

Interoperability Takes Center Stage to Help Healthcare Providers Create Imaging Health Records



Addressing the Challenge.

Healthcare needs to transcend technical, institutional and governmental boundaries.

The healthcare enterprise is akin to the human body in that it is astoundingly complex, and all its many systems must work together seamlessly for the entire organism to function at its best. Interoperability could be described as a well-functioning central nervous system, coordinating the enterprise's many roles and tasks toward a common end: the well-being of each patient.

When communications are slow, incomplete or missing between any two entities – for example, between patients and providers, primary care physicians and specialists, central and remote locations, and so on – the timeliness and quality of patient care can suffer. And while patient experiences and outcomes should always be the number-one concern, many other parts of the total healthcare ecosystem can be affected as well: costs can rise, resources can be allocated inefficiently and opportunities for constructive collaboration can be lost.

If you think that last paragraph describes the current state of affairs in healthcare, you're not alone. Virtually every provider and user of health information technology acknowledges the need for greater interoperability, especially in light of the reforms mandated by the American Recovery and Reinvestment Act of 2009 and the Affordable Care Act of 2010. Governments and healthcare IT providers around the world are also pursuing greater interoperability, and are looking to the U.S. for leadership in the development of the necessary standards and technologies.

Healthcare needs to transcend technical, institutional and governmental boundaries. For a more efficient healthcare system that delivers better results, information systems that were historically developed in relative isolation need to begin speaking a common language.

In this white paper, we'll explore why interoperability matters, why it's challenging to accomplish and what the health IT industry is doing to achieve it. We'll close by looking at the contributions Carestream Health is making with our Clinical Collaboration Platform for interoperable capture, management, storage and distribution of clinical images and supporting data. Our goal is to remove barriers to effective collaboration across each enterprise and between all the enterprises that need to work together to deliver the highest standard of care.

How are Market Forces Shaping Clinical Imaging Requirements?

Today, enhancements in healthcare are converging in a landscape marked by an increased demand for seamless access to clinical images and data. Developments across the healthcare landscape are converging in ways that increase both the demand for and the feasibility of providing frictionless access to clinical images and data. Increasingly, there's an expectation that quality healthcare depends on the ability to securely deliver clinical information to anyone who needs it, anytime and anywhere.



The Importance of Sharing.

Enterprises need the ability to share data from EHRs freely, including clinical images and data from all departments.

In the U.S., for example, Medicare and Medicaid provide incentive payments to doctors and hospitals for demonstrating “meaningful use” of certified electronic health record (EHR) technology – a benefit made available under provisions of the HITECH Act, enacted as part of the American Recovery and Reinvestment Act. The results have been dramatic: while only 16 percent of hospitals had even a basic EHR in 2010, 85 percent of eligible hospitals had received payments for demonstrating meaningful use of EHRs by the end of 2014.

This rapid adoption of EHR technology, coupled with rising clinical and business needs for cross-continuum data, is driving a renewed focus on interoperability technologies. It has motivated IT vendors and managers to integrate systems by adopting standards and simplifying the links required to deliver clinical information within a consolidated, longitudinal record. Because clinical images are essential for the meaningful use of these records and are the basics of so-called “evidence-based medicine”, images that have historically been relegated to multiple departmental silos now need to be stored, managed and accessed.

Radiology information systems have led the way in adopting standard formats and exchange protocols, so they’re often first in line to be decommissioned as separate departmental systems and instead integrated as a module within the EHR. Images from other departmental systems will also need to be made available to the EHR, and in many cases, this may require the standardization of workflows, formats and communication protocols wherever these standards don’t currently exist.

Standards also need to be adopted at the enterprise and departmental levels. Regulatory and market forces are motivating hospitals and provider organizations to consolidate in order to gain efficiencies and economies of scale to cope with rising compliance costs and decreasing reimbursements. These enterprises need the ability to share data from EHRs freely, including clinical images and data from all departments, in order to deliver quality care and effective administration across a greatly expanded healthcare ecosystem.

