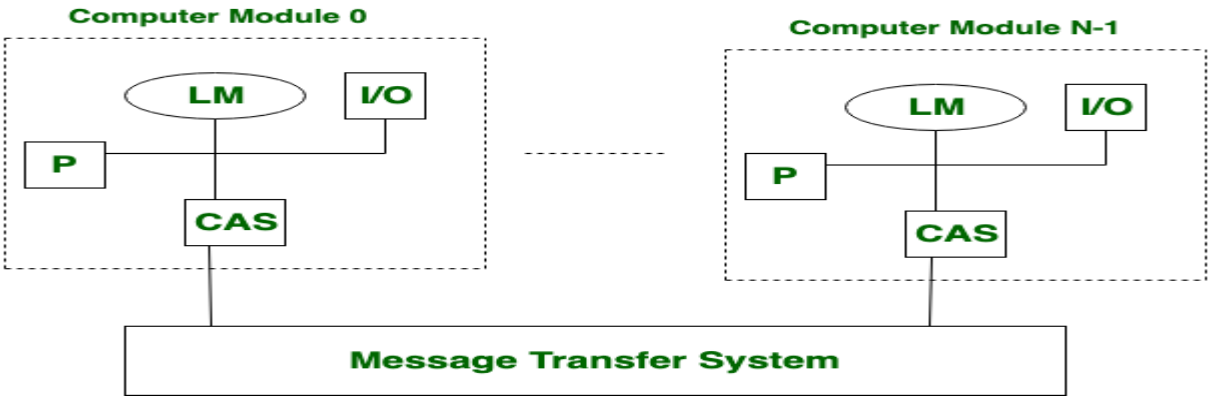
Second Topic:

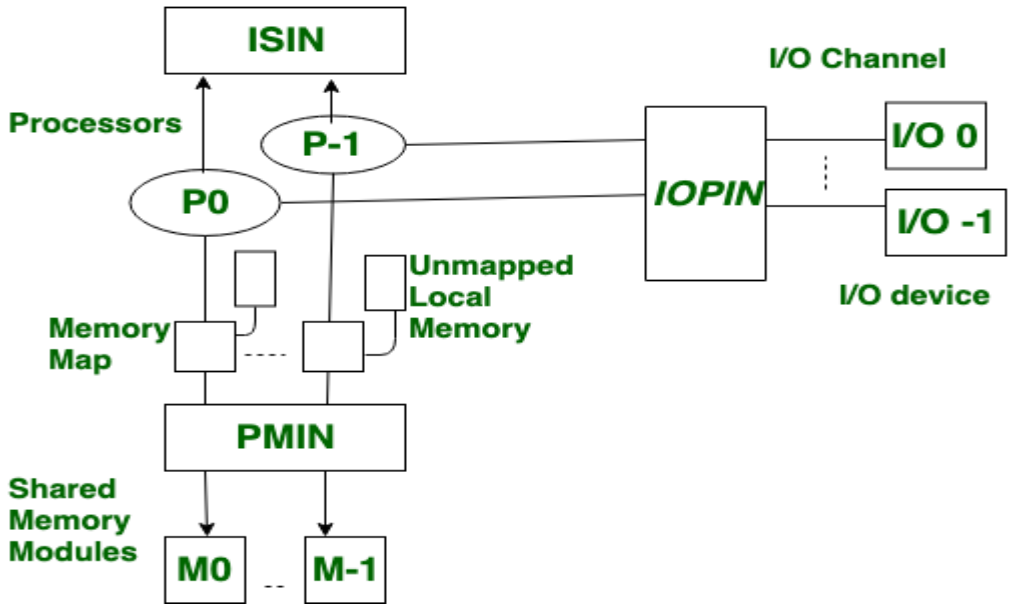
Difference between Loosely Coupled and Tightly Coupled Multiprocessor System

- **Loosely Coupled Multiprocessor System:**

It is a type of multiprocessing system in which, there is distributed memory instead of shared memory. In loosely coupled multiprocessor system, data rate is low rather than tightly coupled multiprocessor system. In loosely coupled multiprocessor system, modules are connected through MTS (Message transfer system) network.



- **Tightly Coupled Multiprocessor System:**It is a type of multiprocessing system in which, There is shared memory. In tightly coupled multiprocessor system, data rate is high rather than loosely coupled multiprocessor system. In tightly coupled multiprocessor system, modules are connected through PMIN, IOPIN and ISIN networks.



Let's study the difference between loosely coupled and tightly coupled multiprocessor system:

S.NO	Loosely Coupled	Tightly Coupled
1.	There is distributed memory in loosely coupled multiprocessor system.	There is shared memory, in tightly coupled multiprocessor system.
2.	Loosely Coupled Multiprocessor System has low data rate.	Tightly coupled multiprocessor system has high data rate.
3.	The cost of loosely coupled multiprocessor system is less.	Tightly coupled multiprocessor system is more costly.
4.	In loosely coupled multiprocessor system, modules are connected through **Message transfer system** network.	While there is PMIN, IOPIN and ISIN networks.
5.	In loosely coupled multiprocessor, Memory conflicts don't take place.	While tightly coupled multiprocessor system have memory conflicts.
6.	Loosely Coupled Multiprocessor system has low degree of interaction between tasks.	Tightly Coupled multiprocessor system has high degree of interaction between tasks.
7.	In loosely coupled multiprocessor, there is direct connection between processor and I/O devices.	While in tightly coupled multiprocessor, IOPIN helps connection between processor and I/O devices.
8.	Applications of loosely coupled multiprocessor are in distributed computing systems.	Applications of tightly coupled multiprocessor are in parallel processing systems.

