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Experiences with ALM tools in Software Engineering course



Outline

- Software Engineering course entitled 'Software development 2'
- Scrum
- Application lifecycle management tools
- Projects realized within the course 'Software development 2'
- Conclusions and future directions



Software Development 2

Software development 2 is an elective course held at the Faculty of Mathematics, study program Informatics, during the first year of Master studies.

Software development 2 is structured in such way that course central activity is focused on projects.

Course goal: Mastering software development advanced activities as complex teamwork.

Course content: Software projects lifecycle; Software requirements and software specification; Software architecture, design and implementation; Coding, debugging, testing, optimization; Software deployment and configuration; Project management in software projects.



Software Development 2

Literature:

1. Gamma E, Helm R., Johnson R., Vlissides, J: Design Patterns - Elements of Reusable Object-Oriented Software, Addison-Wesley, Reading, 1995.
2. McConnell Steve: Code Complete 2, Microsoft Press, 2004
3. Evjen Bill, Hanselman Scott, Rader Devin, Muhammad Farhan, Sivakumar S. Srinivasa : Professional ASP.NET 2.0 Special Edition, Wrox Press, Birmingham, 2006.
4. Robinson Steven: C# 2nd Edition, Wrox Press, Birmingham, 2003.
5. Crawford William, Farley Jim: Java Enterprise in a Nutshell, 3rd Edition, O'Reilly, 2005.

Classes: 2+3+2

ECTS: 9



Software Development 2

Software development 2 is focused on projects

- Real project for real client who intends to use the software in production
- Students select their own project, any branch of software development
- Group presentations and reports will be created for every project
- At the end, projects will be evaluated as a whole, and each member of the team will explain his/her part
- Projects will be evaluated with the client's representative
- In order to establish common baseline for project evaluation, project must be realized using Agile methodology Scrum and ALM tools



Software Development 2

Phases:

1) Contact potential clients

- Gain idea of their expectations
- Estimate scope and complexity of the project
- Discuss business decisions
- If teacher is a client, his expectations will be a little bit higher than the expectations of a regular client

2) Assemble project team

- Post message to all students in the mailing group
- Advertise at the beginning of class
- Teams should be cross-functional (essential for Scrum methodology)



Software Development 2

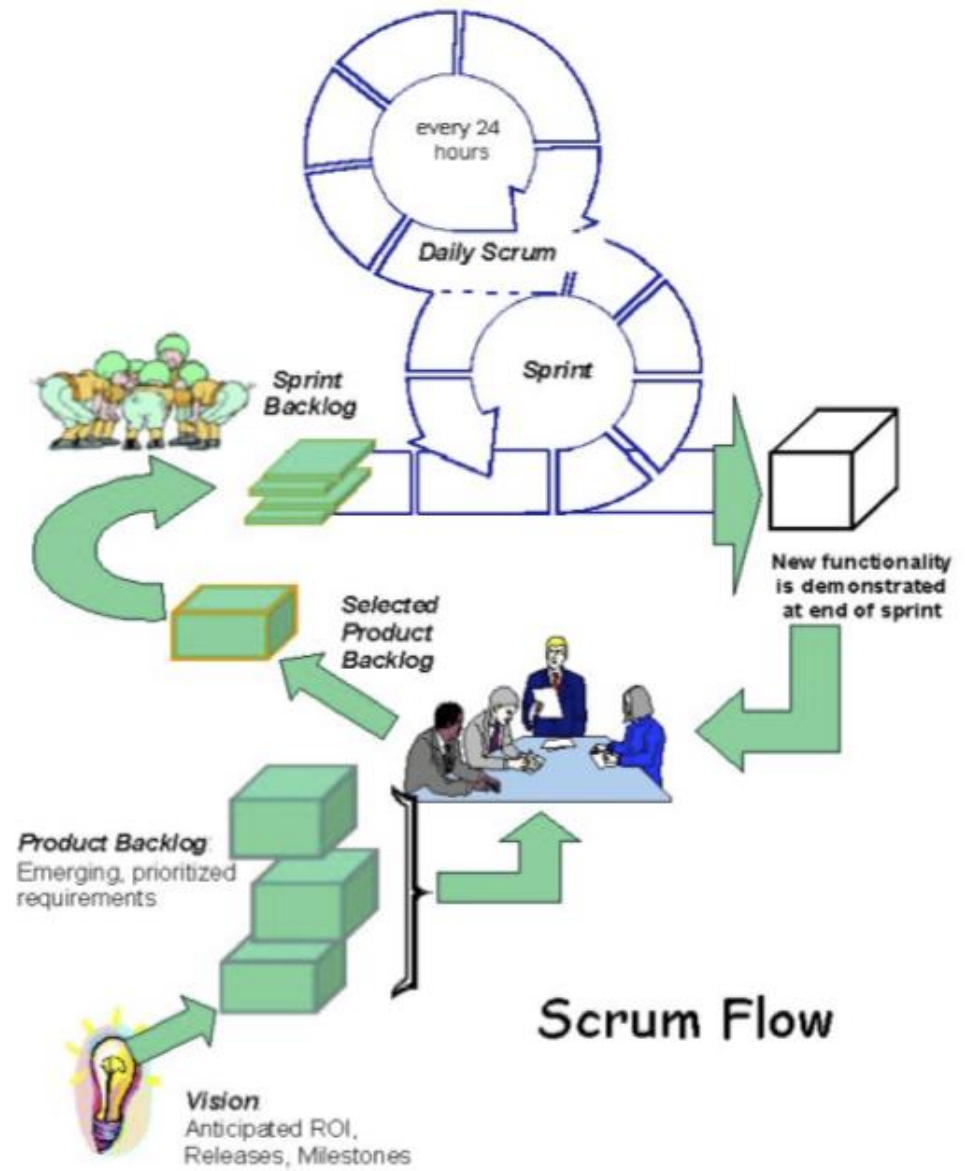
3) Design, implement and deploy solution

- Target must be a production system (not research)
- Client should be one or two designated people - client should be prepared to meet with team regularly and attend the presentations
- Teams need many strengths - organizational, technical, writing, etc.
- Consider appointing a leader to coordinate the effort
- All Scrum roles should be covered by members of project team
- All Scrum product deliverables should be produced
- All work on analysis, architecture, design, implementation and deployment goes through ALM system.



