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Smart Museum of Everyday Life History in Petrozavodsk State University: Software Design and Implementation of the Semantic Layer

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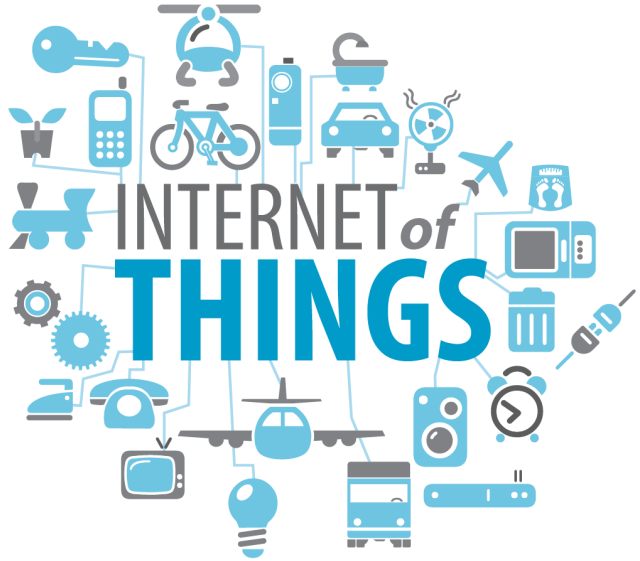
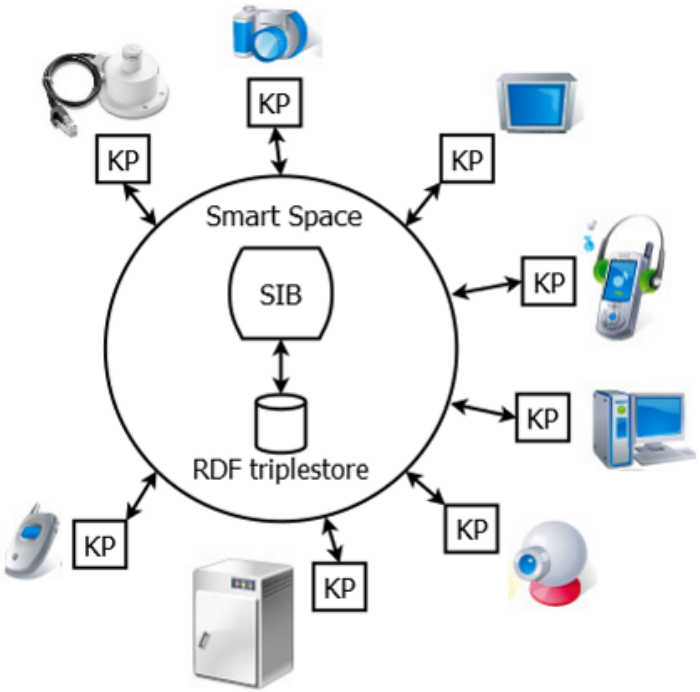
The History Museum of PetrSU

- Everyday life history
- Exhibits: photographs, various textual documents, newspapers, academic journals, etc
- Surrounding wide-format screens
- The museum information system (MIS)

IoT and smart spaces in museum environment

- Exhibits are transformed to IoT objects
- They provide information about themselves and interact with users and other objects
- The IoT technology enables integration of MIS with visitors activity

