Applications Anywhere White Paper
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1.0 Introduction

1.1 Cloudhouse

Cloudhouse simplifies the Cloud enablement of Enterprise apps. We let you deliver your legacy, on premise client server and desktop applications as Cloud apps without needing remote desktops or any re-development enabling you to consolidate supporting infrastructure, improve agility and reduce TCO.

Deploy and manage applications from the Cloud – Applications Anywhere

The most cost effective way to deliver Windows rich client apps to your users. Reduce the complexity of testing and deployment whilst providing your users with a Private or Public Cloud App Store experience.

Streamline version control for all apps whilst centrally managing licensing and usage. Dynamically configure apps with the right settings for each user from a single central package. Enable secure BYOD implementations and application entitlement.

Move Data to the Cloud – Data Anywhere

Allows for distributed environments to be consolidated and run from a centralised Cloud or Data Centre. Give your apps LAN like performance, security and reliability over the Internet/WAN from the client to the server and choose where to store your data and host your app servers.

1.2 This Document

This document provides an outline description of Cloudhouse Applications Anywhere and the App Store solutions. It is a high level description intended to explain the principles and benefits of Applications Anywhere and the App Store. It does not explain the detailed design or implementation.
2.0 Cloudhouse Applications Anywhere Introduction

Cloudhouse Applications Anywhere allows any Windows® client application to be deployed from the Cloud using simple Click & Run™ technology, no matter how complex the app, or what language it is written in. No changes are made to the source code of the app; it is packaged using next generation Application Virtualization technology and deployed with no local installation.

Applications Anywhere is a combination of an advanced deployment scripting engine with a next generation application virtualization technology, all developed by Cloudhouse. It can optionally be combined with the Cloudhouse App Store so that licenses and versions can be centrally controlled.
3.0 How Applications Anywhere works

Applications Anywhere allows a user to Click & Run any Windows application from the Cloudhouse App Store, with no admin rights and no pre-installed components on the target machine. This can be combined with the Cloudhouse Data Anywhere products to deliver multi-user applications from the Cloud. The diagram below shows the combined Cloudhouse solution with Applications Anywhere being represented on the left half of the Diagram.

Figure 1 – Applications Anywhere Solution

The user goes to the App Store and logs in, either using the Cloudhouse user management or Single-Sign on with support for multi-tenant Active Directory or LDAP integration. They are then presented with a list of the applications that they are entitled to.
The App Store administrator can manage which applications are available to users or groups of users and how many licenses that are available. They can also manage what version of the application is delivered to the users.

When the Launch button is clicked a small .exe file is downloaded which the user then runs. The Launcher allows Applications Anywhere to initialize on any machine without any required dependencies other than Windows XP SP3 or later. The Launcher.exe (downloaded as AppNameLauncher.exe) is also used to pass the context from the browser to the local machine which contains a secure token that is used to track the user ID and the app they were launching.

The Launcher then prepares the machine to run the full Applications Anywhere deployment process, this is done by detecting if .Net 4.0 is installed on the local machine and downloading the .Net 4.0 virtual package if it is required and not already installed. It then starts downloading Applications Anywhere. Applications Anywhere is a .Net 4.0 C# application but uses the virtualized .Net package if it is not already installed. This allows Applications Anywhere to run on any machine without any pre-requisites or requiring local administrator rights. The branded splash screen for the application that is being launched is shown whilst the Launcher runs and continues to show during the Applications Anywhere process.
Applications Anywhere then goes through the required process to deploy the virtual application to the local machine. This is done using an advanced proprietary deployment scripting engine within Applications Anywhere.

Figure 3 - Launch Splash Screen
This script goes through the following process shown below, including the process flow of the Launcher:

![Diagram of the Launcher and Applications Anywhere process flow](image)

**Figure 4 - Launcher and Applications Anywhere process flow**
The launcher process, outlined above, completes by starting Applications Anywhere. When Applications Anywhere runs it places shortcuts either on the desktop, start menu or both depending on the package configuration and creates any required file associations. These can then be used to launch Applications Anywhere directly without requiring the launcher. The launcher is only typically used once per application to create the virtual environment.

