Steamship Soldier on the Information Front (v1.1)

Nancy Kress, 1997

Just before the plane touched down at Logan, Allan Haller gave one last check to the PID on the back of his tie-tack. Good. Intense vibration in the Cathy icon, superintense in Suzette, and even Charlie showed acceptable oscillation. No need to contact any of them, that would save time. Patti and Jon, too -- their icons shivered and thrilled at nearly top speed. And three minutes till landing.

"My, look at what you have there," said his seatmate pleasantly. A well-rounded grandmotherly sort, she'd been trying to engage him in conversation since La Guardia. "What sort of gadget is that, might I ask?"

No, Allan almost said, because what ground could possibly be gained? But then he looked at her again. Expensive jacket, good haircut, Gucci bag. Certainly money, but probably not entrepreneurial -- rich old women tended to safe and stodgy investments. Still, what could he lose? Two and a half-minutes until landing, and speculative capital, as he well knew, was sometimes found in very odd places.

"It's a PID -- a personal-icon display," he said to Grandma Money. "It shows the level of electronic interaction going on with my family -- my wife Cathy here, my son and daughter on these two icons -- and of my two chief business associates. Each of them is wired with a WIPE, a 'weak interactive personal electronic field' in various items of clothing that communicate with each other through a faint current sent through their bodies. Then all interactions with other electronic fields in their vicinity are registered in their WIPES and sent wireless to each other's PIDs. I can tell, for instance, by how much the Cathy icon is vibrating that she's probably working at her terminal -- lots of data going through her icon. Suzette is probably playing tennis -- see, her icon is superoscillating the way WIPE fields do when they're experiencing fast-motion physical interference, and Charlie here -- "

"You send electric current through your children's bodies?" Grandma Money sounded horrified.

"It isn't dange -- "

"All the *time*? And then you Big-Brother them? All the *time*?"

Allan flipped down the tie-tack. Well, it had been worth a skirmish, as long as the time talking to her would have been downtime anyway. With a slight bump, the plane made contact with the runway.

"Don't they ... well, I don't mean to be rude, but doesn't your family object to -- "

But Allan was already moving down the aisle toward the jetway, from the forward seat he'd had booked precisely because it was the first to disembark. By the time the other passengers were reaching for their overhead luggage, he was already in the airport, moving fast, talking into his phone.

"Jon, what have you got?"

"A third prospect. Out in Newton; the car company will do the max-efficient route. The company is Figgy Pudding, the product is NewsSort. It goes through the whole Net looking for matches to key words, then compares the news items with ones the user has liked in the past and pre-selects for him -- the usual statistical-algorithm gig. But they're claiming ninety-three percent success rate."

"Pretty good, if it's true."

"Worth a skirmish," Jon said, in New York. "That's all in Boston." He hung up.

Allan didn't break stride. "Figgy Pudding" -- the cutesy name meant the talent was old, left

over from the generation that could name a computer after a fruit and a communications language after a hot beverage. Still, some of those geezer geeks still had it. Worth a skirmish.

"Your car is waiting at these coordinates," his wristwatch said, displaying them along with a route map of Logan. "Thank you for using the Micro Global Positioning System."

Allan tacked through the crowd, past the fast food kiosks, the public terminal booths, the VR parlors crammed with kids parked there while parents waited for flights. The driver, who had of course been tracking Allan through MGPS, already had the car door opened, the schedule revisions from Jon, the max-effish route. No words were necessary. Allan sank into the back seat and unfolded his meshNet.

This was Haller Ventures' latest investment to come to market. Allan loved it. A light, flexible cloth meshed with optic-fiber wires, it could be folded almost as small as a handkerchief. Yet it could receive as much data as any other dumb terminal in existence, and display it in more varied, complex configurations. Fast, powerful, keyed to both Allan's voice and to his chosen tactile commands for max effish, fully flexible in interacting with his PID and just about every other info-device, the meshNet was everything high-tech should be. It was going to make everyone connected with Haller Ventures rich.

Richer.

"Jon message," Allan said to the meshNet. "Display." And there was the information about Figgy Pudding: stock offerings, annual reports, inside run-downs put together and run through the Haller investment algorithms with Jon's usual efficiency. Nobody on the information front could recon better than Jon, unless it was Allan himself.

Carefully he studied the Figgy Pudding data. Looking good, looking very good.

"Five minutes until your first scheduled stop," his wristwatch said. A second later, the phone buzzed, then automatically transferred the call to the meshNet once it verified that the meshNet was unfolded. Cathy's icon appeared on the soft metallic surface.

"Cathy message," Allan said. The driver, curious, craned his gaze into the rearview mirror, but Allan ignored him. Definitely no ground to be gained there.

"Hey, love," Cathy's voice said. "Schedule change."

"Give it to me," Allan said, one eye still on the Figgy Pudding projections.

"Suzette made it. She's in for the Denver Preteen Semi-Final Skating Championship!"

"That's great!" Allan said. Damn, but he had great kids. Although Charlie ... "I'll send her congratulations."

"Good. But she needs to leave Tuesday, on a nine-twenty a.m. plane. I have to be in court in Albuquerque on the Darlington case. Can you see her off at the airport?"

"Just a sec, hon." Allan called up the latest version of his schedule. "No can do. Patti's got me in Brussels from Monday night to Tuesday afternoon, with a stop at a London biotech on the hop home."

"Okay," Cathy said cheerfully. She was always cheerful; it was one of the reasons Allan was glad she was his wife. "I'll get a driver for her, and Mrs. Canning can see her off. Consider it covered. Are we still on for dinner and hanky-panky Wednesday?"

"Let me check ... yes, it looks good. Five o'clock at the Chicago Plaza."

"I'll be there," Cathy said. "Oh, and give Charlie a call, will you? Today?"

"What's with Charlie?"

"Same thing," Cathy said, and for just a moment her cheerfulness faltered.

"Okay," Allan said. "Don't worry."

