

THE DEFINITIVE GUIDE TO

Desktop as a Service



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What This Book Covers

Digital workspaces are rapidly replacing physical desktops and laptops in many work environments. These workspaces may be delivered by virtual desktop infrastructure (VDI) running in your datacenter, but companies of all sizes are increasingly turning to desktop-as-a-service (DaaS) solutions to satisfy digital workspace needs.

This book describes the benefits of digital workspaces for both users and IT teams and explains how DaaS can serve as a complement to VDI or a replacement for VDI. It also introduces the critical characteristics you should consider when choosing a DaaS solution.

Later chapters introduce Nutanix Frame, a unique DaaS platform built for the cloud age. Frame has been built from scratch for the cloud, resulting in a cost-efficient, scalable, simple-to-use, multi-tenant application and desktop delivery platform. The Frame user experience and administrator experience are explained, as well as some of the most popular use cases.



CHAPTER 1

The Digital **Workspace**

Why Should Enterprises Virtualize Desktops and Applications?

Intelligent digital workspaces, delivered by on-premise virtual desktop infrastructure (VDI) or desktop-as-a-service (DaaS), enable users to access applications and information from anywhere while data remains secure, making them ideal for end-user computing needs. Physical desktops and laptops are becoming a poor fit for today's dynamic, digital workplace.

Digital workspaces (also known as virtual desktops) have many advantages:

- Address the needs of both IT and the user community
- Simplify application management
- Improve data security and availability
- Enable bring-your-own-device (BYOD) with access from any device, anywhere
- Simplify and accelerate onboarding/offboarding
- Lower costs

Let's look more closely at the benefits of transitioning to digital workspaces, both from the perspective of your IT team and your end users.

What is a Digital Workspace?

In the old way of working, company employees are tethered closely to a desktop or laptop for much of their work. A digital workspace provides greater flexibility, so that employees can access the applications and data they need—from any device and any location. This is a much better fit for the way many businesses, across many industries operate today.

Instead of running on a local device, the applications and services of the digital workspace run in a datacenter and output is transmitted quickly and securely to the user across a network.

A digital workspace can be provided by:

- **Virtual desktop infrastructure.** Each user's desktop runs in a VM in your datacenter.
- **Application virtualization.** An instance of the specific application a user needs runs in your datacenter.
- **Desktop-as-a-service.** A third-party provider satisfies your digital workspace needs, eliminating the need to own and manage infrastructure.



How Digital Workspaces Benefit IT

Managing and supporting a large number of desktop and laptop workstations with locally installed software is nobody's idea of a good time. Employees may come and go regularly, and appropriate devices have to be supplied—and retrieved.

Keeping close tabs on desktops and laptops across numerous physical locations is difficult, time consuming, and expensive. Each computer needs regular software updates, patches, and additions, not to mention fixing failures, backing up data, and providing user support. Because hardware is evolving quickly, these systems can have a very short useful life.

But for most companies, device management is a far smaller concern than the security risks created by the recent large-scale shift to work from home, and by the hard-to-control devices with locally stored data. Not surprisingly, many organizations have reported data breaches associated with the increased cybersecurity threats of remote work. According to a published study by Accenture, “68% of business leaders feel their cybersecurity risks are increasing.”

Adopting a bring-your-own-device (BYOD) policy, as many companies are now doing, only makes device management and security challenges more intractable. Even if your company hasn't formally adopted BYOD, the reality is that employees inevitably find ways to use their own devices to access corporate apps and data.

A digital workspace approach fits well with many companies' transformation goals, and it addresses the challenges described above by moving a lot of the “heavy lifting” into an enterprise or cloud datacenter:

- User applications no longer need to be installed or run locally on each computer.
- Company data remains in your datacenter or the cloud where it is much more secure.
- If a user's device fails, the user can simply switch to a different device and pick up where they left off.

Existing desktops and laptops don't just go on the garbage heap. Most companies redeploy them as access points to digital workspaces. The important difference is that the software required on each system is simpler and easier to standardize, data is no longer stored on internal drives, and user productivity is no longer dependent on the capabilities or reliability of a particular device. As a result, the useful lifetime of existing desktops and laptops may be substantially extended. This is a big shift from thinking about hardware lifecycle in the typical 3-5 year terms. As desktop systems are retired, many companies replace them with “thin clients” or **Chromebooks** that are cheap, simple, and easy to maintain.

Chromebooks for the Enterprise?

Chromebooks are gaining a foothold in the enterprise for a variety of reasons. They are inexpensive, there are a lot of choices available, and Google has a management console that lets your IT team manage the devices.

Chromebooks have surpassed thin clients in unit sales volume and can often serve the same purpose. Because they support the mobility needs of many workers, they are an increasingly good fit for use in conjunction with digital workspaces.

If you're shifting to digital workspaces, you should definitely evaluate Chromebooks for your needs. However, keep in mind that a Chromebook may not take the place of a laptop for employees that travel frequently and need to work on flights or in locations without a network connection. They also may not be well-suited for those using graphics applications remotely.

“Gone are the days of workers tethered to their desks: now workers can—and must—collaborate anytime, anywhere, and on any device to keep up with business demands. Yet, a minority of employees (43%) feel satisfied with the tools their organization provides them with to do their jobs and only a third are happy with the number and quality of apps their organization provides.”

— Forrester Research.

How Digital Workspaces Benefit Users

To keep up with growing business demands, employees need greater flexibility regarding where and how they work and which devices they use. A user may want to work on a project in her office in the morning, collaborate with a team in a separate building in the afternoon, pick up where she left off at home that evening, and work with a team in another country the following day.

The benefits can be even more pronounced in situations where users must collaborate on large digital files. For example, a global architecture firm may have teams around the world designing a new building. Each team can use digital workspaces to get to and collaborate on evolving the common architectural model without having to copy large data files from one physical device to another.

Today, job responsibilities change quickly, and the needs of users engaged in project-based work may shift. A computer that's adequate to meet a user's needs now may be inadequate in six months—or six days. A user may need advanced graphics or more compute power than a particular device provides.

Intelligent digital workspaces address the challenges that modern workers face. A worker can access their applications and data from any device and any location, without being limited by the performance of the device. Users can shift from desktop to laptop to tablet to phone—and find everything right where they left it. And, with digital workspaces, a device failure, loss, or theft is much less of a disaster. Applications run on reliable virtual hardware in the datacenter or the cloud, so there's no loss of work or exposure of data.



