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Integration of chatbots with Knowledge Graphs in eGovernment: The case of *Getting a Passport*

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Context and Aim

- Context
  - inGov is a 3-year (1/1/2021-31/12/2023) Research and Innovation action funded by EU H2020 programme
  - inGov aims to enhance existing and device new ***Policies, Methods and ICT Tools*** for ***inclusive Integrated Public Service (IPS) Co-creation and Provision***
- Aim of this paper
  - To investigate the ***integration*** of ***chatbots*** with ***Knowledge Graphs*** for providing ***personalized*** information on Public Services

Rationale

- Information on Public Services (aka PS descriptions) is often provided in eGovernment portals, PS e-catalogues or dedicated websites, e.g. www.passport.gov.gr. These:
  - ✓ Use national standards or *ad hoc* ***data models*** for PS descriptions
  - ✓ Often do not provide personalized information
- The EU has introduced Core Public Service Vocabulary (***CPSV***) to harmonize PS data models across EU
- ***Chatbots*** can facilitate human-machine communication to provide personalized PS information
- ***Knowledge Graphs*** allow the creation of databases in a simple way with the ability to return more information than in a relational database
- In previous work Passbot and a KG have been developed for *Getting a Passport*
- There is still no work integrating ***chatbots and knowledge graphs for providing personalized PS information modeled using CPSV***

