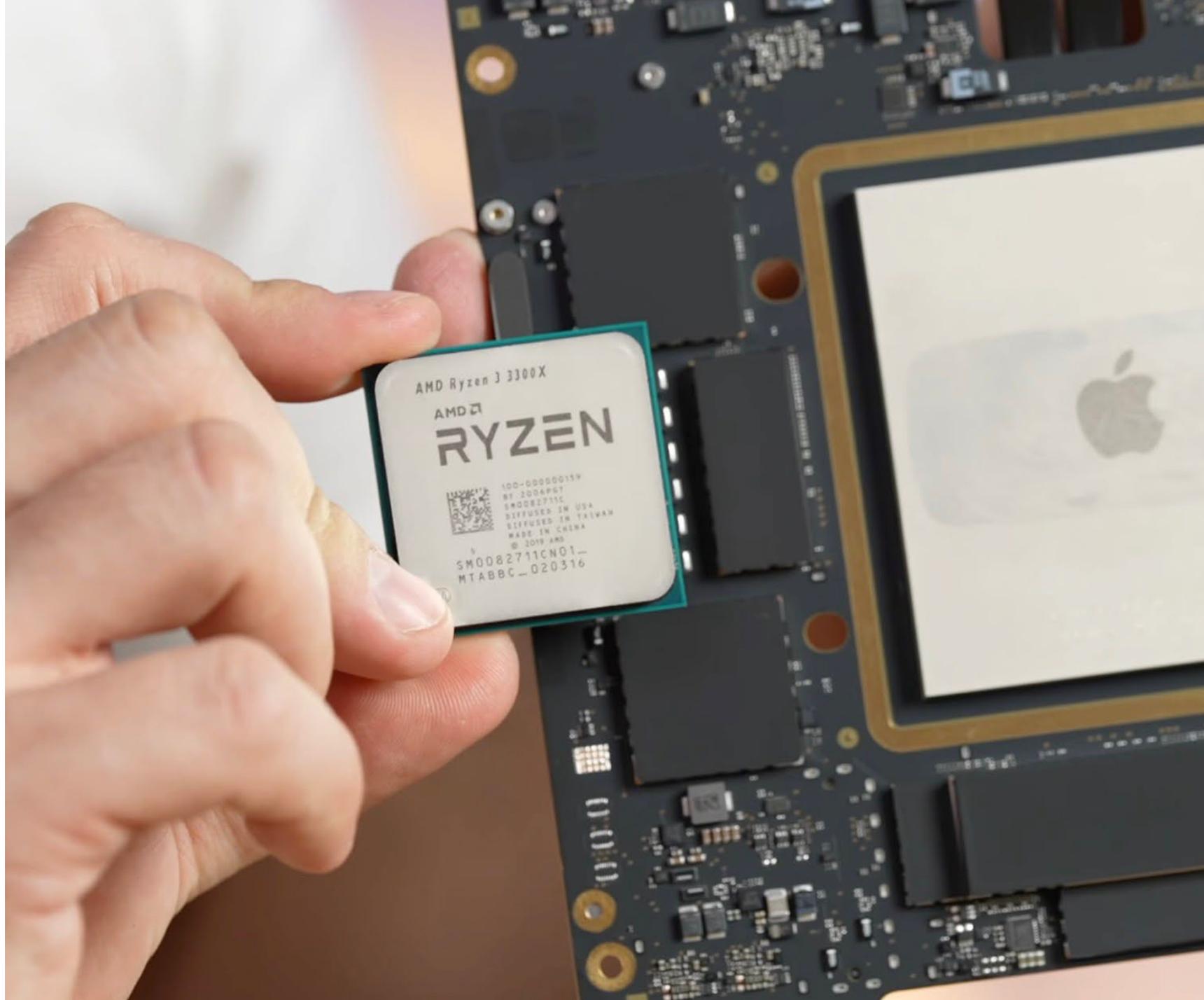
As a result, these processors follow data processing instructions that differ from those used for accessing the memory.

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

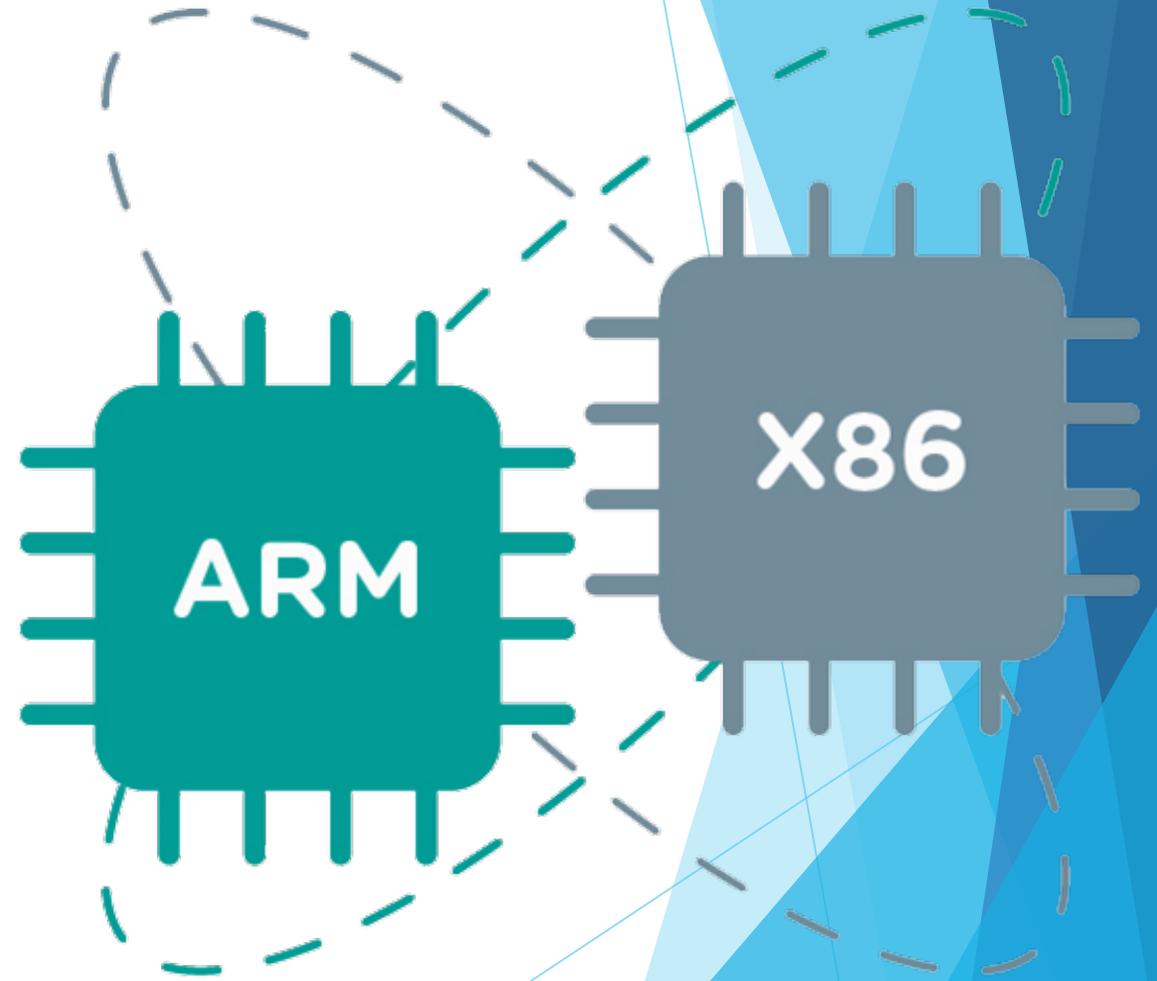
Size comparison
between
AMD Ryzen 33300X
and Apple M1 Max



ARM vs x86

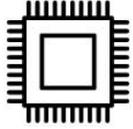
Since AMD & Intel are the only manufacturers for x86, each CPU is generally considered compatible.

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



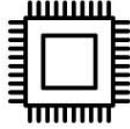
ARM versus x86

ARM



Uses Reduced Instruction Set computing Architecture (RISC).

X86



Uses Complex Instruction Set computing Architecture (CISC).

ARM



Executes single instruction per cycle.

X86



Executes complex instruction at a time and it takes more than a cycle.

ARM



Pipelining of instructions is the unique feature.

X86



Less pipelined.

ARM



Optimization of performance with Software focused approach.

X86



Hardware approach to optimize performance.

ARM



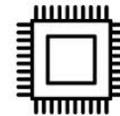
Requires less registers, more memory.

X86



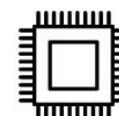
Uses more registers and less memory.

