

Virtual Class Room

distant education on-line project



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Virtual Heads Team
from Nizhniy Novgorod State
University
presents



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distant education on-line project



Virtual Heads Team

Nizhniy Novgorod State University students,
studying on department of Calculating Math. and Cybernetics:

- **Evgeny Gorodetsky** - 2nd year master student;
- **Alexey Polovinkin** - 2nd year master student;
- **Sergey Sidorov** - 2nd year master student;
- **Sergey Liverko** - 4th year student;

Scientific adviser:

Vadim E. Turlapov (professor, doctor of technical science)

Team was working since **October 2006**.



Project motivation and goals

- **Problems of modern distant education:**

- No tools for effective live communication between teacher and large group of students;
- Live audio and video exchange between all participants of the lection is too expensive with general internet connection;
- No integrated tools for communication and presentation;
- No integrated instruments for automated scheduling and conducting lections;

- **Solution is to develop a set of integrated tools for:**

- Organization and conducting lections in large groups of students;
- Live communication between all participants of the lection;
- Effective built-in tools for presentation demonstration.

What is Virtual Class Room?

- **User control:**
 - users registration with role based security for students and teachers;
 - users authorization;
 - users group access permissions.
- **Lesson organization:**
 - creating lesson schedule by teachers;
 - registration to scheduled lessons for students.
- **Presentation demonstration:**
 - current slide review by all students during lesson;
 - auto slide switching for all users by teacher;
 - sharing of hand-written drawings on presentation by teacher.
- **“Live faces” visualization:**
 - teacher and all students see “live faces” each other;
 - auto checkup for users’ presence on lesson.
- **Voice communication during lesson:**
 - teacher’s voice transfer (from microphone) to all presented students;
 - join several students to conversation.
- **Lesson statistics:**
 - Presence on lesson auto-collection by student faces;
 - Average understanding level of lesson by student votes;



VCR Functionality for Users



- **All Students and Teachers can:**

- View information about registered users and lections (Web-Site);
- Upload personal virtual heads or select from list of shared (Web-Site);
- Control personal schedule of lections (Web-Site);
- During the lection (Win-Client):
 - **Talk** with each other;
 - **See live talking heads** of all participants of the lection;
 - **See current slide** of the presentation and hand-written notes on it;



- **Only Teachers can:**

- Create schedule of future lections (Web-Site);
- Upload presentations and add notes for lections (Web-Site);
- During the lection:
 - **Switch current slide** of the presentation (Win-Client);
 - **Add hand-written** and text notes to the presentation (Pocket-PC);
 - **See average understanding level** of lection at the moment (Win-Client);



