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INTEGRATION INFRASTRUCTURE:

Building 21st Century Health Information Technology

A Chilmark Research Market Trends Report

Published April 2021

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Key Takeaways

21st Century Cures Act sets a tone for the next phase of healthcare interoperability

Cures Act establishes framework for expanded availability of patient data across healthcare

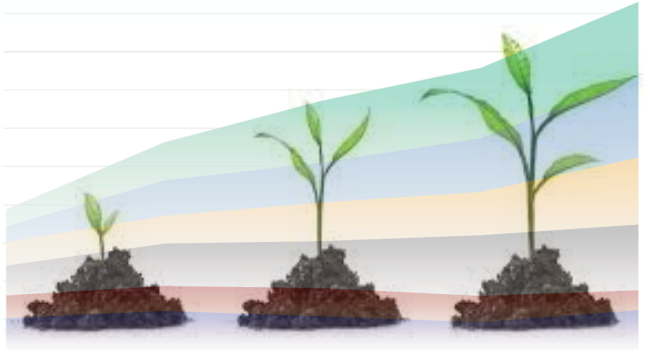
APIs and FHIR are not widely adopted yet but will become dominant in the healthcare industry

Healthcare enterprises will adopt API-based development and integration as the go-forward approach for new development and integration projects

Large number of relatively narrow business cases will justify new projects

Cures Act is no substitute for a business case

Fastest growing vendors support many and varied use cases, each with narrow justification and ROI



Many healthcare players want and will pay for access to high-value provider data

Forecast 14% CAGR in products and services spending over 5 years on integration projects

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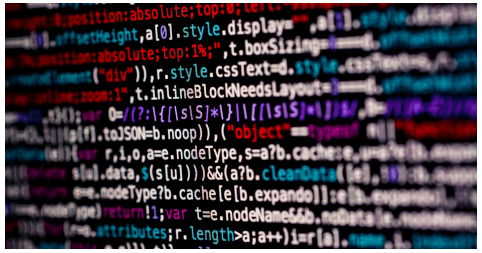
The Interoperable Healthcare Data Platform

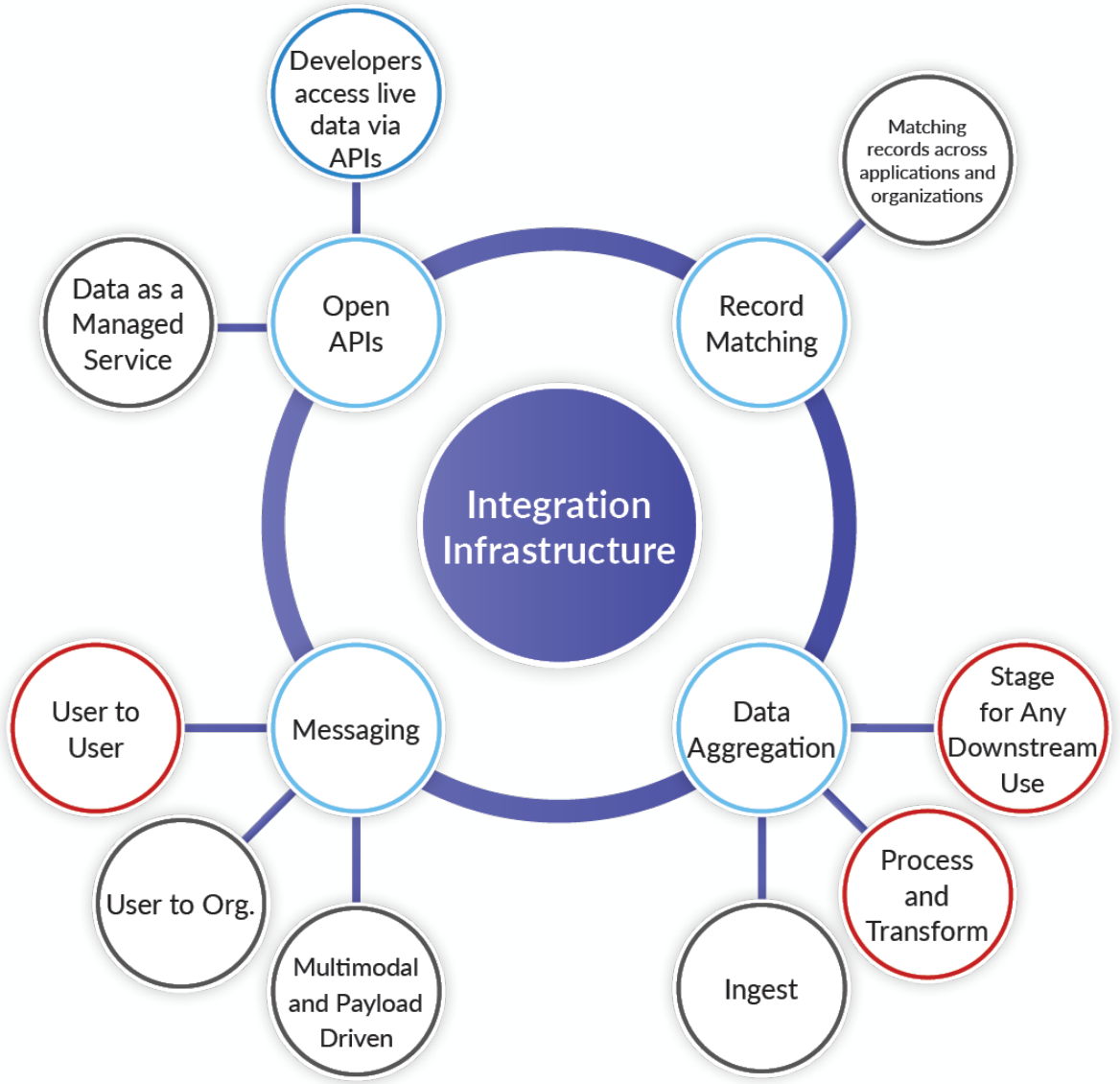
Integration Infrastructure

Special purpose enabling software for information exchange

Highly variable capabilities



Software or managed service



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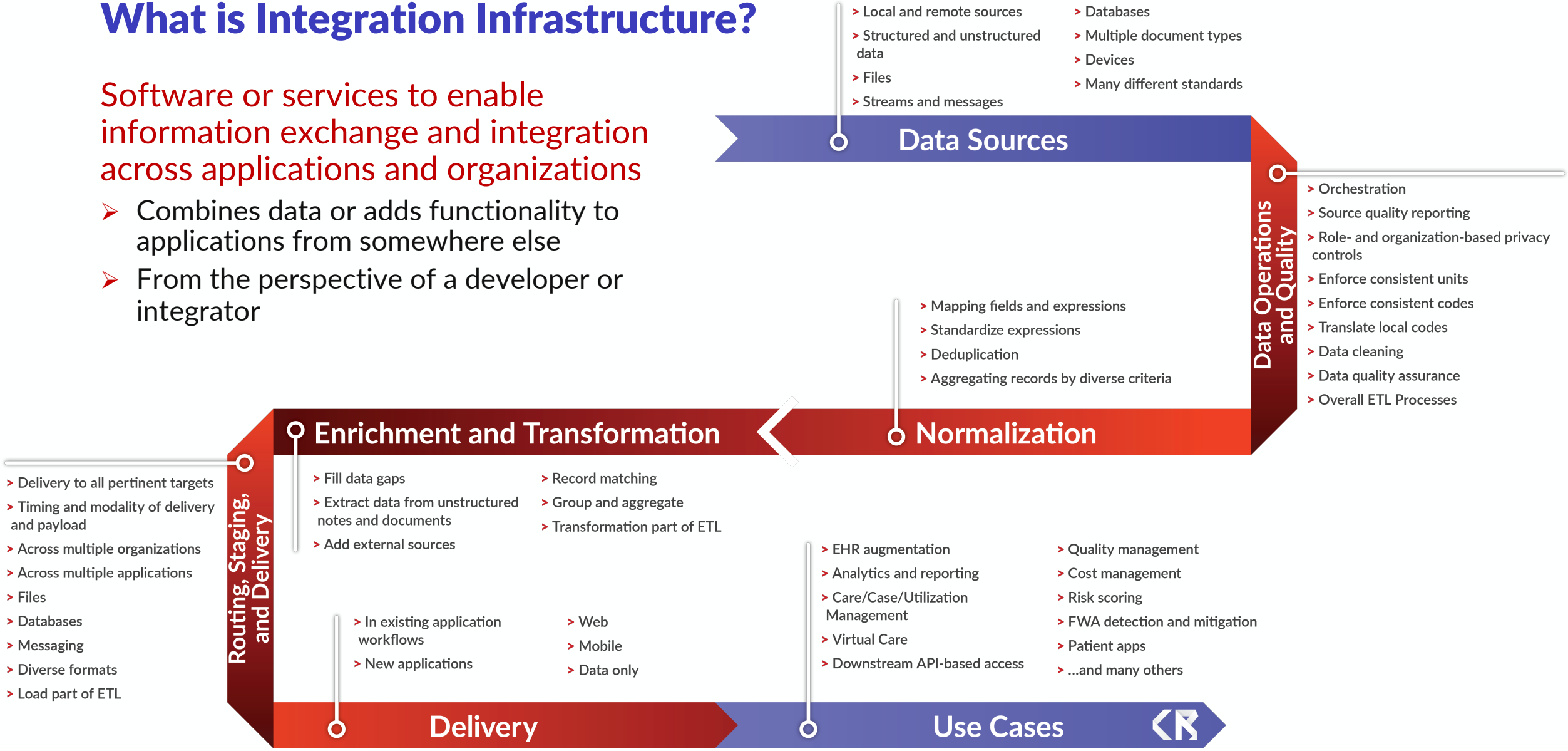
What is Integration Infrastructure?

