
LeanKit

Lean Metrics

How to measure and improve the flow of work

Chris Hefley, CEO of LeanKit

November 5th, 2014

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Introduction to Lean Metrics

- What metrics should you measure?
- How to track them?
- What effect do they have on each other?
- What are your team's improvement goals?
- How to run improvement experiments?

Introductions

CHRIS HEFLEY

CHIEF EXECUTIVE OFFICER

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What are Lean Metrics?

- Flow Metrics
  - WIP
  - Blockers
  - Queues
  - Lead Time and Cycle Time
  - Throughput
  - Cumulative Flow Diagrams
- Quality
- Predictability
- Risk
  - Cost of delay
  - Forecasting and Monte Carlo simulations

Vanity Metrics and Proxy Variables

"A proxy variable is a quantified measure that substitutes for the real economic objective: life-cycle profits."

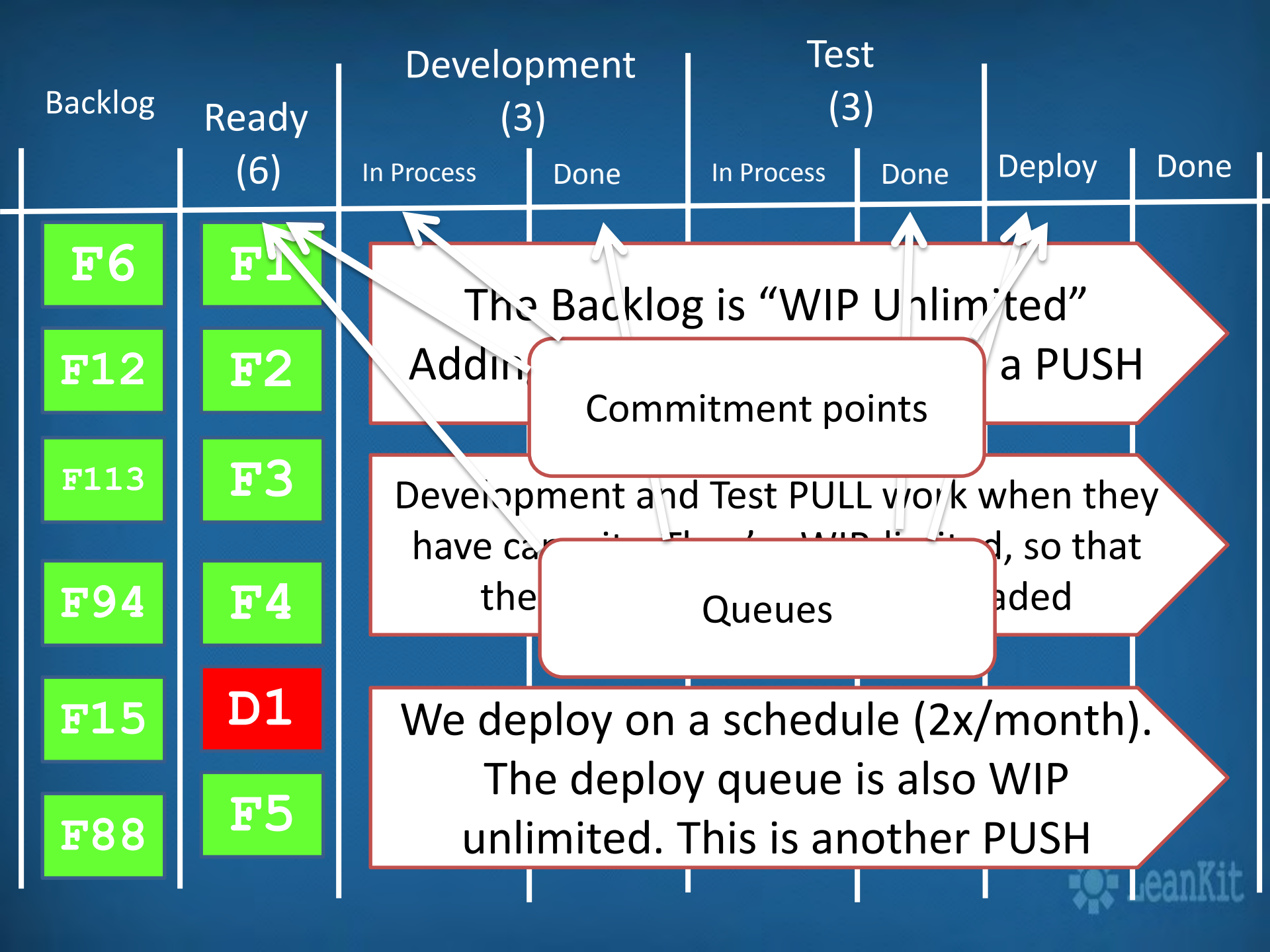
"By focusing on proxy variables, product developers delude themselves into thinking they understand their economics. They do not."

"It's only when we understand the mapping between proxy variables and life-cycle profits that we can really see the economic consequences of our choices."

- Don Reinertsen in *The Principles of Product Development Flow*

Understanding the System

- Economics
- Push and Pull
- Commitment Point
- Queues
- Delivery Point
- Flow


Backlog
Ready (6)
Development (3)
In Process
Done
Test (3)
In Process
Done
Deploy
Done
F6
F12
F113
F94
F15
F88
F1
F2
F3
F4
D1
F5
The Backlog is "WIP Unlimited"
Addin
a PUSH
Commitment points
Development and Test PULL work when they
have ca
, so that
the
aded
Queues
We deploy on a schedule (2x/month).
The deploy queue is also WIP
unlimited. This is another PUSH
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Choosing What to Measure

"I always start by developing an understanding of the economics, identifying the queues, and then determining their costs. However, there are actually many places a company can start. Some companies start by reducing batch sizes in their processes, others by making work-in-process inventory visible with visual control boards, and others by implementing WIP constraints.

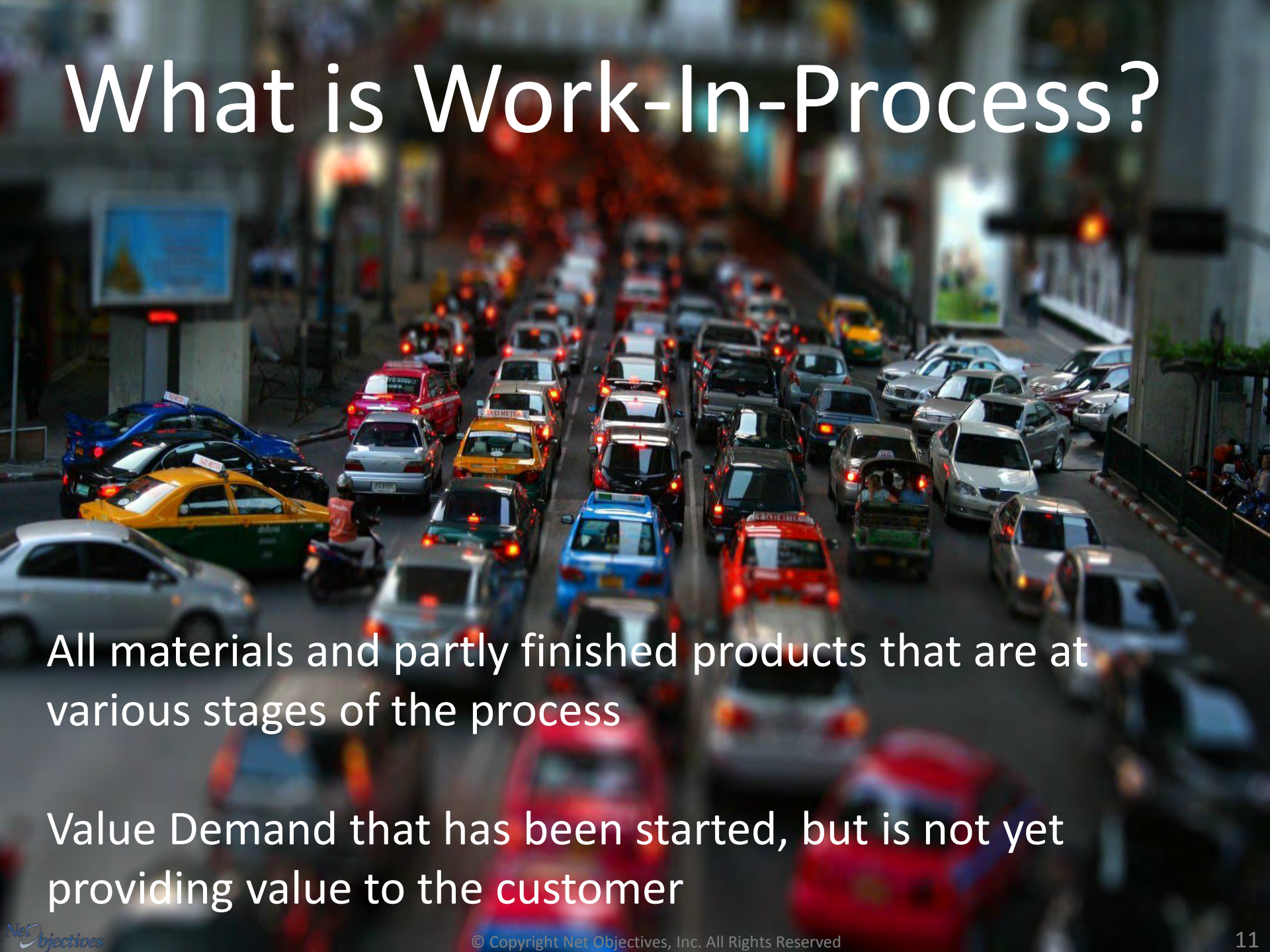
In general it helps to pick something that is causing pain and to produce meaningful results quickly. This generates energy that can be harnessed to make broader changes."

- Don Reinertsen

Flow Metrics

- WIP
- Blockers
- Queues
- Lead Time and Cycle Time
- Throughput
- Cumulative Flow Diagram

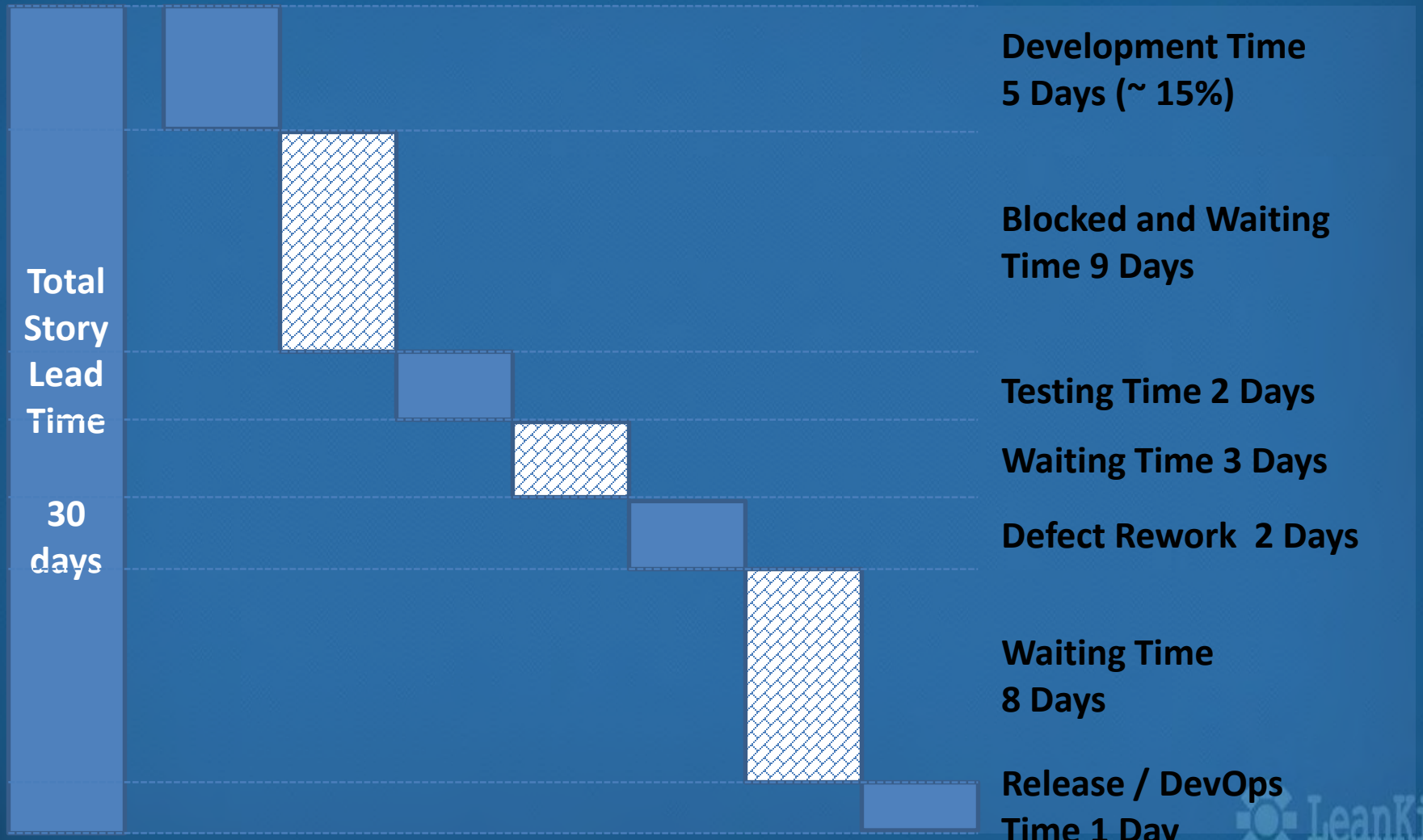
What is Work-In-Process?



All materials and partly finished products that are at various stages of the process

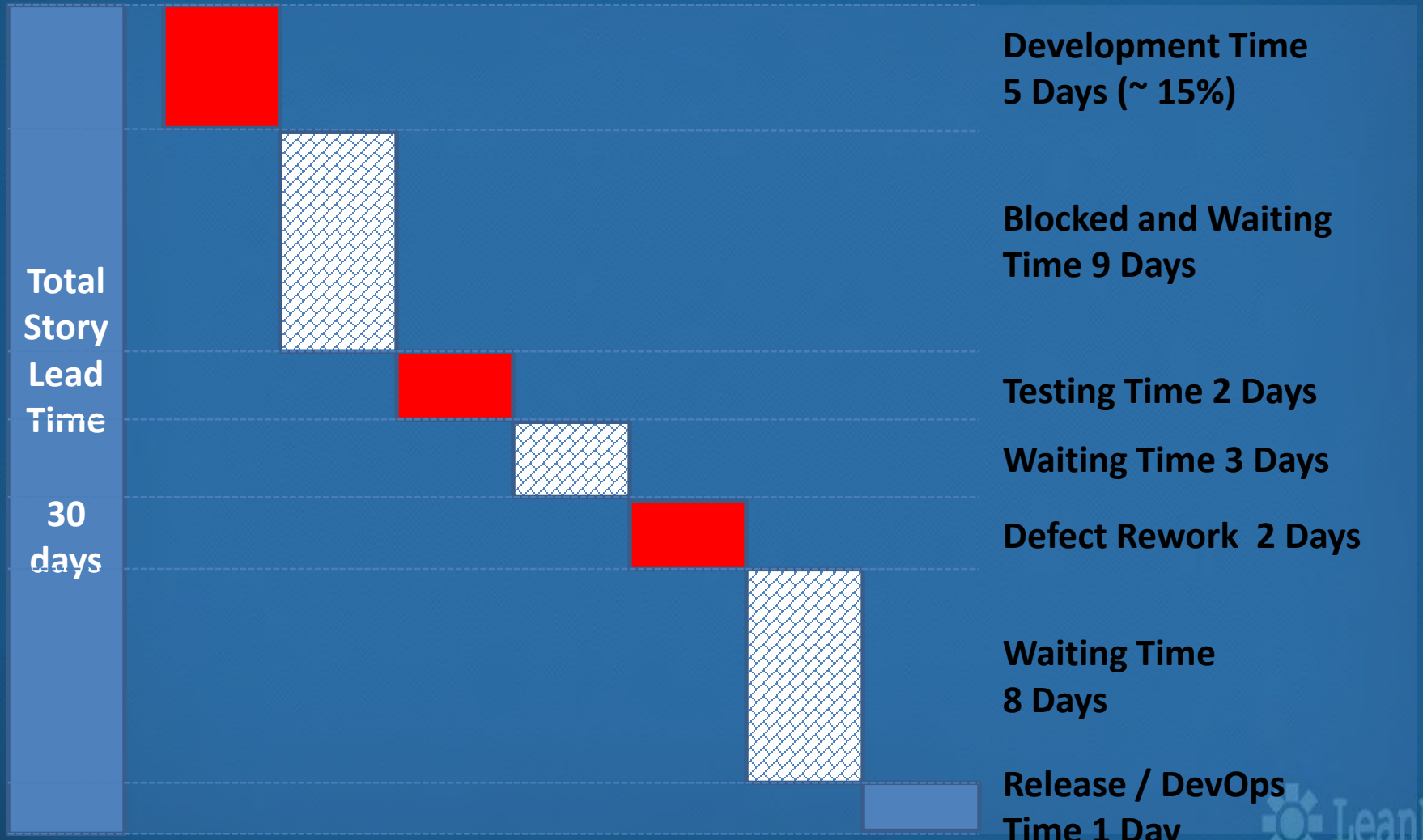
Value Demand that has been started, but is not yet providing value to the customer

