**Lean Method**

Introduce the Topic

* GOAL: goal of this methodology is to develop software in 1/3 of time, with very limited budget, and very less amount of required work flow
* Lean development originated from lean manufacturing and Toyota production in Japan
  + Also known as the “just-in-time” manufacturing
  + Lean manufacturing is a process management philosophy that transformed the car manufacturer’s approach to building vehicles.
  + Expand here?
* Lean Software Development: An Agile Toolkit
  + 2003 book by Mary Poppendieck and Tom Poppendieck
  + Presents the lean principles and compares then to traditional agile tools
* What is it? (http://www.allaboutagile.com/7-key-principles-of-lean-software-development-2/)
  + Principles
    - 1. Eliminate Waste
      * 3 general forms of waste identified by the Toyota Production System
        + Muda – meaing unproductive
        + Mura – unevenness, inconsistency
        + Muri – over burden, unreasonableness
      * 7 types of waste

1. Over production
2. Unnecessary transportation
3. Inventory
4. Motion
5. Defects
6. Over processing
7. Waiting
   * + - Everything that does not add value to the customer is waste
         * Mary and Tom Poppendieck related this as:

Unnecessary code or functionality

Starting more than can be completed

Delay in the software development process

Unclear or constantly changing requirements

Bureaucracy

Slow or ineffective communication

Partially done work

Defects and quality issues

Task switching

Avoidable process repetition (often caused by insufficient testing)

* + - * The iterative process of constantly learning found in agile is key for constantly removing waste.
      * Making improvements “little but often” creates a culture that is constantly improving and an overall learning environment.
      * In order to eliminate waste, one should be able to recognize it
        + If some activity could be bypassed or the result could be achieved without it, it is waste
        + Partially done coding eventually abandoned during the development process is waste
        + Extra processes and features not often used by customers are waste
        + Waiting for other activities, teams, processes is waste
        + Defects and lower quality are waste
        + Managerial overhead not producing real value is waste
      * A value stream mapping technique is used to identify waste
      * Second step is to point out sources of waste and eliminate them
      * Waste removal should take place iteratively until even seemingly essential processes and procedures are liquidated
    - 2. Amplify Learning
      * This is the best approach for improving a software development environment
      * Accumulation of defects should be prevented by running tests as soon as the code is written
      * Instead of adding more documentation or detailed planning, different ideas could be tried by writing code and building
      * Process of user requirements gathering could be simplified by presenting screens to the end users and getting their input
      * Learning process is sped up by usage of short iteration cycles – each one coupled with refactoring and integration testing
      * Increasing feedback via short feedback session with customers helps with determining the current phase of development and adjusting efforts for future improvements
      * During these short sessions both customer representatives and the development team learn more about the domain problem and figure out possible solutions for further development
        + Thus, the customer better understand their needs, based on the existing result of development efforts, and the developers lean how to better satisfy those needs
      * Another idea in communication and learning process with a customer is set-based development
        + Concentrates on communicating the constraints of the future solution and not the possible solutions

This promotes the birth of the solution via dialogue with the customer

* + - 3. Decide as late as possible
      * Better results should be achieved with an options based approach, delaying decisions as much as possible until they can be made based on facts and not on uncertain assumptions and predictions
      * The more complex a system is, the more capacity for change should be built into it
        + Enable the delay of important and crucial commitments
      * Iterative approach promotes this principle
        + The ability to adapt to changes and correct mistakes, which might be very costly if discovered after the release of the system
      * Agile software development approach can move the building of options earlier for customers
        + Delay certain crucial decisions until customers have realized their needs better
        + Also allows later adaptation to changes and the prevention of costly earlier technology bounded decisions
      * This does not mean no planning should be involved
        + Planning activities should be concentrated on the different options and adapting to the current situation as well as clarifying confusing situations by establishing patterns for rapid action
      * Evaluating different options is effective as soon as it is realized that they are not free, but provide the needed flexibility for late decision making
    - 4. Deliver as fast as possible
      * The sooner the end product is delivered without major defects, the sooner feedback can be received, and incorporated into the next iteration
      * The shorter the iterations, the better the learning and communication within the team
      * With speed, decisions can be delayed
        + Speed assures the fulfilling of the customer’s present needs and not what they required yesterday
        + Gives them the opportunity to delay making up their minds about what they really require until they gain better knowledge
      * Customers value rapid delivery of a quality product
    - 5. Empower the team
      * Managers are taught how to listen to the developers, so they can explain better what actions might be taken, as well as provide suggestions for improvements
      * Favors the aphorism “find good people and let them do their own job”, encourage progress, catching errors, and removing impediments, but not micro-managing
      * People need motivation and a higher purpose to work for
      * Developers should be given access to the customer
      * Team leader should provide support and help in difficult situations as well as ensure that skepticism does not ruin the team’s spirit
    - 6. Build quality in
      * Pair Programming
        + Seeks to avoid quality issues by applying the minds of two developers to each task
      * Benefits from the collective, combined experience of two developers instead of one
        + Often resulting in better productivity as they see solutions that on their own they might not have done
      * Improved quality, since one person can be thinking slightly ahead of the other, catching issues before they occur.
      * Test Driven Development
        + Writing tests before writing code
        + Stubbing out the code and writing automated unit tests for each of the test conditions before actually writing the code. The developer then writes the code to pass the tests.
        + Prevent quality issues from happening
      * Constant Feedback
        + By doing development in small incremental steps, through close collaboration, and by developing in small iterations
        + These agile methods provide the opportunity for constant 2-way feedback between the Product Owner and the team.
        + This feedback can valuable to ensure the right level of quality the right product.
      * Minimize time between Stages
        + Building quality into the development process is to minimize the time between development, testing and bug fixing
        + Don’t log bugs – deal with them immediately
      * Frequent Iterations
        + Continuous integration, with code integrated into the overall system, built and automatically unit tested as soon as it is checked in
        + Minimizing this gap also reduces integration waste