Once Applications Anywhere starts the first task is to ensure that the binaries required to start and run the target application are downloaded, or if the application has been run before check if any updates are required. Updates can be delivered as a delta to speed up the process of updating so that only the required parts of the application that have been changed are updated. The binaries are downloaded in an encrypted and compressed archive and then extracted on the local system. All files that are downloaded are cached in the Cloudhouse local environment. The local cache can be set to persist or be temporary depending on the requirements of the application and the environment.

The files that are downloaded contain the footprint of everything that the application would need to run normally, although the contents of the files can be delivered on demand where appropriate. The files are encrypted where necessary (exe files are encrypted by default) so that they cannot be launched without using Applications Anywhere to validate the version, license and configuration.

Once the application binaries are downloaded, the shortcuts and shell extensions are registered, so that the application can be launched again as the same App Store user without going back to the App Store.

Applications Anywhere supports the unique concept of dynamic configuration of applications. Any number of dynamic configurations can be applied at run-time. For example if the package is run on a 32 bit machine, the 32 bit binaries can be downloaded and on a 64 bit machine the 64 bit binaries are downloaded, or for example, on a machine with the French language installed, a set of French binaries or language extensions can be automatically applied. Dynamic configuration can also change files (xml, ini etc.) or registry settings within the virtual package so that individual machines or users can automatically receive specific configuration parameters.

During packaging, any runtime requirements (for example .Net framework versions, java versions etc.) are added to the package by the Cloudhouse AutoPackager. When Applications Anywhere runs the package it first verifies if the required runtimes are available on the target machine, if they are not available then the runtimes are virtualized for the target application. This speeds up the time of initial deployment of an application and reduces the amount to be downloaded for components that are already installed. If the runtimes are already installed then the local versions are used and the virtual versions are not downloaded. Once a runtime has been virtualized on a target machine it is available for all the packages that are run on that machine.

Applications Anywhere packages are encrypted to ensure that they cannot be moved to another machine and either run without going through the App Store to validate the license or having a valid offline license for that machine. Applications Anywhere requests a license from the App Store each time the app is run and if the license has an offline allowance then this token is stored on the local machine in an encrypted store. This ensure that applications cannot be decrypted and run without a valid license but can be used offline for a specified time.

The target application is then started using any of the specified entry points, such as shortcuts or file associations which are invoked when documents are opened. When the application runs, any changes that are made are persisted on the local machine so future executions of the application can make use of those changes. Local files such as “My Documents” are typically defined to be outside of the virtual environment so these calls are allowed to go through to the local file system.

During runtime the application is tracked so that usage statistics can be reported back to the App Store. The usage data includes details on the user, machine, and application and how long the application was used for. Specific usage statistics can be supported for more granular reporting if required.
3.1 Client side virtual environment

In order to run Windows applications without them being installed, Applications Anywhere is able to intercept the Windows API calls that applications make to interact with the local Operating System. This allows a virtual file system and virtual registry to be created for the application, which is layered on top of the local file system and registry. This approach means that the target application can “see” a combination of the virtual and local file system and registry, and it is very light weight with no performance impact on the application or local machine as it is not running a full virtual OS.

The files have a virtual file system configuration that determines how the target application “sees” the file system when it runs. For example, an application might require its files to be in “C:\Program Files\Application Vendor\Application Name” or C:\Windows\System32\AppName.ini”, these files are virtualized so that when the application looks for files in “C:\Program Files\Application Vendor\Application Name” the file system API calls are redirected to the Applications Anywhere virtual file system, but calls outside of the defined configuration are allowed to go through to the local file system (e.g. “C:\Users\UserName\Documents.”)

Windows applications can also make use of the registry in a similar way to the file system, registry calls which are included in the virtual registry configuration are redirected to a known location within HKEY_CURRENT_USER\Software\Cloudhouse, and other calls are allowed to go through to the local registry.
4.0 Features

4.1.1 Click & Run™ applications

In order to deploy the target application to a new machine the end user just needs to run the small Launcher. exe file. This can be pulled on-demand from the Cloudhouse Portal or deployed using existing push deployment technologies. The splash screen will display, informing the user of the progress of the application deployment. Without any interaction required by the user, the target application will deploy and start within a few short minutes.

Each subsequent time that the application is run it can be started by using the shortcuts placed on the desktop and start menu or by opening an associated file (this can be configured during the packaging of the application.)

