Agility and Lean for Avionics

XP inside – Welcome aboard

Plan-Driven vs Agile

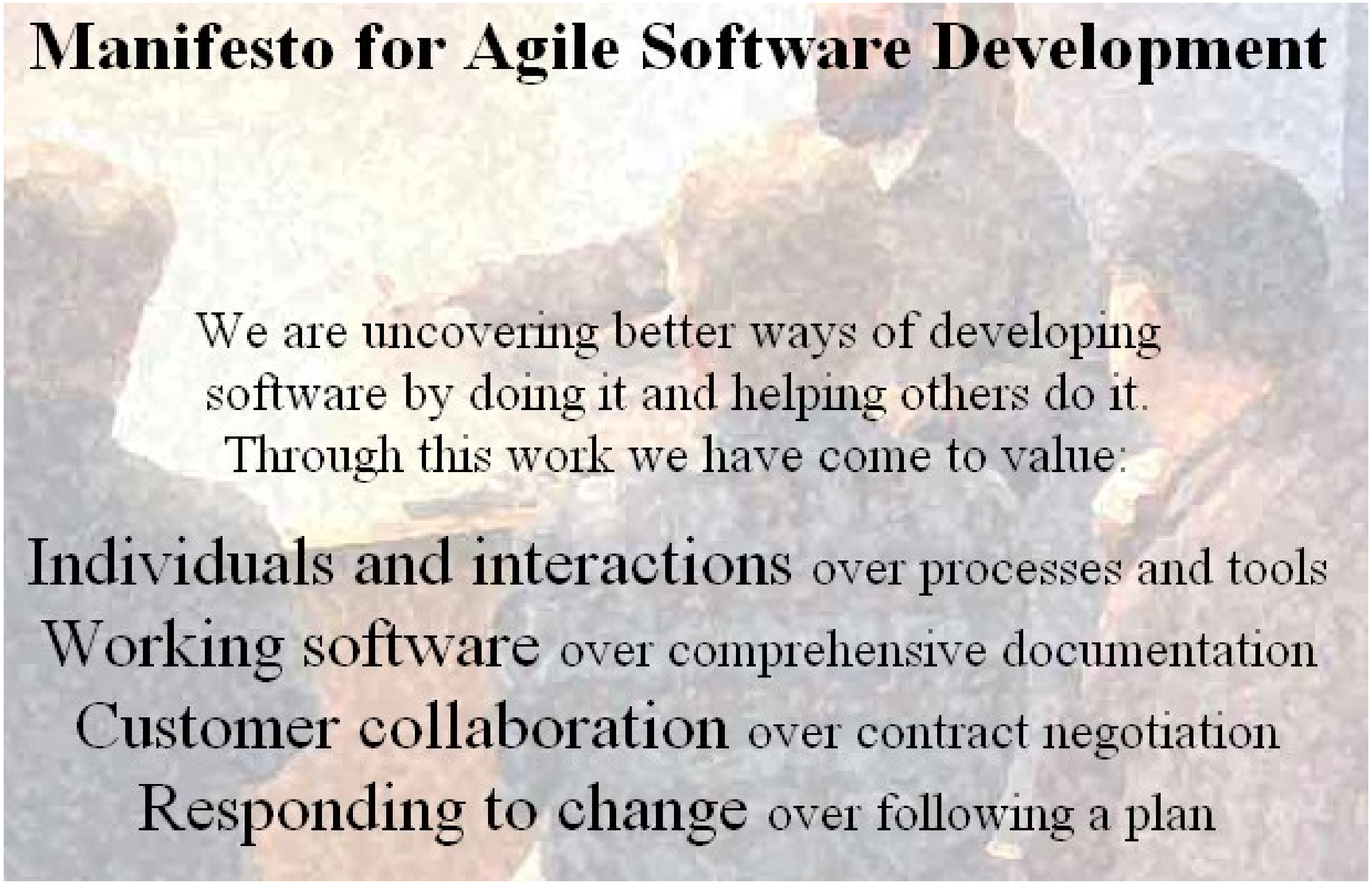
Topics

Avionics;

Specific problems & how Agile helps;

Agile contributes to Lean.

Agile Software Development



Manifesto for Agile Software Development

We are uncovering better ways of developing
software by doing it and helping others do it.
Through this work we have come to value:

Individuals and interactions over processes and tools
Working software over comprehensive documentation
Customer collaboration over contract negotiation
Responding to change over following a plan

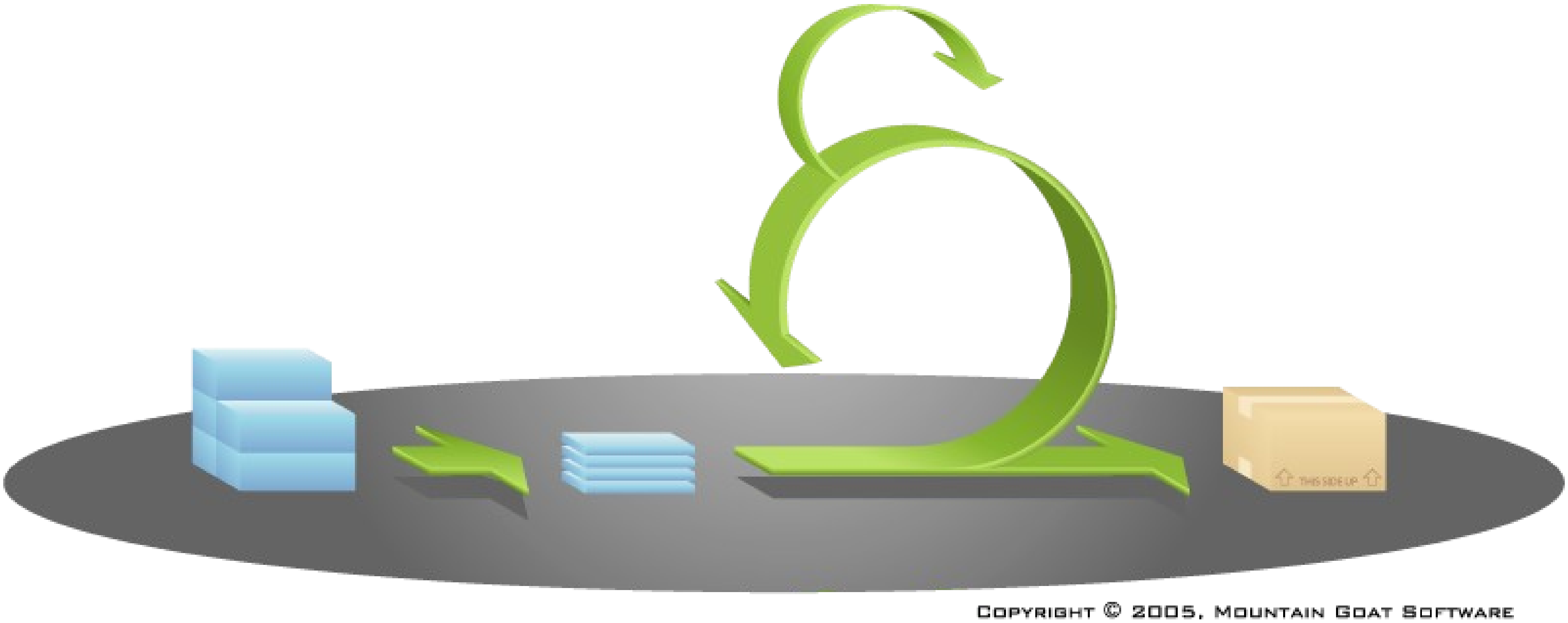
Far removed from our tradition?

Agile / Extreme Programming

Pair Programming;
Test Driven Development;
Refactoring;
Simple Design;
Continuous Integration;
Small Releases;
Whole Teams;
...

Hacking & Cowboy Coding or Rigor & Discipline?

Agile / Scrum



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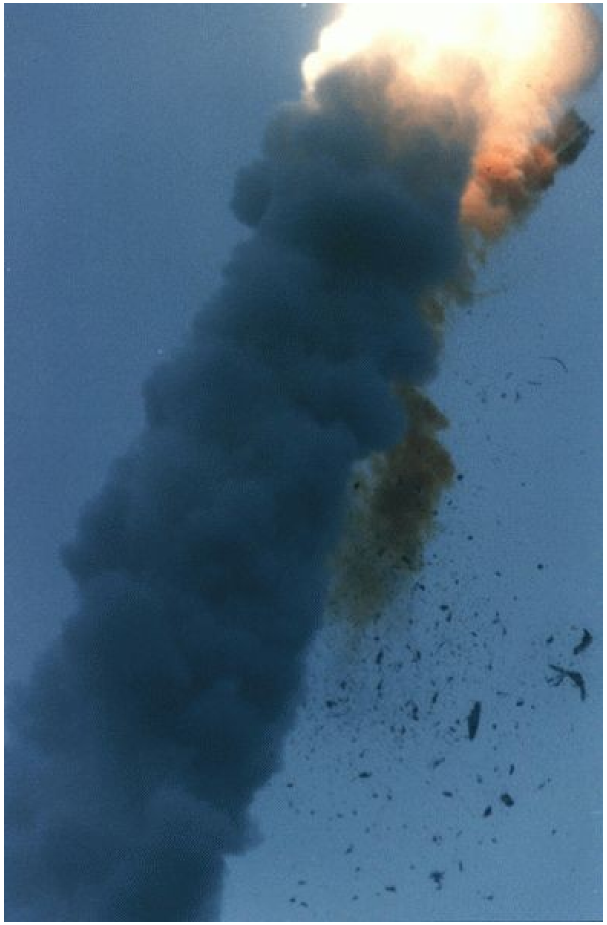
Iterations, increments, prioritized features;
Scrum + XP.

