LS2: The Agile Enterprise: Real World Experience in Creating Agile Companies

Leadership Symposium
Grand Ballroom South

Jeff Sutherland, Ph.D.
Co-Creator of the Scrum Development Process
http://jeffsutherland.com/scrum

AGILE DEVELOPMENT

Jeff Sutherland jeffsutherland.com/scrum

- **Agile Systems Architect since 1986**
  - CTO/VP Engineering for 9 software companies
  - Prototyped Scrum in 4 companies
  - **Conceived and executed first Scrum at Easel Corp. in 1993. Rolled out Scrum in next 5 companies**
  - Scrum consultant to leading companies in Europe, North and South America, and Russia.
  - Senior Advisor, OpenView Investments, LLC
- **Signatory of Agile Manifesto and founder of Agile Alliance**
- **Scrum Certification World Tour**

Feb 7-8 CSM Aarhus	Jun 6-7 CSM Aarhus
Feb 22-23 CSM Ft Myers	Jun 11-12 CSM Copenhagen
Mar 1-2 CSM St. Petersburg	Jun 13 Oresund Agile Copenhagen
March 12-13 CSM QCon London	Jun 14-15 CSM Saxo Bank Copenhagen
March 22-23 CSM Boston	Jun 18-19 CSM Oslo
Apr 3-4 CSM Amsterdam	Jun 20-21 CSM Stockholm
Apr 11-12 Scrum Tuning Boulder	Jun 23-24 Exigen St. Petersburg
Apr 18-19 CSM Boston	Jun 26-27 CSM Amsterdam
Apr 25-26 CSM Aarhus	Jul 11-12 CSM Charlotte
Apr 28-29 Deep Agile Boston	Jul 16 Nortel Ottawa
with Ron Jeffries	Jul 25-26 CSM Healthwise Boise
May 7-11 Scrum Gathering Portland	Aug 1-2 CSM Silicon Valley
May 17-18 CSM Boston	Aug 6-9 CSM MySpace
May 3-Jun 1 CSM Stockholm	Aug 13-17 Agile 2007 Washington, DC

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Current Clients

Partial Scrum

Microsoft, Google, Yahoo, Adobe, GE, Oracle, Siemens, BellSouth, Ulticom, Palm, St. Jude Medical, DigiChart, Healthwise, Sony/Ericsson, Accenture, GuideWorks, Exigen Services/Starsoft Labs, SirsiDynix, Softhouse, Philips, Barclays Global Investors, Constant Contact, Wellogic, Inova Solutions, Medco, MySpace, Johns Hopkins, Wachovia, IBS Interprit, OpenView Venture Partners

Company Wide Scrum

PatientKeeper, Solutions IQ, Trifork, Systematic Software Engineering, Saxo Bank, Xebia, Inova Solutions

Some Characteristics of Real World Agile Companies

- Agile is strategic imperative

- Scrum and XP is institutionalized

- Teams pass the Nokia test for Scrum

- Senior management and developers are totally involved

- Scrum is used outside of development

- Companies have dramatic growth in size and revenue. Products are best of breed and projects are best in class.

- Product companies move into GartnerGroup magic quadrant.

Getting there: Xerox Parc innovations

Personal Workstation

Mouse

Ethernet

Windows Interface
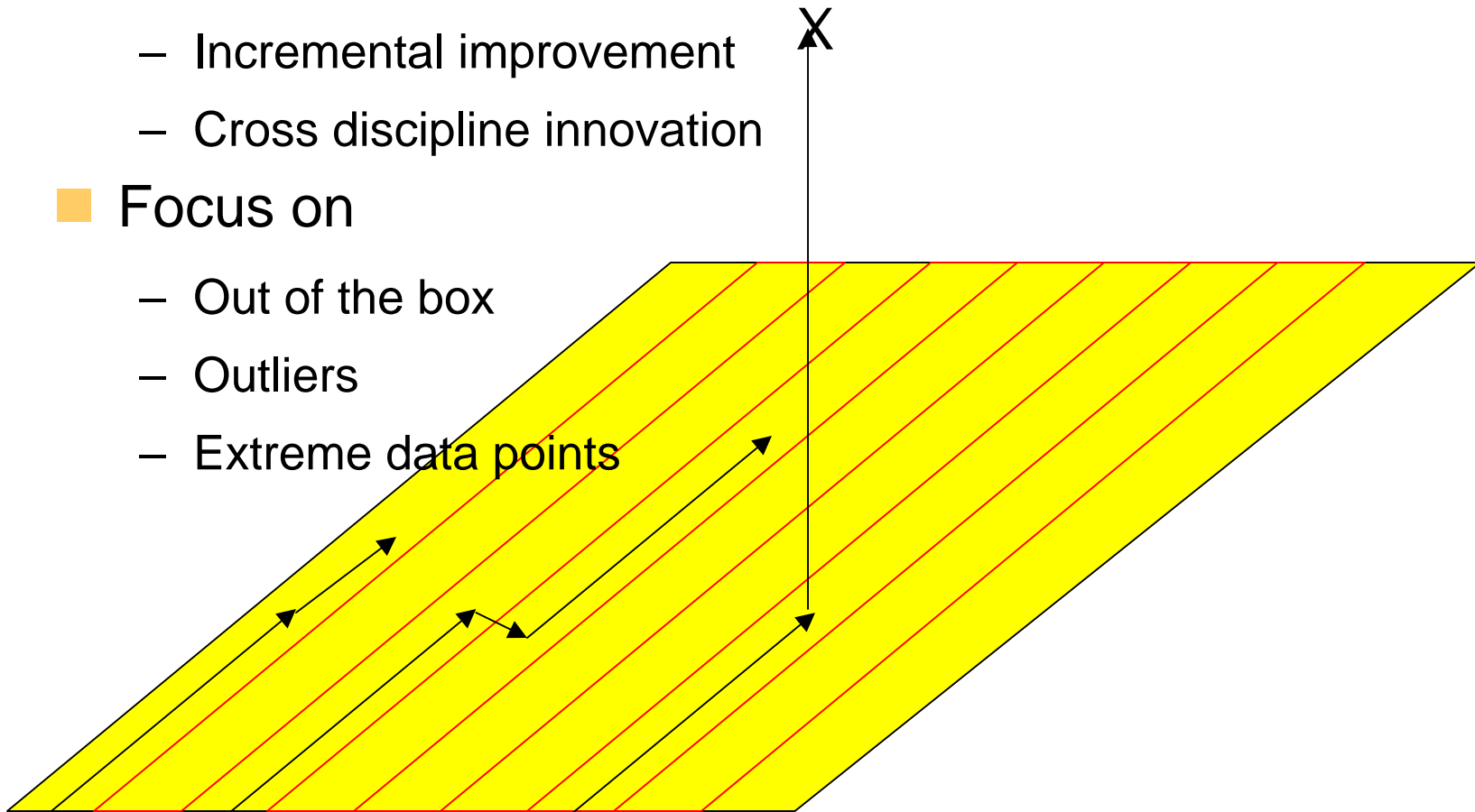

Laser Printer
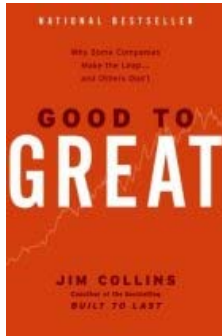

Smalltalk

Alan Kay's Strategy

- **Forget about**
  - Incremental improvement
  - Cross discipline innovation
- **Focus on**
  - Out of the box
  - Outliers
  - Extreme data points

Out of the Box

- Scrum looked at projects that were off the plate
  - IBM surgical team
  - Borland Quattro Project
  - Takeuchi and Nonaka new product development strategies
- *Scrum: A Pattern Language for Hyperproductive Software Development*
  - By M. Beedle, M. Devos, Y. Sharon, K. Schwaber, and J. Sutherland. In Pattern Languages of Program Design. vol. 4, N. Harrison, Ed. Boston: Addison-Wesley, 1999, pp. 637-651.
- First Scrum was a hyperproductive Scrum. Management and sales asked the team to slow down.
- Latest Scrum is a hyperproductive revenue generating Scrum. The Board asked the company to slow down revenue recognition.

