Remote graphic workloads and clients

25 june 2019

Meet the team

Rody Kossen

Patrick van den Born

TeamRGE
Remoting Graphics Experts

Citrix Technology Professional

NVIDIA VIRTUAL GPU COMMUNITY ADVISORS #NGCA

Citrix Technology Advocates

Agenda

- Real world scenario
- Different graphic workloads
- Native clients
- Web HTML5 clients
- Lessons learned

Real world scenario

Real world scenario

- Customer invested in HCI VDI-backend
  - Citrix VDI
  - Windows 10
  - Nutanix AHV (2 clusters; 20 nodes in total)
  - All-flash storage – Machine Creation Services
  - NVIDIA M10
- VDI Performance is awesome!
- Mindset customer: lower the investment in “thin clients”
- Advised customer to test their personas on different clients:
  - Office worker (M10-1B, Actively Changing regions)
  - 2D CAD Engineering (M10-2Q, H.264 YUV444)
- We’ve seen learned some interesting things we want to share with you

Different graphic settings

Citrix HDX 1903

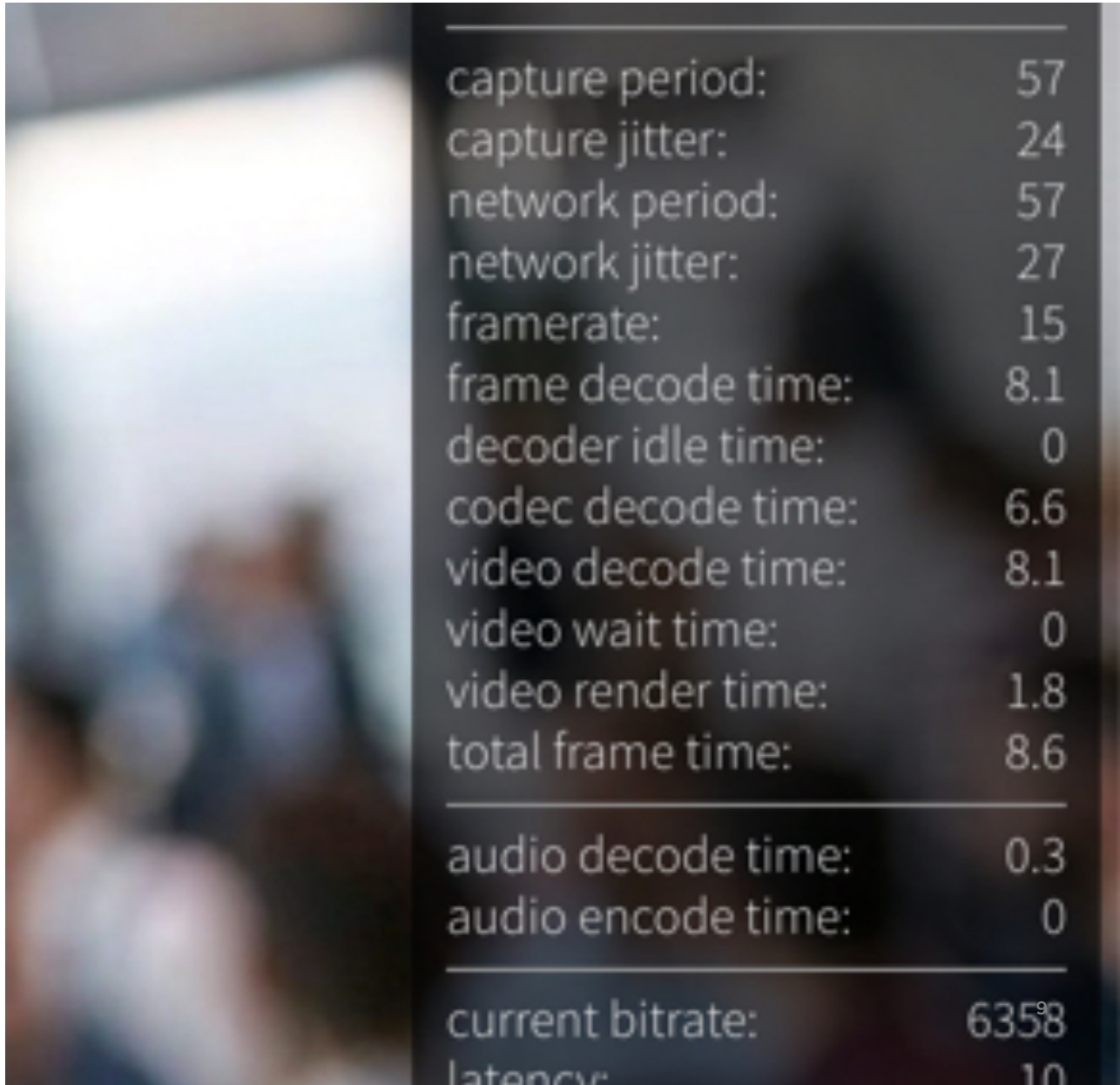
- ThinWire
- Adaptive display (Actively changing regions)
- H.264 For the entire screen – YUV420
- H.264 For the entire screen – Allow Lossy Compression– YUV444
- H.264 For the entire screen – Build to lossless
- H.265
- Lossless compression

