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COMPUTER CENTER PLANNING

V. W. Masson

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COMPUTER CENTER PLANNING

The area of computer center planning is of considerable current interest; how it is practiced and implemented at Lawrence Livermore Laboratory with the computer center is the basis for this discussion. Included will be our planning philosophy as well as practical applications with some examples as they relate to user needs and their satisfaction in terms of hardware, software and facilities.

To digress somewhat from the practical to the abstract is appropriate in an attempt to convey or establish a general understanding of our planning philosophy, both in the long term as well as the short term. It is not intended that this be a theoretical dissertation on planning techniques; but without some appreciation of the framework in which we have conditioned ourselves to function, the application of our technique and the results or outcome may be less obvious.

Considerable emphasis over the past several years has been placed on the importance and the necessity for long-range planning (three to five years). Many guidelines have been established, and considerable effort has gone into defining general objectives. From my point of view it is unfortunate that so little stress has been placed on short-term planning (one year or less). It appears that, to many, the assumption is made that long-range planning will take care of short-range planning if such planning is precise. Changes in budget cycles, changes in program direction, etc., have influenced the accentuation of long-range planning. However, it is questionable whether any long-range plan can succeed without effective short-range planning procedures to implement it. Long-range planning is not a panacea. Within any operating environment, be it a computer facility, a general support function of a large institution, or the institution itself, one finds that, though short-range planning is partially conditioned by the long-range objectives of the group or tiers of groups, insufficient attention is often given by upper management to short-range planning. Too often the general plan is conceived at a relatively high level, and it is assumed that it can be automatically implemented. It, therefore, becomes somewhat paradoxical that while the long-range objectives of upper management depend upon adequate and precise short-range planning for its successful implementation, the latter generally receives less attention from those long-range planners responsible for it. We have concluded that this is a situation that must be avoided if at all possible.

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Assuming that there are at least two levels of planning responsibility (very likely there are three or four), how does one assure that both functions are maintained in concert with one another. This can be answered with one word, communication, which unfortunately has become somewhat of a buzz word. Communication can be defined in the planning context as the passing on of a clear understanding of the general aims and specific objectives. What is to be accomplished? How is it to be accomplished?

Later we will discuss how we attempt to execute this in a practical way, but first let's continue this vein somewhat further.

Any number of basic planning routines have been written about and discussed, but let me give you my version of what works best for us. Let's call these the seven essential steps to good planning, be it long or short term.

1. Clearly establish the direction of effort or overall mission

What is the program or effort that is to be undertaken? What is the product of the effort? e. g., operate a large scientific laboratory, design nuclear weapons, provide modern scientific tools, operate a computer center, etc. ?

To some it may appear somewhat immaterial to consider such a general aspect. Too many people in a planning role fail to realize how restricted a viewpoint others may have of what is the primary direction of effort. For example, as a computer facilities operator, our primary effort is providing computation services; but the Laboratory's primary effort is nuclear weapons design. We must understand and appreciate this broader primary mission.

2. Establish specific objectives

The general direction of effort has been established and is understood. What now are the specific objectives? e. g., acquire a computer, provide a time sharing network, train personnel, build a particular device? How does it fit within the overall mission? Is it achievable?

If the overall mission is understood, the specific objective can be defined. How then do you go about accomplishing the specific objective?

3. Develop a plan

How can the objective be accomplished? If there are alternatives, what are they? Should dual or concurrent courses of action be taken? Each sub-element of the plan or plans should be examined in sufficient detail relative to their importance to the comprehensive plan.

Most often it is at this point that the planner solicits the participation, aid, or counsel of others. They must have an appreciation of Steps 1 and 2 if they are to function effectively in the planning cycle.

4. Test the plan

Is it sound? Will it answer the objective? Can it be funded? Will it enhance the direction or aim and accomplish the objective?

Many a plan has died at this point and rightfully so. In many respects this is like a market survey. Will the consumer buy? In our particular business, our product is service. The consumers are our users; therefore, we must survey their response to our proposed product.

5. Implement the plan

Assemble the manpower to acquire the hardware or staff the effort. Define for them the mission, the objectives, the degree of planning to date, the schedule for completion, and the specific task each is to be responsible for. It is essential that at this point one individual be assigned project responsibility. An individual may have been assigned this responsibility earlier, but an effort should not be allowed to proceed beyond this step without a focal point. That focal point should always be in a position to advise of the current and future status of a project.

