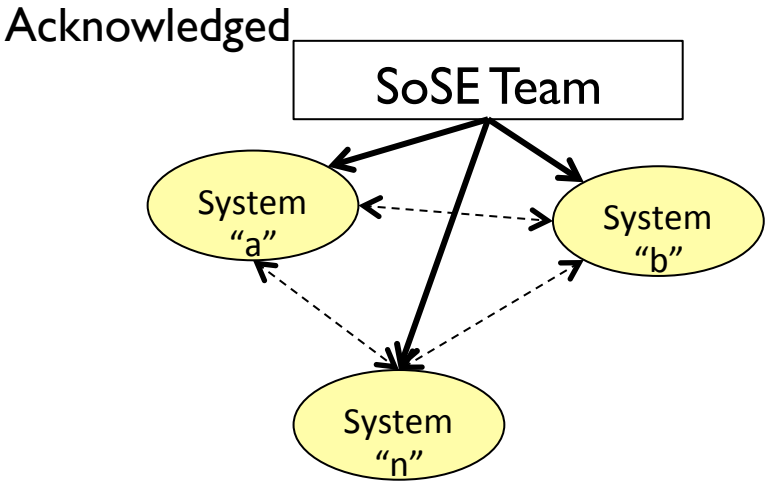
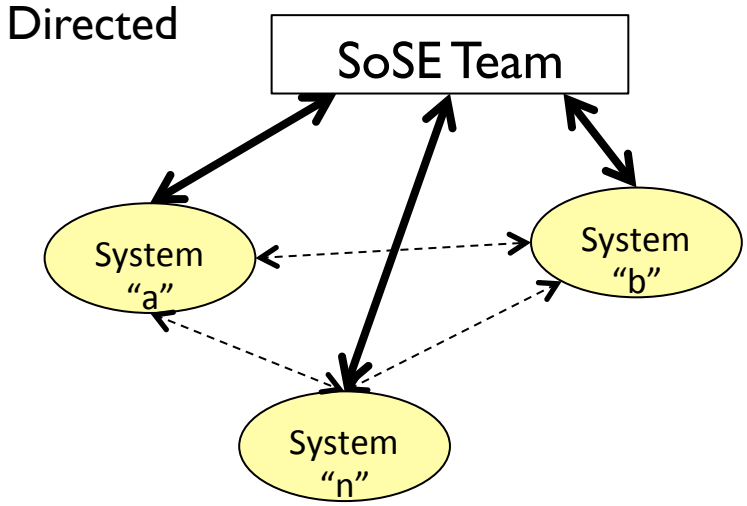
Simulation of Kanban-based scheduling for SoS

