The Kanban Game

Kanban, Pull and Organizational Change Management



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# Introducing the Game

The purpose of the game is to teach the mechanics of a pull system, the benefits of limited WIP and getting things done, the importance of managing queues correctly, the metrics that should be captured in a pull system, how to use those metrics to enact effective change, and how a team can effectively self-organize to accomplish the goals.

The intent of this game and the document(s) describing the game are not to say that there is one correct way to play the game. Rather, the setup, rules and processes described here-in are a set of guidelines based on what I have found to be effective in running this game.

# Setting up the Game

Before starting the game, there are a number of steps that should be taken to set up the persons involved in the game, the game play area, and the work item cards for the game.

## The Facilitator

The job of the facilitator is to keep the game going, help the participants see and understand the principles and practices of a Kanban system, and offer insight through questions and comments about the current state of the game in relation to the goals of the participants.

The facilitator should have a strong understanding of Kanban and Pull systems, the metrics being captured, and how those metrics should facilitate improvements in the system. The facilitator should also have some experience as a team coach and engaging team members in Socratic dialogue to enable learning.

## The Participants

To keep the game moving and prevent interest from waning, I recommend no more than 5 to 7 participants in addition to the facilitator. As the team grows in size, it takes more and more time to complete a round, which may cause interest to drop over time.

Prior to playing the game, the participants should have a least a cursory understanding of what a Kanban system is – how to visualize a process and identify queues, why limited WIP is important, and the basic mechanics of a pull system. This can be done just prior to the game being played, or can be done via other presentations and discussions at an earlier time.

### Organizing the Team

Once the participants for the game have been identified, they will need to set their initial team organization – how they plan to get work done and processed through the system. The team is free to organize themselves in any manner that they see fit. This may include organizing by function – certain people are attached to certain steps in the process, organizing by feature – certain people are attached to certain tickets until they are done, or any other method of team organization that they wish to use.

The team is allowed to reorganize themselves at any point that they wish. The facilitator should use the metrics that have been gathered and the leading indicators of the current WIP to begin dialogue and discussion around the current team organization. The goal is to facilitate any changes in the team that will improve the performance of the overall system.

## The Game Play Area

A very large whiteboard is the optimal playing area for the game. I recommend at least 8 to 10 feet wide and 3 to 4 feet tall. If you can get a larger area, you should. If no whiteboard of sufficient size is available, a large sheet of paper should suffice.

The game play area should be set up to represent a simple system that work will flow through, as a visual task board with queues and areas to notate the work in process limits. The steps in the process that will be drawn onto the game play area should include:

* **Ideation**: the area where work items first appear in the game. Represents some initial ideas about what the system may need to do. This is a queue of items that are ready to be worked through the system
* **Problem Definition**: the first ‘work’ step of the game. Represents anything from requirements gathering to analysis, and any other task that may be involved in understanding the problem to be solved. There should be a ‘Done’ queue attached to this step, to hold work that has been completed and is ready for the next step
* **Solution Definition**: the second ‘work’ step of the game. Represents the design and implementation of a solution to the problem, including UI design, software development, and any other tasks involved in creating a solution for the defined problems. There should be a ‘Done’ queue attached to this step, to hold work that has been completed and is ready for the next step
* **Demo and Delivery**: the final ‘work’ step of the game. Represents the process of demoing the working solution to the customer, obtaining any needed feedback, and making final delivery of the solution into the production environment
* **Delivered**: the ‘output’ of the game. All work items should eventually end up in this holding tank. Final metrics for work items will be calculated when work items reach this step.

I recommend that no more than three ‘work’ steps be included in the process, once again to facilitate the continued movement of the game and keep interest of the participants.

The Kanban board, when drawn on the game play area, should resemble the following:

### Setting WIP Limits

One of the core concepts of a Kanban system is recognizing the inherent capacity of a system and the team working in that system, to get work done. This capacity – the total Work In Process (WIP) – should be made explicit on the Kanban board. At the top right hand corner of each step in the process that requires work, there is a small blank square. This square should be used to note the current WIP limit for the given step.

After the team of participants has been formed and they have decided how they want to organize themselves initially, the team should be guided down the path of setting the initial WIP limits for each step in the process. Once the initial WIP limits are set, they should be noted on the board.

The team is free to change the WIP limits of any or all steps, at any point in time. The facilitator should look for opportunities to educate the team on how the current WIP limits may be helping or hindering the team. This should facilitate the team’s understanding of how to change the WIP limits and when.

The type of WIP limit mentioned here is only one of many possibilities. WIP can be limited by resources, for example. A single person may only be allowed to have 2 or 3 items in progress at any given time. It can get more complicated when resources and stages have WIP limits and the multi-dimensional limits have to be tracked correctly. Need to expand on this section and probably create some additional images to discuss the WIP limits by resources, or teams, or …

### Tracking Round and Roll Order

Beside the Kanban board, an area should be marked off to keep track of the round number and the order of dice rolls for the participants.

