



Creative Innovation using a Voice of the Customer Process

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Introduction

The terms “Six sigma quality processes” and “innovation” are not often heard together. Quality processes bring to mind incremental improvements and measurement of existing products and processes. Innovation usually brings to mind the “Art of the Start”¹ and “The Soul of the New Machine”². So, how can a structured, Lean Six Sigma quality process actually be used by entrepreneurial teams to foster real innovation?

One of the critical factors in the success of new products and services is whether they address an unsolved need for a customer that has high value. But both small entrepreneurial companies and large established multi-billion dollar companies face the same problem in determining the customer need – how to deeply engage customers to understand their problems -- for very different reasons. Start-up companies, while small and agile, often have no existing customers to talk to in order to get customer information. Large companies, on the other hand, often have many customers, but the distance between the engineering teams and customers can be very great. In both cases, it is not in the nature of engineers to be comfortable talking to customers – even less so when there is no product to talk about.

For these reasons, a structured process for collecting customer input is very useful – but it must be tailored to the special needs of innovation in order to maintain and enhance the creative elements of that innovation.

¹ Guy Kawasaki, *The Art of the Start: The Time-Tested, Battle-Hardened Guide for Anyone Starting Anything* (New York: Penguin Group, 2004)

² Tracy Kidder, *The Soul of a New Machine*, (Boston: Little, Brown, 1981)

In EMC's Unified Storage Division, we have begun to apply a simplified version of the Lean Six Sigma Voice of the Customer process, also known as the Kano process³ to our early innovation projects. The early benefits include:

- More rigorous capture of requirements for a larger number of customers
- More creative open dialogue between customers and engineers about problems, not solutions
- Direct participation by all members of the engineering and cross functional product team
- Early involvement of the user experience engineers
- Early prototyping of ideas
- Shorter design and development time
- Lower product acceptance risk

This article will describe the simplified Voice of the Customer process used for the Cloud Integrated Storage project within the Unified Storage Division of EMC. This early stage project is chartered with defining our future product solutions for cloud storage, a new emerging market. In addition, the Voice of the Customer process has been integrated with EMC's SAFe (Scaled Agile Framework Environment)⁴ agile development environment to achieve rapid prototyping and development. This article will describe some of the results and early benefits of using this process, as well as lessons learned.

³ Larry M. Shillito, *Acquiring, Processing, and Deploying Voice of the Customer* (New York: St. Lucie Press, 2001), 191.

⁴ Scaled Agile Framework: A Proven Publicly Available Framework For Applying Lean/Agile Practices at Enterprise Scale, Last modified January 11, 2014. Last Accessed January 14, 2014. <http://scaledagileframework.com/>.

Part 1: Introducing Lean Six Sigma

Six Sigma has been used as a measurement standard since the 1800s. Six Sigma processes were originally applied to improvement of manufacturing processes. When applied to products, three sigma from the mean is usually used to describe the point at which a process needs correction because it is “out of control”. The term “six sigma” is a registered trademark of Motorola, who first applied this type of statistical analysis to problem solving. Motorola executives transformed six sigma from a quality measurement tool into the more general methodology for data driven measurement and change management that it is today. This methodology has been applied widely by many companies and has resulted in many Billions of dollars of cost savings and incremental business for those companies.

“Lean” is an approach to production that measures the amount of work needed to create value, that was derived mainly from Toyota and popularized by the book “The Machine that Changed the World”⁵ in 1990. Lean has been most applied to eliminating waste, and in production this is measured as the number of defects per unit.

“Lean Six Sigma” is used to describe the combination of these two approaches and was first popularized in 2002 by Michael George and Peter Vincent in the book “Lean Six Sigma: Combining Six Sigma with Lean Speed”⁶. By combining “lean” which focuses on improving the speed of processes, with “Six Sigma”, which focuses on the quality of processes, we can apply the approach to a much wider range of business problems, and especially to move outside of the realm of manufacturing. Thus, in 2003, Michael George wrote a second book “Lean Six Sigma for Service:

⁵ Daniel Roos, Ph.D; James Womack, Ph.D. and Daniel T. *The Machine That Changed the World – Toyota’s Secret Weapon in the Global Car Wars* (New York: Free Press, 1990).

⁶Michael L. George, *Lean Six Sigma: Combining Six Sigma Quality with Lean Speed* (San Francisco: McGraw-Hill, 2002).

How to use Lean Speed & Six Sigma Quality to Improve Services and Transactions”⁷, to address the common misconception that these principles were only for manufacturing.

For the rest of this article, we are going to focus on applying Lean Six Sigma principles to one specific area of service: Designing and Developing successful products. By eliminating “waste ” in the product design and development process, we can speed time to market for products and ensure that the product value to the customer is maximized. By ensuring “quality” in the product design and development process, we are developing products that meet the most customer needs with the fewest defects.