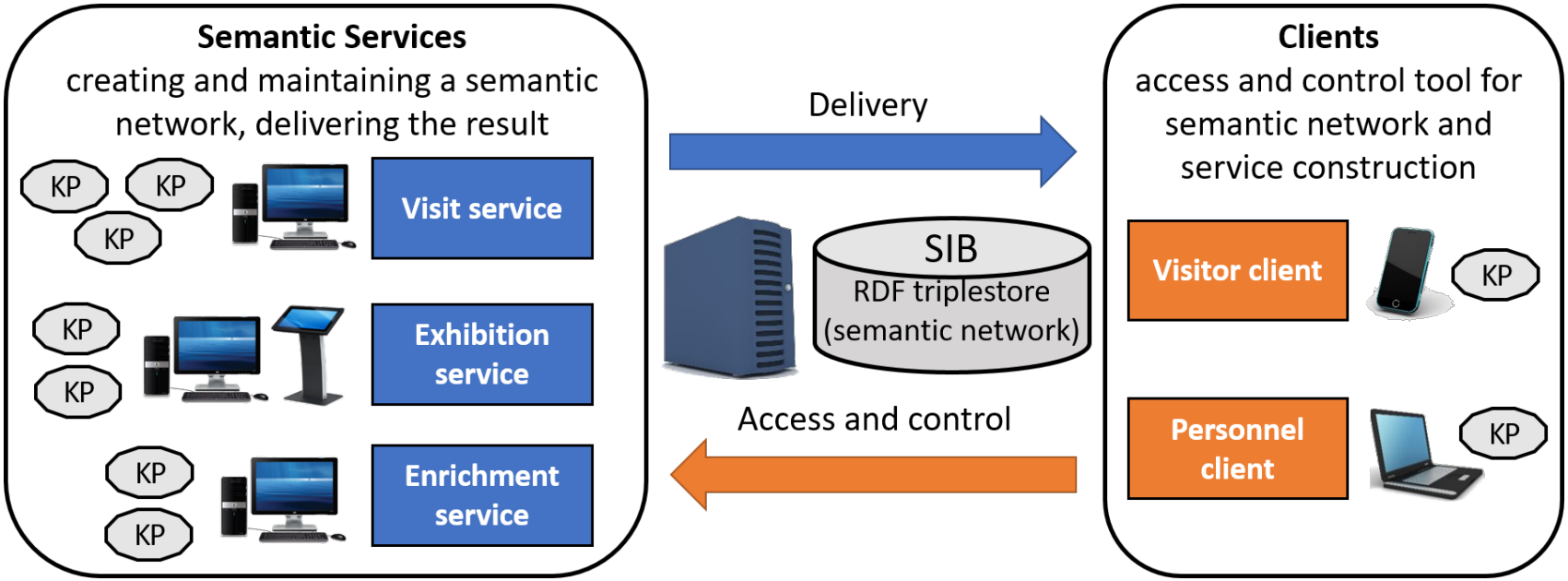




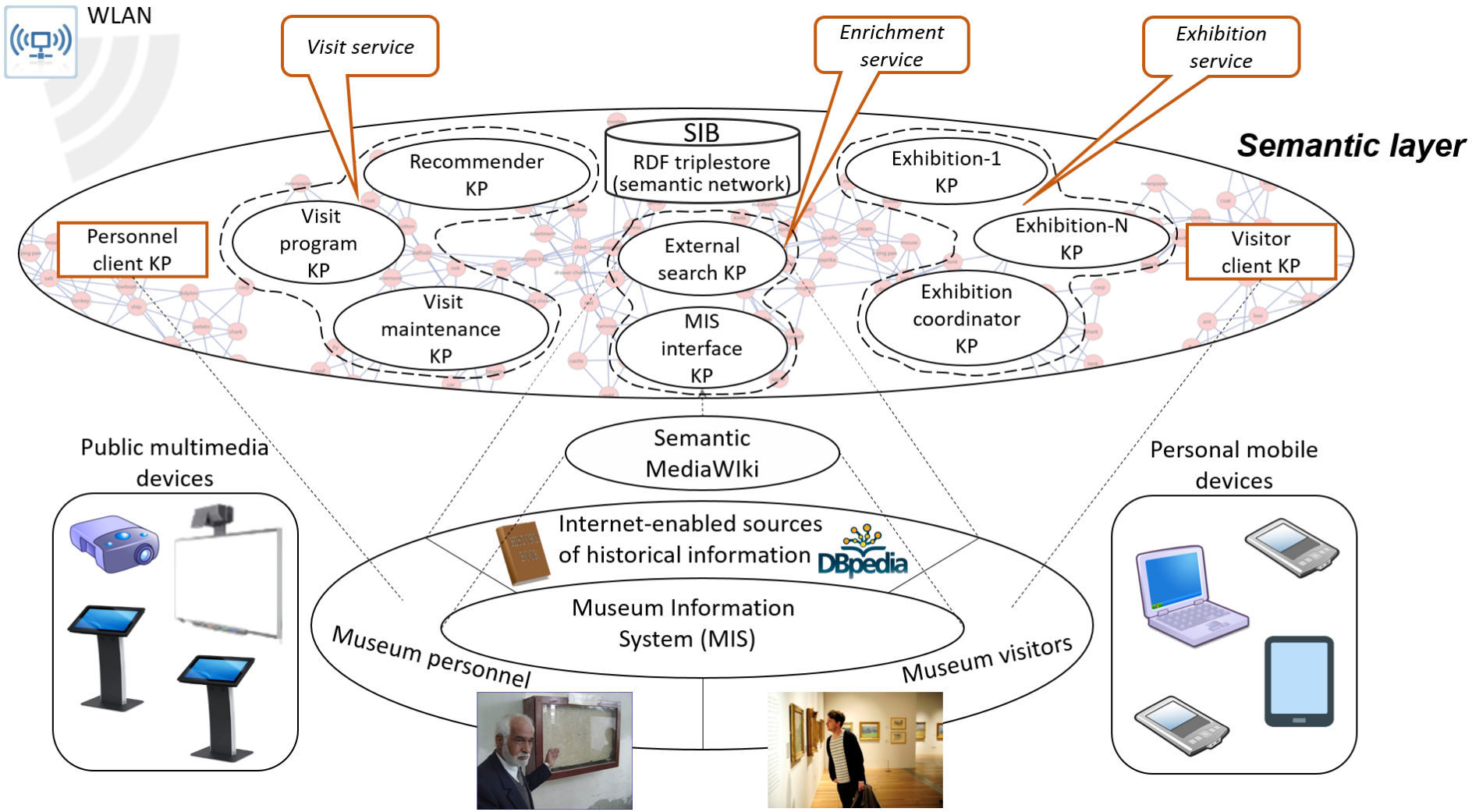
- Museum is service-oriented multi-agent environment
- Software infrastructure consists of semantic information broker (SIB) and knowledge processors (KPs)
- Objects are virtually represented and interconnected, as it happens in Semantic Web

Basic software infrastructure components

- **Visit service** constructs a personalized exposition of recommended exhibits for a visitor to study.
- **Exhibition service** show recommended exhibit descriptions using appropriate multimedia devices.
- **Enrichment service** supports evolution of the cultural heritage knowledge by museum personnel and visitors themselves.
- **Visitor and personnel clients** provide access and control tool for the semantic network and for services construction.



Smart Museum Environment and Semantic Layer



Problem Statement

Problem 1

Offering personal recommendations on the museum collection with the use of semantic ranking methods and in context of the user and exhibition.

Visit service	Construction of a personal visit program
Exhibition service	Visualization of most interesting information derived from the available knowledge for current context and situation

