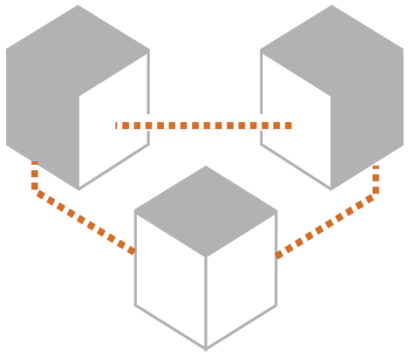
CUREX

SECURE AND PRIVATE HEALTH DATA EXCHANGE



Jason Sioutis MSc, MBA

8Bells

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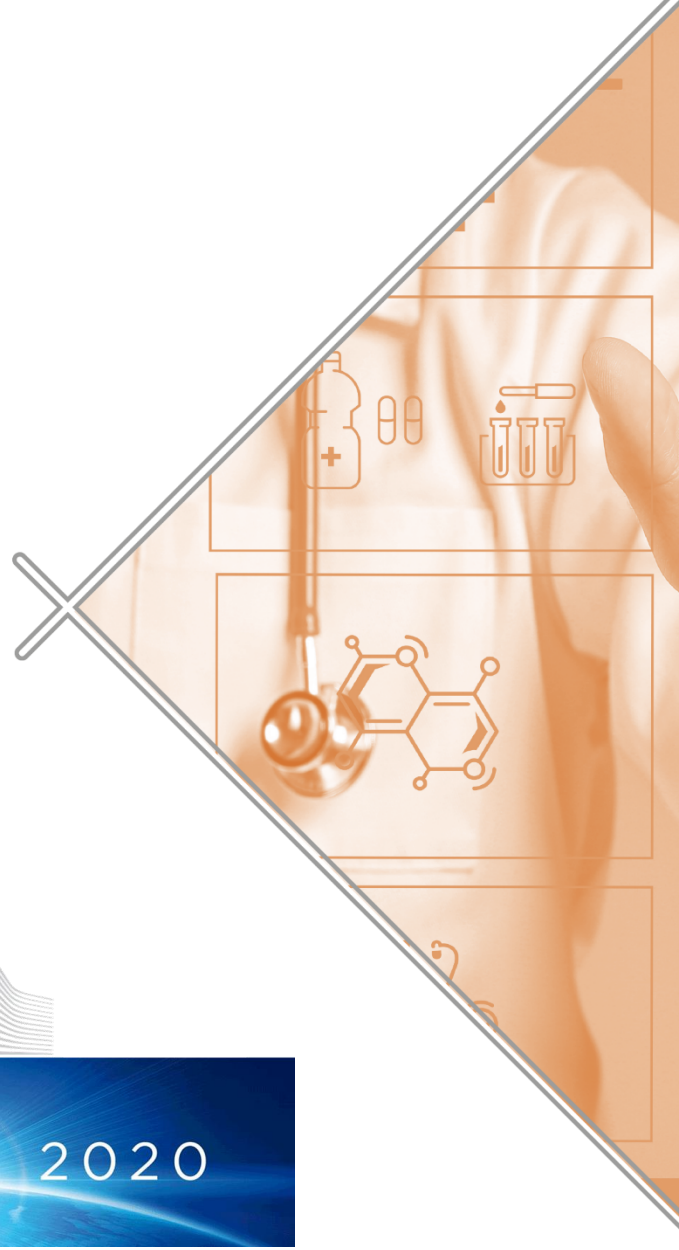
Project Information

- **CUREX:** se**CU**re and p**R**ivate h**E**alth data e**X**change
- **Grant Agreement ID:** 826404
- **Topic:** SU-TDS-02-2018
- **Call:** H2020-SC1-FA-DTS-2018-1
- **Funding Scheme:** RIA - Research and Innovation action
- **Funded under:** H2020-EU.3.1.5.1.
- **Overall budget:** € 4,987,825
- **EU contribution:** € 4,987,825

- **Start Date:** December 1st, 2018
- **End Date:** November 30th, 2021



The Consortium

- **16 partners** from **9 EU countries**
  - **2 x** Large industries
  - **6 x** SMEs
  - **6 x** Research Institutes and Universities
  - **2 x** End-users/representatives of healthcare industries

www.curex-project.eu

Motivation (1/2)

