



Open Source Software

**Open Source SW Development
CSE22300**

Proprietary Software

Proprietary Software



iOS



Windows 10



Microsoft Office

Definition

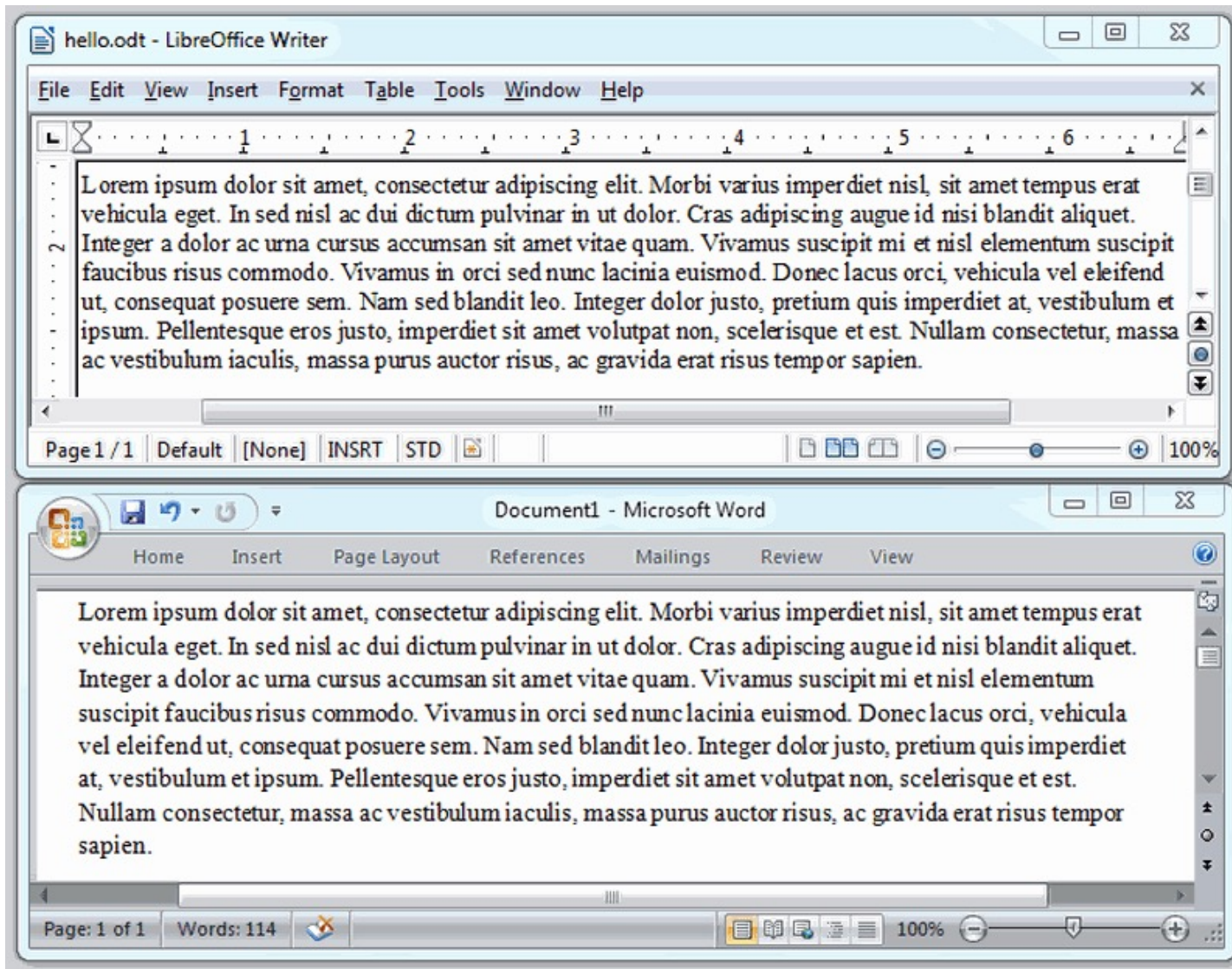
- **Definition**
 - Computer software licensed under exclusive legal right of the copyright holder
 - Restricted from other uses, such as modification, further distribution, or reverse engineering
- **Pros**
 - Consistent feature development
 - Stability
 - Responsibility for bugs, errors and updates
- **Cons**
 - High start-up costs
 - Dependency
 - Single company releasing patches

