Chapter 02
Open Source Software History

Open Source SW Development
CSE22300

Chapter 01 Review

Proprietary Software

- **Computer software licensed under exclusive legal right of the copyright holder**
- **Restricted from other uses, such as modification, further distribution, or reverse engineering**

Create → **Modify** → **Sell**

Open Software

- **Source code is available to the public**
- **Anyone to copy, modify and redistribute the source code**
- **GNU/Linux, Eclipse, Apache, Mozillar**

Create → **Modify** → **Share**

Open Versus Proprietary

|	Open-source	Proprietary
Collaboration	Volunteer	Teams or Structure Groups
License	Free	Fees
End user support	Many eyes looking for bugs	One-Stop shop provided
Security	Code can be seen and fixed by anyone No one is responsible for open source	May not always release advis ories for all bugs No one knows what bugs exist
System Requirement	Minimal	Higher
Forces Upgrade on users	No	Yes

Software Types

- **Freeware**
  - **Non-chargeable copyrighted software**
- **Shareware**
  - **Software delivered without charge but continued usage subject to payment**
- **Proprietary Software**
  - **Non-Free Software**
- **Free Software**
  - **Copylefted Software**
  - **Has freedom to use, modify and distribute to others**
- **Open Source Software**
  - **Similar to free software but stressed in source code availability**

Cathedral Versus Bazaar

- **Cathedral**
  - **Top-down**
  - **Leads to large complex programs**
  - **Well-organized, full time development team**
  - **Release far between (not until it's "perfect")**

- **Bazaar**
  - **Bottom-up**
  - **Decentralized and Cooperative**
  - **Source code available for public testing**
  - **Loosely-organized volunteer (Hackers)**
  - **Release made frequently to attain feedback**

Software Development Model

Cathedral   Bazaar
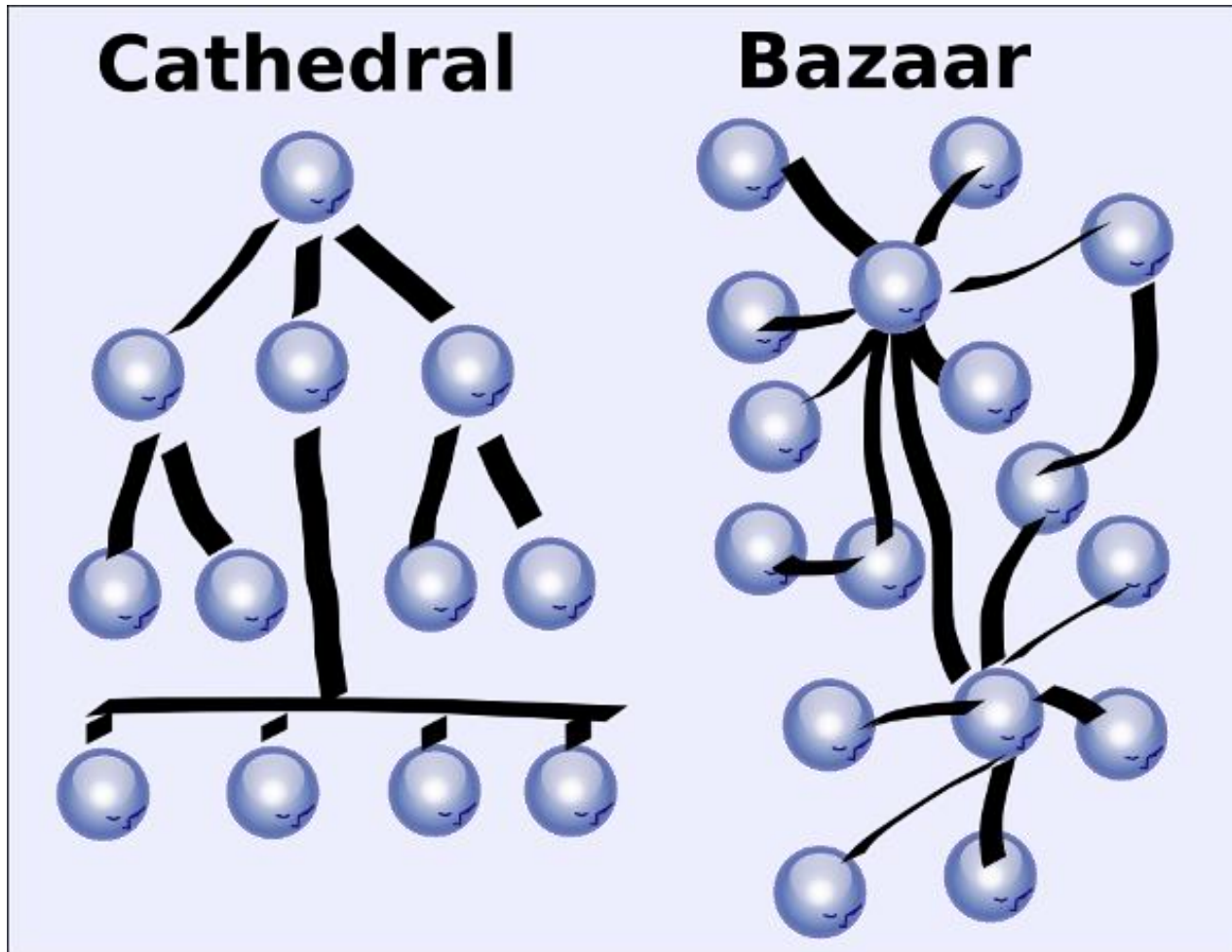
Types Of Open Source Licenses