Avionics / Critical products



A failure may impact the safety of flight

Avionics / Certified products

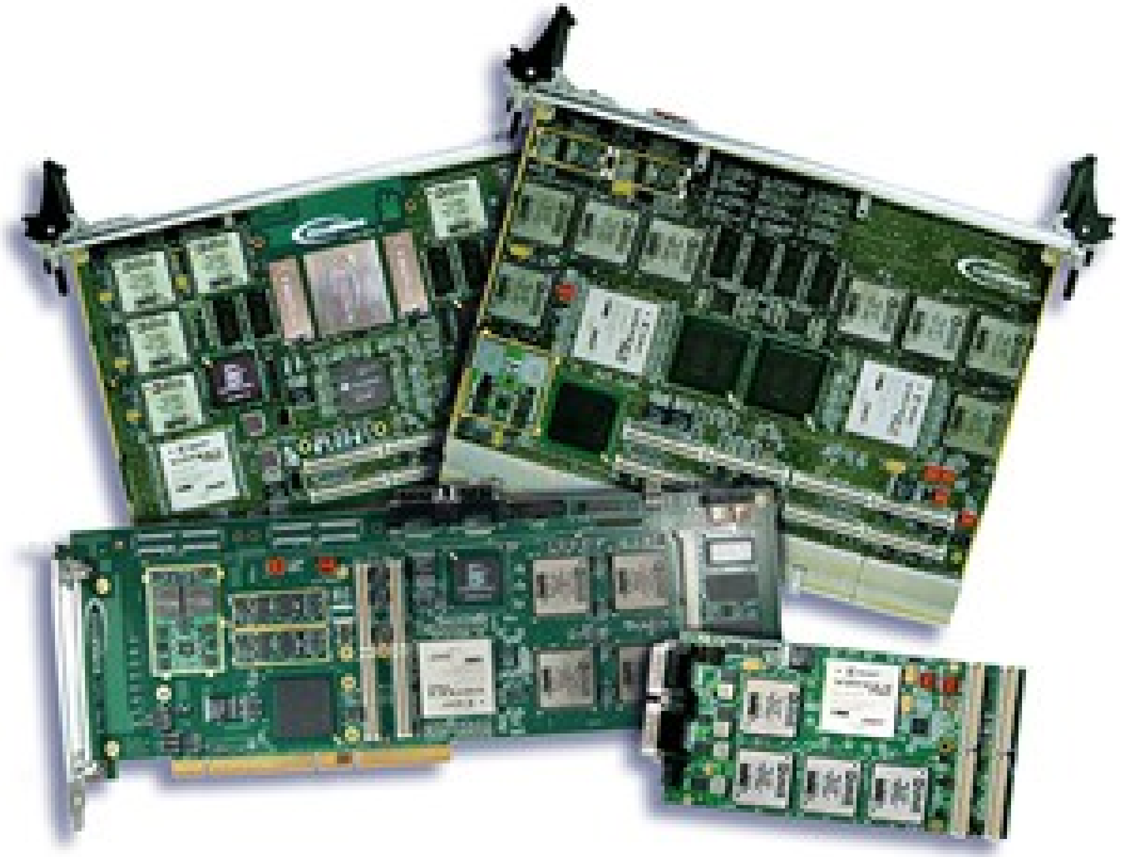
Critical SW must be certified

Avionics / Major difficulties

Real-time, embedded technology;
&
Safety.

How does XP help?

Real-time embedded / Specific HW & RTOS

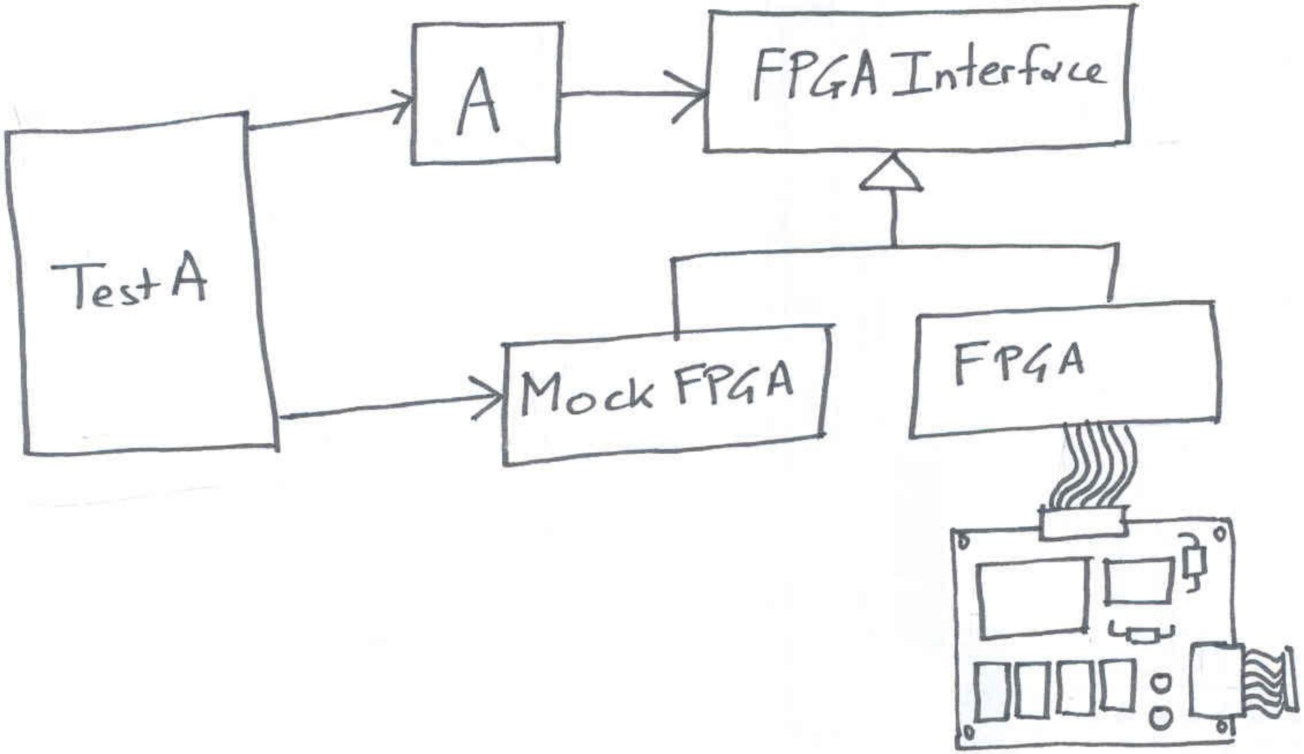


Real-time, multi-threading & limited resources

Real-time embedded / Test and integration / Issues

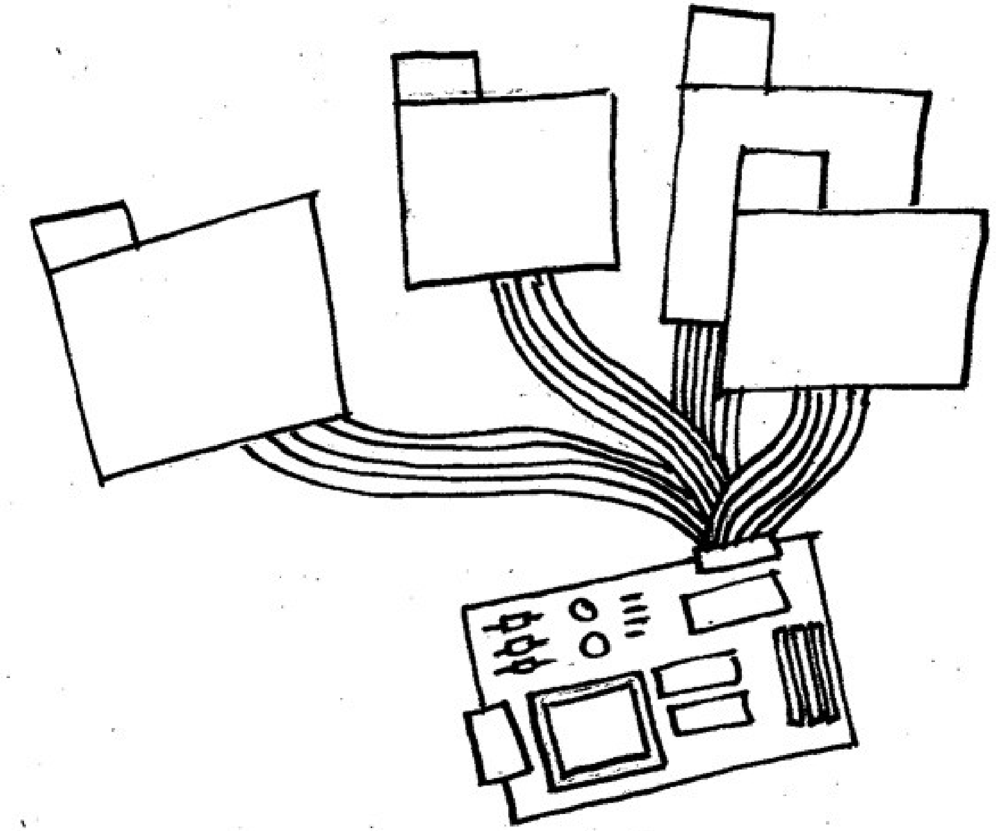
Late Big-Bang integration;
Testing is not efficient

Real-time embedded / Test and integration / Agile solutions



TDD + OO = Progress before HW;
& Separation of concerns.