Why Does Interoperability Matter?

Generally speaking, interoperability can be defined as the ability of separate information systems to exchange data and connect processes in the most useful way. When interoperability is adopted in healthcare, it gives providers access to patient data from across the care continuum, coordinates processes across applications and health system members, and unlocks secondary uses of data for analysis and research. Those initiatives often include not only providers, but also payers, public health agencies, individual patients and others.



Interoperability: Who Benefits?

From a marketplace standpoint, every stakeholder in the healthcare delivery process stands to benefit from interoperable systems that deliver collaborative transparency and efficiency.

Health IT interoperability matters for the same reasons the Internet matters. Information generated by different systems, on different networks and for different purposes becomes far more useful when a unified framework is in place for capturing, distributing and using the information. While the sources and types of healthcare information may be highly specialized, the goal of interoperability is to generalize information access and usability – removing any barriers of time, place or technology.

Ideally, with the appropriate security credentials, any individual user or collaborative team should be able to interact with the information they need, in the format they prefer, on their choice of device. As the health IT ecosystem becomes ever more complex, achieving that ideal becomes both more challenging and more essential. Yet, despite the difficulties, we foresee a future in which widespread interoperability will be required to meet a broad range of marketplace, ecosystem and regulatory demands.

From a marketplace standpoint, every stakeholder in the healthcare delivery process stands to benefit from interoperable systems that deliver collaborative transparency and efficiency. To cite just a few examples of the collaborative relationships at stake:

- Payers are motivated to collaborate with providers for improved efficiency and transparency by a changing regulatory landscape that includes new reimbursement models and cost-control pressures.
- Patients who want to take more active responsibility for their own health and well-being are looking for closer collaboration with their care providers.
- Primary care physicians and specialists are seeking meaningful collaboration, without information gaps, delays or redundancies that could compromise quality.
- Providers in remote and rural areas need the ability to share clinical images and data with centrally located specialists who can offer diagnostic expertise not available locally.

With an increasing emphasis on wellness and integrated clinical pathways, healthcare teams are looking for a collaborative view of clinical data across departments, patients and histories of care.



Why Does Interoperability Matter?

Interoperability can lower costs, support integrated clinical pathways and improve safety and quality – all leading to better outcomes.

From the standpoint of the IT ecosystem, interoperability is an ongoing project to preserve the ability of developers in a free marketplace to provide new and better solutions, while promoting standards-based information exchange between disparate systems and networks. Goals include reducing or eliminating data redundancy, ensuring consistency and accuracy, and, above all, removing barriers to collaborative information-sharing while maintaining trust.

From a regulatory standpoint, the Office of the National Coordinator for Health Information Technology (ONC), housed within the U.S. Department of Health and Human Services, is charged with the task of coordinating the implementation of interoperable health information technology nationwide.

According to ONC’s “10-Year Vision to Achieve an Interoperable Health IT Infrastructure,” by 2024, individuals, care providers, communities and researchers should have an array of interoperable health IT products and services that allows the healthcare system to continuously learn and advance the goal of improved healthcare. This “learning health system” should also enable lower healthcare costs, improved population health, truly empower consumers and drive innovation. For example, all individuals, their families and care providers should be able to send, receive, find and use health information in a manner that is appropriate, secure, timely and reliable.

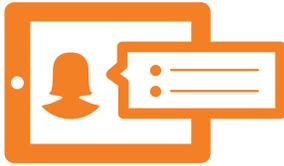
With the U.S. taking a strong role in promoting the development and adoption of interoperability standards, health organizations around the world will likely be following suit. Although total interoperability of health IT systems is many years away – assuming it’s even possible, given the complexity and scope of the challenge – every step taken toward that goal advances the ability to deliver quality outcomes.

Lowering costs, supporting integrated clinical pathways and improving safety and quality, all leading to better outcomes – are the core reasons interoperability matters.

