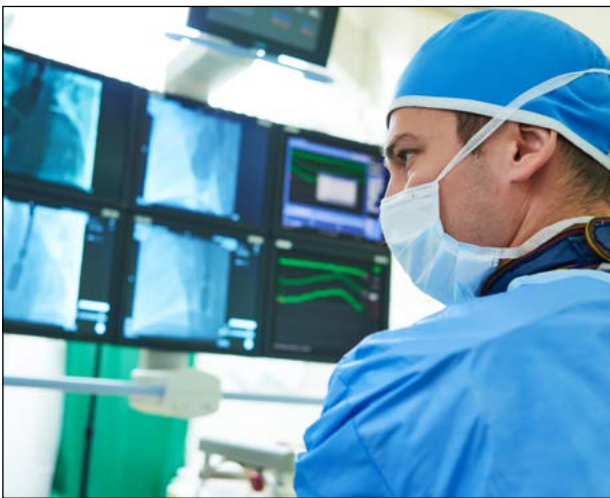


Complexity, Consolidation and Cost

How enterprise imaging can help providers succeed in a new era of care.

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Introduction

Healthcare providers are facing unprecedented challenges: stretched resources, decentralised care models, rapid virtualisation, outcome-based financial models. More than ever before, providers must transform, streamline and evolve, nimbly solving complex care challenges today while preparing for a new era of integrated, virtual healthcare.

Nowhere is this more evident than diagnostics, a segment rapidly re-imagined in the wake of the COVID-19 pandemic. Diagnostic data is required to be more accessible to a wider group of stakeholders, throughout the patient’s care journey and across multiple care settings. Precision medicine and multidisciplinary care pathways demand greater interoperability and federation of complex healthcare data. Healthcare providers must better manage diagnostic assets to ensure utilisation and accessibility for a larger patient cohort, while maintaining or reducing costs and streamlining service lines.

The era of siloed, discrete, fee-for-service healthcare provision is over. The era of outcome-based, interconnected digital health has already begun.

With relentless pressure and a rapidly changing health ecosystem, it has become increasingly difficult for healthcare providers to adapt health systems to meet demand near-term, let alone formulate robust care and operational strategies long-term. Nowhere is this more evident than healthcare informatics. Digitalisation of healthcare systems has been shaped by regulation, advances

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in technology and the requirements of key stakeholders in the healthcare system.

However, most healthcare providers are managing a complex mix of applications, databases and platforms, requiring ongoing integration, maintenance and support. IT resources are over-stretched, costs are rising, and security risk exposure is increasing. For care stakeholders, interoperability and exchange of information within most networks is patchy, constrained by customised interfaces and legacy applications with redundant, ageing technology.

Concurrently, advances in diagnosis, care and financial support for care are moving towards an era of personalised, precision medicine with a far greater focus on care outcomes. Yet, many health systems are unable to adapt to this evolution, constrained by a fragmented and ageing IT network. Nowhere is this more evident than in medical imaging.

Diagnostic imaging is commonly viewed as at the forefront of digital healthcare progression, with advanced imaging technology from multi-million-dollar scanners able to diagnose patients more accurately and promising research and development in artificial intelligence promising a new era of assisted and automated diagnosis. Yet a gulf exists between the capability of image acquisition and analysis compared to the inability of disseminating this data into the wide care system.

The focus of this paper will therefore dig deeper into this gulf, outlining the major challenges facing



healthcare providers in addressing cost, system consolidation and complexity in the context of imaging informatics and the broader enterprise. It will also propose that without substantial change to health informatics strategy, many providers will be unable to meet the near-term and long-term requirements of healthcare provision. Further, it will outline how healthcare providers can tackle these unique challenges, leveraging development and adoption of an enterprise imaging strategy as a foundation for imaging and associated data liquidity within the healthcare enterprise, while offering some key considerations for healthcare providers in development of enterprise imaging roll-out.

Navigating care provision challenges – complexity, consolidation and cost.

Healthcare providers building a robust imaging informatics strategy have a multitude of requirements to consider, addressing the challenges of care provision today, but also meeting future demand. This therefore requires a careful balancing of addressing near-term operational and cost priorities against longer terms plans.

