

## Halo

### Charles Stross

The asteroid is running Barney: it sings of love on the high frontier, of the passion of matter for replicators, and its friendship for the needy billions of the Pacific Rim. "I love you," it croons in Amber's ears as she seeks a precise fix on it: "let me give you a big hug ... "

A fraction of a light-second away, Amber locks a cluster of cursors together on the signal, trains them to track its Doppler shift, and reads off the orbital elements. "Locked and loaded," she mutters. The animated purple dinosaur pirouettes and prances in the middle of her viewport, throwing a diamond-tipped swizzle-stick overhead. Sarcastically: "big hug time! I got asteroid!" Cold gas thrusters bang somewhere behind her in the interstage docking ring, prodding the cumbersome farm ship round to orient on the Barney rock. She damps her enthusiasm self-consciously, her implants hungrily sequestering surplus neurotransmitter molecules floating around her synapses before reuptake sets in: it doesn't do to get too excited in free flight. But the impulse to spin handstands, jump and sing, is still there: it's *her* rock, and it loves her, and she's going to bring it to life.

The workspace of Amber's room is a mass of stuff that probably doesn't belong on a space ship. Posters of the latest Lebanese boy-band bump-and-grind through their glam routines; tentacular restraining straps wave from the corners of her sleeping bag, somehow accumulating a crust of dirty clothing from the air like a giant inanimate hydra. (Cleaning robots seldom dare to venture inside the teenager's bedroom.) One wall is repeatedly cycling through a simulation of the projected construction cycle of Habitat One, a big fuzzy sphere with a glowing core (that Amber is doing her bit to help create): three or four small pastel-colored plastic *kawai* dolls stalk each other across its circumference with million-kilometer strides. And her father's cat is curled up between the aircon duct and her costume locker, snoring in a high-pitched tone.

Amber yanks open the faded velour curtain that shuts her room off from the rest of the hive: "*I've got it!*" she shouts. "It's all mine! I rule!" It's the sixteenth rock tagged by the orphanage so far, but it's *her* first, and that makes it special. She bounces off the other side of the commons, surprising one of Oscar's cane toads — which should be locked down in the farm, it's not clear how it got here — and the audio repeaters copy the incoming signal, noise-fuzzed echoes of a thousand fossilized infant's video shows.

"You're so *prompt*, Amber," Pierre whines when she corners him in the canteen.

"Well, yeah!" She tosses her head, barely concealing a smirk of delight at her own brilliance. She knows it isn't nice, but Mom is a long way away, and Dad and Step-Mom don't care about that kind of thing. "*I'm brilliant, me!*" she announces. "Now what about our bet?"

"Aww." Pierre thrusts his hands deep into his pockets. "But I don't *have* two million on me in change right now. Next cycle?"

"Huh?" She's outraged. "But we had a bet!"

"Uh, Doctor Bayes said you weren't going to make it this time, either, so I stuck my smart money in an options trade. If I take it out now, I'll take a big hit. Can you give me until cycle's end?"

"You should know better than to trust a *sim*, Pee." Her avatar blazes at him with early teen contempt: Pierre hunches his shoulders under her gaze. He's only thirteen, freckled, hasn't yet learned that you don't welsch on a deal. "I'll let you do it *this* time," she announces, "but you'll have to pay for it. I want interest."

He sighs. "What base rate are you — "

"No, *your* interest! Slave for a cycle!" She grins malevolently.

And his face shifts abruptly into apprehension: "As long as you don't make me clean the litter tray again. You aren't planning on doing *that*, are you?"

Welcome to the third decade. The thinking mass of the solar system now exceeds one MIP per gram; it's still pretty dumb, but it's not dumb all over. The human population is near maximum overshoot, pushing nine billion, but its growth rate is tipping toward negative numbers, and bits of what used to be the first world are now facing a middle-aged average. Human cogitation provides about 1028 MIPS of the solar system's brainpower. The real thinking is mostly done by the halo of a thousand trillion processors that surround the meat machines with a haze of computation — individually, a tenth as powerful as a human brain, collectively, they're ten thousand times more powerful, and their numbers are doubling every twenty million seconds. They're up to 1033 MIPS and rising, although there's a long way to go before the solar system is fully awake.

Technologies come, technologies go, but even five years ago nobody predicted that there'd be tinned primates in orbit around Jupiter by now: a synergy of emergent industries and strange business models have kick-started the space age again, aided and abetted by the discovery of (so far undecrypted) signals from ET's. Unexpected fringe-riders are developing new ecological niches on the edge of the human information space, light-minutes and light-hours from the core, as an expansion that has hung fire since the 1970s gets under way.

Amber, like most of the post-industrialists aboard the orphanage ship *Ernst Sanger*, is in her early teens: her natural abilities are enhanced by germ-line genetic recombination. Like most of the others, half her wetware is running outside her skull on an array of processor nodes hooked in by quantum-entangled communication channels — her own personal metacortex. These kids are mutant youth, burning bright: not quite incomprehensible to their parents, but profoundly alien — the generation gap is as wide as the 1960s and as deep as the solar system. Their parents, born in the gutter-years of the twentieth century, grew up with white elephant shuttles and a space station that just went round and round, and computers that went beep when you pushed their buttons: the idea that Jupiter was somewhere you could *go* was as profoundly counter-intuitive as the internet to a baby boomer.

Most of the passengers on the can have run away from parents who thought that teenagers belong in school, unable to come to terms with a generation so heavily augmented that they are fundamentally brighter than the adults around them. Amber was fluent in nine languages by the age of six, only two of them human, and six of them serializable; her birth-mother — who had denied her most of the prenatal mods then available, insisting that a random genotype was innately healthier — had taken her to the school psychiatrist for speaking in synthetic tongues. That was the final straw for Amber: using an illicit anonymous phone, she called her father. Her mother had him under a restraining order, but it hadn't occurred to her to apply for an order against his *partner* ...

Vast whorls of cloud ripple beneath the ship's drive stinger: orange and brown and muddy grey streaks slowly ripple across the bloated horizon of Jupiter. *Sanger* is nearing perijove, deep within the gas giant's lethal magnetic field; static discharges flicker along the tube, arcing over near the deep violet exhaust

cloud emerging from the magnetic mirrors of the ship's VASIMR motor. The plasma rocket is cranked up to maximum mass flow, its specific impulse almost as low as a fission rocket but thrusting at maximum as the assembly creaks and groans through the gravitational assist maneuver. In another hour, the drive will flicker off, and the orphanage will fall up and out toward Ganymede, before dropping back in toward orbit around Amalthea, Jupiter's fourth moon (and source of much of the material in the Gossamer ring). They're not the first canned primates to make it to Jupiter subsystem, but they're one of the first wholly private ventures. The bandwidth out here sucks dead slugs through a straw, with millions of kilometers of vacuum separating them from scant hundreds of mouse-brained microprobes and a few mechanical dinosaurs left behind by NASA or ESA. They're so far from the inner system that a good chunk of the ship's communications array is given over to caching: the news is whole kiloseconds old by the time it gets out here.

Amber, along with about half the waking passengers, watches in fascination from the common room. The commons are a long axial cylinder, a double-hulled inflatable at the center of the ship with a large part of their liquid water supply stored in its wall-tubes. The far end is video-enabled, showing them a realtime 3D view of the planet as it rolls beneath them: in reality, there's as much mass as possible between them and the trapped particles in the Jovian magnetic envelope. "I could go swimming in that," sighs Lilly. "Just imagine, diving into that sea ... " Her avatar appears in the window, riding a silver surfboard down the kilometers of vacuum.

"Nice case of wind-burn you've got there," someone jeers: Kas. Suddenly, Lilly's avatar, heretofore clad in a shimmering metallic swimsuit, turns to the texture of baked meat, and waggles sausage-fingers up at them in warning.

"Same to you and the window you climbed in through!" Abruptly the virtual vacuum outside the window is full of bodies, most of them human, contorting and writhing and morphing in mock-combat as half the kids pitch into the virtual deathmatch: it's a gesture in the face of the sharp fear that outside the thin walls of the orphanage lies an environment that really *is* as hostile as Lilly's toasted avatar would indicate.

Amber turns back to her slate: she's working through a complex mess of forms, necessary before the expedition can start work. Facts and figures that are never far away crowd around her, intimidating. Jupiter weighs  $1.9 \times 10^{27}$  kilograms. There are twenty-nine Jovian moons and an estimated two hundred thousand minor bodies, lumps of rock, and bits of debris crowded around them — debris above the size of ring fragments, for Jupiter (like Saturn) has rings, albeit not as prominent. A total of six major national orbiter platforms have made it out here — and another two hundred and seventeen microprobes, all but six of them private entertainment platforms. The first human expedition was put together by ESA Studios six years ago, followed by a couple of wildcat mining prospectors and a u-commerce bus that scattered half a million picoprobes throughout Jupiter subsystem. Now the *Sanger* has arrived, along with another three monkey cans — one from Mars, two more from LEO — and it looks as if colonization would explode except that there are at least four mutually exclusive Grand Plans for what to do with old Jove's mass.

Someone prods her. "Hey, Amber, what are you up to?"

She opens her eyes. "Doing my homework." It's Su Ang. "Look, we're going to Amalthea, aren't we? But we file our accounts in Reno, so we have to do all this paperwork. Monica asked me to help. It's insane."

