ConnectKey.com: The use of Open Source technologies to provide cost effective services for eBusiness to SMEs

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Abstract: The emergence of Linux as an open source operating system for business use over the past decade, and of the WWW as a platform for distributed applications development, has led to the availability of a complete software environment which is open source, and yet robust enough to allow the development of on-line services for SMEs. This paper analyses the various open source options available, and explores the experience of ConnectKey.com in offering a subset of these to Irish SMEs.
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1 Introduction

Over the past number of years there has been a huge growth in the popularity of the Open Source model for software development, and the beginnings of trust for this model in the business community. This growth has been directly fuelled by the growth of the Internet. Indeed, many of the key components of the Internet are based on Open Source projects (e.g. sendmail, Apache). This paper addresses the issues related to the development of on-line services for Small and Medium Sized Enterprises (SMEs), and looks to the solutions available in the Open Source marketplace for such services.

Rather than digressing into legalese on the relative merits of different types of software licences, the interested reader is directed to Bruce Perens' (Treasurer, Open Source Initiative) definition that has become a full article in itself [2]. The latest agreed definition is available at the Open Source website [3]. Other interesting issues are raised in Eric Redmond's seminal article on the 'Cathedral and the Bazaar' [4].

This paper looks at the open source software available to developers at a number of levels: operating system, database, web server application development, application server and at applications themselves. The paper then describes the platform and services offered in the ConnectKey.com ASP site.

2 Open Source Technologies

2.1 Open Source Operating Systems

The most obvious open source operating system is Linux. Certainly, many SMEs who host websites do so on Linux platforms which provide Internet Service Providers (ISPs) with

cost-effective, yet reliable operating system platform upon which to offer their services, in particular web page hosting.

Arguably, it is already true that most SMEs should use a Linux server as a file server/web server/mail server for small networks. However, this assumes that they have the in-house expertise to configure such a system, or the availability of local expertise to outsource specification, installation, configuration and maintenance. This, certainly in Ireland, is not available and so other options often end up being more cost effective for SMEs due to the unavailability of expertise. However certain Linux distributions, such as e-smith [5] are focusing on this market.

Certain products have begun to emerge in this domain, specifically targeted at SMEs. At their simplest these devices are pre-configured boxes to do specific tasks (e.g. small office mail server), thus requiring little or no configuration (often a remote web-based administration module is provided). The trend will be for more embedded Linux and more products for SMEs built on such platforms such that the SMEs may not even realize they are using an open source operating system [6]. Larger SMEs may find a place for explicitly supporting Linux in their workplace, but most will not.

2.2   Open Source Web Servers

The Apache Web Server [7] is the most popular web server in the world at present [8], a significant open source success story. Although most of these servers run on Linux, the product now can run on the Windows platforms as well. There are some other, more specialised open source web servers around, but Apache is the leading open source alternative to Microsoft's Internet Information Server (the next most popular web server, and the most popular web server for secure transactions using SSL).

With suitable help, Apache on Linux would make an excellent intranet or Internet web server for any SME. In the shorter term it seems likely that SMEs would outsource such activity (and not have an intranet).

2.3   Open Source Databases

The two main contenders for the leading open source database are MySQL [9] and PostgreSQL [10]. The former is easier to set up and maintain, and it is usually claimed to be faster when deployed, but it lacks some of the more advanced features of the latter (e.g. row level locking, stored procedures). The leading proprietary alternatives are Oracle and MS SQL-Server. Oracle recently acknowledged the large impact MySQL has made on the market by providing an upgrade kit for MySQL to Oracle [11].

It is probably too complex an IT task for SMEs to use open source databases directly in-house, so again the potential is for outsourcing the use of such technologies. It is possible that new pre-configured products will emerge for the SME market based on open source database engines (e.g. financial software).