Planon Type B Scrum
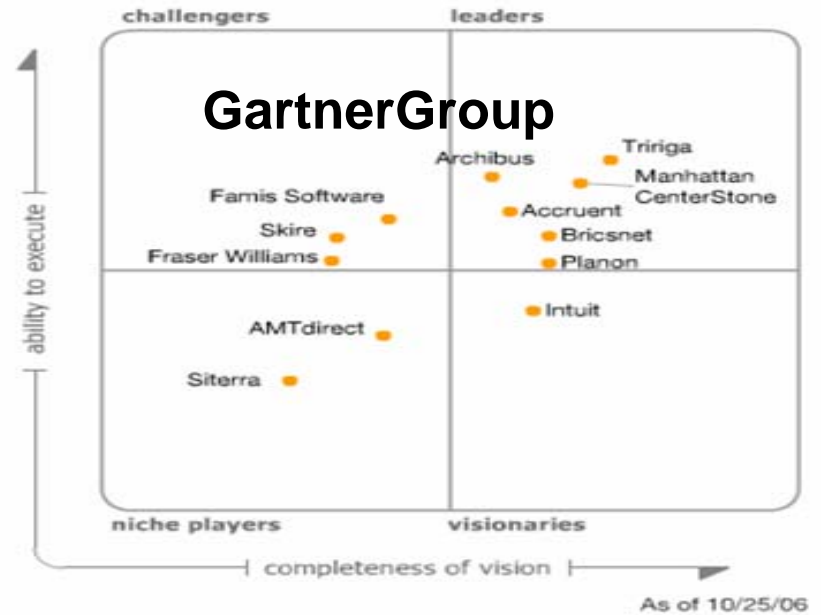
- Great means you are the industry leader in your market and revenue is skyrocketing
- Anyone can aspire to be great!
- That aspiration will make you and your company better

PatientKeeper Type C Scrum
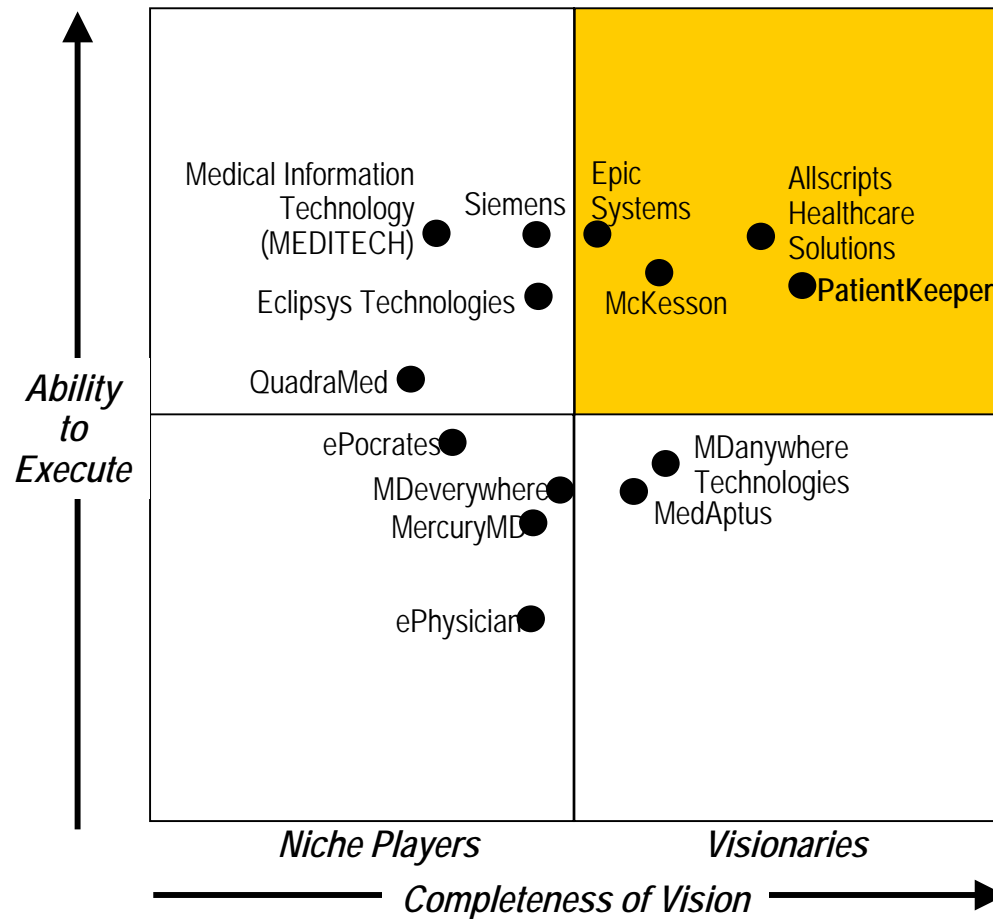
- **First Scrum** hyperproduced software but not revenue
- Achieved hyperproductive revenue state in July 2007
- All-at-Once Type C Scrum designed for hyproductive software *AND* revenue

I find that the vast majority of organizations are still trying to do too much stuff, and thus find themselves thrashing. The only organization I know of which has really solved this is Patient Keeper. *Mary Poppendieck, 2007*

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Are you doing Scrum?
The Nokia Test by Bas Vodde

- First, you must be doing iterative development

  – Iterations must be timeboxed to less than six weeks

  – Software must be tested and working at the end of an iteration

  – Iteration must start before specification is complete

- Then you must meet the Nokia Scrum test

- 1969 - Earliest published reference to Iterative Incremental development

  – Robert Glass. Elementary Level Discussion of Compiler/Interpreter Writing. ACM Computing Surveys, Mar 1969

  – See Larman, Craig and Basili, Vic. Iterative and Incremental Development: A Brief History. IEEE Computer, June 2003 (Vol. 36, No. 6) pp. 47-56

For those doing Scrum

- You know who the product owner is
- There is a product backlog prioritized by business value
- The product backlog is has estimates created by the team
- The team generates burndown charts and knows their velocity
- There are no project managers (or anyone else) disrupting the work of the team
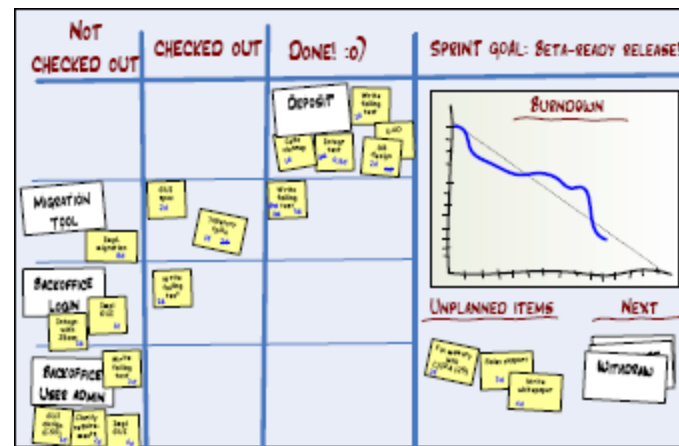
Kniberg, Henrik. Scrum and XP from the Trenches: How We Do Scrum. Version 2.1, Crisp, 5 Apr 2007.

OpenView Venture Partners

- Invest only in Agile companies

- Scrum and XP are Oracle and SQL Server of Agile processes. Portfolio companies must use them.

- Portfolio companies must pass the Nokia test

  - One product owner, one product backlog, estimated by developers

  - Fixed iterations with software done (working and tested)

  - Teams have burndown charts and know their velocity

  - No external disruption of teams during Sprint

Experiences with people doing Scrum
Hyperproductive Scrum Teams

- It is easy to double productivity with Scrum by implementing only high business value features.

- To quadruple productivity (Toyota effect) requires surfacing impediments and removing them (inspecting and adapting).

- Scrum was designed for 5-10 times productivity improvement. This has been experienced in three types of teams:

  - *The first Scrum team and similar colocated teams.*

  - *The first distributed Scrum team.*

  - *Large distributed/outsourced projects.*

- Understanding hyperproductive Scrum teams can help improve your software development with Scrum.

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Hyperproductivity in Distributed Scrum

- IDX (now GE Healthcare) – 567 developers, many locations

- IDX Web Team Scrum 1996-2000
  - Burlington, VT
  - Boston
  - Seattle

- Factors accelerating the IDX hyperproductive Distributed Scrum
  - Scrum organizational pattern
  - Engineering practices
  - Daily meeting of distributed team
  - Tools (direct connection to Microsoft development)

Distributed Scrum Styles
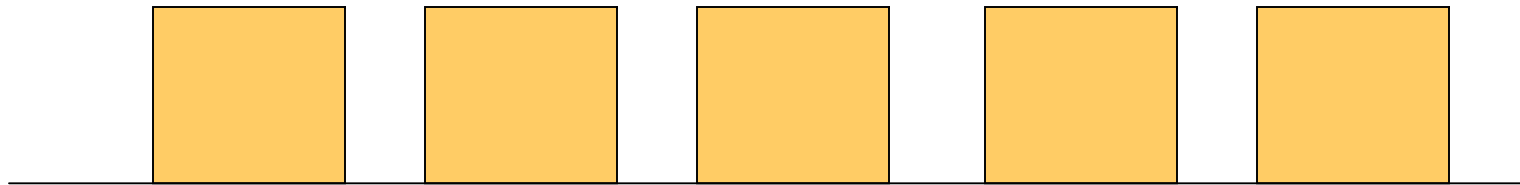
Isolated Scrums
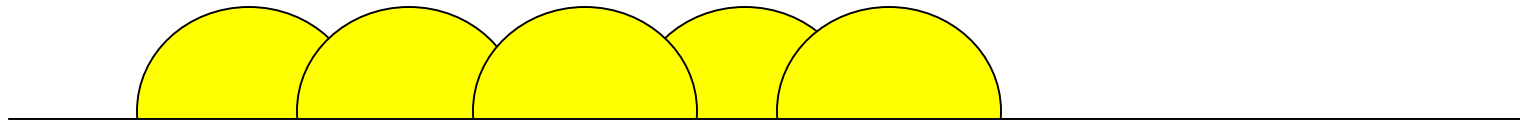
Distributed Scrum of Scrums
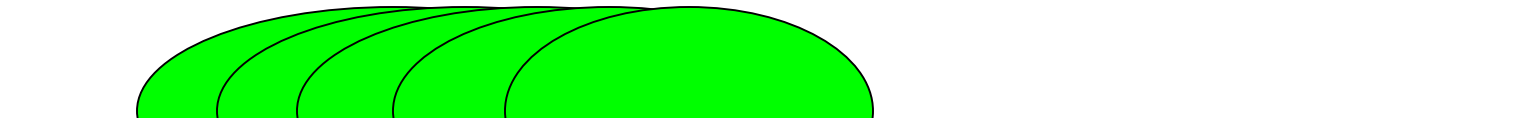
Totally Integrated Scrums

