

R&D and Public-Private Partnerships for Low and No-Cost Assistive Technologies

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Public-private partnerships allow assistive technology projects to benefit from both the innovation and efficiency so often found in the private sector, with the scale that only governments can offer. In the following sections we will present some models being used around the world and what have become best practices in public support of assistive technology R&D. However, it is important to first describe the realms of technological development we are including in this section, what we are considering public-private partnering, and the trends affecting and being shaped by individuals and companies in the assistive technology sector.

* Assistive Technology: A broad perspective

In the ICT sector, assistive technology is often considered to be items such as screen reading software for the blind or TTY devices for the deaf, however, these and many other assistive technologies can only work as part of a larger ecosystem where communication protocols, file standards, and interfaces accommodate the needs of persons with disabilities by either offering direct access to information or through compatibility with specialized software. In other words, the best TTY devices will not work effectively if communication protocols are not standardized and implemented the same way across telecommunication providers. In turn, the same open standard strategy is required to ensure equivalent usability of office productivity software and other applications.

A classic case study of the importance of standards for persons with disabilities is the contrast between electronic-mail and instant messaging as these were used in the 1990s. Because e-mail is based on open standards, there were many fully inter-operable e-mail clients developed by both companies and individuals. The fact that some of those clients were not compatible with screen readers used by the blind, resulted in no significant damage to the rights of persons who are blind to participate fully in activities with their sighted colleagues that required e-mail. Companies or individuals developing inaccessible e-mail software simply lost market share to competitors that delivered better e-mail clients.

The initial experience with instant messaging technology was dramatically different. Because there was no concern with interoperability--some companies actually attempted to block interoperability on purpose--blind and other users were always vulnerable to decisions made by the company controlling the instant messaging network they might be interested in. As a result, companies that disregarded the needs of persons with disabilities in their design of instant messaging client software and kept their

communication protocols closed, kept anyone with a disability that required better interface design blocked from the network and any educational, social, or professional benefit that they might have derived from it.

The contrast between the instant messaging and e-mail end-user experiences made it clear that the needs of persons with disabilities and their rights are not well served by systems that have both the tools, e.g. e-mail and instant messaging software, and the medium, i.e. messaging protocols, closed to individual and corporate competitors. For this reason it is essential to give as much importance to communication protocols, file standards, and software interfaces as to what are more conventionally considered assistive technologies since the utility of screen reading software, virtual keyboards, and other assistive technologies, depend as much on the overall digital infrastructure around them as on their own capabilities.

* Public-Private Partnering: A holistic approach

While public-private partnering is often seen as a productive bargain where the private sector offers economic growth in exchange for government R&D support, as far as society is concerned, the partnership need not stop there. In fact, public-private partnering is most effective in ensuring the rights of persons with disabilities when government uses every public policy tool at their disposal to promote both competition and accessibility in the ICT marketplace.

While R&D funding is an important policy tool, government leadership in ensuring access to ICT by persons with disabilities does not always involve direct financial support. For example, criteria used in public procurement and other means by which open and accessible standards are required for ICT interfaces, communication protocols, and file formats are extremely powerful ways to ensure full access by those with disabilities to education, employment, and culture. In other words, the same well-known public procurement strategy of requiring open standards so as to ensure interoperability and a competitive marketplace can also bring enormous benefits for citizens with disabilities when those standards take into account their needs.

* Market Trends: Towards social and economic realities

The market for ICT-related assistive technologies is inherently challenging: persons with disabilities as a whole are geographically disperse, the vast majority is unemployed and has little or no education and a disproportionately high portion of them live in poverty. In wealthy economies however, there are significant percentages of this community that have had access to education and have found employment. More importantly, in terms of the market for assistive technologies, wealthy societies have government programs that purchase assistive technologies for citizens that require such accommodation for education or employment. However, the above market structure, with its necessarily reduced demand, does not allow mass manufacturing and prices for

assistive technology tend to be fairly high.

