Welcome to the ITEA Technology webinar

Cyber-Physical Metaverse in healthcare

26 May 2026, Online

Dirk Elias, ITEA Chairman

ITEA 4

Cyber-Physical-Metaverse in healthcare

Meet the contributors

ITEA Technology webinar

Dirk Elias
ITEA Chairman

Maryse van 't Klooster
Clinical Affairs Manager

TriamecT

Danny Ruijters
Principal Scientist

PHILIPS

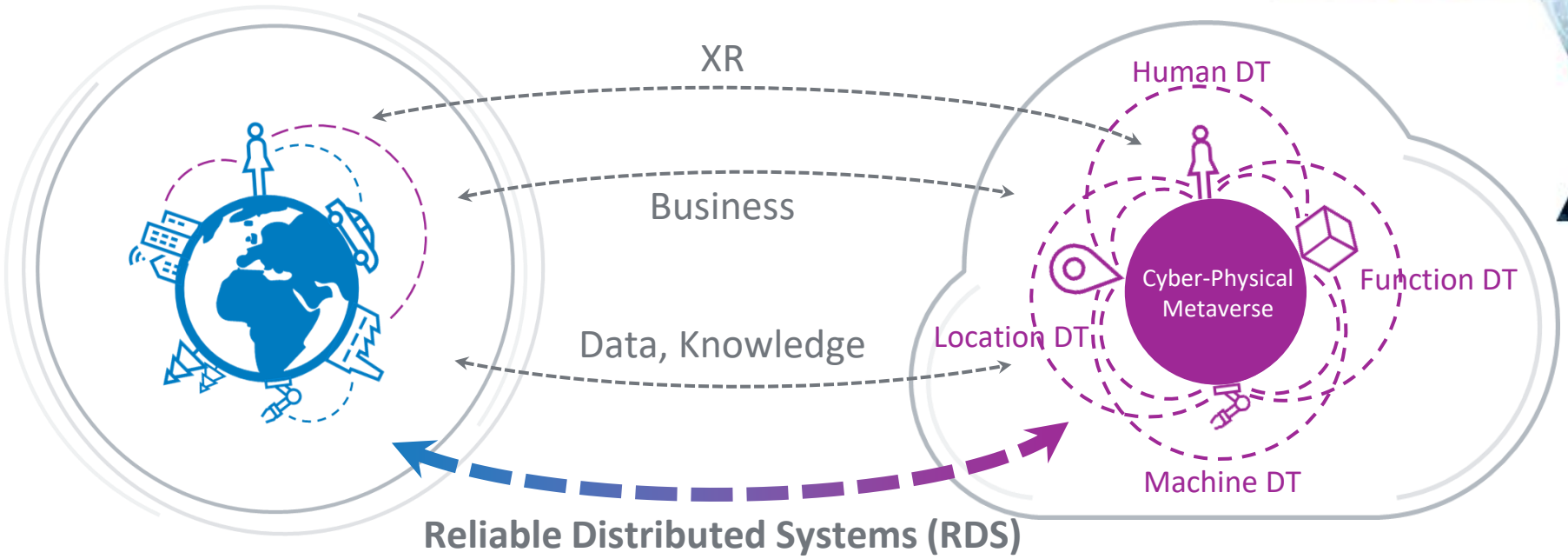
Johan Plomp
Senior Scientist

VTT

ITEA 4 | Σ

Cyber-Physical-Metaverse in healthcare

Recall & background



No question if, only when!

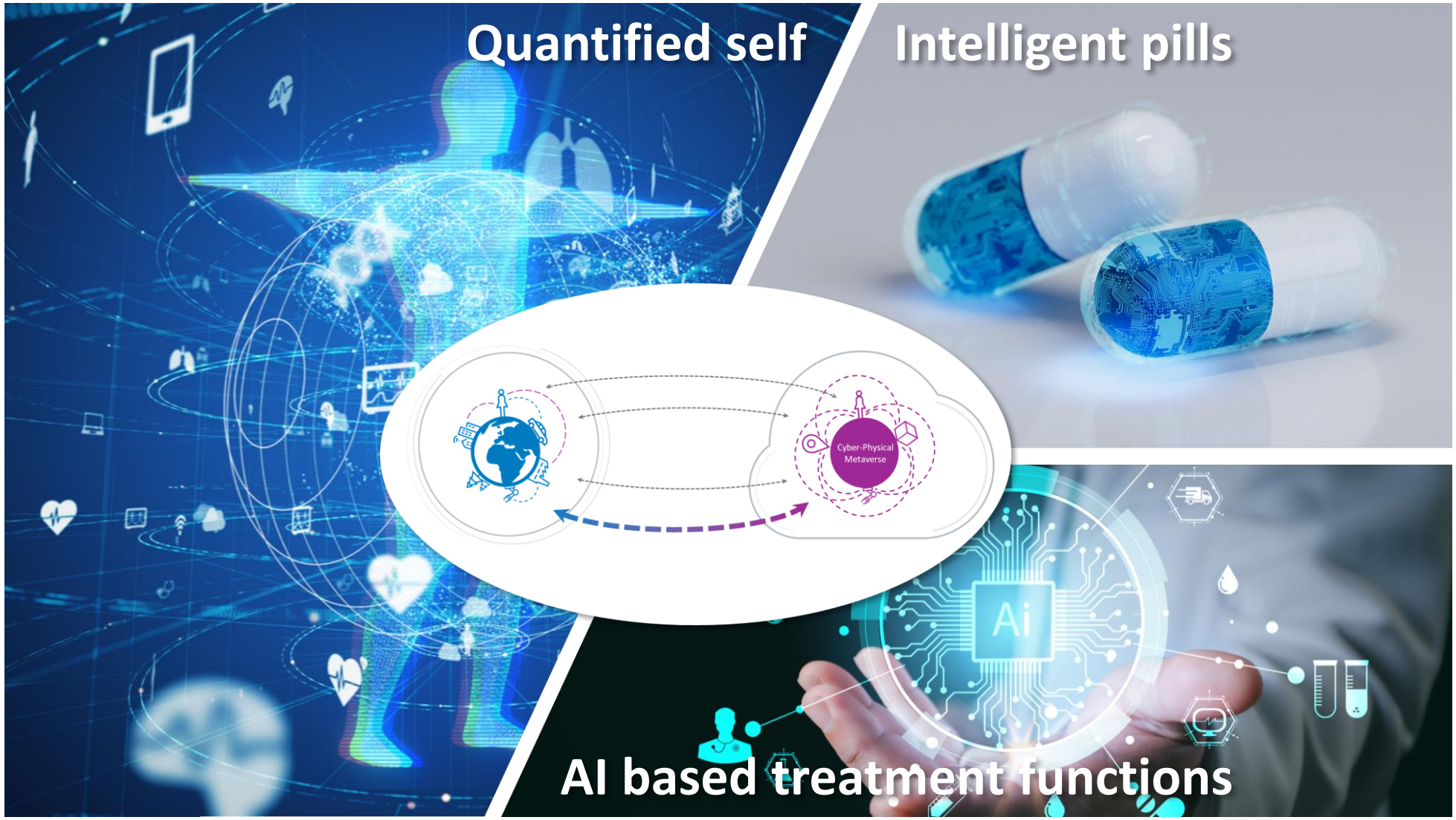
Check: https://itea4.org/itea-technology-webinar-cyber-physical-metaverse-introduction.html

ITEA Technology webinar

ITEA 4 | Σ

Cyber-Physical-Metaverse in healthcare

Setting the healthcare scene (1/2)



Cyber-Physical-Metaverse in healthcare
Setting the healthcare scene (2/2)

- Giant step forward for early detection and prevention of serious diseases. Leading to higher life expectancy and quality, higher productivity as well as lower health care system cost.

- Many low hanging fruits allow for an immediate introduction, followed by incremental extension to more complex solutions.

➔ One example: Heart failure

ITEA
Technology
webinar

ITEA 4 | Σ

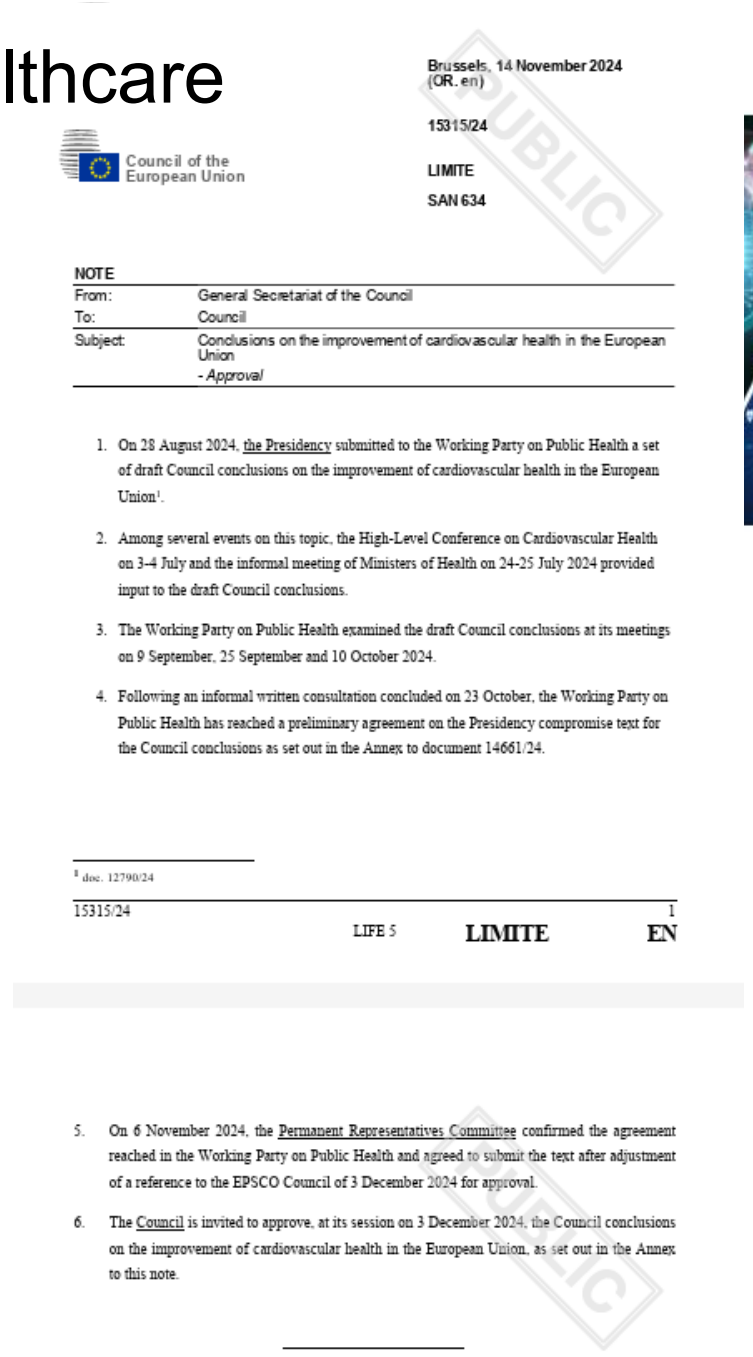
Cyber-Physical-Metaverse in healthcare

No wait to start! One example

- In December 2024, EU has adopted Council Conclusions that will set a milestone for the continent's cardiovascular health.
- Cardiovascular disease (CVD):
  - Is the leading cause of death globally, accounting for over 1.7 million deaths annually
  - Costs its economy an estimated €282 billion/year
  - Heart failure stands for 10+% of the total CVDs

→ **Many CPM solutions can be implemented already now!**

→ **Vast savings potential for health care systems and economy**



Council of the European Union

Brussels, 14 November 2024
(OR. en)

15315/24

LIMITE

SAN 634

PUBLIC

NOTE

From:	General Secretariat of the Council
To:	Council
Subject:	Conclusions on the improvement of cardiovascular health in the European Union - *Approval*

1. On 28 August 2024, the Presidency submitted to the Working Party on Public Health a set of draft Council conclusions on the improvement of cardiovascular health in the European Union[1].
2. Among several events on this topic, the High-Level Conference on Cardiovascular Health on 3–4 July and the informal meeting of Ministers of Health on 24-25 July 2024 provided input to the draft Council conclusions.
3. The Working Party on Public Health examined the draft Council conclusions at its meetings on 9 September, 25 September and 10 October 2024.
4. Following an informal written consultation concluded on 23 October, the Working Party on Public Health has reached a preliminary agreement on the Presidency compromise text for the Council conclusions as set out in the Annex to document 14661/24.

[1] doc. 12790/24

15315/24 LIFE 5 **LIMITE** **EN** 1

5. On 6 November 2024, the Permanent Representatives Committee confirmed the agreement reached in the Working Party on Public Health and agreed to submit the text after adjustment of a reference to the EPSCO Council of 3 December 2024 for approval.
6. The Council is invited to approve, at its session on 3 December 2024, the Council conclusions on the improvement of cardiovascular health in the European Union, as set out in the Annex to this note.

PUBLIC

ITEA
Technology webinar

ITEA 4 | Σ

Cyber-Physical-Metaverse in healthcare
Too complex?

- What about the complex scenarios, not only for healthcare, but also other domains?

