



PHILIPS

Interoperability solutions

Seamless healthcare.
Connecting data,
systems, and people.

Taking interoperability to the next level.

Seamless Healthcare

Connecting data, systems, and people

Executive Summary

IT at the heart of the healthcare revolution

Platforms and services that intelligently and automatically combine patient data from all of the organizations and healthcare professionals involved in a patient's journey and delivers them through an interface that can be easily individualized for each provider's needs. This vision is high on all clinicians' – and hospital managers' – wish list. At Philips, we believe that seamless interoperability – together with patient-centric multidisciplinary collaboration – is essential, and we are fully committed to making it happen.

The future of healthcare and interoperability

Beyond a 'system of record' such as an EHR, hospitals require a 'system of engagement'. It's not simply about giving them a portal. Our technology is different; it can change your business. It can drive not only innovation, but also differentiation across many areas. It provides the key to seamless data flows within and between hospitals as well as to analyses of patient populations done at scale. It's also the key to understanding patients and 'nudging' them in the direction of better health.

The way ahead

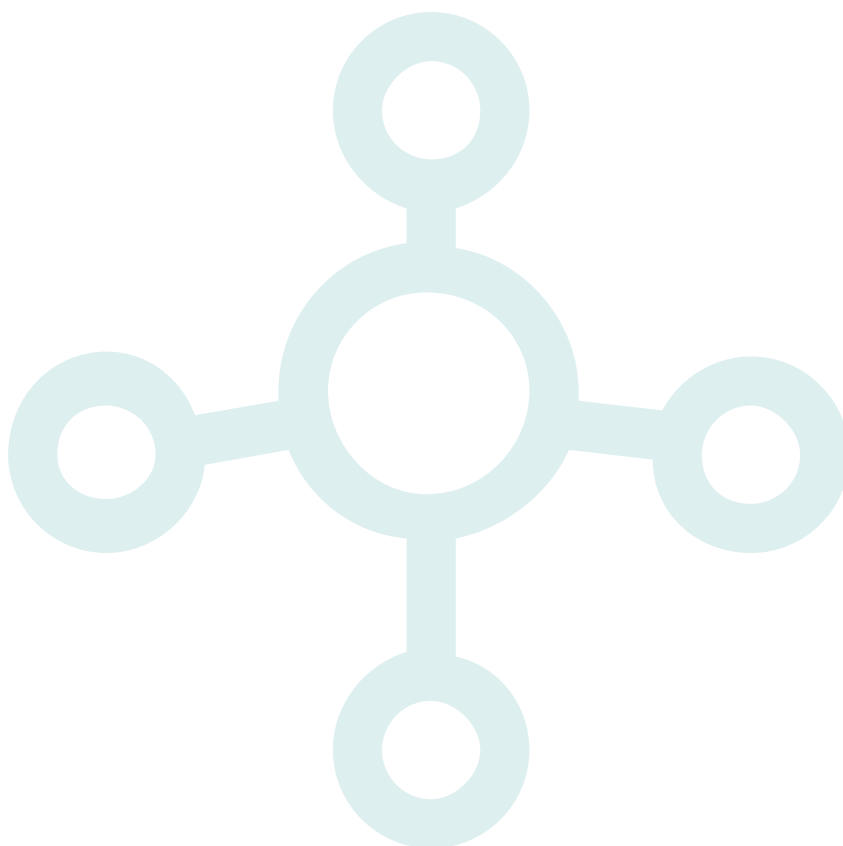
Philips provides you with a route map to the future. As we move from a mainly transactional to a value-based pathway, interoperability and usability will drive the industry forward. It's exciting to think of what's possible when care providers can access the tools and technologies they need to create a fully integrated and transformed healthcare system. Philips has that technology, the right tools, and the expertise to be your partner on this journey.

Seamless Healthcare

Interoperability – connecting data, systems, and people

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The future of healthcare and interoperability

At Philips, we believe that seamless interoperability – together with patient-centric multidisciplinary collaboration – is essential, and we are fully committed to making it possible.

It's clear that the patient will be central and clinical information will be essential to healthcare's future. However, the far-reaching ability of computer systems and software to exchange and make use of information will be vital in the healthcare revolution.

