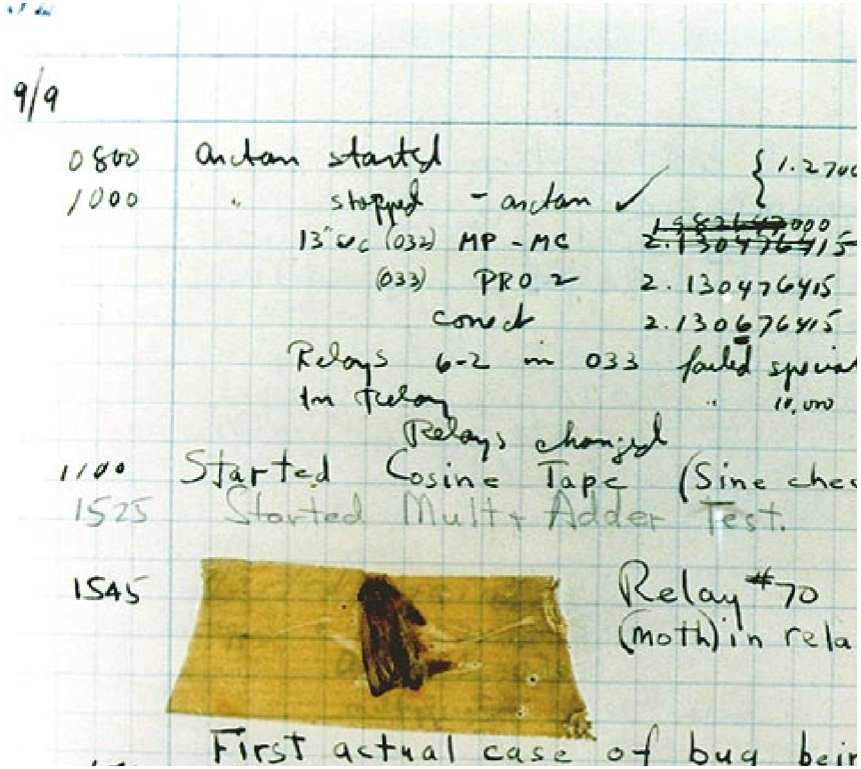
Lecture 4

Lecture overview

- In this lecture we will describe and discuss:
  - **Preventive maintenance**
  - **Troubleshooting**
- At the end of this lecture, the student will be able to:
  - check HW and SW to ensure proper system operation
  - Systematically analyze and solve problems in a faulty computer system

Bug


9/9
0800 Arctan started
1000 " stopped - arctan ✓
13"UC (032) MP - MC
(033) PRO 2
2.13047 6415
Relays changed
1100 Started Cosine Tape
1525 Started Multy Adder Test.
1545
Relay #70
(moth) in rela
First actual case of bug

Sources of problems

- Hardware
  - Malfunctioning memory modules
  - Worn connectors
  - Loose connections
  - Cooling/ventilation issues
- Software
  - Driver incompatibilities
  - Viruses/Malware
  - Construction problems, bugs