Real-time embedded / Reuse and porting / Issues



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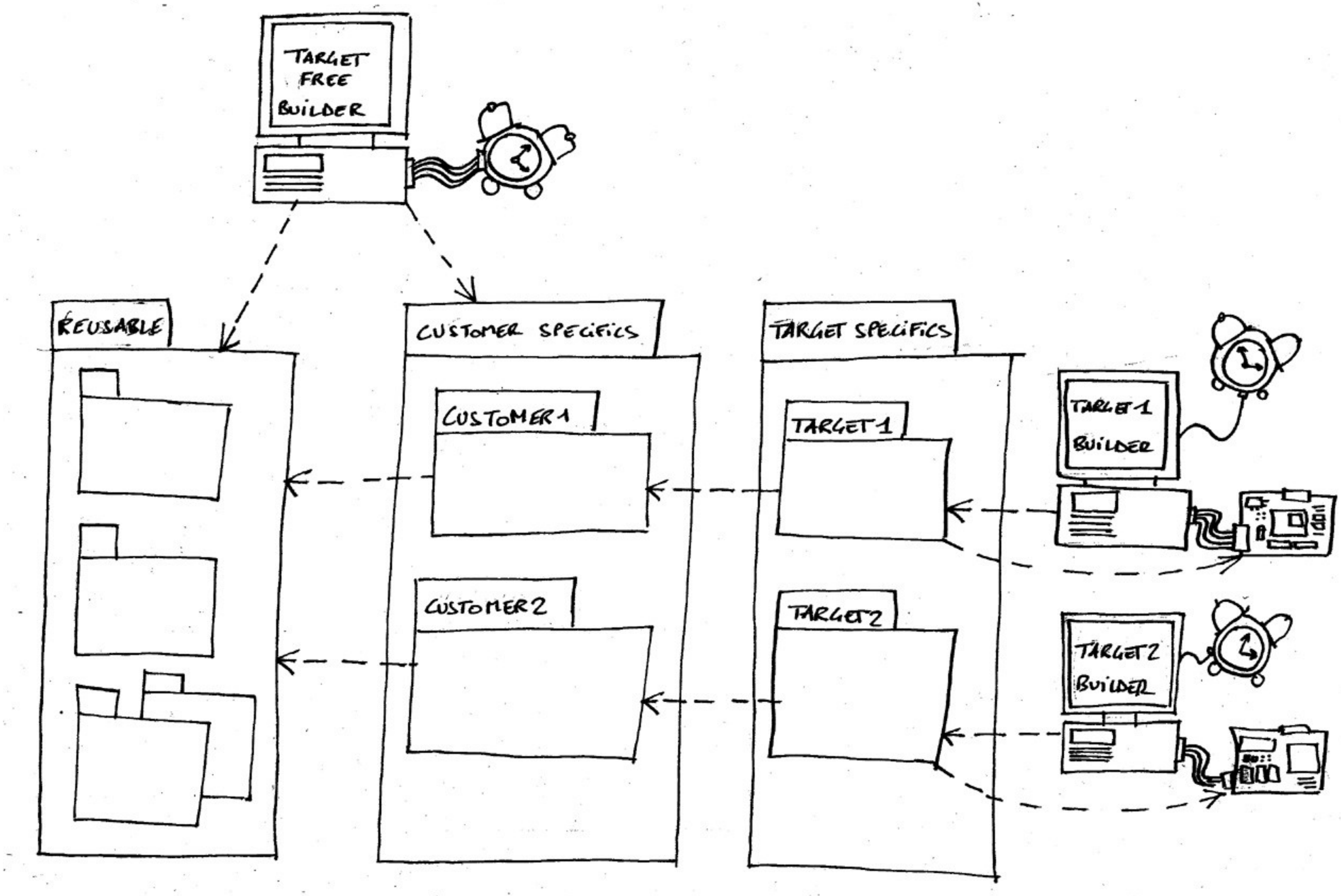
Real-time embedded / Reuse and porting / Agile solutions



Safety / Level of citicality

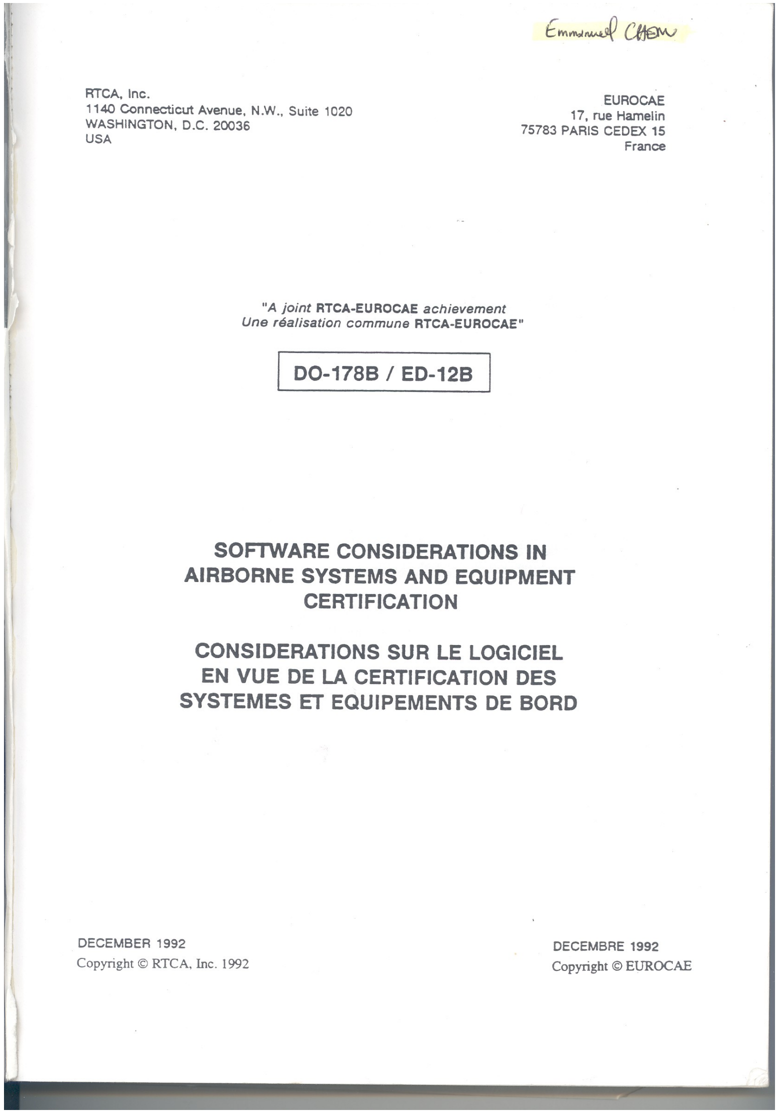
Impact of failure:

A. Catastrophic: may cause a crash

…

E. No effect

Safety / Guidelines



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DO-178B / ED-12B

**SOFTWARE CONSIDERATIONS IN
AIRBORNE SYSTEMS AND EQUIPMENT
CERTIFICATION**

**CONSIDERATIONS SUR LE LOGICIEL
EN VUE DE LA CERTIFICATION DES
SYSTEMES ET EQUIPEMENTS DE BORD**

DECEMBER 1992
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DECEMBRE 1992
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Objectives;
Audits;
Proof of activities.

Avionics / Safety / Objectives

Objectives & rigor on the development process.

The clean water pipe

The clean water pipe

Safety / Issues

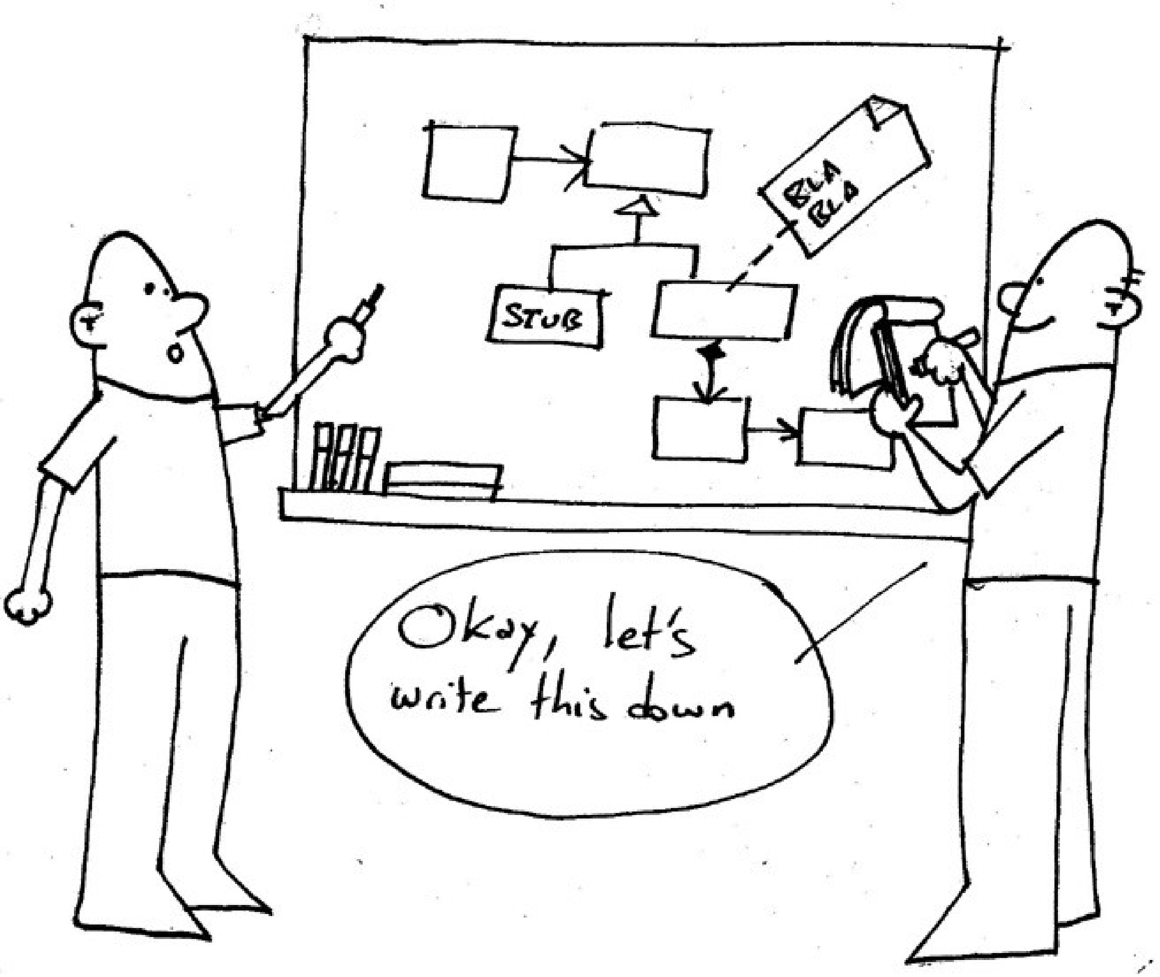
No more code than required;
Airborne version 100% tested;
Airborne version 100% reviewed.

Safety / Agile solutions

Incremental construction;
Systematic acceptance tests;
Systematic developer tests;
Independance of tests versus code;
Latest version fully and repeatably tested;
Systematic reviews.

XP brings value for certification.

Safety / Formalism!



