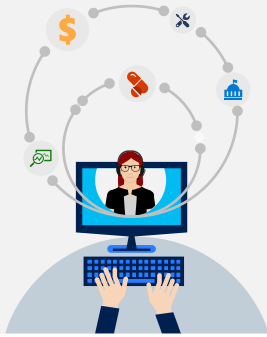**Microsoft**

Windows Virtual Desktop

Customer Presentation

Fall 2019

Virtualization can address a broad range of business needs

Security and regulation

Financial Services

Healthcare

Government
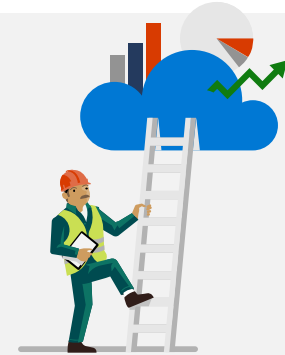
Flexible workforce

Mergers and acquisition

Short term employees

Contractor and partner access

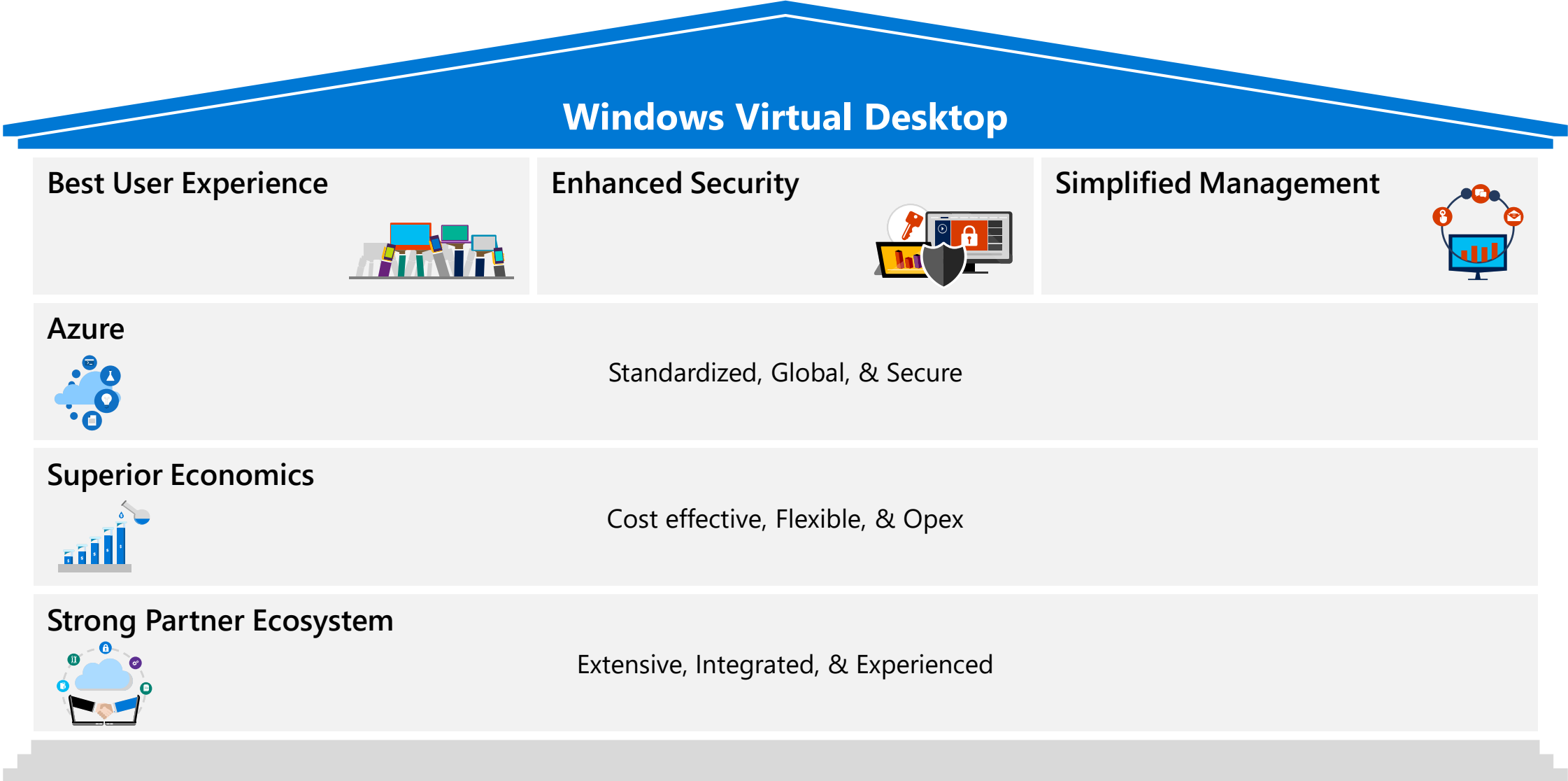BYOD and mobile

Call centers

Branch workers

Specialized workloads
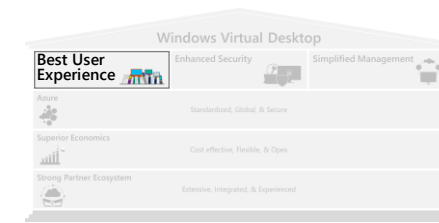
Design and engineering

Legacy apps

Software dev test

WVD is Microsoft's virtualization service and delivers compelling value

Windows Virtual Desktop

Best User Experience

Enhanced Security

Simplified Management

Azure

Standardized, Global, & Secure

Superior Economics

Cost effective, Flexible, & Opex

Strong Partner Ecosystem

Extensive, Integrated, & Experienced

Best Virtualized End-user Experience

Windows Virtual Desktop

Best User Experience

Enhanced Security   Simplified Management

Azure

Standardized, Global & Secure

Superior Economics

Cost effective, flexible, & Open

Strong Partner Ecosystem

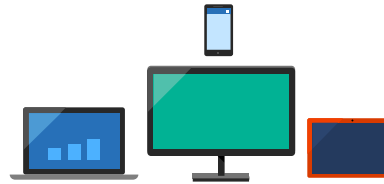Extensible, Integrated, & Experienced

Platform of your choice

- Connect from any device of your choice (Windows, MacOS / iOS, HTML5, Android, Linux*)

* Coming soon

Windows differentiation

- Like-local Windows experience
- Extensive support for devices

Enhanced protocol

- Support for Windows Hello for Business
- Dynamically adapting bandwidth utilization

Containerized User Profiles

- Containerized User Profiles (FSLogix) with fast VHD load times

Native O365 performance

- Uncompromised O365 email and calendar performance, Real-time Outlook search
- Persistent and non persistent environments

Teams Enhancements

- Best conferencing and media experience
- Multimedia redirection capability, high-performance, low latency audio & video calling

Office 365 ProPlus also supported on Windows Server 2019 (with OneDrive Files-on-Demand capabilities)

Enhanced Security with Simplified Configuration

Windows Virtual Desktop
Best User Experience
Enhanced
Security
Simplified Management
Azure
Standardized, Global, & Secure
Superior Economics
Cost effective, flexible, & Open
Strong Partner Ecosystem
Extensive, Integrated, & Experienced

| Azure AD **Security** Services	Reduced **Attack** Surface	Granular **Access** Control	Isolated **User** Sessions
Sophisticated security services easily configured through Azure AD (e.g. MFA, CA, etc.)	Reverse connect technology eliminates the need to open inbound ports to the VMs	Multiple admins can be assigned role-based access control	Isolated user sessions in both single and multi-session environments

Efficient and Simplified Management
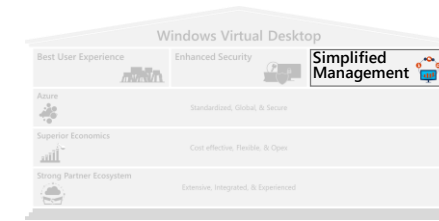
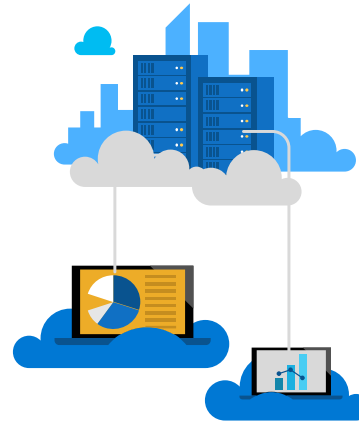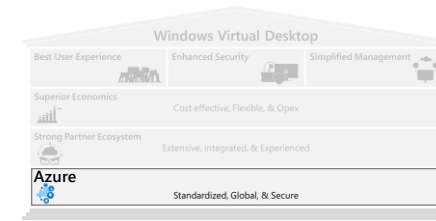| User Experience Management	VM Management	WVD Service Management
• One service supports <u>both</u> Desktop & RemoteApp experience • Flexible user experience through a <u>single host pool,</u> with multiple app groups • Familiar Azure AD credentials, to access WVD resources	• Multiple tools for automated VM deployment • Enhanced OS/App update tools • Disaster Recovery with integrated Azure Site Recovery	• Simplified and effective troubleshooting using advanced diagnostic service • 3rd party value-added services enabled by APIs

Built on Azure: Standardized, Global, and Secure Cloud

Windows Virtual Desktop

Best User Experience | Enhanced Security | Simplified Management

Superior Economics | Cost effective, Flexible, & Opex

Strong Partner Ecosystem | Extensive, Integrated, & Experienced

Azure
Standardized, Global, & Secure

Standardized

Consistent infrastructure across regions

IaaS

Compute

Storage

Networking

PaaS

Uniform deployment via serverless architecture

Serverless Platform

Containers

Microservices

Integration services

Purpose-built, **standardized infrastructure** across geos
Modernized workloads for **simplified deployment**

Global

Largest geographical footprint of any cloud provider with more than **54 Azure regions**
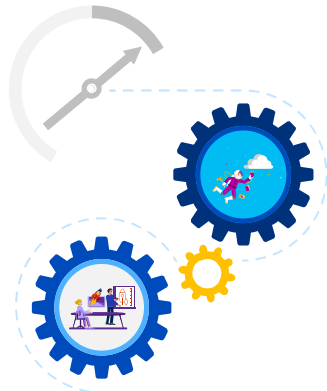
Secure

Microsoft Cyber Defense Operations Center

>3,500 full-time security professionals

6.5 trillion global signals daily

$1 billion annual cybersecurity investment

Superior Economics from Significant Cost Savings
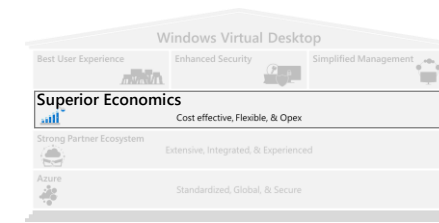
Infrastructure

~70%* Savings

- Windows 10 experience at multi-session cost
- Cost effective compute and storage
- Flexible network provisioning
- Best value compute rate
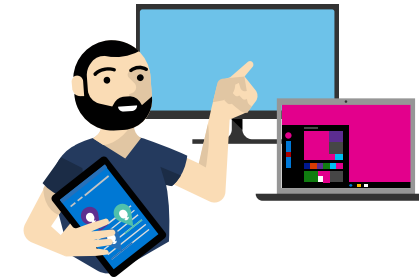- Opex spend aligned to business usage

Licensing

~60%* Savings

- WVD management service included with the licenses you already own
- Savings on RDS CAL with multi-session deployment
- 3-year Windows 7 ESU included

Labor

~60%** Savings

- Lower labor cost because compute and storage move to cloud
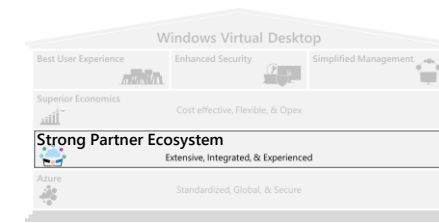- Lower labor cost when you use PaaS services

Note: Infrastructure includes compute, storage (IaaS/PaaS), and networking
*See Example Scenario: WVD Economic Benefits
** industry analysis

Extensive Partner Ecosystem with Strong Virtual Desktop Expertise

Windows Virtual Desktop
Best User Experience · Enhanced Security · Simplified Management
Superior Economics · Cost effective, Flexible, & Opex
Strong Partner Ecosystem
Extensive, Integrated, & Experienced
Azure · Standardized, Global, & Secure

WVD Approved Providers	WVD Value-Added Partners
CITRIX® **vmware**®	**Cloud Jumper** **Lakeside**® **people✕TECH** **liquidware**™ **ThinPrint** **nerdio**

- Citrix and VMware provide value add to WVD (e.g. hybrid deployment management)
- Windows 10 Enterprise multi-session is also available with Citrix & VMware management planes
- Customer ultimately decides the management plane(s) of choice

- WVD customers have access to a broad SW/Services partner network with expertise in
  - Customer Environment Assessment
  - Diagnostics & End User Experience Monitoring
  - Application Layering
  - Management
  - Printing
  - App Compatibility Assessment / Remediation

Detail on WVD value drivers follows ("double-click")