Software or services to enable information exchange and integration across applications and organizations

- Combines data or adds functionality to applications from somewhere else
- From the perspective of a developer or integrator



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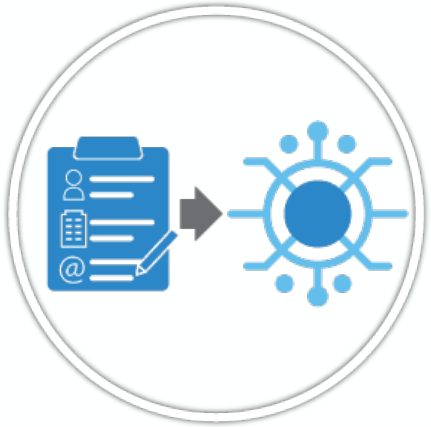
Frequently Implemented Generic Integration Use Cases



Receiving data from a different organization and using it in an application

Orders and results

Notifications (e.g., ADT)

Payment transactions and processing

EHR ⇔ Non-EHR

Document query and retrieval, across organizations

Summary of patient information from any certified EHR for different purposes

Parsed for use in other applications

Bulk data aggregation

Analytics and reporting

Staging data for use via APIs

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Why Integration Infrastructure?

Innovation

Underpin new and changing care and delivery models

Find more efficient and effective care pathways

Value

Drive value-based care programs

Reduce IT infrastructure, development, and integration costs

Speed

Accelerate developer productivity

Maximize clinical and administrative user productivity

Usability

Reduce clinician burden

Improve patient experience

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Who Buys Integration Infrastructure Products and Services?

Organization Type	Conventional Approach to Integration	Future Approach to Integration
Provider Organizations	➢ Event- and message-driven ○ HL7, X12, CDA, NCPDP, and IHE dominate ➢ File Transfer ➢ Portals for user access	➢ Largest, most complex are the early adopters of HTTP/JSON and API-based options ➢ Most HCOs will follow their EHR vendor's lead ➢ Growing volume of API calls a leading indicator ➢ Increasing interest in 3rd party apps for their users and patients
Payers and Health Plans	➢ Event and message-driven ○ Primarily X12 ➢ Proprietary flat and CDA file transfer ➢ Chart pulls common	➢ Strong preference for CDA file transfer over all other methods ➢ New Patient Access APIs could cause many to rethink how they consume and provide data
Digital Health and ISVs	➢ Frustrated with access difficulties and healthcare's pace of change ➢ Views HL7, IHE, CDA, and X12 as unduly complex ➢ Access to market often through EHR vendor or other intermediary	➢ Overwhelming preference for well-documented HTTP/JSON APIs ➢ Cloud first implementations ➢ Need intermediary for access to market
Clinical Research and Life Sciences	➢ Frustration with data access and use rights ➢ Primarily in-organization usage and subject to IRB review ➢ Chart pulls common ➢ Significant data transformation and QA when machine-readable data available	➢ Some EHR vendors have nascent data offerings to this market ➢ Working closely with hyperscalers to build effective applications ➢ Continuing efforts to federate with outside data sources

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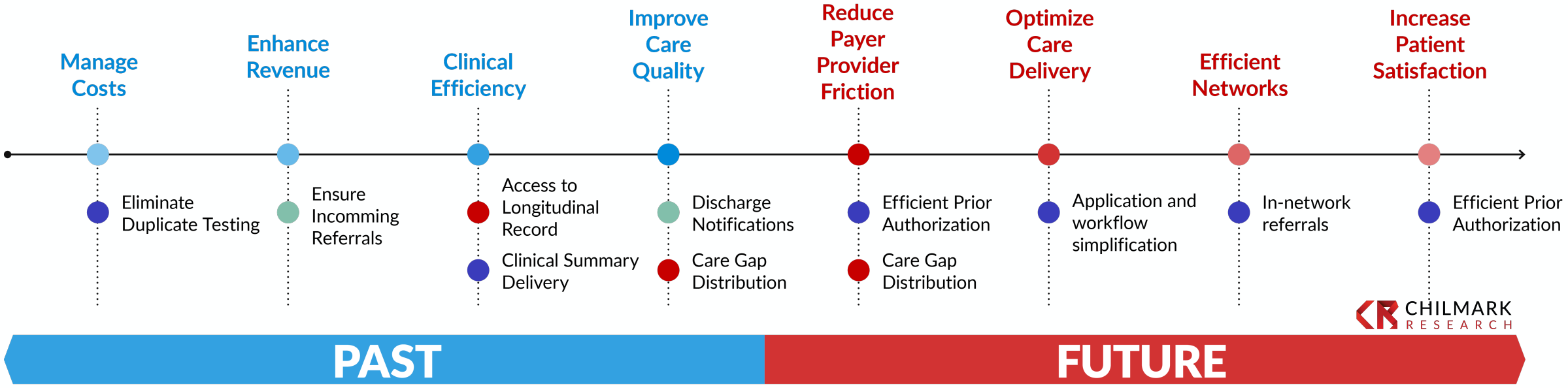
The Evolving Business Case(s) for Integration for Providers and Payers

- Regulatory compliance is not a business case
- Fastest growing vendors enable and support large numbers of narrow business cases



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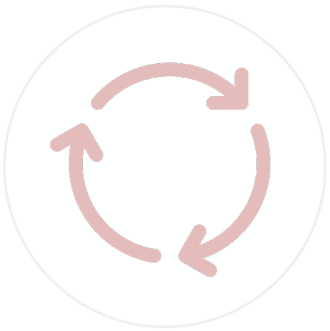
Obstacles and Challenges for Future Integration Approaches



Capacity for Change

Organizations adopt and exploit new technologies at their own pace

Organizations need better reasons to interoperate with each other

Data Rights

Provider clinical data is still highest value to all market segments

Providers see patient data as proprietary and are not eager to share

Data Quality

All integration projects confront data quality issues

Inconsistent adherence to standards

Skills

Tools are unfamiliar to most organizations

Legacy technologies and approaches work for many use cases

Privacy and Security

Fear of HIPAA enforcement

Fear that bad actors will get patient data

Conflicting Incentives

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Industry Context and Regulatory Review

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Vendor Categories

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Vendor Profile Inclusion Criteria:

≥3 live customers and $2 million in relevant annual revenue

Vendor Category	Vendors Profiled	Other Similar Vendors
EHR	Allscripts, Cerner, Epic, NextGen	eClinicalWorks, MEDITECH
HIE Stalwarts	CareEvolution, InterSystems, Lyniate, NextGen (Mirth), Orion Health, Philips, Redox	4Medica, Infor
Hyperscalers	Amazon Web Services (AWS), Google Cloud Platform(GCP), Microsoft	IBM, Oracle, Salesforce, Snowflake

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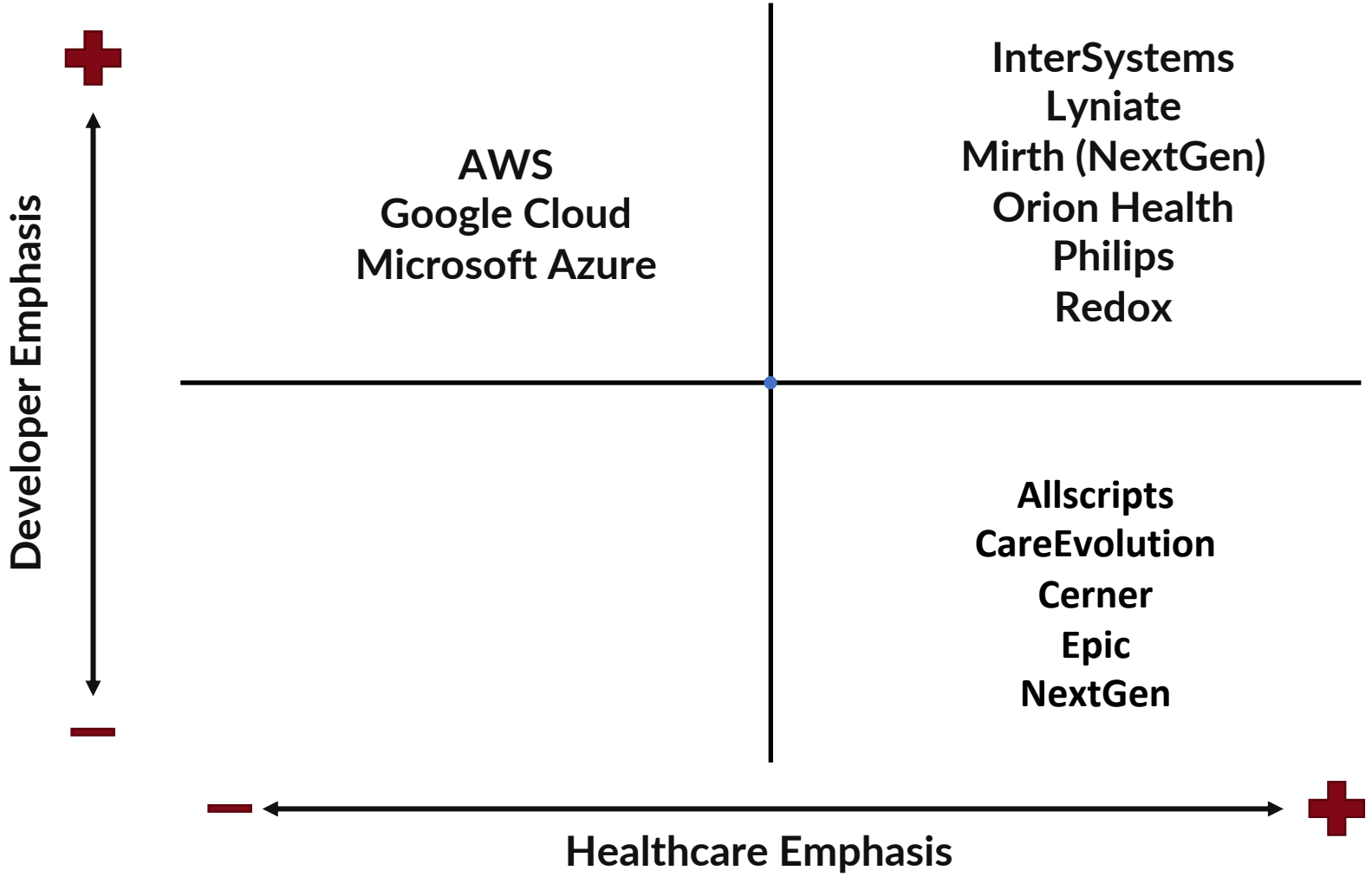
Emphasis on Healthcare and Developer Support



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Market Forecast

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Product and Market Categories and Descriptions

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Product Categories and Descriptions

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Caveats and Qualifications

18 Product Categories

- Data Provisioning and Quality Assurance (4 categories)
- Standards Support (5 categories)
- Functional Support (6 categories)
- Offering Scope (4 categories)

Notes:

- The product categories we define in this market may not align exactly with existing offerings
- A vendor's offering may combine the functionality defined by us as discrete

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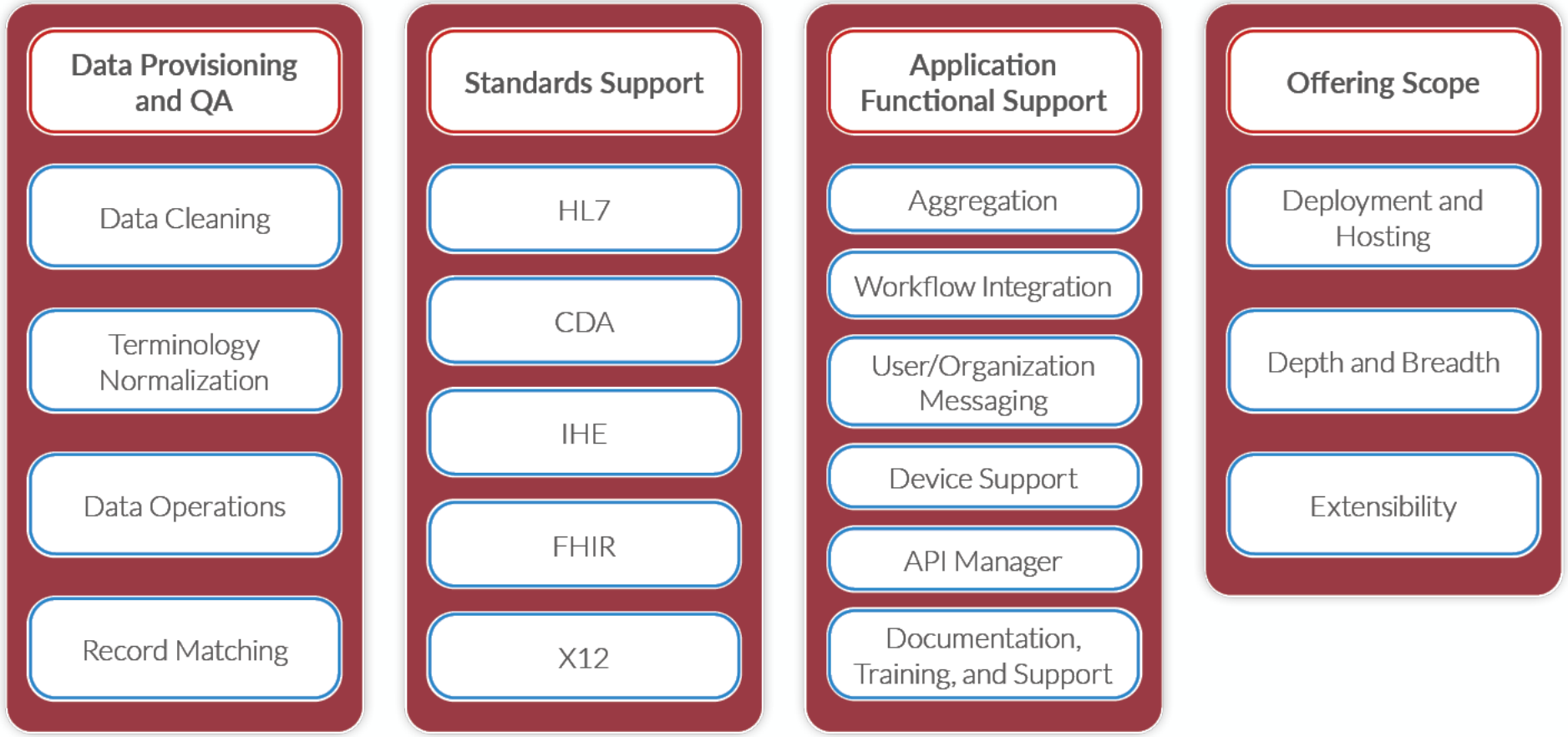
Integration Infrastructure Product Ratings Categories

