

## Digit Treats a Deadly Virus

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“Ah-chew! How much dust can a computer have inside it,” I wonder out loud, “and still run?” There are about a dozen PCs here in the Math room, and my job is to connect them all together into a network. I just installed the last interface card and I’m going to plug in all these cables just as soon as I stop sneezing!

Mr. Paulson, my Math teacher, got a big fat grant to upgrade the Computer Lab, as it’s now called. Tomorrow he’ll configure the network software and add more memory to each of the older PCs. He had to attend a faculty meeting, so he asked me to try wiring the network by myself.

The computer store had all the interface cards and cables we needed, but we had to order a new 16-port, Gigabit *switch* for our computer network; it came in yesterday. The network interfaces in our old computers are slower than the new switch, so we added faster interface cards to the old computers. You plug one end of a cable into each computer’s card and the other end into a port on the switch. It couldn’t be much simpler. We’ll have a gigabit network when we’re done – that’s over a billion bits per second!

Our new tower computer has 4 gigabytes of memory, two huge hard drives, and a tape drive for backups. It’s going to be configured as a combination file server and network firewall. When all of our applications and files are stored on the file server, anyone on the network will be able use them, the applications will be easy to upgrade, and all of the files can be backed up to tape each night. Best of all, the firewall is going to support a high speed Internet connection that all of our PCs can share. And when we add a wireless access point I can use my laptop, too!

There are millions of Internet users at any given moment and they are all interconnected, so anyone can potentially access anyone else’s computer. Our server will have a unique

Internet Protocol, or IP address, that is available to anyone. Each of the old computers, however, will have an internal IP address known only to the firewall. The firewall uses NAT (whatever that means!) to isolate our network computers from the outside world. All this network security stuff can be really confusing. I don't understand much of it yet, but I'm learning...

I understand now, for example, that our setup at home is not that different. Dad's desktop computer connects directly to a WiFi router, which contains a firewall and a switch. My laptop has a wireless connection to the router that puts it on the same network as Dad's desktop computer. Our WiFi controller is a combination router, firewall, and switch that sits between our two computers and the Internet, just like the tower computer at school.

"There," I say proudly, "that's the last cable and they're all in a nice neat bundle. I'm out of here!"

I can't believe that it's four o'clock already! I grab my books and head out into the deserted hallway. This building has a *solid* feel to it. The walls are blocks, but with a smooth surface of some kind. The overhead hanging lamps are cast metal, made to look like wrought iron antiques, and the floors are all large, dark linoleum tiles. What little warmth it has comes from the wood frames around the doors, and the ornate paneling inside the classrooms and offices. After 50 years and a dozen coats of varnish, wood takes on the color of a warm, dark liquid with a bitter-sweet smell, like exotic coffee.

At the bus stop, a lingering chill in the air robs me of any warm feeling I might cling to, and I believe that it's better to suppress the effect that a city bus has on one's senses.

When I get home, Dad is typing furiously on the computer and has the phone clamped between his ear and his shoulder. He manages a nod in my direction in response to my hello – a risky gesture, I think, but it's appreciated. Dad takes time for me; he's a good father and an all around pretty cool guy.

I look in the freezer and find only one frozen dinner. He's off the phone now, but still typing. "Are we going out to eat tonight?" I ask.

"Sure, if you want to. I need to finish up here first. Give me a minute, okay?"

I toss my book bag onto the counter on the way to my room to check for email on my laptop and text messages on my Sidekick. I've got lots of messages, but nothing that can't wait till tomorrow.

I head back to the living room. "What's up that's got you so busy?"

"This is a *really* important case," he says. "I have to get as much information as I can before I come to any conclusions about this guy."

"What guy," I ask.

"Ever hear of Nick 'the Stick' Malone?"

"Are you serious?! He's involved in an insurance scam?" Dad's a private investigator, specializing in insurance fraud. Malone is a notorious mob boss and not too likely to need insurance with all those goons around him, I think, smiling to myself.

"Not directly. The Feds are trying to get him into court to face murder charges. They say he ordered execution-style killings of high ranking members of a rival gang, but he keeps getting continuances on his court date for medical reasons. His attorneys say he fell off a ladder, and that he's heavily medicated and in a lot of pain. The Feds think he's stalling long enough to figure out who their eye-witness is, and do him in before he gets to court. The whole case depends on that witness."

