

Data Center Projects: Project Management

By Neil Rasmussen

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White Paper #141

Prepare

Design

Acquire

Implement

APC[®]
Legendary Reliability[®]

Executive Summary

In data center design/build projects, flaws in project management and coordination are a common – but unnecessary – cause of delays, expense, and frustration. The ideal is for project management activities to be structured and standardized like interlocking building blocks, so all parties can communicate with a common language, avoid responsibility gaps and duplication of effort, and achieve an efficient process with a predictable outcome. This paper presents a framework for project management roles and relationships that is understandable, comprehensive, and adaptable to any size project.

Introduction

In a project to build or upgrade data center physical infrastructure, a structured and standardized **process** provides the essential foundation for efficient project execution and a successfully deployed system. A model for such a standardized process is described in APC White Paper #140, “Data Center Projects: Standardized Process.” A major element of this standardized project process is *project management*, which guides the project through its various phases and coordinates the work of all parties to the project.

Even if a project is being led by an experienced consulting firm, there will be other parties to the project – the end user, various hardware or service providers, a general contractor – who have a role in the management of project activity. The responsibilities and interrelationships among these various contributors must be coordinated and documented in order to avoid dropped handoffs and ambiguous responsibility. Such problems are not necessarily due to flaws in the activity of the parties involved, but rather to the lack of an overarching, shared process guiding all parties as a management *team*, clarifying accountability and communication.

As data center build and upgrade projects move away from art and more toward science, project management must be re-examined using the same principles as the rest of the process. Just as the *steps* of the project work should be structured and standardized to simplify and streamline the process, it is equally important that project *management* activities be structured and standardized. The benefits of a well-documented, standardized, and mutually understood project management model are similar to the benefits obtained from the rest of any standardized process model:

A common language. When all parties to project management are operating from the same model, using the same terminology to refer to same things, many problems caused by miscommunication and different viewpoints are eliminated.

Transparent terminology. With management roles having names that clearly represent what they do, another cause of miscommunication is eliminated.

Clear delineation of responsibilities. A mutual understanding of who is doing what clarifies relationships and avoids duplication and conflict.

Complete coverage of necessary activities. A carefully designed model ensures that all management responsibilities are accounted for, and nothing “falls through the cracks.”

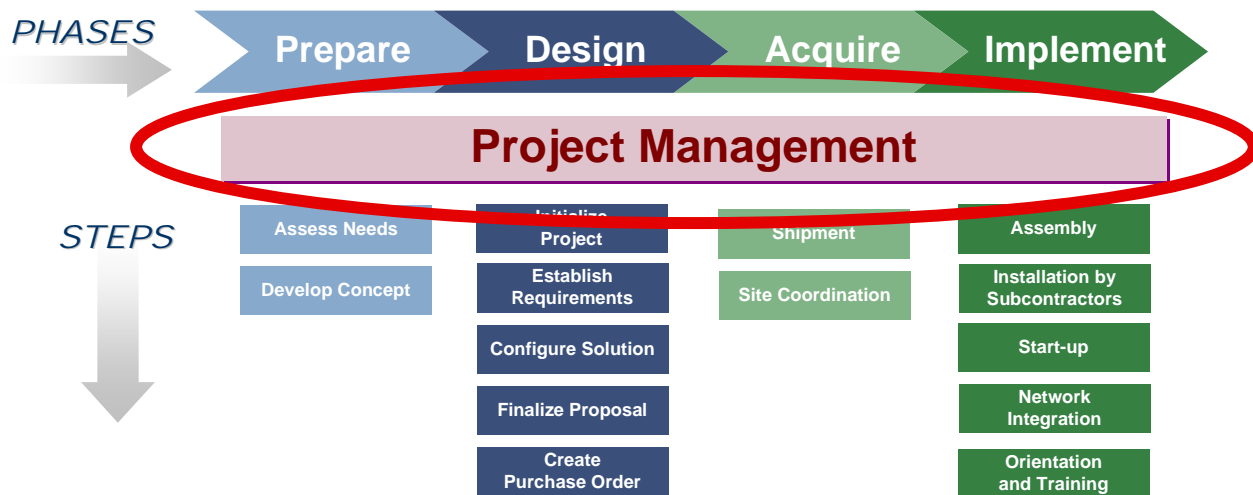
This paper presents a model for management roles and the relationships among the project management activities of the end-user (the customer) and the various suppliers of products and services for the project. It does not attempt to describe project management techniques – rather, it describes a framework for the structure of a *standardized model and terminology* for project management in data center design/build

projects. This model can be adapted according to the preferences of the user/customer and the specific requirements of the particular project.