Proprietary Format

- **Used by individual programs**
- **Unique : cannot be read by other programs**
- **Huge barrier to rival**
- **Example**
 - **DWG : AutoCAD drawing**
 - **PSD : Adobe Photoshop's native image format**
- **Ownership of created content**



Word VS Writer



Open Source Software



Open Source

- **Open source software**
 - Source code is available to the public
 - Anyone to copy, modify and redistribute the source code
 - GNU/Linux, Eclipse, Apache, Mozillar
- **Pros**
 - Low cost
 - Flexibility
 - Reliability and quality
 - No dependency
- **Cons**
 - No Warranty
 - Restricted choice
 - Speed of change

Term

- **Free software movement**
 - **Freedom to change the source code to whatever you need to do**
 - **Social movement**
 - **Negative image to business**
- **“Open Source” label**
 - **Created at a strategy session on Feb. 3rd, 1998 in Palo Alto**
 - **In reaction to Netscape’s source code release**
 - **By Tim O’Reilly, Eric Raymond and Larry Augustin**
 - **Methodology**

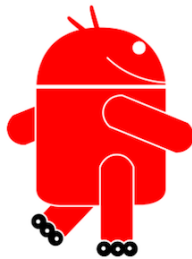
Open Source Initiative

- **Open source initiative**
 - Organization dedicated to promoting open source software
 - Founded in Feb. 1998 by Bruce Perens and Eric Raymond
- **Open source definition**
 - Document published by the Open Source Initiative
 - Based on the Debian Free Software Guidelines
 - Written by Bruce Perens
 - Does not mean access to the source code
 - **Redistribution!**



Open Source Definition

- **Free redistribution**
 - License shall not require a royalty or other fee for such sale
- **Source code**
 - Must include source code & allow distribution
- **Derived works**
 - Must allow modification & allow them to be distributed



Replicant

A fully free
Android distribution

Open Source Definition

- **Integrity of author's source code**
 - The license may restrict source-code from being distributed in modified form
 - License allows the distribution of "patch files" with the source code
 - License may require derived works to carry a different name or version number from the original software

Open Source Definition

- **No discrimination against**
 - **Persons, groups**
- **Distribution of license**
 - **Rights to program must apply to all without the need for execution of additional license**
- **License must not be specific to a product**
 - **The rights attached to a program must not depend on the program's being part of a particular software distribution**

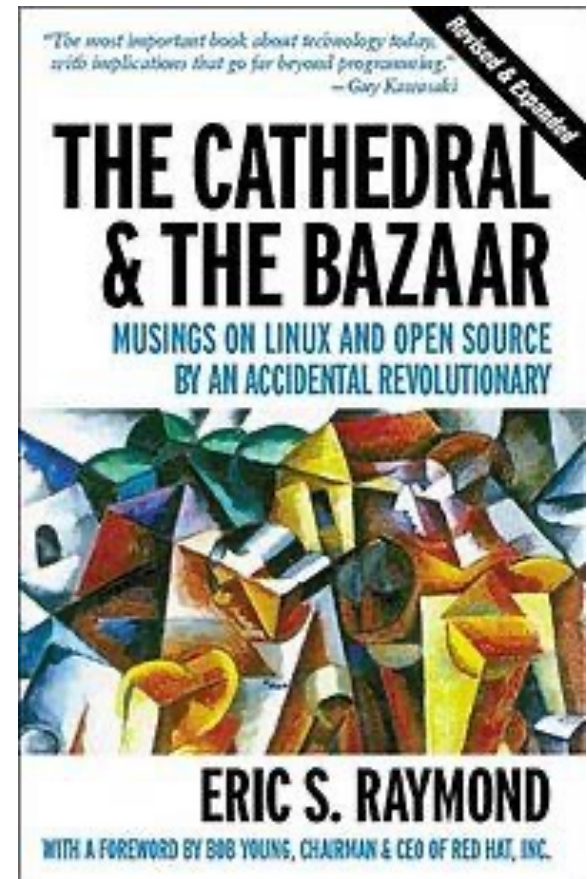
Open Source Definition

- **License must not restrict other software**
 - The license must not place restrictions on other software that is distributed along with the licensed software
- **License must be technology-neutral**
 - No provision of the license may be predicated on any individual technology or style of interface

