

# 6-Sigma Applied to IT

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Director, IT 6-Sigma Deployment &  
Master Black Belt

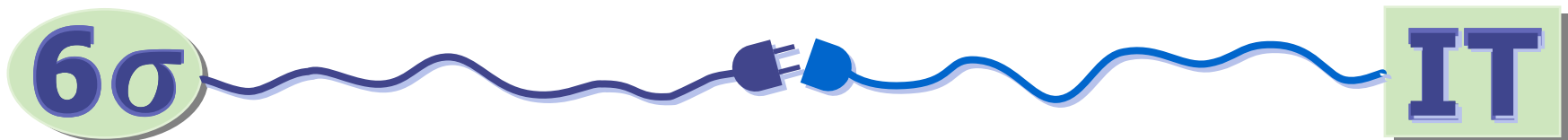
Ford Motor Company

September 9, 2004  
Oakland University



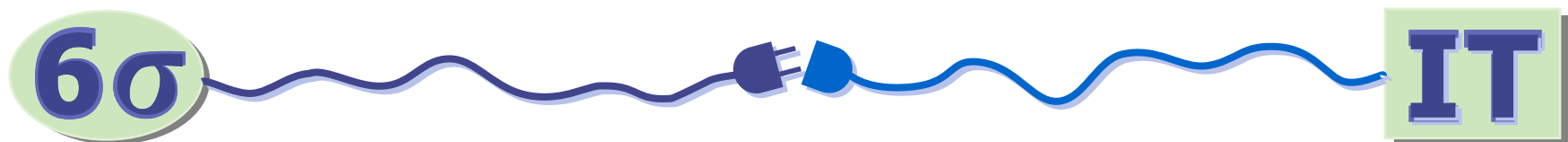
# Key Discussion Topics

- Strategic application of 6-Sigma within the IT Organization
- Applying 6-Sigma for IT Process Improvement
- Applying 6-Sigma for IT Product Improvement
- Design For 6-Sigma: Building in Capability

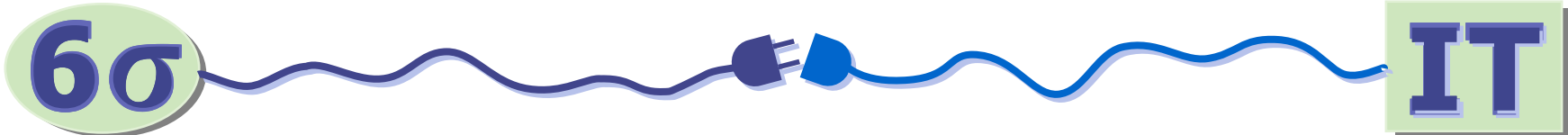
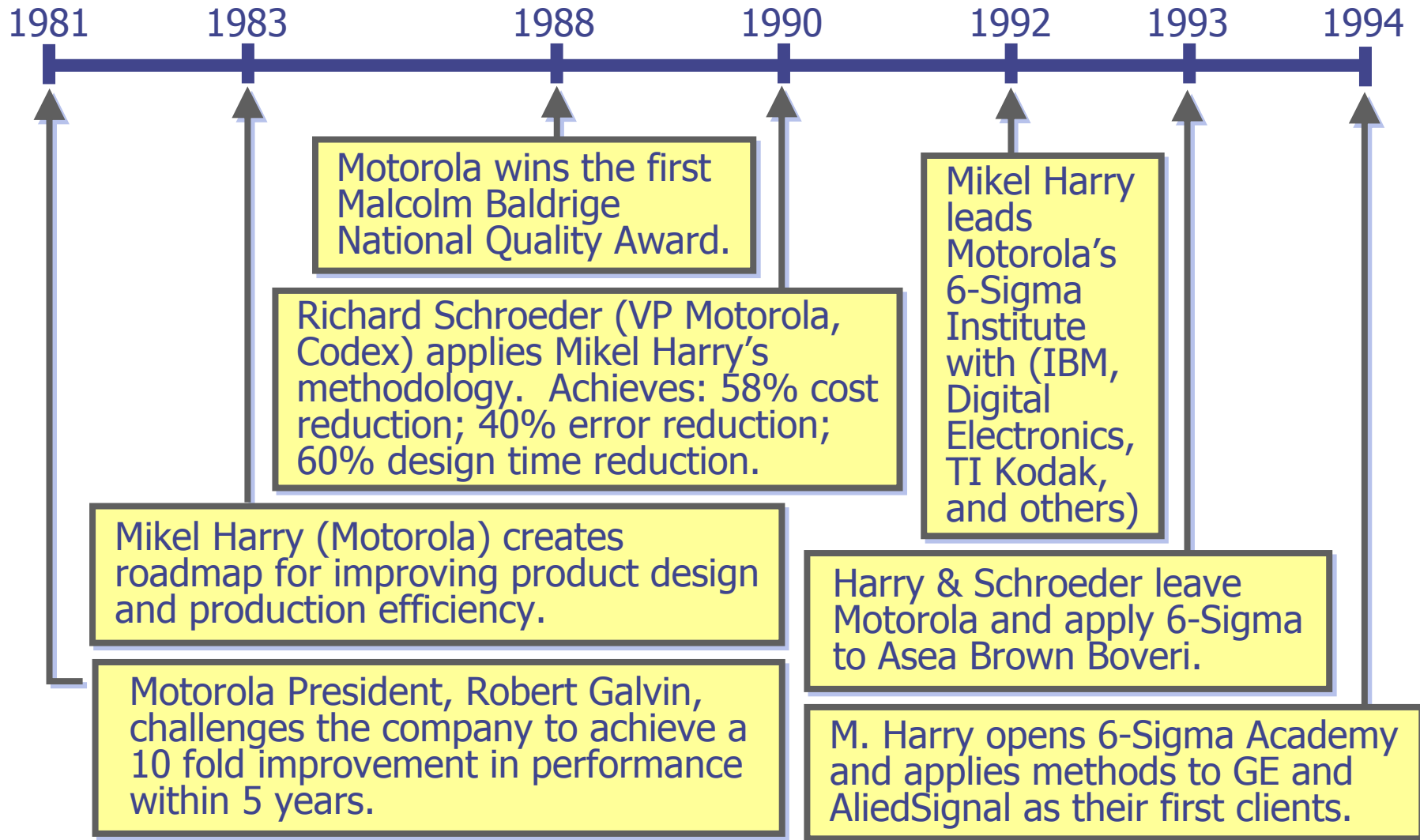


# What is 6-Sigma?

- The goal of 6-Sigma is to increase profits by eliminating variability, defects and waste that undermine customer satisfaction and loyalty.
- It is a disciplined, data-driven and strategic methodology for eliminating defects and improving performance in any process -- from manufacturing to consumer services and from business strategy development to product creation.



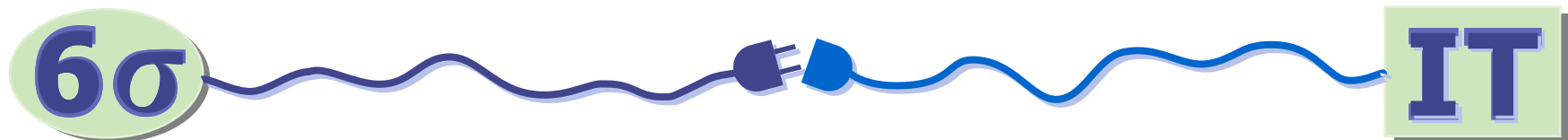
# 6-Sigma Historic Evolution



# Companies Leveraging 6-Sigma

(iSixSigma.com message board - Monday, 7th April 2003)

3M, A.B. Dick Company, Abbott Labs, Adolph Coors, Advanced Micro Devices, Aerospace Corp, Airborne, Alcoa, Allen Bradley, Allied Signal, Ampex, **Apple Computers**, Applied Magnetics, ASQC, Atmel, Baxter Pharmaseal, Beatrice Foods, Bell Helicopter, Boeing, Bombardier, Borden, Bristol Meyers - Squibb, Bryn Mawr Hospital, Campbell Soup, **Cellular 1**, Chevron, Citicorp, City of Austin, TX, City of Dallas, TX, Clorox, Cooper Ind, Dannon, Defense Mapping Agency, Delnosa ( Delco Electronics in Mexico), **Digital Equipment Corp**, DTM Corp, Eastmen Kodak, Electronic Systems Center, Empak, Florida Dept. of Corrections, Ford Motor Company, GEC Marconi, General Dynamics, General Electric, Hazeltine Corp, **Hewlett Packard**, Holly Sugar, **Honeywell**, **Intel**, Junior Achievement, Kaiser Aluminum, Kraft General Foods, Larson & Darby, Inc, Laser Magnetic Storage, Lear Astronics, Lenox China, **Litton Data Systems**, Lockheed Martin, **Loral**, Los Alamos National labs, Martin Marietta, McDonnell Douglas, Merix, **Microsoft**, Morton Int'l, **Motorola**, **NASA**, Nat'l Institute of Corrections, Nat'l Institute of Standards, **Nat'l Semiconductor**, Natural Gas Pipeline Company of America, Northrop Corp, PACE, Parkview Hospital, Pentagon, Pharmacia, PRC, Inc, Qualified Specialists, Ramtron Corp, Rockwell Int'l, Rohm & Haas, Seagate, Society of Plastics Engineers, Solar Optical, Sony, Star Quality, **Storage Tek**, Symbios Logic, Synthes, **Technicomp**, Tessco, Texaco, Texas Commerce Bank, Texas Dept. of Transportation, **Texas Instruments**, Titleist, Trane, TRW, Ultratech Stepper, United States Air Force, United States Army, United technologies, UPS, USAA, **Verbatim**, Walbro Automotive, Walker parking, Woodward Governor, **Xerox**, and many others.



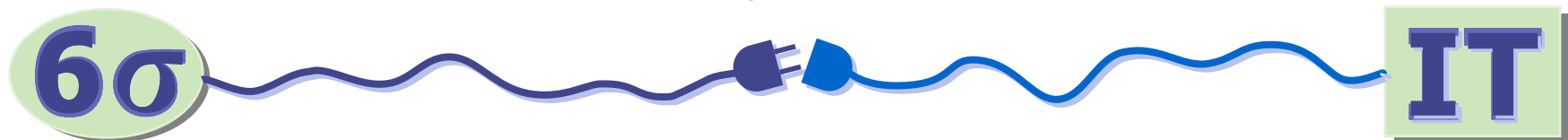
# 6-Sigma Objective

To implement a measurement-based strategy that focuses on process improvement and variation reduction through the application of 6-Sigma projects.

