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Customer Success Is Our Mission

Everything You Wanted to Know About CMMI® and Six Sigma but Did Not Know Who to Ask

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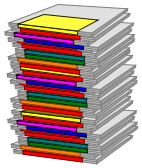
Today's Mission

- **QUICK Introduction to Six Sigma**
- **Relationship of Six Sigma to the CMMI**
- **Applying Six Sigma**
- **Examples of Six Sigma Tool Usage to Improve**

BlackBelt training is 160 hrs



Intro to CMMI is 24 hrs

I have 30 Minutes

What Do You Think Six Sigma Is All About?

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Benchmark?

Metric?

Method?

Philosophy?

Vision

Pipe Dream?

Disease?

Stretch Goal?

What Is Six Sigma?

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A customer-driven management methodology to significantly increase **customer** satisfaction through reducing and eliminating variation and thus defects.

A concept developed by Motorola to achieve a desired level of quality, virtually defect-free products and processes

With this definition, six sigma is applicable to any development or manufacturing process

The Many Facets of Sigma

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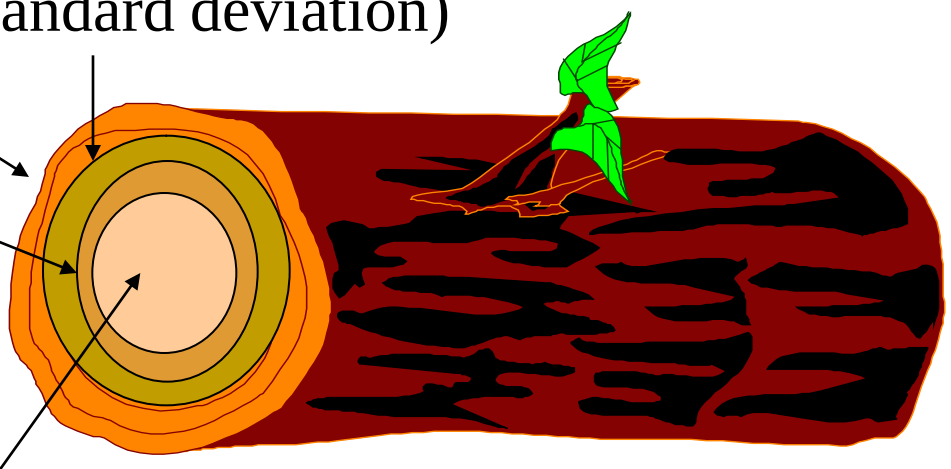
Sigma is a letter in the Greek alphabet

"**Sigma**" is used to designate the distribution about the mean of any process or product characteristic (standard deviation)

"Sigma value" indicates how often defects are likely to occur



"Sigma level" is the number of standard deviations between the process center and the CLOSEST spec limit

Premise for Six Sigma

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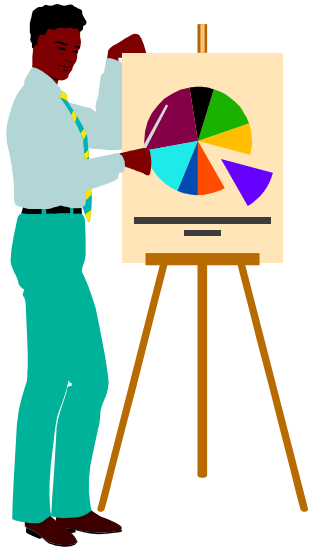
- Sources of **variation** can be
  - Identified
  - Quantified
  - Mitigated by control or prevention

- The elements of a process responsible for variation are called the “6 M’s”
  - Man (people)
  - Machine
  - Material
  - Method
  - Measurement
  - Mother Nature



Variation is the Enemy

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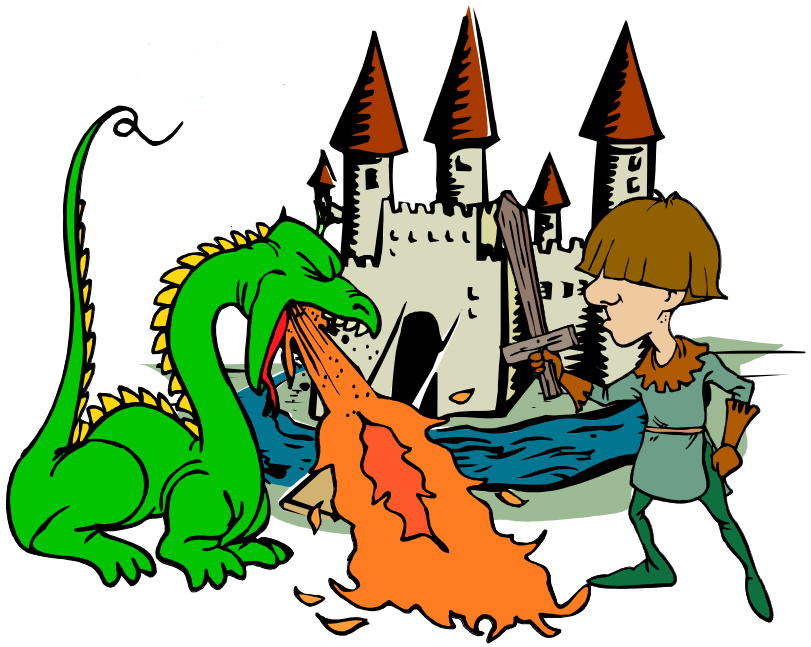
- Variation exists in everything

- If it is assumed that everything is a result of some process, then it is safe to conclude that the process introduces product variation

