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4 Key Flow Metrics and how to use them in Scrum's events

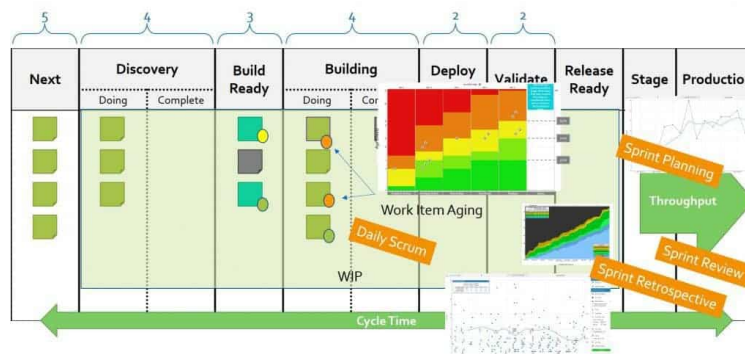


Yuval Yeret

May 10, 2018

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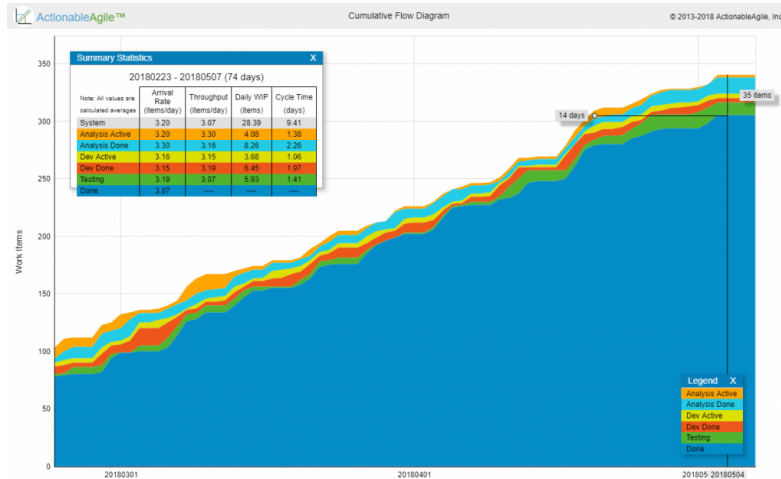
In the [Kanban Guide for Scrum Teams](#) and the [Professional Scrum with Kanban](#) workshop, we introduce 4 key flow metrics that we believe Scrum teams can use to improve their flow:

Work in Progress (WIP)

The number of work items started but not finished (according to the Scrum Team's definition of "Workflow").

Note the difference between WIP and the WIP Limit. The WIP Limit is a policy which the Scrum Team uses as a "constraint" to help them shape the flow of work. The goal of the WIP Limit is to reduce the amount of actual work in process (WIP). The team can use the WIP metric to provide transparency into their progress towards reducing their WIP and improving their flow.

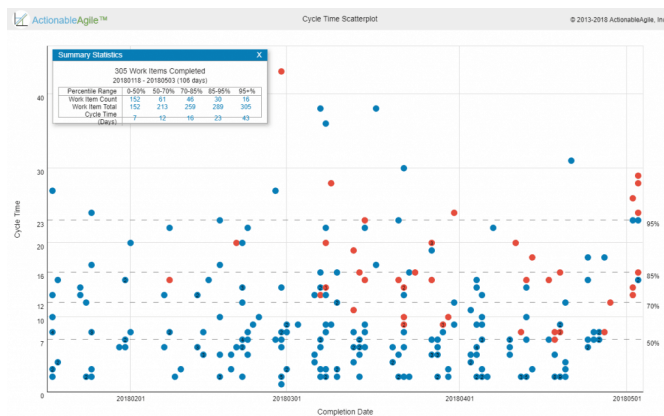
While teams can directly visualize the WIP levels over time (which I recommend), most people use the Cumulative Flow Diagram to visualize the WIP.



Cycle Time

The amount of elapsed time between when a work item "starts" and when a work item "finishes."

