Digitalization and AI

Technology that adapts to improve people's lives

Henk van Houten
Chief Technology Officer
ESI Symposium, April 9th, 2019

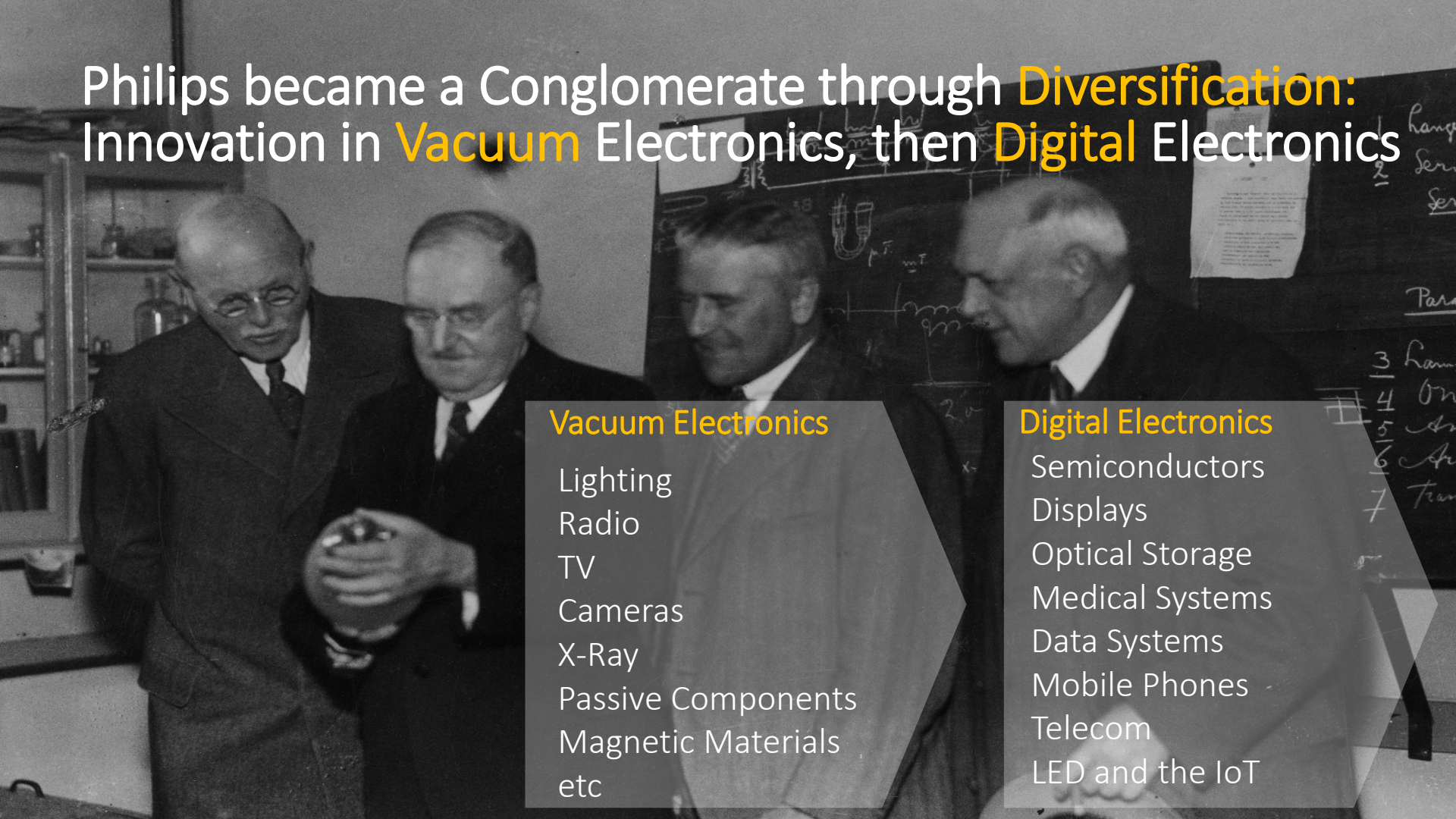
innovation + you

PHILIPS

Digitalization

The force behind the transformation of Philips

Philips became a Conglomerate through Diversification: Innovation in Vacuum Electronics, then Digital Electronics



Vacuum Electronics

- Lighting
- Radio
- TV
- Cameras
- X-Ray
- Passive Components
- Magnetic Materials
- etc

Digital Electronics

- Semiconductors
- Displays
- Optical Storage
- Medical Systems
- Data Systems
- Mobile Phones
- Telecom
- LED and the IoT

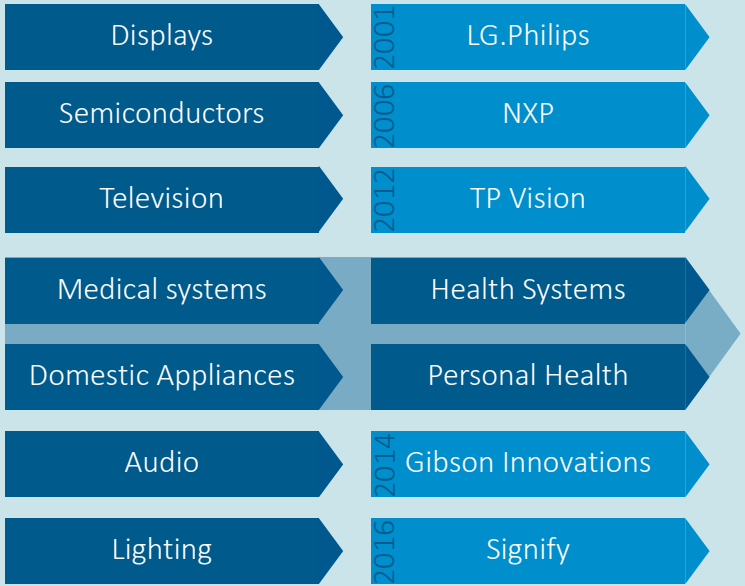
Digitalization spawned Deverticalization

Philips radio in the late 1960's

Philips Ambilight TV introduced 2004

Digitalization led to Deverticalization
Deconstructing the Conglomerate

From a diversified tech conglomerate….



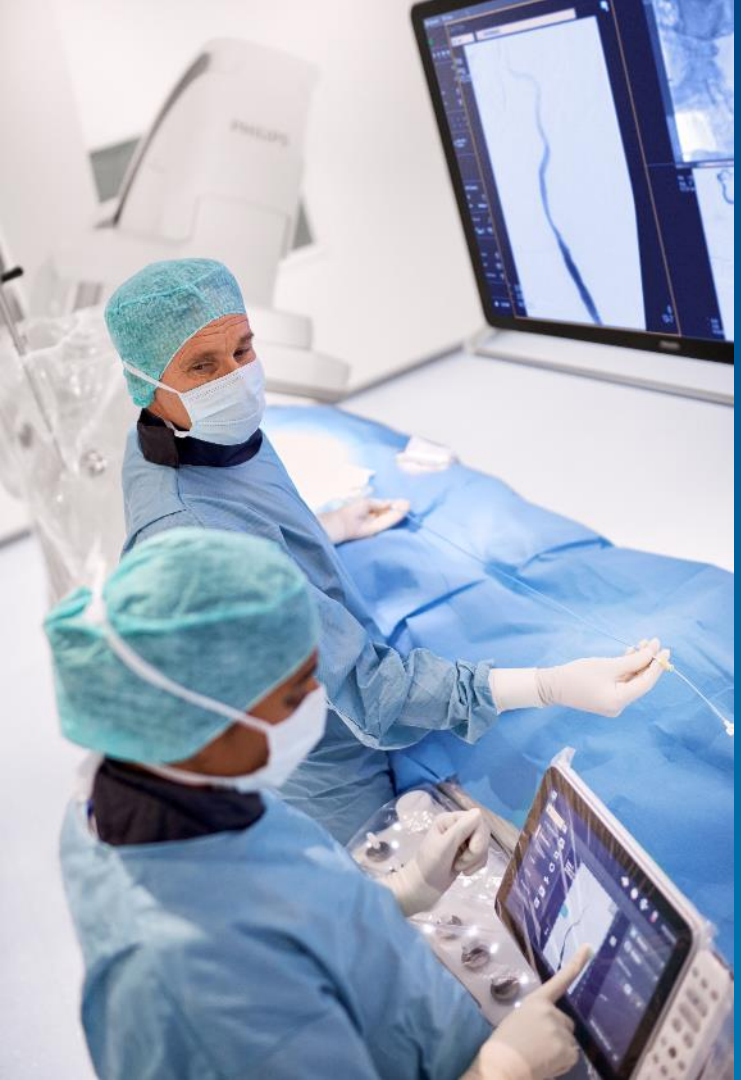
…to a focused company in HealthTech

Organic growth through innovation: e.g. Genomics, Digital Pathology, Cardiology Informatics, Image Guided Interventions, Air,…