Scrum

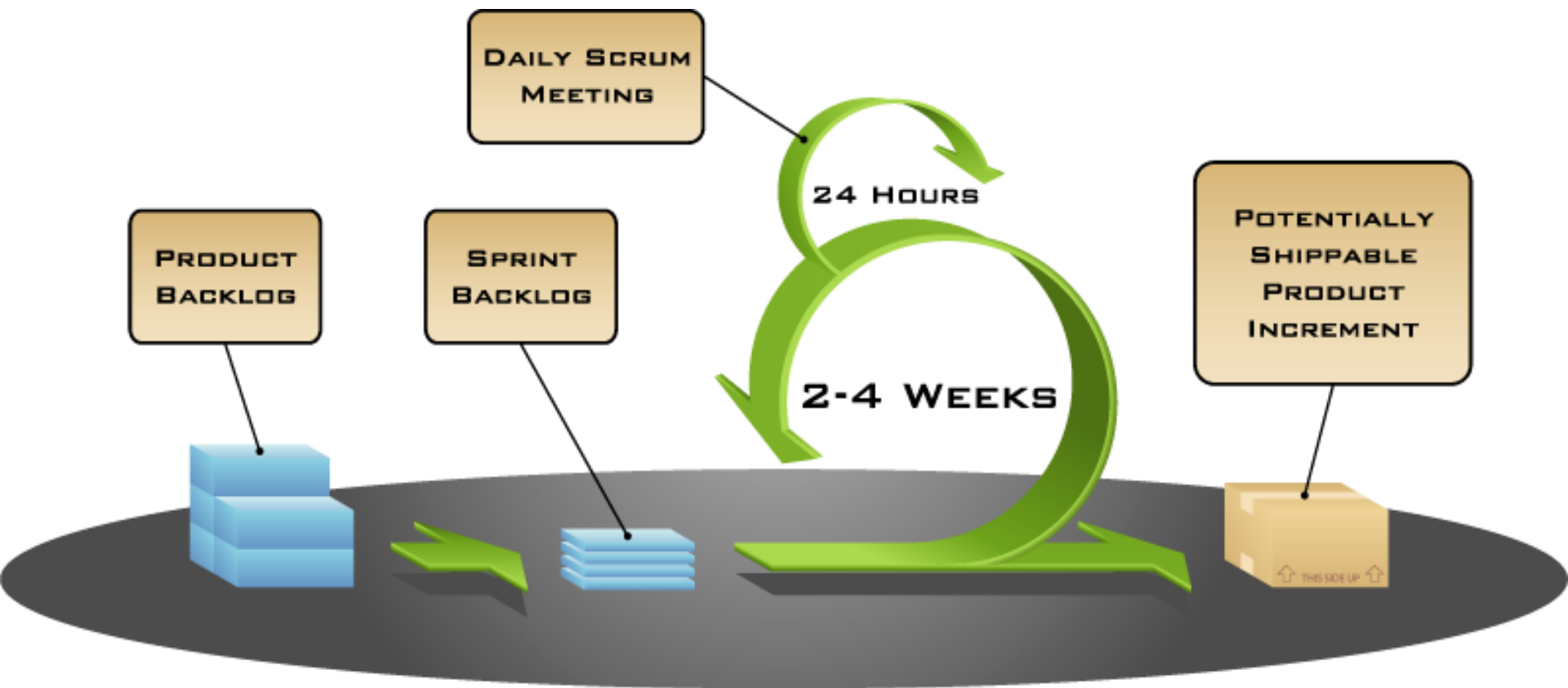
Scrum is an iterative, incremental framework for project management often seen in agile software development, a type of software engineering.



Timeboxes, Roles, Rules



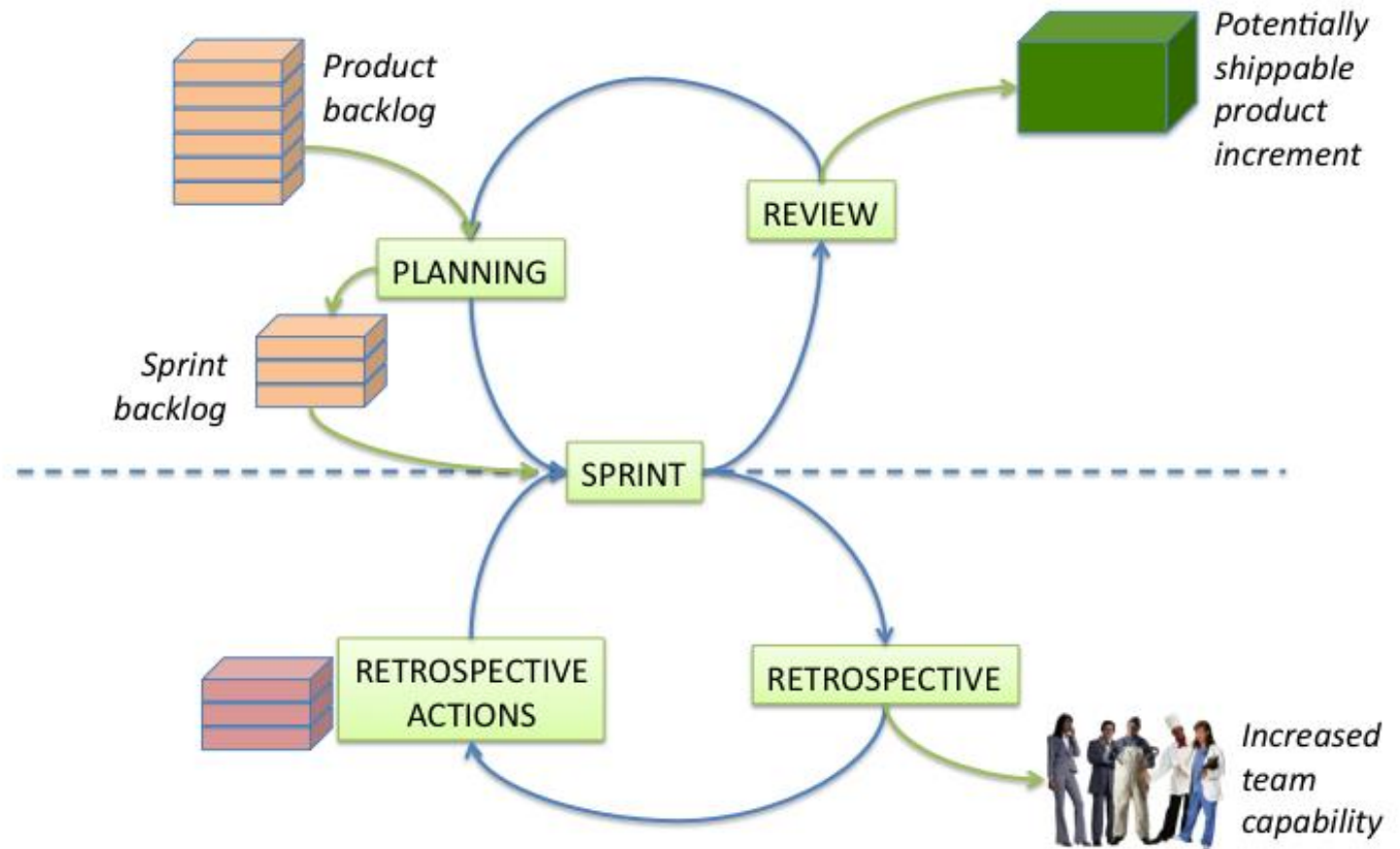
Scrum





Scrum

Product deliverable



Capability deliverable



ALM

Application Lifecycle Management (ALM) is a continuous process of managing the life of an application through governance, development and maintenance.

ALM is the marriage of business management to software engineering made possible by tools that facilitate and integrate requirements management, architecture, coding, testing, tracking, and release management.



ALM

Benefits

- Increases **productivity**, as the team shares best practices for development and deployment, and developers need focus only on current business requirements
- Improves **quality**, so the final application meets the needs and expectations of users
- Breaks **boundaries** through collaboration and smooth info flow
- Accelerates **development** through simplified integration
- Cuts **maintenance time** by synchronizing application and design
- Maximizes **investments** in skills, processes, and technologies
- Increases **flexibility** by reducing the time it takes to build and adapt applications that support new business initiatives

Disadvantages

- Increases an application's **whole-life cost**
- Increases **vendor lock-in**



ALM tools

IDE continues to evolve and tool vendors are increasingly integrating their products to deliver suites. IDEs are giving way to tools that reach outside of pure coding and into the architectural, deployment, and management phases of the application lifecycle, providing full ALM.