VMware Blast Extreme 7.8

- JPG/PNG
- H.264 – YUV420
- H.264 – High Color Accuracy – YUV444
- H.265

Nutanix FRAME

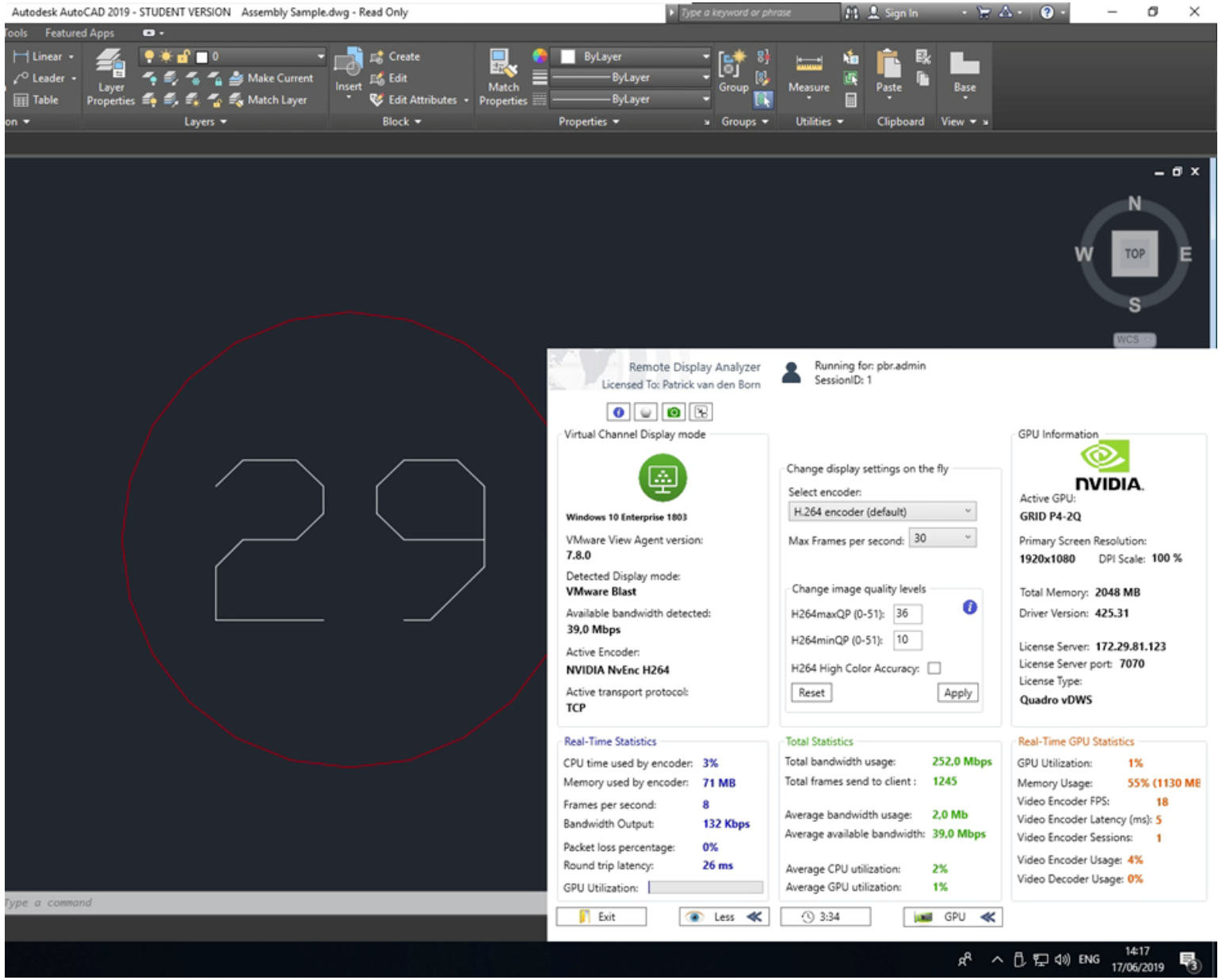
- Codec 0x1x1 (Google Chrome)
- Codec 0x1x1 HQ – equivalent of YUV444
- Codec 0x5x4 (Mozilla FireFox)