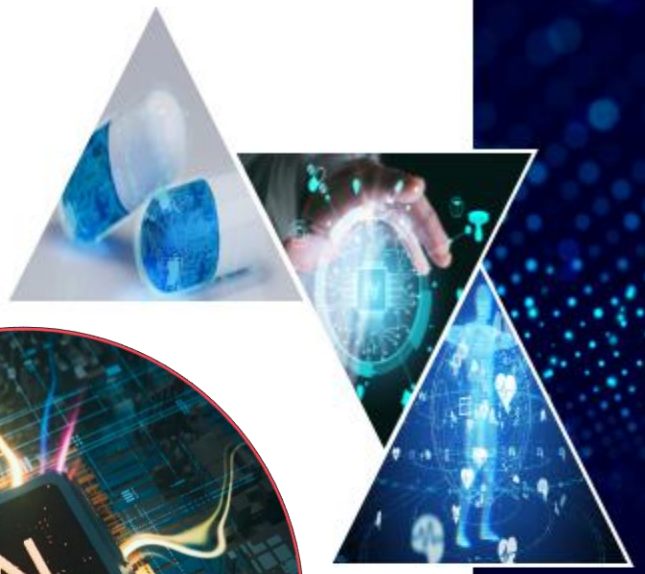
- Is the implementation of the CPM and the integration of the giant number of technologies and building blocks too complex to lead to a reliable and market ready solutions?

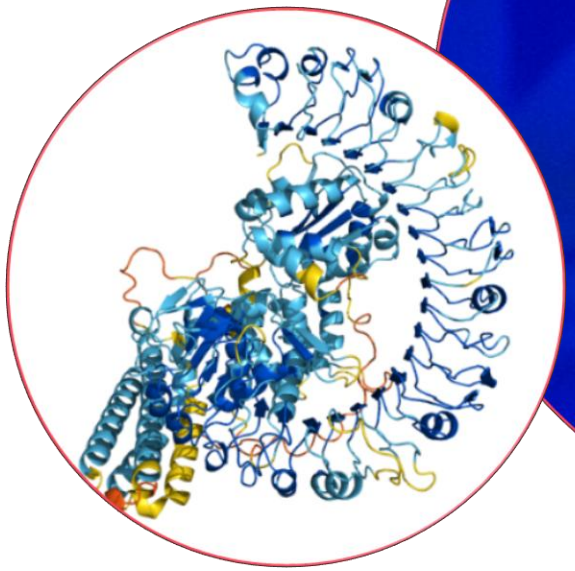
ITEA
Technology
webinar

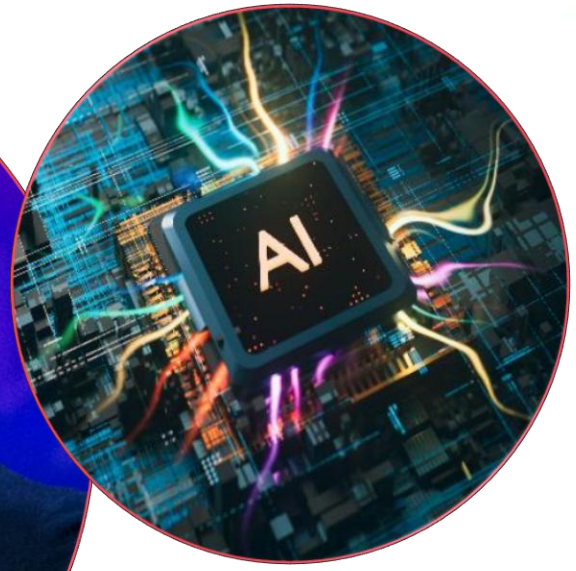
ITEA 4 | Σ

Cyber-Physical-Metaverse in healthcare

Mind Ray Kurzweil & Agentic AI







https://alphafold.ebi.ac.uk/

https://en.wikipedia.org/wiki/Ray_Kurzweil

ITEA

Technology

webinar

ITEA 4 | Σ

Thank you!

ITEA 4

Trianect

Closing the gap in stroke care:

How ***StrokePointer™*** merges EEG Biosensing and ML at the ambulance

Maryse van ‘t Klooster, PhD.

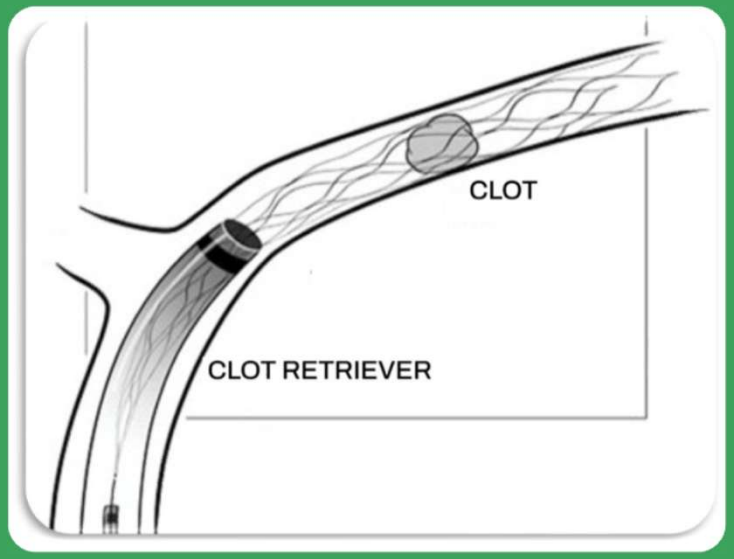
Clinical Affairs

m.a.vantklooster@trianect.com

UtrechtInc, Netherlands

trianect.com

*L*VO stroke treatment



In case of a large vessel occlusion stroke, a blood clot blocks a major blood vessel feeding the brain.

This clot needs to be removed mechanically as soon as possible, using endovascular treatment.

Every Second Counts

Trianect®

The deadly detour

without *StrokePointer*

Ambulance

Closest hospital

Comprehensive stroke center

Trianect®

Direct to treatment

with *StrokePointer*

Ambulance

Comprehensive stroke center

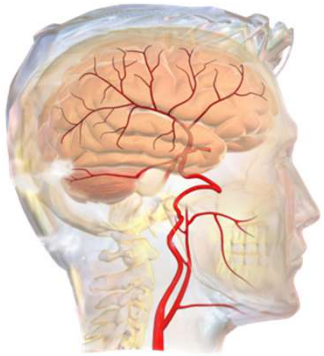
Direct transport
60 minutes faster

+ Direct to Angiography
30 minutes faster

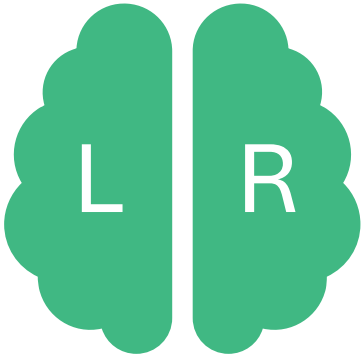
Trianect

Trianect

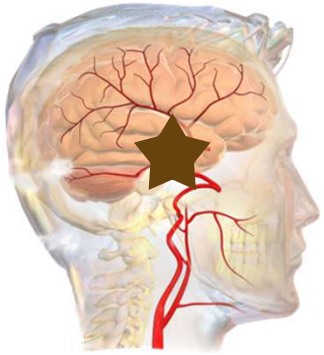
Rationale for EEG



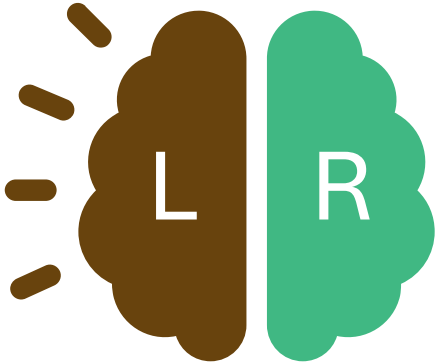
Healthy brain perfusion



Symmetric
brain activity



LVO stroke

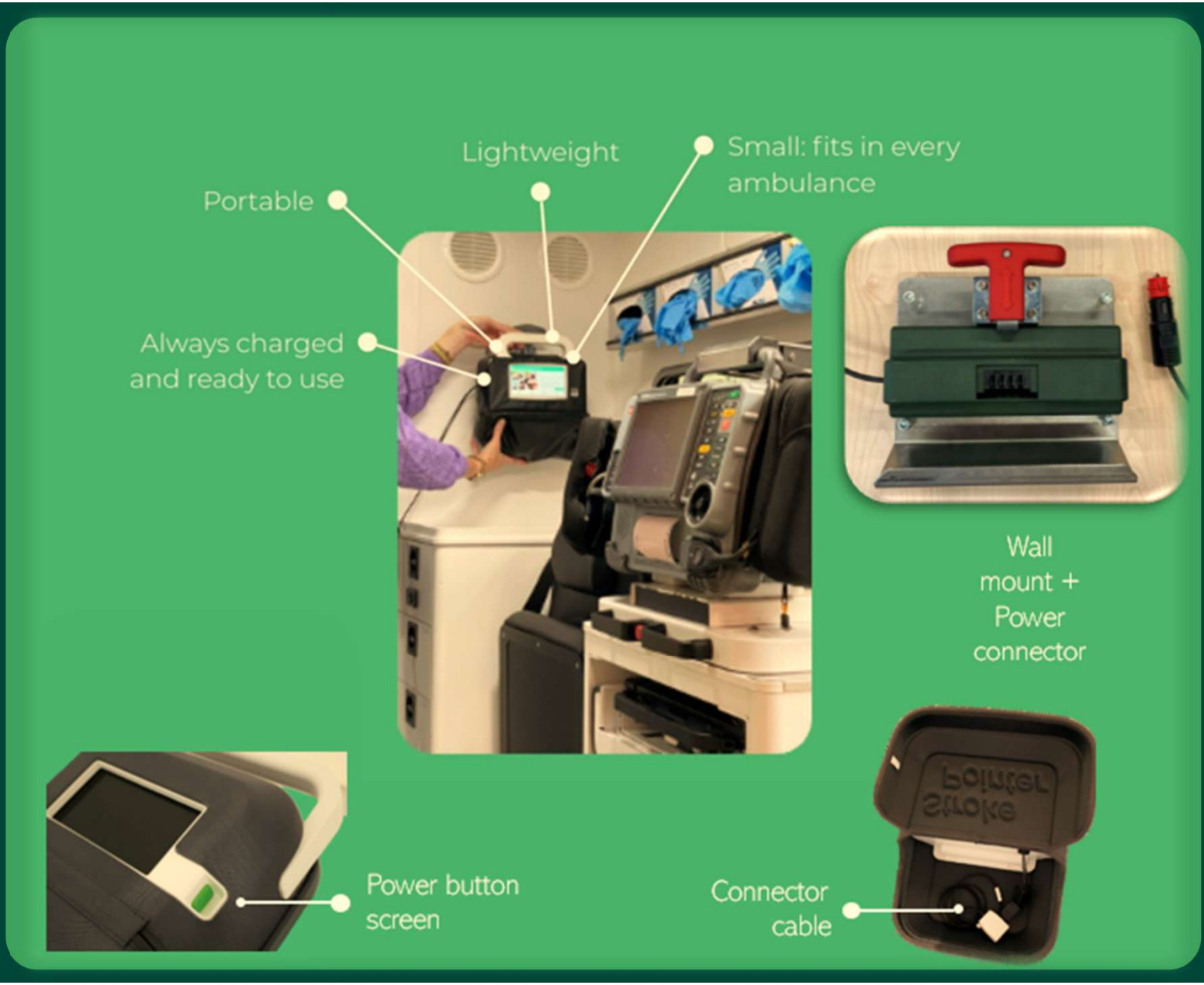


Asymmetric
brain activity

1. Suitcase
2. Wall mount
3. Headset
4. Software

Built with those who respond first

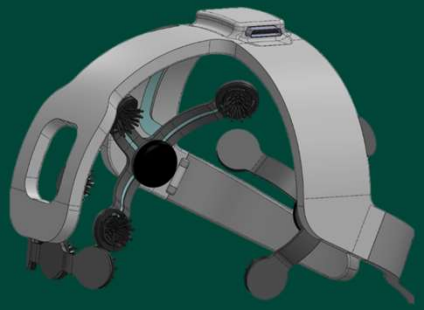
StrokePointer™



Trianect

Focus on physical usability

Dry EEG: fast application



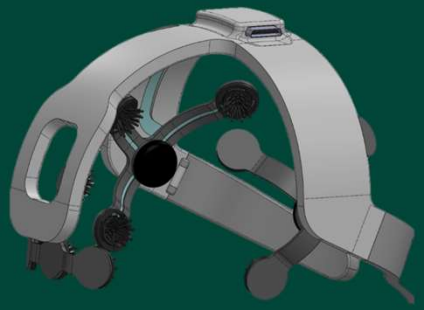
Minimalistic, intuitive design

Validated in the ambulance

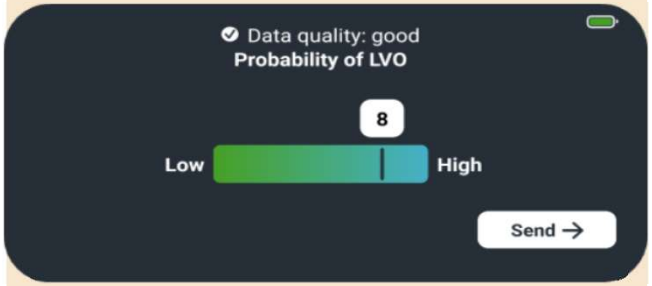
Trianect

Focus on physical usability

Dry EEG: fast application



Minimalistic, intuitive design

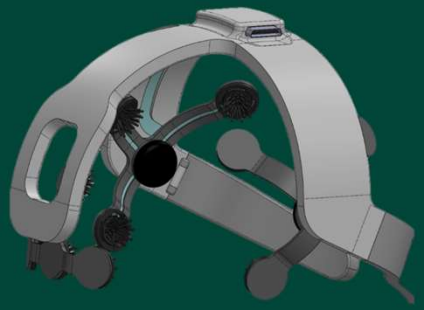


Validated in the ambulance

Trianect

Focus on physical usability

Dry EEG: fast application



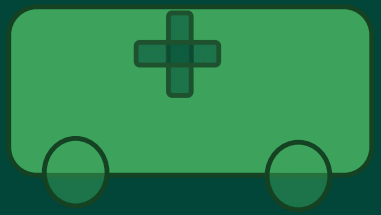
Minimalistic, intuitive design

Validated in the ambulance

Trianect

*B*ridging the *C*yber-*P*hysical *M*etaverse

Physical world



Ambulance

Ambulance professional

Patient

Brain signals (EEG)

