EUROPEAN COMMISSION
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The usage of Linux and Open Source

(a study on the possible usage of Linux and Open Source on the PC within the Commission environment)

Final Report

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1. MANAGEMENT SUMMARY

From December 2002 to April 2005, a pilot was conducted in DG INFSO to evaluate the use of Linux based PC's in the Commission environment, which involved a selected group of users. This group consisted of about 40 persons with a wide diversity of functional profiles (project officer, secretary, financial officer, deputy director general, assistant, etc. …). The scope of the pilot was the testing of the interoperability between the Linux and the Windows environment in terms of electronic file and printer sharing, text processing, spreadsheet, presentation, email / groupware software, other software and support facilities, this specifically in the EC environment.

In co-operation with the Informatics Directorate, a reference configuration was set-up on a number of PC's based on the Linux Operating System and other Open Software products.

Main conclusions are:

- The integration of the Linux based clients in the Windows NT environment did not cause any problems. Integration in the newer NET1 environment (based on the Active Directory) was also successful without major problems. Electronic files and printers both from the Linux environment and the Windows environment could be shared with each other.

- Compatibility tests of the Open Source text processing, spreadsheet, and presentation software were generally satisfactory. Conversion of complex documents showed to be sometimes problematic because of the differences between MS Word and OpenOffice and some problems were encountered with the proprietary fonts of Microsoft. On the other hand, some features were available in OpenOffice that did not exist in the Microsoft Office suite. Further improvements are to be expected now that Microsoft is supporting XML based file formats.

  Some problems relating to important Commission-specific extensions to MS Word, such as the ones used for the preparation of official notes and legal documents, were identified. A redevelopment of these extensions would be required to solve this issue.

- At the level of the email most of the features are available and no major problems were encountered. However, the shared mail and calendar resources functionality caused several problems at the level of the interoperability with the present Commission email infrastructure. Interoperability tests with the future Commission email infrastructure (foreseen for implementation in 2006) were positive and most of the problems were solved. Some problems relating to specific extensions used within the Commission (Email Archiving System) remained.

  The question can be raised if a totally new environment based on Open Source at Commission level could be envisaged. Several Open Source solutions are available with functionality comparable to Microsoft's email platform. Initiatives worthwhile mentioning are the development of Kroupware (funded by the German Administration), eGroupWare and OpenGroupware.

- Compatibility tests of Commission-wide applications were negative. Redevelopment of these types of applications as web applications will resolve the problems. The Commission environment would evolve to a more Windows-independent environment, if a strategy could be adopted on these lines. Within the present planning of DG DIGIT it is foreseen that the corporate applications under their responsibility will be redeveloped by 2008. This is already a realisation of a large part of that strategy.

However, it is imperative that any web application should be developed in a browser independent way, which should be feasible to do. The browser independence is further emphasised by the commitment of the Commission to implement the first level of the Web Content Accessibility Guidelines for the Europa and the Intracomm website.

● The Open Source world has proven to have the ability to adapt to new versions of the Microsoft software / environment. This was demonstrated with the changeover from the NT domain to the NET1 domain and with the changeover from the older versions of Office / Email to the newer versions. Sometimes there was a delay in the development of the adaptation depending on the magnitude of the differences. Also, sometimes certain useful features available in OpenSource world do not exist in the corresponding software in the Microsoft environment.

● The availability of third party software is not completely positive and is greatly depending on the market and profit analysis done by the corresponding software vendor.

The question can again be raised if totally new software based on Open Source could not be envisaged. Most of the time Open Source solutions are available with functionality comparable to the original third party software.

In general, the Linux platforms that were tested show a very fair level of usability and compatibility. An environment based on Linux is today technically feasible for limited groups with specific needs. Although there are many other factors that could play a role in the decision in favour of the implementation of an environment based on Linux, the present testing shows that is not possible to implement it at this moment in time on a large scale. Amongst the most blocking factors is the availability of Commission and local applications. The redevelopment of applications would be necessary to solve this problem. In any case, a migration of more than 25000 users is an entirely different project with different objectives, starting with a necessary cost/benefit analysis. The project of a general migration would need to be prepared and planned very carefully, in the hypothesis of a satisfactory OSS platform and a political and technical decision, in order to guarantee minimal disturbance to the users and a similar level of functionality.

Apart from this technical evaluation, it must be said that the Commission has a political role to play in ensuring that the competition rules are respected.

2. INTRODUCTION

2.1. Purpose

The Linux Feasibility study by DG INFSO started in November 2002 as a research action in the field of Linux and Open Source software, in close collaboration with the Informatics Directorate. It has been identified as high priority, and a certain political pressure exists to achieve it.

The goal of this study is to determine if and how Linux Operating System based servers and workstations can be integrated into the existing Commission's Information Technology environment, making as much as possible use of Open Source application software. It will also try to identify the incompatibilities of the Linux environment and the Commission's environment with respect to a number of its key applications like email, browser and office productivity suite. Where possible, solutions are described.

2.2. Methodology

This project was divided into a number of phases:
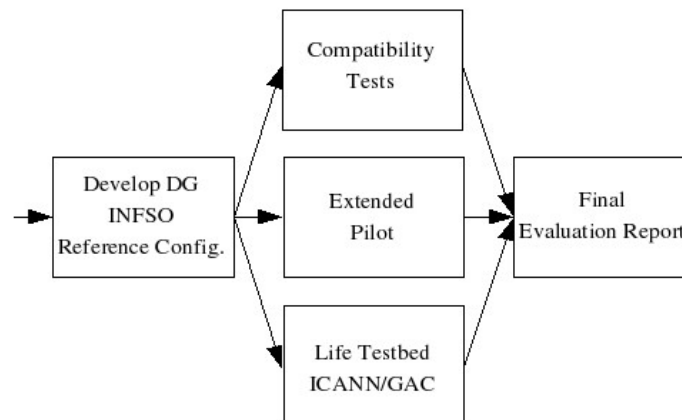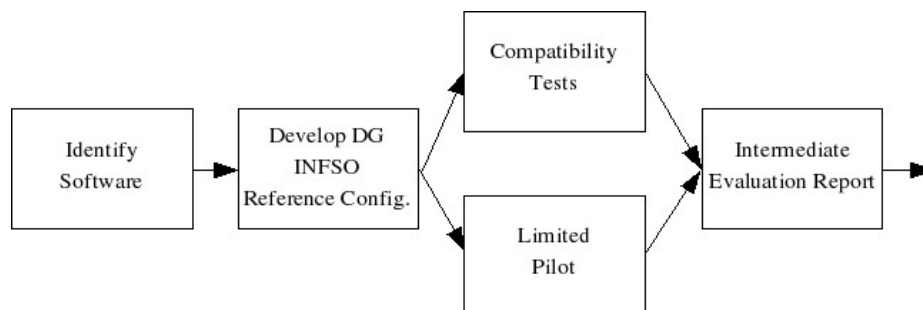
2.2.1. First phase: compatibility test and pilot with limited users

- Software selection and installation comprising:
  - The selection and installation of the Linux distribution to be used in the tests
  - The installation of a Linux server and its integration into the existing Microsoft Windows NT Domain environment.

- o The selection of Linux workstation key software, more particularly the email, groupware and office productivity applications, to be used in a limited end-user pilot test.
- o The creation of a Linux Workstation Reference Platform with these key applications, to be tested and evaluated in the end-user pilot test.

- Selection of pilot users.

- Deployment and compatibility testing comprising:
  - o Deployment of the Workstation Reference Platform to the pilot users.
  - o Compatibility and interoperability testing on the selected email, groupware and office applications.
  - o Search for and evaluation of alternative solutions for occurring problems.

- Information gathering:
  - o Meetings with the pilot users to identify and evaluate problem areas, and to search and test solutions.
  - o Contacts with different services (Informatics Directorate, Informatics department European Parliament, IDA, Informatics department of Member States,...) for information.

- Intermediate technical report of the conducted research.

2.2.2. Second phase: compatibility tests and wider scale pilot

- Installation:
  - o New, updated versions of the Workstation Reference Platform were created, based on the experience gathered during the first phase.
  - o Evaluation and improvement of the Workstation Reference Platform's integration into the Commission's IT environment.
  - o Integration into the Commission's new NET1 network environment was tested and installed.

- Selection of pilot users to create a heterogenous group to cover a large spectrum of user types.

- Deployment and compatibility testing:
  - o Deployment of the Workstation Reference Platform to the pilot users.
  - o Compatibility and interoperability testing on the new versions of the email, groupware and office applications.
  - o More practical experience on deployment, usage, maintenance and similar topics was gathered.
  - o Maintenance and upgrade procedures were defined and deployed.

- Installation of a live testbed for the independent group ICANN/GAC Secretariat.
  - o Installation of a server with the necessary services.
  - o Installation of workstations based on the DG INFSO reference configuration.

- Information gathering:
  - o Meetings with the pilot users to identify and evaluate problem areas, and to

        search and test solutions.

- o Contacts with different services (Informatics Directorate, Informatics department European Parliament, IDA, Informatics department of Member States,...) for information.

- Evaluation of the pilot through a user survey
- Full technical report of the conducted research.

3. OBJECTIVES

This study is a feasibility assessment to evaluate the usage of a PC platform environment based on the Linux Operating System and Open Source Software such as OpenOffice within the present informatics infrastructure and identifying the problems relating to the interoperability.

The objectives of the study were:

- Preparing a Linux Workstation Reference Platform for installing end-user workstations providing the same functionality as a typical Windows based workstation, including key applications like email, web browser, office productivity software.

- Testing of file- and printer sharing between the Linux and Microsoft Windows environments.

- Testing of authentication mechanisms between Linux and the Microsoft Windows Domains.

- Testing the usability of OpenOffice.org as an office suite.

- Verifying compatibility issues between the Microsoft Office suite, including the Commission's extensions to it (EuroLook and Legiswrite), and the OpenOffice.org suite.

- Searching, testing and evaluating methods of remote maintenance and software installation for the user's workstations.

- Searching, testing and evaluating methods for providing user support for the user's workstations.

- Testing of a groupware suite, and its integration in the Commission's infrastructure: email connectivity, calendar possibilities, sharing of calendar, contacts.

The tasks of the first phase were:

- Meetings with the Informatics Directorate to decide on a number of key issues regarding the definition of the Linux server and client set-up and participation in the definition of the tests to be carried out.

- To select a suitable Linux distribution for the Linux servers and workstations.

- To install a Linux test server, integrating it as seamlessly as possible into the Commission's IT infrastructure, providing file-, print- and other services.

- To select suitable key applications to run on the typical Linux workstation based on the need to integrate these applications into the Commission's current infrastructure.

- To prepare a Linux Workstation Reference Platform image for an end-user.

- To select a limited group of users for the first phase of the pilot.

- To deploy the workstations for the selected group of users.

- To perform the first basic tests to insure compatibility and functionality of the chosen applications.

- To get feedback from the users through a number of meetings.

- To gather information from other outside Institutions, and include them in the report.

Those of the second phase:

- To get feedback from the pilot-test users who were given a Linux workstation. Their experience and evaluations allowed us to improve the Workstation Platform or to propose improvements that were addressed in the second phase of this study.

- To adapt the reference configuration for the integration into the Commission's new NET1 network environment.

- To deploy the workstations for the selected group of users.

- To implement a live testbed based on the Workstation Reference Platform in the ICANN/GAC Secretariat as a production environment.

- To evaluate the Pilot Reference Workstation Platform and run compatibility tests on the key software components and their integration into the existing Commission's IT infrastructure.

- To test other packages for the solution of issues or enhancements of the current Reference Platform.

- To test the functionality of the Commission's secure email (signing and encrypting of emails) and other specific extensions (like Email Archiving System).

- To design and deploy a system for remote maintenance and software installation.

- To select and deploy tools for remote user support for the Linux desktops.

- To test the more recent version of the OpenOffice.org suite for improvements against the first findings of this study.

- To investigate an Open Source groupware solution.

- To test Linux-based anti-virus solutions.

- To get feedback from the users through a number of meetings.

- To gather information from other Institutions outside the Commission, and include them in the report.

- To evaluate the pilot through a user survey.

4. PILOT TEST HARDWARE

The hardware used for the pilot consisted of a server and a number of workstations.

The hardware made available for the first pilot were older, discarded PC's. This had of course important consequences on the target user's overall experience of this test, more particularly regarding performance.

It is however a fact, as multiple test reports available on the Internet have demonstrated, that for equivalent performance, a Linux server or workstation in general needs less performing hardware than Microsoft Windows. So, although the hardware might be considered to be obsolete by many, it was still very usable in a Linux context.

When the second Workstation Reference Platform was rolled out, the workstation hardware was replaced with the standard Commission's PC platform to address the criticism of the users participating in the first phase.

4.1. Linux test server

The hardware for the Linux test server was a Digital Prioris ZX6000 system with 4 Pentium Pro 200MHz processors, 1GB RAM, an Adaptec AHA3940 SCSI controller, a Mylex DAC960 SCSI RAID controller, 7 x 4.3GB and 6 x 18,2GB SCSI hard disks, a DLT tape streamer and a CD-ROM.

Since the bottleneck for file- and print services would be the network, rather than disk I/O or CPU performance, this machine was very well suited for these tasks. This server hardware remained the same for the two phases of the project.

4.2. Linux Workstation Reference Platform version 1

For the first platform, the hardware for the pilot test systems was recovered Olivetti M6000 and M7000 PC's. Processors are Pentium II with speeds from 333MHz up to 400MHz. All systems were configured with 128MB RAM, a 6GB or 9.4GB hard disk, ATI Rage Pro Turbo AGP 2X graphics board, sound board, USB ports and Intel EtherExpress Pro/100+ network adapter.

As mentioned above, this hardware platform was sufficient for running a Linux workstation.

The Linux Reference Platform would at that point however also have benefited from being tested on more up-to-date hardware, to obtain a better evaluation of differences in the user's performance perception as compared to the PC's based on the Commission Reference platform (for Microsoft Windows).

4.3. ICANN/GAC Secretariat

For the ICANN/GAC Secretariat workstations, the same hardware as for the Workstation Reference Platform version 1 was installed.

The server was also the same Olivetti hardware, except for an extra DLT tape streamer and a CD writer.

4.4. Linux Workstation Reference Platform versions 2 and 3

From the second Workstation Reference Platform on, new and more comparable hardware was selected. The standard workstation PC hardware selected was: Fujitsu/Siemens SCENIC E600, i850G, 256MB RAM, 40GB hard disk.

To avoid imposing two screens, keyboards and mice on the users, a KVM switch was installed for most of them.

This new hardware platform proved to be very well appreciated by the users from the first pilot still participating in the second pilot, because it improved greatly their working experience.

5. LINUX DISTRIBUTION

5.1. Selection criteria

The basic criteria that influenced the selection of the Linux distribution for server and workstation were:

- Availability and stability

- Ease of installation

- Maintainability, ease of updating/upgrading

- Availability of documentation, support

- Support by the application software developers of Open Source software

- Personalization possibilities and manageability

Previous studies from DG DIGIT already made motivated propositions for a number of Linux distributions, and were used to make the selection decisions. The *Linux Evaluation Study* of O. Sgalbiero (DI) of December 2001 and the *Intermediate Report - Version 7* of H. Brand (DI) of July 4, 2002 were used for guidance.

These reports indicate that the best server oriented choices out of the investigated set of distributions are Red Hat[1] and SuSE[2]. No direct workstation oriented research was done and no recommendations in that area were made. The selection of Red Hat as the standard distribution for the server platform was made after the start of the pilot.

The releases that were evaluated by O. Sgalbiero and H. Brand were at the time of the beginning of this study unfortunately already considered to be outdated. It is important to know that Linux distribution releases follow each other at a relatively high pace, in general at least once a year, and that sometimes a new version of the same distribution could receive a different evaluation result than its predecessor(s).

5.2. Availability of distributions

For the first Workstation Reference Platform, two choices were considered, based on the study by DG DIGIT:

Red Hat Linux was without a doubt the most commercial of the distributions. At the time, public download of the basic version was available, but to get notifications of the upgrades and security fixes, a subscription to the commercial Red Hat Network service was needed. The professional versions of the Red Hat distribution (RH Enterprise Linux AS, ES or WS) could only be obtained – via download or boxed – by buying them via their website or via a local distributor or reseller. Later on, the general policy of Red Hat changed, and the public version of Red Hat Linux was no longer available, but was replaced with the Red Hat sponsored Fedora Core distribution.

SuSE proposed both a free download version and a commercial version of their distribution. There were slight differences between the basic and commercial versions,

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[1] http://www.redhat.com
[2] http://www.suse.com

mostly due to licensing reasons. Just like for Red Hat, SuSE delivered the specialized "professional" distributions only in a commercial version, which were sold by a local distributor or reseller. Access to upgrades and fixes was free.

Quite a number of alternative distributions were available, the best known and most popular ones being **Debian**, **Mandrake**, both well-supported full-fledged distributions, and **Gentoo**, a source distribution which needs to be recompiled for/on the target system(s).

5.3. Selected distribution for the first phase

For the first Workstation Reference Platform, the **SuSE 8.0 Professional** distribution was chosen, based on previously mentioned studies and because of its European origin[3], rather than **Red Hat**, originating from the United States of America.

The software was available both on CD and on DVD.

At the time of start of this study (November 2002), new releases of this distribution were already available, both for download and commercially (*SuSE 8.1 Professional* or *Personal*). There was also a server-oriented version (*SuSE Linux Enterprise Server 8*).

5.4. Modifications for the second phase

For the second Workstation Reference Platform, prepared at the start of the second phase of this study, based on our experience with the first one, the **SuSE** distribution was replaced with **Mandrake[4] Linux 9.2 Download Edition**, a French distribution, for its better manageability, packaging and support as well as better possibilities for personalization.

This distribution was also installed on the servers (internal and for the ICANN/GAC Secretariat) configured during the second phase.

The third Workstation Reference Platform installment was mainly an upgrade to **Mandrake Linux version 10.1 Download Edition**. It included newer versions of mostly all software packages that were used.

Mandrake is now called **Mandriva**[5] since their purchase of Conectiva.

The ICANN/GAC Secretariat workstations were based on the Workstation Reference Platform version 2.

During the second phase of this study, SuSE was bought by **Novell**[6]. They continue the development of the SuSE Linux distribution[7] besides their own Novell Linux distribution.

