

iPad Data Processing and Storage Details

U3A Bendigo Apple Users Group

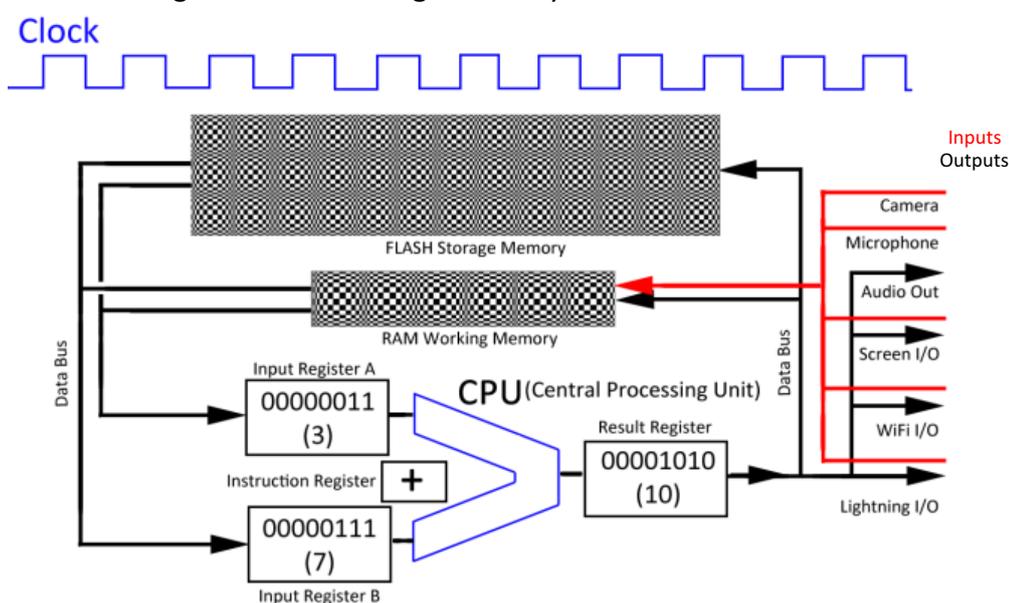
Michael Gallagher

2nd March 2017

iPads have two sorts of memory:

1. An amount of Working Memory or RAM which requires power to work—its contents are lost when the iPad powers down.
2. A larger amount of Flash Storage Memory, also called Non-volatile RAM, which retains its contents when the power is off.

When you take a photo, record a movie, download a file, type an email, or enter a contact's details, etc., the data is put in the iPad's working memory (RAM) and from there moved to long-term Flash Storage Memory.



A block diagram of an iPad data processing circuitry. All data is stored electronically as binary digits. Data input devices put data directly into RAM Working Memory. The input devices put data into RAM Working Memory. The Central Processing Unit fetches data from memory, processes it and stores it back in memory or sends it to an output device. (The diagram shows the state of the device after two numbers have been added). A Clock determines the rate at which data can be moved from place to place in the device.

The apps on your iPad are stored in Flash Storage Memory and each app that can acquire data has an associated file storage space. For example: if you take a photo, the image file is stored in the Camera App's storage space; if you enter a new contact, the details are stored in the Contact App's storage space; if you download an eBook from the Kindle store, the file is stored in the Kindle App's storage space.

The sandboxed iPad file storage system contrasts markedly with open-ended PC file storage systems. PC Users create can create a set of folders to store their data as they see fit. For example, all files related to a project can be placed in the same folder, regardless of the application used to create them. iPad Users are restricted to storing their data in the space allocated to the app used to enter or acquire the data.

Some apps have access to the storage space of other apps. For example: the Photos App accesses the files in the Camera App's storage space—it is used to arrange the

photos in albums, delete unwanted photos, crop and edit images, etc.; the Phone App accesses the data in the Contacts App's storage space, allowing it to serve as one's personal phone book.

Some apps enforce Digital Rights Management (DRM) restrictions. For example: the music files stored in the Music App's storage space cannot be played by other Music Playing apps. Likewise, the eBooks stored in the Kindle App's storage space cannot be read by other eBook Reader apps.

	Original	iPad 2	3rd-generation	4th-generation
Date	Apr 2010	Mar 2011	Mar 2012	Nov 2012
Front and Back Cameras	-	Yes	Yes	Yes
3-axis Gyroscope	-	Yes	Yes	Yes
Retina Display	-	-	Yes	Yes
Lightning Port	-	-	-	Yes
Storage Memory	16, 32 or 64 GB	16, 32 or 64 GB	16, 32 or 64 GB	16, 32, 64 or 128 GB
Processor	ARM Cortex-A8	A5 Processor	A5X Processor	A6X Processor
Processor Cores	32-bit Single Core	32-bit Dual Core	32-bit Dual Core	32-bit Dual Core
Processor Speed	1 GHz	1 GHz	1 GHz	1.4 GHz
RAM	256 MB	512 MB	1 GB	1 GB

iOS 10, Apple's operating system for iPad, iPhones and iPods, released in September 2016, is compatible only with devices fitted with Lightning Ports

iPad Mini 2
iPad Mini 3
iPad Mini 4
iPad Air
iPad Air 2
iPad Pro 9"
iPad Pro 12"

The iPad Pro (Nov 2015) has up to 256 GB Storage Memory, a 2.24 GHz, 64 bit, Dual Core A9X processor and 4 GB of RAM

Rapid development in chip technology has resulted in significant increases in iPad memory capacity and processor speed. The first iPads were released with three Flash Storage memory options: 16, 32, or 64 GB and with no option to expand storage. The fourth-generation iPad offered up to 128 GB of flash memory. The iPad Pro released in 2016 offers up to 256 GB. Similarly, the amount of RAM Working Memory, data processing speeds, the number of processors and the width of the data pathway have expanded over time.

iPad Storage Expansion Options

Apple sells a "camera connection kit" with an SD card reader, but it can only be used to transfer photos and videos to and from the iPad Camera App's storage space.

Various manufacturers sell Flash Memory devices with a Lightning connector. These allow compatible apps to access the files on the drive. SanDisk iXpand drives, for example, when used with SanDisk iXpand App, allow music, photos, videos and document files stored on the device to be viewed, played and edited. The iXpand App also allows photo and music files to be moved to and from the iPad's Photo App storage space and the iXpand.

Various apps allow iPads to access via WiFi data stored on WiFi Direct drives, networked USB drives and Network Attached Storage (NAS) units. Some examples are listed in: *iPad Data Storage Options*.