User Stories Applied

for Agile Software Development

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Chapter 2

Writing Stories

In this chapter we turn our attention to writing the stories. To create good stories we focus on six attributes. A good story is:

- Independent
- Negotiable
- Valuable to users or customers
- Estimatable
- Small
- Testable

Bill Wake, author of *Extreme Programming Explored* and *Refactoring Workbook*, has suggested the acronym INVEST for these six attributes (Wake 2003a).

Independent

As much as possible, care should be taken to avoid introducing dependencies between stories. Dependencies between stories lead to prioritization and planning problems. For example, suppose the customer has selected as high priority a story that is dependent on a story that is low priority. Dependencies between stories can also make estimation much harder than it needs to be. For example, suppose we are working on the BigMoneyJobs website and need to write stories for how companies can pay for the job openings they post to our site. We could write these stories:

1. A company can pay for a job posting with a Visa card.
2. A company can pay for a job posting with a MasterCard.

3. A company can pay for a job posting with an American Express card.

Suppose the developers estimate that it will take three days to support the first credit card type (regardless of which it is) and then one day each for the second and third. With highly dependent stories such as these you don't know what estimate to give each story—which story should be given the three day estimate?

When presented with this type of dependency, there are two ways around it:

- Combine the dependent stories into one larger but independent story
- Find a different way of splitting the stories

Combining the stories about the different credit card types into a single large story ("A company can pay for a job posting with a credit card") works well in this case because the combined story is only five days long. If the combined story is much longer than that, a better approach is usually to find a different dimension along which to split the stories. If the estimates for these stories had been longer, then an alternative split would be:

1. A customer can pay with one type of credit card.
2. A customer can pay with two additional types of credit cards.

If you don't want to combine the stories and can't find a good way to split them, you can always take the simple approach of putting two estimates on the card: one estimate if the story is done before the other story, a lower estimate if it is done after.

Negotiable

Stories are negotiable. They are not written contracts or requirements that the software must implement. Story cards are short descriptions of functionality, the details of which are to be negotiated in a conversation between the customer and the development team. Because story cards are reminders to have a conversation rather than fully detailed requirements themselves, they do not need to include all relevant details. However, if at the time the story is written some important details are known, they should be included as annotations to the story card, as shown in Story Card 2.1. The challenge comes in learning to include just enough detail.

Story Card 2.1 works well because it provides the right amount of information to the developer and customer who will talk about the story. When a devel-

A company can pay for a job posting with a credit card.

Note: Accept Visa, MasterCard, and American Express. Consider Discover.

Story Card 2.1 A story card with notes providing additional detail.

oper starts to code this story, she will be reminded that a decision has already been made to accept the three main cards and she can ask the customer if a decision has been made about accepting Discover cards. The notes on the card help a developer and the customer to resume a conversation where it left off previously. Ideally, the conversation can be resumed this easily regardless of whether it is the same developer and customer who resume the conversation. Use this as a guideline when adding detail to stories.

On the other hand, consider a story that is annotated with too many notes, as shown in Story Card 2.2. This story has too much detail ("Collect the expiration month and date of the card") and also combines what should probably be a separate story ("The system can store a card number for future use").

A company can pay for a job posting with a credit card.
Note: Accept Visa, MasterCard, and American Express. Consider Discover. On purchases over $100, ask for card ID number from back of card. The system can tell what type of card it is from the first two digits of the card number. The system can store a card number for future use. Collect the expiration month and date of the card.

Story Card 2.2 A story card with too much detail.

Working with stories like Story Card 2.2 is very difficult. Most readers of this type of story will mistakenly associate the extra detail with extra precision. However, in many cases specifying details too soon just creates more work. For example, if two developers discuss and estimate a story that says simply "a company can pay for a job posting with a credit card" they will not forget that their discussion is somewhat abstract. There are too many missing details for

them to mistakenly view their discussion as definitive or their estimate as accurate. However, when as much detail is added as in Story Card 2.2, discussions about the story are much more likely to feel concrete and real. This can lead to the mistaken belief that the story cards reflect all the details and that there's no further need to discuss the story with the customer.

