

The Architecture of Intelligent Agent-based Educational System for Training Students in a Technical University



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The Architecture of Intelligent Agent-based Educational System for Training Students in a Technical University

Research problem statement: development of reasonable design solutions to support education of students in technical fields at Vologda State University.

Basic requirements for the information and educational environment of a technical university:

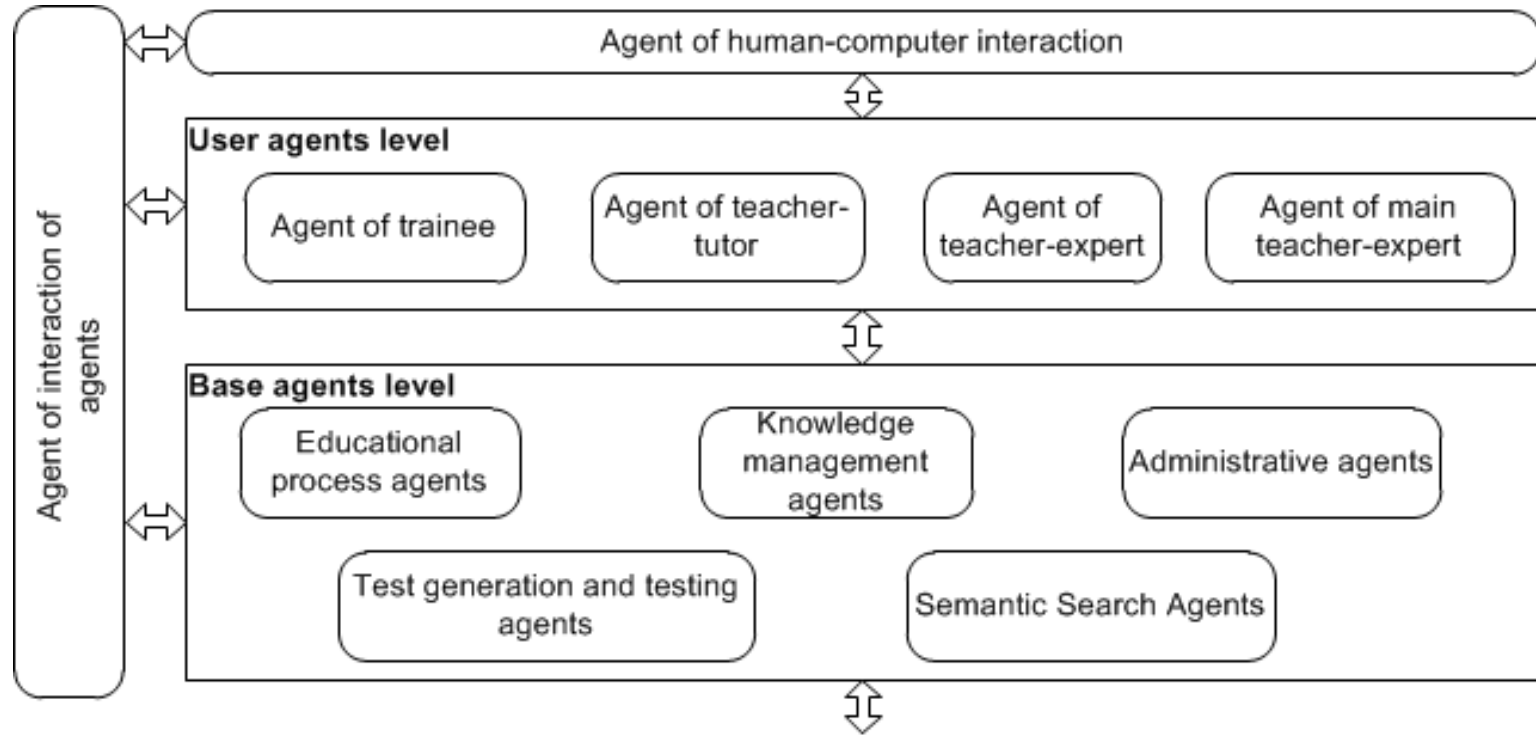
- Flexibility, openness and scalability
- Interactivity and visualization
- Integration
- Adaptability, etc.

