

Welcome to SDOSS

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Embedded Linux

Is it Everywhere?

<http://www.m-w.com/dictionary/ubiquitous>

- **ubiquitous**
- One entry found for **ubiquitous**. Main Entry:

ubiq·ui·tous

Pronunciation: yü-'bi-kw&-t&s

Function: *adjective*

: existing or being everywhere at the same time : constantly encountered :

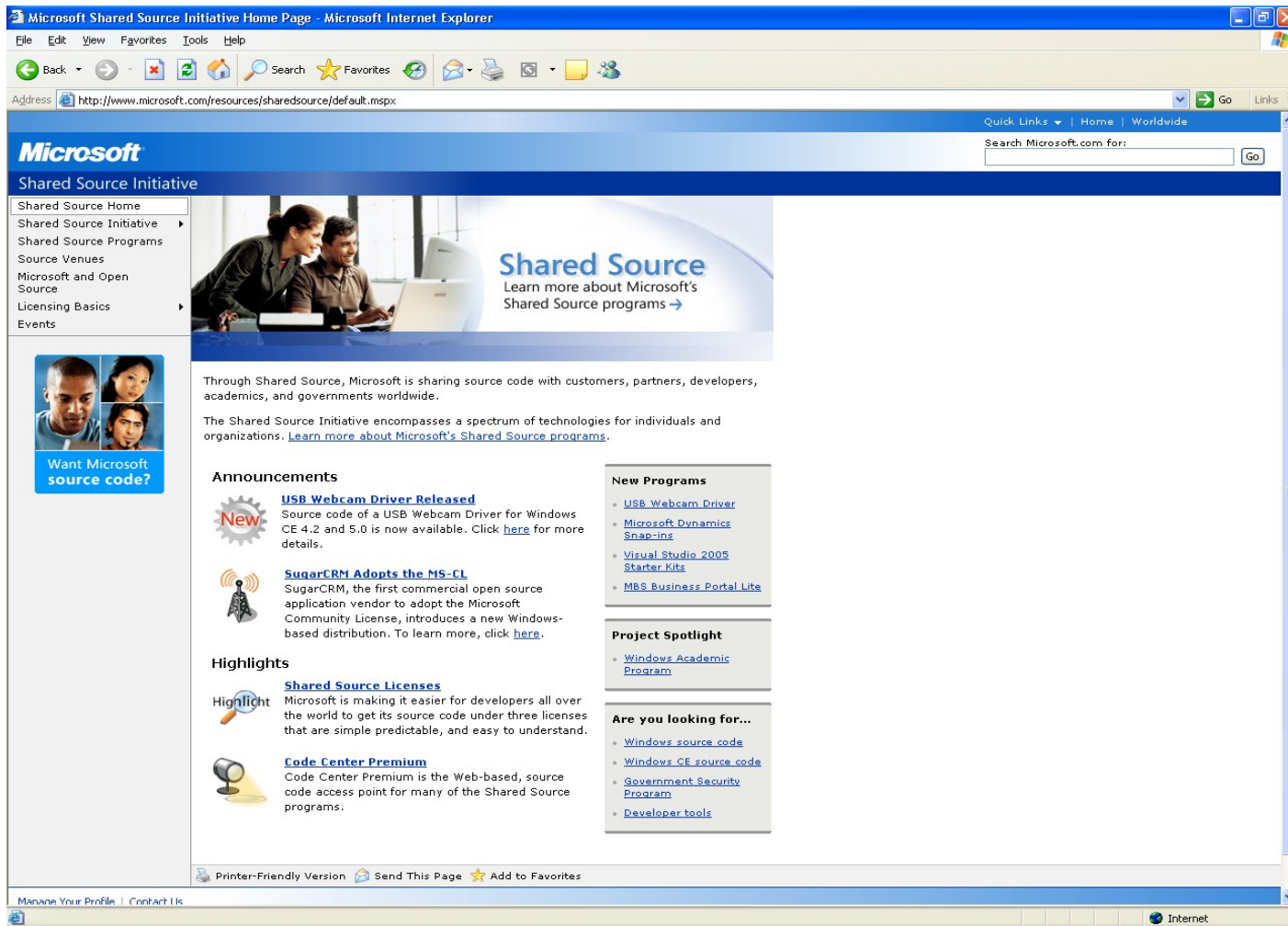
WIDESPREAD

The Linux Battleground

- In your face : The Desktop
 - Too many users with too many habits to break
 - Windows will always dominate here
- Behind the scenes : The Server Room
 - Decisions can be made based on technology, not personal habits
 - Linux is strong here
- Underground : The Embedded Device
 - Does it work and how much does it cost?
 - Linux shows signs of dominance here

David and Goliath

- Uncle Bill would have you believe that Microsoft innovates and that OSS is un-American
- His cash-cow allows him to be a business bully
- In early-90s the internet and Netscape gave him nightmares, MS created IE and made the nightmares go away
- <http://www.cio.com/archive/091504/microsoft.html>
 - 1989 – 1998 MS gives \$162,000 in soft money
 - March 1998 BG testifies in Congress
 - March – Dec 1998, MS gives \$689,816 in soft money
- What do you suppose his current nightmare is?



Did Microsoft suddenly find open-source religion? Hardly. It was dragged there kicking and screaming by its customers, who are increasingly drawn to open-source software like Linux...

<http://news.com.com/2009-1001-961354.html>

Consumer Electronics

Is the Playing Field Level?

- Consumers want innovative, cheap and high quality devices to play with
- If they're "sexy" so much the better
- Software is the Great Differentiator
- Linux is the Great Equalizer

Software Differentiates

- Imagine being able to invest engineering in a single HW design and create multiple products from that HW that span price ranges
- Now imagine a soft interface on the gadget that allows it to not only have different features, but also different personalities
- Now imagine coming to market with a portfolio of products, rather than a single product, within the same timeframe