Safety / Adapt XP

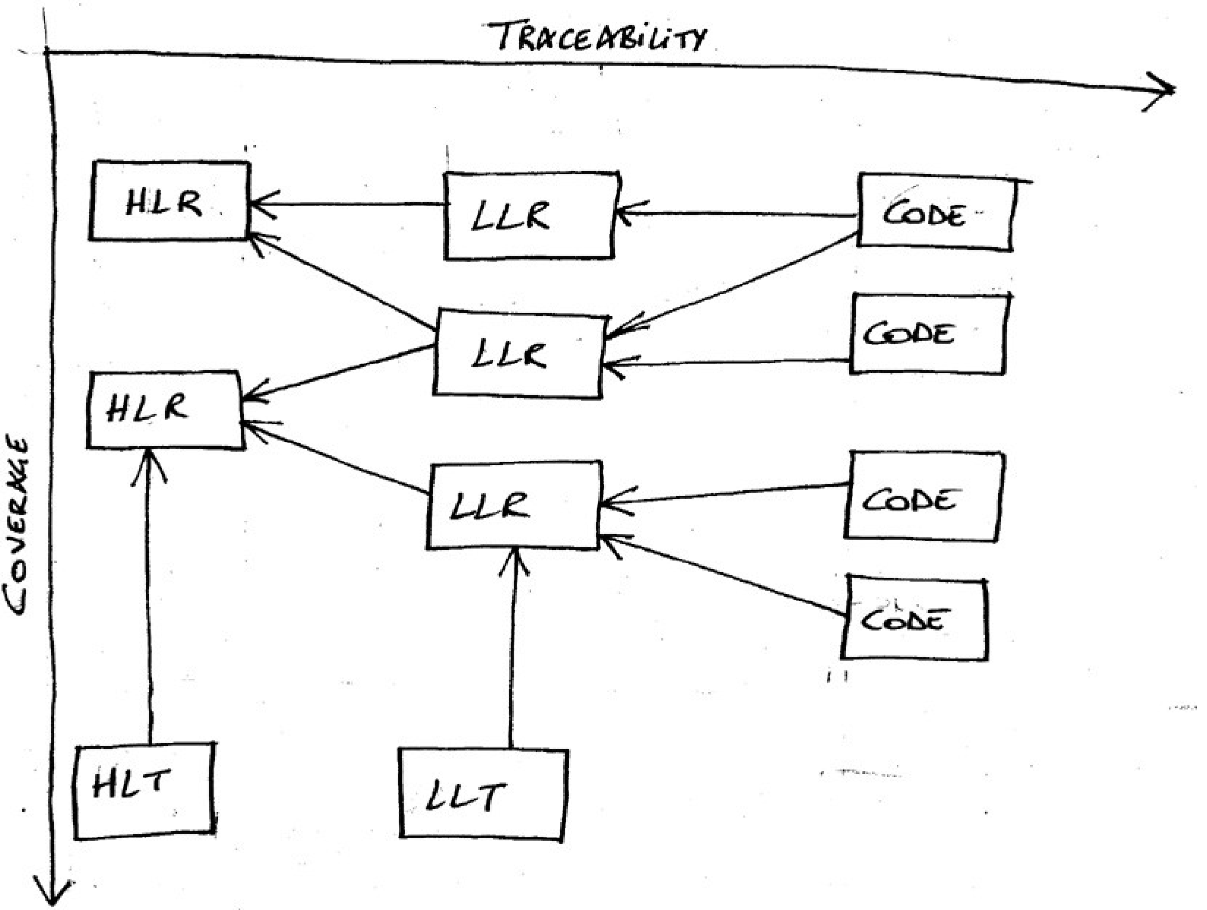
XP values : OK

XP principles : OK

XP practices : KO ... with adaptations: OK

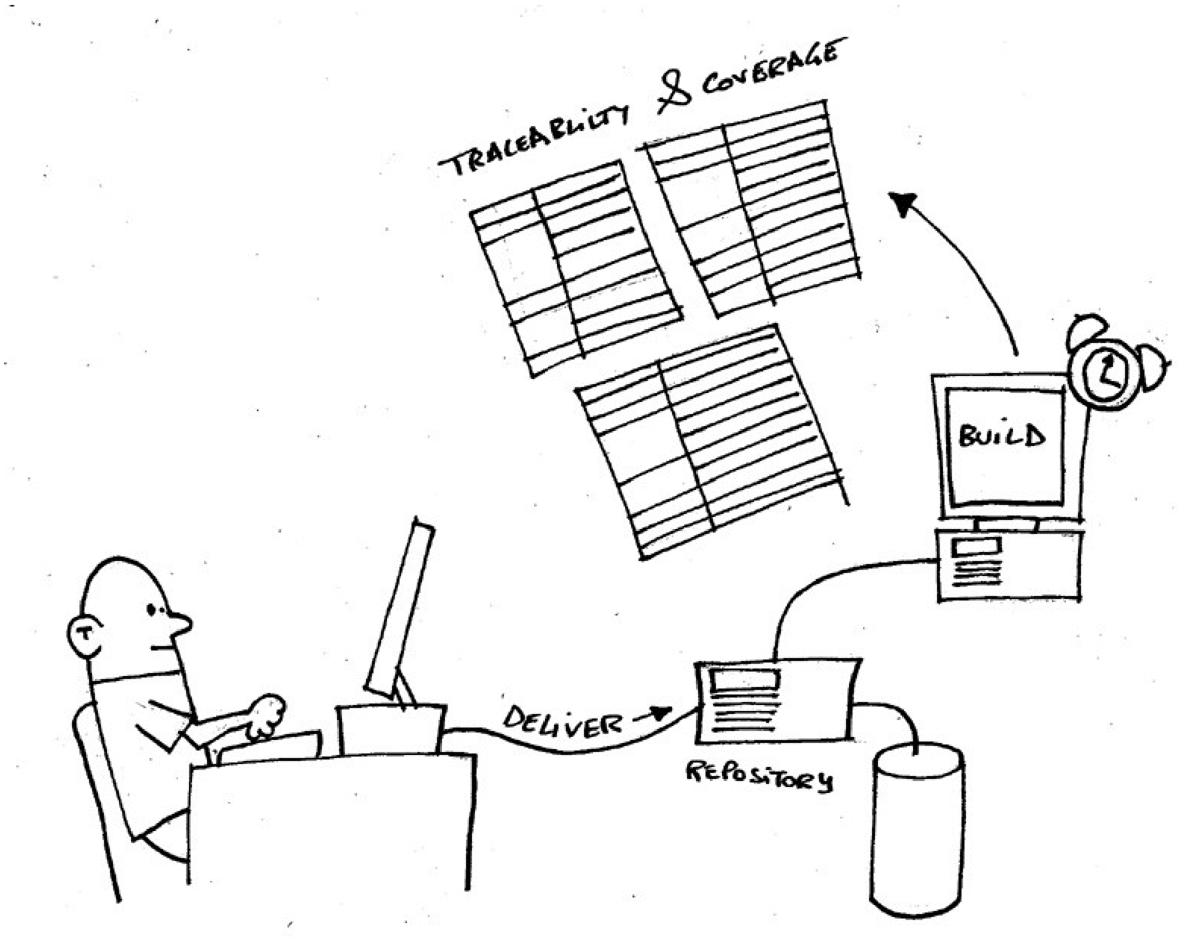
Example: Incremental documentation

Safety / Reqs and traceability / Issues



Certification issues mainly concern requirements and traceability.

Safety / Reqs and traceability / Agile solutions



Continuous activities, continuously shippable

Agile helps / Conclusion

Agile & XP help for embedded and life-critical SW

But

Need to add and tailor some practices.

