

# Open Source compliance: Technical must-knows for legal experts

Open Source Automation Development Lab (OSADL) eG

# What is “booting a computer”?

# Booting a computer (example: Linux)

Linux embedded system

Boot-ROM

Linux PC

BIOS

# Booting a computer (example: Linux)

Linux embedded system

Linux PC

**Boot-ROM**

**BIOS**



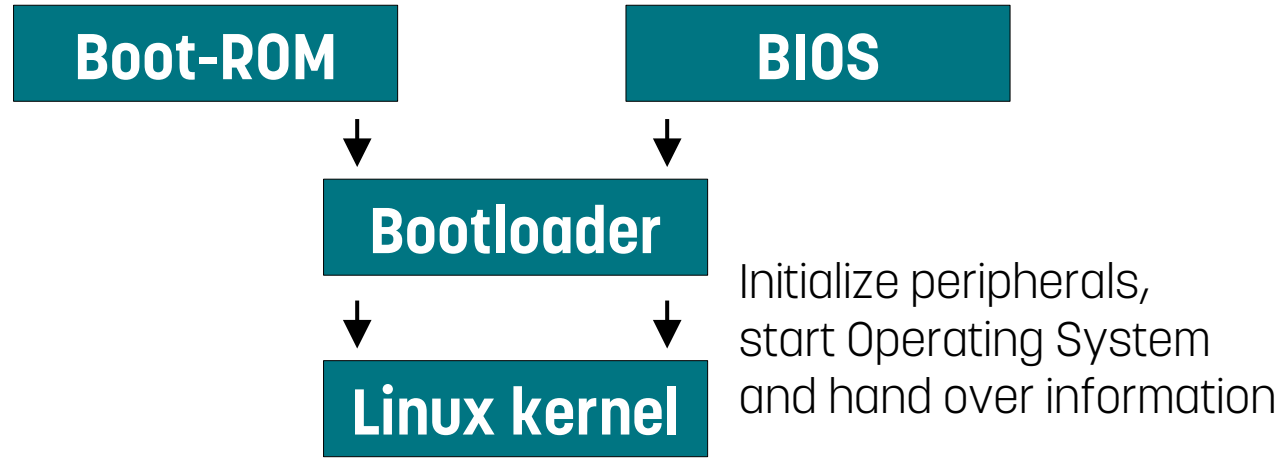
**Bootloader**

Start code from boot media  
(based on a given boot order)

