

HSPC’s Impact to the Health Industry 2018 Roadmap

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1 Introduction

The Healthcare Services Platform Consortium (HSPC) was formed as a nonprofit industry consortium to effect change within the health and health IT (Information Technology) landscape; positively affecting wellness and improving care delivery. By fostering the advancement of open platforms, systems, standards, and content, HSPC is a diverse community with a wide span of interests and projects. This document fills a need within the ecosystem providing a consensus set of community priorities to scope the mainstream of HSPC work, and to better articulate to members and non-members the major activities and milestones being undertaken by our community in the form of an Industry Roadmap.

Since its inception, HSPC has established a number of initiatives that have produced a host of products and guidance including:

- Clinical models
- Terminology models
- Reference architectures
- Testbed environments
- SMART applications
- Open source implementations

These efforts have been driven as a result of community and benefactor priorities and delivered through multiple initiatives and underlying projects. The Roadmap is an effort to take these efforts to the next level, harmonizing interrelationships among efforts, proactively engaging the HSPC, focusing the membership and broader community to determine and sequence priorities, and charting a unified course forward to achieve our organizational objectives.

Any one organization can (and does) undertake specific projects to achieve their intended purpose, but rarely do those efforts have an amplified effect of changing the industry. Through the strength of community and the reach of the HSPC organization, there is an economy-of-scale impact, building on prior work and fostering sharing, co-investment, and encouraging a broader adoption that would be achieved otherwise.

The Roadmap defines the journey that begins in the present state and articulates the critical-path toward the future state of health and health IT (HIT). The path to the future is, in fact, several intersecting roads, each representing different dimensions of the challenges faced within the Health domain:

- Knowledge expression
- Data interoperability
- Sharable technical infrastructure
- Plug-and-play services and service-oriented architecture
- Secure systems with integrity supporting patient privacy concerns and protecting sensitive information from misuse
- A defined set of business priorities affecting the solutions we prioritize and the needs of our stakeholders.

While not a standards body itself, the relationship between HSPC and standards bodies is something frequently examined. Indeed, at a high level HSPC's mission and goals have a lot in common with other standards initiatives like the Argonaut Project¹, The Sequoia Project² (eHealth Exchange, Carequality), and Commonwell³. A goal of HSPC is to work collaboratively with standards groups whenever possible.

In the case of the Argonauts and HSPC, both organizations are interested in creating FHIR profiles. The Argonauts have focused on making profiles of HL7 FHIR Resources that cover the meaningful use common data set. HSPC is committed to use the Argonaut profiles as the starting point for further specialization of these resources to enable true interoperability.

eHealth Exchange and Carequality projects of Sequoia are establishing the trust framework and network connectivity that is essential to sharing patient information. Right now, data is being exchanged using CDA documents, but they are moving to send discrete data via FHIR services. HSPC will benefit tremendously from the network that Sequoia has established, and HSPC would like to work jointly with Sequoia to establish a common set of approved FHIR profiles that support semantic interoperability.

Commonwell is committed to creating interoperability. The initial focus has been on patient identity and administrative data. HSPC would like to work jointly with Commonwell when they focus on FHIR based services for administrative transactions and when they broaden their work to include discreet clinical data.

HSPC has the goal of working with all organizations that are working to create interoperability, and to do so in a way that complements and builds on the work of others. Ultimately, HSPC's role within the industry is as an enabler and transformation agent. Through the efforts of this community, we will be making available tools, techniques, content, and approaches to improve the clinical viability of marketplace products, to help healthcare providers make more informed adoption decisions and better utilize the solutions they acquire, and to help marketplace vendors improve their ability to effectively interoperate by leveraging HSPC assets.

1.1 Purpose of this document

HSPC has outlined a vision of the future of healthcare fostering vendor-neutral platforms and assets serving as a transformation agent to help realize and enable a future state of information and knowledge sharing, data availability, and effective use of that information to help foster improvements in care and ultimately patient benefits and individual wellness. To realize these goals necessitates the alignment and coordination of multiple efforts concurrently, and the mobilization of the HSPC community to work together and in concert to realize our objectives. The HSPC Industry Roadmap plays a key role in achieving this.

As an open community with a diverse membership, determining how the pieces fit together is essential in realizing our future vision. In particular, understanding how different activities and projects relate, determining the "critical path", establishing shared community priorities, and articulating our

¹ Please see http://argonautwiki.hl7.org/index.php?title=Main_Page

² Please see <http://sequoiaproject.org>

³ Please see <http://www.commonwellalliance.org/>

community journey are all key elements that are essential if HSPC is going to deliver on our intended objectives.

This Roadmap serves several specific objectives:

- It parses a complex domain space into “swim-lanes” allowing both the general public and the HSPC community to see the key focus areas that comprise the future state
- It defines the core set products to be developed by or within the community
- It defines a service-oriented platform providing core and enabling services supporting the next generation of HIT
- It identifies tangible milestones, organized both by “swim-lane” and by time, setting expectations for outcomes to be achieved by the community.
- It reflects a set activities deemed to be shared priorities for the majority consensus of the HSPC community.
- It defines a set of expectations intended to relate to the broader community and non -HSPC stakeholders interested in leveraging HSPC work.

(Note that there are other activities happening within HSPC that may not appear within the Roadmap. This is to be expected. It is also expected that activities will migrate from “incubator” activities into the HSPC critical path that is reflected in this document. Lastly, this Industry Roadmap is a living document. It is expected to have low volatility, with anticipated annual updates).

1.2 Why produce a Roadmap?

As discussed above, HSPC has a broad membership with a diverse set of interests. One of the challenges with such a diverse and dynamic community is that there are thousands of worthy efforts and activities. That said, clearly defining if and how those pieces fit together, and more importantly how they complement one another to achieving the intended target state is murky at best without a plan. This Industry Roadmap is that plan.

By applying good Enterprise Architecture principles, this Roadmap builds upon strategic planning and business transformation practices to elaborate the future-state vision and depict the path the HSPC community has chosen to achieve it. It provides an “at a glance” view of the principal activities underway within HSPC, and establishes the basis for a business case for onboarding new members and resources to contribute to key activities needed for the industry.

In our community experience, the HIT industry is very much in need of a cohesive vision of the future, and this Roadmap serves both to help define such a vision, and articulate the path to realize it.

Enterprise Architecture (EA) is based upon a set of broadly accepted core principles, which appear in most EA methodologies.

- Separation of concerns to focus on each factor/dimension in turn
- Business Driven
- Durable, multi-year planning
- Formal governance, testable, traceable

1.3 What this Roadmap is (and isn't)

The HSPC Industry Roadmap represents the critical path milestones and products that comprise the mainstream critical path of work crosscutting HSPC community efforts. A set of very specific inclusion criteria (e.g., role in achieving the target state, applicability across projects/efforts, etc.) as applied to determine which milestones were appropriate for inclusion in the Roadmap. (Please reference Section 2.2 of this document). In a nutshell, you will notice only those activities that benefitted multiple projects and that were enablers of the future-state vision were included. This approach keeps the Roadmap focused on the mainstream of the ecosystem and how that will achieve community goals. It identifies key priorities, illustrates the relative timing of work being performed, and creates an “at a glance” view for HSPC community activities represented in broad strokes.

Not every project or HSPC activity will appear on the Roadmap – it is not a community inventory. Instead, it is an “at a glance” view of those projects deemed as critical path toward achieving the target-state vision defined by the community. HSPC does and will continue to foster incubating projects that have not yet matured to be included on the roadmap, and other community artifacts are important but not necessarily critical path, and those are not included.

The Roadmap is not, nor is it intended to be, a project management artifact or a holistic inventory of all efforts occurring under the HSPC umbrella. While the Roadmap does identify key community deliverables and milestones, it is a complement to traditional project management tools, and by design does not include internal project activities or deliverables.

Finally, the Roadmap does not limit the work that might be performed within the HSPC community – it merely reflects the mainstream of HSPC work by depicting strategic priorities of the community along architectural lines to “separate concerns”. The community can and will undertake additional efforts, as incubator projects, as member-driven initiatives, and as community efforts, all of which are appropriate and to be expected.

1.4 How to use this Document

This document has several intended uses, which vary significantly depending upon your organization and its objectives. These views can be broadly categorized into groups; Industry, HSPC Community use, and HSPC Member Use. A more detailed treatment of these perspectives is available in Section 5, but are summarized here for convenience.

The Industry View, the Roadmap serves as a communications vehicle to document and illustrate our primary focus and journey, it identifies opportunities for participation and engagement, and it crystallizes areas of specific need serving as a potential entry-point into healthcare for individuals and organizations seeking to participate in this vertical. The Roadmap identifies major areas of activity, key milestones and product deliverables developed or fostered by HSPC, a timeline during which activities are occurring, and a classification of activities. Taken together, this provides HSPC the means to set expectations of interested parties so that they might make plans to consume relevant HSPC products, to co-invest in areas self-interest to further industry goals, and to determine the fitness-for-purpose of HSPC work to their own organizational needs. In fact, many organizations have elected to participate in HSPC as a way to amplify the impacts of their investment, realizing an economy-of-scale benefit.

The HSPC Community View, the Roadmap serves primarily as an organizing and prioritization function. As a broad and diverse community, one significant challenge relates to bringing different organizations “onto the same page” in terms of priorities and work efforts. In order to be successful as a community, a thoughtful course must be charted to provide the semantic and technical infrastructure enablers that can be used by projects and community stakeholders as the basis for building the future state. The Roadmap provides that structure.

Specific goals of the Roadmap within the community include:

- Articulating of externally-facing project deliverables
- Improving understanding of cross-project dependencies
- Establishing Phased Deliverables of major sets of capability to the marketplace
- Prioritizing which industry standards will be supported by HSPC, determining how they are used, and ascertaining how to engage with the respective communities.
- Indicating and advancing overall community maturity and that relationship to project activities (e.g., improved governance, availability of community assets, etc.)
- Scoping HSPC work / priorities
- Attracting new members and participants

The HSPC Member View differs from the community view in a few significant ways. The expectation within this perspective is that members engage and participate in their self-interest. It is important to note that a member self-interest is not necessarily in conflict with a community interest, and in fact these are often aligned. That said, they are distinct differences. HSPC members are likely to use the Roadmap document to determine specific projects, deliverables, or milestones of direct interest, and to determine the extent to which they plan to engage or consume those assets.

We expect HSPC members to advocate for their priorities within the overall community, building agreement and adding new activities to the critical path as deemed appropriate by the community. These priorities will help drive investment decisions, both in terms of direct resource contribution toward specific efforts, or cost-avoidance by consuming efforts being done by others within the ecosystem. It will also help members align with broader interests, fostering interoperability on a bigger scale and better positioning participating institutions to take advantage of the advances being developed.

2 Driving the Health Industry Transition

The development methodology used to develop the Roadmap took into consideration the HSPC Mission and Goals, the community’s strategic initiatives, existing projects, aspirational goals and needs, and industry gaps and risks. These were then analyzed to consider inter-project dependencies, architectural considerations, and the financial model/viability of HSPC to create a critical path.

The HSPC Roadmap reflects a community consensus – the agreement among a strong supermajority of the HSPC membership, serving as a guide to both maintain focus on our overall objective, and to define interim deliverables that advance HSPC’s cause. The Roadmap is a living document; it is expected to have low volatility, with anticipated annual updates to accommodate changing needs, but avoiding

frequent dramatic shifts allowing the HSPC, its membership and the community to remain steadfast in achieving community priorities.

This section describes the Transition map, how it is constituted, and what meaning is represented in its core elements.

2.1 Transition Roadmap (T-Map)

The Transition Map is the focal component of the HSPC Roadmap. It was created through an iterative process of brainstorming, analysis, and modeling, with each step being assessed for fitness-for-purpose based upon the intended goal of articulating the areas of priority for HSPC and the scope that the community felt was key to achieving our mission.

Background and Process. Initially the “As Is” and “Future State” sections were documented to frame the work. Based upon that understanding, consideration was given as to which “dimensions” would be most effective as swim-lanes. Since the swim-lanes determine the ultimate focal paths around which the thinking is organized, this step is particularly important. In fact, the group underwent several iterations of swim-lane elections before the baseline set was determined. Some lanes, such as the “Knowledge” lane reached an early consensus, while others (e.g., the “Software” a “Technical Infrastructure” lanes) underwent much more discussion.

