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Open Standards - Open Source

The Business, Legal, and Technical Challenges Ahead

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In association with

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A Business Case Study of Open Source Software

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Business Panel
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MITRE

Introduction

- The MITRE Corporation is a not-for-profit corporation working in the public interest
  - Addresses issues of critical national importance, combining systems engineering and information technology to develop innovative solutions that make a difference
- MITRE conducted award-winning research on Open Source Software in Military Systems
  - "This MITRE study is the first study of Linux and other open source software that addresses both the technical advantage and the business case for using open source in the Department of Defense"*

Mark Norton, Office of the Assistant Secretary of Defense

*MITRE received a Leadership Award from the non-profit Potomac Forum for investigating the technology and economics of open source software in its research project "Open Source Software in Military Systems."

Is Open Source Acceptable from a Business Perspective?

- OSS can be a long-term viable solution, but there are risks
- Optimal choice of OSS vs. traditional COTS varies according to specific requirements and runtime environment of software
  - OSS is often good option for products relevant and interesting to large Community with highly skilled developers
  - OSS typically compares favorably for server and embedded system implementations that may require some customization
  - OSS can provide substantial advantages for long-lived embedded systems, through lifecycle licensing and support savings
  - OSS generally fares no better than COTS for typical desktop applications
- Program Managers need complete taxonomy of costs and benefits to make software-purchasing decisions

OSS: Open Source Software; COTS: Commercial-Off-the-Shelf; Findings based on publicly released document: Carolyn A. (Kenwood) Kahn, "A Business Case Study of Open Source Software, The MITRE Corporation, MP 01B0000048, July 2001.

Environmental Scanning

Successful Track Record of Open Source

- Open source products:
  - Emacs: text editor that is widely used for software development; one of the first open source products
  - Apache: web server known for functionality & reliability; comprises over 60% of web server market and growing**
  - Sendmail: moves mail from one machine to another; carries nearly 90% of e-mail traffic*
  - Linux: Unix-like operating system; worldwide users estimated at 18 M***
- Open source processes:
  - Perl (Practical Extraction and Reporting Language): system admin and computer programing language widely used throughout the Internet
  - TCP/IP: protocol allows computers to share info across a network (creation funded by DoD)

* O'Reilly and Ether Dyson, "Open Mind, Open Source."
** O'Reilly, Tim, Linux eSemminar Series, 1999.
*** The Linux Counter, http://counter.li.org/, January 30, 2002.

Comparison of OSS to Traditional COTS

Typical Benefits

- Technical excellence, efficiency (fewer lines of code)
- Rapid release rate of fixes/patches
- Easy to manage (central admin, remote mgt)
- Ability to tailor source code to meet specific needs, tightly control system resources
- Re-use of code already written by another user
- Lifetime of OSS systems and their upgrades can be extended indefinitely
- High degree of interoperability
- High quality support at minimal costs (competitive)

Typical Issues/Risks

- Poor code if OSS project is small and attracts interest of few trained developers
- OSS process has tendency to focus on technical user at expense of non-technical user
  - Highly technical, skilled developers
- Need for version control if system requires integration and development
- Risk of fragmentation
- Lack of available applications
- Seen as competitor by comparable or substitute products

Assess Feasibility over the Full Lifecycle

To assess the feasibility to the Program Manager, both the economic benefits and costs of open source usage and maintenance must be evaluated over the full lifecycle.

Feasible Business Opportunity?

OSS Taxonomy of Benefits and Risks

Qualitative Attributes
Ability to customize
Availability/reliability
Interoperability
Scalability
Design flexibility
Lifetime
Performance
Quality of service and support
Security
Level of difficulty/ease of management
Risk of fragmentation
Availability of applications

Example Rating Scale

Very Strong

Strong

Neutral

Weak

Very Weak

OSS taxonomy of benefits and risks should be evaluated relative to customer's specific requirements.

Feasible Business Opportunity?

OSS Cost Element Taxonomy

Start:

Direct Costs

- Software and Hardware
  - Software
    - Purchase price
    - Upgrades and additions
    - Licensing fees
  - Hardware
    - Purchase price
    - Upgrades and additions
- Support Costs
  - Internal
    - Installation and set-up
    - Maintenance
    - Troubleshooting
    - Support tools (e.g., books, publications)
  - External
    - Installation and set-up
    - Maintenance
    - Troubleshooting

Continue:

- Staffing Costs
  - Project management
  - Systems engineering/development
  - Systems administration
    - Vendor management
  - Other administration
    - Purchasing
    - Other
  - Training
- De-installation and disposal

Indirect Costs

- Support Costs
  - Peer support
  - Casual learning
  - Formal training
  - Application development
  - Futz factor
- Downtime

OSS cost element taxonomy needs to be customized for the specifics of a customer's environment and proposed initiatives.

