PHILIPS

Whitepaper

How to innovate mobile asset management in hospitals by providing actionable IoT insights based on real-time location data

PerformanceFlow Solution

A solution to address operational inefficiencies by introducing real-time decision support

In the modern healthcare environment, operational procedures are supported by a substantial technological and scientific commitment. This requirement, however, is constantly being challenged by significant budget pressure, complex clinical processes, and severe resource deficiencies of qualified personnel. In such volatile surroundings, it is easy to understand *why orchestrating resources, workflows, and capacities has become an art* for a hospital's managerial staff.

More precisely, it can be observed that clinical, technological, and administrative personnel must deal with growing numbers of mobile equipment and consumables, the management of which becomes increasingly more frustrating. Additionally, there are typically no insights on the availability of these assets, nor information on their current whereabouts. Furthermore, when smart data is not connected in a meaningful manner, it often results in historic information being scattered across numerous IT solutions. Can you imagine the doctors who might spend more time searching and coordinating required resources rather than being with their patients? Think about nurses who lose valuable time because the alarms triggered by their smart infusion pump are only sent to isolated vendor-dedicated cloud solutions. Imagine nurses who run into bottlenecks on their ward because the only clean bariatric bed appears to be broken. Or the overloaded biomed who needs to balance the demands of asset-related work orders in his Computerized Maintenance Management System as well as manage the Hospital Inventory Management Solution for multiple sites. Just as concerning, imagine the Head of the Gastroenterology Department who convinces the hospital to procure new endoscopes, although the current usage level is surprisingly low due to missing statistical evidence. There are *endless examples of how the lack of real-time operational data and poor data consistency affect hospital financials*.

To relieve such operational burden for staff members as well as enabling hospital-wide use cases, Philips has designed the PerformanceFlow solution which delivers real-time operational decision support. PerformanceFlow uses an *intelligent IoT platform to converge data from different location engines, agnostic IoMT smart device data, and existing software*. While simultaneously offering Change Management expertise in the healthcare domain, from the implementation journey and beyond, PerformanceFlow optimizes efficiency between staff, equipment, and facilities.

Discover how hospitals can achieve operational excellence based on real-time insights and maximize data quality hospital wide. Thanks to PerformanceFlow, *the time has come to smarten your hospital operations.*