Ang leans over and reads, upside down. "Environmental Protection Agency?"

"Yeah. Estimated Environmental Impact Forward Analysis 204.6b, Page Two.

They want me to 'list any bodies of standing water within five kilometers of the designated mining area. If excavating below the water table, list any wellsprings, reservoirs, and streams within depth of excavation in meters multiplied by five hundred meters up to a maximum distance of ten kilometers downstream of direction of bedding plane flow. For each body of water, itemize any endangered or listed species of bird, fish, mammal, reptile, invertebrate, or plant living within ten kilometers — ' "

" — Of a mine on Amalthea? Which orbits one hundred and eighty thousand kilometers above Jupiter, has no atmosphere, and where you can pick up a whole body radiation dose of ten Grays in half an hour on the surface?" Ang shakes her head, then spoils it by giggling. Amber glances up.

On the wall in front of her someone — Nicky or Boris, probably — has pasted a caricature of her own avatar into the virch fight. She's being hugged from behind by a giant cartoon dog with floppy ears and an erection, who's singing anatomically improbable suggestions while fondling himself suggestively. "Fuck that!" Shocked out of her distraction — and angry — Amber drops her stack of paperwork and throws a new avatar at the screen, one an agent of hers dreamed up overnight: it's called Spike, and it's not friendly. Spike rips off the dog's head and pisses down its trachea, which is anatomically correct for a human being: meanwhile she looks around, trying to work out which of the laughing idiot children and lost geeks around her could have sent such an unpleasant message.

"Children! Chill out." She glances round: one of the Franklins (this is the twenty-something dark-skinned female one) is frowning at them. "Can't we leave you alone for half a K without a fight?"

Amber pouts. "It's not a fight: it's a forceful exchange of opinions."

"Hah." The Franklin leans back in mid-air, arms crossed, an expression of supercilious smugness pasted across her-their face. "Heard that one before. Anyway — " she-they gesture and the screen goes blank " — I've got news for you pesky kids. We got a claim verified! Factory starts work as soon as we shut down the stinger and finish filing all the paperwork via our lawyers. Now's our chance to earn our upkeep ... "

Amber is flashing on ancient history, three years back along her timeline. In her replay, she's in some kind of split-level ranch house out west. It's a temporary posting while her mother audits an obsolescent fab line enterprise that grinds out dead chips of VLSI silicon for Pentagon projects that have slipped behind the cutting edge. Her mom leans over her, menacingly adult in her dark suit and chaperonage earrings: "You're going to school, and that's that!"

Her mother is a blonde ice-maiden madonna, one of the IRS's most productive bounty hunters — she can make grown CEOs panic just by blinking at them. Amber, a tow-headed eight-year-old tearaway with a confusing mix of identities, inexperience blurring the boundary between self and grid, is not yet able to fight back effectively. After a couple of seconds, she verbalizes a rather feeble protest: "Don't want to!" One of her stance demons whispers that this is the wrong approach to take, so she modifies it: "they'll beat up on me, Mom. I'm too different. 'Sides, I know you want me socialized up with my grade metrics, but isn't that what sideband's for? I can socialize *real* good at home."

Mom does something unexpected: she kneels down, putting herself on eye level with Amber. They're on the living room carpet, all seventies-retro brown corduroy and acid-orange paisley wallpaper: the domestics are in hiding while the humans hold court. "Listen to me, sweetie." Mom's voice is breathy, laden with an emotional undertow as strong and stifling as the eau de cologne she wears to the office to cover up the scent of her client's fear. "I know that's what your

father's writing to you, but it isn't true. You need the company — *physical* company — of children your own age. You're *natural*, not some kind of engineered freak, even with your skullset. Natural children like you need company, or they grow up all weird. Don't you know how much you mean to me? I want you to grow up happy, and that won't happen if you don't learn to get along with children your own age. You're not going to be some kind of cyborg otaku freak, Amber. But to *get* healthy, you've got to go to school, build up a mental immune system. That which does not destroy us makes us stronger, right?"

It's crude moral blackmail, transparent as glass and manipulative as hell, but Amber's *corpus logica* flags it with a heavy emotional sprite miming the likelihood of physical discipline if she rises to the bait: Mom is agitated, nostrils slightly flared, ventilation rate up, some vasodilatation visible in her cheeks. Amber — in combination with her skullset and the metacortex of distributed agents it supports — is mature enough at eight years to model, anticipate, and avoid corporal punishment: but her stature and lack of physical maturity conspire to put her at a disadvantage when negotiating with adults who matured in a simpler age. She sighs, then puts on a pout to let Mom know she's still reluctant, but obedient. "O-kay. If you say so."

Mom stands up, eyes distant — probably telling Saturn to warm his engine and open the garage doors. "I say so, punkin. Go get your shoes on, now. I'll pick you up on my way back from work, and I've got a treat for you: we're going to check out a new Church together this evening." Mom smiles, but it doesn't reach her eyes. "You be a good little girl, now, all right?"

The Imam is at prayer in a gyrostabilized mosque.

His mosque is not very big, and it has a congregation of one: he performs salat on his own every seventeen thousand two hundred and eighty seconds. He also webcasts the call to prayer, but there are no other believers in trans-Jovian space to answer the summons. Between prayers, he splits his attention between the exigencies of life-support and scholarship. A student of the Hadith and of knowledge-based systems, Sadeq collaborates in a project with other mujtahid scholars who are building a revised concordance of all the known isnads, to provide a basis for exploring the body of Islamic jurisprudence from a new perspective — one they'll need sorely if the looked-for breakthroughs in communication with aliens emerge. Their goal is to answer the vexatious questions that bedevil Islam in the age of accelerated consciousness: and as their representative in orbit around Jupiter, these questions fall most heavily on Sadeq's shoulders.

Sadeq is a slightly built man, with close-cropped black hair and a perpetually tired expression: unlike the orphanage crew, he has a ship to himself. The ship started out as an Iranian knock-off of a Shenzhou-B capsule, with a Chinese-type 921 space-station module tacked onto its tail: but the clunky, nineteen-sixties lookalike — a glittering aluminum dragonfly mating with a Coke can — has a weirdly contoured M2P2 pod strapped to its nose. The M2P2 pod is a plasma sail: built in orbit by one of Daewoo's wake shield-facilities, it dragged Sadeq and his cramped space station out to Jupiter in just four months, surfing on the solar breeze. His presence may be a triumph for the Ummah, but he feels acutely alone out here: when he turns his compact observatory's mirrors in the direction of the *Sanger*, he is struck by its size and purposeful appearance. *Sanger's* superior size speaks of the efficiency of the western financial instruments, semi-autonomous investment trusts with variable business-cycle accounting protocols that make possible the development of commercial space exploration. The Prophet, peace be unto him, may have condemned usury: but surely it would

have given him pause to see these engines of capital formation demonstrate their power above the Great Red Spot.

After finishing his prayers, Sadeq spends a couple of extra precious minutes on his mat. He finds that meditation comes hard in this environment: kneel in silence and you become aware of the hum of ventilation fans, the smell of old socks and sweat, the metallic taste of ozone from the Elektron oxygen generators. It is hard to approach God in this third-hand spaceship, a hand-me-down from arrogant Russia to ambitious China, and finally to the religious trustees of Qom, who have better uses for it than any of the heathen states imagine. They've pushed it far, this little toy space station: but who's to say if it is God's intention for humans to live here, in orbit around this swollen alien giant of a planet?

Sadeq shakes his head: he rolls his mat up and stows it beside the solitary porthole with a quiet sigh. A stab of homesickness wrenches at him, for his childhood in hot, dusty Yazd and his many years as a student in Qom: he steadies himself by looking round, searching the station that is by now as familiar to him as the fourth-floor concrete apartment that his parents — a car factory worker and his wife — raised him in. The interior of the station is the size of a school bus, every surface cluttered with storage areas, instrument consoles, and layers of exposed pipes: a couple of globules of antifreeze jiggle like stranded jellyfish near a heat exchanger that has been giving him grief. Sadeq kicks off in search of the squeeze bottle he keeps for this purpose, then gathers up his roll of tools and instructs one of his agents to find him the relevant sura of the maintenance log: it's time to fix this leaky joint for good.

An hour or so of serious plumbing, and then he will eat (freeze-dried lamb stew, with a paste of lentils and boiled rice, and a bulb of strong tea to wash it down), then sit down to review his next flyby maneuvering sequence. Perhaps, God willing, there will be no further system alerts and he'll be able to spend an hour or two on his research between evening and final prayers. Maybe the day after tomorrow, there'll even be time to relax for a couple of hours, to watch one of the old movies that he finds so fascinating for their insights into alien cultures: *Apollo 13*, maybe. It isn't easy, being the only crew aboard a long-duration space mission: and it's even harder for Sadeq, up here with nobody to talk to, for the communications lag to earth is more than half an hour each way — and so far as he knows he's the only believer within half a billion kilometers.

Amber dials a number in Paris and waits until someone answers the phone. She knows the strange woman on the phone's tiny screen: Mom calls her "your father's fancy bitch," with a peculiar tight smile. (The one time Amber asked what a fancy bitch was, Mom hit her — not hard, just a warning.) "Is Daddy there?" she asks.