ARM



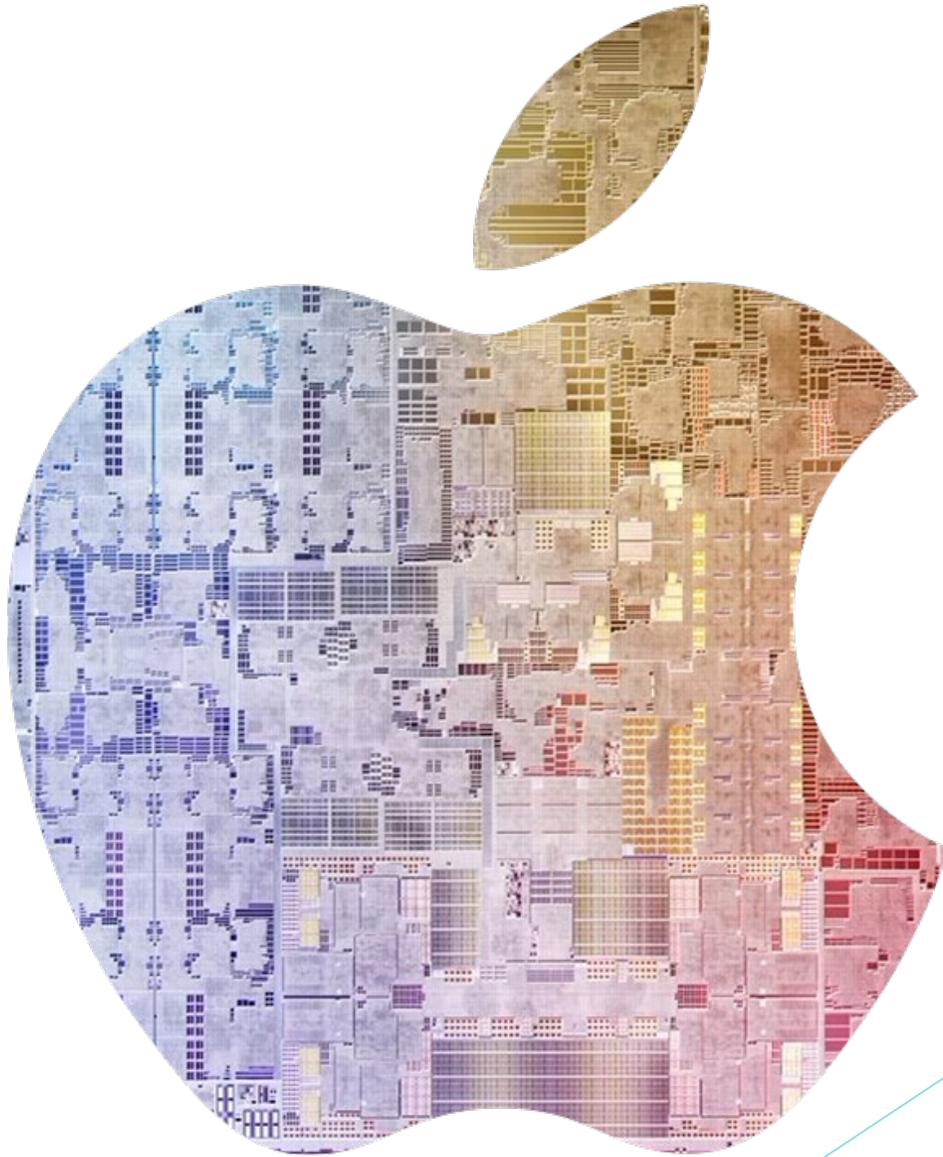
Faster Execution of Instructions reduces time.

X86

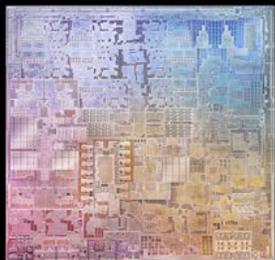


Time to execute is more.