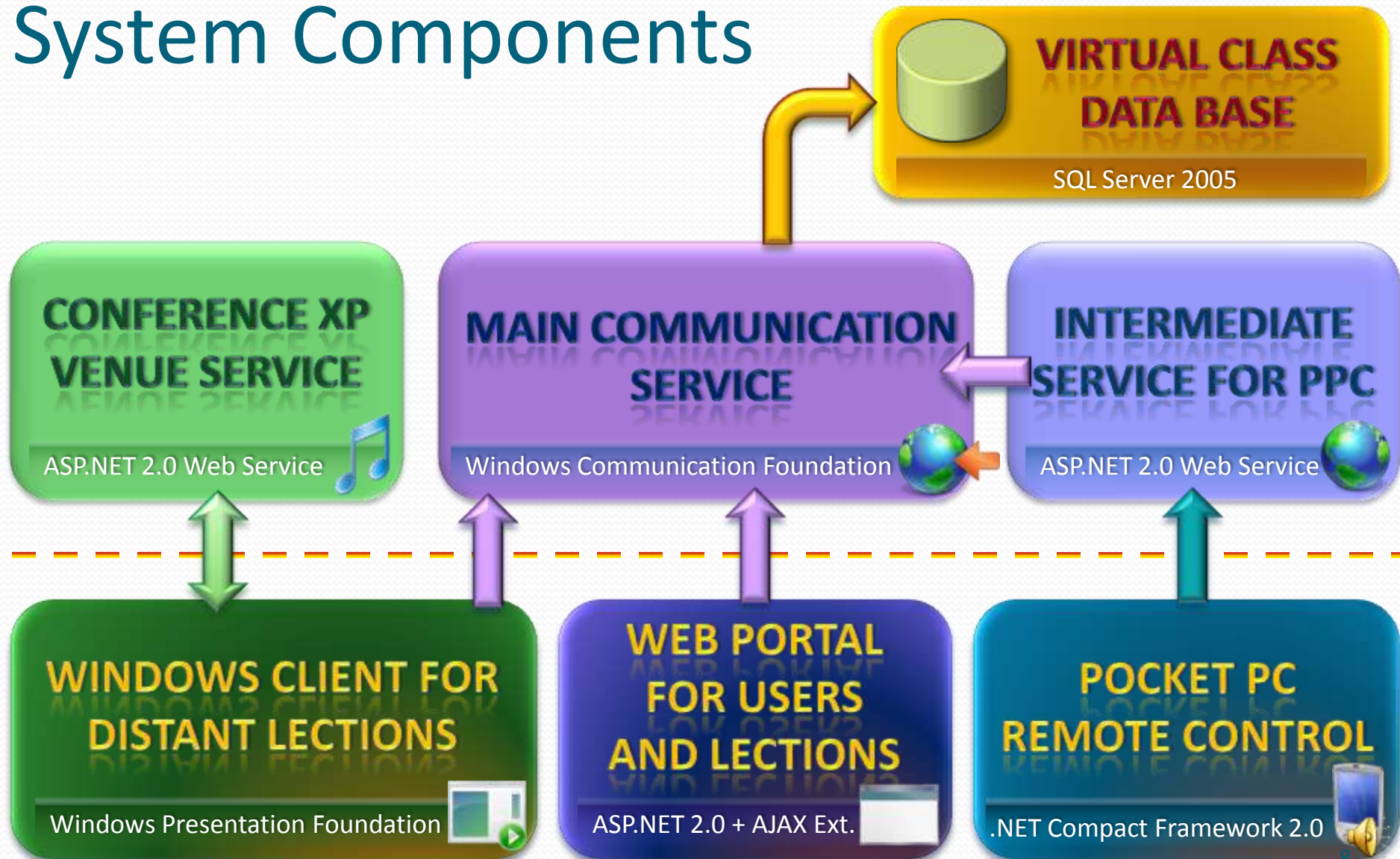
- **Only Students can:**

- Register to lections (Web-Site);
- Vote for understanding of lection material (Win-Client);