The Voice of the Customer

The Lean Six Sigma methodology can be used to cover all company processes. When applied to the product commercialization process – the process of defining, designing and developing products – the methodology brings statistical rigor to processes that have historically been viewed as an “art”. What does it mean to apply statistical analysis to the process of collecting customer requirements? There are two levels of statistical rigor: 1) tools that are used in the process of collecting and processing customer input, are designed to provide measurable results. 2) Since these tools have been used across so many companies over the years, we can apply statistics also to determine the likelihood that the results will be sufficient based on the number of customers from who we collect data. For example, the Voice of the Customer process has been used by a sufficient number of companies that based on previous results, if a company collects Voice of the Customer (VOC) data from 10-12 customers, they will have captured at least 80% of critical customer requirements,

⁷ Michael L. George, *Lean Six Sigma For Service: How to Use Lean Speed & Six Sigma Quality to Improve Services and Transactions* (San Francisco: McGraw Hill, 2003).

and that 90-95% of critical customer requirements are collected if a company interviews 20 to 30 customers and prospects.⁸

There are several key tools that are used in the product commercialization process: Voice of the Customer (VOC) and Quality Function Deployment (QFD). In this section, we briefly describe each of these processes as a basis for the discussion of their application as part of product definition.

Voice of the Customer (VOC) Tools

Voice of the Customer describes a set of tools and processes used to capture input from customers for the definition of new or enhanced products. It is also important to understand that the VOC process is an iterative process. In other words, the tools, may be applied multiple times in order to get more and more detailed understanding of the customer needs.

Voice of the Customer is a process used to capture requirements and feedback from customers. This information can be collected in a number of ways: Interviews, surveys, focus groups, observation, complaint logs, etc. Voice of the Customer does not proscribe the way that customer data must be collected. It is focused on how the data is processed and understood so that the output is a set of “critical Customer Requirements” (CCRs).

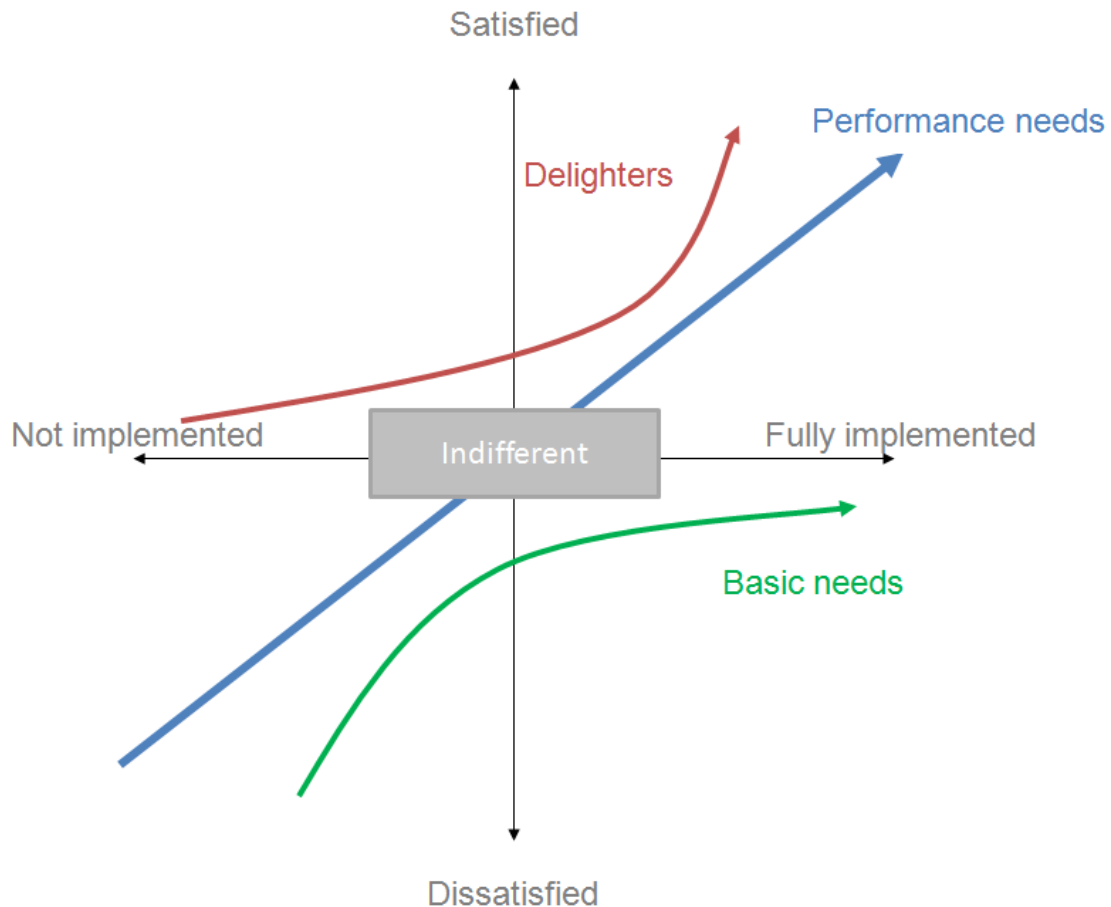
At EMC, we have focused on using semi-structured customer interviews in conjunction with customer surveys to collect customer input.