The strange woman looks slightly bemused. (Her hair is blonde, like Mom's, but the color clearly came out of a bleach bottle, and it's cut really short, mannish.) "*Oui*. Ah, yes." She smiles tentatively. "I am sorry, it is a disposable phone you are using? You want to talk to 'im?"

It comes out in a rush: "I want to see him." Amber clutches the phone like a lifesaver: it's a cheap disposable cereal-packet item, and the cardboard is already softening in her sweaty grip. "Momma won't let me, auntie 'Nette — "

"Hush." Annette, who has lived with Amber's father for more than twice as long as her mother did, smiles. "You are sure that telephone, your mother does not know of it?"

Amber looks around. She's the only child in the rest room because it isn't break time and she told teacher she had to go right *now*: "I'm sure, P20

confidence factor greater than 0.9." Her Bayesian head tells her that she can't reason accurately about this because Momma has never caught her with an illicit phone before, but what the hell. *It can't get Dad into trouble if he doesn't know, can it?*

"Very good." Annette glances aside. "Manny, I have a surprise call for you."

Daddy appears on screen. She can see all of his face, and he looks younger than last time: he must have stopped using those clunky old glasses. "Hi — Amber! Where are you? Does your mother know you're calling me?" He looks slightly worried.

"No," she says confidently, "the phone came in a box of Grahams."

"Phew. Listen, sweet, you must remember to never, ever call me where your mom may find out. Otherwise, she'll get her lawyers to come after me with thumb screws and hot pincers, because she'll say *I* made you call me. Understand?"

"Yes, Daddy." She sighs. "Don't you want to know why I called?"

"Um." For a moment he looks taken aback. Then he nods, seriously. Amber likes Daddy because he takes her seriously most times when she talks to him. It's a phreaking nuisance having to borrow her classmates' phones or tunnel past Mom's pit-bull firewall, but Dad doesn't assume that she can't know anything because she's only a kid. "Go ahead. There's something you need to get off your chest? How've things been, anyway?"

She's going to have to be brief: the disposaphone comes pre-paid, the international tariff it's using is lousy, and the break bell is going to ring any minute. "I want *out*, Daddy. I mean it. Mom's getting loopier every week: she's dragging me around to all these churches now, and yesterday she threw a fit over me talking to my terminal. She wants me to see the school shrink, I mean, what *for*? I *can't* do what she wants; I'm not her little girl! Every time I tunnel out, she tries to put a content-bot on me, and it's making my head hurt — I can't even think straight any more!" To her surprise, Amber feels tears starting. "Get me out of here!"

The view of her father shakes, pans around to show her tante Annette looking worried. "You know, your father, he cannot do anything? The divorce lawyers, they will tie him up."

Amber sniffs. "Can *you* help?" she asks.

"I'll see what I can do," her father's fancy bitch promises as the break bell rings.

An instrument package peels away from the *Sanger's* claimjumper drone and drops toward the potato-shaped rock, fifty kilometers below. Jupiter hangs huge and gibbous in the background, impressionist wallpaper for a mad cosmologist: Pierre bites his lower lip as he concentrates on steering it.

Amber, wearing a black sleeping-sack, hovers over his head like a giant bat, enjoying her freedom for a shift. She looks down on Pierre's bowl-cut hair, his wiry arms gripping either side of the viewing table, and wonders what to have him do next. A slave for a day is an interesting experience, restful: life aboard the *Sanger* is busy enough that nobody gets much slack-time (at least, not until the big habitats have been assembled and the high bandwidth dish is pointing at Earth). They're unrolling everything to a hugely intricate plan generated by the backers' critical path team, and there isn't much room for idling: the expedition relies on shamelessly exploitative child labor — they're lighter on the life-support consumables than adults — working the kids twelve-hour days to assemble a toe-

hold on the shore of the future. (When they're older and their options vest fully, they'll all be rich — but that hasn't stopped the outraged herdnews propaganda back home.) For Amber, the chance to let somebody else work for her is novel, and she's trying to make every minute count.

"Hey, slave," she calls idly: "how you doing?"

Pierre sniffs. "It's going okay." He refuses to glance up at her, Amber notices. He's thirteen: isn't he supposed to be obsessed with girls by that age? She notices his quiet, intense focus, runs a stealthy probe along his outer boundary: he shows no sign of noticing it but it bounces off, unable to chink his mental armor. "Got cruise speed," he says, taciturn, as two tons of metal, ceramics, and diamond-phase weirdness hurtles toward the surface of Barney at three hundred kilometers per hour. "Stop shoving me: there's a three-second lag and I don't want to get into a feedback control-loop with it."

"I'll shove if I want, *slave*." She sticks her tongue out at him.

"And if you make me drop it?" he asks. Looking up at her, his face serious — "Are we supposed to be doing this?"

"You cover your ass and I'll cover *mine*," she says, then turns bright red. "You know what I mean."

"I do, do I?" Pierre grins widely, then turns back to the console: "Aww, that's no fun. And you want to tune whatever bit-bucket you've given control of your speech centers to: they're putting out way too much *double-entendre*, somebody might mistake you for a grown-up."

"You stick to *your* business and I'll stick to *mine*," she says, emphatically. "And you can start by telling me what's happening."

"Nothing." He leans back and crosses his arms, grimacing at the screen. "It's going to drift for five hundred seconds, now, then there's the midcourse correction and a deceleration burn before touch-down. And *then* it's going to be an hour while it unwraps itself and starts unwinding the cable spool. What do you want, minute noodles with that?"

"Uh-huh." Amber spreads her bat-wings and lies back in mid-air, staring at the window, feeling rich and idle as Pierre works his way through her day-shift. "Wake me when there's something interesting to see." Maybe she should have had him feed her peeled grapes or give her a foot massage, something more traditionally hedonistic: but right now just *knowing* he's her own little piece of alienated labor is doing good things for her self-esteem. Looking at those tense arms, the curve of his neck, she thinks maybe there's something to this whispering-and-giggling he *really likes you* stuff the older girls go in for —

The window rings like a gong and Pierre coughs. "You've got mail," he says dryly. "You want me to read it for you?"

"What the — " A message is flooding across the screen, right-to-left snaky script like the stuff on her corporate instrument (now lodged safely in a deposit box in Zurich). It takes her a while to page-in the grammar agent that can handle Arabic, and another minute for her to take in the meaning of the message. When she does, she starts swearing, loudly and continuously.

"*You bitch, Mom! Why'd you have to go and do a thing like that?*"

The corporate instrument arrived in a huge FedEx box addressed to Amber: it happened on her birthday while Mom was at work, and she remembers it as if it was only an hour ago.

She remembers reaching up and scraping her thumb over the delivery man's



clipboard, the rough feel of the microsequencers sampling her DNA; afterward, she drags the package inside. When she pulls the tab on the box it unpacks itself automatically, regurgitating a compact 3D printer, half a ream of paper printed in old-fashioned dumb ink, and a small calico cat with a large @-symbol on its flank. The cat hops out of the box, stretches, shakes its head, and glares at her. "You're Amber?" it mewls.

"Yeah," she says, shyly. "Are you from Tanté 'Nette?"

"No, I'm from the fucking tooth fairy." It leans over and head-butts her knee, strops the scent glands between its ears all over her skirt. "Listen, you got any tuna in the kitchen?"

"Mom doesn't believe in seafood," says Amber: "it's all foreign junk, she says. It's my birthday today, did I tell you?"

"Happy fucking birthday, then." The cat yawns, convincingly realistic. "Here's your dad's present. Bastard put me in hibernation and blogged me along to show you how to work it. You take my advice, you'll trash the fucker. No good will come of it."

Amber interrupts the cat's grumbling by clapping her hands gleefully. "So what *is* it?" she demands. "A new invention? Some kind of weird sex toy from Amsterdam? A gun, so I can shoot Pastor Wallace?"

"Naaah." The cat yawns, yet again, and curls up on the floor next to the 3D printer. "It's some kinda dodgy business model to get you out of hock to your mom. Better be careful, though — he says its legality is narrowly scoped jurisdiction-wise."

"Wow. Like, how totally cool!" In truth, Amber is delighted because it *is* her birthday, but Mom's at work and Amber's home alone, with just the TV in moral-majority mode for company. Things have gone so far downhill since Mom discovered religion that absolutely the best thing in the world tante Annette could have sent her is some scam programmed by Daddy to take her away. If he doesn't, Mom will take her to Church tonight (and maybe to an IRS compliance-certified restaurant afterward, if Amber's good and does whatever Pastor Wallace tells her to).

The cat sniffs in the direction of the printer: "Why dontcha fire it up?" Amber opens the lid on the printer, removes the packing popcorn, and plugs it in. There's a whirr and a rush of waste heat from its rear as it cools the imaging heads down to working temperature and registers her ownership.

"What do I do now?" she asks.

"Pick up the page labeled READ ME and follow the instructions," the cat recites in a bored sing-song voice. It winks at her, then fakes an exaggerated French accent: "Le READ ME contains directions pour l'execution instrument corporate dans le boîte. In event of perplexity, consult the accompanying aineko for clarification." The cat wrinkles its nose rapidly, as if it's about to bite an invisible insect. "Warning: don't rely on your father's cat's opinions, it is a perverse beast and cannot be trusted. Your mother helped seed its meme base, back when they were married. *Ends.*" It mumbles on for a while: "fucking snotty Parisian bitch, I'll piss in her knicker drawer, I'll molt in her bidet ... "

"Don't be vile." Amber scans the README quickly. Corporate instruments are strong magic, according to Daddy, and this one is exotic by any standards: a limited company established in Yemen, contorted by the intersection between shari'a and the global legislatosaurus. Understanding it isn't easy, even with a personal net full of sub-sapient agents that have full access to whole libraries of international trade law — the bottleneck is comprehension. Amber finds the documents highly puzzling. It's not the fact that half of them are written in Arabic

that bothers her — that's what her grammar engine is for — or even that they're full of S-expressions and semi-digestible chunks of LISP: but that the company seems to assert that it exists for the sole purpose of owning slaves.