This is accomplished through the use of two 6-Sigma sub-methodologies: DMAIC and DMADV.

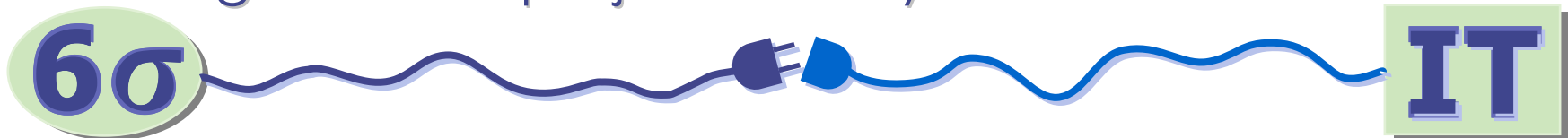
- ❑ The DMAIC method (Define, Measure, Analyze, Improve, Control) is an improvement system for existing processes that require significant incremental improvement.
- ❑ The DMADV method (Define, Measure, Analyze, Design, Verify) is an improvement system used to develop new processes or products at 6-Sigma quality levels. It can also be employed if a current process requires quantum level improvements.

Both 6-Sigma methods are executed by Green Belts and Black Belts, and are overseen by Master Black Belts.

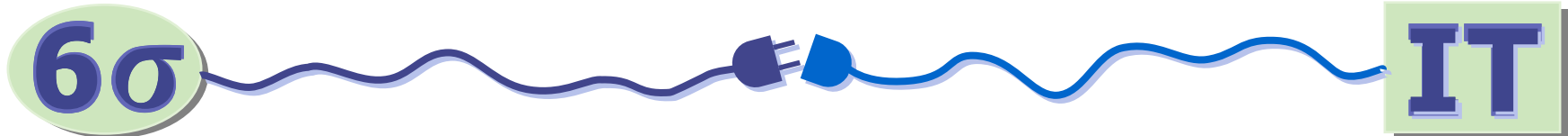
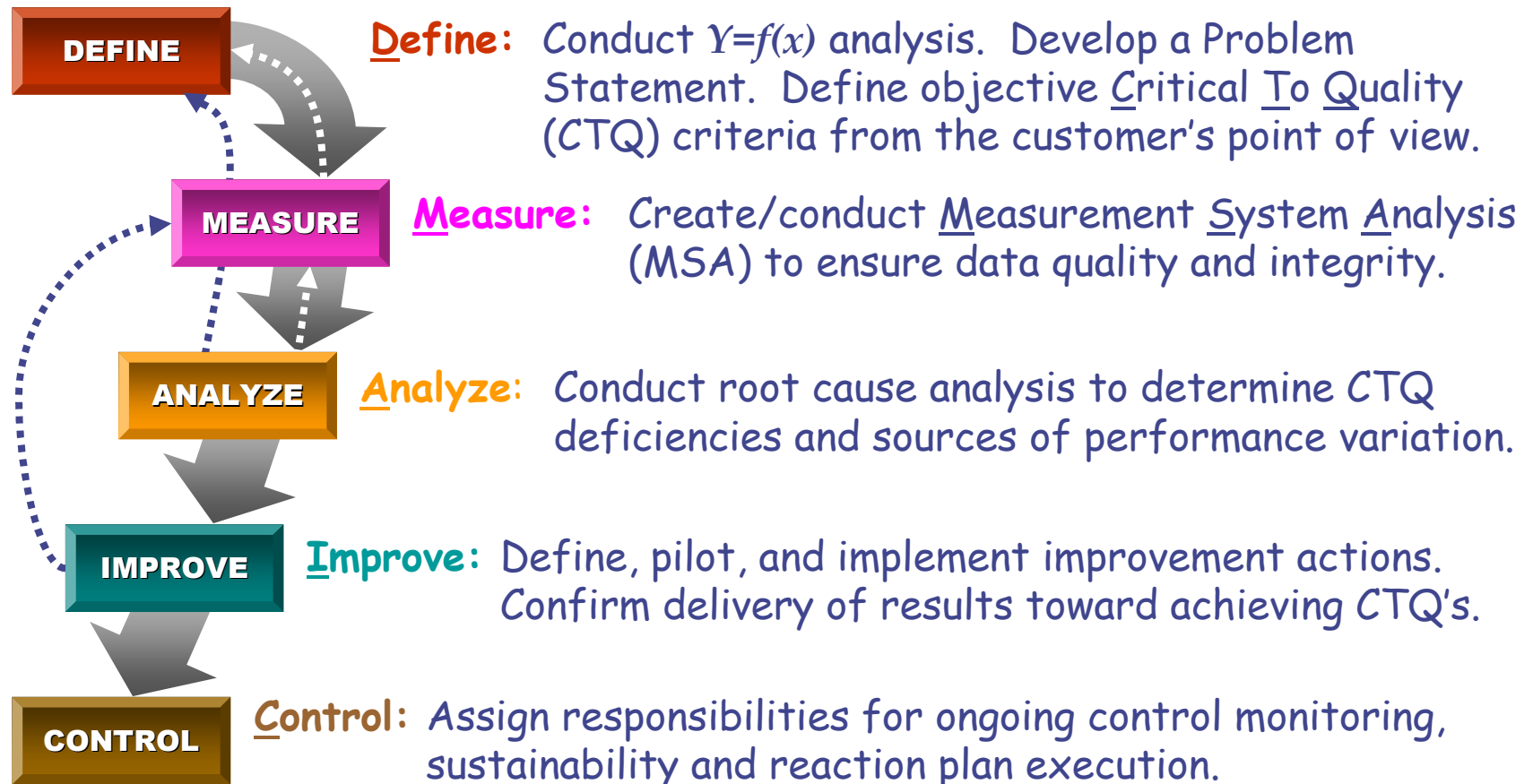


# Key Roles & Responsibilities

- ❑ **Green Belts** make up SME's on project teams and execute.
- ❑ **Black Belts** lead project teams and drive the 6-Sigma methodology.
- ❑ **Master Black Belts** mentor at all levels and drive management to maximize 6-Sigma leverage.
- ❑ **Process Owners** are engaged and are seeking solutions to their problems.
- ❑ **Project Champions** remove roadblocks and drive key business priorities that they own.
- ❑ **Executive Leaders** lead by example and drive alignment of projects to key business enablers.

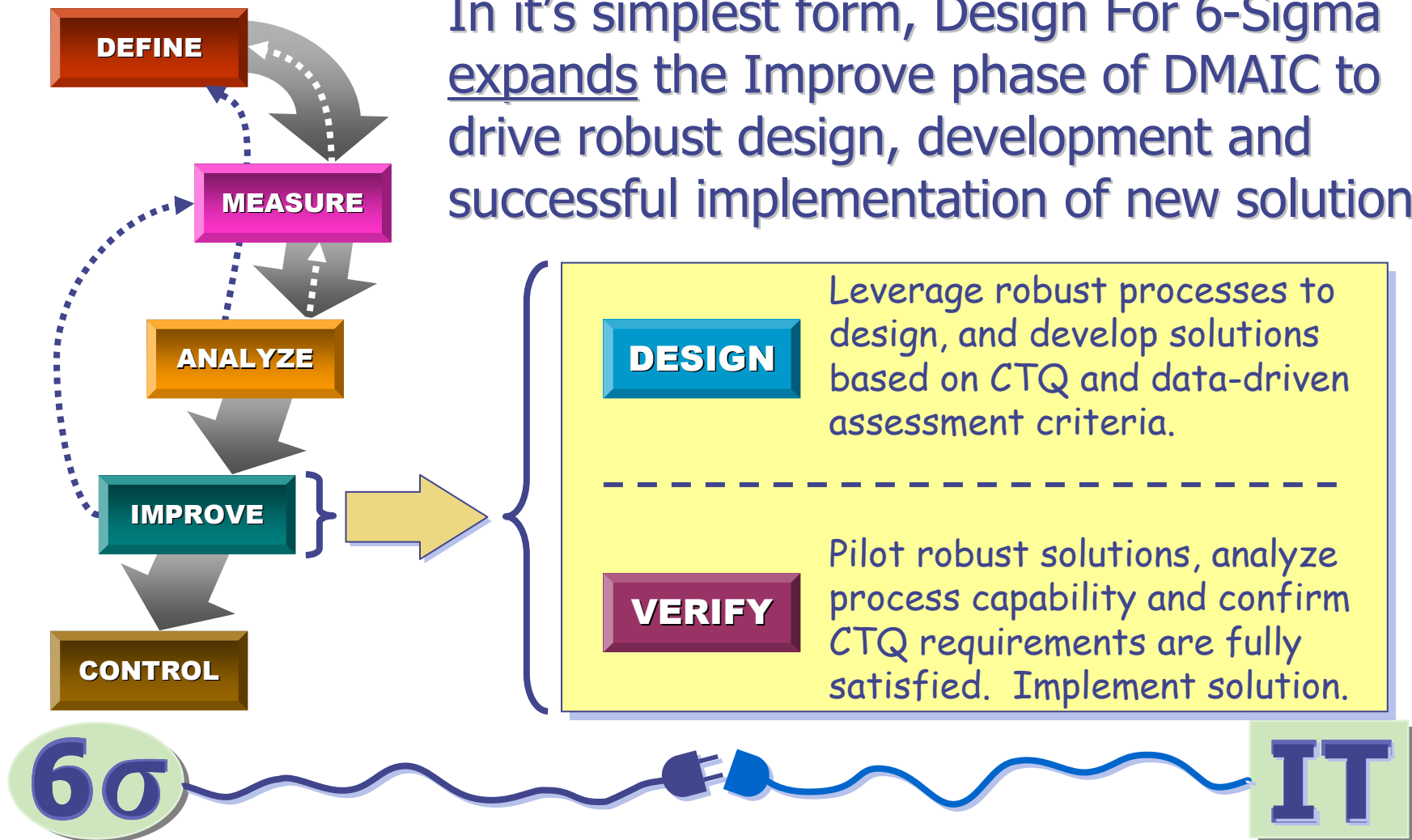


# DMAIC Method Description



# DMADV Method Description

In it's simplest form, Design For 6-Sigma expands the Improve phase of DMAIC to drive robust design, development and successful implementation of new solutions.



