= OpenBSD =

OpenBSD is a Unix @-@ like computer operating system descended from Berkeley Software Distribution (BSD) , a Research Unix derivative developed at the University of California , Berkeley . In late 1995 , Theo de Raadt forked it from NetBSD . Besides the operating system as a whole , the project maintains portable versions of many subsystems , most notably OpenSSH , which are available as packages in other operating systems .

The project is known for its developers ' insistence on open @-@ source code , good documentation , code correctness , and security . It has strict policies on licensing , preferring the ISC license and other variants of the Simplified BSD License . Many of its security features are optional or absent in other operating systems . Its developers frequently audit the source tree for software bugs and security holes .

De Raadt coordinates the project from his home in Calgary , Alberta , Canada . Its logo and mascot is a pufferfish named Puffy .

= = History and popularity = =

In December 1994 , NetBSD co @-@ founder Theo de Raadt was asked to resign from his position as a senior developer and member of the NetBSD core team . The reason for this is not wholly clear , although there are claims that it was due to personality clashes within the NetBSD project and on its mailing lists .

In October 1995 , de Raadt founded OpenBSD , a new project forked from NetBSD 1 @.@ 0 . The initial release , OpenBSD 1 @.@ 2 , was made in July 1996 , followed by OpenBSD 2 @.@ 0 in October of the same year . Since then , the project has followed a schedule of a release every six months , each of which is supported for one year .

On 25 July 2007 , OpenBSD developer Bob Beck announced the formation of the OpenBSD Foundation , a Canadian non @-@ profit organization formed to " act as a single point of contact for persons and organizations requiring a legal entity to deal with when they wish to support OpenBSD . "

Just how widely OpenBSD is used is hard to determine as its developers do not publish or collect usage statistics . In September 2005 , the BSD Certification Group performed a usage survey which revealed that 32 @.@ 8 % of BSD users (1420 of 4330 respondents) were using OpenBSD , placing it second out of the four major BSD variants , behind FreeBSD with 77 % and ahead of NetBSD with 16 @.@ 3 % .

= = Uses = =

= = = Security = = =

OpenBSD 's security enhancements , built @-@ in cryptography , and the pf packet filter suit it for use in the security industry , such as on firewalls , intrusion @-@ detection systems , and VPN gateways .

Proprietary systems from several manufacturers are based on OpenBSD , including devices from Armorlogic (Profense web application firewall) , Calyptix Security , GeNUA , RTMX , and .vantronix. Later versions of Microsoft 's Services for UNIX , an extension to the Windows operating system providing Unix @-@ like functionality , use large amounts of OpenBSD code .

= = = Desktop = = =

OpenBSD ships with the X Window System and is suitable for use on the desktop . Packages are available for popular applications , including desktop environments such as GNOME , KDE , and Xfce , and web browsers such as Firefox and Chromium . The project also includes three window

managers in the main distribution : cwm , FVWM , and twm .

= = = Server = = =

OpenBSD features a full server suite and can be easily configured as a mail server , web server , FTP server , DNS server , router , firewall , NFS file server , or any combination of these .

= = Component projects = =

Despite the small team size and relatively low usage of OpenBSD , the project maintains portable versions of many parts of the base system , including :
LibreSSL , a free implementation of the Secure Sockets Layer (SSL) and Transport Layer Security (TLS) protocols , forked from the OpenSSL 1.0.1g branch
OpenBGPD , a free implementation of the Border Gateway Protocol 4 (BGP @-@ 4)
OpenOSPFD , a free implementation of the Open Shortest Path First (OSPF) routing protocol
OpenNTPD , a simple alternative to ntp.org 's Network Time Protocol (NTP) daemon
OpenSMTPD , a free Simple Mail Transfer Protocol (SMTP) daemon with IPv4 / IPv6 , PAM , Maildir and virtual domains support
httpd , an HTTP server first included in the 5 @.@ 6 release
OpenSSH , a free implementation of the Secure Shell (SSH) protocol
OpenIKED , a free implementation of the Internet Key Exchange (IKEv2) protocol
Common Address Redundancy Protocol (CARP) , a free alternative to Cisco 's patented HSRP / VRRP server redundancy protocols
PF , an IPv4 / IPv6 stateful firewall with NAT , PAT , QoS and traffic normalization support
pfsync , a firewall states synchronization protocol for PF firewall with High Availability support using CARP
spamd , a spam filter with greylisting support designed to inter @-@ operate with the PF firewall
sndio , a compact audio and MIDI framework
Xenocara , a customized X.Org build infrastructure
cwm , a stacking window manager
tmux virtual console multiplexer
Some subsystems have been integrated into the base system of several other BSD projects , while many are available as packages for use in other Unix @-@ like systems .