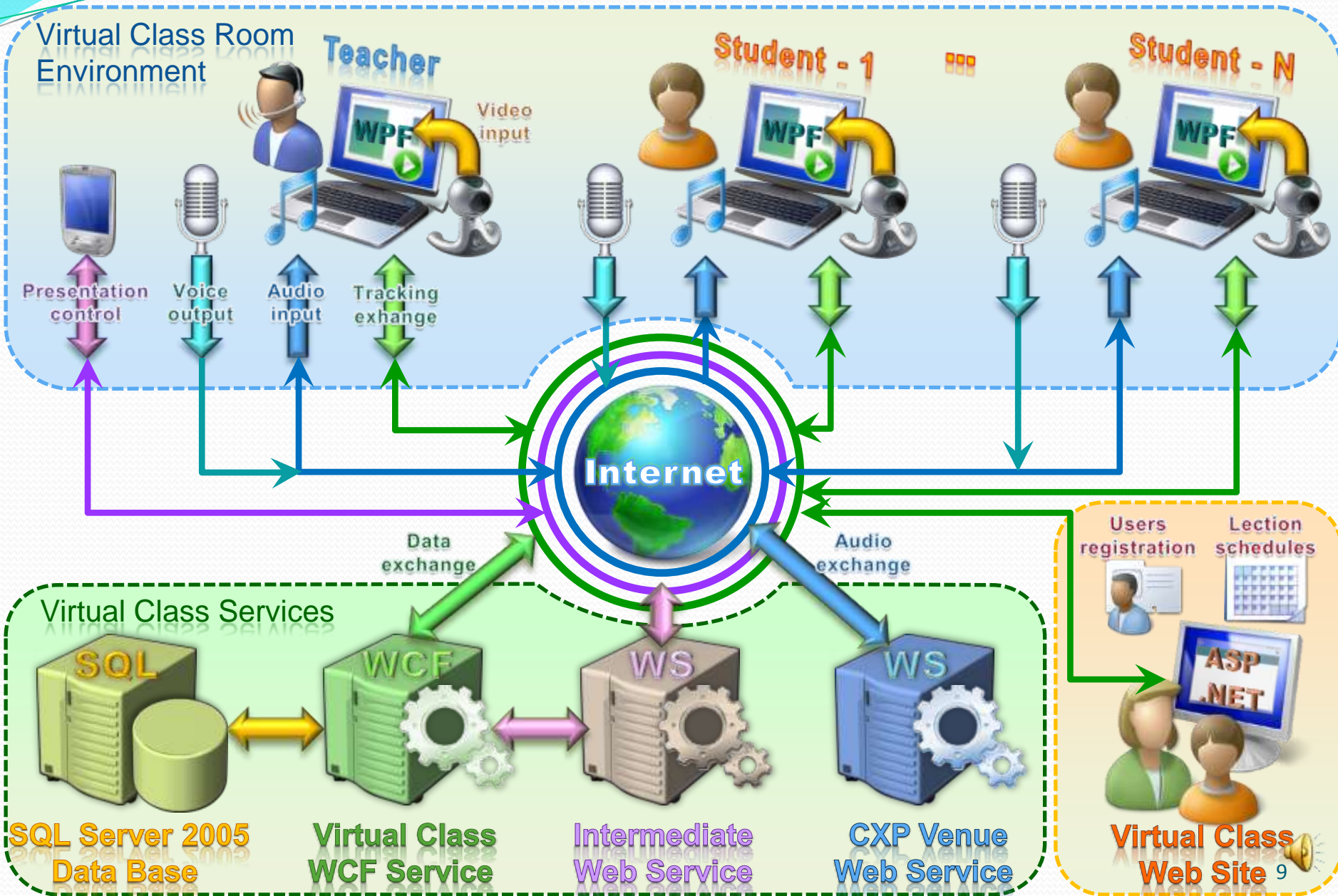
Implementation technologies

- .NET Framework 3.0:
 - Windows Communication Foundation (WCF);
 - Windows Presentation Foundation (WPF);
- .NET Framework 2.0:
 - Compact Framework for Pocket PC;
 - ASP.NET Web Services;
- Intel OpenCV (Computer Vision), SharperCV;
- Managed DirectX 9.0;
- XML Paper Specification (XPS);
- SQL Server 2005;
- ASP.NET 2.0 with AJAX Extensions;
- Audio Capabilities of Conference XP;
- Microsoft Learning Gateway.

System Components

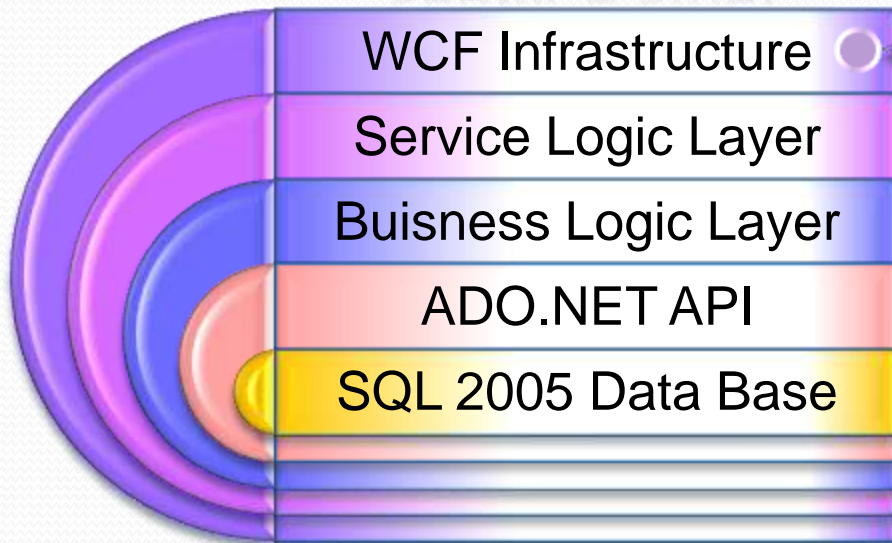


High level Architecture

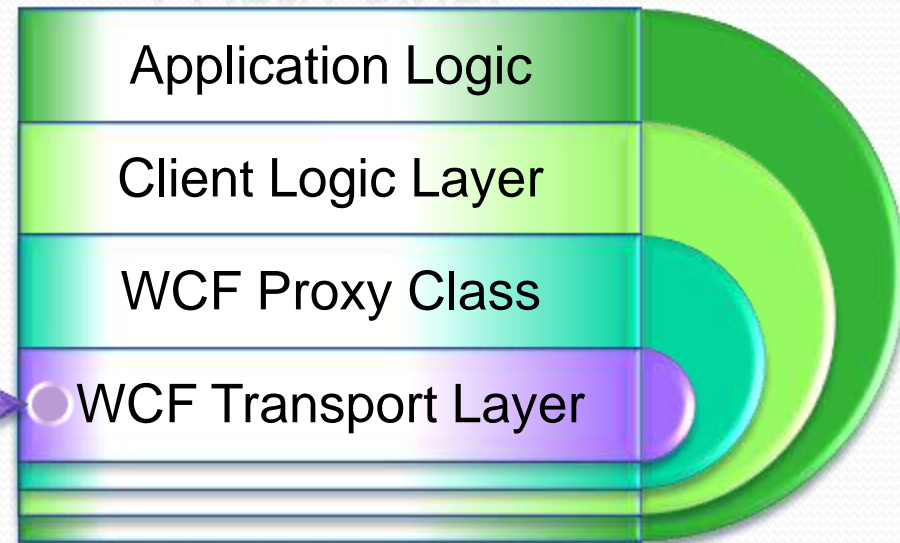


Virtual Class WCF Service

SERVICE SIDE:



