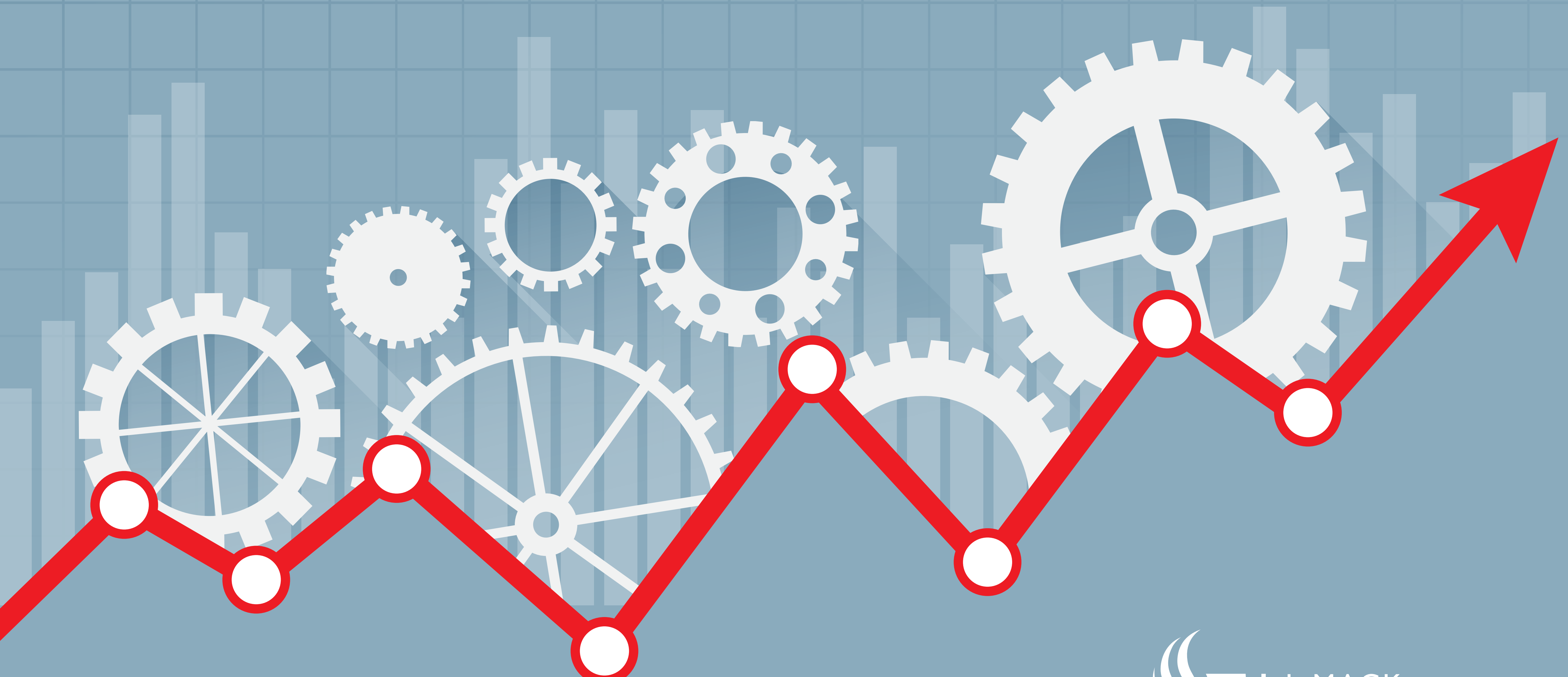
Removing the Effects of Unwanted Variance



CIS 8010

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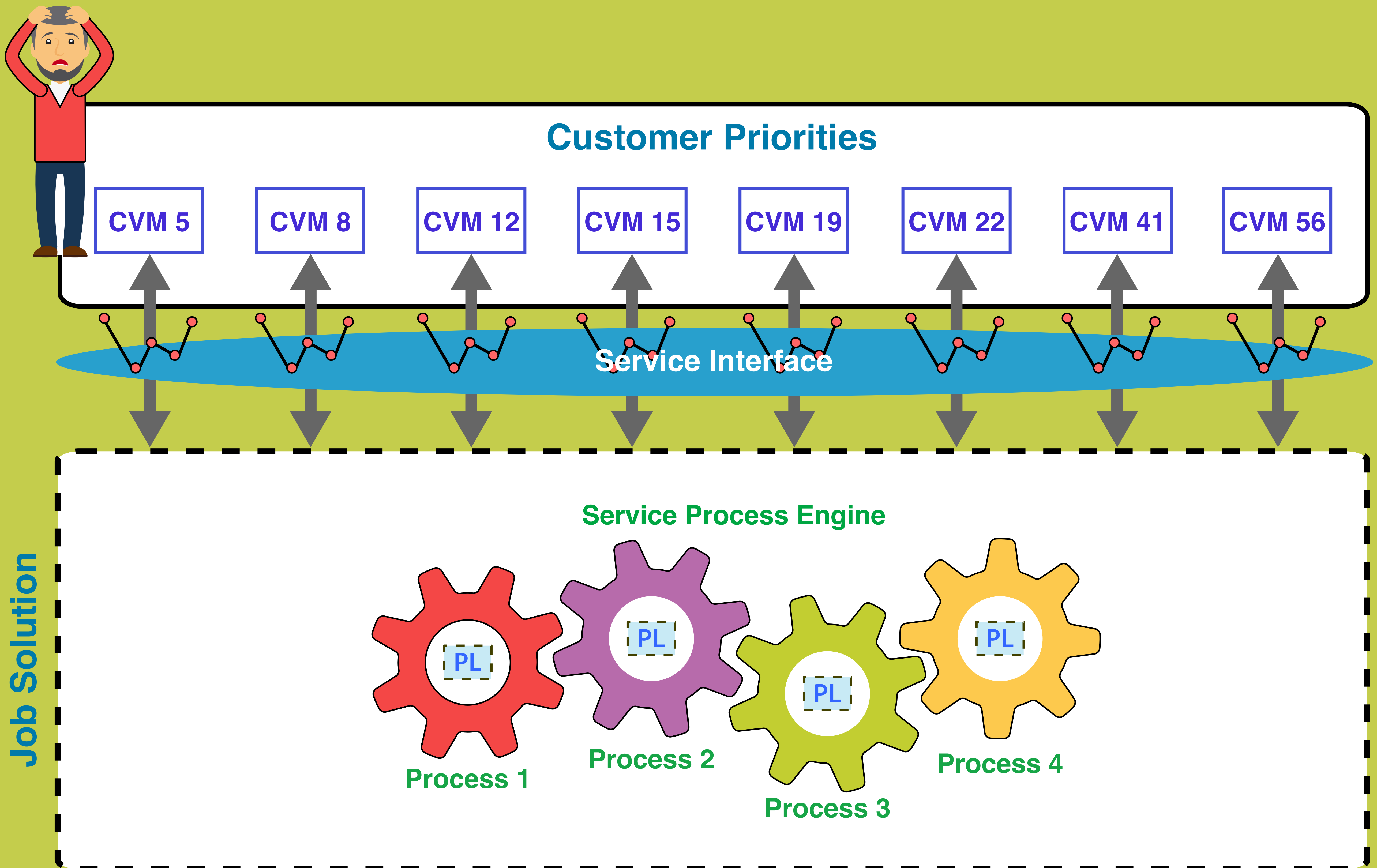
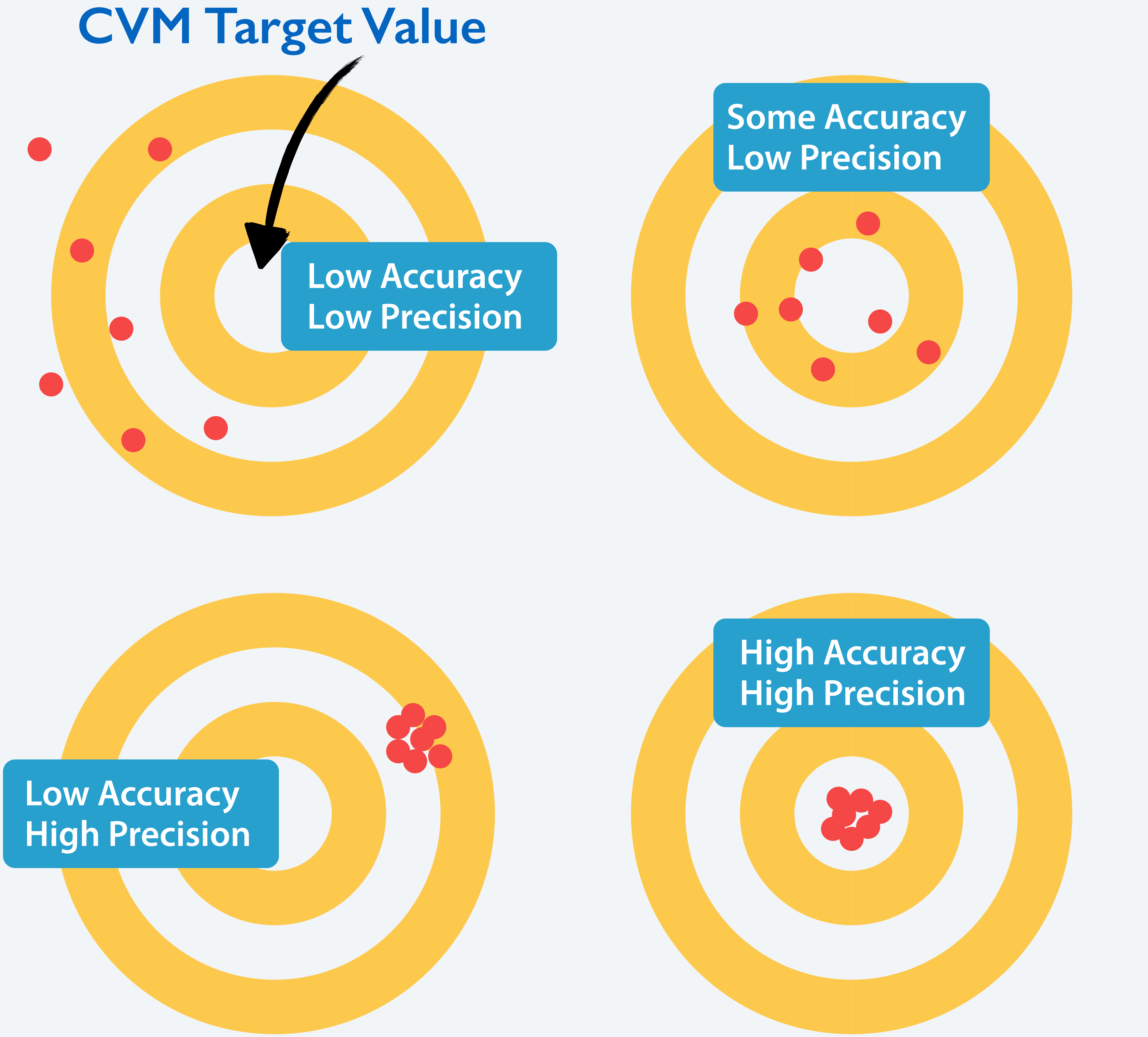
The Six Sigma Improvement System II

