

The relationship between Open Source Software and Government Policy

*Understanding commercial models and issues of
sustainability for Open Source development in education*

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Headlines

"the great thing about open source is nobody owns it, a company like Oracle is free to take it for nothing, include it in our products and charge for support, and that's what we'll do. So it is not disruptive at all, you have to find places to add value. Once open source gets good enough, competing with it would be insane".

Larry Ellison CEO Oracle, 18th April 2006, Financial Times

<http://news.ft.com/cms/s/5f7bdc18-ce85-11da-a032-0000779e2340.html>

This document is divided into 3 main parts. This single page of headlines provides a quick indication what it is all about. The executive summary provides more details for those in a hurry. The main paper provides a more comprehensive analysis for those wanting to understand the full rationale.

1. Open Source Software (OSS) is currently the most significant issue related to global change and reform in the ICT industry. Virtually every major player in the industry has developed or is developing an OSS strategy.
2. OSS is a techno-social issue that has deep educational significance beyond the technologies themselves.
3. Good educational practice will ensure that Open Source development is sustained by involving young people and their teachers in participative technological learning.
4. OSS development is highly congruent with the Government's stated e-strategy for schools. It complements policies including social inclusion, social enterprise, personal learning, vocational education, and citizenship.
5. There is credible and growing support for Open Source strategies that can significantly enhance Government policies and the e-strategy.
6. Co-operation between Government, commercial and third sector organisations within the umbrella of the OSS community, is a powerful public-private-third sector partnership waiting to be exploited.
7. Clear leadership has the potential to save literally billions of pounds starting with low risk key strategies. There is huge scope to reduce costs and improve efficiency.
8. A high profile for OSS promotes increased competition that will force down prices and reduce the technological divide providing better value for tax payers.
9. Innovative governments are providing world leadership in technology reform through Open Source Strategies.
10. Public sector education requires an OSS strategy starting with a limited practical research and development exercise to explore better and more efficient methods for public sector software procurement as well as developing the community role of schools.

Executive Summary

Introduction

1. Open Source Software (OSS) continues to grow on a global scale¹. It has established itself as a long term, sustainable and important aspect of the global technological economy and for that reason alone it is relevant to education.
2. Open Source is a sociological revolution² The debate about Open Source has shifted from "Is it sustainable?" to "How can we use it to best effect?"
3. This paper concentrates on the relevance of Open Source to the schools sector. In particular, the relevance of OSS to UK Government policy and strategy together with the practical methods for using OSS development to support transforming learning and bridging the digital divide⁴.
4. The Open Source model is proving to be far more efficient than the systems it is replacing⁵. It therefore has scope to improve value for money in education and throughout the public sector.

Government policy

5. Government education policy⁶ places emphasis on Internationalism, Citizenship, Social Enterprise, Inclusion, Vocational Learning, Personalised Learning, Understanding Technology and the Environment.
6. Open Source Software and the associated development communities are a largely untapped resource that is directly relevant to each of these themes and to the e-strategy "Harnessing Technology: Transforming learning and children's services"
7. Open Source communities are collaborative "Third Sector" organisations, often international in nature. They have the real practical potential and the track record to turn rhetoric about transforming learning into reality. It is not just about technology, there is relevance to participation for many subjects, from literacy and languages to business and enterprise. The principle of personal individual contributions to projects and peer support is deeply ingrained in the culture of Open Source development communities.
8. The "Learning Through Participation" paradigm is inherent to the Open Source development method and the learning and support is personalised through community membership. Training is therefore implicit to participating in Open Source communities.
9. Open Source communities have a proven track record in global leadership in technological change and capability. By involving people at grass roots level in the development of their own resources we make them less dependent and more capable. The

principle does not need to stop at coding but involves marketing, content production, quality assurance and a whole range of useful skills and knowledge all in the context of social enterprise.

10. Open Standards are at the heart of e-gif⁷ policy. Open Source communities have provided leadership in Open Standards through, for example, W3C⁸ and ISO 26300³. Reform requires doing things differently. This is just as true for resourcing software development and interoperability as it is for teaching methods.
11. Educational initiatives such as the Specialist Schools and City Academies⁹ programme are central to the Government's strategy for education reform. Specialist Schools and Academies have a mandate to provide national leadership in their specialism but also in general areas such as ICT and enterprise. Involving pupils in international community projects that use internet technologies for global communications to promote citizenship directly, supports the "Essential Characteristics" of Specialist Schools. The research evidence⁵ shows that investment in Open Source is instrumental in moving to a new level of efficiency and effectiveness in our delivery and therefore directly contributes to a key objective in the e-strategy.
12. By participating in an Open Source project, a pupil is learning by creating something useful for the community. This prepares the pupil for work in international co-operative environments where technological understanding is valued. This really is transformational learning for the 21st Century.
13. Understanding has always been a more worthy educational aim than simply knowing¹⁰. The very methods that led to the science that is at the heart of every developed economy in the world is the foundation of Open Source. As learning environments, Open Source communities are potentially far more important than any products that come from them.
14. Throwing away around a million computers from schools every few years, is environmentally unsustainable¹¹. Strategies that accelerate the production of internet-based applications and Open Source software are likely to make a significant impact on environmental waste and are fully compatible with the DfES's e-strategy and environment policy. A school where 80% of the terminals are thin clients¹³ will save thousands of pounds in electricity reducing carbon dioxide emissions.

Social inclusion, equality of opportunity and the digital divide

15. Social inclusion, equality of opportunity and bridging the digital divide are closely related. Inclusion starts with access but is dependent on expertise. To sustain inclusion there is a need to get fundamental costs down to a point where all can participate. Open Source enables this to happen.
16. Investment of public money needs to be better targeted on

learning applications that run on standards compliant browsers on low cost terminals if social inclusion really is a high priority.

Competition and the commercial market

17. Efficient performance is not specifically driven by whether or not the organisation is in the public or private sector, it's usually a function of accountability. Private sector monopolies are primarily accountable to their shareholders for optimised profits and so the prime consideration will be to get the biggest possible return for shareholders spending the least possible on service to the customer. Competition is a prime driver of accountability to the customer, particularly in the private sector. It's therefore in any large customer's interest to stimulate increased competition in private sector markets where it is lacking.
18. It's much more straightforward to adopt a strategy that avoids expensive competition legislation. Open Source software provides the means of devising such a strategy to promote competition to optimise value for money. There is ample support from a range of commercial and not for profit organisations.

The economics of Open Source development

19. Software costs have two key components. The first is the cost of developing the code, the second the cost of getting people to use the code. The latter is often more related to marketing and branding than it is to fitness for purpose, particularly in a monopoly. Value for money is achieved if the intended outcomes are fit for purpose and the development, distribution and marketing costs are as low as possible.
20. It is easy to see why much of the revenue from software license sales never finds its way back into development. Marketing, legal costs and taken profits can easily account for most of the revenue. Buying licenses doesn't make much economic sense when equivalent tools are freely available and it makes even less sense for large organisations that end up paying more in license fees than the entire development cost of the software that they are using.
21. Paid for licenses share the cost and absolve the user from the development risk but with scope for huge inefficiency. This model assumes that development has to start from scratch but in large applications such as OpenOffice.org, Moodle and Firefox, most of the work is already done so the risk of contributing relatively small extensions and incremental improvements is small. Clearly Open Source development is based on a different economic paradigm to commercially licensed proprietary software¹⁶ and it exists and grows so the model must work. For small applications such as software content supporting a particular learning objective, risk is minimal since the application is relatively simple and inherently low cost at the outset.
22. Unlike many other products there are virtually no manufacture or

distribution costs for software. Marketing for Open Source is largely by word of mouth and the fact that anyone can distribute and try out the software freely. As long as we are reasonably sure of what we want to achieve and build on existing resources, direct funding of Open Source software is orders of magnitude less expensive than buying software licenses. As a specific example, consider how much new software has been generated from a £330 million investment in Curriculum On-line?¹⁵

23. For £330 million plus all the overhead in managing installation of copy protected software it would be possible to develop an On-line Curriculum covering ages 5-16 in every subject at least 10 times over. This volume of standards compliant learning applications would also enable schools to migrate to lower cost open platforms significantly reducing infrastructure costs and enabling home access.

