



# Applying Kanban Principles to Software Development

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# Agenda

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- Motivation
- Overview of Kanban
- Experimental Kanban project
- Kanban board and WIP limits
- Conclusions

# Motivation

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- Kanban as a novel approach to software development that combines agile and lean principles
  - Rapid growth of users
  - Impressive results of early adopters
  - Scientific literature is still scarce and many issues regarding Kanban adoption are still open
    - An interesting topic offering many research opportunities
- State of agile development survey by VersionOne
  - Scrum and its variants are still the most popular
  - The number of Kanban and Scrumban users nearly doubled in 2012
- The early adopters report significant improvements
  - Sjøberg et al., IEEE Software, September/October 2012: the introduction of Kanban almost halved the lead time
  - Anderson et al., LNBIP, 2012: the lead time decreased from 125-155 days to only 14 days

# Kanban overview

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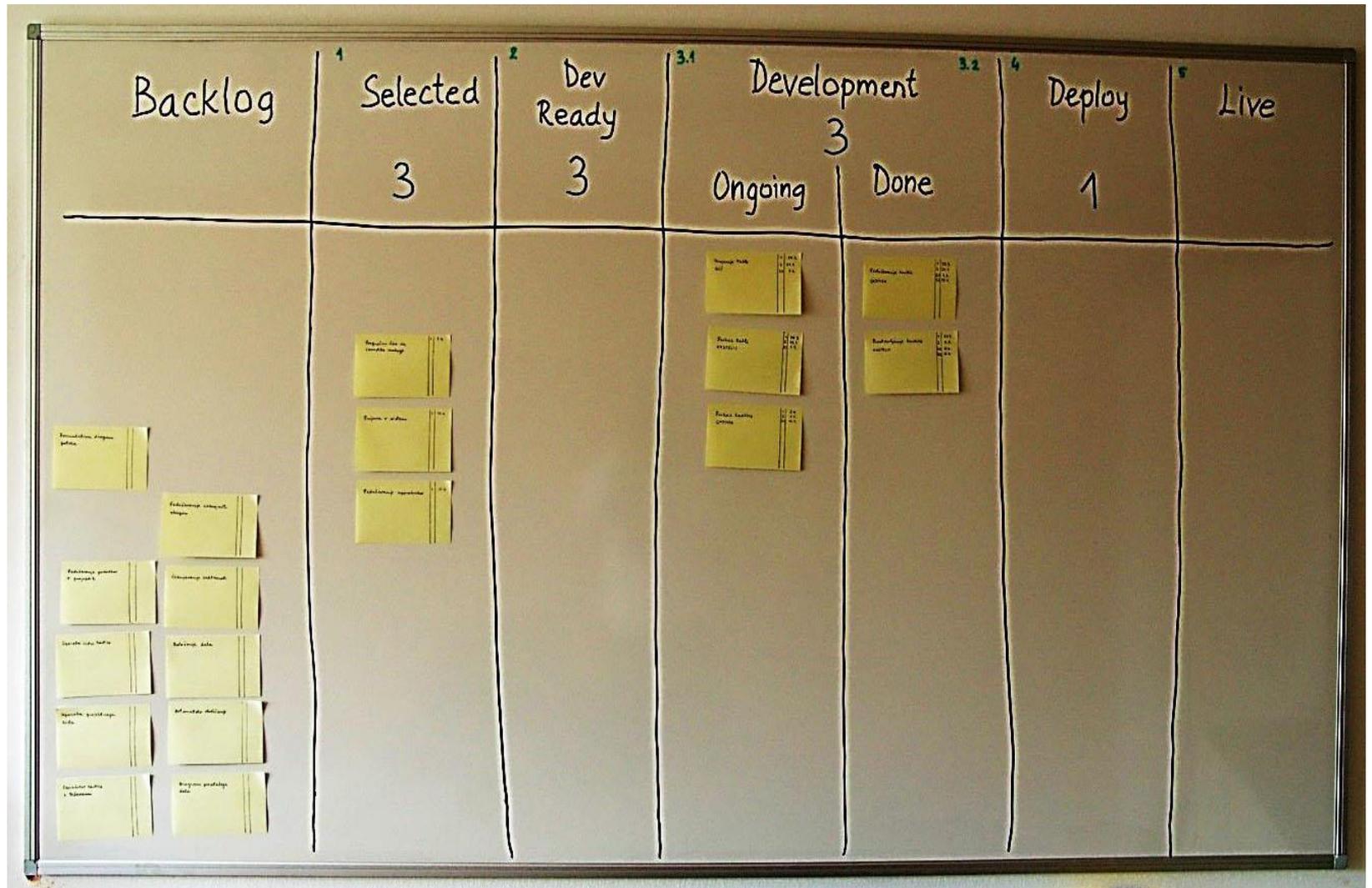
- Kanban is a Japanese term meaning signal card
  - Implies that a visual signal is produced to tell an upstream step in a process that new work can be started
  - Pull system: new work is pulled when there is capacity to handle it instead of being pushed into the system from the outside
- Basic idea: Work in Progress (WIP) should be limited
  - Something new should be started only when an existing piece of work is delivered or pulled by a downstream function
  - WIP limit defines the capacity of each step in terms of the number of work items that may be in progress at each workflow state
  - Appropriate WIP limits ensure that a pull system cannot be overloaded and maintains a sustainable pace of development