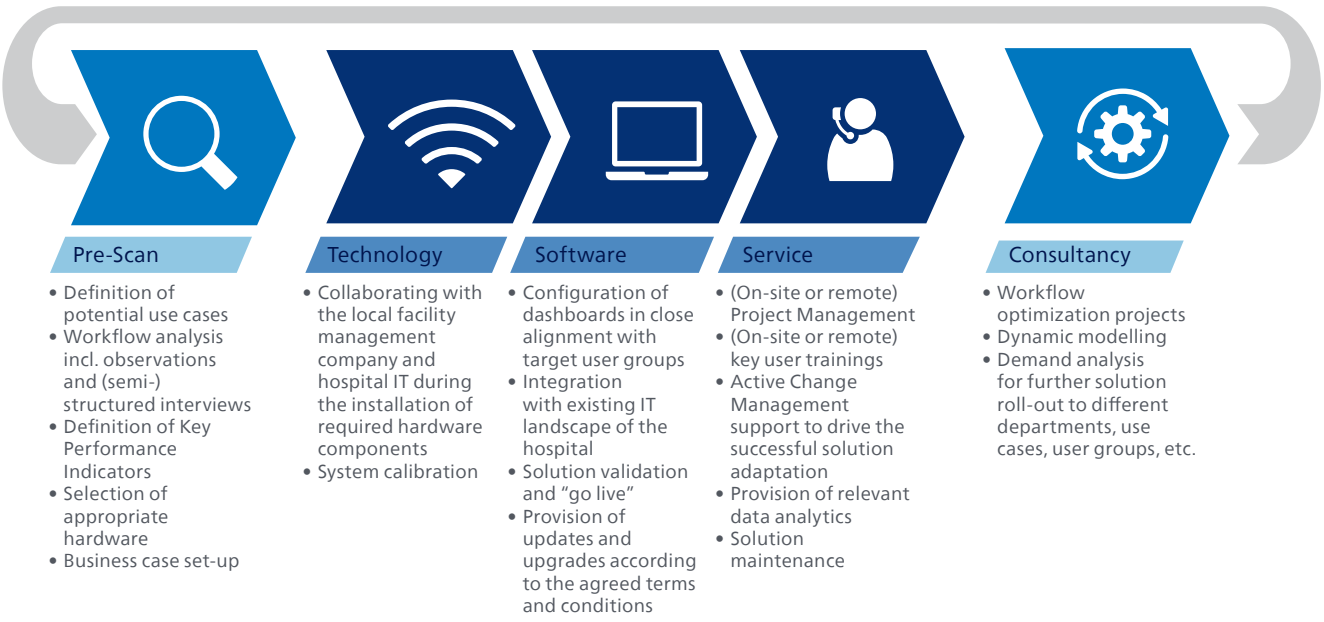


Figure 1: Philips offers an integrated solution consisting of hardware, software, and services along the entire solution lifecycle

" Our ambition is to become a smarter hospital by setting up facilities with sensors that drive the optimization of our resources, workflows and capacities. Realizing this vision requires us to collaborate with strategic partners. Together we build the foundation for optimized care, from logistics and maintenance to patient flows. PerformanceFlow provides us with the opportunity to start small and grow big over time."

Roland Loeffen PDEng – Clinical Engineer Radboudumc

" We often do not have accurate information about our assets' real-time location and movements. This information is required to optimize our processes, workflows and to support making data driven decisions. PerformanceFlow will allow us to gain insights into the behavior of the movements of each asset and analyze where we can improve."

Roland Loeffen PDEng – Clinical Engineer Radboudumc

" We aim to have the right assets available at the right time in our buffer locations. With PerformanceFlow, we have an accurate overview of our inventory, will receive automated notifications and work orders in real-time. This allows us to streamline and automate our processes and therefore granting us time to focus on patient care.

Marcel van Keeken – Coordinator central management medical technology Radboudumc

How operational excellence based on real-time insights makes the difference

While diving deeper into a multitude of use cases, we have been able to simplify the use of real-time location data in combination with seamlessly integrated IT data sources:

Real-time localization

It is challenging for hospital staff to continuously determine the whereabouts of assets, resulting in inefficient use of their equipment and the need for significantly higher stock levels than required. The PerformanceFlow solution provides real-time insights on the location of assets, automatically calculates the distance to each asset, and visualizes all equipment on a hospital-wide floorplan via user-friendly dashboards – jointly developed with end users.

Intelligence

Many asset types are used daily. It is of great importance to have the right asset available at the right time. In order to achieve this, it is essential to facilitate the integration of existing hospital IT data sources with the location, status, and maintenance window of all available assets. Improving the process based on pre-defined rules saves a significant amount of time and increases staff satisfaction. Creating automatic status changes such as making assets available when entering a dedicated storage location, in use once connected to a patient, or sending a notification to the maintenance department once an asset is marked as broken, are only a few examples of potential use cases.

Maintenance compliance

Locating assets which require maintenance within the allocated time window, can be time consuming and result in non-compliance. The ability to integrate existing Computerized Maintenance Management Systems with pro-active notifications of maintenance due dates, along with insights on utilization based on movement patterns and real-time locations, dramatically reduces search time and increases (legal) compliance.

Stock level management

Efficient stock level management is an art. Departments that hoard assets, asset scarcity in other locations, and lost assets can frustrate this effort. Being notified when the number of assets in storage locations drops below or rises above a configurable threshold, contributes to more efficient use, fewer phone calls, and enhanced staff satisfaction.

Activity-based costing

To promote sustainable behavior in the sharing of assets across departments, and to facilitate fair cost allocation, transparency regarding the time a particular asset was in use in each department, provides valuable decision-making information. Moving from estimates to actual insights makes the difference.