Technology Categories

Functional Capabilities



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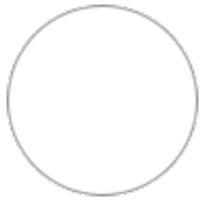
Harvey Ball Ratings Key



Not applicable

Meets Some Market Requirements

Meets Market Requirements

Exceeds Market Requirements

Market Leading

- Every vendor receives a rating in every Product Category
- Most vendors do not offer functionality in every category
- Harvey ball rating is relative to all other vendors in report and product requirements defined in the broadest sense

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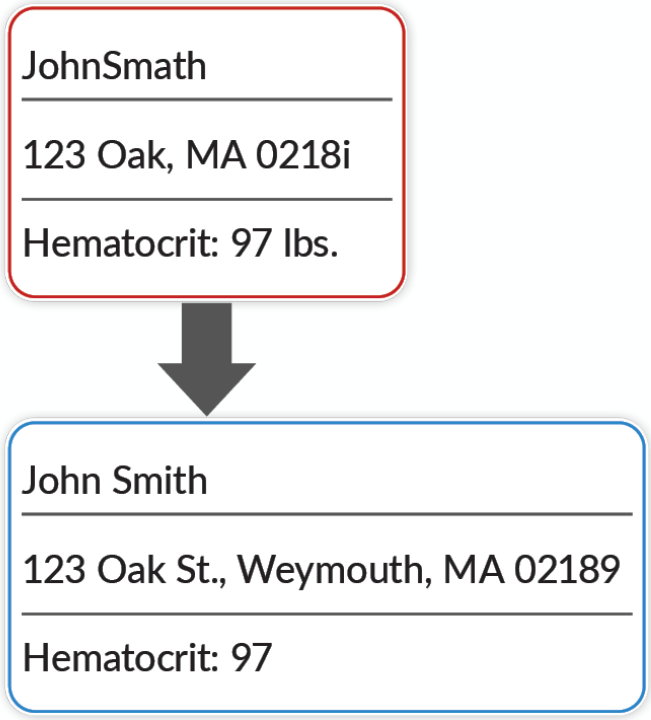
Data Cleaning

Innovation

Deliver consistent, computable data for any processing purpose.

Description

For examining data derived from any application or organizational source and identifying and performing transformations that mitigate variations, errors, duplication, and omissions of content, formatting, placement, or sequencing.



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Terminology Normalization

Innovation

Deliver uniformly expressed coded data to developers, applications, and users.

Description

For translating any standards-based, external, local, or variant expressions into a single expression for a specific purpose. Also considers the ability to evaluate any given data source to understand the variability of coded data elements.

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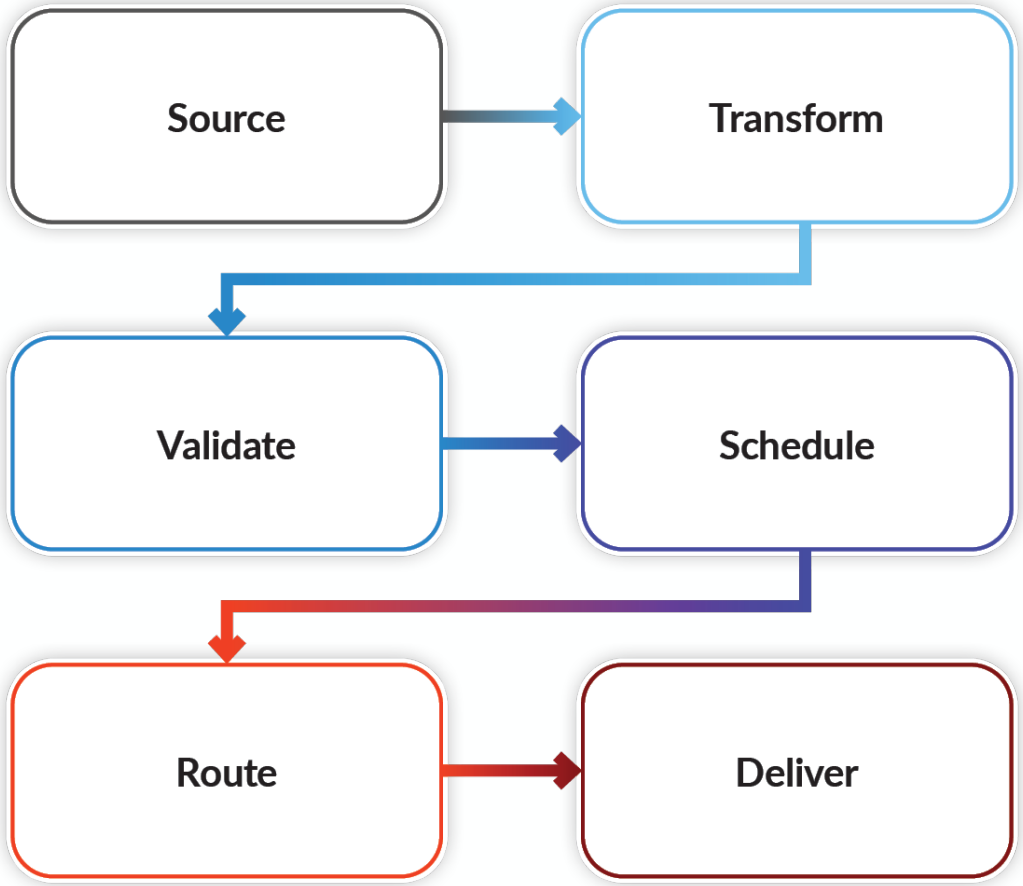
Data Operations

Innovation

Enable management and control of the process of creating infrastructure and data.

Description

For monitoring and controlling the supply and provisioning diverse data feeds, ensuring that data is received and provisioned at the time and in the quantities anticipated, and that variations and exception conditions are identified and resolved. Focused on the needs of developers, administrators, and operators to build, test, deploy, optimize, and administer the resulting infrastructure. Includes APIs, development and test tools, sandboxes, configuration aids, containerization and orchestration support, and simulation capabilities.



