A Closer Look at

SERVER-SIDE RENDERING

Technology Overview

SYNAPSE 5

FUJIFILM
Value from Innovation

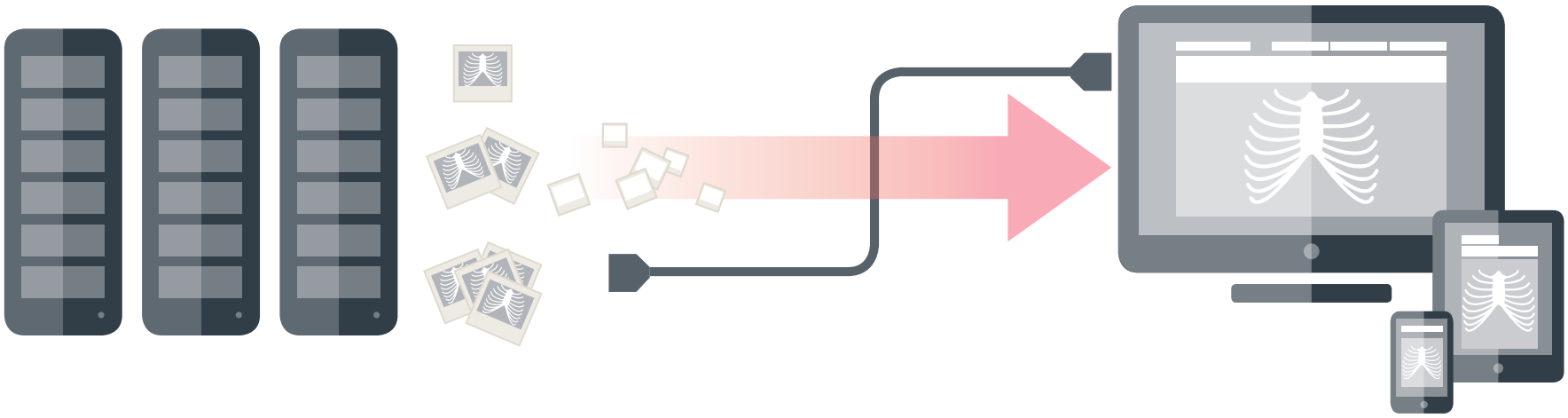
Driven by server-based rendering, **Synapse® 5 is the fastest PACS in the medical industry,** offering subsecond image delivery and diagnostic quality.

Why Image Rendering Technology Matters

Image rendering can be performed on a workstation or a server – with significantly different results.

Image rendering is the process of converting compressed DICOM image data to a presentation format suitable for display of medical images on workstation monitors. The process consists of decompression, decoding, processing, scaling, and layout of the images for diagnostic display.

Because Synapse 5 employs secure server-side technology, it delivers uncompromised image quality at greater speeds, with less bandwidth and better security.



Workstation Rendering Versus Server Rendering

The main difference between workstation and server rendering is the way the images are delivered. In medical terms, workstation rendering requires image delivery from the server to the workstation in a large bolus, while server-rendered images are delivered in a steady drip.

Workstation	vs.	Server
Uses local workstation resources		Uses a pool of powerful, central resources
Workstation client pulls the entire dataset up front, before rendering even begins		Workstation client pulls only relevant images on demand as they are displayed
Legacy architecture		Modern architecture
Images cached on workstation disk		Images cached on server
Datasets are larger—DICOM files contain images and metadata		Datasets are smaller—only rendered data is delivered to the workstation as needed
1 Gbps workstation connection to the storage appliance		10 Gbps server connection to the storage appliance (40 Gbps now available)
Uses pre-caching to mitigate slow networks		Pre-caching is not necessary