"What's going on?" she asks the cat. "What's this all about?"

The cat sneezes, then looks disgusted. "This wasn't *my* idea, big shot. Your father is a very weird guy and your mother hates him lots because she's still in love with him. She's got kinks, y'know? Or maybe she's sublimating them, if she's serious about this church shit she's putting you through. He thinks that she's a control freak. Anyway, after your dad ran off in search of another dome, she took out an injunction against him. But she forgot to cover his partner, and *she* bought this parcel of worms and sent them to you, okay? Annie is a real bitch, but he's got her wrapped right around his finger, or something. Anyway, he built these companies and this printer — which isn't hardwired to a filtering proxy, like your mom's — specifically to let you get away from her legally. *If* that's what you want to do."

Amber fast-forwards through the dynamic chunks of the README — boring static UML diagrams, mostly — soaking up the gist of the plan. Yemen is one of the few countries to implement traditional Sunni shari'a law and a limited-liability company scam at the same time. Owning slaves is legal — the fiction is that the owner has an option hedged on the indentured laborer's future output, with interest payments that grow faster than the unfortunate victim can pay them off — and companies are legal entities. If Amber sells herself into slavery to this company, she will become a slave, and the company will be legally liable for her actions and upkeep. The rest of the legal instrument — about 90 percent of it, in fact — is a set of self-modifying corporate mechanisms coded in a variety of jurisdictions that permit Turing-complete company constitutions, and which act as an ownership shell for the slavery contract: at the far end of the corporate firewall is a trust fund of which Amber is the prime beneficiary and shareholder. When she reaches the age of majority, she'll acquire total control over all the companies in the network and can dissolve her slave contract; until then, the trust funds (which she essentially owns) oversee the company that owns her (and keeps it safe from hostile takeover bids). Oh, and the company network is primed by an extraordinary general meeting that instructed it to move the trust's assets to Paris immediately. A one-way airline ticket is enclosed.

"You think I should take this?" she asks uncertainly. It's hard to tell how smart the cat really is — there's probably a yawning vacuum behind those semantic networks if you dig deep enough — but it tells a pretty convincing tale.

The cat squats and curls its tail protectively around its paws: "I'm saying nothing, you know what I mean? You take this, you can go live with your dad. But it won't stop your ma coming after him with a horse whip and after *you* with a bunch of lawyers and a set of handcuffs. You want *my* advice, you'll phone the Franklins and get aboard their off-planet mining scam. In space, no one can serve a writ on you. Plus, they got long-term plans to get into the CETI market, cracking alien network packets. You want my honest opinion, you wouldn't like it in Paris after a bit. Your dad and the frog bitch, they're swingers, y'know? No time in their lives for a kid. Or a cat like me, now I think of it. They're out all hours of the night doing drugs, fetish parties, raves, opera, that kind of adult shit. Your dad dresses in frocks more than your mom, and your tante 'Nettie leads him around the apartment on a chain when they're not having noisy sex on the balcony. They'd cramp your style, kid: you shouldn't have to put up with parents who have more of a life than you do."

"Huh." Amber wrinkles her nose, half-disgusted by the cat's transparent scheming, and half-acknowledging its message: *I'd better think hard about this*, she decides. Then she flies off in so many directions at once that she nearly

browns out the household net feed. Part of her is examining the intricate card pyramid of company structures; somewhere else, she's thinking about what can go wrong, while another bit (probably some of her wet, messy glandular biological self) is thinking about how nice it would be to see Daddy again, albeit with some trepidation. Parents aren't supposed to have sex: isn't there a law, or something? "Tell me about the Franklins? Are they married? Singular?"

The 3D printer is cranking up. It hisses slightly, dissipating heat from the hard-vacuum chamber in its supercooled workspace. Deep in its guts it creates coherent atom beams, from a bunch of Bose-Einstein condensates hovering on the edge of absolute zero: by superimposing interference patterns on them, it generates an atomic hologram, building a perfect replica of some original artifact, right down to the atomic level — there are no clunky moving nanotechnology parts to break or overheat or mutate. Something is going to come out of the printer in half an hour, something cloned off its original right down to the individual quantum states of its component atomic nuclei. The cat, seemingly oblivious, shuffles closer to its exhaust ducts.

"Bob Franklin, he died about two, three years before you were born: your dad did business with him. So did your mom. Anyway, he had chunks of his noumen preserved, and the estate trustees are trying to recreate his consciousness by cross-loading him in their implants. They're sort of a borganism, but with money and style. Anyway, Bob got into the space biz back then, with some financial wizardry a friend of your father whipped up for him, and now they-he are building a spacehab that they're going to take all the way out to Jupiter, where they can dismantle a couple of small moons and begin building helium-three refineries. It's that CETI scam I told you about earlier, but they've got a whole load of other angles on it for the long term."

This is mostly going right over Amber's head — she'll have to learn what helium-three refineries are later — but the idea of running away to space has a certain appeal. Adventure, that's what. Amber looks around the living room and sees it for a moment as a capsule, a small wooden cell locked deep in a vision of a middle-America that never was — the one her mom wants to retreat into. "Is Jupiter fun?" she asks. "I know it's big and not very dense, but is it, like, a happening place?"

"You could say that," says the cat, as the printer clanks and disgorges a fake passport (convincingly aged), an intricate metal seal engraved with Arabic script, and a tailored wide-spectrum vaccine targeted on Amber's immature immune system. "Stick that on your wrist, sign the three top copies, put them in the envelope, and let's get going: we've got a flight to catch."

Sadeq is eating his dinner when the lawsuit rolls in.

Alone in the cramped humming void of his station, he contemplates the plea. The language is awkward, showing all the hallmarks of a crude machine translation: the supplicant is American, a woman, and — oddly — claims to be a Christian. This is surprising enough, but the nature of her claim is, at face value, preposterous. He forces himself to finish his bread, then bag the waste and clean the platter, before he gives it his full consideration. Is it a tasteless joke? Evidently not: as the only quadi outside the orbit of Mars he is uniquely qualified to hear it, and it *is* a case that cries out for justice.

A woman who leads a God-fearing life — not a correct one, no, but she shows some signs of humility and progress toward a deeper understanding — is deprived of her child by the machinations of a feckless husband who deserted her years before. That the woman was raising the child alone strikes Sadeq as disturbingly western, but pardonable when he reads her account of the feckless

one's behavior, which is degenerate: an ill fate indeed would await any child that this man raises to adulthood. This man deprives her of her child, but not by legitimate means: he doesn't take the child into his own household or make any attempt to raise her, either in accordance with his own customs or the precepts of shari'a. Instead, he enslaves her wickedly in the mire of the western legal tradition, then casts her into outer darkness to be used as a laborer by the dubious forces of self-proclaimed "progress." The same forces that Sadeq has been sent to confront, as representative of the Ummah in orbit around Jupiter.

Sadeq scratches his short beard thoughtfully. A nasty tale, but what can he do about it? "Computer," he says, "a reply to this supplicant: my sympathies lie with you in the manner of your suffering, but I fail to see in what way I can be of assistance. Your heart cries out for help before God (blessed be his name), but surely this is a matter for the temporal authorities of the dar al-Harb." He pauses: *or is it?* he wonders. Legal wheels begin to turn in his mind. "If you can but find your way to extending to me a path by which I can assert the primacy of shari'ah over your daughter, I shall apply myself to constructing a case for her emancipation, to the greater glory of God (blessed be his name) in the name of the Prophet (peace be unto him). Ends, sigblock, send."

Releasing the Velcro straps that hold him at the table, Sadeq floats up and then kicks gently toward the forward end of the cramped habitat. The controls of the telescope are positioned between the ultrasonic clothing cleaner and the lithium hydroxide scrubbers: they're already freed up, because he was conducting a wide-field survey of the inner ring, looking for the signature of water ice. It is the work of a few moments to pipe the navigation and tracking system into the telescope's controller and direct it to hunt for the big foreign ship of fools. Something nudges at Sadeq's mind urgently, an irritating realization that he may have missed something in the woman's email: there were a number of huge attachments. With half his mind, he surfs the news digest his scholarly peers send him daily: meanwhile, he waits patiently for the telescope to find the speck of light that the poor woman's daughter is enslaved within.

This might be a way in, he realizes, a way to enter dialogue with them. Let the hard questions answer themselves, elegantly. There will be no need for the war of the sword if they can be convinced that their plans are faulty: no need to defend the godly from the latter-day Tower of Babel these people propose to build. If this woman Pamela means what she says, Sadeq need not end his days out here in the cold between the worlds, away from his elderly parents and brother and his colleagues and friends. And he will be profoundly grateful: because, in his heart of hearts, he knows that he is less a warrior than a scholar.