Capabilities (Without Application Licensing Restriction)	GPL (Linux)	Dual-GPL (MySQL)	LGPL/MPL (OpenOffice, Firefox)	Apache/BSD (Apache, FreeBST)
1) Download	✔	✔	✔	✔
2) Evaluate	✔	✔	✔	✔
3) Deploy	✔	✔	✔	✔
4) Redistribute	🚫 [1]	✔ [3]	✔	✔
5) Modify	🚫 [2]	🚫 [2]	🚫 [2]	✔ [4]

1) Application needs to be licensed under GPL if redistributed with the GPL asset.
2) Library code modifications need to be licensed under the same license as the originating asset.
3) Usually requires a commercial license from the copyright holder.
4) Although much more permissive than an OSI license, some BSD based licenses, such as Apache V2, still have some copyleft materials.

Stars

Richard Stallman

- **The last of the true hackers**
- **Began working in the MIT AI lab**
- **Founder of Free software movement**
  - **Software should be free**
- **Founder of the GNU project**
  - **Runs within the Linux kernel**
  - **One of his greatest achievement**
- **Part founder of the open source movement**
- **Open Source Guru**
  - **He wrote most of the GNU operating system**
- **Copyleft**
  - **General way to make a piece of software**

Richard Stallman

- **Copyleft**
  - **General way for making a program free, and requiring all modified and extended versions of the program to be free as well**

Copyright
Protects work of the Author from unauthorized copying or selling the work
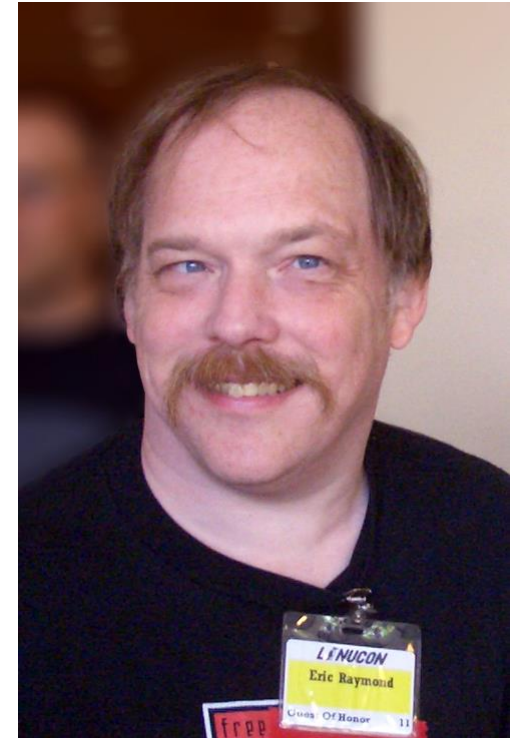
Copyleft
Provides a method for work to be modified & distributed back to the community

Eric Raymond

- **Writer**
  - **The Cathedral and the Bazaar**
  - **The Art of Unix Programming**
- **Open Source Development Model**
- **Founder of Open Source Initiative**
- **Contributed on GNU projects**

Linus Tovalds

- **Finnish software engineer**
- **Created Linux Kernel**
- **Principle developer of Linux kernel**
- **Created GIT, a revision control system**
- **IEEE Computer Pioneer Award**

