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Deliverable DS4.1.2: Report on Summer School for Developers

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Abstract

This document reports on the Summer School for Developers 2011, covering general event information, event structure, the scope of workshops and coding sessions. The report also summarises attendee feedback and results.

Table of Contents

Executive Summary	1
1 Introduction	2
2 SDS 2011 Structure and Scope	3
2.1 Test-Driven Development Workshop	3
2.2 TDD-Based Coding Sessions	3
2.2.1 Introduction / Motivation	4
2.2.2 pSbase3-Driven Task	4
2.3 Lightweight Peer-Reviewing Workshop	5
3 Survey Results	6
3.1 perfSONAR pSbase3 Feedback	6
3.2 Survey Summary	8
4 Summary	14
4.1 Beneficial Aspects for the GN3 Project	14
4.1.1 Test-Driven Development	14
4.1.2 Peer Reviewing	14
4.1.3 pSbase and perfSONAR Development	15
5 Conclusion	16
References	17
Glossary	18

Table of Figures

Figure 3.1: Overall impression of pSbase3 stability	6
Figure 3.2: Difficulty of perfSONAR service development with pSbase3	7
Figure 3.3: Ease of developing automated test cases with pSbase3	7
Figure 3.4: Sufficiency of pSbase3 documentation for developers	8
Figure 3.5: Tutorial topic's evaluation	8
Figure 3.6: Coding session's topic evaluation	9
Figure 3.7: The value of information and experience	9
Figure 3.8: Knowledgeability of lecturers	10
Figure 3.9: Usefulness of provided materials	10
Figure 3.10: Accommodation and event facilities	11
Figure 3.11: Event's organisation	11
Figure 3.12: Social event's organisation	12
Figure 3.13: Social atmosphere at the event	12
Figure 3.14: Overall rating	12

Executive Summary

This document reports on the GN3 Summer School for Developers (SDS) 2011 in Wroclaw, Poland, which was the second summer school event that SA4 (Software Governance) Task 1 (Best Practices) organised for GN3 software developers. The objectives of the SDS 2011 were to:

- Convey technical knowledge about software development approaches.
- Provide hands-on coding experience.
- Facilitate an exchange of expertise and software development good practices.
- Improve the confidence of development teams in applying development processes.
- Leverage the quality of GN3 software and services.

The main aim of the SDS 2011 was to popularise the Test-Driven Development (TDD) approach and other agile practices among GN3 software developers. This report details the TDD workshop, the coding sessions where attendees were given tasks to be solved using TDD practices, and the lightweight peer-reviewing tutorial and practical exercises. Coding sessions were based on the newest release of the pSbase3 framework (part of the perfSONAR project), which was a first opportunity to validate the framework by an unbiased group of Java developers. The event's closing session was held in a form of a workshop, where all participating teams presented their solutions to coding tasks and the correctness of solutions was discussed.

The report also provides the results of a survey which was conducted to evaluate the organisational aspects of SDS 2011 and the maturity of perfSONAR pSbase3 framework.

The report concludes by highlighting the events' influence on the daily routine of GN3 developers, the importance of peer-reviewing practices and its impact on code quality.

1 Introduction

This summer, from 19th until 23rd September, the GN3 SA4 Activity organised the second GN3 Summer School for Developers in Wroclaw, Poland. This workshop for researchers who develop software in the GN3 project aimed to convey technical knowledge about software development approaches and hands-on coding experience through collaborative sessions. The overall goal was to improve the confidence of development teams in numerous aspects of the project development process, and to leverage the overall quality of software and services within the GN3 project. In response to SA4's invitation to the GN3 developers to take part in the Summer School, 22 attendees contributed to the event, from SA2 Task 3, SA2 Task 5 and all SA4 Tasks, representing AMRES, BREN, DANTE, GRNET, LRZ/DFN and PSNC.

The Summer School for Developers 2011 event was divided into the following:

- **Test-Driven Development workshop**
A TDD session and series of development-oriented tasks supervised by external experts. Attendees of the event were paired up during the TDD workshop to solve provided tasks.
- **Hands-on coding sessions**
Attendees were divided into teams of four and asked to solve programming tasks related to one of the GN3 perfSONAR services, based on the TDD approach. The tasks involved the use of pSbase3 framework (GN3 SA2 Task 3 software) and a number of Java frameworks and libraries (e.g., JUnit, Mockito, FestAssert, JAX-WS, JPA, Fuse Server). The teams used a testbed of virtualised Juniper routers set up especially for SDS 2011.
- **Software peer-reviewing lecture and practical sessions**
Solutions provided by particular teams provided the starting point for open discussions and experience exchange at the closing workshop. The motivation behind the event outline was to allow attendees to learn to use new tools and techniques that might be too time-consuming to learn during their daily routines.

