Kanban, Flow and Cadence

Karl Scotland
KFC Development

**Kanban**
- Controlled Work

**Flow**
- Effective Work

**Cadence**
- Reliable Work
Kanban

Controlling the Workflow
Kanban (in kanji 看板 also in katakana カンバン, where kan, 看 カン, means "visual," and ban, 板 バン, means "card" or "board")
“The two pillars of the Toyota production system are just-in-time and automation with a human touch, or autonomination. The tool used to operate the system is kanban.”

Taiichi Ohno, Toyota Production System (adopted 1962)
Heijunka Box (Visual Scheduling)

http://www.flickr.com/photos/jnywong/2222481466/
Kanban Pull

Work Items

<table>
<thead>
<tr>
<th>Stage 1</th>
<th>Stage 2</th>
<th>...</th>
<th>Stage n</th>
<th>Done</th>
</tr>
</thead>
<tbody>
<tr>
<td>Queue</td>
<td>In Process</td>
<td>Queue</td>
<td>In Process</td>
<td>Queue</td>
</tr>
</tbody>
</table>

© Copyright 2009 EMC Corporation. All rights reserved.
That’s it

Except for one more important element

Kanban Limits

– Queue
– WIP
Kanban Pull – With Limits
Work In Progress

- Improve Productivity
- Reduce Inventory
- Enhance Teamwork
Little’s Law

Little’s Law for Queuing Theory

\[
\text{Total Cycle Time} = \frac{\text{Number of Things in Process}}{\text{Average Completion Rate}}
\]

Therefore, to improve cycle time

1. Reduce Number of Things in Process
2. Improve Average Completion Rate
20% time lost to context switching per ‘task’

Gerald Weinberg, Quality Software Management: Systems Thinking
Sequential yields results sooner
Exercise

3 Projects
- Write the 1st 10 digits in a column
- Write the 1st 10 letters in a column
- Write the 1st 10 roman numerals in a column

Sequential (non multi-tasking)
- Column by column

Parallel (multi-tasking)
- Row by row
Inventory

Throughput Accounting

Unit of Inventory = Idea
Value of Inventory = Investment to Create the Idea
Investment = Value_{Input}
Value_{Output} = Sales Price - Direct Costs
Value Added = Value_{Output} - Value_{Input}
Throughput = Value_{Output}

\[
\text{Net Profit} = \text{Throughput} - \text{Operating Expense}
\]

\[
\text{Return on Investment} = \frac{\text{Net Profit}}{\text{Investment}}
\]

David Anderson, Agile Management for Software Engineering
Teamwork

Enhances Teamwork
– Team focus on goals that add value not individual tasks

Encourages Swarming
Guidelines

What are you going to work on?

1. Work directly on an existing kanban to progress it
2. Collaborate with team members on an existing kanban to remove a bottleneck or constraint
3. Begin working on a new kanban if a slot is available
4. Find some other useful work
Being Blocked

Lower priority work…
- Spikes
- Analysis

Other interesting work…
- Refactoring
- Tool Automation
- Personal Development
- Innovation

But NOT
- Anything which will create work downstream
WIP Limit Sizes

- Depends on type of work and size of team
- Should be adjusted to achieve maximum flow
Queue limits help to keep the flow smooth by:

- Keeping the team busy
- Avoiding premature prioritisation
### Example

#### Work Items

<table>
<thead>
<tr>
<th>UED</th>
<th>Build</th>
<th>Test</th>
<th>Release</th>
<th>Done</th>
</tr>
</thead>
<tbody>
<tr>
<td>Queue:</td>
<td>WIP:</td>
<td>Queue:</td>
<td>WIP:</td>
<td>Queue:</td>
</tr>
<tr>
<td>Fill Me!</td>
<td>Fill Me!</td>
<td>Fill Me!</td>
<td>Fill Me!</td>
<td>Fill Me!</td>
</tr>
<tr>
<td>Fill Me!</td>
<td>Fill Me!</td>
<td>Fill Me!</td>
<td>Fill Me!</td>
<td>Fill Me!</td>
</tr>
<tr>
<td>Fill Me!</td>
<td>Fill Me!</td>
<td>Fill Me!</td>
<td>Fill Me!</td>
<td>Fill Me!</td>
</tr>
<tr>
<td>Fill Me!</td>
<td>Fill Me!</td>
<td>Fill Me!</td>
<td>Fill Me!</td>
<td>Fill Me!</td>
</tr>
<tr>
<td>Fill Me!</td>
<td>Fill Me!</td>
<td>Fill Me!</td>
<td>Fill Me!</td>
<td>Fill Me!</td>
</tr>
</tbody>
</table>

**Remember!**

It’s the whole team’s responsibility to progress work items.
Why Kanban?