StrokePointer™

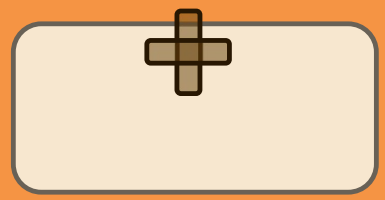
ML analysis of EEG

LVO triage

5G

Secured data encryption

Digital world



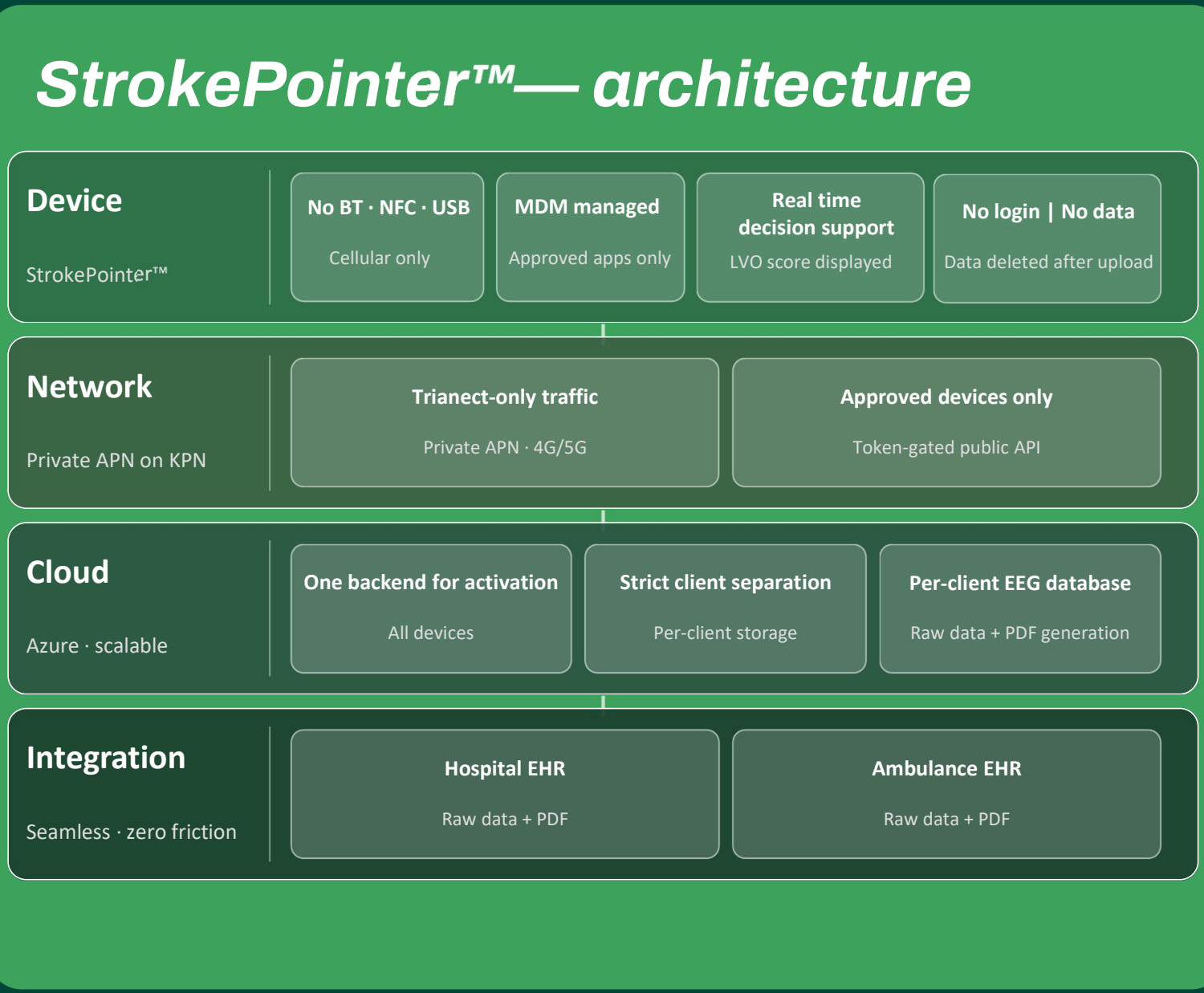
Pre-notification

Optimized workflow while patient still en route

Encrypted structured data

.

StrokePointer™— architecture

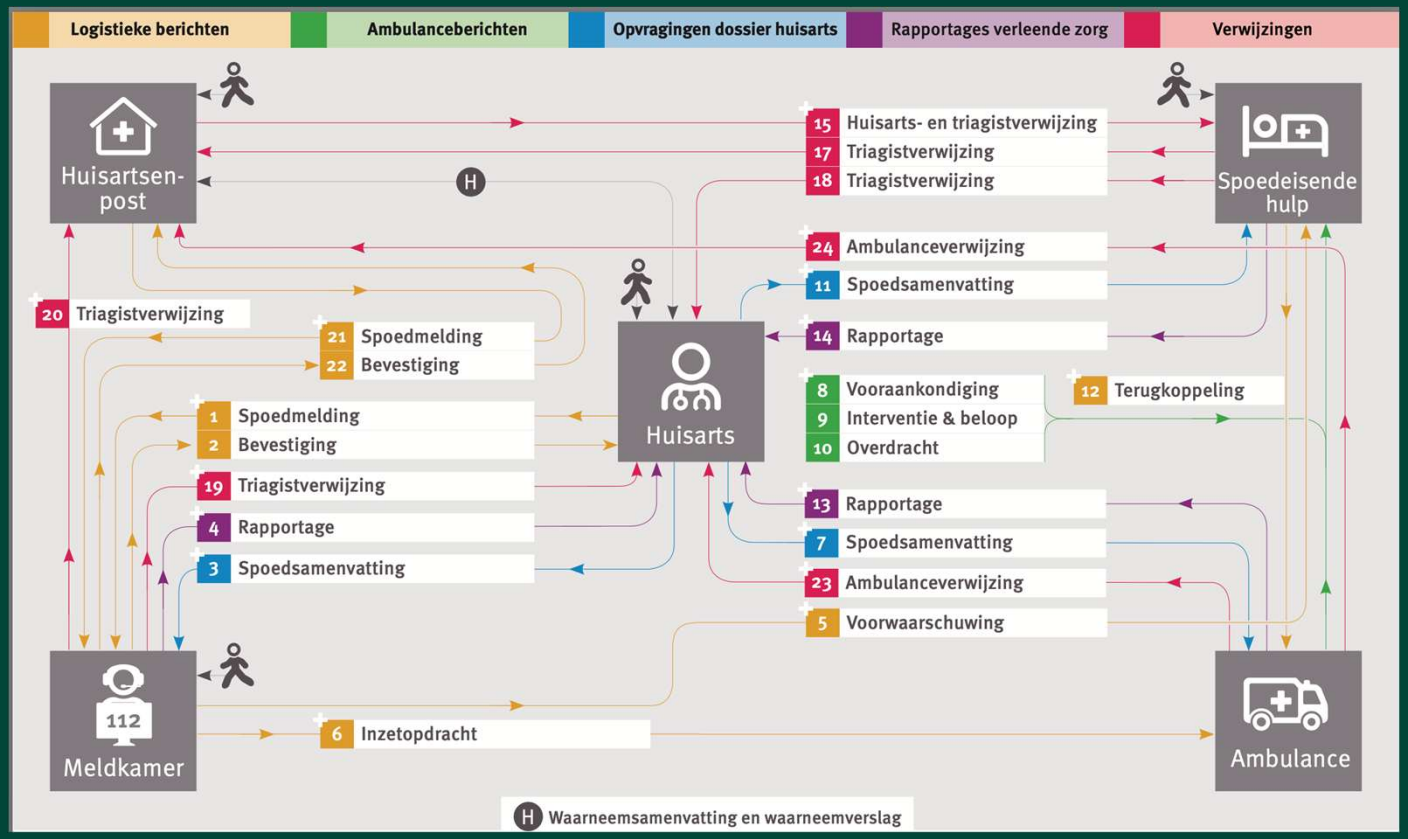


Cyber Physical Metaverse

Trianect®

Information exchange in acute care

A complex landscape



“Richtlijn gegevensuitwisseling acute zorg”

becomes field standard in the Netherlands

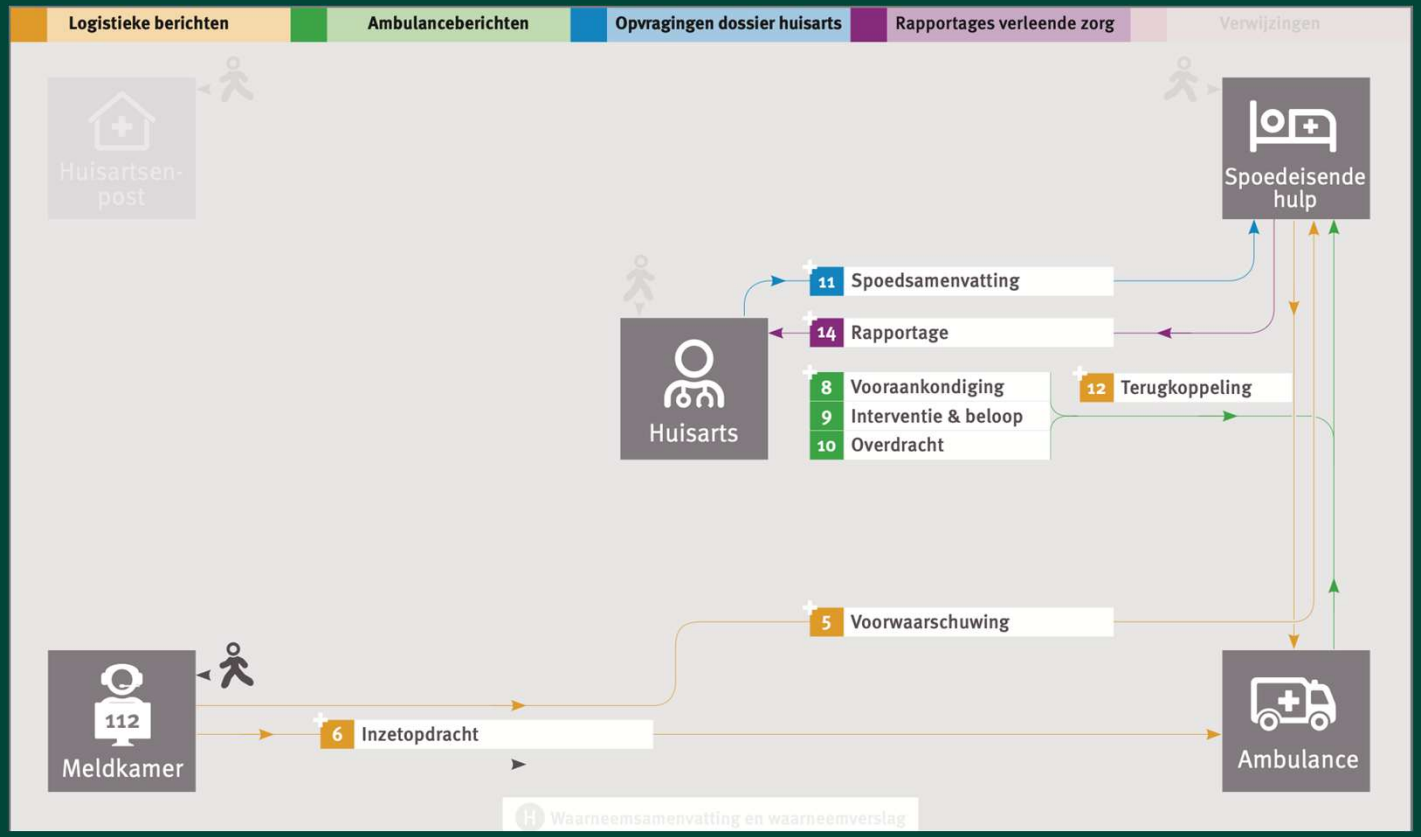
2020

Supported by:

Branche organisations
Healthcare professional
Acute care providers
Gouvernment (VWS)
Health insurers
Hospitals
Nictiz

Information exchange in acute care

Example of a 112 call



MESSAGE 9:
Intervention & Clinical course

MESSAGE 12:
Feedback

Message content
HL7 message standard (XML)

Send reference to measurement location

OR

Encode PDF in the XML file

Guideline Information exchange acute care [in Dutch]:

https://nictiz.nl/app/uploads/2014/07/Richtlijn-Gegevensuitwisseling-acute-zorg-versie-4-2022.pdf