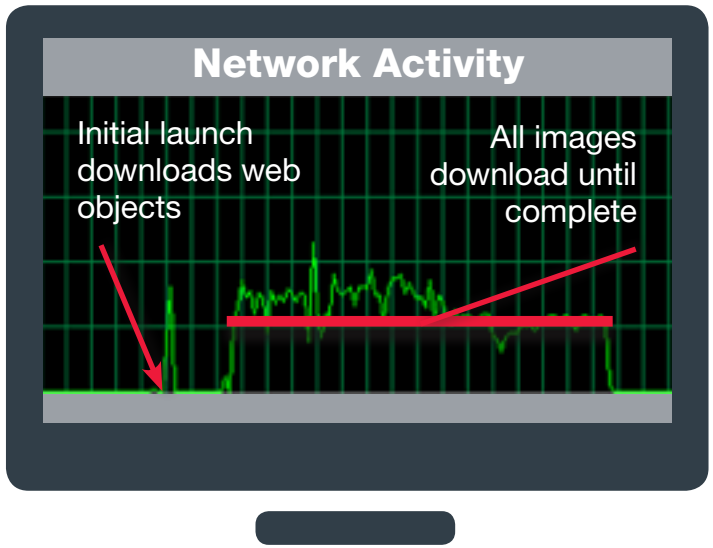
Server rendering is faster and more efficient. It allows the rendering process to begin sooner using dedicated server resources and delivers the fully rendered diagnostic-quality images to the workstation in small files as needed.

Less Network Traffic, Better Performance

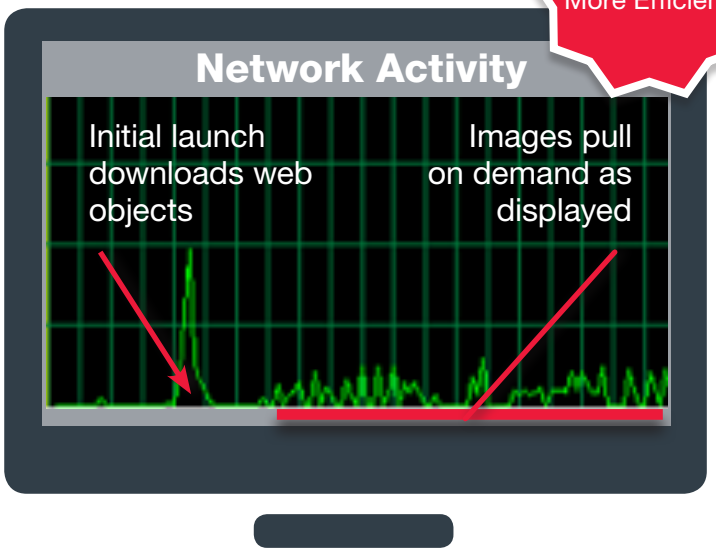
Workstation Rendering **vs.** **Server Rendering**

6x-20x More Efficient

20-30% Network Spike



Greater Network Consumption



1-5% Network Spike

Less Network Consumption

The server-rendering model achieves optimal speed with less impact on resources and the facility's LAN.

Managing Massive Datasets

Ever-growing datasets exacerbate the problems inherent in workstation rendering. Wide adoption of full-body PET, diagnostic breast tomosynthesis (DBT), cardiac CT, and functional MRI (fMRI) generate huge datasets.

	Full-Body PET	DBT	Cardiac CT	fMRI
Number of Images	2,500	500	18,000	20,000
Size	1 GB	9 GB	36 GB	300 GB

Networks get bogged down by current and relevant priors. By sharing 8-16 GB of RAM between PACS, dictation, and other necessary applications, workstations can crash due to lack of resources necessary to process data and render images

State-of-the-Art Architecture

Synapse 5 delivers uncompromised image quality with more speed, consuming less bandwidth, and delivering improved security using the following technologies:

Server-Based Rendering

Only essential images and data are delivered.

Servers have scalable CPU and RAM for rendering in a virtualized environment.

The full DICOM dataset never leaves the datacenter.

Rendered images are cached on the server, not the workstation.

HTML5

Latest workstation web browser technology provides maximum flexibility and easy deployment.

No installation required.

Runs on Chrome or Internet Explorer browsers.

Includes built-in tools for 3D, PET/CT Fusion, MPR, and diagnostic breast tomosynthesis.

WADO-RS

Web access to DICOM Persistent Objects transfer protocol enables rapid and reliable access to reports and images.