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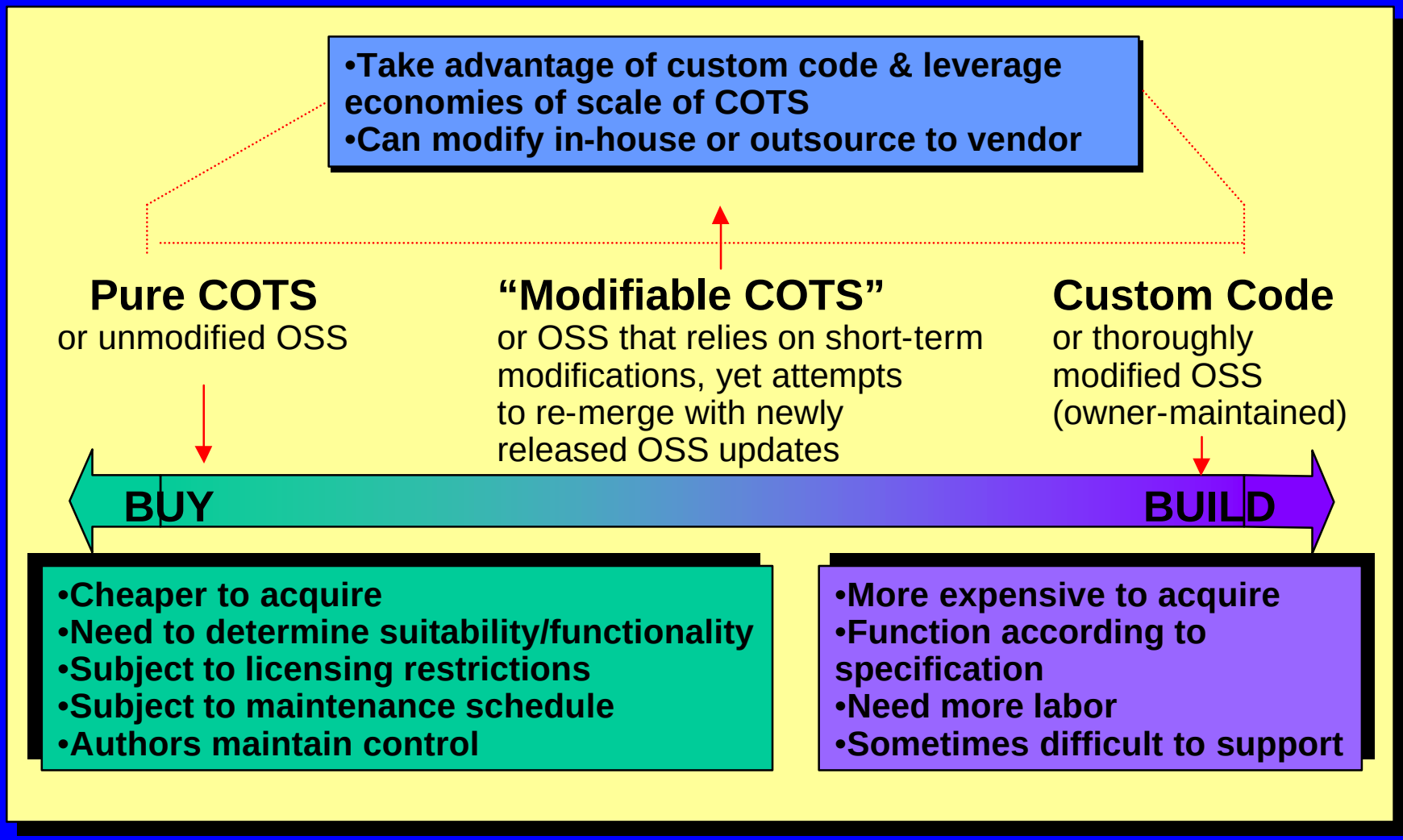
Feasible Business Opportunity?

Buy Versus Build Argument



The maintenance burden of OSS can be similar to pure COTS ("buy"), custom code ("build"), or lie somewhere in between.

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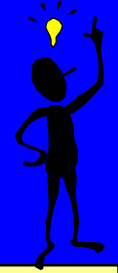
Steps for Making Decision: OSS vs. Traditional COTS?