2.4   Open Source Web Server Application Development

The combination of an operating system (Linux), a web server (Apache), a database (MySQL), and a scripting language (Perl/Python/PHP) has become known as LAMP [12] which is now seen as the leading open source development platform for web-based applications. In fact, this is not a single platform, but a range of potential development platforms. At its simplest, Perl CGI scripts [13] can be run in subprocesses on the web server, and these scripts can access a backend database thus creating a potential three-tier scripting development environment. In order to avoid the overhead of repeated database

authentication and connection establishment (each time a page is accessed) such applications can be re-engineered to use Apache's Perl module, mod_perl so that some server-side persistence and session management is possible. Alternative scripting languages to Perl include PHP [14], which is very attractive in that the PHP tags are inserted into source HTML and so the process is much easier to learn for novice programmers (similar to Microsoft's Active Server Pages). The third scripting language in terms of popularity is Python [15] (see below).

It should be mentioned that there is one other well known open source scripting language often used in web-based scripting, tcl (pronounced 'tickle'). Some web servers have special support for tcl built-in (making it very efficient) [16].

Most SMEs would not have the expertise to use any of the LAMP development environments themselves (unless this was their business area), however such a platform is a very cost effective development environment for companies to produce products for SMEs. The development tools and the deployment environment itself is free, the cost in the training and the development time. One argument against this model of development is that some commercial integrated development environments are both easier to master, and more productive.

2.5   Open Source Application Servers

In reaction to the inadequacies of the simplistic web-based development paradigm, a whole swathe of new application server technologies have emerged in the past few years. Simplistically, they can be broken down into three categories:

(a) Microsoft's much lauded .NET platform with its multi-scriptable components and new language C# using XML/SOAP as a distributed object parameter passing mechanism (this can be seen as a logical growth of the COM/DCOM/COM+ object focus of Microsoft's development with the promise of platform neutrality at long last, though cynics doubt this last claim);

(b) The whole Java server-side approach with Servlets, Enterprise Java Beans (EJB), Java Server Pages (JSP), and JDBC database connectivity (this can be seen as a logical growth of CORBA and distributed object computing, in fact Java's distributed parameter passing protocol is backwards compatible);

(c) Anything else such as ColdFusion, Zope, or other attempts to bring true object-oriented rigour to the unseemly typeless mess of web scripting.

The catch here is that many of these options require a huge investment in licensing costs for application servers capable of serving up objects of these types. This is certainly not an obvious choice for SMEs. However, the promise is that, with these architectures, developers can produce and deploy applications that can be accessed from anywhere on the Internet, or potentially even from mobile phones, TVs, games consoles or other smaller clients. This is the so-called "Application Service Provider" (ASP) model (not to be confused with Microsoft's, much more limited, Active Server Pages with the same acronym). Of course, even simple web-based applications can be said to fall into this emerging paradigm, but in a poorly designed, inefficient and un-maintainable way (or so would argue the true ASP promoters). So SMEs here are one potential market for such services. Instead of purchasing software, and installing it locally, SMEs will rent services from providers (ASPs), much as they rent Internet access from Internet Service Providers (ISPs) at present.

Where does open source fit into this brave new world? There are a few bright lights in the firmament. Perhaps the simplest, and yet most powerful, is Zope [17]. This is a development platform with its own built-in web server (though it can be configured to use others such as Apache) and its own built-in object database. Each web page is considered

to be an object with properties, and the owner can enable on-line editing of these properties (including the output HTML contents). Many add-on modules exist for common eCommerce tasks, so that deploying shopping carts and the like in a highly organised and editable fashion is relatively easy for those with Python scripting skills.

There are also one or two open source application servers that support the enterprise Java architecture (J2EE). For Servlet and JSP support there is Tomcat (one of the Java-focused Apache Jakarta group of projects) [18]. For a very complete list of application servers see the TechMatrix listing [19] and the community site theserverside.com [20]. This lists some alternative open source application servers as well as the key proprietary ones.

So it is much less clear which of these platforms will win out in the market place, but the general concept of ASP is here to stay. The jury is still out on whether the Java J2EE environment will be the key server-side architecture, or whether Microsoft will succeed in pushing their new .NET framework into pole position. In either case, there will be open source versions of (or alternatives to) these key architectures. Within these frameworks many new services for SMEs will be developed.