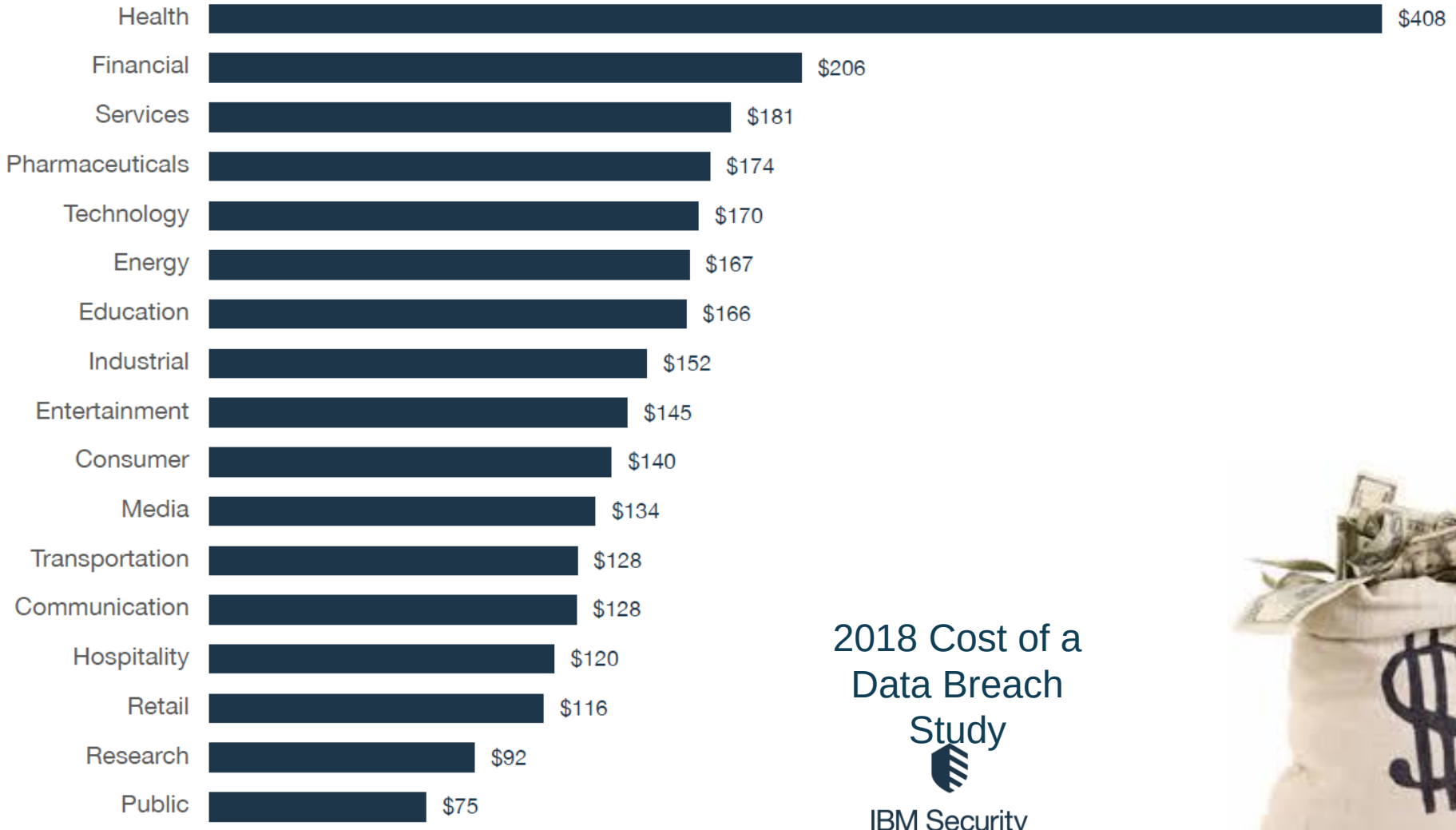
- Digital healthcare infrastructures are recognized as **Critical Information Infrastructures**.
- **Future healthcare services** will be highly dependent on:
  - **Increased connectivity** between platforms, devices & organizations
  - **Massive exchange of data**
- **Health data exchange** takes place during:
  - The operation of **healthcare services**
  - A **cross-organisation** transaction
  - **Cross-border situations** need to be covered too

Motivation (2/2)

- Interconnections create a fairly **large attack surface**.
  - Zero-day vulnerabilities
  - Advanced threats (APT)
- **Cyber-attacks** targeting health data may:
  - **Put at risk** both **patients' privacy** and **health**
  - Cause **severe operational disruptions**
  - **Major economic losses** for **healthcare organizations**

- **GDPR** creates additional obligations for organisations who operate on **clinical** & **medical data**.

