Project report

Neronet

Toolbox for managing the training neural networks

CSE-C2610
Software Project

Aalto University

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Aalto University
School of Science
and Technology

Project report
Neronet
People
Project
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Demo
Quality
Process
Effort
Remarks

Outline

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Forecitation

"I have supervised several bachelors' theses and other student projects.

You and the product surpassed my expectations. I did not expect such professional results."

Pyry Takala, PO

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Team

At the start of the course, we were all both

- terrified, and
- inspired

by our project topic!

Product owner

- Machine learning researcher at Aalto
- Past: Amazon, McKinsey & Company, Goldman Sachs, August...

Agile coach

- Continuous delivery researcher at Aalto
- Past: Prosys PMS Ltd, WiRCA-miehet, Aalto...

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Pyry's problem

Challenges in training neural networks:

- Long duration of individual experiments
- Difficult to manage of experiment variations, queues and computing nodes
- Difficult to monitor and analyse experiment progress
- Difficult to log experiment histories

Ideas

Could a toolbox be developed that would

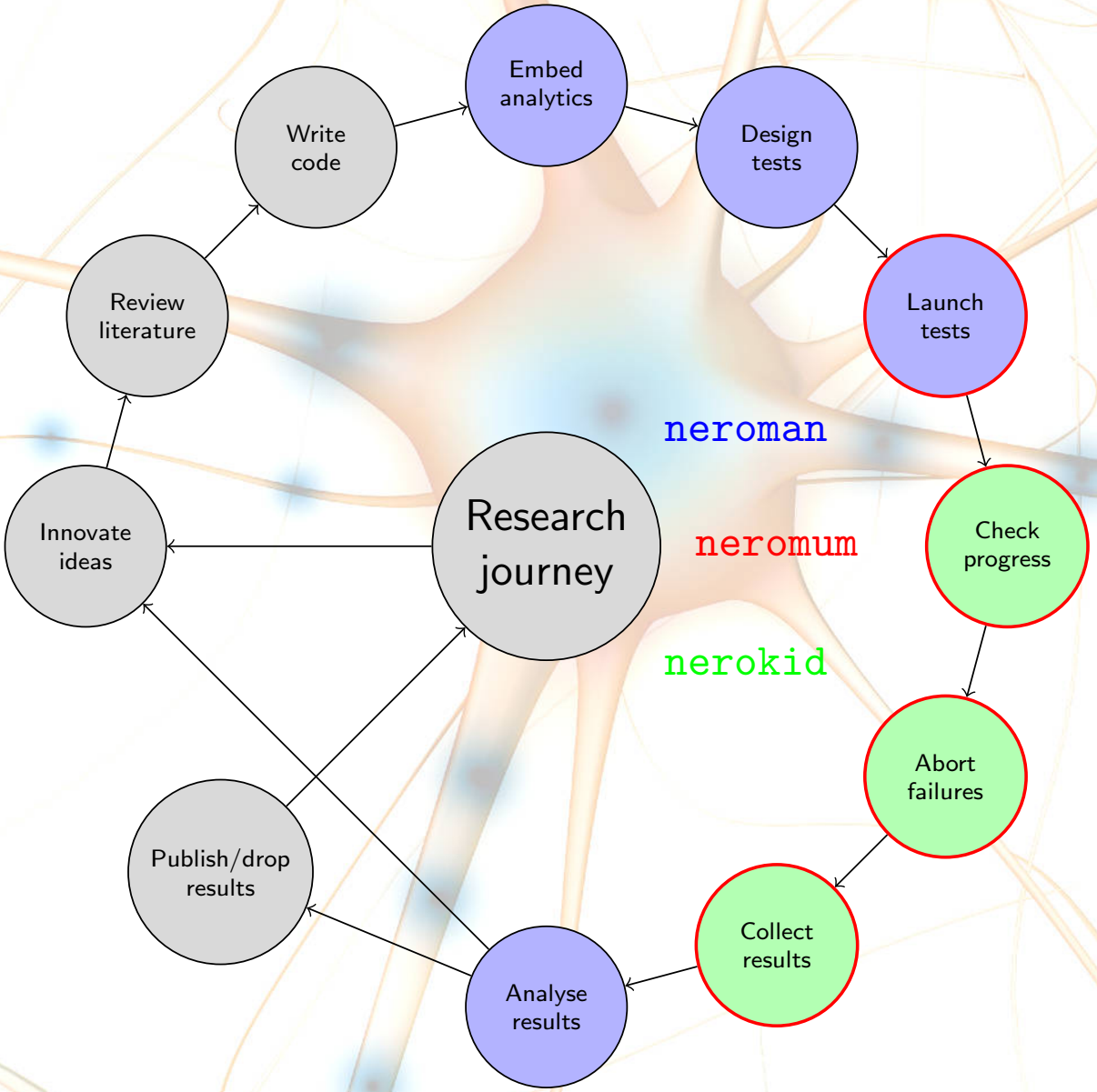
- monitor experiment logs and detect problems
- notify of and/or autoterminate poorly developing experiments
- facilitate experiment variation
- faciliate experiment and queue management
- enable easy access to experiment data
- potentially also visualize parameter evolution