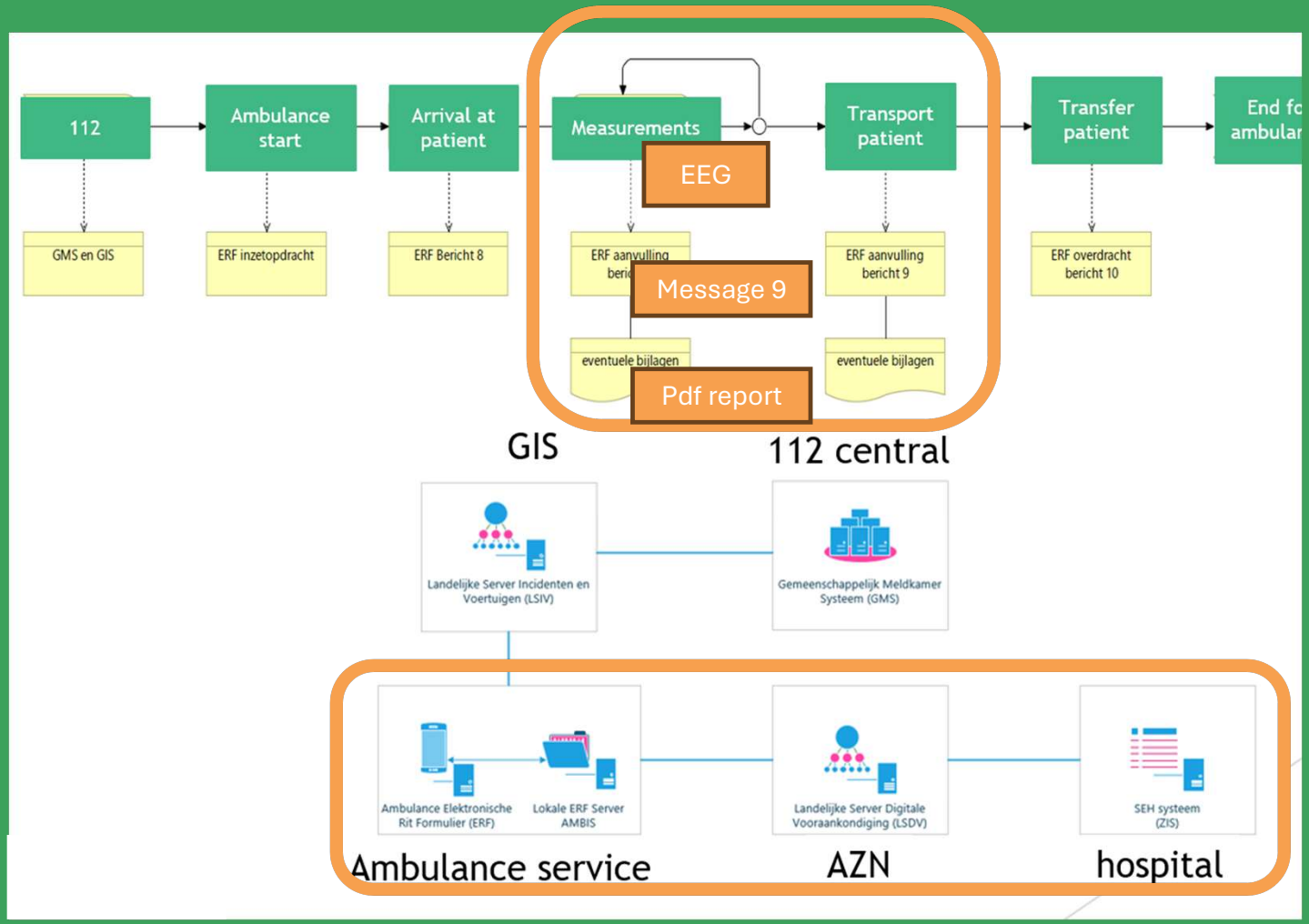
Allowed attachments

Code	Weergavenaam
001	12 afleidingen ECG
002	ritmestrook
003	advies patient
004	cardiologisch begeleidingsformulier
005	IBS/CM
006	intern rapport/overdracht
007	niet reanimeren verklaring
008	patient weigert hulp
009	RM/ZM
010	eerste hulp, geen vervoer
011	foto
012	video
013	Prehospitaal EEG (per 2025)

Data
Speed
Survival

Trianect®

Messages during ambulance transport



Current roll out status

Implemented

Not implemented (yet)

Unknown

52%

(per Sept'25)

Open challenges

EU cloud migration
We use Azure blob storage & Azure Apps. How do we move to an EU sovereign cloud — and which parties would you suggest?

Secure connections
How do we make device-to-cloud connections more secure without adding VPN complexity and errors that come with it?

Closing the feedback loop
How do we get the final diagnosis back from the hospital — requested by ambulance crews and critical for model improvement?

StrokePointer™
early triage
no delay

Trianect©

info@trianect.com | trianect.com


STROKEPOINTER
EARLY TRIAGE
NO DELAY
Trianect

Trianect

Momentum

2026

ISO 13485 certified

Largest pre-hospital EEG database

Q3-4 2026

StrokePointer in 3 EU countries

2027

CE certification

EU launch

Umbrella

Funded by the European Union

POC4TRIAGE

CROSS ROADS

Netherlands Enterprise Agency

ITEA 4

Data, AI and cyberspace in image-guided interventions and therapy

Danny Ruijters
Principal Scientist – Image Guided Therapy
2026 May 26

PHILIPS

Agenda

- What is image guided therapy?
- Philips in image guided therapy
- Cyberspace in image-guided therapy:
  - Opportunities and challenges
- The long game in cyberspace:
  - Hyper-personalized treatment
- Conclusions

What is image guided therapy?

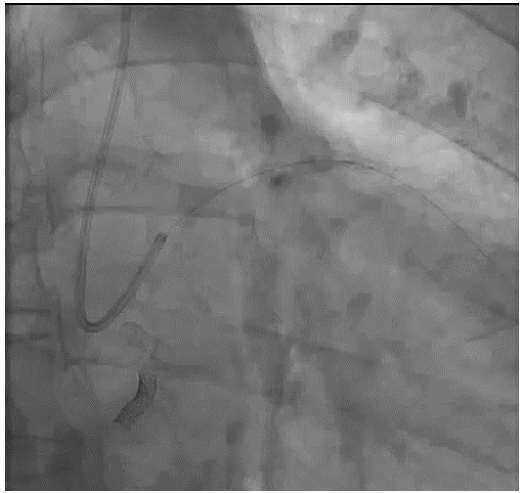
Minimally Invasive Treatment

- **Effective therapeutic effect**
  - with less trauma
  - less scarring
  - a quicker recovery time

- **Examples include:**
  - Catheterization
  - Endoscopy
  - Laparoscopy
  - Arthroscopy
  - …

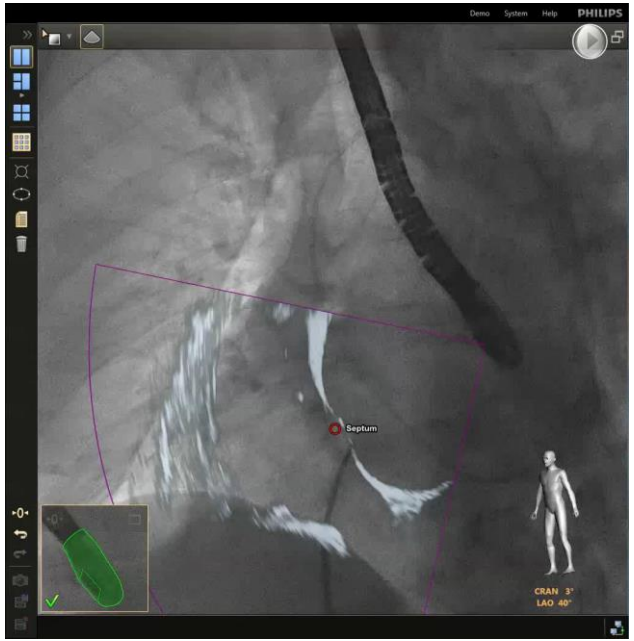
Image Guidance

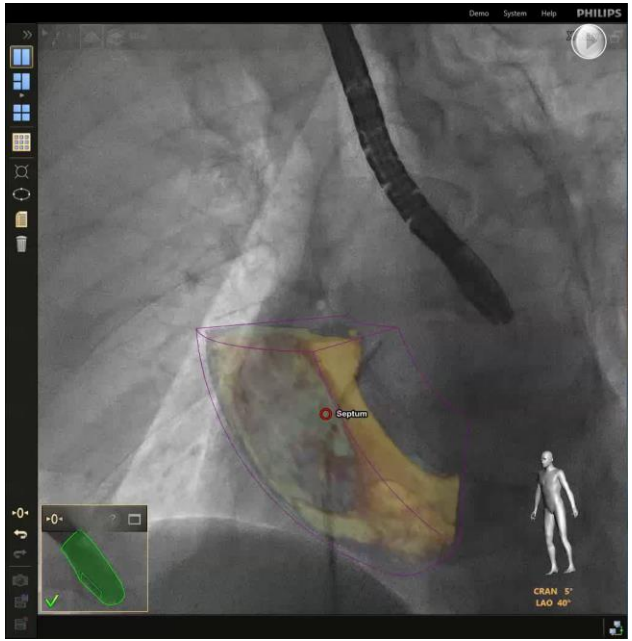
- No direct sight inside the patient
- Key enabler: real-time imaging
  - X-ray guided therapy
  - Ultrasound
- Other real-time information sources
  - ECG
  - blood pressure
  - respiratory data
  - oxygen levels
  - …
- => Fully data driven



PHILIPS

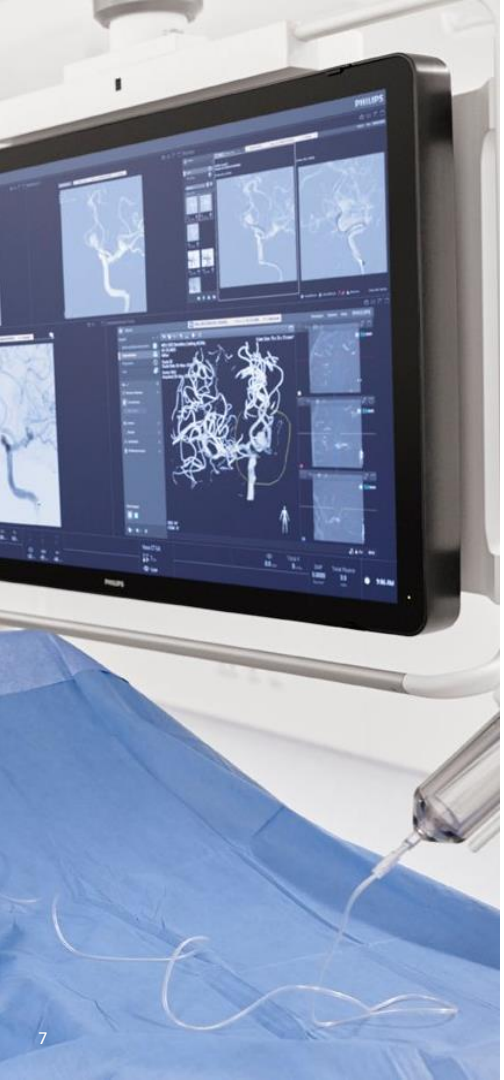
Advanced Image Guidance



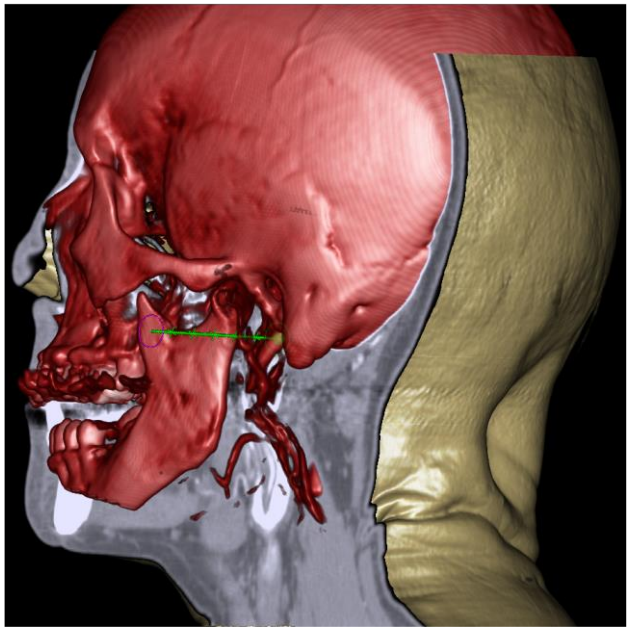


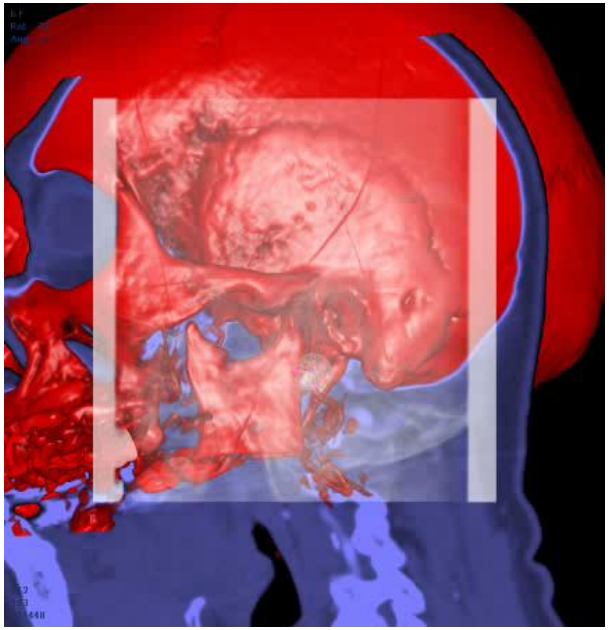
Thaden et al.: “Echocardiographic and Fluoroscopic Fusion Imaging for Procedural Guidance: An Overview and Early Clinical Experience”, 2016
Arujuna et al.: “Novel System for Real-Time Integration of 3-D Echocardiography and Fluoroscopy for Image-Guided Cardiac Interventions:” 2014

PHILIPS



Advanced Image Guidance





Spelle et al.: “First clinical experience in applying XperGuide in embolization of jugular paragangliomas by direct intratumoral puncture”, IJCARS 2009

PHILIPS

Philips in image guided therapy

How big is image guided therapy?