Preventive maintenance

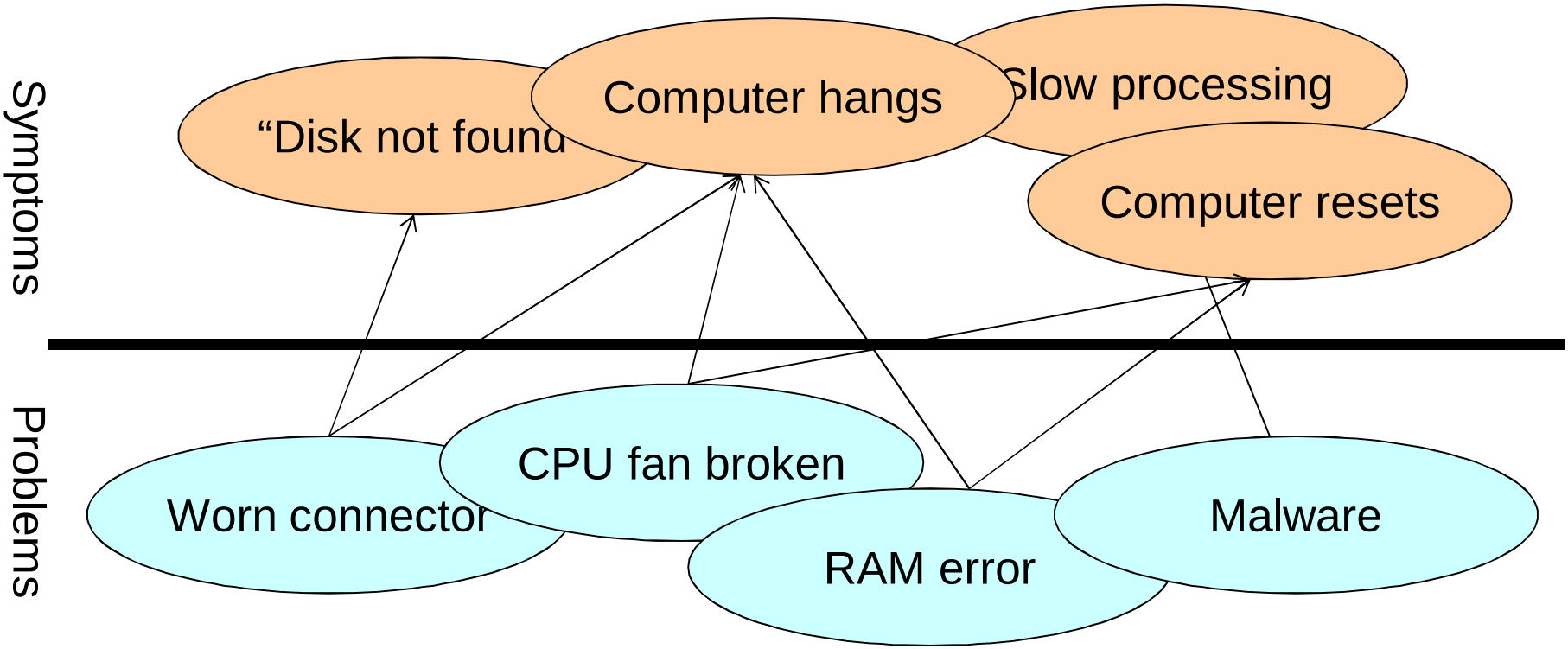
- Helps to prevent failure of parts, materials, and systems by ensuring that they are in good working condition
- Reduces the probability of hardware or software problems
- Benefits
  - Data protection
  - Reliability
  - Prevent and reduce failures, which leads to reduced costs

Preventive maintenance

- **Procedure**
  - Systematically and periodically checking hardware and software to ensure proper operation
  - Regular and systematic inspection
  - HW
    - Check the condition of cables, components, and peripherals
  - SW
    - Check for updates (OS, programs, drivers, antivirus)
    - Scan and defragment HDD
  - Cleaning
  - Replacement of faulty parts

Troubleshooting

- Systematic approach to locate the cause of a fault in a computer system
- Problems have symptoms



Troubleshooting

- **Tools**
  - Hardware
    - “Known-good” replacement parts/identical systems
    - Voltmeter, mechanical tools
  - Software
    - Bootable diagnostic software
  - Documentation
    - System manuals
    - Diagnostic flowcharts
    - Journals
  - Experience

Troubleshooting

- **Procedure**

1. Data protection
- **Backup of data**
2. Identify the problem
3. Establish a theory of probable causes
4. Determine an exact cause
5. Implement a solution
6. Verify solution and full system functionality
7. Document findings

Troubleshooting

2. Problem identification

- User-description/Observation
  - What are the symptoms of the problem?
  - Error messages
  - Beep codes
  - Has it occurred before?
  - Have changes been made recently?
- Check the maintenance journal
- Retrieve system logs
  - Event viewer and Device manager
- Try to reproduce the error