4.1.2 No player or plug-ins required

Applications Anywhere does not require any preinstalled player, drivers or other dependencies to run. A user can go to any machine with Windows XP SP3 onwards with nothing else installed and Click & Run any application.

4.1.3 No administrator rights required on the client system

Applications Anywhere has a next generation User-Mode application virtualization engine which allows the deployed target application to be run without being installed. This means that the end user does not need any local administrator right and can be fully locked down using group policy. Nothing is written to the system in any of the protected areas so all that is required is the basic permissions to write to the C:\ProgramData\Cloudhouse folder (or C:\Documents and Settings\All Users\Application Data\Cloudhouse on Windows XP) folder and the HKEY_Current_User\Software\Cloudhouse registry key which all users have by default.

4.1.4 Full integration with any local devices

Traditionally, User-Mode application virtualization solutions have been tightly sandboxed and unable to break out of their virtual environment to integrate with local devices. Local integration has previously only been possible using Kernel-Mode solutions, which require an administrator to install and manage drivers or players.

The Applications Anywhere next generation User-Mode application virtualization engine is unique in its ability to support integration from the virtual application to any local device without needing to worry about what the devices are or managing any drivers.

4.1.5 Full integration with any locally installed apps

A more complex issue is supporting integration between the virtual application and local or other virtual applications. This is again something that cannot normally be done with User-Mode application virtualization solutions.

Applications Anywhere is unique in its ability to support integration from the virtual application to any locally installed application or other Applications Anywhere virtual applications. This works without specific configuration and does not require any prior knowledge of what the locally installed application is or what version it is.

For example, if the virtual application has a button to launch Microsoft Word it is able to access the local registry to find out what version of Word is installed, where it is installed and then has the ability to launch the application.

4.1.6 Support for inbound application integration and Microsoft Office™ Plugins

Applications Anywhere also supports inbound integrations from locally installed applications by automatically hooking into locally installed processes (either all processes or specific processes.)

For Microsoft Office applications (Word toolbars etc.) there is a Cloudhouse plugin that can be automatically set to load by Applications Anywhere each time a Microsoft Office application starts.
4.1.7 Advanced protection

In order to ensure that the application cannot be moved/copied to another machine or launched without using Applications Anywhere, critical files are encrypted. By default all .exe files are encrypted although other files can also be encrypted if required.

4.1.8 Co-branded splash screen

Figure 5 - Splash Screen branding

Applications Anywhere allows for branding of the splash screen for the application which is shown each time the application is launched. The splash screen is specified during packaging.

4.1.9 No runtime dependencies – even for .NET apps

Applications Anywhere is able to run on any system from Windows XP SP3 onwards without any required dependencies, pre-installed components or administrator rights. For example, the target application can require any version of .Net and will run on a machine without .Net installed.

4.1.10 Dynamic Configuration during deployment

Applications can be dynamically configured during deployment to allow a single package to work for large number of users. For example an application may have a 32 bit and 64 bit native versions, 3 multiple language packs and a different configuration for each geographic location. In an Enterprise with 3 global office this would traditionally mean 18 different packages, with Applications Anywhere this can be delivered from a single package. The platform is detected during deployment so that the correct 32 bit or 64 bit versions of the files and registry are deployed based on the target system, the system language settings can be used to detect the correct language pack to deploy and the group or company/division of the user in the App Store can be used to configure any settings in any text based (xml, ini etc.) files or the registry as required.
4.1.11 Cloud based version control

Each time an application is run the required version for the user is checked against the App Store and delivered or updated as required. This allows granular version control of who gets what version of an application and allows for multiple live versions to be managed at once, if required. The version control system can also be used to ensure that all users are always updated to the latest version, thus reducing the number of old versions in the field that have to be supported. The updating can have additional logic applied so that it is co-ordinated with any server updates for multi-user applications.

4.1.12 Rationalize Testing from dozens of platforms to a single OS

Applications Anywhere’s virtualization engine decouples the application from the underlying OS. This allows a single package to run on XP right through to Windows 8.1, and in the future other platforms. This reduces the testing required for any new or updated package from dozens of OS version combinations to a single OS test.