The dice roll order is arbitrary. It does not matter who goes first and who goes last and the order is not tied to the specific functions (steps in the process) or activities that a given person may participate in during the game.

Round # is used to calculate how long a work item has been in the system as a whole, as well as the individual steps. A round is started when the first person in the dice roll order is ready to roll the dice. A round ends when the last person in the dice roll order has rolled their dice and performed the appropriate actions.

### Tracking Overall Metrics

An area should also be marked off to track to the metrics for the game, including average lead time, average time in queues, process cycle efficiency, etc. The list of metrics that should be captured and why, will be detailed later in **Playing The Game**.

## The Work Item Cards

To simulate work in the system, work item cards should be created, using 5x7 index cards. These cards will contain information about how much work needs to be done for each step of the process, as well as metrics to show the performance of the team in each of the steps and for the system as a whole, concerning the individual work item.

### Tracking Progress of Work Items

The work item cards should contain a column for each of the steps in the overall system process. These columns will be used to track various metrics as the work item progresses through the steps of the system. Additionally, a column for tallying the final metrics for the card should be added to the cards.

### Tracking Round # for Each Step

When a work item card enters a given step, the current round number should be noted in the ‘Round #’ column. This will facilitate the Lead Time metric and allow the participants to see how long a work item card has been in a given step and in the system as a whole.

### Required # of Successful Rolls

For every card, in every step in the process, there is a place to note the required number of successful rolls. This is used to indicate how much work it will take to call a specific task for a specific work item ‘Done’. This number at each step represents an estimate of how much work it will take to complete the work item. Rather than having actual estimates done by the participating team members, though, the required number of successful rolls will be set up when the work item card enters the ‘Ideation’ queue.

### Successful Rolls

As the game progresses, dice rolls are used to determine what actions happen against a given work item. When a dice roll indicates a ‘Successful’ roll, a tick mark is added to the ‘Successful Rolls’ section of the work item card, for the correct step.

# Playing the Game

The basic process of the game is to play in rounds, rolling the dice and processing work item tickets through the various steps, to completion. There are a number of steps that should be taken to facilitate the simulation of a non-linear, variable system such as software development. Each of the steps in playing the game has been specifically designed to facilitate the metrics and the goals of the system, as well as the teams’ understanding of the system and how the team organization is affecting the flow of work.

## The Goals of the Team

The primary goal of the team is to complete the work items with the lowest possible lead time per work item. The team should focus on preventing bottlenecks from building up high WIP.

Additionally, the team should prevent resources from being starved for work as this causes unnecessary overhead on the team.

## The Rules of the Game

The basic rules of the game are fairly simple:

1. The team of participants decides how to organize to get work done and can reorganize at any given time, to facilitate getting work done more efficiently. Try to be ‘realistic’ about how the team is organized
2. The team of participants decides on the WIP limits of each step and can change the WIP limits at any time, provided they can state reasons for the change. Try to be reasonable about the WIP limits.
3. Don’t exceed the WIP limits of any given step

## Work Items and the ‘Ideation’ Queue

All work items start their progress through the system in the ‘Ideation’ queue.

### Adding Cards the ‘Ideation’ Queue

The facilitator should monitor the ‘Ideation’ queue to ensure that it does not run out of work item cards. At a minimum, this queue should contain at least one card at all times, to ensure that the ‘Problem Definition’ step is able to pull in work immediately, when capacity is available. It is recommended that the facilitator keep more than the minimum of one card in the queue, though.

### Setting the Required Number of Successful Rolls

Before a card is added to the ‘Ideation’ queue, the ‘Required # of Successful Rolls’ must be set for each step in the process. To ensure some variability in the system, a roll of the dice should be used to determine the required number of rolls for each step.

To facilitate the continuous flow of work items through the system, it is recommended that the maximum number of required successful rolls be set at 3. Given a six sided dice to determine the number of required rolls, the following table of values is recommended for translating from six possible values, into three values.

Dice Roll of **1 or 2 = 1** Required Successful Roll

Dice Roll of **3 or 4 = 2** Required Successful Rolls

Dice Roll of **5 or 6 = 3** Required Successful Rolls

The facilitator can choose to use a different formula, manually assign the number of required rolls, or any other process that they see fit. The facilitator may also wish to employ an assistant to maintain the ‘Ideation’ queue and the number of required rolls on each work item card.

