End User Computing
State of the Union 2020

#VDILIKEAPRO

Version 1.0 – June 2020

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Highlights

VDI Like a Pro conducted the seventh worldwide 'End User Computing – State of the Union' survey in 2020. Over the years, similar surveys were conducted in 2012, 2014, 2015, 2017, 2018 and 2019
The 'End User Computing – State of the Union' is truly unique because it's unbiased, independent, powered by the community and the results are available for everyone—free of charge.
The document provides valuable insights in trends, real-world deployments, configuration and usage, both on-premises and public cloud environments, from more than 695 people who supported the survey.

- **695 people supported** the survey and on average, completed the survey in 10 minutes.
- **North America** has the largest response distribution and is clearly the largest region by far. There is a relatively high number of participants from the Netherlands (17.9%), likely because VDI Like a Pro and their team members are well-connected with end-users, partners, and vendors in this region.
- The audience that filled in this survey has been **mostly technical (Engineer, Administrator, Architect)** with 47,48% followed by consultants (25,90%) and IT managers (11,75%).
- With **15.35% Finance became the largest business vertical** market for virtual desktops and application solutions. Healthcare with 13.19% is 2nd and Government with 11.75% is 3rd largest vertical.
- **26.17% is using a multi-user operating system** (with multiple users actively sharing the VM) while 22.74% is using a single-user operating system.
- **With 37.25% Windows Server 2016 is used** the most followed by Server 2019 with 20.24% and Server 2012R2 still used by 18.22% of the respondents. Windows 10 EMS (Enterprise multi-session) was introduced in 2019 and is used with 11.13% of the organizations.
- The **majority** of respondents in the 2020 survey are **running** their workload VMs to virtual desktops and applications **in a private cloud environment** using on-premises or co-located datacenters.
- The majority of respondents of the 2020 survey, 55.35%, is running and supporting the EUC infrastructure 'broker' as part of their own IT service while **30.5% is consuming the control plane or broker as a service** from e.g. Microsoft, Amazon, Citrix, Nutanix, VMware and others.
- A perfect (according to users and administrators) virtual desktop and application environment is more common in 2020 with 10.90% an increase of 6.68% compared to 2019.
- **VMware remains by far the largest vendor delivering virtual hypervisor infrastructure** for virtual desktops and applications, although the usage is slowly decreasing from 65.8% in 2014, 64% in 2015 and 2016, 61.4% in 2018, 56% in 2019 and 55% in 2020. Microsoft Hyper-V usage is slowly decreasing from 13.18% in 2019 to 11% in 2020
- This year 59.5% of participants stated they didn't have any plans to change their hypervisor while 7.53% is still investigating hypervisor options.
- **The biggest GPU competitors isn't AMD versus Intel versus NVIDIA—it's the CPU (again).** Many organizations think the CPU can handle the graphics-related activities and therefore don't use GPUs. "No GPU" declined from 78% in 2014, 67% in 2016, 56% in 2017, 44.92% in 2018, 43.06% in 2019 and is at 35.41% in 2020.
- This year for the first time we asked if GPUs are using in public cloud. The majority of virtual desktop and application deployments aren't using GPUs, 44.91% while NVIDIA NV instance types on Azure are using 21.56%.
- **AMD is slowly entering the EUC space** with promising EPYC CPUs and Radeon GPUs, the AMD GPUs have entered the public cloud space with Azure NVv4 machines but on-premises AMD GPUs unfortunately aren't used a lot.

- **FSLogix Profile Container** is the most popular user environment management this year, after the acquisition in 2018 by Microsoft. The decision to make the product available for almost everyone has been an important for this adoption rate.
- **The total usage of Microsoft FSLogix profile containers is 20.49%.** Citrix user environment management solutions is 16,23 % in 2020, VMware solutions is 7.21% and Appsense (Ivanti) declined from 8.32% in 2019 to 7.54% in 2020 while RES Workspace Manager (Ivanti) declined from 8.87% in 2019 to 4.59% in 2020.
- **The adoption of Office 365 ProPlus increased from 26.95% in 2019 to 53% in 2020**. Microsoft 2016 declined from 44.48% in 2019 to 28% in 2020. Google GSuite is being used in 1.58% of the deployments and slowly increasing but still minor compared to Microsoft.
- **The use of unified communications with voice and video support has increased rapidly** from 13.4% in 2014, 30.6% in 2017, 37.90% in 2018, 38.72% in 2019 and 47.92% in 2020. While Unified Communications in virtual applications and desktops always is 'attention' and often challenging it is great to see usage increasing.
- **We are surprised to see that IT Admins are increasingly using manually installation** and update of OS and applications within the master image.
- 46.65% of the respondents do report that their complete application landscape does contains **80% or more Windows applications**.
- Microsoft **App-V still is the main application virtualization solution** in virtual desktops and applications with 31.44% in 2019 and 30.41% in 2020.
- **ControlUp is the most popular solution to monitor** the virtual desktop and application environment, 13.01% of the respondents are using the solution which is an increase of 5.07% compared to 2019.
- A Unified Workspace portal will bring Windows, Web/SaaS applications and data together. A workspace portal often is referenced as "Workspace aggregator". **Citrix Workspace is used the most with 47.20%** followed by VMware Workspace ONE with 14.91%. Also 23.60% of the respondents are investigating different options.
- **With the increment working more from home, all dual-display configurations combined totals of 61.74% in 2020 an increase of 3.17%** compared to 2019. Dual display at Full HD is used the most with 45.97% in 2020.
- **Dual display configurations are more popular than a single display** configuration at 31.21%. Dual display configuration surpassed a single display configuration in 2019. Ultrawide screen entered the survey with 0.67% in 2020.
- **Cloud first strategy for virtual desktops and applications is the main reason for DaaS usage**. 17,57% of the respondents in 2020 an increase of 3.94% compared to 2019.
- The four biggest challenges in adopting public cloud for Desktop as a Service (DaaS) are cost/positive business case (29.89%), Legal and regulation (13.30%), trust (11.21%), and performance (9.57%).
- **37.34% of the of respondents** are designing, **running a Proof of Concept, pilot or run their Desktop as a Service solution** in pre-production. 19.33% do use the solution in production for 1 year or less. 14.66% of the respondents do use DaaS in production for 2+ years.
- The cloud strategy with regards to workload VMs for the **majority of respondents is hybrid with 56.76%**. A single public cloud strategy is second with 35.81% and multiple public cloud providers as strategy is being used by 7.43% of the respondents.
- The most **important reason to use for Desktop as a Service** is the ability to support **flexible/temporary** workers with 16.49%.
- The **majority** do have a **hybrid data storage Desktop as a Service solution**. 56.85% of the respondents do store data local / on-premises and use public cloud resources now or long term.
- The **Top 3** of **most important** Workspace **initiatives for 2020/2021** are**; (1) Desktop as a Service**, (2) **Application Containers** and (3) **Microsoft Office 365.**

Introduction

Welcome to the "VDI Like a Pro" - End User Computing – State of the Union 2020 edition.
We believe the results presented in this report do provide valuable insights in trends real-world deployments, configuration, and usage of end-user computing (EUC) solutions such as Virtual Desktop and Applications – Virtual Desktop Infrastructure (VDI) and Desktop as a Service (DaaS) both on-premises and public clouds. This document will also provide a great perspective on key end-user computing trends for the forthcoming years, which will help you with planning and creating your EUC roadmap.

Topics in the survey will cover Virtual Desktop Infrastructure (VDI), Desktop as a Service (DaaS), public cloud, security, devices, single session and multi-session Operating Systems, storage, hypervisors, GPUs, manageability, tools and the key EUC initiatives for 2021 and beyond.
The goal of the survey is to get a clear view on how the industry is changing and to support all involved with valuable, independent, and unbiased research results based on actual and objective customer data. 695 people supported the survey and, with support from the EUC community, the results are freely available to everyone. This is truly a great achievement and community effort.

About VDI Like a Pro

Independent research organization VDI Like a PRO started the State of the Union Survey in 2013, with the goal to provide an annual insider view of the End User Computing (EUC) market.
VDI Like a Pro (www.vdilikeapro.com) is an initiative by Ruben Spruijt, Sr. Technologist at Nutanix and former CTO at Frame. Mark Plettenberg, Senior Product manager at Login VSI and Christiaan Brinkhoff as Global Black Belt at Microsoft

With most of the questions repeated annually, the survey not only gathers data about the current status of the industry but also discovers changes and trends. This year more than 695 respondents participated in the survey, making this research initiative one of the largest on the EUC market currently. The survey closed on 18/05/2020.

The results of the survey are reported in this whitepaper which is available to all at www.vdilikeapro.com. The content from this survey will also be presented at leading industry and community events such as Microsoft Ignite, VMWorld, ExpertsLive, Citrix Synergy, NVIDIA GTC, E2EVC, Nutanix .NEXT and more.

If you want to share information from the survey or participate in the EUC community, feel free to contact Christiaan, Mark or Ruben.

Made possible by: Login VSI

Login VSI (www.loginvsi.com) is the industry standard in synthetic load testing and active monitoring for SBC/VDI and DaaS environments (infrastructure and applications). The software of Login VSI is used by enterprises with centralized desktop environments and/or business-critical applications running in VDI, and by all major IT vendors that offer infrastructure solutions for VDI. Login VSI has paid for the use of the survey tool ($1200, per year).

Teamwork

A community project cannot be successful without inspiring individuals and dynamic companies. Here are some that made this possible:

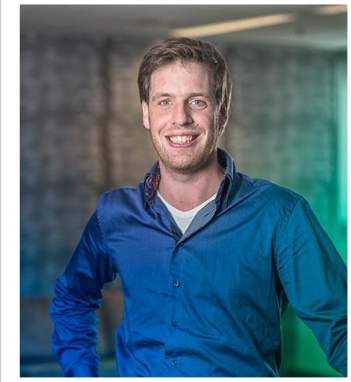
- Jack Madden, for announcing the survey at BrianMadden.com
- Login Consultants & PQR for running earlier surveys as ProjectVRC
- Login VSI, Atlantis Computing and FRAME for running earlier surveys as TeamVRC
- The Login VSI marketing team for their support
- Login VSI and Nutanix for support of this year's survey
- Many other community friends on LinkedIn and Twitter

Team and contact

All information about VDI Like a Pro can be found at www.vdilikeapro.com.
We try to provide accurate, concise, and practical information. We appreciate any feedback.
If you have any comments, corrections, or suggestions for improvements of this document, then we want to hear from you!
Please send an email to Mark Plettenberg (m.plettenberg@loginvsi.com), Christiaan Brinkhoff (mail@christiaanbrinkhoff.com) or Ruben Spruijt (ruben@rspruijt.com) and include in your message: the title of the document, the version number, and the page that you refer to.

Leaderboard

The State of VDI survey is executed by:



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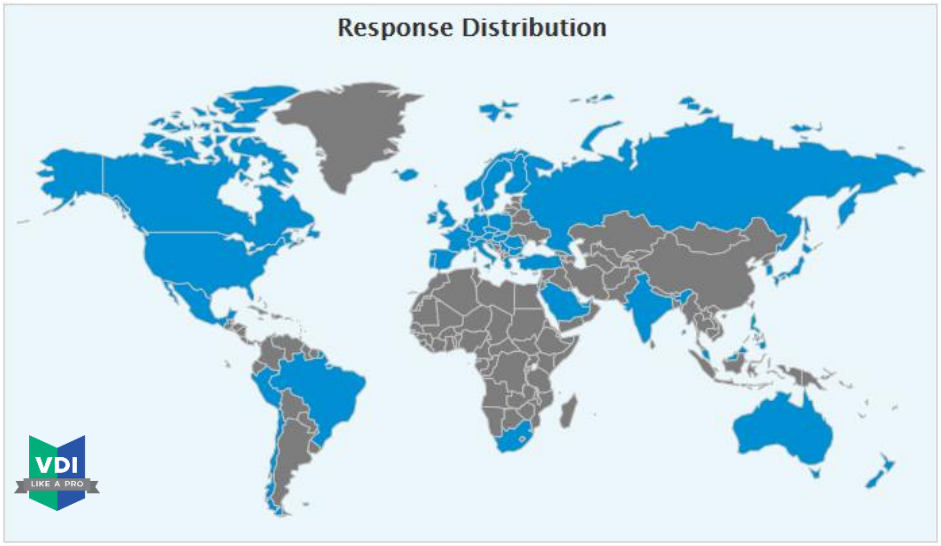
The change from VDI and SBC to virtual apps and desktops

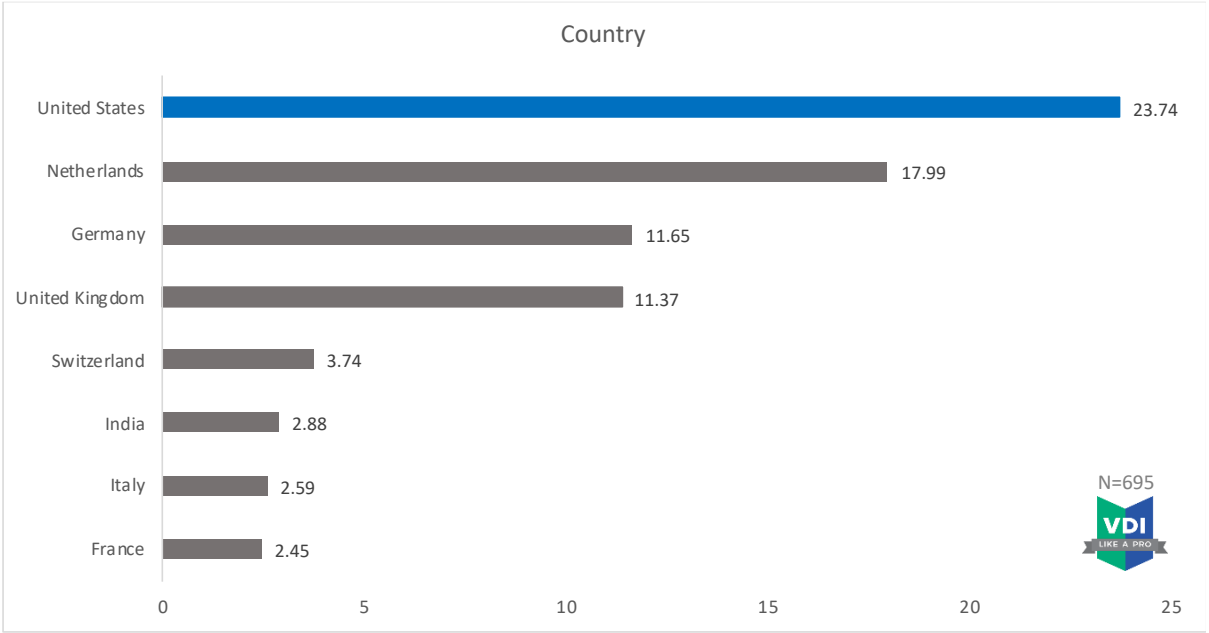
In the 2019 state of the End User Computing union we used 'Virtual Desktop Infrastructure – VDI' and 'Server Based Computing – SBC' terminology. This year and moving forward we will use single user and multiuser operating system. The main reason for this change is the development of Desktop as a Service (DaaS) and the usage of different and new operating systems supporting single user and multiuser sessions.

Also, it helps to create a better flow into the survey to address on-premises, public cloud and hybrid scenarios of virtual applications and desktops. Important: when we compare 2020 survey results with 2019 and earlier, we have combined the single user (VDI) and multi-user (SBC) results into a single category called virtual applications and desktops.

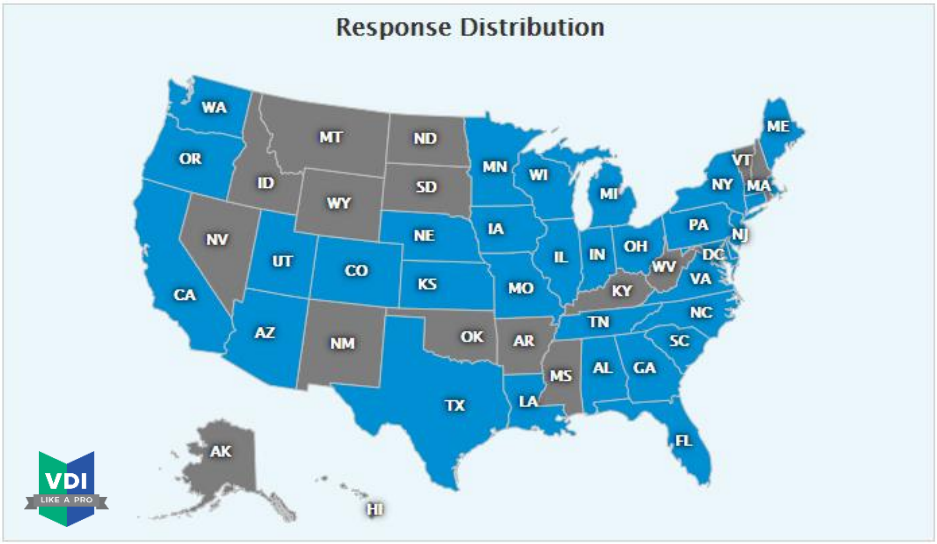
Participant information

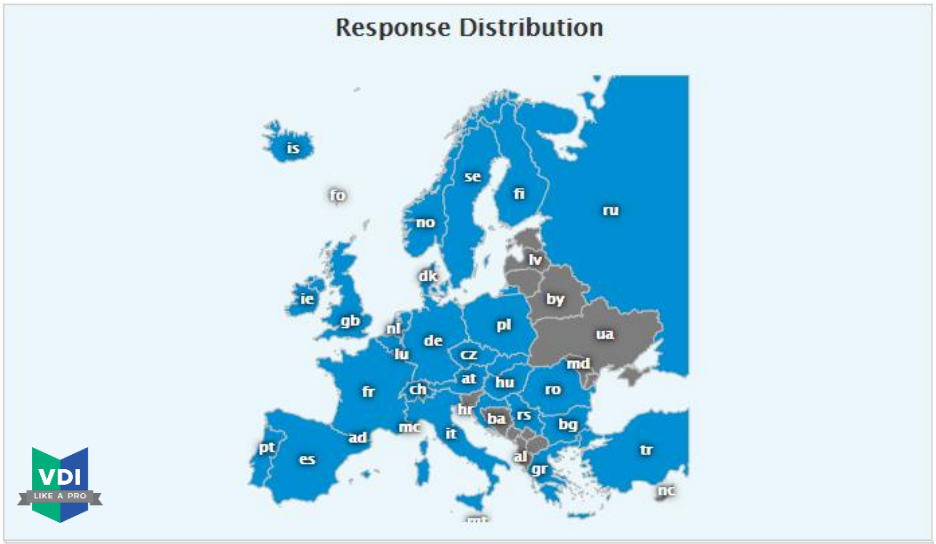
695 people supported the survey and on average, completed the survey in 10 minutes. Participants from almost 50 different countries around the globe took part in the survey, with a majority in North America. The response is measured based on client IP address.

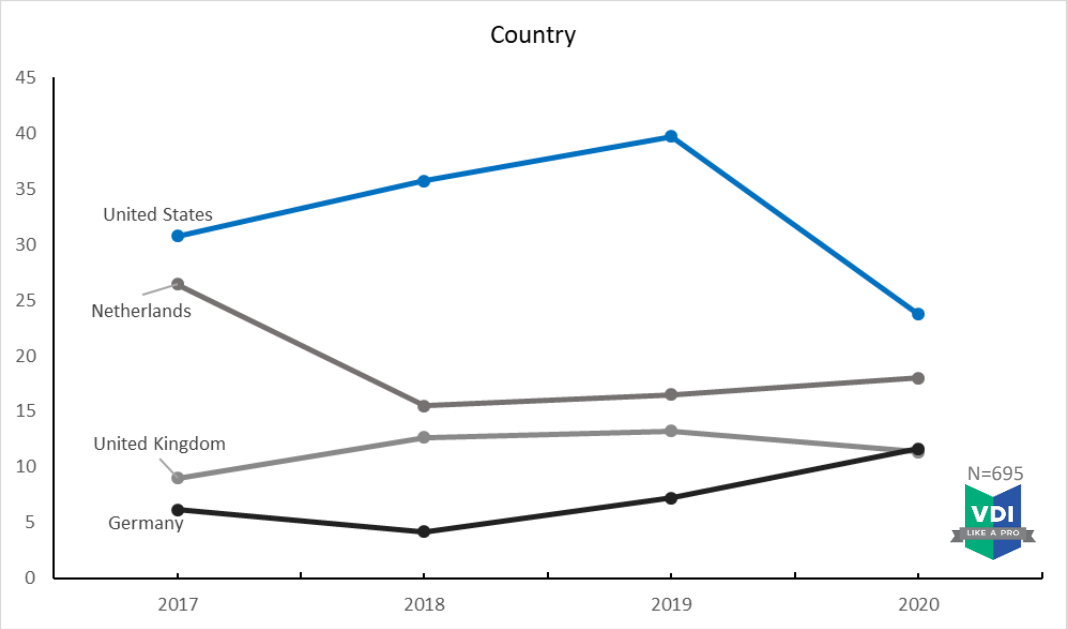




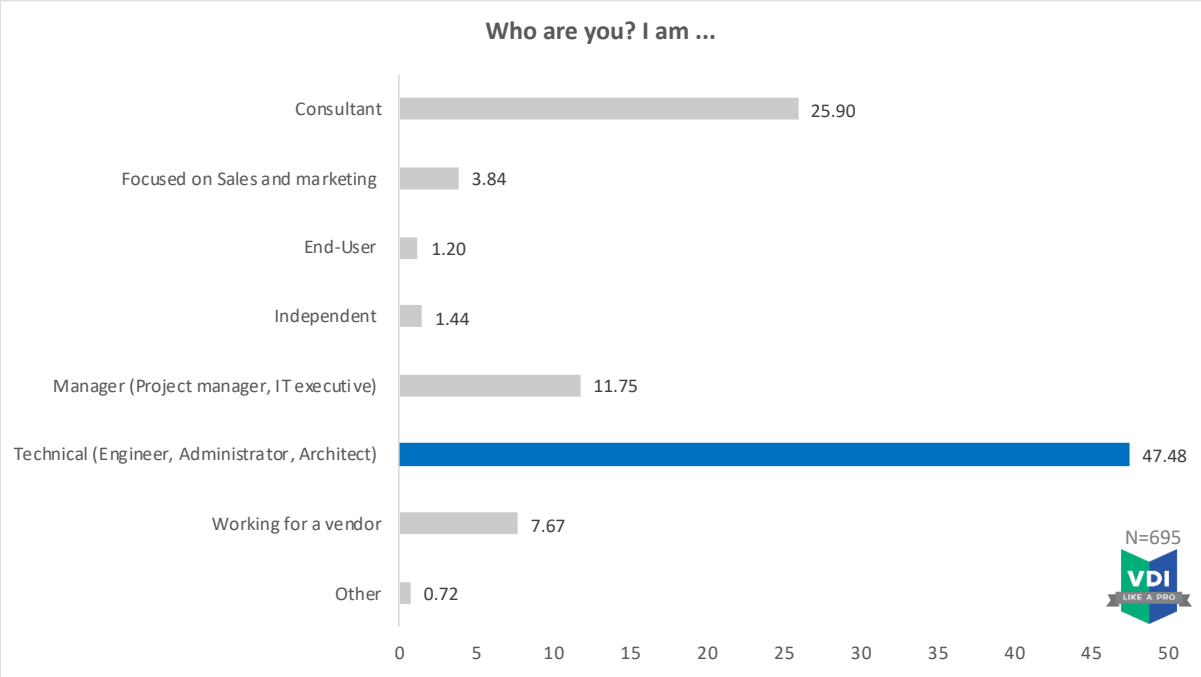
North America has the largest response distribution and is the largest region by far. There is a relatively high number of participants from the Netherlands (17.9%), likely because VDI Like a Pro and their team members are well-connected with end-users, partners, and vendors in this region. We could have said that the Dutch are leading the way in the EUC space with their high adoption rate, awesome customer deployments, and the deeply engaged community consisting of leading MVPs, CTPs, NTCs, and vExperts -- but that's just bragging about the Dutch and isn't based on survey results.





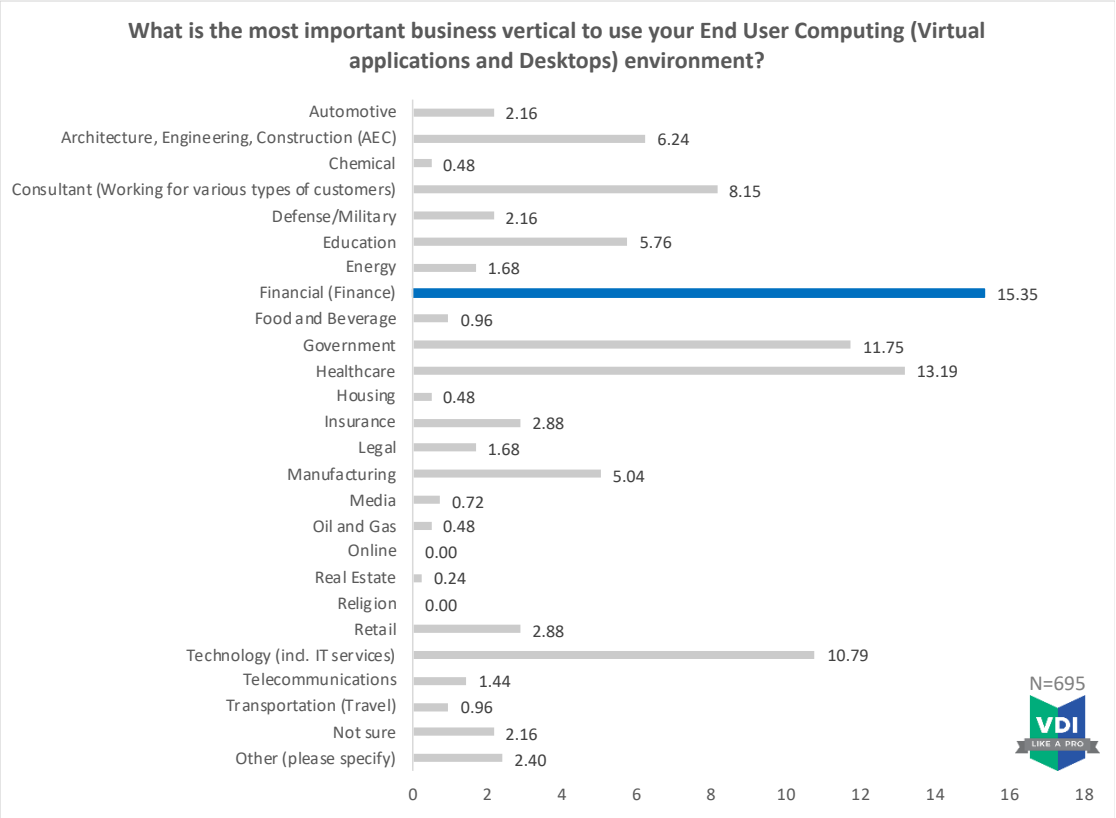


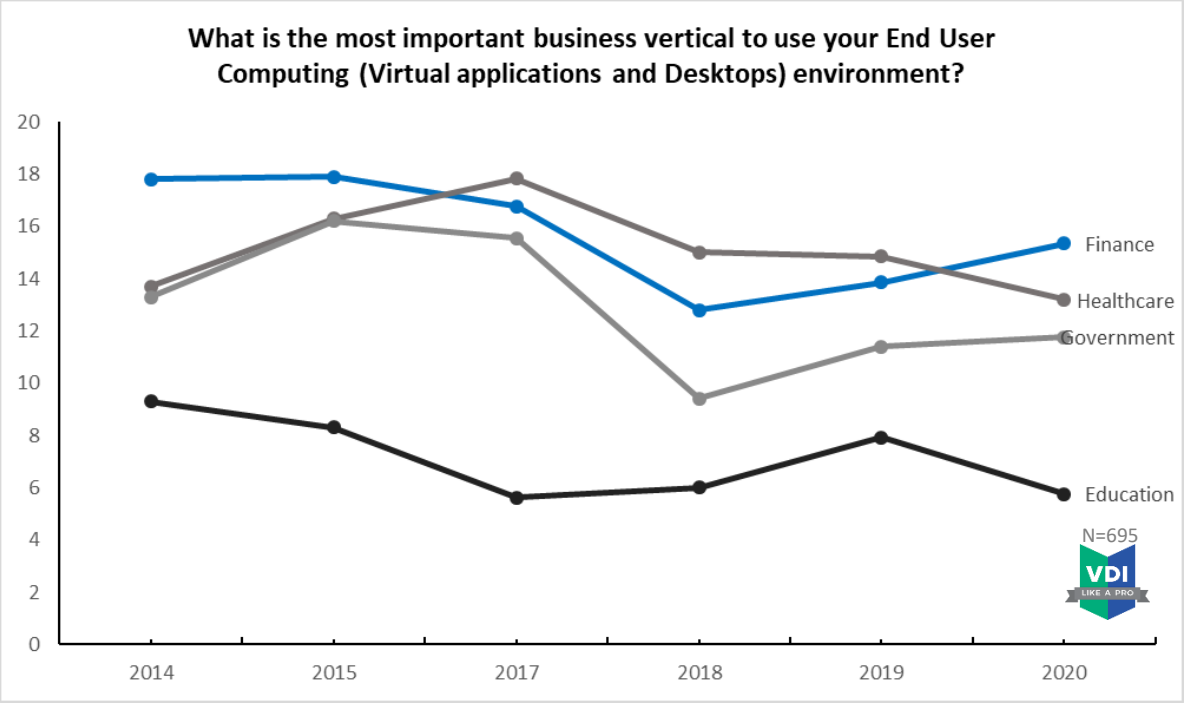
Who contributed to the state of the union?



What is the most important business vertical to use your Virtual applications and desktops environment?

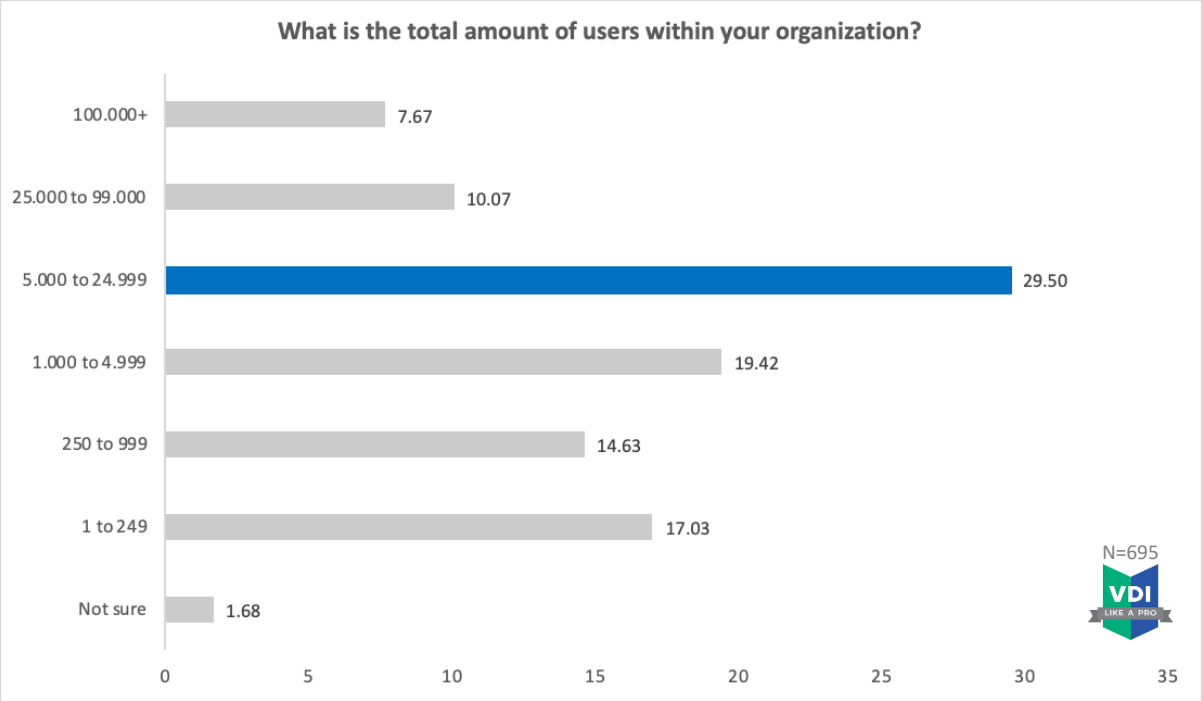
With 15.35% Finance became the largest business vertical market for virtual desktops and application solutions. Healthcare with 13.19% is 2nd and Government with 11.75% is 3rd largest vertical. Usage of virtual desktops and applications in Finance, Government is increased in 2020 while Healthcare and education were declining a bit. Curious to see what 2021 will bring with more organizations supporting work from home due to COVID-19.