IT at the heart of the healthcare revolution

Platforms and services that intelligently and automatically combine patient data from all of the organizations and healthcare professionals involved in a patient's journey and delivers them through an interface that can be easily individualized for each provider's needs. This vision is high on all clinicians' and hospital managers' wish list. Typically there will be numerous standalone IT systems and software suites across that journey, making this vision a costly nightmare to implement and that's why that aim is rarely achieved.

The Philips approach to interoperability puts healthcare professionals at the heart of medical systems. By making clinical pathways transparent, our platform provides the right information, to the right people, at the right time. Making an information-rich workflow seamless for all users. This means that professionals no longer need to spend precious time searching for information.

In this whitepaper we aim to demonstrate how this works through a real patient journey, which reveals how our partners achieve better, more cost-effective, patient-centered healthcare by using our interoperability platform to empower the flow of clinical information and processes between

hospital specialties and departments, with primary care, secondary care, physiotherapy, rehab professionals, ... in fact all of those involved in delivering an individual patient's care.

As well as improving the cost efficiency of delivering treatment, and simplifying complex data management tasks, interoperability can also contribute to reducing clinical risk by making timely and essential information about each patient clearly available. To help you minimize the risk involved with such a project, we provide support from defining the project scope and designing efficient care and IT processes to implementing the solution in phases and training your staff to easily adapt it in clinical practice.

The challenges of IT systems that are not interoperable

There are rapidly increasing pressures on healthcare, with threats of epidemics, aging populations and therefore increasing demand, greater complexity, and the challenges of new technology (especially machine learning and AI) that not only makes care delivery complex but often inefficient and collaboration between caregivers becomes challenging.

- Aging populations, often with multiple comorbidities, being managed by different clinical teams working in silos, sometimes even with conflicting treatments.
- An ever-increasing range of competing therapies and interventions.
- Ever-changing treatment 'guidelines'.
- Increasing demands for better self-management of chronic disease, requiring better informed and better educated patients.
- An exponential growth in separate health-related data collections and systems, the power of which is rarely released due to a lack of interoperability.

Leveraging the power of data is a key task for CIOs, who face their own challenges:

- 1) There's growing resistance to classically closed systems (such as electronic health records (EHRs)) with some governments enforcing open standards through legislation
- 2) There's a lack of ROI following large EHR implementations
- 3) There's an increasing role for patients
- 4) The patient journey: collaboration frequently involves different systems, geographical locations, specialties, etc., as opposed to fixed teams working on a case.

People and care.

Collaboration is key.

Data is powerful in any industry. In healthcare, it has the power to enable essential collaboration and transform lives by aligning clinical workflows that can benefit patients' health. However, healthcare has lagged behind many other industries. Historically, it has been constrained by a lack of appropriate technology. Now that technology has advanced significantly, it's time to foster collaboration among key players in order to revolutionize our industry by linking data and ensuring that its flows work to enhance cost-effective patient care.

We build on current foundations (including the four over-riding aims of healthcare):



Improving
health outcomes



Improving the
patient experience



Improving
staff satisfaction



Cutting the
cost of care

It's time to foster collaboration among key players

Harnessing data requires a collaborative culture. But there are organizational and technical roadblocks along the road toward achieving this. Traditional keepers of data – those who have spent years hosting, storing, and managing data – now need to make data, long stored in their own silos, available to health professionals. What's more, vendors are often unwilling to share data in an effort to create or maintain monopolies. Vendors clearly need to collaborate to make interoperability successful.

The complexity challenge

Interoperability is increasingly seen as fundamental for realizing the promise of seamless health information exchange. A number of trends, support this perspective:

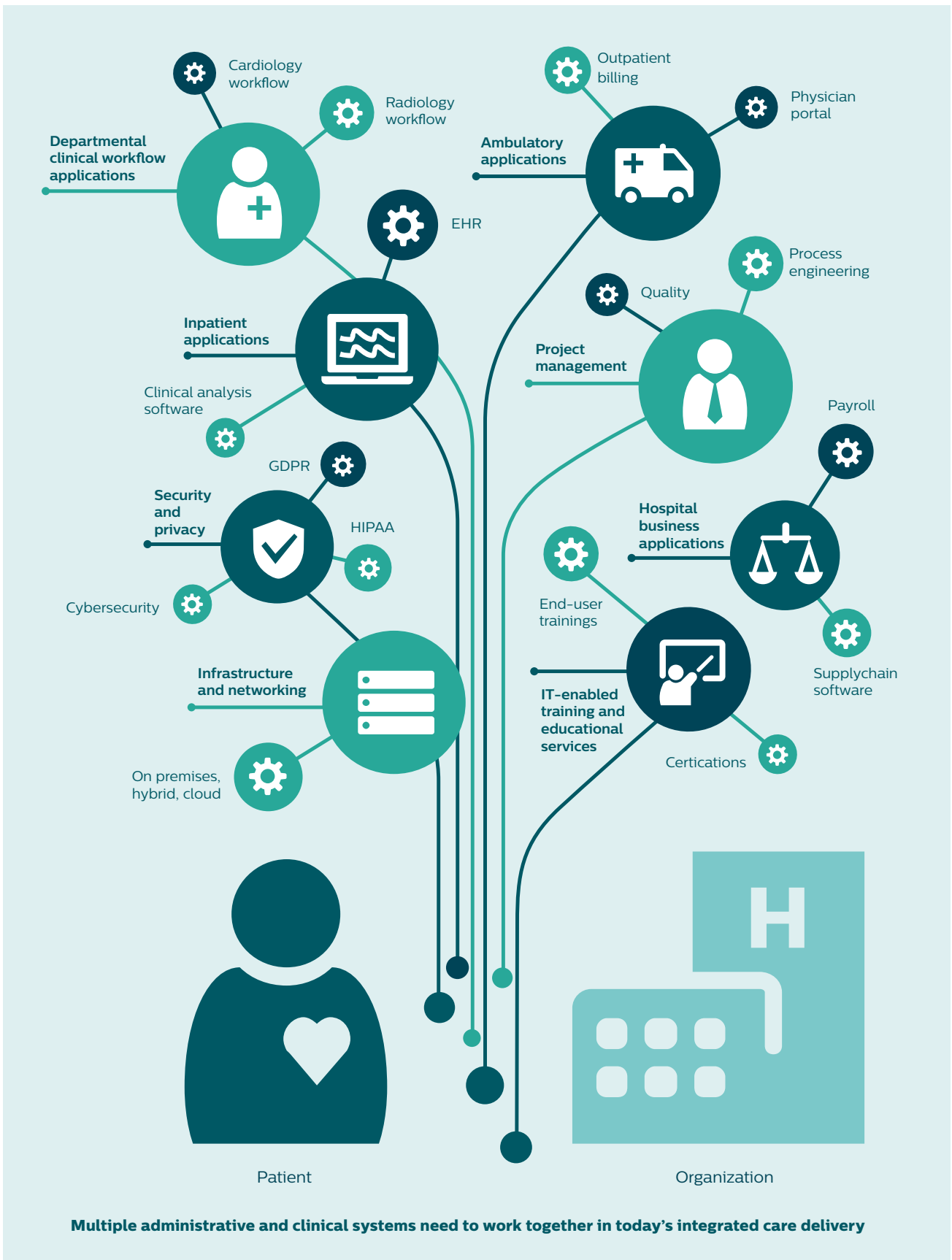
- Patient-centric care paths are becoming more and more complex, resulting in the participation of more professionals and systems.
- There is strong tendency toward optimal solutions, allowing professionals to use their system of choice.
- Organizations and collaboration networks are becoming larger and their scope is widening.
- Business efficiency, artificial intelligence, machine learning, value-based care and population health management all require the aggregation of data across a wide variety of systems.
- Governments as well as CIOs, CMIOs and CTOs are demanding IT systems that are open source and interoperable.

In the meantime we see a lot of innovation in the development of mobile healthcare applications by many (often niche) players. Achieving full potential requires seamless integration with existing healthcare information systems, creating the need for scalable platform solutions.