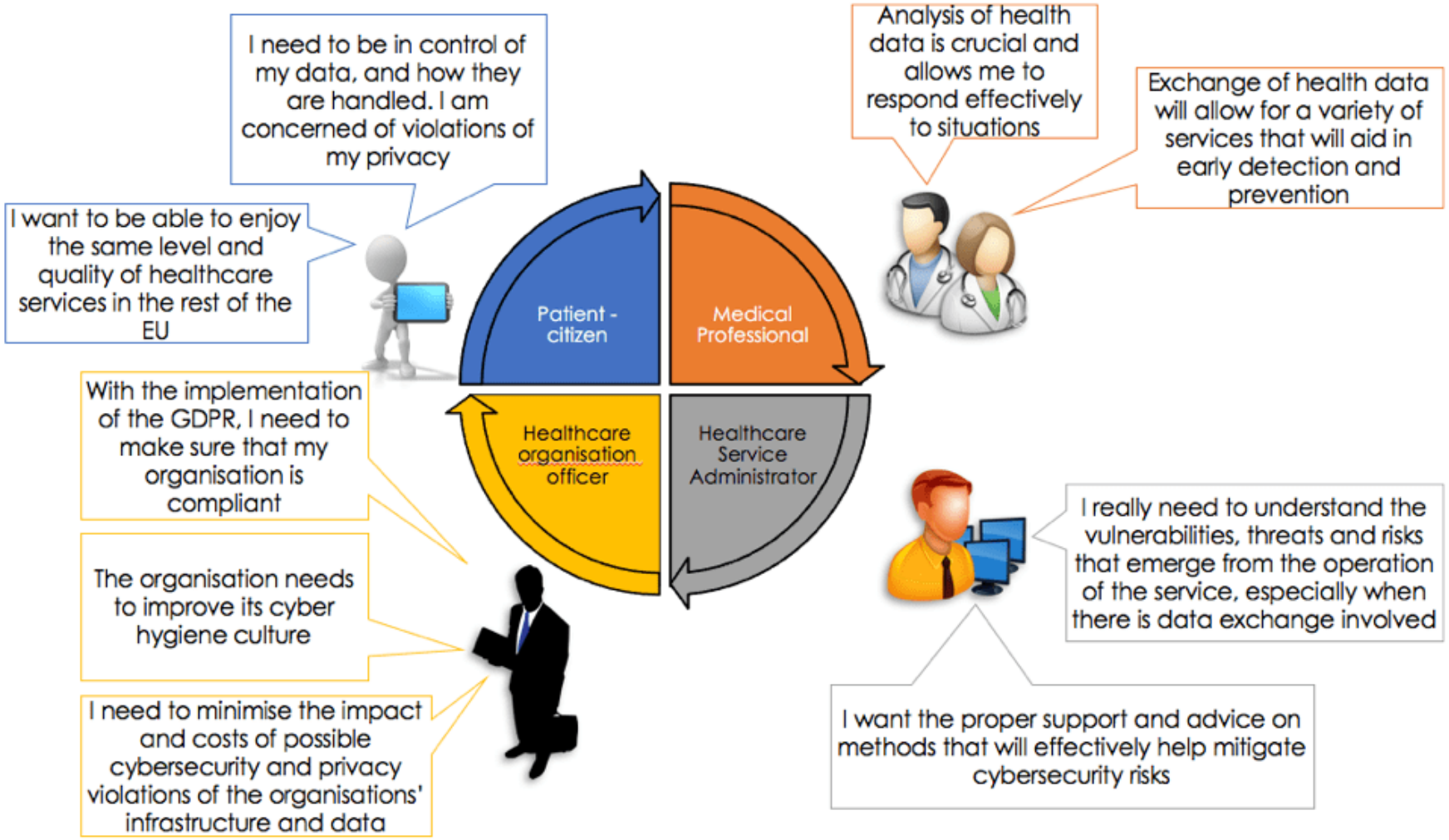
Average cost for a lost/stolen record per sector



2018 Cost of a Data Breach Study

IBM Security

End User Requirements in Healthcare

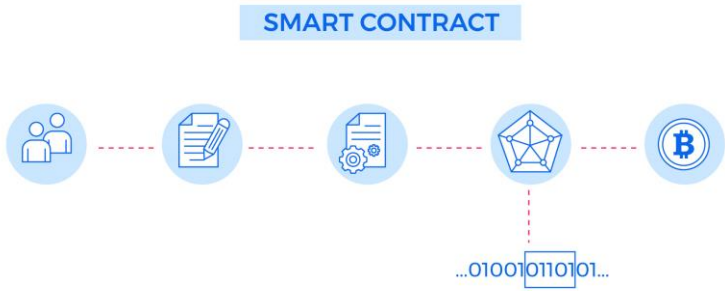


Challenge & Response (1/2)