Ideas

Such a toolbox should also be

- lightweight
- easily extensible
- open source
- framework agnostic
- convenient in practice

Journey map


Embed analytics
Write code
Design tests
Review literature
Launch tests
neroman
Research journey
Innovate ideas
neromum
Check progress
nerokid
Abort failures
Publish/drop results
Collect results
Analyse results

Technical challenges & ASRs

- deeply technical and an advanced domain
- remote computing nodes and cluster management
- good usability? according to whom?
- framework agnostic?

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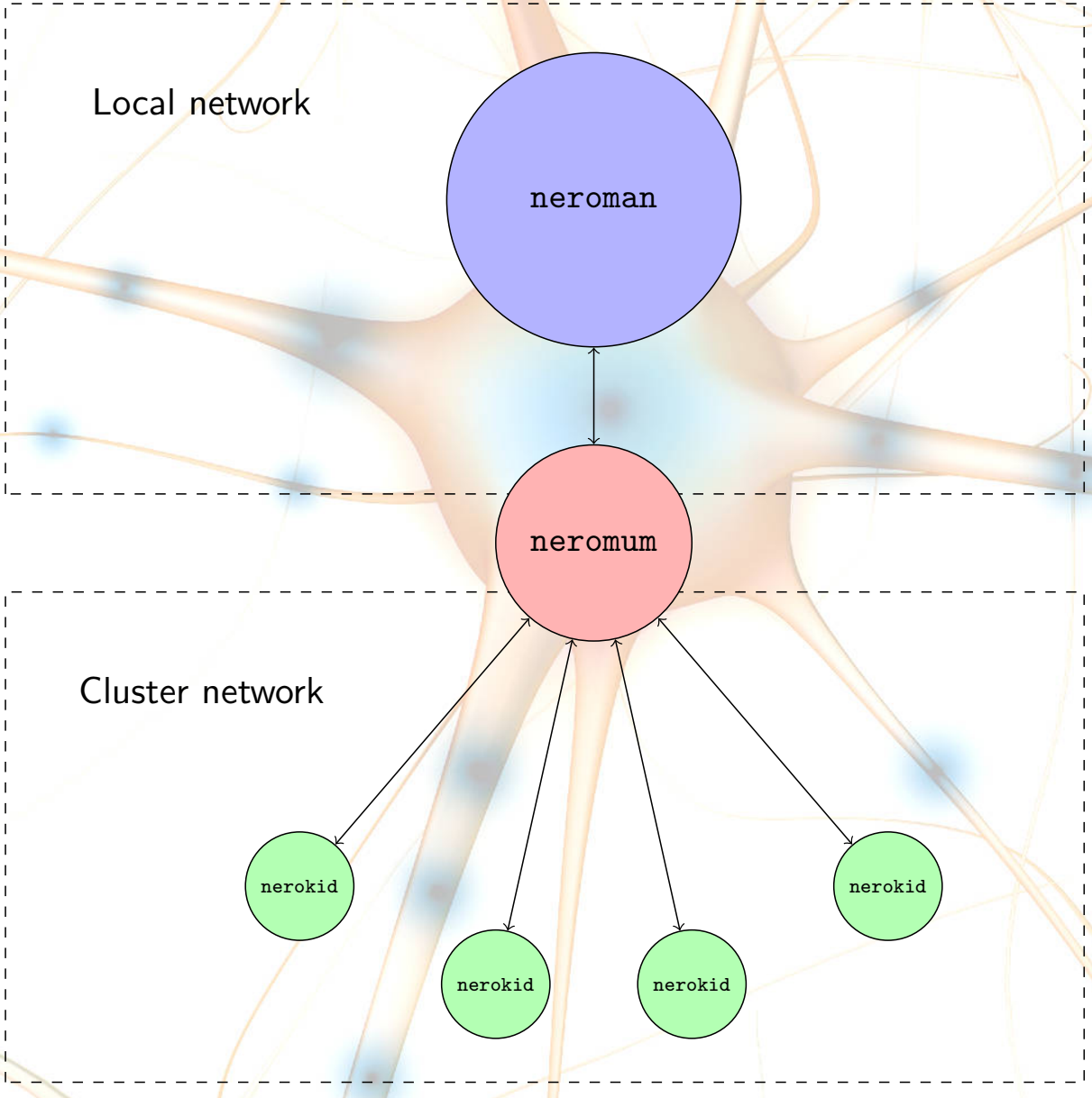
Result

