Groupware and Collaborative Interaction

Collaborative Software Development

M2R Interaction / Université Paris-Sud / 2018 - 2019

Cédric Fleury (cedric.fleury@lri.fr)

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
- Software development methods

Outline

Collaborative software development

Version control

Continuous integration

Software development 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

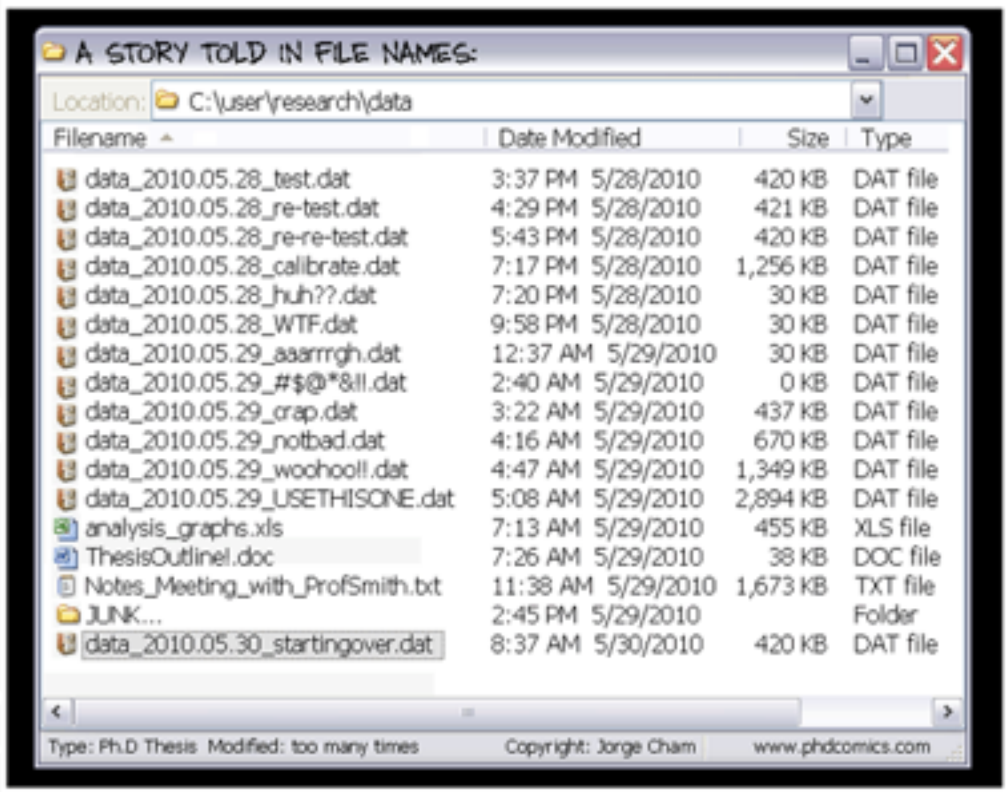
We want to able to:

- 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

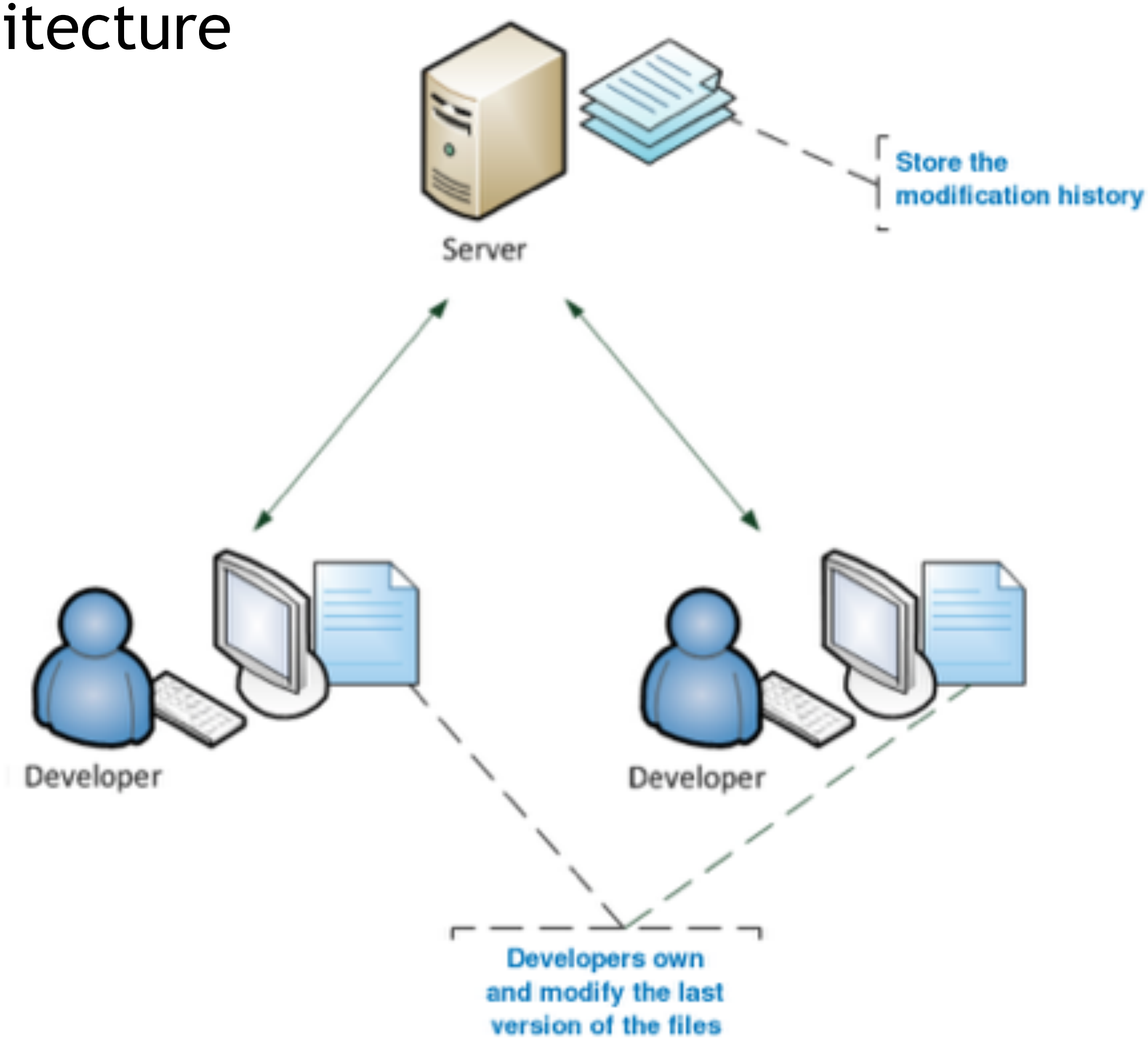
2 kinds of architecture

- 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

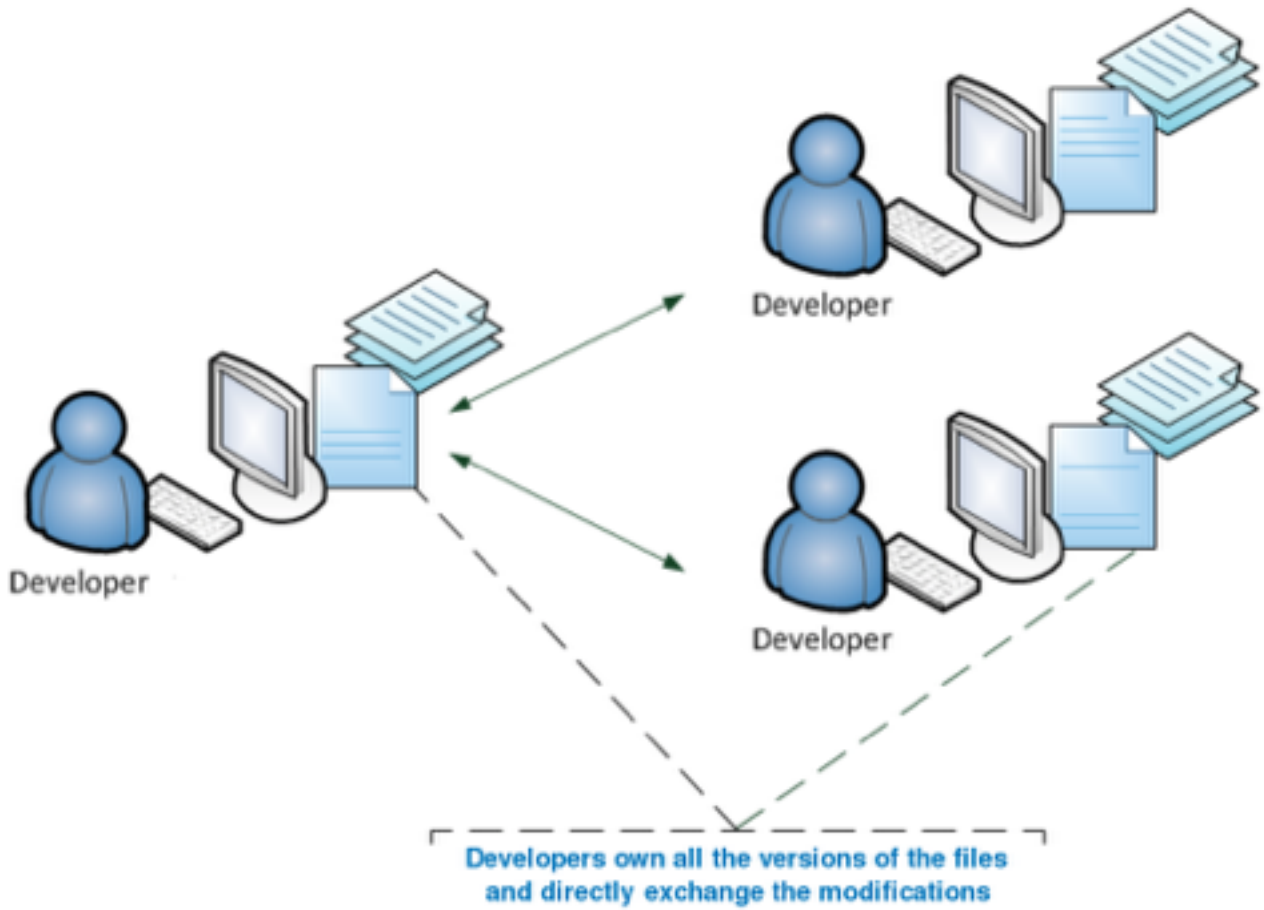
Version control

Centralized architecture



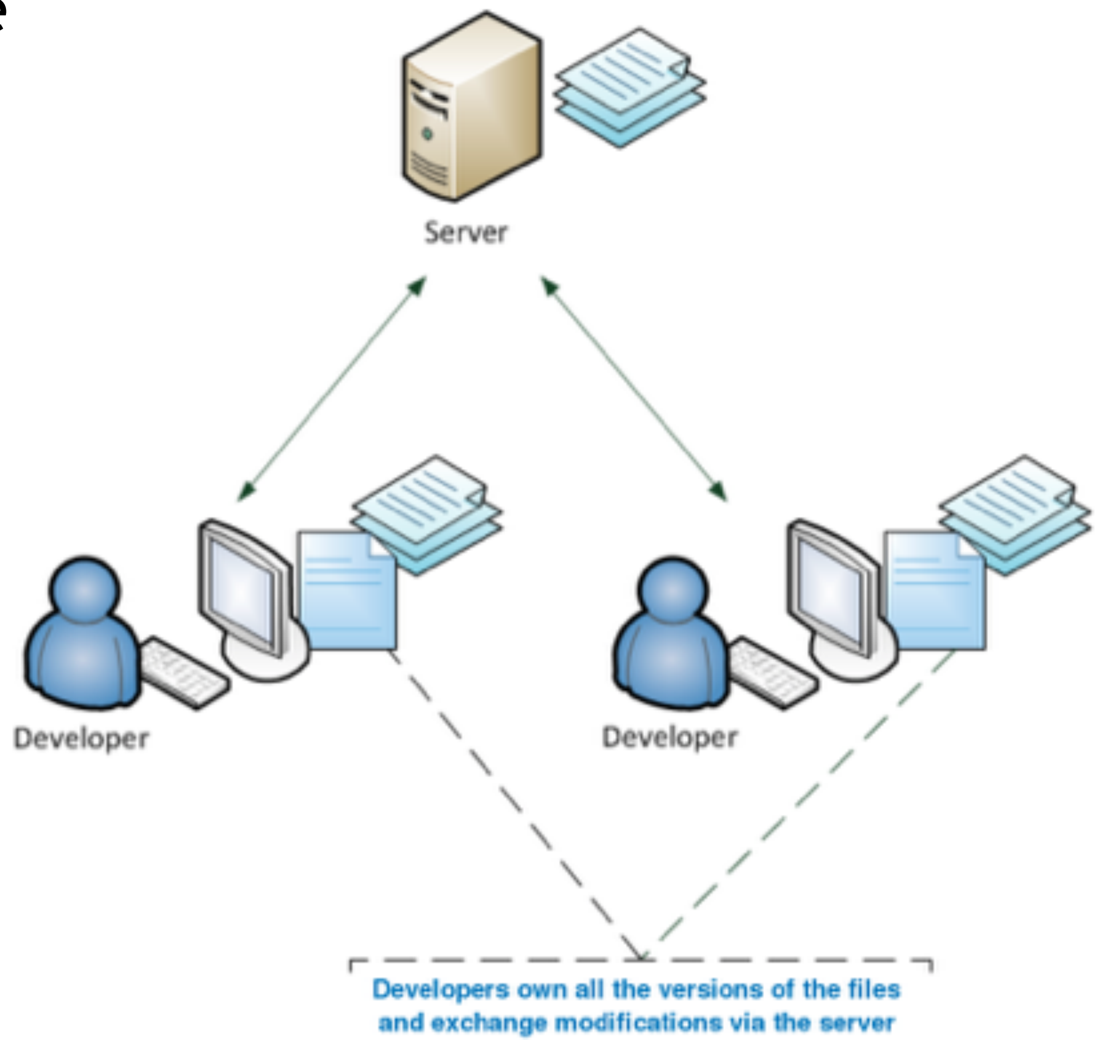
Version control

Decentralized architecture



Version control

Hybrid architecture

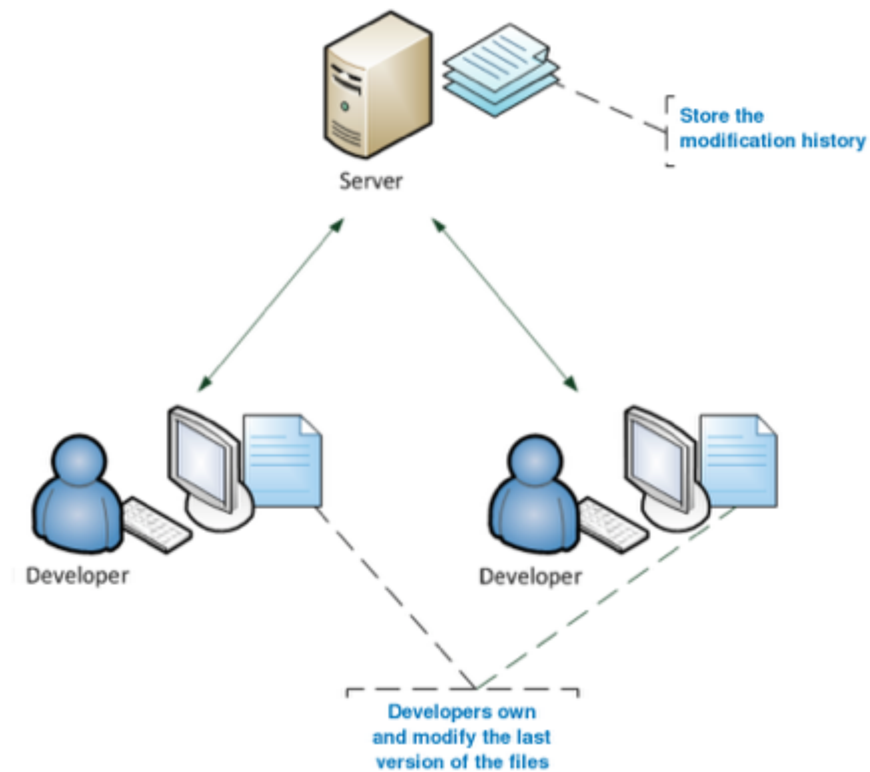


Version control

Vocabulary (SVN)

- Architecture
  - Repository
  - Working copy
- Actions
  - Checkout
  - Update
  - Commit
  - Revert
  - Diff, log, status

Centralized Architecture



Version control

Drawbacks of the centralized architecture

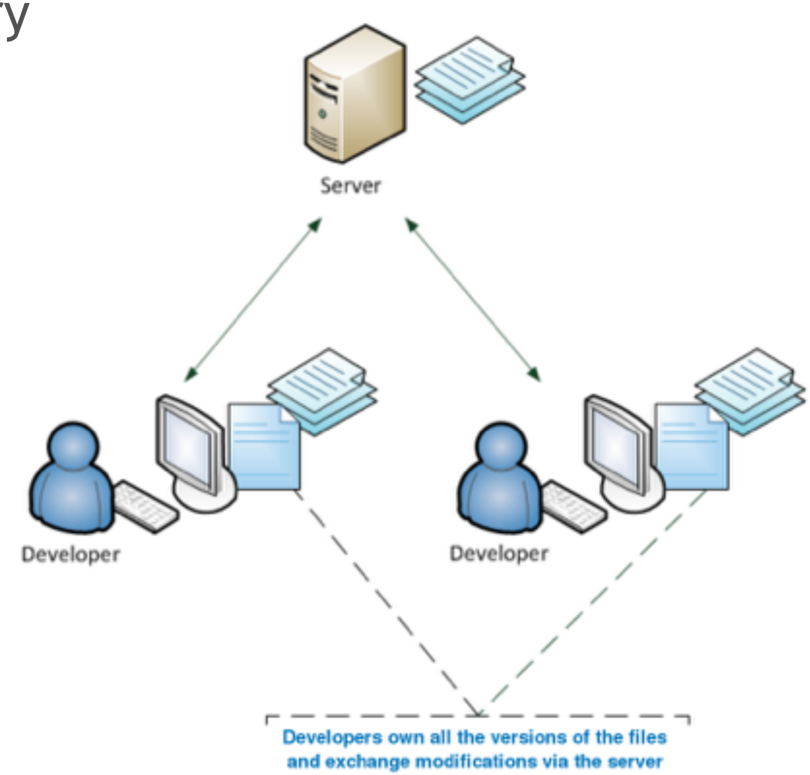
- Just one access point to the data
- Just one communication point between users
- Just one historic of the files
- Versioning and sharing are the same operation
  - Need to have a stable state before "committing"

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

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

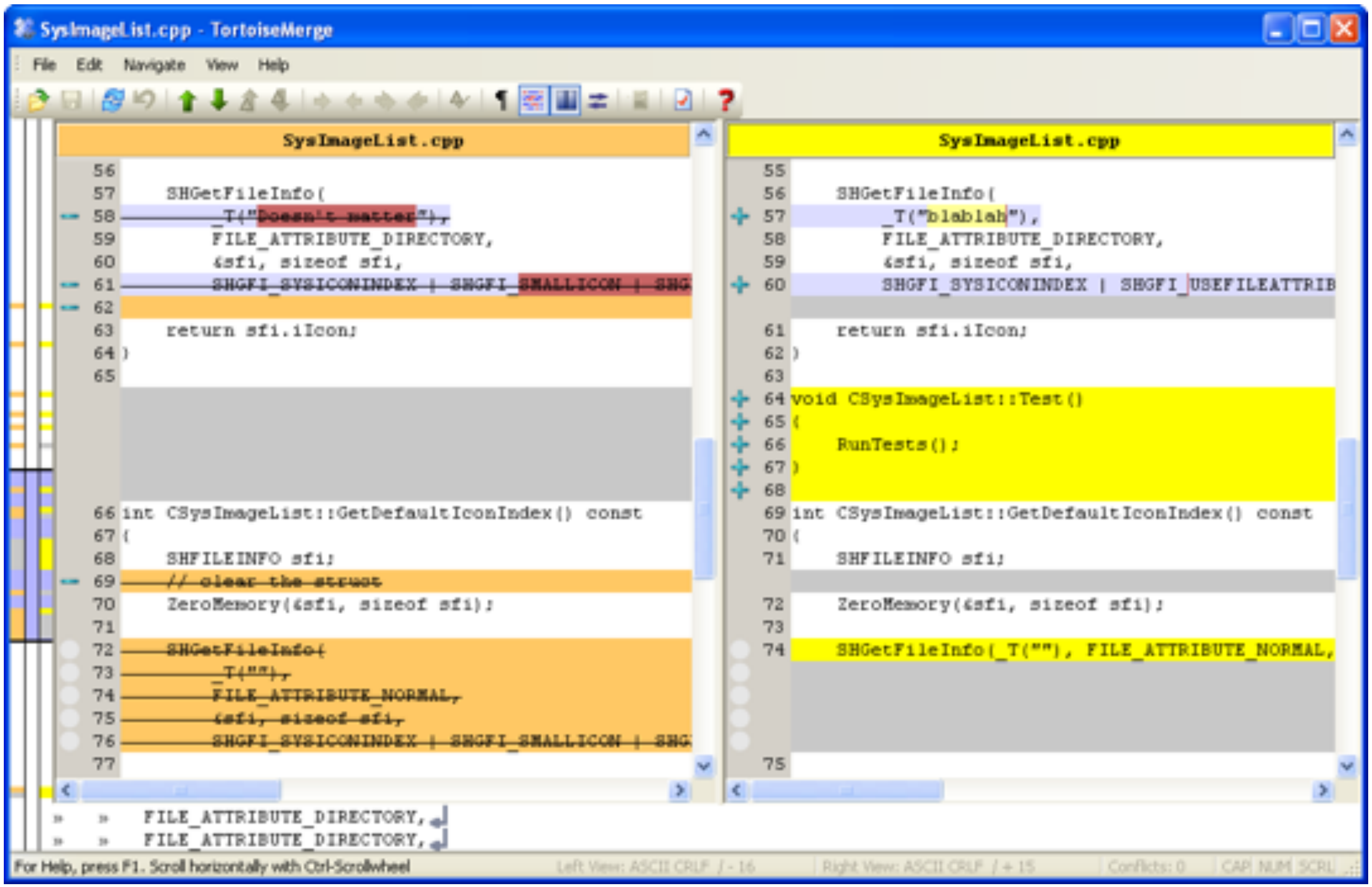
```
08/10/2010  11:44 AM                      94 test.txt
08/10/2010  11:44 AM                      26 test.txt.mine
08/10/2010  11:44 AM                      27 test.txt.r2
08/10/2010  11:44 AM                      31 test.txt.r3
```

test.txt

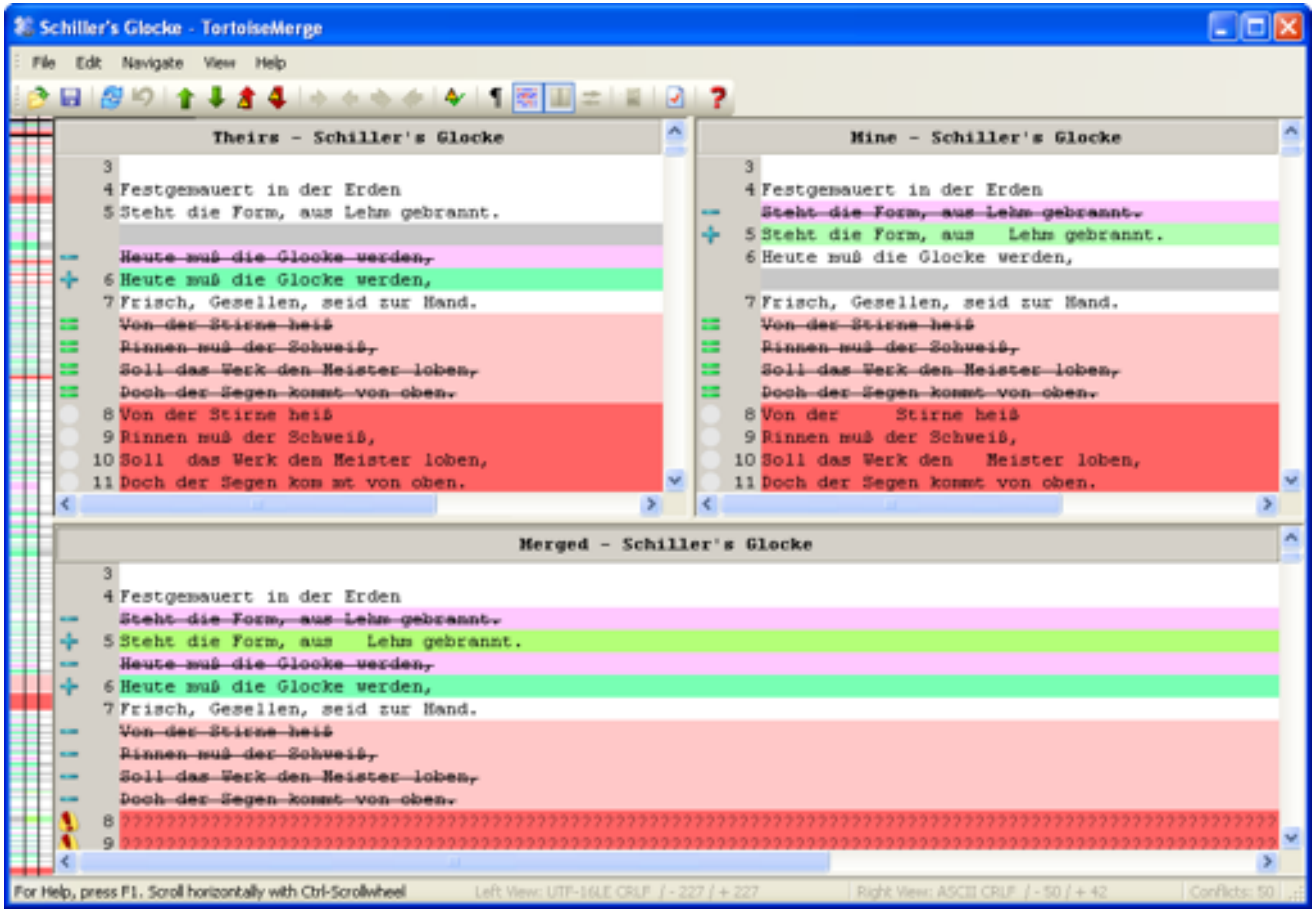
```
<<<<<<< .mine
test User2 making conflict
=======
User1 am making a conflict test
>>>>>>> .r3
```

Version control

Tools for conflict management (TortoiseMerge)