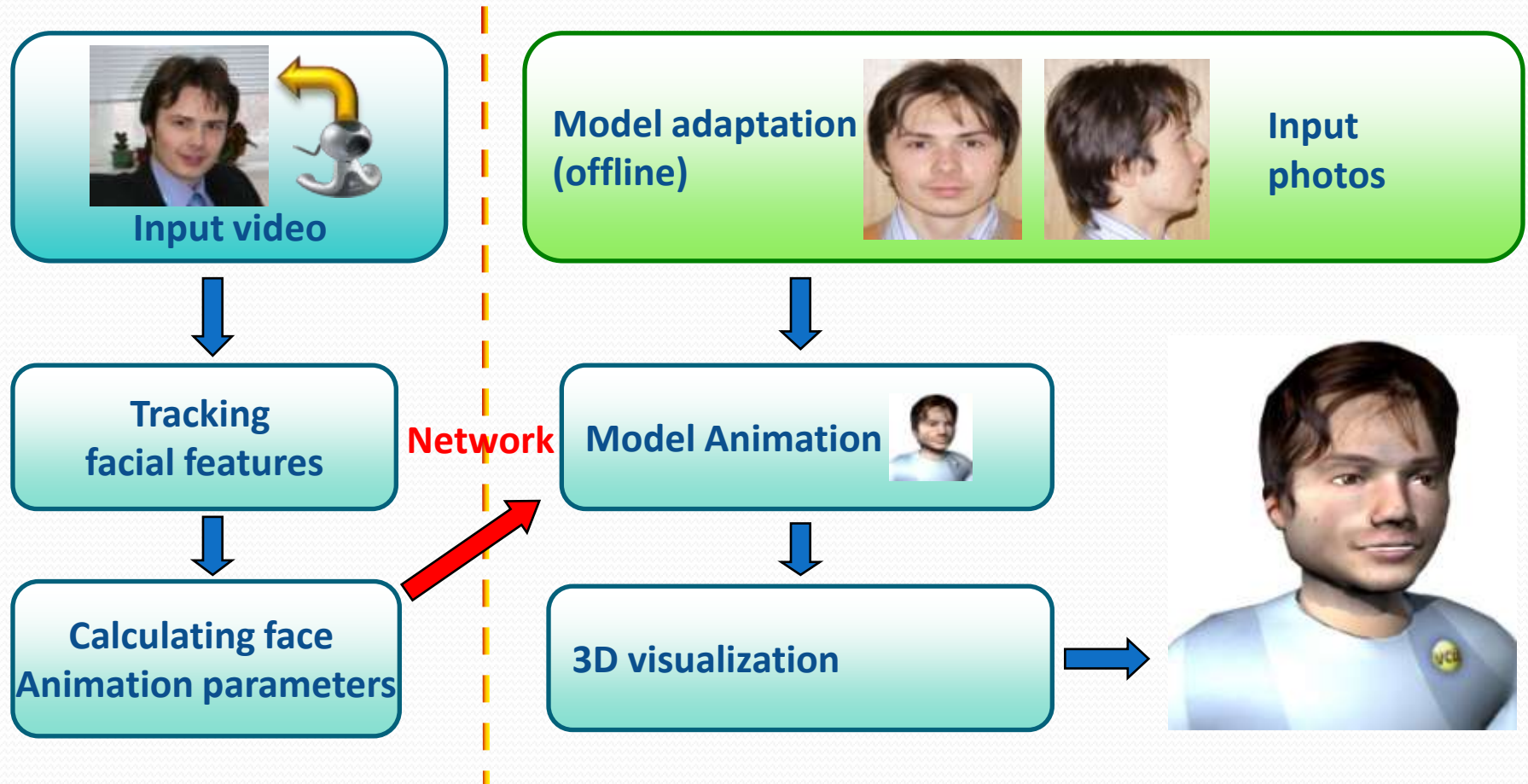
CLIENT SIDE:



Service functionality:

- Users authorization and registration (with role based security);
 - Lesson scheduling and registration;
 - Provide all information about users, lessons, registration lists, etc.
 - Presentation upload and storing;
- Load and provide virtual heads for visual communication of users;
 - Synchronize presentation slide and drawing, currently shown during lesson;
 - Exchange animation parameters of virtual talking heads.