H.264 YUV420 vs YUV444

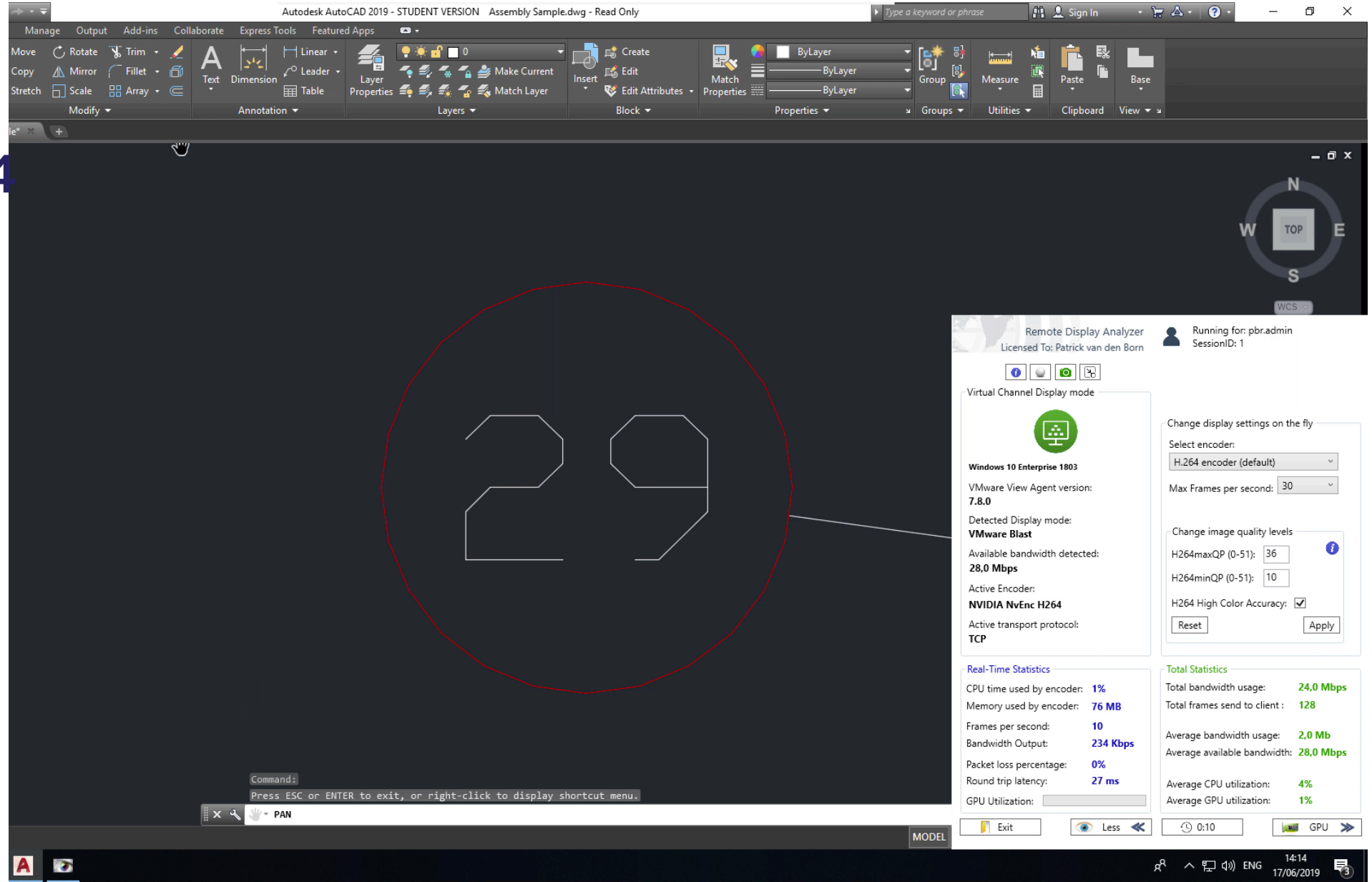
PQR

YUV420


Autodesk AutoCAD 2019 - STUDENT VERSION Assembly Sample.dwg - Read Only
Remote Display Analyzer
Licensed To: Patrick van den Born
Running for: pbr.admin
SessionID: 1
Virtual Channel Display mode
Windows 10 Enterprise 1803
VMware View Agent version:
7.8.0
Detected Display mode:
VMware Blast
Available bandwidth detected:
39,0 Mbps
Active Encoder:
NVIDIA NvEnc H264
Active transport protocol:
TCP
Change display settings on the fly
Select encoder:
H.264 encoder (default)
Max Frames per second: 30
Change image quality levels
H264maxQP (0-51): 36
H264minQP (0-51): 10
H264 High Color Accuracy:
Reset
Apply
GPU Information
NVIDIA
Active GPU:
GRID P4-2Q
Primary Screen Resolution:
1920x1080 DPI Scale: 100 %
Total Memory: 2048 MB
Driver Version: 425.31
License Server: 172.29.81.123
License Server port: 7070
License Type:
Quadro vDWS
Real-Time Statistics
CPU time used by encoder: 3%
Memory used by encoder: 71 MB
Frames per second: 8
Bandwidth Output: 132 Kbps
Packet loss percentage: 0%
Round trip latency: 26 ms
GPU Utilization:
Total Statistics
Total bandwidth usage: 252,0 Mbps
Total frames send to client : 1245
Average bandwidth usage: 2,0 Mb
Average available bandwidth: 39,0 Mbps
Average CPU utilization: 2%
Average GPU utilization: 1%
Real-Time GPU Statistics
GPU Utilization: 1%
Memory Usage: 55% (1130 MB
Video Encoder FPS: 18
Video Encoder Latency (ms): 5
Video Encoder Sessions: 1
Video Encoder Usage: 4%
Video Decoder Usage: 0%
Exit
Less
3:34
GPU