Agile bottom-up & Lean top-down

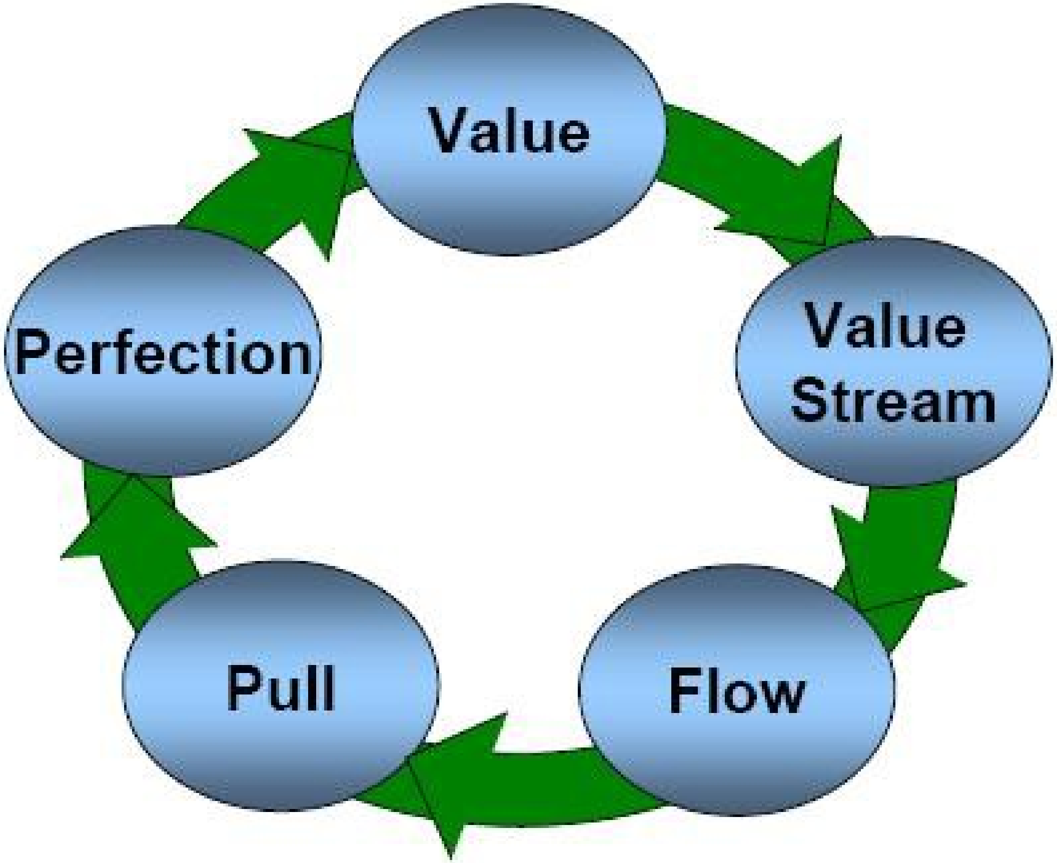
Lean

Toyota, High-Integrity & Lean

Mass-Production To Lean

Agile contributes

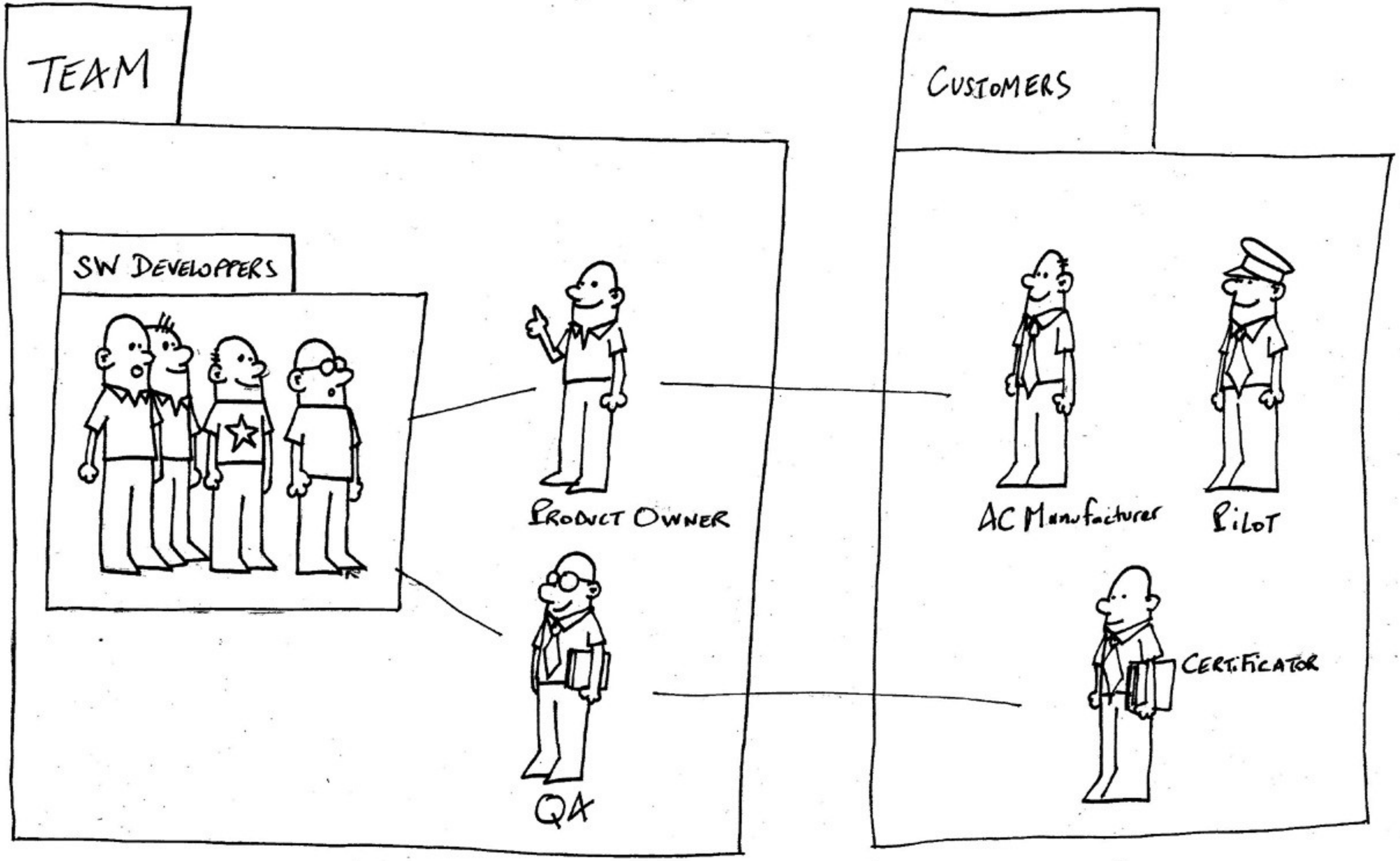
Lean / 5 pillars



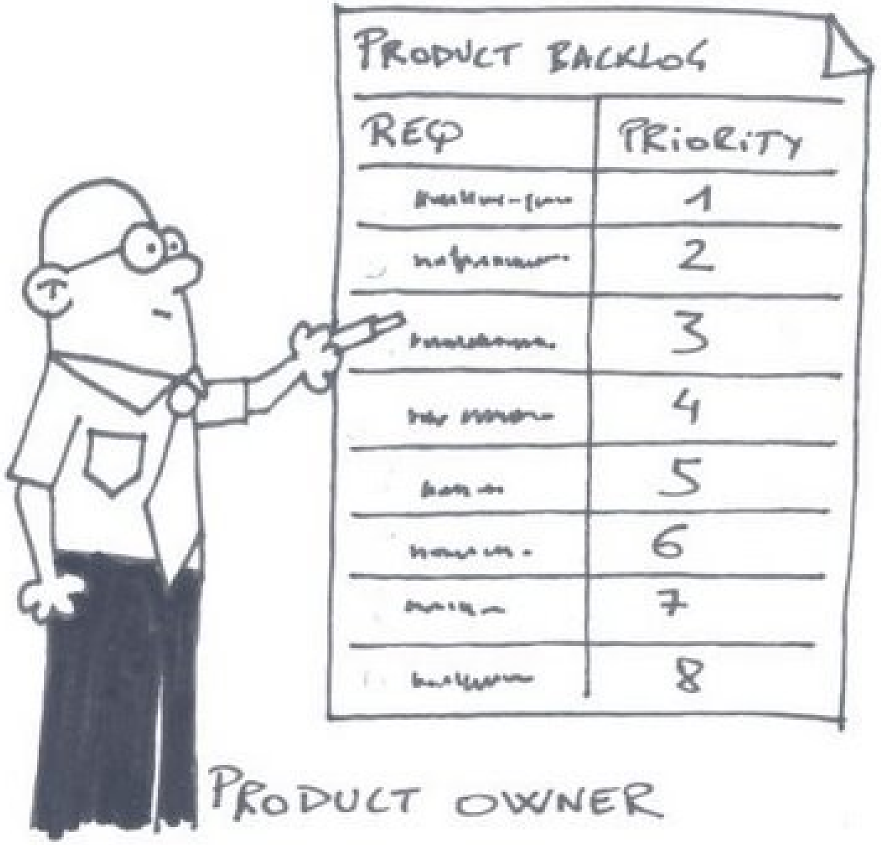
How does Agile contribute?

Lean / Value (1/2)

Specify value from the standpoint of the end customer



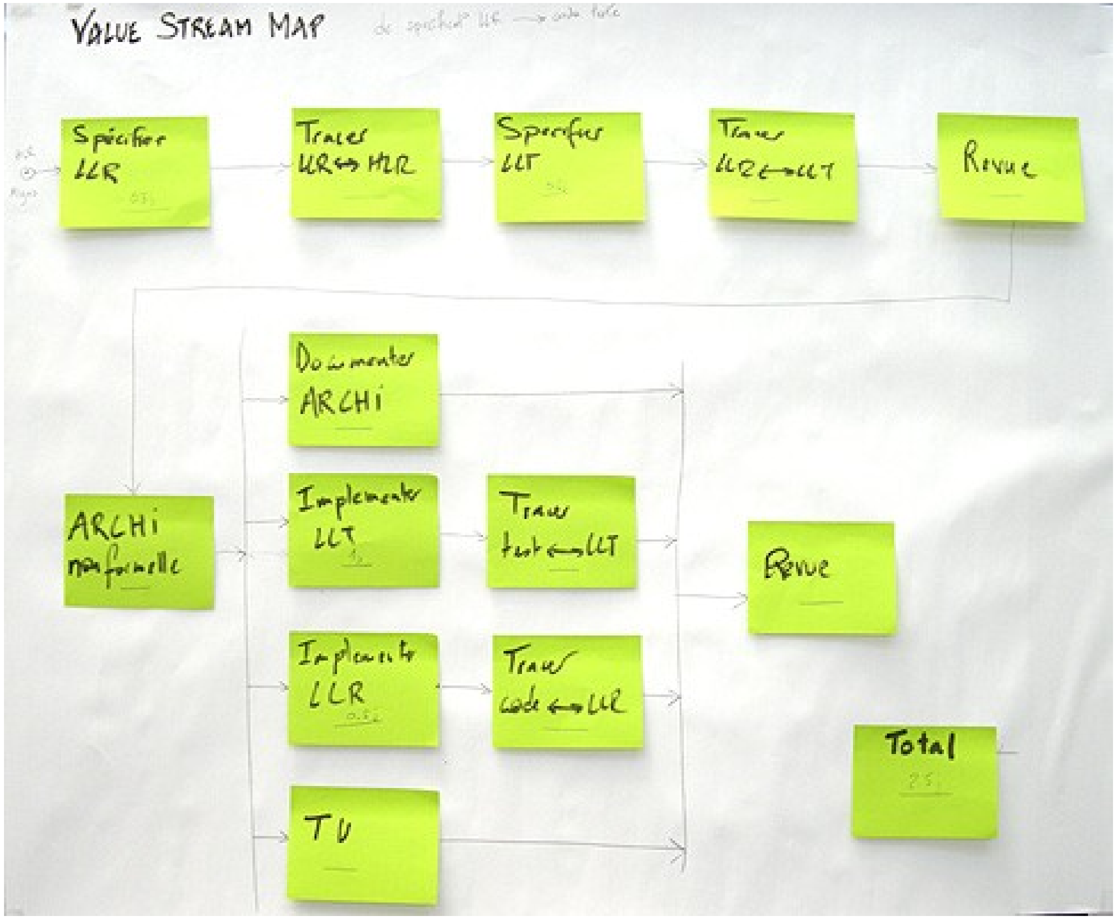
Lean / Value (2/2)



Requirements, acceptance tests, priorities, ROI

Lean / Value stream

Identify all the steps in the value stream eliminating each step that does not create value.