Tim O'Reilly

- **Founder of O'Reilly Media**
- **Popularized the terms Open Source and Web 2.0**
- **Rebrand free software under the term Open Source**
- **Founder of Open Source Initiative**
- **Web 2.0**
  - **Resurgence of the web after dotcom crash of 2000**
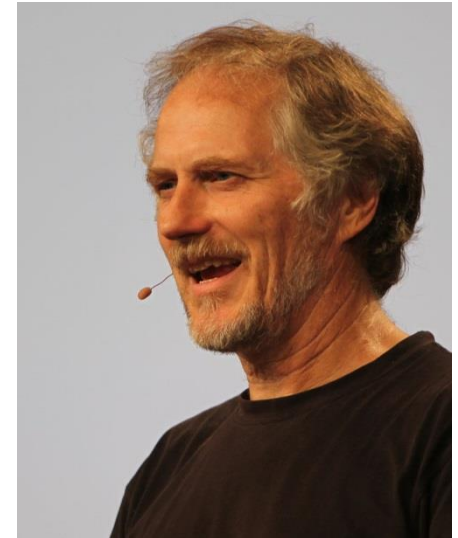
History of Open Source Software

50s, 60s

- **Until the late 1960s Computers**
  - **Hardware-centric Free Software**
  - **Huge and expensive mainframe machines**
  - **Usually supplied on a lease rather than purchase basis**
  - **Service and all software supplied without separate charge**
  - **Source code was also provided**
  - **SHARE user group that was formed to facilitate the exchange of software**

Separating Software From Hardware

- **Destroying Business by Bundling Free Software**
  - **By US Department of Justice in 1969**
  - **IBM unbundled its software**
  - **IBM led to an industry change by starting to charge separately for software**
  - **Birth of proprietary software**

1960-1980

- **Focus on Academic Computer Science**
  - **Berkeley, MIT, CMU**
  - **Corporate Research like Bell Labs and Xerox's Palo Alto**

- **Unix OS**
  - **Developed by Ken Thompson at the AT&T Bell Lab in 1969**
  - **Multi-user operating system**
  - **Operating system with commands or utilities that would do one thing well (e.g. UNIx)**
  - **Ken Thompson compiled Unix in C to makes Operating system "portable" to other computers system**

1980-1990

- **In mid-1970s it software was proprietary**
  - Users were not allowed to redistributed it
  - That source code was not available
  - Users could not modify the programs

- **AT&T began to treat Unix as proprietary in early 80s**
  - Different "flavors" of the OS
  - Berkeley's BSD Unix, HPUX, SUN
  - Free Software Foundation
  - GNU Software and the General Public License (GPL)

- **Bill Gate's 1976 "Open Letter to Hobbyist"**
  - What hackers call "Sharing" was, in his word, "Stealing"

February 3, 1976

An Open Letter to Hobbyists

To me, the most critical thing in the hobby market right now is the lack of good software courses, books and software itself. Without good software and an owner who understands programming, a hobby computer is wasted. Will quality software be written for the hobby market?

Almost a year ago, Paul Allen and myself, expecting the hobby market to expand, hired Monte Davidoff and developed Altair BASIC. Though the initial work took only two months, the three of us have spent most of the last year documenting, improving and adding features to BASIC. Now we have 4K, 8K, EXTENDED, ROM and DISK BASIC. The value of the computer time we have used exceeds $40,000.

The feedback we have gotten from the hundreds of people who say they are using BASIC has all been positive. Two surprising things are apparent, however. 1) Most of these "users" never bought BASIC (less than 10% of all Altair owners have bought BASIC), and 2) The amount of royalties we have received from sales to hobbyists makes the time spent of Altair BASIC worth less than $2 an hour.

Why is this? As the majority of hobbyists must be aware, most of you steal your software. Hardware must be paid for, but software is something to share. Who cares if the people who worked on it get paid?

Is this fair? One thing you don't do by stealing software is get back at MITS for some problem you may have had. MITS doesn't make money selling software. The royalty paid to us, the manual, the tape and the overhead make it a break-even operation. One thing you do do is prevent good software from being written. Who can afford to do professional work for nothing? What hobbyist can put 3-man years into programming, finding all bugs, documenting his product and distribute for free? The fact is, no one besides us has invested a lot of money in hobby software. We have written 6800 BASIC, and are writing 8080 APL and 6800 APL, but there is very little incentive to make this software available to hobbyists. Most directly, the thing you do is theft.