ENG
14:17
17/06/2019

PQR

YUV444


Autodesk AutoCAD 2019 - STUDENT VERSION Assembly Sample.dwg - Read Only
Manage Output Add-ins Collaborate Express Tools Featured Apps
Modify Annotation Layers Block Properties Groups Utilities Clipboard View
N W TOP E S WCS
Command:
Press ESC or ENTER to exit, or right-click to display shortcut menu.
PAN
MODEL
Remote Display Analyzer
Licensed To: Patrick van den Born
Running for: pbr.admin
SessionID: 1
Virtual Channel Display mode
Windows 10 Enterprise 1803
VMware View Agent version:
7.8.0
Detected Display mode:
VMware Blast
Available bandwidth detected:
28,0 Mbps
Active Encoder:
NVIDIA NvEnc H264
Active transport protocol:
TCP
Change display settings on the fly
Select encoder:
H.264 encoder (default)
Max Frames per second: 30
Change image quality levels
H264maxQP (0-51): 36
H264minQP (0-51): 10
H264 High Color Accuracy:
Reset
Apply
Real-Time Statistics
CPU time used by encoder: 1%
Memory used by encoder: 76 MB
Frames per second: 10
Bandwidth Output: 234 Kbps
Packet loss percentage: 0%
Round trip latency: 27 ms
GPU Utilization:
Total Statistics
Total bandwidth usage: 24,0 Mbps
Total frames send to client : 128
Average bandwidth usage: 2,0 Mb
Average available bandwidth: 28,0 Mbps
Average CPU utilization: 4%
Average GPU utilization: 1%
Exit
Less
0:10
GPU
ENG
14:14
17/06/2019

Clients test

Physical Clients

- Rich clients
  - Windows 10 x64
  - MacOS Mojave
  - Ubuntu LINUX
- Thin Clients
  - HP T630 with ThinPro
  - IGEL UD Pocket
  - nComputing Workspace Hub
  - Raspberry Pi 3