DaaS is a Smart Choice for Digital Workspaces

Today, organizations are choosing both VDI and DaaS solutions to address digital workspace needs. Whether your organization:

- Already has a successful VDI deployment supporting thousands of seats
- Has experimented with VDI with mixed results
- Is brand new to the idea of digital workspaces

DaaS can offer substantial benefits because it offloads much of the deployment, management, and support burden from your team. This book explains why DaaS may be the right solution for you:

- Chapter 2 explores the challenges that VDI may pose for IT teams and the potential advantages of DaaS—either as a complement to VDI or an alternative.
- Chapter 3 explains the criteria to consider when choosing a DaaS solution.
- Chapter 4 introduces Nutanix Frame, a unique DaaS platform built from scratch for deployment in any cloud.
- Chapter 5 describes how Frame functions, from both an IT and end user perspective.
- Chapter 6 discusses some of the industries that are benefitting from DaaS and Frame.
- Chapter 7 shows you how you can try Frame for yourself and how to get started.

CHAPTER 2

Why **Desktop-as-a-Service?**

With DaaS, you contract with a third-party provider to satisfy your digital workspace needs rather than deploying and managing the hardware and software for VDI yourself. Most DaaS offerings are hosted either in the cloud or in a service provider's datacenter, but there are also alternatives where the provider deploys and manages the service on the infrastructure in your datacenter.

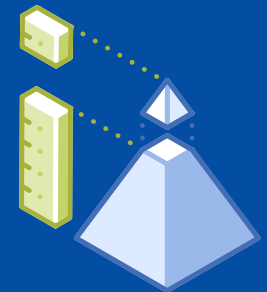
Today, many enterprises are choosing DaaS solutions as a complement to their existing VDI deployments, while others choose it as an alternative to VDI. In both scenarios, DaaS provides substantial benefits because it can:

- Eliminate the need for VDI infrastructure deployment and management
- Accelerate delivery of digital workspaces to users
- Reduce capital costs

The Perfect Complement to VDI

If you already have a successful VDI deployment, it may not be immediately clear why you would also need DaaS, but there are a variety of use cases where DaaS can help you address datacenter space, IT staff, and budget constraints, complementing your existing VDI deployment(s):

- **Temporary, seasonal, and contract workers.** If your business experiences big changes in worker numbers, DaaS can enable you to meet demand for workers without sizing your VDI deployment for peak usage and adding capital expense. You can instead provision digital workspaces immediately and terminate access when contracts expire.
- **Business continuity/disaster recovery.** With DaaS, you can quickly provision secondary workspaces if disaster strikes and ensure that your employees are able to remain productive.
- **M&A.** DaaS can help you accelerate onboarding of new employees during acquisitions and enable them to get immediate access to important company applications, data, and services.
- **ROBO.** It can be difficult to deploy infrastructure to support remote locations, and they may be too far from your datacenters to be supported by your existing VDI deployment. DaaS can make it possible to support remote locations with minimal onsite infrastructure. It can also help get new locations up and running quickly.
- **Emerging needs.** DaaS can also make it possible to quickly address needs that your current VDI deployment doesn't handle. For example, you may need to add support for applications with GPU-accelerated graphics or you may need to support highly mobile employees who are never in the same location—or even the same country—from one week to the next.



- **Project-driven work.** DaaS can allow you to quickly respond to the needs of a project that involves a ramp up and down of workers (employees, consultants, partners, and even customers) where you don't want to expose your entire organization's network and intellectual property to those workers. Put the data and applications required for them to do their work in the cloud.
- **Dev/Test.** Eliminate shadow IT with consistent, pre-configured development and test environments that are easy to consume and IT approved.

Many companies are choosing DaaS to increase business agility and address use cases like the ones described above, while continuing to depend on VDI for more predictable end-user requirements.

Choose Nutanix HCI for VDI

Is your organization thinking about VDI, or a strategy combining VDI and DaaS? If so, you may be concerned about the challenges of VDI as described in this chapter.

You should know that most VDI challenges are easy to overcome—provided you choose the right hardware architecture. Hyperconverged infrastructure (HCI) has proven to be a far better choice for demanding VDI deployments.

Nutanix HCI can make VDI much easier to deploy and manage, allowing you to:

- Deliver a great experience for all users
- Start small and scale to thousands of users without re-architecting
- Deploy validated end-to-end solutions 8x faster
- Pay as you grow and slash TCO by as much as 60%



An Ideal Alternative to VDI

For some companies, DaaS may simply be a better fit than VDI. Running VDI in-house can be challenging for many companies due to constraints that may include datacenter space, budget limitations, and staffing. IT teams are already oversubscribed and hiring experienced administrators can be difficult. Adding VDI to the mix just multiplies your challenges.

As with any hardware-based solution, with VDI there are significant upfront capital expenses. You may find yourself regularly adding hardware as the number of virtual desktop users grows, and you'll probably completely refresh your VDI infrastructure every three to five years. If demand shrinks, you're left with a lot of extra hardware sitting idle.

Your organization may have hundreds or thousands of users, each with unique expectations, application requirements, and perceptions. Ensuring consistent performance can be a challenge: demands can swing wildly depending upon usage patterns, the time of day, and the applications in use. Boot storms, antivirus scans, and patch updates all put sudden loads on the infrastructure and slow down performance for users.

For organizations in the midst of digital transformation, DaaS often makes perfect sense. You trade CapEx for OpEx, and you enable your team to focus attention on new and expanded services. You also gain the ability to add workspaces for new users with no delays. As users increasingly rely on Software-as-a-Service (SaaS) and other applications hosted in the cloud, DaaS can actually bring users, data, and applications closer together, improving perceived application performance for users.

CHAPTER 3

Picking the Right **Desktop-as-a-Service** Solution

There are a variety of DaaS offerings, ranging from major cloud vendors to regional and local providers. It's important to identify the capabilities that matter most for your company so you can make an educated choice.

Table 1 shows a fairly comprehensive list of selection criteria that could play a role in your decision. For the purposes of this discussion, let's focus on a few of the most important considerations:

- Agility
- Flexibility
- Performance
- Security and Compliance
- Partner Ecosystem
- Multi-Cloud Support

If you choose a solution that meets your needs in these six areas, you'll be well on your way to success.

