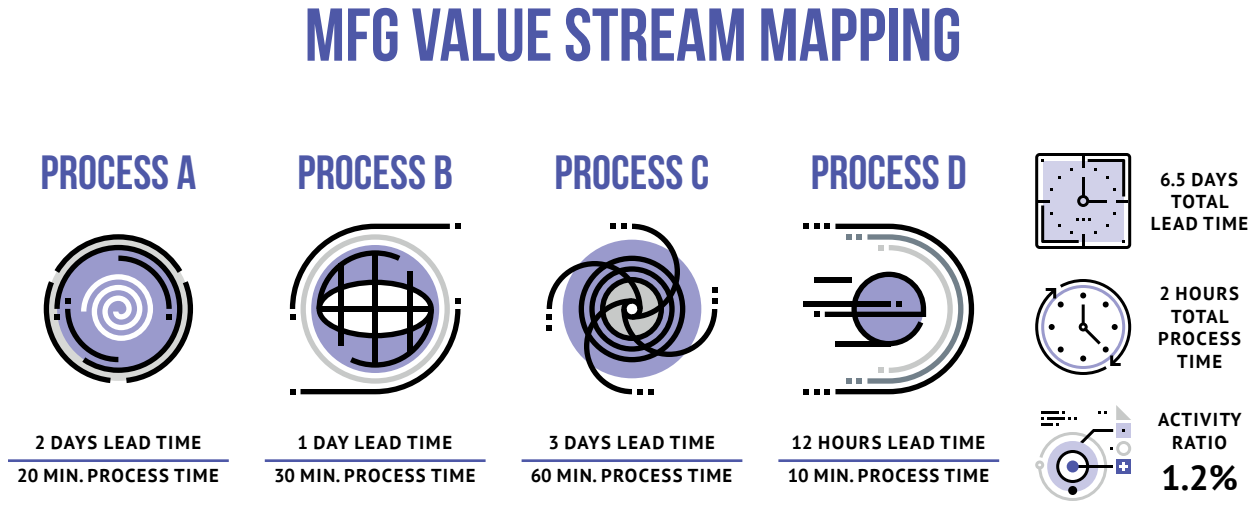
COMMON MISTAKES IN APPLYING VALUE STREAMING MAPPING TO SOFTWARE

A WHITEPAPER BY GARY GRUVER

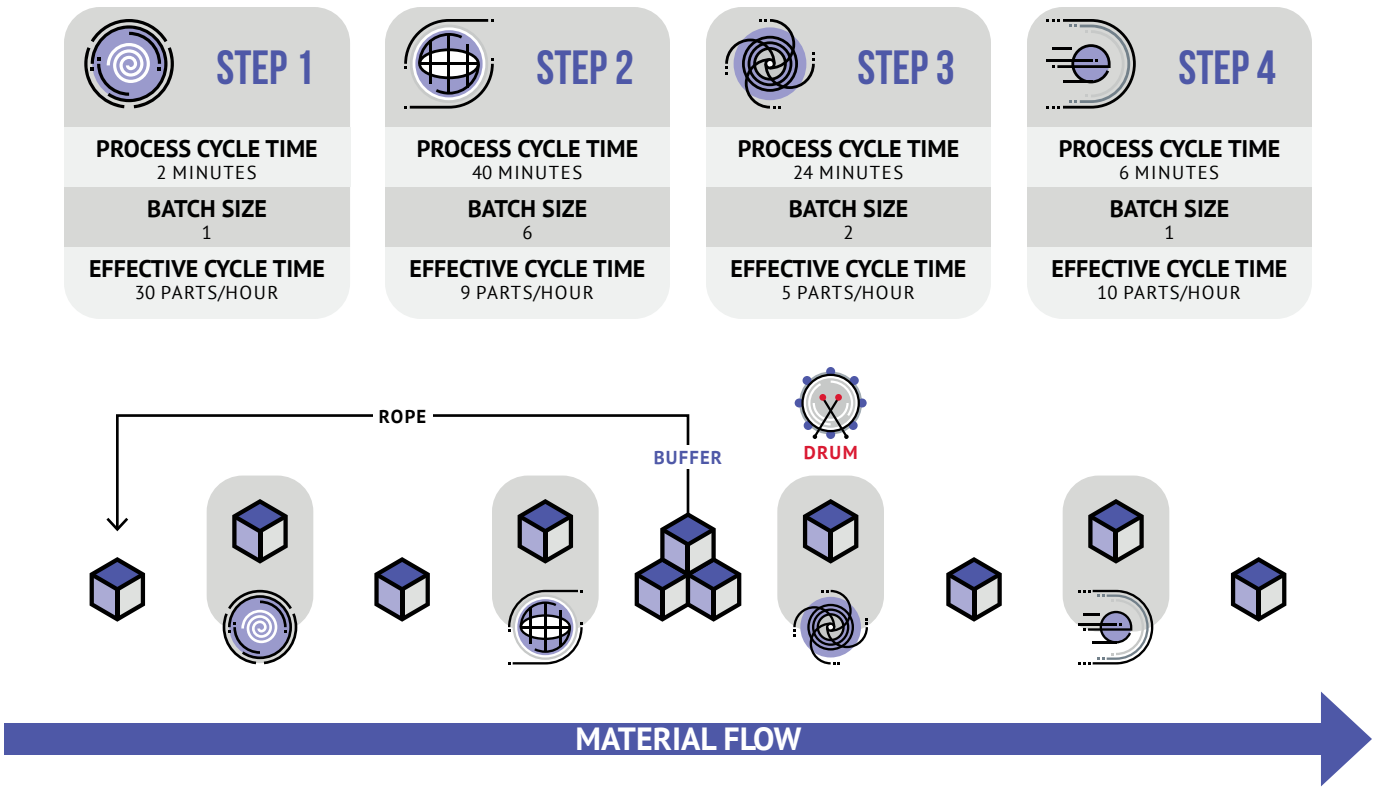
VALUE STREAM MAPPING is starting to be used more and more in software organizations as a tool for identifying opportunities for improvement. It is an approach used to make waste and inefficiencies visible that started in manufacturing and has since been used for a variety of applications including software. Recently as I have been consulting with different organizations, I have had the opportunity to see lots of different maps they have created that I think highlight common mistakes. Or, more accurately stated, how when applying the classic approach of Value Stream Mapping to software it frequently doesn't do a very good job of highlighting the biggest sources of waste that are slowing down organizations or what to do about it. My goal in writing this white paper is to make these issues visible so that everyone can be more efficient in identifying opportunities for improvement and transforming their software development and delivery processes.

Value Stream Mapping is a tool that was developed in manufacturing to identify opportunities for improvement. It starts by mapping all the process steps required to create a product or value for the customer. Once you have each process step identified then you need to collect a couple of metrics for each step. The first is the lead-time or the total time the part spends in that process. The second is process time or how much time is required to add value in that step. For the total value stream you can then calculate the activity ratio which is total process time / total lead time to identify the magnitude of the opportunities for improvement as shown in the graphic below.