Open Source Strategies to complement standards policy

24. Start from the premise that the over-riding priority for Government funding is compliance with open standards and publicise this at every opportunity to embed the principle in the culture of development companies. That alone would make a significant impact on accelerating progress towards achieving the e-strategy.
25. Ensure that all future applications developed from public funds work across open platforms and that the products have an Open Source license unless there is a really insurmountable reason why not. Make development funded by the public purse open for the benefit of all the taxpayers who paid for the development.
26. Establish Moodle as a reference standard for VLEs. This is not to say that schools can not use any VLE that they choose, just that it has to interoperate reliably with Moodle as the reference standard. This will ensure a high degree of interoperability between all VLE platforms. Since Moodle is Open Source there is no commercial advantage being given to any particular company.

Leadership

27. Leadership²² starts with understanding problems and potential solutions to problems and then uses this knowledge and understanding to instil confidence in others to follow. No change and reform will take place without leadership and leadership does require risk. On the other hand doing nothing can be a bigger risk, particularly in a global environment where others are only too willing to benefit from the disruptive innovation that characterises technological change.
28. The fact is that for infrastructure, Open Source already has sustainable²⁴ momentum behind it worldwide, the internet is fundamentally dependent on Open Source software and governments from China to South America have taken action to promote its use²⁵. It's more a matter of how quickly, rather than if, it will grow further. Globally, Open Source will continue to grow

whatever action the UK Government takes, the choice is whether to be a leader or a follower.

Examples of specific low risk projects

29. **OpenOffice.org.** A public/private/third sector partnership between the DfES and the Open Document Fellowship to produce a compact reader for ISO 26300 documents would cost an estimated £75,000 in Government matched funding. (The community would donate a lot more than 50% of the development resource). It would provide positive leadership in moving to less expensive software in the public sector even if only because of the effect on competition. Inexpensive, low risk but a practical means of improving value for money in the public sector that far outweighs the finance required. Make it policy that schools, LAs and Government agencies accept documents in ISO 26300 format.
30. **Web based Open Source applications.** Extend the Specialist Schools and Academies project to source the development of an Open Source section for Curriculum On-Line. From April 2007, earmark 20% of current COL funding ie £20 million a year to support this development through additional grant funding for the schools that show capability of commissioning/producing Open Source web based learning resources.
31. **Competitions for learning content.** Operate school based competitions for the best contributions to Virtual Learning resources. If all VLEs are interoperable with Moodle it won't matter which platform is used. Students contributing useful resources will have the added benefit of the work counting towards a VRQ¹⁹ at L2 through the Learning Machine Ltd. For example, specialist schools could be required to submit something useful in their subject specialism as part of their qualification for redesignation. City Academies should produce a new and original virtual course as part of their incorporation. In short, provide incentives for the pioneers to transform learning through participation and to promote social enterprise and others will follow.

Conclusion

32. A strategy for Open Source is needed if UK education is to keep up with global technology developments. The next section covers the ground in this summary in more depth and with more examples providing an evidence base for the judgements made.

Main Paper

Introduction

33. Open Source Software (OSS) continues to grow on a global scale¹. There is no doubt that it has established itself as a long term, sustainable and important aspect of the global technological economy and for that reason alone it is relevant to education.
34. It's common for Open Source to be seen as a purely technical issue, driven by existing commercial imperatives when in fact it is a sociological revolution² that challenges accepted economic practice. Open Source has proved its power in influencing global standards e.g. Apache web server and Open Document (ISO 26300)³. It exists and thrives so there are clearly commercial models that work even if they are different from the more familiar paid for software license. The debate has shifted from "Is it sustainable?" to "How can we use it to best effect?"
35. This paper concentrates on the relevance of Open Source to the schools sector. In particular, the relevance of OSS to UK Government policy and strategy together with the practical methods for using OSS development to support transforming learning and bridging the digital divide⁴.
36. Commercial models for OSS are already sustainable in education but can be seriously inhibited or enhanced by Government intervention even in seemingly unrelated spheres. It is therefore vitally important that the OSS community, of which the Government is a member, works collaboratively to ensure that the fledgling software development environment for OSS applications in schools is appropriately supported when compared to the established closed source proprietary licensed sector. It's not a matter of complete polarisation of all one or all the other, it's about incremental management of change reflecting what is happening in the global technology industry with a view to providing best value for the tax payer.
37. A great deal of this is dependent on learning about the different ways in which the resources for development are made available and some immediate practical research and development is the sensible way forward. The good news is that the support required in order to achieve a significant impact is likely to be far, far less than the grants being provided for purchasing software licenses. The Open Source model is proving to be far more efficient than the systems it is replacing⁵.

Government policy

38. Government education policy⁶ is extensive and complex but we can pick out some key relevant themes:
39. Internationalism, Citizenship, Social Enterprise, Social Inclusion, Vocational Learning, Personalised Learning, Understanding Technology and the Environment.
40. The e-strategy "Harnessing Technology: Transforming learning and children's services" provides four key objectives.
 - transforming teaching, learning and child development, enabling children and learners of all ages to meet their highest expectations
 - connecting with hard-to-reach groups in new ways
 - opening up education to partnerships with other organisations
 - moving to a new level of efficiency and effectiveness in our delivery.
41. Open Source Software and the associated development communities are a largely untapped resource that is directly relevant to each of these objectives.
42. Taking each of the six priorities in turn:
 - an integrated on-line information service for **all** citizens
43. Social inclusion and equality of opportunity require universal access and that is the value proposition of both Open Standards and Open Source. Without Open Standards and Open Source infrastructure, the cost and complexity of providing on-line services will further entrench the technological divide.
 - integrated on-line personal support for children and learners
44. Integration is enabled by standards. Active support for fully open standards improves the chances that the fundamental infrastructure is freely accessible by anyone from anywhere. Active support for Open Source enables basic access without having to pay for software licenses which then allows more of the financially disenfranchised to participate. It is impossible to target every potentially disadvantaged group with subsidies. Far better to provide the basic tools freely for everyone at very low cost. This can be achieved since most of the development work has already been done.
 - a collaborative approach to transforming teaching and learning
45. Open Source communities are the epitome of the collaborative approach and directly complement "Third Sector" policy. They have the real practical potential and the track record to turn

rhetoric about transforming learning into reality. It is not just about technology, there is relevance to participation for many subjects, from literacy and languages to business and enterprise. The principle of personal individual contributions to projects and peer support is deeply ingrained in the culture of Open Source development communities.

- a good quality training and support package for practitioners

46. The "Learning Through Participation" paradigm is inherent to the Open Source development method and the learning and support is personalised through community membership. Training is therefore implicit to participating in Open Source communities. Open Source communities already support personalised learning, it's nothing new to those that take part, young or old.

- a leadership and development package for organisational capability in ICT

47. Open Source communities have a proven track record in global leadership in technological change and capability. By involving people at grass roots level in the development of their own resources we make them less dependent and more capable. The principle does not need to stop at coding but involves marketing, content production, quality assurance and a whole range of useful skills and knowledge all in the context of social enterprise. This means that the methods can support most of the subjects in the school curriculum. Organisations such as SF-UK, OSC and OFE can help support the development of leadership through Open Source communities.

- a common digital infrastructure to support transformation and reform

48. A common digital infrastructure implies Open Standards if it is to be freely and fairly accessible and conform with e-gif⁷ policy. Open Source communities have provided leadership in Open Standards through, for example, W3C⁸ and ISO 26300. Transformation and reform require doing things differently. If we don't change the methods we will not change the outcomes. That is just as true for resourcing software development and interoperability as it is for teaching methods.