The following chapters detail the content of the SDS 2011 and its results, which may have an impact on the quality of GN3 services.

2 SDS 2011 Structure and Scope

2.1 Test-Driven Development Workshop

The goal of this one-day workshop was to popularise the agile development style among developers involved in GN3 Service Activities by familiarising them with agile coding practices through examples. In this approach, the user stories are expressed in programming language by writing corresponding unit tests. These tests are written following the 'given-when-then' syntax which forces developers to think about system interfaces (rather than feature implementation) before they extend already existing software features.

The workshop was led by external experts (the Mockito testing framework co-owner, Szczepan Faber, and Sabre [Sabre] lead software developer, Bartosz Bańkowski) who are trainers on agile and test-driven development and developers of Mockito [Mockito] and Gradle [Gradle]. Concepts explored during this workshop included writing readable unit tests, minimal fixture and applying builder pattern by using fluent interface. This approach was illustrated through an initial live pair programming demonstration of test-driven development, followed by further elaboration of additional scenarios by workshop participants. These exercises were combined with team code reviewing. The workshop concluded with a tutorial on using the Gradle build tool. Gradle is an adaptable alternative to Maven which may be of interest for some GN3 developers who need additional flexibility in their projects' build process.

2.2 TDD-Based Coding Sessions

The main topic of the SDS 2011, Test-Driven Development in a domain of software engineering, which was introduced during the day one workshop sessions, was continued in the second part of the SDS, the hands-on coding sessions, led by the SA4 T1 leader, Branko Marović, in cooperation with Błażej Pietrzak, lead developer of the pSbase3 framework. The task specified for the coding sessions also acknowledged that developers would be faced with changing requirements while implementing software solutions. In the main coding task, the perfSONAR pSbase3 framework was used as the foundation for developing a perfSONAR service. The task was meant to be carried out according to the TDD approach, with the development teams implementing a number of stories the service should cover.

2.2.1 Introduction / Motivation

The pSbase3 framework has been developed after the in-depth perfSONAR audit delivered by SA4 (M19 - M20). It is intended to be used as a platform for further development and reworking of perfSONAR services. It was selected as a backbone for the main coding task because it has been designed to use many advanced and modern development concepts.

As a new development (in beta version), the framework requires an evaluation of its accessibility by a wider group of developers so that any problems it may cause are spotted and its usability is improved. The pSbase3 framework also delivers a wide range of functionality that is necessary for a number of services within the perfSONAR project. Therefore, it made sense to develop a realistic and practical sample service during the SDS 2011 coding sessions.

2.2.2 pSbase3-Driven Task

For the main task, attendees were split into groups of four and asked to use the pSbase3 framework to design, implement and test a perfSONAR service (previously called SSH/Telnet Measuring Point - MP). The service was meant to communicate with a number of registered devices (in this case Juniper and Cisco routers) and allow a number of commands on such machines to be executed. The exact stories to be covered included:

- Ability to send echo status messages.
- Ability to send self-test results including a status of communication with service persistence layer and status of communication with registered devices.
- Ability to retrieve a list of available commands on all registered or specific devices.
- Ability to execute commands on all or specific devices.

Following the Test-Driven Development approach, the main focus was on the test suites developed by the teams. In particular, unit testing and system testing scenarios played a very important role in the final scores the SDS teams achieved. In evaluating the teams' solutions, the following aspects were considered:

- Object model: concept and implementation.
- Unit testing:
 - Use of mock objects (e.g. Mockito framework).
 - High branch coverage.
- Implementation of a given functionality:
 - Use of pSbase3 framework.
 - Use of Velocity templates.
 - Interaction with real network devices provided as testing environment by using a Java open source library for SSH/TELNET communication.
 - Validation of input data.
 - Overall coding quality, appearance of bad code smells.

- System level testing:
 - Deployment of a developed bundle in the application container supporting OSGi.
 - Implementation of a client application which uses a functionality of a developed service.
 - Coverage of required functionality in testing scenarios.

The evaluations of the given aspects ranged from 1 (the lowest score) to 5 (the highest score).

2.3 Lightweight Peer-Reviewing Workshop

Code reviewing is a careful and methodical review of software design, architecture or code for defects without executing the code.

The peer-reviewing workshop was introduced by the SA4 T1 leader who compared testing and reviewing, and described different reviewing scenarios. Participants were introduced to the specifics of lightweight reviewing through a discussion of review phases (setup, execution, evaluation). Practical recommendations for organising and carrying out reviews were given, including recommendations for establishing a professional attitude to code reviews and their results.

