The Open Group Snapshot

Healthcare Enterprise Reference Architecture (HERA)

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This Snapshot is intended to make public the direction and thinking about the path we are taking in the development of the Healthcare Enterprise Reference Architecture (HERA). We invite your feedback and guidance. To provide feedback on this Snapshot, please send comments to hcf-healthcare@opengroup.org.

This is a Snapshot of a work-in-progress. Do not require or claim conformance to this document.

This Snapshot document is valid through October 10, 2018 only.

For information on joining The Open Group Healthcare Forum, please contact Steve Borchert at s.borchert@opengroup.org.

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Healthcare Enterprise Reference Architecture (HERA)

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Contents

Preface

The Open Group

The Open Group is a global consortium that enables the achievement of business objectives through technology standards. Our diverse membership of more than 600 organizations includes customers, systems and solutions suppliers, tools vendors, integrators, academics, and consultants across multiple industries.

The Open Group aims to:

- Capture, understand, and address current and emerging requirements, establish policies, and share best practices
- Facilitate interoperability, develop consensus, and evolve and integrate specifications and open source technologies
- Operate the industry's premier certification service

Further information on The Open Group is available at www.opengroup.org.

The Open Group publishes a wide range of technical documentation, most of which is focused on development of Open Group Standards and Guides, but which also includes white papers, technical studies, certification and testing documentation, and business titles. Full details and a catalog are available at www.opengroup.org/library.

The Open Group Healthcare Forum

The Healthcare Forum is relatively new. The Forum membership varies in professional background (Enterprise Architecture is a common thread for most), country of origin, and stakeholder type. Members live in countries with very different healthcare systems: India and Scandinavia, Japan and Germany, Australia, the US, the UK, Canada, and elsewhere. Many work for global companies with a very broad market presence. What members have in common is their organizations' interest in and perceived need for a Healthcare Enterprise Reference Architecture (HERA). As individuals, all are passionate about trying to do something that improves health and healthcare in this world.

The global span of the Healthcare Forum membership is a valuable attribute. We have found that stakeholder differences drive variation in member views more than cross-country differences. The Forum's operational procedures and processes, developed and refined over the past two-and-a-half decades by The Open Group, help members understand why others may have different viewpoints, help members see things from others' perspectives, and help members develop consensus positions and products. Each of these benefits – the development of consensus products in particular – can be difficult to find outside the formal Forum activities derived from the membership model and rules of The Open Group.

All Forum members have input into the Healthcare Forum's activities, which include shaping the specification, testing, governing, and promoting (*via* certification, for example) of the HERA. The dozen or so Forums of The Open Group address the leading IT and technology issues (e.g.,

Internet of Things (IoT), Digital Transformation, Open Process Automation™, cybersecurity, managing IT, and more) shared by large and small businesses worldwide. The Healthcare Forum benefits from and contributes to all Forums of The Open Group.

For more information on the Healthcare Forum, see www.opengroup.org/healthcare.

This Document

This document is a Snapshot of what is intended to become The Open Group Healthcare Enterprise Reference Architecture (HERA) Standard. It is being developed by The Open Group.

The HERA is the product of an ongoing multi-year collaboration of the global membership of the Healthcare Forum.

About The Open Group Healthcare Enterprise Reference Architecture (HERA)

Many of the problems healthcare organizations need to solve today are not new problems. The healthcare industrial complex has been dealing with cost, quality, access, and information flow issues for decades. Legacy systems, typically a patchwork of "quick fixes" and band-aid measures, now make some seemingly simple solutions complicated and complex. Sometimes wiping the slate clean and starting over appears to be the best, if not the most expensive, approach, at least in the short term. When starting over is not realistic, as is usually the case in developed economies, then the HERA helps focus problem solving by simplifying system complexity so decision-makers and technical staff can develop practical solutions.

The HERA is a framework for the development of a reference architecture for a healthcare company, from big to small (50 employees or more).

The HERA is a logical, cognitive map that can help most healthcare stakeholders improve their business by using IT in a smarter way. "Smart" means integrating IT into the whole business, and on a macro-scale, into the whole enterprise.

The HERA is specified in this Snapshot as four views layered from most general to most specific. Each view addresses business processes at a different "nested" level of abstraction.

Level 0 is the most abstract. Level 1 provides more detail than Level 0, Level 2 more detail than Level 1, and so forth. Metaphorically, the views are a magnifying scope (think binoculars) to enable the user to build a better understanding of the vast healthcare landscape and how and where their company (enterprise) fits in. As the user focuses in on the landscape, they gain a more detailed understanding of the common cycles, processes, and types of tools generally applicable to healthcare enterprises. The HERA framework can help enterprises *focus* on the inter-related processes and specific tools that will help to deliver value to customers.

In summary, the HERA:

- Is an architecture of the whole healthcare enterprise designed by diverse stakeholders from around the world
- Lets you zoom in and out, focusing on business problems large and small
- Provides an evidence-based, integrative framework in which you use existing, known, and familiar tools to meet your business needs

Why is the HERA Needed?

This prototype 0.1 version of the HERA starts to fill in an important missing piece of the healthcare enterprise; namely, the "big-picture view". Granted, organizations of many types have produced big-picture views for a long time. But in the private sector, they focus on a company or company type, a stakeholder or stakeholder type, or a limited combination of both. In the not-for-profit sector, research organizations focus big-picture views on broad issues (for instance, the organization, finance, or delivery of healthcare; or long-term care, primary care, or "access"; health IT, personalized medicine, or Digital Transformation). In government and quasi-government sectors, where a big-picture view of the healthcare enterprise is perhaps most expected, big-picture views tend to be focused on a crisis situation (emergency department overcrowding, the opioid crisis, the obesity epidemic, access), a defined group of stakeholders (veterans of war and their families), or a chronic healthcare problem (e.g., healthcare interoperability, the solvency of public programs, comparative effectiveness research). What we need, and what the HERA is designed to provide, is a cognitive map and conceptual guide to help decision-makers grasp the larger ecosystem in which they compete.

The value of the HERA is expressed in the following properties that, alone and in combination, show that at a conceptual level, at least, it is a unique and useful framework that healthcare enterprises can use to solve business problems, large and small.

- The HERA provides an integrative framework that facilitates bridge-building across intra- and inter-organizational silos
- The HERA responds to the need for an enterprise-wide framework for collaboration among other standard development organizations and the many assorted efforts to solve key healthcare problems including, but not limited to, interoperability
- The scope of the HERA extends to the "whole health enterprise" (see Figure 1)
- Its conceptual underpinnings are tied to the shared understanding that complex systems, like healthcare, require complex yet clear solutions – while complex and clear are difficult by themselves, together they are even more challenging
- A key insight about organizational behavior is built into the HERA; namely, that IT and technical change involves human beings and their motivation and ability to learn and adapt, desire to change, their workflow dynamics, and the pervasive ether we call culture
- The HERA is supported by the key sociology of knowledge insight that "what you see depends on where you sit"
- The HERA is closely aligned with The Open Group vision of Boundaryless Information Flow™: "achieved through global interoperability in a secure, reliable, and timely manner"[1]
- The silo mentality is anathema to the HERA

  It is designed to improve information flow and the healthcare services that follow, but the usefulness of the HERA depends first on breaking boundaries and silos among the key actors in an organization. Open and multi-directional communication between management, builders, and operators is necessary for Continuous Quality Improvement (CQI) and business' response to advances and change in IT and technology.