WIP and Queues



By Troy Magennis, FocusedObjective.com – used by permission

WIP and Queues



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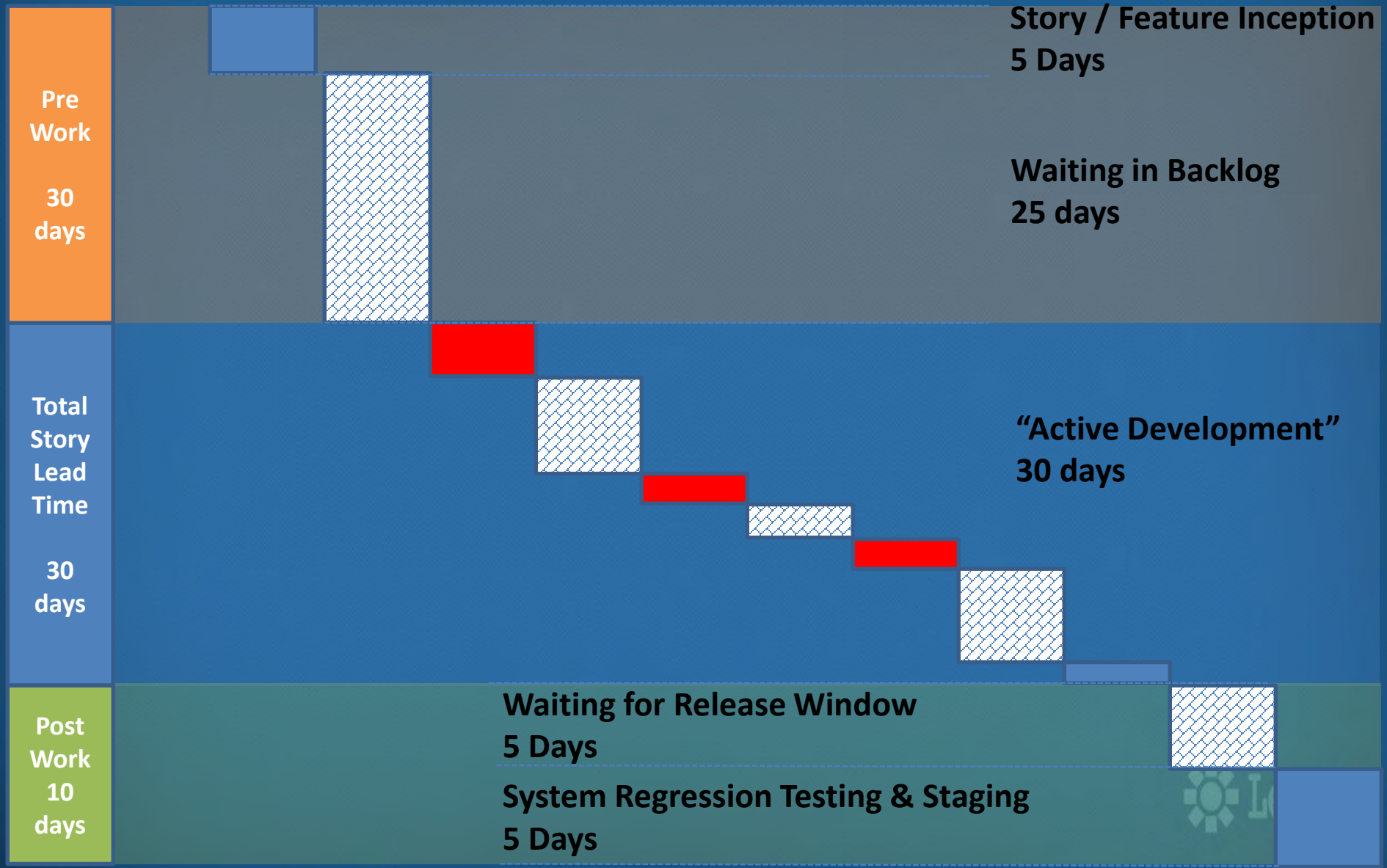
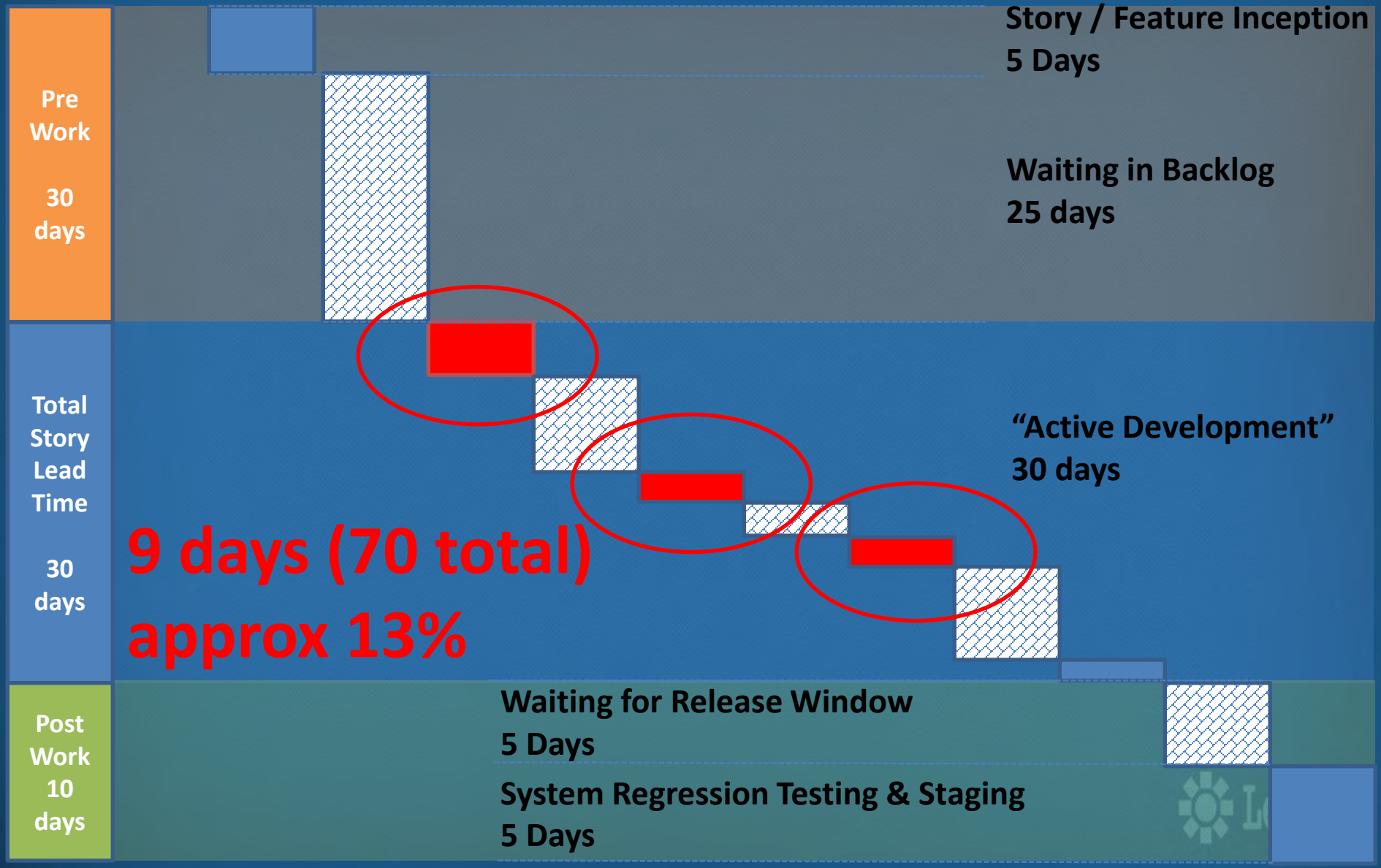
WIP and Queues



WIP and Queues



Work in Process

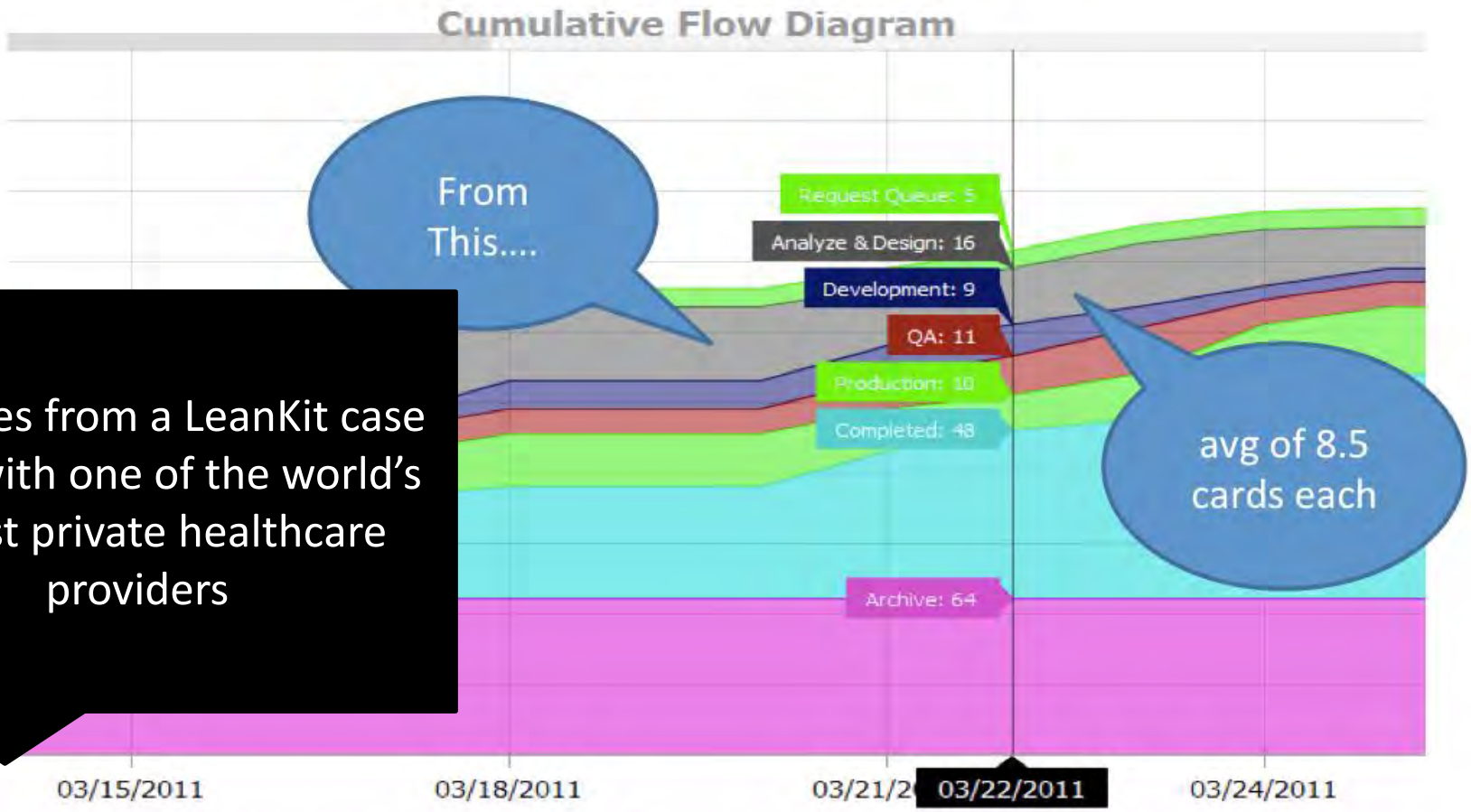
- Managing Queues

- Work in Process vs Work in Progress
  - Often interchangeable
  - In Progress – all work on the board
  - In Process – currently working on
  - Only make the distinction if required by your context

  See http://moduscooperandi.com/featured/in-progress-v-in-process/

- **Measure overall WIP**

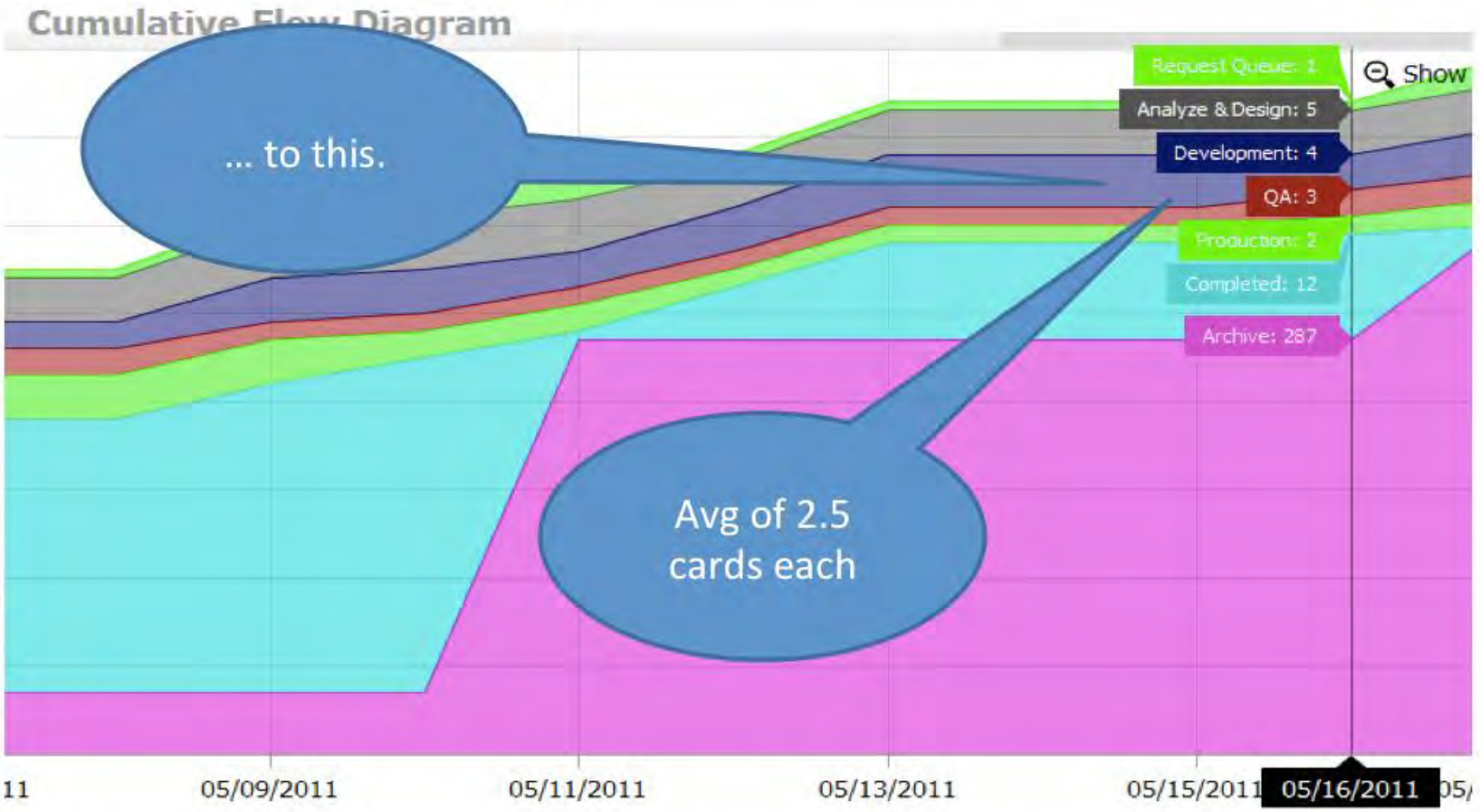
Improving Flow by limiting WIP



Examples from a LeanKit case study with one of the world's largest private healthcare providers

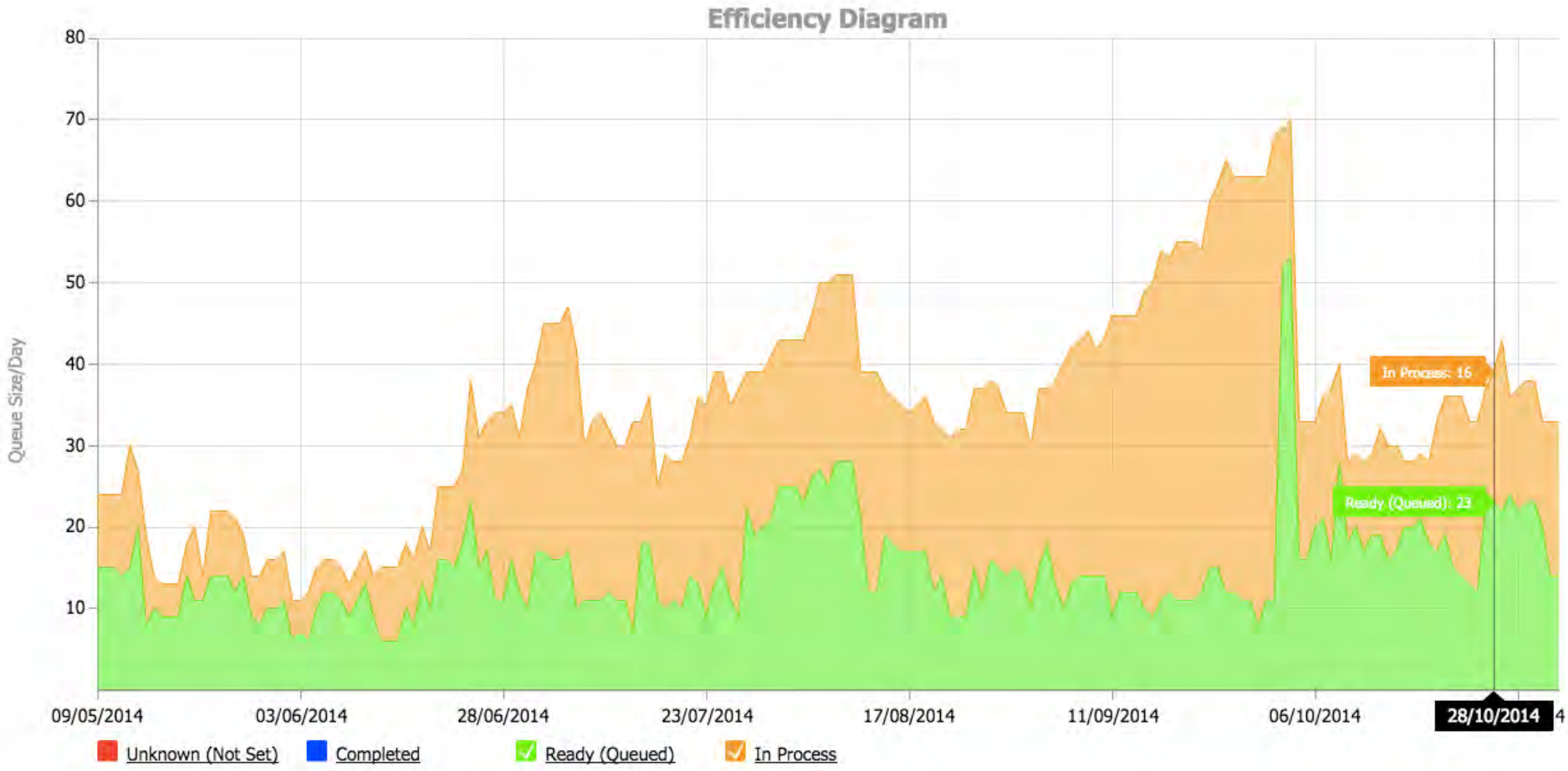
At the beginning, modeling our current state, we were averaging 8.5 items concurrently per person. Multi-tasking and task switching were the norm.

Improving Flow by limiting WIP



Now, with our current WIP limits, we were averaging 2.5 items concurrently per person. Multi-tasking and task switching have decreased significantly.

