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**RAM GENERATIONS**

RAM (Random Access Memory) is a part of computer's Main Memory which is directly accessible by CPU. RAM comes in a variety of shapes capacities (measured in [MB or GB](https://www.lifewire.com/network-data-rates-817365)), speeds (measured in [MHz or GHz](https://www.lifewire.com/story-of-hertz-megahertz-and-gigahertz-818308)) and architectures. When upgrading RAM you should consider that:

* Older-generation computers are unlikely to accommodate the more recent types of RAM technology.
* Laptop memory won’t fit in desktops and vice versa.
* RAM is not always backward compatible
* A system generally can't mix and match different types and generations of RAM together.

Although all RAM basically serves the same purpose, there are a few different types commonly in use today:

* Static RAM (SRAM)
* Dynamic RAM (DRAM)
* Synchronous Dynamic RAM (SDRAM)
* Single Data Rate Synchronous Dynamic RAM (SDR SDRAM)
* Double Data Rate Synchronous Dynamic RAM (DDR SDRAM, DDR2, DDR3, DDR4)
* Graphics Double Data Rate Synchronous Dynamic RAM (GDDR SDRAM, GDDR2, GDDR3, GDDR4, GDDR5)
* Flash Memory

1. **Static RAM (SRAM)**

Time in market: 1990s to present

Popular products using SRAM: Digital cameras, routers, printers and LCD screens.

It is one of the two basic memory types. It requires a constant power flow to function hence doesn’t need to be refreshed to remember the data being stored. It is called ‘static’ because – no change or action is needed to keep data intact. However, SRAM is a volatile memory, which means that all the data that had been stored in it becomes lost once the power is cut off. It is used in: CPU cache (L1 cache, L2 cache, L3 cache), hard drive buffer/cache and digital-to-analog converters (DACs) on video cards.

Advantages of SRAM over DRAM:

1. Lower power consumption
2. Faster access speeds.

Disadvantages of SRAM over DRAM:

1. Lower memory capacity
2. Expensive to manufacture
3. **Dynamic RAM (DRAM)**

Time in market: 1970s to mid-1990s

Popular products using DRAM: Video game consoles, networking hardware

* It is the second basic memory types that requires a periodic ‘refresh’ of power to function. The capacitors that store data in DRAM gradually discharge energy which means the data becomes lost hence called ‘dynamic’ as constant change or action is needed to keep data intact. DRAM is also a volatile memory, which means that all the stored data becomes lost once the power is cut off. It is used in: System memory and video graphics memory. Later, Extended Data Out Dynamic RAM (EDO DRAM) was developed, followed by Burst EDO RAM (BEDO DRAM) which had increased performance and efficiency at lower costs. It was later replaced by SDRAM.

Advantages of DRAM over SRAM:

* Less expensive to manufacture
* Greater memory capacity

Disadvantages of DRAM over SRAM:

* Higher power consumption.
* Slower access speeds

1. **Synchronous Dynamic RAM (SDRAM)**

Time in market: 1993 to present

Popular products using SDRAM: Computer memory, video game consoles

It is a classification of DRAM that operates in sync with the CPU clock i.e. waits for the clock signal before responding to data input. DRAM is asynchronous, therefore responds immediately to data input. But the benefit of synchronous operation is that a CPU can process overlapping instructions in parallel referred to as pipelining. Pipelining allows for more instructions to be completed simultaneously but does not affect time taken to process instructions. SDRAM memory is divided into separate banks making it support pipelining hence it is preferred to basic DRAM.

1. **Single Data Rate Synchronous Dynamic RAM (SDR SDRAM)**

Time in market: 1993 to present

Popular products using SDR SDRAM**:** Computer memory, video game consoles

SDR SDRAM is the expanded term for SDRAM most frequently referred to as just SDRAM. The ‘single data rate’ indicates how the memory processes one read and one write instruction per clock cycle. This labeling helps clarify comparisons between SDR SDRAM and DDR SDRAM, which is the second generation of SDR SDRAM.

1. **Double Data Rate Synchronous Dynamic RAM (DDR SDRAM)**

Time in market: 2000 to present

Popular products using DDR SDRAM: Computer memory

DDR SDRAM operates like SDR SDRAM, only twice as fast therefore capable of processing two read and two write instructions per clock cycle hence the ‘double’. The physical difference is that SDR SDRAM has 168 pins and two notches on the connector while DDR SDRAM has a 184 pins and a single notch on the connector. It also works at a lower standard voltage of 2.5 V- 3.5 V HENCE PREVENTING BACKWARD COMPATIBILITY WITH SDR SDRAM.