“Employees want devices that enable continuous productivity; they can't afford to wait around for an issue to be fixed before continuing their work. Flexibility and easy, cross-device experiences are another must. The majority of workers value: the ability to access files and apps from any location or device; the continuity of passwords and single sign-on across devices; and the ability to collaborate with colleagues in real time.”

— Forrester Research.

Desktop-as-a-Service Selection Criteria

Geography Where is the solution hosted? If you have users in Europe and North America but the solution is only hosted in the U.S., that's a problem.	Performance Users can be extremely sensitive to desktop performance. Can the solution meet the performance expectations of all types of users? What about power users that need accelerated graphics?
Scalability You may need to onboard large numbers of users on short notice. How quickly can that happen? Is it fully automated?	Elasticity The number of users on the service will vary widely based on the day and time. Do you pay for resources even when they aren't in use?
Security and Compliance All enterprises are concerned about security and some must comply with strict regulatory requirements. Does the solution address your security needs?	Where's Your Data? Do users need to access cloud data services such as Dropbox or Google Drive? If users need data and services from your datacenter, how easy is it to integrate? If your data is in a public cloud, you may need a desktop solution that runs "near" your data.
Ease-of-Use Is the solution easy and intuitive for users?	Ease-of-Management Even the simplest environment requires configuration and customization. How easy is the solution to manage?
Availability Your users' productivity will depend on this service. What's the SLA for availability?	Software and Services Will the solution work with the authentication, SSO, and other standards-based tools you use?
Support What (if any) support comes with the service? What hours (in what time zone) is support available?	Client Software What client software does the solution require on each user's device? How will users obtain that software and how will you make sure it's up to date?
Cloud Lock-In Does the solution lock you in to a particular public cloud? What happens when cloud prices change?	Cost Pricing models vary widely among providers. Is there a minimum term or minimum number of seats? Can you pay as you grow? Beware of hidden costs.

Table 1: One platform that encompasses all of these criteria is Nutanix Frame.

Agility to Address Uncertainty and Opportunity

Change is the only constant for modern business. Your DaaS provider should make it effortless to ramp the number of users up or down in response to unexpected new projects, seasonal business variations, or M&A activity. You don't want to be forced to renegotiate your contract every time you need to support more users nor may you have the luxury of waiting for your provider to install new hardware or manually configure software to address your needs.

Specialized client-side software or other complexities that keep users from doing productive work or tie up hours of administrator time are also an impediment to business agility.

Flexibility to Support New and Changing Use Cases

Another important attribute of DaaS is flexibility. For instance, suppose your customer service team is hosted by a DaaS provider. Are you limited to a specific VM configuration for each of those seats? What if a new application requires more computing power?

GPUs are another example. What if you need to support occasional or frequent use of applications that need GPU acceleration? Make sure the provider you choose will be able to address your needs—both now and in the future—and give you the flexibility to evolve as your operational needs change.

Performance is Directly Linked to Productivity

Your users are extremely sensitive to desktop and application performance. Poor performance not only makes users unhappy, it decreases their productivity. Some solutions inherit all the performance challenges of VDI running in the datacenter. Make sure your chosen provider is able to accommodate spikes in activity, like when 1,000 users all log in at the same time.

Make sure your chosen desktop provider is able to meet the needs of all your expected users. Do you have users that run high-end graphics applications such as CAD and 3D modeling? You'll need a solution that provides GPU support. Many companies find that GPU-accelerated digital workspaces are a great alternative to expensive on-site graphics workstations that need to be refreshed every few years. Digital workspaces also make it possible to allocate GPU resources efficiently for each requirement without under or overprovisioning. With physical workstations, not only do expensive systems sit idle much of the time, but you may have multi-GPU systems tied up by people who aren't using that resource.

In a perfect world, users would be able to switch between “regular” and “accelerated” desktops and applications when they need them, so you're not paying for an expensive resource when it's not in use.

Be sure you consider other factors that will affect the user experience like networking and distance to the user. If you choose a service that's only hosted in one or a few locations, users who are far away from those locations may be a lot less happy with the performance they see than those who are closer. If you know network performance is going to be an issue, look for solutions optimized to adapt to network capabilities.

Security and Compliance are Non-Negotiable

Digital workspaces can greatly reduce security risks by eliminating the need for local data on user devices, but that doesn't mean that all providers are equal in regard to security. Make sure that your chosen provider can satisfy your particular security requirements, especially if you're in a regulated industry like healthcare, financial services, or government. Look for a provider that is not only certified to meet the relevant regulations for your industry but that has direct experience serving it.

User authentication and authorization are a critical part of security across your organization. Choose a provider that integrates with your existing identity authentication provider (IDP) and single sign-on (SSO) to streamline user access.

An Open Partner Ecosystem Means Unlimited Potential

Your digital workspace solution needs to interoperate with all the software, services, and tools that your users and your operations rely on. In particular, this includes:

- **IDP and SSO.** As discussed above.
- **Networking.** To facilitate connections between clouds and to backend systems in your datacenters.
- **Storage.** To ensure that users can access their files no matter where they are stored.



Multi-Cloud Support Prevents Lock-In

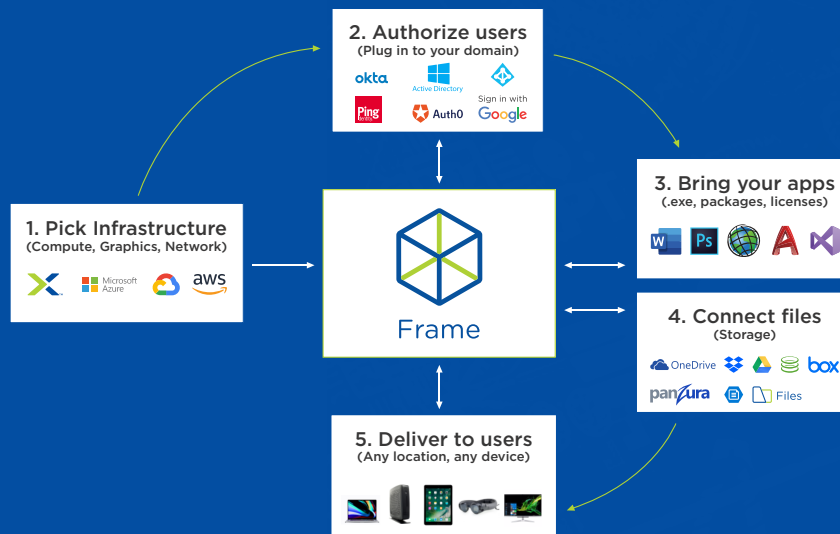
It's an increasingly multi-cloud world. Most enterprises have applications and data in multiple public and private clouds and are trying to avoid getting locked into any single provider. If this applies to your organization, it makes sense to choose a DaaS provider that operates across multiple environments that may include public clouds, service providers, and on-premise infrastructure.



