



# Solution Engineering: Some Basics

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This is a short version of the Solution Engineering story. It is also the first paper in which I set forth the process model and the concepts of Points of Action or Intervention, Points of Impact and Points of Evaluation.

## ***Overview***

Let's begin with the obvious: To solve a problem, you must change something. If you don't, then the problem continues unresolved or matters take care of themselves. In neither case can you take credit for solving the problem.

For the kinds of problems typically addressed in complex organizations, change is usually indirect, that is, you don't change it, you change something else and it changes as a result. Simply put, you change things in one place so as to create the desired effects in another.

It follows that the effects you wish to create and the changes you make must somehow be connected – and they are. They are connected by way of the structure of the situation in which you will intervene. The effects or results you seek and the things you can change are both embedded in the structure of some larger situation. Thus it is that changes you make at one point (the Point of Action) ripple through the structure

of this situation and produce the desired effects at another (the Point of Impact).<sup>1</sup> It follows also that if you do not understand the structure that links the ends you seek with the means at your disposal, the actions you take might not produce the desired results and might also produce other, entirely unintended and unwanted effects.

Consequently, to solve a problem or, better yet, to engineer a solution, you must be concerned with the following kinds of activities:

1. Identifying the required results, the effects you wish to create and their associated Points of Impact (i.e., the places where you will measure the extent to which the required results have been achieved).
2. Identifying the structure in which these effects and their associated Points of Impact are embedded.
3. Identifying suitable Points of Action, that is, places in the structure of the situation where (a) changes can be made and (b) those changes will ripple through the structure of the situation, producing the desired effects at the Points of Impact.
4. Configuring planned courses of action, that is, intentions regarding actions to be taken, changes to be made, results to be monitored, and adjustments as required.
5. Marshaling support for your view of the desired results, the actions that will lead to them, and their value in relation to the resources required to obtain them.
6. Carrying out the proposed courses of action.

### ***Basic Terms***

#### **Solution Engineering**

“Solution Engineering” is my label for the process by which solutions are configured and carried out. By “solution” I mean a course of action that, once carried out, brings about some desired state of affairs. The use of engineer in this context is as a verb meaning “to arrange or bring about through skillful, artful contrivance.” This usage of engineer shows up in

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<sup>1</sup> I sometimes use Point of Action and Point of Intervention interchangeably. I also refer at times to the Point of Impact and the Point of Evaluation. These, too, may be treated interchangeably at times but not always.

statements such as, “The top management team engineered a remarkable turnaround in the company’s financial performance.”

**Solutions**

As stated above, a solution is a course of action that, once carried out, brings about some desired state of affairs. This new state of affairs is often referred to as “the solved state.”

Solutions might be broad or narrow in scope, quite complex or extremely simple, and short lived or long in duration. A solution might cost a few dollars or many millions, and require the efforts of only one or a few persons or it might involve a cast of hundreds or even thousands. Thus, the term “solution” encompasses courses of action that range from mundane, everyday acts such as repairing a television to feats of organizational artistry such as turning around a failing company.

**Problem**

One can hardly use a term like “solution” without speaking to the other term generally found in its company: “problem.”

A problem is a situation in which action is required and difficulty is encountered because the action to take is not known. In many ways, it is uncertainty regarding action that makes a problem a problem. As one person wrote, “Problem solving is what you do when you don’t know what to do.”

A requirement for action suggests an existing or potential discrepancy between actual and required conditions. Four possibilities exist: (1) you want something you don’t have; (2) you have something you don’t want; (3) you’re about to lose something you have that you want to keep; or (4) you’re about to have something happen you don’t want to happen.<sup>2</sup>

On occasion, the gap between actual conditions or results (*what is*) and required conditions or results (*what should be*) comes about as a consequence of something going wrong. At first, conditions are acceptable, then something happens and conditions are no longer acceptable: reject rates soar, sales plummet, margins disappear, and share of market rapidly erodes. Problems needn’t be on such a grand scale; often they involve something as simple as a flat tire or a TV set that fails to come on. In all cases, however, there is an unacceptable difference between actual and required conditions. Consequently, action is required.