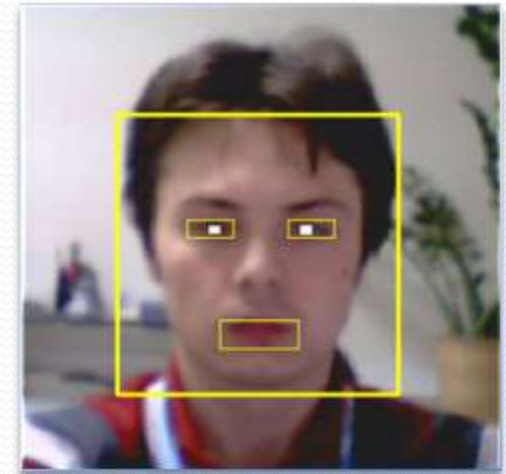
Virtual 3D Heads Technology



Computer vision technologies

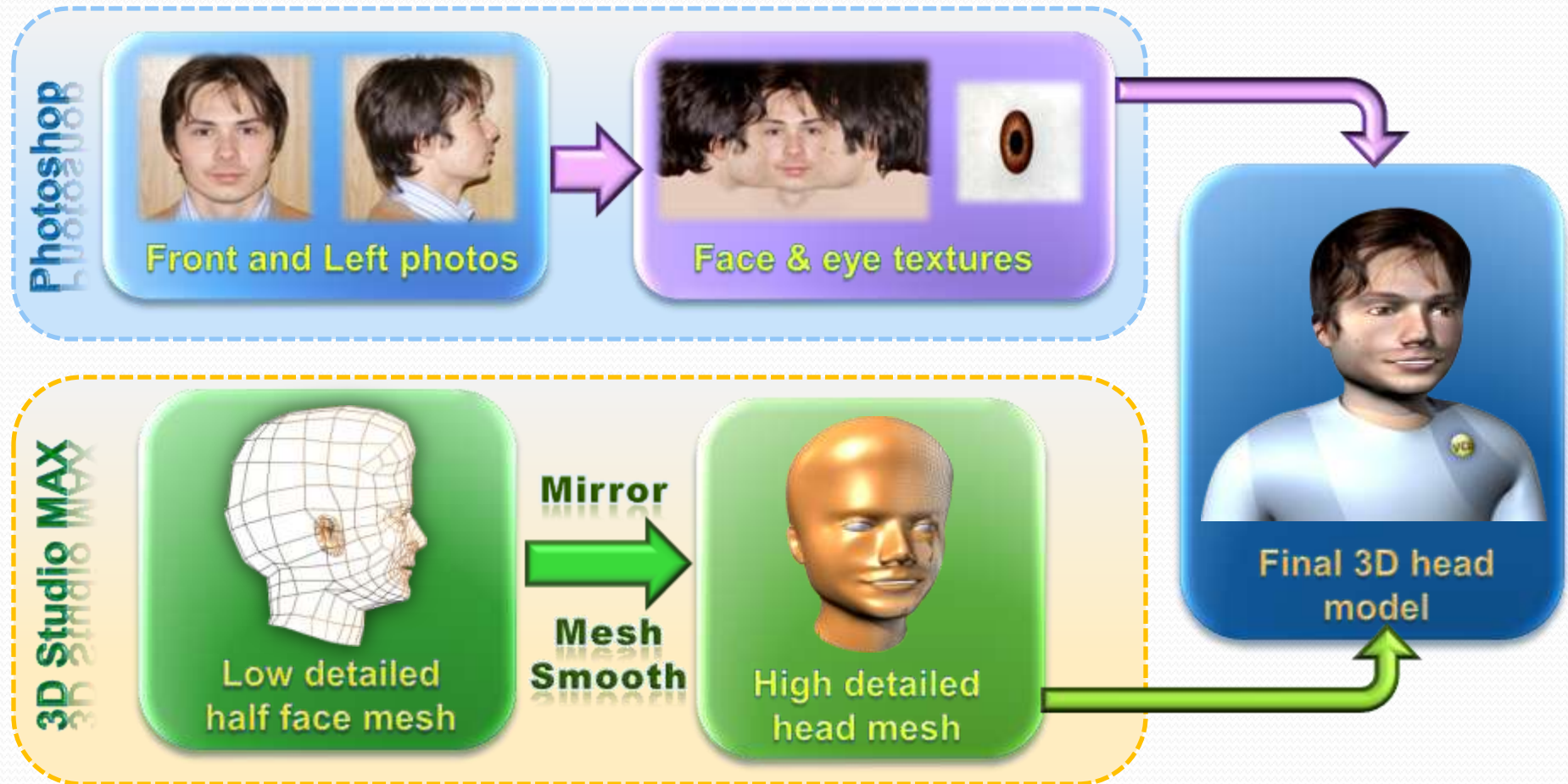
- **Computer Vision** libraries:

- **Intel OpenCV** - used to capture frames from web-cam and find rectangle that contains face;
- **SharperCV** - .NET wrapper over Intel OpenCV.



