Chapter 3

Episode 3.01

Episode title: **What is a CPU?**

Objective: N/A

Episode 3.02

Episode title: **Modern CPUs**

Objective:

- The capability of a CPU is measured via clock speed and cores
- Modern CPUs support advanced features such as multi-cores
- ARM chips operate using a Reduced Instruction Set Computing (RISC) methodology
- Accelerated Processing Units (APUs) are CPUs with graphics cards built in

Lower 3rds

CPU - Executes system and program instructions

Instruction Set Architectures (ISAs)

Common architectures: x86 / x64

Complex Instruction Set Computer (CISC)

Reduced Instruction Set Computing (RISC)

Lower 3rds

x86 by Intel

x64 by AMD

The ARM CPU is based on the RISC architecture

Cores and clock speed.

Clock speed - measured by number of tasks done in one second

Complex Instruction Set Computer (CISC)

Large complex set of built-in instructions

- Several of which are multiple cycle operations
- Versatile working with hardware

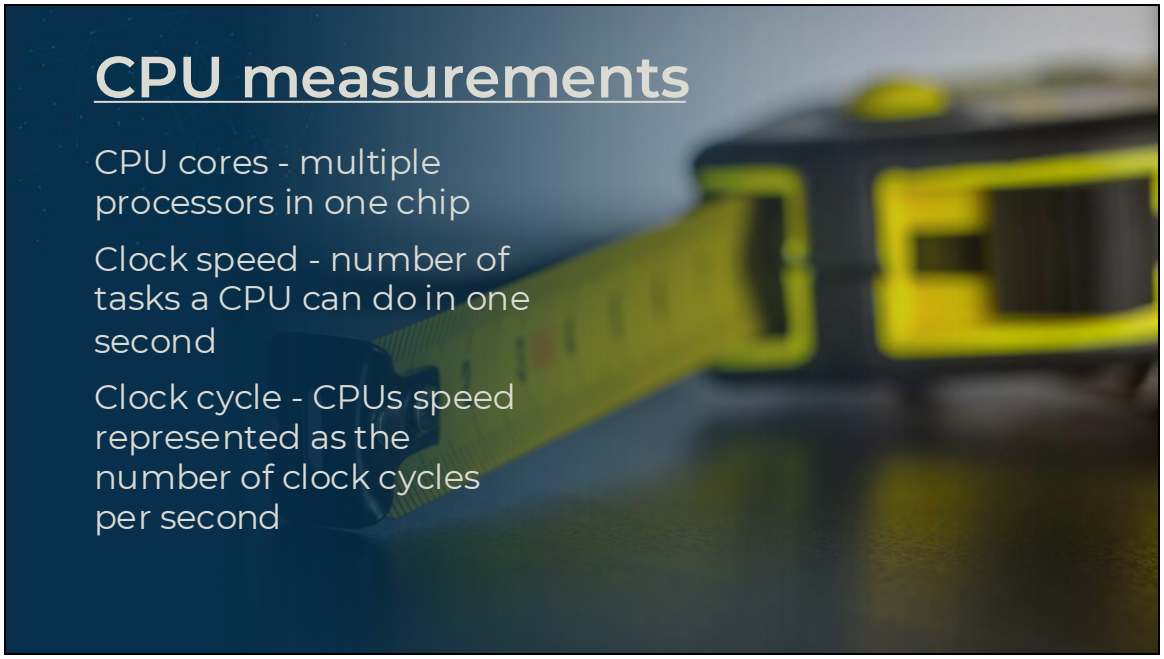
Reduced Instruction Set Computing (RISC)

Smaller and simpler built-in instruction set

- Focused on efficiency and speed

Comparing x64/x86

x64	x86
64-bit ISA	32-bit ISA
16 exabytes of RAM	4 GB of RAM
Supports 32 & 64-bit systems	Supports 32-bit systems
Faster	Slower


CPU measurements
CPU cores - multiple processors in one chip
Clock speed - number of tasks a CPU can do in one second
Clock cycle - CPUs speed represented as the number of clock cycles per second

Episode 3.03

Episode title: **32-Bit Vs. 64-Bit Computing**

Objective:

x86, x86-64, x64, and IA-32 all support different Instruction Set Architectures (ISAs)