Outsourcing

- Outsource $2M development
- Outsourcing costs - $1.6M
  - Industry data show 20% cost savings on average
- Introduce Scrum locally
  - 240% improvement at IDX, for example
- Local Scrum costs – $0.83M
- SirsiDynix radically reduced outsource costs making oursourcing reasonable for:
  - Gaining expertise that is unavailable locally
  - Expanding and contracting development staff without layoffs

Jack Blount CTO
SirsiDynix

- 30 years in the computer software industry
- Began as a software engineer in Raleigh, NC for IBM
- SVP Engineering at Novell in the 80s
- CTO at TeleComputing, MobileWare, JD Edwards
- COO at Borland, Raindance
- CEO at USDA, Picus, MobileWare, Dynix, AlphaBay

Nick Puntikov VP
Exigen Services (formerly CEO, StarSoft)

- USSR Academy of Sciences
- XP Advocate

Better. Together.

Decision Criteria to Outsource

- Fixed R&D budget based on declining sales of old product

- Limited Java expertise available locally

- Critical time to market to achieve $30 million growth in sales based on stalled market and sales pipeline for new product

- Dramatically improved performance, security and scalability required by market

Better. Together.

Outsourcing Selection Process

■ Contacted multiple firms for phone interviews

- – 18 in India

- – 7 in China

- – 9 in Russia

■ Scheduled on-site interviews

- – 6 firms in India

- – 4 firms in China

- – 5 firms in Russia

■ Jack Blount personally flew to all three countries and held the interviews from both a technical and business perspective

Better. Together.

Risk Associated with Outsourcing

■ Unable to staff project on time

■ Unable to keep staff on the project once it starts

– India and China have about 35% annual staff rotation

– This is the generally viewed as the largest exposure and always results in delayed projects

■ Poor communications

– Remote development always has communications challenges

– Different time zones of US and outsource countries

– Lack of formal processes

– Language barriers

Better. Together.

SirsiDynix Distributed Scrum

■ Over a million lines of Java code

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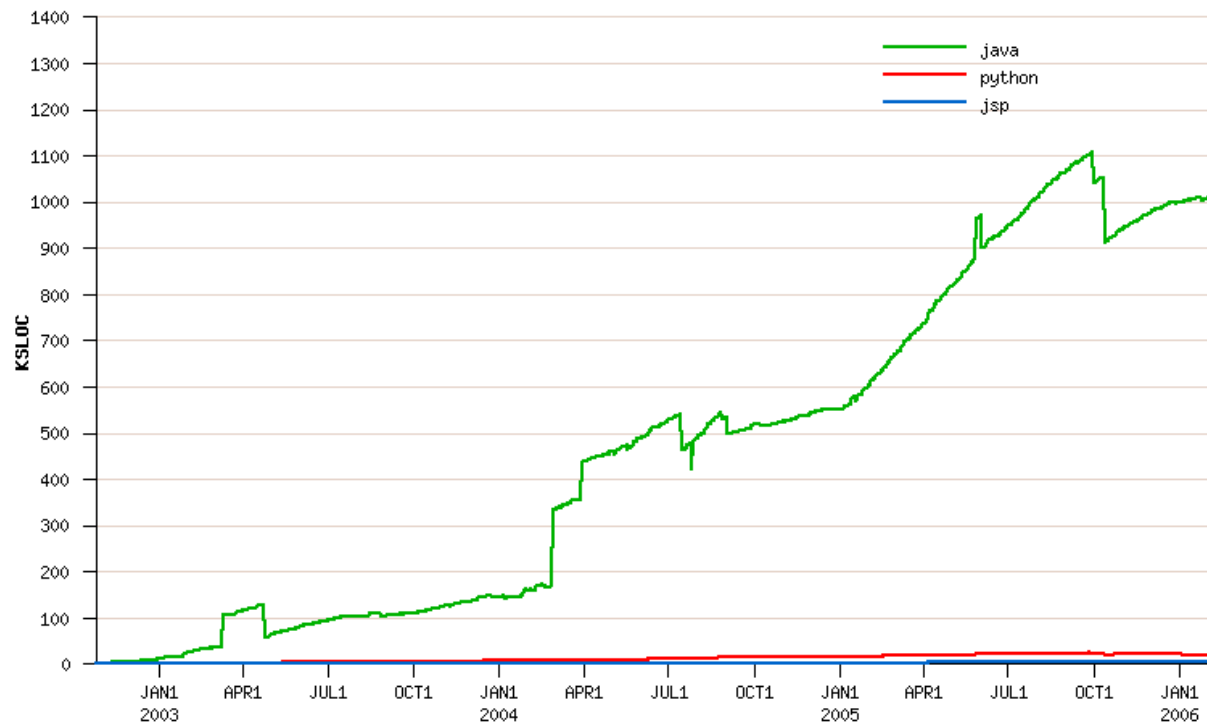
SirsiDynix Distributed Scrum

■ 56 developers distributed across sites

© Jeff Sutherland 1993-2007
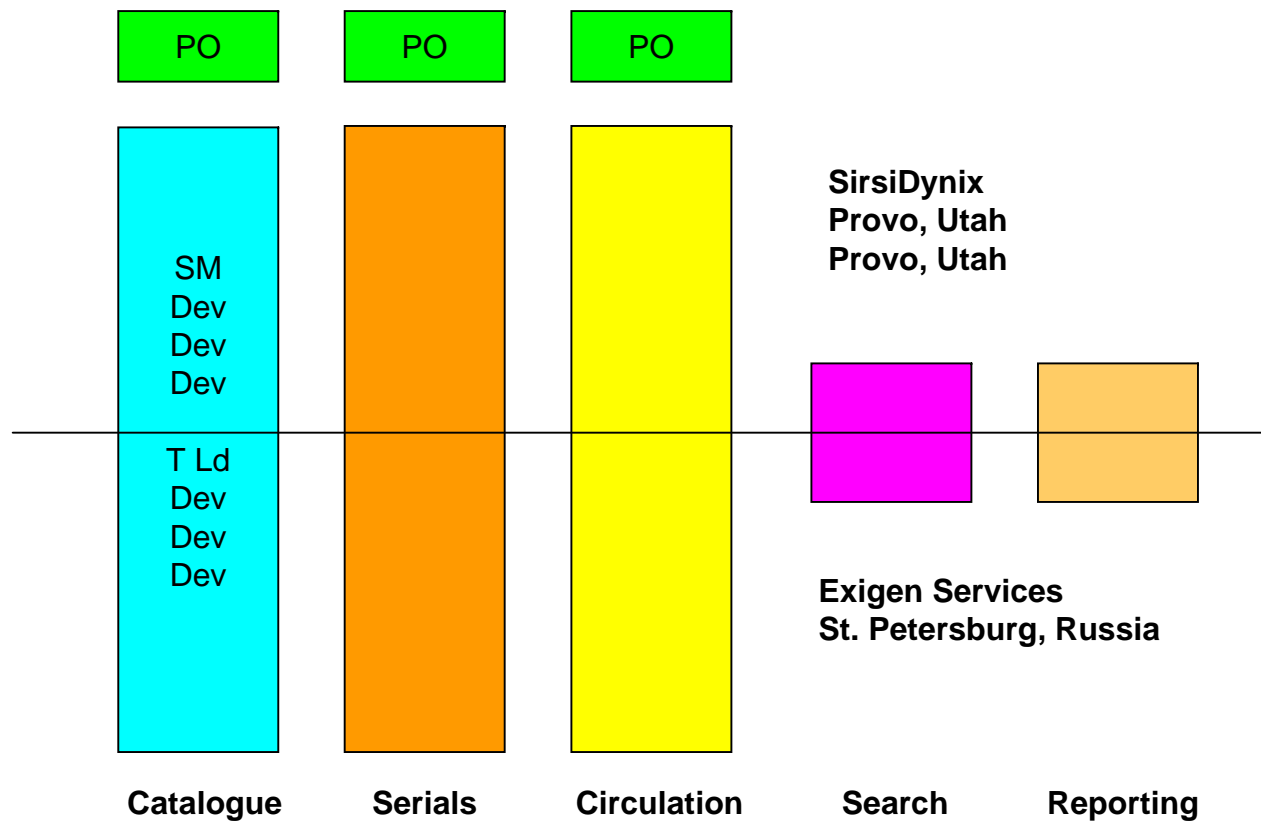
SirsiDynix Distributed Scrum