+

Inorganic growth through acquisitions + innovation: e.g. Respironics, Volcano, Spectranetics, VitalHealth, TomTec,…

Not exhaustive



Philips Today

A focused leader in health technology

EUR 1.8 billion
invested in R&D in 2018

2018 Top 100 Global Innovator
for the sixth year in a row according to Clarivate Analytics

65,000 patents

#1 ranking
for medical technology patents filed at the European Patent Office in 2017

~60%
of R&D personnel in software and data science

The digital revolution: how photography evolved

Mechanization →

Digitization →

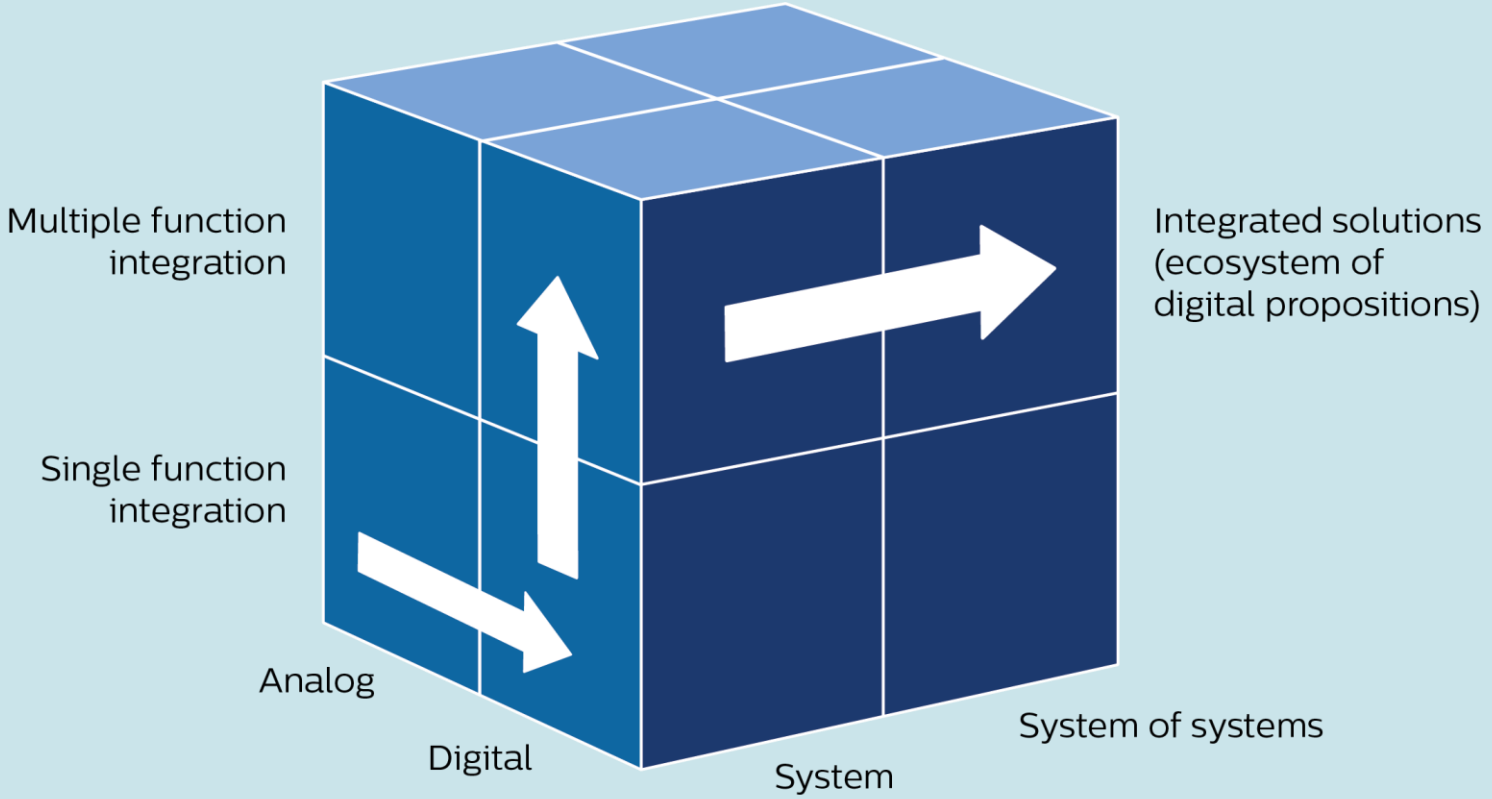
Integration →

Internet →

An ecosystem of digital propositions

The pathway of the digital revolution

Disrupting industries and society



Patient Monitoring start: analogue, single function

Sanborn –
First portable
ECG Machine, 1928

First
Patient Monitor
'Viso-Scope', 1957

Cardiotachometer

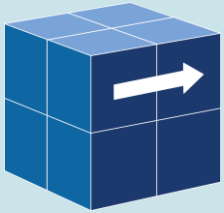
Blood Pressure Monitor

Body Temp and
Respiration Rate

Patient Monitoring
in the ICU today

Digital monitoring platform: **all basis measurements plug and play**

Coming up: decision support and analytics in the cloud



CDS

Acute respiratory distress syndrome

Acute kidney injury

Clinical information extraction

Acute respiratory failure

IntelliSpace console critical care

Decision for non-invasive ventilation

Patient deterioration

Patient acuity

Multi-organ failure

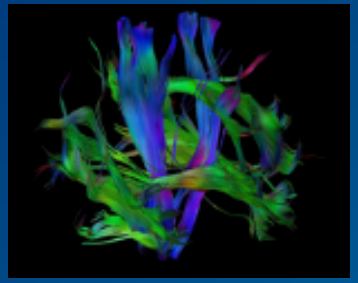
Critical care forecasting

Decision for emergency care

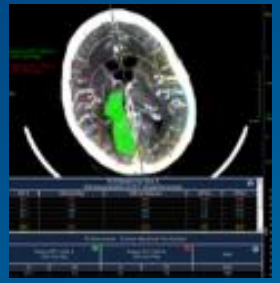
Hemodynamic instability

Patient deterioration at home

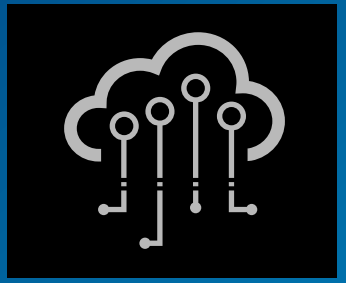
Going forward, digital technologies will help transform healthcare in many different ways



Advanced Visualization



Quantification

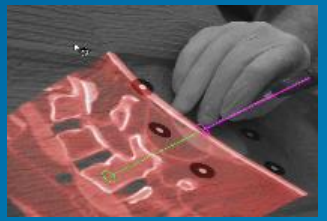


IoMT and cloud

Ubiquitous Patient Monitoring

Smart Catheters

Navigation Technologies



AR/VR

Digital Twin

Adaptive Intelligence

Solutions and Outcomes

The way the world looks at health is changing

Value-based healthcare

Population health

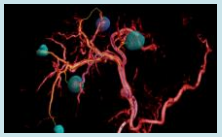
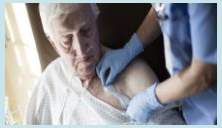
Consumerization of healthcare

This requires a shift from product to solution and from transaction to relationship