- Health data exchange introduces **new types of threats**.
  - ➢CUREX provides a **cybersecurity risk assessment toolkit** tailored to healthcare organization, infrastructures and services.
- **Privacy violations** are more likely to occur when **exchanging data**.
  - ➢CUREX provides a **Privacy Assessment Tool**
    - ✓Assesses the **compliance with GDPR**
    - ✓Ensures that data is processed and exchanged in an **appropriate and privacy-aware manner.**

Challenge & Response (2/2)

- The lack of a **collectively accepted** and **auditable exchange record** leads to **reduced trust between parties**.
  - CUREX will integrate the developed **toolkits** and **applications** into a **private blockchain consensus business network** implementing required **Smart Contracts**.



The vision of CUREX is to safeguard patient privacy and increase their trust in the currently vulnerable critical healthcare information infrastructures, especially in cases where data is exchanged

The CUREX Platform

- The integrated CUREX Platform will rely on the following discrete layers:
  - The **Asset Discovery** layer that maps data, technical and human resources into ontological models.
  - The **Threat Intelligence** layer that discovers the **vulnerabilities** and **identifies potential threats**.
  - The **Risk Management** layer that **quantifies risks considering both cybersecurity** and **privacy threats** as well as **proposing optimal safeguards** and **cyber hygiene** enhancing techniques based on **decision support systems**.
  - The **Trust Enhancing** layer, which includes the deployment of a **business consensus-based blockchain** that will store **compiled risks** reports from the previous layers and **will integrate the CUREX tools** and **end-user applications** into a fully **GDPR compliant platform**.

CUREX Toolkit (1/2)

- **Asset Discovery Tool (ADT)**
  - Automated mapping of resources
  - Hierarchical grouping and ontological representation of data and policies
- **Vulnerability Discovery Manager (VDM)**
  - Identifying, analyzing and reporting vulnerabilities detected in a target system
  - Uses as input information provided by ADT
  - Feeds the Threat Intelligence Engine (TIE)
- **Threat Intelligence Engine (TIE)**
  - Anomaly detection using advanced machine learning & data analytics algorithms

CUREX Toolkit (2/2)

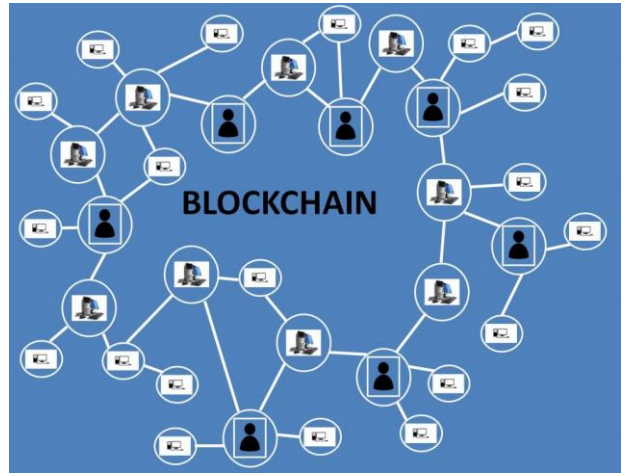
- **Cybersecurity Assessment Tool (CAT)**
  - A SIEM solution enhanced to support big data
  - Collecting and analyzing cybersecurity events in real time
  - Uses the results for Risk Assessment
- **Privacy Assessment Tool (PAT)**
  - Assessing hospitals and care centers towards alignment with the GDPR directives
  - Identifying and quantifying the associated risk
  - Compiles a risk analysis that feeds Optimal Safeguards Tool (OST)
- **Optimal Safeguards Tool (OST)**
  - A decision support tool to proposal optimal safeguards to mitigate risks

Patient Application & Health Professional Application

- The **Patient Application** (mobile app) will
  - **Complement** health data exchange through the CUREX Platform
  - Enable **data owners** (patients and citizens) **to review and define** the way their data is handled.
  - Incorporate **dynamic consent**, an essential **GDPR** feature
  - **Inform users** in real-time fashion of every transaction and access to their data
- The **Health Professional Application** will allow the
  - **Creation** of data transactions by health professional
  - **Validation** of said transactions by peer HPA instances across the CUREX network
  - **Recording** of all transactions to the Private Blockchain
    - ✓ Security and integrity is ensured with **Smart Contracts**

Private Blockchain (1/2)

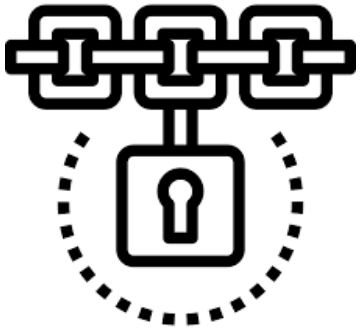
- The **Private Blockchain (PrB)** will provide a **decentralized database** to store auditable information such as:
  - Activity into the system
  - Risk assessment report
  - Data sharing process
- As an integral part of the **cybersecurity and privacy toolkit**, **CUREX PrB** will be used to record:
  - the **cybersecurity** and **privacy risk scores** derived by the relevant assessment methodologies
  - **all transactions** that occur between **all stakeholders**.