The Cathedral and the Bazaar

The Cathedral and The Bazaar

- **Written by Eric Raymond**
- **Collection of essays**
- **Explores open source development, hacker culture, economics of open source**
- **First complete and commercially distributed book published under an open source document license**
- **Contains Fetchmail story**



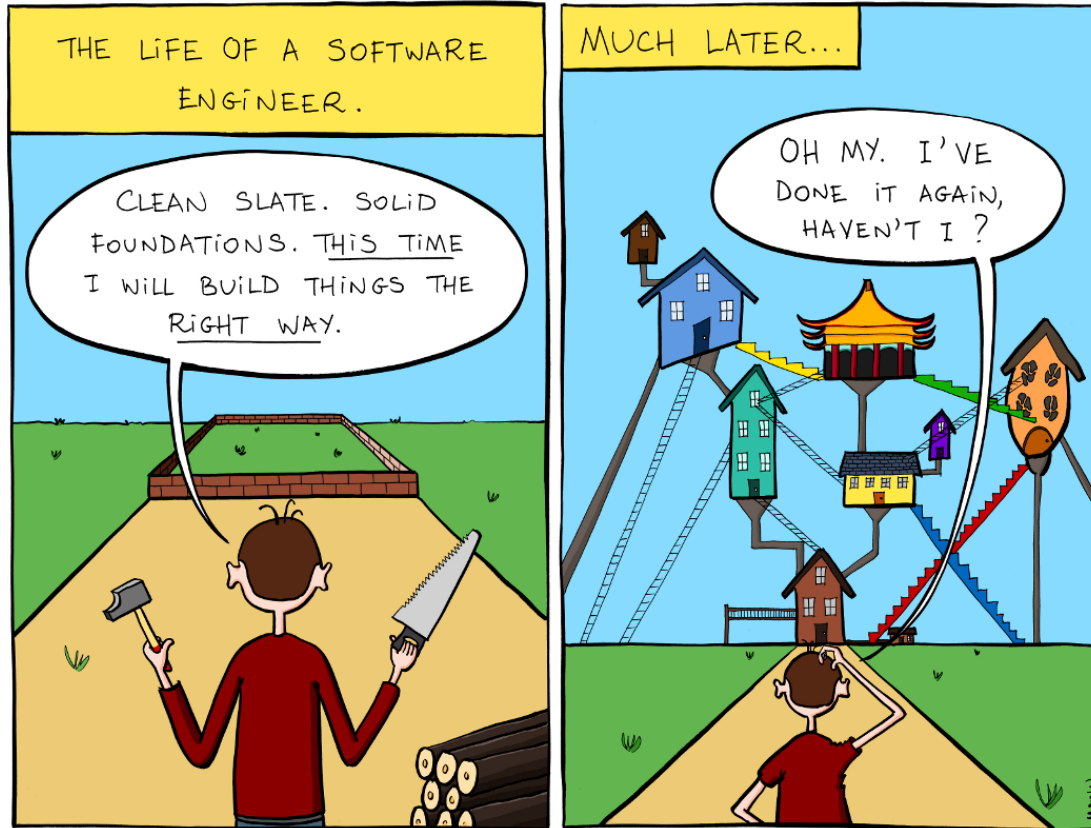
Fetchmail

- **Needs**
 - Access mail from stand-alone computer that's not always on-line
 - Can't simply forward
 - POP3 Server available, need POP3 client
 - Need to tack on end of email address
- **Every good work of software starts by scratching a developer's personal itch**
 - Necessity is the mother of invention