In the wake of COVID-19 following a period of huge uncertainty and pressure on healthcare systems, focus has naturally shifted to near-term operation challenges, ensuring day-to-day operation of imaging service lines and fundamental care provision can continue in the face of unprecedented demand. However, many health systems have over the period of COVID-19 “stress”, better understood the shortcomings of their own imaging informatics networks. Some systems have already adapted, manifesting in a massive increase in remote reading for radiology, adoption of virtual multidisciplinary consultations and short-term “fixes” to allow care services while adhering to COVID-19 safeguarding.

Few systems have had chance to look further ahead in terms of mid and long-term priorities or adapt past plans to meet the future needs of care provision in a post COVID-19 world. To help providers consider future requirements, we have outlined below how the priorities and demands of care provision will change based on the complexity, cost and consolidation of care systems, in context of imaging informatics.

CHALLENGE FOR HC PROVIDERS	TODAY'S PRIORITIES	FUTURE DEMANDS
COMPLEXITY OF CARE	<p>Intra-network connectivity and interoperability –enabling sharing and workflow to support exchange of images and associated diagnostic and clinical data within and between healthcare systems without need for resource intensive custom integrations</p> <p>Decentralisation of imaging location (acute, outpatient, home) – integration of imaging data regardless of image acquisition location</p> <p>Multi-stakeholder accessibility – allowing diagnosticians, clinicians and patients to access pertinent diagnostic imaging data regardless of location</p> <p>Multi-disciplinary care pathways and reimbursements – enabling MDT team access to imaging and associated reports and data throughout a patients journey through a care system, via the EMR</p>	<p>Inter-network interoperability and leveraging new diagnostic data (digital health, remote monitoring, supporting native ingestion and management of diverse diagnostic content from all care settings</p> <p>Hybrid, optimised in-person / virtual care patient journey curation of relevant diagnostic imaging and associated clinical data to support complex patient treatment and care pathways</p> <p>Adaptive accessibility – data ownership and authorisation system a manages access authorisation based on credentials and permissions, including patient permissions for third party access</p> <p>Precision medicine and AI utilisation allows federation of imaging and broader clinical data sets for development of new therapies, research and AI training; core platform designed for use with AI-based tools and advanced analytics, to support predictive, personalised care</p>
CONSOLIDATION OF CARE	<p>M&A consolidation – enabling access and ingestion of imaging and associated diagnostic and clinical data from disparate siloed systems in recently acquired or merged healthcare provider systems</p> <p>Reducing diverse range of IT applications and care systems into centralised platforms – legacy application retirement of rarely used or redundant software, reduction in custom integration requirement and burden on IT resources; lowering security threat risk for organisation with centralised management and maintenance of all imaging-related software applications</p> <p>Increased competitiveness between fewer healthcare providers – ensuring imaging service line performance offers a competitive edge enabling patient retention and providing differentiation versus other systems for future growth in patient population</p>	<p>Integrated eco-system of care providers offering unified service changing care locale and democratisation of imaging services requires enterprise scalability and synchronicity between care sites</p> <p>Data federation and “learning” health system / longitudinal patient records changing care models, scale of health networks and reimbursement to outcome-based models demands use of predictive care models and seamless longitudinal patient record access; the enterprise imaging platform should enhance enterprise patient care record</p> <p>Competitive benchmarking and patient retention intensifying competition between healthcare providers requires clinical IT deployments to offer care outcome and service differentiation versus market peers</p>
COST OF CARE	<p>Near-term cost-saving and adaptation to new care models – leveraging analytical tools to measure and manage near-term operational costs and support use of integrated care models, reducing “waste” and increasing utilization of imaging assets and staff resources</p> <p>Centralised contracting – lowering the administrative burden of contracting for single applications and software products, towards consolidated product solutions or managed service agreements with modular offerings from a single vendor (or vendor ecosystem)</p> <p>Managed services transitioning away from capital intensive models of contracting towards more flexible, service -based offerings in partnership with key vendor partners. Increasing predictability of near and mid-term spending for core imaging-related software and services.</p> <p>IT outsourcing/hybridisation leveraging advances in IT technology, such as cloud services, to better manage and resource network maintenance, storage and access to imaging and associated diagnostic content, while reducing or better managing IT resource cost.</p>	<p>Predictive and preventative care provision. – Enterprise imaging platform should actively support population health management and care analytics to improve care outcomes</p> <p>KPI/Outcome-based contracting provider-vendor contracting should transition to partnership-based approach, offering shared risk and reward through ongoing measurement and refinement of operational and care outcome performance indicators and goals.</p> <p>Service line contracting extension of centralised contracting towards solution-based, service line procurement, combining mix of software, services and equipment, either from single vendor or via partnership model.</p> <p>Leveraging advanced cloud technology for care innovation / high-tech application utilisation platform allows scalability, access and leverages cloud services to enable smart information lifecycle management, hybrid cloud deployment based on application requirement and leverages advanced compute power of cloud for advanced application deployment in diagnostics and analytics.</p>

