

THE DEFINITIVE UNIVERSAL VIEWER CHECKLIST

✓ Consolidates imaging information from disparate repositories

✓ Allows images to be accessed by multiple clinical stakeholders from a single viewing interface

Essential attributes of a mature enterprise visualization solution

Commonly referred to as an enterprise or universal viewer, an enterprise visualization platform has become a sought-after technology solution to enhance the visibility of medical images throughout a healthcare organization. Using industry standards, these systems consolidate imaging information from disparate repositories and allow it to be accessed by multiple clinical stakeholders from a single viewing interface.

Many vendors offer tools that they have branded as universal viewers, but not all are created equal. The solution you choose needs to support your referential viewing demands and provide advanced visualization features that address the specific requirements of specialty departments. This guide highlights the essential attributes, qualifications and functionality to consider when selecting an enterprise visualization solution that will meet your needs today and well into the future.

GENERAL FEATURES

- ❑ **Verified browsers:** The enterprise viewer should be a zero-footprint solution and not subject to any local software requirements such as Flash or Silverlight. It should be able to run on any commercially available browser (such as Internet Explorer, Firefox, Chrome, Safari or Opera).
- ❑ **Verified devices:** The enterprise viewer should be accessible from any internet-capable device (PC, Mac, tablet or any handheld device).
- ❑ **Multi-touch support on Windows 10:** The enterprise viewer should support all multi-touch capabilities as presented within the Windows 10 operating system.
- ❑ **DICOM, C-Store, SCU/SCP and MWL SCU:** The enterprise viewer should support the imaging standards for transmitting, storing, retrieving, printing, processing and displaying medical imaging information.
- ❑ **DICOMweb:** The enterprise viewer should support the DICOM standard for web-based medical imaging by supporting use of a RESTful set of services that enable healthcare images to be unlocked using industry-standard toolsets. The solution should allow DICOMweb to be implemented directly or as a proxy to the DIMSE service to offer modern web-based access to DICOM-enabled systems.



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- **API interface to VNAs:** An API Interface should exist that allows the enterprise viewer to be launched from any underlying application including EMRs, RIS or other applications.
- **DICOM activity monitor:** The enterprise viewer should display current, completed, failed, deleted, inbound, outbound, retrievals and data correction activities within a DICOM monitor.
- **Federated search:** The enterprise viewer should be capable of simultaneously searching multiple PACS or VNAs that reside within the primary network domain. This includes archives that host DICOM, XDS or other customer web services.
- **XDS and XDS-I consumer:** The enterprise viewer should be able to retrieve published imaging and document information, query an XDS registry and retrieve a DICOM manifest. The solution should be capable of decoding the manifest to extract the identifiers to the available imaging information. The viewer should also display the document or imaging information as part of the imaging workflow and consume that information within any available XDS or XDS-I repository.
- **User management:** The enterprise viewer should manage user access through a single interface for all users. User management should also be capable of Microsoft Active Directory integration.
- **Role-based access:** The enterprise viewer should support user access based upon specific user roles allowing users to be aligned with features and functions that are associated with their job role within the organization.
- **Public and private folders:** The enterprise viewer should incorporate the use of folders to create a collection of studies that you want to view as a group. The ability to select specific studies to include in a folder should also be available.

- **Printing:** The enterprise viewer should allow users to print patient studies loaded in the image viewing area. The viewer should enable DICOM printing, 3D printing, as well as paper printing of patient study information.
- **Multiple active directory authentication:** The enterprise viewer should be able to integrate with multiple active directory domains to support user management.
- **Local active directory authentication (for guest):** The enterprise viewer should support guest functionality for occasional users, such as external referring physicians.
- **Encrypted EMR URL integration:** The enterprise viewer should be capable of a fully encrypted URL connection.
- **Open API for launch, authentication and report ingestion:** The enterprise viewer should have the ability to be launched in context of a patient record. The launch should incorporate user identification as well as display all DICOM and non-DICOM medical images.
- **Lifecycle management:** The enterprise viewer should specify the activities that will occur if certain policy rules are satisfied (e.g., retain a series for six months before moving to a storage location, allow the movement of series to an offline storage location after two years).
- **Prefetch capability:** The enterprise viewer should be capable of retrieving archived images from external sources in advance of a scheduled patient visit, ensuring prior exams are available for comparison.
- **Multi-tenancy:** The enterprise viewer should support a refined multi-tenancy architecture that allows users to easily access internal institutional imaging studies separately from external studies. The viewer should be able to operate within a virtual enterprise imaging site and database unique to its specific enterprise domain while sharing the same specific enterprise imaging architecture that exists across multiple domains.

- **Multiple languages:** The enterprise viewer should provide support in multiple languages.

