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Comprendre le monde, construire l'avenir®

Groupware and Collaborative Interaction

Collaborative Software Development

M2R Interaction - Université Paris-Sud - Année 2013-2014

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Software development

- Several users work on a same project
  - Remote or collocated users
  - Each one works on its own computer (asynchronous)
    - Work on different tasks
    - Work at different times
- Collaboration is hard to organize
  - Versioning, synchronization between users
  - Tasks distribution, social aspects

Outline

- Collaborative software development
  - Version control
  - Continuous integration
  - Agile methods

Outline

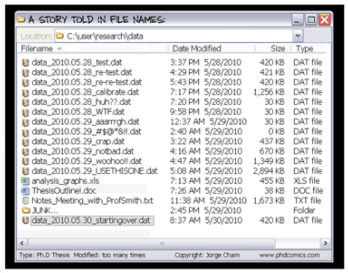
- Collaborative software development
  - Version control
  - Continuous integration
  - Agile methods

Version control

- Problematic
  - We want to avoid:
    - Manually share the files (USB key, email, Dropbox)
    - Delete or overwrite the files of other users
    - Broke all the project by making a mistake
  - We want to able to:
    - Edit the project at the same time
    - Keep an history of the modification
    - Keep the older version of the files + hierarchy

Version control

- Problematic
  - We want to avoid this:



["Piled Higher and Deeper" by Jorge Cham: www.phdcomics.com]

Version control

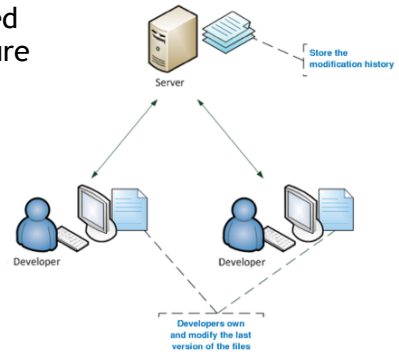
- Version control software
  - Save & restore different versions of the files
  - Synchronize users' versions
  - Keep track of modifications and their authors
  - Manage Branching and merging
- Not only for software development
  - Report, images, data from experiments

Version control

- 2 kinds of architecture
  - Centralized
    - CVS, SVN, …
  - Decentralized (peer-to-peer):
    - GNU Arch, Mercurial, Bazaar, Git,…
  - Decentralized can be used as a Hybrid Architecture
    - One peer can be a central server

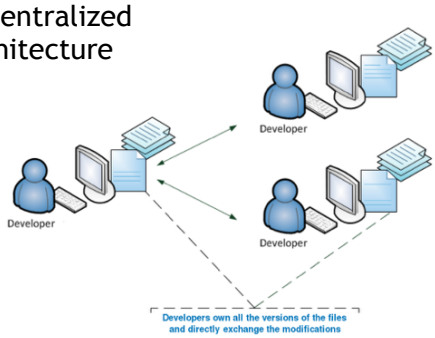
Version control

- Centralized architecture



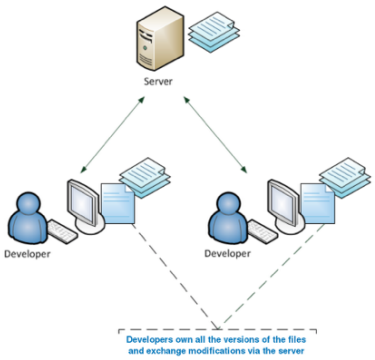
Version control

- Decentralized architecture



Version control

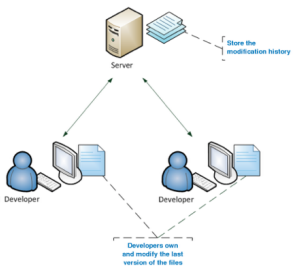
- Hybrid architecture



Version control

- Vocabulary (SVN)
  - Architecture
    - Repository
    - Working copy
  - Actions
    - Checkout
    - Update
    - Commit
    - Revert
    - Diff, log, status