How enterprise imaging lays foundation for connected healthcare systems

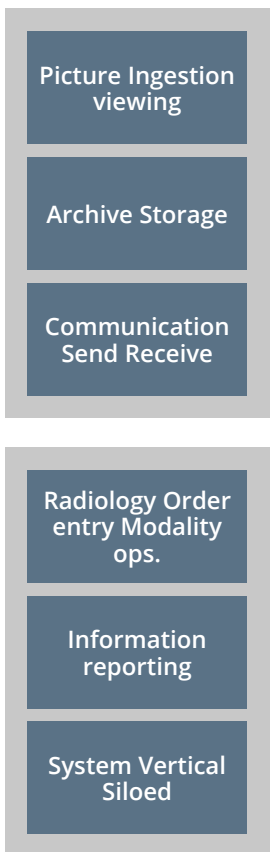
The concept of enterprise imaging in healthcare has existed for some time, though given its complexity, has been a challenge for many providers to adopt. Defined, under the HIMSS-SIIM consensus definition, enterprise imaging is “a set of strategies, initiatives and workflows implemented across a healthcare enterprise to consistently and optimally capture, index, manage, store, distribute, view, exchange, and analyse all clinical imaging and multimedia”. This places a substantial onus on healthcare provider governance for deployment, with no set blueprint for roll-out, given each provider has its own unique context and aims. Furthermore, few imaging informatics products today can deliver

the full requirements of an enterprise imaging strategy today – providers cannot purchase enterprise imaging “off the shelf”. To assist in supporting the formation and delivery of an enterprise imaging strategy, we have outlined a framework for how most imaging informatics applications are being delivered.

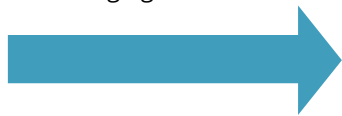
The framework, based on the concept of application “competency” and key stakeholder groups within healthcare provider networks, has four main layers, with each combining a range of different applications, software and services. Most imaging informatics vendors can offer a substantial proportion of the four layered model, ideally delivered as a central platform; almost all will however also offer third-party solution partnerships or APIs to allow seamless integration and workflow with additionally required applications.

A new blueprint for imaging IT platforms – Competency

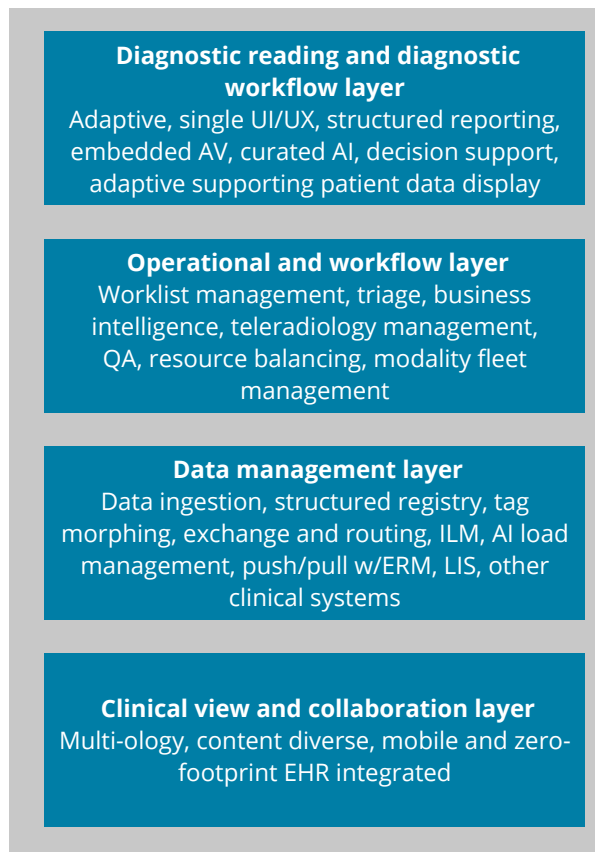
Legacy Imaging IT (PACS/RIS)



Enterprise imaging strategy and broader healthcare system influences are forcing shift to **competency based platform structure** for imaging IT software