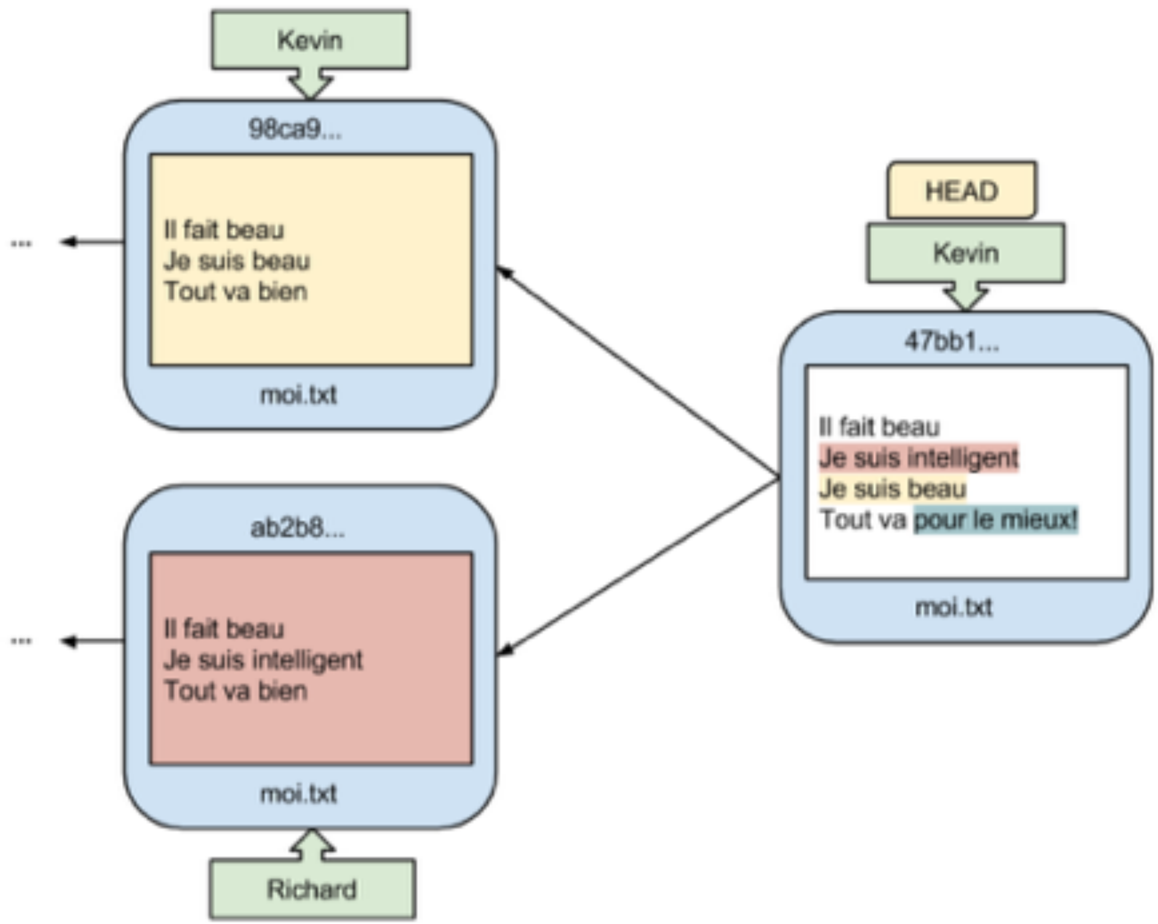


Tools for conflict management (TortoiseMerge)



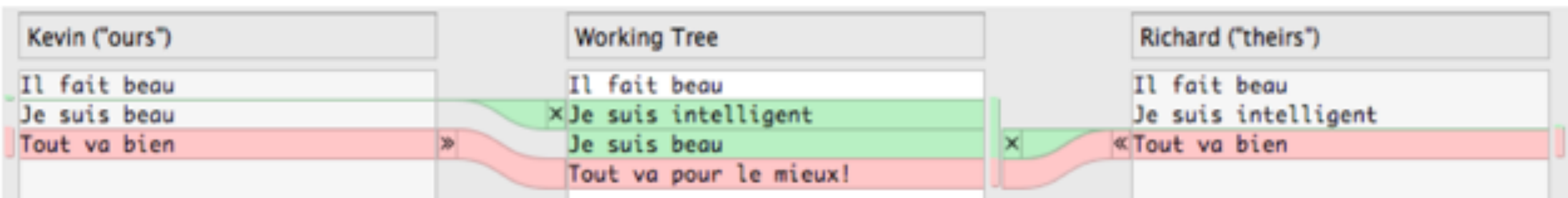
Version control

Tools for conflict management (SmartGit)



Version control

Tools for conflict management (SmartGit)



Version control

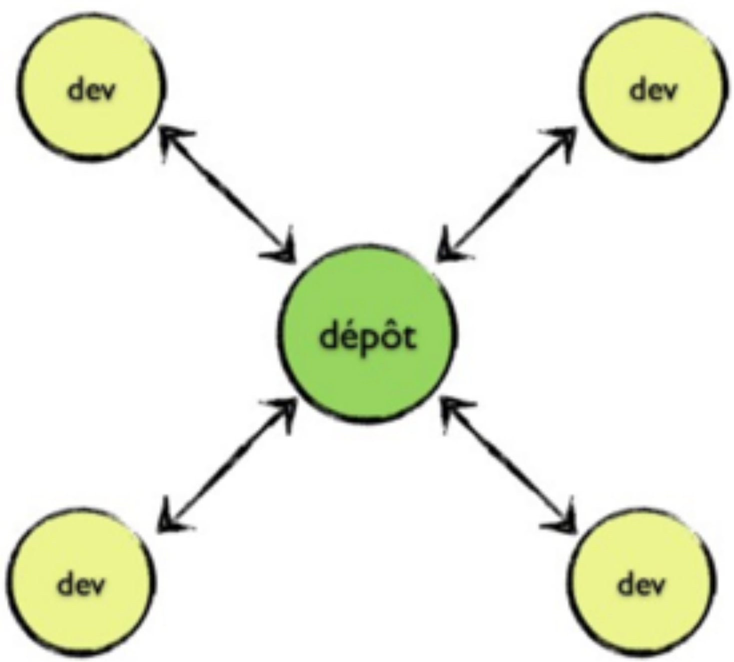
Conflicts management

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.

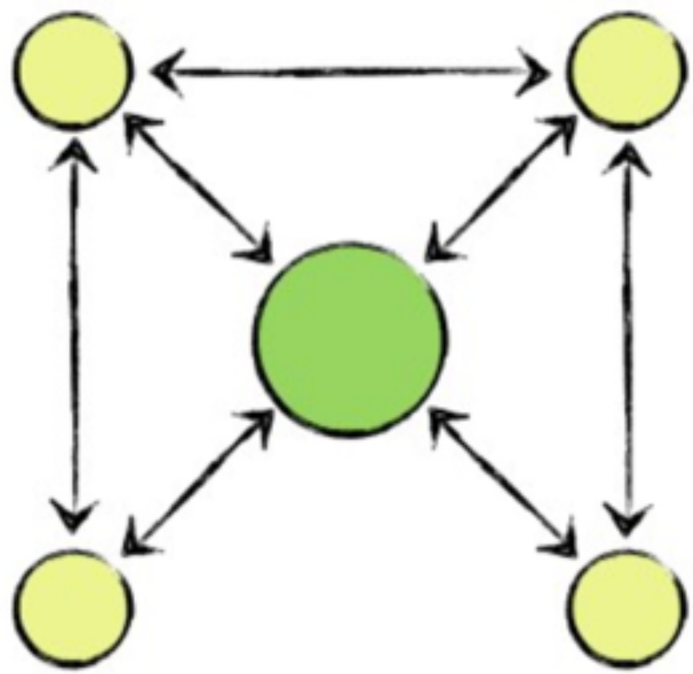
Version control

Collaboration scenario : centralized (SVN)



Version control

Collaboration scenario : decentralized (Git)



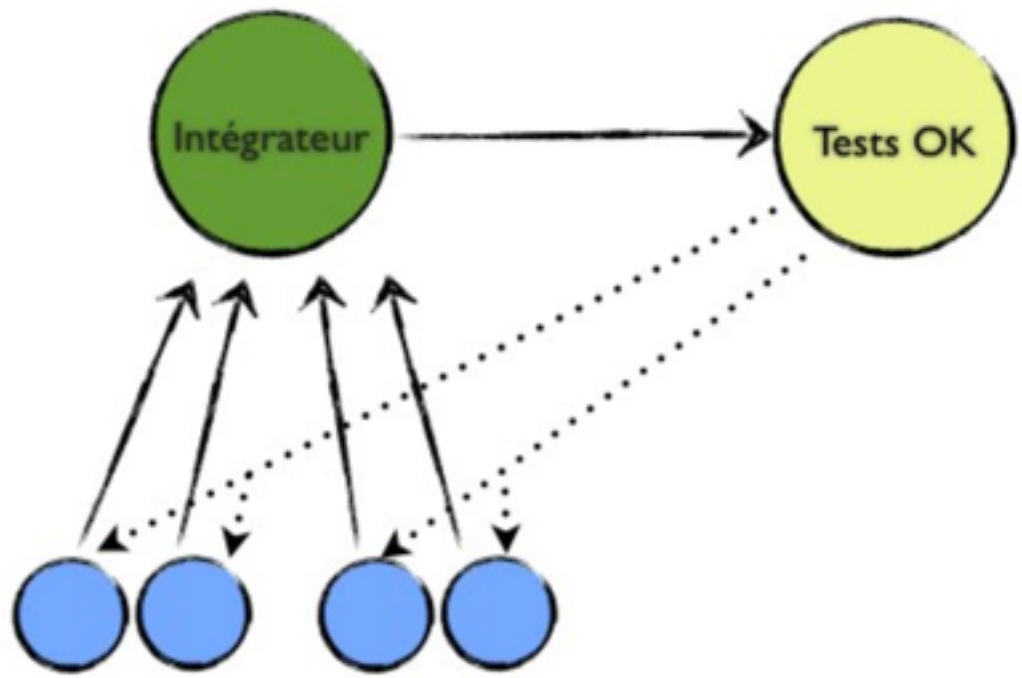
Inter-personal communications

Version control

Collaboration scenario : decentralized (Git)

Integrator mode

A repository
is in charge
of the test

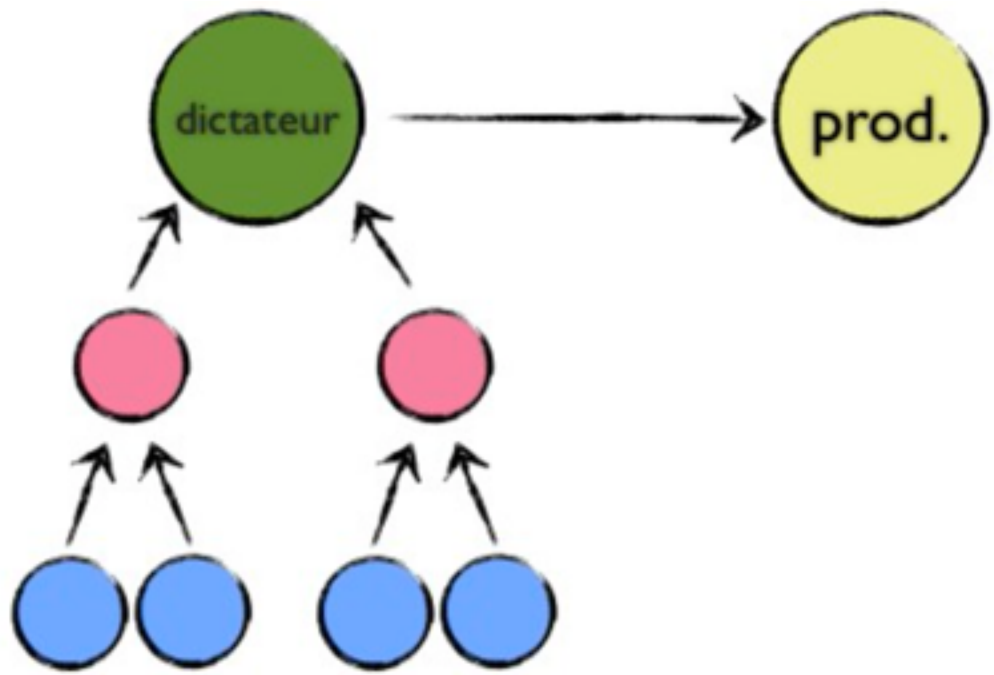


Version control

Collaboration scenario : decentralized (Git)

Dictator mode

- Open-source projects
- "Lieutenants" make a first check before sending to the "dictator"

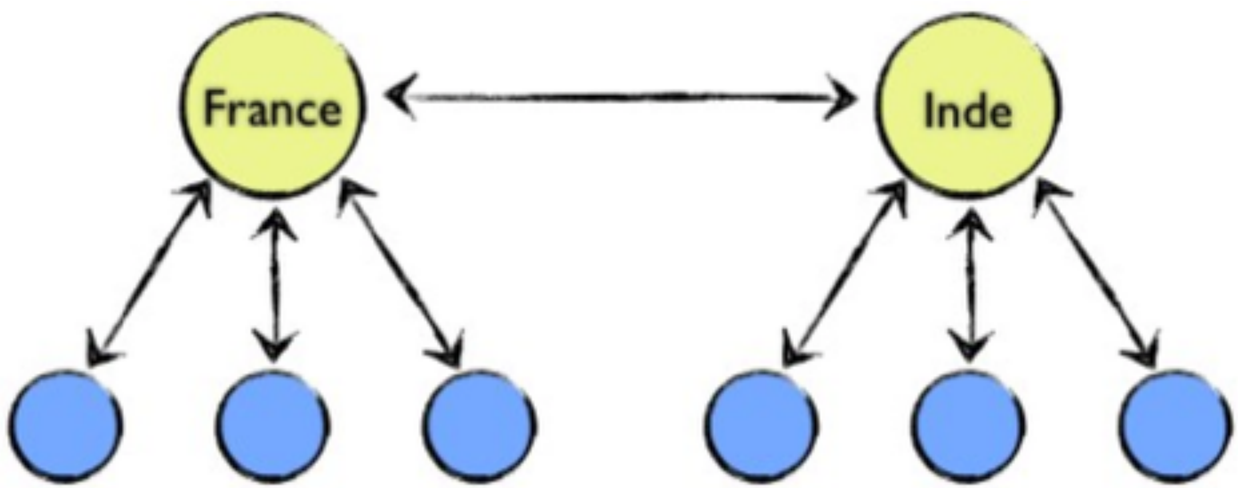


Version control

Collaboration scenario : decentralized (Git)