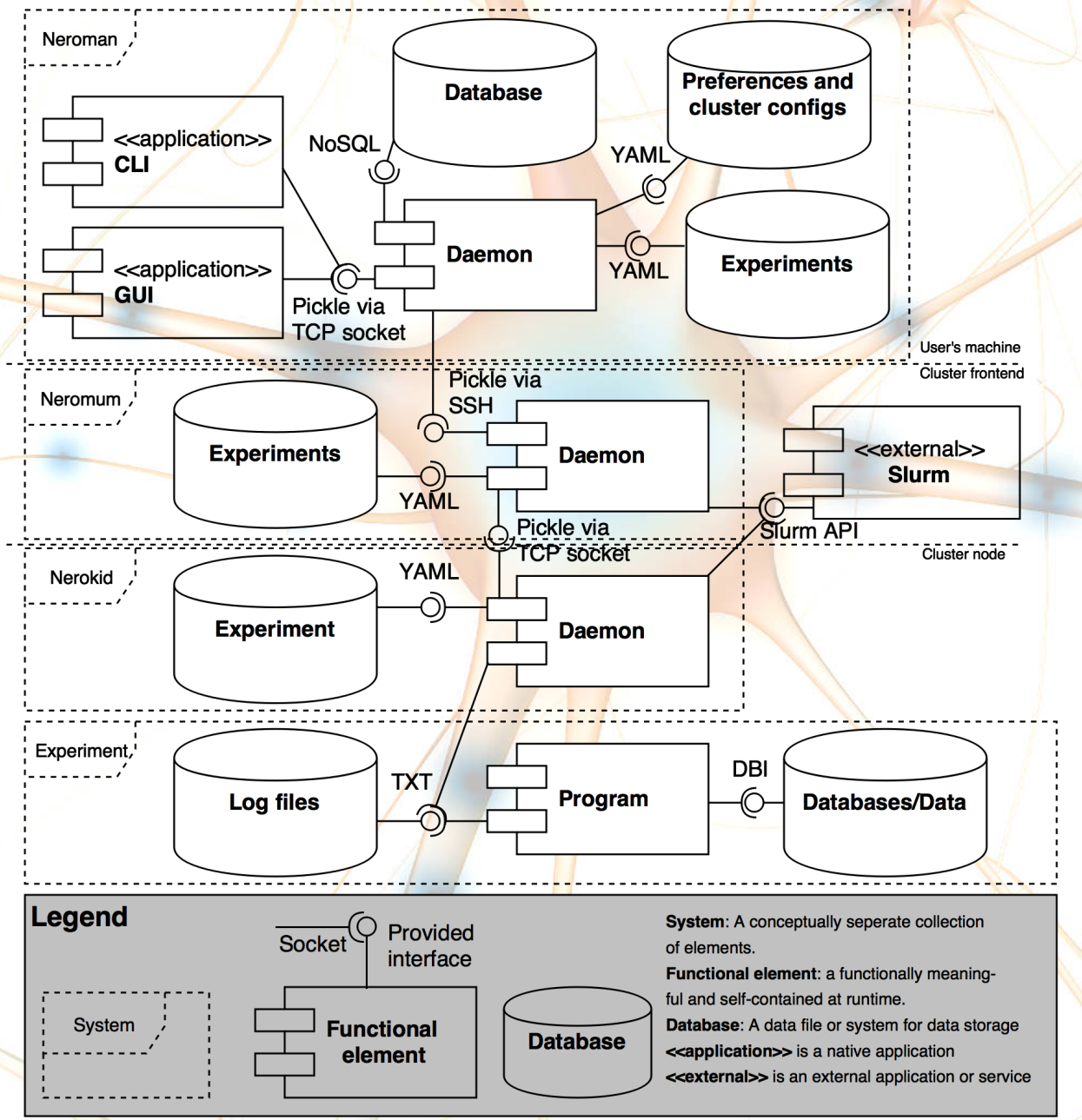
A three component tool involving Python, SSH and sockets that ... meets the vision!