Windows Virtual Desktop

Best User Experience
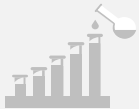
Enhanced Security

Simplified Management

Azure

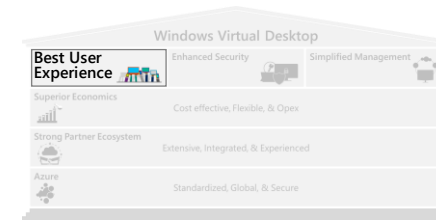Standardized, Global, & Secure

Superior Economics

Cost effective, Flexible, & Opex

Strong Partner Ecosystem

Extensive, Integrated, & Experienced

Best Virtualized End-user Experience

Platform of choice

WVD allows users to connect from any device of their choice

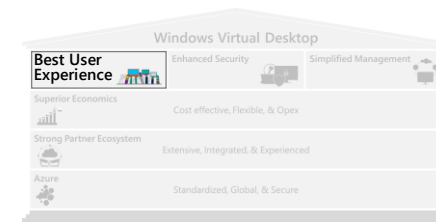| User Experience Benefits |
|---|
| *Local and remote UI is optimized for the various form factors across all supported platforms: Windows, macOS, iOS, HTML5, and Android* |
| *Linux SDK* will enable partners to build their own high performance WVD clients for their Linux endpoints* |
| *Performance of clients built on Linux SDK is at parity with other non-Windows clients* |
| *Windows experience is indistinguishable from native* |
| *MacOS client provides integrated RemoteApp experience* |
| *iOS, Android, and HTML5 clients provide immersive RemoteApp experience* |

* Coming soon

Differentiated Windows Experience

Windows devices deliver the best WVD experience for end users

User Experience Benefits

Like-local Windows experience (integrated Start Menu, task bar, action center, App Switcher)

Extensive support for devices
Multiple monitor support (max 16 monitors with up to 8k x 8k resolution each)

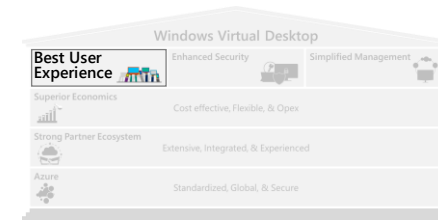*RemoteApp indistinguishable from local apps*

Integration with accessibility tools (e.g. Jaws)

Support for 3rd party extensions

Enhanced WVD / remote desktop protocol

RDP enhancements deliver the optimized WVD experience for end users

User Experience Benefits

Support for Windows Hello for Business and smartcard authentication

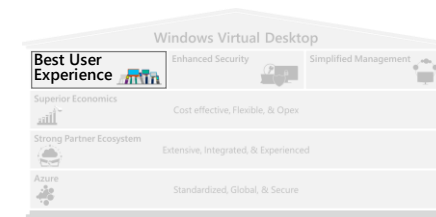*Dynamically adapting bandwidth utilization*

Devices and resources redirection (camera, printers, multi-touch, pen, time zone, clipboard)

Dynamic resolution and scaling

Better user experience with graphics optimized with mixed-mode encoding (clear text code for text and H.264 for video)

Containerized user profiles enable fast VHD load times

End users receive seamless O365 experience

WVD

Containerized profiles

User profiles

Placed into a VHD container that is stored on Azure
- Dynamically attached at user logon
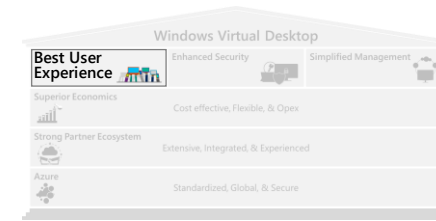- Content appears to be in its native location

User Experience Benefits

Achieves extremely fast logon times

Uses native Windows VHD capabilities – no hypervisor

Outlook Enhancements, OneDrive & Desktop Search Improvements

End users get native O365 performance and behavior in both non-persistent and persistent virtual environments

WVD

Deploy Cached Exchange Mode in virtual environments

Cached Mode improvements
- ✓ Syncing of Inbox prior to Calendar for faster startup experience
- ✓ Admin option to reduce calendar sync window
- ✓ Reduce the number of folders that are synced by default*

Windows Desktop Search index is now per-user and can be persisted with the user profile

Reliable OneDrive syncing in non-persistent environments

OneDrive Files-on-Demand capabilities

* Coming soon

User Experience Benefits
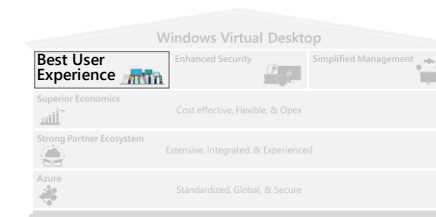
Uncompromised O365 email and calendar performance

Real-time Outlook search

Speedy, persistent, per-user Windows Desktop search

Seamless O365 co-authoring and collaboration in non-persistent environments
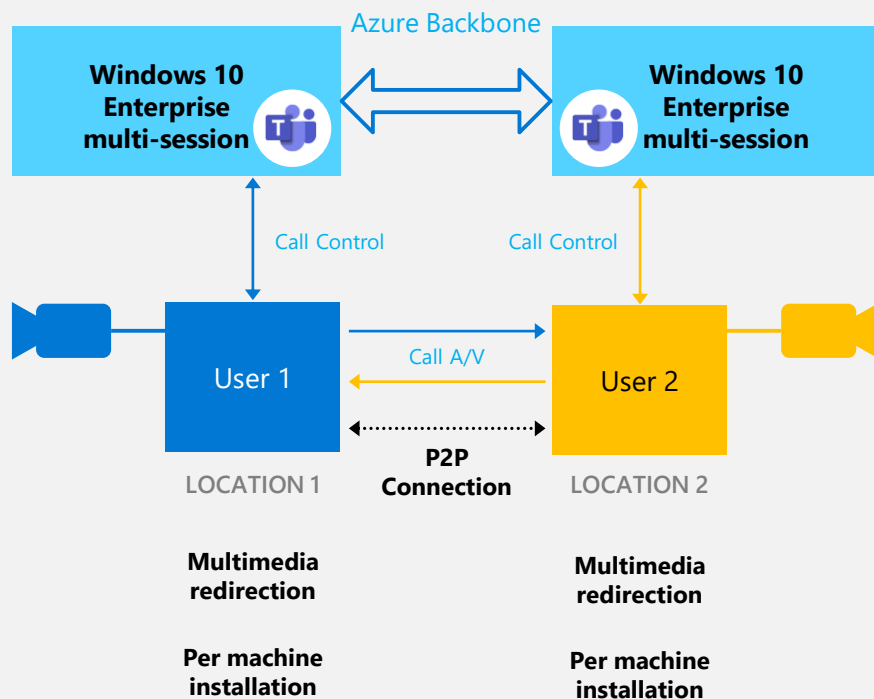
Teams Enhancements (Coming soon)

Teams provides end users with better conferencing and media experience

Teams on WVD – With Enhancement

Azure Backbone

Windows 10 Enterprise multi-session ⟷ **Windows 10 Enterprise multi-session**

Call Control   Call Control

User 1   User 2

Call A/V

P2P Connection

LOCATION 1   LOCATION 2

Multimedia redirection   **Multimedia redirection**

Per machine installation   **Per machine installation**

User Experience Benefits

Less network bandwidth compared to USB camera redirection

Increased video framerates, up to 30 fps

Enhanced UI for ease of use in virtualized environments

Ability to redirect multiple cameras

High-performance, low latency audio & video calling

Windows Virtual Desktop

Best User Experience

Enhanced Security

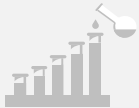Simplified Management

Azure

Standardized, Global, & Secure
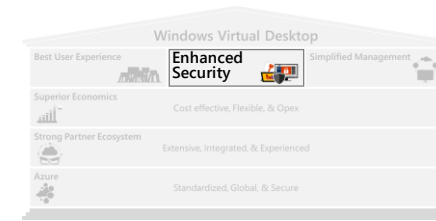
Superior Economics

Cost effective, Flexible, & Opex

Strong Partner Ecosystem

Extensive, Integrated, & Experienced

Azure AD security services are readily available

Customer Scenario – Moving from on-prem virtualization to WVD

- WVD customers can readily utilize sophisticated Azure AD security services via built-in integration

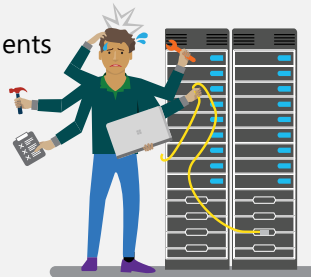| On-prem Virtualization	WVD	Security Benefit
Security Services Manually Deployed by IT	**Azure AD Security Services Easily Configured by IT**	
? MFA Conditional Access Intelligent Security Graph	Menu	
Install NPS extension	✅ MFA	*Enhanced security capabilities, already built in*
Configure NPS components on RD Gateway	✅ Conditional Access	
Configure NPS extension	✅ Intelligent Security Graph	
Verify and troubleshoot	✅ ...	

Note: with WVD on Azure AD, admin can set up Conditional Access (CA) controls once and then easily expand that CA to other applications
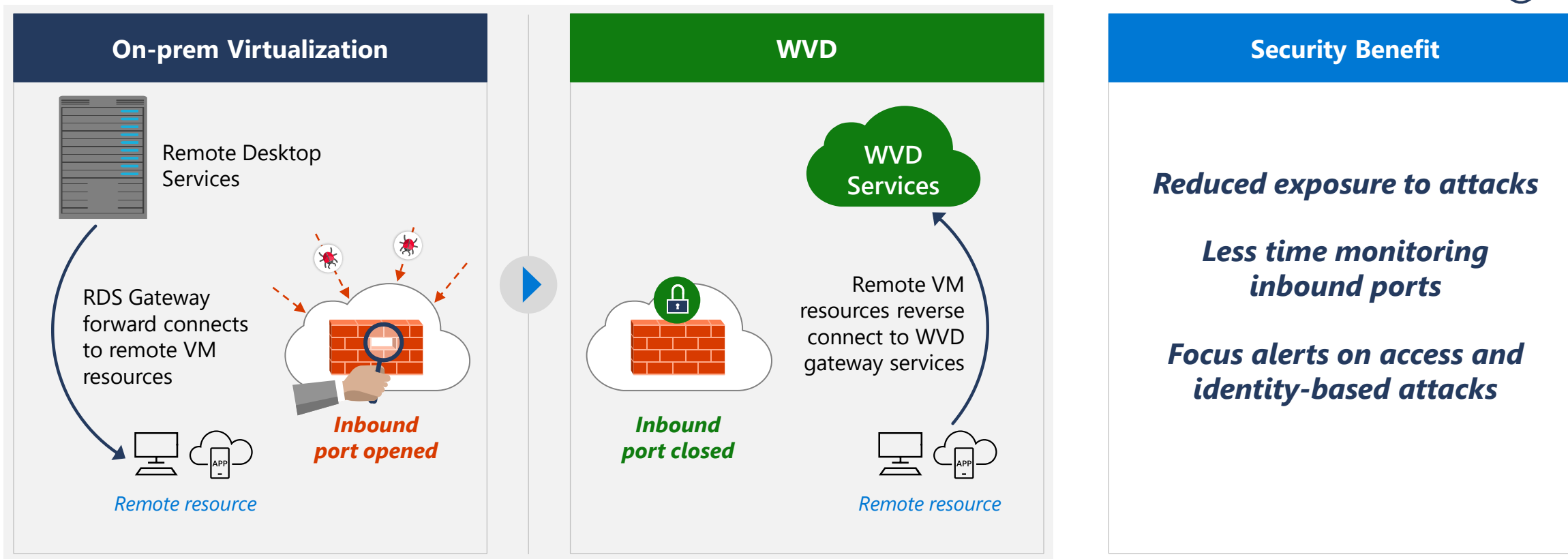
Enhanced Security with Simplified Configuration
The attack surface is reduced, compared to on-prem

Customer Scenario – Moving from on-prem virtualization to WVD

- Reverse connect eliminates the need to open inbound ports, reducing the attack surface

On-prem Virtualization

Remote Desktop Services

RDS Gateway forward connects to remote VM resources

Inbound port opened

Remote resource

WVD

WVD Services

Remote VM resources reverse connect to WVD gateway services

Inbound port closed

Remote resource

Security Benefit

Reduced exposure to attacks

Less time monitoring inbound ports

Focus alerts on access and identity-based attacks

Granular access control enables role-based administration
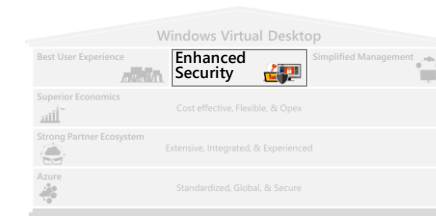
Customer Scenario – Moving from on-prem virtualization to WVD

- WVD role-based access control enables delegation of admin rights at granular level