# Booting a computer (example: Linux)

Linux embedded system

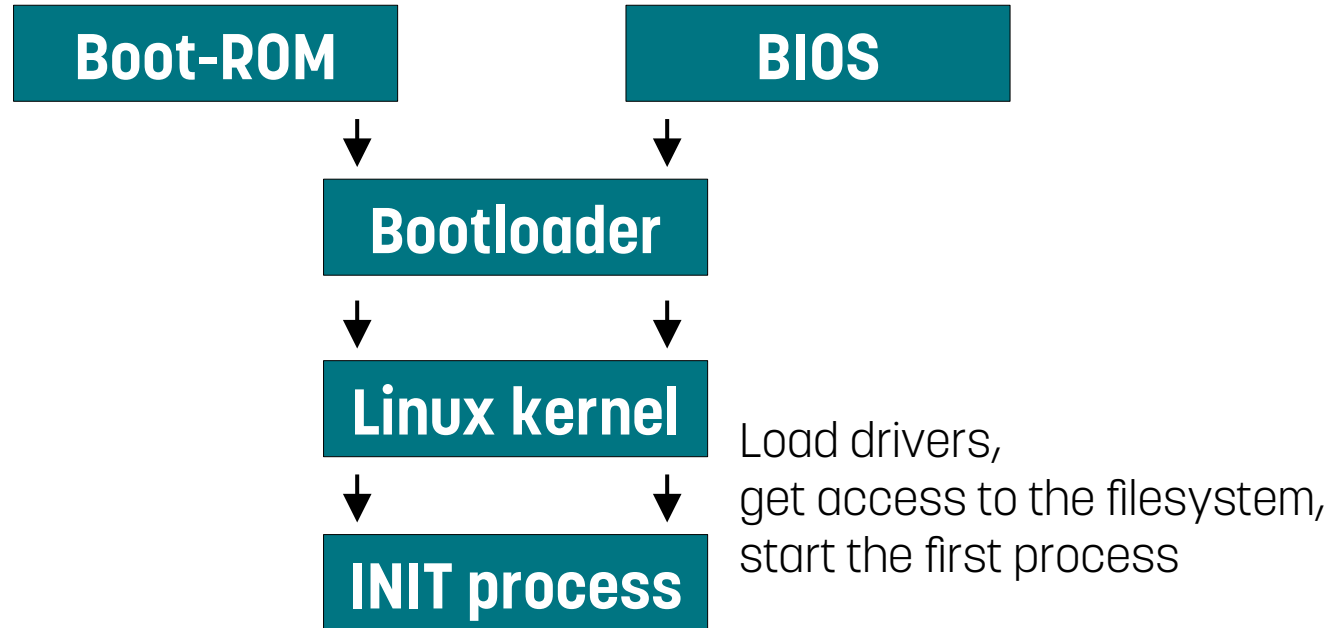
Linux PC



# Booting a computer (example: Linux)

Linux embedded system

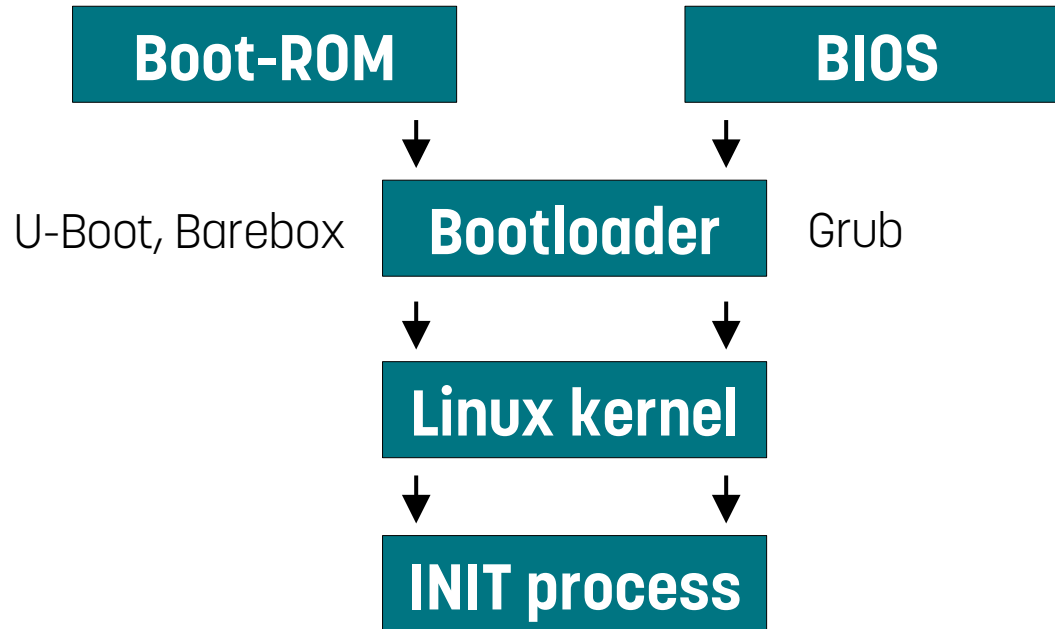
Linux PC



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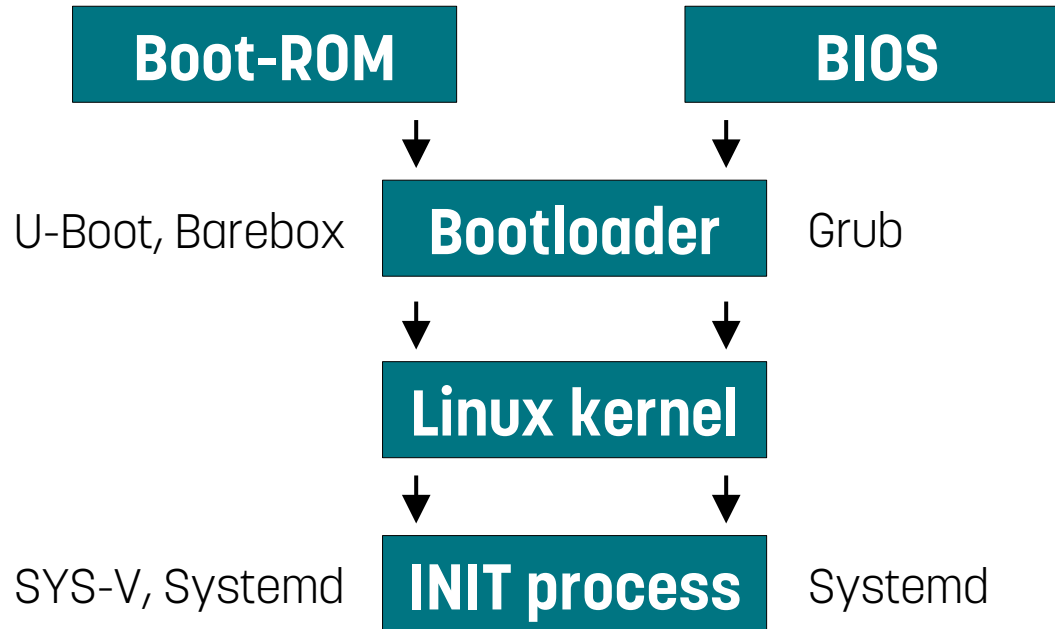
Linux PC



# Booting a computer (example: Linux)

Linux embedded system

Linux PC





# What is Secure Boot?

Linux embedded system

Linux PC

Boot-ROM

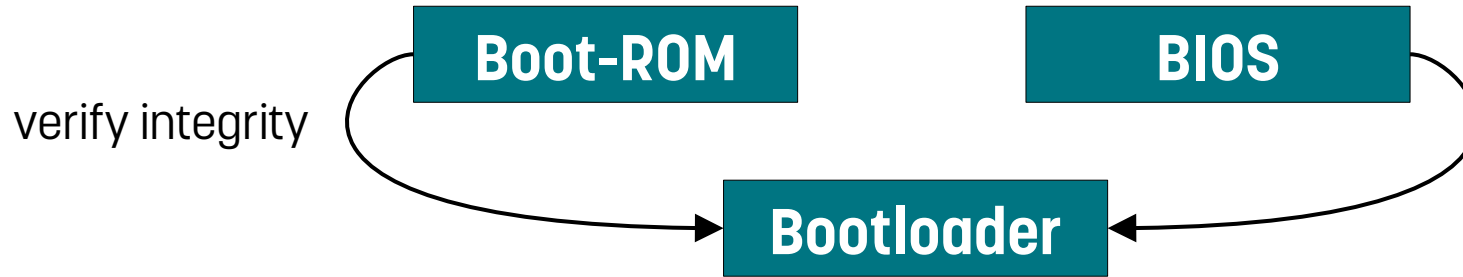
BIOS

Bootloader

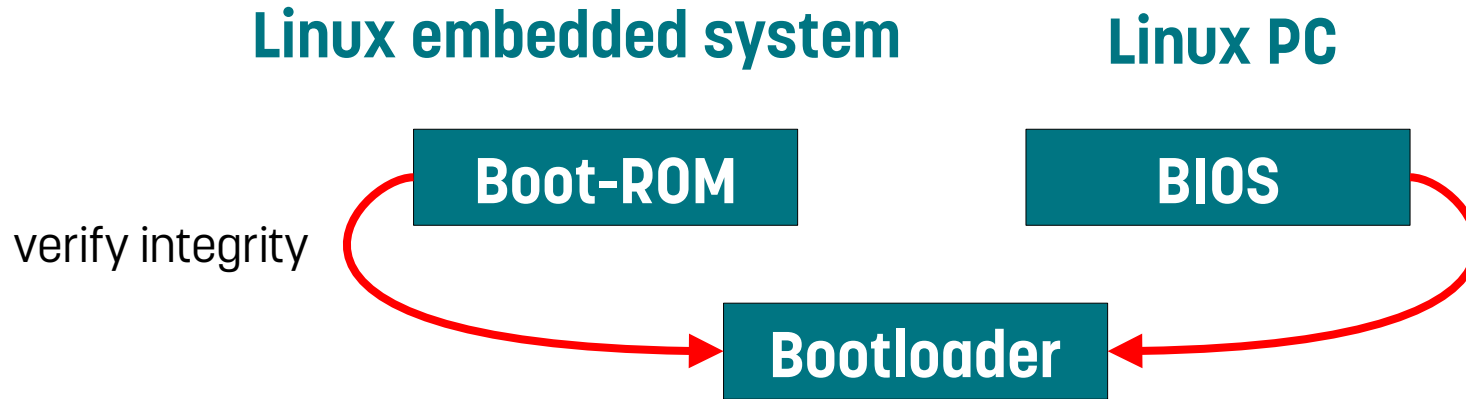
# What is Secure Boot?

Linux embedded system

Linux PC



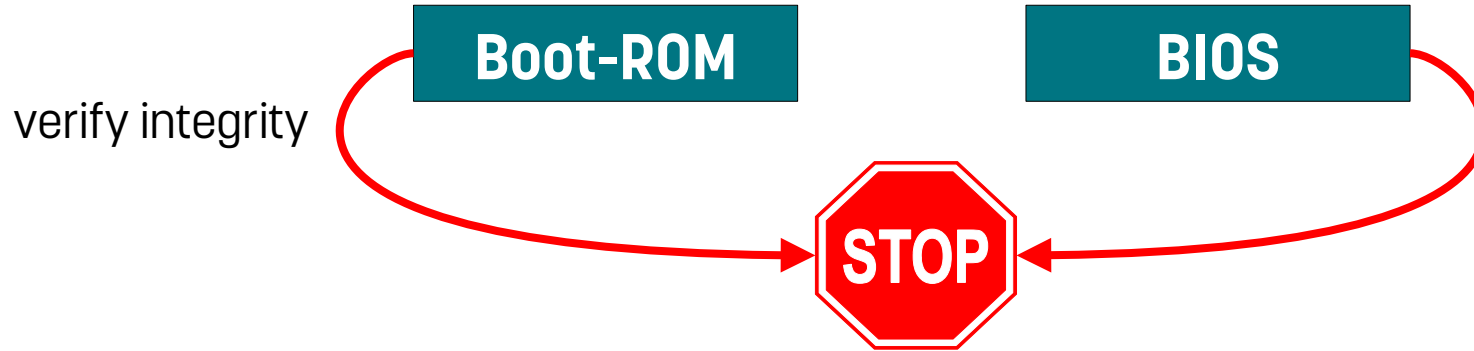
# What is Secure Boot?