In Context to Process Innovation: *Characterizing the Voice of the Customer*

Big Problem:
Significant Variation Around Priority Customer Needs

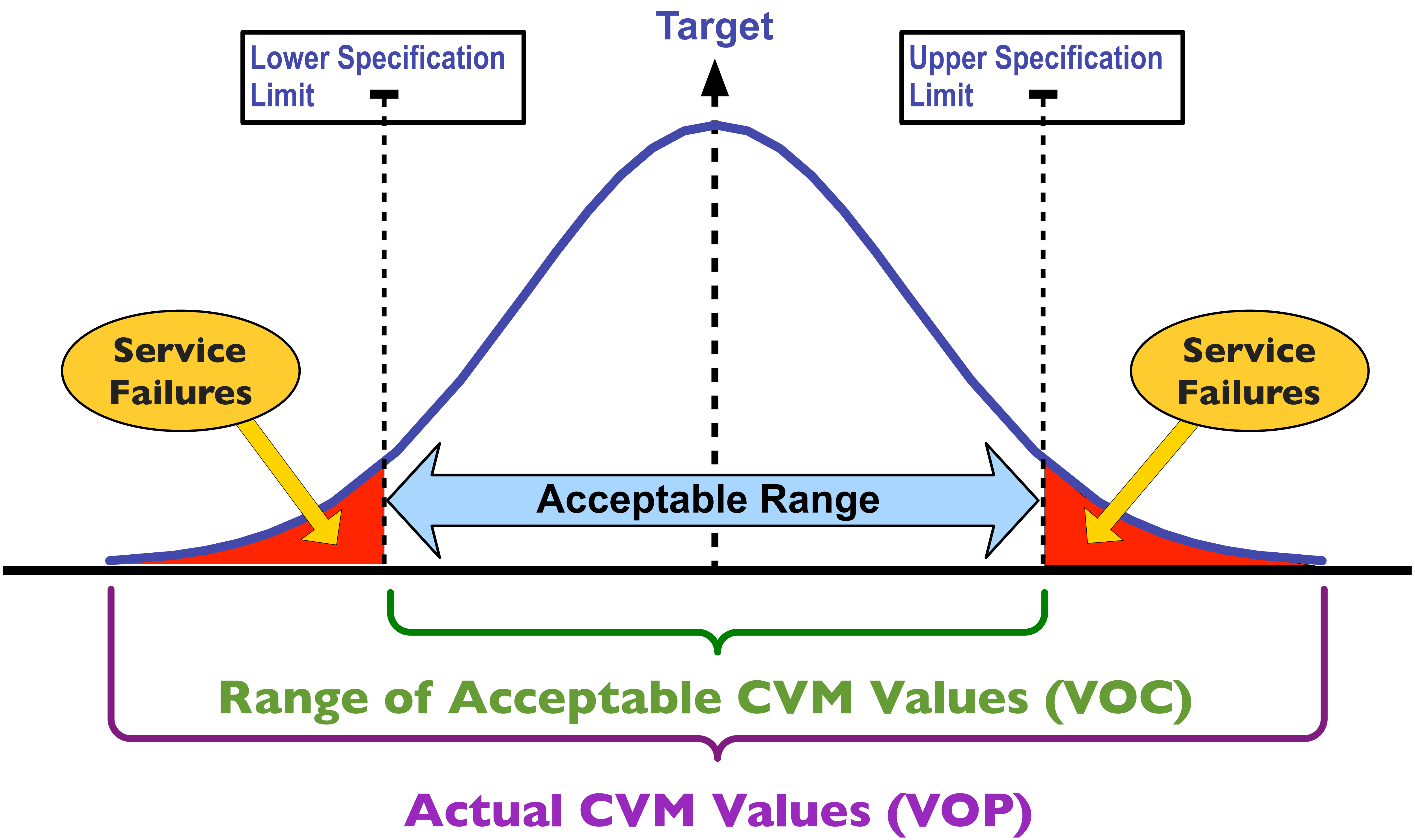


Accuracy Versus Precision



Service Failures Caused by Variation

(VOC Expressed as a 2-Sided Range)

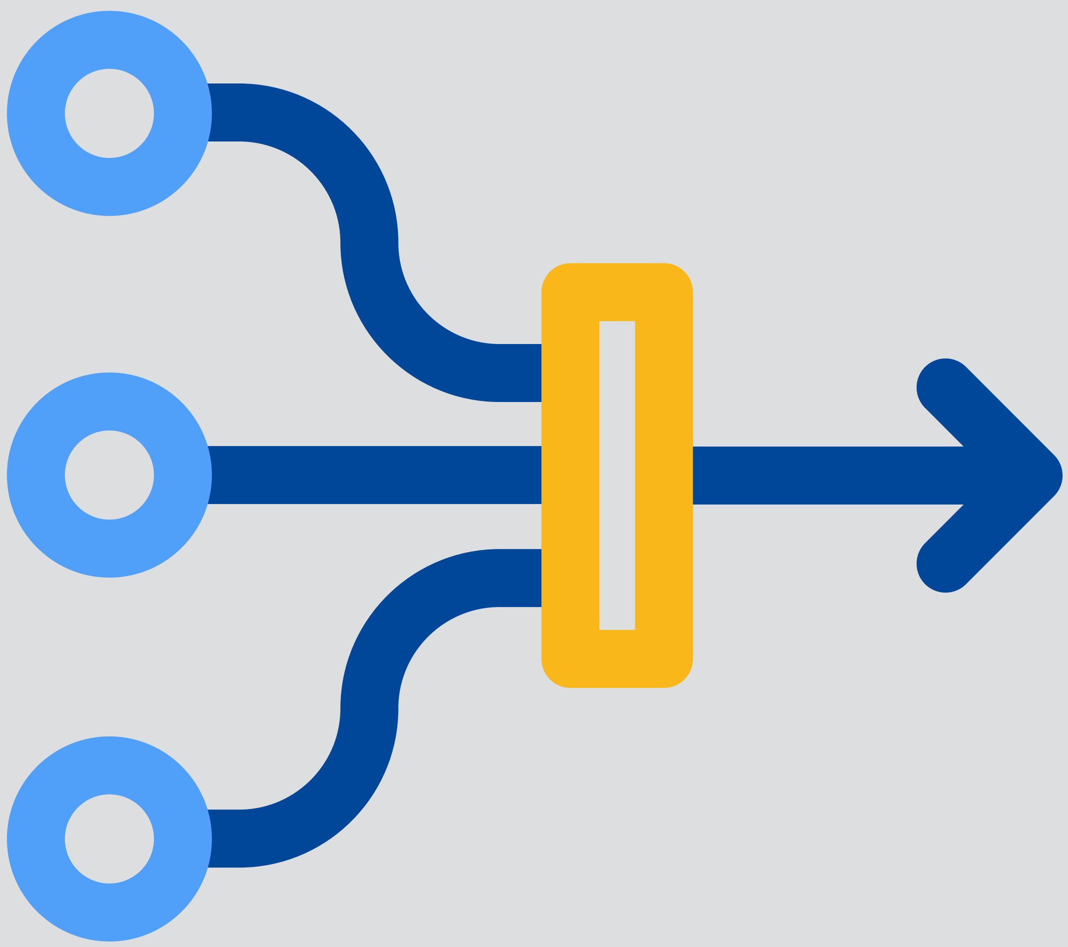


Ultimate Goal of Six Sigma:

