

White paper

The value of workflow simulation

Improving clinical workflows
across entire departments
using Digital Twin technology

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Value
Partnerships

Edition #02



Executive Summary

Digital twin technology has proven its value in manufacturing, where use of connected technology to monitor performance, model processes, and optimize efficiency is already a mainstay of “Industry 4.0”. The link between the physical and virtual worlds is a key facet of this emerging manufacturing paradigm. Now, through the efforts of multi-disciplinary teams, hospitals are creating four-dimensional digital twins of patient care to simulate workflows. They’ve realized the value of running “what-if” scenarios for optimizing departmental operations.

Simulating workflows using a digital twin can help healthcare enterprises identify ways to enhance and streamline processes, improve patient experience, lower operating costs, and increase higher value of care. The digital twin creates models of physical spaces and processes. Then, cost and quality optimization parameters are examined and ultimately selected based on the insights gained from simulations. These insights can be further enhanced with complimentary technologies like Real-Time Locating Systems (RTLS), which provides a robust data source and a means to test changes in layout, process, etc.

The key to success of simulating workflows leveraging digital twin models is a strong partnership between the hospital and a technology provider who understands the clinical, workflow, and financial imperatives of healthcare providers. Siemens Healthineers creates Value Partnerships with provider organizations in order to help them create value and optimize care delivery.

This white paper will discuss the successful implementation a digital twin model to simulate and optimize workflows and the vital role Value Partnerships play in building a digital twin.

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Introduction

Simulations are commonplace in many work environments. They help to identify strategies that work, and possible avenues for improvement, without the time and expense of rearranging real-world enterprises.

Simulations are especially important for complex, high-risk and/or technical tasks. Aircraft pilots train on simulators all the time. Medical students perform tasks on simulation mannequins so that they can identify issues with a technique in a safe, controlled environment.

A digital twin is a four-dimensional model (here, time constitutes the 4th dimension) of a care unit, multiple departments. A digital twin links the physical and virtual worlds, turning data into actionable insights. This is a key facet of the emerging manufacturing paradigm known as Industry 4.0.

Digital twins model key aspects of a healthcare enterprise:



Physical layout – the spatial dimensions for a specific department or function. This includes reception, registration, waiting areas, doctor's offices, exam rooms, equipment and furniture placements, and more.



Flow and Resources – robust data captured on doctor, patient and equipment movement is incorporated into a digital twin, adding an invaluable layer of process-related insight to the model.

A digital twin enables healthcare providers to move assets around, reconfigure departments, and see the effects of changes to the simulated environment. Because it models so many dimensions, the twin produces a detailed look into how the hospital is working. The effectiveness of a healthcare facility digital twin can be enhanced by leveraging powerful data sources like Real-Time Locating

Systems. RTLS tracks the movement of equipment, files, even individuals, and can refine the twin's accuracy in simulating processes. RTLS data can also enable use of the digital twin to predict the availability of equipment and resources, and can rapidly assess the real-world effect of changes suggested by simulations.

Nevertheless, it is not necessarily required RTLS data, it is also common to use other data sources for simulations enhanced with measurements and on-site interviews.

Key uses for digital twins in healthcare institutions

There are three primary domains where digital twins can be effective in healthcare:

- Predicting the outcome of a specific scenario; perhaps a reorganization of the patient flow and clinical workflow in a specific department.
- Evaluating, on a quantitative basis, the impact of different layout scenarios, such as re-arranging examination rooms or distributing and splitting waiting areas for specific modalities.
- Performing operational stress testing on a department.

Simulation modeling has been used for quite a while across industries, in order to get the most out of their facilities and people. In healthcare there are a couple of situations where simulation modeling is very helpful such as a typical departmental operation or extreme situations like emergencies that lead to sudden influx of patients. Simulation modeling helps hospitals to be at their best on 'normal' days, and also during high-stress emergencies.

Workflow simulation in medical imaging

Medical imaging facilities are using workflow simulation to predict the impact of operational changes in a protected and virtual 3D environment by forecasting processes and layouts with a digital twin of their institution. In the US, for example, there are more than 80 million CT scans performed annually¹, and that number is continually increasing. This huge demand for diagnostic medical imaging is a logistical challenge for providers around the world. How can they make the best use of space, equipment, and staff to provide the best possible care for patients? The value of a robust, high-fidelity simulation in this situation is clear.

"We're tracking the patient from check-in to reports being furnished to the patient," says Helen Calvey, Country Lead Ireland, Enterprise Services for Siemens Healthineers. "All of that information is put into the model. We come up with a very patient-centered workflow." By building a dynamic model of a care facility, a provider organization can identify and spread best practices in order to improve efficiency, patient experience, and quality of care.