Queues

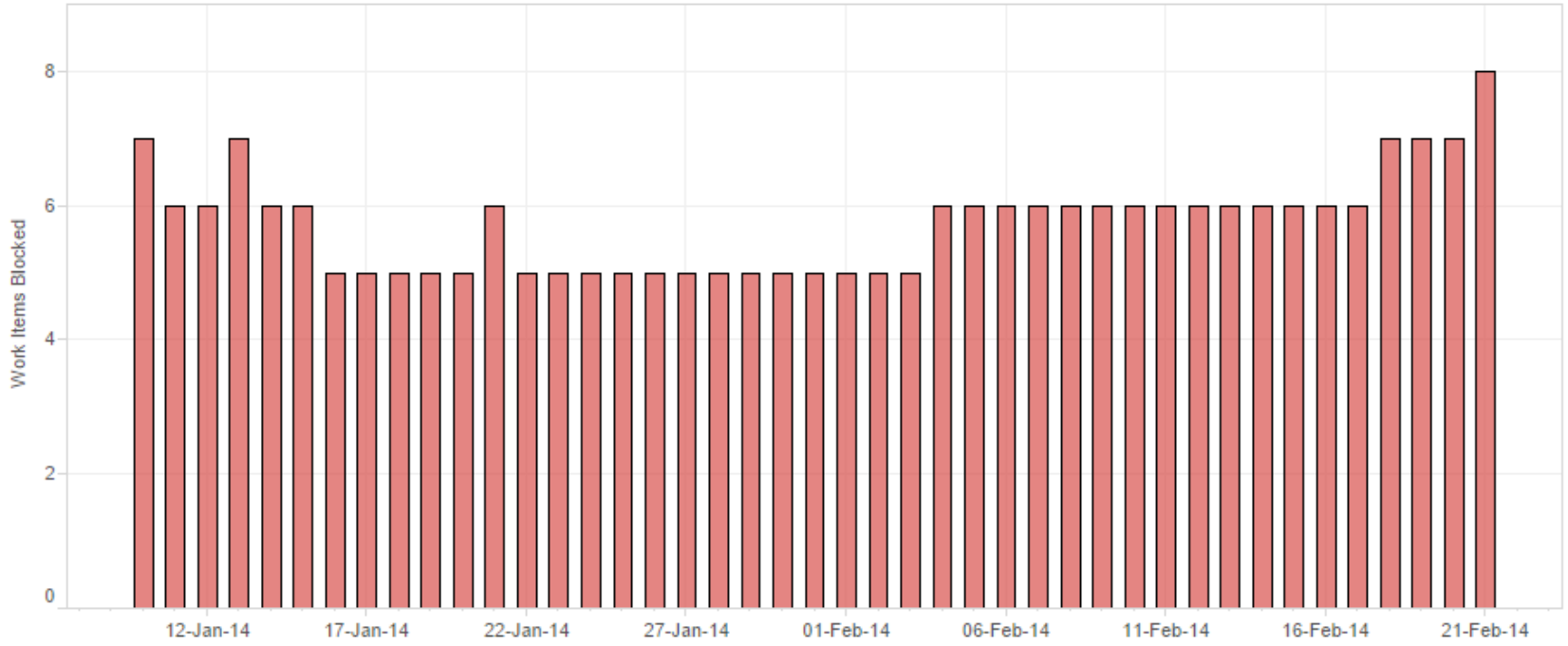

Efficiency Diagram
Queue Size/Day
80
70
60
50
40
30
20
10
09/05/2014
03/06/2014
28/06/2014
23/07/2014
17/08/2014
11/09/2014
06/10/2014
28/10/2014
In Process: 16
Ready (Queued): 23
Unknown (Not Set)
Completed
Ready (Queued)
In Process

Blockers

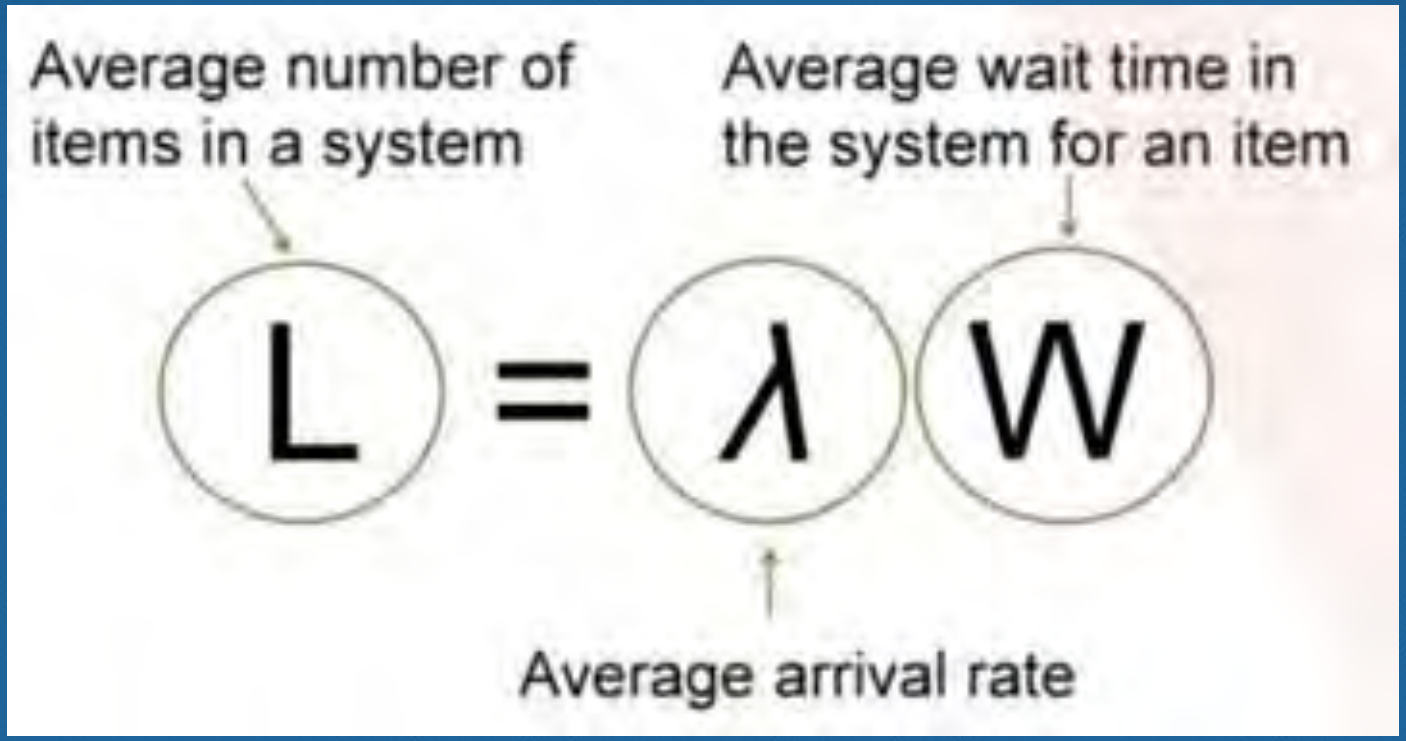
- How many items are blocked?
- How long do they stay blocked?

Constraint Report

Work Item Name	Type	Trade	Blocked On	Unblocked On	
Letting cards be unassigned from a user even if the user has no access to the boa..	Defect	* Not Set	9-Sep-2013	10-Sep-2013	
Provide list of all tags from which they can be deleted; make them non-case sensitive	Standalone Story	* Not Set	6-Jun-2013	9-Jun-2013	
			10-Jun-2013	10-Jun-2013	
			15-Oct-2013	5-Dec-2013	
Paginate user mgmt screens for acct & board to help large accts	Standalone Story	* Not Set	14-Jul-2013	15-Jul-2013	
			22-Oct-2013	22-Oct-2013	
Add a "Board Creator" permission to the user admin screen	Standalone Story	* Not Set	4-Dec-2013	9-Dec-2013	
			10-Nov-2013	14-Nov-2013	
			14-Nov-2013	15-Nov-2013	
			18-Nov-2013	18-Nov-2013	
			20-Nov-2013	21-Nov-2013	
			31-Oct-2013	31-Oct-2013	
Shared Boards	Standalone Story	* Not Set	1-Dec-2013	14-Jan-2014	
			16-Sep-2013	25-Sep-2013	
Lane header menu: Find better ways to access to it	Standalone Story	* Not Set	9-Oct-2013	9-Oct-2013	
			15-Oct-2013	27-Nov-2013	
Consolidate card context menu options & remove those that don't apply to that car..	Standalone Story	* Not Set	26-Dec-2013	26-Dec-2013	

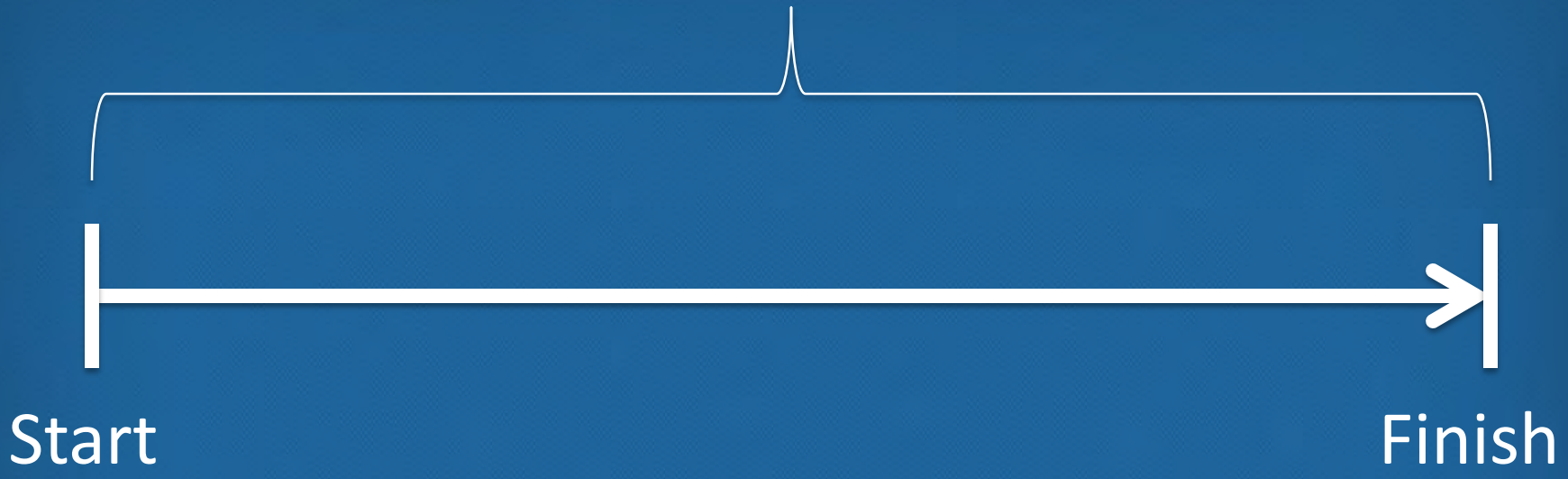


Little's Law



$$\text{Cycle Time} = \frac{\text{Work in progress (WIP)}}{\text{Average completion rate}}$$

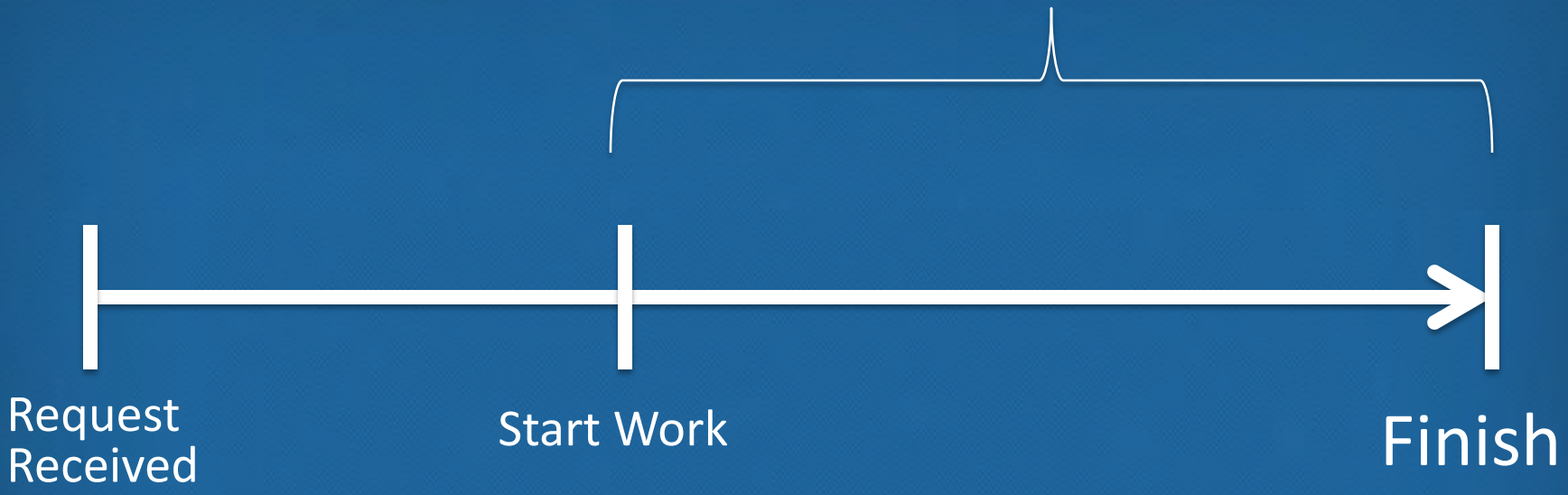
Lead Time



Start and Finish points are arbitrary

So, we can talk about “Customer Lead Time” or “Development Lead Time” or “QA Lead Time”

Cycle Time



Often used interchangeably with Lead time

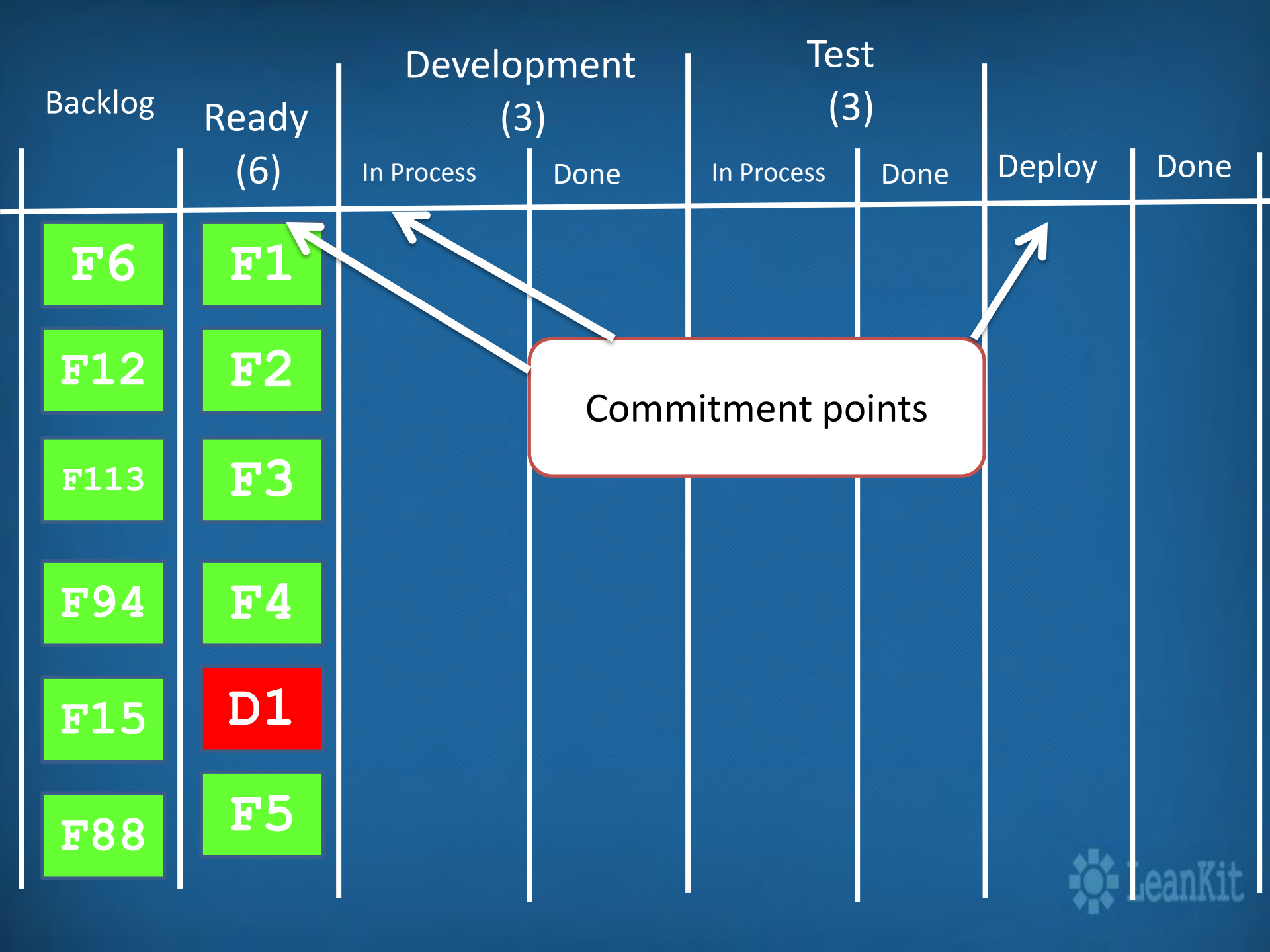
You may consider Cycle time to begin at the commitment point

