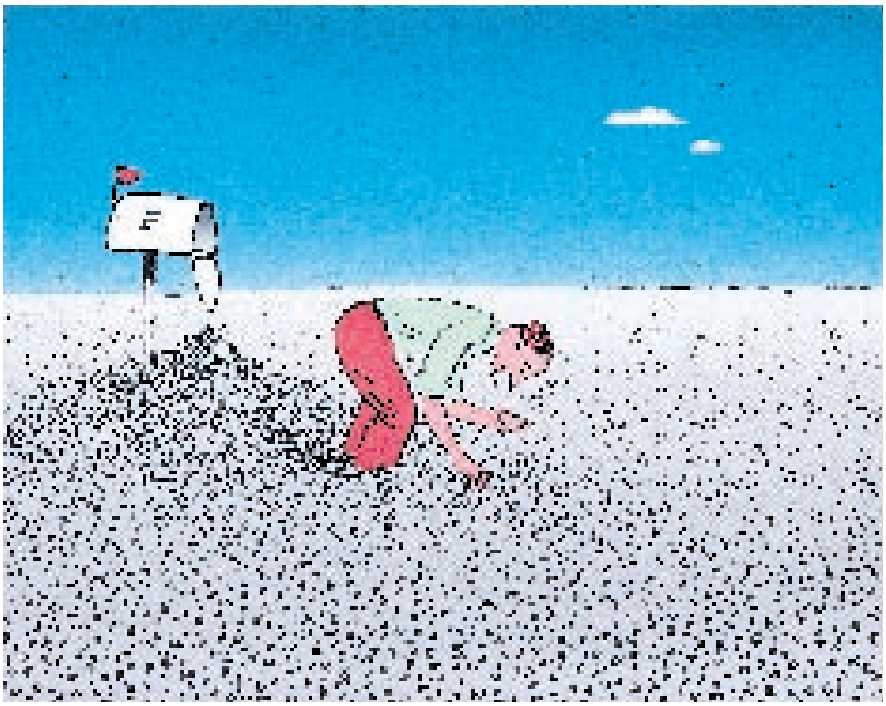


GUY BILLOUT

OUR FAR-FLUNG CORRESPONDENTS

YOUR MAIL HAS VANISHED

What happens to the messages you never got?

BY MICHAEL SPECTER

NOT long ago, I sent an E-mail to a friend of mine who works at *The New Yorker.* There was nothing unusual about that; I send a lot of E-mail. But this message never got to him. Somewhere between my desk, in Rome, and his, in Manhattan, the note disappeared—vanishing among the millions of similarly unimportant messages that must have crossed the Atlantic that day. Most people seem to accept those periodic losses as part of a cyberian life. I assumed that my friend had somehow overlooked my note, but he swore the message wasn't there. So I retrieved my copy from the "Sent Items" folder and sent it again. I also wrote to two other people with "newyorker.com" in their addresses. This time, everyone had received the mail when I called to check, less than five minutes later.

How could that be? How could some of my messages navigate through thousands of miles of cables—across a continent, beneath an ocean, around the East Coast of the United States (with, as it turned out, a regular detour to Illinois)—plow into the intense electronic maze of New York City, switch from my Internet service to their Internet service, and then pop up on several desktops simultaneously about fourteen seconds later? More important, how could that other message have failed to do the same thing? Was it out there coursing hopelessly through the ether, or had it broken apart into thousands of meaningless bytes—like one of those rockets that reënter the atmosphere at slightly the wrong trajectory?

I take E-mail very seriously, and, judging by just about any statistic you wish to consider, I am not alone. In the first quarter of this year—just three months—fifty-seven million new E-mail boxes appeared on the planet, bringing the total to nearly four hundred million. The United States accounts for about sixty per cent of them, but the figures everywhere are growing so fast that it's hard for anybody to keep track. Not every American has an E-mail address, of course. Some people have several, and many of the other addresses are corporate mailboxes. Still, every survey—and there have been dozens—shows that E-mail is by far the most frequently used and highly prized feature of the Internet. Not eBay, or MP3s, or the card catalogue at your local library. Not even pornography. Just mail.