Private Blockchain (2/2)

- The **CUREX PrB** will be integrated to the **MyHealthMyData** *(H2020 Project)* blockchain as a parallel channel.
- The **communication** between the networks will be performed by **smart contract** specially designed to manage the **interoperability** of both systems.
- The **CUREX-MHMD smart contracts** will notify the events in both ledger to query the blockchains between each other.

MY HEALTH MY DATA



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Use Cases & Demonstration Scenarios

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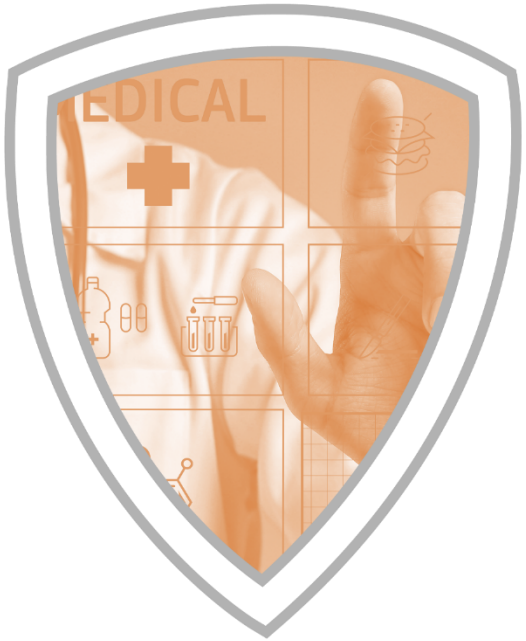


Use Case 1

Data exchange for cross-border patient mobility

Use Case 2

Data exchange in remote healthcare services

(2a)
Risk Assessment for an IoT Healthcare Platform

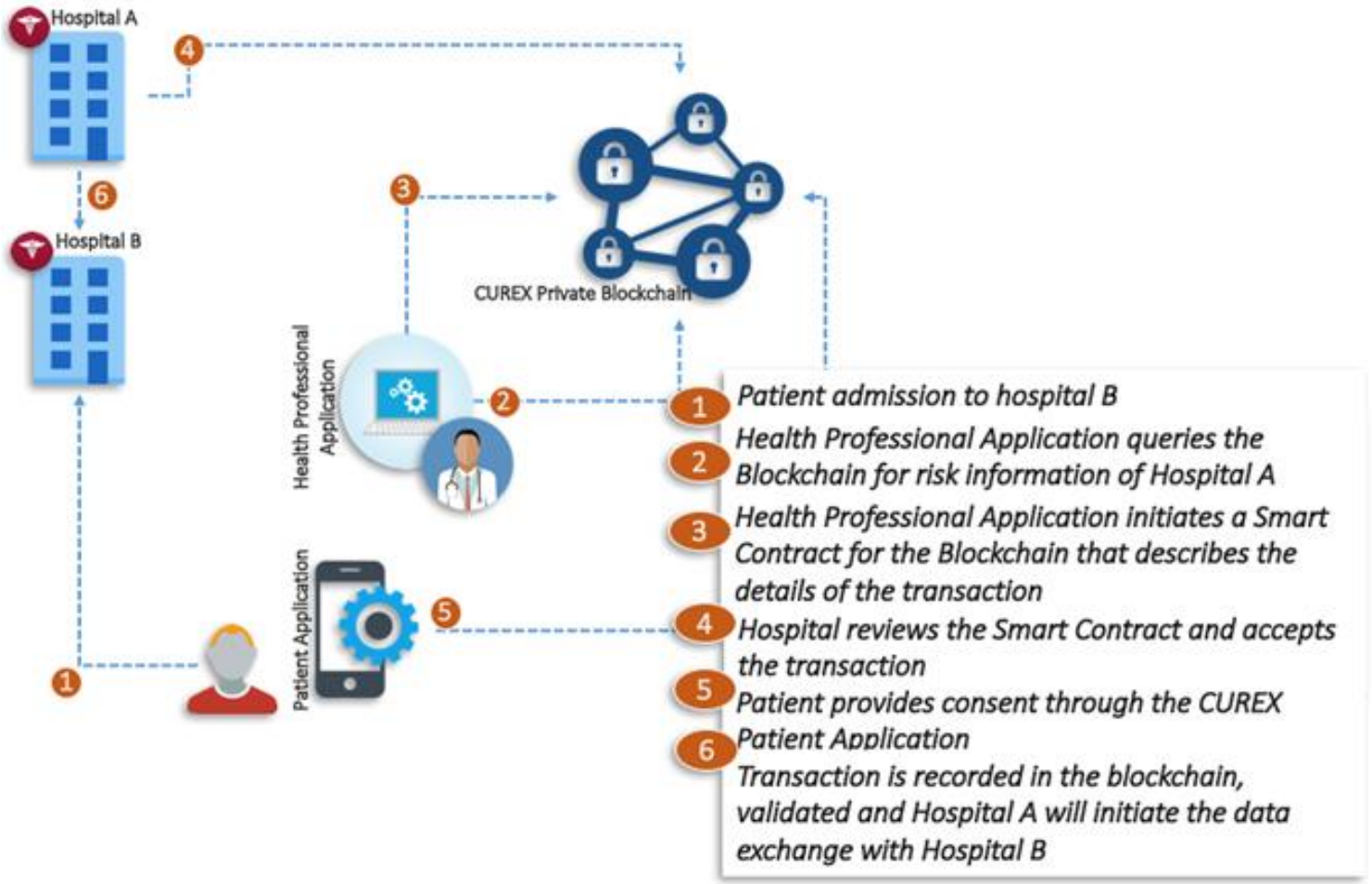
(2b)
Risk Assessment for a Point of Care System