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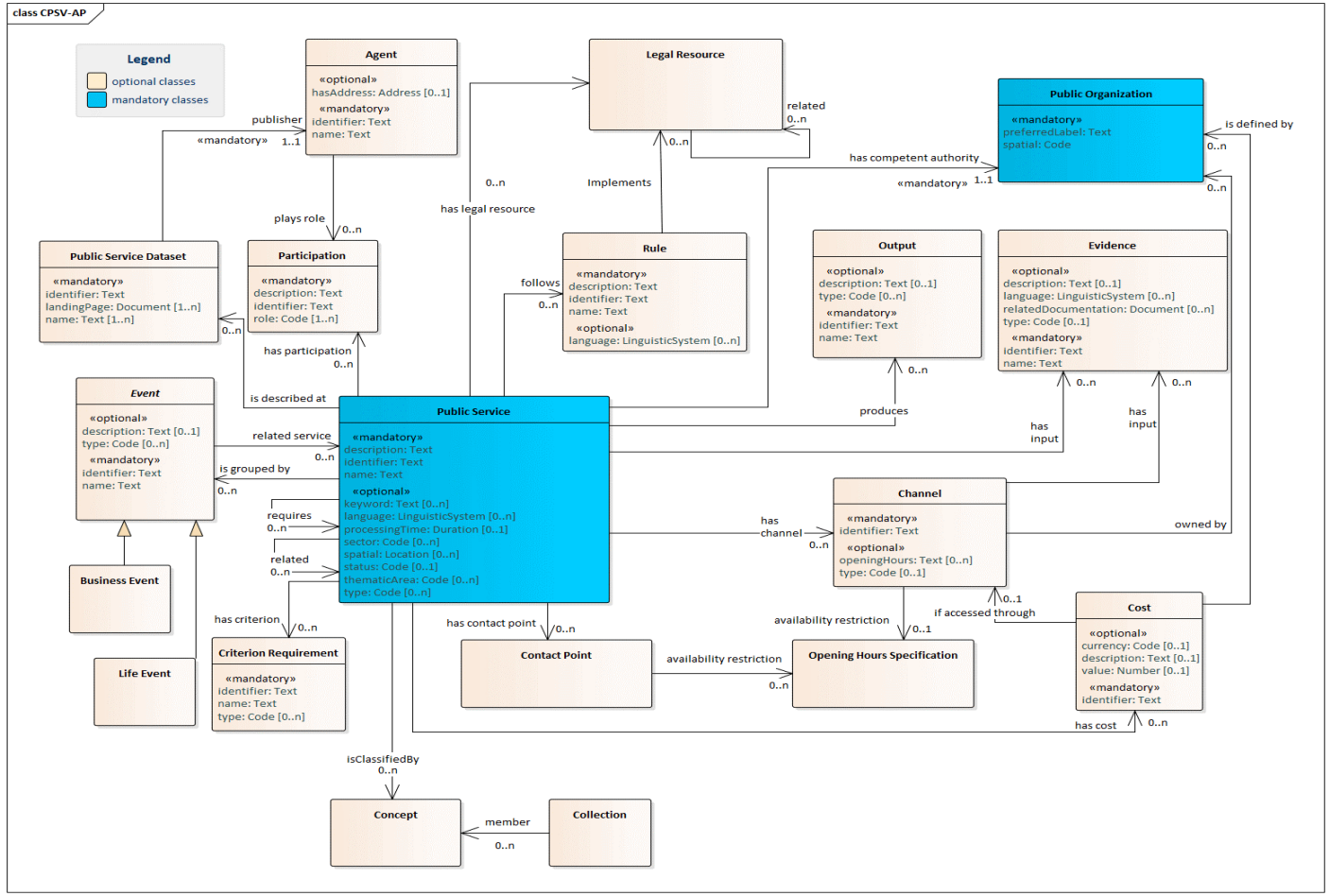
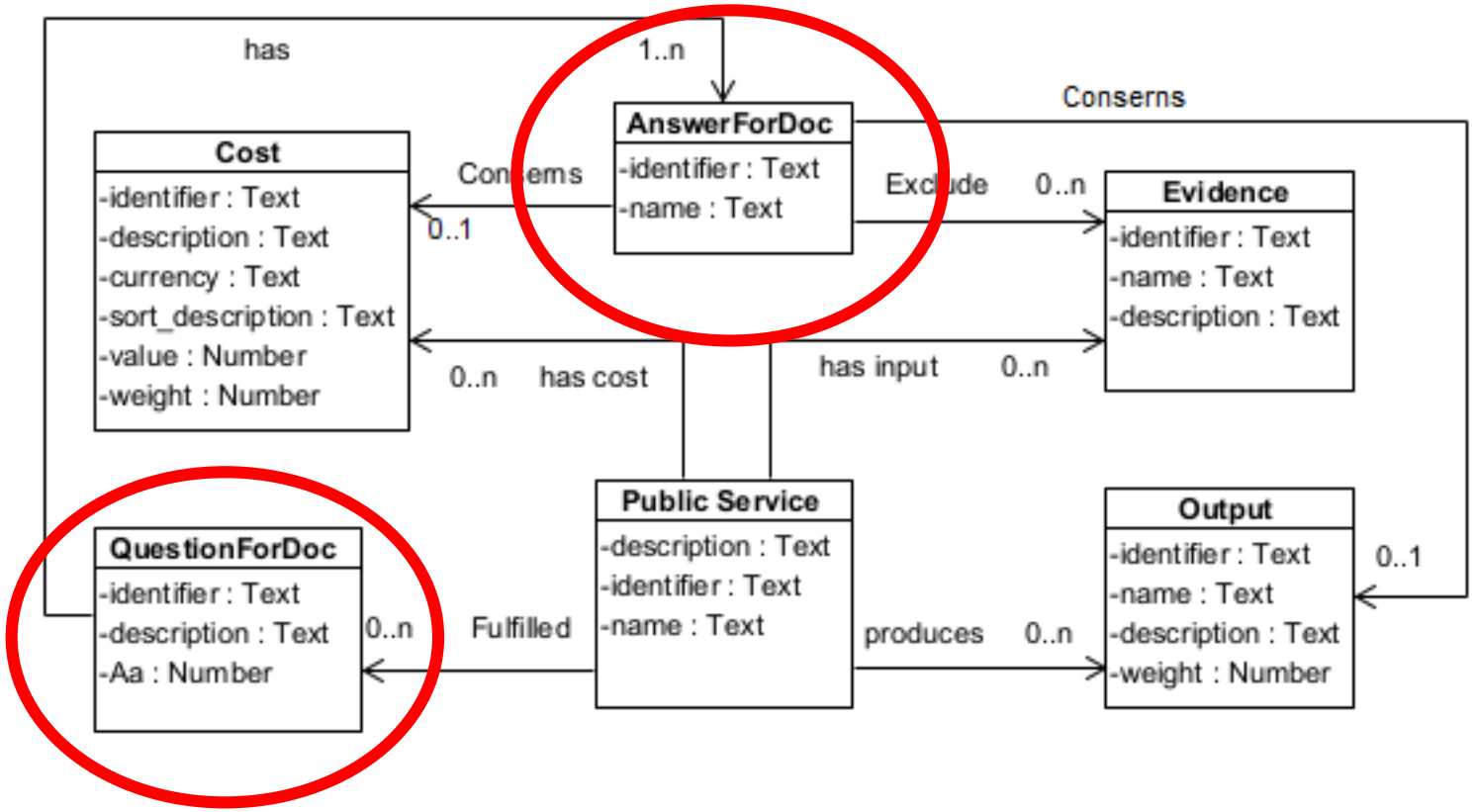
CPSV-AP

