InteropEHRate

EHR in people's hands across Europe

HR INTEROPERABILITY PROTOCOLS

IEHR 1ST ESB MEETING – NOVEMBER 7TH 2019, BERLIN

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USERS' PROBLEM

- **Starting point: explain from the point of view of the Final User**

PRESENTATION OUTLINE

- Terminologies
- Problem Statement
- State of the Art
- Solutions Implemented
- Conclusions & Next Steps

TERMINOLOGIES

- **Protocol:**

  a **set of rules** about how to format, transmit and receive data so computer network devices can communicate

- **Library:**

  a **set of code** that packages the operations (it **implements the functionality of the protocol**)

- **API:**

  a **set of methods** of communication among components that only expose objects or actions the developer needs

USER'S PROBLEM (1/2)

- **Healthcare sector** terms such as "Machine Learning", "APIs" and "Blockchain", **promising to solve the challenge of maintaining and facilitating the exchange and sharing of healthcare information.**

- **Medical information** is stored on **paper**, and when it has to be shared between providers, it happens by **mail**, **fax** or by the **patients themselves**, who often bring their files from appointment to appointment.

- When **exchanging healthcare information** and the exchanged **data is inaccurate**, this leads to:
  - **Inefficiency**
  - **Errors**
  - **Avoidance of administrative burden**
  - **Costs**
  - **Impede the care that patients receive**

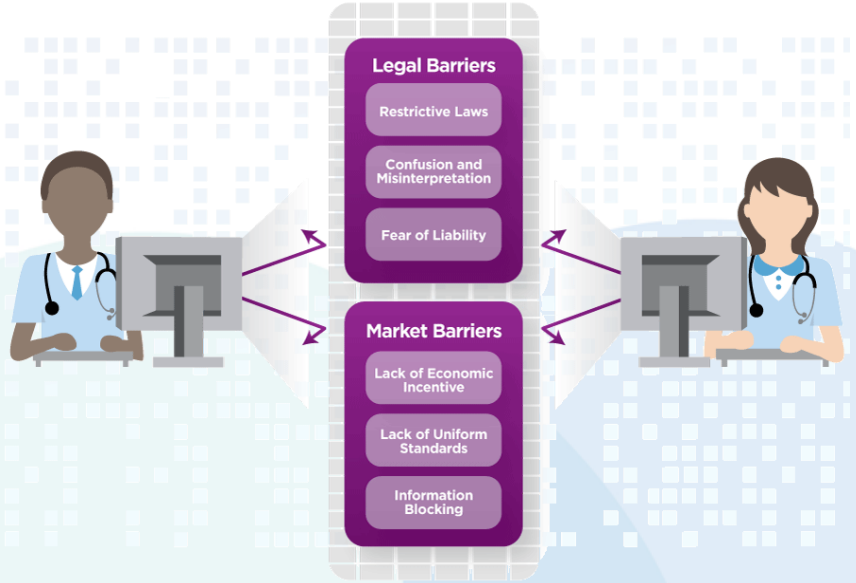
USER'S PROBLEM (2/2)