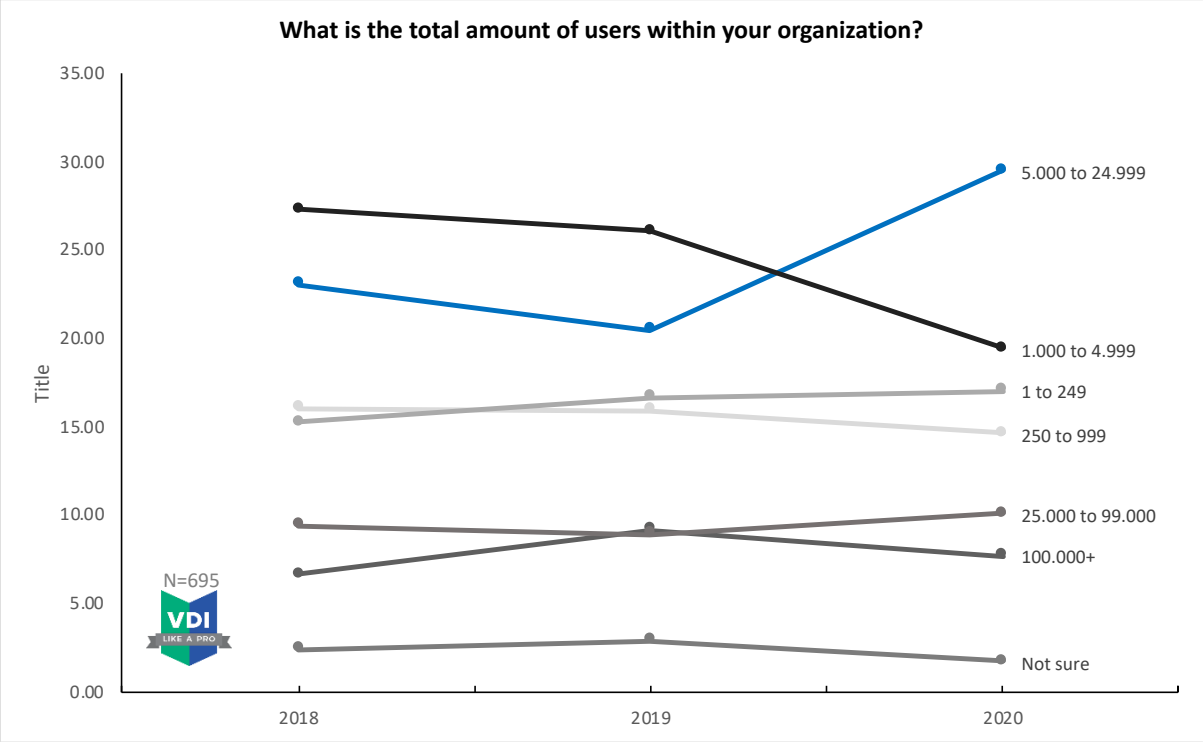




What is the total amount of users within your organization?

In 2019, the survey respondents working in an organization with 100,000+ users totaled 9.16%. This year, the percentage totals 7.67%. While the percentage has declined, this does not necessarily mean that their virtual desktop and application environments are the same size.
More information will be provided later in this document. While in 2019 organizations in size 1.000-4.999 was the majority in 2020 organizations in size 5.000 to 24.999 became the majority using virtual desktops and applications.



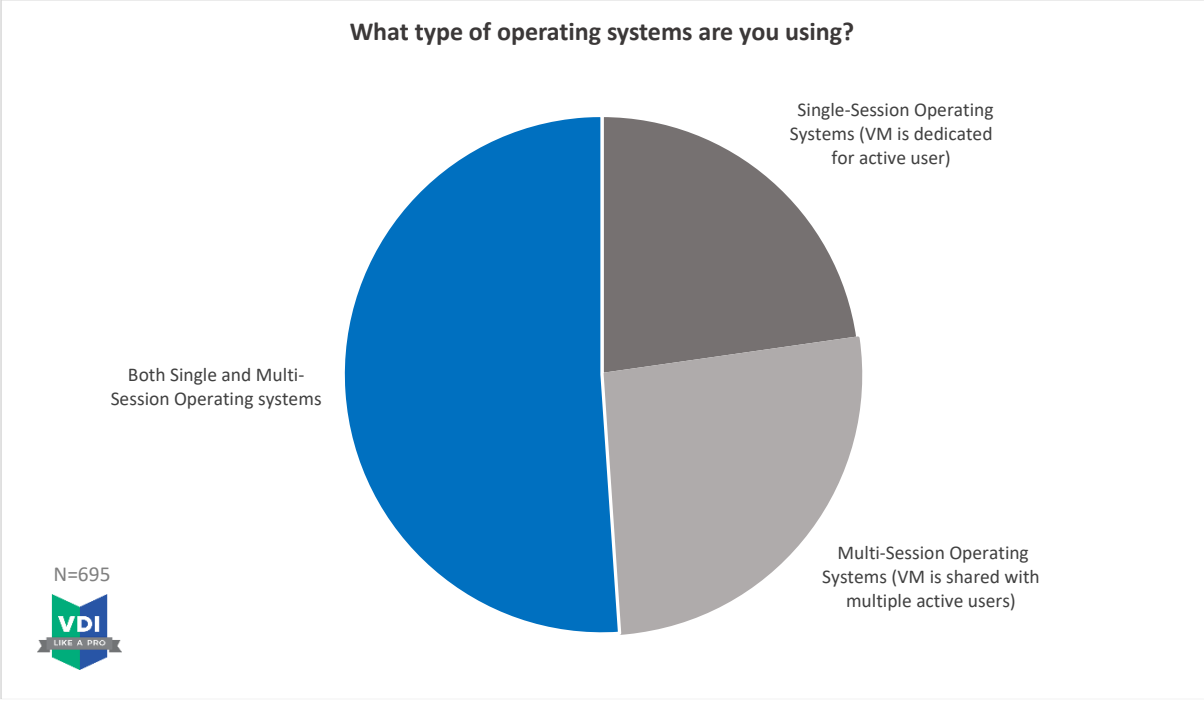


Operating Systems

What type of operating systems are you using?

In 2020 51.09% of the respondents are using both a single user and multi-user operating system to support their users with virtual applications and desktops. 26.17% is using a multi-user operating system (with multiple users actively sharing the VM) while 22.74% is using a single-user operating system.

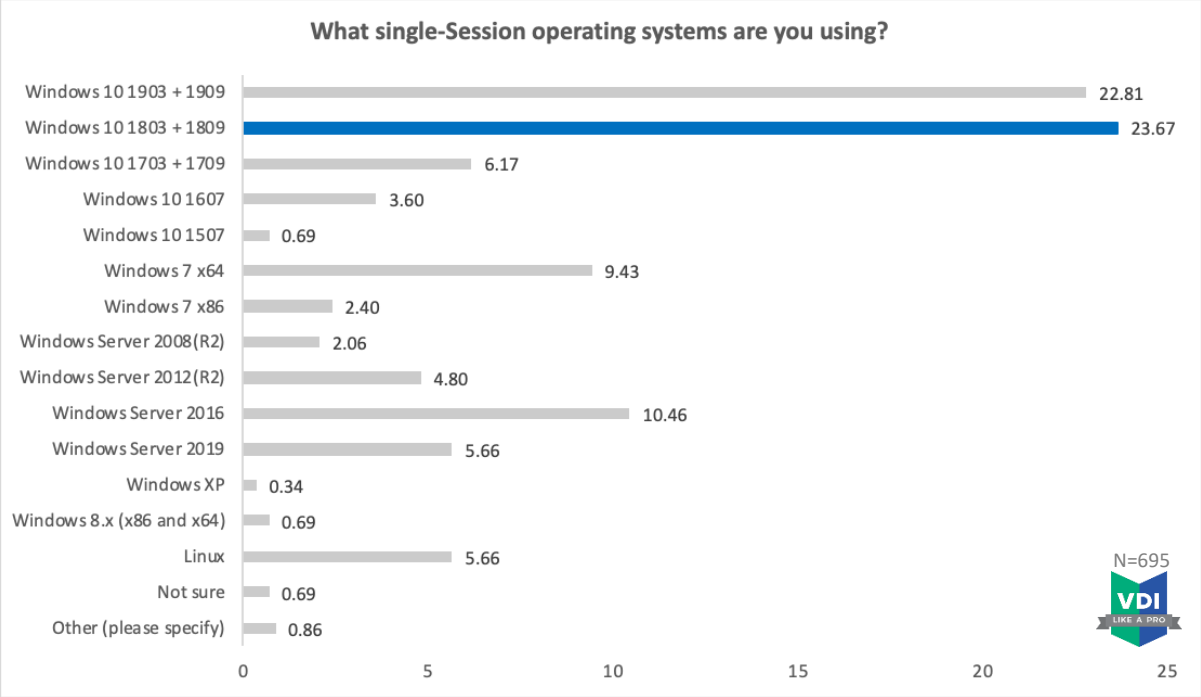
Note from the authors; The Windows Server Operating system and Windows 10 can support both single-user and multi-user scenarios. This is possible when the 'Session Host' role is enabled on Windows Server or Windows 10 Enterprise Multi-Session as part of Microsoft WVD is being used.

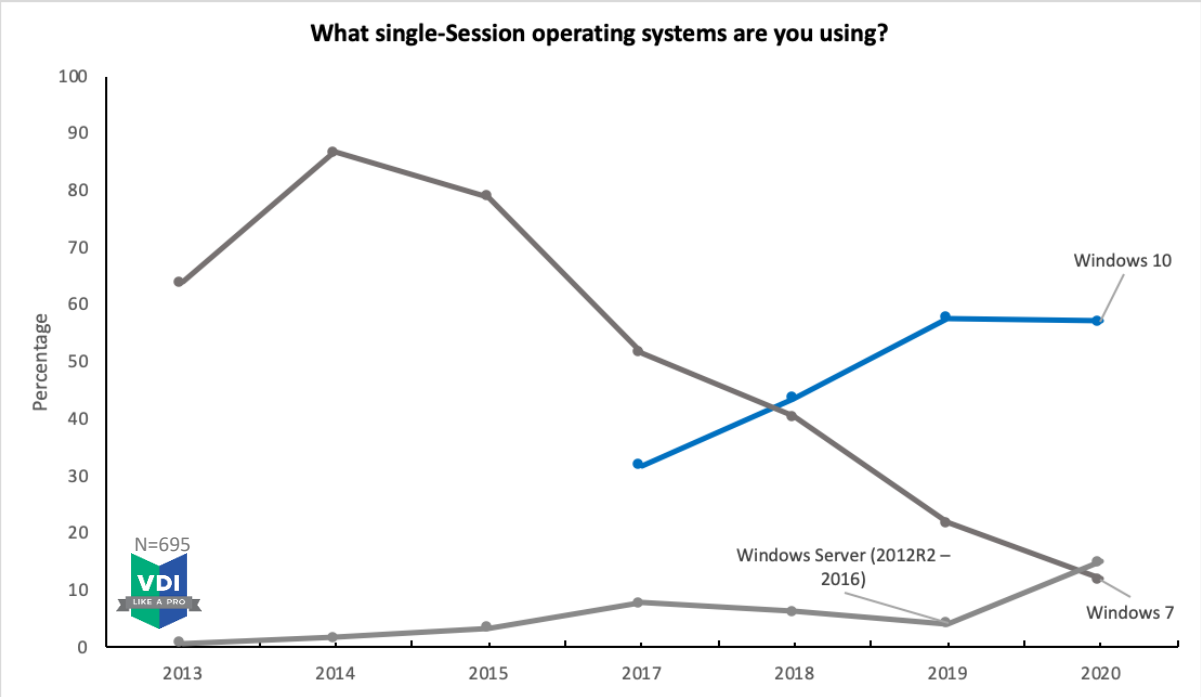


What single-Session operating systems are you using?

With 56.94% Windows 10 is used the most with versions 1803 and 1809 leading the usage. Interestingly compared to the 2019 survey results the usage of Windows 10 is roughly the same. Windows 7 usage continued the decline from past years with 11.83% still using Windows 7 as a guest operating system in 2020. Interesting to see Windows Server being used much more compared to 2019 with 25.04%.

We do expect this growth to be attached to the increase of Desktop as a Service where the use of Windows Server OS is common to due Microsoft (Windows 10) licensing constraints in public clouds. Usage of Linux as Guest OS for virtual desktops and applications is slowly increasing from 3.95% in 2019 to 5.6% in 2020.

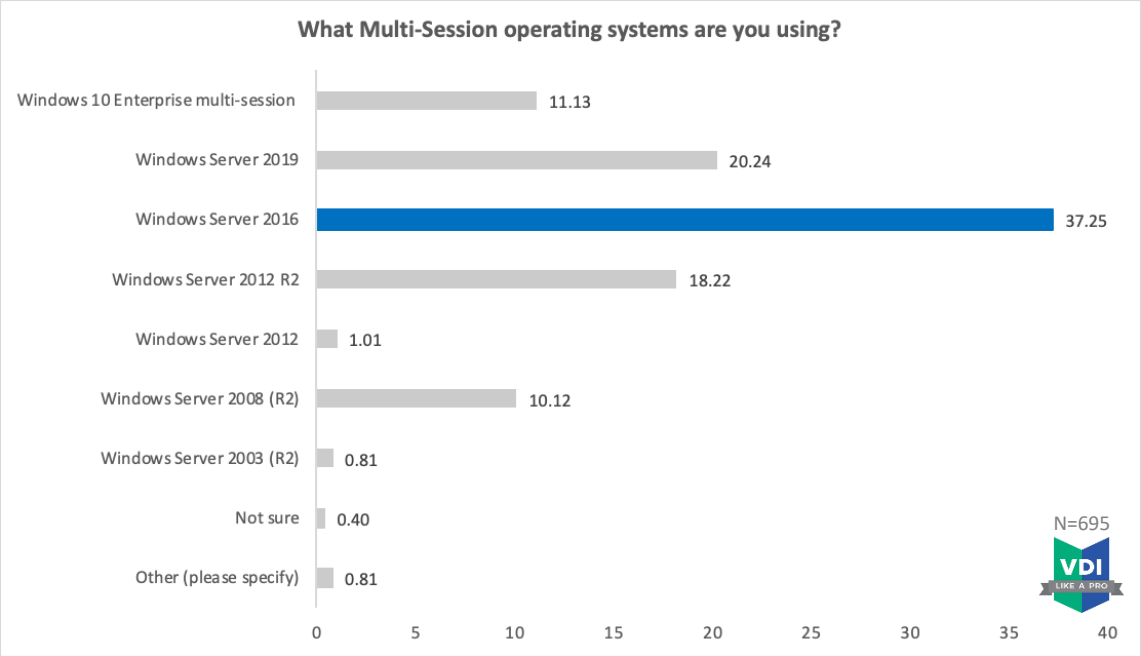




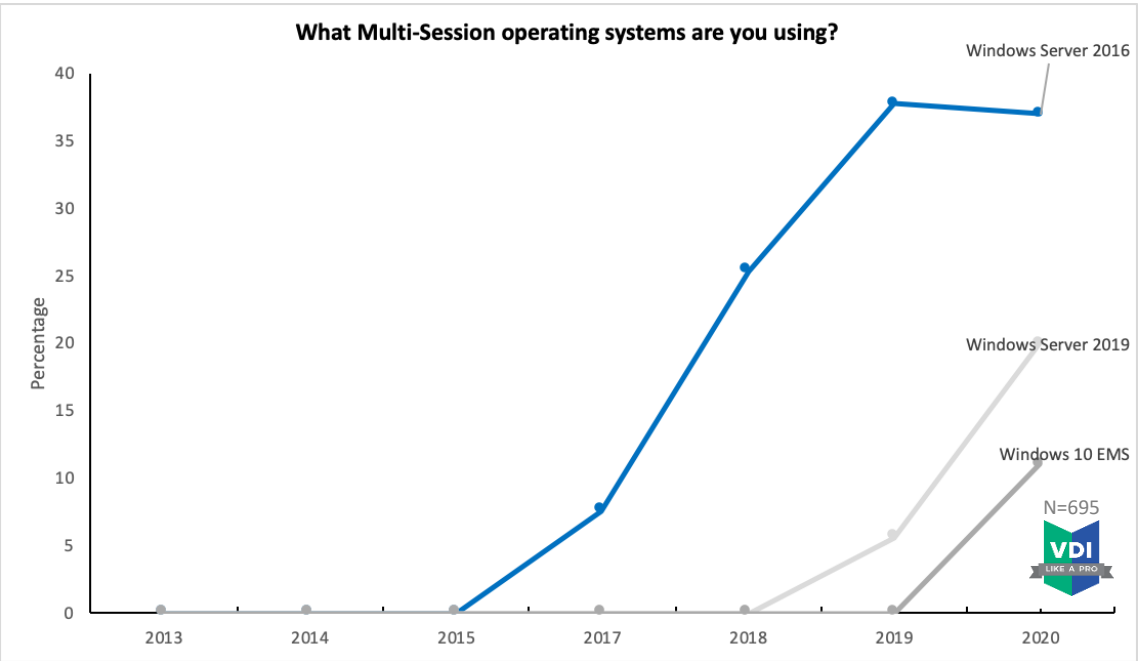
What multi-session operating systems are you using?

A multi-session operating system is often referred to as Remote Desktop Session (RDS), RD session hosting, XenApp, Terminal Services, or even Server Based Computing.

A multi-session operating system continues to be a popular choice for delivering published desktops or published applications into an organization. Windows 10 Enterprise multi-session as part of Windows Virtual Desktops (WVD) is another example of an operating system to support virtual desktops and applications.

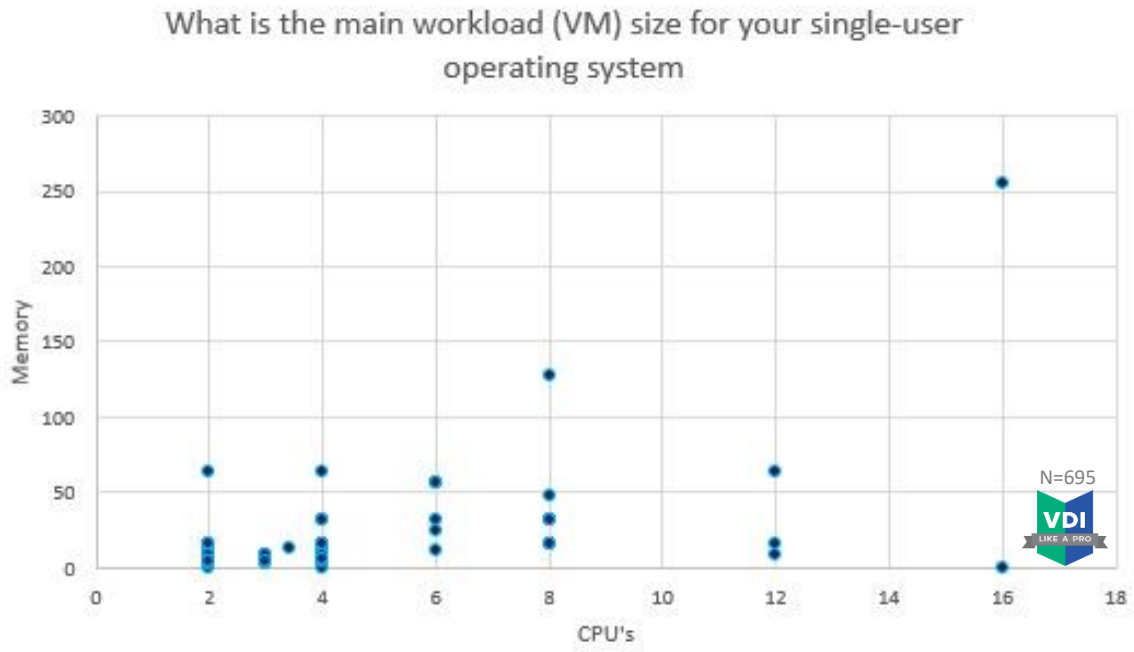


With 37.25% Windows Server 2016 is used the most followed by Server 2019 with 20.24% and Server 2012R2 still used by 18.22% of the respondents. Windows 10 EMS (Enterprise multi-session) was introduced in 2019 and is used with 11.13% of the organizations. This number is high, and we believe this is because many organizations are evaluating Desktop as a Service and the involvement of the active DaaS/WVD community.



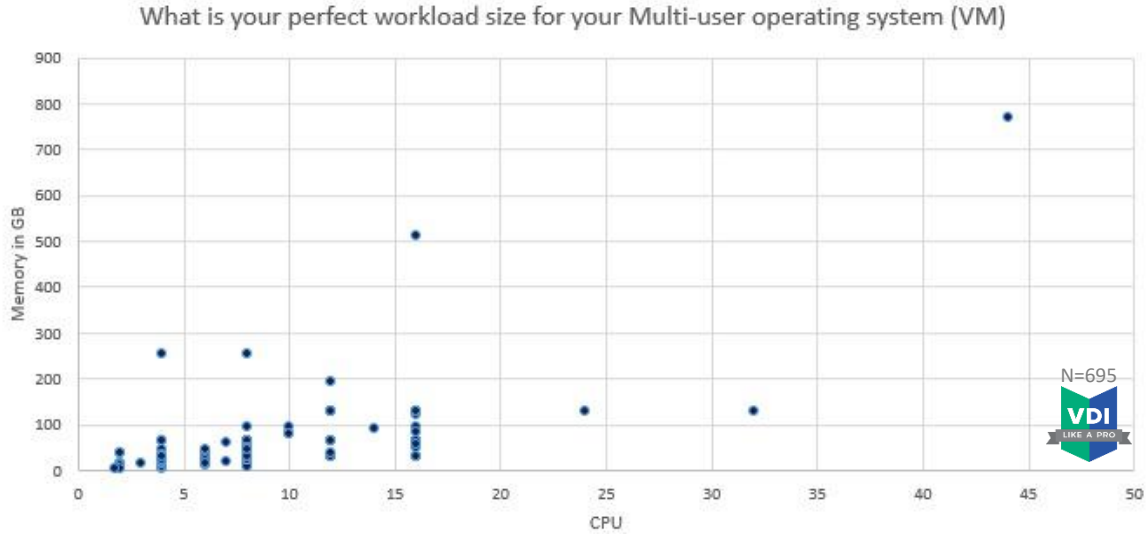
What's your perfect workload size for your single-user operating system (VM)?

We've done the math and it turns out the average single user operating system machine size for our respondents is 3,4 CPU's and 12,2GB of memory. In practice however we notice that especially the numbers for memory are a lot lower. But there are certainly use cases that can benefit from these specifications. Due to the large number of respondents on this question taking out the extremes e.g. 256GB of memory does not change the average outcome significantly.



What's your perfect workload size for your multi-user operating system (VM)?

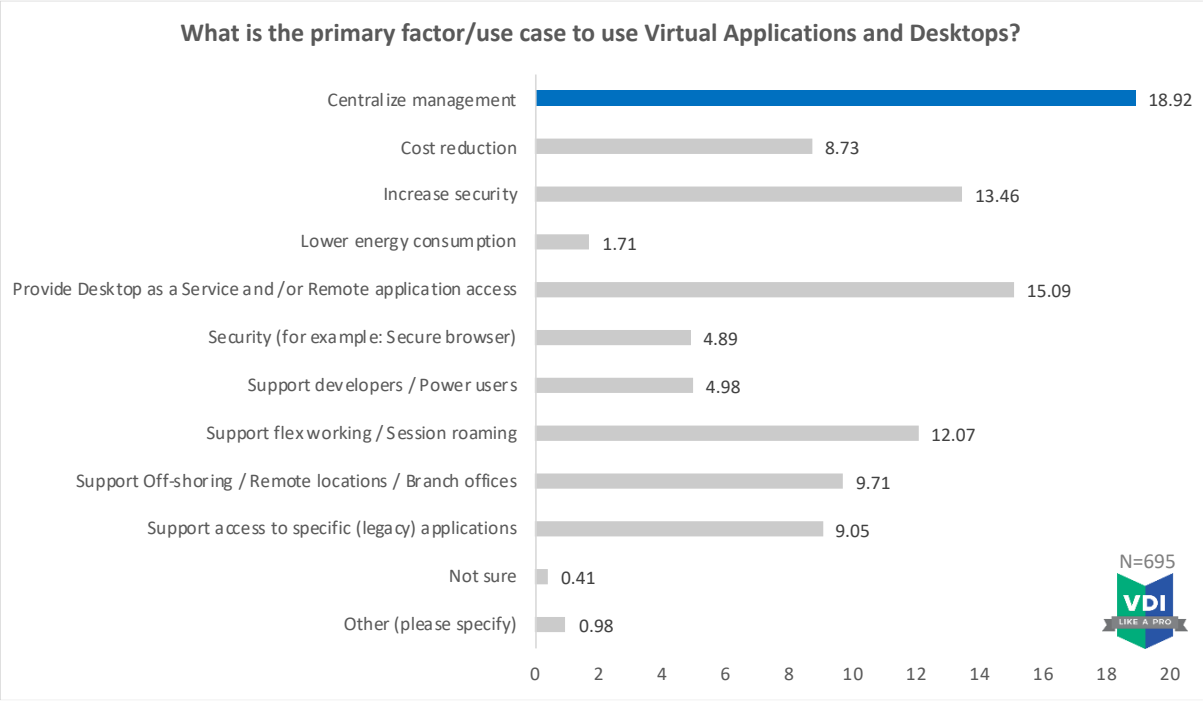
Naturally a multi-user operating system desires more resources the average outcome from all respondents is 8,8 CPU's and 63,3GB of memory. This is in line with what we see in practice.

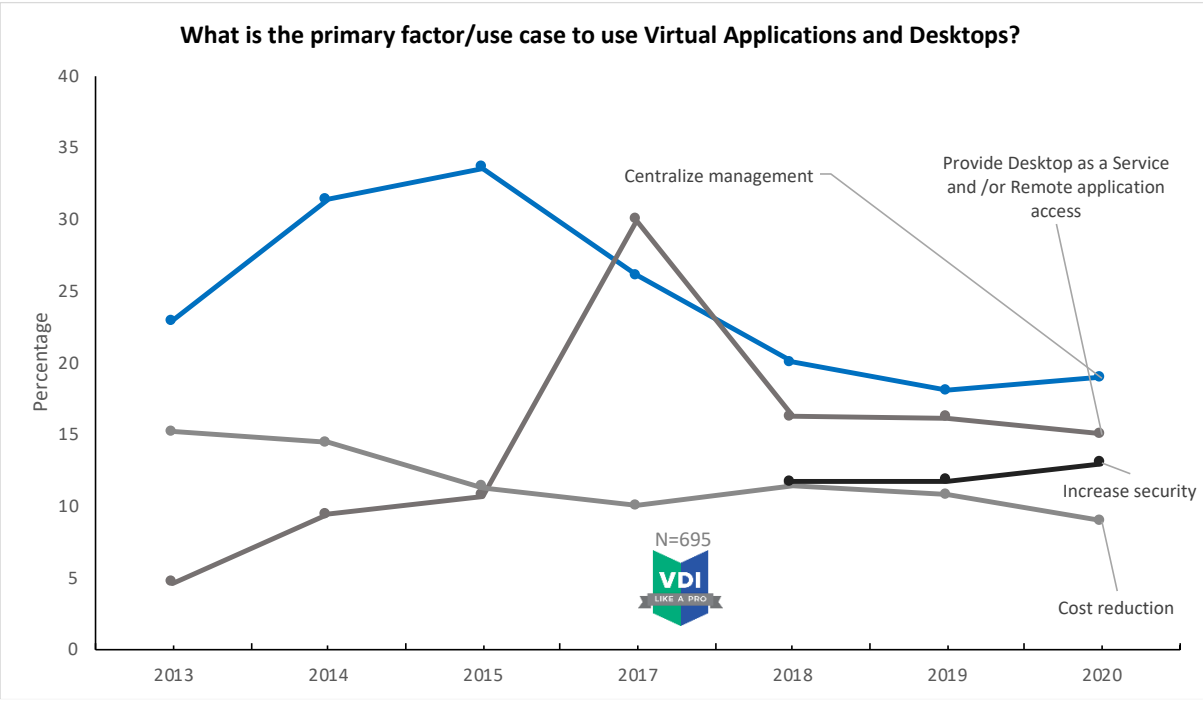


Use-cases, products usage, data locality, persistent/none-persistent and more

What is the primary factor/use case to use Virtual Applications and Desktops?

Centralized management provide access as a Service (DaaS), and security are the primary reasons for virtual applications and desktops adoption. Work from home or 'flex working' becoming an increasingly important factor as well.

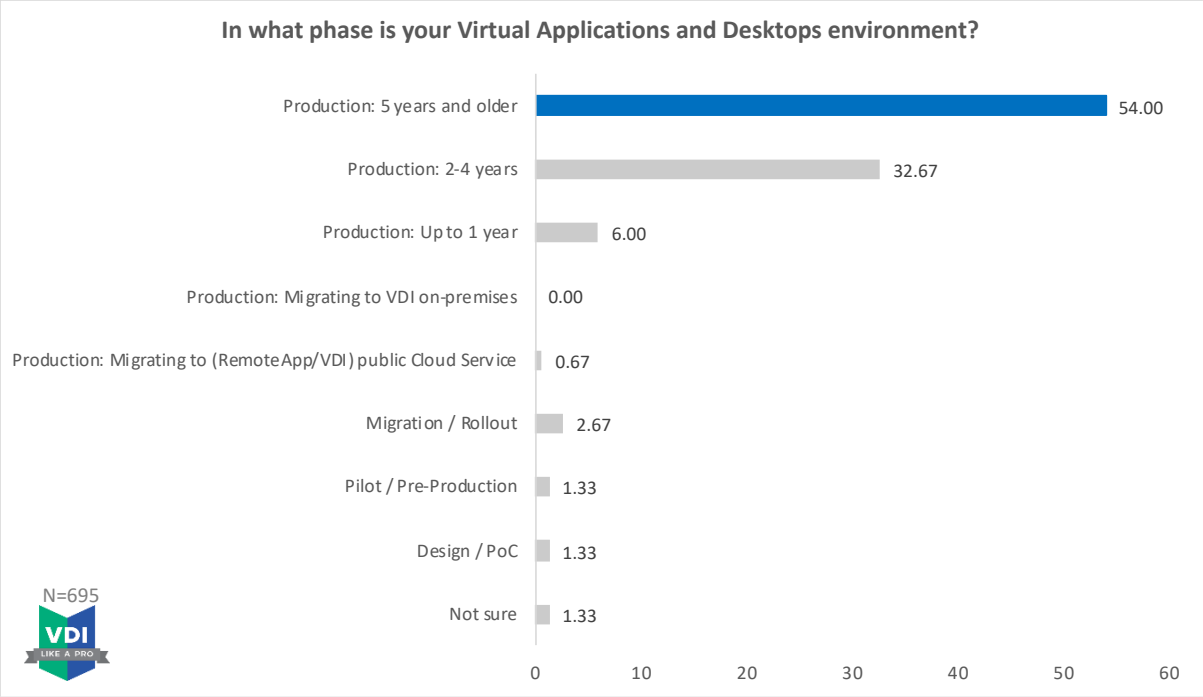




In what phase is your Virtual Applications and Desktops environment?

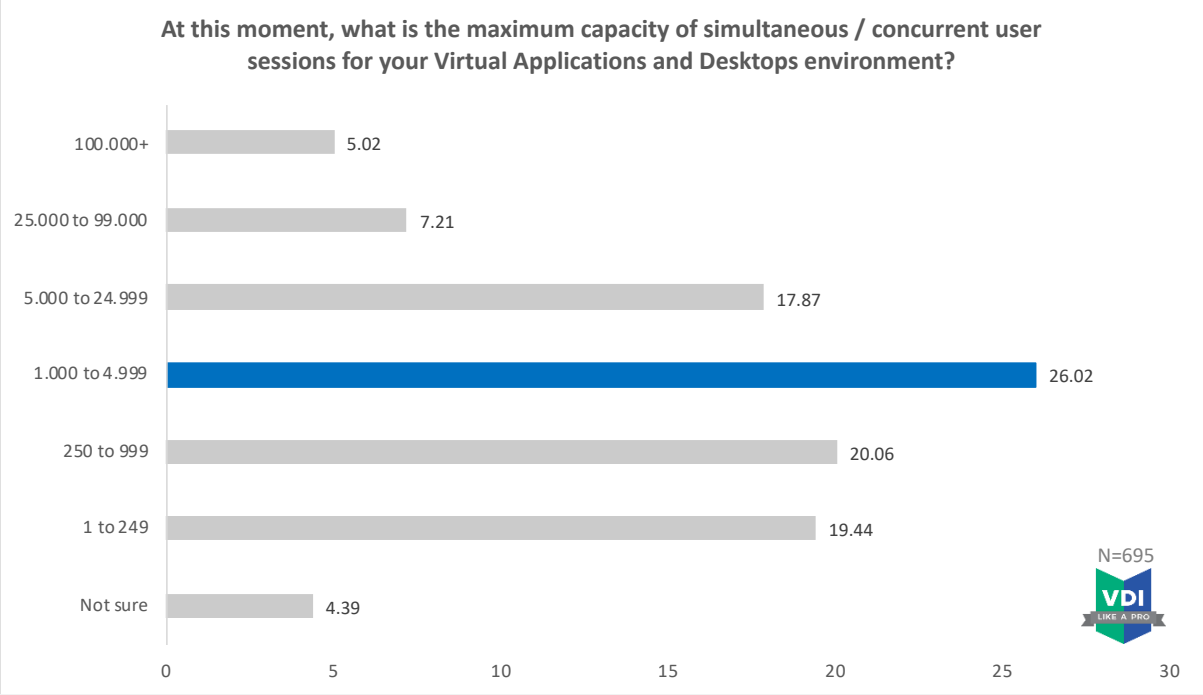
The following chart shows how rapidly the virtual applications and desktop environments are changing.

Note: In previous years we differentiated the question between 'VDI' and 'SBC'. Starting 2020 we merged 'VDI' and 'SBC' into Virtual Applications and Desktops.



What is the maximum capacity of simultaneous / concurrent user sessions for your Virtual Applications and Desktops environment?

There are more large-scale deployments of 100,000+ virtual desktop and application environments in 2020 compared to 2019. 2.6% of the respondents in 2019 and 5.0% in 2020 are running such a larger scale deployment. However, in medium-sized enterprises (5,000-24,999 users) we do see an incline of usage of 15.7% in 2019 to 17.87% in 2020. Also, the usage within enterprises of 1,000-4,999 simultaneous sessions there is an increase from 22.6% in 2019 to 26.0% in 2020.