During the second phase, DG DIGIT has selected the Red Hat distribution as a standard for the server platform.

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[3]SuSE Linux AG, Nürnberg, Germany
[4]http://www.mandrakelinux.com

[5]http://www.mandriva.com

[6]http://www.novell.com

[7]http://www.opensuse.org

6. KEY PRODUCTIVITY SOFTWARE

6.1. Workstations

For this study, next to the Linux distribution itself, a number of key applications needed to be selected to provide a workstation with comparable functionality as the standard Commission's workstation.

- The Graphical User Interface was the first choice to be made, since this would influence the user's perception of the work environment.

- An email, agenda and address book groupware application.

- An office productivity suite, compatible with Microsoft.

- A standards-compliant web browser.

- The access to the Commission's network resources and authentication.

- Support facilities.

- Specific Commission wide and local applications.

The choices were made in agreement with the Informatics Directorate, following most of their recommendations.

6.1.1. Workstation Reference Platform version 1

- *Graphical User Interface: KDE 3.0*

At the moment the decision was made, the most popular Linux GUI environments were KDE[8] and GNOME[9]. Others were available, but were not as complete and lacked certain possibilities or user interface features.

KDE 3.0 was chosen and installed from the SuSE distribution as the system's GUI. This Open Source graphical environment offers, next to very extensive configuration and personalization possibilities, a user interface that resembles the Microsoft Windows user interface closely, if so configured.

The reason for this choice was to provide a Graphical User Interface that the modal Microsoft Windows user already knows, understands, and knows how to use.

In many Linux distributions, KDE is considered the standard user GUI, as is also the case in SuSE 8.0 Professional.

The latest stable KDE 3.0 release of that moment, available on their website, was version 3.0.5a.

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[8]http://www.kde.org
[9]http://www.gnome.org

- ***Email, agenda, groupware: Ximian Evolution***

The Linux groupware suite that comes closest to Microsoft Outlook and its functionalities is Ximian[10] Evolution. This was reason enough to evaluate this software and test its integration in the Commission's email environment.

Another advantage of Ximian Evolution was that it provided for a – at that time commercial – extension, named *Ximian Connector*, that allowed Evolution to connect to Microsoft Exchange 2000 mail servers via the built-in WebDAV support, and provided for group scheduling, access to public folders and global address lists amongst other possibilities. It was however not possible to use this, since the Commission's infrastructure was – and still is – based on Microsoft Exchange 5.5 Server.

- ***Office productivity suite: OpenOffice.org***

There were a number of interesting office productivity suites available for the Linux Operating System. OpenOffice.org[11], Koffice[12] (from the KDE application suite) and Abiword[13] were probably the best known and most popular of these Open Source and free packages.

StarOffice[14] from Sun was the best known commercial package, using the same code base as OpenOffice.org. The difference lies in the availability of extra import/export filters, clip art, templates and documentation.

Requirement for the selected suite was that its compatibility level with Microsoft Office had to be as high as possible, preferably offering a similar user interface and functionality to keep the learning curve as flat as possible. OpenOffice.org fitted best this condition.

Our goal was also to select an office suite that would have a broad language support, not so much for the user interface, but rather for spell checking, hyphenation and if possible thesaurus. Here too, OpenOffice.org had the highest scores.

- ***Browser: Konqueror and Mozilla***

Linux offers a vast choice of browsers, proposing various degrees of compatibility with the standards.

The KDE 3.0 Graphical User Interface provided for Konqueror[15], which was a combination of an Open Source File Manager, Viewer application and Web Browser, much like Microsoft's offering. It would have been an interesting and well-integrated choice, but unfortunately it did not offer enough standards compliance in this version of the KDE GUI.

The best standards-compliant browser available at that time in the SuSE distribution was Mozilla[16], an Open Source offspring of the Netscape[17] Communicator suite. Just

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[10]http://www.ximian.com
[11]http://www.openoffice.org
[12]http://www.koffice.org
[13]http://www.abisource.com
[14]http://www.sun.com/staroffice
[15]http://www.konqueror.org
[16]http://www.mozilla.org
[17]http://www.netscape.com

like Netscape itself, it offers a browser, an HTML editor, an email and news client and even an IRC client. It is bundled with most Linux distributions.

For the Workstation Reference Platform, both the Konqueror and the Mozilla browser version 0.9.8 with integrated HTML page composer were selected from SuSE 8.0 Professional. The mail and IRC components were not installed. No Mozilla plug-ins were installed at that time.

The Konqueror browser was added to allow access to some Commission's internal web applications that either only accepted MS Internet Explorer or that required NTLM authentication before accessing the pages. Mozilla did not provide a solution for these issues at that time.

- *Access to Commission network resources:*

  - *SMB/CIFS withSamba*

    To allow for Microsoft Windows NT domain user authentication as well as for connecting to file- and print services and providing file services from the workstation itself to the network via the SMB/CIFS protocol, the Samba[18] Client and Server suite was installed on both the server and workstation platforms.

    The Samba Server software includes tools that allow a user to authenticate against the NT Domain PDC or BDC's from a Linux client, even without having an existing Linux account on that PC.

    The version 2.2.3a bundled with SuSE 8.0 Professional was used.

  - *Printer integration: CUPS*

    The CUPS[19] printing system allows a Linux user to use local printers, printers directly accessible on the network and printers available through a Microsoft Windows printer server or through a Linux/UNIX LPD server, CUPS or Samba printer server. This is now the default printer manager package for most Linux distributions.

    The CUPS software control panel is available both as a native application, mostly incorporated in the distribution's management tools (Yast2 for SuSE Linux), and as a web-based application, accessible through http or https protocols on port 631 of the server. This allows CUPS to be managed both locally and remotely.

- *Support facilities:*

  - *VNC/RFB with Krfb*

    To be able to efficiently provide support for the pilot users, a tool was needed that would allow the support engineer to view and take over the desktop of a remote user. This is in general done through the VNC/RFB server and client

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[18]http://www.samba.org
[19]http://www.cups.org

software. This tool was already in use in the Commission for managing remote servers.

The vncviewer version 3.3.3r1 that was included in the SuSE 8.0 Professional distribution was installed. The server side however, vncserver, did not comply with the requirements since it was not possible to view the user's desktop and to take it over using this server.

The KDE Remote Frame Buffer server[20] provided exactly the type of service that was required. This is a VNC/RFB server based on x0rfbserver[21] that allows a system administrator or support engineer to connect to the user's desktop using any regular VNC/RFB client (Windows or Linux), and to take over the user's screen, mouse and keyboard to fix problems on the user's machine.

No binary distribution was available for this package, so sources of version 0.6 were downloaded, compiled and installed. This application was later integrated in the KDE 3.1 GUI.

- ***WRP image production with mkCDrec***

   Suitable software was needed for producing an image of the Workstation Reference Platform that could easily be used for cloning and Disaster Recovery.

   First tests with the Norton Ghost[22] utility were not conclusive, probably due to a mix of reasons: obsolete version, wrong or incomplete command-line parameters to correctly duplicate the image on the Master...

   A suitable tool for reproducing (cloning) the Linux Master was found in the mkCDrec utility[23]. This is a backup and Disaster Recovery tool that allows creating a bootable CD from which a partial or complete recovery of the Linux computer can be done. The backup of the data can optionally be done onto a multi-volume CD set, on tape or on any other backup medium.

   Version 0.6.7 of mkCDrec was downloaded and installed, together with its dependencies (Linux development system, mkisofs, cdrecord) from the SuSE 8.0 Professional distribution, and the installable image was produced with this software.

- ***Commission wide and local applications:***

These packages were not installed on the Linux Workstation Reference Platform of the selected user group, but were needed for our testing environment.

- ***Wine***

   The Wine[24] package emulates the Windows API allowing native Microsoft Windows programs to run in the Linux environment without actually installing Microsoft Windows. This software was used to conduct tests of

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[20]http://www.tjansen.de/krfb/
[21]http://forum.hexonet.com
[22]http://www.symantec.com/region/reg_eu/product/ng_index.html
[23]http://mkcdrec.ota.be
[24]http://www.winehq.org

common Commission applications (like SIC, Adonis, …), developed in PowerBuilder.

- *Oracle*

  The Oracle server software was installed on the Linux server from this study to evaluate the installation procedure and to check out any potential problems on the SuSE 8.0 platform.

  To test connectivity to Oracle[25] databases, the Oracle client environment was also installed on a workstation PC. This allowed us to test the Oracle JDBC drivers from within the OpenOffice.org applications.

  The Oracle ODBC and JDBC drivers were also available for separate download via the Oracle Technology Network[26] (subscription needed).

- *Kolab/Kroupware*

  To evaluate a possible replacement for the Microsoft Exchange Server and Exchange 2000 Server products, this Open Source server suite was installed on top of a downloaded SuSE 8.1 distribution, since support for the selected SuSE 8.0 release was not available.

  On the client side, the Workstation Reference Platform was upgraded with the KDE 3.1 graphical user interface, needed to run the client programs.

  This setup would offer the following functionality:

  - Email functionality
  - Contacts
  - Address books
  - Shared agenda
  - Notes
  - Task lists
  - Shared resources
  - Print services
  - Palm PDA synchronisation

6.1.2. Workstation Reference Platform version 2 and 3

Because of configuration and maintenance problems with SuSE Linux, an alternative distribution, Mandrake 9.2 Download Edition, was selected. Later on it was maintained and finally updated to version 10.1 for the latest Reference Platform. Mandrake has since been renamed to *Mandriva*[27] after buying Brazilian-based *Conectiva*[28].

The latest versions of the selected software packages (KDE, Evolution, OpenOffice.org, ...) were installed and maintained up-to-date for this distribution.

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[25]http://www.oracle.com
[26]http://otn.oracle.com
[27]http://www.mandriva.com

[28]http://www.conectiva.com.br/

- *Graphical user Interface: KDE*

The latest available version of the KDE environment and supporting packages was installed from the Mandrake distribution and from then on maintained up-to-date. The latest version of the KDE environment is 3.2.3.

- *Email, agenda, groupware: Evolution*

Since the first platform, Ximian was bought by Novell. Novell continues to develop and support Evolution, now named *Novell Evolution*[29], and bundles it with their *Novell Linux Desktop* product. Novell has put the *Connector* (allowing an integration with Exchange 2000 or higher) in the open source domain. The version bundled with the Mandrake distribution was installed and kept up-to-date through the Mandrake update service. The latest version is 2.0.3. This version has allowed testing the interoperability with exchange 2003 (functionalities like group scheduling, access to public folders, etc…).

- *Office productivity suite: OpenOffice.org*

The version bundled with the Mandrake distribution, with supporting language files for spell check and hyphenation, was installed and kept up-to date. The latest version is 1.1.3.

- *Browser: Mozilla*

Since specific problems were encountered when connecting to certain EC web applications, due to browser identification (the server tests the browser version, and refuses access to any browser except Microsoft Internet Explorer) and NTLM authentication (a Microsoft-only single sign-on authentication protocol), the *Mozex*[30] plug-in solving these issues was installed in the Mozilla browser. This was also used to link applications to handle specific MIME formats, for example *Xine* for video content, *Xmms* for audio content.

The latest available *Macromedia Flash Player* for Linux, version 7.0, and *J2RE* (Java 2 Runtime Engine), now at version 1.4.2, were also installed.

Unfortunately, no solution was found for the issues involving incompatible (Microsoft-only) JavaScript programs, used by some EC applications.

The latest Mozilla version is 1.7.2.

- *Access to Commission network resources:*

  - *Smb4K/ Konqueror*

    The LinNeighborhood SMB client was found to be rather unstable and slow. A more performant and stable *Smb4K*[31] application was tested, allowing to browse the network for available servers and shares, and allowing to

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[29]http://www.novell.com/products/desktop/features/evolution.html

[30]http://mozex.mozdev.org/

[31]http://smb4k.berlios.de/

connect/disconnect them. Finally, the KDE's Konqueror SMB browser was used in the latest platform, and performs reliably.

- ***pam_mount***

  A shellscript (*/etc/shares_first_login*) was created to set up the user's network shares environment using the *pam_mount*[32] PAM (Pluggable Authentication Modules) module. This allowed for automatic mounting of the user's shares at login time and automatic unmounting when the user logs out again.

- ***Commission wide and local applications: tsclient/rdesktop***

In phase 2 of the project, a Microsoft Windows 2000 Terminal Server was installed to allow the project's users to access it through the *tsclient/rdesktop* tools and execute the programs on this server that were not available for the Linux platform.

- ***Support facilities:***

  - ***xf4vnc***

    The KDE Remote Framebuffer Server (Krfb) application was found to be rather unstable in the first Reference Platform, and was replaced with *xf4vnc*[33]. This was integrated into the user's start-up configuration and worked impeccably since.

  - ***Mondo Rescue***

    The platform's image production software, mkCDrec, was replaced with a less technical and more user-friendly application *Mondo Rescue*[34]. This is now used to create an installable image (clone) for duplication and rescue.

- ***Other software***

Other application packages (Gimp, gaim, Xine, Xpdf, ...) were installed on request of the users to increase the usability of the Linux Workstation platform.

Gimp: image manipulation software

Gaim: instant-messaging client

Xine: multimedia player

Xpdf: PDF file viewer

6.2. Server

Different functionalities were implemented on the server:

● file server (Samba software)

---

[32]http://www.flyn.org/projects/pam_mount/

[33]http://xf4vnc.sourceforge.net

[34]http://www.mondorescue.org

● update of software (rsync)

The test server was reconfigured with Mandrake 9.2, and became a mirror of the official Mandrake Linux distribution, configured to be kept up-to-date once nightly using *rsync*, and allowing ftp access from the workstations to do the software updates. This seriously increased the speed of the updates and upgrades of the client PC's, since only local network access was needed, and it limited bandwidth utilisation towards the Internet dramatically.

● web server (apache)

This server was also configured as an internal web server for the project with upgrade information and useful documentation.

● update of anti virus software and virus signatures (freshclam)

The sever was configured, for the antivirus tests with *ClamAV,* to act as the local virus signature database server, using the *freshclam* utility to update the server's database from the official ClamAV site.

6.3. ICANN/GAC Secretariat

In July 2003, the implementation of a live testbed consisting of the Linux Workstations and of a Linux server was requested for the ICANN/GAC Secretariat. The preparation of a number of Linux workstations and one Linux server on a separate LAN (with separate cabling, independent from the Commission network cabling), connected to the Internet via an ADSL modem was necessary for this project.

● *Workstations*

For the workstations, the Workstation Reference Pilot version 2, based on Mandrake 9.2 Download Edition was used.

A specific image was created with mkCDrec of this configuration to clone the setup and as Disaster Recovery tool.

● *Laptops*

An image for configuring Linux laptops was derived from the above configuration, modified for laptop use and with wireless network (WiFi) support enabled.

Here too, an mkCDrec image was created to easily install this image on a new laptop.

● *Server*

The server at ICANN/GAC was configured with following services:

- External mail server (MTA) for the gac.icann.org subdomain and internal mail delivery agent (MDA) using the Postfix mail server and the IMAP server.

- A software (Squirelmail) providing a web interface for the email server.

- External gac.icann.org web server using Apache and Perl.

- Internal DHCP server for workstations and printers.

- Internal caching DNS server with authority for the local LAN addresses.

- Time server for all internal systems using NTP.

- File server for the workstations using the SMB/CIFS Samba server.

- Secure shell (ssh) for secure and encrypted external access via port forwarding over the ADSL modem (incoming TCP port 1501 forwarded to the SSH port of the server). This is also used for internal access to the server besides the server's console.

- Backup facilities: the server was also equipped with a CD writer and a tape streamer and adequate software packages to allow for backups of the server and of the workstations.

An image was created with mkCDrec for Disaster Recovery purposes.

7. INSTALLATION AND CONFIGURATION

7.1. The Linux Server

7.1.1. First phase

- *Operating System*

After checking the server's RAID configuration, the **SuSE 8.0 Professional Linux** operating system was installed.

For a production server, it will most probably be best to select a "Minimum system" for installation, adding manually only the packages that are needed and their dependencies after that.

For this test system "Default installation" was selected, and additional packages were selected/unselected manually.

All hardware was identified correctly.

The server was equipped with a VGA adapter (S3 Trio32/64/64V+) with limited memory. This resulted in an X server installation with 640x480 16-bit color resolution. This is not always sufficient, even for the graphical configuration tools, although a Graphical User Interface is not really important at a server level.

The network connection was configured with a fixed IP address and used the DG INFSO domain's DNS server and gateway. A name for this server was added in DNS.

- *Server Software*

Telnet

To enable remote logins, the telnet server was installed and activated. This should however be used with extreme care, since all information, including user name and password during the login procedure, travel in clear text over the network.

For administering the server, an encrypted alternative such as a secure shell (like OpenSSH[35]) should be and was used instead.

OpenSSH

The ssh server package was installed and configured for administration purposes. Protocol 2 only was activated, since there were known exploits for the Protocol 1 version.

For authentication, the RSA protocol was activated, since it offers much stronger authentication than the usual user name and password combination. The user name and password login was not disabled, but this should be done in a production environment.

Samba

---

[35]http://www.openssh.com

The SMB/CIFS protocol server Samba was installed and configured. The Linux server was integrated into the DG13 NT domain. To do this a documentation file from the Samba distribution[36] was used as a guideline.

Integrating the server into the domain was done by:

● Making sure that the Samba server was not active

● Joining the server into the domain:
  smbpasswd -j <domain name> -r <pdc> -U <administrator>
  This resulted in the message:
  smbpasswd: Joined domain <domain name>
  and created the file */etc/samba/secrets.tdb*

● The two large RAID5 devices from the RAID array were prepared as extra filesystems, and made available through Samba to the network users.

● The *winbind* daemon, part of the Samba Server package, was configured to allow seamless integration into the existing DG13 NT domain, without the need to create and maintain all the domain users on the Samba server.

● The default Samba startup/shutdown script */etc/init.d/smb* was modified to include startup and stopping of the *winbind* daemon. The original script was preserved in */etc/init.d/smb.original*.

● The native Samba web-based configuration utility, *Swat*, was enabled at boot time and started. This allows administrators to manage the Samba configuration remotely, using a web interface with a special URL[37]. A web server does not need to be installed to use Swat.

7.1.2. Second phase

For the second phase, the server was reconfigured to become a mirror site containing the updates to the Mandrake distribution used for the Workstation Reference Platform and to act as internal server for the ClamAV virus signature database.