"I'm sorry, but the Borg is attempting to assimilate a lawsuit," says the receptionist. "Will you hold?"

"Crud." Amber blinks the Binary Betty answerphone sprite out of her eye and glances around at the cabin. "That is *so* last century," she grumbles. "Who do they think they are?"

"Doctor Robert H. Franklin," volunteers the cat. "It's a losing proposition if you ask me. Bob was so fond of his dope that there's this whole hippie groupmind that's grown up using his state vector as a bong — "

"Shut the fuck up!" Amber shouts at him. Instantly contrite (for yelling in an inflatable spacecraft is a major faux pas): "Sorry." She spawns an autonomic thread with full parasympathetic nervous control, tells it to calm her down: then she spawns a couple more to go forth and become fuqaha, expert on shari'a law. She realizes she's buying up way too much of the orphanage's scarce bandwidth — time that will have to be paid for in chores, later — but it's necessary. "She's

gone *too* far. This time, it's *war*."

She slams out of her cabin and spins right around in the central axis of the hab, a rogue missile pinging for a target to vent her rage on. A tantrum would be *good* —

But her body is telling her to chill out, take ten, and there's a drone of scriptural lore dribbling away in the back of her head, and she's feeling frustrated and angry and not in control, but not really mad now. It was like this three years ago when Mom noticed her getting on too well with Jenny Morgan and moved her to a new school district — she said it was a work assignment, but Amber knows better, Mom asked for it — just to keep her dependent and helpless. Mom is a psycho bitch control-freak and ever since she had to face up to losing Dad she's been working her claws into Amber — which is tough, because Amber is not good victim material, and is smart and well-networked to boot. But now Mom's found a way of fucking Amber over *completely*, even in Jupiter orbit, and Amber would be totally out of control if not for her skullware keeping a lid on things.

Instead of shouting at her cat or trying to message the Borg, Amber goes to hunt them down in their meatspace den.

There are sixteen Borg aboard the *Sanger* — adults, members of the Franklin Collective, squatters in the ruins of Bob Franklin's posthumous vision. They lend bits of their brains to the task of running what science has been able to resurrect of the dead dot-com billionaire's mind, making him the first boddhisatva of the uploading age — apart from the lobster colony, of course. Their den mother is a woman called Monica: a willowy brown-eyed hive queen with raster-burned corneal implants and a dry, sardonic delivery that can corrode egos like a desert wind. She's better than the others at running Bob, and she's no slouch when she's being herself: which is why they elected her Maximum Leader of the expedition.

Amber finds Monica in the number four kitchen garden, performing surgery on a filter that's been blocked by toadspawn. She's almost buried beneath a large pipe, her Velcro-taped toolkit waving in the breeze like strange blue air-kelp. "Monica? You got a minute?"

"Sure, I have lots of minutes. Make yourself helpful? Pass me the anti-torque wrench and a number-six hex head."

"Um." Amber captures the blue flag and fiddles around with its contents. Something that has batteries, motors, a flywheel counterweight, and laser gyros assembles itself — Amber passes it under the pipe. "Here. Listen, your phone is busy."

"I know. You've come to see me about your conversion, haven't you?"

"Yes!"

There's a clanking noise from under the pressure sump. "Take this." A plastic bag floats out, bulging with stray fasteners. "I got a bit of vacuuming to do. Get yourself a mask if you don't already have one."

A minute later, Amber is back beside Monica's legs, her face veiled by a filter mask. "I don't want this to go through," she says. "I don't care what Mom says, I'm not Moslem! This judge, he can't touch me. He *can't*," she repeats, vehemence warring with uncertainty.

"Maybe he doesn't want to?" Another bag. "Here, catch."

Amber grabs the bag: too late, she discovers that it's full of water and toadspawn. Stringy mucous ropes full of squiggling comma-shaped baby tadpoles explode all over the compartment and bounce off the walls in a shower of

amphibian confetti. "Eew!"

Monica squirms out from behind the pipe. "Oh, you *didn't*." She kicks off the consensus-defined floor and grabs a wad of absorbent paper from the spinner, whacks it across the ventilator shroud above the sump. Together they go after the toadspawn with garbage bags and paper — by the time they've got the stringy mess mopped up, the spinner has begun to click and whirr, processing cellulose from the algae tanks into fresh wipes. "That was really clever," Monica says emphatically, as the disposal bin sucks down her final bag. "You wouldn't happen to know how the toad got in here?"

"No, but I ran into one that was loose in the commons, one shift before last cycle-end. Gave it a ride back to Oscar."

"I'll have a word with him, then." Monica glares blackly at the pipe. "I'm going to have to go back and re-fit the filter in a minute. Do you want me to be Bob?"

"Uh." Amber thinks. "Not sure. Your call."

"All right, Bob coming online." Monica's face relaxes slightly, then her expression hardens. "Way I see it, you've got a choice. Your mother's kinda boxed you in, hasn't she?"

"Yes." Amber frowns.

"So. Pretend I'm an idiot. Talk me through it, huh?"

Amber drags herself alongside the hydro pipe and gets her head down, alongside Monica/Bob, who is floating with her feet near the floor. "I ran away from home. Mom owned me — that is, she had parental rights and Dad had none. So Dad, via a proxy, helped me sell myself into slavery to a company. The company was owned by a trust fund, and I'm the main beneficiary when I reach the age of majority. As a chattel, the company tells me what to do — legally — but the shell company is set to take my orders. So I'm autonomous. Right?"

"That sounds like the sort of thing your father would do," Monica says neutrally. Overtaken by a sardonic middle-aged Silicon Valley drawl, her north-of-England accent sounds peculiarly mid-Atlantic.

"Trouble is, most countries don't acknowledge slavery; those that do mostly don't have any equivalent of a limited-liability company, much less one that can be directed by another company from abroad. Dad picked Yemen on the grounds that they've got this stupid brand of shari'a law — and a crap human-rights record — but they're just about conformant to the open legal standards protocol, able to interface to EU norms via a Turkish legislative firewall."

"So."

"Well, I guess I was technically a Jannissary. Mom was doing her Christian phase, so that made me a Christian un-believer slave of an Islamic company. But now the stupid bitch has gone and converted to shi'ism. Now, normally, Islamic descent runs through the father, but she picked her sect carefully, and chose one that's got a progressive view of women's rights: they're sort of Islamic fundamentalist liberal constructionists! 'What would the Prophet do if he were alive today and had to worry about self-replicating chewing gum factories.' They generally take a progressive, almost westernized, view of things like legal equality of the sexes, because for his time and place, the Prophet was way ahead of the ball and they figure they ought to follow his example. Anyway, that means Mom can assert that *I* am Moslem, and under Yemeni law I get to be treated as a Moslem chattel of a company. And their legal code is very dubious about permitting slavery of Moslems. It's not that I have *rights* as such, but my pastoral well-being becomes the responsibility of the local imam, and — " She shrugs helplessly.

"Has he tried to make you run under any new rules, yet?" asks Monica/Bob. "Has he put blocks on your freedom of agency, tried to mess with your mind? Insisted on libido dampers?"

"Not yet." Amber's expression is grim. "But he's no dummy. I figure he may be using Mom — and me — as a way of getting his fingers into this whole expedition. Staking a claim for jurisdiction, claim arbitration, that sort of thing. It could be worse; he might order me to comply fully with his specific implementation of shari'a. They permit implants, but require mandatory conceptual filtering: if I run that stuff, I'll end up *believing* it!"

"Okay." Monica does a slow backward somersault in mid-air. "Now tell me why you can't simply repudiate it."

"Because." Deep breath. "I can do that in two ways. I can deny Islam, which makes me an apostate, and automatically terminates my indenture to the shell, so Mom owns me. Or I can say that the instrument has no legal standing because I was in the USA when I signed it, and slavery is illegal there, in which case Mom owns me, because I'm a minor. Or I can take the veil, live like a modest Moslem woman, do whatever the imam wants, and Mom doesn't own me — but she gets to appoint my chaperone. Oh Bob, she has planned this *so well*."

"Uh-huh." Monica rotates back to the floor and looks at Amber, suddenly very Bob. "Now you've told me your troubles, start thinking like your dad. Your dad had a dozen creative ideas before breakfast every day — it's how he made his name. Your mom has got you in a box. Think your way *outside* it: what can you do?"

"Well." Amber rolls over and hugs the fat hydroponic duct to her chest like a life raft. "It's a legal paradox. I'm trapped because of the jurisdiction she's cornered me in. I could talk to the judge, I suppose, but she'll have picked him carefully." Her eyes narrow. "The jurisdiction. Hey, Bob." She lets go of the duct and floats free, hair streaming out behind her like a cometary halo. "How do I go about creating myself a new jurisdiction?"

Monica grins. "I seem to recall the traditional way was to grab yourself some land and set yourself up as king: but there are other ways. I've got some friends I think you should meet. They're not good conversationalists and there's a two-hour lightspeed delay ... but I think you'll find they've answered that question already. But why don't you talk to the imam first and find out what he's like? He may surprise you. After all, he was already out here before your mom decided to use him against you."