Centralized Architecture



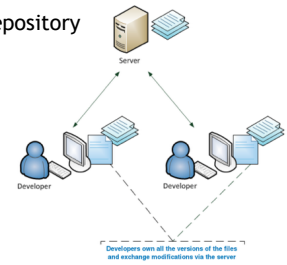
Version control

- Drawbacks of the centralized architecture
  - Just one access point to the data
  - Just one communication point between users
  - Just one historic of the files
  - Versioning and sharing are the same operation
    - Need to have a stable state before "committing"

Version control

- Vocabulary (Git)
  - Architecture
    - Remote and local repository
    - Working copy
  - Actions
    - Clone
    - Pull, Push
    - Commit
    - Reset
    - Diff, log, status

Hybrid Architecture



Version control

- Good practices
  - Work on the local copy
  - Send the modification
    - Check if the code compiles locally
    - Check for updates from the other users
      - Manage conflicts if there are some
    - Check if the code compiles with the updates
    - Commit the code on the shared version (server)

Version control

- Users can modify the same file
  - But at different part/section of the files
- If they modify the same part of a file
  - A conflict appends
    - Usually, it cannot be resolve automatically
    - Users have to fix the conflit
      - By telling to the system, which version is correct
      - By merging the modifications of the users

Version control

- Conflicts management

```
C:\workspace\test>svn up
Conflict discovered in 'test.txt'.
Select: (p) postpone, (df) diff-full, (e) edit, (r) resolved,
        (mc) mine-conflict, (tc) theirs-conflict,
        (s) show all options: p
C    test.txt
Updated to revision 3.
Summary of conflicts:
  Text conflicts: 1
```


Version control

- Conflicts management

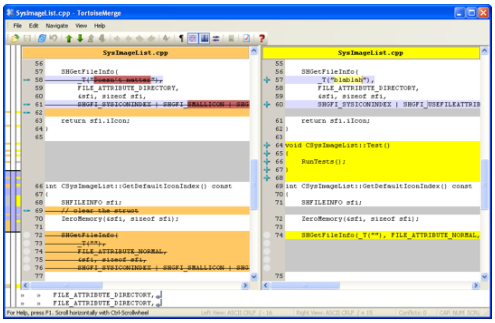
```
08/10/2010  11:44 AM                94 test.txt
08/10/2010  11:44 AM                26 test.txt.mine
08/10/2010  11:44 AM                27 test.txt.r2
08/10/2010  11:44 AM                31 test.txt.r3
```

test.txt

```
<<<<<<< .mine
test User2 making conflict
=======
User1 am making a conflict test
>>>>>>> .r3
```

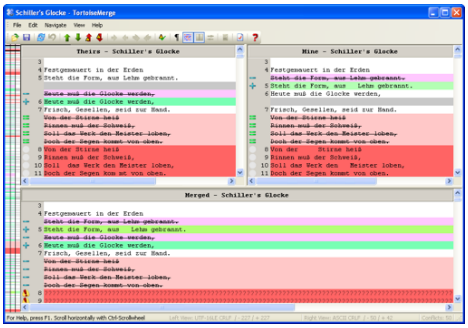
Version control

- Tools for conflict management (TortoiseMerge)



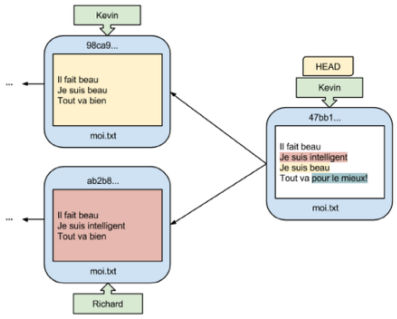
Version control

- Tools for conflict management (TortoiseMerge)



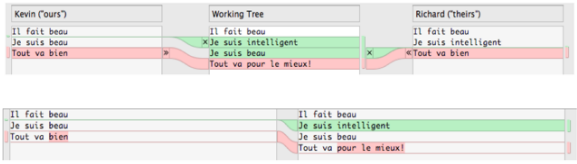
Version control

- Tools for conflict management (SmartGit)



Version control

- Tools for conflict management (SmartGit)

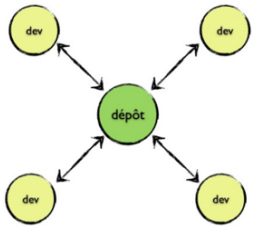


Version control

- Conflicts management
  - To avoid conflict:
    - Users are able to "lock" a file
      - Only the user who locks the file can modify it
      - If another user try to lock a file while it is locked by another user, he receives an error message
    - Users have to manually unlock the file when they have finished to work on it.