■ Scrum daily meetings

St. Petersburg, Russia 17:45pm

Local Team Meeting

7:45am Provo, Utah

Scrum Team Meeting
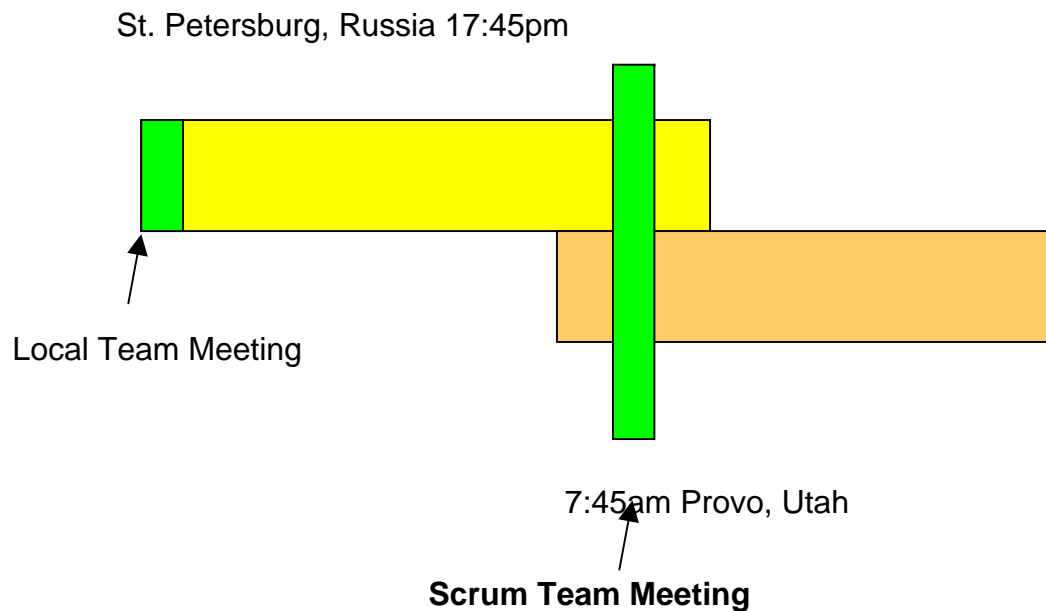
SirsiDynix Distributed Scrum

- Common tools

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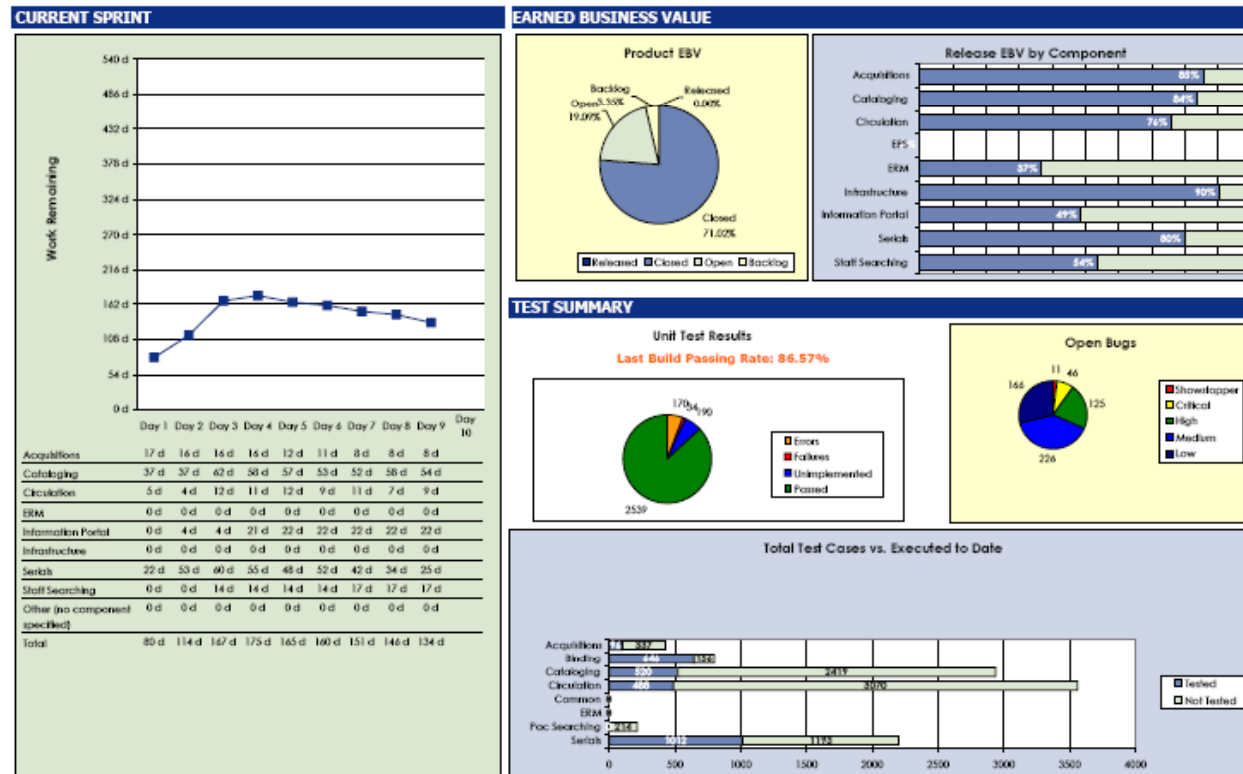
SirsiDynix Distributed Scrum

■ Uncommon performance

	Colocated Scrum*	Waterfall*	SirsiDynix Distributed Scrum**
Person Months	54	540	827
Lines of Java	51,000	58000	671,688
Function Points	959	900	12673
FP per dev/month	17.8	2.0	15.3

*M. Cohn, User Stories Applied for Agile Development. Addison-Wesley, 2004
**J. Sutherland, A. Viktorov, J. Blount, and N. Puntikov, "Distributed Scrum: Agile Project Management with Outsourced Development Teams," in HICSS'40, Hawaii International Conference on Software Systems, Big Island, Hawaii, 2007.
.

SirsiDynix was off the charts

- Distributed
- Outsourced
- Hyperproductive
- Linearly scalable
- Out of the Box