• *Operating System*

The same distribution as for the workstations was used: *Mandrake 9.2 Download Edition*.

• *Server software*

OpenSSH

To administer the server, the *OpenSSH* package was installed. Like for the first phase's server, only Protocol 2 was activated.

Apache

To use the server as an internal web server for the Linux Pilot, the *Apache* package was installed and configured (default installation).

---

[36]/usr/share/doc/packages/samba/htmldocs/DOMAIN_MEMBER.html
[37]https://<server name or IP>:901/ (for example https://pinguin.dg13.cec.eu.int:901/)

rsync

Two download methods were available to configure the server as a mirror of one of the official Mandrake update mirrors: *ftp* or *rsync*. The advantage of *rsync* is that it is an intelligent system, transferring only the modified packages in a compressed transmission. It is much more effective – faster and needs less bandwidth – as the *ftp* package. For these reasons, the *rsync* package was installed and configured.

ProFTPD

To provide ftp access from the workstations to the Mandrake Linux upgrades mirror, the *ProFTPD* package was installed and configured.

ClamAV

For the antivirus software tests, the *Clam Anti Virus* software package was installed, specifically to use the freshclam daemon, allowing downloading the latest virus signatures database file as soon as it becomes available.

The database was then made available for the internal systems.

7.2. The Workstations

7.2.1. Workstation Reference Platform version 1

- *Operating System*

To prepare the client, *SuSE 8.0 Professional* was installed with the "Default system with Office" option. Interesting and required packages were added manually, unnecessary packages were removed.

The relevant updates for security and bug fixes, available from the SuSE FTP site, were installed and applied.

- *Graphical User Interface*

The Graphical User Interface is an important aspect of the user's experience with an Operating System. The *KDE 3.0* GUI was installed from the SuSE 8.0 Professional distribution. Unlike other Linux distributions, SuSE provides a modified version of the KDE environment, based on a number of scripts that automatically reconfigure the user interface and menus at login or when certain programs (specifically, any part of *Yast2*, the SuSE configuration tool) are executed. This has a very frustrating effect, since it effectively prohibited us to provide a personalized starting environment for a new user, and prevented the user to further modify certain aspects of his working environment without risking loosing all his personal settings.

We had to modify the SuSE-provided scripts to partially disable this effect, which required quite some work and testing. We were not able to disable it completely.

A possible alternative was to choose for a "standard KDE" behavior, which however still did not provide for standard KDE menus. In this mode, the system menus would have to be redefined almost completely, and the SuSE behavior of re-arranging the menus and the desktop after any access to configuration tools could still not be avoided.

This disturbing behavior was, as mentioned, linked to the SuSE distribution. Tests done with other Linux distributions did not show such behavior.

- *Additional Software*

Samba Client

The *Samba* client software was installed, to allow access to and use of SMB/CIFS file- and print services on the network.

A special login script, */etc/domain_login*, was created. This script was executed at KDE login time, and connected all the network shares for the user. A second script, */etc/domain_logout*, was created to disconnect from the user's shares at logout.

Both scripts were inserted into the Graphical User Interface's startup script */opt/kde3/bin/startkde*.

The *LinNeighborhood* application, a network SMB/CIFS browser tool similar to Microsoft Windows *Network Neighborhood,* was configured and an icon was put on the desktop for easy access to it. It allowed browsing the network for available shares and connecting to or disconnecting from SMB/CIFS network shares.

Samba Server

To integrate the Linux workstation in the DG13 network, Windows NT domain authentication was needed. This service was provided by *winbind*, one of the tools in the *Samba Server* package.

A startup and shutdown script was created for the winbind daemon, and placed in */etc/init.d/winbind*.

To be able to authenticate a Windows NT Domain user on the Linux workstation, and to automatically create the user's local environment on the client computer when he logged in the first time, the *pam_winbind* module had to be inserted into a number of the PAM[38] configuration files[39], as well as the *pam_mkhomedir* module that creates the default home directory structure for the user at first login.

This made it possible to prepare a default Linux client PC environment without having to pre-configure a local user (only *root*, the administrator user, was installed). The end-user was able to log in with his/her normal Windows NT Domain login credentials. The format of the login name was *<DOMAIN>+<user ID>*.

Ximian Evolution

Ximian Evolution version 1.0.2, bundled with SuSE 8.0 Professional, was unfortunately obsolete. Tests with this version showed that the email client worked correctly, but the connection to the Commission's LDAP address book servers failed.

This situation did not change after installing the Evolution update from SuSE to version 1.0.6.

---

[38]PAM: Pluggable Authentication Modules
[39]In directory /etc/pam.d

With version 1.0.8, bundled with more recent Linux distributions[40], tests showed that connections to the Commission's LDAP servers worked correctly. Version 1.2 was available for download from the Ximian website[41], using their Ximian Red Carpet service.

We installed version 1.2 from Ximian, to be able to evaluate the latest version and its possibilities. It has to be noted that this version came with a number of dependencies. These dependent packages could eventually be overwritten when installing or upgrading standard SuSE distribution packages! This dependency problem would cause Evolution to fail after an update of the SuSE distribution. The problem was afterwards corrected by Ximian in their subsequent releases of Evolution and Red Carpet.

Linux email clients can use the POP3 or IMAP protocols downstream and the SMTP protocol upstream, both with or without SSL/TLS support.

Given that the native protocol of exchange could not be used and that the IMAP protocol could not be provided for security reasons, it was agreed with DG DIGIT to install a separate Exchange server in DG INFSO for the pilot. The mail client had to be configured correctly for the end-user, connecting it to this newly installed secondary Microsoft Exchange server, that provided for the IMAP mail protocol to connect the clients.

The connection to the Commission's different address directories was also established easily via the LDAP protocol. Three different directories were connected to successfully: European Commission, European Parliament and European Council.

Connecting a Palm V PDA was implemented using the palm connectivity software.

The aspect of connecting directly to a standard Microsoft Exchange mail server using *Ximian Connector,* enabling the use of shared resources, required a Microsoft Exchange 2000 (or higher) Server setup – the Commission's current Exchange 5.5 server was not supported – and also required a trial license for the Connector software. This was tested in the second phase.

OpenOffice.org

OpenOffice.org version 0.6.41, as included in the SuSE 8.0 Professional distribution, was obsolete.

The stable version at the time of selection and installation was 1.0.1, available from the OpenOffice.org website. This version was also included in most of the recent Linux distributions, including SuSE 8.1 Professional. Since this was the 1.0 version path rather than a beta version of the suite, it was downloaded and installed instead of the bundled version.

The Drawback is that the OpenOffice.org applications had to be introduced manually into the SuSE KDE menu system, because they were not integrated automatically. In the "pure" KDE mode however, automatic integration worked correctly.

The first time the user ran one of the suite's applications, the setup tool would automatically be executed to create the user's local directories and files, needed by the application.

---

[40]RedHat 8.0 and Mandrake 9.0 were tested
[41]http://www.ximian.com

All available language packages for spell checking and hyphenation were installed. To make these – or a selection of them – available in the user's environment, the *Tools -> Options -> Language Settings* had to be adapted, and the tools had to be activated into the user's work environment.

The languages that were installed on the Workstation Reference Platform are shown in the following table:

Language	Spell Check	Hyphenation
Spanish (es)	*	*
Danish (dk)	*	*
German (de)	*	*
Greek (el)	*	
English (en)	*	*
French (fr)	*	*
Italian (it)	*	*
Dutch (nl)	*	*
Portugese (pt)	*	*
Finnish (fi)		
Swedish (sv)	*	
Bulgarian (bg)	*	
Croatian (hr)	*	
Czech (cz)	*	
Hungarian (hu)	*	
Irish (ie)	*	
Lithuanian (lt)	*	
Norwegian Bokmaal (no)	*	
Norwegian Nynorsk (no)	*	
Polish (pl)	*	
Slovak (sk)	*	
Slovenian (sl)	*	*

The Finnish spell checker and hyphenation was found after the start of the pilot.

Konqueror / Mozilla

The stock *KDE Konqueror* was installed from the SuSE distribution as browser for the Commission's intranet sites. The browser identification was modified to give an Internet Explorer answer to fool the sites checking the browser version. The default page was set to INFSO's intranet server[42].

Mozilla version 0.9.8 was bundled with the SuSE 8.0 Professional distribution.

The latest stable release of Mozilla was however version 1.0.2, available from the Mozilla website, which would provide for bugfixes, more stability and features. It was unfortunately not yet available for SuSE 8.0.

No Mozilla plugins were installed at that time.

CUPS

The *CUPS* printer server and supporting printer databases were installed as standard part of the SuSE 8.0 Professional installation, providing access to local printers, network printers and, through the Samba software, to SMB/CIFS printers.

No standard default printer was configured on the Workstation Platform.

---

[42]http://intra.infso.cece.eu.int/

Krfb

Version 0.6 or *Krfb* for KDE 3.0.x was downloaded and installed to start automatically in the user's default environment. It appeared in the embedded application list on the KDE desktop panel.

The goal was that, when the user requested for help, a support person would be able to connect to his current X Windows session on the workstation. The user would then see a connection request window appearing, where he/she could accept or deny the connection. Once connected, the support person would be able to see the user's desktop, and to use mouse and keyboard for input. The user would still be able to use his desktop.

The typical client for this server was *vncviewer* available in Windows and Linux environments.

In later releases, this functionality would be available in the *kdenetwork* package of KDE 3.1 and later, and would not have to be installed separately any more.

mkCDrec

To reproduce the Workstation Platform Reference disk image, *mkCDrec* was chosen. This was installed on the Master to produce a bootable CD that would allow reproduction of the Master image, omitting certain directory paths.

The mkCDrec directory itself was one of the excluded paths, so that the produced image did not contain the utility.

The main advantages of mkCDrec were that it produced a bootable CD, provided an extremely fast recovery or full re-installation, that the target computer hardware didn't need to be identical to the original, and that it was independent from other resources (for example network).

7.3. Workstation Reference Platform versions 2 and 3

As already mentioned, the SuSE platform was not satisfactory in a number of ways. Mainly the setup, configuration and maintenance issues motivated the migration to another Linux distribution.

- *Operating System*

Mandrake Linux 9.2 Download Edition was selected as a replacement for SuSE. Building on the experience with the first Reference Platform, preparing the new platform was straightforward. The same software was selected, no specific problems were encountered.

- *Graphical User Interface*

The stock KDE graphical user interface was installed and configured.

- *Additional Software*

The newer versions of the different software were installed (samba, Ximian, OpenOffice, Konqueror, Mozilla, CUPS, Krfb) as part of the standard installation of

Mandrake Linux version 9.2 or 10.1. The configuration was done in the same way as for the workstation reference platform version 1.

xf4vnc

The *LinNeighborhood* SMB/CIFS client was replaced with the more stable *xf4vnc*[43].

Other software

As a result of the user meetings, besides the latest versions of the application packages, some extra packages were installed:

- *Xine*[44] – a multimedia (essentially video) player

- *Xpdf*[45] – a viewer for Adobe PDF files

- *gaim*[46] – a multi-protocol instant-messaging client

- *The Gimp*[47] – an Adobe Photoshop-like bitmap image manipulation program.

7.4. Network integration

One of the objectives of this study was to integrate of the Workstation Reference Platform as completely as possible into the existing Commission's infrastructure.

These integration goals included:

- Use of login and authentication of a user defined on the login server, but unknown in the local user table on the Linux system.

- Connecting to available network resources (disk shares and printers) and making use of them.

- Providing local resources (disk shares and printers) to the network services.

This integration was first realized into the INFSO DG13 NT domain. In 2004 the Commission migrated to the new NET1 network environment, based on Microsoft Active Directory Service, and migration to this new environment was realized.

7.4.1. Integration into the DG13 NT network

The Workstation Reference Platform was prepared so that a user could type in his NT Domain's user ID (in *<domain>+<user ID>* format) and password on the Linux PC to be authenticated. The user did not need to exist in the Linux system's local user table (*/etc/password* and */etc/shadow*).

---

[43]http://xf4vnc.sourceforge.net

[44]http://xinehq.de/

[45]http://www.foolabs.com/xpdf/

[46]http://gaim.sourceforge.net/

[47]http://www.gimp.org/

This was done by installing the *samba-winbind* server package and by configuring manually the PAM configuration to include the *pam_winbind* and *pam_mkhomedir* entries.

When a new user logged in for the first time on the Linux workstation, his home directory would be created and a script would be executed that determined the user's network shares and that prepared a configuration file for subsequent logins. This script needed to ask the user's password to insert it in this configuration file.

At the subsequent logins, the script would connect the workstation to the user's network shares automatically, without the need for the user to enter his password.

A drawback of the method that was used (a *LinNeighborhood* configuration file), was that the user's password was stored in clear text in the configuration file. It was well-protected by the file's access rights, but this still could be problematic in some situations.

For the Workstation Reference Platform version 1, we investigated a number of alternative solutions on the SuSE 8.0 platform to solve this problem. The PAM (Pluggable Authentication Modules) system, used by most Linux distributions today, was able to provide for a much better way to mount the shares without needing the user's password in a configuration file, since it was simply passed on from the PAM authentication module to the *pam_mount* mounting module. Unfortunately, this PAM method did not work on the SuSE 8.0 Professional platform.

When we prepared the Workstation Reference Platform version 2 however, based on Mandrake Linux, we did apply this method successfully. After installing the *samba-winbind* package, we modified the PAM configuration file */etc/pam.d/system-auth* by replacing it with *system-auth-winbind* that was provided by winbind. We also included the *pam_mount* module in the /etc/pam.d/kde3 configuration file (see 7.4.2)

7.4.2. Migration to NET1 Active Domain Service

In 2004, the EC migrated to the new Microsoft Active Directory Service based NET1 network architecture. As a result, the Linux Workstation configuration needed to be modified to be integrated in this environment.

The tools needed for this integration were supplied by Samba, the CIFS/SMB client-server software suite, but unfortunately this functionality was very new in Samba 3.0, the latest version available at that moment, still very unstable and not tested in a large and complex network environment like that of the EC. As a result of this, we had to test several versions of the tools, do a lot of debugging, and even communicate with the developers to finally have a working setup.

We managed to get it to work eventually in the pre-Windows 2000 login mode. Using the ADS mode first failed with Kerberos authentication. We were told it would also work in ADS mode if the pre-Windows 2000 login and the ADS login names were identical.

For the authentication to work, the EC's Windows ADS servers needed to be configured to allow for pre-Windows 2000 login mode.

Later on, after several Samba updates, we tested Kerberos authentication again, and it worked.

Samba 3.0 and later needed to be configured in Domain mode. This was done by specifying following parameters in the workstation's Samba configuration file */etc/samba/smb.conf* :

```
realm = NET1.CEC.EU.INT
workgroup = NET1

security = domain
password server = net1-linux
```

The first two parameter lines set up the workstation to be in the NET1 environment, the third tells Samba to use ADS.

The *password server* parameter line points to a round-robin DNS name for the ADS servers located in Brussels, this to avoid the login via servers of other locations. This was important, since latency times of the remote servers were sometimes important.

Before use, the workstations needed to be joined into the NET1 network using the command:

```
net join "Dgs\INFSO\Computers\Workstations\Linux" \
        -U <admin>
```

The *<admin>* in the command line is the user ID of an authorized administrator.

The *pam_mount* PAM module was now added to the authentication system, next to the *pam_winbind* and *pam_mkhomedir* modules, allowing automatically mounting and unmounting the user's network shares. The */etc/shares_first_*login script was adapted to the NET1 environment. The latest configuration files for this look like this:

/etc/pam.d/system-auth

```
#%PAM-1.0
auth      required        pam_env.so
auth      sufficient      pam_winbind.so
auth      sufficient      pam_unix.so likeauth nullok use_first_pass
auth      required        pam_deny.so

account sufficient        pam_winbind.so
account required          pam_unix.so

password  required        pam_cracklib.so retry=3 minlen=2  dcredit=0
ucredit=0
password  sufficient      pam_unix.so nullok use_authtok md5 shadow
password  required        pam_deny.so

session required          pam_mkhomedir.so skel=/etc/skel/ umask=0022
session required          pam_limits.so
session required          pam_unix.so
```

/etc/pam.d/kde3

```
#%PAM-1.0
auth      required        pam_stack.so service=system-auth
auth      required        pam_nologin.so
auth      optional        pam_mount.so use_first_pass
account required          pam_stack.so service=system-auth
password  required        pam_stack.so service=system-auth
session required          pam_stack.so service=system-auth
session optional          pam_console.so
session optional          pam_mount.so
```

The /etc/shares_first_login script

```bash
#!/bin/bash
#
# shares_first_login
#
# This shellscript needs to be run only once, at first login of a
# user.
#
# It creates a configuration file for the PAM pam_mount module to
# automatically mount the default network shares for the user.
# The configuration file is $HOME/.pam_mount.conf, the format is:
#
# volume <user> smb <server> <volume> <mount_point>
#     <mount_options> - -
#
# The mount points are located in $HOME
#
# Written by Robert Sprockeels
# Version: 1.0
#

trap "" 1 2 3 4 5 6 7 8 10 11 12 13 14 15
export PATH=/bin:/usr/bin
ConfigFile=$HOME/.pam_mount.conf
SharesDir=$HOME
LdapHost
UserName=${1:-$USER}


###
###      Functions
###

# AddShare server volume mount_point
function AddShare {
    # Create the mount point directory
    [ -d $3 ] || mkdir $3
    # Create the line in the config file
    Options="uid=$UserName,gid='Domain Users',workgroup=NET1"
    echo "volume $UserName smb $1 '$2' $3 $Options - -" \
        >>$ConfigFile
}


###
###      Main program
###

# Exclude root
[ "$UserName" = "root" ] && exit 0

# Exclude local users
# A domain user has his home in a subdirectory of /home,
# the local user in /home itself
UserHome=${HOME%/$UserName}
[ "$UserHome" = "/home" ] && exit 0

# Check if config file already exists. If so, bail out silently.
[ -f $ConfigFile ] && exit 0

# Create shares directory if necessary
[ -d $SharesDir ] || mkdir $SharesDir

# Start new config file with heading
echo "# $ConfigFile" >$ConfigFile
echo "# generated on $(date) by $(basename $0)" >>$ConfigFile
echo "# " >>$ConfigFile

# First, do the fixed-name shares
AddShare              "infso (shared space)" $SharesDir/J
AddShare         "documentscan" $SharesDir/M
AddShare              "oracle$" $SharesDir/S
```

```
AddShare                $UserName $SharesDir/Z

# Then the ones based on the LDAP entry of the user
DIV=$(/usr/bin/ldapsearch -x -h $LdapHost -b "uid=$UserName, \
ou=People, o=cec.eu.int" -s base |
awk '($1 == "div:") {printf "%d",$2}')
DIR=$(/usr/bin/ldapsearch -x -h $LdapHost -b "uid=$UserName, \
ou=People, o=cec.eu.int" -s base |
awk '($1 == "dir:") {print $2}')

[ -n $DIR ] && {
    AddShare             ${DIR}${DIV} $SharesDir/H
    AddShare             ${DIR} $SharesDir/I
}

### EOF ###
```