How Can Clinical Information Be Made Meaningful and Usable?

Rapid advancements in information technology and a growing health IT marketplace have brought a rush of vendors into the arena, adding to the sheer volume and variety of information originating from different systems. The onslaught of data in structured and unstructured formats adds to the challenge of delivering a complete and integrated view of patient care via enterprise-wide interoperability.

EHRs are inherently built around structured digital data, including patient demographics, admission status, physical and diagnostic findings, prescriptions, discharge status and many other fields. However, true interoperability requires



Advanced Image Tagging.

Metatagging adds a meaningful context to clinical images and data while making information you need easily searchable.

providing integration with access to unstructured information as well. Images and videos, paper charts and scanned documents, emails and many other documents that bear on healthcare decisions may not have a structure that makes them easy to incorporate into an EHR.

Typically, these unstructured data items are generated by and reside on department-specific systems, many of which were implemented years before interoperability came into focus as a desirable goal. As a result, these siloed systems may be lacking when it comes to cybersecurity. Moreover, patient information may not be complete or 100% aligned with the enterprise's EMR. Organizations need to determine which classes of unstructured data will be most useful to access across systems – and add structure to these items to make them interoperable and accessible.

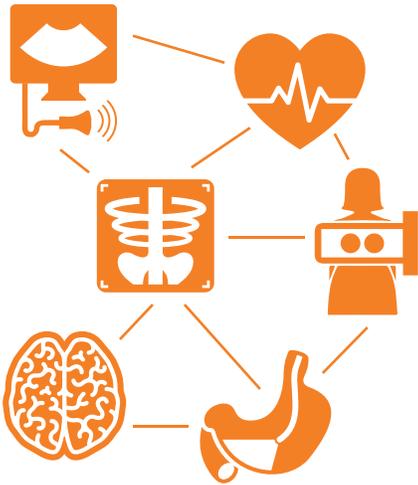
For both structured and unstructured data, adding metadata tags in DICOM can be a powerful way of providing a context that makes clinical information easy to search, retrieve, and interpret for any given user's needs. For more information about the metadata tagging process and its benefits, read our white paper, "Metadata: Creating Meaningful Access to Clinical Images and Data for Any User."

The sheer volume of health-related data, structured and unstructured, will only increase as new technologies emerge both within and outside of clinical settings. For example, think of the possibilities offered by in-home or telehealth devices and even wearable health and fitness monitors. Consider also that accepted healthcare standards and practices are in continuous flux – for example, what's considered a normal lab result today may raise a red flag tomorrow in light of new research.

The takeaway here is that interoperability is not a destination, but an ongoing journey with many paths by which it can be reached. As with healthcare research, administration and delivery, IT providers and professionals need to be continually learning and working together to advance the art and science of holistic care.

What are the Technical Challenges and Solutions for Delivering Meaningful Information?

Modern radiology departments have made great progress in capturing, managing, storing and retrieving data for meaningful use through the implementation of PACS (Picture Archiving and Communication System) and DICOM (Digital Imaging and Communication in Medicine) architectures. Delivering meaningful clinical information across the enterprise requires analogous methods and tools for effective image capture, workflow management, image management, consolidated storage, and the ability to access and share images throughout the enterprise.



What Will it Take?

To make the transition from departmental imaging to enterprise and cross-enterprise imaging, healthcare organizations need to implement interoperable systems that take advantage of mature industry standards, protocols and technologies.

However, the standards typically found in radiology rarely exist in other image-intensive specialty care teams. Several challenges must be solved in order to bring these departments into a fully integrated enterprise imaging environment, including:

Disparate images: Enterprise imaging data resides in different data silos with inconsistent formats and communication protocols – and in some cases, with no ability to communicate beyond the department.

Acquisition: Clinical data acquisition is not order-driven or scheduled and is prone to human errors. It may also be incomplete, which can be misleading when searching back information. In addition, data acquired with poor context (e.g. just patient first name and surname) may even introduce patient safety issues.

