Why Free-Libre / Open Source Software (FLOSS)? Look at the Numbers!

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http://www.dwheeler.com/numbers
http://www.dwheeler.com/oss_fs_why.html

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Outline of Quantitative Information on FLOSS*

Quantitive measures justify considering FLOSS

- **Background**
- **Quantitative measures**
  - **Market Share**
  - **Reliability**
  - **Performance**
  - **Scalability**
  - **Security**
  - **Total cost of ownership**
- **Non-quantitative**
- **Conclusions**

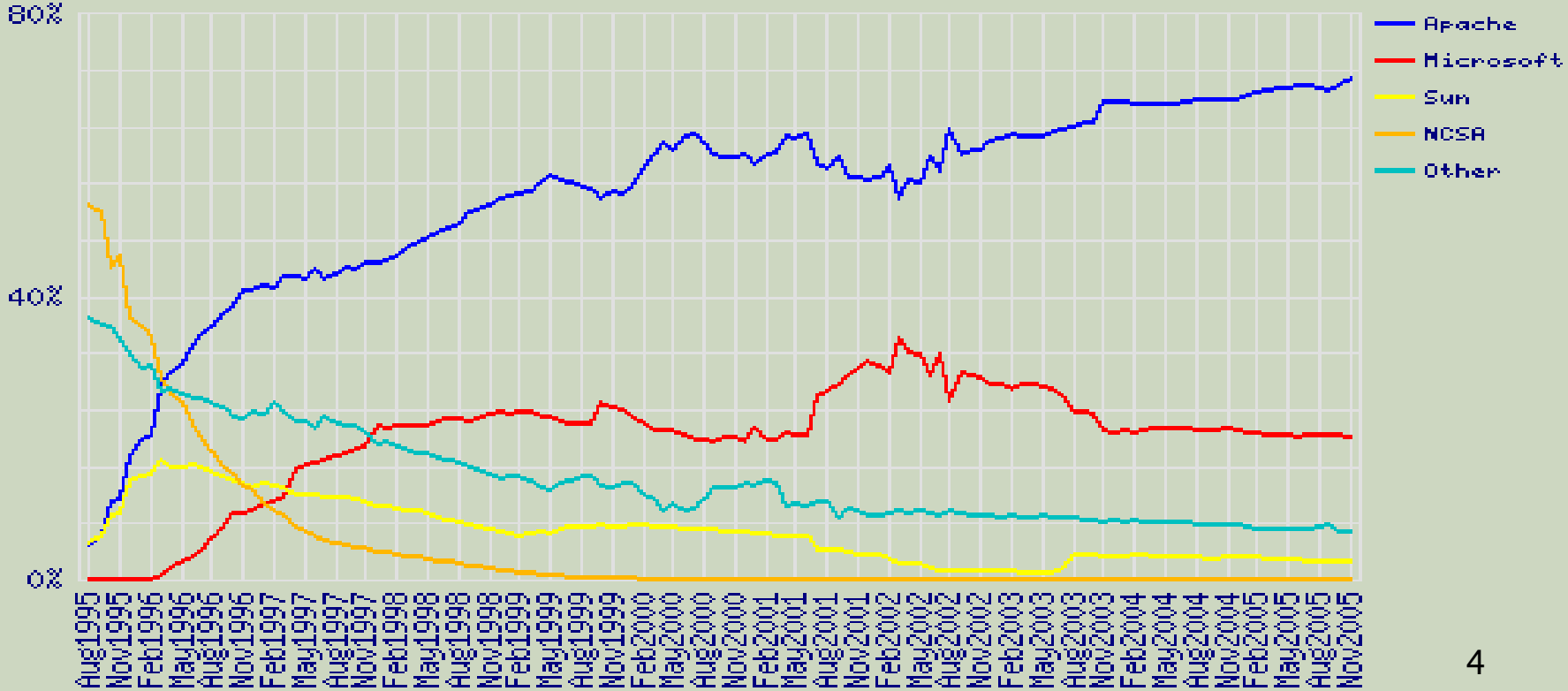
*FLOSS: Free-Libre / Open Source Software / Free Software; aka Open Source Software (OSS), Free Software (FS), OSS/FS, Libre or Livre Software, FOSS

Background

- In 2000, many claims about FLOSS, yet their advocates gave little evidence
- Investigated & found there *was* evidence
- Collection now widely-referenced
  - California Performance Review, 2004
  - Google "open source software" #5
- Challenges:
  - Vendor-funded studies (conflict of interest)
  - Some proprietary licenses forbid speech
- Numbers can't prove "always better"