49. Educational initiatives such as the Specialist Schools programme and City Academies⁹ are central to the Government's strategy for education reform. These initiatives emphasise key educational dimensions that are thought to add value to a common base-line for statutory education. Specialist Schools and Academies have a mandate to provide national leadership in their specialism but also in more general areas such as ICT and enterprise.

50. In a globalised economy, pupils need to be internationally aware. Some schools specialise in Modern Foreign Languages and all Specialist Schools and City Academies have a remit to promote

internationalism. E-commerce and international trade have been revolutionised by the internet and citizenship has become a new subject in its own right for all schools. So what would be better than involving pupils in international community projects that use internet technologies for global communications to promote citizenship? There is obvious scope for schools in developed countries to work co-operatively with those in developing countries on focused projects related to Open Source communities.

51. Open Source communities are characterised by their international contributors and form a natural vehicle for international co-operation for community benefit directly complementary to the Citizenship strands in the statutory secondary curriculum, namely:

- knowledge and understanding about becoming an informed citizen
- developing skills of enquiry and communication
- developing skills of participation and responsible action.

52. The definition of a good citizen in an Open Source Community is someone that gives as well as takes from the community. The benefit to the community is summed up by the phrase "Give a brick, get a house". Open source communities are examples of international, participative, social enterprise in action enabled by the internet. Anyone is free to join in.

53. The research evidence⁵ shows that investment in Open Source is instrumental in moving to a new level of efficiency and effectiveness in our delivery and therefore directly contributes to another key objective in the e-strategy.

54. Moreover, by participating in an Open Source project, a pupil is learning by creating something useful for the community. Apart from generating more motivation than working towards a purely theoretical end, this prepares the pupil for work in international co-operative environments where technological understanding is valued. This really is transformational learning for the 21st Century.

55. Understanding has always been a more worthy educational aim than simply knowing¹⁰ and in a world of rapid change, understanding is absolutely essential in preparing pupils for technological change. Open Source communities are personalised learning environments, effectively free international schools, where understanding is valued and effectiveness peer assessed on the value of the outcome. The very methods that led to the science that is at the heart of every developed economy in the world. The outcomes are directed by the interests of the individuals providing a dimension of badly needed curriculum flexibility in what is becoming and increasingly prescribed set of activities. It may be that as learning environments, Open Source communities are shown to be far more important than any products that come from them.

56. Environmentally, the current cycle of refresh, throwing away

around a million computers from schools every few years, is unsustainable¹¹. Effectively, there is a commercial drive to obsolescence because every new machine sold results in the sale of an operating system and the specification of the hardware is determined by the design of the operating system. When 90% of the software applications require one operating system from a single source of supply, and it's the operating system rather than the applications that determines the hardware specification, there is a constant pressure for abuse of that monopoly position¹².

57. Open Source software makes hardware longevity more likely because the development pressure is to improve the code, not to sell more licenses through forced upgrades linked to de facto standards. The forced upgrade model has had its day. The writing was on the wall as soon as internet based applications started to appear^{12.1}. So any strengthening of the Open Source infrastructure is likely to result in environmental benefits. This is also true of the shifting paradigm, from the desktop PC as the platform for running applications, to the Open Internet which is recognised in the DfES e-strategy. All other things being equal, developing web applications is less expensive than developing for the desktop, less complex and more sustainable. Strategies that accelerate the production of Internet-based applications and Open Source software are likely to make a significant impact on environmental waste and are fully compatible with the DfES's e-strategy and environment policy. A school where 80% of the terminals are thin clients¹³ will save thousands of pounds in electricity reducing carbon dioxide emissions. Thin clients will get greater take up if there are more internet based applications developed to support learning. The situation just requires leadership to support open technological infrastructure and web based, open applications to support learning.

Social inclusion, equality of opportunity and the digital divide

58. Social inclusion, equality of opportunity and bridging the digital divide⁴ are closely related. With the evidence that people are 8 times more likely to use a home internet connection than one in their place of education¹⁴ and that social classes A/B have approximately 3 times as many Internet users as social classes D/E, the digital divide is still a considerable problem.
59. Inclusion starts with access but also depends on expertise. Access means a connection and terminal and the immediate availability of appropriately organised resources together with the levels of literacy and technical skills to make use of them. The more ubiquitous access is, the less likely anyone will be excluded. Achieving universal access to 90% of applications is more inclusive than giving 60% of the population access to 100% of the applications. For this reason there should be a shift from seeing innovation as cutting edge and expensive technologies to an emphasis on innovation as getting universal take up of the most commonly used applications. This does not mean no use of cutting

edge technologies, it means that the priority simply shifts from the technology itself to the social and educational impact it has on people.

60. In many cases where there is danger of exclusion or inequality, Government intervention takes place, whether through legislation, regulation, or funding specific projects. Ironically, some well-intentioned projects have exactly the opposite effect than intended. Subsidies and funding specifically targeted on buying software licenses in a sector that would not have bought them otherwise is great business for companies that make their money from selling such licences. It is a disaster for the commercial Open Source sector and does nothing to tackle the longer term root problem, entrenching current de facto standards and ensuring the universal adoption of open standards is further delayed. This in turn delays bridging the digital divide.
61. Expertise and its uniformity is a significant factor in providing equality of opportunity to learners. If the teachers in one school are more expert at choosing software than those in another, some students are relatively disadvantaged compared to others. To an extent this is inevitable, the question is how to reduce the effect? A freely accessible core of learning support materials that systematically covered the National Curriculum from 5-16 would certainly diminish this effect and contribute to a fairer situation for learners.
62. Social inclusion requires very low cost or free access from home as well as school. Investment of public money needs to be better targeted on learning applications that run on standards compliant browsers on low cost terminals if social inclusion really is a high priority. Worry less about technically complex applications that require the latest expensive technology to which few people have access and more about simple and elegant learning solutions that require minimal resources to be accessible by all and comply with internationally agreed open standards. This will not happen without a serious shift in attitudes and leadership to implement practical strategies for change.
63. In terms of the digital divide there are two clear options. Get the price of access down so that even the poorest can afford it or subsidise all/some of those who can't afford to participate. Open Source software provides an opportunity for fundamentally lowering costs, increasing the effective level of competition and motivating people to learn through active participation. On those grounds alone it makes sense to have a clear national strategy for Open Source software development as part of the wider strategy for social inclusion in education.

Competition and the commercial market

64. The Competition Commission is responsible for ensuring that competition is not "distorted, restricted or prevented" in any UK market for goods or services. It is complemented by the Office of Fair Trading which investigates issues related to cartels (Chapter I

prohibitions) and abuse of a dominant market position (Chapter II prohibitions)¹⁷. There is a clear aim to ensure that there is healthy competition in markets and appropriate regulation where this can not be achieved.

65. In highly competitive commercial markets competition forces prices down and poor quality of service simply means the customer moves to another supplier. Regulation is used where monopoly supply is difficult to avoid, e.g. in the provision of education or commodities such as water or electricity. Efficient performance is not specifically driven by whether or not the organisation is in the public or private sector, it's usually a function of accountability. Private sector monopolies are primarily accountable to their shareholders for optimised profits and so the prime consideration will be to get the biggest possible return for shareholders spending the least possible on service to the customer. Competition is a prime driver of accountability to the customer, particularly in the private sector. It's therefore in any large customer's interest to stimulate increased competition in private sector markets where it is lacking.
66. It is in some ways surprising that the Competition Commission and the Office of Fair Trading have not acted with more vigour in the ICT industry given their activities with the utility companies. After all, operating system and general productivity software have become universal utility commodities¹⁸ on which most people are dependent. Part of the reason at least is in the complexity not only of the technology but the way in which it is licensed and the fact that unlike the utility companies the ownership of the commodity originates outside the direct legislative scope of the Government. For these reasons, it is much more straightforward to adopt a strategy that avoids expensive legislation and regulatory bodies. Open Source software provides the means of devising such a strategy and the Open Source community has the knowledge and expertise to turn strategy into effective practice at low cost.