CHAPTER 4

Introducing **Nutanix Frame**

Nutanix Frame is a unique DaaS platform built for the cloud age. Frame doesn't just move VDI technology that was designed for on-premise deployments into the public cloud; it has been built from scratch for the cloud, resulting in a cost-efficient, scalable, simple-to-use, multi-tenant application and desktop delivery platform.



Your users gain easy access to remote virtual desktops or the ability to stream one or multiple applications on any device, with a multi-cloud platform designed for agility, performance, security, and flexibility.

But Nutanix also understands that, while your organization may want and need the benefits that Frame has to offer, the public cloud is not ideal for every industry and every possible use case. That's why we'll also be bringing the benefits of Frame to Nutanix HCI running in your datacenter.

Nutanix Frame Terms You Should Know

Instance. A virtual machine allocated to or available for a Frame user. Frame instances are typically distinguished by the number of CPUs, amount of RAM, and the number of GPUs.

Sandbox. For Frame accounts, the Sandbox is a special instance that serves as your “gold master image.” It is where administrators install and/or configure the applications available to users and other environment specifics such as Windows settings.

Publish. Once you are done configuring or making changes to your Sandbox, you must publish the changes in order for them to take effect.

Launchpad. The user-facing part of the Frame software interface that lets users launch and manipulate desktops and applications. Administrators access a special view of the Launchpad that lets them configure applications and features.

Session. When a user selects an application or desktop from the Launchpad, a VM is allocated to the user, initiating a session.

Dashboard. The administrator-facing part of the Frame software interface that gives admins full access to all aspects of the Frame service, including on-boarding applications, setting application properties, managing capacity, and more.

Disconnect and Close Session. There are generally two options when a user exits a session:

- Disconnect from the session but keep it active, in which case the user can return to the session.
- Close Session to completely end the session. The instance then reboots and becomes available for the next user.

Desktop Simplicity and Agility

With Nutanix Frame, everything runs in an HTML5-capable browser window, so there's no proprietary client software to install. Any device capable of running a supported web browser—including Chrome, Firefox, Safari, Microsoft Edge and others—should be capable of connecting to Frame. This enables users to be almost instantly productive from nearly any device whether that device is a desktop, laptop, tablet, or smartphone.

From an administrative standpoint, Nutanix makes it easy to get started, easy to add new software or support new integrations for identity, networking, and storage, and simple to scale your environment up or down. Most changes take effect in a matter of seconds or minutes, not days or weeks. Users that are active when a change is made will see the change in their next session. (Chapter 5 explains both the user and the administrator experience in more detail.)

Performance Without Compromise

Nutanix Frame is designed to ensure that your users are always as productive as possible, even in high-latency and low-bandwidth conditions. A foundational part of the platform, the Frame Remoting Protocol, is designed to deliver maximum performance across networks of all types using adaptive quality of service (adaptive QoS) and adaptive codecs. Frame provides a pragmatic balance between image quality and bandwidth that works well for delivering both rapidly changing video content and high-resolution graphics. Frame users can see network performance metrics and have the ability to manually tune default settings to address marginal network conditions. (You can enable or disable access to this capability.)

With some DaaS solutions, multiple users share a single virtual machine (VM). Frame allows you to allocate a VM to each user, eliminating “noisy neighbor” effects and ensuring consistent performance.

For demanding applications including CAD, 3D modeling, and computational software, Frame provides options for GPU and multi-GPU sessions. Many Frame customers use the platform for high-end, GPU-driven applications at up to 60 frames per second. Both administrators and end users can switch between CPU and GPU instances from the Frame console as needed.

Security First

The Nutanix Frame platform is designed to meet the most stringent security demands. By eliminating the need for client-side software or plugins, Frame also eliminates a critical point of vulnerability. All communication between the end user's browser and the cloud service is encrypted with TLS and 2048-bit public key certificates.

Frame offers SOC2 type II compliance, supports FIPS mode, and is FedRAMP Moderate Authorized.

Core tenets of Frame security include:

- **Small Attack Surface.** Frame minimizes the available attack surface by using well-known, structured APIs, limiting communication to a minimum set of ports and protocols, and using automated and repeatable design patterns.
- **Isolation by Design.** Frame separates and isolates system components into small, discrete units. Any unwanted or malicious changes that occur during a user session (including zero-day threats) are eradicated when the session ends and don't persist. This makes it more difficult for external actors to implement exploits to reach your data.

- **Security at Scale.** The Frame platform automatically handles infrastructure scaling to ensure your desired security model is maintained at scale. From one user to thousands of users, a consistent security profile is maintained for your entire deployment.

- **Simplified Compliance.** Frame provides enhanced security capabilities natively. Enable two-factor authentication for sensitive corporate applications or limit data movement outside of defined virtual network boundaries.

Experts across our security, DevOps, and support teams follow strict processes to ensure the integrity of your system. We run regular penetration tests and work with third-party security specialists and infrastructure partners, like AWS and Microsoft Azure, to keep our systems safe and secure. The list of Frame security certifications includes:

For U.S. government organizations handling sensitive, highly regulated information, Frame supports AWS Gov Cloud, AWS C2S, regions and Azure Government.

Elastic by Design

Innovative auto-scale functionality provides the best performance for the lowest possible cost, at any scale deployment. Frame is a true pay-as-you-go cloud platform. You are charged for infrastructure that you actually use. The comparison to a traditional fixed-cost VDI model, where resources are provisioned for peak capacity even though you don't need them 99% of the time, is extremely favorable.

Broad Partner Ecosystem

Frame is designed to work with your existing IT environment—whether on premises, in the cloud, or both—to support complex client-server applications.