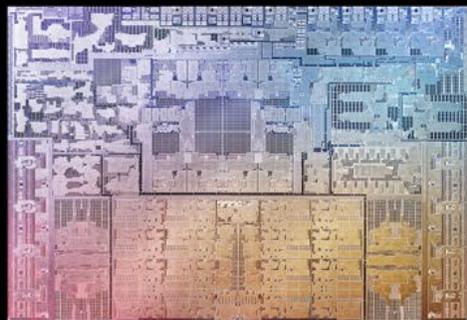
Overview of Apple's ARM Processors



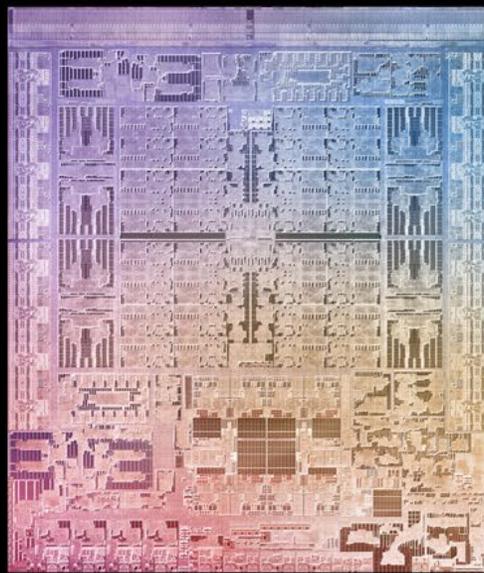
Apple's M1 ARM Silicon Family



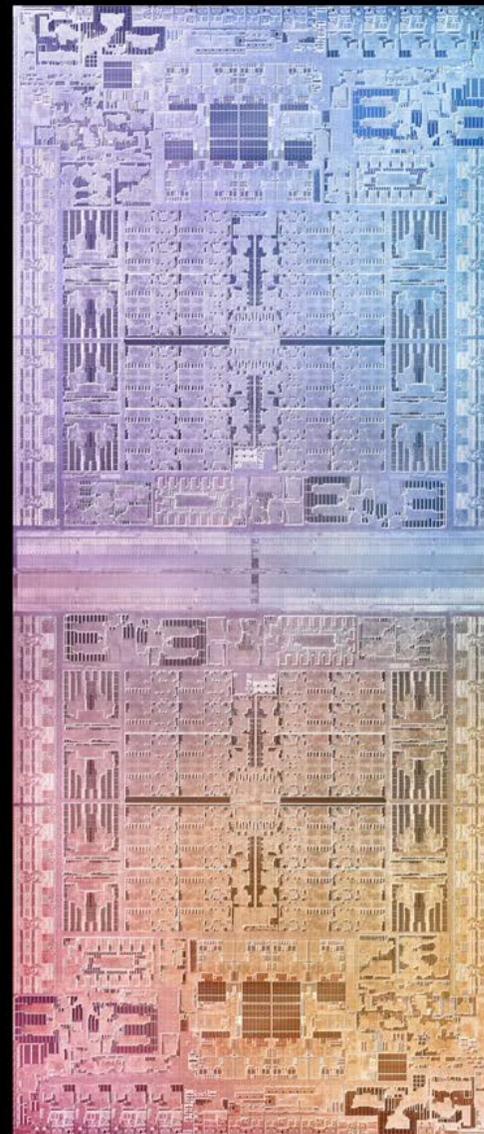
Apple M1



Apple M1 Pro

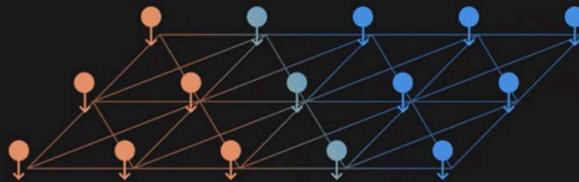


Apple M1 Max



Apple 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

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



16-core

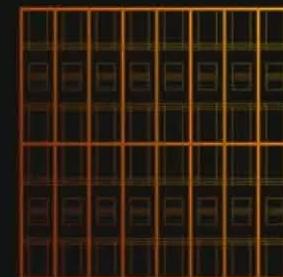
**Neural
Engine**

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

ProRes

encode and
decode



Thunderbolt 4



Secure Enclave



Support for four external displays

Up to

64GB

Unified memory

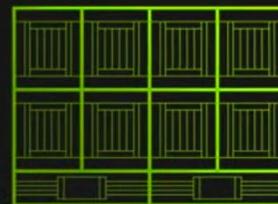
57 billion
Transistors



16-core

**Neural
Engine**

11 trillion operations per second



10-core
CPU



Up to
32-core
GPU

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

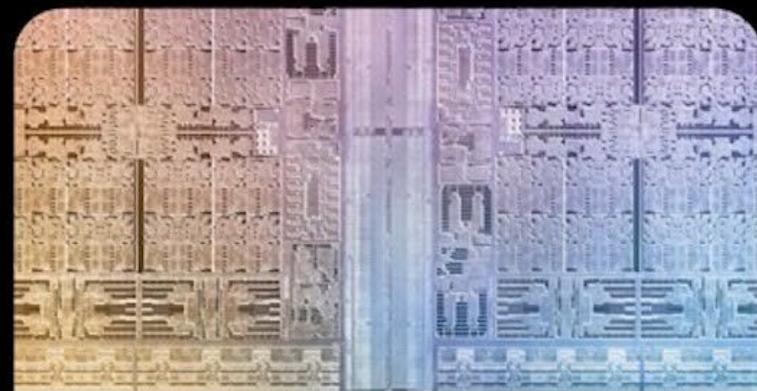
2.5TB/s

interprocessor bandwidth

800GB/s

Memory bandwidth

Apple M1
ULTRA



UltraFusion
architecture



20-core
CPU

Up to



64-core
GPU

32-core Neural Engine

22 trillion operations per second



Secure Enclave

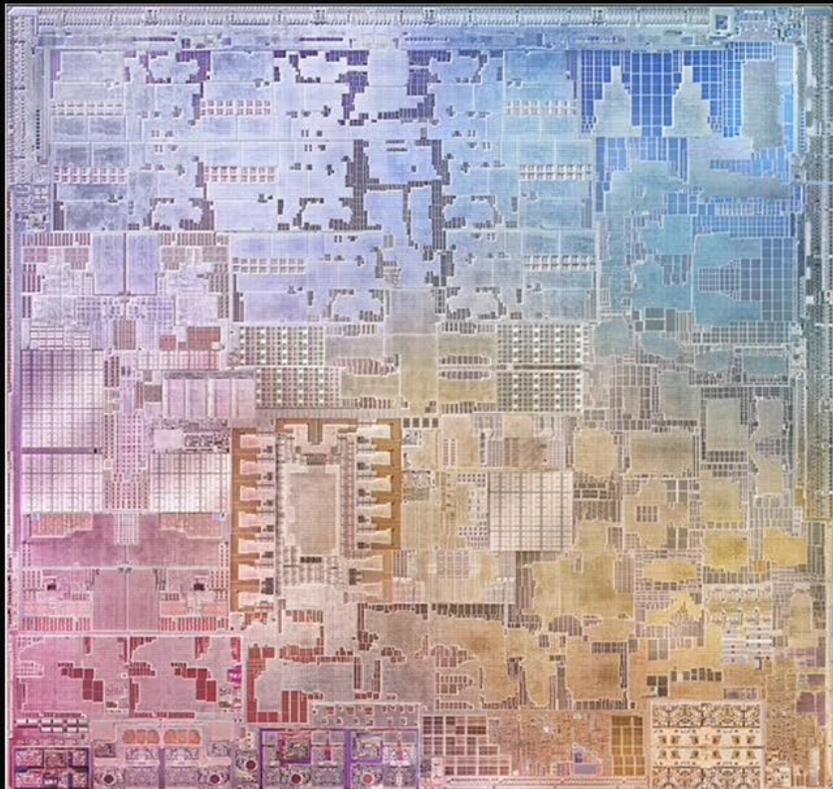
Industry-leading
performance per watt

Up to

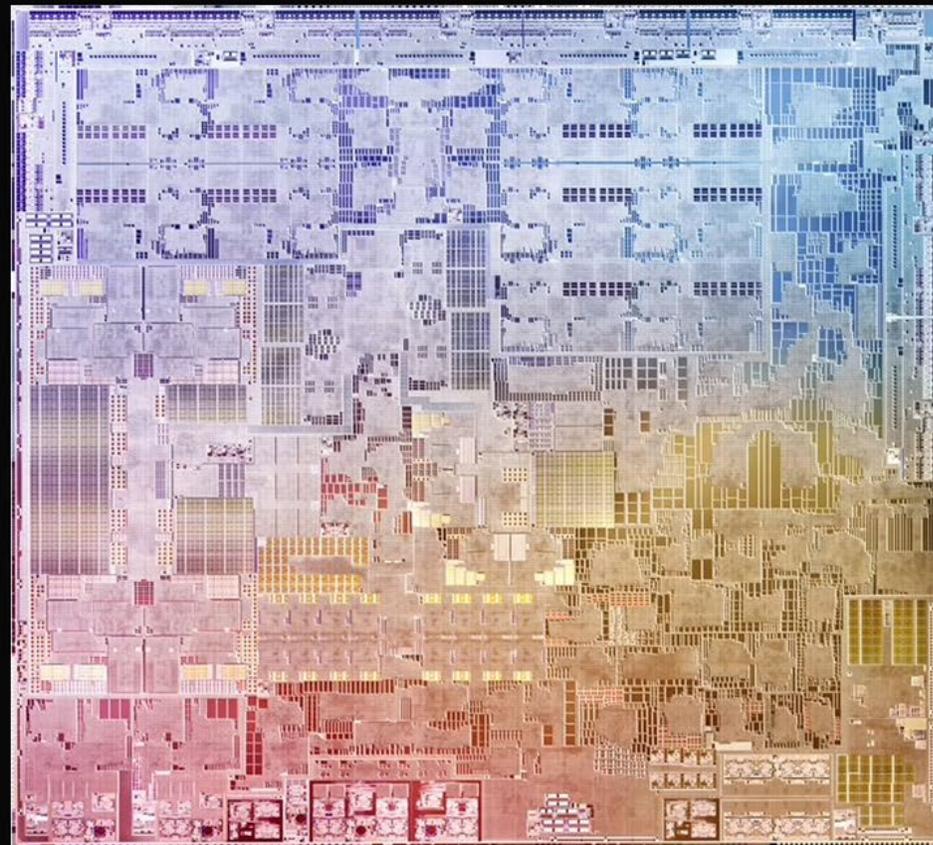
128GB

unified memory

Apple's M2 Processor



Apple M1



Apple M2

Up to

24GB

LPDDR5 memory

High-performance
media engine

40%

Faster Neural Engine

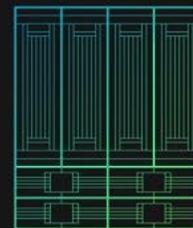
Up to

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

Over

20 billion

transistors

Industry-leading
performance per watt

50%

More memory
bandwidth

18%

Faster CPU

35%

Faster GPU

100GB/s

Memory bandwidth

Apple's ARM Silicon Family - Recap

The logo for the Apple M1 chip, featuring the Apple logo and the text 'M1' in white on a black background.

- 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.

The logo for the Apple M1 Pro chip, featuring the Apple logo and the text 'M1 PRO' in white on a black background.

- 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 logo for the Apple M1 Max chip, featuring the Apple logo and the text 'M1 MAX' in white on a black background.

- 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.

The logo for the Apple M1 Ultra chip, featuring the Apple logo and the text 'M1 ULTRA' in white on a black background.

- 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.

The logo for the Apple M2 chip, featuring the Apple logo and the text 'M2' in white on a black background.

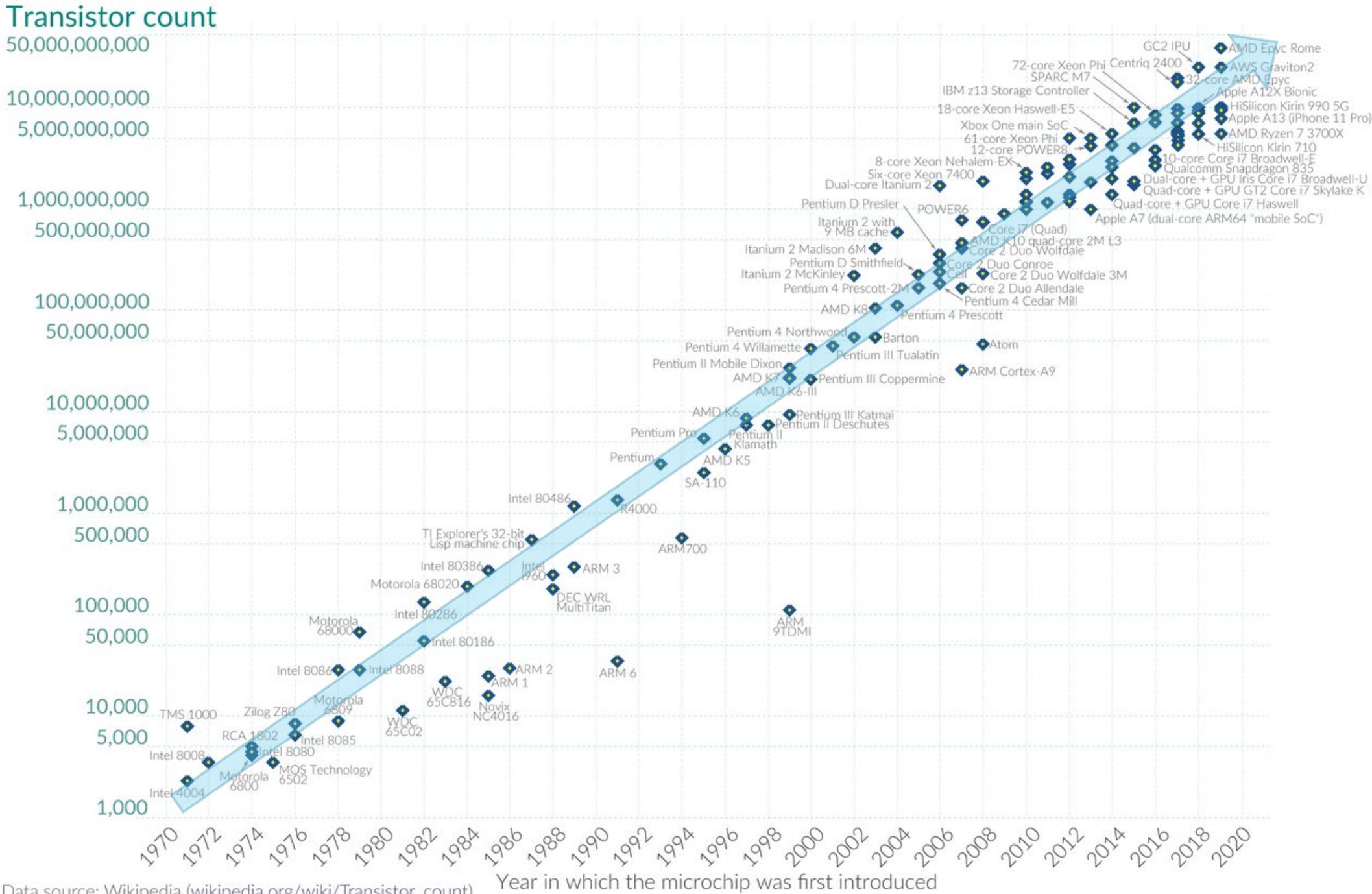
- Rolled out on June 6, 2022, the M2 chip powers the MacBook Air and the 13-inch MacBook Pro.
- Based on improved 5-nm technology.
- The chip houses over 20 billion transistors and can include up to 24 GB of RAM and 2TB of storage.
- The M2 chip has four efficiency & four performance cores and includes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

