



# Open Source and Open Standards



Open source software (OSS), unlike proprietary software, is usually free to obtain, use, edit and redistribute. Open standards facilitate interoperability between software, making them important for the development and uptake of OSS. This note examines the quality, cost and security of OSS and considers government plans to adopt open standards.

## Background

OSS has been considered for use by the government since 2002.<sup>1</sup> The Coalition's 2010 manifesto promised to create a level playing field for OSS and closed source (proprietary) software, and the government's 2011 IT strategy calls for OSS to be given fair consideration in procurement.<sup>2</sup>

Standards describe how a technology should operate and interoperate with others. The IT strategy calls for the adoption of compulsory open standards by government to enable software from different companies, whether open or closed source, to interoperate. This gives users more choice of software and could therefore encourage use of OSS.

The government's key aims in using open standards are operational and financial efficiency. Advocates say that using open standards can bring benefits such as avoiding 'lock-in' to one vendor and increasing re-use of IT solutions between government departments. The government hopes that following open standards will put it in a stronger position during procurement. The definition of an open standard is not formally agreed upon, and was the subject of a Cabinet Office consultation which closed in June 2012. The consultation considered standards for software, data and document formats, but not hardware or telecommunications.

## Overview

- Open source software can match proprietary software in terms of quality and security and can be cheaper in some circumstances.
- There are some indications that open source software is underused by government.
- Open standards are designed to improve the interoperability of software, whether open source or proprietary.
- Adopting open standards within government would help achieve a level playing field for open source software during procurement.
- Some argue that the benefits of open standards will only be achieved if their implementation is royalty-free. This point is controversial and as yet undecided.

## Open Source Software

All computer programs consist of source code, the instructions that tell the computer what the program should do. Open source software makes this source code available to users, allowing them to see and if necessary edit the program. This is in contrast to closed source software, for which the source code is not released by the vendor. In recent years, the line between these models has blurred, as proprietary software projects often make use of open source components, and vice versa.

Some OSS products have emerged as popular and high-quality alternatives to proprietary software. For example, in March 2012, 22% of traffic on the Wikimedia websites originated from open source Mozilla Firefox browsers, compared to 28% from Microsoft Internet Explorer. Open source projects are developed by communities of users, and can draw on large pools of talent and innovation. As the source code is visible to users, it is possible to directly assess its quality.

## Licensing

Openness of source code is a necessary but insufficient requirement for OSS. The key distinction between OSS and proprietary software is the extra permission granted in the licence. Broadly speaking, anyone has the right to copy, edit

and redistribute OSS, usually at no cost. OSS is released under many licences which cover a range of permissions for how the software can be used and redistributed.

- The GNU General Public Licence (GPL) requires that altered or extra code added to GPL software is also licensed under the GPL. This ensures the propagation of OSS but can cause licensing conflicts if GPL and proprietary software are combined.
- The Berkeley Software Distribution (BSD) licence gives anyone the freedom to release updates or modifications of the software under any licence they wish.
- The Lesser GPL (LGPL) is a compromise between the restrictive GPL and the permissive BSD. Altered LGPL software must continue under LGPL, but extra code can be added under almost any licence the author wishes.

### Security

Software security aims to prevent people outside the user's computer or network from gaining access or control. The Government's Communications Electronics Security Group published a report in 2011 stating that: "Open source, as a category, is no more or less secure than closed proprietary software".<sup>3</sup> Qinetiq came to the same conclusion,<sup>4</sup> and the Office of Government Commerce has said that: "OSS can be at least as secure as proprietary systems".<sup>5</sup>

Security-critical faults exploited in unexpected attacks are a risk to organisations, and opinions differ as to whether these are handled better by open or closed source projects. Both types of project release 'patches' for their software in order to correct faults, but there are differing approaches.

- Open source code and patches to it are visible to all. This transparency can allow flaws to be quickly spotted and rectified. However it can also expose vulnerabilities in as-yet unpatched systems.
- The contents of closed source patches are usually not disclosed (although closed source code is often scrutinised by third parties, including security agencies, before release). This can prevent hackers exploiting the vulnerability, but can also mean that faults are not disclosed in order to maintain the impression of security.