Innovative value-added, integrated solutions

Developed to better meet customer needs and capture greater value

Packaged suite of systems, smart devices, software and service

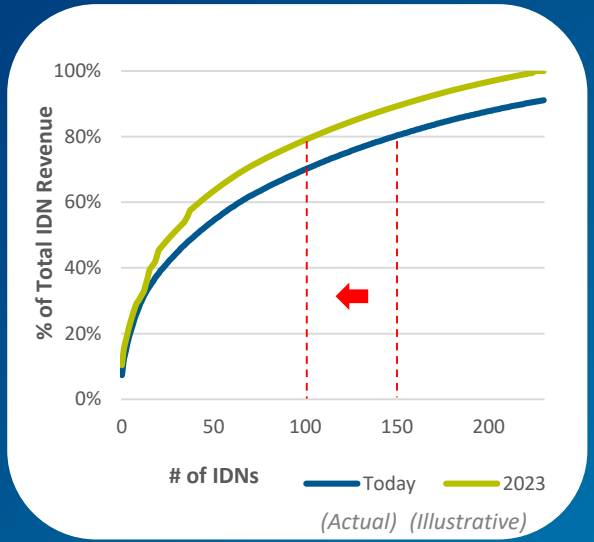
Image-guided therapy solutions	 Image-guide therapy systems	+	 Smart catheters	+  Disease-specific navigation software +  Cath lab management, services, consulting
Early warning of patient deterioration	 Monitoring	+	 Cableless measurements, biosensors	+  IntelliVue Guardian software +  Integration, services, consulting
Total sleep management solutions	 Dream Series therapy devices	+	 Care Orchestrator Care Management Platform	+  Patient services +  DreamMapper patient engagement

Hospitals are consolidating & Industrializing

Leading to shifting customer needs

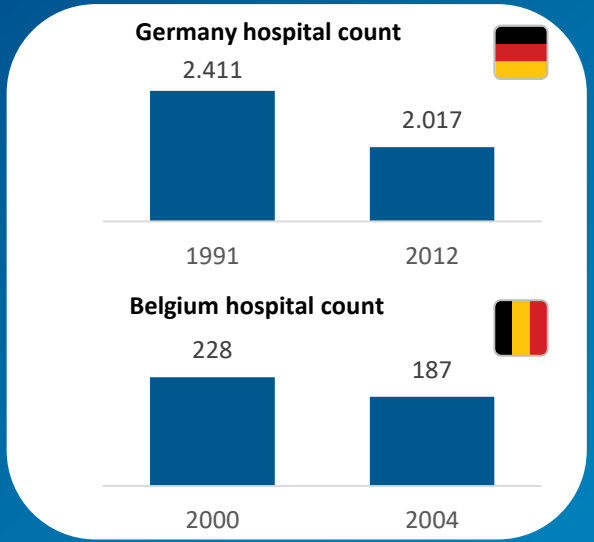
North America:

~80% of IDN spend will be controlled by top 100 IDNs by 2023



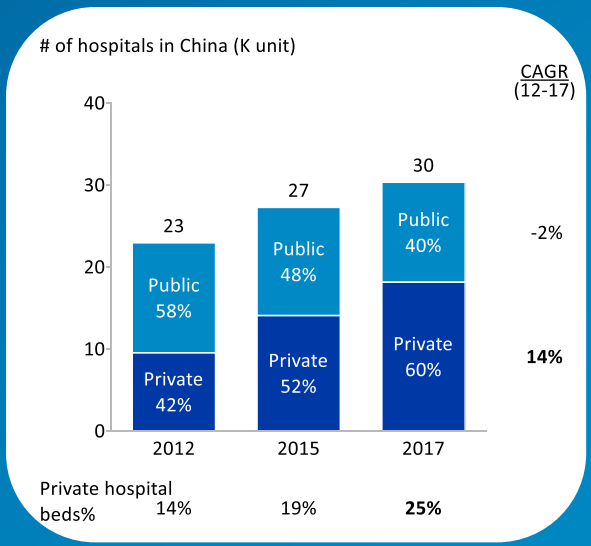
Europe:

Hospitals have been consolidating across major markets



China:

Private hospital growth continues, while public hospitals are declining



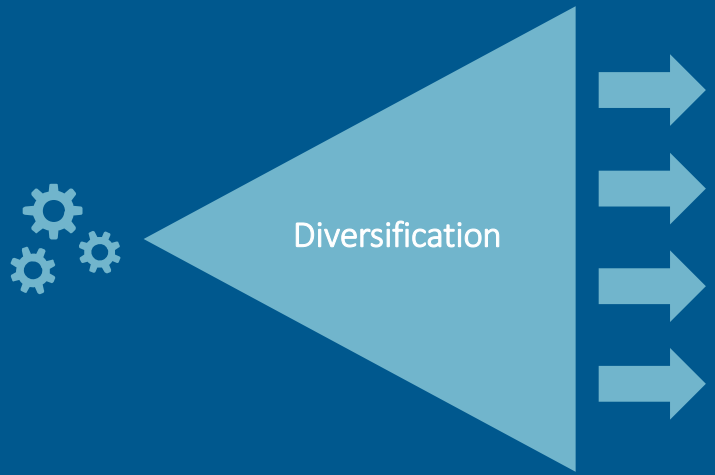
C-Suite customers need new types of innovation

Partnering opportunities to cope with challenges

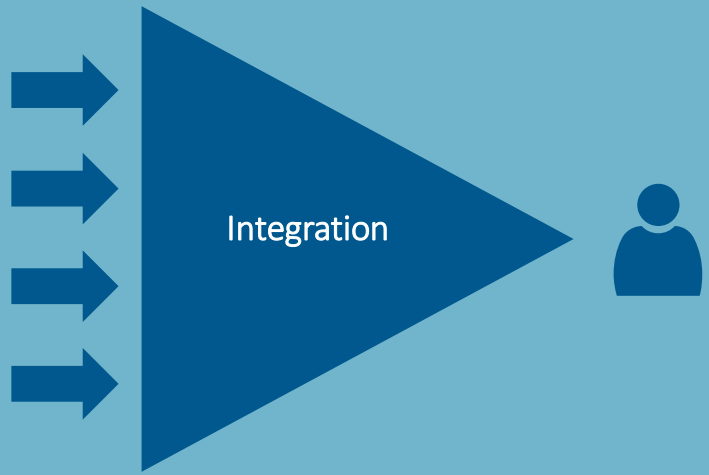
CEO	CIO	Chief Nursing Officer	CMO	CFO
Focusing on outcomes New business models	System interoperability across care sites Data and system security	Patient and caregiver satisfaction Outcomes	Linking hospital care with the home Optimizing clinical operations and workflow	Cost reduction New financing models Outsourcing, e.g. Radiology

Moving from products to solutions is transformative

Technology push: maximize product opportunity



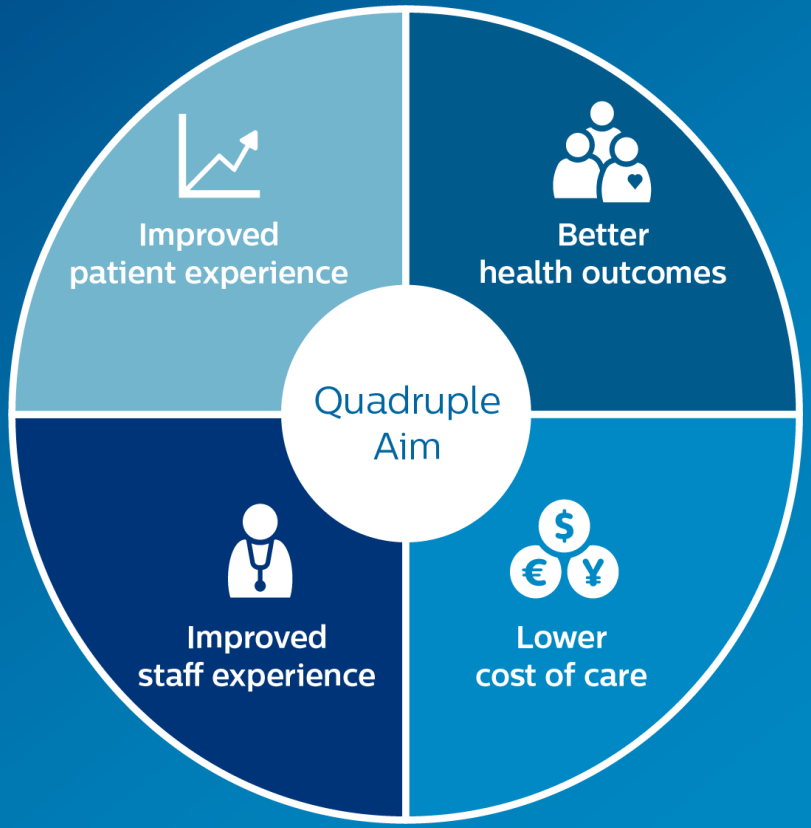
Solutions pull: maximize customer opportunity