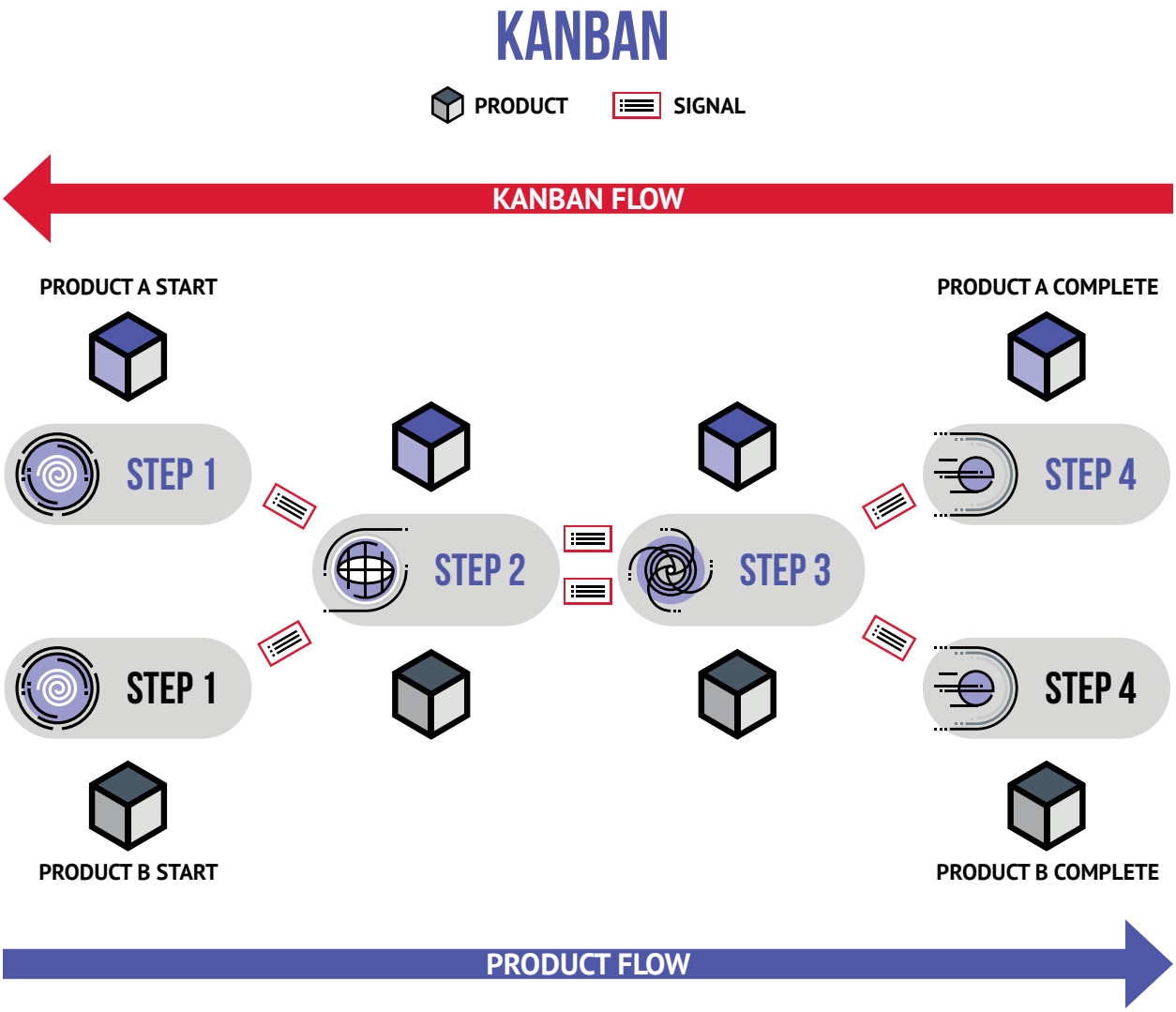


For manufacturing processes, this approach tends to highlight the waste associated with having too much inventory or work in process. For manufacturing this waste was addressed by controlling how work was release into the process to limit inventory. Henry Ford did this for high volume manufacturing of one product by creating a completely linked assembly line with limited room for excess inventory. Goldratt used "Theory of Constraints" and "Drum buffer rope." Toyota used Kanban.

Goldratt starts by finding the constraint or bottleneck in the process by looking at the cycle-time and batch size of each step to find the effective cycle-time and bottleneck for the process. He would create a small buffer in front of the bottleneck to ensure it was never starved for work. Then, he linked the release of work at the front of the process with a rope tied to the bottleneck and used the effective cycle-time of the bottleneck as the drum or rate for releasing work into the process as shown below limit excess inventory.

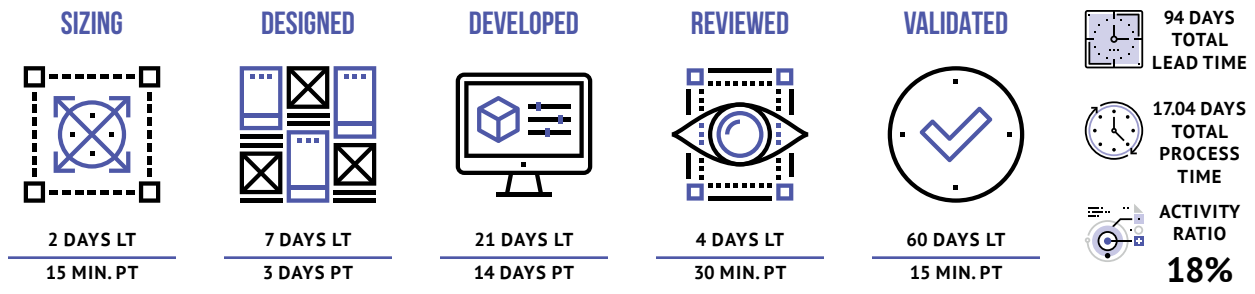


Taiichi Ohno further refined this process to ensure there were not short-term bottlenecks building up between different process steps with Kanban. He would limit the inventory between each process step with a tub or a card that would signal to the upstream process that until it got an empty tub or card back from the downstream process it shouldn't create any more products as shown below. Using this Kanban approach for managing flow he could ensure excess inventory and wait times were not building up in the system while ensuring the bottleneck was not starved for work.