## Playing the Game in Rounds

The game is played in rounds. The purpose of the rounds is to keep the game orderly and also to help generate the needed metrics. A round of the game is started when the first person on the Dice Roll Order is ready to roll the dice. A round of the game ends when the last person on the Dice Roll Order has rolled their dice and performed the necessary actions.

### The Round Begins

At the beginning of each round, mark the current round number in the Round # area. Go through the list of the Dice Roll Order one by one and have the people perform the following actions and any required subsequent actions.

### Decide What to Work on

The current participant will decide which work item to work on, if any are available and if they have the capacity to do the work. If there are multiple work items available for the person to work on, the person should decide which item they are going to work on before rolling the dice.

### Pulling In Work

If no work items are currently available for the person, they may pull in a work item from the previous step’s ‘Done’ queue (or the ‘Ideation’ queue if the person is working on the first ‘Problem Definition’ step).

If work is available for the person, and the current step in the process that they are intending to work is at its WIP limit, the person is not allowed to pull work into that step.

If no work is available for the person, after examining all options, they lose their turn.

### The Dice Rolls

If the person has work, the person then rolls the dice and performs the appropriate actions.

There are multiple possible outcomes for any given dice roll, including ‘successful’ rolls, ‘failure’ rolls, and ‘Draw A Card’ rolls. Each of these outcomes has specific actions that need to be taken.

The following is the list of possible rolls, based on standard 6 sided dice:

**1 – 4: Successful Role**. The work item that was chosen is marked with a ‘Successful’ tick. Success represents progress made toward the goal of completing the task for the current step. This may be in the form of documentation, working software, or other artifacts that are produced during the normal development cycle.

**5: It Happens**. The person doing the work draws a card and performs the actions stated on the card, including any potential benefits or detriment to the system and team. The ‘It Happens’ actions may or may not have an impact on the work item that was chosen.

**6: Failure Role**. The work item that was chosen is not updated with any tick marks and no additional action is taken. Failure represents blocking issues, questions and clarification, and other issues or interruptions and can occur during the normal development cycle.

### When ‘It Happens’

When a ‘5’ has been rolled for a given work item, a card should be drawn from the ‘It Happens’ pile. The specific actions on the card should be taken. This may include immediate action as well as deferred action for future rounds. In the case of deferred actions for future rounds, the participant that drew the card should hold on to the card until all of their required actions have been completed.

(For a complete list of the cards and to print them out, please see the ‘It Happens Cards’, document.)

### Completing a Step

When a work item card has obtained all of the required successful rolls for the current step, the work item is considered complete for that step. The card can then be pushed into the ‘Done’ queue that is attached to the step and is now available for a resource in the next step. If there is no ‘Done’ queue attached to the step in question (the ‘Demo & Delivery’ step), then the work item card is immediately moved into the next step (the ‘Delivered’ state).

### Completing a Work Item

Once a work item has completed all steps and it is sitting in the ‘Delivered’ state, the work item is considered complete and no additional work is required for that item. At this time, the facilitator or the participant that completed the work item, should tally up the final metrics for this work item card and note them on the card.

# Capturing and Using Metrics

As the game progresses, the individual work item cards will be updated with various metrics. When a work item is completed and the final metrics for that work item are tallied, the systemic metrics can then be updated and posted.

## Leading Indicators

The following metrics are considered leading indicators of the system’s performance. That is, they are able to be monitored and acted upon while work items are moving through the system. Leading indicators give us insight into the current state of the system and help us to predict the possible near-future states of the system. Leading indicators can be used to facilitate proactive measures to prevent issues from showing up in the system.

### Current WIP for a Given Step

The current WIP for any given step is the total number of cards in the step itself plus the step’s ‘Done’ queue if it has one. For example, if a step has two items that are currently in process and one item in the ‘Done’ queue, the current WIP for that step is 3.

The current WIP of any given step should be compared to the WIP limit of that step on a regular basis. If a step is at its WIP limit, the participants that are processing items in that step are not allowed to pull any additional work items into the step. This applies to work items that are currently being processed and work items that are done. Therefore, if a step has a WIP limit of 3, and the step’s ‘Done’ queue has a total of 3 cards in it the participants that are processing items in that step are not allowed to do any work in that step. A backup of WIP in a given step is typically an indicator of problems downstream. The following step should be examined to understand why it is currently unable to pull work items into that step, and appropriate action should be taken by the blocked team members, to help alleviate the downstream problem(s).

### Total WIP for All Steps

I believe it’s possible to calculate delays by paying attention to this metric. However, I’m still not sure it’s valuable for the purposes of this game. ??? not sure if this is useful… need to think about it some more.

### Current ‘Successful’ Ticks for a Work Item

Gives the players an indication of how much work is left to do for a given ticket. This may help to drive the decisions of which work items to handle next. For example, it may be easier to get 1 additional roll on a low priority ticket and keep the system flowing, than to get 3 additional rolls for a high priority ticket and potentially clog the system up.

