White Paper

On the path to success: Thin & zero clients with Linux

Linux has proven itself to be a lean, flexible and low-cost operating system in the thin client market. No other one is so successful at present. It is a match for Windows in terms of looks and functionality. Note, however, that not every Linux system is the same, and that not every thin client concept is really future-proof.

IGEL® TECHNOLOGY

Thin clients, and in particular zero clients should be inexpensive and offer the advantages of low maintenance, energy efficiency and a small footprint. These design premises mean that the systems should boast not only efficient hardware, but also a lean operating system that is easy to update as and when required, even if only low bandwidths are available. Ultimately, the objective is to slash IT and especially desktop costs. There is hardly any other thin client operating system (OS) with which these goals can be achieved more easily than with Linux.

All IGEL hard- and software solutions are available with Linux.

Linux firmware: a market share of over 27 percent

Installing Linux-based firmware on thin and zero clients is a successful solution concept worldwide. As IDC's annual analysis for 2012 shows, 27 percent of thin clients sold worldwide are shipped with a Linux OS. The second-largest group is thin clients "without a local OS" (19%), although Linux also plays a part here – for example as mini-firmware for proprietary zero clients. The success of Linux in becoming established as a thin client OS is shown by the recent device certifications by VMware, Citrix, Microsoft and Red Hat, whose VDI and cloud computing solutions ensure that the user experience on a thin or zero client workstation is comparable to that on a powerful PC and that even CAD workstations can be replicated in conjunction with virtual desktops.

The secret of success: lean, secure, flexible

The success of Linux as a thin client OS is not only due to the fact that there are no licensing costs, but also due to the great degree of freedom as regards programming and the related benefits for end users. Linux operating systems can be adapted to deal with customer-specific problems quickly and easily, yet also promote standardization since they use certified software clients for accessing the respective cloud environments.

A further argument in favor of Linux thin and zero clients is the high level of security: Unlike for Windows-based client operating systems, there is very little malware for Linux, so far. Nevertheless, like their "rivals" with Windows Embedded Standard, Linux thin clients can be configured in the familiar point & click manner using a self-explanatory local GUI, and so do not require any special IT training.

A high level of future-proofness thanks to universal approaches

Modern Linux-based thin clients that also make central Windows desktops accessible have been around since the beginning of the 1990s. Their success is closely linked to that of Citrix and Windows Terminal Services and was given a further boost some 20 years later by virtual desktop infrastructures (VDI) and other cloud computing approaches. Derivatives of the Linux distributions Ubuntu or SuSE are the operating systems most widely used today. From the beginning, manufacturers have appreciated the great adaptability of the system and the advantages of membership