So, electronic learning environment should be **complex distributed system with some intellectual capabilities.**

One of the effective ways to overcome the complexity of an information system with intellectual behavior is a **multi-agent approach.**

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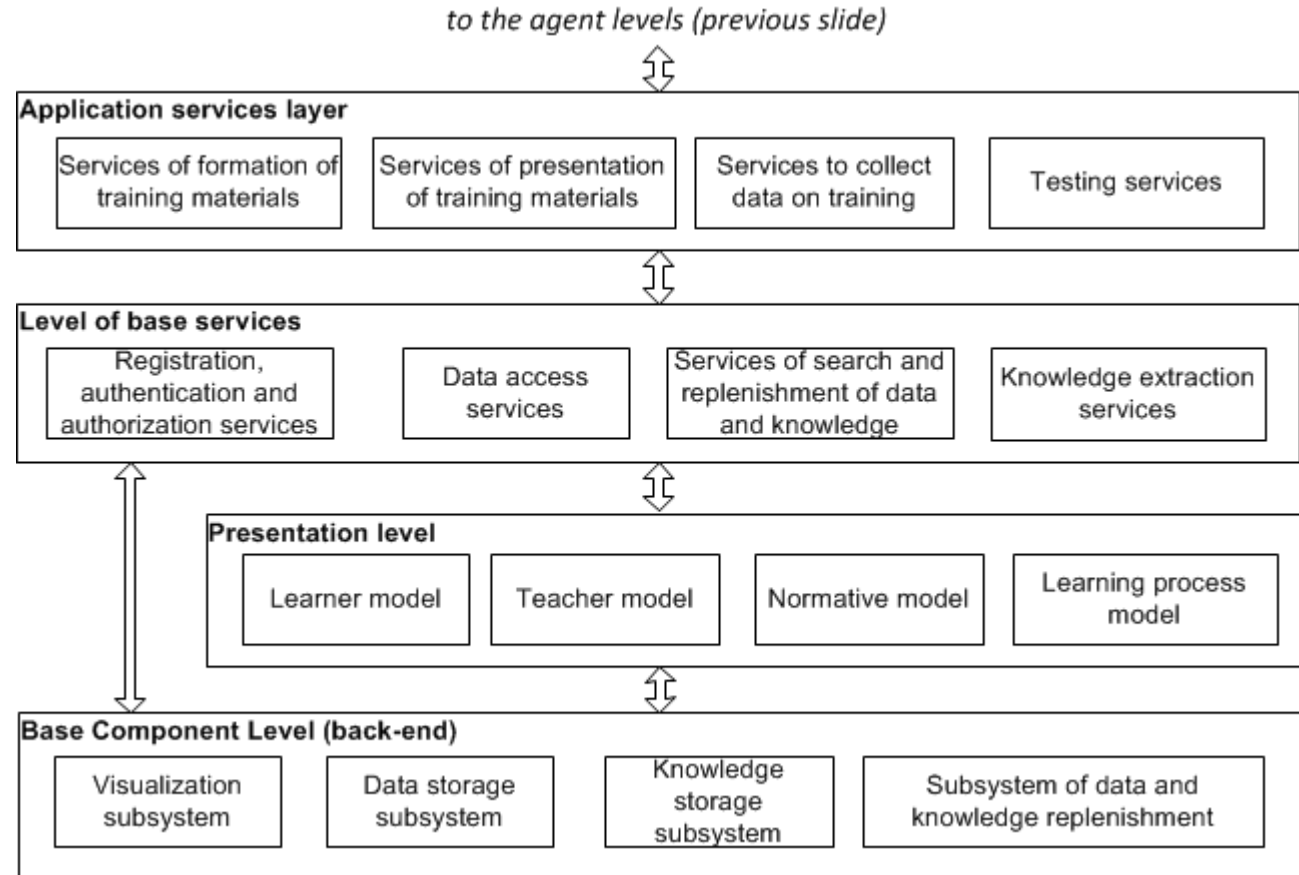
Architecture of the intelligent agent-based educational system, agent levels:



To the levels of services (next slide)