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Linux embedded system

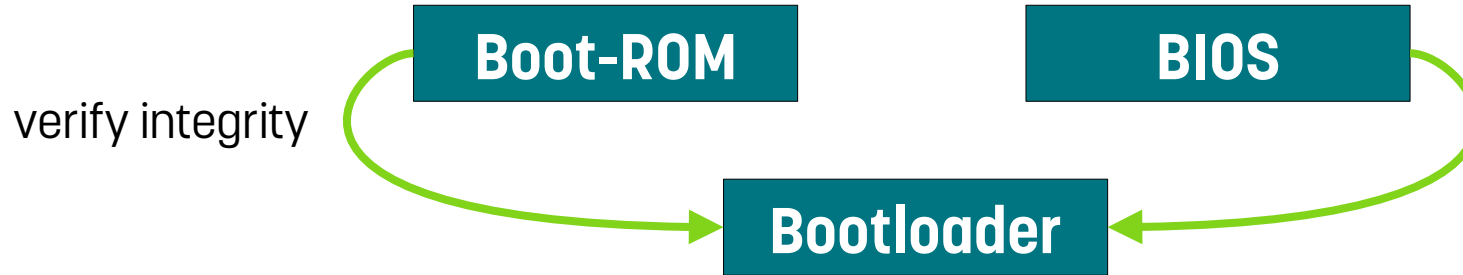
Linux PC



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Linux embedded system

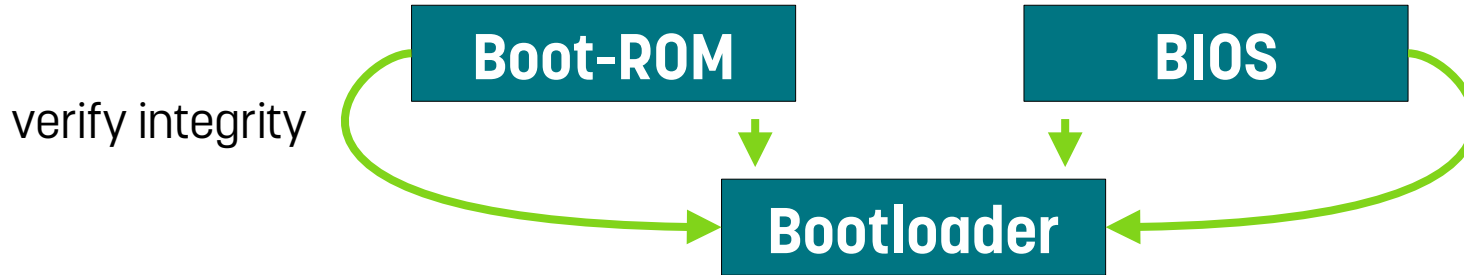
Linux PC



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Linux embedded system

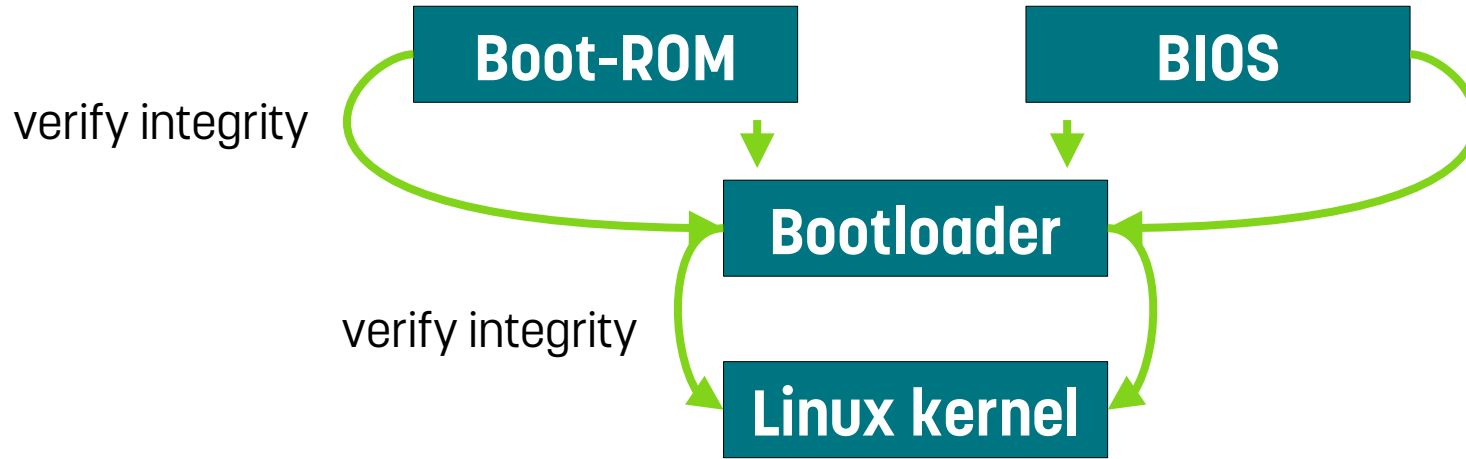
Linux PC



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Linux embedded system