6. Carry out the plan

Acquire the hardware, develop the software, accomplish the task.

The final step and a very important one is to:

7. Evaluate performance

Was the overall effort enhanced? Was the objective achieved? Could it have been carried out more smoothly? Did everything go as planned? Were the planning and implementation techniques adequate?

When using this approach for both long- and short-range planning, there is no hard and fast rule for the amount of time spent on any one segment or on the entire process for that matter. It is only relative to the initial direction or aim to be achieved. This is a form of planning or a framework that can be used by almost anyone in any environment. However, the most favorable environment is one in which there already exists a strong management and one that is reasonably well financed. This is not meant to be fallacious. Successful planning depends upon several factors.

1. Adequate time to carry out the planning cycle with sufficient time to thoroughly study and comprehend the mission, the objective and its impact. It cannot be approached casually or superficially.
2. Sufficient staff with a mix of talents necessary to fully examine all aspects of the problem.
3. Management involvement, understanding and support. This requires participation throughout all cycles.

Let's leave the philosophical world now and look at some practical problems.

Mentioned earlier were the three areas of interest as they relate to the determination and satisfaction of user needs: 1) hardware, 2) software, and 3) facilities. Though highly overlapping, each can be discussed separately.

As a support group our computer users are our customers. Because you cannot sell something that is not wanted, user requirements must be carefully and continually monitored. But we are not concerned only with those things that are wanted but also those things that are needed. New innovations, a complete change in direction because of unavoidable circumstances often must be planned for and be implemented without consensus agreement. Our approach is to take our planning up to Step 4, Testing the Plan, before submitting it to the users as a body. This is not meant to imply that at all levels there is not involvement of selective users; in fact, frequently they are the initiators of the requirement. However, generally, direct and broad involvement occurs at Step 4. To assure representation of users, a number of standing committees have been formed to establish and maintain a flow of ideas. For the most part, these groups are interested in specific areas--graphics, remote terminals, languages, operating procedures, etc.

Let me give you an example of long-range planning that evolved over a number of years remaining as a long-range plan yet made up of a series of short-term steps.

In 1963 we conceived our version of time sharing built around the CDC 6600 which was delivered late in 1964. The original configuration included worker computers communicating with a communication controller which in turn controlled remote terminals and a large data base file. The concept was fashioned after the hub of a wheel or an octopus with its center and many spokes or tentacles (see Figure 1). A considerable amount of equipment was assembled and connected together. Each unit and therefore the cycle step was planned with the overall mission in mind. Software was developed to allow for the operation of the hardware, a long-range plan, broken down into many short-range segments, all with the same generalized objective. The planning and implementation cycle spanned a period of five to six years. During this period the system grew from one 6600, 64 remote

terminals, and limited data base file capacity to four 6600's, 300 remote terminals, and a trillion bit plus data base structure. By 1969 though it had become apparent that, at least within our operating environment, the central hub concept had a major deficiency--that was the hub itself. Any failure in the hub or concentrator computer affected the availability and, hence, the productivity of all other segments of the system.

We then entered a new series of planning cycles, again all with the same mission, which has resulted in our converting to the distributed network approach with each of the functions now supported on a subnetwork basis (see Figure 2). The original mission remained the same--providing a broad based, time sharing system with a high level of interactivity. The objective remained the same--providing the users with specific hardware and software tools, i. e., remote terminals and a time sharing operating system. However, a new plan was developed, tested, implemented and has been carried out. We await its evaluation.

In the systems development or software area, planning takes on somewhat of a different dimension. The cycle is shorter and can be related to more specific objectives. A new computer is acquired; therefore, an operating system must be developed which will provide as a minimum the same capability as installed equipment. Obviously, software development is highly dependent upon hardware planning and acquisition; but it is not an after-the-fact situation. Software planning must be as precisely thought out and conceived as any other project and must be carried out concurrently with hardware planning.

Our technique is to assure early involvement of our software groups in all hardware planning. The consequence is that they too must develop an objective plan using the same general planning philosophy. In fact, the organization of our systems development group has been structured to facilitate planning in concentrated areas. One group is responsible for operating systems, another has network responsibility, the third has language development. This way individuals with demonstrated talents in a particular area can contribute more effectively. As indicated earlier, the planning cycle here is much shorter--a long-range plan may be two to three years, with the short range generally less than one year.