Almost all modern hardware and software supports 64-bit systems and are backwards compatible with 32-bit systems

x64 systems offer greater data handling, improved graphics performance, and better security

Lower 3rds

Differences of 32-bit/64-bit = amount of data addressed in RAM

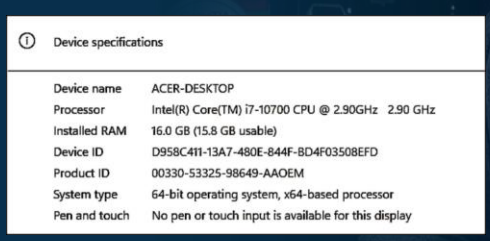
Nearly all computers in the past 5 years have been 64-bit systems

Linux distros still have 32-bit versions

64-bit system can address and move a lot more data

32-bit or 64-bit?

Check if your Windows system is a 32 or 64 bit system - access the About option on the Settings app System page to display the Device specifications.



Device specifications

Device name	ACER-DESKTOP
Processor	Intel(R) Core(TM) i7-10700 CPU @ 2.90GHz 2.90 GHz
Installed RAM	16.0 GB (15.8 GB usable)
Device ID	D958C411-13A7-480E-844F-BD4F03508EFD
Product ID	00330-53325-98649-AAOEM
System type	64-bit operating system, x64-based processor
Pen and touch	No pen or touch input is available for this display

32-bit or 64-bit?

On a MacOS system, enter the command:

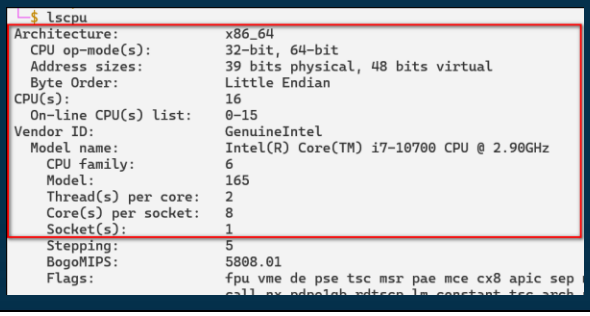
sysctl -n machdep.cpu.brand_string

Example:

```
% sysctl -n machdep.cpu.brand_string
Intel(R) Core(TM) i5-5257U CPU @ 2.70GHz
```

32-bit or 64-bit?

On a Linux distro, enter the command: lscpu
at a command prompt



Episode 3.04

Choosing the Right CPU

- CPUs designed for laptops come with features to help with power consumption and battery usage
- Higher-end CPUs offer more cores and a faster clock speed
- Intensive tasks such as 3D gaming and video editing benefit from CPUs with extra cores
- Some CPUs are unlocked and can be overclocked

Lower 3rds

Central processing unit (CPU)

CPU Requirements

Purpose or application

Desktop CPUs - more horsepower

Laptop CPUs – better power efficiencies

Initial Considerations

- What is the primary purpose of the PC?
- What platform is best for your needs:
  - desktop
  - laptop
  - hand-held