Multi-location team

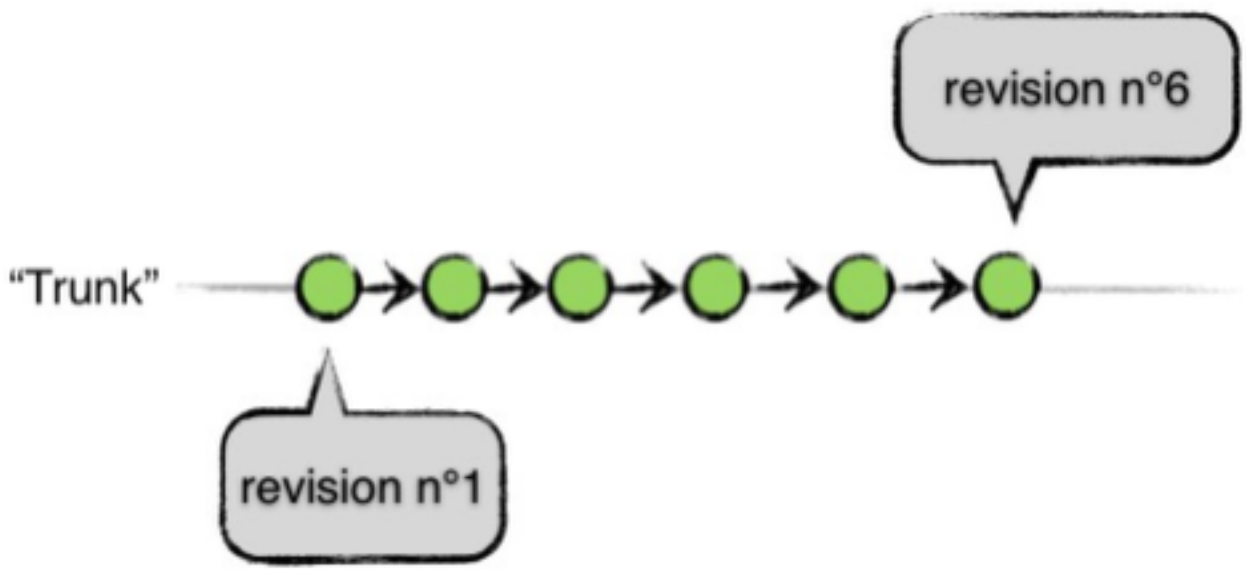
- Each team can work independently
- Regular integration of the work of each team can be done



Version control

Historic management

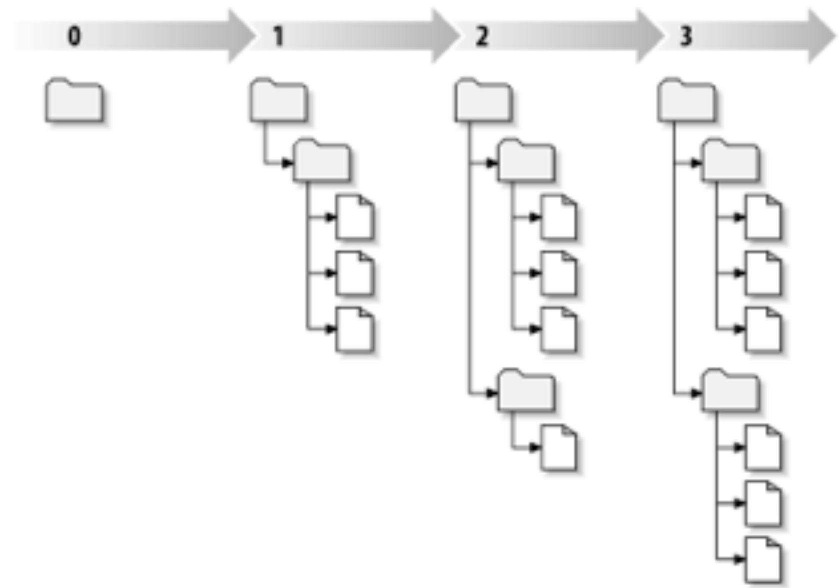
- Computation of the historic is linear according to the "commit" order



Version control

Historic management

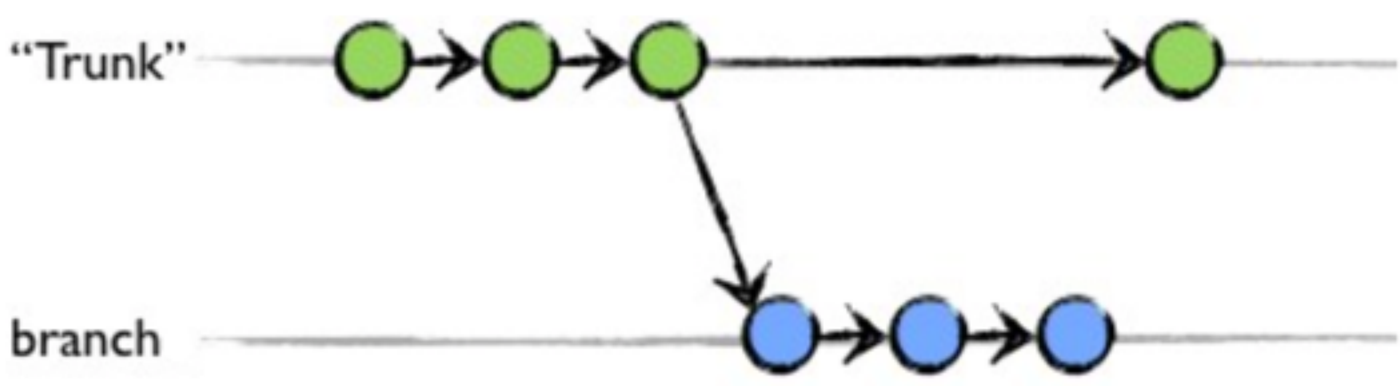
- SVN assigns a revision number to all the project
- Git assigns a revision number peer file



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

Version Control

Branch management



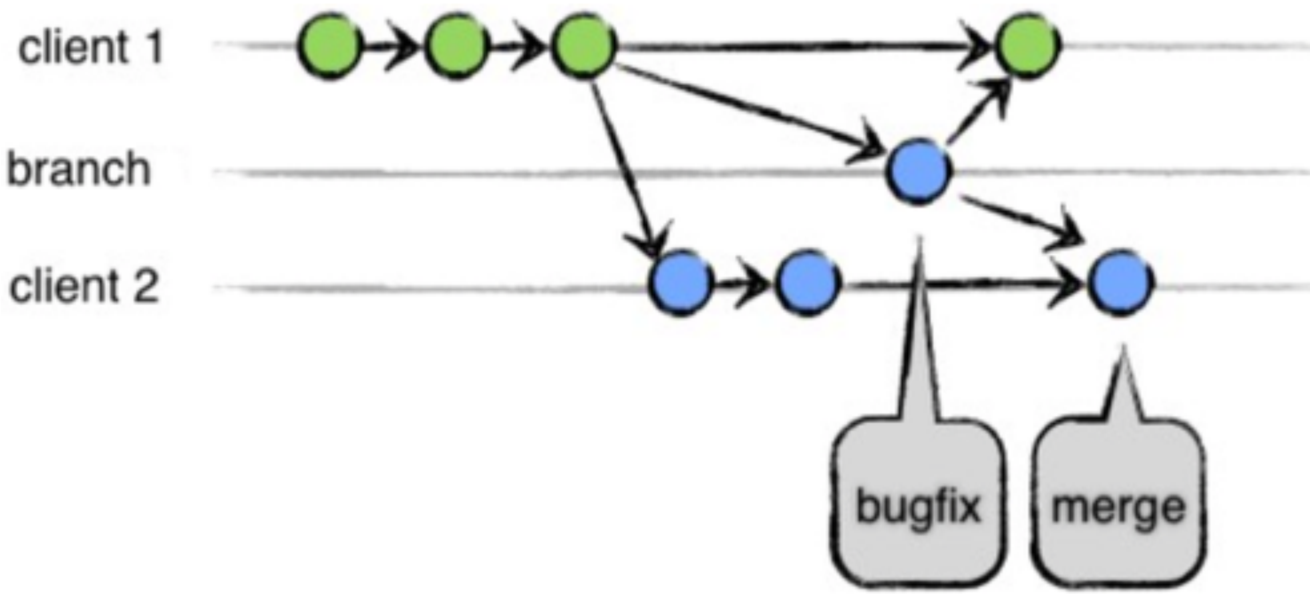
SVN make a copy of the all repository

Git make a link to a particular state of the files

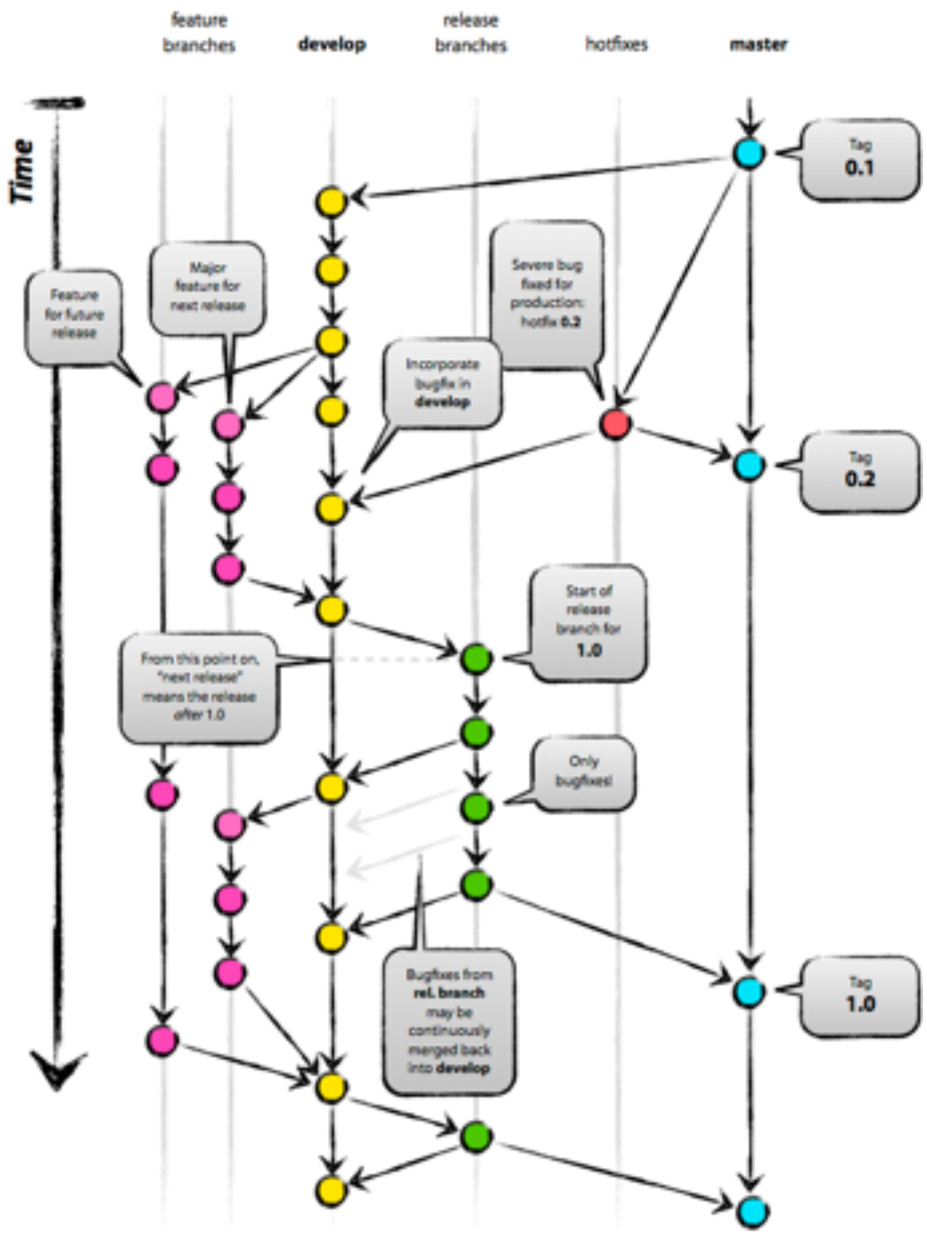
Version Control

Branch management

Merging branch (very complex to achieve with SVN)



Version Control



Branch management

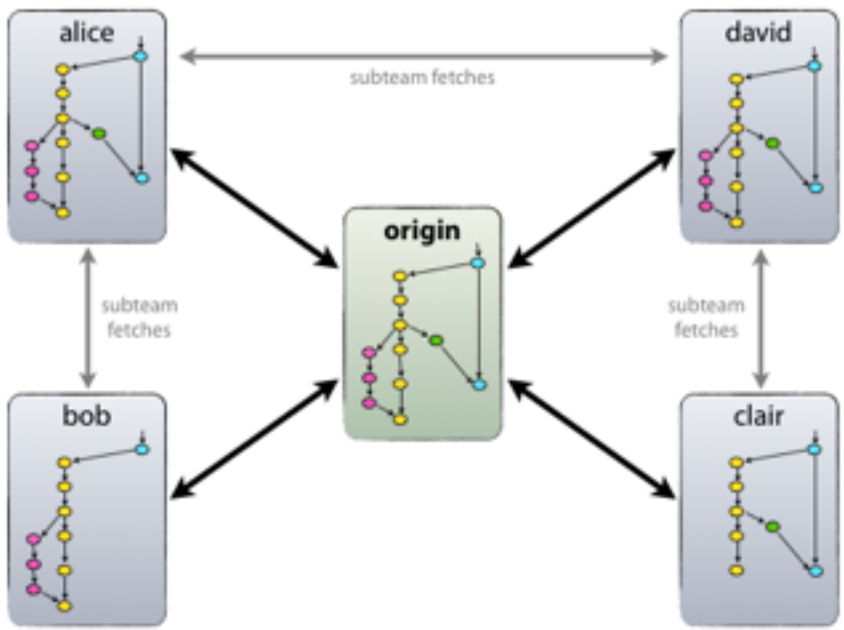
Classical organisation of a project into branches

