

AGILE Software development of embedded systems

ITEA 2 Symposium 2007 - Berlin, Germany
Pekka Abrahamsson, VTT



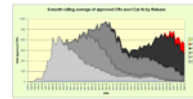
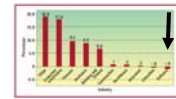
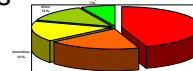
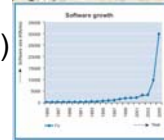
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- Motivation
- Technological starting point
- AGILE project goals & partners
- Results
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 - Tools
 - House-of-AGILE service
- Dissemination
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Embedded software The great challenge

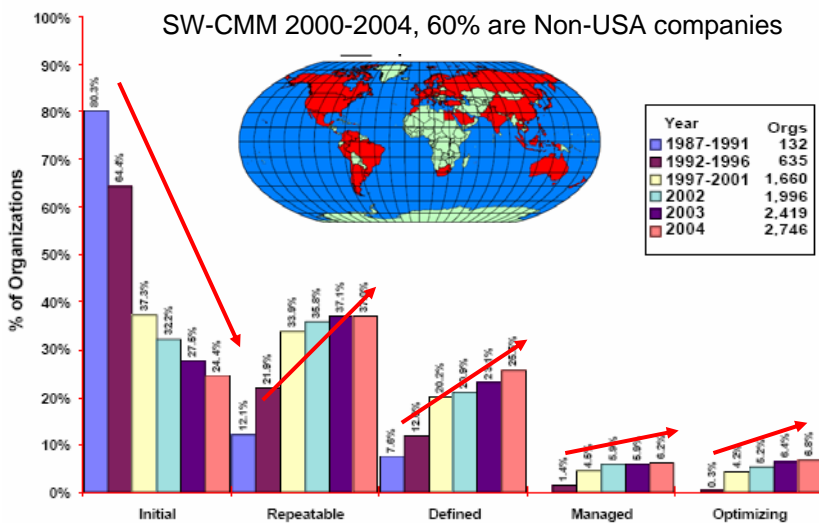
- Today, 90% of innovations in the automotive sector comes from software and electronics (ITEA 2)
 - The amount of software in embedded devices grows faster today than the Moore's Law (Philips)
- 60% of the features in Software-intensive Systems are rarely or never used (Gartner)
- Human capability of producing software has not increased over the past 10 years (www.economy.com)
- Change is the only known constant in software design & development (e.g., the 3GPP - over 5000 accepted change requests)



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CMMI dominates systems & software process improvement efforts

SW-CMM 2000-2004, 60% are Non-USA companies



Source: Software Engineering Institute, March 2005

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Benefits of software process improvement reconsidered



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1000+ studies in the IEEE database alone



0.21% of these studies show some concrete ROI Figures (Van Solingen, 2004)



Still, SPI is fairly expensive - up to \$53000 per single engineer (Jones, 1997)



Moreover, 70% of the software process improvement projects fail (SEMA, 2002)

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AGILE software development Starting technological base in 2004



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Agile

Manifesto for Agile Software Development

We are uncovering better ways of developing software by doing it and helping others to 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

That is, while there is value in the items on the right, we value the items on the left more.

AGILE
manifesto

1. Satisfy customer through early and frequent delivery	2. Welcome changing requirements even late in the project	3. Deliver working software frequently
4. Business people and developers work together daily throughout the project	5. Build projects around motivated individuals	6. Place emphasis on face-to-face communication
7. Working software is the primary measure of progress	8. Promote sustainable development	
10. Simplicity is essential	11. The most efficient and effective way of organizing work is to help the team	

Some practices

	Project Management	Engineering	Support
LD	Decide as late as possible See the whole Empower the team	Deliver as fast as possible	Eliminate waste Amplify learning
SCRUM	Daily Scrum Sprint Planning Meeting Sprint Review Meeting	Product Backlog Sprint Backlog	Product Owner Scrum Master Scrum Team
FOOD	Plan by Feature	Domain Object Modeling Developing by Feature Inspections Regular Builds	Individual Class (Code) Ownership Fixture Teams Configuration Management Reporting/Visibility of Results
XP	Planning Game Small Releases On site Customer	Pair Programming Coding Standards System Metaphor Testing Simple Design	Collective Ownership 40-hour work
ASD	Speculate Collaborate Learn	Refactoring Continuous Integration	