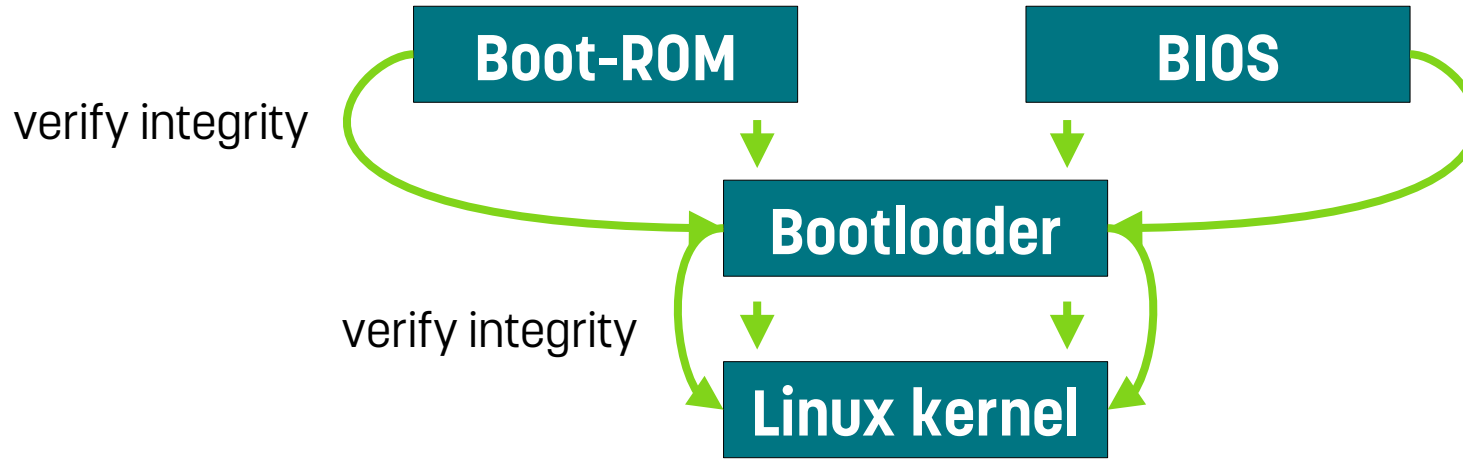
Linux PC



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Linux embedded system

Linux PC

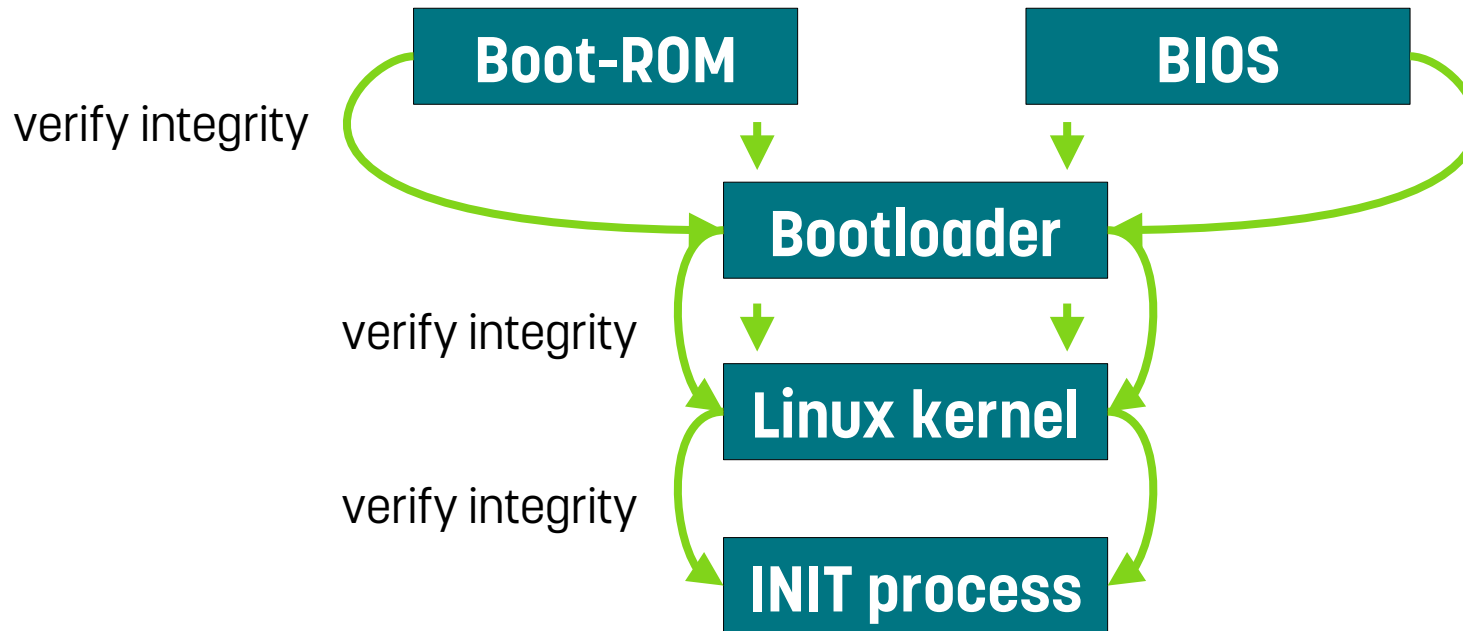




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Linux embedded system

Linux PC

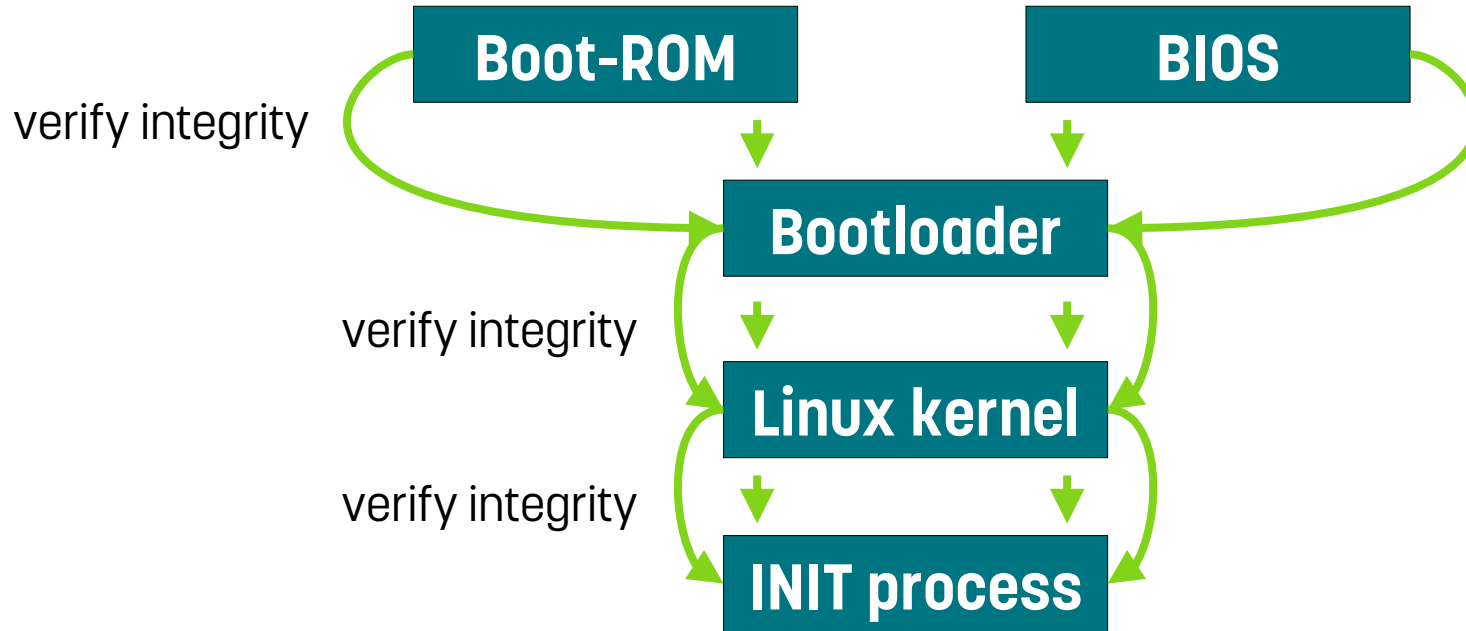


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# What is Secure Boot?

