SYSTEM ENGINEERING
SOFTWARE DEVELOPMENT
PROCESS & RAMS CONSULTING
VALIDATION & VERIFICATION
EMBEDDED SOFTWARE

Agile-R®

A new approach to combine Agile and EN 50128 for Railway software development

Trademark registered

Agile-R

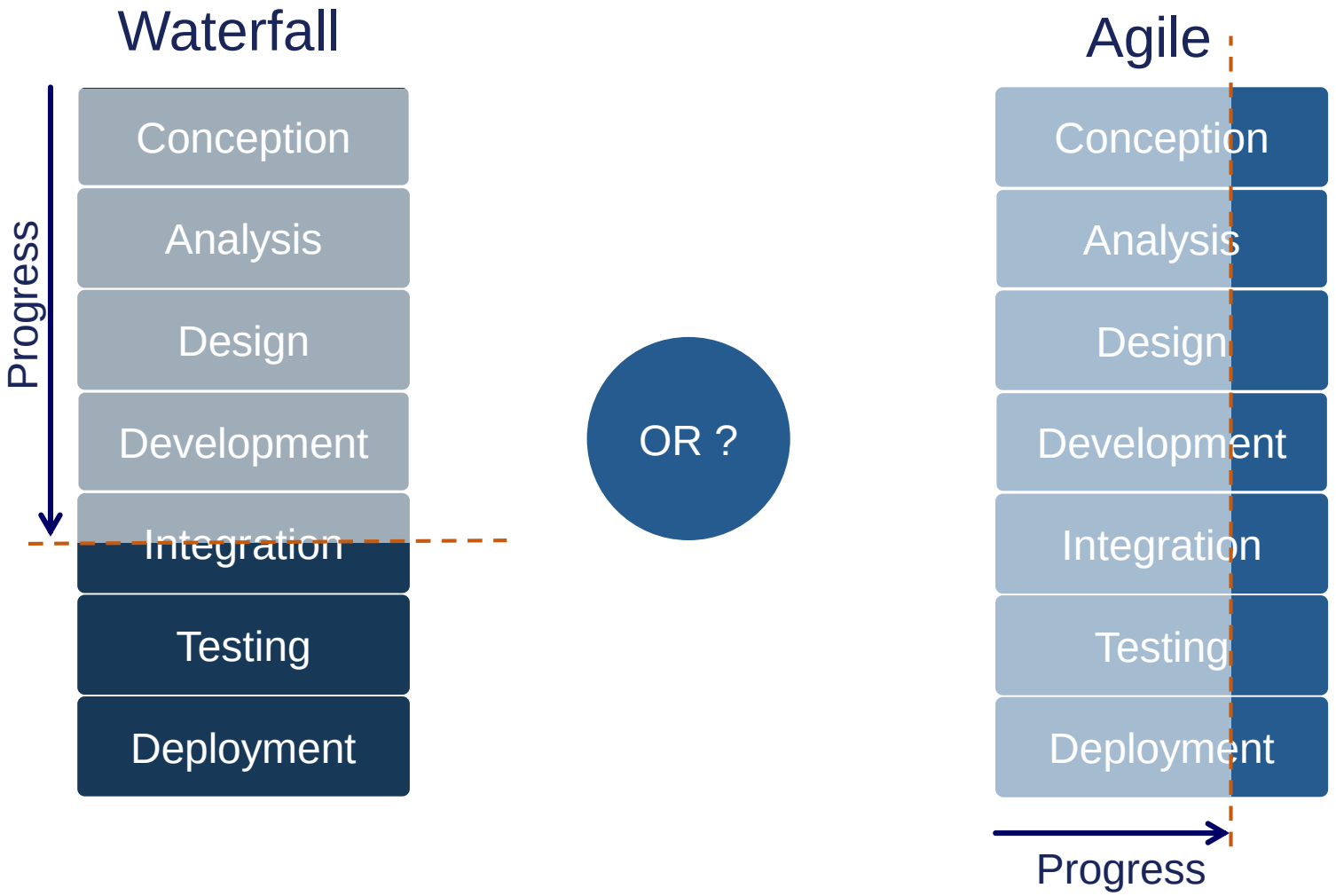
Agenda

01 Agile Overview

02 A new approach – Agile-R®

03 A case study at Intecs

A radical Life Cycle change



Agile Goals

- Reduce time to market and improve responsiveness to change
  - Shortening the time between development and bug fixing