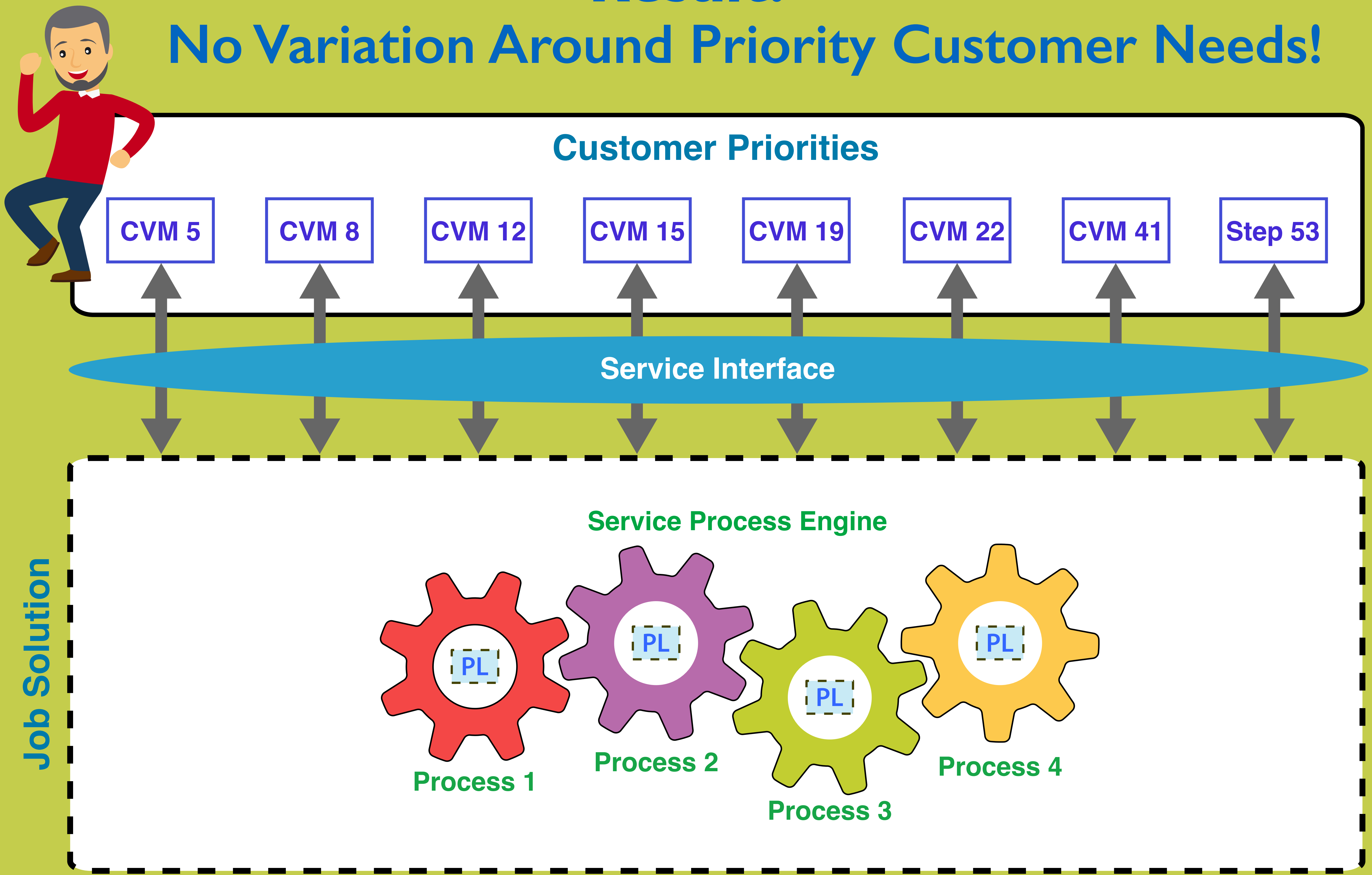
Align the Voice of the Process (*Service-Process Engine*)

with

the Voice of the Customer (*Priority Needs - CVMs*)



Result:
No Variation Around Priority Customer Needs!



Process Behavior Charts:

Characterizing the Voice of the Process

Informed Action

Before you can **effectively** improve any process you must first listen to the Voice of the Process to understand what is causing the service failures. With this understanding you will be able to take informed action to:

1. Eliminate the root cause factor(s) responsible
2. Fundamentally improve how the process works

Action that is not informed by this understanding is called "tampering" and may unwittingly create more service failures in the future.

Detecting Signals in the Noise

- We analyze data to know when a change has occurred in a process. We want to know about such changes in a timely manner so that we can take informed (effective) action.

- However, the problem is that the numbers can change even when the process does not

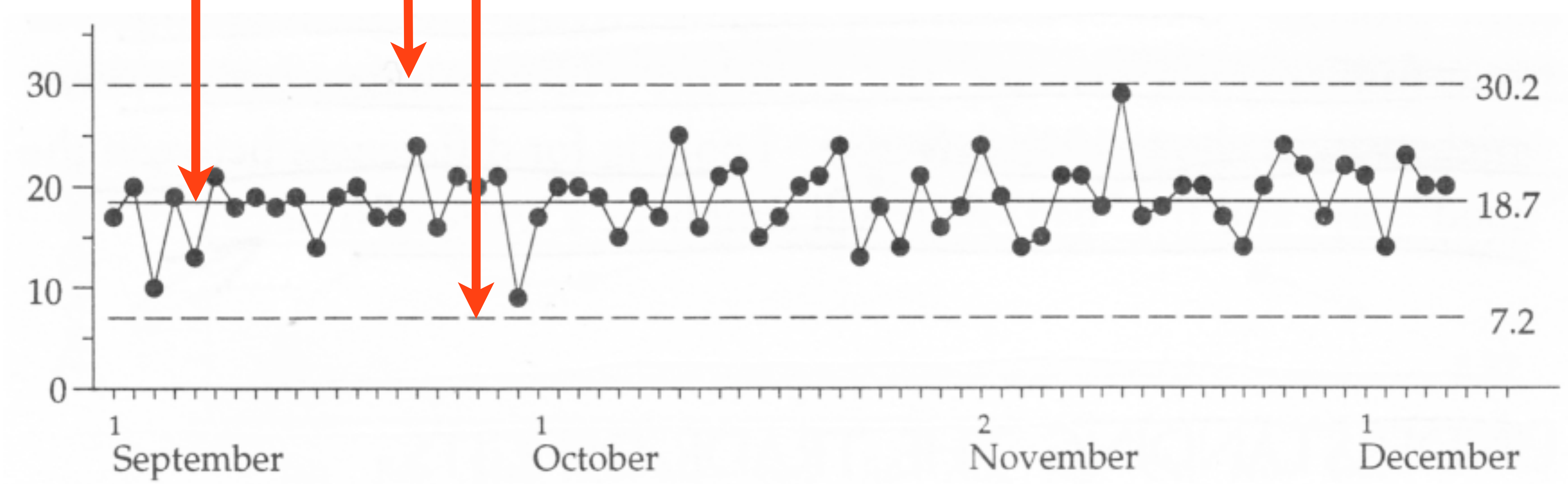
- Therefore, we need a way to distinguish those changes in the data that represents **changes in a process** from those that are essentially noise.

Features of a Process Behavior Chart

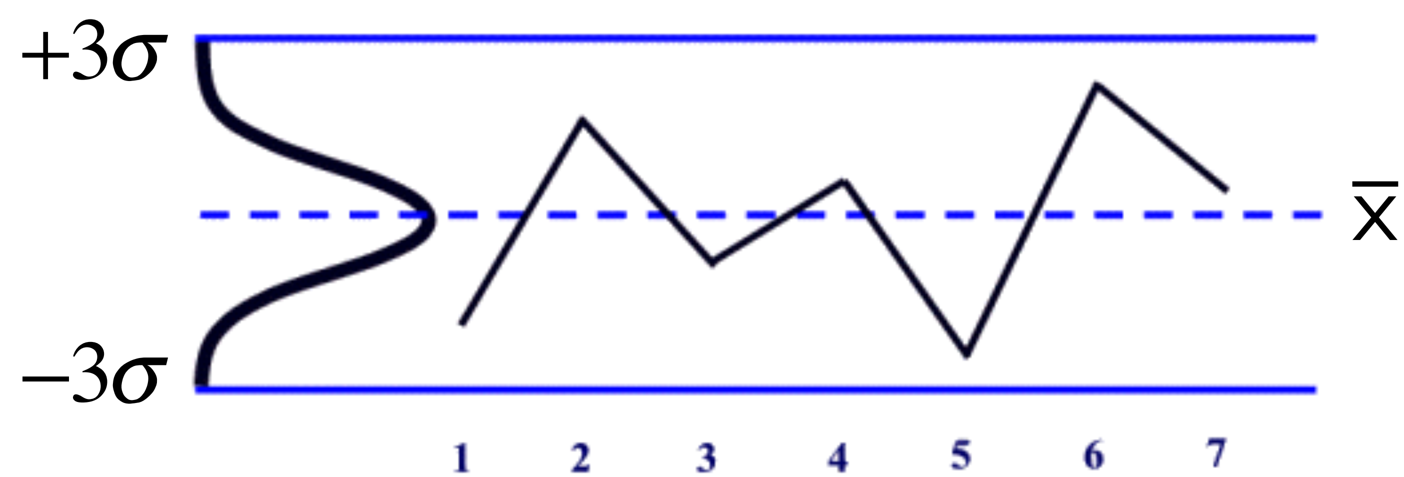
The process behavior chart begins with the data plotted in a time series.