Kano Process

The Kano model can be used to classify requirements in terms of how they are perceived by the customers. Consistent with the Lean philosophy, this tool puts the focus on requirements that are “differentiating” or adding value, rather than all

⁸ J. R. Hauser and D. Clausing, “The House of Quality”, *Harvard Business Review* (May-June, 1988): 43-63.

customer requirements. This model is typically used in conjunction with customer data captured from customer interviews and surveys as a way to classifying those requirements.



Source: en.Wikipedia.org/wiki/Kano_Model⁹

Quality Function Deployment (QFD)

The third major process used in translating customer input into product design is the Quality Function Deployment process. “QFD is a method for structured product planning and development that enables a development team to specify clearly the customer’s wants and needs, and then to evaluate each proposed product or service

⁹ Kano Model. Last modified January 7, 2014. Last Accessed January 18, 2014. http://en.wikipedia.org/wiki/Kano_model.

Similarly to the VOC process, the QFD process can also be an iterative process. It can be used to address many aspects of the planning process, and it can also be used to define further detailed product capabilities by iteratively rotating the matrix so that the columns become rows and new columns are created.

Applying Lean Six Sigma to Customer Requirements Gathering

Every company is different, but getting customer input usually falls into one of the following categories:

- a. Don't do it at all
- b. Talk to existing customers with ad hoc conversations
- c. Do a survey
- d. Hold a focus group or use a customer advisory board
- e. Buy 3rd party market data
- f. Collect a list of competitive product features

A surprising number of companies fall into categories a) and b). In fact, some companies actually justify a low level of customer input by arguing that if you only listen to existing customers (or any customers for that matter), you are not being innovative. Many repeat the famous Steve Jobs quote:

“You can't just ask customers what they want and then try to give that to them. “You can't just ask customers what they want and then try to give that to them. By the time you get it built, they'll want something new”.¹²

This viewpoint is based on old processes that ask customers “what do you want in a product”. As we will discuss later, this can be an issue, but is easily addressed with a process that incorporates well designed interview questions that focus on the customers' problems, not on their ideas for solutions. As Steve Jobs noted in the same interview that he said the above:

¹² Bo Burlingham and George Gendron, “The Entrepreneur of the Decade, An Interview with Steve Jobs”, *Inc. Magazine*, April, 1989.

“Oh, sure. You can get into just as much trouble by going into the technology lab and asking your engineers, “OK, what can you do for me today?” That rarely leads to a product that customers want or to one that you're very proud of building when you get done. You have to merge these points of view, and you have to do it in an interactive way over a period of time—which doesn't mean a week. It takes a long time to pull out of customers what they really want, and it takes a long time to pull out of technology what it can really give.”¹³

Another problem common to all of the above approaches is the focus only on existing customers. It is important to collect data from both customers and non-customers. Innovative products are often discovered by talking to people who have not historically bought products from your company. Of course, with startup companies, there are no customers so product requirements must come from non-customers.

Performing surveys has the positive benefit of collecting a statistically significant amount of data and preventing the potential for bias. However, it makes the results completely dependent on the interview design, and eliminates the opportunity for open interaction, which is critical to facilitating true innovation.

The worst possible approach to customer requirements gathering is to assume that competitors have already done this work and simply copy their features.

Focus groups or customer advisory boards address the weaknesses of surveys by allowing for a deeper conversation and more open discussion with customers. But, these groups often lack the diversity and size needed to get good statistically

¹³ Bo Burlingham and George Gendron, “The Entrepreneur of the Decade, An Interview with Steve Jobs”.

significant unbiased results. The best customer interactions combine some of the characteristics of all of the above methods. The key to success lies in the design of the questions asked of customers, and the method used to process that data to get the most value out of it.

One of the benefits of using a standard Lean Six Sigma process is the ability to benchmark against the results of hundreds or thousands of other projects. After use in thousands of product definition projects, it has been statistically shown that the VOC process, properly executed, will generate 80% of critical customer requirements if at least 10 customers are interviewed and if 20 to 30 customers are interviewed, the process has been shown to generate 90-95% of critical customer requirements!¹⁴

The bottom line—it doesn't take hundreds of interviews or large competitive marketing budgets to accurately collect customer requirements.

Applying Lean Six Sigma to Requirements Generation and Processing

Most companies start the process of designing new products with a "Market Requirements Document". In many companies, this is an art form. Customer input is collected (or not) and a marketing person takes that information and generates a list of market requirements. These are compiled and then passed to engineering, often with little or no communication or interaction. Engineering then begins the design process using this document. In most product development processes, these steps are assumed to be sequential.

Unfortunately, this process has many limitations. It depends on one person or a small group to translate customer input into requirements. It is not an iterative approach so it doesn't allow for customer input as the requirements and design progresses. This means that there is a long delay between the time customers

¹⁴ J. R. Hauser and D. Clausing, "The House of Quality", *Harvard Business Review*, May-June, 1988, 43-63.

provide their initial input and the time that they react to the design – i.e. through purchase and running the product.

Agile programming is an engineering development process that seeks to capture customer feedback on product design in a much earlier stage of development. But, the agile process, by itself, does not allow for iterative feedback in the marketing requirements setting process that precedes development.