What about the guys who re-sell Altair BASIC, aren't they making money on hobby software? Yes, but those who have been reported to us may lose in the end. They are the ones who give hobbyists a bad name, and should be kicked out of any club meeting they show up at.

I would appreciate letters from any one who wants to pay up, or has a suggestion or comment. Just write me at 1180 Alvarado SE, #114, Albuquerque, New Mexico, 87108. Nothing would please me more than being able to hire ten programmers and deluge the hobby market with good software.

Bill Gates

Bill Gates
General Partner, Micro-Soft

21

Free Software Movement

- **Initiated by Richard Stallman**
  - A shift from a free Unix Culture to a proprietary software Culture

- **Announced the GNU Project in September 1983**
  - Ultimate goal of the GNU Project was to build a free operating system

- **Founded the Free Software Foundation in October 1985**
  - Users have the four essential freedoms

Four Freedom

- **Free Software**
  - **Freedom to run the program, for any purpose**
  - **Freedom to study how the program works, and adapt it to your needs**
  - **Freedom to redistribute copies so you can help others**
  - **Freedom to improve the program, and release your improvements to the public**

Free as in Liberty

- **Free in free software does not mean free as in having no price, but rather free as in liberty**
- **Think of free as in free speech, not as in free beer**

GNU Projects

- **Launched by Richard Stallman in 1983**
- **Write a complete free operating system**
  - **Develop a complete UNIX-like operating system**
  - **First project was to replicate the Unix operating system**
- **Mass collaboration project of software developers**
- **Recursive acronym**
  - **GNU is Not UINX**

- **Component**
  - **GNU Compiler Collection (GCC)**
  - **GNU C Library (glibc)**
  - **GNU Debugger (GDB)**
  - **GNU Binary Utils (binutils)**
  - **GNU Bash Shell**

GNU Projects

```
From CSvax:pur-ee:inuxc!ixn5c!ihnp4!houxm!mhuxi!eagle!mit-vax!mit-eddie!RMS@MIT-OZ
From: RMS%MIT-OZ@mit-eddie
Newsgroups: net.unix-wizards,net.usoft
Subject: new Unix implementation
Date: Tue, 27-Sep-83 12:35:59 EST
Organization: MIT AI Lab, Cambridge, MA

Free Unix!

Starting this Thanksgiving I am going to write a complete
Unix-compatible software system called GNU (for Gnu's Not Unix), and
give it away free(1) to everyone who can use it.
Contributions of time, money, programs and equipment are greatly
needed.

To begin with, GNU will be a kernel plus all the utilities needed to
write and run C programs: editor, shell, C compiler, linker,
assembler, and a few other things.  After this we will add a text
formatter, a YACC, an Empire game, a spreadsheet, and hundreds of
other things.  We hope to supply, eventually, everything useful that
normally comes with a Unix system, and anything else useful, including
on-line and hardcopy documentation.

GNU will be able to run Unix programs, but will not be identical
to Unix.  We will make all improvements that are convenient, based
on our experience with other operating systems.  In particular,
we plan to have longer filenames, file version numbers, a crashproof
file system, filename completion perhaps, terminal-independent
display support, and eventually a Lisp-based window system through
which several Lisp programs and ordinary Unix programs can share a screen.
Both C and Lisp will be available as system programming languages.
We will have network software based on MIT's chaosnet protocol,
far superior to UUCP.  We may also have something compatible
with UUCP.
```
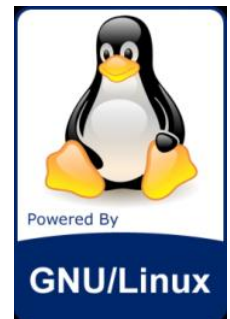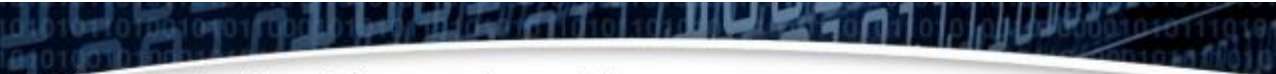
Linux

- **Minix**
  - **Written by Andy Tannenbaum**
  - **Unix like operating system based on System V Unix for the IBM PC & PC/AT Computer**

- **By 1990, the GNU Project had created all of the major O/S components except for the kernel**

- **Linus Torvalds developed a free Unix/Minix-based operating system in 1991**

Linux

Hello everybody out there using minix -

I'm doing a (free) operating system (just a hobby, won't be big and professional like gnu) for 386(486) AT clones. This has been brewing since april, and is starting to get ready. I'd like any feedback on things people like/dislike in minix, as my OS resembles it somewhat (same physical layout of the file-system (due to practical reasons) among other things).