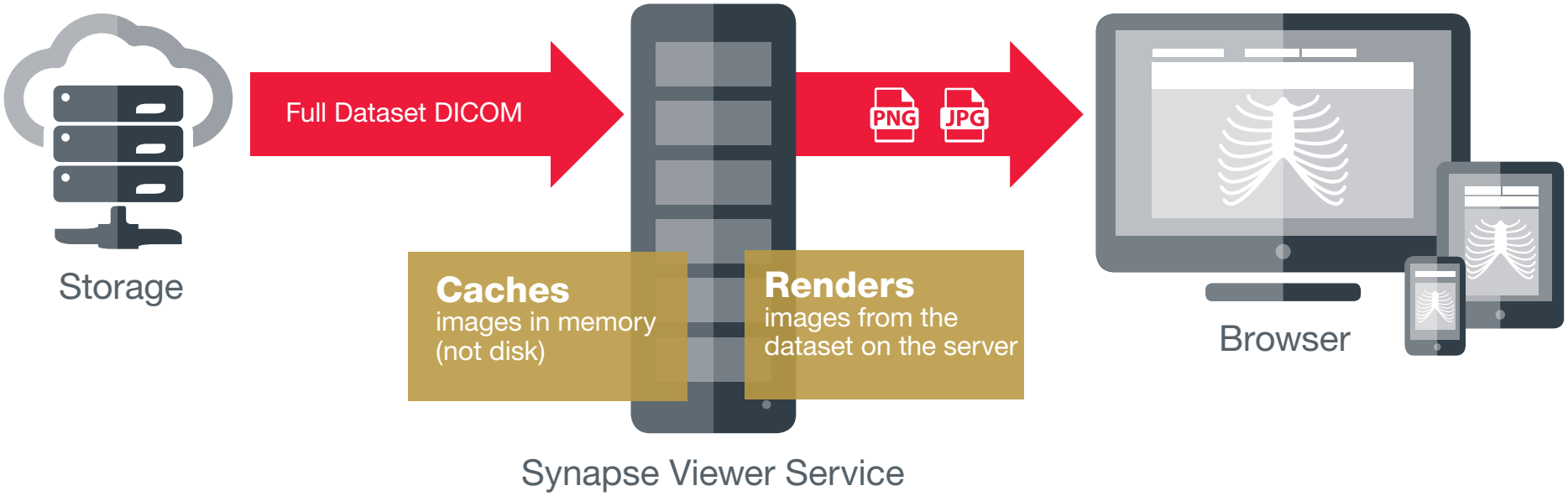
Provides access from any web client to images and reports.

Is a standards-based protocol.

Uses HTTP and HTTPS for fast and secure image display.

Synapse 5 Image Rendering

When a study is launched, the Synapse Server immediately gets the images from the storage array and renders, caches, and delivers them to the browser for display.



Portable Network Graphics (PNG) is used for diagnostic image display because it solely uses lossless compression and provides the highest-quality image possible with zero artifacts.

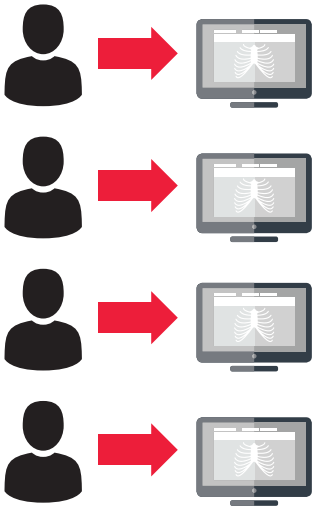
JPEG is used for series thumbnails and non-diagnostic image display because it supports higher-rate lossless and lossy compression modes.

Proven Performance

We vigorously measure and benchmark the performance of every Synapse release. The metrics and data we gather are used during product development to exceed targets and build the fastest solutions possible.

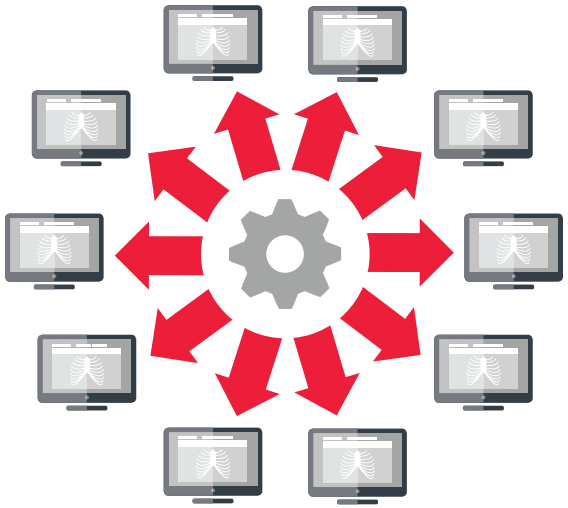
REAL-WORLD ENVIRONMENT

Live Radiologists



MACHINE-DRIVEN ENVIRONMENT

Emulated Radiologist



Sophisticated algorithms emulate real-world clinical usage (Chrome and Internet Explorer) pushing the system to its limits.