- **Own algorithms** for face features (mouth, eyes, irises) detection have been developed and implemented.

Design of 3D Head model



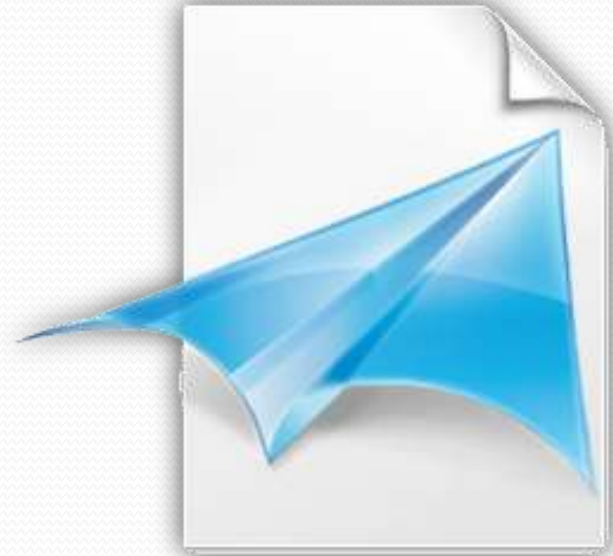
Remote XPS presentation demonstration

- **Benefits of XPS format:**

- portability;
- small size;
- independence from software and OS.

- **VCR presentation functionality:**

- Presentation is stored in database as XPS document;
- Uploaded before the lection by teacher through the web-site;
- Shown to all participants during the lection;
- Teacher can switch slides in Windows or PPC client application;



Pocket PC application for teacher

Pocket PC application* functionality:

1. Allows teacher to log in;
2. Demonstrates presentation;
3. Allows control presentation demonstration:
 - slide switching;
 - drawing notes for students on current slide with stylus.



*connects to main WCF service through the intermediate ASP.NET Web Service.