I've currently ported bash (1.08) and gcc(1.40), and things seem to work. This implies that I'll get something practical within a few months, and I'd like to know what features most people would want. Any suggestions are welcome, but I won't promise I'll implement them :-)

Linus (torvalds@kruuna.helsinki.fi)

PS. Yes – it's free of any minix code, and it has a multi-threaded fs. It is NOT portable (uses 386 task switching etc), and it probably never will support anything other than AT-harddisks, as that's all I have :-(.

—**Linus Torvalds** (25 August 1991)

fppt.com

Netscape Navigator

- **In 1990s, the leading web browser**
  - **A powerful browser, credited with developing important protocols and what remains the main client-side scripting language (Javascript)**

- **Netscape released their source code to the Mozillar Organization in 1998**
  - **Mozillar Firefox**

- **In reaction to Netscape's source code release**
  - **Open Source label came out**

Open Source Business

Dangers with Licensed Software

- **Ernie Ball**
  - **Music company**
  - **Transferred out-dated computers to secretarial work**
  - **Sued by Microsoft for unknown breaching of licensed agreements**
  - **Cost $100,000**
  - **CEO, Sterling Ball, within 6 months used no Microsoft products**
  - **Uses all open source (saved $80,000+)**

Traditional Business Model

- **Paying programmers to create software**
- **Closed source code**
- **Requiring customer to pay for each copy of software**
- **Making money off software design, not maintenance and support**
- **Examples:**
  - **Microsoft XP**
  - **Apple Mac OS**

The Five Models

- **Open Source + Service**
- **Mixed**
- **Open Source + Buy Off**
- **Open Source + Aggregation**
- **Open Source + Hardware**

Elements of an open source business strategy

Revenue triggers
Closed source license
Support subscription
Value-add subscription
Support/services
Other products/services
Software services
Custom development
Advertising

End user licensing
Single open source
Multiple open source
Dual licensing
Open core
Open complement
Open edge
Open foundation
Open platform

Copyright control
Vendor
Foundation
Distributed
Withheld

Software license
Strong copyleft
Non-copyleft
Weak-copyleft
No preference

Development model
Cathedral
Bazaar
Aggregate
....
Vendor
Community
Mixed

the(451)group

Open Source + Service

- **Companies sell support and services around open-source software**

- **Advantages**
  - **Pay only for support, not software**
  - **Low switching cost**

- **Examples**
  - **Red Hat (Linux)**
  - **JBoss (middleware)**
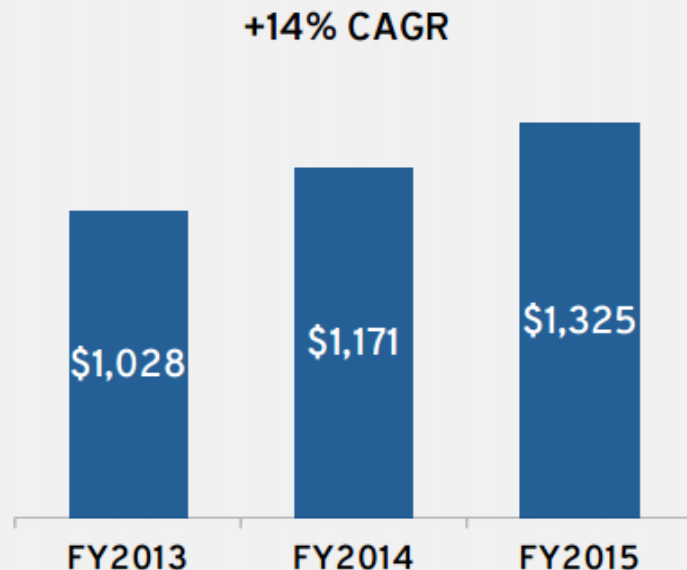
Open Source + Service

- **Redhat : Value of the subscription**
- **Subscription – one price, all included**
  - **Product & Documentation**
  - **Updates**
  - **Upgrades**
  - **Access to Red Hat Network**
  - **Ecosystem access**
  - **Technical Support**

Redhat Revenue

INFRASTRUCTURE-RELATED SUBSCRIPTIONS

($millions)