# 6-Sigma Application to: IT Products and Services

## Strategic Planning

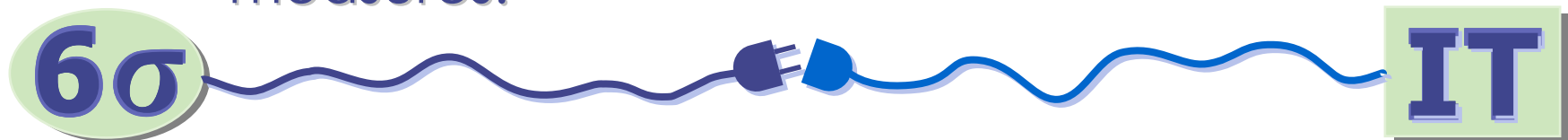
- Mutual understanding of customer needs (present and future) and deeper insight into the application of technology trends

## Product Improvement

- High quality, cost effective products and services that meet the needs first time through.

## Building in Capability

- Products and Services have built-in control mechanisms with feedback and monitoring loops driving robust proactive and reactive measures.



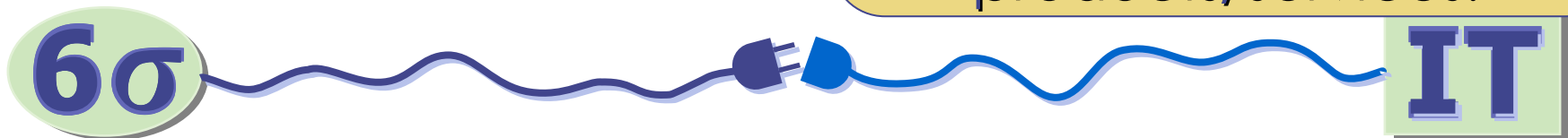
# Leveraging & Applying 6-Sigma for IT Product Improvement

## VOC Customer Satisfaction Drivers

- Managed Relationships
- Required/Desired Functionality
- Bug Free
- Ease of Use
- Delivery – on time and to promise
- Competitive costs

### ***Translate VOC into CTQ's to Determine Key Measures***

Need to focus our 6-Sigma efforts on our IT Processes that drive the satisfaction/value equation of our products/services.



# Getting to the bottom of Customer Satisfaction

What Matters Most to the Customer?

VOC



Qualitative



CTQs



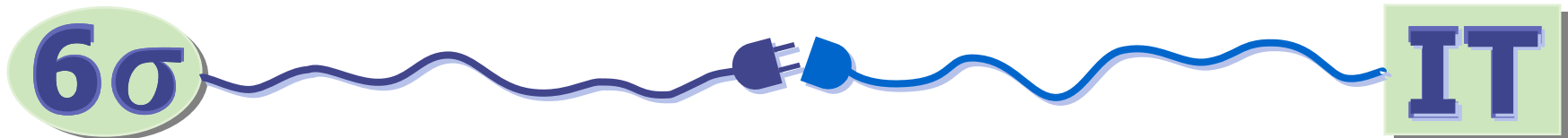
Quantitative



Metrics



Objective  
Measures



# Requirements Map to CTQs

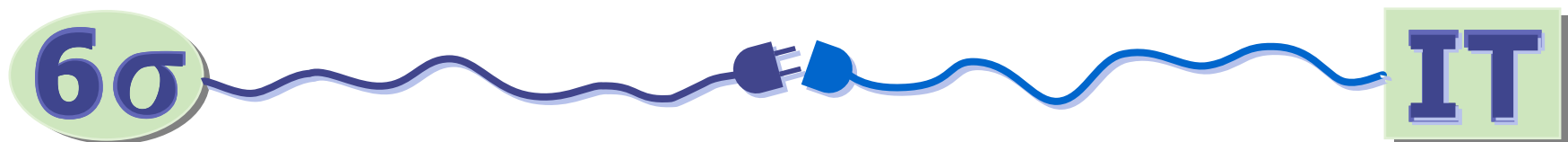
Reqs  $\neq$  CTQs

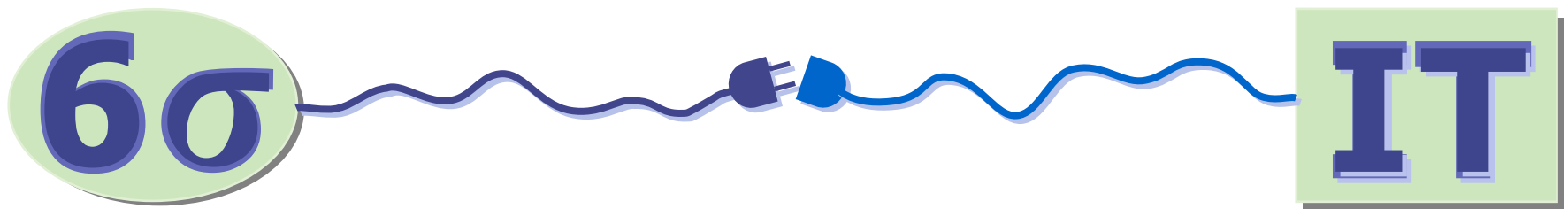
Reqs  $\longrightarrow$  CTQs



*This says many requirements are often used to develop one CTQ*  
It's a many to one relationship