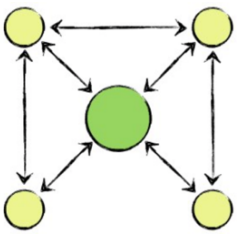
Version control

- Collaboration scenario : centralized (SVN)



Version control

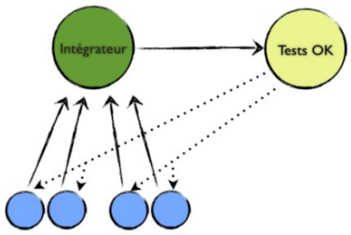
- Collaboration scenario : decentralized (Git)



Inter-personal communications

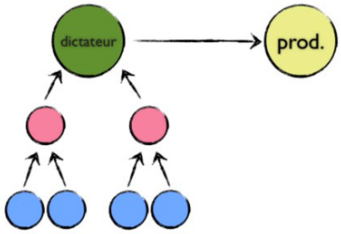
Version control

- Collaboration scenario : decentralized (Git)
  - Integrator mode
    - A repository is in charge of the test



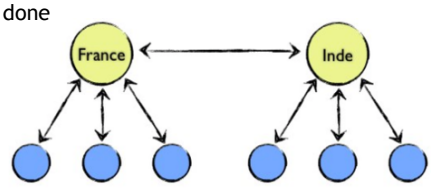
Version control

- Collaboration scenario : decentralized (Git)
  - Dictator mode
    - Open-source projects
    - "Lieutenants" make a first check before sending to the "dictator"



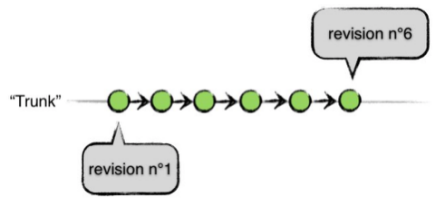
Version control

- Collaboration scenario : decentralized (Git)
  - Multi-location team
    - Each team can work independently
    - Regular integration of the work of each team can be done



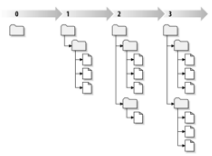
Version control

- Historic management
  - Computation of the historic is linear according to the « commit" order



Version control

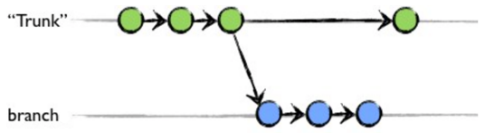
- Historic management
  - SVN assigns a revision number to all the project
  - Git assigns a revision number peer file



  - This difference has a strong impact on collaboration
    - Using branch for collaboration is easier with Git

Version Control

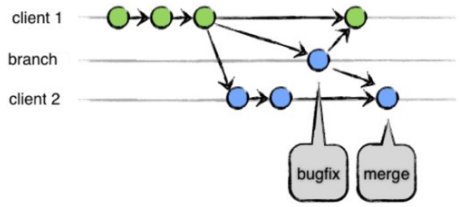
- Branch management

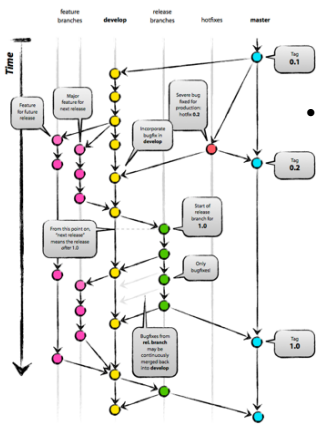


  - SVN make a copy of the all repository
  - Git make a link to a particular state of the files