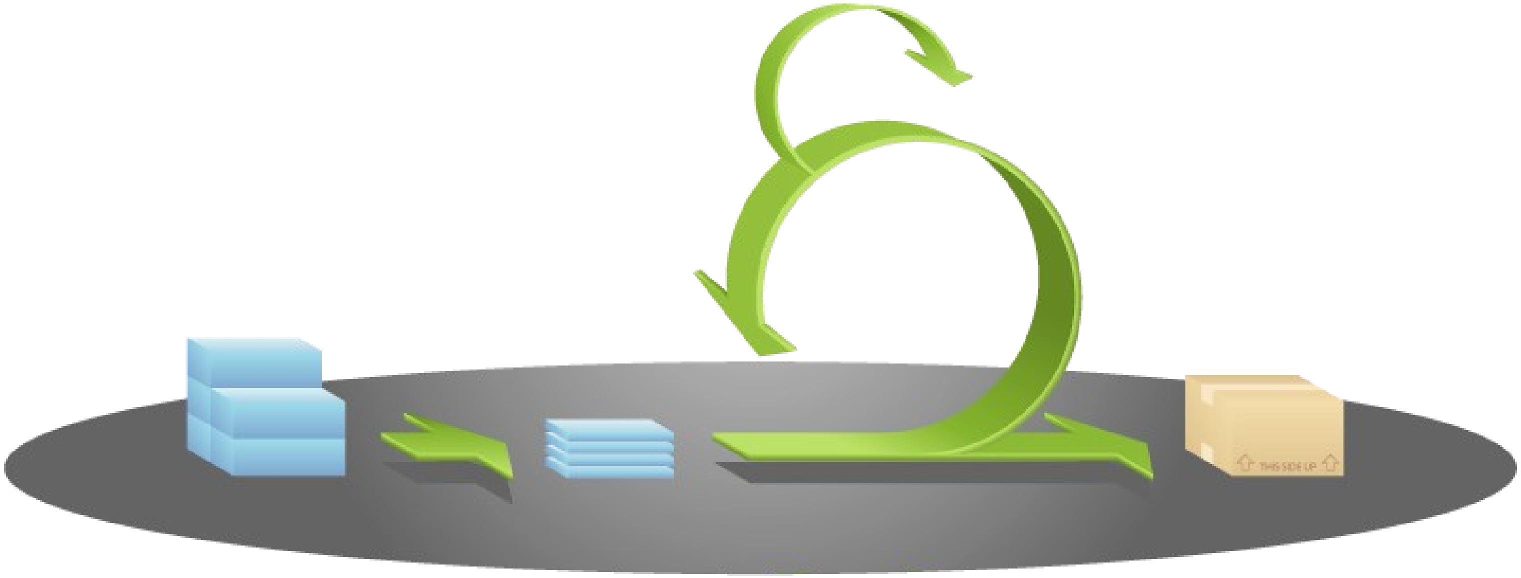


Lean / Value stream / Do not spur a willing horse

Premature optimization is waste!

Lean / Flow

Make the remaining value-creating steps occur in a tight and integrated sequence so the product will flow smoothly towards the customer.



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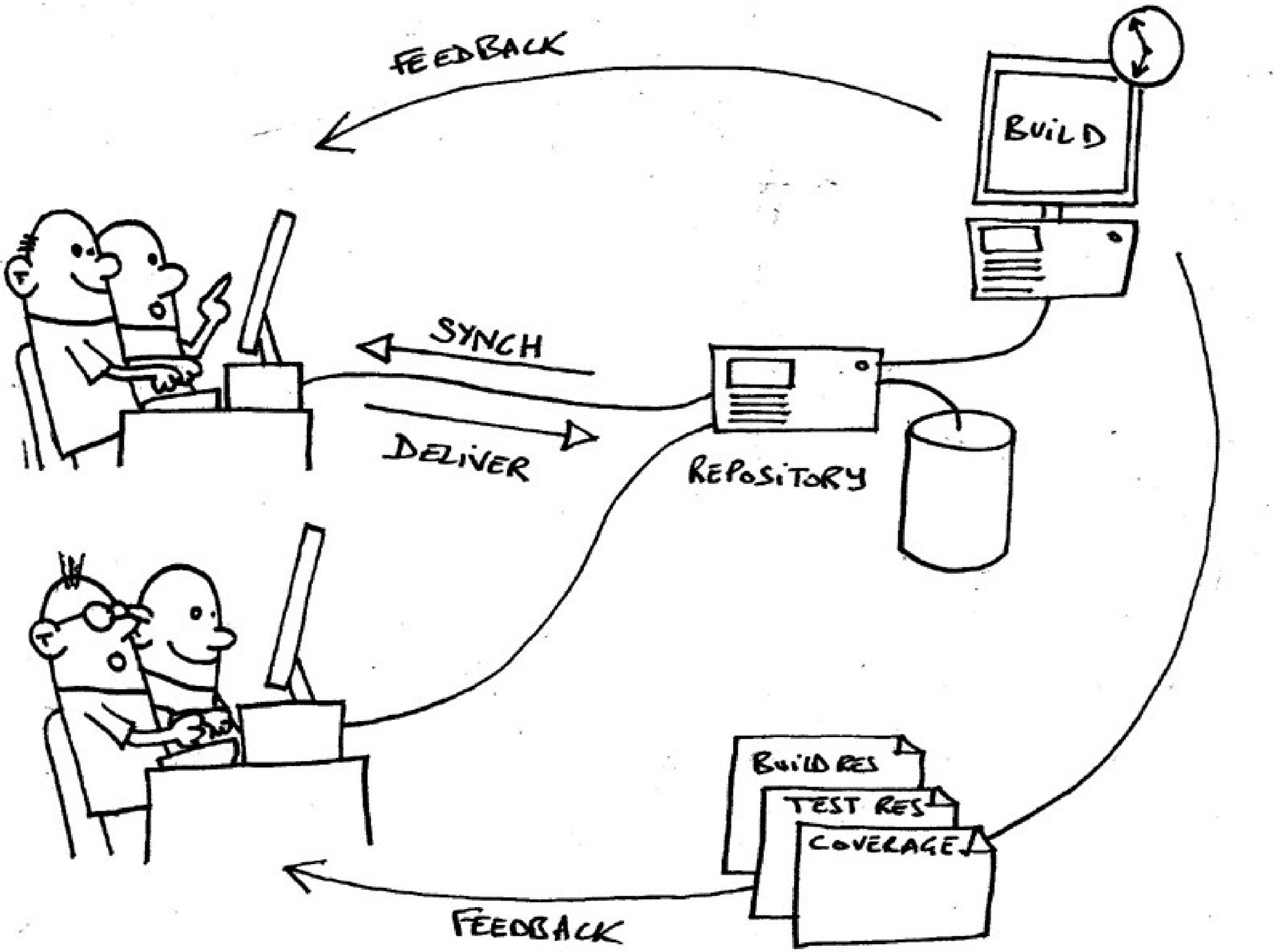
Steady flow: small batches of work + short regular cycles + fix problems slowing flow

Lean / Flow / Desynchronizations

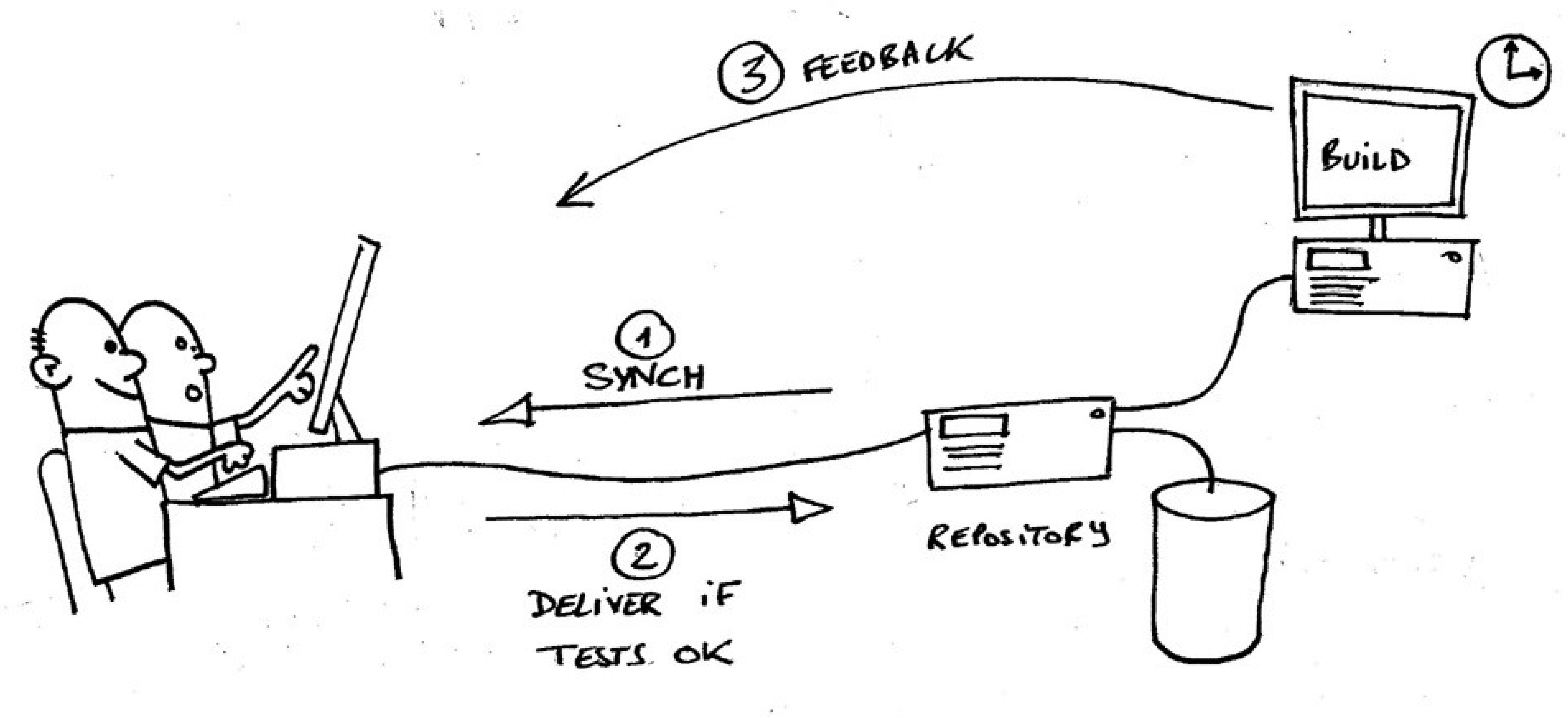
Daily-Stand-Up Meetings = Synchronized Teamwork