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

Software development methods

Continuous integration

Integration

- Merging the work of several developers

Goals

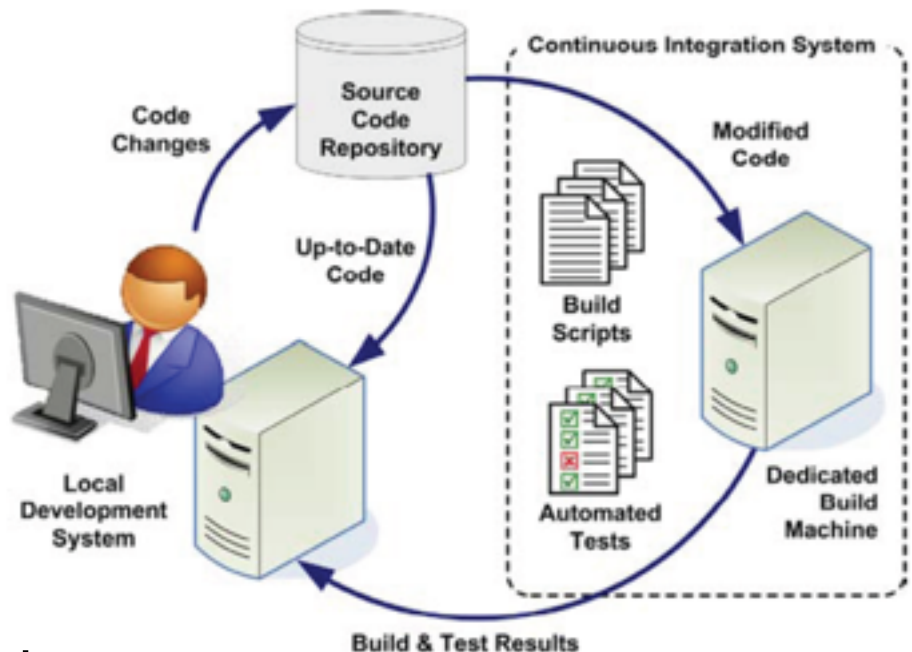
- Test modifications form the beginning
- Detect integration problems at an early stage
- Avoid fastidious integration phases
- Always have the system running
  - Tests, demos, discussion with the customers

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

Software development methods

Software development

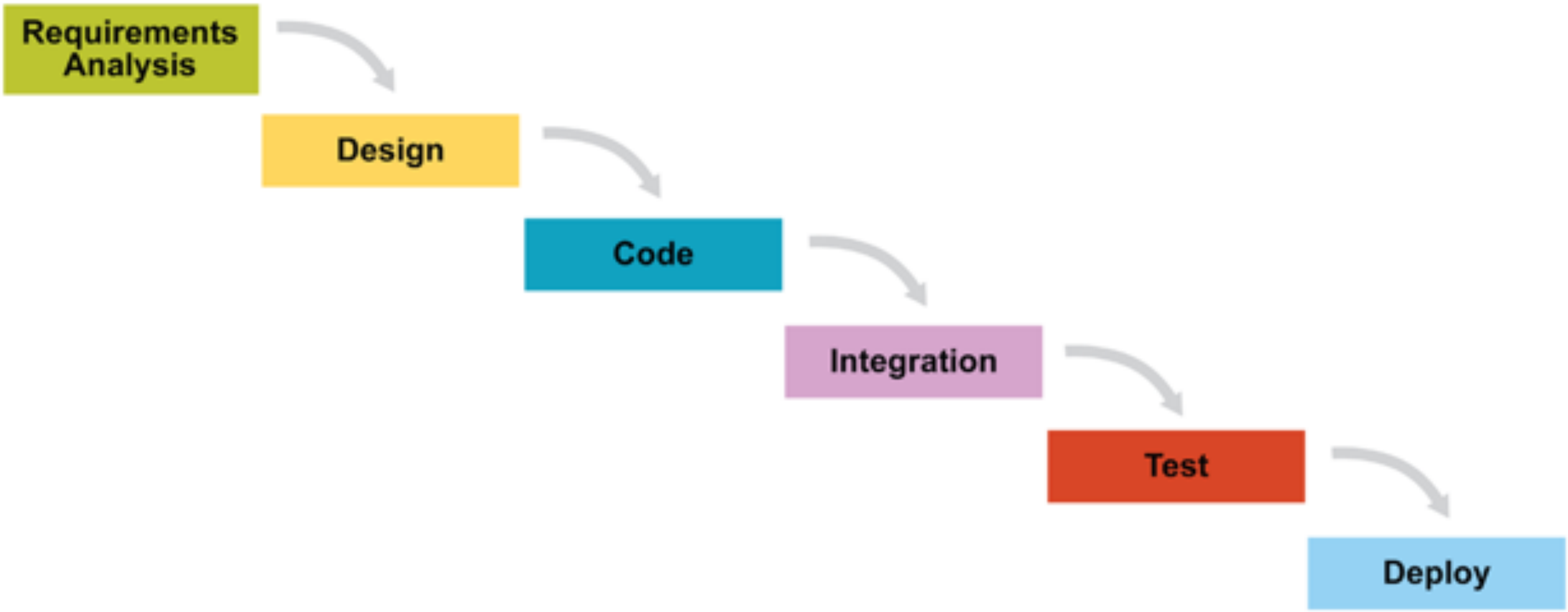
Methods for software development

- 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

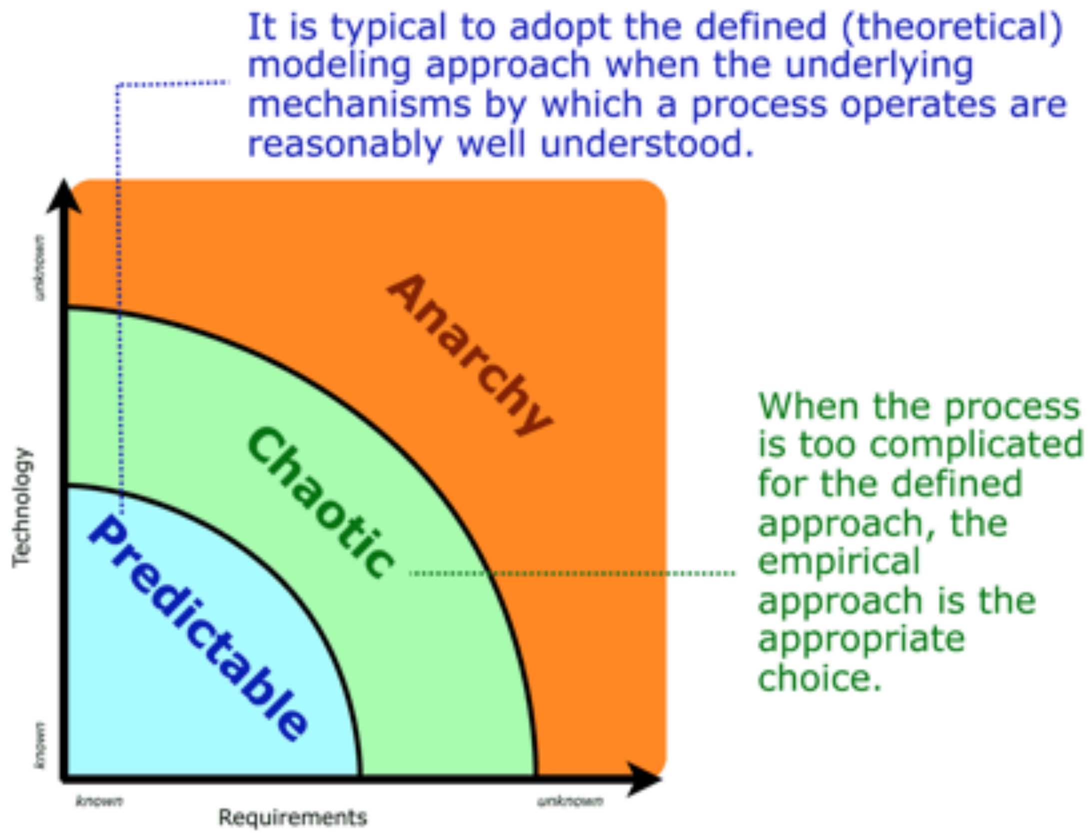
- Usually, requirements are unpredictable
  (especially for software involving interactions with users)
  - Customers don't precisely know what they want
  - Hard to evaluate the cost of different options
  - Hard to estimate which features are useful

⇒ Requirements should be flexible in these cases

Video

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

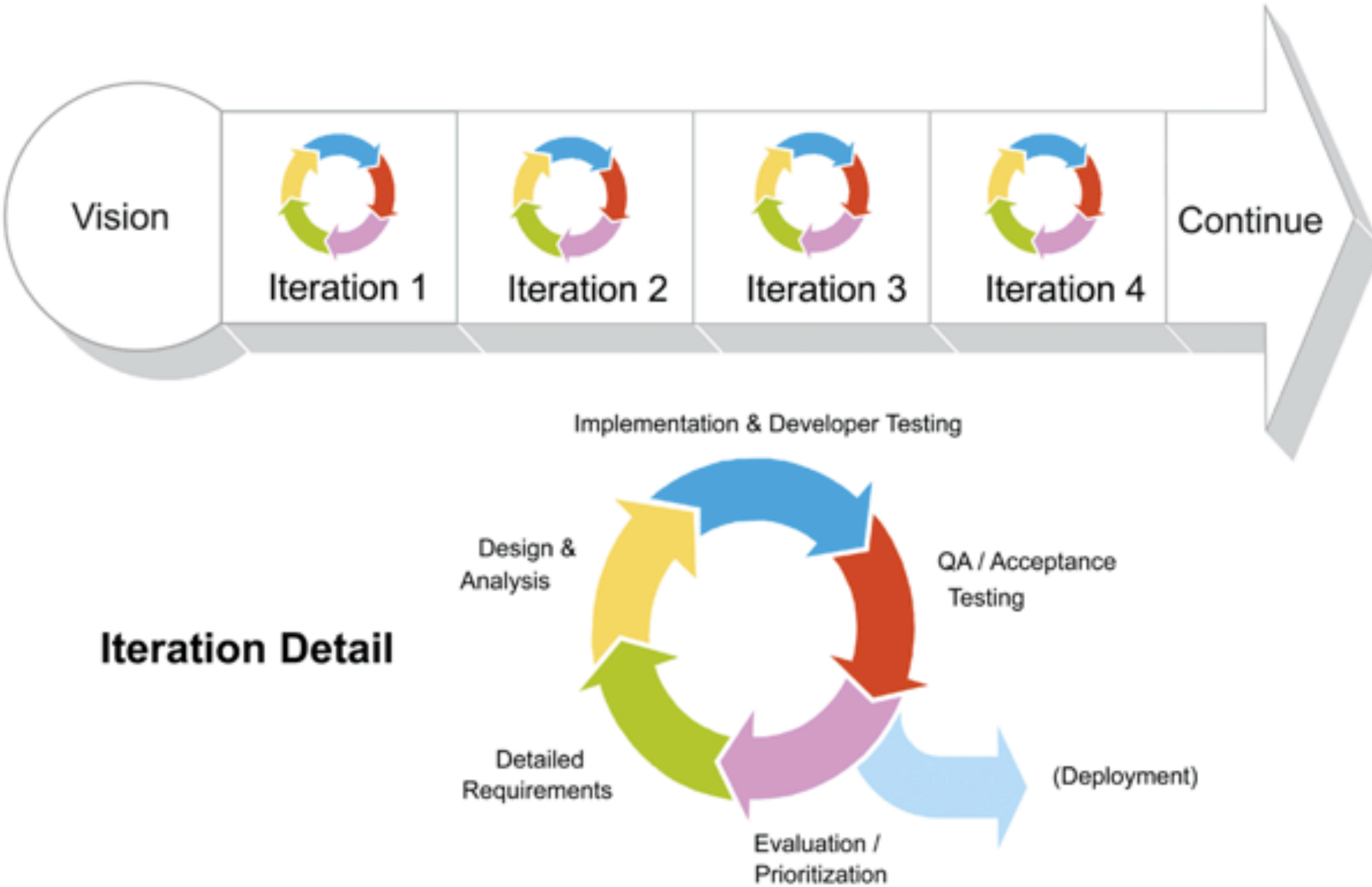
Working software over comprehensive documentation