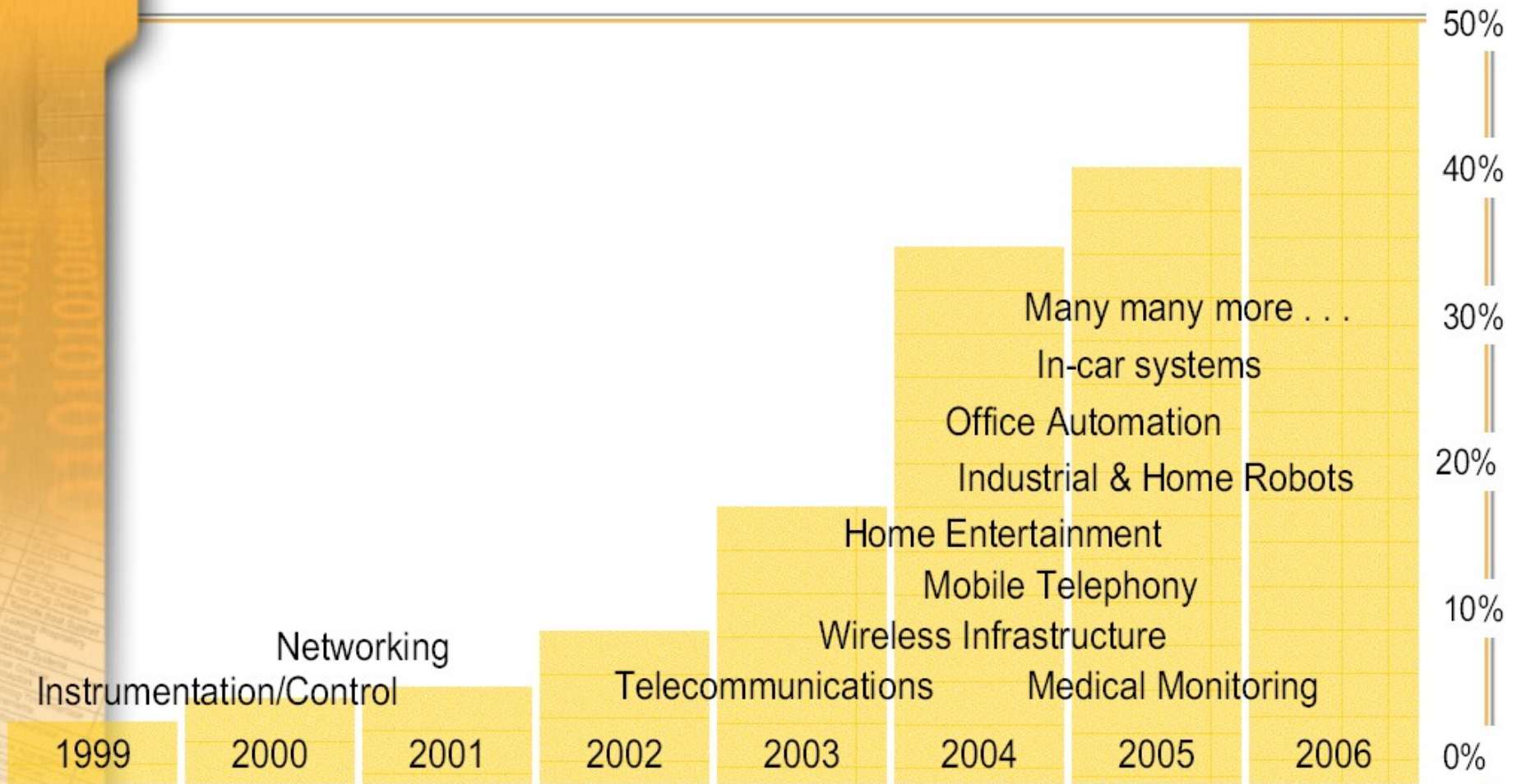
Linux Equalizes

- Cost of entry is lowered
- Innovative products appear globally
 - First cell-phones with Linux appeared in Asia in 2001-2002
- Standards make devices more adaptable and useable
- COGS should be lower compared to a device built from proprietary components
- Gadgets are now feature-rich because building-block software is leveraged, rather than re-written by every gadget vendor

Disclaimer on Statistics

- The next couple of slides deal with surveys and statistics.
- They come from two sources:
 - Linuxdevices.com
 - Informal, site visitors, tend to intrinsically favor Linux, due to nature of visitors to site
 - OSDL
 - Formal data, often from VDC, etc.