Third Topic:

BUS Arbitration in Computer Organization

Bus Arbitration refers to the process by which the current bus master accesses and then leaves the control of the bus and passes it to another bus requesting processor unit. The controller that has access to a bus at an instance is known as a **Bus master**.
A conflict may arise if the number of DMA controllers or other controllers or processors try to access the common bus at the same time, but access can be given to only one of those. Only one processor or controller can be Bus master at the same point in time. To resolve these conflicts, the Bus Arbitration procedure is implemented to coordinate the activities of

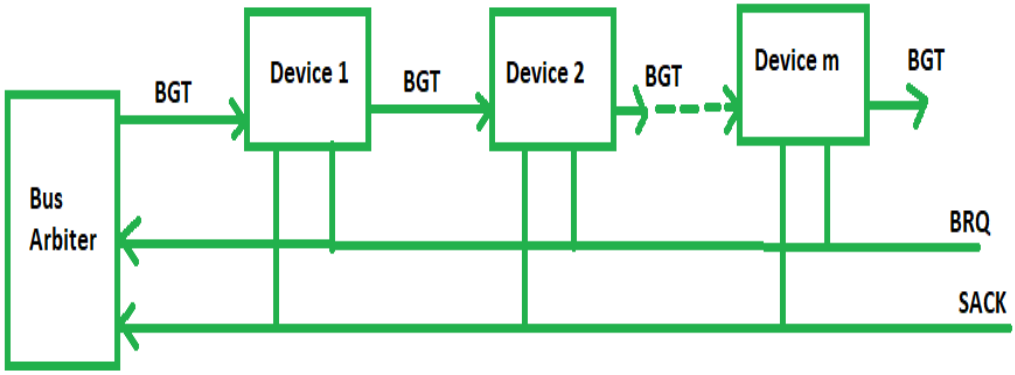
all devices requesting memory transfers. The selection of the bus master must take into account the needs of various devices by establishing a priority system for gaining access to the bus. The **Bus Arbiter** decides who would become the current bus master.
There are two approaches to bus arbitration:

1. **Centralized bus arbitration –** A single bus arbiter performs the required arbitration.

2. **Distributed bus arbitration –** All devices participating in the selection of the next bus master.

    - **(1) Methods of Centralized BUS Arbitration:** There are three bus arbitration methods:

(i) Daisy Chaining method: It is a simple and cheaper method where all the bus masters use the same line for making bus requests. The bus grant signal serially propagates through each master until it encounters the first one that is requesting access to the bus. This master blocks the propagation of the bus grant signal, therefore any other requesting module will not receive the grant signal and hence cannot access the bus.
During any bus cycle, the bus master may be any device – the processor or any DMA controller unit, connected to the bus.

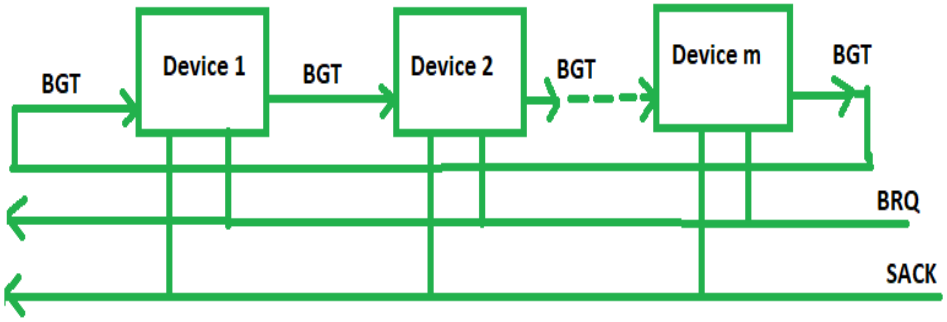


Daisy chained bus arbitration

Advantages:
- Simplicity and Scalability.
- The user can add more devices anywhere along the chain, up to a certain maximum value.

Disadvantages:
- The value of priority assigned to a device depends on the position of the master bus.
- Propagation delay arises in this method.
- If one device fails, then the entire system will stop working.

(ii) Polling or Rotating Priority method: In this, the controller is used to generate the address for the master (unique priority), the number of address lines required depends on the number of masters connected in the system. The controller generates a sequence of master addresses. When the requesting master recognizes its address, it activates the busy line and begins to use the bus.



Rotating priority bus arbitration

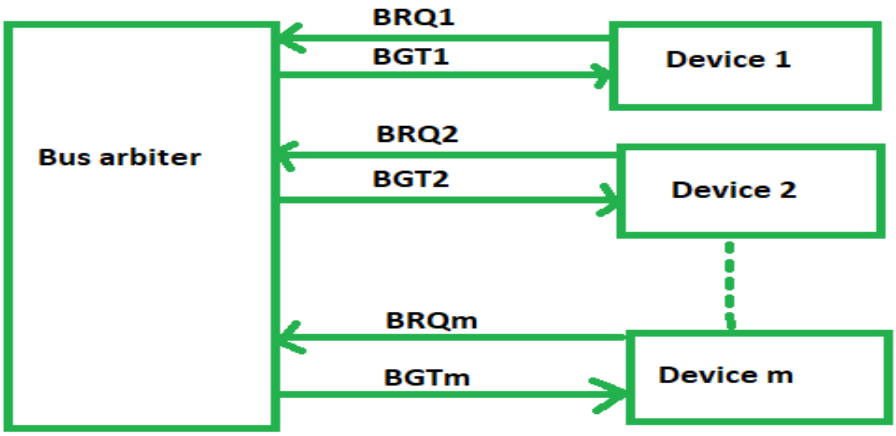
Advantages –

- This method does not favor any particular device and processor.
- The method is also quite simple.

Disadvantages –

- Adding bus masters is difficult as increases the number of address lines of the circuit.
- If one device fails then the entire system will not stop working.

(iii) Fixed priority or Independent Request method – In this, each master has a separate pair of bus request and bus grant lines and each pair has a priority assigned to it. The built-in priority decoder within the controller selects the highest priority request and asserts the corresponding bus grant signal.



Fixed priority bus arbitration method

Advantages –

- This method generates a fast response.

Disadvantages –

- Hardware cost is high as a large no. of control lines is required.

- **(2) Distributed BUS Arbitration:** In this, all devices participate in the selection of the next bus master. Each device on the bus is assigned a 4bit identification number. The priority of the device will be determined by the generated ID.

Fourth Topic:

Co-Processor: If in microprocessor chip, new circuitry can be added with special purpose to perform special tasks or to perform operations on numbers in order to offload the work of the core CPU. The CPU can then work faster. We may use a conveyor belt to do some extra work while motor is running. So, the motor is more effectively utilized. Similarly, supplementary processor, i.e., a co-processor handles the mathematical part of the work when we run complex applications.

What is a coprocessor?

- A co-processor is many times referred as a Math Processor. As the coprocessor performs routine mathematical tasks, the core processor is freed up from this computation and its time is saved. By taking specialized processing tasks from core CPU, coprocessor reduces the strain on the main microprocessor, so that it can run at a greater speed.
- A coprocessor can perform special tasks like complex mathematical calculations or graphical display processing. They perform such jobs faster than core CPU. As a result, overall computer speed of the system increases.
- To an ARM processor, we can attach the coprocessors. A coprocessor when added, we need to expand instruction set of Core CPU or add configurable registers, to increase the processing power. The coprocessor interface permits a couple of coprocessor to be connected to the ARM CPU.