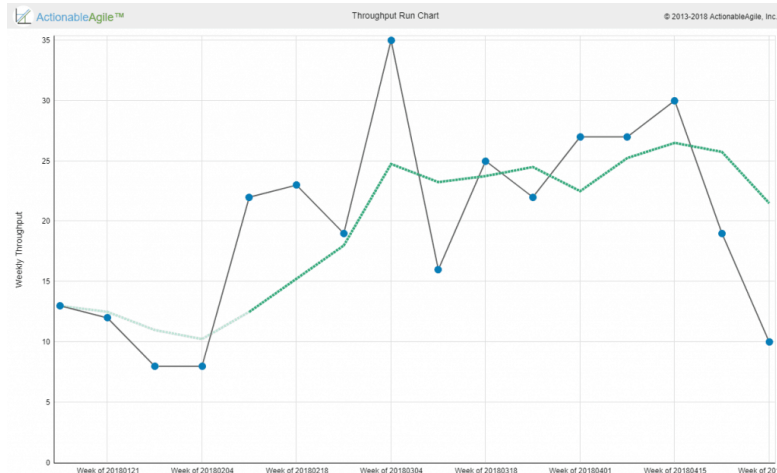
This metric is a lagging indicator of flow. It is available only after an item is actually finished from the workflow perspective (e.g. reached a Done lane on the Kanban board). It is typically used to drive improvement work as well as to be able to establish internal/external expectations as to the team's turnaround time on specific items. The main chart/report used to visualize and analyze Cycle Times is the Cycle Time Scatterplot where teams can understand their Cycle Time trends, distributions, look at anomalies.



Throughput

The number of work items "finished" per unit of time.

Note the measurement of throughput is the exact count of work items, without any compensation for item size - which is a major difference between throughput and story-points based velocity. Throughput is measured at a certain step in the workflow, typically at the finish line of the workflow. Throughput can be visualized via a separate run chart or by looking at the angle of curves on a Cumulative Flow Diagram.



Work Item Age

For currently active items - The amount of elapsed time between when a work item "started" and the current time.

WIP and Cycle Time are classic metrics every Kanban practitioner is probably familiar with and throughput is somewhat similar to Velocity.

Work Item Age is the new guy on the block. Work Item Age complements Cycle Time. If Cycle Time is a lagging indicator only relevant for finished items, Work Item Age is a leading indicator only relevant for non-finished items. The basic idea is to provide transparency to which items are flowing well and which are sort of "stuck" even if not formally blocked.

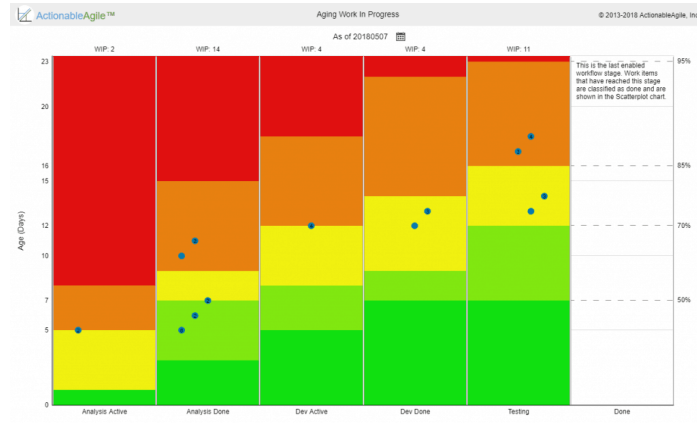
I've been using some variant of this metric with most Kanban teams I've worked with. I also worked with several Kanban tool vendors to introduce some way to visualize card/item age.

Age on its own is interesting but not enough. We also want some indication of flow health. One common thing to visualize is the age in the current step in the workflow also known as "cards that didn't move recently".

Another way to look at it would be to look at the overall age but combine it with where the work currently is in the workflow as well as what the team expects their cycle time to be (We call that expectation Service Level Expectation (SLE) in the Kanban guide for Scrum teams and the PSK class). Combining all this information can help the team focus on the items that are at the most risk of missing the team's expectations/SLE. For example, let's say a team has an SLE of 16 days with 85% confidence. If one of the cards on their board has an age of 10 days, is that ok? is it a problem? The answer is that it depends. If that card is very close to the end of the workflow it is probably not a problem. If it is very close to the start of the workflow it is probably an indication of a problem that requires attention. The "Aging Work in Progress" chart below provides this perspective of both where active items are in the workflow, what the typical cycle times for this team are, and based on that which items are indications of flow risks (obviously orange-red means very low probability of finishing within the team's flow expectations).