Growing Market for Embedded Linux



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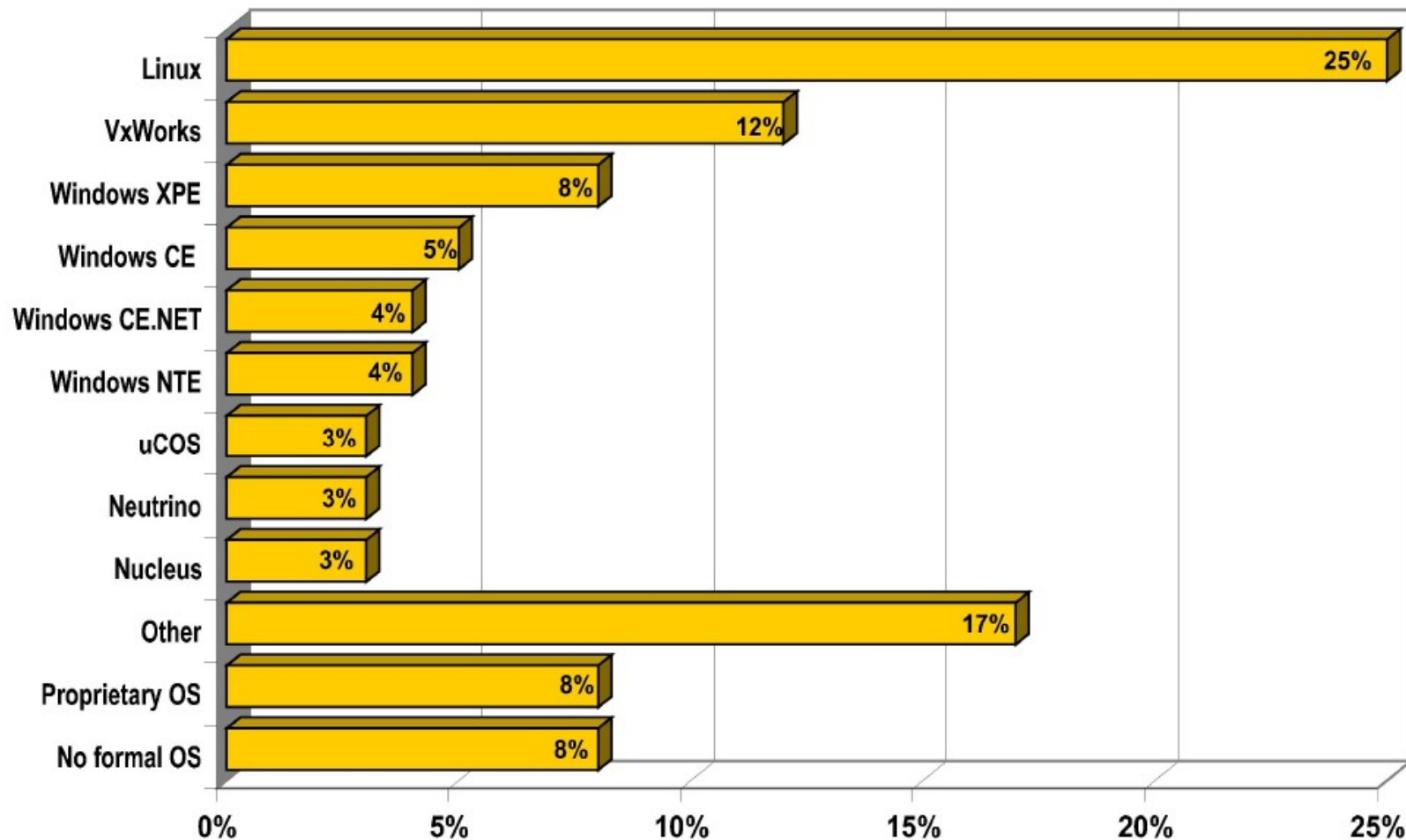
The Survey Says...2005

- From linuxdevices.com website, top 4 Oses

OS	Past 2 years	Next 2 years
Linux	42%	55%
MS Windows	15%	11%
HomeGrown	9%	7%
VxWorks	9%	7%

Our 2003 survey found that 33 percent of respondents used Embedded Linux in their (or their company's) products during The past two years, while 49 percent expected to within two years. This year, 43 percent say they have used Linux, while 55 percent Expect to. Linux use in embedded continues to swell

Linux in Embedded – Reality Check



VDC: OS Choice for 32/64 bit applications in 2005



Device Smack-Down

21.Dec.2005 (linuxdevices.com)

Device Category	Windows Embedded	Embedded Linux
PDAs, handhelds	120 devices	41 devices
Mobile phones	55 devices	30 devices
VoIP phones/devices	13 devices	15 devices
Robots	(included in other)	11 devices
Audio/video devices	23 devices	68 devices
Thin client devices	45 devices	28 devices
Tablets/webpads	40 devices	14 devices
Gateways, servers, Aps	(included in other)	91 devices
Other	52 devices	69 devices
Total :	348 devices	367 devices

Quote from Smack-Down Article

Server-like devices – from carrier-class systems for telecommunications infrastructure to SOHO firewall/routers and access points – are natural wins for Linux, with its strong server-OS heritage and Internet-access strengths. Graphical-user-interfaced devices that tend to interoperate with desktop PCs, on the other hand – including PDAs, web tablets, and mobile phones – are product categories where Windows-familiarity flexes its muscle.