# Kanban overview

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- The work must be split into pieces
  - Each work item is usually represented as a user story written on a paper note card
- Work items must be presented on a Kanban board, which serves as a visual control mechanism
  - How the work flows through the various stages of development process
- The Kanban board consists of a sequence of columns
  - Each column represents a step in the development process
  - Each column has on its top a WIP limit
    - How many cards can be in the corresponding workflow state at any one time
  - When a card is completed in one column it moves to the next, thus creating an open space to pull a completed card from previous column
  - If cards in one column cannot be completed and moved forward the WIP limit is reached
    - The development team must fix the bottleneck instead of starting new work
- Lead time is the major measure of throughput and productivity
  - Predicting delivery and making service level commitments

# Kanban overview



# Experimental Kanban project

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- Kanban does not prescribe
  - which columns the Kanban board should have
  - what the WIP limits should be
- Kanban users are expected to experiment with the process and customize it to their environment
  - By changing values of different parameters
  - By closely monitoring the impact of each change
- One of the typical parameters to think about is the WIP limit
  - Too low WIP limit -> idle people, low productivity
  - Too high WIP limit -> idle tasks, increased lead time
- Experimental Kanban project
  - Summer term of the Academic Year 2012/13
  - The development team consisted of 3 graduate students; the teacher played the role of Product Owner
  - All participants were familiar with Scrum
    - Start with Scrum-like iterations and iteration planning process
    - Add Kanban features to the team's internal process

# Experimental Kanban project

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- Development of a web based tool for managing Kanban projects
  - The Product Backlog consisted of 18 user stories
  - Four different user roles: the System Administrator, the Kanban Master, the Product Owner, and the Development Team
- The Kanban Master is responsible for methodology
  - Structure of the Kanban board and WIP limits
  - Cumulative flow diagrams and burn-down charts
- The Product Owner
  - Work items in form of user stories
  - Deciding when a user story is done
- The Development Team
  - Estimating effort
  - Moving work items from one workflow state to another
- The System Administrator
  - Assigning user roles
  - Maintaining data required for proper functioning of the system

