

Immutable Data for Scalable Interoperability

Challenge

How to resolve discrepancies across multiple sources of truth (systems of record) to construct a single, canonical patient record that is essential to support better care at the point-of-service and to achieve better health outcomes?

The current information model in health IT is critically outdated and has hit its ceiling in terms of producing a patient record that can be reasoned about, clinically or otherwise. A key limitation is accessibility of patient data at the point of care in a context relevant to telling the patient's story and facilitating the resolution of knowledge gaps. That story from the point of view of any one system of record is currently fragmented, reflecting the episodic nature of patient care, with the provider having no practical way of discerning where those gaps exist across the multitude of other systems of record in which their patient's data resides.

Solution

Employing a simple, fact-based, metadata-rich, and time-savvy information model predicated on data immutability and the continual accumulation of new information over time allows the user to capture the transaction context, including the *who*, *what*, *where*, *when*, and *why* of a given fact, and whether a fact is being inserted or is no longer true. This transaction is not limited to a clinical service; rather, it overcomes the episodic accumulation of patient data, integrating them into a well-informed, up-to-date continuum of patient information. This makes it possible to construct entity (*patient*) "stories", where confidence in the factual data representations can be expressed in relevant ways at point-of-service encounters, thereby overcoming the current data fragmentation associated with dispersed patient data.

Benefits

For Developers:

- Leverages the unique capabilities of, and existing investments in, third-party database technologies such as InterSystems Caché, G.T.M, MarkLogic, and other databases.
- Supports a wide variety of SQL databases, including those that provide a complete JDBC driver (Oracle, SQL Server, PostgreSQL, etc.)
- Supports a number of popular NoSQL storage options, including, but not limited to, Cassandra, DynamoDB, CouchDB, Riak, and Inifinispn.

For Users:

- Enables a longitudinal patient record for patient and provider care services.
- Enables a more accurate view of data in real-time Business Intelligence (BI) dashboards.

For System Administrators:

- Uses a unique Master Identity Index (MII) to manage surrogate keys by default.
- Provides an always up-to-date data lake of immutable data across time.
- Provides on-demand snapshots of data for identified business or clinical scenarios.
- Enables synchronization between MII database ForeverDB™ and both upstream systems-of-record and downstream applications or other consumers.
- Enables an easy integration point for third party solutions.
- Creates a fast on-ramp for merger and acquisition scenarios as the Healthcare industry moves towards consolidation and vertical integration.
- Cloud hosting reduces capital and operational costs.

Highlights

- Industry-standard HL7 FHIR® is employed for the core data model for long-term storage.
- Data can be queried at any point in time, even according to the schema that was in force at that time.
- Schemas can change as needed without impacting the integrity of the data stored from that point, whether forwards, backwards or from other systems-of-record.
- Queries can be conducted over arbitrary ranges of time and time periods.
- Queries can be conducted “as if” a new collection of information were added to the system, before actually transacting that data into the system.
- The evolution of certain identities in the database, and how those identities evolved over time, can be reconstructed, including changes to the schema itself that affected this evolution.
- Fosters inter-system communication and collaboration.
- Supports the heavily regulated domain, where security and auditability are mission-critical based on the need to share information across organizational boundaries.

Summary

Through our new information model and ForeverDB™ database management system, we are able to facilitate interoperability between enterprise SORs in the presence not only of semantic and syntactic differences, but also of organizational boundaries, including the practical challenges that those create. The historical accuracy of all data is maintained by accumulating, rather than overwriting, changes in the data, further fostering true interoperability by reconciling data discrepancies and offering a comprehensive and accurate view of the patient record over time as well as at the point-of-service.