



Success Story

Virtual Labs Powering Connected Care Validation at Scale

How a Fortune 500 Healthcare Company
Accelerated Connected Device Testing
Through Virtualization



Summary

A Fortune 500 healthcare company with a broad portfolio across critical, hospital, nutritional, and surgical care embarked on a strategic initiative to build hospital-scale connected care programs. By integrating smart beds, infusion pumps, nurse call systems, and vitals monitoring devices, the company aimed to enable real-time visibility, seamless clinician workflows, and precision patient care.

The healthcare major transformed their connected care validation strategy by implementing Doppelio's virtual lab platform.

Facing the challenge of testing thousands of interconnected medical devices at hospital scale, the company moved beyond physical lab limitations to achieve comprehensive validation through virtualization, enabling faster release cycles and improved system reliability.



Key Validation Requirements

To support this vision, the company needed a robust validation strategy capable of handling:

1

Hundreds of connected devices simultaneously

Testing at true hospital scale with realistic device densities

4

Real-world hospital workflows under load

Validating clinical processes under realistic operational conditions

2

Diverse Devices

Supporting several communication standards across device types including TCP, UDP, MQTT and medical standards like HL7 and DICOM

5

EMR integrations across multiple systems

Ensuring seamless data flow to electronic medical records

3

Fault tolerance and alarm propagation

Testing critical safety systems and emergency response protocols

Physical Testing Limitations

The company invested heavily in a sophisticated physical validation lab with multiple servers, network infrastructure, and a limited set of devices. However, this approach had critical limitations:

1

Limited device availability in lab for scale testing

Physical constraints prevented validation for hospital-scale deployments and beyond

4

Complex setup for each test scenario

Time-intensive reconfiguration between different test cases

2

Challenging to validate complex workflows

Existing simulators had limitations to simulate EMR integrations and complex workflows

5

Inability to simulate fault conditions

Difficulty reproducing network failures and edge cases safely

3

Slow regression testing cycles

Extended timelines impacting release schedules and quality assurance

Doppelio Solution

Doppelio's platform enabled complete virtualization of the medical device ecosystem, creating realistic digital twins that behave identically to physical devices while supporting massive scale testing.

Implementation Approach

Device Virtualization

Created virtual doppels of infusion pumps, connected beds, nurse call systems, and central stations

Protocol Support

Modeled complex communication flows over MQTT, TCP, and UDP with unique IP addresses and port configurations

Behavioral Modeling

Simulated events, alarms, drug downloads, configurations, and OTA updates with stateful behaviors

Fault Injection

Introduced network faults, firmware mismatches, and latency variations for comprehensive testing

Automated Testing

Enabled regression, load, and performance tests with hundreds of devices at the click of a button



Results & Business Impact

Operational Benefits

Hospital-scale validation without device fleets

Continuous and reproducible testing

Accelerated product release timelines

Comprehensive fault scenario coverage

Authoritative test reports for compliance

Technical Achievements

Validated real workflows under load conditions

Verified cloud telemetry consistency

Tested alarm propagation and responsiveness

Ensured interoperability across systems

Supported middleware and integration layers



"Virtual labs gave us the scale and flexibility we needed to validate hospital workflows thoroughly – without waiting for physical devices or setting up complex labs."

— Senior Program Manager, Connected Care



Technical Highlights

The solution addressed complex technical challenges inherent in medical device ecosystems:

Multi-Protocol Support

Seamless handling of TCP, UDP, and MQTT communications with realistic timing and behavior

Network Topology

Virtual devices acting as both clients and servers with unique IP addresses and port configurations

Stateful Simulation

Maintained device states across test scenarios, including configuration changes and firmware updates

Load Testing

Concurrent simulation of hundreds of devices generating realistic data flows and alarm conditions

Integration Validation

End-to-end testing from device level through middleware to EMR systems

Why Virtual Labs Matter

As hospitals increasingly depend on interconnected medical devices, the ability to validate complex systems at scale, early and continuously becomes critical. Virtual labs provide a repeatable, cost-efficient, and scalable alternative to physical test environments, accelerating innovation while maintaining safety and reliability standards.



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Customers Do**

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