The concept of grouping the swim-lanes into “segments” stemmed from practicality. While subsequent refinement work was underway, many milestones vacillated between lanes as a result of subtleties unsurfaced in the analysis. There was a natural cohesion among certain themes, such as Knowledge and Data/Information. Additionally, the community interested in the corresponding topics were often the same. The resultant decision was to create Segments to recognize this cohesion of topics.

Reading the Diagram. The heart of this roadmap document is the central graphic – the “Transition Map”⁴ (abbreviated as T-Map) – that depicts an “at a glance” a visualization of the major areas of interest and corresponding milestones related to those areas.

The principal objective of the T-Map is to illustrate the transitory path from a current “As Is” state toward an intended “Future State”, depicting the milestones as way-points to be achieved during the transition. Within its construct, activities are grouped into cohesive

⁴ This work is based upon a methodology from The Open Group (<http://opengroup.org>), used with permission.

T-Map Described

Current State (“1” on the figure). The *current state* appears on the T-Map as a box in the lower left corner. It contains 5-7 bullet points describing the state of the industry as it stands today. Specifically, the Current State describes today’s interoperability challenges and common practices in HIT.

Future State (“2” on the figure). The *future state* appears on the T-Map as a box in the upper right corner, describing our aspirational future reality: the world as we would like it to be. Specifically, the Future State is based upon HSPC’s Mission and Goals, community input, active and planned work, and strategic initiatives.

Segments and Swim-lanes (“3” on the figure). Reflected on the diagram as the “sunburst” from the upper right corner, the complex domain has been divided into segments and then again into swim-lanes. Each segment represents a specific perspective by exclusively focusing on a defined high-level theme, and is characterized by a principal problem statement appearing along the boundary of each swim-lane. The swim-lane construct simplifies these complexities by “telling the story” one perspective at a time, noting that interdependencies exist among them.

Phases (“4” on the figure). Appearing as radial arcs, the *phases* within the T-Map represent time, with the outermost band representing the present day and the innermost reflecting the target state. Note that the phases transcend the swim-lanes, and in fact unify activities and milestones.

The phases represent “major deliverables” and can be anecdotally considered HSPC 1.0, 2.0, 3.0, etc.

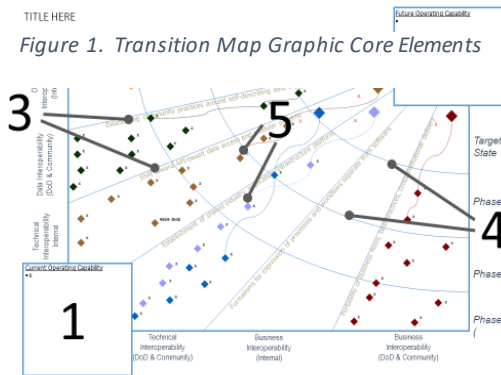
Milestones (“5” on the figure). Within each swim-lane are identified a number of milestones, each of which indicates an objective, measurable point indicating the completion of an activity within that lane. The milestones represent the path from the “As Is” to the “Future State”.

“swim-lanes”, each of which maintains a directed focus around a specified theme representing a key dimension of the problem space.

These swim-lanes are not categories and are not mutually exclusive. They are perspectives, looking at the problem space from a particular point-of-view, and highlighting milestones and considerations reflected from that point of view. Architecturally speaking, this is a “separation of concerns”, where each swim-lane represents a different dimension of this health information technology landscape. For this reason, it is common for one project or activity to have milestones in multiple swim-lanes, and that occurs in this HSPC T-Map.

There is no one intended way for this diagram to be consumed. One of the strengths of the T-Map construct is that it represents multidimensional data. Those interested in understanding the overall

TITLE HERE
 Figure 1. Transition Map Graphic Core Elements



journey to the intended target state can begin their exploration with the key themes for each swim-lane (appearing on the radial lines for each swim-lane segment). Others may have interest in which capabilities are to be delivered when, for which the Phase Orientation (in the radial arcs) would be more useful. Note that the following sections of the document provide detailed breakouts elaborating the

content of the T-Map along both Phased (time-oriented) and Swim-lane (topic-oriented) axes.

As depicted in the figure on the prior page, the T-Map construct is comprised of five core elements, each reflected by the numbered area corresponding to the sections below. The callout box above provides additional detail in terms of the goal and content of each of these sections.

1. Current State – A vignette of the “state of the industry” today.
2. Future State – A brief description of the aspirational future we are enabling.
3. Segments and Swim-lanes – Separation of the complex landscape via focused perspectives
4. Phases – Time-oriented slices depicting major units of functionality and business capability
5. Milestones – specific measurable, achievable progress points and deliverables.

The Transition Map for HSPC appears in Figure 4, following, which depicts a holistic picture of the activities and outcomes that the HSPC community seeks to realize. Note that the swim-lane/segment view does not reflect one particular project or product, rather it provides the cross-section of milestones affecting multiple HSPC efforts, illustrating the critical path to achieving our future vision.

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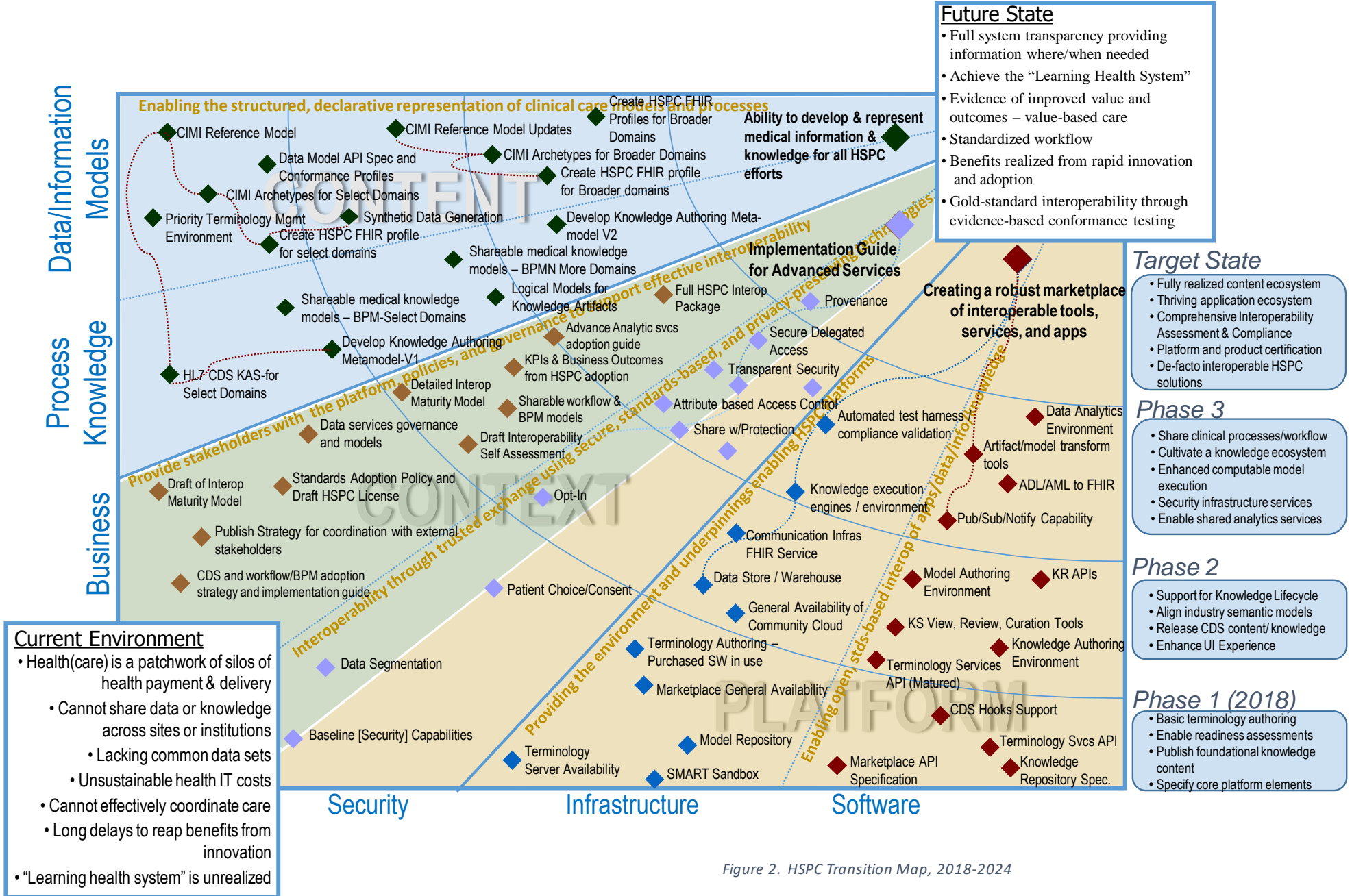


Figure 2. HSPC Transition Map, 2018-2024

2.2 Inclusion Criteria – What belongs on the Roadmap?

Since the Roadmap represents the mainstream projects and the critical path to achieving HSPC’s vision, by design it is not a complete inventory of activities or milestones. With dozens of projects today, likely to grow to hundreds in the future, a consistent set of criteria had to be established to maintain the integrity of the roadmap.

To set expectations correction, the Roadmap is a mathematical “intersection” among HSPC efforts, identifying those milestones that both support multiple projects or initiatives, and supportive of the target future state. *(Note that it is deliberately not a mathematical “union” of all products, milestones, or activities occurring in HSPC).*

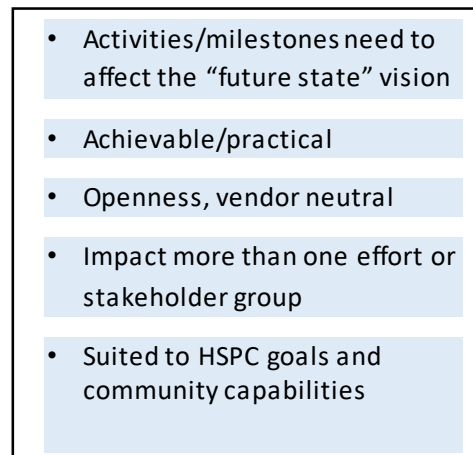
- 
- Activities/milestones need to affect the “future state” vision
 - Achievable/practical
 - Openness, vendor neutral
 - Impact more than one effort or stakeholder group
 - Suited to HSPC goals and community capabilities

Figure 3. HSPC Roadmap Inclusion Criteria

Figure 5 enumerates the criteria that have been used as the “gate” to assess potential roadmap milestones. While somewhat simple in nature, these criteria assure that the high-level granularity of the Roadmap is maintained, and that it does not devolve into a project management asset for any one specific effort.

Future State Vision

The health industry is at a crossroads, and if we are to realize the promise of a learning health system there are a number of foundational elements that either do not exist, are immature, or are poorly adopted that are adversely affecting our ability to achieve. HSPC has a critical role to play in transforming the health IT sector to be able to achieve this promise. The following tenets are crucial in HSPC’s view to achieving a viable target state of the industry:

- Establishing and fostering full system transparency, enabling information to freely flow where and when it is needed, and supporting the evidence basis for value-based care
- Promoting adoption of rapid innovation approaches and solutions, seamlessly integrated with legacy, to accelerate the pace and reduce the pain of adoption of new technology.
- Establish the foundation to allow for the unfettered sharing of clinical knowledge and workflows, improving the portability, consistency, and availability of proven solutions and best-practices in support of patient-centered care and a seamless care experience.
- Realize within the health community those common understandings and representations of data to achieve full semantic interoperability, reducing development time, burden, and costs
- Fostering an open ecosystem and marketplace for HIT innovation by establishing a gold-standard of interoperability via conformance testing and serving as a trusted intermediary

As exemplars, HSPC has several key projects underway that are helping to achieve this vision. The HSPC Sandbox project allows teams to rapidly create and leverage a host of tools in support of SMART on FHIR

applications, virtually eliminating technical startup burden for SMART project development. HSPC CIMI (Clinical Information Modeling Initiative) work is developing rich content models that are standards-based, that leverage broadly accepted clinical terminologies, and that are semantically unambiguous, fostering broad sharing of health information that can, for example, be used for direct care, can leverage clinical decision support, and supports secondary use analytics. The SOA (Service Oriented Architecture) Platform effort is establishing a service bus of health-oriented SOA services supporting capabilities such as the distribution of clinical content, the availability of core functions such as master person index, terminology services, and others – the essential building blocks for inter and intra-institutional sharing.