Using a VOC process and linking it to a QFD process addresses the challenges above by making the entire customer input and feedback process iterative from the point of initial requirements gathering all the way through to final product delivery. One of its additional benefits is that of facilitating much wider input and communication inside the company by engaging cross-functional teams in the entire process from initial customer interviews through the design process. Further linking this process to the agile development process, as we will discuss below, stretches the iterative customer input process all the way through the product development process.

The problem of applying these solutions to innovation

One of the critical factors in the success of new products and services is whether they address an unsolved need for a customer that has *high value*. But both small entrepreneurial companies and large, established multi-billion dollar companies face the same problem in determining the customer need – how to deeply engage customers to understand their problems -- for very different reasons. Start-up companies, while small and agile, often have no existing customers to talk to in order to get customer information.

Why is it, that so many of the next generation products and technologies come from startup companies and not from the companies that have near control over customer environments? Large companies often have many customers, but the distance between the engineering teams and customers can be very great. The market requirements tend to be biased by knowledge of existing products and

existing customer processes. Sometimes, this prevents companies from hearing and interpreting customer input. Even when input is heard, these companies lack the ability to translate customer pain points into new product ideas. In other words, it is difficult to provide the highest “value” solutions in new ways.

The Lean Six Sigma Voice of the Customer process is designed to help companies to:

- Collect customer input in a way that identifies the high value unaddressed needs
- Engage cross functional teams in all aspects of the process to ensure the widest innovative thinking
- Speed up the design and development process in order to speed time to market
- Enable an iterative process that engages customer feedback throughout every stage of the process

All of these characteristics make the Lean Six Sigma VOC process ideal for innovation, debunking the myth that innovation is an art and not a science. In our experience, the science of the process is the key enabler for the art of designing products.

Integrating the results with an Agile development process

We have taken the additional step of integrating the Voice of the Customer process with our agile programming process. Agile programming is a set of software development methods based on iterative and incremental development. This process integrates well with the Voice of the Customer output and the QFD process. The output of the QFD process can be used as the input for creating backlogs in the agile process. In turn, the agile process is designed around 2-4 week cycles and at the end of each cycle, the desired outcome is a set of end-to-end functionality that can be demonstrated. This cycle can be used to capture new customer feedback from the demos, facilitating the iterative customer feedback process. Thus,

integrating VOC, QFD and Agile can result in an end-to-end product development process that exhibits the best characteristics of Lean Six Sigma.

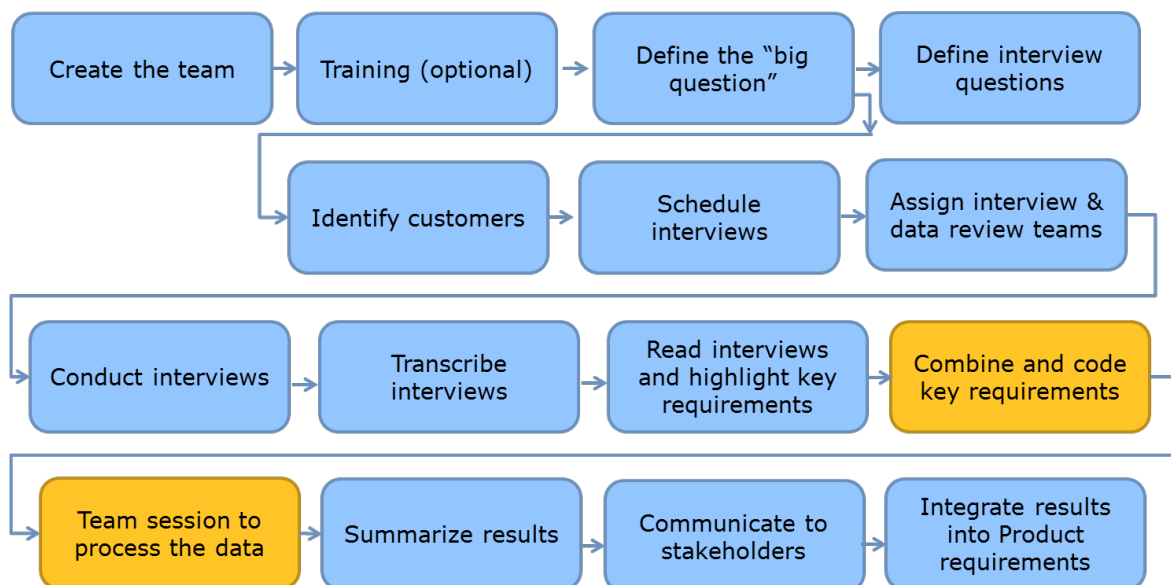
Part 2: Putting it all Together – A Sample Project

We put the Voice of the Customer process to use for defining a new Cloud Storage solution for EMC. We had a number of goals:

- Come up with an architecture that would allow us to deliver a product quickly
- Meet the most valuable use cases first...
- But also allow us to implement all of our use cases over time
- Enable creativity in thinking
- Help us to make the best decision using the data from some existing customer survey data as well as from new customer interviews
- Educate and train the first group within EMC on this new process
- Integrate well with our new agile development framework

The Process

There are a number of steps in the process:



General timeline for each step looks something like this:

	Elapsed Time	Team Lead	Team Members	Outside Support
Training, Question Preparation	2 weeks		2 hr mtg + 1 hr on own	
Interview Scheduling	In parallel	8 hrs	0	Sales team 2 hrs/interview
Interviews	2 weeks		1 day	
Transcribing interviews	1 week	4-8 hrs		Transcription svc 20-40 hrs
Data Processing and assembly	1 week	4-8 hrs	2-4 hrs	
Team Meeting to process results	2days	10-20 hrs	8 hrs	Facilitator or trained leader

Stage 1: Interviewing Customers

The interview stage of the VOC process involves creating an interview guide or protocol, identifying interview candidates and scheduling, training team members in interview techniques, performing the interviews and transcribing the results. These steps are described in more detail below.

Creating the interview Guide

We started with the “big question” that needed to be answered. In this case, we were interested in:

“What role can the cloud play in the management, access and use of your data?”

The next step was to break this down into more specific questions exploring possible customer use cases. Specifically,

- For which of the use cases above, are you currently using or would you consider using cloud-based storage?
 - Archive
 - Backup
 - Disaster Recovery

- File sharing/collaboration/mobility
- Remote Office/Branch Office (ROBO)
- Other cloud storage
- What about security, performance, cost, service level, regulatory restrictions, EMC brand, etc.

The team leads created a draft version of the interview guide and it was revised in a full team meeting, resulting in a two-page document. To make sure we were extracting all the important use cases, we started with some open-ended questions:

As we get started we would like to first get a better understanding of your role and your company's storage deployment. We would then like to walk through a series of use cases with you and get your thoughts.

- Please describe your current role at [Company Name]
- Can you provide a high level overview of your company's current storage deployment (e.g. size of storage, mix of high end vs. mid-range, ROBO, etc...)
- What are the biggest things you are working on this year?

And in closing, we asked:

- Are there any key issues that we neglected to mention in our conversation that you feel are important to discuss?
- May we contact you with follow-up questions?
- Do you have any other colleagues you would refer to our interview program?

Identifying Interview Candidates & Scheduling Interviews

The hardest and longest part of the process was identifying people interested in cloud storage and scheduling the interviews. We pursued several approaches to create a “pipeline” of possible candidates:

- Sales account managers
- Corporate Systems Engineering
- Attendees of cloud storage related talks at EMC World and other sessions
- Usability participant database

We tried to recruit a mix of different size companies, industries, etc. to fully uncover the customer requirements and use cases. Using the VOC statistical history, we wanted to talk to enough customers and prospects to get a known percentage of requirements:

- With no market or industry specific bias
 - We wanted to talk to at least 10-12 new customers and prospects so that we collected 90% of critical customer requirements.
- With industry bias
 - Use the numbers above for each unique industry group
 - Look for unique customer requirements per industry

After identifying candidates, the team lead either contacted them directly or worked with the customer's sales account team to setup interviews. The entire process took several weeks to complete. To track progress, we used a wiki listing contact name, company, status, last contact, account team contact, interview date, etc. In the end we ended up with 13 customer interviews for this project.

Interviews

For each interview, we had a lead interviewer with some training, and one or more team members as observers. We conducted interviews both in person as well as over the phone. It was better to do this in person at the customer's location, but that was not always possible. Interviews took one hour or less and were recorded if permitted. Basic training in interview observing was done before the interviews. Questions were very open-ended, asking the customer to explain their current use cases and how those could change by employing cloud storage.

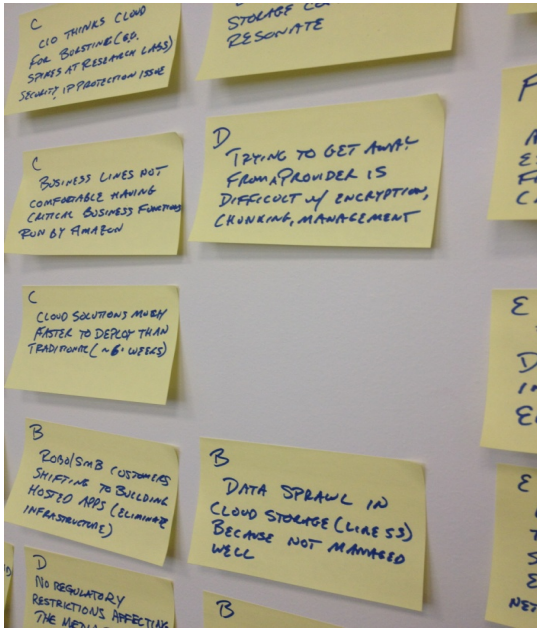
It is critical to involve the entire team in the interview process. Ideally, each team member should observe at least two interviews and transcribe two other interviews. This ensures that each person on the team has several direct customer

interactions and several indirect access to additional interviews by reading them and processing them.