[1] See www.opengroup.org/aboutus/vision.

- Interoperability issues – focused on information model harmonization and seamless information exchange – stood front and center in early formulations of the HERA

  However, the HERA designers wanted to build a broader, more inclusive framework that precedes an architectural model (focused on building and delivering solutions) with a management model (that focuses on strategy and planning) and supersedes it with an operations/CQI model

- HERA designers understood that, to be truly useful and improvement-oriented, the framework must capture the reality that change does not typically happen in a linear fashion; thus, the HERA is designed with agility in mind

- The HERA is built through global collaboration

  In many cases, this provides an obvious asset and advantage over solution frameworks with a narrower focus. This is especially relevant for companies that have a global presence and those that wish to "go global".

Intended Audience

Who will benefit from using the HERA? Payers, providers, vendors, consultants? Is it applicable to the private sector only or does its relevance extend to public sector healthcare organizations as well? Does it apply to healthcare organizations internationally? Is it for engineers and architects or managers? The answers to all of these questions is an unqualified "Yes".

Trademarks

Acknowledgements

The Open Group gratefully acknowledges the contribution of the following people in the development of this document:

- Stig Hagestande, Managing Enterprise Architect, CTO Office – Nordic Healthcare, Capgemini
- Jason S. Lee, PhD, Director, Healthcare Forum, The Open Group
- Members of The Open Group Healthcare Forum

The authors would like to thank all Members of the Healthcare Forum, and especially Oliver Kipf, Phillips (Chair, Healthcare Forum).

Referenced Documents

The following documents are referenced in this Snapshot.

(Please note that the links below are good at the time of writing but cannot be guaranteed for the future.)

- Health Care Information Systems: A Practical Approach for Health Care Management, 3rd Edition, Karen A. Wager, Frances W. Lee, John P. Glaser, Jossey-Bass, 2013
- The Elements of Architecture, Henry Wotten, 1624; refer to: http://archiv.ub.uni-heidelberg.de/artdok/1870/1/Davis_Fontes68.pdf
- Using a Plan-Build-Run Organizational Model to Drive IT Infrastructure Objectives, Himanshu Agarwal, Nagendra Bommadevara, Allen Weinberg, McKinsey & Company, 2013; refer to: www.mckinsey.com/business-functions/digital-mckinsey/our-insights/using-a-plan-build-run-organizational-model-to-drive-it-infrastructure-objectives

1 Introduction

1.1 Objective

The subject of this Snapshot is the specification of The Open Group Healthcare Enterprise Reference Architecture (HERA). It describes a framework for the development of a reference architecture for a very wide range of healthcare companies.

The purpose of this Snapshot is to seek feedback from readers in advance of publishing The Open Group HERA 1.0.

This Snapshot is intended to make public the direction and thinking about the path we are taking in the development of the HERA. We invite your feedback and guidance. To provide feedback on this Snapshot, please send comments to hcf-healthcare@opengroup.org no later than October 10, 2018.

1.2 Overview

The HERA is a like a cognitive map. It can be used in whole or part by virtually all types of stakeholders in the healthcare landscape. It can be applied globally, both in the sense of its application by multi-national enterprises, and in the sense that it applies virtually anywhere there is a healthcare system and is global in scope.

It provides a layered set of views into the healthcare enterprise. The "enterprise" in this context is considered to be the companies and organizations that contribute to the healthcare economy at the most meaningful levels of aggregation: markets, states, provinces, regions, countries, etc.[2] At the top layer of views is the HERA Level 0, a highly generalized conceptual framework based on the longstanding and seminal "plan-build-run" conceptual model employed across numerous manufacturing and service sectors.[3] From there, the HERA is used to "drill down" or "zoom in" to the key processes involved at each finer level of detail. Thus, from the most abstract level (Level 0), the HERA provides more detailed views from Level 1 to Level 2 to Level 3. Level 3 is the most specific generalized point of view that remains relevant to the whole healthcare enterprise. In other words, Level 3 is the "jumping off point", not *from* the HERA framework itself, but *into* the details of a specific enterprise.

The HERA presents its insights in an integrative framework. From the broadest perspective – that is, "zoomed out" to the highest level of abstraction – the HERA specifies the key models and cycles common to all healthcare businesses. At the next level, it shows and explains how a

[2] It is confusing sometimes when the word "enterprise" is used, validly, in both a macro and micro sense (though not at the same time, of course). From the macro perspective, enterprise means all companies and all types of companies. From the micro perspective, enterprise means a specific company or type of companies. The context usually dictates which meaning is intended.

[3] According to McKinsey: "sophisticated infrastructure organizations are increasingly turning to functional 'plan-build-run' organizational models, which, by breaking down silos and working across technology domains, can facilitate a broad set of performance-improvement and transformation objectives". (McKinsey Article: Using a Plan-Build-Run Organizational Model to Drive IT Infrastructure Objectives, by Agarwal et al. (see Referenced Documents)).

dozen common processes are inter-related, how they provide feedback to one another, and how they interact. This is what we call the HERA's whole-health system perspective.

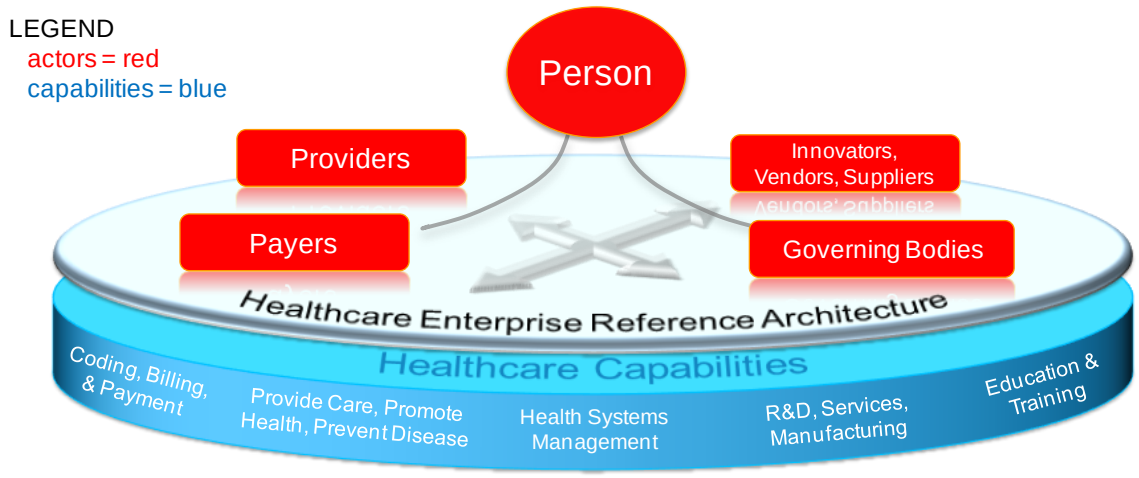


Figure 1: The HERA Landscape

Figure 1 illustrates the breadth of the landscape of the HERA ecosystem. The ecosystem is defined by *actors* in red and *capabilities* in blue. The actor categories are broad; perhaps none more so than "innovators, suppliers, and vendors". The scope of the HERA is the healthcare enterprise, writ large. The HERA is designed to be useful to virtually all healthcare enterprises.