Embedded Linux Application Space

- Communications Infrastructure
 - Switches, routers, base stations, access points, hot spots, media gateways, SLAM, firewalls . . .
 - Wireless and wire-line
- Consumer Electronics
 - Handheld devices – cell phones, PDAs, media players, cameras
 - Automotive – in-car entertainment, navigation, satellite radio
 - Home entertainment – TV, HDTV, DVR/PVR, home gateways, home control
- Instrumentation and Control
 - Medical devices, industrial monitoring, manufacturing control, test equipment
- Aerospace and Defense
 - Secure networking, command and control, launch systems, simulation
- Office and Retail Automation
 - Printers, faxes., scanners, MFDs, voice mail, voice conferencing, POS, transaction terminals, thin clients
- Almost every other type of embedded design!

Case Study : Cell Phone

- Mark VandenBrink made a presentation on Motorola's use of Linux in current and next generation cellular phones, at LinuxWorld, April.2006
- Following are some quotes from a NewsForge article on the presentation.
- <http://mobile.newsforge.com/article.pl?sid=06/04/05/1815218&tid=97>

VandenBrink enumerated Motorola's reasons for adopting Linux as a mobile phone platform, including the expected cost savings and flexibility over non-free alternatives, but also a decreased time-to-market, and the intrinsic benefit of building a product on the same platform that all of its hardware suppliers are using, and in most cases, developing drivers for first.

On the non-technical side, VandenBrink says that Linux has moved past the “will it work?” stage and into the “what next?” stage.

Motorola believes that for embedded Linux to grow in mobile phone devices, it must evolve as a platform that multiple handset manufacturers, application vendors, and phone service carriers all build together.

This level of standardization is necessary to foster innovation and accelerate development, he says. The alternative – fragmented development – helps no one and will stall development. Handset manufacturers all know that consumers pick phones on the basis of features and feel; unifying the lower levels of the platform will help them get their phones to market, but still leave room for them to differentiate their products from one another.