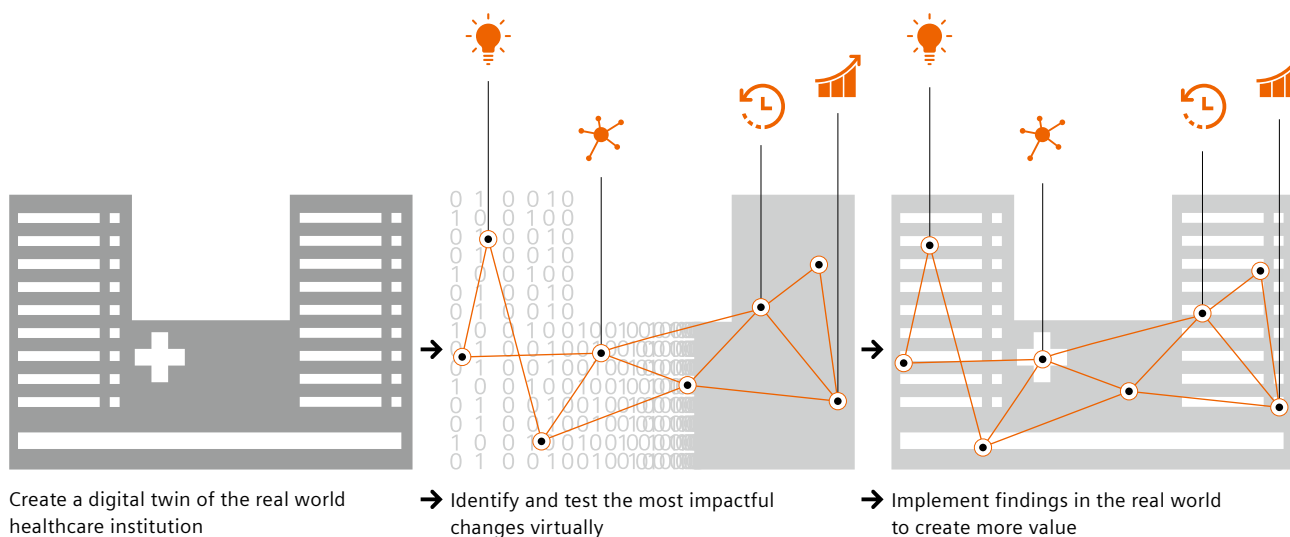
¹ Harvard Business Review: Radiation risk from medical imaging
<https://www.health.harvard.edu/cancer/radiation-risk-from-medical-imaging>

Partnership: The key to successful development

A partnership with multiple parties, both internal and external, is necessary to simulate a workflow using digital twin technology. Clinical staff, hospital workers, receptionists, appointment schedulers, administrative team members, hospital architects, and a committed, qualified technology partner all play key roles in creating an effective digital twin.

And that technology partner has to be much more than a vendor. Healthcare organizations are looking for guidance on how they can optimize performance, expand capabilities, and advance innovation to deliver higher value of care. Siemens Healthineers has developed Value Partnerships, long-term, performance-oriented partnerships with MedTech offer providers expertise for successful projects.

Under the Value Partnerships umbrella, Siemens Healthineers helps to address specific domains and enhance value. Value Partnerships provide our healthcare partners complimentary technology, operational, facility, and workforce solutions. These collaborative engagements can also include holistic initiatives for excellence in strategic transformation and digital innovation. Together, we can improve efficiency with innovative technologies, such as digital twins and RTLS.



Success stories

Medical University of South Carolina, United States

Exceeding expectations and expanding capabilities

Public/Private:	Public
Beds:	1,600
Duration:	10 years



Medical University of South Carolina

Scope of Partnership

The Medical University of South Carolina (MUSC) faced challenges in driving performance, clinical excellence, and significant value. In 2018, the organization entered into a 10-year Value Partnership with Siemens Healthineers to implement new capabilities, streamline existing workflows, and provide innovations in care delivery. This collaboration helped MUSC support its expanding pediatric, cardiovascular, radiological, and neuroscience footprints with enhanced performance and workflows.

MUSC sought to overcome fragmentation, costs, and inefficiency in healthcare delivery. To meet these goals, Siemens Healthineers offered technology management services and operational optimization. It includes the delivery and commissioning of over 100 medical devices, covering all medical imaging technology, as well as “digital twin” technology – or virtual replicas of healthcare facilities. This relationship also offered advisory expertise for optimized clinical capabilities, reduced length of inpatient stays, and increased revenue due to greater testing capacity and fewer same-day cancellations.