Don't reinvent the wheel

- **Candidates**
 - 9 existing programs were close
 - Selected 'fetchpop' first
- **Example**
 - Linux Torvalds started, not from scratch, but with Minix
- **Good programmers know what to write. Great ones know what to refactoring (and reuse)**

Don't reinvent the wheel



Never fear refactoring

- **Fetchpop**
 - Consists of amateur codes
 - Handles only POP3
- **Fetchpop → Popclient**
 - Written by Carl Harris
 - It was more cleanly written
 - However lacked some key, difficult to implement features
- **Plan to throw one away, you will, anyhow**

Be kind and share

- **Popclient**
 - Carl Harris had basically lost interest in popclient
 - The code was a bit dusty, with minor bugs hanging
 - Popclient is taken over to Eric Raymond
- **When you lose interest in a program, your last duty is to hand it off to a competent successor**
 - Carl Harris handed ‘popclient’ code to Eric Raymond

Users as developers

- **Users can become co-developers.**
 - Source code is available, they can be effective hackers.
 - This can be tremendously useful for shortening debugging time
- **Treating your users as co-developers is your least-hassle route to rapid code improvement and effective debugging**
 - Power was underestimated until Linux
- **“I’m basically a very lazy person who likes to get credit for things other people actually do – Linus Torvalds**