We are currently involved in a detailed study of the future development of languages and their utility at LLL. A rather comprehensive plan has been developed which will dictate the course of action we will take over the next two to three years. Within our environment it is apparent that in the immediate future Fortran and its variants--Fortran-Extended and LRL Tran--will continue to dominate as the major production level languages. It is also our belief that this will be the case at most other large scientific facilities. This is of interest to us because of obvious intercommunication problems. Star and its APL base will influence future plans; but at present APL, PL1, and other forms of higher

level programming languages appear to be in a state of acceptance wherein it is premature to assess in which direction they will grow, if at all.

Wherever possible, we attempt to condition our people to the necessity of an importance for planning. I have commented on a specific effort--future development of languages--but this same approach is followed in the area of operating systems, data base management, and user service routines.

Ideally the responsibility for planning should affect everyone at every level; because if it doesn't, then the long-range objectives are in jeopardy due to inadequate implementation in the short-range cycles.

The final area to be discussed is that of facilities planning. All the grand plans in the hardware and software area would come to naught if you cannot get the product to the consumer. Here the planning cycle is even shorter; therefore, we have developed a kind of check list approach to planning. In few other areas is precise scheduling so essential. Either hardware is to be installed on some fixed schedule, or manpower must be available and trained to undertake a particular task. Generally, at least within our organization, these two areas, equipment installation and manpower training, have a direct correlation.

For the sake of discussion, let us assume a new system has been acquired and is scheduled for delivery. Using the same planning approach discussed earlier and assuming Steps 1 and 2 have already been satisfied, what specific factor must be considered in an installation plan? We have found it quite beneficial to build our installation plans on a set of milestones which can be likened to a check list. Both the physical installation aspects as well as manpower support are assured consideration.

Equipment Installation

1. Select the site

Does the site satisfy the equipment requirements?
Can maximum utility be realized with a minimum of modification? Is the area operationally adequate?
How will operators and users be affected by the location?
Is the installation permanent or temporary?

2. Establish equipment specifications

What special requirements must be met to conform with manufacturers specifications for use of the equipment?
This is particularly important with new hardware or systems.

3. Design the layout

How is the equipment to be operated? Have human considerations been given sufficient review? Possibly time and motion studies should be considered.

4. Create working engineering plans

At this point a number of tasks must be reviewed to assure that certain factors are not overlooked:

- a. Flooring, ceiling, and walls.
- b. Power supplies and cable layout.
- c. Lighting, communications (particularly important for remotes).
- d. Environmental conditions.

- Acoustics
- Air conditioning
- Temperature control
- Filtration
- Humidity control
- Vibration

- e. Safety.
- f. Appearance.

5. Establish completion schedule

Set up a PERT schedule. Is it realistic? Is there sufficient overlap against delay at any step?

6. Provide for post-installation adjustment

Clean up, minor alterations or relocations. If your planning has not provided for this type of contingency, your plan is in all likelihood underestimated.

Manpower Planning

1. Manpower levels

Will equipment represent an increase or decrease in manpower. If an increase, how many? If a decrease, what new tasks have highest priority?

2. Training

Can the task be performed by current staff? Do new talents have to be developed? Is the current staff capable of handling new training? When should training be accomplished--before delivery or after delivery?

3. Phase over

With fixed staff, can phase-in/phase-out period be bridged? Will phase over affect production?

4. Human factors

What will be the impact on moral? Will site location and system layout decisions hold up during useful lifetime? Have equipment environmental considerations adversely impacted human factors?

As is the case in other areas of our responsibility, a particular group of people is responsible for facilities planning. They utilize a planning technique which we have found to be effective and responsive. In all cases, we require monthly progress reports to assure that both the planners and implementors communicate their achievements as well as their problems.

In summary, at LLL we have established a planning philosophy built around a series of cycles or steps. We use these steps as a guideline. They are.

1. Establish the direction of effort or overall mission.
2. Establish the objective.
3. Develop a plan.
4. Test the plan.
5. Implement the plan.
6. Carry out the plan.
7. Evaluate performance.

We apply these guidelines to both long-term as well as short-term planning. Where possible, a form of check list has been developed to assist the planners.

It works for us, it might work for you.

Fig. 1. The classical OCTOPUS concept.

Fig. 2. Octopus Distributed Network