If we think about the story card as a reminder for the developer and customer to have a conversation, then it is useful to think of the story card as containing:

- a phrase or two that act as reminders to hold the conversation
- notes about issues to be resolved during the conversation

Details that have already been determined through conversations become tests. Tests can be noted on the back of the story card if using note cards or in whatever electronic system is being used. Story Card 2.3 and Story Card 2.4 show how the excess detail of Story Card 2.2 can be turned into tests, leaving just notes for the conversation as part of the front of the story card. In this way, the front of a story card contains the story and notes about open questions while the back of the card contains details about the story in the form of tests that will prove whether or not it works as expected.

> A company can pay for a job posting with a credit card.
>
> Note: Will we accept Discover cards?
> Note for UI: Don't have a field for card type (it can be derived from first two digits on the card).

Story Card 2.3 The revised front of a story card with only the story and questions to be discussed.

Valuable to Purchasers or Users

It is tempting to say something along the lines of "Each story must be valued by the users." But that would be wrong. Many projects include stories that are not valued by users. Keeping in mind the distinction between *user* (someone who uses the software) and *purchaser* (someone who purchases the software), suppose a development team is building software that will be deployed across a

Test with Visa, MasterCard and American Express (pass).
Test with Diner's Club (fail).
Test with good, bad and missing card ID numbers.
Test with expired cards.
Test with over $100 and under $100.

Story Card 2.4 Details that imply test cases are separated from the story itself. Here they are shown on the back of the story card.

large user base, perhaps 5,000 computers in a single company. The purchaser of a product like that may be very concerned that each of the 5,000 computers is using the same configuration for the software. This may lead to a story like "All configuration information is read from a central location." Users don't care where configuration information is stored but purchasers might.

Similarly, stories like the following might be valued by purchasers contemplating buying the product but would not be valued by actual users:

- Throughout the development process, the development team will produce documentation suitable for an ISO 9001 audit.
- The development team will produce the software in accordance with CMM Level 3.

What you want to avoid are stories that are only valued by developers. For example, avoid stories like these:

- All connections to the database are through a connection pool.
- All error handling and logging is done through a set of common classes.

As written, these stories are focused on the technology and the advantages to the programmers. It is very possible that the ideas behind these stories are good ones but they should instead be written so that the benefits to the customers or the user are apparent. This will allow the customer to intelligently prioritize these stories into the development schedule. Better variations of these stories could be the following:

- Up to fifty users should be able to use the application with a five-user database license.
- All errors are presented to the user and logged in a consistent manner.

In exactly the same way it is worth attempting to keep user interface assumptions out of stories, it is also worth keeping technology assumptions out of stories. For example, the revised stories above have removed the implicit use of a connection pool and a set of error handling classes.

The best way to ensure that each story is valuable to the customer or users is to have the customer write the stories. Customers are often uncomfortable with this initially—probably because developers have trained them to think of everything they write as something that can be held against them later. ("Well, the requirements document didn't say that…") Most customers begin writing stories themselves once they become comfortable with the concept that story cards are reminders to talk later rather than formal commitments or descriptions of specific functionality.

Estimatable

It is important for developers to be able to estimate (or at least take a guess at) the size of a story or the amount of time it will take to turn a story into working code. There are three common reasons why a story may not be estimatable:

1. Developers lack domain knowledge.
2. Developers lack technical knowledge.
3. The story is too big.

First, the developers may lack domain knowledge. If the developers do not understand a story as it is written, they should discuss it with the customer who wrote the story. Again, it's not necessary to understand all the details about a story, but the developers need to have a general understanding of the story.

Second, a story may not be estimatable because the developers do not understand the technology involved. For example, on one Java project we were asked to provide a CORBA interface into the system. No one on the team had done that so there was no way to estimate the task. The solution in this case is to send one or more developers on what Extreme Programming calls a *spike*, which is a brief experiment to learn about an area of the application. During the spike the developers learn just enough that they can estimate the task. The spike itself is always given a defined maximum amount of time (called a *timebox*), which allows us to estimate the spike. In this way an unestimatable story turns into two stories: a quick spike to gather information and then a story to do the real work.

Finally, the developers may not be able to estimate a story if it is too big. For example, for the BigMoneyJobs website, the story "A Job Seeker can find a job" is too large. In order to estimate it the developers will need to disaggregate it into smaller, constituent stories.