Imaging IT Platform: Four competency layer model





As mentioned above, each competency layer also relates specifically to a core stakeholder in enterprise healthcare provision:

- **Diagnostic Reading and Diagnostic Workflow layer:** Radiologists & other diagnostic specialists
- **Operational Workflow layer:** Administration, CMIO, Senior Care Executives, Technicians
- **Data Management layer:** IT and Imaging Administration
- **Clinical View and Collaboration layer:** non-specialist clinicians, multi-disciplinary clinicians and patients

There is also significant overlap between layers and user groups, hence the preference from most providers to look for a central platform vendor partner that can offer the foundation of enterprise imaging competency from a single integrated solution or portfolio.

How enterprise imaging plays a vital role in addressing cost, complexity and consolidation in a new era of care

As outlined in the table previously, healthcare providers have an evolving set of priorities and requirements to meet the new standards of care in the post COVID-19 era. Enterprise imaging strategy should play a substantial part in supporting this evolution. Below, we have outlines specific examples of how enterprise imaging should play a role in care delivery.

Complexity of care:

Care complexity has intensified for healthcare providers, creating a considerable challenge for to manage the flow of pertinent imaging and associated clinical data across enterprise health systems. Furthermore, with an increasingly diverse user-base for diagnostic imaging content in care pathways, across a range of sites within large

networks, ensuring the right data is available to the right caregivers at the right stage of the care pathway requires careful planning and a clear policy on enterprise imaging data federation and management.

During the COVID-19 pandemic, the limitations of imaging and clinical data flow were exposed, in part due to many networks existing based on a legacy of ageing, siloed diagnostic and clinical applications. Furthermore, the pandemic highlighted the need for healthcare system leadership to quickly access clinical and data records in a centralised and federated manner, to assess and predict near-term impacts on care provision and ensure resources and care pathways can adapt to changing demands.

HOW DOES EI ADDRESS THESE CHALLENGES?

Enterprise imaging strategy can play a key role in solving enterprise care complexity, primarily in ensuring provider roll-out centralised data management to handle all diverse diagnostic imaging and clinical data from across the care continuum, curating and enriching the EMR. Healthcare providers should therefore consider the following priorities for enterprise imaging adoption:

- **Integration with EMR and broader care records for richer longitudinal record of care:** this should include integration of all diagnostic reporting and access via an embedded clinical viewer to all native imaging and associated diagnostic data from within the EMR user interface
- **Removing siloes and improving flow of diagnostic and clinical data across care teams:** legacy application retirement of ageing, siloed applications and IT network governance of common APIs to the central enterprise imaging data platform for all existing and newly acquired applications should ensure a minimum standard of native data ingestion, management and access across diagnostic and clinical departments.
- **Foundation for AI adoption – harmonised integration and workflow:** with growing need for advanced technology in diagnosis and clinical care to help streamline care provision, ensuring a consistent governance for ingestion and management of diagnostic and clinical data creates a foundation for establishing new care workflows utilising advanced technology. Structured reporting, analytics and AI-based diagnostic and operational tools have most impact when deployed and integrated.





Consolidation of care:

Care systems continue to evolve in terms of scale, partnership and location of care. With a growing focus on democratisation of imaging, home reporting for radiologists, remote clinical access for physicians and patients and ongoing hospital mergers, healthcare providers must be able to adapt rapidly. This changing landscape also places considerable pressure on network and care provision strategies and deployment, often stretching IT and operational resources.

HOW DOES EI ADDRESS THESE CHALLENGES?

When considering enterprise imaging strategy, healthcare providers should, as discussed above, aim for a common foundation in terms of data management, user interface and information governance. This is especially critical when assessing the viability of newly acquired care sites (and their diverse IT systems) and in provisioning and deploying existing imaging informatics into new care locations. Furthermore, patient access to care records continues to be a target of regulators and care consumers, the patients themselves.

Healthcare providers should therefore consider the following priorities for enterprise imaging adoption:

- **Home reporting accessibility and virtual peer-review:** the increasing “virtualisation” of peer-review and growing preference for flexible home reporting in the wake of COVID-19 now demands greater accessibility for key care stakeholders in the diagnostic workflow. Enterprise imaging strategy should focus on deployment of common thin-client diagnostic viewers that can perform with equivalence regardless of location.
- **Zero-footprint viewers enabling patient, referring physician, clinical team access to vital diagnostic data;** changing care models towards multidisciplinary team increases the access requirements to medical imaging and associated clinical multimedia; access should ideally be integrated via a common enterprise clinical system, such as the EMR or enterprise patient record.
- **Structured ingestion and consolidation of diagnostic and clinical data** – creating a source of truth of all diagnostic and clinical imaging and multimedia, regardless of point

of acquisition. Creating rich new sources of data for advanced analytics, research and care planning tools.