2.6 *Open Source Portal & eBusiness Applications*

One important subset of the generic application server concept, is that of a portal website. Here the emphasis is on a website which can automatically keep itself up-to-date by aggregating content from diverse sources and presenting it in a digestible format to a community with particular common interest (or a number of such communities). Portal sites usually have come concept of membership, and authenticated members can customise the look and feel of their portal home page (e.g. listing the weather forecast for their home town). Members can participate in group discussion and maybe use an email address linked to the portal site, sometimes Person2Person (p2p) features are enabled so you can see which members of your group are on-line and send instant messages to them. Some of the largest portal sites are Netscape (my.Netscape.com), Microsoft Network (msn.com), and Yahoo! (yahoo.com). However, there are a wide range of more targeted portal sites. Interestingly, simply getting local SMEs to use such a system (where the email could be relatively secure by using SSL encryption-based web mail access) is enough for many simple forms of eBusiness. More complex eBusiness systems simply enforce more standards in the data exchanged between businesses (e.g. using a predefined XML order form format). Of course, this requires a huge culture change in the SMEs towards the regular use of such a business portal in order to access orders/etc. coming via this route.

Key to portal sites is the toolset that enables community activity. At the top end of the market are the eBusiness and Portal heavyweights such as Allaire, iPlanet, Ariba and the like. However, there are some open source community tools available. Jon Udell's book on groupware [21] outlined many of the open source tools that could be pieced together to provide such a service. In fact a search of Freshmeat [22] lists 45 open source projects relating to portals, and 38 relating to groupware. One interesting project is TWIG [23] which uses PHP to provide a number of on-line community-related features.

In general, it is harder to choose good application level open source projects as there are so many competing projects, few of which have the polished feel of commercial products. Unlike open source operating systems, web servers, and language tools, no leading open source solution has yet emerged to set a standard as a community portal application. This means that for any application level portal project, one has to do customized programming within the chosen open source framework, rather than picking an off-the-shelf product. However, the commercial products are not much better, often with slightly more effort in graphical design (so that it looks good) and a lot more effort on marketing (so that it sounds

good) commercial companies often sell SMEs something which is almost available for free in an open source marketplace (if they had the skill set to utilise such a resource).

2.7   *Potential use of Open Source Technologies by SMEs*

The main barrier to the use of open source technologies by SMEs is one of training and expertise.   There are therefore many opportunities for consultancy and product development to help SMEs take advantage of the range of resources that are open source. One approach is to bundle open source technologies into standalone products that can be deployed within an SME environment, potentially with remote on-line support. This is already happeing to some extent (e.g. e-smith [5] as mentioned above). The other approach is to develop on-line services that SMEs can access with an Internet connection. This means that there is a relatively low technical threshold for SMEs accessing the service. However, the cost of such access may be an issue in certain parts of Europe, in particular peripheral regions and new applicant states.   Some analysts even suggest that communications costs to access broadband may go up before they come down as major users migrate towards communication hubs with better infrastructure. The approach taken by the NITOURA II project was to develop on-line services using open source components. The next section details the technologies used, and the issues that were raised.

3   ConnectKey.com Experience

3.1   *The NITOURA II Project*

The NITOURA II project aimed to cost effectively provide an on-line portal for SMEs in a number of EU regions: Waterford (Ireland), Karlskrona & Ronneby (Sweden), Ganderkesee (Germany), Madeira (Portugal) and l'Ardèche (France). Each region had its own requirements and existing services, and built on initial offerings though customisation of the initial services for the SMEs in each region. Some technologies were exchanged between countries, and the issues of cultural transferability and internationalisation were addressed. All of these regions are peripheral to their country's main core business centres, with a relatively low population and a high percentage of small SMEs (often tourism focused) contributing to the region's economic activity. The ambition was that by encouraging the take up of new technologies, these could help combat the disadvantage of distance from major urban centres and their facilities.