Value Stream Mapping has also been used extensively for business process re-engineering. A typical example would be re-engineering an insurance claim process. In this case you would map out all the steps and people required to process the insurance claim documenting process and lead time as shown below. This type of analysis tends to show waste associated with handoffs between different people as the biggest sources of waste as opposed to excess inventory. The improvement then typically required eliminating handoffs and moving to having one person manage the end to end process dramatically reducing wait time and get to a much higher activity ratio.

The approach I frequently see now when organizations Value Stream Map their software processes is that they map a new request from idea to delivery. This is fairly straight forward to track a requirement in tools through all the different states and document how long it takes to move from one state to then next until it is released to the customer as documented below.



This type of analysis frequently shows there is a fair amount of wait time and opportunities for improvement. The challenge I have with it is that it doesn't do a very good job pointing out everything that needs to be fixed like it does for manufacturing or business processes re-engineering. It could be too much work in process like in manufacturing that is causing the wait time between sizing, designed, and developed and we need to address how we release work into the system to avoid building up too much inventory. It could be the handoffs between developed and reviewed that needs to be addressed especially if the work environment is ticket driven. The classic approach to value stream mapping is very good at pointing out issues with these things and opportunities for improvement where the requirements are processed one at a time.

The difficulty I see with this approach is that it doesn't do a very good job of highlighting the waste associated in the value stream from when the requirement is complete and reviewed to when it is released to the customer for validation. This release process is frequently the biggest source of issues for most large companies and the classical approach of tracking requirements from request to delivery or validation doesn't do a very good job of highlighting the waste and inefficiencies in that process.

For the release process we need to move from tracking individual requirements to mapping how a group of requirements come together into a release because that is how the process works for most organizations. This release process takes all the requirements that are ready, batches them up, and runs them through the deployment pipeline for a release which is very different than business processes or manufacturing that handles one item or batch of items at a time. We don't have to worry about inventory building up in front of this process because the batch size can grow as large as required even though large batches might not be very efficient. Also the inefficiencies in the release process aren't typically slowed down by hand-offs between different groups.

The types of things that slow down a release and create waste and inefficiencies are different. It might be an organization's Software Development Lifecycle that states until a certain milestone like "Development Complete" is reached requirements are not moved to the next stage in the deployment pipeline. It might be that organizations have to spend extended time and energy in hardening phases to inspect in quality because they have not shifted to building in quality. It might be waste associated with manually creating environments, deploying code, or testing that need to be automated to improve the efficiency of the release process. The problem I see when reviewing software Value Stream Mapping from organizations using the classical approach is that these types of issues are not identified.

We can use classic Value Stream Mapping for the steps in the process that have a fixed batch size as shown below but for the deployment pipeline used for the release process, we need a different approach to identify the challenges that are unique to these batch processes. It can't be just tracking one requirement to see how long it takes because that duration is defined by the release process. It needs to be an approach designed for making that batch process and the issues slowing it down visible.

OPTIMIZING SOFTWARE BOTTLENECKS

The next challenge in applying Value Stream Mapping to software is what approaches should we use for reducing lead-time and improving the activity ratio. Manufacturing focused on reducing work-in-process by managing how work was released into the process. Business process re-engineering focused on reducing hand-offs and wait times. The approach that makes sense for software really depends on the bottleneck in the process. If the bottleneck for the organization is in the requirements process, it makes sense to focus on wait times and hand-offs. If the bottleneck for the organization is development or release, the most effective way to improve the activity ratio of the requirements part of the value chain is to change how work is released into the process.

Most organizations I see that do classic Value Stream Mapping for their software development and delivery processes highlight the requirements processes as their longest lead-times with the lowest activity ratios due to hand-offs and process delays. This leads them to believe that if they re-engineered these processes, they will improve throughput and productivity. This though overlooks what Goldratt taught us which is any improvement outside the bottleneck won't improve throughput of the organization. If the bottleneck for the organization is development or the release, then improving flow through the requirements process is just going to build a bigger pile of work-in-process sitting in front of the real bottleneck.