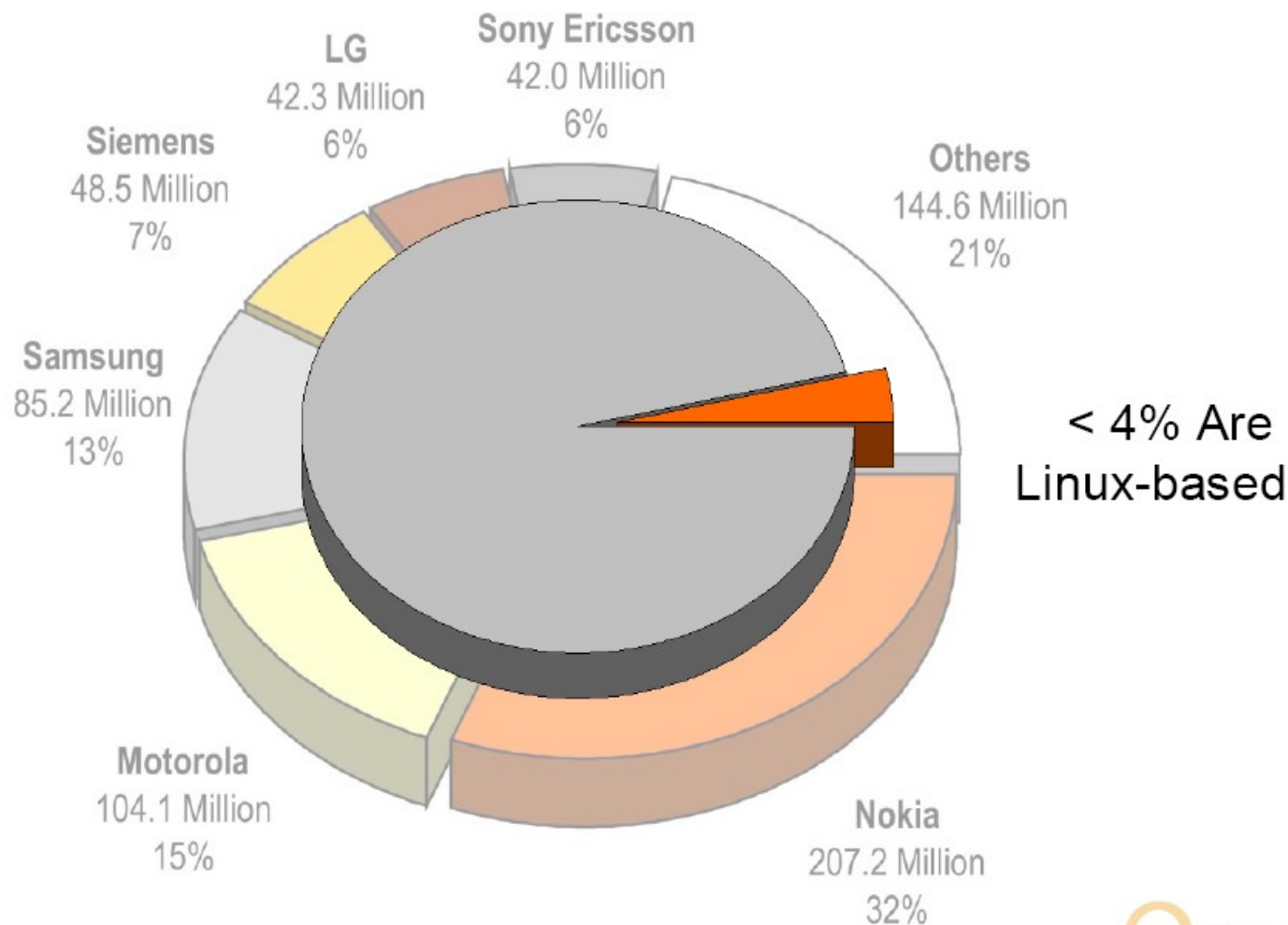
Still unresolved, VandenBrink says, is a common understanding of what it means to be a “good GPL citizen.” Hardware and software vendors disagree, leaving different pieces of the stack at different levels of “openness.” Motorola’s stance is that a commitment to openness is critical; it learned that during its first generation of Linux phones.

*As an aside, there is a website setup to track and correct GPL violators, this is a link to that site’s FAQ for vendors:
<http://gpl-violations.org/faq/vendor-faq.html>*

Motorola Decision-Makers

- **The basics...**
 - Expected cost savings
 - Flexibility
 - Decreased time-to-market
 - Same platform as suppliers
 - First driver platform
- **Will it work -> What next?**
- **Build it together**
 - Handset manufacturers
 - Application vendors
 - Phone service carriers
- **Standardization**
- **Good GPL Citizen**