- Core Public Service Application Profile (CPSV-AP) was developed in 2014:
  - ✓ Main objective: the description of public services
  - ✓ CPSV-AP is a data model for PS description
  - ✓ It exploits Linked Open Data (LOD) as an underpinning technology



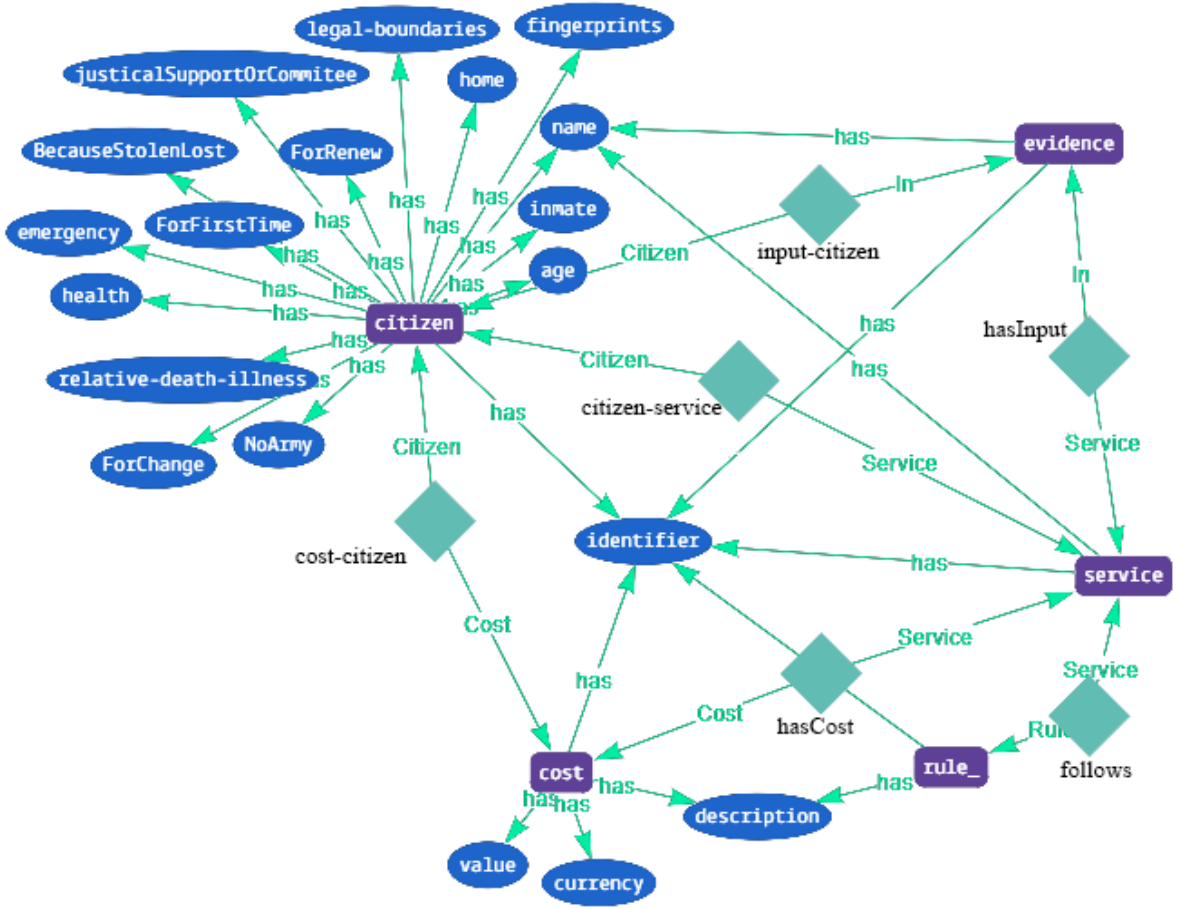
Previous work: Passbot (chatbot for *Getting a Passport*)

- Chatbot with *relational database* to store data
- *Based on CPSV-AP model*
- Developed using *Rasa 1.x*
- Extended classes
  - AnswerForDoc
  - QuestionForDoc
  - Feedback
- Positive feedback from users



Previous work: Knowledge Graph for *Getting a Passport*

- Knowledge graph about Getting a passport PS in Greece
- *Based on CPSV-AP model*
- Entity *Citizen* added to the model
- Developed using *Grakn.ai*
- KG tailored *specifically* for this PS



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Research Methodology

- Step 1. Understand existing systems and platforms.
- Step 2. Design the overall architecture of the chatbot-KG integration.
- Step 3. Design a new KG schema.
- Step 4. Develop proof-of-concept for chatbot-KG integration.
- Step 6. Evaluate proof-of-concept chatbot-KG integration.