Troubleshooting

- **3. Establish a theory of probable causes**
- Create a list of possible causes ordered by likelihood
- Create test cases for each possible cause
- Stepwise elimination
  - Only make one change per step
- “Known-good” method
  - Switch identical components
  - Minimal working configuration

Troubleshooting

- **4. Determine an exact cause**
- Rank causes
  - Likelihood
  - Ease of testing
- Create a diagnostic checklist or flowchart

Troubleshooting

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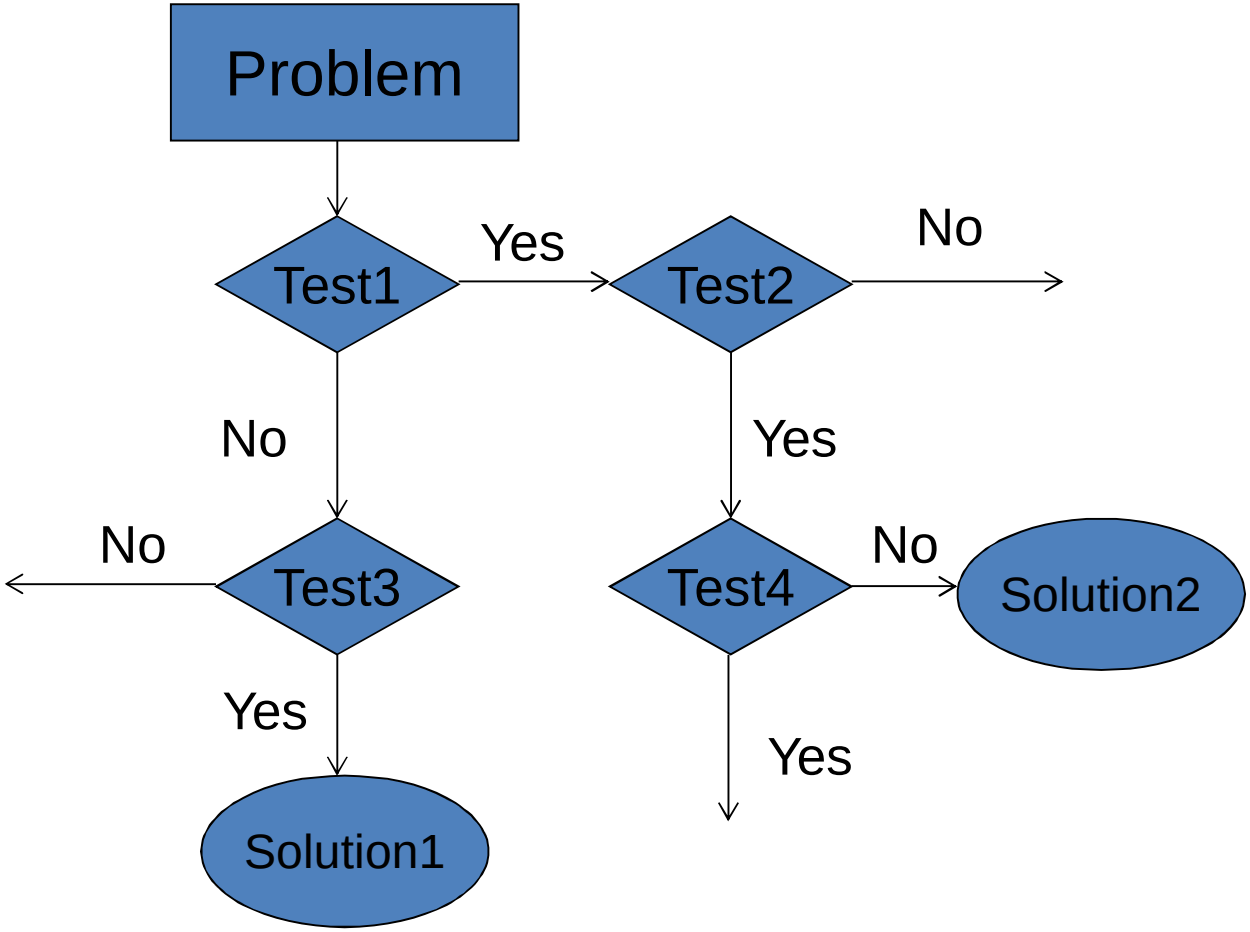
Troubleshooting