Again, be sure to clarify what you mean when using these terms

Takt Time

Takt Time = the time that elapses between two units being delivered

Rarely used in Kanban for knowledge work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D1
F5
Commitment points
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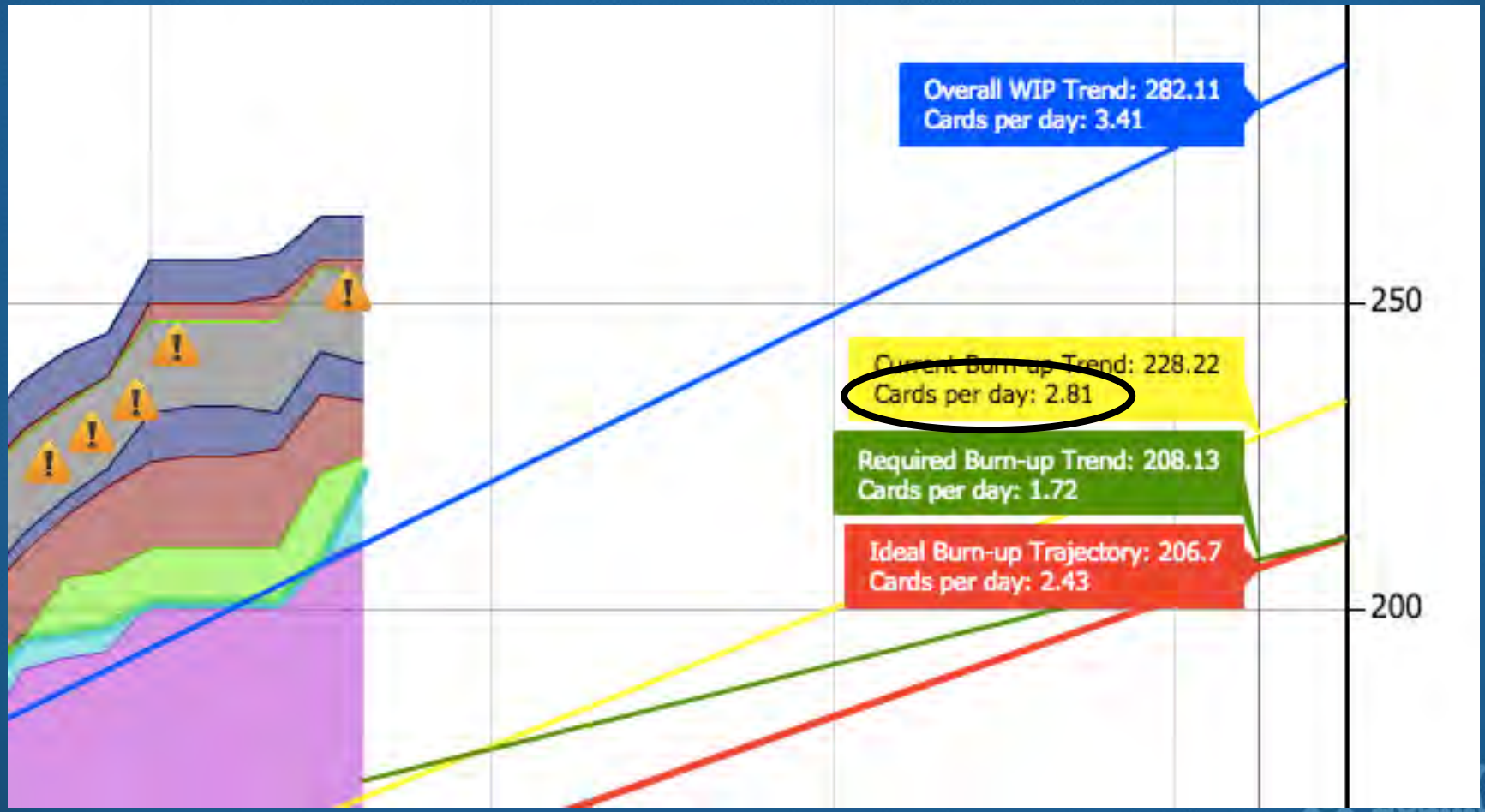
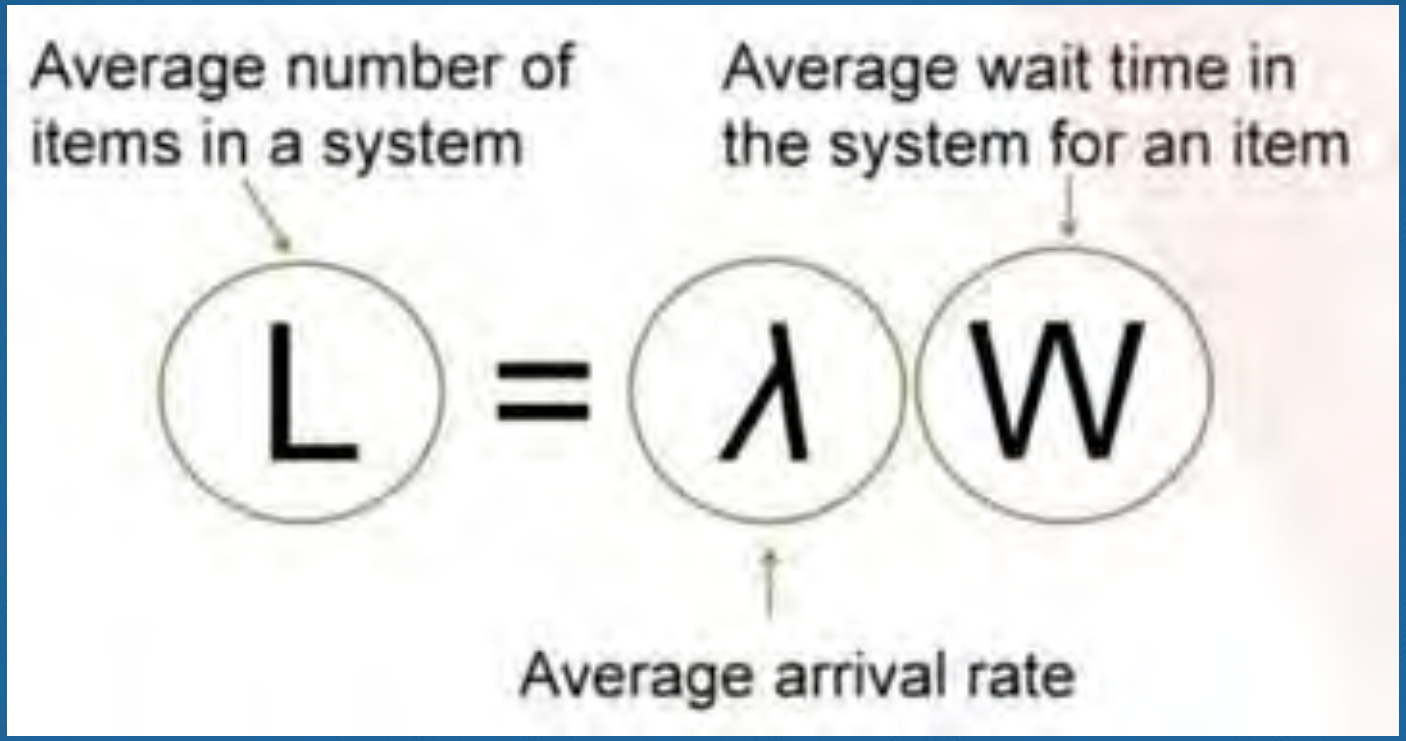
Throughput

- Throughput = Average number of units processed per time unit



Little's Law, again



$$\text{Cycle Time} = \frac{\text{Work in progress (WIP)}}{\text{Average completion rate}}$$

Little's Law Example

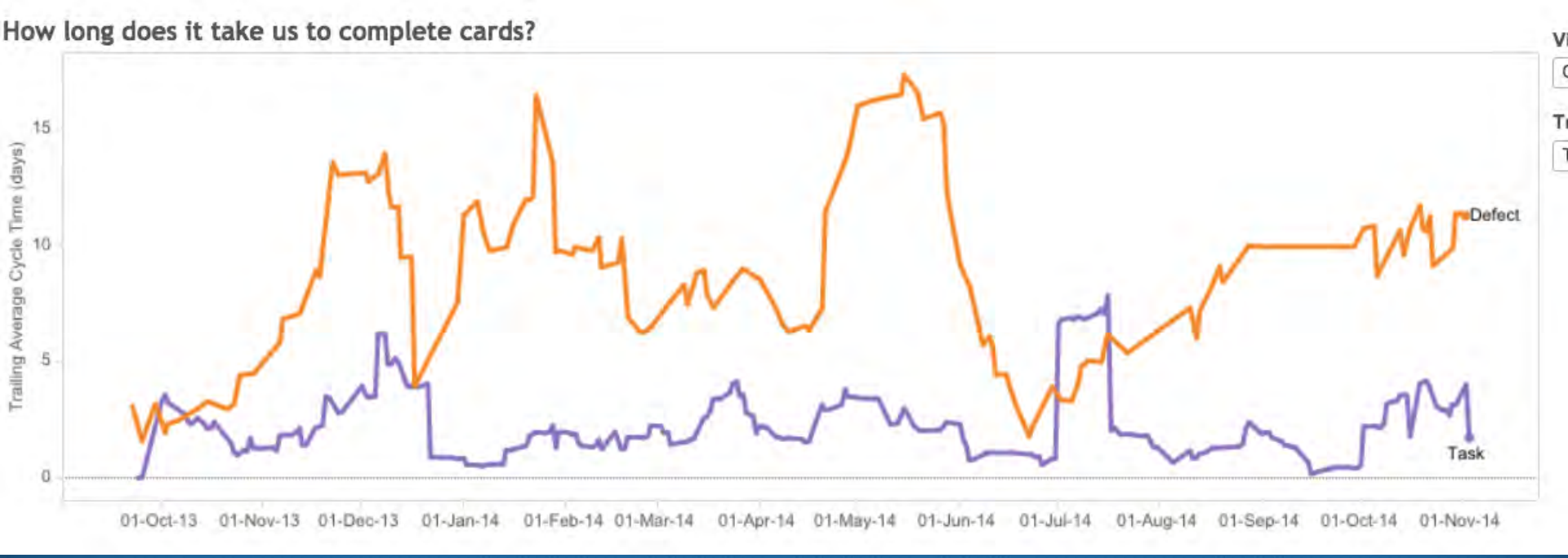
- WIP = 32 cards
- Throughput (average) = 1.25 cards/day
- Cycle Time = 32/1.25 = 25.6 days

- Now say WIP starts going up, to 40 cards
- Cycle Time = 40/1.25 = 32 days

- Little's law allows us to roughly predict the effect of allowing additional WIP into the system

- What if WIP goes down?
- Cycle Time = 20 cards/1.25 cards/day = 16 days

Lead and Cycle Time Charts



- Average Cycle Time by Card Type

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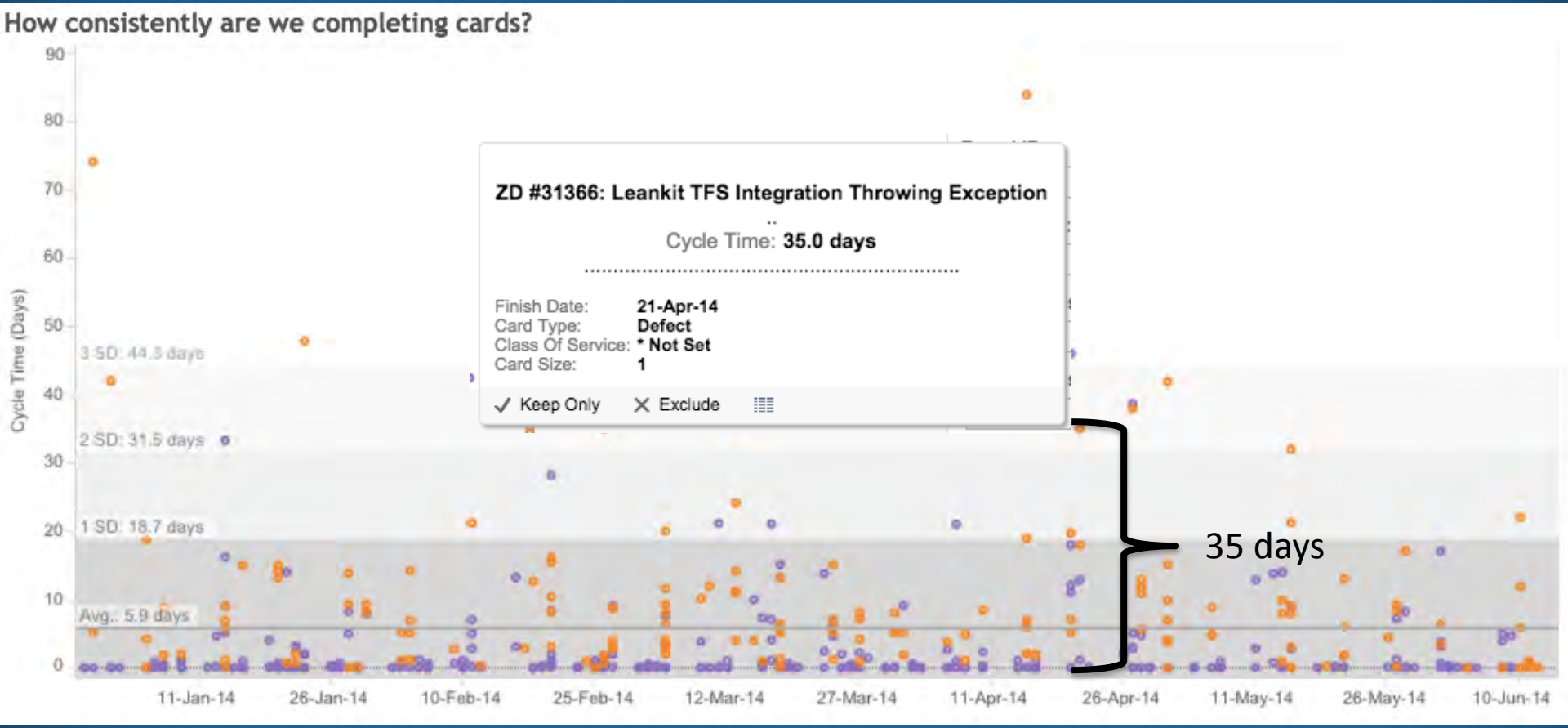
Lead and Cycle Time Charts



- Statistical Process Control (SPC) Chart

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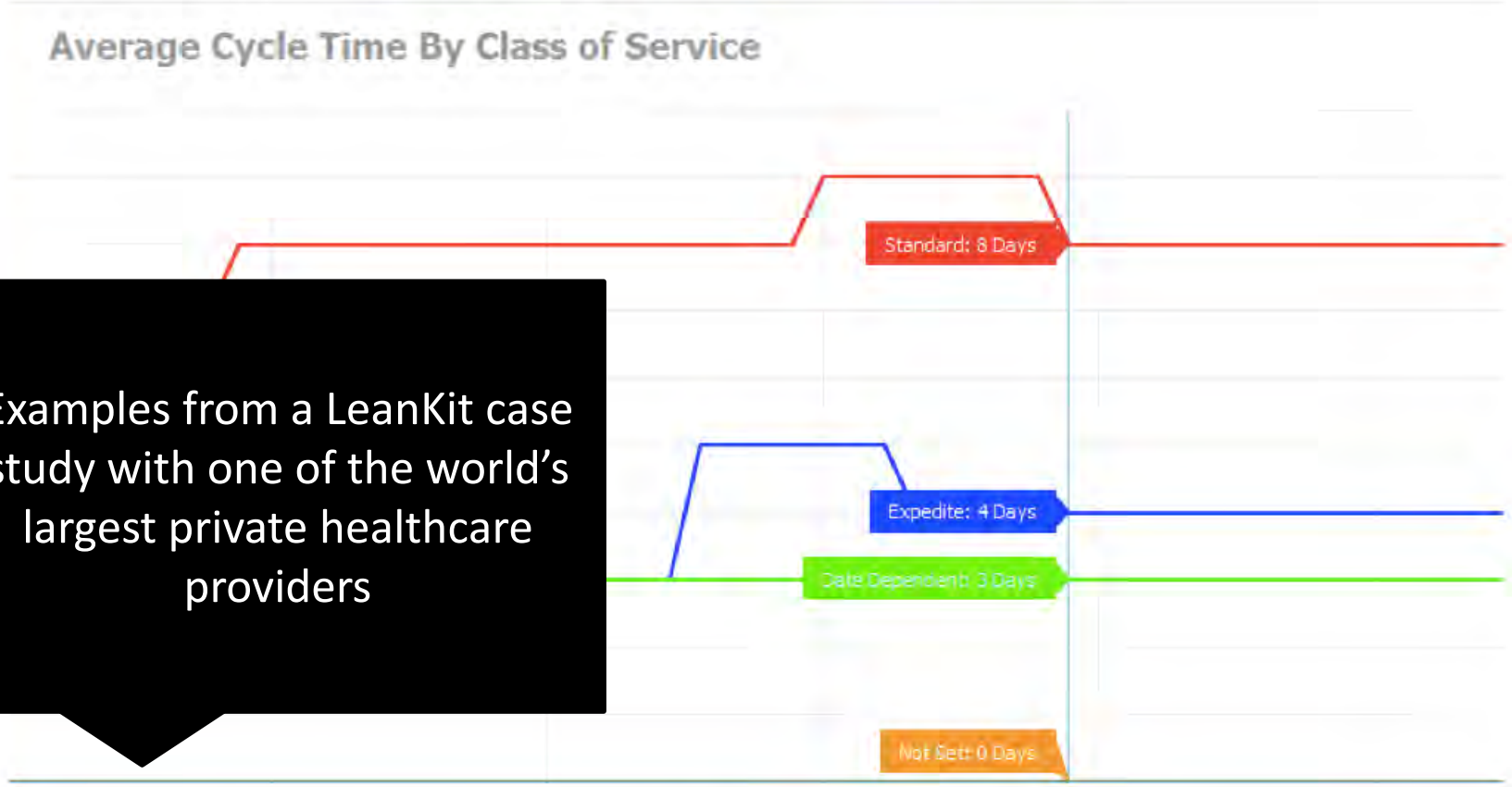
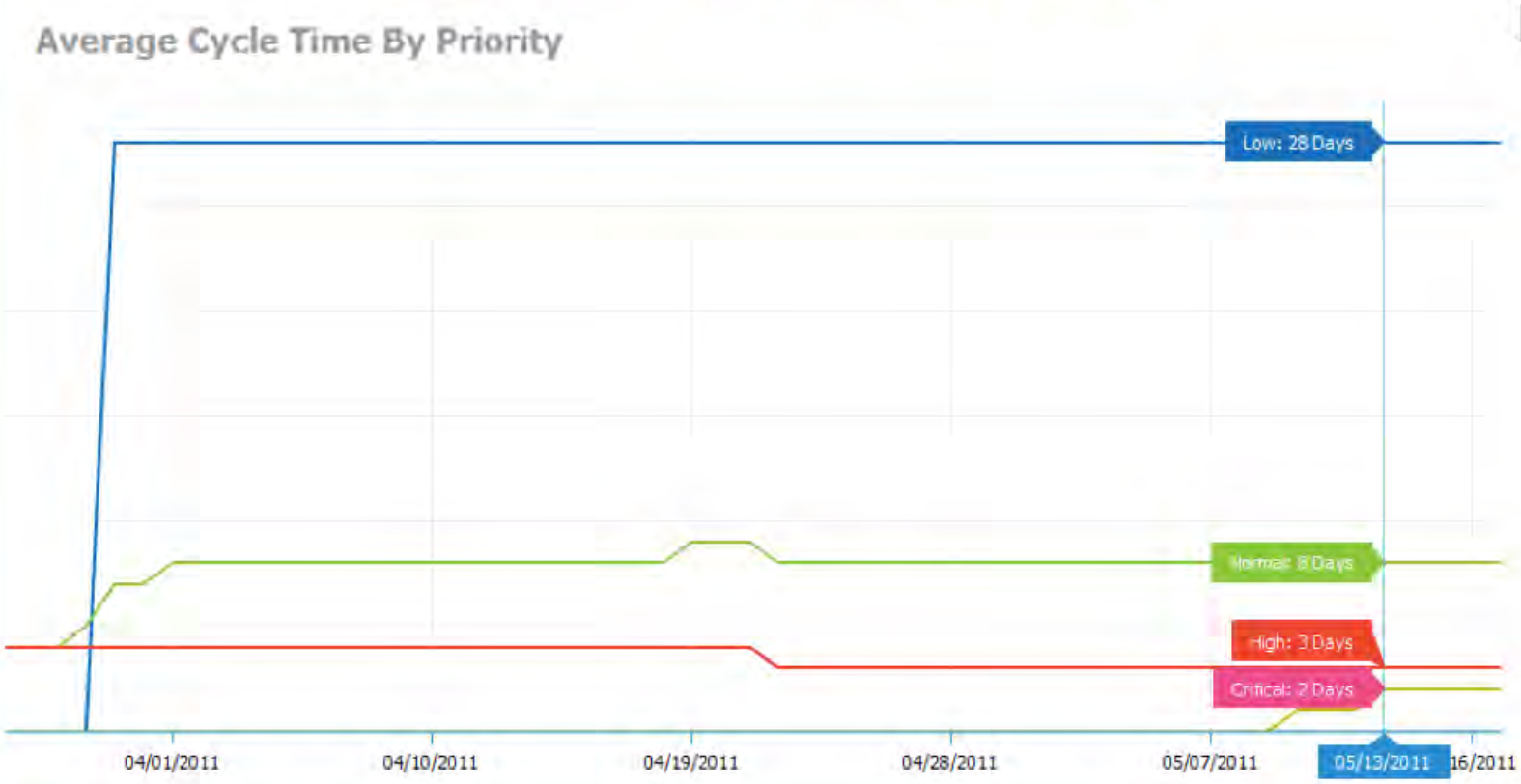
Understanding our Capacity



