



EMBEDDED LINUX

By : Anfal Thear Hussein

Dep. Master Of Computer Science & Information Technology

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OUTLINE

- **Introduction .**
- **Embedded System Definition .**
- **Embedded Linux Definition.**
- **major components.**
- **Embedded Linux build systems .**
- **Embedded Linux (Advantages).**
- **Drawbacks of embedded Linux .**
- **Growth of Embedded Linux .**
- **Consumer device embedded Linux system .**
- **Reference .**

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Introduction :

what a Linux ? When the system was discovered ? open-source and free software principles, advantages in the embedded space, hardware needed for embedded Linux .

Embedded System Definition :-

An "embedded system" is any computer system or computing device that performs a dedicated function or is designed for use with a specific embedded software application . integrated into a larger appliances that is not a computer (i.e. oven , gas station pump, ATM machine) or small devices (i.e. cell phone, PDA) .

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Embedded Linux Definition

Linux is the operating system the use of Linux in embedded computer systems , choice for many embedded computer systems such as :

Smartphones , tablets , PDA , set-top boxes, and personal media players. Any version of Linux used to operate such machines is known as **Embedded Linux**. Linux is a natural choice for many of these devices due to its low cost , ease of customization, and the fact that it has already been ported to many custom-purpose microprocessors.

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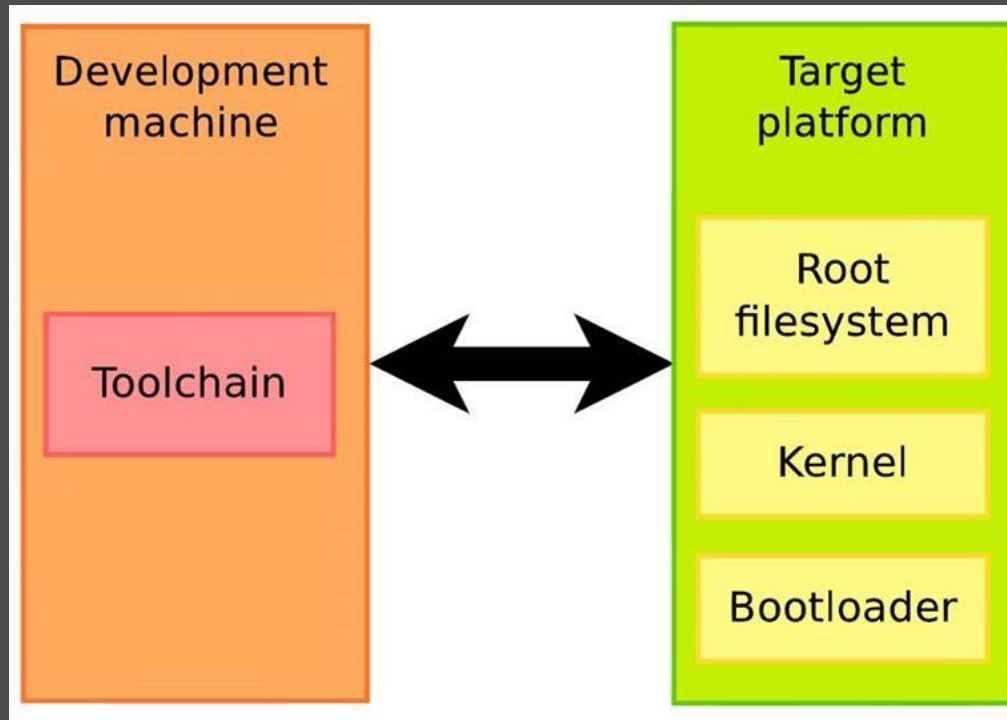
Four major components: -

Every embedded Linux system needs four major components to work :

- **Toolchain** : which doesn't run on the target platform, but allows to generate code for the target from a development machine .
- **Bootloader** : which is responsible for the initial boot process of the system, and for loading the kernel into memory .
- **Linux Kernel** : with all the device drivers .
- **Root filesystem** : which contains all the applications and libraries .