Configuring Project Management Roles

In the standardized model of the project process, *project management* is a broad category of oversight activity that occurs throughout the course of the project to provide communication, planning, coordination, and problem resolution (**Figure 1**).

Figure 1 – Project management in the project process map



For more about this process map, see APC White Paper #140, "Data Center Projects: Standardized Process"

As with any business project, data center project management provides dedicated oversight to address project-critical activities such as

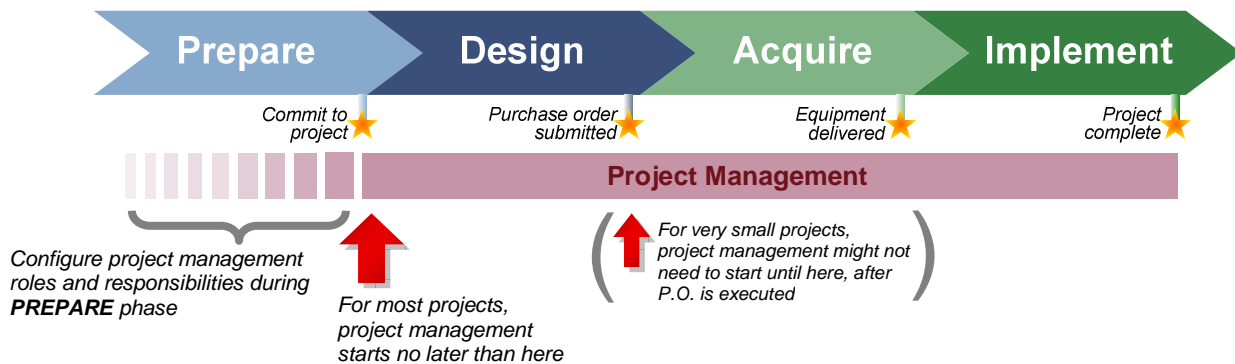
- Scheduling
- Resources
- Scope of responsibilities
- Continuity (handoffs)
- Budget
- System changes
- Process defects
- Status reporting

General techniques, training, and tools for project management are well documented in business and industry literature, and are beyond the scope of this paper. This paper focuses on the particular project management roles needed for data center projects, and how those management responsibilities can be divided up and accounted for, in order to meet the needs of a specific project. Determining which management *roles* are needed for the project, and who will perform them, is part of **configuring** the process for the project at hand. **The proper configuration of the process is as important to the success of the project as the configuration of the physical equipment of the system.**

When does “project management” start?

The configuration and delegation of project management activity is a critical element of process design that must be considered and determined up front, well before the time comes to execute it. Depending upon the size, scope, and clarity of the project initiative at the outset, assigned and dedicated management may not begin until after the initial fact-finding activities of the **Prepare** phase, which identifies and clarifies the endeavor as a “project” (**Figure 2**). Note that the milestone defining the end of this first phase is **Commit to Project**, which typically marks the beginning of whatever tracking and database activities will be used to support the project, and in some cases may be the point at which formal “project management” starts.

*Figure 2 – For a typical data center project, project management should be configured and ready to execute by the end of the **Prepare** phase*



Projects of greater scope or with more customized engineering may require that project management activity begin earlier – during the **Prepare** phase – whereas for smaller data center expansion projects, project management may not need to start until later, after the purchase order is executed at the end of the **Design** phase. The size, complexity, and criticality of the project will determine when “project management” needs to become a structured, dedicated role.

Regardless of how and when project management is configured, there will always be some project management activity in the customer organization from the very beginning, if only to make the configuration decisions and possibly negotiate contracts for outsourced management. This ongoing management role is shown as “customer-side project management” in **Figure 7**, later in this paper.

