

Why Program?

- Hardware Architecture

welcome back to hardware architecture now you might ask you know why do I tell you about hardware architecture you're not probably you're not gonna build any hardware although it's fun stuff to do and if you're going to become a computer scientist which most of you won't want to be its a great thing to study and its a those who build our hardware are amazingly talented individuals and it's a really rewarding job the reason I like talking to you about hardware is because I want to be able to use words at some point in CEO secondary storage or central processing unit or or random access memory or peripherals you know input devices and I want to be able to use those words and I want you to be able to understand them and so I got that start with a little piece of hardware called the Raspberry Pi and the Raspberry Pi is a cute little single board computer we as we go forward these things are smaller and smaller and smaller and the interesting thing is is that the architecture of these stays the same but the number of components drops so I'm going to start and give you a block diagram of sort of a generic computer and tell you the major parts of it now I'm gonna show you some really old hardware some really new hardware and then some hardware that is of medium age and the medium age hardware's probably easiest one to see the architecture is the same okay and so the basic block diagram is that the brains if there are brains in computers which they really aren't the software is the closest thing computers have to brains but in hardware the closest brain computer has is this called a micro processing unit or a central processor unit and this is designed you know 3 billion times to sector 3 billion times a second to ask the question what do you want me to do next in these little pins on the back RR instructions like 32 or 64 of these pins 3 billion times a second we send an instruction into these things now we can't sit there and talk to it we cant and so the instructions we store in what's called the main memory in this memory is really fast and the memory sort of feeds this and so every time the CPU needs a new instruction it asks the memory where that instruction is so this the memory feed the instructions CPU CPU does it says give me another instruction CPU does it give me another instruction And that is the basic essence of programming this asks what's next and this is where your program is stored or a program you purchased or came with your hardware where that's all stored and those are your places and so you end up inside your programs end up inside this memory so then there's a I mean and so in software you tend to program the CPU and if you had bought a desktop computer number of years back it would have this thing called the motherboard and the motherboard is called this because it kind of connects all the components together and so if you bye memory by itself it does nothing but it has a place to plug into the motherboard and if you buy a microprocessor it has a place to plug into the motherboard and if you why hard drive this is a really old hard drive it has a place to plug in on the motherboard and so the motherboard sort of connects everything together the hard drive is secondary storage not the way how secondary storage is different than the main memory which there is I got on file this stuff so this main memory is really fast but as soon as you turn the member of the power of of this memory it's sort of vanish is an so to store files like word processing files or text files more whatever you got to start on something that last a little bit longer and so thats the purpose of the secondary storage it's permanent when the powers off it starts at this one here is in such bad shape that isn't probably storing anything but it's got these little heads and it spins around and goes in a noun will have a video later that shows you one of these things that's not quite in his bad shape if you look to says 4 different platters that are all spinning around and so this is just using magnetic material and electronics that sort of magnetising be magnetised this stuff and if you look at a disk their they're often rated physical disks are rated in revolutions per minute and that's how many times this thing spins around if you got old desktop and you hear it spin up this is the thing that spinning and its the place that your operating system lives your files live your applications live while they are stored in all the computers turned off and then they are loaded into this while they are running and then CPU takes the data from the main memory and error program runs at 3:00 billion operations per second so let's talk a little

bit about something that this is probably from the 1960's or 70s this actually has if you're electrician electrical person has capacitors little little silver things are capacitors these little coloured things are resistors and that's more capacitors and then there's wires wires move everything and so when you say like this has millions of transistors ohh wait that is in a capacitor that's a transistor that's a transistor when you say that this here has echt if you look closely at this go look at a picture of a microprocessor online you will see that has millions lovely sanso the difference between 1960 and today is this circuitry of capacitor capacitors resistors and transistors has been micro izdan put on to this it's using a photographic process and their tiny rain tiny rain putting more and more on and if you think going from millions of these to one of these is crazy nothing is happening now and the reason we have whole computers inside our pocket is that everything all of this this whole thing CPU memory everything all of it connected and the storage is being made smaller and smaller and so this little single board computer called the Raspberry Pi has one thing in it what has the main memory and has the cpu it has connections for things like peripherals like