Lean / Flow / Desynchronizations



Continuous Integration = Synchronized shippable product

Lean / Flow / Defects / Prevention

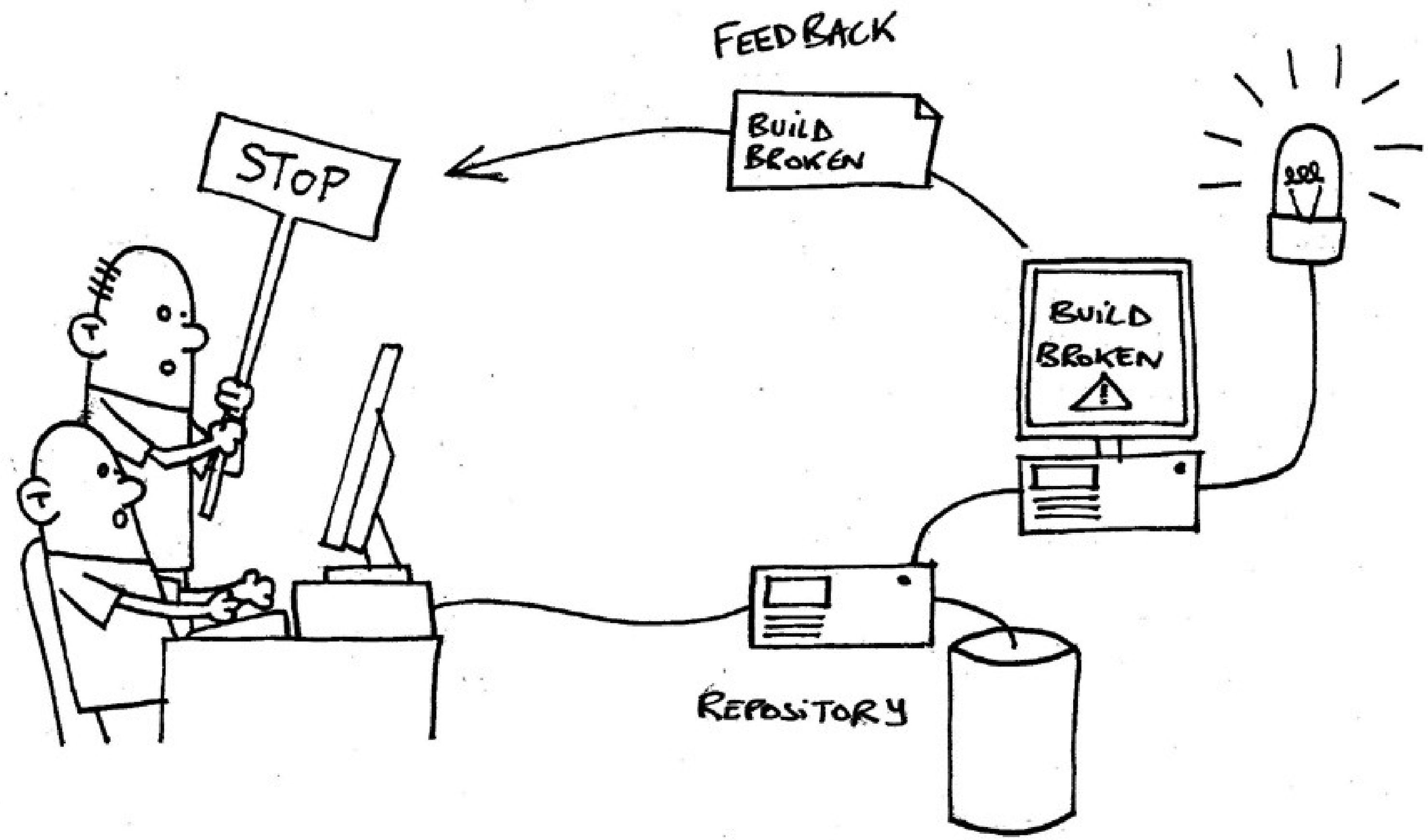


TDD prevents bugs & **Safe Deliver** prevents failed builds

Lean / Flow / Defects / Prevention

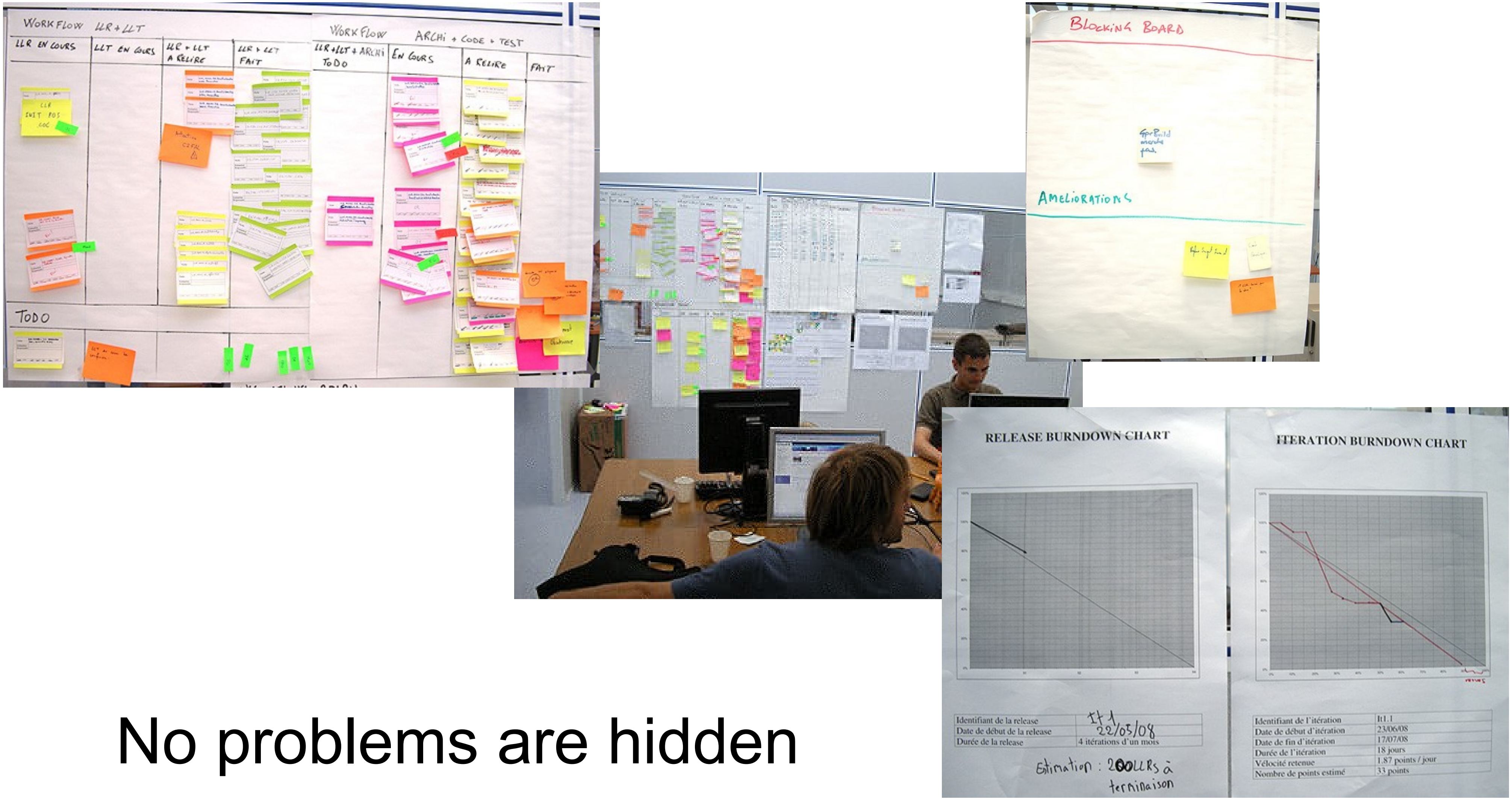
Pair Programming prevent bugs,
Design by Contract = foolproof code

Lean / Flow / Defects / Stop the line!



Continuous Integration + Design by Contract
= Stop to fix problems!

Lean / Flow / Visual Control



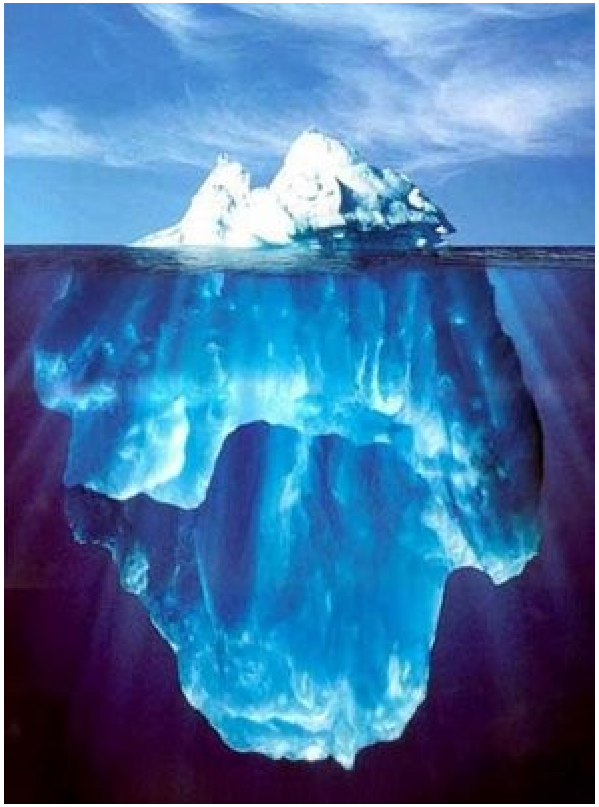
Identifiant de la release	It 1
Date de début de la release	22/05/08
Durée de la release	4 itérations d'un mois

Estimation : 200LLRs à terminaison

Identifiant de l'itération	It1.1
Date de début d'itération	23/06/08
Date de fin d'itération	17/07/08
Durée de l'itération	18 jours
Vélocité retenue	1.87 points / jour
Nombre de points estimé	33 points