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<sup>2</sup> See my paper in this series titled “The Goals Grid” for a more elaborate treatment of these four possibilities.

For a problem to exist, there must be more than a requirement for action, there must also be some impediment, some difficulty, some doubt or uncertainty about the action to take. For many people, a flat tire presents no problem at all. Action is required and the required action is apparent and capable of immediate execution. Open the trunk, get out the tools and the spare, jack up the car, change the tire, put everything away and be on your way. But, let the jack be missing, or the spare be flat, or the motorist be frail, and a different situation ensues. Now the course of action is not so clear. Hailing another motorist might work. A call placed via the car or cellular phone might move things along, too. Waiting patiently for a state trooper to come along seems to be an option used by many. Hiking down the road to a gas station is a course of action chosen by others. There is, then, as the old saying has it, "More than one way to skin a cat." We have options, choices, different courses of action available to us or that we can configure to suit our aims, requirements, and the limits under which we must operate.

Not all problems are the result of something gone wrong. A discrepancy between what is wanted and what exists can come about as a result of raising one's sights, of not being willing to accept the status quo. Continuous improvement programs generate a never-ending stream of problems as a consequence of regularly ratcheting up expectations regarding performance. Problems are also created as a consequence of defining some new, never before achieved state of affairs. President John F. Kennedy created precisely this kind of problem when he announced the goal of putting a man on the moon.<sup>3</sup>

### ***Key Concepts***

#### **Solving Problems and Problem Solving**

As stated, a problem exists when action is required but the action to take is not known. This means someone must figure out what to do. The process of figuring out what to do is commonly known as "problem solving."

More is required to solve a problem than figuring out what to do; one must also do it. Actually solving a problem hinges on intervening, on changing things with some purpose or outcome in mind.

It is useful, then, to think of Solution Engineering as having two phases: *investigation*, and *intervention*. The first is concerned with figuring out

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<sup>3</sup> See my paper in this series titled "Forget about Causes, Focus on Solutions" for a review of the five basic sources of gaps between *what is* and *what should be*.

what to do, and the second with doing it, with systematically, purposefully changing things "over here" to produce desired results "over there."

**Point(s) of Impact**

This term refers to those places in the structure of the situation at which the intended effects of the solution are meant to be felt.

**Point(s) of Evaluation**

Whatever result, effect or impact is being sought, the extent to which it is realized must be measured.<sup>4</sup> The where and how of measuring a business result define its point(s) of evaluation. Suppose, for instance, that "financial health" is a key business result. Suppose, further, that one chooses to measure this through some combination of measures of profitability, liquidity, and new revenue generation. The specific measures used and where and how they are applied define the point(s) of evaluation for the point of impact called "financial health."

**System Structure**

The point(s) of evaluation are tied to some system structure, some network of variables, connections, and relationships. System structures have two very different yet complementary aspects; one is abstract and arithmetic, the other is concrete and operational. Profit, for example, is an abstract, arithmetic structure that, in its simplest form, consists of the difference between revenue and expense. Revenue and expense, in turn, are tied to still other abstract, arithmetic variables (e.g., the sum of individual sales, and the sum of various expense amounts). Other structures are much more concrete and operational (e.g., the flow of raw materials into and through a production line). Through a process of analysis and decomposition, it is possible to establish the links between the abstract, arithmetic aspects of a system structure and its concrete, operational aspects. In other words, one can identify and trace the linkages between the variables that enter into the calculation of profit and much more concrete factors such as people, activities, events, and materials.

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<sup>4</sup> On occasion, the intended impact cannot be measured directly (e.g., as is the case with "financial health" or "improving morale"). In such cases, indirect measures or "indicators" of the end result must be used (e.g., in the case of improved morale, we might use indicators such as reduced turnover or lowered grievance rates). When we can measure desired results directly, the Point(s) of Impact and the Point(s) of Evaluation are one and the same. When we must measure results indirectly, the Point(s) of Impact and the Point(s) of Evaluation must be treated separately.