Alexey Tregubov, Jo Ann Lane

System of Systems

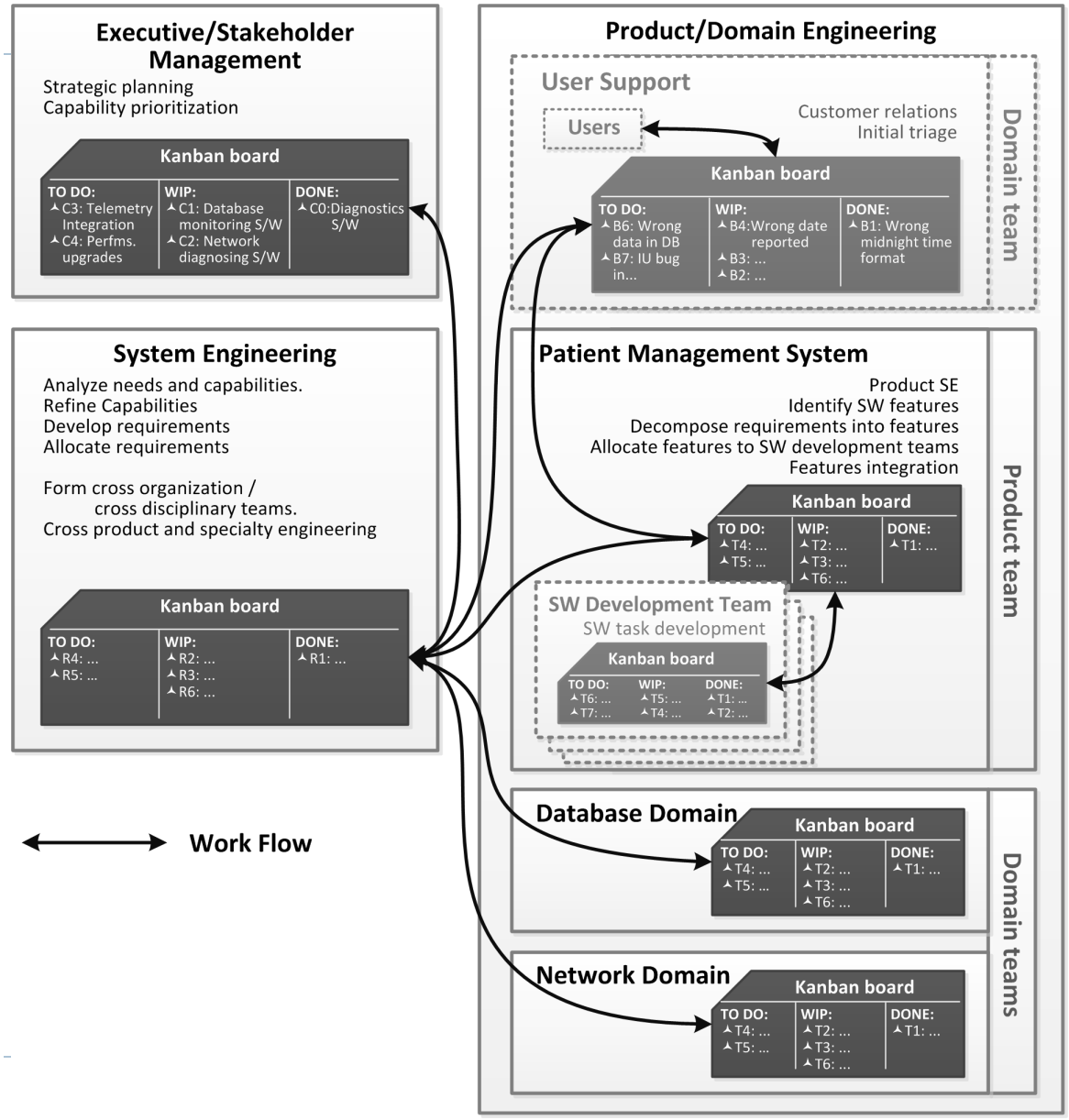
- Acknowledged and directed SoS:





- Three main levels:
  - Executive/Stakeholder management
  - System Engineering team
  - Product/Domain teams
- Example: Health care SoS (next slide)