EUR 12 billion
addressable market in 2025

~7% CAGR
(2025-2028)

Aging population and rise of chronic disease

Driving demand for minimally invasive interventions

Staff shortages and productivity pressures

Demand for efficient workflows

Large eligible patient pools remain untreated

Demand for access to care

Innovation enables more complex and new procedures

Clinical evidence drives guidelines and reimbursement

Generating strong revenue growth for hospitals

Shift towards data-driven, and AI-supported interventions

Philips capital markets day, https://www.philips.com/c-dam/corporate/about-philips/investors/calendar/2026/CMD_2026_Transcript.pdf

How big is Philips in image guided therapy?

Systems
EUR 2.4 billion

Global #1 for over a decade
20,000+ systems in **80+ countries**

Devices
EUR 1.1 billion

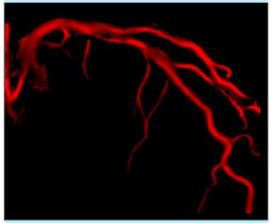
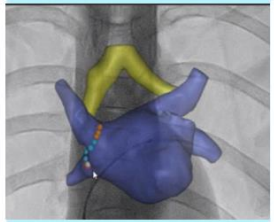
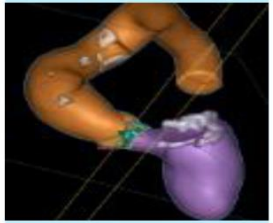
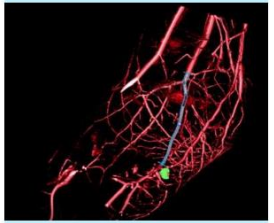
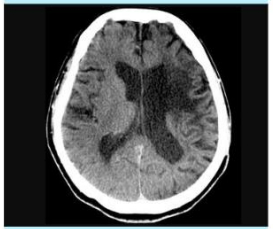
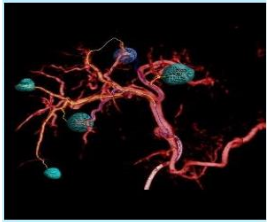
Global #1 across different segments
>50% of labs are device-ready[1]




One Integrated Interventional Platform

PHILIPS

Which clinical segments does Philips serve?

Coronary artery disease	Heart rhythm disorders	Structural heart disease	Peripheral vascular disease	Stroke	Cancer
					
Strong growth in complex PCIs[1]	Acceleration of Atrial Fibrillation treatment	New therapies and reimbursement	Growing severity demands better limb saving care	Access to care for Ischemic stroke patients	Rise of targeted cancer therapies
Systems					
Devices					
Patients[2] (millions)	250	60 *Atrial Fibrillation*	85	250	15	13

PHILIPS

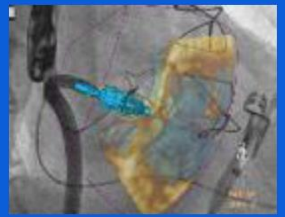
Delivering procedure innovation in complex clinical areas

Philips interventional platform

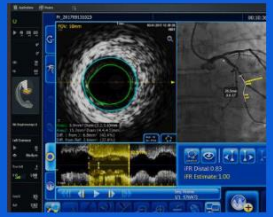
Azurion

Interventional imaging systems

Image fusion software and AI



Integrated device console, with co-registration



Diagnostic and therapeutic devices

Global market share[1]: ~46%

EPIQ

Cardiovascular ultrasound

~47%

IntelliVue

Hemodynamic patient monitoring

~54%

Largest installed base ready for Philips and partners devices

Integrated workflow **17%** reduction[2] in procedure time and **65%** dose reduction[3]

Procedure innovation unlocks new procedures and revenue growth for hospitals

One commercial team with clinical procedural support to drive adoption, customer intimacy

Philips capital markets day, https://www.philips.com/c-dam/corporate/about-philips/investors/calendar/2026/CMD_2026_Transcript.pdf

PHILIPS

Cyberspace in image-guided therapy:

Opportunities and challenges

PHILIPS

AI in image guided therapy

- Advanced Image Guidance require advanced algorithms
  - Image segmentation
  - Multi-modal image registration

- Agentic AI enable new applications
  - Workflow automation
  - AI assistant for intra-procedural Q&A
  - Decision support systems

- Digital twin concepts

AI requires data…

- AI requires data…
- Lots of data…
- Multimodal data streams: pre-operative imaging, intraoperative sensors, patient records, device telemetry
- Data volumes are exploding as procedures generate richer, higher-resolution imaging and continuous monitoring
- Interoperability remains a core challenge across DICOM, HL7 FHIR, and proprietary device protocols
- Data quality and curation are essential for training reliable AI models
- Balancing data accessibility for innovation with strict privacy requirements (GDPR, HIPAA)

Building the Cath Lab of the future with Azurion Eye

Azurion Eye

World's first AI-powered interventional platform

Ambient co-pilot, seamlessly integrated into the Azurion platform to drive procedural and operational efficiency and optimize patient outcomes

Unlocking new opportunities

Adjacent high growth software

Deployable on existing and future Installed Base

Accelerating AI and data leadership
From 160 million multi-modality images collected to date, to >1 Million images per day in 2027

Release modules progressively over 2026–2028

Note: Azurion Eye represents a future vision and is not an existing product

PHILIPS

Going cloud…

- AI is exponentially accelerating the digitalization of the entire society
  - On premise hardware will be less powerful than cloud computing and outdated quickly
  - Cloud allows to roll out and update algorithms
- Data is foundational for developing AI technology
  - Data needs for developing AI technology are orders of magnitude larger than for traditional algorithms
  - To collect data at scale a cloud platform, cloud tooling and cloud data hosting is needed
- Cloud enables a single platform
  - A single platform for the surgery suite, with multiple vendors of validated tools
  - Centralizes security and privacy handling

Regulatory landscape

- FDA Section 524B (2023): mandatory cybersecurity plans, SBOM, and secure update mechanisms for all cyber devices
- EU Cyber Resilience Act: 21 mandatory requirements; reporting obligations from September 2026
- NIS2 Directive: supply chain security obligations for essential healthcare entities across the EU
- Revised EU MDR/IVDR (2025): cybersecurity integrated into general safety requirements; 30-day incident reporting
- 83% of healthcare organizations now integrate cybersecurity standards directly into device procurement

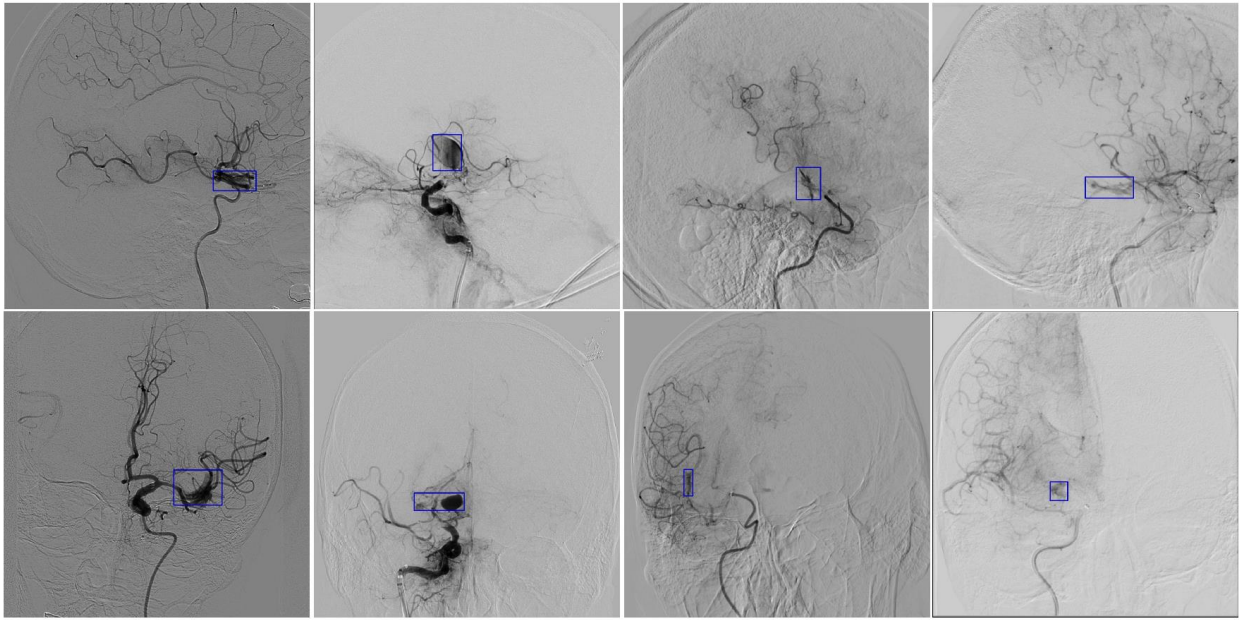
U.S. Food and Drug Administration, "Cybersecurity of Medical Devices," FDA, 2023.
European Commission, "Cyber Resilience Act (Regulation (EU) 2024/2847) – Reporting Obligations," 2026.
European Union, "Directive (EU) 2022/2555 on measures for a high common level of cybersecurity across the Union (NIS2)," Official Journal of the European Union, 2022.
Moody's, "Healthcare Providers – Global Cyber Survey," 2024.

The long game in cyberspace:

Hyper-personalized treatment

PHILIPS

Example 1:
Automatic hemorrhage detection in brain X-ray angiograms through machine-learning



Su, van der Sluijs, et al.: “Spatio-temporal deep learning for automatic detection of intracranial vessel perforation in digital subtraction angiography during endovascular thrombectomy”, Medical Image Analysis 77, 2022. https://doi.org/10.1016/j.media.2022.102377

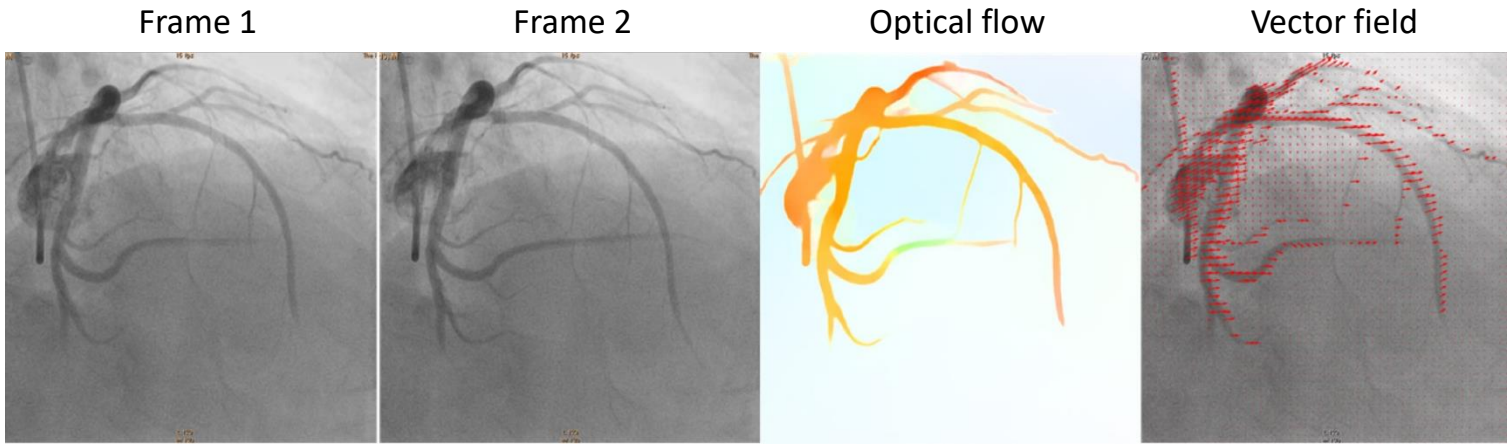
Example 2:
German Heart Center Munich

- > 300 000 heart patients treated for coronary artery disease
- Database:
  - > 180 000 individual cath lab cine clips + structured reports
  - 5 500 coronary CTs (completely annotated), including 3a clinical follow-up
  - 1 500 heart MRIs
  - 65 000 structured ultrasound reports
  - 11 000 genotyped individuals
  - ICD10 codes, lab results, clinical measures, study information, ECG, etc.

Example 2: German Heart Center Munich

Extract cardiac motion patterns in angiograms

- Two consecutive angiographic X-ray frames showing moving coronary arteries filled with iodine contrast medium
- Through the optical flow algorithm, the motion is established
- Delivering a vector field describing the motion per pixel between the two frames.