Lifespan of a computer system

- Heat
- Accidentals
- Obsolescence
- Vulnerability

Additional criteria

- Budget
- Manufacturer
- Motherboard

Lower 3rds

CPU cost range - $39 to under $10k

Land Grid Array or LGA socket

Motherboards

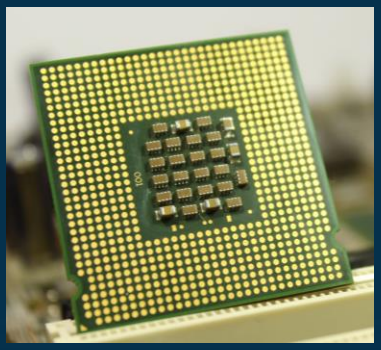
Consider CPU mounting socket

Intel motherboards

AMD motherboards

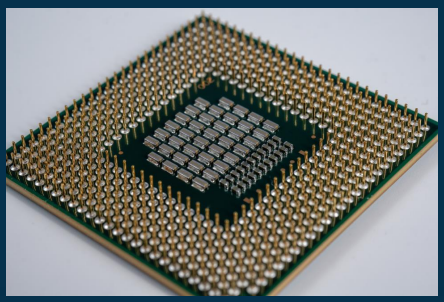
Motherboards

Intel motherboards have a Land Grid Array (LGA) socket



Motherboards

AMD motherboards have a Pin Grid Array (PGA) socket



Episode 3.05

Episode title: **CPU Generations and Architecture**

Objective: 220-1101

3.4 Given a scenario, install and configure motherboards, central processing units (CPUs), and add-on cards.

- Motherboard compatibility
- CPU sockets
- ADM and Intel

Lower 3rds

OBJ - Motherboard compatibility

OBJ - CPU sockets

OBJ - AMD and Intel

Understanding the CPU can help you identify the right one

CPU name components - Intel and AMD

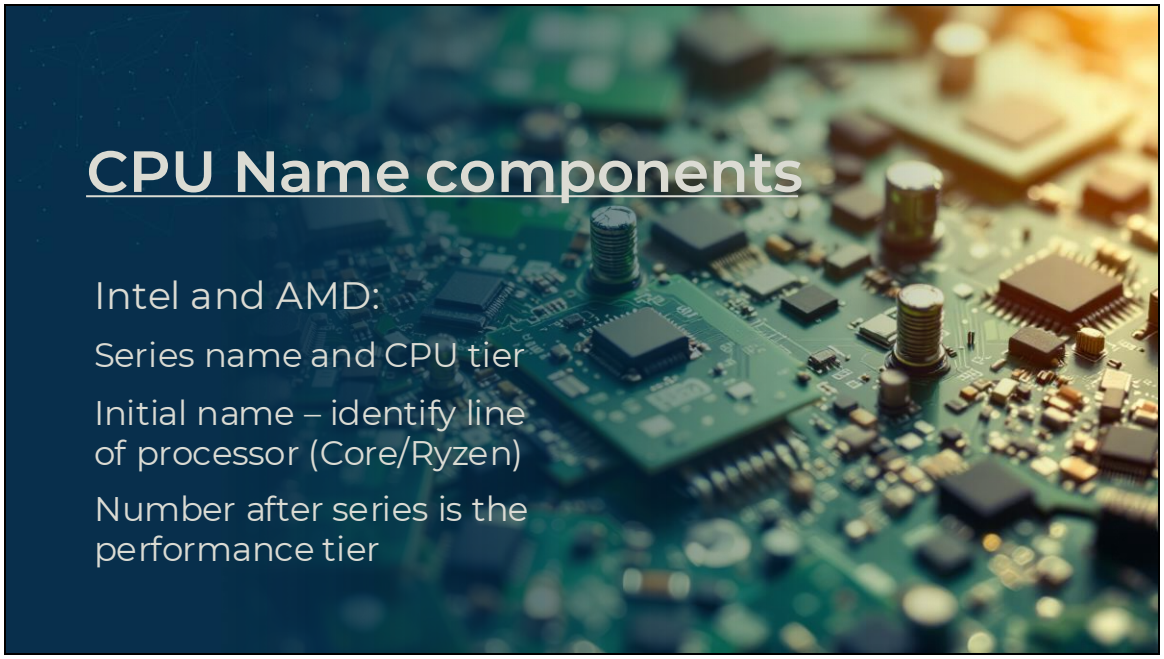
The generation is a good indicator of a CPU's age

Lower 3rds

Series: Core and Ryzen

Performance tier: 9/i9, 7, 8, i5, or i7

12900K of the Intel CPU and the 5900X of the AMD CPU



CPU Name components

Intel and AMD:

Series name and CPU tier

Initial name – identify line of processor (Core/Ryzen)

Number after series is the performance tier

Series name

Identifies the specific line of processors

Right fit

Understanding the branding and nomenclature on a CPU can help you to know whether a CPU is the right one

- Also helps you find what meets your specific requirements

Episode 3.06

Episode title: **CPU Cooling**

Objective:

- Heat sinks use metal fins and pipes to passively transfer heat
- Thermal paste and pads are both used to fill in gaps and provide better thermal conductivity between CPU and heat sink
- There are numerous sizes of fans and radiators to choose from
- Liquid cooling has higher thermal transfer capabilities than air-cooling