Overview of KSS Network



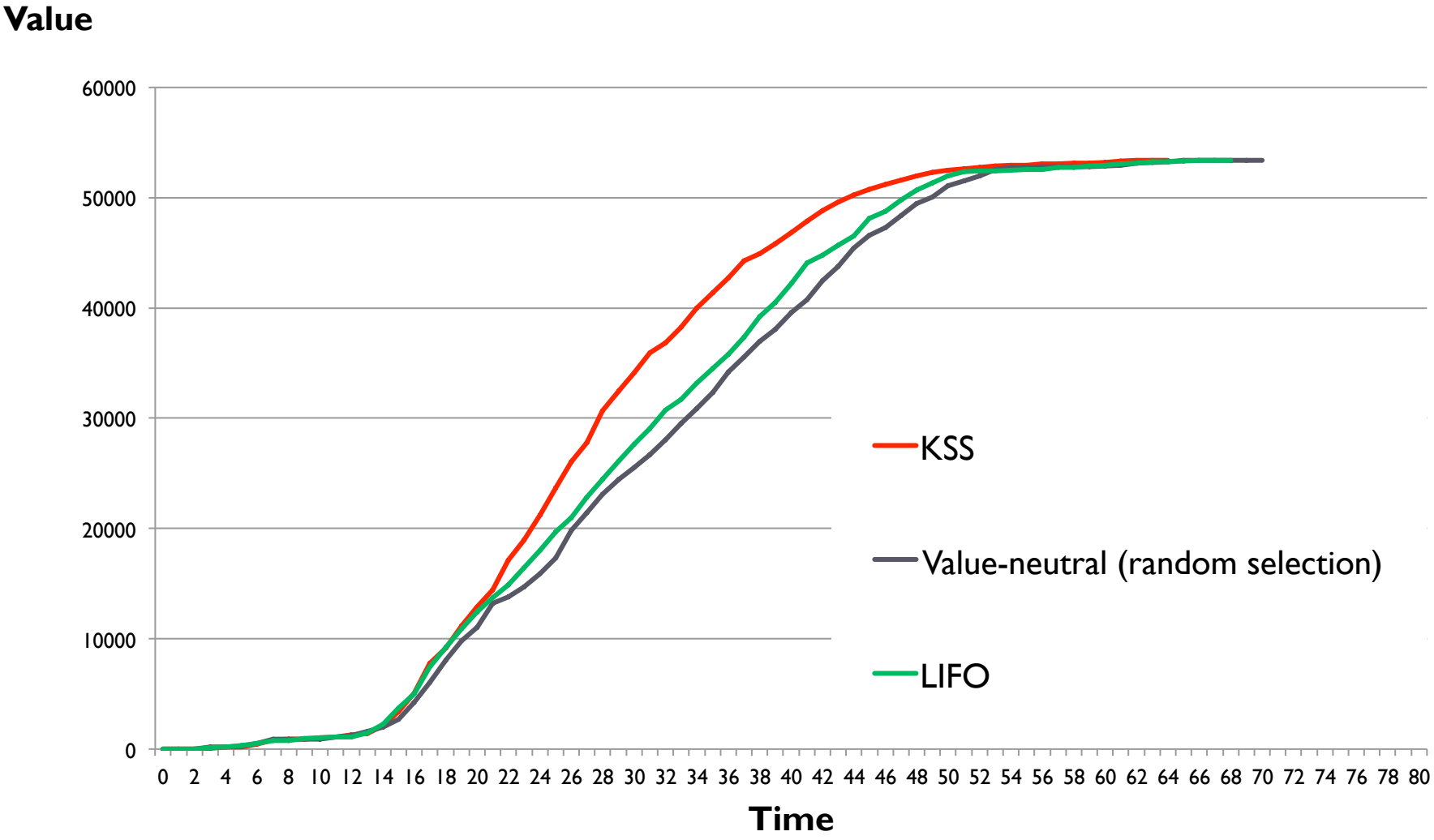
System of Systems' observed issues

- Lack of visibility
- Inefficient use of resources
- Time wasted on context switching
- Valuable capabilities are not delivered first
  - value delivery cadence is not satisfactory
  - stakeholders cannot effectively update priorities when values change