Yin, et al.: Optical flow estimation of coronary angiography sequences based on semi-supervised learning, Computers in Biology and Medicine 146, 2022, https://doi.org/10.1016/j.compbiomed.2022.105663

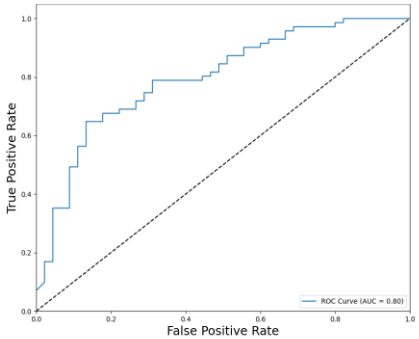
Example 2: German Heart Center Munich

Motion pattern classification in angiograms

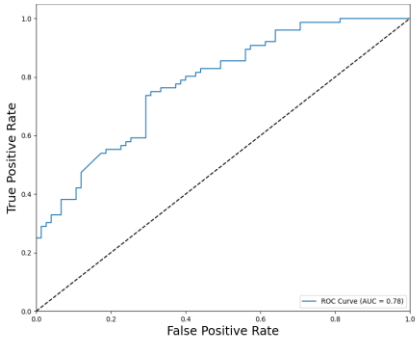
Deutsches Herzzentrum München
des Freistaates Bayern
Klinik an der Technischen Universität München

- A receiver operating characteristic (ROC) curve can be used examine the performance of a classifier
- The closer the ROC curve is to the 45-degree reference, the poorer the classifier performs
- ROC curves for cardiac ejection fraction, hypertension, and nicotine can be predicted from the coronary motion fields.
- The ROC curve diabetes is very poor -> not correlated to the coronary motion field is not correlated to diabetes

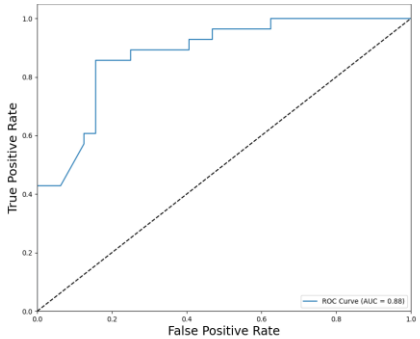
Ejection fraction



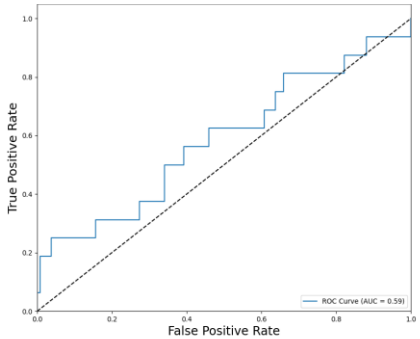
Nicotine



Hypertension



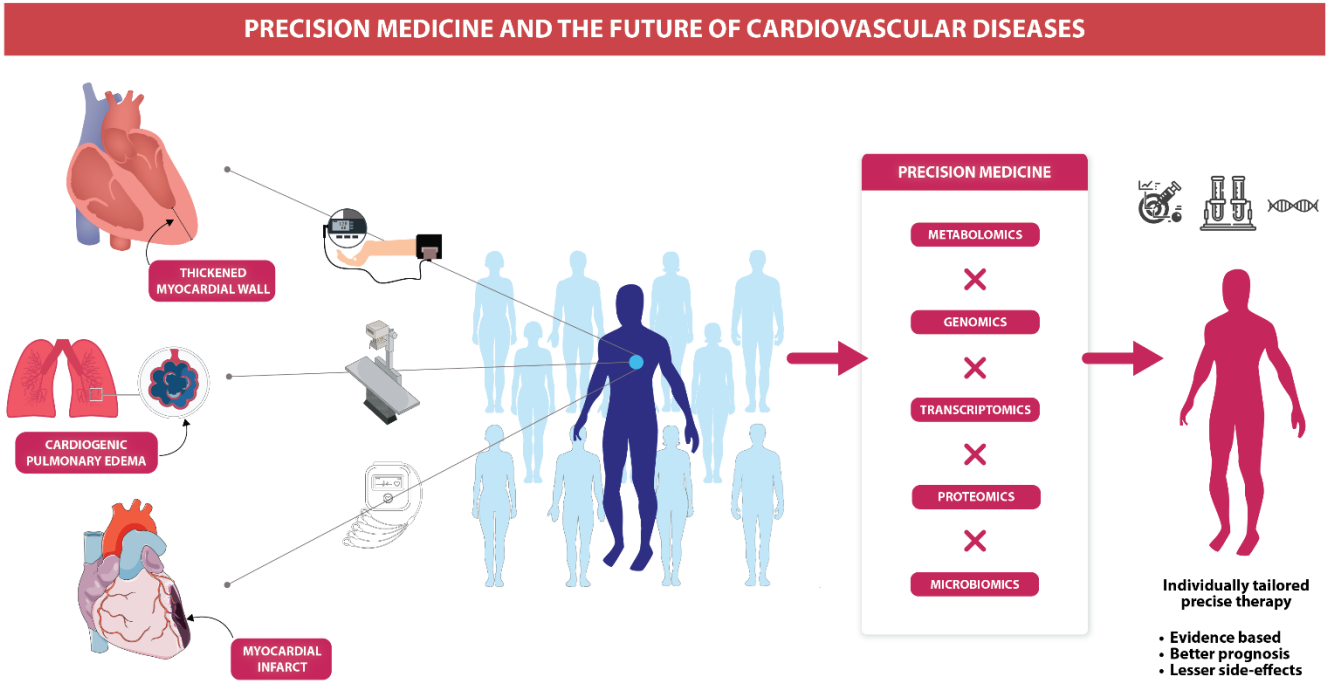
Diabetes



R. Tao: Coronary Artery Motion Clustering based on Optical Flow. Master thesis. TU/e. May 25, 2023.

PHILIPS

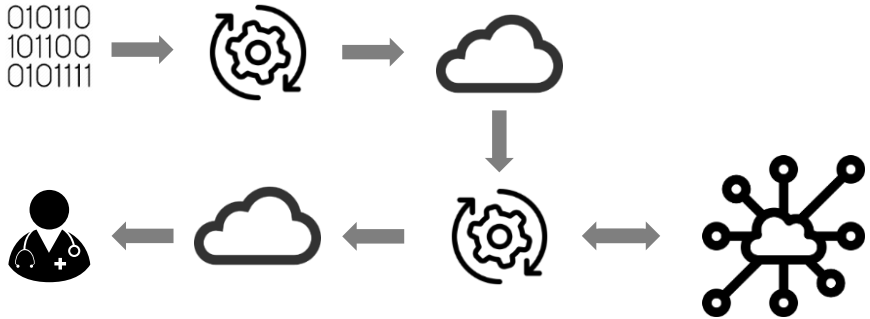
Precision medicine



Sethi, et al. Precision Medicine and the future of Cardiovascular Diseases: A Clinically Oriented Comprehensive Review. J. Clin. Med. 2023, 12, 1799. https://doi.org/10.3390/jcm12051799

Data cycle

- The full data cycle of gathering data, pre-processing, uploading to the cloud. In the cloud processing and matching with (pre-processed) big data. Consequently, storing the results and feeding them back to the clinical user.



Ruijters, "Data-driven patient treatment: imagine the future of data-driven minimally invasive patient treatment", Inaugural lecture, Technische Universiteit Eindhoven, 8 September 2023,

Conclusions

Conclusions

- AI will transform image guided therapy
- AI requires lots of data
- Large scale data collection requires connectivity and a cloud platform
- This enables digital twins
- Which unlock hyper personalized treatment
- The long-term goal: precision interventions that are personalized, data-driven, and inherently secure

PHILIPS

When your Digital Twin falls ill

ITEA Cyber-Physical-Metaverse in Healthcare

Johan Plomp

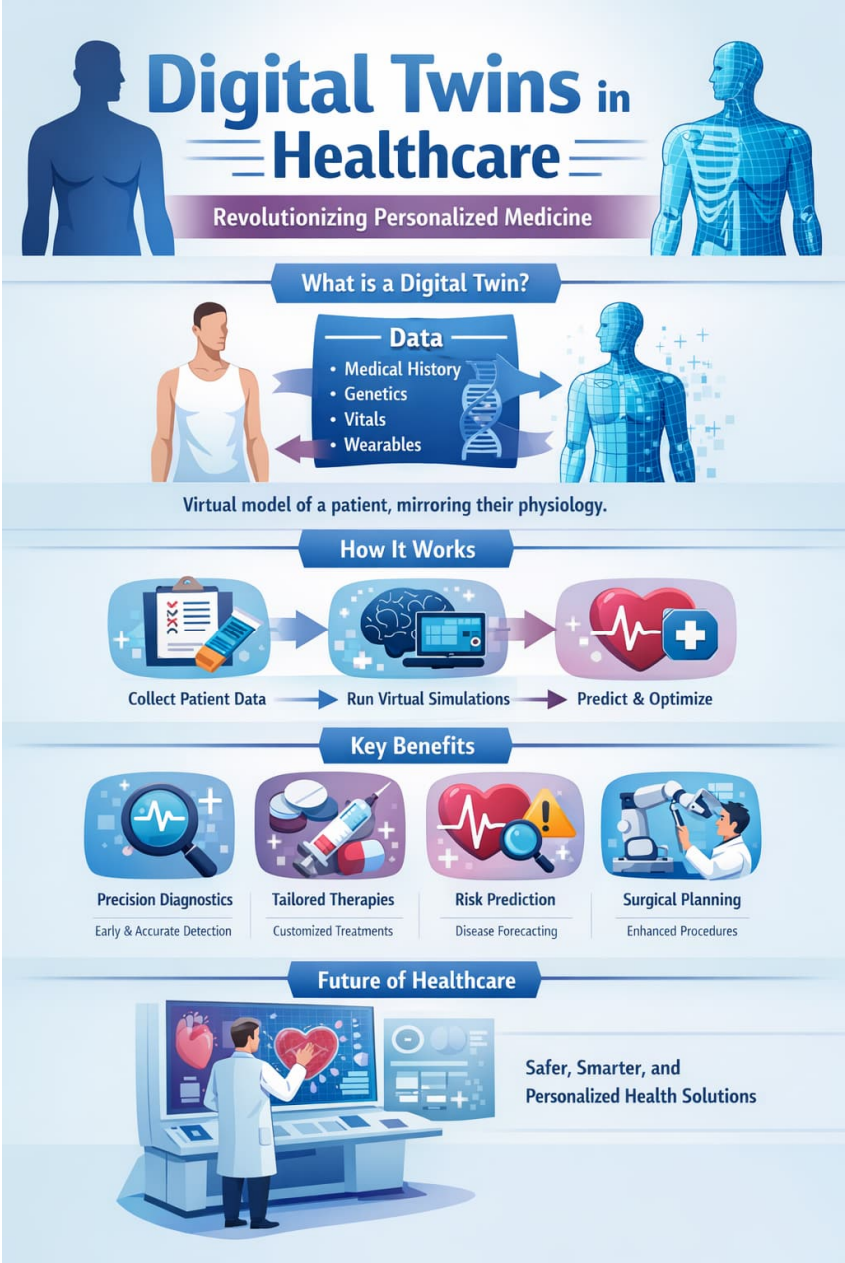
26/05/2026 **VTT – beyond the obvious**

Content

- Digital twins in healthcare
- How to train your digital twin
- Human sensing background
- Project examples
  - RM4Health (ITEA)
  - DistriMuSe (Chips JU)
- Living and dying with a digital twin
- Next – your digital twin makes friends

Digital twins in healthcare

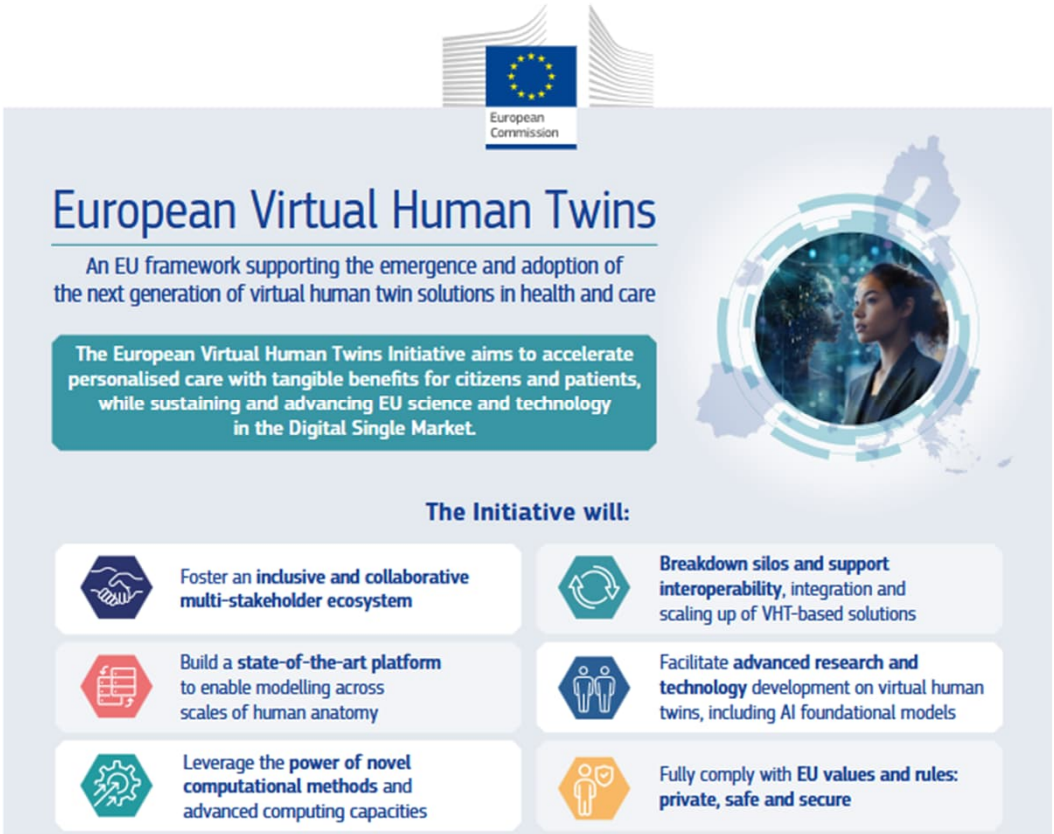
- A digital twin can be used in healthcare for:
  - *Modeling human physiology*
    - *Limited to specific organ or full body*
    - *Level of detail may vary*
    - *Can focus on physical (surgical planning), biochemical or functional aspects*
    - *May specialise e.g. for drug response*
  - Modeling mental state
    - E.g. stress under heavy loads
  - Modeling population health
    - Including e.g. simulation of effects of pandemics or polution
  - Modeling medical devices
    - Device digital twins are used also in industry
  - Modeling care processes
    - Hospital management
    - Care paths for specific diseases
  - In-silico clinical trial design