There is no consensus as to whether security by obscurity or transparency is more effective, and both open and closed source projects vary in the extent to which they reveal information about vulnerabilities to their users.

### Cost

OSS is normally free to obtain, which can lead to initial savings compared to paying a licence fee per user for proprietary software. However, the Total Cost of Ownership (TCO) is difficult to calculate, as it also includes the cost of customising and maintaining software, migrating users and data to the new system, support for users and eventual exit. In 2011 the TCO of open and closed source software was compared in a survey of 32 organisations.<sup>6</sup> It found that amongst those surveyed, costs were often lower overall when using OSS. Reducing vendor lock-in and value for money were cited as the most important reasons for using OSS. However, a 2011 study by the Dutch Court of Audit on

OSS in government concluded that the potential for savings was likely to be marginal. Both studies are somewhat controversial and case studies show that in some situations using OSS can lead to substantial savings, while in others it has been more costly (Box 1).

With any IT system, it is important to balance the benefits offered by a new setup, whether open or proprietary, against the risk associated with changing an existing solution. Consultants recommend against sudden big changes, instead advocating small pilot programmes to build confidence and expertise.

### Support and Maintenance

As proprietary software is closed source, users have no choice but to receive maintenance and support from the vendor or an approved supplier. Proprietary companies can lock users into a cycle of paying for upgrades to maintain compatibility with other programs. OSS code and updates are freely available, so in theory users are able to choose who they will receive support from. In practice most users will obtain OSS through a company providing some level of customisation, which can also lead to lock-in.

#### Box 1. Open Source Software – Case Studies

- **Birmingham City Council** piloted OSS on hundreds of desktops in its public libraries in 2005-6. It originally planned to install Linux (an open source operating system), but this was over-ambitious for the time frame of the project and compatibility problems meant that the open source OpenOffice (office suite) and Firefox (web browser) were eventually run on Windows XP. The project cost £100k more than a straight Windows installation would have done, due to 'first-time' costs of OSS such as development, training and testing. However, the Council said the OSS programs used proved a viable alternative to proprietary software. At the end of the pilot, it expected to start making cost savings over time and was looking to 'significantly increase' its use of open source.
- **Transport for London** achieved immediate operational savings of 80% after using the OSS vendor Red Hat to provide an open source and open standards solution to updating the Oyster web portal in 2009. As well as reducing costs, the project has increased functionality, and improved performance and security. TfL is now compliant with the latest payment card industry regulations, and the system ran without interruption for over 12 months.
- **The UK Parliament** information management system upgrade in 2011-12 implemented an OSS project for the new Parliamentary search tool. This option offered a capable solution that was broadly comparable with other products in terms of functionality. Upfront savings of 50% (£200k) over the proprietary option meant it offered the best value for money. Contract developers working in-house implemented the project from scratch and permanent staff will take over support, which reduces reliance on third parties and allows for more flexibility. The main challenge will be to transfer knowledge to permanent staff and to retain those skills so that the tool can be supported and enhanced. As there is no contract, the project lifetime is not artificially limited. This avoids an enforced procurement, meaning savings could continue into the future.

### Standards

A standard is a document that describes how a technology should operate and interoperate with others. For example, the electric plug complies with a standard which allows any appliance to connect to the electricity grid. IT standards can

involve, for example, hardware, software and formats for documents and data.

Standards are usually produced by standards organisations (Box 2). They are typically updated every few years as the technology they relate to advances. Standards involve mandatory features and optional best-practice recommendations. There is consensus that standards are necessary and sensible, increasing choice and encouraging innovation.

### Box 2. Standards Organisations

Many standards organisations exist at national and international level, and within different industries. Standards are initiated by these organisations and their members, and are written by experts from industry, academia or elsewhere. Standards organisations administer and disseminate standards and often run accreditation training schemes, which demonstrate that businesses and organisations are compliant. There are various funding models for standards organisations, seen in the examples below.