Regular builds and frequent iterations avoid lengthy iterations and regression testing phases.

* + - * Automation
        + Agile development methods also encourage automated regression testing.

Not just a Lean Principle but it’s a crucial aspect

* + - 7. Optimize the whole
      * Mary and Tom Poppendieck give 2 examples of the software engineering tendency to sub-optimize:
        + Vicious circle number 1

A customer wants some new features ‘yesterday’.

Developers hear: get it done fast, at all costs!

Result: sloppy changes are made to the code.

Complexity of the code base increases.

Number of defects in the code increases.

* + - * + Vicious circle number 2

Testing is overloaded with work.

Result: testing occurs a long time after the code is originally written, or testing is reduced.

Developers don’t get immediate feedback, or some things are not properly tested.

There are more defects in the code.

Testers have more work.

Feedback to developers and quality improvements are delayed further.

* + - * Lean seeks to optimize the whole value stream, not just individual functions or teams
      * The best way to organize teams is so they are complete, multi-disciplined, co-located product teams that have all the roles and skills they need to deliver a request from start to finish, without reference to other teams.
      * Putting all of this together with the better optimized workflow, the benefits or organizing in this way can be extremely significant – not only in terms of the team’s performance, but also in terms of the quality of the product, which ultimately can make your organization more competitive.
* Term lean software development originated in a book by the same name, written by Mary Poppendieck and Tom Poppendieck
  + Book presents the traditional lean principles in a modified form as well as a set of 22 tools and compares the tools to agile practices
* Lean development originated from lean manufacturing and the Toyota Production System in Japan
* History
  + Lean is a manufacturing & production practice that considers the expenditure of resources for any goal other than the creation of value for the end customer to be wasteful, and thus a target for elimination
  + “value” is defined as any action or process that a customer would be willing to pay for
  + lean is centered around preserving value with less work
  + lean manufacturing is based on optimizing flow, increasing efficiency, decreasing waste, and using empirical methods to decide what matters rather than uncritically accepting pre-existing ideas
  + Toyota was a leader in implementing lean practices in the 80s
* Eliminate Waste
  + Tool 1: Learn to see waste
  + Tool 2: Learn to reduce waste
    - Reduce management activities
    - Minimize tracking by creating a smooth flowing work system
  + Rethink Authorization systems
  + Retrain your brain to see waste – “Why am I really doing this”
  + Map your value stream to identify inefficiencies
  + Solution:

1. Make a list of 10-15 most important activities and rate them from a scale of 1-5 (1 being the customer doesn’t really care, 5 being they value this highly)
2. Take lowest 2 scoring (the waste) and plan to cut the time on these activities in half
3. At team meeting, discuss the 7 principles of Lean and ask the following questions about the waste