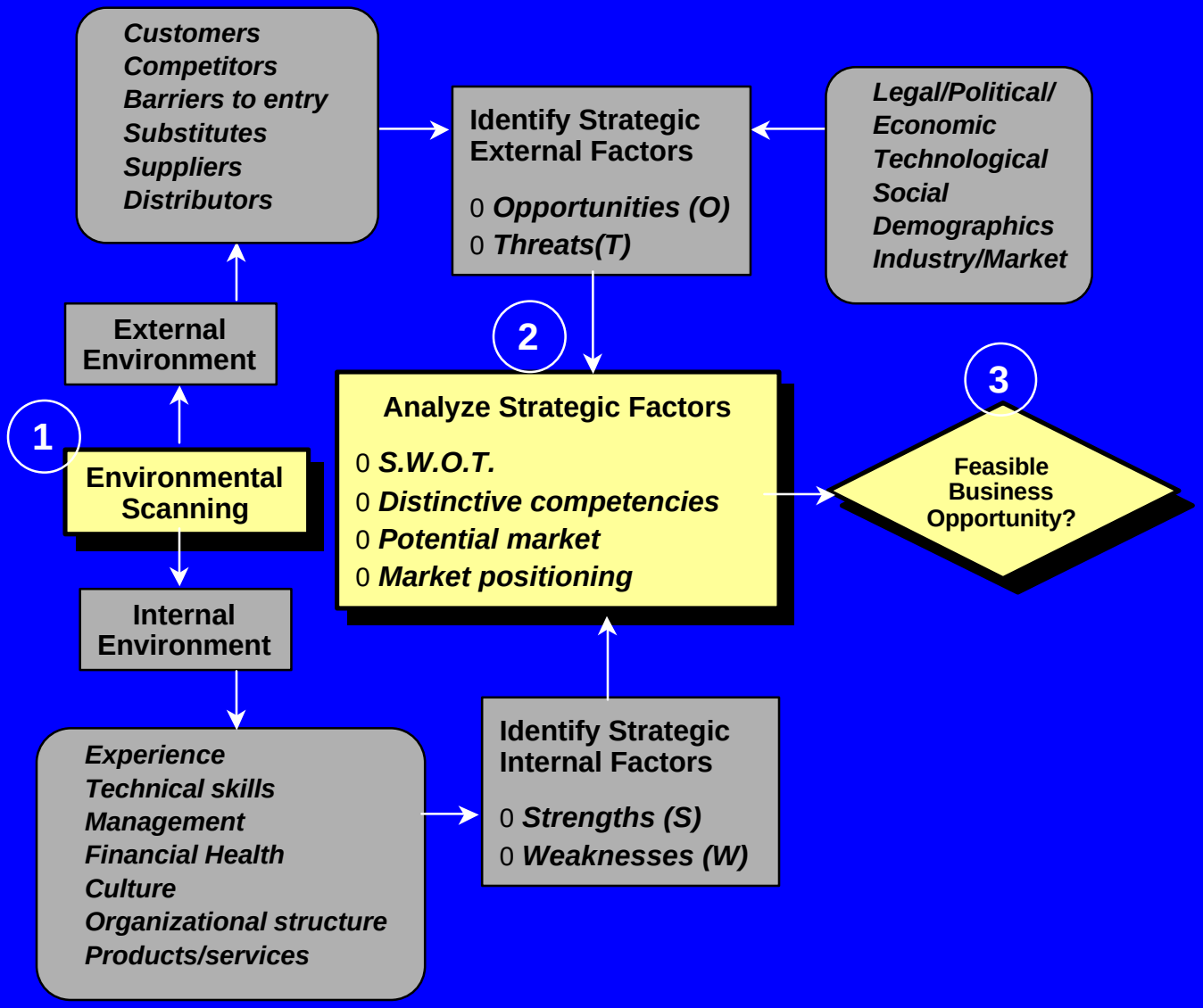
1. **Assess supporting OSS developer community (e.g., Linux)**
   - Look for large, talented, and well-organized communities
2. **Examine the market**
   - Is there strong and increasing demand for the OSS?
   - Have complementary services emerged in the marketplace to provide needed support not available from the community?
3. **Conduct a specific analysis of benefits and risks**
   - OSS taxonomy of benefits and risks compares products relative to specific economic/performance/mission objectives
4. **Compare the long-term costs**
   - OSS cost element taxonomy compares long-term costs associated with usage and maintenance relative to objectives
5. **Choose and execute your strategy**
   - Steps will provide information/detail to choose and then execute most effective option combination of OSS, traditional COTS, and proprietary development to support objectives

Back-Up

The MITRE Corporation Research
Open Source Software in Military Systems

- **Problem**
  - **Software development and integration makes up a large part of the total cost of many military systems**
  - **MITRE can help our sponsors increase productivity and quality, and save money by encouraging use of open source products and practices in tactical systems acquisition and development programs**
- **Technical approach**
  - **Analyze the economic viability of OSS for military systems**
  - **Determine level of conformance of OSS to known industry software standards (POSIX, CORBA)**
  - **Demonstrate Tactical Internet services capability**
  - **Demonstrate potential real-time performance and pitfalls**
  - **Undertake a large-scale project using OSS and capture lessons learned (EBC on Linux)**

Review of Business Case Framework
Application to Open Source Products/Processes



Environmental Scanning

Open Source Business Case
Key Elements of S.W.O.T. - Linux Case Study

Internal Environment

Massive programming expertise 120,000 programmers worldwide

R&D covered by volunteer labor Worth $2B

Accepted leadership structure Linux Torvalds and appointed delegates

Quick release rate (fixes, patches) Version 2.0x iterated 34 versions in 2 years

Parallel debugging/development 435 projects, marginal cost of code devt approaches zero

Maturity of code Created 1991, 1.5M lines of code (1998), Windows 2000 has over 38M lines of code

Culture of sharing GNU General Public License http://www.linux.org/info/gnu.html

Long-term accessibility

Importance to many Self-scaling

Less conventional Fear, Uncertainty, Doubt (FUD) http://www.geocities.com/SiliconValley/Hills/9267/fuddef.html

Lack of "ownership"

Hard to originate OSS

Less user-friendly GUI shortcomings, http://www.seul.org

External Environment

Internet connectivity 24x7 monitoring

Many distributors RedHat, Caldera, Debian, Slackware, SuSE

Competitive support structure Infoworld's Best Technical Support award in 1997 & 1998

Anti-Microsoft sentiment 1500+ Internet sites; Microsoft Boycott Campaign http://msbc.simplenet.com and Punch Bill Gates http://www.well.com/user/vanya/bill.html

Influx of start-up companies Doubled between 1984 and 1994

Garnering support Linux Advocacy Project http://www.10mb.com/linux/

Trained staff "Off-the-shelf" availability, but existing employees may not have proper training

Competition http://opensource.org/halloween; second-source "bargaining chip" to improve COTS support

Risk of Fragmentation Catering to user segment, but could have bad maintainer or personality conflicts

Lack of compatible applications

Need for version control

Linux has many strengths & opportunities, with some risks.