Native Clients

		Citrix HDX (1903)						Vmware Blast Extreme (7.8)		
OS	Device	ThinWire	ACR	H264-YUV420	H264-YUV444	B2L	Loseless	JPG/PNG	H264-YUV420	H264-YUV444
Windows 10 1809	Intel NUC	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MacOS Mojave	MacBook Pro	Yes	Yes	Yes	No*	Yes	Yes	Yes	Yes	Yes
Ubuntu 19.04	Intel NUC	Yes	Yes	Yes	No*	Yes	Yes	Yes	Yes	Yes
IGEL / LINUX	Intel NUC	Yes	Yes	Yes	No*	Yes	Yes	Yes	Yes	Yes
HP ThinPro	HP T630	Yes	Yes	Yes	No*	Yes	Yes	Yes	Yes	Yes
Citrix Workspace Hub	nComputing	Yes	Yes	Yes	No*	Yes**	Yes	n/a	n/a	n/a
Stratodesk	RPi3	Yes	Yes	Yes	No*	Yes**	Yes	Yes	Yes	No

* Fallback is ThinWire AlwaysLossless!

** Works, but UX is not great

Nutanix Frame doesn't have a native client at the moment.

ACR = Actively Changing Regions

B2L = Build to Lossless

REX Analytics: Native client experience

Web HTML5 clients

- Google Chrome
- Mozilla FireFox

- There are other browsers we've skipped:
  - Safari
  - Internet Explorer 11 (deprecated)
  - Edge
  - Opera

While Frame applications run on virtually any combination of browser, OS, and device, some perform better than others. Here's a quick reference that you can use to compare to the performance on your system:

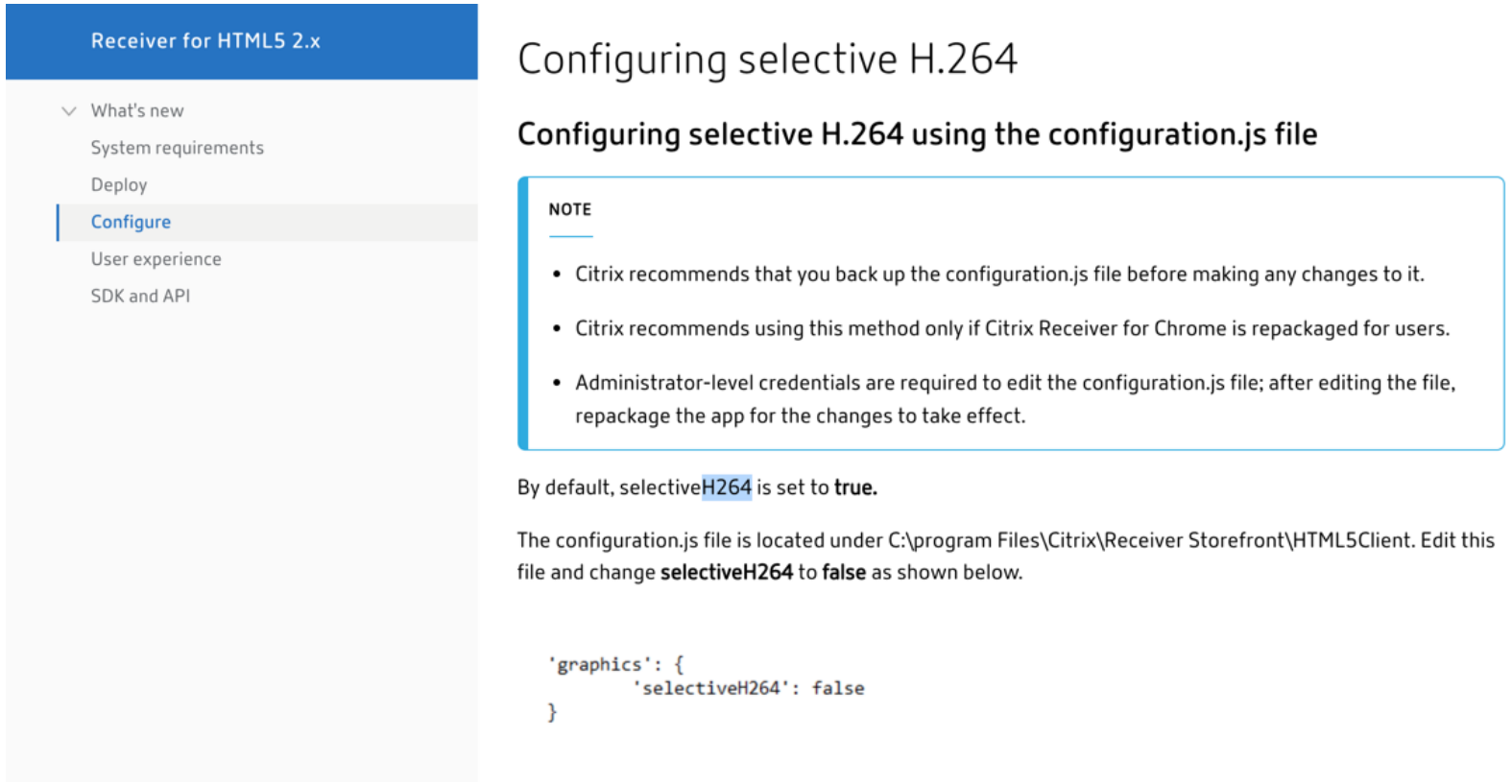