+14% CAGR

FY2013	FY2014	FY2015
$1,028	$1,171	$1,325

DRIVERS

- Market share gains
- On-demand public cloud
- Synergy as demand for emerging technologies grows
- Security concerns
- Embedded to IoT
- Usage of open source technologies
- Free to paid

Mixed

- **Open-source code base with proprietary add-ons**
- **Advantages**
  - **Proprietary add-ons may not be necessary**
  - **Acquire experience before buying add-ons**
- **Example**
  - **Sourcefire (security)**

- **Sourcefire**
  - **Snorted-based IDS (Intrusion Detection System)**

Sourcefire

Discover → **Determine** → **Defend**

Discover	Determine	Defend
Intrusion Sensor Appliances	**Defense Center Appliance**	**A** **Alert** — Syslog, SNMP, helpdesk systems, e-mail, SMS etc.
RNA (Real-time Network Awareness) **Software running on RA and/or IS Appliances**	**Web browser**	**B** **Block** — IPS in-line blocking or Remediation via firewalls, routers, switches etc.
Intrusion Agents loaded on your own Open Source Snort® sensors — Snort 2.6.0 RC2		**C** **Correct** — Remediation via Nessus active scan, Shavlik patch & configuration management etc.
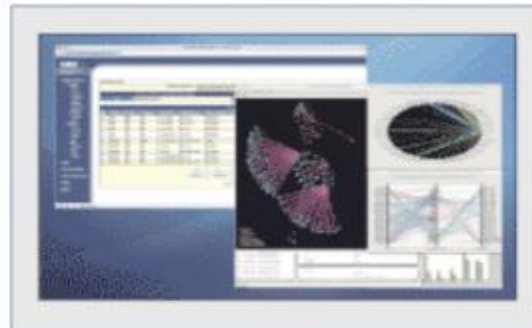
Sourcefire Revenue

FYE: December 31

($MM, GAAP)

| Year	Revenue
2002	1.9
2003	9.5
2004	16.7
2005	32.9
2006	44.9
2007	55.9
2008	75.7
2009	103.5
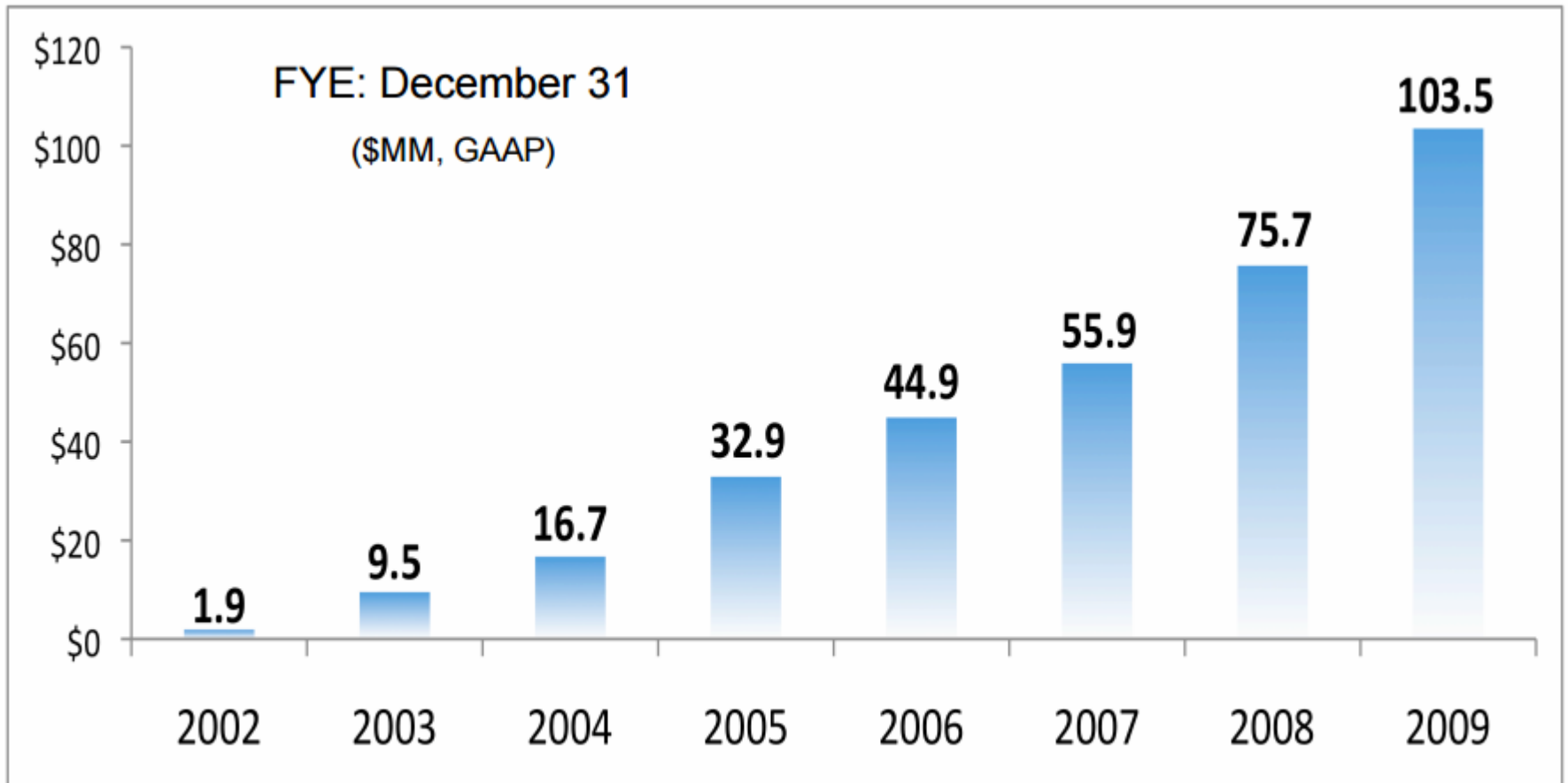
Compound Annual Growth Rate 2002-2009 = 77%