Customer needs

When we look at the healthcare interoperability market, we see several requirements:

- Healthcare professionals want to have access to all relevant information about their patients. For this to be effectively used in clinical practice, it should be seamlessly accessible from their electronic health record (EHR) system. The need for access to information requires healthcare organizations to share this information along a clinical pathway with all stakeholders who are involved. For specific stakeholders (e.g. a primary care physician or the patient him or herself) a complete longitudinal view of the entire patient medical history is needed.
- Hospitals and specialized clinics need to be able to refer patients to other healthcare organizations. It's important that they have all the information they need for the procedures that they perform, while also being able to share the status and the results of procedures with (remote) colleagues. These professionals want to share exactly the required amount of information (not more, not less) with minimum effort. During and after a procedure they need to be fully informed.
- Healthcare organizations – and in particular private institutions and specialized hospitals – want to optimize efficiency and reduce waiting times, by increasing throughputs and cutting costs. For this, easy availability of information is crucial.
- IT departments demand simple, safe, and secure IT connectivity with minimal time spent on installation and maintenance. Furthermore, IT staff are scarce and healthcare organization may not always be able to attract top talent.
- Healthcare organizations want to prevent large upfront financial investments and they strive to minimize financial risks.



Across the spectrum

We need to be able track patients across a care delivery network inside and outside the hospital, as well as at home. Outpatient and ambulatory care have become even more critical, and additional systems such as patient portals are essential for patients' confidence in their healthcare systems.

Complexity multiplies when we add public and population health management systems. But that isn't everything. EHR systems were simply not built with the current complex multidisciplinary geographically dispersed settings in mind.



This is Jim's story

Let's take a look at the patient journey of Jim Williams. Jim is 71-years old and retired. A couple of years ago he moved to Miami, Florida, where he currently lives with his wife. He previously resided in Louisville, Kentucky, where over the past decade a series of medical examinations were carried out. So, his medical records are in Louisville, where he was an outpatient. He has a number of previous medical conditions, with comorbidity (diabetes, chronic obstructive airways disease, hypercholesterolemia, hypertension and a history of acute myocardial infarcts (MI)). Jim consents to his data being shared.

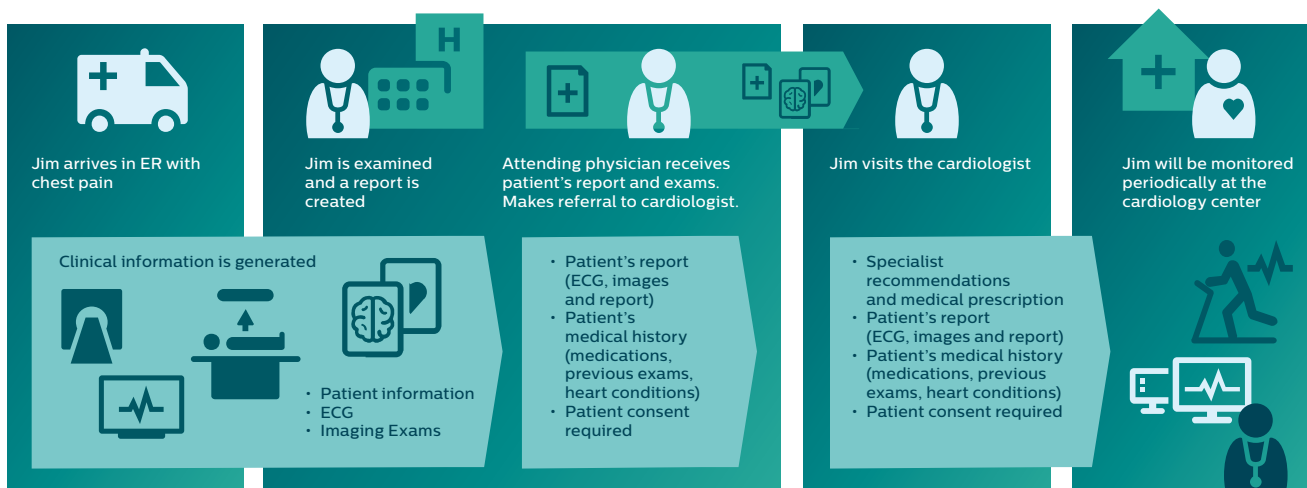
On January 13, Jim feels unwell: he had been suffering from a severe chest infection for several weeks; now he has developed chest pain with palpitations and acute shortness of breath. His wife calls his family physician Doug House, who asks her to bring Jim to his office immediately. Jim says he's fine and will walk to the surgery. While waiting for Jim to arrive, Doug is able to collect all relevant data through Philips Interoperability platforms and services.