- **ISO:** International Organisation for Standardisation. International standard-setting body, with 163 member nations. It is funded by means-tested member subscription and the sale of standards.
- **ETSI:** European Telecommunications Standards Institute. European body which produces standards for telecommunications and broadcasting, most notably the GSM mobile phone system.
- **BSI:** British Standards Institution. A national standards body which represents the UK to the ISO. It operates the Kitemark product quality certification scheme and is funded by selling standards.
- **W3C:** World Wide Web Consortium. Led by Sir Tim Berners-Lee, the founder of the web, W3C makes freely available standards such as HTML. It is funded by means-tested membership fees.
- **IETF:** Internet Engineering Task Force. IETF develops and promotes internet standards. It has no membership requirements, and develops freely available standards by an open process.

## Open Standards

A standard is said to be 'open' if it is available for anyone to access, influence and implement. This contrasts with a closed standard, which is controlled by a single vendor or group of vendors. Open standards increase competition, as they allow anyone to participate in the market.

The precise meaning of 'open' is not universally defined. There are several possible elements to an open standard:

- an open process is used to create the standard, with stakeholders able to contribute ideas and feedback;
- the standard is available to access for all users;
- the standard is available to implement at zero or 'reasonable' cost.

A consultation was launched by the Cabinet Office in February 2012 on this question. Defining the reasonable cost of implementing an open standard has been a contentious part of the debate on the meaning of openness.

In order to comply with some standards, implementers can be required to use patented technology and thus to pay royalties (Box 3). Fair, reasonable and non-discriminatory (FRAND) terms are usually applied, but this is still seen by some as a barrier to entry into the market. Standards which make such a requirement are said to be 'encumbered by patent'. To avoid this, the patent owner can licence their

intellectual property rights on a restriction and royalty free (RF) basis, normally in the interest of growing the market. Of 970 responses to a Cabinet Office survey in spring 2011, 87% said that they thought open standards should be RF. However, some patent-encumbered standards have become widely used (Box 4).

### Box 3. Software Patents

The validity of software patents remains a delicate issue. The European Patent Office does not grant patents for software that just does calculations, but only for 'computer implemented inventions'. For instance, the program must have a technical outcome such as moving a robotic arm. Applying this distinction in practice is complex, and no such distinction is applied in the US patent system.

Experts disagree on whether software patents help or hinder innovation. Patents are intended to protect investment, but in the US, there are concerns that innovation is increasingly being stifled by non-practicing 'patent trolls' purchasing patents and using threats of litigation to amass licensing revenues. Contesting a patent can be prohibitively expensive. Companies can cross-license their patent portfolios as part of a deal negotiation. This can disadvantage small businesses, which tend not to have extensive portfolios of patents to trade.

### Standards Wars

Given the economic importance of standards, companies can try to influence them for their own benefit. If dominant vendors do not see interoperability as desirable they can block the development of standards or make them overly complicated. In 2002, an Office of Fair Trading report found that standards can lead to serious competition issues, which in turn can create significant barriers to entry.<sup>7</sup> Since then, most major vendors have recognised the benefits of open standards. For example, Microsoft has developed an open document format (OOXML), although there are currently variations between the ISO OOXML standard and Microsoft's implementation. Adobe's PDF technology was also submitted to and approved by the ISO.

### Box 4. IT Standards

- **Document standards:** ODF and OOXML are the two main open standards for editable documents. PDF was originally a proprietary (Adobe) standard for a non-editable document format, but since 2008 has been open and royalty free.
- **Image standards:** GIF is an image standard which was encumbered by patent until this expired in 2006. GIF can now be used freely. PNG and JPEG are both royalty-free open standards.
- **Moving image standards:** H.264 is a video codec which is encumbered by patent and growing in popularity. VP8 is a patent-free alternative developed by Google.
- **Language standards:** HyperText Markup Language (HTML) is an open standard which is said to have contributed to the success of the Web. C++ is a programming language which is so widely used that it has been standardised.

### Document Interoperability

The ambition of open document standards is for users, each using their own choice of editor, to be able to exchange files between themselves. Despite the efforts of standardisation, problems remain in achieving this seamless interoperability.<sup>8</sup> Problems cited include the formatting and styling of documents, under-specified standards and implementations

trailing behind the standard due to their product development cycle. This often means that documents must be edited in their original software for perfect results. It is hoped that this situation will improve as standards mature and stabilise and vendors address differences between their implementations. Collaborative 'plugfest' meetings between implementers have already yielded benefits.