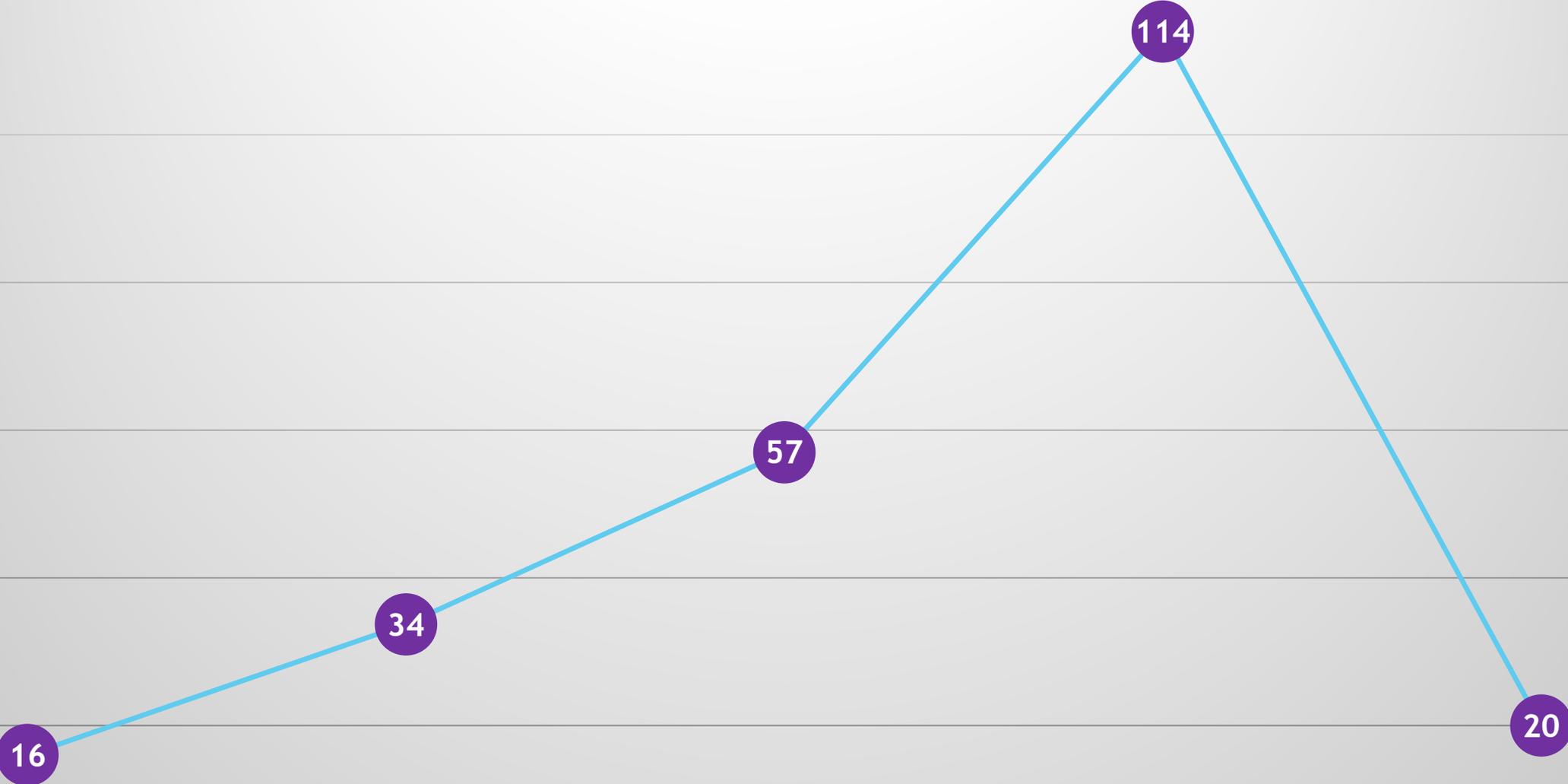
Data isn't published for all chips. Number is only one measure of chip complexity.

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.
 Licensed under CC-BY by the authors Hannah Ritchie and Max Roser.

Billions of Transistors



M1

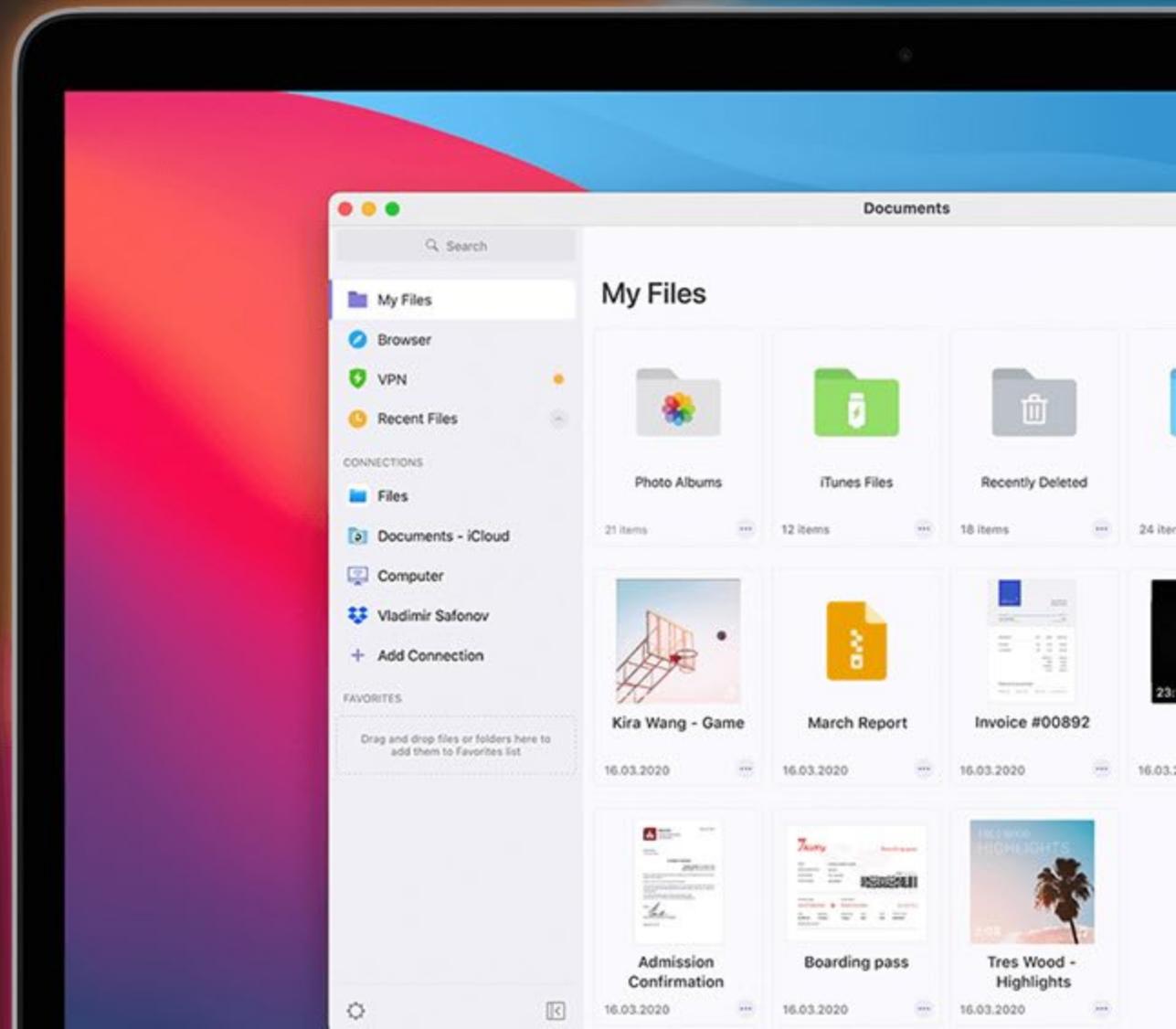
M1 PRO

M1 MAX

M1 ULTRA

M2

How to run iOS apps on Mac



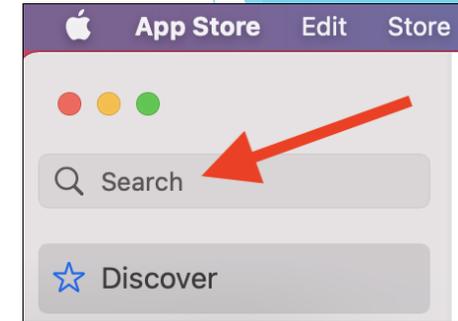
How to Run iOS Apps on macOS?