“So where do you come in?”

“Well, and this is not for publication, Malone’s attorneys have a pile of paperwork in support of his medical condition. They’ve got emergency room visits and examination records from several doctors, including a chiropractor. Here’s the best part: he’s made several claims on a medical insurance policy,” Dad says smiling broadly. “Assuming he’s faking all of this, we can prosecute this guy for insurance fraud we can put him away just like they did to Capone.”

Wow, I think to myself. Al Capone was a big time Chicago mob boss who was accused of similar crimes back in the 1920s. They could never convict him on any of them, but they finally got him through one of his accountants, for tax evasion! If Dad can find evidence of fraud, they can at least get this guy off the streets. That should slow him down long enough to convict him on the murder charges and, hopefully put him away forever.

“Frank is heading up the local team.” Frank was Dad’s old partner when he was a cop. “He got me copies of all the medical claims data, and I’m doing a follow-up on each of his visits. I’m hoping to find a time and date when we can prove he was some place other than the ER or the doctor’s office he claimed to be.”

“Please be careful, Dad,” I say. “These people are pretty scary.”

“Don’t worry. Frank has my involvement pretty well under wraps: I’m working for the insurance company, not the cops, and I am an *invisible* subcontractor who reports directly to one of their investigative agents.”

I had a hard time sleeping that night, worrying about Dad’s involvement with a bunch of ruthless killers. I trust Frank, but the mob has a lot of resources who are, shall we say, highly motivated to prevent people from getting too close to the truth!

Next morning I wave goodbye to Dad, still hunched over the computer. I hope he got at least *some* sleep last night, but I know enough to just leave him be when he gets focused on a case. It's what makes him good at what he does. Dad motions to me as I reach for the door. "This is ironic," he says. "I've been focusing on where Malone was when he claimed to be with a doctor, but the key to all this is where his doctor was at the time! Frank and I are going to see this doctor this morning, so I'll be out most of the day."

At school I spot Mr. Paulson in the hall. "Hi," I wave. He pauses to tell me he's got a meeting to go to, but he'll meet me later this afternoon, in the Lab. He's a great guy, and it's fun to see him get so excited about this new opportunity.

Later I watch carefully over his shoulder as he configures the network software on each of the old computers, assigning them each an address. "These are internal addresses," he explains, "from a special range of non-routable numbers. That means you can't connect to them from the Internet, and that keeps the bad guys out."

"So how can they connect to a Web site," I wonder aloud.

"Good question! The firewall uses NAT, or native address translation," he explains.

"When one of our network computers connects to a Web site, the firewall forwards the connection request with its own IP address, but it remembers which internal computer is associated with that session. When the response arrives it is addressed to the firewall, which forwards it to the internal computer. The firewall acts as a proxy, or *middleman* between each of our older PCs and the Internet," he explains, but I'm not sure that I follow all of it.

"So nobody knows about our internal computers except the firewall. Is that right?"

“Yep, you got it. And the firewall protects itself by being fussy about what kinds of connections and packets that it will respond to and accept.”

“Hiding a dozen computers is a lot of work,” he continues, “but this new tower computer can handle all that and more. A firewall is a very complex piece of software. I’m still trying to figure out how to set it up properly. I’ll give you a demonstration when I get it all working.”

Mr. Paulson is a smart man. He could earn three times the salary that the high school pays him, but he really loves to teach. We need more like him – that’s for sure!

That morning, Dad and Frank enter the doctor’s office near the top floor a high rise building. It has lots of glass and warm colored wood paneling, and a sweeping view of the lake front. They pad across plush carpet through an otherwise empty waiting room. “I’m here to see Dr. Warren,” Frank said to the receptionist. “Do you have an appointment?” she asked. When he showed her his badge, she got up nervously and opened a door that said PRIVATE. Inside stood a tall, meticulously groomed man wearing a long white lab coat, with a stethoscope draped around his neck. He turned to look at them half way through a back swing on his executive putting green.

“What can I do for you gentlemen,” he asked smoothly, but with a wary expression on his face.

“I’m with the Chicago Police Department. We’re investigating a homicide case,” Frank said, closing the door behind them. “Is a Mr. Nick Malone under your care?”

“Why yes,” he said, stiffening slightly. “He suffered a fall a while back and is in a great deal of pain.”