- Variation in the product is due to variation in the process

- Variation comes in two forms - **common** and **special cause**



We Must Slay the Enemy

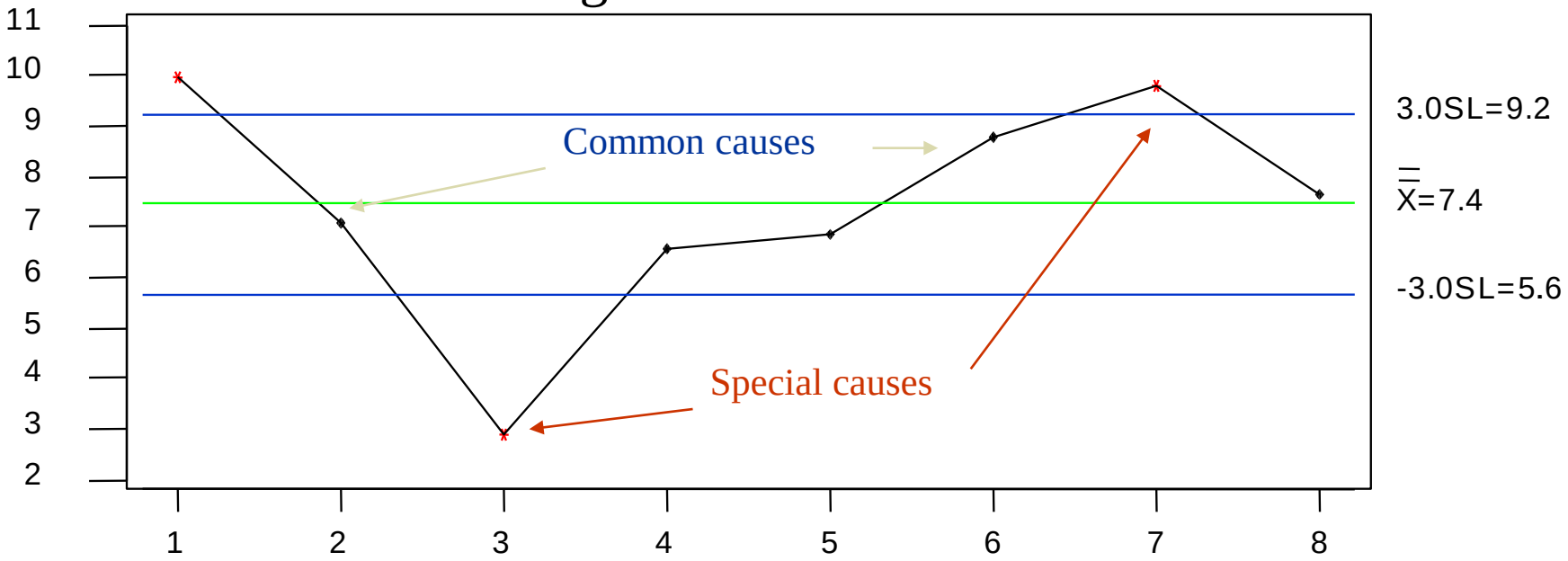
Common and Special Causes

Common Causes

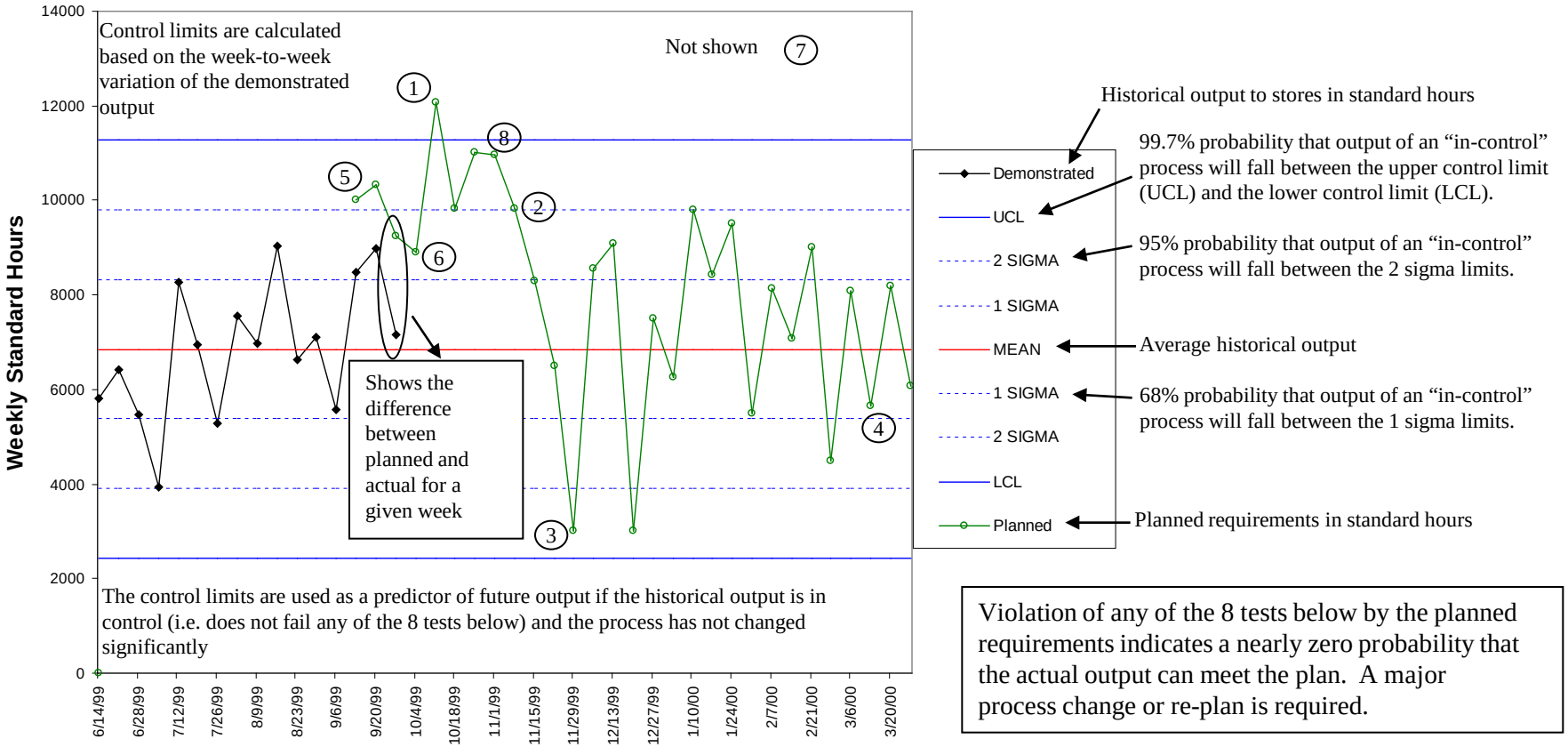
- Continuously active in the process
- Predictable

Special Cause

- Extraordinary events
- Can assign a reason
- Can do something about it



Reading a Control Chart



Violation of any of the 8 tests below by the planned requirements indicates a nearly zero probability that the actual output can meet the plan. A major process change or re-plan is required.

Tests for out-of-control conditions in a control chart

1. One point more than three sigmas from the mean
2. Nine points in a row on the same side of the mean
3. Six points in a row all increasing or decreasing
4. Fourteen points in a row, alternating up and down
5. Two out of three points more than 2 sigmas from the mean
6. Four out of five points more than 1 sigma from the mean
7. Fifteen points in a row within 1 sigma of the mean
8. Eight points in a row more than 1 sigma from the mean

Six Sigma is All About Variation

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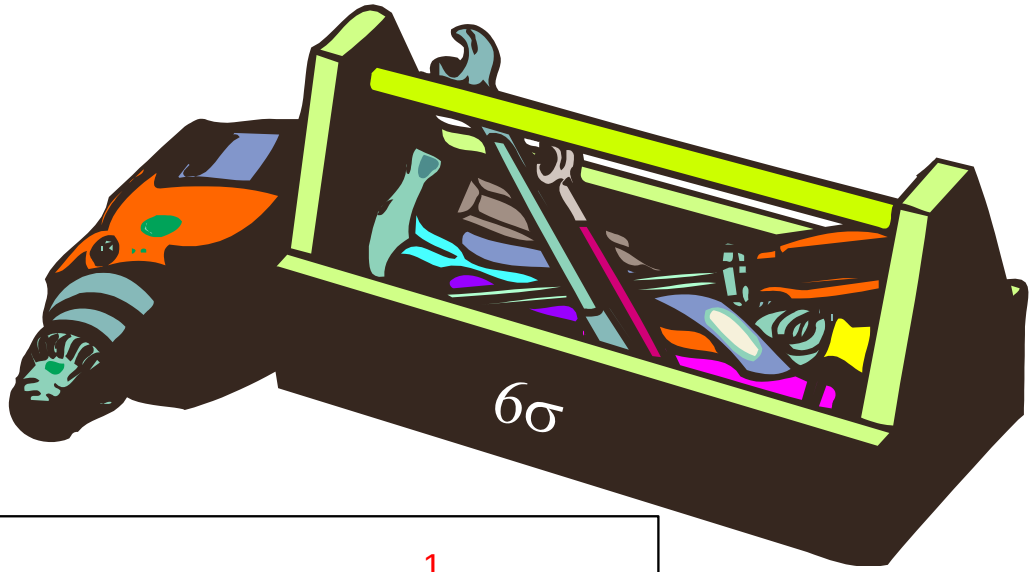
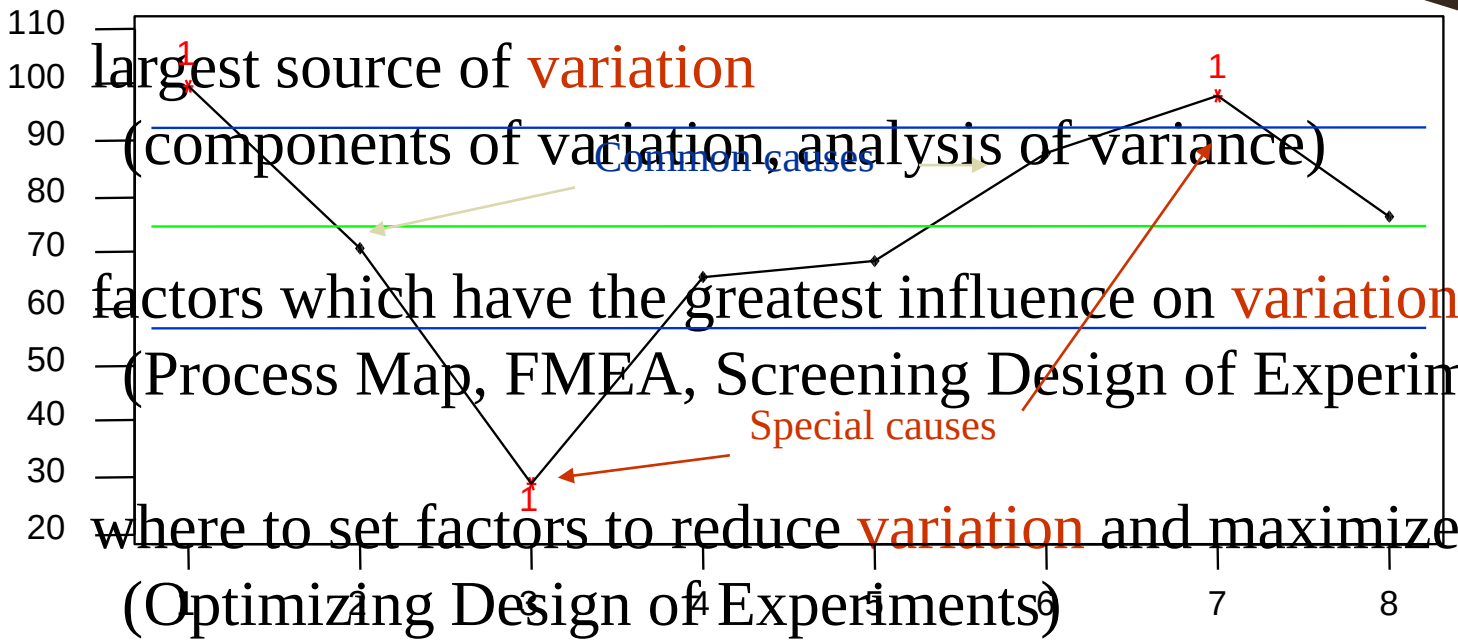
Six Sigma tools help identify

types of variation
(control chart)