Stage 2: Analyzing Interview Data

Processing interview data involves extracting individual requirements and transcribing these on post-it notes. It is important to keep as much of the “voice of the customer” as possible by using direct quotes when summarizing requirements. Each customer is assigned a company code (A, B, C, D...) to anonymize them and prevent bias when processing the results. Each customer is also assigned to a vertical industry. Each requirement is assigned to a category. For example:

Code	Vertical	Category	Requirement statement
A	Healthcare	General	“I really need a DR solution that protects my small clinics”
A	Media & Entertainment	Use Case	“I need a way to have one copy of data that we can create in datacenters in the US, and then process on in India during the next shift”
B	EDA	Security	“Data needs to be encrypted over the wire with the same level of security that it has when we move it for replication internally”
C	SLED	Data Movement	“We need to meet HIPPA and Dept of Justice compliance requirements with our offsite data”
E	Service Provider	Cloud Type	They want to be able to carry their next generation architecture into a hybrid cloud solution.



In the end, we collected about 130 unique requirements across the 13 customers transcribed onto post-it notes.

Stage 3: Processing Interview Data to generate Critical Customer Requirements

The next step involved having the entire team meet to read and understand each requirement and prioritize the most important “Critical Customer Requirements”. Several had to be explained by the interviewer or transcriber in more detail. Again, all participants tried

to represent the customer voice and priorities as much as possible.

This meeting had to be done in two locations (Massachusetts and California) due to the split of team members across the locations. We tried to do it using video conferencing, but ended up having two separate meetings using the same facilitator. Though there was some concern about separately creating two versions of the results, we found that the results in both cases were very similar. This helped to reinforce that the process was not biased too much by our internal thinking.



At this point, each team member picked their top requirement and championed it to the entire group explaining why it was important.



There was some give and take from the team and in the end we ended up with 31 requirements representing the overall set of user requirements. These ended up on the wall:



Next, the team members reviewed the top requirements and grouped them logically into themes/clusters. Again, there was a lot of discussion and rearrangement of clusters:



After agreeing on the grouping, we created summaries for each group:



We ended up with five groups, with a description for each group using the customer's voice:

- Lower cost
 - “Cloud can help me lower costs and give me high value...”
- Trusted
 - “...with the required enterprise protections for security, privacy, compliance, and investment protection...”
- Performant
 - “...and meeting my performance needs...”
- Sharing & long term retention
 - “...delivering key functions like file sharing, archive & tiering, and backup...”
- Anywhere access & use
 - “...and enabling new management capability on that data.”

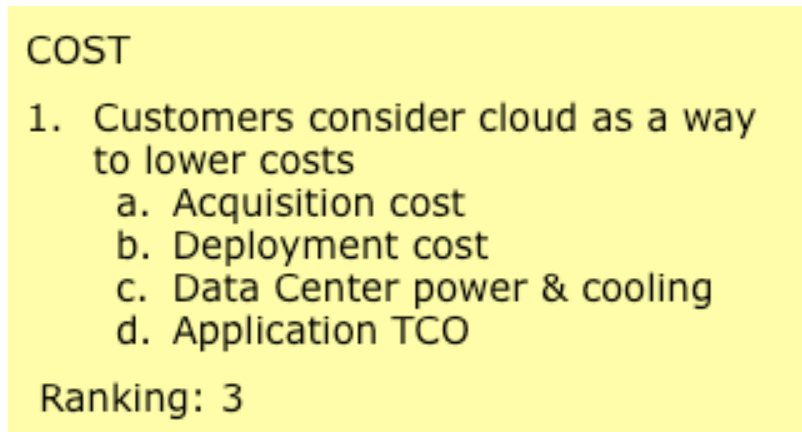
We next prioritized each requirement by assigning an importance weight of 1 (lowest), 3, or 9 (highest). Every team member voted at the same time (to prevent bias) and the outliers explained their reasons for weighting a requirement higher or lower. In order to ensure separation between the scores, we used a 9,3,1 scoring



method instead of a 3,2,1 scoring. All votes were reconciled into a 1, 3, 6, or 9. (6 was used when there was a big split between 3 and 9 votes.). Alternatively, we could have classified each requirement using the Kano method instead. But, since this was the first time that the team was using this

process, we opted for a simpler classification based on simple importance weighting.

We wrote down the importance weight/ranking for each high level critical customer requirement on each post-it note:



Stage 4: Turning Requirements into product capabilities (aka Building a House of Quality)

After extracting the requirements, we moved on to determine product features/components needed to satisfy these requirements. For example, we were hoping to develop high level product capabilities like: security, encryption engine, key management, diagnostic capability, logging service, etc. The entire team met via video conferencing in a brainstorming meeting to identify the features that would be required in order to satisfy all of the critical customer requirements. There was a spirited discussion about each feature explaining why it was needed and how important it was. To encourage full team participation, we went around the virtual room and made sure that everyone had a chance to contribute their ideas.