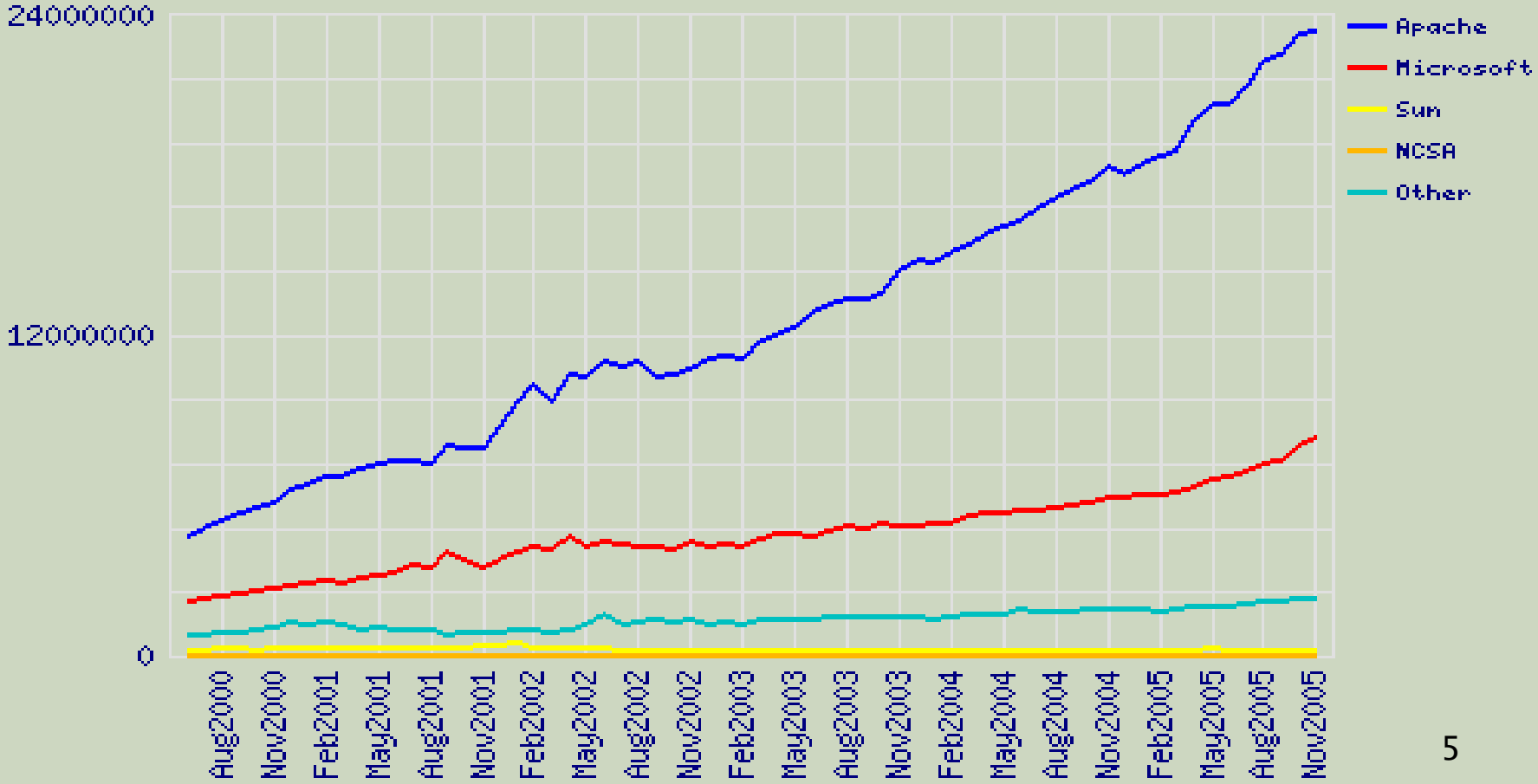
Market Share: Web Servers

- **FLOSS dominates web serving.**
  November 2005: Apache 70.98%, IIS 20.24%
  [Netcraft survey of 74,572,794 sites]