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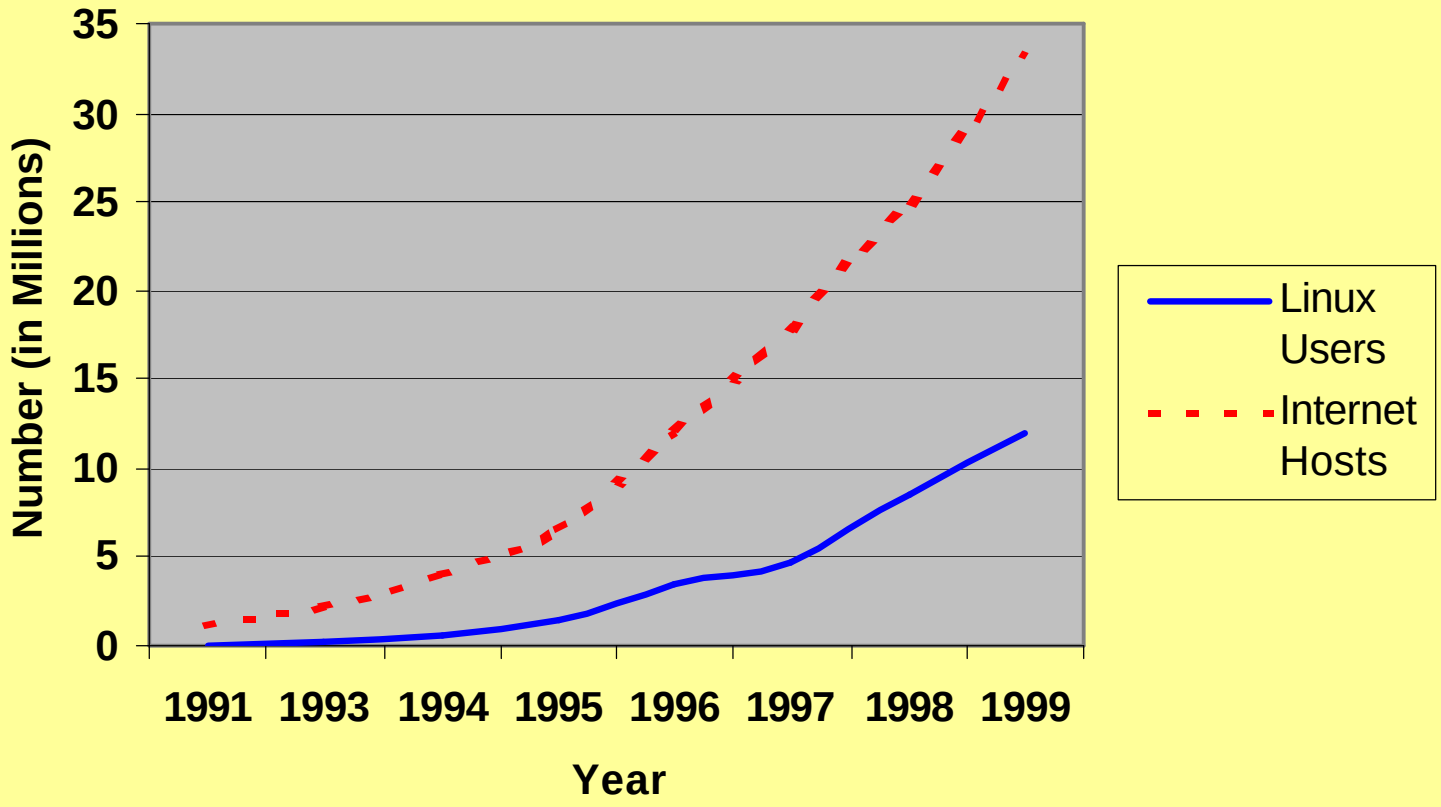
Reliability and Availability

- Reliability is primary goal of Linux; weakness of Windows
  - More programmers work to improve Linux code; bugs are more likely to be discovered and fixed to improve stability
- Linux kernel uses virtual memory management system that shares memory across all active programs
  - Gives each program separate virtual address space, reducing effect of one program on another
  - Prevents programs from overwriting critical areas of memory
- Computer often must be restarted when Windows NT incurs reconfiguration or software loading problems (unlike Linux)
- Availability - Bloor Research Group: Linux 99.5%; NT 99.26%
  - Linux machine crashed once; took 4 hours to fix
  - Windows NT crashed 68 times; took 65 hours to fix
- Availability - Giga Information Group: Unix 99.8%; NT 99.2%

Sources: DiDio, Laura, cited by Derek Slater, "Deciding Factors - Operating Systems," CIO Magazine, February 1, 2000 and Frans Godden, “How do Linux and Windows NT Measure Up in Real Life?” GNet, January 2000.