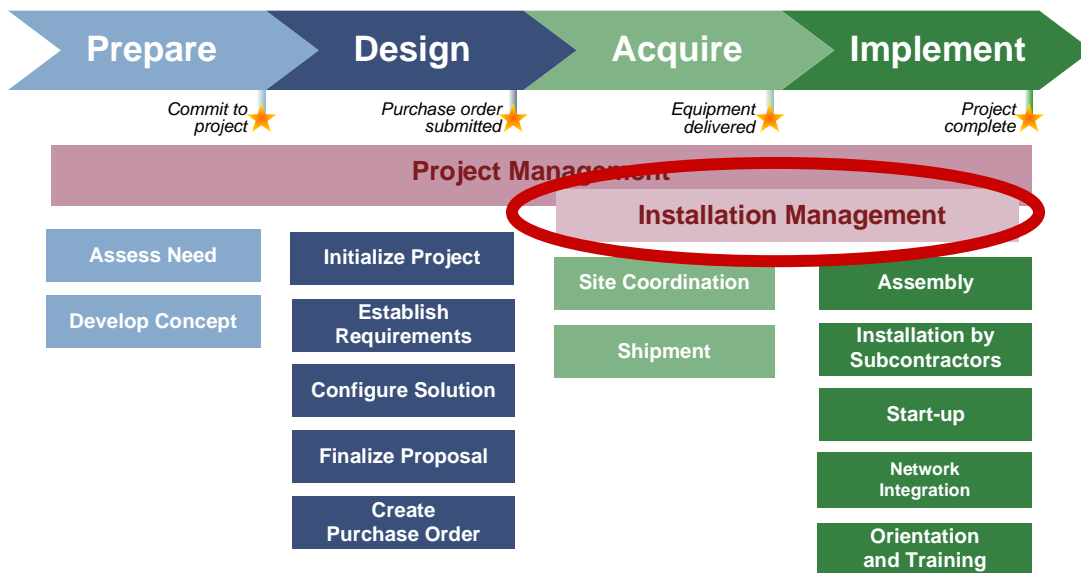
Subordinate management roles

The general process map of **Figure 1** shows project management as a single bar across the top, implying that it is one job. It *can* be one job, and in smaller projects it might be configured that way. More often it is configured as more than one job, or an oversight job with subordinate jobs under it. For example, “installation management” can be defined as a separate role spanning the **Acquire** and **Implement** phases, overseeing on-site activity related to delivery and setup of the physical system (**Figure 3**). Management roles such as this should be considered modular elements of overall management, remaining subordinate to the overall end-to-end project management role.

Theoretically, management responsibility could be subdivided further by assigning separate management to each of the four phases, or even to combinations of steps within a phase (not generally recommended, but it could be appropriate in special circumstances). More typically, management responsibility is subdivided by the organization(s) providing hardware and services – for example, APC or sub-contractors – not by steps in the process model.

At the most granular level, note that *step* management is already built into the process, as the “owner” that is assigned to each step (see “Anatomy of a Step” in APC White Paper #140, “Data Center Projects: Standardized Process.”)

Figure 3 – Subordinate management roles, such as installation management, can be defined under the overall project management role



Dedicated point-of-contact

Regardless of how project management responsibilities are configured, the objective of each management role is the same: seamless coverage within its scope of responsibility, integration with other management roles, and a dedicated point-of-contact at all times. A dedicated point of contact is especially critical when the ultimate responsibility lies with delegated sub-roles or third party providers. Such a dedicated point-of-contact, whose job it is to field, direct, and coordinate communication, should be considered an essential role in every project. For example, in APC's implementation of the standardized project process (used to conduct the sale and execution of a customer project – see later section **Project Management Detail**) the “project commitment manager” is the dedicated point-of-contact for the project. This management role monitors and facilitates fulfillment of all commitments made to the customer – delivery dates, appointments, and other promises – during the course of the project, with authority to do “whatever it takes” to clear roadblocks and solve coordination problems.

Documentation and tracking

Regardless of how project management roles are configured for the project, an essential project management responsibility is documentation and tracking of project activity. Current project information must be easily accessible at all times to authorized project team members and service partners. A common and effective method is an online Web site. This interactive project record should not only provide up-to-date information, but it should also accept feedback, comments, requests, and problem statements, and route the information appropriately. The project database should be able to provide updates and reports, and log ad hoc information such as contractors' vacation schedules, alternate phone numbers, and miscellaneous remarks.

Coordination of Multiple Suppliers

Most data center projects will have more than one supplier of hardware or services contributing to the work of the project. The customer may engage separate equipment vendors or service providers for power, cooling, racks, security, fire suppression, electrical work, mechanical work, and perhaps a general contractor if building construction is required. Each supplier of hardware or services will have potential interaction or dependencies with the other suppliers to the project. For example, fire suppression installation depends upon piping and wiring that must be installed first, both of which may be handled by a different supplier.