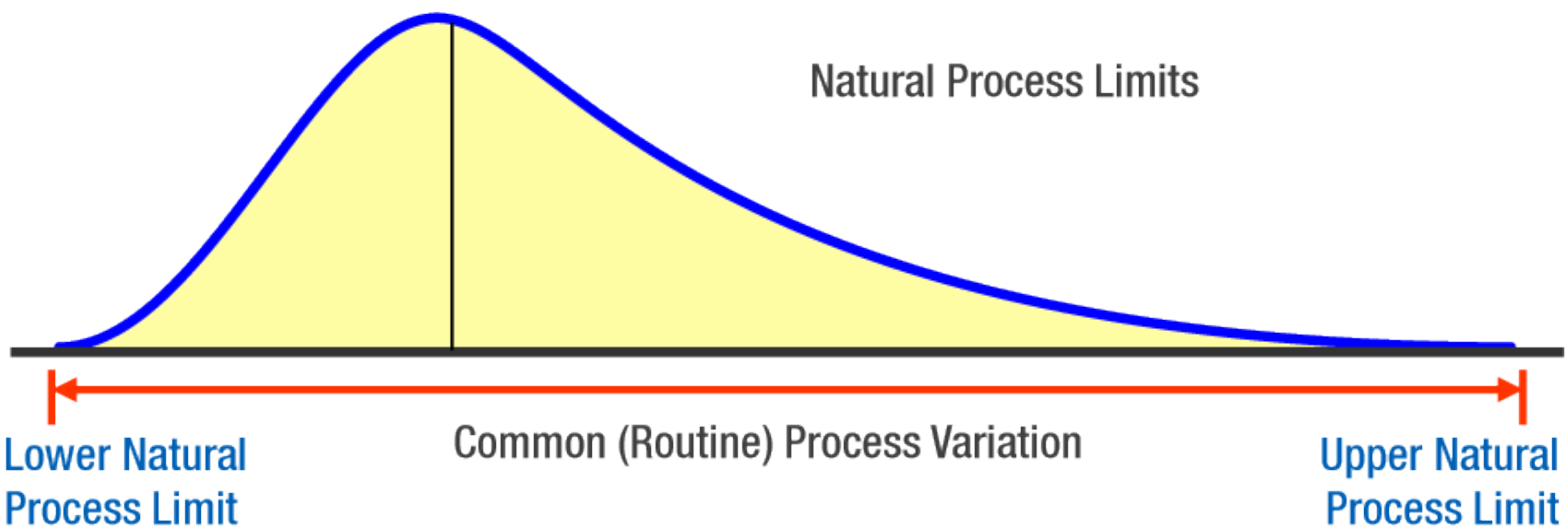
A central line is added as the visual reference for detecting shifts or trends.

Upper and lower control limits (natural process limits) are computed from the data and placed symmetrically on either side of the central line.

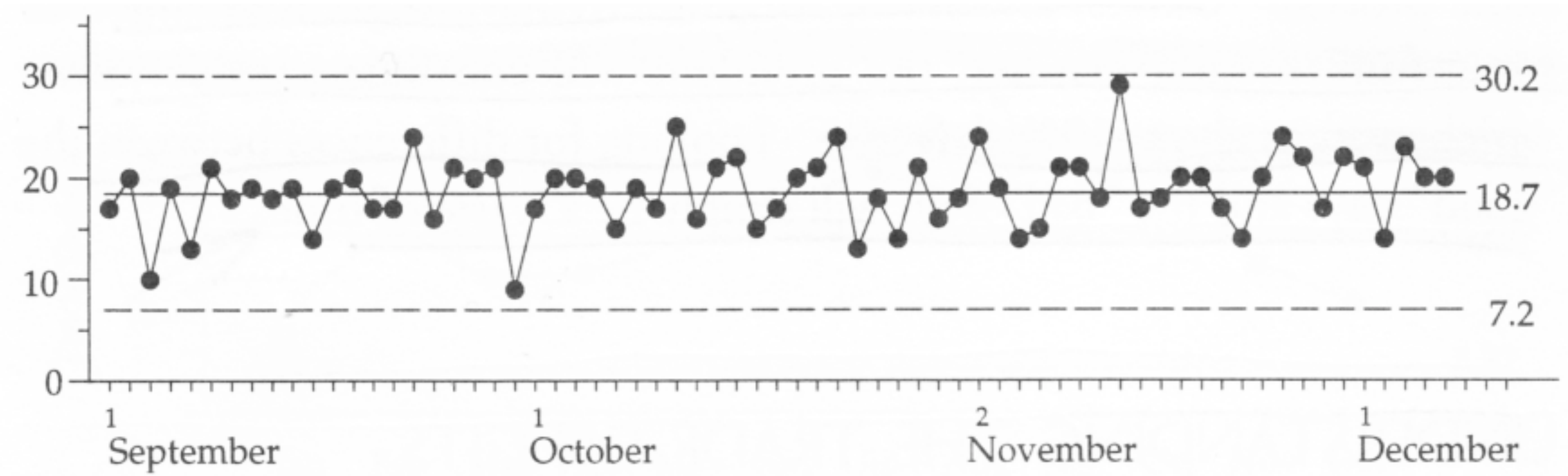


The natural process limits bracket nearly all of the routine variation in a process



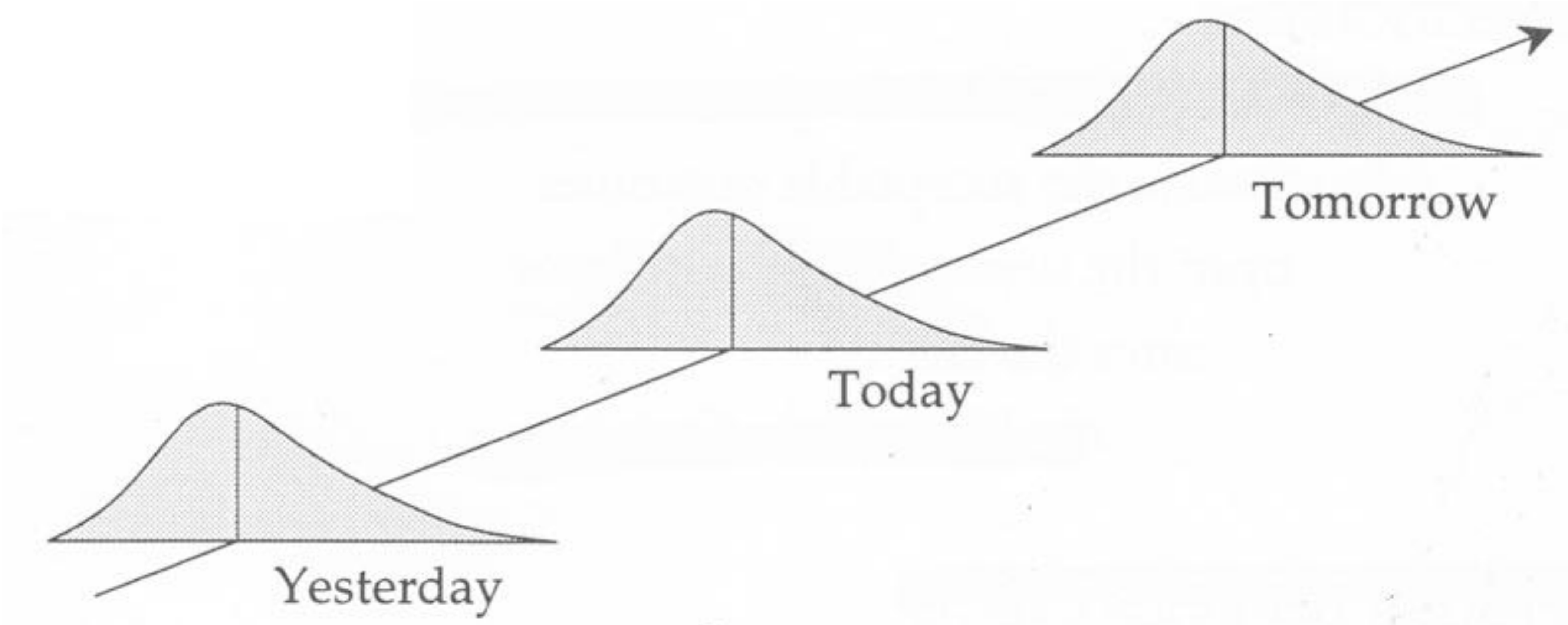


By characterizing the extent of routine variation, the process limits allow you to **differentiate between routine variation and exceptional variation**.



If over time all the points fall within the limits (and with no discernible pattern) the process is characterized only by routine variation.