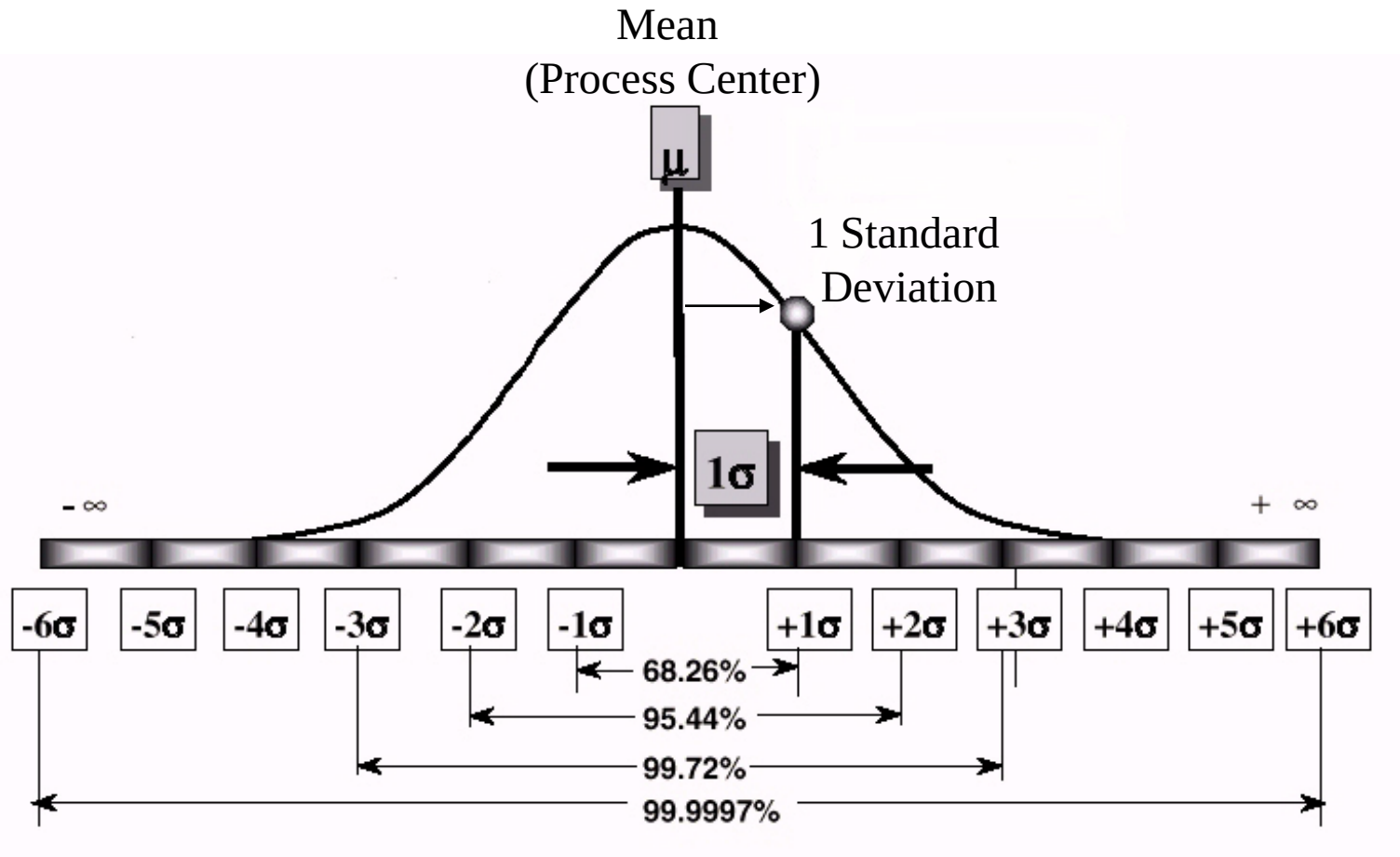


largest source of variation
(components of variation, analysis of variance)

factors which have the greatest influence on variation
(Process Map, FMEA, Screening Design of Experiments)

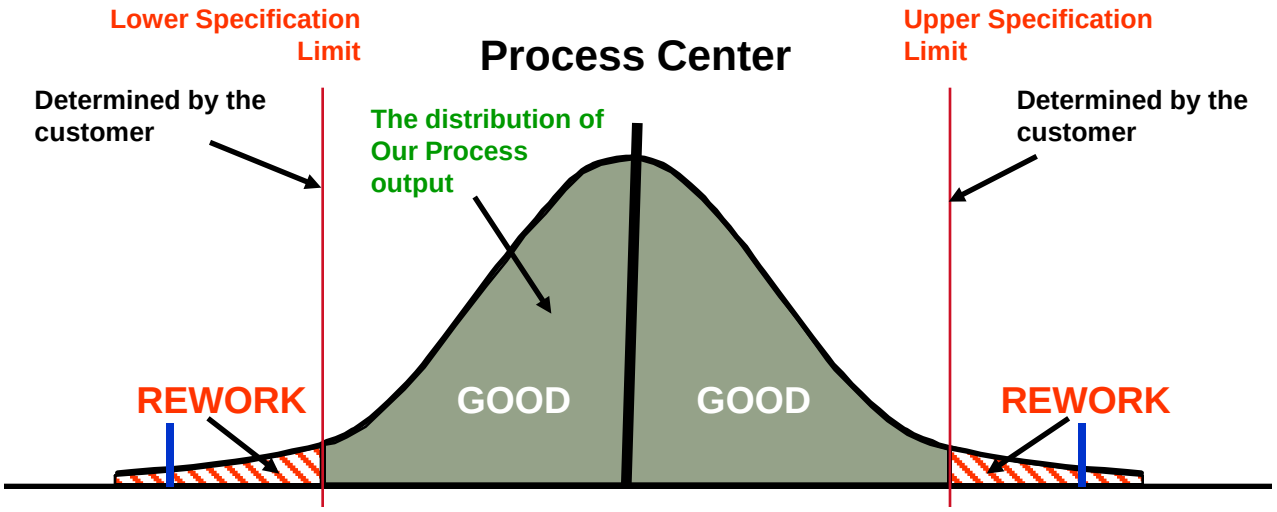
where to set factors to reduce variation and maximize the output
(Optimizing Design of Experiments)

Six Sigma is Based on Statistics



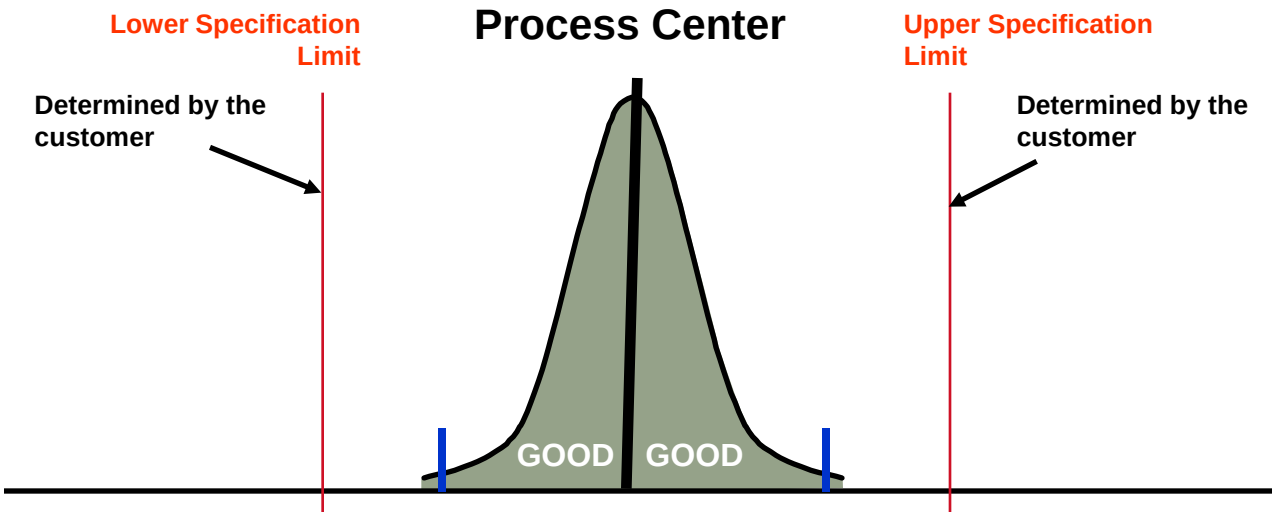
Remember - no statistics today

States of a Process



Incapable Process

- We have **REWORK** because some of what we make is waste
- Process is **WIDER** than the specification limits