The Economics of Open Source development

67. There are three key aspects to consider in the economics of software development. The first is the cost of developing the code, the second the degree to which the code developed is fit for purpose and the third the cost of getting people to use the code. Software is fit for purpose if the investment in its production results in the intended outcomes. Value for money is achieved if the intended outcomes are fit for purpose in the eyes of the users and the development, distribution and marketing costs are as low as possible. To start with I will consider the commercial "licenses for sale" model followed by the Open Source model and then look at them in terms of the recent funding of education software applications by the DfES through Curriculum On-line.
68. Funding of development in the commercial licensed proprietary software arena is complex. "At risk" finance is used to develop code which is then promoted and if popular recoups the

investment by selling licenses after the development has taken place. Often the main cost is marketing and promotion and quite often it's the most heavily promoted application that wins out, not necessarily the best product. It is easy to see why much of the revenue from sales never finds its way back into development. In addition, revenue after development might simply be taken as profits. For an individual, buying a license has become the standard method of acquiring access to powerful software applications. However, this doesn't make much economic sense when equivalent tools are freely available and it makes even less sense for large organisations that end up paying more in license fees than the entire development cost of the software that they are using. Reduction of risk is a consideration, but not the only one when it comes to achieving best value.

69. Open Source development is based on a different economic paradigm to commercially licensed proprietary software¹⁶. Understanding how it works is not intuitive, if it was, change would have happened a lot earlier. But many discoveries are non-intuitive. It was not intuitive to Galileo's contemporaries that all objects accelerate to earth at the same rate irrespective of their weight.
70. *"Discovery consists of looking at the same thing as everyone else and thinking something different."*
Albert Szent-Gyrgyi, Nobel Prize winner
71. The resources for Open Source development have to be available at the time the development takes place as with the previously described model but the motivation for development can't be predicated on selling licenses in the future. The traditional argument against direct funding of development is that it's too big a task for individuals and too big a risk for public sector organisations. What if the software is badly received, goes over budget or is full of bugs? For sure, the risk is big if we assume we are dealing with a large monolithic project that is unlike anything that has gone before. In many cases, this is not the situation. In large applications such as OpenOffice.org, Moodle and Firefox, most of the work is already done so the risk of contributing relatively small extensions and incremental improvements is small and many people can share what risk there is because anyone is free to contribute and there are still highly organised quality assurance procedures. For small applications such as software content supporting a particular learning objective, risk is minimal since the application is relatively simple and inherently low cost at the outset. So it is clearly possible to minimise the risk. Often the paid license model will present greater risk because the customer has to fit to the software and in the case of monopoly supply, pays highly for lock-in. Despite extensive safeguards and complex procurement procedures large closed source software projects, commissioned by Government, have a poor reputation in providing fitness for purpose or value for money. It might be that Government is no better at seeding Open Source projects but there is very little empirical evidence from research and development to be certain.

72. Unlike many other products there are virtually no manufacture or distribution costs for software. Once the development is complete, allowing others to freely improve the resources at no cost to the tax payer is a much more efficient use of public funds for the public good. The DfES has inbuilt promotional channels removing much of the advertising cost of getting products to schools and there are additional benefits such as learning through participation that are of value even though difficult to quantify. As long as we are reasonably sure of what we want to achieve, direct funding of Open Source software development is orders of magnitude less expensive than buying software licenses for large scale projects as we shall see later. Even if the first version of the product (s) was lacking, most of the work would be done and community members would be free to improve and enhance the work. This requires a fundamentally different attitude to funding software development. It does not mean that there is absolutely no place for commercially licensed proprietary software, but it does mean that fundamental changes in the management approach are needed. No innovation, no change, no reform.
73. Let's now look at a specific example. Take the recent funding for educational software development as an example. How much **new** software that is fit for purpose in terms of the e-strategy, has been generated by the investment of £330 million in Curriculum On-line?¹⁵ How would an independent audit judge value for money on this investment?
74. It seems that only a relatively small amount of the software available through Curriculum On-line complies fully with web based standards and much of it is nothing at all to do with on-line learning. On-line purchase of curriculum software, perhaps, but that seems a particularly unambitious goal in the context of building schools for the future (BSF). Fit for purpose? There is no coherent systematically organised support for what is a statutory curriculum getting on for 20 years old. What would a reasonable baseline for a fit for purpose on-line curriculum look like? Perhaps being able to go to any standards compliant web browser and obtain access to learning applications that give systematic and full coverage of the statutory curriculum with the resources matched to a range of learning needs. Indeed this too is a requirement for social and economic inclusion.
75. One would also expect ease of maintenance and ease of use to be fitness for purpose criteria for any software. So how easy is it for schools to try out Curriculum On-line software before buying it in order to ensure value for their money? Compare booking an airline ticket or ordering a book on the Internet with gaining access to learning resources for a primary school. First, order software, receive it, unpack it from its box, read a manual about the methods for installation and then install to maybe 100 individual machines each needing a different license key and subject to a range of security issues. All this just to access one application which could turn out to be a lot less useful than first envisaged. If airlines can handle their complex transactions

through standards compliant browsers, is it too much to expect similar simplicity in access to learning resources? Clearly the cost of Curriculum On-Line software is a lot higher than just the license fees.

76. The relatively new Open Source companies, many of which are small businesses, make money¹⁶ from services, support and products associated with Open Source Software. According to the large software companies, software licenses are a marginal aspect in the total cost of ownership. The average spending on ICT in a secondary school in 2004 was £88,200. The cost of MS Schools Agreement¹² licenses for 1000 seats in a school of the future would alone be about a third of that expenditure before buying any educational application or other non-MS productivity tools, technical support, broadband subscriptions or hardware replacements. This does not take account of the basic cost of operating systems that come with every new computer, about £80 of the buying price or £80,000 for 1000 seats. The Open Source view is that if software development is in the whole scheme of things a marginal cost, let's just absorb the cost into other services because the alternative is to have a marginal issue that dictates the entire ICT strategy in the school.
77. In fact, software development costs for most infrastructure and productivity tools are only a fraction of the buying price of licenses^{12,2} so the development cost really is very small if tackled sensibly - Typically 75% profit margins are made on MS Windows and MS Office so only 25% of the price is for development and other business expenses, in reality probably less than 5% for development when marketing, legal costs and subsidies of unprofitable business are taken into account. Compare the size of the development team of OpenOffice.org - around 80 developers, and Firefox - 20, with the 11 billion in revenue from MS Office in 2005. IBM, Sun, Google, Oracle and Novell seem to have grasped this reality and virtually all the big industry players have Open Source strategies. It is the model of commercial software licensing that is unsustainable, not the Open Source model, particularly in schools where the need is 1:1 access. As hardware prices have fallen, the proportion of the price of a computer that is software licenses is getting ever larger. The e-strategy states that "moving to a new level of efficiency and effectiveness in our delivery" is a key objective and this will only be achieved through changes in attitudes to software procurement.
78. Its easy to find fault, but what of solutions? Take a reasonable cost of developing one hour of open source web based learning content at £1000 (figure is based on real experience so it is of the right order of magnitude) £500m would generate 500,000 hours of learning content all of which is free for re-use, modification and recombination. In an 11 year National Curriculum with 1000 hours of teaching per year that is 45 different possible strands of support for the entire curriculum from 5-16. Even if we were only 20% efficient it would still be 9 levels of differentiation for every single year in all the subjects. This demonstrates that Open Source development is at least an order of magnitude more efficient than

the conventional paid for license method and possibly as high as two if we take into account that the software pool can be freely augmented with voluntary contributions and has virtually no installation or administrative overheads. After what will be a £500 million investment, the taxpayer is entitled to ask where the freely usable resources compliant with Open Standards are to be found? Where is the universally accessible on-line curriculum on the National Grid for Learning?