Developers were asked to perform a lightweight code review of the code developed during two TDD-based reviewing sessions. Equipped with review checklists adapted for the given task, they had the opportunity to explain and discuss the solution developed by their own group, and to comment the code written by other groups, thus producing a review report for every group's result. In doing this, participants were able to practise agile code reviewing.

3 Survey Results

During the closing session, attendees were asked to fill in a non-anonymous (personal) survey to provide feedback on the pSbase3 framework itself and on event logistics. The aggregated results are detailed below. The survey concentrated on the pSbase3 framework and organisational aspects of the event.

3.1 perfSONAR pSbase3 Feedback

The questionnaire comprised questions related to framework stability, the quality and completeness of documentation for developers as well as ease of test cases development with the use of pSbase3 framework.

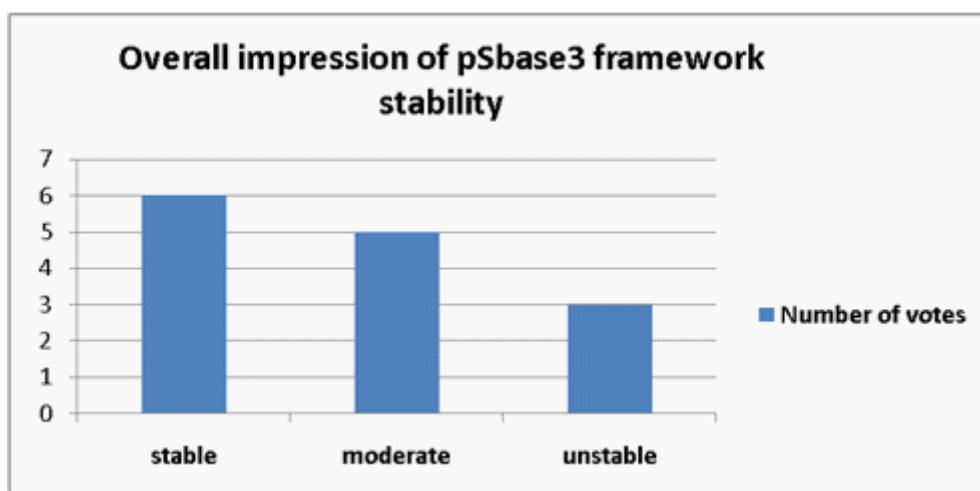


Figure 3.1: Overall impression of pSbase3 stability

The majority of answers (about 80%) valued the stability of the pSbase3 framework as moderate or stable. However, as depicted in Figure 3.2, the difficulty of developing the perfSONAR service based on the pSbase3 framework was marked as significant. This correlates with the attendees' opinion regarding the difficulty of developing automated test cases, illustrated in Figure 3.3. Both may be due to insufficient framework documentation (this also scored also quite low), as the majority of attendees indicated that more documentation on architecture and more examples of framework use would be welcome.

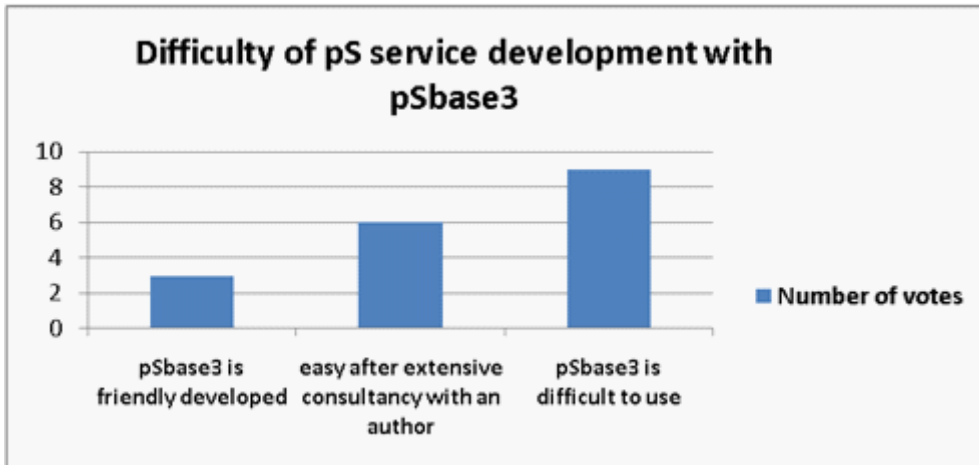


Figure 3.2: Difficulty of perfSONAR service development with pSbase3

Additionally, some difficulty in developing a service based on the newest version of pSbase3 may be related to the fact that pSbase3 introduced an innovative and modern annotation-based API with Javadoc documentation, which differs significantly from the traditional API and document-based technical guides.