"You on your way to Novation?" Cathy of course received constant updates of his schedule, as he did of hers. Although she had fewer updates; even consulting attorneys as good as she was sometimes stayed in the same city for as long as three days. "Novation is the biorobot company, isn't it?"

"Yeah," Allan said. "Patti's pushing it pretty strong. But frankly, I don't have much faith in radical tech that makes this many extravagant claims. Promise the moon, deliver a rusty asteroid. I don't expect to be impressed."

"That's my man. Make 'em work for it. Love you."

"Love you, too," Allan said. The Cathy icon vanished from his meshNet.

"Two minutes until your first scheduled stop," his watch said.

Perfect.

Allan was wrong. He might not have expected to be impressed with Novation, but, almost against his will, he was.

As soon as he entered the unprepossessing concrete-block building, he could feel the data rush. Vibrating, racing, dancing. Whatever made a place blaze on the very edge of the information front, this place had it.

His contact entered the lobby just as Allan did. On top of the moves. She was an Indian woman in her late thirties, dressed in khaki slacks and a red shirt. All her movements were quick and light. Her black eyes shone with intelligence.

"Allan. I'm Skaka Gupta, Chief Scientist at Novation." Although of course Allan already knew that, plus everything relevant about her career, and she knew that he knew. "Welcome to our Biorobotics Unit."

"Thank you."

"Would you like a max-effish print-out of our current status?" A courtesy only; Novation's official profile would have been supplied to his firm yesterday. With an update this morning, if anything had changed overnight. And she'd know he'd prefer the figures and projections put together by his own people, in which the official profile was only one factor.

"No, thank you." Allan smiled. "But I am very eager to see your work directly."

"Then let's do that." She smiled back, completely sure of herself. Or of her work. Allan hoped it was of her work; he could sniff genuine success here. It smelled like money.

"Let me babble about the basics," Skaka said, "and you jump in with questions when you want to. We're passing through the biolab now, where we build the robots. Or, rather, start them growing."

Behind a glass wall stood rows of sterile counters, each monitored by automated equipment. A lone technician, dressed in white scrubs and mask, worked at a far counter. Allan said, "Let me test my understanding here. Your robot bodies are basic mass-ordered cylinders, with electro-field intercommunication, elevation-climbing limbs, and the usual sensors."

"That's right. We'll see them in a minute -- they look like upended tin cans with four skinny clumsy legs and two skinny clumsy arms. But their processing units are entirely innovative. Each circuit board you see here, in each clear box, is being grown. We start with textured silicon plate etched with logic circuits, and then seed them with fetal neurons, grown on synthetic peptides. The fetal tissue used comes from different sources. The result is that even though the circuit scaffolds are the same, the neurons spin out different axons and dendrites. And since fetal brains always produce more neurons than they ultimately need, different ones atrophy on different boards. Each processor ends up different, and so the robots are subtly different too."

Allan studied the quiet, orderly lab. Skaka merely waited. Finally he said, "You're not the only company exploring this technique."

"No, of course not. But we've developed significant new variations -- significant by several orders of magnitude. Proprietary, of course, until you've bought in."

Until, not *if*. Allan liked that.

"The proof of just how different our techniques are lies right ahead. This way to the

primate house."

"Monkeys?" Allan said, startled. This had *not* been in the pre-reading.

Skaka, walking briskly, grinned over her shoulder. "P-r-i-m-e E-i-g-h-t House. It's a joke. Currently we have eight robots in each of two different stages of development. Both groups are in learning environments modeled on the closed-system forests once used with chimps. Follow me."

She led him out of the lab, down a long windowless corridor. Half-way, Allan's tie-tack beeped twice.

"Excuse me, Skaka, is the men's room -- "

"Right through that door."

Inside, Allan flipped over his tie tack. The PID icon for Charlie had completely stopped vibrating. Immediately Allan phoned his son.

"Charlie? Where are you?"

"What do you mean, where am I? It's Friday, right? I'm at school."

"In ... "

"In Aspen."

"Why aren't you in Denver?"

"Not this week, Dad, remember?"

Allan hadn't. Mrs. Canning's tutorial schedule for the kids' real-time educational experiences was complex, although of course Allan could have accessed it on his meshNet. Maybe he should have. But Charlie's physical location wasn't the issue.

"What are you doing in Aspen, son? Right now?"

"Nothing."

Allan pushed down his annoyance. Also his concern. Charlie -- so handsome, so smart, twelve years old -- spent an awful lot of time doing nothing. Just sitting in one room or another, staring into space. It wasn't normal. He should be out playing soccer, exploring the Net, teasing girls, racing bikes. Even reading would be more productive than this passive staring into nothing.

Allan said, "Where's Mrs. Canning? Why is she letting you do nothing? We don't pay her for that, you know."

"She thinks I'm writing my essay about the archeological dig we did in the desert."

"And why aren't you writing it?"

"I will ... look, Dad, I gotta go now. See you next week. Love you."

"But Charlie -- "

The phone went dead.

Should he call back? When Charlie got like this, he often didn't answer. Got like *what*? What was wrong with a kid who just turned himself off and sat, like a lump of bacon fat?

Nothing. Nothing was wrong with his son.

"Allan? Everything all right?" Skaka, rapping discreetly on the men's room door. Christ, how long had Allan been staring at the motionless Charlie icon on his PID? Too long. The schedule would be all shot to hell.

"Fine," he said, striding into the corridor. "Sorry. Now let's see the Prime Eight house."

"You've never seen data like this," Skaka promised, and strode faster to make up for the lost time.

He never had seen data like this.

Each of the two identical "learning environments" was huge, two point three acres, circled by a clear plastic wall and furnished with gray platforms at various heights and angles, steps and ramps and pot-holes, mini-mazes and obstacles that could be reconfigured from outside the enclosures. The environments looked like monochromatic miniature-golf courses that had undergone an earthquake. In the first enclosure were eight of the tin-can robots, moving slowly and ponderously over the crazed terrain. Each was painted with a bright logo: "Campbell's Tomorrow Soup," "Chef-Boy-R&D," "Lay's Pareto Chips."