1.3 Conformance

This is a Snapshot, not an approved standard. Do not specify or claim conformance to it.

1.4 Normative References

None.

1.5 Terminology

For the purposes of the HERA, the following terminology definitions apply:

Can	Describes a possible feature or behavior available to the user or application.
May	Describes a feature or behavior that is optional. To avoid ambiguity, the opposite of "may" is expressed as "need not", instead of "may not".
Shall	Describes a feature or behavior that is a requirement. To avoid ambiguity, do not use "must" as an alternative to "shall".
Shall not	Describes a feature or behavior that is an absolute prohibition.
Should	Describes a feature or behavior that is recommended but not required.
Will	Same meaning as "shall"; "shall" is the preferred term.

1.6 Future Directions

Short-Term

This Snapshot features the HERA prototype 0.1. It has six-month shelf life. During this time, the Forum seeks feedback that will help it produce a HERA 1.0 standard. Members encourage any and all constructively framed requests for changes. For example, "I don't like *x* because of *y* and here is how I would change it …," rather than a simple statement of approval or disapproval, such as "I don't like *x*". Please send feedback to hcf-healthcare@opengroup.org. Please state whether feedback should be kept anonymous or not.

Longer-Term

The second course of future work is to demonstrate that the HERA is *executable*. Members of the Forum, and by collaboration agreement, others, will test the HERA to assess its usefulness. If sufficient evidence supports its usefulness we would consider that a success and we would move forward from there. "Forward" is in the direction of collecting more useful data on the HERA's "fit for purpose" qualifications. Ultimately, after repeated testing-revision cycles, the HERA will be developed as a standard and certification processes will be developed.

2 Definitions

For the purposes of this standard, all terms are as defined in the Merriam-Webster's Collegiate Dictionary.

3 Foundations of the HERA

The HERA builds on and extends the *plan-build-run* organizational model.[4] The longstanding success of this model – its widespread use across enterprises – can be attributed to its wide scope of relevance, its fit for multiple purposes, and its simplicity. The Healthcare Forum appreciates the factors underlying its success but feels that the usefulness of plan-build-run for healthcare organizations is limited by its generality and lack of specific healthcare-relevant use-cases.

The HERA builds on plan-build-run by logically extending and aligning "plan" with a *management model*, "build" with an *architectural model*, and "run" with an *operations model*. This foundation supports the most abstract presentation of the HERA (Level 0), discussed in Chapter 4.

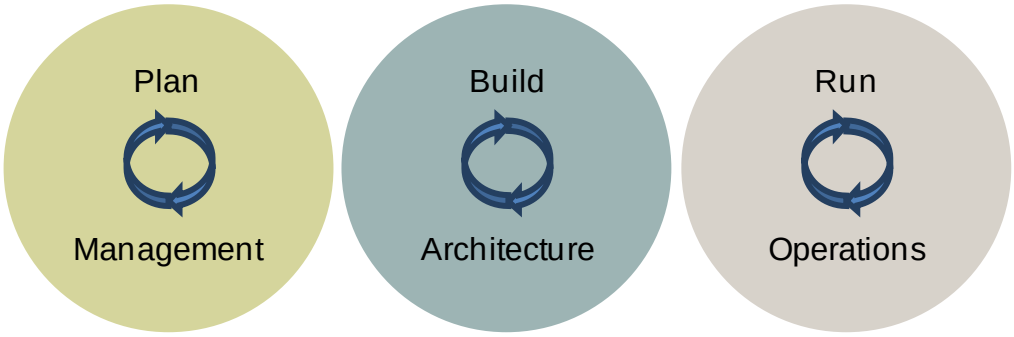


Figure 2: Plan-Build-Run and Three Key Models

[4] For a discussion of the utility of "plan-build-run" see the McKinsey Article: Using a Plan-Build-Run Organizational Model to Drive IT Infrastructure Objectives, by Agarwal et al. (see Referenced Documents).

4 The HERA Level 0: Models and Cycles

At this level of the HERA, we align the management, architecture, and operations *models* with three *cycles* that are necessary for enterprise success – which in our case means better health and healthcare for persons and populations.

4.1 Strategy & Plan Cycle

The ultimate responsibility for the strategic planning and direction of an organization is assigned to the Chief Executive Officer (CEO). The other C-suite role occupants (CFO, CIO, CMO, among others) have unique functional responsibilities and they also advise the CEO on enterprise strategic planning. The work of strategists and planners is represented in the HERA's *management model*. This model embraces the Strategy & Plan cycle, which includes understanding business drivers, setting goals, assessing and developing capabilities and resources, and setting priorities. We elaborate these specific processes and some of the tools used to accomplish them in the subsequent sections of this document that go deeper into the HERA.

4.2 Build & Deliver Cycle

The work of architects and designers is represented in the *architecture model* at Level 0 of the HERA. This model embraces the *Build & Deliver* cycle that includes information, application, and technology and results in products and services based on the strategies and plans specified by executives. Here it must be said that clear and consistent two-way communication between managers and technicians is essential for successful business operations. Yet, it is well known that organizations tend to be silo'ed and that communication barriers between managerial and technical business units are known roadblocks in the effort to use IT and technology more effectively to solve problems in healthcare. The HERA does not tell an organization how to bridge this gap, but it does (again, at a deeper level) specify how processes are related to one another, and from this, users may deduce where information flow problems are most dire and can advise and act accordingly.

4.3 Operate & Evolve Cycle

The *operations model* encompasses key enterprise operations and improvement processes. Because operations produce "real-world" data that can be used to improve the enterprise, the HERA expands the concept of "do" to include measurement, quality improvement, and evolving the enterprise. Thus, the operations model is associated with the *Operate & Evolve* cycle in the HERA. Rapid evaluation and analysis of outcomes tied to processes is key to implementing a "design approach" and to using agile methods to improve the enterprise.