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Four major components diagram : -



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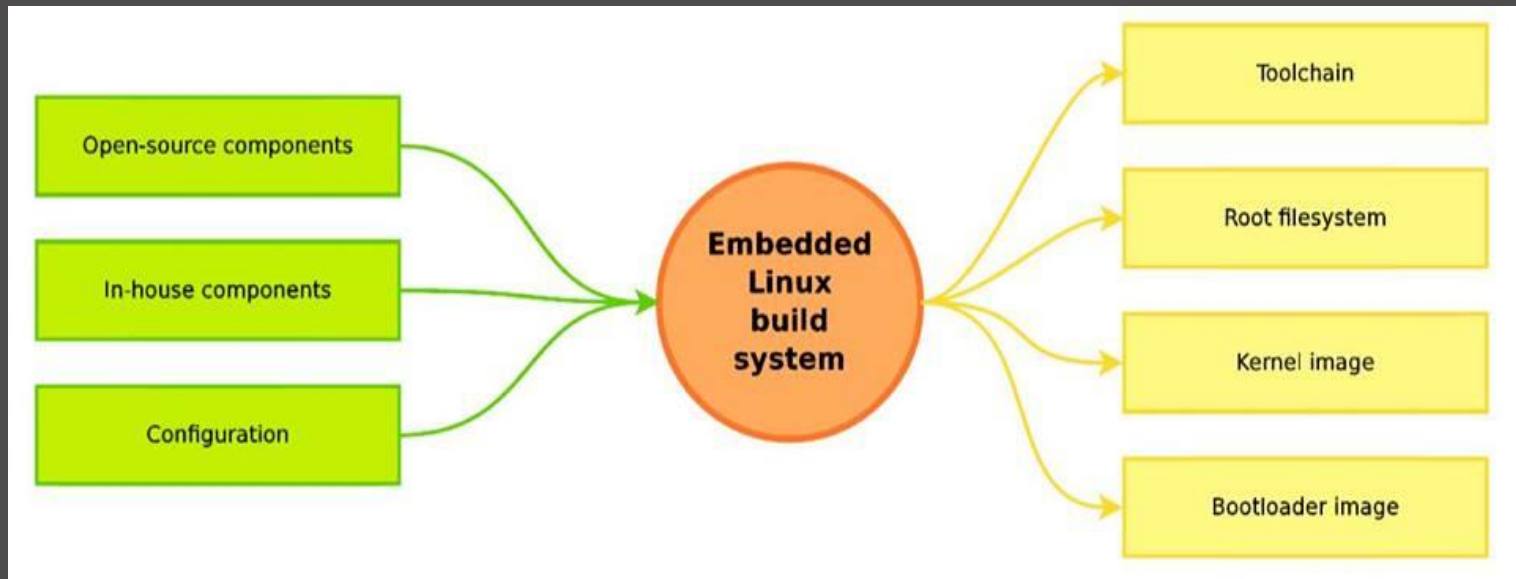
Embedded Linux build systems

that build from source all the elements of a Linux system and generates the toolchain , root Filesystem image , kernel image and bootloader image .

- Advantages: huge control over the system and components configuration, automated mechanism to reproduce the build, lightweight system.
- Drawbacks: need to learn a new tool, long compilation times .

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Embedded Linux build system: principle diagram : -



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Embedded Linux (Advantages)

- Free and Open Source.
- Well Documented.
- Network Friendly.
- Linux is Real-Time Too.
- Free Development Tools and Software.

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Embedded Linux (Advantages)

- **Free and Open Source :-**

Linux is free because it is distributed under GPL(GNU public license). With the source code always accessible .

- **Well Documented :-**

Source code can not be usable without any documentation. Linux Open Source Community's volunteer put several 'How to' and other guides on the net. It gives speed to the process of Embedded Linux.

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Embedded Linux (Advantages)

Network Friendly :-

Linux is pre-configured with TCP/IP protocol stack and IPX, SNA stacks are fully supported. Incorporation of TCP/IP reduces development time of Embedded Linux Systems .

Linux is Real-Time Too :-

Real-time systems produce the output response within a certain time limit. The time critical functions need to be done at interrupt level. The priority of these interrupts and the functions that they perform need to be carefully designed .RT-Linux fulfill this type of interrupt control.

Free Development Tools and Software :-

The most famed tools is GNU tool chain consisting gcc (GNU C Compiler), gdb(GNU Debugger), gas(GNU assembler),GNU Linker.