The hallmark of these suites is a common user interface, meta model, and process engine that also enable ALM team members to communicate using standards-based architectures and technologies such as Unified Modeling Language (UML).

ALM tool that is chosen for course 'Software development 2' is Microsoft Team Foundation Server (MS TFS).

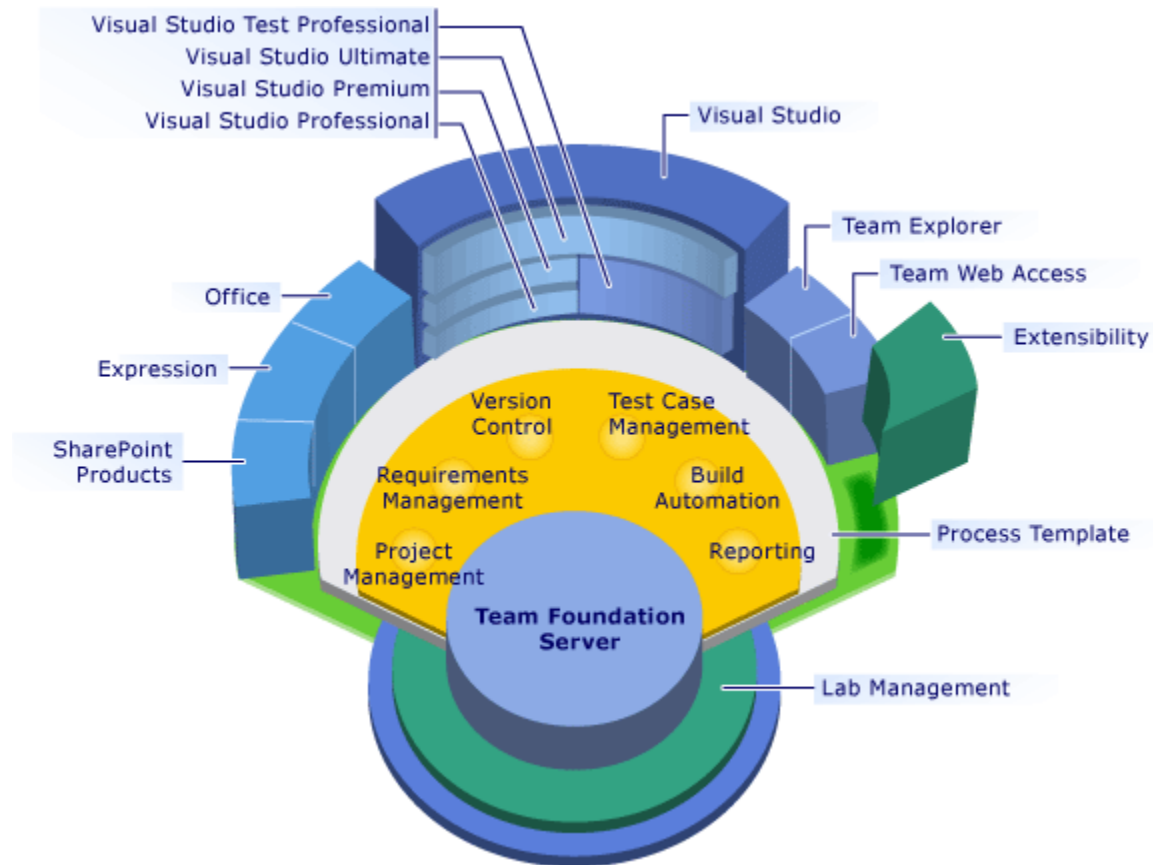
Choice of the ALM tool dictates that whole student's project will be realized in Microsoft .NET technology.



MS TFS

Team Foundation Server (MS TFS) is a Microsoft product offering source control, data collection, reporting and project tracking.

It is intended for collaborative software development projects.





MS TFS

Team Foundation Server works in a **three-tier** architecture:

- **Client** tier is used for creating and managing projects and accessing the items that are stored and managed for a project. TFS does not include any user interface for this tier, rather it exposes web services which client applications (like Visual Studio Team System) can use to integrate TFS functionality with themselves.
- The web services are in the **application** layer. The application layer also includes a web portal and a document repository facilitated by SharePoint Services.
- The **data** layer, MS SQL Server 2005 Standard, provides the persistent data storage services for the document repository.



MS TFS

A **work item** is a single unit of work which needs to be completed. It has fields to define Area, Iteration, Assignee, Reported By, a history, file attachments, and any number of other attributes.

Work items can be of several different types, such as a **Bug**, a **Task**, a **Quality of Service Assessment**, a **Scenario**, and so forth. The framework chosen for any given project in a MS TFS defines what types of work items are available and what attributes each type of work item contains.

Each work item has associated **control policies** which control who is allowed to access and/or change the items. It also includes **notification** and **logging capabilities** to log all the creation, access or change events (controlled by policies) and optionally notify certain users when certain events occur.



MS TFS

Any given TFS contains one or more **Team Projects**, which consists of Visual Studio solutions, configuration files for Team Build and Team Load Test Agents, and a single SharePoint repository containing the pertinent documents for the project.

A team project contains the user defined **work items**, **source branches**, and **reports** that are to be managed by TFS.

When creating a project, a software development framework must be chosen, and cannot be changed afterwards. TFS includes several templates for the most common ones, including agile and formal methodologies. Choosing the framework populates the project with predefined items such as project roles and permissions, as well as other documents like project roadmap, document templates, and report definitions. These items can be then linked to work items as well.



Using MS TFS

StudentskiDom - Team Web Access - Windows Internet Explorer

http://liss4.matf.bg.ac.rs:8080/tfs/web/Index.aspx?pguid=04602f84-2354-401e-866e-6445222019c0

File Edit View Favorites Tools Help

Visual Studio 2010 Team Web Access

Home Work Items Source Build

rs101118 StudentskiDom (RS2)

Enter search text Search

Favorites No recent items.

New Work Item No recent items.

Queries Product Backlog All Sprints Unfinished Work

StudentskiDom

Queries Source Control Build

My work items

Customize Refresh

Work Items

227	Product Backlog I... New	Prenocista
121	Sprint Created	
220	Product Backlog I... New	Baza

Done Internet | Protected Mode: Off 100%



Using MS TFS

StudentskiDom/Team Queries/Product Backlog [Query Results] - Team Web Access - Windows Internet Explorer

http://liss4.matf.bg.ac.rs:8080/tfs/web/UI/Pages/Workitems/QueryResult.aspx?pguid=04602f84-2354-401e-866e-644522019c0&path=StudentskiDom%2fTeam+Queries%2fProduct+Backlog

File Edit View Favorites Tools Help

StudentskiDom/Team Queries/Product Backlog [...]

Microsoft Visual Studio 2010 Team Web Access

rs101118 StudentskiDom (RS2)

Home | StudentskiDom | Team Queries | Product Backlog

Home Work Items Source Build

New Tools

Settings Help

Work Item # Go!

Enter search text Search

Favorites

No recent items.

New Work Item

No recent items.

Queries

- All Sprints
- Product Backlog
- Unfinished Work

StudentskiDom/Team Queries/Product Backlog Save As...