Doug examines him and immediately calls an ambulance to take Jim to the cardiology department at the local hospital. In the ambulance an ECG can be performed that will be available at the hospital through the platform. Jim's condition worsens quickly and, by the time he reaches the hospital, he is in respiratory distress and appears a little confused as to his previous history and meds.

At the request of the senior physicians, the hospital has recently worked with Philips to implement an Interoperability Solution, which is designed to support cross-organization and cross-departmental clinical workflows by making relevant information available instantaneously.

The cardiologist is able to access all of Jim's historical clinical data, his most recent test results, including data from other departments that have clinical information, such as his Diabetologist, who has recently started Jim on daily injections of insulin. The platform makes data available through the cardiology system, including data which has been taken directly from the hospital pharmacy and from Doug's primary care system. This can save lives. Previously none of the systems outside and even in the same hospital could talk to each other.

A holistic, longitudinal view of Jim's medical record



The first examinations include blood pressure and a second ECG. The cardiologist analyzes the results and, using Philips Interoperability Solution, can quickly compare them against previous records and some recent notes made by Doug in his surgery. These reveal a steadily worsening condition, suggesting that Jim may be entering heart failure.

So Jim receives further examinations, including blood tests, and an echo to check his heart function and arrive at a more accurate diagnosis. It now becomes clear that Jim is indeed in the early stages of heart failure, but that his acute respiratory distress was mostly related to his chest infection.

Medication (ACE inhibitors, diuretics) is prescribed and a further examination - an MRI - is made to determine the most appropriate treatment. All this data is shared across the platform, making information available to his Diabetologist and his family physician Doug.

Jim is referred to a specialized hospital for bypass surgery.

After Jim is discharged, he gets a checkup at his family physician's office. Doug is able to show him the test results from both hospitals and explain what has happened.

The local hospital has a cardiac rehabilitation program and Jim asks to be referred to it. With the information made available through the Interoperability Platform, the rehab team can immediately assess his needs, including all his comorbidities, and start him at an appropriate level of exercise while educating him about diet and weight management. As the weeks go by, they share his progress with Doug and the Cardiology and Diabetes teams at the hospital.

Interoperability enabled faster care delivery

Prior to implementing the Interoperability system, the cardiologists would have been pretty much working in the dark and the multidisciplinary 'team' that provide his care - a team that includes primary care physicians, Diabetology, Cardiology, Pharmacy, and the Cardiac Rehab teams - would not have had immediate access to the 'whole picture' and therefore be able to deliver holistic care. Time and resources taken in requesting medical records, and possibly duplicating investigations such as scans has been greatly reduced and clinical decision-making speeded up. This not only provides a better patient journey but also a safer and more cost-effective one. At Philips we are actively participating in initiatives such as eHealth Exchange, Carequality and the CommonWell Health Alliance - Interoperability frameworks that enable nationwide care coordination in the US. Such nationwide data exchange solutions would make all the difference to Jim, given his complex health issues.

Interoperability as a multivendor solution

Better patient care starts with collaboration and end-to-end interoperability. The only way to deliver patient-centric care is by creating a multivendor-positive platform for all systems, without vendor lock in.

Based on open standards such as IHE, FHIR, HL7 and DICOM®, this approach offers a positive answer to today's interoperability challenges, while it welcomes and supports vendors at every level, allowing systems and departments to communicate with each other and exchange clinical information inside and outside the enterprise.

Philips Interoperability Solution is:

- Based on open, global standards.
- Multivendor-positive, so there's no vendor lock in.
- Scalable, suitable to grow as your organization grows.

People are at the core of interoperability. In Jim's story, the main actors are the caregivers, who are empowered by tools that enable them working together. Interoperability is not just about data exchange. That is, of course, essential, but it doesn't convey the full picture of what's required.

The core of our approach is seamless, patient-centric collaboration with professionals in the interest of patients. Philips is a healthcare informatics company that takes real-world processes as its starting point and enriches them by means of technology.