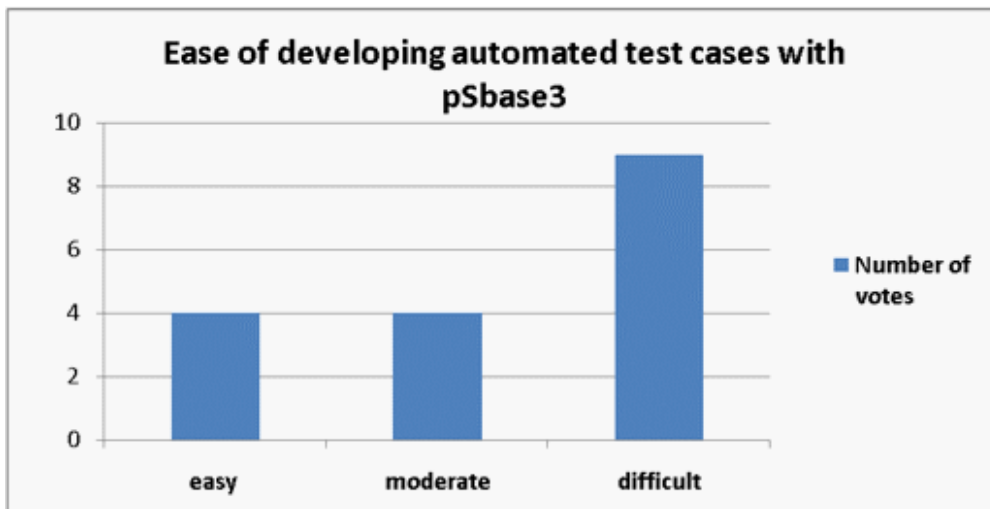


Figure 3.3: Ease of developing automated test cases with pSbase3

While quite a high percentage of attendees rated the development of test cases with the use of pSbase3 framework as moderate or difficult, the perfSONAR team is planning to take action to eventually facilitate test development by providing an auxiliary library for test suite development, especially for web services.

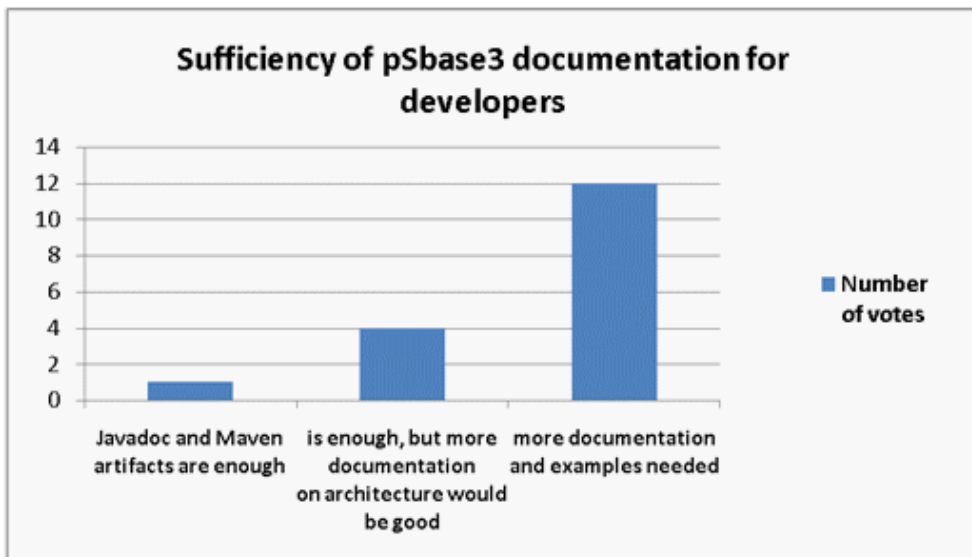


Figure 3.4: Sufficiency of pSbase3 documentation for developers

3.2 Survey Summary

Another part of the survey was related to the rating of the event. The following charts illustrate the aggregated feedback, addressing both the evaluation of event topics and organisational aspects.