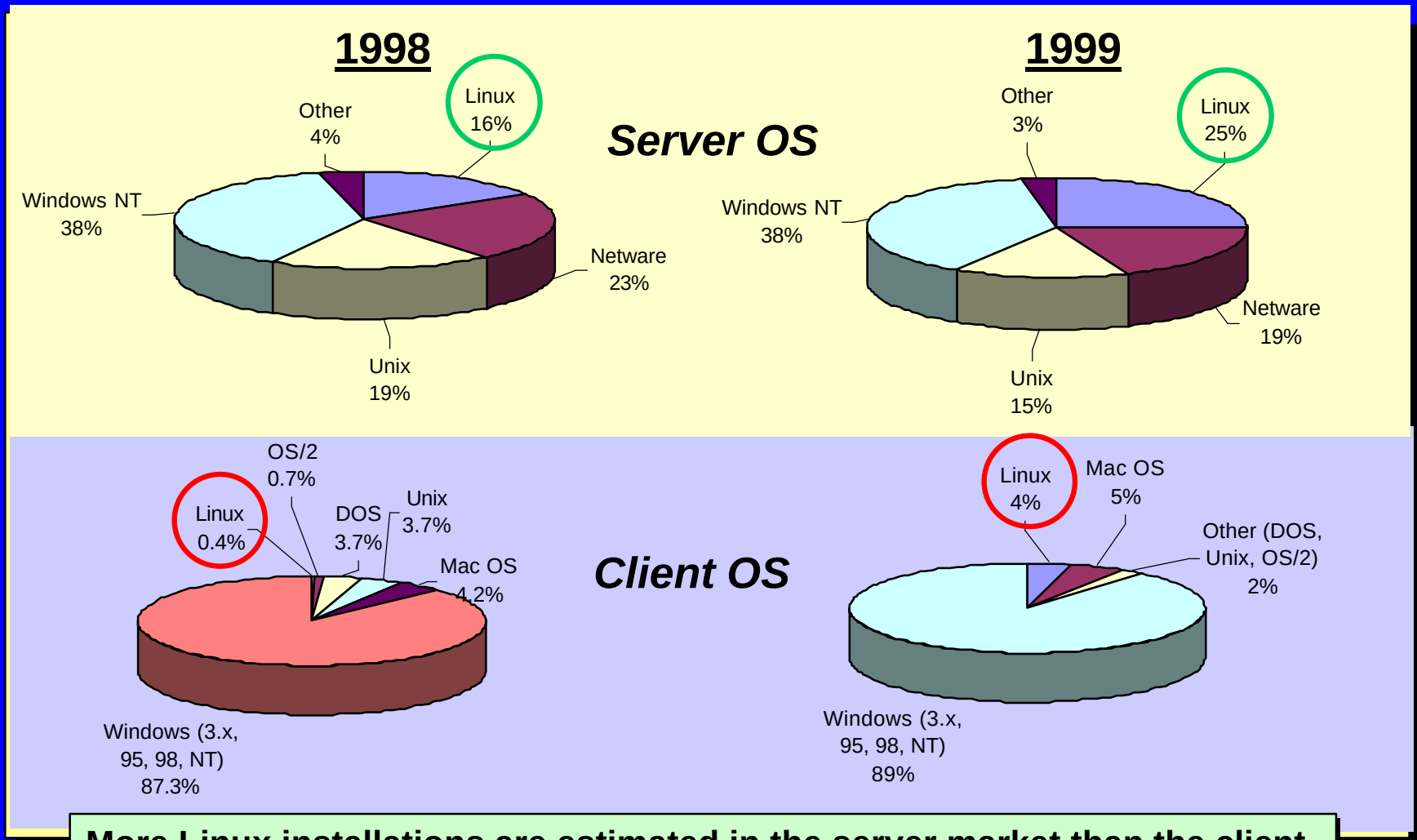
Worldwide Success of Linux in the Marketplace



Number of Linux users grew with number of Internet hosts.

Sources: Linux estimates derived from GartnerGroup, IDC, and Red Hat market research. Internet estimates based on research from Bruce L. Egan, 1996.