Limitless Opportunity for Linux

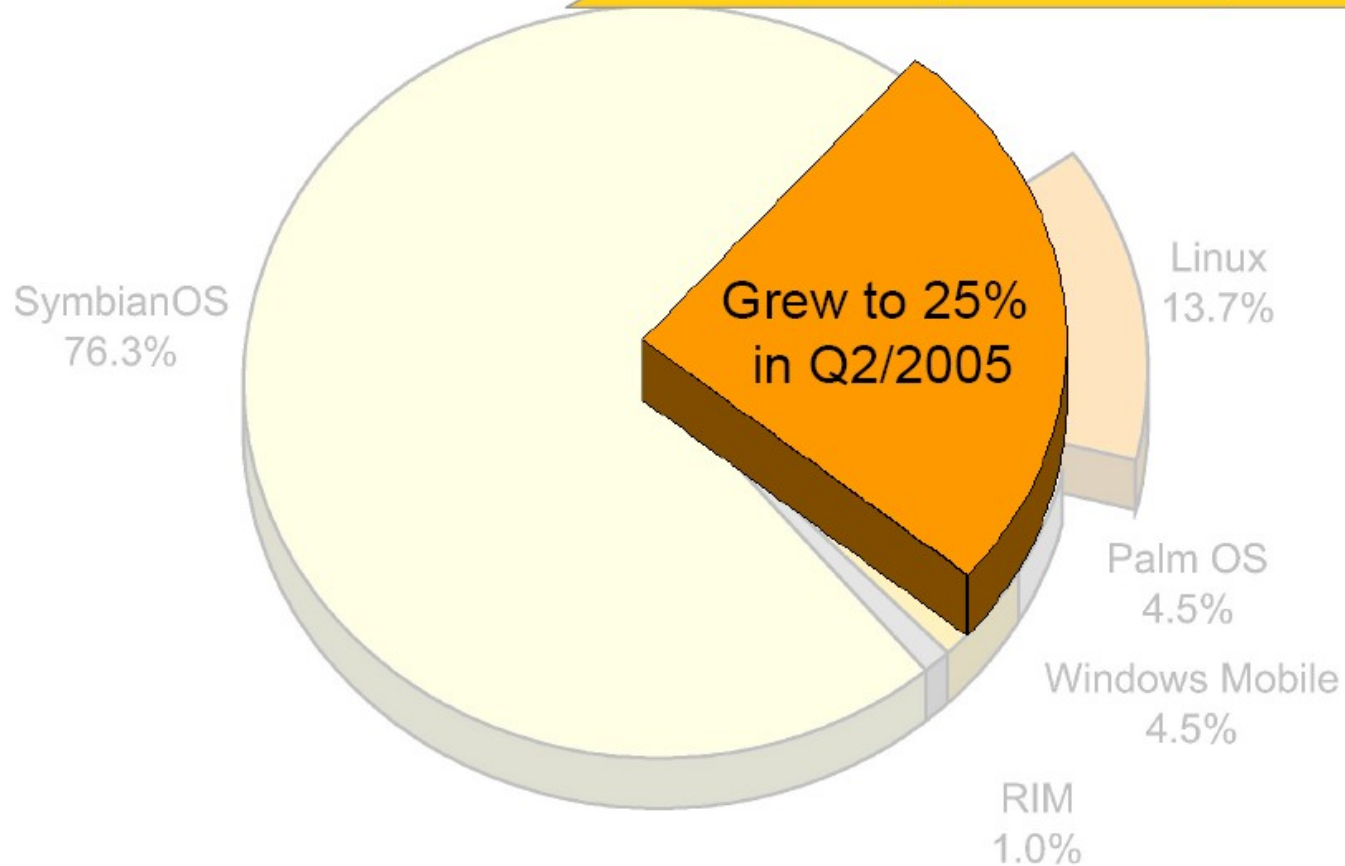


Worldwide Unit Shipments 2004 – Source: Gartner

Linux Strong in SmartPhones

Smartphone Marketshare – Q1/2005

Linux and WindowsMobile projected to surpass SymbianOS by 2010 (TGD)



Linux : 412% growth from 3.4% in Q1/2004

Worldwide Unit Shipments 2005 Q2 and Q2 – Source: Gartner

David and Goliath Re-visited

- Quote from Smack-Down article on linuxdevices.com
 - In light of all these accomplishments, it comes as no surprise that Microsoft reported record mobile and embedded segment quarterly revenue of \$97 million in the fourth quarter of its 2005 fiscal year. Nonetheless, the division was still operating in the red, showing a quarterly loss of \$14 million.