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Medical Device Integration for Better Decision Making in the Healthcare Industry: A Case Study From Engineering Ingegneria Informatica S.p.A

March 11, 2019

Vichitra Godamunne

Medical devices that communicate with one another...sounds futuristic (or like something from a science fiction movie or novel), but it's happening today. Engineering Ingegneria Informatica S.p.A, an Italian based software solutions provider, developed a Medical Device Integration (MDI) solution that enables devices to communicate securely, efficiently, and intelligently, enhancing patient care and monitoring capabilities. And to create their solution, they rely on the entire WSO2 Integration Agile platform.
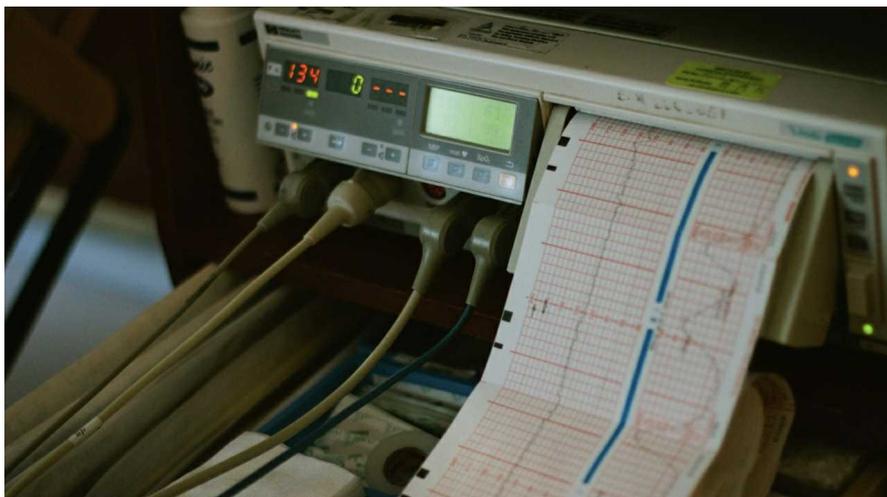
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Medical Device Integration with the WSO2 Integration Agile Platform

MDI comes with its distinctive set of challenges. Communication between medical devices is complex, hence each device needs a standard and secure communication protocol based on multiple channels. Then there's the issue of processing thousands of events. A large hospital has a multitude of patient data, generated from thousands of sources. Engineering Ingegneria Informatica S.p.A needed to analyze these events and view patient data in the form of trend lines on customized dashboards. Also needed were monitoring dashboards displaying data regarding the status of devices.

The architecture behind MDI makes use of WSO2 Identity Server, WSO2 API Manager, WSO2 Enterprise Integrator, and WSO2 Stream Processor, along with WSO2's IoT platform (now developed and supported by Entgra). To begin with, WSO2 Identity Server – a holistic identity and access management product – makes this solution and communication between components secure by using protocols such as OAuth2 with JWT tokens. This identity platform also generates tokens to access WSO2 API Manager.

WSO2 Enterprise Integrator facilitates all the communications in this solution and comes with integration runtimes, message brokering, and business process modeling capabilities. This agile integration platform is responsible for communicating with external modules, between the various devices and the central MDI system, and with Terminology Services to perform compensation and transformation of incoming/outgoing streams. Furthermore, WSO2 Enterprise Integrator provides technology for this solution to generate alerts or notifications from MDI to application solutions.

WSO2 Stream Processor – a lightweight stream processing platform – analyzes clinical messages from the device driver in real-time. Technical and clinical information has been divided into different complex event processing (CEP) flows. This makes it possible to manage technical warnings or CEP feeds of clinical data, and the machine learning component acquires and refines classified algorithms to help predict critical situations. WSO2 Stream Processor, in particular, has helped Engineering Ingegneria Informatica S.p.A to address the challenges of processing and analyzing the many events and the need for a customized dashboard.
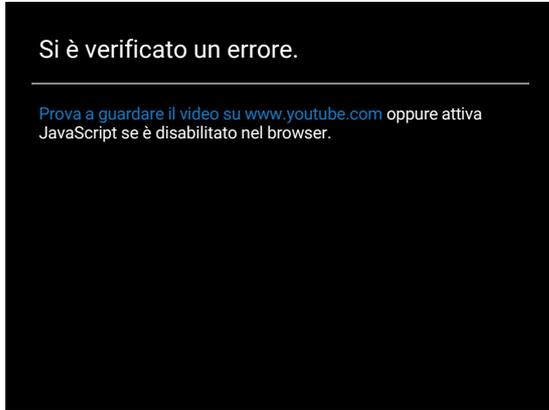
The IoT capabilities are used to develop device drivers with installation packages. Each device driver has a health module that transmits technical information (which ranges from data like the heartbeat to the status of components). Each driver is also able to transform specific device protocols (such as RS232, HL7, etc.) into an encrypted generic platform message, thereby eliminating the need for MDI to identify each protocol.

The Benefits for Patients in Real Life

There's quite a complex architecture in operation, so how does it function in a real-life situation? Marco Mastroianni, a software architect at Engineering Ingegneria Informatica S.p.A, explains how their solution applies to an Intensive Care Unit (ICU). Patients in the ICU are dependent on monitoring and life-sustaining devices where the use of information from combined (or integrated) data sources play a critical role in predicting a patient's condition. Underpinning everything is time and the speed of communication. In such environments, monitoring capabilities and notification mechanisms come to the foreground. The data generated by these devices appear in the form of signals which is of value to signal processing techniques. Therefore, this process helps to both monitor patients and design algorithms that are used to implement patient alarms.

Patient monitoring is not limited to hospital premises – the MDI solution helps to monitor them in their homes too. Monitoring is dependent on communication between devices, how they're managed, and how patient data is received by medical professionals. An MDI solution such as this reduces the probability of errors (particularly human errors) – greatly supporting the wellbeing of patients and the quality and speed of decision making.

You can listen to Marco's presentation for more details on the MDI solution built by Engineering Ingegneria Informatica S.p.A.

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