How we ensure seamless exchange of information

To tackle the challenge of information exchange we see two major trends:

1. Large systems that are designed to solve everything (such as large Vendor-Neutral Archives (VNAs) and EHRs). In recent decades, large systems came onto the market, promising to solve all healthcare IT challenges. VNAs were expected to provide regional sharing of large data sets such as diagnostic images. EHRs were designed to provide access to patient medical records. Both types of system have claimed a substantial position in the healthcare IT market. Neither of them – let alone a combination of both – have lived up to their promise. Because of the wide variety of vendors and the often closed nature of these systems, complexity has only increased.
2. Brittle point-to-point connections are often provided by information brokers, who supply fully tailored implementations. However, because of their one-off character and the amount of work required, this solution is non-scalable.

Our approach is different in a number of respects:

- We take patient-centric care as our starting point (leveraging Philips clinical expertise)
- We support a heterogeneous IT landscape, and
- We do not replace any existing systems, avoiding risky and costly migration, modifications, and large disinvestments

The multivendor-positive and open-standards approach has enabled Philips to build strong relationships with major healthcare IT and clinical players. Our knowledge of the applications and technologies used by major vendors helps us to build efficiencies of scale. This means that CIOs are free to continue to work with their current technology partners – and add new partners as the healthcare enterprise evolves.



Promoting a **care** **collaboration ecosystem**

Single vendor/vendor lock-in is no longer acceptable, our innovation strategy is based on integrating enterprise systems through an interoperability layer, that plays the key role of an enabler – particularly breaking data out of silos, getting discrete data to enable AI, and enabling ecosystem innovation.

The right strategy

With a complex ecosystem, healthcare inevitably involves a range of players.

Step-by-step approach

Step 1

Semantic interoperability:

building the foundations for care collaboration, seamlessly exchanging patient data across multiple care settings

Step 2

From fragmented to federated:

making relevant data available to everyone

Step 3

From high tech to high touch:

cementing collaboration

Step 1

Semantic interoperability building on the current foundations

In the US the Health Information Technology for Economic and Clinical Health (HITECH) Act drove EHR adoption and digitalization in healthcare from less than 20% to more than 90% in a decade. However, EHRs are no longer the central data repository in hospitals. Rather, the care delivery network is an ecosystem with multiple 'systems of truth', including EHRs. Systems need to be wired together so data can be shared seamlessly. International standards such as HL7 to support

workflows, DICOM® for medical imaging, FHIR for exchanging healthcare information, and Cross- Enterprise Document Sharing & Workflow (XDS and XDW) create the flexibility needed to exchange data between systems supplied by a range of vendors. Doing this semantically through frameworks such as Integrating the Healthcare Enterprise (IHE) avoids lock-ins to particular vendors' equipment. Semantic interoperability ensures that systems use the same specifications.

Step 2

From fragmented to federated

Federation allows interoperability and information sharing between semi-autonomous de-centrally organized lines of business, information technology systems, and applications. Federation is more important than precise semantic morphing.

Federation makes the exchange of information between clinical systems easier, where the data seeker is aware not only of the data but also of where to get the data. At Philips, we design federated architectures that allow interoperation with existing clinical ecosystems, while enabling dynamic clinical workflows and pathways across the healthcare landscape.

EHR is still most hospitals' primary data warehouse. There have been attempts to convert it into a decision-support system, but most of the clinical workforce do not buy into that argument. There are a variety of other clinical 'sources of truth' within hospitals, and these need federated structures to work effectively. Data, and especially its quality,

timeliness, and context, are key to the emerging fields of healthcare-related artificial intelligence and predictive analytics.

Interoperability crucial to AI-enabled applications. Doctors are increasingly using algorithms, AI and machine learning for diagnoses and to make decisions about treatment as well as long-term prognoses. AI can already diagnose medical conditions more accurately than most doctors, but it is also scalable in the sense that it can be used to help an infinite number of patients. Biotech and the IT revolution will be among the dominant technologies of the 21st century. Interoperability is a crucial catalyst to the ecosystem of AI-enabled applications. The quantity and scope of data models to be used in both current and projected applications demand a much more flexible approach to sourcing than traditional record-keeping. To get to that view, we must design systems with the intent to share information, in other words, we must use federated architectures.

