**Local Government Embraces Open Source Technology**

Garden Grove, a southern California City with a population of over 169,000 began utilizing Open Source Technology in 1995. Open Source software is freely distributed, includes source code, and preserves the integrity of the author's code, while allowing for derivative works. While many organizations have shied away from using Open Source software, Garden Grove has benefited greatly from its use of it. Open Source filled the City's requirements in an IT infrastructure: advanced features, stable performance, robustness, ease of implementation, and low cost of use.

Before looking at how the City is benefiting from Open Source technology it is important to first look back at its history. Prior to 1995, the City's data needs were mostly handled by a $400,000 Data General Avion running the City's Pick database (now called D3 by Raining Data) and Word Perfect on DGUX. Users interfaced with the mini computer through serially connected dumb terminals. Several departments had standalone, non-networked PCs. The City saw a need for a PC network, and hired a consultant to recommend a solution. The consultant recommended the Banyan Network solution, known as VINES (Virtual Network System), a UNIX-based proprietary suite of protocols. The cost of this proposed implementation exceeded 1 million dollars. Both Information Systems staff and City management summarily rejected the proposal as being outdated and expensive.

After evaluating both Novell and the newly-released, Windows NT, IT Staff determined that a UNIX-based networking solution would best integrate with the existing environment. After evaluating many NSF clients, staff discovered [Samba](http://www.samba.org/), an open-source project that allowed Microsoft Windows clients to communicate with UNIX servers over Microsoft's SMB (CIFS) protocol. Initially, Samba was used on PC servers running SCO UNIX. However, in reading more about Samba, IT Staff discovered that Samba had been created on an Open Source operating system named [Linux](http://www.linux.org/). In comparing Linux with other commercial network operating systems, IT Staff found it to be more advanced, robust, easier to support, easier to implement, and free. The decision was made to go to Linux. In 1995, two Pentium PC servers running Linux replaced the Data General mini-system. One server ran Samba, handling File and Print Sharing, and the other ran the City's D3 database that had just been ported to Linux. Thus began the City's use of Open Source Software.

Today, the City has 11 production Red Hat Linux servers, 10 Red Hat Linux boxes acting as encrypting IP routers and firewalls, 8 Windows NT/2000 servers, and 2 Digital Unix Servers. Linux, however, remains the Operating System of choice for servers and is utilized to integrate the mixed server environment. Although the City runs Microsoft Windows 98/XP/NT on over 600 desktop PC's, File and Print sharing duties are still handled by Linux/Samba servers[[1]](http://ch.ci.garden-grove.ca.us/internet/is/linuxwhitepaper.html%22%20%5Cl%20%22footnote1) with one Linux box serving as a Primary Domain Controller (PDC)[[2]](http://ch.ci.garden-grove.ca.us/internet/is/linuxwhitepaper.html#footnote2) allowing for domain logins and roaming profiles.

Open Source software has enabled the City to take advantage of many advanced networking capabilities. Garden Grove's Internet and Intranet server utilizes many different Open Source packages. It runs on Linux, runs the [Apache](http://www.apache.org/) webserver using [OpenSSL](http://www.openssl.org/), and has a search engine based on [htdig](http://www.htdig.org/). In August of 2003, the City will launch a new Internet web site that will be created and maintained using the [Zope](http://www.zope.org/) application server and content-management system[[3]](http://ch.ci.garden-grove.ca.us/internet/is/linuxwhitepaper.html%22%20%5Cl%20%22footnote3). Both the Intranet and Internet sites include numerous CGI applications written in the [TCL](http://www.tcl.tk/) scripting language utilizing the [cgi.tcl](http://expect.nist.gov/cgi.tcl/) library[[4]](http://ch.ci.garden-grove.ca.us/internet/is/linuxwhitepaper.html%22%20%5Cl%20%22footnote4). These CGI applications also integrate data from Windows NT and 2000 servers using Open Source tools such as Samba, [NFS](http://sourceforge.net/projects/nfs), [OpenSSH](http://www.openssh.com/), and [UnixODBC](http://www.unixodbc.org/). The web server also handles DNS needs using [BIND](http://www.isc.org/products/BIND/).

Garden Grove's D3 database continues to run on Linux[[5]](http://ch.ci.garden-grove.ca.us/internet/is/linuxwhitepaper.html%22%20%5Cl%20%22footnote5). Staff has also begun writing new applications as well as porting legacy applications to a Linux server running the [PostgreSQL](http://www.postgresql.org/) database[[6]](http://ch.ci.garden-grove.ca.us/internet/is/linuxwhitepaper.html%22%20%5Cl%20%22footnote6). Another Linux server was used to host a document imaging system to handle archived data[[7]](http://ch.ci.garden-grove.ca.us/internet/is/linuxwhitepaper.html%22%20%5Cl%20%22footnote7). This system was written mostly in TCL, TCL/TK, and C, while integrating many other Open Source packages such as [SWISH-E](http://swish-e.org/), [a2ps](http://www.gnu.org/software/a2ps/), [ps2pdf](http://www.ps2pdf.com/convert/index.htm), [md5sum](http://www.gnu.org/manual/textutils-2.0/html_node/textutils_21.html), [GOCR](http://jocr.sourceforge.net/), [netpbm](http://netpbm.sourceforge.net/), and ImageMagick’s [Mogrify](http://www.imagemagick.org/www/mogrify.html).

The Linux-based mail server runs HP’s OpenMail, a messaging and collaboration solution[[8]](http://ch.ci.garden-grove.ca.us/internet/is/linuxwhitepaper.html%22%20%5Cl%20%22footnote8). [Sendmail](http://www.sendmail.org/) and [Mutt](http://www.mutt.org/) are also used to meet email needs and [SquirrelMail](http://www.squirrelmail.org/) provides users with web email access. Linux servers are also used to integrate many of the NT/2000 based servers.