To sum up - Work Item Age is the best metric to look at if you want to determine when an item that has already started is going to finish. This is in contrast to an item that hasn't started - where your best bet is your historical Cycle Times. The Service Level Expectation is just an expectation set by the team to themselves answering the

question "What Cycle Time do we expect to see for an item of this type, and what is our confidence level for this?".



Note: The charts above were created using the demo version of [ActionableAgile Analytics](#) - a tool created by my co-steward of the Professional Scrum with Kanban class - Daniel Vacanti. You can access the demo yourself and play with these metrics and think about how they would help your Scrum team.

Using the Flow metrics in the Scrum events

So how can these flow metrics be used to improve the Scrum events? This is one of the key learning objectives in the [Professional Scrum with Kanban](#) class. In a follow up discussion with some of the Professional Scrum Trainers who attended last week's class, we came up with a matrix mapping the metrics to the events. (credit [Maarten Kossen](#))

Metric	Sprint Planning	Daily Scrum	Sprint Review	Sprint Retrospective
Cycle Time			Also	Key
Throughput	Key		Key	Key
WIP		Key	Also	Key
Work Item Aging	Also	Key		Also

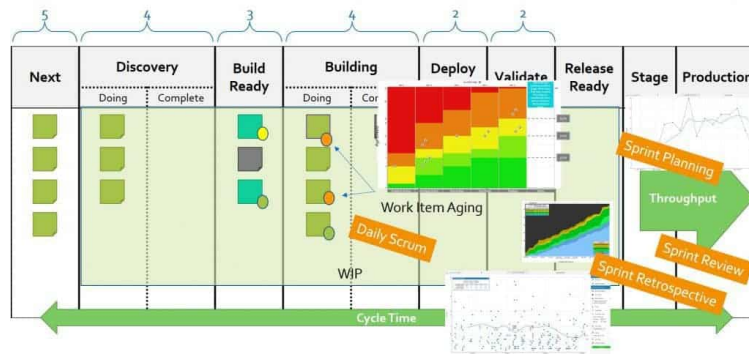
I'll explain -

Sprint Planning mainly leverages Throughput in order to create a realistic forecast for the Sprint Backlog. Work Item Age might be relevant when you have some items left over from the previous Sprint and you want to decide what to do about them.

The focus of **Daily Scrum** is the ongoing flow within the Sprint so naturally what we care about is what's currently going on. Therefore, Current WIP and Work Item Age are the most important metrics in the Daily Scrum.

Sprint Review includes a review with stakeholders of both the Increment as well as overall flow behavior of the team - trends in Cycle Times and Throughput are interesting. Throughput can also be used as part of release planning/road-mapping discussions, especially when combined with Monte-Carlo simulations provide some better visibility/confidence into "What can be done by when". NOTE: It is always important to emphasize that these are projections/forecasts, not commitments.

Sprint Retrospective is all about inspecting and adapting the process and the workflow. Therefore it is the place to look at WIP, Cycle Times, Throughput from a perspective of looking for areas to improve.



To learn more about flow metrics and how they can be used in a Scrum context, check out the [Professional Scrum with Kanban](#) curriculum.

This blog post was originally published on the [AgileSparks Blog](#).

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Katrina Latyshava • 3 months ago

So far the most helpful article amongst those recommended for PSK I . It was a quick read, although learnt something new, something that wasn't mentioned in D.Vacanti's book "Actionable Agile Metrics for Predictability". THANK YOU!

^ | • Reply • Share >



Kremenena • 10 months ago

Dear Yuval, thanks a lot for sharing the matrix mapping the metrics to the events, I find this very comfortable as this will help me to better organize what to show and focus in each event :) Kudos!

^ | • Reply • Share >



Patrick • 2 years ago

Yuval,

Thank you very much for the post and for all your fine work. It's very helpful as I prepare for the PSK-I.

My question relates to the Aging Work in Progress Chart, and what determines the height of the red/orange/yellow/green color bars.

Please correct me if I'm mistaken: I surmise the rationale for the height of the color bars is that the earlier in the Workflow state, and the longer a Work Item takes to move to the next state, the greater the chances of it missing the SLE.