Step 3

From high tech to high touch: cementing collaboration

Healthcare is highly regulated and moving from fee-for-service to value-based care. There are complexities within its many systems that create both duplication and, all too often, a suboptimal experience. Despite the complexities, the right people with the right expertise can navigate adeptly together.

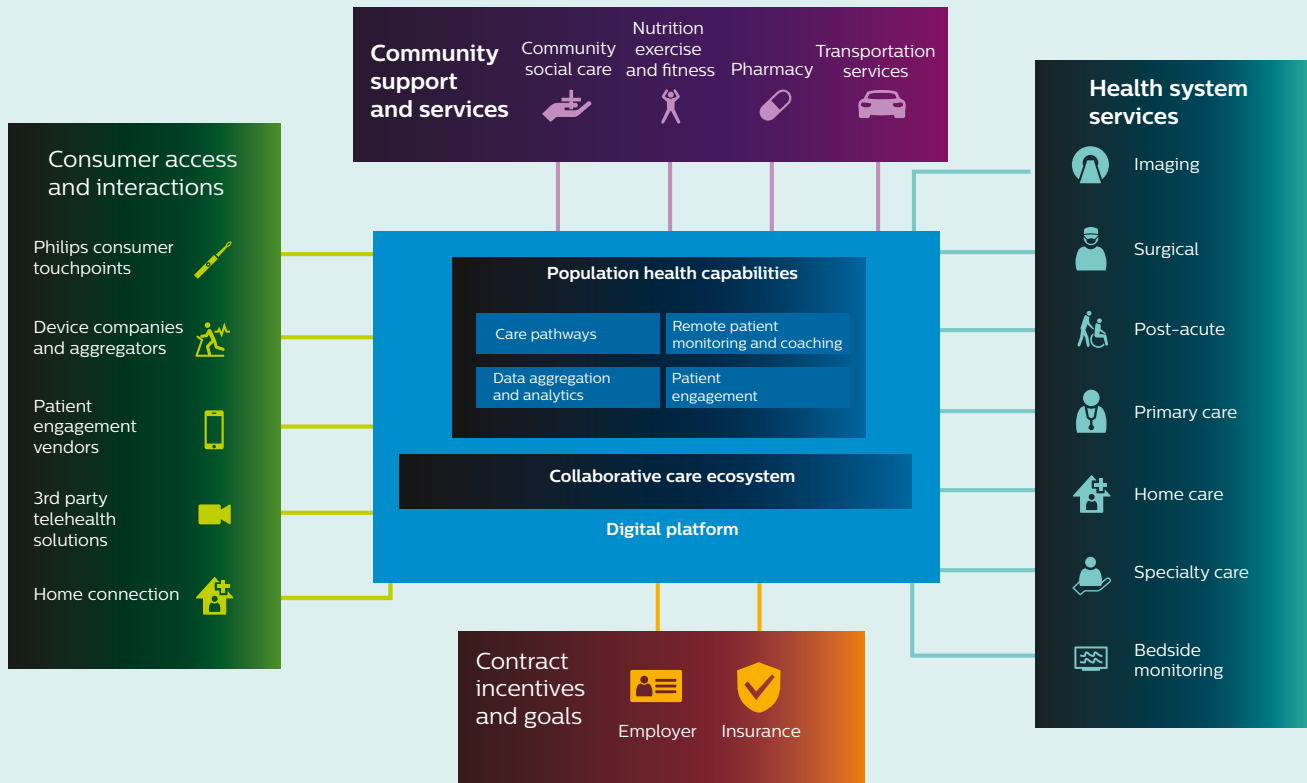
At Philips, we believe data liquidity is a collaborative effort in which the right players come together to provide the right solution. At Philips, we believe that data liquidity and automated connectivity can facilitate a

collaborative effort in which the right players come together to provide the right solution. To do this, we design systems using open standards so that we can liberate and exchange data across the continuum of care.

For CIOs, CTOs and CMIOs it's essential to find the right healthcare integration partner – one who:

- Understands what's needed to create healthcare ecosystems
- Is multivendor-positive – i.e. has the right tools, expertise, and attitude to include systems and equipment from other vendors.