Problem 2

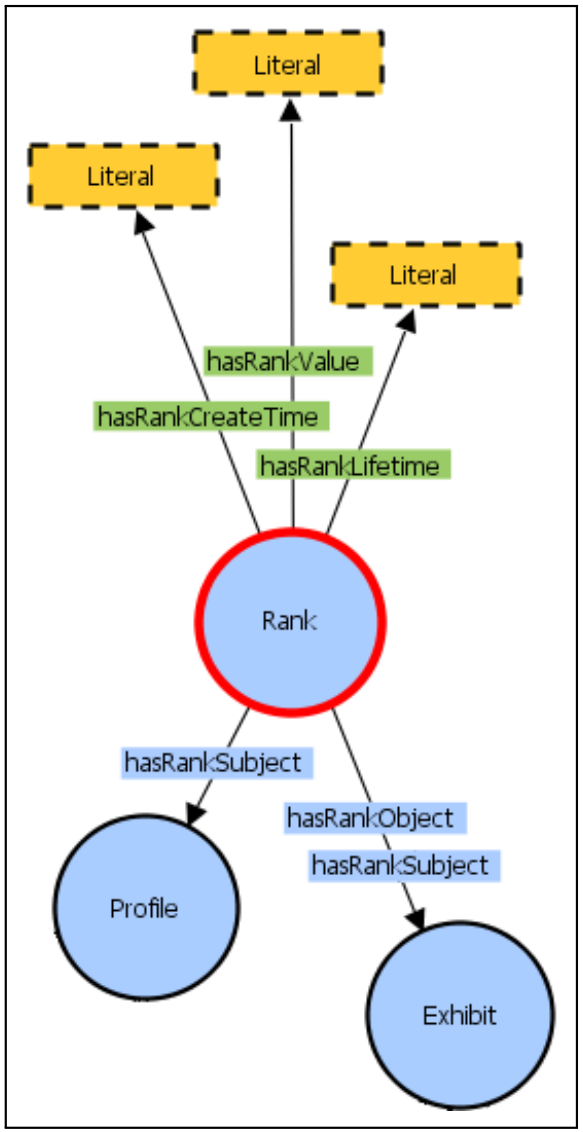
Collaborative addition of information sources and their semantic annotation within the museum collection.

Enrichment service	Evolution of semantic network by museum personnel and visitors
Visitor client	Enrichment of studied exhibits in the form of adding comments
Personnel client	Semantic analysis of comments received by visitors and annotation of exhibits based on this

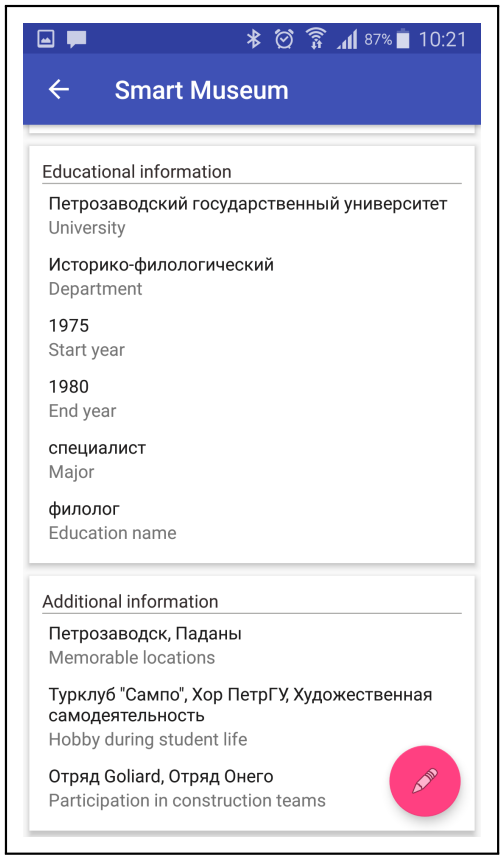
Information Ranking and Semantic Matching

Semantic matching method

1. ranking of each exhibit based on the visitor profile
   - such ranging is used from Visit service for construction of the personal program
2. ranking of each exhibit relatively to other exhibits
   - such ranging is used from Exhibition service when a visitor views the current exhibits
3. iterative ranking of objects, where the visitor views a particular exhibit
   - a search of relatives to particular exhibits
   - these exhibits are ranked according to the visitor profile



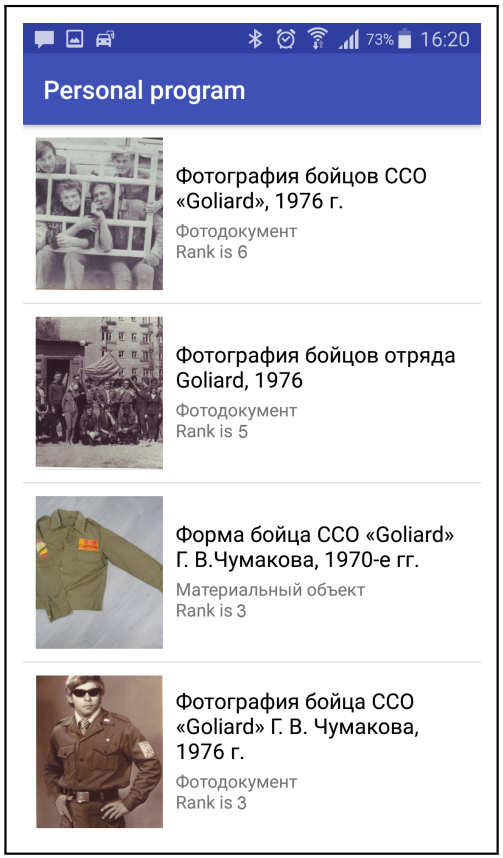
Use Case: Semantic matching and Personal Program