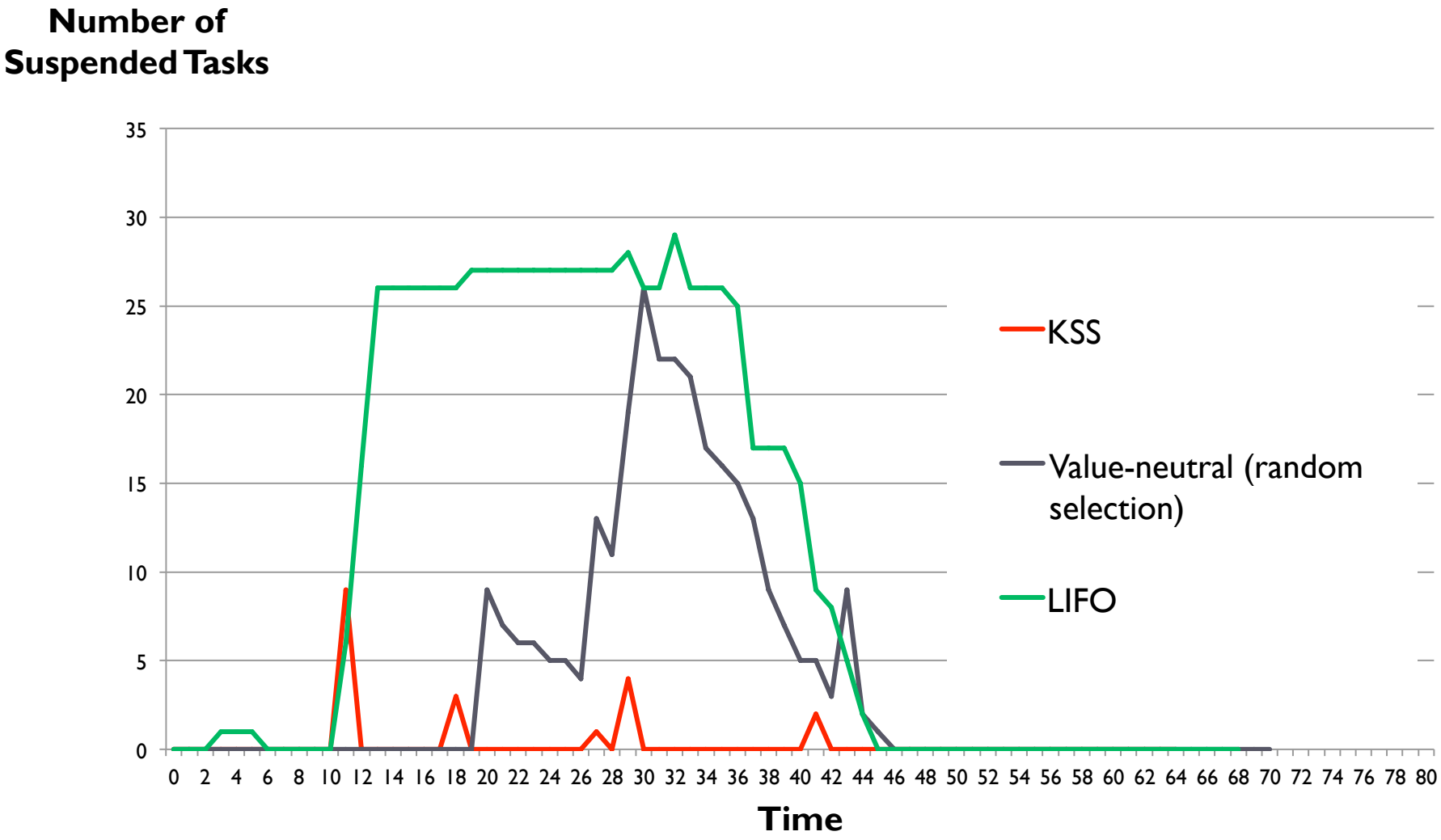
Example 1

- 10 teams (20 members each) + system engineering team.
- 20 new capabilities at start.
- Each capability unfolds into 30 requirements on average
- Each requirement unfolds into 9 tasks on average.
- Each tasks takes 3-15 days.
- There are 5 expedite tasks that cause blocked work (blocked tasks)