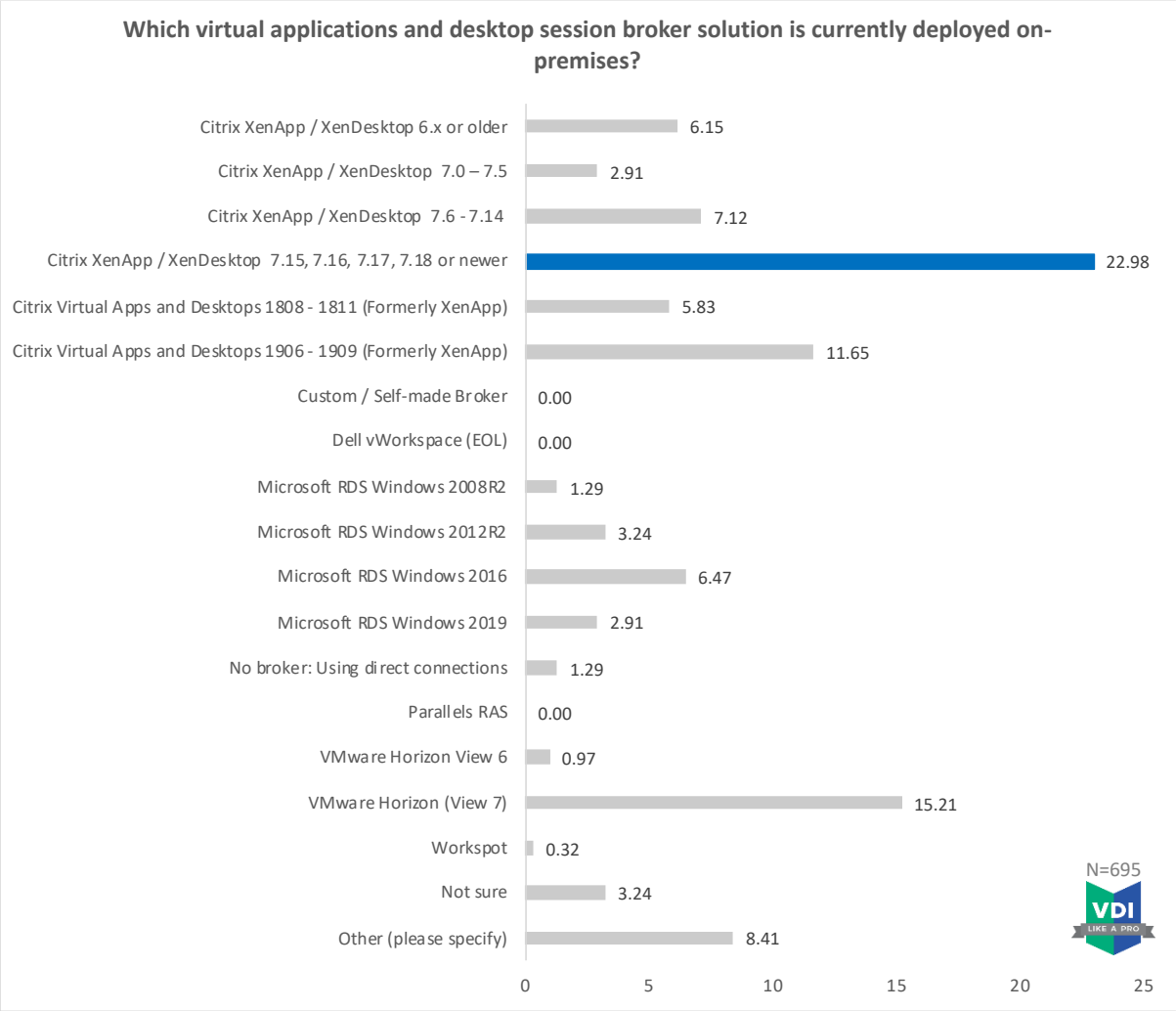


Note: In previous years we differentiated the question between 'VDI' and 'SBC'. Starting 2020 we merged 'VDI' and 'SBC' into Virtual Applications and Desktops.

Which virtual applications and desktop session broker solution is currently deployed on-premises?

With virtual desktops and applications running on-premises it's clear that Citrix is in the lead with 57% usage overall. VMware with 16% and Microsoft with 14% are 2nd and 3rd.

Note: In previous years we differentiated the question between 'VDI' and 'SBC'.
Starting 2020 we merged 'VDI' and 'SBC' into Virtual Applications and Desktops.



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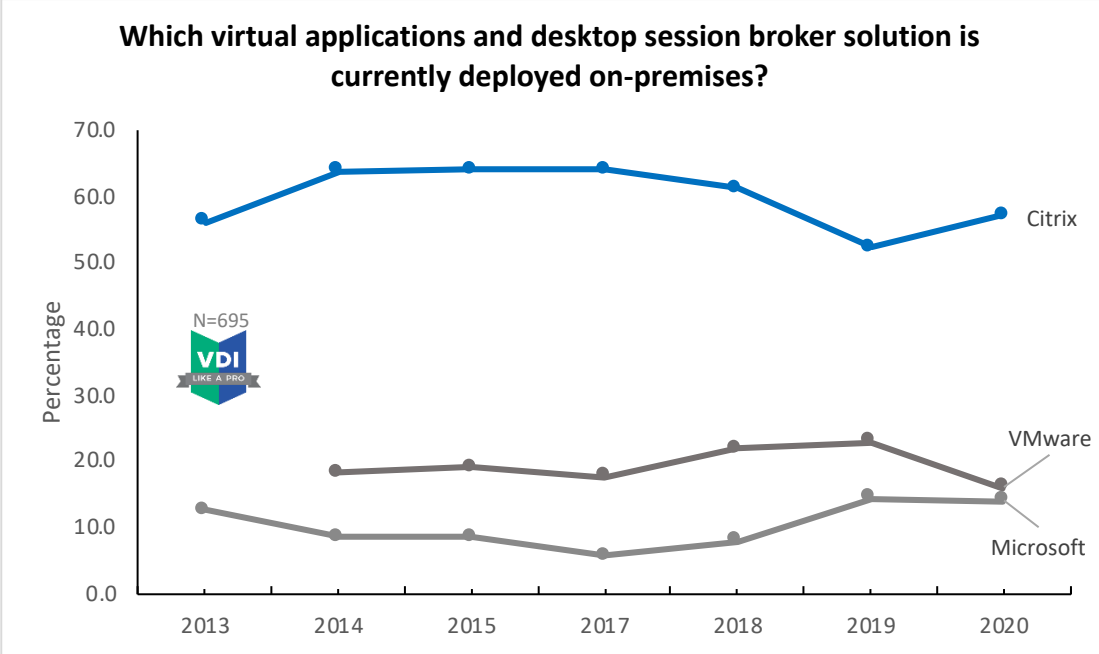
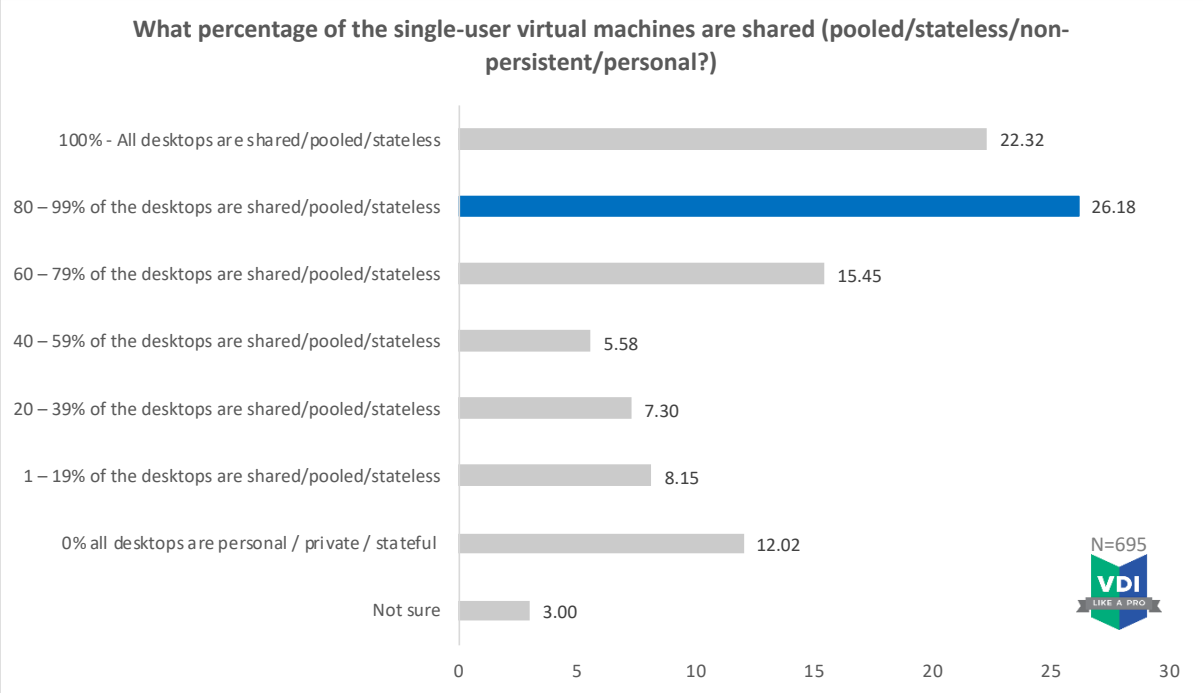
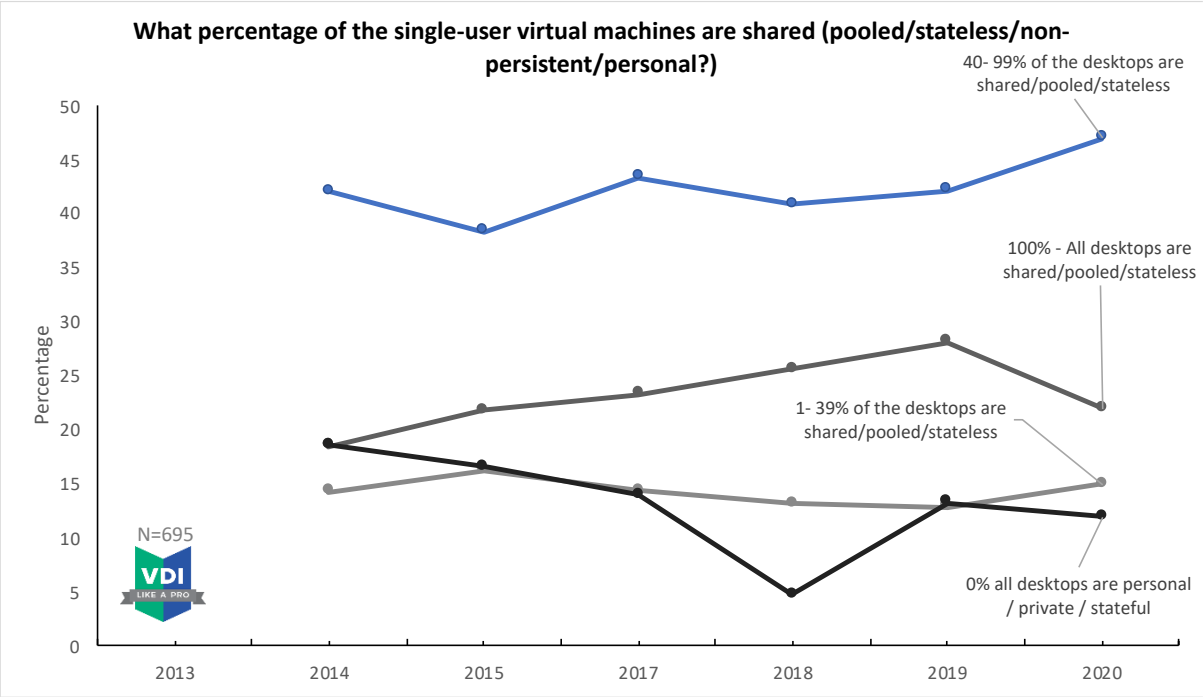

Which virtual applications and desktop session broker solution is currently deployed on-premises?
Percentage
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
N=695
Citrix
VMware
Microsoft
2013
2014
2015
2017
2018
2019
2020

What percentage of the single-user virtual machines are shared (pooled/stateless/non-persistent/personal?)

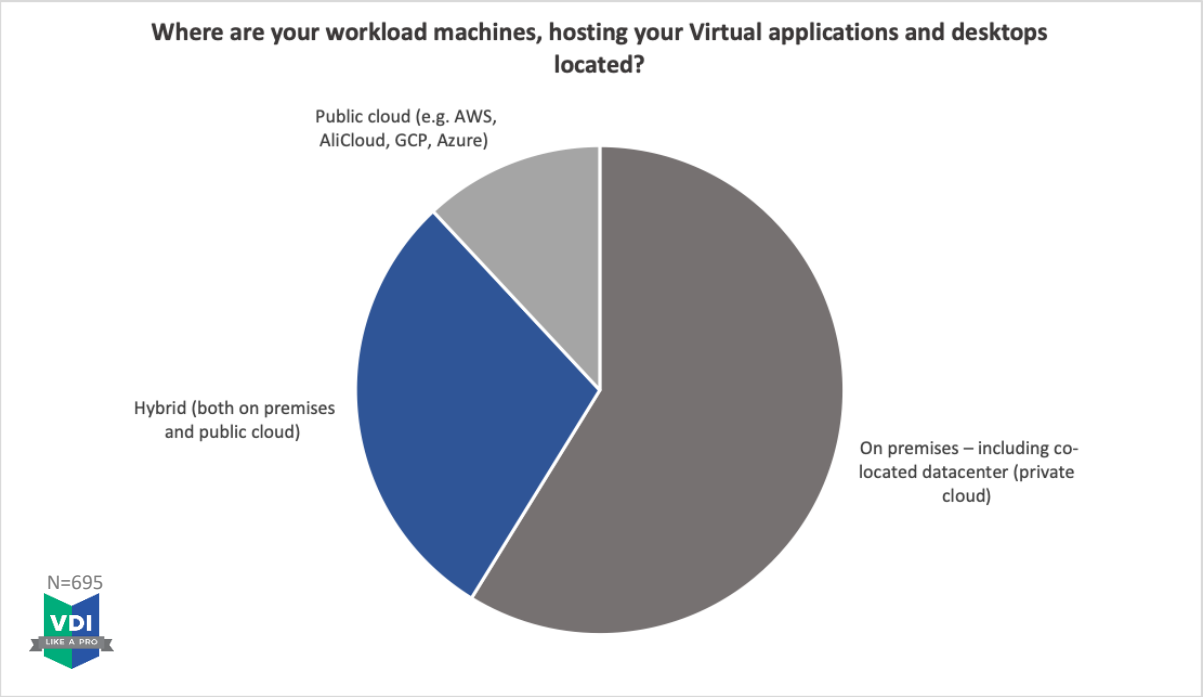
48.50% of the respondents are using virtual desktops and applications in a 80-100% stateless or 'pooled' fashion. While 12.02% of the respondents are using full personal or private instances of virtual applications and desktops.





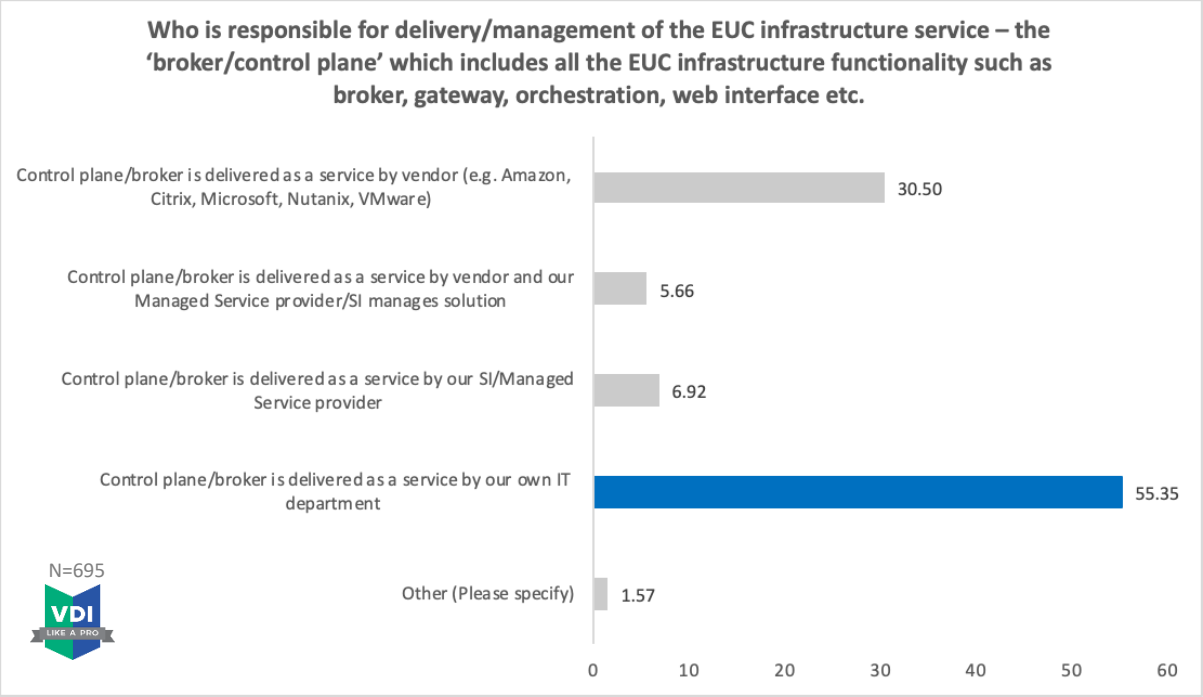
Where are your workload machines, hosting your Virtual applications and desktops located?

The majority of respondents in the 2020 survey are running their workload VMs to virtual desktops and applications in a private cloud environment using on-premises or co-located datacenters. 29.25% is using both private and public clouds to while 11.95% is using public cloud to run the workload Virtual Machines.



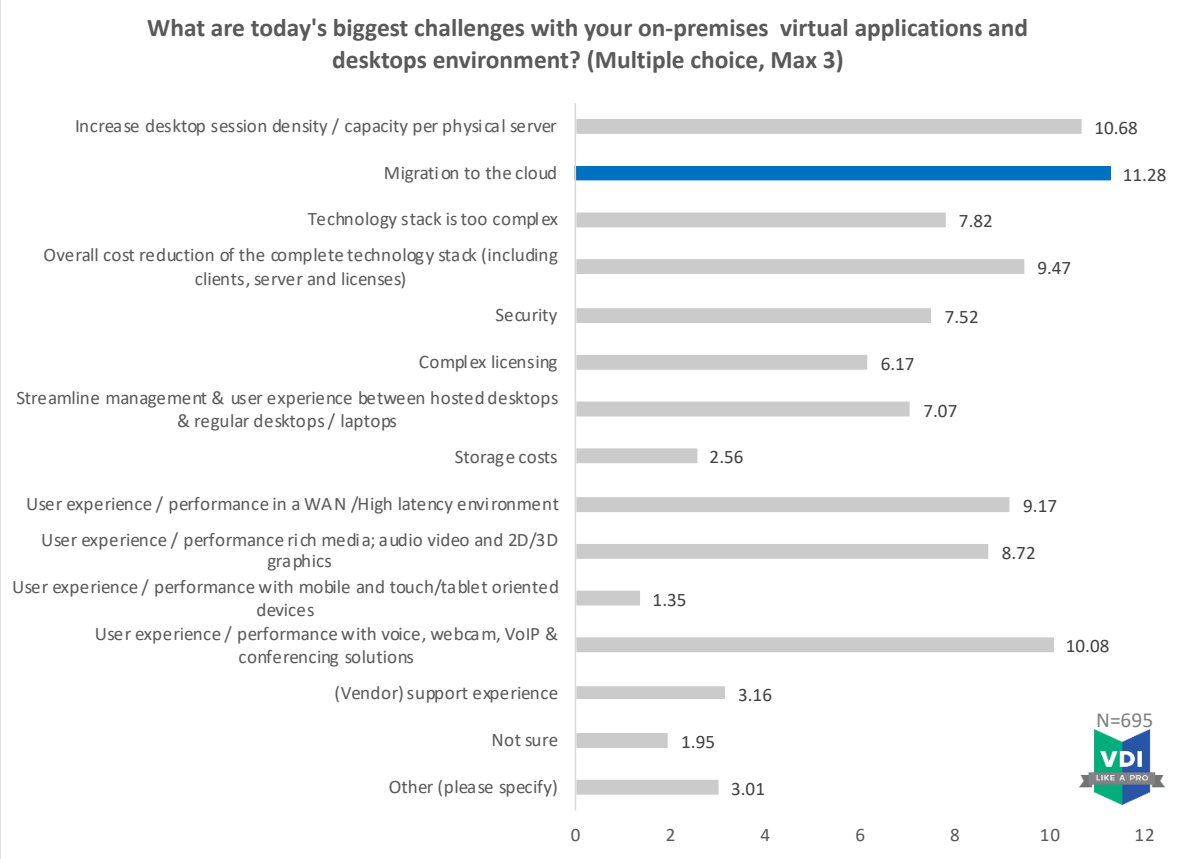
Who is responsible for delivery/management of the EUC infrastructure service?

The 'broker/control plane' includes all the EUC infrastructure functionality such as broker, gateway, orchestration, web interface etc. Most respondents of the 2020 survey, 55.35%, are running and supporting the EUC infrastructure 'broker' as part of their own IT service while 30.5% is consuming the control plane or broker as a service from e.g. Microsoft, Amazon, Citrix, Nutanix, VMware and others.



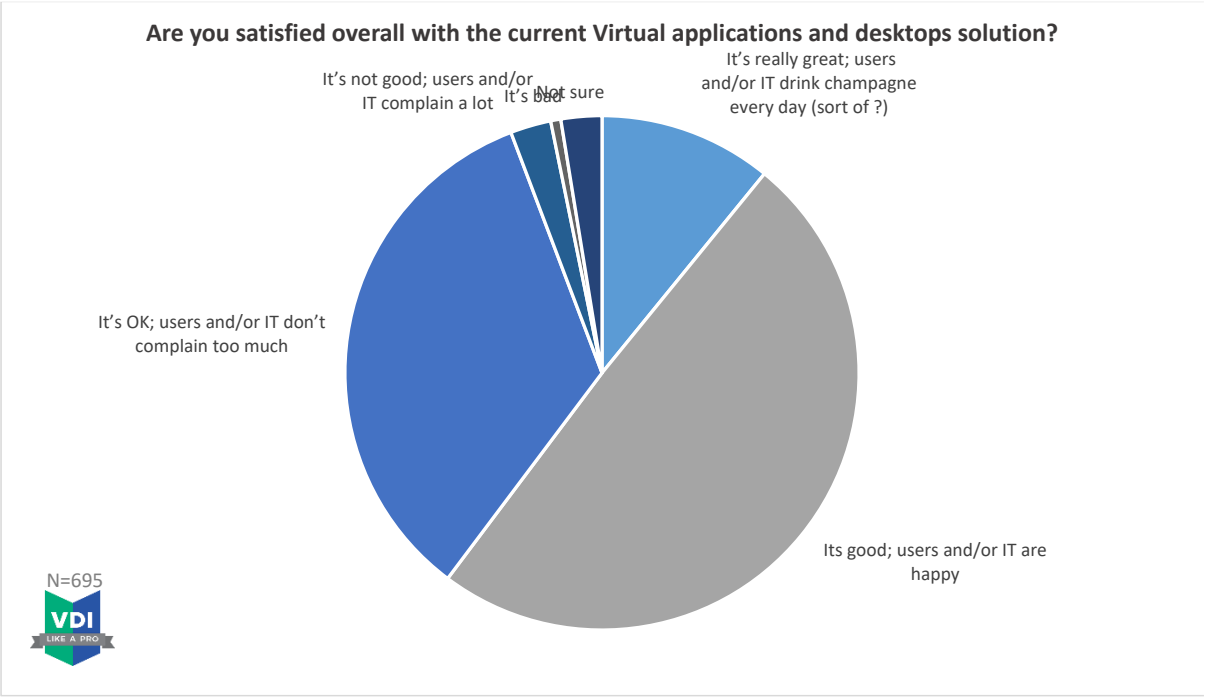
What are today's biggest challenges with your on-premises virtual applications and desktops environment?

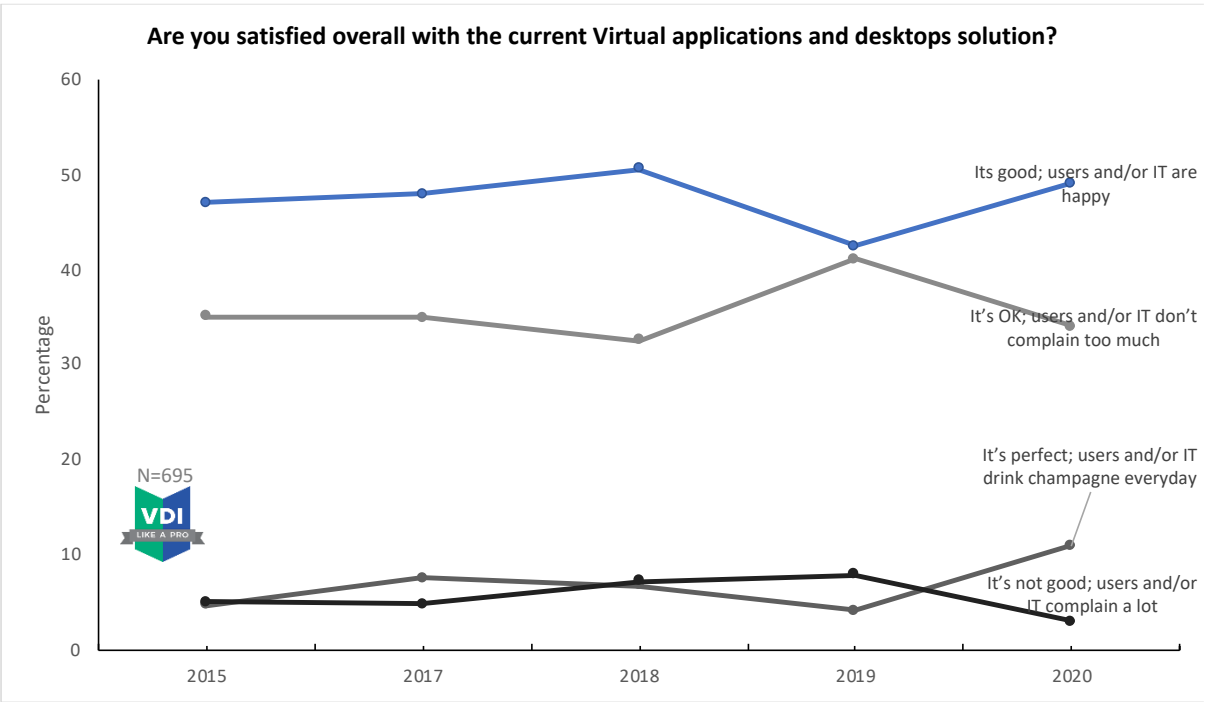
The biggest challenges with the on-premises virtual desktop and application environment are migration to the cloud with 11.28%, increase capacity per physical server (Intel security fixes and Windows 10 performance impact is likely reason here) with 10.68%. Also, user experience with unified communications with 10.08% and overall cost reduction of the complete technology stack is a challenge with 9.47% of the respondents.



Are you satisfied overall with the current Virtual applications and desktops solution?

A perfect virtual desktop and application solution is more common in 2020 with 10.90% an increase of 6.68% compared to 2019. An environment which is performing well and delivering a good experience is the reality 49.36% of the respondents an increase of 6.89% compared to 2019.
It's great to see an overview increase in well designed, well performing environments with happy end-users.





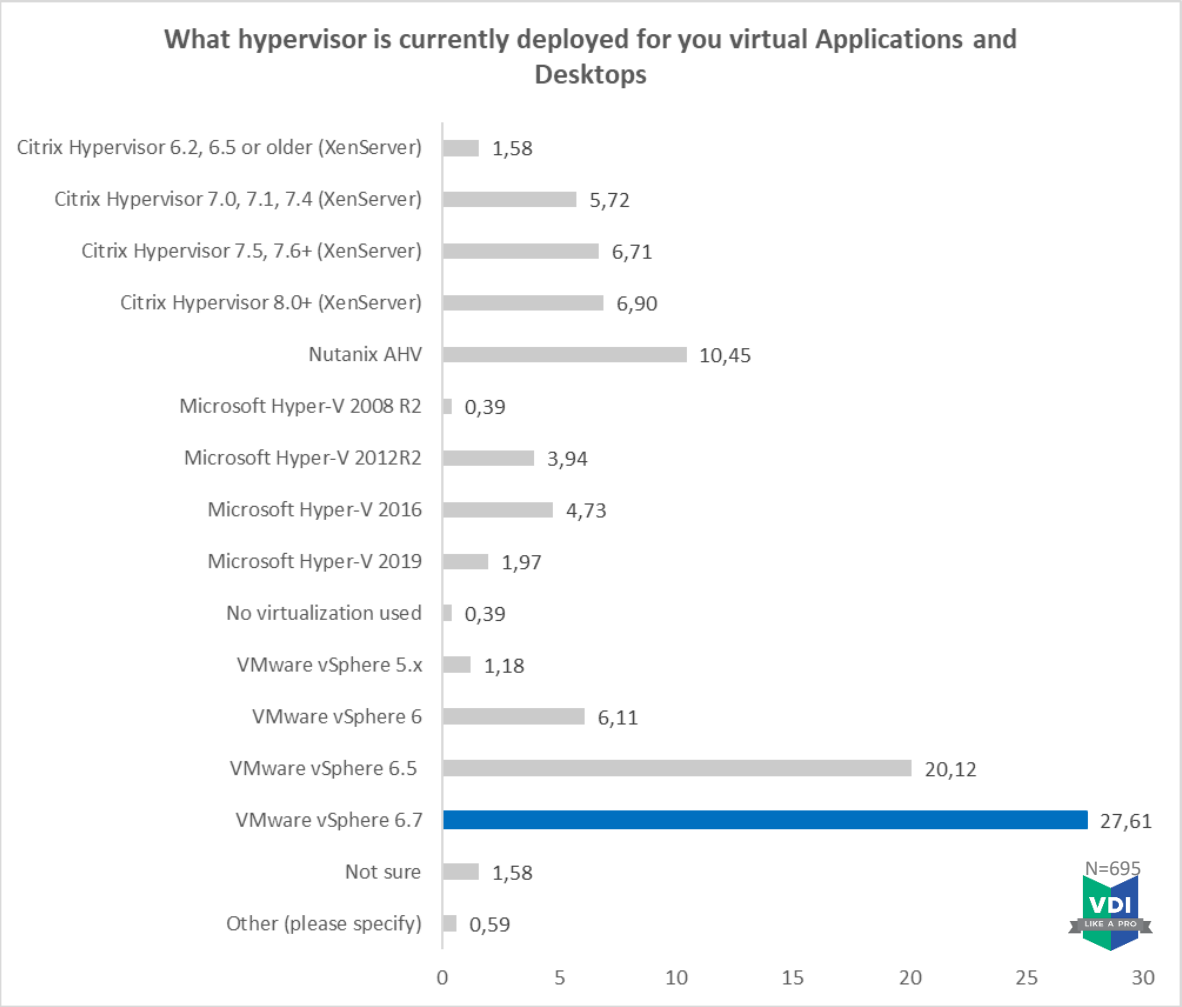
Infrastructure: Hypervisor, Servers, Storage, GPUs and more

What hypervisor is currently deployed for you virtual Applications and Desktops?

VMware remains by far the largest hypervisor vendor delivering virtual infrastructure for virtual desktops and applications, although the usage is slowly decreasing from 65.8% in 2014, 64% in 2015 and 2016, 61.4% in 2018, 56% in 2019 and 55% in 2020. Microsoft Hyper-V usage is slowly decreasing from 13.18% in 2019 to 11% in 2020

While VMware and Microsoft hypervisor usage for virtual desktops and applications are decreasing, Citrix and Nutanix adoption are increasing. Adoption of Nutanix is growing from 6.13% in 2018, 7.15% and 10% in 2020. Citrix Hypervisor usage increase from 17.87% in 2019 to 21% in 2020.