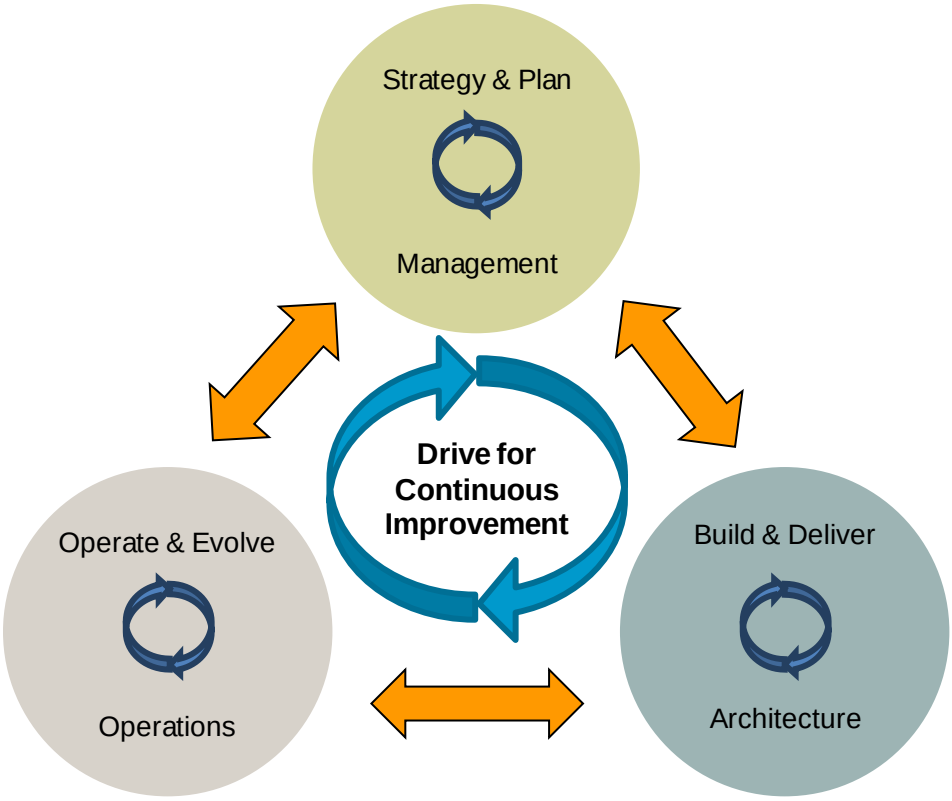


Figure 3: The HERA Level 0

Finally, it is important to highlight another extension of the traditional *plan-build-do* foundation of the HERA. As shown in Figure 2, *plan-build-do* are linear phases. That is, once planning is complete, it moves to building, and once building is complete, it moves to doing. There is an obvious logic to this order. It describes how new companies enter a market, and it describes the overall logic of change and transformation in mature enterprises. However, the HERA does not assume that enterprises always function in a linear fashion. To capture the non-linear and recursive nature of actual business dynamics, the HERA places the three key models/cycles in a circle in which each is related to the other bi-directionally. Thus, depending on the business problem the user is trying to solve, entrance to the HERA might start with Build & Deliver, then return to Strategy & Plan, then feed into the Operate & Evolve cycle, which then feeds back to the Strategy & Plan cycle. And of course there are many other permutations.

5 The HERA Level 1: Process Domains

At the next level of the HERA, each of the three core cycles described in Level 0 is further divided into four discrete *process domains* to elaborate the tasks that are required to complete each cycle and to create a holistic architecture.

5.1 Strategy & Plan Cycle

The Strategy & Plan cycle focuses on the key business concerns that need to be addressed by all enterprises. These concerns must be formulated using clear language to facilitate a meaningful dialog among the business decision-makers and stakeholders. Strategy & Plan addresses key business concerns, from what drives and impacts the business (e.g., market conditions, government regulation), to business goals, strategies, and plans for change. The output from this cycle is a *transformation portfolio*, which gives direction to the critical and challenging processes encompassed in the Build & Deliver cycle. The output from this cycle should:

- Be open, explicit, and clear
- Facilitate communication between C-level and mid-level management, engineers, and technicians who architect and build deliverables

Figure 4: Process Domains in the Strategy & Plan Cycle

5.2 Build & Deliver Cycle

The Build & Deliver cycle uses output from the Strategy & Plan cycle (i.e., the transformation portfolio) to drive the architectural efforts needed to realize business strategies. In this cycle we divide healthcare Enterprise Architecture into four process domains: business, information, application, and technology. Initially, work in this domain should start in the business quadrant to ensure that the architecture addresses the business needs in a top-down approach. Build & Deliver is complete (but must always be revisited given the dynamic nature of healthcare enterprises) when discrete deliverables are produced and can be implemented in the Operate & Evolve cycle of the business.

One word about this cycle. We formerly called it the "BIAT wheel" (business, information, application, and technology). In the Forum's early days, members focused only on the development of the BIAT wheel. Why? This should not be a surprise. This is where many architects and medical informaticians (including CIOs, CMIOs, semantics and taxonomy experts) devote most of their time and effort – particularly in the information process domain. Building and harmonizing health information models is a very difficult, time-consuming, and costly challenge. First there is the technical challenge of capturing health information in a broad, widely applicable model. Second, most private enterprises that provide electronic health record capabilities – including point-to-point interoperability – do not make this information open and available to others. It is highly proprietary. Thus, health information model building is both extremely complex and highly political. Similar issues exist in the application process domain.

In light of the heavy focus on the information and application processes of the architecture model, the leadership and members of the Healthcare Forum determined that healthcare needs a reference architecture that frames *all* key functional dynamics in the healthcare enterprise at both a broad and more detailed level. Thus, the Forum began to work on a prototype of the HERA based on the view that architects (or, "builders" more generally) need to adopt a more enterprise-wide perspective.

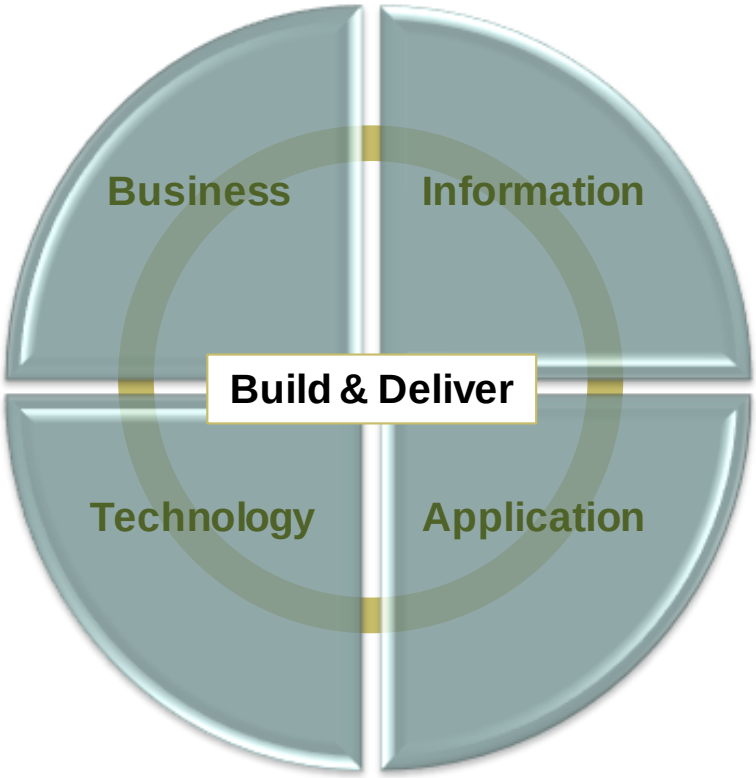


Figure 5: Process Domains in the Build & Deliver Cycle

5.3 Operate & Evolve Cycle

The Operate & Evolve cycle is enabled by deliverables produced in the Build & Deliver cycle. In this cycle, there is a repeating loop of four process domains – Operate, Measure, Analyze, and Evolve – that is necessary to ensure continuous delivery of high-quality services. The operations domain includes all the processes necessary to produce value for customers and consumers. Operations also produce data that is collected according to Key Performance Indicator (KPI) guidelines. KPIs, in turn, are analyzed – in big to small data sets, using a variety of analytic tools to improve and evolve the business. The HERA developers recognize that continuous improvement is not enough; there must be close attention given to evolving the services delivered to remain agile and meet the demands of a high-speed changing environment.