- **How does coprocessor work?** Coprocessors assists the system in running more efficiently by offloading specific tasks of the CPU. They can be:

1. **Independent type** – It work in an asynchronous manner with the CPU. Whenever it performs any task/ some calculations, that is not synchronized with the CPU. Co-processor can take decisions independently here. CPU can then do its own work without worrying about co-processor's work. Instead of synchronously waiting, CPU that issued the request is freed up to perform another task.
2. **Direct control type** – Direct control type such as floating-point units – controlled by coprocessor's instructions that are CPU instruction set's part. The CPU that initiated the request waits or checks until co-processor completes operation. The coprocessor is not independent here & is governed or controlled by the main CPU. CPU & coprocessor works in synchronization here.

The processor is designed and implemented in manner so that it can send, both data and instructions to several coprocessors. These coprocessors are designed to perform in coordination with the core and are pipelined in the identical manner.

By adding a new set of specialized instructions, coprocessor can expand instruction set. For example, to handle vector floating-point (VFP) operations, a series of specialized instructions can be added to the normal ARM instruction set. When the instruction is decoded and it is encountered as coprocessor instruction, that instruction is passed on to the appropriate coprocessor. However, if the coprocessor isn't present or doesn't find instruction in its instruction set, an undefined instruction exception is thrown by ARM.

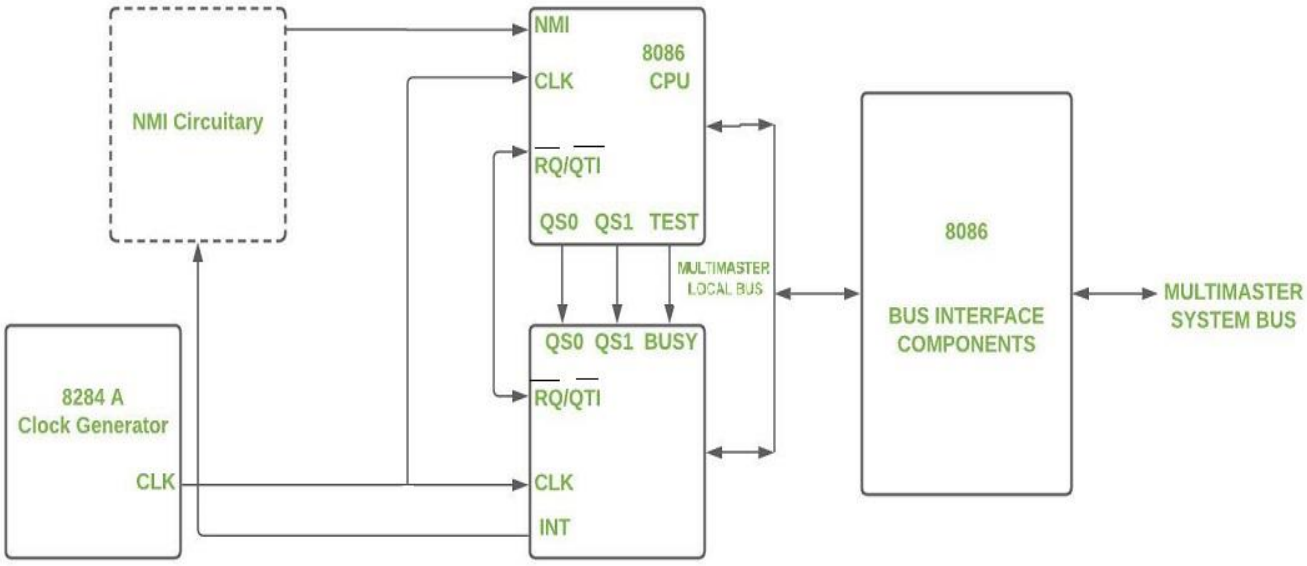
- **Properties of Coprocessor:**

1. Without primary microprocessor, coprocessor cannot function.
2. Main processor has to identify and segregate computationally intensive instructions in a program.
3. The instructions which have an intensive amount of calculations are performed by coprocessor.
4. The main processor handles all other activities.

- **Functionalities of a Coprocessor:**

- Coprocessors are incapable of retrieving instructions from memory, managing memory, executing instructions (flow control types) directly, performing I/O operations, etc.
- The coprocessor relies on the host (main) processor to retrieve coprocessor instructions and take care of all other operations not related to the coprocessor.
- A coprocessor is not the main processor of the system.
- Coprocessor can perform: Floating point arithmetic operations such as addition, subtraction, multiplication, Calculating the square root of the given number, estimating the logarithmic value of the given number etc. (for float point values), or signal, string, graphical processing or encryption/decryption etc.
- Coprocessors enable a computer customization, so the clients do not need to pay if they do not require the additional performance.

Example – Intel 8087 Coprocessor : The Intel 8087 was first math co-processor suited for operations of 16 bit. It was built to be paired with the Intel 8086 Microprocessor. Its main purpose was to decrease time required by the applications to give output (that require high floating point computations).With introduction of co-processor along with the main processor, it was noticed that performance of the applications improved from 20% to 500%. 8087 coprocessor Performance – About 50 Kilo Floating Point Operations per second(KFLOPS).



Functional Diagram of 8087 Co-Processor

Intel 8087 co-processor supports :

- Integer
- BCD

- Single Precision floating point number
- Double Precision floating-point number
- Extended precision (80 bit) floating-point number

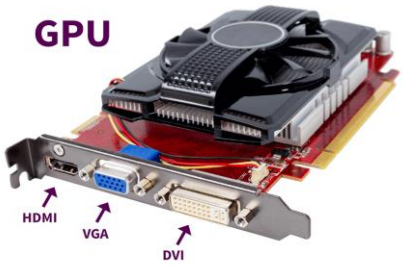
The diagram shows the connectivity of a co-processor with 8086 Microprocessor. Most of the co-processors has – Arithmetic module, Temporary registers and logic module.