Query Results: 10 results found (1 currently selected).

ID	Work Item Type	Backlog Priority	Title	Assigned To	State	Effort	Busine...	Iteration Path
220	Product Backlog Item	1	Baza		New	6		StudentskiDom
221	Product Backlog Item	1	Master Page		New	6		StudentskiDom
222	Product Backlog Item	2	Iseljenje		New	6		StudentskiDom
223	Product Backlog Item	2	Iseljenje		New	6		StudentskiDom
224	Product Backlog Item	3	Zamena mesta		New	4		StudentskiDom
225	Product Backlog Item	3	Pregled svih soba u domu		New	4		StudentskiDom
226	Product Backlog Item	3	Pretraga studenata		New	4		StudentskiDom
227	Product Backlog Item	3	Prenocista		New	4		StudentskiDom
228	Product Backlog Item	5	Korisnicka pretraga		New	4		StudentskiDom
229	Product Backlog Item	6	Galerija		New	4		StudentskiDom

Done

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Using MS TFS

Product Backlog Item #229:Galerija - Team Web Access - Windows Internet Explorer

http://liss4.matf.bg.ac.rs:8080/tfs/web/UI/Pages/WorkItems/WorkItemEdit.aspx?id=229&pguid=04602f84-2354-401e-866e-6445222019c0

Product Backlog Item #229: Galerija

Title: Galerija
Iteration: StudentskiDom

Status
Assigned To:
State: New
Reason: New backlog item

Details
Backlog Priority: 6
Effort: 4
Business Value:
Area: StudentskiDom

Description Test Cases Tasks

Font Font Size B I U A [Icons]

Kao studentu potrebna mi je strana sa najnovijim desavanjima u okviru doma: studentske zurke, pozoriste, bioskop,svirke, sportski turniri, repertoar na videobim-u, kao i da pogledam slike sa nekog od tih desavanja.

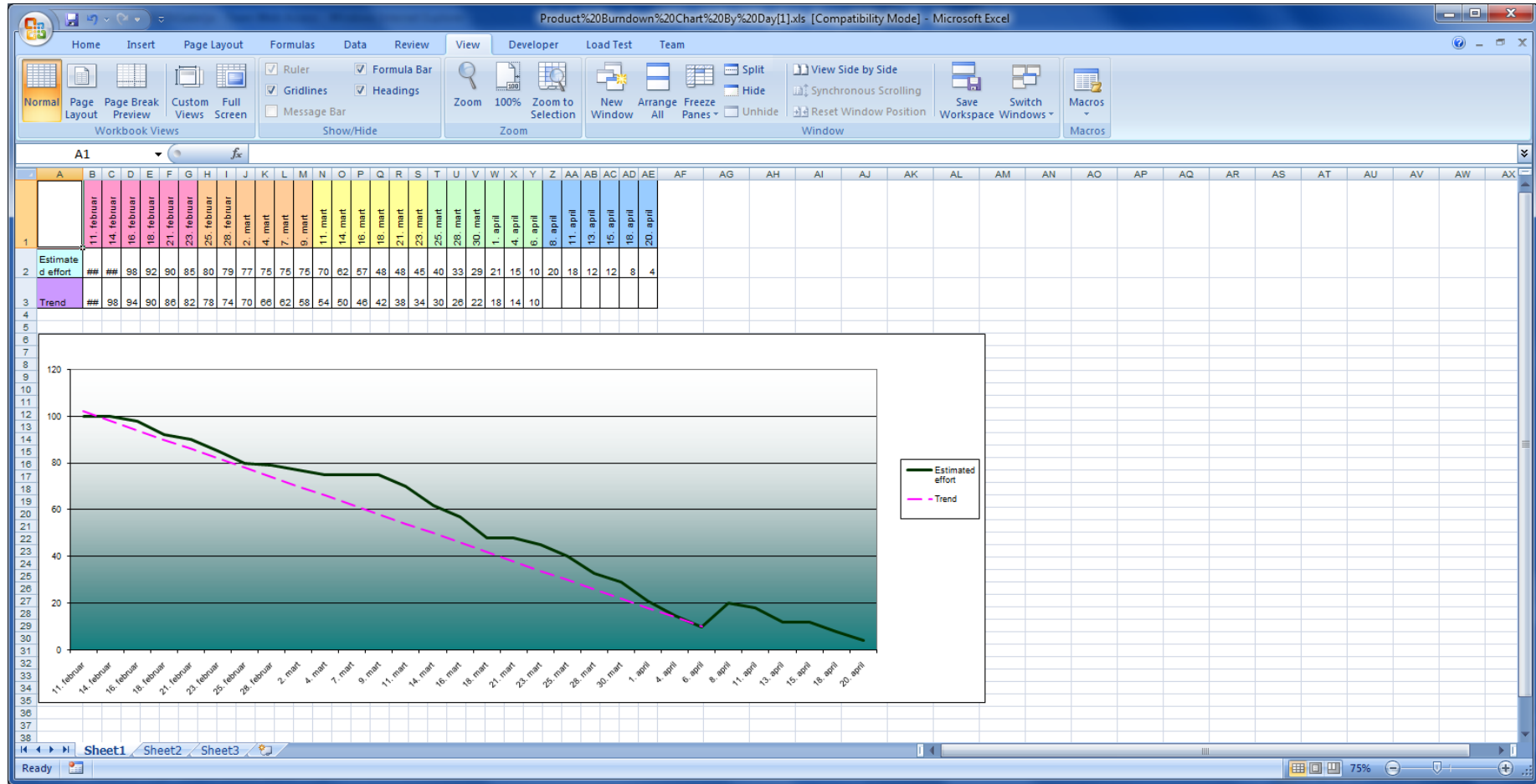
Acceptance Criteria History Links Attachments

Name	Size	Comment	Delete All
Product Burndown Chart By Day.xls	16 KB	Product Burndown Chart By Day	Delete
Product Burndown Chart By Sprint.xls	15 KB	Product Burndown Chart By Sprint	Delete