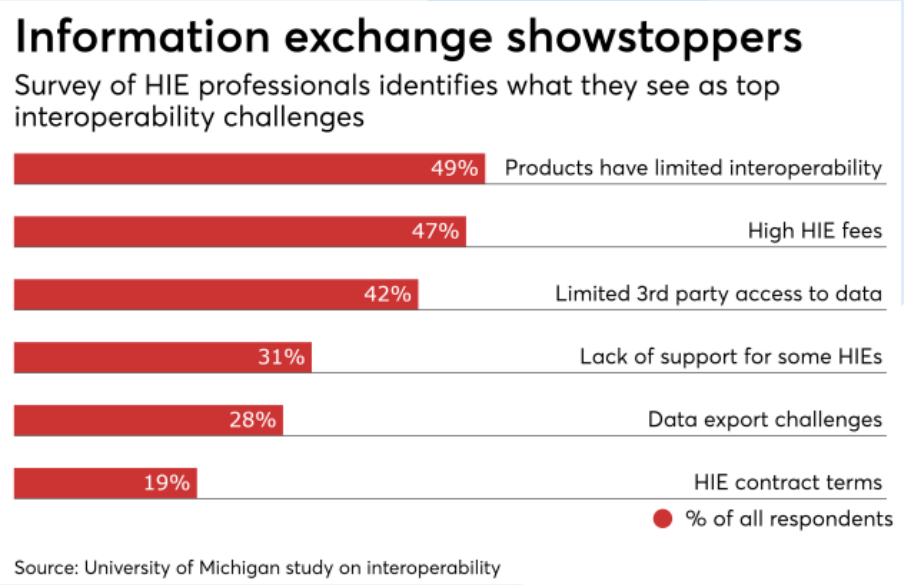
Citizens

- **Different web apps** to download documents from/to different hospitals/labs
- **Different mobile apps** to download/send structured data from/to different hospitals/labs
- **Country specific apps** to download/send health data from/to National EHR
- **No control** on completeness of health data
- **Third party health data** cannot be accessed without internet
- Do not want to have data stored in **cloud infrastructures**

Healthcare Practitioners (HCPs)

- **Cannot access** health data produced in foreign countries
- **Third party health data** cannot be accessed without internet
- **Delays** accessing current patient data → major barrier to effective use of healthcare information
- **Increased costs** to set up connections to transmit information





STATE OF THE ART (1/3)

Health Information Exchange (HIE)

- **Clinicians, nurses, pharmacists, healthcare providers and patients** to access and securely share medical information electronically, improving the **speed**, **quality**, **safety** and **cost** of patient care.

Current Status

Current Status of Health Information Exchange:

- **Focus** of: (**a**) modernizing the Centres for Medicare and Medicaid Services' EHR Incentive Program, and (**b**) Merit-Based Incentive Program (MIPS) Advancing Care Information (ACI) quality reporting category
- EU cases with direct exchange of information **only between Healthcare Institutions**
- Application vendors are **using different protocols** – upon specific agreements – for HIE
- **Multiple credentials to authenticate citizens** and Healthcare Institutions in the same countries
- **No cross border scenarios** for HIE in EU

Missing

!

- HIE between **Citizens and Healthcare Institutions**
- **Open Specification** protocols for HIE
- **Common authentication method** for different Healthcare Institutions (i.e. single set of credentials)
- **Common application** for every Healthcare Institution

STATE OF THE ART (2/3)

Device to Device (D2D) Data Exchange Systems

- Systems that provide **wireless connectivity** for **transferring data from millimetres to a few hundreds of meters**, providing **data exchange in absence of internet** and **constructing service access** in local areas.

Current Status

- Key requirements: **portable**, **easy** to install, **flexible** and eliminate the **cost of expensive wiring**
- Minimize the **power consumption** at the conditions of the transceiver, namely **transmitting**, **receiving** and **idle** states
- Multiple short-range wireless communication systems: **Bluetooth**, **BLE**, **NFC**, **RFID**, **ANT+, ZigBee**, **Wi-Fi Direct**

Missing

- Focus provided **to the security of exchanging data** and **not the user requirements and the current needs**
- **Techniques** for HIE in a short-range distance
- **Common protocol** for cross-border short range distance HIE
- Involvement of cases where **internet connection is not available**

STATE OF THE ART (3/3)

Remote to Device (R2D) Data Exchange Systems

- Secure **communication protocol** (and API), using **internet**, for cross-border exchange of health data among S-EHR and EHR applications.

Current Status

- **Government solutions:** current EU model is based on eHDSI, an infrastructure for cross-border health data exchange between national healthcare information systems of Member States.
- **Commercial solutions:** mobile apps based on proprietary protocols/ proprietary data representation provided to Citizen in order to collect personal health data (coming from heterogeneous sources).