As a result, there has been for many years a large moral and economic incentive to achieve economies of scale in the manufacturing of hardware-based assistive technologies, and a parallel need to develop low and no-cost software-based solutions. While these market pressures have resulted in significant consolidation among hardware manufacturers, the clearest reductions in price and proliferation of options has taken place in the software arena. In addition to the obvious barriers to entry that large investments in manufacturing capacity represent, the unusual dynamism observed in the software segment can also be explained by the increase in availability of solutions developed under open source licenses.

The free and open source software (FOSS) development philosophy requires that the source code, or inner commands that make up a software product, be available for all to see and improve upon. FOSS licenses in some cases require that improvements to the publicly available code be shared back with the community and in other cases, such as with the core of the operating system used by Apple Inc., the sharing of software improvements made by a company is optional. However, in all cases the FOSS development model presents an attractive way for both volunteer and paid programmers to contribute to projects knowing that such work will usually remain available to the general public regardless of the strategic or tactical decisions of any company or organization.

Just as important, from the perspective of persons with disabilities, companies and organizations can sell or give away FOSS-based assistive technology, depending on what other benefits or services they include with the transaction, but the nature of such software requires competitive pricing. Any company or organization charging in excess of the value it offers its customers, will simply offer an opportunity for a competitor to repackage the same or compatible open source software and offer a better value proposition to the market.

* Examples of Low and No-Cost Assistive Technologies

There are many for and non-profit private sector initiatives that lend themselves particularly well to scaling-up by government agencies and programs since they adopt either open tools or media and therefore force no vendor lock-in for either the government, service providers, or the end-user. These initiatives range from development of basic software technologies such as communication protocols or programming languages; development of basic assistive technology components such as speech synthesizers that can be used in a variety of products, from screen readers to augmentative communication systems; development of specific products such as screen readers, that will be used by non-technical individuals; integration of complete solutions, including operating system, productivity software, and assistive technology; and even the development of training material and offering of technical support services. The following examples touch on all these elements, which are essential for the longevity and

health of a thriving assistive technology ecosystem.

From Australia...

The NonVisual Desktop Access (NVDA) Project from NV Access, an NGO based in Australia, is an outstanding example of what can be achieved with open standards and open source initiatives. NVDA is a screen reader that works on Microsoft windows and is currently being used by over ten thousand blind individuals around the world. To put their success in perspective, NV Access has been in existence for less than two years, has received very limited funding, and their product has more users than the number of subscribers of the vast majority of free blindness-related electronic publications available in Australia, the United Kingdom, and the United States.

NVDA has been especially successful, not merely because it is distributed for free, but because it is open source. Contributors know that any developer can modify NVDA or update it if NV Access ever stops supporting the project or decides to make changes that users dislike in any way. This works as an incentive for the community to contribute, since the resulting product effectively belongs to all. An example of the effectiveness of this model is clear when we observe that NVDA itself was developed using Python, an open source programming language, and is shipped with eSpeak, an open source speech synthesizer available in many languages. So many languages in fact, that NVDA is available in Afrikaans, Brazilian Portuguese, Croatian, Czech, Finnish, French, Galician, German, Hungarian, Italian, Japanese, Mandarin, Polish, Portuguese, Russian, Slovak, Spanish, Swedish, Thai, Ukrainian, and Vietnamese. NVDA is clearly a project that has proven its worth around the world.

From Brazil...

Some of the most promising initiatives in Brazil resemble the training being offered by the municipality of the city of Vitória. The CRPD (Portuguese acronym for Reference Center for Persons with Disabilities), offers training on the Orca screen reader. Orca is an open source screen reading and magnification software that is available for free on numerous Linux distributions. The CRPD course uses Orca to teach students text editing with Open Office, web browsing via Firefox, and e-mail and instant messaging via Evolution and Pidgin. All these software packages benefit, as is the case with NVDA, from a large international community of individuals and companies for their ongoing development.