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 bar 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.

Results for "hbo max"

Mac Apps iPhone & iPad Apps

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.

Results for "hbo max"

Mac Apps iPhone & iPad Apps

HBO Max: Stream TV & Movies
Watch films & shows you love
Designed for iPad

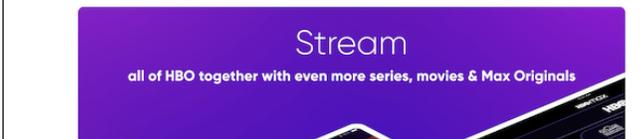


Click the "Get" or Download button (which looks like a cloud icon) to start the download process.

Results for "hbo max"

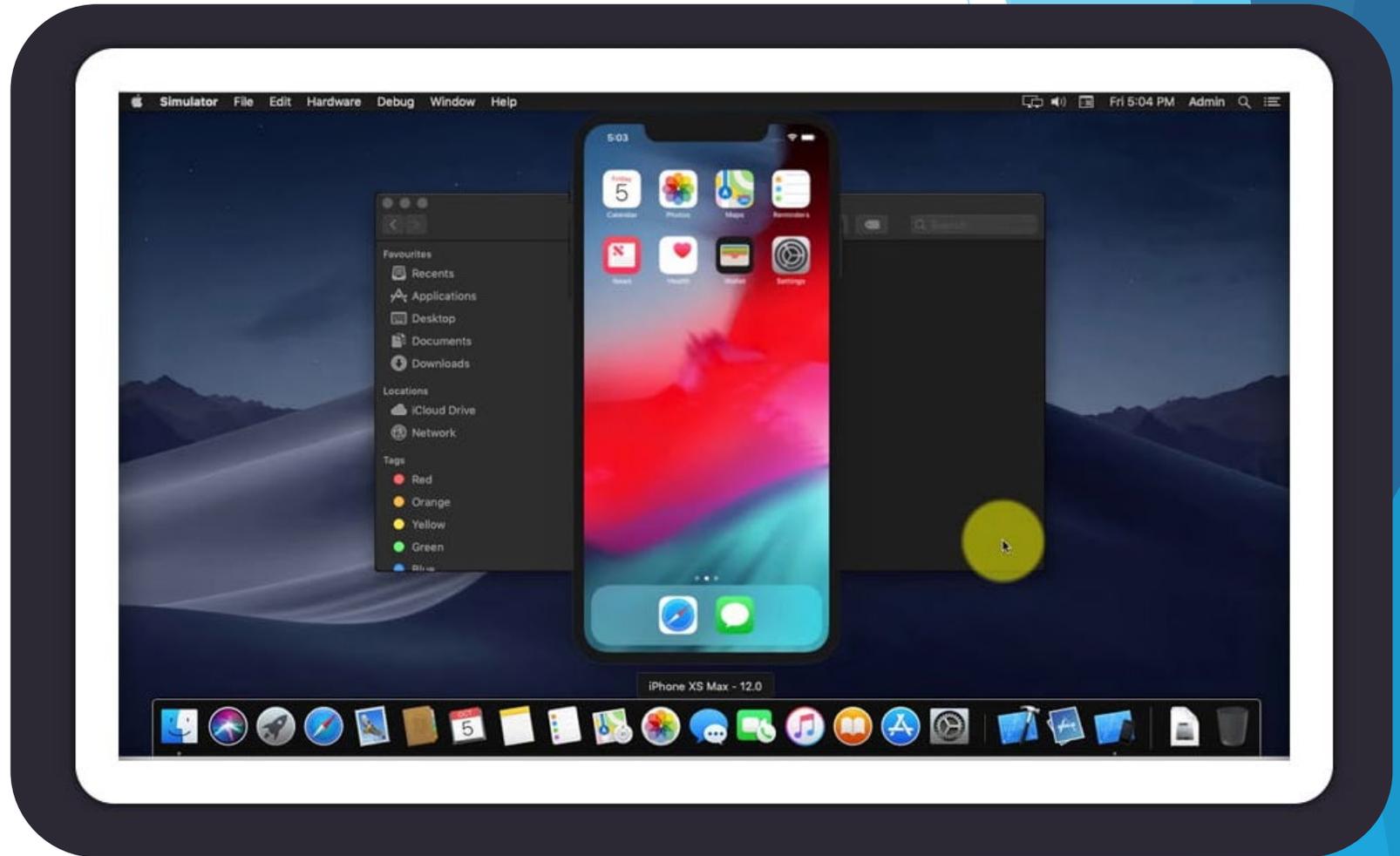
Mac Apps iPhone & iPad Apps

HBO Max: Stream TV & Movies
Watch films & shows you love
Designed for iPad



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

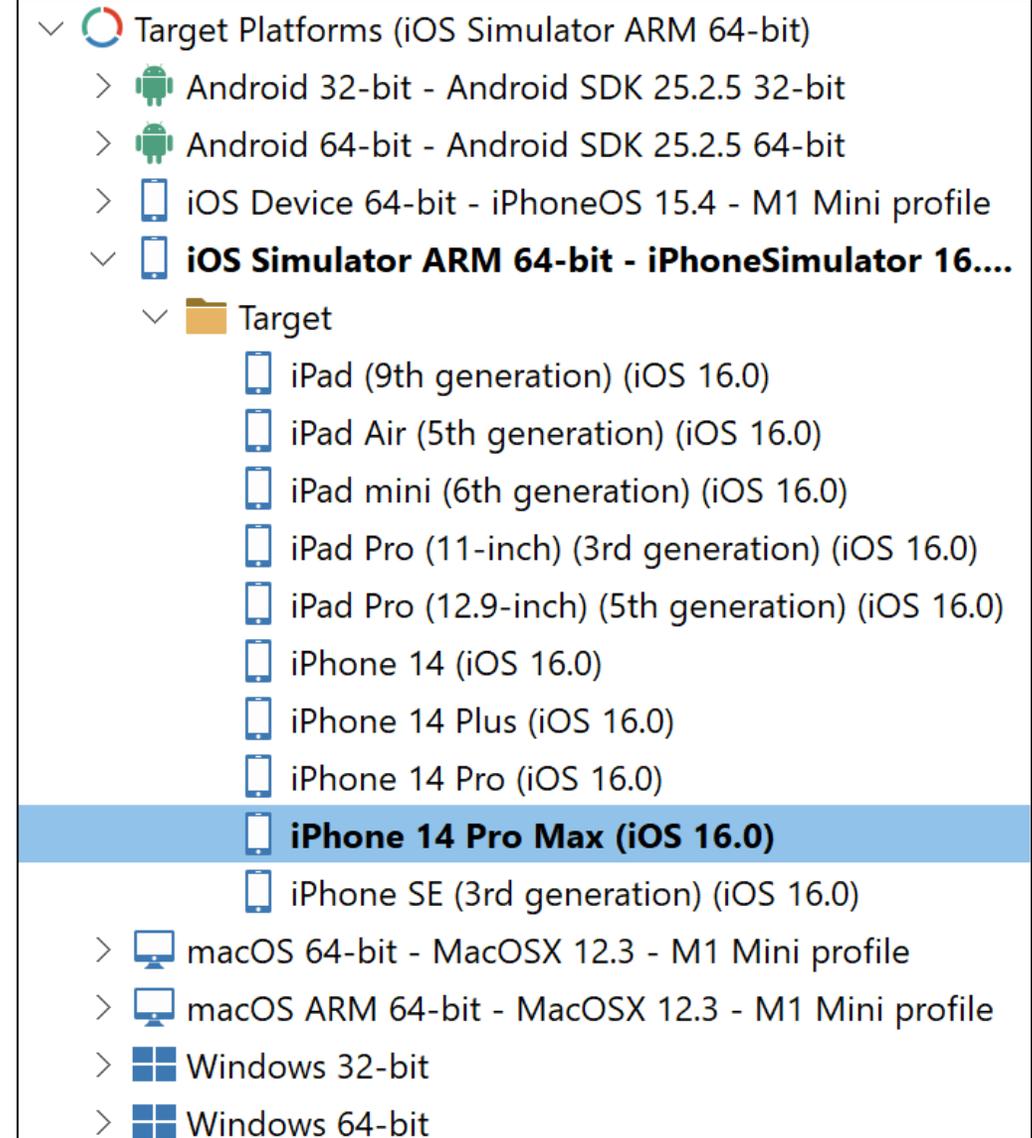


Use Simulator to:

- 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



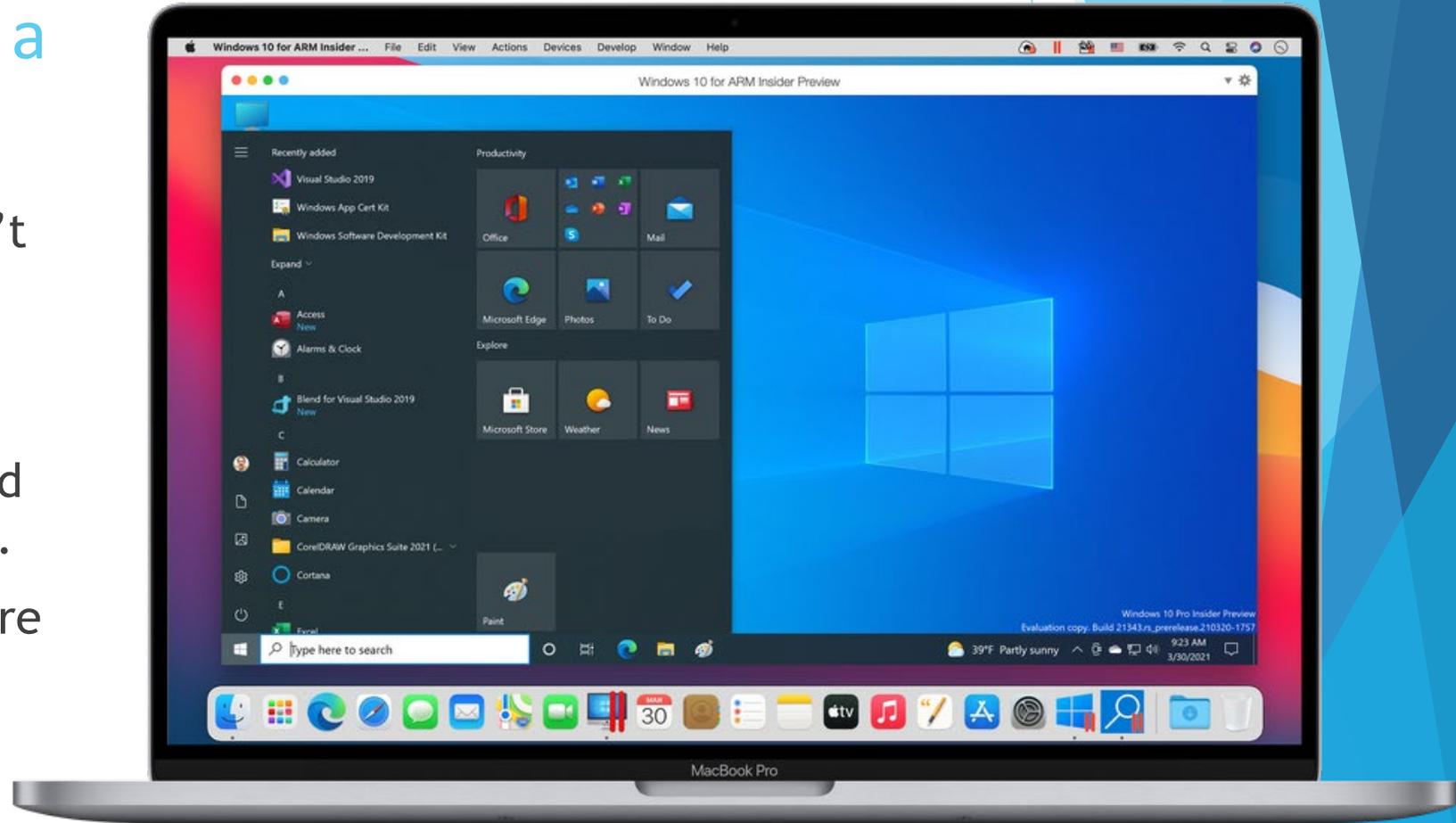
- ARM support still in Tech Preview
- VMware Fusion Public Tech Preview 22H2
- Release 2022-09-22
- No plans for Emulation.



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.





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



Create New

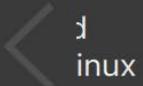


Get Windows 11
from Microsoft



Install Windows
or another OS
from a DVD or image file

Free Systems



Download
Fedora Linux



Download
Debian GNU/Linux



Download
Kali Linux



Download
macOS



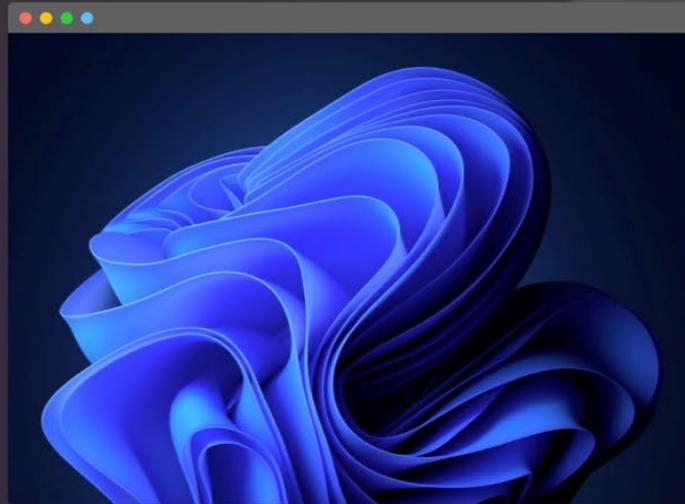
Open...

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

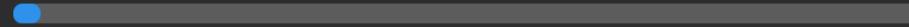
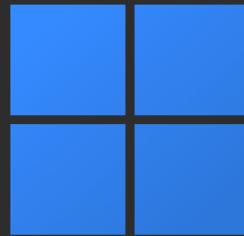
Install Windows



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 & Running 64-bit Linux x86 on Apple ARM with UTM



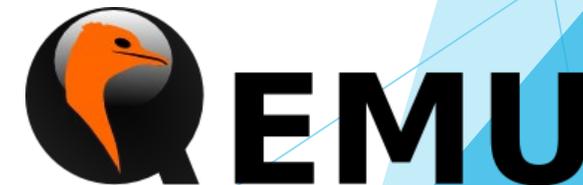
Installing and Running 64-bit Linux x86 in a UTM VM

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.

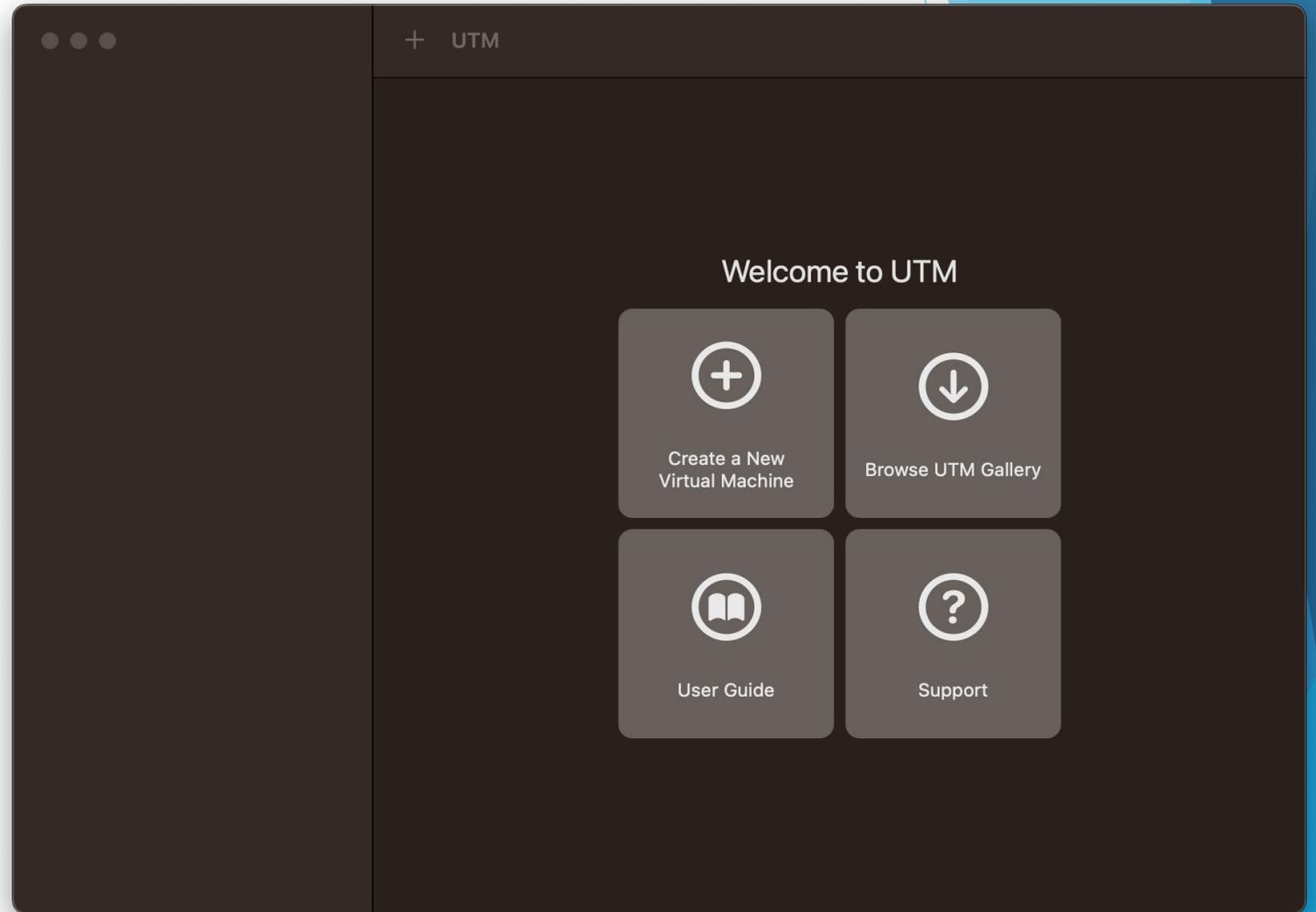
(It also supports x86 VMs on iOS...)