79. This volume of standards compliant learning content that worked on any computer platform would be usable on refurbished hardware running free software. That would directly contribute to bridging the digital divide by lowering the cost of access at the same time reducing environmental waste. More machines taken out of landfill and more terminals in schools and homes including more of those that are currently excluded.
80. While the DfES has ploughed hundreds of millions and perhaps billions over the years into the commercial license model, it has invested virtually nothing in the up and coming Open Source model, not even small amounts to specific projects for practical research and development. Since direct or indirect Government funding is what drives educational software development, it's rather unsurprising that the quantity of Open Source applications focussed on education is low. If there was a fully informed investigation of the value for money provided by Curriculum On-line what conclusions would be likely to be drawn?

Support for Open Source applications

81. One of the criticisms levelled at Open Source software is that it lacks support. This is entirely incorrect. There is support from the volunteers taking part in the projects themselves which is free, support from community organisations such as SchoolforgeUK and commercial support from large companies such as Sun Microsystems as well as a range of SMEs. The SME sector is particularly interesting because these small specialist companies are the large companies of tomorrow and most are founded on highly educated enterprising people where intellect and knowledge is the stock in trade. These are the very hi-tec companies with the capacity to recognise industry trends early. They have the capacity for growth that is the future life-blood of an advanced economy.
82. As an example, directly related to education, initiatives such as the International Grades in Office Technology¹⁹ where students can achieve L2 VRQ certification by making contributions through community participation, add educational value to the Open Source proposition in a way that is impossible with traditionally licensed software. This is also consistent with QCA's "vision for assessment". Please refer to the Schoolforge UK web site at www.schoolforge.org.uk for further case studies.

Open Source Strategies to complement policy

83. If on-line resources fully meet W3C⁸ standards they will be accessible using Open Source applications. Where on-line resources do not conform to Open Standards or are written specifically for a proprietary browser or operating system that does not conform to Open Standards there is an increased likelihood that some or all aspects will not work reliably. This is also true of on-line assessment resources. Start from the premise that the over-riding priority for Government funding is compliance with open standards and publicise this at every opportunity to embed the principle in the culture of development companies. That alone would make a significant impact on accelerating progress towards achieving the e-strategy. Short term savings from using proprietary applications and defacto standards often represent a false economy when judged against the return on investment.
84. Ensure that all future applications developed directly or indirectly (licenses purchased) from public finances support open standards and work across platforms. This is no different in principle to requiring new buildings to have facilities for the disabled or meeting certain ISO standards. In any future direct public funding of new applications, ensure that the products have an OSI Open Source license and that they are able to run across at least GNU/Linux and Apple platforms as well as Windows unless there is a really insurmountable reason why not. Invite suggestions from knowledgeable Open Source experts to advise on whether perceived insurmountable problems really are unrealistic to resolve. All educational web based resources should be capable of running on GNU/Linux through a standards compliant browser as

well as being WCAG priority 2 compliant simply on the grounds that the GNU/Linux users are just as much a minority group as blind or deaf people. They are simply being economically disenfranchised rather than as a result of physical disability.

85. While in the first instance it will not be possible to ensure every single software application conforms to the principles of Open Architecture, that should be the goal and it is worth making an effort to get to that position. Making development funded by the public purse open for the benefit of all the taxpayers who paid for the development seems more than reasonable.
86. There are two ways of defining standards. One is to write detailed specifications as in the 800 pages of documentation for ISO 26300 (Open Documents), the other is to create a reference application that defines the standard. The problem with the former approach is that it can be very difficult to be sure to include all the relevant details in the specification and testing an application to assure compliance against the standard can be a complex task. Defining a reference application can be very useful and is in fact the way de facto standards usually work. The reference standard for the .doc file format is Microsoft Word. The advantages of a reference standard are that checking compliance is much simpler than reading extensive documentation. The problem with a proprietary reference standard is that it conveys an unfair market advantage to a single proprietary interest. This is not a problem with Open Source reference standards since there is no commercial interest in the reference standard that can not be exploited by anyone. In this way OpenOffice.org is the reference standard for ISO 26300, but KOffice and indeed any closed source software application including MS Office can still adopt the standard and test their own compliance through interoperability with OpenOffice.org.
87. Part of the e-strategy is the use of virtual learning environments. Ensuring interoperability between different VLE platforms is a key problem. If one child's information is in one platform and that child moves schools how can we be sure that all the information is easily transferable if the schools are using different VLEs? Defining a reference standard gets round this problem in a simple way. If it is mandatory that all VLEs inter-operate reliably with the reference application interoperability is much more certain. If the reference standard is Open Source anyone can build a product that will interoperate with it. There is already a very credible candidate for such a reference application.
88. Moodle²⁰ thrives worldwide. It has 100,000 registered users on the main site, increasing daily and representing 150 countries and 70 languages. There is no need to look further for a reference standard for VLEs. Adopting Moodle as a reference standard ensures that competition in the VLE space because no single commercial product will be able to establish a monopoly based on data formats. For proprietary commercial products to be taken up they will need to add some significant value to the functionality of Moodle other than simply establishing a large user base with proprietary data formats. If they can't do this, why should the tax

payer pay for tools that are free with Moodle and do the job just as well? In summary, we are not saying that schools can not use any VLE that they choose, we are just saying that it has to interoperate reliably with Moodle as the reference standard. This is rather like translation engines that use Esperanto as the intermediate step in translating between two languages. Esperanto is spoken by a relatively small number of people, but it is a very useful reference in translation since each language only needs to be able to translate to and from Esperanto, not every other possible language. It might not be perfect, but its a lot better than the alternatives.

89. Open Source projects are an innovative route to public, private and third sector partnerships that draw genuine resource from the community. They also provide a very efficient means of providing useful resources to developing countries. This is why leadership and vision are important. Talking the talk of innovation is easy, walking the walk is more of a challenge but does not have to be high risk if the change is managed from a foundation of knowledge and experience.

Leadership

90. Leadership ²² starts with understanding problems and potential solutions to problems and then uses this knowledge and understanding to instil confidence in others to follow. The entire IT industry is based on confidence. Consumer confidence in the IT industry is derived largely from comfort and familiarity. There has been long-term acceptance of high costs and low quality rather than a critical drive to reduce costs and increase quality. As the industry matures and core applications become commodities, this will become increasingly unsustainable.
91. The main starting point for de facto standards in microcomputers was IBM, the dominant force in global computing. They provided confidence in the industry through the IBM PC²³. An open hardware architecture backed by the biggest player in the market who actually thought microcomputers were not really very significant. (At the time components like processors and operating systems were not considered to be strategically important) This provided security and confidence. An expensive, monochrome, silent machine at a time when there were inexpensive, multi-screen mode, colour and polyphonic machines in abundance. This is the power of leadership in establishing a national or international standard. Instilling confidence in the user base so that applications developers believe there is a sustainable market. This is the leadership challenge for governments with Open Source Software. Open Source software provides the same potential open-architecture advantages for software that IBM established for hardware.
92. The fact is that for infrastructure, Open Source already has sustainable²⁴ momentum behind it worldwide, the internet is fundamentally dependent on Open Source software and governments from China to South America have taken action to

promote its use²⁵. It's more a matter of how quickly, rather than if, it will grow further. Globally, Open Source will continue to grow whatever action the UK Government takes. The DfES can either be seen as reactionary to technological change or it can embrace and accelerate it. Leader or follower? A clear Government statement that Open Source development was high on its agenda backed by some modest but strategically significant public/private/third sector partnership projects will provide clear leadership that reinforces a range of Government policies. Initial projects can be modest but scalable in order to support change management, reduce risk and promote early success.

