

## State the Problem Before Describing the Solution

Leslie Lamport  
Computer Science Laboratory  
SRI International  
Menlo Park CA 94025

After several years of writing papers in computer science, I discovered the basic expository rule embodied in the title of this note. As obvious as this rule may seem, there are fields in which it is seldom observed. (Computer networking is one example.) A typical paper in such a field is organized as follows:

- (1) a brief informal statement of the problem;
- (2) the solution;
- (3) a statement and proof of the precise correctness properties satisfied by the solution.

In order to abide by the rule, the following organization should instead be used:

- (1) a brief informal statement of the problem;
- (2) the precise correctness conditions required of a solution;
- (3) the solution;
- (4) a proof that the solution satisfies the requisite conditions.

Although it may not be obvious at first glance, there is a profound difference between these two approaches. In the first, the precise correctness conditions can be (and usually are) stated in terms of the solution itself. Some results are proved about the solution, but it is often not clear exactly what problem is being solved. This makes the comparison of two different solutions rather difficult. With the second approach, one is forced to specify the precise problem to be solved independently of the method used in the solution. This can be a surprisingly difficult and enlightening task. It has on several occasions led me to discover that a "correct" algorithm did not really accomplish what I wanted it to. I strongly urge everyone to observe the rule.

(I am ignoring as unworthy of consideration the disturbingly large number of papers that never even attempt a precise statement of what problem they are solving.)