Linux embedded system

Linux PC

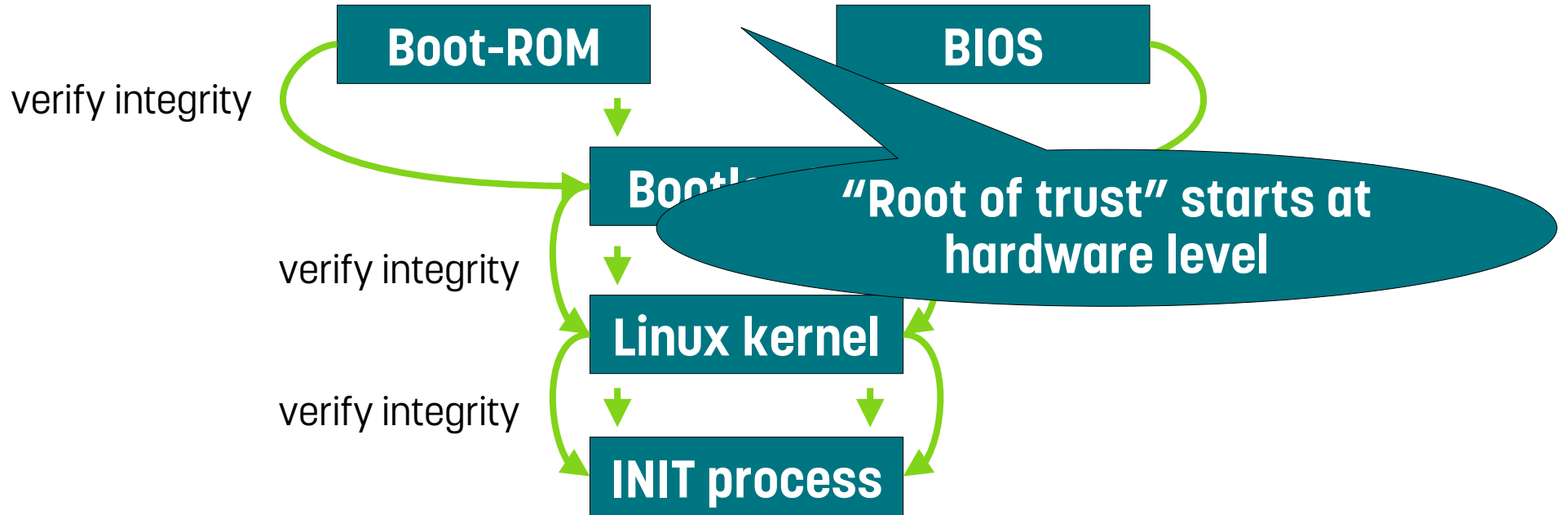


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Linux embedded system

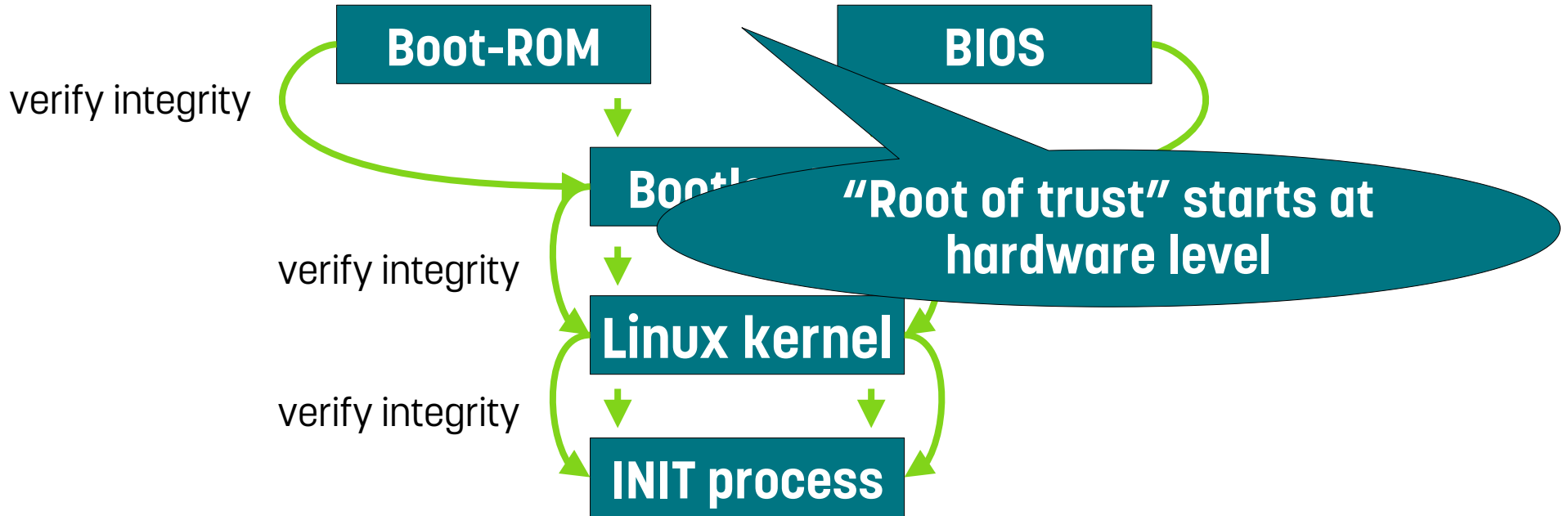
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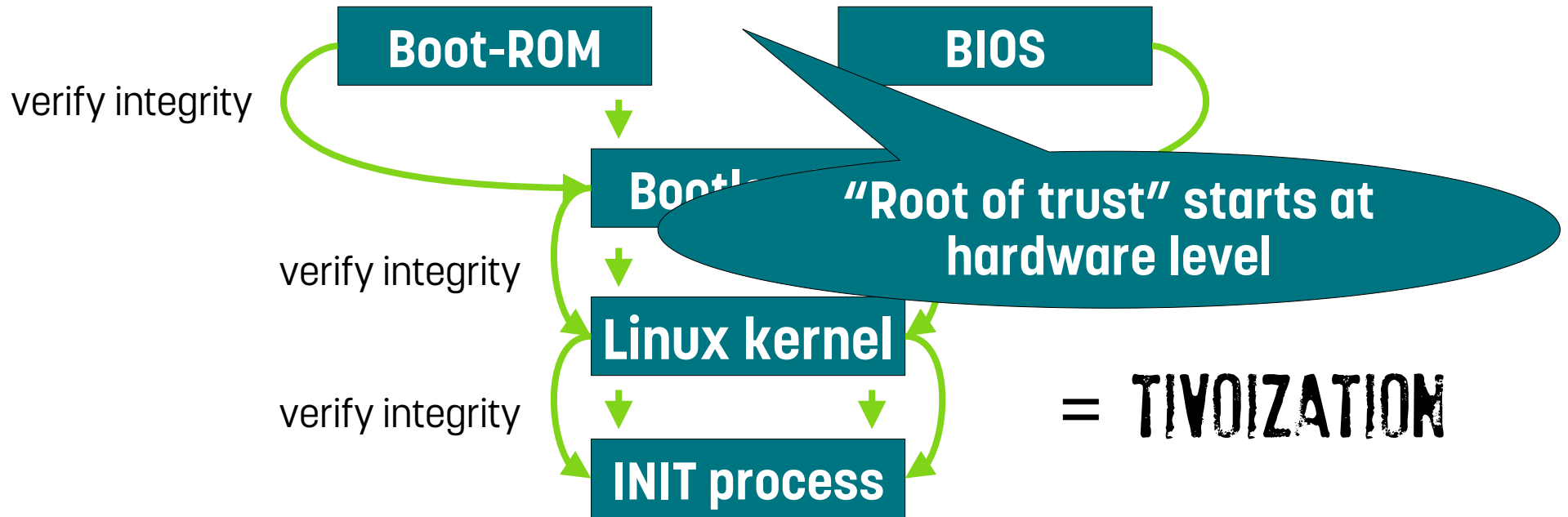
Linux PC