2012: MARKET SHARE OF THIN CLIENT OPERATING SYSTEMS

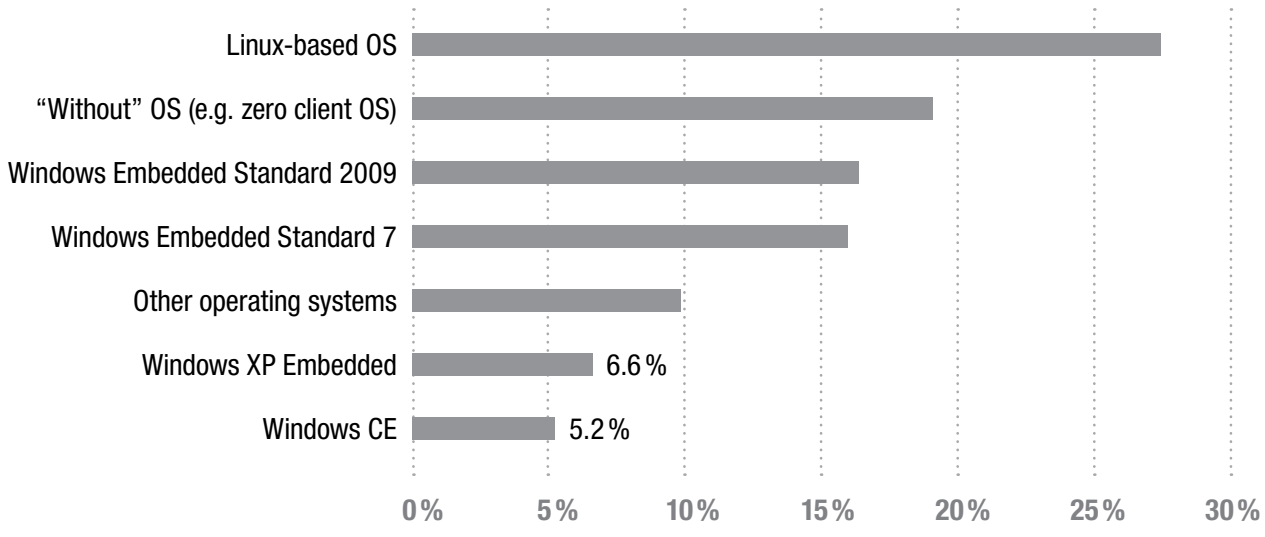


Figure: Linux is the world's best-selling thin client OS (source: IDC, 2013)

PROVISIONING SOLUTION	Certificate for Linux end-user devices	Software clients	Supported protocols
VMware Horizon View	VMware Ready	VMware Horizon View Client	PCoIP, Microsoft RDP
Citrix XenDesktop / XenApp	HDX Ready / HDX Ready SoC	Citrix Receiver	Citrix HDX (formerly ICA)
Microsoft VDI (Remote Desktop Services in Windows Server)	Microsoft RemoteFX Logo	IGEL RDP	Microsoft RDP, Microsoft RemoteFX
Red Hat Enterprise Virtualization for Desktops	-	Red Hat SPICE Client	SPICE

Table: Certifications for Linux thin clients (source: IGEL Technology, 2013)

in the open source community. (German market leader IGEL Technology, for example, has long offered devices with a Linux OS, and 80 percent of the company's orders worldwide are for thin clients with IGEL Linux.) As a result, they can focus their human resources more on developing innovations and also ensure high code quality for the open source software parts of the operating system.

Open source: Manufacturers and partners benefit

The typical advantages of open source software, such as quick reviewing processes and rapid bug fixes, not only benefit manufacturers, who can deploy their development resources in a more pinpointed way, but also technology and channel partners. The former sometimes leverage the great adaptability of the thin client OS to implement customized and industry-specific solutions by using standard drivers for peripherals, such as for external smartcard readers or microphones for digital dictation. For their part, IT service providers use the outstanding manageability of Linux devices to offer a fully managed thin client as part of a desktop as a service (DaaS) model and so tap into additional revenue streams.

Not every Linux system is the same

Not every thin client OS based on Linux is standardized and can be used with the same degree of flexibility. Some vendors offer a strongly adapted Linux system with a proprietary design. In such cases, original drivers and applications from third-party vendors cannot be integrated so reliably and efficiently. If the OS is also firmly tied to a specific VDI solution, users soon become stuck in a technological blind alley. Such lock-ins are not a factor with thin client solutions based on an open source distribution, which enables standard drivers and clients to be used. Alternatively, special driver adaptations can also be implemented through the open source community.

Example from practice: Ubuntu becomes IGEL Linux

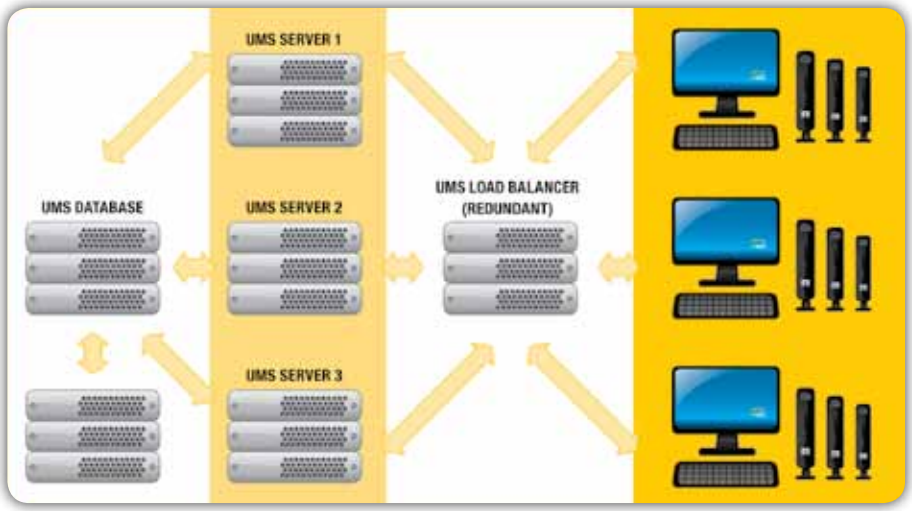
IGEL Technology, the leading provider of Linux-based thin clients in Germany and Europe's No. 3 bases its IGEL Linux operating system on the Ubuntu distribution. Its long time support (LTS) version offers the manufacturer high functional continuity, regular security updates and bug fixes. LTS versions of Ubuntu are published every two years and are maintained for five. On the basis of IGEL Linux, IGEL delivers a firmware with many software clients, tools and protocols that support a total of 15 different VDI and cloud computing solutions and so offer high investment protection. IGEL feeds improvements in the open source code, such as bug fixes in the X server, back to the open source pool. These publications are made under the original license models, such as GNU GPL or GNU LGPL.