3 Phase-oriented View⁵

The HSPC Industry Roadmap has been defined in four phases of activity to begin in 2018 and running through approximately 2024, with each phase lasting for approximately two years. The intention of the phasing is to define “plateaus” of functionality – organized as major releases of HSPC Community products – setting delivery goals for within the community and setting expectations of consumers of HSPC work.

As might be expected, the community visibility into the content of Phase I is more rich and likely more accurate than our vision for Phase IV. We have a much better handle on the work that is underway today and the current market forces influencing that work. As we traverse the roadmap to the out years, many more variables are in play, and the dependencies on prior year work become stronger. As such, the milestones identified and described for the out-years will likely be less precise and less specific than work being performed sooner, and we will have higher confidence in closer-in work at this stage. The annual refresh cycle, by design, will allow practical experience to influence our strategic plan, maturing this Roadmap over time.

One of the key objectives of the phasing is to define the “major chunks of capability”, which can loosely be considered our integrated product release. If we consider the assets available today as HSPC 1.0, then one can consider the completion of Phase I to be the HSPC Version 2.0 product, with each subsequent phase producing the next major release.

The analysis work reflected by the milestones that have been identified in each swim-lane serves to scope the priorities of the HSPC community, and their placement into Phases indicates the capabilities to be delivered considering Time as an axis. Generally speaking, milestones in Phase II depend upon deliverables from Phase I, and so on.

The four sections that follow provide a vignette as to what will be delivered in each phase, and discuss the business implications of the capabilities for each HSPC release.

3.1 Phase I (Present through 2018)

The principal focus of this phase is to establish foundational infrastructure and capabilities to position the community to take on more advanced work beyond Phase I. To realize the vision supported by open platforms and the unfettered exchange of meaningful and semantically consistent health information, a

⁵ The Phase-orientation of the Transition Map was designed with an expectation of two year phases. Due to resource dependencies and other out-year factors, dates beyond Phase 1 are now reflected only notionally.

number of foundational tools, content, and process artifacts are missing and will be developed in this phase to meet industry needs.

Phase I will see the establishment of core services in areas of

- Terminology and authoring
- Repository support
- Organizational assessment and readiness tools and underlying processes for curation
- Management, acquisition, and deployment of HSPC assets within healthcare institutions

Refinement of existing community processes and policies will continue, such as intellectual property licensing, community compliance and certification, and so on. Content development will result in publication of HSPC knowledge for specified domains, forming a foundation that will be broadened in subsequent phases. In addition, core components of the HSPC Platform will be specified, forming the basis for subsequent certification activities, and select services will be available as executable and deployed into HSPC test environments.

Highlights of the key business capabilities available at the conclusion of Phase I appears in Figure 4, following, and relates those highlights to corresponding projects or deliverables. This deliverable set is not exhaustive, rather it is representative of work being performed in that phase as related to the business objectives identified.

Capabilities Provided	Representative HSPC Product(s)
Establish foundation for open system creation, acquisition	<ul style="list-style-type: none"> • Standards Adoption Policy Recommendations
Support for organizational readiness assessment and planning	<ul style="list-style-type: none"> • HSPC Enterprise Readiness Strategy and Implementation Guide • Organizational Governance Model for Knowledge Content
Publish Foundational Knowledge Content	<ul style="list-style-type: none"> • Produce HSPC CIMI Models and FHIR Profiles for select domains (Laboratory Results (including pregnancy tests), Vital Signs, Wound Assessment, Pain Assessment, Pulmonary Embolism, and Neonatal Admissions Assessment) • Develop model patterns to support VMR, QDM, FHIR, CEM
Establish core tooling environment	<ul style="list-style-type: none"> • Establish Knowledge Repository • Publish Marketplace API Specification • Establish Terminology Services • Establish Knowledge Authoring Environment
Establish baseline of security services	<ul style="list-style-type: none"> • Provide core services for identity management, authentication, authorization, audit, confidentiality, integrity. • Document expected security best-practices

Figure 4. HSPC Phase I Capabilities Realized

3.2 Phase II

Loosely characterized as an elaboration phase, the Roadmap stage is the predominant launch of many new HSPC efforts, now realizable as a result of the foundation established in Phase I. For many

sustained efforts, iterative refinement continues, and the elements to be able to define and test what it means to be “adopting HSPC” is created.

From a Business perspective, the conclusion of this phase provides HSPC stakeholders and consumers with a Maturity Model and a robust suite of self-assessment tools, allowing them to determine risks and gaps in their own organizational portfolios and assisting with navigation to relevant community assets. This phase also brings the underpinnings for certification, including a self-certification toolkit as part of the full HSPC Interoperability Toolkit envisioned in later phases.

The HSPC tooling portfolio, particularly related to terminology authoring and support, becomes available with the delivery of the HSPC Knowledge Representation toolset, supporting the view, review, curation, environment, and access API to this resource.

Knowledge creation will include evaluation of current models within the industry, such as the Federal Health Information Model (FHIM), and the involvement of clinical domain experts. Knowledge produced and curated by HSPC expands commensurate with the availability of enhanced knowledge authoring and management environments. In addition to information and terminology models, the scope of curated content expands to include clinical decision support and workflow models.

Security capabilities continue to mature, and inclusion of “Opt-In” capabilities become available.

Highlights of the key business capabilities available at the conclusion of Phase II appears in Figure n, following. The table indicates the business capability realized, and then relates some of the specific products delivered that support that capability in the corresponding column.

Capabilities Provided	Representative HSPC Product(s)
Deployment of HSPC Knowledge Representation Tool Suite	<ul style="list-style-type: none"> • Knowledge Authoring Environment • KR View, Review, Curation Tools • Modeling Authoring Environment
Improved alignment among industry semantic models	<ul style="list-style-type: none"> • Process for surveying Terminology Standards and Info Models • Development of CIMI Model Patterns
Release of Clinical Decision Support content/knowledge	<ul style="list-style-type: none"> • Defined CDS Knowledge Artifacts • Care Process Resource Model
Enhanced User Experience consistency	<ul style="list-style-type: none"> • Example Display Components for UI

Figure 5. HSPC Phase II Capabilities Realized

3.3 Phase III

Phase III can be broadly characterized as the general availability of integrated HSPC Platform capabilities, processes, and knowledge. Prior to this phase, HSPC projects and activities were mutually-aware but largely loosely dependent. Beginning in Phase III, those interdependencies among activities become more closely bound, forming more integrated suites of capability allowing HSPC consumers to benefit from higher orders of value.

The maturation of HSPC technical services into integrated suites, forming the basis for the HSPC Platform and its certification efforts brings together technical components and begins to foster execution-time consumption of knowledge artifacts created. Infrastructure established in this phase

allows for the curation, management, and distribution of process models, and sees in compliance critical to allow for validation and vetting of those models.

With the underpinnings largely complete, early stages of more complex, composite goals can be fostered, such as improving transparency and visibility into metrics across processes, and the establishment of analytics capabilities.

SOA Governance is now in place, allowing for the integration, oversight, and certification of products and platforms as HSPC compliant.

Highlights of the key business capabilities available at the conclusion of Phase III appears in Figure 6, following. The table indicates the business capability realized, and then relates some of the specific products delivered that support that capability in the corresponding column.

Capabilities Provided	Related HSPC Product(s)
Analytics Services	<ul style="list-style-type: none"> • Analytics Model Sharing • Analytics Compliance Self-Assessment
Enhancement of computable model execution environments	<ul style="list-style-type: none"> • Publication/subscription/notification services • ADL/AML to FHIR Services • Artifact/Model Transformation Tools
Extended and enhanced clinical knowledge catalog	<ul style="list-style-type: none"> • Refined and matured knowledge authoring, workflow models, care process models
Security infrastructure services substantially available	<ul style="list-style-type: none"> • Attributed-based Access Control • Secure Delegated Access • Share with Protection
Sharable clinical workflow models	<ul style="list-style-type: none"> • BPM for Health Model Repository • Hosted Clinical Workflow Modeling environment

Figure 6. HSPC Phase III Capabilities Realized

3.4 Phase IV

As the final phase, the conclusion of Phase IV sees a fully realized and thriving HIT ecosystem, fueled and fostered by innovations from HSPC and beyond. Tooling is available, mature, and under ongoing refinement to support the knowledge, processes, and software supporting the provision of healthcare and maintenance of health.

Available to the industry are self-assessment tools, implementation guidance, asset repositories, and certified solutions that are fit for purpose to help realize value-based care and support learning health systems. HSPC’s Interoperability Toolkit is a practical and valuable indicator helping organizations make informed decisions, and HSPC’s marketplace is a trusted delivery channel for the discovery and acquisition of relevant software and content supporting the delivery of health IT solutions.

Highlights of the key business capabilities available at the conclusion of Phase IV appears in Figure 7, following. The table indicates the business capability realized, and then relates some of the specific products delivered that support that capability in the corresponding column.

Capabilities Provided	Related HSPC Product(s)
Clinical Knowledge Marketplace / Content Ecosystem	<ul style="list-style-type: none"> • HSPC Marketplace • Executable Workflow Model compliance testing
Interoperability Assessment and Compliance	<ul style="list-style-type: none"> • HSPC Interoperability Toolkit • SOA Platform Certification

Figure 7. HSPC Phase IV Capabilities Realized

3.5 Summary of Phases

The following is an integrative look at key milestones and deliverables across HSPC encompassing work in each swimlane and attributed to the phase when delivery is expected. It is intended to provide a holistic view across the community and its work.

Swim-lane	Capability Provided	Milestone (Label/Description and Rationale)	Milestone Type	Phase I	Phase II	Phase III	Phase IV
Data/Info	Prerequisites for Semantic Interoperability	<ul style="list-style-type: none"> Develop CIMI Model Patterns to capture expressivity of VMR, QDM, FHIR, CEM 	Content; Document	x			
Knowledge	Prerequisites for Semantic Interoperability	<ul style="list-style-type: none"> Declarative Representations of Workflows, Care Processes using Sharable Knowledge Models 	Content ;Document	x			
Knowledge	Publish Foundational Knowledge Content	<ul style="list-style-type: none"> Produce HSPC CIMI Models and FHIR Profiles for select domains (Laboratory Results, Vitals; Clinical assessments for Wound, Pain, Neonatal Admissions, Pulmonary Embolism) 	Content; Document	x			
Knowledge	Publish Foundational Knowledge Content	<ul style="list-style-type: none"> Develop model patterns to support VMR, QDM, FHIR, CEM 	Content; Document	x			
Business	Establish core to create, acquire open systems	<ul style="list-style-type: none"> Standards Adoption Policy Recommendations 	Document	x			
Business	Support for org readiness assessment and planning	<ul style="list-style-type: none"> HSPC Enterprise Readiness Strategy and Implementation Guide 	Document	x			
Business	Support for org. planning, readiness assessment	<ul style="list-style-type: none"> Organizational Governance Model for Knowledge Content 	Document	x			
Security	Establish baseline of security services	<ul style="list-style-type: none"> Provide core for identity mgmt, authentication, authorization, audit, confidentiality, integrity. 	Document	x			
Security	Establish baseline of security services	<ul style="list-style-type: none"> Document expected security best-practices 	Document	x			
Infrastructure	Establish core tooling environment	<ul style="list-style-type: none"> Develop Priority Term. Mgmt Environment Establish Terminology Services 	Software & Services	x			
Infrastructure	Establish core tooling environment	<ul style="list-style-type: none"> Establish Knowledge Repository Establish Knowledge Authoring Environment 	Software & Services	x			
Infrastructure	Establish core tooling environment	<ul style="list-style-type: none"> Publish Marketplace API Specification 	Document	x			
Data/Info	Improved alignment among industry semantic models	<ul style="list-style-type: none"> Process for surveying Terminology Standards and Info Models Development of CIMI Model Patterns 	Content; Document		x		
Knowledge	Release of CDS content/knowledge	<ul style="list-style-type: none"> Defined CDS Knowledge Artifacts Care Process Resource Model 	Content; Document		x		
Knowledge	Enhanced User Experience consistency	<ul style="list-style-type: none"> Example Display Components for UI 	Content; Document		x		
Business	Detailed interop maturity Model	<ul style="list-style-type: none"> This maturity model will also incorporate a self-certification toolkit as part of the full HSPC interoperability toolkit as that is released. 	Document		x		
Business	KPIs/ Business Outcomes from HSPC Adoption	<ul style="list-style-type: none"> Develop and provide value proposition and set matrix arising from HSPC adoption 	Document		x		
Business	Draft Interop Self - Assessment Methodology	<ul style="list-style-type: none"> Develops and provide written conformance for self-certification 	Document		x		
Security	Sharing with Protection	<ul style="list-style-type: none"> Opt-in, Patient Choice with Consent Secure Delegated Access 	Content; Document		x		