If you spend time managing large, complex backlogs, they could be eliminated.

If you find the ceremony of time-boxing interrupts your work they could be eliminated.

If estimation is not helping planning, it could be eliminated.
Flow

The Work in the System
“In lean enterprises, traditional organizational structures give way to new team-oriented organizations which are centred on the flow of value, not on functional expertise.”

http://www.poppendieck.com/papers/LeanThinking.pdf
One Piece Flow

Moving one piece at a time between stages in a workflow

as opposed to

Moving batches of work between stages in a workflow
“A minimal marketable feature is a chunk of functionality that delivers a subset of the customer’s requirements, and that is capable of returning value to the customer when released as an independent entity”

M Denne & H Cleland-Huang, Software by Numbers
Minimal

As small as possible

– Progressive delivery (realise product sooner)
– Reduce feature bloat (the core features are the most important)
– A feature has a cost to a user (added complexity)
I will be able to write an entry in our product blog about this new feature
Kano Model

- **Excitement**
  - Need well fulfilled
  - Dissatisfied
  - Indifference

- **Performance**
  - Need not fulfilled
  - Satisfied
  - Indifference
Kano Revisited

Table Stakes
- Parity to the competition
- Minimum needed to be in the game

Differentiator
- Differentiates from the competition
- Delights the customer

Spoiler
- A competitor's differentiator
- Raises the bar for parity

Cost Reducer
- Reduces cost
- Improves the margin
Distinct, Deliverable, Observable

Fits the INVEST acronym

- Independent
- Negotiable
- Valuable
- Estimable
- Sized Appropriately
- Testable
Large Batch
Smaller Batches
Agile

Analysis
Design
Build
Test
Release
Continuous Flow
The Backlog Iceberg

- **Story** – a description of desired functionality told from the perspective of a user or customer
- **Minimal Marketable Feature** – the smallest valuable set of Stories in a Theme
- **Theme** – a collection of smaller related Stories
- **Epic** – a large Story
The Backlog Map

- Goal: business or user objective
- Activity: user centred pursuit
- Task: element of performing an activity
- Tool: solution detail
## Two Tier Kanban - 1

<table>
<thead>
<tr>
<th>Queue (4)</th>
<th>Development (3)</th>
<th>Done</th>
</tr>
</thead>
<tbody>
<tr>
<td>MMF</td>
<td>MMF</td>
<td>MMF</td>
</tr>
<tr>
<td>MMF</td>
<td>MMF</td>
<td>MMF</td>
</tr>
<tr>
<td>MMF</td>
<td>MMF</td>
<td>MMF</td>
</tr>
<tr>
<td>MMF</td>
<td>MMF</td>
<td>MMF</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Proposed</th>
<th>In Progress (5)</th>
<th>Done</th>
</tr>
</thead>
<tbody>
<tr>
<td>User Story</td>
<td>User Story</td>
<td>User Story</td>
</tr>
<tr>
<td>User Story</td>
<td>User Story</td>
<td>User Story</td>
</tr>
<tr>
<td>User Story</td>
<td>User Story</td>
<td>User Story</td>
</tr>
<tr>
<td>User Story</td>
<td>User Story</td>
<td>User Story</td>
</tr>
<tr>
<td>User Story</td>
<td>User Story</td>
<td>User Story</td>
</tr>
</tbody>
</table>
## Two Tier Kanban - 2

<table>
<thead>
<tr>
<th>Queue (4)</th>
<th>MMF (3)</th>
<th>Proposed</th>
<th>WIP (5)</th>
<th>Done</th>
<th>Done</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="MMF" /></td>
<td><img src="image" alt="User Story" /></td>
<td><img src="image" alt="User Story" /></td>
<td><img src="image" alt="User Story" /></td>
<td><img src="image" alt="User Story" /></td>
<td><img src="image" alt="MMF" /></td>
</tr>
<tr>
<td><img src="image" alt="MMF" /></td>
<td><img src="image" alt="User Story" /></td>
<td><img src="image" alt="User Story" /></td>
<td><img src="image" alt="User Story" /></td>
<td><img src="image" alt="User Story" /></td>
<td><img src="image" alt="MMF" /></td>
</tr>
<tr>
<td><img src="image" alt="MMF" /></td>
<td><img src="image" alt="User Story" /></td>
<td><img src="image" alt="User Story" /></td>
<td><img src="image" alt="User Story" /></td>
<td><img src="image" alt="User Story" /></td>
<td><img src="image" alt="MMF" /></td>
</tr>
</tbody>
</table>

**Legend:**
- **MMF**
- **User Story**
Why Flow?

If you struggle to break down functionality into time-box sized increments, then you could just focus on larger MMFs.