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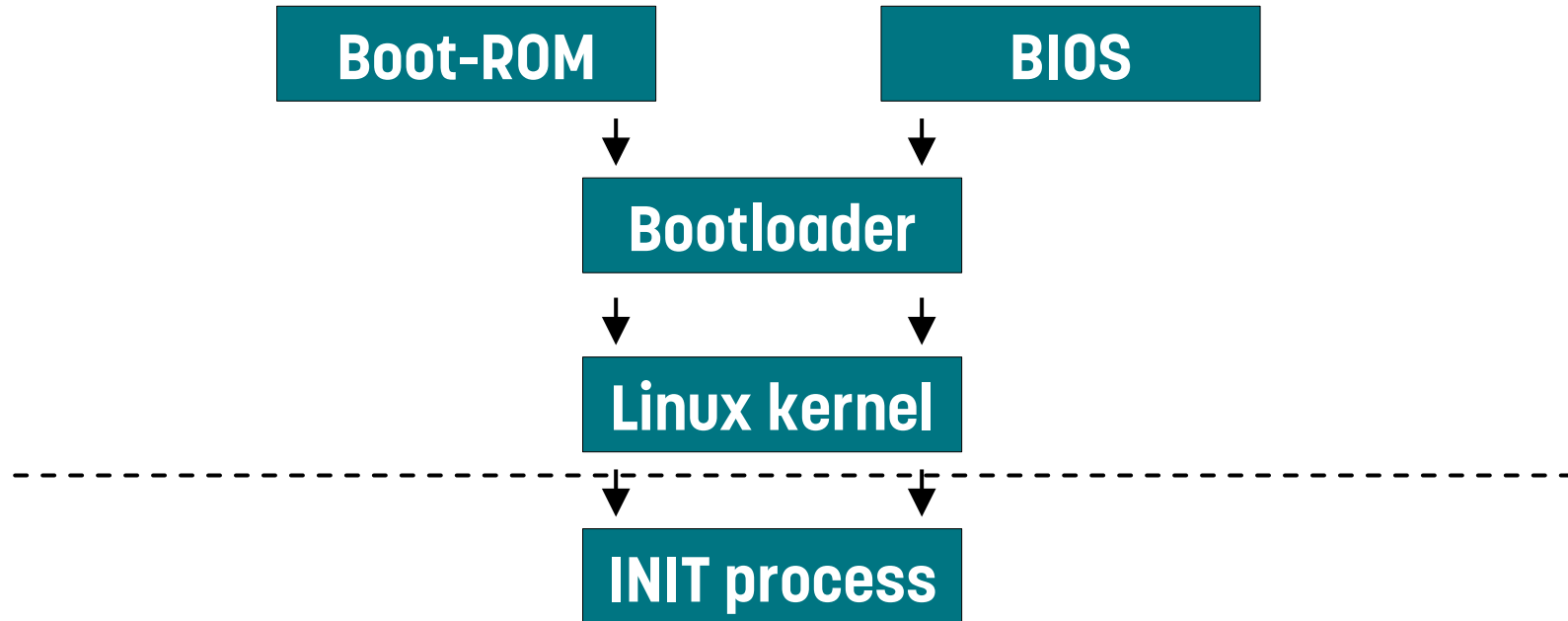
Linux PC