4.1.13 Self-healing applications to reduce support overheads

Each time an application is run it is checked to make sure it is the correct version for the user but is also checked for consistency to self-heal the application in cases where critical files or registry keys have been deleted or corrupted.

4.1.14 Private Beta support for Mac OS X

Cloudhouse are actively working to support target devices beyond Windows. Currently Applications Anywhere for Mac OS X is in private beta and allows the same package for a Windows app to be run on a Mac without any additional packaging.
4.2 Supported Platforms

- Windows XP SP3 or later – x86 or x64 editions
- Windows Vista – x86 or x64 editions
- Windows 7 – x86 or x64 editions
- Windows 8 – x86 or x64 editions
- Windows Server 2003 – x86 or x64 editions
- Windows Server 2003 R2 – x86 or x64 editions
- Windows Server 2008 – x86 or x64 editions
- Windows Server 2008 R2 – x86 or x64 editions
- Windows Server 2012 – x86 or x64 editions
- Terminal Services fully supported
- Citrix XenApp and XenDesktop fully supported
- Virtualized Windows machines running under VMWare, Microsoft Hyper-V, VirtualBox and Microsoft Virtual PC etc.

4.3 Supported Development Languages

- C/C++
- Microsoft .NET all languages
- Microsoft Visual Basic
- Java
- Delphi
- Pascal
- PowerBuilder
- COBOL for Windows
- MUMPS
- Visual FoxPro
- Microsoft Access
4.4 Security

- Web services access can be HTTP or HTTPS
- Application files are encrypted using 256-bit AES encryption
- License tokens are 256-bit AES encrypted

4.5 Technical Specifications

- The Initial app launcher is C++, without any C runtime requirements.
- Cloudhouse Applications Anywhere is C# 4.0 – this can be run without .NET installed as it is virtualized on demand by the Initial app launcher
5.0 Cloudhouse App Store

The Cloudhouse App Store is used in conjunction with Applications Anywhere and provides the web interface to allow configuration of apps, licenses and versions and to view usage reports.

![Cloudhouse App Store Admin](image)

**Figure 6 - Cloudhouse App Store Admin**

The simple web interface allows customers to be added in seconds and for any settings that they require to be set instantly. The applications and licenses that are assigned determine what users are able to view when they logon to the App Store.

The App Store supports Single-Sign on integration, either via LDAP or SAML for Active Directory using Federation Services. When using Single-Sign on, rights in the portal are managed based on the groups that the users belong to.

Usage statistics within the portal, which are gathered by Applications Anywhere, allow administrators to view important information about who is using which applications. This can also be used to manage the billing for the customer, allowing for new business models like usage based licensing.

A full suite of APIs allows for integration with existing systems/portals and everything within the portal can be accessed using the API. The portal can be fully co-branded.
Figure 7 - Example GE Healthcare Branded App Store

The App Store has been designed natively to run in a Cloud environment so is highly scalable and multi-tenanted to allow for large scale deployments. Cloudhouse host a globally distributed multi-tenanted portal for many customers, but the portal can also be hosted by customers where required.

Applications Anywhere's protocols and configuration file specifications are available allowing a customer to integrate Applications Anywhere with their own portal or systems if desired.

5.1 Supported Browsers

- Microsoft Internet Explorer – v8 onwards
- Google Chrome – v15 onwards
- Mozilla Firefox – v12 onwards
- Apple Safari – v5 onwards

5.2 Security

- Web portal access can be HTTP or HTTPS

5.3 Technical Specifications

- Cloudhouse App Store is a .Net 4.0 C# web application hosted on IIS
6.0 Cloudhouse AutoPackager

6.1 Overview

Cloudhouse AutoPackager allows even the most complex of Windows apps to be packaged for the Cloudhouse platform in a few simple steps. The AutoPackager takes all the complexity out of packaging with a simple UI and Auto Publishing to the Cloudhouse Platform. The AutoPackager allows any ISV or Enterprise to package their own apps and publish them to the Cloudhouse Platform. Cloudhouse can also provide this as a professional service.

