

Application Virtualization

A Technical Overview of the Thinstall Application Virtualization Solution



A THINSTALL TECHNICAL WHITE PAPER



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1. WHAT IS APPLICATION VIRTUALIZATION?

Thinstall defines application virtualization as the ability to deploy software without modifying the host computer or making any changes to the local operating system, file system or registry.

Using this next generation technology, organizations can deploy custom and commercial software across the enterprise without installation conflicts, system changes or impact on stability or security.

Virtualized applications eliminate nearly all of the complexities and support issues associated with delivering and accessing traditional applications for both fat and thin-client deployments. The time and regression testing required to successfully deliver applications and updates is shortened to hours instead of weeks.

Thinstalled applications can be run without any modifications or additions to a PC, including administrative security permissions. Applications virtualized with Thinstall operate exclusively in user mode and therefore the host operating system and other applications are protected from potential corruption by installation modifications.

1.1 The Market for Virtualization Solutions

Despite the consolidation hype, the number of applications businesses are supporting is growing and becoming increasingly complex as more applications continue to be stacked on top of each other. These complex applications also need to operate simultaneously and seamlessly communicate with each other. Over time, the systems supporting such a complex web of intertwined software becomes increasingly fragile.

As a result, software deployments are increasingly expensive, support intensive and time consuming. IT faces months of time on multi-application regression testing, end-user support and downtime caused by unforeseen application conflicts.

Traditionally, reliable and readily accessible software requires constant planning and a great deal of ongoing support. Forrester Research reports companies spend on average more than \$500 per year, per desktop, just managing applications: Enter Application Virtualization.

“IDC believes the market will increasingly implement virtualization in a growing set of use cases, in order to help customers create much more agile service oriented infrastructures (SOI). Corporations are looking for virtualization solutions that are easily managed, reduce costs and provide a stable, secure program that is easily implemented. Thinstall is providing a dynamic solution to meet a range of user demands,” says Michael Rose, Associate Research Analyst, Enterprise Virtualization Software at IDC.

1.2 Benefits of Thinstalled Applications

Thinstall Application Virtualization ensures faster deployment of software with a more seamless end-user experience. The benefits realized through Application Virtualization with Thinstall include the following.

- Fully portable and virtual: Thinstalled applications have the ability to stream from ANY network share without a local client or a backend server
- Increased efficiency of application deployments: Virtualized applications enable administrators to confidently deploy or de-commission applications on the fly with little or no regression testing, even to the most secure desktops.
- Eliminates runtime conflicts: Deploying Thinstalled applications reduces lengthy QA and regression testing.
- Single application packages can be supported by any Windows platform.

Thinstalled Applications can run without requiring any modification of administrative security permissions, which protects the host operating system from possible corrupting installation modifications.

Thinstall technology solutions are uniquely different from other “virtualization” methods for application deployment. Thinstall is a true self-contained virtual application and the strategy behind the technology addresses the problems of host integrity and end-user productivity. Thinstall provides remote and mobile users with their own familiar desktop environment, wherever their physical location might be, ensuring the security and stability of desktops.

Thinstall fully supports Windows Vista and makes migration easier by eliminating Limited User Account (LUA) related errors and compatibility issues.

2. THINSTALL'S VALUE PROPOSITION

2.1 Reduced TCO

Reducing conventional installation of applications to devices means IT can more easily manage and maintain applications centrally. It also minimizes the adverse effects of diverse endpoint devices. In this way, IT is able to standardize the use of applications without having to standardize the end-user machine running the application.

Significant benefits result from centralized management. There has been a major shift towards centralization. Service Orientated Architecture (SOA) initiatives, outsourcing, consulting, sharing of information with partners, and the Internet have all lead IT managers to re-examine the fundamentals of the Application Service Provider (ASP) model, which looked so promising in years prior. IT must often manage access to applications from devices that are external to its own corporate assets. If conventional methods are used, this external interaction escalates the chances of problems with deployment, security and standardization. Thinstall reduces or eliminates the problems associated with the installation of applications and allows the enterprise to maintain central control. A demonstrable reduction in TCO for desktop management can be realized using Thinstall's virtualization solutions.

2.2 Maintain or Increase Security

The integrity of PCs is crucial to every aspect of a business's day-to-day operations.

Additionally, many industries must maintain locked-down PCs in order to meet legal and compliance regulations. The Pentagon estimates that prior to its adoption of Thinstall, 40% of applications would not run correctly on locked-down PCs. Thinstall enables applications to run in restricted user accounts on locked-down PCs with no system changes and without reducing the security policy.