On-prem Virtualization

Security Admin

Full Admin Rights

Manage whole deployment   Troubleshooting   Manage Apps

Each admin must have full admin rights

WVD

Owner   Operator   Contributor

Manage whole deployment   Troubleshooting   Manage Apps

Each admin can have role-based admin rights

Security Benefit

Granular, role-based access control allows the admin to apply the "principle of least privilege"

Enhanced Security with Simplified Configuration
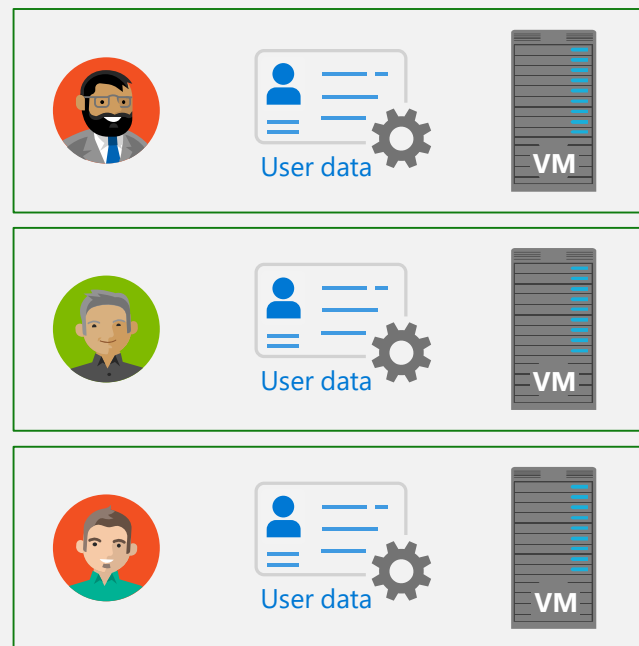
User sessions are isolated

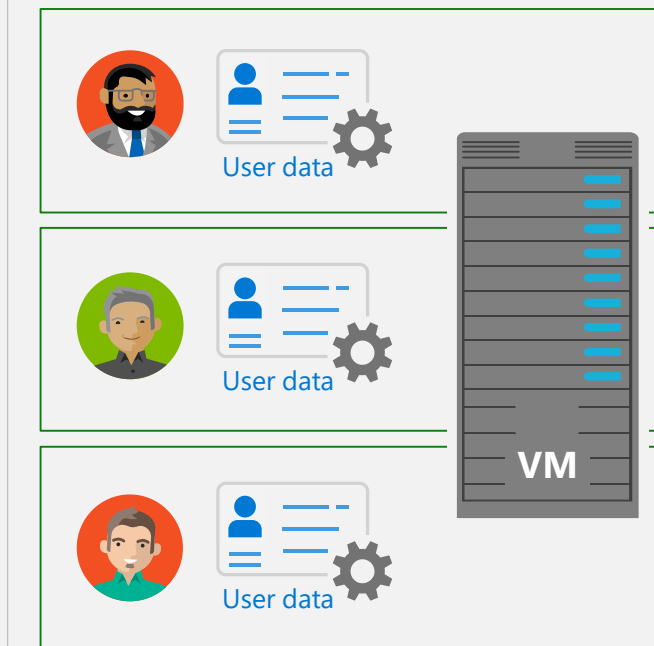**Customer Scenario – Deploys both Windows 10 Enterprise single-session and multi-session in WVD**

- WVD ensures user isolation in both single and multi-session environment

Windows 10 Enterprise Single-session in WVD	Windows 10 Enterprise Multi-session in WVD	Security Benefit

Users are always isolated, whether using single or multi-session

Windows Virtual Desktop

Best User Experience

Enhanced Security

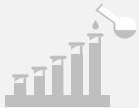## Simplified Management

Azure

Standardized, Global, & Secure

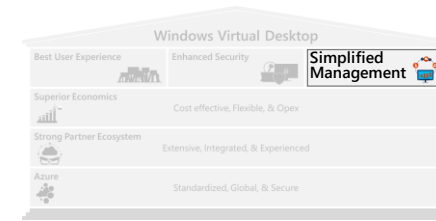## Superior Economics

Cost effective, Flexible, & Opex

Strong Partner Ecosystem

Extensive, Integrated, & Experienced

Efficient and Simplified Management
One service supports both desktop & RemoteApp experience

Customer Scenario – From on-prem virtualization to WVD
- Both desktop and RemoteApp are managed through one WVD service

On-prem Virtualization

Desktop

RemoteApp

VDI deployment

Session host deployment

Admin

Admin has to manage two separate services

WVD

Desktop

RemoteApp

WVD

VDI and session host deployments

Admin

Admin manages one service

Management Benefit

Less labor and time required to manage both VDI and session host deployments
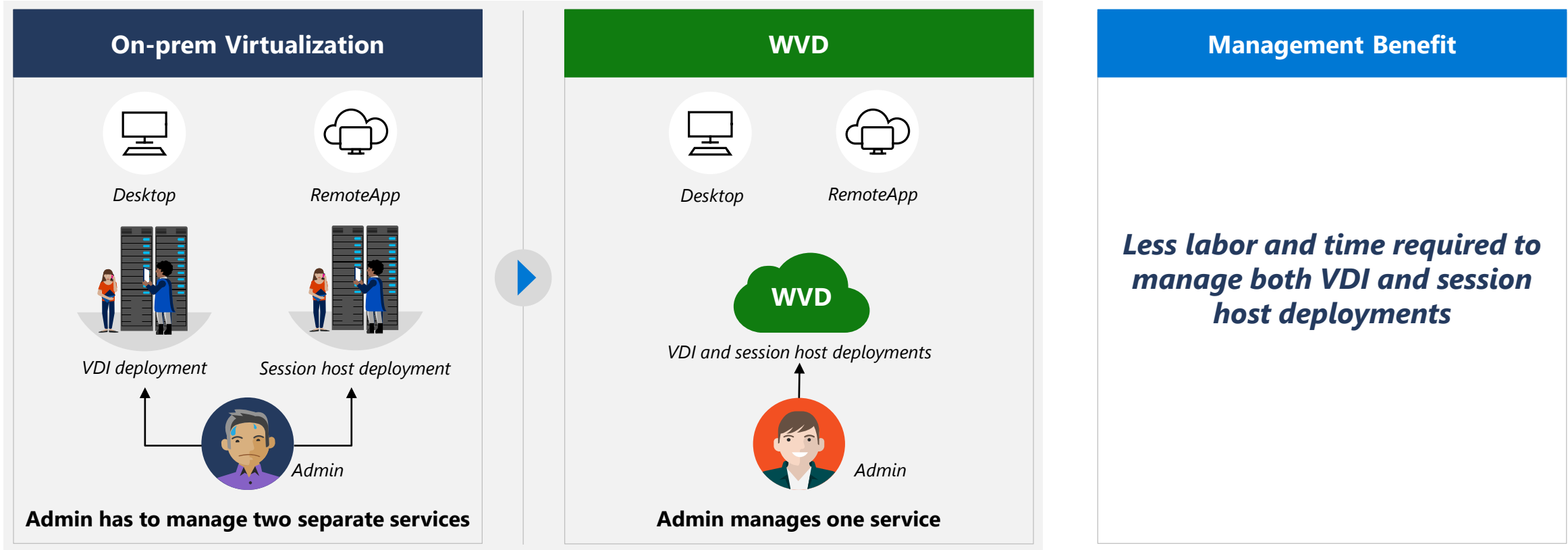
Readily-available VM management tools
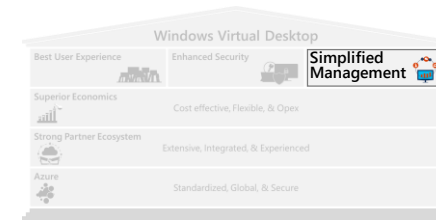
Customer Scenario – From on-prem virtualization to WVD

- WVD customers can leverage a broad set of VM management tools via WVD and Azure

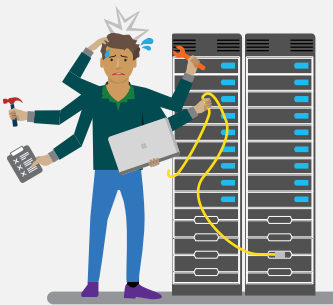| On-prem Virtualization	WVD	Management Benefit
Complicated VM Management Manually Conducted by IT	**Readily-available, Built-in Tools Easily Utilized by IT**	

On-prem Virtualization:
- VM Deployment
- OS and App Management
- DR Setup and Configuration

WVD:
Menu
- ✅ VM Deployment (e.g. Azure Update Management)
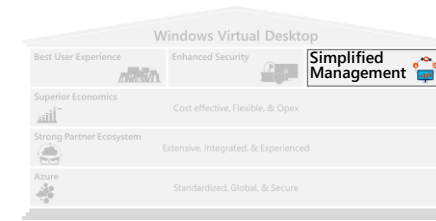- ✅ Multiple OS and App Management tools at choice
- ✅ DR with Azure Site Recovery
- ✅ …

Management Benefit:

Simplified management via versatile tools and automation

Simplified and Efficient Troubleshooting with Diagnostic Service

Customer Scenario – From on-prem virtualization to WVD

- Advanced Diagnostic Service enables WVD customers to identify root cause and fix issues more efficiently

On-prem Virtualization	WVD	Management Benefit
Issue Investigation	Issue Investigation	
Logs dispersed across client, RDS servers & VM	End-to-end diagnostic information provided by WVD service	*Fast root cause identification via advanced diagnostic services*
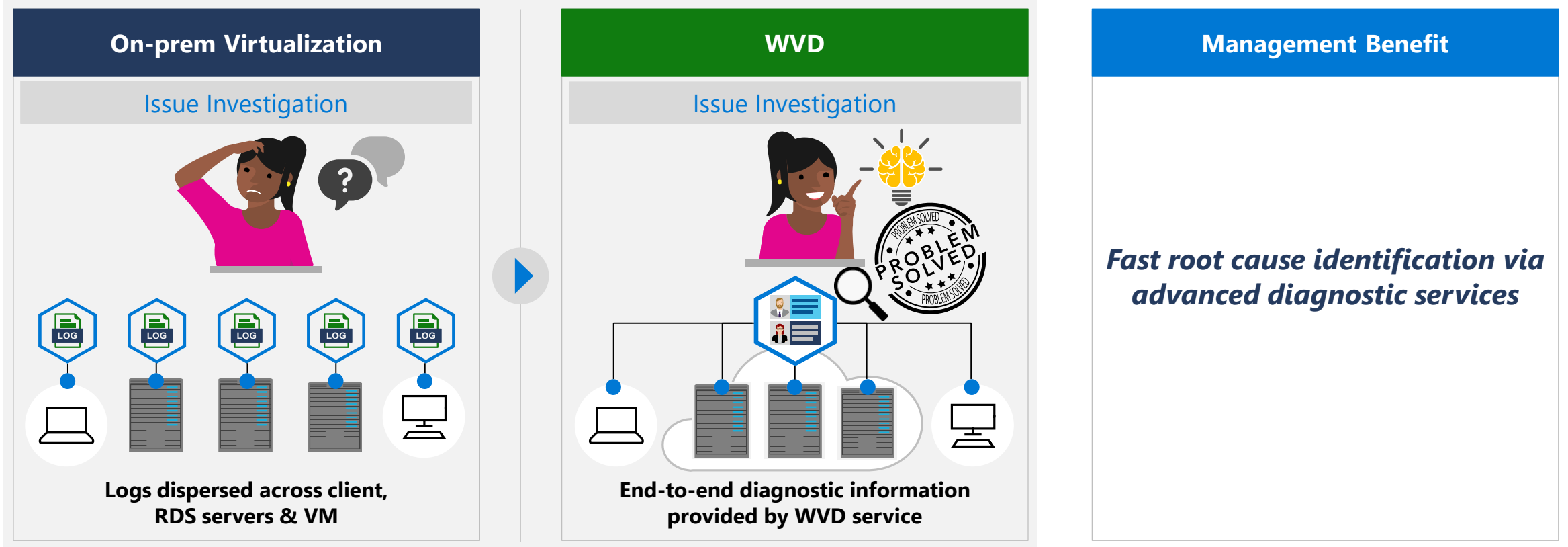
Extensive 3rd Party Value-added Services Enabled by APIs
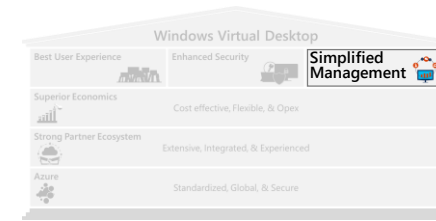
Customer Scenario – From on-prem virtualization to WVD