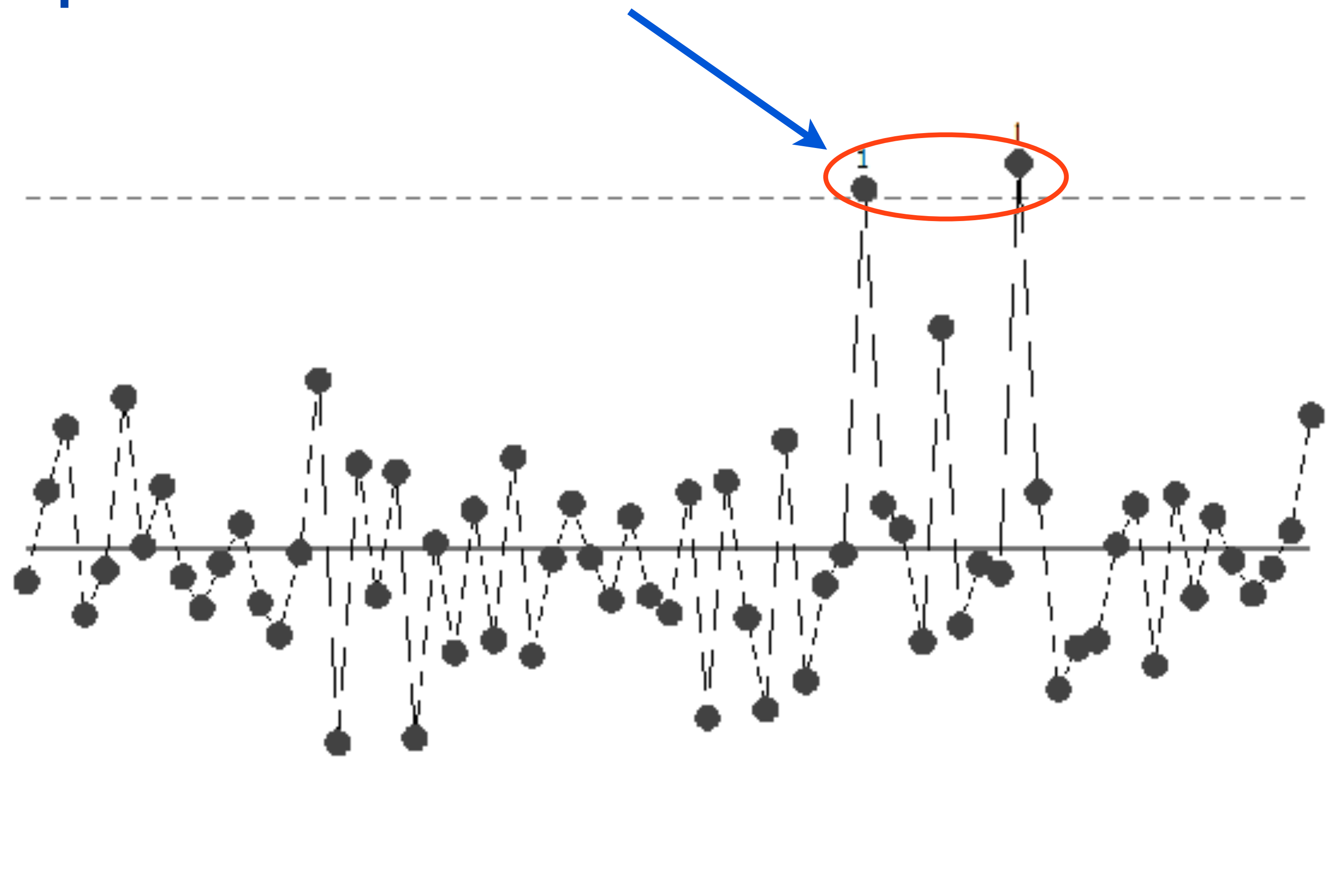
With only routine variation the process is predictable within the limits and unless something changes, it is reasonable to expect the process will behave this way in the future.



When a process is predictable it cannot be improved by simple tweaking. *Since a predictable process is operating at full potential, you can only improve it by changing it in some fundamental manner.*

When points fall outside the process limits, they are interpreted as signs of exceptional variation

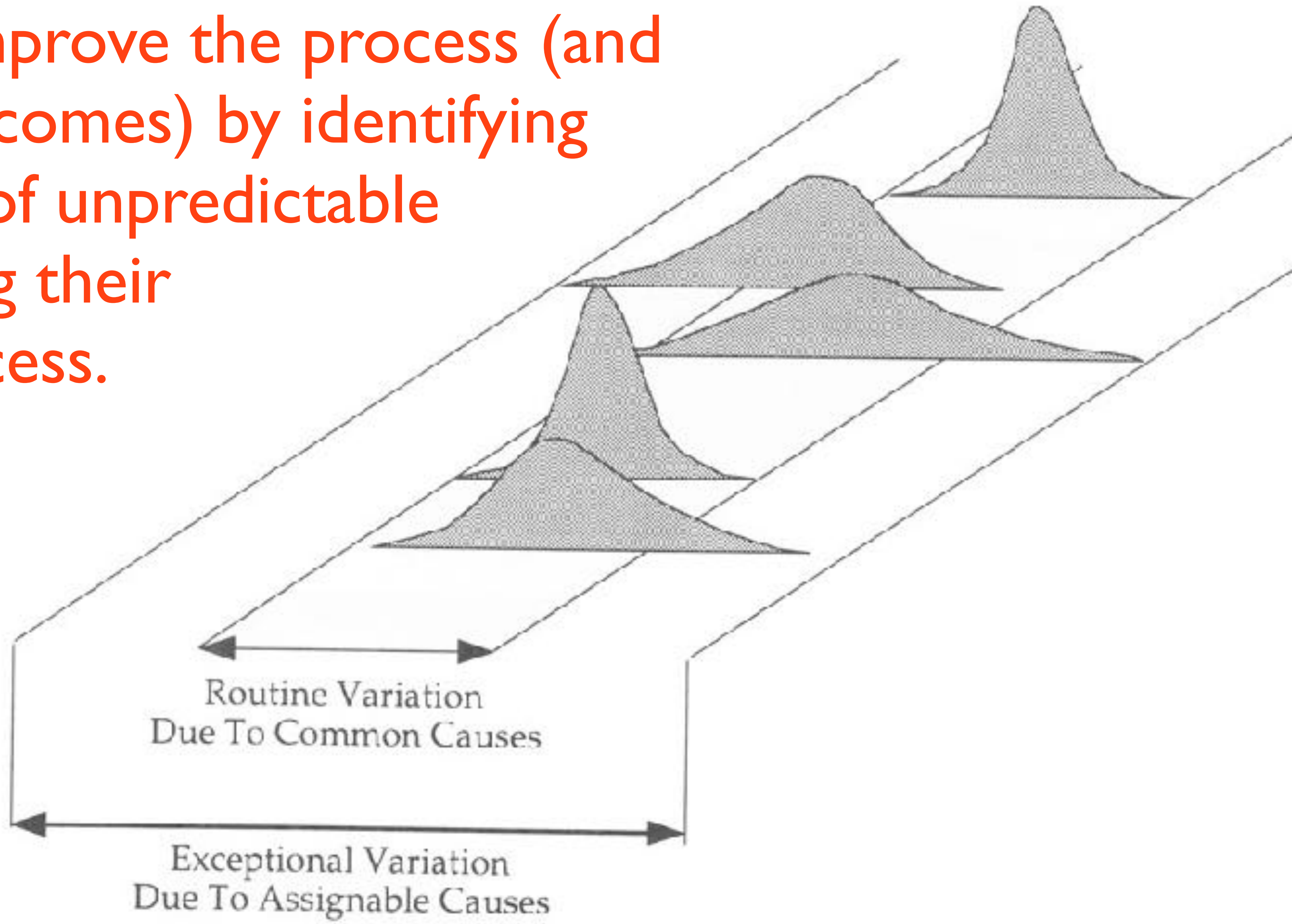
Exceptional variation is attributed to assignable causes which, by definition, dominate the many common causes of routine variation



The presence of exceptional variation is a signal that there are dominant cause-and-effect relationships which affect your process and which you are not effectively controlling.

The presence of exceptional variation makes a process unpredictable and it will likely behave unpredictably in the future producing service failures.