X
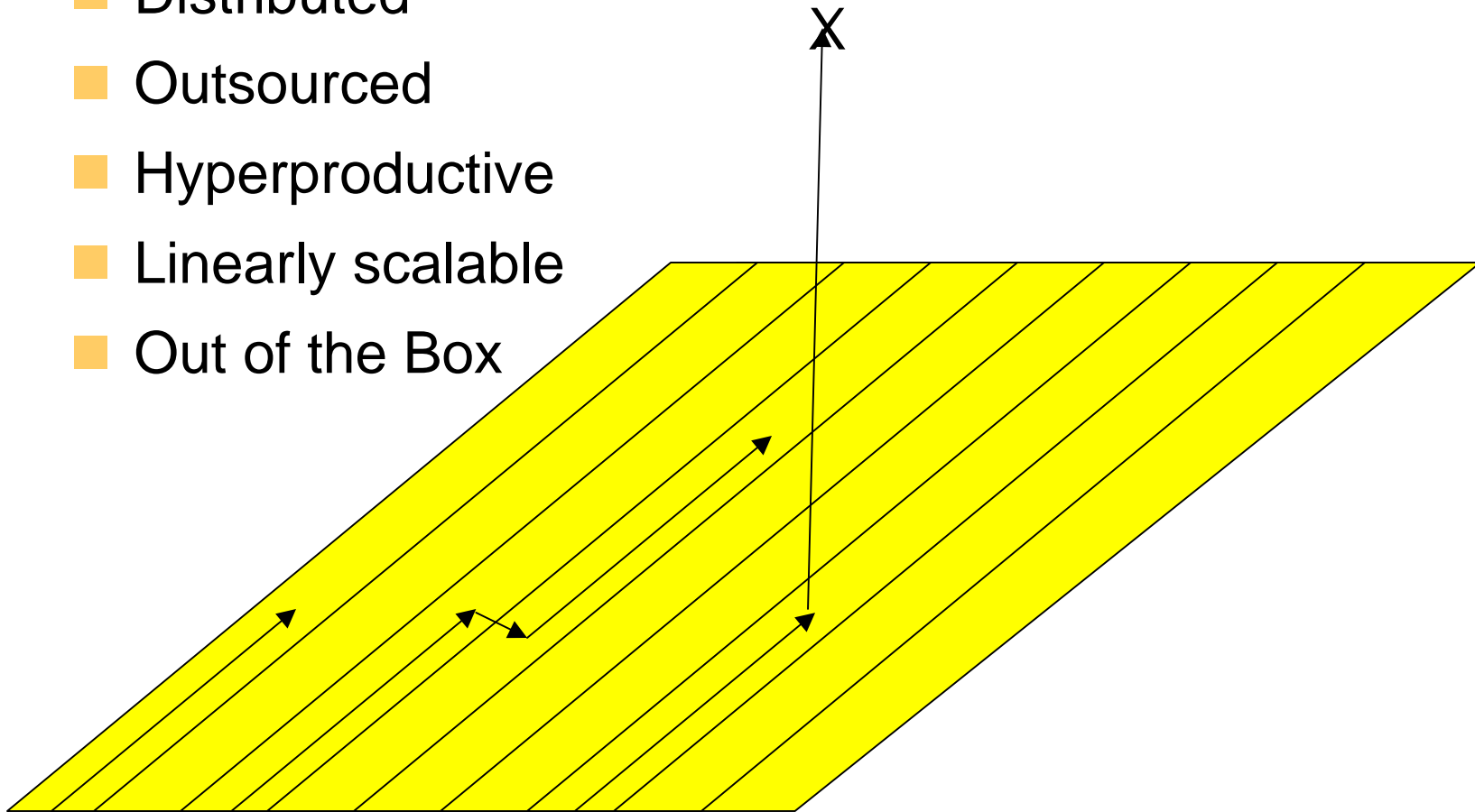
First Demonstration of Linear Scalability
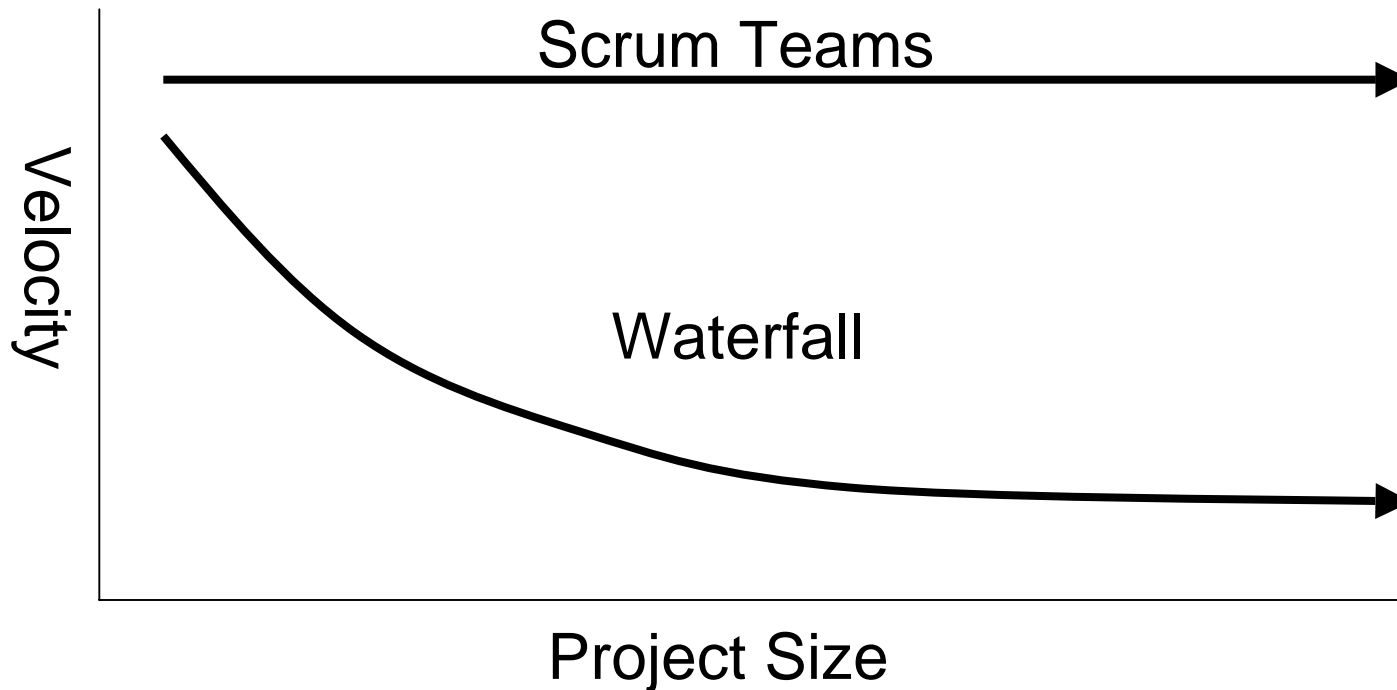
Scrum Teams

Velocity

Waterfall

Project Size

•J. Sutherland, A. Viktorov, J. Blount, and N. Puntikov, "Distributed Scrum: Agile Project Management with Outsourced Development Teams," in HICSS'40, Hawaii International Conference on Software Systems, Big Island, Hawaii, 2007.
•J. Sutherland, C. Jacobson, and K. Johnson, "Scrum and CMMI Level 5: A Magic Potion for Code Warriors!," in Agile 2007, Washington, D.C., 2007.

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Poppendieck Lean Thinking Tools

| P1 Eliminate waste	P2 Amplify Learning	P3 Responsible decisions	P4 Fast Delivery	P5 Empower team	P6 Buil integrity in	P7 See the Whole
Tool 1: Eliminate Waste	**Tool 3:** Feedback	**Tool 7:** Options Thinking	**Tool 10:** Pull	**Tool 13:** Self-determinatoion	**Tool 17:** Perceived integritet	**Tool 21:** Measures
Tool 2: Value Stream Mappig	**Tool 4:** Iterations	**Tool 8:** Latest Responsible Moment	**Tool 11:** Queue Theory	**Tool 14:** Motivation	**Tool 18:** Conceptual Integritet	**Tool 22:** Contracts
	Tool 5: Synchronization	**Tool 9:** Decision Making	**Tool 12:** Cost of Delay	**Tool 15:** Leadership	**Tool 19:** Refactoring	
	Tool 6: Setbased development			**Tool 16:** Expertise	**Tool 20:** Test	

Systematic's new model for Lean SW development

Tools can be divided in three dimensions

	Value	**Flow**	**Pull**	**Perfection**
Engineering	*P6 Build Integrity in* T19 Refactoring T20 Test	*P2 Amplify learning* T5 Synchronization T4 Iterations	*P2 Amplify Learning* T3 Feedback T6 Setbased development	*P6 Build Integrity In* T18 Conceptual integrity T17 Perceived integrity
Management	*P1 Eliminate Waste* T1 Eliminate Waste T2 Valuestreams	*P4 Fast Delivery* T11 Queuing Theory T12 Cost of Delay	*P7 See the whole* T22 Contracts T21 Measures T10 Pull	*P3 Decide in latest Responsible moment* T7 Options thinking T8 Latest responsible Moment T9 Beslutningstagning
People	*P5 Empowerteam* T16 Expertise	*P5 Empower team* T14 Motivation	*P5 Empower team* T15 Leadership	*P5 Empower team* T13 Self-determination

These are thinking tools – Projects and employees knows best how to transform them

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Systematic Pilot Projects

- Selected projects were asked to volunteer for Agile development.

- Project staff were trained in the Lean mindset.

- The result was selection of Scrum and a focus on early testing based on story-based development.

Systematic Pilot – Small Project

- First pilot was initiated on a request for proposal
  - The project had a teamsize of 4 and concerned software for a customer in Danish Government.
- Key reasons for Systematic award:
  - commitment to deliver working code bi-weekly
  - providing a very transparent process to the customer.

Small Project Success Factors

- Delivery plan and customer involvement resulted in early detection of technology issues.

  - Had a traditional approach been used these issues would have been identified much later with negative impacts on cost and schedule performance.

- Productivity of small project was at the expected level for small projects.

- Another small project with a team size of 5 working for a Defense customer using Scrum showed a similar productivity and the same indicators of high quality and customer satisfaction.

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Pilot of Larger Project

■ Team of 10 worked on a military messaging system.

 – They invented a new story based approach to early testing in software development.

 – The name "Story based" development was inspired from XP, but the approach included new aspects like: short incremental contributions, inspections and was feature driven.

■ The idea of story-based development was to subdivide features of work, typically estimated to hundreds of hours of work into smaller stories of 20-40 hours of work.

 – The implementation of a story followed a new procedure, where the first activity would be to decide how the story could be tested before any code was written.

 – This test could then be used as the exit criteria for implementation of the story.

New Approach to Testing Reduced Defects by 38%

- The combination of a good definition of when a story was complete, and early incremental testing of the features, provided a precise overview of status and progress for both team and other stakeholders.

- Developing a series of small stories rather than parts of a big feature creates a better focus on completing a feature until it fulfills all the criteria for being "done".

