



Inside the RDP (Protocol)

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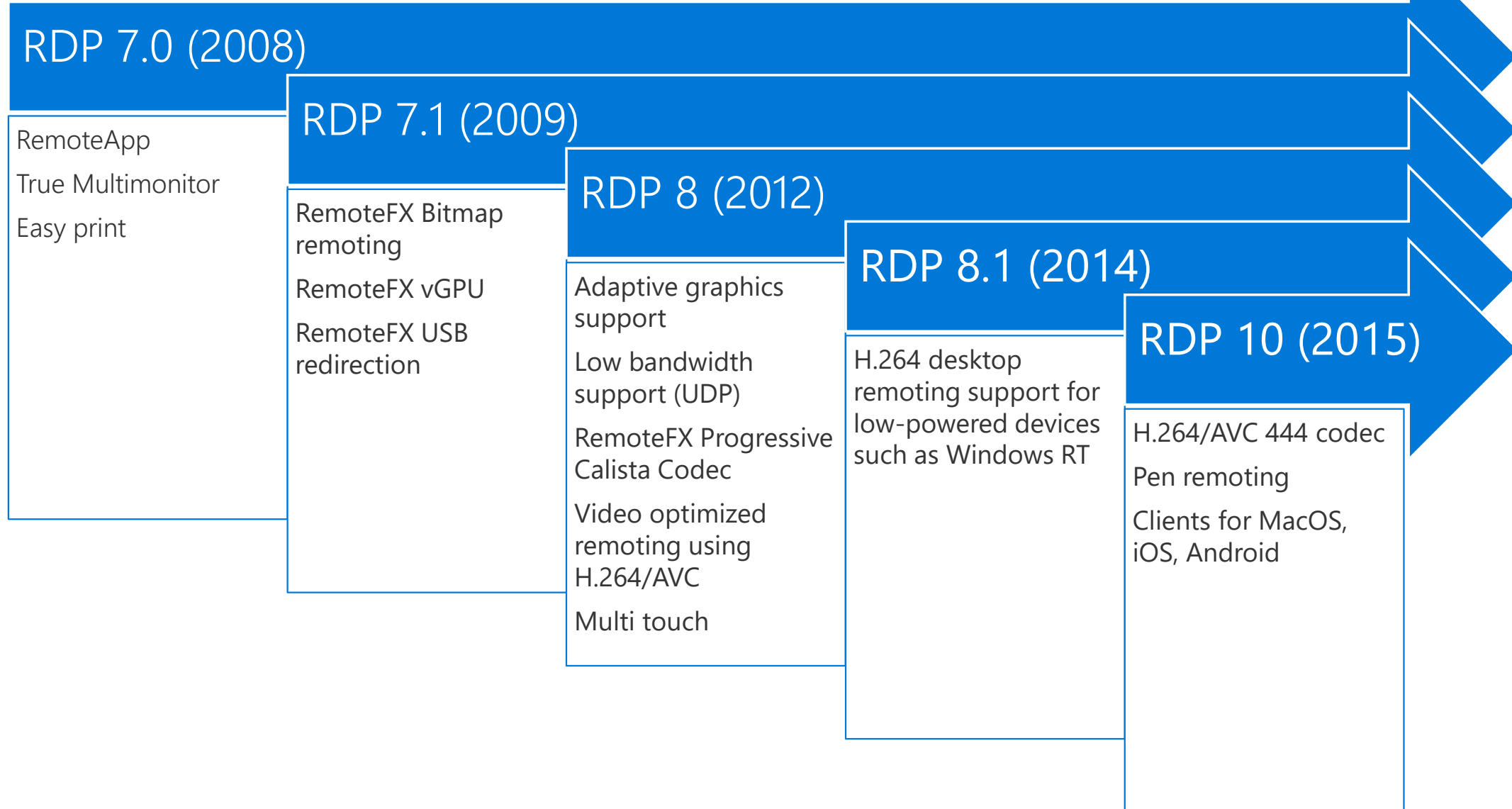


Remote Desktop



- Introduced with Windows NT 4.0 Terminal Server Edition (Hydra) in 1998
- First version was RDP 4.0
- New features with every Windows release
- Used by many Windows components

Remote Desktop Protocol (RDP) evolution



Remote Desktop Protocol (RDP) evolution

RDP 10.3 (Windows 10 1703)

- Sensor Redirection
- Location Sensor
- RDP SDK for UWP and other OS
- HW decoding on the client

RDP 10.4 (Windows 10 1709)