Swim-lane	Capability Provided	Milestone (Label/Description and Rationale)	Milestone Type	Phase I	Phase II	Phase III	Phase IV
Infrastructure	Deployment of HSPC Knowledge Representation Tool Suite	<ul style="list-style-type: none"> Knowledge Authoring Environment KR View, Review, Curation Tools Modeling Authoring Environment 	Software and Services		x		
Knowledge	Extended and enhanced clinical knowledge catalog	<ul style="list-style-type: none"> Refined and matured knowledge authoring, workflow models, care process models 	Content; Document			x	
Business	Full HSPC interoperability package	<ul style="list-style-type: none"> Provide complete HSPC version 1.0 interoperability and SOA services adoption 	Content; Document			x	
Business	Sharable clinical workflow models	<ul style="list-style-type: none"> BPM For Health Model Repository Hosted Clinical Workflow Modeling environment 	Content; Document			x	
Business	Analytics Services	<ul style="list-style-type: none"> Analytics Model Sharing Analytics Compliance Self-Assessment 	Content; Document			x	
Security	Security infrastructure services substantially available	<ul style="list-style-type: none"> Attributed-based Access Control Secure Delegated Access Share with Protection 	Software and Services			x	
Infrastructure	Enhancement of computable model execution environments	<ul style="list-style-type: none"> Publication/subscription/notification services ADL/AML to FHIR Services Artifact/Model Transformation Tools 	Software and Services			x	
Knowledge	Clinical Knowledge Marketplace / Content Ecosystem	<ul style="list-style-type: none"> HSPC Marketplace Executable Workflow Model compliance testing 	Content ; Document				
Knowledge	Interoperability Assessment, Compliance	<ul style="list-style-type: none"> HSPC Interoperability Toolkit SOA Platform Certification 	Content ; Document				
Business	Implementation Guide for Advanced Services	<ul style="list-style-type: none"> Provide HSPC adopters with strategy and implementation guide for advanced HSPC version 2.X interoperability and SOA services. 	Content ; Document				
Security	Fully Secure Interoperability	<ul style="list-style-type: none"> Transparent Security SOA Platform Certification 	Content ; Document				

4 Swim-lane and Segment Detail

In this section, we explore each of the swim-lanes (and segments), considering the journey from the “As Is” state to the “Future State”. Each segment was produced by a dedicated project team focused on that viewpoint and with participation from existing HSPC projects and initiatives in that space.

What is reflected in this section is a description of the overall objective of each swim-lane, and then a detailed breakout of select milestones illustrative of the work being performed in that swim-lane. As previously mentioned, the Roadmap does not and is not intended to be an exhaustive list of all work being performed, nor does all the work of any given project appear in one swim-lane.⁶

For the milestones included within this section, you will find a short summary of the work reflected underneath that milestone, the rationale for its inclusion on the roadmap, its relationship to the phased

⁶ This architectural “separation of concerns” is a classic analysis approach commonly used in the Enterprise Architecture discipline. Manifestations of this approach can be found in The Open Group Architecture Framework (TOGAF), the DOD Architecture Framework (DODAF), the Zachman Framework, and many others.

project roadmap (as some milestones are iteratively matured over multiple phases), and identification of specific dependencies where they are known.

4.1 Content Segment

The Content Segment comprises the Data/Information and Knowledge Swimlanes. This segment addresses the semantic interoperability of health information including how that data, information and knowledge are standardly represented and shared. Semantic interoperability implies that the meaning of the information, in the context it was generated, is properly preserved in the transfer. This provides the level of integration between systems that can support logical and formulaic processing and automation that is needed to bring the full value of modern science to bear on information that spans across software systems. Particularly relevant for this segment is the intersection with other organizations and standards activities, as data representation and clinical content spans dozens if not hundreds of other efforts occurring in multiple standards communities.

The pairing of these swim-lanes was fortuitous, particularly as the distinction between information models and knowledge can be somewhat muddled depending upon your perspective and experience. The content segment is elaborated within the swim-lane descriptions.

Note that a detailed treatment of Content segment milestones and their relationship to Phases can be found in [Appendix IV](#).

4.1.1 Data/Information Swim-lane

The Data/Information Swim-lane complements the Knowledge Architecture Swim-lane in that both aim to support “true semantic interoperability” by enabling the structured and declarative representation of clinical care models manifested in captured health data compliant with those models and available to do complex and heuristic inferencing based on that data. This swim-lane defines those milestones necessary to have all of the models and tools available to represent medical information and knowledge for HSPC projects and platforms.

4.1.1.1 Data/Information Swim-lane Milestones Summary

Milestone	Phase I	Phase II	Phase III	Phase IV
Develop Priority Terminology Management Environment	X			
Develop CIMI Model Patterns to capture expressivity of VMR, QDM, FHIR, CEM	X			

4.1.1.2 Data/Information Milestones Detail

Milestone: Develop Priority Terminology Management Environment

Overview: Terminology management is a critical enabler and the foundation upon which information semantics are specified and modeled – a capability that will be used by many other milestones and in support of multiple use cases with dependencies on terminology. This milestone will enable the core of terminology management capability, including support for SOLOR, LOINC, SNOMED, and RxNORM and access to value sets in addition to providing SNOMED/LOINC integration.

Milestone Name:	Develop Priority Terminology Management Environment
Milestone Type	Software Deliverable
Applicable Phases	Phase I
Known Dependencies	Terminology Authoring Environment availability Terminology Repository availability Terminology Authoring Process Governance

Comments: This activity will mature and extend into subsequent phases

* * * * *

Milestone: Create CIMI to FHIR Transformation

Overview: CIMI provides general, foundational models, and the ability to transform these into FHIR will allow them to be exposed as part of the FHIR standard. This activity will encompass authoring declarative transformation for CIMI expressed models.

Milestone Name:	Develop CIMI Model Patterns to capture expressivity of VMR, QDM, FHIR, CEM
Milestone Type	Software
Applicable Phases	Phase I
Known Dependencies	Terminology Management Environment Profile Management Environment Terminology File Repository Profile File Repository Terminology Authoring Process Governance Profile Authoring Process Governance

Comments: None

4.1.2 Knowledge Swim-lane

The Knowledge Swim-lane complements the Information/Data Swim-lane in that both aim to support “true semantic interoperability” by enabling the structured and declarative representation of clinical care models and providing the infrastructure and tools necessary to create, curate, manage, and distribute that content. This swim-lane defines those milestones necessary to have all of the models and tools available to represent medical information and knowledge for HSPC projects and platforms.

4.1.2.1 Knowledge Swim-lane Milestones Summary

Milestone	Phase I	Phase II	Phase III	Phase IV
Process for Surveying Terminology Standards/ Information Models		X		
Create HSPC CIMI Models and FHIR Profiles for Selected Domains	X			
Develop CIMI Model Patterns to capture Expressivity of VMR, QDM, FHIR, CEM		X		
Develop Knowledge Authoring Environment	X	X	X	X
Declarative Representations of Workflows and Care Processes using Sharable Medical Knowledge Models	X	X	X	X
Provide Example Display Components for UI		X		
Defined CDS Knowledge Artifacts		X		
Care Process Resource Model		X	X	X

4.1.2.2 Knowledge Swim-lane Milestones Detail

Milestone: Process for surveying terminology standards/information models

Overview: In order to develop reasonable models, a review of existing terminology and information models needs to be undertaken. Establishing a process that can be applied consistently and repeatedly is important as this will be undertaken many times.

A process will be developed and documented outlining steps to survey current standards and information models, including FHIR, when developing CIMI information models.

Milestone Name:	Process for surveying terminology standards/information models
Milestone Type	Process Deliverable
Applicable Phases	Phase II
Known Dependencies	Terminology Management Environment (into which we can embed the process) Environment availability

Comments: The intention is to evolve this work from initially documenting activities and maturing the process definition into a semi-automated workflow.

* * * * *

Milestone: Create HSPC CIMI models and FHIR profiles for selected domains

Overview: Clinical information models are a foundational product of HSPC. Clinical Information Models, in the form of HSPC CIMI Models and FHIR profiles, are a collection of definitions that together define a specification for the appropriate set of attributes for specific clinical events, actions and phenomena. Models define the structures, fields, data-types and values required for specific clinical situations such as observations, procedures, and orders. Models allow for robust information sharing.

Specific requirements supported by this milestone include:

- Creation of sharable HSPC/ FHIR profiles for reading data
- Creation of sharable HSPC/ FHIR profiles for writing data
- Sharable HSPC/ FHIR profile for supporting a publish/ subscribe environment

Milestone Name:	Create HSPC CIMI models and FHIR profiles for selected domains
Milestone Type	Content
Applicable Phases	Phase I
Known Dependencies	Terminology Management Environment Profile Management Environment Terminology File Repository Profile File Repository Terminology Authoring Process Governance Profile Authoring Governance

Comments: Elaboration of this work will continue in subsequent phases

* * * * *

Milestone: Develop CIMI Model Patterns to capture expressivity of VMR, QDM, FHIR, CEM

Overview: An assessment of VMR, QDM, FHIR, and CEM is required to guarantee that HSPC modeling activities will meet or exceed previously recognized requirements for data models. Subjects of analysis will include:

- Assertion
- Procedure including specializations
- Evaluation Result
- Lab Evaluation Result (QN, ORD, Nom)
- Order and Order Sets
- Goal

Milestone Name:	Develop CIMI Model Patterns to capture expressivity of VMR, QDM, FHIR, CEM
Milestone Type	Content
Applicable Phases	Phase II
Known Dependencies	Terminology Management Environment Profile Management Environment Terminology File Repository Profile File Repository Terminology Authoring Process Governance Profile Authoring Process Governance

Comments: Elaboration of this work will continue in subsequent phases

* * * * *

Milestone: Develop Knowledge Authoring Environment, Versions 1-4

Overview: A general environment that supports the use of models in clinical applications, this will be a part of the tooling allowing developers to specify and configure models of data, events, orders, etc. within their applications. The authoring environment will:

- Allow for the creation of new models in a variety of knowledge areas
- Support different types of users
- Support the full artifact lifecycle governance

Milestone Name:	Develop Knowledge Authoring Environment, Versions 1-4
Milestone Type	Software
Applicable Phases	Phases 1-4, with incremental enhancement in each phase
Known Dependencies	Terminology Management Environment Profile Management Environment Terminology File Repository Profile File Repository Terminology Auth. Process Governance Profile Authoring Process Governance Model mgmt and authoring environment Model Repository Model Authoring Process Governance

Comments: Elaboration of this work will continue in subsequent phases

* * * * *

Milestone: Declarative representations of workflows and care processes using sharable Medical Knowledge Models, Versions 1-4

Overview: Workflow and process models (functional clinical models) are the target of this effort in order to enable and foster the sharing of clinical processes among care institutions more accurately, easily, and quickly. Models developed using industry standard formalisms, such as Business Process Modeling Notation (BPMN) can be constrained by use of process patterns and style guidance to promote portability and sharability.

This activity will include development of process models using BPMN, CMMN, and DMN to create computable guidelines. Candidate areas include PE, HTN, Mental Health, and Pregnancy. Subsequent work on Diagnostic and Risk Assessment models based upon pub/sub environment such as PMML and DMN could be used for Pneumonia, Sepsis, and others.

Milestone Name:	Declarative representations of workflows and care processes using sharable Medical Knowledge Models
Milestone Type	Content
Applicable Phases	Phases 1-4, with incremental enhancement in each phase
Known Dependencies	Terminology Management Environment Profile Management Environment Terminology File Repository Profile File Repository Terminology Auth. Process Governance Profile Authoring Process Governance Model mgmt and authoring environment Model Repository Model Authoring Process Governance

Comments: Elaboration of this work will continue in subsequent phases

* * * * *

Milestone: Provide Example Display Components for UI

Overview: In order to move closer to plug-and-play applications, the ability to implement and demonstrate standards-based user interfaces is important. This activity will define the characteristic of select display components (such as an application banner) whose use will promote portability and interoperability.