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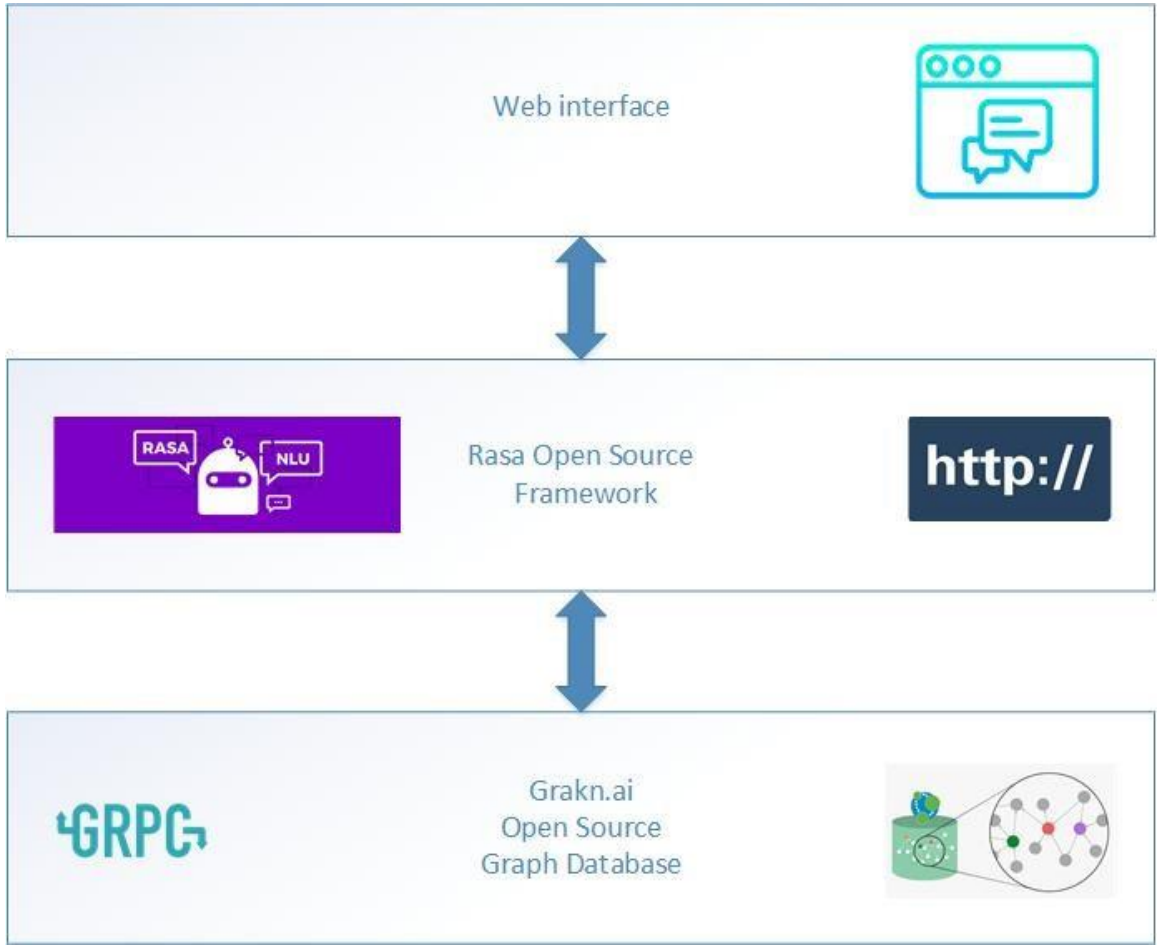
- Background and Previous work
- Research Methodology
- Integrating PassBot with KG
- Conclusions and Future Work