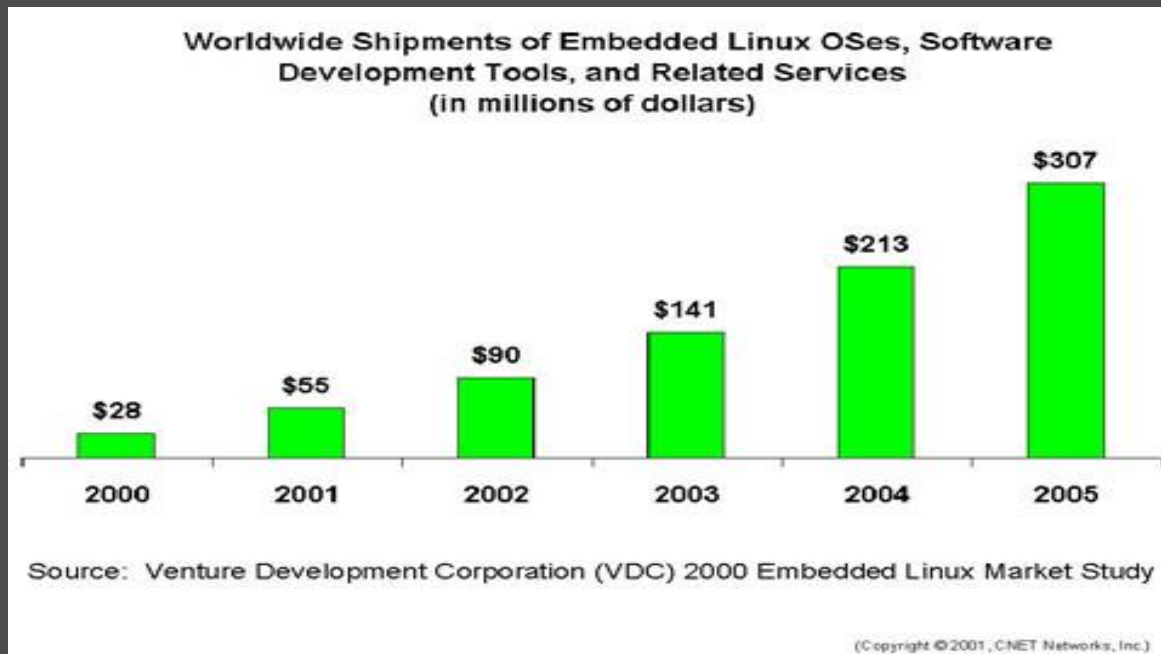
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Drawbacks of embedded linux

- Large choice : At the same time a strength and a drawback of free software and open source .
- New skills needed : compared to bare metal development with traditional embedded operating systems .
 - Need for training .
 - Need for recruiting new profiles.
- Licensing fear : Generally over-exaggerated .

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Growth of Embedded Linux



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Consumer device embedded Linux system : point of sale terminal



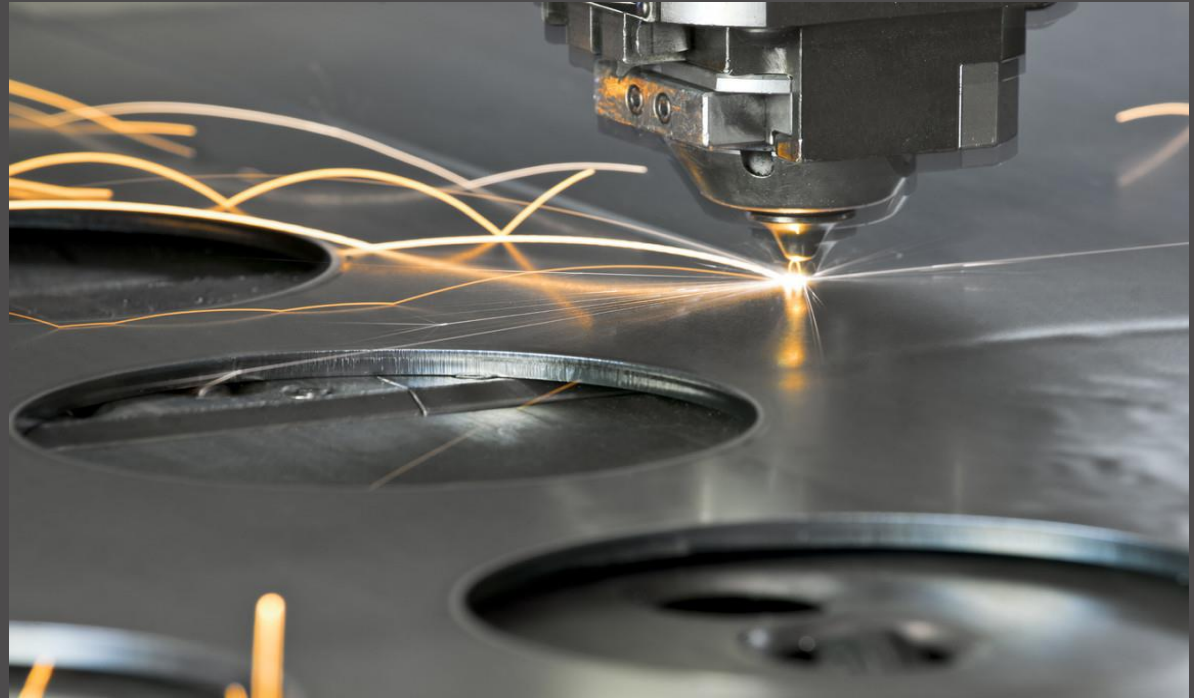
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Consumer device embedded Linux system : wind turbine