* DDR2 SDRAM is the evolutionary upgrade to DDR SDRAM. It is faster because it can run at higher clock speeds. Standard DDR memory modules top out at 200 MHz, whereas standard DDR2 memory modules top out at 533 MHz. It also runs at a lower voltage of 1.8 V with more pins (240), which prevents backward compatibility.
* DDR3 SDRAM improves performance over DDR2 SDRAM through advanced signal processing (reliability), greater memory capacity, lower power consumption of 1.5 V and higher standard clock speeds of up to 800 MHz. Although DDR3 SDRAM shares the same number of pins as DDR2 SDRAM (240), all other aspects prevent backward compatibility.
* DDR4 SDRAM improves performance over DDR3 SDRAM through more advanced signal processing, even greater memory capacity, lower power consumption of 1.2 V and higher standard clock speeds of up to 1600 MHz). DDR4 SDRAM uses a 288-pin configuration which also prevents backward compatibility.

**LPDDR4**

LPDDR SDRAM stands for Low-Power Double Data Rate Synchronous Dynamic Random Access Memory. It is a type of DDR SDRAM that uses less power consumption and is intended for mobile devices hence the name Mobile DDR abbreviated as mDDR. Its generations are: LP-DDR (1), LP-DDR2, LP-DDR3, LP-DDR4, LP-DDR4X and LP-DDR5.

LP-DDR4

It is the memory used to store short term data used by applications. The [LPDDR4](https://www.androidauthority.com/tag/LPDDR4) specification aims to double data rates up to 3200 Mbps and to save on energy consumption for mobile devices.it has a two-channel die with 16 bits per channel, for a total of 32 bits total which lowers the core’s power due to shorter data paths and improves operational speed. The bandwidth is 17GB/s per die, but can still be arranged in a dual-channel configuration to reach much higher speeds.

1. **Graphics Double Data Rate Synchronous Dynamic RAM (GDDR SDRAM)**

Time in market: 2003 to present

Popular products using GDDR SDRAM: Video graphics cards and some tablets

GDDR SDRAM is a type of DDR SDRAM that is specifically designed for video graphics rendering in conjunction with a dedicated GPU (graphics processing unit) on a video card. Modern computer games are known to require incredibly realistic high-definition environments, often requiring hefty system specs and the [best video card hardware in order to play](https://www.lifewire.com/top-video-cards-for-computer-gaming-1983599).

It also has an evolutionary line composed of: GDDR2 SDRAM, GDDR3 SDRAM, GDDR4 SDRAM, and GDDR5 SDRAM. For GDDR SDRAM, bandwidth is favored over latency as it is required to process massive amounts of data, not necessarily with the highest speed.

GDDR5

GDDR5 stands for graphics double data rate type five synchronous dynamic random-access memory, is a modern type of [synchronous graphics random-access memory](https://en.wikipedia.org/wiki/Synchronous_dynamic_random-access_memory#Synchronous_graphics_RAM_.28SGRAM.29) (SGRAM) with a high [bandwidth](https://en.wikipedia.org/wiki/Bandwidth_(computing)) interface designed for use in [graphics cards](https://en.wikipedia.org/wiki/Video_card), [game consoles](https://en.wikipedia.org/wiki/Video_game_console), and [high-performance computing](https://en.wikipedia.org/wiki/High-performance_computing). It is a generation of [GDDR SDRAM](https://en.wikipedia.org/wiki/GDDR_SDRAM).

GDDR5 has been one of the best High-end low latency RAM among the current graphics cards. It can offer **the speed of up to 8 GB per sec**with high bandwidth memory performance and comparatively low power consumption. A single 32-bit GDDR5 chip has about 67 signal pins and the rest are power and grounds in the 170 [BGA](https://en.wikipedia.org/wiki/Ball_grid_array) package.

1. **Flash Memory**

Time in market: 1984 to present

Popular products using flash memory: Digital cameras, smartphones/tablets, handheld gaming systems/toys

It is a type of non-volatile storage medium that retains all data after power has been cut off. It is closer in form and operation (i.e. storage and data transfer) to solid-state drives (SSD) than the RAM types mentioned before. It is most commonly used in: printers, memory cards, USB flash drives and portable media players.

**SO-DIMM**

DIMM stands for Dual In-line Memory Module. It is an attempt to improve on the earlier single inline memory module (SIMM), which used matched pairs. It uses only one circuit board, thus increasing memory speed and storage.