Specific further development

In addition, IGEL Linux contains unique solutions, such as the software IGEL Universal MultiDisplay (UMD), that can be used to control up to eight monitors per workstation at the same time using standard hardware components. Further examples of IGEL-specific in-house developments are the read-only file system, the fail-safe update mechanism and the bandwidth-saving buddy update. The latter enables a ramified organization to provide just one device with the new firmware instead of the entire thin client pool at a location and to use that device as the update server for all further thin clients of the same type. The IGEL Linux firmware is around 500 MB in size, but that can be reduced to as little as 256 MB thanks to the partition mechanism, which has also been developed by IGEL. Another innovative IGEL function is the Shared WorkPlace (SWP). It enables IGEL thin clients to be configured automatically depending on the particular user, a feature that is of interest especially to call centers and in other scenarios where the device settings are changed frequently.

UBUNTU LINUX

- **Ubuntu** is a free Linux distribution based on Debian. The Zulu name roughly translates as "humanity towards others" and denotes an African philosophy. Ubuntu is intended to help overcome the digital divide in society by providing free software for everyone. With Ubuntu, software developers aim to create an operating system that is easy to install and use and has carefully tuned software. The project is sponsored by the software vendor Canonical Ltd., which was founded by the South African entrepreneur Mark Shuttleworth. The first version of Ubuntu appeared in October 2004. Since then, its popularity has grown so strongly that it now has an estimated 25 million users, making it one of the most well-known and most-used Linux distributions.

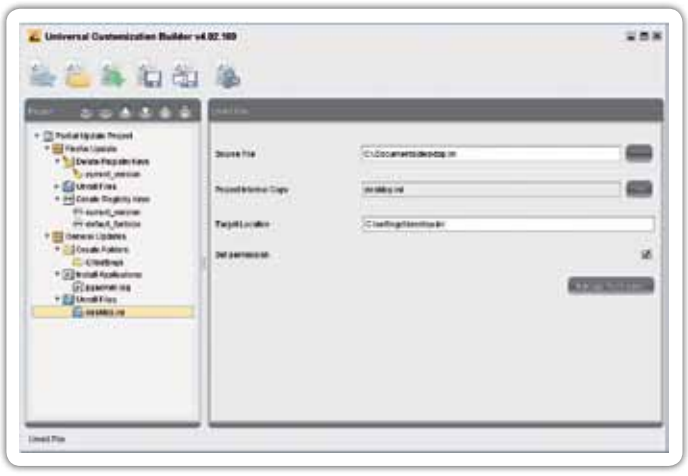


IGEL Universal Management Suite with High Availability Extension

Focus on service

IGEL's closeness to the open source movement is also expressed by the fact that its business model is based less on license fees than on service. For instance, IGEL offers pre-sales, consulting and training services and also boasts the broadest portfolio of supported security features in the industry. The remote management software IGEL Universal Management Suite (UMS) comes supplied as standard and helps speed up rollout for the customer and reduce the maintenance overhead significantly. The free firmware updates for IGEL Linux are published every quarter and are maintained for up to three years after the hardware has been discontinued (UD series). A license fee is payable for program extensions that require a large amount of development work – for example, for the UMS extension "High Availability," with which the management infrastructure can be made highly available so that compliance requirements such as Basle III are met.

Future potential of Linux as a thin client OS



View of the Universal Customization Builder (UCB)

As a thin client OS, Linux is also increasingly proving its value as an efficient basic technology for very simple conversion of PCs into remotely manageable thin clients. Such "soft migration" can be accomplished using the software thin client IGEL Universal Desktop Converter 2 (UDC2), for example. In addition, IGEL has developed Universal Customization Builder (UCB), a tool that can be used subject to a charge and which enables previously trained administrators to reliably make customer-specific firmware adaptations on their own. In line with the shareconomy philosophy, IGEL thus shares its software integration knowledge with its partners and customers. With predefined templates and automatic debugging, the UCB solution therefore makes it easier to perform typical tasks, such as integration of customer-specific drivers or other software in a free firmware partition (custom partition).

