CASE TITLE: HealthSuite

Module: Service Oriented Design, academic year 2021|22
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Background Philips

Royal Philips is a leading health technology company focused on improving people's health and well-being, and enabling better outcomes across the health continuum – from healthy living and prevention to diagnosis, treatment and home care.

Philips leverages advanced technology and deep clinical and consumer insights to deliver integrated solutions. Headquartered in the Netherlands, the company is a leader in diagnostic imaging, image-guided therapy, patient monitoring and health informatics, as well as in consumer health and home care.

HealthSuite System of Engagement

The HealthSuite System of Engagement (or HealthSuite for short) is an integrated, modular set of standards-based capabilities that support the development of digital health propositions that facilitate users' seamless interaction with the data in the Systems of Record.

In contrast to many 'systems of record', which are typically based on static, siloed files of patient information, HealthSuite enables patients and all the staff they interact with, to better manage the care experience and pathways. By taking a federated approach to data integration, HealthSuite supports healthcare providers in capturing the value of data from across their existing IT infrastructure, reducing complexity for healthcare professionals and discovering new opportunities for care innovation.

HealthSuite provides capabilities for IoT (Internet of Things), Identity and Access Management and GDPR-compliant Data Management. Its deployment models include hosting and operating health applications in the cloud, on edge and on-premise.

Challenges

Hospitals increasingly want to leverage HealthSuite for clinical and operational data to be federated and shared across devices and solutions from Philips and third parties within the healthcare enterprise in order to create new insights, often also to create new AI algorithms and models to e.g. improve care pathways, diagnosis and treatments.

Hospitals are collecting huge amounts of data from its devices during diagnosis and treatment. Hospitals have the choice to keep this data on-premise or send it to the cloud. In many cases, Hospitals opt for a hybrid model where parts of its data and processing happen on premise and parts in the cloud.

This creates a few challenges – or at least interesting questions, which will be explained in the following case description.

Case Description

A particular interesting use case of the above is the following:

1) Data is collected from hospital devices
2) Data is sent to cloud through an Edge device
3) Data models and algorithms are created in cloud (learning)
4) The AI model is triggered/inferred (either in Cloud/stays in Cloud) or is sent back on-premises for installation and inferred on premise
5) Clinical/AI application is delivered and installed on the device from the healthsuite cloud seamlessly

What sustainability requirements are created for the above pattern/hybrid setup?
Examples of areas of where the requirements apply: Environment impact (Energy footprint), social impact (Improve healthcare), user impact (technical).

What are the tradeoffs in choices of, for example:
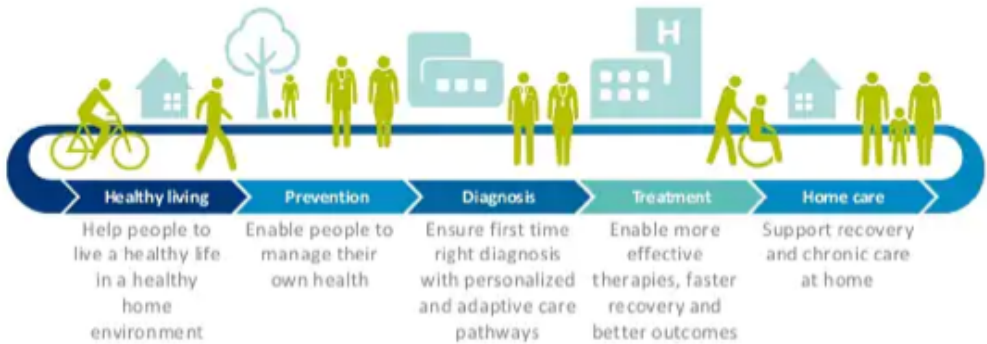- Data formats
- Data compression

- Data storage
- Frequency of data access
- Connectivity protocols
- Security protocols
- Edge computing vs computing on the cloud vs on premise
- API interaction patterns

What metrics & tools can be used to measure actual energy consumption on the:
- Devices over multiple platforms (embedded, mobile, desktop, etc.)
- Computing Infrastructure
- Data storage
- Data archiving
- Network Infrastructure
- On-premise/edge/cloud
- Device Logs

Would we be able to seamlessly move/spread loads (computational workload, data staging etc.) in the most sustainable way (dynamic) across cloud, on-premise and edge considering known constraints? Examples of constraints: Regulation, privacy & security constraints from healthcare providers, etc.