- Multiple Pen redirection
- AVC mixed mode
- Printer redirection improvements

RDP 10.5 (Windows 10 1803)

- Camera redirection
- 4k remoting improvements
- RD sessions can be load balanced across multiple GPUs on the server
- Improve graphics encoding performance when misclassification is detected
- Display drives redirected over RDP in a dedicated File Explorer group
- Lift 4GB limit when copying files via clipboard redirection

RDP 10.6 (1809)

- URCP
- 4K-DDS Dynamic Down-sampling
- mGPU-E Smart Load-Balancing
- RemoteFX vGPU deprecation
- Camera Controls Redirection
- MFT-based codecs
- Toast notifications for RemoteApp

RDP 10.7 (1903)

- Performance Improvements on networks with inherent loss by using a delay-based rate control algorithm
- RDPIDD single user

Encoding and Video Optimizations

Multiple GPU Encoding (mGPU-E)

- Encoding using all available GPUs on the box
- Encoding using all GPUs or GPU partitions in a VM
- Works with GPUs provided from different manufacturers
- Using load balancing
- Improved scale, higher frame rate and reduced latency

Video Playback Optimizations

- Hardware video encoding
 - Higher frame rate for video
 - Lower latency
- Video window move
 - Smooth playback
 - No tearing
 - Single channel for all graphics data
 - Frames from different codecs are presented together