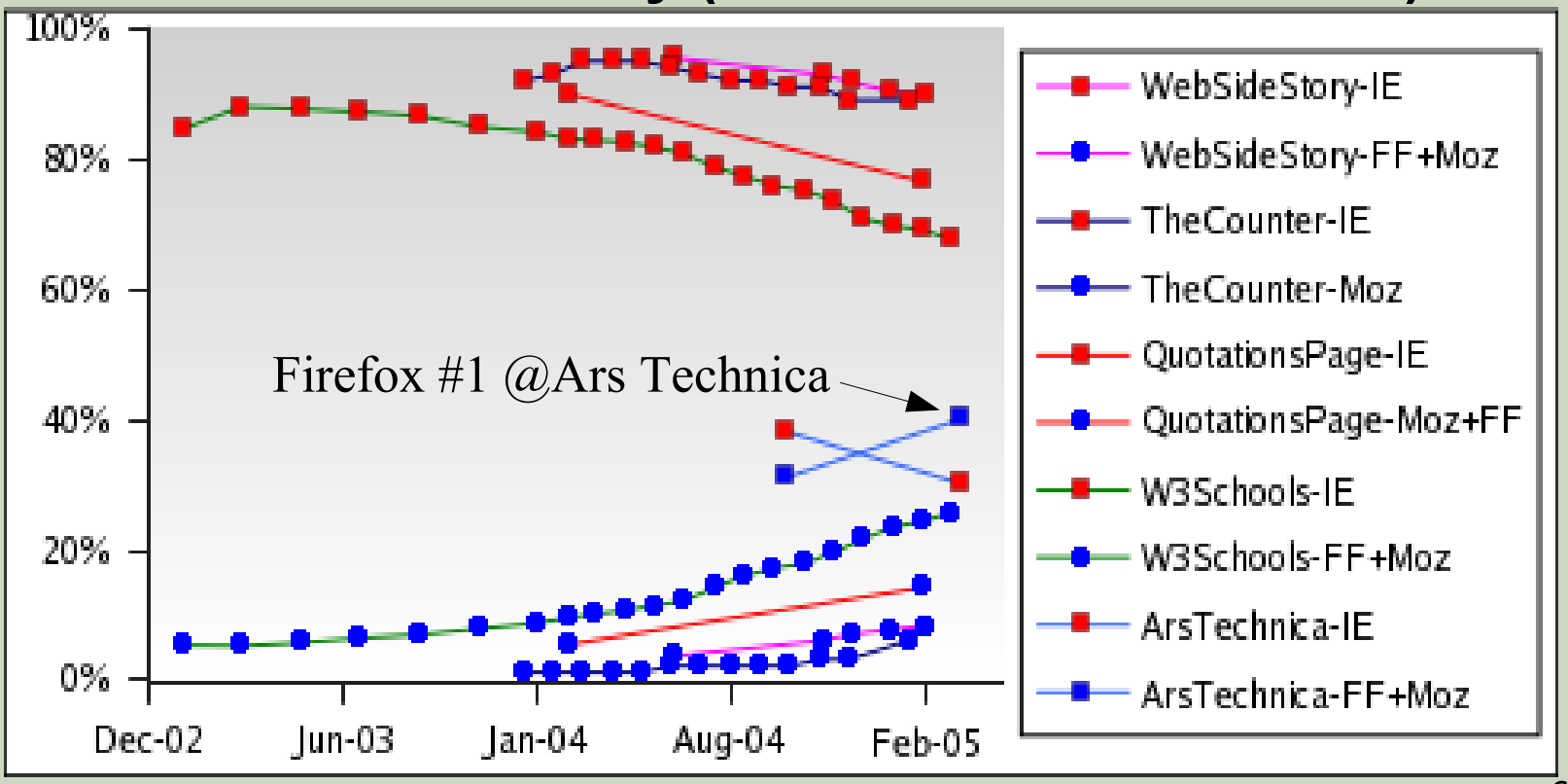
Market Share: Web Servers

- **Active Sites: Apache 69.36%, IIS 24.31% [Netcraft]**



Web Browsers: Growing Fast

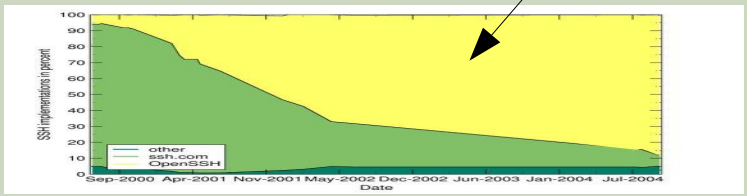
- **Mozilla/Firefox use growing, esp. among web/ technical community (who make web content!)**



Other Market Share Examples

- GNU/Linux #2 server OS sold 99, 00, 01 (24%, 27%, 25%)
- DNS: bind supports 95% of reverse-lookups [Manning]
- PHP #1 server-side scripting language [Netcraft]
- Sendmail #1 Email server [Bernstein]
  - Sendmail 42%, Microsoft Exchange 18%
- OpenSSH #1 SSH (87.9% Sep04)
  ~5% Summer 2000,
  50% November 2001 [scanssh]