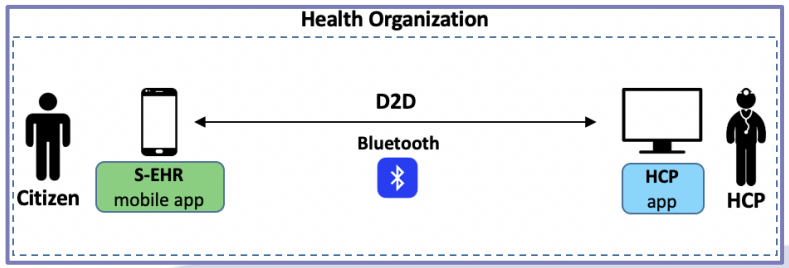
Missing

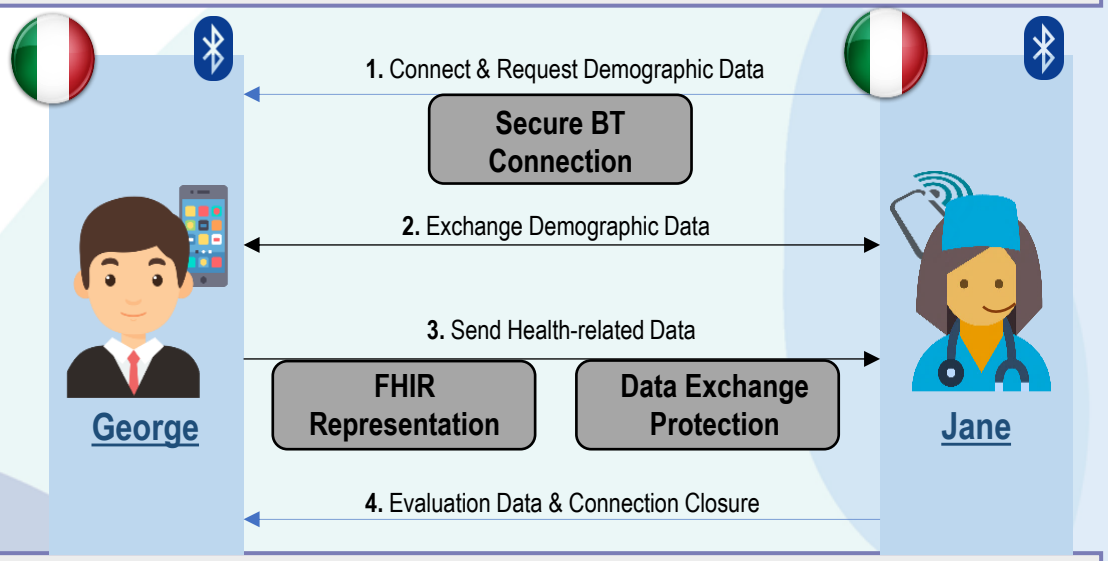
- **eHDSI** supports the exchange of data among healthcare organizations and not with citizens
- **eHDSI** defines its own ad hoc API and uses a standard data model representation (CDA)
- **Commercial apps** often require the healthcare organization to adopt proprietary products, APIs or authentication mechanisms, being limited to specific healthcare organizations

SOLUTIONS IMPLEMENTED (1/5)

D2D Protocol Specification

Series of **specified Bluetooth messages** regarding the **information that is exchanged** (e.g. in terms of successful or failed data exchange), including healthcare related data, between a **healthcare practitioner** and a **citizen**, without the usage of internet connection.