Click to add a new attachment

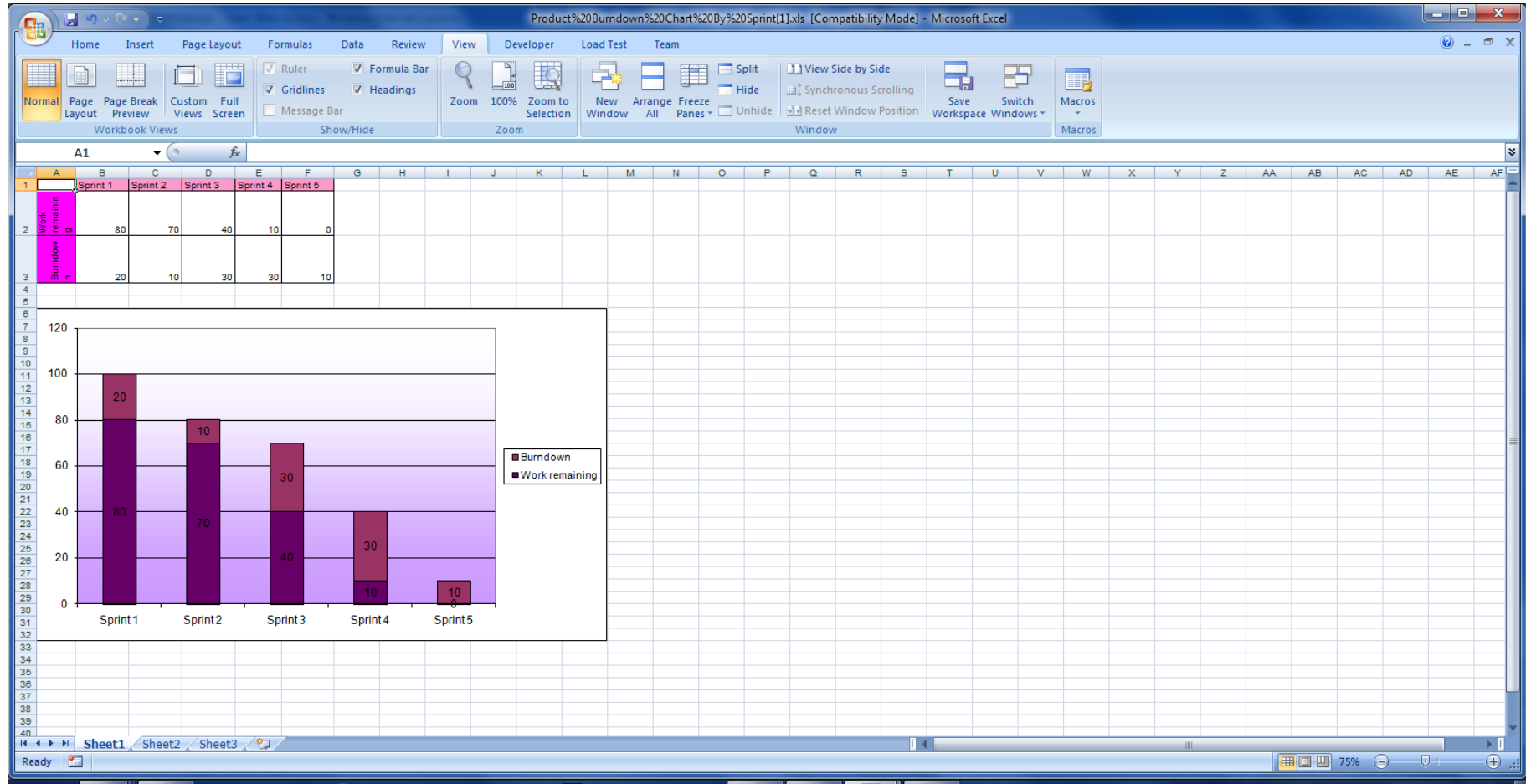
http://liss4.matf.bg.ac.rs:8080/tfs/web/tswa-resource.axd/tfs/attachment?pguid=04602f84-2354-401e-866e-6445222019c0&url=http%3a%2f%2fliss4%3a8080%2ftfs%2fRS2%2fWorkItemTracking%2f

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Using MS TFS





Using MS TFS

StudentskiDom/Team Queries/All Sprints [Query Results] - Team Web Access - Windows Internet Explorer

http://iiss4.matf.bg.ac.rs:8080/tfs/web/UI/Pages/WorkItems/QueryResult.aspx?path=StudentskiDom%2FTeam%20Queries%2FAI%20Sprints&guid=04602f84-2354-401e-866e-6445222019c

File Edit View Favorites Tools Help

Find: Metodika Previous Next Options

Microsoft Visual Studio 2010 Team Web Access

Home Work Items Source Build

rs101118 StudentskiDom (RS2)

Enter search text Search

Favorites No recent items.

New Work Item No recent items.

Queries

- Product Backlog
- Unfinished Work
- All Sprints

New Bug Impediment Product Backlog Item Shared Steps Sprint Task Test Case Query

Series/All Sprints Save As...

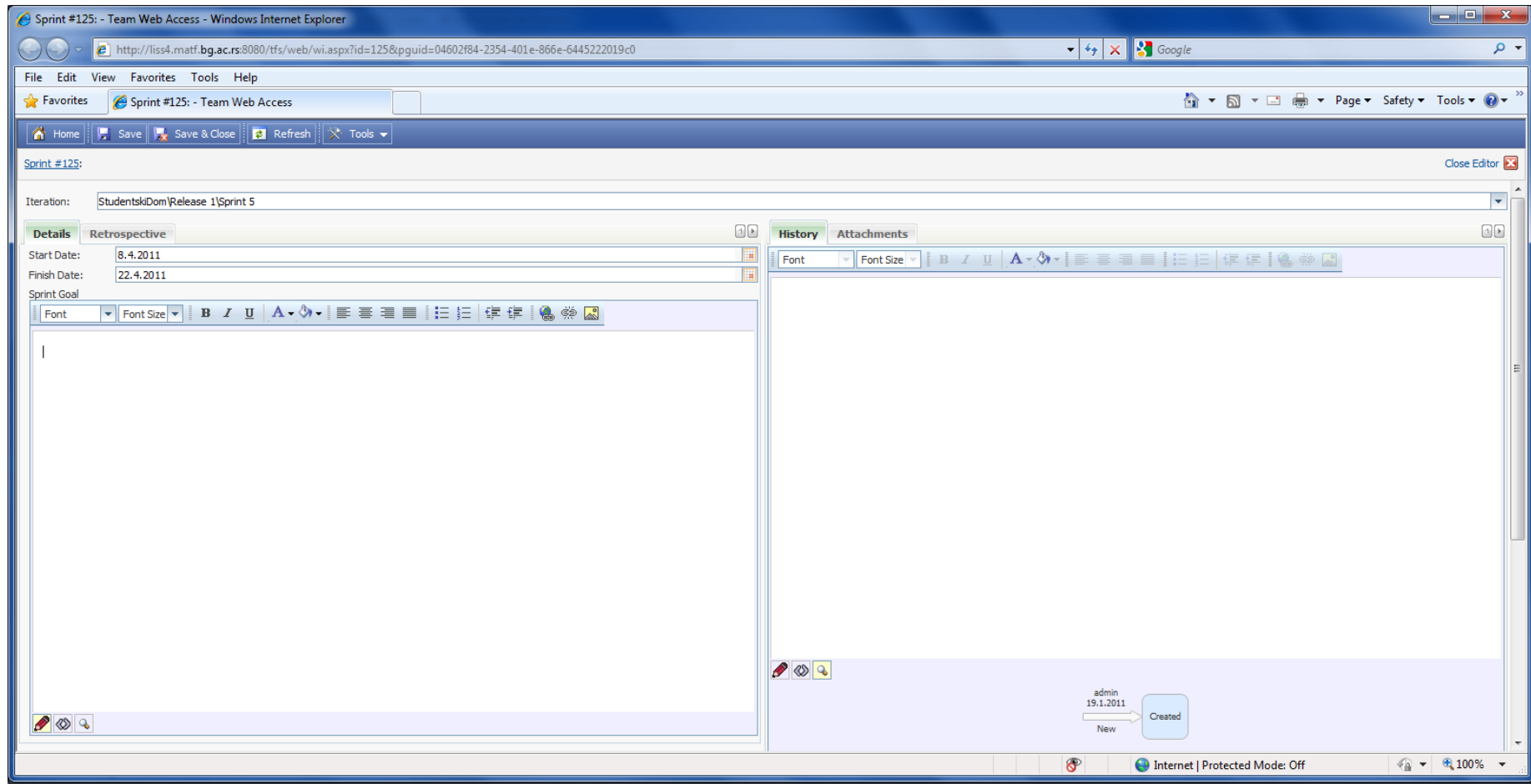
1 currently selected.