Figure 6: Process Domains in the Operate & Evolve Cycle

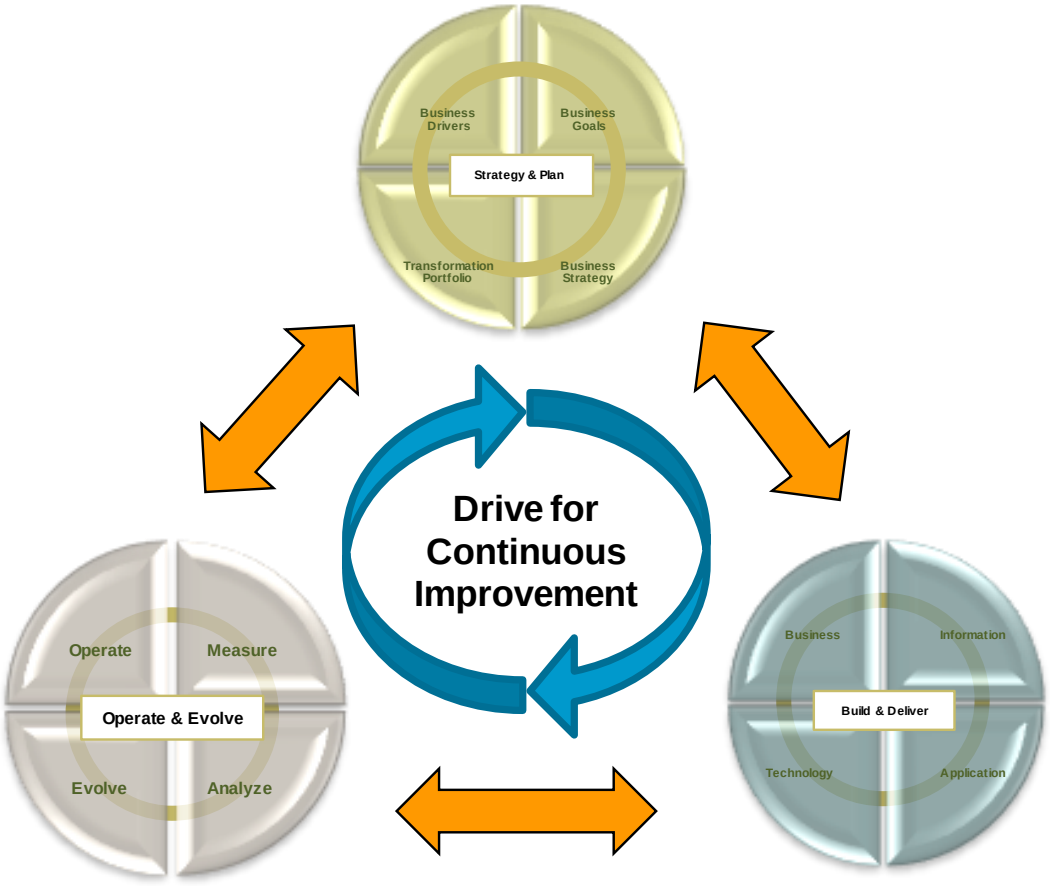


Figure 7: The HERA: Level 1

In summary, the HERA Level 1 view is composed of three cycles, with four process domains each, and 12 inter-related processes in all.

The ability to change in response to new business demands requires continuous high-paced iterations of the HERA's three cycles.

6 The HERA Level 2: Processes

Thinking about the HERA framework as three cycles with four process domains each, Level 2 of the HERA focuses on the key processes in each domain of each cycle.

6.1 Strategy & Plan Cycle

The Strategy & Plan cycle focuses on the business and, like all other cycles, is iterative. There must be an understanding of the business drivers or the *why*: what is our business?; why are we here?; and what are the internal and external changes that necessitate continuous transformation in an enterprise that rapidly changes on so many levels? An assessment is done to formulate the business goals. The business goals must address who the stakeholders are and their concerns. It must take into consideration the business requirements to formulate a transformation plan for how to realize the business goals. This plan is the basis for a business strategy to decide how changes need to be implemented. The business capabilities (existing or to-be-developed) determine where to direct enterprise effort to move from the "as-is" to the "to-be," identified using a gap analysis of the business baseline and target. This analysis suggests what specific target goals need to be included in an enterprise's transformation portfolio, which is the sum of all work packages derived from the Strategy & Plan cycle. The transformation portfolio is the output to the next Build & Deliver cycle. As noted earlier in this document, the HERA can be employed linearly. Or, the user can jump into the HERA at any-to-all of the 12 process domains.

Figure 8: Processes in the Four Domains of the HERA Strategy & Plan Cycle

6.2 Build & Deliver Cycle

The transformation portfolio from the Strategy & Plan cycle drives the efforts undertaken in the Build & Deliver cycle. This cycle is service-oriented and its main objective is to realize improved business functions and services. Business service requirements guide value set (i.e., raw and/or semi-structured data) needs. Raw and semi-structured data is codified using information models. Information model needs are determined by a user's enterprise-specific HERA reference model. Ultimately, a structured information model is required to achieve true interoperability. When the information model is exposed through interfaces, interoperability can be achieved through common services and reduces the number of point-to-point integrations. These interfaces are provided by application services that expose application functions to enable information exchange and transformation. The application services create an abstraction layer that removes the dependencies for business services to interact directly with physical applications. This enables coexistence with legacy systems and allows for a migration without affecting the business services. Technology services create the same form of abstraction level for the application services and enable the coexistence and migration of legacy platforms and technology.