- All core functionality Done.
- Most features accessible both via CLI and GUI.
- PO satisfied.
- We are proud!

Solution


Local network
neroman
neromum
Cluster network
nerokid
nerokid
nerokid
nerokid

Structural architecture



Features

Core features:

- extensible experiment specification system
- easy experiment submission to remote nodes
- experiment state and progress information easily accessible
- access to computing node resources information
- customizable notification and autotermination system
- additional conveniences: drag drop, experiment template, customizable parameter value plotting

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Demo

Live demonstration of the final product including:

1. Cluster & experiment configuration
2. Experiment submission
3. Fetching updates/results
4. Viewing plots

Focus on the GUI this time.

Recap

In essence the product is a Python-based tool that enables computational researchers to conduct their research more effectively.

- It utilizes SSH and TCP sockets to distribute computational experiments into remote computer nodes.
- It is framework agnostic in that it permits the use of a very wide variety of tools to actually conduct the computing needed (Theano, Torch, Scipy, Matlab, R, C++, whatever).

User feedback

We utilized lots of end user testing and received great feedback from Simo Tuomisto, a Triton admin:

- Thought that our design and architecture was well devised.
- Offered performance improvement ideas.
- In general he liked our usability.

User feedback

From our peer team we received feedback as well.
Thus we did several

- bug fixes
- usability improvements
- improvements to project documentation and the user guide

User feedback

Pyry also gave us great feedback during development, regarding requirements and usability etc.
In the end he claimed that

- the end product was surprisingly professional
- the usability was excellent
- and that our team had expertise

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Quality

Quality assurance was based on

- the DoD, and
- our QA practices

We updated our DoD and practices several times.

Definition of done

We defined Done at the BI, sprint and project level.

- BI level: unit tests, code confromity, commenting, documentation, peer review
- Sprint level: BIs Done, unit and system tests ok, sprint goal achieved.
- Project level: all sprints Done and PO satisfied.

QA practices

Used QA practices and tools:

- Unit test framework
- Commenting & documentation
- System testing
- Peer review

Quality attributes

Added emphasis on these attributes:

- Usability
- Reliability
- Extendability
- Performance

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Process overview

- Each developer as a sprint team leader in turn
- Teamwork sessions almost every Wed & Fri at Maari
- Scrum as required
- Tried to employ professional SD practices
- Tools: Github, Agilefant, Flowdock, WhatsApp, Google Calendar, ShareLaTeX, Skype, Floobits

Schedule

Time	Event	Participants
30.10. 16-18	Project kickoff	team, PO
13.11. 15-17	S0 demo	team, Coach
16.11. 11-13	S1 planning	team, PO
04.12. 16-17	S1 & progress review	team, PO, Coach
04.12. 17-18	S2 planning	team, PO
13.01. 19-20	S2 review & S3 planning	team, PO
01.02. 14-16	S3 review & S4 planning	team, PO
29.02. 13-14	S4 & progress review	team, PO, Coach
29.02. 14-15	S5 planning	team, PO
30.03. 16-18	S5 review & S6 planning	team, PO
13.04. 16-17	S6 & project review	team, PO, Coach
19.04. 16-20	Quality award & party	team, Coach

Sprints

- S1: Develop a prototype that offers the most basic functionality via a CLI Done
- S2: Develop a stable version for end user testing Done
- S3: Finish asynchronous system functionality and create a GUI mockup Done
- S4: Publish Neronet as an open source project Done
- S5: Finish Neronet 1.0 Done
- S6: Grab the quality award! ?

There were few stories that were deferred or completely cancelled, but no unpleasant surprises.