Examples from a LeanKit case study with one of the world's largest private healthcare providers

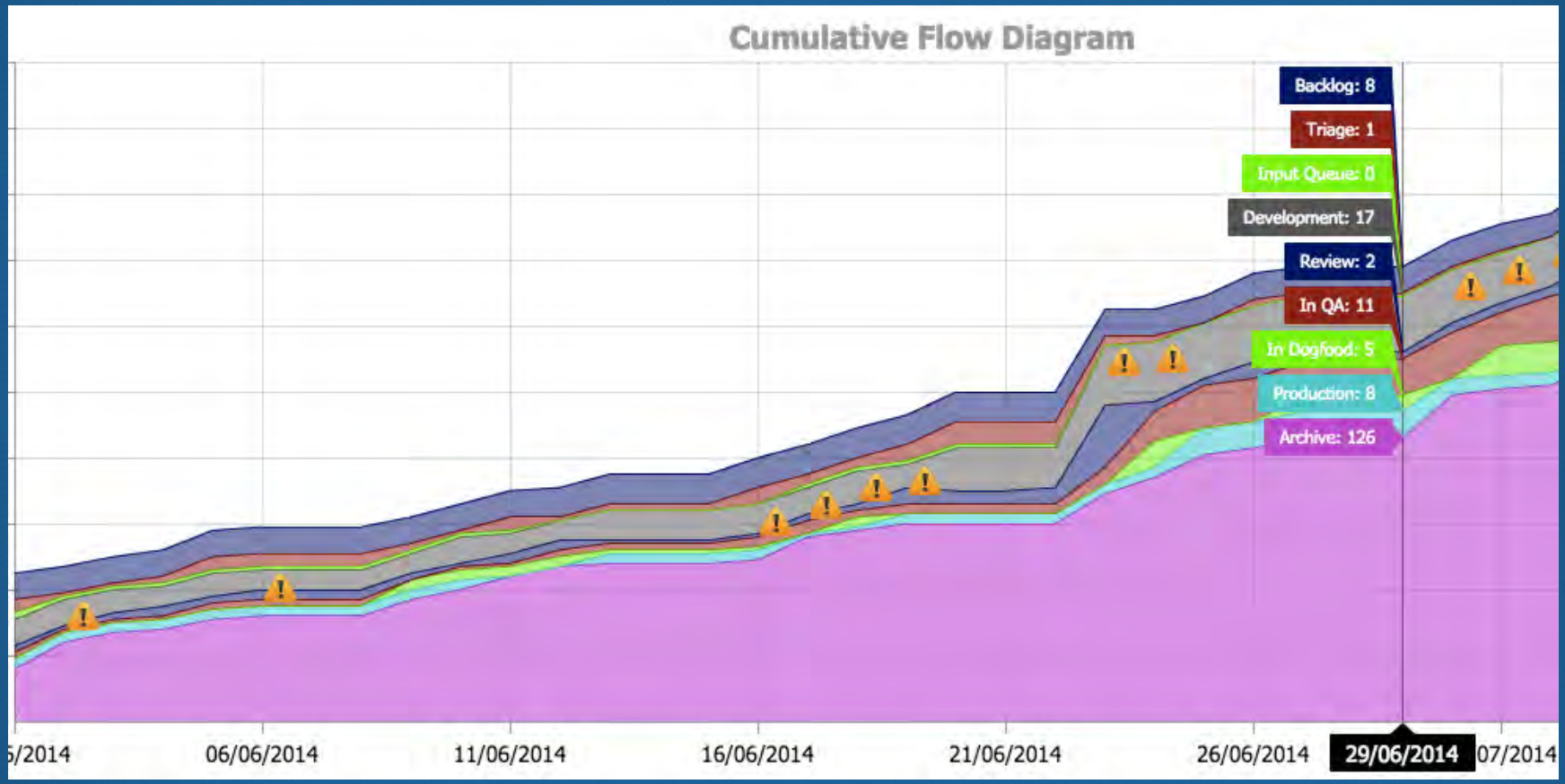
Standard items are completed, on average, within 8 days, while expedited and date dependent are significantly faster with 4 and 3 days respectively. This means that based on class of service we are able to adjust and turn things around quicker.

Understanding our Capacity



Corresponding to the class of service, normal priority items are completed, on average, within 8 days, while high are turned around within 3 and critical by 2 days. Again we are adjusting and turning around the high and critical items quicker.

Cumulative Flow Diagrams



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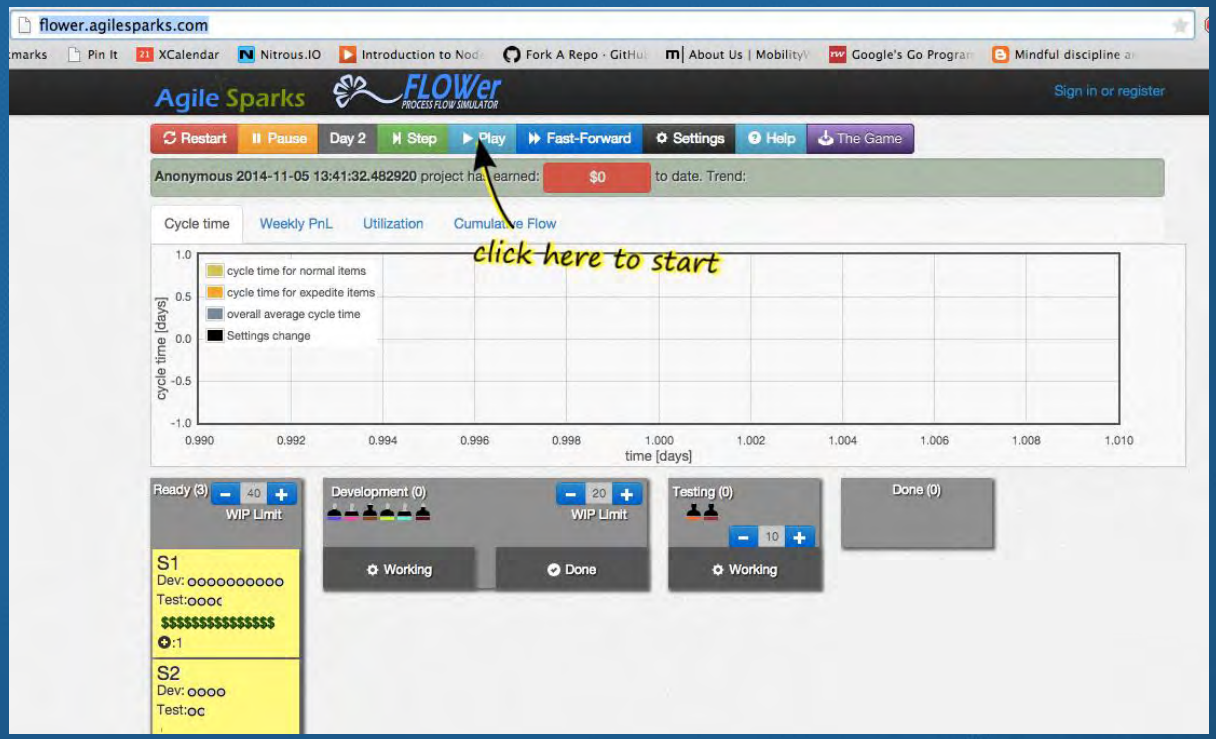
http://www.slideshare.net/yyeret/explaining-cumulative-flow-diagrams-cfd

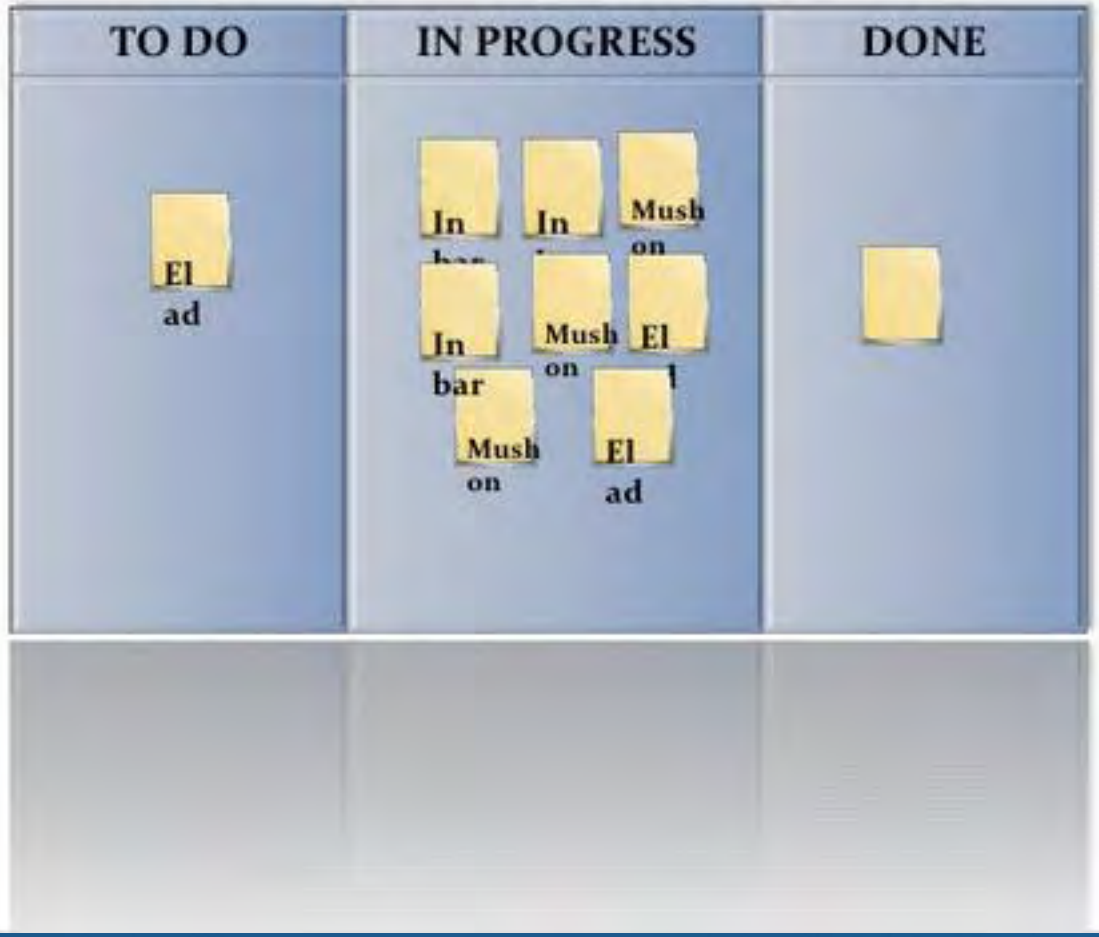
Process Flow Simulator

flower.agilesparks.com

agilesparks.com



Agile Sparks
Challenging your comfort zone



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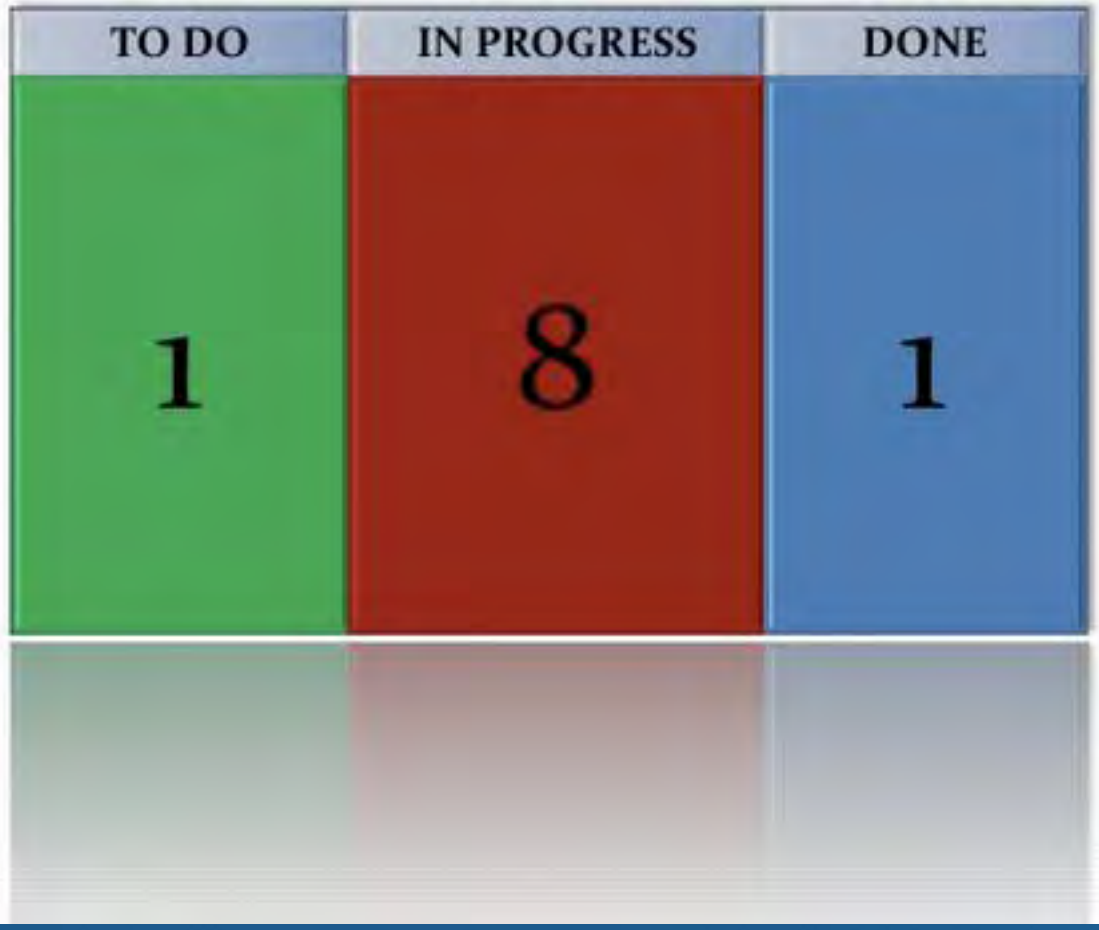