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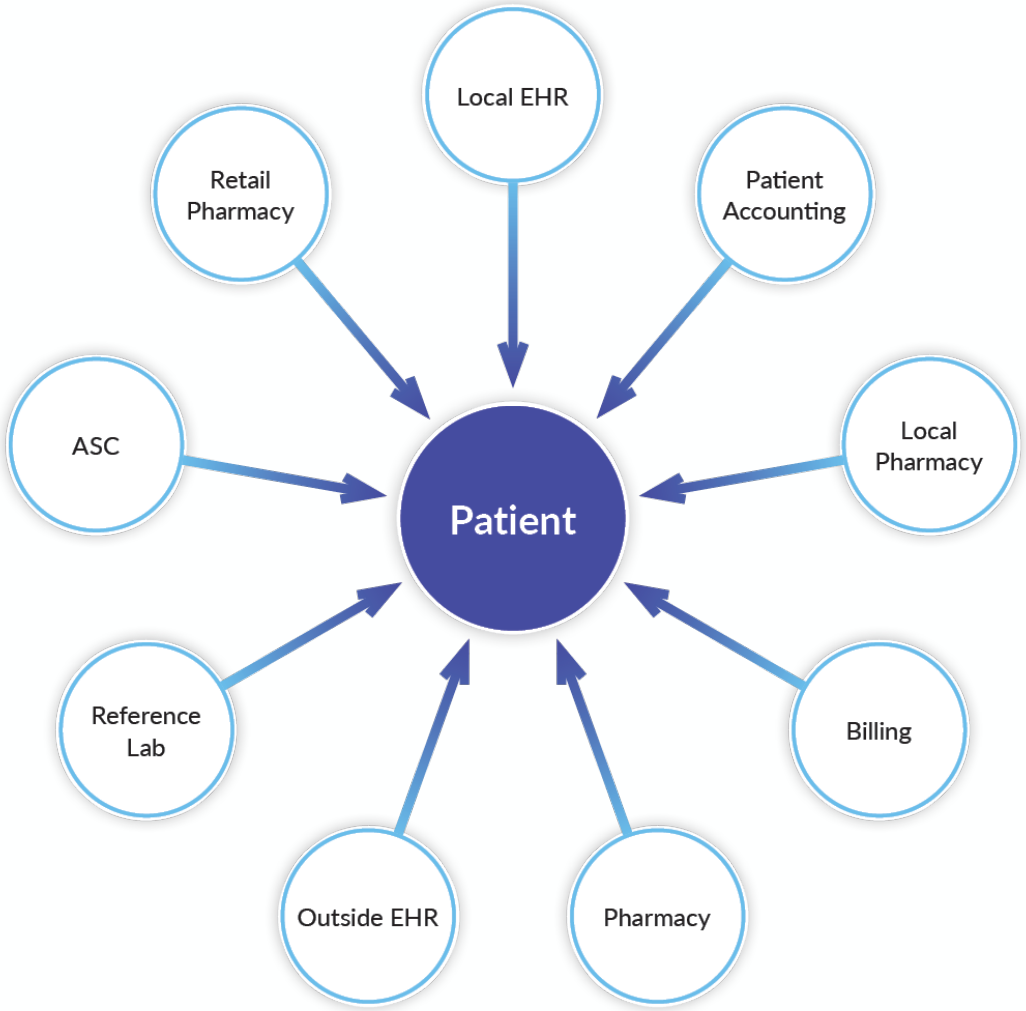

Record Matching

Innovation

Link data from disparate organizations and applications based on a common data element.

Description

The ability to associate or link disparate records based on a common or suspected identifier such as patient, family, episode, condition, clinician, organization, encounter, health plan, cohort, or other special-purpose identifier, including the elimination of duplicate records.

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Standards Support

Category	Description
CDA Support	For building, deploying, and using CDA-based documents in applications and workflows.
HL7 Support	For building or maintaining applications that involve HL7-based events, messages, documents, or transactions.
FHIR Support	For building and maintaining FHIR-based resources, documents, and transactions in applications and workflows.
X12 Support	For building EDI-based transactions and documents in applications workflows.
IHE Support	For buildings and deploying IHE-based flows, profiles, and applications.

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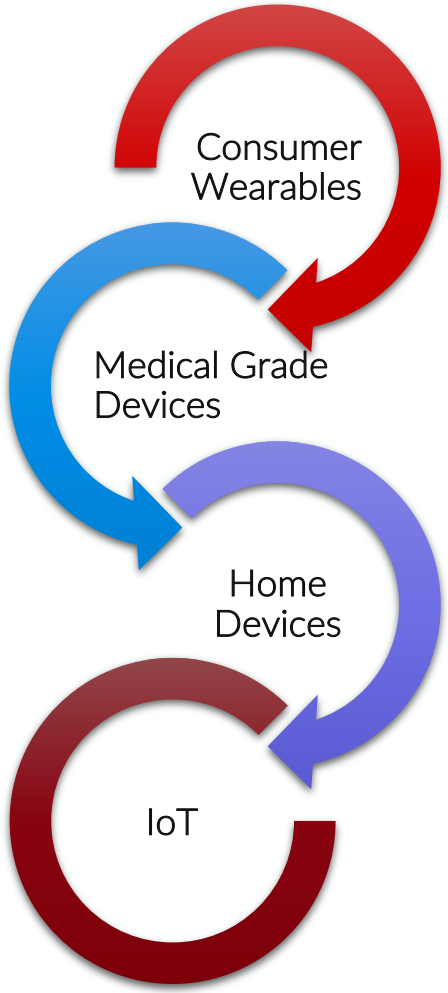
Device Support

Innovation

Incorporate and use data from devices in and out of the healthcare system.

Description

The ability to source, store, and make available data from a range of different devices and IoT entities.



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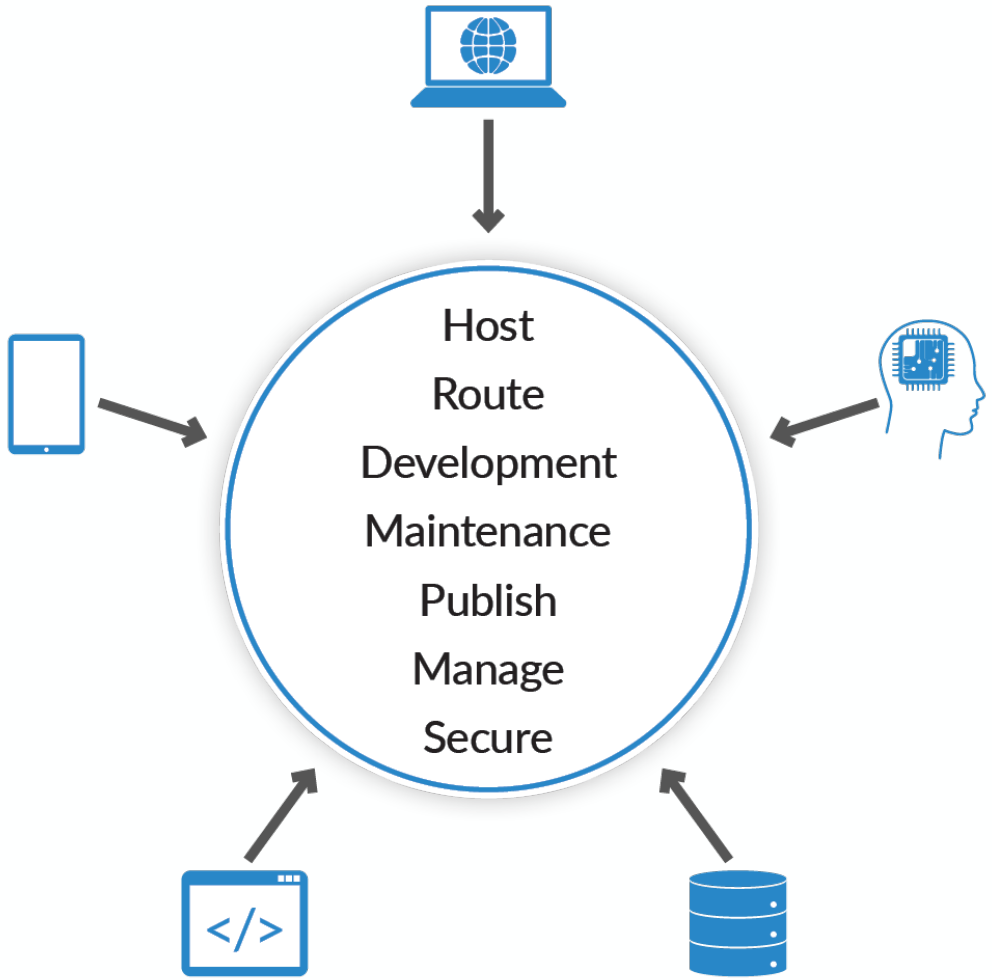

API Manager

Innovation

Permit programmatic access to data, transactions, and user flows for developers and integrators.

Description

For building and deploying APIs and underlying data or infrastructure for any use case or purpose. Includes considerations of the extent of available functionality and data.