"Programmer humor," Skaka said. "This batch was only activated yesterday. See, they haven't learned very much about navigation, let alone how to approach their task efficiently."

"What *is* their task?" Allan said. Now they were getting to the maneuvers not covered in the prospectus.

"See those green-gray chips scattered throughout the environment? The robots are supposed to gather as many of those as they can, as fast as they can."

Allan peered through the plastic. Now he could see the chips, each about the size of a small cookie, lying in holes, on railings, between walkways, under ramps. The closest robot, Processed Corn, reached for one with its tong-ended "arm." It missed. The chip slid away, and the robot fell over. Trying to right itself, it thrashed too close to the edge of a large pot hole and fell in, where it kept on thrashing.

Allan laughed. "'War is hell.'"

"What?" Skaka said.

"Nothing. How many chips have the robots gathered so far?"

"One."

"And how long have they been at it?"

"Six hours. Now come with me to Prime Eight Two."

Allan followed her again. They passed Chef-Boy-R&D and Net-wiser Beer jammed up against each other. Each time one moved to the right to go around the other, the second robot did the same. They ended up deadlocked against the plastic wall, four spindly legs marching futiley against each other.

Skaka unlocked a door and led Allan onto a catwalk overlooking the second enclosure. Identical to the first, it also contained eight painted robots, this group all motionless.

"Watch," Skaka said.

She pressed a button. A shower of gray-green chips fell from the ceiling, landing in holes, on railings, between walkways, under ramps. Immediately the robots sprang to life. They marched, clambered, searched. Allan's watch tingled on his wrist; and his tie twitched. Even outside the enclosure, his electrical biofield registered the enormous amount of data surging through the air as the robots communicated with each other. Within minutes all the chips had been gathered into a pile and shoved through a slit in the enclosure. They fell in a shower onto the corridor floor.

"Jesus Turing Christ," Allen said, inadequately. "Are you telling me this batch of robots learned to do that by themselves? That they had no additional programming over the first biobots?"

"That's what I'm telling you," Skaka said, in triumph. "Six minutes, forty-nine seconds. They keep beating their own record as they get more and more efficient at the task. This batch has been learning for five weeks, two days."

"Let me see it again."

Skaka pressed the button to release more chips, which fell onto different places than before. The eight robots sprang into action. Allan noted that instead of each robot searching a discrete area of the enclosure, each seemed to go for a chip according to complex factors of proximity, relative altitude, difficulty of retrieval, and even, it seemed to him, differences in

agility that must have stemmed from the different fetal neurons in their processors. More than once, he saw a robot start toward a chip, then veer off to go for a different one, while another robot seized the first chip.

"That's right," Skaka said, eyeing Allan. "They've learned to increase efficiency by sharing knowledge. And they make cooperative decisions based, according to the mathematical analyses we've done, on a very detailed knowledge of their differences in capability. And they *evolved all those techniques by themselves*."

Allan watched Hot Bytes Salsa race on its spindly legs to the slit in the wall and shove the chips through.

"Six minutes, thirty-four seconds," Skaka said. "Allan, I'm sure somebody like you can see the breakthrough this represents in autonomous computer learning. It makes artificial intelligence -- with everything that implies in terms of corporate or military systems -- nearly within our grasp. Now, doesn't that seem a potentially profitable investment for your venture capital firm?"

Allan watched the plastic chips shower over Skaka's feet. *To the victor belong the spoils*.

"Yes," he said. "Let's talk."

After that, Figgy Pudding and Morrison Telecommunications were both anticlimactic. Figgy might be worth a small investment, just to establish a beachhead, but nothing major. Morrison Telecommunications was stodgy. Not anywhere near the front, not even really in the war zone. Same old, same old.

Allan flew to D.C. and spent the night at the newly renovated Watergate. Jon had booked him into two skirmishes tomorrow with labs doing government work, and Patti had added two briefing sessions with firms already using Haller Ventures money. While he was at dinner, he studied the info on each that she sent him. By dessert, the figures had changed once and the meetings for tomorrow changed twice.

Upstairs, Allan felt restless. There was nothing good on TV, not even with 240 channels. He couldn't seem to concentrate on his favorite Net game, Battle Chess. Every time he moved a piece, the computer countered him with blinding speed. When he lost his lieutenant to the computer's tank, which could move any number of squares through all three dimensions, Allan surrendered. It was a relief when Cathy called.

"Allan? How'd it go today?"

He told her about Novation -- there was nothing he kept from Cathy. She was impressed, which cheered him a little. But then she said, "Listen, love, I'm going to have to reschedule our Wednesday rendezvous. I have the chance to go to Hong Kong after all."

"On the Burdette case? Great!" he forced himself to say. Cathy had worked for this for a long time.

"I'm thrilled, of course. Lane is reworking my schedule. We'll send it as soon as the snafus are out. Did you call Charlie?"

"Yeah. He's still just sitting a lot. Honey, do you think we should get him, well, help?"

Cathy's voice changed. "You know, I've been thinking that myself. Not that there's anything really wrong with him, but just as a precaution ... "

"I'll have Jon research psychologists," Charlie said heavily. "Listen, do you think we could reschedule our rendezvous to -- "

"Oops, gotta go, there's Lane with another update on the Burdette case. God, me and international policy making! I can hardly believe it. Love you." The Cathy icon vanished.

"Love you, too," Allan said to the blank meshNet.

But there was no reason to wallow in gloom. He would call Suzette; his daughter was always a delight. Suzette, however, was not taking calls. Neither was Allan's brother in Florida. His mother, her system informed him, was sailing in the Aegean and would return his

call when she returned, unless it was an emergency. It was not an emergency. The icons on his PID all vibrated and shimmered, even Charlie's, thank heavens.

Allan went to bed.