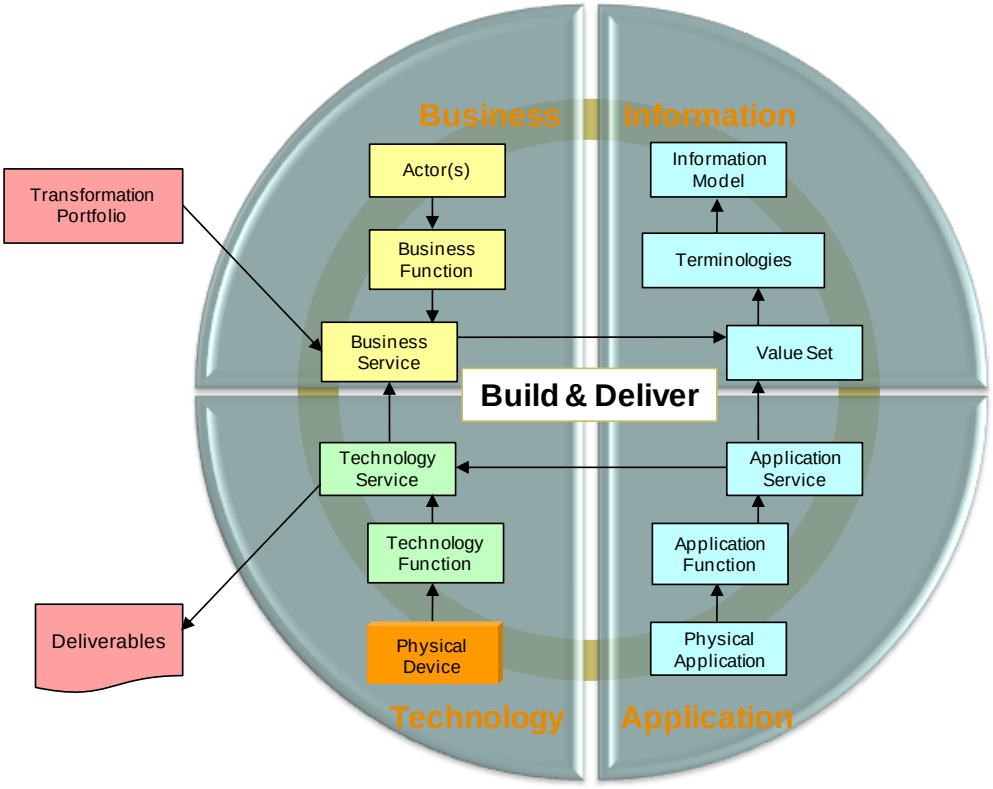


Figure 9: Processes in the Four Domains of the HERA Build & Deliver Cycle

6.3 Operate & Evolve Cycle

Deliverables from the Build & Deliver cycle drive the efforts in the Operate & Evolve cycle. Of course, the specific processes in the operations domain vary from company to company, but the "outcome of business operations is the harvesting of value from assets owned by a business".[5] Growing assets and increasing value requires accurate, timely, and CQI data. The Measure domain in this cycle addresses this requirement through the collection of KPI data relating to business, IT, and clinical outcomes.[6] (Of course, identifying and building capabilities to collect KPI data are key processes in the Strategy & Plan and Build & Deliver cycles.) The collection of KPI data leads naturally to the analysis process domain of the current cycle. The analysis of data to produce information and knowledge is the primary function of the application of analytic tools. Some processes, like the development of a patient reminder system, can be fully automated. Others require extensive exploratory analysis, including the use of big data and predictive analytic tools. The knowledge gained from analytic processes directly informs the evolve process domain.

[5] Source: https://en.wikipedia.org/wiki/Business_operations.
[6] "A Key Performance Indicator (KPI) is a type of performance measurement. KPIs evaluate the success of an organization or of a particular activity in which it engages." (Source: http://eitbokwiki.org/Glossary#eit.)

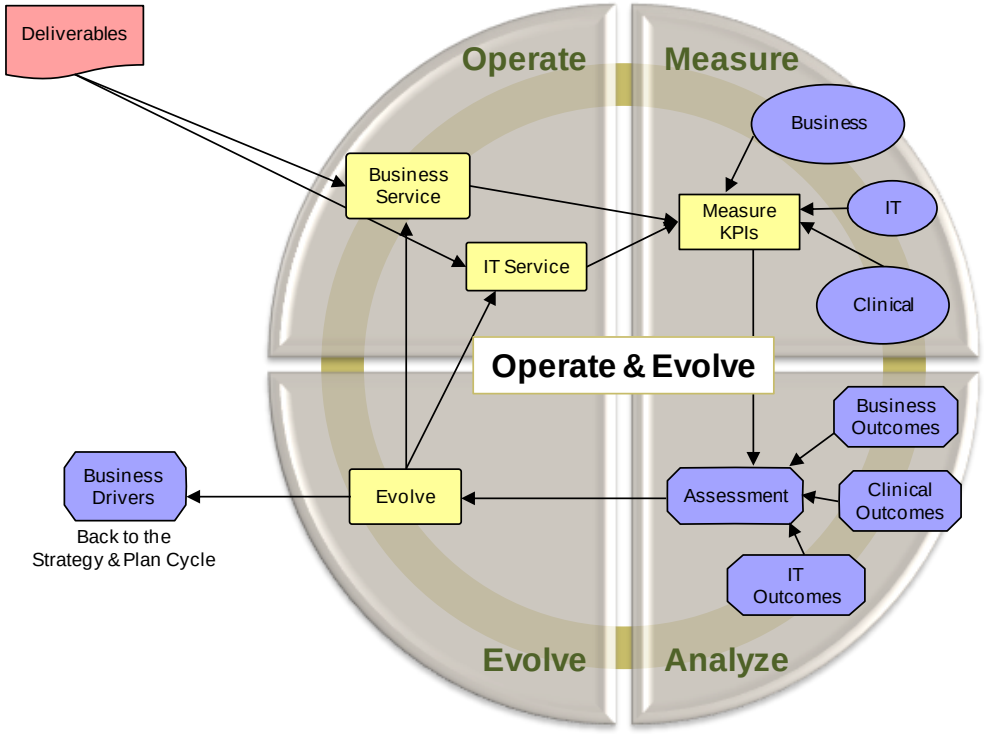


Figure 10: Processes in the Four Domains of the HERA Operate & Evolve Cycle

7 The HERA Level 3: Tools, and Using the HERA in Practice

In this chapter we take each HERA cycle, quadrant by quadrant, and provide examples of well-known generic resource tools available to users. We do not advocate for one tool or another. Not all useful resources are cited in the following figures. Our aim is simply to indicate that the HERA is highly flexible and can accommodate a wide range of tools available to users. Level 3 of the HERA is the most specific level of the general framework. Here, one begins to see healthcare-specific tools specified. Beyond Level 3, a user begins to specify the tools that are most useful given the capabilities, resources, and legacy systems of their companies.