No technology has ever become so ubiquitous so fast. It took the telephone forty years to reach its first ten million customers; fax machines were adopted that widely in less than half the time. Personal computers made it to ten million American homes within five years after they were introduced, in 1981, but E-mail reached that many users in little more than a year. In fact, in 1995, the amount of electronic mail delivered in the United States surpassed the amount of "snail" mail printed on paper and handled by the United States Postal Service. Among those few people who noticed were worried postal officials; recent predictions suggest that the volume of first-class mail delivered in the United States will peak in 2002. After that, the trend lines all point seriously in the wrong direction. It is impossible to predict how many of America's 38,019 post offices will be around in a decade, but, unless the Postal Service manages to ship a large percentage of all future purchases made on the Internet, the number certainly isn't going to be anywhere near thirty-eight thousand. So E-mail matters.

But when something matters, it has to be reliable—like the telephone. That's one reason that the lost message bothered me so much. I decided to call the people who maintain the computer networks at *The New Yorker* and try to find out what happened. They told me that the servers in the building—the central computers that hold the mail when it comes in and act essentially as local electronic post offices—had been working without any problem that day. Then I called their counterparts at Condé Nast, whose servers control *The New Yorker's* servers. Nothing was wrong there, either.

That suggested the trouble had to lie in the only other link in the electronic chain—my Internet service provider, the I.B.M. Global Network. I called the local support number in Rome, pushed a button that meant I would prefer to

get my help in English, and was immediately connected to a woman in Dublin who told me very gently that my message was gone for good. She was polite, but she clearly thought I was worth about thirty seconds of her time, especially after I admitted that I had kept a copy of the original message, that it wasn't important in the first place, and that the second time I sent it the message got where it was going without delay. She laughed, obviously having encountered people like me before. "I can't imagine what your problem is then, sir," she said in a rich, untroubled brogue. "There is nothing wrong with our system today. Nothing wrong anywhere in the world. Sometimes these things just happen and they can't be explained. I suggest you chalk it up to fate."

I DON'T believe in fate; I believe in technology. So I decided to continue the search. I wasn't optimistic about the prospects of finding my message, but I wanted to know how something can simply disappear into a telephone wire and never come out again. It soon became clear that the next place I would have to look was Schaumburg, Illinois. Schaumburg, about fifteen miles from Chicago, is the home of A.T. & T. Global Network Services. I.B.M. sold Global Network Services to A.T. & T. last year, because A.T. & T. is in the bandwidth business—the pipelines that connect the dot-coms on the Internet—and I.B.M. is not. A.T. & T. is now doubling its bandwidth capacity every six months, as are most of its biggest competitors. All over America, scientists are scrambling to find ways to cram ever more light—and therefore more data—into the roughly ten million miles of fibre-optic cable tunnelling through the nation.

It took me a few days to find anybody willing to discuss my problem. (A.T. & T. was skittish, no doubt, because pointless allegorical quests don't interest the company much.) Still, the people there said they were willing to show me how the system works. So, before long, I found myself in suburban Illinois, standing in a giant parking lot and staring at a thoroughly unremarkable eleven-story office building. All around me, hundreds of tons of late-model S.U.V.s were whizzing along I-90, toward O'Hare International Airport.

I told Nancy Smith, who handles public relations for A.T. & T., that I wanted to see where my mail was stored and how it got there. She was incredibly helpful, but, before she said a word, I think I heard her sigh. She told me straight off that you can never fully trace a lost E-mail; it's hard enough to trace mail that gets where it's supposed to go. She also said that people often imagine giant E-mail depots to be the modern equivalent of the great public-works projects of earlier eras—like the Grand Coulee Dam, for example. "I know what you are expecting to see," Smith had told me before I set off. "You won't find it. It sounds very dramatic, but it's not. There is actually very little there. Some boxes and wires really. You could be disappointed."

I didn't think so. My visions ran more toward the control room at Cape

Canaveral. I imagined a place full of technicians determined to orchestrate the flow of the world's E-mail as it pulsed through enough fibre-optic cable to strangle the earth. It wasn't such an irrational thought. The economic and technical realities of this virtual world are like those of no place that has ever existed: they really do seem to be greater than the sum of their parts (as anyone who has invested in the E-stock market may have noticed). Now that A.T. & T. owns the I.B.M. Internet service, it has two and a half million customers in fifty-two countries. There are about six thousand five hundred such Internet service providers in the United States. Many of them are little local services, and others, like EarthLink, which recently merged with MindSpring, are growing rapidly. Even the surprisingly insignificant Microsoft network has been on a roll in the past six months. But only America Online, which dwarfs all its competitors, with more than twenty million members, is bigger than A.T. & T.