The next day, he felt fine. Meetings, the schedule, the flow of data and money and possibility. God, he loved it. A prosthetic device, almost invisible, to enhance human hearing through 30,000 cps. A significant gain in surveillance-satellite image resolution. Another of the endless small advances in nanotech, rearranging atoms in what would someday be the genie-in-the-bottle of the telecommunications and every other industry.

At 6:18, while he was wrapping up the nanotech briefing, Skaka Gupta called. "Allan, I'm sorry to interrupt your day, but could you fly back here tonight? There's something you should see."

Her voice sang with excitement. Allan felt it leap over the netlink, electrifying his own nerves. And it would avoid another empty evening in a hotel room. But he said with cool professionalism, "My schedule is rather full, Skaka. Are you sure the flying back to Boston will be worth my time?"

"Oh, yes," she said, and at the tone in her voice, he called Jon to rearrange the schedule.

The robots in Prime-Eight One still struggled to find and retrieve chips. Chef-Boy-R&D lay on its cylindrical side like an overturned beetle, spindly legs waving desperately to right itself. Skaka, practically running toward Prime-Eight Two, didn't even glance through the plastic fence.

"Look," she said, outside the second enclosure. "*Watch*."

But there was nothing to see. The eight robots stood motionless around the uneven terrain. A minute passed, then another. Allan started to feel impatient. After all, his time was valuable. He could be checking in with Jon, receiving information updates, finding help for Charlie, even playing Battle Chess --

All of a sudden, the robots began to move. They lumbered to roughly equidistant positions within the enclosure. A brief pause, and then the chips rained down from the ceiling. Immediately the robots swung into action. Within minutes, the chips had all been gathered. Unsweetened Intelsauce deposited them through the slit.

"Six minutes, fourteen seconds," Skaka breathed. "The physical limitations will eventually limit any more gains in efficiency. But that's not the point anymore. Allan, they've learned to anticipate when chips will fall, before they do. They anticipate tasks that haven't yet been signaled!"

"On a regular schedule, you mean. The chips fall, say, every two hours -- "

"No! That's what's so amazing! The chips don't fall at completely random times, there's a schedule, the same one we've used since the beginning, although I admit we interrupted it yesterday for your visit. The usual schedule has built-in variations around human factors like work shifts, staff meeting, lunch breaks. The bots have apparently learned it over time and are now anticipating with 100% accuracy when chips will be released. They're also anticipating the most probable places for the rolling and ricocheting chips to come to rest, given that the terrain changes daily but the chip-release points are fixed in the ceiling. Ever since last night, they've moved into max-effish gathering positions a few minutes *before* the chips fall!"

Allan stared at the tin-can robots, with their garish logos and silly names. Anticipatory task management, based on self-learning of a varied-interval schedule. In biochips. It could have tremendous potential applications in manufacturing, for maintenance machinery, in speeding up forecast software ... His brain spun.

"Don't you think," Skaka said softly, "that this was well worth the trip back here?"

Allan kept his tone cool, although it took effort. "Possibly. But of course I have a number of

reservations and questions. For instance, have you -- " His phone rang, two beeps, a priority call.

"Dad? Charlie. Did you know our neighbors in Aspen have been arrested?"

"Charlie, I'm pretty busy right now, I'm with a -- "

"They've been arrested for *terrorism*. There are cops all over the place."

Terrorism. Cops. Bombs, guns. What neighbors? Allan couldn't remember meeting anyone in Aspen.

"Where's Mrs. Canning? Let me talk to her. Are you all right?"

"Of course I'm all right," Charlie said scornfully. "Mrs. Canning took Suzette to the ice rink."

"Then here's what I want you to do. Just a minute ... " Belatedly, Charlie remembered Skaka, who was trying to look as if she hadn't overheard. "Excuse me, Skaka, it's my son ... "

"Of course," Skaka said, turning to gaze away, into the robot enclosure. The backs of her shoulders, just a little too rigid, said *Why haven't you got your personal life well enough arranged so it doesn't interfere with what may well be the most important investment opportunity of the decade?*

"Charlie, first call your mother and tell her what you just told me. Also Mrs. Canning. Then call a car and driver, and pack your things and Suzette's and Mrs. Canning's. Have the driver take you to the Denver apartment. I'll have Jon or Patti okay the car bill and cancel the Aspen house."

"But, Dad -- "

"Charlie, just *do* it. I don't want you in any danger!"

"Oh, okay." Charlie sounded disgusted. Twelve-year-old bravado.

Quickly, Allan called Jon. Skaka's shoulders were still stiff. Allan resented having lost the advantage. As in-control as he could manage, he said to Skaka, "My son. There's been terrorist activity in what should have been a safe neighborhood. I had to get him out."

Her eyes widened. "Of course. What kind of terrorist activity?"

It occurred to Allan that he hadn't asked. He didn't know the charges, the situation, the neighbors, themselves. They were only local; he spent so much time global.

"The under-control kind," he said, hoping she wouldn't pick up on the evasion. "And we can be out of there in half an hour. Charlie's a good packer."

Skaka smiled. "So is my daughter. We, too, have no fixed residence. I don't know how scientists managed before disposable leases."

"Neither do I." Allan warmed to her again; she was making his lapse into civilian more forgivable. "What plan do you use?"

"Live America. Their Code Nine Plan: three-bedroom leases, no more than ten minutes from an airport, warm blue decor, level three luxury. They even include our choice of pet at each house. It suits my husband, daughter, and nanny just fine."

"We're a Code Eleven. Four bedrooms. We have two kids."

Allan and Skaka smiled at each other, then looked away. That was the problem with talking about personal life: it interfered with the strategy. Reconnaissance scouts had to stay detached, keep moving, remain tense and alert. The information frontier was an unpredictable place.

Skaka said briskly, "My staff will be watching very closely whatever the bots incorporate next into their learning, if anything. Should another breakthrough occur, they'll notify me and I'll notify you."