“We read your report,” Frank said. “I’m more interested in *when* you treated him.”

He looked worried now as he strode toward his desk. “Miss Tallman,” he said into the intercom, “Bring me the Malone file.” She entered instantly and noiselessly, handing him the file. She turned and left, but not without careful scrutiny from Frank.

“She’s been with me a long time,” he said, breaking the silence. “Mr. Malone was in my office on August 25<sup>th</sup> and 28<sup>th</sup>, and again on September 3<sup>rd</sup>,” he stated cautiously, reading from the folder.

“But you weren’t?” Frank probed.

“Uh, well...” the doctor stammered.

Frank handed him a summary of Dad’s report which showed him presenting a paper at a conference on September 3<sup>rd</sup> in another state.

“There must be some mistake,” the doctor pleaded.

“Yes. I’d say so,” Frank told him. “Let’s continue this conversation downtown.”

“My patients...” he protested.

“Bring him along,” Frank said, handing him the golf ball. He was led out in handcuffs past the receptionist. Her mouth opened slightly, but she remained silent.

When they arrived at the Station, they confiscated the doctor’s shoe laces, belt, etc., and placed him in a holding cell – more intimidation than safety measure – just to let him sweat a while. After a quick sandwich across the street, they came back and had the

doctor transferred to a soundproof interrogation room; Dad stayed outside, listening to the intercom and watching his old partner at work through the one-way glass. Memories of past interrogations Dad and Frank had orchestrated began flooding back. Frank was a master at rattling even the toughest criminals, and this one broke in under a minute. The doctor was in tears when Frank came out of the room.

“You’ve always been a good *bad* cop,” Dad offered with a grin. “You certainly haven’t lost your touch!”

“I’m going to have a talk with the ADA,” Frank said. “I’ll let you know what kind of a deal we strike with this clown. Com’ on, I’ll give you a lift back home.”

When Dad got home he had an email waiting for him from the insurance company’s legal office. A split second after he opened it, he deeply regretted doing so. The disk *access* light came on solid and the screen froze. He desperately tried the control-alt-delete key combination to stop it, but it had no effect. He took in a quick breath and pulled the power plug out of the wall.

On my walk home from school it was hard not to think about the danger that Dad could be in. I’m really starting to worry about him. I see the computer screen blink out, just as I walk in the door. My hello doesn’t get past my lips. I freeze, staring at Dad on one knee with a cord in his hand and a very distraught expression on his face. “What...” I manage.

Dad drops the cord, gets up, and sits back down in his chair, wearily. “I got an email from the insurance company’s legal department. It said I would need these documents for my investigation. About the same time I double-clicked on that attachment, I realized that nobody in Legal knew my name, let alone my email address, but it was too late. Nothing was working but the disk drive access light – pulling the plug was all I could think of.”

“Wow. That move might have saved your bacon,” I offered. “Can I help?”

“Absolutely,” he said. “This looks serious and it’s way over my head. I sure hope you can get me out of this mess. I just created all these files and they’re the only copies I’ve got.”

“Dad,” I shook my head slowly. He knew better than to not take a backup copy, but I let that drop. He goes to the counter and pours himself a cup of coffee, though I suspect he’d prefer something else. (Dad always holds a coffee cup by the cup, not by the handle. He says if it’s too hot to hold, it’s too hot to drink.) He slumps into his easy chair so he can keep an eye on every move I make, while stay well out of my way. Good choice, I think.

I disconnect the Internet cable, plug the computer’s power cord back into the wall outlet, and read all the nasty messages as it refuses to boot. I try to bring it up in *safe* mode, but that doesn’t seem to work either. Halfway through presenting the desktop, it completely locks up again. I unplug it from the wall and smile at him, saying with mock confidence, “I’ve got another idea.”

“I’m very, very glad to hear that,” he says as I disappear into my room. I return with my laptop and a toolbox, and put them both on the counter.

I remove the monitor from Dad’s desktop, open the case, and undo some brackets to get at the hard drive. I take the disk into the kitchenette area and set it on the counter, next to my laptop. Next, I open the laptop. (This really gets Dad’s attention. He’s by me now, looking intently over my shoulder.) I disconnect the disk drive from my laptop, rearrange some tiny jumpers, add an extension cable, and motion approvingly at the pile of loosely connected components. “Observe,” I say with a flourish. (It all looks more like the robot repair shop in a science fiction movie, but I keep that observation to myself.)