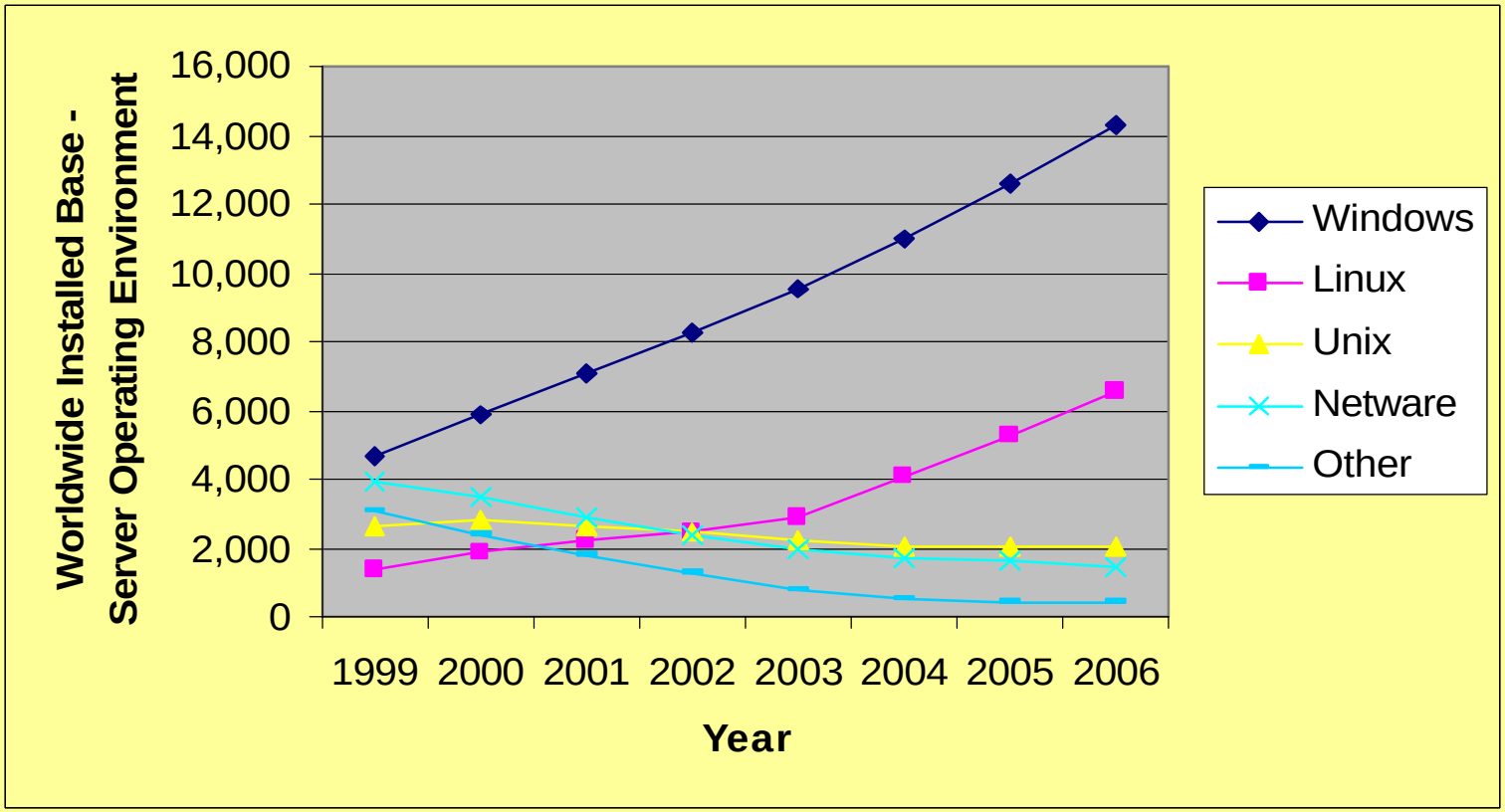
Use of Linux



More Linux installations are estimated in the server market than the client OS market. Significant investments (ease of use, configuration) needed for success on desktops.