7.5. Email integration

7.5.1. Microsoft Exchange 5.5 Server

The following environment was set up in Phase 1 in collaboration with DG DIGIT in order to test the email / groupware functionality:
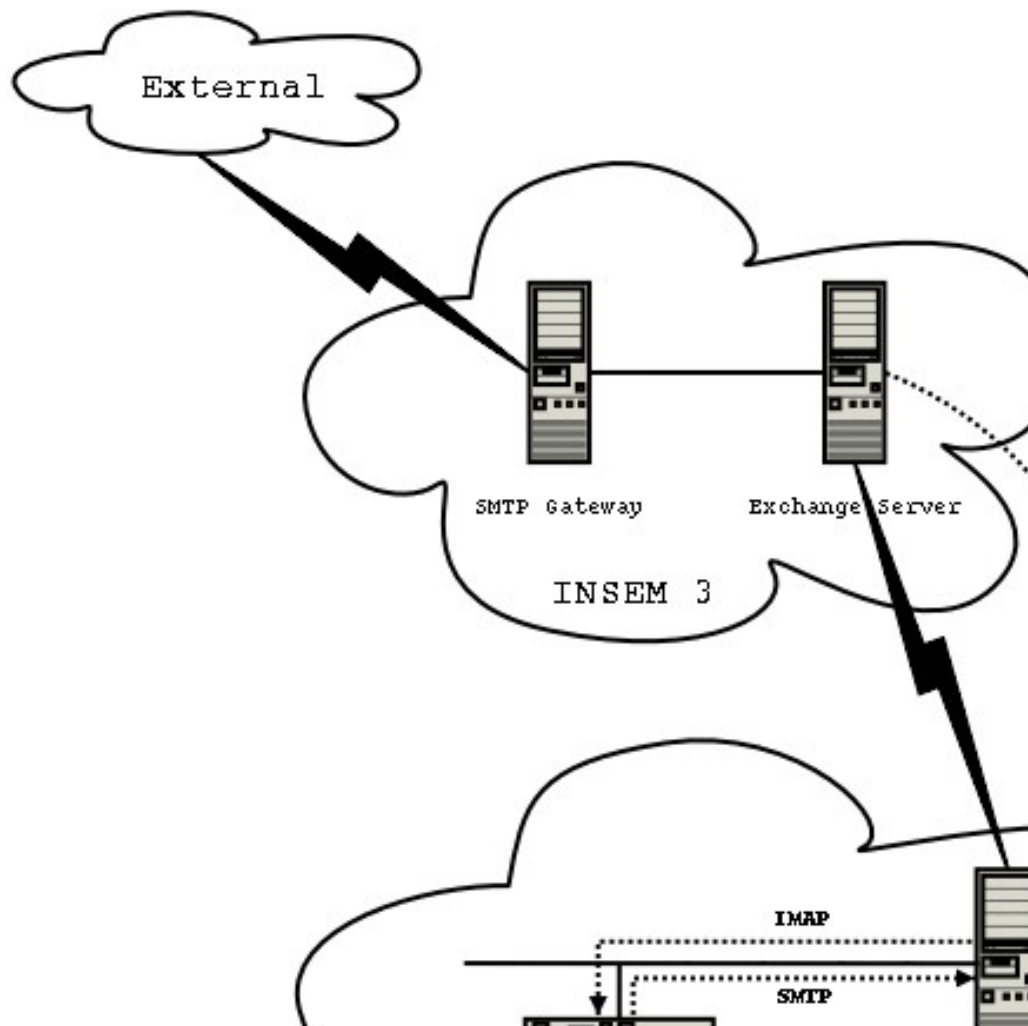
A secondary Microsoft Exchange Server 5.5 was installed at DG INFSO since the Commission's INSEM 3 production environment did not allow for IMAP protocol

connections due to security reasons. No interference with the production environment was experienced.

The incoming mails for selected users of DG INFSO were forwarded by the INSEM 3 production environment to the secondary Exchange server, named *linux-pilot.dg13.cec.eu.int*, to make them accessible to the Linux clients over IMAP. Upstream mail was sent by the Linux workstation to the secondary server using the SMTP protocol and from there forwarded to the INSEM 3 servers.

This meant that the users participating in the evaluation of the Workstation Reference Platform still had access to their "official" mailbox to avoid any loss of mail, but also to their mailbox on the secondary DG INFSO server. The disadvantage was that these users had to manage both their mailboxes.

7.5.2. Microsoft Exchange 2003 Server

When Ximian was bought by Novell, the *Connector* module for *Novell Evolution* quickly became available in Open Source. This module allows Evolution to connect to a *Microsoft Exchange 2003 Server* and to use the available shared resources (agenda, shared mailboxes, public folders, ...) through the WebDAV and IMAP protocols.

To test compatibility between Evolution and Microsoft Outlook and to compare the functionality of these two packages using this module, the MS Exchange 5.5 server located at INFSO was upgraded to MS Exchange 2003 in July 2004 in agreement with DG DIGIT. The connection scheme remained the same as for the Exchange 5.5 server and also the use of a second mailbox for the pilot.

7.6. ICANN/GAC Secretariat configuration

As already specified earlier, the basic configuration for the ICANN/GAC Secretariat was derived from the Workstation Reference Platform version 2. Some modifications were applied for their specific environment.

The network setup was the following:
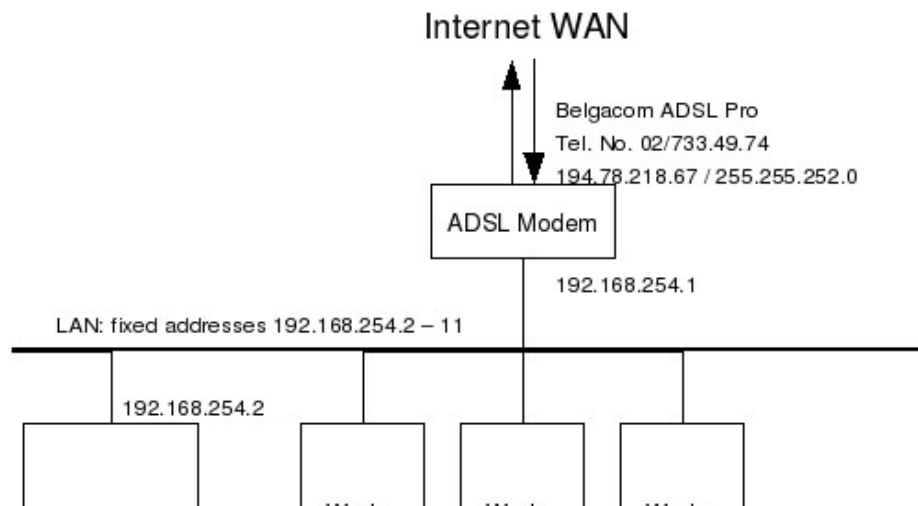
The ADSL modem received a fixed IP address and connected the LAN to the Internet providing a limited number of NATted private address space IP addresses and firewall functionality.

Server

The server provided SMTP, HTTP, HTTPS and SSH services to the outside world by port forwarding the relevant ports on the modem towards the server. The server also provided IMAP4, SSH and SMB/CIFS services to the internal network.

The server was configured from scratch using the Mandrake Linux 9.2 Download Edition, installing the packages needed for the desired services.

A backup procedure was designed for the server: system backup was provided by the mkCDrec utility, providing a bootable CD image from which the server could easily be recovered or re-installed. A backup script was installed to allow separate backup of the data to the DLT tape device of the server. A cron entry was created to automate this backup.

Workstations

For the workstations, a new image was created from the Workstation Reference Platform version 2, modified for the use at ICANN/GAC: the network login and authentication service would not be used and was disabled. User(s) would be defined locally in the /etc/password file.

A new image was prepared using mkCDrec, and this was used to clone the Linux configuration onto the workstation PC's.

Each PC's ethernet interface was then reconfigured with a fixed address in the range delivered by the ADSL modem.

A user was created on each of the PC's.

A local printer was connected and defined in the local CUPS server of each PC, and made available to the network.

Laptops

A new image was also created, based on the workstation image, for installation on laptops. It was adapted to the specific laptop's hardware configuration and WiFi networking (802.11b) was enabled.

This image was installed on three laptops.

A user was created on each of the laptops.

8. FUNCTIONALITY AND COMPATIBILITY TESTS

These tests were conducted in a number of specific areas: functionality of OpenOffice.org (OOo), compatibility between the OpenOffice.org and Microsoft Office suites, email and groupware functionality and compatibility between Linux and the Commission's current Microsoft environment.

Compatibility of certain other applications that were used in the Commission was also tested.

We also did functional tests for anti virus, remote access / deployment and maintenance of remote installations.

8.1. First Office Suite Tests

The interoperability tests of OpenOffice.org version 1.0.1 were done against Microsoft Office 97, which was part of the reference platform at that time.

The user interface of OpenOffice.org is very similar to Microsoft Office's, although it is not identical. A user migrating to OOo should experience little or no problems.

OpenOffice.org provides a subset of the MS Office features. There are advanced features of MS Office that are not available in OOo, but these are in general rather rarely used.

OpenOffice.org can exchange files with the Microsoft Office environment through import/export filters. Thanks to these, files from Word, Excel and PowerPoint can be opened but can also be saved in OpenOffice.org. There are however a number of issues: due to the differences in available features between the two packages, there are a certain number of incompatibilities that can be considered normal because feature-dependent, and there are also issues that could be considered bugs, and should be corrected. It should be noted, however, that the Microsoft file formats for the tested version of Office were proprietary and undisclosed, which made creating good import/export filters for them very difficult.

- *OOo Email interface*

For the *File -> Send -> Document As E-mail* menu option to work, a correct preferred email client setup had to be done. The tested OpenOffice.org version proposed the Netscape and KMail personalities for transmitting the parameters to the email client. The email client could however be freely chosen.

In combination with Ximian Evolution, this did unfortunately not work in the first tests, since Evolution did not accept attachments on the command line at that time, as did other email clients.

A *mailto:<email.address@domain>* link in a document could be configured to launch the preferred email client when clicked.

The same goes for the *http*, *https* and *ftp* hyperlinks in the documents: here too, the preferred browser could be configured in the options.

This configuration needed to be done through the *Tools -> Options -> External Programs* menu option, and was not installed for the initial Workstation Reference Platform, but during our compatibility tests.

- ***OOo Writer – MS Word***

The table below shows test results of the OpenOffice.org Writer application:

Feature	Result	Remarks
Character style	OK	The 'Blink' font style is not available in Word. Bullets are represented by different fonts.
Paragraph style	MIX	Modified paragraph styles are reset to default styles when exported to Word format, but preserved in RTF format.
Page style	MIX	Headers and footers are lost in Word format, not in RTF.
Template importing	OK	A Word template must be imported as a normal document, and saved as OOo template.
Template exporting	OK	The OOo template must be saved as Word document, and in Word then saved as template.
Form letters	OK	Section protection is lost with both importing and exporting.
Page, column and section breaks	MIX	Word ignores a section break just after a page break. Odd and even section breaks do not work.
Fields	OK	Number of pages field (Statistics) needs to be updated in MS Word to be correct. User fields are recognized in RTF, but not in Word format.
Insertion of pictures, clip art, autoshapes, text box	OK	In RTF format text boxes are not recognized.
Frames	OK	Embedded objects are ankered to the document, not to the frame when importing. Shadings and embedded objects are lost when exporting.
Hyperlinks	OK	Setup of 'Preferred browser' feature in OOo.
Notes	OK	
Borders and shadings	MIX	No shadings in Word format, but OK in RTF.
Spellcheck	OK	Languages need to be installed and activated.
Hyphenation	OK	Languages need to be installed and activated.
AutoCorrect	OK	
Indexes	OK	
Table of contents	OK	
Cross-reference	OK	
Headers/Footers	MIX	Lost in Word format, not in RTF.
Footnotes/endnotes	OK	Endnotes are on a separate page in OOo, on the last page in Word.
Tables	OK	With conversions, formulas in the tables are lost.
Link to external file	OK	
Calculations	OK	
Numbering	OK	
Outline numbering	OK	
Mailmerge	FAIL	Word format loses database fields when exported from OOo. Importing works, but fields need to be re-connected to data.
Password protection	FAIL	OOo does not support password protection with .doc files.
OLE support	FAIL	Not available
Bullets / numbering	MIX	Some problems were encountered with the interchange of documents based on the Eurolook templates.
Oracle connectivity	OK	Tested with "thin" only, not with "oci" JDBC interface.

There was an OpenOffice.org Dictionary Installer[48] available that allowed a user to download and install any of the available languages directly from the Internet. Version 0.55, both with dynamic and static libraries, was tested, but crashed at startup on the SuSE platform, probably due to library dependencies. This program worked correctly

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[48] http://ooodi.sourceforge.net

under Red Hat 8.0 and Mandrake Linux 9.0. Because of the problem, it was not integrated into the Workstation Reference Platform.

As a conclusion of these tests, we can state that the compatibility was very high, though not complete. It failed mostly in a certain number of advanced features. Certain issues with basic features (like headers/footers, embedded objects, modified paragraph styles) were more important and needed to be fixed. In a number of situations, saving the document in RTF as an intermediate format rather than the MS Word format gave better results to exchange documents between the two environments.

- *OOo Calc – MS Excel*

The OpenOffice.org Calc application tests results:

Feature	Result	Remarks
Macro's	MIX	OOo has a subset of MS Excel's possibilities. VBA programs often fail because of compatibility.
Charts	MIX	OOo has a subset of MS Excel's chart types, custom chart types are replaced with standard types. Axis titles and scales are lost. Customizations to the chart are sometimes lost.
Graphs	OK	Axis titles and scales are lost.
Data pilot	OK	
Data outlining	OK	
Consolidation	OK	
Cell formatting	OK	
Import/export csv	OK	
Password protection	FAIL	Same remark as for Writer.

Here too, the compatibility level with Microsoft Excel was in general more than satisfying. The potentially problematic areas were the conversion of Excel charts and the VBA macro's.

- *OOo Impress – MS PowerPoint*

The OOo equivalent of PowerPoint, Impress, also provided for a large subset of MS PowerPoint's possibilities, and showed these compatibility results:

Feature	Result	Remarks
Multimedia content	FAIL	Sound is lost in conversion.
Slide transitions	OK	
Object transitions	OK	In certain cases, an extra (intermediate) transition is inserted when converting from .ppt to OOo, resulting in the need for an extra keystroke.
Overlaying objects	OK	
Fonts	OK	Fonts are rendered correctly when present. Differences in size and type when font replacement is needed.

Compatibility with MS PowerPoint presentations was excellent for simple presentations, satisfying for more complex ones. Multimedia contents were somewhat problematic. Conversion to PowerPoint did not generate problems.

- ***OOo – MS Access***

OpenOffice.org had DBF and flat text files as default native database formats. It had a somewhat hidden MS Access-like user interface that allowed creating databases, tables, queries, forms, reports, and so on. The data could be easily integrated into the other OOo applications.

Data between MS Access and the native OpenOffice.org database types could be exchanged using industry standard CSV format or the very popular DBase DBF format. Another way was to use ODBC or JDBC connectivity to the MS Access database. The native MS Access *.mdb* file format could not be used by OOo. There were however Open Source tools available on the Internet that allowed accessing, reading and converting these files, like for example the *mdbtools*[49] package.

- ***Connecting to Other Databases***

ODBC and JDBC access from OOo to other databases was also available, and required the specific database's ODBC or JDBC modules to be installed on the Linux client. Both commercial and free drivers were available, depending on the database to be connected.

JDBC was tested with access to an Oracle database at INFSO, and worked quite well, but only with the "thin" interface. We had no success with the "oci" interface, but did not take the time to further investigate the problem.

ODBC Connections to databases like PostgreSQL[50], MySQL[51] and even Microsoft Access and Microsoft SQL Server databases seemed to give no problems.

Once the connection was defined and established, the same user interface as for the native OOo databases was available.

- ***Macro Language***

A macro language, similar but not identical to MS Visual Basic for Applications, is available in OOo. The API's of the applications are however completely different, what makes the VBA programs incompatible with OOo. This means that VBA programs could probably be adapted, but that this would require a re-development.

Ideally, native OOo programs should be developed.

The OOo user could control if, when saving a modified MS Office document, the modified (OOo) macros would be saved or rather the original Microsoft VBA macros.

There is a very complete and well documented OOo API that allows its components to be controlled from various programming languages. Primary languages are Java and C++. A development kit is available from the API website[52]. The Developer's Guide can be downloaded in PDF format.

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[49]http://mdbtools.sourceforge.net/
[50]http://www.postgresql.org
[51]http://www.mysql.com
[52]http://api.openoffice.org

OOo proposed *Netbeans*[53] and *Forte for Java*[54] as best choice for Integrated Development Environment. The most popular IDE environment today however is IBM-sponsored *Eclipse*[55].

- *Eurolook*

Due to its very tight links with the Microsoft Windows Registry and the use of MS Windows specific constructs and functionalities, the Eurolook application did not work as such in the Linux environment.

Several attempts were made to make this software run, but none of them were successful.

We received the sources of the Eurolook application to further investigate these issues, and even tried recompiling the software on the Linux platform. This failed due to application library dependencies and incompatibilities.

As a workaround, it was possible to export the styles of a Eurolook document by creating an empty document in MS Word, saving it, and using it as a template in OOo. This allowed the user to use the styles and attributes that were defined for the type of document that was chosen. Some problems were still encountered with the usage of numbering and bullets.

It should be possible to develop an application like Eurolook for the Linux OpenOffice.org environment, making use of the OOo API.