While each of these suppliers will have its own “project manager” to conduct the work it contributes to the project, there is an additional project role that spans all suppliers: **coordination**. Coordination provides an interface among suppliers with whom there are equipment or time dependencies. It is a role that can be difficult to assign when there are many suppliers to a project.

If dependencies among suppliers are not coordinated, delays and expense can result from supplier site visits that are scheduled too soon for the handoff, or from one supplier unnecessarily waiting for something

from another. Coordinating the work of all suppliers is a critical part of project management that can be overlooked in planning, but is essential to the efficient and reliable progress of the project.

Minimizing the number of suppliers – for example, by bundling some services and equipment under a single vendor – shifts some of the coordination burden to the intermediate vendor and reduces the risk of faulty communication between suppliers (**Figure 4**). While it may not be possible to have everything handled by a single vendor, reducing the number of vendors can significantly decrease the coordination burden, especially when all possible interdependencies are considered (**Figure 5**).

Figure 4 – Bundling project elements under one vendor

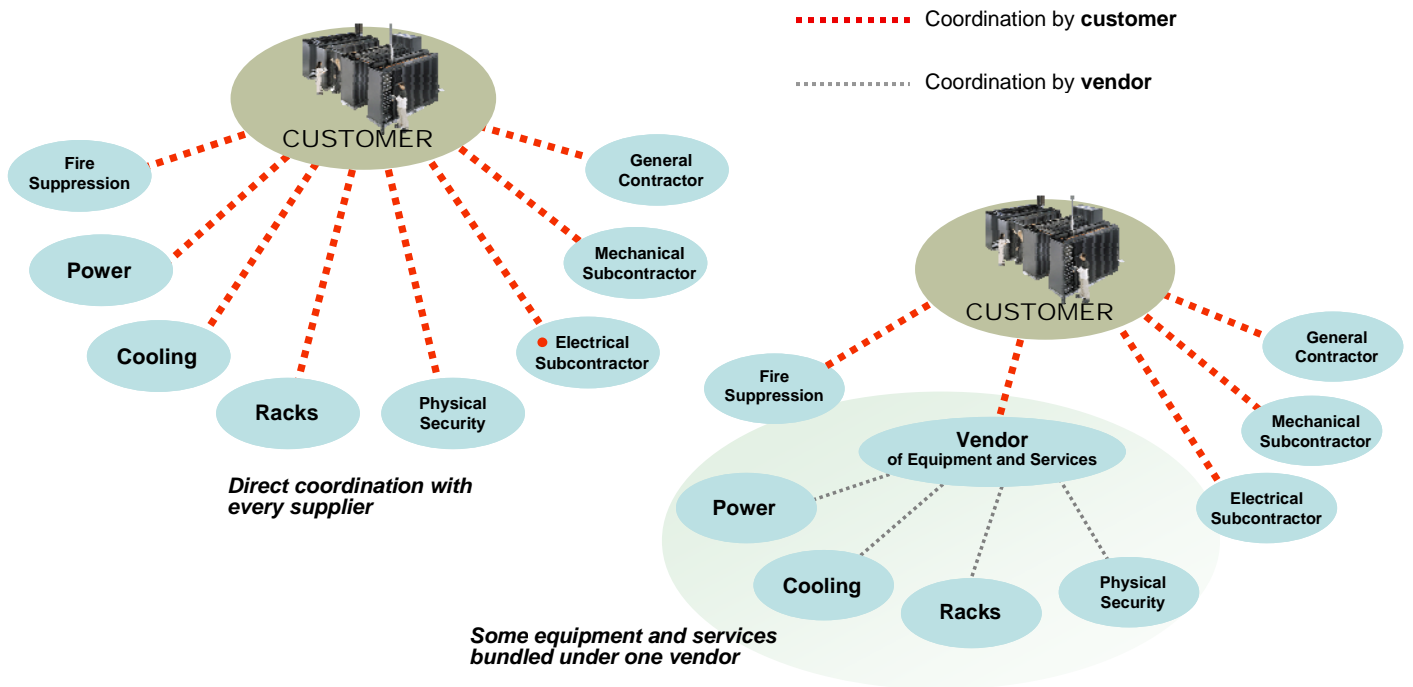
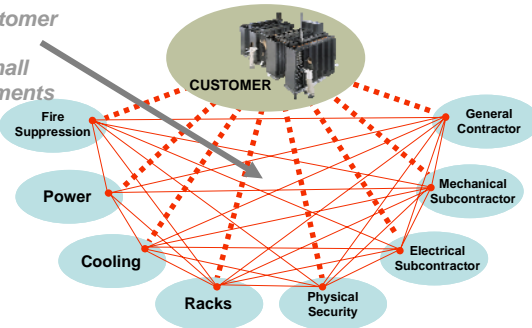