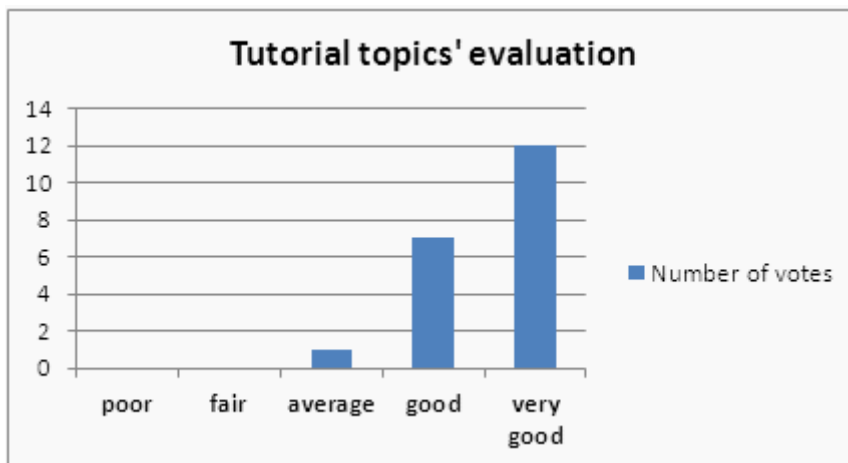


Figure 3.5: Tutorial topic's evaluation

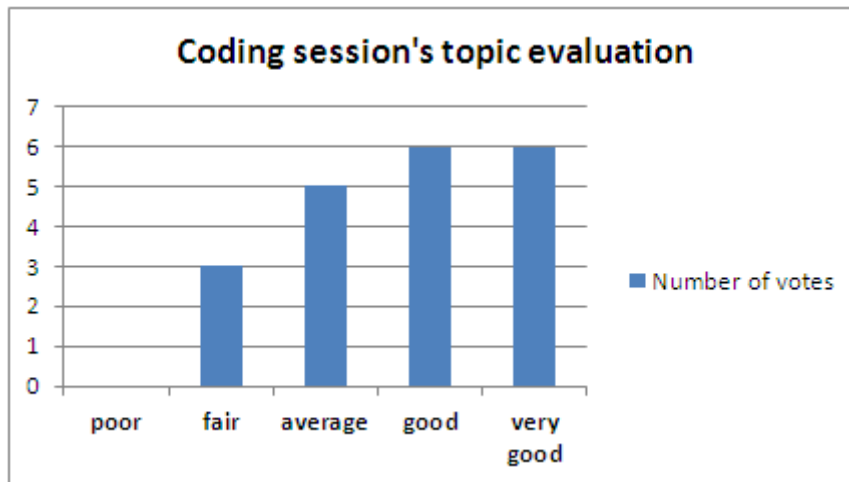


Figure 3.6: Coding session's topic evaluation

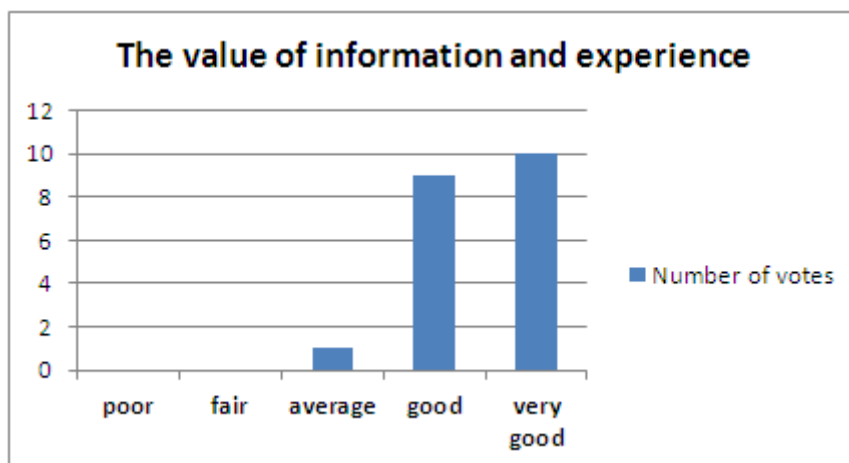


Figure 3.7: The value of information and experience

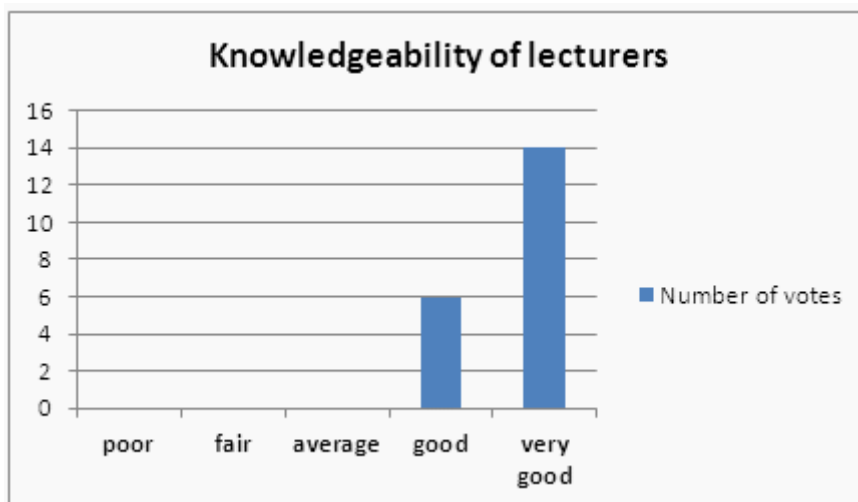


Figure 3.8: Knowledgeability of lecturers

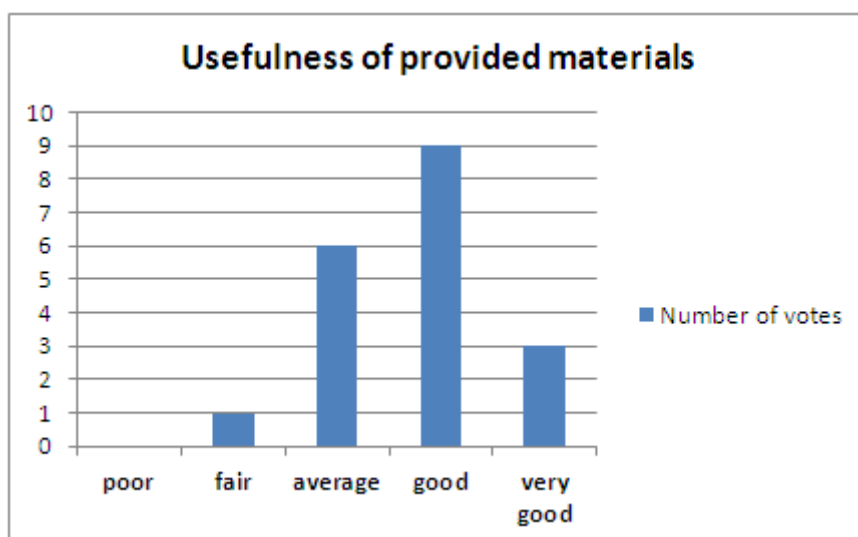


Figure 3.9: Usefulness of provided materials

The figures showing the evaluation of the workshop-related aspects of the event show that the selection of topics for SDS2011 was appropriate. Although the coding sessions' topic and practices to be applied were in keeping with the main concept of the event, some of the attendees marked this correlation quite low. This may be due to the developers being exposed to a brand-new programming framework, which caused some difficulty. However, the value of the information and experience attendees gained during the event is remarkable, which is also reflected in the evaluation of the know-how of the lecturers who conducted the sessions. Compared to the evaluation of the SDS 2010, this year the theoretical part was much more in line with the workshop part and coding sessions.

The evaluation of the event's organisational aspects is shown in the following figures:

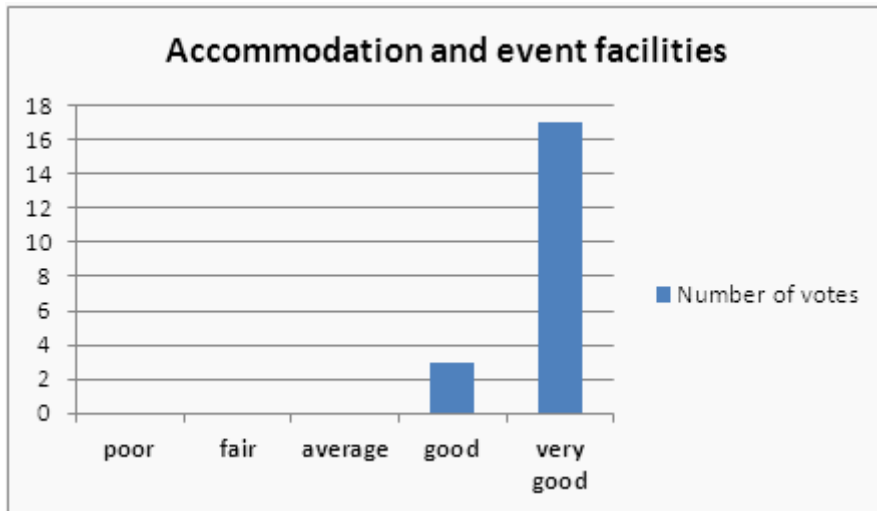


Figure 3.10: Accommodation and event facilities

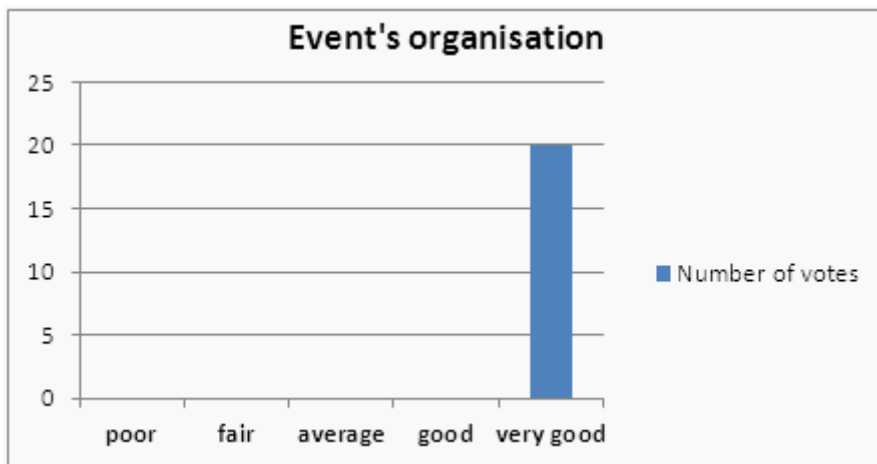


Figure 3.11: Event's organisation



Figure 3.12: Social event's organisation

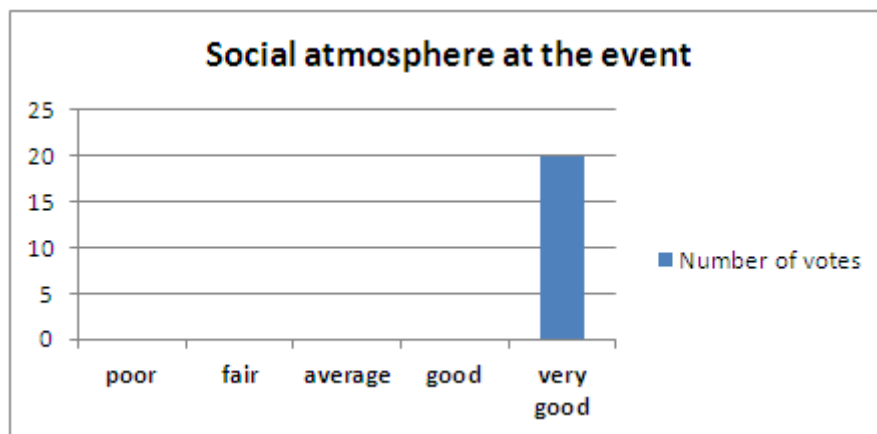


Figure 3.13: Social atmosphere at the event

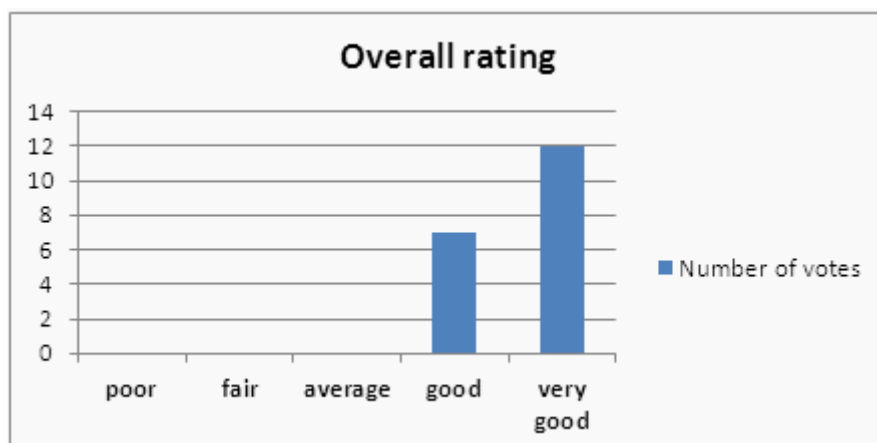


Figure 3.14: Overall rating

The organisational aspects of the event were almost unanimously given high scores, providing a very positive overall rating.

4 Summary

4.1 Beneficial Aspects for the GN3 Project

4.1.1 Test-Driven Development

The Test-Driven Approach introduced and exercised during the SDS 2011 plays a vital role in the daily routines of developers who follow agile principles. As testing is often an underestimated and neglected activity in software development, developers were given clear examples of how beneficial such an approach can be and how the development of tests can be turned from a chore to a worthwhile activity.