The Cathedral and The Bazaar



Sagrada Família



The Grand Bazaar

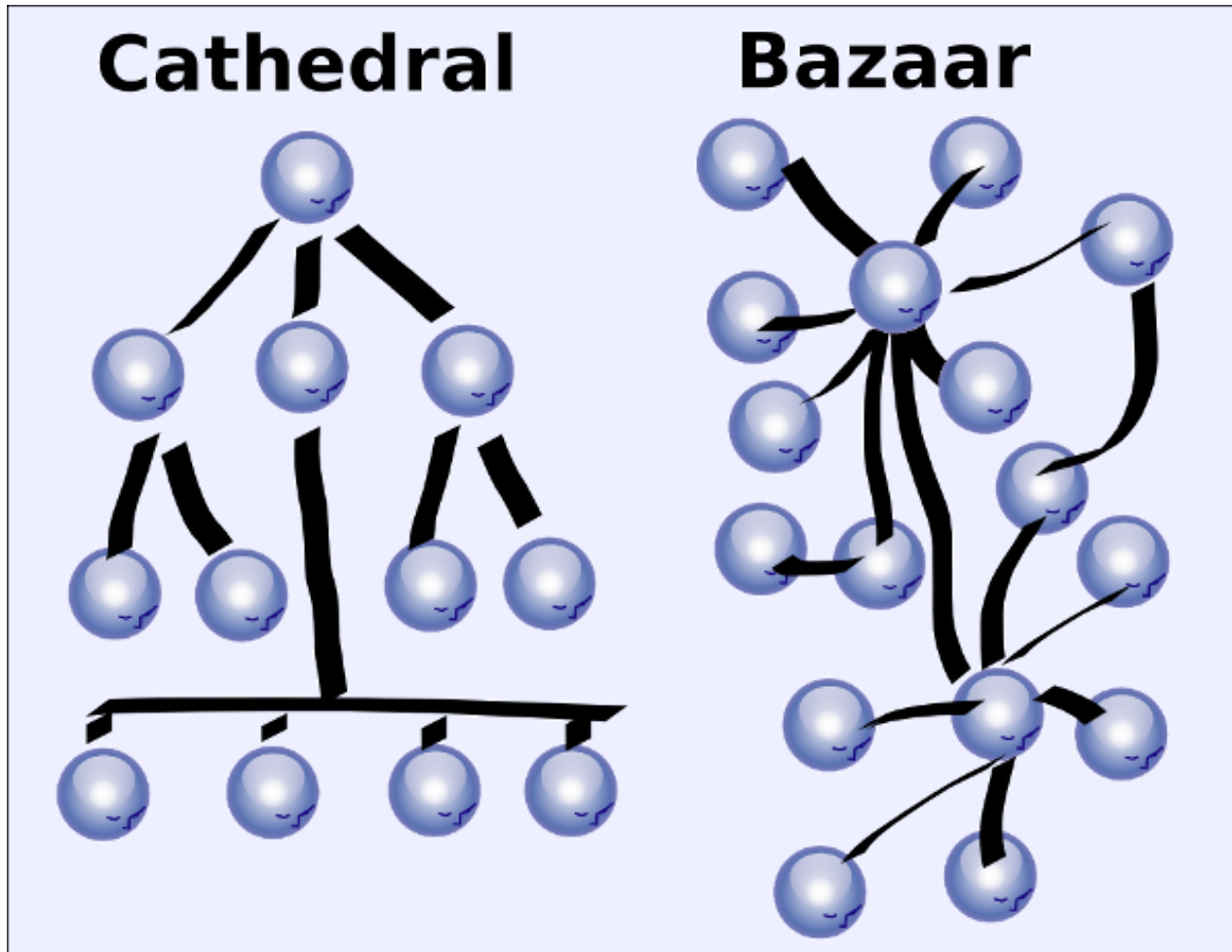
Cathedral Approach

- **Top-down**
- **Command-and-control**
- **Leads to large complex programs**
 - IBM, Microsoft
- **Well-organized, full time development team**
- **Followed by corporate teams**
- **Worked on by teams of “high-priests/cathedral builders”**
- **Release far between (not until it’s “perfect”)**

Bazaar Approach

- **Bottom-up**
- **Decentralized and Cooperative**
- **Source code available for public testing**
- **A large network of communicating developers**
- **Loosely-organized volunteer (Hackers)**
- **Release made frequently to attain feedback**

Software Development Model



Open Source Software License

Most slides from <https://www.blackducksoftware.com>

Types Of Open Source Licenses

- **Restrictive**
 - Requires licensor to make improvements or enhancements available under similar terms
 - **Sharing obligation**
 - Example is the GPLv2
- **Permissive**
 - Permissive licenses do not try to guarantee that future versions of the software will remain free and publicly available
 - Software under a permissive license can later be made proprietary
 - Examples: Berkeley Software Distribution (BSD), Apache Software License

General Public License

- **GPL is a copyleft license**
 - Requires derivative works to be released under the same license
 - Programs linked with a library released under the GPL must also be released under the GPL.
- **GPLv3**
 - Stronger Protection Against Patent Threats

Lesser GPL License

- **Can be linked to by non-GPL compatible software**
 - **GPL license force to link to only GPL software**
- **The license allows developers and companies to use and integrate software released under the LGPL**
 - **Proprietary software can use GPL software**
- **If you change LGPL software which link to yours, you have to distribute your software under LGPL**

Apache License

- **Permissive free software license**
 - **Written by Apache Software Foundation**
 - **Requires preservation of the copyright notice and disclaimer**
- **Apache License allows the user of the software the freedom to use the software for any purpose, to distribute it, to modify it, and to distribute modified versions of the software**

Dual License

- **Multi-license**
 - **GPL or Commercial**
- **Recipients can typically choose the terms under which they want to use or distribute the software**
- **Mysql**
 - **MySQL Commercial License or GPL**
 - **If your software is not under GPL, you have to buy commercial license of mysql**