Fifth Topic

VRAM (video RAM)

Video RAM is just like a normal RAM, but video RAM's job is to process the picture so that the monitor can show you the picture. All types of VRAMs are special arrangements for dynamic RAM. The video RAM is a buffer between the computer and the monitor. It is also called a frame buffer. When images are sent to display on the screen by the system, they are read by the processor onto the dedicated video RAM or integrated video RAM. Then the video is processed into the RAM and appears on the monitor.

Previous high-performance Video RAM types were a double-ported, which means that while the CPU is making a new picture to VRAM, the screen reads from VRAM to modify its current display data. The double-port design was the main difference between computer RAM and video RAM in the 1980s and 1990s.



Multibank Dynamic RAM is a high-performance RAM built by MoSys, which separates memory into multiple 32-kilobyte sections or banks that can be independently accessed. Traditional VRAM is monolithic with access to the entire frame buffer at one time. Having contiguous memory banks enables the simultaneous execution of accesses, boosting overall performance. Multibank Dynamic RAM is also cheaper since cards can be produced with only the correct amount of space for a given resolution bandwidth, rather than multiple megabytes, unlike many other Video RAM types.

Synchronous Graphics RAM is a relatively low-cost, clock-synchronized DRAM video memory. SGRAM is singular-port memory, but this can function like dual-port memory by constructing new memory pages simultaneously, rather than just one.

Windows RAM has no association with Microsoft Windows. It is a high-performance dual-ported VRAM with around 25 percent more capacity than VRAM, but it costs less money. It has characteristics that read the data for use in block fills and text drawings more effectively. Using the right color, WRAM can be used for very high resolution.

VRAM usage

Modern graphics cards use an SGRAM variant called GDDR5. As the title suggests, GDDR5 is the RAM double data rate. The DDR4 is used in today's electronics as machine RAM.

The only key difference between VRAM and device RAM is the speed and the potential to imitate dual-port functionality. VRAM is ideal for applications that view complex textures of images or render three-dimensional structures based on polygons. Video games or 3D graphic design software are the most popular example of these applications.

The number of VRAM on a system's video card is not nearly significant for services that run on complex data processing functions.

Importance of Video RAM for gaming

VRAM plays an important role in efficiency with gaming, such as loading times and image quality. Certain VRAM levels are required to run games at various resolutions. Rendering a massive AAA game at 1920*1080 resolution is different from rendering a game at 4K UHD quality, which requires extra graphics memory (like 6GB, 8GB, 12GB). Extra Video RAM is needed to render an image of high quality properly, otherwise, the textures and images that a user attempts to render would overwhelm the Video RAM and cause the GPU to spill data into the RAM. This can cause performance issues.

Keyboard (computing)

In computing, a **keyboard** is an input device, partially modeled after the typewriter keyboard, which uses an arrangement of buttons or keys, which act as mechanical levers or electronic switches. A keyboard typically has characters engraved or printed on the keys and each press of a key typically corresponds to a single written symbol. However, to produce some symbols requires pressing and holding several keys simultaneously or in sequence. While most keyboard keys produce letters, numbers or signs (characters), other keys or simultaneous key presses can produce actions or computer commands.

In normal usage, the keyboard is used to type text and numbers into a word processor, text editor or other program. In a modern computer, the interpretation of keypresses is generally left to the software. A computer keyboard distinguishes each physical key from every other and reports all keypresses to the controlling software. Keyboards are also used for computer gaming, either with regular keyboards or by using keyboards with special gaming features, which can expedite frequently used keystroke combinations. A keyboard is also used to give commands to the operating system of a computer, such as Windows' Control-Alt-Delete combination, which brings up a task window or shuts down the machine.

Types

- **Standard**

Standard keyboards, such as the 101-key US traditional keyboard 104-key Windows keyboards, include alphabetic characters, punctuation symbols, numbers and a variety of function keys. The internationally-common 102/105 key keyboards have a smaller 'left shift'

key and an additional key with some more symbols between that and the letter to its right (usually Z or Y).

- **Laptop-size**

Keyboards on laptops and notebook computers usually have a shorter travel distance for the keystroke and a reduced set of keys. As well, they may not have a numerical keypad, and the function keys may be placed in locations that differ from their placement on a standard, full sized keyboard.

The keyboards on laptops such as this Sony VAIO have a shorter travel distance and a reduced set of keys.

Gaming and multimedia

Keyboards with extra keys, such as multimedia keyboards, have special keys for accessing music, web and other oft-used programs, a mute button, volume buttons or knob and standby (sleep) button. Gaming keyboards have extra function keys, which can be programmed with keystroke macros. For example, 'ctrl+shift+y' could be a keystroke that is frequently used in a certain computer game. Shortcuts marked on color-coded keys are used for some software applications and for specialized uses including word processing, video editing, graphic design and audio editing.

Thumb-sized

Smaller keyboards have been introduced for laptops, PDAs, cellphones or users who have a limited workspace. The size of a standard keyboard is dictated by the practical consideration that the keys must be large enough to be easily pressed by fingers. To reduce the size of the keyboard, the numeric keyboard to the right of the alphabetic keyboard can be removed, or the size of the keys can be reduced, which makes it harder to enter text.

Another way to reduce the size of the keyboard is to reduce the number of keys and use chording keyer, i.e. pressing several keys simultaneously. For example, the GKOS keyboard has been designed for small wireless devices. Other two-handed alternatives more akin to a game controller, such as the AlphaGrip, are also used as a way to input data and text. Another way to reduce the size of a keyboard is to use smaller buttons and pack them closer together.

Such keyboards, often called a "thumbboard" (thumbing) are used in some personal digital assistants such as the Palm Treo and BlackBerry and some Ultra-Mobile PCs such as the OQO.

Numeric

Numeric keyboards contain only numbers, mathematical symbols for addition, subtraction, multiplication, and division, a decimal point, and several function keys (e.g. End, Delete, etc.). They are often used to facilitate data entry with smaller keyboard-equipped laptops or with smaller keyboards that do not have a numeric keypad.

Non-standard or special-use types

Chorded

A keyset or chorded keyboard is a computer input device that allows the user to enter characters or commands formed by pressing several keys together, like playing a "chord" on a piano. The large number of combinations available from a small number of keys allows text or commands to be entered with one hand, leaving the other hand free to do something else. A secondary advantage is that it can be built into a device (such as a pocket-sized computer) that is too small to contain a normal sized keyboard. A chorded keyboard designed to be used while held in the hand is called a keyer.

