

Special purpose Linux

- There are many different consumer and enterprise devices running many different versions of embedded Linux. A few examples:
 - Network routers, firewalls, load balancers, NAS appliances, network cameras, etc.
 - VoIP phones – Zultys, Snom
 - Mobile phones – OpenMoko
 - Set-top multimedia boxes, in-flight entertainment system, etc.
 - Information kiosks, ticket purchasing systems, etc.
 - General purpose embedded systems
 - Industrial control

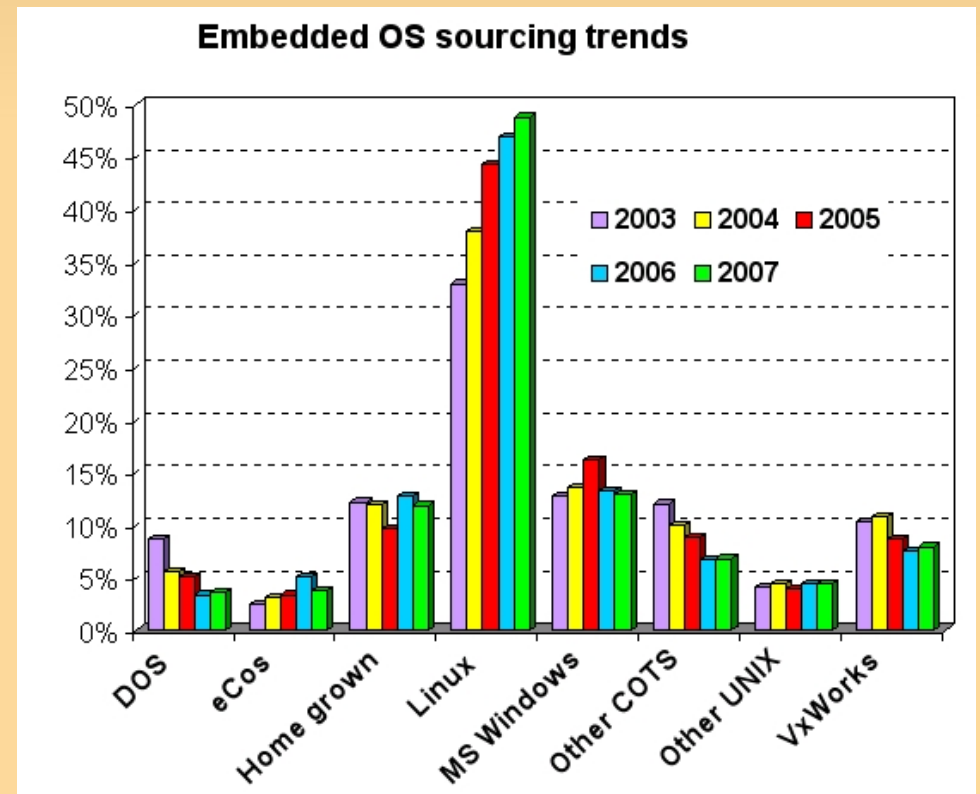
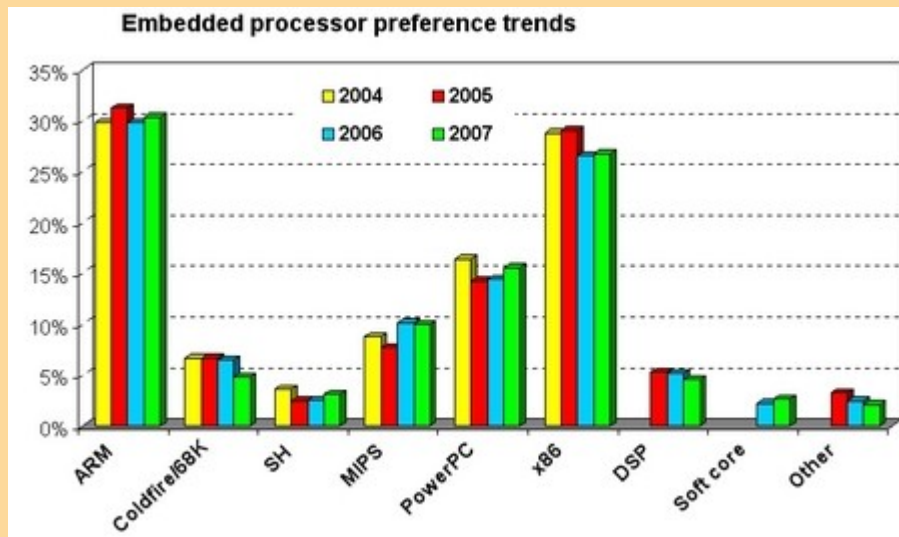


How are these different than a regular PC?