Acquisition devices: Mobile devices such as phones and tablets, cameras, scopes, workstations and others do not have interoperable standards and are not workflow-driven.

Data formats and protocols: Departments have limited ability to store and exchange imaging data in a variety of formats that may include extremely long videos, high frame rates, still images, audio, EEGs, ECGs, in many other challenging technical forms.

Metadata: Tagging data with meaningful metadata ensures that clinical information with a relevant context can be retrieved when needed and correctly interpreted. Proprietary metadata formats exist, but because they are unstructured and inconsistent, their usefulness is limited beyond the departmental level.

Storage: Management capabilities, including data-lifecycle management, are lacking at the enterprise level.

Context: Departmental workflows – especially beyond the radiology department – often do not provide for linking of imaging data to a meaningful context at the time of image acquisition.

To make the transition from departmental imaging to enterprise and cross-enterprise imaging, healthcare organizations need to implement interoperable systems that take advantage of mature industry standards, protocols and technologies. While this is a challenging project, all the technical elements needed to complete it are in place today.

In particular, the IHE initiative for improved use of computer systems in healthcare, the standards developed by the international HL7 organization and the DICOM standard widely used in radiology departments all provide important guideposts for achieving full imaging interoperability across and beyond each healthcare organization.

For example, at Carestream Health, we make use of the following proven standards and profiles in our Clinical Collaboration Platform to address the enterprise's data capture, storage, integration, discovery and presentation challenges:

Acquisition and capture: The IHE Web-based Image Capture (WIC) profile provides a simple, lightweight, mobile-friendly mechanism to encode and send captured images, videos and evidence documents from the capture device to the platform's Image Manager so that these objects can easily be integrated into the rest of the imaging workflow.

Data formats and protocols: The IHE Cross-Enterprise Document Sharing (XDS) profile provides native support for many different file formats such as DICOM, CDA, PDF, JPEG and more. It offers a consistent way to communicate, index and access data in department-specific formats using standard, secure web services.

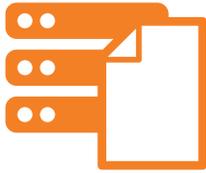
Enterprise data discovery: DICOMweb provides the web-based APIs QIDO-RS, WADO-RS and STOW-RS to enable query, retrieval and storage of patient and exam data. These DICOMweb APIs offer a simple way to implement standard methods for data providers and consumers to store, find and access clinical imaging information without being constrained by incompatible or proprietary systems.

Cross-enterprise data discovery: The IHE Cross-Community Access (XCA-I) profile provides the means to query and retrieve patient-centered medical data held by multiple facilities and enterprises, enabling a unified patient record to be created and delivered across communities of care.

Patient demographic data discovery: The IHE Patient Demographics Query (PDQ) profile provides a very simple means for searching patient demographic information associated with acquisition data. The Patient Demographics Query for Mobile (PDQm) profile defines a lightweight RESTful interface to a patient-demographics supplier using standard technologies already available to mobile applications and lightweight browser-based applications.

EHR Integration: FHIR (Fast Healthcare Interoperability Resources), the next-generation standard from HL7, enables advanced web capabilities for providing and consuming patient-centric health records. FHIR uses existing logical and theoretical models to offer a consistent, easily implemented method for exchanging data between healthcare applications, such as between the EHR and vendor-neutral archive (VNA).

All of these standards, and many more, play important roles in health IT interoperability. In particular, we believe over the next few years that FHIR will become a crucial standard for bringing diverse and complex systems together under a simple, shared framework, while eliminating many of the implementation challenges and delays that have hampered interoperability projects in the past.



EMR/EHR System Integration.

Make clinical imaging management and access an integral part of your patient-centered medical records management system.



Adaptable to Your Complete Ecosystem.

The Clinical Collaboration Platform supports departments with or without existing PACS and using DICOM or non-DICOM interfaces.



Backward and Forward Compatible.