6.2 Features

- Simple and intuitive interface for packaging apps
- Snapshot based capture of app installation – collect the files and registry changes made by the app install
- Intelligent filtering to exclude unnecessary files and registry changes
- Auto Publishing to the Cloudhouse Platform
- Recommended to package on a clean Windows 7 x86 VM with all .NET versions installed for best OS compatibility
- Auto detect of .NET runtimes – no need to package .NET with the app
- Support for packaging native x86 or x64 apps
- Automatically self-updates to the latest version

6.3 Supported Platforms for Packaging

- Windows XP SP2 or later – x86 or x64 editions
- Windows 7 – x86 or x64 editions
- Virtualized Windows machines running under VMWare, Microsoft Hyper-V, VirtualBox and Microsoft Virtual PC etc.

6.4 Technical Specifications

- Cloudhouse AutoPackager is C#
- Cloudhouse AutoPackager enable simple packaging and publishing of applications
7.0 Primary Use Cases

7.1 Server based computing displacement

Most client server applications are designed on the assumption that the clients and server(s) will be on the same LAN. This means that when the back end servers are centralised it is normally assumed that the clients need to be moved to the central location as well. This has meant that the typical way for centralising or hosting a client server application has been to use Server based computing (SBC) to host the clients near the servers.

SBC requires the client application and an underlying Windows operating system to be running in the Data Centre or Cloud. This means that expensive servers have to be bought and maintained to run the client OS (or a server OS shared to behave like a client OS.) This also means that there is a duplication of all the licensing for Windows, and often Microsoft Office, as well as the SBC licensing and many 3rd party application like anti-virus, management tools etc. Given that the end user already has a perfectly good Windows machine that is already licensed, has Microsoft Office, and all the compute power needed to run the application this is a total waste of money and resources.

The Cloudhouse architecture of a distributed client server application (from combining Applications Anywhere with Data Anywhere) allows for a dramatic reduction in TCO as all of the above doubling up of hardware and licensing is no longer required. All of the SBC infrastructure is no longer needed, representing typically half or more of the infrastructure required to host an application. There are significant savings in hardware/infrastructure, hosting costs (co-location, rack, power, or Cloud fees), licensing savings, lower support resources and more.

Furthermore SBC has major problems, which are often insurmountable, with getting the remote application to integrate with the users local devices and applications. This means that often only limited devices can be supported, thereby reducing the functionality of the application. For example printers are often a problem, and scanners or USB or legacy devices are very problematic.

Integrating with local applications from SBC is in most cases impossible, so the user is presented with a disjointed experience where even basic integrations like sending an email from the hosted application, require a remote version of Office which does not have the same configuration as the users local Office. More advanced integrations are just not able to work at all, this removes the ability for the rich eco-system of partner applications that go alongside most major line of business applications to work in an SBC deployment.

Cloudhouse’s unique architecture allows for the lowest TCO in the industry for hosting of centralised client server applications, with the best possible user experience and no loss of functionality in the application.

7.3 Self-service App Store

Traditionally there have been three main approaches to distributing software to users. Send an engineer to the desktop to install the software, get the end user to download the installer (or load from CD/USB) and manually install the application themselves, or to use centralised push based deployment.

Sending an engineer is an incredibly expensive and very slow process. Getting users to self-install causes a large amount of support issues, gives a poor user experience and is not possible in many environments where users are not able to be local administrators of their machines. This means that most enterprises have resorted to pushing applications to user’s machines from a central deployment system.

Most ISVs still provide their applications as installers that either the end users download and install or an enterprise has to repackage into another format to allow automated push deployment. Therefore providing applications from a self-service app store that allows users to just Click & Run™ means a significant reduction in the cost of support and a much better user experience. Also the ability to control licenses and get usage statistics allows for greater information, control and even new business models.
Push deployments create a large amount of complexity in the packaging process as the package has to work on all the various devices it will be pushed to, or multiple packages have to be maintained, this leads to a high TCO for these solutions. With the ability for Applications Anywhere to create a single package that is dynamically configured to the target machine during deployment, the costs of packaging and maintaining packages is greatly reduced.

