

## **Chapter 1: Start-Up** / By: Tal Levanon

### **1.1 The Investors**

“Sorry,” Todor said, shaking his head and settling into his black armchair near a table laden with refreshments. “Things just can't go on like this.”

The color drained from the face of Philippe, the CEO. He was also the first to break the silence that had paralyzed the large board room. “Exactly what are you referring to, Todor?”

“We represent three venture capital funds that invested a huge sum in your start-up a year ago,” answered Todor.

“By now we should have seen something working,” Eric took up the thread, “and we're hearing circumvents but we've seen nothing.”

David opened his mouth to respond, but Ron was faster. “You committed to a schedule that stated – and hear I quote...” Ron said, as he leafed through the pages, “alpha prototype will be ready two weeks from today, and the beta prototype will be at the first client six and a half months from today.”

“And now,” Todor continued, his voice quiet and authoritative, “you're sitting here opposite us, and telling us that the alpha version isn't ready yet and the beta will be another year from now. Six months delay? Not acceptable to us.”

“Wait a second,” Philippe cleared his throat. “I need to explain something. This is a future-oriented product, it's revolutionary!” As he became enthused, the color returned to his cheeks. “The product's based on electro-optic components operating on light instead of an electron basis. Currently the components of all the communications systems we're familiar with work on the basis of speed of sound, or electron speed. But with our components, they'll work at the speed of light! It'll revolutionize every sphere of life, from the internet download rate for large files to satellite communications. Everything will change...”

“Yeah, sure,” Eric cut him short. “We saw that presentation two years ago.”

“We submitted one of the innovative components already six months ago,” David began, “and although it was still a lab version, we showed you its ability. Meanwhile we've encountered various technological issues that we're busy solving at the moment, as well as certain problems not dependent on us. Before we started with development, there was no way we could've known that of all the materials needed for the product, we'd need special lenses which can be supplied by only two producers in the world, and whose timetables run to somewhere between four and six months to delivery. That delay isn't our fault!” By the time David finished, he was almost yelling.

“David,” Ron said, “we represent people who've invested large sums in you so that you can develop a product that will return their investment with high interest while creating a

workplace of excellence for yourselves, with plenty of bonuses. If you'd have maintained the timetables you set, we'd be sitting here today, drinking coffee, nibbling the biscuits you've set out for us, smiling at each other and moving forward. We would have reported to the investors on the project's progress according to plan, and you'd be presenting your alpha model in two weeks."

"Except that that's not the case," Eric continued, in a low, decisive voice. "Now, suddenly, you need additional investment. How does that sit the page you've given us, explaining in four lines that all the milestones are running late?"

"That's the final straight, which we need to shape the technology into a product!" Geoff, Vice Director of Financing, cut into the conversation. "Yes, it's further investment, but it will lead to the yield!"

"Geoff," Todor said, "only after we receive more data we'll be able to determine if it's a good investment or if it's 'good money after bad money'."

"Which data do you need?" Philippe asked.

"We want to see a work plan," Todor answered. "We want a comprehensive plan, with timetables detailing who's doing what and when, showing us how you get from the alpha to beta versions on predetermined dates. We want to see that you've structured a serious outline, one you can uphold."

Todor paused briefly, exchanging looks with Ron and Eric. "If we see serious teamwork from you, we'll consider recommending additional investment, each of us to the particular fund we represent. But," and his voice dropped in pitch, "if we're presented again with a page showing only milestones, we'll be forced to recommend immediate shutdown."

"Todor," Philippe responded, a light tremor audible in his voice, "we have complete faith in our technology, and our people, and it would be a great shame for all our work to go down the drain at this stage!"

"Shall we set the next meeting for two weeks' time?" Ron asked.

"I'll be overseas then, for a full two weeks," Todor answered.

"Work or play?" Eric asked, and was the first to take a bite from the refreshments served at the beginning of the meeting.

"Both," Todor said. "So shall we set the next meeting for an earlier date? Ten days?"

"No," Philippe answered quickly. "Todor, we want to do this thoroughly, because we all live and breathe this project. Could we meet once you're back?"

"Done," Todor agreed, exchanging glances again with Eric and Ron. "Our secretaries will coordinate the meeting."

The three foundation representatives simultaneously stood and after a round of quick handshakes, left the board room.

Philippe flopped into his chair and looked at the refreshments left on the table. “David, we need to set up a professional schedule and stick to it. Geoff, we have to check our cash flows and figure how much time we can hold out, and what alternatives exist.”

“There aren’t many possibilities,” Geoff replied. “If there’s money, we can work. If there isn’t, we’ll have to let people go, or close the company. I’ll try to look for some other creative sources of financing. This needs inventive thinking,” he said, as he left the room.

David took a deep breath just as Jon, head of electronics, burst like a thunderstorm into the room. “David, it’s impossible to go on like this!” His hand darted towards the plate of pastries. Munching on one, he continued: “I need two more people, urgently!” he demanded as a crumb landed on his shirt.

“Jon, right now that’s out of the question!” David responded quietly.

“But really, things can’t go on like this. We’re at it round the clock,” Jon’s eyes narrowed to slits, “from morning to night. My whole team’s building electronic programs, planning the circuits, and checking components, but we can’t keep to the timetables. I’ve got really good, skilled people who’re giving their soul, but we need at least two more staff members just so that we can manage to implement all the tasks!” Jon’s voice had risen so loudly that a vein in his neck could be seen throbbing. “Either we add people, or we reduce the number of tasks! I can’t sleep nights because of this!”

“Jon, we’ll check every option and get back to you. Right now, there’ll be no additional staff joining, nor can you skip anything of what needs to be done,” Philippe answered decisively. “Take some pastries to your team, on your way out.”

Jon stood for a few seconds longer, as though weighing his choices. He picked up two plates laden with goodies, and left. Philippe and David rose and left, too. Michelle, the company secretary, entered, tidied the chairs neatly around the table, gathered the drinks and refreshments, turned off the lights and air-conditioner, and left the room.



## 1.2 'Things that Aren't in My Control'

David entered his office, and stared at the computer's screen. Forty seven emails had come in since the start of the day, it was already midday, and he hadn't really done any work yet. A reminder for the 5 pm meeting of the Hi-tech Development Vice Director's Forum flickered on his screen, accompanied by a ringtone. *No time for that today*, he thought, but reset the reminder for three hours' time anyhow. *An interesting lecture's scheduled*, he mumbled. *Maybe I can make it....*

The phone rang.

"How's my beloved physician today?"

"Don't ask," Judy sighed.

"What's up?" David was alarmed. "Something dreadful at Casualty?"

"At last we're ready at the front door by twenty minutes to eight, and then Sharon looks at me and says, 'Mommy, I need the toilet...'"

"Aaah," David let out a sigh of relief, and skimmed the email from the manufacturer set to deliver the special lenses that day.

"What can I say to the kiddo? Hold on? Wait till kindergarten? She's only three, and the thought of her using the kindergarten toilet doesn't make me so very happy," Judy detailed.

David laughed. "OK, so what did you?"

"What could I do? I told her to go to the bathroom and be as quick as possible. Why are you laughing?"

"I was sure you'd be telling me a horror story connected with the hospital and the kids, not an anecdote about going to the toilet!" David read the email again, to be sure he'd understood well: there was a customs strike at their end and they could only send the lenses in two weeks' time!

"It's not funny," Judy moaned. "It made us ten minutes late for kindergarten."

"That's ridiculous," David answered, comparing ten minutes' delay to the ten day delay on international delivery.

"I'd like to see you standing there, with the kindergarten teacher having just gotten all the kids together for story time," Judy's voice was angry, "and even though I apologized for the 'unexpected bathroom event', which wasn't under my control, she said that our lateness was 'just not acceptable to me'."

"So get everyone up ten minutes earlier!" David concluded, hitting the 'reply' button on the lens supplier's email message.

“Really!?” Judy exploded. “Waking the three of them at 6.30 is hard enough, so you suggest getting them out of bed at 6.20? And anyhow, even if we get up at 6.20, who can guarantee that Sharon wouldn’t have decided she needs the bathroom right then anyway? You and your solutions. Know what? Let’s see you handle all this tomorrow!”

“Judy, don’t scream. Please. I’m having a tough day here, really tough,” David said, lowering his voice.

“Why? What’s happened?”

“I can’t talk about it right now. I’ll tell you when I get home,” he answered.

“Which will be when?”

“Not sure at the moment. There’s the bi-monthly Development Managers’ conference this evening, and I’m thinking of attending. I might get home late.”

“OK. I’m being paged. Remember, tomorrow’s your responsibility. Bye,” Judy closed off quickly.

“See you later,” David just barely managed to reply before the call disconnected.

David looked at the phone and sighed. It was turning into a day of aggravation: the investors and Judy had been mad at him, and now he was planning to be mad at the lens producer. His response would be unequivocal: a customs strike is no reason not to uphold the delivery timetable.

He started with “Dear...” and stopped, thinking through his conversation with Judy. *What was it she’d said? That she had no control over the time Sharon spent in the bathroom? And what had the kindergarten teacher answered? That the lateness simply was not acceptable to her. Hadn’t he just said the same to Todor about the lens supplier’s delivery time? And Todor? He’d agreed to an extension provided there was a serious work program scheduled, because he was also not willing to accept ‘not under my control’ as a plausible reason.*

David thought about what he himself was planning to respond to the supplier: that the strike doesn’t interest him in the slightest and it’s no excuse. He closed his eyes, leaning his head on his hands. The parallel was too painful. If he thought he was right regarding the supplier, and he advised Judy to wake the children ten minutes earlier, then Todor was also right in stating his demands, and he was even polite about it. He actually could have closed operations down on the spot.

David looked at the screen and reconsidered how to respond to the lens producer. Eventually he settled on explaining the severity of the situation, asking that an alternative solution be found as quickly as possible. He added a request for a discount in light of the current status. Perhaps that would lessen the damage a little.



### 1.3 Pressure

By afternoon, David had managed to respond to only half the emails in his inbox. Philippe stuck his head around the door.

“David, got a minute?” he asked quietly. “I need to show you something.”

Philippe held a sheaf of stapled papers out to him. “Here, look at this. A friend from abroad sent it. I need you to read it and tell me what the risk factor means for us, and I hardly need to stress how urgent it is!” Philippe sighed.

David’s eyes skimmed the titles. Someone was working on something similar to theirs and had even published an article on it! He knew he would have to read it immediately.

“You don’t look well,” Philippe looked at David. “Let’s have some lunch.”

A heavy silence filled the kitchenette where David, Philippe and Geoff sat, eating. David saw Geoff moving his lips but did not manage to understand what he was saying. He ate something but could not really identify its taste. Philippe stood up, saying: “Michelle’s called the department heads. They’re waiting. Let’s go.”

Jon, Wesley, Sinead, Daryl and Nate waited tensely in the board room.

Philippe entered. “We had a meeting today with the investors. They want us to present a detailed work plan that proves we’re able to implement the project successfully within twelve months. I have complete confidence in you all, and I want each of you to prepare a detailed timetable and hand it in to David within two days.”

“What?” Wesley and Nate almost yelled simultaneously.

“How can we manage that?” Jon was clearly stunned.

“Oh, no,” Sinead smiled in desperation.

“It’s not the 1st of April today, right?” Daryl asked in a pseudo-hopeful plea.

David looked at them all. “What’s the problem, exactly? The timetable for presenting the schedule?”

They shook their heads by way of response. David looked at Philippe and waited for his reaction.

“Right,” Philippe summed up, “you’ve got three days to get the task done, and that closes this meeting.”

The atmosphere in the room suddenly became thick with tension, and David was happy to leave. He sat down in his office and looked quickly at his screen. Thirteen more emails had come in during the two hours he had been absent. His gaze wandered, and fell on the mobile phone on his desk. The phone had been oddly quiet since the morning. A quick check revealed that he had accidentally left it on quiet mode since yesterday. There were eleven unanswered calls and nine voice mail messages. He sighed deeply, just as the

internal office rang and made his heart skip a beat. Michelle advised that Todor's secretary had called and the next meeting was scheduled for exactly four weeks' time. As he closed the phone, he noticed the article that Philippe had brought in earlier and was hit by a sudden rush of nausea and stricture. *I can't do this anymore, I've got no air!*, he screamed within his mind, just as the bell chimes sounded reminding him of the lecture commencing in an hour's time.

David looked at the title of the invitation to the conference: "Hidden Critical Paths in the Project" and took an instantaneous decision. Decisively slipping the laptop into his briefcase, he took his phone, checked that the car keys were in his pocket, and left the office.

"David, are you going?" asked Sinead, head of the optics department as they passed each other in the hallway.

"Yes. The vice CEO's forum is once in two months and I must be there," he answered apologetically.

"Will you be back today?" she asked, and David knew she was thinking that he'd dropped too heavy a load on them while he himself was going home early.

"Not sure yet, we'll see," he answered, letting the words trail behind him as he strode quickly to the parking lot.



#### 1.4 Hidden Critical Paths

David reached the auditorium just as everyone was being asked to take their places. The lecturer, Razi Whitman, took her place on the stage. “Welcome to you all, good evening,” she commenced.

*I really hope this’ll be a profitable evening and not a complete waste of time, considering everything I left behind in the office,* David thought.

David opened his laptop. He could listen to the lecture and read a few documents at the same time, which would be more time effective. Razi introduced herself as a Scheduling Consultant. *Maybe I’m not wasting time here after all,* David hoped.

Razi commenced the lecture by showing the first slide on the screen.



**Image 1: An iceberg as a metaphor for a project timetable**

“A commonly known phenomenon of the iceberg is that only one ninth of it is visible, while a weighty eight-ninths remains out of view beneath sea level,” Razi explained. “A ship’s captain can only see the tip of the iceberg, so might find the ship crashing into the

part that is out of sight, below sea level. And an accident like this, as you well know, can have fatal results.”

She looked around at the audience before continuing. “A project schedule, also correctly known as a Gantt, containing more than eighty activities, is just like the iceberg. The Gantt chart holds a wide range of data and details: what activities should be implemented, when to implement them, what precedes each activity and what succeeds it, who performs the activity, how much it costs and much more. But what does the project manager see from this maze of data? Only the ninth of the iceberg that’s above water.”