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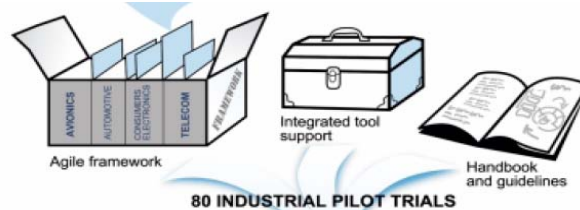
AGILE Embedded design issues

- Embedded systems are more rigid, complex and constrained than other software systems
- Agile methods are not so common in embedded domain
- Different pace of development in SW and HW, certification
- Embedded system development/test environments limit the methods to be used
- Architecture design in SW/HW interface
- Communication issues between SW and HW people (multi site environment)
- Embedded/Real-time operating systems
- Real-time and timing exact behavior

Source: Agile embedded workshop, Sofia, June 2006

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Goals for AGILE



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Project partners

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Agile

www.agile-itea.org Total effort 171 PY

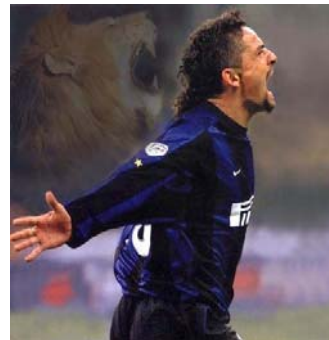
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Results of AGILE project

European leadership in Software-intensive Systems and Services. The Future of Embedded and Distributed Software.

Summary of principal results

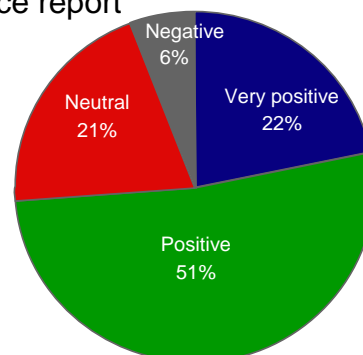
- Strong evidence based on 68 pilot projects: Concrete impact figures of AGILE in embedded domain
- Public methods: Mobile-D™, Eddy-process model, RaPiD7, Iterative Improvement Process for AGILE development
- 12 new tools, 3 in commercialization process, guidelines, new practices, patterns
- 112 publications, 3 international conferences, press & media attention, influenced 2 standards, 140 invited talks + 10 keynotes



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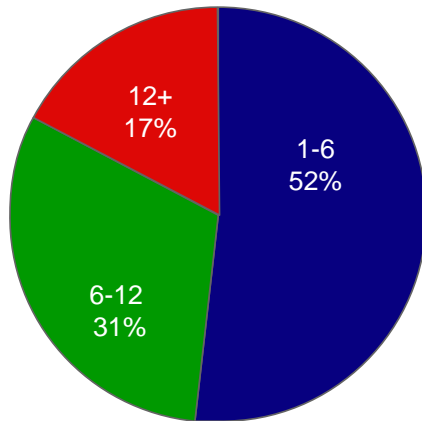
Results: AGILE's industrial trials

- Extensive number of Industrial trials executed
 - 68 pilot projects executed in 2004-2006
 - 1800 engineers in 17 companies involved
- Each pilot produced an experience report
- 73% of the pilot results either positive or very positive

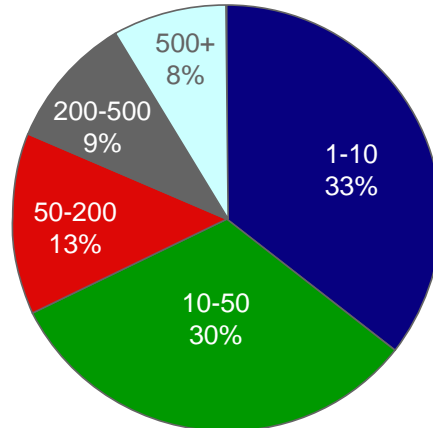


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Industrial trial characteristics