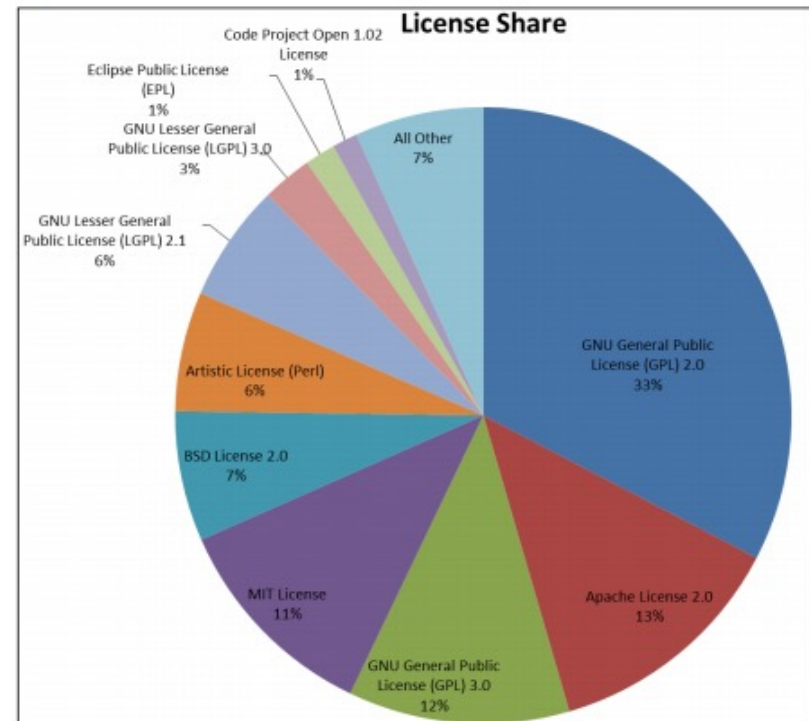
Top 20 Open Source License

Rank	License
1	GNU General Public License (GPL) 2.0
2	Apache License 2.0
3	GNU General Public License (GPL) 3.0
4	MIT License
5	BSD License 2.0
6	Artistic License (Perl)
7	GNU Lesser General Public License (LGPL) 2.1
8	GNU Lesser General Public License (LGPL) 3.0
9	Eclipse Public License (EPL)
10	Code Project Open 1.02 License
11	Microsoft Public License
12	Mozilla Public License (MPL) 1.1
13	Common Development and Distribution License (CDDL)
14	BSD 2-clause "Simplified" or "FreeBSD" License
15	Common Public License (CPL)
16	zlib/libpng License
17	Academic Free License
18	GNU Affero GPL v3
19	Microsoft Reciprocal License (Ms-RL)
20	Open Software License (OSL)

Source: [//www.blackducksoftware.com/oss/licenses#top20](http://www.blackducksoftware.com/oss/licenses#top20)
July 2013

Ranked according to number of open source projects using the license:

- Top 10 licenses account for **93%**
- Top 20 licenses account for **97%**
- GPL family of licenses account for **53%**
- Apache+BSD+MIT licenses account for **31%**



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**
- **Open Source + Proprietary**
- **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

Software license

Strong copyleft
Non-copyleft
Weak-copyleft
No preference

Copyright control

Vendor
Foundation
Distributed
Withheld

End user licensing

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

Development model

Cathedral
Bazaar
Aggregate
.....
Vendor
Community
Mixed



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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

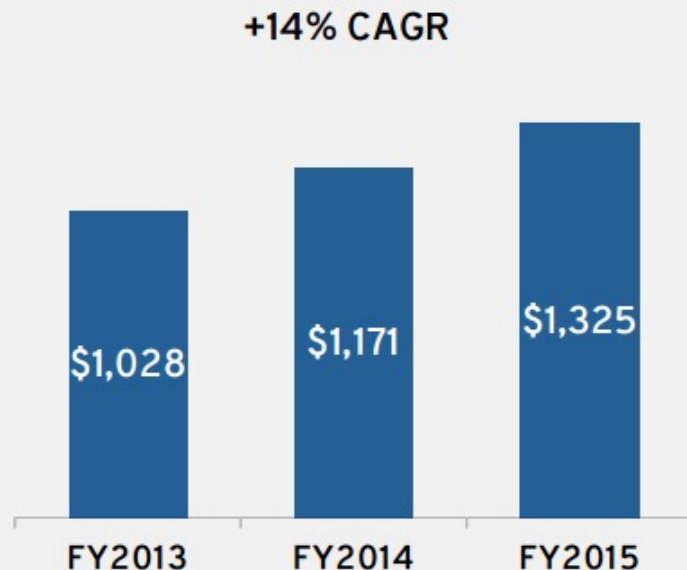
- **Redhat : Value of the subscription**
- **Subscription – one price, all included**
 - **Product & Documentation**
 - **Updates**
 - **Upgrades**
 - **Access to Red Hat Network**
 - **Ecosystem access**
 - **Technical Support**