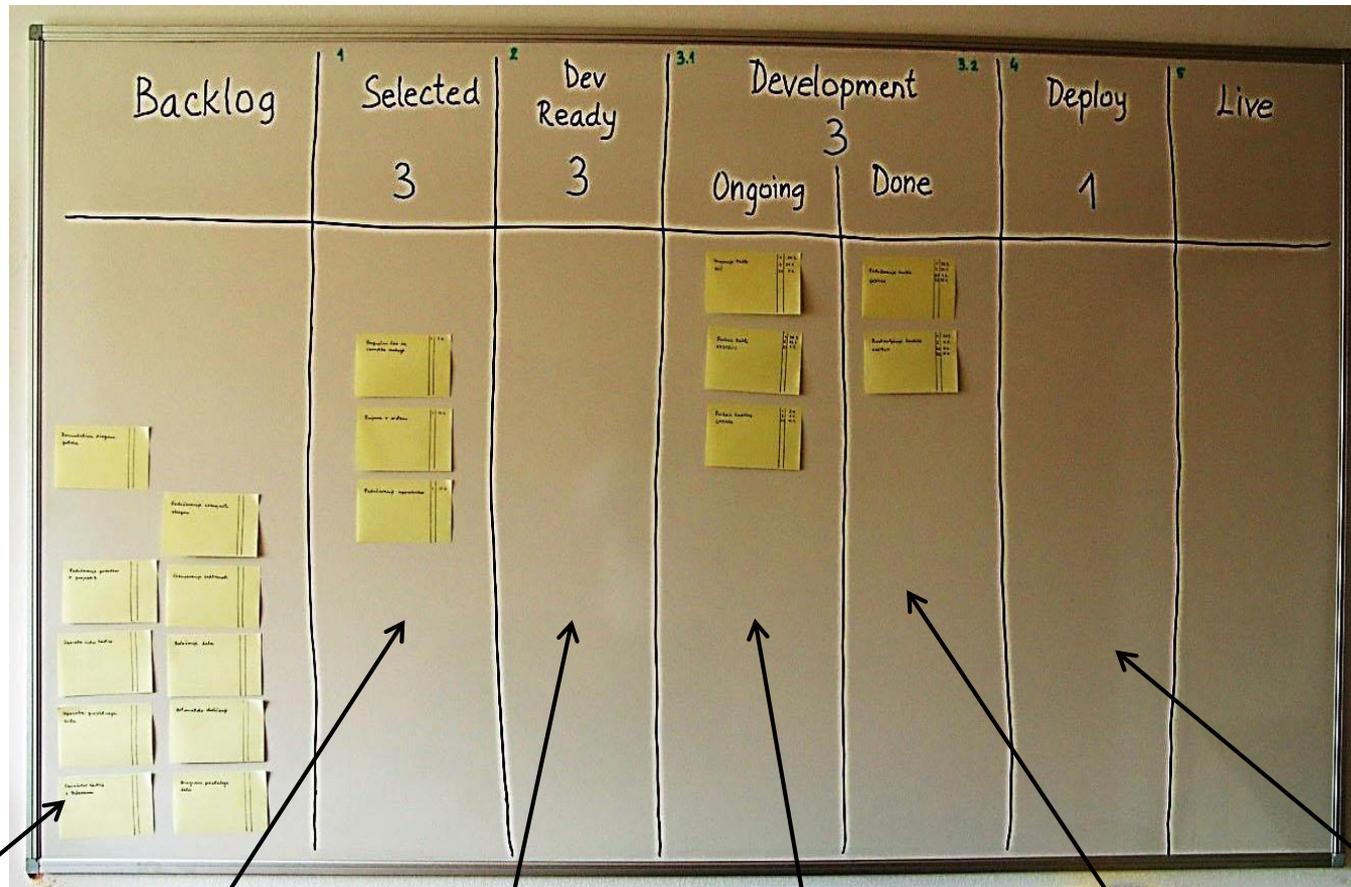


# Experimental Kanban project

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- The tool was designed to be as flexible as possible
  - Arbitrary number of columns (representing workflow states)
  - Arbitrary number of rows (representing different projects a development team can work on simultaneously)
- Each user was allowed to play
  - several roles on the same project
  - different roles in different projects
- Special attention was devoted to specification of rules for moving work items from one column to another
  - Who (which role) can move a work item to the next or previous column
- Each move was assigned a time-stamp
  - To determine how long a work item remained in each workflow state
  - To compute the lead time