It's important to mention that multiple hypervisors could be selected. Selecting your hypervisor is a long-term commitment, organizations are updating their solutions but the migration to another platform isn't happening overnight



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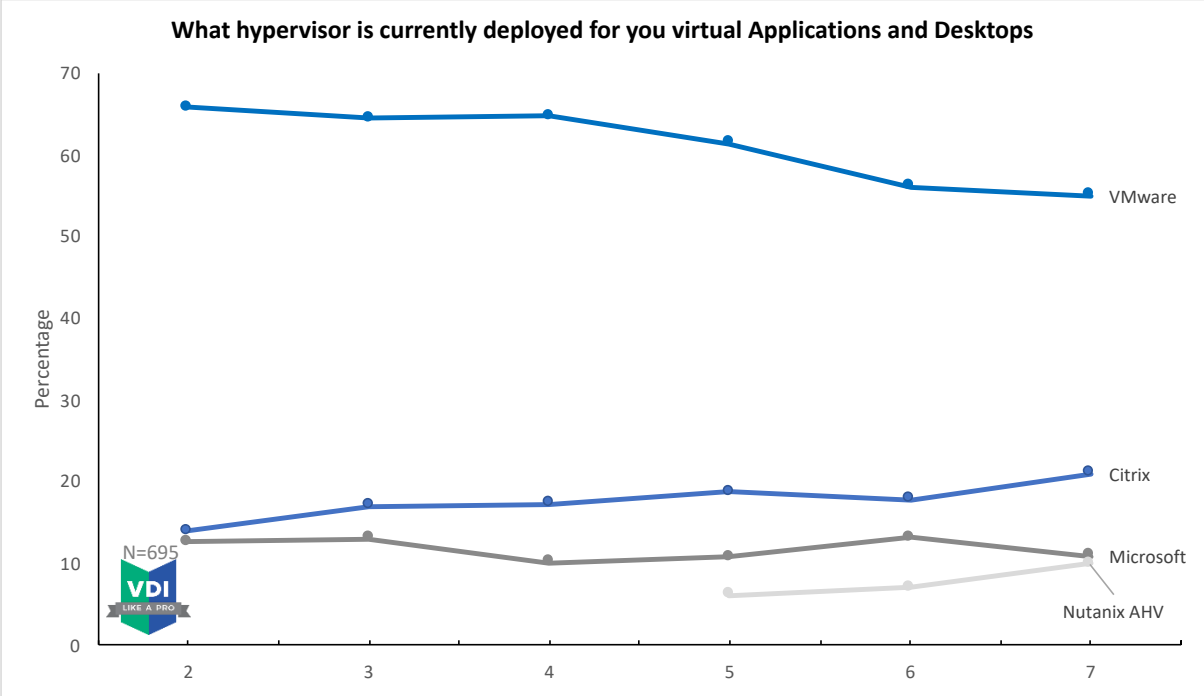
What hypervisor is currently deployed for you virtual Applications and Desktops
Percentage
70
60
50
40
30
20
10
0
2
3
4
5
6
7
VMware
Citrix
Microsoft
Nutanix AHV
N=695

Will you introduce or change to a different hypervisor for your Virtual applications and Desktops workload?

This year 59.5% of participants stated they didn't have any plans to change their hypervisor while 7.53% is still investigating hypervisor options. 11.47% of the participants are seriously considering Nutanix AHV. Nutanix and Public cloud IaaS are both areas of growth for virtual desktop and application scenarios.

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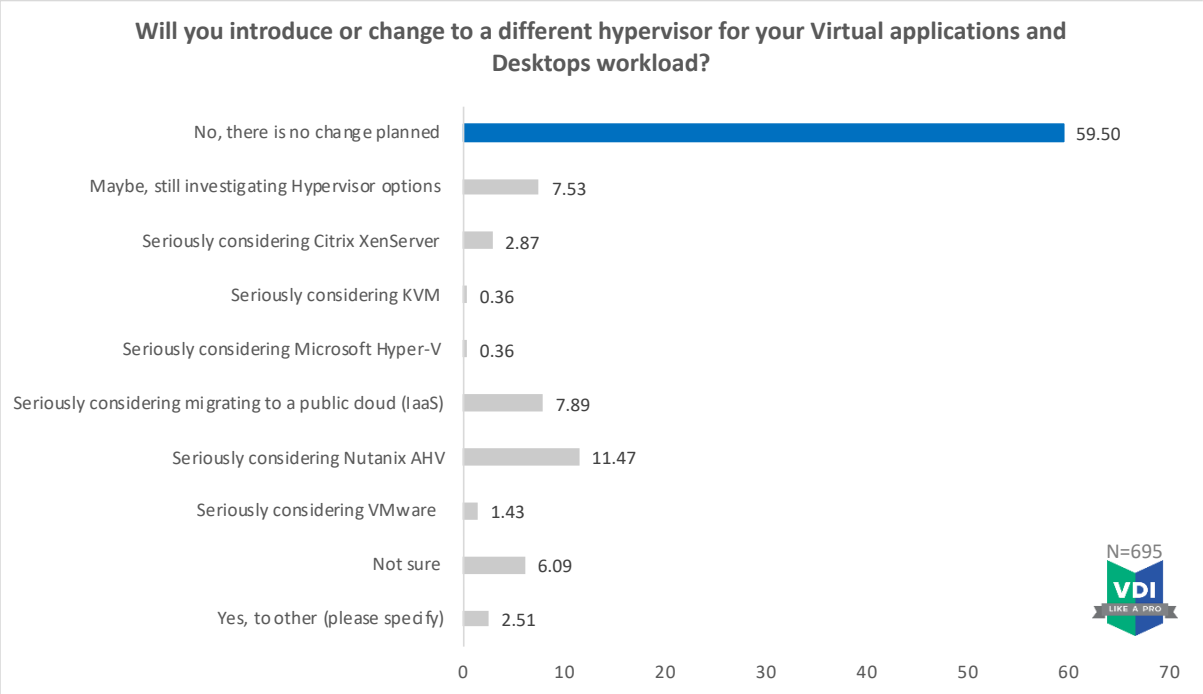


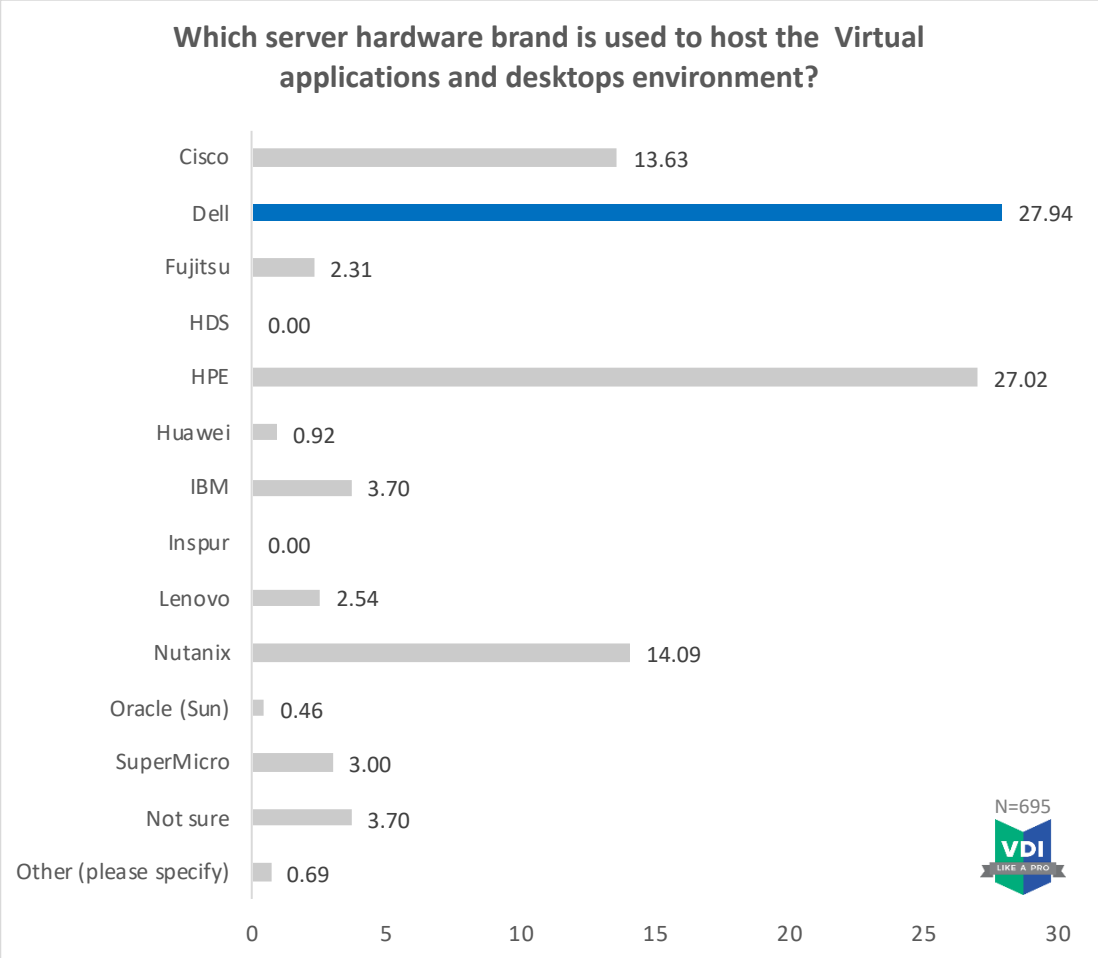
Which server hardware brand is used to host the Virtual applications and desktops environment?

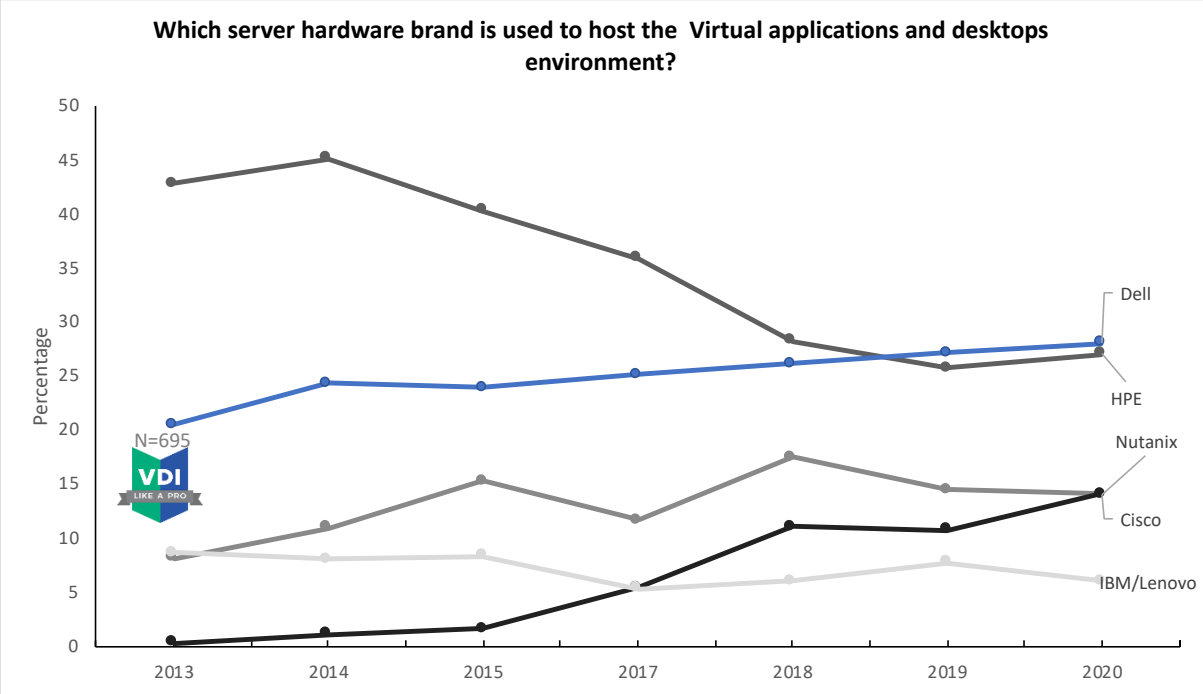
With 27.10%, DELL is the server vendor being used the most with VDI and SBC workloads, closely followed by HPE with 25.70%. We see a gradual decrease for HPE—from 45% in 2014, 40% in 2015, 35% in 2017, 28.24% in 2018 and 25.70% in 2019.

Dell is slowly increasing its market share—from 23% in 2015, 25% in 2017, 26.11% in 2018, 27.10% in 2019 and 27.94% in 2020.

After a huge jump from 10.9% in 2014 to 15% in 2015, Cisco's marketing share declined to 12% in 2017, increased to 17.4% in 2018 and declined to 14.49% in 2019 and 13.63% in 2020.
HPE adoption decreased from 40.25% in 2015, 35.8% in 2017, 28.24% in 2018, 25.70% in 2019 and increase a bit to 27% in 2020.

Finally, Nutanix jumped from just 1.1% in 2014, 1.6% in 2015, 5.42% in 2017, 11.03% in 2018, 10.75% in 2019 and 14% in 2020 becoming the 3rd largest platform to run virtual desktops and applications.

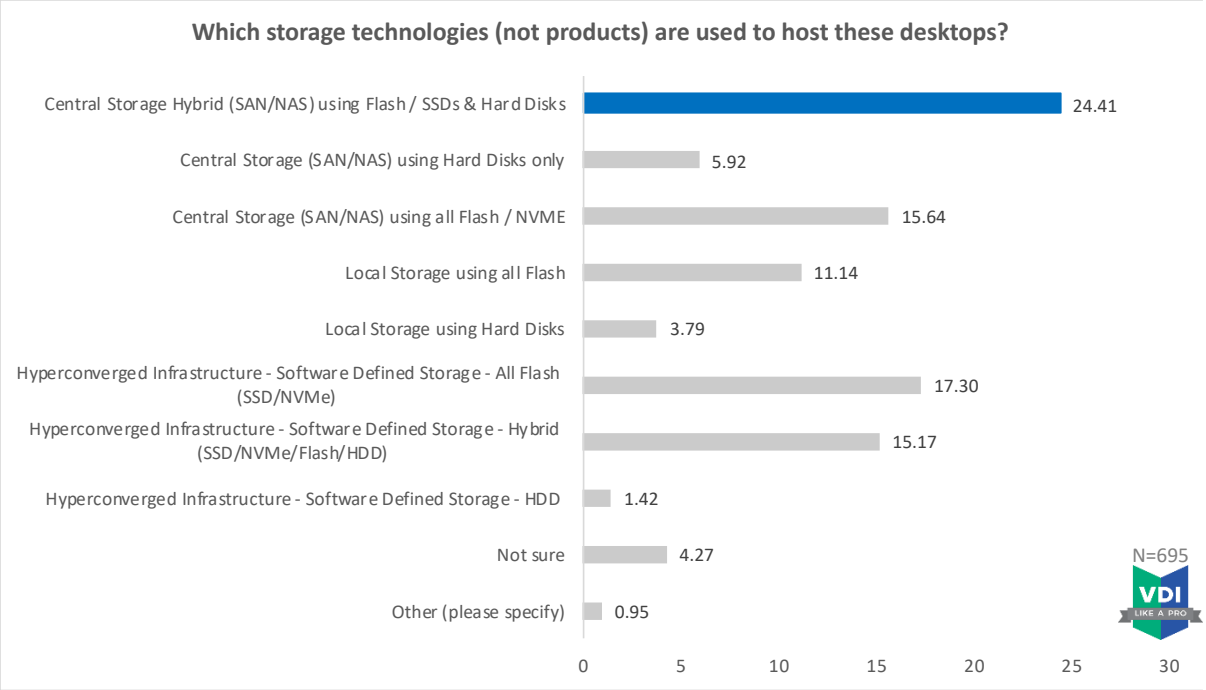


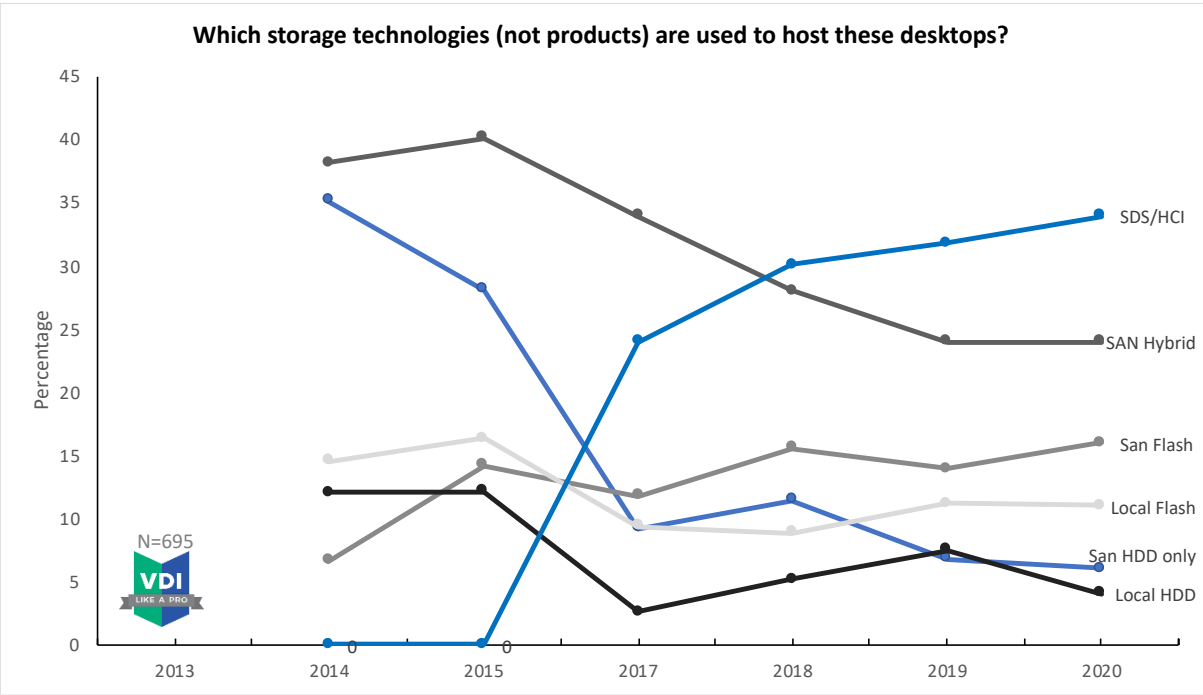

Which server hardware brand is used to host the Virtual applications and desktops environment?
Percentage
50
45
40
35
30
25
20
15
10
5
0
2013
2014
2015
2017
2018
2019
2020
Dell
HPE
Nutanix
Cisco
IBM/Lenovo
N=695

Which storage technologies (not products) are used to host these desktops?

Central Storage technologies combined are being used in 45.97% of the virtual desktop and application scenarios with SAN All Flash increasing. Hyper-converged infrastructure (HCI) and Software-defined storage (SDS) usage is being used in 33.89% of the deployments in 2020 and increased from 24.27% in 2018 and 31.87% in 2019.

It's also interesting to see more people use the local HDD and Flash in 2019 compared to 2018 and 2017. We're not sure why but it may be related to technology leveraging RAM and HDD in such scenarios or building their own scale-out storage services (HCI/SDS).



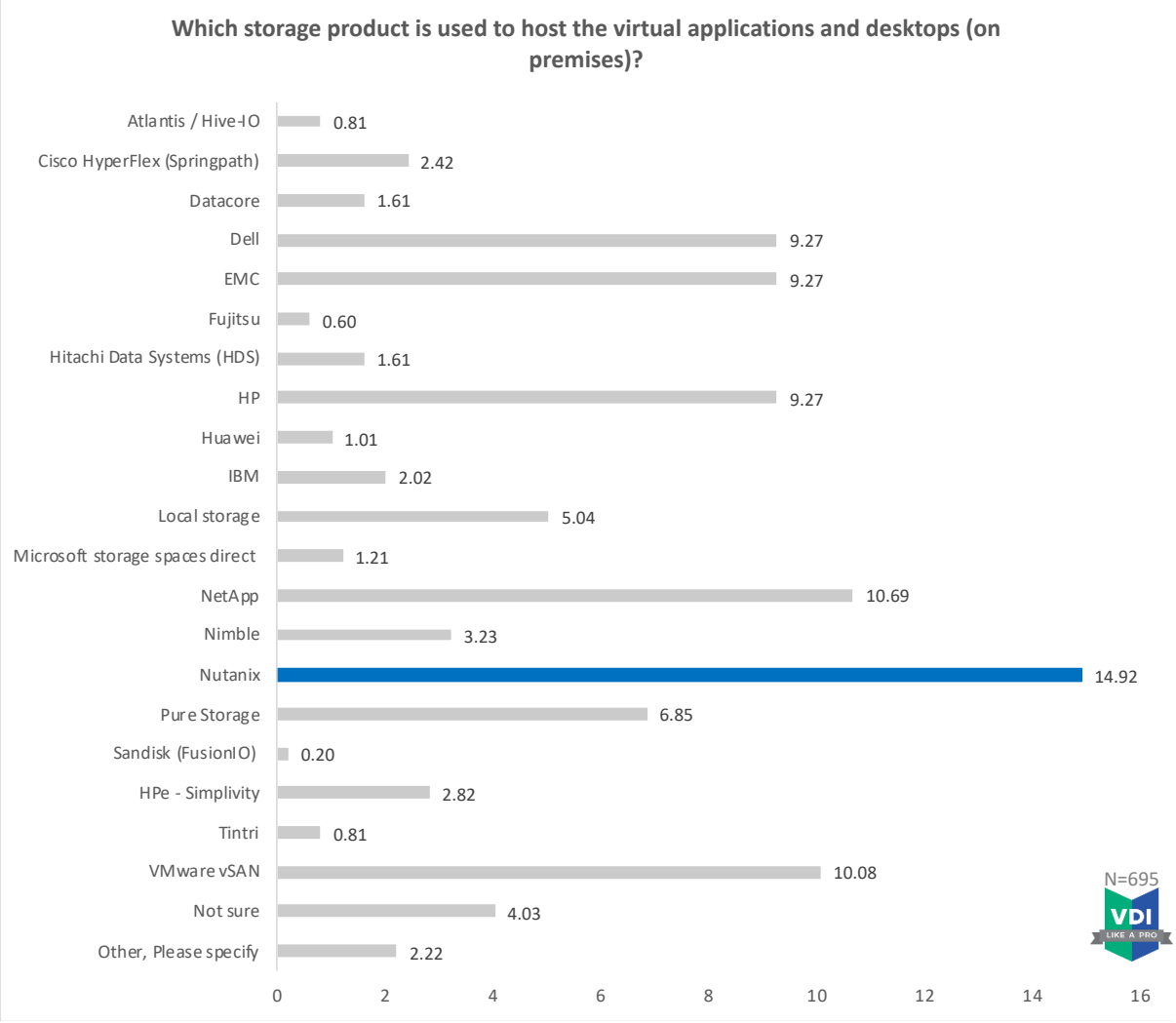


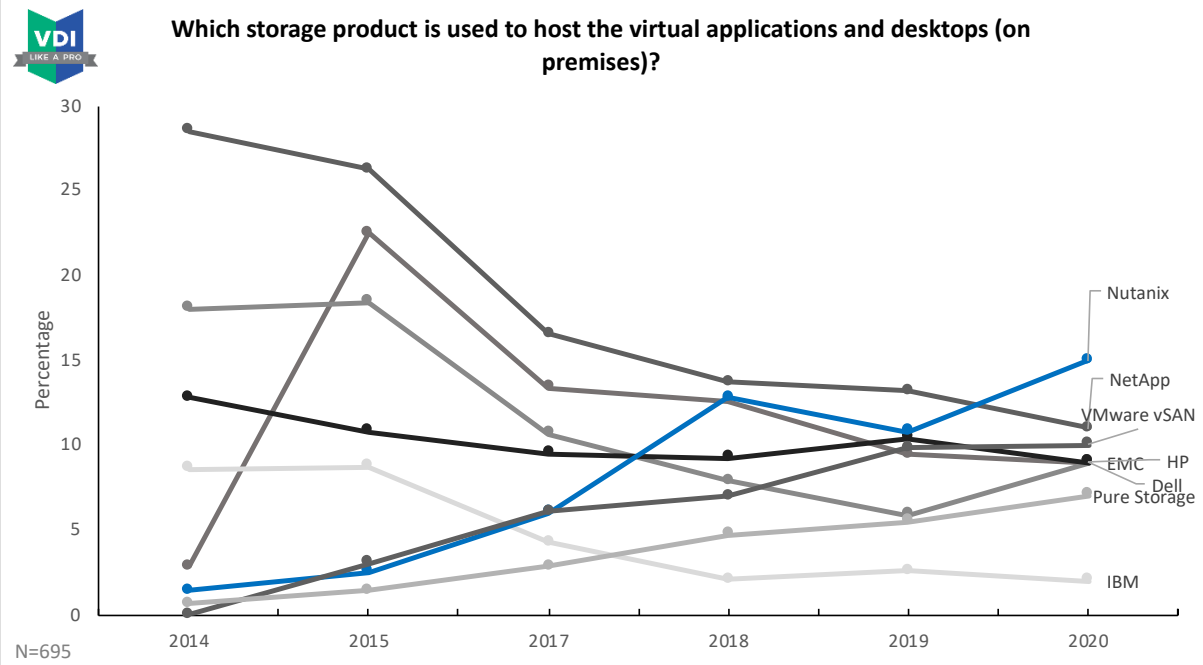
Which storage product is used to host the virtual applications and desktops (on premises)?

Traditional 3-tier storage vendors, such as NetApp, EMC, HPE, and IBM are all facing a strong decline in the usage of their solutions in virtual desktop and application scenarios.
NetApp dropped from 28.5% in 2014, 17% in 2017, 13.71% in 2018, 13.16% in 2019 to 10.69% in 2020. EMC declined from 22.8% in 2014, 13.3% in 2017, 12.58% in 2018, 9.43% in 2019 and 9.27% in 2020. HPE declined from 18% in 2014, 10.6% in 2017, 7.87% in 2018 and 5.89% in 2019 and increased to 9.27% in 2020

Pure storage adoption is increasing from 2.81% in 2017, 4.72% in 2018, 5.50% in 2019 and 6.85% in 2020. VMware VSAN increased from 6.97% in 2018, 9.82% in 2019 and 10.08% in 2020.
Nutanix usage increased from 10.81% in 2019 to 14.92% in 2020.
HCI solutions from Cisco and HPE/Simplivity combined are used in 5.24% of the deployments.

Market share of software-defined storage (SDS) and hyper-converged infrastructure (HCI) solutions is growing rapidly, Nutanix and VMware are the leading with close to 25% adoption.

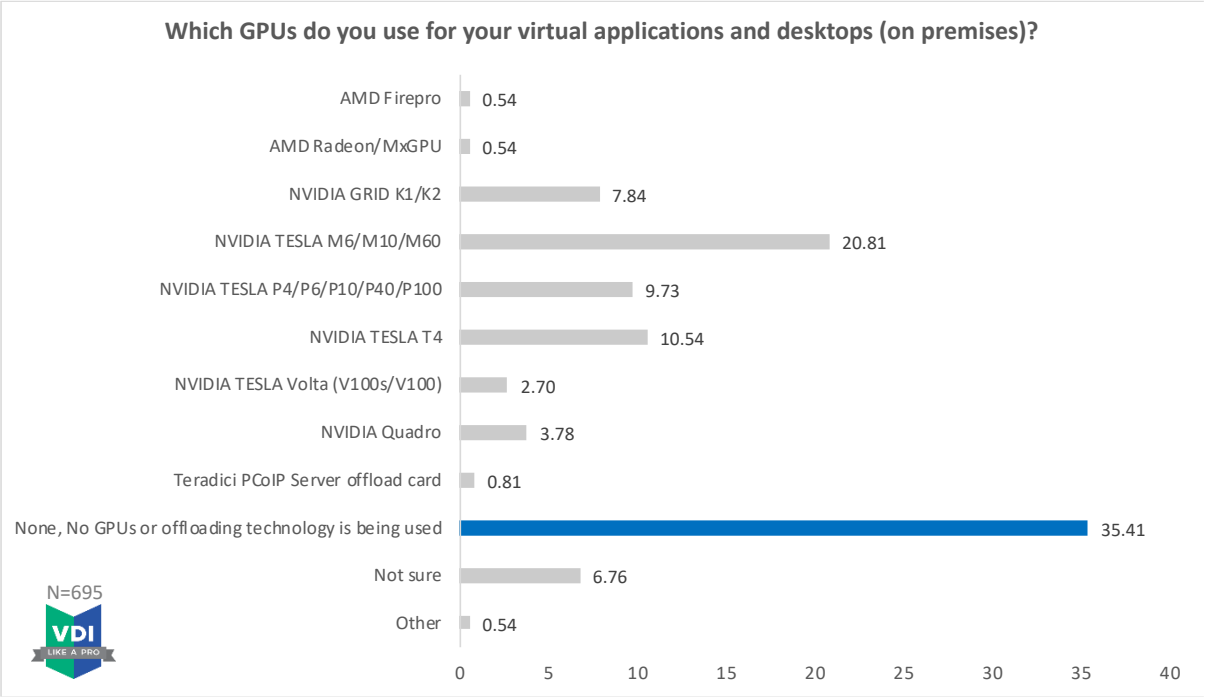


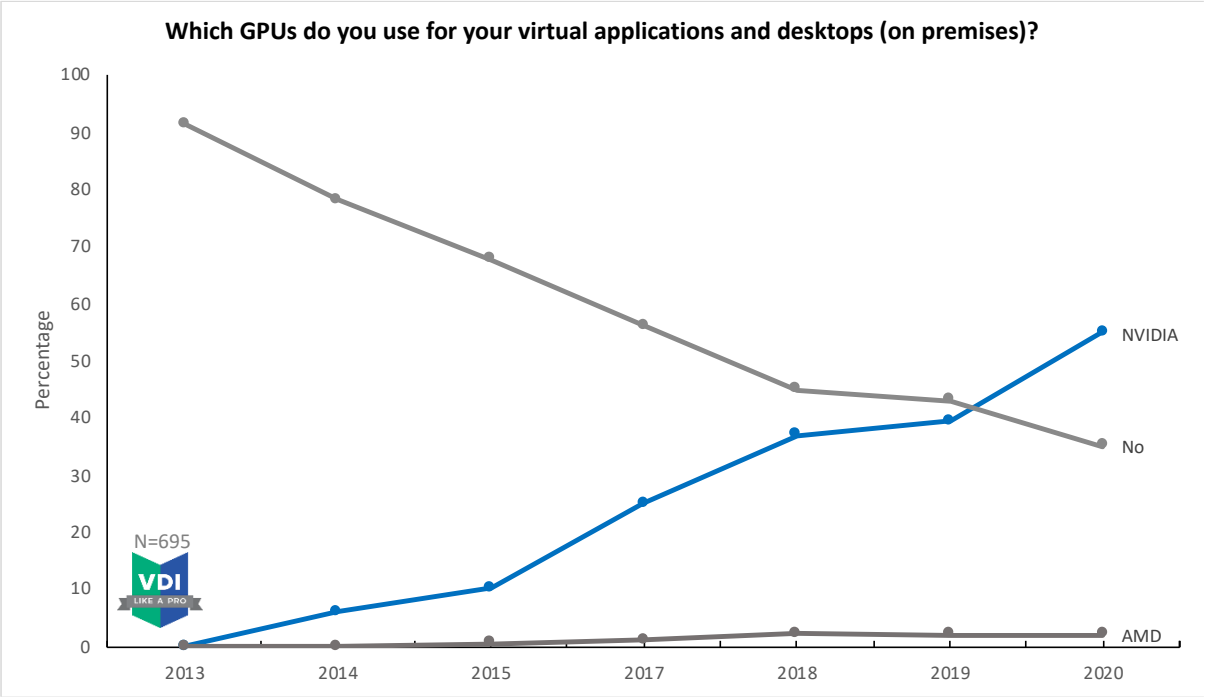

Which storage product is used to host the virtual applications and desktops (on premises)?
Percentage
30
25
20
15
10
5
0
2014
2015
2017
2018
2019
2020
N=695
Nutanix
NetApp
VMware vSAN
EMC
HP
Dell
Pure Storage
IBM

Which GPUs do you use for your virtual applications and desktops?

The biggest GPU competitors isn't AMD versus Intel versus NVIDIA—it's the CPU (again). Many organizations think the CPU can handle the graphics-related activities and therefore don't use GPUs. "No GPU" declined from 78% in 2014, 67% in 2016, 56% in 2017, 44.92% in 2018, 43.06% in 2019 and is at 35.41% in 2020.

Despite this feedback, we can see usage of GPUs (NVIDIA specifically) grew from 6% in 2014, 10% in 2015, 25% in 2017, 40.60% in 2018, 43.35% in 2019 and 55% in 2020 surpassing 'No GPU' this year! A question we will ask in next year survey is the actual % usage of GPUs in virtual desktops and application deployments. AMD is slowly entering the EUC space with promising EPYC CPUs and Radeon GPUs, the AMD GPUs have entered the public cloud space with Azure NVv4 machines, but on-premises AMD GPUs unfortunately aren't used a lot.