Microsoft security guidelines recommend purchasing user-mode solutions to reduce the potential and scope of security vulnerabilities. Thinstall operates entirely in user mode with no device drivers that could compromise machine security or cause system crashes. Windows Vista enforces a locked-down desktop model and the demand for secure desktop deployment solutions will increase significantly in 2007 and 2008. Thinstall is positioned to make the transition to Vista considerably easier for both administrators and users.

2.3 Support for Instant Vista Migration

The inevitable migration to Microsoft Vista poses a huge challenge for IT departments. Many legacy 16-bit applications and standard applications, as well as existing applications, have already proved incompatible with the new OS and create an operational dilemma. Thinstall fully supports Windows Vista and makes migration easier by eliminating compatibility issues, Side-by-Side (SxS) applications, and Least-privileged User Account (LUA) related errors.

2.4 Performance, Scalability and Upgradeability

Compared with machine virtualization technologies such as VMWare, Thinstall has negligible resource requirements and zero runtime CPU overhead. It leverages existing desktop hardware and can turn existing LANs into SOA within hours. Thinstall's unique streaming functionality allows applications to be instantly streamed to hundreds of desktops with no additional server infrastructure or hardware cost.

Thinstall enables applications to be upgraded from a central location while they are still running on the end-user desktop. Unlike screen-scraping technologies used by Citrix and Terminal Server, Thinstalled applications run locally on desktops. They are able to operate completely independent of network resources, leveraging only the local devices and processing power.

2.5 Improving Business Agility

Thinstall brings the benefits of web-based applications to desktop applications. Thinstall's innovative technology approach will truly revolutionize the way the industry views software deployment. The approach of Thinstall lets IT quickly bring new users online. When companies engage in new partnership, expansion or mergers, the process of enabling new users with Thinstall can take minutes or hours, rather than weeks

or months. Applications can be centrally managed, instantly updated and run from anywhere in isolated, per-user, per-application sandboxes with no impact on the host PC. Thinstall enables on-the-fly deployments of virtual applications and opens the door to dynamic allocations and removal of applications on the end-user's PC.

2.6 Competitive Advantages

While the market presently has other solutions with different approaches to virtualization, Thinstall's technology is fundamentally different. Thinstall is apart from competition, and unique for these singular characteristics. Thinstall is:

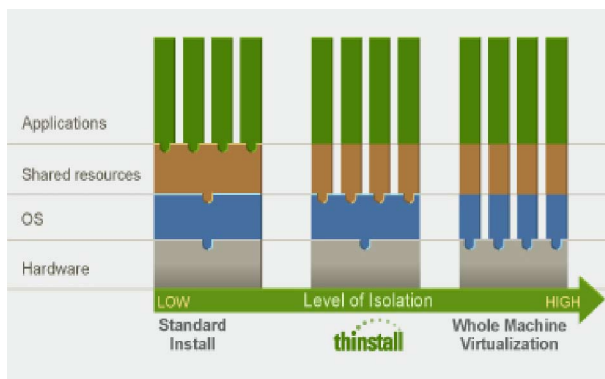
- **Client-less and server-less:** Requires no pre-installed software on the host PC. Thinstall's client-less architecture makes it easy for an Original Equipment Manufacturer (OEM) to embed the technology into desktop management solutions and ISV software.
- **Infrastructure agnostic:** Runs from any device using the existing infrastructure.
- **Secure with no kernel-mode interaction:** Runs entirely in user mode on locked-down PCs.
- **Wide platform support:** Supports older platforms such as NT4 as well as the latest Vista 64bit platforms. Thinstall can run on Linux and MacOS using Wine and Crossover.
- **Simple to use, deploy and maintain:** New users can learn to use Thinstall and deploy their first package in a matter of hours. Thinstall's driver-less, client-less architecture makes it safe to use even by less experienced IT staff.

Other solutions require device drivers that must be independently rolled out and maintained on desktops, introducing significant long term maintenance costs as well as opening new security and stability risk. Device driver based solutions are largely unacceptable for companies that must work with a set of unmanaged computers from recent M&A actions, B2B co-development relationships, and ISVs or contractors. Forced centralization of agent deployments and updates creates new bottlenecks that virtualization is designed to address, and limits the ability of individual groups to take advantage of new versions of the technology as they become available.

3. THE THINSTALL APPLICATION VIRTUALIZATION SOLUTION

Central to Thinstall's virtualization platform is Application Isolation. Isolation enables software delivery without changes to the file system and registry of the host computer. Not only does Thinstall allow previously incompatible versions of the same application to be co-located, they can also run side-by-side. This is a unique innovation that promises a change in software industry approaches to management.