David was listening intently. Razi continued: “What does that ninth contain? It holds the critical path, the path that determines the end date. When this needs to be extended, the project is not upholding its target date. This ninth can also carry some human resources, sometimes detailed in the chart, and management risk.”

Razi stopped for a moment, changing her tone of voice. “The entire project is the whole iceberg, and not just the visible ninth. Therefore, as soon as we commence implementing a project, the question is not **whether** we’ll crash into the hidden part of the iceberg, but **when** that will happen.”

*Just like the outset of our project, David thought. The lenses weren’t in the critical path so they weren’t in the tip of the iceberg but in the part submerged in the dark sea. Who could have guessed their importance earlier?*

Razi explained further. “The idea behind HCP – Hidden Critical Paths – is to spotlight for the project manager those darkened areas of the iceberg.” She paused and moved to the other side of the stage. “Would I be assisting the project manager if I could shine a light on all the other eight ninths below sea level?”

“I don’t think so,” a hesitant voice from the audience answered.

“That’s right,” Razi confirmed. “And why is that so?”

“Because you’d be loading the project manager with so many details that they’d become noise, instead of providing effective information,” the same voice responded.

“True again,” Razi agreed. “But if I shone a spotlight onto only those sections that we’re likely to slam into, would that help the project manager?”

The answer seemed obvious. *She’s claiming that she could have told me in advance that the lenses from overseas would be a problem?* David was skeptical.

“So what are these hidden critical paths?” someone else in one of the front rows asked. Razi looked at him and replied: “Let’s say your project is for a twelve month period. How long is your critical path?”

There was silence in the audience. *The answer should be twelve months, that’s easy enough, David thought. But she doesn’t look like someone who’d ask such an obvious question, so maybe it’s better to say nothing...*

Razi waited. Someone ventured: “Twelve months”

“Exactly,” she said. “That wasn’t a trick question...” She smiled, and sighs of relief could be heard in the auditorium.

“Now, let’s take a different path in the project. The path’s comprised of a sequence of activities and the whole sequence has a certain duration. For example, a path lasting eleven and a half months. Is it critical?”

“No,” David found himself responding out loud. “It’s got a float of two weeks, which equals half a month.”

“And what’s two weeks relative to the whole project?” Razi turned to him with the question. Clicking her fingers, she said, “They go, just like this, and are over.”

“Oh sure, I hardly have time to say ‘Jack Robinson’ and a whole week’s passed! I’m always so surprised when it’s Friday again, and another week’s over!” David answered. Many others were murmuring in agreement.

“Right, so when you’re managing that project, you have to manage its path of 11.5 months with the same managerial attention as you would for a critical path! The shorter path is **almost** as critical as **the** critical path!” Razi stopped for a moment to examine the reaction of the attendees and see whether her message had been absorbed.

“When you manage a project, it’s important to know how to identify not only the longest path, but also the next path, and the one after it, and so on. These are the **hidden critical paths**. An analysis of the hidden critical paths highlights the darkened parts of the iceberg in the right places.”

*That’s nice, David thought, but it’s pretty trivial. Obviously you need to know the hidden critical paths, but does she really think they can be pointed out in advance?*

The slide changed, and Razi read out the text:

**The goals of HCP are:**

- a. Predict the ability to complete the project on time, on spec and on budget
- b. Identify hidden risks in the project
- c. Pinpoint proactive steps for schedule improvement

“Proactive steps are activities involving initiative and actions taken in advance, intended to avoid problems or to provide solutions for specific issues,” Razi explained.

*Forecasting project success? Locating risks? Advance problem preventative actions? David mumbled to himself. That’s exactly what we need to convince our investors to increase their investment in our project! Is that really possible? Hard to believe...*

The title of the next slide appeared:

What are hidden critical paths?

Razi presented a simple Gantt chart. “This project is authentic, so some of the activities have been masked, but in principle, this project relates to production of an electronic card. The card and its parts need to be defined, a supplier must be found, and a contract closed with the supplier to allow work to begin. Simultaneously, the processes for checking the card must be defined, testing equipment must be purchased, the tests must be run, and the final card produced. This schedule shows 32 lines representing 26 activities and 6 summary tasks. A summary activity is a chapter heading under which all the related activities are concentrated. The summary activity is not considered an activity.”

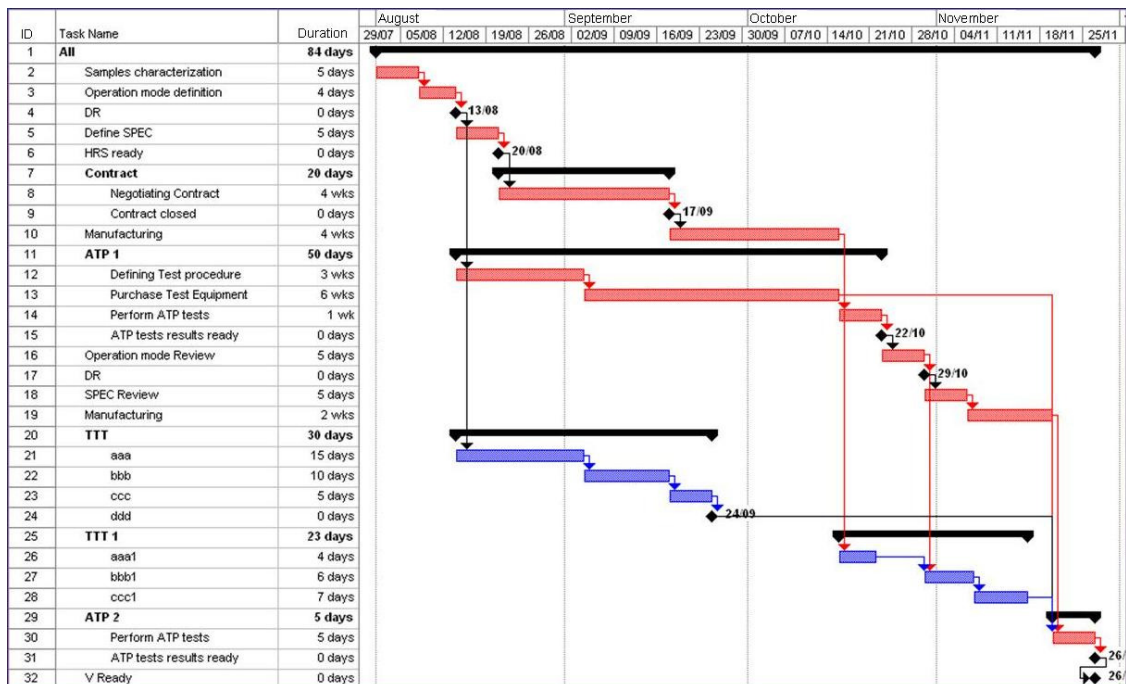
Razi now turned to face the audience. “I chose this schedule because it can be presented in just one slide,” she added, smiling.

David was stunned. Such a small project, producing one electronic card, with 26 activities? He wondered how many activities there would be in the schedule they needed to present to the investors.

David thought about the three system cards they were planning. One was highly complex, although the other two were small. Beyond these, there were a great many more system components. He wondered about his chances of calculating the number of activities for his company’s schedule! *I need to think about it differently*, he realized. *We’ve got five teams. Let’s say each writes only fifty activities, which is really not a lot, relative to the schedule Razi’s showing here, then we’d get to 250 activities!?* David stifled a cry of shock. *We’ve got an enormous iceberg, not a newly forming one! How could we present the investors with only four milestones?* David’s initial shock turned to a wave of pressure: how would they write up an appropriate schedule?

Razi had meanwhile added further details relevant to the project. “The whole project takes only four months, and a team of three implemented it. Now I have a tough question for you,” she said, facing the audience, which had fallen silent.

“If a path is defined as a sequence of activities, beginning with the first, which has no previous activity, and moves through the connectors marked with arrows, to the last activity after which there are no more, how many paths are there, in your view?”



**Image 2: Finding hidden critical paths in a simple schedule. Activities 1, 7, 11, 20, 25 and 29 are summary activities.**

Razi continued: “The colored markings are like those of all the current programs: the red boxes represent critical activities and the blue ones are non-critical. Summary activities and milestones are marked in black,” she explained, then returned to the question: “So, how many paths are there?”

David examined the chart. It looked very much like a waterfall. Every drop could be carried through different channels and each channel represented a path, but it was not so easy to pick up on the paths. Not a sound could be heard in the hall. The audience examined the chart with interest. David caught sight of two people to his left trying to follow the marks with their hands as they attempted to count the number of paths.

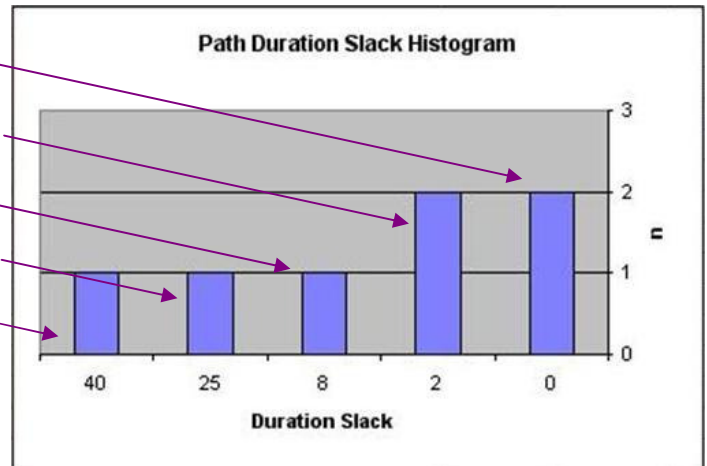
“Someone’s got to be brave enough to estimate the possible number of paths here, otherwise we can’t move forward with the lecture!” Razi challenged. The immediate reaction was a wave of laughter in the hall, and people began calling out their figures.

“Four,” came from one person. “Twenty” was another’s estimate. David looked again, and guessed at six.

“Thank you!” Razi answered with a smile. “We’ve got seven paths here, which split as follows.” She moved the next slide into place.

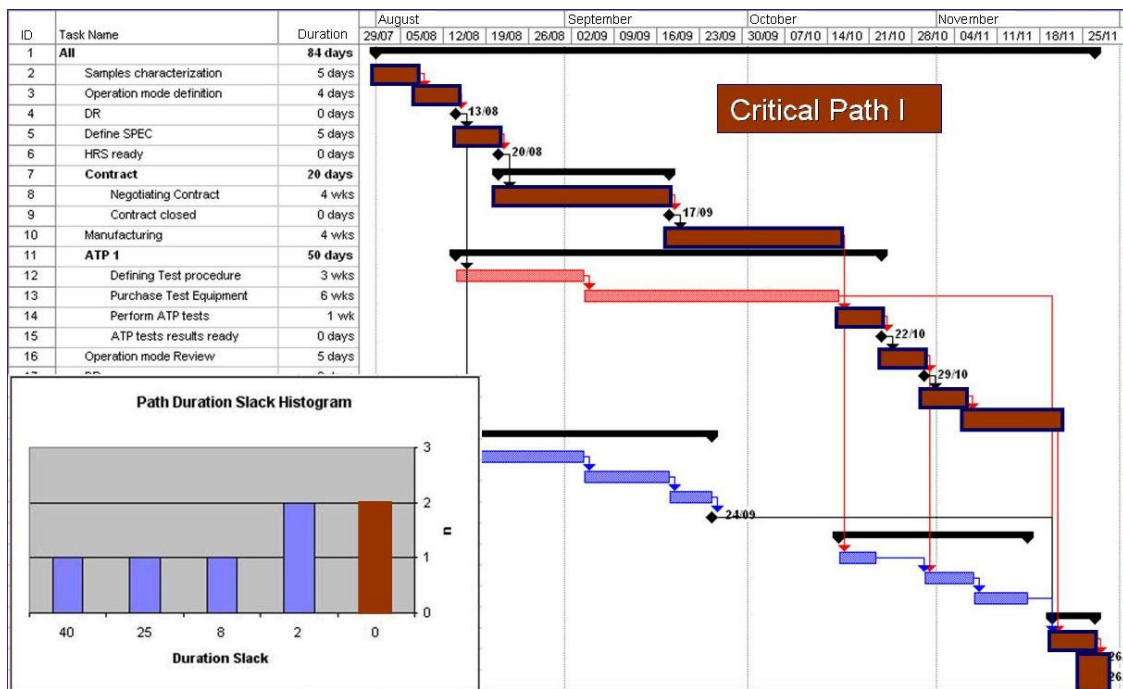
“The lower axis of the graph indicates how many slack days, also called float days, there are in the path, while the second axis indicates how many paths are in the schedule. A path’s float days are the difference between the duration of the longest path and its own path. In other words, this graph says that:

- For two paths here, the float is 0 days, which makes them critical.
- Two paths have a float of 2 days.
- One path has a float of 8 days.
- Another path has a float of 25 days.
- Finally, another path has a float of 40 days.”