= = Third @-@ party components in the base system = =

OpenBSD includes a number of third @-@ party software components , many with OpenBSD @-@ specific patches .
These include X.org (the X Window environment) , GCC (which acts as the default compiler) , Perl , SQLite , NSD , Unbound (DNS server) , Ncurses , Binutils , gdb and Awk .
OpenBSD used to include a fork of Apache 1 @.@ 3 , which was later replaced by Nginx . In the 5 @.@ 6 release , Nginx was replaced with httpd , an HTTP server with FastCGI and Transport Layer Security support . As of May 2016 , Apache and Nginx are still available as ports .

= = Development and release process = =

Development is continuous , and team management is open and tiered . Anyone with appropriate skills may contribute , with commit rights being awarded on merit and de Raadt acting as coordinator . : xxxv Two official releases are made per year , with the version number incremented by 0 @.@ 1 , and these are each supported for twelve months (two release cycles) . Snapshot releases are also available at frequent intervals .
Maintenance patches for supported releases may be applied manually or by updating the system against the patch branch of the CVS repository for that release . Alternatively , a system

administrator may opt to upgrade using a snapshot release and then regularly update the system against the -current branch of the CVS repository , in order to gain pre @-@ release access to recently added features .

The standard OpenBSD kernel , as maintained by the project , is strongly recommended for end users . Customized kernels are not supported by the project : " Users attempting to ' customize ' or ' optimize ' their kernel usually cause far more problems than they solve . "

Packages outside the base system are maintained by CVS through a ports tree and are the responsibility of the individual maintainers , known as porters . As well as keeping the current branch up to date , porters are expected to apply appropriate bug @-@ fixes and maintenance fixes to branches of their package for OpenBSD 's supported releases . Ports are generally not subject to the same continuous auditing as the base system due to lack of manpower .

Binary packages are built centrally from the ports tree for each architecture . This process is applied for the current version , for each supported release , and for each snapshot . Administrators are recommended to use the package mechanism rather than build the package from the ports tree , unless they need to perform their own source changes .

OpenBSD 's developers regularly meet at special events called hackathons , where they " sit down and code " , emphasizing productivity .

Every new release includes a song .

The OpenBSD Foundation was accepted as a mentoring organization for the 2014 Google Summer of Code .

= = Open @-@ source and open documentation = =

The OpenBSD Project is noted for its high @-@ quality user documentation , considered top among the BSD family operating systems , all of which have excellent documentation . When OpenBSD was created , de Raadt decided that the source should be easily available for anyone to read at any time , so , with the assistance of Chuck Cranor , he set up the first public , anonymous CVS server . At the time , the tradition was for only a small team of developers to have access to a project 's source repository . Cranor and de Raadt concluded that this practice " runs counter to the open source philosophy " and is inconvenient to contributors . De Raadt 's decision allowed " users to take a more active role " , and signaled the project 's belief in open and public access to source code .

OpenBSD does not include closed source binary drivers in the source tree , nor do they include code requiring the signing of non @-@ disclosure agreements .

Since OpenBSD is based in Canada , no United States export restrictions on cryptography apply , allowing the distribution to make full use of modern algorithms for encryption . For example , the swap space is divided into small sections and each section is encrypted with its own key , ensuring that sensitive data does not leak into an insecure part of the system .

OpenBSD randomizes various behaviors of applications , making them less predictable and thus more difficult to attack . For example , PIDs are created and associated randomly to processes ; the bind system call uses random port numbers ; files are created with random inode numbers ; and IP datagrams have random identifiers . This approach also helps expose bugs in the kernel and in user space programs .

The OpenBSD policy on openness extends to hardware documentation : in the slides for a December 2006 presentation , de Raadt explained that without it " developers often make mistakes writing drivers " , and pointed out that " the [oh my god , I got it to work] rush is harder to achieve , and some developers just give up . " He went on to say that vendor @-@ supplied binary drivers are unacceptable for inclusion in OpenBSD , that they have " no trust of vendor binaries running in our kernel " and that there is " no way to fix [them] ... when they break . "

= = Licensing = =

A goal of the OpenBSD Project is to " maintain the spirit of the original Berkeley Unix copyrights " ,

which permitted a " relatively un @-@ encumbered Unix source distribution . " To this end , the Internet Systems Consortium (ISC) license is preferred for new code , but the MIT and BSD licenses are also accepted . The widely used GNU General Public License is considered overly restrictive compared to these .