Compare levels of isolation



3.1 Thinstall's Unique Technology

- Clean architecture, no footprint: streamed without becoming part of the infrastructure, no client or device driver installation
- Runs entirely in user mode: will not crash the operating system and can run in any high security context
- Accessed from the network (LAN, WAN or Internet) or thumb drive or CD-ROM
- Uses a virtualized operating system (about 400K in size) and is included with every application that is delivered to the user desktop system
- Any change, including data that is kept in a sandbox, is completely isolated from the physical system

4. THINSTALL FEATURES

4.1 100% User Mode

Thinstall is the only virtualization solution available that runs completely in user mode. This has many system stability, security, infrastructure and ease-of-use benefits. Microsoft's "best practices" recommend user-mode solutions to reduce the scope and impact of security breaches. Thinstall executes entirely in user mode with no kernel-mode code or device drivers. This enables seamless distribution to locked-down desktops with complete assurance that local security policies cannot be violated by kernel-mode code. Because Thinstall runs completely in user mode, it can execute on Linux and Mac platforms using Wine and CrossOver technologies.

4.2 Use Case: Deployment of SAP client to federally mandated locked-down desktops

For mobile users, Thinstall turns managed kiosk PC into a preconfigured workstation with any USB Flash device. For Citrix and MS Terminal Server environments, Thinstall ensures system stability and limits security breaches to specific user-mode sandboxes by executing entirely in user mode. Thinstall eliminates the need to grant applications administrator privileges in cases where they were improperly designed to write to global file system or registry locations.

4.3 No Device Drivers

Because Thinstall requires no device drivers, it can run applications without administrator rights and requires zero changes to the PC—even if the user is running on a locked-down PC. Microsoft reports third party device drivers cause over 80% of machine crashes, and a large number of new machine-wide vulnerabilities come from bugs in device drivers.

4.4 Application Isolation Capabilities

Thinstall allows applications to run without any modification to the host PC's registry or file system. Other applications running on the same PC will not be aware of virtual-

ized applications, so regression testing (a major cost in application deployment) can be drastically reduced. Much of the cost for application deployments relate to testing new applications against a variety of deployment scenarios. Many other virtualization solutions make registry and file system changes temporarily or permanently, so regression testing continues to be needed and application rollouts still have the possibility for breaking other applications on the desktop. The Thinstall VS includes new file system and registry isolation capabilities that prevent applications from being affected by other software installed on the same system. Two versions of the same applications can appear to be installed and run from the same directory without conflicts, even where virtual and non-virtual versions exist at the same location. Thinstall's VS also provides Windows side-by-side DLL isolation capabilities without having to redevelop applications or needing to upgrade to XP/Vista.

4.5 Multiple Simultaneous Client Versions

Thinstall is the only virtualization technology that supports multiple, concurrent running copies of the client on the same PC. This means you can package "Application A" using Thinstall 3.100 and deploy it to 500 user desktops. Later, you may upgrade to Thinstall 3.500 to take advantage of new features. You can deploy a new "Application B" using Thinstall 3.500 without affecting previously deployed "Application A".

This is especially critical when multiple divisions within a company want to use the technology independently and do not need to synchronize around a central version. In fact, Thinstall 2.0 has been used to deploy applications to over 100 million desktops around the world through various software developers and publishers. These applications will continue to operate independently of Thinstall 3.0. Other virtualization solutions only support one version of their client on a single PC at any time. Since any application deploying new versions is equivalent to deploying a major service pack to all PCs, companies can only afford to upgrade once or twice a year at a significant cost. Because Thinstall has the ability to support multiple, concurrent client versions, it has a very fast product release cycle—about once a month. For this reason, Thinstall customers can take advantage of new features immediately without impacting previously deployed applications.

4.6 Instant Portable Deployment (USB Flash / CD-ROM)

Thinstall can easily convert standard applications like Microsoft Office into portable applications that can run from USB Flash or CD-ROM. For USB deployment's, Thinstall's portable mode redirects application registry and file system changes intended for the host PC to files stored on the portable device. Because Thinstall has no device drivers and runs in Guest/Restricted user accounts, Thinstalled portable applications can be used on kiosk PCs, even if they are locked-down and do not permit any installation.

4.7 Security - Group Policy Cannot be Circumvented

Thinstall has no kernel-mode code, and so cannot violate machine Group Policy applied to user accounts. This makes Thinstall safe to deploy in environments where security and stability are vital. Thinstall has no ability to give application-elevated permissions to devices on the machine, such as the real file system/registry, networking devices, printers, etc. For companies that have invested a lot of time constructing account security policies, they can rest assured that the Microsoft OS team is fully responsible for implementing a secure environment, and Thinstall does not bring any file system filters which might modify that.