Iteration Path	Start Date	Finish Date
StudentskiDom\Release 1\Sprint 5	8.4.2011 8:05:32	22.4.2011 8:27:46
StudentskiDom\Release 1\Sprint 4	25.3.2011 11:03:13	8.4.2011 8:05:17
StudentskiDom\Release 1\Sprint 3	11.3.2011 8:18:23	25.3.2011 8:18:28
StudentskiDom\Release 1\Sprint 2	25.2.2011 22:21:35	11.3.2011 22:21:38
StudentskiDom\Release 1\Sprint 1	11.2.2011 21:40:11	25.2.2011 11:21:08
126 Sprint StudentskiDom\Release 1\Sprint 6		
127 Sprint StudentskiDom\Release 2\Sprint 1		
128 Sprint StudentskiDom\Release 2\Sprint 2		
129 Sprint StudentskiDom\Release 2\Sprint 3		
130 Sprint StudentskiDom\Release 2\Sprint 4		
131 Sprint StudentskiDom\Release 2\Sprint 5		
132 Sprint StudentskiDom\Release 2\Sprint 6		
133 Sprint StudentskiDom\Release 3\Sprint 1		
134 Sprint StudentskiDom\Release 3\Sprint 2		
135 Sprint StudentskiDom\Release 3\Sprint 3		
136 Sprint StudentskiDom\Release 3\Sprint 4		
137 Sprint StudentskiDom\Release 3\Sprint 5		
138 Sprint StudentskiDom\Release 3\Sprint 6		
139 Sprint StudentskiDom\Release 4\Sprint 1		
140 Sprint StudentskiDom\Release 4\Sprint 2		
141 Sprint StudentskiDom\Release 4\Sprint 3		
142 Sprint StudentskiDom\Release 4\Sprint 4		

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Using MS TFS



The screenshot shows the Visual Studio 2010 Team Web Access interface. The main pane displays a file explorer view of the \$/StudentskiDom/StudentskiDom/ directory. A context menu is open over the Default.aspx file, showing options like View, Download Latest, Find Changesets, Compare, Annotate, and Version History. The table below lists the files in the directory, their pending changes, the user who made the changes, and the version number.

Name	Pending Change	User	Version
[.]			
Account			206
App_Code			783
App_Data			886
Bin			783
images			206
Scripts			206
Styles			206
About.aspx	edit, [more]	rs101042 [IT_HP7800_176], [more]	206
About.aspx.cs	edit, [more]	rs101042 [IT_HP7800_176], [more]	206
According.css	edit	rs101042 [IT_HP7800_176]	783
Default.aspx	edit, [more]	rs101042 [IT_HP7800_176], [more]	206
Default.aspx.cs	edit, [more]	rs101042 [IT_HP7800_176], [more]	206
Galerija.aspx	edit	rs101042 [IT_HP7800_176]	885
Galerija.aspx.cs	edit	rs101042 [IT_HP7800_176]	885
Global.asax	edit, [more]	rs101042 [IT_HP7800_176], [more]	206
Informacije.asmx	edit	rs101042 [IT_HP7800_176]	885



Using MS TFS

History - Team Web Access - Windows Internet Explorer

http://liss4.matf.bg.ac.rs:8080/tfs/web/UI/Pages/Scs/History.aspx?path=%24%2FStudentskiDom%2FMasterPage.master.cs&cs=782&pguid=04602f84-2354-401e-866e-6445222019c0

★ Favorites

History for \$/StudentskiDom/StudentskiDom/MasterPage.master.cs

Changeset	Compare	Change	User	Modified	Comment
782	<input type="radio"/> <input checked="" type="radio"/>	edit	rs101042	15.4.2011 8:10:21	
206	<input checked="" type="radio"/> <input type="radio"/>	add	rs101042	25.2.2011 8:49:10	Useljenje

Results 1 - 2 out of 2

Done

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Using MS TFS

Differences between `$/StudentskiDom/StudentskiDom/MasterPage.master.cs` Version:206 and `$/Studen` - Windows Internet Explorer

<http://liss4.matf.bg.ac.rs:8080/tfs/web/UI/Pages/Scs/Difference.aspx?opath=%24%2FStudentskiDom%2FStudentskiDom%2FMasterPage.master.cs&ocs=206&mpath=%24%2FStudentskiDom%2FStudentskiDom%2FMasterPage.master.cs&mcs=782&pguid=04602f84-2354-401e-866e-6445222019c>

Previous Difference Next Difference

`$/StudentskiDom/StudentskiDom/MasterPage.master.cs` Version:206

```
1 using System;
2 using System.Collections.Generic;
3 using System.Linq;
4 using System.Web;
5 using System.Web.UI;
6 using System.Web.UI.WebControls;
7
8 public partial class MasterPage : System.Web.UI.MasterPage
9 {
10     protected void Page_Load(object sender, EventArgs e)
11     {
12
13     }
14 }
```

`$/StudentskiDom/StudentskiDom/MasterPage.master.cs` Version:782 (Latest)

```
1 using System;
2 using System.Collections.Generic;
3 using System.Linq;
4 using System.Web;
5 using System.Web.UI;
6 using System.Web.UI.WebControls;
7
8 public partial class MasterPage : System.Web.UI.MasterPage
9 {
10     protected void Page_Load(object sender, EventArgs e)
11     {
12
13     }
14 }
15
16
17
18 }
```