## Trailing Indicators

The following metrics are considered trailing indicators of the system’s performance. That is, they are calculated after work items have been processed through the system. Trailing indicators do not give us any insight into the future state of the system. Rather, they report on the past state of the system. Therefore, trailing indicators may be of less value than leading indicators, but they are nonetheless valuable. Trailing indicators can be used to facilitate reactive measures to help improve the system’s overall performance.

### Average Lead Time

The lead time for any given work item is the total number of rounds that it took for the work item to be processed through the system. Lead Time can be calculated as the ‘Completed Round #’ of the work item ticket, subtracting the ‘Round #’ of the ‘Problem Definition’ step (when the card entered the system). For example, if the ‘Completed Round #’ is 23 and the ‘Round #’ of the ‘Problem Definition’ step is 3, then the total Lead Time for that work item was 20 rounds.

### Average Queue Time

The average amount of time that a work item spends in queues vs. being worked on. ??? not sure if this is useful or if we should track it.

### Average Cycle Time

??? not sure if this is useful or if we should track it.

### Process Cycle Efficiency

??? not sure if this is useful or if we should track it.

# Variations to Toss In

After the game has stabilized and the participants are getting the hang of the basics, there are a number of additional variations that can be thrown in to the system to more accurately represent the real word. Each of these variations will have their own impact on the system’s performance and should cause a different set of behaviors to emerge in the team.

## High Variance Work Item Size

Toss in some work items that require up to 6 successful rolls. Continue the goal of lowest possible lead time per work item. Possibly introduce the idea of production leveling and task breakdown after the team sees the effect of high variance in work item size. Need to expand on this section.

## Larger Value-Stream

When production leveling is introduced via the high variance items, it may be necessary to introduce a new stage to the game, prior to ‘Ideation’ – or to split ‘Ideation’ out into multiple stages. The purpose of this would be to facilitate the ‘design of work’ in order to take highly variant work item sizes and break them down into more manageable chunks. It may be necessary to involve additional participants at this time to handle the work break down. You may also wish to have existing team members participate in the work break down. This needs to be prototyped and run a few times to figure out some guidelines.

The process of breaking down large work items into smaller work items will likely involve dice rolls during the rounds. An initial dice roll may determine how many work items are broken out of the original. For example, if the dice roll is a 1 or 2, the work item may be split down into 2 separate items. If the dice roll is a 3 or 4, the work item may be split down into 3 work items. If the dice roll is a 5 or 6, the work item may be split down into 4 work items. Each of these work items would then travel through the rest of the process as usual. This needs to be prototyped and run a few times to figure out some guidelines.

## Multi-Tiered Flow Tracking Board

In the process of breaking down work items, it may be of interest to create a multi-tiered kanban system to show the flow of larger ‘features’ vs. smaller ‘work items’. As a work item is slated for breakdown, the original item could be placed in a separate kanban board for ‘features’ where the steps may be ‘Design’, ‘In Progress’, and ‘Done’. The work item cards in this board would move into ‘Design’ step during the work break down. When the work breakdown is complete and the first work item from the breakdown starts processing through the regular system, the feature work item card would be pushed into the ‘In Progress’ step. When all work items that were broken down from the original are completed through the standard process, the feature work item card would be pushed into the ‘Done’ list of features. This may help to show how the features and work items can be tracked in relation to each other, and help to visualize where the larger value of features are, and how they flow through the system vs. the individual work items. This needs to be prototyped and run a few times to figure out some guidelines.

## Variable Value Work Items

Mark the work items that are entering the system with a range of values: High, Medium and Low. Change the goals of the team to account for the value-size of the work items. Consider adding a “time” variable where each round reduces the total value of the tickets in the queue, and require all work items to be finished with the highest possible value. The higher value tickets may need to have a faster expiration of value, as higher value may represent higher risk or time-sensitive value. Need to expand on this section.

## Start with a Team’s Existing Process

Rather than starting with the pre-defined stages as outlined above, start with the steps in an existing team’s process, including how they organize their team around the work to be done. Don’t put any WIP limits in place or enforce pull. Let the team push work through the system for a while and collect the metrics. Begin posting the metrics by the work items and the steps and hopefully facilitate the conversations on how to reduce the lead time for the work items. If no conversation is engaged by the team around this, you may want to begin asking questions and pointing things out, to get the conversation started.

After the discussions on how to improve lead time are started, talk about limiting WIP and start from there. Then when the team starts to see that they can’t work items because of WIP limits, talk about reorganizing the way the team works to handle bottlenecks and facilitate flow, etc. This needs to be prototyped and run a few times to figure out some guidelines.

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