Due to the complexity of deploying applications using push technologies and the risk of conflicting applications, most enterprises push a common set of applications to all machines or machines within a certain department, based on assumptions of what applications various users will require for their roles. This can be very inefficient, both in terms of supporting these machines with many applications deployed to them and in terms of the costs of licensing and deploying often unnecessary applications. A self-service app store where applications are only deployed on demand from the end user when they really need them there can be significant reduction in unnecessary licensing. For example in an engineering company that is run using Microsoft Project, rather than deploying Project to all machines just in case they need to work on the project plan, users can just self-serve Project when they need it or if they only need to view the plan self-serve the free Project viewer.

License tracking and reporting allows ISVs to ensure customer are only able to use what they have paid for and allows enterprises to only license the applications they are really using. The audit trail of license usage gives detailed reporting to ensure that any vendor license requirements are complied with. ISVs are able to use these controls and reports to create new business models for selling their software, supporting any conceivable model from basic subscription or feature based billing.

7.3 Legacy Web Application Compatibility

Many web applications that were built in the last ten years or more were not built using the latest HTML5 capabilities, therefore to get the full functionality requires some local dependencies on the desktop. This could be a particular browser version, browser configuration, plugins, ActiveX controls, Java runtimes etc.

These applications therefore have the same level of complexity and issues as you would have with deploying and supporting a full client application. Cloudhouse Applications Anywhere's unique combination of next-generation user mode application virtualization with its ability to provide total local integration and dynamic configuration means that these issues can be solved.

When the user goes to the web applications logon page, the local machine will be checked to confirm that it has all of the required local dependencies, and any that are missing can be virtualized without administrator rights and integrated with the remaining local components.

This allows the life of these legacy web applications to be extended without redevelopment as the user will always have the right components needed to run the application.
8.0 Competitive Landscape

8.1 Competitive Overview

Cloudhouse’s various products compete against solutions in a number of different areas involved in deploying, hosting and managing applications.

In application virtualization the advantages of a user mode solution versus a kernel mode solution are described above, as well as the pitfalls that all other user mode solutions have.

All alternative application management solutions are not able to cover the breadth and depth of functionality available from Cloudhouse that drive efficiencies in the lowest possible Total Cost of Ownership (TCO) for managing applications, especially when Applications Anywhere and the App Store are combined together.

When Cloudhouse Data Anywhere is added into the solution the ability to centrally deliver and host any client server application becomes possible. This then gives the unique combination of the lowest possible TCO for delivering fully functional Windows applications with the ability to centrally host the server infrastructure without the overhead, costs, complexity and limitations of a Server Based Computing solution.

All of this can be achieved without having to make any changes to the application code so is the fastest way to realise the cost and agility advantages without the many years, huge investments and loss of functionality involved in a re-write of an application.
8.2 Cloudhouse Applications Anywhere and App Store

A summary of the major unique advantages over any competing technologies are:

- The only way to provide complex Windows Applications with a simple “Click & Run” from an App Store. Allows users to launch applications with no technical knowledge or elevated privileges.

- The unique combination of a next-generation user mode application virtualization solution, with total local integration. This allows any application to be deployed without needing administrator rights but for the application to behave like it is locally installed with full integration to and from any other local or virtual applications or devices.

- No player or other pre-requisites. Allows users to instantly run any application without needing to install a player, agent or any other pre-requisites like .NET frameworks regardless of what the application needs.

- Run Windows apps on Mac OS X. Available soon, giving the unique capability to “Click & Run” Windows applications on OS X.

- Dynamically configure applications during deployment. Whilst an application is being deployed the configuration is dynamically applied to allow a single packaged version of the application to be deployed to any number of users with varying configurations.

- Granular version control. Control which users get what version of an application and have multiple live versions of an application at any time.

- Support any license model. Using the license API integration any type of license model can be used, right down to usage or even feature based licensing.

- Highly saleable native Cloud based architecture. Support millions of users globally with an architecture that was built to support unlimited scale with very low infrastructure requirements.
8.3 Cloudhouse Data Anywhere

A summary of the major unique advantage over any competing technologies are:

- Uniquely able to prove LAN reliability over any internet connection. Applications are unaware of any problems with the underlying internet connection and are able to recover from any changes of connection or reconnections.

- The only real-time multi-user acceleration that solves latency related performance issues. Reduce the number of round-trips required to make a step change in the performance of applications running over the internet or WAN.

- No additional infrastructure required. The lowest possible TCO in the industry by not requiring any additional infrastructure or 3rd party licensing.