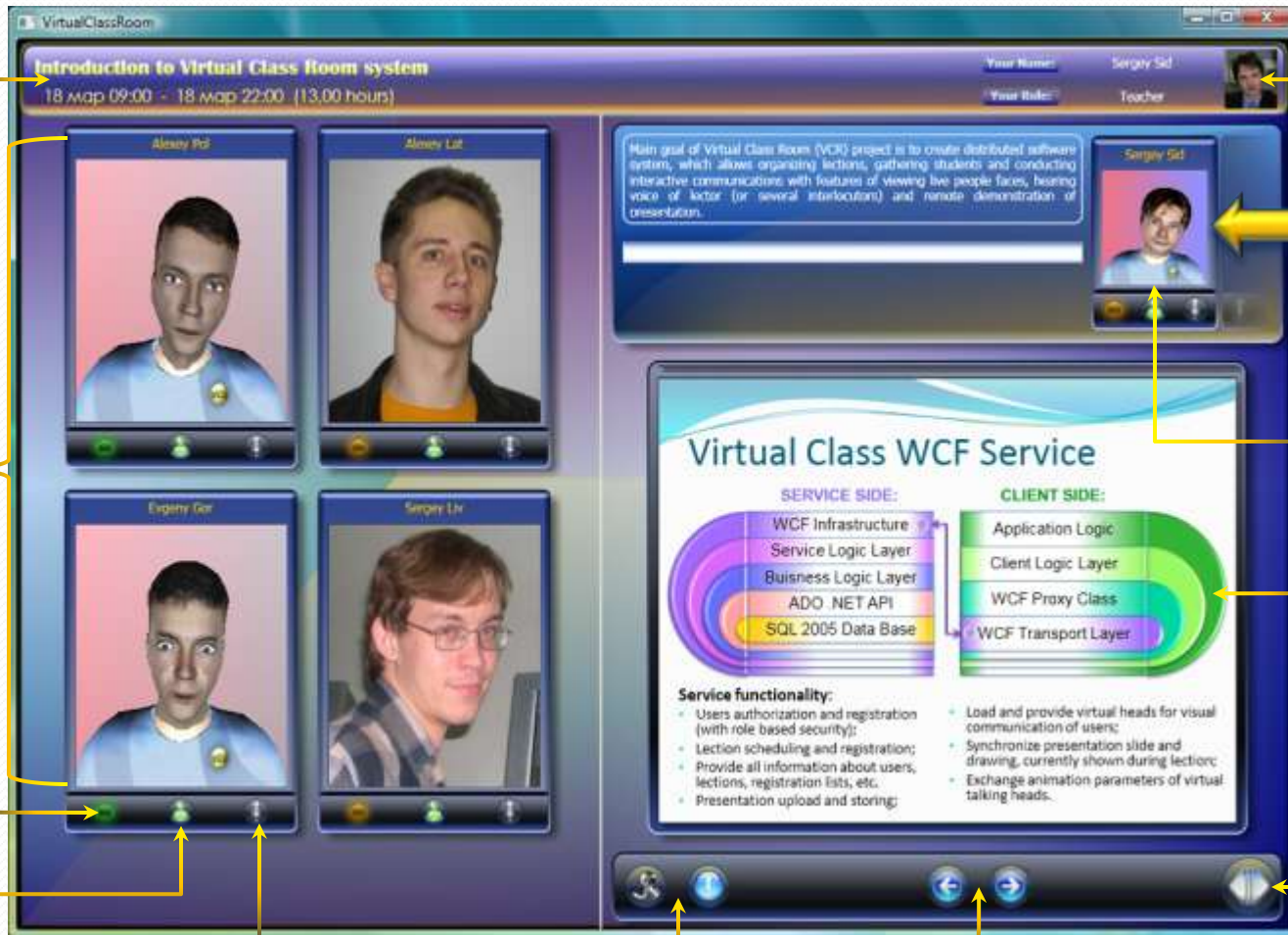


Audio exchange with Conference XP

- Conference XP is a Microsoft Research software product that allows to carry out distributed video and audio conferences.
- We use CXP library capabilities to transmit and join audio streams.



Virtual Class Room WPF application



Lecture Header

Details of current user

Registered students

Teacher's virtual head

On-Line indicator

Presentation slide show

Head view switching

Voice volume control

Audio and Video configuration

Presentation controls

Heads Area size switching

VCR web-site: Registered People

Virtual Class Room
distant education on-line system

People | Lessons | Statistics | Tools

Web site header

Current user details

Eugeny Gorodetsky
Role: Student
E-mail: evsgor@gmail.com
[Add Head](#)
[Log Out](#)

Personal schedule

Schedule

- 08.04.2007 Introduction to Virtual Class Room system
Sergey Sidorov

Reminder

Calendar date

- 08.04.2007 Introduction to Virtual Class Room system
Sergey Sidorov

Search

Search [Go](#)

People

Here are listed all registered users of the Virtual Class Room system: teachers and students. You can view users by selected role. Users by role
To view detailed information about the user (including his photo and virtual head preview), use select link in the table.

☐ Teachers
☒ Students

List of students

	Name	E-Mail	Information
Select	Alexey Polovinkin	polalexx@bk.ru	
Select	Eugeny Gorodetsky	evsgor@gmail.com	
Select	Sergey Lherko	liverkos@mail.ru	
Select	Alexey Latyshev	alatyshhev@inbox.ru	
Select	Yuri Gorunov	yorickg@mail.ru	

Page Description

Group of users


Selected User Details

Name: Alexey Latyshev
E-Mail: alatyshhev@inbox.ru
Role: Student

User Photo / Head Preview


☒ Photo
☐ Head


VCR web-site: Lektion Schedule





Virtual Class Room


distant education on-line system

People

Lectures

Statistics

Tools



Evgeny Gorodetsky
Role: Student
E-mail: evsger@gmail.com
[Add Head](#)
[Log Out](#)

Schedule

- 08.04.2007 Introduction to Virtual Class Room system
Sergey Sidorov

You are here

- 08.04.2007 Introduction to Virtual Class Room system
Sergey Sidorov

Lectures

This page allows teachers create schedules of future lections and lets students register on the scheduled lections. All users can view list of all future lections with lists of registered students. Page provides several controls for filtering list of lections: you can view common or personal lection schedules, apply custom filters and view lections by date.