EU backed work towards virtual human twins

Virtual Physiological Human (VPH)
Society for in-silico medicine - https://vph-society.org/

https://zenodo.org/records/14769224



https://www.virtualhumantwins.eu/

How to train your digital twin

- Initialising – modelling the person
  - The initial model includes all relevant knowledge of the person at the start of use
  - The model can consist of existing ”physical” models and ML models
  - Models are often parametrised generic models, which are adjusted to fit the person’s features
    - Transfer learning
  - Measurements, imaging etc can be used to obtain the person’s physiological parameters
- Maintaining the digital twin state
  - Keeping the model up to date is necessary for continuous monitoring applications
    - ”Single use” models can also be useful, e.g. for simulations
  - Regular measurements allow to have the digital twin to be updated at all times
    - Interval may vary:
      - Yearly health check-ups
      - Streaming measurements from wearables
    - Scope of measurements may be smaller than initially
      - ”easy to measure” physiological data maintains digital twin state and other parameters are estimated from the input

50 Years of Health Monitoring Evolution

Key Trends in Human Health Monitoring (1970s–2020s)

1970s–1980s
Clinical Physiological Monitoring

ICU & Hospital Settings

1990s
Point of Care Monitoring

Portable Medical Devices

2000s
Wearable Diabetes Monitoring

Continuous Glucose Meters

2010s
Wearable Activity & Smart Watches

Fitness & Health Tracking

2020s
Elderly Monitoring

Home & Remote Care

2020s

1970s — 1990s — 2000s — 2020s →

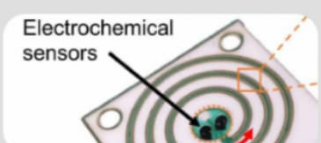
From Hospital to Home | From Devices to Wearables

VTT Health: Towards Personalized and Holistic Healthcare

CONTINUOUS REAL-TIME HEALTH MONITORING

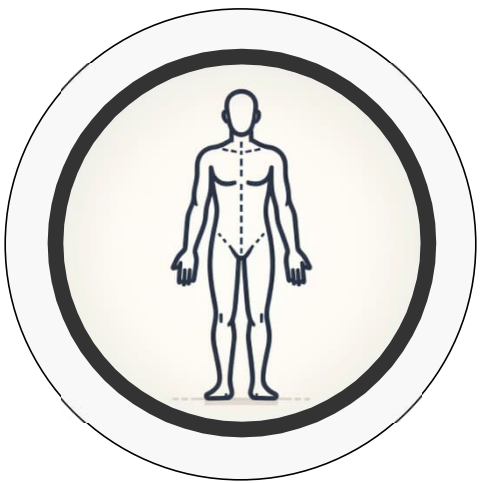
Vital signs
- ECG
- PPG
- Blood pressure
- O_2 Saturation
- Respiratory rate

Metabolism
- Lactate, Glucose
- Electrolytes



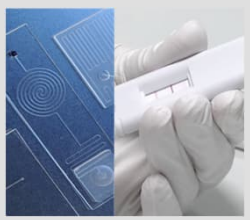
Cognitive state
Multiple biosignals, Incl.eye movements

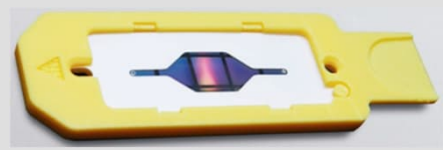
Medical-grade health assessment capabilities, expanding clinical monitoring outside hospitals

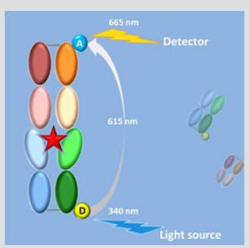


AI models for health assessment and decision assistance

TARGETED HIGH-SENSITIVE MOLECULAR DIAGNOSTICS







Diagnostic platforms and photonics readers.
Novel antibodies to detect:
- Hormonal balance
- Infections
- Cancer

MULTIMODAL DATA INTEGRATION & AI

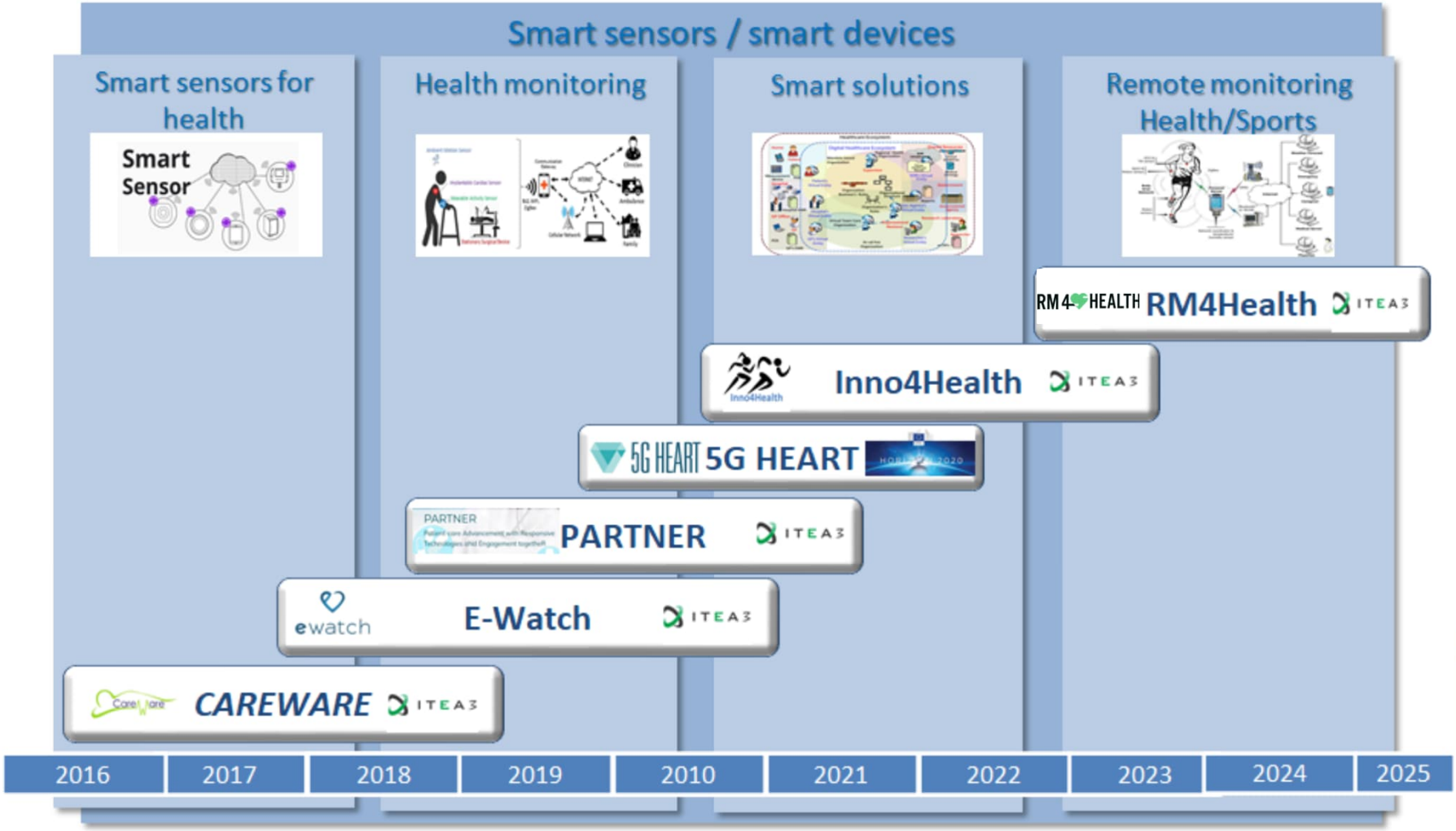
Trustworthy health twin
- Edge AI
- Federated data analyses

AI-assisted signal processing

COMPLEMENTARY HEALTH DATA

- Exposome
- Genome
- Medical history

Development of project topics in ITEA (examples)



RM4Health – Remote monitoring in health and sports (ITEA)

- To make use of existing wearables and develop new **wearable solutions** for selected **metrics** (blood pressure, core body temperature) and use these as data sources for further innovations on data integration and algorithm development to turn these **physiological measurements** into **clinical insights** supporting the selected **use cases**.
- To advance the **remote monitoring platforms** to allow partners to use them as solution for continuous data collection of wearables and devices used by patients and athletes, for developing advanced algorithms and data models, and for **connecting with apps and dashboards** for particular use cases, patient groups and athletes.
- To create **digital twins for patients and athletes** which can continuously track the status of their physiological performance.
- To use the data-driven insights to develop **care and training programs**, with, e.g., dashboards, alerts and recommendations to participating patients and their health providers, or athletes and their coaches.

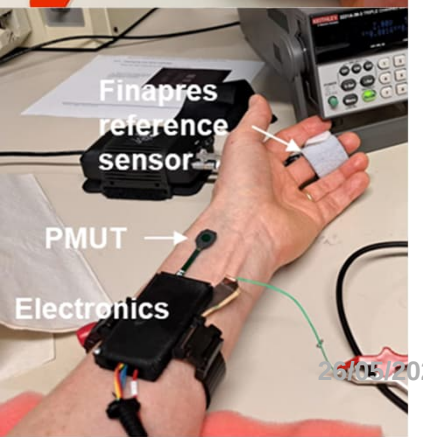
	Partners
NL	**Philips**, Evalan, TU Eindhoven, Catharina Hospital, Maxima Medical Center, Sportbizz
ES	HI-Iberia
FI	Everon, Polar, VTT, University of Turku, Nokia, Emfit
PT	Wiseware, ISEP, University of Porto Faculty of Medicine

https://rm4health.eu/

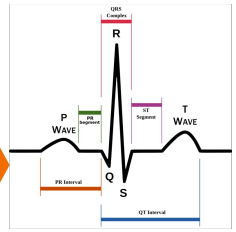
RM4Health use cases

UC1: Remote monitoring for post-operative care for surgery patients and for telerehabilitation of chronic heart failure patients
UC2: Detection of respiratory diseases in children through the analysis of the digital stethoscope signal
UC4: Early detection of heart failure decompensation
UC5: Remote Monitoring 4 Elderly Daily Activities
UC6: Exercise monitoring for sports and rehabilitation
UC7: Innovation for physical fitness and performance assessment in athletes

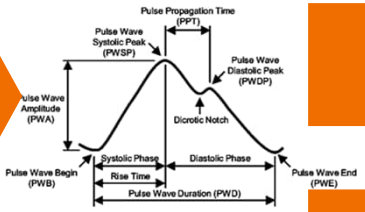
VTT sensors and envisioned digital twin



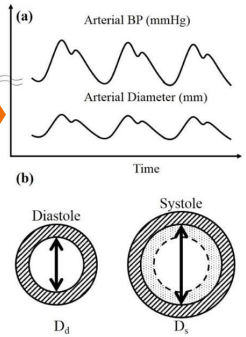
ECG



PPG



Artery diameter

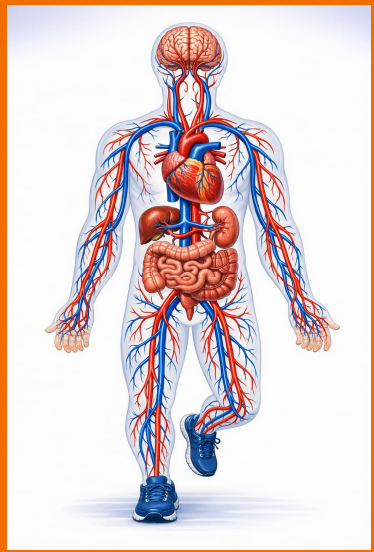


Signal morphology

Timing

Patch location

Hemodynamic ”Digital Twin”



HR, HRV

PAT, PB, CO

SVR

Subject phenotype

Ambient

Distributed multi-sensor systems for human safety and health

O1
- Improved innovative **multimodal sensors and sensor systems** optimised for advanced human observation, measurement, and interaction

O2
- ML-based **data analytics and multi-sensor fusion** for (semi) real-time decision-making

O3
- Supporting **adaptive distribution of computation and algorithms** across available resources from edge to cloud for efficient real-time operation

O4
- Building a comprehensive understanding of **human physical health, mental state, intentions and safety risks**

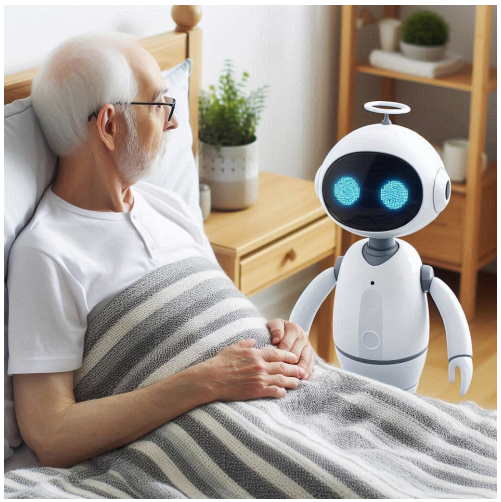
O5
- Validating the technologies in **human-centric use cases** :

1. health and wellbeing monitoring and support;
2. real-time traffic safety enhancement, including for vulnerable road users;
3. safe interaction and cooperation of humans with robots and automated factory systems.