Redhat Revenue

INFRASTRUCTURE-RELATED SUBSCRIPTIONS

(\$millions)



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

Open Source + Proprietary

- **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

Intrusion Sensor Appliances



RNA (Real-time Network Awareness) Software running on RA and/or IS Appliances



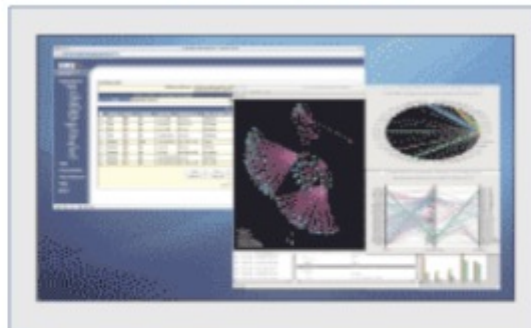
Intrusion Agents
loaded on
your own
Open Source
Snort®
sensors

Determine

Defense Center Appliance



Web browser



Defend



Syslog, SNMP,
helpdesk systems,
e-mail, SMS etc.

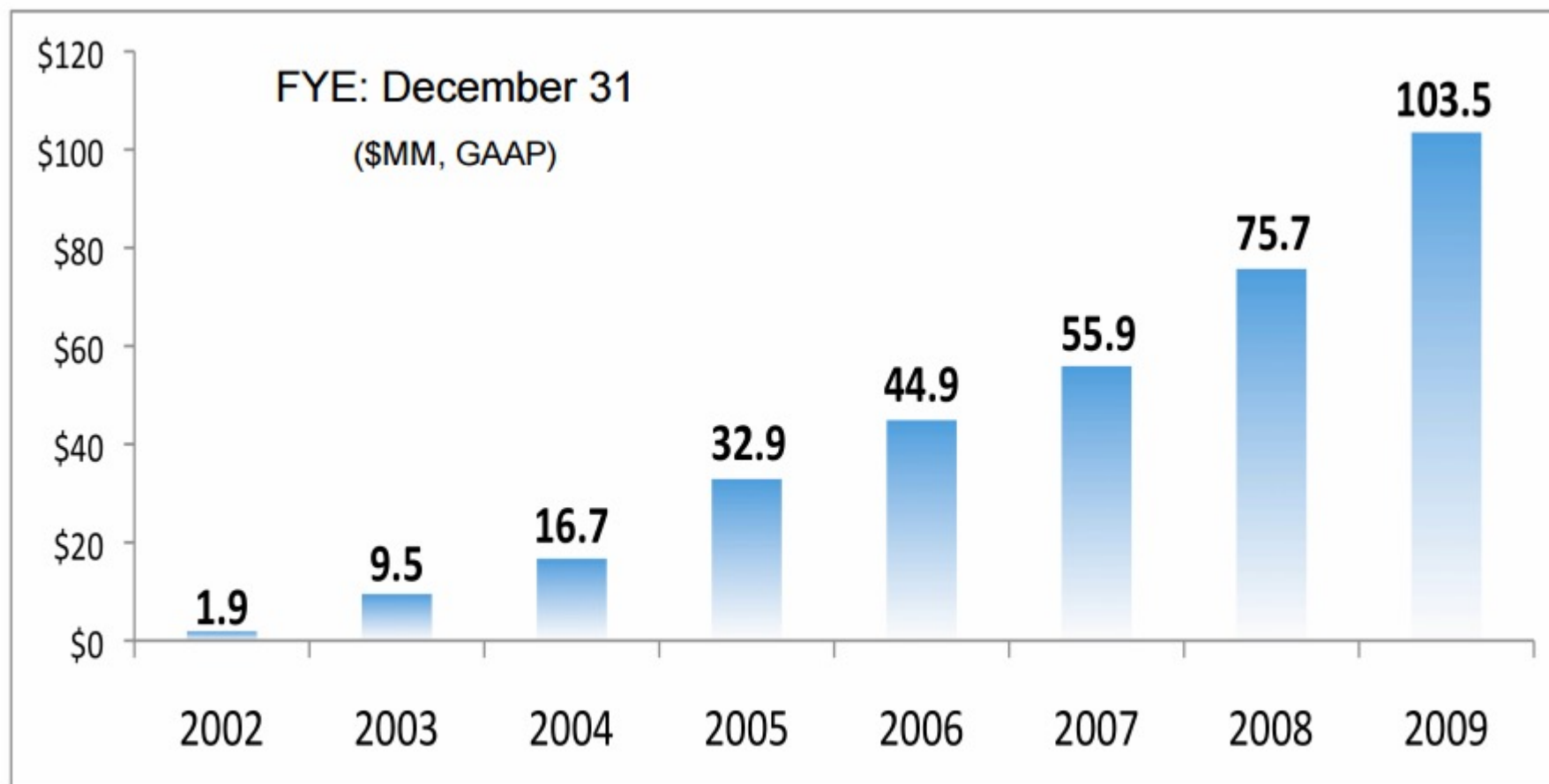


IPS in-line blocking
or Remediation via