All are tied to Business Need





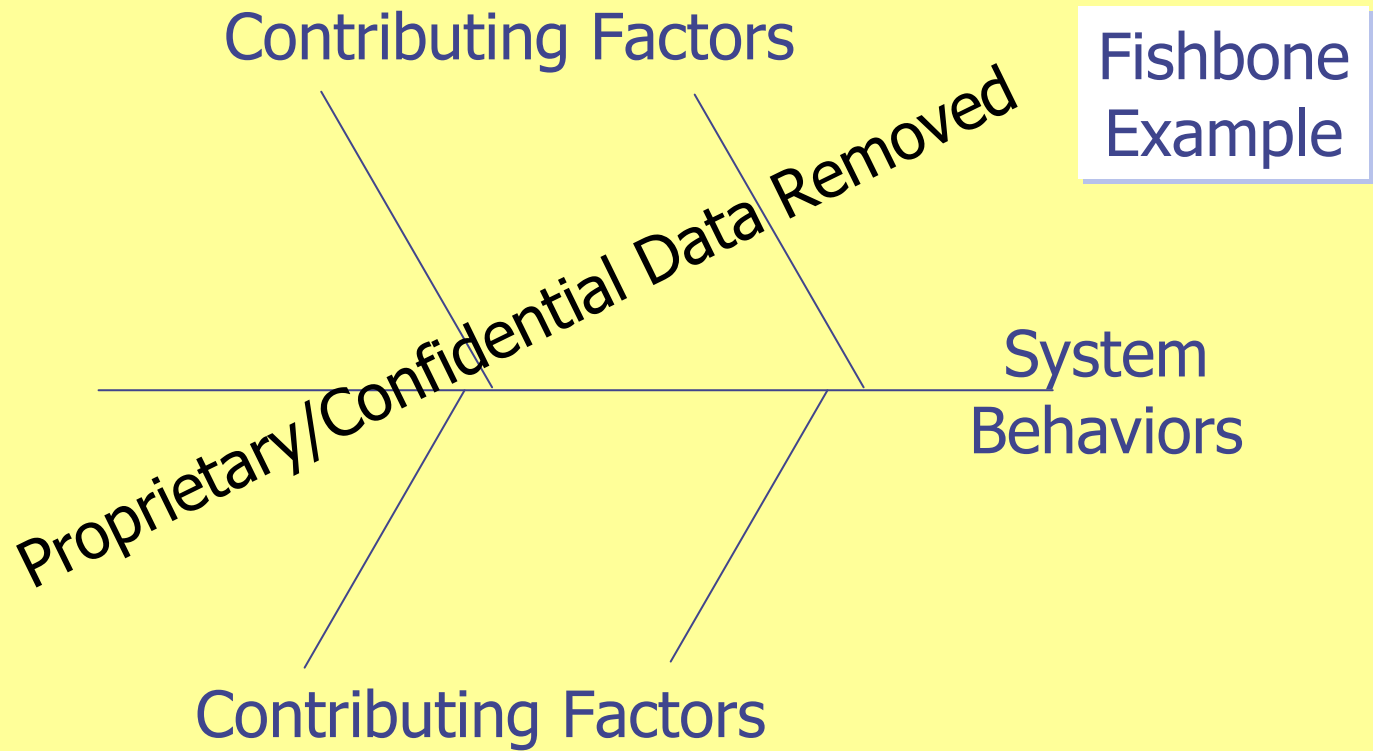
## **A Few Real Examples ...**

Client/Server Application Issues

Mainframe CPU Consumption Issue

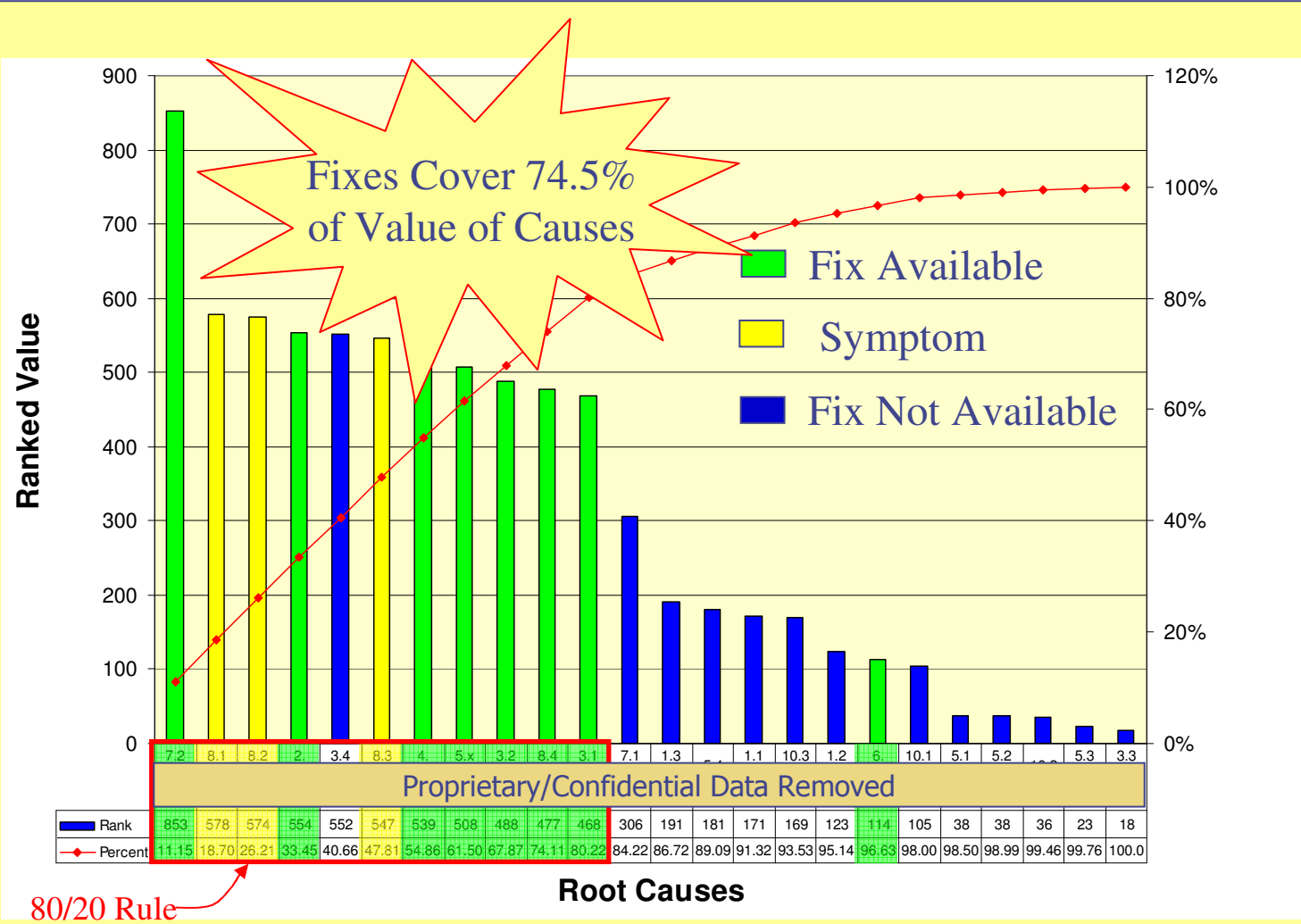
# Client/Server System: System Behavior Issue Resolution

Map the System Behaviors to identify relationships





# Client/Server System: System Behavior Issue Resolution

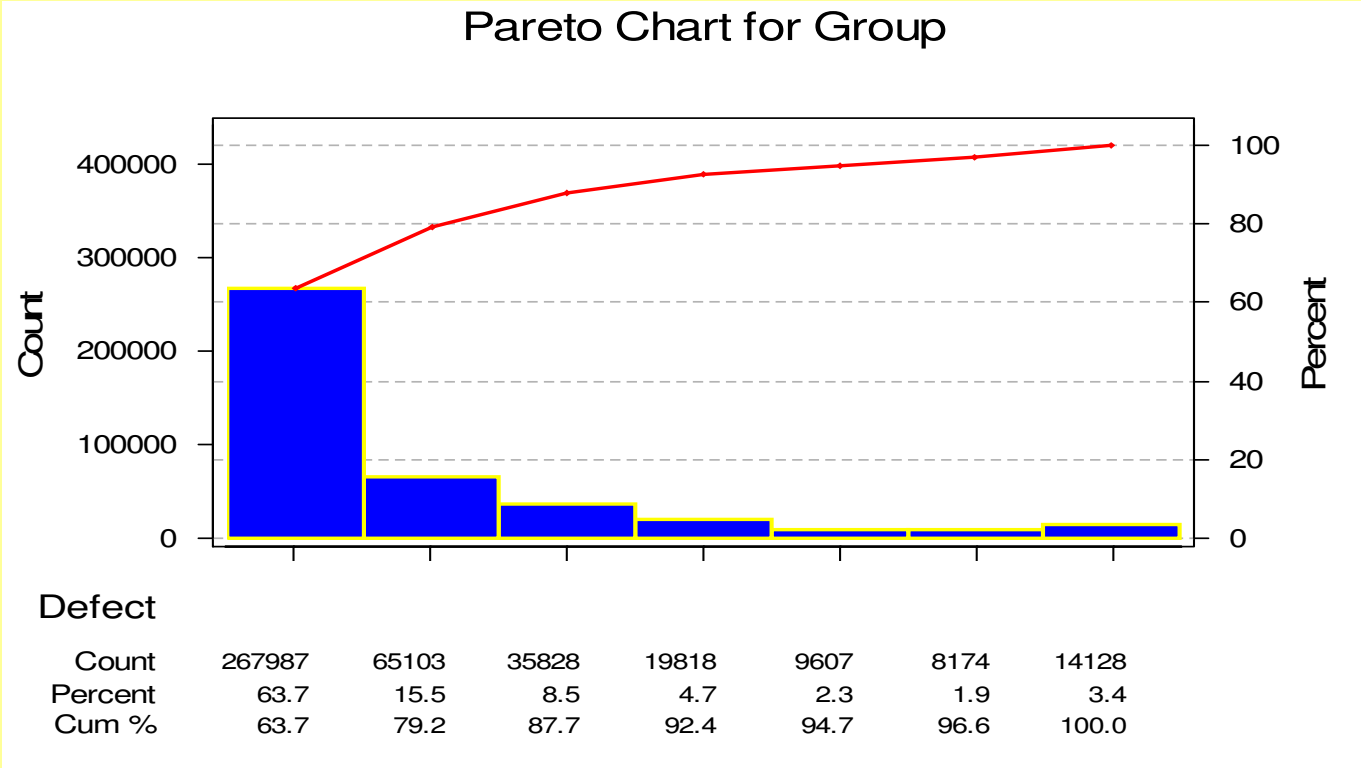


# Client/Server System: System Behavior Issue Resolution

## DPMO Performance Calculations Defects Per Million Opportunities

	<u>Before</u>	<u>After</u>
<u>DPMO</u>		
System 1	303,111	119,173
System 2	210,381	78,488
<u>Sigma</u>		
System 1	2.02	2.68
System 2	2.31	2.98

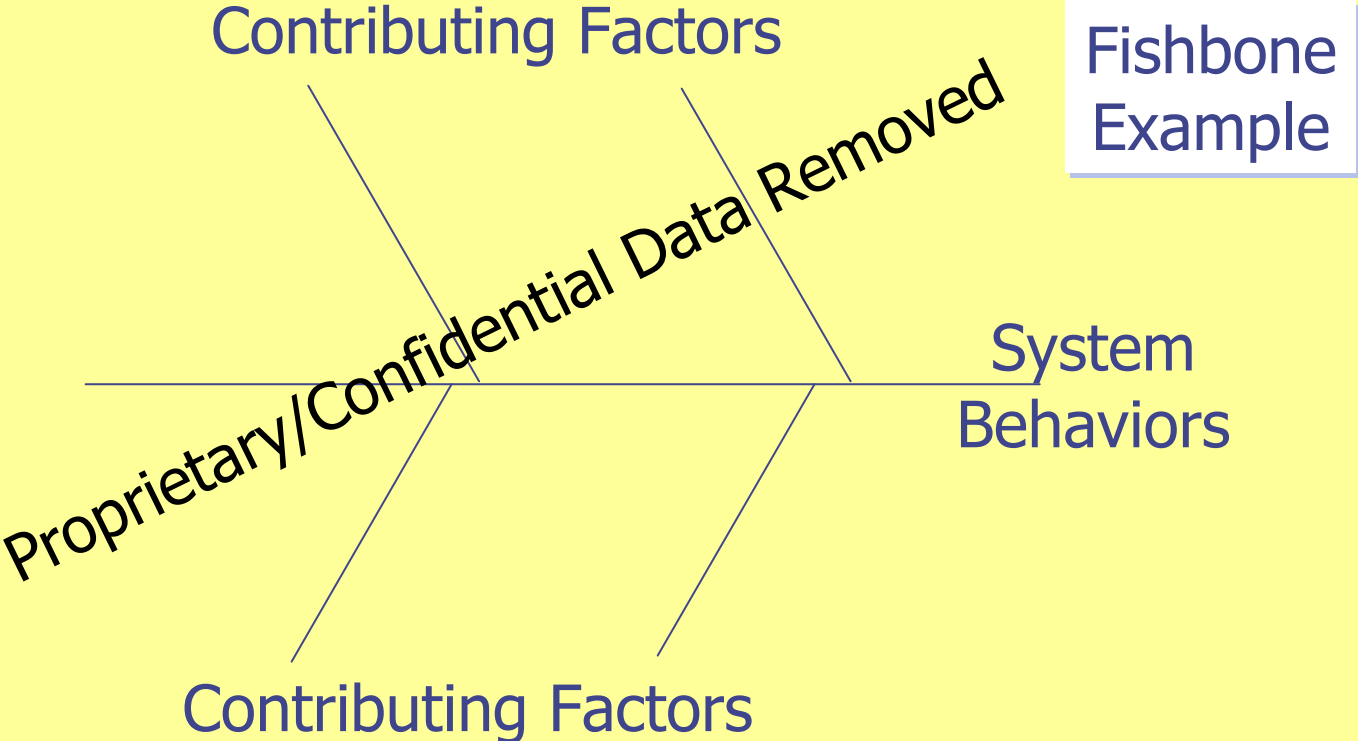
# Mainframe Application: CPU Consumption Project