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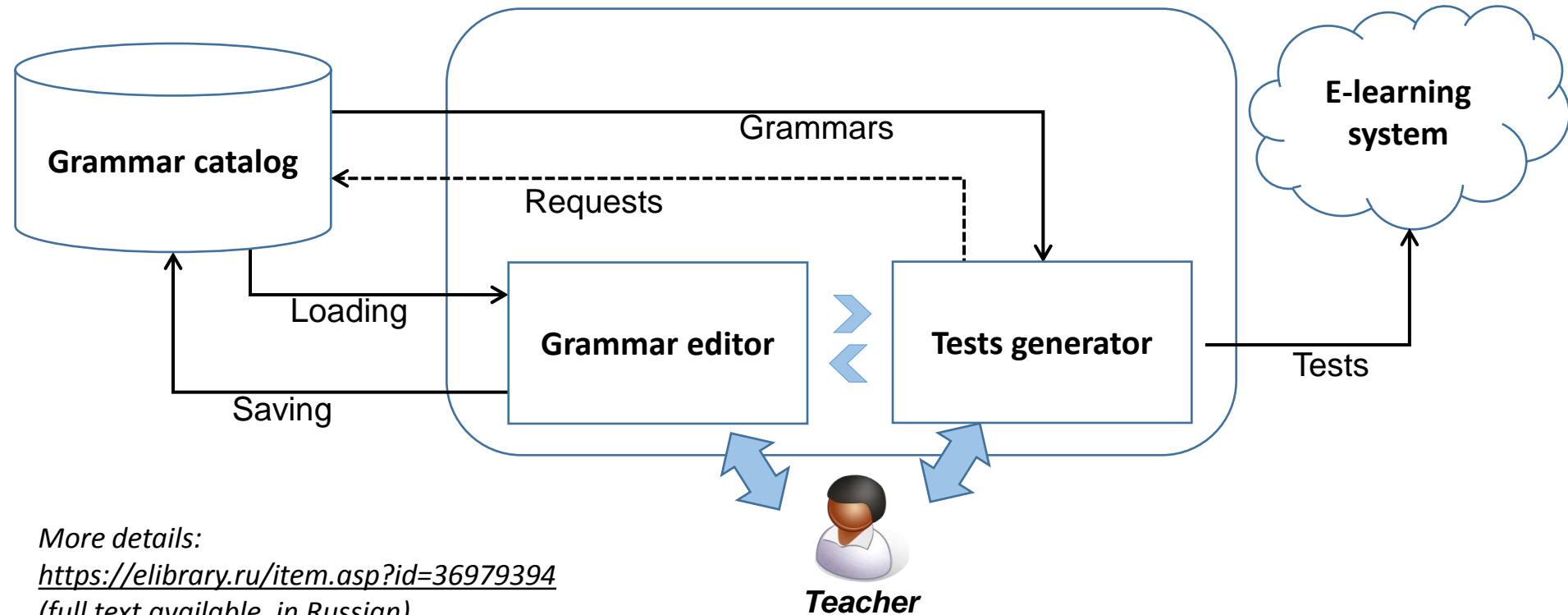
Services level,
Presentation level,
Back-end:



Next, consider in more detail some interesting elements of the educational system:

- Using formal grammars to generate test questions
- Semi-automatic generation of questions from texts in natural language
- Remote workshop on programming and databases
- Plagiarism detection subsystem for the remote workshop
- Elements of adaptive learning