In June 2001 , triggered by concerns over Darren Reed 's modification of IPFilter 's license wording , a systematic license audit of the OpenBSD ports and source trees was undertaken . Code in more than a hundred files throughout the system was found to be unlicensed , ambiguously licensed or in use against the terms of the license . To ensure that all licenses were properly adhered to , an attempt was made to contact all the relevant copyright holders : some pieces of code were removed , many were replaced , and others , such as the multicast routing tools mrinfo and map @-@ mbone , were relicensed so that OpenBSD could continue to use them . Also removed during this audit was all software produced by Daniel J. Bernstein . At the time , Bernstein requested that all modified versions of his code be approved by him prior to redistribution , a requirement to which OpenBSD developers were unwilling to devote time or effort .

Because of licensing concerns , the OpenBSD team has re @-@ implemented software from scratch or adopted suitable existing software . Of particular note is the development , after license restrictions were imposed on IPFilter , of the pf packet filter , which first appeared in OpenBSD 3 @.@ 0 and is now available in other major BSDs . OpenBSD developers have also replaced GPL licensed tools (such as diff , grep and pkg @-@ config) with BSD licensed equivalents .

= = Funding = =

Although the operating system and its portable components are used in commercial products , de Raadt says that little of the funding for the project comes from the industry : " traditionally all our funding has come from user donations and users buying our CDs (our other products don 't really make us much money) . Obviously , that has not been a lot of money . "

For a two @-@ year period in the early 2000s , the project received DARPA funding , which " paid the salaries of 5 people to work completely full @-@ time , bought about $ 30k in hardware , and paid for 3 hackathons . "

In 2006 , de Raadt expressed concern about the asymmetry of funding : " I think that contributions should have come first from the vendors , secondly from the corporate users , and thirdly from individual users . But the response has been almost entirely the opposite , with almost a 15 to 1 dollar ratio in favor of the little people . Thanks a lot , little people ! " However , since 2014 several large contributions to the OpenBSD Foundation have come from corporations such as Microsoft , Facebook , and Google as well as the Core Infrastructure Initiative .

In 2006 , the OpenBSD Project experienced financial danger . The Mozilla Foundation and GoDaddy are among the organizations that helped the OpenBSD Project to overcome its financial troubles .

On 14 January 2014 , Bob Beck issued a request for funding to cover electrical costs . If sustainable funding was not found , Beck suggested the OpenBSD Project would shut down . The project soon received a US $ 20 @,@ 000 donation from Mircea Popescu , the Romanian creator of the MPEx bitcoin stock exchange , paid in bitcoins . The project raised US $ 150 @,@ 000 in response to the appeal , enabling it to pay its bills and securing its short @-@ term future .

= = Security and code auditing = =

Shortly after OpenBSD 's creation , de Raadt was contacted by a local security software company named Secure Networks (SNI) . They were developing a " network security auditing tool " called Ballista , which was intended to find and attempt to exploit possible software security flaws . This coincided with de Raadt 's own interest in security , so for a time the two cooperated , a relationship that was of particular usefulness leading up to the release of OpenBSD 2 @.@ 3 and helped to define security as the focal point of the project .

OpenBSD includes features designed to improve security , such as :

secure alternatives to POSIX functions in the C standard library , e.g. , strlcat and strlcpy
toolchain alterations , including a static bounds checker
memory protection techniques to guard against invalid accesses , such as ProPolice and the W ^ X page protection feature
strong cryptography and randomization

To reduce the risk of a vulnerability or misconfiguration allowing privilege escalation , many programs have been written or adapted to make use of privilege separation , privilege revocation and chrooting . Privilege separation is a technique , pioneered on OpenBSD and inspired by the principle of least privilege , where a program is split into two or more parts , one of which performs privileged operations and the other ? almost always the bulk of the code ? runs without privilege . Privilege revocation is similar and involves a program performing any necessary operations with the privileges it starts with then dropping them . Chrooting involves restricting an application to one section of the file system , prohibiting it from accessing areas that contain private or system files . Developers have applied these features to OpenBSD versions of many common applications , such as tcpdump , file , tmux , smtpd , and syslogd .

OpenBSD developers were instrumental in the creation and development of OpenSSH , which is developed in the OpenBSD CVS repositories . OpenSSH is based on the original SSH . It first appeared in OpenBSD 2 @.@ 6 and is now by far the most popular SSH client and server , available on many operating systems .