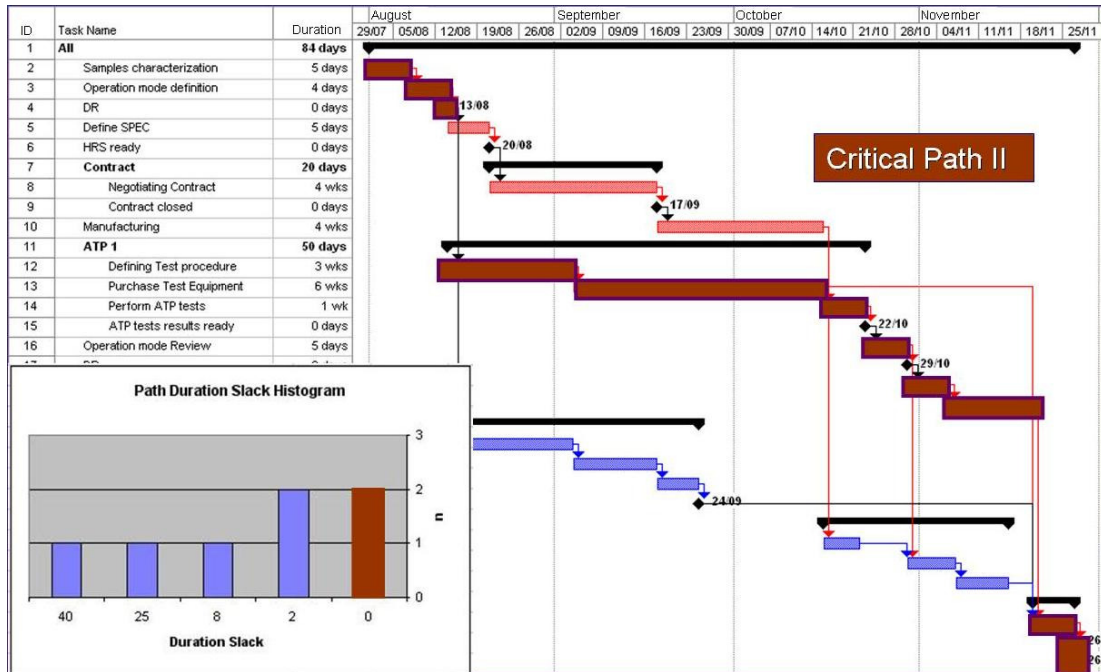
**Image 3: The paths distribution of the simple schedule above.**

Razi waited briefly before asking: “Where are they? Here’s the first critical path, the longest, of 84 days,” she said, showing it highlighted on the schedule.



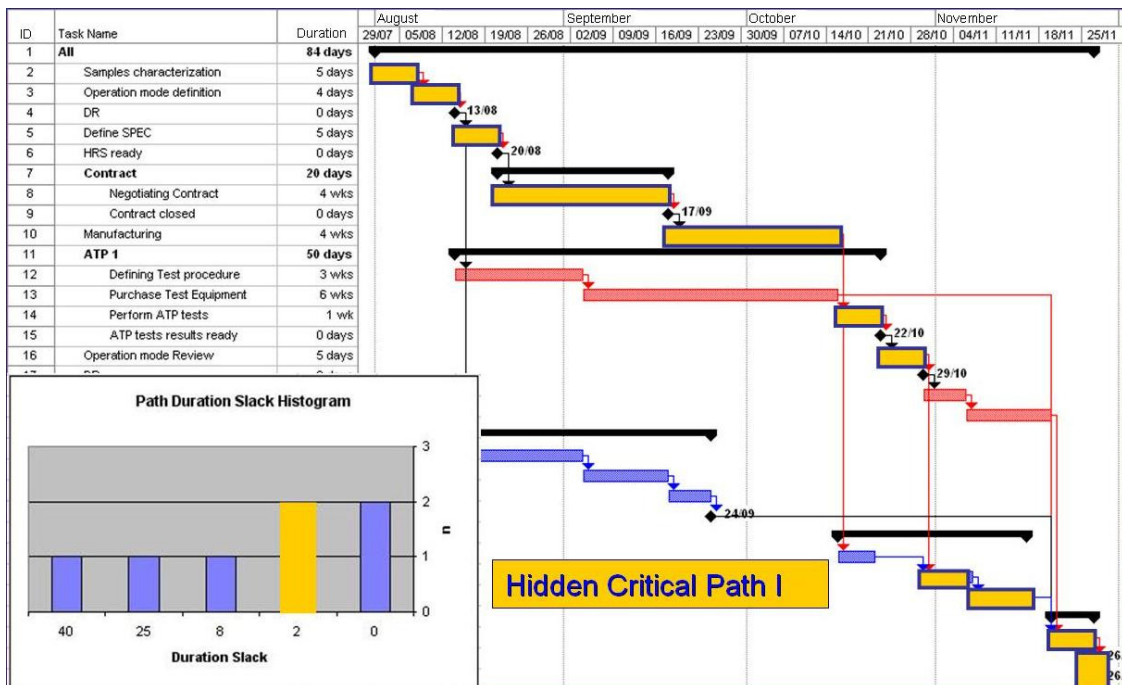
**Image 4: The first critical path, emphasized in brown.**

“Here’s the second critical path, which also lasts for 84 days with a float of zero.” As the path began showing on the slide, she added, “Up to this point, I haven’t invented anything yet. This is the well known CPM – Critical Path Method.”



**Image 5: The second critical path is emphasized in brown.**

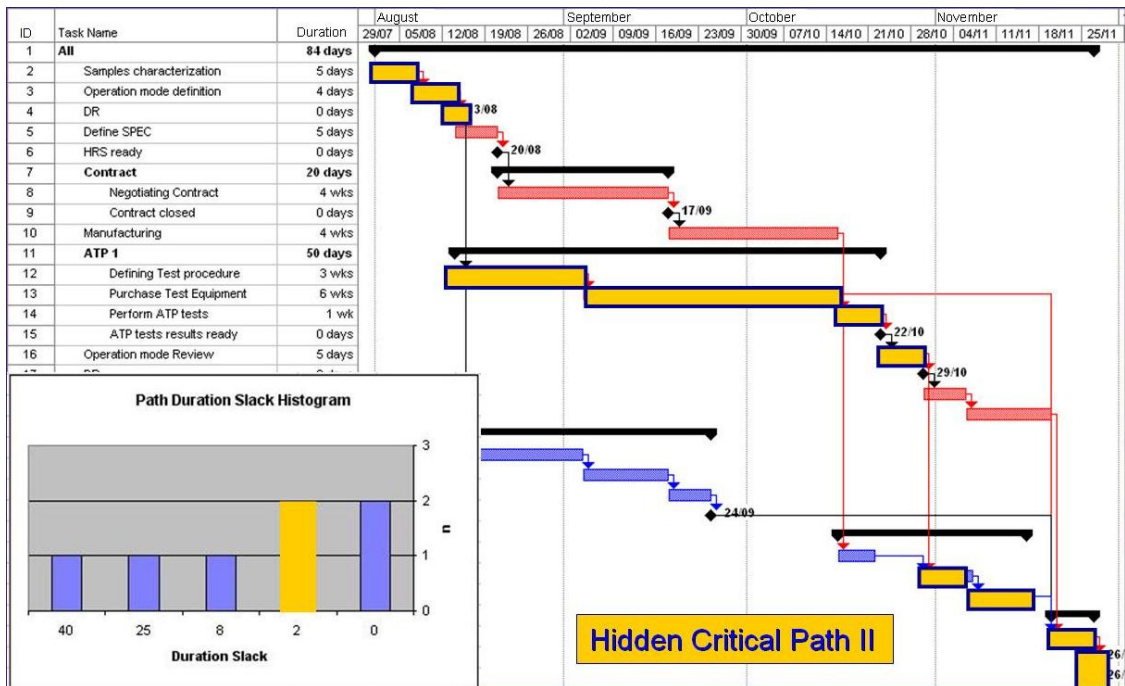
“But now, we get to the interesting part. Watch this. Here’s the first hidden critical path. It lasts 82 days, so it has only a 2-day float within the four months in which the project is to be conducted.”



**Image 6: The first hidden critical path, with float of only 2 days compared to the longest path, marked in yellow.**

There was palpable silence in the hall, so much so that David could hear the buzzing of a fly somewhere.

“Here’s the second hidden critical path, which also has a float of only two days compared to the critical paths,” Razi added.



**Image 7: The second hidden path, also with a float of only 2 days compared to the longest path, marked in yellow.**

“What’s the significance of these two hidden critical paths?” Razi asked, and quickly provided the answer. “It means that if one of the **exclusive activities of the hidden critical paths** extends by only two days, these paths will become critical, and the project will then contain 4 critical paths. But if one of these activities extends by three days, these paths will become critical, and the formerly critical paths will become hidden critical paths!”

*The lenses, David realized, were on a hidden critical path! We had no idea what their float would be but clearly we must have used it all, when the supply time extended from two to four months, and then it became a critical path! Now with the customs strike at supply source, the lenses are on a super-critical path. Razi claims that she could have discovered this hidden critical path in advance. Is that possible? David’s mind was a whirlwind of thoughts.*

The fly’s buzzing became bothersome. It seemed others had also noticed it within the heavy silence. “Excuse me,” the woman next to him said, “but I think your mobile phone’s calling you.”

David roused himself as though waking from sleep, feeling in his pockets for the phone as the laptop almost slipped from his knees and crashed to the floor. He saw two messages, the first from Judy: “When will you be home? I’m exhausted.”; and the second from the office: “Urgent question, call when you can, Sinead.”

He sighed. The staff was still working and it was clear he would not be going home early, not even by nine that night. He texted Judy: “Coming home very late. Hope you can hold out.”

“So what does this example teach us?” Razi asked, and without waiting for answers, continued her explanation.

“A. The difficulty in locating the project’s paths. It’s really not easy to see all the critical paths and know just where they are from looking at the schedule. You have to remember that the schedule before us is a very simple one with only 26 activities which can be presented on one page. Who of you has schedules like this one?”

No one reacted. “Who of you has schedules with up to 100 activities?” Razi asked. A few hands showed. “Who has schedules with several hundred activities?” Almost all hands went up now. “Thousands of activities?” Several hands shot up. “So you can see how hard it is to comprehend the true complexity of the schedule and confidently identify the hidden critical paths which can turn critical within only a few days!”

“B. No two projects are identical. Projects are like your children. Each child has one head, two arms, two legs, and yet no two of your own children are quite alike. A similar thing occurs with projects. They all have a beginning, activities, and connections between activities, but pay attention to what happens between activities 27 and 28 here. They are responsible for creating the two hidden critical paths, so they are called ‘hidden critical activities’. In this project, they’re towards the end, but you’ll find them in every project in different places. Project managers must manage these hidden critical activities with the same level of importance as they manage critical activities. If they don’t, one morning these hidden activities will suddenly turn critical, and that will be already too late. The reaction time for managing these activities will be too short, and the project? It won’t uphold its completion target date.”

Razi waited briefly, then took a deep breath, as though about to commence a seriously long monologue. “I’m being signaled to break for now, so we’ll carry on in fifteen minutes.”

The line of people waiting to ask Razi questions was almost as long as the line for coffee. David decided to skip coffee and call Sinead instead. “Sinead, what’s up? What’s so urgent?”

“I saw your answer to the lens manufacturer. Tell me, what am I supposed to do with my people until those lenses arrive? We were supposed to work on them from tomorrow, we prepared everything, and now what... go on vacation?”

David sighed. “What about your other tasks?”

“Everything’s stuck without the lenses. I can tell them to start documenting the experiments and results that we did today, but that will take two to three days at the most. And then...?”

“Ok,” David confirmed, “start with documentation. It usually takes a good deal more than two days. I’ll think about it and we’ll talk tomorrow morning.” He remembered that he had to take the children to school and kindergarten the next morning. That would make him late for work. He decided to say nothing to Sinead.

“David,” Sinead continued, drawing him back to their problems, “how am I supposed to draw up a schedule without the lenses? How can I possibly guess when they’ll turn up?”

“Use your feminine intuition! It’s probably a lot better than mine,” he answered. He heard her sigh.

“How’s the lecture?” Sinead changed the topic.

“Fascinating.”

“What’s it about?”

“Hidden critical paths.” David gave Sinead a brief summary.

“You know something, it sounds like it’s what we’re experiencing now,” Sinead’s tone was interested.

“Yes, if I can get the lecturer to visit us, she could prove invaluable in preparing a schedule for the investors.”

“Use your masculine wiles,” Sinead laughed.

“Keep your fingers crossed, then,” David answered, and ended the call.

The line of people waiting for Razi had barely shortened, but the fifteen minute break was over and she continued with the lecture.

David felt he needed to take some action. He left the hall and phoned Philippe, updating him on the lecture content and his plan. He text messaged all the team leaders: “Urgent. All team leaders meeting in 90 minutes.” He sent a separate message to Jon: “Please order dinner for everyone plus one guest.” When he returned to the room, the summarizing slide was being displayed.

**Insights and Applications of HCP to Project Management at Multiple Levels**

- Senior Management
  - Schedule integrity issues
  - HCP histogram
  - Project success expectation in various aspects: time, budget, spec
- Project Management
  - HCP critical path
    - Is it identical to the CPM critical path?
    - Opportunities for Bringing Forward the Schedule's End Date
    - Overlapping activities in the HCP critical path
  - Hidden critical activities
  - Locating weak points in control
- Claims
  - Key schedule and analysis dates in analyzing the schedule

David examined the list: *to succeed with the project we must understand what our hidden critical paths are, and show the investors that we're ready for every possibility, and can cope with the hidden risks and surprises. If we can also find a way to shorten the project time, that'd be a real gift from heaven.*

Razi ended the lecture, and requested questions from the audience.

“How do you find the hidden critical paths?” asked someone to David’s left.

“Through an algorithm I developed, which is also under patent pending,” Razi answered with a smile. David raised an eyebrow in admiration.

“And have you actually assisted any projects with your HCP or is this just a cool theory?” another person asked in a clearly cynical tone.

“There are a lot of success stories already, which I’d be happy to talk about if I’m invited for a second lecture. The follow-up talk is called “Reflecting Projects through the HCP Mirror,” Razi explained.

“How can I apply the HCP to my project?” a woman enquired.

“Two possibilities,” Razi answered. “First, to post your schedule to the HCP website, or secondly, through a magic ten-digit number,” Razi winked, “which you’ll find on my business card.”

Laughter could be heard in the hall. “Thank you all very much,” Razi closed the evening as the audience applauded.



## 1.5 In the Parking Lot

David was last in line to meet with Razi. The line was moving forward, and business cards were being exchanged. “Hello, Razi. Nice to meet you. I’m David,” he said, shaking Razi’s hand.

“Nice to meet you, too,” Razi answered.

“I’m the Vice Manager of Development in a start-up that develops innovative components and we need to structure a schedule for our investors,” he presented the issue concisely.

“David, it’s late already. Do you mind if we talk about this as we walk to the parking lot?”

“Not at all,” David answered. “But I do have another problem.”

“And that is...?” Razi asked, as she began unplugging the laptop from the projection equipment.