Conclusion: The future speaks for Linux

With the open source operating system Linux, IGEL has succeeded in reconciling the apparently contradictory ideals of maximum adaptability and standardization in the interests of customers and partners and has thus succeeded in creating future-proof solutions. Linux will stay important as a thin client OS: Given the continuing trend toward VDI and cloud computing, resource efficiency, investment protection and data security will remain key IT issues.

REASONS IN FAVOR OF LINUX AS A THIN CLIENT OS:

- **Low costs** (procurement, licenses, operation, etc.)
- **High security** (viruses, malware, etc.)
- **High stability** (lean operating system)
- **Low system requirements**
- **Good adaptability**
- **High future-proofness**

DE

GERMANY (HQ)
IGEL Technology GmbH
Hanna-Kunath-Str. 31
D-28199 Bremen | Germany
Phone +49 (0)421 52094-0
info@igel.com | www.igel.de

AU

AUSTRALIA
IGEL Technology Australia
Level 32 | 101 Miller Street
North Sydney, NSW, 2060 | Australia
Phone +61 432103599
info@igel.com | www.igel.com

AT

AUSTRIA
IGEL Technology
Wienerbergstraße 11/A12
Vienna Twin Towers
1100 Wien | Austria
Phone +43 (0)1 99 460-6238
info@igel.com | www.igel.com

BE

BELGIUM
IGEL Technology BVBA
Researchpark Haasrode 1820
Interleuvenlaan 62
3001 Leuven (Heverlee)
Phone +32 (0)16 39 47 57
info@igel.com | www.igel.com

CH

SWITZERLAND
IGEL Technology GmbH
Zweigniederlassung Schweiz
World Trade Center
Leutschenbachstraße 95
8050 Zürich
Phone +41 (44) 308 37 41
info@igel.com | www.igel.com

CN

HONG KONG
IGEL Technology
Care of: Melchers (H.K.) Ltd.
1210 Shun Tak Centre | West Tower
168-200 Connaught Road C.
Hong Kong | China
Phone +852 2546 9069
info@igel.com | www.igel.com/cn

BEIJING
IGEL Technology
Care of: Melchers Beijing Ltd.
Beijing Tower | Room 503-504
10 Changan Ave. (East)
Peking 100006 | China
Phone +86 10 65257775
info@igel.com | www.igel.com/cn

SHANGHAI
IGEL Technology
Care of: Melchers (Shanghai) Ltd.
13 Floor | East Ocean Centre
588 Yanan Road (East)
Shanghai 200001 | China
Phone +86 21 6352 8848
info@igel.com | www.igel.com/cn

GUANGZHOU
IGEL Technology
Care of: Melchers Guangzhou Ltd.
Room 1108 | T.P. Plaza
9/109 Liu Hua Road
Guangzhou 510010 | China
Phone +86 20 8666 8700
info@igel.com | www.igel.com/cn

FR

FRANCE
IGEL Technology
57, Esplanade du Général de Gaulle
92081 PARIS LA DEFENSE CEDEX
Phone +33 (0)1 46 96 56 89
france@igel.com | www.igel.fr

NL

THE NETHERLANDS
IGEL Technology
Orteliuslaan 850
3528 BB Utrecht
Phone +31 (0)30 767 1055
benelux@igel.com | www.igel.nl

SE

SWEDEN
IGEL Technology
Fridhemsgatan 94D
854 61 Sundsvall
Phone +46 (0)70 267 16 16
info@igel.com | www.igel.com

SG

SINGAPORE
IGEL Technology
Care of: C. Melchers GmbH & Co.
Singapore Branch | 101 Thomson Road
24-01/05 United Square
Singapore 307591
Phone +65 6259 9288
info@igel.com | www.igel.sg

UK

UNITED KINGDOM
IGEL Technology Ltd
Merlin House Brunel Road
Theale | Reading | Berkshire
RG7 4AB | United Kingdom
Phone +44 (0)118 340 3400
info@igel.com | www.igel.co.uk

US

UNITED STATES
IGEL Technology America, LLC
2106 Florence Avenue
Cincinnati | OH 45206 | USA
Phone +1 954 739 9990
Toll free (US only): +1 877 GET IGEL
info@igelamerica.com | www.igel.com

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