- *Legiswrite*

The Legiswrite application was even more strictly linked to MS Windows than Eurolook, and could not be used in a Linux environment either.

A Legiswrite-like application for OpenOffice.org could probably also be developed.

8.2. Second Office Suite tests

For the more recent Workstation Reference Platform versions, version 1.1.3 of the OpenOffice.org office suite was installed. Since this version contained a lot of enhancements, we tested its compatibility with the Commission's new reference application: Microsoft Office XP on Windows XP.

Like for the first tests, most of the conversion problems between OpenOffice.org and Microsoft Office were due to the OOo import/export filters. The obvious reason for this was that the Microsoft file formats were undocumented, proprietary formats. But on the Internet we also found complaints about the quality of these filters, compared to those of some other (commercial) packages. These companies would however most probably have signed a non-disclosure agreement with Microsoft, and would then have received or bought the file specifications.

Like for the first tests, a number of problems disappeared when using the open standard RTF format in certain situations.

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[53]http://www.netbeans.org
[54]http://www.sun.com/forte/ffj/index.html
[55]http://www.eclipse.org

An alternative that could be considered if this incompatibility is an issue, is the use of Sun's commercial version of OpenOffice, the low-cost StarOffice 7 that ships with other – reputedly better – import and export filters.

With the experience of the first instalment and the feedback we had from the Pilot users, we investigated a little bit further and deeper into the problematic areas. This is why the second test results may seem more negative than the first ones.

- ***OOo Writer***

Feature	Results	Remarks
Character Styles		
- Importing	OK	
- Exporting (Word)	OK	The *Blink* font style and a number of *Strike through* styles not available in MS Word.
- Exporting (RT)	OK	The *Blink* font style and a number of *Strike through* styles not available in MS Word.
Page Styles		
- Importing	MIXED	Headers and footers are lost in MS Word .doc format, not in RTF.
- Exporting (Word)	FAIL	Headers and footers are lost by the export filter.
- Exporting (RTF)	OK	
Templates		
- Importing	OK	A Word template must be imported as a normal document, then saved as an OOo template.
- Exporting	OK	An OOo template must first be saved as MS Word document, then saved as template in MS Word.
Sections		
- Importing	MIXED	Importing an MS Word document with sections will often be formatted differently than the original document.

Feature	Results	Remarks
- Exporting	FAIL	When exporting either to Word or to RTF, a large number of problems exist. Very often section information is lost or mangled by the OOo export filters. – Section names are lost – Multi-column sections loose their separation lines if present. – Section breaks are lost. – Column widths are not respected. – Section protection (write protected, password protected and hidden sections) is exported loosing the attributes. – Other attributes (background color, embedded pictures...) are lost
Breaks		
- Page break	OK	When exporting, a section break that immediately follows a page break is mangled in the Word format, OK with RTF. There might be other similar problems that were not detected during these tests.
- Column break	FAIL	See exporting section.
- Section break	FAIL	See remark of page break and section exporting.
Fields		
- Date & time	MIXED	Converted to plain text in RTF
- Page numbers	MIXED	Total number of pages converted to plain text in RTF.
- Special fields	MIXED	Word format: – Document fields are OK (creation date, title, subject,...) – Statistics fields need to be refreshed (F9) – User fields are converted to plain text – Variables OK RTF format: – A number of document fields are OK, other converted to plain text – Statistics fields user fields, variables are converted to plain text
Insertion of		

Feature	Results	Remarks
- Picture	MIXED	Word format: – Positioning mangled in multi-column section – Often loss of certain attributes (size, positioning, wrapping...) – Shadow attribute always lost RTF format: – Picture is saved in separate file (normal behaviour) – Some attributes are lost (shadow...) – Lost in multi-column section – In frame context: original anker position is lost (now ankered to paragraph)
- Clip art	MIXED	Word format: – Positioning (anker) position modified – Certain attributes are lost like object shadow RTF format: – Anker position modified – Loss of certain attributes (shadow, spacing,...)
- Draw objects	MIXED	Word format: – Anker position modified – Loss of certain attributes (shadow,...) RTF format: – Completely lost
- Frame (Text box)	MIXED	Mostly OK, loss of shadow attribute See also above (embedded objects)
- Hyperlink	OK	Must be set up correctly before use in OOo.
- Notes	MIXED	– Word format: lost in frame – RTF format: always lost
Spellcheck	OK	
Hyphenation	OK	
AutoCorrect	OK	
Indexes	OK	
Table Of Contents	OK	
Cross-reference	OK	
Headers/footers	MIXED	Word format: lost
Endnotes	OK	On separate page in OOo, on last page in Word

Feature	Results	Remarks
Tables		
- Merged cells	OK	
- Splitted cells	OK	
- Sorting	OK	
Formulas	FAILED	Formulas are lost, replaced with resulting values
Link to external file	OK	
Multi-column text	MIXED	Some attributes get lost (separation line,...) See above (embedded objects)
Calculations	OK	
Numbering	OK	
Outline numbering	OK	
MailMerge	MIXED	OOo uses a different approach to MailMerge than MS Word, and is incompatible. Fields are present in the converted document, but need to be reconnected to the data.
Password-protection	FAILED	MS Word uses a proprietary password mechanism. For this reason, OOo can not save or read password-protected Word documents.
Database connectivity	OK	With ODBC, JDBC and native methods

Like for the first tests, compatibility with Word was very positive, but problems did arise with complex documents.

- *OOo Calc*

Even though OOo version 1.1 was able to read MS Workbooks, the compatibility is mostly fine on worksheet level. Workbooks with VBA macros did not function in OOo.

There is a quick introduction document from OOo programming, *Porting Excel/VBA to Calc/StarBasic*, describing the issues and methods for porting the macro's and VBA programs to the OOo environment.

Feature	Results	Remarks
Formulas	OK	
Macro's	MIXED	OOo has a different object model than MS Excel, and macro's are therefore mostly incompatible. The MS macro's can in general be ported to OOo, but this requires re-programming them.

Feature	Results	Remarks
Charts/graphs	MIXED	OOo is more limited than MS Excel in its charting and graphing possibilities. As compared to the previous version, OOo now also has a limited set of 3D charts. When importing, custom MS Excel chart types are replaced with standard types. When exporting to Excel, the chart attributes may change a little.
Data Pilot	OK	
Data Outlining	OK	
Consolidation	OK	
Cell formatting	OK	

- *OOo Impress*

In general, a slide show created in OOo Impress would be rendered correctly in MS PowerPoint. The inverse was not necessarily true however, depending on the features and fonts that were used.

Feature	Results	Remarks
Multimedia content	MIXED	Sound clips sometimes are not played completely.
Slide transitions	OK	
Object transitions	OK	
Multimedia	MIXED	The multimedia content like audio for slide transitions and object transitions works, but sometimes with strange/unwanted results.
Overlaying objects	OK	
Fonts	MIXED	Standard fonts are OK, but size and style may vary if font substitution is used.

- *OOo Basic*

A macro language, very similar to Microsoft's Visual Basic for Applications, was available for OOo, called *StarBasic*. There was a very important issue, however, that made using MS macro's "out of the box" very unlikely: the Microsoft and OpenOffice.org object models were completely different.

For the programmers, an *OpenOffice.org Developer's Guide*[56] as well as extensive online *API documentation* was available on OOo's website[57].

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[56]http://api.openoffice.org/DevelopersGuide/DevelopersGuide.html

Other extremely useful programmer's information documents like *Useful Macro Information for OpenOffice*[58] and Sun's *StarOffice™ 7 Office Suite Basic Programmer's Guide*[59] described the OOo API and the Basic programming language's possibilities. Sun's StarOffice has also a conversion software for transferring Microsoft Visual Basic for Application macro's, but this was not tested given that it was a commercial product.

OOo's environment allows for use of a variety of programming languages. For an Integrated Development Environment (IDE), OOo proposed to use *NetBeans*[60]. Today the most popular IDE would certainly be *Eclipse[61]*.

Since the beginning, the OpenOffice.org data files were in an open XML format, allowing third party developers to interact with these files. OASIS, the international e-business standards consortium, approved OpenOffice.org's *Open Document Format for Office Applications version 1.0*, used in the upcoming version 2.0 of OpenOffice.org, as a standard. Microsoft is in its new version of Office also supporting the XML format. It is to be expected that the interoperability will increase in the future through the support of XML in MS Office. However, it might still be problematic, since even though they have opened these formats to some extent, these are still proprietary, and they even tried to patent some of their XML format technology[62]!

Another experience is that the interoperability also increases with the newer versions of OpenOffice in comparison to the same version of MS Office. This was demonstrated when going from OpenOffice version 1.0.1 to version 1.1.3 in comparison to MS Office 97 and going from OpenOffice version 1.1.3 to version 2.0 in comparison to MS Office XP.

The new version of OpenOffice has got a whole new database environment based on the Java-based HSQL[63] database engine

8.3. Mail and Groupware tests

The features were mainly tested with Ximian Evolution 1.2.0 and with the KDE 3.0 applications KMail, KAddressBook and KOrganizer.

The KDE environment was version 3.1. An upcoming Kroupware/Kolab client/server package set was also evaluated.

A number of MS Exchange Server related features of the Open Source Ximian Evolution program (groupware functionality) were only available when the *Ximian Connector*, at the time of the first phase a commercial add-on, was installed. More specifically the connection to the server-side agendas and tasks, both private and shared, would be possible when connected to a Microsoft Exchange server. This could not be

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[57]http://api.openoffice.org/

[58]http://www.pitonyak.org/oo.php

[59]http://docs.sun.com/db/doc/817-1826?q=StarOffice

[60]http://www.netbeans.org

[61]http://www.eclipse.org/

[62]http://www.eweek.com/article2/0,1895,1458740,00.asp

[63]http://hsqldb.org/

tested in the first phase, since this required at the time an Exchange 2000 server and a license for the Connector.

Regarding the interoperability with a PALM V PDA, both synchronization and information exchange (agenda, address book,...) worked perfectly well both ways, and was well integrated in Evolution.

Later on, when Ximian was bought by Novell, the Connector was put in the public domain, enabling us to test its possibilities and compatibility in the second phase.

- *Mail features*

This is a comparison table of the availability of mail features we tested in the different email clients:

Feature	MS Outlook	Ximian Evolution	KMail/KOrganizer
Sending (SMTP)	Yes (Internet Mode)	Yes	Yes
Receiving (IMAP and IMAP/S)	Yes (Internet Mode)	Yes	Yes
Rich format	Yes	Yes (HTML)	Yes (HTML)
MIME support	Yes	Yes	Yes
Local contact list	Yes	Yes	Yes
Shared contact list	Yes	Yes (LDAP)	Yes (LDAP)
Local distribution list	Yes	Yes	Yes
Shared distribution list	Yes	Yes (LDAP)	Yes (LDAP)
Local folders	Yes	Yes	Yes
Central folders	Yes	Yes (IMAP)	Yes (IMAP)
Shared folders	Yes	Yes (IMAP or Connector)	Yes (IMAP)
Spellcheck	Yes	Yes (configurable, language can be selected in composer)	Yes (dictionary, encoding and client program can be selected in composer)
Message priority	Yes	No	Yes
Return receipt	Yes	No	Yes
Digital signature	Yes	Yes	No
Encryption	Yes	Yes	No
Filters	Yes	Yes	Yes
Forms	Yes	No	No
Virtual folders	No	Yes	No
User Inteface customization	Yes	Yes	Yes
Import PST folders	--	Yes (see below)	Yes (see below)
Import distribution lists	Yes	Yes	Yes
Multiple IMAP accounts	Yes (Internet mode)	Yes	Yes
Managing other user's account	Yes	No	No
Spell checking	Yes	Yes	Yes
Virus checking	Yes (external anti-virus)	Yes (external anti-virus)	Yes (external anti-virus)

Microsoft Outlook uses a proprietary format for the personal folders, the PST files. A search on the Internet allowed us to find a number of solutions to export the Outlook folders and import them into Linux email clients.

A number of these methods were evaluated or tested:

- Export method over MS Outlook Express: it was reported that Outlook Express was able to convert a .pst file into the industry standard mbox format (RFC-822 or RFC-2822), which could then be imported on Linux. This solution was not available any more.

- Conversion using Mozilla Mail[64] on Windows: this version could convert Outlook mailboxes, because it uses the MS Windows MAPI.DLL to access them, saving the data in mbox format.

- Conversion using an IMAP server: MS Outlook can also connect to a Linux IMAP server (for that, it needs to be in Internet Mode). Mails can then be copied from one to the other. Don't use drag and drop, since this will **move** the mails instead of copying them. This proved to be the most effective and reliable method, where no mails or attachments would be lost.

- Using export filters on Windows: a number of free solutions were available on the Internet, but all suffered from a major flaw: attachments were lost. We found only one tool that worked correctly and seemed to export all attachments. This was a commercial program called Outlook2Mac from a company called Little Machines[65] . It was designed for Apple Macintosh, but also worked perfectly well for Linux, and claimed to be able to convert all versions of Outlook to the mbox format. Cost of this program was US $10.

- We tested Outlook2Mac's evaluation version, limited to 5 mails, and found it to work perfectly well: mails, contact list and calendar info were converted and usable in Evolution. No tests were done for KMail and KOrganizer, but they follow the same mbox/iCal standards, and should work equally well.

  After purchasing a license for Outlook2Mac, and converting a number of user's mailfolders, we did encounter some problems, though. Sometimes the program would loose attachments and even entire mails. This could have been caused by corrupted mails.

The best and most reliable way to transfer the mails was to connect MS Outlook (in Internet Mode) to both MTA's and – simply by using the drag-and-drop method – copying the mails to the new server.

Two email client features, the selection of the priority of the message (traditionally: High, Normal, Low) and the possibility to request a return receipt (on read or on delivery, sometimes both), are not present in the Evolution mail composer, and would have been useful.

Multi-language spell checking was available for all the packages. The required language(s) needed to be installed and configured.

- *Groupware features*

The groupware feature tests were done in relation to the Commission's current mail server environment, but we also investigated some alternatives.

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[64]http://www.mozilla.org
[65]http://www.littlemachines.com

This table shows the available features in the Linux Workstation Pilot applications as compared to MS Outlook:

Feature	MS Outlook	Ximian Evolution	KMail/KOrganizer
Local agenda	Yes	Yes	Yes
Shared agenda	Yes	Via Ximian Connector	No
Local Task list	Yes	Yes	Yes
Shared Task list	Yes	No	No
Send meeting requests	Yes	Yes	Yes
Handle meeting requests	Yes	Yes	Yes
Free/busy info publishing	No	Yes	Yes
Connection to Exchange Server	Yes	Via Ximian Connector	No
Summary mode	Yes	Yes	No
Local projects	No	No	No
Shared projects	No	No	No
Import/export	Yes	Yes	Yes
Merge agendas	Yes	Yes	Yes
Archiving old entries	Yes	No	Yes
Palm PDA synchronization	Yes	Yes	Yes

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a. Ximian Evolution Compatibility

In the first phase of the study, the tests were done with a Microsoft Exchange 5.5 server. The Ximian Connector, at that time a commercial plug-in, needed minimum a Microsoft Exchange 2000 and was therefore unavailable. This resulted in poor interoperability results.

Later on in the study, Ximian was bought up by Novell, and the Connector was put into the public domain. At that stage, it however required a Microsoft Exchange 2003 Server, which was not available in the Commission's infrastructure. In agreement with DG DIGIT, a Microsoft Exchange 2003 server was installed and configured at DG INFSO for the second phase of the pilot. The interoperability tests in this new environment were conclusive: the workgroup features could now be used from Evolution.

The compatibility tests between Ximian Evolution and the Microsoft environment gave the following results:

Feature	
Attachments	Could be exchanged in both directions.
Meeting requests	There was an incompatibility between Ximian Evolution and MS Outlook due to the mail message format: Evolution did send its requests as a text/calendar MIME *email type*, whereas Outlook expects the mail to have a text/calendar *attachment*. This problem was solved in later versions of Evolution.
Free/busy info	These messages were not recognized by Outlook, due to the message MIME type incompatibility. Evolution could handle the messages coming from Outlook correctly.
VBA scripting	This is a feature available in Outlook that is not available in Evolution. A side effect of this is that Evolution does not support forms. On the receiving end, however both environments can hand over an email message to a program or script for handling.
Access to public folders	Worked with Connector and MS Exchange 2003.
Access to shared agendas	Worked with Connector and MS Exchange 2003.

Meeting requests were transmitted as special email messages typically using the industry-standard vCalendar formats. No clear standard for the mail message that contains the meeting request is defined up until now. This explains the different approaches between Microsoft and Ximian. The Ximian Evolution product seemed however to be able to handle both types of mails. The meeting requests seemed to work both ways on a MS Exchange 2000/2003 server.

b. KMail/KAddressbook/KOrganizer

The Workstation Platform, based on SuSE 8.0 Professional, used KDE version 3.0. The mail, address book and organizer applications in this version had limitations, which made them too limited for use in the Commission's environment.

A quick overview of the features of KDE 3.0 in relation to the Microsoft environment shows us:

KDE Feature	Import	Export	Direct Access
KMail access to Exchange Server	Yes (See below)	No	No
KAddressBook access to LDAP server	Yes (csv format)	Yes (csv format)	No Yes: >= KDE 3.1
KOrganizer access to Exchange Server	No Yes: >= KDE 3.1	No Yes: >= KDE 3.1	No

The stable version of KDE during the first phase, version 3.1, had more features that allowed a better interaction of these programs with the Microsoft environment and provided for better security:

● KMail gained several privacy and security enhancements like S/MIME, PGP/MIME and X.509v3 support.

● The KOrganizer calendar and scheduling application had a plugin for accessing calendar data on a Microsoft Exchange 2000 Server. This plugin used the WebDAV protocol of Microsoft Exchange 2000 Server, which required the Outlook Web Access (OWA) feature to be enabled. It allowed to import and export calendar data from and to the Exchange 2000 Server. It did **not** allow to see the user's data in real-time or to share data with other users.

● KAddressBook included the LDAP and vCard standards. This allowed it to access central LDAP directories and to exchange vCard-formatted data with other applications.

● KPilot provided integration for Palm OS based PDA's with a number of conduits.

As can be concluded from the above, a number of the features depended on an MS Exchange 2000 Server in stead of the at that moment available Exchange 5.5 Server on Windows NT.