Novelties:

- Based on a **globally used short-range distance data exchange protocol (Bluetooth v4.0)**
- D2D protocol that can be **supported by the main market Operating Systems** (Android, Apple)
- **Secure** and **easy-to-use** data exchange process with m**inimum user interactions**
- **Control** with whom **the data is being exchanged**

SOLUTIONS IMPLEMENTED (2/5)

D2D Protocol Specification

Step 1: HCP app gets the advertised connection request

Step 2: S-EHR app gets the connection's unique session identifier

Step 3: HCP app gets the connection's unique session identifier (verification)

Step 4: S-EHR app gets the Healthcare Organization identity

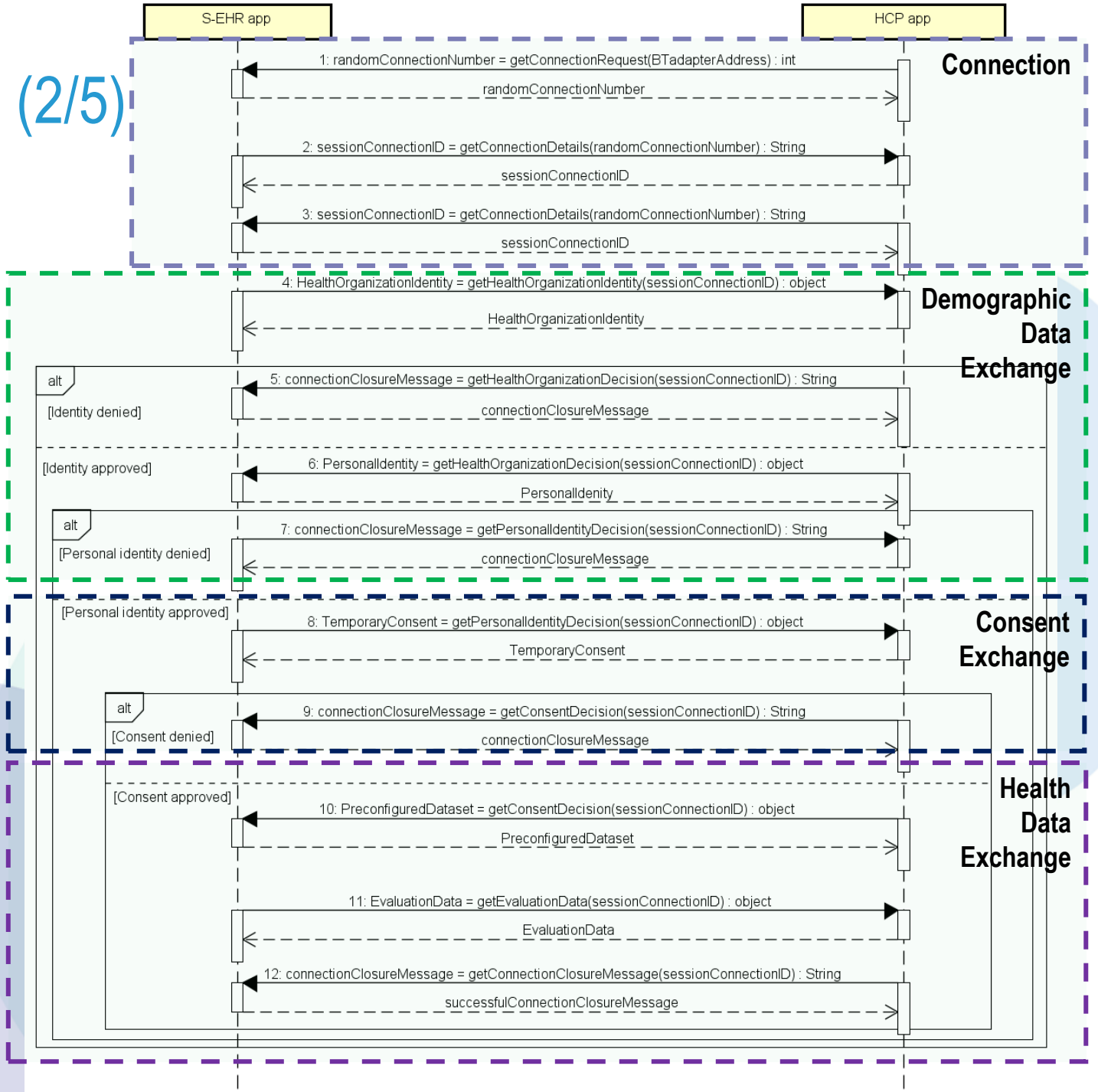
Step 5-6: HCP app gets the decision from the side of the S-EHR app (possibly including Personal Identity)