Lower 3rds

OBJ - Cooling

Keeping CPU within temperature tolerance = Extends life/assures performance

Airflow is important to keep the CPU cool

Dust

Dust or particles can prevent operation of fans and trap heat

Defective fans - Damaged system or fan can reduce cooling

Lower 3rds

CPU or GPU

Applications

OBJ - Fans

Cooling fans - fundamental component of an air cooling system

cubic feet per minute (CFM)

OBJ - Heat sinks

Integrated Heat Spreader (HIS)

Lower 3rds

Heat sink absorbs heat from CPU by thermal paste

OBJ - Thermal paste/pads

Thermal paste is applied between the CPU and a heat sink to fill any air gaps

OBJ - Liquid

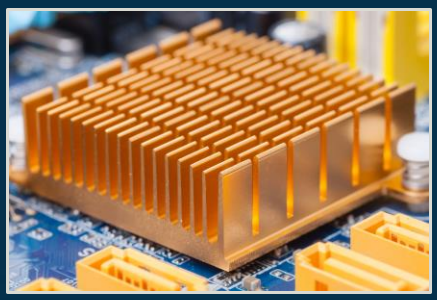
Liquid cooling systems circulate coolant to absorb the heat and then exude the heat to cooling elements

Cooling Fans

Fans move warm air out and pull cool air into the case

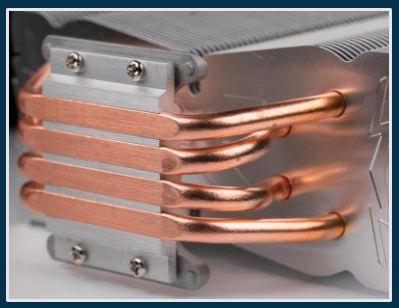
Heat Sinks

Absorbs heat away from the of a CPU through the thermal paste



Heat Pipes

Absorb the heat through its base cool it through pipes filled with water or alcohol



Episode 3.07

Episode title: **Installing and Troubleshooting a CPU**

Objective:

- Always use ESD prevention methods when handling CPUs
- Pin Grid Array (PGA) and Land Grid Array (LGA) are the two most common types of CPU sockets
- The Zero-insertion force (ZIF) mechanism is used to secure the CPU into the motherboard's CPU socket
- When troubleshooting a non-functional CPU, first check all connections and make sure the fan, heat sink, and CPU itself are seated properly before proceeding

Lower 3rds

OBJ - Motherboards have specific manufacturer's designs

2 primary manufacturers: Intel - AMD

LGA socket format - Intel CPUs

PGA socket format - AMD CPUs

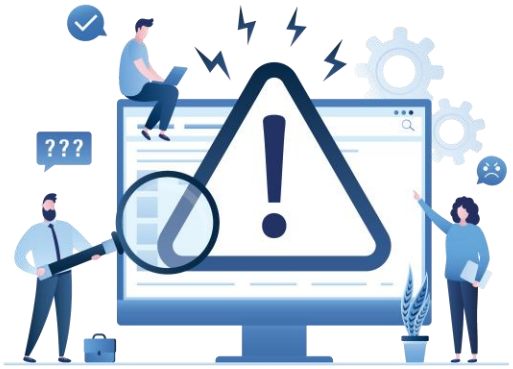
ZIF socket designed for easy insertion/extraction