firewalls, routers,
switches etc.



Remediation via
Nessus active scan,
Shavlik patch &
configuration
management etc.

Sourcefire Revenue



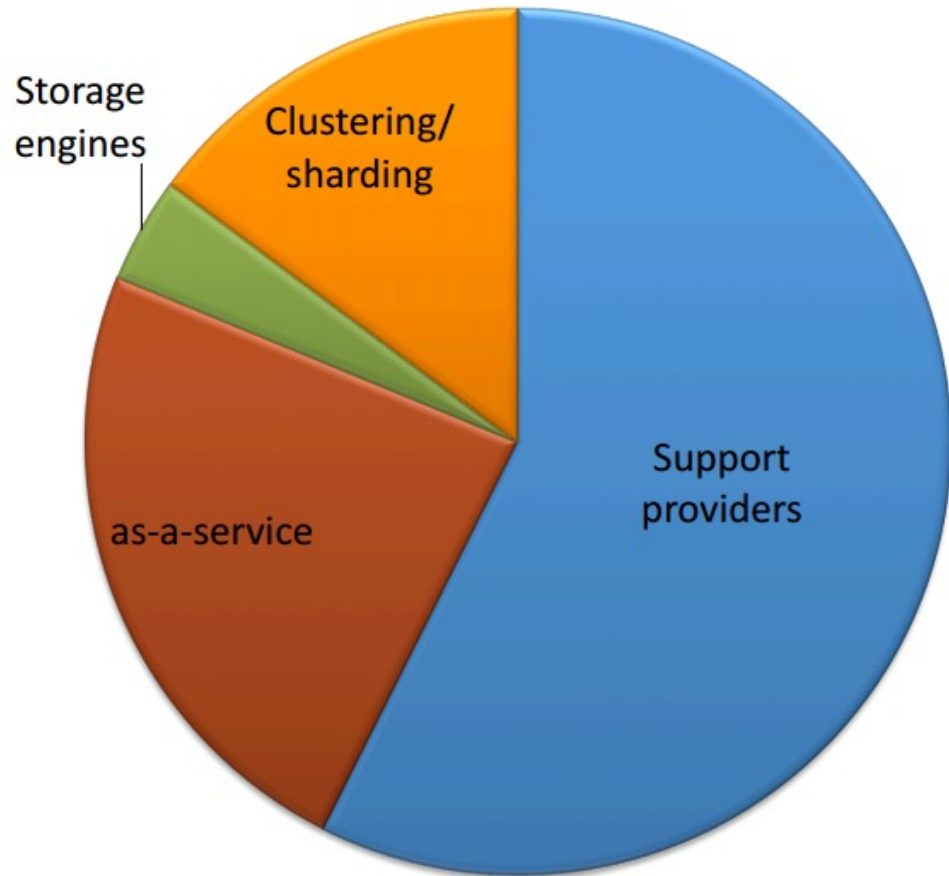
Compound Annual Growth Rate 2002-2009 = 77%

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)**

Open Source + Hardware

- **Cisco embed open source SWs in their routers**

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 Arnc

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 libcgrouper 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

Importance of Open Source

- **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**

End