If the bottleneck in the process is with requirements and the developers are just sitting around waiting for work, then re-engineering the requirements process will clearly improve the overall flow. If, on the other hand, the bottleneck like most organizations is with developers or the release process, then this re-engineering will just create a lot of work and not improve the overall flow. Instead, organizations should leverage the manufacturing approach of limiting the work-in-process by changing how they release work into the process and changing how they define when the value stream starts. Does the value stream start when someone dreams up an idea they can do with software? Or, does it start when the bottleneck finishes the last batch of work and is ready to pull in the next highest prioritized set of requirements?

The problem with starting the value stream metric when someone dreams up an idea for software is that it is so much easier to come up with ideas than it is to deliver them, so that most organizations have more ideas than they can ever deliver. Additionally, a lot of those ideas aren't good enough to be prioritized and shouldn't be delivered, so that any work going into defining them ends up as waste. In these cases, we should release requirements into the process based on the pull from the bottleneck and measure the value stream's start based on when this work is started. This gives us visibility of the process going from an idea we decide to do to a requirement ready to develop, that the organization has the capacity to deliver. This enables us to focus on the bottleneck to improve flow, avoid building up too much work in process, and have a value stream metric that doesn't drive the wrong behavior.

SOFTWARE DEVELOPMENT PROCESS

IDEATION	DEVELOPMENT	DEPLOYMENT PIPELINE	TRIAGE
PROCESS CYCLE TIME DEPENDS ON INVESTMENT	**PROCESS CYCLE TIME** VARIABLE FOR EACH REQ.	**PROCESS CYCLE TIME** FIXED ONCE AUTOMATED	**PROCESS CYCLE TIME** DEPENDS ON BATCH SIZE
BATCH SIZE 1	**BATCH SIZE** 1	**BATCH SIZE** → ∞	**BATCH SIZE** → 1
EFFECTIVE CYCLE TIME DEPENDS ON INVESTMENT	**EFFECTIVE CYCLE TIME** VARIABLE FOR EACH REQ.	**EFFECTIVE CYCLE TIME** → 0	**EFFECTIVE CYCLE TIME** AS SHORT AS POSSIBLE

CONCLUSION

The approach of using Value Stream Mapping for software to make the process visible and better understand cycle-times is important. It just needs to adjust a bit to work well for software just like any other technique we leverage from physical assets. Tracking requirements through fixed batch size processes like definition and development can use the classical approach. Variable batch size processes like testing and release though will need a different approach to highlight the issues that are slowing it down. These steps will help make the process visible so organizations can align on how work is flowing through the organization and where it is slowing down. The next step is understanding how best to improve that flow. This requires overlaying Goldratt's Theory of Constraint on the value stream map to see which parts of the process we should focus on how we release work to limit work in process and where we need to optimize flow.

The goal of **"Engineering the Digital Transformation"** is to teach people methods and approaches like this that help make their processes visible so they can align on improvements that will help their organizations the most. It is not designed to tell you what to do based on what worked for someone else with different issues. Instead, it teaches people how to make unique issues visible so they can align on a continuous improvement journey and pick improvements they believe will help their business the most. I took everything I had learned from identifying waste in large organizations to provide a framework that goes beyond classical Value Stream Mapping, and provides a systematic approach for analyzing a broad range of applications based on software. After using this approach for several years, my experience is that it highlights issues that just don't show up in the software Value Stream Maps I am seeing in the industry. Call them common mistakes or just the need to think differently about how to identify opportunities for improvement in the software development and delivery process.

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For over a decade, one of the most effective tools I have used to engage with clients has been the *Value Stream Mapping* assessment. I have done 100s of Value Stream Mapping assessments over this time, working with organizations across the maturity and size spectrum. From startups struggling to survive, to traditional mid-size companies fighting off upstarts, to global enterprises looking to become innovative, technology driven organizations. Value Stream Mapping, if done right and with the right stakeholders, always exposed the maturity or lack thereof of the organization. In this paper Gary Gruver, author of *Engineering the Digital Transformation* shares the common mistakes and challenges he has seen when applying Value Stream Mapping techniques to software delivery. Gary is one of the few people I know who truly gets enterprise scale transformation of software delivery. He has led them on both sides of the table — as a leader within the enterprise, and as a consultant and coach to the transformation leader in the enterprise. His experiences with Value Stream Mapping are right here for all readers to learn from and apply.

—Sanjeev Sharma
Principal Analyst, accelerated strategies

Gary Gruver is the CEO of Gruver Consulting, an acclaimed author, and in-demand speaker. Gary brings a proven track record of transforming software development and delivery processes in large organizations.

For more information, click here.