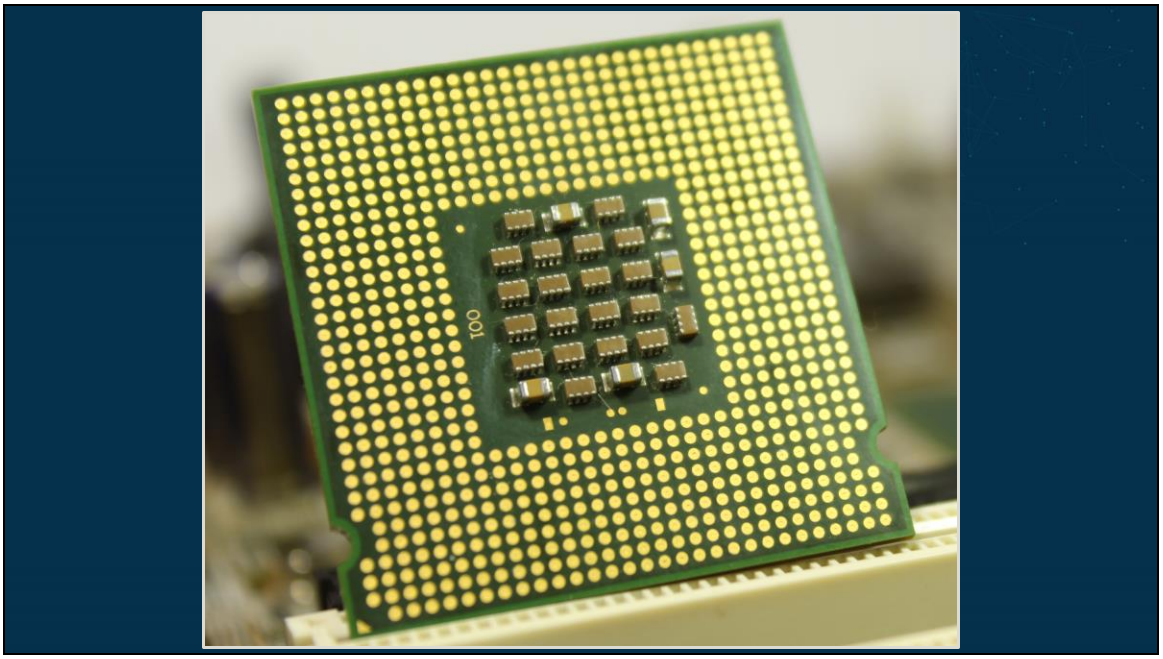
Lower 3rds

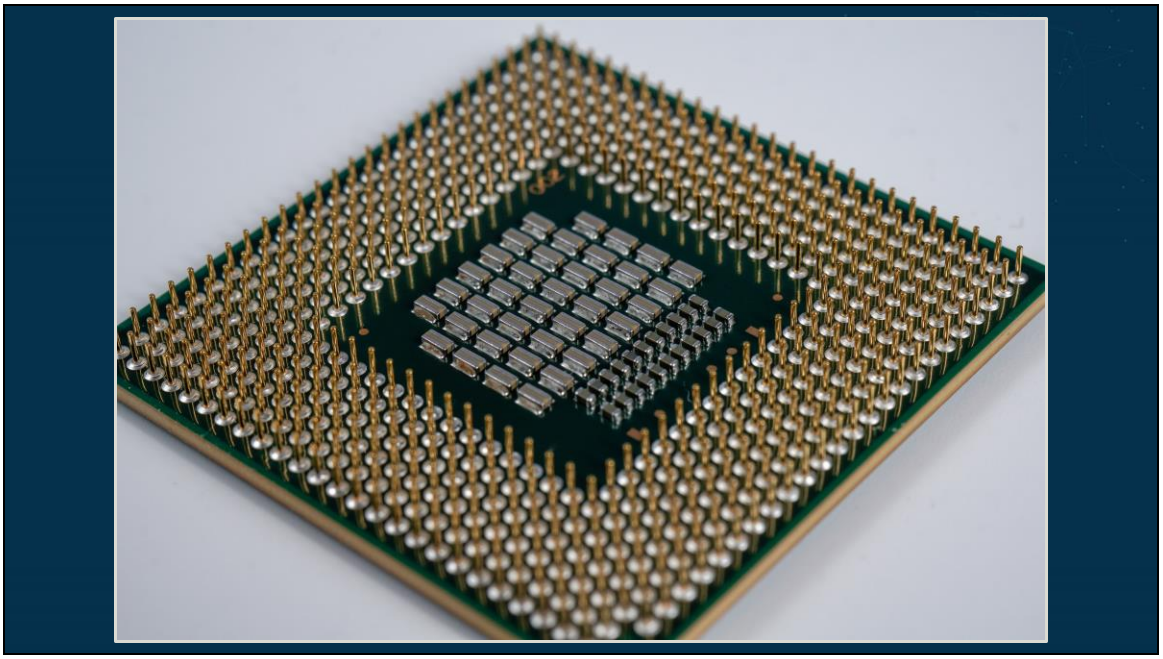
1. Identify the problem
2. Question the obvious
3. Test the theory
4. Establish a plan of action
5. Verify functionality
6. Document the findings