### **Relevance of Open Standards to OSS**

Some OSS advocates say that royalty-free open standards are necessary to put OSS and proprietary software on a level playing field. Over half of open source projects are licensed under the GPL or LGPL, which cannot comply with a standard which is encumbered by patent. Some say that requiring OSS developers to pay royalties would be incompatible with the free distribution model of open source. Others claim there are counter-examples (such as Mozilla 'supporting' the patent encumbered video codec H.264) although no examples are accepted as conclusive.

There is broad consensus that open standards do not favour open over closed software; rather they widen the scope for all new software solutions. Some therefore argue that RF open standards are economically important, as they allow for market diversification and competition.

### **Open Standards and OSS in Government**

The UK public sector IT budget for 2010-11 was £18bn, accounting for 5% of public sector spending and 15% of the total UK IT market. Around 10% of this figure is estimated to be spent on software and 50% on services.<sup>9</sup>

The government has committed to creating an IT infrastructure based on a suite of compulsory open standards.<sup>2</sup> Whether to allow multiple standards where competing open standards exist, or to mandate only one, remains undecided. Using more than one open standard could increase the potential for interoperability problems. However, as the government is such a large IT customer, mandating one open standard above others is seen by some as a market intervention. It has been suggested that mandating a standard which is encumbered by patent could amount to state aid to the patent holder.

Some experts from business are unconvinced that mandating standards is the best way to achieve a level playing field, and say it would be better to enforce existing good practice in procurement and strict competition laws.

### **Implications for Government**

#### *Procurement*

Using open standards could protect the government from relying too much on a single vendor, and might allow the government to contract home-grown IT firms. Designing IT systems around open standards offers certainty, as any changes to open standards must be agreed with the user base. Consultants advise that migration to a new setup, irrespective of whether it is open or closed source, will be easier if open standards are followed. Therefore, the

government would be in a more powerful bargaining position when procuring new solutions or renegotiating existing ones. Whether choosing an open or closed source solution, procurement processes should ensure that customisation by the supplier does not effectively lock the government in.

#### *Cloud Computing*

In addition to following open standards, cloud computing is one of the main means by which the government expects to improve its use of IT. Cloud computing allows the user to outsource data storage and processing to services supplied by a third party. In October 2011 the Government launched its G-Cloud strategy. This includes the CloudStore, where companies can upload details of their software for consideration during public sector procurement. The aim is to enable small businesses to bid for small projects and allow these to be reused across central and local government. Cloud computing is expected to account for 50% of the government's IT spend by 2015.<sup>10</sup>

Academics warn that standards for cloud computing are lacking, due to the newness of the technology but also because most clouds are owned by large companies such as Google, Amazon and Microsoft. Getting locked-in to a cloud may be tomorrow's version of today's software lock-in.

#### *Archiving and Curation*

Academics suggest that the government could begin to convert documents from proprietary into open formats, which would reduce the risk of losing access to them in the future. While OSS ensures that documents are saved in an open format, this is not always the case for proprietary software. Using open formats in the future would bypass the expense and unreliability of converting documents.

### **Implications for Citizens**

There is consensus that the government should not require its citizens to use specific technologies to access its services. For example, the government has a duty to ensure data and documents are available and accepted in open formats, that websites work in any common browser, and that users of online public services are not constrained in their choice of software. An example is the implementation of the online benefits system by the DWP. This currently requires that users have Microsoft Windows, which most see as an unreasonable requirement by the DWP. Advocates of open standards argue that they are the easiest way to ensure transparency and interoperability.

#### **Endnotes**

- 1 POSTnote 242 – Open Source Software, June 2005
- 2 Government ICT Strategy, March 2011
- 3 Cabinet Office – Open Source Software Security, December 2011
- 4 Qinetiq – Analysis of the Impact of Open Source Software, October 2001
- 5 OGC – OSS Trials in Government, October 2004
- 6 LSE – Total Cost of Ownership of Open Source Software, November 2011
- 7 OFT – Innovation and Competition Policy Part 2, March 2002
- 8 Kesan – Interoperability Issues for Open Standards, September 2008
- 9 Research by Kable via Intellect, September 2010
- 10 Government ICT Strategy – Strategic Implementation Plan, October 2011