Version Control

- Branch management
  - Merging branch (very complex to achieve with SVN)





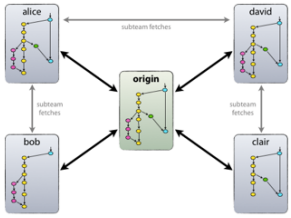
Version Control

- Branch management
  - Classical organisation of a project into branches

http://nvie.com/posts/a-successful-git-branching-model/

Version Control

- Branch management
  - Each user can work on particular branches
  - Branches can be synchronized between users



Outline

- Collaborative software development
  - Version control
  - Continuous integration
  - Agile methods

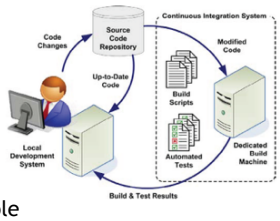
Continuous integration

- Integration
  - Merging the work of several developers
- Goals
  - Test modifications form the beginning
  - Detect integration problems at an early stage
  - Avoid fastidious integration phases
  - Always have the system running
    - Tests, demos, discussion with the customers

http://martinfowler.com/articles/continuousIntegration.html

Continuous integration

- Principles
  - Version control on a repository
  - Automatic and fast build
  - Auto-testing
  - "Commit" every day
  - Deployment on an integration computer after each "commit"
  - Automatic deployment
  - Executable always available
  - Every body know the build state



Continuous Integration

- Feedbacks for collaboration
  - Token on the desk of the person who builds
  - Make a sound when a build is valid
  - Web page of the integration server
  - Bubble light
  - Wallboard

Outline

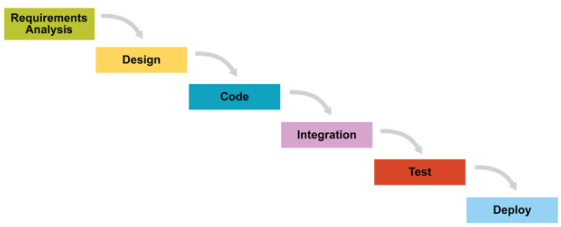
- Collaborative software development
  - Version control
  - Continuous integration
  - Agile methods

Software development

- Methods for software development
  - No methods: "Code and fix"
    - Efficient for small project
    - Difficult to add new features or to find bugs
  - Engineering / plan-driven methodologies
    - Come from civil or mechanical engineering
      - Drawing / construction plan / task distribution / construction
  - Agile methodologies
    - Adaptive rather than predictive
    - People-oriented rather than process-oriented

Software development

- Engineering methodologies
  - Example: Waterfall



Software development

- Engineering methodologies
  - Separation of design and construction
    - *Design*
      - Unpredictable
      - Require creative people
    - *Construction*
      - Predictable
      - Require people with lower skill
  - Example: civil engineering
    - construction is bigger in cost and time than design

Software development

- *Design* and *Construction* for software?
  - UML = *Design*, coding = *Construction*?
  - Source code = *Design*, compilation = *Construction*
    - Construction is quick and cheap
    - Source code requires creative and talented people
    - Creative processes are unpredictable
    - Are the engineering methodologies well adapted ?

[Jack Reeves, C++ Journal, 1992]
http://www.bleading-edge.com/Publications/C++Journal/Cpjour2.htm

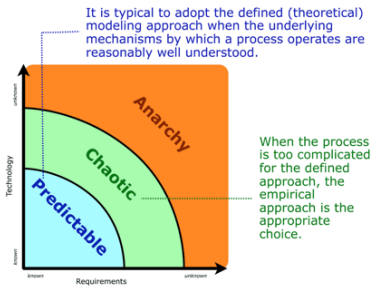
Software development

- Is software development predictable?
  - Yes in some cases…
    - NASA programs
  - Usually, requirements are unpredictable
    (especially for software involving interactions with users)
    - Customers don't precisely know what they want
    - Hard to evaluate the cost of different options
    - Hard to estimate which features are useful

⇒ Requirements should be flexible in these cases

Software development

- Is software development predictable?