A Lack of Domain Knowledge

As an example of needing more domain knowledge, we were building a website for long-term medical care of chronic conditions. The customer (a highly qualified nurse) wrote a story saying "New users are given a diabetic screening." The developers weren't sure what that meant and it could have run the gamut from a simple web questionnaire to actually sending something to new users for an at-home physical screening, as was done for the company's product for asthma patients. The developers got together with the customer and found out that she was thinking of a simple web form with a handful of questions.

Even though they are too big to estimate reliably, it is sometimes useful to write epics such as "A Job Seeker can find a job" because they serve as placeholders or reminders about big parts of a system that need to be discussed. If you are making a conscious decision to temporarily gloss over large parts of a system, then consider writing an epic or two that cover those parts. The epic can be assigned a large, pulled–from–thin–air estimate.

Small

Like Goldilocks in search of a comfortable bed, some stories can be too big, some can be too small, and some can be just right. Story size does matter because if stories are too large or too small you cannot use them in planning. Epics are difficult to work with because they frequently contain multiple stories. For example, in a travel reservation system, "A user can plan a vacation" is an epic. Planning a vacation is important functionality for a travel reservation system but there are many tasks involved in doing so. The epic should be split into smaller stories. The ultimate determination of whether a story is appropriately sized is based on the team, its capabilities, and the technologies in use.

Splitting Stories

Epics typically fall into one of two categories:

- The compound story
- The complex story

A compound story is an epic that comprises multiple shorter stories. For example, the BigMoneyJobs system may include the story "A user can post her resume." During the initial planning of the system this story may be appropriate. But when the developers talk to the customer, they find out that "post her resume" actually means:

- that a resume can include education, prior jobs, salary history, publications, presentations, community service, and an objective
- that users can mark resumes as inactive
- that users can have multiple resumes
- that users can edit resumes
- that users can delete resumes

Depending on how long these will take to develop, each could become its own unique story. However, that may just take an epic and go too far in the opposite direction, turning it into a series of stories that are too small. For example, depending on the technologies in use and the size and skill of the team, stories like these will generally be too small:

- A Job Seeker can enter a date for each community service entry on a resume.
- A Job Seeker can edit the date for each community service entry on a resume.
- A Job Seeker can enter a date range for each prior job on a resume.
- A Job Seeker can edit the date range for each prior job on a resume.

Generally, a better solution is to group the smaller stories as follows:

- A user can create resumes, which include education, prior jobs, salary history, publications, presentations, community service, and an objective.
- A user can edit a resume.
- A user can delete a resume.

- A user can have multiple resumes.
- A user can activate and inactivate resumes.

There are normally many ways to disaggregate a compound story. The preceding disaggregation is along the lines of create, edit, and delete, which is commonly used. This works well if the create story is small enough that it can be left as one story. An alternative is to disaggregate along the boundaries of the data. To do this, think of each component of a resume as being added and edited individually. This leads to a completely different disaggregation:

- A user can add and edit education information.
- A user can add and edit job history information.
- A user can add and edit salary history information.
- A user can add and edit publications.
- A user can add and edit presentations.
- A user can add and edit community service.
- A user can add and edit an objective.

And so on.

Unlike the compound story, the complex story is a user story that is inherently large and cannot easily be disaggregated into a set of constituent stories. If a story is complex because of uncertainty associated with it, you may want to split the story into two stories: one investigative and one developing the new feature. For example, suppose the developers are given the story "A company can pay for a job posting with a credit card" but none of the developers has ever done credit card processing before. They may choose to split the stories like this:

- Investigate credit card processing over the web.
- A user can pay with a credit card.

In this case the first story will send one or more developers on a spike. When complex stories are split in this way, always define a timebox around the investigative story, or spike. Even if the story cannot be estimated with any reasonable accuracy, it is still possible to define the maximum amount of time that will be spent learning.

Complex stories are also common when developing new or extending known algorithms. One team in a biotech company had a story to add novel extensions

to a standard statistical approach called expectation maximization. The complex story was rewritten as two stories: the first to research and determine the feasibility of extending expectation maximization; the second to add that functionality to the product. In situations like this one it is difficult to estimate how long the research story will take.