**Top 5 programs consumed 64% of the Total CPU consumed by all the programs**

# Mainframe Application: CPU Consumption Project

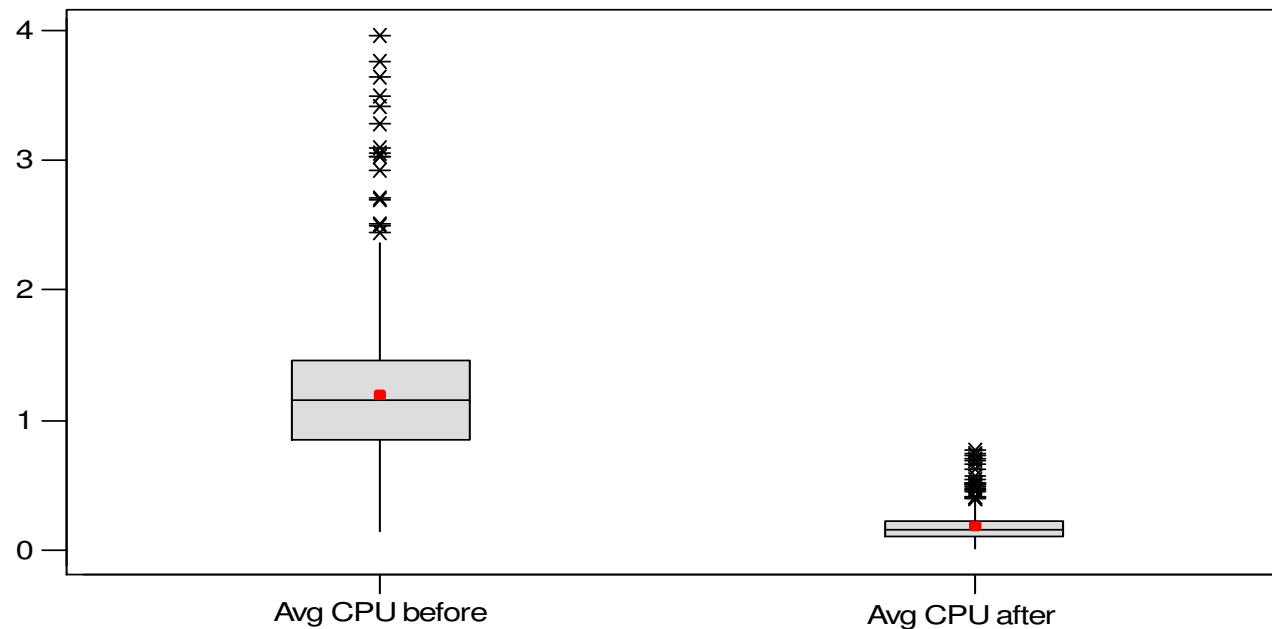
## Cause & Effect Diagram



# Mainframe Application: CPU Consumption Project

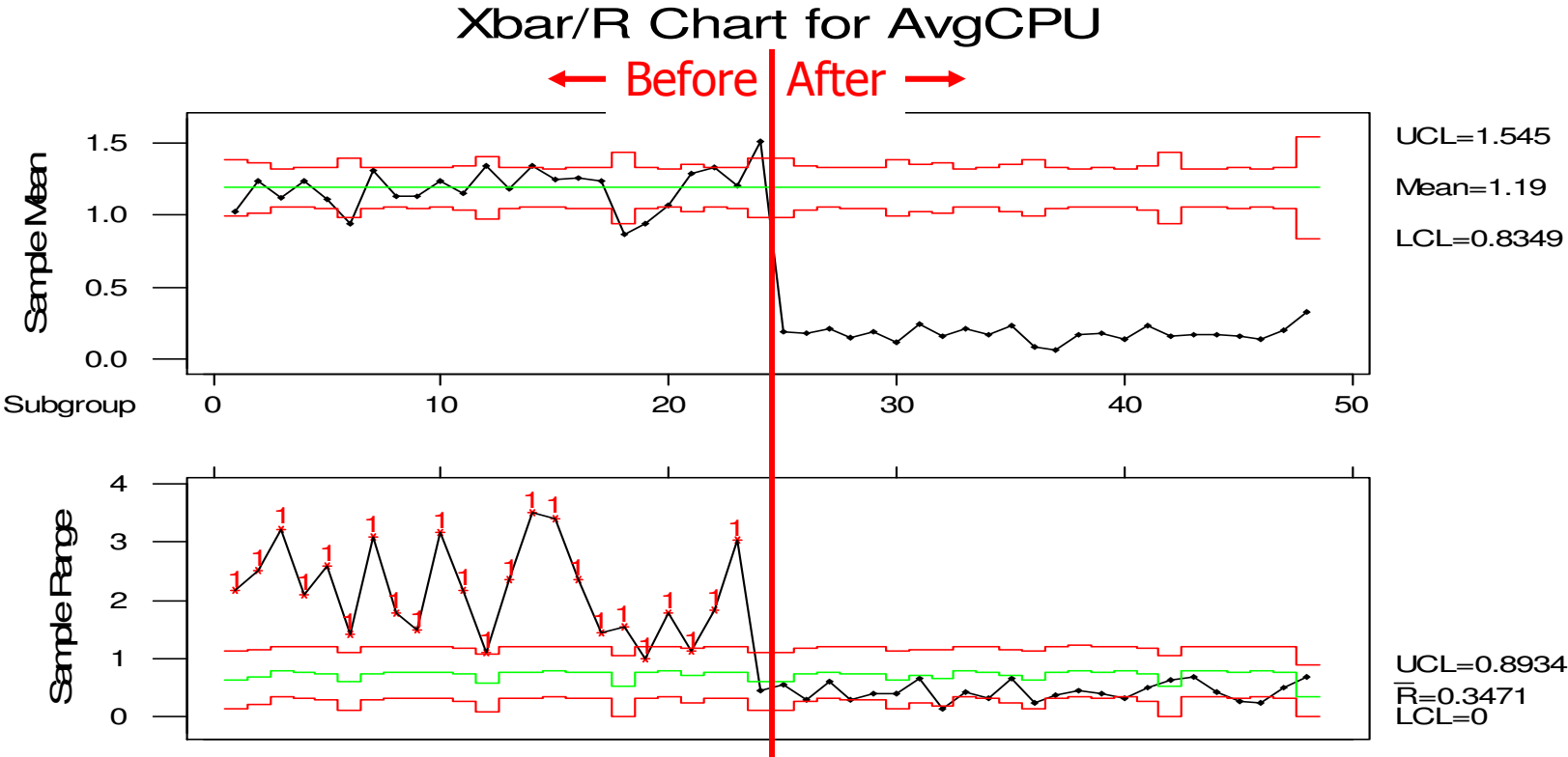
Graphical results of 2 sample t-test on application program

Boxplots of Avg CPU before and Avg CPU after  
(means are indicated by solid circles)



# Mainframe Application: CPU Consumption Project

Control Chart of Ongoing CPU Performance Measures



# 6-Sigma Application to: IT Processes and Methods

## Strategic Planning

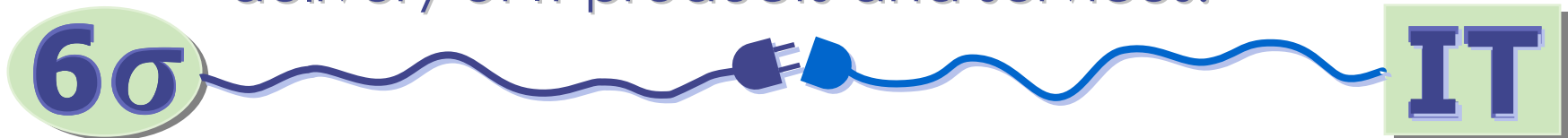
- Top-down alignment of Business and Customer Objectives to IT Goals and Deliverables.

## Process Improvement

- Maximizing efficiency and effectiveness in the IT Systems Development Lifecycle.

## Building in Capability

- Objective Measures drive variability reduction and performance improvements in the internal IT Processes which delivers robust scoping, sizing, forecasting, and ultimate delivery of IT products and services.



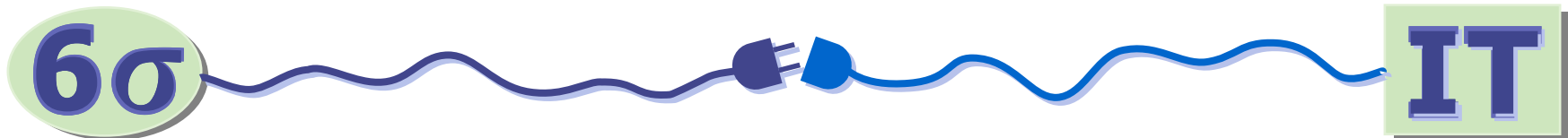
# Leveraging & Applying 6-Sigma for IT Process Improvement

## Defining the Process Metrics


- ❑ Process Step Metrics (timing, \$\$\$, concurrency, cadence)
- ❑ Function Point Metrics
- ❑ Defect Density Algorithms
- ❑ Release cadence (cycles)
- ❑ Mean/Median Time Between Failures
- ❑ Mean/Median Time To Market
- ❑ Application Causal Factors (Code, H/W, Requirements, Configuration, Testing, Packaging, etc.)