The *Sanger* hangs in orbit thirty kilometers up, circling the waist of potato-shaped Amalthea. Drones swarm across the slopes of Mons Lyctos, ten kilometers above the mean surface level: they kick up clouds of reddish sulfate dust as they spread transparent sheets across the surface. This close to Jupiter — a mere hundred and eighty thousand kilometers above the swirling madness of the cloudscape — the gas giant fills half the sky with a perpetually changing clockface: for Amalthea orbits the master in under twelve hours. The *Sanger's* radiation shields are running at full power, shrouding the ship in a corona of rippling plasma: radio is useless, and the human miners run their drones via an intricate network of laser circuits. Other, larger drones are unwinding spools of heavy electrical cable north and south from the landing site: once the circuits are connected, these will form a coil cutting through Jupiter's magnetic field, generating electrical current (and imperceptibly slowing the moon's orbital momentum).

Amber sighs and looks, for the sixth time this hour, at the webcam plastered on the side of her cabin. She's taken down the posters and told the toys to tidy

themselves away. In another two thousand seconds, the tiny Iranian spaceship will rise above the limb of Moshtari, and then it will be time to talk to the teacher. She isn't looking forward to the experience. If he's a grizzled old blockhead of the most obdurate fundamentalist streak, she'll be in trouble: disrespect for age has been part and parcel of the western teenage experience for generations, and a cross-cultural thread that she's sent to clue-up on Islam reminds her that not all cultures share this outlook. But if he turns out to be young, intelligent, and flexible, things could be even worse. When she was eight, Amber audited *The Taming of the Shrew*: now she has no appetite for a starring role in her own cross-cultural production.

She sighs again. "Pierre?"

"Yeah?" His voice comes from the foot of the emergency locker in her room. He's curled up down there, limbs twitching languidly as he drives a mining drone around the surface of Object Barney, as the rock has named itself. The drone is a long-legged crane-fly lookalike, bouncing very slowly from toe-tip to toe-tip in the microgravity — the rock is only half a kilometer along its longest axis, coated brown with weird hydrocarbon goop and sulfur compounds sprayed off the surface of Io by the Jovian winds. "I'm coming."

"You better." She glances at the screen. "One twenty seconds to next burn." The payload canister on the screen is, technically speaking, stolen: it'll be okay as long as she gives it back, Bob said, although she won't be able to do that until it's reached Barney and they've found enough water ice to refuel it. "Found anything yet?"

"Just the usual. Got a seam of ice near the semimajor pole — it's dirty, but there's at least a thousand tons there. And the surface is crunchy with tar. Amber, you know what? The orange shit, it's solid with fullerenes."

Amber grins at her reflection in the screen. That's good news. Once the payload she's steering touches down, Pierre can help her lay superconducting wires along Barney's long axis. It's only a kilometer and a half, and that'll only give them a few tens of kilowatts of juice, but the condensation fabricator that's also in the payload will be able to use it to convert Barney's crust into processed goods at about two grams per second. Using designs copylefted by the free hardware foundation, inside two hundred thousand seconds they'll have a grid of sixty-four 3D printers barfing up structured matter at a rate limited only by available power. Starting with a honking great dome tent and some free nitrogen/oxygen for her to breathe, then adding a big webcache and direct high-bandwidth uplink to Earth, Amber could have her very own one-girl colony up and running within a million seconds.

The screen blinks at her. "Oh shit. Make yourself scarce, Pierre!" The incoming call nags at her attention. "Yeah? Who are you?"

The screen fills with a view of a cramped, very twen-cen-looking space capsule. The guy inside it is in his twenties, with a heavily tanned face, close-cropped hair and beard, wearing an olive-drab spacesuit liner. He's floating between a TORU manual-docking controller and a gilt-framed photograph of the Ka'bah at Mecca. "Good evening to you," he says solemnly. "Do I have the honor to be addressing Amber Macx?"

"Uh, yeah. That's me." She stares at him: he looks nothing like her conception of an ayatollah — whatever an ayatollah is — elderly, black-robed, vindictively fundamentalist. "Who are you?"

"I am Doctor Sadeq Khurasani. I hope that I am not interrupting you? Is it convenient for you that we talk now?"

He looks so anxious that Amber nods automatically. "Sure. Did my mom put



you up to this?" They're still speaking English, and she notices that his diction is good, but slightly stilted: he isn't using a grammar engine, he's actually learned it the hard way. "If so, you want to be careful. She doesn't lie, exactly, but she gets people to do what she wants."

"Yes, she did. Ah." A pause. They're still almost a light-second apart, time for painful collisions and accidental silences. "I have not noticed that. Are you sure you should be speaking of your mother that way?"

Amber breathes deeply. "*Adults* can get divorced. If *I* could get divorced from her, I would. She's — " she flails around for the right word helplessly. "Look. She's the sort of person who can't lose a fight. If she's going to lose, she'll try to figure how to set the law on you. Like she's done to me. Don't you see?"

Doctor Khurasani looks extremely dubious. "I am not sure I understand," he says. "Perhaps, mm, I should tell you why I am talking to you?"

"Sure. Go ahead." Amber is startled by his attitude: he's actually taking her seriously, she realizes. Treating her like an adult. The sensation is so novel — coming from someone more than twenty years old and not a member of the Borg — that she almost lets herself forget that he's only talking to her because Mom set her up.

"Well. I am an engineer. In addition, I am a student of *fiqh*, jurisprudence. In fact, I am qualified to sit in judgment. I am a very junior judge, but even so, it is a heavy responsibility. Anyway. Your mother, peace be unto her, lodged a petition with me. Are you aware of it?"

"Yes." Amber tenses up. "It's a lie. Distortion of the facts."

"Hmm." Sadeq rubs his beard thoughtfully. "Well, I have to find out, yes? Your mother has submitted herself to the will of God. This makes you the child of a Moslem, and she claims — "

"She's trying to use you as a weapon!" Amber interrupts. "I sold myself into *slavery* to get away from her, do you understand? I enslaved myself to a company that is held in trust for my ownership. She's trying to change the rules to get me back. You know what? I don't believe she gives a shit about your religion, all she wants is me!"

"A mother's love — "

"Fuck love!" Amber snarls, "she wants *power*."

Sadeq's expression hardens. "You have a foul mouth in your head, child. All I am trying to do is to find out the facts of this situation: you should ask yourself if such disrespect furthers your interests?" He pauses for a moment, then continues, less abruptly, "Did you really have such a bad childhood with her? Do you think she did everything merely for power, or could she love you?" Pause. "You must understand, I need an answer to these things. Before I can know what is the right thing to do."

"My mother — " Amber stops. Spawns a vaporous cloud of memory retrievals. They fan out through the space around her mind like the tail of her cometary mind. Invoking a complex of network parsers and class filters, she turns the memories into reified images and blats them at the webcam's tiny brain so that he can see them. Some of the memories are so painful that Amber has to close her eyes. Mom in full office war-paint, leaning over Amber, promising to take her to church so that Reverend Beeching can pray the devil out of her. Mom telling Amber that they're moving again, abruptly, dragging her away from school and the friends she'd tentatively started to like. Mom catching her on the phone to Daddy, tearing the phone in half and hitting her with it. Mom at the kitchen table, forcing her to eat — "My mother likes *control*."

"Ah." Sadeq's expression turns glassy. "And this is how you feel about her? How long have you had that level of — no, please forgive me for asking. You obviously understand implants. Do your grandparents know? Did you talk to them?"

"My grandparents?" Amber stifles a snort. "Mom's parents are dead. Dad's are still alive, but they won't talk to him — they like Mom. They think I'm creepy. I know little things, their tax bands and customer profiles. I could mine data with my head when I was four. I'm not built like little girls were in their day, and they don't understand. You know that the old ones don't like us at all? Some of the churches make money doing nothing but exorcisms for oldsters who think their kids are possessed."

"Well." Sadeq is fingering his beard again, distractedly. "I must say, this is a lot to learn. But you know that your mother has accepted Islam, don't you? This means that you are Moslem, too. Unless you are an adult, your parent legally speaks for you. And she says that this makes you my problem. Hmm."

"I'm not Moslem." Amber stares at the screen. "I'm not a child, either." Her threads are coming together, whispering scarily behind her eyes: her head is suddenly dense and turgid with ideas, heavy as a stone and twice as old as time. "I am nobody's chattel. What does your law say about people who are born with implants? What does it say about people who want to live forever? I don't believe in any *god*, mister judge. I don't believe in any limits. Mom can't, physically, make me do *anything*, and she sure can't speak for me."

"Well, if that is what you have to say, I must think on the matter." He catches her eye: his expression is thoughtful, like a doctor considering a diagnosis. "I will call you again in due course. In the meantime, if you need to talk to anyone, remember that I am always available. If there is anything I can do to help ease your pain, I would be pleased to be of service. Peace be unto you, and those you care for."

"Same to you too," she mutters darkly as the connection goes dead. "*Now* what?" she asks, as a beeping sprite gyrates across the wall, begging for attention.

"I think it's the lander," Pierre says helpfully. "Is it down yet?"

She rounds on him. "Hey, I thought I told you to get lost!"

"What, and miss all the fun?" He grins at her impishly. "Amber's got a new boyfriend! Wait until I tell everybody ... "

Sleep cycles pass: the borrowed 3D printer on Object Barney's surface spews bitmaps of atoms in quantum lockstep at its rendering platform, building up the control circuitry and skeletons of new printers. (There are no clunky nano-assemblers here, no robots the size of viruses busily sorting molecules into piles — just the bizarre quantized magic of atomic holography, modulated Bose-Einstein condensates collapsing into strange, lacy, supercold machinery.) Electricity surges through the cable loops as they slice through Jupiter's magnetosphere, slowly converting the rock's momentum into power: small robots grovel in the orange dirt, scooping up raw material to feed to the fractionating oven. Amber's garden of machinery flourishes slowly, unpacking itself according to a schema designed by pre-teens at an industrial school in Poland, with barely any need for human guidance.

