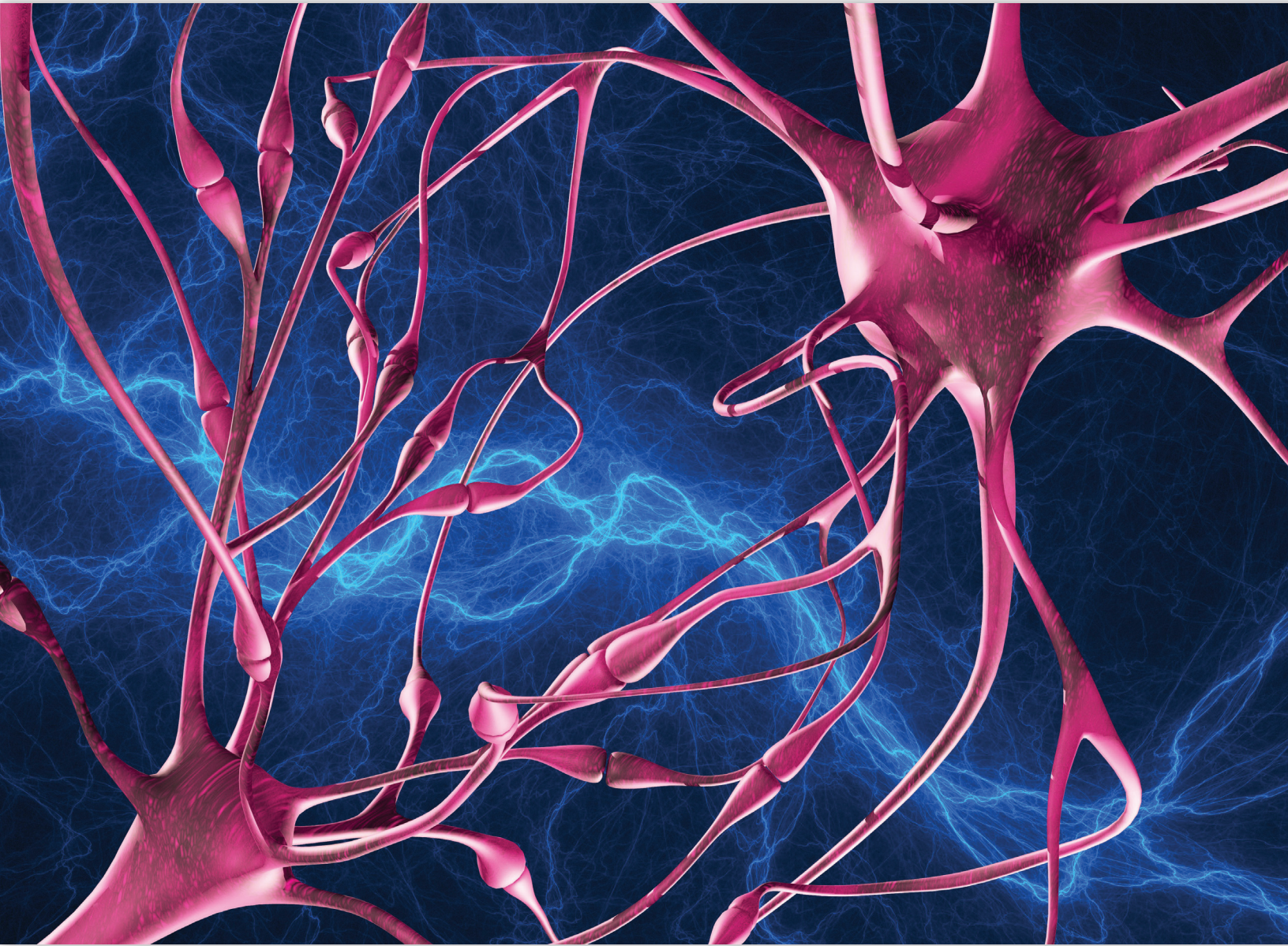# Addressing the Healthcare Connectivity Challenge: Selecting a Health Service Bus

INTERSYSTEMS®

Addressing the Healthcare Connectivity Challenge: Selecting a Health Service Bus

Introduction

In healthcare, information accessibility can impact the outcome of a medical decision, or the success of a bundled payment initiative. To ensure that the right information is available at the right place and time, healthcare organizations typically have used HL7® interface engines to share data among clinical applications. But the demands on healthcare information technology are changing so rapidly that these simple engines are no longer sufficient.