It is only a solution if it addresses the customer KPI's: *becoming an outcomes company*

Becoming an Outcomes Company

Our new North Star: The Quadruple Aim



Win with solutions along the health continuum

Guardian Early Warning connected care solution – addressing the Quadruple Aim

Health outcomes

86% reduction of Cardiopulmonary Arrests[1]

66% reduction in mortality of patients transferred to the ICU[1]

Cost of care

24% reduction in ICU admission rate[1]

can reduce length of stay[2]

Patient experience

Patients feel safer in general care unit[2]

Faster hospital discharge[2]

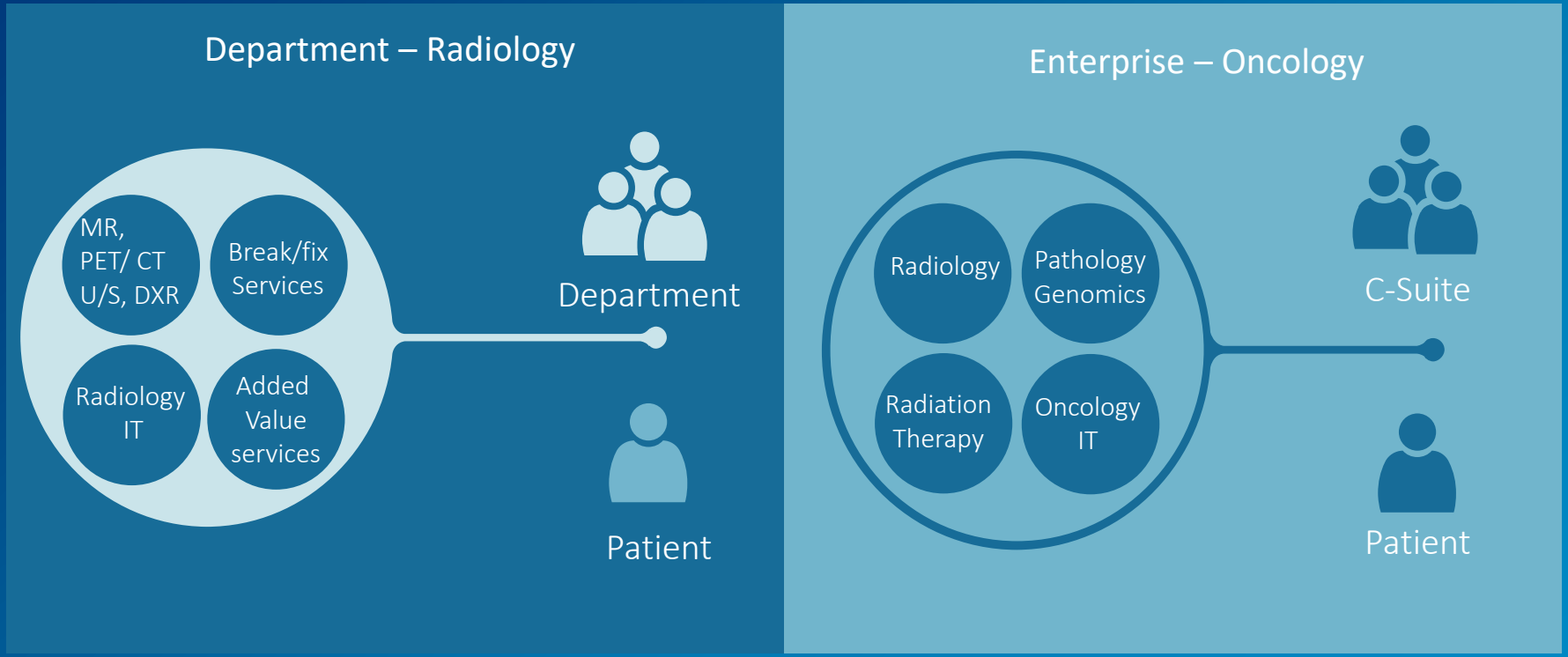
Staff satisfaction

35% reduction of severe Adverse Events[1]

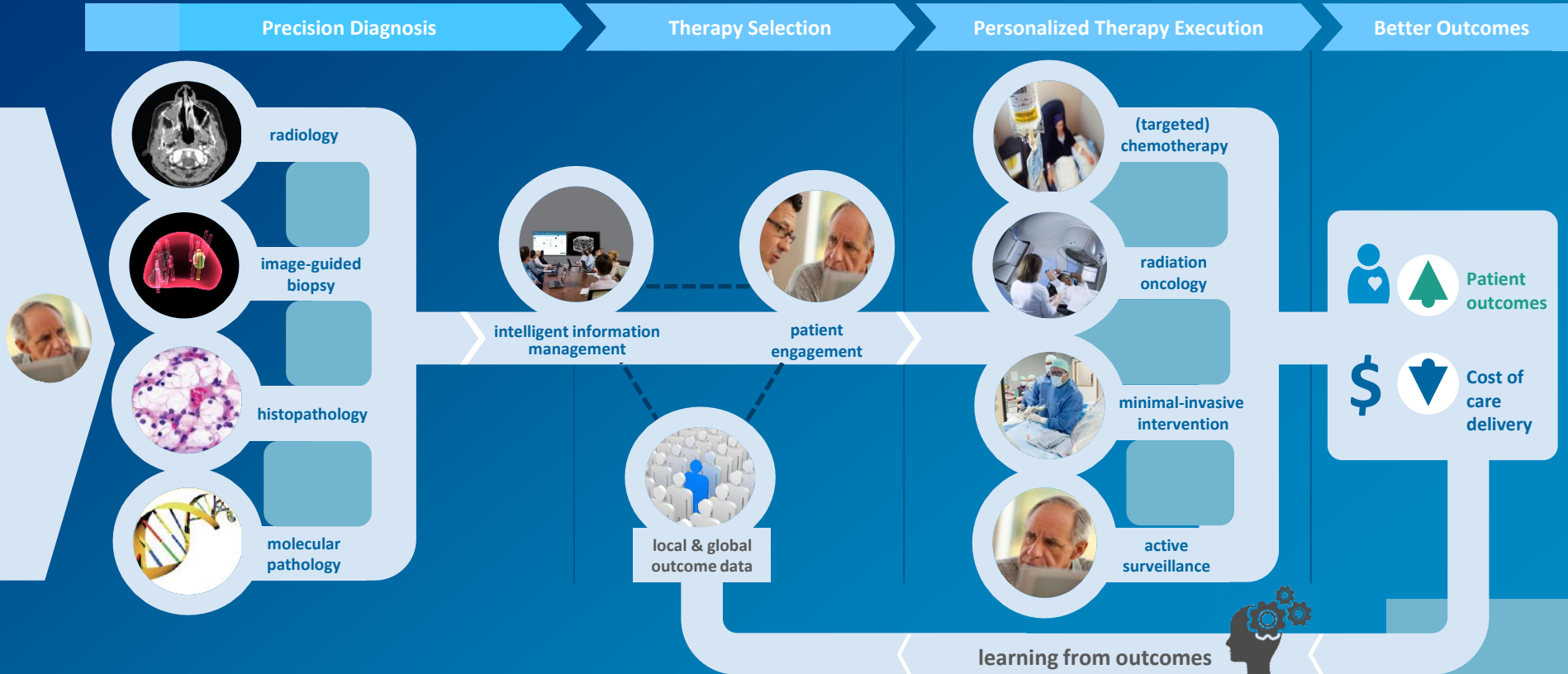
52% improvement in notifications to trigger interventions[1]