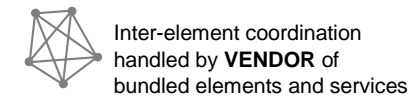
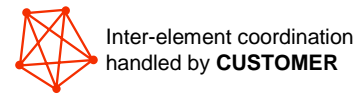
Figure 5 – Bundling project elements reduces coordination burden on the customer

ALL inter-element coordination by customer

Appropriate for a small project with few elements (e.g. wiring closet)

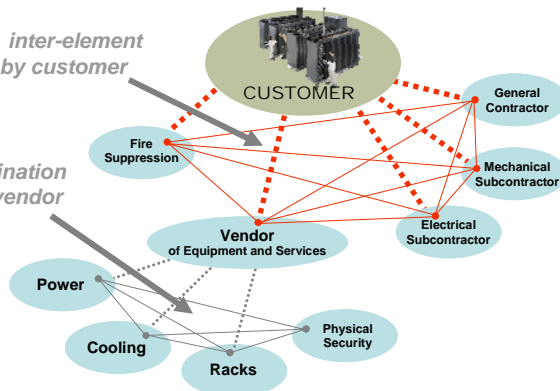


a. All independent suppliers



REDUCED inter-element coordination by customer

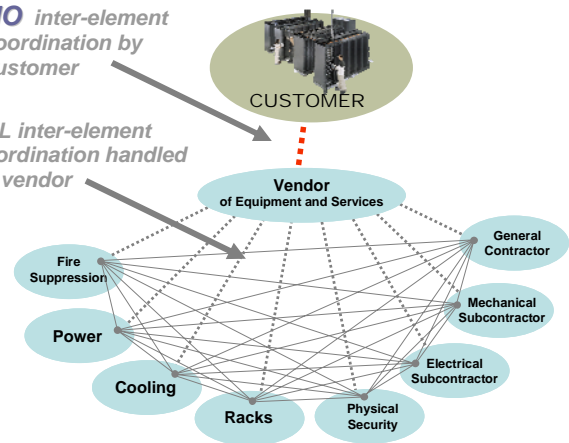
Some coordination handled by vendor



b. Some elements supplied by a single vendor

NO inter-element coordination by customer

ALL inter-element coordination handled by vendor



c. Vendor provides services to manage all other suppliers

Using Services for Project Management

Qualified service providers may be included in the project management configuration, to supply some or all project management activities. Whether, how much, and to whom the organization decides to delegate project management duties depends upon the nature of the project and the preferences of the organization. There are three general models for engaging external service providers in project management responsibilities:

Do-it-yourself. All project management is done internally, from start to finish.

Partial outsource. Handle some management duties internally, outsource some to one or more providers. A typical example is outsourcing the “installation management” portion (see **Figure 3**).

Complete outsource. Hire out all management responsibilities to a service provider, with internal oversight only. (Even with complete outsourcing, there must always be someone within the user organization who, if not actually *doing* project management, is monitoring who *is*.)

Resources, skills, budget, and preference will determine how much of the project’s management is handled in-house and to what extent management is outsourced to a service provider.

Statements of Work

Regardless of the scope of involvement, any portion of project management that is outsourced to a service provider must have a “statement of work” that clearly defines the work to be done, including deliverables, assumptions, scope of responsibility, and work details. A robust statement of work helps all stakeholders quickly understand benefits, outputs, cycle time, and pricing. The customer should be able to assemble a project management configuration that meets the project requirements using such modular statements of work that can be “plugged in” to an overall management plan.

Choosing partners

In choosing partners for collaboration in the project process (to provide elements of the process as services), decisions regarding whether and whom to engage will be primarily guided by the availability of qualified expertise in project process activity. If that challenge can be met, the considerations in choosing service providers are similar to those generally stated for any IT outsourcing:

- **Optimize resources.** The main consideration in outsourcing is the prospect of freeing up scarce IT resources to focus on core competencies and strategic business activity. With a competent service provider, project process activities are in the hands of someone for whom project process is the core competency. The result, if the provider is qualified, will be lower cost, faster results, and fewer defects.
- **Minimize vendor interfaces.** A current partner, if qualified in the area of project process, provides the advantage of an existing (and presumably trusted) relationship, which means little or no incremental resources needed to establish or maintain an additional provider interface.
- **Minimize handoffs.** The process will be more reliable if the number of handoffs between providers is minimized



Example statement of work:
APC “Installation Management” service

- **Demand statements of work.** Detailed and accurate statements of work – in the context of a clearly articulated overall process – clarify in advance what the vendor will provide, enable understandable and predictable work results, and minimize wasted time.