- ▶ Install UTM from mac.getutm.app
- ▶ Download an 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



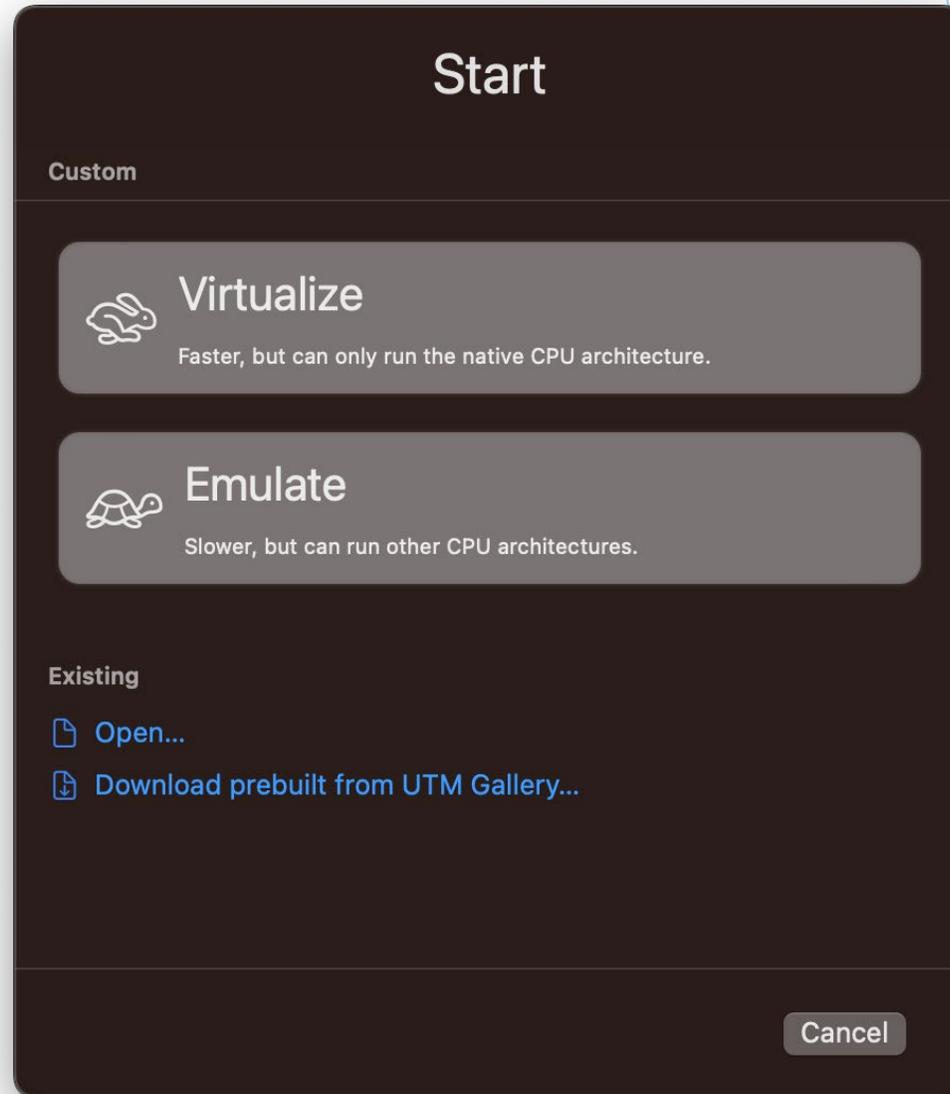
UTM Welcome Screen

Select Create New Virtual Machine



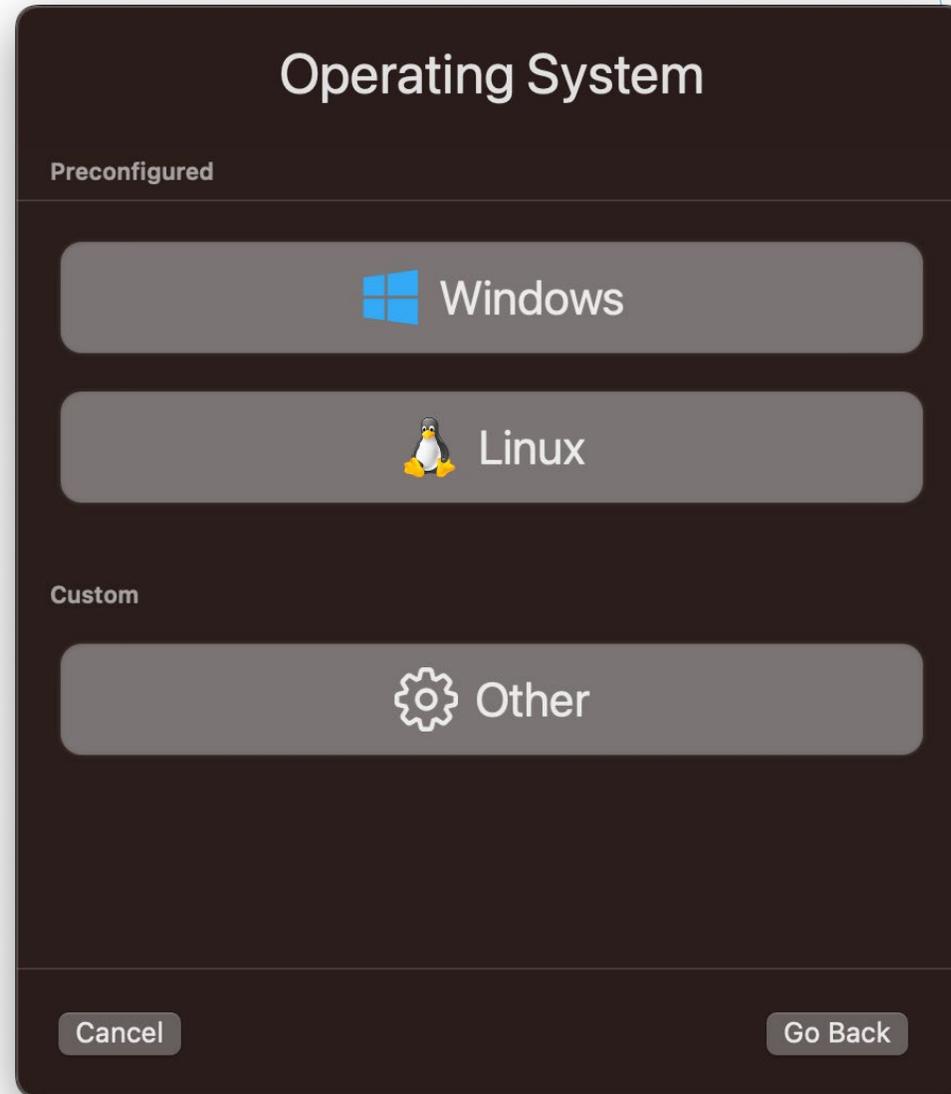
Virtualize vs Emulate

When the Guest OS doesn't match the Host hardware use Emulate.



Operating System

We are installing Linux



Select ISO

Browse to the ISO you downloaded.