[1]Subbe et al. Effect of an automated notification system for deteriorating ward patients on clinical outcomes. Critical Care (2017) 21:52. Effect of an automated notification system for deteriorating ward patients on clinical outcomes. 2. Lilly CM, et al. Hospital Mortality, Length of Stay and Preventable Complications Among Critically Ill Patients Before and After Tele-ICU Reengineering of Critical Care Processes. JAMA. June 2011

Solutions can be at department or enterprise level



Cancer Care from Diagnosis to better Outcomes



Connected Oncology Demonstrator for Prostate

Presented at Astro 2018

Diagnostics

IntelliSpace portal

UroNav

IntelliSite digital pathology

Treatment selection & Follow-up

IntelliSpace Precision Medicine

IntelliSpace Pathways

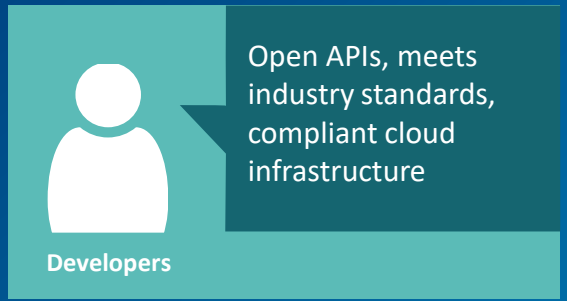
Treatment planning & execution

IntelliSpace Radiation Oncology

Designed to enable	Prepared for	Prostate treatment plan creation within	Accuracy of AutoContouring
same-day simulation to treatment	1-click planning	25 minutes	≥70%


PHILIPS
Solutions need unlocking the power of Data
HealthSuite as “System of Engagement”

Customer needs related to Data

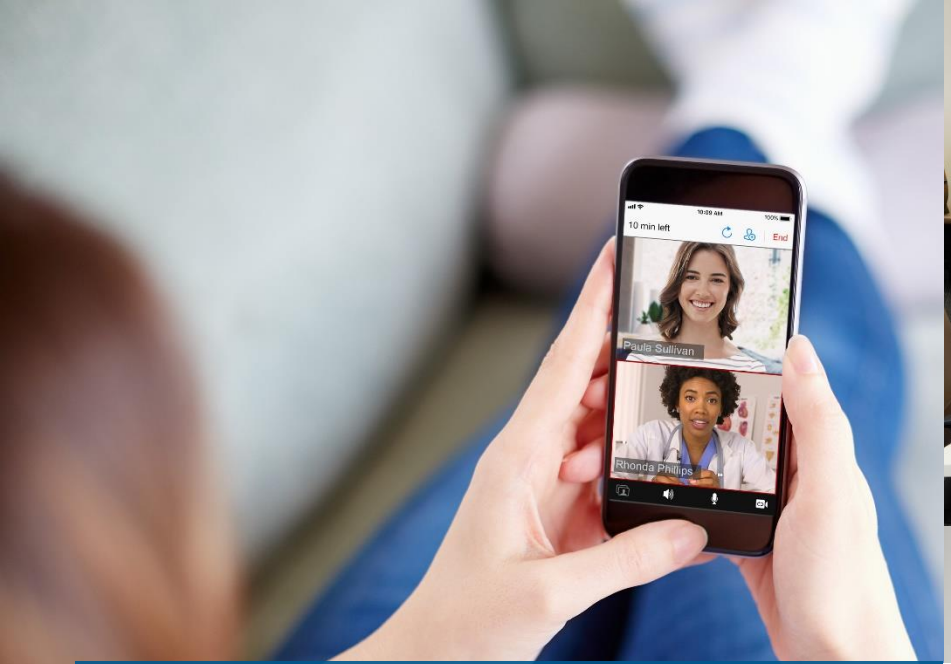


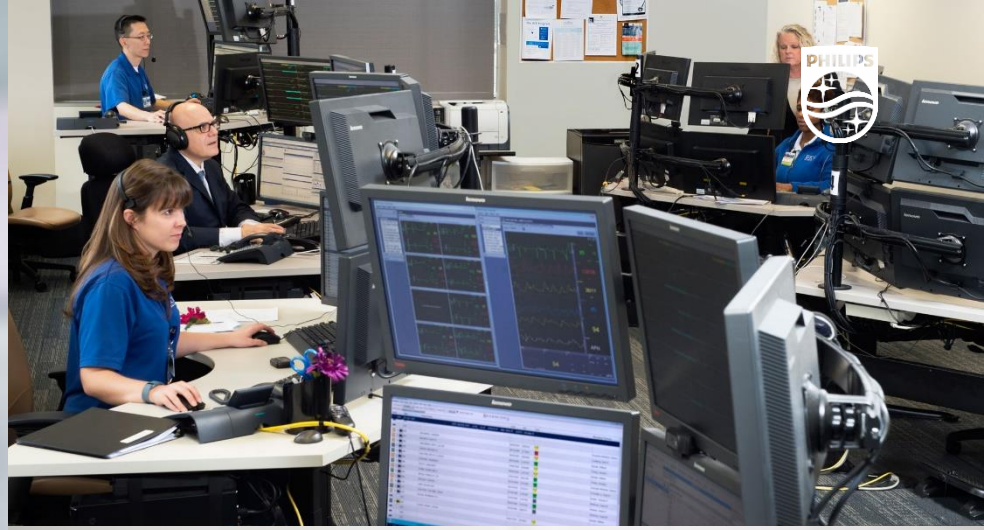
Seamless, connected care that fits the workflow and daily routines of staff

HealthSuite – a unique Platform evolving into a System of Engagement on top of the EMR*

Quadruple aim	Better **health outcomes**	Improved **patient experience**	Improved **staff satisfaction**	Lower **cost of care**
Clinical journeys	**In the home**	**In the hospital**	**Care management**	**Precision diagnosis**
Solutions	**Products, SW, Systems** →	**Services** →	**Ecosystems**	
HealthSuite	**Workflow**	**Intelligence**	**Engagement**	
	Host Cloud and On Premise	**Authorize** Federated identity Access control	**Connect** Healthcare IoT	**Store** Secure data stores Data federation	**Share** Interoperability	**Analyze** Analytics
EMR	**System of Record:** Patient History, Medication lists, Clinical Documents, Notes, Protocols, Guidelines			

*and other Hospital IT systems for billing, lab mgt etc





Enabling Virtual care

Making scarce resources available 24/7
Optimization of resources and better quality of care, by virtual consults, networked care and remote monitoring

eICU

Remote Monitoring

Command Center

SleepCare
Empowering consumers to manage chronic disease

Direct Consumer Engagement	Diagnostics	People-centric Therapy	Connected Proposition	Care Management Services
				
>3 million consumer visits annually to our websites	**Leader** in lab and home sleep tests **#1 in the** United States	**Award-winning Dream Family** fuels market growth	**~5 million devices** connected **>575K registered** DreamMapper users	**>325k** patients managed Expanding across **US, UK, France and India**

Insights from 2.3 billion nights of cloud-based data enables improving care pathways and services


PHILIPS
The next wave:
Adaptive Intelligence

Everyone is talking about Artificial Intelligence

The opportunity of AI in Healthcare

- AI applications can potentially create $150B in annual savings for US healthcare by 2026
- Growth in the AI health market is expected to reach $6.6 billion by 2021— a CAGR of 40 %
- In just the next five years, the health AI market will grow more than 10x.
- Opportunities are in clinical, operational, and financial domains

Application	Value*
Robot-Assisted Surgery	**$40B**
Virtual Nursing Assistants	**$20B**
Administrative Workflow Assistance	**$18B**
Fraud Detection	**$17B**
Dosage Error Reduction	**$16B**
Connected Machines	**$14B**
Clinical Trial Participant Identifier	**$13B**
Preliminary Diagnosis	**$5B**
Automated Image Diagnosis	**$3B**
Cybersecurity	**$2B**
Total	**~$150B**