- **Actionable, real-time operational data insight**, created from deployment of analytics and business intelligence to support care efficiency optimisation at enterprise and service-line level

Cost of care

HOW DOES EI ADDRESS THESE TRENDS?

- **Consolidation of diagnostic and clinical applications into central platform approach lays foundation for cloud deployment**; consolidation of data management into a structured registry and repository allows a clearer path to emerging cloud deployment models, offering substantial information lifecycle management, network maintenance and security risk de-escalation
- **Reduced complexity to manage diverse applications across the enterprise network** reduced reliance on custom APIs for integrations and lowering IT resource load on day to day running and maintenance of the network



- **Lowering security risk and potential for data breach or ransomware attack** – consolidation of all access nodes and applications allows centralised security management and faster route to network protection in event of cyber attack
- **Flexibility of business model and reduction in on-premises capital investment** – better managing and predicting future network outlay and removing burden of capital-intensive purchasing
- **Efficient integration and management of outsourcing and third-party services** – clear centralised workflow for exchange and collaboration with teleradiology and other third-party care stakeholders

While not every imaging informatics platform available today may be able to provide all these benefits “out of the box”, healthcare providers should have a clear roadmap of phased requirements and expectations of competencies and capability of their selected imaging informatics solution.

Key considerations for deploying enterprise imaging

To support providers in developing a framework for enterprise imaging strategy deployment, we have further outlined below some of the key considerations that providers should address. Furthermore, providers should be aware of the unique context of their implementations in terms of legacy architecture, key operational priorities and long-term strategic aims; no provider has the same mix of applications, platforms and IT infrastructure; therefore, some level of customisation or specialist adaptation will usually be required.

From our experience, the most successful enterprise imaging deployments have the same common early focus, as outlined below:

- **A transparent, costed business case for implementation**: including focus on expected ROI, key project milestone and a clear description and definition of what constitutes success for each key stakeholder group in the care system. Establish near term KPIs to ensure near-term success is captured and ensuring the enterprise imaging deployment complements

broader enterprise IT strategy for the provider (e.g., cloud or new architecture deployment) is also critical.

- **Selecting a vendor partner;** ensuring the chosen or shortlisted vendors have a clear track record of success in enterprise imaging deployment, with a clear focus on long-term partnership, solving service-line challenges with a mix of software and professional services and a clear innovation roadmap for future upgrades and expected costs.
- **Early phase focus on data management consolidation and establishing a robust registry/repository;** defining and structuring the data management platform, while less evident to frontline users, sets a long-term foundation for successful deployment and streamlines integration and accessibility of new and legacy application retirement later in the project. Interoperability, standards harmonisation, reducing customization and IT resource requirements should all be clarified and refined early.
- **Ensure seamless integration with EMR** - with most healthcare providers today using an enterprise EMR as the primary administration, operational, billing and clinical information system, ensuring clinical viewing integration for imaging and associated clinical multimedia launched from within the EMR should be an early priority, while immediately improving care quality by supporting access and a more seamless flow of information between care teams.

- **Implement operational workflow tools and analytics to measure impact of enterprise imaging adoption.** Given the scale, complexity and substantial investment required for long-term enterprise imaging adoption, providers should utilise a range of operational analytics and business intelligence tools to measure the impact and service line improvement that enterprise imaging consolidation can provide. This will ensure ongoing stakeholder engagement in the project, while also providing evidence and data to help shape decision making on completion of additional project phases.

Above all, healthcare providers should approach enterprise imaging deployment as a long-term phased strategic initiative, which can help solve many near term and long-term challenges.

Executed well, enterprise imaging can transform care standards, improve accessibility of critical diagnostics and associated data, lower or better manage service line operational costs, streamline IT processes and create opportunity to leverage new innovative diagnostic technologies. However, successful execution requires strong governance, long-term vendor partnerships and clear strategic goals for defining deployment success. Following this approach, healthcare providers will not only be able to better address the near-term challenges of cost, complexity and care system consolidation, but be well prepared to thrive in a new era of digital connected care and precision medicine.



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