Examples of specific low risk projects

93. **OpenOffice.org.** A public private partnership between the DfES and the Open Document Fellowship to produce a compact reader for ISO 26300 documents would cost an estimated £75,000 in government matched funding. (The community would donate a lot more than 50% of the development resource). It would provide positive leadership in moving to less expensive software in the public sector even if only because of the effect on competition. Inexpensive, low risk but a practical means of improving value for money in the public sector that far outweighs the finance required. Since ISO 26300 is an internationally ratified open standard it should be mandatory that public sector organisations accept files in this format. This does not prevent data being accepted in proprietary formats, only that those that want to use Open Standards are not prevented from participating.
94. Such a reader would support government departments in providing the leadership needed to establish Open Documents as a standard directly complementary to the spirit of Government e-gif⁷ policy as well as social inclusion and bridging the digital divide. It would bring positive worldwide publicity. Wherever a Government department makes available a document for download use ISO 26300 and the reader with a note to say fully open and free editors are also available providing the appropriate links. This then supports a fully open file format for both reading and editing documents with freely available tools for doing both. Explain that the policy is to use fully open formats and ISO standards wherever reasonably possible, to promote interoperability for the common good. Recommend that schools and LAs download and install the free reader and editors and encourage their use. Expect some complaints and adverse reactions, it's all part of management of change, but expect a lot of praise too from the more technologically educated for providing positive and international leadership.
95. **Web based Open Source applications.** Extend the Specialist Schools and Academies project to develop an Open Source section for Curriculum On-Line. From April 2007, earmark 20% of current COL funding ie £20 million to support this development through additional grant funding for the schools that are most effective in commissioning/producing Open Source web based learning resources and are most effective in involving their pupils in

production. Develop international links to involve co-operative development by UK students and students in developing countries in their own projects to produce Open Source learning resources for the benefit of all. Start by commissioning some fully documented Open Source examples of good practice to provide models for others to follow. Demonstrate applications that are open, well-documented, run cross-platform and support progression in the National Curriculum in primary schools. Divide work into small manageable low risk packages and invite schools to bid for them so there is no need for huge and complex tendering procedures. Only pay grant for satisfactory work on its completion. Encourage individuals and small companies to work in partnership with the schools to reinforce the wider community dimension. This will keep the development price down because small players have lower overheads and at the same time strengthen the links between the schools and local businesses. Use this as an R&D exercise for public sector software procurement to see if doing things differently actually does pay dividends. If Government is serious about reform it needs to test new methods in real situations.

96. **Competitions for learning content.** Operate school based competitions for the best contributions to Virtual Learning resources. If all VLEs are interoperable with Moodle it won't matter which platform is used. For example, specialist schools could be required to submit something useful in their subject specialism as part of their qualification for redesignation. City Academies should produce a new and original virtual course as part of their incorporation. Students contributing useful resources will have the added benefit of the work counting towards a VRQ¹⁹ at L2 through the Learning Machine Ltd. In short, provide incentives for the pioneers to transform learning through participation at grass roots. Promote social enterprise and others will follow.

97. **Potential objections**

Commercial suppliers have invested millions in their VLE products yet the Government is showing favouritism to one product.

98. The reason for choosing Moodle as a reference standard is that it is fully open, in widespread use globally and enjoys *continued* support and development. If any of the commercial suppliers is willing to release their control over their product code through an approved Open Source license, it could be considered in the same way. The DfES' prime considerations are reform of the process of learning to meet 21st Century learning needs and value for money for the taxpayer. Consistent with National Audit Office guidance and the e-gif policy there is an onus on Government to avoid proprietary lock-in and promote interoperability. Moodle represents the best current option to avoid lock-in to specific vendors and to further interoperability between schools in England and Wales and internationally. These factors are highly valued and are decisive in choosing the benchmark for learning platforms. If a company has a significantly better product or more cost-effective

strategy for schools and RBCs, there is nothing to prevent take up of that product but the product must be capable of interoperability with Moodle as the adopted reference application for interoperability.

99. Schools are too busy to develop software

In the UK tradition, some of the best ideas for software to support learning have come from schools which is where the learning expertise is focused. We are simply strengthening the community dimension consistent with existing Government initiatives, in particular, the Specialists Schools and Academies programme and City Learning Centres to enable greater participation by students. This will reinforce the national leadership role of City Academies and Specialist Schools in their subject specialism promoting practical citizenship and social enterprise with a technological focus. The requirements are not onerous and more than adequately covered by the community funding that is already available. Additional grants will be available for schools to commission technical support if they so wish and simply act as quality controllers for the resources developed in their name. The individual school then benefits from all the resources developed by the other schools. If they are prepared to give a brick, in return, they get a house.

100. This will undermine the commercial software sector

101. The Government has put £330 million into the commercial software sector through Curriculum On-line and will presumably continue to fund the purchase of proprietary licensed software. If this modest initiative undermines the sector that is based on selling commercial software licenses it simply demonstrates that the commercial software sector is not producing resources efficiently in the first place. The purpose of Government is not primarily to keep software salesmen in a job. This Open Source initiative is to complement existing provision and encourage community and grass roots involvement reducing dependency culture and fostering technological enterprise. It reflects contemporary global technological practice and supports working to a position where students can be involved and learn through participation. Schools can buy commercial support if they choose and any commercial supplier with appropriate qualifications can be included on the list of potential supporters. Such an initiative is far more likely to stimulate software production that is founded in the UK curriculum and provides support for learning in the field of technology that is sadly lacking at present.

Conclusion

1. This paper provides a rational argument for an Open Source strategy for public education. It provides practical evidence of why such a strategy is consistent with existing Government policy and examples of how it could be fairly implemented with low risk to the tax payer. There is the expertise available to support the

development of such a strategy. The bigger risk is to do nothing. Leadership, value for money and change management are consistent themes running through the paper. No change, no reform.

References

If a web link does not work immediately by clicking on it try copying and pasting into the URL input of your browser. On paper and pdf versions of this document the end of the reference titles will have strange characters. For the Open Document format file, these provide links back to the reference for those that prefer to read from a computer screen.

1 Growth in Open Source Software. Click the IT at the end of the line to jump back^{It T}

<http://www.iist.unu.edu/globaldesktop/>

2 Techno-social tipping points. Click "that" at the end of the line to jump back^{The that}

http://www.cio-today.com/story.xhtml?story_id=30926

3 Open Documents (ISO 26300) ^{It Ref}

<http://www.odfalliance.org/about.php>

4 Digital Divide. ^{Coar}

http://en.wikipedia.org/wiki/Digital_divide

<http://www.ecommercetimes.com/story/50329.html>

Getting access to the information is fundamental to bridging the digital divide. While it's not the only factor, getting the price point of "good enough" technology down to a level affordable by the disenfranchised is still significant and more significant the poorer you are.

5 BECTA research on Total Cost of Ownership: Click to jump back ^{t sh. ws}
TCO study outside education

http://www.becta.org.uk/corporate/publications/documents/BEC5606_Full_report18.pdf

<http://news.zdnet.co.uk/software/linuxunix/0,39020390,39180701,00.htm>

Note that TCO is a complex issue and is often used as a marketing tool. It first came to prominence when PCs became much less expensive to buy than Apple computers due to economies of scale and Apple claimed that the savings due to ease of use of their machines outweighed the initial higher purchase costs. It is worth considering that any new relatively small scale technology is likely to get less expensive as people learn more and initial transitory costs are absorbed in mass take up. The return on investment in making change is in the long run more important than the immediate short term TCO. In the steady state, a system with no license fees is always going to be less expensive than one with if all other things are equal. The issue is in how long any immediate costs of making a change take to be recouped by lower long term costs. The migration experience of Bristol LA suggests the real cost of change have often been over-estimated. "So far, the experience of migrating users has proved that the cost of migration is low and ease of use is high. We now have concrete evidence that less effort is required to deploy the software, support and train users than we estimated," said Gavin Beckett.