### ***These are Proactive Measures***

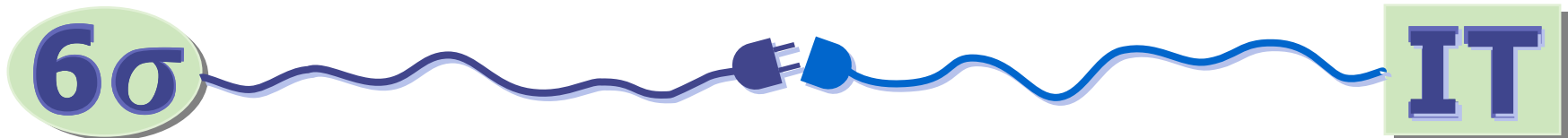
**We need to focus our 6-Sigma efforts on driving consistent process efficiency with robust controls and root cause analysis.**



# Process Capability

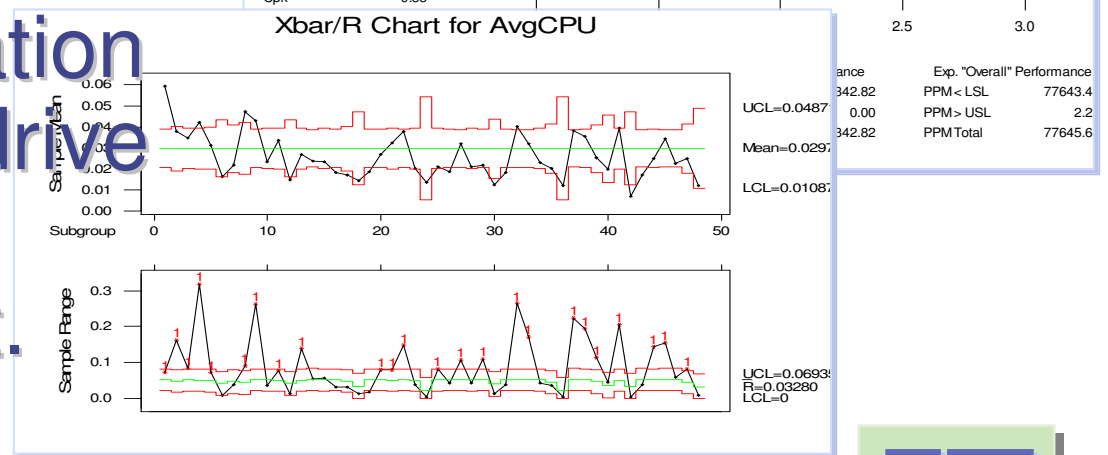
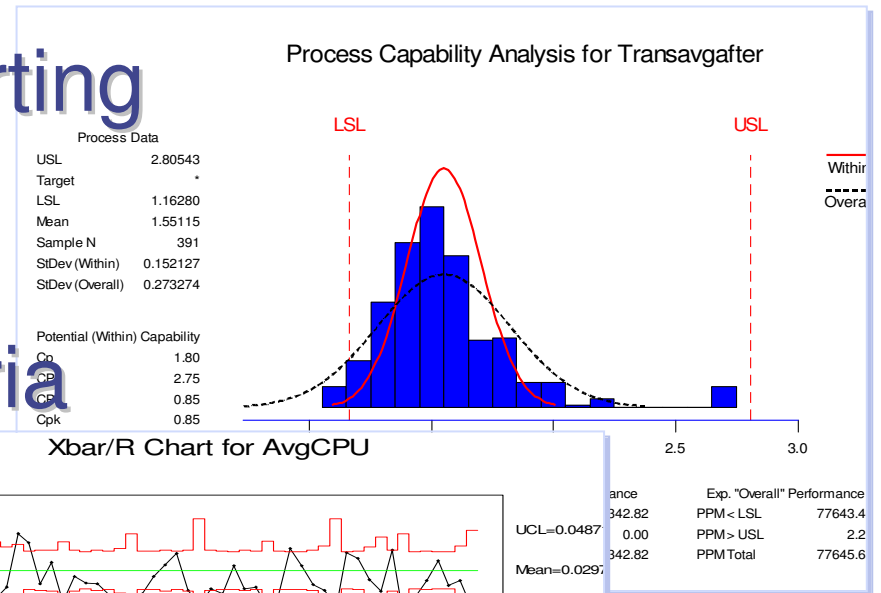
CTQs  Metrics

Metrics are the measures that determine how capable the process is.



# Process Capability

- Appropriate metric selection and reporting dashboards drive desired behaviors.
- Adding target criteria and specification parameters drive performance improvement.

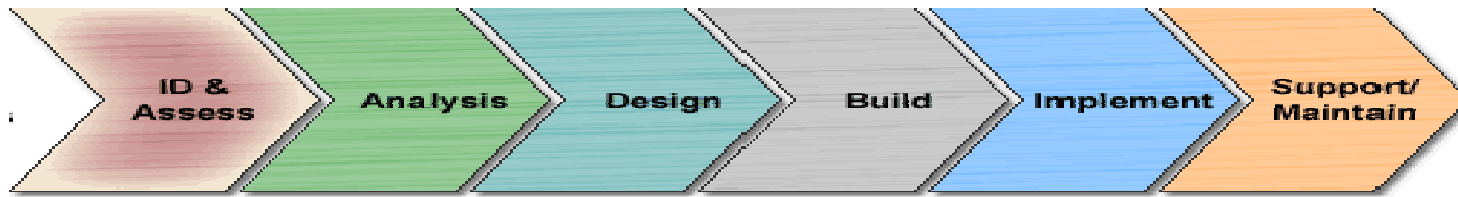


6σ



IT

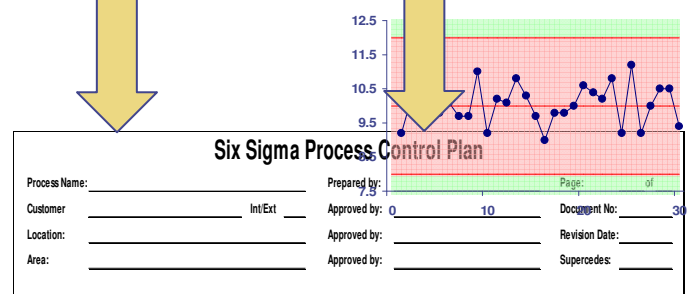
# 6-Sigma Components Map to IT Solution Development



## Voice of the Customer

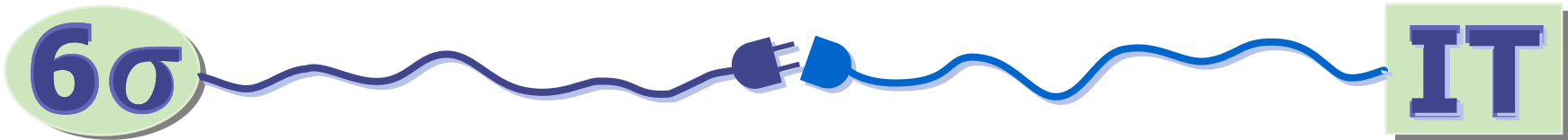


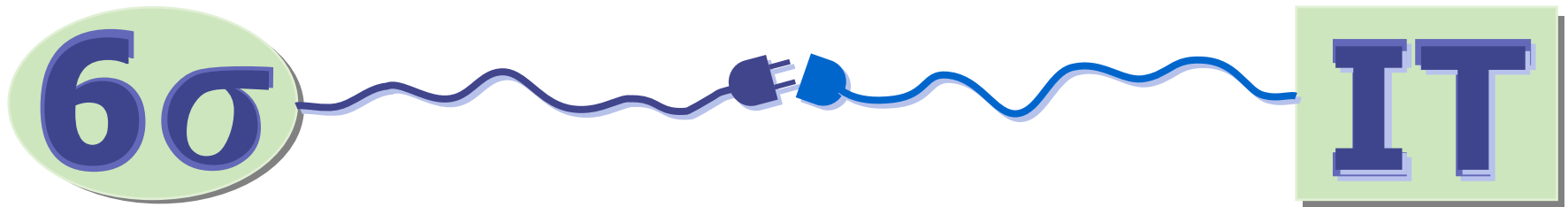
Req'l ID	Customer Critical to Quality Requirements (CTQ's)	Metric	Impact of Non-Performance	Perf. Target Value	USL	LSL	Baseline		Implementation	
							Sigma Value	DPMO	Sigma Value	DPMO
1	Timeliness of Order	Time from order to delivery	User satisfaction w th system will decrease if vehicles are not delivered w hen promised.	45	45					
2	Accuracy of Order	# of Differences from order as specified through web interface.	User satisfaction w th system will decrease if vehicles are not delivered w th build options specified. Missed delivery dates, rework, and a potential for lost sales is introduced.	100%	100%					
3	Damage to Vehicle	# scratched or dented panels on vehicle	User satisfaction w th system will decrease if vehicles have any damage. Warranty costs will increase when damage is introduced.	100%	100%					



Sub Process	Sub Process Step	CTQ		KPIW/KPOV Requirement	Specification Requirement		Measurement Method	Sample Size	Frequency	Who Measures	Where Recorded	Decision Rule/ Corrective Action	SOP Reference
		KPOV	KPIW		USL	LSL							