Select schedule

Type of schedule

Schedule on the day

List of students register on selected lection

Filter: (Show Details)	April 2007						
	Ln	Br	Cp	Wr	Fr	Sa	Su
	26	27	28	29	30	31	1
	2	3	4	5	6	7	8
	9	10	11	12	13	14	15
	16	17	18	19	20	21	22
	23	24	25	26	27	28	29
	30	1	2	3	4	5	6

Lesson Name	Teacher Name	Lesson Start	Lesson End	Students Count	Free Places
Select Introduction to Virtual Class Room system	Sergey Sidorov	08.04.2007 9:40:00	08.04.2007 19:50:00	4	6
Select Geometry and algebra	Nikolai Zolotikh	09.04.2007 8:00:00	09.04.2007 9:30:00	0	20
Select Linear programming	Nikolai Zolotikh	15.04.2007 11:20:00	15.04.2007 12:50:00	0	25
Select Operating systems	Sergey Sidorov	16.04.2007 14:40:00	16.04.2007 16:20:00	0	30

Lesson Name

Introduction to Virtual Class Room system

Lesson Start

08.04.2007 9:40:00

Lesson End

08.04.2007 19:50:00

Description

Main features of VCR: WPF application, WCF service, web-site, PPC application, etc

Action

Unregistration

Schedule 08.04.2007

- 08.04.2007 Introduction to Virtual Class Room system
Sergey Sidorov

Students

Alexey Polovinkin

Evgeny Gorodetsky

Sergey Liverko

Alexey Latyshev

VCR web-site: Lesson Statistics



Sergey Sidorov
Role:
Teacher
E-mail:
sidorovsergei@mail.ru
[Add Head](#)
[Log Out](#)

Schedule

- 16.04.2007 Operating systems
Sergey Sidorov

Search

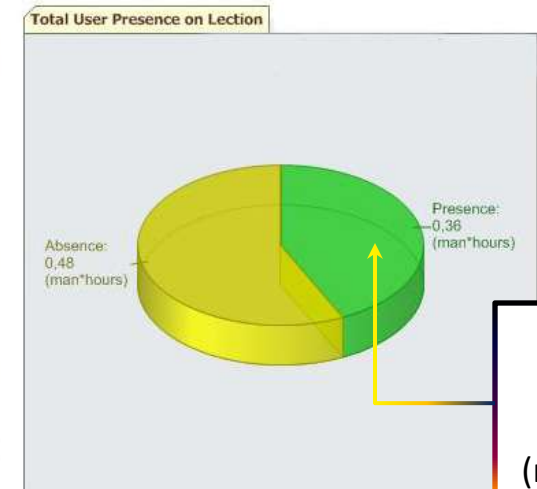
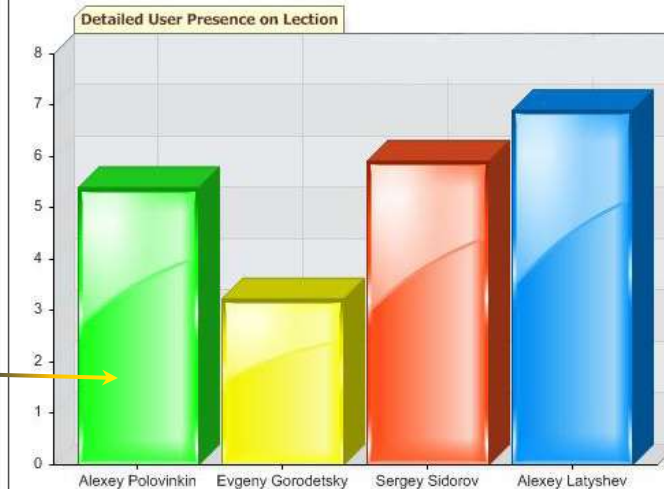
[Go](#)

Time of presence
on lesson for all
participants

Statistics

	Lesson Name	Teacher Name	Lesson Start	Lesson End	Students Count	Free Places
Select	Introduction to Virtual Class Room system	Sergey Sidorov	07.04.2007 17:40:00	07.04.2007 17:50:00	4	6

☐ In comparison with total lesson time



Past
lessons

Summary
lesson
presence
(man-hours)

Hardware Requirements



- Ethernet 100Mbit LAN (or WLAN 802.11g);



- Pocket PC with Windows Mobile 2003 or Windows Mobile 5.0 OS;



- Web-camera with 0.3MPx CCD at the least;



- Microphone and audio device;



- Multi-core CPU is recommended (VCR Windows Client uses **multithreading!**)

Project impact

Virtual Class Room enables better education for all:

- VCR Web site allows teachers easily organize and conduct lectures for large groups of students;
- Students can remotely participate in live communications, talking and seeing virtual faces of each other;
- Demonstration of presentation is integrated in a solid system and is convenient to use for Teachers.

Team plans:

- Centralized dialog process control for Teachers;
- Improve 3D Head visualization and full system performance.

Statistics

- 5 main components (solutions);
- 18 projects;
- 127 classes;
- Approximately 30000 code lines;

Thanks

- NNSU and Information Technology Laboratory (ITLab).

We especially express our thanks to our colleagues:

Gorunov Yuri



Latyshev Alexey



Suslov Alexander



Questions?