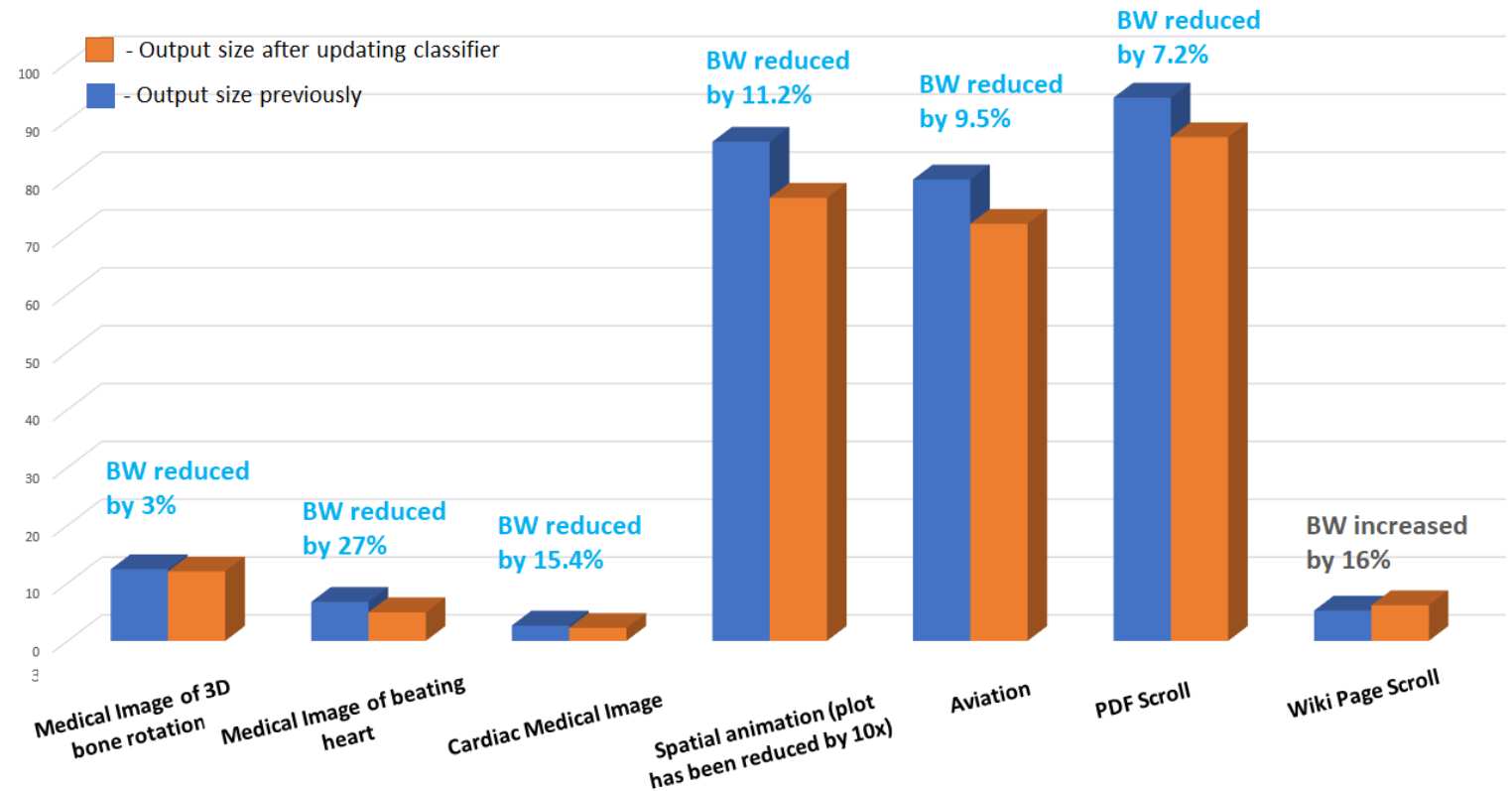
Codec Improvements

- AVC444 V2 improvements for HTML5
- Use of Media Foundation Platform

Region Classification Improvements

Remote Desktop uses different codecs to efficiently encode text, graphics and video regions of the display content. Regions must be classified properly before passing the data to the corresponding encoders to provide optimal user experience.

- Reduces the number of misclassified image and text regions for screens with mixed gray scale content
- Improves scale with reducing CPU processing time
- Reduces network traffic using the most optimal codec for encoding the region
- Up to 27% savings in some scenarios



Transport and Device Redirection

Universal Rate Control Protocol

- Provides proper reporting of the network conditions
- RD protocol can make better decision how to deplete the various virtual channel queues
- Improves perception for responsiveness of the system

Printing Progress Messaging

- Improved user experience by providing info about progress and completion of the job
- Series of RD protocol changes for supporting printing progress messages
- RD MSTSC.exe client is a showcase implementation:
 - Print start
 - Progress
 - Success/error user messages