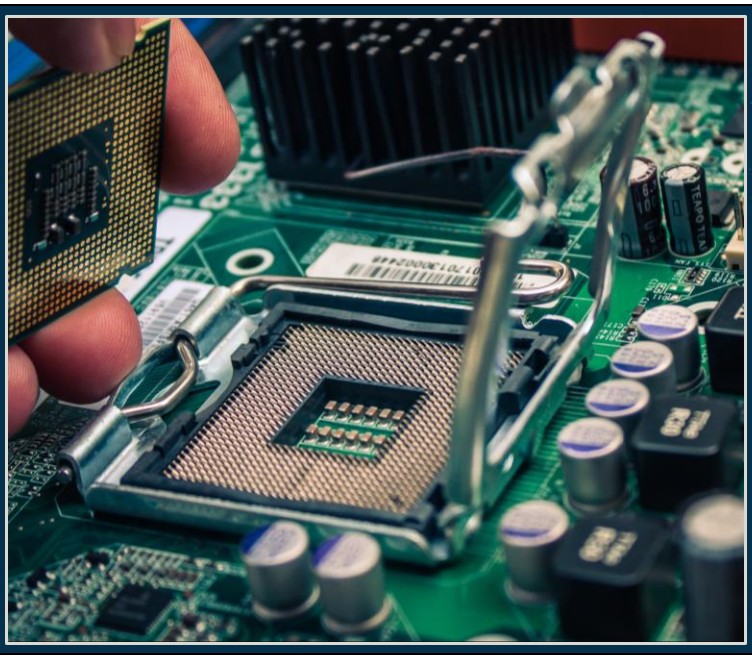
CompTIA troubleshooting

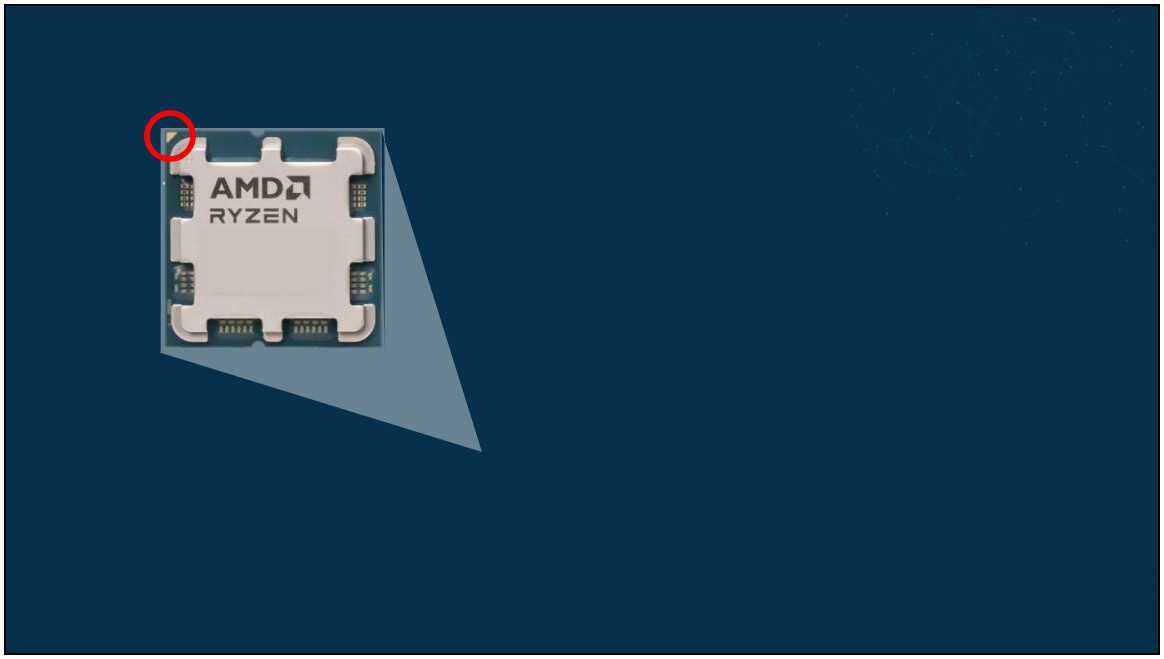
1. Identify the problem
2. Question the obvious
3. Test the theory
4. Establish a plan of action
5. Verify functionality
6. Document the findings










AMD
RYZEN