A Collaborative Care Ecosystem



Implementing interoperability requires delivery of a true solution. The Philips approach involves combining building blocks that are tailored to meeting diverse workflow needs, connecting third-party systems, and enabling seamless data flows across the healthcare continuum.

Orchestrating the ecosystem

It's clear that we need an actor that is able to orchestrate these ecosystems, connecting all the building blocks required to deliver a truly integrated solution. Our final goal is to develop platforms and services that connect all systems (including third-party systems), regardless of vendor, to create a collaborative and dynamic environment that will fully empower data flows and meet workflow-specific needs.

As a first step, we establish semantic interoperability; then we take interoperability beyond the boundaries of an individual network – across hospitals and care settings; and, finally, we aim to collaborate with partners and customers to create a truly effective care collaboration ecosystem.



Welcome to the Philips **Healthcare Continuum**

Interoperability does not have to be cumbersome. At Philips we are committed to healthcare interoperability and fostering collaboration. Our priority is to provide both the right technology and the right experts to help you with your interoperability strategy. In our journey toward impacting three billion lives around the globe by 2030, we use co-creation principles to deliver solutions that exceed our customers' expectations and meet our goal of transforming care across the health continuum.

“Technology improves healthcare and integration is just the first step”

Co-creating solutions

Enabling a connected healthcare ecosystem means designing it around the patients, clinicians, and administrators it serves. We advocate placing human-centered design practice at the heart of delivery systems. In today's complex and ever-changing world, it's impossible to innovate alone. Transforming the delivery of healthcare in this challenging context calls for a different, more human-centered approach to innovation. At Philips, we call this co-creation.

Co-creation allows you to gain an in-depth understanding of the patient's context. It helps to sharply articulate the challenges facing CIOs and what's important for them. You discover new and unexpected solutions, make these solutions tangible, and test them to understand how they improve people's lives. It's about doing, learning, and adjusting as you go.

We want to work with National Networks that support seamless collaboration within large enterprises as well as Integrated Delivery Networks (IDNs) that need to better manage their resources/investments and optimize the patient experience.

Philips as a credible partner

We see it as our goal to help IT staff to truly support their clinical partners in the interests of patients. So we focus on patients and workflows, not data exchange, which for us is essential. In fact, integration is just the first step toward a connected healthcare ecosystem. To achieve this we engage in co-creation with partners in the US and around the world. At Philips we co-create solutions using existing infrastructure to reduce cost and unknowns, enabling a connected healthcare ecosystem that is designed around the patients, clinicians, and administrators it serves.

What makes our solutions unique?

At Philips we have always been a pioneer in innovation. Today, the desire for systemic, needs-based innovation – leveraging rich available and emerging technologies – is more urgent than ever. And it's precisely what more and more people in today's societies need. Our Interoperability solutions span the healthcare continuum, including medical devices, departments and hospitals, covering primary, secondary and tertiary care. And we are committed to open standards.

We tackle the whole ecosystem. EHRs are a good start, but by no means the end of the road; we provide multivendor, enterprise-wide solutions. The success of this approach clearly depends on cooperation, seamless interoperability, and openness to solving future challenges.

At Philips we offer an enterprise-wide interoperability strategy to ensure that insight-rich data is put to meaningful and appropriate use, helping to transform the delivery of healthcare for everyone. We believe the future of care will be about connecting the dots and fixing broken workflows so care givers can freely share images, results, reports and notes with each other along the clinical pathway.

Interoperability not only links systems of record with systems of engagement, but also involves systems of innovation and systems of differentiation.

“As an industry leader in healthcare informatics, we believe the future will involve multiple parties sharing data across programs, practitioners, and patients.”

Shashank Shekhar, Senior Product Manager - Interoperability, Enterprise Integrated Solutions

Invisible. Indispensable. Interoperability.

Bringing it all together.

In this White Paper we aim to convince you that interoperability and collaboration are essential to today's healthcare IT ecosystems. As we move from transactional to value-based care, patient outcomes, interoperability, and usability will continue to drive the industry forward. It's exciting to think of what's possible when care providers have the tools and technologies they need to create a fully integrated and transformed healthcare system. Philips has both the technology and the expertise to be your partner on this journey toward greater interoperability.

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How to reach us

Please visit www.philips.com
healthcare@philips.com