# What does the kernel, what does a user program?

Linux embedded system

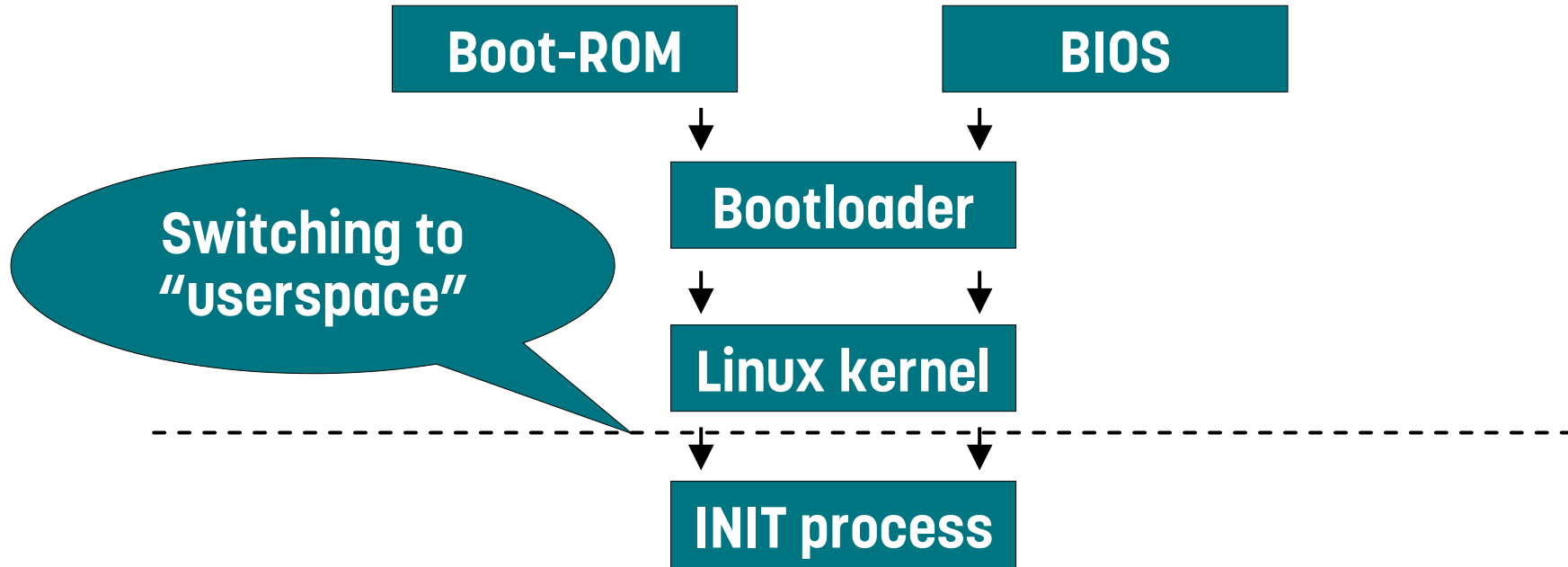
Linux PC



# What does the kernel, what does a user program?

Linux embedded system

Linux PC



# Kernel space vs. user space

Kernel

---

User



# Kernelspace vs. userpace

**ABOUT 5% OF THE  
EXECUTION TIME**

Kernel

---

User

# Kernel space vs. user space

ABOUT 5% OF THE  
EXECUTION TIME

Kernel

---

User

ABOUT 95% OF THE  
EXECUTION TIME

# Kernel space vs. user space

**HARDWARE DEPENDENT**

Kernel

---

User

**HARDWARE INDEPENDENT**

# Kernelspace vs. userpace

**PRIVILEGED MODE**

Kernel

---

User

**UNPRIVILEGED MODE**

# Kernelspace vs. userpace

**PRIVILEGED MODE**

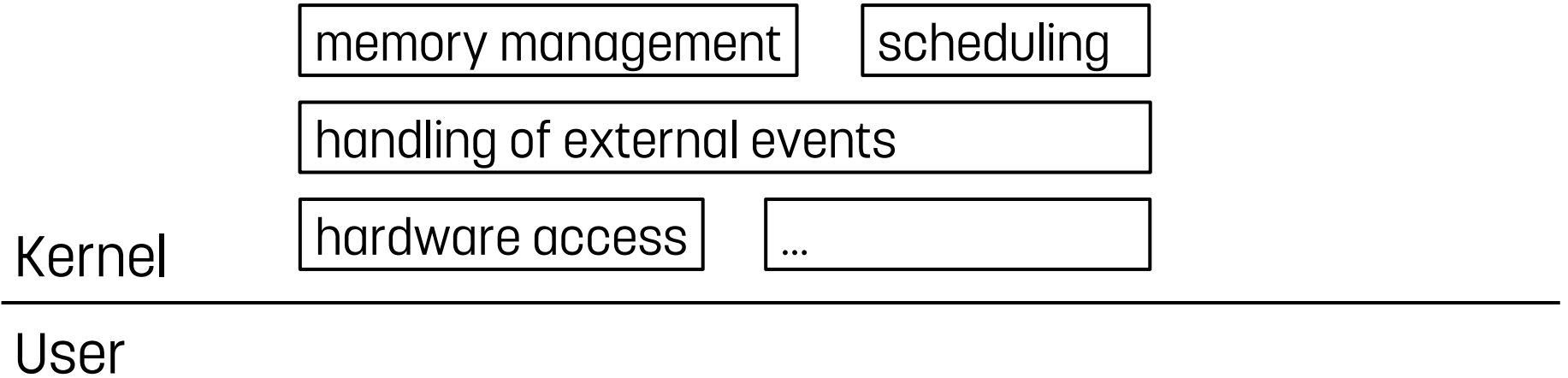
Kernel

User

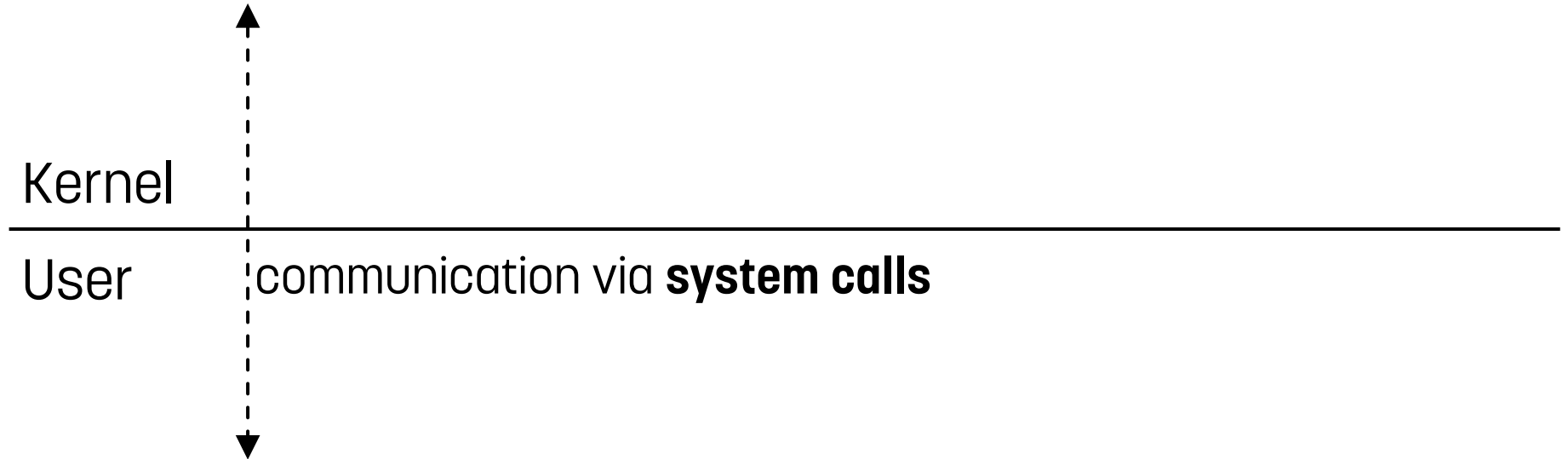
**Some instructions can only  
be executed in this mode**

**UNPRIVILEGED**

# Kernelspace vs. userspace



# Kernelspace vs. userpace



# Kernelspace vs. userpace

Based on the so-called  
"syscall exception" of the  
Linux kernel's GPL-2.0 license a system  
call does not lead to derivation.