# Kanban board in Sprint 1



Stories to be developed

High priority stories

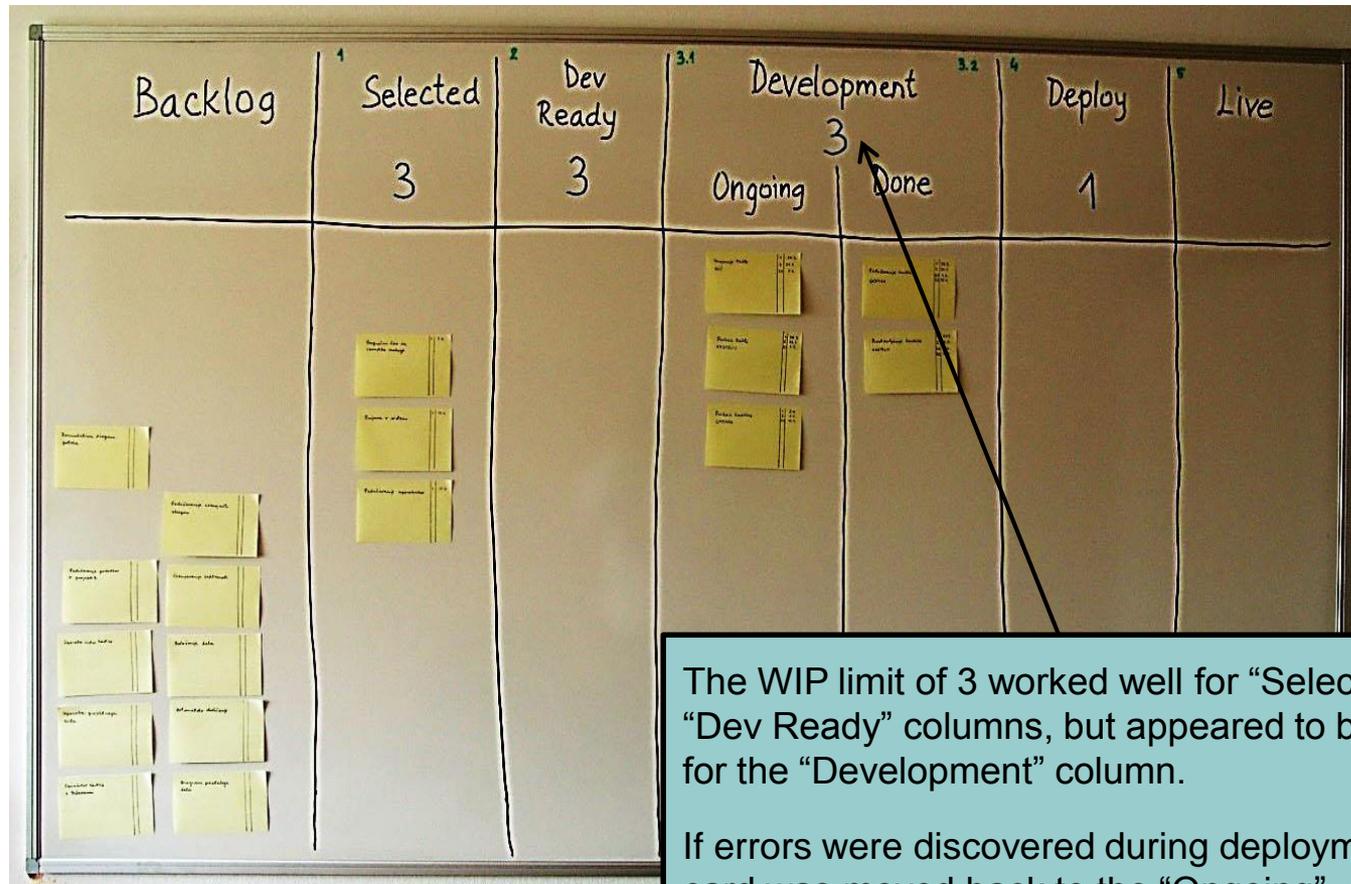
Decomposition into tasks

What is being developed

Completed stories

Stories in deployment

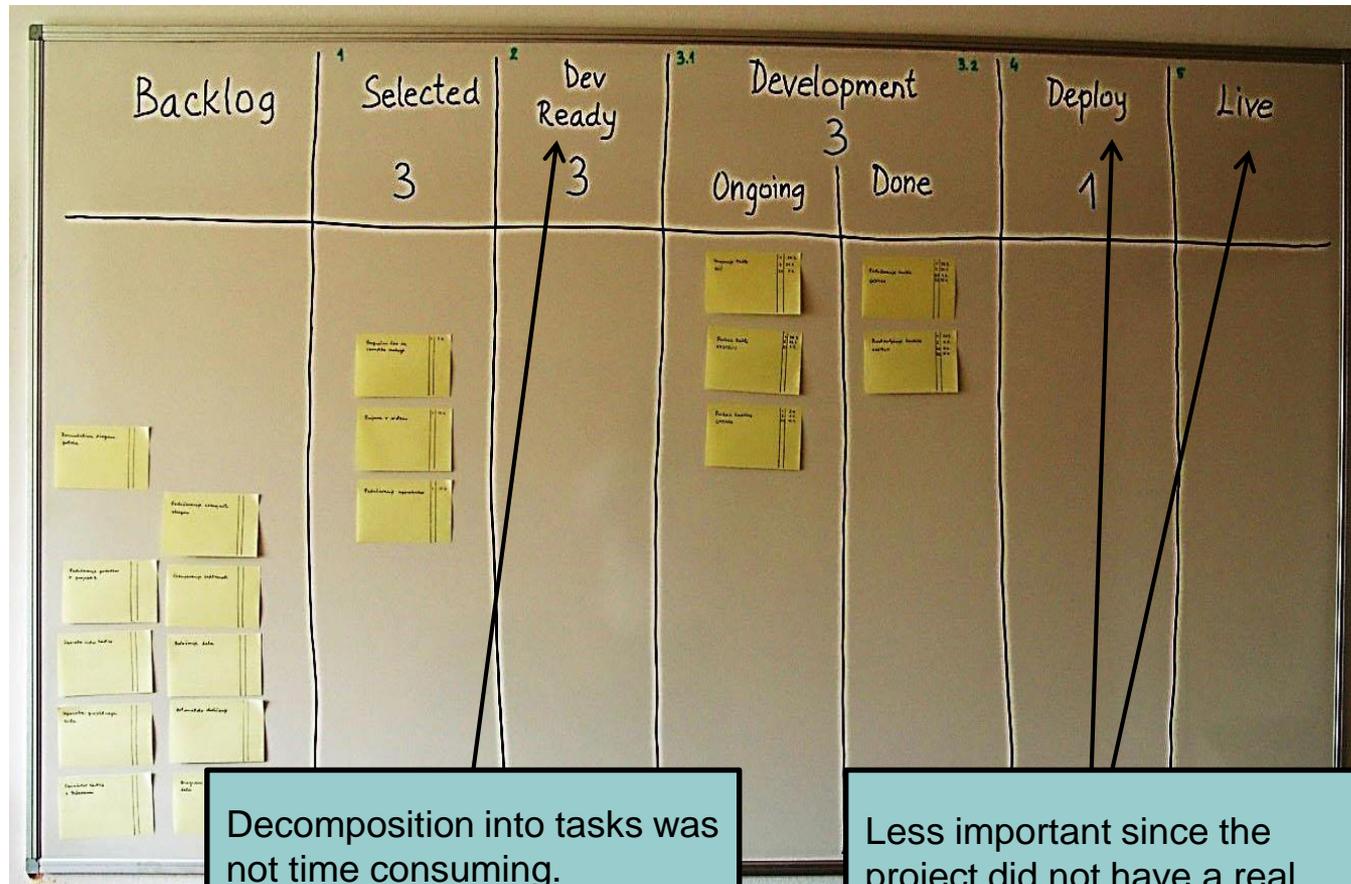
# Kanban board in Sprint 1



The WIP limit of 3 worked well for “Selected” and “Dev Ready” columns, but appeared to be too low for the “Development” column.

If errors were discovered during deployment the card was moved back to the “Ongoing” column, which caused a violation of the WIP limit