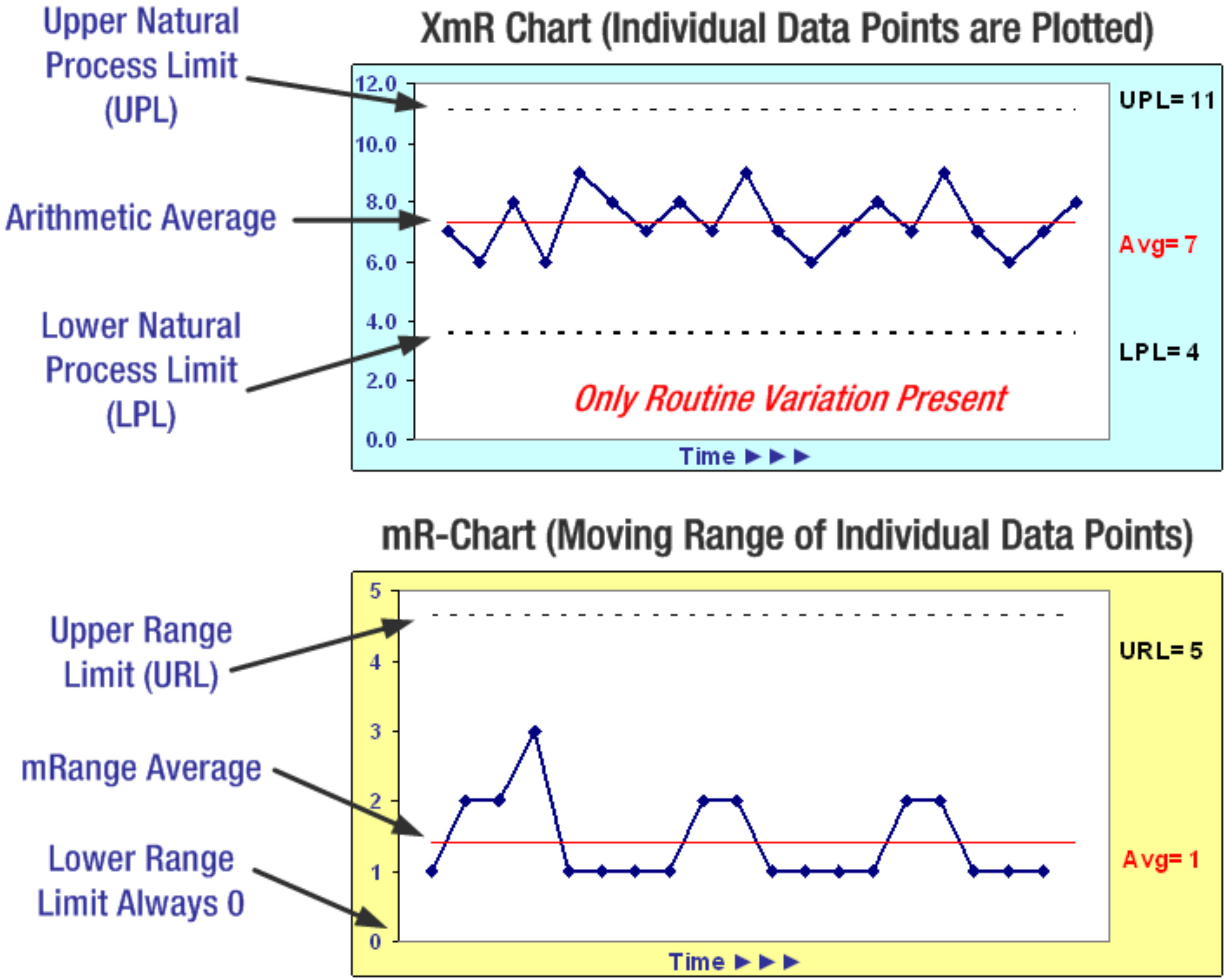
When a process displays unpredictable behavior, you can most easily improve the process (and therefore process outcomes) by identifying the assignable causes of unpredictable variation and removing their effects from your process.



Example: No Signals

Source Data

#	Measures
1	7.0
2	6.0
3	8.0
4	6.0
5	9.0
6	8.0
7	7.0
8	8.0
9	7.0
10	9.0
11	7.0
12	6.0
13	7.0
14	8.0
15	7.0
16	9.0
17	7.0
18	6.0
19	7.0
20	8.0



Example: Signals Assignable Cause

Source Data

#	Measures
1	14.0
2	13.0
3	15.0
4	12.0
5	30.0
6	15.0
7	14.0
8	17.0
9	17.0
10	20.0
11	15.0
12	12.0
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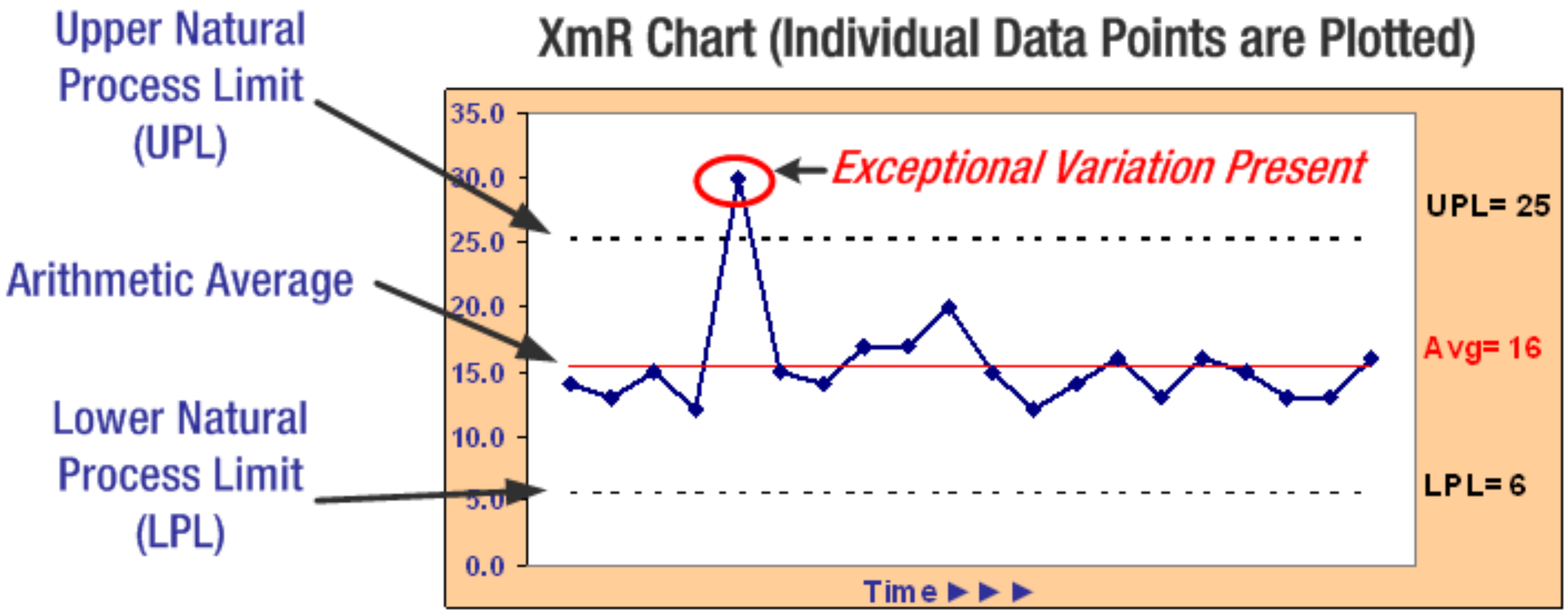
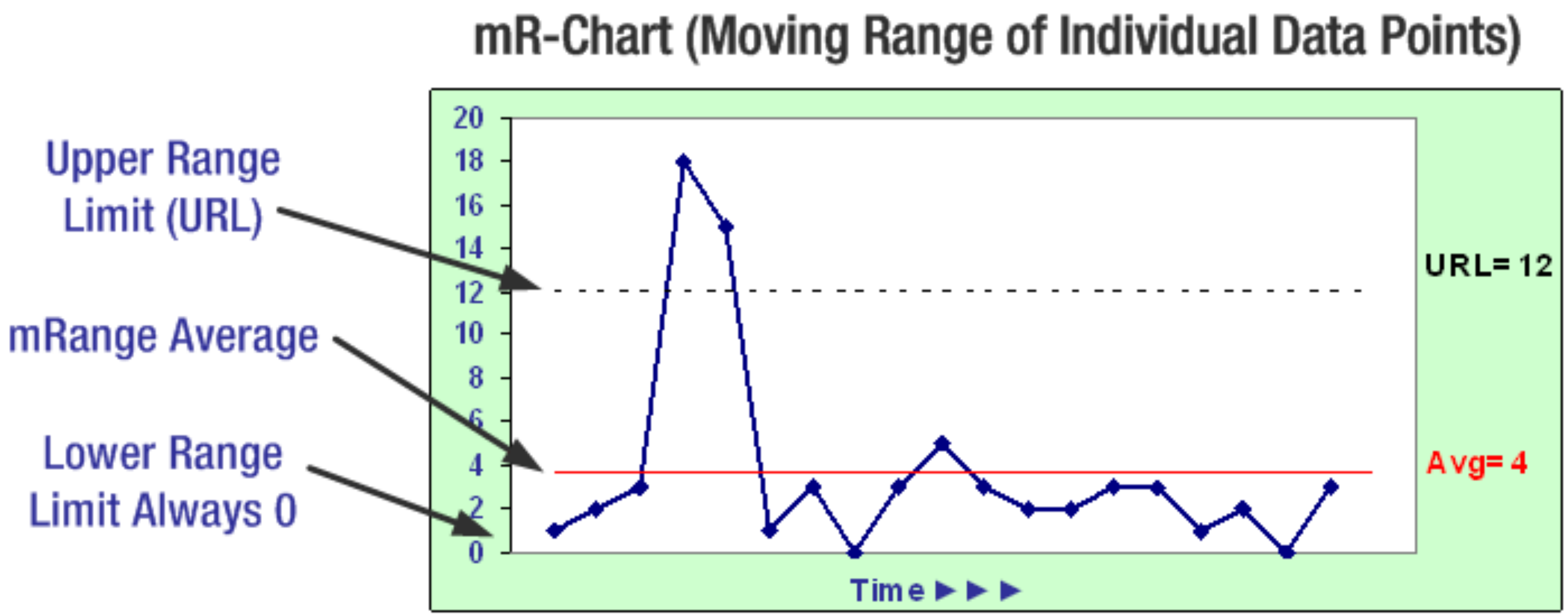
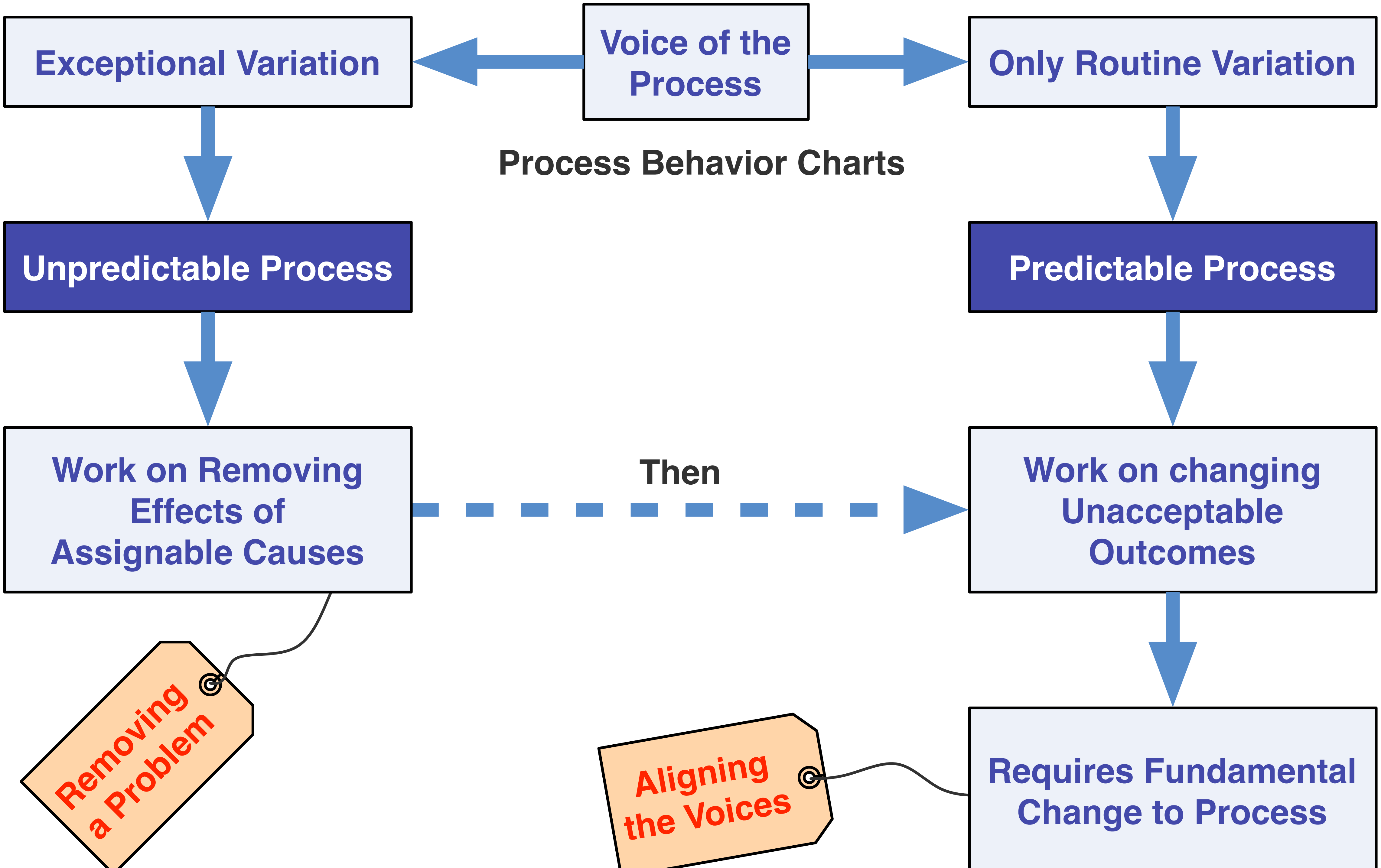
16	16.0
17	15.0
18	13.0
19	13.0
20	16.0