High in orbit around Amalthea, complex financial instruments breed and conjugate. Developed for the express purpose of facilitating trade with the alien intelligences believed to have been detected eight years earlier by SETI, they function equally well as fiscal firewalls for space colonies. The *Sanger's* bank

accounts in California and Cuba are looking acceptable — since entering Jupiter space, the orphanage has staked a claim on roughly a hundred gigatons of random rocks and a moon that's just small enough to creep in under the International Astronomical Union's definition of a sovereign planetary body. The Borg are working hard, leading their eager teams of child stakeholders in their plans to build the industrial metastructures necessary to support mining helium three from Jupiter: they're so focused that they spend much of their time being themselves, not bothering to run Bob, the shared identity that gives them their messianic drive.

Half a light-hour away, tired Earth wakes and slumbers in time to its ancient orbital dynamics. A religious college in Cairo is considering issues of nanotechnology: if replicators are used to prepare a copy of a strip of bacon, right down to the molecular level, but without it ever being part of a pig, how is it to be treated? (If the mind of one of the faithful is copied into a computing machine's memory by mapping and simulating all its synapses, is the computer now a Moslem? If not, *why* not? If so, what are its rights and duties?) Riots in Borneo underline the urgency of theotechnological inquiry.

More riots in Barcelona, Madrid, Birmingham, and Marseilles also underline a rising problem: social chaos caused by cheap anti-aging treatments. The zombie exterminators, a backlash of disaffected youth against the formerly greying gerontocracy of Europe, insist that people who predate the supergrid and can't handle implants aren't *really* conscious: their ferocity is equaled only by the anger of the dynamic septuagenarians of the baby boom, their bodies partially restored to the flush of sixties youth but their minds adrift in a slower, less contingent century. The faux-young boomers feel betrayed, forced back into the labor pool but unable to cope with the implant-accelerated culture of the new millennium, their hard-earned experience rendered obsolete by deflationary time.

The Bangladeshi economic miracle is typical of the age. With growth rates running at over 20 percent, cheap out-of-control bioindustrialization has swept the nation: former rice farmers harvest plastics and milk cows for silk, while their children study mariculture and design sea walls. With cellphone ownership nearing 80 percent and literacy at 90, the once-poor country is finally breaking out of its historical infrastructure trap and beginning to develop: another generation, and they'll be richer than Japan in 2001.

Radical new economic theories are focusing around bandwidth, speed-of-light transmission time, and the implications of CETI, communication with extra-terrestrial intelligence: cosmologists and quants collaborate on bizarre relativistically telescoped financial instruments. Space (which lets you store information) and structure (which lets you process it) acquire value while dumb mass — like gold — loses it: the degenerate cores of the traditional stock markets are in free fall, the old smokestack microprocessor and biotech/nanotech industries crumbling before the onslaught of matter replicators and self-modifying ideas and the barbarian communicators, who mortgage their future for a millennium against the chance of a gift from a visiting alien intelligence. Microsoft, once the US Steel of the silicon age, quietly fades into liquidation.

An outbreak of green goo — a crude biomechanical replicator that eats everything in its path — is dealt with in the Australian outback by carpet-bombing with fuel-air explosives: the USAF subsequently reactivates two wings of refurbished B-52s and places them at the disposal of the UN standing committee on self-replicating weapons. (CNN discovers that one of their newest pilots, re-enlisting with the body of a twenty-year-old and an empty pension account, first flew them over Laos and Cambodia.) The news overshadows the World Health Organization's announcement of the end of the HIV pandemic, after more than fifty years of bigotry, panic, and megadeath.

"Breathe steadily. Remember your regulator drill? If you spot your heart rate going up or your mouth going dry, take five."

"Shut the fuck up, 'Neko, I'm trying to concentrate." Amber fumbles with the titanium D-ring, trying to snake the strap through it. The gauntlets are getting in her way: high orbit spacesuits — little more than a body stocking designed to hold your skin under compression and help you breathe — are easy, but this deep in Jupiter's radiation belt, she has to wear an old moon suit that comes in about thirteen layers, and the gloves are stiff. It's Chernobyl weather, a sleet of alpha particles and raw protons storming through the void. "Got it." She yanks the strap tight, pulls on the D-ring, then goes to work on the next strap. Never looking down: because the wall she's tying herself to has no floor, just a cut-off two meters below, then empty space for a hundred kilometers before the nearest solid ground.

The ground sings to her moronically: "I fall to you, you fall to me, it's the law of gravity — "

She shoves her feet down onto the platform that juts from the side of the capsule like a suicide's ledge: metalized Velcro grabs hold, and she pulls on the straps to turn her body around until she can see past the capsule, sideways. The capsule masses about five tons, barely bigger than an ancient Soyuz. It's packed to overflowing with environment-sensitive stuff she'll need, and a honking great high-gain antenna. "I hope you know what you're doing?" someone says over the intercom.

"Of course I — " she stops. Alone in this TsUP-surplus iron maiden with its low bandwidth comms and bizarre plumbing, she feels claustrophobic and helpless: parts of her mind don't work. When she was four, Mom took her down a famous cave system somewhere out west: when the guide turned out the lights half a kilometer underground, she'd screamed with surprise as the darkness had reached out and touched her. Now it's not the darkness that frightens her, it's the lack of thought. For a hundred kilometers below her, there are *no* minds, and even on the surface there's not much but a moronic warbling of bots. Everything that makes the universe primate-friendly seems to be locked in the huge spaceship that looms somewhere just behind her, and she has to fight down an urge to shed her straps and swarm back up the umbilical that anchors this capsule to the *Sanger*. "I'll be fine," she forces herself to say. And even though she's unsure that it's true, she tries to make herself believe it. "It's just leaving-home nerves. I've read about it, okay?"

There's a funny, high-pitched whistle in her ears. For a moment, the sweat on the back of her neck turns icy cold, then the noise stops. She strains for a moment, and when it returns, she recognizes the sound: the heretofore-talkative cat, curled in the warmth of her pressurized luggage can, has begun to snore.

"Let's go," she says, "time to roll the wagon." A speech macro deep in the *Sanger's* docking firmware recognizes her authority and gently lets go of the pod. A couple of cold gas thrusters pop, deep banging vibrations running through the capsule, and she's on her way.

"Amber. How's it hanging?" A familiar voice in her ears: she blinks. Fifteen hundred seconds, nearly half an hour gone.

"Robes-Pierre, chopped any aristos lately?"

"Heh!" A pause. "I can see *your* head from here."

"How's it looking?" she asks. There's a lump in her throat, she isn't sure why. Pierre is probably hooked into one of the smaller proximity cameras dotted around the outer hull of the big mothership. Watching over her as she falls.

"Pretty much like always," he says laconically. Another pause, this time longer.

"This is wild, you know? Su Ang says hi, by the way."

"Su Ang, hi," she replies, resisting the urge to lean back and look up — up relative to her feet, not her vector — and see if the ship's still visible.

"Hi," Ang says shyly. "You're very brave!"

"Still can't beat you at chess." Amber frowns. Su Ang and her over-engineered algae. Oscar and his pharmaceutical factory toads. People she's known for three years, mostly ignored, and never thought about missing. "Listen, you going to come visiting?"

"Visit?" Ang sounds dubious. "When will it be ready?"

"Oh, soon enough." At four kilograms per minute of structured-matter output, the printers on the surface have already built her a bunch of stuff: a habitat dome, the guts of an algae/shrimp farm, a bucket conveyor to bury it with, an airlock. It's all lying around waiting for her to put it together and move into her new home. "Once the Borg get back from Amalthea."

"Hey! You mean they're moving? How did you figure that?"

"Go talk to them," Amber says. Actually, she's a large part of the reason the *Sanger* is about to crank its orbit up and out toward the other moon: she wants to be alone in comms silence for a couple of million seconds. The Franklin collective is doing her a big favor.

"Ahead of the curve, as usual," Pierre cuts in, with something that sounds like admiration to her uncertain ears.

"You too," she says, a little too fast. "Come visit when I've got the life-support cycle stabilized."

"I'll do that," he replies. A red glow suffuses the flank of the capsule next to her head, and she looks up in time to see the glaring blue laser-line of the *Sanger's* drive torch powering up.

Eighteen million seconds, almost a tenth of a Jupiter year, passes.

The imam tugs thoughtfully on his beard as he stares at the traffic-control display. These days, every shift seems to bring a new crewed spaceship into Jupiter system: space is getting positively crowded. When he arrived, there were less than two hundred people here: now there's the population of a small city, and many of them live at the heart of the approach map centered on his display. He breathes deeply — trying to ignore the omnipresent odor of old socks — and studies the map. "Computer, what about my slot?" he asks.

"Your slot: cleared to commence final approach in six nine five seconds. Speed limit is ten meters per second inside ten kilometers, drop to two meters per second inside one kilometer. Uploading map of forbidden thrust vectors now." Chunks of the approach map turn red, gridded off to prevent his exhaust stream damaging other craft in the area.