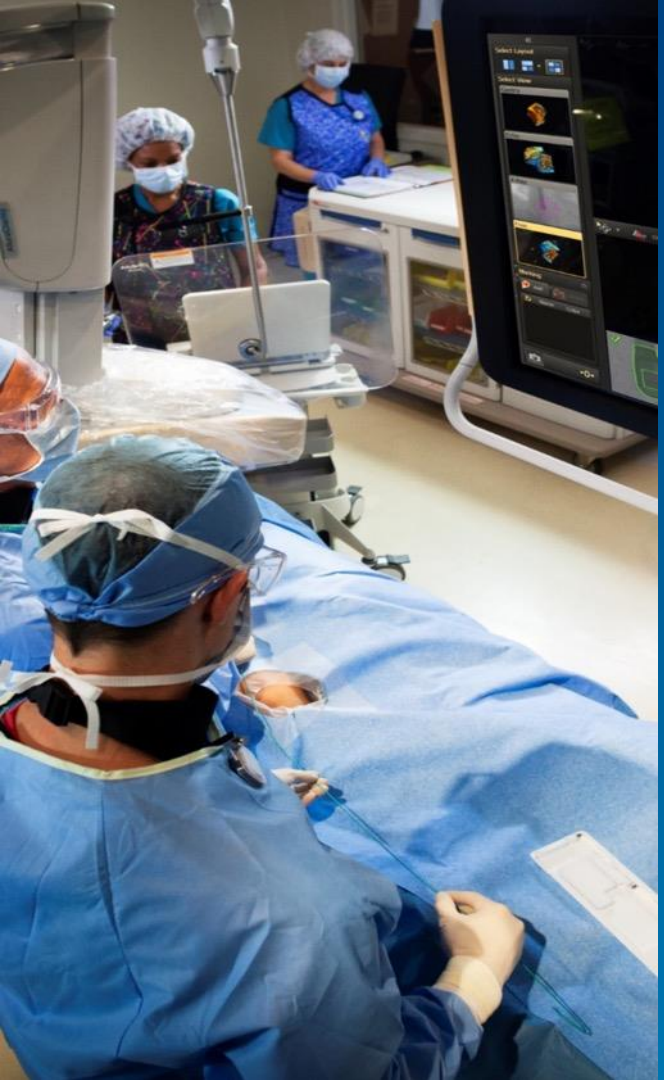
* Frost and Sullivan, by 2026

Coral Dev Board

AI is starting in the cloud, but will become embedded as well

- AI software providers are tailoring their AI models and algorithms for deployment on machines and devices outside the data center
- Chip manufacturers are increasingly embedding support for AI directly into devices
- AI chips are being developed that can perform complex computations but consume minute amounts of power
- Machines with embedded AI are beginning to appear in many industries, including health care
- Annual shipments of devices with embedded AI are projected to increase from 79 million last year to 1.2 billion in 2023

https://www2.deloitte.com/insights/us/en/focus/signals-for-strategists/pervasive-intelligence-smart-machines.html



Dealing with AI responsibly will be key to success

Appropriate validation on well curated , annotated, and representative test data is key (avoiding bias)

We must be mindful about customer/patient concerns related to **their personal data**

Trustworthy companies become **preferred data partners**

Ethical dimension is very important. AI must not **harm or adversely affect citizens**

When it comes to legal requirements, **transparency, choice and access** are fundamental principles

Philips positioning is *Adaptive Intelligence*

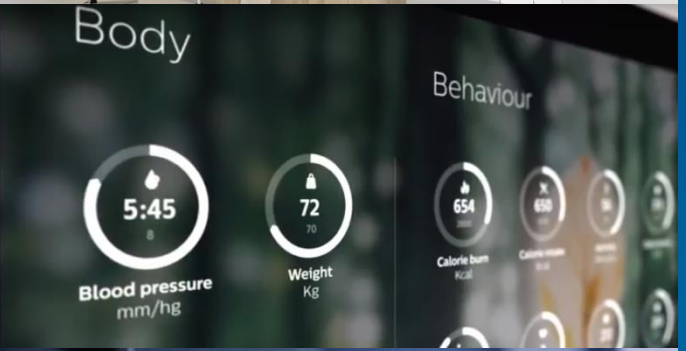
Using AI to help turn large amounts of data into actionable insights to support and empower people

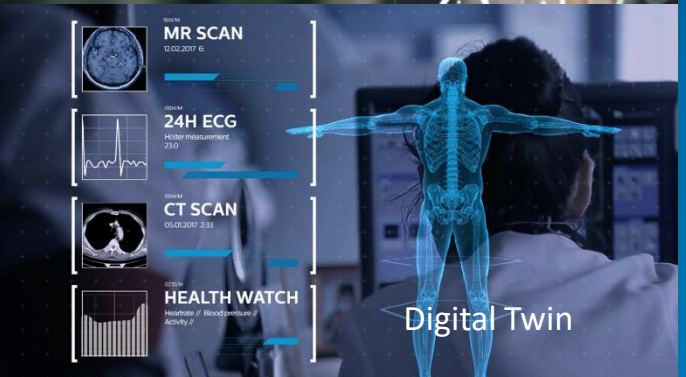
Enhances the people who use it

Adapts to the context

Is embedded into people's workflows or daily environment

Adaptive intelligence combines the power of AI and other technologies with clinical and operational domain knowledge





Adaptive Intelligence
Attributes

Dynamic: changes dynamically, in response to you

Unobtrusive: integrates into the environment

Context-aware: devices recognize you & your context

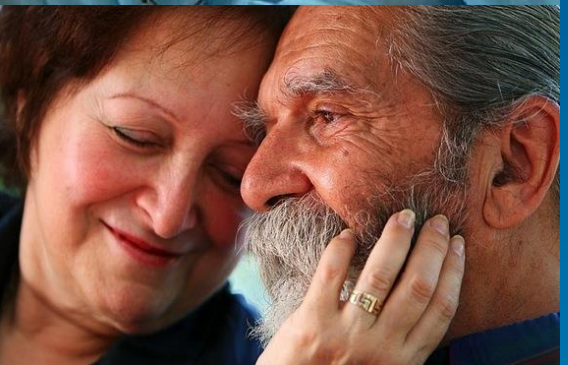
Natural: interact and converse in an intuitive way