Another type of intermediation is best represented by Canonical Ltd., and European company that puts together the Ubuntu Linux distribution. In essence, Canonical reduces complexity for the end-user by distributing a wide variety of FOSS packages, ranging from the Linux operating system and productivity applications such as Open Office, to the Orca screen reader and the Gnome On screen keyboard, already preconfigured to work together. The company distributes these applications freely and sustains itself by charging for customization and technical support services.

Coming back to the Brazilian portion of our examples, the Canonical/Ubuntu business model allows NGOs such as Mais Diferenças, based in São Paulo, to offer public schools and companies adapted versions of Ubuntu that come preconfigured for use by someone with a specific disability. If Canonical helps customers by collecting the best FOSS has to offer in one package, Mais Diferenças selects and pre-configures on a USB Flash drive, the Ubuntu packages that are most relevant, for example, for a blind student. In addition this Brazilian NGO also offers training for public school teachers on how they may integrate these technologies into their day-to-day classroom activities.

Canonical, CRPD, and Mais Diferenças, illustrate not just a typical value chain, showing segments of the market where the value add is mostly technical, to segments closer to the end-user where value lies on a detailed understanding on the practical needs of each individual, but also the multiplicative potential of investments made in the most basic technologies. Just like improvements in the graphical interface used by many Linux companies such as Canonical, will impact Ubuntu, orca, open Office, and many other software packages; an improvement in the eSpeak speech synthesizer will benefit many projects that use it, including Orca (the screen reading and magnification software used in many Linux distributions), NVDA (a screen reader for Microsoft windows), and even software used in telephony applications. Other basic technological building blocks that have an impact in a variety of applications, but which are especially important in assistive technologies, include optical character recognition (OCR) engines, speech recognition algorithms, and language rule tables for Braille transcription.

From India...

India provides a wealth of examples from development of core assistive technologies, such as synthesizers for local languages, to assistive technology applications for the end-user and large scale training programs. Prof. Arun Mehta and his team at Radiophony.com, a systems integration and software development firm, have developed software packages such as Skid and eLocutor to help children and adults with serious motor impairments, autism, cerebral palsy or dyslexia to communicate using cellular phones or personal computers. While their software works on both proprietary operating systems such as Microsoft windows or Palm OS, and open source operating systems such as Linux or Android, their work is itself licensed under the GPL FOSS license. This has enabled cooperation and sharing of their highly specialized work with NGOs in Brazil, for example, just like they themselves have had access to Dasher, FOSS assistive technology for persons with serious motor impairments originally developed in the United Kingdom.

India is also home to entities such as the Comet Media Foundation, based in Mumbai, which have integrated the Ubuntu Linux distribution into software development training and employment programs that have already trained an estimated 250 teachers and helped over 3000 blind individuals in both the states of Tamilnadu and Kerala. The objective is to reach 500 schools and benefit over 10,000 blind and visually impaired individuals by June 2009 in the sate of Tamilnadu alone, and the project is expected to meet or exceed these goals as well as expand to the state of Madhya Pradesh.

Mr. Krishnakant Mane, Project Coordinator at Comet Media Foundation, explains that government funding for the projects was relatively easy to get thanks to the open source nature of the technology being used. "State agencies felt protected from any number of potential future problems since they could always hire another NGO or software firm to assist them if they encountered any difficulties with us or with the specific versions of the software that we were using." More importantly--given the very high levels of unemployment among the blind around the world--students trained by the Comet Media Foundation did not require expensive software to work along-side their sighted counterparts in local software firms making them equally appealing to large firms such as IBM and TCS or small software businesses.

The success of these projects is contagious. There are promises from the National Association for the Blind (Delhi State Branch), creators of the Safa screen reader for windows, to open source their software. In addition, the C-DAC (or Centre for Development of Advanced Computing), which distributes the BOSS Linux Distribution plans to make its version of Orca speak in all 18 Indian languages. The beauty of the synergy achieved through FOSS, is that not long after Orca is able to speak all Indian languages (Assamese, Bengali, Gujarati, Hindi, Kannada, Malayalam, Marathi, Oriya, Punjabi, Sanskrit, Tamil, Telugu, Bodo, Urdu, Kashmiri, Maithili, Konkani, and Manipuri) on Linux PCs, one can expect NVDA to start acquiring these capabilities as well.