Geofencing and thief protection

Critical assets (or even babies) leaving the hospital accidentally or through theft can imply serious financial, legal, and operational burdens. Through the geofencing capabilities of PerformanceFlow, security can receive real-time notifications to prevent such situations.

Reduce spreading of infectious diseases

In the event of an outbreak of infectious diseases, tracing of assets and patients becomes high priority. The ability to trace back locations and contact points is vital in such a situation and minimizes further spread. Monitoring environmental data such as temperature and humidity using intelligent sensors ensures that vaccines and laboratory samples are safely transported and stored.

Improve workflows

Hospital staff would often agree that workflows are not optimal. Finding the root cause and quantifying their impressions can be challenging. Thanks to a real-time location system and consultancy support provided by former healthcare professionals and process experts on our Healthcare Transformation Services team, hospitals gain insights into their processes and can jointly define optimal workflows to drive continuous improvements.

Internet of (Medical) Things

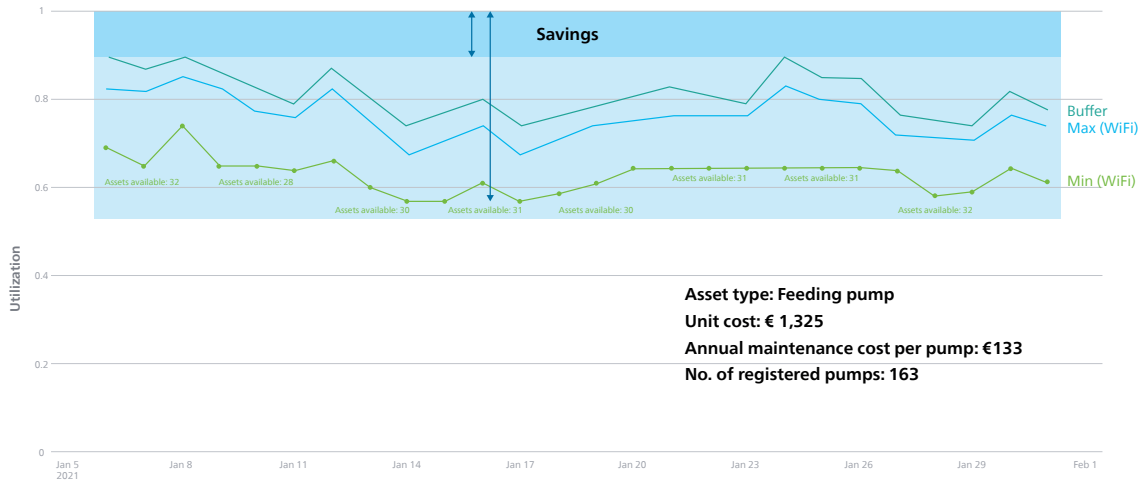
Assets are increasingly becoming smart and connected. Gaining insights on all relevant data often requires accessing a host of scattered applications. The PerformanceFlow solution offers integration with a range of these devices leveraging their smartness and providing a single, vendor-agnostic source with all the information you need to achieve operational excellence. For this purpose, Philips has created a catalog of device drivers, which to-date already includes hundreds of devices.

Best Practice 1 | Het Onze Lieve Vrouwe Gasthuis (OLVG) Amsterdam How location-based utilization measurements help to identify cost savings

In general, the average number of medical assets needed to treat a patient has increased significantly over the past decade.[1] A worrying aspect is that while the number of assets has increased, the utilization rates of these assets can go down to as low as 40%. In fact, on average, hospitals can have around 25% more devices than needed.[2] The trend of an increasing number of assets coupled with extremely low utilization rates can be attributed to the inability of hospitals to monitor the location and utilization of assets in real-time. It is evident that having a system that provides complete transparency of asset utilization metrics can significantly improve the way hospitals manage and invest in their mobile medical assets.