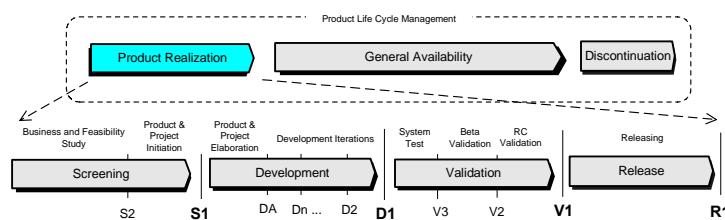


Duration in months:
17% lasted over a year



Size in person months: 17% were larger than 200 person months

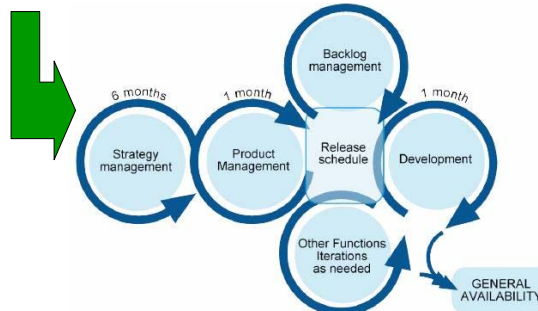
Impact of AGILE trials: Case F-Secure (FIN)



Product life-cycle and product realization cycle

- In F-Secure trials resulted in up to 70% reduction in lead-time and costs

- Achievements lead to a complete renewal of corporate R&D processes

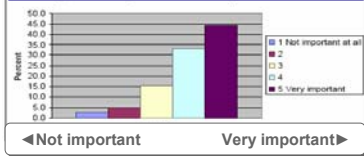


Impact of AGILE trials: Case Nokia (FIN)

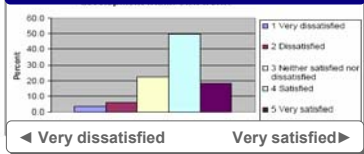
Domain: Telecom
Context: Base stations, network elements
Data: 18 Industrial Trials

- Over 1500 engineers trained
- 400+ engineers, testers and managers surveyed after one year of agile experience
- AGILE applied in all business units

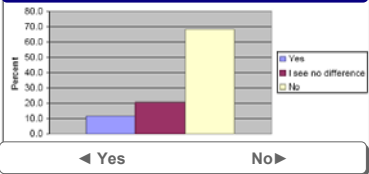
Importance of agile development in the future



Satisfaction with agile approaches

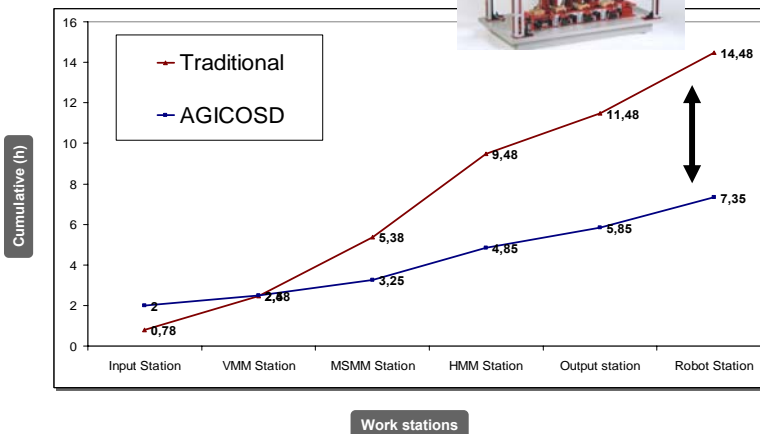


Would you go back to the old way of working?



Impact of AGILE trials: Case Engisud (ITA)

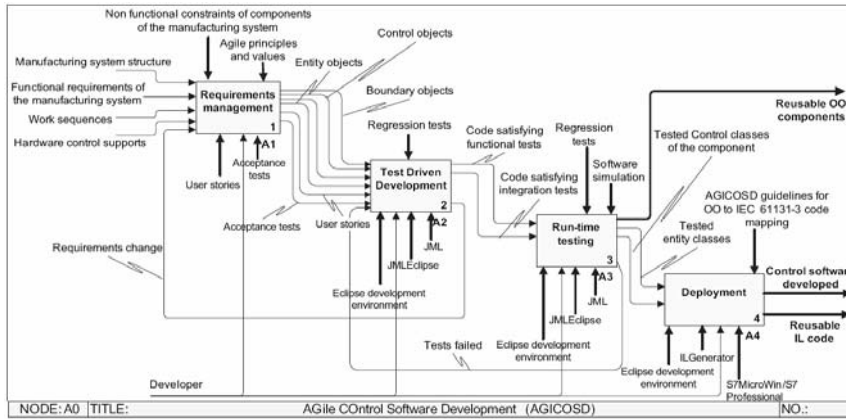
Domain: Industrial Automation
Context: PLC Control System
Data: 5 Industrial Trials