- New data sharing and interoperability standards and protocols arise and evolve continuously

- The volume, variety, and velocity of data — including images, genomic data, and other outputs from new diagnostics, therapeutics, and monitoring devices — are constantly growing

- Business models are evolving from fee-for-service to pay-for-value, creating demand for greater care coordination across care teams that include the patient and health plans

To keep pace with these demands and reduce the burden they place on in-house software development, many healthcare organizations have turned to enterprise service bus (ESB) products and their support for service-oriented architecture (SOA). Specifically, they have been looking to:

- Make the organization's data easier to capture and use

- Deliver information into existing applications and clinician workflows for better care coordination

- Keep up with rapidly changing healthcare communication and interoperability standards by leaving that task to the ESB vendor

The utility of ESBs and SOA is not limited to a specific industry. It is important to remember, however, that these technologies were developed to address the needs of e-commerce and online retail. They were not built with the special challenges of the healthcare environment in mind.

The early explorers of ESB technology in healthcare found that most products didn't address all of their unique business needs. Most important, these ESBs enabled connectivity but not interoperability. They allowed different systems to communicate but could not eliminate the bottlenecks presented by different data models, coding and content standards, vocabularies, and use of structured and unstructured data such as laboratory results and clinical narratives. These deficiencies can lead to costly and inefficient workarounds. Over time, CIOs, CMIOs, and their IT departments are often unable to keep up with the need for more connections, better use of information, and faster-paced innovation.

Choose an ESB engineered for healthcare

The availability of a healthcare ESB, a "health service bus," is a game-changer. The health service bus is a natural evolution of ESB technology. It combines the sophisticated SOA features found in non-healthcare ESBs with support for healthcare interoperability standards, native high-performance data management, and the ease of use and rapid integration associated with HL7 interface engines.

SOA: To be successful, healthcare organizations must follow a practical approach to SOA. This means using a proven health service bus that combines essential SOA features with healthcare-specific interoperability, functionality, and standards.

The remainder of this document provides guidelines for selecting a health service bus to meet the demand for better, more coordinated, and more cost-effective care. These guidelines are organized under five categories: standards and interoperability, data, ease of management, mobile and composite application development, and business model change.

Standards and interoperability

Evolving standards

Most non-healthcare ESB products are designed to support relatively simple e-commerce and other Web-style applications. The assumption is that there are only a few applications in play and that these applications offer extensive Web services — unlike in a typical integrated delivery network (IDN) or hospital environment. There is little to no support for standards-based healthcare data sharing, since this concept typically has little meaning outside of healthcare. In addition to HL7v2 and HL7v3, a health service bus should support:

- FHIR®, CDA®, CCD®, IHE profiles, NwHIN Direct, DICOM, and X12

- Outside of the U.S., it's important to also support the ITK (U.K.), NEHTA (Australia), and DMP (France) standards and protocols

A lack of understanding and rich support for these messaging standards — and their idiosyncrasies — is a major shortcoming of non-healthcare ESB products when used within a healthcare setting. Non-healthcare ESBs, for example, may fall short in addressing common health information exchange challenges, such as producing information in the format required by a receiving system. A health service bus, on the other hand, will be able to take data in the source system's format and translate it into the required format (such as HL7 or CDA/CCD) for delivery to the target system.

FHIR: InterSystems and a growing number of organizations are adopting the emerging FHIR (Fast Healthcare Interoperability Resources) standard. When fully specified, FHIR will complement other standards, such as those from IHE (Integrating the Healthcare Enterprise), which are essential for the interoperability and exchange of complete health information documents. In the near term, FHIR will likely play a major role in the granular exchange of health information in mobile applications.

Certification

Certified interoperability also has a special role within healthcare. The aggregation and sharing of complex data records — specifically, composite patient records — among multiple applications is a challenge unique to healthcare. No other industry has confronted a problem similar to health information exchange. Doing this successfully — while respecting healthcare's security, privacy, and consent concerns — requires a rigorous and robust implementation of health interoperability standards. Organizations seeking healthcare interoperability should look for:

- Multiple current certifications from IHE USA and ICSA Labs to ensure that the chosen product can deliver the required interoperability

- Detailed and proven support, and a multiyear commitment, for multiple IHE Profiles and domains

IHE: Integrating the Healthcare Enterprise is an initiative focused on improving the ways in which computer systems in healthcare share information. It is the de facto standard for complete and composite health information exchange. IHE International continually improves these interoperability standards, and current IHE certification of products is essential for ensuring interoperability. IHE certification goes beyond what's demonstrated at a single "Connectathon" event (another important test of interoperability) and is more reflective of a product's ability to interoperate right now, in the real world.

Data

Scalability

The messaging traffic of integrated systems and the quantity of information to support them will increase dramatically as your healthcare enterprise grows, more medical devices are connected, home health data sources are integrated, new diagnostic tests produce reams of complex data, and they all are connected into the electronic health record (EHR) system. The health service bus must be massively scalable — able to support your legacy applications as well as new big data, social, mobile, and cloud computing needs.