EVERY piece of mail sent to an attglobal.net address—whether the owner of the mailbox lives in Vladivostok or Paris or Shaker Heights—makes at least a quick stop at a postbox in Schaumburg, and it sits there until it's collected through one of about thirteen hundred and fifty local phone numbers that A.T. & T. maintains for that purpose. I have moved around often in the five years since first signing on with I.B.M., and I was curious to see my server. I knew, of course, that it's just a hard drive, a small chunk of magnetized metal that I share with about a quarter of a million people, none of whom I will ever meet. But that's a little like saying that my American Express card is just a little piece of plastic. That server is a pulpit, a launchpad, and the communal hub of my life. Whether I'm in Moscow or Miami, or anyplace between, my principal connection to the rest of the world sits on a metal rack in Schaumburg. The thought that every piece of E-mail I have received since 1995 had to pass through this one building left me feeling a little woozy.

When I got there, I was going to have the opportunity to become one of the few Americans ever to visit their POP server—the computer that stores

your mail when you are not connected to the Internet. POP stands for "post office protocol," and the server, in this case, runs a software package designed to handle E-mail. Once you sign on, your E-mail program asks the server to deliver your mail, and under normal circumstances the mail is then taken from the server's hard drive and forwarded directly to wherever you happen to be.

Nancy Smith had also promised to gather some specialists for my benefit. One of them was Rick Gretsch, an affable man who helped launch the I.B.M. Internet Connection Service, and is still in charge of the team, although he was traded—along with the wires, the cables, the servers, and several thousand of his colleagues—to A.T. & T. in the sale, last April. When I arrived at his office, Gretsch told me, "E-mail isn't as different from regular mail as people think. You have a message you want to send, it has an address, and we are carriers whose job it is to figure out how to get it from one place to the next."

Sounds simple enough. But in fact the complexities of E-mail are vast, and, other than being undeterred by rain, sleet, or dark of night, it has little in common with traditional correspondence. First, when you send a message by E-mail—whether it's headed toward a computer a mile away or one on the other side of the world—the mail gets chopped into digestible pieces of data, called packets, which are easier to push through crowded phone lines and easier to recover. During times of real congestion, each packet can take a different route to the same place—it's as if every page in a letter were delivered by a separate mailman. But each packet is assigned a unique identification number by standard Internet software, and when the packets arrive at their destination they are stitched back together and delivered in their original form. If they don't get back together, they don't get delivered. That's one reason some messages arrive so quickly, others take a while, and a few never make it at all.

Obviously, nobody can sit around and "figure out" electronic mail routes when a message sent from Rome usually takes less than a minute to get to New York. In that time, if you use A.T. & T., the message will typically pass through the company's network hubs in Milan, Berlin, Southern England, suburban Maryland, and two or three places in New York. The decisions have all been programmed into computer software that can send a piece of mail by the quickest, or cheapest, or most efficient, route. (And no, the quickest or cheapest way is not always the most efficient.) The route can be quite simple or astonishingly indirect.

Essentially, all Internet E-mail today follows a protocol—a kind of electronic recipe—called S.M.T.P., which stands for "simple mail transfer protocol." S.M.T.P. has become standard in just the way the basic engineering for a microwave oven or a VCR is now universal. Whether you are using Eudora or Netscape Mail or Microsoft Outlook, it's really just all S.M.T.P. under the covers, governing how the mail gets routed from place to place. And, as the E-mail travels from source to destination, it leaves a little trace of itself—

like a few electronic bread crumbs—everywhere it goes. That puts a record at each stop along the way, a detail that is stored in a "header" at the front of the E-mail. Those headers often get long and technical, so most E-mail programs or Internet service providers strip them off or hide them from the recipient. They are not often missed; after all, does anybody send a package of cookies to a child at camp and then wonder which roads it travelled to get there?