Milestone Name:	Provide Example Display Components for UI
Milestone Type	Software
Applicable Phases	Phase II
Known Dependencies	Model management and authoring environment Model Repository Model Authoring Process Governance SMART on FHIR Support CDS Hooks Support

Comments: None.

* * * * *

Milestone: Defined CDS Knowledge Artifacts

Overview: In order to demonstrate the success of HSPC’s approach, there will need to be a collection of working data models, decision support models, workflow models, documentation models, etc. available for download and evaluation. This activity will establish libraries of HL7 standards-based rules, orders sets, and documentation templates to make them available for consumption and use.

Milestone Name:	Defined CDS Knowledge Artifacts
Milestone Type	Content
Applicable Phases	Phase II
Known Dependencies	Terminology Management Environment Profile Management Environment Terminology File Repository Profile File Repository Terminology Auth Process Governance Profile Authoring Process Governance Model mgmt and authoring environment Model Repository Model Authoring Process Governance SMART on FHIR Support CDS Hooks Support

Comments: None.

* * * * *

Milestone: Care Process Resource Model

Overview: Detailed models of care processes invariably refer to resources available in the healthcare delivery environment. These include tests, procedure, facilities, and the roles played by different care providers. To make models portable, they must reference resources in a way that facilitates mapping to local instances of resources, allowing for the adoption of sharable models. This work becomes a key support element leveraged by process modeling activities. The work will encompass the creation of models and terminologies to support care processes. It will describe provider capabilities and roles (e.g., within their scope of practice and context).

Milestone Name:	Care Process Resource Model
Milestone Type	Content
Applicable Phases	Phases 2, 3, 4
Known Dependencies	Interoperability Maturity Model Model management and authoring environment Model Repository Model Authoring Process Governance

Comments: None.

* * * * *

4.2 Context Segment

4.2.1 Business Swim-lane

4.2.1.1 Business Swim-lane Milestones Summary

Milestone	Phase I	Phase II	Phase III	Phase IV
Standards Adoption Policy Recommendations	X			
HSPC Enterprise Readiness Strategy and Implementation Guide	X			
Organizational Governance Model for Knowledge Content	X			
Detailed Interoperability Maturity Model		X		
KPI's/Business Outcomes from HSPC Adoption		X		
Draft Interoperability Self-Assessment Methodology		X		
HSPC Version 1.0 Interoperability Package			X	
BPM for Health Model Repository			X	
Hosted Clinical Workflow Modeling Environment			X	
Analytics Model Sharing			X	
Analytics Compliance Self-Assessment			X	
HSPC Adopters Strategy/Implementation Guide				X

4.2.1.2 Business Swim-lane Milestones Detail

Phase I - These are activities that are necessary for an enterprise to get started on HSPC Interoperability and SOA Roadmap

Milestone: Draft of Interop Maturity Model Published

Overview: HSPC will provide an interoperability and SOA standards maturity model for enterprises to benchmark their evolution of full interoperability and SOA service capabilities.

Comments: None.

Milestone Name:	Open standards and IP content recommended license and policy
Business Value	To acquire buy in from members and potential adopters for long term acceptance of HSPC interoperability mission.
Milestone Type	Document
Applicable Phases	Phase I
Known Dependencies	None

* * * * *

Milestone: Strategy for Coordination with External Stakeholders

Overview: Develop a coordinated strategy for the HSPC organization to engage with health system and standard org in the development and adoption of the HSPC interoperability roadmap and maturity model.

Comments: None.

Milestone Name:	Strategy for Coordination with External Stakeholders
Business Value	Enable timely and wide spread consensus and adoption of HSPC standards and services by engaging our constituents early in the process.
Milestone Type	Document
Applicable Phases	Phase I
Known Dependencies	None

* * * * *

Milestone: CDS and workflow/BPM adoption strategy and implementation guide

Overview: HSPC will provide an enterprise adoption strategy and implementation guide for Clinical Decision Support SOA services incorporating the HSPC-recommended technical infrastructure, knowledge model and content, cybersecurity, and SOA governance standards

Comments: None.

Milestone Name:	CDS and workflow/BPM adoption strategy and implementation guide
Business Value	Provide a high value near-term use case and adoption strategy for an initial HSPC implementation.
Milestone Type	Document
Applicable Phases	Phase I
Known Dependencies	None

* * * * *

Milestone: Data services governance and models

Overview: HSPC will provide an enterprise adoption strategy and implementation guide for Clinical Decision Support SOA services incorporating the HSPC-recommended technical infrastructure, knowledge model and content, cybersecurity, and SOA governance standards

Milestone Name:	Data services governance and models
Business Value	The guide includes necessary data standards and resources required to begin adoption of the HSPC SOA and interoperability standards and services.
Milestone Type	Document
Applicable Phases	Phase I
Known Dependencies	None

HSPC will provide an enterprise readiness strategy and implementation guide.

Comments: None.

* * * * *

Milestone: Open standards and IP content recommended license and policy

Overview: HSPC will provide a governance strategy, IP issues analysis, and license recommendation for the open standards addressing roles for the HSPC constituency (members, adopters, technical contributors), includes sustainable adoption strategy for enterprises.

Milestone Name:	Open standards and IP content recommended license and policy
Business Value	Allows enterprise to legally begin adoption of HSPC standards and services
Milestone Type	Document
Applicable Phases	Phase I
Known Dependencies	None

Comments: None.

* * * * *

Phase II - These are activities that are necessary/sufficient to say “adopting HSPC”.

Milestone: Detailed Interoperability Maturity Model

Overview: This maturity model will also incorporate a self-certification toolkit as part of the full HSPC interoperability toolkit as that is released.

Comments: None.

Milestone Name:	Detailed Interoperability Maturity Model
Business Value	Allows adopters the ability to benchmark their progress toward interoperability in comparison to their peers and to implement interoperability capability across multiyear budgets
Milestone Type	Document
Applicable Phases	Phase II
Known Dependencies	None

* * * * *

Milestone: Advanced Analytic Services Adoption Guide

Overview: HSPC will provide and mechanism for members and adopter to share domain- or use-case-specific analytics models and implementations that are HSPC compliant.

Comments: None.

Milestone Name:	Advanced Analytic Services Adoption Guide
Business Value	Support value based healthcare transformation and improve population health by adopting this HSPC use case package
Milestone Type	Document
Applicable Phases	Phase II
Known Dependencies	None

* * * * *

Milestone: Sharable Workflow/BPM Model Content

Overview: HSPC will provide an enterprise adoption strategy and implementation guide for Clinical Workflow/Business Process Management SOA services incorporating the HSPC-recommended technical infrastructure, knowledge model and content, cybersecurity, and SOA governance standards

Comments: None.

Milestone Name:	Sharable Workflow/BPM Model Content
Business Value	HSPC will provide a mechanism for members and adopter to share domain- or use-case-specific workflow/BPM models and content that are HSPC compliant.
Milestone Type	Document
Applicable Phases	Phase II
Known Dependencies	None

* * * * *

Milestone: KPIs and Business Outcomes from HSPC Adoption

Overview: Develop and provide value proposition and set matrix arising from HSPC adoption

Comments: None.

Milestone Name:	KPIs and Business Outcomes from HSPC Adoption
Business Value	Allow widespread enterprise adoption of HSPC standards
Milestone Type	Document
Applicable Phases	Phase II
Known Dependencies	None

* * * * *

Milestone: Draft Interoperability Self-Assessment Methodology

Overview: Develops and provide written conformance for self-certification.

Comments: None.

Milestone Name:	Draft Interoperability Self-Assessment Methodology
Business Value	Allow enterprises to implement maturity model using testable certification criteria
Milestone Type	Document
Applicable Phases	Phase II
Known Dependencies	None

* * * * *

Phase III - These are activities that are necessary for full agile releases and for an enterprise to say they are adherent to initial full HSPC functionality (HSPC V1.x)

Milestone: Full HSPC Interoperability Package

Overview: Provide complete HSPC version 1.0 interoperability and SOA services adoption package

Comments: None.

Milestone Name:	Full HSPC Interoperability Package
Business Value	Allow organizations to adopt first complete version of HSPC package
Milestone Type	Document and Technical IP Content
Applicable Phases	Phase III
Known Dependencies	None

* * * * *

Phase IV - These are activities that are necessary for full agile releases and for an enterprise to say they are adherent to advanced HSPC functionality (HSPC V2.x)

Milestone: Implementation Guide for Advanced Services

Overview: Provide HSPC adopters with strategy and implementation guide for advanced HSPC Version 2.X interoperability and SOA Services. Enables enterprise to adopt HSPC advanced functionality.

Milestone Name:	Implementation Guide for Advanced Services
Business Value	Enables enterprise to adopt HSPC advanced functionality.
Milestone Type	Document
Applicable Phases	Phase IV
Known Dependencies	None

Comments: None.

* * * * *

4.2.2 Security Swim-lane

The security swim-lane focuses on establishing Interoperability through trusted exchange using secure, standards-based, and privacy-preserving technologies.

This means to provide security features supporting clinician needs, identifying sensitive information, and providing rules-based notifications when clinical risk (e.g., drug-drug interactions) are present by incorporation into CDS. It also means changing the healthcare model to sharing information first and allowing recipient organization to manage access based upon need and relevant policy. Clinical need driven security also means to achieve a baseline measure of trust that has the goal of providing and not limiting or blocking data exchange. The technology features described below provide for exchange with protections rather than hiding and redaction, along with provenance enabling data integrity and confidence in the reliability and trustworthiness of information. It also provides for a security model that rewards transparency and an awaking new technology which aims to provide benefits while eliminating the intrusiveness of security as an impediment to work.

4.2.2.1 Security Swim-lane Milestones Summary

Milestone	Phase I	Phase II	Phase III	Phase IV
Baseline [Security] Capabilities	X			
Secure Interoperability				X
Share with Protection			X	X
Attribute-based Access Control			X	X
Data Segmentation	X	X	X	X
Patient Choice/Consent	X	X	X	X
Provenance				X
Transparent Security			X	X
Secure Delegated Access			X	X
Opt-In		X	X	X

4.2.2.2 Security Swim-lane Milestones Detail

Milestone: Baseline [Security] Capabilities

Overview: Baseline services necessary prior to the implementation of new and improved capabilities

Services and capabilities assumed at the beginning, to include:

- Identity: establish means to classify discrete users.
- Authentication: Verifying users are who they say they are.
- Authorization: Confirm users are supposed to have access to the resources requested
- Audit: Record user access to resources and for what purposes.
- Confidentiality: Prevent unauthorized access to information.
- Integrity: guard against unauthorized modification of healthcare information

Milestone Name:	Baseline [Security] Capabilities
Business Value	It is necessary to baseline where we are in order to measure progress toward our industry goal.
Milestone Type	Best Practice
Applicable Phases	Phase I
Known Dependencies	None

Comments: None.

* * * * *

Milestone: Secure Interoperability

Overview: Automated cross-enterprise trust, consent, authorization, and privacy-preserving access at runtime. Common interoperable semantic value sets for cross-enterprise security and privacy. Runtime negotiation for context-sensitive exchange.

Milestone Name:	Secure Interoperability
Business Value	
Milestone Type	Software Deliverable Best Practice
Applicable Phases	Phase IV
Known Dependencies	Success dependent upon implementation of other milestones.

Comments: None.

* * * * *

Milestone: Share with Protection

Overview: Security and Privacy protections are carried with the content. All information returned in request. Specific data masked by purpose of use or clearance. All information available to trusted CDS to ensure patient safety.

Comments: None.

Milestone Name:	Share with Protection
Business Value	Avoids practice of redacting data. All information backed by policy-based granular protections based on role and clearance. Ensures that needed information is available to ER without exception.
Milestone Type	Best Practice
Applicable Phases	Phases 3-4
Known Dependencies	Assumes ability to classify content (including unstructured data) according to sensitivity.

* * * * *

Milestone: Attribute-based Access Control (ABAC)

Overview: Classifying data sensitivity provides basis for access control based upon need. Provides capability to provide security for FHIR resources, medical devices and IoT. Modernizes and transforms the way security and privacy is managed and enforced. Provides the ability to manage access control at a granular level, and facilitates managing emerging technologies such as FHIR.

Comments: None.