Virtual

Main article: Virtual keyboard

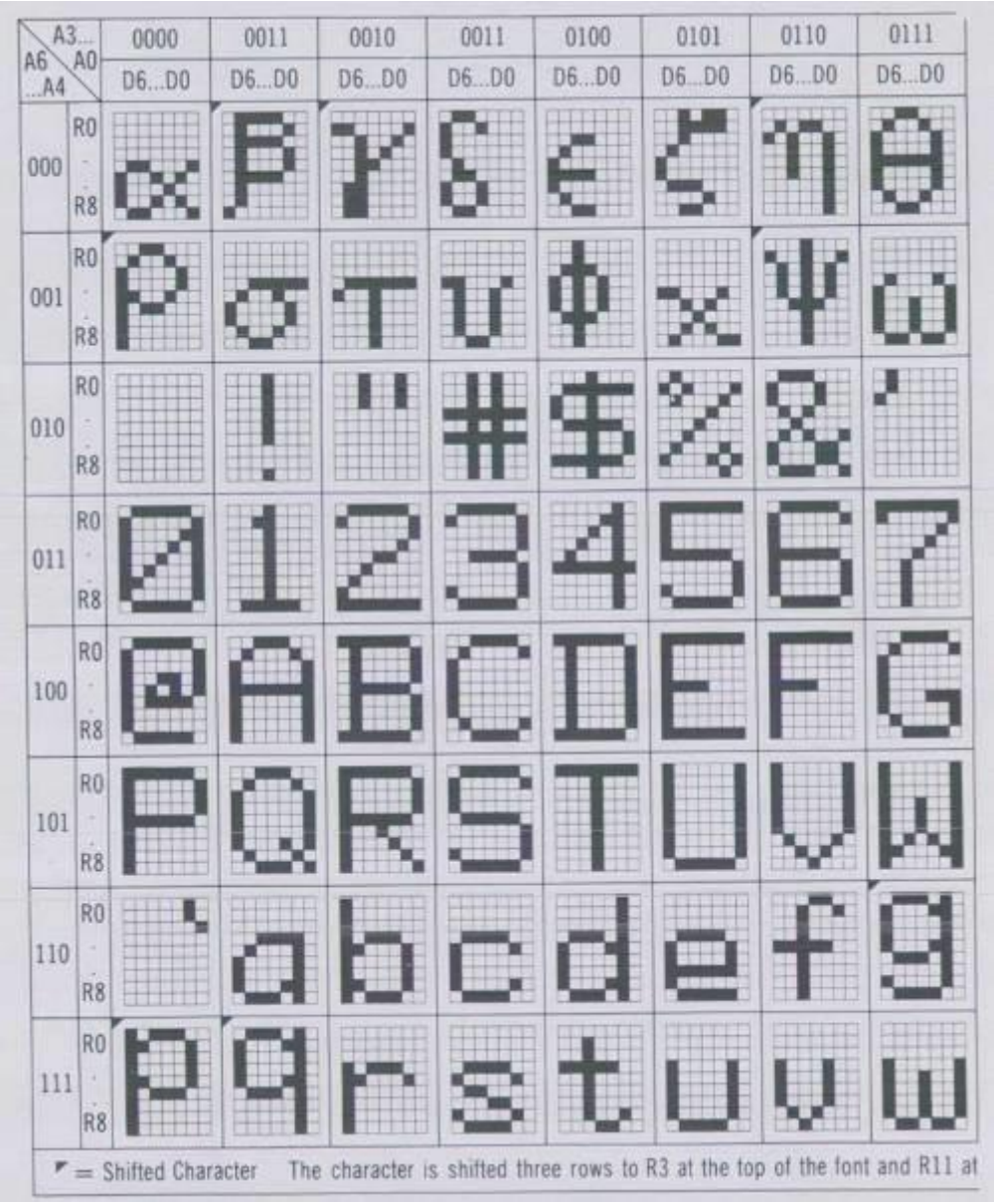
Virtual keyboards, such as the I-Tech Virtual Laser Keyboard, project an image of a full-size keyboard onto a surface. Sensors in the projection unit identify which key is being "pressed" and relay the signals to a computer or personal digital assistant. There is also a virtual keyboard, the On-Screen Keyboard, for use on Windows. The On-Screen Keyboard is an image of a standard keyboard which the user controls by using a mouse to hover over the desired letter or symbol, and then clicks to enter the letter. The On-Screen Keyboard is provided with Windows as an accessibility aid, to assist users who may have difficulties using a regular keyboard. The iPhone uses a multi-touch screen to display a virtual keyboard.

Sixth Topic:

THE CHARACTER GENERATOR ROM

Most computers today use a special device called a *character generator ROM* to convert the ASCII bytes to a tiny dot matrix pattern for displaying on the tv screen. This dot matrix can have a density ranging from 5×7 (the most coarse and not allowing lowercase) to 10×12 (the most dense and allowing all symbols of the alphabet). As the resolution of the dot matrix of the character increases so does the cost of the ROM chip; so the 5×7 and 7×9 matrixes have become popular, the 7×9 in Fig. 2-4B having uppercase, lowercase, and Greek math symbols. Besides cost, another factor that limits the character matrix density is maximum dot frequency permitted by the tv. This simply means that the internal circuits of the television set will not

allow a dot pattern to be resolved if there are frequency components in it which exceed about 6 MHz.



(B) The 7×9 character font from 6571 character generator ROM. ***Fig. 2-4 cont'd. Popular character fonts.***

The basic trick to making a memory-mapped display work is shown in Fig. 2-5. The large switch shown to the left of center in the figure represents circuits that scan the bytes in the screen memory and send them to the character generator ROM.

The purpose of the character generator ROM is to accept the ASCII bytes from memory and convert them to a row of dots for the character that these bytes represent.


1000
1001
1010
1011
1100
1101
1110
1111
D6...D0
D6...D0
D6...D0
D6...D0
D6...D0
D6...D0
D6...D0
D6...D0

the bottom.