Linux

Boot Image Type

Boot from kernel image

[Ubuntu Install Guide](#)

Boot ISO Image

xubuntu-22.04.1-desktop-amd64.iso

Hardware

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



Hardware

Architecture

x86_64

System

Standard PC (Q35 + ICH9, 2009) (alias of pc-q35-7.0) (q35)

Memory

4096 MB

CPU

CPU Cores 4

Hardware OpenGL Acceleration

Enable hardware OpenGL acceleration (experimental)

Cancel Go Back Continue

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.



Storage

Size

Specify the size of the drive where data will be stored into. GB

Shared Directory

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



Shared Directory

Shared Directory Path

Shared Clear Browse...

Share is read only

Optionally select a directory to make accessible inside the VM. Note that support for shared directories varies by the guest operating system and may require additional guest drivers to be installed. See UTM support pages for more details.

Cancel Go Back Continue

Summary

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



Summary

Name	Xubuntu x86
	<input checked="" type="checkbox"/> Open VM Settings
Engine	QEMU
	<input type="checkbox"/> Use Virtualization
Architecture	x86_64
System	Standard PC (Q35 + ICH9, 2009) (alias of pc-q35)
RAM	4 GB
CPU	4 Cores
Storage	68.72 GB
	<input checked="" type="checkbox"/> Hardware OpenGL Acceleration
Operating System	Linux
	<input type="checkbox"/> Skip Boot Image
Boot Image	/Users/jim/Downloads/xubuntu-22.04.1-desktop-

Cancel Go Back Save

System Settings

- Enable *Force Multicore*



Information

System

QEMU

Input

Sharing

Devices

Display

Network

Sound

+ New... ▾

Drives

IDE Drive

IDE Drive

New...

Hardware

Architecture x86_64

System Standard PC (Q35 + ICH9, 2009) (alias of pc-q35-7.0) (q35)

4096 MB

CPU

Default

CPU Cores

4 Cores

Force Multicore

Force multicore may improve speed of emulation but also might result in unstable and incorrect emulation.

JIT Cache

Default MB

Default is 1/4 of the RAM size (above). The JIT cache size is additive to the RAM size in the total memory usage!

Cancel Save

QEMU Settings

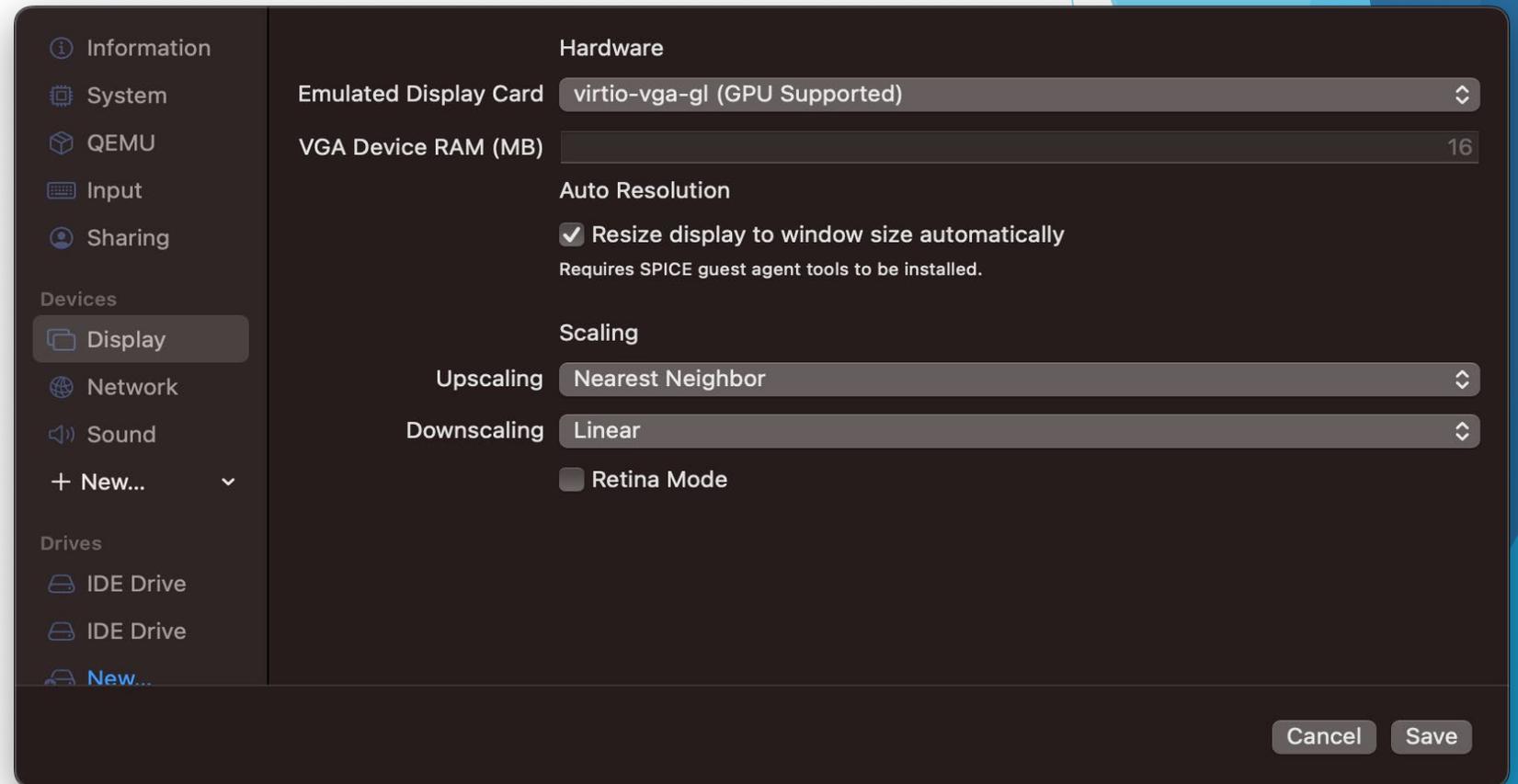
- Enable Balloon Device - This allows VM memory to allocate dynamically.



A screenshot of the QEMU settings window. The left sidebar shows a list of settings categories: Information, System, QEMU (selected), Input, Sharing, Devices, Display, Network, Sound, + New..., Drives, IDE Drive, IDE Drive, and New... The main panel is divided into sections: Logging (Debug Logging is disabled, with an Export Debug Log button), Tweaks (UEFI Boot, RNG Device, Balloon Device, Use Hypervisor, Use local time for base clock, Force PS/2 controller), QEMU Machine Properties (Default), and QEMU Arguments. A note below the Tweaks section states: "These are advanced settings affecting QEMU which should be kept default unless you are running into issues." At the bottom right, there are Cancel and Save buttons.

Display

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



Information

System

QEMU

Input

Sharing

Devices

Display

Network

Sound

+ New... ▾

Drives

IDE Drive

IDE Drive

New...

Hardware

Network Mode **Bridged (Advanced)**

Bridged Interface **en0**

Emulated Network Card **Intel Gigabit Ethernet (e1000)**

MAC Address **AA:2C:CD:C1:FC:58** **Random**

Show Advanced Settings

Cancel Save

Ubuntu *Flavors*

Ubuntu comes in a few flavor variations

Kubuntu - KDE Plasma

- ▶ Lubuntu - LXQt desktop
- ▶ Ubuntu Budgie
- ▶ Ubuntu Kylin - Chinese
- ▶ Ubuntu MATE
- ▶ Ubuntu Studio - Content creators
- ▶ Ubuntu Unity
- ▶ Xubuntu - Xfce (lightweight)

Other Ubuntu-based distros:

Linux Mint, Pop!_OS, Zorin OS, Feren OS, Nitrux, & Elementary OS



Ubuntu



ubuntu.com/desktop/flavours

After Install for Ubuntu/Debian Linux

- ▶ If you installed Server and want Desktop
 - ▶ `sudo apt update`
 - ▶ `sudo apt install ubuntu-desktop -y`
 - ▶ `sudo reboot`
- ▶ Enable Clipboard and Directory sharing
 - ▶ `sudo apt update`
 - ▶ `sudo apt install spice-webdavd spice-vdagent -y`
- ▶ 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

The screenshot displays the RAD IDE's 'Create a Connection Profile' wizard. The 'Profile information' step is active, showing a profile name of 'Xubuntu on M1' and a platform of 'Linux 64-bit'. The 'Remote machine information' step is also visible, with the remote machine IP address set to '192.168.64.28' and port number '64211'. An 'Add a New SDK' dialog box is overlaid on the wizard, showing the selection of 'Linux 64-bit' platform, 'Xubuntu on M1, (Host: '192.168.1.27', Port Number: '64211')' profile, and 'Ubuntu 22.04.1 LTS' SDK version. The 'Make the selected SDK active' checkbox is checked. The wizard has a 'Test Connection' button and navigation buttons at the bottom.

All About Apple ARM

Jim McKeeth, Developer Advocate
Embarcadero Technologies



Slides, replay, and more:

blogs.embarcadero.com/all-about-apple-arm-on-the-desktop