For the adventurous, there is a program called traceroute, which can be run in a DOS window. If I run a trace on the route of an E-mail I sent to a friend in the Hamptons, I can watch it bounce along from city to city until it switches to what seems to be a local A.O.L. server in New York. This particular trip took about seven seconds. Most are shorter. Here is an E-mail I received from Brian E. Carpenter, who is the chairman of the Internet Architecture Board and the program director for I.B.M.'s Internet Standards & Technology. He was trying to explain how a message he sent found its way to my computer:

Michael,
If I look up "newyorker.com" in the Domain Name System, I find that SMTP mail for newyorker.com is to be sent to a machine called cnpsm.condenast.com. So then I logged into a Unix machine at the I.B.M. Hursley lab in England and typed

traceroute cnpsm.condenast.com

and Unix replies thus:

traceroute to cnpsm.condenast.com (204.252.201.4), 30 hops max, 40 byte packets

1 hurroute (9.20.4.7) 2 ms * *

2 mersey (9.20.62.10) 3 ms 3 ms 2 ms

3 efw (194.196.110.1) 11 ms 4 ms 4 ms

4 ign-gw (195.212.14.225) 6 ms 5 ms 6 ms

5 port1br1-1-5-1.pt.uk.ibm.net (152.158.23.250) 34 ms 62 ms 47 ms

6 port1br3-10-1-0.pt.uk.ibm.net (152.158.23.27) 267 ms 171 ms 133 ms

7 nyor1ar1-0-7.ny.us.ibm.net (165.87.140.6) 146 ms 124 ms 136 ms

8 nyor1sr2-10-0-0.ny.us.ibm.net (165.87.28.117) 144 ms 117 ms 149 ms

9 nyc-uunet.ny.us.ibm.net (165.87.220.13) 161 ms 134 ms 143 ms

10 105.ATM2-0.XR2.NYC1.ALTER.NET (146.188.177.158) 164 ms 123 ms 142 ms

11 294.ATM6-0.XR2.NYC4.ALTER.NET (146.188.178.106) 142 ms 145 ms 162 ms

12 188.ATM9-0-0.GW2.NYC4.ALTER.NET (146.188.178.141) 134 ms 147 ms 150 ms

13 cnprouter.condenast.com (204.252.200.33) 152 ms 165 ms 165 ms

14 * * *

15 * * *

16 * * *

What this tells me is that the routing is through three routers at IBM Hursley, then #4 is a quick hop across the IBM Global Network (which IBM recently sold to ATT), then there are five hops across IBM.NET and three hops across Alternet, which must be the Internet service provider used by Condé Nast. After that, we get a bunch of asterisks, which tells me that Condé Nast is hiding its internal network layout from my prying eyes. That's a common security precaution. The figures such as "152 ms" are round-trip times in milliseconds (measured three times).

In Schaumburg, Gretsch and several of his colleagues explained things while we sat in a conference room, eating a techno lunch: bananas, double-chocolate-chip cookies, and Diet Cokes. They told me that every router on the Internet constantly sends out messages that measure which paths are open and which are backed up, so that it can move traffic efficiently. (A router is a special device that determines the next place on the Internet to send a packet of data.) It's like the Rapid Transit Operations Command Center of the New York subway system. Traffic can often be diverted, held up, or rerouted to avoid delays on a busy trunk route. (In fact, when the World Trade Center was bombed, in 1993, the folks at Schaumburg—who were routinely monitoring the activity of several major customers in Manhattan at the time—noticed that something was amiss in the building even before one of their most important World Trade Center clients did.) After we talked for a while, Gretsch took me to see where my mail was kept.

THE United States government won't describe in detail how it protects NORAD missile silos. It's difficult to believe, though, that they are defended more vigorously than the five A.T. & T. servers in Schaumburg. "We run an entirely secure worldwide business out of this one building," Gretsch told me as we started our tour. There was some discussion about whether I could identify the building that houses the servers. The A.T. & T. people were nervous, but, recognizing that the information is already publicly available, they decided that I could at least mention the town. "People need to know that their E-mail will be there tomorrow," Sid Overbey, a vice-president in charge of Internet-access services, told me. "We have done everything possible to make certain it will be, no matter what tomorrow brings. A nuclear blast would take us out, of course. But we are as close to a hardened missile site as you can get without being built into the side of a mountain."