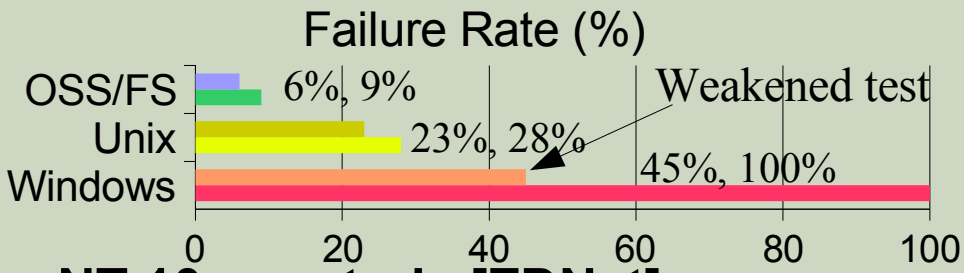
OpenSSH



- Open Source DBMS (MySQL, PostgreSQL, and Firebird) used by 64% of developers and database administrators of those who use FLOSS – February 2005 [Evans Data Corp.]
- OpenOffice.org in 2004 had 14% large enterprise office systems market (MS 95% overall) [CSC]

Reliability

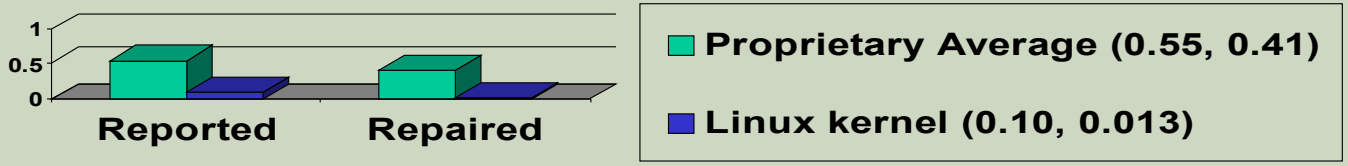
- **Fuzz studies found FLOSS applications significantly more reliable [U Wisconsin]**



- **GNU/Linux vs. Windows NT 10 mo study [ZDNet]**
  - **NT crashed every 6 weeks; both GNU/Linuxes, never**
- **IIS web servers >2x downtime vs. Apache [Syscontrol AG]**
- **Survey of 6MLOC: OSS "maintainability index" equal & sometimes better vs. closed [Samoladas in CACM, Oct 2004]**
- **FLOSS: More modular [MacCormack, Harvard Bus. School]**

Reliability (2)

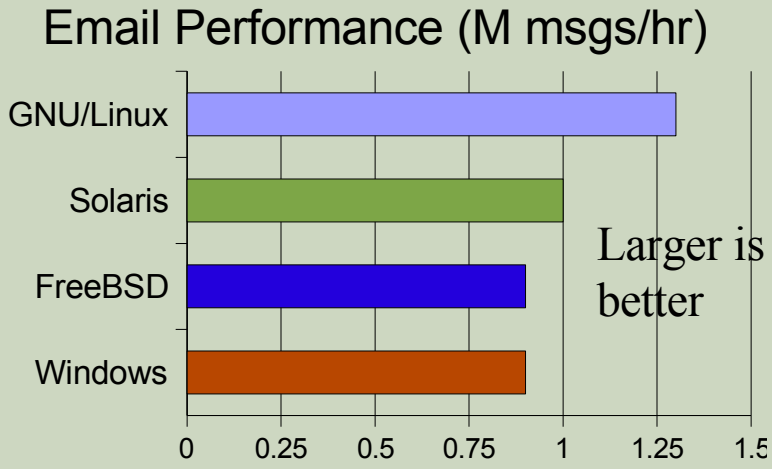
- **Automated defect detection analysis:**
  - **Linux kernel: of 5.7MSLOC, only 985 detected (>5000 expected, 80% fewer) [Coverity]**
  - **MySQL: 0.09 defects/KSLOC vs. 0.57 average defects/KSLOC avg. 200 proprietary [Reasoning]**
  - **Linux kernel TCP/IP had smaller defect density [Reasoning]**

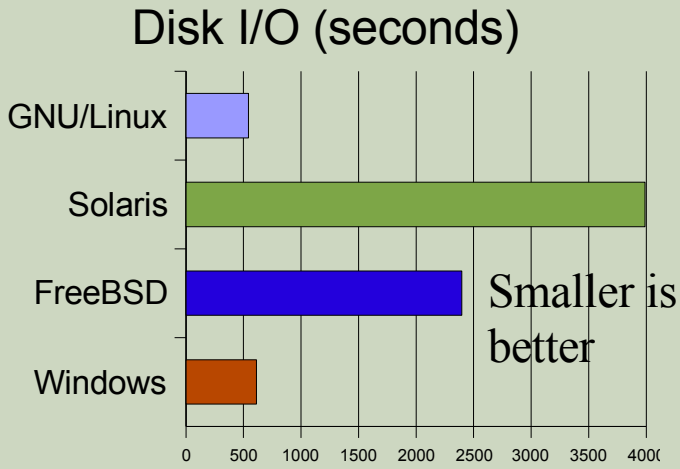


Performance: GNU/Linux

Performance varies widely by circumstance!