Milestone Name:	Attribute-based Access Control
Business Value	Key trend in access control. Ideal approach to IoT. According to Gartner, 70% of organizations will employ ABAC by 2020. ABAC has emerged within NIST as providing policy-based enforcement rules.
Milestone Type	Best Practice
Applicable Phases	Phases 3-4
Known Dependencies	Assumes ability to establish and enforce policy including provisioning of clinical staff by assigned duties or workflow.

* * * * *

Milestone: Data Segmentation / Security Labeling Service

Overview: Technical mechanism for analyzing structured and unstructured data and applying labels according to flexible security and privacy rules. Identify, mark, and segment healthcare information at an appropriate granular level of functionality according to organizational and patient policy/rules. This provides a key enabling capability.

Comments: Security remains in background, unobtrusive. Goal is to eliminate security as an impediment to clinical workflow. This would support crosscutting policy. Core HL7 standards have been in place since 2014.

Milestone Name:	Data Segmentation / Security Labeling Service
Business Value	Security labeling is well understood, however, implementation in healthcare requires construction of detailed rules requiring high confidence of proper operation.
Milestone Type	Software Deliverable Content Deliverable Best Practice
Applicable Phases	Phases 1-4
Known Dependencies	HL7 Label vocabulary, Availability of mature security labeling services.

HL7 content has been created “label” ready. See:

- HL7 Privacy and Security Healthcare Classification System (HCS),
HL7 Privacy and Security Services: Security Labeling Service

* * * * *

Milestone: Patient Choice/Consent

Overview: This milestone merges concepts of electronic patient consent, and choice (individual control of their own information as provided by law). This typically involves “authorizations”

(approvals and/or directions to share and “restrictions” (patient policy restricting access to certain information to authorized persons organizations.). It also includes “Directions” to healthcare organizations to transmit a copy of their own information to destinations of their choice under patient right of access law. Electronic patient permissions regarding disclosure of their own protected health information.

Milestone Name:	Patient Choice/Consent
Business Value	Eliminates a burden on providers to maintain paper records. Allows automated management of patient privacy preferences.
Milestone Type	Document Software Deliverable Best Practice
Applicable Phases	Phases 1-4
Known Dependencies	Electronic Consents, Secure Delegated Access, Security Labeling Service, ABAC

Comments: Paper based consents are not computable and represent a significant management burden. Implementing electronic consents ensures electronic workflows are not broken. Electronic consents provide the “policy” for Secure Delegated Access engines. Technical implementation using patient managed OAuth Authorization Server demonstrated during HIMSS 2017. See milestone “Secure Delegated Access”.

* * * * *

Milestone: Provenance
Overview: Determine the origin and history of healthcare information; Ensures the integrity of data from origin to destruction.
Comments: None.

Milestone Name:	Provenance
Business Value	Integrity is one of the most desirable characteristics of a trustworthy health record.
Milestone Type	Content Deliverable
Applicable Phases	Phase II – Initial exploratory proofs-of-concept Phase III – Early adopters, supporting trust frameworks; industry acceptance Phase IV – Maturation
Known Dependencies	Availability of suitable technology. Blockchain ledger has been proposed, however, concerns remain regarding overhead impacts. Also there remains great concern over risk of supporting smart contracts yet to be resolved. Nevertheless, issues are rapidly being addressed and there is great interest in developing this capability.

* * * * *

Milestone: Transparent Security
Overview: Provide appropriate safeguards to healthcare information while minimizing impact to clinical workflow or information availability.

Comments: Security remains in background, unobtrusive. Goal is to eliminate security as an impediment to clinical workflow. This would support crosscutting policy.

Milestone Name:	Transparent Security
Business Value	
Milestone Type	Best Practice / Implementation Guide
Applicable Phases	Phases 3-4
Known Dependencies	ABAC, workflow enhancements; HL7 Implementation Guide may lag need.

* * * * *

Milestone: Secure Delegated Access

Overview: Provides patients with ability to express their choices for disclosure of protected health information. This is a mechanism for implementing patient control.

Comments: None.

Milestone Name:	Secure Delegated Access
Business Value	This provides a significant benefit to providers when dealing with protected health information. Intent is to implement OAuth and OpenID Connect Authorization Server. See ONC HIMSS Patient Choice demonstration. Secure Delegation Access is part of HL7's approved international standard for Privacy and Security services: Access Control
Milestone Type	Best Practice / Content Deliverable
Applicable Phases	Phases 3-4
Known Dependencies	

* * * * *

Milestone: Opt-In

Overview: Healthcare information is shared by default. Patients may opt-out or use restrictions to control disclosure of protected health information. The opt-in model represents an approach most beneficial to the majority of patients. Patients that do not wish to share protected health information have the option of opting-out or requesting restrictions on disclosures. This approach provides the most economical mechanism for healthcare organizations while providing patients a choice in how they wish their information to be disclosed. Legislation has been proposed to Congress in support of this initiative.

Comments: None.

Milestone Name:	Opt In
Business Value	This provides a significant benefit to providers when dealing with protected health information.
Milestone Type	Best Practice
Applicable Phases	Phases 2-4
Known Dependencies	Congressional Action

4.3 Platform Segment

4.3.1 Infrastructure and Software Swim-lanes

In today’s HIT systems, the data they store, the information upon which that data is based, and the knowledge of the clinical domains are generally “locked” and inaccessible to the institutions that run them and the marketplace of innovators seeking to add value atop those systems. The use of proprietary formats limit the ability to share these content across HIT products and health provider organizations.

When sharing does take place it frequently defaults to either a “least-common denominator” or a coarse-grained, high-level representation such as a document-oriented standard like HL7’s Clinical Document Architecture (CDA). Knowledge assets, such as decision support logic and care practice guidelines, are almost entirely vendor- or technology-specific.

HSPC seeks to foster the development of platforms that will create a robust marketplace of software – including tools, services and applications – that are open and standards-based. This will allow the health provider community to share the various information assets produced by health providers, HIT vendors, and knowledge creators more efficiently and completely.

The milestones that follow are critical path elements necessary to realize this open software platform vision, based upon standards, fostering interoperability of data, information, knowledge, and applications.

4.3.1.1 Software Milestones Summary

Milestone	Phase I	Phase II	Phase III	Phase IV
Knowledge Repository Specification	X			
Marketplace API Specification	X			
CDS Hooks Support	X			
Terminology Services API	X	X		
Knowledge Authoring Environment		X		
Knowledge Representation View, Review, Curation Tools		X		
Knowledge Representation API		X		
Model Authoring Environment		X		
Publication/Subscription/Notification Capability			X	
ADL/AML to FHIR Services			X	
Artifact/Model Transform Tools			X	

4.3.1.2 Software Milestones Detail

Milestone: Knowledge Repository Specification

Overview: A Knowledge Repository (KR) is necessary in the Platform in order to contain and share knowledge artifacts. The KR Specification outlines the functions that a KR needs to support, including artifact storage capabilities, metadata requirements, artifact access services, and governance policies.

Milestone Name:	Knowledge Repository Specification
Milestone Type	Document
Applicable Phases	Phase I
Known Dependencies	None

Comments: None.

* * * * *

Milestone: Marketplace API Specification

Overview: The Marketplace is where developers of information assets can make their products available to others in the health community, and where customers can browse, find and access/download these assets.

Milestone Name:	Marketplace API Specification
Milestone Type	Document
Applicable Phases	Phase I
Known Dependencies	None

The API Specification describes how developers and customers can access the Marketplace. Note that there may actually be more than one physical/virtual Marketplace, but a single API specification would help developers and customers to access any Marketplace in a common way.

Comments: None.

* * * * *

Milestone: CDS Hooks Support

Overview: CDS Hooks is a newer specification, now under HL7 oversight, for allowing CDS services to be called from an HIT application (e.g., EHR) using a standard API and triggering events. Support for

Milestone Name:	CDS Hooks Support
Milestone Type	Software
Applicable Phases	Phase I
Known Dependencies	Development Environment Initiative CDS Hooks Leadership and Resource Support

CDS Hooks within the Platform is a first step towards a more general capability to support decision support logic in an open, standards-based environment. Software Deliverable.

Phase I. Dependencies on Development Environment Initiative and its resources, CDS Hooks leadership and resource support.

Comments: None.

* * * * *

Milestone: Terminology Services API

Overview: In order to be truly interoperable, data will need to be transformed from a source terminology (standard or proprietary) to a secondary terminology. Applications, including decision support services,

Milestone Name:	Terminology Services API
Milestone Type	Software
Applicable Phases	Phases 1 and 2
Known Dependencies	Content Segment Leadership Terminology Server availability Terminology Content (for testing)

will also need to access terminology in order to resolve terms, domains, and term relationships. Translations may also be needed for terminology within knowledge assets. The Terminology Services API will provide open, standards-based methods for handling these terminology functions at run-time.

Comments: None.

* * * * *

Milestone: Knowledge Authoring Environment

Overview: In order to support efficient generation and editing of sharable knowledge assets, including decision support logic, automated guidelines, and survey tools, a Knowledge Authoring

Milestone Name:	Knowledge Authoring Environment
Milestone Type	Software
Applicable Phases	Phase II
Known Dependencies	Content Segment Leadership

Environment that incorporates terminology services and approved data models is needed. This Environment would access the KR for storage of knowledge assets.

Comments: None.

* * * * *

Milestone: Knowledge Representation View, Review, Curation Tools

Overview: KR View, Review and Curation Tools: Users of the KR will need to view assets within the KR in vendor and technology agnostic environment. The

Milestone Name:	Knowledge Representation View, Review, Curation Tools
Milestone Type	Software
Applicable Phases	Phase II
Known Dependencies	Content Segment Leadership for Requirements Sample Knowledge Content (for testing)

assets will also need to go through a review process during their development lifecycle, and tools to support this process are needed so that reviewers may make comments on assets and these comments can be efficiently addressed by developers. Curation tools will allow the full lifecycle of the knowledge assets to be handled, from original development to review, and subsequently to testing, promotion, regular review and retirement.

Comments: None.

* * * * *

Milestone: Knowledge Representation API

Overview: The KR API will support the various functions of the KR for creating, editing, searching, accessing, and managing the knowledge assets within the KR. It is informed by the KR Specification. Software Deliverable. Phase II. Dependent on Content Segment leadership for requirements.

Milestone Name:	Knowledge Representation API
Milestone Type	Software
Applicable Phases	Phase II
Known Dependencies	Content Segment Leadership for Requirements

Comments: None.

* * * * *

Milestone: Model Authoring Environment

Overview: This is a special case of the Knowledge Authoring Environment since models are a knowledge asset. The Model Authoring Environment will allow model authors to develop detailed clinical models according to best practices and aligned with a specific modeling language.

Milestone Name:	Model Authoring Environment
Milestone Type	Software
Applicable Phases	Phase II
Known Dependencies	Content Segment Leadership for Requirements

Comments: None.

* * * * *

Milestone: Publication/Subscription/Notification Capability

Overview: A Publication/Subscription capability allows systems to publish events on their systems in an open, standards-based method, and allows users to subscribe to events of interest to them. The notification capability provides notification of events through multiple communication channels (e.g., email, text, cell phone alerts) and allows users to specify their channel of choice.

Milestone Name:	Publication/Subscription/Notification Capability
Milestone Type	Software
Applicable Phases	Phase III
Known Dependencies	None identified

Comments: None.

* * * * *

Milestone: ADL/AML to FHIR Services

Overview: These services would provide the capability to transform models, and model instances, from ADL/AML (the preferred languages for HSPC detailed clinical modeling) to FHIR Resources. FHIR Resources are the current physical messaging model chosen by HSPC for transmitting and sharing data.

Milestone Name:	ADL/AML to FHIR Services
Milestone Type	Software
Applicable Phases	Phase III
Known Dependencies	Dependency on Tooling Initiative Input from Content Segment

Comments: None.

* * * * *

Milestone: Artifact/Model Transform Tools

Overview: These tools are the general case tools for transforming models from one standard to another. (See AD/AML to FHIR Services for a specific use case.)

Milestone Name:	Artifact/Model Transform Tools
Milestone Type	Software
Applicable Phases	Phase III
Known Dependencies	Dependency on Tooling Initiative

Comments: None.