Use Case 3

Data exchange for healthcare research

Use Case 1: Data exchange for cross-border patient mobility

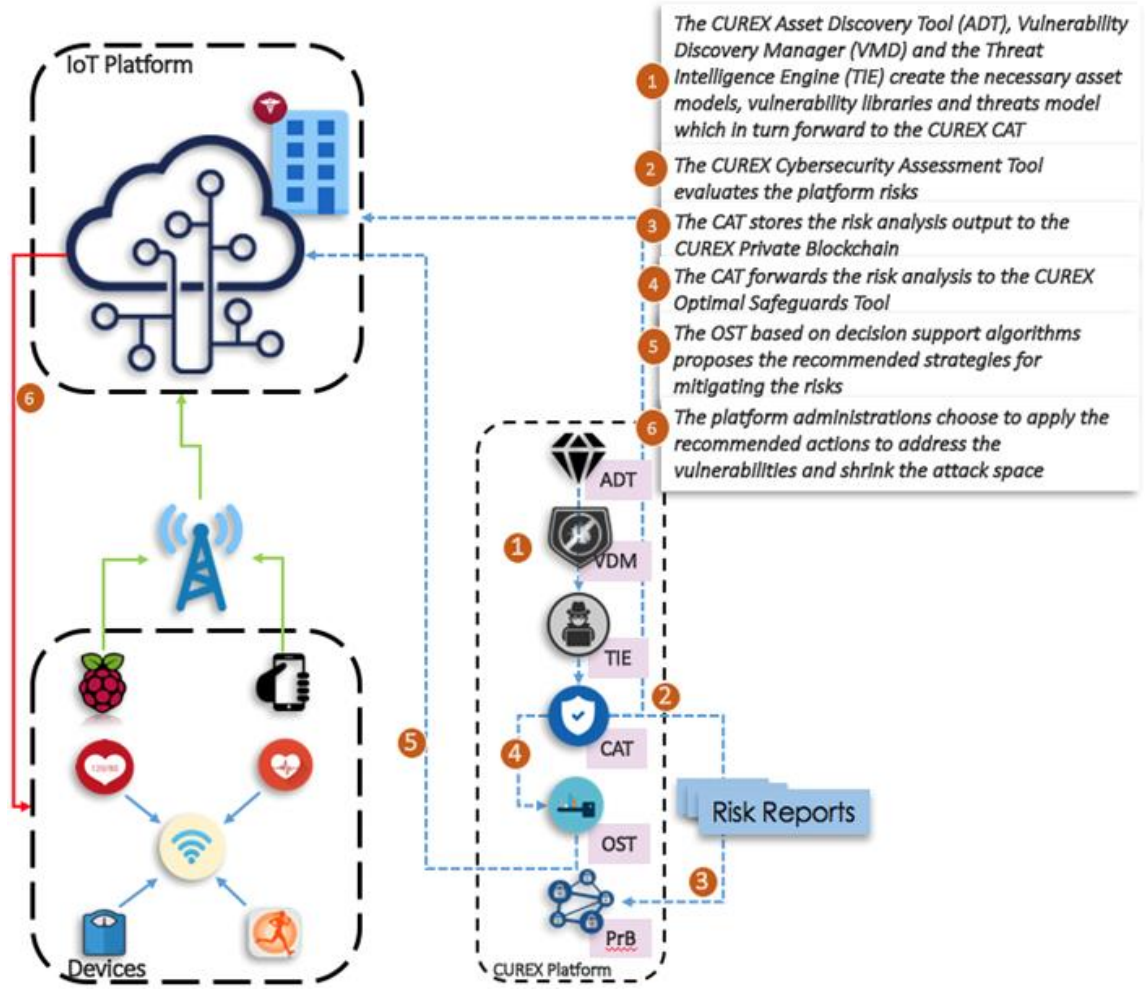
This will be done in the context of a patient traveling abroad who needs to visit a hospital due to an emergency situation.