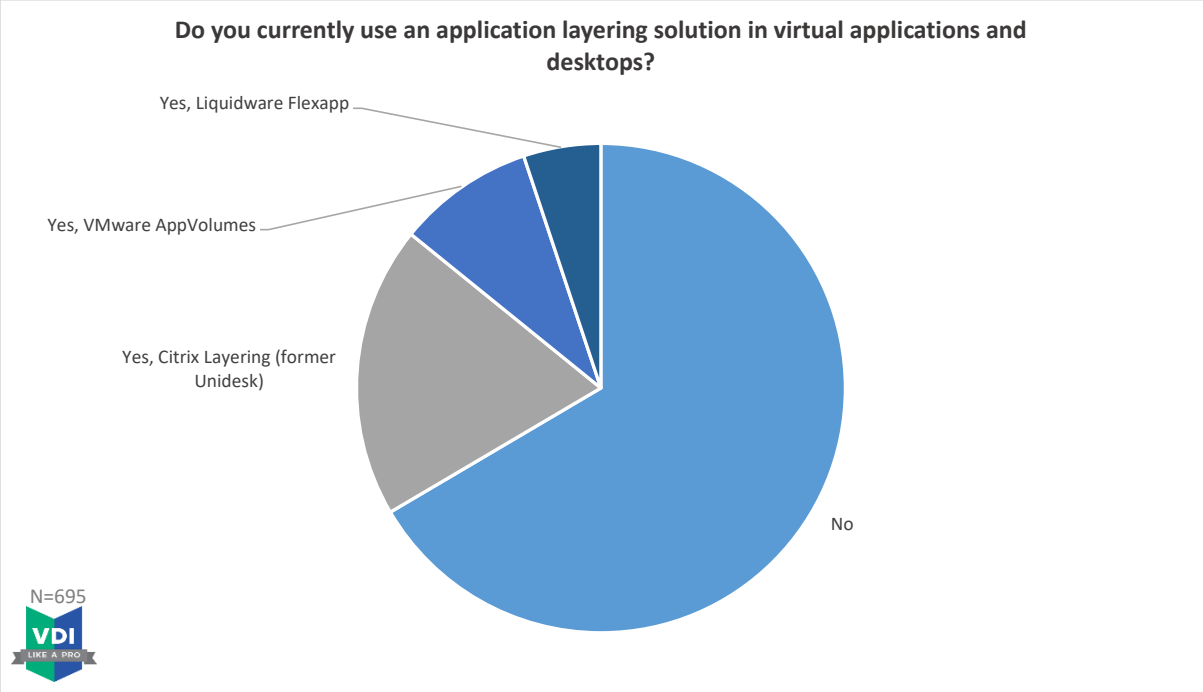


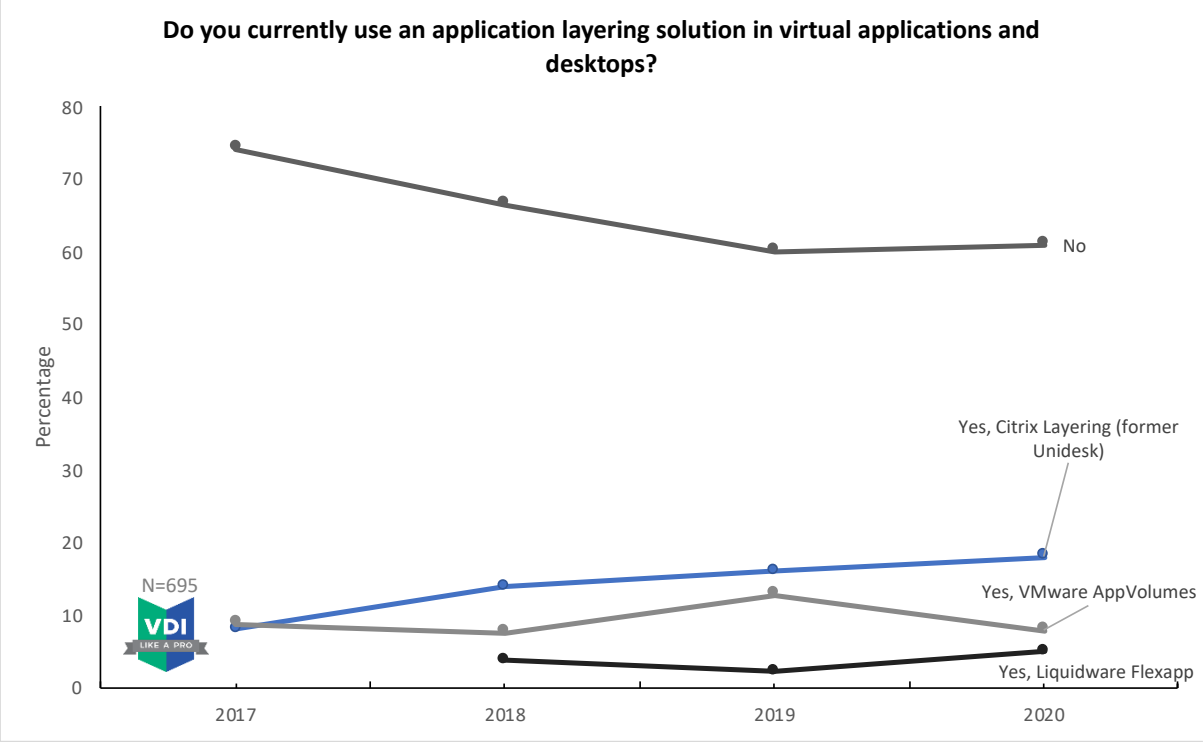


Applications: Layering, imaging, updates, management, isolation, antivirus, workspace portal and more

Do you currently use an application layering solution in virtual applications and desktops?

While most respondents aren't using layering solutions in virtual desktops and applications, 74.16% in 2017, 66.59% in 2018, 60.13% in 2019, and 61.45% in 2020. Citrix is leading with 17.82%, followed by VMware with 8.36. Liquidware FlexApp usage increased from 2.25% in 2019 to 4.72% in 2020.

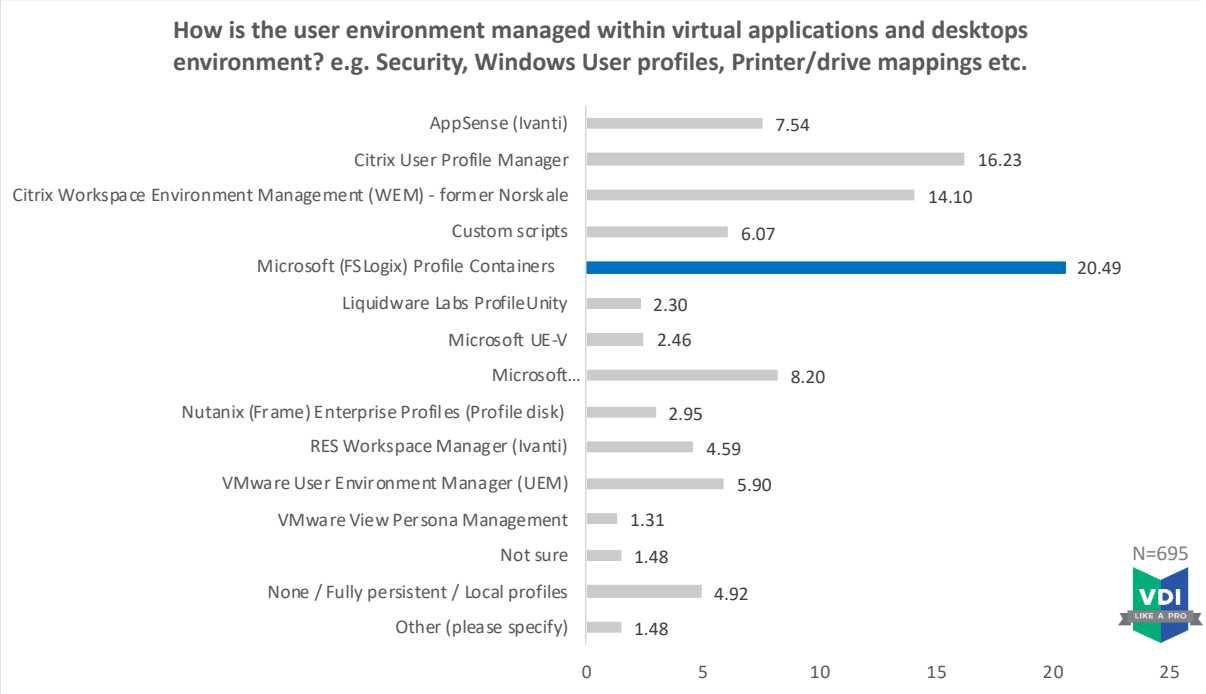


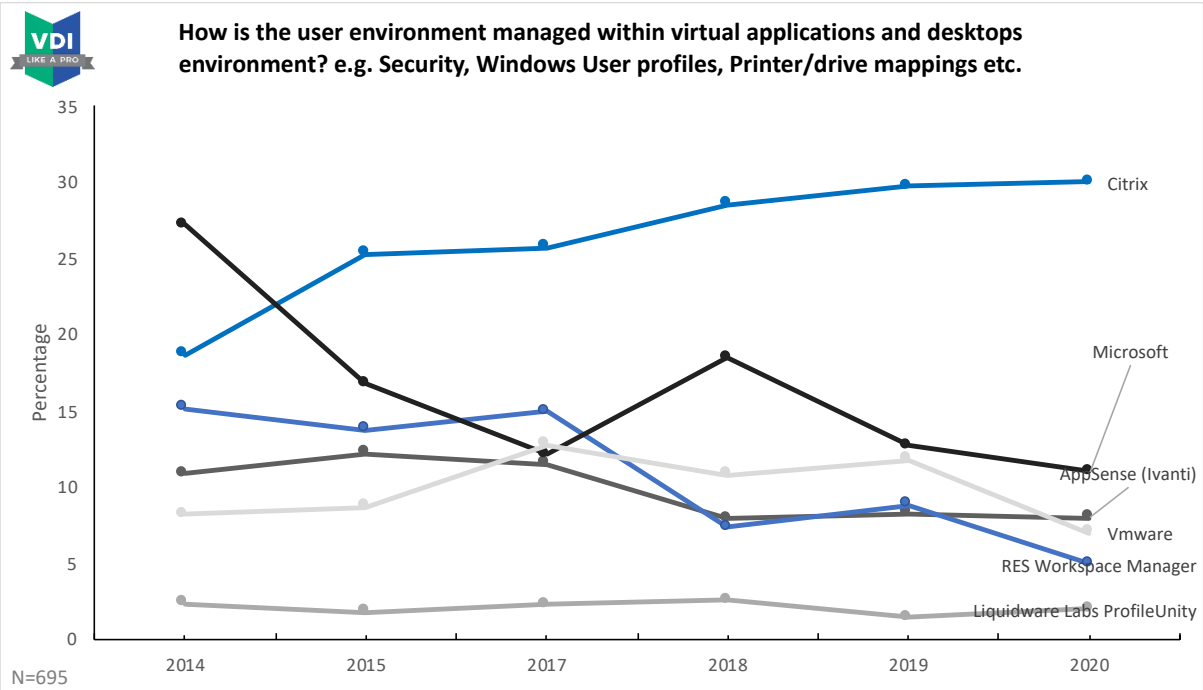


How is the user environment managed?

The most popular choice for organizations is to use the FSLogix Profile Container product from Microsoft this year, after the acquisition in 2018 – and the decision to make the product available for almost everyone has been an important decision point.

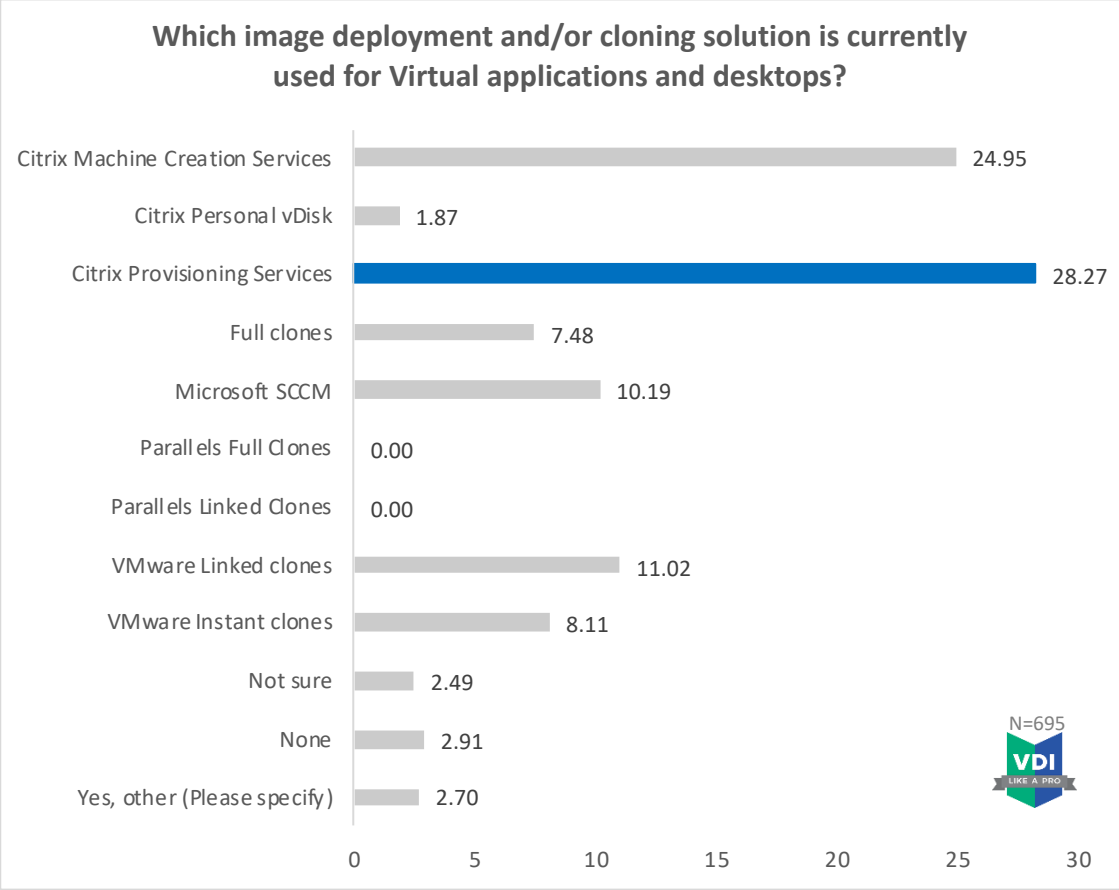
The total usage of Microsoft FSLogix profile containers is 20.49%. Citrix user environment management solutions is 16,23 % in 2020, VMware solutions is 7.21% and AppSense (Ivanti) declined from 8.32% in 2019 to 7.54% in 2020 while RES Workspace Manager (Ivanti) declined from 8.87% in 2019 to 4.59% in 2020. Liquidware Profile Unity increased from 1.48% in 2019 to 2.30% in 2020. The use of custom scripts declined from 8.23% in 2018, 7.76% in 2019, and 6.07% in 2020.

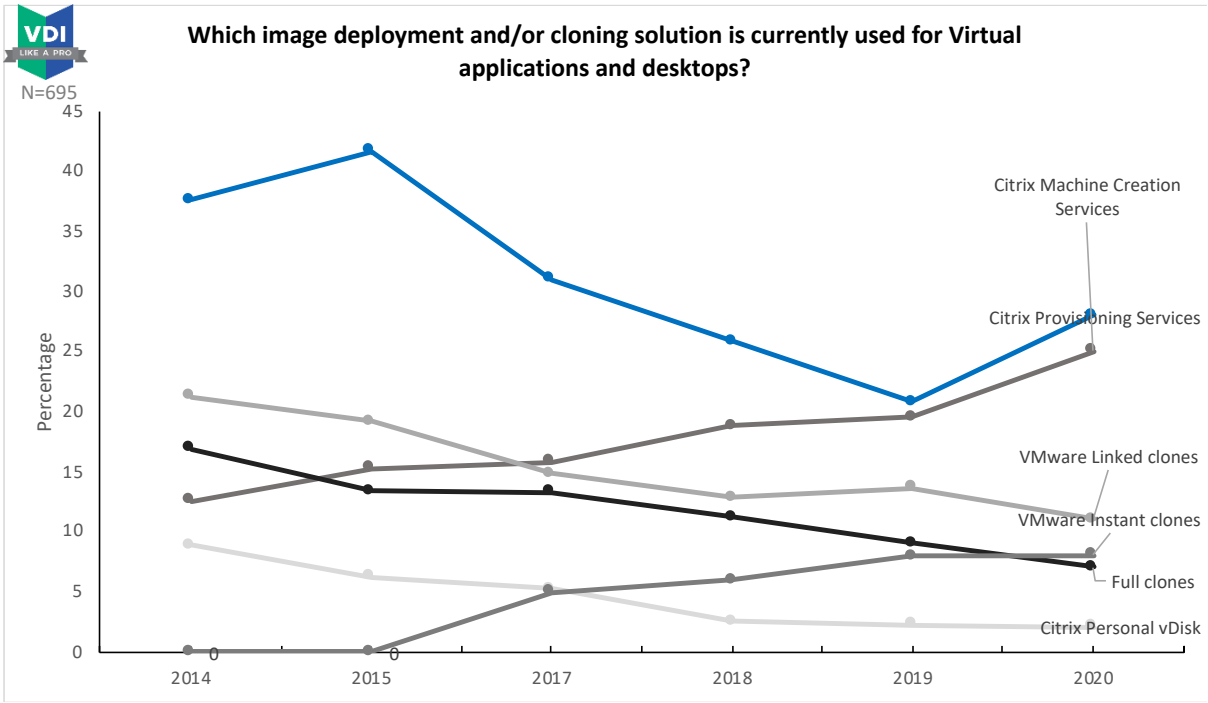




Which image deployment and/or cloning solution is currently used?

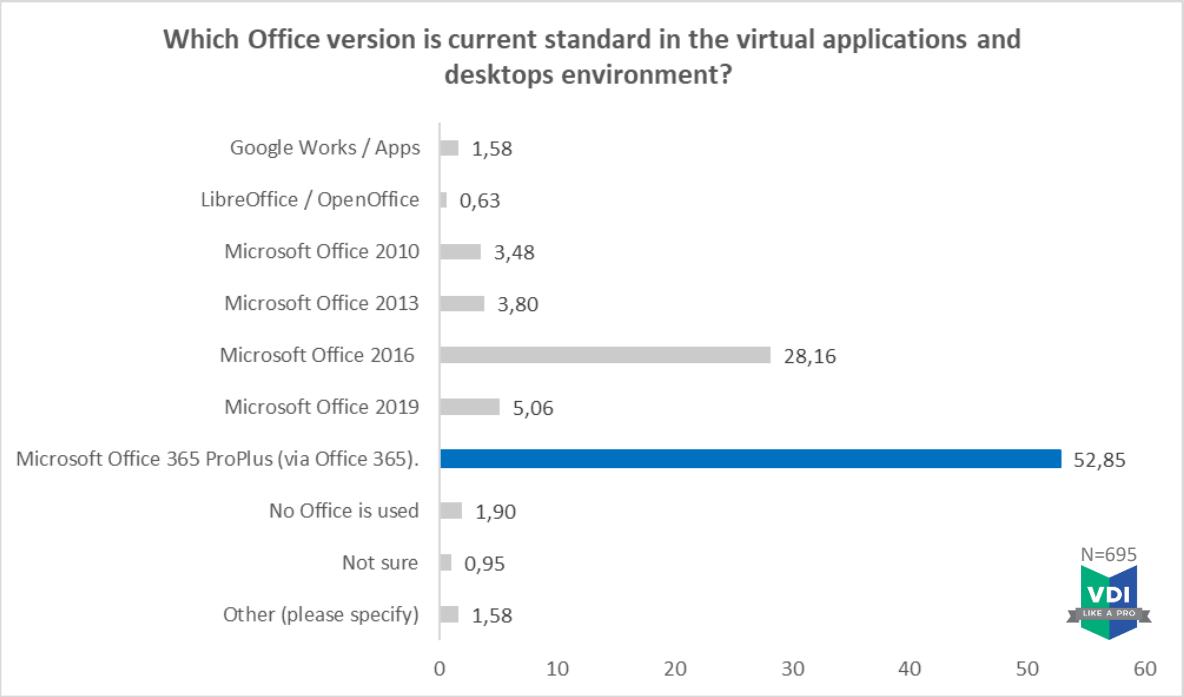
While Citrix Provisioning Services (PVS) remains a popular choice in many Citrix environments with 28.27% in 2020. Citrix Machine Creation Services (MCS) usage has increased from 15.78% in 2017, 18.72% in 2018, 19.47% in 2019 and 24.95% in 2020. VMware instant and linked clones are used in 19% of the deployments.

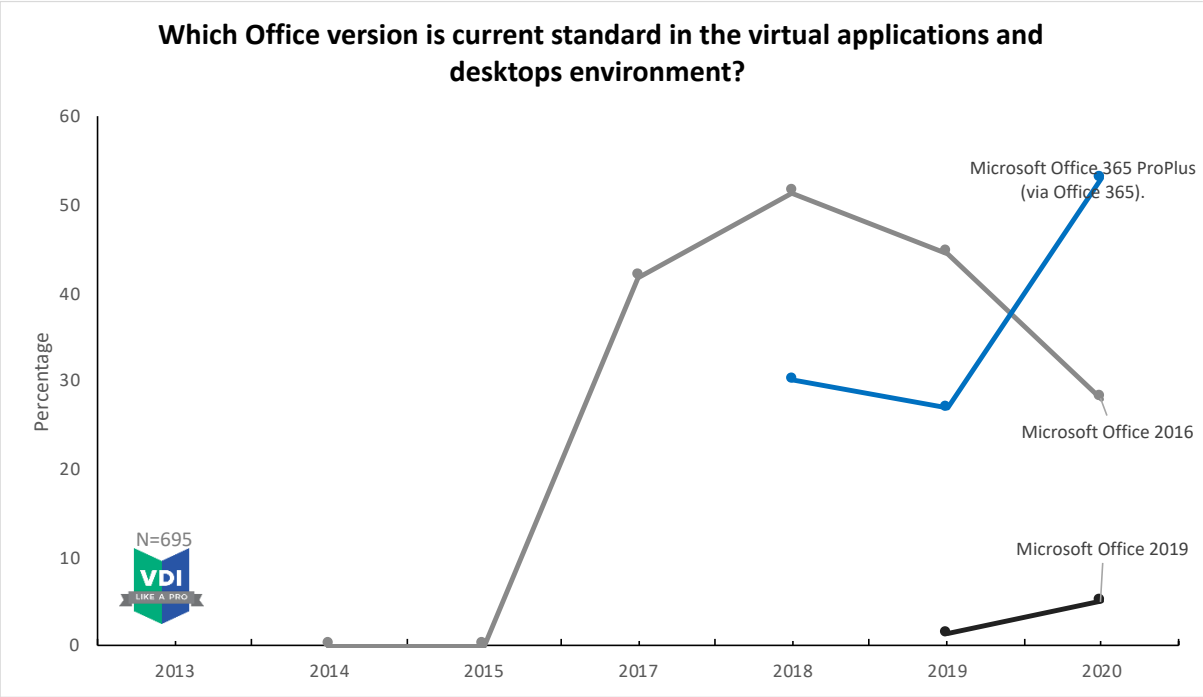




Which Office version is current standard in the virtual applications and desktops environment?

The adoption of Office 365 ProPlus increased from 26.95% in 2019 to 53% in 2020. Microsoft 2016 declined from 44.48% in 2019 to 28% in 2020. Google GSuite is being used in 1.58% of the deployments and slowly increasing but still minor compared to Microsoft. Based on customer feedback in the field, especially retail and education we do see Google growing especially on physical devices, such as Chromebooks and other devices

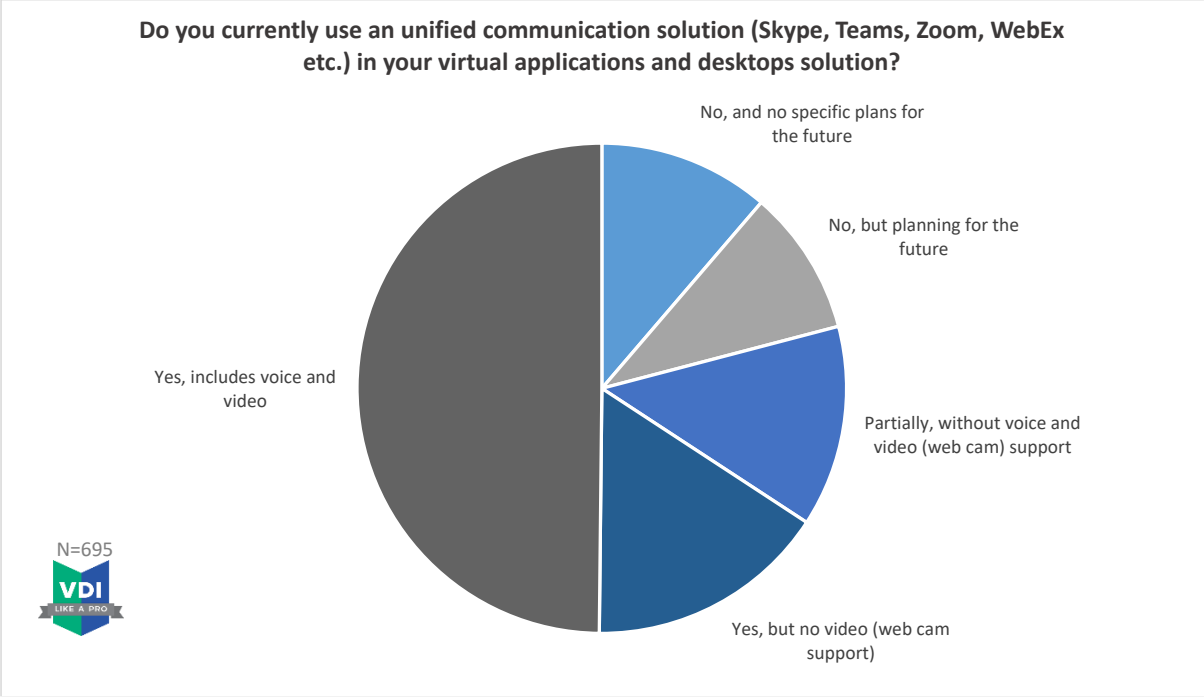


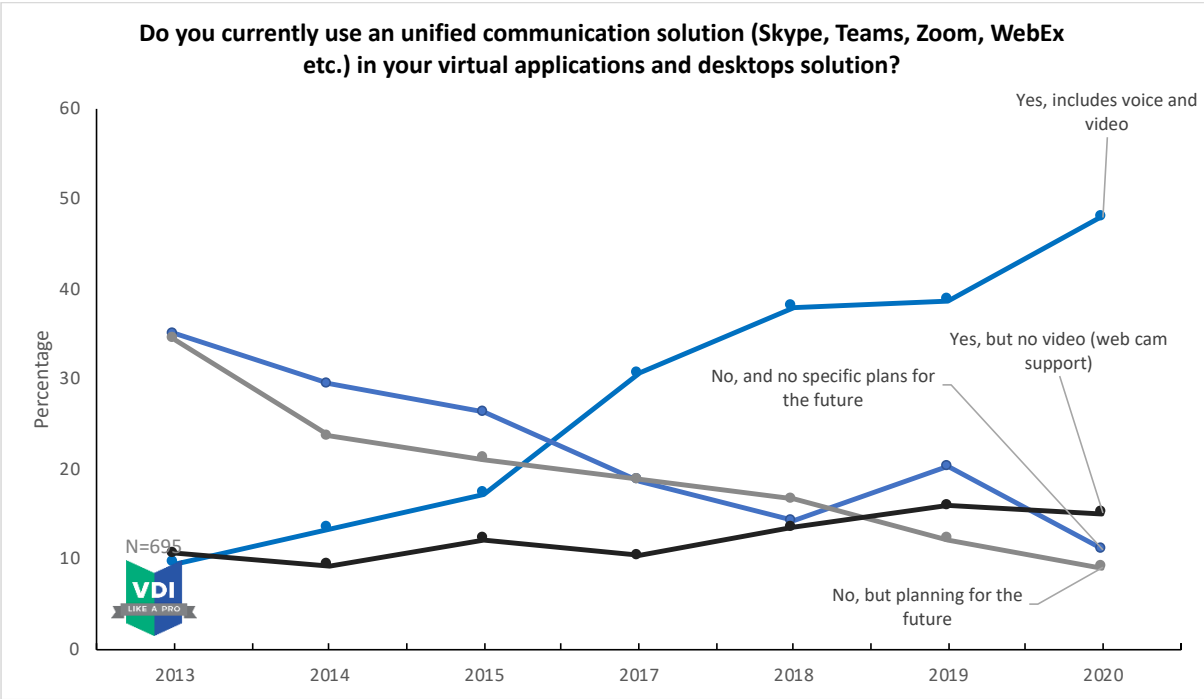


Do you currently use unified communication solution?

"Work isn't a place, it's something you do" -- this statement applies to many especially these days with COVID-19. With increasing focus on work from home, future of work and digital transformation, we see more people are using unified communications.

The use of unified communications with voice and video support has increased rapidly from 13.4% in 2014, 30.6% in 2017, 37.90% in 2018, 38.72% in 2019 and 47.92% in 2020. While Unified Communications in virtual applications and desktops always is 'attention' and often challenging it is great to see usage increasing.

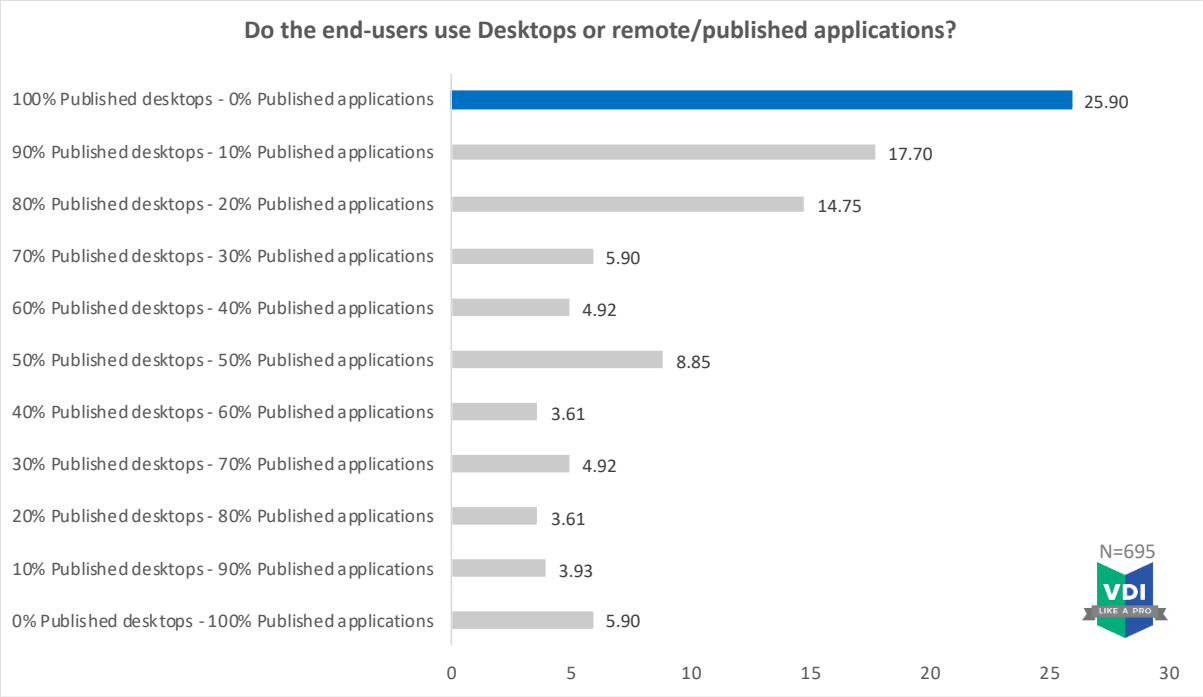




Do the end-users use Desktops or remote/published applications?

Desktop delivery instead of published applications is the mainstream method for end-users to access their virtual desktops and applications.

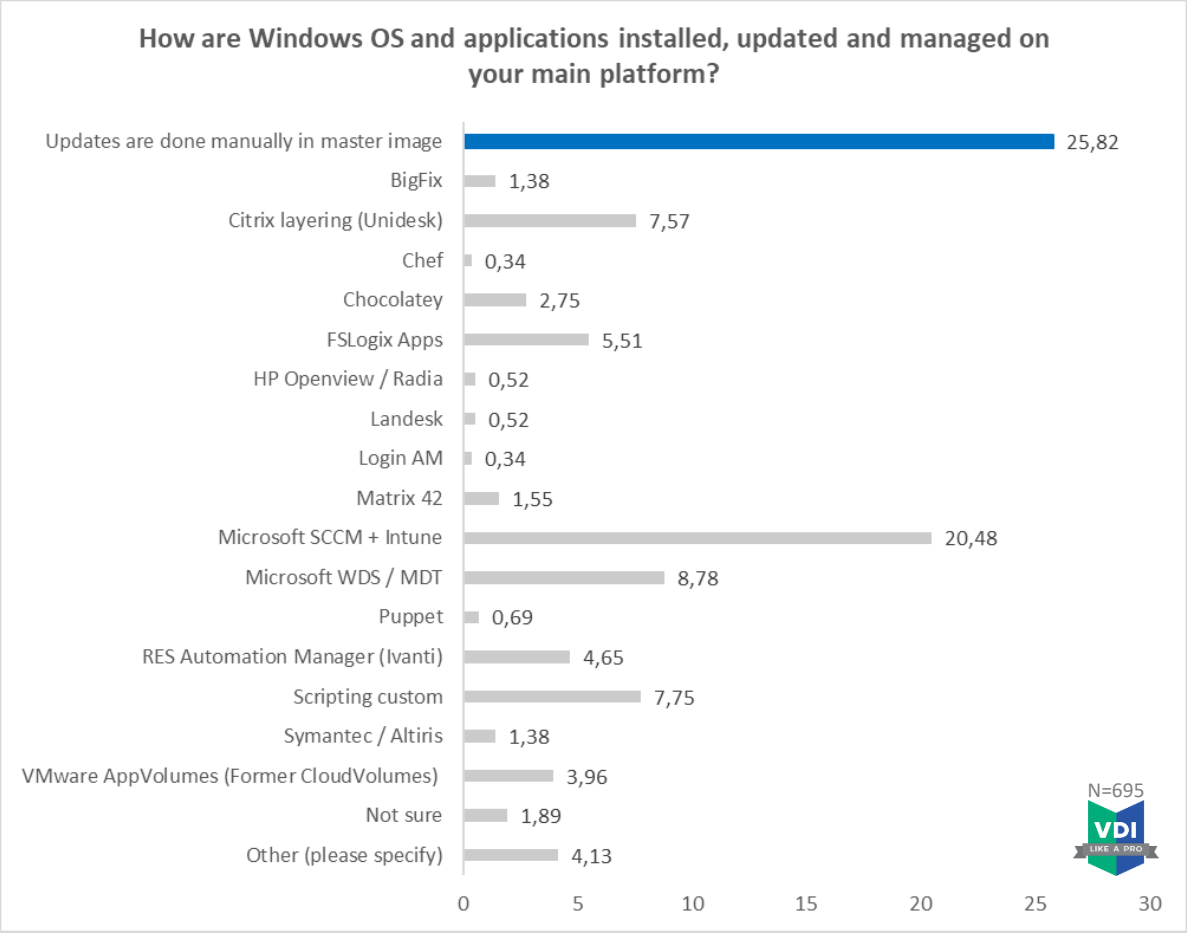
With 58.35% of the total respondent's do deliver 80-100% of the desktops virtually and 25.90% do deliver desktops in 100% of the scenarios. 5.90% of the respondents only focus on virtual application delivery only.

