BK Medical
Distributed Systems for Medical Ultrasound

BK Medical moves further towards the Industrial IoT with ultrasound system architecture research

Modern ultrasound medical systems serve a number of diagnostic and therapeutic functions. Although they are designed to be portable and easy to use, they are standalone systems that meet specific needs at a specific place and time. Image interfaces and connectors are built to enable access to the patient information they gather, which is essentially centered around the device (Fig. 1).

Figure 1. Modern standalone ultrasound system.

Because of the growing number, variety and complexity of medical devices, they must evolve to become more readily and easily integratable into both hospital care systems and research laboratories. The data has to be better maintained for both patient records and to meet the increased regulatory and legal compliance. Ultimately, the goal is to improve both healthcare quality and practices.

To build out these new product capabilities, BK Medical decided to embark on a multi-year research program. The program aims to determine the extent to which their standalone ultrasound systems can be integrated into multiple distributed systems, without losing any

current functionality. The program is also mindful of impacts to the hospital environment, future plans for the Industrial Internet of Things and cyber security.

Challenge

As a large distributed system scales, the ability to simultaneously maintain or enhance performance and reliability creates its own set of unique challenges. How do you address the distributed future, ensure you learn from your past experiences and build on the investments customers have already made? The challenges are real, and in the process of overcoming them BK Medical is building healthcare systems that are more cost effective, and provide greater integration into the patient care systems to facilitate improved decision making for doctors.

Part of the process of distributing an ultrasound system requires determining how much of the existing standalone system can be deconstructed into constituent elements while retaining functionality, reliability and performance. This might include the transducer for obtaining the data, the algorithmic engine for processing data, the display device for presenting images and the integration with back office systems (Fig. 2).

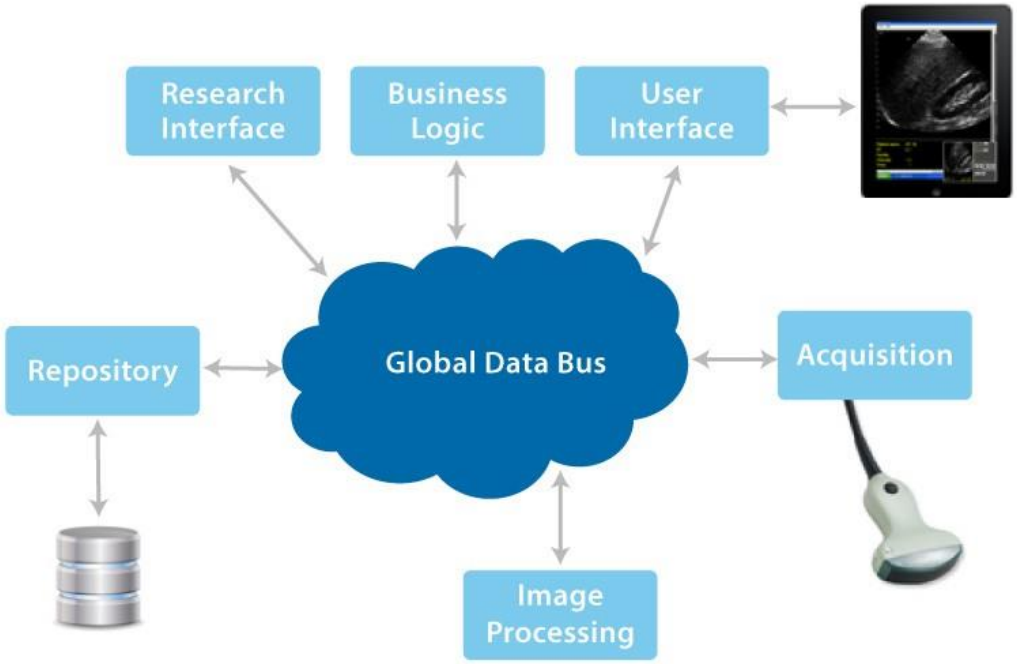

Figure 2. Future ultrasound system architecture.

Shifting from a centralized, tightly-coupled, standalone architecture to a distributed system significantly impacts the development methodology. The distributed sub-system development teams need greater autonomy to evolve and develop features specific to their function. Ultimately, the architectural approach must simultaneously meet both system and developer needs.

The Solution

Early in their process, BK Medical identified data as the key integration point. However, the complexity of the data quickly became apparent. They had to consider both the type of data, as well as how it was used in the system:

- How often it was updated
- How quickly various sub-systems needed access to it
- How reliably it could be delivered across various media, including wired and wireless

They looked for a way to manage the data consistently across all their independent developers while simultaneously, but independently, enhancing performance capabilities for very large data-streams from the scanner.

Because each distributed system is modular and potentially independently developed, BK Medical needed a mechanism that focused on data to ensure a loose-coupling between system elements. They opted to use a global data bus and a data-centric design approach that includes management tools for performance, reliability and other system attributes. As a result, they would not only decouple applications from each other, but also decouples applications from the need to understand or know anything about underlying physical delivery media or network topology.

Results

The main benefit of using a Connext DDS-based Global Data Bus was flexibility that helped to:

- Develop applications independently
- Implement plug and play, and assess proprietary and commercial hardware architectures
- Finely control performance
- Provide real-time response and action in a distributed system

DDS readily addresses the challenge of mixing real-time communications with IT infrastructure, an essential requirement for BK Medical ultrasound systems.

Due to the flexibility DDS offers, features can be developed independently of the need to integrate security into future releases. RTI Connext DDS Secure can be easily and smoothly added to any legacy system.

As hospitals and healthcare providers establish their communications infrastructure, their suppliers must adapt their system architecture to meet emerging needs. The data-centric

approach adopted by BK Medical ensures that their distributed system architecture will lead the way, both for ultrasound system technologies, and integration with the Industrial IoT.

ABOUT RTI

RTI provides the connectivity platform for the Industrial Internet of Things. RTI Connext® messaging software for smart, distributed applications allows devices to intelligently share information and work together as one integrated system. RTI was named "The Most influential Industrial Internet of Things Company" in 2014 by Appinions and published in Forbes.

Our customers span the Internet of Things, including medical, energy, mining, air traffic control, trading, automotive, unmanned systems, industrial SCADA, naval systems, air and missile defense, ground stations, and science. RTI provides the leading implementation of the Object Management Group (OMG) Data Distribution Service (DDS) standard.

ABOUT THE INDUSTRIAL INTERNET CONSORTIUM

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