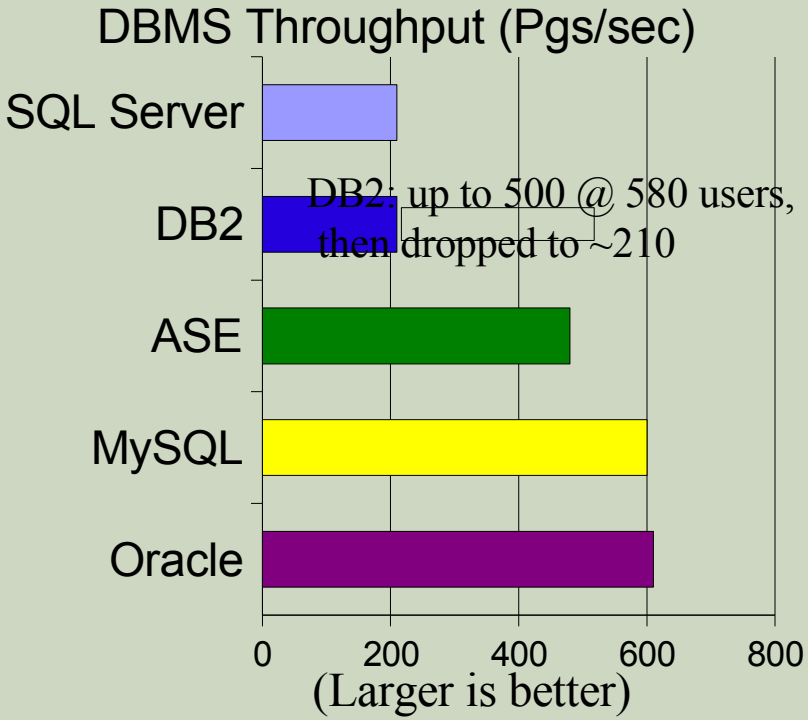
- **GNU/Linux with Samba faster fileserving at Windows' own file protocols [PC Magazine]**
  - **Nov 2001, top end, 130MB/sec vs. 78MB/sec**
  - **April 2002, performance 2x; 4x many clients**
- **GNU/Linux fastest (untuned systems) [Sys Admin]**

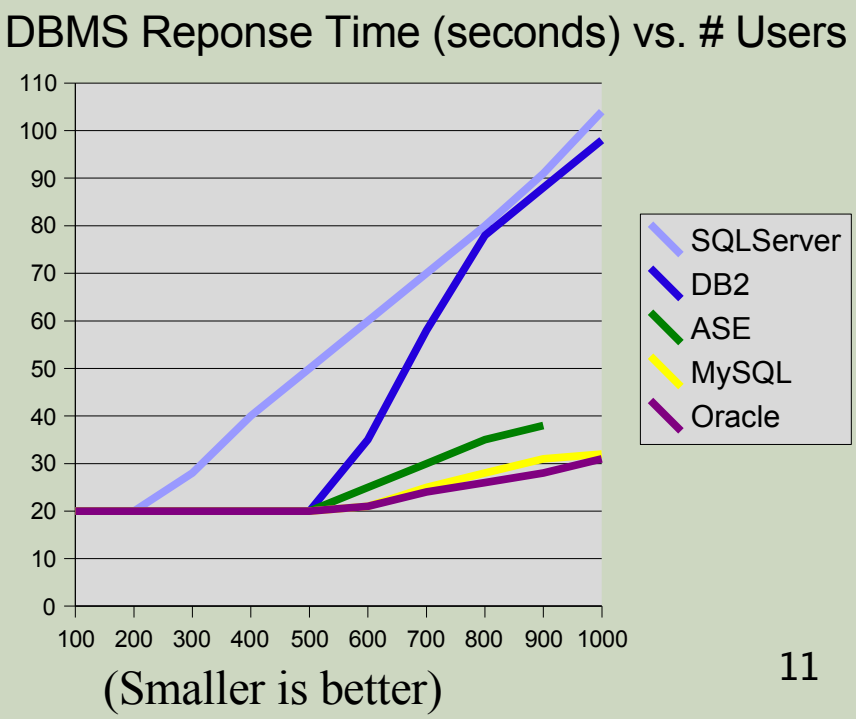




Performance: DBMSs

- **eWeek Labs/PC Labs 2002 DBMS evaluation**
  - **Unusual; most DBMS licenses forbid publication**
  - **MySQL (FLOSS) did *very* well**





Scalability

- GNU/Linux and NetBSD support more hardware platforms & performance ranges than any other
  - PC hardware, PDAs, mainframes, clusters, supercomputers
- 78% of supercomputers run GNU/Linux as of Nov. 2005, up from 60% March 2005 [Top500.org]
- FLOSS can develop large software systems
  - Red Hat Linux 7.1 had 30million SLOC
  - Represents approximately 8,000 person-years
  - To re-develop proprietary, $1 Billion USD (a "Gigabuck") [Wheeler]