If you deliver frequent User Stories, but struggle to deliver business value, then you could focus on delivering larger MMFs.
Cadence

Commitment and Reliability
“If the team isn’t estimating or planning with fixed time-boxes, how can it make reliable commitments?”

Anonymous(es)
“A regular cadence, or ‘heartbeat,’ establishes the capability of a team to reliably deliver working software at a dependable velocity. An organization that delivers at a regular cadence has established its process capability and can easily measure its capacity.”

http://www.poppendieck.com/pipeline.htm
@marick Iteration-based agile is like a metronome where we seek feedback at every tick, Kanban is like a drummer who feels the rhythm

06:59 PM November 28, 2008 from Syrinx in reply to marick

andypalmer
Andy Palmer
De-coupling

- Input (Planning/Prioritisation)
- Output (Release)
- Review
  1. Stop the Line for special cause problems
  2. Monthly Retrospectives with Operations Reviews for common cause problems
  3. Quarterly Value Stream Mapping to re-assess the whole value stream
- Operational
• Throughput - the amount of output of a process in a given period of time
• Cycle Time - the length of time to complete a process

Throughput = WIP / Cycle Time

Throughput allows forecasting of future capability
Cycle Time allows appropriate prioritisation
Commitment

Cycle Time becomes an SLA with the business

- "When we agree to take on a work request, we intend to deliver it within n days"


May need to size and/or classify MMFs where there is variation

Due Date Performance (DDP) is the percentage of MMFs delivered with the SLA
Reliability

- Forecast quarterly goals and objectives
- Prioritise MMFs to meet those goals and objectives
- Release regularly
- Build trust that the team is working to its full capacity
Cumulative Flow Diagram

Inventory

Cycle Time

WIP

Queue
Analysis
Design
Code
Test
Release
Done

© Copyright 2009 EMC Corporation. All rights reserved.
Throughput Chart

Throughput

- Throughput
- 4 Wk. Mov. Avg.

© Copyright 2009 EMC Corporation. All rights reserved.
Cycle Time Chart

Cycle Time

Weeks

Cycle Time

1 2 3 4 5 6 7 8 9 10 11 12 13
If you find the time-box ceremonies too restricting, or unproductive, then they can be decoupled to allow a more natural rhythm.

If your estimation and planning is not accurate or reliable, then it can be replaced with measurements to forecast capability.
Simulation - Push

Setup
- The system includes a cup of Raw Material tokens, several workers in a row, and a cup for Finished Goods.
- Each worker has a fair die.
- Place 6 tokens between each worker

Game
- Worker 1 removes tokens from the cup according to the number of dots rolled on the die. The tokens are moved to a point between Worker 1 and Worker 2. Worker 2 rolls the die and moves tokens from between Worker 1 and Worker 2 to between Worker 2 and Worker 3. Then number processed is the maximum of the number rolled and the number of tokens available (WIP) at that location

Process
- Play the game for ten days. Each worker will roll the die once each day.
- Record the final amount of Finished Goods and Work in Process
Simulation - Kanban

Setup
• The system includes a cup of Raw Material tokens, several workers in a row, and a cup for Finished Goods.
• Each worker has a fair die.
• Place 6 tokens between each worker

Game
• On day 1, the last worker moves the tokens into the finished goods cup according to the roll of the dice. The next to last worker rolls and tries to replenish the WIP before the last worker to its Kanban level of 6.
• Sometimes the next to the last worker will be short and will have to make up the shortage on future days. Sometimes the next to the last worker will roll a high number and could exceed the Kanban level. Don’t allow the Kanban level (WIP between two workers) to go above 6 tokens.

Process
• Play the game for ten days. Each worker will roll the die once each day.
• Record the final amount of Finished Goods and Work in Process
Simulation - Discussion

How did the two processes compare?
- Finished Goods?
- Work in Process?
- Throughput?

Any other observations?
Flow

Mihalyi Czikszentmihalyi, *Flow: The Psychology of Optimal Experience*

![Diagram showing the flow zone between skills and ability. The diagram includes labels for anxiety, time-boxing, and Kanban.](image-url)
Kanban & Agile

Kanban is an alternative, not a replacement

However, rather than focusing on being Agile which may (and should) lead to being successful, Kanban focuses on becoming successful, which may lead to being Agile.

Therefore, Kanban can sit on top of any existing process
Thank You

karl.scotland@emc.com
http://availagility.wordpress.com
http://groups.yahoo.com/group/kanbandev/