- **Diagnostic flowchart**



Troubleshooting

- **Root cause analysis (RCA)**
  - "The five why's"
  - Example
  - The PC does not start
  - Why? The motherboard has no power
  - Why? The PSU is broken
  - Why? PSU damaged by electrical surge
  - Why? Insufficient surge protection
  - Why? Surge protection not in requirements specification
  - Why? …

Troubleshooting

5. Implement a solution

- Start with the easiest and fastest to implement.
- Apply one solution at a time
- If it does not work, reverse the solution and try another

6. Verify solution and full system functionality

- To confirm that you have solved the original problem
- To ensure that you have not created another problem while repairing the computer

Troubleshooting

7. Document findings

- Description of the problem
- Steps to resolve the problem
- Components used in the repair
- Time to repair

Troubleshooting

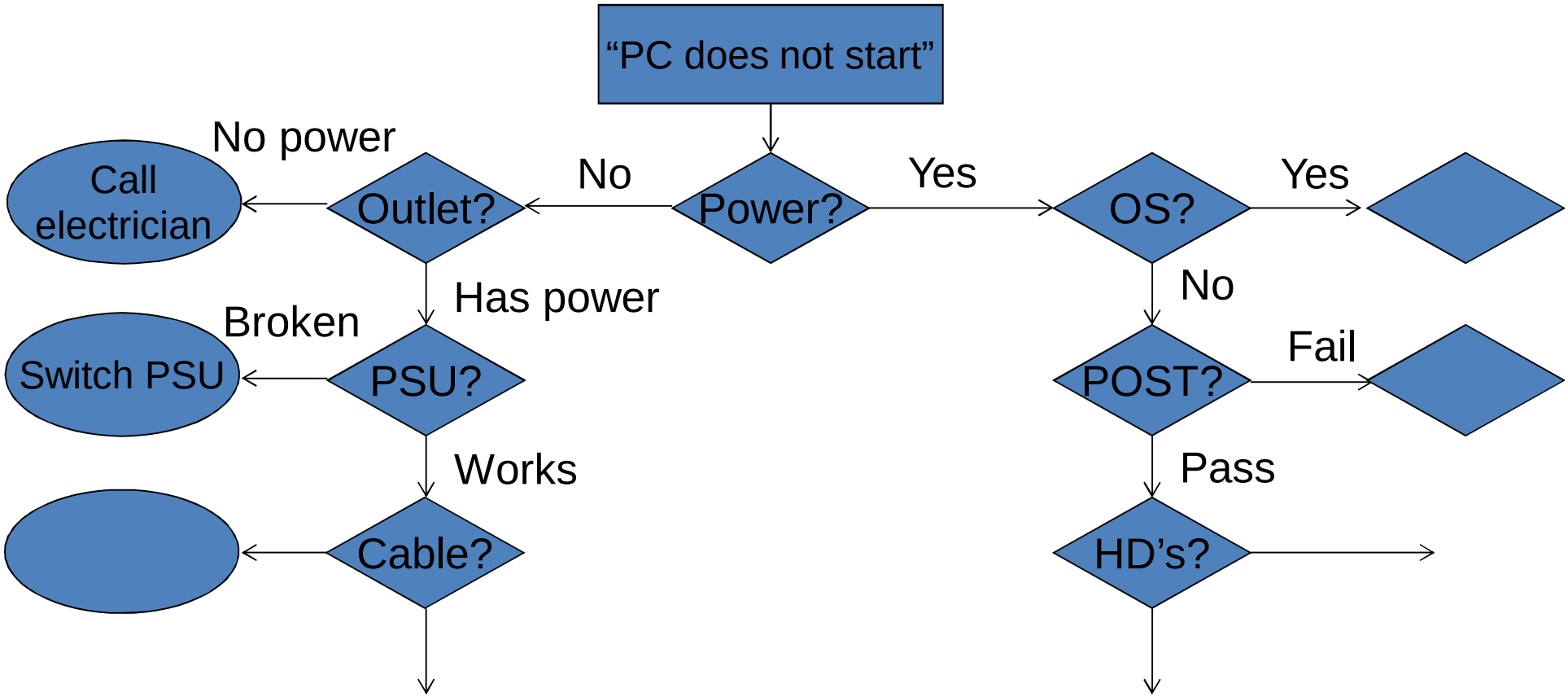
A troubleshooting example

"I arrived this morning and my computer doesn't work!"

- Identify the problem
  - "It worked yesterday"
  - "The lights flash and I can hear the hard drive"
  - "At first I see a lot of text that appears and disappears quickly"
  - "Then the screen is black except for a blinking underscore"

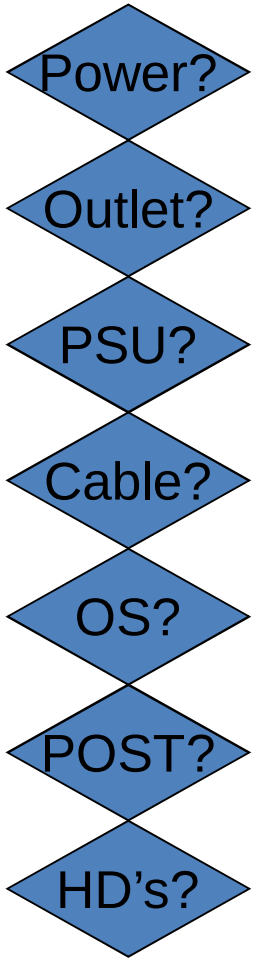
Troubleshooting

- Identify possible causes and test cases
- **Diagnostic flowchart**



Troubleshooting

- Identify possible causes and test cases
- **Test cases**



Does the computer power on? HD spins up, lights flash, etc.

Is there power in wall outlet? Test using voltmeter/desk lamp

Switch PSU from broken machine with known-good PSU

Use voltmeter to check continuity of power cable

Does operating system boot? OS logos, messages, etc.