- WVD customers have access to best-of-breed management solutions, including 3rd party apps
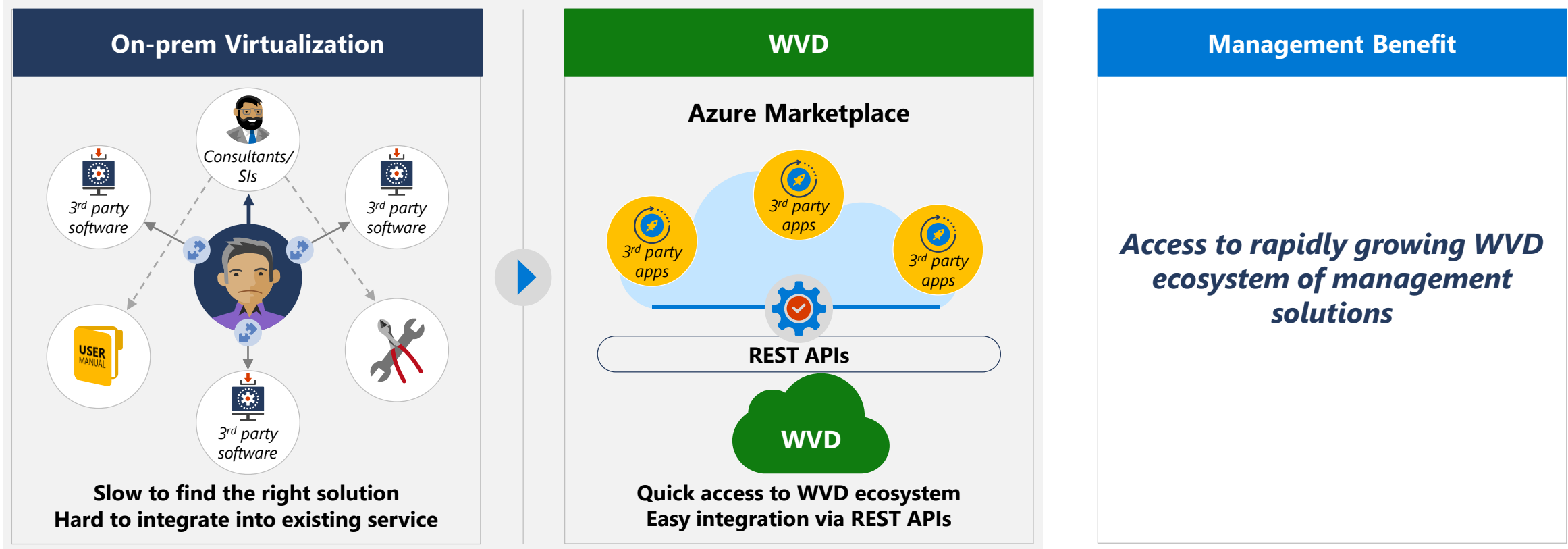

On-prem Virtualization	WVD	Management Benefit

On-prem Virtualization

Consultants/SIs

3rd party software

3rd party software

USER MANUAL

3rd party software

Slow to find the right solution
Hard to integrate into existing service

WVD

Azure Marketplace

3rd party apps

3rd party apps

3rd party apps

REST APIs

WVD

Quick access to WVD ecosystem
Easy integration via REST APIs

Management Benefit

Access to rapidly growing WVD ecosystem of management solutions

Windows Virtual Desktop

Best User Experience

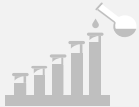**Enhanced Security**

Simplified Management

Azure

Standardized, Global, & Secure

Superior Economics
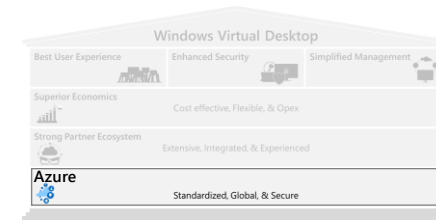
Cost effective, Flexible, & Opex

Strong Partner Ecosystem

Extensive, Integrated, & Experienced

Built on Azure: Standardized, Global, and Secure Cloud

Standardized

Consistent infrastructure across regions

IaaS

Compute

Storage

Networking

PaaS

Partner ecosystem across multiple sites

SI

Infosys · HCL · DXC.technology · wipro · IBM · Cognizant

ISV/IHV

vmware · SAMSUNG · IGEL · Lakeside · liquidware · SAP · CITRIX · NetApp

Purpose-built, standardized infrastructure across geos
300,000+ global partner ecosystem, leveraging consistent standards and IT architectures

Global

Largest geographical footprint of any cloud provider with more than **54 Azure regions**

Secure

Microsoft Cyber Defense Operations Center

>3,500 full-time security professionals

6.5 trillion global signals daily

$1 billion annual cybersecurity investment

Windows Virtual Desktop

Best User Experience

Enhanced Security

Simplified Management

Azure

Standardized, Global, & Secure

Superior Economics
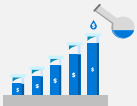
Cost effective, Flexible, & Opex

Strong Partner Ecosystem

Extensive, Integrated, & Experienced

Windows 10 Experience at Multi-session Cost
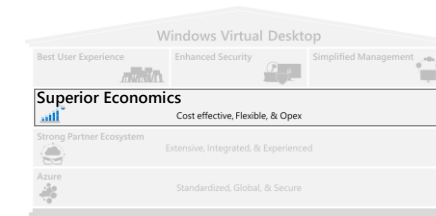
Customer Scenario – From Windows 10 single-session on-prem to Windows 10 multi-session in WVD
- Trade many small dedicated VMs for few large shared VMs (with higher utilization and lower operational costs)

Windows 10 Single-session on-prem

1 user to 1 smaller VM with low utilization

■ Utilization

Windows 10 Enterprise Multi-session in WVD

$$

Many users per 1 larger VM
with high utilization and lower operational costs

■ Utilization

Example Economic Benefit $ per user per month

-85%

$40*

$7

Windows 10 Single Session

Windows 10 Multi-session

1 user per D2s v3 (2 vCPUs, 8 GiB RAM)

32 users per D8s v3 (8 vCPUs, 32 Gib RAM)

Note: WVD is the only way to run Windows 10 Multi-Session
Note: Figures are illustrative and based on pre-configured assumptions; actual savings vary by user requirements and infrastructure configuration
*The $40 PUPM for single session cost is modeled for a common configuration: Windows 10 single-session in WVD starts at ~$15 per user per month for 1 vCPU, 2 GiB RAM configuration

Cost Effective Compute and Storage*

Windows Virtual Desktop

| Best User Experience | Enhanced Security | Simplified Management |

Superior Economics
Cost effective, Flexible, & Opex

Strong Partner Ecosystem
Extensive, Integrated, & Experienced

Azure
Standardized, Global, & Secure
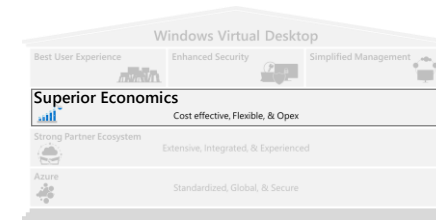
Customer Scenario – From on-prem virtualization to WVD

- Pay for actual usage instead of peak usage; optimize compute by using both Pay-as-you-go and Reserved Instance

On-prem Virtualization

Provision and pay for peak usage

Resource Usage

Time

— Amount of resource used
- - - Amount of resource paid for

WVD

Provision and pay for actual usage

Resource Usage

Time

— Amount of resource used
▬ Amount of reserved instance paid for
- - - Amount of pay-as-you-go

(Compute) Example Economic Benefit
$ per month for 25 VMs

-30%

$2,850

$2,060

$1,390 — PAYG

$670 — RI

On-prem*   RI+PAYG

*On-prem cost varies widely depending on asset depreciation, RI cost on cloud is used as the proxy for average on-prem cost

*When using Azure NetApp Files or Azure Files for storage, customers pay for actual consumed storage (vs. pay for fixed-sized disks)
Note: Figures are illustrative and based on pre-configured assumptions; actual savings vary by user requirements and infrastructure configuration

Flexible Network Provisioning
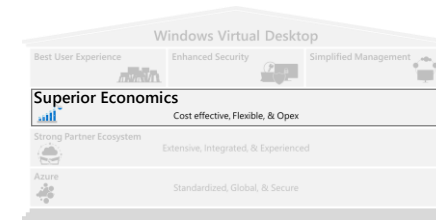
Customer Scenario – From Physical Network on-prem to Network Provisioned in WVD

- Pay for actual outbound data transfer instead of peak two-way data transfer;
- Optimize networking cost by using both fixed fee and variable outbound traffic

Physical Network On-prem

Provision and pay for <u>peak two-way</u> traffic

Resource Usage / Time

— Amount of network bandwidth used
--- Amount of network bandwidth paid for

Network Provisioned in WVD

Provision and pay for <u>actual outbound</u> traffic

Resource Usage / Time

— Amount of network bandwidth used
■ Amount of ExpressRoute (fixed fee) paid
--- Amount of variable outbound traffic paid

Example Economic Benefit
$ per month for 1,500 users

-20%

$2,750
On-prem*

$2,235
WVD

$1,945 — Variable outbound traffic
$290 — ExpressRoute (fixed fee)

* Networking cost on-prem varies widely. ExpressRoute Unlimited Plan is used as the proxy for average on-prem cost; ExpressRoute Metered Plan is used for WVD cost

Note: Customers can connect from on-prem physical networks to Azure virtual networks via two ways: Virtual Private Network (VPN) or ExpressRoute
Note: Variable outbound traffic can be implemented via Virtual Network or ExpressRoute
Note: Figures are illustrative and based on pre-configured assumptions; actual savings vary by user requirements and network configuration

Cost-optimized infrastructure
Best Value Compute Rate
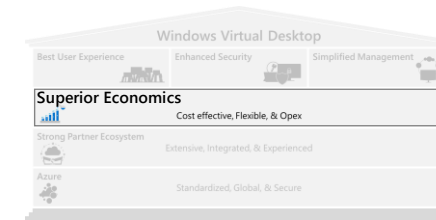
Customer Scenario – From Windows Server on-prem to Windows Server in WVD
- WVD doesn't require Windows Server license for session host VMs (i.e. session host VMs charged at Linux compute rate)

Windows Server RDS On-prem

RDS CALs with SA

WINDOWS SERVER LICENSE

RDSH VMs

+

File Server VMs

License Server VMs

Windows Server RDS in WVD

RDS CALs with SA

WINDOWS SERVER LICENSE ✗

RDSH VMs

+

File Server VMs

License Server VMs

Example Economic Benefit
$ per VM for 1,000 compute hours

-65%

$570

$200

Windows Server VM on-prem

Windows Server VM in WVD (charged at Linux rate)

*Azure VM cost at Windows Server rate is used as the proxy for average on-prem VM cost that requires a Windows Server license; on-prem cost is likely underestimated

Note: Non-session host VMs still require Windows Server license (only if Azure Hybrid Benefits are not available)
Note: With Azure NetApp Files or Azure Files, customers also save the cost of Windows Server license and its hosting VM that would otherwise be required by File Server
Note: Figures are illustrative and based on pre-configured assumptions; actual savings vary by user requirements and infrastructure configuration
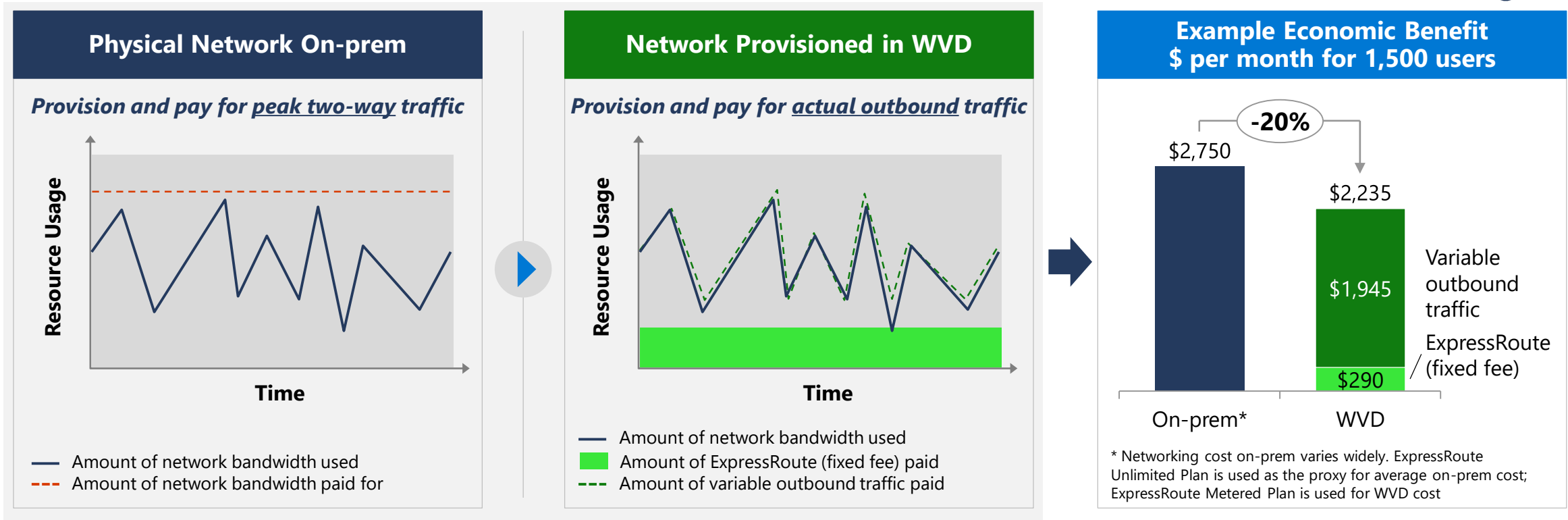
Cost-optimized infrastructure