Look for a platform that supports a variety of data types — structured, unstructured, images, documents, and messages — and that can combine clinical, administrative, genomic, and patient-entered data within a consistent, easy-to-manage environment. It should have demonstrated capabilities to guarantee the delivery of millions of HL7 messages each day, process complex multi-megabyte X12 and CCD documents, ingest genomic variant files, and support API-based connectivity to analytics platforms.

Strong data management capability and capacity are also crucial when you're ready to expand the service bus from simply passing messages to supporting critical services for full health information exchange, such as:

- A master patient index
- Patient consent
- Aggregating a comprehensive health record across multiple providers, locations, and episodes of care
- Analytics

Reliability

No matter how much you harden your information systems, there will always be something beyond your control threatening to take them down. A rock-solid technology foundation is essential in an environment where people's lives are at risk. System downtime and data corruption are unacceptable.

Reliability for a health service bus means proven performance, guaranteed message delivery, and the ability to minimize downtime through automatic recovery from hardware failures without data loss.

Proven performance
Mission-critical infrastructure technology, such as a health service bus, must be proven in widespread use, in complex and simple IT environments. And it must operate without undue complexity, which can hinder manageability, lead to instability of integrated systems, and continually put your organization in "fire-fighting" mode.

Guaranteed message delivery
Critical healthcare data must always be available at the point of care, exactly when needed. You can avoid data loss and message delivery delays if your choice of health service bus includes a high-performance enterprise-class database that stores all messages and process states.

Minimal downtime
In the event of a hardware failure, power loss, or other adverse event, the health service bus must provide recovery options to match your service-level goals and tolerance for latency.

Ease of management

A solution is developed once, but the need to manage it is long term, making ease of management a critical selection factor. Connected healthcare solutions can be difficult to manage because they link disparate application components, often spanning multiple hardware platforms, operating systems, and technology frameworks. A health service bus must provide management capabilities that can perform equally well in hybrid environments (on-premise and cloud-based).

The health service bus should provide a single, consistent management portal to view, monitor, and manage all components of such solutions.

Automated alerts to system issues

The problems most likely to be encountered with ESBs are not found during development and testing; they're discovered in the operational phase. Despite good intentions and best practices, applications will continue to go offline, and software upgrades will occur without everyone being informed. Network and data errors will occur. So it's crucial that a health service bus include robust and flexible event monitoring and alerting to inform key people when problems occur. There must also be easy and powerful mechanisms to quickly diagnose and correct these issues.

Features to look for include:

■ Dashboards for viewing system status at a glance.

■ Automated alerts via email, phone, or other means upon detection of significant events — whether something has happened (e.g., a message queue has exceeded its limits for that day and time) or has not happened (e.g., there have been no messages from the emergency department in a given period of time). Alerts should enable operators to quickly understand the problem and provide a fast way to diagnose and fix it.

■ The ability to aggregate, analyze, and report on messages flowing through the system, without resorting to external database and analysis software.

■ The ability to stop, start, and upgrade individual interfaces while the system is running.

■ The ability to trace any message through the system, to see how it's transformed at each stage and any errors associated with it, along with the duration of each step in the process.

Applications as services: Partners HealthCare, a major U.S. integrated health system based in Boston, has used InterSystems HealthShare to enable more than 200 enterprise applications for use as software services across its network. These services form the basis of Partners' Event Notification Framework, which provides valuable alerts and other services to the entire Partners network.

Business process orchestration and human workflow

A business process is a sequence of operations performed to complete an objective, such as checking a patient into a hospital. Orchestration is a design activity that focuses on process rather than on technology.

Taking this view, the health service bus should provide graphical tools that enable analysts or developers to diagram processes and information flows, including rules and workflow, with a focus on the logical interactions between systems.

Typically, an ESB focuses on synchronous requests and replies — yet most healthcare organizations function asynchronously, sometimes with processes occurring over long periods of time. A health service bus that also supports event-driven, asynchronous, and long-running business processes is essential to successful service bus use in healthcare organizations.

For the greatest efficiency and powerful composite applications, look for a health service bus with:

■ A rich graphical editor for diagramming process and information flows

■ Automatic generation of code from business process diagrams

■ Support for long-running business processes, including human workflows

■ A workflow engine to distribute and move tasks among users while incorporating their decisions automatically into the business process

Mobile and composite application development

When healthcare organizations move from custom-developed software to packaged solutions, innovation — such as a successful navigation to managed care or the creation of task-specific mobile applications — becomes more difficult. The organization can become locked into its software vendors' product timetables and road maps. One goal of adopting a health service bus is to enable local innovation while preserving the economies of scale provided by packaged solutions. A health service bus should support SOA and important healthcare interoperability standards as a means to extend the behavior of purchased applications or the creation of lightweight mobile apps. Support for FHIR, in particular, is important for extracting and delivering task-specific data to support the shift to social, mobile, and cloud computing that is reshaping the healthcare landscape.