Profile details

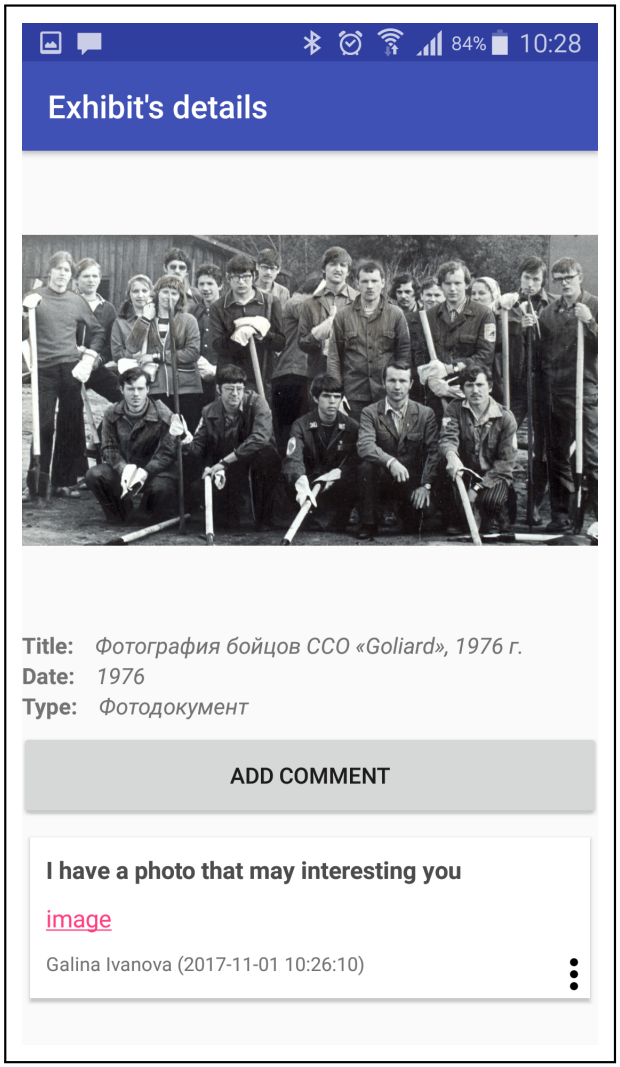
№	exhibit	semantic matching with the user profile	rank
1	Photo of members of the student construction brigades «Goliard» 	– date **1976** – refer to department **the Department of History and Philology** – has been made in place **Padanyi** – represents possible friends: 1) S. Verigin (has Person Education: **1973-1978 the Department of History and Philology in PetrSU**) 2) T. Yuldashev (has Person Education: **1973-1978 the Department of History and Philology in PetrSU**) 3) V. Efimov (has Person Education: **1974-1979 the Department of History and Philology in PetrSU**)	6
2	Photo of members of the student construction brigades «Goliard» 	– date **1976** – refer to department **the Department of History and Philology** – has been made in place **Padanyi** – represents possible friends: 1) V.Birin (has PersonEducation: **1974-1979 the Department of History and Philology in PetrSU**) 2) N. Pochtovalov (has Person Education: **1974-1979 the Department of History and Philology in PetrSU**)	5
3	Uniform of G. Chumakov 	– date **1976** – refer to department **the Department of History and Philology** – owner is a possible friend: G. Chumakov (has Person Education: **1973-1978 the Department of History and Philology in PetrSU**)	3
4	Photo of G. Chumakov 	– date **1976** – refer to department **the Department of History and Philology** – represents a possible friend: G. Chumakov (has Person Education: **1973-1978 the Department of History and Philology in PetrSU**)	3