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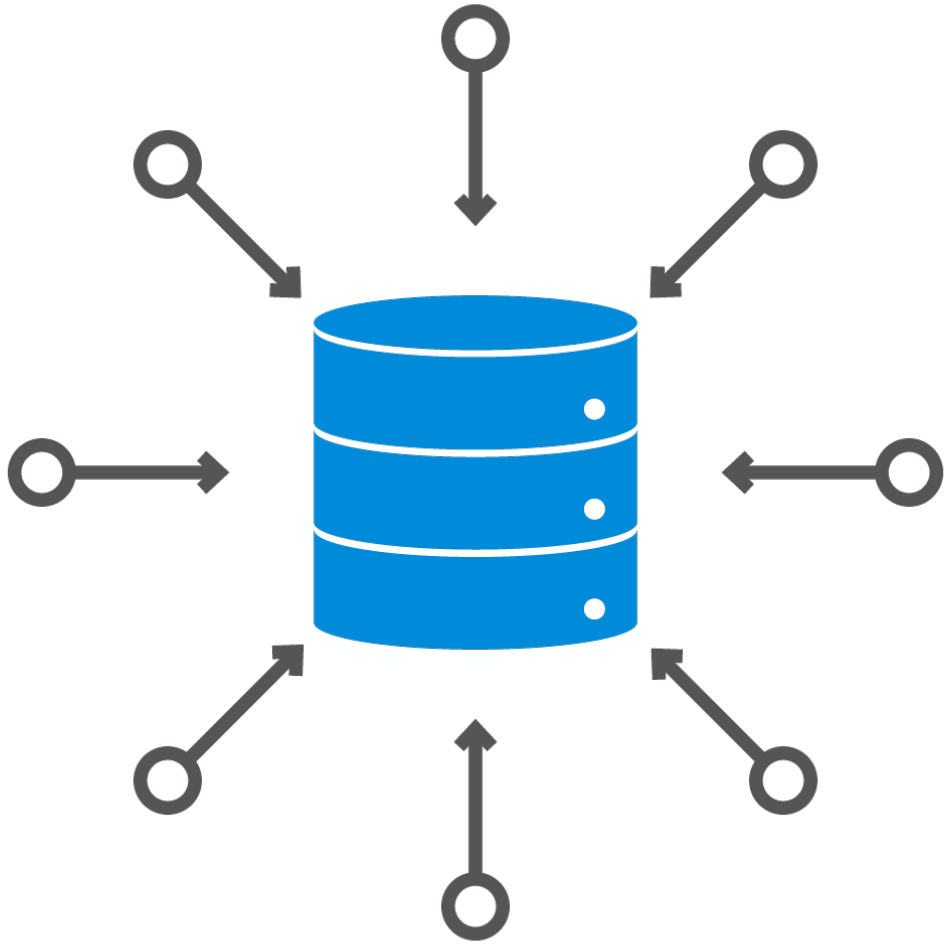
Aggregation

Innovation

Build data stores organized around an identifier from disparate applications and organizational data sources.

Description

Combining diverse data sources in bulk and providing a developer-accessible data model that provides access and supports processing using criteria such as contract, cohort, condition, episode, drug class, or other identifiers and data elements.



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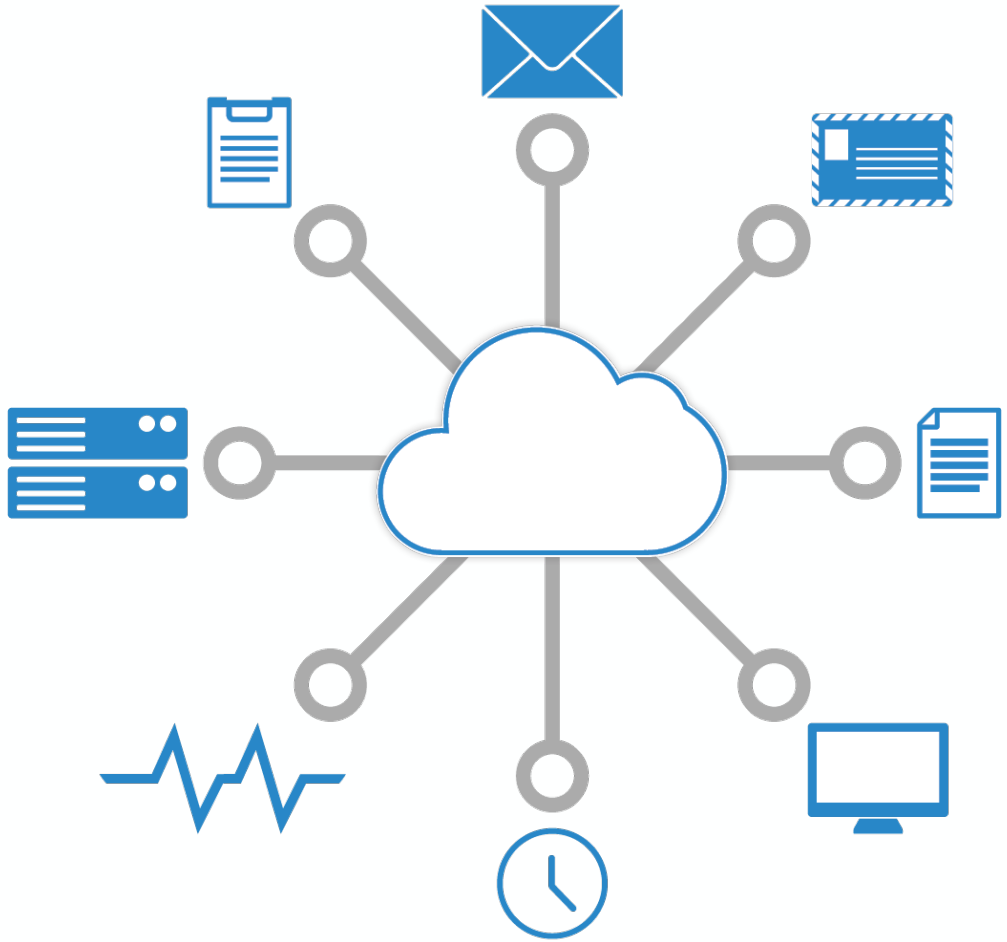

User and Organizational Messaging

Innovation

Enable different kinds of messaging to deliver data to individuals and applications.

Description

For transmission, delivery, and incorporation of data in secure or non-secure messages, notifications, with content payloads among individuals, organizations, and applications, including the ability for senders and receivers to configure and control content, timing, and method.

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Workflow Integration

Innovation

Support blending of diverse user applications and workflows.

Description

For incorporating data and/or functionality into existing applications and workflows.

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Documentation, Training, and Support

Innovation

Efficient development of skill, knowledge, and abilities for developers, integrators, operators, and users.

Description

The range of educational and support resources available to developers and others including virtual, on-site, community, and third-party offerings.