5 Using the Roadmap

The HSPC Roadmap will serve several purposes and objectives, depending upon your individual role and the nature of engagement with the HSPC community. It merits mention that most stakeholders will likely interact with only portions of the Roadmap in any given context. For example, a specific HSPC project will likely produce one or several products that are identified as Roadmap milestones, but will also have other milestones that do not appear. That is to be expected. Similarly, that same project will likely have dependencies on other Milestones produced by other efforts. The roadmap provides a unified view, showing how different parts of the ecosystem fit together to build the greater whole.

In the subsections below are characterized some of the likely interactions with the Roadmap document. These should be considered informative and not declaratory, as each individual situation may vary. That said, the examples provided should give some context for how the Roadmap document fits a variety of needs, and illustrate how it might be leveraged.

5.1 Use within HSPC

While HSPC is one community with a shared Mission and Vision, it is also a collection of organizations, initiatives, projects, members, and relationships that naturally comprise what is a complex ecosystem. One of the challenges of this type of environment is that there are multiple sets of intersecting interests that blend into a community.

The HSPC Roadmap has a role to play for many of those constituencies, and for the organization as a whole, it provides a unified view showing how different parts of the ecosystem fit together to build the greater whole.

Establishing Community Priorities. For the HSPC organization itself, determining what are key priorities and the mainstream activities of the HSPC Organization is a principal role of the HSPC Roadmap. The iterative refinement process, followed by membership voting on the document, and its ultimate ratification by the HSPC Board establishes the Roadmap as the principal scoping document to define the mainstream of activities for HSPC. There are intended intersection points with other HSPC efforts, including but not limited to HSPC Strategic Initiatives. The expectation is that a natural tension will exist between these efforts, with the Initiatives affecting and changing the Roadmap over time, and the Roadmap defining and shaping existing and potentially new initiatives.

By design, the Roadmap document will be a living but durable document. To maintain long-term integrity, an organization cannot change its strategic goals too frequently. The Roadmap will be refreshed annually, with the expectation that incremental enhancements will be made, but not drastic changes unless areas prove untenable.

While it is a scoping mechanism, the Roadmap does not and should not limit or prohibit work from occurring within HSPC, or limit or constrain HSPC members from contributing, initiating, or incubating new work not reflected on the Roadmap. Fostering innovation is a key tenet of HSPC, and today's incubating project may become tomorrow's critical path.

Maturing Work into the Mainstream. As a document defining the path from the current to future state, it is to be expected that new projects and initiatives that are incubating will become critical path

as they mature, and other efforts might be superseded and atrophy over time. As part of the annual refresh cycle, new efforts would be evaluated and a determination made as to what gets placed onto the roadmap. The Roadmap is intended to reflect the broad consensus of the community. HSPC is also a community about fostering innovation.

The expectation is that the “onboarding” process will be defined and itself matured to reflect the overall will of the community and the alignment with the mission as reviewed by the Steering Committee and the Board. In the future, we should expect specific compliance criteria to be defined as pre-conditions for mainstream HSPC work, and we should expect the Roadmap Inclusion criteria to align.

HSPC Initiatives. For HSPC Initiatives, the Roadmap provides an architectural melting pot, blending the key milestones and products from across initiatives to show distinct perspectives based upon the Data, Knowledge, Business, Security, Platform, and Technical Infrastructure perspectives. HSPC Initiatives are not specific projects, rather they are disciplines that have broader goals and are likely to spawn work in multiple projects that work together. The Roadmap helps foster understanding that spans initiatives, helping to identify cross-initiative dependencies, potential collaborative work, situational awareness, and outwardly communicating delivery intention.

Initiatives should expect to identify key milestones that should be surfaced to the Roadmap, to review and ingest related work affecting internal timelines and work dependencies, and to identify related or potentially duplicative work. Note that initiatives do not live within any one swim-lane or segment, rather they are likely to influence and consume activities from across the entirety of the T-Map.

HSPC Projects. Any given project within HSPC will have its own milestones, deliverables, inter-project dependencies, and potentially relationship to HSPC Strategic Initiatives. For projects, the HSPC roadmap is a way to see holistically what else is going on, fostering community and assisting in making strategic decisions. For example, if a given project has need of an information model or terminology construct, they could use the Roadmap to make product release decisions, determining at what stages they can establish dependencies on other HSPC efforts, such as accessing a terminology server. Conversely, projects will be delivering capabilities upon which others will depend, and putting those milestones onto the Roadmap will allow others to make informed decisions.

Just as with the HSPC Initiatives, the Roadmap has a role to play in assisting to identifying related work, fostering cross-project collaboration and in avoiding duplication where sensible. These objectives, as well as defining cross-project dependencies and shared milestones, benefit project management activities as well. Also, projects do not reside exclusively within any swim-lane, and it is appropriate to both contribute and consume from across the entire T-Map.

HSPC Leadership. The Roadmap has the potential to be a valuable tool to HSPC Leadership in that it encompasses a scope and vision against which the community is executing, and it charts the course as to how we are going to achieve it. For the HSPC Board, a review of identified priorities and milestones should be expected, resulting in either affirmation or revision to assure alignment with the HSPC mission. For the CEO and other HSPC Executives, the Roadmap can serve as a tool with which to have conversations with prospective members, determining areas of interest and alignment with community needs. For the CxO community, this becomes a benchmark for how well the community is performing and advancing, serving as a management tool to maintain focus on what we collectively have determined to be important.

5.2 Member (or Prospective Member) Organization Use

The needs of HSPC members differ from those of the HSPC community, and the Roadmap has a role to play for both. HSPC members elect to participate within the community for what could be a vast variety of reasons. Regardless of the reason, few (if any) members are able to participate in everything, and as a result members will have stronger interest in some areas than others.

Ascertaining an awareness of where HSPC as a whole is going, determining those specific areas of organizational interest, and determining which specific activities and milestones that are important to their own organization are all areas where the Roadmap can play a role.

For internal project planning, the Roadmap sets expectations in terms of what is being produced by HSPC and when it will be available. This allows member organizations to make investment decisions regarding contributions to community efforts, and consumption decisions related to artifacts being produced by the community.

For some organizations, the Roadmap will serve as a legitimator, demonstrating the importance of certain activities, and helping to substantiate a business case for investment. Other organizations will leverage the roadmap for internal strategic planning, following a complementary path to HSPC, and perhaps extending the HSPC Roadmap to address specific institutional needs beyond those of the community. Ultimately, for HSPC Members the Roadmap serves as a communication and alignment vehicle.

5.3 Other Uses

There are other potential uses and benefits of the HSPC Roadmap. For example, only HSPC members are able to vote on the roadmap, and thus able to impact the community priorities. As a collaborative tool, the Roadmap will be used in joint efforts and discussions with peer organizations to determine co-investment and collaborative opportunities, and potentially to identify cross-organizational dependencies.

For non-members, the roadmap communicates the intentions of the community. I might identify an area of need and bring that to HSPC as a gap to be filled, potentially proposing a new incubator project and carving my niche within the community. Alternatively, I may find efforts in which I'm presently investing and where collaboration would allow me a cost avoidance.

Finally, for interested parties or consumers of HSPC products, the roadmap sets expectations (via the phased releases) about what will be available and when, and how pieces fit together, allowing me to make my plans and take advantage of what HSPC is offering.

6 Roadmap Refresh Process

The HSPC Roadmap will be refreshed annually. Following the initial baseline release, we anticipate that the core content of the roadmap will be essentially stable, validated annually and adjusted as necessary. Since the Roadmap serves as a strategic transition plan, we anticipate limited volatility within the document.

This will form the basis for public commitments and external expectations of the HSPC community, so it is important that we “stay the course” and adjust only where absolutely necessary. Adding new priorities is expected and will occur as they are identified and vetted via the inclusion criteria.

Any changes to the Roadmap will need community affirmation consistent with the acceptance/governance processes established by the HSPC Board. As a matter of practice, it is anticipated that the document will undergo update as needs permit, with the working document not holding any official status until it has been voted/approved. A policy determination will need to be made whether the emergent next release of the document will be generally available, or available only to HSPC members.

Next Steps.

This baseline version of the HSPC Roadmap represents a significant amount of work, but many items have been identified that are known improvement areas. Following the adoption of the 1.0 Version of the document, it is anticipated that work will commence on many of the following items.

- Provide a short “Executive Summary” version of this Roadmap document.
- “Companion” Document Looking At HSPC Adoption/Compliance. This roadmap primarily focuses on setting a course and scoping key priority areas and projects for development within HSPC. It does not specifically address how those artifacts get adopted, what we envision in terms of marketplace support for HSPC artifacts, or how individual organizations make assessments and incorporate HSPC content. This companion document would complement the Roadmap by addressing these issues.
- Develop an *HSPC Roadmap to Action* plan, based upon the Roadmap, considering institutional priorities, funding commitments, community resourcing commitments, and firm dates. The HSPC Roadmap is ambitious, and the organization recognizes that resourcing commitments will be required to achieve the identified objectives. This will include operational guidance to make the Roadmap actionable.
- In the detail sections of the document, considering the relationship of products delivered and relative sequencing among efforts (e.g., interdependencies between milestones and across swim-lanes) will need to be elaborated so as to better describe how all of the pieces of the roadmap fit together.
- The need to further elaborate roadmap and overarching guidance to the benefit of HSPC projects and HSPC adopting organizations has been recognized, and the development of “Implementation Blueprints” or more detailed adoption guidance is a potential future activity. This activity may also include an industry wide business capability model. Portions of this work are underway now as part of the HSPC SOA initiative, but that falls short of a true Enterprise Architecture.

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(Note: In the likely event that contributors were inadvertently omitted, we ask your forgiveness and will address in subsequent releases of the document. Thanks to everyone whom contributed their words, their energy, their time, and their ideas to make this artifact a reality).

Appendices

Appendix I – Glossary

Term/Acronym	Definition
BPM	Business Process Management, often related to formalized languages for expressing business processes and workflows. BPM Health effort is an initiative from the Object Management Group to define how Business Process Modeling Notation and other standards are used together to meet the needs of expressing clinical workflows.
CDS	Clinical Decision Support
CEM	Clinical Element Model
CIIC	Clinical Information Interoperability Council
CIMI	Clinical Information Modeling Initiative
Enterprise Architecture	A discipline for aligning activities to business priorities, portfolio rationalization, and separation of concerns to allow for effective analysis of complex organizations. The HSPC Roadmap has been based upon many core tenets drawn from Enterprise Architecture.
FHIR	Fast Health Interoperability Resources. An HL7 standard producing REST-based data constructs and corresponding APIs allowing for the access to and sharing of health information.
HSPC	Healthcare Services Platform Consortium. A not-for-profit, provider-led industry trade consortium dedicated on establishing scalable, interoperable data and services architecture for healthcare.
IT	Information Technology
Initiative	A goal-based collection of projects and efforts to further HSPC board-identified priorities serving as key enablers of the HIT industry and HSPC as a whole.
KR	Knowledge Representation
LOINC	A standard for identifying health measurements, observations and documents, typically focused on laboratory based content. http://loinc.org
Open Group	The Open Group is a global consortium enabling the achievement of business objectives via open, vendor-neutral technical standards and certifications. http://opengroup.org
Project	In the context of the HSPC Roadmap, a project is a defined scope of work that results in the creation of products or achievement of milestones on the Roadmap. Note that projects are not limited to one swim-lane, and typically will have dependencies on and deliverables affecting multiple lanes.
RxNORM	A US Drug terminology that provides normalized names for clinical drugs and links its names to many of the drug vocabularies commonly used in pharmacy management and drug interaction software, including those of First Databank, Micromedex, MediSpan, Gold Standard Drug Database, and Multum allowing for mediation among these vocabularies. https://www.nlm.nih.gov/research/umls/rxnorm/

Segment	Union of conjoined swim-lanes within the HSPC Transition Map, based upon topic areas that are closely related. Within the roadmap are segments for <i>content, context, and platform</i> .
SNOMED	Systematized Nomenclature of Medicine
SOA	Service-oriented Architecture
SOLOR	A unified terminology incorporating normalized concepts from across SNOMED, LOINC, and RxNORM.
Swim-lane	A theme-based dissection of a complex domain space. Each swim-lane is characterized by an overarching goal determining the path and direction for the target state, as well as a set of milestones exhibiting deliverables and/or progress en route to that state. Swim-lanes are complementary with one another and based upon Enterprise Architecture-based separation of concerns.
TMap (T-Map)	Transition Map. A graphic depiction of evolutionary path and long-term plan for the community of interest. The methodology is based upon intellectual property that is part of the Open Group Healthcare Forum, used with permission.