Consider Putting the Spike in a Different Iteration

When possible, it works well to put the investigative story in one iteration and the other stories in one or more subsequent iterations. Normally, only the investigative story can be estimated. Including the other, non-estimatable stories in the same iteration with the investigative story means there will be a higher than normal level of uncertainty about how much can be accomplished in that iteration.

The key benefit of breaking out a story that cannot be estimated is that it allows the customer to prioritize the research separately from the new functionality. If the customer has only the complex story to prioritize ("Add novel extensions to standard expectation maximization") and an estimate for the story, she may prioritize the story based on the mistaken assumption that the new functionality will be delivered in approximately that timeframe. If instead, the customer has an investigative, spike story ("research and determine the feasibility of extending expectation maximization") and a functional story ("extend expectation maximization"), she must choose between adding the investigative story that adds no new functionality this iteration and perhaps some other story that does.

Combining Stories

Sometimes stories are too small. A story that is too small is typically one that the developer says she doesn't want to write down or estimate because doing that may take longer than making the change. Bug reports and user interface changes are common examples of stories that are often too small. A good approach for tiny stories, common among Extreme Programming teams, is to combine them into larger stories that represent from about a half-day to several days of work. The combined story is given a name and is then scheduled and worked on just like any other story.

For example, suppose a project has five bugs and a request to change some colors on the search screen. The developers estimate the total work involved

and the entire collection is treated as a single story. If you've chosen to use paper note cards, you can do this by stapling them together with a cover card.

Testable

Stories must be written so as to be testable. Successfully passing its tests proves that a story has been successfully developed. If the story cannot be tested, how can the developers know when they have finished coding?

Untestable stories commonly show up for nonfunctional requirements, which are requirements about the software but not directly about its functionality. For example, consider these nonfunctional stories:

- A user must find the software easy to use.
- A user must never have to wait long for any screen to appear.

As written, these stories are not testable. Whenever possible, tests should be automated. This means strive for 99% automation, not 10%. You can almost always automate more than you think you can. When a product is developed incrementally, things can change very quickly and code that worked yesterday can stop working today. You want automated tests that will find this as soon as possible.

There is a very small subset of tests that cannot realistically be automated. For example, a user story that says "A novice user is able to complete common workflows without training" can be tested but cannot be automated. Testing this story will likely involve having a human factors expert design a test that involves observation of a random sample of representative novice users. That type of test can be both time-consuming and expensive, but the story is testable and may be appropriate for some products.

The story "a user never has to wait long for any screen to appear" is not testable because it says "never" and because it does not define what "wait long" means. Demonstrating that something never happens is impossible. A far easier, and more reasonable target, is to demonstrate that something rarely happens. This story could have instead been written as "New screens appear within two seconds in 95% of all cases." And—even better—an automated test can be written to verify this.

Summary

- Ideally, stories are independent from one another. This isn't always possible but to the extent it is, stories should be written so that they can be developed in any order.
- The details of a story are negotiated between the user and the developers.
- Stories should be written so that their value to users or the customer is clear. The best way to achieve this is to have the customer write the stories.
- Stories may be annotated with details, but too much detail obscures the meaning of the story and can give the impression that no conversation is necessary between the developers and the customer.
- One of the best ways to annotate a story is to write test cases for the story.
- If they are too big, compound and complex stories may be split into multiple smaller stories.
- If they are too small, multiple tiny stories may be combined into one bigger story.
- Stories need to be testable.

Developer Responsibilities

- You are responsible for helping the customer write stories that are promises to converse rather than detailed specifications, have value to users or the customer, are independent, are testable, and are appropriately sized.
- If tempted to ask for a story about the use of a technology or a piece of infrastructure, you are responsible for instead describing the need in terms of its value to users or the customer.

Customer Responsibilities

- You are responsible for writing stories that are promises to converse rather than detailed specifications, have value to users or to yourself, are independent, are testable, and are appropriately sized.

Questions

2.1 For the following stories, indicate if it is a good story or not. If not, why?

- a A user can quickly master the system.
- b A user can edit the address on a resume.
- c A user can add, edit and delete multiple resumes.
- d The system can calculate saddlepoint approximations for distributions of quadratic forms in normal variables.
- e All runtime errors are logged in a consistent manner.

2.2 Break this epic up into appropriately sized component stories: "A user can make and change automated job search agents."