DEPARTMENTAL WORKLIST/QUALITY ASSURANCE

- **Video editing:** The enterprise viewer should support video editing, allowing users to remove irrelevant information while saving the segments they wish to retain as a new file.
- **DICOM attribute editing:** The enterprise viewer should allow users to modify DICOM attributes for a patient, study, series or image (e.g., correction of a patient's name). Attributes should also be able to be edited, added or deleted.
- **Reconciliation with MWL scheduled procedures:** The enterprise viewer should allow users to query one or more Modality Worklist (MWL) service providers for scheduled workflow items associated with a specific patient, study, modality, station name and AE Title. This allows more accurate patient/study data to be stored, distributed and viewed.
- **Series splitting:** The enterprise viewer should allow users to split a study by modifying a specific series and moving the modified series to a new study. The ability to maintain the unmodified series in the original study or delete it should also be available.
- **Masking:** The enterprise viewer should be able to create confidentiality masks and redact areas of an image to obscure patient data. The viewer should also enable users to automatically tie confidentiality profiles to specific folders.
- **Labels/markers:** The enterprise viewer should allow users to add missing labels to an image or correct labels that have been burned into an image.

- **Anonymization/confidentiality masks:** The enterprise viewer should support the ability to create confidentiality profiles that define how patient data will be anonymized based on DICOM attributes. In addition, the ability to use the default confidentiality profile, called Nominal, which is based on the DICOM standard “PS3.15 Table E.1-1. Application Level Confidentiality Profile Attributes” should be standard.
- **Outbound IOCM messaging to update third-party systems:** The enterprise viewer should support image object change management (IOCM) messaging to ensure remote servers are notified when studies, a series of images, or individual images are deleted from the main server; and that the main server is notified when these items are deleted from remote servers.
- **Folders/lists:** The enterprise viewer should allow specified patient data to be structured by lists or folders. These lists and folders allow for quick access to a particular set of pre-defined data and anonymize patient data based on applied policies.
- **Integration with external worklists:** The enterprise viewer should support integration with external worklists that exist within radiology workflow engines or PACS.
- **Quality control and data assurance components:** The enterprise viewer should come equipped with image study quality controls including advanced image measurement tools such as eclipse, region of interest, contour and spine measurement.
- **Data quality control and data assurance tools:** The enterprise viewer should provide a method to discover inconsistencies and other anomalies in the patient data, as well as performing activities to improve the data quality.

BASIC IMAGE VIEWING

- **2D image manipulation:** Enterprise viewers should include the following 2D image manipulation capacities:
 - Scroll
 - Pan
 - Zoom
 - Rotate
 - 1:1
 - Quadrant zoom
 - Invert
 - Window level
 - Gamma
 - Enhance
 - Smart zoom
 - Relate
 - Link
 - Annotations and measurements
 - Key image
 - Titles
 - Full quality
 - Reset
 - Hanging protocols
 - Study layout
 - View
 - Rendering
 - Reference
 - Thickness
 - Clipper
 - Curved MPR
 - Segment
 - NM map
 - Fusion map
 - Fusion blend
 - Cine
 - RT template
 - First, previous, next, last
 - Add notes to a study
 - Apply presets
 - Create a series with all images
 - View stereometric images
 - View CAD marks
- View DBT slice position
- View study annotations
- Edit videos
- **CINE:** The enterprise viewer should have CINE capabilities that allow users to view images in a study as a “movie.” CINE features should include:
 - Run, pause
 - Sync across viewports
 - Change speed
 - Select range
 - Replay/yo-yo
- **Non-DICOM image viewing:** The enterprise viewer should be able to consume non-DICOM images and incorporate them within the product’s workflow capabilities.
- **Display of reports:** The enterprise viewer should allow users to display reports within workflow configurations, allowing them to be viewed alongside study images. The reports supported should not only include DICOM SR, but PDF, textual and FHIR reports as well.
- **Toolbar configuration:** The enterprise viewer should have customizable toolbars that support easy access to underlying functionality.
- **Batch viewing:** The enterprise viewer should allow users to open and review multiple studies in a single session without having to return to the patient study directory.
- **3D rendering/multiplanar viewing:** The enterprise viewer should offer multidimensional viewing capabilities, including volume, Maximum Intensity Projection (MIP), average and multiplanar reconstruction.
- **Secondary capture:** The enterprise viewer should be able to capture images with added annotations, markups and image manipulations (ex: zoom, window level) in the DICOM SC standard.
- **MPR features:** The enterprise viewer should include multiplanar reconstruction (MPR) or reformatting capabilities such as rotation, slab thickness adjustments, volume, average or MIP views, reference lines and related points across all planes displayed.