Project Management Detail

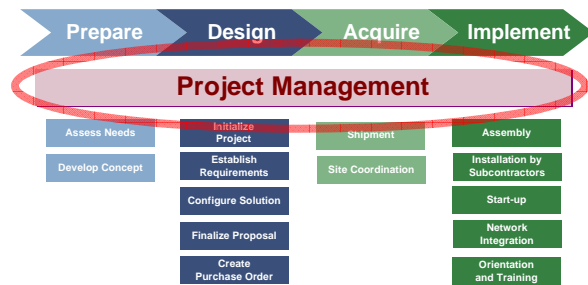
The project process described so far in this paper is a generic framework for the structure of a standardized project process, which has been developed and generalized from APC’s experience with project process.

When APC becomes involved in a customer’s data center or computer room project – as a supplier of hardware and services – it follows a detailed process like this generic one, to collaborate with the customer in ensuring that nothing is omitted and everything occurs at the right time. This section details the components of the “project management” portion of the APC project process, to illustrate how management roles are divided among project stakeholders in a typical project. (In **Figure 4**, earlier, APC would be the vendor supplying a bundled package of project elements.)

APC Process – An Example of Project Management Roles

Since some readers of this paper may, now or in the future, be involved with APC in a data center or computer room project, this section details the terminology and responsibilities of project management roles as they are configured in the standardized process used by APC when conducting a data center project for a customer.

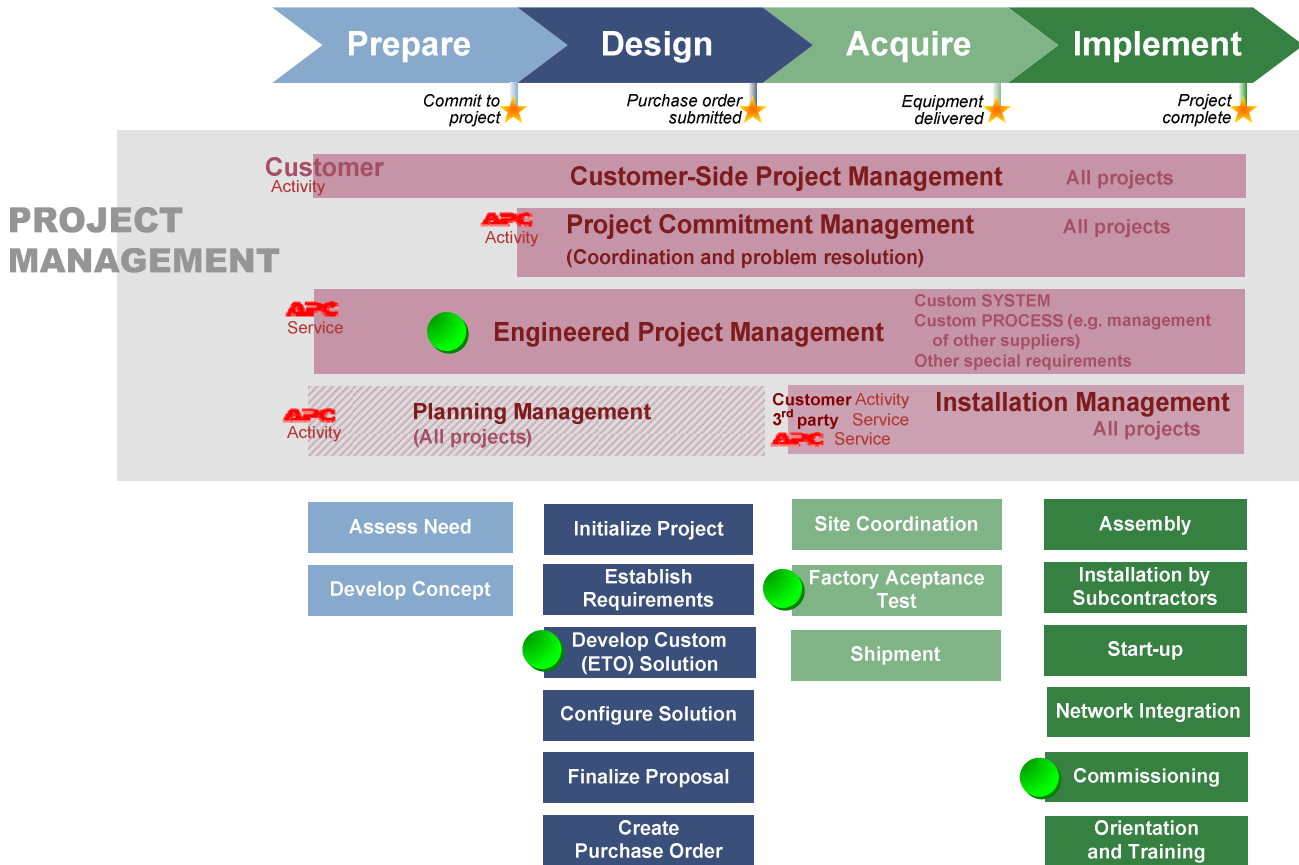
The project management portion of the standardized process was introduced earlier in **Figure 1** (repeated here) as a single bar spanning all phases. In practice, the responsibilities that comprise “project management” can be delegated, combined, split, subordinated, or outsourced in a variety of ways among the end user, the primary equipment supplier (APC in this case) or a third-party service provider.