- **Storage integration.** Frame gives users native access to storage services such as Dropbox, Box, Google Drive, and Microsoft OneDrive. Access to persistent home and group folders can also be provided in the form of personal and team persistent drives. Other existing on-premise and cloud file shares also connect easily to Frame. If enabled, users can upload and download files stored on their local or USB device via a user-friendly interface.

- **Network integration.** Front-end user applications running in Frame often need to communicate with back-end services such as databases. VPN gateways and VPC/VNET peering are among the options that can be used for communications to shared networks whether on premises or in the cloud.

“The Frame platform is really easy to use. It's very straightforward. It feels user-friendly, both to me and whenever I show it to someone. When I train contractors, I don't have to spend too much time with them explaining the platform, which means I can focus on the big picture.”

— Autodesk

- **Identity integration.** Frame provides native integration with modern Identity Providers (IdPs), such as Azure Active Directory, VMware Identity Manager, Google Sign-In, Ping, Okta, and others. Additional integrations can be performed using Security Assertion Markup Language (SAML) 2.0, OAuth 2, Open ID Connect, or custom protocols. Frame leverages the two-factor authentication (2FA) and multi-factor authentication (MFA) capabilities of these IdPs. You can also connect with classic Active Directory integrated resources such as File/Print and SQL services from within Frame-powered applications and desktops.

Freedom to Cloud

One of the biggest advantages of Frame is that it gives you more choice and more flexibility to run the applications you want the way you want to run them in your choice of cloud—or on premise.

Desktop and Application options:

- Microsoft Windows
- Linux

Current Cloud Options:

- Amazon Web Services
- Microsoft Azure
- Google Cloud Platform
- Nutanix Cloud Platform

Running Nutanix Frame in Your Datacenter

Nutanix Frame allows user workspaces to run on Nutanix HCI hardware on-premise, allowing you to deliver the benefits of virtual desktops and applications from the infrastructure you own and control.

This permits organizations to offer virtual desktops and applications on-premise without requiring a lot of expertise in deploying and managing VDI infrastructure. The Frame management plane continues to reside in the public cloud. There's no change to the user experience or management experience for the service.

When a user initiates a session, Frame user instances are started on Nutanix nodes running the Nutanix native hypervisor, AHV. You continue to manage and monitor your AHV nodes and cluster via Nutanix Prism or Prism Pro as normal.

Yearbook Publisher Streamlines Business Model with Nutanix Frame

Jostens is the leading publisher of student yearbooks in the United States, serving hundreds of schools in all 50 states. Before Jostens adopted Frame, supplying software to each school was a challenge. Each yearbook team had to manage its own computing infrastructure and software, often relying on the school districts' IT departments to procure and install the latest versions of Adobe InDesign and Photoshop. IT also had to manage Jostens' own software, called YearTech, that integrated with InDesign.

Today with Frame over 15,000 Jostens users are supported from a single deployment. Data is safe and secure, and there's no software to install or manage.

- Work from anywhere
- Work on any device
- Bring in data from multiple sources
- Collaborate securely

[**Learn more**](#)



Nutanix Frame: Benefits-at-a-Glance

- **Anytime, anywhere access.** Users only need a browser and a network connection to access desktops and applications
- **Scalability.** Whether you have ten users or ten thousand, Nutanix Frame scales to meet the needs of your business.
- **Performance.** Frame is optimized to deliver great performance, even over low bandwidth, high-latency networks. A variety of performance options, including GPU and multi-GPU sessions, give users the performance they need.
- **Security.** With its built-in security, Frame turns almost any endpoint into a client device with no need for local data. Frame not only delivers stringent controls, it gives you complete visibility into the configuration and operation of your digital workspace environment. Client sessions are always returned to an approved state on termination.
- **Ecosystem.** A broad and growing ecosystem of storage, network, and identity partners helps ensure that Frame fits seamlessly with your operations.
- **Controlled costs.** The elastic nature of the cloud allows you to deliver high performance digital workspaces on-demand, with usage measured in minutes and hours rather than days, months, or years.

Using **Frame**

Now that you understand some of the benefits of Nutanix Frame at a high level, it's time to learn a little more about how Frame works. This chapter hits some of the high points in terms of both the administrator experience and the user experience.

Nutanix Frame User Types

In Frame, there are four user types:

- **End User.** End users have the ability to login and access the Frame Launchpad and can run desktops and applications in a session that have been configured for them. End users have no direct access or control over anything outside their individual sessions.
- **Account Admin.** Account Admins have control over a single Frame account, including the ability to add users, install and configure new applications, manage updates, and much more.
- **Organization Admin.** An Organization Admin can manage multiple Frame accounts across multiple regions that are all part of the same organization or department.
- **Customer Admin.** Large enterprises may have multiple divisions and many accounts. Customer Admins have visibility and authority over all organizations and all accounts within the customer's environment making it possible to oversee multiple geographies, departments, app sets, and more.



The Nutanix Frame User Experience

The goal of Frame is to keep the user experience as straightforward as possible so that there's nothing to get in the way of productive work. For most users, this means simply opening a window in an HTML5-compatible browser and navigating to a URL. However, Frame enabled applications can also be embedded in a web page or an end-user portal using Frame APIs to accommodate your operational needs.

User authentication takes place according to your organization's identity methods you've configured. If you have SSO, users working on-premise may be automatically logged in. The first thing that a user sees after authentication is the Frame Launchpad:

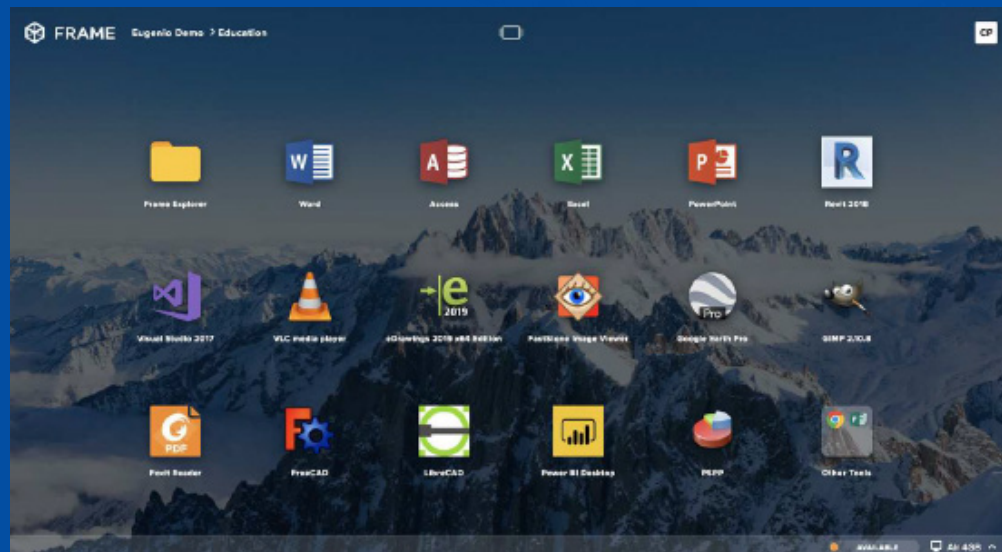


Figure 1. Example of a Frame Launchpad

From the Launchpad the user is able to run applications and desktops and access files. Note that if a user just needs to access a particular application—whether it's a standard Windows application or a custom in-house application, they can launch the application directly without opening a desktop.

The user's Frame session doesn't begin until they launch an application or desktop. Once they do, a VM instance of the appropriate type is allocated to them. The user has the ability to select the instance type they need (if enabled) before commencing a session.

After a session begins, users see the application or desktop with the Frame status bar at the bottom of the browser window. This status bar allows them to see how Frame is performing and provides access to various Frame features including the ability to launch other applications inside the same session and switch between them for multi-application workflows.

Other capabilities available to users include (if configured): sharing a session to collaborate with another user, printing, switching the session type, and access to cloud storage. In addition, the Frame status bar includes a variety of useful performance information such as:

- Network bandwidth and latency
- Distance to the user's workload vm
- Window scaling
- Elapsed time/Max session time

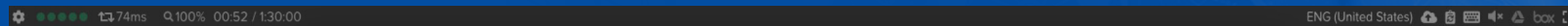


Figure 2. The Frame status bar.

When users are done with their sessions, they have two options:

- **Disconnect.** This preserves the running state of the session, enabling the user to reconnect (from a different device if desired) and start working where they left off.
- **Close Session.** This ends the session and frees the associated VM. The VM returns to the initial state.

User Profiles in Frame

In VDI environments, it's common to distinguish between “persistent” versus “non-persistent” desktops. Persistent desktops allow users to save their preferences and data just like on physical desktops or laptops. With non-persistent desktops, every time a user logs out and logs back in the desktop returns to a default state that they have no control over.

Frame offers a “best of both worlds” experience: persistence of user data and profiles, coupled with user data mobility on a non-persistent desktop. This gives users the desired flexibility and faster access to applications because there's no wait time to boot up a specific image of each user?

- **User profiles.** Frame supports user profiles that persist between sessions allowing users to save their preferences for things like application settings, background, fonts, etc. When user profiles are enabled, every time an authenticated user logs in to Frame that user's profile will be in effect.
- **User data.** Frame supports persistence and mobility of user data by intelligent use of cloud drives like One Drive and Google Drive. Each user's cloud drive is mapped into the user desktop at login, and users can save data on the cloud drive just as naturally as they would to a local desktop file system.

Frame currently does not allow users to install their own applications in non-persistent desktops. However, if a user needs to install their own applications, you could deliver a persistent desktop. Frame also allows your organization to create multiple launchpads for different sets of users, thereby providing choice and options for the resources to provide.

Configuring and Managing Frame

Frame administrators are responsible for configuring and managing the full environment on behalf of users, including:

- The Sandbox which serves as a Gold Master for user VMs.
- User logins and user Launchpads. (Users can be invited individually, in groups, or pre-authorized.)
- One or more production pools of VMs available to users.
- Utility servers that provide necessary services for your application environment.
- External network connections to the cloud and on-premise.

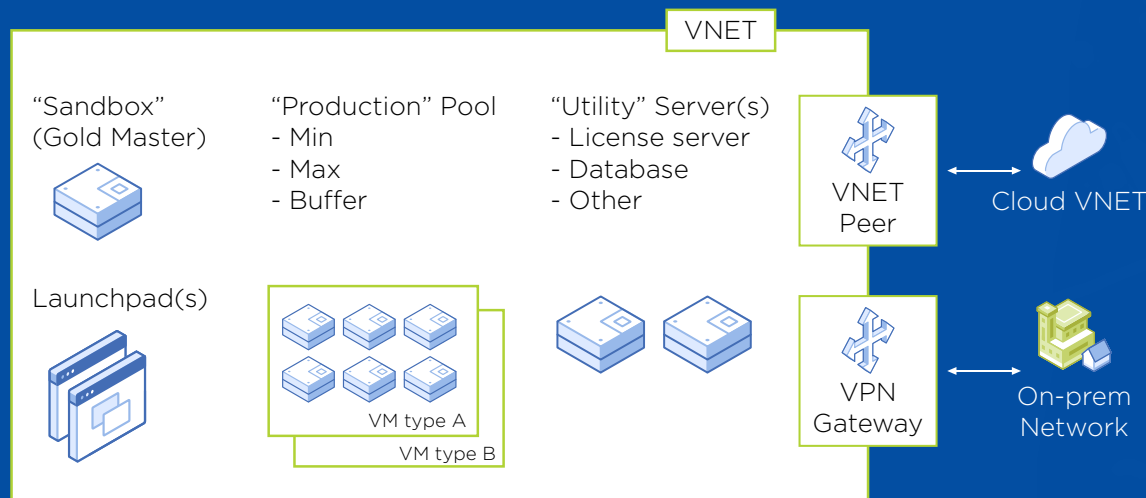


Figure 3. Elements of a typical organization's Frame account

Our goal with Frame is to make managing the underlying digital workspace environment as easy as possible so that you only need to focus attention on delivering and maintaining the application environments your users depend on.

Onboarding Applications with the Frame Sandbox

The Frame administrator can easily create different Launchpads and application environments to address user needs. One of the unique features of Frame is the ease with which a user application environment can be configured. This is accomplished using the Sandbox, accessible from the Frame Dashboard which administrators access from the Launchpad.