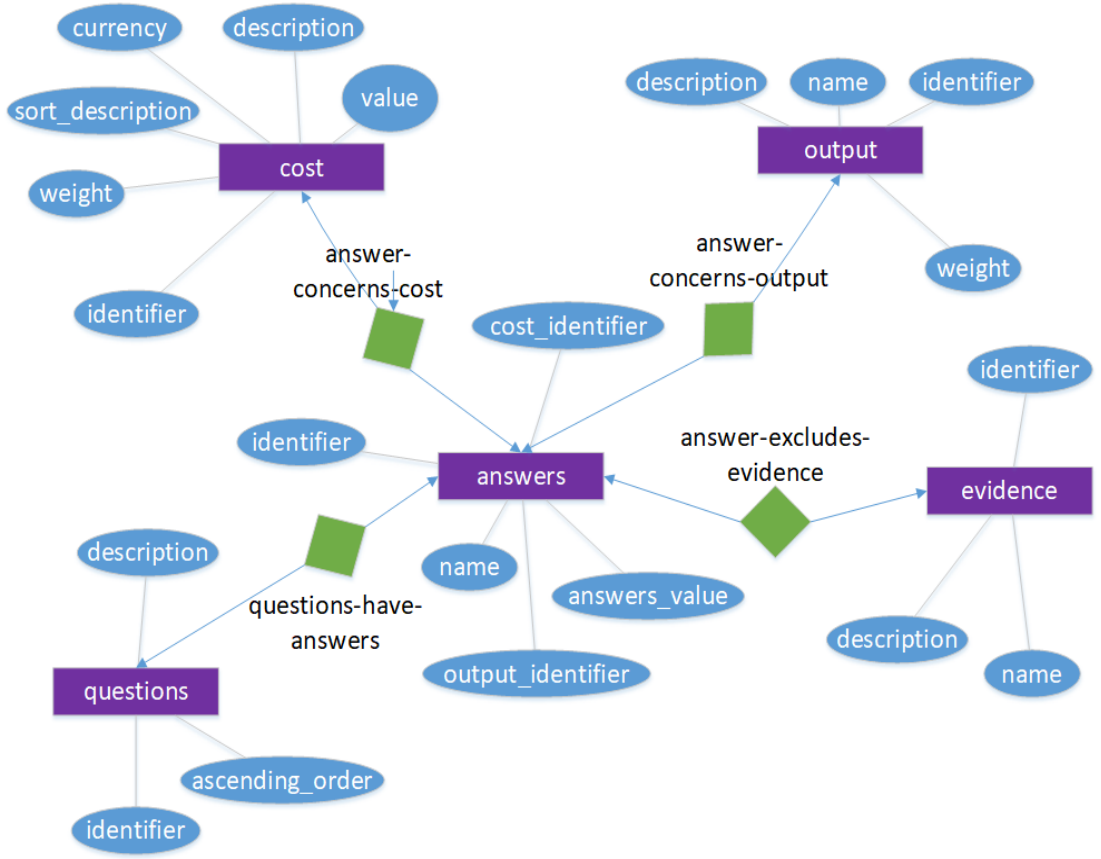
Overall Architecture



Rasa ver. 2.x had been released

The new KG schema - Advantages

- Compared to RDBMS
  1. Allows the expression of self-referential questions in a simpler way
  2. Easily scalable with new entities and relationships unlike the strictly defined schema used by RDBMS
  3. Allows queries to be created without any restrictions
  4. Easier to understand and query
- Compared to the previous graph
  1. Fewer relations and features (92 LOC from 440)
  2. Covers many different types of documents with little or no conversions
  3. Development now based on object-oriented paradigm
  4. No data is entered by uncertified users thus improving security



Evaluation

- Questionnaires based on Technology Acceptance Model (TAM) and System Usability Scale (SUS)
  - TAM: 18 questions questionnaire
  - SUS: 10 questions questionnaire
- Participants are students from IS and eGov courses of University of Macedonia
  - Ages between 20 - 25 years
  - 65 students completed TAM questionnaire
  - 62 students completed SUS questionnaire
- 89,3% agreed that the use of chatbot was easy and did not require much mental effort
- 86,1% agreed that using the chatbot allowed them to obtain the needed information for passport issuance in less time than before
- SUS score of 76,8 which classifies the chatbot as acceptable

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Conclusions and Future Work

- Use of KG can simplify the design of the database, which follows standards such as CPSV-AP for describing PS.
- Data integration could be done gradually without the constraints imposed by a relational database
- The integrated chatbot and KG schema, after some small configurations, can be used in different PS for providing information
- Technical challenges remain towards an operational system (short descriptions, FAQ, Greek language)
- Future work includes a thorough examination of the use of a KG for the CPSV-AP model.
- We also plan:
    1. To experiment with oral speech as it could greatly improve user experience.
    2. To connect the chatbot with external APIs that are popular with users (e.g., Facebook Messenger)
    3. To develop an alternative chatbot design that answers general questions about different public services, instead of asking questions only about Passport Issuance.
- Citizens' acceptance as well as potential benefits and challenges for PAs must be more thoroughly investigated

Thank you for your attention!

Questions?

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