Open Source + Buy Off

- **Companies offer a proprietary license for their open-source software**

- **Users can modify the software and redistribute it without making the code open**

- **Examples**
  - **MySQL (database)**
  - **Gluecode (web servers)**

MySQL Revenue

MySQL ecosystem	
2016 Total revenue:	**$939m**
Support providers	58%
as-a-Service	24%
Storage engines	4%
Clustering/sharding	13%
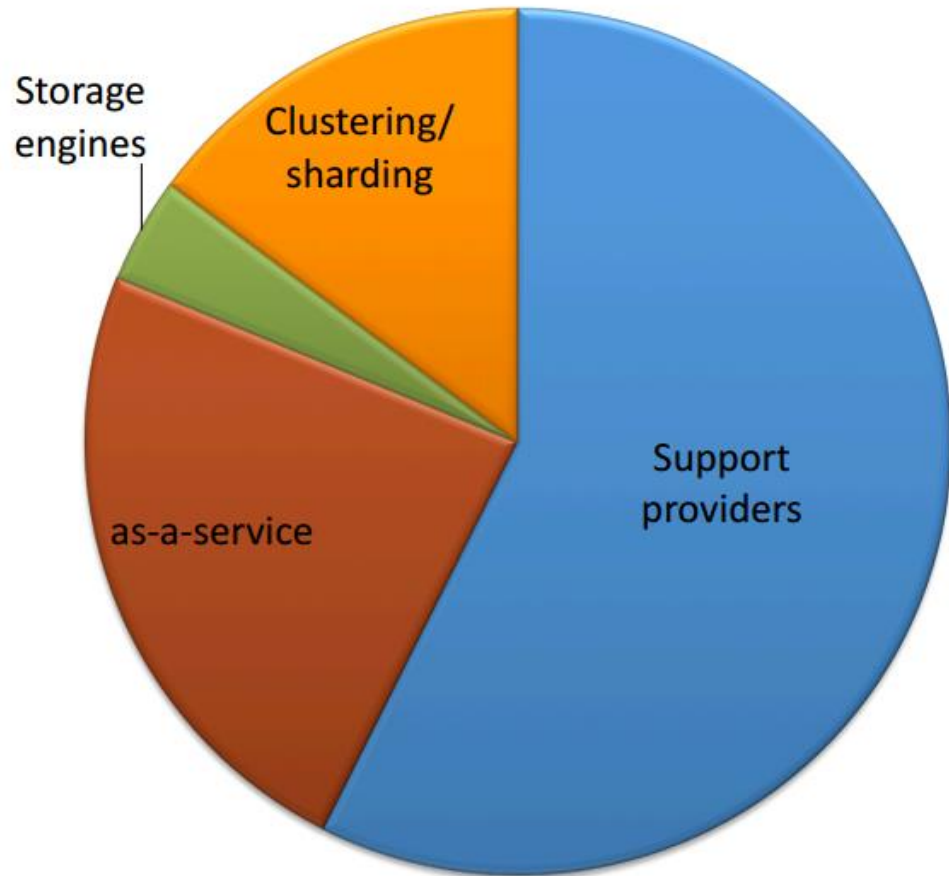
Open Source + Aggregation