Changed Text Inserted Text Deleted Text

Done Internet | Protected Mode: Off 100%

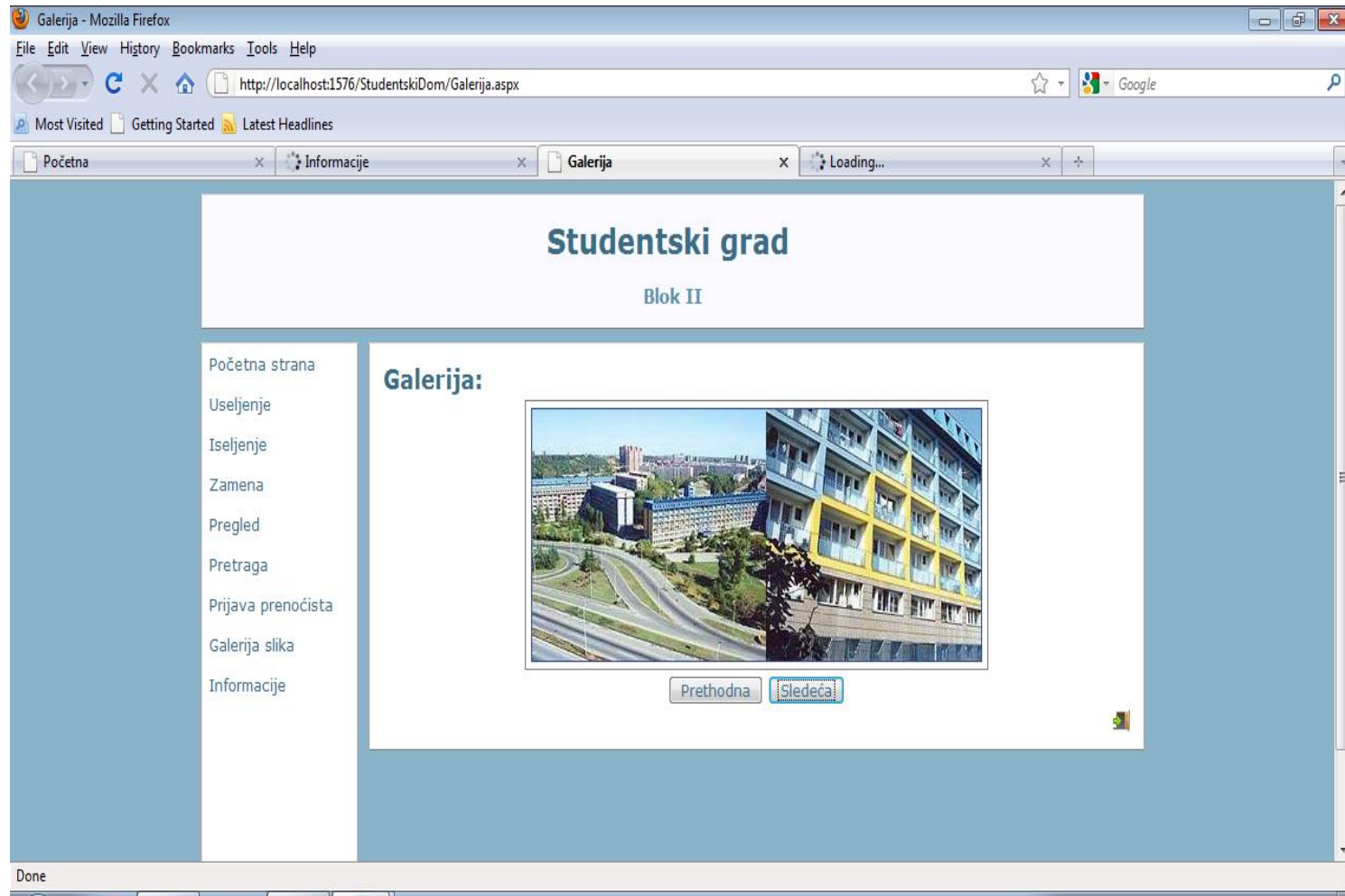


Finished projects (until now)

1. Web-based Time-table system for Serbian railways
2. Web-based application for 'Studentski grad'
3. Promo application for the architecture system Bex

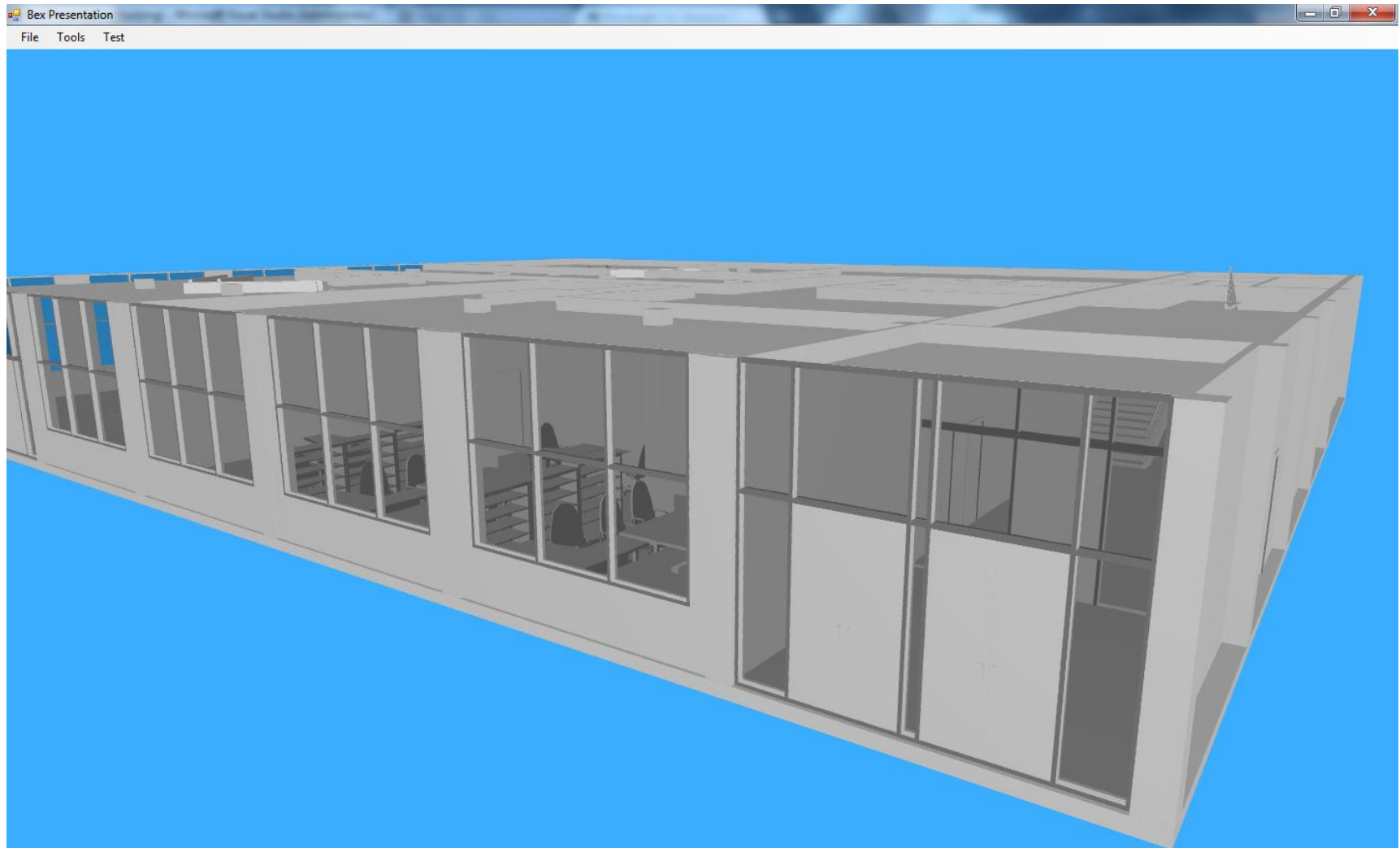


Finished projects (until now)