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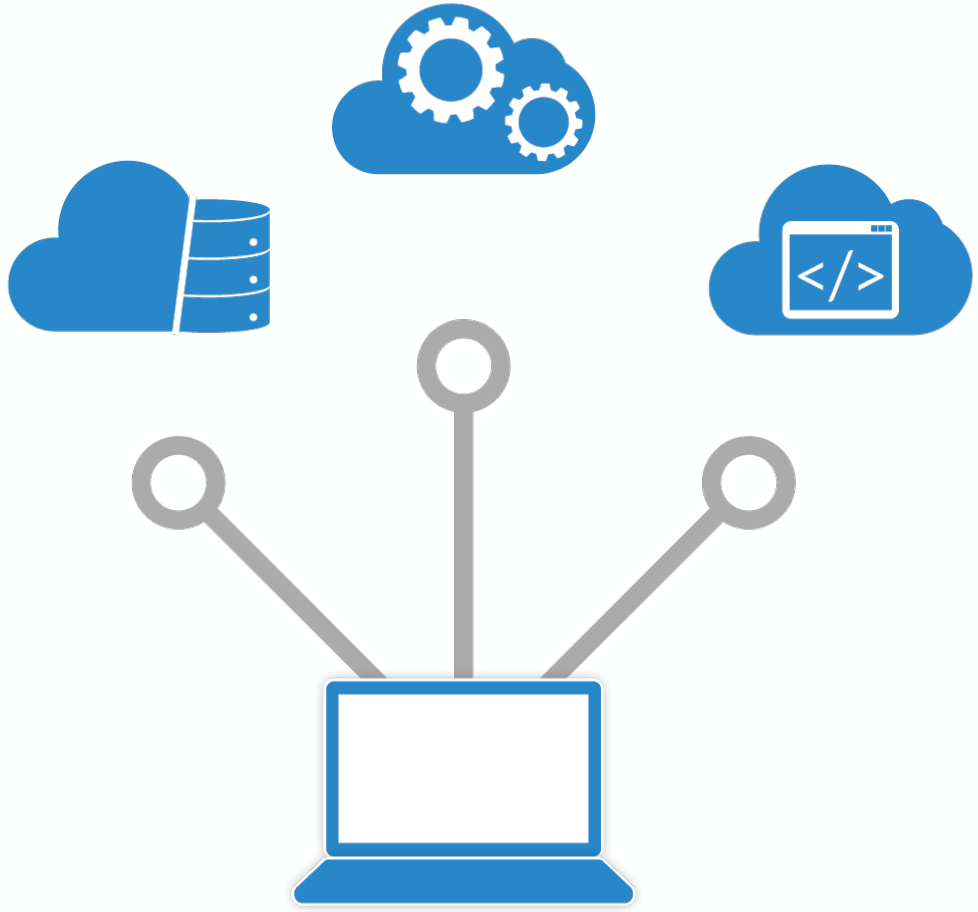
Deployment and Hosting

Innovation

Support optimal, cost-effective deployment.

Description

The range of different options available to customers for deployment of infrastructure, including on-premises, remote-hosted, SaaS, public, private, or hybrid cloud.



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Offering Scope

Depth and Breadth

Innovation

Estimates the current reach of product or services for existing customers

Description

Summarizes the current functional scope of the vendor's offering based on the range of functional capabilities, the variety of potential use cases, and its impact on implementing organizations.

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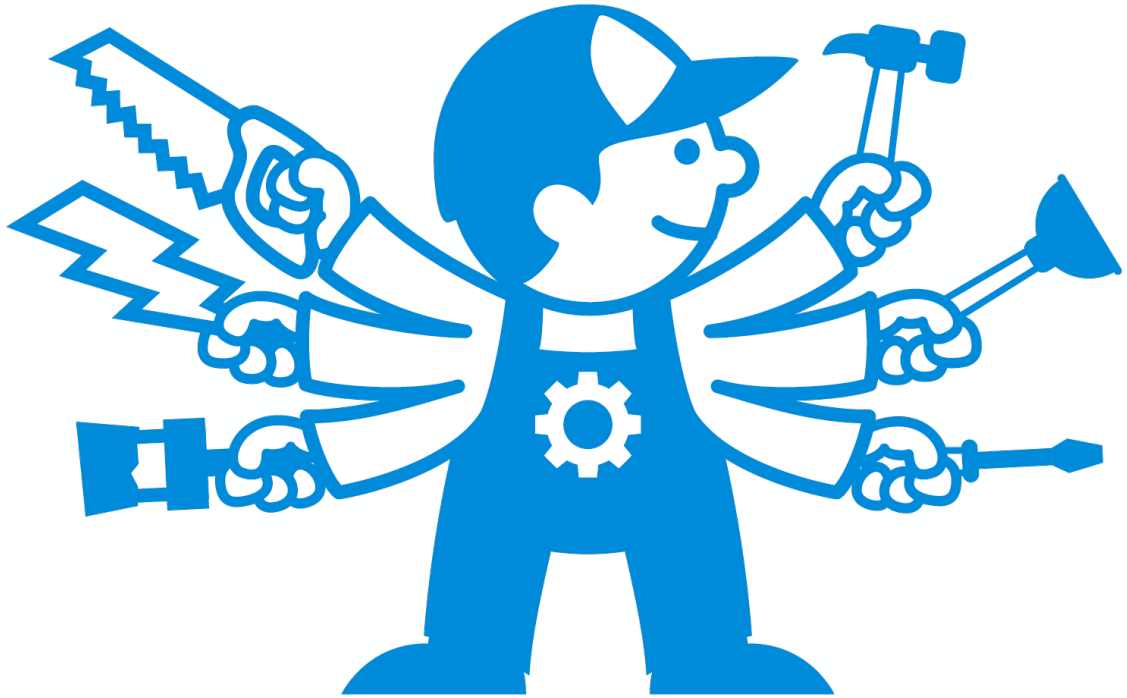
Extensibility

Innovation

To permit implementers to apply the offering in diverse and new use cases and settings.

Description

How readily the offering adapts to evolving needs of existing users and organizations, new clinical or administrative circumstances or programs, and expanding customer requirements.



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Product Ratings

Vendor	Data Operations	Data Cleaning	Terminology Normalization	Record Matching	HL7 Support	IHE Support	FHIR Support	X12 Support	CDA Support	Device Support	Data Aggregation	Workflow Integration	User and Organization Messaging	Documentation, Training, and Support	Deployment and Hosting	API Manager	Depth and Breadth	Extensibility
Allscripts																		
AWS																		
CareEvolution																		
Cerner																		
Epic																		
Google Cloud																		
Health Catalyst																		
InterSystems																		
Lyniate																		
Microsoft Azure																		
NextGen (Mirth)																		
Orion Health																		
Philips																		
Redox																		

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Market Categories and Descriptions

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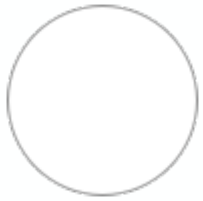
Harvey Ball Ratings Key



Not applicable

Meets Some Market Requirements

Meets Market Requirements

Exceeds Market Requirements

Market Leading

- Every vendor receives a rating in every Market category
- Most vendors do not participate in every market described here or have relevant programs in every one of these categories
- Harvey ball rating is relative to all other vendors in report and market requirements in the broadest sense

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Market Categories

Category	Description
Hospital or Health System	Any facilities-based care delivery organization that own or control hospitals.
Independent Community Provider	Any care delivery organization that is not owned by, controlled by, or sited in hospital or health system.
Community Organization	Any care delivery organization that is not owned by, controlled by, or sited in hospital or health system.
Health Information Network	Any public or private network that carries and delivers data or transactions between unaffiliated organizations involved in the healthcare delivery or payment.
Clinical Research	Organizations that design and perform basic investigation and research with actual or anticipated clinical application or ramifications.
Government	Federal or state network that carries or delivers data or transactions that support information flow for government programs.
Payers and Health Plans	Any organization that pays for healthcare services on behalf of its members.
Public Health	Public or private agencies and organizations that collect, compile, and se data on diseases, conditions, or the environment to support health programs or aims.
Digital Health	Independent companies that develop digital health offerings.
Life Sciences	Companies primarily involved in pharmaceutical or medical device manufacturing and/or development.
Life and Disability	Companies involved in underwriting and issuing life and/or disability insurance contracts.
Independent Software Vendors	Any organization engaged in the development and sale of software-based offerings based on the vendor's offering to any healthcare customer.