CTQ's → Process Capability Scorecard → Control Plan



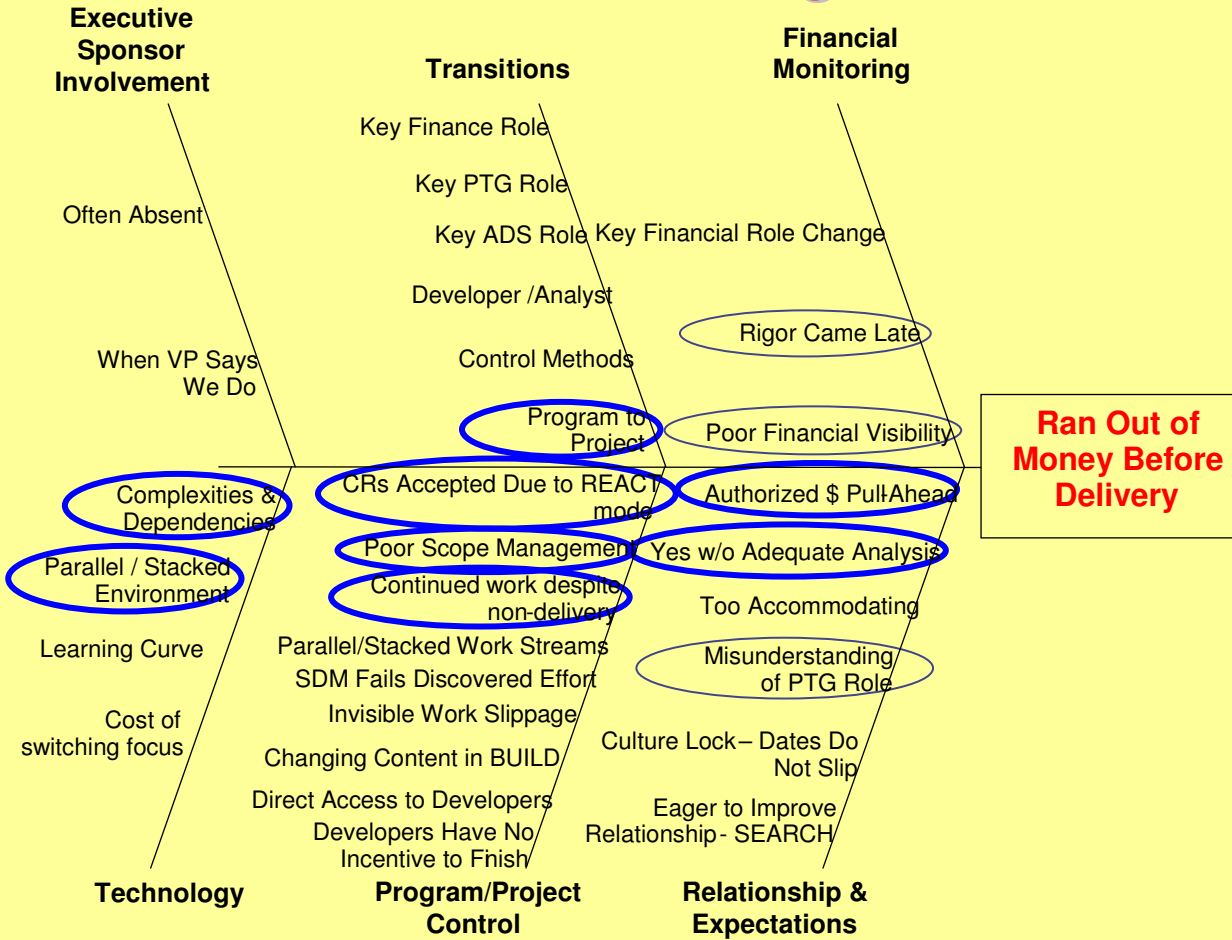


## **A Few More Examples ...**

Scope Creep & Funding Issue Resolution  
Robust Performance Testing Process

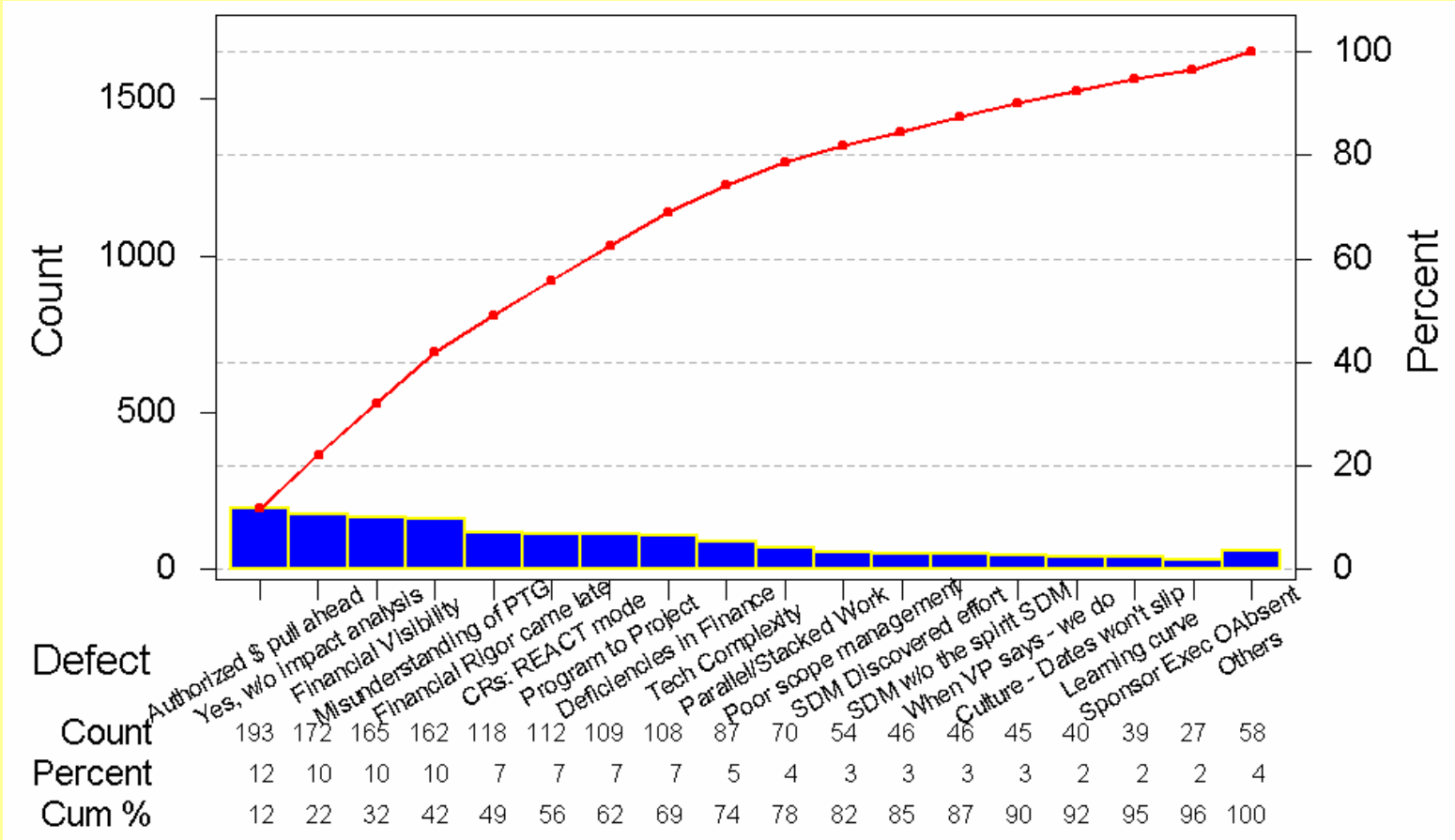
# Strategic Project: Scope Creep & Project Funding Issues

## High Level Cause and Effect Diagram



# Strategic Project: Scope Creep & Project Funding Issues

## Pareto Analysis for Causal Themes





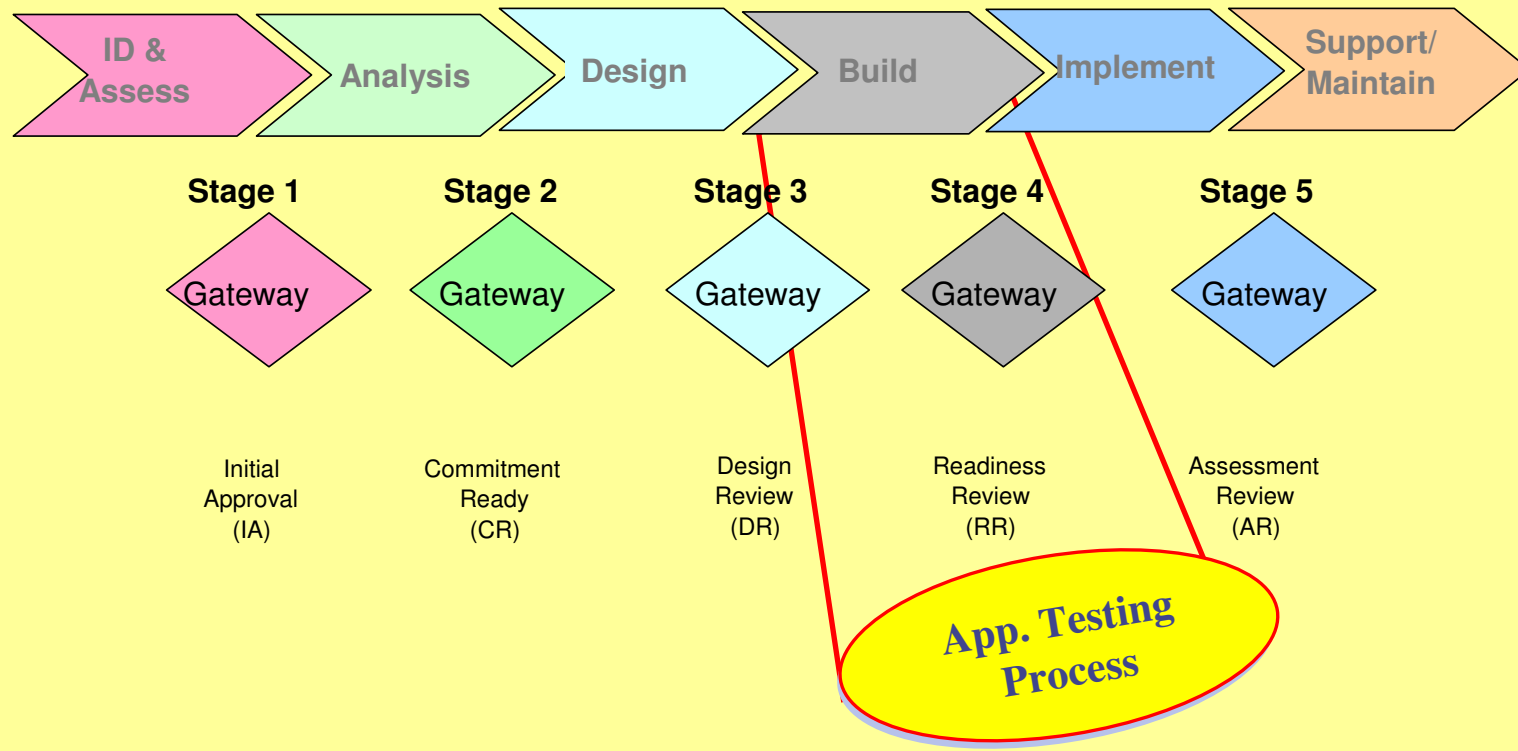
# Strategic Project: Scope Creep & Project Funding Issues

		Too accomodating, eager to improve relationship in light of Search difficulties Yes, w/o impact analysis	Authorized \$ pull ahead	Poor vis into Financial status	Deficiencies /Misunderstanding of Key PTG roles- oversight, interface -Cust had direct access to Dev	Program Level to Project Level Controls without insight into roll up effect	Financial Rigor came late	Complexity and Dependencies
		9	9	9	9	3	3	3
PTG	Advocacy Partner	9	9	9	9	0	0	0
PTG	Enable Customer	9	9	9	9	0	0	0
PTG	Stronger financial discipline	9	9	9	9	0	9	0
PM	Enable/Empower PM beyond status reporting	9	0	0	3	9	1	1
PM	Stick to SDM	9	0	0	1	1	0	3
FIN	Financial representation at OCM	3	3	3	0	0	3	0
PM	Chunk for Delivery	3	0	0	1	3	0	9
EXEC	Stronger Executive sponsorship engagement	1	3	1	0	3	1	0
TECH	More conservative approach when delivering new technology	3	0	0	0	0	0	3
TECH	Better control over the environment (Test & Development)	0	0	0	0	0	0	3