“We need to convince our investors that it’s worth staying with us, and they want to see a schedule.”

“What have you given them so far?”

“We had...,” David paused and then corrected himself, “we have presented only milestones.”

“Did you manage to uphold them?”

David sighed. “Unfortunately, we can’t even keep those simplest of targets.”

Razi stood still, looking directly at David. “Do you currently have a financial problem?”

“If things don’t improve and the investors don’t add funds, yes, we’ll have a problem.”

Moving again towards her car, Razi asked: “And do the people in the company know about this?”

“We’re trying to keep it silent, but no one’s stupid. Information on the scope of the initial investment was in the media, and everyone can make a simple calculation, estimate how much we’re spending each month, and how much is left.”

Razi opened her car door and leaned in to place her laptop on the passenger seat. “What’s the time frame you’re presenting to the investors as justification for adding further investment?”

“The investors demand a plan that shows how we come out with a beta level finished product and one serious potential client within twelve months. I hope to do this through a very good work plan, and this is where you enter the picture. Do you think you can help us?”

“Yes, gladly. Let’s see when,” Razi said, opening her diary. “Tomorrow’s no good, and the day after I’m really overloaded. Next week’s fully booked and the week after I’ll be overseas to lecture, so that means my first available time is three weeks from now. ”

“Razi, please excuse my brashness,” David said, clearing his throat, “But our presentation date is in four weeks’ time, our situation’s critical, and all the team leaders are still at work as we speak. How about if you come with me now?”

Razi looked at him and smiled cynically.

“We’re really close to here!” David pressured, and something in his voice made Razi look at him more closely.

“I suppose I could put in a session with you now and tomorrow start my day a bit later, but...,” and Razi hesitated for a few seconds, “Would I have your permission to publicize your case, if it’s as interesting as you describe?”

“Yes, of course,” David agreed, feeling that a positive turning point had been reached, “only if you don’t reveal our commercial secret. You’ll follow in your car?”

David’s mobile phone rang, as he left Razi. “Daddy?” crying could be heard on the other side. “You promised to read to me before sleep and you’re not even home, and Mommy’s forcing me to go to bed...” The sobbing became stronger with each word.

“Shelly, sweetie, Daddy’s really sorry. I’ve got to finish this work, but I’ll read to you tomorrow, ok?” David felt his heart breaking.

“Promise?” came a little voice.

*Promise – what a small but enormous word, David thought. I must keep the promise. I want to keep the promise. But how will I be sure to?* “I promise, sweetie,” he answered, closing the phone.



## 1.6 The Meeting – or – Why do we need a Scheduling Consultant?

The faces of the team leaders showed their exhaustion, and the air-conditioner hummed cold air into the tension. “Good that I brought a shawl,” Razi said, as she entered after David. “Those penguins are going to start jumping around the table!” David smiled at her.

“We keep it cold to help us stay awake at this hour,” one of the attendees explained, yawning. Razi sat at David’s right.

“Hello to everyone,” David began. “I’m sorry for this very late hour, but it’s not as though we’re unused to working at this time... I attended Razi’s lecture this evening, on the subject of *Hidden Critical Paths*, and have invited her here because she’s a project scheduling consultant.”

David turned to Razi: “Have I got that right?” Razi smiled and nodded in agreement.

“I think we need her assistance in structuring our project schedule, so that our beta will be ready inside of the allocated 12 months. Before we start the discussion, I’d like each of you to introduce yourselves by stating your name and position for Razi’s benefit.”

“Philippe”, said the man on David’s left, looking at the next person along, as though passing an over invisible baton. David caught the question in Razi’s eyes and explained, “Philippe is our CEO.”

“Nice to meet you,” Razi said. David thought how only a CEO might indeed assume everyone automatically assume his role in the company.

“Geoff, Vice of Financing,” said a man with glasses, smiling. “I’m just here to listen.”

“Daryl,” said the next person, a tall thin man with beard and long hair.

“Let me guess? You’re the head of software?,” Razi said.

“How’d you know?” Daryl asked, surprised.

“Professional secret,” Razi answered.

“Sinead,” said a petite woman with an abundance of bronze, waist-length, somewhat unruly curls. “Would you like to guess my sphere of responsibility?”

“There’s a limit to the risks I’m prepared to take,” Razi laughed.

“Head of optics,” Sinead, the only woman on the team, answered.

“Jon. Electronics,” came from a young man whose hair was already flecked with gray.

Next to him sat a large man with a deep bass. Caught in a purple hair-band, his straight light brown hair showed blatant non-interest in grooming. “Nate, head of the math team.”

“Wesley,” said the last person at the board room table, who seemed to be in his early thirties, and had an intense gaze. “Head of system engineering.”

David turned to Razi. “There are some twenty people in the company. Each team head here directs three or four subordinates, and sometimes, five people in a team.”

“And even that’s not enough!” Jon interjected, clearly angry.

“So, does the work plan have to be structured for everyone?” Razi questioned.

“What’s the big issue? What’s so difficult about it? It’s only a time table, a few lines, and that’s it,” Wesley said. “That’s what we’ve stayed late for? Couldn’t this have been done tomorrow?”

“If we didn’t manage to make it clear yet earlier today,” David said, “then let’s zoom in on the point right now: the schedule is our first test for getting the additional infusion of funds. Razi has agreed to come here tonight, in response to my special request, because her own schedule is overloaded and no other immediate time was available. So, I *strongly* suggest,” David emphasized, “that we all open up our minds and learn something here tonight, so that we can come up with worthwhile results tomorrow.”

Razi stifled a yawn. “Good evening to you all,” she began, clearly tired herself. “I know everyone’s tired, but let’s try to make best use of this time, in the hope that it won’t take too long.”

She looked around at the team leaders. “The main process in structuring the Gantt, or as it’s more commonly known, the schedule, is based on presenting questions and writing answers up in an organized way, so that in the end a work program is produced which can be upheld. After structuring the schedule, you can configure the monthly set of activities to be implemented, and ensure that each month’s goals are achieved.”

Razi continued. “For this evening to be effective, it’s better I don’t give a lecture here. Let’s get straight to the point. What’s **the** biggest problem you’re dealing with, in structuring the schedule?”

There was silence in the room, broken by a laugh of despair: “**The** biggest problem?” asked Wesley cynically. “Do you have any idea how many ‘biggest problems’ there are with the technology? With the raw materials? With insufficient human resources? From here, the schedule is looking like one of our simplest problems!”

“Wesley,” said Philippe in an icy voice, “we need this schedule in order to get further investment.”

Daryl turned to Razi. “You said that structuring the schedule is done by presenting questions. Maybe the biggest problem is knowing which questions to ask. What kind of questions do you mean?”

“The questions themselves are fairly simple,” Razi replied, as she began writing on the marker board. “As follows:

- (1) What tasks or activities need to be implemented?
- (2) What time duration should be allocated for each one?

(3) Who implements each one?

(4) What is the activity or tasks to be done next when one is completed?

(5) Finally, check that each task or activity has indeed been linked to all the tasks or activities before and after it.”

“Well, we can do that ourselves,” said Wesley with a wave of his hand.

“Right. It’s not difficult. You just need to pay attention to details,” Razi answered.

“And someone needs to be brought in from outside, to do this?” Jon was angered.

“No, not at all. You can do it yourselves,” Razi replied. “I can receive your results and just guide you on the technical issues that need to be corrected in the schedule. For example, activities that don’t show successors. But you still haven’t answered my question: what’s the biggest problem in structuring the schedule?”

The team leaders focused on the board.

“Razi,” David said, “concerning clause 1, you say that tasks and activities need to be written up. Is there a difference between the two?”

“No, not really, it only depends under which program the schedule is being managed.”

“Clause 2 doesn’t look to be problematic either,” Jon yawned.

“Actually, it doesn’t look so simple at all,” answered Sinead quickly. “Let’s say that I know all the tasks that need to be implemented, even though I’m not so sure I really do,” Sinead laughed, “but even then, I can’t be sure about assessing the time frame for each one. So how will a work plan help?”

“Good question,” Razi responded admiringly. “Assessing the time you need for each activity or task is really not an easy task in itself.”

“Hang on, aren’t you the one who specializes in schedules? So why don’t you give us an assessment of time frames?” asked Wesley, his voice still obviously unfriendly.

“Let’s say that you think the activity of writing the documents accompanying the product will take two weeks,” Razi responded, “but I define that as only one week. What’s the first thing you’ll say to me in reaction?”

“Do it yourself, then!” Jon chimed in without thinking twice. “Especially when it’s an insufferable chore like writing up documents!” Laughter from the team leaders relaxed the tension a little.

“Allocating time represents your commitment to the time frame in which you are to undertake that activity. I can’t commit on your behalf,” Razi noted.

“Well, clause 3 doesn’t look too complex, other than the fact that I don’t have enough people,” Jon said, looking pointedly at David and Philippe. “This morning you said

there's no budget, but for this, for structuring a schedule, there does seem to be a budget!"

"Hmm, things are getting overheated here," Razi tried to placate. "The icebergs are melting. Soon the penguins will be jumping into the water, and I can remove my shawl," but no one was smiling.

"Jon, you're mixing oranges and apples," Philippe interjected. "Taking a consultant for a limited, short time frame is not like taking on another employee". Philippe stopped, giving careful consideration to what he would say next, then shot his statement into the tension. "This is the third and final time I will repeat what I've said before. If we do not deal with the investors' requirements successfully, there will be no technological problems, no raw materials problems, and no deficiency in employees. The main problem will then be where to find a new place of employment."

Jon swallowed the words on the tip of his tongue, and remained silent.

Focusing the attention back on herself, Razi continued. "Do you remember my question? What is **the biggest problem** right now in structuring the schedule?"

The team leaders shifted uncomfortably in their chairs. Sinead looked at the list on the board and clearly stated: "The relationships between us."

"We've on really good terms with each other, we get on fantastically!" Nate said, smiling. "We see more of each other than we do of our families," but his smile became a grimace as he glanced at his watch.

"I'm referring to our interfaces. Who'll be responsible for writing up the interfaces between us? Who's to be responsible for all the necessary interfaces being in the schedule? Who will link the interfaces correctly at the right points, between my schedule and yours, so that we can see how your work impacts my work?" Sinead exclaimed.

"That is actually your biggest problem in structuring the schedule," Razi agreed. "The issue here is to identify the interfaces between you all. The schedule must reflect the project in the most realistic way possible."

There was a moment in which everyone was steeped in thought. "How do we solve this problem, then?" asked Wesley.

"In stages," David stepped into the practical role of problem solver. "Tomorrow each of you will prepare a flow chart of the activities that your team must do for this project. All these charts will be coordinated by ...," he looked around, "Sinead." Sinead nodded in agreement. "You and I can meet tomorrow afternoon, Philippe, and confirm the activities, so that each team leader can prepare her or his schedule in the two days following that. In addition to the flow charts, present me with a list of issues related to your teams, but which also require involvement or connect to any other teams. I have my own views on the subject, and I want to compare with your approaches to the project."

Promising sounds could be heard on the other side of the board room door. "Dinner's arrived!" Jon called out.

“Bring it in, then!” Philippe directed the messenger.

“What, we haven’t finished yet?” asked Nate.

“To present the investors with a schedule? We’ve barely started. But for today, yes, we’re done for today.” Razi said. “There’s only one question left. What’s the critical path for dinner?”

Everyone looked at Razi, surprised. “That’s simple!” Sinead responded. “The line for the coffee machine!”



## 1.7 Money and Schedules

Buzzing with activity, the food was unpacked onto the table, plates and silverware handed out, and hot drinks prepared. David sat down beside Razi.

“Razi, my sincere thanks for coming out tonight at this irregular hour. As soon as there’s a completed schedule, I’ll contact you.”

“You’re welcome to contact me even if questions arise partway through the process,” Razi offered.

The staff members chatted as they ate. Geoff sat down on the other side of Razi and turned to her: “What about project costs?”

“What do you mean?”

“Time is money,” he said. “Is there a way to connect these two areas in the schedule?”

Philippe sat down next to Geoff and looked at Razi. The word ‘money’ caused all the conversations to die down immediately.

“In the schedule, we can cost every activity in several ways. We can write down hourly costs of work of the person performing the activity, or the cost of materials required for the activity, especially if they are degradable, or an overall cost can be figured, or any combination of these options.”

“That’s interesting,” Geoff said. “Then it’s possible to figure the overall project cost?”

“Yes, and also the cash flow needed for the project on a daily basis,” Razi added.

“That’s good!” Geoff’s eyes lit up.

“Who should be seeing this information?” Philippe asked.

David noticed that while all the team members seemed to be very busy with their meals, their ears were attuned to the conversation.

“Everyone writing up a schedule can obviously see what he or she has written. Once the schedules are integrated, everyone should be able to see the final outcome.”

Philippe raised an eyebrow as Geoff’s face fell, explaining: “Salaries are one of the biggest secrets in the company.”

“I’m fully aware of that aspect, which is why I didn’t raise it. You need to tackle the financial sphere from a different angle, while taking the schedule into account. For example, after writing the schedules, it should be very clear when special materials need to be purchased.”

“What do most of the companies you’re involved in, do?” Philippe pursued the idea.

“Most see the issue of money as highly confidential and classified. If there’s no need, it’s not customary to involve the employees and consultants in all the number crunching

connected with the company. Several programs allow defining proxies and determining who's authorized to see what, but planning and building a proxy system requires time and often isn't very effective. As a result, people may end up accessing information that management would prefer classified."

"Geoff, my friend," David said, grinning, "we'll focus on times and won't add monetary information into it. This particular hot potato can stay in your field."

"Yikes!" Geoff exclaimed, "What's hot? My coffee's completely cold."



## 1.8 Morning, at Home

David returned home close to midnight. Everyone in his household was asleep. A fridge magnet held a note.

Hi David,

Couldn't stay awake.

Remember: tomorrow I have night shift and you need to come home early to pick the children up, dinner, showers, etc.

Tomorrow you're Daddy-at-home !