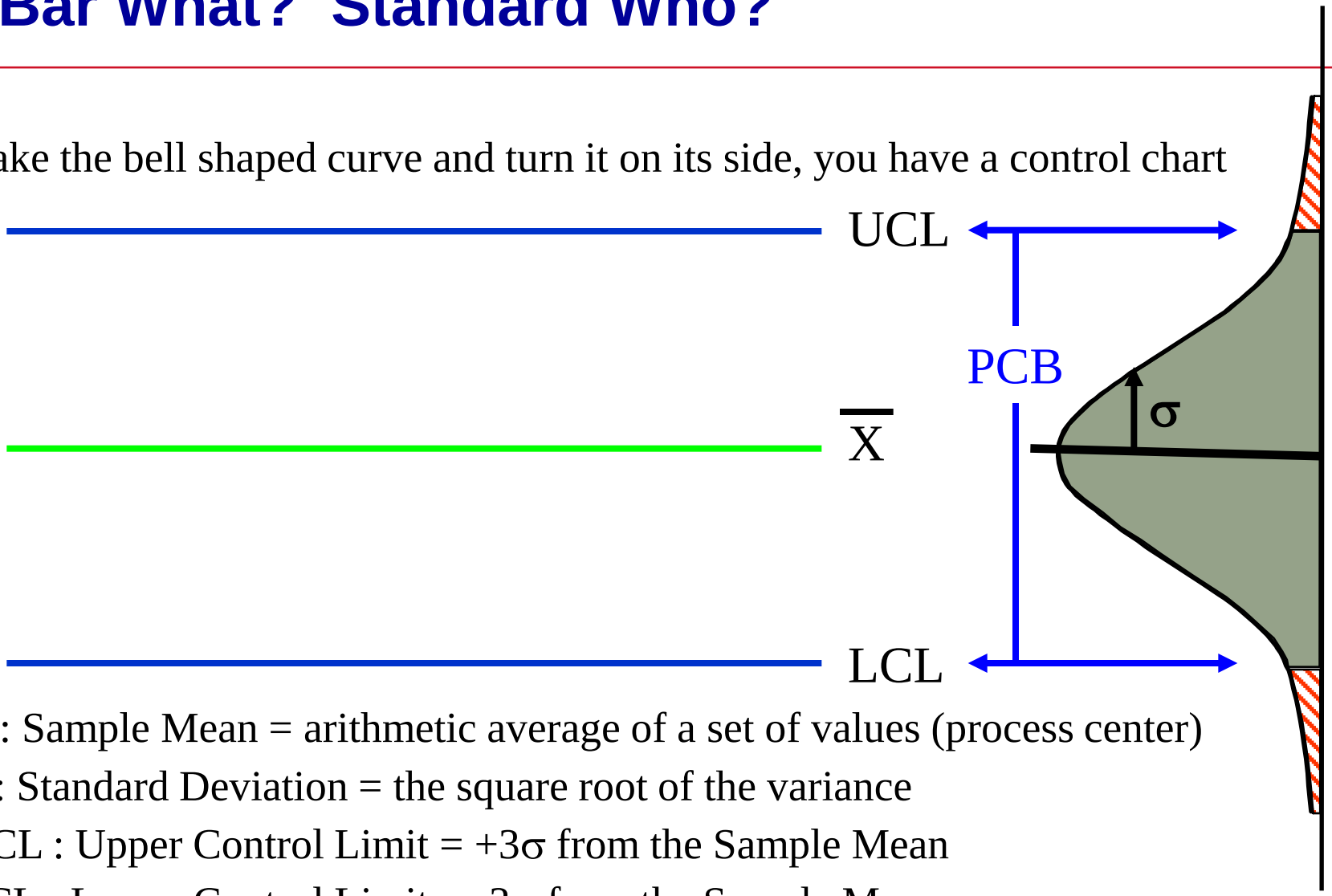


Capable Process

- We make as much as the customer needs and have very little waste
- Process **FITS** within the specification limits

X Bar What? Standard Who?

If you take the bell shaped curve and turn it on its side, you have a control chart



$\overline{X}$: Sample Mean = arithmetic average of a set of values (process center)

σ : Standard Deviation = the square root of the variance

UCL : Upper Control Limit = +3σ from the Sample Mean

LCL : Lower Control Limit = -3σ from the Sample Mean

PCB : Process Capability Baseline = “normal” variation for the sample

So Long As We Satisfy the Requirements, Right?

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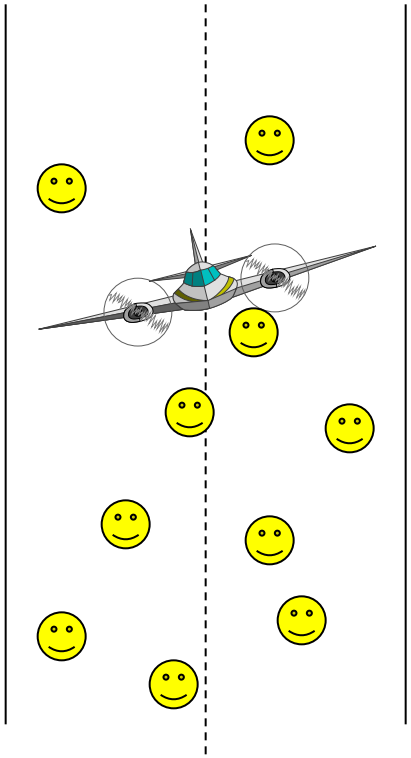
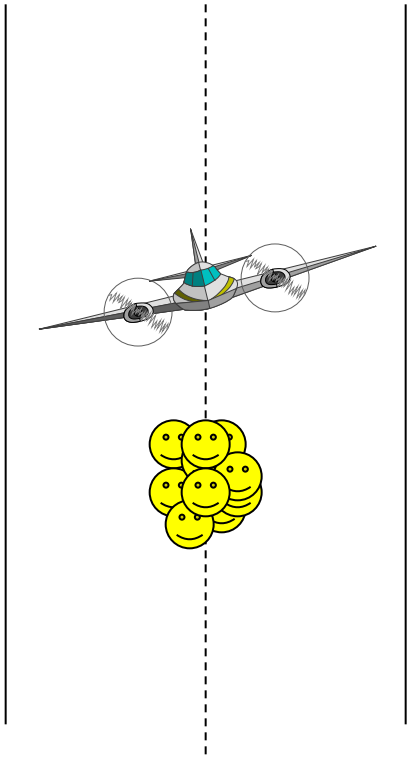
Pilot A



Both within spec,
same average landing

Pilot B



Which pilot would you want to fly with? Why?

Moving Towards Six Sigma

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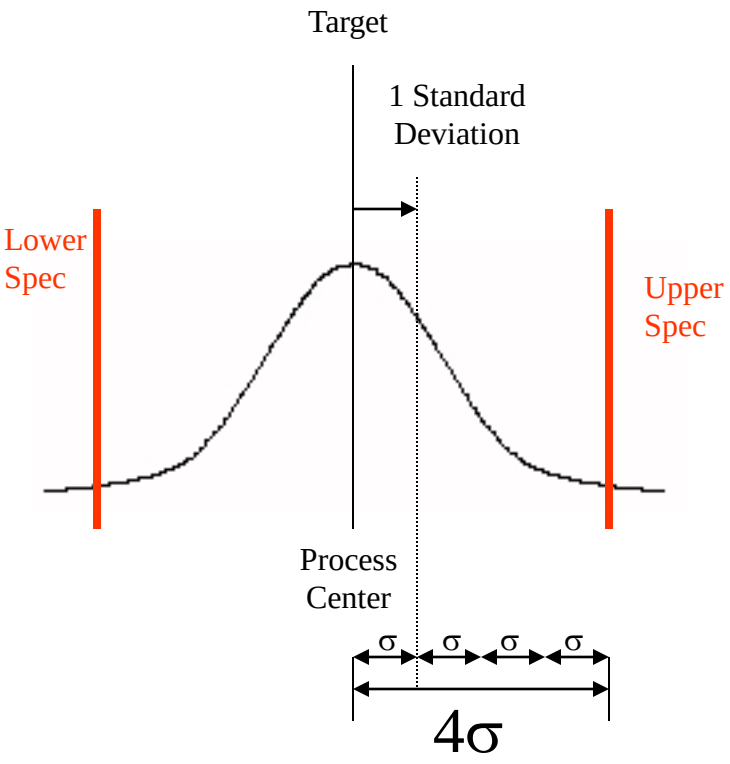
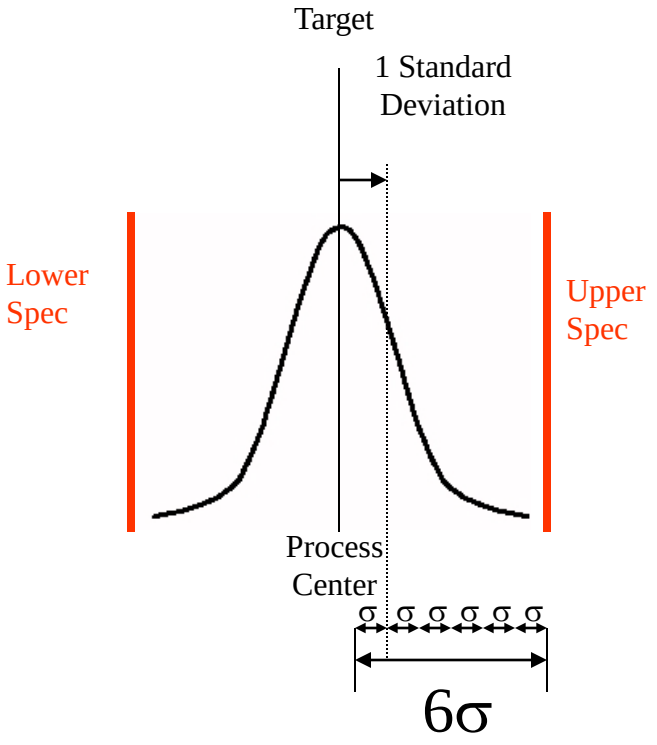
Pilot A's Distribution