A number of conversion tools were available on the Internet that allowed exporting data from the MS Exchange Server to the KDE applications. One of them was Outlook2VCal[66], for use on a Windows PC, which scanned and exported all the user's appointments to an industry standard vCalendar file that could then be used to import the data into KOrganizer or Ximian Evolution.

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[66]Workshop: http://korganizer.kde.org/workshops/Outlook2VCal/en/index.html

The next version, KDE 3.2, provided for a complete integrated groupware system (Kontact). It integrated the major PIM (Personal Information Manager) applications already mentioned, but also incorporated the achievements of the Kolab project.

- ***Kolab/Kroupware***

An Open Source development project, funded by the German government (Agency for Information Technology Security) from October 2002 to July 2003, called Kolab/Kroupware[67] aimed to provide an alternative groupware server and client, based only on Open Source and Open Standards technology. It positioned itself as an Open Source replacement for the Microsoft Exchange (and Exchange 2000) servers. It is now integrated in the KDE program suite as the Kolab/Kontact package.

The server was composed of the standard Open Source packages Postfix, Cyrus IMAP, OpenLDAP, OpenSSL, ProFTPD and Apache, that were combined together in a coherent way to provide for a groupware server platform providing email, private and shared agendas and task lists.

The client side for Linux was called Kroupware (now Kontact): it consisted of several modified KDE tools: KMail (email client), KAddressBook (address book), KOrganizer (agenda, to do, notes), Kitchensink (synchronization with Palm PDA).

On Microsoft Windows, it would be possible to use MS Outlook as a client to the Kolab server by installing a commercial plug-in for Outlook, the Bynari Insight Connector 1.09. Full functionality of this client as in the Linux client was not planned.

No connection to or interaction with Microsoft Exchange or Exchange 2000 were planned in the Kroupware project.

The Kolab/Kroupware combination was tested with mixed results. This software was at that moment still under development, and no stable release was available.

The Kolab server seemed to be stabilizing, but the administration web interface was too simplistic and did not provide the necessary management and configuration tools. The client – partly due to its shifting dependencies – was more difficult to install and configure correctly, still had quite some bugs, and could not be considered ready for production at the time.

Currently, the Kolab[68] server package is at version 2.0. The available clients are KDE Kontact[69], Microsoft Outlook with the Toltec Connector 2[70] for Outlook plugin, Konsec Konnector[71] for Outlook, Horde[72] webmail.

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[67]http://www.kolab.org
[68]http://www.kolab.org

[69]http://www.kolab.org/about-kolab-clients.html#kdeclient2

[70]http://www.kolab.org/about-kolab-clients.html#toltec2

[71]http://www.kolab.org/about-kolab-clients.html#konsec

[72]http://www.kolab.org/about-kolab-clients.html#horde

8.4. Browser

During our tests, several issues were discovered in relation to the Commission's intranet websites. These problems were related to the NT Domain authentication that some of the applications require before allowing access to the site. This type of authentication could only be provided by MS Internet Explorer, and would fail for any other browser.

A second issue in this area was the MS Internet Explorer browser identification string that was checked by some applications before allowing access (SYSPER 2). No other browser would be allowed. This could be circumvented when using the native KDE browser, Konqueror, where the identification string can be changed, and by inserting a plugin into the Mozilla browser to "fool" the webserver.

A third issue was discovered in the use of Microsoft-only JavaScript language extensions in Commission's web pages. Currently, there are no other solutions available for this issue than to redevelop these pages without the Microsoft-specific JavaScript code. It is therefore imperative that web applications should be developed in a browser independent way.

8.5. Anti-Virus

Although Linux itself is not subject to virus activity thanks to its security design – only one proof-of-concept Linux virus is known, it had no malign payload and could only affect a user's environment – an anti-virus solution to scan files and directories needed to be investigated. The ideal solution was a daemon that would do on-access scanning on the local disks. We investigated two possible solutions, one Open Source and one commercial.

- *ClamAV*

The most popular Open Source anti-virus solution for Linux is *Clam Anti Virus*[73], which can be used as a command-line scanner, a multi-threaded daemon, an anti-virus plug-in for email servers and clients and on-access scanner. It uses a virus database updater with support for digital signatures that allows regular and automatic database updates. It does detection of over 39.000 viruses, worms and trojans. It is considered to be better than a lot of commercial grade anti-virus programs. This anti-virus solution is most used in the context of an email server (MTA) and file server (Samba) configuration.

In the Workstation Reference Platform context, we installed the ClamAV anti-virus package and the KlamAV[74] user interface for the KDE desktop.

- The on-demand functionality worked successfully. One issue in the pilot environment was: to be able to exclude the scanning of network shares in a directory tree, the mount points of the network drives should be standardized and put at the same level as the local home directory of the user.

- The on-access functionality was problematic on our Reference Platform: using ClamAV, KlamAV and the Dazuko[75] module for the kernel to allow automatic on-access scanning. The scan seems to fail, without any relevant messages in the

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[73]http:// www.clamav.net/

[74]http://klamav.sourceforge.net/

[75]http://www.dazuko.org/

system's and in ClamAV's logfiles. We could not determine where the problem was situated. It was related to the specific version of the distribution. A test on another distribution was successful.

In conclusion, this is a very reliable, complete and powerful anti-virus solution for Linux servers and workstations, both in on-demand and on-access modes. To be implemented on the Workstation Reference Platform the problem with the on-access scan mode would need to be fixed.

- *McAfee VirusScan for UNIX*

The *McAfee VirusScan for UNIX*[76] product was also tested, since it figures in the list of the EC supported products. The version available on digitline was used for the testing.

The product was installed and worked correctly.

The downsides of this product are that it only supports on-demand scanning, and that it presented the same network share mount points standardization issue as ClamAV.

Another McAfee product, LinuxShield, proposes on-access scanning, but was not tested.

8.6. Other Applications

- *Wine*

An important part of the Commission's applications uses Sybase's PowerBuilder[77] RAD tool. Unfortunately, a PowerBuilder runtime environment is not available for Linux.

We tested if the PowerBuilder applications would run in the Open Source Windows API emulator Wine[78]. These tests showed that the database connection software for the central Oracle databases failed. We tested both the Linux native transport and the Windows version in the Wine emulator. Neither one worked with the PowerBuilder applications.

- *tsclient/rdesktop*

In order to give the user the possibility to use Commission-specific applications, mostly based on PowerBuilder, an MS Windows 2000 Terminal Server was installed with these applications. This allowed a user from a Linux PC to connect to this server using the tsclient/rdesktop tools combination, and execute the Windows programs remotely on the Terminal Server from his Linux desktop.

This solution was viable for a limited number of simultaneous users taken into account the required resources on the MS terminal server. This solution was well appreciated by the pilot users.

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[76]http://www.networkassociates.com/us/products/mcafee/antivirus/desktop/vs_commandline.htm

[77]http://www.sybase/com/products/internetappdevttools/powerbuilder

[78]http://www.winehq.com

8.7. Availability of drivers

- *Video boards*

Most PC video boards that are available are well supported. Unfortunately, a number of manufacturers refuse to disclose their API to the Open Source developers. These boards may lack accelerated drivers and even certain functionality. They will however work in a downgraded way.

For use in an office environment, no specific problems are to be expected.

- *Printers*

The CUPS printing system comes with a very large database of supported printers. Most models are completely or partially supported. Support for a printer or printer family is done through printer definition files. Such a file can be created – it is a flat text file – for any printer and for any supported feature. It is of course a specialist's job to create these definition files. Before trying to create one, it is worth while checking if somebody else already provided a working definition file.

If the printer is not listed in the supported printers list, and no equivalent is available, a default setting (raw printer, Postscript printer,...) can be chosen from the Generic Printers list. This can happen for non mainstream printers . It can then be used as a printer, but with a more limited functionality (for example no stapling facilities, etc). It would however be possible to create a specific printer driver for this equipment that would make most of its features, if not all of them, available.

The supported printer features depend on the PPD definition file and on the specific features that can be used from within the application software. Almost all modern printer features can be supported.

- *Scanners*

A large range of scanners – using parallel, scsi or usb interfaces – is supported by the Linux scanning software XSane[79] that makes use of the Sane library[80]. It is available in most Linux distributions.

This software allows direct scanner access, or can be used as a plug-in in a number of Linux packages. OpenOffice.org and Gimp are packages that can benefit from this support. It is well-tested and allows refined control of the scanning device and the resulting image.

The software is client/server based, making it very easy to install the scanner on one machine and use it – over the network – as a workgroup scanner.

- *Other peripherals*

Linux has support for a vast range of peripherals on all the different interface types available for PC's: parallel and serial ports, SCSI controllers, USB and USB2, FireWire (IEEE1394) to name the most popular ones.

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[79]http://www.xsane.org
[80]http://panda.mostang.com/sane/

Among the most popular devices that are supported, we can mention Iomega Zip and Jaz drives, all kinds of tape drives, ORB drives of different brands, external disks on SCSI, USB/USB2 and FireWire, CD and DVD writers on IDE, SCSI, USB/USB2 and FireWire, all-in-one printers (scanner + printer + copier + fax) on serial/parallel/USB/USB2, USB/USB2 memory sticks, USB/USB2 PDA cradles, USB/USB2 photo cameras, FireWire Digital Video, WiFi (802.11 wireless networking) PCMCIA cards, and so on.

This is only a sample, and there are a lot more working devices available. The list of supported peripherals is very dynamic, and can change rapidly. In general, the "bleeding edge" technology needs a little time before it is supported in the Linux environment, since most of the device drivers are developed by volunteers. In general, the quality of the drivers is excellent.

8.8. Maintenance and Support deployment

8.8.1. Use of the Workstation and Server Image

To produce the Workstation Reference Platform image, mainly used for cloning this installation towards the user's client PC's but also to allow for easy Disaster Recovery, a suitable tool was needed.

The various Linux images (INFSO server and workstation, ICANN/GAC server, workstation and laptop) were first created with the *mkCDrec* utility. After migrating to Mandrake Linux for version 2 of the Workstation Reference Platform, this utility was replaced with *Mondo Rescue*. The functionality remained the same, however:

- Creation of a bootable CD image of the system.

- Possibility to clone the image onto a new, unconfigured PC.

- Possibility to partly or completely restore a damaged server or workstation from this image.

Both the mkCDrec and Mondo Rescue utilities did not provide for a multicast option like the one available in *Ghost*. Linux allows however remote network booting and OS image loading via the bootp protocol, that would provide a similar functionality.

8.8.2. Network authentication and remote support

A very important aspect for integrating the servers and workstations into the existing Microsoft Windows environment was to provide for the SMB/CIFS[81] protocol connectivity. This enables Windows domain user authentication and makes it possible to use or to provide for Microsoft-compatible file- and print services. The only functionality that did not work was the Distributed FileSystem (DFS) with the present version of Samba.

For support purposes a VNC/RFB[82] protocol server application that would allow an administrator or support staff member to take over the user's computer remotely was also considered very useful.

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[81]Server Message Block / Common Internet Filesystem
[82]Virtual Network Computing / Remote Frame Buffer

8.8.3. Setup of internal upgrade mirror

SuSE as well as Mandrake provide on-line updates of their distribution for normal (bugfix) as well as for security updates. When a number of workstations and/or servers need to be updated, this potentially means that for each of them the same packages need to be downloaded, resulting in wasted bandwidth.

This is why, in phase 2 of the project, the Linux server of the first phase was recycled to create a local mirror of the Mandrake updates. The server was reconfigured with the Mandrake Linux 9.2 Download Edition and an *rsync* mirror was set up to download the updates daily, for minimum used bandwidth.

From that moment on, the workstations could connect to this server using ftp, and download and install the updated packages.

This not only conserved Internet bandwidth, it also allowed to check if the update worked correctly on a test system before deployment. The downloads towards the workstations were also a lot faster.

8.8.4. Remote update

To avoid having to deploy a Linux LanDesk environment for the limited group of users in the test group, and to have to purchase licenses for them, remote updates were done through scp/ssh. Typically, a small shellscript was created to execute the update on a workstation. This was then copied over scp to the target workstations and executed with ssh. This update procedure would typically be executed at night. The network card's Wake On Lan ability was used to "wake up" workstations that were turned off.

The script would make use of the standard rpm tools to install the updates, downloaded from the internal updates mirror mentioned above.

In a "real life" situation, this kind of update method would probably be the most effective and easiest to implement and maintain. All that would be needed is to elaborate a couple of shell scripts to automate the update cycles.

8.8.5. Remote maintenance and support

To support the users of the test group, a number of possibilities were available, besides physically walking over to the location of the workstation:

- Remote login on the systems as system administrator (root user) was made possible over a secure shell (*ssh*) encrypted network connection. Graphical programs could also be run remotely, thanks to ssh's X11 tunnelling support.

- For more elaborate support, where an access to the user's graphical session was needed, a VNC client allowed the support engineer to take over the user's graphical session to assist him.

8.9. Security scanning

A security scan of a Linux workstation was done by the Security Directorate using *nessus*, the open-sourced security scanner. It showed no vulnerabilities, only a number of open ports:

ssh (22/tcp)

The OpenSSH server is running on this port to provide for access by support engineers. Only Protocol 2 was activated.

Currently, there are no known exploits.

ntp (123/udp)

Nessus reports that a lot of information of the remote host can be determined by querying the NTP variables. Actually, only the Linux kernel version, NTP version and time stamp information was available. This information could be hidden by setting the "restrict" parameter of the NTP configuration file. This was not done on the Pilot workstations, since only the NTP client was activated, not the NTP server.

General/tcp

Nessus also reports that on the general tcp ports, some system information was available that could be used. Actually, only the Linux kernel version and the system time were available. This information can not directly be used for exploits.

In the same section, it mentions that SYN/FIN packets are not discarded. This is of no immediate concern in the internal network. When directly connected to the Internet, the iptables-based Shorewall firewall package can be activated, eliminating this behaviour. It was estimated that there was no need to implement a firewall on every workstation in the pilot.

Some supplementary services can be activated, but that has an impact on the number of open ports:

ipp (631/tcp)

The CUPS software is running this service port to allow administration through the built-in webserver and to allow sharing of the locally-defined printers. This service can be limited to the local host, effectively turning the port off for any external connection.

To provide for printer sharing and remote maintenance, this port needs to be opened. For printer sharing, the PUT method needs to be activated. Currently, there are no known exploits.

X11 (6000/tcp)

By default, the X11 (graphical server) port is enabled, but external access to the service is not allowed. It needs explicitly to be activated/allowed if necessary.

On the other hand, the availability of this service can be important for support reasons, allowing to remotely run X11 programs.

Currently, there are no known exploits.

8.10. Availability of Third Party software

This list compares with the *Products List, Office Automation and Documents Management*, published in the *Bulletin Informatique – Janvier 2003*, from page 68.

It presents the available third party software or comparable products in the Open Source and commercial domain. The following list is not exhaustive and only gives examples of comparable products. It is by no means complete. It just shows that for most proprietary products something comparable can be found.

LAN Integration Products

NFS	Native
Samba	OK

Emulators

3270	X3270
VT220	Xterm
ssh and scp	OpenSSH

System Management products

LanDesk	OK

Security

Network Monitoring Suite	Nmap / Nagios
Firewall	Iptables / pf / MonoWall / LEAF

Word Processing

MS Word	OpenOffice.org Writer

Spreadsheet

MS Excel	OpenOffice.org Calc

Presentation

MS PowerPoint	OpenOffice.org Impress

Agenda

MS Outlook	Novell Evolution (previously Ximian)

Graphics Tools

Visio	Kivio[*]
Adobe Photoshop	Gimp
Corel Draw	Gimp / Inkscape

Document Exchange Tools

Acrobat Reader	Adobe Acrobat Reader / Xpdf / Kpdf / ggv
Acrobat	OpenOffice.org / ps2pdf

Viewers

Quickview+	Quiv / Kviewer

HTML Authoring Tools

MS FrontPage	Quanta Plus[*] / NVU[*] / Screem[*] / BlueFish[*] / Mozilla Composer[*]/ OpenOffice.org[*]

Web Editors

DreamWeaver MX	Can run on Linux with CodeWeaver

Web Browsers

MS Internet Explorer	Mozilla / Mozilla Firefox

Plug-Ins

SUN JRE	OK, also J2RE

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[*]Not compatible, but provides more or less the same functionality

[*]Not compatible, but provides more or less the same functionality

Quicktime	Xine / Mplayer
Flash Player	Macromedia Flash 7
Real Player	Real Player / Xine / Mplayer
Media Player	Xine / Mplayer

Project Management

MS Project	Planner*

Electronic Mail

MS Outlook	Novell Evolution / Kmail / Mozilla Thunderbird

Communication

MS NetMeeting	GnomeMeeting

OCR

Omnipage	gocr + Kooka

Security and Crypto Tools

	gpg and others

Anti-Virus

Mc Afee	Linux is for the moment not sensitive to virus attacks. ClamAV / Mc Afee VirusScan

Database

Oracle	Oracle / MySQL / PostgreSQL

3rd Generation Languages

C, C++	OK
Java	OK
APL	OK
Cobol	OK
Fortran	OK

4th Generation Languages

Visual Basic	Gambas*, REALBasic*
MS Access	OpenOffice.org Basic*, Gambas*, REALBasic*

Web Servers

MS IIS	Apache*

Application Servers

ColdFusion MX	OK
Weblogic	OK
Oracle IAS	OK

Business Process Management Tools

OracleWorkflow	OK

Statistical Tools

Oracle OLAP	OK

Administrative Packages

SAP	OK

*Not compatible, but provides more or less the same functionality

9. USER FEEDBACK AND SUPPORT

9.1. Support

A training course was given at the start of each phase of the pilot to all the users participating in that phase of the pilot. Also, a small documentation map was provided to the users explaining the different functionalities and a number of tips & tricks.

The users were informed about the modifications to the platform and about any other useful information via a central website.

A support group was set-up to provide user support during the pilot.

The support of the users was mostly done through VNC, taking over the user's desktop. This method allows support to guide a user at the same time over the phone and visually on the screen for usage-related questions. It also allowed support to use the normal GUI configuration tools on the user's desktop.

Since VNC duplicates the user's GUI on the support engineer's desktop, it is obvious that it requires quite some network bandwidth. While testing this interface, another version of the VNC client program, Tightvnc[83] was tested, and proved to be much more efficient by compressing the data before transmission over the network. This reduced the network load efficiently, and even allowed for a performing VNC connection over a slow link, for example a modem connection.