- **Chrome**: when possible, we use hardware acceleration called PNaCL (this is Google's proprietary technology). Expected decode time per frame on a mid-range PC, Mac, or Chromebook is <10 ms. On a faster machine (e.g., high-end PC or MacBook Pro), the decoding time per frame can drop to < 2ms. When PNaCL is not available (e.g., on AndroidOS), we fall back to pure JavaScript decoding, which is still very fast in Chrome.
- **Firefox**: Frame takes advantage of Firefox's support for asm.js, an optimizable, low-level subset of JavaScript. Video decode times per frame are in the 5-10 ms range on most modern desktop/laptop platforms (PCs, Macs). Decoding performance is great on a large range of devices – most computers sold in the last 5-6 years should have no problem running apps on Frame with great performance.
- **Safari**: While there's no equivalent of Google's PNaCL or Firefox's asm.js, Apple's javascript engine is very fast. Expected video decoding time is <10ms on a MacBook Air and < 5ms on MacBook Pro.
- **Internet Explorer 11 and Edge**: Native JavaScript performance in Internet Explorer 11 and Edge (for the purpose of decoding an incoming Frame stream) is OK, but lags behind other mainstream browsers, especially on underpowered devices. If you see video decode times in excess of 100 ms per frame, the Frame Protocol will adjust the frame rate, which might be reported as an increased network latency as well (as some frames are dropped during the adjustment).