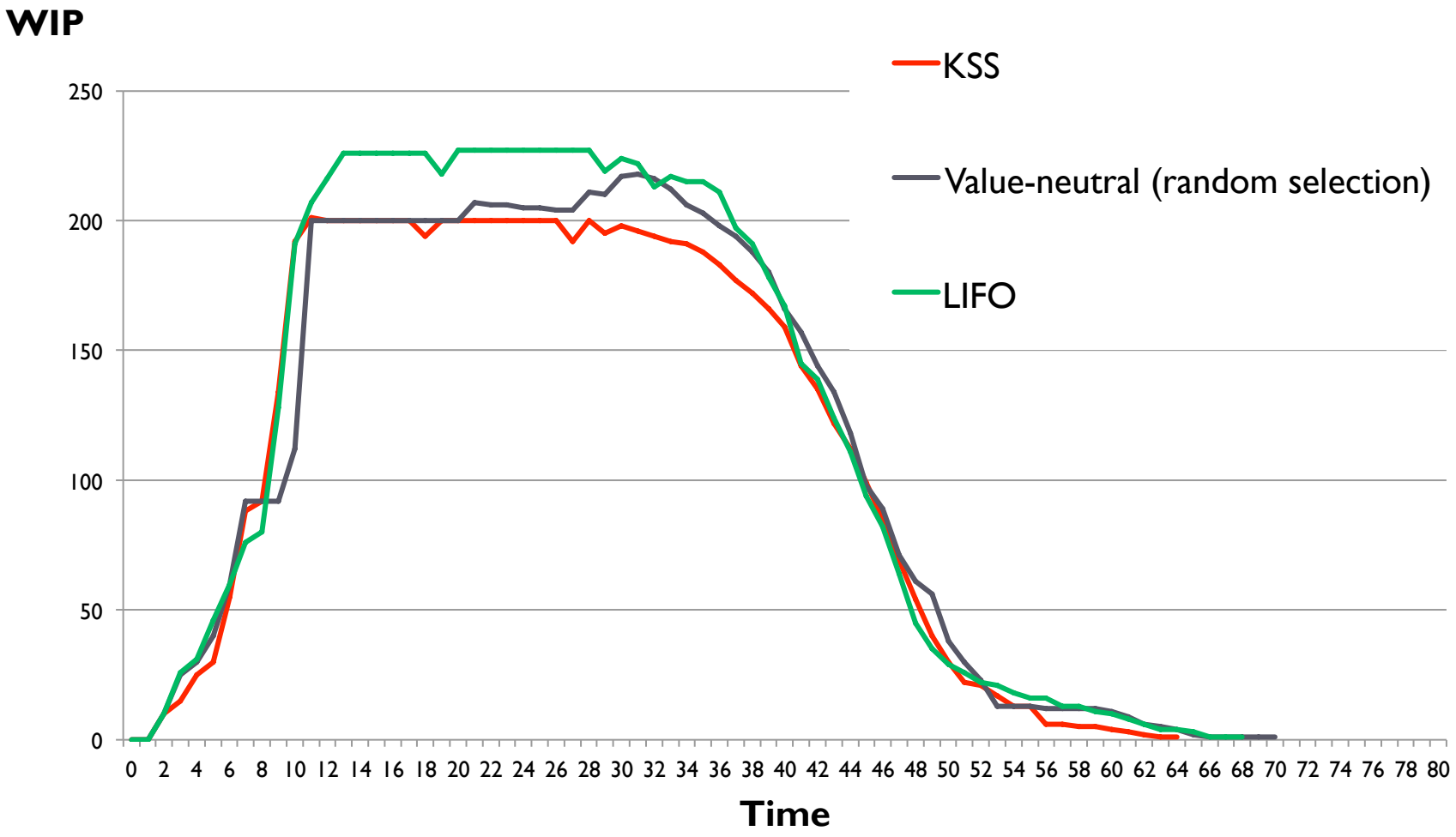
Example 1: value comparison



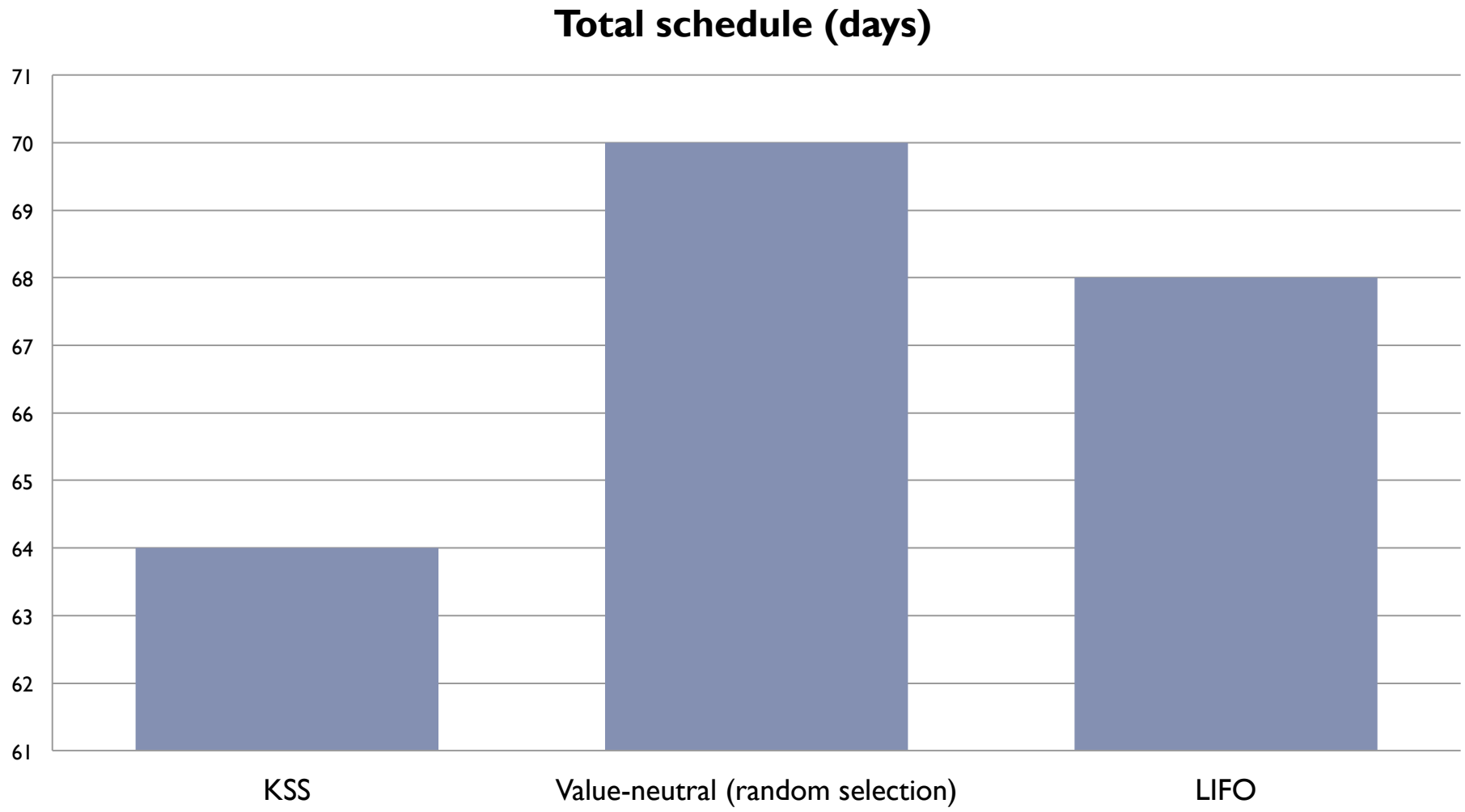
Example 1: number of suspended tasks