51%
cost
savings

Impact of AGILE trials: Case Engisud (ITA)

- New model including tools developed and experimented
AGICOSD development model - main activities



Source: Aiello et al (2007) An Agile methodology for manufacturing control systems development. INDIN 2007 (IEEE), Vienna, Austria. July, 2007

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Impact of AGILE trials: Case British Telecom (Exoftware, IRL)

AGILE core practices

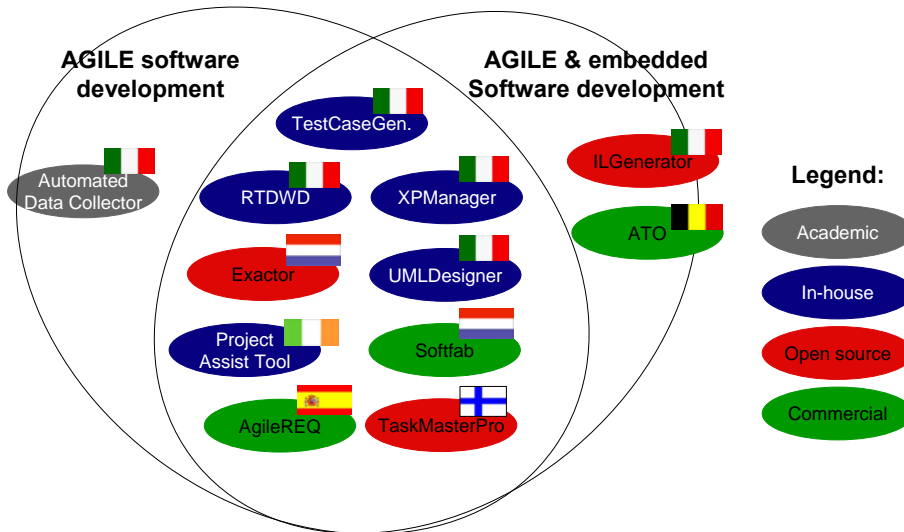
BEFORE

AFTER

1	Customer Involvement - Agile methods consistently emphasise ongoing involvement of the Customer with the IT team throughout the cycle, providing constant input and feedback.	Transformation 0%	75%
2	Iterative Development - Agile projects base delivery of software and other project outcomes around fixed periods of time called Iterations within the 90 day cycle.	Transformation 0%	100%
3	User Stories – The User Story is the basic unit of scope in an Agile project and describes the who, what, why of a requirement	Transformation 5%	100%
4	Automated Testing - The underlying principle is the efficient delivery of timely feedback by doing testing as early as possible and as quickly as possible.	Transformation 10%	40%
5	Continuous Integration - fully automated build and test process that allows a team to build and test their software many times a day.	Transformation 0%	25%

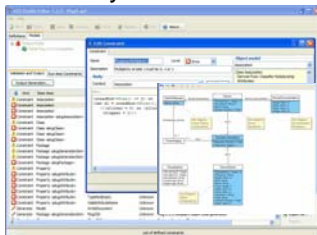
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Results: New tools developed in AGILE project



Results: Tool exploitation

ATO by E2S



- Developed by E2S in co-operation with KULeuven & Barco
- AGILE modeling through lightweight Model Driven Architecture
- Supports fast iterations, quick customer feedback, automated test case & document generation
- Prototype tested in AGILE, available in commercial markets in 2008