Source: https://docs.frame.nutanix.com/enduser/enduser-session-perform.html

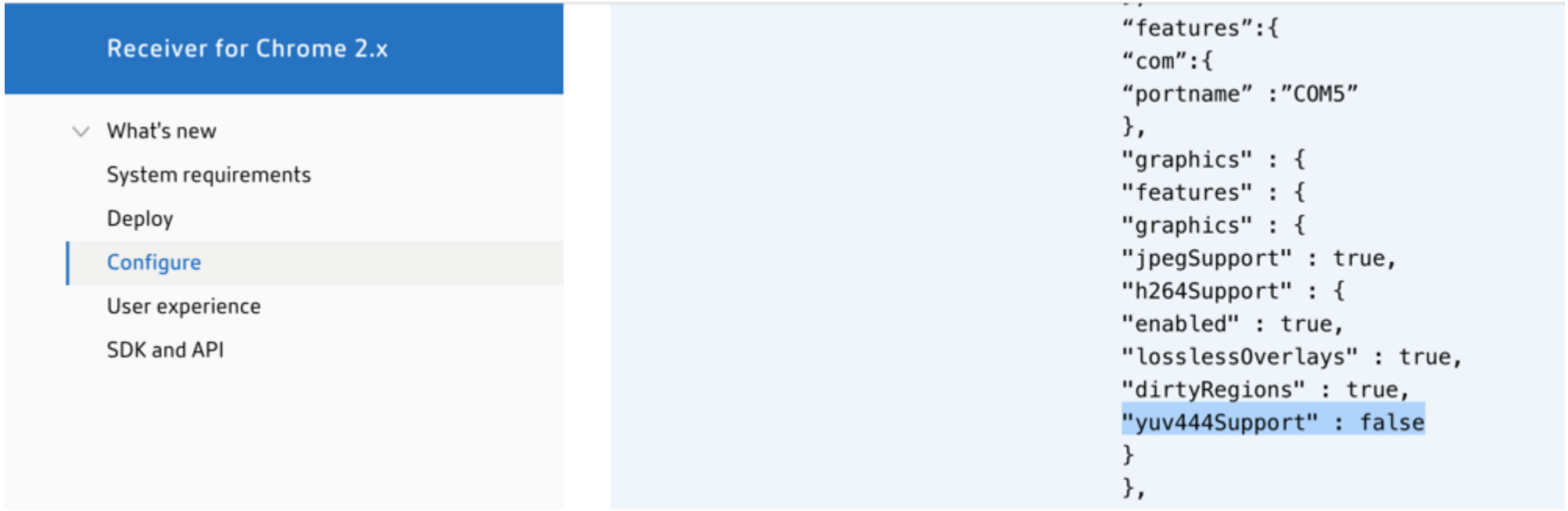
Use Cases

VMware recommends Blast Extreme for most use cases. It is required for connections to Linux desktops and for HTML Access. HTML Access uses the JPG/PNG codec except for Chrome browsers, which can be configured to use the H.264 codec. For a detailed description of these codecs, see Codecs Used by Blast Extreme.

Source: https://techzone.vmware.com/resource/blast-extreme-display-protocol-vmware-horizon-7#section1



Source: https://docs.citrix.com/en-us/receiver/html5/current-release/configure.html#configuring-selective-h264



C:\Program Files\Citrix\Receiver StoreFront\HTML5Client

yuv444support : true

Source: https://docs.citrix.com/en-us/receiver/chrome/current-release.html

Runs in any browser, but best UX with Chrome!

Web browser HTML5-clients

			Citrix HDX (1903)						Vmware Blast Extreme (7.8)			Nutanix Frame		
OS	Device	Browser	ThinWire	ACR	H264-YUV420	H264-YUV444	B2L	Lossless	JPG/PNG	H264-YUV420	H264-YUV444	0x1x1	0x1x1 HQ	0x5x4
Windows 10 1809	Intel NUC	Chrome	Yes	Yes*	Yes	Optional	Yes*	Yes	Yes	Yes	No	Yes	Yes	No
		FireFox	Yes	Yes*	Yes	Optional	Yes*	Yes	Yes	No	No	No	No	Yes
MacOS Mojave	MacBook Pro	Chrome	Yes	Yes*	Yes	Optional	Yes*	Yes	Yes	Yes	No	Yes	Yes	No
		FireFox	Yes	Yes*	Yes	Optional	Yes*	Yes	Yes	No	No	No	No	Yes
Ubuntu 19.04	Intel NUC	Chrome	Yes	Yes*	Yes	Optional	Yes*	Yes	Yes	Yes	No	Yes	Yes	No
		FireFox	Yes	Yes*	Yes	Optional	Yes*	Yes	Yes	No	No	No	No	Yes
IGEL / LINUX	Intel NUC	FireFox	Yes	Yes*	Yes	Optional	Yes*	Yes	Yes	No	No	No	No	Yes
HP ThinPro	HP T630	FireFox	Yes	Yes*	Yes	Optional	Yes*	Yes	Yes	No	No	No	No	Yes
Citrix Workspace Hub	nComputing	Chromium	No	No	No	No	No	No	No	No	No	No	No	No
		FireFox	No	No	No	No	No	No	No	No	No	No	No	No
Stratodesk	RPi3	Chromium	No	No	No	No	No	No	No	No	No	No	No	No
		FireFox	No	No	No	No	No	No	No	No	No	No	No	No

ACR = Actively Changing Regions

B2L = Build to Lossless

HTML5 on ARM based RPi Clients to slow

REX Analytics: HTML5 client experience

Lessons learned

- Try different clients per use case with your customer
  - There is a difference in UX per operating system
- Try web browsers on different devices
  - There is a difference in UX per web browser
- For YUV444 use cases (2D CAD)
  - Use Windows when using Native clients
  - Use Chrome when using a web browser
- Any browser is supported, but Chrome gives you the best UX from all vendors
- LINUX-based Thin Clients, check update cycles
- Client hardware is important i.e. decoding hardware for H264 or H265
  - Check your hardware compatibilities

POR
Thanks