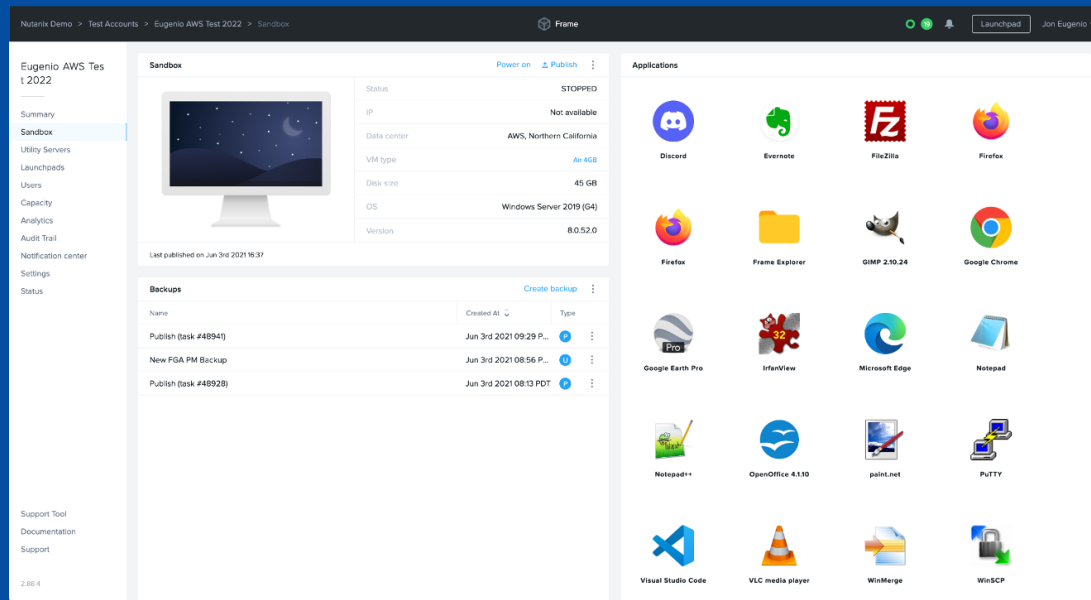


Figure 4. The Frame Dashboard.

Powering on the Sandbox takes you to the Sandbox desktop. From the Sandbox desktop you can easily add applications to make them accessible to users. Doing so is an extremely simple process:

- Upload the installer using the browser by dragging and dropping the installer files on the Sandbox desktop or access from a cloud drive.
- Install and onboard the application following Frame's prompts.
- Test the application for the Sandbox desktop. Once you've made all the desired changes, you have to publish those changes to have them take effect for users. The publishing process accomplishes three things:
 - It creates a backup of the current Gold Master in case you need to rollback.
 - It creates a Gold Master from your updated Sandbox.
 - It pushes the master image out to VMs running in the Production Pool.

Once the publishing process completes, the changes take effect. Users who were active when publishing occurred will see the changes take effect on the next login.

Production Pools

Frame uses Production Pools to ensure that resources are available for users who need them without having more instances than necessary sitting idle.

Each Production Pool consists of VMs of a specific instance type. This allows you to support the needs of different types of users ranging from customer support workers to power users that need multi-GPU capabilities.

Each Production Pool is controlled by three main settings:

- **Min (minimum).** The minimum number of instances that are powered on at a given time, ready to accept sessions.
- **Buffer.** The number of extra instances waiting, ready for users.
- **Max (maximum).** The maximum number of concurrent users you want to allow for this type. This is also the number of available VMs for users.

To understand how these settings work together, consider a pool where **min** is five, **buffer** is three, and max is 20. When no users are connected, there are always five instances (**min**) waiting idle.

If three users connect, the number of idle instances falls to two. Since that's below buffer (three), Frame starts another instance.

As more users connect, Frame continues to start additional instances to ensure that the set number of idle instances is maintained until the number of active instances plus idle instances reaches **max**.

Frame also lets you schedule exceptions to these elastic scaling parameters for certain times of day or days of the week. For example, you may want your minimum and buffer reduced to zero at night, if you don't expect any users to connect, or there may be a particular time of day when you expect a large number of users.

How Min, Buffer, and Max Settings Can Affect Your Frame Costs

The purpose of the **min, buffer, and max** settings, combined with the ability to schedule exceptions, is to allow you to flexibly address user needs while allowing you to control costs by minimizing the number of sessions sitting idle.

Note that even with no users on the system, if **min** is set to five you always have five sessions running—waiting for users and incurring costs. Similarly, if **buffer** is set to five, once users connect, you continue to have five sessions sitting idle (until **max** is reached).

You can minimize costs by setting both **min** and **buffer** to zero, but this forces each user to wait approximately two minutes for an instance to start to connect to a session. A good rule of thumb is to set **min** and **buffer** to the number of users likely to log in during a two minute period. Schedule exceptions to increase **min** and **buffer** for periods when many people connect.

Note that in most cases, you want **max** to remain the same at all times. If you reduce the setting during some intervals, instances will be unnecessarily terminated only to be re-provisioned when the setting increases, incurring unnecessary instance usage on your account.

Most Frame accounts observe user activity and fine tune the default settings and exceptions as clear patterns emerge.



Utility Servers

A Utility Server is a standalone, general purpose server that can be added as an option to your Frame account. Utility servers are useful for supporting more complex user application environments and typically run 24 x 7. Common uses are backend servers for client-server applications, license servers, or file servers.

By default, utility servers are configured as relatively low-powered instances, but you can request any type of instance you need. Utility Servers are accessed from the Frame Dashboard, where you can power them on and connect to install applications.

Connecting to External Networks

Your Frame account is always configured to run as a secure, isolated environment. For example, in AWS your Frame environment runs as a VPC; in Azure your environment runs as a VNET.

In all likelihood, you'll need your Frame environment to connect to other parts of your operations, either in the cloud, on-premises, or both. Depending on the particulars of your Frame account, you can configure your environment with:

- Peer-to-peer connections to other cloud environments.
- Virtual private network (VPN) connections to on-premise datacenters.

Endless Possibilities

This section really only scratches the surface of the capabilities of Frame.