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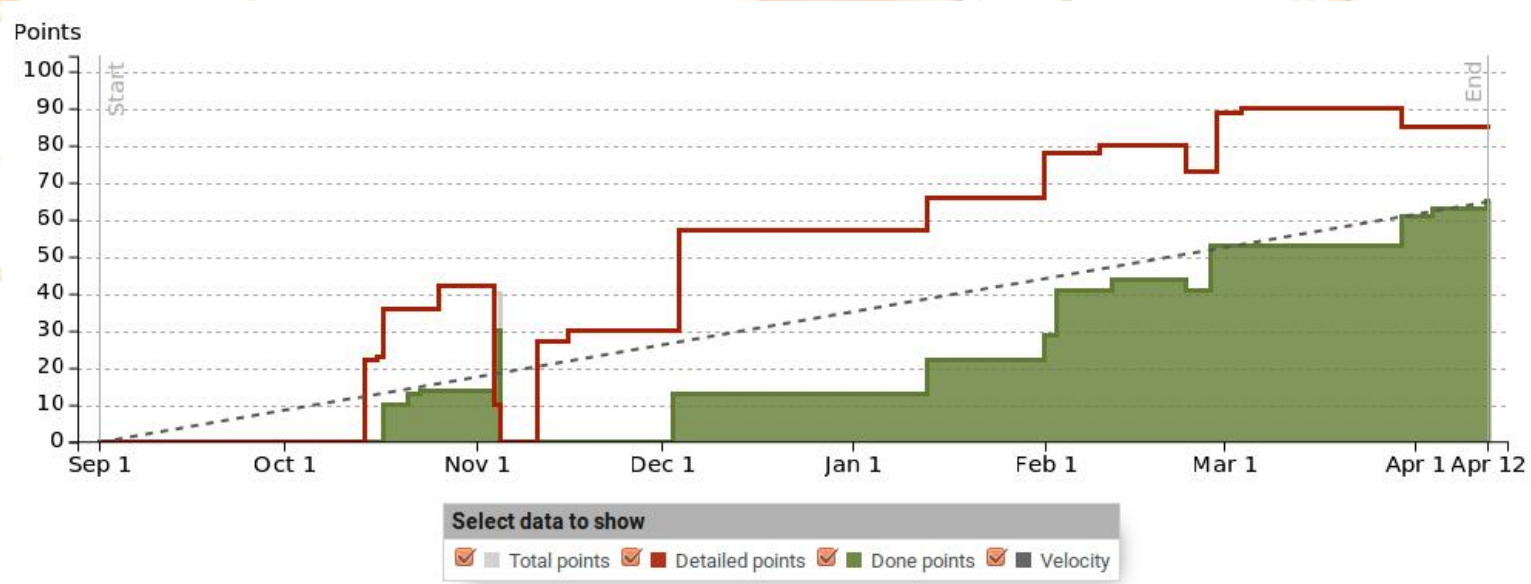
Effort

Spent and budgeted effort in hours by team member and sprint:

S	Samuel	Teemu	Tuomo	Joona	Iiro	Matias
0	140/50	36/35	45/35	40/35	36/35	43/35
1	52/30	37/33	42/33	46/33	32/33	37/33
2	42/30	27/33	41/33	25/33	27/33	30/33
3	24/15	28/33	14/33	23/33	20/33	27/33
4	37/15	35/33	28/33	32/33	25/33	32/33
5	18/20	31/40	49/40	16/40	39/40	29/40
6	17/15	9/18	10/18	16/18	16/18	10/18
	330/175	203/225	229/225	198/225	195/225	208/225

Burnup


Points
100
90
80
70
60
50
40
30
20
10
0
Start
End
Sep 1
Oct 1
Nov 1
Dec 1
Jan 1
Feb 1
Mar 1
Apr 1
Apr 12
Select data to show
Total points
Detailed points
Done points
Velocity

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Future

The goal was to develop a tool with a bright future.

- Extensive documentation, manual and user guide
- Published as an open source project
- Located in Github and installable via `pip`

Complicating factors

Complicating factors

- PO mostly in London
- Little additional CSE expertise available (only the Coach)
- Very difficult domain
- Very inexperienced team
- Only five developers
- The PO nor the scrum master had participated in the course before

Simplifying factors

Simplifying factors

- Our PO was very motivated and straightforward
- Our coach gave us very valuable support
- We had high motivation

Additional points

Additional points

- Sprint team leader system
- User guide/manuals in communication
- Early end user testing
- OS future focus

Summary

Summary:

- The process was smooth
- All sprints were successful
- More than fulfilled the initial vision
- Surpassed PO's expectations
- We learned and had fun together :)