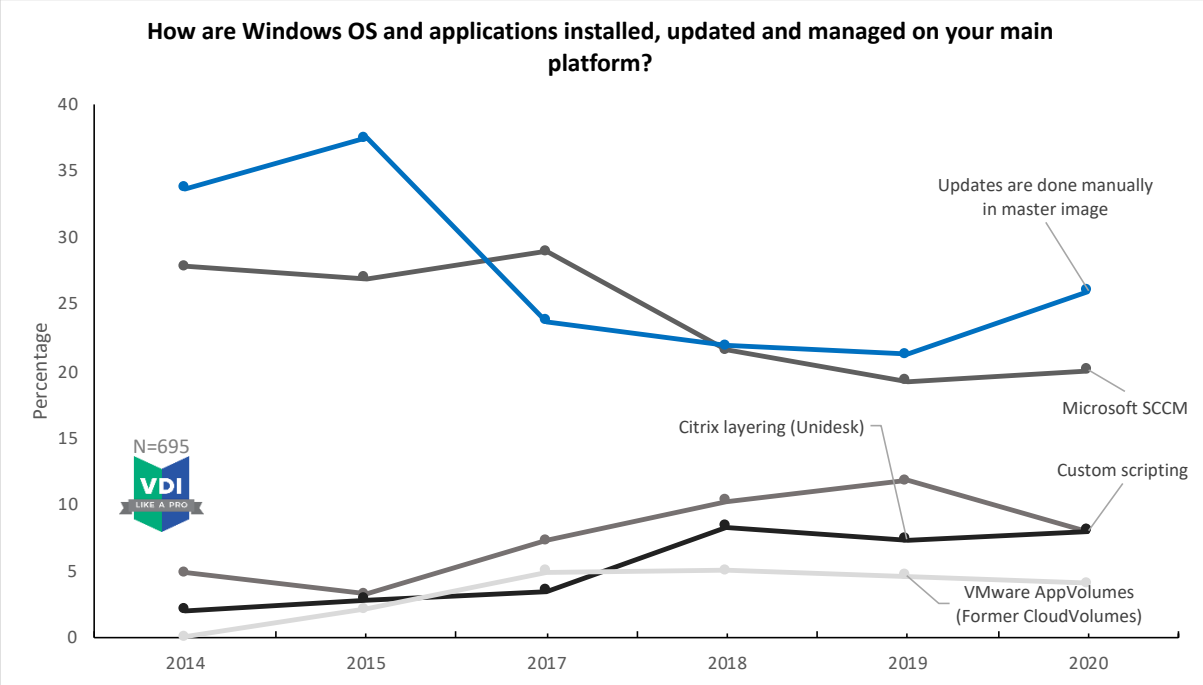


How are Windows OS and applications installed, updated and managed on your main platform?

We are surprised to see that IT Admins are increasingly using manually installation and update of OS and applications within the master image. 25.82% in 2020 an increase of 6.59% compared to 2019. This labor-intensive and error-prone way of working can seriously impact the performance and uptime of your environment, while plenty of alternatives already exist that can automate these tasks.

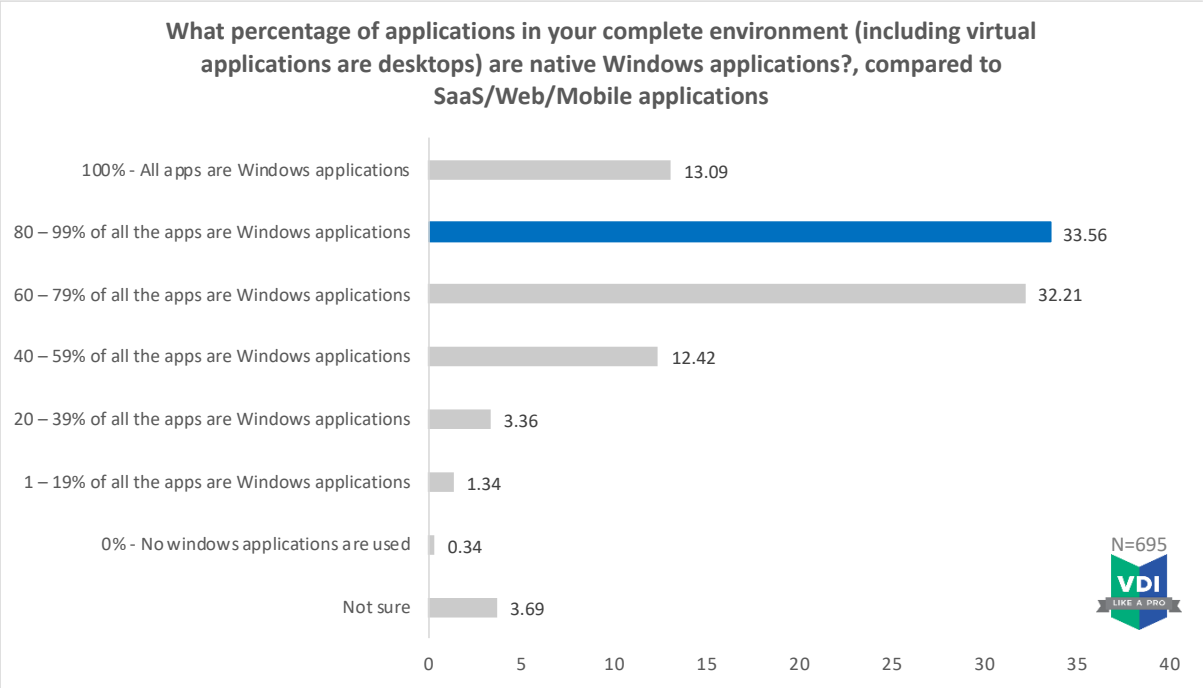
Microsoft SCCM adoption was declining from 28.93% in 2017, 21.86% in 2018, 19.23% in 2019 and slightly increase to 20.48% in 2020. Microsoft WDS/MDT was increasing from 4.87% in 2017 to 9.60% in 2018 and decreasing in 2019 to 7.69% and slightly increased to 8.78% in 2020. The use of Citrix layering is stable past three years with 7.57% usage in 2020. VMware AppVolumes usage is 3.96% in 2020 which was 4.58% in 2019 and 5.02% in 2018.




How are Windows OS and applications installed, updated and managed on your main platform?
Percentage
40
35
30
25
20
15
10
5
0
2014
2015
2017
2018
2019
2020
Updates are done manually in master image
Microsoft SCCM
Citrix layering (Unidesk)
Custom scripting
VMware AppVolumes (Former CloudVolumes)
N=695

What % of applications in your environment are native Windows applications?

46.65% of the respondents do report that their complete application landscape does contains 80% or more Windows applications.

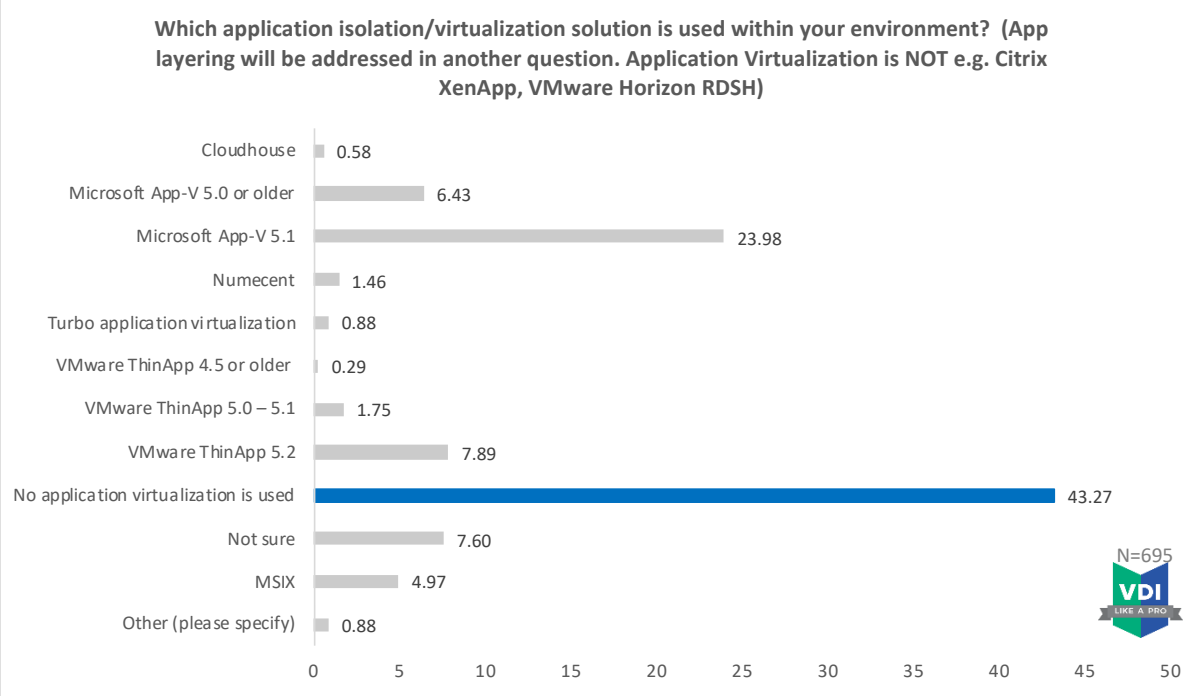


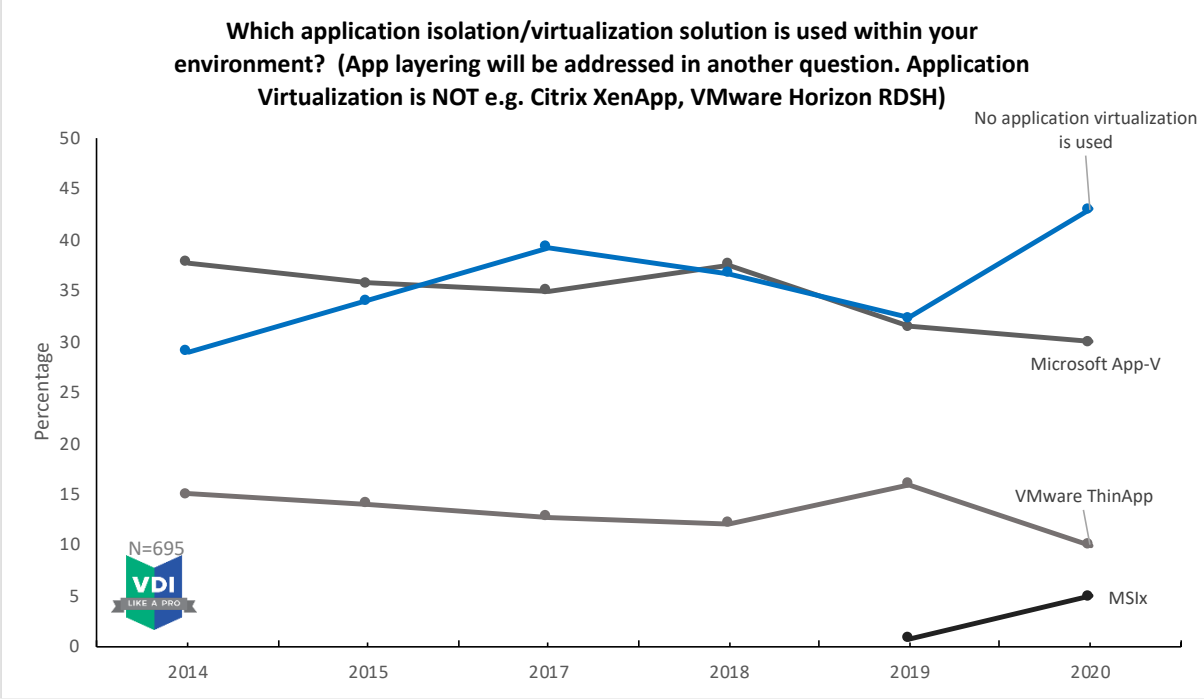
Which application isolation/virtualization solution is used within your environment?

The biggest competitor for application isolation/virtualization solutions isn't Microsoft or VMware -- it's 'NoAppVirt'. Almost 43.27% of the organizations are not using any application virtualization solutions (like Microsoft App-V, VMware ThinApp, Cloudhouse, Numecent or Turbo) and increase of 11.02% compared to 2019.

Compared to previous years, we can see a decrease of participants using application virtualization. More of the participants aren't using application virtualization at all,
Microsoft App-V still is the main application virtualization solution in virtual desktops and applications with 31.44% in 2019 and 30.41% in 2020. While VMware ThinApp, with 9.93% is the second most common application virtualization solution for virtual desktops and applications.

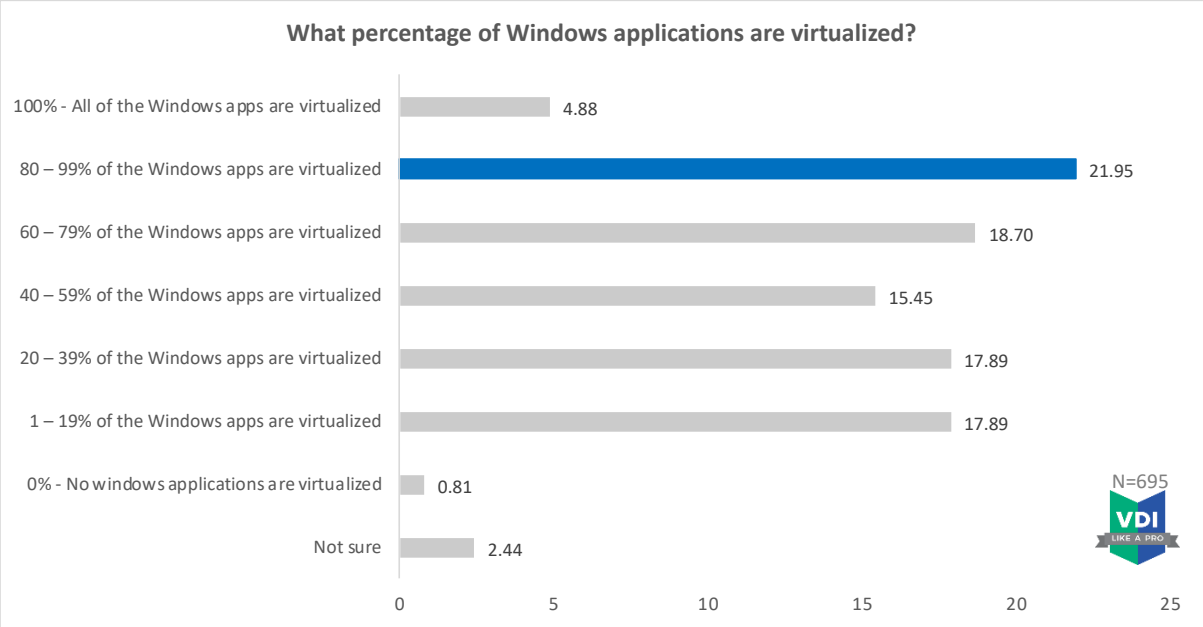
ThinApp usage increased from 12.09% in 2018, 15.99% in 2019 and 9.92% in 2020.
It's interesting to see MSIX entering the market slowly with 4.97% usage in 2020 and increase of 4.16% compared to 2019. Turbo and Numecent aren't being used a lot in virtual desktop and application scenarios – combined 2.34% usage in 2020.

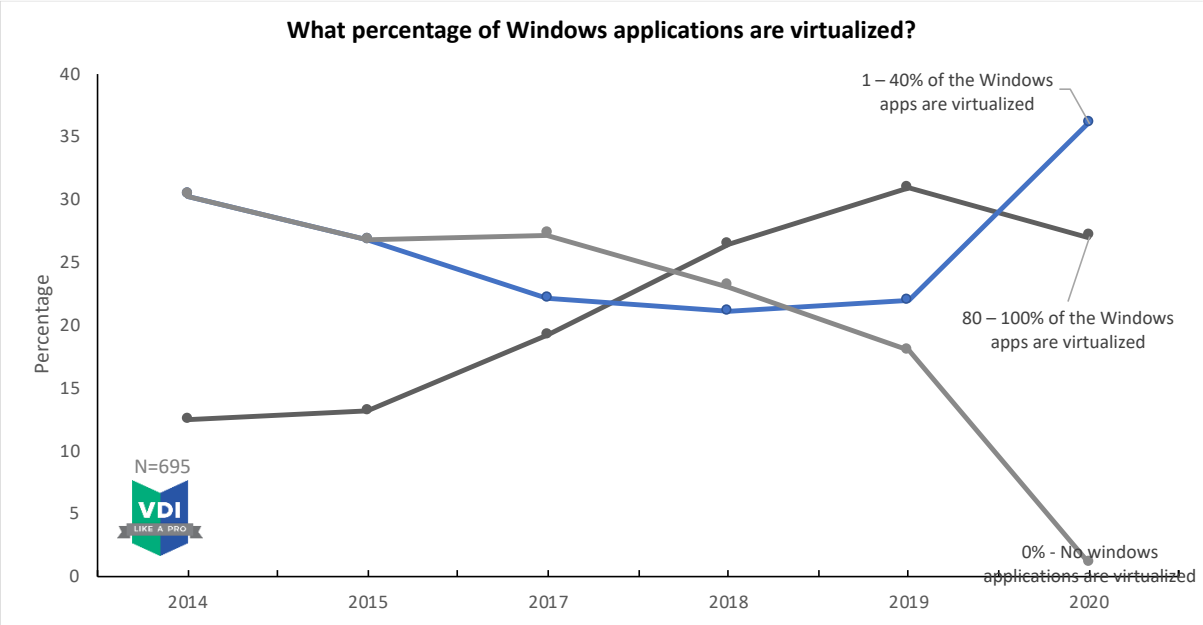



Which application isolation/virtualization solution is used within your environment? (App layering will be addressed in another question. Application Virtualization is NOT e.g. Citrix XenApp, VMware Horizon RDSH)
No application virtualization is used
Microsoft App-V
VMware ThinApp
MSIx
Percentage
50
45
40
35
30
25
20
15
10
5
0
2014
2015
2017
2018
2019
2020
N=695

What percentage of Windows applications are virtualized?

Fewer participants are using application virtualization solutions; We do see that those who do virtualize their applications have a lower adoption rate as the 80-100% category dropped from 30.86% in 2019 to 26.83% in 2020. The category of 1-40% of the applications is virtualized increased from 21.91% in 2019 to 35.78% in 2020.



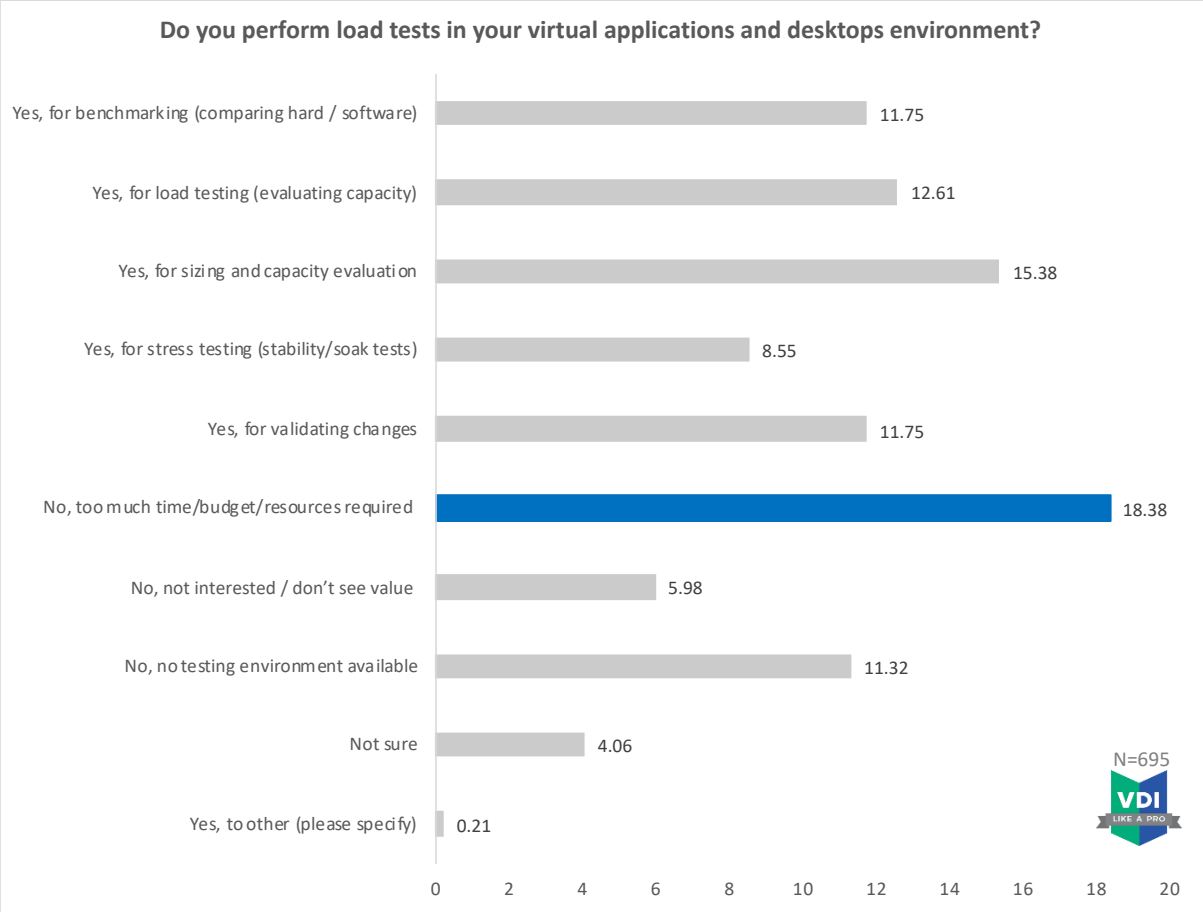


Various questions: Load testing, patching, devices, display config

Do you perform load tests in your virtual applications and desktops environment?

In total 60.00% perform load tests in their virtual desktop and application environment which is a 5.7% increase compared to 2019.

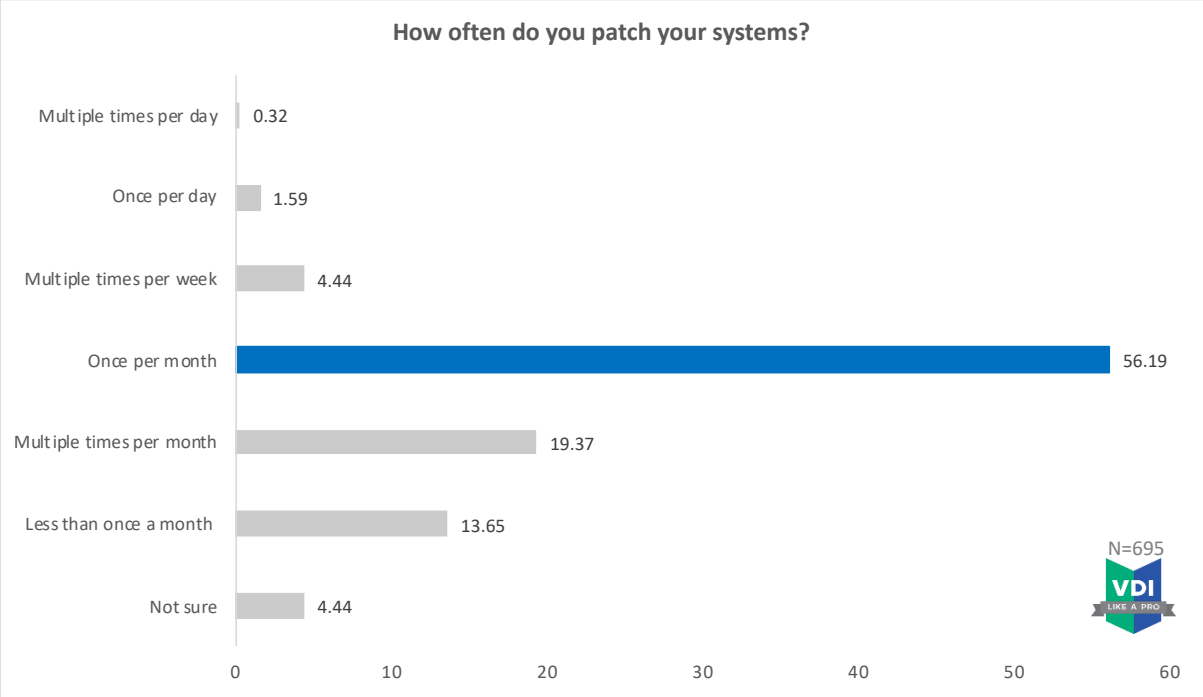
Load testing has become increasingly popular over the years. Not only for newly built environments but more importantly to continuously monitor the performance of the applications and desktop from the end-user perspective -- especially after various intel security fixes. Many of the participants (11.3%) don't have a test environment available to do performance testing. While 18.38% of the respondents don't perform load/stress tests because of budget/resources or time constraints

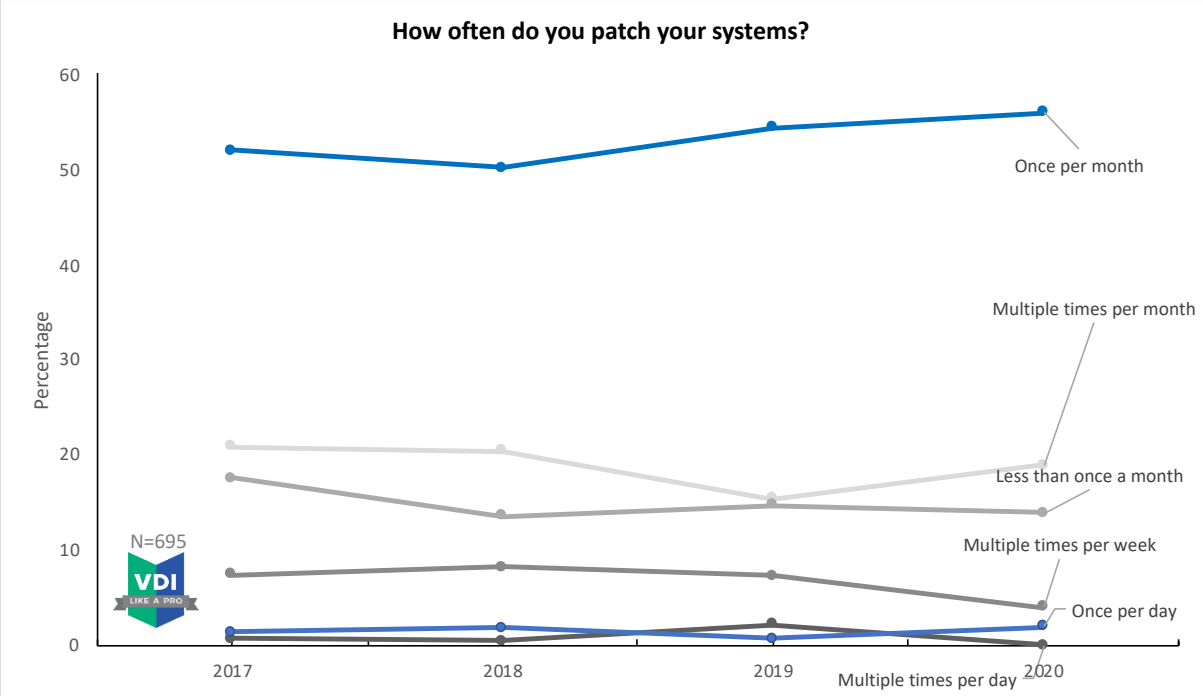


How often do you patch your systems?

More than half the respondents (56.19%) patch their systems once per month in 2020, a small increase of 1.78% compared to 2019 while 19.37% of the respondents patch multiple times per month which is an increase of 3.93% compared to 2019.

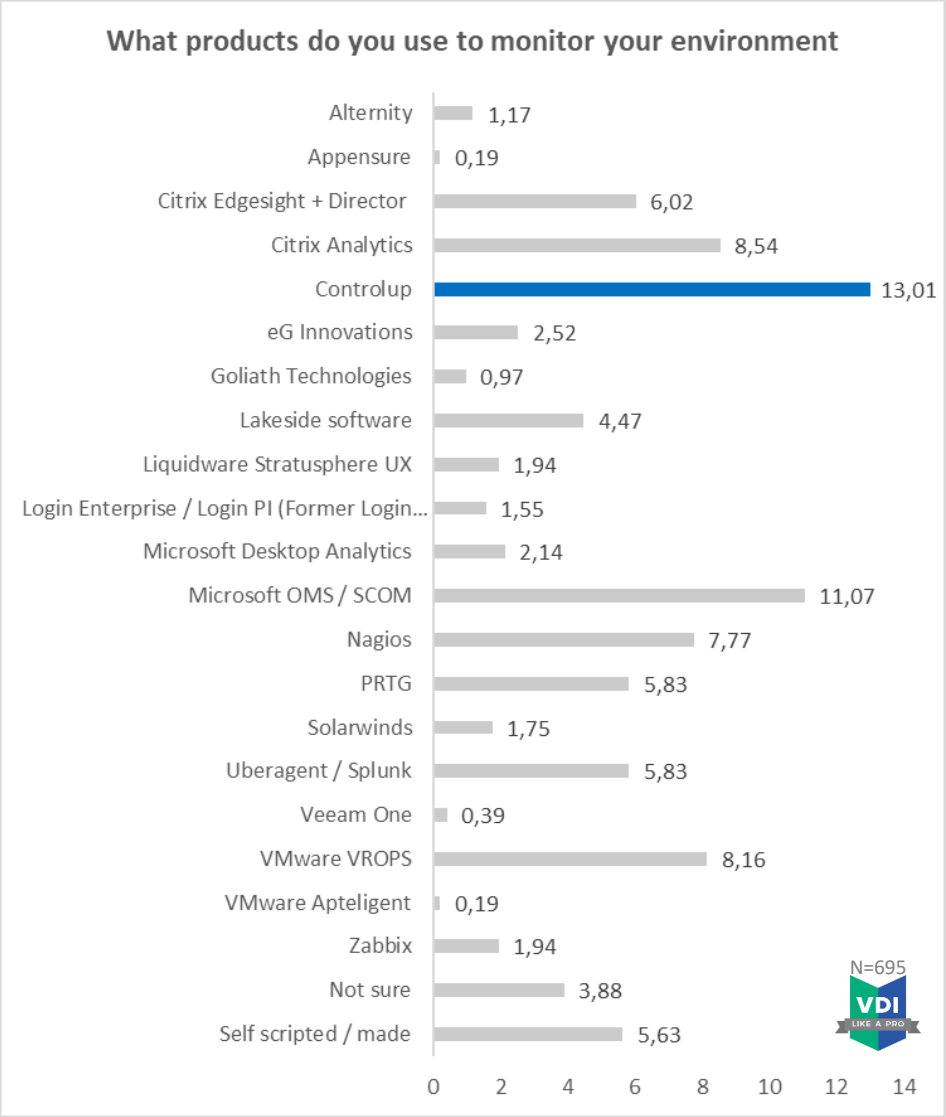
We can see an increase in people who patch less than once a month, 14.71% in 2019 and 13.65% in 2020.





What products do you use to monitor your environment?