No problems are hidden

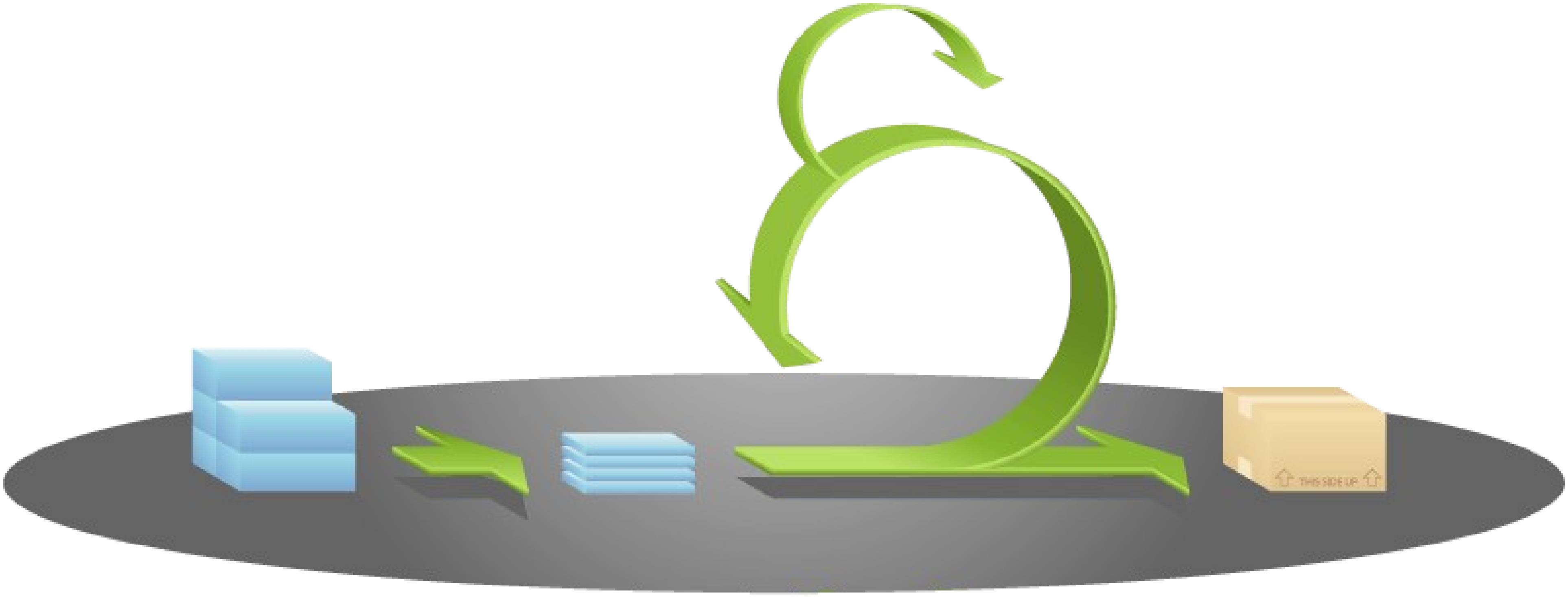
Lean / Flow / Conclusion



Bring problems to the surface;
Stop and fix.

Lean / Pull / Iter & Inc

As flow is introduced, let customers pull value.



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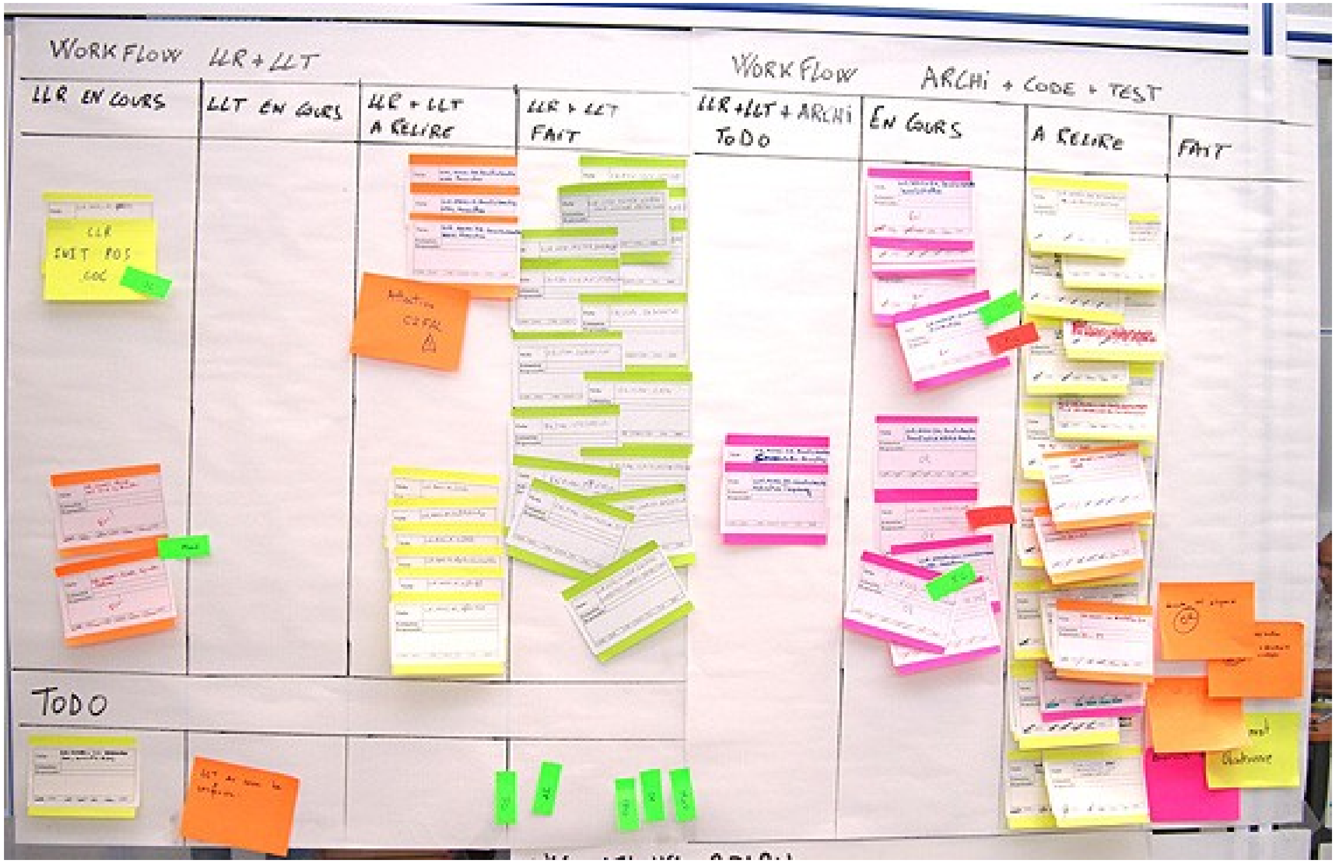
Iterative & Incremental Development of features prioritized by the customer = Pull

Lean / Pull / Kanban



Value Stream Map activities pulled by Kanban

Lean / Pull / TDD

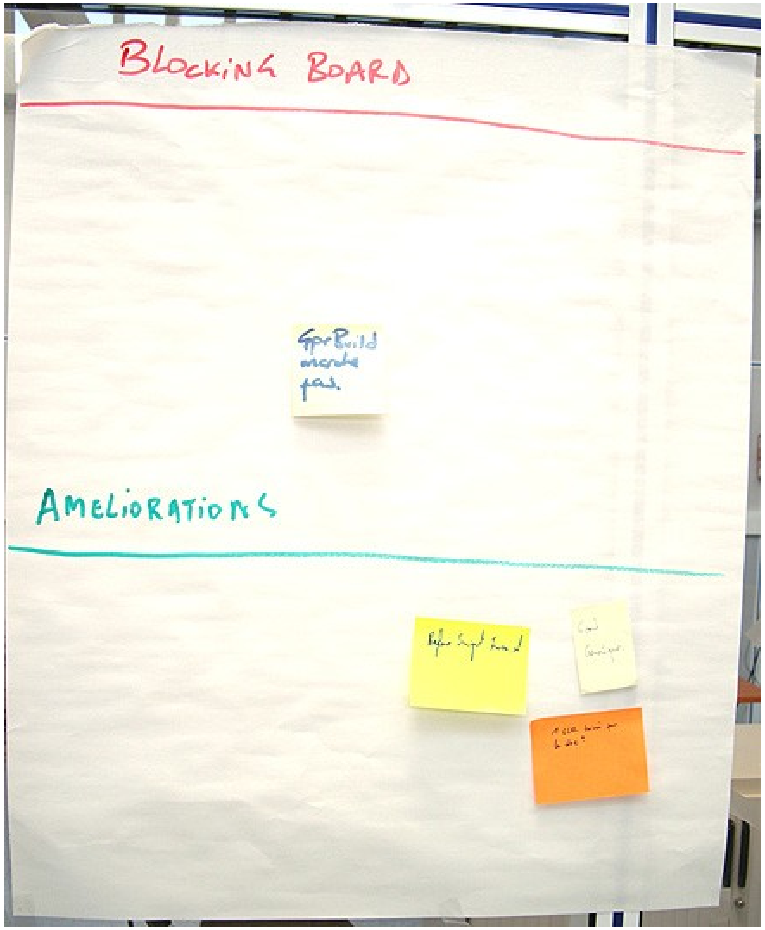
Test-First Programming:

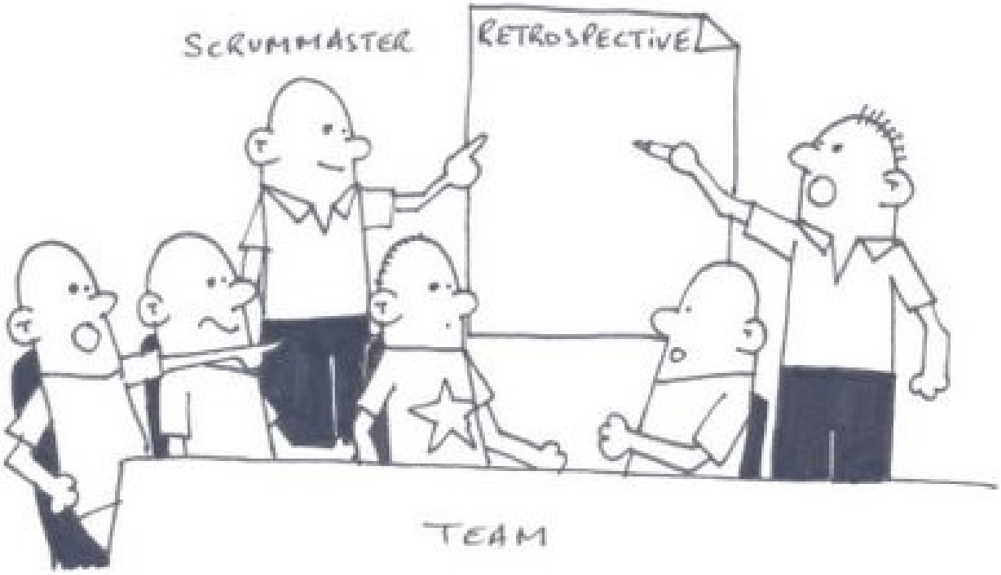
Failing Acceptance Tests
&
Failing Unit Tests

pull coding!

Lean / Perfection

Persue perfection through continuous improvement.





Conclusion

Agile helps for high-integrity SW;
Agile contributes to Lean;

Organizational and engineering practices;
Technical excellence.

Thanks!

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