Camera redirection

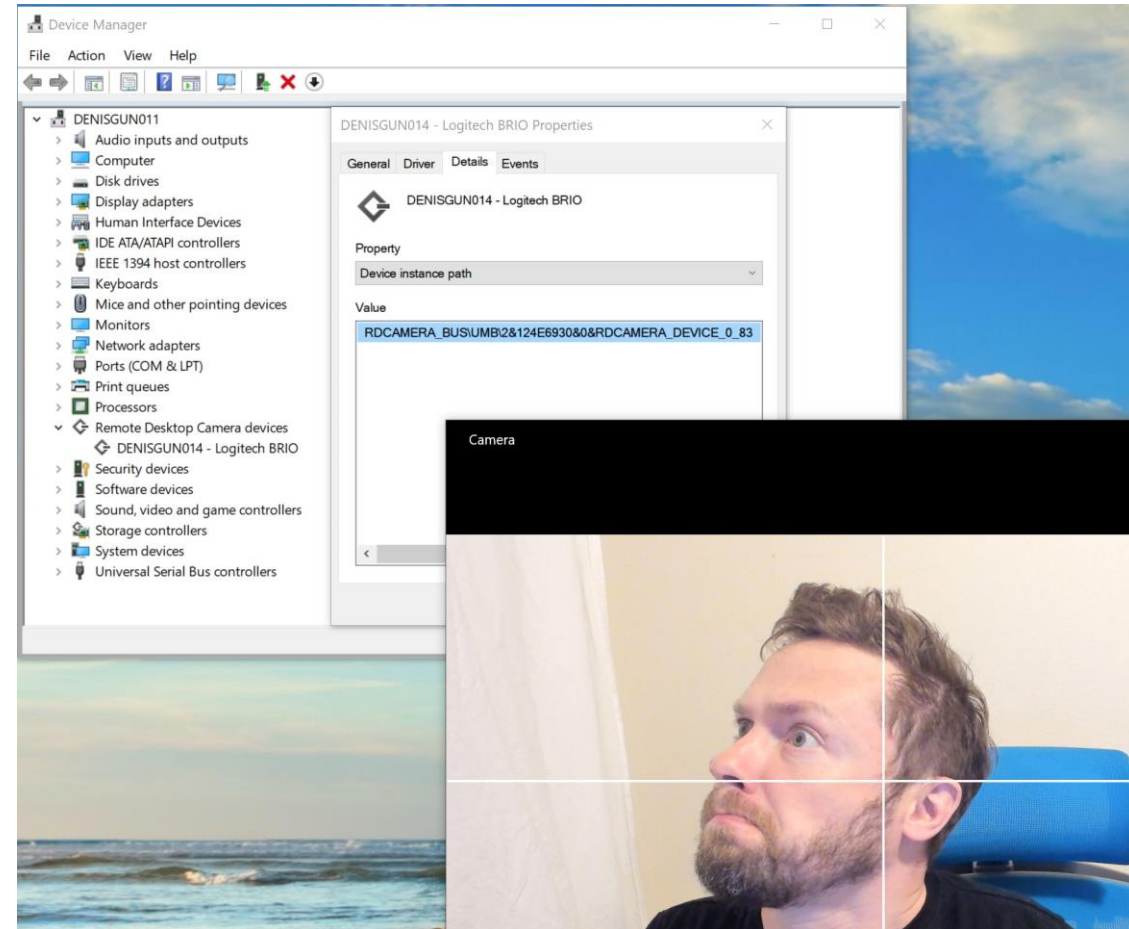
High-level device redirection

RDP redirects H.264 encoded video stream captured by the camera

Less network traffic compared with USB redirection

Works with multiple cameras

Works with new and legacy Windows apps



AVC444

Prerequisites

- Client needs to advertise it can do AVC (default if 10.2 is supported by clients)

- Enabled by default for GPU scenarios

- Enabled by GP for RDSH

Video Quality

- H265 quality, compatible with existing H264 decoders

- AVC444 over AVC420 (requires software for composing the streams)

- AVC Full Screen or Calista Mixed Mode (no AVC mixed mode)

Network Bandwidth

- RDP 10.2 AVC444 Approximately ~40% higher bandwidth for text

Multimonitor Support

- Remote App: RDP 10.1 caps does not work, RDP 10.2 caps the entire surface limited to 4K

- Desktop: each monitor limited to 4K, general RDP limit up to 16 monitors

Universal Rate Control Protocol (URCP)

- Provides proper reporting of the network conditions
- Improve the performance on wide area networks (WANs) or wireless networks with inherent packet loss noise
- Utilize a higher network bandwidth share while reducing the variation in packet transit delays.
- Share network resources fairly with other competing network flows.
- Supports "Reliable" UDP mode
- Does not include a FEC mechanism

RemoteFX vGPU

- Unsupported in WS2019
- Only vGPU is removed, all other RemoteFX branded technologies are in place
- Clean OS installation cannot share RemoteFX vGPUs with new Hyper-V VMs
- Upgrade warning if RemoteFX vGPU is enabled in the upgraded OS
- If you had RemoteFX vGPU enabled VM it will continue to work after upgrade
- Admins can remove RemoteFX vGPU after upgrade to WS2019
- The PowerShell cmd-lets still exists.
- 1903/Server 2019 can be used as a VM with RemoteFX enabled if host is Windows Server 2016 or earlier
- **RemoteFX is supported in Windows Server 2016 until 12/2022 (12/2027)**

What is next?



RDP Graphics – Future

- GPU partitioning
 - In development
 - Requires SR-IOV support on GPU
 - Each partition receives a guaranteed slice of the GPU (fixed configuration)
 - Supports multiple guest OS versions
- WDDM GPU virtualization
 - Future development, eventual replacement for RemoteFX vGPU
 - Share a GPU to one or multiple virtual machines, resources shared across VMs
 - Improved performance and app compatibility vs. RemoteFX vGPU
 - Requires same OS version in host and guest