- This project finished early, and reduced the number of coding defects in final test by 38% compared to previous processes.
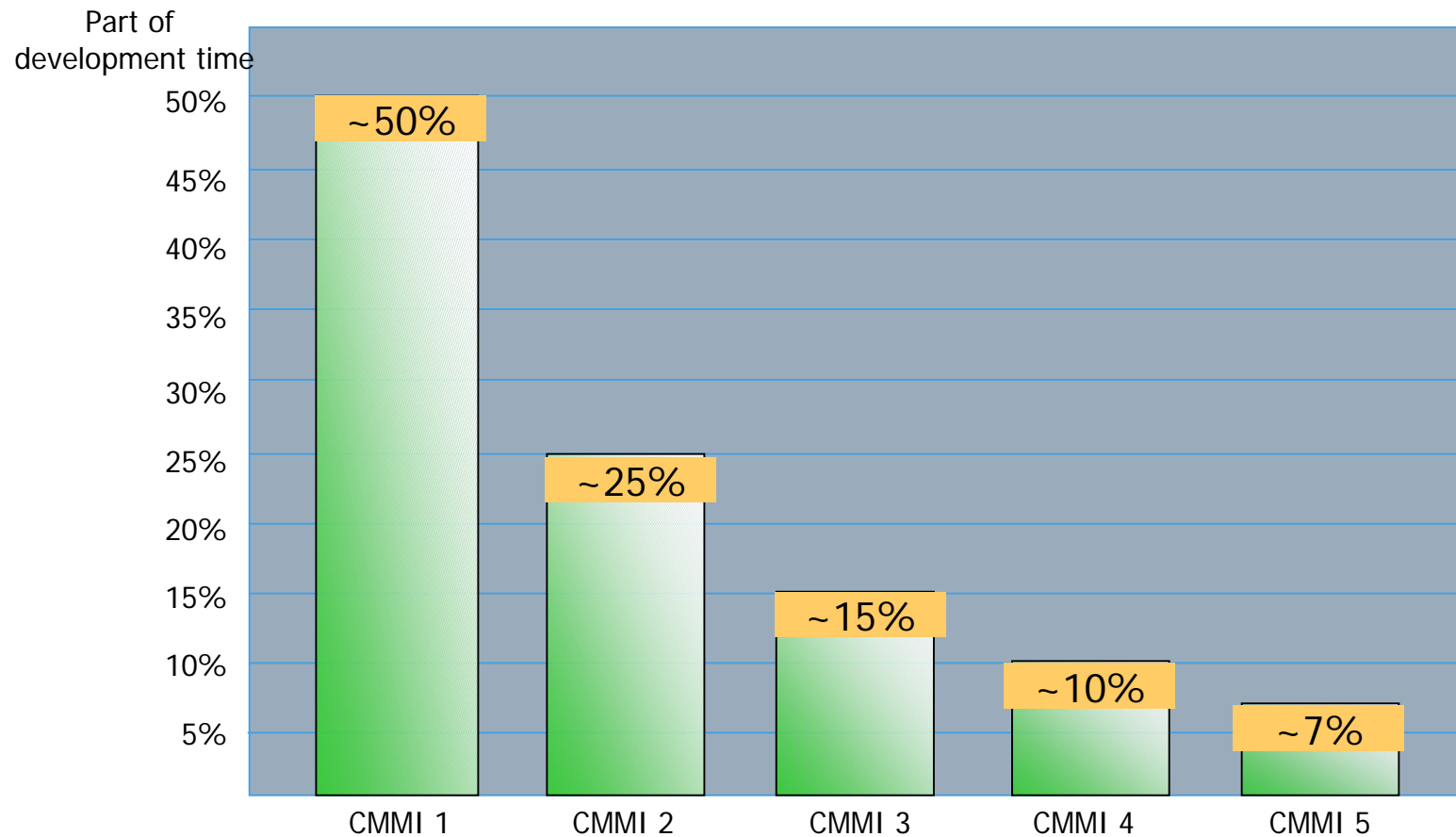
Another Larger Project

- Team of 19 working on a module to a electronic patient record system, also worked with early testing.

- For each week the project defined a goal to be achieved. The project ensured that test and domain specialists were co-located with the developers.

- The number of coding defects in final test were reduced by 42% compared to previous processes.
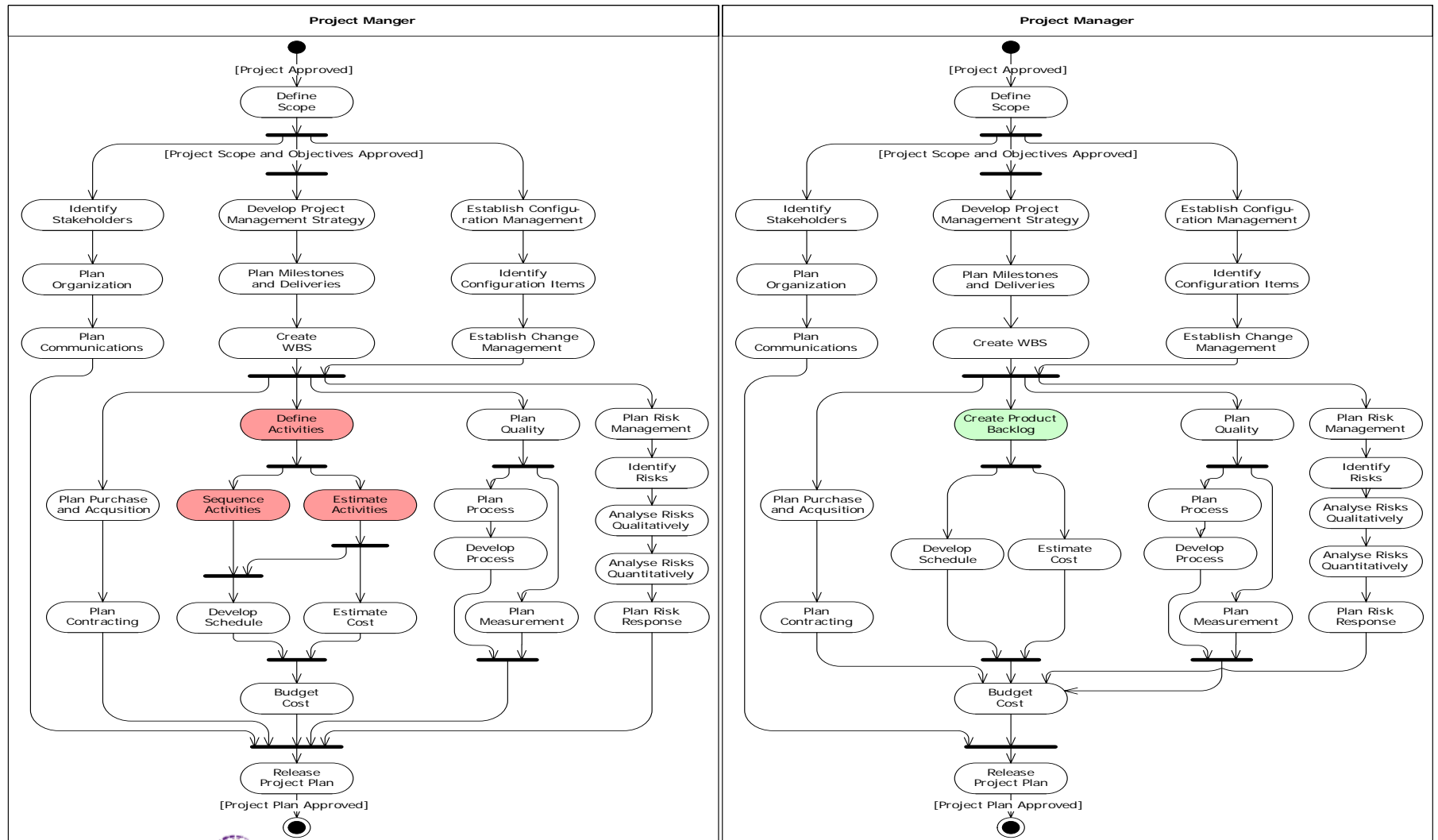
Systematic adoption of Scrum in at CMMI Level 5

■ Process Action Teams (PATs) were formed to integrate the experience and knowledge gained from the pilots, into the processes shared by all projects in the organization.

■ The largest change to project planning is that features and work are planned in *sufficient detail* as opposed to a complete initial detailed analysis.

– Result is a Scrum Product Backlog with a complete prioritized list of features/work for the project.

– All features have a qualified estimate, established with a documented process and through the use of historical data, but the granularity of the features increase as the priority falls.

– The uncertainty that remains is handled through risk management activities.