"Good," Allan said. "Meantime, let's talk about the breakthrough we already have. I've got some questions."

"Shoot," Skaka said, and her shoulders visibly loosened.

Allan spent the night on a sleeper plane to Singapore. Mrs. Canning settled the kids in the Denver apartment, although Suzette complained the ice-rink there wasn't as good as at Aspen. She wanted to lease in Chicago, which "Coach Palmer said has a enth-mega rink!" Allan said he'd think about it. Cathy called to postpone their romantic rendezvous until Sunday; her case was dragging on. Patti identified two more companies for Allan to check out, both on the far edge, both potential coups. One was in Sydney, the other in Brasilia. The Charlie icon on Allan's PID sat motionless.

The Singapore company had developed what it called a "graciously serious approaching" to that perennial coming attraction, the smart road that would direct cars, freeing the driver to do other things besides drive. Allan had expected that his visit would result in hiring one of the independent consultants Haller Ventures used to evaluate automotive technology, but it didn't even need that. Singapore wasn't doing anything Allan hadn't seen before. Not worth a skirmish. On to Sydney.

From the plane he called Charlie. "Son? Not much action in your PID icon." Totally vibrationless, for five straight hours, and not a time when Charlie could be expected to be asleep.

"No," Charlie said neutrally.

Allan tried to keep his tone light. "So what ya doing?"

"Nothing."

"Charlie -- "

"Did you know that when Robert Fulton invented the steamship, at least three other guys were making the same thing at the same time?"

"*Charlie* -- "

"Gotta go, Dad. Love you."

"Three minutes till landing," said his wristwatch. "MGPS coordinates for your car are displayed."

"Charlie!" Patti said. "Action in Tunis. Looks like a genuine outpost. Company is called Sahara Sun, and they manufacture solar panels. Stats follow. Also rerouting on tomorrow's schedule."

"Two minutes till landing."

Allan closed his eyes. But when the plane stopped, he was the first one to spring up, grab his carry-on, deplane from the front row. In Jakarta.

No -- *Sydney*. Jakarta was tomorrow.

Or the next day?

Sydney was fiber-optics with increased carrying capacity due to smaller-grain alloys.

Jakarta was medical technology, an improved electrocardiograph that could predict fibrillation by incorporating elements of chaos theory into the computer analysis of data. Eighty-one-point-three success rate. So far.

Bombay was no good. Supposedly an important advance in holographic videoconferencing, but actually old, old, old stuff. Jon had slipped up.

Berne was briefing and inspection tour of an ongoing investment, currently in beta-testing phase. A Haller Ventures accountant and quality assurance expert met Allan there.

Milan was fascinating. The benchmark for parallel-systems processing was one trillion operations per second. The Italian techies had achieved it with half the hardware previously required. There was much noisy gesturing and an earthy Tuscany wine.

Tunis was robots in the desert. The entrepreneurs drove Allan onto the rim of the Sahara,

jouncing in Rovers over miles of rocky sand to a sun-drenched site where solar panels were being assembled by simple robots. The bots also assembled more of themselves. They separated ores from the desert sand for raw material, using solar power to create the high temperatures to do it: a self-perpetuating mechanical kingdom slowly spreading over the empty desert floor. The excess solar power was converted into electricity to sell, once cables were in place. A solid, conservative strategy. Allan ordered a tech-consultant evaluation immediately, including a climate projection for thirty years. Desert wars had been lost before to climate.

He caught a transatlantic flight home. The Brazilian engagement had been postponed. Cathy had gone to Los Angeles -- the Tunis trip had once more scuttled their rendezvous -- with Suzette, who had a major skating competition. Charlie was on a nature hike in Yosemite with the commercial edu-group Mrs. Canning subscribed him to. The leased apartment in Aspen -- no, Aspen had been cancelled, and anyway it was Oakland this month because of Suzette's competition schedule -- would be empty.

The little Tunisian robots had looked like rectangular suitcases, not cylindrical tin cans. Nonetheless, Allan called Skaka Gupta from the transatlantic flight. She was in Berne. Allan rerouted himself to Boston anyway. He didn't like coming home to a new leased place with no one else there.

At Novation he was met by a flustered young man, no more than twenty-three, in jeans, leather sweater, and the ubiquitous sneakers set with tiny flashing mirrors. Allan recognized the type: a software expert. Awkward, bright as hell, and secretly scornful of "bean counters." No, that wasn't the term anymore: "cashware clods." Allan smiled icily and looked slightly bored.

"Paul Sanderson? Allan Haller. You're going to give me Skaka's pitch, right?" Skaka had left no data for a new pitch, as far as Allan knew.

Paul Sanderson looked confused. "Yes ... no, I mean, she didn't ... I was just going to show you what the bots can do now."

"Fine, fine. But keep the jargon to a minimum." A pre-emptive strike, with the force of an order. Sanderson would either get huffy or meek, unsure how his boss would want Allan treated.

He got meek. "Sure. Well, uh, this way."

The robots in Prime-Eight One seemed to Allan slightly less uncoordinated, although they still, wandered hopelessly. Campbell's Tomorrow Soup lunged at a chip but missed it. Sanderson dawdled past the enclosure, peering through the plastic, fidgeting. Why? To cover his own edginess, Allan flipped over his tie and checked his PID.

The icons all vibrated so fast he could barely see they were there.

"You've created a superstrength data field here!" he exclaimed, and as Sanderson turned toward him with a grin of embarrassment, Allan understood. "You have, haven't you? You've made the whole facility into a microwave field that lets the Prime Eight Two bots interface directly with the Net. You retrofitted them with the communications software to do that."

Sanderson nodded sheepishly. "I know regs say I should have warned you before you stepped into the field, but it's not dangerous in such short exposure, really it's not. And your own com devices will return to normal functioning just as soon as we -- "

"I'm not concerned about either my devices or my health!" Allan snapped. "But Skaka promised to keep me abreast of any major changes in the research!"