6 Government Policy: Click to jump back ^{pi}

Higher Standards, Better Schools for all, more choice for parents and pupils
14-19 Education and Skills

<http://www.dfes.gov.uk/publications/schoolswhitepaper/pdfs/DfES-Schools White Paper.pdf>

<http://www.dfes.gov.uk/publications/14-19educationandskills/pdfs/14-19WhitePaper.pdf>

Internationalism

http://www.dfes.gov.uk/pns/DisplayPN.cgi?pn_id=2004_0021

Citizenship

<http://www.dfes.gov.uk/citizenship/section.cfm?sectionId=5&hierachy=1.5>

Social Enterprise

<http://www.standards.dfes.gov.uk/forums/showflat.php?Cat=&Number=1966&page=0>

Vocational learning

<http://www.ssatrust.org.uk/vocationallearning/default.aspa>

Personalised learning

<http://www.standards.dfes.gov.uk/personalisedlearning/>

Understanding technology

<http://www.dti.gov.uk/innovation/index.html>

The environment and innovation

<http://www.parliament.uk/documents/upload/POSTpn212.pdf>

7 e-gif Policy pol poas

[http://archive.cabinetoffice.gov.uk/e-envoy/briefings-top/\\$file/interoperability.htm](http://archive.cabinetoffice.gov.uk/e-envoy/briefings-top/$file/interoperability.htm)

8 W3C - The World Wide Web Consortium ISO anst

<http://www.w3.org/>

9 Specialist Schools and Academies Trust prog a

<http://www.specialistschools.org.uk/>

10 Parliamentary standing committee comments on GCSE science and why exams need improving to reflect greater understanding and less rote learning. he and

<http://www.publications.parliament.uk/pa/cm200102/cmselect/cmsctech/508/50808.htm>

11 Environmental costs of computer manufacture StraEff

http://www.guardian.co.uk/uk_news/story/0,3604,1164372,00.html

12 Monopolies and closed standards o

Open Source communities have no competitors, they exist to further the needs of the community and anyone can be a member of the community. However, individual Open Source products do have competition from and provide competition to other software products. The competition is most significant with products based on closed standards that have global take up. It is therefore inevitable that Microsoft and its business strategies come into almost every discussion of OSS even though the company itself is not the issue, it's the effect of the monopoly on the industry at large. Simply, companies with business models based on selling proprietary licenses are going to be hit hardest as Open Source take up makes operating systems, infrastructure and productivity tools free from the need for paid licenses. Every key player in the market understands it, even Microsoft. Microsoft has to try to delay the outcome, though, in order to find alternative business models to replace its traditional business and it is not going to find another monopoly like Windows easily.

Abuse of a dominant position in the market

<http://cyber.law.harvard.edu/msdoj/>

<http://cyber.law.harvard.edu/msdoj/>

It seems likely that Microsoft will continue to break the law as long as in doing so it makes more money than the fines levied. It is to them a legitimate business expense and delaying judgments through appeals and prevarication maintains a large income. The disincentive for a government to take legal action is huge since the company reserves billions as a legal war chest to fight such action and cases are complex and technical. It is therefore likely that a great deal more of MSFT's activities are illegal but taking action is effectively deterred. Microsoft Schools Agreement, is a good example. A strategy to promote Open Source as a viable competitor is probably a lot less expensive and more effective than taking legal action.

Microsoft Schools Agreement lic

http://www.pugh.co.uk/Products/microsoft/school_agreement.htm

Microsoft Schools Agreement could be illegal. It effectively makes schools pay licenses for computers that do not run any MSFT software so it is clearly anti-competitive. If a GNU/Linux vendor tries to sell a PC running GNU/Linux to a school operating Schools Agreement, the school has to pay MSFT an annual license fee. That is the equivalent of BT requiring payment if NTL put a cable to your house. The OFT investigated but failed to come to a definitive conclusion. The correspondence with the OFT seems to indicate that this is more to do with the cost of taking on MSFT in a legal battle than anything else. The only way to definitely determine if Schools Agreement is illegal is to test it in court and since MSFT submitted 30,000 pages of evidence to the investigation this is likely to be expensive. The worst strategy would be if the DfES bought into a MS School agreement type arrangement for all schools. On the face of it, it might look a financially attractive option with lower prices through an economy of scale in the short term but it would make the chances of change almost impossible by fully locking all schools into a single vendor monopoly and killing any incentive to produce any desktop applications that ran on anything but Windows.

12.1 Microsoft and technology hegemony so

<http://www.joelonsoftware.com/articles/APIWar.html>

While the whole of this article is interesting and relevant to understanding why the MSFT business model is showing signs of faltering (eg recent fall in share price), the most relevant part to the referenced text is towards the end in the section "It's not 1990".

12.2 Microsoft product lines and profitability_s

http://www.microsoft.com/msft/earnings/FY05/earn_rel_q4_05.msp

Microsoft client segment is all about Windows client operating systems. In 2005 it achieved a revenue of \$12.2 billion dollars with a profit of \$9.4 billion - approximately 77% margin. The information worker segment which is Microsoft Office achieved a revenue of \$11 billion and operating profit of \$7.9 billion. approximately 72% margin. Server products \$9.8 billion and a \$3.3 billion profit or 34%

Together these products account for profits of \$20.6 billion. The overall profit from all business was \$14.5 billion showing that the operating system and office products are subsidising the rest of the business to the tune of \$6 billion dollars a year. The money spend on software development is relatively small and would probably be smaller still if the business had to be efficient in a fiercely competitive market. Fundamentally, MSFT is not profitable except in markets where it has a monopoly derived from the desktop operating system.

13 Thin Clients will w

Thin clients are computer terminals that run applications on servers. They can be physically small and run low power consumption processors that do not need cooling fans and therefore reduce noise and heat. They do not need disc drives and can operate with minimal memory and are therefore low power consumption. Neither do they use a lot of network bandwidth. However, thin clients do need more powerful servers and so there is some trade off in cost and power consumption. Nevertheless, in principle thin clients should lower infrastructural costs and reduce total cost of ownership because upgrading half a dozen servers automatically upgrades perhaps two hundred clients. Managing the servers effectively manages all the clients. The main commercial supplier of thin client software is Citrix and the premium paid for Citrix licenses negates a good part of any initial cost savings forming a barrier to adoption. In addition to this, the volume of software applications that are dependent on locally installed Windows is also a barrier to change. Open Source thin clients are free of license costs but again the dependency of applications on Windows makes the wholesale adoption of this technology slow and consequently the lack of economies of scale mean the hardware is relatively more expensive than it would be if sold in large volume. One school of thought is that mobile telephones will evolve into thin client terminals and certainly there is no real technical reason for this not to happen now. All that is needed is for new screen technology that can be folded to fit in a pocket to become widespread. Again, it's the inertia of old legacy technologies that holds back more efficient ways of working. Current Open Source thin client technology is particularly well-suited to generic productivity tools and web based applications that conform to open standards which is another reason for stimulating the production of open web based learning applications.

14 Use of the Internet by different social groups an

<http://www.citizenonline.org.uk/statistics>

15 Curriculum On-line For seems

<http://www.curriculumonline.org.uk/>

16 The Economics of Open Source Development d it Ufrom

<http://perens.com/Articles/Economic.html>

17 Competition commission and Office of Fair Trading There

<http://www.competition-commission.org.uk/>

<http://www.oft.gov.uk/default.htm>

18 Software as a commodity on

http://www.netc.org/openoptions/pros_cons/markets.html

Scroll down a bit to read the part on software as a commodity

19 Open Source VRQ L2 whereat

<http://www.theINGOTs.org/>

20 Moodle thrives
<http://moodle.org/>

21 OpenOffice.org Statistics
<http://stats.openoffice.org/#stats>

22 Leadership tastarts

I first looked for a leadership reference on the site of the National College for School Leadership <http://www.ncsl.org.uk/> but didn't find any generally useful explanations of what leadership actually is or requires. The summary below would probably be a good thing to link from their home page http://www.meansbusiness.com/summary_p.asp?FID=E994C0B0D7E543C6AF7F9B62A2884E82 Additional material from <http://en.wikipedia.org/wiki/Leadership>

Wikipedia is yet another world class free resource enabled by the principles of the Open Source Community.