Use Case 2: Data exchange in remote healthcare services (1/2)

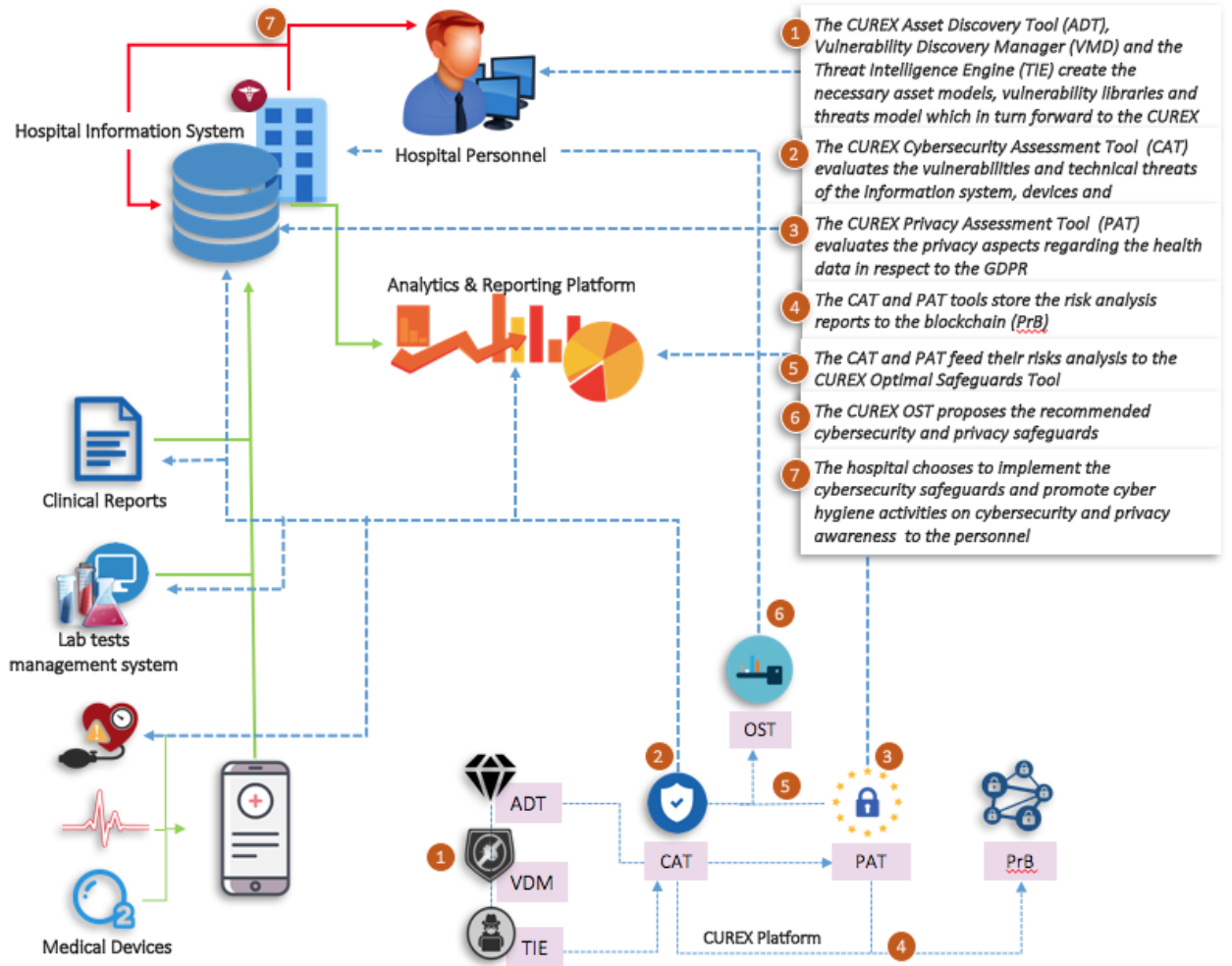
- This use case comes into two flavors:

(2a) *In the first one, the emphasis is on risk assessment for an* ***IoT Healthcare Platform*** *along with the associated recommendations of cybersecurity and privacy safeguards.*



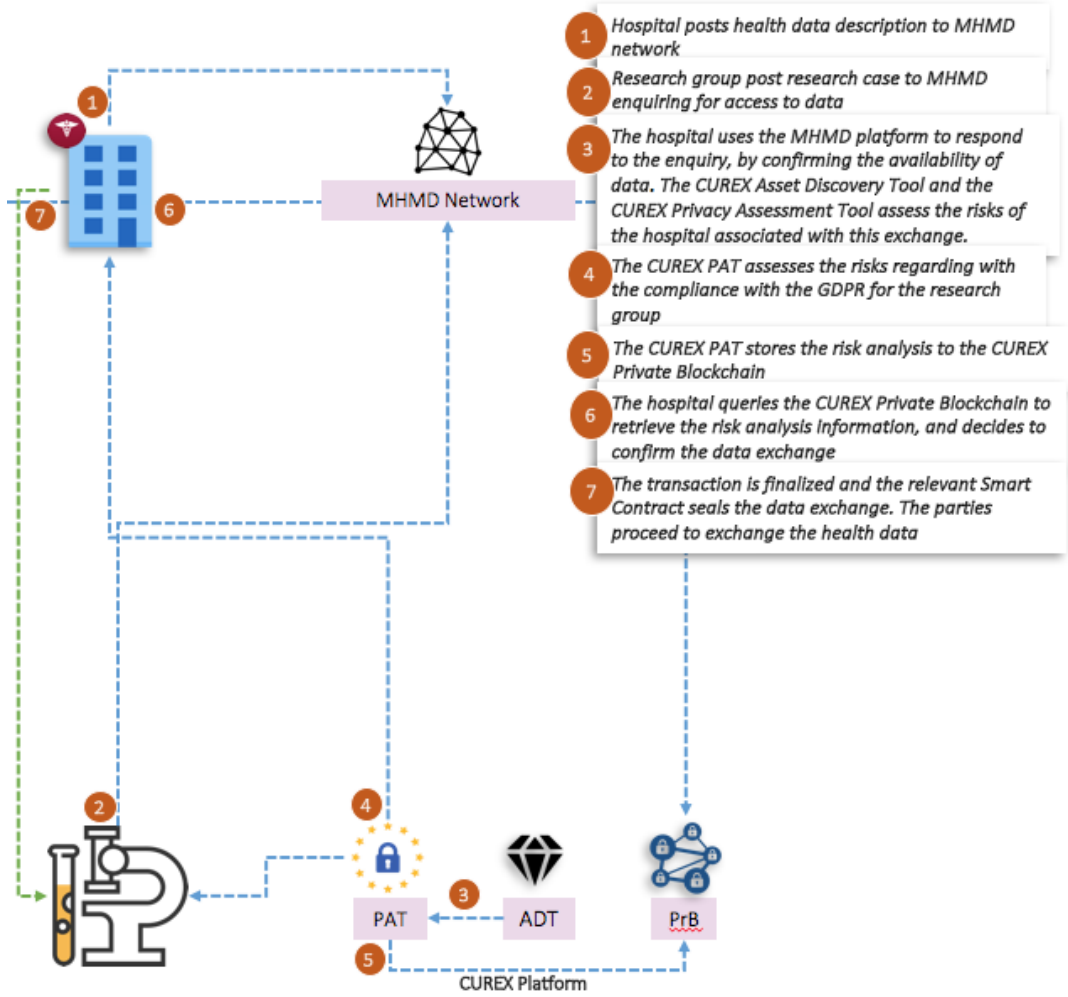
Use Case 2: Data exchange in remote healthcare services (2/2)

(2b) *In the second one, the emphasis is shifted to risk assessment for a* ***Healthcare Point of Care (POC) System*** *and promoting cyber hygiene in such a setting.*



Use Case 3: Data exchange for healthcare research

- *This use case deals with the operation of the CUREX Platform in parallel with the **MyHealthMyData (MHMD)** Platform focusing on compatibility and smooth integration issues.*



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Jason Sioutis, MSc, MBA
Project manager, 8Bells

jason.sioutis@8bellsresearch.com

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