(From **Figure 1**)

Figure 6 shows the breakdown of project management activity in the process that APC uses when it is engaged in a customer project as a supplier of hardware and services. While specific to the way APC conducts the process, these roles are representative of the activity that takes place in any data center project. Each project management bar is defined following the figure.

Figure 6 – Detail of project management activity in the process used by APC to conduct a customer project



 = Additional process elements for custom engineered system (also called ETO, or engineered-to-order)

Definitions of project management roles in Figure 6

Customer-Side Project Management

Customer Activity **Customer-Side Project Management** (All projects)

Customer-side project management is what the customer (the end-user or “owner”) does to manage and track the project. For a small project it may be hands-on control of the entire process; for large projects it may be oversight of delegated or outsourced responsibilities. At a minimum, this role includes basic administrative activities:

- Coordinate with vendors
- Negotiate contracts
- Release payments

Whatever level of involvement it assumes, this role is always present in the customer organization.

Project Commitment Management



Project Commitment Management (Coordination and problem resolution)

All projects

Project commitment management is a management role that any vendor should have in place for handling customer projects.¹ This role has “swat team” authority to troubleshoot problems and take the necessary action to solve them. The responsibilities of this role focus on activities that ensure the project runs smoothly and efficiently:

- Communicate with the customer regarding the status of all commitments made
- Coordinate internal tasks to ensure that all commitments are fulfilled and time dependencies are correctly managed
- Coordinate with other suppliers to ensure that time and equipment dependencies are optimally managed
- Initiate corrective action against any identified delays, shortages, ambiguities, or other problems
- Serve as the customer’s single point of contact with this vendor

Ideally, commitment and scheduling information is visible to all project stakeholders (including the customer) using a convenient access method such as a Web-based tracking site, which the project commitment manager updates and manages.

Engineered Project Management



Engineered Project Management

Custom SYSTEM
Custom PROCESS (e.g. management
of other suppliers)
Other special requirements

Engineered project management is for any project having elements beyond what can be handled by standardized system architecture or by the steps and management roles of the standard project process.

Projects that need this service are those having one or more of the following:

- Custom engineering of the physical system
- Custom process – most commonly, the management of third-party suppliers (for example, managing the specification, acquisition, and installation of customized switchgear or piping systems)
- Any other nonstandard project requirements

¹ The role of “project commitment manager” is only **part** of what a vendor would typically call “project management” within its own organization. The rest is (1) whatever the vendor does to manage its internal operations that support the work done on the project and (2) customer-facing project activity that supports special requirements of the customer’s project – this nonstandard management activity, if present, falls under the “Engineered Project Management” role in **Figure 6**.

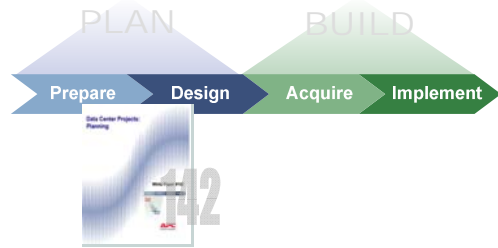
The details of this management service are determined on a custom basis, depending upon the project.