Agile methods

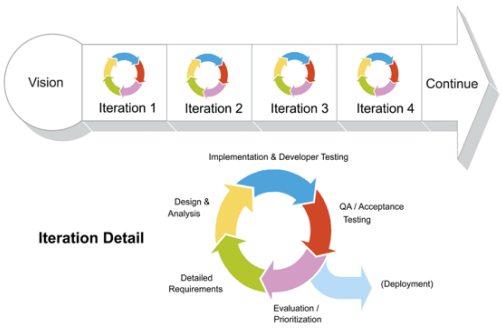
- Deal with unpredictable requirements
  - Iterative development
    - Involve the customers at each iteration
    - Improve the team organization (self-adaptive process)
  - Effective team of developers (people first)
    - Do not consider developers are replaceable parts
      - Analysts, coders, testers, managers
    - Developers are responsible professionals
      - Make the technical decisions
      - Evaluate the time required to perform the tasks

Agile methods

- Manifesto for Agile Software Development
  - Individuals and interactions over processes and tools
  - Working software over comprehensive documentation
  - Customer collaboration over contract negotiation
  - Responding to change over following plan

http://agilemanifesto.org

Agile methods

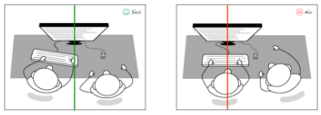


Agile methods

- Examples
  - XP (Extreme Programming)
    - Test driven development, pair programming
  - Scrum
  - Crystal
    - Safety, efficiency, habitability (less discipline than XP)
  - Open source process
    - Distributed contributors, parallelized debugging
  - Lean development (Lean @ Toyota)
    - Just in time, Jidoka ("automation with a human touch")
  - RUP (Rational Unified Process) ?
    - Use case driven, iterative, architecture centric

Pair programming

- Two programmers
- One computer
- Roles
  - One "drives": operating mouse and keyboard
    - Code: syntax, semantics, algorithm
  - One "navigates": watchs, learns, asks, talks, makes suggestions
    - Higher level of abstraction
      - Test, technical task, time since the last commit,
      - Quality of the overall design



Pair programming

- Advantages
  - Code quality
    - Better designs
    - Fewer bugs
  - Spreading Knowledge
    - Pairs have to switch off regularly
    - Technical and conceptual knowledge
  - Social aspects
    - No loneliness, conviviality, better motivation

Pair programming

- Productivity

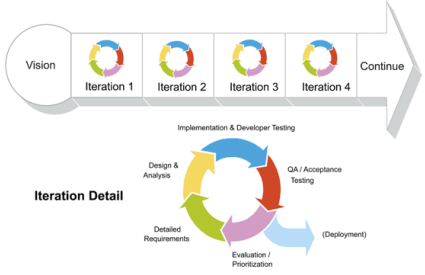
  (it depends on how you measure productivity : lines of code VS running and tested features)
  - Short-term productivity might decrease slightly (about 15%)
  - Long-term productivity goes up
    - Because the code is better
    - Even better if you consider staff turnover
      - Truck number in XP
        - » Close as possible to the team size

Pair programming

- Pairing strategies
  - In XP, all production code is written by pairs
  - In non-XP agile teams, usually pairing is not used at all
  - A trade-off can be found
    - For some particular tasks
      - Mentoring new hires
      - Extremely high-risk tasks
      - Start of a new project when the design is new
      - When adopting a new technology
    - On a rotating monthly or weekly basis
    - Developers who prefers to pair

Scrum

- Iterations called Sprint (about 1 month)