  - Reducing regression risks
  - Avoiding large and late integration of software
- Better control and predictability of the development process
  - Progress is measured by the state of the product's actually working and implemented functionalities rather than estimations and presentations
- Decrease the risk of producing unsatisfactory solutions
  - Strong involvement of the product owner

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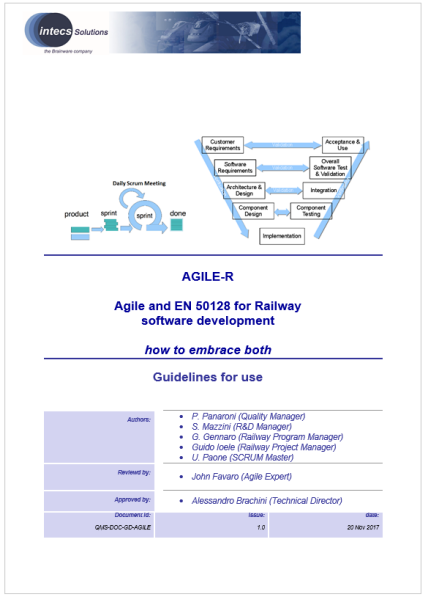
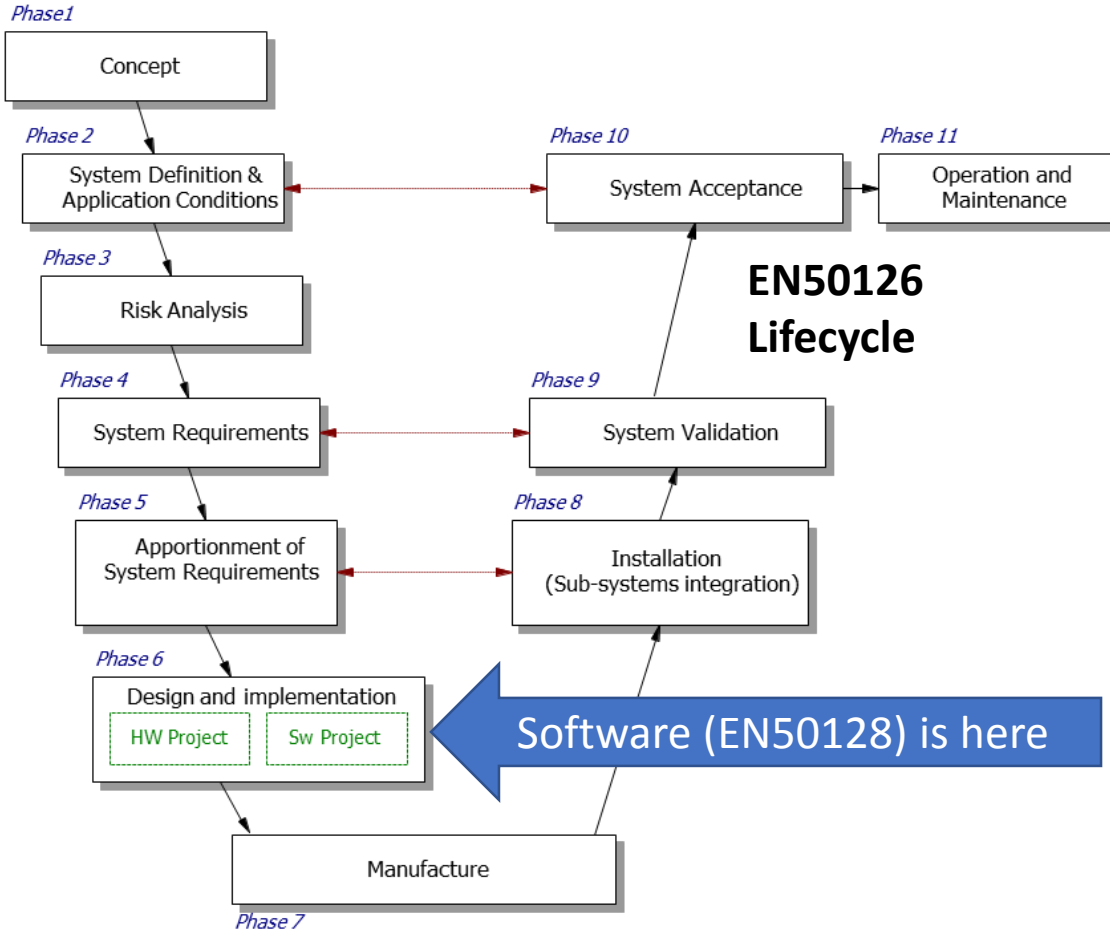
Agile-R®