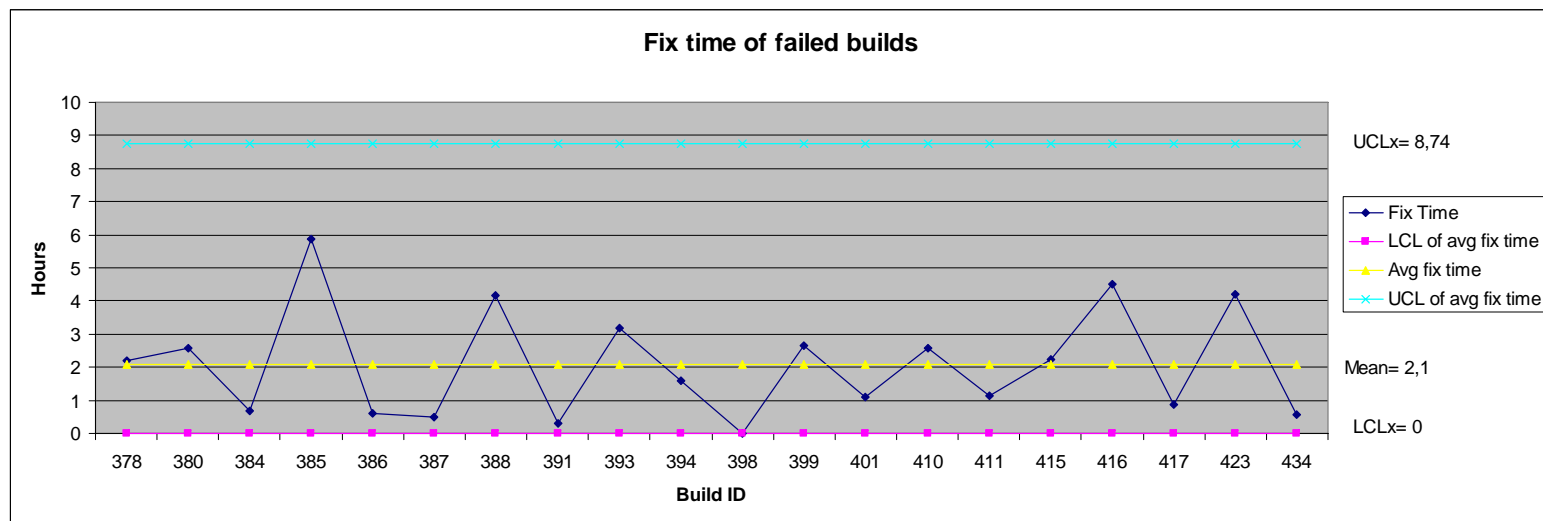■ This approach radically reduces the cost of planning.

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Published experiences with "rework"

Part of development time

~50%	CMMI 1
~25%	CMMI 2
~15%	CMMI 3
~10%	CMMI 4
~7%	CMMI 5

Source: Krasner & Houston, CrossTalk, Nov 1998
Diaz & King, CrossTalk, Mar 2002

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SCRUM and PDP-Common

Control chart of build process

Build errors
Unit test errors
FXCop failed

Fix time of failed builds

UCLx= 8,74

Fix Time
LCL of avg fix time
Avg fix time
UCL of avg fix time

Mean= 2,1

LCLx= 0

Hours

Build ID

378 380 384 385 386 387 388 391 393 394 398 399 401 410 411 415 416 417 423 434

Rework at Systematic
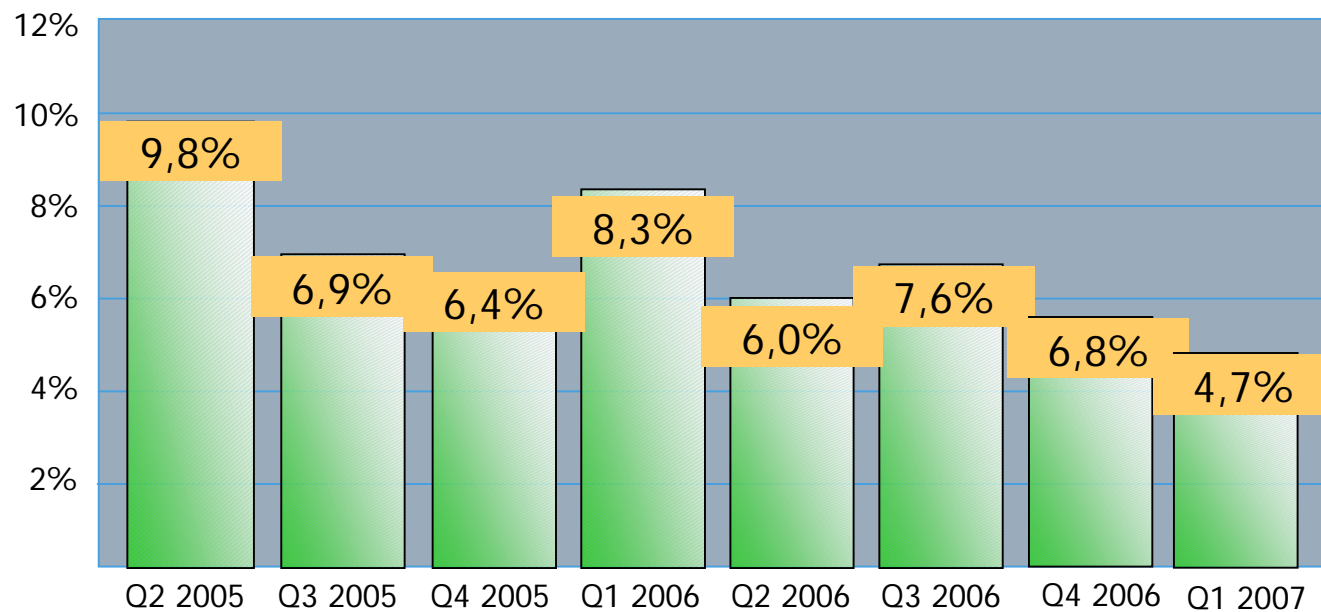
Scrum applied to CMMI Level 5 company

– *6 month results*

Project effort

Legend:
- **Rework** (red)
- **Work** (green)
- **Process focus** (blue)