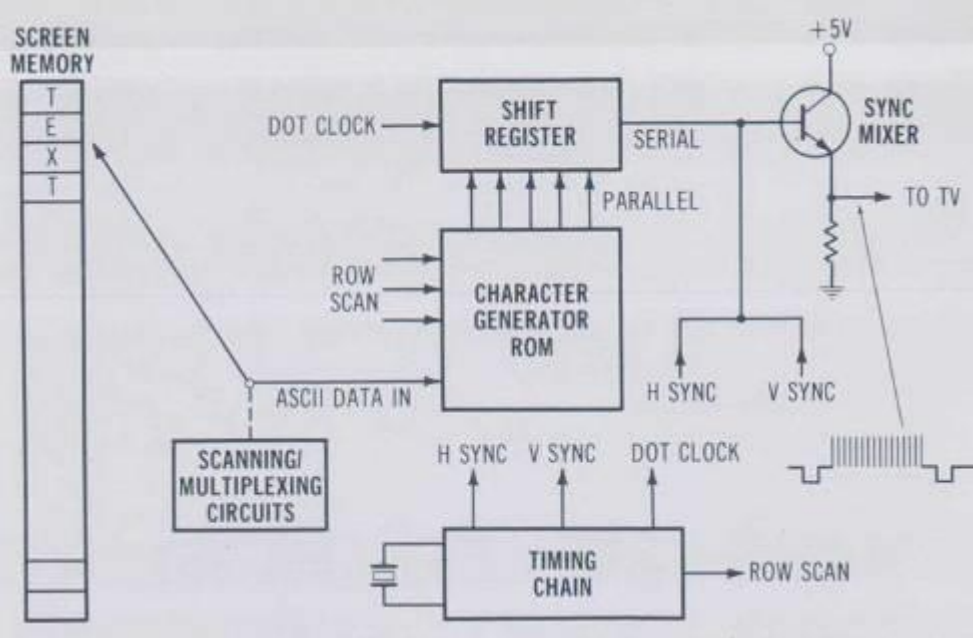


Fig. 2-5. Basic functions of a video display circuit.

The secret to understanding how the video circuits work is to realize that the ROM puts out all the dots for one row of all the characters on a single line of text on the screen (which might be 25 to 80 characters long. This is shown in Fig. 2-6. In this figure the top row of dots of *all* characters on the first line are being displayed. Each row here takes 63 μs. Characters in a line are presented to the ROM eight times, once for each row.

Thus each character on a line of text is accessed from screen memory several times until all the rows are laid down. If the characters are on a 5×7 matrix then each character is accessed seven times, one time for each of the seven rows. The more rows in the character matrix, the better and faster the video circuits must be.

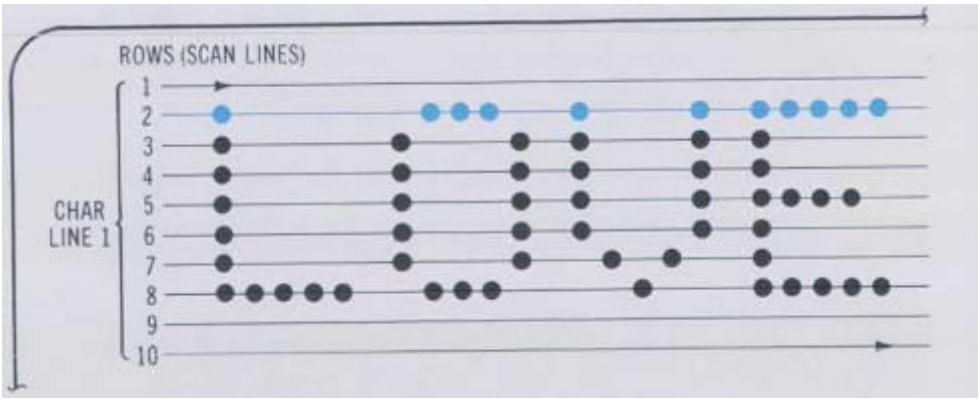


Fig. 2-6. The 5×7 dot matrix characters are laid down a row of dots at a time.

Referring back to Fig. 2-5, the box labeled timing chain generates horizontal and vertical sync pulses just like the kind the broadcasting people generate, along with a row scan signal for the character generator ROM and a high-frequency dot clock signal for driving the shift register. The shift register takes the parallel row of dots from the ROM and converts it to a serial bitstream called the *raw video*. The transistor is a simplified version of a mixer which adds the

horizontal and vertical sync to the raw video. Since everything is digital all signals can be synchronized to the high-frequency dot clock and we get a rock-solid display.

Fig. 2-7 shows a typical low-cost character generator ROM called the 2513. It lacks lowercase and therefore uses only 64 of the 128 ASCII characters. This is why there are only six character inputs to the ROM (two raised to the sixth power is 64). The three remaining inputs (A1, A2, A3) generate the seven row addresses for the characters in the ROM. The dot clock shifts the latched word out serially to form the video data stream.

A complete video display circuit block diagram is presented in Fig. 2-8. Here we see that the timing chain (the five boxes on the left) must keep a count of the character cell, row (cell line), and line. In addition the figure shows the multiplexer, which allows either the video circuits to scan the RAM and put data on the screen or the computer to access the screen memory to write new data or sometimes to read old data.*

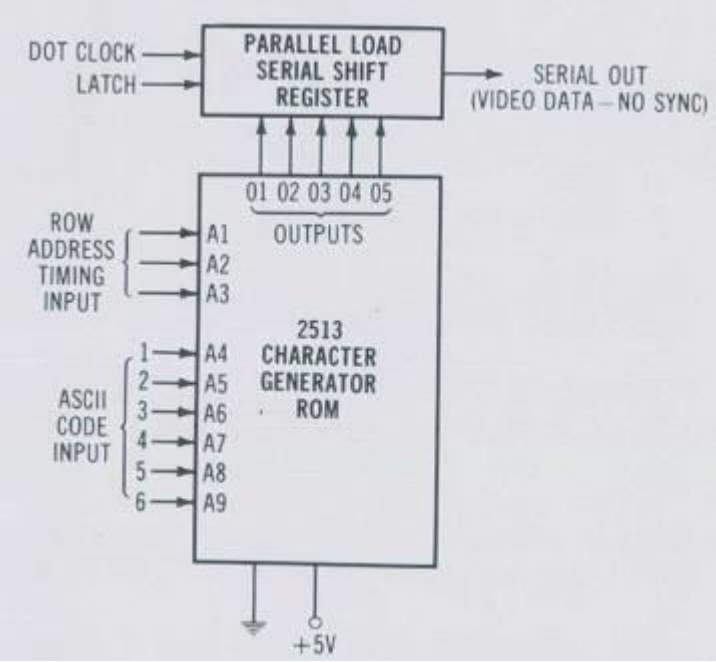


Fig. 2-7. A 5×7 row-scan uppercase-only character-generator ROM feeding parallel load shift register.