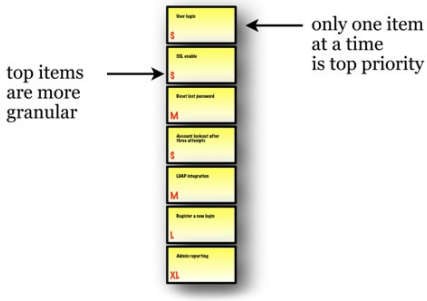


Scrum

- Roles
  - Product Owner
    - Single person
    - Responsible for products vision
    - Constantly re-prioritizes the Product Backlog
    - Accepts or rejects product increment
  - Development team
    - Self-organized
    - Negotiate commitments with the Product Owner
    - Has autonomy regarding how to reach commitments
    - Intensely collaborative
  - Master
    - Facilitates the Scrum process
    - Helps resolve issues
    - Shields the team from external inferences and distractions
    - Has no management authority

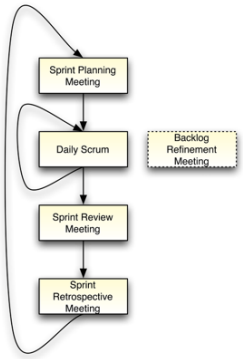
Scrum

- Product Backlog

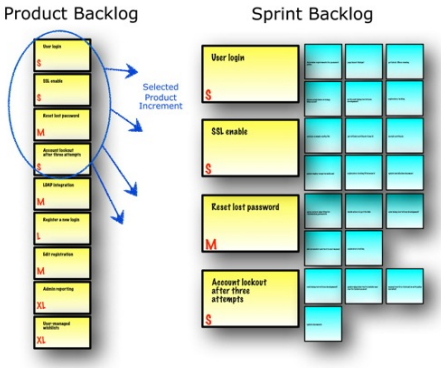


Scrum

- Sprint
  - Planning Meeting
    - Negotiate which Product Backlog items will be processed
    - Break items into a list of sprint tasks

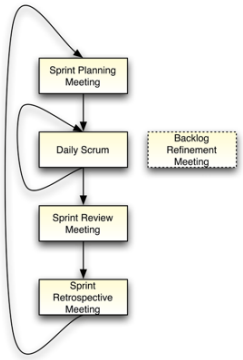


Scrum



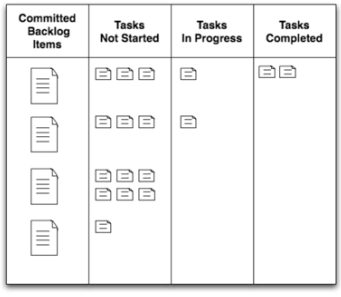
Scrum

- Sprint
  - Planning Meeting
  - Daily Meeting
    - Same time and place
    - 15 minutes, standing up
    - Summarize work of previous day, work of today, issues
    - Maintain tasks list (not started, in progress, done), issues list and burn-down chart.
    - Product Owner may attend



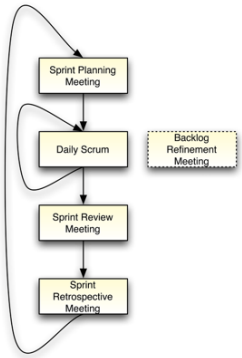
Scrum

- Sprint Backlog



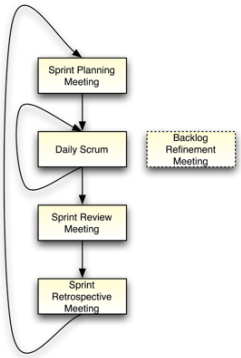
Scrum

- Sprint
  - Planning Meeting
  - Daily Meeting
  - Review Meeting
    - Demonstrate the working product increment to the Product Owner
    - Product Owner declares which items are done
    - Unfinished items return to the Product Backlog
    - Master proposes new items for the Product Backlog



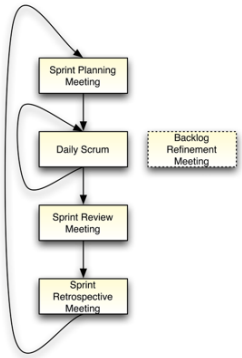
Scrum

- Sprint
  - Planning Meeting
  - Daily Meeting
  - Review Meeting
  - Retrospective Meeting
    - Team reviews its own process
    - Team takes to adapt it for futur Sprints
    - Master have to manage the psychological safety of the meetings