CMMI 1:
- 100 %
- 50 %
- 50 %

CMMI → SCRUM

CMMI 5:
- 69 %
- 9 %
- 50 %
- 10 %

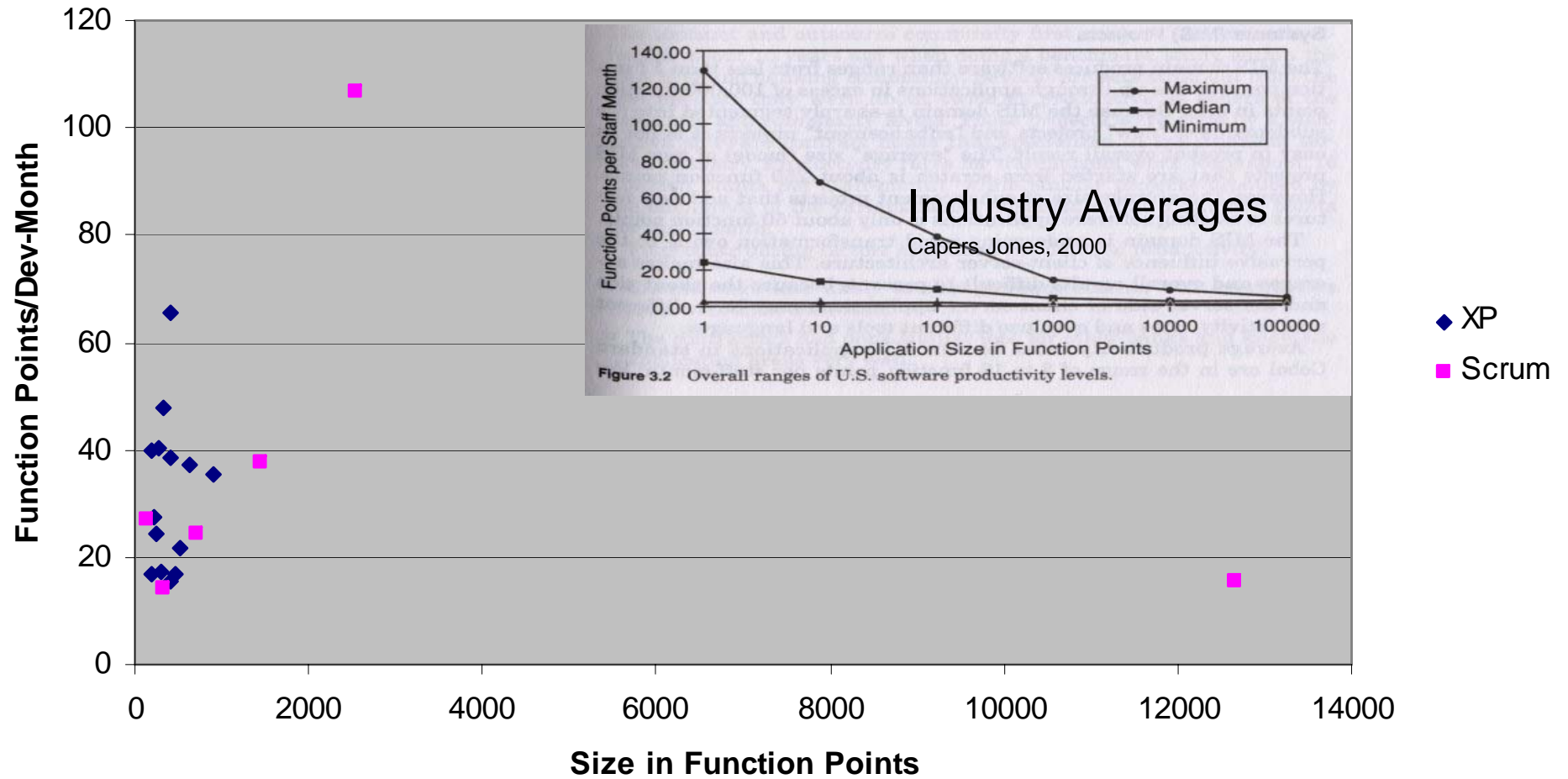CMMI 5 SCRUM:
- 35 %
- 4 %
- 25 %
- 6 %
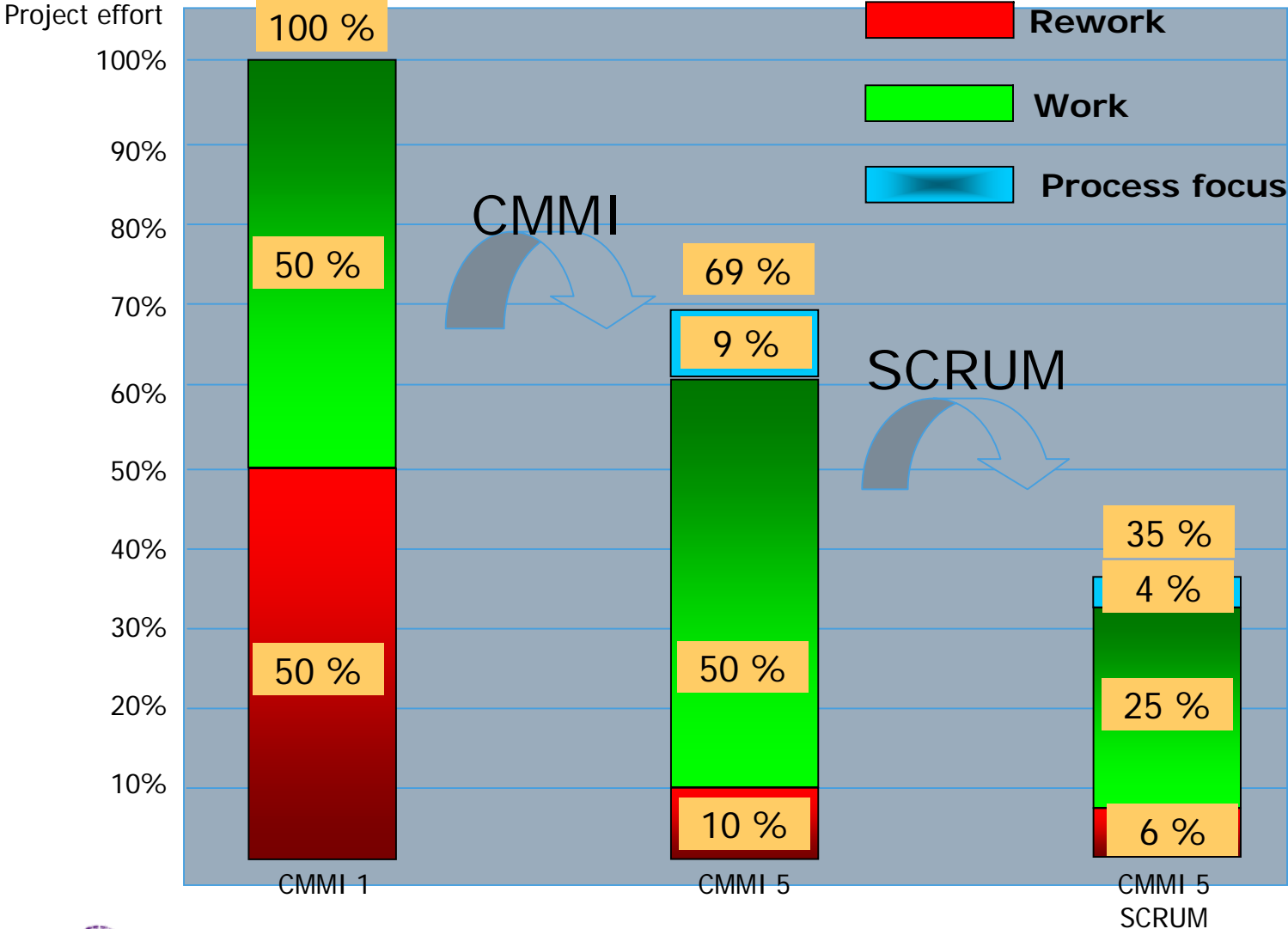
Systematic CMMI 5 Analysis
First six months of Scrum

- ~80% reduction in planning and documentation costs (still under discussion at Systematic)
- 40% reduction in defects
- 50% reduction in rework
- 100% increase in overall productivity
- Systematic decided to change CMMI Level 5 process to make Scrum the default mode of project management
- When waterfall project management is required, they are now need to be contracted for twice the price of Scrum projects
  - Required by some defense and healthcare agencies
  - Results are lower business value
  - Lower customer satisfaction
  - Lower quality
  - Twice the cost

Sutherland, J., C. Jacobson, et al. (2007). Scrum and CMMI Level 5: A Magic Potion for Code Warriors! Agile 2007, Washington, D.C., IEEE.

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AGILE2007 Conference

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Exigen Services Productivity

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Trifork

- Company wide Scrum
- Goals
    - Every employee a Certified ScrumMaster
    - Every part of company run by Scrum
- Sales force are Certified ScrumMasters and only execute Agile contracts
- JAOO run by Scrum – bigger than Agile 2007

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Trifork 2004-2007

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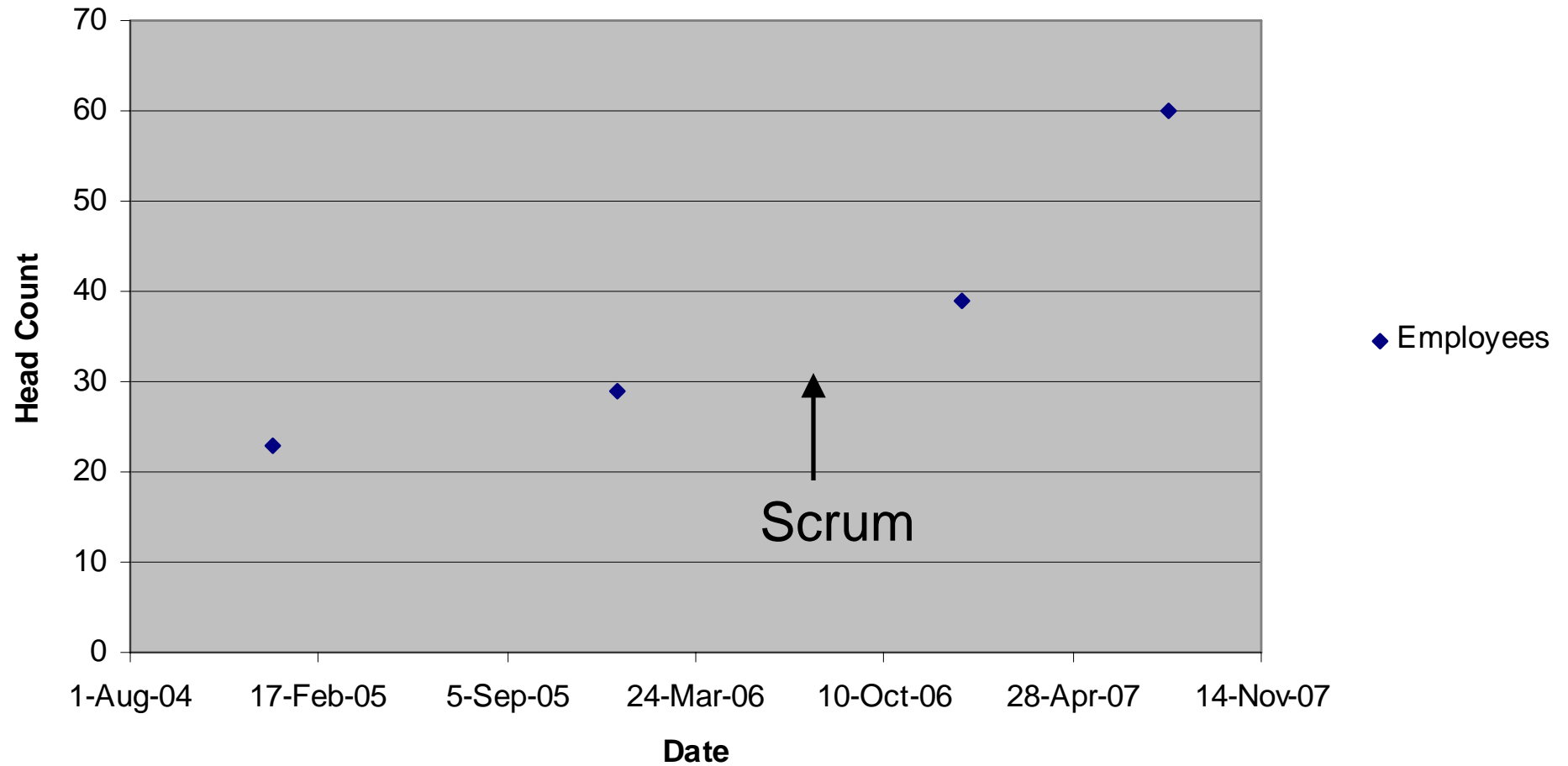
Sutherland, J., A. Viktorov, and J. Blount. **Adaptive Engineering of Large Software Projects with Distributed/Outsourced Teams.** In *Proceedings of the International Conference on Complex Systems*. 2006. Boston, MA, USA.