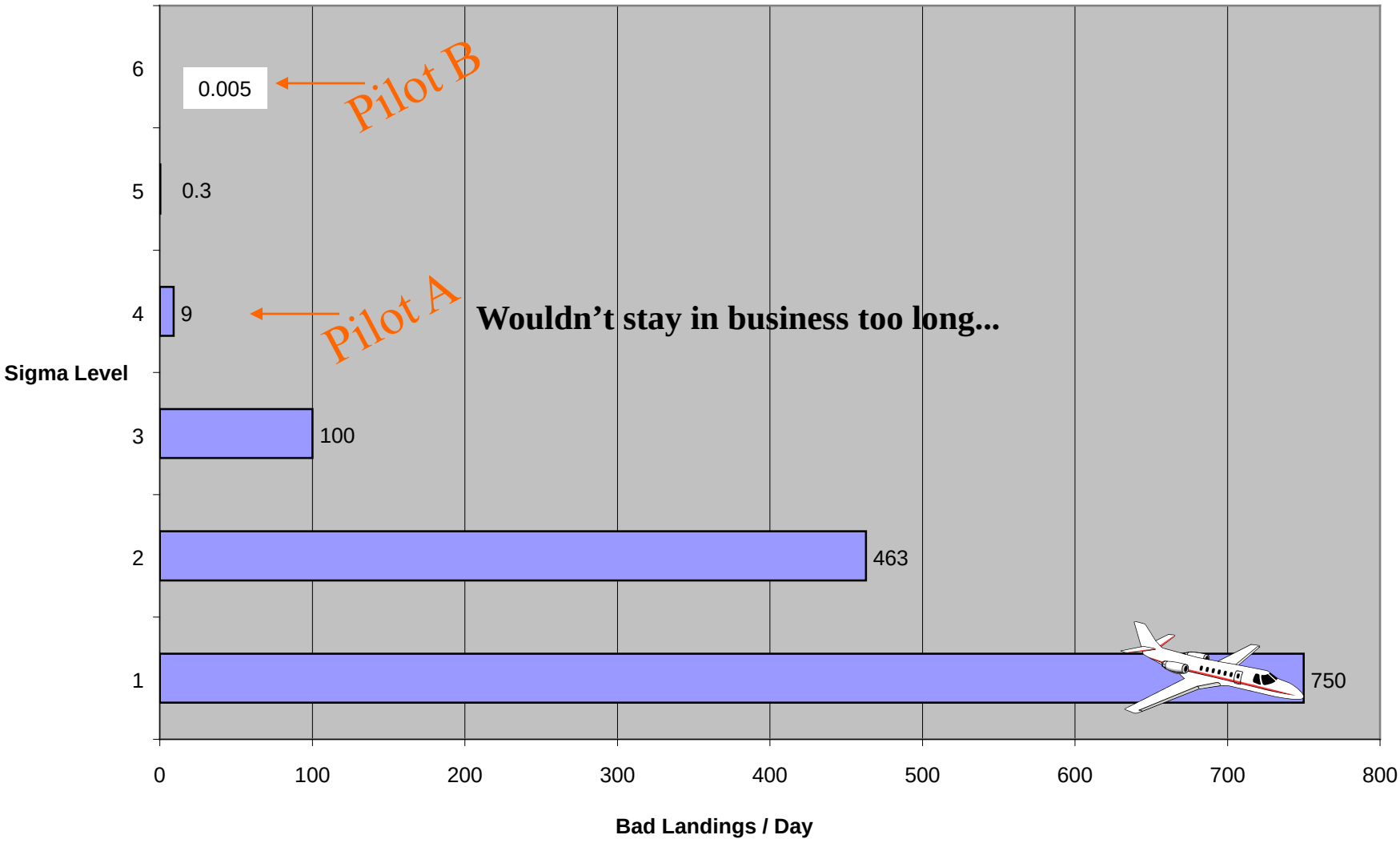
Pilot A is at 4 sigma

Pilot B's Distribution



In order to be six sigma, like Pilot B, the variation in Pilot A's landings must be reduced

Pilot A and B at Sky Harbor Airport



Higher Sigma Equates to Major Reduction in Defects

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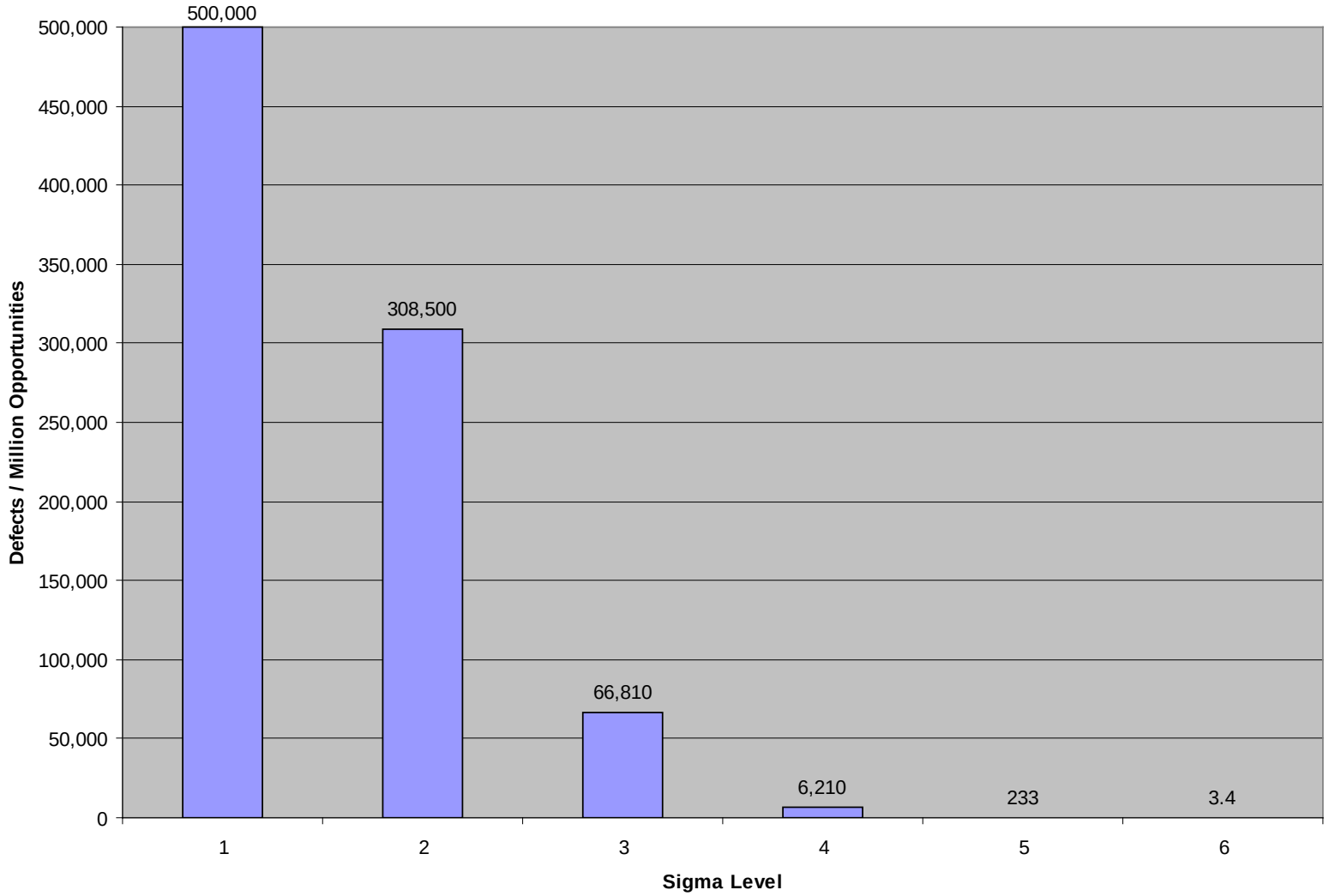

Six Sigma -The Other Story

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1σ - 170 misspelled words per page in a book

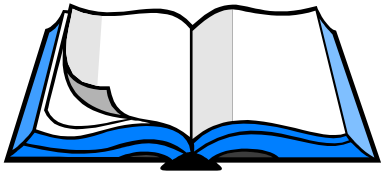
2σ - 25 misspelled words per page

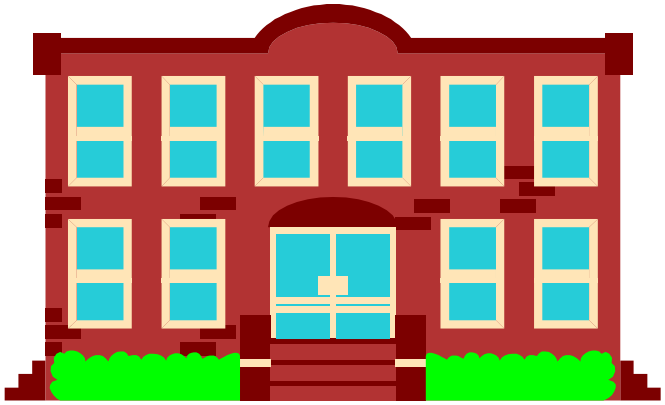
3σ - 1.5 misspelled words per page

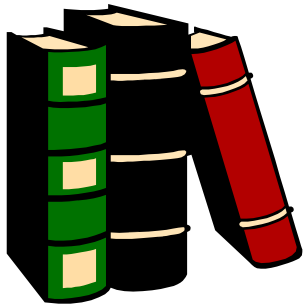
4σ - 1 misspelled word per 30 pages

5σ - 1 misspelled word in a set of encyclopedias

6σ - 1 misspelled word in all the books in a library







Understand you customers' needs
And balance with cost

CMMI Meets Six Sigma

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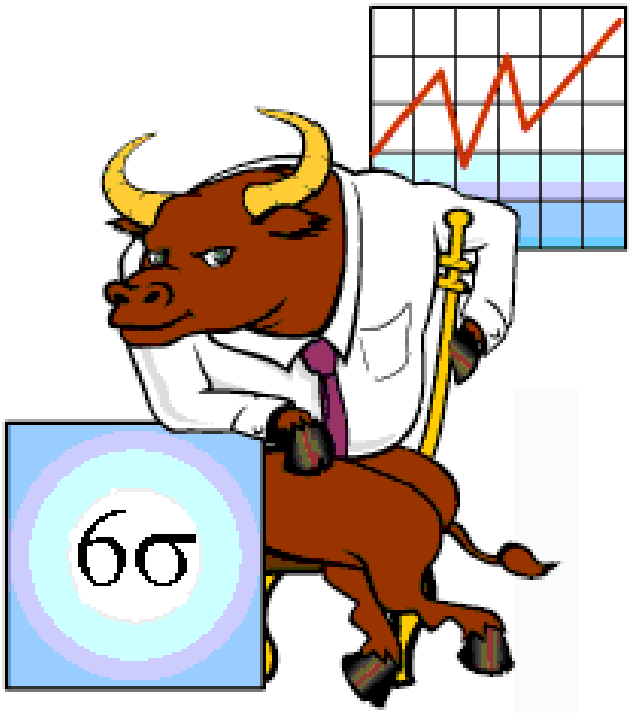