Opex Spend Aligned to Business Usage
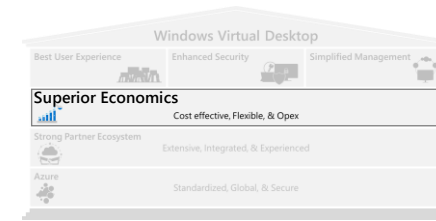
Customer Scenario – On-prem to Cloud
- From up-front Capex commitment to flexible Opex investment

On-prem	Cloud	Economic Benefit

On-prem panel:
High CAPEX cost
Capacity
Usage
Time
Invest and build for peak demand

Cloud panel:
Efficient OPEX cost
Capacity
Time
Pay on monthly basis for actual capacity

Economic Benefit panel:
Avoid large upfront financial commitments and deployment projects

Match capacity to operational needs

Align IT HW, SW, and services with changing business requirements

Enable accurate departmental cross-charge and COGS alignment

Note: Figures are illustrative and based on pre-configured assumptions; actual savings vary by user requirements and infrastructure configuration
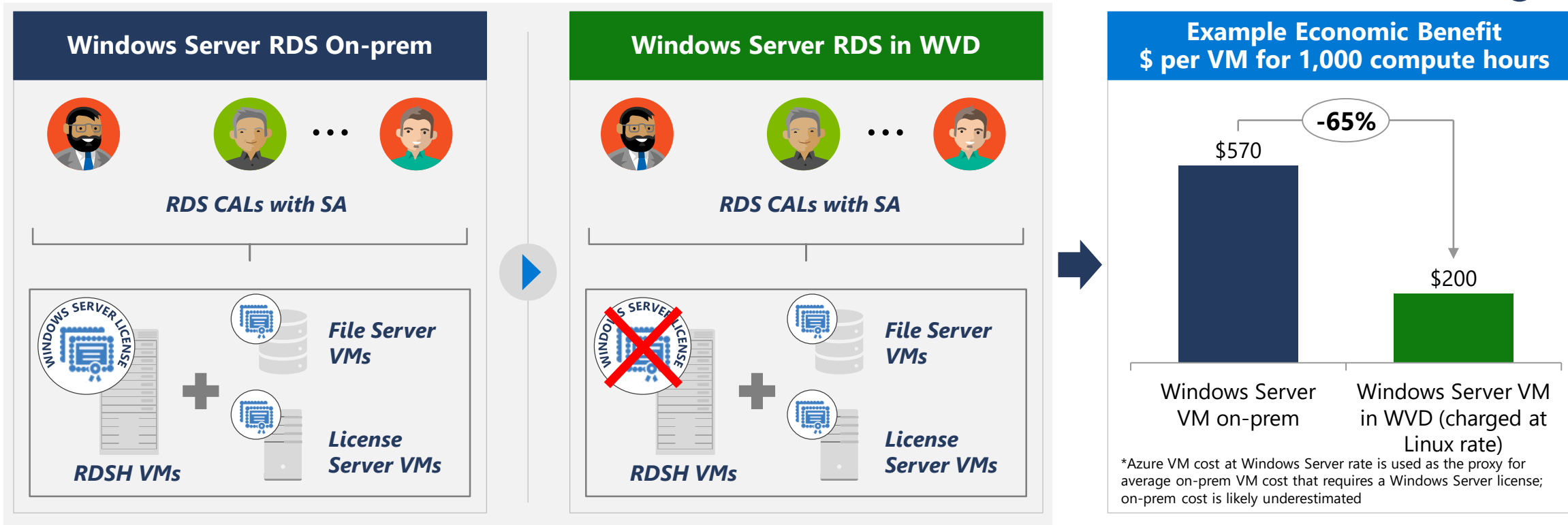
Management Service Included With the Licenses you Already Own

Windows Virtual Desktop

Best User Experience	Enhanced Security	Simplified Management

Superior Economics — Cost effective, Flexible, & Opex

Strong Partner Ecosystem — Extensive, Integrated, & Experienced

Azure — Standardized, Global, & Secure

Customer Scenario – From on-prem virtualization to WVD

- WVD management service included with the licenses* most Microsoft customers own
- Eliminate the infrastructure cost associated with on-prem management services

---
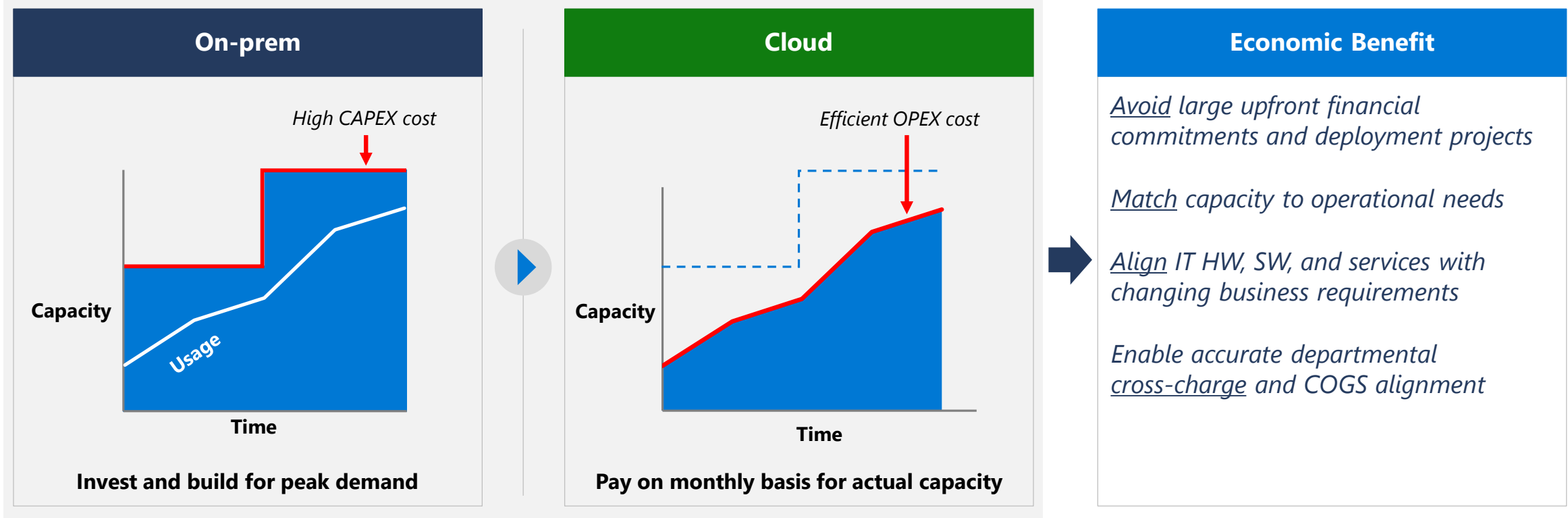
On-prem Virtualization

Management Services deployed by IT

Management service deployment

- 🌐 Web access
- ↔ Gateway
- Y Broker
- 📋 Licensing (server)
- 🌐 Management
- Load balancing
- 🔧 Diagnostics

WVD

Management Services provided by WVD

Management Service

Provided by WVD

Economic Benefit

No management infrastructure needed

No additional licenses required

Reduced labor cost

---

*See Appendix for WVD Client licensing requirements, including specific SKUs
Note: Figures are illustrative and based on pre-configured assumptions; actual savings vary by user requirements and current licensing position
Note: Customers who require Citrix or VMware management services to meet their needs will incur additional cost

Cost-advantaged licensing
Savings on RDS CAL with Multi-session Deployment

Customer Scenario – From Windows Server RDS on-prem to Windows 10 Enterprise Multi-session in WVD
- Save on RDS CAL when migrating from Windows Server RDS on-prem to Windows 10 Enterprise multi-Session* in WVD

Windows Server RDS On-prem	**Windows 10 Enterprise Multi-session in WVD**	**Economic Benefit**
M365 — RDS CAL — M365 — RDS CAL — ··· — M365 — RDS CAL	M365 — ~~RDS CAL~~ — M365 — ~~RDS CAL~~ — ··· — M365 — ~~RDS CAL~~	*$17 Saving*** *Per user per month*
RDSH VMs	**WVD session host VMs**	

**This saving applies when customers migrate from Windows Server deployment to Windows 10 multi-session in WVD; Windows Server in WVD still requires RDS CAL

*Customers can leverage the license (e.g. M365 E3/E5, Win 10 E3/E5) they already own. See Appendix for a complete list of WVD licensing requirements
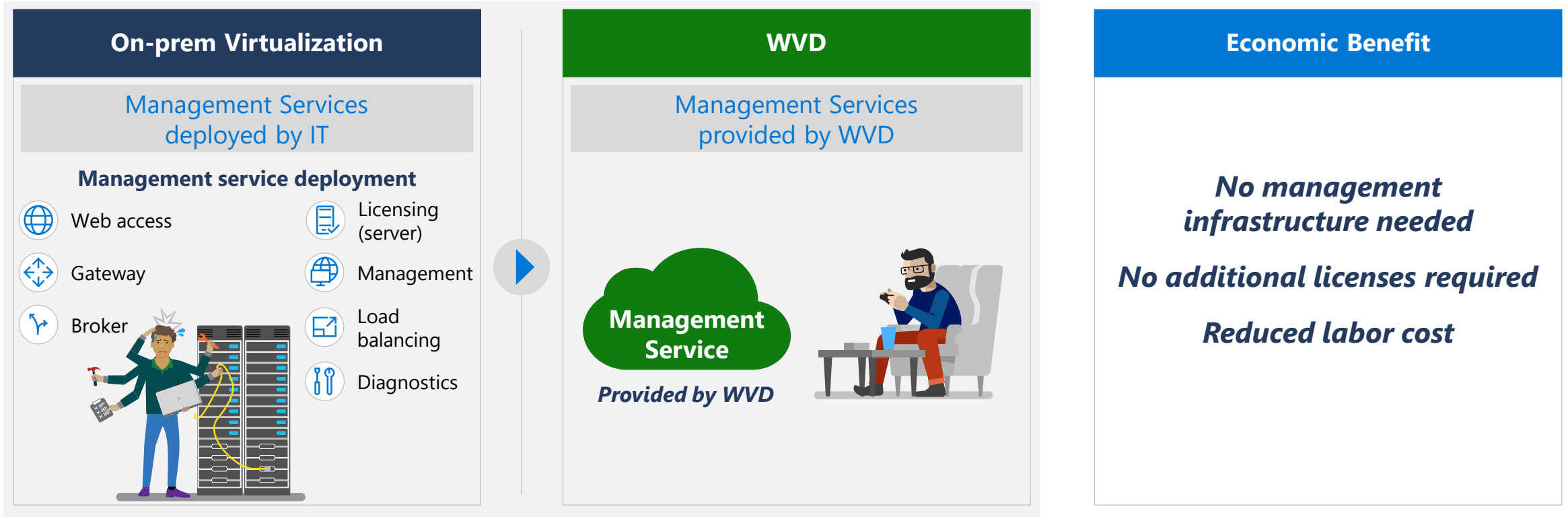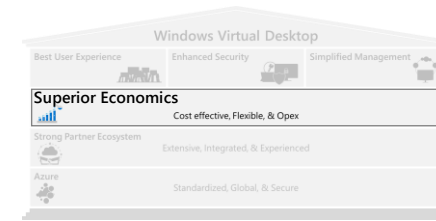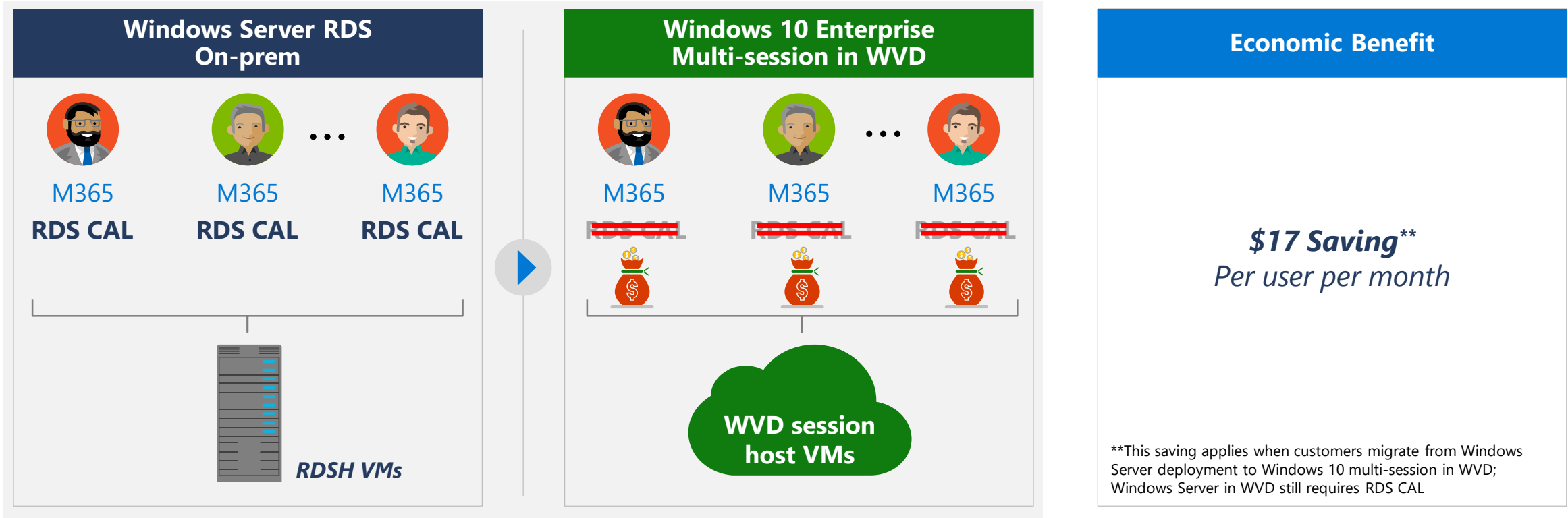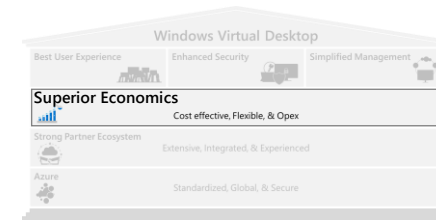Note: Figures are illustrative and based on pre-configured assumptions; actual savings vary by user requirements and current licensing position
Note: Customers need to fully refactor desktops and apps when migrating from Windows Server deployment to Windows 10 multi-session in WVD