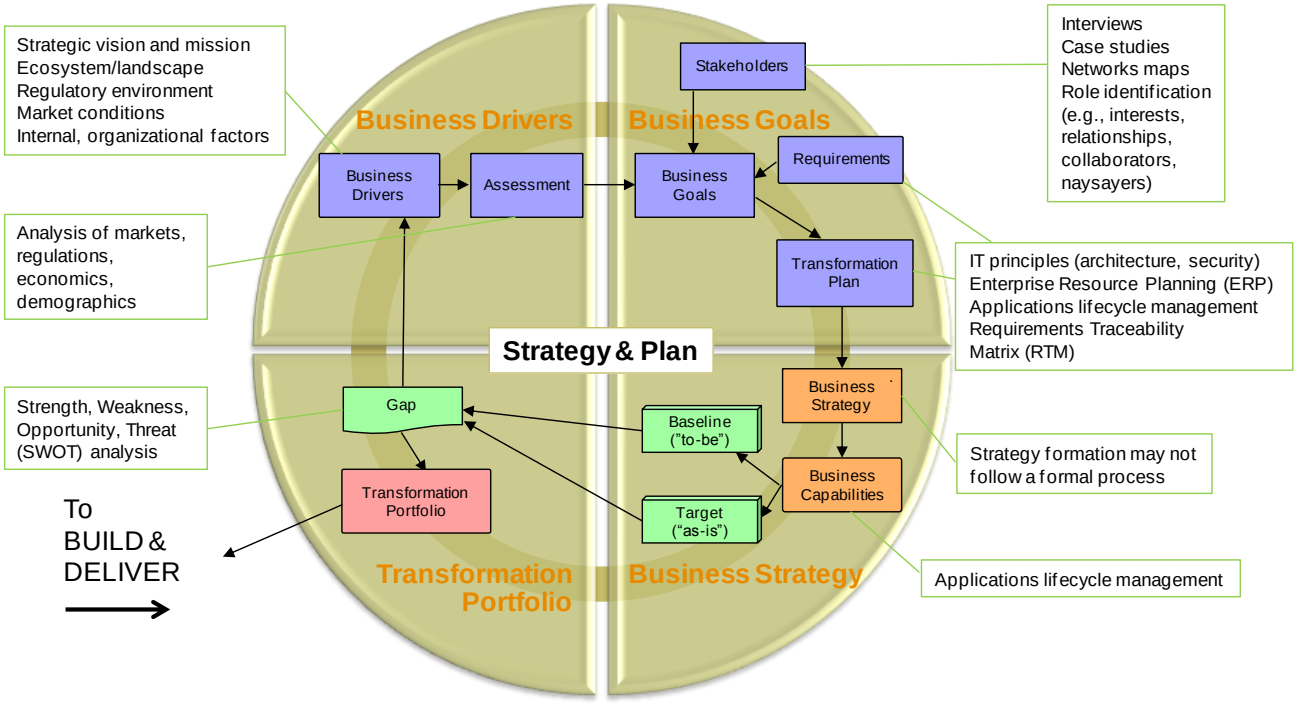


Figure 11: Resource Examples: Strategy & Plan Cycle

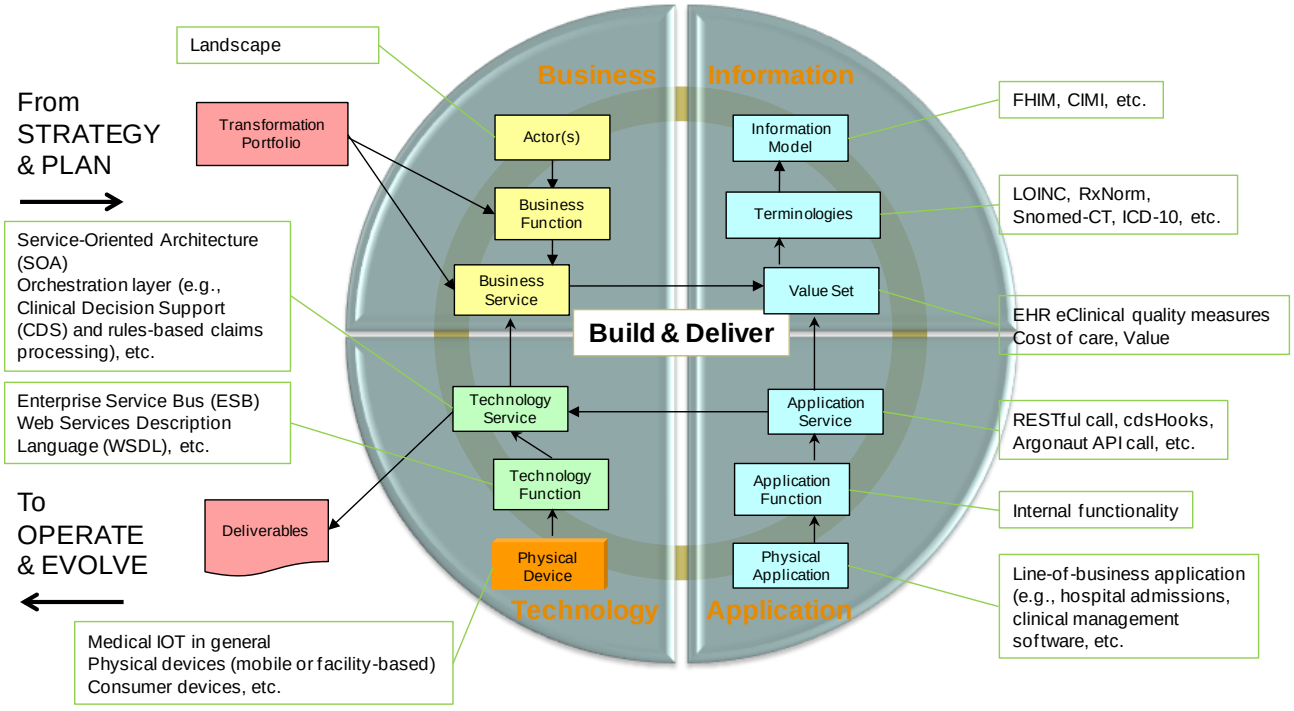


Figure 12: Resource Examples: Build & Deliver Cycle

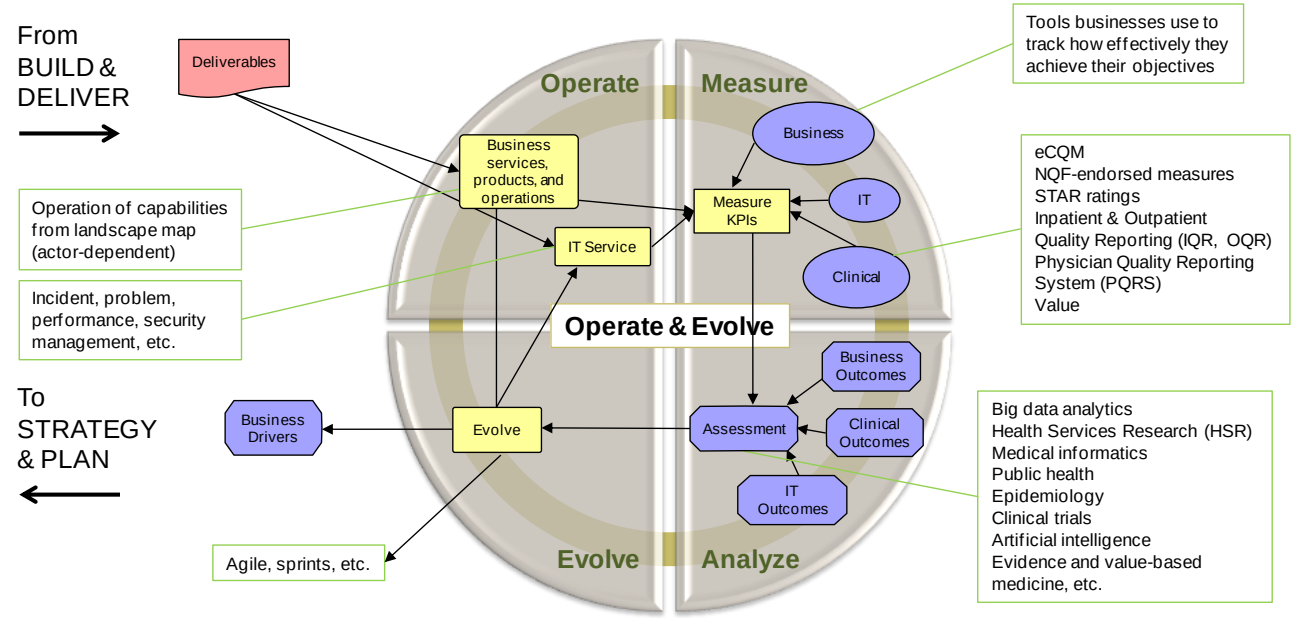


Figure 13: Resource Examples: Operate & Evolve Cycle

A The Healthcare Enterprise and Other Enterprises (Informative)

This appendix looks at why IT in the healthcare enterprise is uniquely difficult compared to other enterprises, and why healthcare needs a reference architecture.

We start by acknowledging some essential facts. Technology, and Information Technology in particular, has reached an unparalleled level of complexity in the healthcare enterprise. By "unparalleled" we mean compared to other industries that use IT to solve business problems. The reasons for this, more thoroughly described in a different context elsewhere,[7] are summarized here:

1. The healthcare enterprise is populated by a very large number of organizations, big and small. This poses quite real cost barriers to IT acquisitions for providers and vendors. (Consider the history of "meaningful use" in the US.)
2. Payment systems (especially fee-for-service reimbursement systems) do not provide sufficient incentives for the adoption of IT.
3. Care is fragmented across different systems (payers, providers, organizations, offices, regions, etc.) that do not share information.
4. The business of healthcare is more complex than any manufacturing process. Standards of care typically allow a provider at least some degree of latitude in treatment decisions, variability in application of standards is well documented, and the evidence base and innovation rate in medicine is highly volatile.
5. Health and medical data is complex. It is difficult to develop agreed code sets using common semantics and syntax. Medical conditions can be nuanced and impossible to express in a fully standardized manner. Machine input can be cumbersome and restrictive compared to using traditional analog methods of data capture.
6. The nature of provider organizations can be a barrier to IT adoption for at least two major reasons:
    a. Provider organizations often view data sharing as a competitive disadvantage. On the flip side, the means by which provider organizations achieve the degree of interoperability they have achieved to-date is treated as among the most proprietary intellectual property the organization owns.
    b. Provider organizations' dual power structures – administrative and clinical – hinder rather than facilitate decision-making.

[7] Health Care Information Systems: A Practical Approach for Health Care Management, Wager et al. (see Referenced Documents).

B Foundation, Levels, and Content Areas of the HERA

	Level 0		Level 1	Level 2	Level 3