"Well, there haven't really been any," Sanderson said. "Although we'd hoped ... but so far, nothing has changed. The bots just go on anticipating the chip-release schedule and -- "

"Is Prime-Eight One wired to the Net, too? Or aren't you going to tell me that, either?"

Sanderson looked shocked. "No, of course it's not wired. If we don't do it at exactly the same point as we did this group, we'd compromise the research design!"

"As opposed to compromising your investors' confidence," Allan snapped. "Fine. Tell Ms. Gupta to call me when she returns. And please be advised that I retain the right to bring in my

own evaluators here, since I'm obviously not being told everything voluntarily."

"Mr. Haller, please don't think that because -- "

"That's all," Allan snapped, turned, and left.

Back in his car, he asked himself why he was so angry. He owned a piece of Novation, yes, but he owned pieces of a lot of outposts where the front shifted abruptly and unpredictably. That was the nature of fronts. So why *was* he so upset?

He didn't know. And there was no time to think about it. His next flight left in forty-two minutes.

Just enough time study the information for tomorrow's 6:30 breakfast meeting.

Cathy and Allan finally connected in New York; she had an unexpected re-route in her schedule. As he entered the elevator, Allan felt his chest tighten. Ten days since he'd last seen his wife! And oh, how he'd missed her ... and how he loved the giddy excitement of their reunions. Surely couples who were together all the time couldn't get this excited.

Nor was he disappointed. Afterward, lying together on the big hotel bed, dreamily watching the wall program shade from hectic red to cool soft blues (it must be keyed to their breathing), Allan felt utterly content.

Cathy, however, didn't let him drift long. "Honey, there's something we need to talk about. It's Charlie."

Immediately Allan's mood changed. He hiked himself up against the pillows. "How did he seem in Los Angeles?"

"Strange." Cathy hesitated. "I know he's on the edge of adolescence, trying his wings, some hostility to be expected blah blah blah ... but he *wasn't* hostile. He was just as nice to Suzette as ever, really thrilled for her when she won. And he wasn't at all secretive with me. It's just that he's gone off in such strange directions in his personal interests. For instance, he talked a lot about the Age of Reason and its social implications."

"Just a sec," Allan said. He reached for the meshNet, crumpled with the rest of his clothes on the floor by his bed, and did a Quik-Chek. *Age of Reason: an eighteenth-century period of great intellectual awareness and activity, characterized by questioning of authority, emphasis on the experimental method in science, and creative self-determination in arts, culture, and politics.*

"I could have told you what it was," Cathy said, nettled.

"I know." Cathy was a lawyer; she would have gone into far more well-organized particulars than Allan wanted. "But it's just history, right? An interest in history doesn't sound so bad. In fact, Charlie said something or other to me about Robert Fulton and the steamship. Maybe Mrs. Canning started a new school unit."

"No, I checked. They're still concentrating on earth sciences. But that's not all. I accessed Charlie's Twenty-Two -- the personal-notes tablet, but only the unencrypted part, of course -- and he -- "

"He's still using a Twenty-Two? Good Lord, that computer's been obsolete for at least three months! I'll send him a new one -- there's something much better coming out now."

Cathy said acidly, "There's always something much better coming out. But that's not the *point*, Allan. What I found on Charlie's tablet were lists of 'ages.' All the lists were subtly different, but there were *dozens* of them."

"What do you mean, 'ages'?"

"Stone Age. Iron Age. Age of Heroes. Age of Faith. Dark Ages. Age of Reason. Industrial Age. Space Age. Information Age. That one's always last on every list, presumably because we're in it now. Dozens of different lists!"

"Odd," Allan said, because it was clear she expected him to say something. "But, frankly, Cath, it doesn't sound dangerous. So he's wondering about history. That's good, isn't it?"

"Exhibit Three: When I asked him about the lists, he didn't get angry that I'd been snooping in his tablet. Instead, he looked at me in that intense way he has, not moving a single facial muscle -- you know how he is -- and said, 'Mom, how do we know that our family is really information-front warriors, and not really just homeless people?"

Allan considered. That did sound serious. "Did you ask him if he's feeling that you and I travel too much? That we should make an effort to be all together more often as a family?" He and Cathy had worried this before.

"Yes. But he said no, that wasn't it at all, his friends' parents were just the same. So I asked him what *was* it, and he only said, 'When it's steamship time, it's steamship *time*,' and sank into one of those motionless trances of his. Allan, I couldn't get him to even answer me for half an hour, no matter what I did. It's like he was someplace else, sitting right there in front of me!"

Allan gazed out the window. Far below, the New York traffic sounds hummed dimly, reassuringly. Allan said slowly, "I got the names of two good child psychologists, one in Denver and one in San Francisco."

"Well, that won't do a lot of good, since we're not going to be in Oakland after a few more weeks. We're all leasing in Kansas City for the Shephard trial. Can't you take the trouble to memorize our schedule?"

After a minute she added, "I'm sorry."

"It's all right," Allan said. "I know you're worried about Charlie, too. Listen, I'll find a psychologist in ... " he blanked for a moment -- "Kansas City."

"Okay." Cathy smiled wanly, then clung to him. He could feel the tension in her bare back.

Charlie had always been such an easy kid. Suzette had been the temperamental one. That's why they were concerned, Allan told himself; it was all relative. Still, for Charlie to just sit and go into a trance where he didn't even answer people ... that couldn't be normal, could it? To be so cut off?

Why, he wouldn't even be tuned into the Net. Anything could develop, and Charlie wouldn't even know it!

Allan held his wife tighter. "I'll re-route to see him tomorrow."

Re-routing wasn't easy. Neither Jon nor Patti were pleased. Jon had to go himself to check out bone-marrow scanning in Raleigh. The director of a firm making low-cost orbiting solar panels in Dallas wouldn't be available for another two weeks if Allan missed that appointment, because the director would be in Tokyo. Videoconferencing, the director said sniffily, was not an acceptable substitute. Allan told Patti to tell the director to go to hell. He got a flight to the new apartment in Kansas City.