Cost-advantaged licensing
3-year Win7 ESU Included

Customer Scenario – From Windows 7 on-prem to Windows 7 in WVD
- With WVD, 3-year Extended Security Update is included for Windows 7 VMs running on Azure*

On-prem

Windows 7

Pricing for extended security updates

Year	ESU Cost (/ device)	
	Enterprise	Pro
2020	$25	$50
2021	$50	$100
2022	$100	$200

WVD

Windows 7

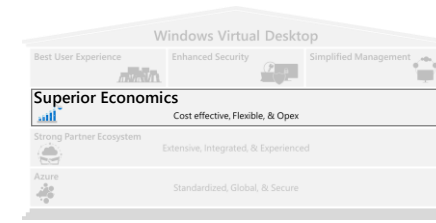| Year	ESU Cost (/ device)	
	Enterprise	Pro
2020	$25	$50
2021	$50	$100
2022	$100	$200

Economic Benefit

$25-200 Savings
Per device per year

*Benefit not applicable to Windows 7 running on local devices
Note: Figures are illustrative and based on pre-configured assumptions; actual savings vary by user requirements and current licensing position

Reduced Labor Requirements

Lower labor cost because compute and storage move to cloud

- Eliminate high overhead associated with managing on-premise infrastructure
- Reduced labor cost due to increased automation in the cloud
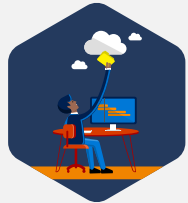
Lower labor cost when you use PaaS services

- WVD delivered as an evergreen PaaS service, reducing your labor cost for managing and upgrading management plane
- Simplified file storage management, leveraging fully managed NetApp Files service

Per Desktop Per Year IT Labor Cost

-60%

| | On prem | Cloud |
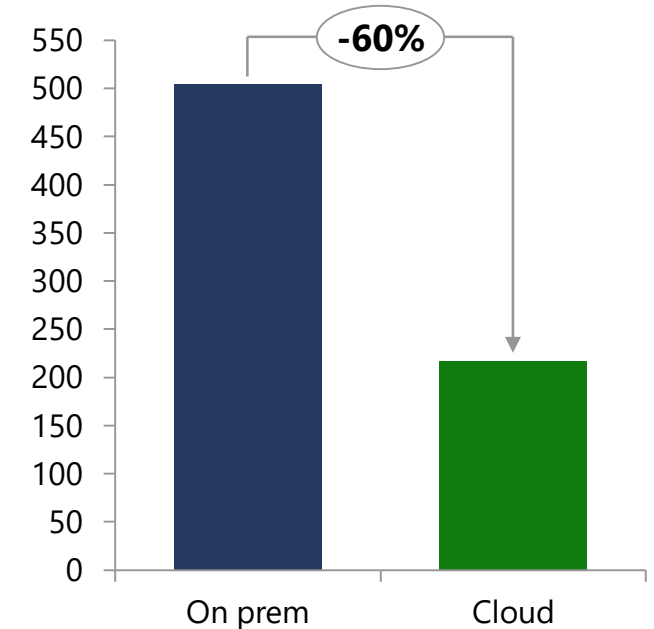
Source: industry analysis

Note: Figures are illustrative; actual savings vary by user requirements and current virtual desktop operating model

Example Scenario: WVD Economic Benefits

Example Migration Scenario

- User Group 1: 800 medium workload users (session running 170 hrs/month): From Windows Server on-prem to Windows 10 multi-session in WVD
- User Group 2: 200 medium workload users (session running 400 hrs/month): From Windows 10 single-session on-prem to Windows 10 multi-session in WVD
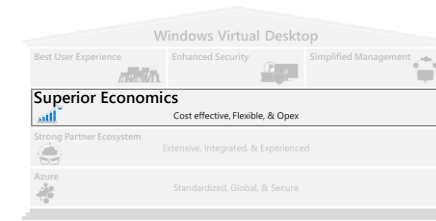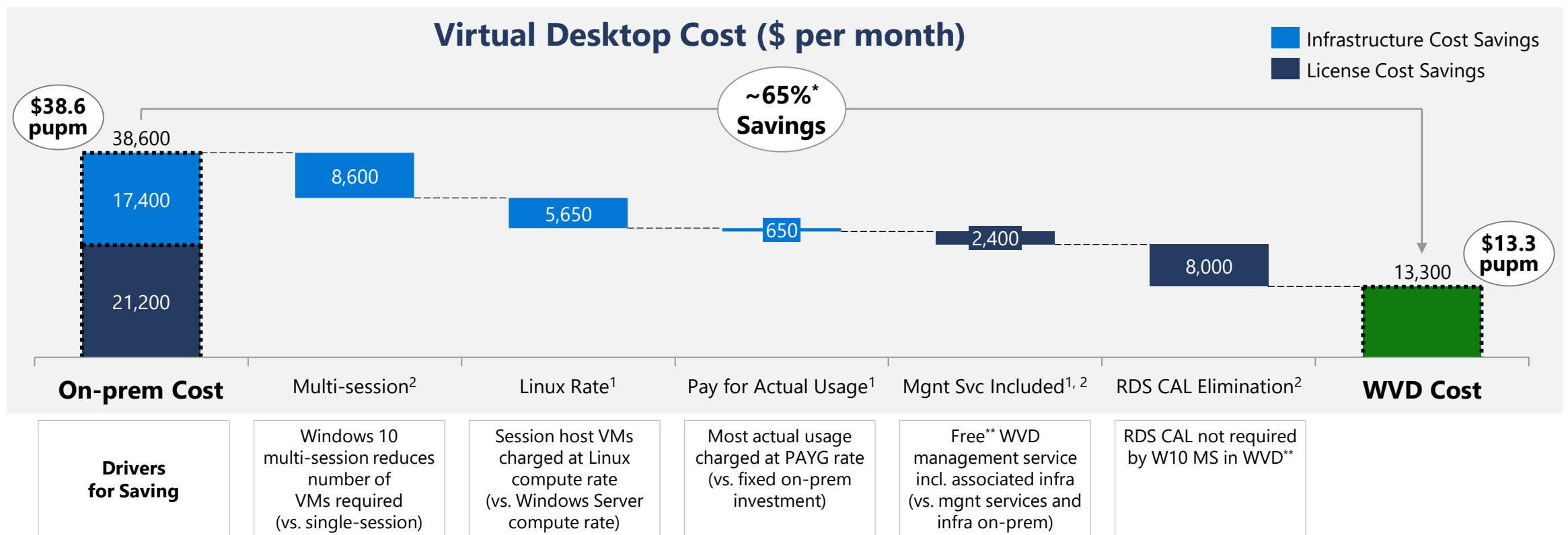
Virtual Desktop Cost ($ per month)

Infrastructure Cost Savings
License Cost Savings

~65%* Savings

$38.6 pupm

38,600

17,400

21,200

8,600

5,650

650

2,400

8,000

13,300

$13.3 pupm

On-prem Cost	Multi-session[2]	Linux Rate[1]	Pay for Actual Usage[1]	Mgnt Svc Included[1,2]	RDS CAL Elimination[2]	WVD Cost
Drivers for Saving	Windows 10 multi-session reduces number of VMs required (vs. single-session)	Session host VMs charged at Linux compute rate (vs. Windows Server compute rate)	Most actual usage charged at PAYG rate (vs. fixed on-prem investment)	Free** WVD management service incl. associated infra (vs. mgnt services and infra on-prem)	RDS CAL not required by W10 MS in WVD**	

Note: Chart shows the overall on-prem and WVD cost and associated cost savings for User Group 1 and 2 combined
Note: Given on-prem costs are highly variable, Azure reserved instance cost is used as the proxy for average on-prem cost; on-prem cost is likely underestimated
Note: Results generated by WVD Solution Configurator, an excel-based tool for sizing WVD opportunities; figures are rounded for simplicity
1 – Savings for User Group 1; 2 – Savings for User Group 2
*~70% Savings on infrastructure cost and ~60% on license cost, respectively; labor cost excluded
**Many customers already own licenses that qualify them for WVD (e.g. Win10 E3/E5, M365 E3/E5, VDA) and incur no additional cost for WVD

Windows Virtual Desktop
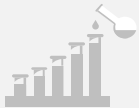Best User Experience | Enhanced Security | Simplified Management
Superior Economics | Cost effective, Flexible, & Opex
Strong Partner Ecosystem | Extensive, Integrated, & Experienced
Azure | Standardized, Global, & Secure

Windows Virtual Desktop

Best User Experience

Enhanced Security

Simplified Management

Azure

Standardized, Global, & Secure
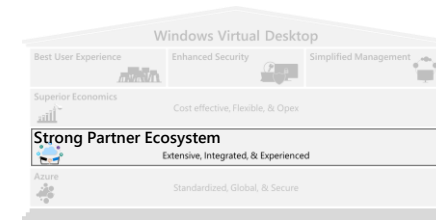
Superior Economics

Cost effective, Flexible, & Opex

Strong Partner Ecosystem
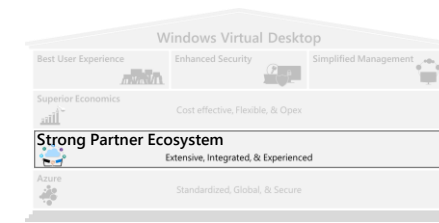
Extensive, Integrated, & Experienced

Extensive Partner Ecosystem

Windows Virtual Desktop
Best User Experience   Enhanced Security   Simplified Management
Superior Economics   Cost effective, Flexible, & Opex
Strong Partner Ecosystem
Extensive, Integrated, & Experienced
Azure   Standardized, Global, & Secure

WVD Approved Providers	CITRIX® vmware®
WVD Value-Added Partners	liquidware™ Lakeside® people⋇TECH Cloud Jumper ThinPrint nerdio
WVD Hardware Partners	IGEL® DELL hp intel SAMSUNG Lenovo™ Microsoft Surface