Customer collaboration over contract negotiation

Responding to change over following plan

http://agilemanifesto.org

Agile methods

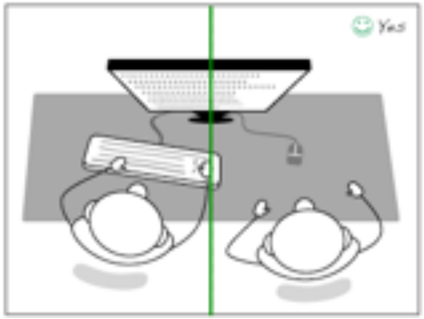


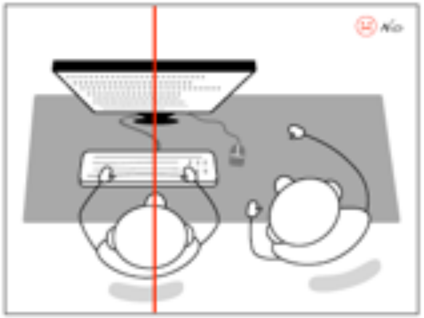
Agile methods

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

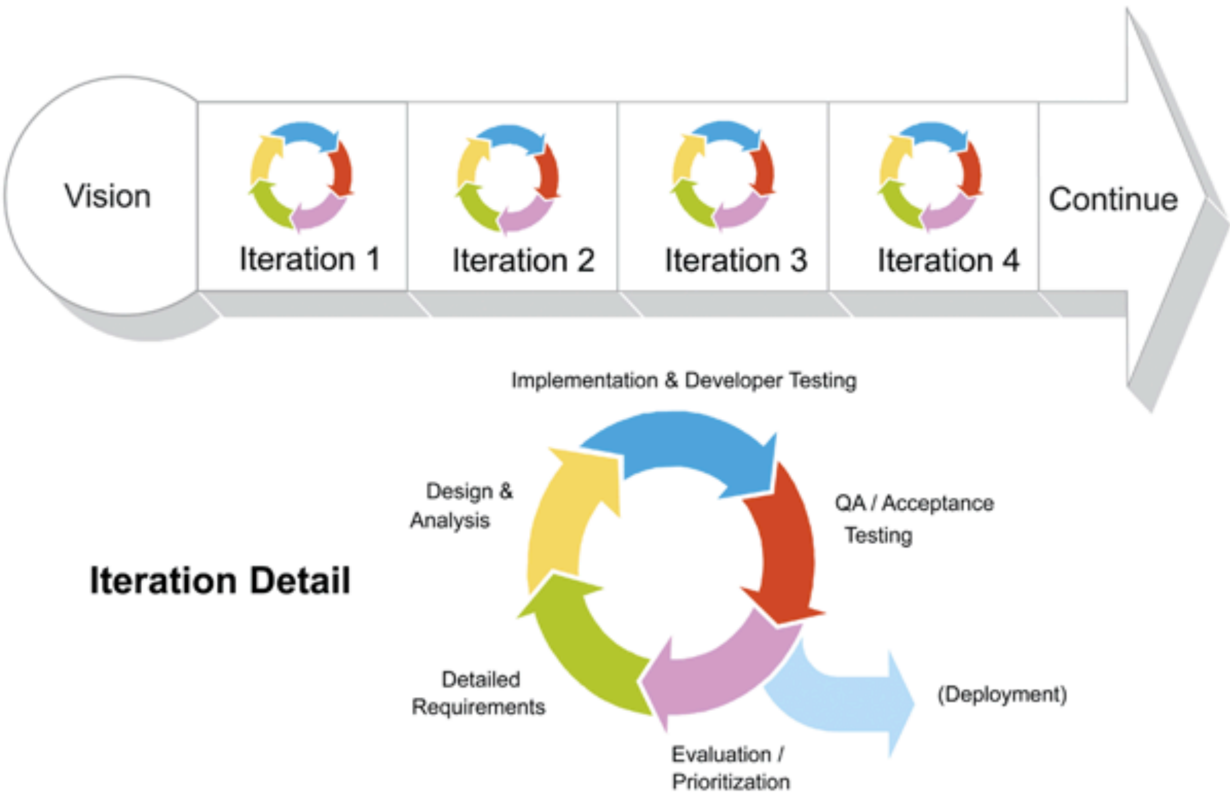
Pair programming

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

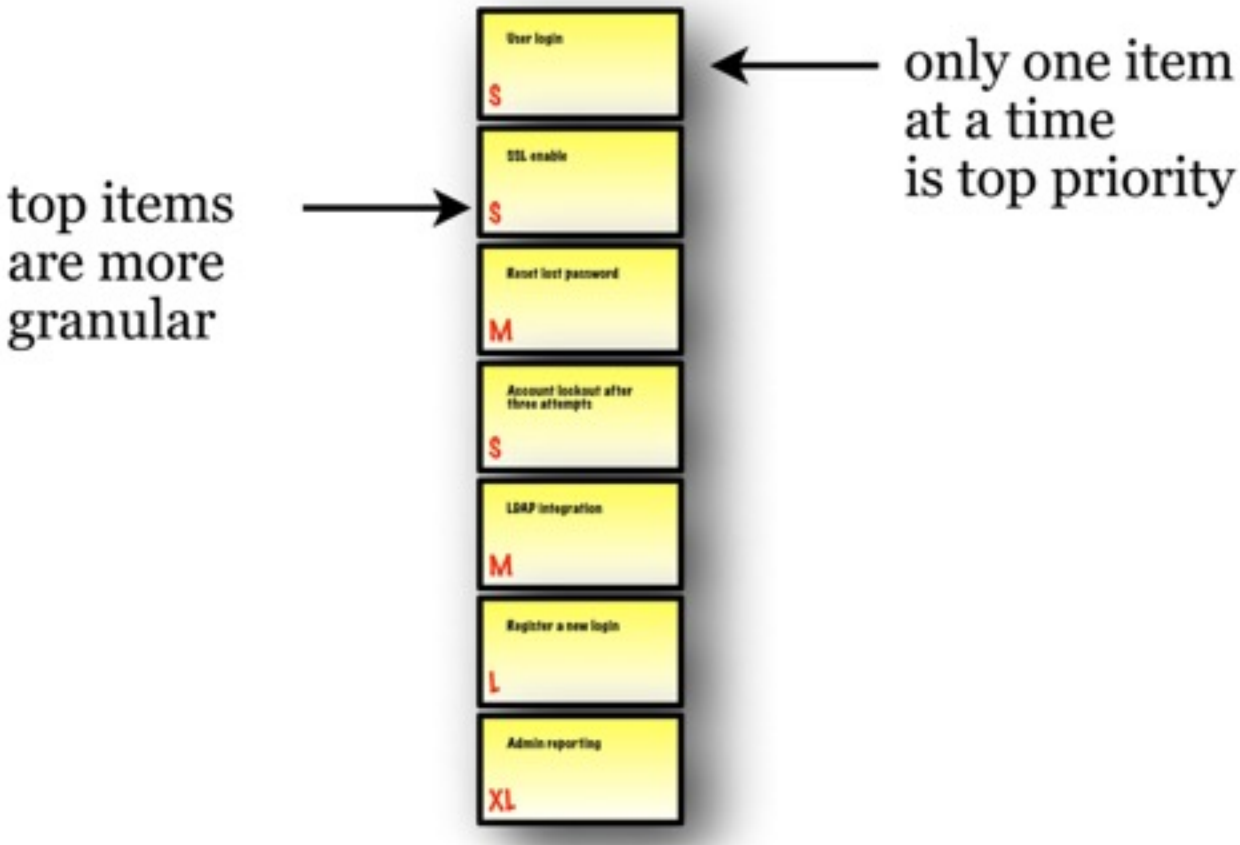
Development team

- 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

Product Backlog



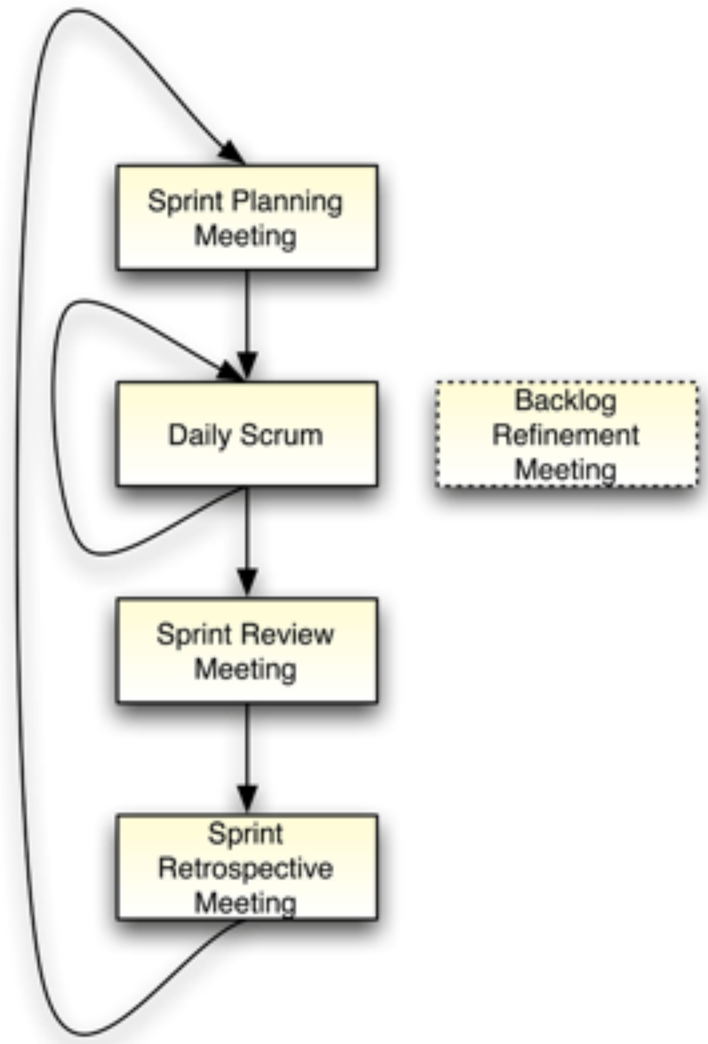
Scrum

Sprint

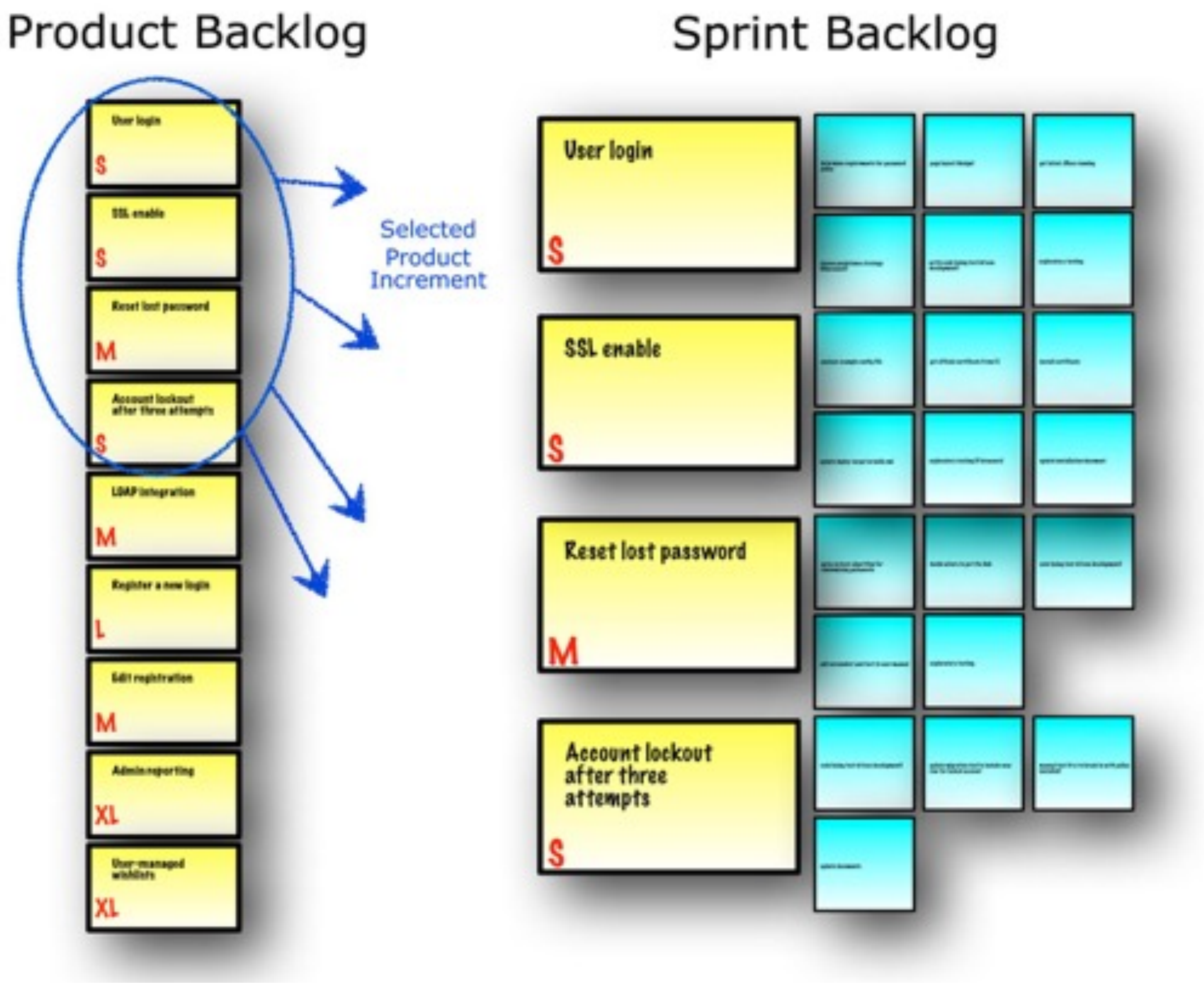
Planning Meeting

Negotiate which Product Backlog items will be processed

Break items into a list of sprint tasks



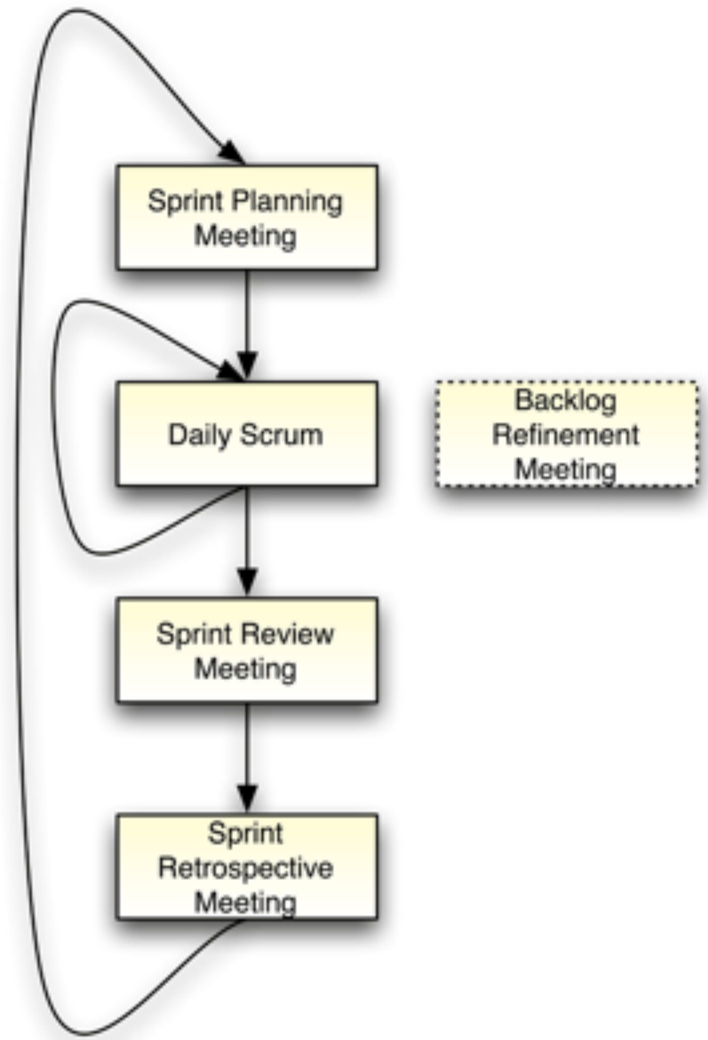
Scrum


Product Backlog
Sprint Backlog
User login
S
SSL enable
S
Reset lost password
M
Account lockout after three attempts
S
LDAP integration
M
Register a new login
L
Edit registration
M
Admin reporting
XL
User-managed wishlists
XL
Selected Product Increment
User login
S
SSL enable
S
Reset lost password
M
Account lockout after three attempts
S