- No keyboard/mouse and video
- Usually it's a single purpose device/appliance
- Low power consumption (low heat discipation)
- In many cases there is a requirement for no moving parts – no hard disks or fans
- Ability to operate in dust and vibrations
- Most "embedded" components have lower performance (not latest technology)
- Long shelf life for industrial applications

Embedded Linux

- **Source: Embedded Linux Market Survey**
- **Linux adoption keeps increasing**
 - Linux has truly established itself as a viable if not dominant embedded operating system that is used in thousands of new designs each year.
- **ARM to outpace x86**



Motorola WR850G

- Very similar to the Linksys WRT54g
- similar designs from Belkin, Buffalo, NetGear
- 200 MHz MIPS, 16 MB RAM, 4 MB Flash
- All the usual firewall, NAT, DNSd, DHCPd
- Can run VPN, Asterisk, etc
- The power of open source – a myriad of alternative firmware versions – DD-WRT, OpenWRT
- Can be configured as router, WiFi AP, WiFi bridge in transparent or NAT mode
- newer Linksys hardware revisions run VxWorks OS (less RAM and flash), so need WRT54GL to run additional software
- Similar: NSLU2



Cobalt Qube 2

- Circa 1999
- MIPS CPU, 32 MB RAM
- Original OS – modified RedHat using Linux 2.0 kernel
- Web server, FTP Server, Firewall, SMB, etc.
- Later models switched to AMD x86 CPU's
- RaQ models
- Open source – Strongbolt & Bluequarz



Tivo

- Probably the most well known Linux embedded platform (and one of the first to market)
- It showed that Linux is a viable choice for multimedia platforms
- MIPS CPU, 48 MB RAM, hardware MPEG decoding
- Quite proprietary, not easy to modify





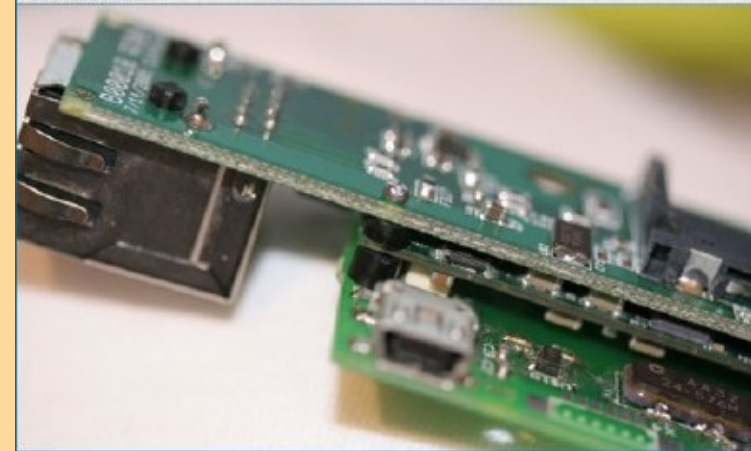
Media Box

- based on VIA Mini-ITX x86
- full PC in mini form-factor
- not truly an embedded platform, but a good example
- still fairly bulky and power hungry
- quite more powerful CPU and much more RAM compared to the other "embedded" platforms



Gumstix

- A "micro PC" modular architecture
- ARM architecture (Intel XScale CPU) up to 600 Mhz
- Up to 128 MB RAM, up to 32 MB strata flash
- 80mm x 20mm, -25C to 85C
- Linux 2.6



Chumby

- Open Hardware Design
- Open Source software
- 350 MHz ARM9
- 64 MB RAM, 64 MB FLASH
- 320x240 3.5" TFT LCD w/ touchscreen
- Stereo 2W speakers
- Squeeze sensor
- 3-axis Accelerometer
- USB 2.0 host mode
- WiFi (802.11g)



Other devices

- "Honorable" mention
 - Nokia N800 tablet (Maemo OS)
 - Asus Eee PC mini-laptop
 - One Laptop Per Child (OLPC)
 - BUG



Links

- WRT54g
 - <http://en.wikipedia.org/wiki/WRT54g>
 - <http://www.dd-wrt.com/>
 - <http://openwrt.org/>
 - <http://en.wikipedia.org/wiki/NSLU2>
 - <http://www.nslu2-linux.org/>
- Cobalt Qube
 - http://en.wikipedia.org/wiki/Cobalt_Qube
- Asus Eee
 - <http://eeepc.asus.com/en/>
- Nokia N800
 - <http://www.nseries.com/products/n800/>
 - http://en.wikipedia.org/wiki/Nokia_N800
 - <http://www.maemo.org/>
- Media Box
 - <http://www.mini-box.com/>
 - <http://en.wikipedia.org/wiki/Mini-ITX>
- Chumby
 - <http://www.chumby.com/>
- Gumstix
 - <http://www.gumstix.com/>
- BUG
 - <http://www.buglabs.net/>
- One Laptop Per Child (OLPC)
 - http://en.wikipedia.org/wiki/OLPC_XO
- Linux Devices
 - <http://www.linuxdevices.com/>
 - Embedded Linux Market Survey