Agile-R® is a Scrum based approach defined by Intecs Solutions to combine Agile and EN 50128 for Railway software development.

- Agile-R® *is described in the dedicated guideline "Agile-R® : Agile and EN 50128 for Railway software development - how to embrace both"*
- *Agile-R® has been shared and discussed with external Independent Safety Assessors*



The Agile-R® context

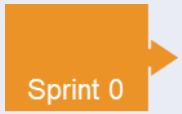


- Agile-R® is proposed **for software development**

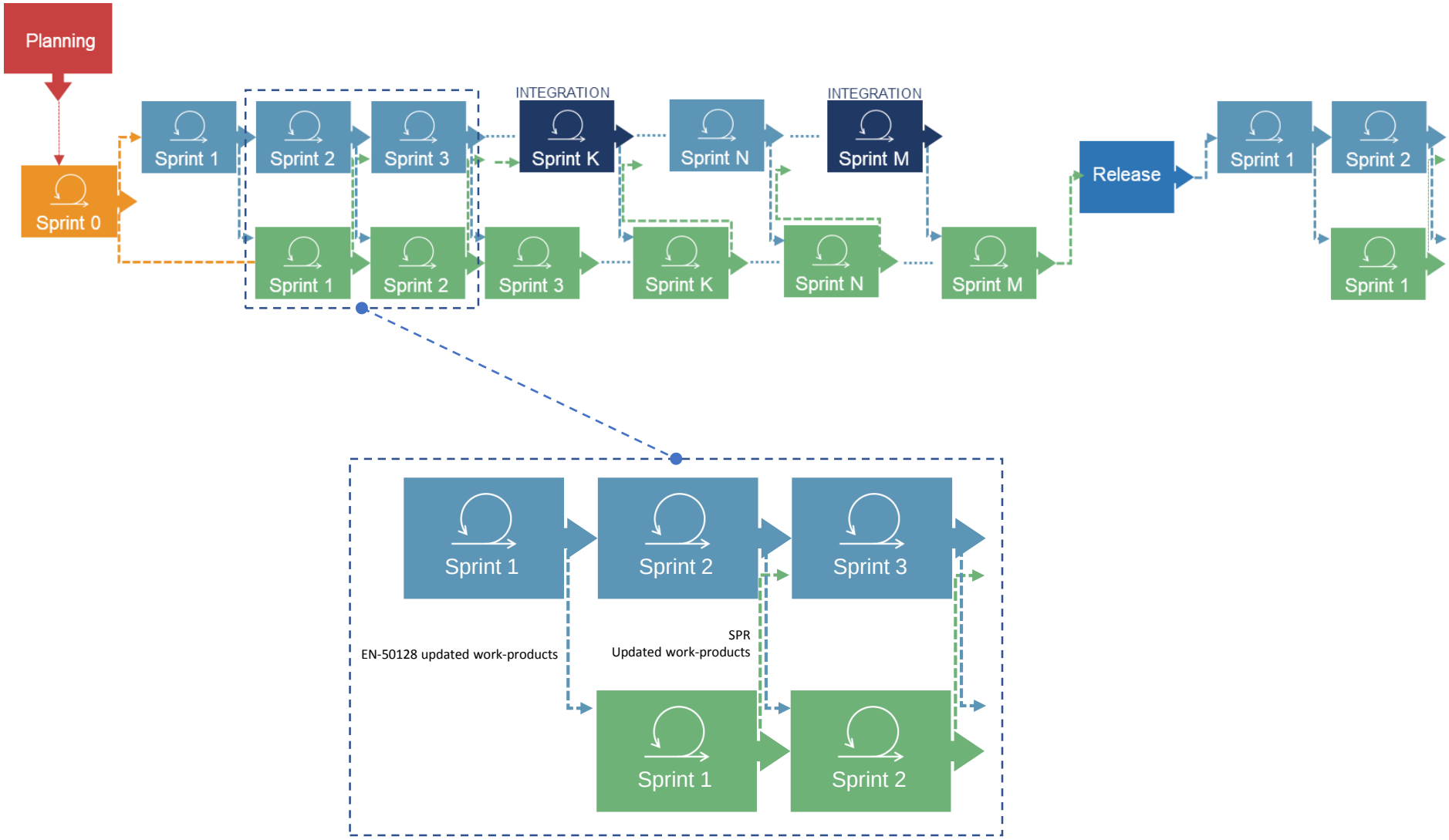
Agile-R® vs EN 50128

- Some fundamental aspects arise from INTECS experience in Sw Engineering and ISA's feedbacks
  - Agile defines **HOW** to manage software development projects, **it is not a new standard**
  - Agile does not impose specific work products
  - Agile is **not in contradiction with WHAT is required by EN50128**
  - Agile does not sacrifice quality (quality is usually better thanks to early detection of bugs and pair programming)
  - Few adaptations are required to best combine the two approaches and achieve the right **Balance of Agility and Discipline**

Agile-R® High Level Overview – Building Blocks

Phase	Purpose
	To coordinate the software development with all affected stakeholders To elaborate all plans To establish the Scrum team
	To provide solid foundations for all other sprints
	Development heartbeat
	To validate the development
	Development Sprint focused on Integration activities
	To finalize work products before a Release

Agile-R® High Level Overview



Agile-R® Major Recommendations

- Engage the assessor from the very beginning and find an agreement on the approach and road map
  - Software development using an Agile approach may appear new to assessors
- Tailor the approach defining the best V&V activities configuration management based on
  - Actual organization
  - Project context
  - Target SIL
  - Tools and testing environment
- Independent Testing
  - Testing of implemented user stories not assigned to the implementers of the same user stories

Agile-R® Managing of Critical Issues (1/2)

Critical Area	Critical Aspects	Proposed Approach
Poor test automation	• Agile effectiveness depends on the availability of fully automatic test suites • Unit tests are easy to automate but system test or overall software tests are often executed manually	• Run manually a focused test set to verify each new feature • Run manually a sanity test-set to verify major regressions • Execute full regression in release phases and selected integration phases

Agile-R® Managing of Critical Issues (2/2)

Critical Area	Critical Aspects	Proposed Approach

Legacy Software	Regression	Different strategies in increasing order of complexity:
		• Test and document only new features
		  • No confidence about the legacy part, high regression risk
		• Scrum Zero set-up of a minimum initial documentation and test suite than refine according the new features
		  • Partial confidence about the legacy part, medium regression risk
		• Large reverse engineering activity before starting any new development
		  • Confidence about the legacy part, low regression risk