Foundation	**Models**	**Cycles**	**Process Domains**	**Processes**	**Tools (see Figure 11 to Figure 13)**
Plan	Management	Strategy & Plan	Business Drivers	Drivers	
				Assessment	
			Business Goals	Goals	
				Stakeholders	
				Requirements	
				Transformation Plan	
			Business Strategy	Strategy	
				Capabilities	
				Baseline	
				Target	
			Transformation Portfolio	As-Is – To-Be Gap	
				Transformation Portfolio	
Build	Architecture	Build & Deliver	Business	Service	
				Function	
				Actors	
			Information	Value Set	
				Terminology	
				Information Model	
			Application	Service	
				Function	

	Level 0		Level 1	Level 2	Level 3
Foundation	**Models**	**Cycles**	**Process Domains**	**Processes**	**Tools (see Figure 11 to Figure 13)**
				Physical Application	
			Technology	Physical Device	
				Technology Function	
				Technology Service	
Run	Operations	Operate & Evolve	Operate	Business Service	
				IT Service	
			Measure	Measure KPIs	
				Business	
				IT	
				Clinical	
			Analyze	Assessment	
				Business Outcomes	
				IT Outcomes	
				Clinical Outcomes	
			Evolve	Evolve	

C Rationale (Informative)

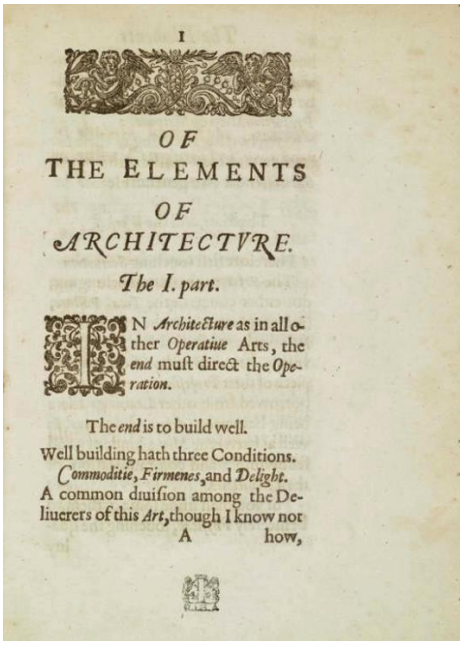
This informative appendix contains additional information concerning the contents of this document.

C.1 Person-Centricity

Figure 1 puts the person in the middle of the landscape. The HERA is patient-centered and customer-focused. Ultimately, outcomes related to the patient are the ultimate metric of success. In this way, the HERA is aligned with value-based medicine and pay-for-performance rather than fee-for-service or capitation schemes that are not directly related to patient health outcomes.

HERA users who represent stakeholders who do not provide direct patient care – i.e., much of the healthcare supply chain – may focus on outcomes that are not directly related to patients. Many IT vendors are in this situation, where the outcome is a product or service that meets certain standards or expectations.

The general point about the HERA is that it is designed for users whose operations are directed by their ends, and their ends are directed by the vision, mission, and specific goals of the organization. As Henry Wotten wrote in the classic *The Elements of Architecture* (1624): "In *Architecture*, as in all other *Operative Arts*, the *end* must direct the *operations*."



1

OF
THE ELEMENTS
OF
ARCHITECTVRE.

The I. part.

IN *Architecture* as in all other *Operatiue* Arts, the *end* must direct the *Operation.*

The *end* is to build well.

Well building hath three Conditions.
Commoditie, Firmenes, and *Delight.*
A common diuision among the Deliuerers of this *Art,* though I know not how,

A

Figure 14: The Elements of Architecture[8]

[8] The Elements of Architecture, Henry Wotten, 1624, p.1; refer to: http://archiv.ub.uni-heidelberg.de/artdok/1870/1/Davis_Fontes68.pdf.

Index