We ended up identifying 83 high level features (which ended up being way too many). These were tracked as columns in our house of quality spreadsheet, while rows represented the critical customer requirements.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	Scalability Usability Reliability Availability Extensibility Manageability	Importance/ Weight	Encryption	Key Mgmt	Role Identity Mgmt	Integration w/existing security systems	Detailed Logging	Detailed Audit Logging & Reporting	Policy Based Movement of Data	Cloud Account Credential Mgmt	Physical Location Mgmt	Off- premises/On- premises com	Simple GUI	Separation of Data and Metadata	Stronger than basic client authentication (e.g. Two-factor Authentication)	Single signon
3	Lower Cost: Acquisition, deployment, power & cooling, application TCO	3	0.00	0.00	1.64	6.27	0.00	0.00	9.27	4.91	3.82	8.45	18.82	2.45	0.27	6
4	Lower Cost: Ease of management	9	4.91	42.55	40.91	35.18	15.55	13.09	44.18	31.09	23.73	35.18	76.09	22.09	7.36	6
5	Lower Cost: EMC value	3	3.27	1.80	2.45	4.91	1.36	2.45	8.18	4.09	4.09	2.45	7.91	5.73	3.55	7
6	Trusted: Privacy & security, easy so users don't bypass	9	73.64	63.82	76.09	51.55	27.00	49.09	22.91	32.73	54.00	49.09	31.09	19.64	76.09	28
7	Trusted: No vendor lock in	3	2.45	6.55	3.00	9.27	0.00	0.00	0.82	10.09	5.18	10.09	0.27	0.82	0.27	2
8	Trusted: sensitive data, encryption	6	54.00	46.36	34.91	34.36	22.91	32.73	16.36	15.82	27.82	22.91	6.55	13.09	37.64	19
9	Performance: ROBO meeting performance requirements over slow and expansive WAN, fast restore from cloud	6	0.00	0.55	0.00	0.00	3.27	0.00	6.55	0.00	14.73	18.00	3.82	18.55	0.00	0
10	Sharing & Long Term Retention: Backup/restore, snapshot, file sharing, meet application RTO	3	0.00	2.73	2.45	1.64	0.00	0.82	11.45	0.00	6.55	5.73	7.36	6.82	0.82	0
11	Sharing & Long Term Retention: File sharing, internally, with outsiders e.g. customers	9	9.82	10.64	54.00	17.18	0.82	9.82	32.73	0.82	7.36	12.27	27.00	14.73	22.09	8
12	Sharing & Long Term Retention: Archive & tiering files based on customer defined policies	6	2.73	5.45	9.82	3.82	1.09	12.55	54.00	0.00	9.27	16.36	20.18	18.55	4.91	1
13	Anywhere Access & Use: Anywhere access in the cloud and manipulate (e.g. search, query, transform) without moving it. Run VMs in the cloud that use the data. Integrated search/query/spooflight.	9	4.91	11.45	24.55	15.55	0.82	0.82	12.27	8.18	17.18	19.64	36.82	32.73	24.55	19
14	Trusted: Compliance (legal and business), e.g. control data location & audits	6	42.55	22.91	22.91	22.91	19.64	34.36	21.27	4.36	28.91	28.91	9.27	11.45	15.27	7
House of Quality / Results (Calculated Average) / Standard Deviation / Anton / Bill / Brian / Bruce / Dave / Jim / Joan / Kevin / Scott / Sreelha / Yula / Incomplete Sheets -->																

Now that we had the set of requirements and an associated set of features / components needed to satisfy these requirements, we distributed the spreadsheet to each team member to assign a relationship weight (0,1,3,6,9) to each cell in the spreadsheet, measuring how critical that particular feature (column) was to meeting the specific critical customer requirement (row). In order to streamline this process we ended up regrouping the requirements to make it easier to pinpoint relationships between features and requirements. The objective of this process was to ensure that each team member was “on the same page” about the relationships between requirements and features. Usually when team members score these relationship cells differently, it is the result of having different understanding of what the requirements really means, or what the capability is really meant to encompass.

Before distributing the spreadsheet we used a copy of the main tab to make tabs for every team member to assign their relationship weighting to each cell. Since the

spreadsheet had grown so much we needed an easy way to see if each team member had assigned an acceptable value. This was accomplished with spreadsheet tools to require a valid selection for every cell and adding an additional invalid selection: 100. Each member's tab was pre-populated with default weightings of 100. This allowed us to see if any cells were missed. Also, we instructed team members to use 100 if they were not clear on the feature and/or needed more information in order to make an informed decision.

Importance score	
0	- not relevant
1	- minor relevance
3	- moderate relevance
9	- major relevance
100	- I'm not sure; need more information

As each team member completed their spreadsheet we rolled that up into the master spreadsheet. We also added two helpful tabs that enabled us to roll up all the data:

1. A tab that calculated the standard deviation of each cell
 - a. This tab allowed us to identify cells where team members had widely differing opinions on the relationship weighting.
2. A tab that calculated the average of each cell
 - a. This tab gave us an overall roll up of the input from each team member.

For the standard deviation, we added color coding formatting in order to identify the largest discrepancies. The team focused on these results first to determine if

	Deviation 0
	Deviation > 4
	Deviation > 5
	Deviation > 6

there was any misunderstanding about the requirements and features, or if there were just different opinions that needed discussion.

For the average we used the graded color scale formatting option to easily see the cells that had the highest relevance numbers.