4.8 Runs in Restricted User Accounts – Allows Applications to Run Without Additional Privileges

Because Thinstall requires no device drivers, it can run the application in Guest User accounts without any previous install. Thinstall allows most applications requiring administrator rights to run without additional privileges. Many applications fail to run without administrator rights because they expect to be able to write to global locations like HKEY_LOCAL_MACHINE and c:\program files. Using sandbox technology, Thinstall makes applications believe they have the ability to make global changes when they are actually writing to user+app specific locations. This feature allows applications to run in security-restricted environments like Terminal Server and Vista. Thinstall makes it possible to take many older applications and convert them to Vista or multi-user applications.

4.9 Thinstall Runtime Embeds in Packages

Deployment cannot get any simpler or more foolproof than using Thinstall. Thinstall accomplishes its zero footprint, zero installation by embedding its entire runtime in each executable that it packages. Because the Thinstall runtime is super-small (~400k), and package data is stored in a compressed state, the overall disk footprint is usually 2X smaller than traditional deployments of the same application not using Thinstall.

4.10 Thinstall Loads By Windows As Normal Application

The impact of deploying Thinstalled applications is the same as deploying any normal application. From Window's perspective, the EXEs generated by Thinstall are simple, notepad-like applications that run without external dependencies. Deploying Thinstalled applications does not effect other applications on the system.

4.11 Thinstall Is Small, Lightweight and Fast

Thinstall is an application-level solution and does not use emulation. All processes are executed natively at full speed without the typical 25-50% speed reduction of other machine virtualization solutions. Thinstall can be loaded into memory in a few milliseconds (even over network) and quickly loads the application. In many cases, Thinstall loads applications faster than Windows. The entire Thinstall runtime occupies ~400k on disk and is embedded with each application so that there is no client to

manage. Additionally, since Thinstall only virtualizes applications, not an entire new OS, additional Windows licenses are not required and memory impact is minimal.

4.12 The Build Process – Setup Capture

Thinstall's Setup Capture program makes conversion of traditional applications to virtual applications an easy process. Setup Capture takes two snapshots of a machine—before and after the target application's install. Thinstall then generates a self-contained virtual EXE directly from these changes. The simple process can be used by a wide range of IT skill levels. The Setup Capture process is the fastest in the industry. A virtualized copy of an application such as Firefox© can be created and deployed in five minutes. Setup Capture supports multiple reboots and has the built-in ability to be run directly from a network share on a clean machine without any installation, enabling the capture of untainted images.

Thinstall uses a directory-based structure to store captured projects. This allows easy browsing, search, editing, and modification using standard file system tools like Explorer and Windows search, so there are no complicated user interfaces to learn. Anyone who knows how to browse a file system will know how to edit Thinstall projects. Because Thinstall projects are simple directories with no absolute path information, they can be easily copied from computer to computer, or be hosted and compiled directly from network shares.

4.13 Compression

Thinstalling an application can reduce the storage footprint of an application by more than 40%. Thinstall is the only solution to provide block-base streaming decompression directly into memory. As a result, compressed data does not need to be first decompressed to disk. Brand new packages can be launched from a network share instantly, without any lengthy decompression steps. All the package data is decompressed at the block level, and as needed by the application. Only the startup data is required to run and is sent over the network. When packages are deployed to PC hard drives for offline use, the disk requirements are significantly reduced because package data remains compressed at all times.

4.14 Scripting

Thinstall allows VBS scripts to be embedded in an application package and executed prior to an application starting. Scripts can be used to configure the virtual environment on a local PC, check for execution rights, log usage, and more. Thinstall extends the VBScript runtime by exposing additional APIs and allowing for script callbacks at specific points in an applications lifecycle.

4.15 Active Directory Authentication

Thinstall allows packages to be tied to specific AD groups so unauthorized users cannot execute packages even if they have a copy. Users can be added and removed

from AD groups from a central location without needing to modify or update individual packages that have been previously deployed.

4.16 Virtual Services

For packages that require background services, Thinstall provides a virtual service control manager which will start and stop virtual services required by the application prior to launching. The application can communicate with virtual services as though they were physically installed on the machine.

4.17 Virtual Windows Loader

Thinstall allows DLLs and ActiveX controls to be loaded directly from compressed packages across network shares by emulating the entire Windows loader subsystem. The virtual Windows loader is responsible for performing Side-by-Side policy resolution, manifest processing, windows search order emulation, and virtual DLL and EXE management. Thinstall's virtual loader enables the latest Microsoft products such as Office 2007 to run with file system changes.