23 The IBM PC An o

<http://inventors.about.com/library/weekly/aa033099.htm>

Interestingly MS DOS was a re-write of c/pm just enough changed to avoid falling foul of copyright, bought by Bill Gates for \$50k and licensed to IBM. Gates idea for Basic built into ROM was already established by Acorn in the UK. There was not much that was innovative about the IBM PC except that it was backed by IBM and that it was built from standard components, open architecture. Open Source software is really the software equivalent of the IBM open architecture hardware without the problems of key components being owned by Intel and Microsoft. Just as the IBM PC hardware has evolved to more sophistication, we see the same thing with Open Source applications over time.

24 Sustainability momemom

<http://www.openconference.net/viewabstract.php?cf=3&id=57>

http://www.oii.ox.ac.uk/research/files/OSSWatch_2006_Sustainability&FLOSS_txt_4+slides0506.pdf

http://www.jisc.ac.uk/index.cfm?name=pub_ossbp

First reference is a European perspective on Open Source and its sustainability in education. The second is a detailed research paper, the third is a shorter summary of Open Source issues with some reference to sustainability.

25 World Governments It'sIt's

<http://news.zdnet.co.uk/software/linuxunix/0,39020390,39150645,00.htm>

http://www.linuxdevcenter.com/pub/a/linux/2002/07/15/osgov_timeline.html

26 Open Document Fellowship

Open Document Fellowship is a voluntary not for profit community organisation dedicated to promoting the Open Document standard ISO 26300. Open Document Fellowship is a member of the Open Document Alliance. Whereas ODF alliance is made up of companies and organisations, OD Fellowship pre-dates the alliance and is made up of individuals. Most OD Fellowship members are also advocates of Open Standards in general and Open Source but OD Fellowship is fundamentally an Open Standards rather than an Open Source pressure group.

<http://www.opendocumentfellowship.org/>

27 Mac OSX

<http://www.apple.com/macosx/>

It's worth noting that Mac OS X is itself derived from BSD Unix, an Open Source operating system. Mac OS X and GNU/Linux are both Unix operating systems at heart.

28 Debian

<http://www.debian.org/>

General references

Explanations of a range of Open Source licenses

<http://www.iist.unu.edu/globaldesktop/>

Relationship between BECTA and the DfES

http://foi.becta.org.uk/content_files/corporate/resources/policy_and_strategy/links/mou_dfes.pdf

Open Source in a Company Business Model

http://www.infrac.com/presentations/present_OSSWATCH_osmodel

Glossary

Apache webserver	The leading global software application for serving Internet web pages.
Apple OS X	Apple Computer's proprietary operating system based on the Open Source Berkley Standard Distribution of Unix.
BECTA	British Education and Communications Technology Agency. Advisor to Government on issues related to ICT in schools.
BETT Citizenship	British Education Training and Technology Show Understanding the responsibilities that accompany rights in a healthy society.
City Academy	New school partly sponsored by private sector and with governance independent of the Local Authority.
Curriculum on-line	Website that catalogues resources eligible for license purchases using e-Learning Credits
De facto standard	A standard that is based on popular usage and is often controlled by a single point of interest.
DfES	Department for Education and Skills. Central government department responsible for education.
Digital divide	Difference in access to ICT facilities based on economic, social or educational factors.
e-gif	e-Government Interoperability Framework. The framework that enables interoperation between a range of technologies.
e-Learning Credits (eLCs)	Government funding for schools in England restricted to spending on licenses for software and digital content that supports learning
e-strategy	Government Policy intended to promote learning through the use of ICT.
Extended services	Government initiative to extend the school day by providing learning opportunities before formal school starts and after it ends.
FLOSSIE conference	Free Libre Open Source Software in Education. Annual conference devoted to Open Source and its use in schools organised by SF-UK.
Forced upgrade	Where a computer has to be upgraded for reasons of compatibility or a decision to discontinue support for a software application. See Linux below.
GNU/Linux	
Hard to reach groups	People on the fringes of society who do not willingly participate in positive social activities and are often actively hostile to authority and attempts to increase their involvement.
ICT	Information and communications technology
Internationalism	Developing awareness, tolerance and co-operation with people in other countries.
INGOT	International Grades in Office Technology. A vocationally related qualification in open standards and office applications with a community dimension for learning through

	participation.
ISO 26300	Open Document format's registered number with the international standards organisation, ISO.
Koffice	Open Source office software that uses OpenDocument format and runs on GNU/Linux. A MS Windows version is being developed.
Key Stage 3 Tests	National tests for 14 year olds. These are provided in English, maths and science with an on-line ICT test in pilot at the time of writing.
Learning through participation	Learning by taking part in productive projects to produce useful services and resources for the community rather than as a theoretical exercise.
Linux	More accurately GNU/Linux. Open Source operating system with a unix-like kernel (Linux) and supporting applications from the Free Software Foundation (GNU).
Local authority	Local political grouping with delegated responsibility for education in its geographical area.
Microsoft Schools Agreement	Microsoft annual license for several core pieces of software with payment based on the number of computers in the school.
Monopoly	Single source of supply. In competition law it means with sufficient market share to use the size of the customer base to impede competition. This can be as little as 25% market share.
Moodle	Open Source virtual learning environment.
Mozilla Firefox	Open Source web browser.
MS Windows	See Windows below.
National Curriculum	The statutory framework for teaching and learning in schools.
National Digital Infrastructure	The hardware, software, standards and protocols needed for running educational software applications and exchanging digital information.
Open Document Alliance	International group of organisations and companies supporting Open Documents.
Open Document Fellowship	International group of individuals and volunteers supporting Open Documents.
Open Document Format	An XML based file format that is not controlled by any individual company or interest and is designated ISO 26300.
Open Forum Europe (OFE)	A not for profit, independent organisation formed to strengthen the use of Open Source Software in business and government.
OpenOffice.org	Open Source office software that uses odf as its default file format. Also a very big International Open Source community.
Open source community	Developers and users of Open Source Software.
Open Source Consortium (OSC)	A not for profit trade organisation that guarantees the quality of Open Source deployments in the public sector.
Open Source Software	Software where the source code is licensed to be freely copied and modified.
Open standards	Standards that can be used freely by anyone without payment and which are not controlled by

	a single for profit company.
OSI	Open Source Initiative, organisation responsible for managing the definition of Open Source.
Personalised learning	Learning that is based on the specific needs and interests of the individual.
QCA	Qualifications and Curriculum Authority responsible for regulating examinations in England.
RBC	Regional Broadband Consortium. Provide filtered internet access to schools.
Redesignation	Process by which specialist schools renew their status and funding as a specialist school.
Schoolforge UK (SF-UK)	A voluntary organisation devoted to promoting open resources for education.
SME	Small and medium sized enterprises
Social enterprise	Enterprising activities that provide resources and benefits for the good of society.
Social inclusion	Including all citizens in important social activities irrespective of their economic or cultural backgrounds.
Software license	The rights granted to users of software by the copyright holder. Commercial proprietary software licenses require payment, usually to the copyright holder. Open Source licenses do not but are often, but not always, conditional on making any improvements made to the original code, freely available to the community.
Specialist School	A school that gets additional government grant to promote raising attainment and community development through focus on one or more subjects in the curriculum.
SSAT	Specialist Schools and Academies Trust. Government funded Agency that supports the Specialist Schools and Academies program.
Thin client	A computer terminal that simply handles screen drawing and input from the keyboard and leaves the running of applications to a sever.
Third sector	Companies, organisations and volunteers who work for the community and social good rather than for personal profit or gain. As distinct from public and private sectors.
VLE	Virtual Learning environment, a suite of software that supports learning, assessment and target setting.
Vocational learning	Learning that prepares people with the specific skills and knowledge needed for employment and voluntary service.
VRQ	Vocationally related qualification.
W3C	The World Wide Web Consortium is an international consortium dedicated to leading the World Wide Web to its full potential by developing protocols and guidelines that ensure long term growth.
WCAG	Web Content Accessibility Guidelines
Wiki	Editable website used for collaborative projects

Windows

Proprietary operating system licensed by Microsoft.

Writely

Web based word processor that uses Open Document Format.