An alternative for remotely managing the Linux PC's was provided by a connection through ssh. Thanks to its X11 tunnelling capabilities, any graphical or text-based application can be executed remotely. This is the preferred interface for system support, configuration and upgrade interventions.

Local intervention at the user's site was very rarely needed. Most of the interventions were done by phone and/or remote network connection.

Most user's questions were related to usage of the Linux platform and the applications.

9.2. User meetings

At regular time intervals meetings were organized with the users participating in the pilot to exchange experiences and provide feedback. Answers, where available, were given to the users and solutions were searched for the encountered problems.
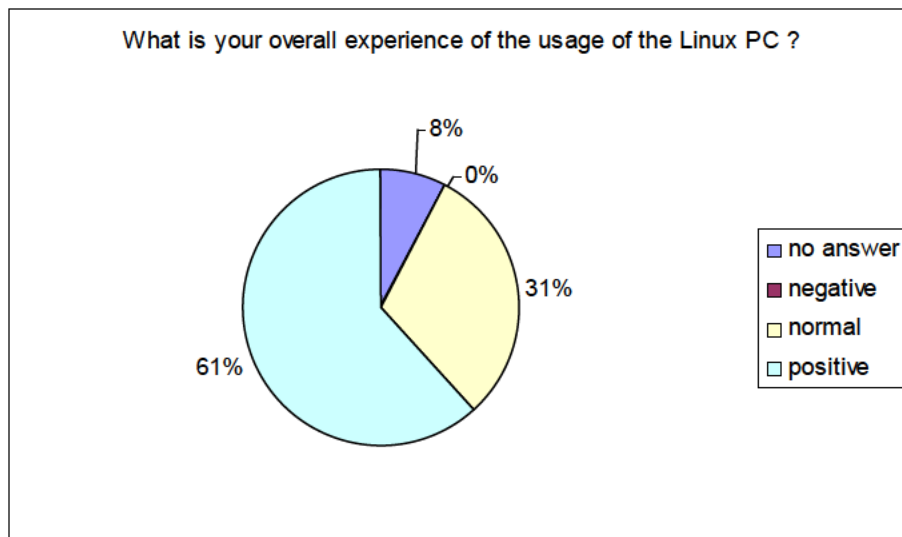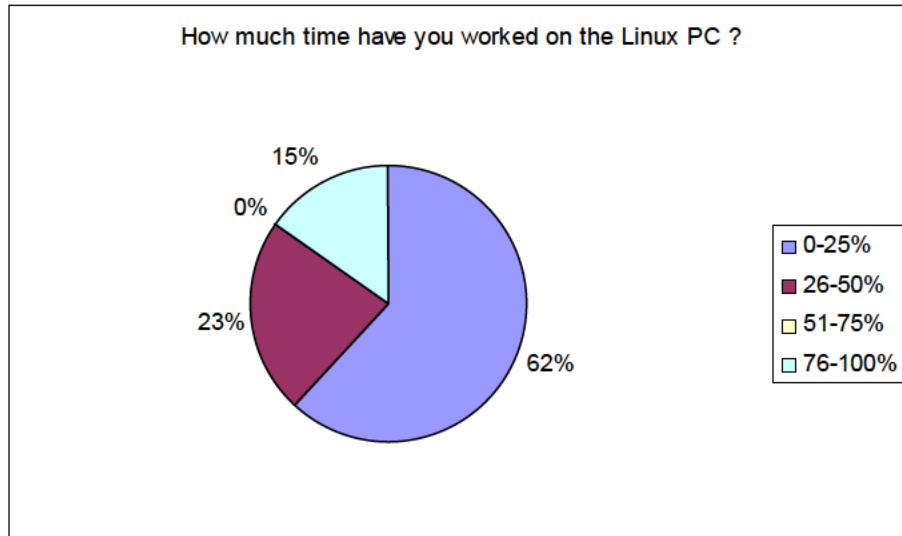
In general the users participating in the pilot had little or no problems to get used to the Linux environment. The desktop and look and feel were considered reasonably similar to the Windows environment. As such, the switch to Linux created only minor problems for the users in general. All participants indicated that the Linux system as implemented had shortcomings in the area of the email handling, calendar management, Eurolook interface and non-web applications (powerbuilder applications) as reported above. Other functionalities that could be tested appeared to be working fine. Apart from the technical results already achieved, the pilot experience has had a positive impact in the attitude towards the use of Open Source and has resulted in a collaborative working atmosphere with various groups within the DG and outside the DG.
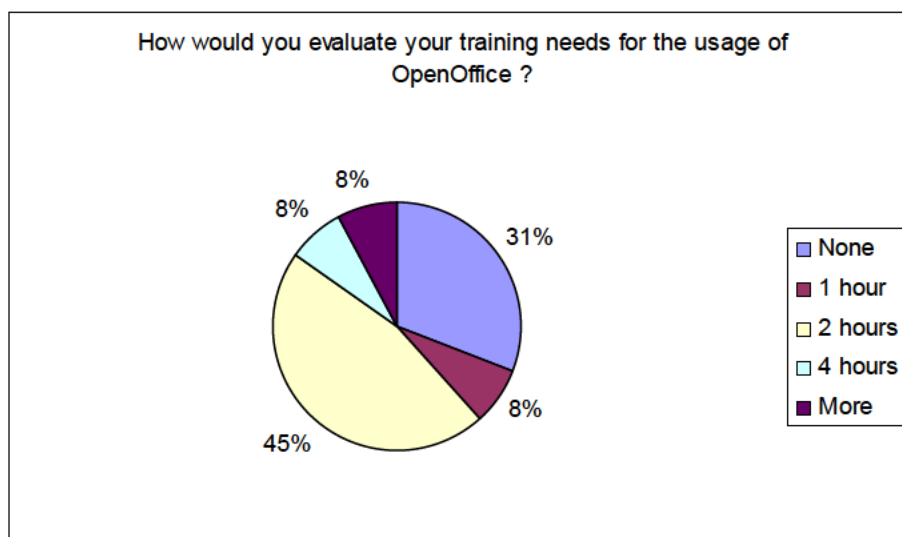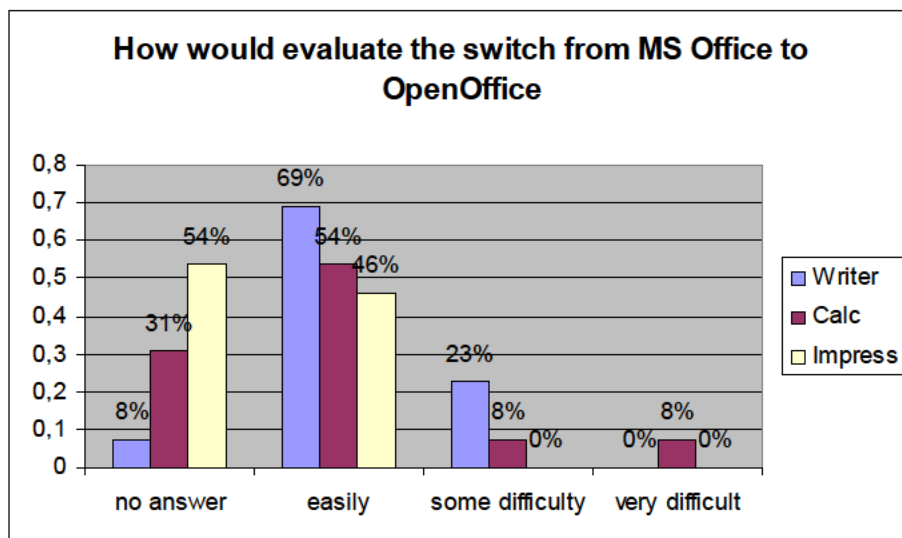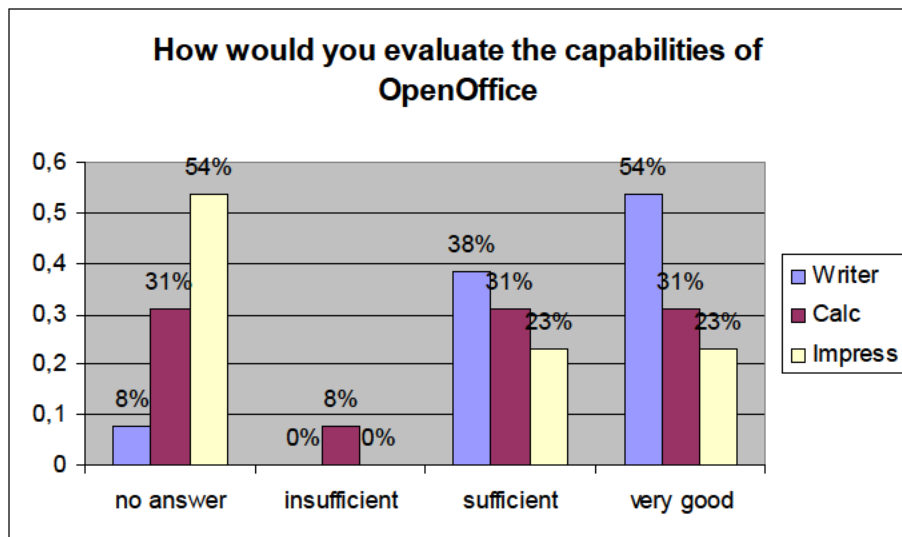
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[83]http://www.tightvnc.com

9.3. User Survey

In order to get a better view on the general usability of the client, users with different profiles (in terms of grade, job type, functionality, directorates) were selected. At the end of the pilot a survey was launched to collect the user's view. About 40% of the users participating in the pilot have answered the questions of the survey.

The results show that nearly all users switched easily from the Windows XP desktop to the Linux desktop. The time worked on the Linux PC was for most of the users up to 25%, but some users did use exclusively the Linux PC. The overall experience was evaluated as positive by the users.

How much time have you worked on the Linux PC ?

- 15%
- 0%
- 23%
- 62%

Legend:
- 0-25%
- 26-50%
- 51-75%
- 76-100%

What is your overall experience of the usage of the Linux PC ?

- 8%
- 0%
- 31%
- 61%

Legend:
- no answer
- negative
- normal
- positive

The usability of the OpenOffice suite is generally evaluated as good and most of the users can switch easily from MS Office environment to the OpenOffice environment. The estimation of the training necessary to switch over is therefore low (the comments regarding the two hours is mainly for advanced features). The interoperability problems encountered by the users are mainly in the field of proprietary fonts, macros and in spreadsheets.

How would you evaluate the capabilities of OpenOffice

How would evaluate the switch from MS Office to OpenOffice

How would you evaluate your training needs for the usage of OpenOffice ?

The overall experience with evolution was good. Most of the comments were in relation to the fact that users could not connect directly to the production environment. This had

implications on the agenda's/meeting invitations, the response time of the central support calls and the visibility of the CC list. Again, most of the users can switch easily from MS Outlook environment to the Evolution environment. The estimation of the training necessary to switch over is therefore low.

How would you evaluate the email capabilities ?

15%

0%

38%

47%

- no answer
- insufficient
- sufficient
- very good

How would you evaluate the switch from Ms Outlook to Ximian evolution ?

0% 8%

31%

61%

- no answer
- easily
- some difficulty
- very difficult

How would you evaluate your training needs for the usage of Evolution ?

- None
- 1 hour
- 2 hours
- 4 hours
- More

8% 0%
31%
38%
23%
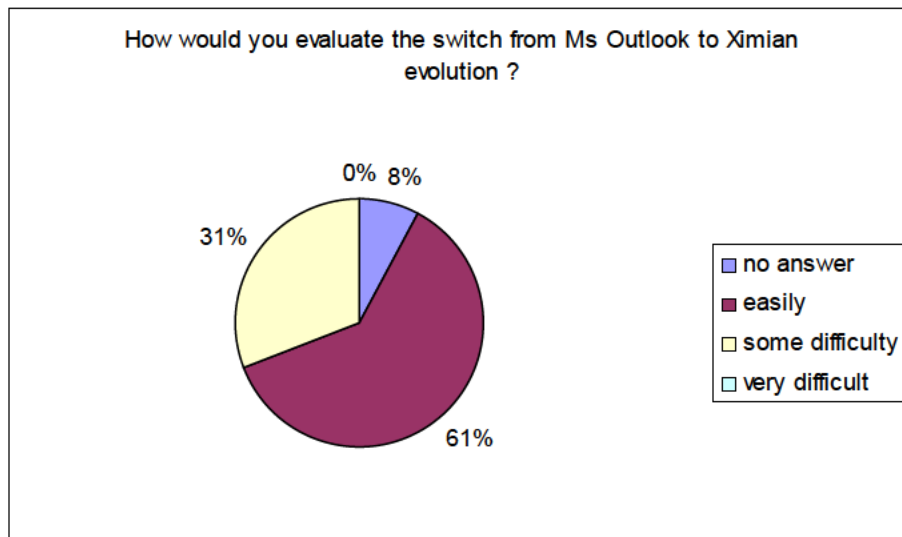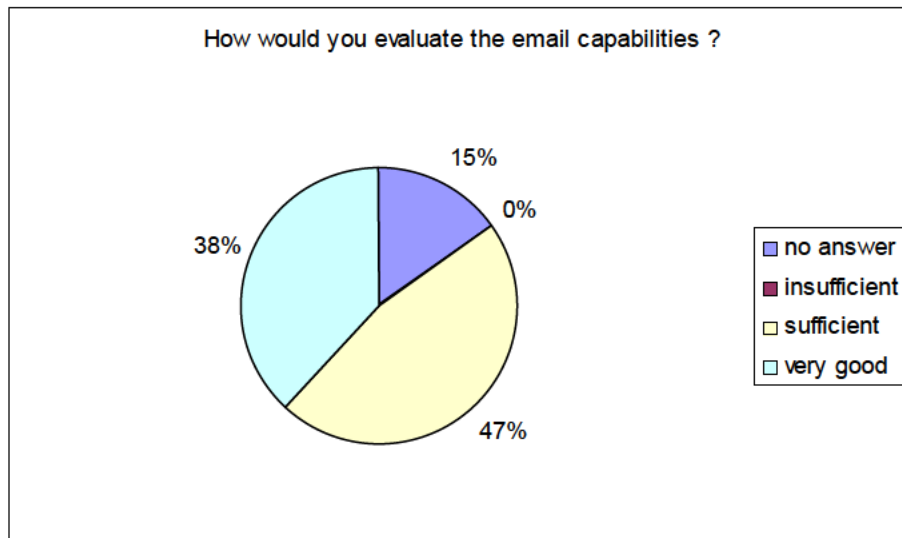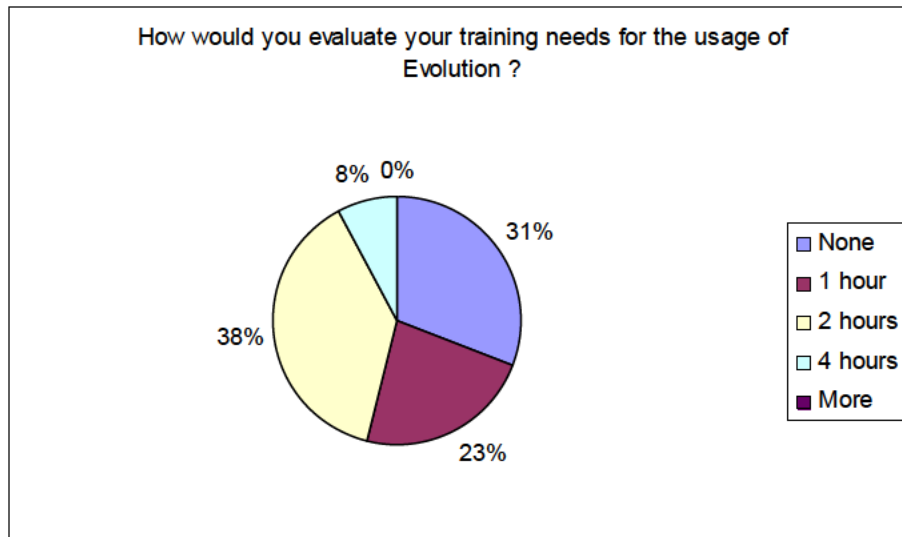
Users did in general experience little problems with the access of the shared resources on the network (except for the usage of URI). The access to the local applications via a terminal server was not widely used and therefore users replied mainly "no answer". The use of a different web browser on the contrary was very much appreciated. Users reported problems with accessing the web applications (due to the use of specific objects of Microsoft in the javascript).

Did you experience problems with the access to shared resources ?