Sound like an exaggeration? I certainly thought so. But the five A.T. & T. servers, which together cost about a million dollars and carry between seven and ten million of the Internet's estimated three billion pieces of mail each day, are accessible to fewer than a dozen

people, each of whom has the coded ID needed to gain entry to the server room. (By contrast, the United States Postal Service would require thousands of employees to carry, sort, store, direct, and deliver those ten million pieces of mail each day.) The walls of the server room are made of the latest fireproof resins, and beneath the floor is a reservoir of halon, the best fire-suppression system commercially available. All this for five POP servers. (Mine is POP 6, but No. 2 was taken out of service a couple of years ago.)

The company has arranged to receive half its electricity from the city of Schaumburg and half from a neighboring town; that way, if one loses power, the building should be able to rely on the other. Besides the fire-detection systems, and the fact that the servers are backed up every week, A.T. & T. has fortified its Internet facility as well as any survivalist awaiting Armageddon. In the basement (the cleanest industrial space I have ever seen), scores of giant batteries fill a room the size of a cafeteria—to power the building in case of a blackout. Four times each month, the technical-support team cuts the building off from both utilities to make sure that the batteries can do their job. But, even if they should fail, not to worry: there are still four two-thousand-kilowatt diesel engines in the basement. They are always fuelled up and ready to take over within forty-five seconds. And, should things get really rocky out there, the company has buried thirty thousand gallons of additional diesel fuel in a secret location within easy reach of the turbines. It's a fair guess that, no matter what happens at the millennium, if there is a world on January 1st, then A.T. & T. customers will get their mail. The people at Schaumburg have decided that on December 31st they will switch to diesel power for at least a day or two, just to be on the safe side.

The servers are kept in a clean white room full of hard drives sitting in metal racks. The only colors one sees are from the red, blue, and green fibre-optic cords snaking around the floor. Nothing moves. There is no clock. In a way, Nancy Smith was right: the room is small, and is filled with wires, cables, and computers. It's a boring little room, but one of those metal boxes was la-

belled "POP. 6." It took me a few seconds to realize that I was staring at my server. "There's your mail," Mike Cassidy, an official who was on the tour with us, said slyly, eager to see how I would react. "Isn't it thrilling?"

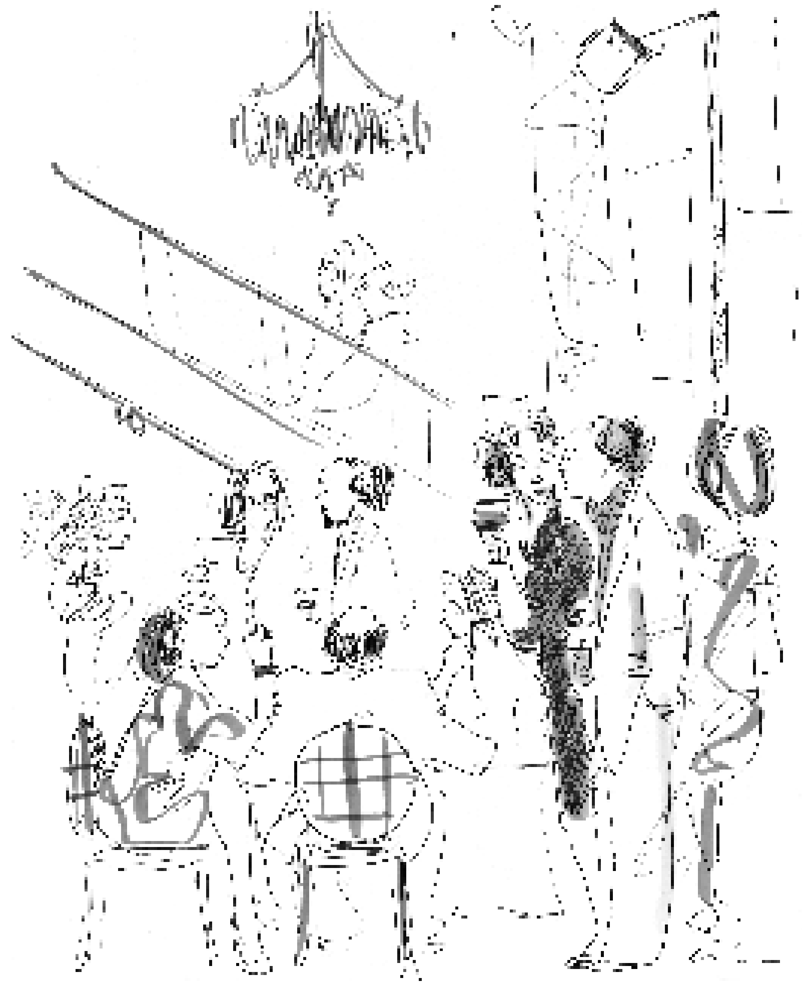
It was, actually, but I can't say why. By this time, I had abandoned my quest for the vanished E-mail I sent a month earlier. As Gretsch explained it, one of my packets might have been corrupted, or a telephone switch might have failed, and that would have shattered the whole piece of mail. Or it could have been destroyed at any one of the intermediate stops it had to make on its journey to New York. And that was clearly as close to an inquest or a corpse as I was going to get.