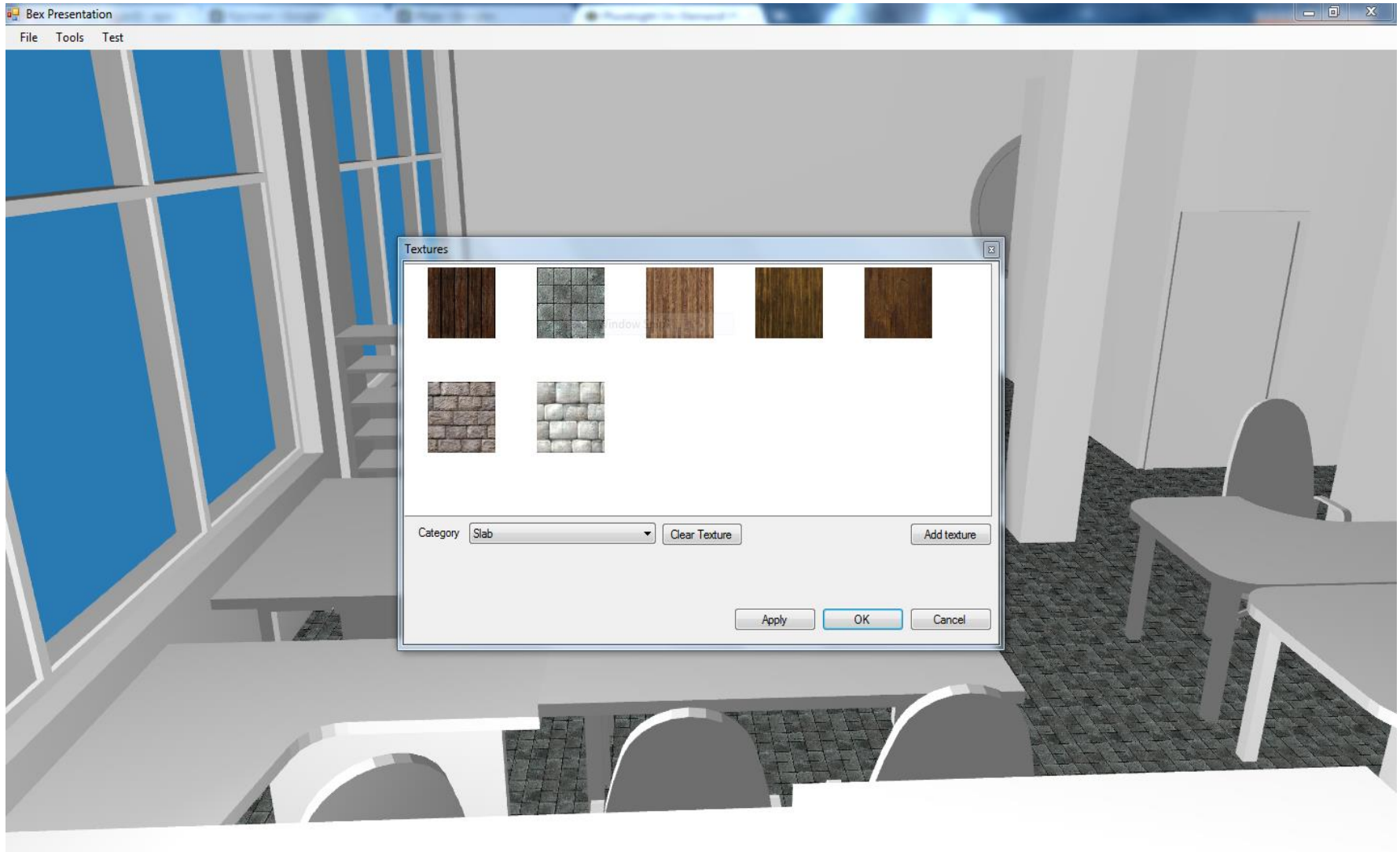


Finished projects (until now)





Finished projects (until now)



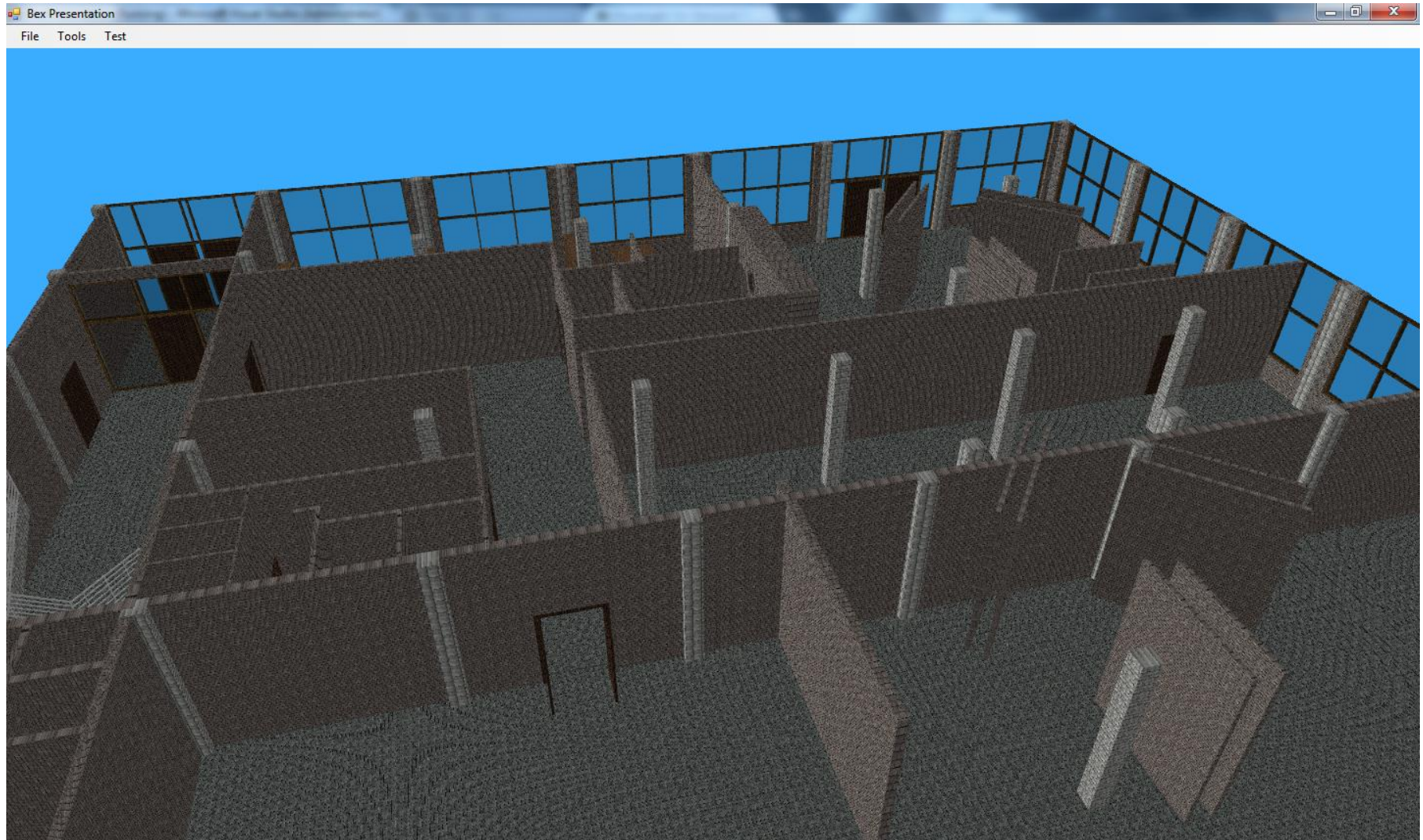


Finished projects (until now)





Finished projects (until now)





Conclusions

- First year of such course organization
- In current school year, 34 students attended the course 'Software development 2'
- Up to now 10 students successfully finished projects, so there is not enough data for detailed analysis
- Master students are better than undergraduate students (on average), so requirements can be 'higher'
- More resources are needed for the organization of such course (servers, virtual machines)
- Teacher and teaching assistant(s) should put more effort in order to make this work



Conclusions

- Students who attended the course had different backgrounds and knowledge
- None of the teams finished their project within one semester (as it was expected – agile development and Scrum require full focus on work for all team members, but students have other obligations)
- Using ALM tools allows teacher to have in-depth visibility of the students' work
- Students get better perspective about development process and teamwork
- On average, students have worked hard in order to get a good mark



Thank you!

My e-mail address is

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