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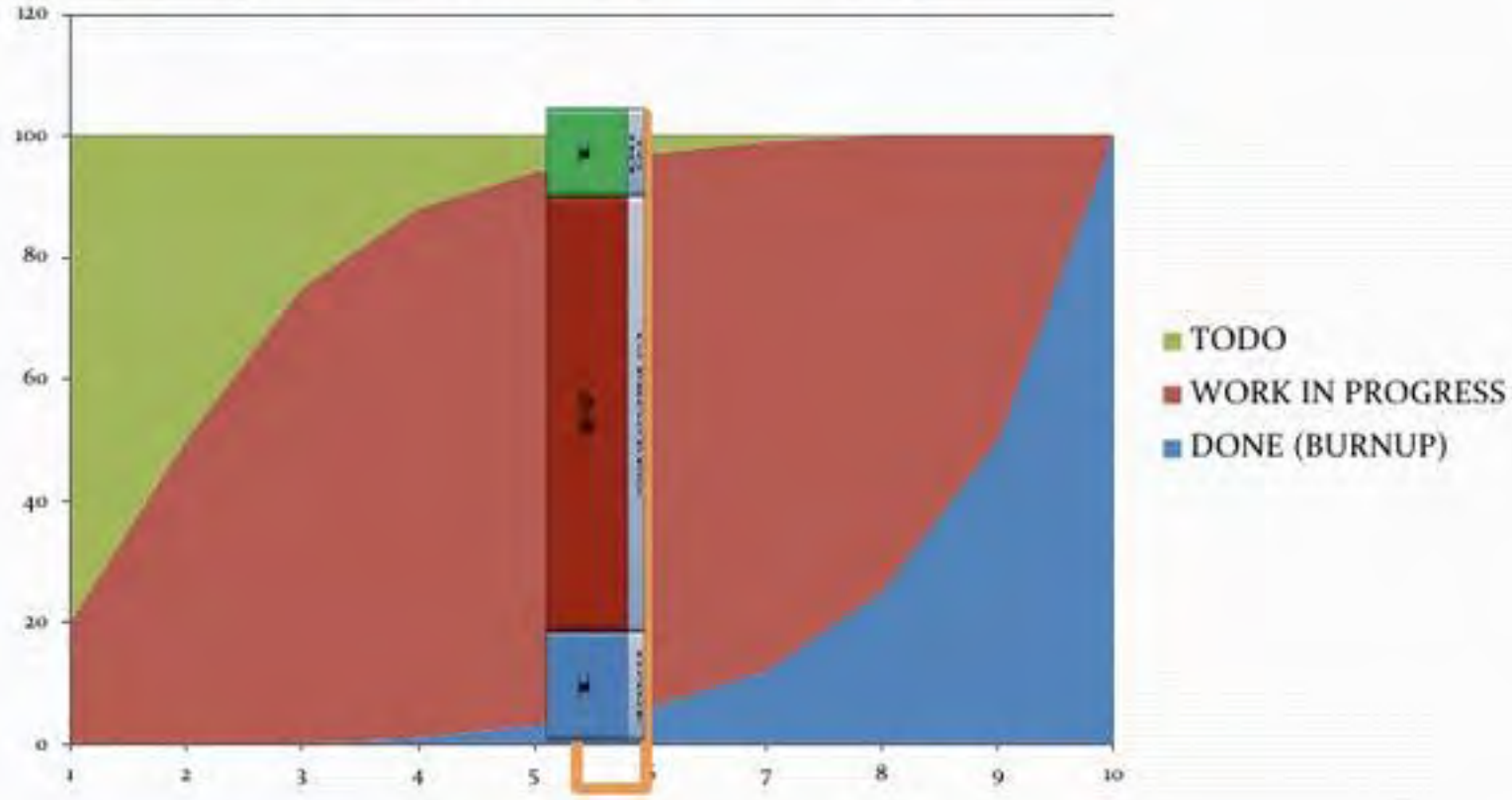
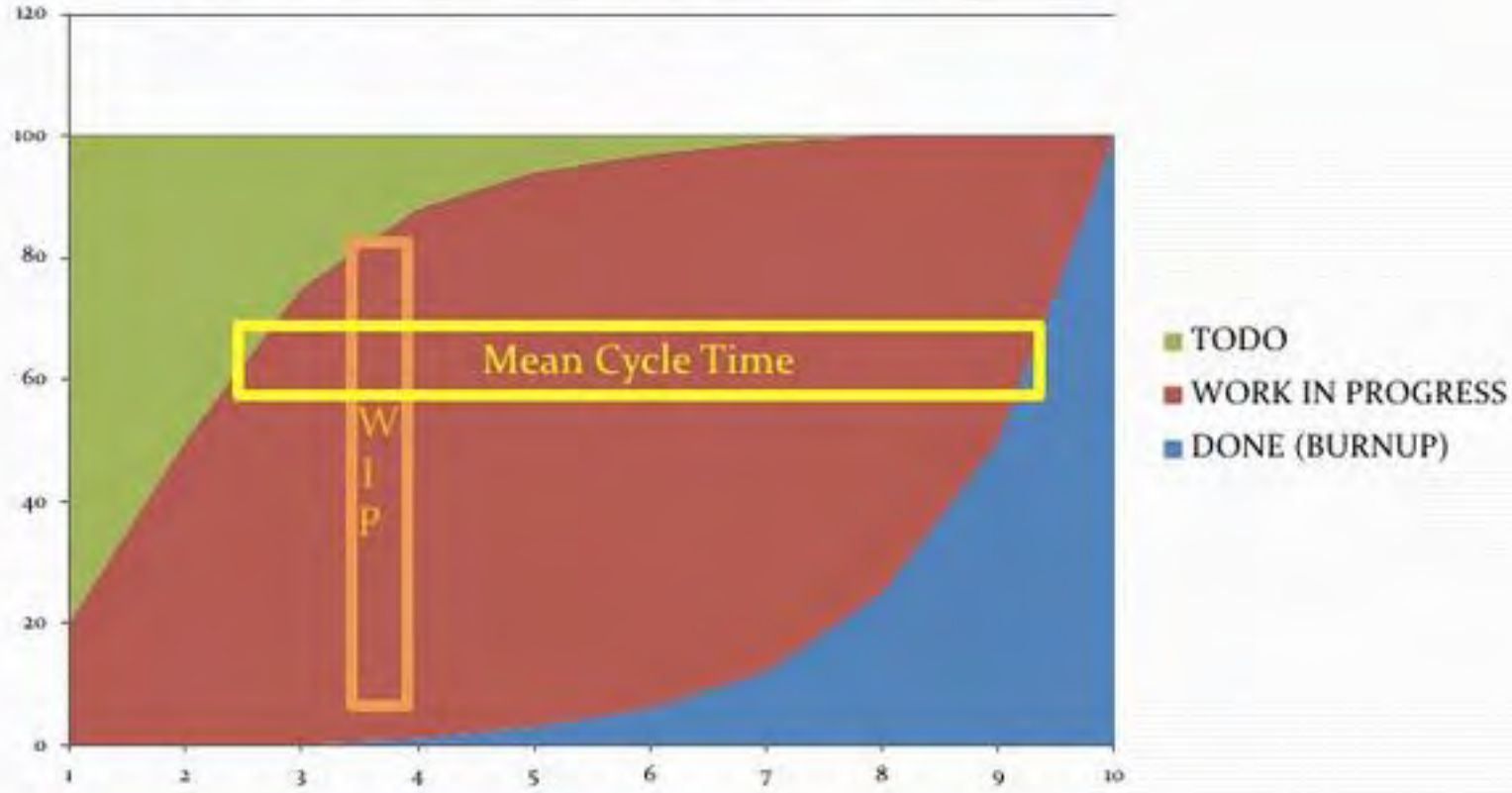
So a cumulative flow is built of snapshots of the board summary per day

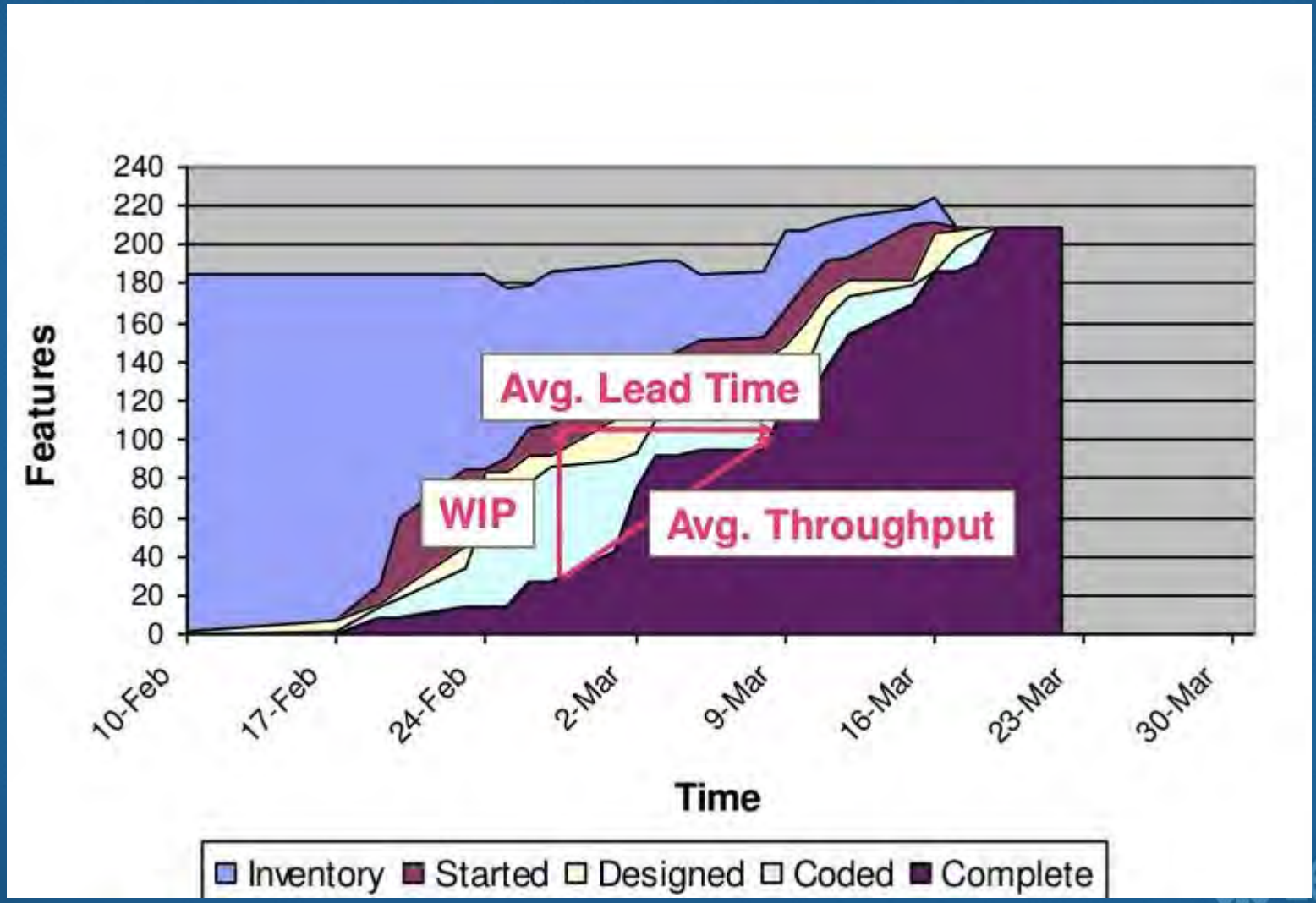


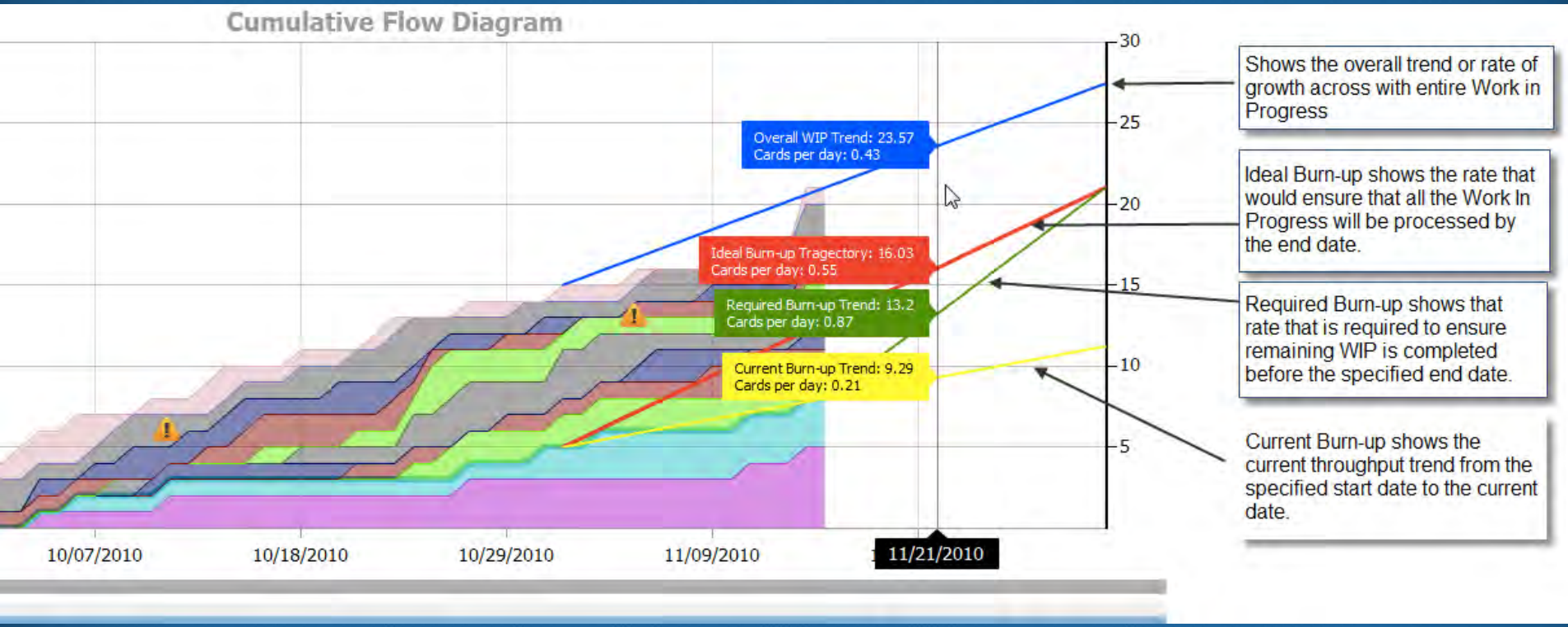
Agile Sparks
Challenging your comfort zone

And provides a LOT of data



Cumulative Flow Diagrams




Cumulative Flow Diagram
Overall WIP Trend: 23.57
Cards per day: 0.43
Ideal Burn-up Tragectory: 16.03
Cards per day: 0.55
Required Burn-up Trend: 13.2
Cards per day: 0.87
Current Burn-up Trend: 9.29
Cards per day: 0.21
30
25
20
15
10
5
10/07/2010
10/18/2010
10/29/2010
11/09/2010
11/21/2010
Shows the overall trend or rate of growth across with entire Work in Progress
Ideal Burn-up shows the rate that would ensure that all the Work In Progress will be processed by the end date.
Required Burn-up shows that rate that is required to ensure remaining WIP is completed before the specified end date.
Current Burn-up shows the current throughput trend from the specified start date to the current date.

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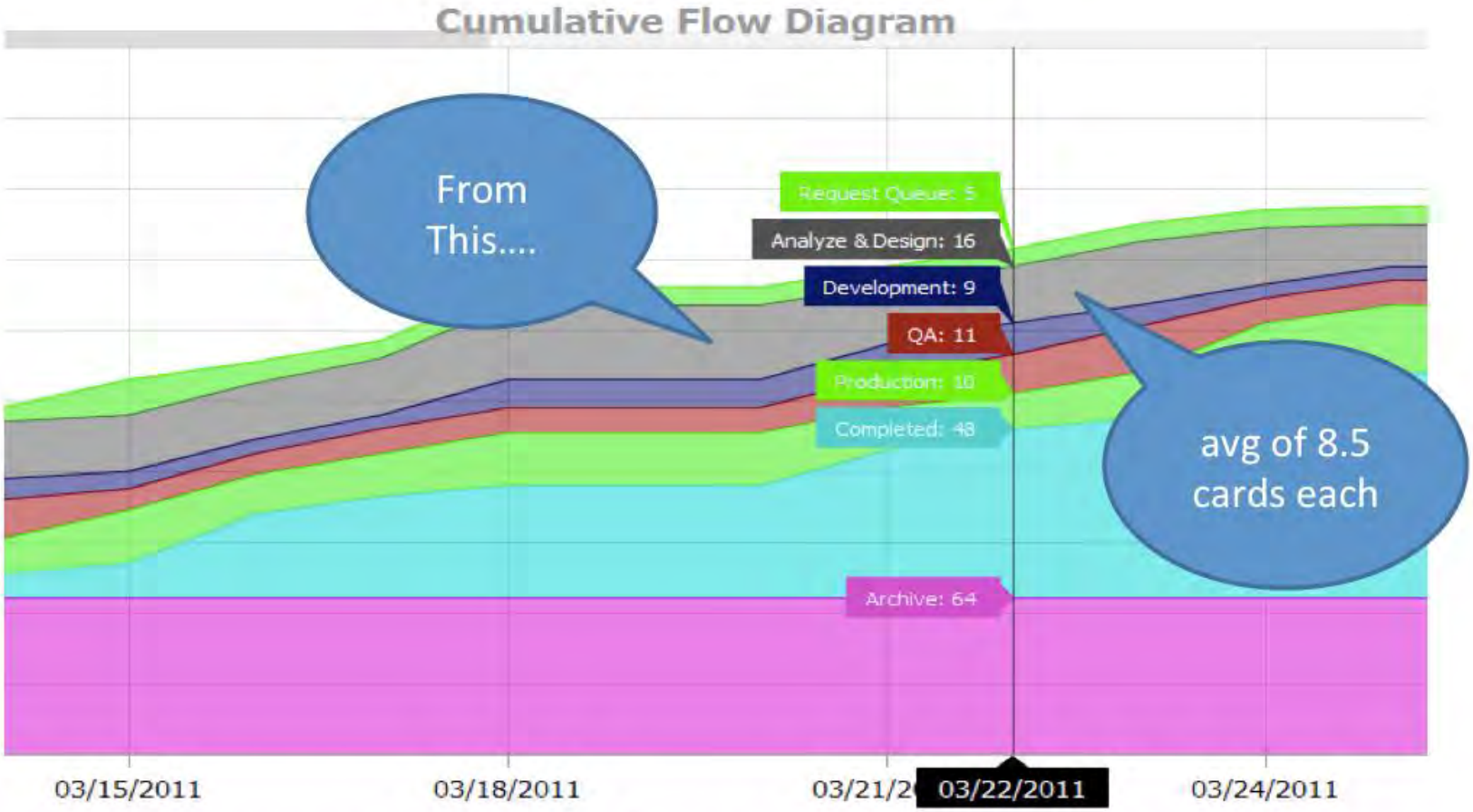
Improving Flow by limiting WIP