Strong Expertise in Virtual Desktop Deployment and Management

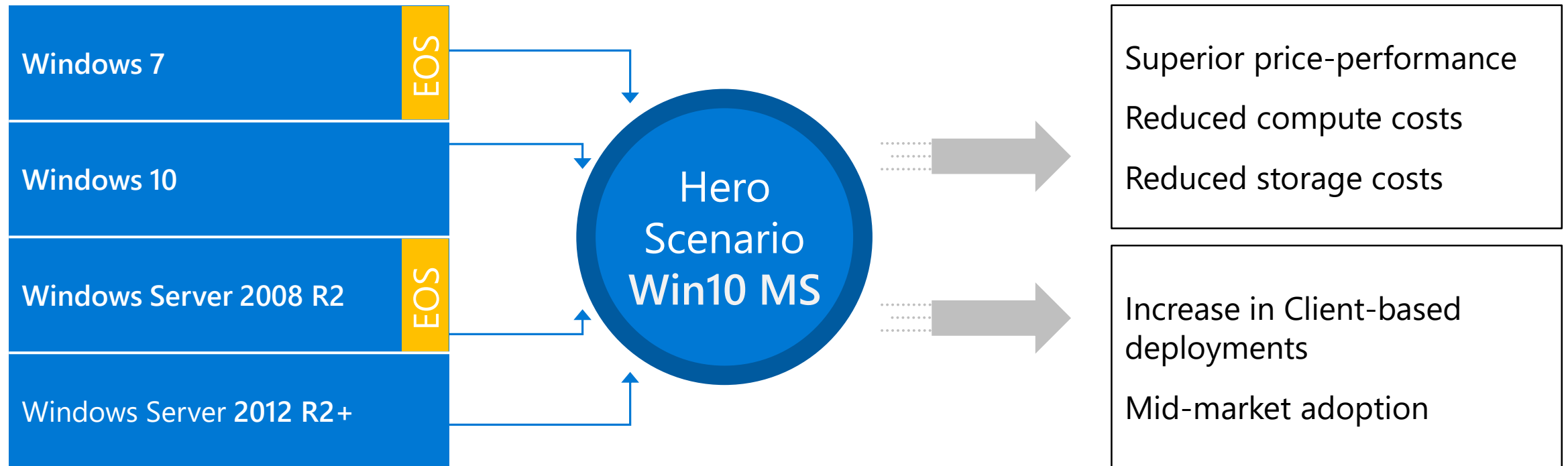| Category	Description	Partner Solution Examples		Delivery Mechanism
Customer Environment Assessment	Assess resource utilization of apps/users/OS, baseline user experiences and recommend sizing for WVD	• Lakeside • Liquidware • ControlUp		• Azure Migrate • OCP
Diagnostics & End User Experience Monitoring	Assess, monitor, and manage end user experiences with GUI enabling reactive troubleshooting as well as predictive troubleshooting leveraging AI/ML	• Lakeside • Liquidware • ControlUp	• RDPSoft • Sepago	• Azure Marketplace
Application Layering	Enable dynamic provisioning of apps during boot/log on time based on user profile	• Liquidware • Citrix's Unidesk		• Azure Marketplace
Management	Deployment and configuration	• Active Cypher • CloudVae • CloudJumper	• Nerdio • PTG Ubikite	• Azure Marketplace
Printing	Remove the need for print server infrastructure	• Uprint • ThinPrint		• Azure Marketplace
App Compat Assessment / Remediation	Assess app compatibility for layering new packaging	• Cloudhouse • Citrix's Unidesk • Numecent	• Liquidware	• Azure Marketplace

Thank You

Appendix

Windows Virtual Desktop

The best virtual desktop and app experience, delivered on Azure

Office 365

Other apps

Windows 10/7

Windows Server (RDS)

Microsoft Azure

The ONLY multi-session Windows 10 experience

Multiple users <u>active simultaneously</u> on the same VM
Each user's data is isolated from every other user

| Windows 7 | EOS |
| Windows 10 | |

Hero Scenario Win10 MS

Superior price-performance

Reduced compute costs

Reduced storage costs

| Windows Server 2008 R2 | EOS |
| Windows Server **2012 R2+** | |

Increase in Client-based deployments
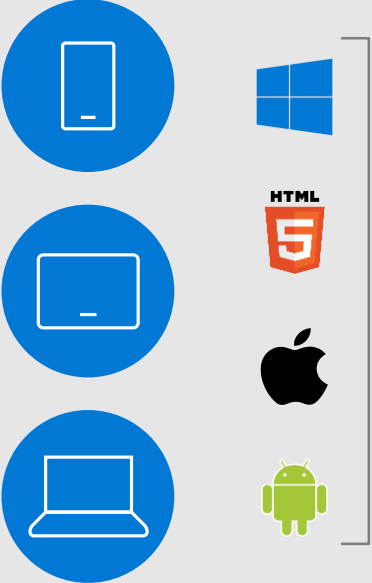
Mid-market adoption

Application compatibility and user experiences **vary** between **Server** and **Client** OS

WVD Architectural Overview

3 BIG PIECES
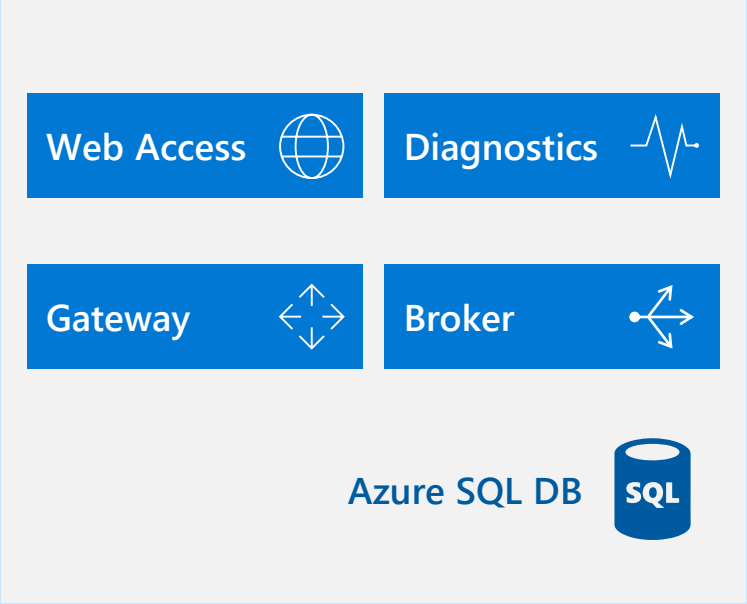
Clients
Customer/Partner-managed
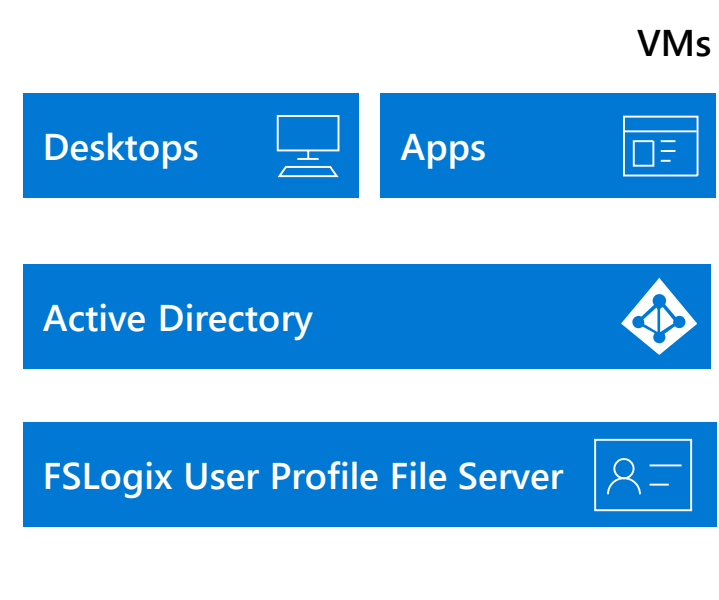
Windows Virtual Desktop
Microsoft-managed

Web Access

Diagnostics

Gateway

Broker

Azure SQL DB

FIREWALL

FIREWALL

Azure VMs & Services
Customer/Partner-managed

VMs

Desktops

Apps

Active Directory

FSLogix User Profile File Server

Citrix & VMware integration

Clients		Windows Virtual Desktop		Azure VMs & Services

Clients

Windows Virtual Desktop

Microsoft

Management Plane

CITRIX®

Management Plane

vmware®

Management Plane

FIREWALL

FIREWALL

Azure VMs & Services
Customer/Partner-managed

Microsoft Sellers are
compensated
on Azure consumption
agnostic
of management plane
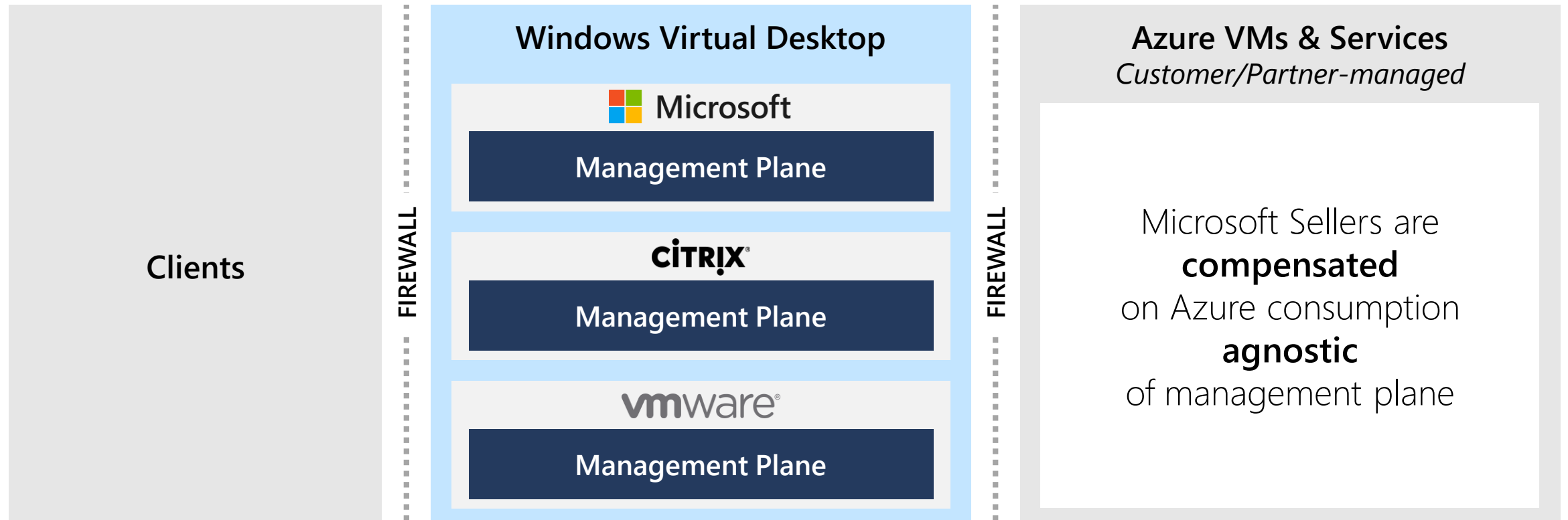
- Citrix and VMware provide value add to WVD (e.g. hybrid deployment management)
- Windows 10 multi-session is also available with Citrix & VMware management planes
- Customer ultimately decides the management plane(s) of choice

Many customers are already eligible for WVD

WVD Licensing Requirements

CLIENT

Customers are eligible to access Windows 10 and Windows 7 with Windows Virtual Desktop (WVD) if they have one of the following licenses*:

- Microsoft 365 E3/A3
- Microsoft 365 E5/A5
- Microsoft 365 F1
- Microsoft 365 Business
- Windows 10 Enterprise E3/E5
- Windows 10 Education A3/A5
- Windows 10 VDA per user

Customers can access Windows Virtual Desktop from their non-Windows Pro endpoints if they have a Microsoft 365 E3/E5, Microsoft 365 A3/A5 or Windows 10 VDA per user license.

SERVER

Customers are eligible to access Windows Server 2012 R2 and newer desktops and apps if they have an RDS CAL license with active Software Assurance (SA)

All discounts and benefits of Azure apply to WVD

▶ Virtualization
endpoints only
Burst-to-Azure (cloud)

▶ Brand new
virtualization env
Lift and shift

▶ Windows Virtual
Desktop
Lift and shift and
Modernize

Azure
Hybrid User
Benefit

Azure
Consumption
based Incentive
Programs

CSP
Margins &
Rebates

Reserved
Instances

DPOR

Azure Enhances Productivity

Infrastructure

Compute

Networking

Storage
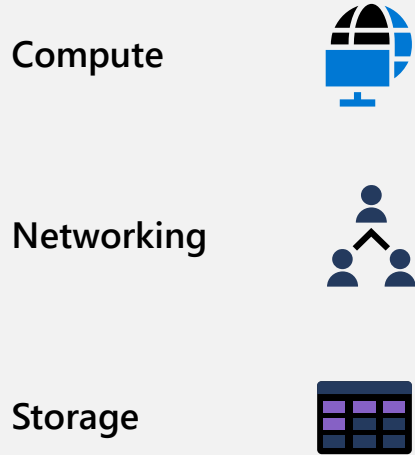
Azure IaaS offers a purpose-built, flexible IT infrastructure designed to fit your company's needs

Data

SQL DB

PostgreSQL

MySQL

MariaDB

Redis Cache

Cosmos DB
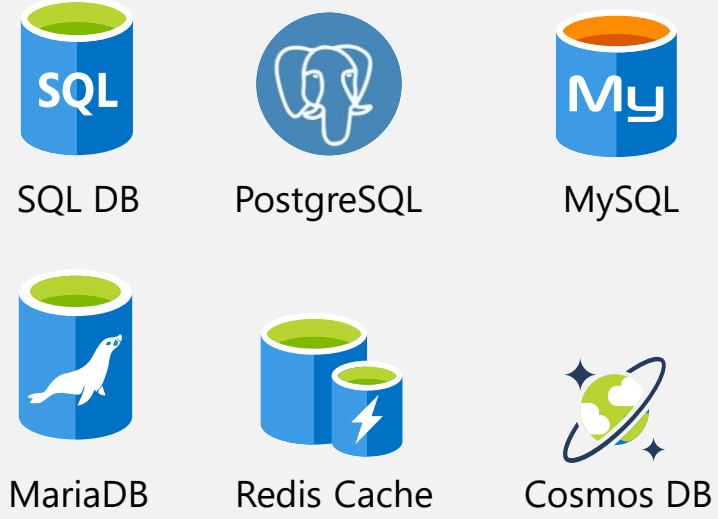
Intelligent
- Intelligent Protection
- Intelligent Performance

