

Use Case Title: Radiology AI In Practice

Short Description

Frank, a 60 year old African-American, is an ICU patient with an acute change in mental status. At the time of the order, the Hyperfine Swoop scanner is finishing another post-op MRI brain in the ICU. Frank's Brain MRI scan is assigned to Hyperfine because that will be much faster to perform a portable Brain MRI scan in the ICU than waiting for transport and nursing availability to take him down to the conventional scanner. Portable MRI scanners also enable care for patients who are too sick to be transported to the Hospital's Imaging/Radiology department

The Hyperfine Swoop MRI Scanner is wheeled into Frank's room and an accelerated scan is obtained. The AI model detects a stroke, sending results encoded in DICOM SR as per IHE AIR, which allows Imaging AI findings from deep learning models to be interpreted and recorded by downstream systems like viewers and reporting systems.

As the result flow into the interface engine, Qvera, its rules cause a notification to be fired off to EMR users assigned to that patient record to get their attention ASAP. This is done via IHE ACM, which allows the care team in the EMR application to be immediately notified about the patient's urgent need for care

Upon conclusion of the scan, the results of the full radiology report are stored in the EMR, Epic, for visualization and further exploration in an embedded application using SMART on FHIR, which enables smooth, context-based integration of applications such as Image Viewers, in this case provided by LifeOmic, into the EMR.

Value Statement:

Standards enable seamless integrations between systems. AIR allows interpretation of Imaging AI findings. ACM allows immediate notifications of urgent issues. SMART on FHIR enables EMRs to launch other apps in context.

Participating Organizations: Epic, Hyperfine, LifeOmic, Qvera, RSNA

Long Description

#	Scenario	Product	IHE Profile /Transaction
1	<p>Epic places order for MRI Brain scan for ICU Patient Frank</p> <p>Frank is a patient in the ICU who experiences an acute change in mental status. To assess the cause of this change an MRI is ordered. Epic sends this order to Qvera in an HL7v2 ORM O01 order message.</p>	Epic Radiant	RAD-2
2	<p>Qvera Dicom Router (Qvera Interface Engine) receives the order from Epic.</p> <p>We are then able to store the order data and expose a DICOM MWL endpoint. This allows the Modality to query for the MWL and receive a list of pending orders for that modality. The modality then loads the Patient and Order information directly from the MWL. This eliminates the need for the provider to manually enter in the patient demographics as well as having to look up the order in the EMR. By removing the manual workflow it allows the clinical staff to remain focused on the patient and reduce wait times. Now that we have stored the order information Hyperfine will now query for the worklist.</p> <p><Pass to Hyperfine></p>	Qvera QIE	SWF RAD-5
3	<p>Hyperfine picks the order off the MWL and performs the scan</p> <p>Clinicians use the Hyperfine, Inc. Swoop® system to pick the order from the MWL and perform the scan.</p> <p>The Hyperfine, Inc. Swoop® MR system is used in Frank’s room because he is too fragile to move. Clinicians use the Swoop® system to perform a modality worklist query to obtain Frank’s MR exam order. The system acquires Fluid-Attenuated Inversion Recovery (FLAIR), Diffusion-Weighted Imaging (DWI), and Apparent Diffusion Coefficient (ADC) map sequences in approximately 25 minutes. It sends the images to the Hyperfine, Inc. BrainInsight™ automated AI tool.</p>	Hyperfine Swoop	SWF RAD-5, RAD-8, RAD-10
4	<p>Hyperfine performs AI analysis and determines a stroke is present. Results sent to Qvera encoded as DICOM SR</p> <p>The Hyperfine, Inc. BrainInsight™ automated AI tool performs AI analysis and suggests a stroke is present. The</p>	Hyperfine BrainInsight	AIR RAD-43, SWF RAD-18, RAD-10

	<p>results are sent to Qvera and encoded as DICOM SR.</p> <p>Hyperfine, Inc. BrainInsight™ automated AI tool algorithms process the images and identify a potential new lesion in the calcarine region of the right occipital lobe. The lesion volume and a bounding box surrounding the region are encoded in a DICOM SR using the IHE AIR profile. The BrainInsight™ automated AI tool transmits the images and the DICOM SR to Qvera.</p>		
5	<p>Qvera Dicom Router routes SR and images to the Pacs and viewer.</p> <p>Qvera Interface Engine has now received the DICOM SR from Hyperfine, Inc. As a DICOM Router we are now able to send the DICOM SR to a PACS system using the DIMSE protocol as well as send a copy to LifeOmic using the DicomWeb connection.</p>	Qvera QIE	RAD-128 Send imaging results (radiology report)
6	<p>Qvera Dicom Router sends results to epic via HL7 and closes the order.</p> <p>Because we have the DICOM SR we can also now extract the diagnosis/notes from the SR and create a ORU HL7 message and send this to Epic. This will enable us to have a note in the patient's chart about what the radiologist found with the help of the AI. We also are able to close the order in epic.</p> <p>This automation enables us to save the clinical staff time on documenting the procedure was complete and putting the notes into the chart while improving accuracy.</p> <p>The report for the study is:</p> <p>Clinical Indication: 60-year-old African American male ICU patient with acute mental status change.</p> <p>Technique: Ultra-low field bedside MR, axial Flair and DWI/ADC</p> <p>Findings: The images demonstrate abnormal hyperintensity on DWI, with corresponding hypointensity on ADC, in the calcarine region of the right occipital lobe. Corresponding abnormal hyperintensity on Flair is seen.</p> <p>No other focal abnormalities are noted.</p>		HL7 ORU