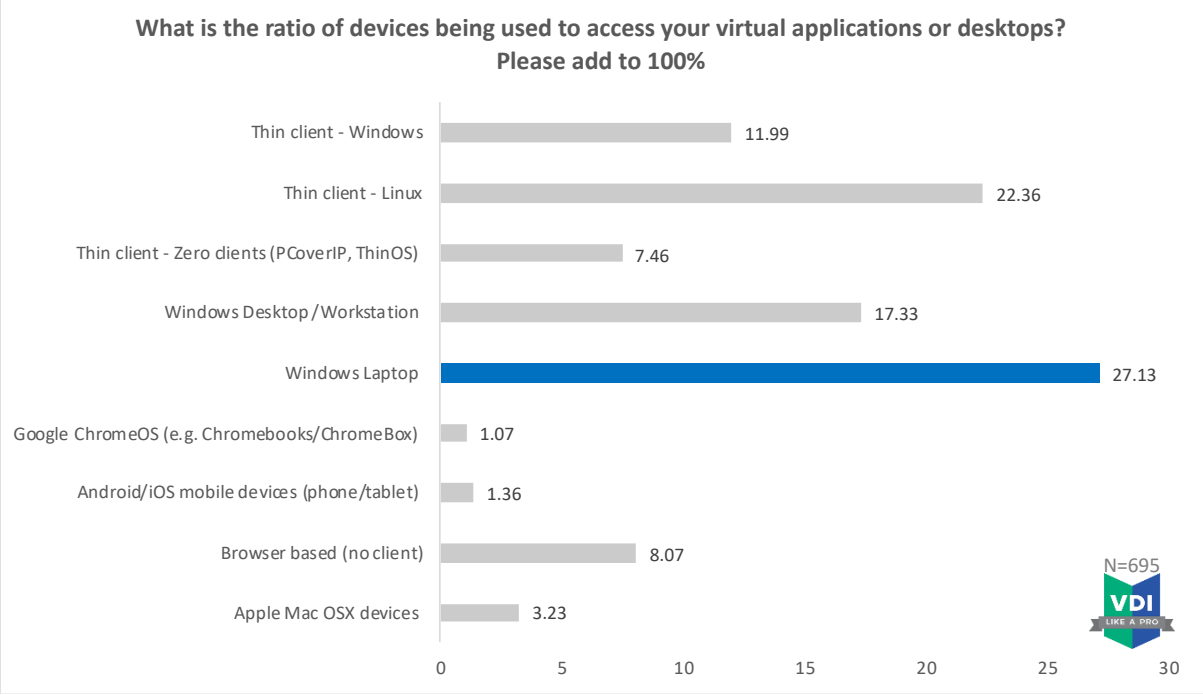
ControlUp is the most popular solution to monitor the virtual desktop and application environment, 13.01% of the respondents are using the solution which is an increase of 5.07% compared to 2019. Microsoft OMS/SCOM is 2nd with a usage of 11.07% in 2020 a small decrease of 1.02% compared to 2019. Citrix Analytics with 8.54% and VMware vROPS with 8.16% (8.16%) are used. UberAgent usage increased in usage from 4.69% in 2019 to 5.83% in 2020

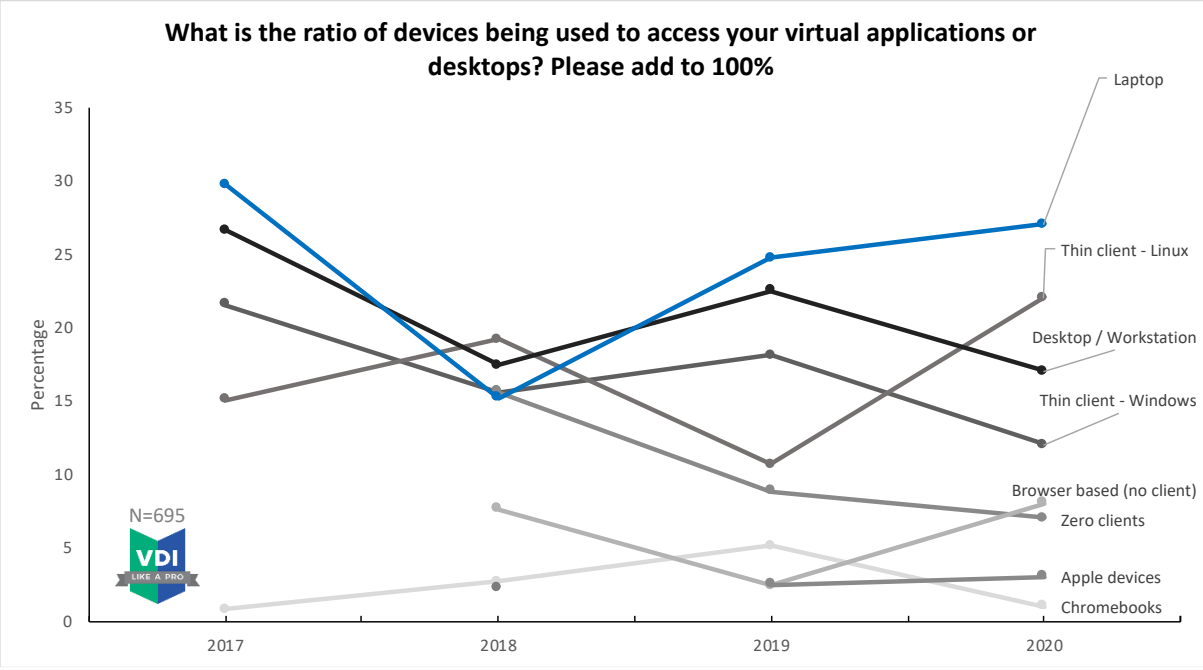


What is the ratio of devices being used to access your virtual applications or desktops?

In 2017, the laptop was the primary used in 29.7% of the cases to access virtual desktops and applications, in 2018 this number was down to 15.18%, in 2019 it increased to 24.74% to 27.13% in 2020. Linux Thin Client usage declined from 19.20% in 2018 to 10.64% in 2019 and increased to 22.36% in 2020. Zero clients (PCoverIP and ThinOS) declined heavily from 8.86% in 2019 to 7.46% in 2020. Also, browser-based (no client) increased from 2.42% in 2019 to 8.07% in 2020.

Desktop/Laptop as a primary access device to access VDI/SBC is the leading platform in 2020 with 44.46%. We do see a decrease in the adoption of Chromebooks to access virtual desktops and applications of 5.08% in 2019 to 1.07% in 2020.



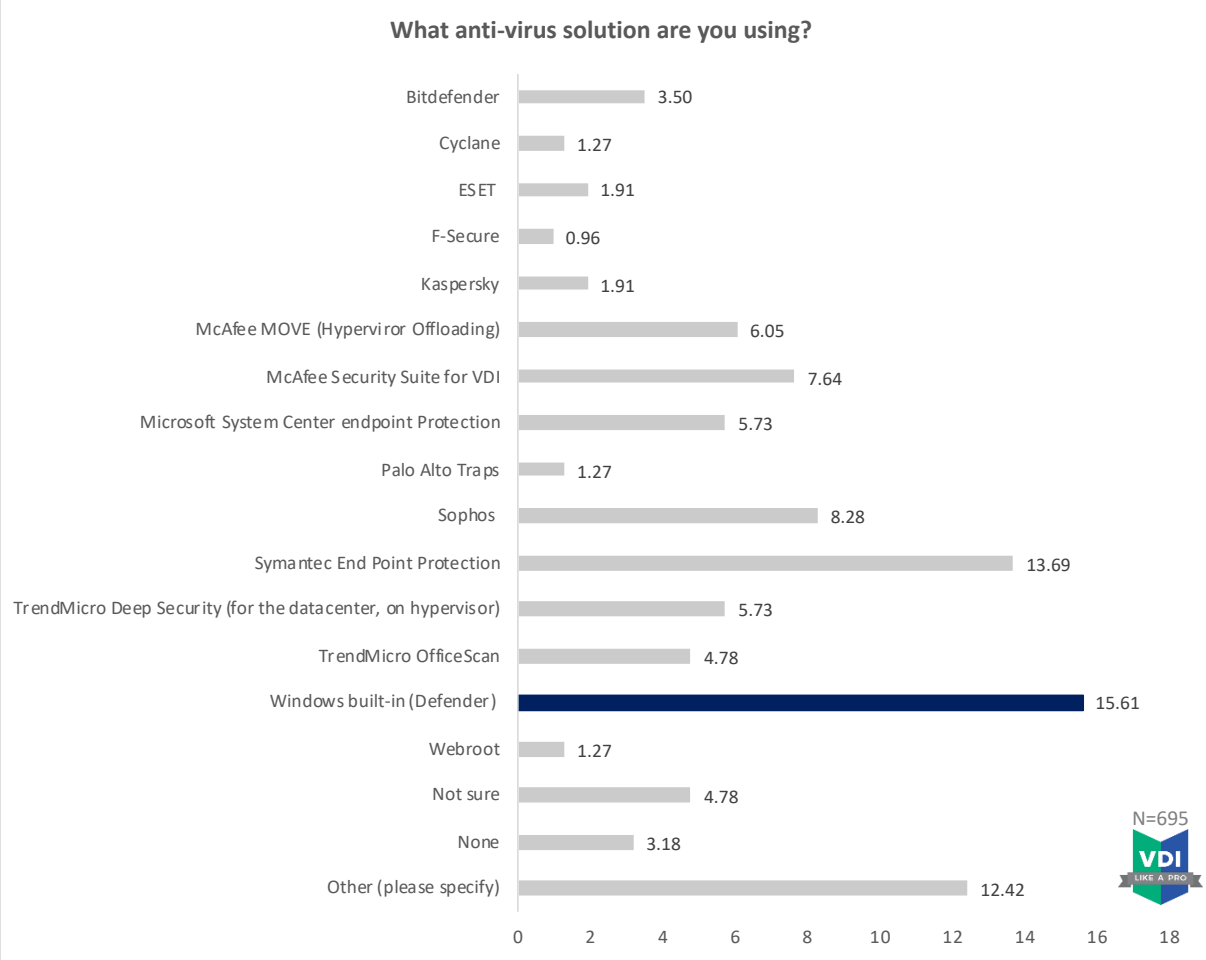


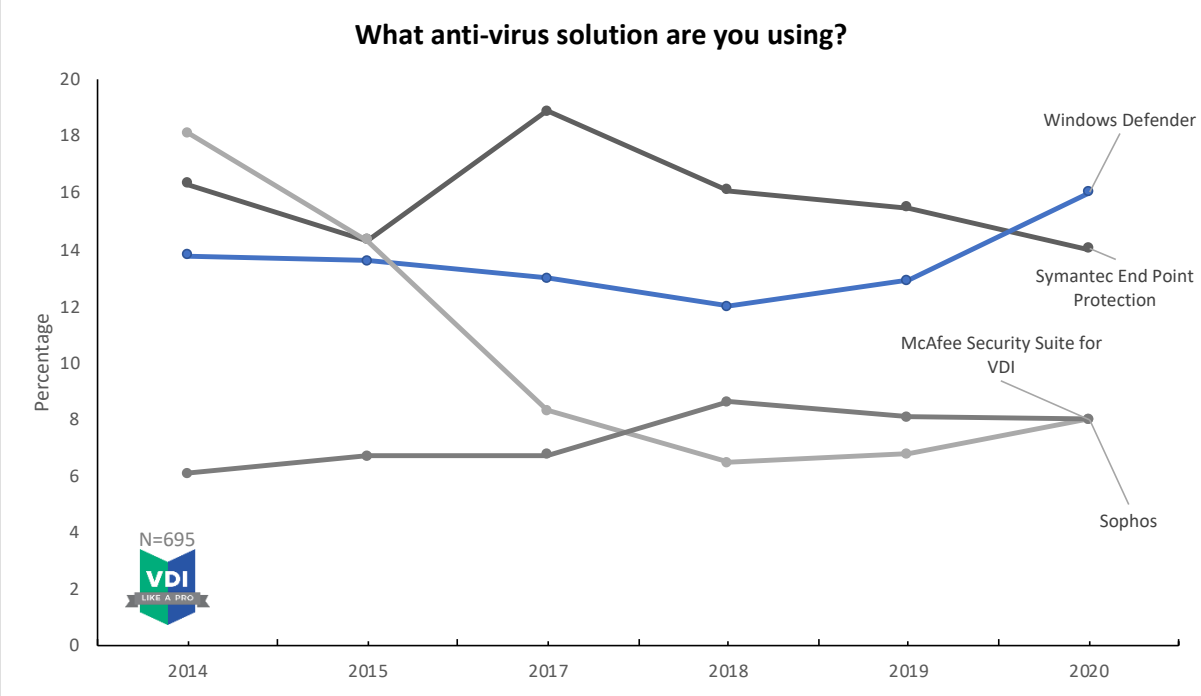
What anti-virus solution are you using?

With common and recent outbreaks of ransomware, the leaks of government-funded zero-day exploits, and the threats of traditional viruses—it's no surprise that, even in virtual environments, anti-virus protection remains popular.
Although you can argue the value of traditional security solutions in virtual desktops and applications with zero-day exploits and unpatched systems in mind, it is common to use end-point security solutions.

The major brands such as Symantec, McAfee, and TrendMicro all see a decline in usage in 2018. Symantec declined from 18.8% in 2017, 16.07% in 2018, 15.48% in 2019 and 13.69% in 2020 McAfee solutions declined from 20.32% in 2017, 14.38% in 2018, 12.58% in 2019 and increase to 13.69% in 2020.

TrendMicro declined from 18.88% in 2017, 13.90% in 2018, 10.97% in 2019 and 10.51% in 2929 Bitdefender usage increased from 3.60% in 2018 to 4.52% in 2019 and decrease to 3.50% in 2020. Microsoft SCEP usage declined from 9.59% in 2018, 7.42% in 2019 and 5.72% in 2929 while Windows Defender increased from 12.90% in 2019 to 15.61% in 2020.

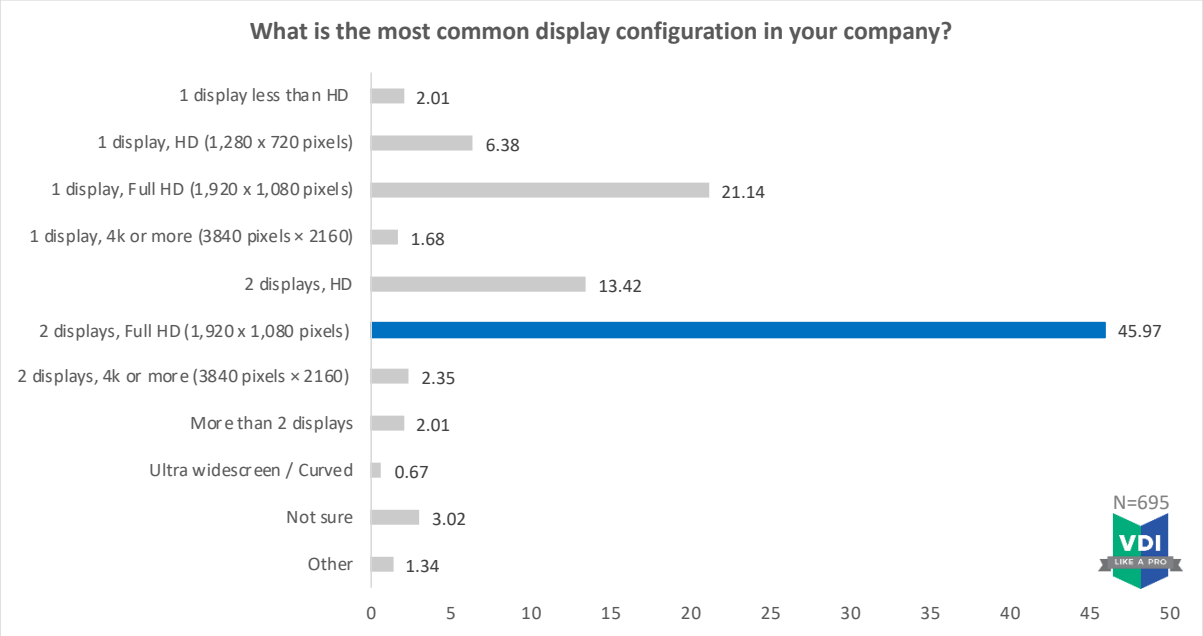


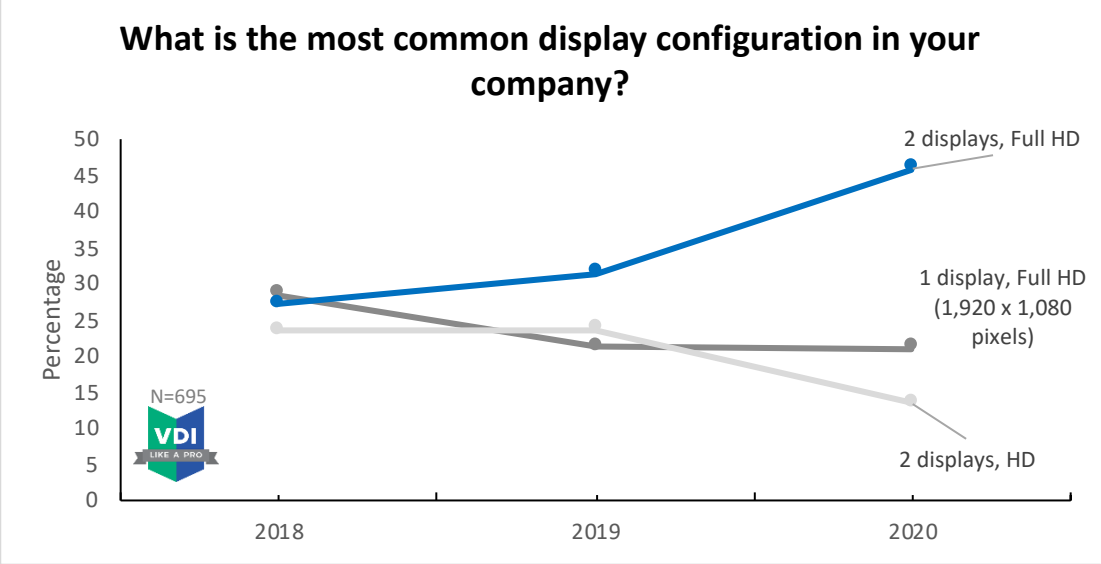

What anti-virus solution are you using?
Percentage
20
18
16
14
12
10
8
6
4
2
0
2014
2015
2017
2018
2019
2020
Windows Defender
Symantec End Point Protection
McAfee Security Suite for VDI
Sophos
N=695

What is the most common display configuration in your company?

With the increment working more from home, all dual-display configurations combined totals of 61.74% in 2020 an increase of 3.17% compared to 2019. Dual display at Full HD is used the most with 45.97% in 2020.

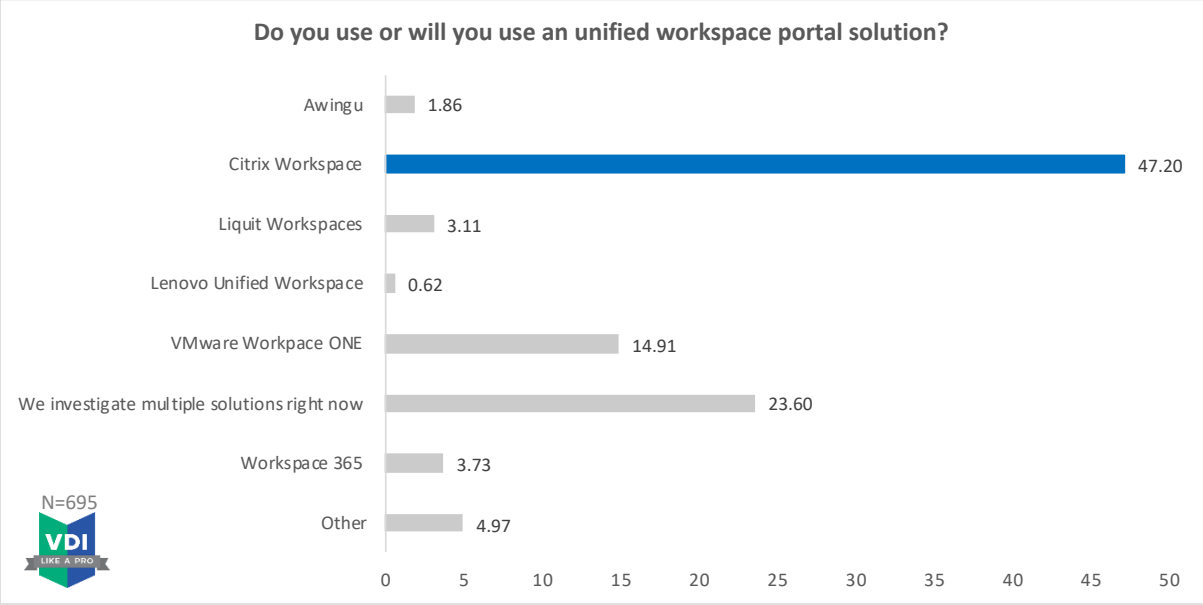
Dual display configurations are more popular than a single display configuration at 31.21%. Dual display configuration surpassed a single display configuration in 2019. Ultrawide screen entered the survey with 0.67% in 2020.





Do you use or will you use a unified workspace portal solution?

A Unified Workspace portal will bring Windows, Web/SaaS applications and data together.
A workspace portal often is referenced as “Workspace aggregator”. Citrix Workspace is used the most with 47.20% followed by VMware Workspace ONE with 14.91%. Also 23.60% of the respondents are investigating different options.

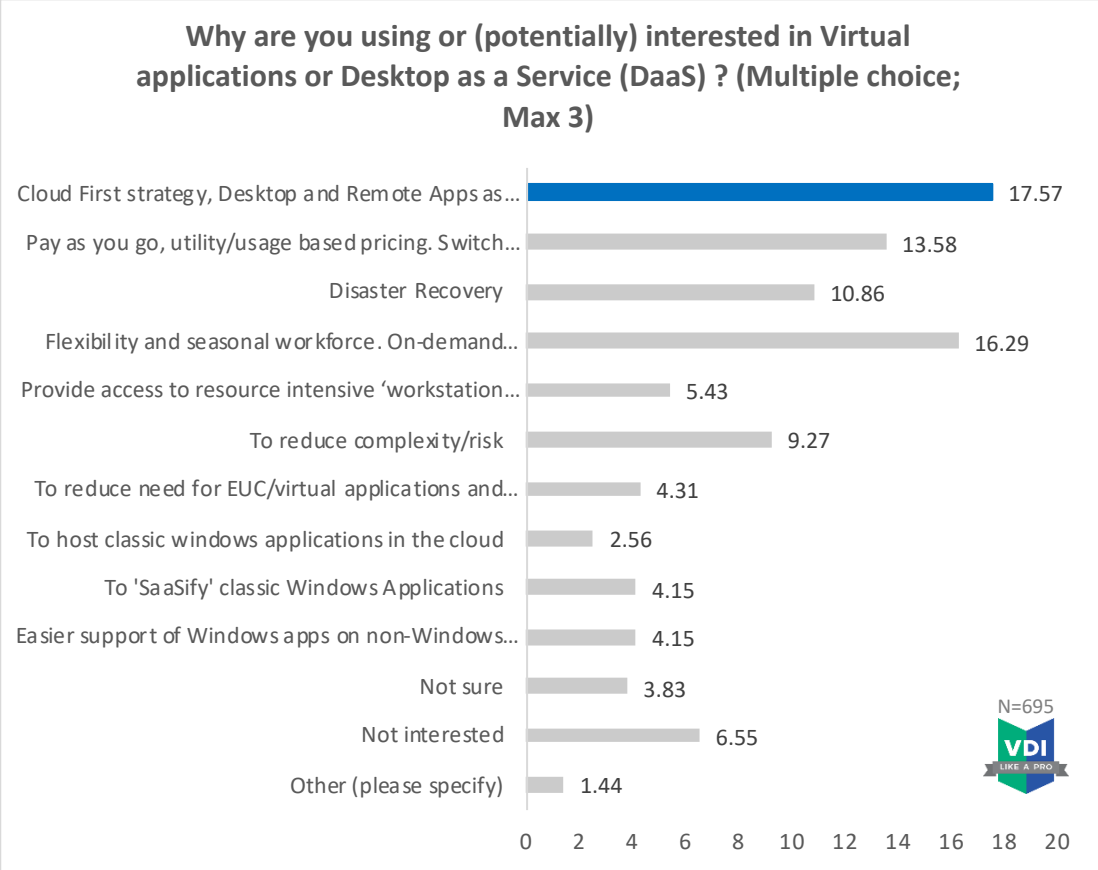


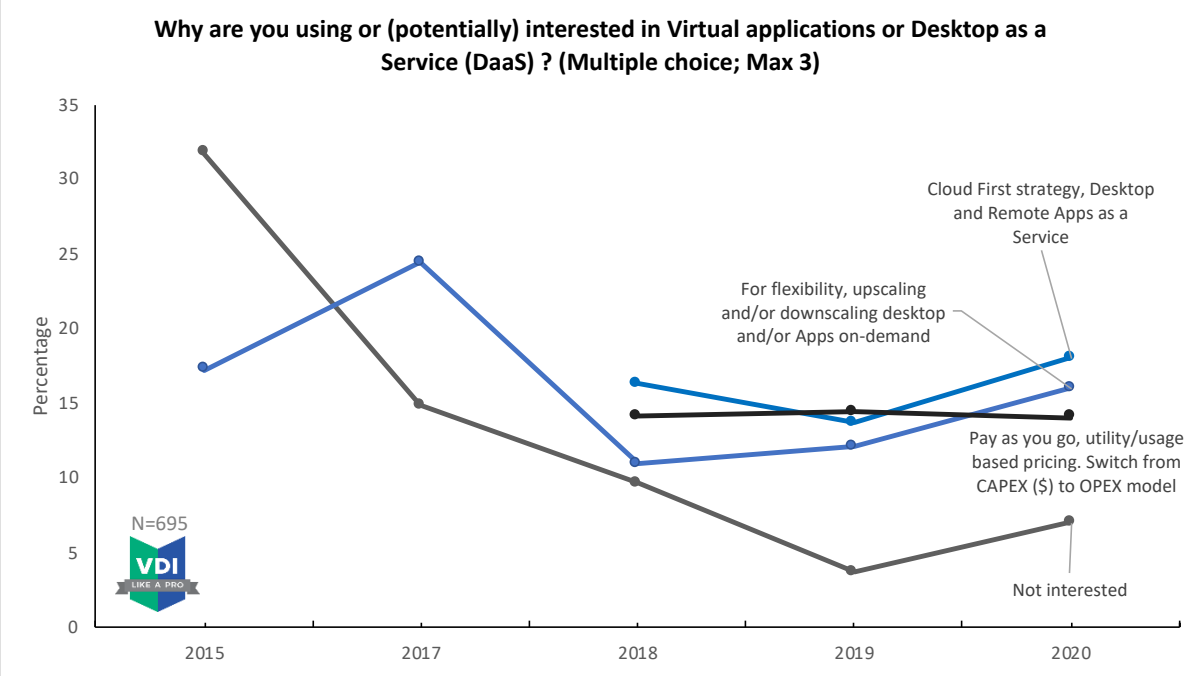
Public Cloud: use-cases, challenges, products, strategy, GPUs,

Why are you using or (potentially) interested in Virtual applications or Desktop as a Service (DaaS)?

Cloud first strategy for virtual desktops and applications is the main reason for DaaS usage. 17,57% of the respondents in 2020 an increase of 3.94% compared to 2019.

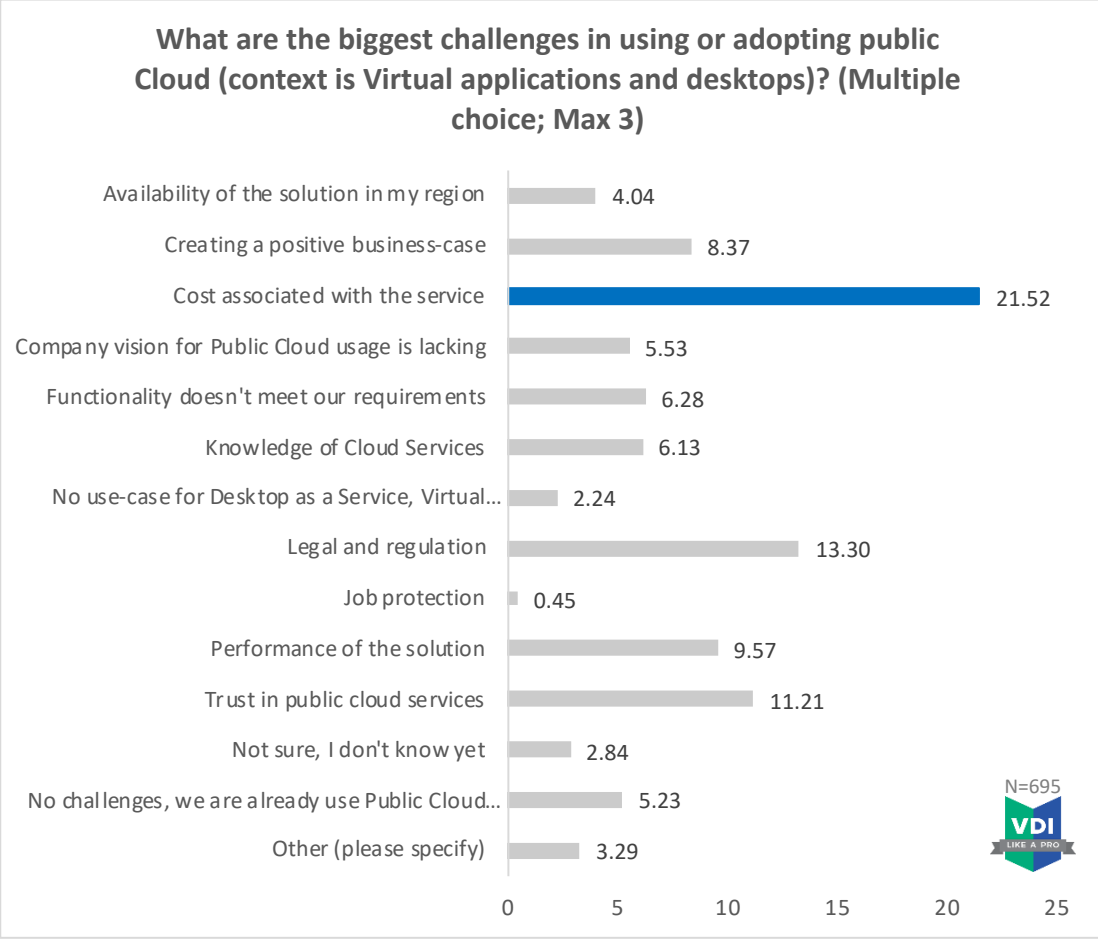
Flexibility - the ability to support a seasonal workforce and on-demand up/down scaling is the second most important reason for Desktop as a Service with 16.29% an increase of 4.20% compared to 2019. Third is pay as you Go with 13.58% a small decrease compared to 14.40% in 2019.




Why are you using or (potentially) interested in Virtual applications or Desktop as a Service (DaaS) ? (Multiple choice; Max 3)
Percentage
35
30
25
20
15
10
5
0
2015
2017
2018
2019
2020
Cloud First strategy, Desktop and Remote Apps as a Service
For flexibility, upscaling and/or downscaling desktop and/or Apps on-demand
Pay as you go, utility/usage based pricing. Switch from CAPEX ($) to OPEX model
Not interested
N=695

What are the biggest challenges in using or adopting public Cloud?

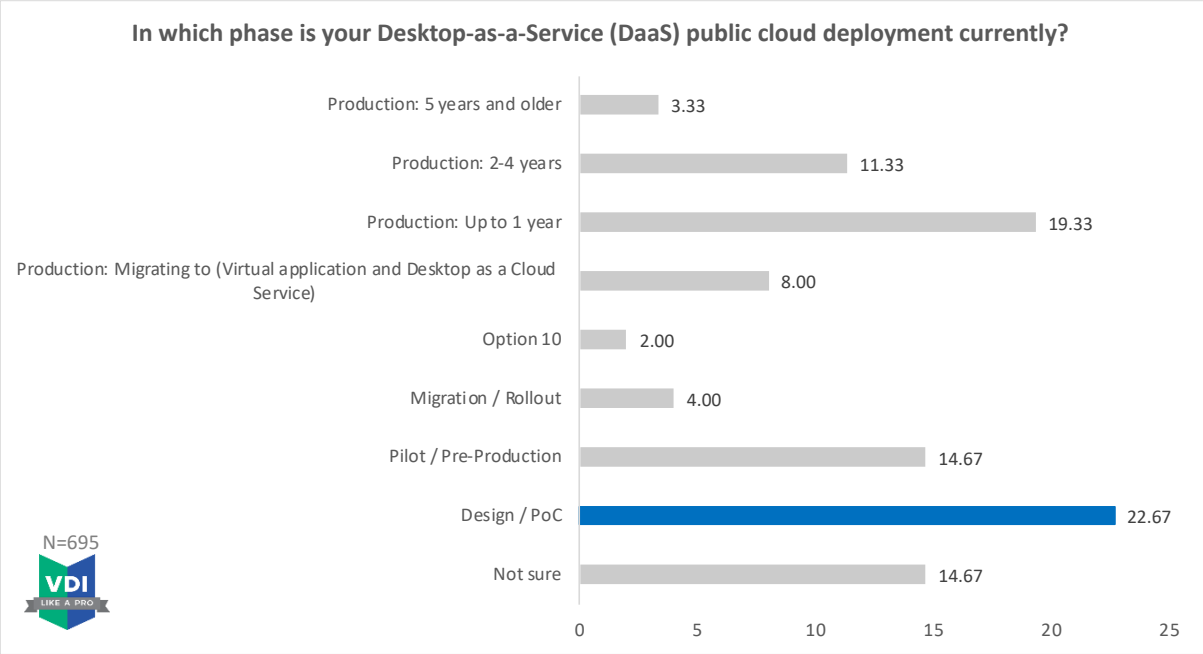
The four biggest challenges in adopting public cloud for Desktop as a Service (DaaS) are cost/positive business case (29.89%), Legal and regulation (13.30%), trust (11.21%), and performance (9.57%).



In which phase is your Desktop-as-a-Service (DaaS) public cloud deployment currently?

Desktop as a Service is relatively young solution to deliver virtual desktops and applications compared to traditional on-premises virtual desktops and applications.

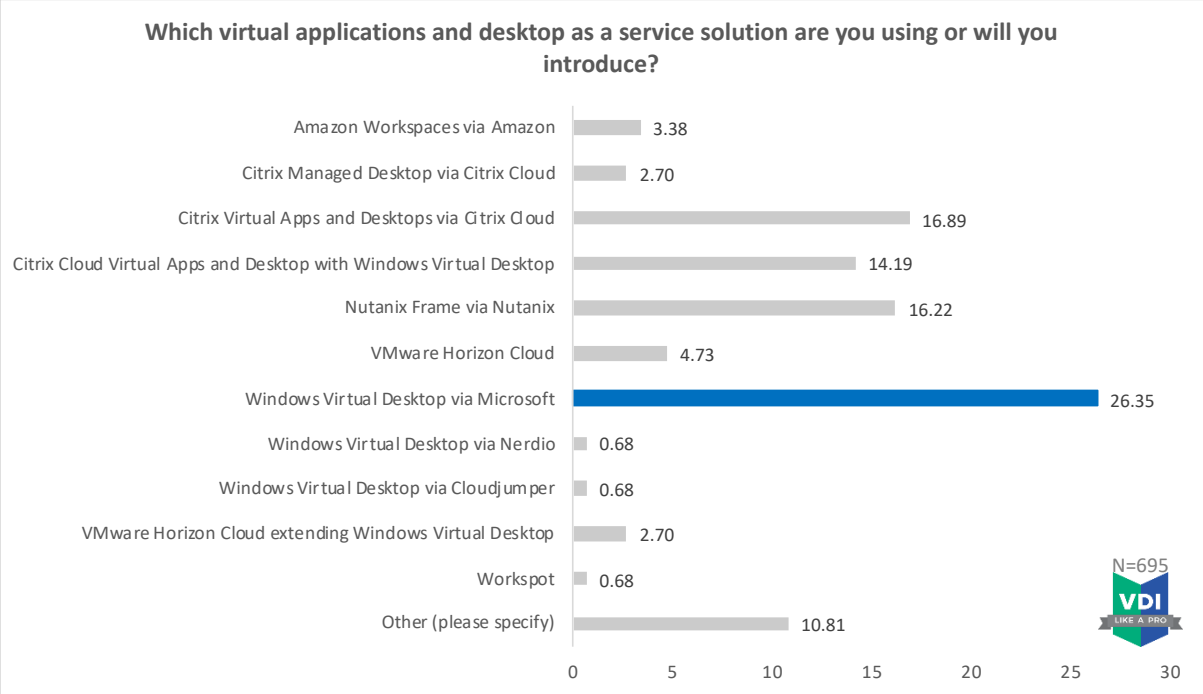
37.34% of the of respondents are designing, running a Proof of Concept, pilot or run their Desktop as a Service solution in pre-production. 19.33% do use the solution in production for 1 year or less. 14.66% of the respondents do use DaaS in production for 2+ years.