RDP Graphics – WDDM GPU virtualization

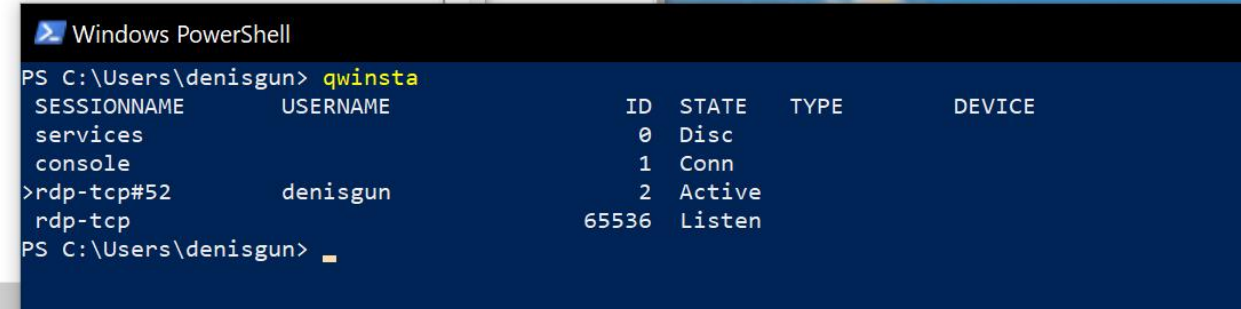
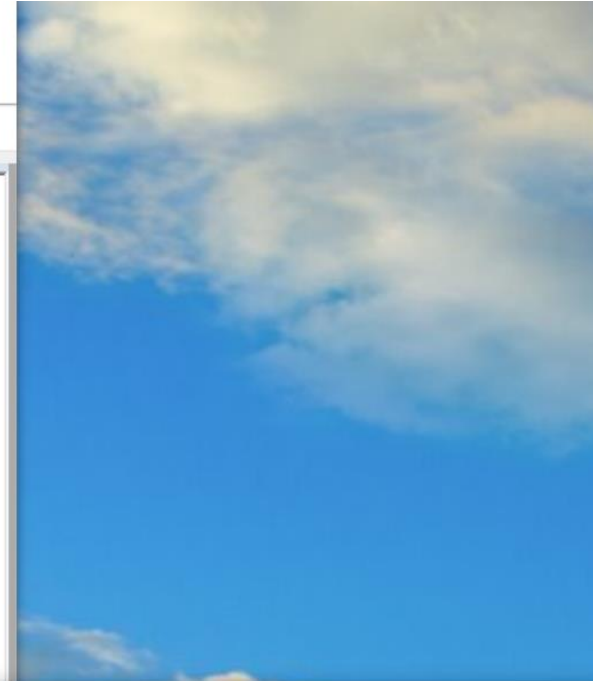
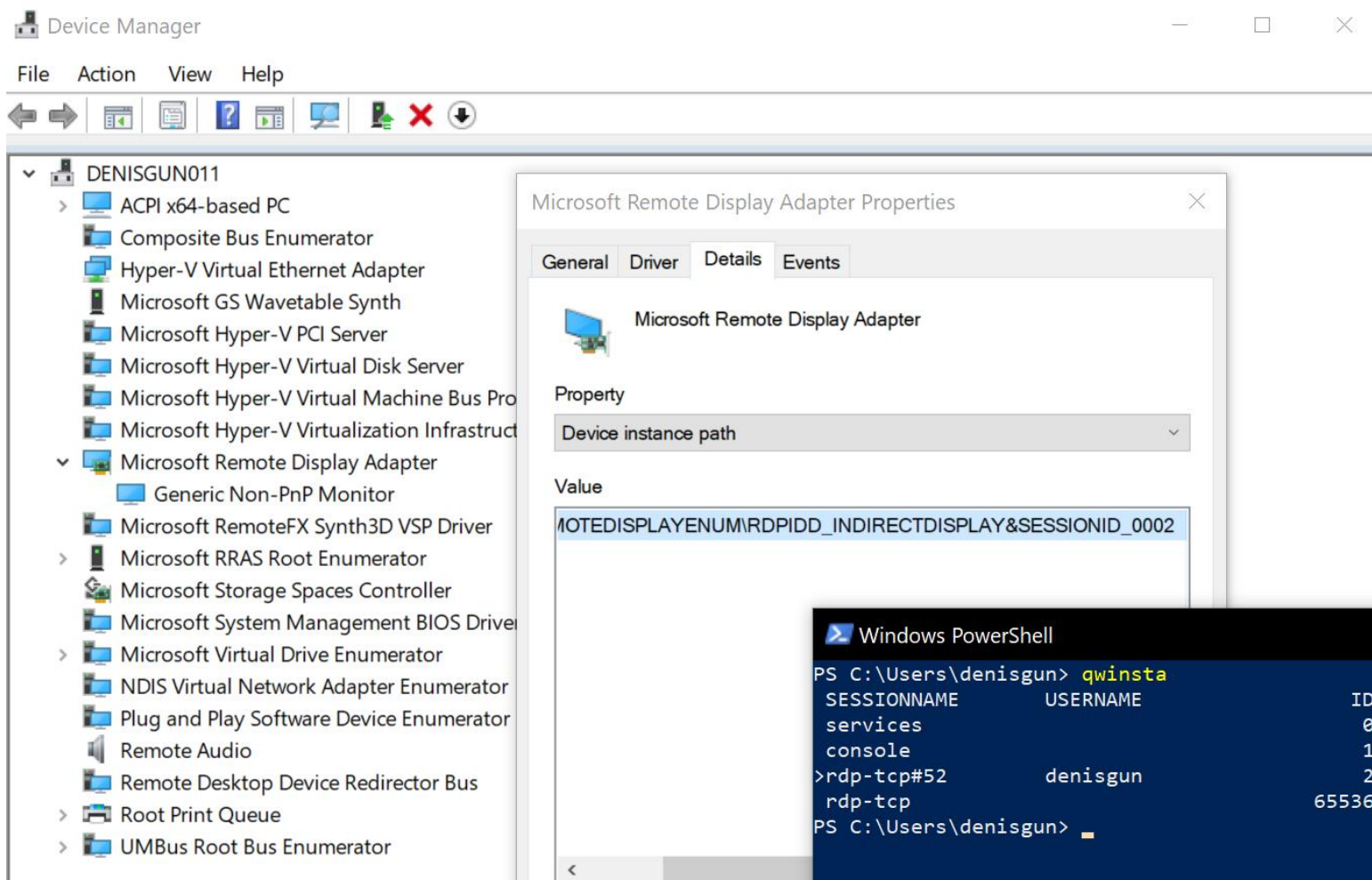
- WDDM vGPU available in Windows Sandbox preview
 - Windows 10 version 1903
 - Compatible CPU and GPU (NVIDIA, AMD, Intel)
 - WDDM 2.5 or newer graphics drivers