Precise: multi-modality perspective for precision

Personalized: configured to your needs

Predictive: anticipate your condition & needs

Pro-active: preventative, enabling early intervention

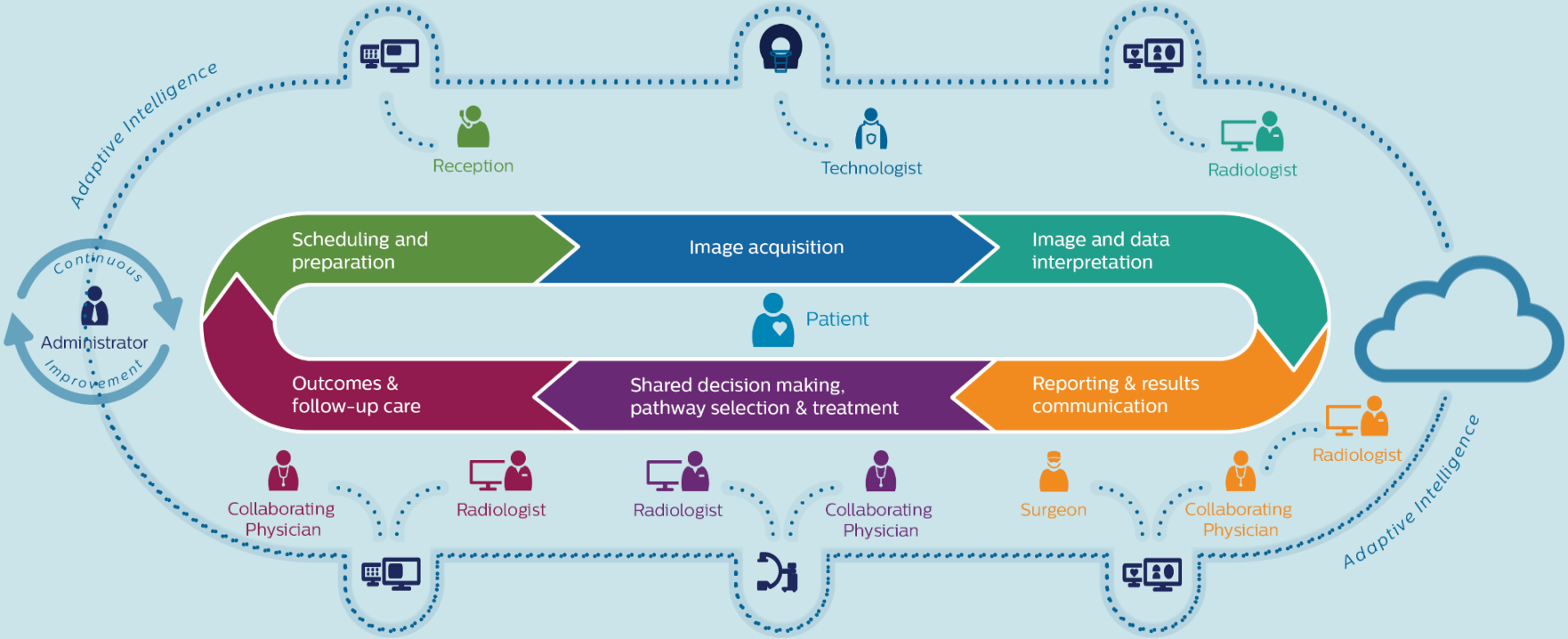


AI in radiology will enable **precision diagnosis and efficiency**

- Integration of vast amounts of diagnostic data for earlier and more definitive diagnosis
- Right study, at the right time, leading to the right therapeutic interventions
- Precise therapies guided by imaging
- Optimal operational performance to ensure equal quality of care across hub-and-spoke health systems
- Simplified and automated workflow to reduce staff workload and variability

Using AI to **augment** healthcare providers

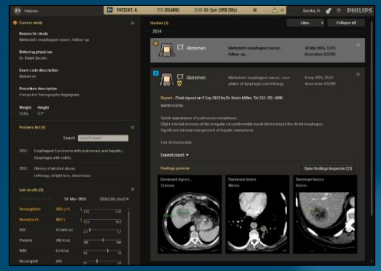
A solutions approach for AI in Radiology



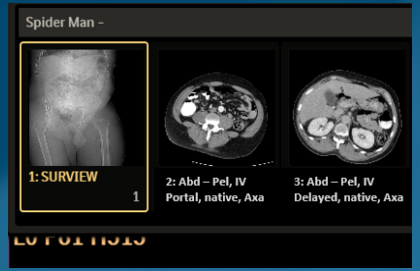
Illumeo with adaptive intelligence

Launched at RSNA 2018

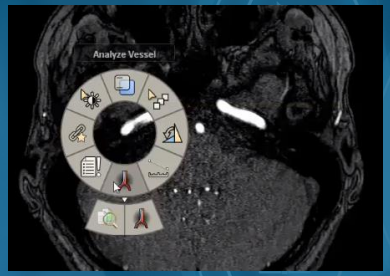
Patient Briefing



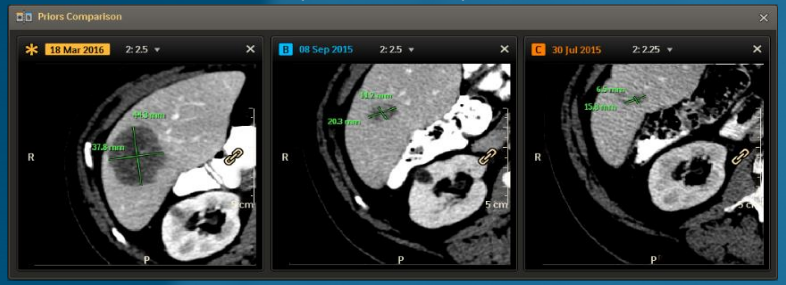
Semantic Labeling



Inspection Reticle



Comparison Inspector



Findings Inspector

Data analytics and insight gathering using Performance Bridge

Phoenix Children's Hospital, USA

Reduced waste
60 Unnecessary exam cards eliminated
7% Repeat scans reduction

20+ minutes of time savings
in changeover time

Improved patient and staff experience

Results from case studies are not predictive of results in other cases. Results in other cases may vary.

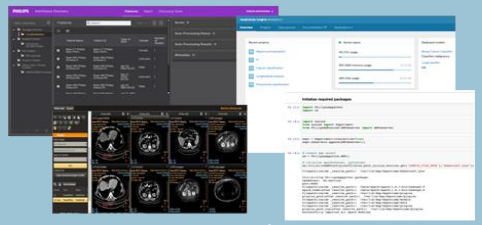
Philips AI Translational Solution for Radiology