Generating different variants of questions in tests using formal grammars

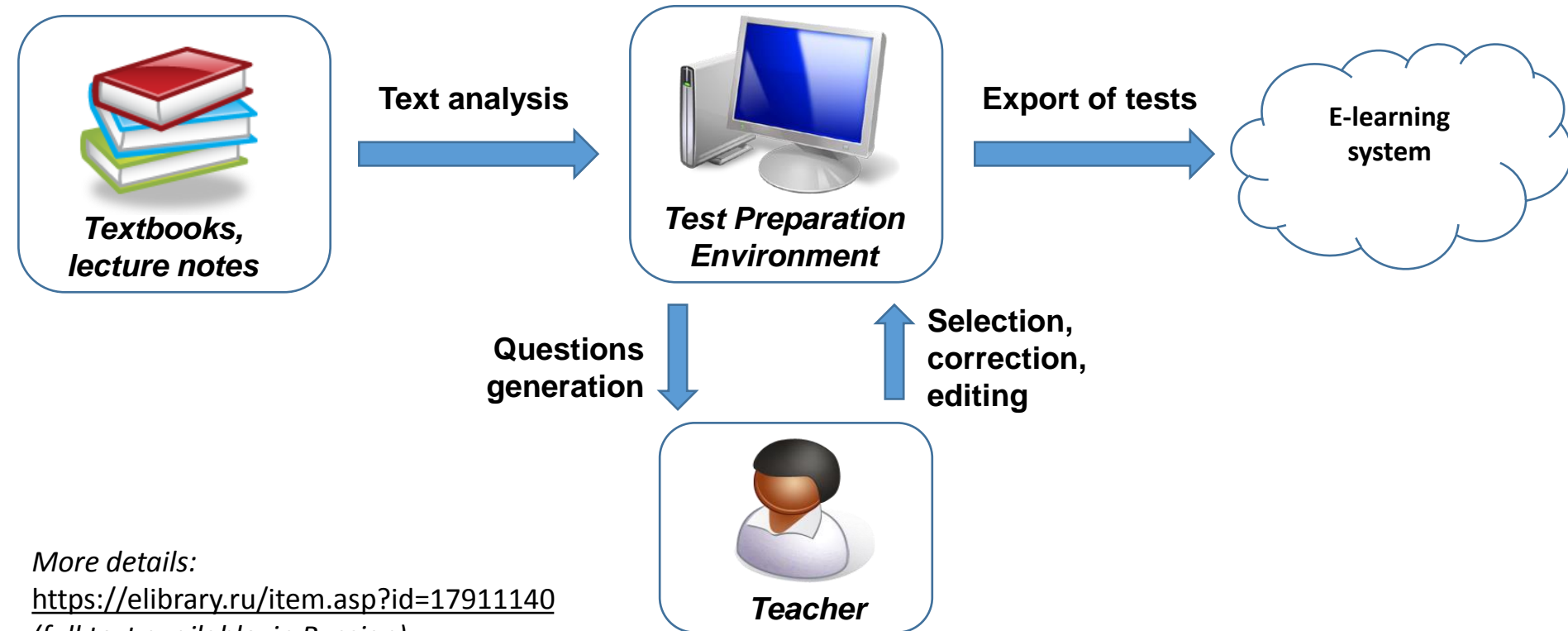


More details:

<https://elibrary.ru/item.asp?id=36979394>

(full text available, in Russian)

Generation questions by analyzing texts in a natural language (work in progress)



More details:

<https://elibrary.ru/item.asp?id=17911140>

(full text available, in Russian)

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Remote workshop on
programming
and databases
atpp.vstu.edu.ru/acm



Language: Russian
English

Remote Training on Programming

[Problems](#)

[Online status](#)

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Problems

Subjects:

- [Educational Courses](#)
 - + [C++ Programming Language](#)
 - + [MRCPK - Databases](#)
 - [Databases. SQL \(92\)](#)
 - [Databases. PL/SQL \(5\)](#)
- [Algorithms and Data Structures](#)
 - [Binary and Ternary Search, two Pointers \(2\)](#)
 - [Enumeration, Dynamic Programming, Greedy algs \(19\)](#)
 - [Data Structures](#)
 - [Graph Algorithms \(11\)](#)
 - [Data sorting and similar topics \(3\)](#)
 - [Student's Problems - old groups \(8\)](#)
 - [Place for problems from students' projects \(8\)](#)
 - [Combinatorics, number theory, etc \(4\)](#)

Problems:

ID	Title	% of Accepted	Solved P
1984	Additions	40%	4
1982	Assignments	18%	3
228	BitArray	15%	100
226	Brackets Control	36%	168
227	Brackets Replace	30%	37
1945	Cockroaches	66%	2
1948	Commercial Calculator	50%	1

Subsystem for detection plagiarism in source code

Comparison of compiled object codes instead of source codes is used.

Benefit: effective counteraction to many intentional code modifications, such as:

- replacement of the *for* loop with *while* loop, or vice versa:

`while(x < 5) → for(;x < 5;)`

- insertion of redundant or never executing code:

`X++; X--;`
`if (false) {...}`

- etc.