Key services

- Development of digital twins based on facility layouts and observed workflows.
- Provision of medical technology and upgrades for seamless integration
- RTLS-enabled layout planning and process optimization
- On-site project management and coordination of third-party vendors

Established Benefits

- RTLS data incorporated into the electronic health record (EHR)
- Digital twins built according to EHR data on facility processes
- Direct observation and process mapping to optimize floorplans
- More efficient workflows for a 33% increase in daily PET-CTs

“The Siemens [Healthineers] partnership allows us to think and perform differently than we could on our own. With this new building we have expectations about creating our operating rooms or theaters and recovery spaces in a certain way. The partnership allows us to plan for that differently – to think methodically through precise ways we can impact [the patient and family experience].”

Dr. Mark Scheurer, MD, MSc, Chief of Children's & Women's Services, MUSC

Red Cross Hospital, The Netherlands

Providing MRI scans to additional 65 patients weekly with an optimized layout

Public/Private: Private

Type of project: Facility Design and
Advisory Project



Red Cross Hospital, Beverwijk, The Netherlands

Scope of the project

To invest into the future, Rode Kruis Ziekenhuis Beverwijk decided to upgrade their radiology department with a new Siemens Healthineers MRI scanner. In order to address their challenges such as: increase patient throughput, optimize the overall diagnostic experience reduce rising waiting times, avoid scans after opening hours and reduce staff overtime, they decided to proof beforehand which layout works best.

As a first step, Siemens Healthineers Facility Design team optimized layouts and assessed the work processes to create a custom-made Workflow Simulation using Digital Twin technology. The results helped Rode Kruis Ziekenhuis to choose the best solution.

Key services

- Digital Workflow evaluation based on a Digital Twin to compare and improve MRI processes and layouts
- Assessment of two scenarios and a stress test:
 - Scenario 1: Given technology*
 - 1 dockable patient table
 - 1 preparation room
 - 2 changing rooms
 - Scenario 2: Given technology*
 - 2 dockable patient tables
 - 2 preparation rooms incl.
 - 2 changing rooms
 - Stress test**: MAGNETOM Sola with faster scan times for both scenarios
- Identification of optimal MRI process to improve workflow, throughput, and patient experience

Established Benefits

- 5 min reduction in MRI occupancy time for each patient by using two dockable tables
- 65 additional patients scanned per week by using two dockable tables and the MAGNETOM Sola***
- MAGNETOM Sola supports advanced and faster clinical scanning

* Scenarios were evaluated based on the current systems scan times.

** Stress test: Average times used, calculated as an average of all process step times and scan times from the different exam types.

*** Comparison of 1 + standard scan times and 2 + MAGNETOM Sola scan times

Future applications

A digital twin is an effective tool to improve the patient experience in almost every area of a healthcare enterprise. From optimizing a clinical department to opening a healthcare facility, this technology offers a four-dimensional assessment of workflows for greater operational efficiency and improved quality of care.

According to Anja Streck, Head of Facility Design and Planning at Siemens Healthineers, digital twin applications provide great opportunities in healthcare. “Anywhere you have a process, a workflow, there’s a chance to improve and optimize with digital twins. This is a powerful tool to enhance operational efficiency – e.g. In radiology, oncology, laboratory, for interdisciplinary pathways and patient centered processes.”

Digital twins yield benefits across the entire healthcare enterprise. A four-dimensional redesign can improve operational efficiency and quality of care, especially for patients who interact with multiple departments and disciplines such as those with prostate cancer. Using digital twin technology, MUSC has optimized its stroke program and ambulatory cardiac care services.

Ultimately, this technology represents a break with established ways of doing business, but workflow simulation can pay tremendous dividends – especially when combined with a MedTech partnership. Siemens Healthineers Value Partnerships leverage evidence-based solutions like digital twins and tailor them to the situation at hand.

Conclusions

Workflow simulation can help facilities plan expansions, install new technology, and revise floor layouts while minimizing the need for costly changes. Complimentary technology like RTLS offers a rich data source for insights to help create digital twin models. RTLS can also help healthcare organizations assess the real-world impact and effectiveness of new layouts and workflows after implementation.

Implementing a workflow simulation using digital twin technology can be challenge, and it requires collaboration between hospital executives, administrators, clinicians, the building architect, and a MedTech partner. Multi-disciplinary teams must work together to evaluate and improve digital twins to refine workflows and layouts and promote quality care. With so many teams collaborating, the implementation is most effective when used in the

context of a partnership. Siemens Healthineers Value Partnerships help healthcare providers leverage the clinical and technological know-how to create value for stakeholders.