From Clinical Research to Clinical Routine

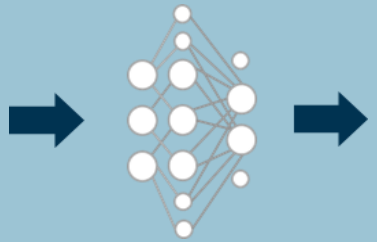
Philips Marketplace

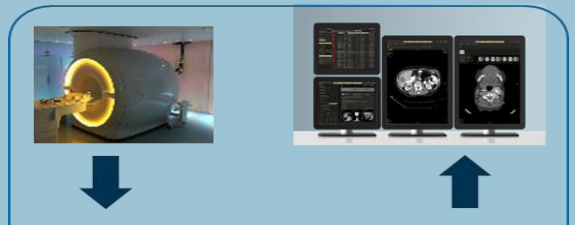
Research Apps

Validated Clinical Apps



ISD and HSI





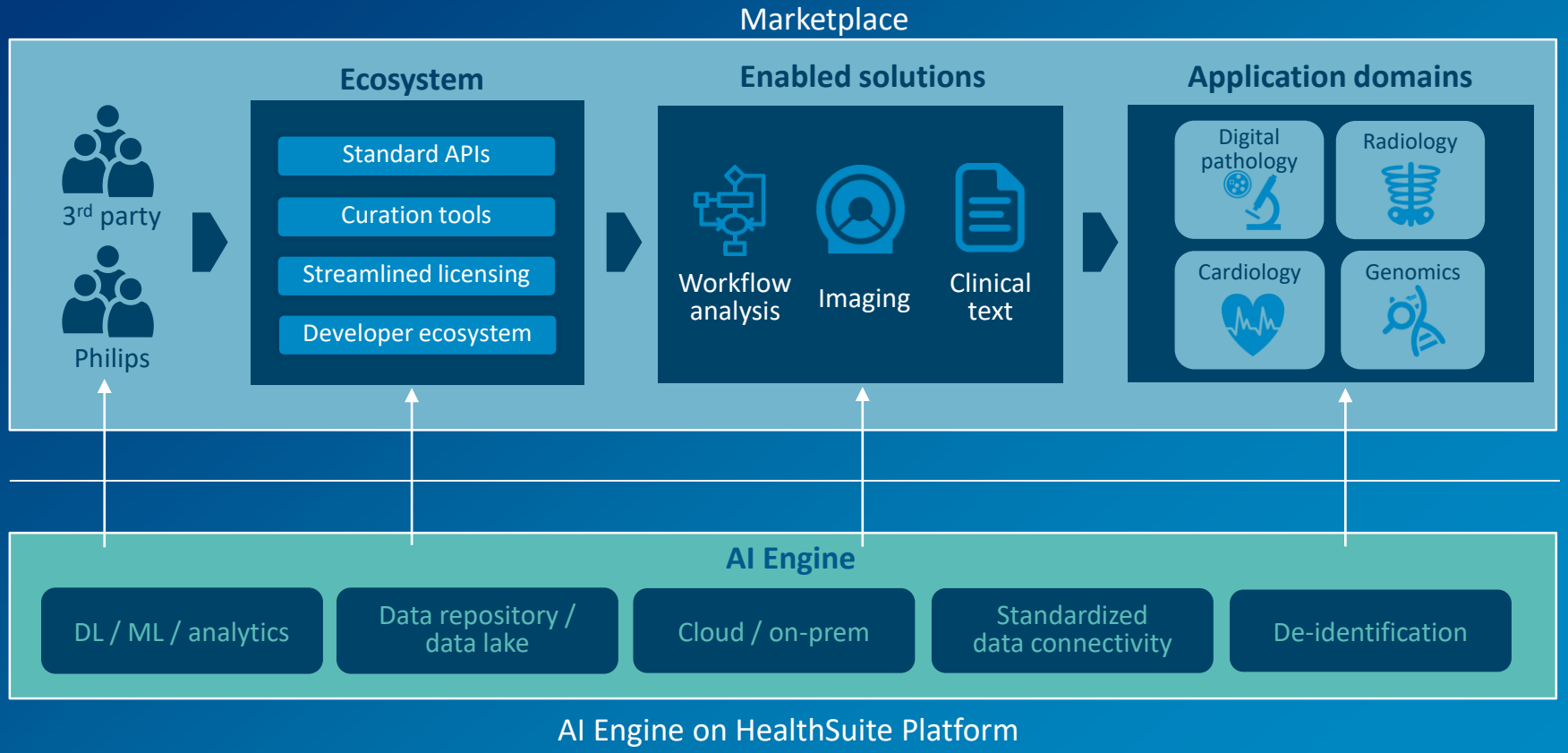
AI for Radiology

Research

Translation

Clinical Routine

Creating an Adaptive Intelligence Ecosystem



AI Engine on HealthSuite Platform

In 2018, 19 AI start-ups were selected from 800 across 11 countries

Ecosystem Innovation

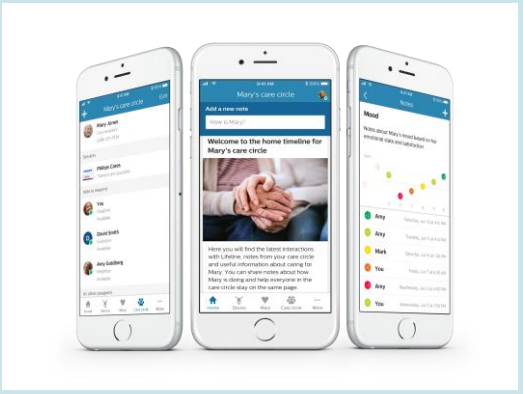
HealthWorks, Market Place, Connected Care Ecosystem

It all comes together in a Connected Care ecosystem

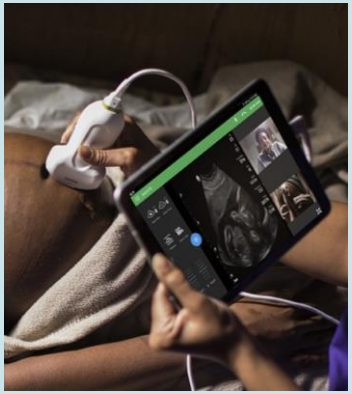
AI will enable deep insight in a person's health, disease drivers and state.
AI supports a more precise diagnosis, better therapy fit and improved adherence

Sleep & Respiratory Care
Coaching & therapy compliance

e-ICU
Real-time monitoring and Intervention



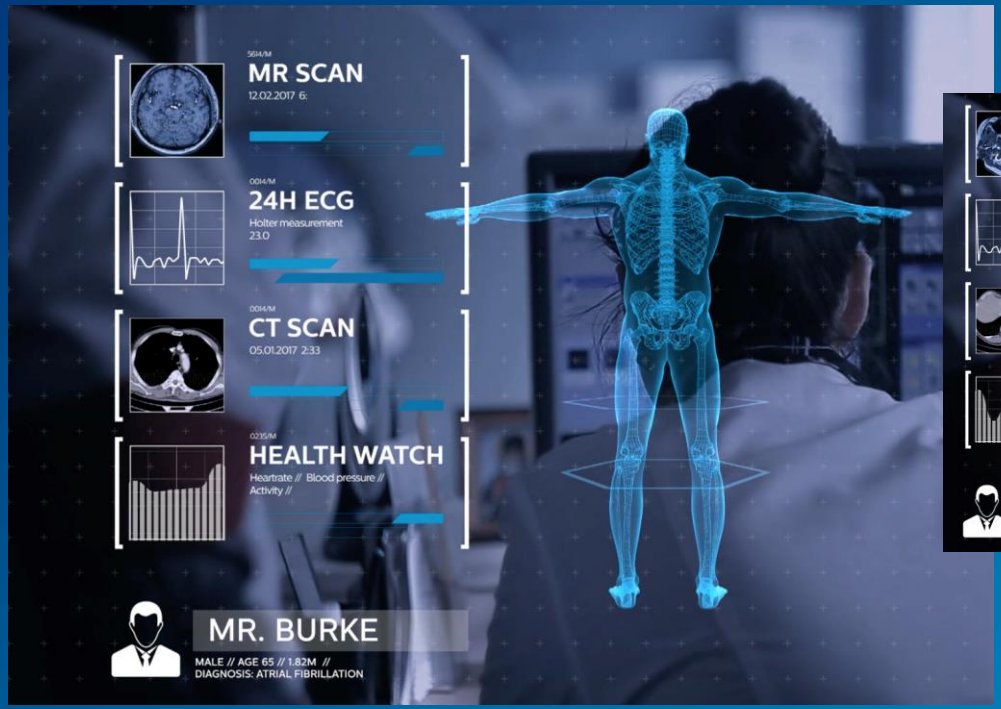
Elderly Care
Behavioral pattern recognition

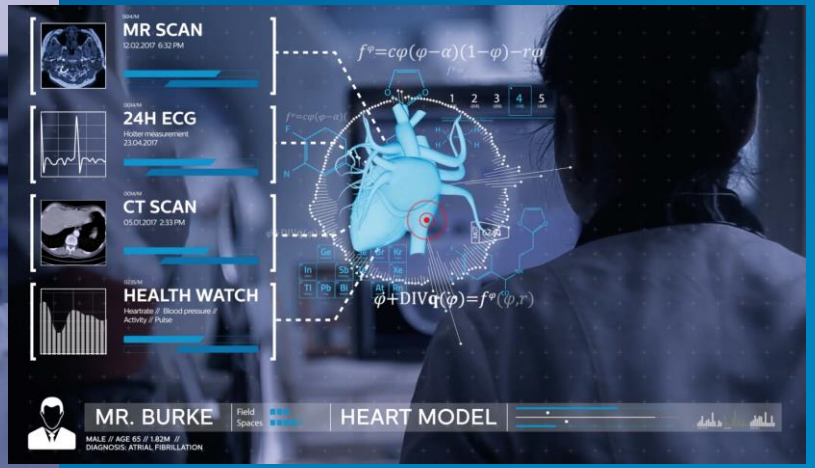


Precision Diagnosis
At the point of care

Your digital twin

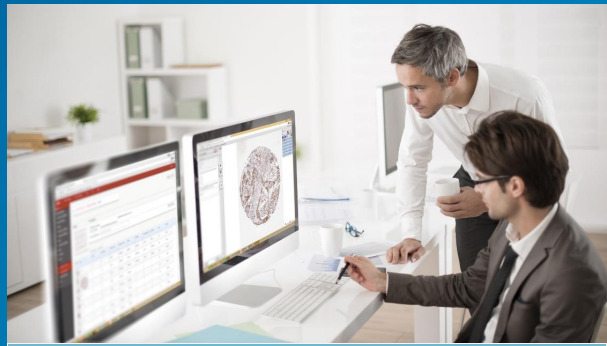
Putting data and AI into a personalized clinical context

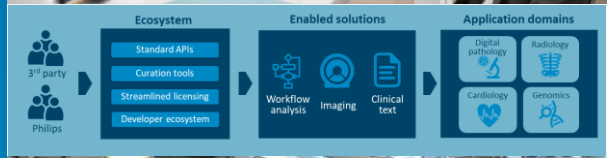




Five ways in which healthcare innovation is changing

- From product features to solutions for value-based care
- Designing solutions aligned with customer KPI's is critical
- This requires ecosystem innovation on open digital platforms
- To unlock the power of data we need a *System of Engagement* with *Adaptive Intelligence* to translate EMR and device data into actionable insights embedded into the workflow
- Research is moving out of the lab to the frontline of innovation – co-creation with customers and ecosystem partners





https://www.linkedin.com/pulse/five-ways-which-healthcare-innovation-has-changed-over-van-houten/

From “the Lab is your World” – to “the World is your Lab”


Q&A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