Flexible
- Hyperscale
- Elastic scaling
- Resource governance

Trusted
- Always Encrypted (secure enclave)
- Business Continuity, HA/DR
- Industry Compliance certifications
- Enterprise security isolation

Code

Containers

Microservices

Integration services

Event-driven

AI

Web & Mobile development
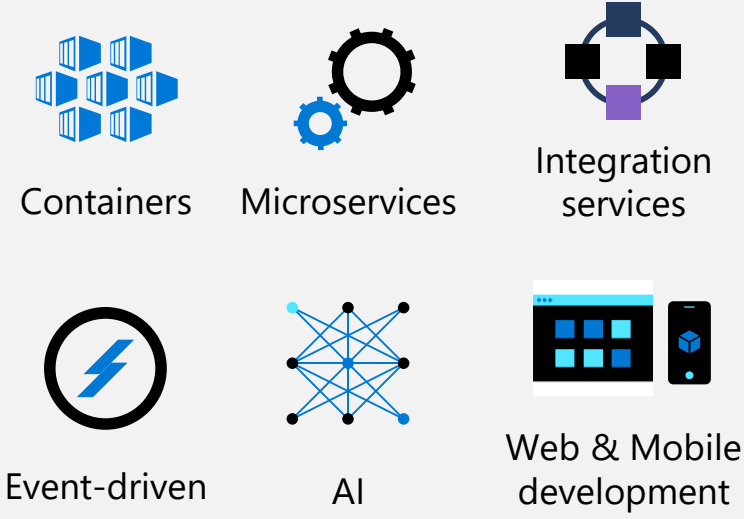
Azure is a turn-key delivery platform for modern applications that offers a broad range of managed services for all application scenarios, allowing you to choose the best approach for your cloud-native applications.

← Unified Management • Security • Governance • Tools • DevOps →

Microsoft is Your Trusted Technology Partner

Trusted business partner
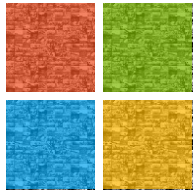
Microsoft mission
"Empower every person and every organization on the planet to achieve more"

Satya Nadella, Microsoft CEO

October 2018

"No customer wants to be dependent on a provider that sells them technology on one end and competes with them on the other. Getting this equation right is key to their success going forward. **Microsoft is uniquely positioned to help**."

Trusted innovation partner

Shared IP Innovation Principles:
Microsoft's policies give customers peace of mind and clarity when innovating with us

Azure IP Advantage:
Microsoft offers best-in-industry protection against IP risks

Patent Pick

Uncapped Indemnification

Springing License

Microsoft is committed to WVD as the future of the Windows platform

1 Broad availability and rapid global rollout of the WVD Service

2 Compelling infrastructure and licensing pricing to end customers

3 Plan to support wide range of devices, including mobile and thin client running other operating systems

4 Rapid innovation/integration with Microsoft and Azure products e.g., Teams, Microsoft Defender ATP

5 Wide partner ecosystem to build on/integrate with WVD
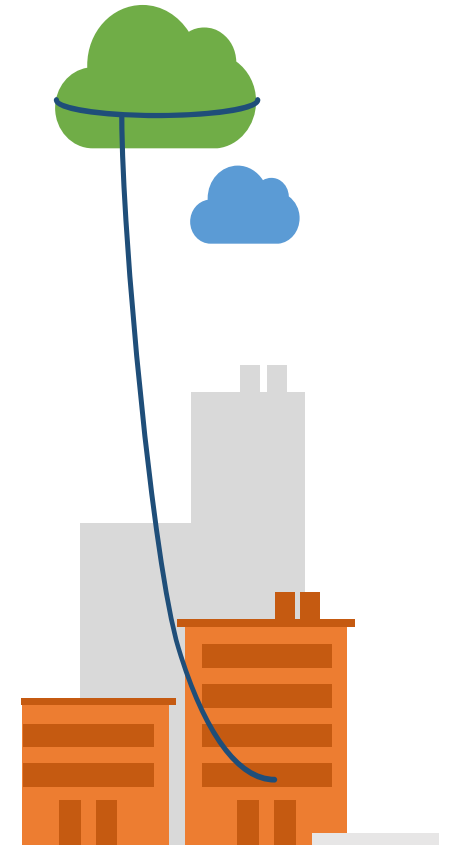
Calculation Backups

WVD Infrastructure Cost* at a Glance

Customer Requirements

- User Type: Medium (Microsoft Office apps users)
- # of Users: 1,000
- Peak Concurrency: 80%
- Profile Storage Requirement: 20GB / user
- Network egress: 100 kpbs / user

Key Infrastructure Assumptions

- **Compute:**
  - East US
  - 3-year Reserved Instance
  - D8s v3 (for multi-session)
  - 4 users/vCPU (for multi-session)
  - D2s v3 (for single-session)
- **Storage:**
  - Azure NetApp Files
- **Networking:**
  - Virtual Network (East US Same Region)
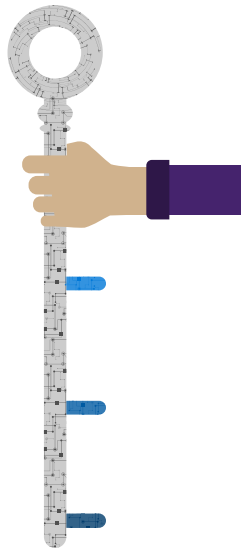
WVD Cost* Per User Per Month
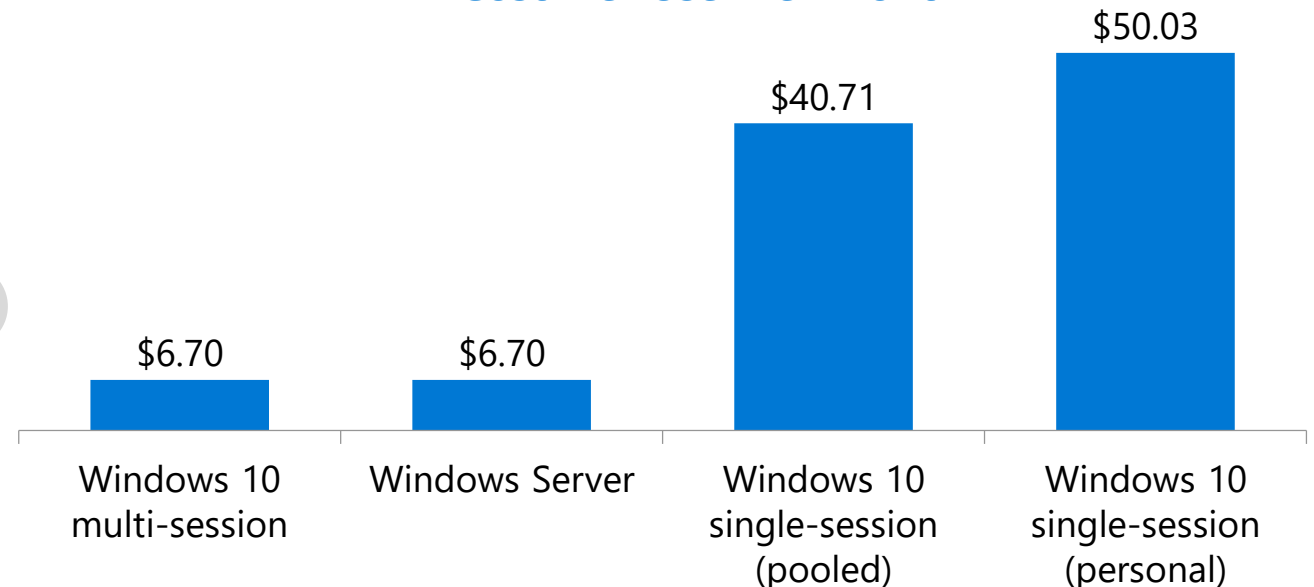
$6.70	$6.70	$40.71	$50.03
Windows 10 multi-session	Windows Server	Windows 10 single-session (pooled)	Windows 10 single-session (personal)

Note: Results generated by WVD Solution Configurator, an excel-based tool for sizing WVD opportunities; figures are rounded for simplicity
*License cost not included; Many customers already own licenses that qualify them for WVD (e.g. Win10 E3/E5, M365 E3/E5, VDA) and incur no additional license cost for WVD

WVD Cost Estimation for Win10 multi-session vs. Win10 single-session(1/3)

Opportunity Profile

WVD Opportunity	User Group 1	User Group 2
WVD (W7, W10, W10 MS, WS)	Windows 10 multi-session	Windows 10
Customer Environment / User Requirements		
User Type	Medium	Medium
Named (total) users	1,000	1,000
Peak Concurrency	80%	80%
Pooled / Personal	Pooled	Pooled
Azure Region (for infrastructure)	US-East	US-East

WVD Cost Estimation for Win10 multi-session vs. Win10 single-session(2/3)

Compute Cost

Session Host VM	User Group 1	User Group 2
OS Type	Windows 10 multi-session	Windows 10
Pooled / Personal	Pooled	Pooled
Deployment Type	Multi-session	Single-session
# users/vCPU (only valid for multi-session) (Default)	4	N/A
VM Instance (Default)	D8s v3	D2s v3
Reserved Instance (Default)	3-year reserved	3 -year reserved
Price / hour per VM	$0.147	$0.0368
Users per VM	32	1
Peak hours / month per VM	730	730
VMS during peak hours	26	801
Total VM cost / month	**$2,797**	**$21,536**

OS Disk (for Session Host VM)	User Group 1	User Group 2
OS Disk size (GB) required (Default)	127	127
# OS Disk per VM (Default)	1	1
OS Disk Tier (Default)	Premium	Premium
OS Disk	premiumssd-p10	premiumssd-p10
OS Disk cost per VM	$19.71	$19.71
# VMS during peak hours	26	801
Total OS Disk cost / month during peak hours	$512.46	$15,787.71
Total OS Disk cost / month	**$512.16**	**$15,787.71**

Storage Cost

Storage Requirements	User Group 1	User Group 2
Storage GB/user (Default)	20	20
Total profile storage required (GB)	20,000	20,000
Azure NetApp Files		
Azure Region	US-East	US-East
Pricing Option	Month	Month
Storage Hours	N/A	N/A
Storage Tier (Default)	Standard	Standard
Cost / GB / (Month or Hour)	$0.15	$0.15
Total Azure NetApp Files Storage cost / month	**$2,949.20**	**$2,949.20**

WVD Cost Estimation for Win10 multi-session vs. Win10 single-session(3/3)

Networking Cost

Virtual Network	User Group 1	User Group 2
Source vNet Region	US-East	US-East
Destination vNet Region	US-East	US-East
Type	Same Region	Same Region
Network egress (Default kbps per user)	150	150
Average work hours (per user per month)	160	160
Network egress (GB per user per month)	66	66
Network egress (total GB)	65,918	65,918
Cost per GB	$0.01	$0.01
Total Virtual Network Cost / month	**$659.18**	**$659.18**

Total Cost

WVD Total Infrastructure Cost (Total cost / month)	User Group 1	User Group 2
Compute	**$3,309.54**	**$37,323.32**
Storage	**$2,949.20**	**$2,949.20**
Networking	**$659.18**	**$659.18**
EA or Other Customer Discount	**0%**	**0%**
Total Azure Infrastructure cost / month	**$6,917.92**	**$40,931.70**
Named (total) users	**1,000**	**1,000**
Azure Infrastructure cost / user / month	**$6.92**	**$40.93**

Default Values (Microsoft Guidance) for WVD Cost Estimation

User Type Profiles	Light	Medium	Heavy	Heavy Graphics
Description	Ideal for lightweight use cases with such as data entry and call center apps.	Ideal for basic Microsoft Office apps such as Word and Excel, as well as database apps.	Ideal for more intensive workloads such as development or engineering.	Ideal for graphics intensive apps such as 3D CAD and Adobe Photoshop.
VM Instance (Default) Multi-session	D8s v3	D8s v3	D8s v3	NV6
VM Instance (Default) Single-session	D2s v3	D2s v3	D2s v3	NV6
# users/vCPU (only valid for multi-session) (Default)	6	4	3	1
OS Disk size (GB) required (Default)	127	127	127	127
# OS Disk per VM (Default)	1	1	1	1
OS Disk Tier (Default)	Premium	Premium	Premium	Premium
Profile Data Disk size (GB) required (Default)	2,000	2,000	2,000	2,000
Storage GB/user (Default)	20	20	20	20
Storage Option (Default)	Azure NetApp Files	Azure NetApp Files	Azure NetApp Files	Azure NetApp Files
Storage Tier (Default)	Standard	Standard	Standard	Standard
Profile Data Disk Tier (Default)	Premium	Premium	Premium	Premium
Network egress (Default kbps per user)	75	150	500	1,000