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Market Ratings

Vendor	Payers and Health Plans	Provider Hospital	Provider Ambulatory	Community Orgnizations	Health Information Networks	Digital Health	Life Sciences	Life and Disability	Clinical Research	Government	Public Health	Independent Software Vendors	Partner Programs	Roadmap and Vision	Market Momentum
Allscripts															
AWS															
CareEvolution															
Cerner															
Epic															
Google Cloud	*Only included in full version of report: chlmrkrsr.ch/IntegrationMTR*														
Health Catalyst															
InterSystems															
Lyniate															
Microsoft Azure															
NextGen (Mirth)															
Orion Health															
Philips															
Redox															

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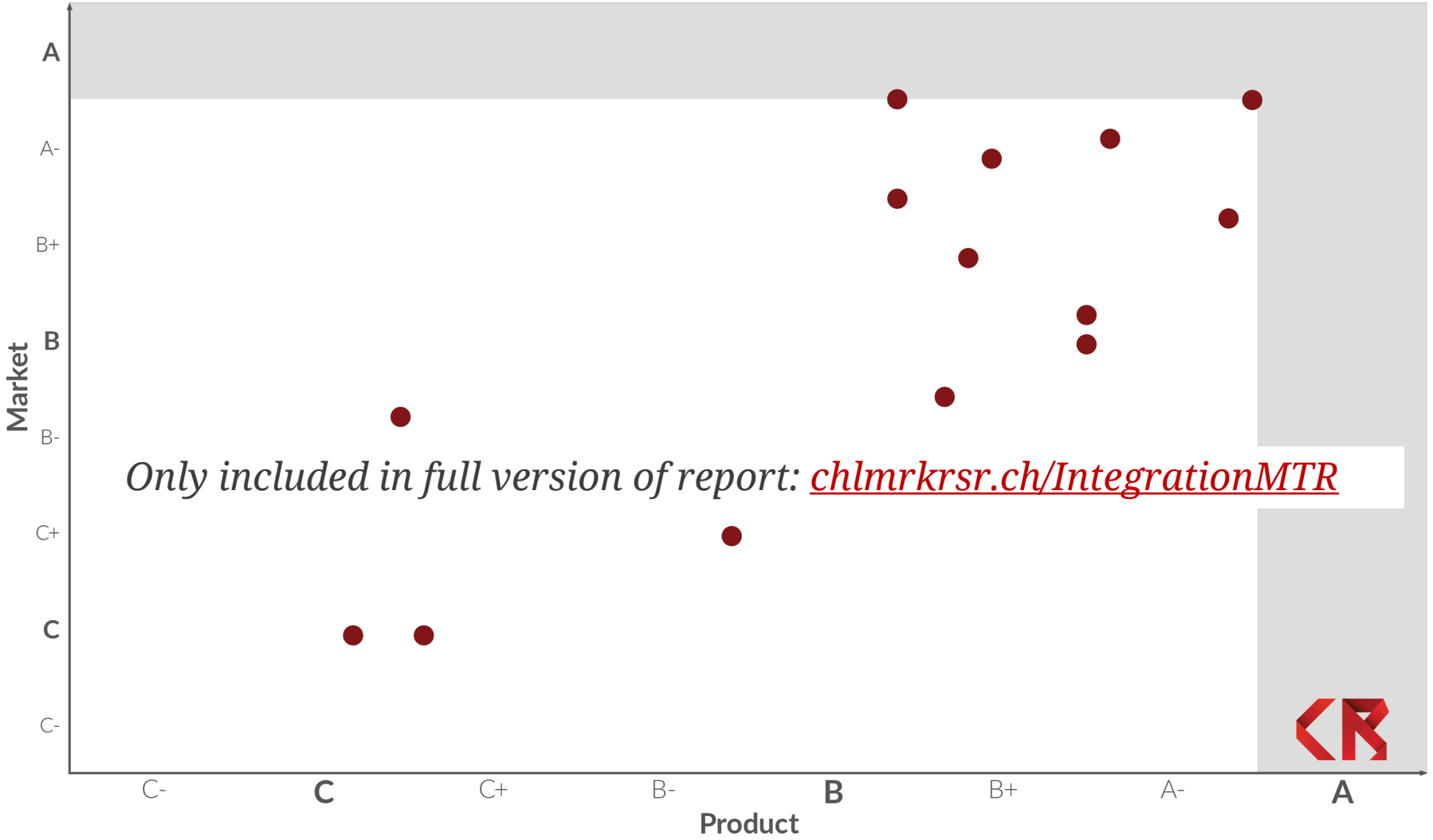
CHILMARK BEARING
Integration Infrastructure Vendors



Vendor	Product Score	Market Score
Allscripts		
AWS		
CareEvolution		
Cerner		
Epic		
Google Cloud		
Health Catalyst		
InterSystems		
Lyniate		
Microsoft Azure		
NextGen (Mirth)		
Orion Health		
Philips		
Redox		

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Vendor Profiles

(Profiles exclusive to full version of report: chlmrkrsr.ch/IntegrationMTR)

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Appendix A: Methodology

- To compile this report, Chilmark Research combined extensive primary and secondary research techniques to create a composite profile for each vendor.
- Primary research was divided into two distinct steps, beginning with soliciting targeted vendors for their involvement in the research.
- We asked participating vendors to complete a questionnaire whose purpose was to collect qualitative and quantitative information about the company and the markets it serves. Questions included among others: relevant revenue, number of employees, primary market, number of healthcare entities currently using its solution, and more in-depth questions regarding features and functions.
- Upon receiving the completed questionnaire, we conducted a follow-up interview with each vendor. These in-depth telephone interviews typically lasted 60 minutes and built on the responses to the questionnaire. This portion of the research effort also focused on topics that cannot easily be captured within the context of a written questionnaire including competitive positioning, product roadmap, partnership strategy, and which solution features are most attractive to prospective customers.
- Chilmark Research performed a final analysis of the vendors via secondary research and telephone interviews with end users and consultants that have advised on, deployed, or used a vendor's system. This information was compiled to provide the in-depth reviews and ratings of the profiled vendors. Prior to publication, all vendors were given an opportunity to review their profile narratives (not rankings) for fact checking. Their comments and feedback were considered and where relevant, incorporated into the final profile narratives.
- In developing this extensive report, Chilmark Research maintained absolute objectivity throughout the entire research process and it is our sincere hope that this report brings greater clarity to this evolving market.

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Appendix B: Acronyms Used

Acronym	Definition	Acronym	Definition	Acronym	Definition
ACO	Accountable Care Organization	ETL	Extract, transform, and load	JTF	Jason Task Force
ADT	Admit, transfer, discharge	FHIR	Fast Healthcare Interoperability Resources	ML	Machine learning
AI	Artificial Intelligence	HHS	Department of Health and Human Services	QA	Quality assurance
API	Application programming interface	HIPAA	Health Insurance Portability and Accountability Act	RCM	Revenue cycle management
CAGR	Compound annual growth rate	HIT	Healthcare information technology	REST	Representational state transfer
CCOW	Clinical Context Object Workgroup	HL7	Health Level 7	ROI	Return on investment
CDA	Clinical Document Architecture	HTTP	Hypertext transfer protocol	RPC	Remote procedure call
CMS	Centers for Medicare & Medicaid Services	IHE	Integrating the Healthcare Enterprise	SHIECAP	State Health Information Exchange Cooperative Agreement Program
eCR	Electronic Case Reporting	IRB	Institutional Review Board	TEFCA	Trusted Exchange Framework and Common Agreement
EHI	Electronic health information	ISV	Independent software vendor	USCDI	U.S. Core Data for Interoperability
EHR	Electronic health records	IT	Information Technology	VBC	Value-based care
ELT	Extract, load, and transform	JSON	JavaScript Object Notation	XML	Extensible markup language

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About the Author

Brian Murphy joined Chilmark Research as an industry analyst in August 2012 and brings a wealth of experience to the table. In addition to being a strong advocate for the critical role that HIT can play in improving the quality of care, Brian has had direct experience as both an analyst at Yankee Group and more recently with the EHR company, Eclipsys, which was acquired by Allscripts.

Brian has worked in the IT business for over 25 years, beginning his career in the field-sales organization of IBM. As a systems engineer, Brian worked with customers across multiple industries, including several hospitals in the metro-Boston area. Brian then joined Yankee Group as an analyst, where he managed an enterprise software service and led research on the dynamics of the database market. Leaving Yankee, Brian joined Eclipsys in corporate marketing prior to its acquisition by Allscripts in 2010. While at Eclipsys, Brian worked with product managers to refine and harmonize their value propositions in light of Eclipsys' broader goals. When not thinking about healthcare IT, Brian is a runner and armchair Boston historian.

Brian is a graduate of both Harvard College and Suffolk Law School.

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