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Consumer device embedded Linux system : laser cutter



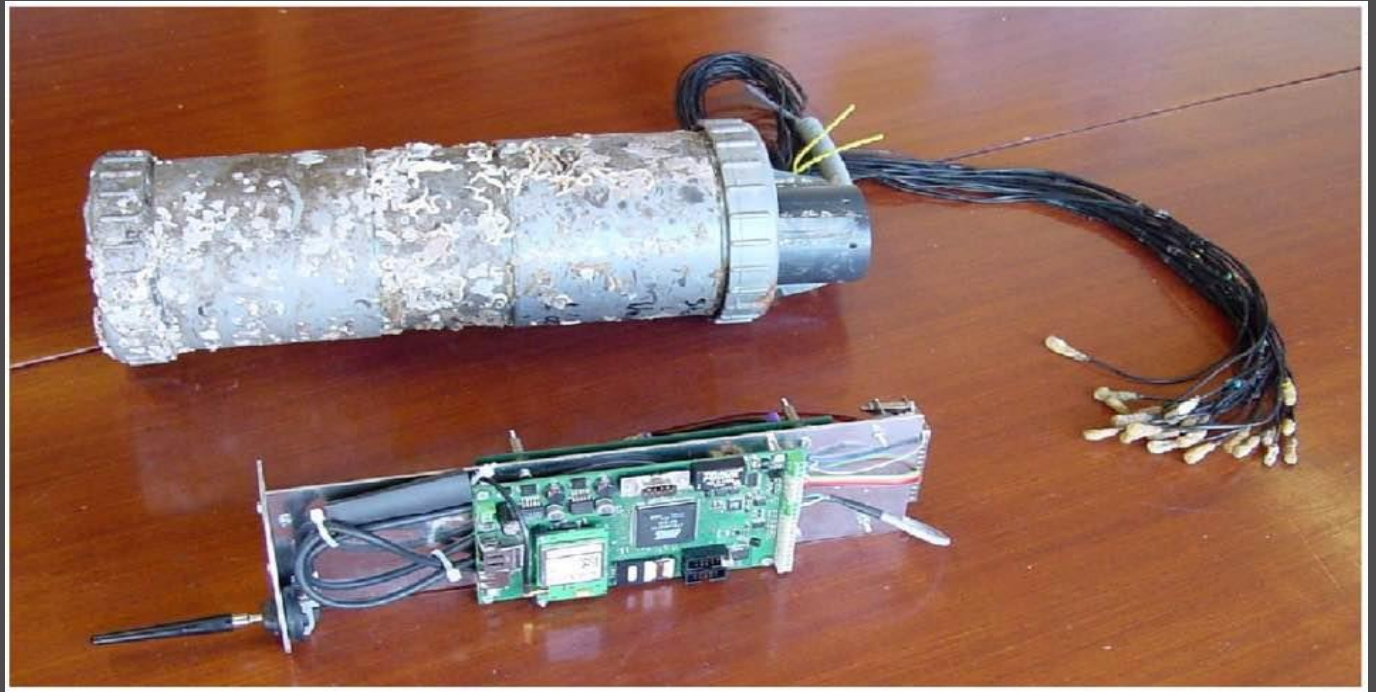
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Consumer device embedded Linux system : viticulture machine



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Consumer device embedded Linux system: sea pollution detection system



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Consumer device embedded Linux system : cow milking



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Consumer device embedded Linux system : snow removal



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Consumer device embedded Linux system : Internet box



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Consumer device embedded Linux system : Network Attached Storage



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Reference

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