Step 7-8: S-EHR app gets the decision from the side of the HCP app (possibly including Temporary Consent)

Step 9-10: HCP app gets the consent decision from the side of the S-EHR app (possibly including Patient Summary)

Step 11: S-EHR app gets evaluation data

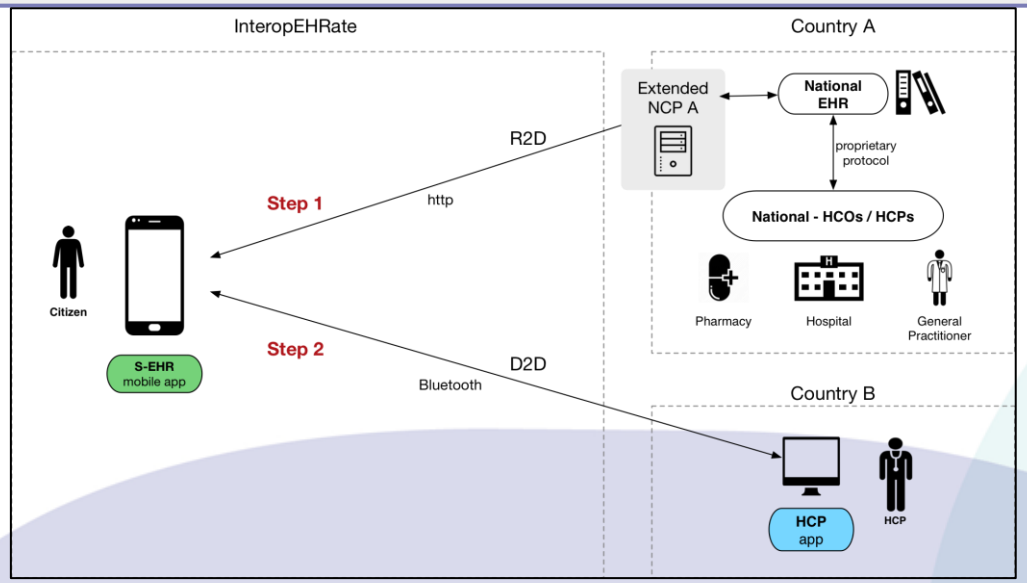
Step 12: HCP app gets the connection closure message