Security

- **J.S. Wurzler hacker insurance costs 5-15% more for Windows than for Unix or Linux**
- **Windows websites disproportionately vulnerable**

Category	Proprietary	FLOSS
Defaced	**66% (Windows)**	**17% (GNU/Linux)**
Deployed Systems	**49.6% (Windows)**	**29.6% (GNU/Linux)**
Deployed websites (by name)	**24.81% (IIS)**	**66.75% (Apache)**

- **Bugtraq vulnerability 99-00: Smallest is OpenBSD, Windows largest (**Don't quintuple-count!**)**
- **Worst vulnerabilities (takeover): Apache 0, IIS 8 (Jun98-Jun01)**
- **Browser "unsafe" days in 2004: 98% Internet Explorer, 15% Mozilla/Firefox**

Security (2)

- Unpatched networked systems: 3 months Linux, hours Windows (variance minutes ... months) [Honeynet.org, Dec 2004]
  - Windows SP2 believed to be better than previous versions of Windows
- 50% Windows vulnerabilities are critical, vs. 10% in Red Hat [Nicholas Petreley, Oct 2004]
- Viruses primarily Windows phenomenon
  - 60,000 Windows, 40 Macintosh, 5 for commercial Unix versions, 40 for Linux
- 91% broadband users have spyware on their home computers (proprietary OS) [National Cyber Security Alliance, May 2003] vs. ~0% on FLOSS

Security (3)

- FLOSS systems scored better on security [Payne, Information Systems Journal 2002]

	Debian	Solaris	OpenBSD
Number of Features:	15	11	18
Features score:	6.42	5.92	7.03
Number of Vulnerabilities:	12	21	5
Vulnerabilities score:	7.72	7.74	4.19
Final Score (larger better):	-1	-3.5	10.2

- Survey of 6,344 software development managers April 2005 favored FLOSS [BZ Research]

	MS Windows Server	Linux	Sun Solaris
Very insecure or Insecure:	58%	6%	13%
Secure or very secure:	38%	74%	66%

What's more Secure?	OSS/FS	Proprietary
Desktop/Client OS:	58%	6%
Web Servers:	43%	14%
Server OS:	38%	22%
Components/Libs:	34%	18%
Database Servers:	21%	34%

Total Cost of Ownership (TCO): Background

- TCO multifaceted; for software-based system: [CSC]
  - Direct software costs (purchase, maintenance, support)
  - Indirect software costs (license admin, audit)
  - Hardware (purchase/upgrade, maintenance, dispose)
  - Staffing (project management, systems engineering, administration (e.g., purchasing), systems admin)
  - Support (install, troubleshoot, casual learning, training)
  - Downtime
- TCO sensitive to circumstances
  - Helpful for single decision, hard to generalize
  - *Anything* has a lower TCO for *some* circumstance
  - Architecture matters!: Independent clients, X-terms, stateless, cluster, etc. *May be best deployed differently*
- Really "Total Cost to Lease," esp. for proprietary

TCO: General FLOSS

- FLOSS usually costs less to acquire than proprietary
  - E.G., Web server, Windows $3610 vs. $156
- Some other factors also tend to be lower
  - Lower upgrade costs, can use cheaper hardware
  - Avoids license management & litigation
  - Downtime less: more modular, remove unneeded [CSC]
- Maintenance/Support: Varies, can be competed
- Cybersource: TCO 24%-34% less w/FLOSS
- InfoWorld Survey of CTOs:
  - 60% CTOs: >$50K/yr savings
  - 32% CTOs: > $250K/yr savings (inc. above)
- Survey of companies > $5M revenue[InternetWeek/InformationWeek]
  - 39%: FLOSS costs 25% to 50% less
  - 27%: FLOSS costs 50% to 75% less

TCO: Specific Examples

- **Measured Web server TCO of GNU/Linux is 40% (<1/2) of Windows' and 14% of Solaris' [RFG]**
- **Amazon.com: $17M savings in 1Q via Linux**
- **UK Gov't Becta* 3yr study: FLOSS savings significant in primary & secondary schools**
  - **Secondaries reduce IT overheads by 24% (inc. software, hardware, and support costs)**
  - **Primary schools cut computer costs by nearly half, primarily from support but also hardware**
- **Willamette U. Library $41K vs. $100-150K using networked X terminals [Murphy]**
- **Netproject: Desktop Linux 35% (save 65%!) of Windows**
- **Largo, FL: $1M/yr savings thin clients**