Planning Management

Purchase order submitted ★



Planning management is a combination of oversight and work that occurs during the **Preparation** and **Design** phases to establish the viability of the idea, define the scope and constraints of the project, and launch the project. Planning management spans the two-phase PLAN half of the process, up to the point where a purchase order is executed, which marks the start of the BUILD half of the process. The planning activity covered by this role is described in APC White Paper #142, “Data Center Projects: System Planning”



Installation Management

Purchase order submitted ★



Installation management covers the on-site activity that receives and installs the physical equipment, from navigating doorways and elevators to starting up the system and training the equipment operators. For a small project, the customer may wish to handle this in-house. For larger projects, it may be desirable to outsource this responsibility to a service provider – either the equipment supplier (APC in this case) or a third-party source. Having this service provided by the equipment supplier (1) ensures that the equipment will be installed according to the supplier’s specification and (2) provides the simplicity of a direct interface with the equipment supplier’s project coordinator for scheduling and commitment tracking.

Tracking Responsibilities

As with all roles in a project, it is essential that all project management roles be not only well defined, but explicitly *assigned*, with complete clarity at all times regarding who is doing what. Every management block in the process diagram of **Figure 6** must be explicitly assigned to a person or party who will be responsible for executing it. Whether managed internally or outsourced to a service provider, it is crucial that every element of project management be clearly accounted for by creating a responsibility list such shown in **Table 1**. An explicit and agreed-upon list of assignees *for every role in project management* provides protection from surprises, delays, and the unwelcome remark “I though someone ELSE was doing that.”

Table 1 – Sample checklist for project management responsibilities

Every project management role in the process must appear in this list

Management Role ↓	Responsibility		
	Customer (✓)	Primary Equipment Vendor (✓)	3 rd Party (Who?)
CUSTOMER-SIDE project management	✓		
COORDINATION of all suppliers			
PLANNING management			
INSTALLATION management			
ENGINEERED project management (If needed)			

Conclusion

The critical value of *process* in a data center build or upgrade project extends to the project management roles that support and direct the project's activity. The responsibilities and interrelationships of project management roles cannot be left to assumption or chance, but must be explicit, assigned, and tracked.

The project management model described in this paper is a framework to show essential characteristics that must be considered in any implementation of a standardized project process. For the particular organization conducting the project, and for any particular project within that organization, the configuration and delegation of project management roles will vary to meet the requirements of the project.

The project management model described in this paper is the one developed by APC to meet the requirements of effective project execution for their customers, who may choose to do some or all project management themselves, or hire services to perform selected portions. A clear and complete definition of management roles enables those roles to be captured as

Keys to Effective Project Management



Consistent terminology

All parties to the project must speak the same language in order to avoid wasted time and defects due to miscommunication

Every role accounted for

Explicit responsibility for every management role must be assigned and tracked

Coordination among suppliers

Every dependency between suppliers of equipment or services must be identified, tracked, and managed, to ensure correctly sequenced timing, smooth handoffs, and no lost time from waiting

Expect change

Well-defined, dedicated procedures must be in place to handle changes and mistakes

statements of work and offered as service modules, for customers who wish to delegate project management responsibilities. Other organizations may have their own description of similar management roles, with different terminology and responsibility grouping, but the goals are the same: clearly defined roles, consistent terminology, and explicit responsibility.

Well articulated management roles should be standard operating procedure for any user-directed project, and demanded of any service provider. A standardized, documented, and understandable methodology assures a lean, *predictable* process that speeds deployment, facilitates communication, reduces cost, drives out defects, and eliminates waste.

About the Authors

Neil Rasmussen is the Chief Technical Officer of APC. He establishes the technology direction for the world's largest R&D budget devoted to power, cooling, and rack infrastructure for critical networks. Neil is currently leading the effort at APC to develop high-efficiency, modular, scalable data center infrastructure solutions and is the principal architect of the APC InfraStruXure system.

Prior to founding APC in 1981, Neil received his Bachelors and Masters degrees from MIT in electrical engineering where he did his thesis on the analysis of a 200MW power supply for a tokamak fusion reactor. From 1979 to 1981, he worked at MIT Lincoln Laboratories on flywheel energy storage systems and solar electric power systems.

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From 1971 to 1981 Suzanne worked on the development team that created Express, a pioneering multidimensional data management system (now part of Oracle). She has been educating diverse audiences for over 30 years using a variety of media from software manuals to photography and children's songs.

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