Worldwide Installed Base – Server Operating System

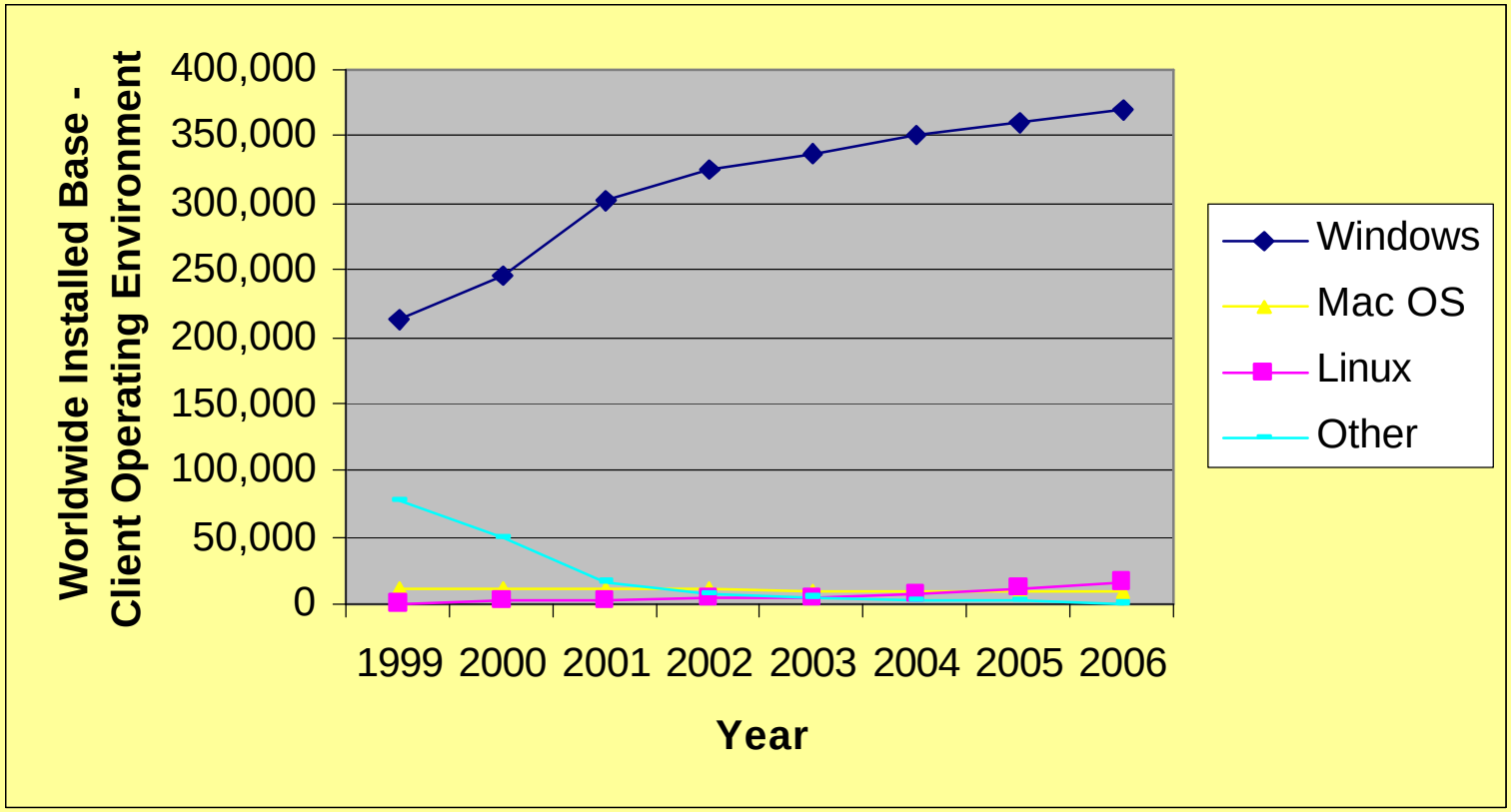
Analyze Strategic Factors



Gillen, Al, "Worldwide Client and Server Operating Environments Forecast and Analysis, 2002-2006," IDC, September 2002.

Worldwide Installed Base – Client Operating Environment

Analyze Strategic Factors



Gillen, Al, "Worldwide Client and Server Operating Environments Forecast and Analysis, 2002-2006," IDC, September 2002.

Embedded Devices

- Linux OS offers many advantages for embedded systems
  - Portability of Linux to many CPUs and hardware platforms
  - Stability
  - Scalability
  - Ease to use for development
  - Can dynamically reconfigure itself without rebooting
  - Can isolate faults and processes
  - Processes can load and remove kernel modules, device drivers, and custom modules based on available resources and dynamic application needs
  - Applications are modular with well-defined interfaces
  - Margins are low in embedded market, and free cost of Linux helps

Linux is expected to play a significant role in the market for embedded devices.