3.2   *The ConnectKey.com (Ireland) Platform*

In Ireland the services were provided by a start-up company ConnectKey.com, formed as a spin off of the technical research group in the local Institute of Technology. The aim was to build up a community of local SMEs and involve them in the process of development and refinement of the service offering. The concept of the service offering was based around the idea of a Virtual Office (effectively web-based services meeting SMEs IT needs). At the start of the project (November 1999) the .com buzz was still on its up cycle, and the local telecommunications companies were publishing plans for the roll out of broadband access to all these regions. Since then, the .com crash and the telecommunications crash have led to many reneged promises. In many of these regions the only Internet connectivity options are 56K modem or ISDN (sometimes). The cable modem/ADSL broadband always-on Internet has not stretched to rural Europe. This key infrastructural weakness now makes it a very difficult environment within which to be

selling on-line services to SMEs. So a service offering made up of Virtual Office facilities (email, group discussion, calendar, todo list, bookmark list based on TWIG) has migrated towards an on-line company directory with editable text (coded ourselves in Perl/CGI).

Open source choices for ConnectKey.com started with the operating system. Linux was chosen, and whilst SuSE was the preferred distribution (due to experience) Red Hat was chosen for ease of remote hosting (i.e. the selected hosting company only supported Red Hat). The rest of the LAMP platform fell into place on top of Linux: Apache web server, MySQL database, Perl and PHP for server-side scripting. Onto this platform the TWIG application was deployed for the virtual office layer. The default mail program sendmail [24] was difficult to customise for IMAP mail usage without creating real system users (with various IMAP daemons) so was replaced with a commercial product Communigate Pro [25].

On this basic framework, a directory of local companies has been built using Perl/CGI and MySQL to store the backend data. A key requirement for linking together the pieces of this service was the need for a single mode of authentication for users. TWIG already provides a range of PHP scripted authentication methods, and the one chosen was authentication via the IMAP server. This meant that the directory scripts needed to authenticate in the same way (so that during a session a member was only prompted once for a password). Fortunately Communigate supplied a number of Perl modules for use with scripting the IMAP server, and these were incorporated into the parts of services that were customised. Currently (June 2001) ConnectKey has over 200 registered SMEs in the South East of Ireland.

In order to link up with relevant on-line content the portal site for ConnectKey has also used some public syndication services: Moreover [26] and iSyndicate [27]. A regularly scheduled background script accesses the syndication services, downloads the news headline contents in XML/RDF format, processes these into HTML and then provides the processed headlines as content for certain sectors of the portal site. In general, this form of standards-based content syndication is becoming the norm for large portal sites.

3.3   SME Feedback

As part of the research project, the SMEs were canvassed for feedback at various stages of proceedings. At first the primary focus was on provision of the on-line virtual office facilities, but in terms of usefulness for the existing small businesses, it was the on-line directory entry (effectively a cheap web presence) that was most useful to them. Therefore this part of the facility has been improved and expanded so that membership allows the companies to directly edit their own directory entry via their on-line account preferences.

Similarly, some companies were interested in hosting options, so the original service offering was expanded to offer simple hosting options suitable for small SMEs with simple requirements. Clearly there is a lot of potential for specialised development of more complex vertical eBusiness solutions for certain SMEs (such as on-line ordering services). However, at present, very few SMEs require such facilities.

In general, the SMEs were not happy to spend much time on-line accessing ASP facilities for three reasons: (i) the expense of peak-time Internet access prohibitive, (ii) the time required could be justified, (iii) pre-training was required.

4   Conclusion

This paper has given an overview of the open source technologies available for developers of on-line services (and potentially some off-line services as well). The conclusion is that, whilst there are many good open source products for the lower level operating system,

database and web-based middleware layers of an on-line information system, the range of options at the applications layer is more limited. However, some products, such as TWIG, can be used for core on-line services and extra features can be added using customised scripting.

The paper has also argued that SMEs in peripheral regions of Europe will be reluctant to take up on-line ASP services as a model of IT outsourcing until the telecommunications infrastructure in these regions can provide reasonably priced continuous Internet access. It seems clear that there will be a huge new market for ASP services as a model for product deployment. Customers of such services need to be careful in their choice of provider, as the recent foreclosures and buyouts have shown that it is potentially dangerous to rely on an external service accessed on the Internet. Recent service closures include: Deja News, Timedance, and eGroups. Despite this warning, it is clear that from a technical point of view open source technologies provide a solid platform for the development of such services.

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