Appendix II – Relating HSPC Initiatives and Projects to the Roadmap

How an example HSPC project relates to the Roadmap

HSPC developed a set of strategic initiatives in order to unify the various members of the HSPC community on specific goals, and to set broad outlines on work that needed to be accomplished in a 1 - to 3-year time period. The Roadmap serves to define cross-cutting milestones that support those initiatives, while also defining new milestones and regular phases of HSPC functionality that will support the broader healthcare community. Within the strategic initiatives, specific projects were defined that addressed objectives within the initiative. The projects are also relevant to the Roadmap in that they may address specific Roadmap milestones, and/or may be

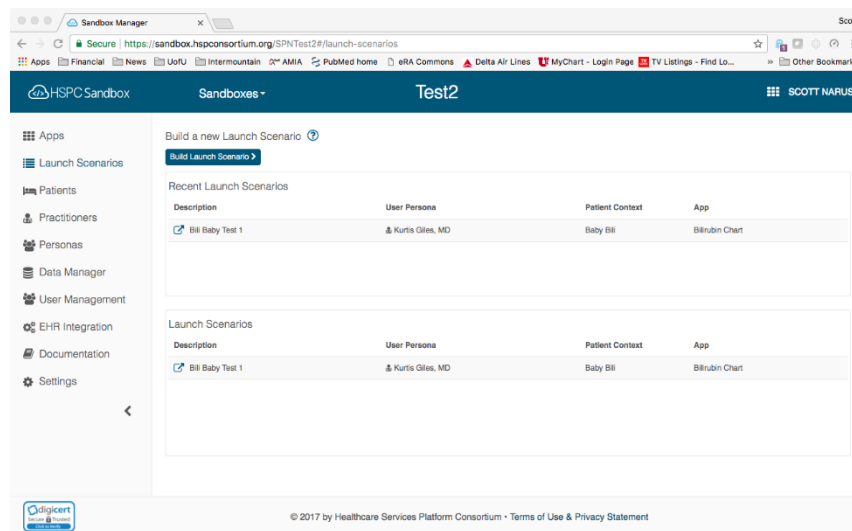


Figure 8. Sample screenshot from HSPC Sandbox.

impacted by the availability of one or more Roadmap milestone(s). To illustrate the relationship between a project and the Roadmap, we will use the HSPC Developer Sandbox project as an example.

The goal of the HSPC Developer Sandbox is to provide an environment where development groups can learn about, and experiment with, data interoperability services (e.g., FHIR), application interoperability frameworks (e.g., SMART), security frameworks for authentication and authorization (e.g., OAuth), and various support services and

functionality that are part of HSPC's vision for an open, standards-based ecosystem for healthcare. The Sandbox also serves as a demonstration of some of the functionality that HSPC is promoting for this ecosystem. Because of this mix and breadth of Sandbox functionality, and their importance to HSPC's long-term goals, some Sandbox deliverables are noted as milestones on the Roadmap, while other Roadmap milestones influence, or are keys to the success of, the Sandbox.

Several parts of the Sandbox are functional today, and several of these appear in Phase 0-1 of the Roadmap, particularly in the Platform segment. For example, the *SMART Sandbox* milestone is available today. Other milestones in progress and scheduled for early release include the *Terminology Server*, *Terminology Services API* and *CDS Hooks Support*. The Sandbox relies on the *HSPC FHIR Profiles for Select Domains* milestone in the Security swim-lane in order to support an objective for FHIR Profile support. It also relies on the *Baseline Security Capabilities* milestone in the Context segment in order to define and support a common security model for use in the Sandbox. Progressing forward, the Sandbox project will rely on the sequencing of the Roadmap milestones, and the functionality/product definition for each Roadmap Phase in order to ensure coordination across the various groups in delivering given functionality, and prioritizing tasks in the appropriate order. Without the Roadmap, it would be difficult to ensure that steady progress on the Sandbox is accomplished.

Appendix III – How this Roadmap was created

The decision to embark on the development of a community roadmap had been in discussion for some time, eventually garnering widespread support. The overall process initiated with several community workshops as part of General Session meetings, but open to Members only. HSPC leadership felt that it was important that this activity was supported by the general membership, and that given the directional and important nature of the work, that the voices influencing the artifact and its target state were members.

The initial session was an open brainstorming around content, scope, role within HSPC, and project planning. The objective of the session was to assess the degree of community interest, to frame the overall artifact and define boundary conditions on the work (for example, limiting core topics to those areas where HSPC has the skills and capabilities to influence but not overreaching in terms of our likely impact).

As the domain of interest took shape, a formalism for subdividing the complex subject matter and articulating the roadmap construct was determined. HSPC entered into a joint collaboration with The Open Group, which made available the Transition Map and a set of Enterprise Architecture practices and methodology that would underpin the work. This provided a solid foundation for the Roadmap grounded in “Enterprise Architecture” best practices, of which this work is a sub-element.

A working group was formed and a regular call schedule set up. The working group was open to any interested HSPC member and met weekly as a community. Based upon the content subdivisions, most of the actual detail work occurred in subgroup meetings aligned along our segmentation of the problem space: content, context, and platform. Each segment had two co-chairs and autonomy to advance the work in whatever manner best suited them. All segments were expected to have representation on the cross-community weekly calls.

As part of developing the map, the group held two face-to-face “offsite” workshops. These were very much working sessions, and were used to harmonize ideas and to discuss the more impactful and crosscutting concerns affecting the overall document. The first workshop was a multi-day event with approximately 20 participants, from which we made the key structural and content decisions that ultimately drove the overall work product. The second workshop was more iterative refinement, focused on closing outstanding gaps and harmonizing work across the segments.

At the conclusion of the above steps, the Alpha document was prepared and released, with a walkthrough conducted at an HSPC General Session. It was at this point that all interested parties were permitted to review and contribute. Ultimately, two public presentations with corresponding comment cycles were conducted, the feedback used to revise the document into a release candidate.

Once finalized by the authoring team and reviewed by the community for accuracy in addressing community feedback, the document was provided to HSPC leadership for distribution and formal approval. The approved, baselined version of this document will have been reviewed and accepted by the HSPC membership via a formal vote.

The expectation is that this document will be a living one, with revisions being made annually.

Appendix IV – Milestones and Deliverables Detail – Content

Collected milestones for Content section of the Road Map.

Milestone	Short Narrative	Milestone Type	Rationale	Phase 1 (2018)	Phase 2	Phase 3	Target
CIMI Reference Model	Reference model (meta-model) for CIMI modeling efforts across information domains.	Data/ Information Models	CIMI models should be constrained by an overarching meta-model	X			
Priority Terminology Management Environment	Terminology management including: <ul style="list-style-type: none"> • SOLOR architecture • LOINC Loaded into OntoServer • SNOMED/LOINC Integration • RxNorm Loaded into Ontoserver • SNOMED/RxNorm Integration • SNOMED Loaded into OntoServer 	Data/ Information Models	Many of the other milestones and a number of products/use cases are dependent on terminology. Terminology management will be a prerequisite for these projects.	X			
CIMI Archetypes for Select Information Domains	Reference model (meta-model) for CIMI modeling efforts within select information domains. Information domains include such things as: <ol style="list-style-type: none"> 1. Laboratory values 2. Medications 3. Diagnoses 4. Etc. 	Data/Information Models	CIMI models within specific domains should be constrained by an information domain meta-model	X			
Create HSPC FHIR Profiles for Select Clinical Domains	Requirements: <ol style="list-style-type: none"> 1. Sharable HSPC/FHIR models for reading data. 2. Sharable HSPC/FHIR models for writing data. 3. Sharable HSPC/FHIR models for a publish-and-subscribe environment (including event models other than store and retrieve). 4. Shareable HSPC/FHIR models for orders and order sets. HSPC/FHIR Models will be developed for the following clinical domains: <ol style="list-style-type: none"> 1. Pregnancy Management 2. Wound Assessment 3. Pain Assessment 4. Pulmonary Embolism 	Data/Information Models	This content represents the foundational product of HSPC.	X			

Milestone	Short Narrative	Milestone Type	Rationale	Phase 1 (2018)	Phase 2	Phase 3	Target
	5. Neonatal admission assessment						
HL7 CDS KAS-for Select Domains	Libraries of HL7 standards-based rules, order sets and documentation templates intended to be shared.	Process Knowledge	In order to demonstrate the success of HSPC's approach, there will need to be a collection of working data models, decision-support models, workflow models, documentation models, etc. available for download and evaluation.	X			
Data Model API Specification and Conformance Profiles	Author declarative transformations for the models outlined above.	Data/Information Models	CIMI provides general, foundational models. The ability to transform to FHIR will allow these to be exposed as a part of the FHIR standard.	X			
Shareable medical knowledge models using BPM: for Select Domains	<ol style="list-style-type: none"> Develop a Process Model using BPMN/DMN/CMMN for a computable guideline. Examples: <ol style="list-style-type: none"> PE HTN Mental Health Pregnancy Diagnostic and Risk Assessment Models based on pub/sub environment (PMML, DMN). Examples: <ol style="list-style-type: none"> Pneumonia Sepsis 	Process Knowledge	Functional clinical models based in standards are the ultimate target of this effort. Models developed using Business Process Management standards provide an additional layer of standardization for evolving applications and increase opportunities for portability.	X			
Develop Knowledge Authoring Metamodel-V1	<ol style="list-style-type: none"> A knowledge model to support an authoring environment allowing the creation of new models in a variety of knowledge areas (Decision-support, clinical protocols, documentation models, etc.). Supports different types of users. Supports artefact lifecycle and governance. 	Process Knowledge	This is a general environment that supports the use of models in clinical applications. It will be a part of the tooling that allows developers to specify and configure models of data, events, orders, etc. within their applications.		X		
CIMI Reference Model Updates	Next generation CIMI models extending original models where needed.	Data/Information Models	Experience with existing models and evolution of the FHIR specification may require updates to existing data models.		X		
Synthetic Data Generation	Demonstrate the ability to generate the synthetic data needed to populate the HSPC sandbox to support the development and testing of select applications.	Data/Information Models	One of the uses of CIMI models will be to simulate the content and behavior of DHR in the context of a specific clinical problem and associated applications.		X		

Milestone	Short Narrative	Milestone Type	Rationale	Phase 1 (2018)	Phase 2	Phase 3	Target
Shareable medical knowledge models using BPM: for Additional Domains	Based on initial experience authoring medical knowledge using BPM technologies, a group of additional clinical problems will be chosen around wish to develop additional models.	Process Knowledge	Functional clinical models based in standards are the ultimate target of this effort. Models developed using Business Process Management standards provide an additional layer of standardization for evolving applications and increase opportunities for portability.		X		
Logical Models for Knowledge Artefacts	Leverage HL-7 CDS knowledge artifact definitions to develop Libraries of HL7 standards-based rules, order sets and documentation templates intended to be shared.	Process Knowledge	In order to demonstrate the success of HSPC's approach, there will need to be a collection of working data models, decision-support models, workflow models, documentation models, etc. reflecting HL-7 CDS standards and available for download and evaluation.		X		
CIMI Archetypes for Broader Domains	Extension and revision of the CIMI archetypes to: 6. Extend their ability to represent previously addressed domains. 7. Address new domains required by new types of clinical applications.	Data/Information Models	This update will respond to experience with the original archetypes and the maturation of service models (i.e. FHIR).			X	
Create HSPC FHIR profiles for Broader Domains	Extension and revision of the library of HSPC FHIR profiles available for use in new types of clinical problems requiring data/information models.	Data/Information Models	We can anticipate that a large number of new clinical applications will suggest themselves based on initial experience with the HSPC knowledge authoring environments.			X	
Develop Knowledge Authoring Metamodel V2	1. Updated version of original knowledge authoring meta-model. 2. Harmonizes different, standards-based, knowledge authoring models. 3. Supports artefact lifecycle and governance.	Process Knowledge	The target is an environment where a variety of standards-based tools can be used to author medical process knowledge and to link knowledge artefacts to services that read and write relevant data and support user interaction with executing clinical processes.			X	
Ability to develop & represent medical information & knowledge for all HSPC efforts	Overall goal of Content Swim lane.	For Entire Content Swimlane.	To develop a knowledge architecture that supports true semantic interoperability and enables the structured and declarative representation of clinical care models and processes.	X	X	X	