* Do you agree this is “waste” why or why not
* Estimate how much time to consumes each week
* What can or should be done to reduce that time
* Amplify Learning
  + Realization of purpose of use rather than conforming to requirement
  + Not intended to produce repeatable results, but to create solutions to unique customer problems
  + Design is done best using discovery solutions – short, repeated cycles of investigation, experimentation and checking results
  + Knowledge generation (or feedback) loops are critical
  + Tool 3: Feedback
    - Introduce and increase feedback loops into the development process
    - Run test as soon as code is written
    - Less documentation, and more coding with real time feedback
    - Take the top 3 and evaluate them
    - Encourage and accept immediate customer response to your work
  + Tool 4: Iterations
    - Short useful cycles of software development: Design > Programmed > Tested > Integrated > Delivered
    - Allow feedback to increase, thusly increasing control
    - Allow the ability to “decide as late as possible”
  + Tool 5: Synchronization
    - Requires a configuration management system
    - Requires a daily build and smoke test
    - Requires automated testing
    - Requires a high level of communication
  + Tool 6: Set Based Development
    - Is about communicating constraints, not choices or solutions
    - Develop multiple options, communicate constraints, and let solutions emerge
* Decide as Late as Possible
  + Tool 7: Options Thinking
    - Customer needs aren’t always clear or understood
    - Can’t predict the future, so maintain flexibility, until uncertainly is removed
    - Options are like trade offs, they aren’t free and have a cost
  + Tool 8: The Last Responsible Moment
    - The moment at which failing to make a decision eliminates an important alternative
    - This isn’t Procrastination
  + Tool 9: Making Decisions
    - Solution:
      * Make list of decisions that need to be made
      * Group into 2 categories – Tough and Easy to make
      * Discuss what you would need to make the tough decisions easier
* Deliver as Fast as Possible
  + Customers like rapid delivery
  + Rapid delivery means less time for customers to change their minds
  + In process, or partially done work can have undiscovered defects
  + Faster you deliver the longer you can delay decisions
  + Tool 10: Pull Systems
    - Allows people to figure out for themselves what needs to be done
    - Work becomes self directing
    - A Just in Time approach allows for decision about work to be made real time, not in advance
  + Tool 11: Queuing Theory
    - Key is to reduce cycle time, or the time it takes to get from one end of the process to the other
  + Managing Slack
    - Practice the 80/20 rule for work load
    - The larger the batch of work, the slower it will be completed, and the more utilization it will take
  + Tool 12: Cost of Delay
    - Rapid Development will save you time and money
    - Determine what delayed delivery will cost you by using a profit and loss statement
* Empowering the Team
  + Tool 13: Self-Determination
    - Let the team design their own working procedures
    - Management’s role is coach, train, and assist the teams
    - Managers need to improve as much as individual workers
  + Tool 14: Motivation
    - Create a sense of purpose at work
    - Must be clear and achievable
    - Team must have access to customers
    - Management’s role is to provide support, resources, guidance, and protection
  + Tool 15: Leadership

|  |  |
| --- | --- |
| Managers | Leaders |
| Cope with Complexity | Cope with Change |
| Plan and Budget | Set Direction |
| Organize and Staff | Align People |
| Track and Control | Enable Motivation |

* + Tool 16: Expertise
    - Promote Mentorship and Pair Programming activities
    - Encourage training and continued self improvement
    - Develop software standards and practice them
* Build Integrity Within
  + Tool 17: Perceived Integrity
    - Short iteration should be used
    - Feedback should be acquired from a wide range of people that can recognize the integrity
    - Complex systems should be represented using models and languages the customer understands
    - Large systems should have a master developer
  + Tool 18: Conceptual Integrity
    - Remove complexity upfront in the design
  + Tool 19: Refactoring
    - Architecture must remain healthy as the system matures and evolves
  + Tool 20: Testing
    - Communicates how thing “should” work
* See the Whole
  + Tool 21: Measurements
  + Tool 22: Contracts

Present details about it (including code and non code based examples)

* Advantages
  + Elimination of waste leads to the overall efficiency of the development process
    - This speeds up the process of software development which reduced project time and cost
    - Deliver more projects in the same timeframe
  + Deliver the product early
    - Development team can deliver more functionality in a shorter period of time, hence enabling more projects to be delivered
    - Will please finance department and end customers
  + Creates a more motivated team
    - Developers can determine how best to develop the functionality which will usually result in a much better end product
  + Helps companies maintain and increase their profits and earning
    - Help them generate a little more savings as the costs are lower
  + If adopted correctly, it will help companies reduce the requirement for physical floor space by about 5% – 30%
  + Creates a more pleasant work environment
    - Manufacturing cultures become standardized and unwanted behaviors of employees and management are for the most part gone
* Disadvantages
  + Project is highly dependent on cohesiveness of the team and the individual commitments of the team members
  + Success in the project depends on how disciplined the team members are and how exceptional are their technical skills
    - Have a problem if the team of individuals don’t have good skills
  + Project sponsors and clients need to know what they want and make decisions they will stick to
    - Decisions have to be made promptly when required and stuck to
  + Role of a business analyst is vital to ensure the business requirements documentation is understood properly
  + Flexibility is great, but too much of it will quickly lead to a development which loses sight of it’s original objectives and which never finishes
  + Must have leaders within the company that can direct teams
  + Training for lean manufacturing is a constant ongoing process
    - First starting out can take a lot of time and effort on everyone’s part
* Don’t use this method if you are dealing with project management stakeholders who are unable to make fast decisions and stick to them or else are managing a project team who are less than stellar

Provide Pointers to additional material on the topic for interested readers

Example of Lean Method

Why should software developers care about this topic?

Other information

* Why Lean and Agile Go Together
  + Agile methods are focused on creating a rapid feedback loop between the users supplying the requirements and the technologists transforming them into a solution
  + Agile also suggest a variety of engineering practices that increase the quality and stability of code
  + Agile has much less to say about how to connect the work of many different teams, and that’s where Lean has a huge impact
  + In a Lean manufacturing system, the work is broken into a set of value streams triggered by demand signals
    - The output of one value stream leads to others
  + Large organizations that are using Agile are applying a value stream approach
  + Lean concept of Kaizen strongly influence the way Agile is being practiced, filling a gap relating to continuous improvement
  + Evolution of Agile is primarily focused on evolving the product toward a better fit with requirements
  + Rally says that its customers get to market 50% faster and are 25% more productive when they employ a hybrid of Lean and Agile development methods

References

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