4.18 Virtual COM and DCOM

Thinstall emulates the windows COM and DCOM subsystems to allow applications to create and use virtual components without changes to the local PC's registry. Thinstall supports both in-process and out-of-process COM objects, enabling any variety of plug-ins and OLE objects to be used seamlessly.

4.19 Streaming

Using streaming, Thinstall can launch very large applications from any shared LAN resource within seconds. Thinstall can stream application code and data from a standard Windows fileserver or network share without a client install or specialized servers required, enabling application streaming with no infrastructure changes. Users can launch an application from a local shortcut, network share, URL or e-mail link. Active Directory can be used to limit access of applications to a specific set of users.

Thinstall uses the standard SMB protocol to stream applications over a LAN, so any Windows file share can instantly become a "streaming server". Thinstall's embedded client technology means users can simply click on EXE files from network shares and the client will be loaded directly into memory.

- Client is Windows (already installed)
- Server is any SMB share (already exists)
- Streams block-by-block
- Packages over 8GB in size can start instantly
- Streams from any source media
- Network shares and iSCSI
- Hard drive, USB Flash, CD-ROM

4.20 Wide Platform Support

- Single package support for Windows platforms: NT, 2k, XP, x2k3, Vista
- Terminal Server and Citrix MetaFrame
- Windows PE (Preinstalled Environment)
- 32-bit applications on 64-bit Vista, w2k3, and XP
- Cross-platform support for 16-bit applications
- Support for MacOS and Linux using Wine and CrossOver

4.21 Sandboxing Prevents Modifications

Thinstall redirects all changes intended for the host PC's file system and registry to a private-per-user sandbox. Sandboxes can be located on a network share allowing application settings to follow users as they move from machine to machine. Because all changes can be separated from the host OS, broken machines can be replaced like light bulbs, with no impact on the user. For mobile users, sandboxes can be stored on local USB Flash devices, thus preventing damage to the host PC or accidental host storage of sensitive data.

- Application EXE remains "read only" at all times
- Stores application modifications on a per-user and per-application basis
- Allows most non-Terminal Server applications to run on Terminal Server
- Allows most non-Vista applications to run on Vista
- Enables IT to maintain locked-down desktops
- "Reset" applications by deleting sandboxes or forcing them to delete when the application closes

4.22 Performance

Most applications experience negligible performance impact. Thinstall's Virtual Platform Technology is extremely lightweight in terms of the disk space, RAM, and CPU required. Thinstall's Virtual Platform was designed to have minimal impact on the performance of the application, to be truly thin:

- **Lightweight on disk:** The VOS, which is embedded into every application created with Thinstall, occupies ~400k of disk space.
- **Lightweight in memory:** The VOS consumes a small amount of fixed RAM (<2MB).
- **Lightweight on the CPU:** Virtualized applications run all native code, no emulation or translation is used. There are no CPU performance penalties for real-time applications.
- **Lightweight on developers:** Any application can be deployed using Thinstall without source code modification or recompilation. Traditional Virtual Machine technologies such as VMWare and Virtual PC slow down execution of programs by 25-50%. However, programs running inside the Thinstall VOS execute exactly the same set of Intel instructions as they normally would, so there is no affect on CPU-only related activities.

5. ABOUT THINSTALL

Thinstall was founded in 1999 as a company providing hacker protection. The technology obfuscated executable files so that they could not be reverse engineered, which gave the solution stability. With the addition of a streaming capability a new value emerged, giving the Thinstall solution its benefit in the business environment. There is virtue in having an IT asset that can be used without becoming part of the infrastructure that must be managed. Yet, this risks documentation of its use to the system of record that must be maintained by the business. Streaming provided the isolation and enabled the ability to deploy applications virtually, with security. With this, Thinstall advanced the next generation of application deployment.

Thinstall's Application Virtualization Platform virtualizes software delivery and access, enabling software companies and enterprises to deploy software without modifying the local operating system. Companies can deploy custom and licensed software across mixed Windows and locked-down corporate desktop environments without installation conflicts, system changes or impact on stability. Software updates are easier and faster because regression testing can be reduced to days instead of weeks, while installation failures and the associated help desk costs are eliminated.

Thinstall has been deployed to millions of desktops around the world. Customers include GE, the US Department of Defense, Qualcomm, Lucent, Northrop Grumman, Morgan Stanley, T-Systems, and Abbott Labs. Thinstall is privately held with company headquarters in San Francisco, CA. For more information, please visit the company's Web site at www.thinstall.com or call 415-274-2558.



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