The TDD sessions were also an opportunity to present and recommend other agile software development techniques and software tools for testing support. The pair-programming technique was received well by attendees as was the description of functional requirements in form of user stories. While developing test cases, programmers admitted the advantages of the mocking approach and the usage of the Mockito open source framework [Mockito]. Another open source library which drew the attendees' attention was the Fest Assert framework [FestAssert]. It introduces a wide variety of assertions, lowering the effort required for creating test cases, and increasing the test cases simplicity and readability.

It is also worth mentioning that, while developing solutions, attendees were using the software development infrastructure created by SA4 Task 3, which improved their collaborative work.

4.1.2 Peer Reviewing

Peer reviewing is an important practice for improving the overall quality of software, as well as team skills and cohesion. The developers' understanding and appreciation of each other's code increases, code is improved, bugs are found, and development time and costs are reduced. Learning about peer code reviewing and performing it in on their own and others' work makes programmers working in GN3 Service Activities more likely to adopt this practice, thus improving skills, results and productivity. The collaborative and social aspect of peer reviewing emphasised during the SDS 2011 may also help in improving the cohesion of GN3 software development teams.

4.1.3 pSbase and perfSONAR Development

One of the ideas behind solving coding tasks by using the pSbase3 framework was to create an opportunity to evaluate the framework by a group of developers. The development of the third version of pSbase framework was initiated and carried out as a response to an in-depth perfSONAR audit, conducted by SA4 Task 1 (M19-M20). As pSbase3 is in early development and the beta version of the framework just released, this was the first attempt to put it to use and check how its design and annotation based API would be received by development teams. The group of 22 developers provided their evaluation and additional remarks. The evaluation results will be addressed by the perfSONAR development team in the following areas:

- Authoring and completing the documentation related to framework architecture and framework usage examples.
- Development of an alternative pSbase3 API, along with annotation based API, to use the framework capabilities.
- Possible re-engineering or even re-development of perfSONAR Java-based services [pSJAVA].
- Minor fixes and configuration amendments to the pSbase3 code base (partially implemented during SDS 2011).
- Implementation of an auxiliary library to support the testing of web services based on the pSbase3 framework.

Exposing perfSONAR developers to a new framework also has an important impact on future perfSONAR developments, as programmers had an opportunity to familiarise themselves with the design and API of the third pSbase release. According to the year 4 work plans of the perfSONAR development team, this framework will be used for re-designing and re-implementing some of the perfSONAR services.

5 Conclusion

The Summer School for Developers 2011 aimed to improve developers' methodological and technical knowledge and practical skills through tutorial and hands-on sessions, focussing on popularising a Test-Driven Development approach, peer reviewing and other agile practices. Based on the survey results, the SDS 2011 successfully fulfilled these objectives, with excellent appraisals of topics, information and experience provided and lecturers' expertise confirming the value of the delivered content.

In addition to promoting a consistent and efficient development approach, the Summer School produced valuable feedback on pSbase3, which will be passed on to SA2 for consideration. Future SDS coding sessions and materials will also be refined, based on the feedback received. According to attendees' responses, the event organisation and facilities were very good and need little improvement.

The selection of the agile practices presented at the SDS 2011 underlined the importance of software testing and source code reviewing. However, new ideas and recommendations for future SDS events have also emerged. From an organisational point of view, the timeframes for task solving and lecture sessions can be improved. More importantly, wider and more in-depth presentations of agile practices like pair-programming or coding by example are needed. Additional sessions on agile management techniques and team work organisation methodologies would also be useful. The Task will also consider suggestions to provide a wider introduction to software libraries and frameworks to be used during programming sessions.

Nonetheless, the SDS 2011 survey summary clearly showed that the main topic, delivered sessions and introduced software tools and frameworks were well-received by attendees, and leveraged the overall quality of the developers' programming routines.

As preparations for the next SDS commence, it is planned to survey GN3 Task Leaders and developers six months ahead of the event in order to identify which software engineering topics would be the most useful to explore. However, considering the experience gained by the organising team and all the remarks and proposals already submitted by attendees, it can already be determined that the next Summer School for Developers should comprise topics that deal with agile development techniques.

References

- [FestAssert]** A family of open source software libraries for easy software testing, including also an interface for assertions
<http://code.google.com/p/fest/>
- [Gradle]** Software build tool
<http://www.gradle.org/>
- [Mockito]** Mockito open source framework for Java
<http://mockito.org/>
- [pSJAVA]** A list of perfSONAR Java based services:
<https://intranet.geant.net/sites/Services/SA2/T3/Pages/PersonarServicesStatus.aspx>
- [Sabre]** <http://www.sabre.com/home>

Glossary

API	Application Programming Interface
MP	Measuring Point
OSGi	Open Services Gateway initiative
SDS	Summer School for Developers
SSH	Secure Shell protocol
TDD	Test-Driven Development