Judy

*These shifts always come at the wrong time*, David thought, but admitted to himself that for someone working in a start-up, there never was a 'right time' for family duties. He flopped down on his bed and slept until Judy's phone rang, waking him too. She quickly exchanged a few sentences with the caller.

"What happened?" David mumbled through his half-sleep.

"Emergency op. I'm on call. I've got to rush to the hospital. The children are yours this morning, I'll set your alarm for 6.30. Will you manage to get up?"

"Do I have any choice?" David mumbled, trying to open his eyes. "What's the time?"

"3.30. Go back to sleep. Good night. I love you."

"Good night. Love y.....," David slipped back into sleep.

When the alarm rang at 6.30, David tore himself out of bed and began waking the children. Within a few minutes, he discovered that his role was that of 'talking clock': "Shiloh, I've been calling you for the past ten minutes, come in for breakfast already! Shelly, it's 7.10, aren't you dressed yet? Sharon, there's no time this morning, it's already 7.20. Have you been to the bathroom already? Shiloh, it's 7.25, where's your bag? Your sandwiches are ready. Shelly, haven't you combed your hair? It's 7.30! Twenty-five to eight, have you all got your water bottles? Everyone ready?"

At last the three children stood by the door ready to go, when Shiloh looked at David: "Daddy, it's twenty to eight, but you're still in pajamas!"



## 1.9 The Unexpected

The day passed quickly, as though someone had moved the watch hands forward faster than usual. Progress on development continued as work commenced simultaneously on the schedules. David sent an email to the team leaders with instructions and the principal milestones that would have to appear in all of the flow charts. David spent much of the rest of that day in reading the article Philippe had given him. It described fast data transfer methods. None of them was identical to the one they were developing, leading David to conclude that the existence of a method identical to theirs was a very low probability, but the chance of future competitors was increasing. The time factor relative to the project began to appear truly critical, David realized, just as the beep sounded, reminding him that he would have to leave work and collect the children from their day care centers on time.

David leapt from the chair, grabbed his laptop, slipped his car keys in his pocket and fished for his mobile phone under a pile of papers on his desk, then dashed out. *A trip home shouldn't be a project!* he thought, *it should be no more than a repeated action with precise statistics.* Only when he turned left at the traffic light and saw the number of cars in front of him did he brake suddenly. Looking in the rearview mirror, he caught the ashen face of the very annoyed driver behind him. When he looked in his own mirror, his face had that same expression. *Oh no, my stats are fine for nine – ten – eleven at night and not for three in the afternoon! I'm not going to make it to the kids by four!*

David started to reconfigure. Shiloh and Shelly were in the same day care center, two floors below where they lived, and Shiloh had a key, so the two could actually go home. Sharon had to be picked up from kindergarten, and by four exactly. David knew that if he did not get there on time, the care-giver would be furious. If she were left standing outside the locked gates of the kindergarten with a small child in hand, the minibus that took all the care-givers home would be kept waiting too, with the other care-givers becoming increasingly angry; and that would be nothing compared to what Judy would have to say.

With these thoughts swirling in his mind, he began to review his 'back up' sources, such as other mothers he could phone and who could pick Sharon up from the kindergarten. The first mother told him her son had been home ill that day. *One down...* he thought. He tried another mother. She had already made babysitting arrangements earlier that day.

*Would Razi have found these hidden paths?* he pondered, while calling the third mother and simultaneously, thinking a small prayer for success. He was amazed to hear laughter when he explained the situation. This mother was not surprised at all by the call: Judy had already phoned and asked her to fetch Sharon, too. Yes, she was just entering the kindergarten... yes, she'd take Sharon. David mouthed a prayer of thanks to the universe and to Judy, as the phone rang: "David, are you here? Philippe can't find you," Michelle said.

"I have to pick up the kids today because Judy's on night shift". David heard himself apologizing as he waited for Michelle to convey the information. "OK, Philippe says he'll catch you later tonight or tomorrow. Bye."

David and Sharon came home, hand in hand, at ten minutes past four. David decided to make best use of the daylight hours available to prepare a fun-filled Gantt for his children.

“Kids, what do you think of going to the park and buying ice cream?”

“Daddy, I have to finish my homework for tomorrow,” came Shiloh’s voice from his bedroom. Shelly poked her head out of her room: “Daddy, I arranged to meet Jordan afterwards and you have to drive me there,” she said, combing her hair.

“And you, Sharon? What do you have to say?” David turned to the youngest. “Let’s have a father and daughter pastime?” Sharon let go of David’s hand and ran to turn the TV on, settling on the sofa to watch a favorite program. “Daddy,” came Shiloh’s voice again, “did you forget? Sharon’s got the baby-jamboree group in an hour, you have to take her and wait there ‘til it’s over.”

Clearly, the Fun Schedule was overruled. In its place was a schedule of predetermined activities. The phone rang again: “David, are you here and it’s only me who can’t find you?”

“No, Sinead, I’m with the kids. Judy’s on call.”

“Aaah,” came the response. “We’re a bit behind on our schedules. When’s the deadline for sending them to you?”

David was just about to answer when a ringing demand could be heard: “Daddy, I’m ready. Where are you?”

“I can hear you’re doing fulltime fathering,” Sinead said.

“Email it by eight p.m. I have to close now. If there’s anything else, call me. Bye.”

“Daddy!” Shelly stood beside David now. “C’mon, we need to go to Jordan.” She pulled him by the hand towards the front door. They drove as Shelly gave instructions on where to turn right or left until they reached Jordan’s home. “After Sharon’s group, come and pick me up. Will you remember?” she asked.

As he drove home, David planned the coming afternoon’s schedule: take Sharon to the group; collect Shelly on the way home from the group; prepare dinner; organize the children’s showers; tell bedtime stories; get the kids to bed. Judy would return either very late or possibly even the next morning, depending on the situation in casualty. Until that point, David realized, he would be a ‘stand-alone’, a separate unit of resource who must manage all the processes connected with the children and the house.

David went to the kitchen and prepared coffee, encouraged at what seemed to be a simple enough schedule to prepare, just as Shiloh came up to him. “Daddy, I need to go to the library. The teacher said not to look for information on the internet, but to open encyclopedias and feel the pages.”

David sat down. *Oh great, another unexpected summary activity just got added: 'Shiloh to library'*, he thought, mentally checking what the task involved:

1. Drive Shiloh to the library.
2. Look with Shiloh in encyclopedias – the first time ever for him!
3. Help Shiloh find the information.
4. Wait for Shiloh to copy out the information.

“When does this need to be done by?” David asked Shiloh, thinking how this additional activity would throw his schedule out of sync. “I could take you to the library now, then take Sharon to her group and just go in and check everything’s ok. Then I could come back to you at the library and help you ‘feel the pages’, but I’d need to leave you there for a little while when you copy out the information, so that I can dash back and pick Sharon up. Then you could wait outside the library for me and I’d get you too, and all of us can go to Jordan’s and pick Shelly up and go home together.”

“Daddy, I don’t know how many times you’ll need to get in and out of the car,” Shiloh answered, his eyes rebuking, “but the problem with your plan is that when we go to the library, Sharon will be here alone at home in front of the TV, and *that* is something Mommy does *not* allow!”

“OK, so why don’t you tell Sharon that today there’s no TV, and we’ll all go out together, now?”

“That’s a possibility,” Shiloh answered David, “except for one thing. If Sharon misses the song at the end of the program, she’ll be in a bad mood for the rest of the afternoon!”

The phone beeped with a message from Sinead: “Daryl and Wesley just sent emails to you. Files from Nate and me coming in an hour. Jon will send by 8 p.m. Enjoy! Good night!”

David sighed at the amount of work waiting for him once he had finished his afternoon’s ‘work’ with the children. He looked up at Shiloh, who was looking back and did not seem pleased.

“When does this homework have to be handed in?” David asked, hoping against hope.

“In two days.”

“Great,” David sighed in relief, “so do this tomorrow with Mommy, ok?”

Shiloh agreed and went to his room. David wrote a fridge-note:

Judy,

Please take Shiloh to the library tomorrow.

'Feel the pages!'

David.

*The summary activity 'Shiloh to the library' will be added to Judy's schedule, he thought.*



### 1.10 Flow Charts

Arriving early in the office to try and make up for his early departure of yesterday, David realized he was in for a very long day. He had received all the team leaders' charts the previous evening, and processed the data, working well into the night. The chart flow printouts were on his desk. David took the set of documents, stopped by the kitchenette to make a cup of coffee, and stepped into Philippe's office.

"Good morning, David. How are you?" Philippe, holding a steaming cup of coffee, was in a good mood.

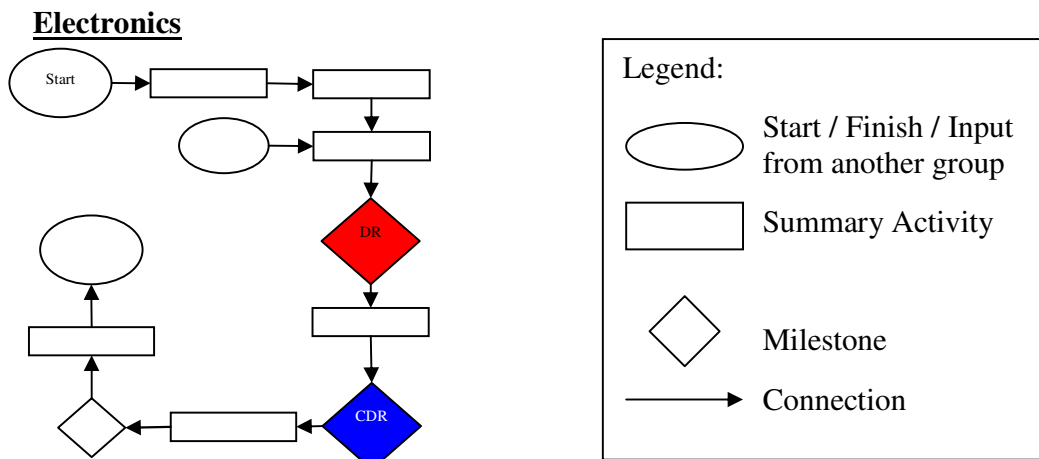
"Great. And you?"

"Good, good. Let's get started." Philippe and David spread the documents over Philippe's desk. "First of all, I want to check that all the team leaders kept the central milestones that we defined. We have:

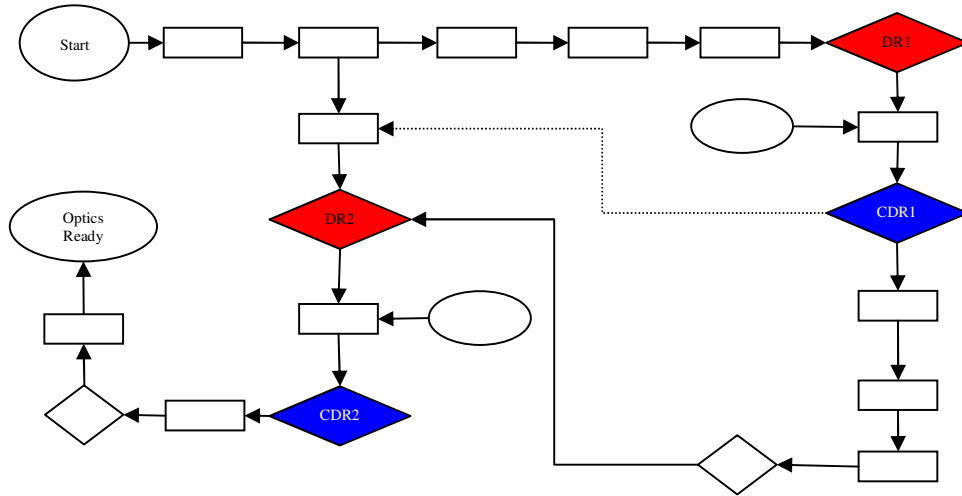
1. DR – Design Review. The first milestone for making decisions in principle on the final product.
2. CDR – Critical Design Review. The second milestone, for deciding critical issues left unresolved at the DR stage."

"In addition, each of the team leaders defined their own international milestones." David added.

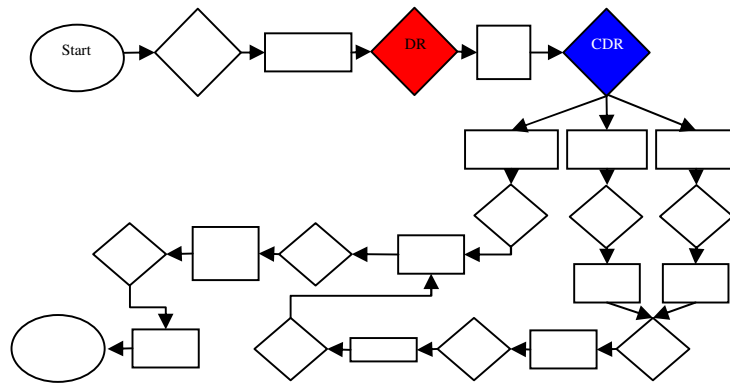
Philippe examined the sketches thoroughly while David waited.