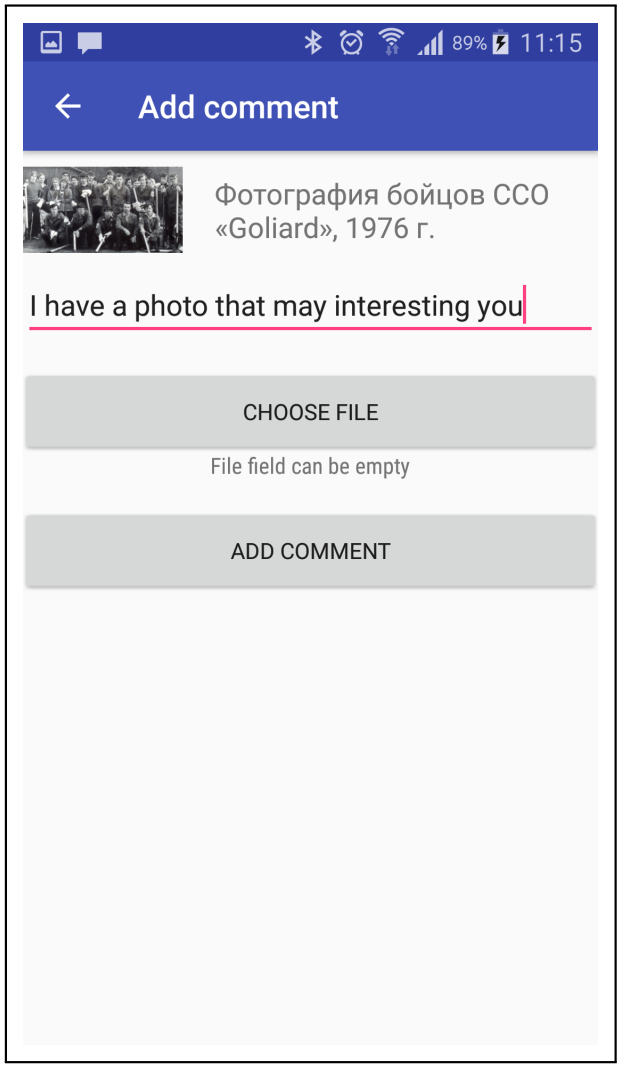
Semantic matching



Personal program

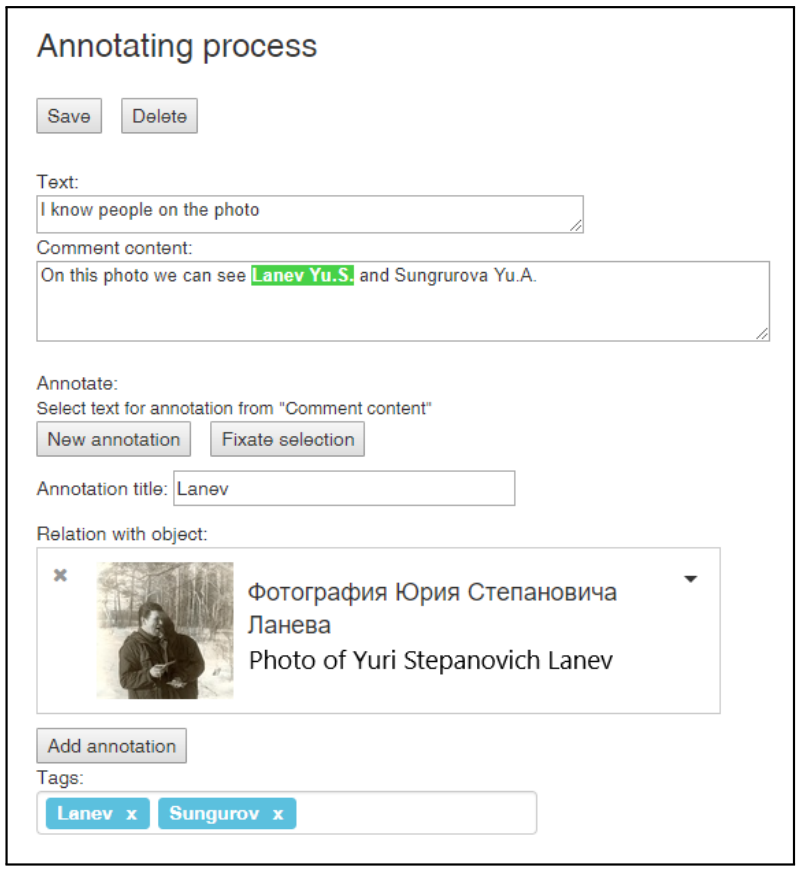
Collective Annotation

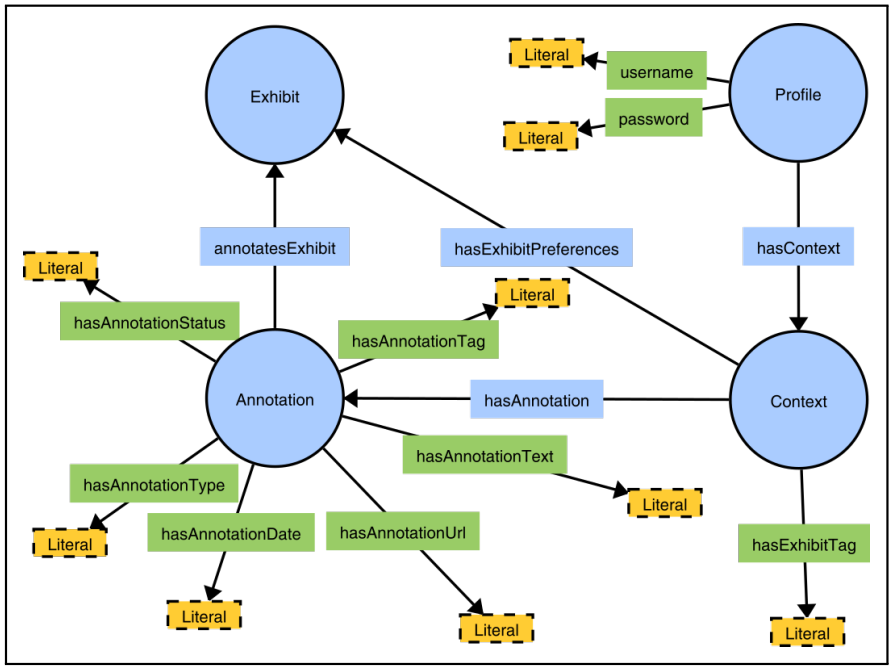




- list with all comments
- any user can add new comment
- uploaded file can be of text, audio, video or image types
- new comment sent to the server as POST request

Annotating Process





- personnel client as tool for annotating
- checking facts and selecting relation between user comment and existing information
- automation in further work

- annotation is stored in smart space
- after, it is possible to generate new exhibit for searching new relation by other services

Project Metrics

- Exhibits number is **296**
- Triples number in triplestore is **17967**
- Smart-M3 platform (**SmartSlog**) is used in most of cases

Component	**Tools**	**Lines of code**
Enrichment service	C++	3478
Visit service	C++	5749
Personnel client (Web app)	Python HTML,JS,CSS	3000 970
Visitor client (Android app)	Java C++ XML	2860 6129 1520

Conclusion

- Solutions to the two applied problems are considered
  - Offering personal recommendations with the use of semantic ranking methods
  - Collaborative addition of information sources and their semantic annotation
- Pilot implementation show effectiveness of Semantic Web, Internet of Things, and smart spaces technologies for this class of digital service-oriented environments
- The users of smart museum services achieve such effective properties as user mobility, service personalization, and collaborative work opportunity

Thank you! We will be glad to see you at the Demo Section!

Now it's time for your questions

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