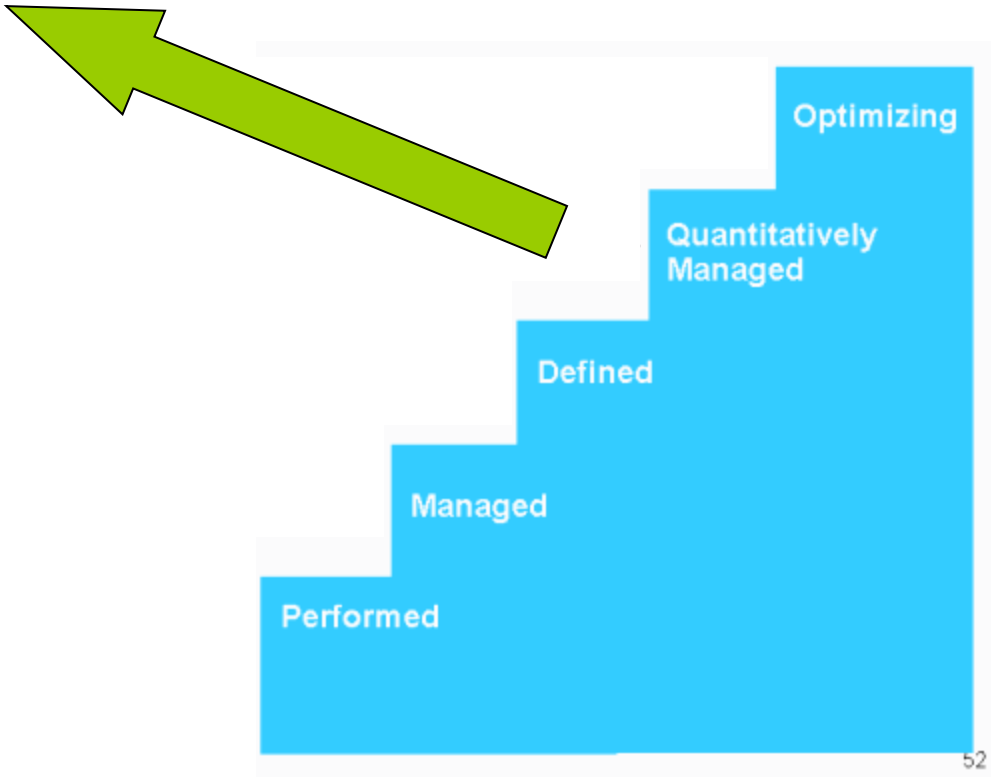

CMMI Reminder

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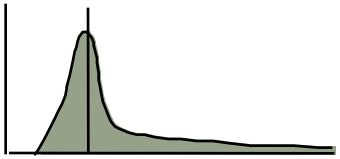
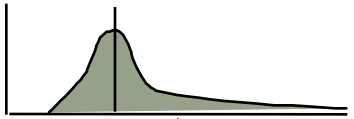
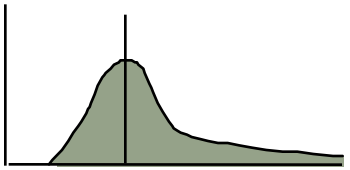
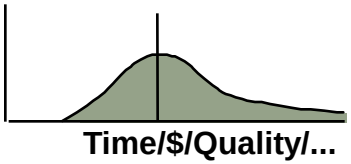
Maturity Level		Predicted Performance
5 Optimizing	the organization concentrates on quantitatively improving the process to maximize the achievement of the organization's and projects' goals	
4 Quantitatively Managed	all the process assets accumulated from Level 2 and 3 are used to quantitatively understand the process performance	
3 Defined	the organization has a defined common process which includes the collection of common product and process metrics	
2 Managed	the best practices reside in the projects	

Level 2 - Measuring the Project

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The initial focus for measurement activities is at the project level. As the organization moves toward Level 3, common measures are defined which prove useful for addressing organization and/or enterprise-wide information needs.

Level 3 – Understanding the Organizational Practices

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At Level 3, project data is collected and analyzed across the organization. Thresholds may be set based on good engineering judgment which trigger corrective action

Level 2/3 set the stage for quantitative and statistical management

- Repeatable, Consistent Processes
- Adequate Resources
- Defined, Consistent Process Measures
- Data Collected From Above Process
- Assurance of Process Compliance

Level 4 – Characterizing and Stabilizing the Process

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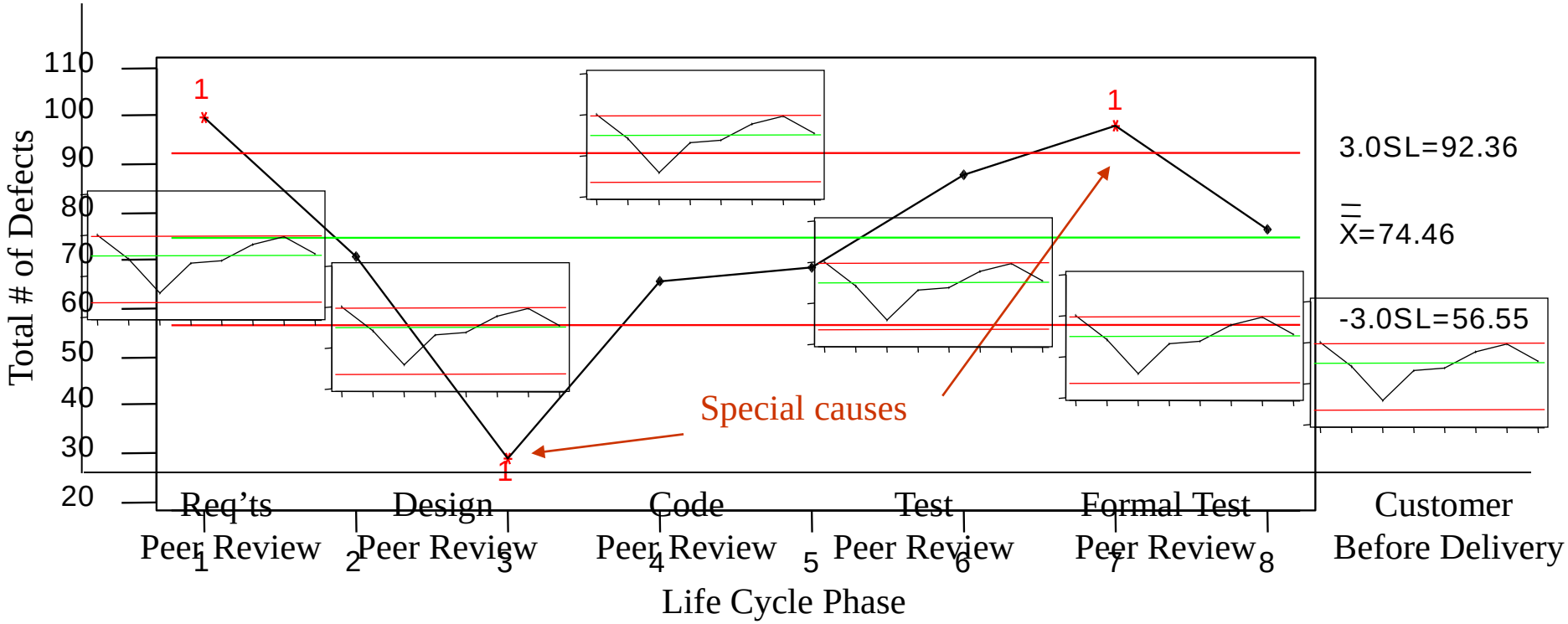
At maturity level 4, quantitative and statistical techniques are used to manage process performance and product quality. Quality and process performance is understood in statistical terms. Special causes of process variation are identified and, where appropriate, the sources of special causes are corrected to prevent future occurrences.