Additional options and capabilities include:

- Set session time limits
- Configure cloud storage
- Set up shared drives for users
- Integrate with Microsoft Office 365
- Support multiple displays
- View detailed Frame analytics

In addition, the Frame API provides ways to integrate the Frame Platform into your website, analytics, and management systems. The Application API can enable your organization to launch applications from your web page or portal. You can use the Web API to measure usage, track sessions, and list team members. You can also start and stop Sandboxes, initiate publishing, and track publishing progress. This allows you to automate administrative workflows.

Frame **Use Cases** and **Industries**

The Frame Platform is applicable to and being used by organizations of all sizes across almost all industries. This chapter explores some specific use cases that may not have occurred to you yet, as well as a few industries where Frame has gained particular traction.

Popular Use Cases

There are a number of use cases for digital workspaces that may not be immediately obvious or that you may not have thought of:

- **BYOD.** Frame makes it possible to support BYOD while minimizing the risk created by employees using—and storing data on—devices that are not under IT control.
- **Seasonal needs.** With Frame, you can provide desktops to meet seasonal and short-term needs without incurring capital expense.
- **Legacy applications.** Most organizations have some legacy applications that are still useful, but that can no longer be updated for some reason. Frame makes it easy to continue to support these applications and make them accessible from any device.
- **Client-server.** Client-server applications require software on the client device that connects to a server on the backend. Frame makes it possible for users to run your existing client-server applications without the need for client software on the device. Nutanix also gives you multiple options to support the server backend. It can be part of your Frame environment, or you can connect to servers running on-premise or elsewhere in the cloud.



- **Web-based apps with plugins.** Some web-based apps may require plugins that aren't available on every device such as Flash, Silverlight, etc. With Frame, users can access these applications from any device, no plugin installation required.
- **Global collaboration.** These days, it's common for enterprises to have business units and teams across multiple geographies. Frame makes it simple for teams to share the same application session, including shared control and the ability to converse using built-in audio.
- **High-end graphics apps.** Some of your users may require only occasional access to high-end graphics applications. With Frame, these users can access GPU-enabled instances whenever they need them without needing a specialized device.
- **Google ecosystem.** Some companies are moving users into the Google Apps ecosystem, even supplying Chromebooks in place of laptops and desktops. Frame makes it simple to provide these users access to Windows and/or Linux applications.

Industries

Architecture, Engineering, and Construction (AEC)

The norm in AEC has been to supply design workers with high-end workstations able to run graphics-intensive applications such as Autodesk Revit and AutoCAD. However, these workstations can be expensive and finicky and may require frequent upgrades. Provisioning users with this equipment has become increasingly challenging in today's dynamic work environment, and the equipment is neither convenient nor portable.

Many organizations find that Frame is a better way to deliver graphics acceleration, even for users that need GPU capabilities on a daily basis. A number of AEC companies have adopted Frame, enabling power users to access digital workspaces powered by the latest GPU technologies from a variety of devices.

KPF Chooses Frame for High-End Graphics Support

Kohn Pedersen Fox (KPF) is a global architecture firm headquartered in New York, with offices in London, Shanghai, Hong Kong, Seoul, and Abu Dhabi. The firm specializes in skyscrapers and other big, collaborative projects, relying on more than 25 graphic-intensive applications including well-known software tools from Adobe and Autodesk.

After initially struggling with on-premise VDI alone, the firm discovered Frame. The combination of Frame and Panzura cloud storage allows KPF employees to access the applications they need, even when they are working at home or at a customer site.

[Learn more](#)

Government

Governments are increasingly moving from traditional on-premise IT to public and private cloud deployments. DaaS allows government IT teams to take advantage of cloud-hosted solutions.

With a fully managed, turn-key solution, Frame helps U.S. Government organizations by eliminating the need for large capital expenditures and greatly reducing administrative complexity, allowing government IT teams to focus on mission-impacting problems. Because no data is stored locally on a user's device, Frame improves data security. All data remains within the confines of a secure government cloud, and the solution has been hardened to address government security regulations.

With Frame, government workers are able to take advantage of a modern, secure solution that delivers advanced capabilities to practically any location on Earth.



Independent Software Vendors (ISVs) and Software-as-a-Service (SaaS)

ISVs find Frame to be extremely useful in several ways:

- **Quickly SaaS-ify Applications.** Many ISVs want to move to a SaaS model for their applications. Frame enables you to make your application available from the cloud with minimal or no changes to the base software.
- **Support Workshops and Training.** If your organization holds regular workshops, trainings, user groups, or conferences, Frame makes it simple to host full user sessions that allow attendees to see and try all the capabilities of your software, while minimizing or eliminating the need to ship a lot of specialized hardware to the site.

Autodesk Leverages Frame for a Variety of Use Cases

If you've ever driven a high-performance car, admired a towering skyscraper, used a smartphone, or watched a great film, chances are you've experienced the results of Autodesk software. This leading ISV relies on Frame for a variety of use cases including:

- **Autodesk University.** It used to take the company a week and thousands of hours of labor to set up hundreds of high-powered workstations for its annual user conference. Switching to Frame saved Autodesk time, effort, and money.
- **Beta testing.** Historically, participants had to download and install pre-production software to try out the latest updates. This limited the frequency and amount of feedback that could be collected. Autodesk chose Frame to virtualize applications for beta testing because it makes it simple to instantly reach customers around the world with the latest software.

[Learn more](#)

CHAPTER 7

Getting Started with **Desktop-as-a-Service**

DaaS and Nutanix Frame can have tremendous advantages for organizations of any size in any industry. If you've read this far, the next step on the journey to DaaS is to try Frame for yourself. Almost all Frame engagements begin with a self-service test drive. Any user gets two hours to try the full complement of Frame capabilities.

To learn more about how Nutanix can help you transform your end-user computing environment visit **www.nutanix.com/frame**.



Getting **Started** with **Nutanix**

To learn more about how Nutanix can help you transform your big data operations and integrate analytics with your business processes, visit nutanix.com/bigdata. You can contact Nutanix at info@nutanix.com, follow us on **Twitter** [@nutanix](https://twitter.com/nutanix), or send us a request at www.nutanix.com/demo to set up your own customized briefing. You can also **take a test drive** of Nutanix infrastructure with no hardware, setup, or cost. Experience the simplicity and agility of public cloud combined with on-premise performance, security, and control via an easy-to-follow guided tour.

Take a Test Drive