	Impression: DDWI-Flair matched lesion, acute stroke, right calcarine occipital cortex		
6	<p>Qvera Dicom Router will send an ACM message to epic.</p> <p>This is to notify the clinical staff that the procedure is complete and the patient is ready for next steps. <add notes about patient condition and what follow could occur></p> <p>This automation of routing the DICOM SR, Sending the notes from the SR to the chart and notifying the clinical staff is to help with the patient care. Giving the clinical staff more time with the patient and less time checking for updates and documenting notes from those resulting in better results for our patient.</p> <p><transition to Epic/Life Omic></p>		ACM
7	<p>Epic visualizes report and notification</p> <p>Epic files the HL7 result message to the patient’s chart. Upon receiving the ACM message a notification is sent in Epic to the provider that the MRI is complete and there is information to review. The provider reviews the results in the patient's chart and then utilizes a SMART on FHIR launch to LifeOmic to view the images and report.</p>	Epic Radiant	
8	<p><i>Embedded LifeOmic UI is used to visualize the DICOM images and AI report</i></p> <p>To better understand the results of the MRI scan, the care team opens the embedded LifeOmic patient viewer. The patient layout has been pre-configured with the DICOM viewer and relevant patient data.</p> <p>The clinician can browse through the images in the DICOM study and explore the structural report from the Hyperfine, Inc.BrainInsight™ automated AI tool algorithm. The full set of tools from the DICOM viewer can be used to inspect the image including measurement and alternate layouts.</p> <p>In addition to browsing the DICOM study, the clinician can quickly see the other relevant data about the patient, such as intracranial pressure, hemoglobin, platelet count, INR or blood pressure.</p>	LifeOmic Platform	Smart on FHIR

Data Exchange Standards

Vendor	Product	Category	Protocol	Interop Body	Interop Profile	Interop Actor	Interop Message	Send or Receive	Transaction Description
Epic	EpicCare	Electronic Health Record	HL7	IHE RAD	SWF.b	Order Placer	RAD-2	Send	Places Order
			HL7	IHE RAD	RD	Result Receiver	RAD-128	Receive	Receive Imaging Result
			WCTP	IHE ITI	ACM	Alert Communicator	PCD-06	Receive	Disseminate Alarm
			HL7	FHIR	SMART App Launch	EHR		Send	Launch Embedded UI
LifeOmic	Platform	Data Storage & Analysis	HL7	FHIR	App Launch	Clinician		Receive	Open embedded UI
			HL7	FHIR	Base	Platform		Send	Fetch FHIR data
			DICOM	web	STOW-RS	Int. Engine	STOW-RS	Receive	Receive DICOM image
Hyperfine, Inc.	Swoop® System	Portable MR Modality	DICOM	IHE RAD	SWF.b	Acquisition Modality	RAD-5 RAD-8 RAD-10	Send	Query Modality Worklist Modality Image Stored Storage Commitment
	BrainInsight™ Automated AI Tool	Automated AI tools for brain imaging	DICOM	IHE RAD	SWF.b	Image Manager	RAD-8	Receive	Modality Image Stored
							RAD-10	Send	Storage Commitment
					AIR	Evidence Creator	RAD-18 RAD-43	Send	Creator Images Stored Store Evidence Documents

Qvera	Qvera Dicom Router	Interface Engine	DICOM	IHE RAD	SWF.b	Image Manager	RAD-8	Receive	Modality Image Stored
							RAD-10	Send	Storage Commitment
						Acquisition Modality	RAD-5	Receive	Query Modality Worklist
					DICOMweb		STOW-RS	Send	Store DICOM objects
			WCTP	IHE ITI	ACM	Alert Communicator	PCD-06	Send	Disseminate Alarm
			HL7	IHE ITI	ORM			Receive	General Order message
					ORU			Send	Observation Message

References