Increased efficiency of system administration and technical support is made possible by such Open Source tools as the [putty](http://www.chiark.greenend.org.uk/~sgtatham/putty/) SSH/telnet client and the [VIM](http://www.vim.org/) editor. Garden Grove also uses [NIS](http://www.linux-nis.org/) to simplify the maintenance of authentication information across all Linux servers. [NTP](http://www.ntp.org/) is used to synchronize the time on all servers and desktop computers. [Rsync](http://samba.anu.edu.au/rsync/) was used to efficiently mirror data to both a a centralized backup system[[9]](http://ch.ci.garden-grove.ca.us/internet/is/linuxwhitepaper.html%22%20%5Cl%20%22footnote9) as well as to an offsite server thereby meeting the City's disaster recovery needs. [Expect](http://expect.nist.gov/) was used to create scripts to simplify user maintenance. Support staff uses [VNC](http://www.uk.research.att.com/vnc/)[[10]](http://ch.ci.garden-grove.ca.us/internet/is/linuxwhitepaper.html#footnote10) to remotely manage the desktop of all users on the network.

Most recently, the City has implemented a Wireless Wide Area Network. There is limited security built into the 802.11B devices used. However, the Police Department requires full 128-bit encryption on all wireless communication. Staff utilized Open Source software once again to meet their needs. First, a Linux-based Firewall[[11]](http://ch.ci.garden-grove.ca.us/internet/is/linuxwhitepaper.html%22%20%5Cl%20%22footnote11) was created using IP Tables and the [Firewall builder](http://www.fwbuilder.org/) GUI. This Linux machine acts as a firewall as well as an encrypting IP router. Each of the remote wireless facilities also has a Linux box acting as a firewall and encrypting IP Router[[12]](http://ch.ci.garden-grove.ca.us/internet/is/linuxwhitepaper.html%22%20%5Cl%20%22footnote12). The encryption is done using [CIPE](http://sites.inka.de/sites/bigred/devel/cipe.html) and the [Blowfish Cipher](http://www.counterpane.com/blowfish.html), both of which are Open Source projects.

Critics of Open Source software often point to the lack of product liability. Garden Grove chooses instead to focus on how robust and stable Open Source has been, thus negating the need to hold anyone liable. The City's network has enjoyed an uptime percentage of nearly 100%. This can be directly attributed to the robustness of Linux and the other Open Source packages of which the network is comprised. The City has also faired much better than its municipal counterparts running NT based networks when it comes to virus attacks, worm attacks and server hacks. Much of this can be attributed to Garden Grove's use of Apache and OpenMail in place of Microsoft's IIS and Exchange.

One reason Linux was chosen over SCO UNIX was because of the robust feature set it contained. That set however, is not truly part of Linux, but a collection of Open Source tools that was combined with the Linux kernel. It includes critical enterprise-level tools such as database engines, mail protocols, web servers, file and print sharing programs, packet filtering, and security modules, just to name a few. It is this rich feature which has enabled the City to create and maintain a complex network.

Simplified implementation and maintainability is another reason Open Source software was chosen. While staff had difficulty finding good support for both DGUX and SCO, help with Linux was in abundance throughout the Internet community. Through web sites and news groups staff could research and find quick answers to any questions that would arise. Solving problems with Linux was also simplified because most of the Open Source tools bundled with it were available upon installation. This was not the case with SCO and DGUX.

The final reason for Garden Grove's use of Open Source software is because it is free to use. Some of the benefits of free software are obvious. Some are not. The obvious benefit is financial savings. By implementing Open Source solutions in place of solutions based on Microsoft software or commercial networking appliances, City staff has saved tax payers at least **$380,551.74** in initial costs as well as **$70,465.05** annually (details can be found in the footnotes below). The less obvious benefit is a reduction of time cutting through red tape. With Open Source, staff spends no time writing RFPs, holding bids, evaluating vendors, seeking management or council approval for funding, or exhaustively researching competing commercial products. Researching an Open Source product, by comparison, is simple: Just download it and use it.

Garden Grove's decision to embrace Open Source software has allowed it to create an IT infrastructure that has advanced features, stable performance, robustness, ease of implementation, and low cost of use. Because of this success, the City expects to increase its use within the organization. Database applications, desktop operating systems, office productivity, GIS and other applications could all move towards Open Source in the future. Open Source software has enabled the city to easily automate many of its best practices. This level of automation and efficiency would not have been otherwise feasible. The Information Systems division looks back on these choices to use Open Source software without regret and without any costly missteps. The use of Open Source software has been such a resounding success at Garden Grove, that the city hopes other public agencies will investigate its use in their environments.

Footnotes:

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| **Open Source Project** | **Initial Savings** | **Annual Savings** |
| 1 File/Print Sharing Servers | $28,920.00 | $4,714.80 |
| 2 PDC Server | $1,902.40 | $462.27 |
| 3 Zope Server | $59,000.00 | $8,666.67 |
| 4 Web Server | $3,510.93 | $692.00 |
| 5 D3 DB Servers | $3,804.80 | $924.53 |
| 6 SQL Database Server | $121,067.95 | $17,497.54 |
| 7 Imaging Server | $35,000.00 | $7,333.33 |
| 8 Mail Server | $65,695.76 | $9,590.58 |
| 9 Backup Server | $13,000.00 | $13,000.00 |
| 10 Remote Software | $7,000.00 | $1,200.00 |
| 11 Firewall Server | $5,000.00 | $3,333.33 |
| 12 Remote Routers | $36,650.00 | $3,050.00 |
| **TOTALS** | **$380,551.74** | **$70,465.05** |