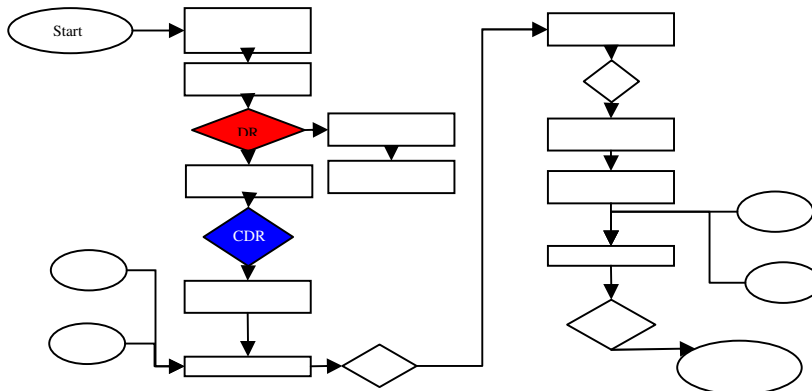
**Physics – Optics**



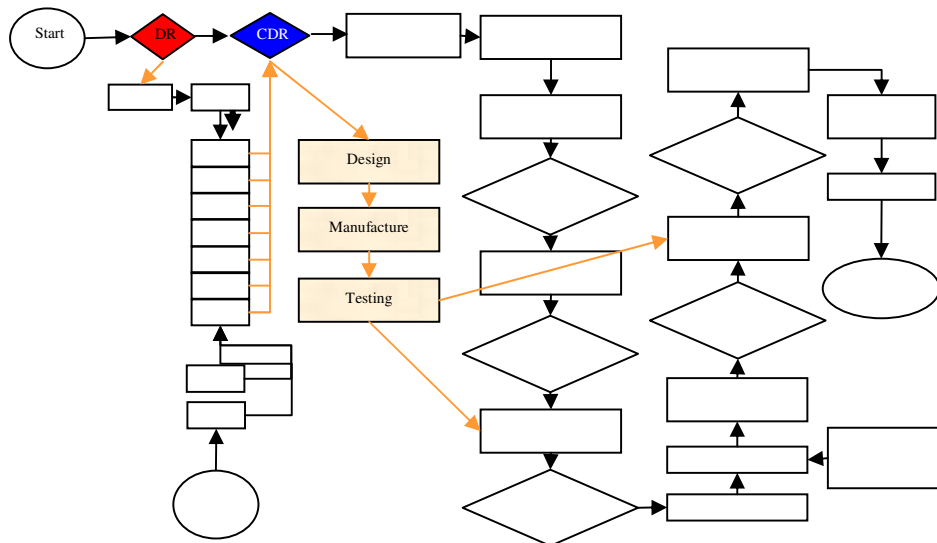
**Software**



**Mathematics**



## System Engineering



“These flow charts look so different from each other; it makes you wonder if everyone’s working on the same project!” Philippe said.

“Each chart is structured by the department’s team leader, according to his or her specific perspective on the project,” David sighed.

“Does that mean,” Philippe responded, “that despite all the hours we spend here together, everyone thinks of the project in different terms? I’m surprised,” Philippe said, looking up from the papers. “To me it was clear that the project was a set of straight avenues, each one being a team, and when all the channels are integrated, we’ll have a completed project!”

“When you look at the team leaders, you see combed long hair tied in a ponytail.... But in fact we seem to have braids, twisting about. Eventually they get tied up together at the end, but each strand has a different path....” David said.

Philippe looked at the charts again. “Are you sure of that? Look. Each chart describes the work procedure, but doesn’t set time frames for all the activities.”

“Yes, that’s why I prepared this table,” answered David, “which estimates the time frame needed to get to each principal milestone. I figure that each summary activity will take a month at the most.”

Team	DR Time Frame
Electronics	2 months
Physics – Optics	3 months
Software	1 month
Mathematics	2 months
System Engineering	Immediately

“That’s not an option!” Philippe exclaimed, “All the DR meetings have to be held on the same day with all participants from the whole company, to reach the decisions that affect everyone. There can’t be a gap of two months!”

David nodded.

“What do you suggest we do, then?” Philippe said, his fingers drumming the table in agitation.

“I suggest we send this data to Razi and consult with her.”

“Do you think we can get her right now?” Philippe asked, calling to the secretary. “Michelle, please, get hold of Razi. Urgently.” Meanwhile, he emailed a copy of the material out to Razi.

“Razi, David and Philippe are here together. Do you have time to take the call?” Michelle asked, as soon as Razi had answered her phone.

“I have a meeting in half an hour. Let’s use the time we have now, sure,” Razi replied.

David updated Razi of the situation while Razi perused the documents which were in her inbox. “What do you recommend?” he asked.

“First issue. Are these charts acceptable to you? Is each group’s chart logical?”

“Yes, I’ve been over them and I think they’re fine,” David replied.

“Alright, then the first thing you need to do is set dates for the DR and CDR.”

“That’s the problem. Everyone sees them as occurring at different times!”

“Your options are the following: to get tough and simply set the DR at, say, one month’s time and everyone just has to make it by that date, no matter what. Or...”

“How encouraging!” Philippe muttered. “What’s our second choice?”

“To check the content of each DR for each group and split it as far as possible. For example, if electronics needs to take 3 decisions at its DR meeting, then:

1. Who’s the supplier providing the boards? This decision also impacts on system engineering.
2. How much space needs to be left on the board for the part connected with the lens? This decision could be taken by optics.
3. What can the maximum board size be? This information is a derivative of system engineering decisions.”

“So you’re saying it’s possible,” David interjected, “to take a decision in system engineering prior to that relative to the lenses, because the lenses will just take longer to receive!”

“Yes, and in the next stage,” Razi continued, “each group’s schedule needs to be constructed according to the chart and the enforced target dates. But you need to pay attention to the fact that every summary activity noted on the chart must be broken down in the schedule into detailed activities at the weekly level, at the very least, and not at the monthly level.”

“Why is this important?” Philippe asked.

“Your project is supposed to be completed within 12 months. With a project of this nature, I recommend doing a progress control check every two weeks. If you do this only once a month, it’s highly probably that when you’ll come across implementation delays, it’ll be too late to correct them. A weekly control check is possible, but is also very weighty on the whole system. The two-weekly control is the most logical time frame. Within this time frame, you need to define activities that are easy to check against the estimated time that the group needs to implement them. If they haven’t been completed, then you can re-evaluate when they will be finished. In this way, the longest activities need to be structured around units of one week only.”

“OK, I’ve got that written down,” David acknowledged. “This means there’ll be a large number of activities in the schedule, right?”

“Yes. I estimate the overall number will be around 500 activities.”

Philippe whistled in surprise. “Isn’t that a huge number?”

“It’s not the smallest schedule, no, but also not in the range of largest. I’ve seen schedules containing thousands of activities, sometimes as many as around 20,000.”

David and Philippe looked at each other, stunned. They had not imagined such numbers.

“Then we need to integrate all the charts into one?” David asked Razi.

“Yes. This unification manifests in indicating the connectors between the different groups, as we’ve discussed already.”

“I see. That’s how we develop a kind of road-map of the project,” Philippe summarized.

“Razi, does asking the team leaders to provide these schedules within a week seem reasonable to you?” David asked.

“If each team leader works only on his or her group’s schedule, then yes, one week is fair. Unifying the schedules, David, will take another week of your time, working with each team leader separately, or sometimes in coordination with several at once.”

“OK,” David said softly, wondering where he would find the extra hours for work on the schedules.

“I’d like to emphasize one thing, though,” Razi finalized. “You have to devote a full work week to this, David. Take into account that during the designated week, you won’t be able to do much of anything else.”

David wondered if she was a kind of mind reader! “Why’s that?” he asked Razi.

“Do you know that saying, *God’s in the details*? Work on the schedules coordinates so many fine details that it just takes a tremendous amount of time. Just keep in mind the scope of the details.”

Razi advised that her meeting was about to start. “I’ve got to close now, but I’ll await your unified schedule in order to run the HCP analysis on it. Will you have your schedule ready in two weeks?”

“Absolutely,” David responded.

“Razi, thanks so much,” Philippe added

“My pleasure and best of luck with it!” Razi ended the call.



## 1.11 Collisions

*What a crazy week*, David thought, looking at the ✓ marks next to software, electronics, mathematics and system engineering. One more meeting, with Sinead, would enable him to mark the meeting with optics as completed, too. Then he would review the schedules one last time before forwarding them to Razi. He was very pleased with himself at having gotten through them in just three days instead of a full work week.

Sinead would be joining him in just five minutes. He read through the various activities in her schedule. Her DR was set for just three months away, but that was too far and could hold the entire project up. No, that would just not be acceptable.

He scanned the schedule, looking for the activity titled DR. Suddenly he noticed another activity: 'Write computer program to read lens output'. Why does Sinead need to write a program? That belongs in Daryl's sphere of responsibility. He remembered seeing this same activity in Daryl's schedule. If Sinead and Daryl were referring to the same activity of program writing, how could it be that each of them arrived at a time different frame, after conducting different activities appropriate only to his or her schedule, and leading to a different set of activities? Was there some kind of interface issue between the two groups, with neither of them aware of the other's perspective? This was exactly the kind of failure that Razi has described. Trepidation crept into David's heart.

Deep in thought, he did not hear Sinead enter the office and sit down in the 'hot seat'.

"Hi," she said softly, but David jumped, startled out of his concentration. His knee hit the underside of the table, the wireless keyboard became a flying carpet, and his coffee cup began to tilt dangerously. Sinead managed to catch the coffee before any real damage occurred, and picked the keyboard up from the floor, as David watched wide-eyed.

"Sorry, I didn't mean to alarm you," Sinead said, "but just don't get a heart attack over it, because I can't remember the resuscitation techniques!" she smiled apologetically.

"It's ok. I was worried, that's all."

"Well, no need. None of the coffee spilled," Sinead answered, "and the keyboard looks fine, too."

"No, not about the coffee. About your DR."

"What's wrong with it? I detailed all the issues that have to be ready by then, to allow taking decisions!" Sinead responded emphatically.

"Sinead, the content is great. The problem's in the time frame. You've set your DR for three months, but I need it for one month as of yesterday."

"Wanting is a positive thing, but we don't get everything we want in life....," Sinead answered nonchalantly, but noticed David was not smiling.

"Look, the DR needs to relate to several issues connected with optics: the final type of lens in the product, the physical space that needs to be prepared for the lens in the product

according to their size, and the link between the lens to the system processing the optic results,” David said, counting out the issues on three fingers.

“I haven’t even received the lenses yet, as you know, so how can I move the DR forward!?” Sinead half-stated half-questioned.

“You didn’t receive the best lenses, which you preferred, but you do have alternative lenses.”

“They’re much worse!”

“We’ll have to manage with them for now, because of time pressures.”

“You understand what that means?” Sinead’s eyes opened wide as she spoke. “The quality of the product will drop so drastically that it may not even be worth producing at all!”

“Sinead, don’t exaggerate.”

“Listen, David, you brought me into this project as your optics expert. So that’s my professional opinion. What am I here for, if you’re not going to listen to me?” Sinead was clearly annoyed.

“I do listen, Sinead. But on the other hand, I need to cope with reality. I need to move ahead with one bird in the hand, rather than the one still flitting about airports and customs, thousands of kilometers away from here.”

Sinead did not answer. David caught the anger in her eyes.

David continued, “Let’s break the DR into two parts. The first DR using the low quality lenses will be implemented in another month. In another three months, we’ll close the final configuration in the CDR, once the better lenses are also here.”

Sinead wriggled uncomfortably in her chair, mumbling, “OK.”

“The other two questions, being the actual physical space needed, and the link to the system, will be in the DR in a month’s time.”

Sinead agreed, moving her schedule on the screen as she checked it. “My ending milestone has the same date. I’ll finish the project in 12 months, as it should be. Are we done?” Her tone was rhetorical as she stood, preparing to leave.

David looked at her in surprise. “We’ve only just started! Please, sit down Sinead,” he answered. “I need you to explain to me what exactly you were referring to when you wrote this?” he said, pointing to a line in the schedule.

Sinead stretched to look over at his computer screen. “I need to attribute the lenses’ output and write a program that receives the input and transfers it to information results that we can work with.”

“Sinead, are you aware that Daryl is also preparing an interface for this in the software, in a different time frame?”

“Daryl?” Sinead was surprised. “Why’s he doing it? It relates to the lenses!”

“Because he also handles this information,” David answered, dialing Daryl and asking him to the office. “Wait, let’s talk to him”.

“What’s up?” Daryl was already on the defensive. “We don’t have a meeting now, do we? Was I meant to send something after yesterday’s meeting...?”

“Everything’s fine,” David assured him. “Sinead is here, and we’ve begun checking the lens output processing program. Please, come on over for a few minutes.”

Daryl had barely stepped into David’s office when Sinead directed her question: “Why are you writing the lens interface?”

“It’s part of the software. Why are you asking?” Daryl responded, surprised.

“How can you write the software if you have no idea which lenses are being used and what data they produce?”

“I’m structuring the interface so that it’ll be possible to use data from the lenses in the software. If I leave it for you to do, I’ll get data in a form that’s good for you but that we can’t work with!”

Sinead’s voice dropped. “On the basis of what exactly are you making this claim?”

“You optics people think you understand software because you know a bit about programming, but you don’t really understand computers,” Daryl jibed. “Exactly why are *you* programming this?”

“Because if we wait for you people to do it, we’ll get nothing until the product is ready!” Sinead shot back.

“Hey, what’s up with you two?” David stopped them. He looked at his two team leaders. “You’re both brilliant professionals. I understand you’re both under enormous pressure. I need you to take a breath and relax, because we need to work together.”

David looked at Sinead and Daryl, both scowling. “Let me summarize the, um, discussion we’ve just had. Daryl, first you need to provide Sinead with data so that she can perform her experiments. Then, Sinead, you need to give the results to Daryl, so that he can prepare the interface. Only after Daryl finishes that, Sinead can run the interface reliability tests. Agreed?”

With no other choice, they both nodded in agreement.

“Daryl, how long do you need, to get Sinead the data?”

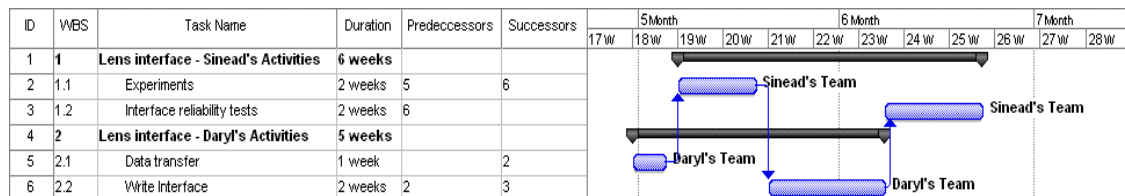
“I can do that within a week,” Daryl’s voice was defiant.

“And how long do you need for experiments, Sinead?”

“Two weeks for experiments, two weeks for checking,” Sinead answered. “And that’s really very little time!”

“And because I’m *really* good, the interface will be ready in two weeks,” Daryl added.

“OK. All we have to do now is insert this connector into your schedules,” David explained, looking at the screen and beginning to type in the data changes.



