National eHealth system in Ukraine

technical aspects and challenges
Who we are

Edenlab - custom software development company specialized in HealthCare, Fintech, Blockchain

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Why - National eHealth main tasks as of 2017

- New financial model for the PHC: Money follows the patient
- Patient data interoperability and national standard
- Big Data for NHS, health management information system
- Government policy implementation tool in HealthCare
- Transition from paper data flow to digitized one
Non-functional requirements

- 600 RPS load ready system
  - 50 millions Patients
  - 500 billions observations
- Microservice architecture
- Asynchronous interactions for EHR
- REST API
- Open source
- FHIR inspired
- tight schedule: 6 months;
- legal status and non-disputability - digital signature
- High-availability
What did we have at the starting point 2017

- post-USSR paper document-based approach of medical data processing
- No patient registry or unique id
- Various state legacy systems (mainly reporting and statistic collection)
- EHR solutions cover up to 5% of the market (private facilities), not interoperable
- Overall level of ICT penetration in healthcare is very low
- national standard or recommendation on EHR never existed
HOW - 2 layers, central component and EHR systems

Private EHR system solutions (we call them MISs): (medical information systems, laboratory information systems, information systems for patients, NHS)

Public Central Component: (National registries, classifiers and terminology services, Central data storage, interoperability)
Technical overview

Kubernetes

Elixir

PostgreSQL

MongoDB

Apache Kafka

A distributed streaming platform

Ceph

React

Docker
PRM - partner relationship manager

- Medical Service Provider registry
- Contracting processes and registry
- Dictionaries
- Business logic automation
- Administration console
- Policy control
MPI - Master Patient Index

- Registry of patients
- Deduplication mechanism
- Data stuarts
Mithril and ABAC

- Authentication and authorization
- oauth 2.0
- Scope-based RBAC auth model
- ABAC authorization
IEHR

- Centralized registry of medical data
- Append only
- Documents to FHIR objects transformation
- Business validation
Key Technical points

- Async POST/PUT operations
- Denormalized data - three collections
- Horizontal scaling - kafka/MongoDB
- Medical data can be accessed via API only by patient
- We do guarantee jobs processing sequence for one patient only
- Medical data shouldn’t contain any personal data
- Medical data cannot be changed
- Digital signature as a legal basis for the medical record creation
- Microservices interaction has been migrated from http to RPC
- Step-back from Microservices
- Database is the weakest element
E-Health roadmap

Stage 1: ePrescription
- MedicationRequest
- MedicationDispense

Stage 2: NHS Capitation
- Patients
- LegalEntities
- MedicalServiceProviders
- MedicalStaff
- Declarations

Stage 3: EHR for PHC
- EpisodeOfCare
- Encounter
- Observation
- Condition
- Immunization
- AllergyIntolerance
- RiskAssessment

Stage 4: Specialized outpatient
- PatientSummary
- Procedures
- ServiceRequests

Stage 5: Specialized inpatient
- FHIRPath
- StructureDefinition
- Bundle
- Composition
- ...

WE ARE HERE
Results and achievements

PHC Facilities: 1,855
PHC Physicians: 25,294
Patients: 28,580,615
Connected MIS: 25

Capitation payments: 12.5 billion UAH
Issued e-Prescriptions: 7,413,079
Dispensed e-Prescriptions: 6,188,425
Average RPS: ~180
Where FHIR helped

- Stick to FHIR to be on safe way
  - Domain knowledge established in FHIR
  - Business analysis
- Time to market
- System development goes smoother -
  - Future Data model is defined
  - Modern standard
- Platform of communication between customer and developer
- Transition from health forms/documents to data
Challenges

- Transition from custom DocFlow to FHIR docFlow
  - 100x of national forms implementation - resource consuming.
  - Structure definition should allow to make it via configuration, not development.
  - The only implemented source of medical data for PHC - national forms. Some of specialized inpatient forms require opposite flow - when medical data can be directly created via API and national form generated based on it.

- Legal conflict
  - FHIR flow: basic obj. -> Document -> Signed Document
  - Legal flow: Document -> Signed Document -> Basic object

- Interoperability
  - Full support of FHIR spec
  - Migration from REST API to FHIR on REST API

- Private-Public partnership model increases overall system flexibility
- FHIR flexibility
Summary

- New financial model for the PHC: Money follows the patient
- Patient data interoperability and national standard
  - Standardised data model
  - Specification
- Big Data for NHS, health management information system;
  - Well-structured data model
- Government policy implementation tool in HealthCare
  - FHIR-path
Thanks!

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