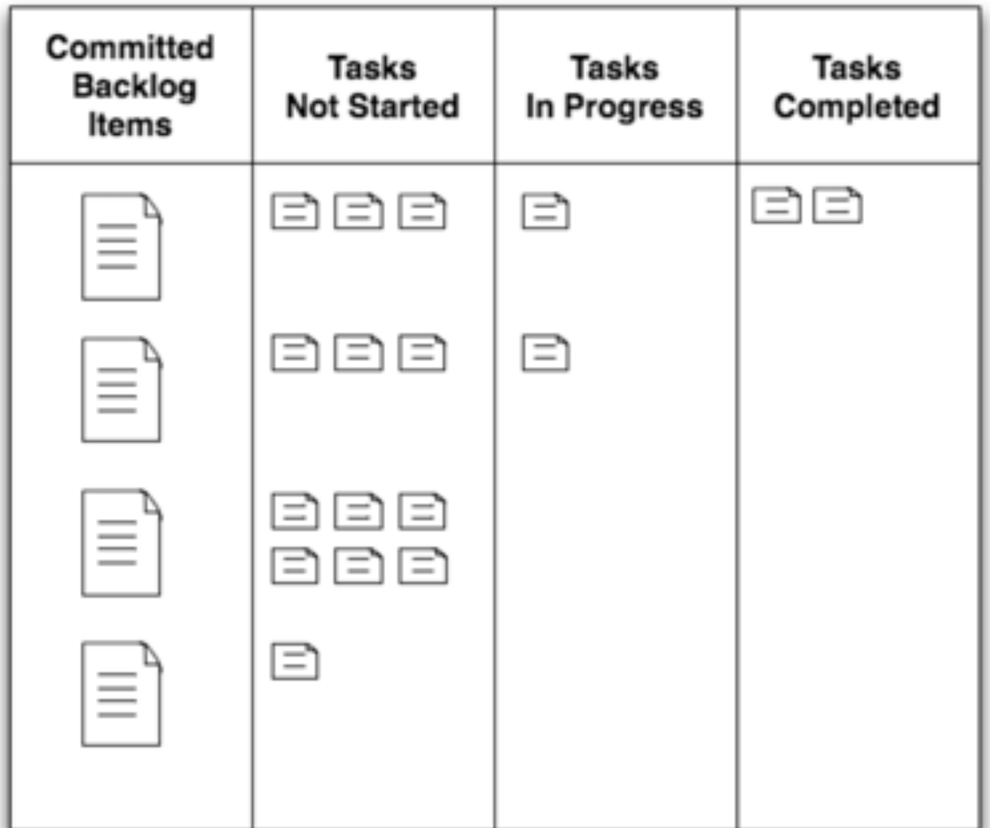
Scrum

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



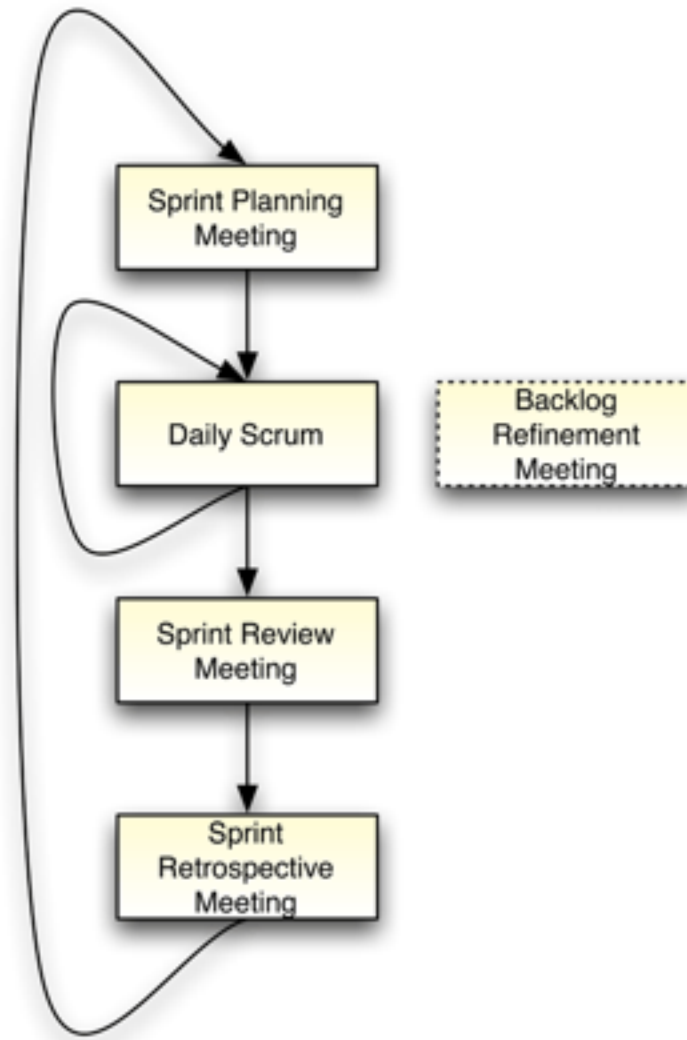
Sprint Backlog



Scrum

Sprint

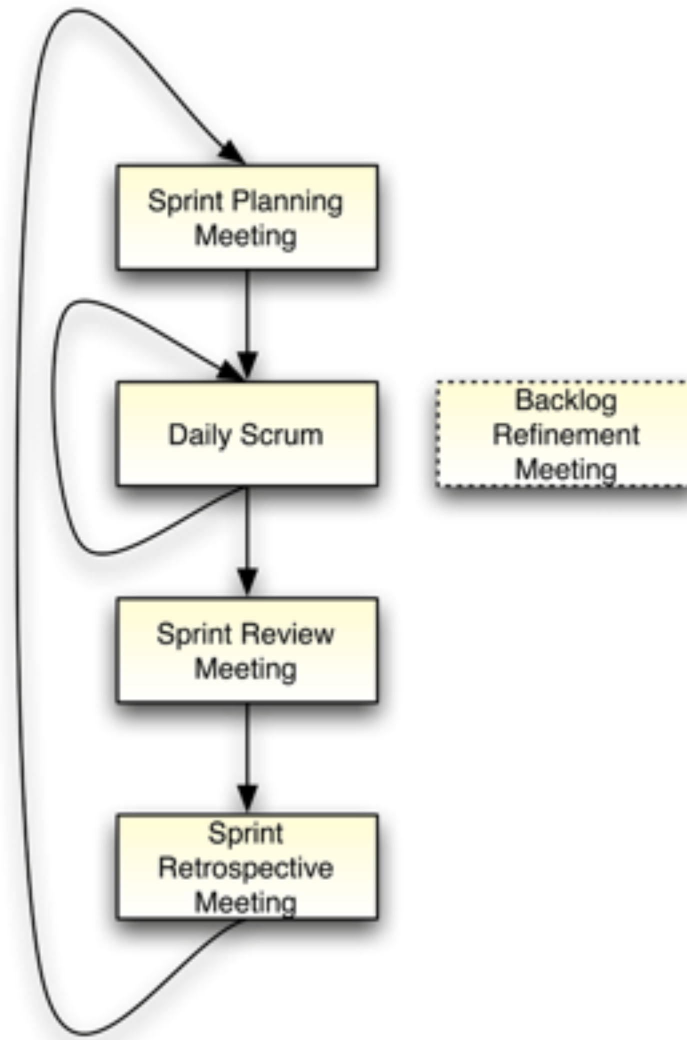
- Planning Meeting
- Daily Meeting
- Review Meeting
  - Demonstrate the working product increment to the Product Owner
  - Product Owner declares which items are done
  - Unfinished items return to the Product Backlog
  - Master proposes new items for the Product Backlog



Scrum

Sprint

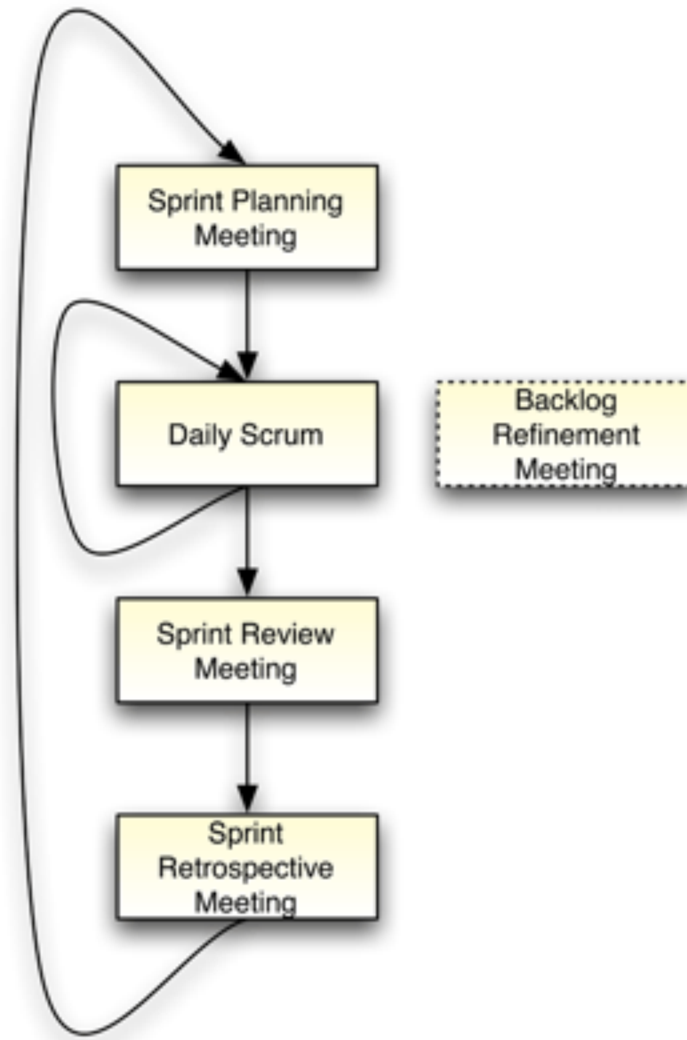
- Planning Meeting
- Daily Meeting
- Review Meeting
- Retrospective Meeting
  - Team reviews its own process
  - Team takes to adapt it for futur Sprints
  - Master have to manage the psychological safety of the meetings