We held a couple of team meetings to discuss the cells with a large variation in weights and come up with an overall weight for each cell. When printed out and

taped to the wall, this spreadsheet ended up being very wide, taking up about a dozen pages:



When the House of Quality spreadsheet was completed, a summary value was created for each column (feature). Using a simple formula, we were able to highlight the features that were most critical to achieving the most important Critical Customer Requirements(CCR):

For each column (feature),

Total Aggregate Relationship Weighting = $\text{SUM}(\text{CCR weighting} * \text{Cell relationship value})$

If the spreadsheet is then sorted by these Aggregate Relationship Weighting values, the columns will be ordered to rank the most important features first.

Stage 5: Generating a Phase 1 Backlog

Working with the product managers, product owners, and executive management, the team identified a set of requirements for Phase 1/2/3 of product delivery, taking into account the importance ranking of the features. Based on the results of this process, we ended up reversing the original order of the phases, switching file vs. block implementation. Having a correlation between features and requirements made it much easier to determine the amount of effort to implement a particular requirement.

We highlighted the features that correlated most closely with the phase 1 requirements and added those to our agile backlog.

The Results

As a result of this House of Quality effort, the team:

- Identified the key product requirements
- Analyzed requirements to determine required features
- Aligned engineering effort with customer requirements
- Validated architectural and product decisions to management
- Prioritized features into a phase 1 backlog

Lessons Learned

We learned several things during this process. The following is a list of our most important lessons learned:

- First and foremost, it brought the team together and encouraged participation from people who normally don't feel comfortable participating.
- The team facilitators need to have some training in the process before tackling this job. This can be from a previous session or more formal training

or by using a trained consultant. It is very important to explain what needs to happen at each stage, make sure everyone is participating, answer questions, etc.

- Identifying customers and scheduling interviews takes a long time. Make sure you start early and allocate enough calendar time.
- We found that the unstructured interview process worked well in most cases, however it is important that the person leading the interviews is experienced and is capable of keeping the interviews on track. Often some gentle prodding is required in order to get customers to open up and to keep their dialogue on track to make sure that the feedback is optimized.
- We found that the process of extracting requirements from the interview transcriptions, and then transposing them onto post-it notes was very time consuming. It is important not to underestimate the effort required. While there are tools for automating some of this process, we chose not to try to use them this first time. In our case, it took a significant investment of time for 2 people who worked together to read through the data and make judgement calls together on how to describe the requirements. These 2 people also shared the actual work of writing up the post-it notes.
- Working with two geographic teams was difficult. Many of the meetings worked better face to face. There are collaboration tools available to facilitate, but nothing works as well as meeting in person.
- Actually listening to customers speak about their use cases in their own words really helped everyone to understand the needs of the customer in a real way. In particular, physically moving post-it requirement notes around on a whiteboard was much better than doing this electronically. When

people had to pick a requirement and champion it, they really put themselves in the shoes of the customer, often for the first time.

- We used only a fraction of the full Quality Function Deployment process, based on the amount of time available and the output we were looking for. We plan to investigate other facets and see how well they work within EMC.
- The group ended up with too many features (83). Having this many features took too long to discuss and prioritize. We definitely saw a diminishing return to the discussion after a couple of hours. In the future, we plan to group features together to have no more than 30 maximum.
- We learned that really working with customer feedback can result in a very different set of priorities and direction for a new product development project than the team thought a-priori. Even though the outcome was a different set of features and order of use cases than originally anticipated, there was complete agreement among the team that this was the right direction. That agreement was one of the most important wins from the process overall.

Part 3: Starting on the Journey for Your Project

To get started on your own journey with Lean Six Sigma Voice of the Customer, there are some simple steps that your team can take. First, get some background and training in the processes and tools. It is important that the team leaders have some training or facilitation. Here are some great ways to start.

Reading Materials

Lean Six Sigma: Combining Six Sigma with Lean Speed, Michael George and Peter Vincent, 2002.

Lean Six Sigma For Service: How to Use Lean Speed & Six Sigma Quality to Improve Services and Transactions, Michael L. George, 2003.

Acquiring, Processing, and Deploying Voice of the Customer, M. Larry Shillito, , 2001.

Quality Function Deployment: How to Make QFD Work for You, Lou Cohen, 1995.

The house of quality, J. R. Hauser and D. Clausing, *Harvard Business Review*, May-June, 1988.

Training

EMC and many other large companies have their own Lean Six Sigma Groups that provide training. At EMC, the Lean Six Sigma training can be found through EMC University. In addition, many third party consulting companies provide training and facilitation in Lean Six Sigma and specifically Voice of the Customer methods and tools. Since certification is one of the key components of Lean Six Sigma, it is possible to hire a “black belt” certified Lean Six Sigma specialist who will have a well defined understanding of tools and methods.

Setting Expectations

It is important to set expectations properly when starting a Voice of the Customer process for the first time. The methods and tools described in this article can be used in a number of ways, and have capabilities that we didn’t even use in our first project. You will find that you want to customize your use of the tools and methods to meet your most important needs over time. So, for your first project, it’s okay to start small and only use a part of the process and a subset of the tools.

As with any quality process, you should view it as a continuous improvement exercise where your results will get much better over time. So don't delay, start small but just get started on your journey to innovative product design through Lean Six Sigma Voice of the Customer!