- no answer
- none
- some problems
- many problems

0%
0%
23%
77%

How would you evaluate the capabilities of the web browsers ?
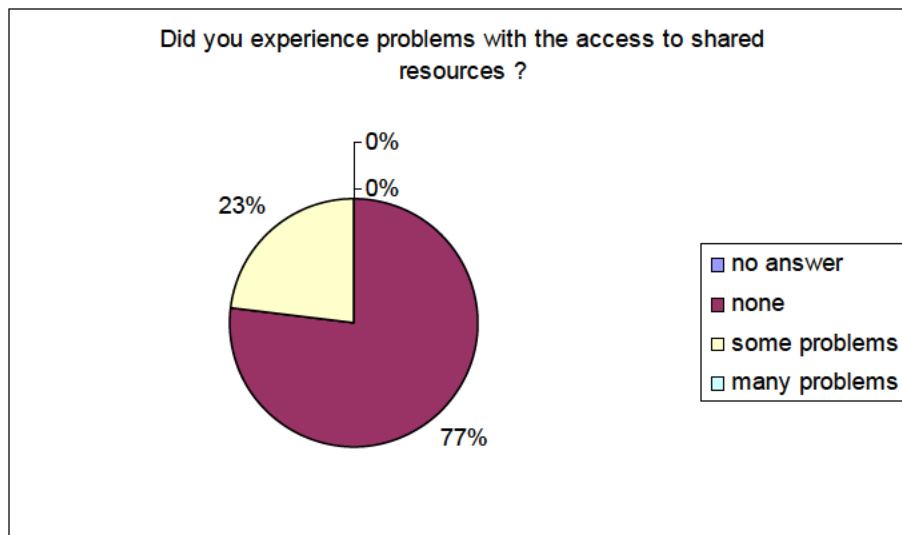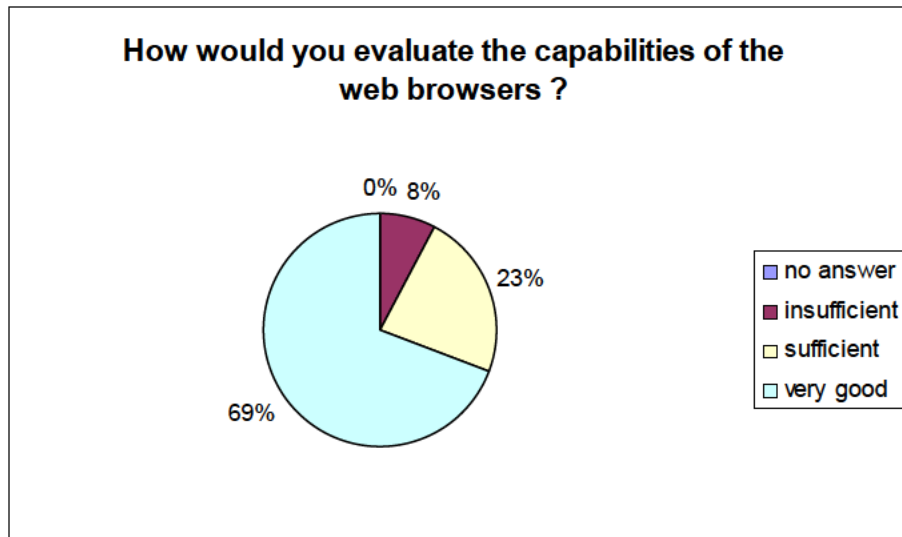
10. SITUATION IN OTHER INSTITUTIONS

Linux (Red Hat Enterprise Advanced server) is classified within the Commission as a class B product with a specific orientation towards servers acting as a single application host. At present there is no orientation foreseen towards clients. Class B products are software of a general interest and are covering a common need of the DG's.

With respect to Open Source Software in general, different Open Source Products are being used throughout the Commission (mostly in server environments). However, no workstation platform based on mainly Open Source software exists.

The situation in several other institutions (European Parliament, Council, EuroControl / Administration) is similar. The main emphasis regarding Linux is on the server side. Either Linux is already used at the server side or tests are being done to validate the use of Linux at the server side. No Linux based user workstation experiments or production environments are scheduled or ongoing in any of these Institutions. In EuroContol, an Open Source study (with a scope covering both front-end and back-end systems and with the objective to evaluate the market, calculate the cost and design scenario's for migration) was delayed due to budgetary reasons.

Also, Open Source software is being used but no workstation platform based on Open Source software is operational in the other institutions.

An inter-institutional project has evaluated the costs and resources related to a full scale migration from the present environment to an environment based on Linux workstations in the different institutions. The results of this project can be obtained with the European Parliament.

11. CONCLUSIONS

Certain conclusions can be drawn from the experience we gathered during the installation and configuration of the server and the preparation of the workstation image, as well as the pilot user's experiences, reactions and questions and the compatibility test results.

11.1. General remarks

Advantages and disadvantages of Linux have already been discussed in length in other studies. However in light of the experience gained during the pilot, some aspects worth mentioning are the respect of standards, the stability and the security. Only a very limited number of viruses have been detected until now. The separation of the Operating System and the applications is better suited for the implementation of a good security. The support and implementation for open standards is much more common practice in the OSS world than in the Microsoft world which tends to load to a lock-into the Microsoft environment situation.

The support for the Linux environment is available. This can be given through the companies who provide the distribution or through third party companies. On the other hand, there is also a part of the support that remains within the Internet/Open Source philosophy. This is based on the availability of information on the distributor site or on the Open Source community sites. The Open Source community sites can be even more reliable and quicker than the normal support contracts (experienced with SAMBA adaptation).

The support personnel were available through the normal channels (framework contract with SERCO/APEM).

Irrespective of the availability of the support, it is imperative to acquire the necessary expertise in house and to stay up-to-date with the developments and the future directions of the products.

11.2. Linux Distribution

Amongst the available Linux distributions the most common used are Red Hat, Suse and Mandrake. In an effort to gain momentum, SuSE, SCO, Turbolinux and Connectiva founded UnitedLinux[84] to create a common, uniform Linux distribution as a Red Hat alternative. This effort has however watered down considerably since the release of UnitedLinux version 1.0 in November 2002, and its current state is unknown. In the course of the pilot, a general tendency has been observed to group the different distributions. The main stream distributions available are Red Hat, Suse (now bought by Novell) and Mandriva.

An alternative to these distributions is to choose a source distribution (Linux From Scratch and Gentoo Linux). This allows composing a suitable Linux image with exactly (and only) the software that is needed or wanted, avoiding the unnecessary packages. This would of course have as a main disadvantage the available support (both in terms of software and maintenance personnel).

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[84]http://www.unitedlinux.com

Both options have their advantages and disadvantages. However, the scope of this study is not to do a comparative analysis between different distributions. The impact of using a different distribution on the functionalities and on the work was however looked at.

- *For servers*

Currently, Red Hat[85] Linux (USA) is considered the most popular server distribution. This is probably also caused by the fact that it is the Linux version that is pre-installed by a number of hardware vendors. SuSE[86] (Germany, now bought by Novell) and Mandrake (now Mandriva since the purchase of Connectiva) Linux[87] (France) are also very popular.

A study done by DG DIGIT identified SuSE and Red Hat as the better distributions. Following the strategy OSS (The Commission will formalise the use of OSS where a clear benefit can be expected), the Red Hat Advanced Server distribution was chosen as the standard distribution for Linux servers within the Commission. This decision was based on the support by the suppliers, the availability of a framework contract and the market share of Red hat. The orientation of the Linux servers is mainly single application host.

No major problems were encountered during the installation of either SuSE or Red Hat on the server. The integration with the NT domain and NET1 domain did not cause any problems either.

There are versions in the same distribution that are more specialized towards server use (for example Red Hat Linux Advanced Server, SuSE Enterprise Server and others), where others aim at the desktop users (Red Hat Advanced Workstation, SuSE Personal or Professional and others).

Often, the specialized server distributions versions are only commercially available.

- *For workstations*

A choice was made for building the first reference configuration between SuSE and Red Hat, the two distributions selected by the DG DIGIT. SuSE was chosen because of the results of the study and its European roots.

Both Red Hat Linux and SuSE are also often installed on workstations. Taking into account the acceptance by the Linux Community, Mandrake/Mandriva seems currently to be a clear winner in this area, since it was the most downloaded GNU/Linux distribution since 2002. This could change in the future, given the pace of the introduction of new Linux distributions and versions.

As mentioned above, a Linux image could be build from the sources. But, given the limited resources we have opted for a binary distribution. However, the composition of a Commission Linux image can only be evaluated when it would be installed on a large scale. Again, this would of course have as a main disadvantage the available support (both in terms of software and maintenance personnel).

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[85]http://www.redhat.com
[86]http://www.suse.de/en/
[87]http://www.mandriva.com/

Since both the study of DG DIGIT as the study of D.H. Brown Associates concentrated on the server aspect and did not consider workstation use at all, some tests were done with the Mandrake distribution. A first series tests have shown that the Mandrake distribution is more flexible in terms of user customisation.

The distribution can also define which packages are available and might have an impact on the functioning of certain other packages (for example: the NT authentication integration via PAM caused problems with the chosen version of SuSE, …).

No major problems were encountered in the support of hardware (printers, scanners, peripherals, PDA, …). An important feature of the Linux desktop (irrespective of the distribution) is the virtual desktop (by default 4).

The official support of third party software is greatly depending on the choice of the distribution. However, the installation and support on the Internet for most of these softwares seems to be available.

This leads to the conclusion that the choice of the distribution is important for the available functionalities, flexibility, applications and support.

Another important aspect experienced was the upgrade of software packages. At the level of the upgrade of specific software on the workstations, a choice can be made between adapted upgrades made available by the distributor and original upgrades of the software. The first choice can "lock in" the user by modifying the package of the software to their configuration or even their preferences. Installing the latest version of application programs in general requires upgrading to the latest distribution version. The second choice can result in a loss of integration with the other packages in the distribution.

At the start, no distribution software functionally comparable to AIM-IT was available. The new software (Landesk) does have a client available for Linux.

Within the Linux environment itself, the RPM (Red hat Package Manage) package allows to install / update software packages. The automatic implementation of RPM packages is dependent on the distribution. Within the pilot, the remote updates were done through scp/ssh (shellscripts).

The OS patches can be kept up to date via the implementation of a internal mirror.

11.3. Integration into the domain.

The integration of the Linux based clients in the DG INFSO NT domain did not cause any problems. Space resources and printer resources both from the Linux environment and the Windows environment could be shared with each other.

The flexibility of mounting resources in the Linux environment may not have been as flexible as in the Windows environment. Most of the resources were either mounted automatically or by central support personnel. The browsing of the network, through LinNeighourHood caused some small problems.

As mentioned above, the specific distribution can have an impact on the integration. In the chosen SuSE distribution, the PAM mount module was not available. A trial of downloading and compiling a version of the PAM module was unsuccessful due to incompatibilities with other modules in SuSE. In the Mandrake distribution the PAM module was available and, after activation, worked immediately.

In the second semester of 2004, the Commission moved to Active Directory (ETP environment). The integration of the Linux platform caused some problems in the beginning, due to bugs in the new Samba 3.0 package.

It required testing of some intermediary versions of the software, with the active help of the developers, before it was possible to integrate the Linux workstations, but this was in reality rather quickly done.

From this experience, we learned that the Open Source community can be very reactive, and can provide for effective assistance when problems occur. This was done in a much faster and more efficient way than a lot of commercial software companies.

The NET1 integration was done with Mandrake Linux standard packages once the Samba 3.0 changes were available in the distribution.

The flexibility of mounting/unmounting resources was largely improved by making use of the *pam_mount* module and the use of Smb4K.

11.4.   Email / Groupware.

At the level of the email most of the principal features are available and no major problems were encountered using the protocols IMAP4 and SMTP with SSL/TLS. The usage of the different address-books via the LDAP interface was implemented without any problems. The usage of contacts and personal tasks was also working.

The usage of shared resources (like agenda's, request for tasks, public folders, etc…) was not possible in the first phase of the pilot due to the unavailability of the Ximian Connector (needed Microsoft Exchange 2000 or higher). Also, the handling of calendar requests and shared tasks caused problems in the first phase.

In the second phase, a Microsoft Exchange 2003 server was installed which corresponds to the future Commission email environment. Most of the problems experienced in the first phase were resolved through the usage of the Ximian Connector. Shared resources (like public folders or shared agenda's, invitation to meetings, request for tasks, etc…) were immediately available. This connector did not need the IMAP protocol anymore, but the connection could be established via the WebDAV interface.

The unavailability of a macro language resulted in the conclusion that no forms could be implemented as in Outlook.

The add-on features of Outlook (Adonis, Safeguard and EAS) are dependent on specific DLL's within Windows and are not portable to the Linux environment. Comparable add-ins need to be found, in order to provide the same functionality in the Linux email client.

The question can be raised if a totally new environment based on Open Source at Commission level could be envisaged. Several Open Source solutions are available with functionality comparable to Microsoft Exchange. Most of them have no interoperability with Exchange for legal and licensing reasons. One initiative worthwhile mentioning is the development of the Kolab/Kroupware software (basic research funded by the German Administration) which was integrated with the KDE environment.

When doing so, it should also be considered to choose an application that will not be platform-dependent, so that Windows, Apple and Linux users could have access to it. The support for standards will, of course, improve the interoperability.

Adapting an existing groupware project, like phpGroupWare[88], eGroupware[89], or OpenGroupware[90], to make it integrate better into the Commission's environment are a possibility, since the sources are available and, thanks to the Open Source concept, allow for extension and modification.

Another possible solution is the Kolab / Kontact project mentioned above. This is an interesting project that aims to develop an Open Source Software groupware solution as an alternative to Microsoft Exchange. Its development was supported by an agency of the German government. It now is integrated into the KDE releases. Within this KDE environment groupware features have been introduced through its many applications.

Summary:

At the level of the email most of the features are available and no major problems were encountered. Interoperability tests with respect to groupware functionality resources (shared agenda's, invitation to meetings, public folders, etc…) in the second phased with the future Commission email infrastructure were positive and most of the problems encountered in the first phase were solved. While the tests were concentrating on the interoperability with outlook/exchange, some features (like for example virtual filters) were found in the OpenSource software that did not exist in Outlook.

However, email add-ons (Adonis, EAS, and safeguard) do not work, due to dependency on a specific Microsoft Windows environment. Neither is a development environment available (forms, etc..).

The question can be raised if a totally new environment based on Open Source at Commission level could be envisaged. Several Open Source solutions are available with functionality comparable to Microsoft Exchange. Most of them have no direct interoperability with Exchange for legal and licensing reasons. One initiative worthwhile mentioning is the development of the Kolab/Kontact software.

11.5.   OpenOffice.org

The tests show that installation and configuration of the OpenOffice.org suite is straightforward, but that integration with the Commission's EuroLook and Legiswrite are impossible. Documents received from DG DIGIT together with own documents were used to test the interoperability. No major problems were encountered. Also the language support is available (some checking was done even for the languages of the new countries). The interoperability tests were done with Microsoft Office 97 (part of the present reference platform). These tests were checked again with Office XP (part of the latest reference platform). The interoperability also improves with the newer versions of OpenOffice with respect to the same version of Microsoft Office.

An advantage of OpenOffice.org is that the native file format is in XML. This allows a much better handling of documents then the proprietary file formats of Microsoft Office. Given that Microsoft Office 2003 supports the open XML file standard, the

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[88]http://www.phpgroupware.org
[89]http://www.egroupware.org

[90]http://www.opengroupware.org

interoperability should in the future increase and better conversion tools between the two environments should become available.

Another advantage of OpenOffice is their OpenDocument has been accepted as a standard by OASIS. Some other interesting feature is the integrated PDF writer.

The templates from the EuroLook suite were adapted to OpenOffice.org as a work-around to reduce the incompatibility with the add-ons Eurolook and Legiswrite. However, this is only a small part of the add-ons. It was impossible to make Eurolook or Legiswrite to work with OpenOffice. Redevelopment of these applications would be the only solution to integrate them with OpenOffice.org.

Also the compatibility of the macro languages in Microsoft Office and OpenOffice.org cause problems, since they are based on completely different API's and operating environments. Macro's would in general need to be redeveloped in the OpenOffice.org environment. A conversion facility exists for StarOffice (the commercial variant of OpenOffice from SUN), but this could not be tested. Also, according to the specialised press, the import/export filters of Star Office should be better.

Summary:

Compatibility tests of the key software components generally showed good compatibility between the office suites OpenOffice.org and Microsoft Office. The macro's (depending on the Microsoft VBA language) and the Microsoft Office add-ons (Eurolook and Legiswrite) cause problems, and require redevelopment for the OpenOffice suite.

11.6.   Browser support

The authentication mechanism used in Intranets can cause problems for the usage of the browsers. Tests in the first phase have shown that NT based authentication causes problems. The solution to these problems is the LDAP based authentication. The problem of the NT based authentication was solved in the second phase of the pilot.

Also the limitations imposed by web applications in terms of supported browsers causes problems. The only solution here is the development of browser independent applications.

The integration of Mozilla in the Reference Configuration was overall satisfactory, despite of the criticism in the Internet community. A lot of Internet users find it not only too large and too slow (requiring too much resources), but also very buggy. When only the browser part of the package is installed, the product is more stable. However, important protocol 'hooks' are then disabled, like for example the mailto: hyperlink possibility. This is not acceptable for most users.

The availability of the necessary plug-ins did not cause a problem.

It could be interesting to explore other possibilities, for example the new version of Konqueror in the KDE 3.1 suite (used by Apple for its new Safari web browser) or Firefox (the follow-up of Mozilla, which is frequently being used within the development community of the Commission).

11.7. Commission and local developed Applications

Although the compatibility of the client server applications was not part of the objectives of the study, tests were performed and proven to be negative. No Common Commission client server applications (like SIC, Adonis, …) or local applications (CETO, TCL) developed in powerbuilder can be used on the Linux platform. Neither a native solution nor an emulation solution is available. The emulation solution based upon Windows emulator WINE was inadequate to cope with the installation of Powerbuilder and Oracle drivers. In the second phase of the pilot, a terminal server was installed that contained all the client server applications. Although this was a satisfactory solution for the pilot (due to the limited number of users), this is not a solution that can be applied at Commission level.

A first conclusion can be that those types of applications need to be redeveloped. In that respect, the initiatives for redevelopment of these types of applications as web applications can only be encouraged. If the Commission environment needs to evolve to a more Operating System independent environment, a strategy needs to be adopted that new applications and redevelopments of applications should become web applications or platform independent applications. This is a decision that has to be taken at Commission level and that has to be supported by all DG's. Within the present planning of DG DIGIT, it is foreseen that all applications under its responsibility will be redeveloped by 2008. This is already a realisation of a large part of the above defined strategy.

One element that cannot be overseen in this process is the support of different browsers. The web applications should in principle work from a Linux based workstation through the browser. However, some of these new applications are being written specifically for the Internet Explorer browser of Microsoft and thus preventing the access to these applications from any other platform than Microsoft. It is therefore imperative that any web application should be developed in a browser independent way which should be feasible. The browser independence is further emphasised by the commitment of the Commission to implement the first level of the Web Content Accessibility Guidelines for the Europa and the Intracomm website.

11.8. Availability of proprietary third party software

Another issue is the availability of software on the Linux platform. Most products mentioned in the Products List, Office Automation and Documents Management, published in the Bulletin Informatique – Janvier 2005, page 68, are available or have a similar counterpart in the Linux environment, either commercially or as free Open Source software. There will however be a small number of products that might currently not be available.

In general, the Workstation Reference Platform shows a fair level of usability and compatibility. An environment based on the Linux Operating System can be technically feasible for limited groups with specific needs. Although there are many more factors that play a role in the decision of the implementation of a new environment, with the present testing, it seems that is not possible at this time to implement it on a large scale. Amongst the most important factors, measures for the applications and add-ins need to be taken to advance in the direction of the solution to this problem.

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13. ANNEXES

Annex 1: Persons that participated in the support and implementation of the study / pilot

Annex 2: CD's with the image of the workstations / servers