Embedded Devices *(Cont.)*

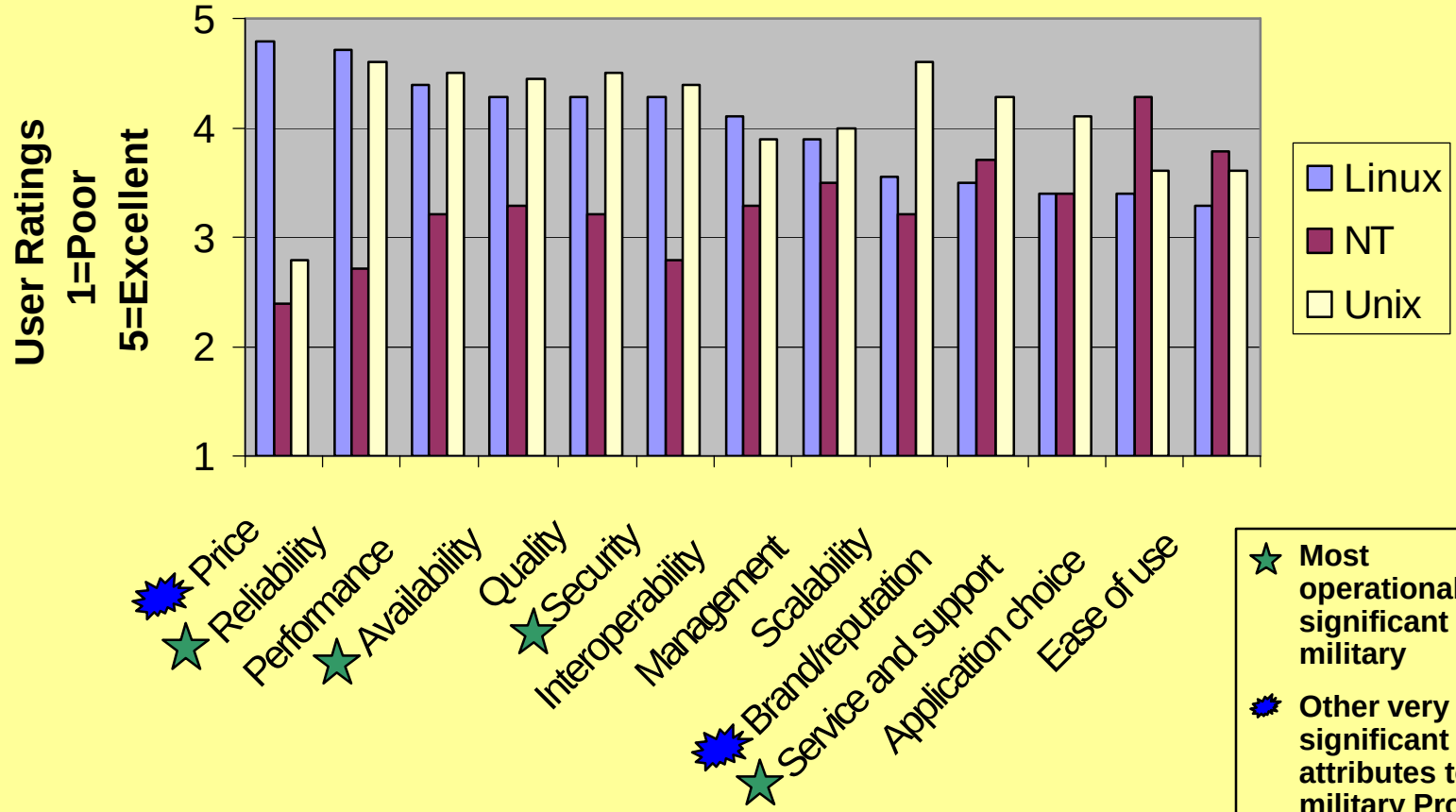
- Huge growth expected in market for embedded and real-time operating systems (RTOSs)
  - Embedded computer market absorbs over 95% of all microcomputer chips minted each year
  - Market for Internet appliance users may be larger than today's entire PC base
  - Household penetration of Internet appliances projected to reach 37.3 M by 2002
- Wide range of embedded devices (cell phones to refrigerators) resulted in over 100 commercial RTOSs
  - Red Hat/Cygnus Solutions developed compatibility layer for standard Linux to drive different devices
- Embedded Linux Consortium is trade association helping to promote and advance Linux OS throughout embedded world

Sources: Embedded Linux Consortium; GartnerGroup, 1998; and Jupiter Communications, "Internet Appliances," cited by Be.

Feasible Business Opportunity?

Benefits of Linux

Linux is used because of its perceived reliability and low price.



Source: US Linux user ratings by server OS from Michelle Bailey, Vernon Turner, Jean Bozman, and Janet Waxman, "Linux Servers: What's the Hype, and What's the Reality," IDC, March 2000.

Snapshot of Linux Code

Example from kernel source code that handles process forking, a basic operation of a Unix-like kernel

```
/*
 * For SMP, we need to re-test the user struct counter
 * after having aquired the spinlock. This allows us to do
 * the common case (not freeing anything) without having
 * any locking.
 */
#ifdef __SMP__
  #define uid_hash_free(up)     (!atomic_read(&(up)->count))
#else
  #define uid_hash_free(up)     (1)
#endif
void free_uid(struct task_struct *p)
{
struct user_struct *up = p->user;
        if (up) {
                p->user = NULL;
                if (atomic_dec_and_test(&up->count)) {
                        spin_lock(&uidhash_lock);
                        if (uid_hash_free(up)) {
                                uid_hash_remove(up);
                                kmem_cache_free(uid_cachep, up);
                          }
                        spin_unlock(&uidhash_lock);
                }
        }
}
```

Screenshot of Linux GUI
http://www.gnome.org/screenshots/index.shtml

Propaganda
Anti-Linux and OSS

- **"No one ever got fired for buying Microsoft"** (Martin J. Garvey, "The Hidden Cost of NT," InformationWeek, July 1998.)
- **"Corporations don't live on good will. They need money to operate."** (Stephen C. Den Beste, "Open Source -- On Why Not, February 28, 2000)
- **"'Revenue' is not a dirty word, and neither is 'profit.' There's nothing immoral about selling software."** (Stephen C. Den Beste, "Open Source -- On Why Not, February 28, 2000)

Propaganda
Pro-Linux and OSS

- **"A Total Cost of Linux Ownership argument is there in the making. Now someone in the Linux community has to step up and make it."** (Jack Bryar, "How Much Does Free Cost?" March 15, 2000)
- **"It's good when [the major Linux stocks] deflate to a level of reality"** (David Bloom quoted by Scott Berinato, "Luster of Linux Fades as Stock Dips," Interactive Week, July 28, 2000)
- **"Microsoft isn't the disease, but they're a symptom"** (Eric Raymond quoted by Aaron Ricadela, "Linux Comes Alive," Jan. 24, 2000)
- **"Open Source security is the best security"** (Steven J. Vaughan-Nichols, "TripWire Delivers Open Source DDoS and Security Answer," Sm@rt Reseller, March 1, 2000)
- **Linux is a "Windows killer"** ("The Future of Linux," CNET, 2000)