Which DaaS solution are you using, or will you introduce?

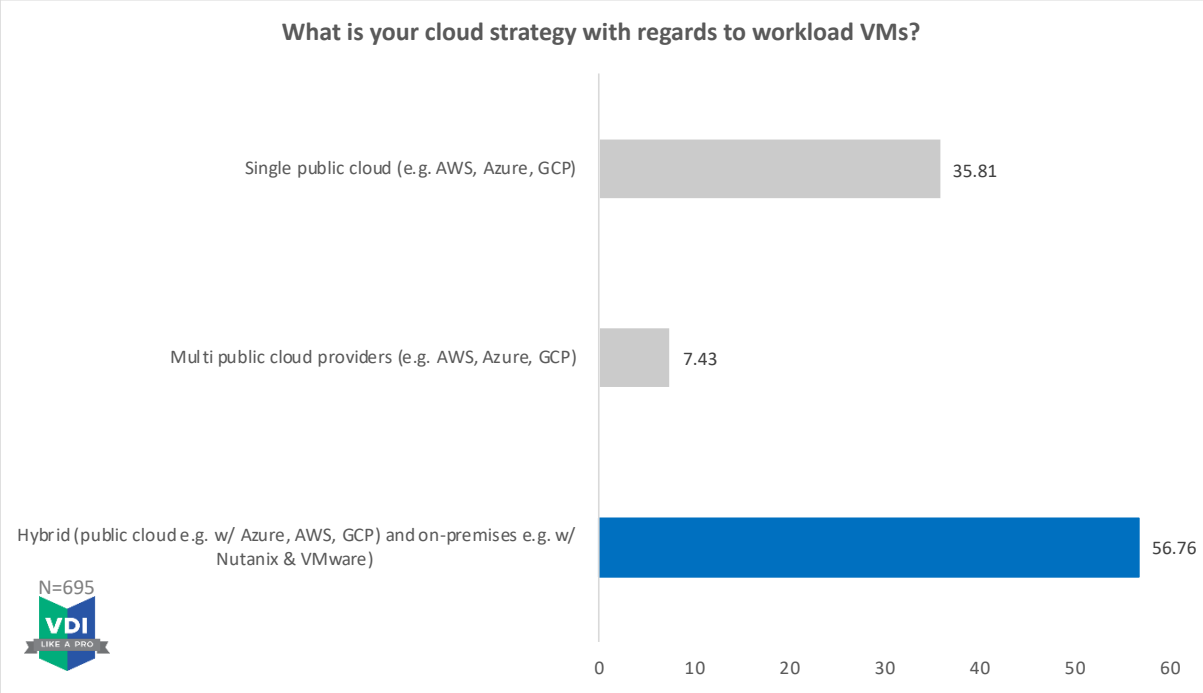
Desktop as a Service provided by Citrix, Microsoft or Nutanix solutions are being considered by 77.71% of the participants. Three different Citrix solutions combined are being used or will be introduces by 33.78%. Microsoft Windows Virtual Desktop (WVD) by 26.35%% and Nutanix Frame is 3rd at 16.22%.

VMware Horizon Cloud solutions are being used or considered by 7.42% and Amazon Workspaces by 3.38% of the respondents.



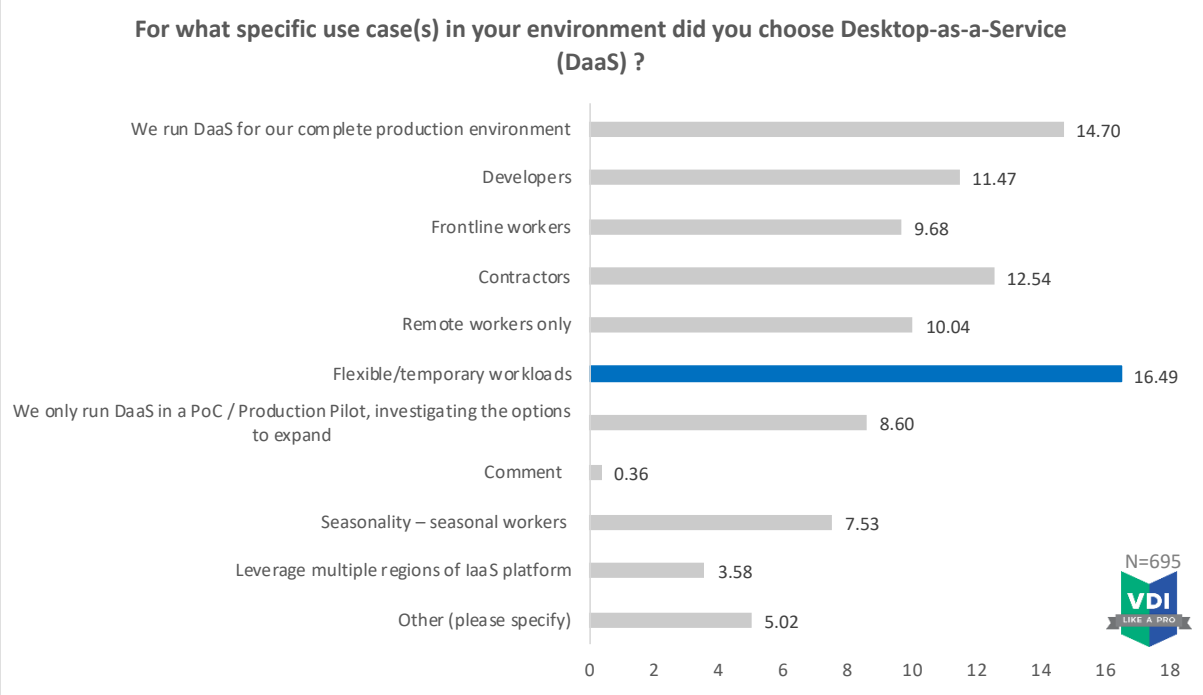
What is your cloud strategy with regards to workload VMs?

The cloud strategy with regards to workload VMs for the majority of respondents is hybrid with 56.76%. A single public cloud strategy is second with 35.81% and multiple public cloud providers as strategy is being used by 7.43% of the respondents.



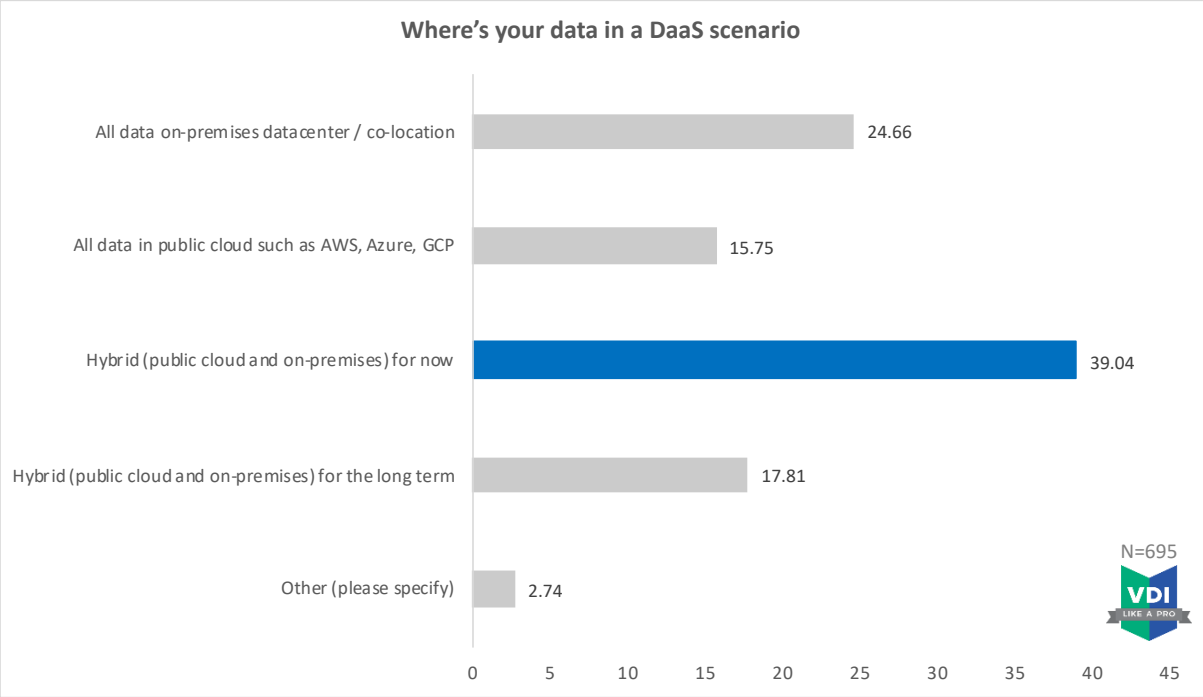
For what specific use case(s) in your environment did you choose Desktop-as-a-Service (DaaS)?

The most important reason to use for Desktop as a Service is the ability to support flexible/temporary workers with 16.49%. The second use-case is ability to run the complete production environment as a service with 14.70% and third is ability to support contractors with 12.54%.



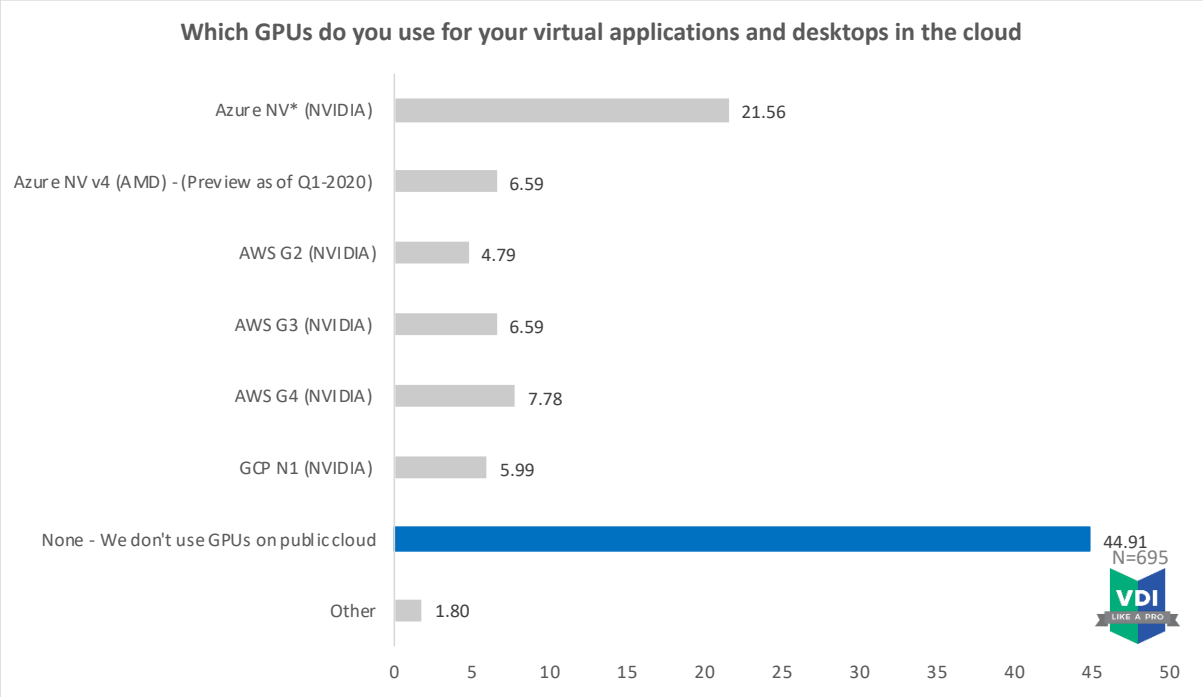
Where's your data in a DaaS scenario?

The majority do have a hybrid data storage Desktop as a Service solution. 56.85% of the respondents do store data local / on-premises and use public cloud resources now or long term. 15.75% of the respondents do store all the data in public clouds(s) while 24.66% do store their data only on-premises.



Which GPUs do you use for your virtual applications and desktops in the cloud?

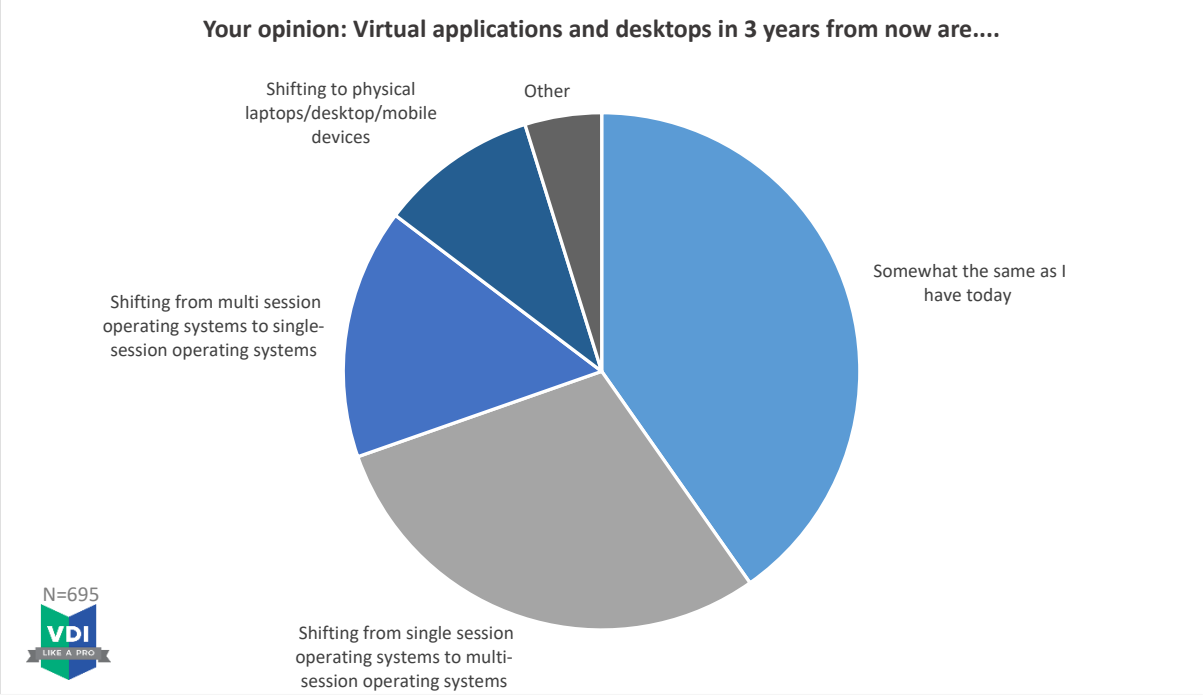
This year for the first time we asked if GPUs are using in public cloud. The majority of virtual desktop and application deployments aren't using GPUs, 44.91% while NVIDIA NV instance types on Azure are using 21.56%. A question we will ask in next year survey is the actual % usage of GPUs in virtual desktops and application deployments.



Workspace initiatives, feedback, comments

Your opinion: Virtual applications and desktops in 3 years from now are:

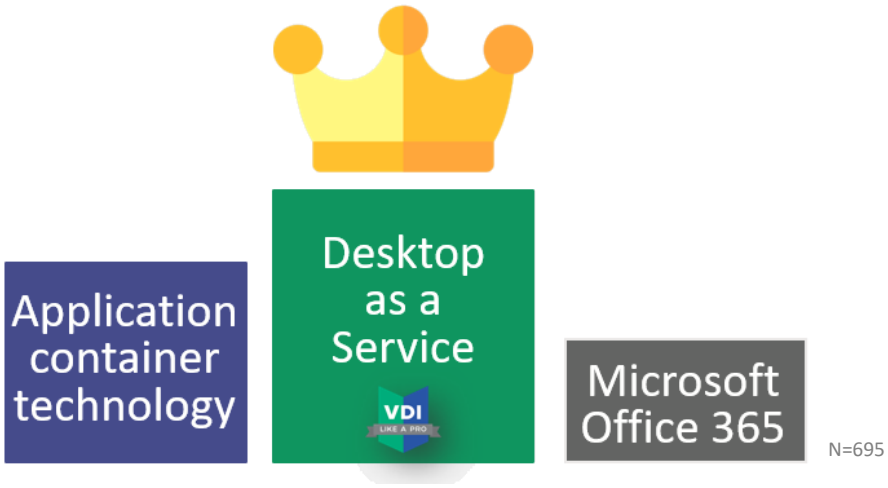
Virtual desktops and applications will be somewhat the same as deployed today said 40.26%, while 9.90% believe it is shifting from virtual desktops and applications to physical PC and mobile. 29.39% believe single-user operating systems being used today will shift to a multi-user operating system while 15.65% believe the use of a multi-user operating system will shift to a single-user operating system.



What is your most important Workspace/EUC initiatives for 2020/2021+?

The Top 3 of most important **Workspace initiatives for 2020/2021 are**:

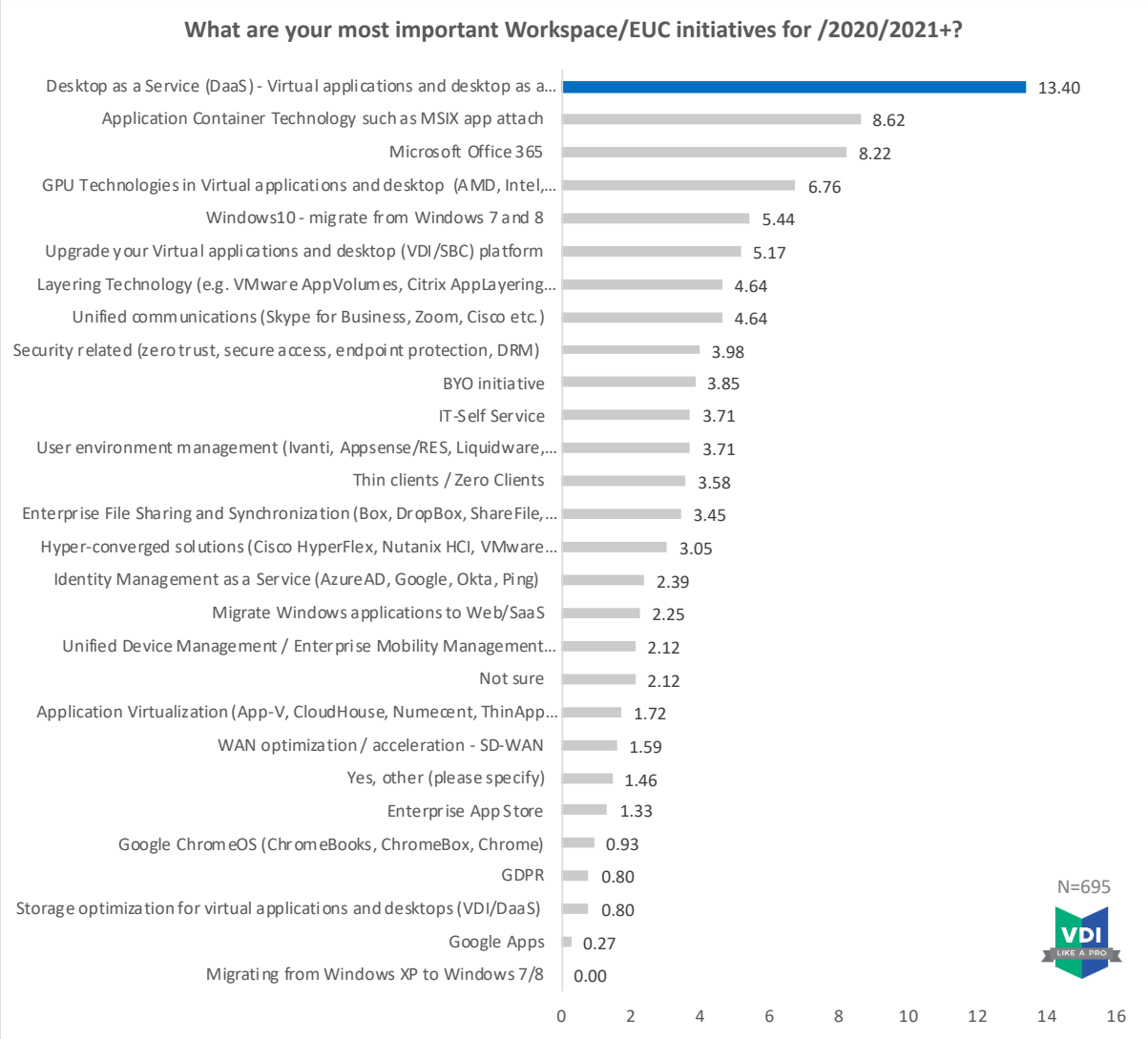
1. Desktop as a Service
2. Application Containers
3. Microsoft Office 365



In interesting change of initiatives **compared to 2019 which** was:

1. Windows 10 – migrate from Windows 7 and 8
2. Microsoft Office 365
3. Desktop as a Service

Clearly the large Windows 7/8 migration to Windows 10 is finished by the majority of respondents and new initiatives such as Desktop as Service and Application containers are on the roadmap for 2020/2021.


What are your most important Workspace/EUC initiatives for /2020/2021+?
Desktop as a Service (DaaS) - Virtual applications and desktop as a... 13.40
Application Container Technology such as MSIX app attach 8.62
Microsoft Office 365 8.22
GPU Technologies in Virtual applications and desktop (AMD, Intel,... 6.76
Windows10 - migrate from Windows 7 and 8 5.44
Upgrade your Virtual applications and desktop (VDI/SBC) platform 5.17
Layering Technology (e.g. VMware AppVolumes, Citrix AppLayering... 4.64
Unified communications (Skype for Business, Zoom, Cisco etc.) 4.64
Security related (zero trust, secure access, endpoint protection, DRM) 3.98
BYO initiative 3.85
IT-Self Service 3.71
User environment management (Ivanti, Appsense/RES, Liquidware,... 3.71
Thin clients / Zero Clients 3.58
Enterprise File Sharing and Synchronization (Box, DropBox, ShareFile,... 3.45
Hyper-converged solutions (Cisco HyperFlex, Nutanix HCI, VMware... 3.05
Identity Management as a Service (AzureAD, Google, Okta, Ping) 2.39
Migrate Windows applications to Web/SaaS 2.25
Unified Device Management / Enterprise Mobility Management... 2.12
Not sure 2.12
Application Virtualization (App-V, CloudHouse, Numecent, ThinApp... 1.72
WAN optimization / acceleration - SD-WAN 1.59
Yes, other (please specify) 1.46
Enterprise App Store 1.33
Google ChromeOS (ChromeBooks, ChromeBox, Chrome) 0.93
GDPR 0.80
Storage optimization for virtual applications and desktops (VDI/DaaS) 0.80
Google Apps 0.27
Migrating from Windows XP to Windows 7/8 0.00
0 2 4 6 8 10 12 14 16
N=695

What keeps you awake at night – IT related –

During this year's survey we asked the people what keeps you awake at night. The following - (unfiltered) – responses came in return. Have fun reading!

- Users doing dumb things.
- User adoption, Security (ransomware).
- All those new stuffs that is spread nowadays. Especially WVD is interesting me and I am very enthusiastic about it!
- Lack of adequate testing/pilot/pre-production environment to pilot changes at a large scale. Currently due to lack of management support, testing is very localized and not thorough. This leads to changes being deployed with minimal testing. When things go wrong it is the engineer (myself) left to clean up the mess.
- Nothing related to Citrix, thankfully.
- Zero day leaks
- Ransomware, speed of changing technologies with almost too many choices. Challenging established IT dogma with a reluctance to embrace new technology and working patterns.
- Sadly, my organization has decided to move away from thin clients, evidently due to management complexity and diminishing cost effectiveness. I just left at the end of the calendar year 2019 and took early retirement. These responses are based on the status as I knew it and my best guesses as to what will happen in the future. Committing adequate resource for equipment upgrades and a very limited training budget let alone time allocated to allow investigating and learning new technologies has been a concern for some time now, as well as pushes into the cloud w/o adequate estimates of what the real costs will be.
- data security
- don't know, I sleep
- Twitter
- There is no Citrix Cloud solution for air-gapped clouds. We need a Citrix Cloud Stack.
- A lot of different upcoming technologies to take care of. To know something about everything somehow.
- Speed of innovation, release cycle
- Top down management decisions
- Speed of innovation
- Security and Regulations
- speed of innovation, respond to market changes, external factors
- digital sovereignty
- I drink bourbon, so I sleep ok.
- Ransomware and lack of physical resources. Too many technologies to manage, patching and updating is becoming a much larger job. Hoping some SaaS product might help reduce that load in future.
- Ransomware and lack of IT direction from above...which allows for great freedom in projects I work on.
- Kids
- Too many projects in flight
- security holes
- Simply not enough time in the day to do everything we want and need to do while still having a family life and personal life!
- Finishing one of my wordpress blog post drafts which has been there for a while :-)
- Ransomware, Backups

- Old but critical apps!
- Complexity of management; Office 365 activation issues
- data security..... UX speed of innovation
- Zero day leaks and future of Citrix
- Ransomware, CPU-performance of current Intel Generation, flaws in the total technology stack because most of the times one vendor causes issues with firmware/drivers
- Speed of innovation and ransomware
- Ransomware, Improved Desktop User Experience (Getting Desktops Even Faster for Users), Better Horizon Specific Monitoring and Performance Tools.
- Twitter, Slack and Co. to interact with the community :)
- User experience
- "Security monitoring, protecting our systems is our priority but monitoring for changes (I.E SIEM technology) is something we aren't doing enough of.
- Rate of innovation and change vs ability/desire to adopt ... risk of being left behind/increase in technical debt
- Ransomware, ageing infrastructure platforms
- Lack of understanding on how Citrix truly works by security and network teams
- Ways to improve end users experience, more efficient ways to handle things, and security.
- Software bugs and bad vendor support
- All of the above. Legacy AF storage as a single point of failure since while it is generally very good, when it gets overloaded all sessions experience poor performance.
- Lack of security and network segmentation
- Ransomware, Disaster Recovery, the constant, rapid implementation cycles, The need to keep many systems updated simultaneously.
- Upgrade obsolete platforms
- sorry, I am sleeping well and deep
- Nothing, I sleep good
- Keeping up with security.
- Exploits like the Citrix ADC one announced in December 2019. Internet exploitable attack vectors that go from announcement to being used widely in under 30 days.
- Ransomware attack and data leak
- Performance, and workstation progression.
- Complexity and pricing of Citrix licensing. Defining a multi-region cloud image and apps provisioning.
- DR strategy | Ransomware
- Inertia of corporate IT
- Zero-day leaks, user unawareness, users avoiding guidelines, shadow it
- Image Versioning and customization
- Work from Anywhere given the COVID current events
- Ransomware
- Customers who struggle to release themselves from the old thinking of 'maintaining' the same version and same methods of delivery for years.
- Vulnerabilities like the NetScaler/ADC end 2019/beginning 2020
- Keeping the software up to date, find a state of versions without bugs ;-)
- Virus
- Cloud Services that promise the world and delivers nothing
- "tight timelines

- security leaks"
- users
- nothing. I stopped caring a while ago
- Users being tricked by phishing
- Patch management, VDI stability, amount of time taken on information security work as an infrastructure manager
- No major worries.
- Organizational obstacles (silos)
- Ransomware, Availability, legacy apps
- Time it will take us to get to our Next Gen VDI platform. Windows 10 upgrade.
- Lack of data security, the complete incompetence of IT managers and the incredibly wrong migration to Office 365. 2020 will be the year of (remote working) data leaks.
- Training users how to get the most out of Xi-Frame
- Data security and keeping patches up to date.
- Coffee
- User Experience for more sophisticated workloads, Win10 GPU Utilization is all over the place from build to build, Security, Agility, Flexibility.
- Zero Day :)
- Lack of innovation on all cloud vendors, all just trying to keep up with each other vs. innovate
- Security Risk Blame Game
- Motivate team to go to the cloud
- I sleep like a baby
- Ransomware / data security
- Speed of innovation
- Outsourcer has left us with manually configured and maintained, out of support, obsolete platform
- Keeping up with all the technologies
- Zero-day leaks and the speed to implement these.
- Ransomware, data security
- Legacy applications. The workspace is all about the application. If that application requires an old operating system/software than that is what you have to work with. When users want a specific application, the customer (sadly) isn't to keen on telling them no (which sometimes you absolutely need to do).
- Bullshit Bingo from vendors which is it related ;-)
- geoscaling
- Vendor support cases - you are not really sure if they are trying to help you or just cover their asses. Apart from that unknown vulnerabilities being exploited without our knowledge (CVE-2019-19781 was an eye-opener).
- Deadlines set by management
- Ransomware, DR.
- Vulnerabilities
- Patching
- With covid19, how to 3x environment in weeks
- security issues
- Compliance challenges
- printing issues, storage concerns,

- Data security, ransomware and end point management
- Just trying to stay up to date with all the changes that are coming from so many directions.
- The quirks of PowerShell across different versions and OS versions.
- Pandemics!
- Cloud service availability
- Availability of Cloud resources, considering on-premises resources as well
- Costs
- Data security and user environment performances.
- Public cloud resource availability
- COVID-19 and social & economic impact for the future
- Microsoft Licensing in a none Microsoft world (Google Apps, GCP (Win10/Office)
- Insufficient situational awareness, too many issues/projects/tasks to take care of
- Customers dealing with coronavirus without a clear cloud Strategy
- Windows image stability and GPOs. No real DR solution
- Knowledge within the company
- Definitely Speed of Innovation
- The complexity increase and quality issues of the various vendor technologies and the overall performance (caused by our security needs and quality issues of vendor technologies)
- Speed of innovation definitely goes so fast, it is sometimes difficult to keep up. Team members who work with theories developed several years ago and do not refresh their knowledge as often as they should.
- User Education; awareness initiatives; as users continue to provide the brightest light and darkest chasm to security in almost equal measure.
- I sleep like a baby! I let someone else manage the VDI side and I manage the Thin client side with IGEL.
- Due to COVID-19 a lot off workers shifted from working from an office to home. Is my data safe, where does my companies IP is saved, how do we stay in control of performance and security without decreasing experience?
- Data security, costs.
- IT departments cannot keep up with the speed; complete vendor lock-in in case of cloud only.
- Innovation
- System availability
- Zero days and compliance
- How to keep control over data: so many online collaboration environments and so many different parties to collaborate with.... where is all sensitive data and how do you make sure it's secure?
- How to reduce Complexity and lower time to market and still maintaining available.
- Keep up with knowledge with this rapid development
- It's hard to keep up with the speed of innovation
- technical debt, fighting for budget
- Data Security, app compatibility, user profile issues, VDIs not reachable, Latency, MS OS and apps issues. list goes on.
- speed of innovation and support from business for innovation.

- Perception that DAAS is moving away from a VDI type solution and to a physical desktop as a service model, due to the perceived complexity associated with VDI. I have seen many companies discussing and planning to move to this model.
- Performance, ransomware
- FSLogix Cloud Cache Deadlocks
- Legacy Win32 apps on Server 2016/2019 (MS Dynamics AX32)
- Software without a silent switch
- Citrix support cases"
- Nothing
- Speed of innovation and security
- Slow or Chaotic Management (political not technically)
- Ransomware
- Which way to go/focus on compared to my age and future interest in IT.
- Focus onprem, focus Azure, EUC or IT processes/consulting not sure if I want to stay on the edge with technique when I reach 60 :-)"
- UX. Downtime.
- High cost of IT
- Data security, disaster recovery and ransomware
- Not be able to scale out quickly enough with on-premises and the cost of cloud compared to on-prem is still more (though coming down)
- IP SEC
- My baby
- managing IT systems and VDI complexity - keeping stuff from breaking given all the updates/patches/changes we are forced to implement

Final comments from respondents

Finally comments respondents shared with Christiaan, Mark and Ruben; Not curated – unfiltered insights.

- Keep up the good work!
- Thanks for putting this together!
- Please note that AppSense is now called Ivanti UWM.
- "Can't wait to see the results at the E2EVC!
- Thanks for the survey guys! Well done."
- Keep up the good work guys and see you on any of the next EUC events after corona is gone
- This was a really great survey! Looking forward to the results.
- Maybe adding a part for people restricted to on premise solution. Like bank for example.
- "Automation! I mean what about automating stuff, on prem or in cloud. It forces us to work consistent, standardize.
- Just scripted complete CVAD environment and W10 Virtual Desktop for large part with help of (EUC) community resources, blogs etc. This can also be a large cut on cost and takes (for a large part) care of Disaster Recovery, standardization, documentation etc."

We would like to thank you for participating, sharing and donating your valuable time to the community, hope to see you back next year!

Christiaan, Mark and Ruben