Assessments are repeated across synthetic enterprises with machine-driven radiologists to ensure system performance. Benchmarks for initial display time, scrolling frames per second, and worklist performance are provided in order to indicate the expected performance for given scenarios.

Performance: Initial Display

The initial display measurement provides average timing of worklist and study display. Studies of various sizes were used to calculate averages.

Measurement	IE 11	Chrome
Time to display a study opened from the worklist or a web query	1.6 seconds	1.7 seconds
Initial worklist display	0.7 seconds	0.9 seconds

See Appendix A for details about the environment used to capture measurements.

The results of the initial display assessment show that worklists open in less than 1 second and opening a study takes less than 2 seconds.

Performance: Concurrent Use

The concurrent-use assessment measures browser performance with increasing numbers of concurrent users. Assessments were conducted with extremely large datasets using the minimum server specifications for a load-balanced solution.

Emulated radiologist agents push the system to its limits, opening and scrolling images faster than any human can.

Study	1 User	30 Users	60 Users
7,000 slice CT Study	2.8 seconds	3.3 seconds	4 seconds
Diagnostic Breast Tomo Study	2 seconds	3.2 seconds	3.1 seconds

See Appendix A for details about the environment used to capture measurements.

Synapse 5's scalable architecture allows additional servers to be added in order to meet the demands of many users.

Image Quality

FUJIFILM Medical Systems U.S.A., Inc. has been in the imaging business for over 80 years, with image quality always a top priority. Synapse 5 delivers diagnostic-quality images in full fidelity along with better performance, more security, and less pressure on the network.

Clinicians often ask how it's possible to deliver smaller datasets to the workstation and still maintain diagnostic image quality. The answer is simple. Synapse 5 moves the rendering process from the workstation to the server. The rendered images are derived from the same DICOM data, but the DICOM data remains on the servers. The much-smaller rendered images are delivered to the workstations. Image quality is maintained, regardless of where the rendering process takes place.

This solution received **FDA 510K certification** on February 3, 2016.

Appendix

A. Server environment for measurement capture (up to 60 concurrent users at minimum spec)

Number of Servers	Server	CPU	RAM	Primary Storage for OS	Secondary Storage
1	Database	12 GHz	16 GB	80 GB	60 GB
2	Engine	12 GHz	16 GB	80 GB	40 GB
2	DICOM	8 GHz	16 GB	80 GB	60 GB
2	Viewer	15 GHz	16 GB	80 GB	40 GB
1	Storage	8 GHz	16 GB	80 GB	100 GB
1	Load Balancer	VMware NSX/Edge			

Appendix

B. Workstation environment used for measurements

Hardware	Software	Browser
Dell Inc., Precision Workstation T3600	Microsoft® Windows® 7 Professional 64-bit	Internet Explorer 11 Google Chrome
Intel® Xeon® CPU E5-1607 @ 3.00 GHz four cores, four logical processors		
16 GB RAM		
Two GPUs: NVIDIA Quadro 600		

Appendix

C. Studies used to calculate average display times

Current Study	Current Study Images	Prior Study(s)	Prior Study Images	Total Images
MR	7,000	N/A	0	7,000
MR	1,000	MR	1,000	2,000
CT	500	N/A	0	500
CT	3,000	N/A	0	3,000
CT	500	CT	500	1,000
MG	4	MG	4	8
US with multiframe	200	N/A	0	200
XA with multiframe	200	N/A	0	200
DX	2	N/A	0	2
CT	1,300	CT	1,300	2,600

More Speed

Less Bandwidth

Tighter Security

Comprehensive Enterprise Imaging

Improved User Efficiency

Instantly access even the largest datasets with the most popular browsers, using less bandwidth throughout the enterprise.

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Learn how **Synapse 5** can improve performance in your organization.

If you would like to schedule a product demonstration or have a representative contact you, please click below.

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