Glossary

Care pathways	Workflow at the hospital. From when the patient arrives until the patient departs the hospital.
Philips devices	Large medical machines such as MRI, CT scanners, but also smaller ones like vital signs monitors, wearable health patches, etc.
Digital health proposition	A unique solution offered to a hospital to solve complex problems with digital technology. For example:provide a way for data to move seamlessly between the departments at the hospital enabling the best user experience for the patient, doctor and technicians.
Quadruple aim	Philips lives by the motto of the quadruple aim: Better health outcomes, improved patient experience, improved staff experience, lower cost of care.
Users	The users of the philips devices typically are patients, doctors, GP, hospital staff, technicians, caregivers etc.
System of Record	Information is stored as "a system of record".
Healthcare providers	Hospital, GP, Pharma, Medical centers etc.
HealthSuite or HSDP	HealthSuite Digital Platform or Philips cloud platform
Data from across their existing IT infrastructure	Assume that there are multiple data silos due to a variety of devices.
HIPAA privacy rule	Health Insurance Portability and Accountability Act of 1996: The HIPAA Privacy Rule establishes national standards to protect individuals' medical records and other personal health information and applies to health plans, health care clearinghouses, and those health care providers that conduct certain health care transactions electronically. The Rule requires appropriate safeguards to protect the privacy of personal health information, and sets limits and conditions on the uses and disclosures that may be made of such information without patient authorization. The Rule also gives patients rights over their health information, including rights to examine and obtain a copy of their health records, and to request corrections.
Philips health continuum	

Example Use cases

User	Description	Medical devices/tests	Additional Questions / Comments
Patient, GP	The patient is referred by the GP for a blood test. Based on the blood test the patient shall receive treatment. The treatment is provided by a machine at the patient's home. Based on the results, the machine's settings need to be updated. The patient can only use the machine after the settings are updated. All the data shall be shared with GP.	Blood Test + Treatment machine	How can Philips improve the experience of the patient? How can we ensure security of data, treatment settings etc.?
Patient, GP	The patient is referred by the GP for an ultrasound scan. The patient arrives at the Hospital. After the Ultrasound, the patient needs to get an ad hoc MRI scan at the same hospital. All the data shall be shared with GP & hospital	Ultrasound + MRI	How can Philips improve the experience of the patient (care pathway)? From the time the patient arrives at the hospital, and departs from the hospital, how can there be seamless data transfer between all the departments at the hospital? How should these appointments be scheduled?
Patient, Hospital	The out patient is receiving a small device which will monitor the patient's vitals. The patient is discharged and will recover at home while being monitored by the hospital for the next 7 days. If the vitals drop, the hospital needs to react as soon as possible.	The small battery powered device periodically sends the patient's vitals to the Philips cloud.	What should be the periodicity of the data being uploaded to the cloud? What should be the architecture of such a device?
Hospital, Technician, Doctors.	An MRI scan is being performed. The patient's scan data is sent securely to the Philips cloud so it can benefit from a newly developed (FDA-approved/EU verified) AI model that can propose critical and incidental findings. The Technologist sees this information real time on their console screen, while the scan is being performed. The Technologist can communicate and share these findings with a Radiologist via the Cloud and give feedback before the Patient leaves the scanner. This could lead to efficiency improvements and patient outcomes. Eventually, such algorithms will reach a level of accuracy and trust by Radiologists in their ability to reliably determine when a scan contains no abnormalities, that this could significantly reduce their work burden to focusing their diagnostic skills on scans with abnormalities. Later in the Radiology workflow, the Radiologist can also apply more sophisticated image reconstruction AI on the raw data created by the MRI scanner, to help with improved diagnosis and clinical research.	Real time MRI + AI in the cloud	Where should this AI model be stored? What can facilitate the real time requirements of such a device? Will the hospital allow the data transfer between the Philips device & the Philips cloud?