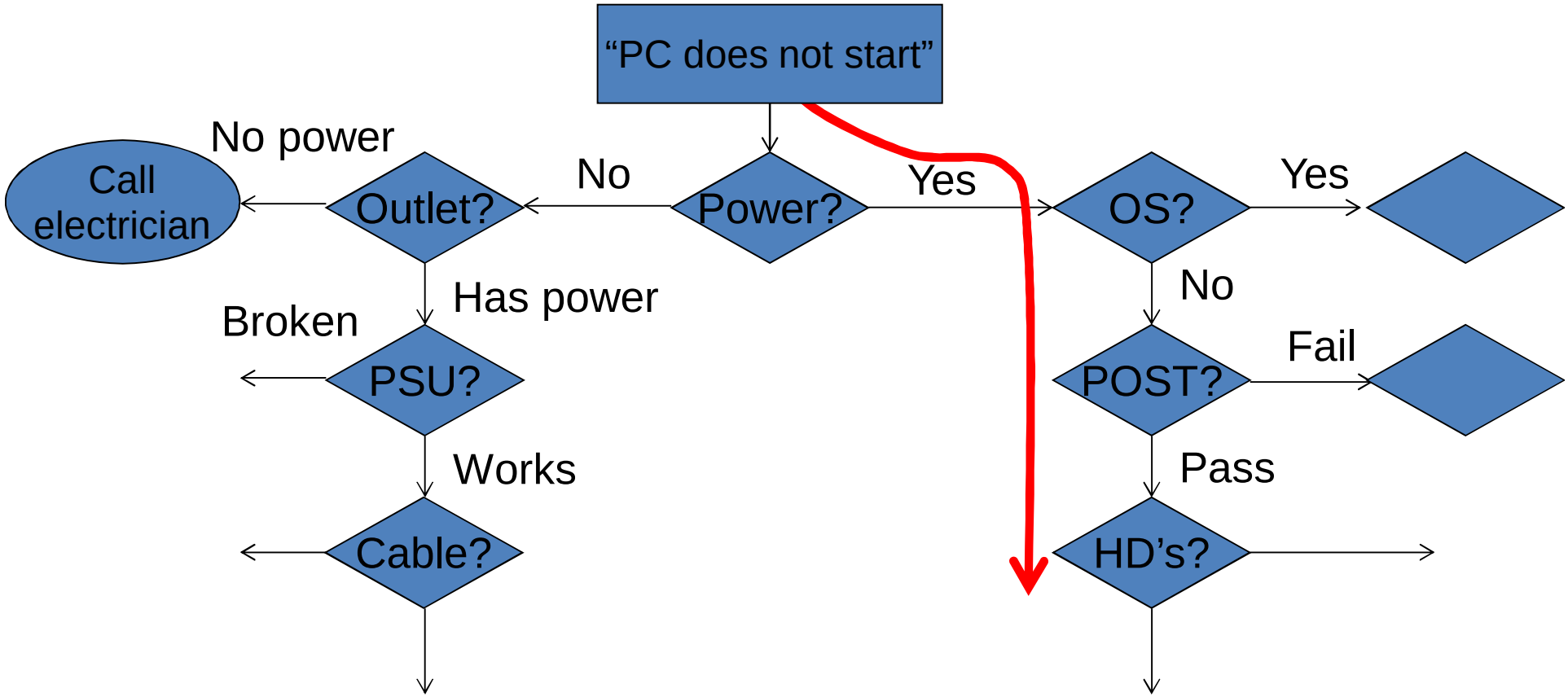
Do any beep-codes occur?

Jumpers, cables, switch with known-good HD's

Troubleshooting

Perform stepwise elimination

- One change per step
- **Which changes solved the problem or not**



Troubleshooting

- Examples of problems and symptoms
- **Power supply**
- Fan failures
- Check for exhaust obstructions, e.g. dust
- Voltage selector set wrong (230V in EU)
- Grounding failure/short circuit
- Blown fuses, ground-fault protector tripped
- **Do not service, replace**

Troubleshooting

- Examples of problems and symptoms
- **Motherboard**
- Loose connectors to PSU
- Cracked/broken connectors
- Too much force used when inserting memory, expansion cards, CPU etc.
- Short-circuits
- Metal objects, typically screws that fall onto the MB
- Bad jumper settings
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Troubleshooting

- Examples of problems and symptoms
- **RAM modules**
- Module not correctly installed in socket
- Module incompatibilities
- Different types/manufacturers
- RAM speed/bus frequency mismatch
- ESD damage
- Often causes random bluescreens
- Run e.g. memtest86

Troubleshooting

- Examples of problems and symptoms
- **Hard drives**
- Jumper settings wrong
- Verify that drives are correctly identified in BIOS
- Listen for atypical HD noise
- “Click of death”, try to salvage data as soon as possible
- Insufficient cooling
- Drives get hot, make sure there is sufficient airflow

Troubleshooting

- Examples of problems and symptoms
- **Network**
- Network Interface Card (NIC) drivers
- Static/dynamic IP assignment
- Is the closest hub/switch reachable?
- Correct type of cabling, crossover/straight

Troubleshooting

- **Review**
- Troubleshooting
- Identify the problem
- Identify the cause
- Identify solutions
- Rank causes and solutions
- Apply solutions
- Test solutions
- Document the procedure
- Root cause analysis
- Common problems and symptoms


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