The project has a policy of continually auditing source code for problems , work that developer Marc Espie has described as " never finished ... more a question of process than of a specific bug being hunted . " He went on to list several typical steps once a bug is found , including examining the entire source tree for the same and similar issues , " try [ing] to find out whether the documentation ought to be amended " , and investigating whether " it 's possible to augment the compiler to warn against this specific problem . "

The default install is quite minimal , which the project states is to ensure novice users " do not need to become security experts overnight " , which fits with open @-@ source and code auditing practices argued to be important elements of a security system .

= = = Alleged FBI backdoor investigated = = =

On 11 December 2010 , Gregory Perry , a former technical consultant for the Federal Bureau of Investigation (FBI) , emailed de Raadt alleging that the FBI had paid some OpenBSD ex @-@ developers 10 years previously to insert backdoors into the OpenBSD Cryptographic Framework . De Raadt made the email public on 14 December by forwarding it to the openbsd @-@ tech mailing list and suggested an audit of the IPsec codebase . De Raadt 's response was skeptical of the report and he invited all developers to independently review the relevant code . In the weeks that followed , bugs were fixed but no evidence of backdoors were found . De Raadt stated " I believe that NetSec was probably contracted to write backdoors as alleged . If those were written , I don 't believe they made it into our tree . They might have been deployed as their own product . "

= = = Slogan = = =

The OpenBSD website features a prominent reference to the security record of the default installation . Until June 2002 , the wording read " Five years without a remote hole in the default install ! " An OpenSSH bug was then discovered that made it possible for a remote attacker to gain root privileges in OpenBSD and in any of the other systems running OpenSSH at the time . It was quickly fixed , as is normal with known security holes . The slogan was changed to " One remote hole in the default install , in nearly 6 years ! " In 2007 , a network @-@ related remote vulnerability was found , which was also quickly fixed . The quote was subsequently altered to " Only two remote holes in the default install , in a heck of a long time ! " As of July 2016 , the wording remains .

= = Distribution and marketing = =

The name OpenBSD refers to the fact that OpenBSD 's source code is freely available on the Internet . It also refers to the wide range of hardware platforms the operating system supports .

OpenBSD is freely available in various ways : the source can be retrieved by anonymous CVS , and binary releases and development snapshots can be downloaded by FTP , HTTP , and rsync . Prepackaged CD @-@ ROM sets can be ordered online for a small fee , complete with an assortment of stickers and a copy of the release 's theme song . These , with their artwork and other bonuses , are one of the project 's few sources of income , funding hardware , Internet service , and other expenses .

In common with other operating systems , OpenBSD provides a package management system for easy installation and management of programs which are not part of the base operating system . Packages are binary files which are extracted , managed and removed using the package tools . On OpenBSD , the source of packages is the ports system , a collection of Makefiles and other infrastructure required to create packages . In OpenBSD , the ports and base operating system are developed and released together for each version : this means that the ports or packages released with , for example , 4 @.@ 6 are not suitable for use with 4 @.@ 5 and vice versa .

OpenBSD at first used the BSD daemon mascot . A specialized version of the daemon , the haloed daemon was drawn by Erick Green . Green was asked by de Raadt to create the logo for the 2 @.@ 3 and 2 @.@ 4 versions of OpenBSD . At first , it was planned to create a full daemon , including head and body , but Green was only able to complete the head part for OpenBSD 2 @.@ 3 . The body as well as pitchfork and tail was completed for OpenBSD 2 @.@ 4 . Subsequent releases saw variations , such as Cop daemon by Ty Semaka , but eventually settling on Puffy , described as a pufferfish . Since then Puffy has appeared on OpenBSD promotional material and featured in release songs and artwork . The promotional material of early OpenBSD releases did not have a cohesive theme or design , but later the CD @-@ ROMs , release songs , posters and tee @-@ shirts for each release have been produced with a single style and theme , sometimes contributed to by Ty Semaka of the Plaid Tongued Devils . These have become a part of OpenBSD advocacy , with each release expounding a moral or political point important to the project , often through parody . Past themes have included : in OpenBSD 3 @.@ 8 , the Hackers of the Lost RAID , a parody of Indiana Jones linked to the new RAID tools featured as part of the release ; The Wizard of OS , making its debut in OpenBSD 3 @.@ 7 , based on the work of Pink Floyd and a parody of The Wizard of Oz related to the project 's recent work on wireless card drivers ; and OpenBSD 3 @.@ 3 's Puff the Barbarian , including an 80s rock @-@ style song and parody of Conan the Barbarian , alluding to open documentation .