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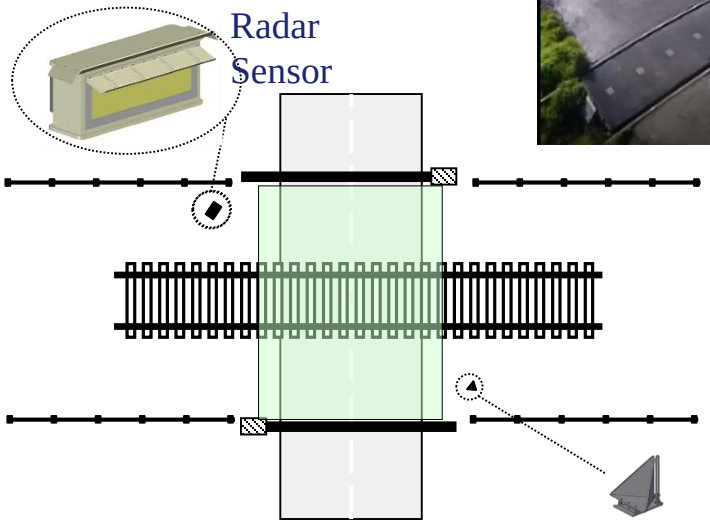
Agile-R® in Practice – SIRIO LX Use Case

- Experimental application to the development of the Level Crossing Protection System SIRIO LX product (CENELEC SIL4)
- Outside the official development path, not starting from scratch
- Overall case study phases
  - Planning (1 week)
  - Sprint Zero (1 week)
  - 2 Sprints (3 weeks each)



Case Study – Roles

Agile-R® Team Role	Team Composition
	1 Sirio Lx System Expert
	1 Internal Scrum Master
	1 RQM/DES 2 IMP/INT/TST 1 VER
	1 VAL

Case Study – Main Goals

- Understand the impact on the EN 50128 planning phase (with respect to a «legacy» waterfall life cycle)
  - Software Quality Assurance Plan
  - Software Configuration Management Plan
  - Software Verification Plan
  - Software Validation Plan
- Understand the impact on the verification activities
  - It is possible to use the same templates?
  - It is necessary to make some particular adaptation to the «legacy» way to do that ?
- Get feedback from the team, composed by domain experts, but not Agile experts
- Learning lessons «from the trenches»

Case Study – Planning Results

- Impact on EN50128 planning phase
  - **Sw Quality Assurance Plan** – minimal impact
    - Deliveries follow traditional Gantt, activities proceed by time-boxed Sprints
    - Agile lifecycle where each «traditional» phase is crossed several times for each functional increment
  - **Sw Configuration Plan** – minimal impact
    - Indication to set a baseline for each phase (Sprint, Integration, Release….)
  - **Sw V&V Plan** – minimal impact
    - Clear indication that «what» and «who» do not change
    - Implementation-V&V as a continuum in order to verify and validate «as soon as possible»
    - Agile concept of «definition of done» shall embed V&V execution
    - V&V activities performed in a iterative, incremental way

Case Study – Feedback

- Positive feedback from the team about the new approach
  - Team members can have a common understanding on the system
  - What is in the Sprint scope and how to demonstrate it is clarified before starting
  - Implementers can run static analysis in the sprint context (no long and boring days to resolve or justify static analysis long after development)
  - Complexity of the document verification activities seems lower than in the traditional approach
    - Analysis of requirements traceability related to a feature and documents is easier

Case Study – Lesson Learned

- The visual management approach could be very impressive but the history of previous Sprints is lost…. we tried to freeze with photos but not really practical
  - we decided to use TuLeap or Jira for future projects
- For SIL 4 software the Validator's work, by its nature, cannot be completely time-boxed
  - The Validator shall have the freedom to perform additional analysis in order to assure the correct behavior
  - This confirms the need for Validation and Release Sprints
- When basic reusable software blocks are needed (e.g. sw timer management, sw queues,…) in our opinion, they should be developed (even partially) in Sprint 0…..like up-front software

Conclusions

- The Agile-R® approach (in our opinion and experience) changes only the «**how**», not the «**what**» or «**who**»
- The «what» and «who» remain strictly compliant to EN 50128 requirements
- Project pitfalls [e.g. a wrong or simplistic design, poor tools, immature test environment] have an impact on the Agile-R® approach in the same way as with a traditional approach but ...
  - You discover it after a short period of time…as we did
  - You can implement counter-measures in an early stage of the project

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Thank you for your attention

Q&A