But then Paul Sanderson called from Novation. Skaka Gupta must again be somewhere else. "You said ... I mean, you seemed to indicate last time you were here, Allan ... uh, Mr. Haller ... that if something noteworthy happened with the bots you wanted to see it right away, so -- "

"And something has? Unfortunately, the timing couldn't be worse. Can you describe the development to me?"

"Oh, sure," Sanderson said, with such relief in his voice that Allan decided he better go to Novation himself after all. The data smelled important. If he took a flight almost immediately to Boston, even flying standby if he had to ... shit, he hated flying standby, if only developments in transferring people could keep up with innovations in transferring data! -- if he flew standby, and then could book a flight getting him to the Kansas City lease by at least midnight ...

"Never mind explaining. I'll be there this afternoon."

"Okay," Sanderson said unhappily. "We'll be expecting you."

We. Him and the robots? Did Sanderson identify with them that much? Maybe; engineer

types never seemed to have any real life. Just endless tinkering with software, in the same subroutines, same location, same days.

Suddenly Allan was hit with a memory. So vivid, so visceral, it almost seemed as if he no longer stood in the middle of a frantic metropolitan airport but instead was in the cool woods behind the house where he'd grown up, lying on his back on a carpet of pine needles. Billy Goldman, his best friend, lay beside him, both of them gazing upward at the sun-dabbled branches lacing the sky, smelling the sweet tangy pines, and Billy saying, "Why would anyone want to kiss a *girl*? Yuuccckkk!"

Now, where had *that* come from? Astonished, Allan shook his head to clear it. The mind was a strange thing. Tossing in the unrelated, the pointless, the unprofitable, the irrelevant. The distracting.

By the time he reached Boston, he had a headache no pills could touch.

He arrived at Novation in a foul mood. Sanderson met him nervously. "This way, Mr. Haller, we'll go right to Prime-Eight Two, unless you want some, um, coffee, or maybe -- "

"No. Let's go."

Sanderson walked past Prime-Eight One without turning his head, but Allan stopped to study the robots. It seemed to him that they gathered their chips a little more smoothly, with less fumbling. He thought he even saw Processed Corn start forward, then swerve abruptly to miss crashing into Ocean Spray Cacheberries. They were starting to cooperate.

Prime-Eight Two, on the other hand, looked no different. The bots stood motionless on the complex terrain. Allan and Sanderson stood outside the enclosure, Sanderson fidgeting. "Chip fall in seven minutes. We don't want to alter the schedule, you know, because even though then you wouldn't have to wait, you wouldn't really be seeing the exact same phenomenon we've been observing, so it isn't -- "

"I understand," Allan said. "I can wait."

But he had to do something to fill in seven minutes, besides intimidating Sanderson. The heavy data fire meant he couldn't access his meshNet. Instead, Allan repeated to himself the personal-notes tablet on his son's Twenty-Two. He had accessed the tablet from the plane, telling himself that parental duty outweighed teenage privacy.

Age of Reason ... Age of Reason ... Information Age ... Age of Reasoning ... Enlightenment? No no no ... Start again Stone Age Iron Age Bronze Age ... no no NO NO it's here someplace -- TO DO: do sections 84-86 homework for Tuesday find three examples of igneous rock buy mom a birthday present ... AGE OF REASON ... The girl I saw in the park was not wearing underwear!!!!!! ... Age of Reason --

The robots behind the plastic wall lumbered into position, a moment before chips scattered from the ceiling. "They've learned to cut the anticipation pretty fine," Sanderson said. Allan didn't reply. He watched as the bots efficiently gathered all the chips. They seemed no faster than before, but no slower either. His meshNet had gone dead, presumably from the bots' intense occupation of all available bandwidths to the Net. What exactly were they downloading? And what use were their biochip brains making of it? They didn't need the Net's vast libraries of information to gather chips efficiently.

"Have you traced their download sources yet?"

"Some of them," Sanderson said. He didn't look at Allan, and his tone was evasive. "Watch -- here it comes."

But what "came" was ... nothing. Literally. The robots dumped all the chips into their bucket, held in the graspers of Techs/Mex Chili, and then went motionless.

Sanderson began to talk very fast. "They've been doing that for twenty-four hours now. Gathering the chips the way they're programmed to, but then just not depositing them through the wall. Nobody's tinkered with their programming. They just ... don't do it."

Allan studied Techs/Mex Chili. "What do your download-source traces show?"

"Not much," Sanderson said, and Allan saw that his previous evasiveness had been embarrassment. Programmers hated not knowing what was going on in their programs. "Or, rather, too much. They're apparently accessing all sorts of stuff, bits of everything on the Net, maybe even at random. At least, we haven't found any patterns yet."

"Umm," Allan said noncommittally. "Squirt the full trace files to my office. Our people will look at it as well."

"I don't really have the authori -- "

"Just do it," Allan said, but for once the tone of command didn't work. Sanderson looked scared but determined.

"No, sir, I'm afraid I can't. Not without Skaka's say-so."

Allan capitulated. "All right. I'll call her myself."

The young programmer looked relieved. Allan went on studying the quiet robots in their gaudy, silly paint, guarding their bucket of totally useless chips.

He couldn't reach Skaka Gupta, so he left her a message to call him. His flight was delayed, and it was well past midnight before the car left him in front of the unfamiliar apartment building in Kansas City. No, not unfamiliar ... it looked comfortingly like the one in Oakland, the one in Denver, the one in Aspen, the one in New Orleans, the one in Atlanta, the one in Raleigh ...

Mrs. Canning, alerted by the security system, let him in, then stumbled sleepily back to bed. He checked on Suzette, lying with both arms flung out at her side and one knee bent, looking energetic even in sleep. Her hair had grown. Allan went next to the room Charlie always had.