The roll out of PerformanceFlow Assets at OLVG hospital is a clear example of how a real-time location-based solution can enable a hospital to develop a deep understanding of its utilization of mobile assets and help it decide on a future medical asset upgrade strategy. The figure below was generated by collecting PerformanceFlow data and utilizing novel algorithms that estimate the utilization of feeding pumps based on a WiFi-based RTLS deployment. The ability of a hospital to re-use its existing WiFi infrastructure to measure the utilization rate of the assets makes it a highly attractive solution, as it is cost-effective and allows enterprise-wide transparency. The below figure illustrates that clarity regarding the daily maximum and minimum utilization rates of feeding pumps covering the entire hospital can help a hospital reduce costs by reducing the number of devices while maintaining an adequate safety margin. More specifically the example describes how OLVG hospital could reduce capital expenditure by around €21k and annual maintenance costs by €2,6k by reducing the number of feeding pumps by 16. While, the savings might seem relatively small, it should be noted that this is only for a specific pump type.

Repeating this analysis for the more than 100 classes of devices that PerformanceFlow is tracking at OLVG will result in savings in the order of millions of Euros.



Example 1:
Asset type: Feeding pump
Max utilization (WiFi): 85%; 5% Buffer: 90%, Savings: 10%

Savings:
Reduce 16 pumps > € 21,200
Reduce annual maintenance > costs € 2,608

1 Horblyuk et al. (2012). Out of Control, how clinical asset proliferation and low utilization are draining healthcare budgets.
2 Malina (2018). A Solution for Inefficient Asset Utilization in Hospitals.

Best Practice 2 | Radboud University Medical Center Nijmegen How PerformanceFlow can support to build the smart hospital of the future

The Radboudumc is a teaching hospital affiliated with the Radboud University Nijmegen and it is one of the largest and leading hospitals of The Netherlands, providing supra-regional care for residents of the eastern part of the country. The hospital is striving to build the smart hospital of the future including smart facilities with sensors that sustainably drive the optimization of resources, workflows and capacities. This vision requires the hospital to work with strategic partners like Philips who think alike and continuously optimize care as building blocks over time: From logistics, to maintenance and patient flow management.

To contribute to this vision, the implemented PerformanceFlow solution relies entirely on existing Cisco WiFi and allows devices to be located across more than 90 buildings without additional hardware. For the future, infrared sensors that will further improve location detection accuracy (e.g. in storage rooms) are currently under consideration. PerformanceFlow does not only visualize real-time location data of the most valuable mobile devices, it goes far beyond.

To provide meaningful support for operational workflows, Philips integrates with the Computerized Maintenance Management System, Ultimo, which the hospital uses to manage the lifecycle of all their assets, respective maintenance due dates, and work orders. Information from Ultimo seamlessly flows into PerformanceFlow via the existing hospital communication server, so that end users can view the real-time location of an asset on the hospital floor plan via a direct link from Ultimo. As part of the partnership, Radboudumc, Philips, and Ultimo further automated the work order creation process based on status changes that can arise from, for instance, button presses on RTLS tags, location changes of assets, or low stock levels in storage areas.

By introducing Philips PerformanceFlow as a track and trace solution, the hospital realizes tangible process improvements, better workflow support by improved central stock management, and less search time to unburden (among others), busy healthcare professionals.

Leverage existing infrastructures to maximize benefits while reducing costs

Localization solutions[3] in healthcare are often frowned upon as being particularly hardware intensive and overpriced. It is important to remember that while this may well have been true in the past, relevant technology has evolved considerably over the past years and industry partners are *already leveraging existing infrastructures (e.g. current WiFi networks) for rudimentary localization on a department level.* The eligible technologies differ significantly in the additional hardware required, which is either wired and connected the existing network using the Local Area Network, or separately set up. As shown in the comparative overview below, each technology can yield a certain precision level which affects the battery life span of the so-called active or passive "tags". These tags are small devices in different shapes, flexibility, and robustness which are attached to e.g. mobile devices, patient wristbands, and staff badges.