Level 4 – Characterizing and Stabilizing the Process

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When performance falls outside normal range of process performance

- Identify the reason
    - Take corrective action when appropriate

A critical distinction between maturity level 3 and 4 is the predictability of process performance. At maturity level 4, the performance of processes is quantitatively predictable and controlled using statistical and other quantitative techniques

Level 5 - Optimizing the Process

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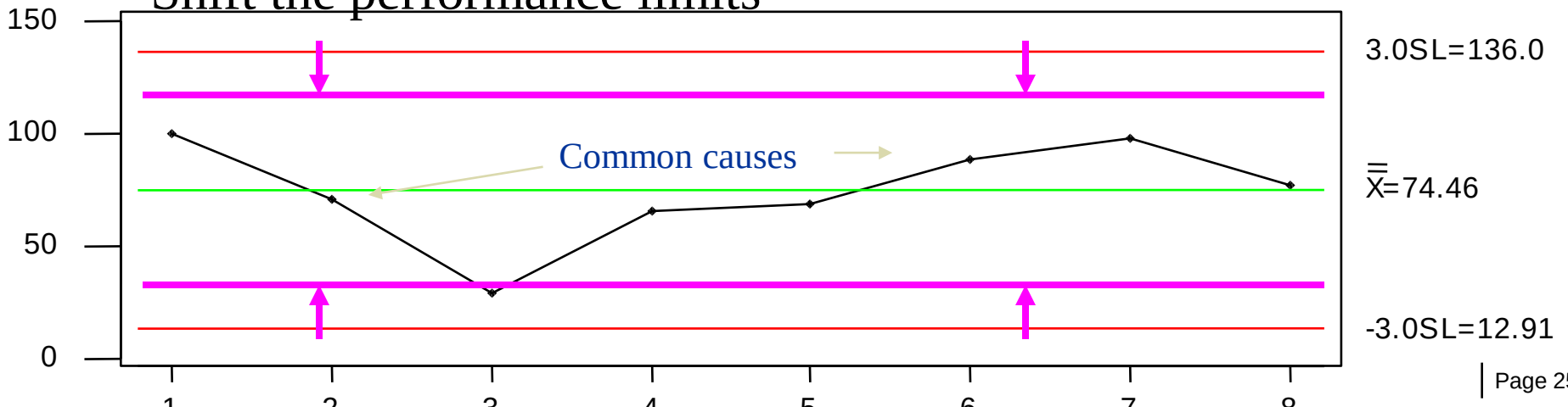
At maturity level 5, an organization continually improves its processes based on a quantitative understanding of the common causes of variation inherent in processes to maximize the probability of achieving its goals

When performance is within normal range of process performance but unable to meet the established objectives

- Narrow the performance limits
- Shift the performance limits



Am I Acting 4 or 5?

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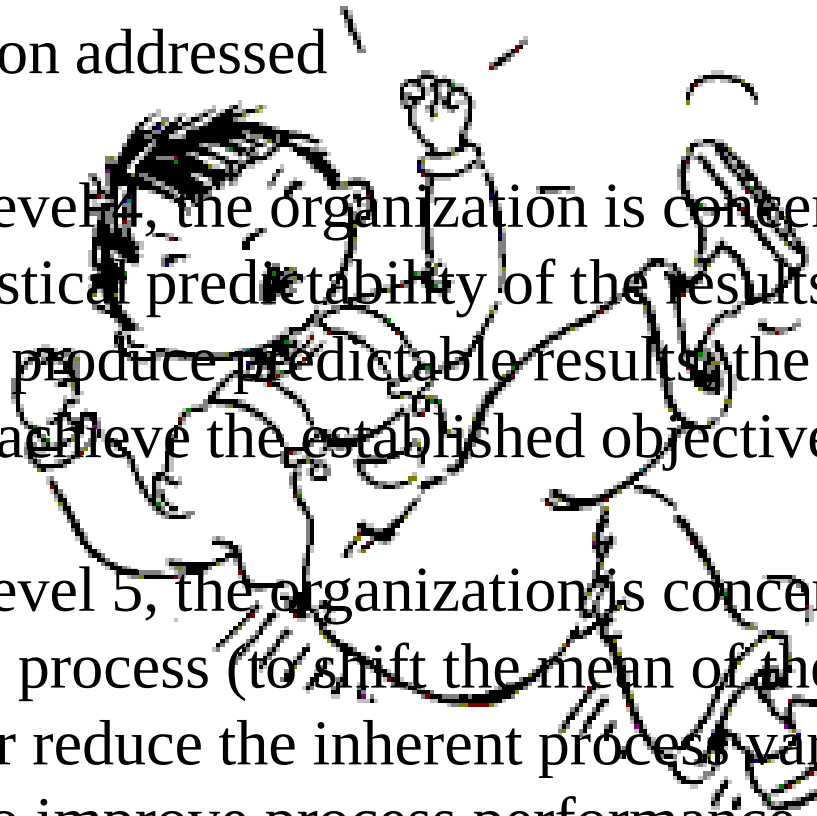
A critical distinction between levels 4 and 5 is the type of process variation addressed



• At maturity level 4, the organization is concerned with providing statistical predictability of the results. Although processes may produce predictable results, the results may be insufficient to achieve the established objectives

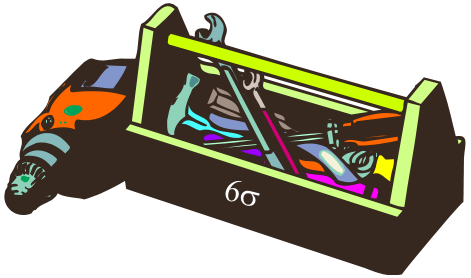
• At maturity level 5, the organization is concerned "bumping" the process (to shift the mean of the process performance or reduce the inherent process variation experienced) to improve process performance and to achieve the established quantitative process-improvement objectives

Six Sigma Tools Enable Levels 4 and 5

Six Sigma methodology provides the tools that enable high maturity

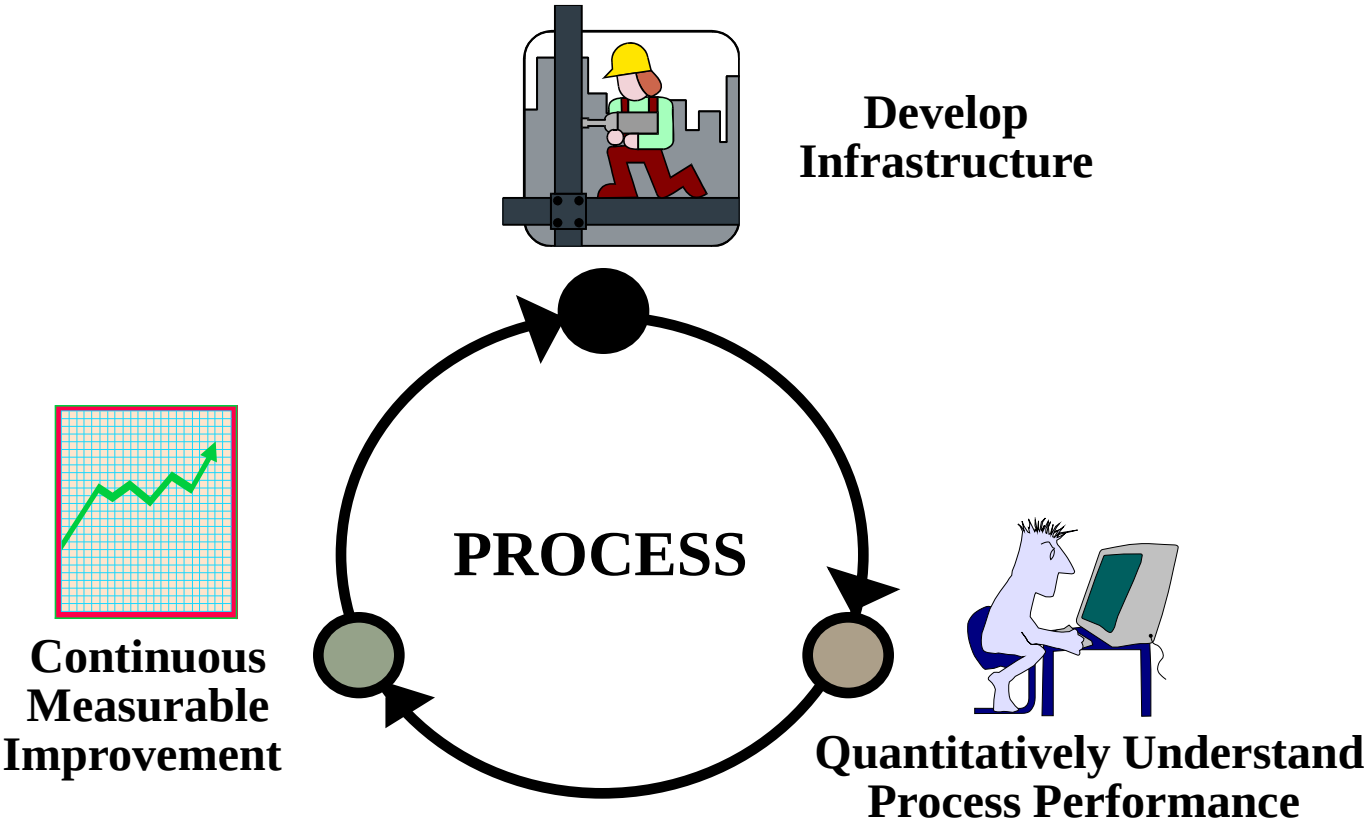
- **Quantitative Project Management,**
- **Organization Process Performance**
- **Causal Analysis and Resolution**
- **Organizational Innovation and Deployment**

CMMI provides a “process wrapper” to effectively and efficiently use the Six Sigma toolbox



A Level 5 organization is one that has implemented, among other things, statistical management

Applying Six Sigma



Develop Infrastructure

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- **Commitment to Process Improvement**
  - Repeatable, Consistent Process
  - Adequate Resources
  - Defined, Consistent Process Measures
  - Data Collected From Above Process
  - Assurance of Process Compliance