Standards-based data capture and ingestion works with legacy modalities while it also supports vendor-neutral change and growth.

Whether healthcare systems are federated or fully integrated – or, whether a combination of the two approaches is used to accommodate the needs of multiple disciplines and facilities – these are the crucial standards to consider when evaluating solutions that promise to deliver clinical data interoperability. And, even in cases where specific systems are not yet ready to be integrated using standards only, Carestream offers capabilities that can help you begin to achieve some of the benefits of full interoperability.

What Is Carestream Health Doing About Interoperability?

At Carestream Health, we believe nothing could be more important for patient health and wellness than to deliver relevant clinical images, presented in a meaningful context, to any stakeholder who needs to review them.

Departmental imaging and workflow systems have largely existed in silos until now – segregated from many EHR, payer, administrative, telemedicine and other systems, and unavailable across different networks. Our Clinical Collaboration Platform is specifically designed to open up these silos, so clinical images and data can be shared as needed throughout the healthcare ecosystem.

The Clinical Collaboration Platform provides a modular, scalable architecture that can be implemented as a complete platform for patient-centric management of clinical images and associated data. Or, select services can be implemented within existing systems to provide EHR-enabled access, vendor-neutral archiving, departmental workflow management and/or a universal viewer with enhanced distribution capabilities for physicians and patients.

As one of the first innovators of interoperability in business, Carestream's Clinical Collaboration Platform communicates internally and externally using well-established standards such as IHE, HL7, DICOM, XDS-I and web services – while providing a pathway forward to even simpler sharing of clinical images by incorporating FHIR and offering standards-based support for mobile apps.

The Clinical Collaboration Platform also provides a framework for ingesting, managing, storing and distributing images and data captured by existing departmental systems that were not designed around established standards. For example, non-DICOM images can be tagged with metadata and ingested into the system for easy management, storage and distribution alongside DICOM images in standard formats, such as JPG, MOV, MP4, PDF, CCR and ECG.

Carestream Health's intelligent VNA provides advanced workflow capabilities for ingestion, management and distribution of both structured and unstructured clinical data, enabling efficient consolidation and sharing of clinical data generated across the healthcare continuum. Different workflows can be implemented through department-specific interfaces and tools, but the



Standards-based, Vendor-neutral.

The enterprise repository can serve as a vendor-neutral archive (VNA) for your existing systems or as part of the full Clinical Collaboration Platform.



Optimized for Clinical Data Formats.

The Clinical Collaboration Platform works with clinical data in all major formats, including JPG, MOV, MP4, PDF, CCD and ECG. Even from mobile devices.

underlying data exists in a single record – eliminating duplication of effort, inconsistencies in data content and quality, and communication gaps that can otherwise be bridged only by developing complicated and expensive interfaces.

Departments can add the modular services they need to achieve the desired level of interoperability, without the expense of replacing existing systems. For example, we offer a patient portfolio explorer, order-entry ingestion and workflow manager, and a universal viewer for images and supporting documents – all with a zero-footprint, web-based interface for easy integration.

Our ultimate goal with the Clinical Collaboration Platform is to accept clinical images from any source, add the appropriate context to make images manageable and meaningful, give them a permanent home in a patient-centric repository, and securely deliver them to physicians, patients, executives, payers and other stakeholders with the right clinical relevance on their preferred systems.

The capabilities Carestream Health delivers today are coming ever closer to the goal of an optimal clinical imaging storage, management and distribution platform. And we'll continue to lead the way as we incorporate new capabilities to take full advantage of every advance in imaging capabilities and diagnostic knowledge. Because the ultimate goal isn't just delivering meaningful access to clinical images. It's about efficiently delivering the highest standard of care.

Learn how we can help optimize your enterprise-imaging strategy and connect healthcare data and technology-driven processes for all of your stakeholders.

[Explore the Clinical Collaboration Platform at carestream.com/collaboration.](https://carestream.com/collaboration)