- **Companies assemble various open-source software packages into integrated units**

- **Advantages**
  - **Simplifies open-source integration and support**

- **Example**
  - **Navica (open source selection)**

Importance of Open Source

- **Know options in purchasing software and applications**
- **The most popular new business model in the software industry**
- **Big corporations are investing in open-source**
  - **IBM and Oracle have both invested over $1 billion each**

Open Source used by CISCO

1.14 clock_util.c 1992
  1.14.1 Available under license
1.15 Commons Collections 3.2.1
  1.15.1 Available under license
1.16 Coreutils 8.21 :2013-02-14 Pádraig E
  1.16.1 Available under license
1.17 CRC32 1.222
  1.17.1 Available under license
1.18 cryptsetup 1.6.2
  1.18.1 Available under license
1.19 curl 7.32.0 :r0
  1.19.1 Available under license
1.20 dante 1.2.0
  1.20.1 Available under license
1.21 DAV Explorer 0.91
  1.21.1 Notifications
  1.21.2 Available under license
1.22 dmidecode 2.12
  1.22.1 Available under license
1.23 dosfstools 2.11 :ASA
  1.23.1 Available under license
1.24 e2fsprogs 1.42.8
  1.24.1 Available under license
1.25 errno.h 1.14
  1.25.1 Available under license
1.26 esapi 2.1.0
  1.26.1 Available under license
1.27 expat 2.1.0 :d058842e12dd37e8829d
  1.27.1 Available under license
1.28 expat/PrintPath 2.1.0 :d058842e12dd
  1.28.1 Available under license
1.29 findutils 4.4.2

1.34 gawk 4.0.2 :2012-12-24   Arno
  1.34.1 Available under license
1.35 getline 1991
  1.35.1 Available under license
1.36 gmp 5.1.1 :2013-02-10 Torbjorn
  1.36.1 Available under license
1.37 gnutls 2.12.23
  1.37.1 Available under license
1.38 grep 2.14
  1.38.1 Available under license
1.39 grub 0.94
  1.39.1 Available under license
1.40 gzip 1.6
  1.40.1 Available under license
1.41 Hibernate Validator 5.0.1 Final
  1.41.1 Available under license
1.42 init-ifupdown 1.0
  1.42.1 Available under license
1.43 initscripts 1.0
  1.43.1 Available under license
1.44 Intel GE Driver - FreeBSD 2.2.3
  1.44.1 Available under license
1.45 ipmitool 1.8.11
  1.45.1 Available under license
1.46 IPMIutil 1.8.2
  1.46.1 Available under license
1.47 ixgbe driver 1.7.5
  1.47.1 Available under license
1.48 jackson-annotations 2.3.1
  1.48.1 Available under license
1.49 jackson-core 2.3.1
  1.49.1 Available under license

1.52 jQuery 2.1.0
  1.52.1 Available under license
1.53 keymaps 1.0
  1.53.1 Available under license
1.54 kmod 14 :3b38c7fcb5
  1.54.1 Available under license
1.55 kmod_LGPLv2.1 14 :3b38c7fcb5
  1.55.1 Available under license
1.56 libcap 2.22 :r5
  1.56.1 Available under license
1.57 libcgroup 0.38
  1.57.1 Available under license
1.58 Libgcrypt 1.5.3
  1.58.1 Available under license
1.59 Libgcrypt_GPLv2 1.5.3
  1.59.1 Available under license
1.60 libgpg-error 1.12 :r0
  1.60.1 Available under license
1.61 libusb 0.1.12 :ASA
  1.61.1 Available under license
1.62 libxml2 2.9.0 :Fri Jul 10 16:11:34 2009
  1.62.1 Available under license
1.63 linux 3.10.19
  1.63.1 Available under license
1.64 Linux-PAM 1.1.6
  1.64.1 Available under license
1.65 Log4j 1.2.16
  1.65.1 Available under license
1.66 lvm2 2.02.95 :10.el6
  1.66.1 Available under license
1.67 mdadm 3.2.6

End