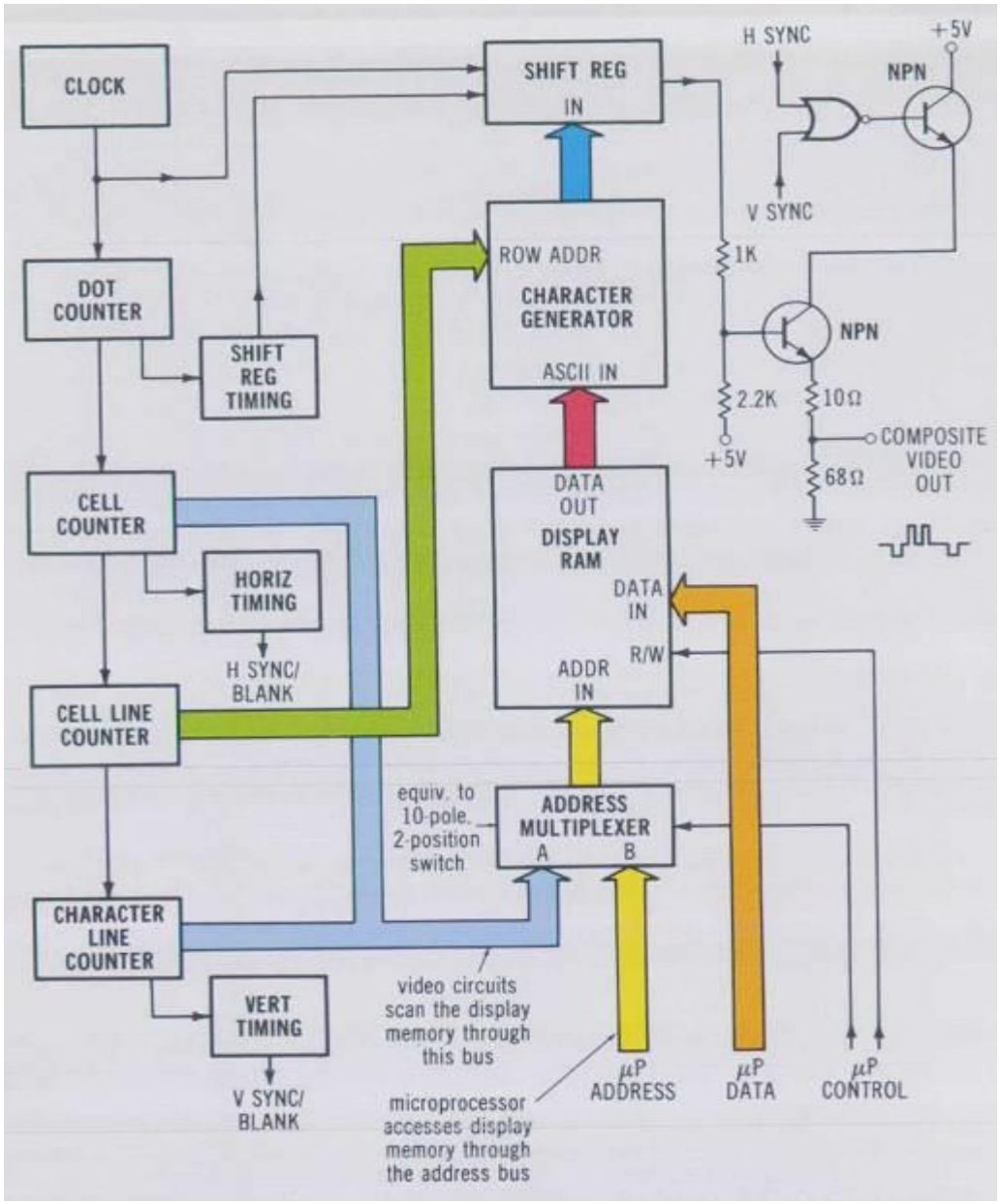
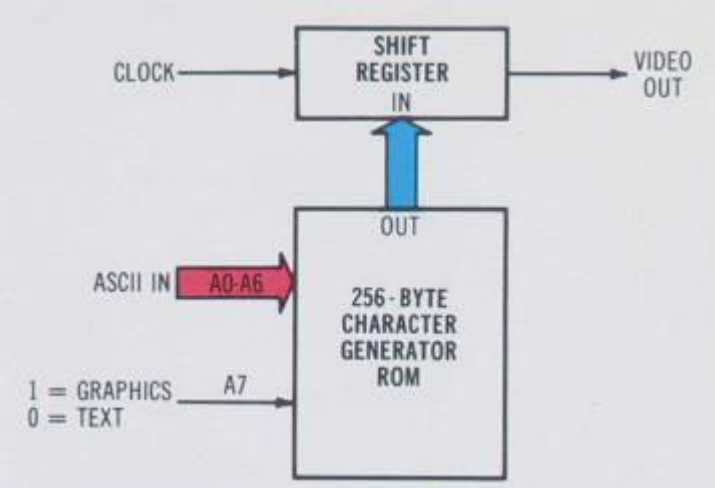
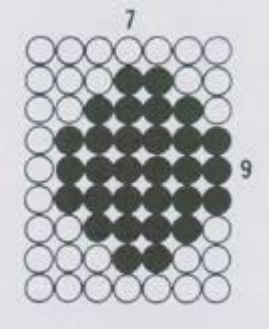


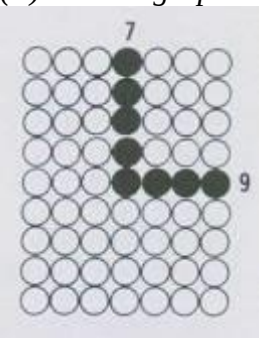
Fig. 2-8. Complete details of a memory-mapped display containing its own display RAM (so it doesn't require any system RAM). * You may wonder what is the maximum number of characters you can squeeze (display) on a standard television set. The fact that the best home computers on the market today that output into a standard television set display a maximum of 64 characters on a single line, with 16 lines total, may tell you something. If the bandwidth of the television if strip is approximately 6 MHz, then *the maximum number of dots per line* (without blurring of dots) is 63 μs×6 MHz = 378 dots. Using a 5×7 dot matrix for the characters, with one "un-dot" column to separate adjacent characters, gives 6 horizontal dots per character and means a maximum of 378/6 = 63 characters per line. Stretching this to 64 characters is okay but a slight blurring of the dots will begin. To get 80 characters on a single line and 24 lines (i.e., an 80×24 screen) using a 7×9 dot matrix (upper and lower case) requires 80×(7 + 1 un-dot) = 640 dots per line. And 640/63 μs ≅ 10 MHz. A custom crt monitor is required to provide this high a bandwidth and this is why most 80×24 crt terminals have built-in crt's.