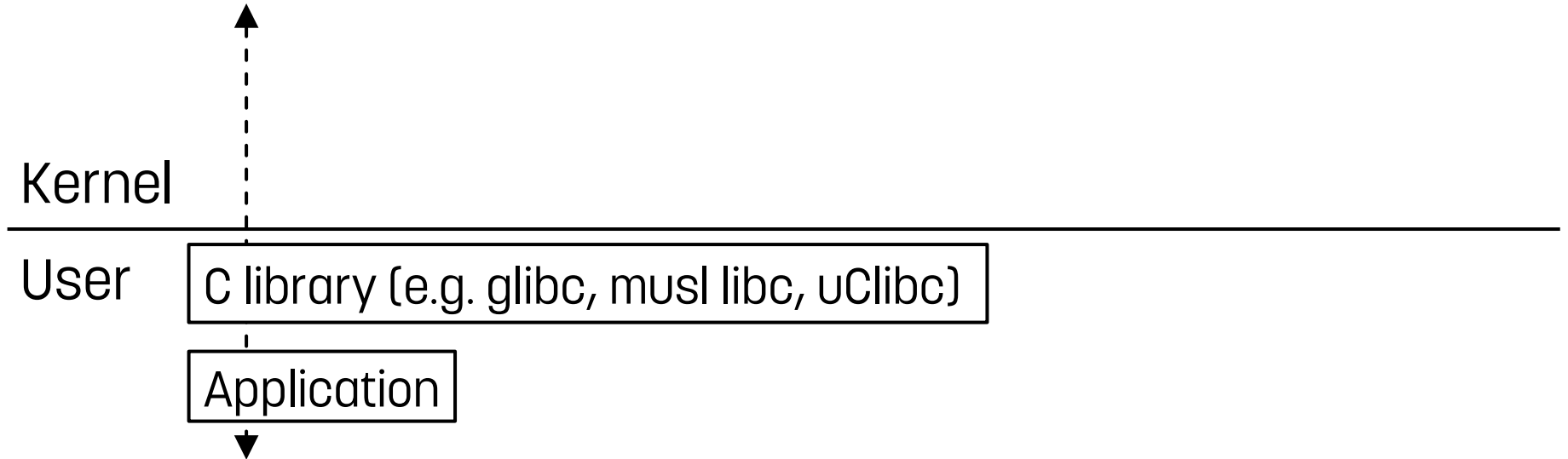
Kernel

User

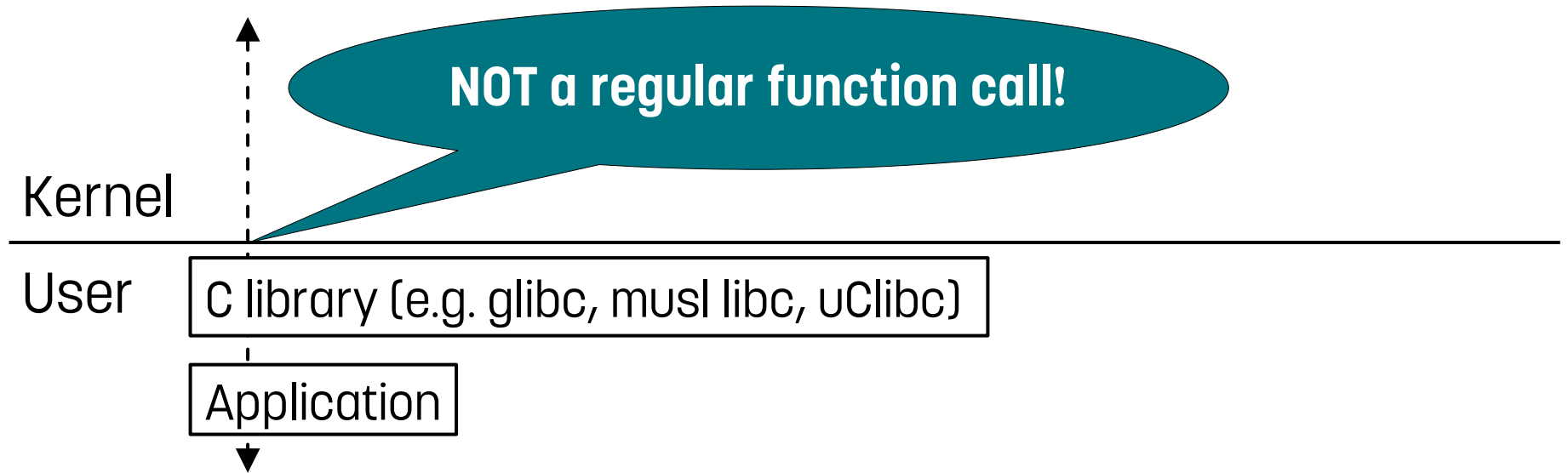
communication via **system calls**



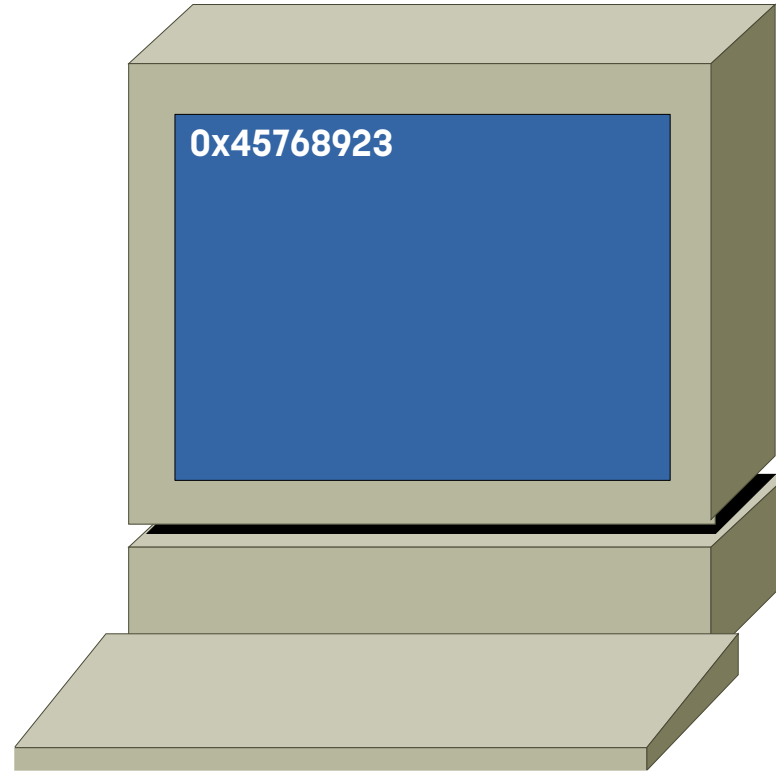
# Kernelspace vs. userspace



# Kernelspace vs. userpace

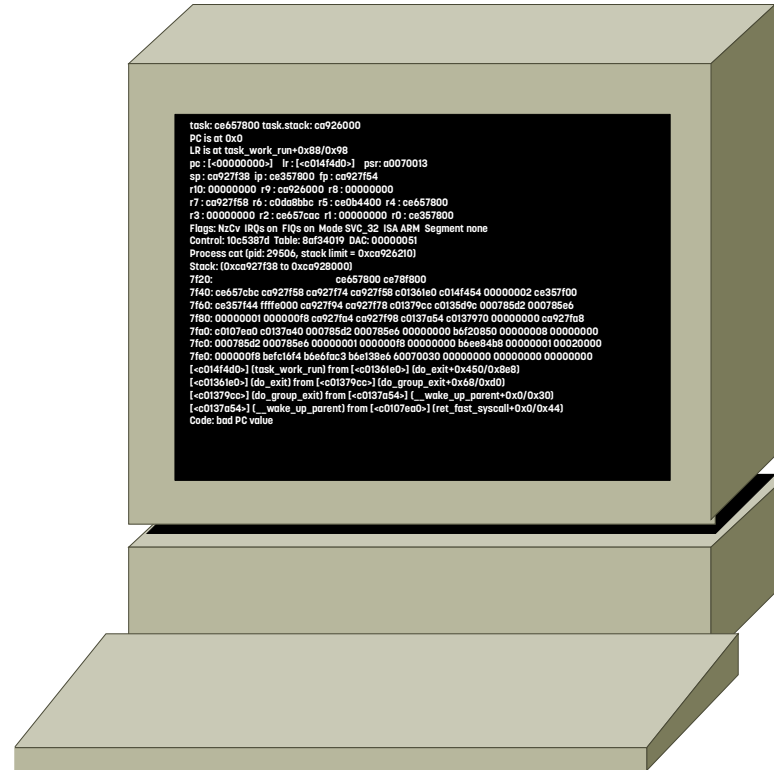


# What is a “computer crash”?



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# What is a “computer crash”?



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# What is a “computer crash”?

- The processor is instructed to execute an “impossible” operation, e.g.
  - Division by zero
  - Access to a privileged resource from unprivileged context
- A crash has different consequences in user and kernel space
  - User space: The program is halted and an error message is presented.
  - Kernel space:
    - The computer can either stop the current action and write a message to the log file, or
    - The computer can no longer be accessed and must be restarted.

# Who is responsible for a “computer crash”?

- Contrary to popular belief, a computer crash is usually not caused by an inappropriate action on the part of the user.
- Instead, a computer crash normally is the result of a programming error – either of kernel or user space developers.
  - In some cases it can also be caused by a severe hardware error.
- Users are encouraged to communicate computer crashes to the developers.