https://distrimuse.eu/

DistriMuse

Domains and use cases



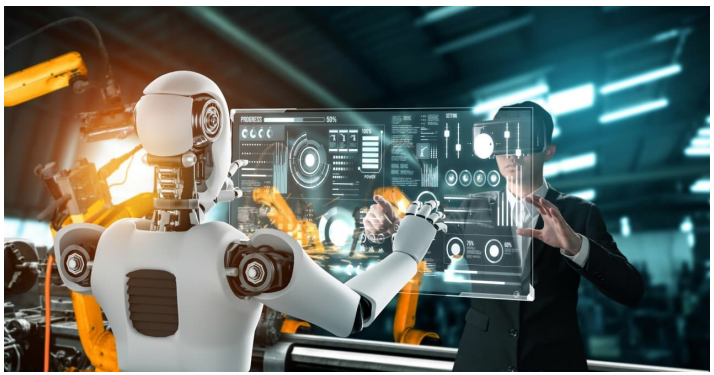
Watching over your health

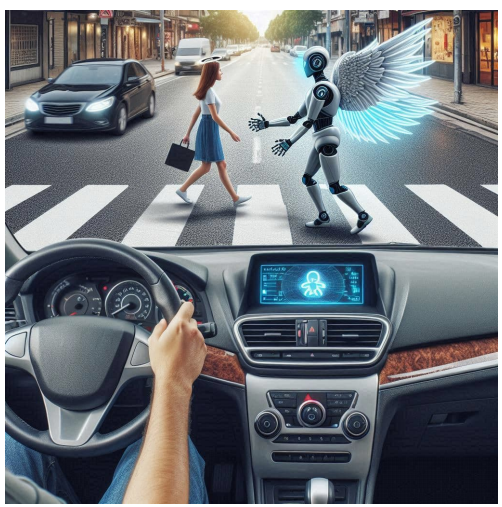
UC1: Continuous hybrid health monitoring

- MCI tracking
- Life-style monitoring
- Sleep monitoring
- Sports performance

Health & Wellbeing

Safe collaboration with robots in factories





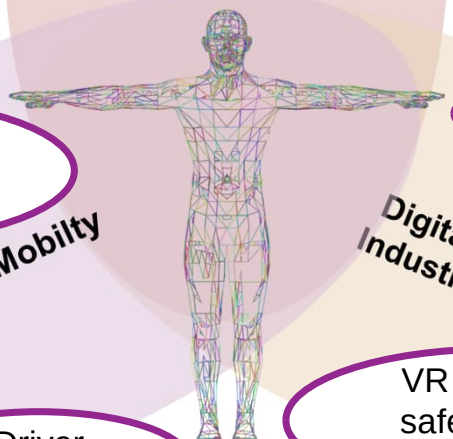
Watching over Pedestrians and cyclists in traffic

Collaborative situational awareness

Mobilty

UC2: Situational awareness for VRU and driver safety

Driver distraction



Digital Industry

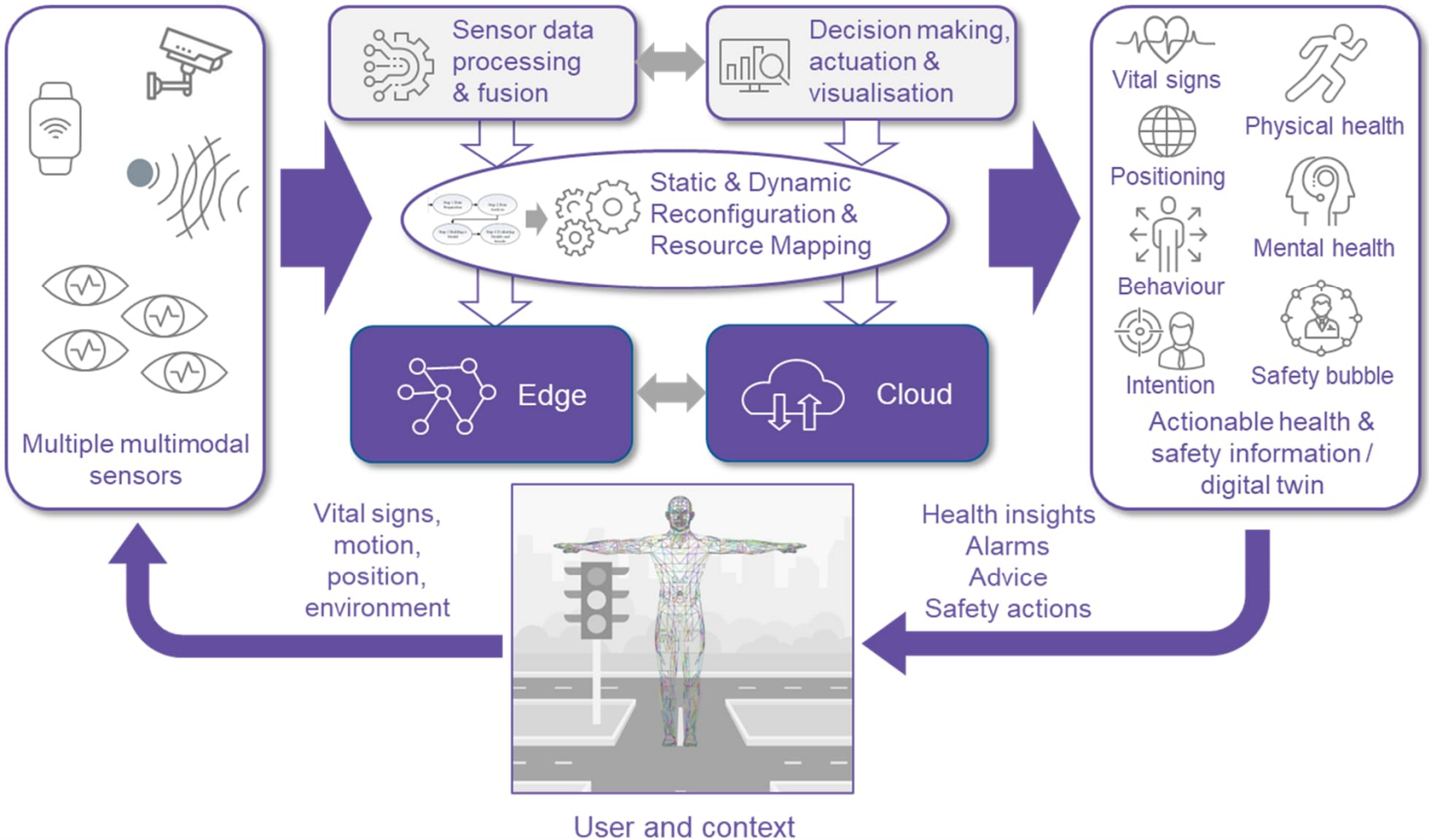
Dynamic human-robot factory management

Adaptive operation in human presence

UC3: Safe interaction and cooperation with robots

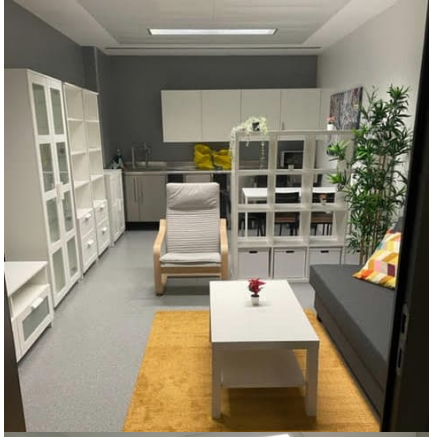
VR model of safe human-robot interaction

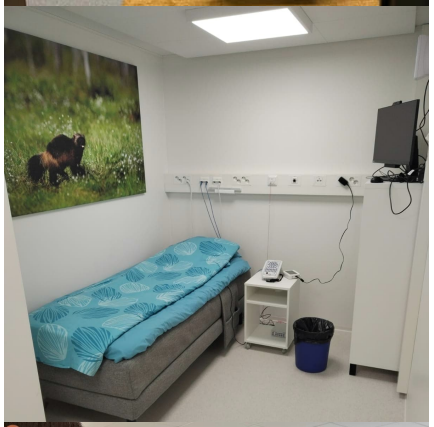
Conceptual architecture



DistriMuSe UC1: Continuous hybrid health monitoring

- *Demo 1.1*: Human **life-style monitoring** which focusses on daily activity monitoring of two main interest groups: **early-stage MCI patients and elderly people** in care facilities and assisted living. The data will be captured using a combination of visual, wearables, radar and other sensors. The developed algorithms and support tools should assist the caregiver in detecting/preventing emergency situation and assure a better follow up.
- *Demo 1.2*: **Sleep Monitoring**, which focusses on the development of less obtrusive methods for the monitoring of sleep and the assessment of sleep disorders. By measuring vital signs in a novel and less obtrusive manner, that can replace measurement methods that are currently part of today's gold standard video-polysomnography setups. As well as the measurement of vital signs (e.g. blood pressure) that are currently not part of gold standard methods due to the obtrusiveness of current measurement setups.
- *Demo 1.3*: **Sports performance and health assessment** focuses on monitoring the physical activity of participants with the overall goal of measuring the activituy and exertion levels and producing estimation of performance levels and maximum effort.



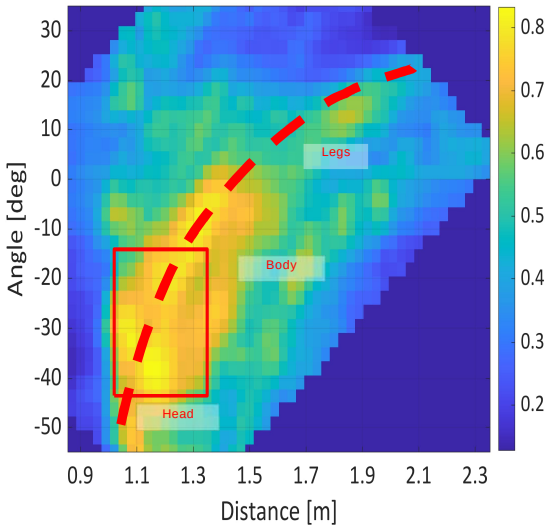


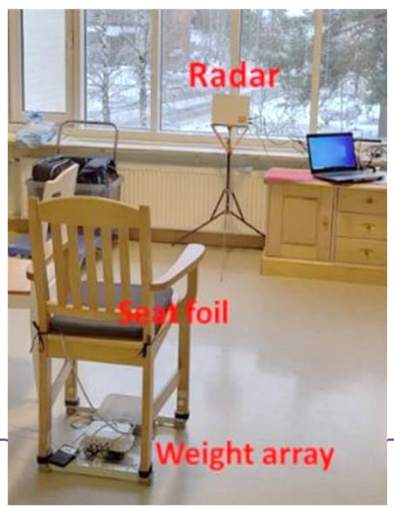
DistriMuSe

VTT

VTT Polarimetric radar for human monitoring

- 60GHz FMCW radar
- Polarimetric imaging
- 4TX and 12 RX channels
- Extracting vital signs
  - HR, BR, HRV
- Used for sleep monitoring and elderly monitoring (gait, TUG)
- VTT hardware





Living and dying with a digital twin

What your twin is like

- Accumulates health data continuously
  - Able to provide history and trends
  - Provides a baseline for diagnostics
    - Never been available before, revolutionised healthcare
- Early detection and risk
  - Detection of subtle changes and adverse trends
  - Assess risks related to lifestyle
- Personalised health
  - Models allows for personalising care and medication
  - Therapy optimisation
- Clinical decision support
  - Allows to simulate / predict outcomes of interventions and treatment
- Health coach
  - Continuously provides advice on life-style including activity, nutrition and sleep
- *Close to a guardian angel?*

When things look bad

- Your twin is not looking good
  - If that is how you feel – it operates properly
- You get annoyed with your twin
  - User acceptance is key!
- Your twin's state does not reflect your health
  - The twin fails to model you correctly and provides wrong indications or advice
  - Can lead to dangerous situations
  - How to ensure correct operation
  - Keep clinical verification in the loop
- Your twin is manipulated or hacked
  - Conspicuous advertisements for specific products
  - Failure to operate properly
  - Ransoms are demanded for its release
- Your twin sells its data
  - The twin represents very personal health and behavioural data – needs to be protected with great care
  - Business with data or (partial) donation for medical science may be possible, but needs proper anonymisation

Next – your digital twin makes friends

- Digital twins are primarily for the benefit of the user
- ”Worn” digital twins are extremely useful for medical research
  - Population health
  - Virtual clinical trials
- What about if digital twins partner up to care for others / a group?
  - E.g. family
  - Nudging
  - Guidance on how to care for a near person

beyond
the obvious

Thank you!

Johan.plomp@vtt.fi

Infographics generated by Co-pilot

Cyber-Physical-Metaverse in healthcare

Synthetic Populations: Seeing the System in 6D to Inform Care Design

MADE IN CANADA

- Myrna Bittner, CEO, Co-founder
- RUNWITHIT Synthetics (2014)
  - High fidelity, localized “living” synthetic populations generated from **never-identified data** through the convergence of relevant research, validated by experts
  - Individuals with CVD co-morbidities along with social determinants of health, genetic risk factors, demographics, and location-related exacerbation
  - In the RUNWITHIT 6D Intelligence Platform, health, interventions, events and scenarios can be configured, dialled forward in time, outcomes analyzed and visualized
  - Utilized in health system design, virtual intervention and remote patient care trials and deployments, public safety and security, community planning, and disaster resilience
  - Currently in year 2 of ITEA ”PHRESH” project consortium

ITEA4 | Σ

Thank you!

ITEA 4