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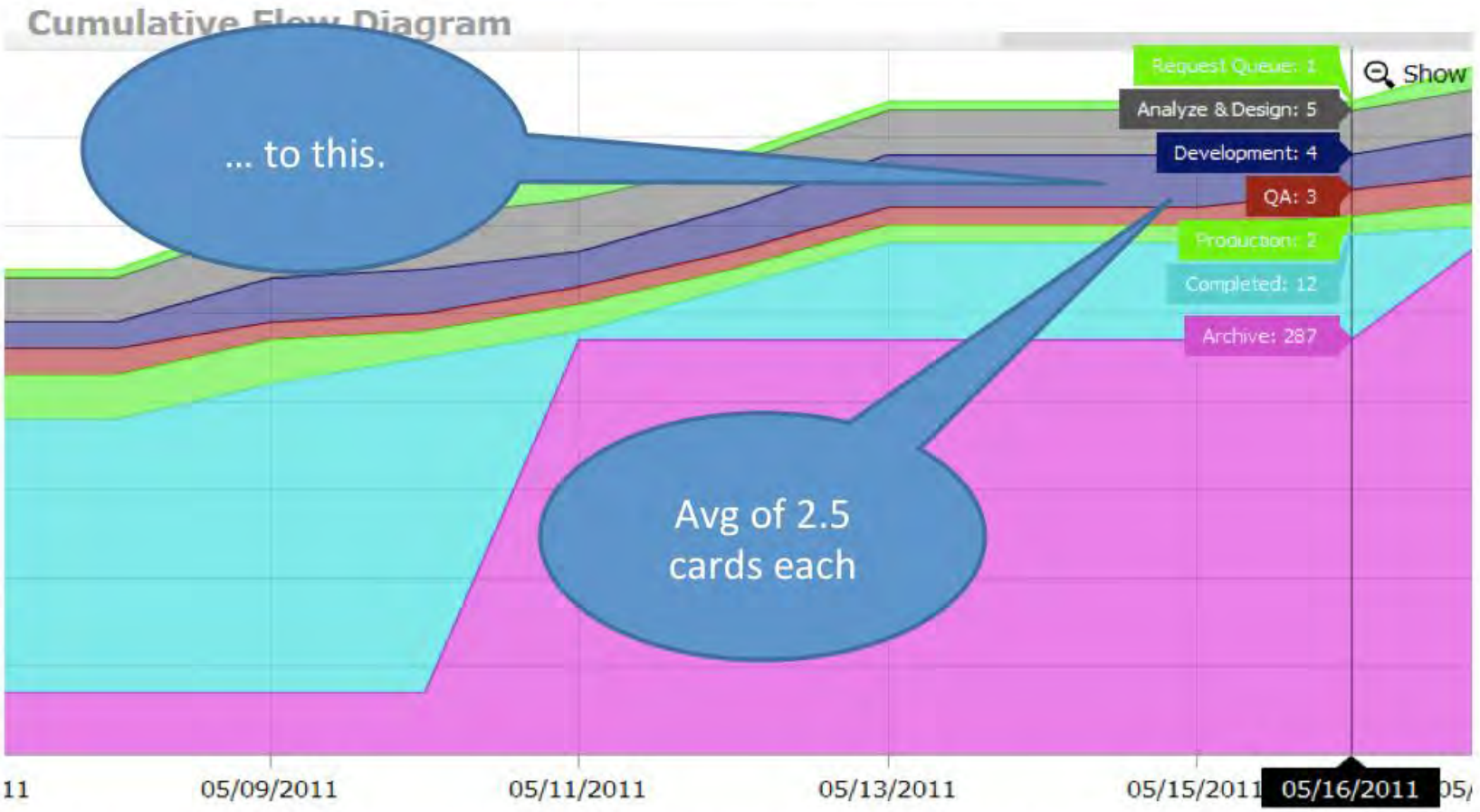
Improving Flow by limiting WIP



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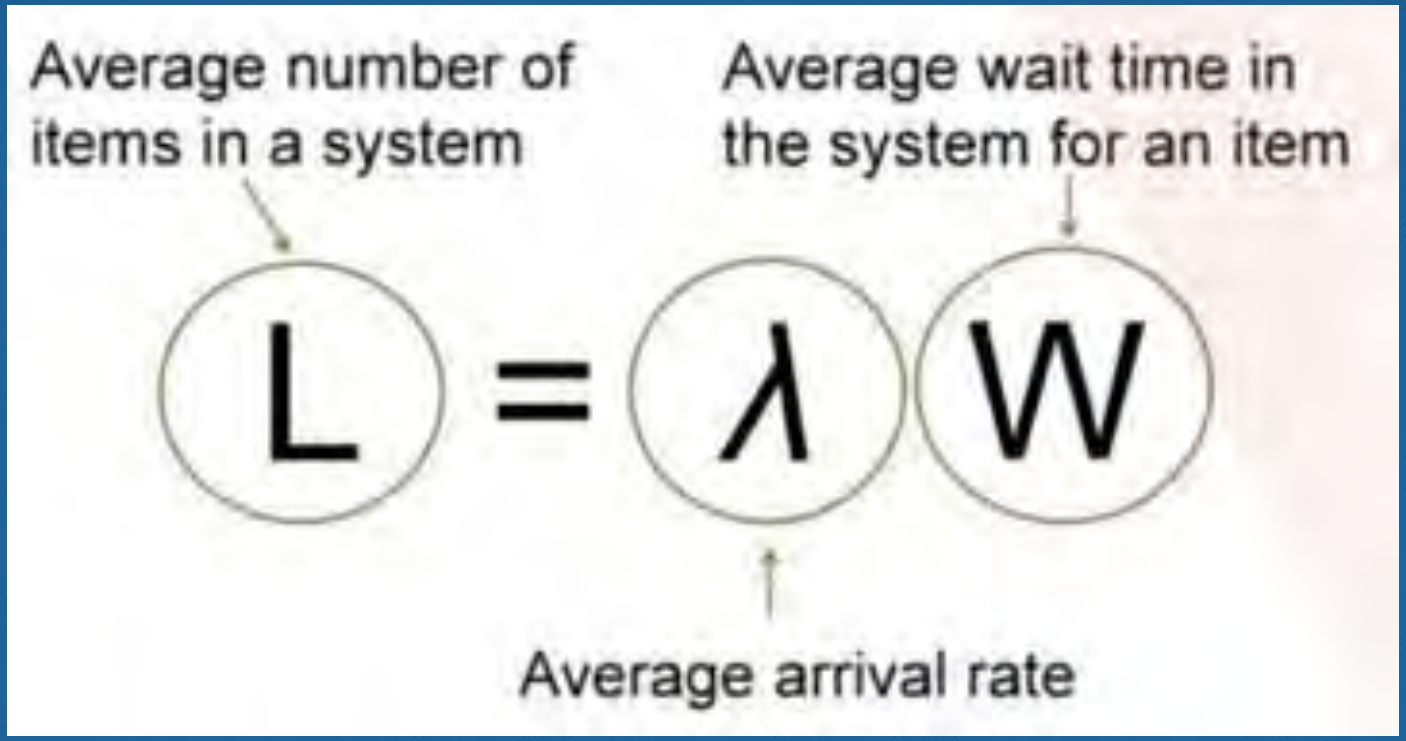
Little's Law, again



$$\text{Cycle Time} = \frac{\text{Work in progress (WIP)}}{\text{Average completion rate}}$$

Quality

- Defects
- Regressions (i.e. Cards moving backwards)
- Failure Demand

Defects

14 Defects

8 Production Defects

Production Defect Trends - Last 45 Days

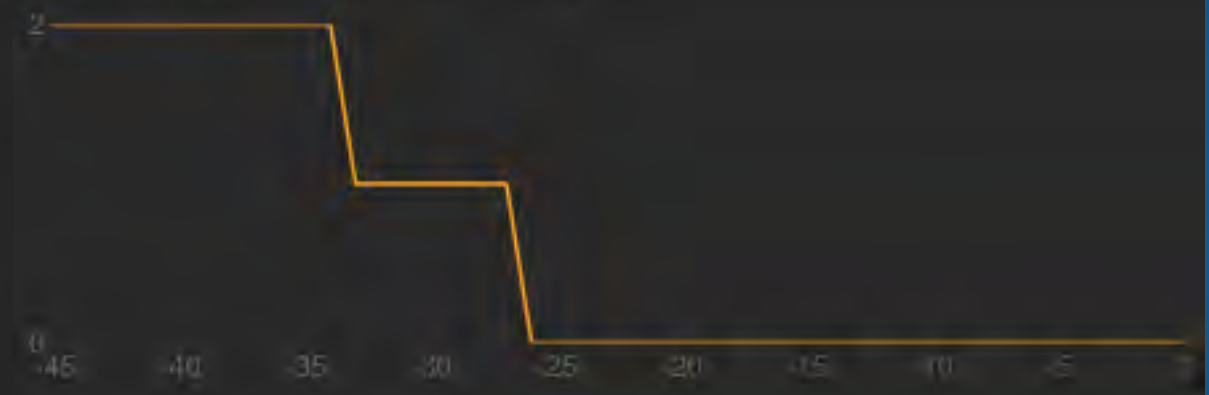
Regressed Cards

0 3+ Regressions

0 Second Regression

0 First Regression

Regressed Card Trends - Last 45 Days



Blocked Cards

1 All Blocked

0 Blocked On Board

Blocked Trends - Last 45 Days

Expedited Cards

2 Critical and High Priority

0 Expedited

Critical and Expedite Trends - Last 45 Days

https://www.geckoboard.com/

Lanes Over WIP

0 Lanes Over WIP Limit

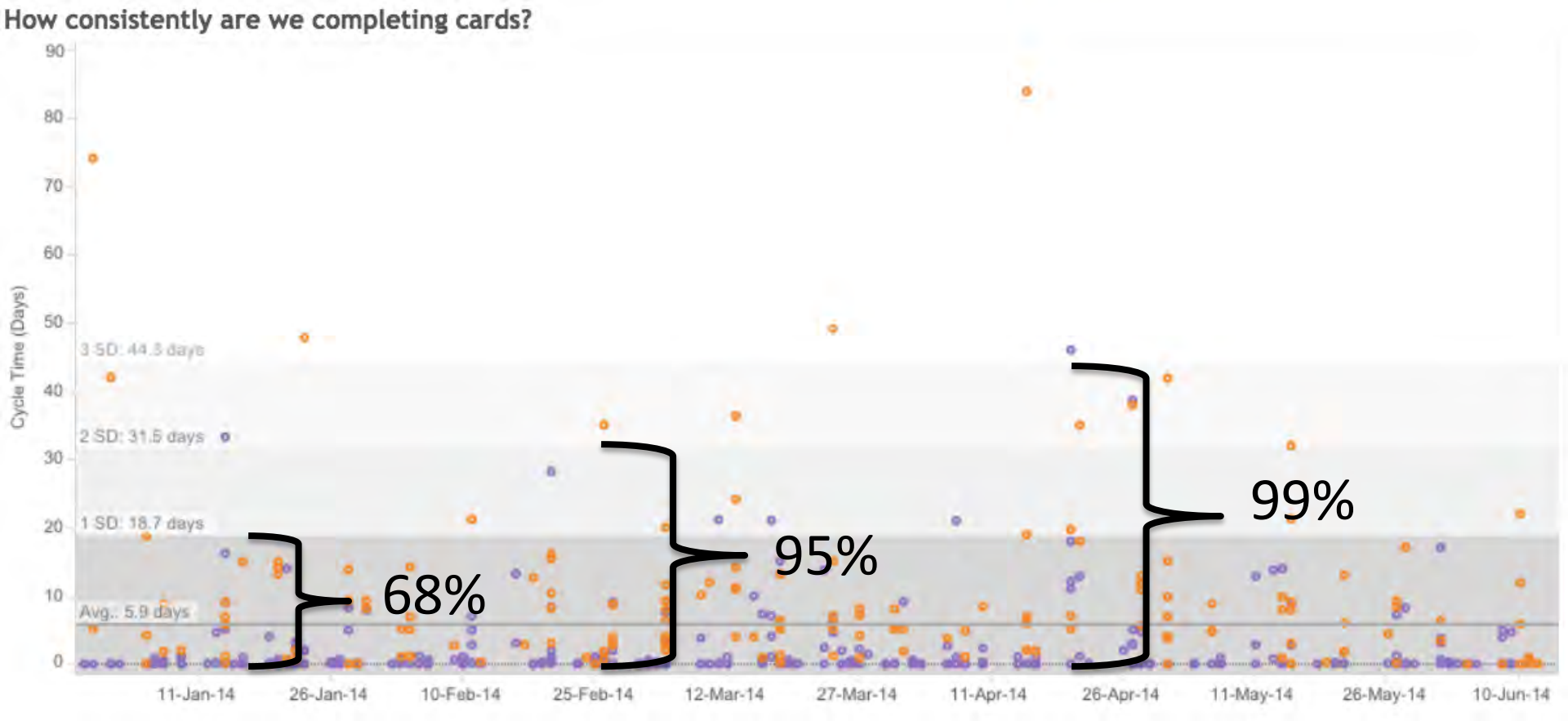
Lane WIP Violation Trends - Last 45 Days

Stale Cards

18 Stale Cards

Stale Card Trends

Predictability



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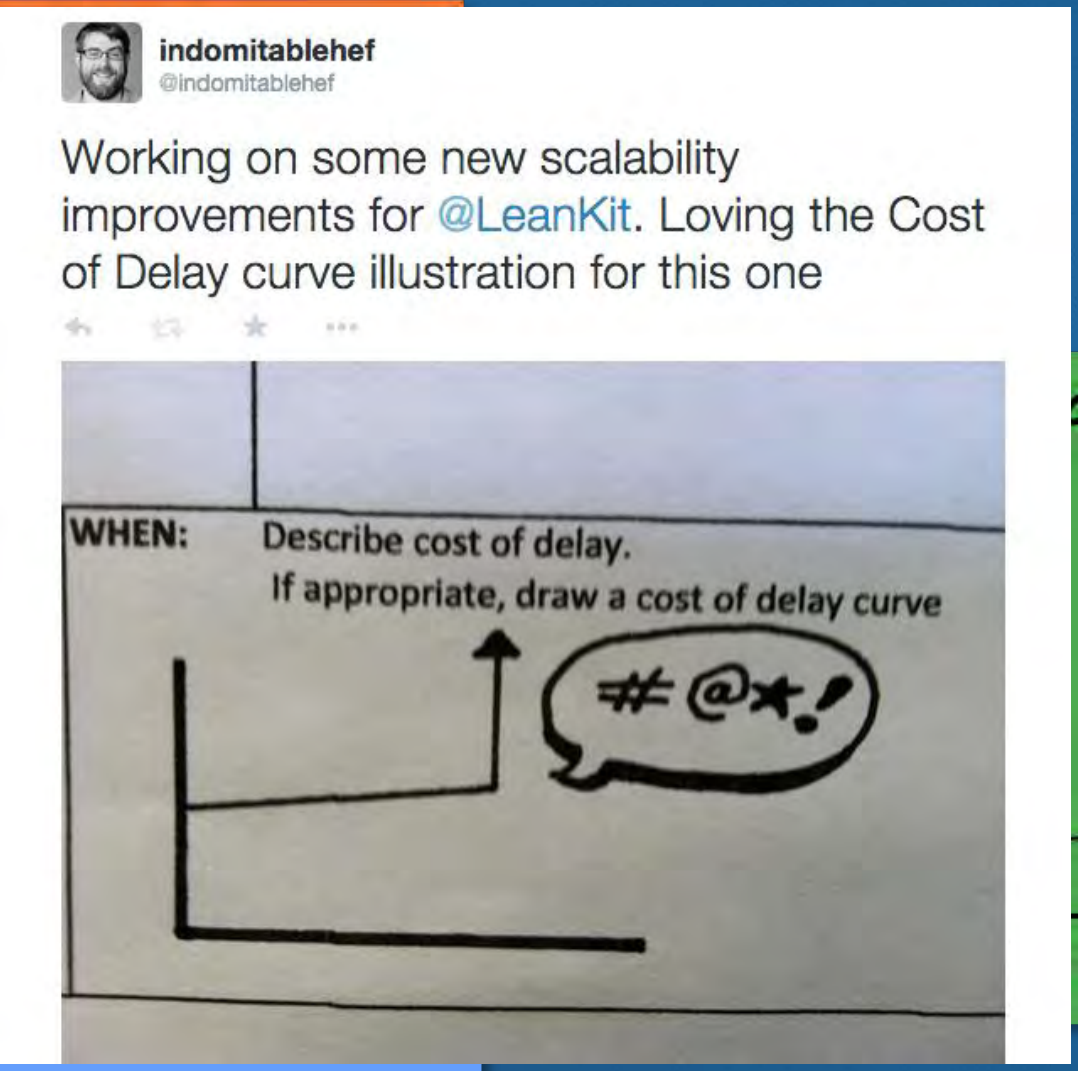
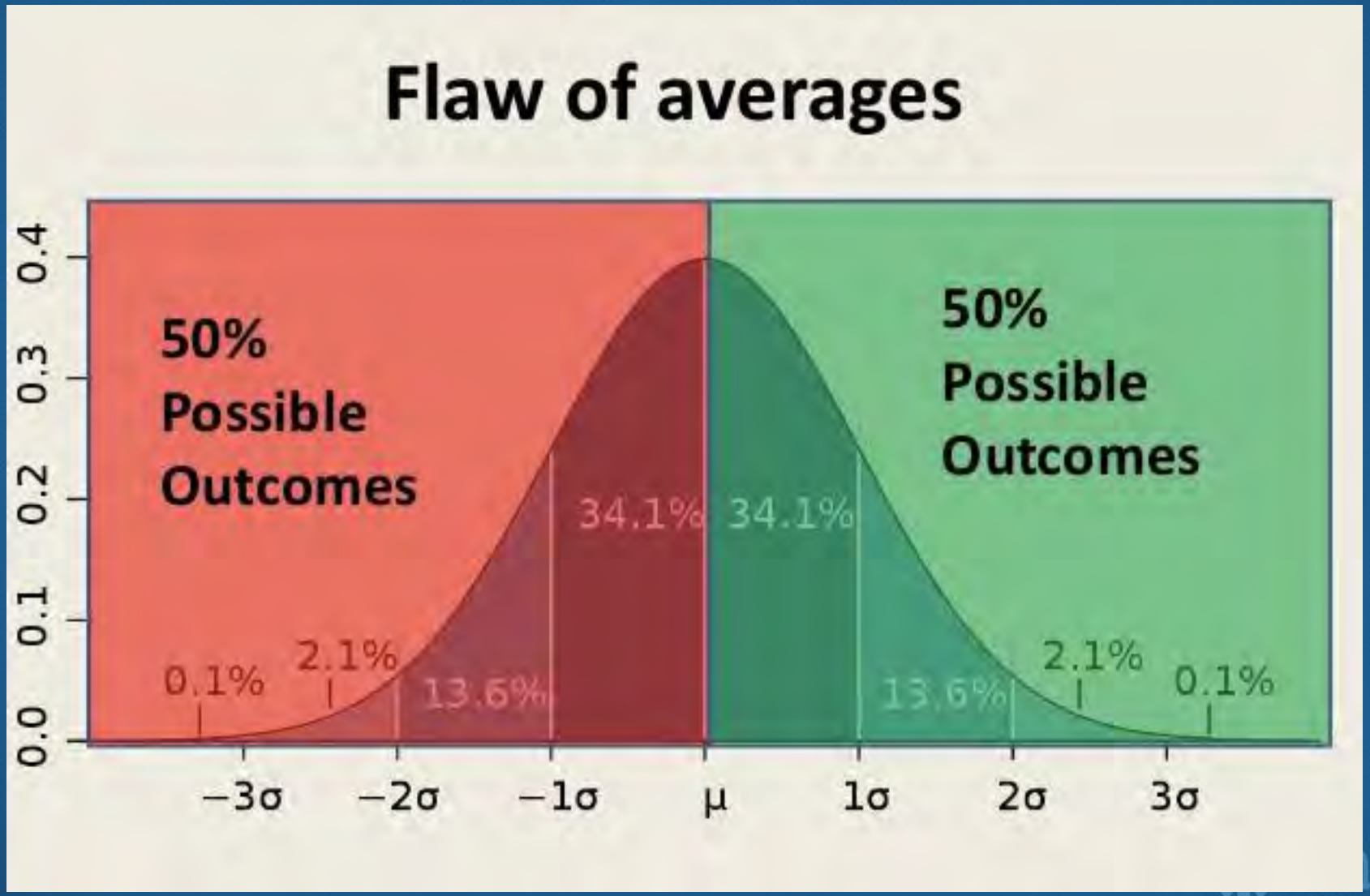
Cost of Delay