*Becta: British Educational Communications and Technology Association

Non-Quantitative

- To many, non-quantitative advantages of FLOSS are more important, e.g.:
  - Social/ethical/moral reasons
  - Avoids risks of single source solutions/lock-in
    - Create reversible decision: can switch/self-support if price jacked up, maliciously changes interface, drops support, needs change (can get data), …
  - (Can) avoid security risks of monocultures
  - Supports domestic IT infrastructure
  - Long-term data retention (format not secret)
  - Many believe it encourages innovation
  - Avoids license management and litigation
  - Greater flexibility
    - Can change software (inc. via hiring) to meet needs

Conclusions

- FLOSS in many cases have measurable advantages over proprietary competition
- Consider using FLOSS software when acquiring
- Don't disadvantage FLOSS in policy
  - Be wary of vendor lock-in
  - Prefer open standards (publicly held, multi-vendor support, don’t require patents)
  - Beware of “vendor pays” assumptions (CC)
  - Software patents justified?
- For more detailed information, see http://www.dwheeler.com/oss_fs_why.html

Backup Slides

- Introduction to FLOSS
  - Basics, history, OSS vs. FS, licenses, development model
- Unnecessary fears
- Acronyms
- Interesting sites/documents

Basics of FLOSS: Free-Libre / Open Source Software (OSS)

- Free-Libre / Open Source Software (FLOSS) programs have licenses giving users the freedom:
  - to run the program for any purpose,
  - to study and modify the program, and
  - to freely redistribute copies of either the original or modified program (without royalties, etc.)
- *Not* non-commercial, *not* necessarily free-of-charge
  - Often supported via commercial companies
- Synonyms: Libre software, FLOS, OSS/FS
- Antonyms: proprietary software, closed software

History of FLOSS

- 1950s, 1960s: Software freely distributed
- ~1970s: Rise of proprietary software
- 1984: Richard M. Stallman establishes "Free Software Foundation", creates "General Public License" (GPL)
- 1990s: Increasing Internet availability enables developer coordination
- 1997: Eric Raymond's "Cathedral & the Bazaar" explains new approaches; term "Open Source Software" coined

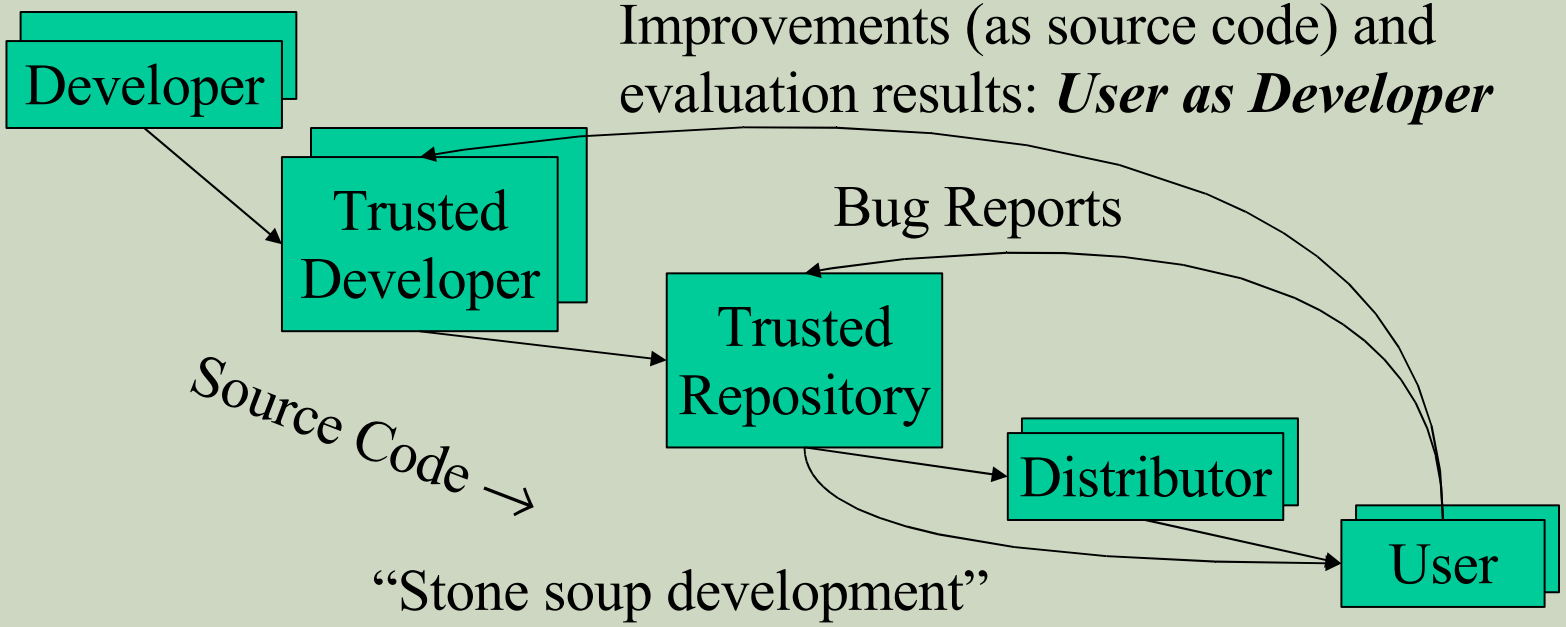
"Open Source Software" vs. "Free Software"