When the laptop comes up, it recognizes Dad’s disk as drive F. I know I’ve got the latest antivirus definitions on my laptop because I updated everything this morning. (A high speed Internet connection makes it so easy that I configured it to update automatically. I sure don’t miss our old dial-up connection!) I start a virus scan of the F drive – Dad’s

drive – and we watch it run together. After several messages about corrupted file pointers the scan detects an infected file, and then another. I am disappointed when it refuses to disinfect or remove them, but I opt to *quarantine* them. I note the name of the virus it found, and Dad and I head over to the library. I'll get some detailed information on it, and hopefully a removal tool.

Much to my relief the antivirus software company's Web site has that particular virus featured on its home page, along with a link to download the removal tool! I am glad there is a fix available. And I am doubly pleased to discover that my flash drive just happened to be in my coat pocket. I didn't even think about bringing it along, though I certainly needed it. I download the tool and we head back to the car.

Home again, I plug the flash drive into my laptop, copy the removal tool onto my hard drive and turn it loose on my F drive, Dad's infected disk. After the requisite "Are you sure?" pop-ups, it finds and removes every one of the infected files that I quarantined after the virus scan. The *readme* file that came with the removal tool says it *attempts to destroy all files that are not currently in use*. We're not out of the woods yet...

I check my word processor's Help documents to figure out how to recover corrupted files. It looks simple enough: I start the utility, point it at Dad's case file folder, and let it chug along until all of his documents except one are completely recovered. It recovered most of that last one, and Dad thinks he can recreate the rest of it from Web sites he was at recently. We recover his spreadsheets using a similar tool. It's going to be a late night.

Finally, after all the files are recovered I open the *properties* menu for Dad's hard drive and start a check of its file system for errors. This takes a long time, but it completes normally. I shut down my laptop, disconnect everything, and reset the jumpers on both disk drives. I install Dad's drive back into the desktop, reattach the monitor, plug it back in and, lo and behold, it boots, but not without a few complaints.

“I think I’ll leave the Internet cable disconnected for a bit longer, if you don’t mind,” I suggest.

“You da man!” he teases, but I see true admiration in his eyes. It’s after eleven, now, but he says nothing about it being a school night, giving me his full confidence. I’ve got a really great father, I think to myself, and keep on working.

When I open his email Inbox, I detect a slight movement out of the corner of my eye. “I’m not going to open the email or its attachment,” I assure him. I believe I saw him blush, if just for a second, as I copy down the server’s IP. “I’ll follow up on this in the morning,” I say. “I’m going to bed now.” I close everything and shut down the desktop computer, reassemble my laptop, and head for my room.

A few minutes later, Dad comes in and sits on the bed. “That was a pretty impressive show, young lady. I hope you know how much I appreciate what you’ve done for me. I couldn’t begin to handle this kind of problem and I don’t know what I’m going to do without you!”

“Get some sleep, Dad,” I say as he leaves, closing the door behind him. I hardly remember my head hitting the pillow – what a night!

Next morning the late spring air is clear and brisk. I’m still pretty groggy, but I force myself to think about my next move. I was going to stop by Mr. Paulson’s office to see if he can help me, but I think this might be a job for TJ.

TJ (nobody seems to know what that stands for), is different from everyone else. Except for a faded penguin logo on his tee shirt, he dresses completely in black. Even his hair is dyed a shiny black, with a straight row of small, but obvious spikes. I don’t count him among my friends, but we respect each other’s skills, and I’m pretty sure that I need someone with his skills to help me solve *this* problem; I’ll look for him at lunch.

Later, after Math class, I head for the cafeteria. I spot TJ in a corner, hunched over his laptop, surfing the Internet through a hotspot operated by one of the coffee shops across the street. “Hi,” I say, interrupting.

He looks up briefly, then down again and continues typing. “What!”

I get right to the point: “My dad was sent an email with a VBS.LoveLetter attached.” (He stops typing.) “I’ve got the IP address and the server from the email headers.” (He looks up at me now.)

“Can I see that?” he asks, reaching for the note paper in my hand. I notice that he’s using Linux on his laptop. He clicks a box on the bottom of the screen and instantly has a fresh desktop – cool, I think to myself. He points a browser at an IP-to-Host translation site and it becomes very clear to me that I asked the right person about this.