"Is a month of delay worth one million dollars or one thousand dollars? Approximately 85 percent of product developers cannot answer this simple question."
– Don Reinertsen

Cost of Delay Curves



Risk


Flaw of averages
50%
Possible
Outcomes
50%
Possible
Outcomes
34.1%
34.1%
13.6%
13.6%
2.1%
2.1%
0.1%
0.1%
0.0
0.1
0.2
0.3
0.4
−3σ
−2σ
−1σ
μ
1σ
2σ
3σ

Estimating the Right Things

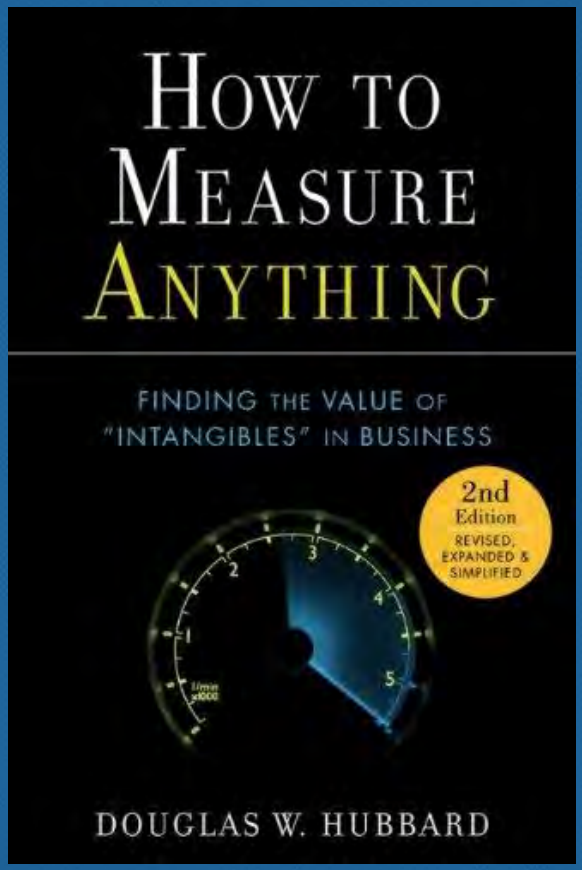
I'm not defending the obvious waste of being asked to estimate work that is going to proceed regardless of the time and cost taken to complete; there is little rational reason to waste time putting together these estimates.

Troy Magennis

FocusedObjective.com

Instead of estimating all the things that should go right, we should be estimating the things that may go wrong.

Monte Carlo Simulation



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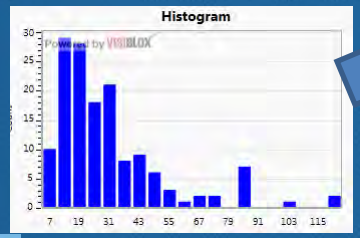
Staff, Work, Risks, Process, Defect Rate, etc.

A model of the project and Team



Historical Data or Expert Judgment

Simulation Engine

Date Forecast
- Date
- Certainty
- Risk Impact

Budget Forecast
- Cost
- Certainty
- Risk Impact

Staff Analysis
- Skill Balance
- Best Utilization
- Retention Risk

Sensitivity Analysis
- Factors to manage next
- Factors worth investigating

A Monte-Carlo simulation can present you with a range of possible outcomes and their likelihood. And the levers you can pull to change the outcomes.

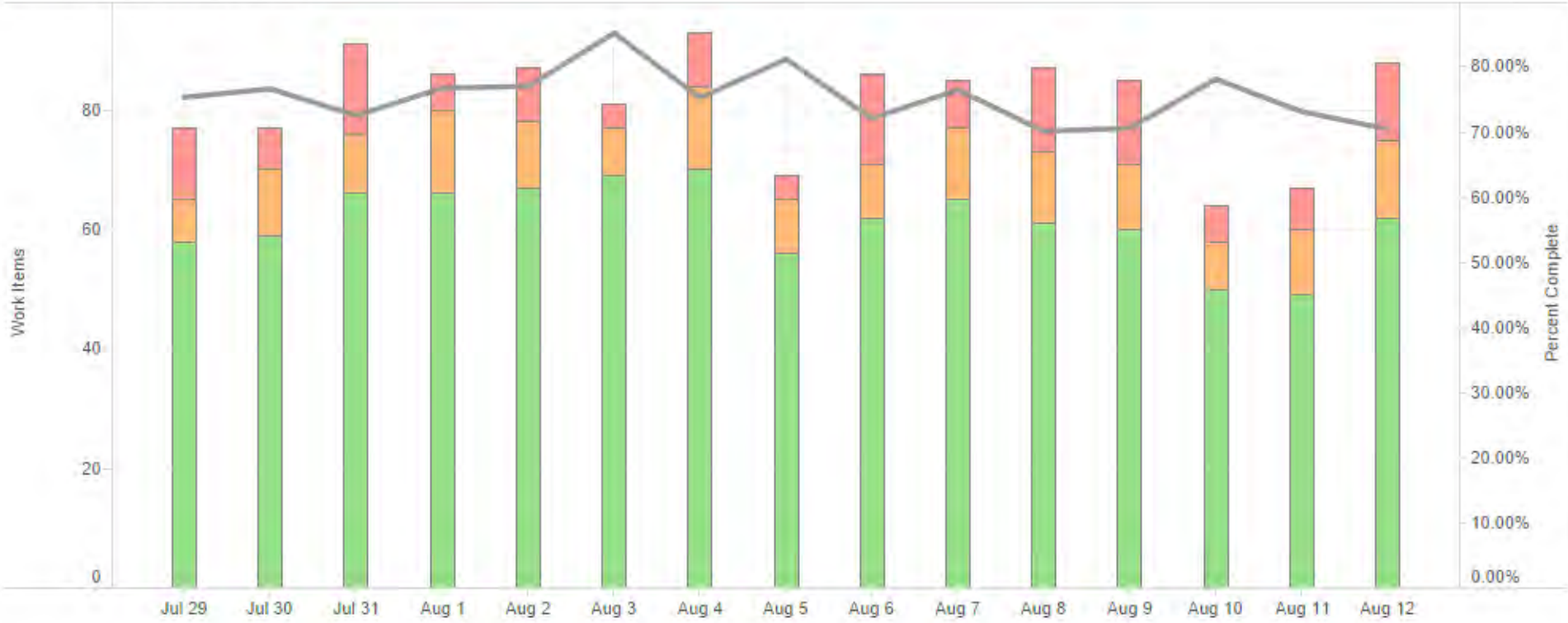
Experiment / Update Loop – Change Model and Test Hypothesis

FocusedObjective.com

Q&A

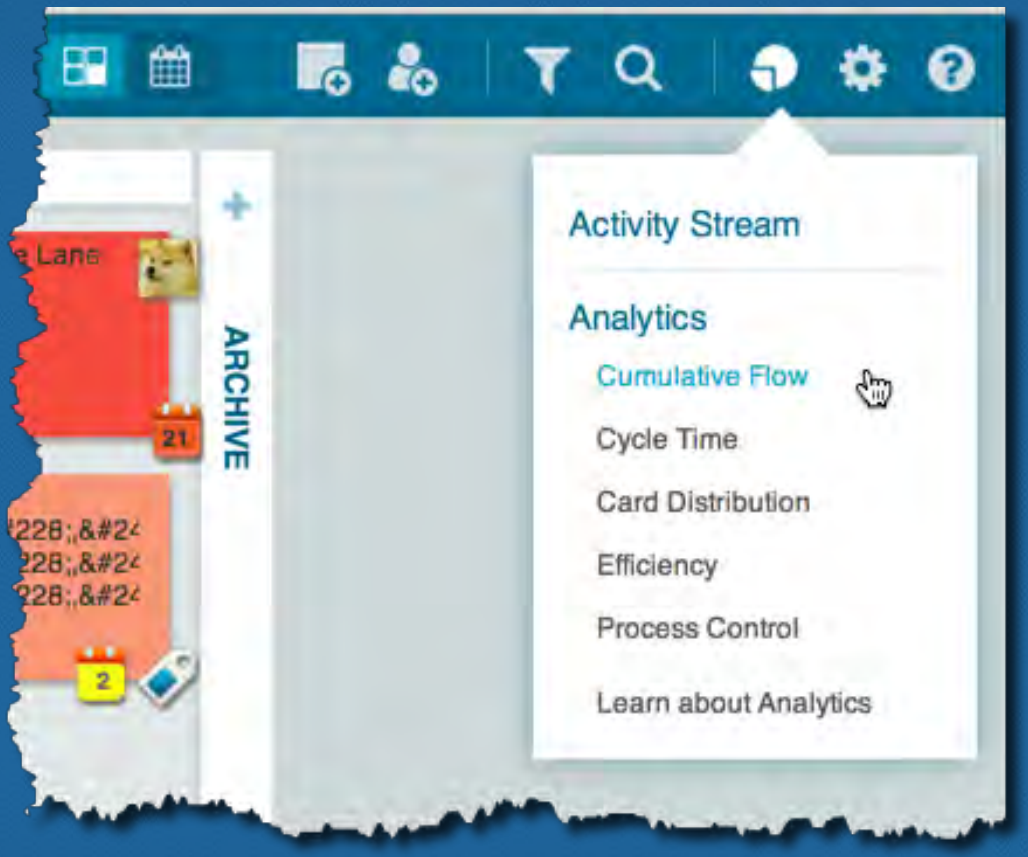
- Can you use this approach for measuring any kind of project?
- How to make the best use of Class of Service?
- How to measure lead time when there are issues waiting on a response or action from customers?
- How do you measure delays between steps?
- If a card is moved backwards does that impact the metrics?
- How to measure business value for ROI of a Lean & Agile initiative when the business doesn't know its value?

Planned Percent Complete



Work Item Title	Card Type	Current Lane	Planned Start	Planned Finish	Actual Start	Actual Finish	
	Feature	Next Release		14-May-2014	9-May-2014	12-May-2014	
				23-May-2014	18-May-2014	21-May-2014	
"www." forwarding for LeanKit accounts	Task	Operational Tasks		8-Jul-2014	3-Jul-2014	6-Jul-2014	
Associate Primavera resource with LeanKit card	Feature	ToDo		5-Jun-2014	31-May-2014	3-Jun-2014	
Determine if via form or API integration	Task	Completed		19-Jul-2014	14-Jul-2014	17-Jul-2014	
Hotel	Administration Request	Archive		11-Aug-2014	6-Aug-2014	9-Aug-2014	
I want to be able to reposition a lane	Task	Completed Features, Bugs, T...		29-May-2014	24-May-2014	27-May-2014	
james.m.roberts@gsk.com	Administration Request	Archive		13-May-2014	8-May-2014	11-May-2014	
Moving Cards on to Calendar view unassigns the User	Defect	Archive		1-Jun-2014	27-May-2014	30-May-2014	
prevent login to different organization from orgname.le...	Task	Completed Features, Bugs, T...		15-Jun-2014	10-Jun-2014	13-Jun-2014	
TFS integration, getting error: "value cannot be null"	Bug	Archive		30-May-2014	25-May-2014	28-May-2014	

Measuring Workflow with LeanKit



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What to Use When

Chart	Use this to…
Cumulative Flow Diagram	Visualize flow of work, including throughput and completion time to see bottlenecks
Cycle Time	Track the average time a work item takes to be processed through the system
Card Distribution	Manage capacity allocation by seeing the distribution of cards by lane, priority, type, user, or class of service
Efficiency	See how much of your work is sitting in “Ready”, “In Process”, or “Done” states
Process Control	Understand the variability of cycle times for work items moving through the process and monitor changes

Learning Resources

- How to Get Started with Continuous Improvement:
  - http://leankit.com/kanban/how-to-continuous-improvement
- How to use analytics in LeanKit
  - https://support.leankit.com/entries/21989408-Board-Analytics

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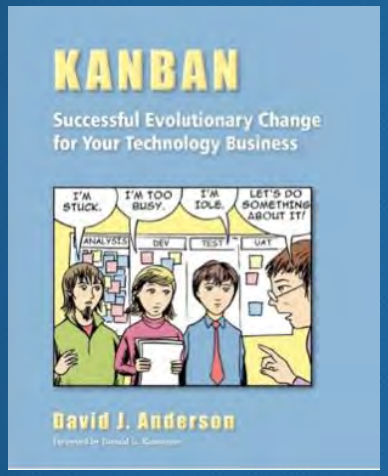
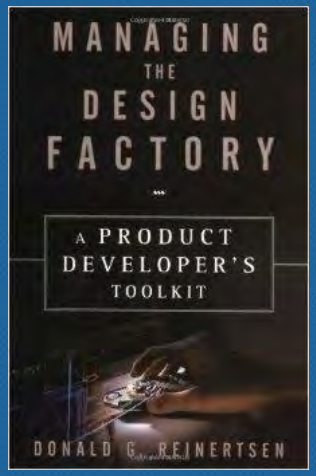
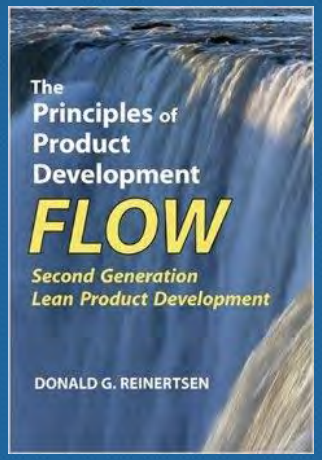
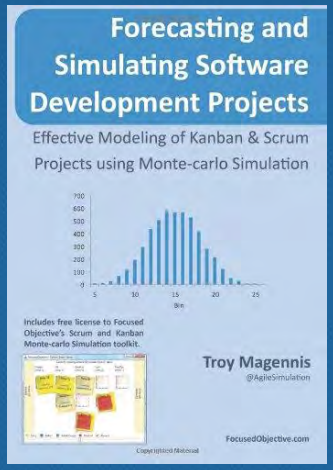
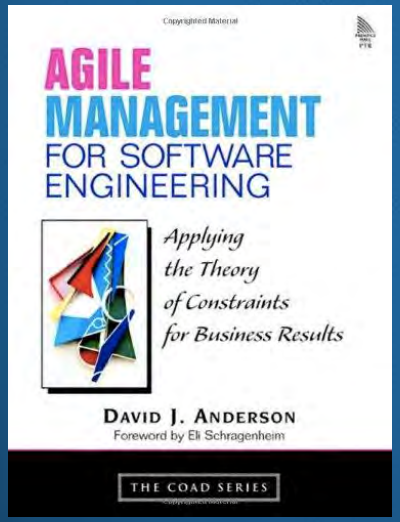
Books

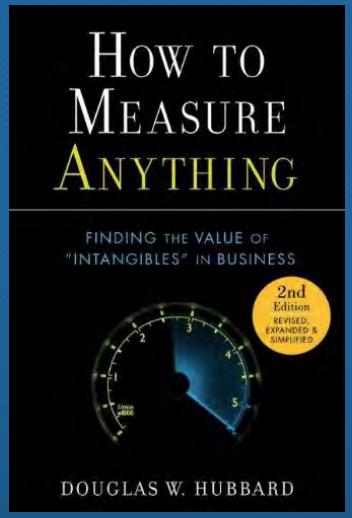


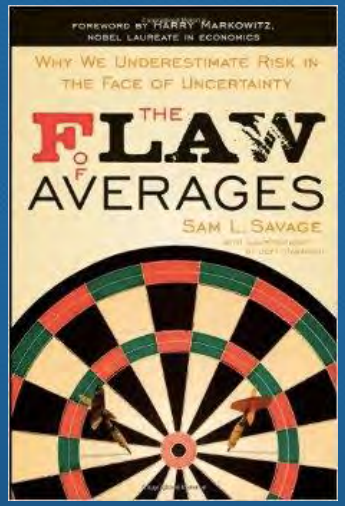


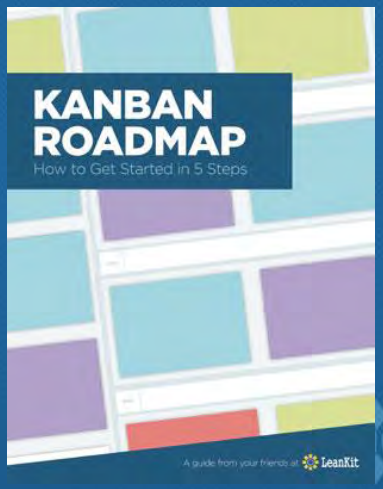












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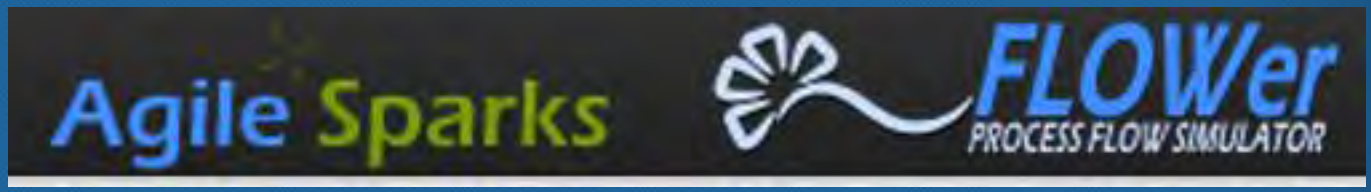
Games

- Agile Sparks Process Flow Simulator

  http://Flower.agilesparks.com



- GetKanban game, online edition from corporatekanban.com

  http://getkanban.corporatekanban.com

Software

- FocusedObjective.com
  - Monte-Carlo Simulations for Kanban and Scrum
- LeanKit! ☺
- www.tableausoftware.com
  - LeanKit's new reporting engine will be based on OEM-ing Tableau

LeanKit

Thank you!