Value Improvement Strategies



(How?)

(Implement Lean)

An assignable cause is seldom obvious.

How do we find it?

The Hunt for Critical Factors

To eliminate exception variation, you must first understand the causal factor(s) that is producing it (the assignable cause).

The assignable cause is called a **critical factor** (also known as root cause).

Process Outcome	Is	A Function of	Key process variables that cause variation in the outcome

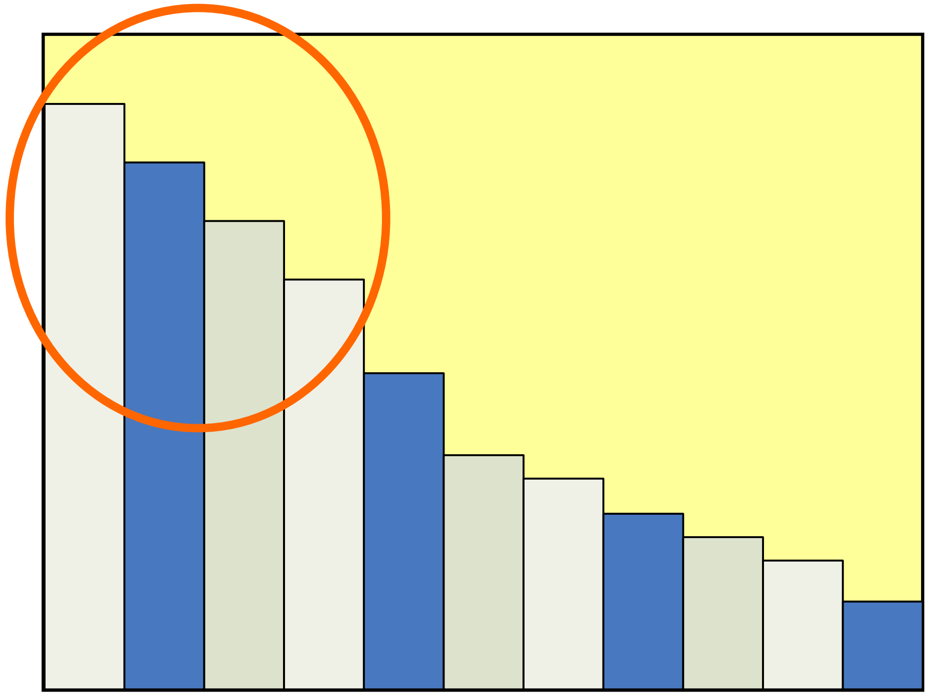
$$Y = f(x_1, x_2, \ldots)$$

The Pareto Principle

Assignable causes (called **red x's**) have a large, dominant effect on routine variation and are able to cause unacceptable outcomes (service failures via exceptional variation).

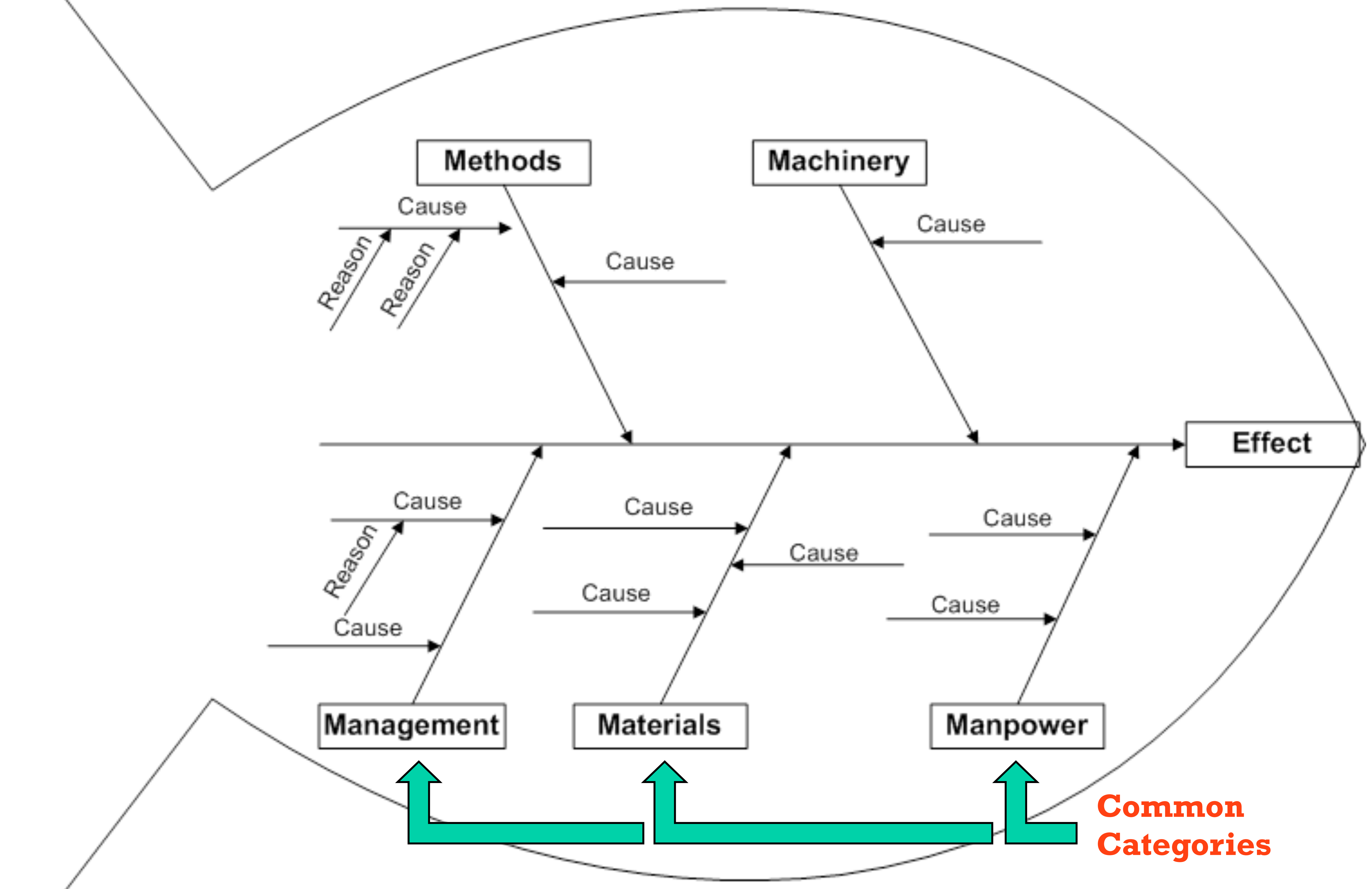
Most of the other (routine) cause and effect relationships will have a progressively smaller effect on the **Y** outcome

This phenomena is known as the **Pareto Principle** or the 80/20 Rule.