**Illustration 8: The links between Sinead’s and Daryl’s tasks**

Sinead and Daryl looked at the result on the screen before them. “I have to wonder, though, how we missed this link between us first time around,” Daryl said.

“I wasn’t even aware of the ‘ping pong’ between our tasks,” Sinead answered, “and that’s a real problem.”

“Why?” asked David, looking at them both.

“I’m responsible for the interface, right?” Sinead said, and David nodded in agreement. “I conduct the experiments, but then I’m dependent on Daryl. Only after he builds the interface, I can start tests. And what happens if he runs late on completion of the interface? I’ll be delayed because of him!”

“Are you implying I’ll cause delay?” Daryl was very angry. “Who’s always behind time because of the lenses?” he shot back.

“But how will I know when I’m supposed to begin my next activity? If Daryl doesn’t uphold times, my activities will always be behind time!”

David gave Daryl no opportunity to respond but jumped into the fray quickly. “I’m going to divide the answers into two parts. Firstly, Sinead, give them some credit. Secondly, I’m going to do a control check each week and review the question: ‘Is your activity nearing completion?’ You’ll all be under constant control and you’ll all have to maintain your targets,” David finalized, looking at Daryl.

Sinead drew a sharp breath, shut her mouth and said nothing.

“Daryl, you’re free to go. Thanks.”

“The truth is,” Daryl said, stopping at the doorway on his way out, “I thought writing up this schedule was another nuisance task. This is the first time I understand how important it really is!” He thought for a moment. “You’ll send me the updates of what we did here, right, David?” and left, happy to be away from the tension.

“I’ll go too, then,” Sinead said, standing again.

“No, no, no,” David answered as he reviewed the now-adjusted schedule.

“What’s the problem?” Sinead asked, concerned, leaning over his shoulder to check the screen.

“The project’s overall schedule ended within 12 months and now it’s gone two weeks over time.”

“How can that be?” Sinead asked, her voice fearful.

David moved the schedule back and forth. “This link between you and Daryl has pushed the dates forward. Now you’re both critical.”

“No, this can't be possible,” Sinead said, pacing the room like a caged lion. “Everything’s so tense all the time. We work so hard, and I hardly see my home. I don’t even get to sleep five full hours every night. It’s not possible to add work hours. You can’t pressure us more!” She stopped in her tracks, appealing with wide movements of her hands and arms. “So the schedule’s moved forward. How important can two weeks be?”

In his own thoughts, David had to agree with her. The pressure was enormous. There were only so many work hours one could devote. His mobile phone rang.

“Daddy?” he heard Shiloh say.

“Yes, Shiloh. Are you still at school? Has something happened?”

“No, Daddy, it’s already two in the afternoon. Mommy told me this morning to phone and remind you there’s a parents and teachers meeting tonight.”

*Two? Already?* David felt as though the morning had begun not more than a few minutes ago. With all the pressure David realized he hadn’t yet eaten lunch!

He opened his diary. Yes, the meeting was entered. “Of course, Shiloh. I remember,” he said, *The day had been so busy, David thought, when had there been time to even glance at the diary?*

“OK Daddy, I’ll wait for you to pick me up at home at 6.30 and we can go to school together,” his organized child said.

“Of course. See you later,” David answered, closing the phone and facing Sinead. “No time, no time. In another four hours I have to be home,” he said, moving papers about on his desk.

“What are you looking for? Did you leave some extra hours on the table?” Sinead asked, smiling.

David smiled back. “I wrote something down when I spoke with Razi this week,” he said, pulling a sheet of paper out from under the pile. “Here it is,” and he began to read out the notes:

Ways to Shorten Project Duration

- Changing connections or sequences
- Shortening duration allocated to activities: with commitments to perform the activities in shortest time frames
- Overlapping activities (performing activities simultaneously)
- Adding staff: shortens duration of activities or export work to subcontractors
- Waiving work spec for this version of the product

“Changing the sequence is impossible,” Sinead determined. “First I need to receive the lenses. Only afterwards, I can run experiments on them.”

“Then you’ll have to shorten other activities,” David suggested.

“No! Under no circumstances!” Sinead almost screamed back, her curls swinging from side to side as she angrily stormed across to the other side of the room.

*If the mighty have succumbed, what may the weak say? David thought. Sinead must be only the tip of the iceberg indicating something of the whole, and I’m sure all the other team leaders are under massive pressure too.*

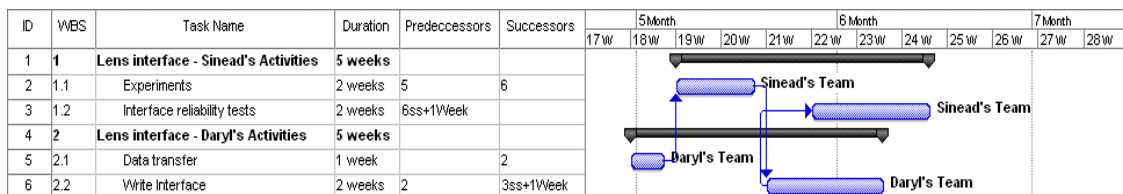
“If removing content from the project is impossible, and adding staff is also not an option, then the only thing left to do is perform activities simultaneously,” David worked through his thoughts out loud.

Sinead flopped back down in the chair. “How?”

“What do you think about starting your tests even before Daryl completes writing his interface?”

Sinead sighed. “Yes, I suppose that can be done,” she said slowly, collecting her thoughts. “If Daryl builds the interface up in segments, in stand-alone units, we can check each section separately.”

“Let’s try it, then,” David agreed, embedding the change.



**Illustration 9: Overlapping activities 3 and 6 shortens the duration of the project by one week**

“It shortened the schedule by one week!,” Sinead noted happily. “But that’s only one week of the two...”

David looked at the result. “I think Daryl will have to begin the interface one week after you begin the tests.” He inserted the additional change and the result showed immediately.

ID	WBS	Task Name	Duration	Predecessors	Successors	5Month					6Month				7Month		
						17w	18w	19w	20w	21w	22w	23w	24w	25w	26w	27w	28w
1	1	Lens interface - Sinead's Activities	4 weeks														
2	1.1	Experiments	2 weeks	5	6ss+1Week												
3	1.2	Interface reliability tests	2 weeks	6ss+1Week													
4	2	Lens interface - Daryl's Activities	4 weeks														
5	2.1	Data transfer	1 week		2												
6	2.2	Write Interface	2 weeks	2ss+1Week	3ss+1Week												

**Illustration 10: Overlapping activities 2 and 6 shortens the project duration by another week**

“The project now ends in exactly 12 months!,” Sinead clapped her hands together.

A notification popped up on the screen indicating email from the lens producer.

“What now?” Sinead asked, suspicious. “More bad news...?”

“Let’s see,” David answered, opening the message which they both read quickly.

“Can that be true?” Sinead whispered.

“I hope so,” David replied.

Sinead almost danced for joy. “They’ve managed to get a special permit despite the strike! The lenses will be here tomorrow! Fantastic!” She was grinning broadly. “And you were pressuring me to start building the product with those low grade lenses...”

Without waiting for an answer from David, she dashed out, calling behind her: “I’m going to let Daryl know about the overlapping. She stopped suddenly, returning for a moment: “We have finished now, right?”

“Ah... yes...” David nodded, checking the screen. *But if everything’s looking good, why do I feel so worried?* He checked the schedule: 12 months of intensive work, tens of parallel activities being simultaneously implemented, twenty employees who need to work together in perfect synchrony, like a well oiled machine, to ensure their product’s beta version. If only one person makes one mistake, everyone would fail. He saved the file once more, and sent it for HCP analysis via Razi’s website. The computer showed the message sent with the current date and time: 17:59.

A thought came screeching into his mind: the parents meeting! He grabbed the car keys and phone, and sprinted down the steps to the car, simultaneously texting Judy: “Meet you at school.” A reply came back quickly: “Hope you get there before the teacher does...”



## 1.12 All or Nothing

The parking lot was full to capacity when he arrived, forcing him to wait until a place freed up. It was already 6.40 p.m. He hoped that the teacher was running late with the individual meetings with parents. He also hoped he would find Judy and Shiloh waiting outside the classroom. He dashed across the school lobby to the classroom, but did not see a single familiar face.

“Is this classroom 3B?” he asked another father.

“No,” came the reply, “these are the classrooms for the Class 2 children. The Class 3 rooms are opposite,” the man said, pointing.

There, he saw some vaguely faces vaguely familiar from end-of-year activities and the like. “Are Judy and Shiloh inside?” he asked a mother.

“Yes, they are.”

David opened the door with a thrust, apologizing for his lateness as he entered. Judy gave him a sour look, and Shiloh looked down, embarrassed. David sat down.

“We’ll be through in just another two minutes,” the teacher said. “Other parents are waiting their turn. I was just saying how responsible Shiloh is. He always brings all his equipment, is never late for class, prepares his homework, and received high grades on all his tests. A lovely boy!” the teacher summarized, smiling.

“I wanted to ask about the work you gave me to do this week on the country’s topography. Do I need to make a 3-D model?” Shiloh asked the teacher.

*How does Shiloh know words like ‘topography’!* David wondered. *He never told me about this project, only about needing to visit the library.*

“Shiloh and I wondered about the materials you’d suggest using for creating a model. What size model did you have in mind?” Judy asked the teacher.

“I think a good size would be that of a small vegetable carton from the supermarket,” the teacher suggested. “You can make the model from any materials you want: plaster, play dough, even natural materials like sand and earth, or a combination of materials. You can also add pictures from different areas.”

“We don’t really get to travel around much,” Shiloh said quietly.

David’s eyes narrowed: *Ah my dear child, he thought, haven’t you learned yet that you don’t have to tell all the truth all the time?* “But we do have some great photos from our trip to New York.” he added.

Judy looked at him sternly and he said nothing more. *Lucky for me that looks don’t really kill,* he thought.

“Thank you, Mrs. Mendoza,” Judy said, “thanks for everything.” She stood up, indicating that the meeting was over.

*At least I know the teacher's name now*, David thought, as Shiloh looked sharply at him. They walked to the car park and David praised his son. "What lovely compliments I heard you receiving, Shiloh!"

"You missed the whole thing, Daddy."

"Yes, pretty much and I'm sorry. There's so much pressure at work..."

"Daddy, I also get a lot of pressure, from Shelly and Sharon, and you heard what Mrs. Mendoza said: I'm never late!"

*Oh, this is weird*, David thought. *How can I answer the child?*

Judy came to his rescue. "Shiloh, you and Daddy aren't exactly busy with the same kinds of things. When you grow up, I hope that you'll always be on time, just as you are now!"

They reached the parking lot and David walked over to his car, while Shiloh accompanied Judy to hers. "Let's talk at home," Judy mouthed to David.

Judy sent the babysitter home. David started with dinner preparations. David and Judy did not talk at the table. Afterwards, Judy showered the two younger children, and David read them bed time stories. Judy came in to give them goodnight kisses, and turned off the light.

In the kitchen, David prepared hot drinks for them. "We need to talk," he said to Judy.

"What d'you say...."

"Judy, please, don't be angry."

"Do you have any idea how anxiously Shiloh waited for you at home?" Her hands flashed about angrily. "He didn't want to go to school with me because 'Daddy could walk in any second now'. You just have to be home more, and with the children more!"

"It could very well be that in the very near future, I will be 100% of the time at home..."

Judy froze in her place. "What did you just say?" she asked quietly, sitting down.

David handed her a cup of tea. "If we can't prove to the investors that we're worth further investment, we'll be closed down. We're working like crazy on proving we're worth it."

"And if you don't succeed, the company will fold?" Judy asked a little disbelievingly.

"Everyone will be sent home, I can be a fulltime home father, and you can be a doctor totally involved in the hospital," David answered, and although he smiled, his eyes showed sadness and tiredness as he sipped his drink.

"Why didn't you say so earlier?"

"We didn't manage to find quiet talking time, and it didn't seem appropriate for a fridge note..."

“And if you do persuade the investors?”

“Then we’ll have to find an alternative arrangement for the kids when you’re on shifts, because I won’t be able to come home early.” He paused. “Maybe I could, once a week...”

Judy was calculating in her mind. “How long would this arrangement... this craziness... last?”

“Exactly one year. Until the product is released.”

Judy’s hand covered David’s. “Fingers crossed for you,” she said, looking into his eyes.

“I need more than that. I need a hug.” His voice emphasized his exhaustion.



### 1.13 Did Someone Turn the Sun Off?

David sat at the board room table and Philippe was looking out through the windows when Razi entered and cheerily greeted them. ‘Hello, how are you?’

“Great. Did you see what the fantastic sun out there? Did you hear the birds chirruping this morning? Don’t we have a really fantastic schedule? Haven’t we put together some good work!?” Philippe chatted, optimistic.

“We’re ok at the personal level,” David answered, in a more measured tone. “But we want you to tell us how we are at the business level...”

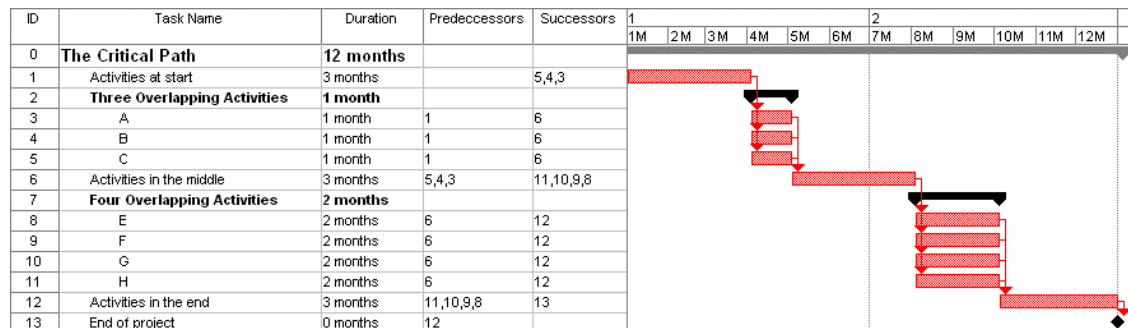
“OK. Let’s start with the analysis results,” Razi was direct and practical.