INTERMEDIATE IMAGE VIEWING

- **Presentation states display:** The enterprise viewer should support measurements and annotations that can be applied to an image and saved in a presentation.
- **Cross correlation localizer display between series:** The enterprise viewer should include tools that allow users to identify a specific point across multiple planes of a spatially localized imaging set and display that common point immediately upon choosing a point on a single image plane.
- **Arrow and text annotations:** The enterprise viewer should provide annotation tools, such as arrow and text annotations, that allow users to mark and measure features on an image.
- **Measurements tools:** The enterprise viewer should have the following basic measurements available:
 - Angles and Cobb angle
 - Plumbline
 - Curvature
 - Spine labels
 - Grease pen
 - Linear: cursor, ruler, contour, polyline, ratio, calibrate
 - Area: ROI-free, ROI-eclipse, ROI-threshold, circle, polygon, square/rectangle, area ratio
 - ECT: HR and interval
 - Reporting of angle at ruler intersections
- **Grease pen annotations:** The enterprise viewer should allow users to highlight a region of interest using a freeform shape with no measurements shown.
- **Measurement propagation:** The enterprise viewer should support cross-sectional images to propagate an annotation or measurement across all images in the series.
- **Blur/sharpen and gamma correction:** The viewer should include tools that enable edge enhancement and gamma correction of images.

- **Curved reformat:** The enterprise viewer should support curved MPR capabilities. Curved MPR allows a curve to be defined in the volumetric dataset and enables an image to be viewed along this curve. This is useful for viewing structures such as blood vessels or the spine.
- **Vessel tracer:** The enterprise viewer should have vessel tracing available. Once applied, the vessel tracer view should be able to identify vessels using seed points and enable centerline and lumen wall adjustments.

STUDY NOTES

- **Study notes:** The enterprise viewer should allow users to add notes to studies as they are being reviewed. These notes should be available when studies are closed and should be saved within a structured report format.
- **Study note standardization:** Study note features should allow users to select from a standardized list of templates, defined by the healthcare organization, to ensure the consistent and efficient display of notes.
- **Study note formats:** Study notes should enable the organization to easily configure templates; allowing users to access to metadata, insert pictures or logos, and incorporate multiple methods of data entry (e.g., dropdown list, checklist, single-line text, multi-line text).

SAVED EVIDENCE

- **Save and send bookmarks:** The enterprise viewer should allow users to use a bookmark to tag an image in a patient study for quick retrieval and sharing.
- **Creation of key images:** The enterprise viewer should identify key images in 2D views and create a series of key images for a study. This allows users to quickly access important images within a series.

- **Creation of presentation states:** The enterprise viewer should support all measurements and annotations applied to an image saved as a presentation state. A draft presentation should automatically be created when a study is opened (if a draft does not already exist). Users should be able to continue adding changes the presentation draft until it is approved.

MULTI-SPECIALTY CAPABILITIES

- **Advanced CT and MR protocols:** The enterprise viewer should support the DICOM Enhanced CT/MR Image Module attributes.
- **Mammography diagnostic workflow:** The enterprise viewer should provide multi-stage hanging protocols common to mammography viewing/interpretation workflows. This capability should allow multiple prior exams to be organized and annotations to be immediately displayed.
- **Ophthalmology diagnostic workflow:** The enterprise viewer should support measurements for wide-field ophthalmic photography images. The viewer should be able to calculate linear and area measurements using a 3D geometric model of the eye.
- **DICOM-ECG:** The enterprise viewer should support DICOM-ECG images under IHE standard ECG viewing layouts.
- **ECG tools panel:** The enterprise viewer should have tools to support gain and timescale, filter, HR and QTQTc annotations.
- **ECG area calculations:** The viewer should include an ECG component that supports linear measurement tools (such as the ruler) and area measurement tools (such as the rectangle), horizontal measurements shown in seconds, and vertical measurements shown in mV.

□ **ECG viewing of specific ECG waveform components:**

The enterprise viewer should support the adjustment of gain and timescale to better define ECG waveforms on a graph.

□ **Heart rate measurements:** The enterprise viewer should include a heart rate tool that calculates the number of heart beats per minute (bpm) between two points on a graph.

□ **Radiation treatment support functions:** The enterprise viewer should support viewing of external beam radiation therapy (RT) plans.

ADMINISTRATIVE TOOLS AND FEATURES

□ **Access to system features, user features and user granularity:** The enterprise viewer should allow administrators to configure organizational parameters and preferences.

□ **Tools and feature usage statistics:** The viewer should record the following usage statistics:

- Patient audit trail
- User activity
- Event audit trail
- Patients accessed by user
- Top users by patient access
- Study access by modality
- User login load-balancing across servers
- Study review load-balancing across servers
- Study review distribution over time
- Login distribution over time

□ **Crash, exception and alerting tools:** The enterprise viewer should allow administrators to monitor for failures to load content, health checks, tools/feature usage, study types, crashes and exceptions.

□ **Study statistics:** The enterprise viewer should provide robust analytics for the administration of the system architecture, security of data integrity and access, and user and event activity auditing.

□ **Loading, rendering and SQL statistics:** The enterprise viewer should support site targeted statistics; DICOM activity, instances loaded, render times, users by patient access, user activity, user login load-balancing across servers, study review load-balancing across servers, event audit trail and logins of SQL query timing.

□ **Break the glass notifications:** The enterprise viewer should support an emergency override (“break glass”) for users and guests. This feature should only be used to search for studies that users have authorization to view but that don’t appear on their typical search/lists.

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