Cause and Effect (C&E) Diagram: "Fishbone"

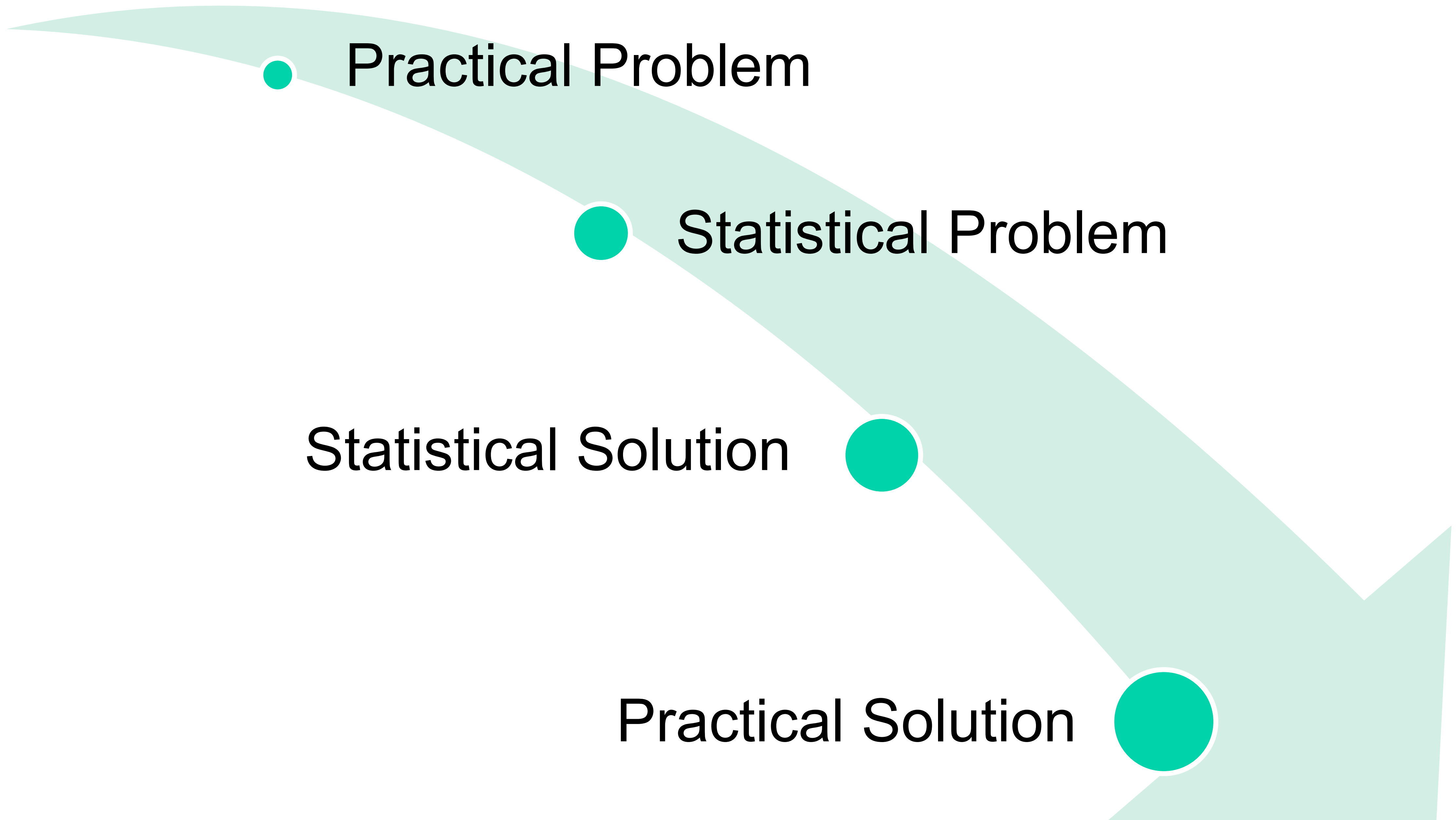
A Tool for Root Cause Analysis



Common Categories

The Overall Six Sigma Approach

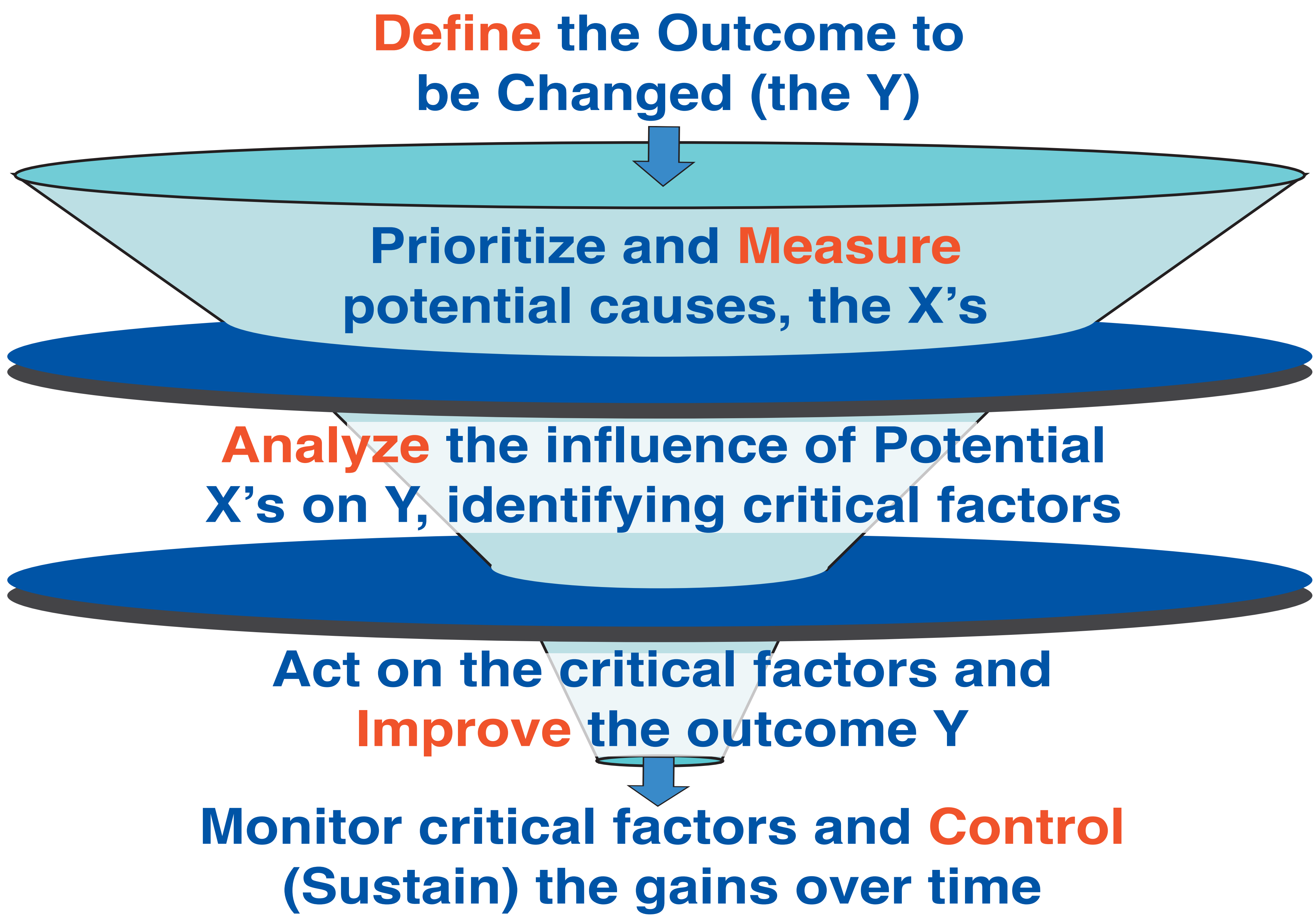
Hunting for Red x's



How do we focus and systematically execute a Six Sigma improvement project?

Six Sigma DMAIC Framework

DMAIC is a methodology for "filtering out" the trivial many and identifying the few Critical Factors



A Very Important Point

- The whole purpose of DMAIC is to deliver red X's (assignable causes) to the Improve Phase.
- Measure and Analyze collect X's and then filter out the less important ones.
- If all the X's collected during Measure were delivered to Improve, it would be overwhelming.
- It is very important to continue to filter out trivial X's as we funnel down to Improve.