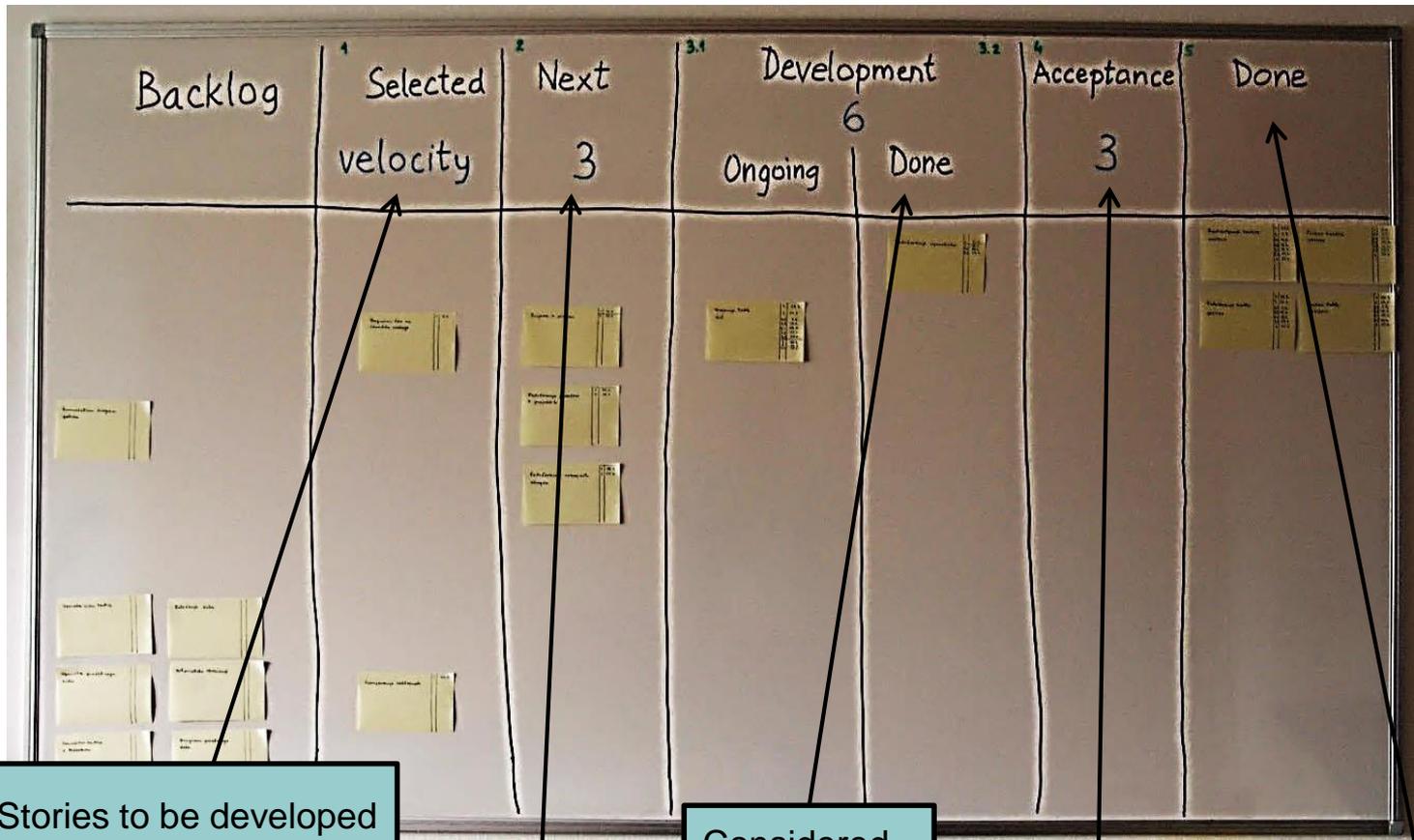
# Kanban board in Sprint 1



Decomposition into tasks was not time consuming. The great majority left this column the same day.

Less important since the project did not have a real user.

# Kanban board in Sprints 2 and 3



Stories to be developed in the next Sprint, with the WIP limit expressed in terms of velocity.

High priority stories

Considered done by the development team

Stories under evaluation

Accepted by the Product Owner

# Conclusions

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- Kanban as a new concept in software engineering
  - Create a smooth flow through the system
  - Minimize the lead timeby visualizing the workflow and limiting the WIP
- Results of an experimental project
  - How Kanban principles work in practice
  - Define appropriate structure of a Kanban board that can be used in combination with a Scrum-based software development process
  - A web based tool that automatizes manipulations with user stories and visualizes their flow on an electronic Kanban board



Thank you!

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Questions ?