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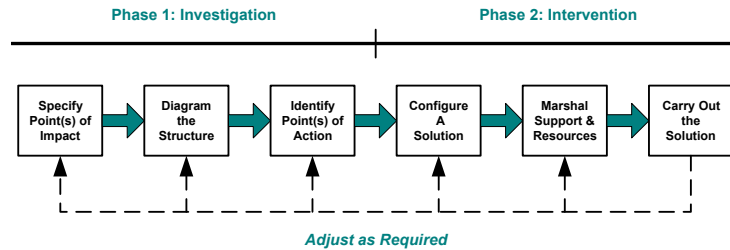


Figure 1 - The Solution Engineering Process

### Point(s) of Action or Intervention

These are places in the concrete aspects of system structure where actions have direct, immediate, observable effects. Moreover, these direct, immediate effects "ripple through" the system structure, creating secondary effects at other places in the system structure. One can, for example, increase the price of an item and, assuming all other factors remain constant, increase revenue and thus profit. (Of course, other factors rarely remain constant, and price increases can lead to loss of business, reduced revenue, reduced profits, loss of market share and a host of other undesirable consequences.) In any case, places in the system structure where actions taken have the desired effects at other, predetermined places in the system structure are known as point(s) of intervention.

### The Solution Engineering Process

At its simplest, the Solution Engineering process may be viewed as having six steps:

1. Specify the Points of Impact
2. Diagram the Structure of the Situation
3. Identify Points of Action
4. Configure A Solution
5. Marshal Support and Resources
6. Carry Out the Solution and Adjust as Required

The first three steps comprise the investigation phase and the second three comprise the intervention phase. This arrangement or framework is depicted in Figure 1.

The essence of Solution Engineering is to work backward from the desired result. First, identify the point(s) of impact and, if necessary, point(s) of evaluation. Next, trace out the network of variables, connections, and relationships that define the system structure. Last, use this

"map" of the system structure to identify point(s) of intervention, places where the effects of actions taken will "ripple" through the system structure in ways that bring about the desired effects as measured at the point(s) of evaluation.

There is more to solving a business problem than figuring out what to do; there is the always difficult matter of getting it done. Solution Engineering is every bit as much about intervention as it is about investigation. In organizations, intervening or changing things typically requires that approvals be obtained, that plans be laid and assignments made, that resources and support be marshaled. Communications must be established and maintained. Intervening, or doing what one has figured out, is not as simple as it sounds.

### ***Summary***

To engineer a solution is to configure and carry out a course of action that produces desired results. This is accomplished by examining the structure of the situation in which the problem is embedded to identify Points of Impact, Points of Action and the paths connecting the two. This mapping of the structure of the situation enables the solution engineer to configure a course of action commonly called a solution. Once a course of action or solution has been configured, it must be carried out. This entails marshaling support and resources as well as managing the actual change effort. The aim is to make changes at the Points of Action, to have the effects of these changes ripple through the structure of the situation altering circumstances at the Points of Impact and to have these altered circumstances be those that define desired results or what might be termed "the solved state" as measured at the Points of Evaluation.

### ***Further Reading about Solution Engineering***

The papers listed below can be found on my articles web site.

1. [Choosing the Right Problem Solving Approach](#)
2. [Forget about Causes, Focus on Solutions](#)
3. [Reengineering the Problem Solving Process](#)
4. [Solution Engineering in Action: A Really Good Example](#)
5. [Ten Tips for Beefing Up Your Problem Solving Tool Box](#)
6. [Three Cases of Figuring Out What to Do](#)
7. [What's Your Intervention Logic? – The Links to the Bottom Line](#)

### ***For More Information***

Contact Fred Nickols by e-mail at [nickols@att.net](mailto:nickols@att.net) and visit his articles web site at <http://home.att.net/~nickols/articles.htm>. There, you will find more about problem solving and Solution Engineering.