Example 2: work items in progress

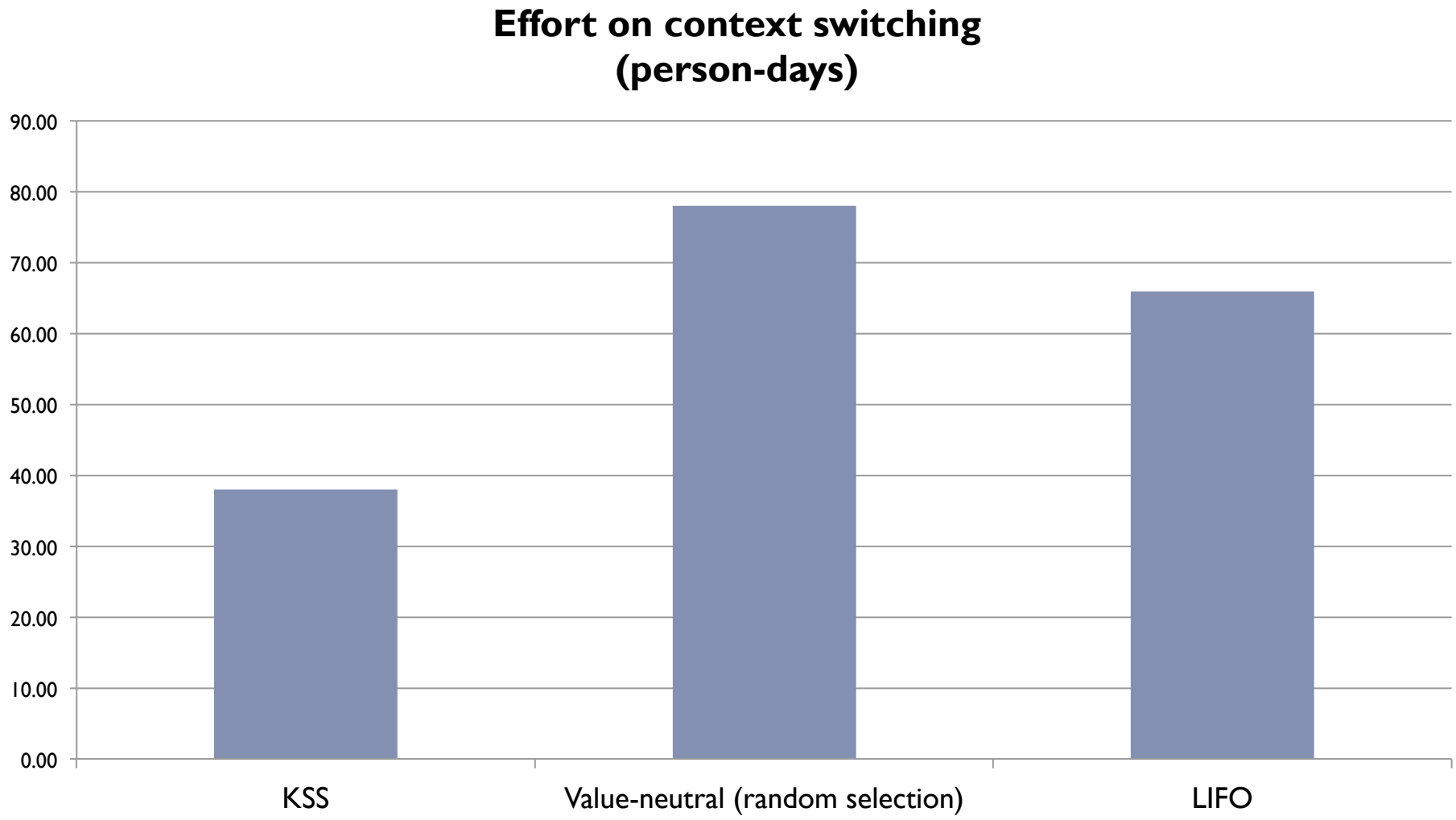


Example 1: total time spent (schedule)