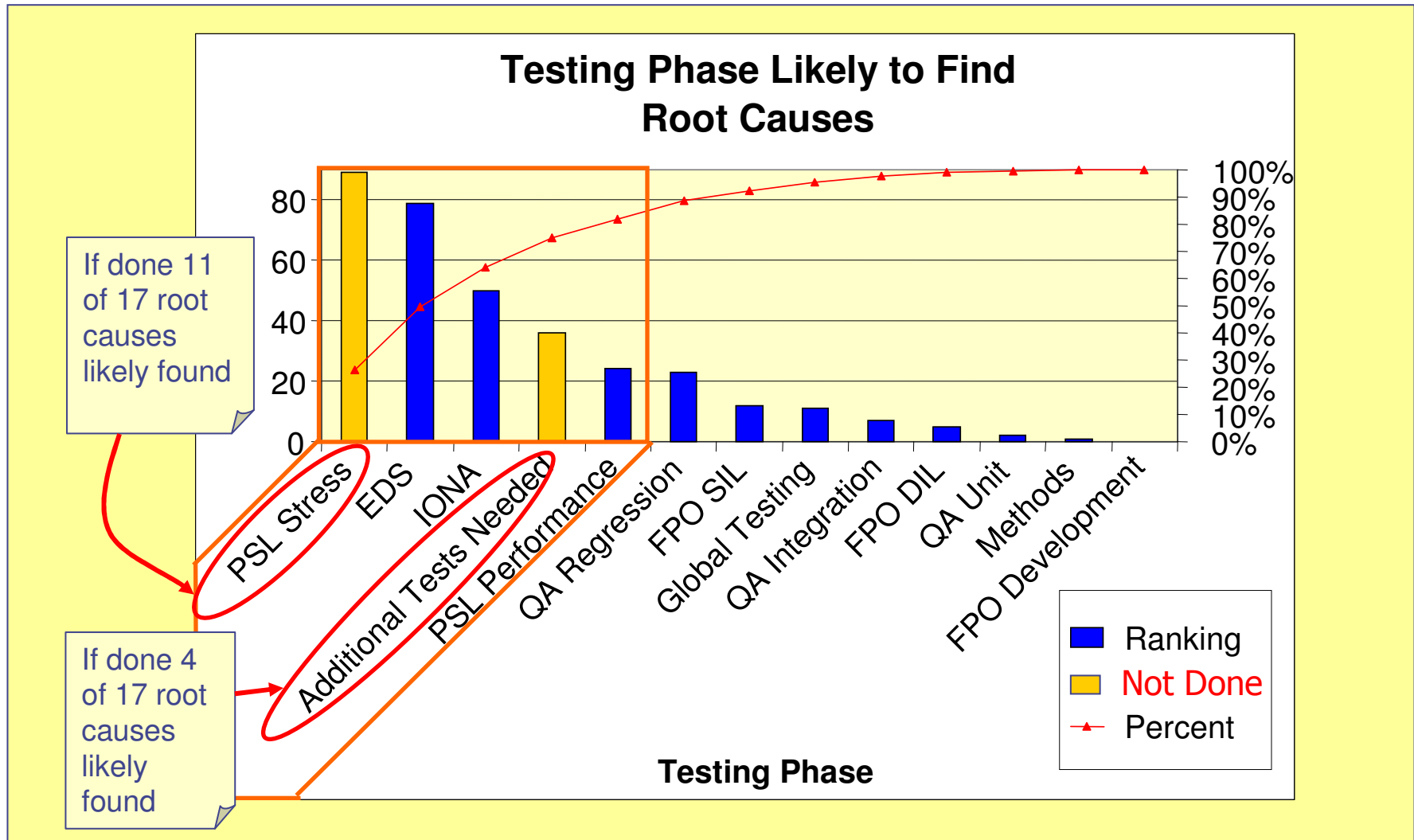
**Remediation Actions Prioritized and Mapped to Causal Themes**

# IT Process & Product Improvement: Performance Testing Issues Resolution

## Software Development Methodology



# IT Process & Product Improvement: Performance Testing Issues Resolution



# IT Process & Product Improvement: Performance Testing Issues Resolution

## Is Improvement Significant?

Boxplots of Old and New  
(means are indicated by solid circles)



$H_0$  = Performance under load is the same with New & Old settings.

Two-sample T for Old vs New

	N	Mean	StDev	SE Mean
Old	300	1615	302	17
New	180	1227	244	18

Difference =  $\mu$  Old -  $\mu$  New

Estimate for difference: 387.8

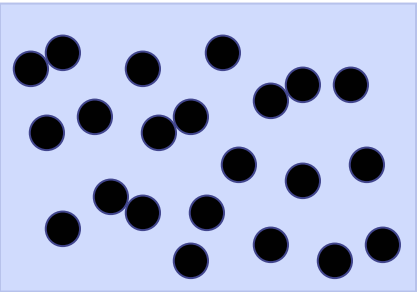
95% CI for difference: (338.3, 437.3)

T-Test of difference = 0 (vs not =): T-Value = 15.40 P-Value = 0.000 DF = 438

Reject  $H_0$  P < .05  
Performance Significantly Better!

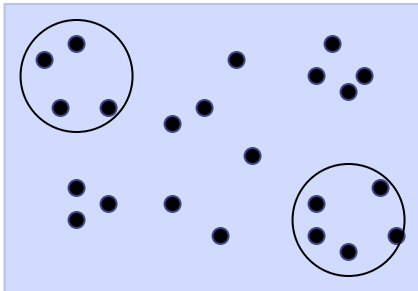
# 6-Sigma Deployment Vision

**Phase I – Year 1**  
Start Up  
 Build Infrastructure  
 Train Critical Mass  
 Learn Methodology



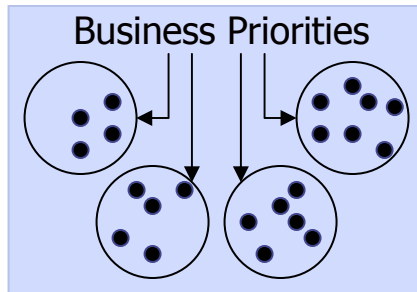
Adhoc Project Selection

**Phase II – Year 2**  
Alignment  
 Self Reliance  
 Feel Results  
 Prepare to Integrate



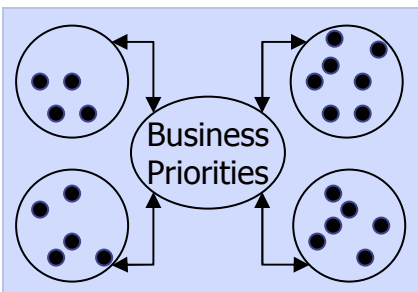
Project Clustering

**Phase III–Year 3/4**  
Integration  
 The Way We Work  
 BB/MBB Leadership  
 100% GB Utilization

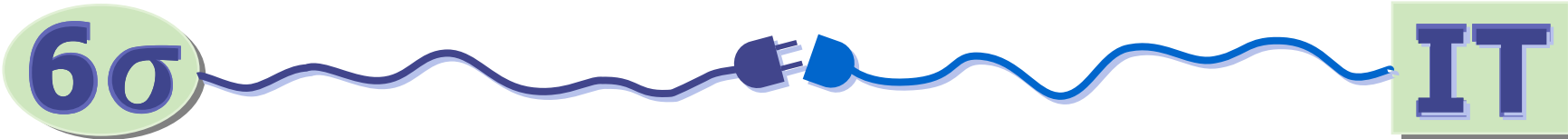


Project Alignment

**Phase IV–Year 5+**  
Leverage  
 Business Leadership  
 6-Sigma Leadership  
 Quantum Results

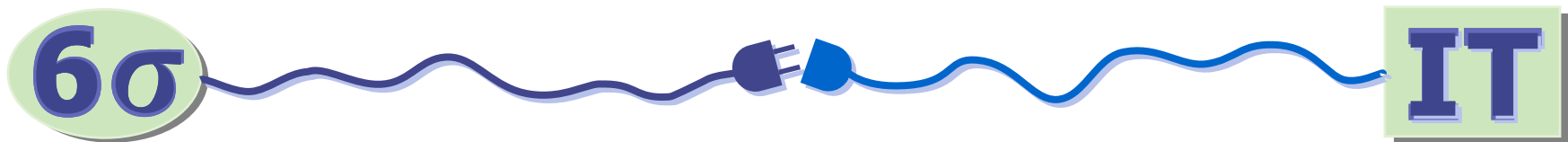


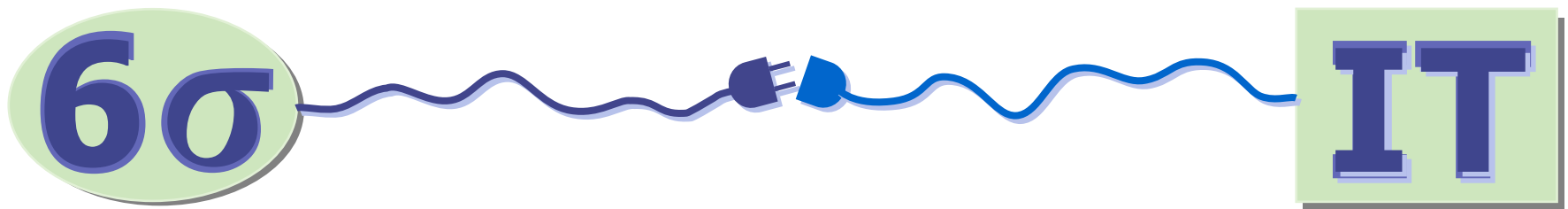
Project Synergies



# 6-Sigma Enablement

- ❑ How can 6-Sigma integrate and enable your IT Operating Model?
- ❑ What would the Integrated Model look like in your business?
- ❑ What do your metrics look like?
- ❑ What are the desired behaviors you are striving for?
- ❑ How would you measure success?





**Thank You**