ONE day this fall, I was having lunch with David Singer, who has worked on the central structure of the Internet and has thought about the basic uses of E-mail since long before either existed in the public mind. Singer is a senior software engineer with the Internet Technology group, at I.B.M.; we were in the cafeteria at I.B.M.'s Almaden Research Center, gazing out at the rich brown scrublands above Silicon Valley.

"You know, this whole revolution was a bit of a fluke, really," Singer said. "We built a network at I.B.M. for file delivery. That was our goal. We wanted to make virtual files out of these giant bundles of punched cards we had. It was a way of moving the cards, and when we did that we realized we could also send messages to each other. Pretty soon it became the point. Then it became more than the point. But we aren't even halfway to where we are going. E-mail is impoverished. It has flaws; there is no tone of voice with E-mail. No subtlety and certainly no privacy. E-mail is postcards, not letters. It's a CB radio. It's primitive and raw, and if somebody wants to listen in he will. Yet the energy it has unleashed is hard to describe. It has already changed everything we do and changed it for good."

Singer believes in the Web completely, but, unlike some of his contemporaries, he is also willing to express ambivalence about the world he is helping to create. "The 24/7 society is wonderful as long as you are not required to be there all 24/7," he told me. "That is one of the things E-mail does for you. It lets you choose terms for communicating. I love the idea that I can get a prescription filled or buy a book at three in the morning. But I am very annoyed at the sense that I could be on call at those hours. I want my privacy, but at the same time I want total access. That is what E-mail gives you. That's where the revolution is."

It is sometimes hard to assess all the claims made for E-mail: that it has contributed to a renaissance in written communication, that it changes the way people relate to one another or think about time, that it eliminates hierarchies that have existed, literally, for centuries. Too often, it seems caught in some middle space—not quite writing, yet more than typing. It is a medium where you are permitted to use words in a way you wouldn't anywhere else. It is easy to be snobby about



"All these people you invited—are they friends or just inventory?"

E-mail; but for many people the words "You've got mail" have become among the most comforting they can hear all day.

In Sylvia Brownrigg's novel "The Metaphysical Touch," the main character, Pi, is a deeply troubled philosopher who loses her books and all her work in the fire that ravaged Berkeley in 1991. Her mind, formed by words and contemplation, goes dark. She won't read or write or think about her past in any way. She is on the run from her intellect. Then, one day, a modem arrives in the mail:

> But Pi's asceticism didn't know what to make of e-mail. E-mail seemed permissible to her. It was quiet; it didn't require immediate response, as a voice on the telephone did; it was in her familiar medium, print, so it emerged though the loved language of her fingertips. But it didn't require a physical body of print on paper. Ontologically, e-mail was not in any recognizable category: neither voice nor paper, neither pure mind nor pure matter. And uncategorizable items often make it past regulations that don't know how to understand them. Pi's edict might have been to stay out of touch, but when she read her two pieces of e-mail she replied to them instantly.

It is, after all, almost impossible to turn away from E-mail—and that is not always a good thing. "All this technology is wonderful," David Singer said over lunch that day. "But only up to a point. It is not supposed to replace human relationships. It's just supposed to make them easier. People sometimes get confused about that, I'm afraid." ♦

California Shakespeare Festival's "The Tempest" is onstage at 7 p.m. at the Bruns Memorial Amphitheatre in Orinda. The Duke of Milan has been ousted from his position of power by his brother and exiled, along with his daughter, to an island. Years later, he uses magic to shipwreck his brother on that same island. To get there, take the Gateway Boulevard exit off Highway 24.—*Oakland (Calif.) Tribune.*

But watch out for Caliban.