Softfab by Philips



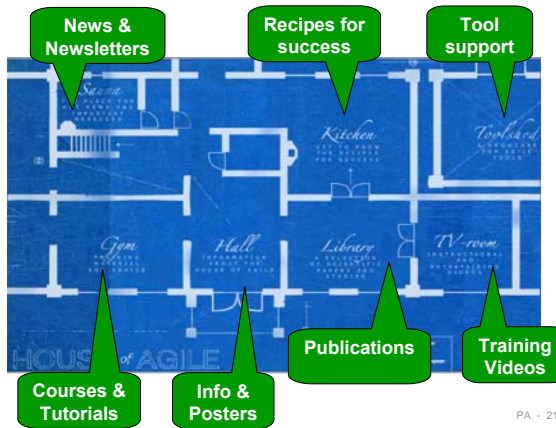
- Softfab takes the headache out from the software development
- Fully automated software build and test tool, resulting in 20-40% cost savings
- Build and test capacity used to its fullest
- Tested in Philips, F-Secure, Ficosa
- Spin-off in 2008

Results: House of AGILE - The one stop service for embedded AGILE knowledge

- Wiki-based portal
- Focuses on AGILE & embedded domain
- Maintained by the consortium
- Is the starting point for AGILE Embedded Institute



Easy entry at:
<http://www.houseofagile.org>

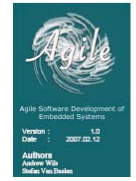
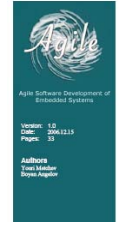
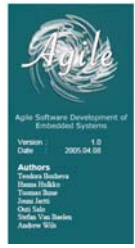


House of AGILE - Training material & expert coaching community

- E.g., Introduction to embedded agile in 5 different languages, deliverables, forums
- Facilitates take-up of agile in European companies

Speakers and their affiliations:

- Brian Hanly, Exoftware (English)
- Alberto Sillitti, U.Bozen-Bolzano (Italian)
- Santiago Estela, SQS (Spanish)
- Jari Still, F-Secure (Finnish)
- Ko Dooms, Philips (Dutch)

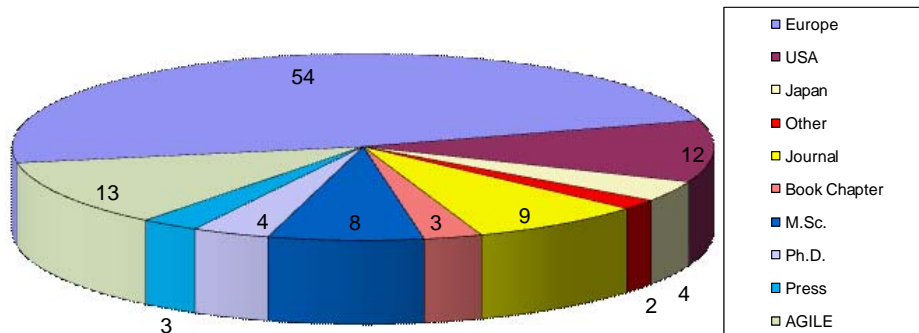


Dissemination and scientific impact



Scientific dissemination

- Excellent number of international publications
 - 112 publications (most of them available in AGILE website)



Forums: IEEE Computer, Information & Software Technology, SPIP, IJAM, Journal of System Architectures, Cutter Journal OOPSLA, XP, ADC, ICAM, IFIP, ICSE, ECMDA, EuroSPI, PROFES, SPICE, QA-TEST, EuroMicro, SoC, ACM SIGSOFT-FSE

Multiple ways of disseminating: **press newsletters, press conferences, road shows**



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Agile Business Conference
2006, London, UK



Oulu, Finland



Como, Italy

- Dissemination results in AGILE include:
 - 3 International conferences organized
 - 2 International press conferences
 - 140 Invited talks (seminars, events)
 - 10 key notes in international conferences and seminars
 - 2 standards under influence: IEEE 1648 and DO-178C



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Conclusions & future



Conclusions & Future

- AGILE offered first-hand concrete empirical evidence that agile development is not only possible but yields significant benefit for embedded software industry
- AGILE impacted several organisations beyond expectations (e.g., new R&D models in use, thousands of engineers & managers trained)
- Excellent exploitation opportunities through standardization, Embedded Agile Institute, commercial and open source tools
- FLEXI-ITEA2 scales up AGILEs results to multi-technology global development scale and extends to business and innovation processes.

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AGILE Team welcomes you to our booth!



Picture from the closing seminar of AGILE project held in January 15-17, 2007, Rovaniemi, Finland

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Thank you *for your attention*



European leadership in Software-intensive Systems and Services. The Future of Embedded and Distributed Software.