More details: <https://elibrary.ru/item.asp?id=26392154>
(full text available, in Russian)

Solution № 503113

Date	Author	Problem	Compiler	Result	Test	Points	Time (sec)	Memory (KB)
28.02.2020 10:19:45	Alexey Ivanov	151	GNU C++ 5.1.0	Accepted		100	0	272

Analysis of plagiarism

The similar solution was sent by Ivan Petrov. Similarity is 58.808%

After visual analysis of sources, teacher should manually define uniqueness of solution

Result: It is unique It is NOT unique

Alexey Ivanov

```
#include<iostream>
#include<vector>
#include<algorithm>
using namespace std;
vector<int>vec;
vector<int> ::iterator it;
int main(){
    int n=0, k=0,v=0,p=0;
    cin>>n;
    for(int i=0;i<n;i++)
```

Ivan Petrov

```
#include <iostream>
#include <vector>
#include <algorithm>
int main(){
    int r, q, d;
    std::cin>>r;
    std::vector<int> data(r);
    for(int v=0; v<r; v++)
        std::cin>>data.at(v);
    std::cin>>q>>d;
```

Elements of adaptive learning

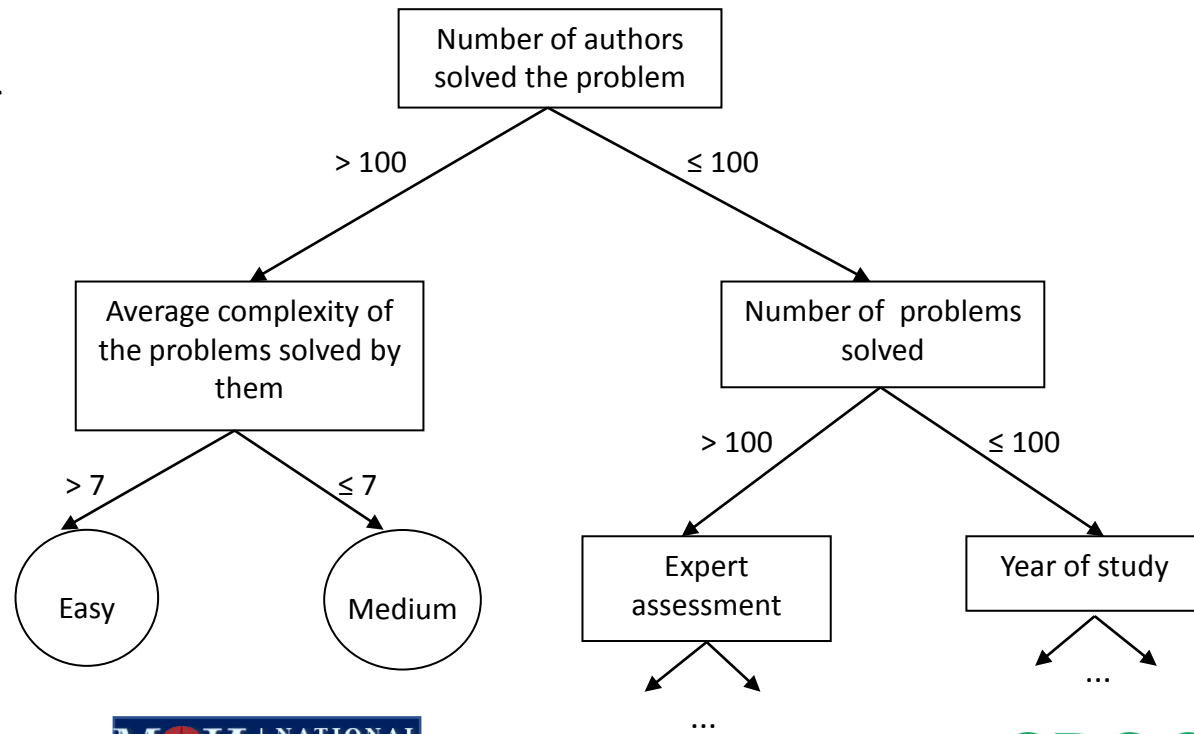
Student should be given assignments according to their skills and abilities.

In order to determine the complexity of a particular problem for a particular student, the recommendation system takes into account:

- solutions of other problems by this student,
- solutions of this problem by another students,
- expert assessment of this problem,
- other data about this student (year of study, etc.)

For classification, a decision tree is constructed.

A fragment of a possible decision tree



Thank you for attention!

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