TJ types in the IP address I gave him, and gets the server’s domain name, which he copies and pastes back into the browser. He looks up at me and says, “Your bad guys have a web site! That email came from an auto body repair shop on the south side.” He clicks on their *Contact Us* button, scrawls the company name, address, and phone number on my piece of paper, and hands it back to me. I watch carefully as he closes the browser, clicks on that box at the bottom again, and is immediately back working on the document he was typing when I first saw him. Note to self: Look into Linux!

“Thank you so much,” I say to him, but he neither responds nor looks up from his work.

When I got home from school that afternoon, Frank’s car was out front again. He brought along a uniformed police officer this time, and he’s questioning Dad.

“They’re trying to get some information from that infected email,” Frank explains to me.

“I just tracked down the source of that email,” I said, handing the piece of paper to Frank.

Screwing up his face to decipher the handwriting, he hands the paper to the officer.

“Have a look at this,” Frank tells him. He flips open his cell phone to make a quick call.

“I know this place,” he says to me as he heads out the door.

I explain what happened during my meeting with TJ to the officer, who seems to be a computer security specialist. When I told him how TJ tracked down the web server he made some notes of his own. I flushed a little when he smiled at me; all cops in uniform are hot, but this one, well...

That night I wake up hearing Dad’s voice, like he’s talking on the phone. I crack open my door a little and listen to his side of the conversation. He seems upset as he hangs up the phone. “Dial \*57 to put a trace on the call,” I offer, but as he picks it up again he says he needs to call Frank – an even better idea, I think.

He looks worried as we move into the kitchenette. “You’re a big girl now, and I’m not going to lie to you,” Dad says as I half sit on the stool next to him. “It was a death threat, and the caller made several references to my investigation. I want you to stay with your Aunt Marge for a while.”

“But I can help you, Dad. Please let me stay here. If somebody wants you dead, you must have gotten close to something important. I know some computer tricks even the police don’t know,” I offer.

“I trust you, but I’m afraid for your safety. I need to know exactly what they think I’m getting close to; maybe you *can* help me. Get some sleep and we’ll talk about this again in the morning.”

Dad is quiet during breakfast. Frank's knock on the door jolts us both out of our thoughts and Dad pours him a cup of coffee. "That email source Digit gave me brought back some unpleasant memories," Frank says. "I busted a chop shop at that same location just after you left the Force. I seemed to remember that the owner was distantly related to Malone through marriage. I drove over there with some of the boys and, sure enough, there he was, back in business."

"It's all legal now. We checked every VIN in the place. I think it's been reduced to a legitimate front for them now, but I can't be sure. I ordered a 24-hour stakeout on the place anyway; we'll see who goes in or out of there for a while."

Dad and Frank were still discussing strategy when I finally grabbed my book bag and headed out the door. "You're taking the bus this morning, young lady," Dad reminded me. "Yeah," I said and headed for the stop.

School was pretty uneventful, or maybe I just wasn't paying much attention to what went on around me. The hoped for text message from Dad never arrived and I was getting even more worried by the minute. I headed for the exit after my last class. I never even thought about the Lab.

When I got home from school Dad was already relaxed in his easy chair, cup in hand and reading the newspaper; quite a change from this morning! He filled me in on the details, and sounded relieved at how the day's events unfolded. This is much better, I thought, as the all too familiar knock interrupted our conversation. Frank came in, followed by the same uniformed cop he brought in a few days ago.

"That threatening phone call came from a pay phone half a block from the body shop," Frank explained, "and Malone's son-in-law left his prints all over it. The good doctor signed an affidavit and agreed to testify against Malone for his part in the insurance scam."

Given that evidence, the judge rescinded the latest continuance and the Feds got court date. Looks like Malone is finished!”

“And you, Miss Digit,” Frank continued, “Got any plans for the summer?”

“Not really,” I said, a little surprised by the question.

“It seems Chicago PD is looking for an intern. My boss and I put in letters of recommendation on your behalf this morning. Are you interested?”

“I’d be a cop?” I asked, which sounded like a really dumb question all of a sudden.

“In the Computer Security Lab,” Frank explained. “Meet your new boss.”

That uniformed cop stepped forward, smiled at me again, and offered me his hand. I stood there like a dope, frozen solid. “Wake me up,” was all I could think.