Example 1: total effort

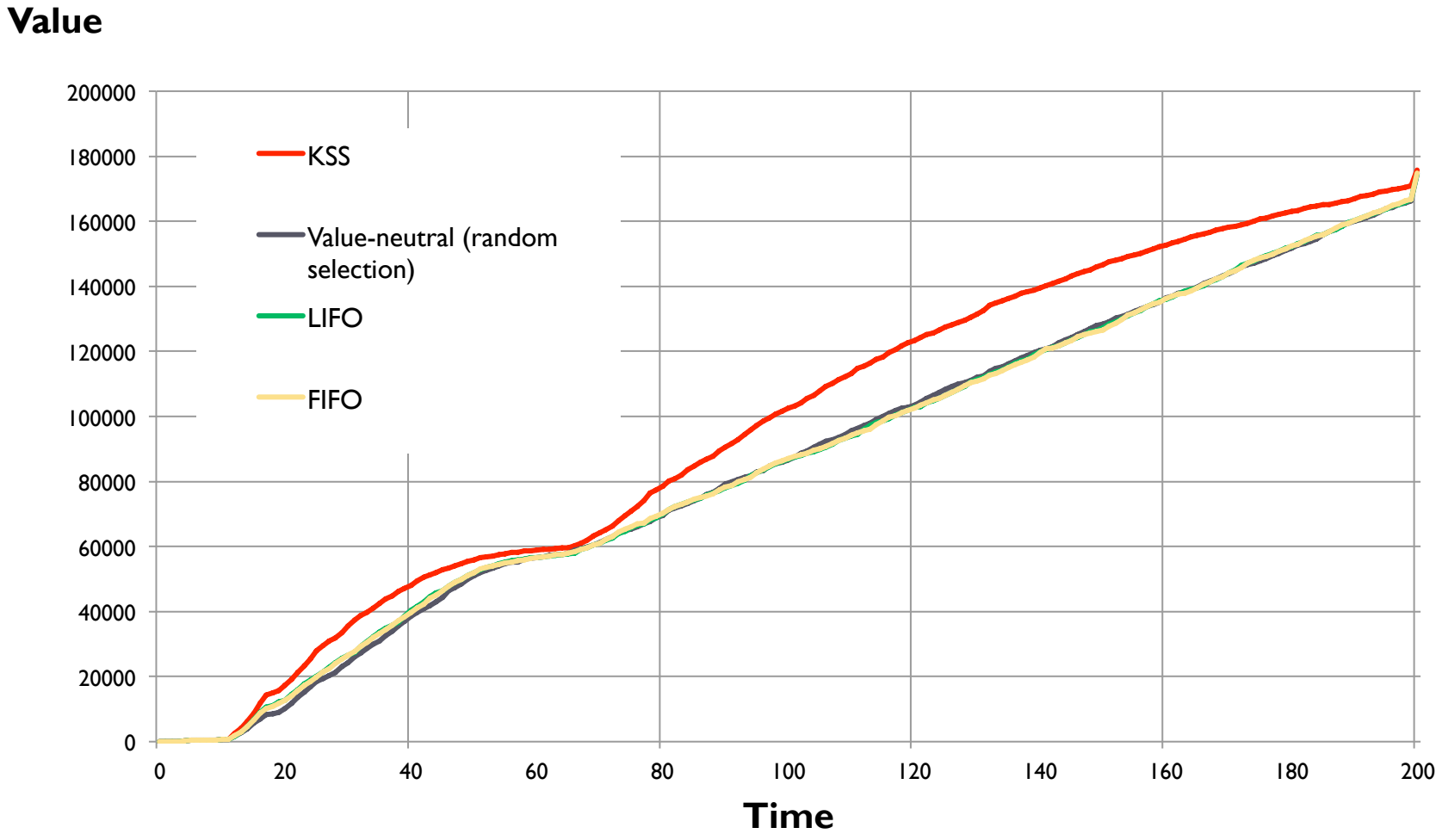
Example 1: context switching



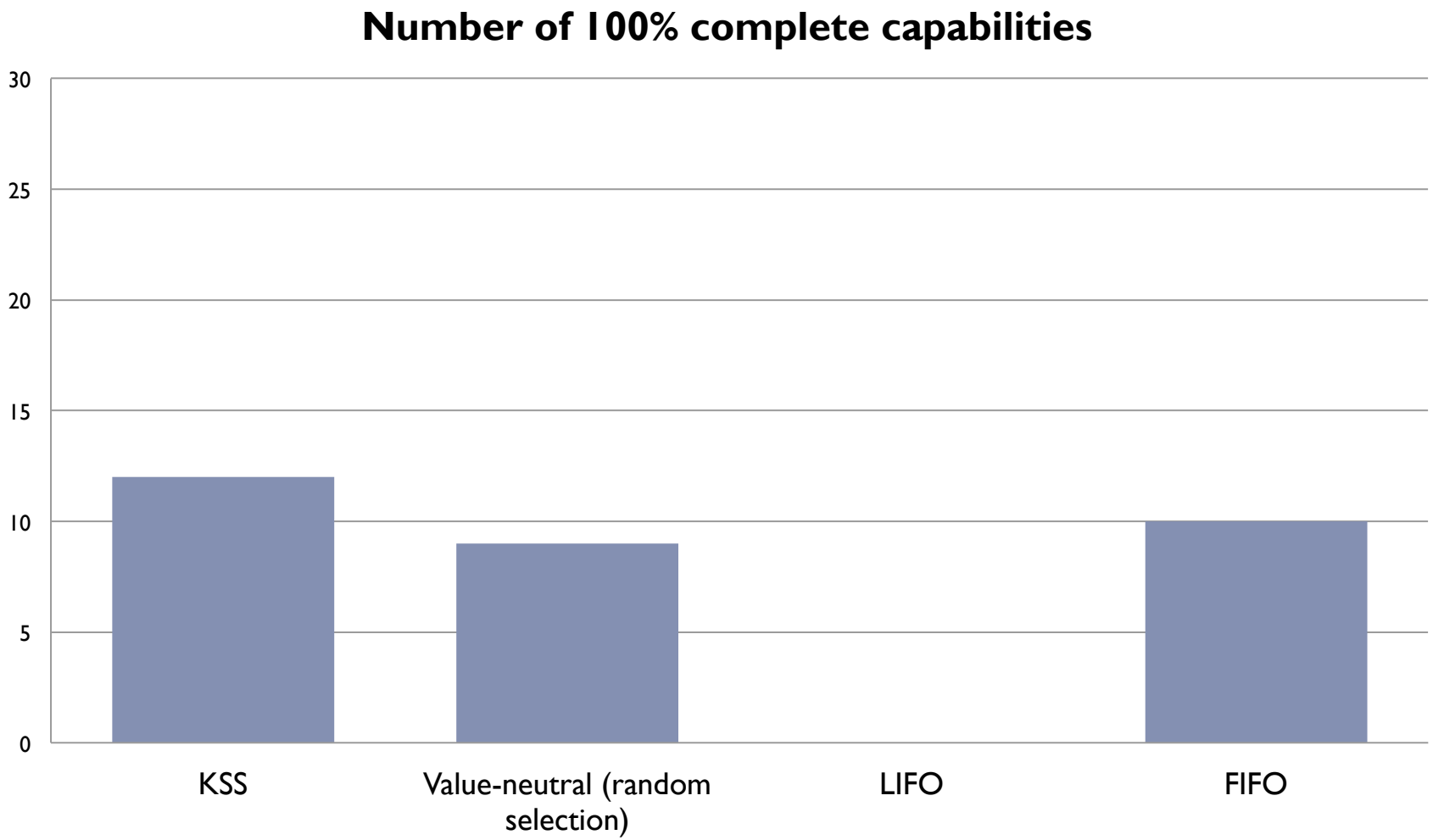
Example 2

- 15 teams (12 members each) + system engineering team.
- 10 new capabilities at start
- 20 more capabilities added during the simulation
- Each capability unfolds into 30 requirements on average
- Each requirement unfolds into 10 tasks on average.
- Each tasks takes 3-15 days.
- There are 10 expedite tasks that cause blocked work (blocked tasks)
- Simulation time-frame: 1 hour
- Simulation length (fixed time simulation): 200 days/1600 hours.

Example 2: even more complex scenario



Example 2: capability completeness



Conclusion: future work

- Pilot the Kanban scheduling with several organizations
- Fine-tune the simulator using empirical data and organizations' feedback
- Scale up the cases we run through the simulator
- Refine and calibrate cost models

Questions & answers

References

- Waldner, Jean-Baptiste (September 1992). Principles of Computer-Integrated Manufacturing. London: John Wiley. pp. 128–132. ISBN 0-471-93450-X.
- "Kanban". Random House Dictionary. Dictionary.com. 2011. Retrieved April 12, 2011.
- Ohno, Taiichi (June 1988). Toyota Production System - beyond large-scale production. Productivity Press. p. 29. ISBN 0-915299-14-3.
- Richard Turner, Jo Ann Lane, Goal-question-Kanban: Applying Lean Concepts to Coordinate Multi-level Systems Engineering in Large Enterprises, Procedia Computer Science, Volume 16, 2013, Pages 512-521, ISSN 1877-0509, (http://www.sciencedirect.com/science/article/pii/S1877050913000550)
- Torgeir Dingsøyr, Sridhar Nerur, VenuGopal Balijepally, Nils Brede Moe, A decade of agile methodologies: Towards explaining agile software development, Journal of Systems and Software, Volume 85, Issue 6, June 2012, Pages 1213-1221, ISSN 0164-1212, (http://www.sciencedirect.com/science/article/pii/S0164121212000532)
- Woods D. Why Lean And Agile Go Together : [Digital document], (http://www.forbes.com/2010/01/11/software-lean-manufacturing-technology-cio-network-agile.html). Verified on 7/7/2013.
- Gerald Weinberg, Quality Software Management: Vol1. Systems Thinking. 1991