Only required for the window you are looking through

Quantitatively Understand Process Performance

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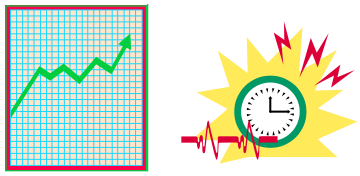
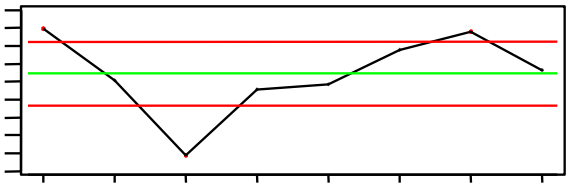
Use Six Sigma tools to identify sources of variation (quantitatively understand process performance) and then act to eliminate or reduce those sources



Measurements of process performance on project

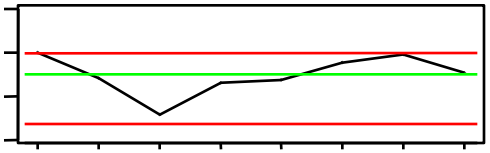
Quantitatively understand the process performance



Discover sources of variation

Implement improvements

Determine the magnitude of the effects due to process changes



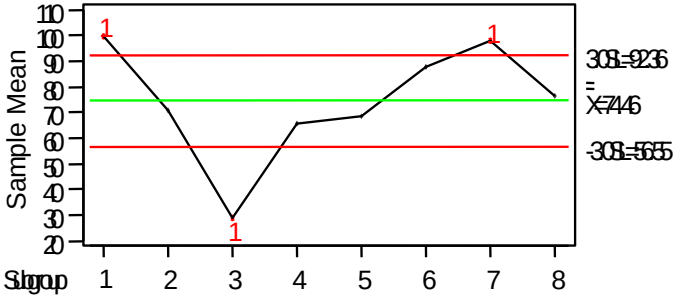
Monitor the impact

Six Sigma – Real Life Example

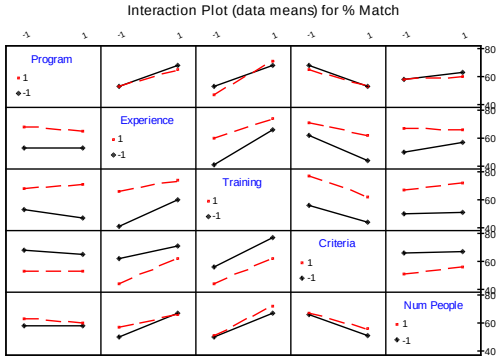
Measurements

	Planning	Customer Rqmts	Rqmts Analysis	Design	Implementation	Test	Formal Test	Customer Before	TOTAL	Leaked
Planning	2.03	0	0	0	0	0	0	0	2.03	0
Customer	0	1.8	1.4	0	4.06	0	16.15	0	23.41	21.61
Rqmts. Analysis	0	0	7.32	12.04	32.77	41.6	56.09	0.79	150.61	143.29
Design	0	0	0.13	41.99	8.2	23.2	118.94	5.28	197.74	155.75
Implementation	0	0	0.17	0.5	154	90.3	88.88	23.3	357.15	203.15
Test	0	0	0	0.16	0.03	19.92	4.5	0	24.61	4.69
Formal Test	0	0	0	0	0	2.34	149.25	0	151.59	2.34
Customer Before	0	0	0	0	0	0	2.7	13.6	16.3	13.6
TOTAL	2.03	1.8	9.02	54.69	199.06	177.36	436.51	42.97	923.44	544.43

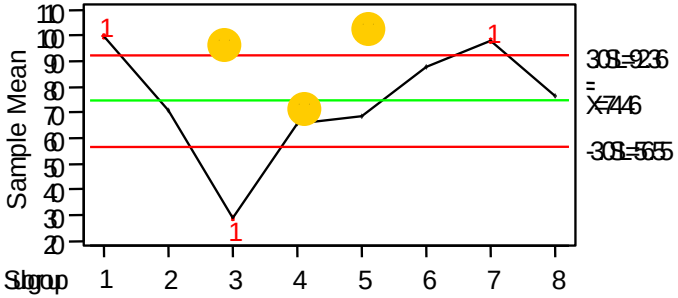
Statistically understand



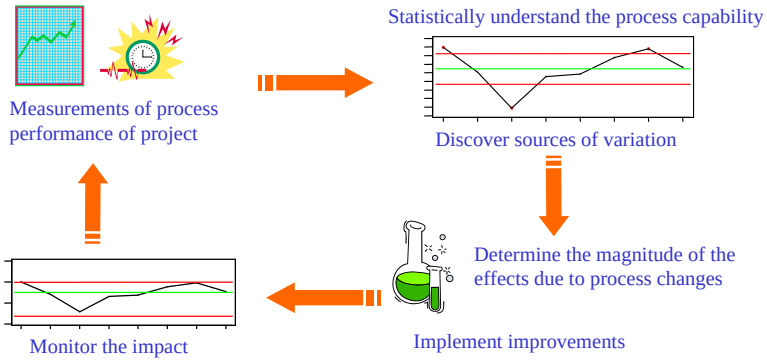
Determine the magnitude



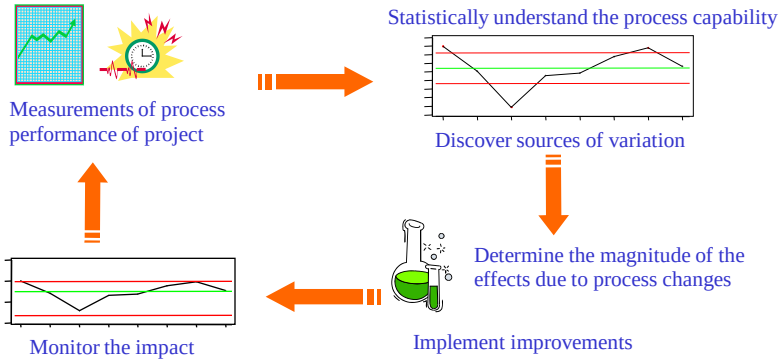
Monitor the impact



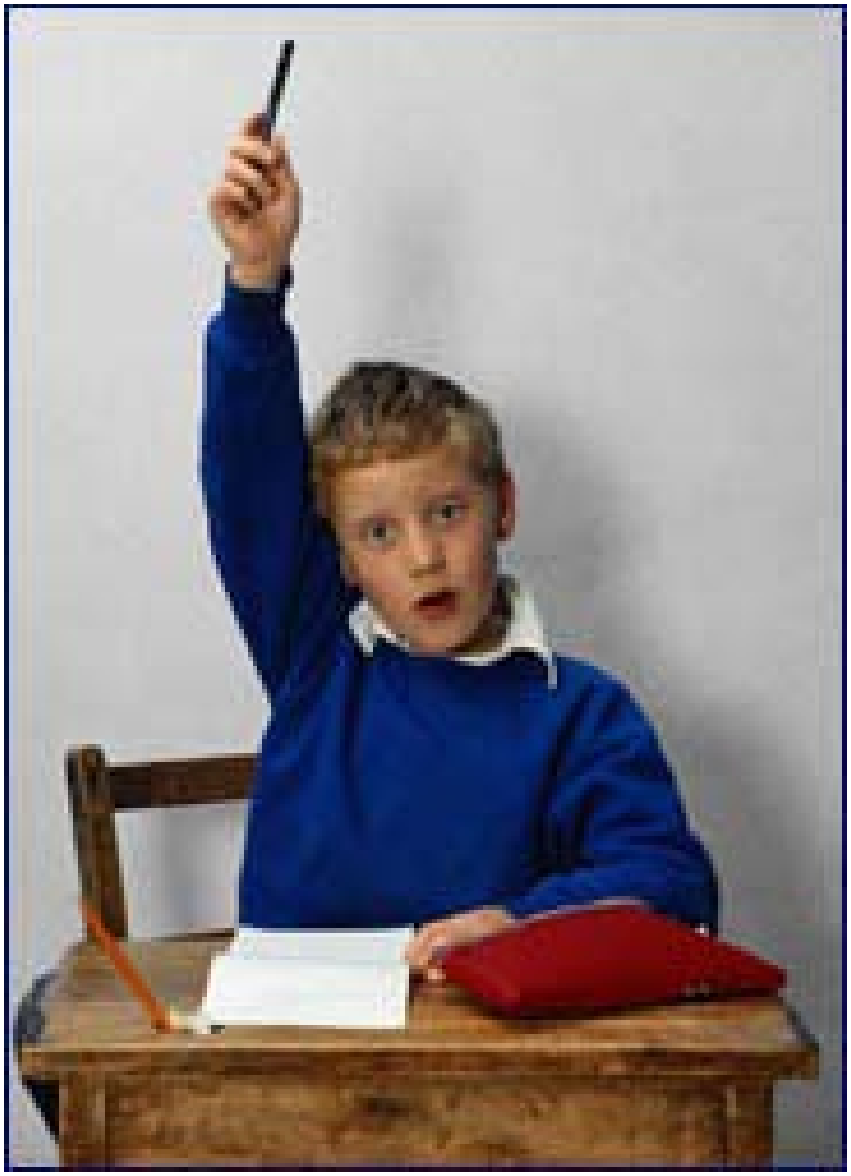
Continuous Measurable Improvement



- Can be next biggest hitter
- Can be next quickest
- Can be next logical problem
- Can be anything the org. determines



Questions



That's All Folks

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