From Kenya...

Computer Aid International, an NGO that has distributed over 130 thousand refurbished PCs in Kenya and other developing countries, acknowledges many of the same reasons for the use of open source assistive technologies. NVDA can be shared legally, it works from low-cost USB Flash drives (also known as memory sticks), and has more local languages than expensive proprietary solutions.

For users that are visually impaired but not blind, and require screen magnification, Computer Aid has used other FOSS solutions such as Virtual Magnifying Glass and even Firefox. Virtual Magnifying Glass enlarges text on the computer screen in a variety of computers, including Windows, Linux, FreeBSD, and Mac OS X machines. In the case of Firefox, many users have used add-ons such as FireVox, that help blind or visually impaired users navigate the Internet by either reading or magnifying web pages for free.

From Spain...

The states of Extremadura and Andalucía in Spain have one of the largest and best known initiatives for the use of low and no-cost assistive technologies because of their adoption of open source software for public schools and community centers. Projects such as the Guadalinux Linux distribution have brought FOSS productivity software and assistive technologies to over 200 thousand school computers, over 650 public libraries,

and have been downloaded hundreds of thousands of times.

The Guadalinux Project is especially valuable for society since it is not just an adaptation of widely used software packages; it also includes contributions made in Andalucía that now benefit persons with disabilities nationally and internationally. One such software package is the Festival speech synthesizer. The Guadalinux project has made significant improvements to the Spanish voices in Festival and this has benefited users even in Latin America.

From Canada, Europe, and the United States...

As discussed earlier, low and no-cost access to digital information and the educational, social, and professional benefits such access allows, depends not only on disability-specific technologies but also on the way communication protocols, file formats, and software are designed. In this regard, Canadian, European, and US companies and organizations have played a crucial role at the World Wide Web Consortium (W3C) through efforts such as its Web Accessibility Initiative (WAI).

While the W3C now has a truly global membership, developed economies have led the world in enacting legislation to Ensure digital accessibility particularly to web-based government services. The most widely known of these accessibility legislations is the US-based Section 508, however, Australia, Canada, France, Ireland, Italy, Japan, Portugal, Sweden, and the United Kingdom, among other countries, are drafting or have already enacted their own analogous legislation. In addition to ensuring the rights of citizens with disabilities to access services and information offered by government agencies, these legislative initiatives raise awareness of the importance of accessibility and inevitably have a spill-over effect in the rest of society.

Another valuable example of public-private partnering for low and no-cost assistive technologies is the AEGIS Project. AEGIS stands for "open Accessibility Everywhere: Groundwork, Infrastructure, Standards" and it brings together 20 companies, NGOs, and university & commercial research organizations from 10 countries. Most of the funding comes from the European Commission through a grant under the "Seventh Framework Programme", project coordination is being done by the Greece-based Center for Research & Technology Hellas, and the technical lead is US-based Sun Microsystems.

* Conclusion

Our survey of forms of public-private partnerships in the search for low and no-cost assistive technologies has shown that such cooperation should not be focused exclusively on specific products or technologies. In fact, every element in what might be called one's digital environment can have a beneficial or prejudicial impact on accessibility; including the disability-specific tool, the application being used, and the medium, i.e. file format or communication protocol.

However, regardless of the realm being analyzed, assistive technology tool, application, or medium, both the disproportionately high incidence of poverty among persons with disabilities and the strategic interests of very diverse groups converge on open source solutions. The first factor, poverty, requires that successful projects be very efficient in their use of resources; and FOSS allows efficient re-use and re-purposing of basic assistive technology building blocks such as speech synthesis engines. The second factor, the strategic interests of a variety of entities, also tends to favor open source software and open standards, since under these cooperation models no organization, be it large or small, public or private, is ever vulnerable to strategic, financial, or political changes in whatever company or organization controls a proprietary or closed portion of the digital environment being worked on (i.e. assistive technology tool, the application, or the medium).

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