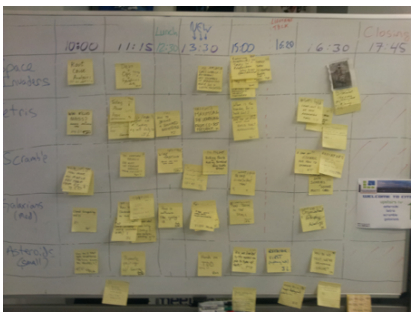
Scrum

- Sprint
  - Planning Meeting
  - Daily Meeting
  - Review Meeting
  - Retrospective Meeting
  - Backlog Refinement Meeting
    - Items are usually too large or poorly understood
    - Refine these items into smaller one
    - Master can help



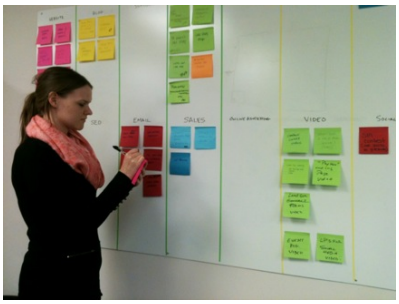
Scrum

- Feedbacks to the team: wallboard



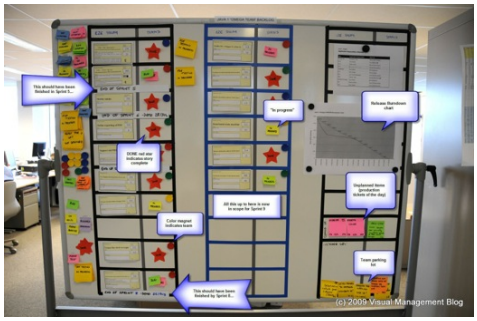
Scrum

- Feedbacks to the team: wallboard



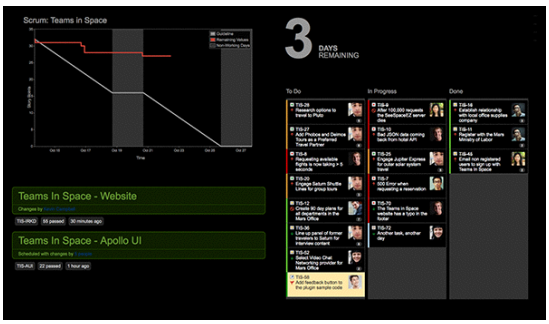
Scrum

- Feedbacks to the team: wallboard



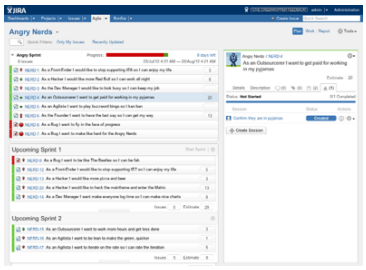
Scrum

- Feedbacks to the team: wallboard



Scrum

- Software to manage Scrum projects



http://youtu.be/KdyV9okLRlc

Conclusion

- Collaboration in software development
  - Is necessary for big projects
  - Is not obvious
    - Technical, organizational and social aspects
- Version control
  - Synchronization, versioning
  - Branching: split work between users
- Continuous integration
  - Improve safety and efficiency
- Agile method
  - Organize the team
  - Propose an adaptative process to unpredictable requirements

References

- Version control
  - http://nvie.com/posts/a-successful-git-branching-model/
  - http://www-igm.univ-mlv.fr/~dr/XPOSE2010/gestiondeversiondecentralisee/dvcs-svn.html
  - http://www.infres.enst.fr/~bellot/java/poly/git.pdf
  - http://fr.openclassrooms.com/informatique/cours/gerez-vos-codes-source-avec-git/qu-est-ce-qu-un-logiciel-de-gestion-de-versions
- Continuous Integration
  - http://martinfowler.com/articles/continuousIntegration.html
- Agile Models
  - http://agilemanifesto.org
  - http://martinfowler.com/articles/newMethodology.html
- Pair Programming
  - http://www.versionone.com/Agile101/Pair_Programming.asp
- Scrum
  - http://scrumreferencecard.com