Future Institute of Technology

Department of Computer Science and Engineering

Technical Report for CA2

Critical Path Analysis and Project Crashing: A Case Study in IT Infrastructure Setup

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ABSTRACT

Project management in the IT sector requires efficient planning, scheduling, and resource allocation. Among the key techniques, Critical Path Analysis (CPA) provides a systematic method to identify crucial activities that directly impact project completion time. Project crashing, on the other hand, offers an approach to shorten project duration by allocating additional resources to critical activities. This report explores CPA and crashing through a case study of setting up an IT infrastructure project—specifically, establishing a new computer laboratory. The study emphasizes the importance of identifying critical tasks, managing dependencies, and applying crashing techniques to meet deadlines in resource-constrained environments.

INTRODUCTION

In today's technology-driven world, organizations and educational institutions rely heavily on robust IT infrastructure to support their operations, enhance productivity, and enable innovation. Projects such as establishing a new computer laboratory, migrating to the cloud, or setting up a data center require meticulous planning and coordination because they involve multiple interdependent tasks like procurement, installation, testing, and integration of hardware and software. The complexity of these projects makes project management techniques essential to ensure timely delivery within budget.

One of the most widely used tools in project scheduling is **Critical Path Analysis (CPA)**. CPA helps in identifying the sequence of tasks that directly determine the minimum time needed to complete a project. Any delay in these tasks delays the entire project, making them critical. By focusing on these activities, project managers can allocate resources more efficiently, monitor progress closely, and anticipate potential bottlenecks.

However, real-world projects often face strict deadlines due to academic schedules, business demands, or client requirements. In such cases, completing a project within the normal timeline may not always be feasible. This is where **project crashing** becomes useful. Crashing involves reducing the duration of critical activities by allocating additional resources or adopting alternative methods, often at an increased cost. While this trade-off between cost and time must be carefully managed, it provides project managers with the flexibility to meet urgent deadlines without compromising overall project quality.

Case Study: Setting up a New Computer Laboratory

Project Scope

The university has decided to set up a new computer lab with **60 systems** for students. The lab must be ready within **10 weeks**, aligning with the start of a new semester. The main activities include procurement, installation, and testing of systems, along with supporting infrastructure like networking, power supply, and furniture.

Activities and Durations

The project activities, dependencies, and estimated durations are shown in **Table 1**.

Activity	Description	Predecessor(s)	Duration (weeks)
A	Finalize lab design and layout	—	1
B	Procure computers	A	3
C	Procure networking equipment	A	2
D	Procure furniture	A	2
E	Electrical wiring and setup	A	2
F	Install furniture	D, E	1
G	Install computers	B, F	2
H	Networking installation	C, F	2
I	System configuration and testing	G, H	2

Critical Path Analysis (CPA)

By constructing a network diagram and performing forward and backward pass analysis, the following results are obtained:

Path 1: A → B → G → I = 1 + 3 + 2 + 2 = **8 weeks**

Path 2: A → C → H → I = 1 + 2 + 2 + 2 = **7 weeks**

Path 3: A → D → F → G → I = 1 + 2 + 1 + 2 + 2 = **8 weeks**

Path 4: A → E → F → H → I = 1 + 2 + 1 + 2 + 2 = **8 weeks**

Project Crashing

Suppose the university requires the lab to be ready in **7 weeks** instead of 8. Project crashing must be applied.

Crash Cost and Time Estimates

Table 2 provides hypothetical crash options.

Activity	Normal Duration	Crash Duration	Crash Cost (₹) per week saved
B	3	2	20,000
E	2	1	15,000
G	2	1	25,000
H	2	1	18,000

Crashing Decision

Since we need to reduce project time by **1 week**, crashing should be applied to the cheapest option on the critical path.

- Activity E can be reduced from 2 weeks → 1 week at ₹15,000.
- This reduces all paths involving E, lowering total project time to **7 weeks**.

Thus, the project can be completed within the university's required deadline at an additional cost of **₹15,000**.

Analysis and Interpretation

The case study shows that **CPA identifies key activities** controlling project duration, while **crashing helps meet strict deadlines at extra cost**. Multiple critical paths increase risk, as delays in any of them affect completion. Crashing must balance **cost vs. urgency**—in this case, ₹15,000 avoided a one-week delay. For larger IT projects like cloud migration or data centers, costs are higher but the same method applies.

CONCLUSION

This case study highlights the critical role of **Critical Path Analysis (CPA)** and **project crashing** in the effective management of IT infrastructure projects such as computer lab setups, cloud migrations, or data center installations. CPA provides project managers with a systematic way to map out all activities, determine dependencies, and identify the sequence of tasks that directly influence the total project duration. By focusing resources on these critical activities, managers can prevent delays and ensure smoother execution. However, projects often face external pressures such as academic schedules, business requirements, or contractual deadlines that demand shorter completion times than the normal schedule allows. In such situations, project crashing becomes an important tool, as it enables managers to reduce the duration of critical tasks by investing additional resources or adopting faster methods. Although this inevitably increases direct costs, the trade-off is justified when the cost of missing deadlines is significantly higher than the extra expenditure. The case study also reveals that projects with multiple critical paths carry higher risks, since any delay across those paths can extend the project timeline, making the careful selection of activities for crashing even more crucial. Moreover, the decision to crash should always weigh urgency against financial feasibility, ensuring that costs are contained while deadlines are achieved. For small projects, the added cost may be manageable, while for large IT projects the implications are more significant, but the methodology remains equally valuable. Thus, CPA and project crashing together ensure a balanced approach to delivering IT projects on time and within acceptable cost limits.

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