The speed of technological evolution and the increase of use cases are reasons why PerformanceFlow is designed as an *open and agnostic platform to connect to the appropriate infrastructure for each hospital.* Philips provides a fully integrated solution consisting of hardware, software, and services – e.g. data analytics, workflow analysis, and change management – while offering independent consultancy to select the appropriate technology, maximize costs vs. benefits, and to reduce risk and administrative burden for hospitals. As a result, hospitals can enjoy the benefits of the solution via an intuitive user interface on their desktop personal computers or mobile device. In parallel, Philips, as an end-to-end solution provider, continuously keeps an eye on the latest industry standards, such as Ultra-Wideband, camera-based tracking, mesh networks, and 5G as well as their compatibility with the existing solution.

	WiFi and RFID combination	Bluetooth Low Energy (BLE)	Infrared (IR)
Localization accuracy	~5m to 15m precision based on radio frequency (=department-level accuracy)	~3m to 5m precision based on radio frequency (=almost room-level accuracy)	Individual zones based on invisible light (=bed-level accuracy)
Infrastructure	Leveraging existing Access Points/ WiFi network and additional low frequency "chokepoints" to avoid floor hopping or guarantee room-level accuracy in particular storage locations	Socket-based hardware infrastructure required based on so-called "locators" that can optionally be integrated into the network of existing BLE-enabled WiFi Access Points	Add-on infrastructure at locations where very high accuracy is required, compatible with WiFi and RFID combination
Location update rate	Down to 5 minutes (= high battery consumption)	Down to 30 seconds (= medium battery consumption)	Down to 1.5 seconds (= low battery consumption)
Use cases	• Device localization • Status management • Bed planning • Basic workflow optimization • Operational decision support	• Device localization • Status management • Bed planning • Basic workflow optimization • Operational decision support • **Predictive maintenance (AI)** • **Indoor navigation/ wayfinding**	• Device localization • Status management • Bed planning • **Detailed** workflow optimization • Predictive Maintenance (AI) • Indoor Navigation/ wayfinding • Operational decision support • **Patient and staff tracking** • **Fall detection** • **Automated patient-bed-assignment (AI)**

Low localization accuracy — High localization accuracy

Figure 2: The selection of the appropriate localization technology depends strongly on the intended use case and the existing technical environment of a hospital, and will be supported by Philips technical experts

3 Often called RTLS (Real-Time Location Systems).

Getting started with PerformanceFlow

Given the complexity of the effort and great variety of possible use cases – ranging from IoMT-driven asset tracking to smart bed orchestration and beyond – Philips offers hospitals a so-called pre-scan analysis as part of its professional service portfolio. A pre-scan serves the purpose of identifying suitable use cases by means of observations, semi-structured interviews with different stakeholder groups, and selection of a scalable infrastructure suitable for the intended purpose. As an outcome, experienced healthcare consultants not only derive the detailed costs of an implementation, but also *develop an easy to comprehend business case which justifies such a project and can be used as starting point for any performance-based business models.*

And this is where the journey really begins. PerformanceFlow is set up either on-premise or cloud-based in the hospital and can be easily integrated into the existing IT infrastructure. Individual floor plans of the hospital can be automatically imported across numerous buildings using the existing CAD files. Be it through interfaces to the Computerized Maintenance Management System or the local Work Order Management Tool, it is also possible *to import intelligent real-time device data in a vendor-independent fashion* (thanks to Philips' significant footprint in clinical IT solutions) and thus, build a user friendly and vendor-agnostic interface for a multitude of devices.

Hence, PerformanceFlow puts an end to manual data entry in many places and guarantees excellent, fully automated decision support for hospital staff members who are involved in mobile asset-related workflow management – on a specific ward, throughout an entire building, or across different campuses.

Figure 3: PerformanceFlow seamlessly fits the current workflow of a hospital, making use of the existing infrastructure of personal computers, and mobile devices, openly sharing data with existing software solutions and applications

Start your continuous improvement journey with PerformanceFlow today!

Are you curious about understanding how PerformanceFlow can smarten your hospital operations? Visit us at **www.philips.com/performanceflow** to ask for an appointment and kick off your individual operational decision support journey.

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