To learn more about Value Partnerships go to



siemens-healthineers.com/value-partnerships

Read the full MUSC white paper at

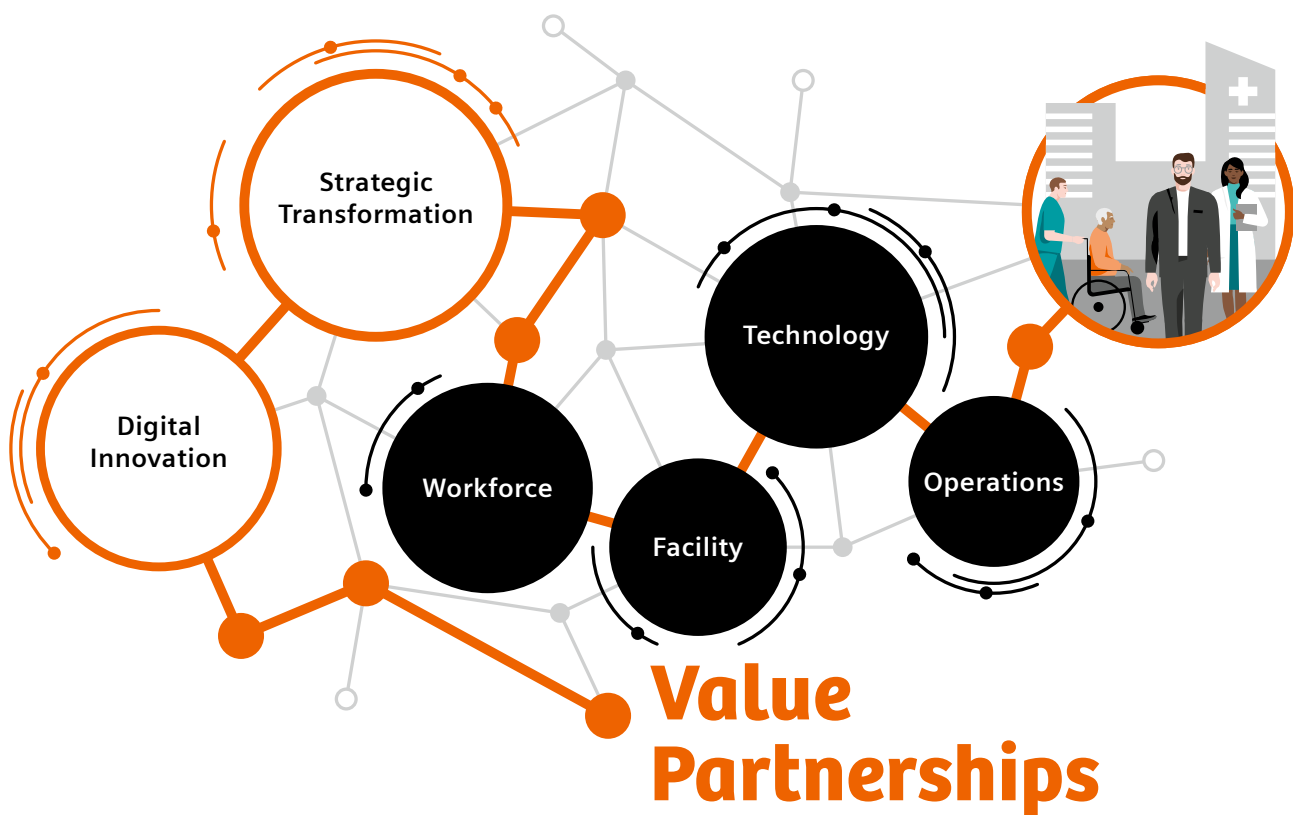


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About Value Partnerships

Siemens Healthineers Value Partnerships are long-term, performance-oriented, collaborative engagements. We bring a combination of clinical insight, medical technology innovation, strategic vision, implementation expertise, and operational excellence to the table for you. As trusted partners, we help you formulate and achieve your strategic goals, increasing enterprise-wide value.

Value Partnerships drive value across your entire enterprise with focus on four domains: Technology, Operations, Workforce and Facility. Furthermore, together we enable breakthroughs through holistic and transformative initiatives such as Strategic Transformation and Digital Innovation.



References

- 1) Frost & Sullivan. Global CT Equipment Procedure Volumes and Reimbursement Growth Opportunities. 2022. www.researchandmarkets.com/reports/5546003/global-ct-equipment-procedure-volumes-and.

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The products/features and/or service offerings (here mentioned) are not commercially available in all countries and/or for all modalities. If the services are not marketed in countries due to regulatory or other reasons, the service offering cannot be guaranteed. Please contact your local Siemens Healthineers organization for more details.

The results described herein by customers of Siemens Healthineers were achieved in the customer's unique setting. Since there is no "typical" hospital and many variables exist (e.g., hospital size, case mix, level of IT adoption), there can be no guarantee that other customers will achieve the same results.

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