“Razi, I hope this won’t be a case of the operation being successful but the patient dying anyhow...,” Philippe joked.

“These are the results. The longest path in this project is not one path. ‘It’ is actually 12 different paths, having the same duration, and which are identical to your project’s critical paths.”

Razi presented the first slide showing the list of activities which created these 12 paths. David and Philippe examined it closely.

“Yes, that looks logical,” David said. “These activities are the most significant for the project. It’s amazing that there are 12 different paths rather than just one.”



**Illustration 11: The critical path – not one but twelve.**

“Razi, why are you describing this as 12 paths? It’s one, with overlapping activities,” Philippe pursued the issue.

“That would appear so, but two summary activities here contain parallel activities. One summary activity has three parallel activities, and the second has four. In other words, if we imagine that we’re looking at a hikers’ map, we can choose any one of 12 possible trails to cover that hike from start to end.”

*Shiloh’s teacher suggests traveling through the country and Razi suggests traveling through the project, and I’d like to take Judy on a real trip next summer, once the project is finalized,* David thought. Instead, he said, “We set up parallel activities as a way of upholding the time frame of 12 months.”

“Were there other options you could have chosen?”

David pulled out the page listing time shortening possibilities for the project. “We looked at changing sequences or precedences, but we couldn’t do more than we’ve done. Everyone committed to the shortest time possible for implementing that team’s activities. We can’t add staff,” he looked over at Philippe, who nodded, “and in order to be attractive to the investors, we can’t waive content for the product. What’s left is creating parallel activities, as we did.”

“And what’s the meaning of these parallels?”

There were a few seconds of silence as David gathered his thoughts. “With so many overlapping activities, **all** of them have to end together: if only one doesn’t, then nothing can move ahead!”

“In other words, the risk we take on ourselves of not completing all the activities on time is far greater than the risk when there is only one activity left to end,” Philippe realized.

“Right,” confirmed Razi. “This means you have to be thoroughly familiar with the activities creating the critical paths and ensure they are implemented as planned.”

Razi looked at the two men. “Behind these are a lot of hidden critical paths. Not just two or three, but when I examined the project, I found these:

1. There are 3 hidden critical paths where the gap between them and the critical paths is only two days.
2. Eighteen paths have a float of 5 days between them.
3. Four paths have a float of 6 work days.
4. One path has a float of 13 work days.
5. Sixteen paths have a float of 15 work days, which are three weeks.”

“And the list goes on. In total, several hundred paths were found at a float of 20% of the project duration, which is about two and a half months.”

“What?” Philippe exploded in frustration. “Three paths with a float of two days! They’re absolutely critical!”

“Paths with a float of 6 days are no less critical,” David gasped, thinking how two weeks pass before one has time to see them on the calendar.

“That means that our paths are comprised not only of twelve critical paths, but of all the hundreds of hidden critical paths,” Philippe grumbled, his head between his hands.

“And every path is a process in the project. Looks like we have hundreds of processes.”

“There’s no way we can implement this project, then. We could just as well close the company now. You’ve just turned our sun off,” Philippe summed up the situation in a voice filled with desperation. “We don’t need to wait for the investors to tell us that.”

“The first thing you need to do is to become better familiarized with all the activities creating these hidden critical paths,” Razi explained.

“Every activity of this kind is a risk factor,” David added, “but what kind of risk?”

“That depends on the activity, David. Let’s take an example. In the hidden critical path with a two day float, we find activities from the electronics group. What do they need for these activities?”

David looked at the chart. “These activities belong to the summary activity called ‘structuring the board’. What it involves is having all the parts ordered a month earlier accessible, then assembling the board, and then running tests with the chosen lenses.”

“In other words, there are a lot of risks here: that the parts won’t arrive, that the parts will arrive but not on time, that the required number of any part may not meet our needs, and that’s just the beginning. It’s horrifying to think about!” Philippe’s voice expressed how overwhelming the situation seemed.

Razi continued quickly. “The risk management process is comprised of three stages: (1) identifying the risks; (2) mapping the risks; and (3) managing the risks.”

“The first of those, identifying the risks, we’ve already done. In effect, that’s the HCP you conducted, right?” David asked.

“Yes. Now we need to analyze each activity for its inherent risk factor. The next stage is to map these out: which is riskier, which will impact forcefully on continuation and which have less impact.”

“Who decides on this?” asked Philippe.

“A team needs to be chosen, which must include you both,” Razi explained, “and should, in my view, also comprise the team leaders, and perhaps any external consultants involved in the work, and whose opinions you value, and perhaps even some or all of the investors. The process involves distributing a questionnaire to everyone, to be completed by each individual on his or her own. Then the results are analyzed and the risk issues are mapped out as red, indicating the most problematic according to the team’s view, green which are low risk, and yellow which are intermediate level risks. After that, you get to the third stage, which is risk management, or ‘creating a mitigation plan’.”

“Which is what?” David and Philippe asked simultaneously.

“At this point, the whole team sits together and prepares an action plan for every risk marked in red, and sometimes for those marked with yellow, too. The action plans must include who is responsible for the risk, and how each risk is to be handled, so that it’s reduced or even voided altogether, or possibly transferred to someone else outside of the company. In other instances, a contingency plan is prepared, so that if the risk materializes, you know what to do about it.”

“When you think about it all in advance, you can avoid problems and plan ahead, quietly, rather than deal with things when all hell breaks loose,” Philippe noted. “OK, so a small ray of sun has just peeped through.”

“Who’s supposed to manage this process? Do we need to find a consultant, or can you do it, Razi?” David asked.

“You can find a risk management consultant, or I can go through the process with you – as you wish.”

“Give us a day to think about it, then,” Philippe said, beginning to stand.

“One moment, we haven’t finished yet,” Razi quickly added.

“Is there more?” Philippe sat back down in his chair with a thud.

“I want to anticipate a probability,” Razi said as David and Philippe looked at each other, wondering what additional probability could possibly surface now.

“All the staff knew about the requirement to complete the project in 12 months, right?”

“Of course,” David responded.

“It’s most likely that they saw, while writing up their schedules, that their time frames would go beyond the required 12 months so they limited themselves. After structuring the schedule of all the teams combined, with all the mutual and interconnected dependencies, it’s likely that you found the project extending beyond the 12 months and then decided to shorten the total time.”

“Have you got secret cameras lodged in here?” David laughed, looking around.

“No. That’s the usual and natural state of things.”

“So what are you trying to allude to?” Philippe asked, sighing. “That the project can’t be completed in 12 months?”

“Philippe,” Razi answered him, “I was taught that in Japanese, there is no such word as ‘no’. But there is a word that means ‘very, very, very difficult’ – ‘muzukashii’. I think this project is close to *muzukashii*.”

“Why is that? If everyone’s committed to completing their tasks on time, then the project has to be completed on time!,” David said with confidence. “Isn’t that right?”

“There are two processes here. One is the desire of the staff to support the project and really finish it on time. The other is called ‘the Planning Fallacy’. It states that people are always optimistic, and even though they have failed several times and not upheld pre-set timetables, they will always want to believe that the next time, they won’t fail. That attitude, by the way, is relevant to all of us.”

David thought about Razi’s explanation. It reminded him of his lateness to the parents’ meeting at school, his lateness in picking up the children after kindergarten...

“Planning fallacy is committed by everyone,” Razi continued. “It only ends when we examine someone else’s actions.”

“OK. And what does that mean?” David asked.

“Here we get to a rule of thumb, which states that if a task has been estimated for a time frame of X, it will actually be fully implemented within a timeframe of X plus 30% of X. In other words, if the project is estimated at 12 months, it will probably need 16 months for completion.”

Philippe considered Razi’s point. “If we tell the staff that they have 16 months, then in actuality, that also won’t be realistic, as we will need to calculate 16 plus 30% of 16, which totals 21 months...”

“Correct,” Razi confirmed his line of logic. “Therefore, several possible mechanisms can help cope with this situation:

1. To say that the project has to be completed within 12 months, but define a safety net of 4 months, and close with the investors that the target date is 16 months, keeping this absolutely confidential.”

“Keeping things like this secret is virtually impossible,” David said, resettling himself in his chair. “Isn’t there a better option? Secrets have a way of being revealed...”

“Yes, let’s look at this further option.

2. Tell everyone that the project has to be completed according to the currently existing plans, within 9 months, and 3 months are the safety net. In other words, the total time frame for the schedule is 9 months, and the other 3 months will be defined as a protective extension for the project, for all kinds of unexpected events that might need to be handled.”

“Nine months?” David almost screamed. “Does that sound realistic? I think everyone will just throw in the towel when they see a target date of nine months, which is clearly impossible to realize!”

Razi added, her voice calm: “There’s a third option:

3. Activating a fine or bonus mechanism. You can define, for both the staff and the investors, that 16 months are the target, and every month of earlier completion gets everyone a bonus, which is increased proportionate to making the final completion date earlier. The prize can be in any number of forms: a meal at a good restaurant, a weekend away, a large money bonus, or anything else... any kind of positive motivator that will help challenge and reach the targets.”

“So much for prizes. And what about fines?” Philippe asked.

“In your case, it seems to me that the fine will be handed out by the investors, in the form of closure. A pretty hefty fine, no?”

David and Philippe looked at each other, acknowledging the amount of work to be done.

“Let’s sum things up,” Philippe said. “Right now, we have a schedule, which we can implement, having shortened it as much as possible. We overcome the planning fallacy by structuring a safety net. We still have to analyze the value of the solution we reached from the risk management viewpoint, and the financial perspective. After we do all that, we can give the investors a schedule?”

“Yes, that sounds right,” agreed Razi.

“Good. So we’re done here for today. At last the sun’s come out again...,” Philippe said, rising from his seat.

“No. No. Just one more matter...” Razi stopped him in his tracks.

“Another storm cloud blocking the view?” Philippe sat down, yet again, his face clearly showing his frustration.

“I want to remind you,” Razi detailed, “of the issue of control that needs to be implemented every two weeks. In other words, every two weeks you need to draw up the activities for the coming two weeks, and when they need to be implemented during those two weeks. The lists must be subdivided by topics, and the team leaders must receive the relevant list.”

“Sure. Every team leader must implement control of activities completed by his or her team, and David needs to conduct a control of all cases where one team impacts the activities of any other team,” Philippe explained, showing his familiarity with the technical material.

“Your goal,” Razi turned to face David, “will be to ensure that nothing falls between the cracks.”

David nodded. “At the end of every two weeks I’ll do a clean up to make sure everything’s been done on time. If anything’s been postponed, or extended, I’ll need to update the schedule and check the significance of what that might lead to...”

“Yes, that’s why the float is so important,” Philippe added.

Razi looked at them both. “Yes, and the control lets you discover that the critical paths are constantly swapping with the hidden critical paths, but you’ll be aware of them all, and the risk mitigation plan will assist in coping with all the changes, so that although the whole process won’t be simple, it will certainly become possible!”

“Well, at least now you’ve shown us the light at the end of the tunnel!” Philippe smiled. “I was convinced earlier that everything had gone black.” He turned to David. “When’s our next meeting with the investors?”

“Next week,” came the reply.

“If you have any meetings planned for the next couple of hours, cancel them. I want to sit with you on everything Razi’s said so far, so that we can:

1. Decide on a defined time frame for our safety net apparatus.

2. Figure how to present the data to the investors and persuade them to accept this safety factor.
3. Examine all the risk factors and prepare a risk mitigation plan according to the HCP analysis.
4. And finally, we need to meet tomorrow morning with all the team leaders about the control mechanism.”

David nodded in agreement.

“Razi,” Philippe turned to her, “I want to thank you for all the serious work you’ve put into this. At least now I have the sense that I know exactly what to do.”

He stood up, and shook her hand.

“I wish you a lot of success with your project,” Razi answered. Picking up her laptop, she shook David’s hand and left the room.

Philippe and David leaned over the pages scattered across the table when one of the printouts seemed to vibrate. David lifted up the page to find his mobile phone indicating: Judy calling.

“Very quickly,” Judy said, as her face appeared on the screen. “I’ve got to rush, there’s an operation. But in light of how things have been going lately, do I have to call Melinda and Ben and cancel tonight? You do remember, we were supposed to go out...”

David looked at Philippe and the papers covering the desk. “Two hours and we’re done?”

Philippe nodded yes.

“Judy, don’t cancel. Check that the babysitter’s still on. We’re going out!” He saw Judy’s surprised, happy face just as she started to run towards the operating theater, and close the phone.



### 1.14 The Meeting and the Investors

David stood in the board room, looking down at the table. Refreshments and fresh water were placed neatly in the center, as they had been at the previous meeting. This time, however, there was an addition: six thick bound documents. Three on one side of the table were for the investors, and three, facing them, were for Philippe, Geoff and himself. The first slide was also displayed on the screen. Philippe entered like a storm wind.

“Good morning. Is everything ready?”

“Yes,” David answered calmly.

“We’re going to present to them,” Philippe began to enumerate, counting out on his fingers, “the schedule and the process by which we created it”.

“So that they realize its complexity!” David added.

“Then the HCP analysis,” Philippe continued.

“And its significance,” David again added.

“Plus the risk analysis deriving from the HCP,” Philippe counted on his third finger.

“And the contingency plan for all the red and yellow risks,” David rounded out the statement.

“And our request to define the project completion target date as 16 months, containing a safety net of 4 months,” Philippe summed up as Geoff walked into the room, adding: “In other words, there’ll be a bonus for effort, investment and acceleration for company staff if we complete the project earlier than 12 months. Wouldn’t it be fantastic if the investors would give the company a bonus, too...”

David caught sight of Todor, Eric, and Ron approaching, led by Michelle. His phone vibrated. There was a text message from Judy: “Fingers crossed. Good luck!”

Two hours later, David replied to the message. “Don’t know how much you’ll see me the coming year, but we’ve got work! Love you. David.”

David’s stomach reminded him that lunchtime had long since passed. He stretched out to take something to eat, only to discover that this time, all the plates of refreshment were empty.



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