Sadeq sighs. "We'll go in on Kurs. I assume their Kurs guidance is active?"

"Kurs docking target support available to shell level three."

"Praise the Prophet, peace be unto him." He pokes around through the guidance subsystem's menus, setting up the software emulation of the obsolete (but highly reliable) Soyuz docking system. At last, he can leave the ship to look after itself for a bit. He glances around: for two years he has lived in this canister, and soon he will step outside it. It hardly seems real.

The radio, usually silent, crackles with unexpected life. "Bravo One One, this is

Imperial Traffic Control. Verbal contact required, over."

Sadeq twitches with surprise. The voice sounds inhuman, paced with the cadences of a speech synthesizer, like so many of Her Majesty's subjects. "Bravo One One to Traffic Control, I'm listening, over."

"Bravo One One, we have assigned you a landing slot on tunnel four, airlock delta. Kurs active, ensure your guidance is set to seven four zero and slaved to our control."

He leans over the screen and rapidly checks the docking system's settings. "Control, all in order."

"Bravo One One, stand by."

The next hour passes slowly as the traffic control system guides his Type 921 down to a rocky rendezvous. Orange dust streaks his one optical-glass porthole: a kilometer before touch-down, Sadeq busies himself closing protective covers, locking down anything that might fall around on contact. Finally, he unrolls his mat against the floor in front of the console and floats above it for ten minutes, eyes closed in prayer. It's not the landing that worries him, but what comes next.

Her Majesty's domain stretches out before the battered Almaz module like a rust-stained snowflake half-a-kilometer in diameter. Its core is buried in a loose snowball of greyish rubble, and it waves languid brittlestar arms at the gibbous orange horizon of Jupiter. Fine hairs, fractally branching down to the molecular level, split off the main collector arms at regular intervals; a cluster of habitat pods like seedless grapes cling to the roots of the massive cluster. Already, he can see the huge steel generator loops that climb from either pole of the snowflake, wreathed in sparking plasma: the Jovian rings form a rainbow of darkness rising behind them.

Finally, the battered space station is on final approach. Sadeq watches the Kurs simulation output carefully, piping it direct into his visual field: there's an external camera view of the rockpile and grapes, expanding toward the convex ceiling of the ship, and he licks his lips, ready to hit the manual override and go around again — but the rate of descent is slowing, and by the time he's close enough to see the scratches on the shiny metal docking cone ahead of the ship, it's measured in centimeters per second. There's a gentle bump, then a shudder, then a rippling bang as the docking ring latches fire — and he's down.

Sadeq breathes deeply again, then tries to stand. There's gravity here, but not much: walking is impossible. He's about to head for the life-support panel when he freezes, hearing a noise from the far end of the docking node. Turning, he is just in time to see the hatch opening toward him, a puff of vapor condensing, and then —

Her Imperial Majesty is sitting in the throne room, moodily fidgeting with the new signet ring her Equerry has designed for her. It's a lump of structured carbon massing almost fifty grams, set in a plain band of iridium. It glitters with the blue and violet speckle highlights of its internal lasers, because, in addition to being a piece of state jewelry, it is also an optical router, part of the industrial control infrastructure she's building out here on the edge of the solar system. Her Majesty wears plain black combat pants and sweatshirt, woven from the finest spider silk and spun glass, but her feet are bare: her taste in fashion is best described as youthful, and, in any event, certain styles — skirts, for example — are simply impractical in microgravity. But, being a monarch, she's wearing a crown. And there's a cat sleeping on the back of her throne.

The lady-in-waiting (and sometime hydroponic engineer) ushers Sadeq to the doorway, then floats back. "If you need anything, please say," she says shyly, then ducks and rolls away. Sadeq approaches the throne, orients himself on the

floor — a simple slab of black composite, save for the throne growing from its center like an exotic flower — and waits to be noticed.

"Doctor Khurasani, I presume." She smiles at him, neither the innocent grin of a child nor the knowing smirk of an adult: merely a warm greeting. "Welcome to my kingdom. Please feel free to make use of any necessary support services here, and I wish you a very pleasant stay."

Sadeq holds his expression still. The queen is young — her face still retains the puppy fat of childhood, emphasized by microgravity moon-face — but it would be a bad mistake to consider her immature. "I am grateful for Your Majesty's forbearance," he murmurs, formulaic. Behind her the walls glitter like diamonds, a glowing kaleidoscope vision. Her crown, more like a compact helm that covers the top and rear of her head, also glitters and throws off diffraction rainbows: but most of its emissions are in the near ultraviolet, invisible except in the faint glowing nimbus it creates around her head. Like a halo.

"Have a seat," she offers, gesturing: a ballooning free-fall cradle squirts down and expands from the ceiling, angled toward her, open and waiting. "You must be tired: working a ship all by yourself is exhausting." She frowns ruefully, as if remembering. "And two years is nearly unprecedented."

"Your Majesty is too kind." Sadeq wraps the cradle arms around himself and faces her. "Your labors have been fruitful, I trust."

She shrugs. "I sell the biggest commodity in short supply on any frontier ... " a momentary grin. "This isn't the wild west, is it?"

"Justice cannot be sold," Sadeq says stiffly. Then, a moment later: "My apologies, please accept that while I mean no insult. I merely mean that while you say your goal is to provide the rule of Law, what you *sell* is and must be something different. Justice without God, sold to the highest bidder, is not justice."

The queen nods. "Leaving aside the mention of God, I agree: I can't sell it. But I can sell participation in a just system. And this new frontier really is a lot smaller than anyone expected, isn't it? Our bodies may take months to travel between worlds, but our disputes and arguments take seconds or minutes. As long as everybody agrees to abide by my arbitration, physical enforcement can wait until they're close enough to touch. And everybody *does* agree that my legal framework is easier to comply with, better adjusted to space, than any earthbound one." A note of steel creeps into her voice, challenging: her halo brightens, tickling a reactive glow from the walls of the throne room.

*Five billion inputs or more*, Sadeq marvels: the crown is an engineering marvel, even though most of its mass is buried in the walls and floor of this huge construct. "There is law revealed by the Prophet, peace be unto him, and there is Law that we can establish by analyzing his intentions. There are other forms of law by which humans live, and various interpretations of the law of God even among those who study his works. How, in the absence of the word of the Prophet, can you provide a moral compass?"

"Hmm." She taps her fingers on the arm of her throne, and Sadeq's heart freezes. He's heard the stories from the claim-jumpers and boardroom bandits, from the greenmail experts with their roots in the earthbound jurisdictions that have made such a hash of arbitration here: how she can experience a year in a minute, rip your memories out through your cortical implants and make you relive your worst mistakes in her nightmarishly powerful simulation system. She is the *queen* — the first individual to get her hands on so much mass and energy that she could pull ahead of the curve of binding technology, and the first to set up her own jurisdiction and rule certain experiments to be legal so that she could make use of the mass/energy intersection. She has *force majeure* — even the

Pentagon's infowarriors respect the Ring Imperium's firewall. In fact, the body sitting in the throne opposite him probably contains only a fraction of her identity; she's by no means the first upload or partial, but she's the first-gust front of the storm of power that will arrive when the arrogant ones achieve their goal of dismantling the planets and turning dumb and uninhabited mass into brains throughout the observable reaches of the universe. And he's just questioned the rectitude of her vision.

The queen's lips twitch. Then they curl into a wide, carnivorous grin. Behind her, the cat sits up and stretches, then stares at Sadeq through narrowed eyes.

"You know, that's the first time in *weeks* that anyone has told me I'm full of shit. You haven't been talking to my mother again, have you?"

It's Sadeq's turn to shrug, uncomfortably. "I have prepared a judgment," he says slowly.

"Ah." Amber rotates the huge diamond ring around her finger, seemingly unaware. It is Amber that looks him in the eye, a trifle nervously. Although what he could possibly *do* to make her comply with any decree —

"Her motive is polluted," Sadeq says shortly.

"Does that mean what I think it does?" she asks.

Sadeq breathes deeply again. "Yes."

Her smile returns. "And is that the end of it?" she asks.

He raises a dark eyebrow. "Only if you can prove to me that you can have a conscience in the absence of divine revelation."

Her reaction catches him by surprise. "Oh, sure. That's the next part of the program. Obtaining divine revelations."

"What? From the aliens?"

The cat, claws extended, delicately picks its way down to her lap and waits to be held and stroked. It never once takes its eyes off him. "Where else?" she asks. "Doctor, I didn't get the Franklin trust to loan me the wherewithal to build this castle just in return for some legal paperwork. We've known for years that there's a whole alien packet-switching network out there and we're just getting spillover from some of their routes: it turns out there's a node not far away from here, in real space. Helium three, separate jurisdictions, heavy industrialization on Io — there is a *purpose* to all this activity."

Sadeq licks his suddenly dry lips. "You're going to narrowcast a reply?"

"No, much better than that: we're going to *visit* them. Cut the delay cycle down to realtime. We came here to build a ship and recruit a crew, even if we have to cannibalize the whole of Jupiter system to pay for the exercise."

The cat yawns, then fixes him with a thousand-yard stare. "This stupid girl wants to bring her *conscience* along to a meeting with something so smart it might as well be a god," it says, "and you're it. There's a slot open for the post of ship's theologian. I don't suppose I can convince you to turn the offer down?"