Therefore, I get that the "Analysis Active" column has the tallest red bar (and any Work Item in that bar would be in "danger" of missing the SLE). Plus, each succeeding red bar is shorter because it means Work Items are closer to meeting the SLE.

Would you please tell me, though:

1. What is the *calculation* that helps determine the height of the red/orange/yellow/green color bars?
2. Can this calculation be performed easily, or does it require some kind of statistical analysis or tool other than a calculator? LOL.

Thanks in advance!

Patrick

^ | v • Reply • Share ›



TheGadgetGuy • 2 years ago

Does Kanban with Scrum have a time boxed Sprints?

^ | v • Reply • Share ›



Steve Loren • 3 years ago

Hi Yuval, This has been a great article and I found it at a time when we are just about to transition to Kanban with a large Scrum team.

In the article you share an image twice of the flow on the sample team with overlapping banners highlighting the Scrum Events and a few Flow Metrics. Is there any chance you could share that same image yet without the Event banners or Metrics? It would prove quite helpful for our purposes.

^ | v • Reply • Share ›



gazza8 • 4 years ago • edited

Thanks for this article, very useful to know other 'metrics' than the Burndown Chart.

However, regarding the 'Throughput', its description could be more explicit: I do not understand how to measure it.

^ | v • Reply • Share ›



Curtis Slough → gazza8 • 4 years ago

"Throughput: The number of work items "finished" per unit of time."

Say your team selects 13 items for a sprint and completes 10 of these selected items; the throughput is 10. Think about football and the different number of points for each way to score. Touchdown is 6 points, extra point kick is 1 point, safety is 2 points, 2-point conversion is 2 points, field goal is 3 points. The final score of your team for the game is 25. It may have taken your team 6 or 8 or 11 successful scoring attempts to makeup that 25 points within the game. Therefore the throughput for the game is the number of times your team scored in the game overall. Hope that helps.

2 ^ | v • Reply • Share ›



Steven Spruce → Curtis Slough • 4 years ago

Confusing analogy if you don't live in the USA :-)

1 ^ | v • Reply • Share ›



Curtis Slough → Steven Spruce • 4 years ago

Steven, you don't have to know American football to understand but I'll further simplify it and hope it helps. The basic point I was making is that you are awarded different points depending on the type of goal you score. Let's take and compare with Scrum. Within Scrum, you assign story points to each product backlog item. So for a sprint, the team plans for 15 stories worth of 45 points. At the end of the sprint, the team completes 12 stories with a total of 32 points. The Throughput for this sprint would be 12 because it's the number of stories/items that they completed. Since

Kanban does not estimate items via story points, the Throughput is used to gauge how much work was completed in a given time.

1 ^ | v • Reply • Share ›



Abhilash Pandey → Curtis Slough • 4 years ago

So here are my 4 sprints:
Sprint Story Points Throughput
S1 50 10
S2 45 15
S3 40 10
S4 35 5

What does the team learn from these numbers?

^ | v • Reply • Share ›



Kremena → Abhilash Pandey • 10 months ago

May be in S4 somebody was on vacation?

^ | v • Reply • Share ›



Curtis Slough → Abhilash Pandey • 4 years ago

Simple, they learned the number of stories that made up the story point totals. Throughput is not a planning metric so unless every story you do has the exact same story point estimation, it cannot be used for planning. It just answers the question of "how many stories made up the story point total".

^ | v • Reply • Share ›



Erez Morabia • 4 years ago

Thanks Yuval for the great post. The images you have attached are a great help for understanding. When it comes to cycle-time, it seems you emphasis that this is an after-fact metric and not a prediction. The prediction metric in that aspect is the SLE (where cycle-time-like prediction is inside it). Is that correct?

Interesting point it the relation between cycle-time, SLE and sprint length. Sprint length should define the desired upper limit for a cycle-time. Therefore, we would like our average cycle time to be less then the sprint length. SLE defines probability and period (16 days with 85% confidence) - the period should be shorter then the sprint length. Any guidelines on how shorter it should be? for example, should we look on the 95% confidence period and make it doesn't exceed the sprint length?

^ | v • Reply • Share ›



yuvalyeret → Erez Morabia • 4 years ago

Erez - thanks for the feedback. Yes cycle times are an after-the-fact metric that can be used to figure out a service level expectation (SLE) that is predictive / I wouldn't

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