SO-DIMM stands for Small Outline Dual In-Line Memory Module. It is used in laptops. It is half the length of a regular size DIMM which allows for greater flexibility in designing memory slots for laptops. Many laptops have a user-accessible section that houses the SO-DIMMs making it easier to update RAM. Earlier SO-DIMMs had 72 pins and supported 32-bit data transfers while modern have 144 pins and support 64-bit data transfer just like a regular DIMM. Although largely used I laptops, it is also used in desktop computers with small form factors.

**UPGRADABLE COMPONENTS**

1. The CPU (Central Processing Unit)
2. Power supply unit (PSU)
3. Random access memory (RAM)
4. Video card
5. Hard drive
6. Disk drive

**LAPTOP VS DESKTOP RAM**

What differentiates a desktop RAM to a laptop RAM is their form factor i.e. size and pin configuration. Desktop RAM uses the DIMM form factor and has a pin configuration of:  100, 168, 184, or 240 pins and is usually 4.5 to five inches in length. Laptop RAM uses the SO-DIMM form factor and has a pin configuration of:  72, 100, 144, or 200 pins and is smaller, about 2.5 to 3 inches

**GPU VS CPU**

CPU stands for the Central Processing Unit. GPU stands for Graphical Processing Unit which is a programmable processor designed to quickly [render](https://www.omnisci.com/platform/render) high resolution images and video. The CPU is good at handling multiple tasks while GPU can handle a few specific tasks very fast. Since GPU supports pipelining, they are now commonly adopted for non-graphical uses. They are best suited for repetitive and highly-parallel computing tasks

GPUs are faster and more powerful than a CPU, but not as versatile as CPUs. CPUs can perform many more kinds of tasks than a GPU due to large and broad instruction sets and also manage every input and output of a computer, which a GPU cannot do. Individual CPU cores are faster and smarter than individual GPU cores, but the sheer number of GPU cores, and the massive amount of parallelism that they offer, more than make up the difference.

**NLTDR IS MISSING**

NTLDR stands for NT loader, is the boot loader for all releases of Windows NT operating systems up to and including Windows XP, and Windows Server 2003.NT loader is typically run from the primary hard disk drive, but it can also run from portable storage devices such as CD-ROM, USB flash drives, or floppy disk. NTLDR can load a non NT-based operating system given the appropriate boot sector in a file. The NTLDR file is normally located in the root directory of the active partition on the first boot drive. This is an issue often caused by BIOS trying to load from an external non-bootable drive.

NT loader contains three files.

* ntldr, the main boot loader
* COM, required for booting an NT-based OS, detects basic hardware information needed for successful boot.
* ini, contains boot configuration (if missing, NTLDR will default to \Windows on the first partition of the first hard drive).

To fix this error you can:

1. Restart your computer
2. Unplug all removable media
3. Change BIOS boot order
4. Reset active partition
5. Update your motherboard’s BIOS
6. Reset all internal data and power cables
7. Rebuild MBR
8. Reinstall windows
9. Replace hard drive

### Restore NTLDR and Ntdetect.com File

**32 & 64-BIT PROCESSORS**

|  |  |  |
| --- | --- | --- |
| **Number of bits** | 32 | 64 |
| **Architecture and Software Description** | 32-bit architecture is based on registers, address or data buses 32 bits (4 octets) wide. For software, 32-bit typically means use of 32-bit linear address space. | 64-bit architecture is based on registers, address or data buses 64 bits (8 octets) wide. For software, 64-bit means code use with 64-bit virtual memory addresses. |
| **Compatibility** | 32-bit operating systems (OS) and applications require 32-bit CPUs | 64-bit OS requires 64-bit CPU, and 64-bit applications need a 64-bit OS and CPU |
| **Systems Available** | All editions of Windows 8, Windows 7, Windows Vista, and Windows XP, Linux | XP Professional, Windows Vista, Windows 7, Windows 8, as well as Mac OS X and Linux |
| **Memory Limits** | 32-bit systems are limited to 3.2 Gigabytes (GB) of RAM 32 bit Windows with address limitation do not attain to a full 4GB. It's hardware dependent, typically 3.25GB. | 64-bit systems allow up to 17 Billion GB of RAM. |
| **Pros** | Fewer issues, more widely compatible | • More RAM access  • More efficiency  • More virtual memory allocation  • More security features |
| **Cons** | Less RAM access, less memory, less efficiency, fewer security features | • Possible driver compatibility  • Some motherboard RAM limits  • Legacy issues |