(A) Adding more ROM for graphics characters. (IMSAI VIO example).



(B) A block graphics character in a 7×9 dot matrix.



(C) A line graphics character in a 7×9 dot matrix. ***Fig. 2-9. How the character generator ROM can contain graphics characters.***

Seventh Topic:

What is a Graphics Card or Display Card?

Graphics card is a hardware which is used to increase the video memory of a computer, and make its display quality more high-definition. It makes the computer more powerful and gives it the capacity to do more high-level works. The quality of the image depends on the quality of the graphics card. It is very much important for gaming and video editing on a PC. Every game needs a graphics memory to start and it depends on the type of the game, and the requirements are mentioned on the game box.

Example :

- **Acer predator –** Nvidia GTX 1050 4GB Graphics Card.
- **Alienware 17 –** Nvidia Geforce GTX 1070 8GB Graphics Card.

Both computers have a high power graphics card for better performance.

GPU :

- GPU stands for Graphics Processing Unit.
- The power of GPU depend on the model of the GPU.
- The graphics as an external component is attached on a slot known as an expansion slot.
- It is the brain of the graphics card and is what creates the visuals that we see on the monitor.

Types of Graphics Card :

1. **Integrated –** The graphics which are built into the motherboard are known as Integrated, are generally used in most laptops, the cannot be easily upgraded.
2. **Discrete –** It is an external graphics card which is a hardware and added on a motherboard as an extra component. Most people may not need an external graphics card for there work on PC. Basic work like creating files, doing office work, watching movies, listing songs, etc may not need a graphics card. But for the users playing high resolutions games and video editing may need an external component i.e graphics card for there purpose.

Features of Graphics Card :

- **Memory –** Graphics card carries its own memory. Memory range could be from 128MB to 2GB of memory. We should buy a card with more memory. More RAM equals higher resolutions, more colors on the screen, and the best special effects.
- **Multiple Screen support –** Most new video cards have the ability to connect two monitors to one card. This feature is very important for video editing and hardcore gamer craves that extra real estate as well. You can either see two separate Desktops or make the two monitors into one Desktop.
- **Gaming And Video Editing –** The discrete graphics card is not only for a gamer but those who use high-end video editing software also get help as a high-quality graphics card to reduce the rendering time of an image also give a high-def environment.
- **Connection –** The graphic card is connected to the monitor using many different ports put the port must be present on both monitor and Graphics card. These are some common ports used to connect graphics card with a monitor.
- **1.** VGA
- **2.** HDMI

  3. DVI

  Some motherboards have more than 1 expansion slot so we can add more than one graphics card to make performance better. Many laptops nowadays come with an integrated graphics card in them.

Manufacturers of Graphics Card : The two main manufacturers of discrete graphics card are:

1. NVIDIA

2. AMD

7. Explain about the control processor of keyboard.

Control processor

The modern PC keyboard has more than just switches. It also includes a control processor and indicator lights to provide feedback to the user about what state the keyboard is in. Depending on the sophistication of the controller's programming, the keyboard may also offer other special features. The processor is usually a single chip 8048 microcontroller variant. The keyboard switch matrix is wired to its inputs and it processes the incoming keystrokes and sends the results down a serial cable (the keyboard cord) to a receiver in the main computer box. It also controls the illumination of the "caps lock", "num lock" and "scroll lock" lights.

A common test for whether the computer has crashed is pressing the "caps lock" key. The keyboard sends the key code to the keyboard driver running in the main computer; if the main computer is operating, it commands the light to turn on. All the other indicator lights work in a similar way. The keyboard driver also tracks the shift, alt and control state of the keyboard.

When pressing a keyboard key, the key "bounces" like a ball against its contacts several times before it settles into firm contact. When released, it bounces some more until it reverts to the uncontacted state. If the computer were watching for each pulse, it would see many keystrokes for what the user thought was just one. To resolve this problem, the processor in a keyboard (or computer) "debounces" the keystrokes, by aggregating them across time to produce one "confirmed" keystroke that (usually) corresponds to what is typically a solid contact.

Some low-quality keyboards suffer problems with *rollover* (that is, when multiple keys are pressed in quick succession); some types of keyboard circuitry will register a maximum number of keys at one time. This is undesirable for games (designed for multiple keypresses, e.g. casting a spell while holding down keys to run) and undesirable for extremely fast typing (hitting new keys before the fingers can release previous keys). A common side effect of this shortcoming is called "phantom key blocking": on some keyboards, pressing three keys simultaneously sometimes resulted in a 4th keypress being registered.

Modern keyboards prevent this from happening by blocking the 3rd key in certain key combinations, but while this prevents phantom input, it also means that when two keys are depressed simultaneously, many of the other keys on the keyboard will not respond until one of the two depressed keys is lifted. With better keyboards designs, this seldom happens in office programs, but it remains a problem in games even on expensive keyboards, due to wildly different and/or configurable key/command layouts in different games.

2. Write short about comparison of RISC AND CISC. IMPLEMENTATION COMPARISON: SUPERSCALAR CISC, SUPERSCALAR RISC, VLIW

The differences between CISC, RISC, and VLIW architectures manifest themselves in their respective

implementations. Comparing high-performance implementations of each is the most telling.

High-performance RISC and CISC designs are called superscalar implementations. Superscalar in this

context simply means “beyond scalar” where scalar means one operations at a time. Thus, superscalar

means more than one operation at a time.

Most CISC instruction sets were designed with the idea that an implementation will fetch one instruction,

execute its operations fully, then move on to the next instruction. The assumed execution model was thus

serial in nature.

RISC architects were aware of the advantages and peculiarities of pipelined processor implementations, and

so designed RISC instruction sets with a pipelined execution model in mind. In contrast to the assumed

CISC execution model, the idea for the RISC execution model is that an implementation will fetch one

instruction, issue it into the pipeline, and then move on to the next instruction before the previous one has

completed its trip through the pipeline.