Even after internal and external resources are orchestrated via the health service bus, there is often a gap between the functionality that users expect and what is delivered to them. The ability to quickly and easily create business logic — composite applications — to fill that gap without bringing on additional developers and development tools or delaying the project is essential. Look for health service bus products with strong development capabilities, including:

- A single, consistent graphical development environment encompassing service creation, business process orchestration, business rule creation, data transformation, workflow, event processing, and dashboard creation

- Rule-based message routing

- Rapid development capability to complete projects when existing back-end services can't provide all of the required business logic or data, and for creating mobile apps

- Service wrapping — the ability to provide services based on applications that don't offer web services

- Service exposure and consumption without coding

The development environment should enable you to create mobile and other composite applications, whether the underlying services, applications, and data sources are deployed on-site or in the cloud. A health service bus should deliver on the promise of "run everywhere," orchestrating calls via APIs or web services to the enterprise applications whose data is needed to make the mobile applications work. Innovation in healthcare also advances with new medical devices, so the health service bus must enable you to connect these devices to data-gathering applications (such as EHR systems) in an economic and predictable manner.

Unified technology: Be wary of ESB/SOA platforms that have been assembled by a vendor through mergers and acquisitions. You may spend more effort integrating your service bus than you do connecting your enterprise. Insist on a unified platform.

Business model change

A path to strategic interoperability

Healthcare IT is shifting to support the evolution of care reimbursement from fee-for-service to pay-for-value models. Healthcare IT's evolution from simple HL7 interface engines to strategic interoperability platforms parallels that shift. Pay-for-value aligns the incentives of payers, providers, and patients with the goal of more coordinated, higher-quality, and more cost-effective care. Strategic interoperability supports pay-for-value through the aggregation and sharing of comprehensive health records across the care community — among providers, payers, and patients — in a timely and meaningful way.

Pay-for-value: The Centers for Medicare & Medicaid Services (CMS), a major driver of healthcare payment reforms across the industry, plans on having 30% of Medicare payments tied to quality or value through alternative payment models by 2016. By 2018, 50% of the more than $500 billion per year that CMS pays out will be through alternative payment models.

To achieve strategic interoperability, choose a health service bus that includes a unified service-oriented framework that enables you to expand its capabilities and to avoid having to integrate the components before using them. Expanded capabilities to consider include health data aggregation and normalization to create a comprehensive health record, along with master patient index, workflow, consent, terminology, clinical portal, analytics, and patient engagement functions.

While serving as a primary actor in the success of value-based payment, the health service bus must be easy to manage and proactive in alerting managers to system issues. It also must provide the ability to quickly model and support new and changing business processes to facilitate greater business agility.

The final questions

Support and vendor accessibility

Vendor support for any mainline application in healthcare is critical. It's even more critical for integration solutions that unite multiple applications and web services. Ask other users of the integration software about the level of knowledge and dedication of the vendor's customer support personnel.

- Will you be able to immediately reach an engineer who understands healthcare and is familiar with your situation, by telephone, 24/7?

- Does the vendor have support specialists in your time zone?

- Has the product lived up to the vendor's claims?

- Has the vendor been there for its customers before, during, and after product rollout?

- Has customer service exceeded expectations?

HealthShare Health Connect

HealthShare Health Connect is InterSystems' health service bus, providing integration based on global healthcare information protocols and messaging formats. Health Connect delivers the high-volume transaction support, unparalleled process management, and continuous monitoring required for the "always on" business of healthcare. Health Connect features include:

- Certified standards-based integration

- Business process and workflow management

- Data transformation

- Event detection and monitoring

- Scalability and security

- Visual diagnostics and auditing

Additional modules in the HealthShare family extend the product to address your growing requirements. These modules include:

- **HealthShare Information Exchange**, uniting all of the functionality and technology needed for broad-based interoperability and secure health information exchange

- **HealthShare Patient index**, a single source of truth for patient identity within a healthcare enterprise or across a health information network

- **HealthShare Personal Community**, a comprehensive and extensible solution for the creation of engaged patient communities

- **Health Insight**, to deliver the data for advanced healthcare analytics

To learn more

Contact us to discuss your transition to a health service bus and service-oriented IT infrastructure, and to learn how InterSystems can help you succeed:

- info@InterSystems.com

- 1-800-753-2571 or +1-617-621-0600.
Visit InterSystems.com/contact for a link to the number of your local office.

[1] "Setting Value-Based Payment Goals — HHS Efforts to Improve U.S. Health Care," by Sylvia M. Burwell, Jan. 26, 2015, NEJM.org.

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