- First named "Free Software" by Stallman
  - Free as in Freedom
  - Officially defined by "Free Software Definition"
  - *Not* necessarily zero price; confused many
- New term coined: "Open Source Software"
  - Officially defined by the "Open Source Definition" (a long 9-point list)
  - Practically all OSS software is also FS
- Terms sometimes indicate motivations
  - FS: emphasize ethical/social issues
  - OSS: technical superiority/flexibility
  - OSS often used due to "zero price" confusion

Major FLOSS Licenses

- Many licenses, but 4 dominate
- BSD-new & MIT license: anything but sue
  - Can incorporate code into proprietary software
  - Financial incentive to use, but *not* aid project
- General Public License (GPL): "Copyleft"
  - If distribute, *must* distribute source code or provide written offer to do so
  - Cannot link (embed) into proprietary software
- Lesser/Library GPL - a compromise
  - Must distribute source code/written offer, but only of component itself
  - *Can* link into proprietary software
- Public domain is FLOSS, but rare

FLOSS Development Model



- FLOSS users typically use software without paying licensing fees
- FLOSS users typically pay for training & support (competed)
- FLOSS users are responsible for developing new improvements & any evaluations that they need; often cooperate/pay others to do so

Unnecessary Fears

- Proprietary software always better supported? No.
  - Non-traditional support (mailing lists, etc.)
  - Pay for traditional support, and can compete it
- Proprietary more legal rights? No.
  - Who do you sue? Nobody, in either case
- FLOSS economically viable? Yes.
  - Many business models
  - Customers can band together

Unnecessary Fears

- **Will programmers starve? No.**
  - Estimated 95% software not developed for sale
  - Companies hire programmers to make changes for themselves
  - Widespread use of FLOSS moves software development into a service (not product) model
- **FLOSS compatible with capitalism? Yes.**
  - FLOSS development involves trade: code for code
  - FLOSS business often based on payment for support or commoditizing complements of products
- **FLOSS mean no competition? No.**
  - KDE vs. GNOME, emacs vs. vim

Unnecessary Fears

- Will FLOSS destroy intellectual property? No.
  - Usually, complaint is about GPL
  - GPL trades you the right to freely incorporate their code into your software in exchange for the right to freely incorporate your code [which incorporates their code] into theirs
  - Intellectual property traded for other intellectual property
  - Microsoft sells GPL'ed software, sponsored several FLOSS projects

Unnecessary Fears

- Viewing and changing source code valuable for non-programmers? Surprisingly, yes.
  - "Would you buy a car with the hood welded shut? If not, what do you know about modern … engine technology?" [Bob Young]
  - Consumers demand this so they can have control over their product support, instead of dealers
- Anti-Microsoft campaign? No, not by all.
  - Jun02, 831 projects use Visual Basic; 8867 projects work on Windows [SourceForge]
  - Microsoft has been repeatedly asked to join community
  - Microsoft long used, and now develops FLOSS
  - Microsoft has sold GPL'ed software

Acronyms

- COTS: Commercial Off-the-Shelf (either proprietary or OSS)
- DoD: Department of Defense
- HP: Hewlett-Packard Corporation
- JTA: Joint Technical Architecture (list of standards for the DoD); renamed to DISR
- OSDL: Open Source Development Labs
- OSS: Open Source Software
- RFP: Request for Proposal
- RH: Red Hat, Inc.
- U.S.: United States

Interesting Documents/Sites

- **“Why OSS/FS? Look at the Numbers!” (larger paper) http://www.dwheeler.com/oss_fs_why.html**
- **“Use of Free and Open Source Software in the US Dept. of Defense” (MITRE, sponsored by DISA)**
- **President's Information Technology Advisory Committee (PITAC) -- Panel on Open Source Software for High End Computing, October 2000**
- **“Open Source Software (OSS) in the DoD,” DoD memo signed by John P. Stenbit (DoD CIO), May 28, 2003**
- **Center of Open Source and Government (EgovOS) http://www.egovos.org/**
- **OpenSector.org http://opensector.org**
- **Open Source and Industry Alliance http://www.osaia.org**
- **Open Source Initiative http://www.opensource.org**
- **Free Software Foundation http://www.fsf.org**
- **OSS/FS References http://www.dwheeler.com/oss_fs_refs.html**

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