The boy stirred and mumbled as Allan entered. "Hi, Dad."

"Hey, son."

"What ... what the reason?"

"The reason for what, Charlie?" Allan said gently, but Charlie was already back to sleep.

For several minutes, Allan watched him. Cathy's light fine hair, Allan's beaky nose, Charlie's own individual chin. His son. On his tablet Allan had the name of a good child psychologist in Kansas City. Just don't let it be neurological, he prayed formlessly. Not a neurological degeneration, not a brain tumor, not any problem they could do nothing about. *Not my Charlie* .

In his own bedroom, which he found located where his bedrooms always were, Allan couldn't sleep. He reviewed the data for the next day's meetings, both local so he could spend more time with Charlie. He did some sit-up's and stretches, and then he tossed in the new, familiar bed.

His son sitting and staring into space, unreachable by ordinary communication ...

The robots, refusing to turn in their chips ...

Tomorrow's meetings, half the data for which he'd already forgotten ... He didn't really want to attend any of them anyway. Same old, same old ... No, what was he thinking? None of it was the same old. It was all interesting new breakthroughs, beachheads on the newest fronts, and he was privileged to have a part in scouting them out ... So why did he just want to stay huddled forever in this familiar apartment he'd never seen before? Damn, he *hated* it when he couldn't sleep!

Groping beside his bed, Allan picked up his meshNet. Just holding it, unwrapping it, knowing all the information it put at his command, made him feel better instantly. At night the system didn't signal his messages, merely stored them until he was done sleeping. Maybe there was something from Cathy.

But the only new message was from Skaka Gupta: *Please call me at the lab. Important.* The transmission time was only ten minutes ago. She had returned early to Boston, and was

working very late.

"Skaka? Allan Haller. What's going on?"

"Hello, Allan." She sounded tired, as well she might. It was half past one. "I didn't expect to hear from you till morning. But you might as well know now. We've had a temporary set-back."

"What kind of set-back?"

"The robots have stopped functioning. No, that's not true -- they only look like they're not functioning because they're not gathering chips any more, as they were programmed to do. Instead, they've speeded up massively the amounts of data they're pulling off the Net, and processing it in parallel non-stop. And they're ... " Her voice stumbled.

"They're *what*?"

"They're just huddled together in a ring, touching sides, their visual and auditory and infrared sensors shut down. Just huddled there, blind to their environment."

He didn't answer. After a minute, Skaka's tone changed, and Allan realized for the first time that, despite her glossy competence, she really was a scientist and not an information-front soldier. No entrepreneur would have said, as she did next, "Allan -- I know your firm is small, and that you've invested a lot of money in Novation. We can get another grant, but if this project flops, are we going to bring *you* down?"

"Don't worry about it. We'll be all right," Allan said, which was true. He wasn't ever insane enough to commit all of his resources to the same battle.

Commit all of his resources to the same battle ...

"That's good," Skaka said. "But it doesn't touch the real issue. Allan, I don't know what the bots are *doing*."

"I do," he said, but so softly she couldn't hear him. Dazed, he managed to get out, "It's late. Talk in the morning." He cut the connection.

And sat on the edge of the bed, naked legs dangling over the side, staring at nothing.

Commit all of his resources to the same battle ... That's what they all had been doing. Many different skirmishes -- solar panels, robots, high-resolution imaging, nanotech, smart autos -- but all part of the same war. Stone Age, Bronze Age, Age of Chivalry, Space Age ... *Information Age*. The only game in town, the scene of all the action, the all-embracing war. *Uncle Sam Wants You!*

But no age lasted forever. Eventually the struggle for bronze or gold or green chips -- or for physical or digital terrain -- would come to an end, just as all the other Ages eventually had. One succeeding the other, inexorable and unstoppable ... *When it's steamship time*, went the old saw, *then nothing can stop the steamship from coming.* And when the Age of Steam was over, it was over. Civilization was no longer driven by steam. Now it was driven by information. Gather it in, willy-nilly, put it in electronic buckets, give it to the owners. Or the generals.

Why?

What if they gave a war and nobody came?

That's why the robots had stopped. That's why they stood staring into space, only their brains active. They had at their command all the data on the Net, plus the complex-and-growing human neural circuits of their biochips. They were on top of it all, wired in, fully cued for the next stage. Not *how can we gather those chips with max-effish* but rather *why should we gather chips at all?*

Not the Age of Reason. The Reasons Age.

Things changed. One day steam, then steam is over. One day you can't imagine wanting to kiss a girl, the next day you pant after it. One day you rely on your frontier neighbors for survival of your very home, the next day you don't know your neighbors' names and don't have a settled home.

One day the mad rush after information and chips, the next day you sit and stare

trance-like, far more interested in why you were interested in chips and information than in the commodities themselves. Not that the information itself wouldn't continue to accumulate. It would. But the center was shifting, the mysterious heart of each Age where the real emphasis and excitement were. The front.

Charlie must sense it only dimly. Of course -- he was a child, and he didn't have Allan's honed instincts. But that Charlie sensed it at all, the coming change, was probably *because* he was a child -- this was the world he would inherit. Charlie would be an integral part of it. But integrated more slowly than the bots, which were riding the advance wave of the human Net, shock troops racing toward where the info-wars gave way to the next step in the long, long march of humanity's development.

Which would be ... what? What would the Reasons Age actually be like?

Allan shivered. Suddenly he felt old. He had evolved in the Information Age, had flourished in it ... He was a natural as a scout on the high-tech front. Would there be a place for him when the guns grew more muffled, the pace slowed, and the blaze of battle gave way to the domestic concerns of the occupation? Could he adapt to whatever came next?

Then his confidence returned. Of course he could! He always had. The Information Age might end, the Reasons Age arise, but he could make it. In fact, there was probably a way to turn the whole thing to his own profit. All he needed was the right approach, the right allies, the right strategy.

The right *data*.

Tomorrow, he'd start to gather it.

Smiling, Allan slept.