RDP Side-by-Side stack

- Protocol stack for WVD
- Installable RDP stack (MSI package)
- Backports RDP 10.x to the older OS
- Brings reverse connect and diagnostics
- Plugs in dynamically to Winstations/TermSrv
- Can be updated separate from OS release cycle
- Updated without server reboot or user disconnect

RDP Indirect Display Driver

- WDDM based display



RDP Indirect Display Driver (IDD)

- Display driver is moved from the kernel mode to the user session
- Reliability and performance improvements
 - RDP Code paths in DWM are parallelized vs. serialized in XDDM
- Support for existing and future APIs
 - Presenter mode API
 - HDR Graphics Remoting
 - 3D/Stereoscopic Remoting

D3D12 sample

FPS: 122.6

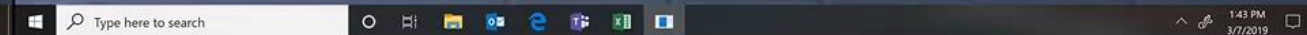
Remote session on XDDM



D3D12 sample

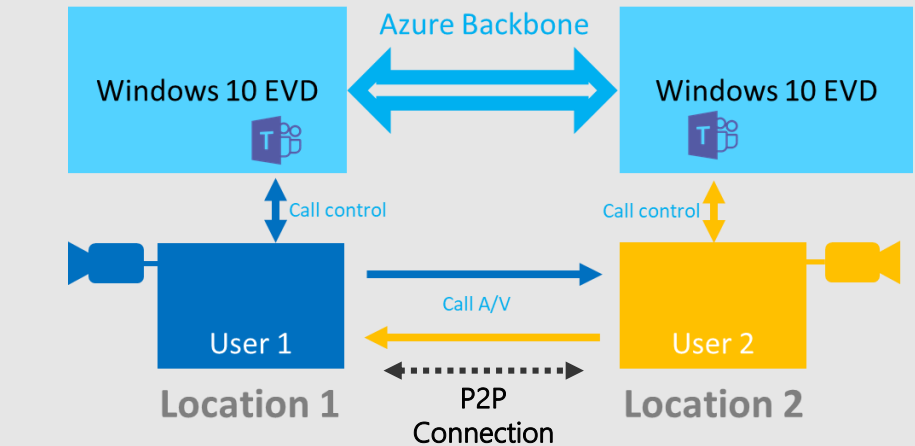
FPS: 201.2

Remote session on IDD



Enabling Teams on WVD

- We will deliver WebRTC-based P2P conferencing for Teams:
- Modular design can support new remote protocols and OS environments with less rework while retaining a common core.
 - Design decision: We have scoped out support for Win7 clients. Support for Win7 clients will be opportunistic based on customer feedback in Teams Public Preview.
- High-performance peer-to-peer streaming facilitated by WebRTC
- On Win10 clients, all the benefits of the modern media stack including HW video decoding



WebRTC Enabled: Peer-to-peer Teams on WVD

RDP SHORTPATH



- Umbrella name for several initiatives for optimizing network routing for WVD and RDS on-prem
 - Gateway-less UDP connection
 - Azure routing
 - Multi-region gateway discovery for roaming users
 - RD gateway v.next
 - ...