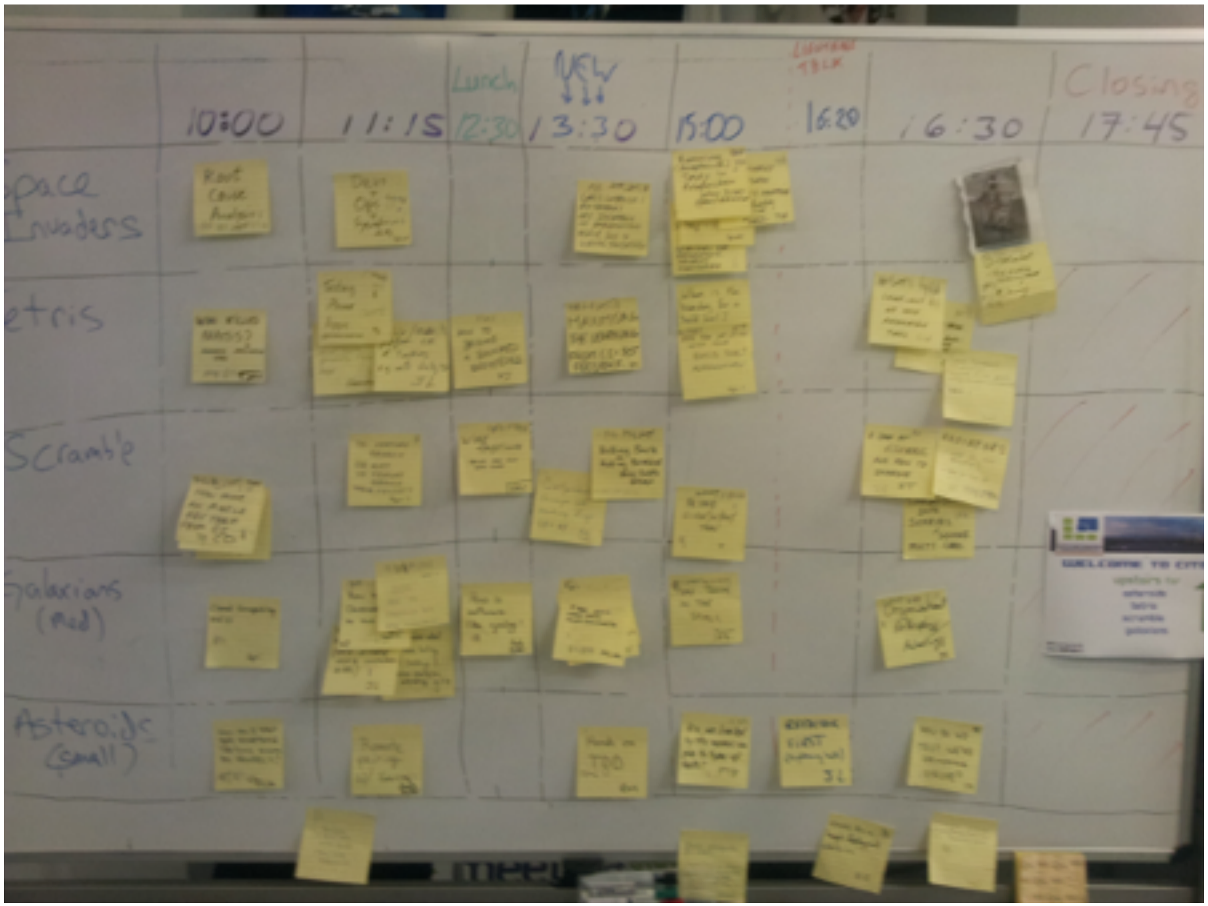
Scrum

Sprint

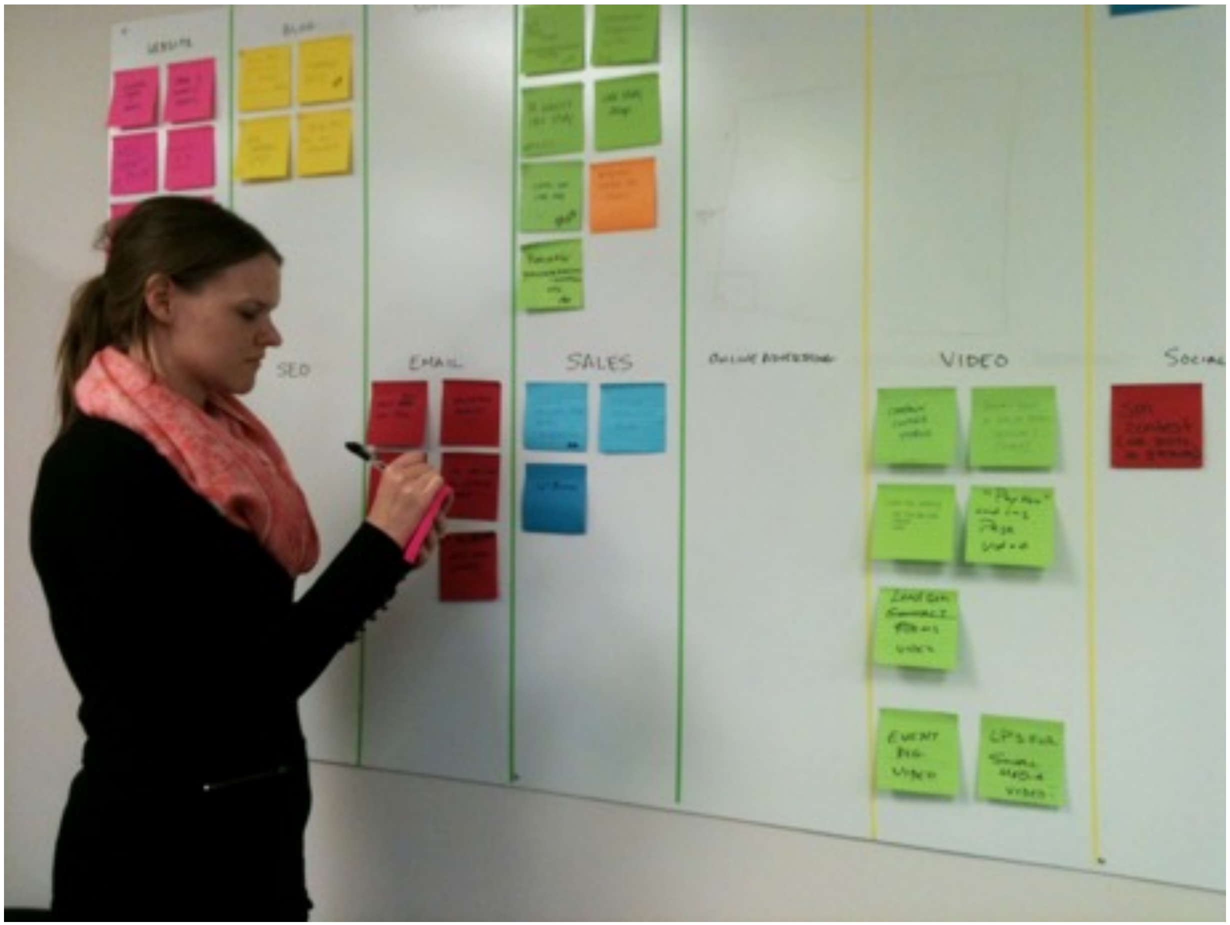
- Planning Meeting
- Daily Meeting
- Review Meeting
- Retrospective Meeting
- Backlog Refinement Meeting
  - Items are usually too large or poorly understood
  - Refine these items into smaller one
  - Master can help



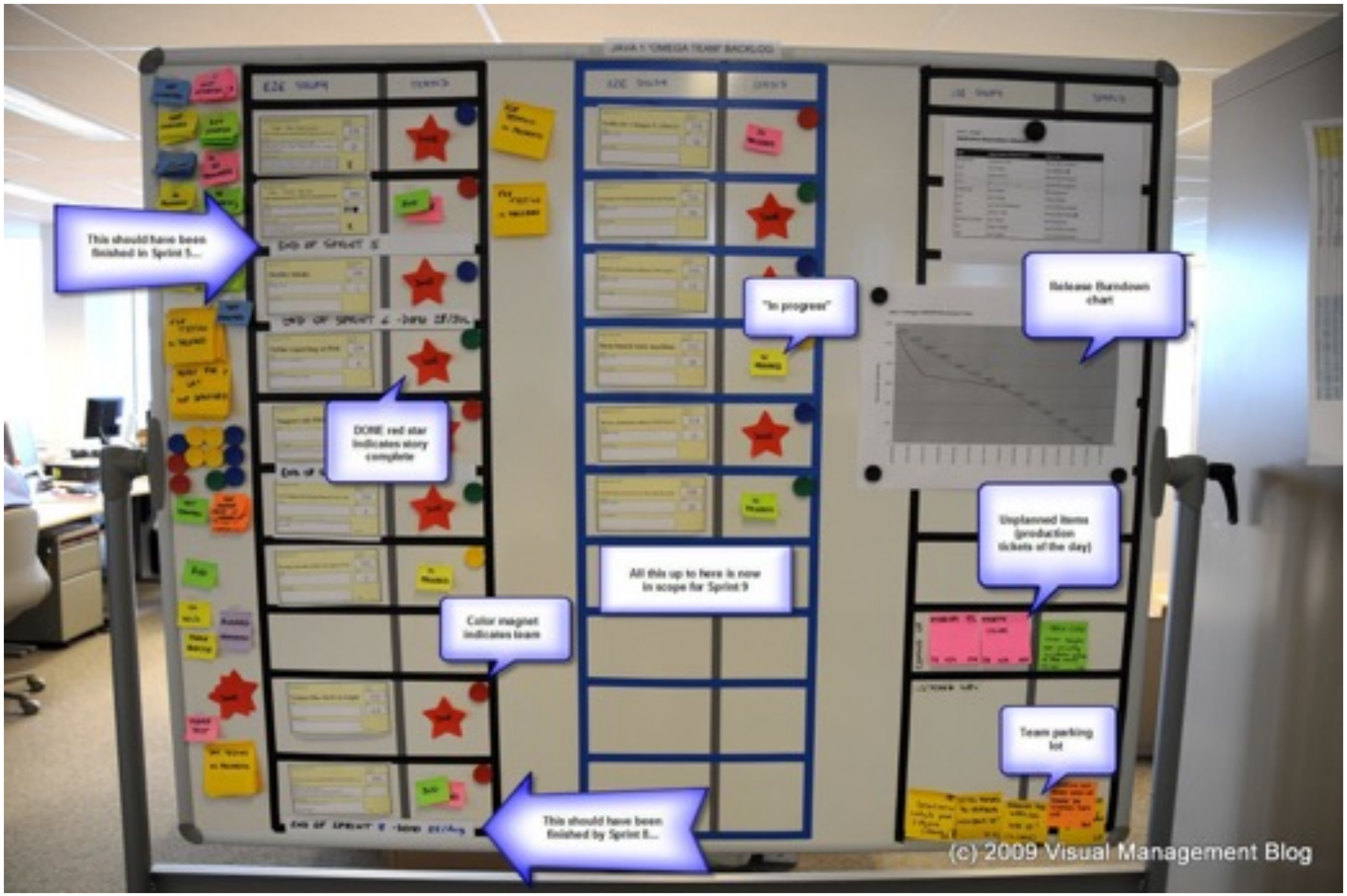
Feedbacks to the team: wallboard



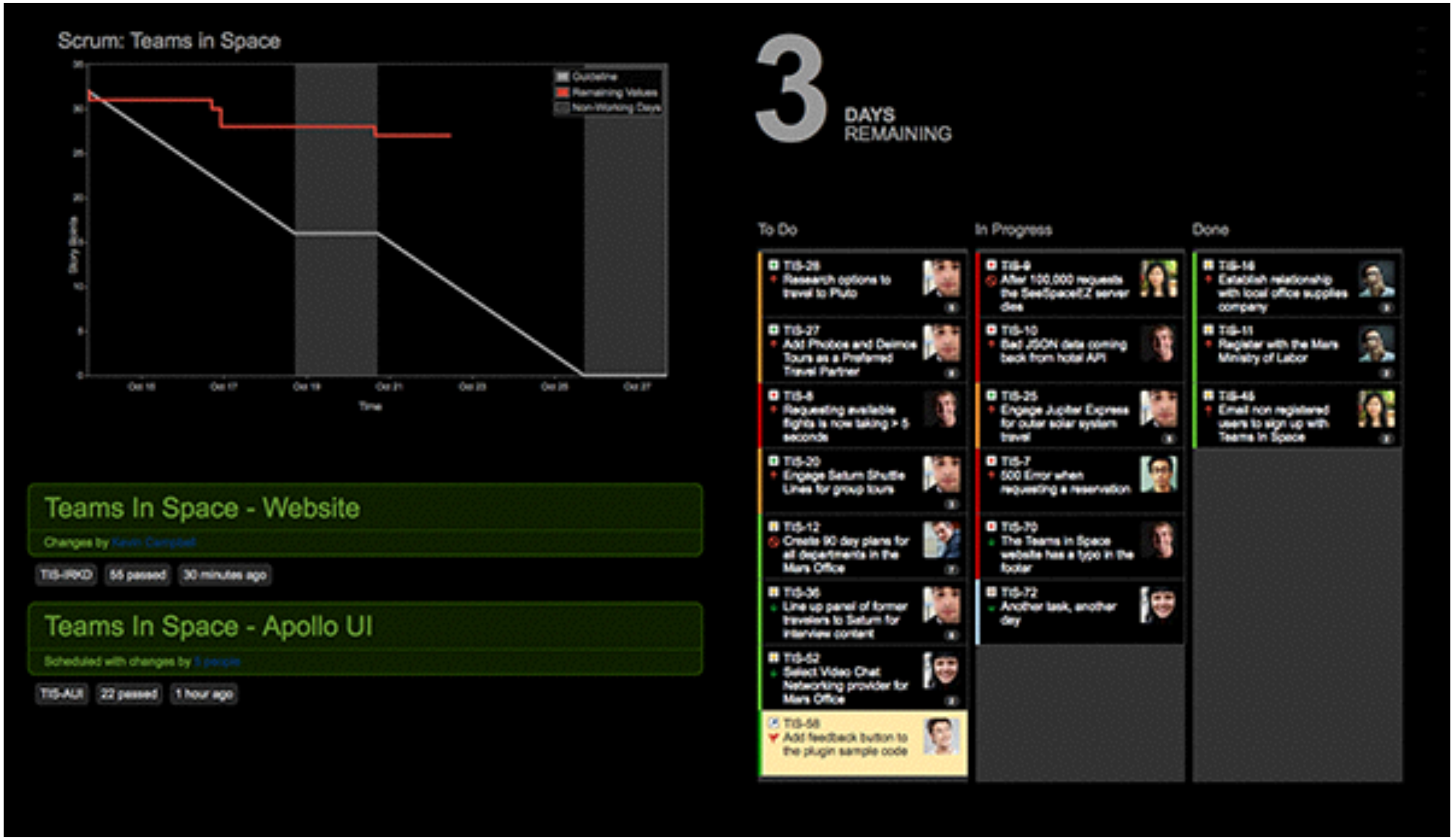
Feedbacks to the team: wallboard



Feedbacks to the team: wallboard

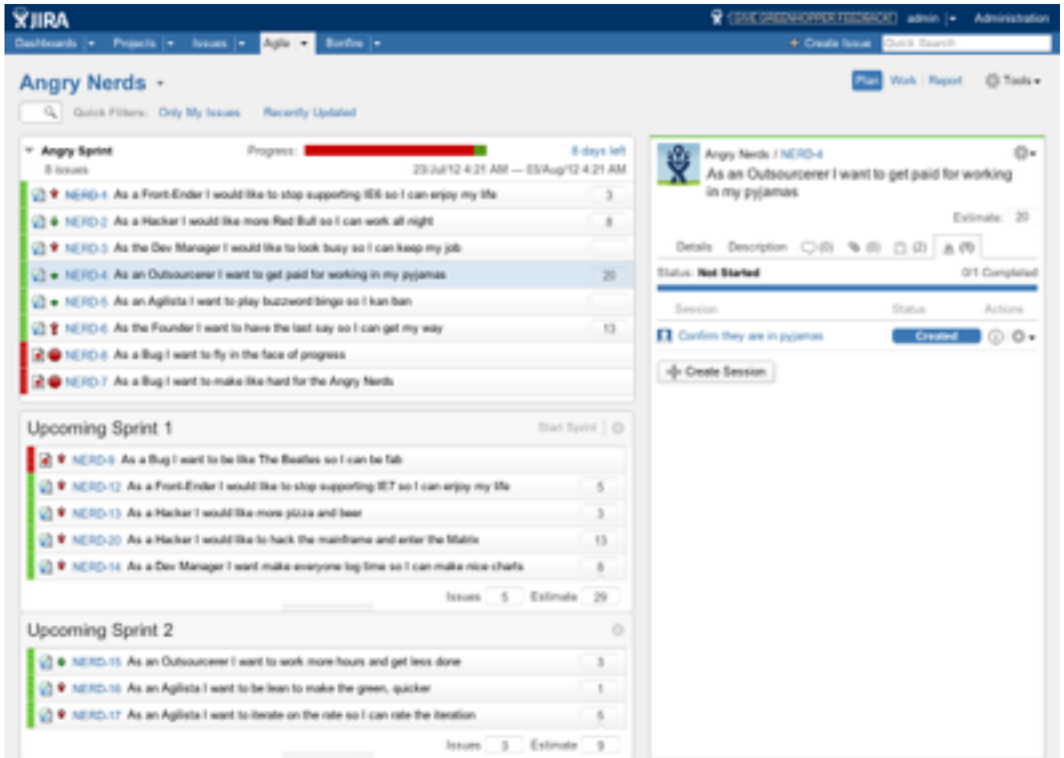


Feedbacks to the team: wallboard



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

Conclusion

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