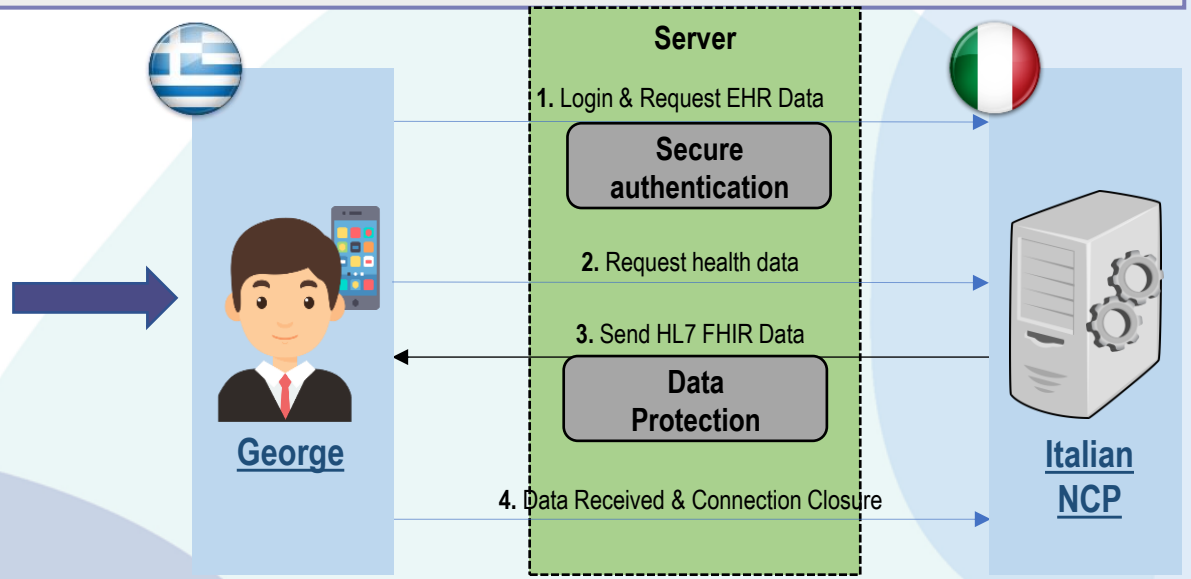


SOLUTIONS IMPLEMENTED (3/5)

R2D Protocol Specification

Abstract operations and their corresponding concrete operations based on **eHDSI API** and **FHIR API** (R2D extends existing standards) and **eIDAS,** for remote data exchange.





Novelties:

- **Allow Patients / Citizens** to **download their health data from the NCP of their country.**
- **Adopt the same standard authentication mechanism (eIDAS)** for any EU country**.**
- **Citizens may choose their preferred S-EHR app independently from the country** (i.e. a vendor may offer the same app to different countries).

SOLUTIONS IMPLEMENTED (4/5)

R2D Protocol Specification

How a NCP can adopt R2D

- **Extending** the **current eHDSI** interaction mechanism **allowing EU Citizens to authenticate to a NCP** (with restricted access only to their data).

- **Providing** a **FHIR API** (to the NCP) in order to:
  - **Adhere to a widely adopted standard**
  - **Provide additional operations beyond those provided by the eHDSI protocol**

SOLUTIONS IMPLEMENTED (5/5)

R2D Protocol Specification

- Operation **getLastRecord():** allows to request the most recent health data of a specific type (specified by requestor)
- Operation **getRecords():** allows to request all health data of a specific type starting from a certain date (specified by requestor)
- Operation **getAllRecords()**: allows to request all health data (of all types) starting from a certain date (specified by requestor)

FHIR API

RestFul Operation

https://ncp/Composition?type=loinc.org|60591-5&_sort=-date&_count=1

HTTP METHOD: GET

eHDSI extension

Web Service Invocation

PatientService.list(args)

CONCLUSIONS

SOLVED CHALLENGES

- **Specification** of **new data exchange protocols for different cases (i.e. D2D, R2D)**
- Worked within the **bounds** of a **concrete implemented example** tackling specified requirements
- Difficulties in **identifying the short-range distance communication technology**
- Exchange **HL7 FHIR resources through Bluetooth** (patient, practitioner, organization)
- **Serialization of healthcare information** based on **Bluetooth**

With D2D

- **Citizens** can **receive on their (S-EHR) app, without internet, evaluation data from healthcare providers**
- **HCPs** can **access, without internet,** to **health data** that **Citizens bring on their S-EHR**
- **Citizens and HCPs** are **not tied to specific application vendors**
- **Citizens** are **in control** of **whom they exchange health data with**

With R2D

- **Citizens** are able to **directly download their personal healthcare data through a NCP**
- **Support** of **FHIR API language, FHIR data model** and **data representation**

NEXT STEPS

GOALS

- **Updates on D2D and R2D Libraries' APIs specification**
- **Testing** with different short-range distance communication technologies (e.g. WiFi Direct)
- Communication between **S-EHR app and S-EHR Cloud**/ communication between **S-EHR cloud and Hospitals**
- **Redesign** of specific operations on exchanging health data (based on feedback and testings)
- **Make the** D2D and R2D libraries' APIs **more similar**

Thank you!

Q&A time.

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