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Good afternoon Mr. Chairman and Members of the Subcommittee. Thanks for the opportunity to speak today. I am going to give an anecdotal account, and I will be followed by Alex LeVine, who will explain the technology behind the story. For the sake of brevity, let me get right into the details of September 11th. I was at work at our offices on Broadway and Wall St--which is adjacent to Trinity Church, 2 blocks south of the Twin Towers. I work for a wireless company, Upoc, Inc., which provides a platform for sending SMS Text Messages from any cell phone or PC to groups of cell phones, across all carriers and devices.

The morning of Sept 11th I was at work at 8.15 a.m. We had a client conference call, which I was on when the first plane went into the towers. Not knowing what was really going on, we continued the call until we heard a loud boom and our building shook. We ended the call and I immediately noticed my cell phone had been beeping with messages. The text messaging group that includes all Upoc employees was buzzing. One advised not to go to work, or to head away from the WTC if you'd started, another said that there was a plane through the WTC. I looked out our office window and saw people outside scurrying towards the bottom of the island. It was like a scene out of a movie, people were running, car alarms were going off and there was a sense of pandemonium. Uncertain of what was going on, I tried to look online, but websites were flooded and unreachable. Then I tried to use the phone--to no avail. Messages kept coming through and the 5 or us that were at work were discussing what we'd all been reading on our phones as well as any dribbles of info we'd found out on our own. At this point, we actually left the building to see if we could make sense of what was going on. None of us imagined we'd be targeted by terrorists and that our lives were in serious jeopardy. I tried to place a cell calls and then realized that everyone around me was plagued by "dead" cell phones; the lines at the pay phones were already 20 people deep. I returned to our office, thinking that amidst the chaos familiar shelter made some sense. In our wildest dreams we couldn't have imagined what would happen next.

Landlines and cells were inoperable. None of us knew what to do. We were, however, continually getting text messages. Within a few minutes, we'd accounted for who was at work and the people who were actively managing the group from various locations were accounting for all employees. Though I still couldn't believe planes had crashed into the towers, it was what my co-workers had told me, and even thought it was shocking, it was comforting to have information that I trusted. I remember specifically saying to a co-worker that terrorists knew

what to go for--clearly the WTC and the Pentagon were obvious targets. About 5 minutes later, an SMS came through about the Pentagon.

Just when we returned to our building, it began to shake and the plumes of smoke everyone saw billowing on TV were the reality outside our office windows. We all hit the ground and hoped that the old building would pull through. We ran for the hallway, though I paused to grab my purse and phone.

We were brought to the bottom of our building and were all text messaging other Upoc employees who could maybe phone our families and let them know we were ok. We continued to get updates. We eventually left our building to go eastward, only to be caught outside when the second tower fell. It again was hysteria, but we found another building and continued to console each other and be in touch with the rest of our co-workers as well as friends and family who were using text messaging. Personally, it was how I reached my fiancé. He was at Arlington hospital and they'd gone into disaster mode, meaning no outside lines were available. Since he seldom is allowed to use his phone inside hospitals, I expected it to be off, but it was my only chance. The text message reached him and I received my first text messages ever from him--he was thankful to hear I was Ok.

We all made it home ok and were glad to be away from downtown. Over the next week our text messaging was crucial to our work and well-being. Phones--cell and land--didn't work regularly for weeks, though text messaging continued to work. One co-worker was a volunteer with EMT and he let us know what was needed and what we could do. We accounted for everyone eventually and continued to be in touch while we all dealt individually with the impact in all our lives.

Alex LeVine

Introduction

Good afternoon Mr. Chairman and Members of the Subcommittee. The events of September 11th affected all of America, but those of us who work in the Wall Street area of downtown Manhattan were among the most impacted. I am honored to have this opportunity to relay to you my company's experience, and to detail some key technologies which withstood the attack, and which I believe could be leveraged in the future for more effective emergency management.

My company, Upoc, Inc., provides a platform for sending SMS Text Messages from any cell phone or PC to groups of cell phones, across all carriers and devices. The offices of Upoc, Inc. are located two blocks south of the WTC in New York City. As the planes hit, the first thing that happened was phone lines began to overload from people all around the world calling their friends and family in NYC to check on them. All the access tandems for long distance lines in the city began to fill up, and there

was no way to make calls in and out of the region, although local calls still worked. But as the events continued to unfold, saturation of phone lines increased--cell towers and local switches reached maximum voice capacity and stayed there, and people watching the conflagration couldn't make calls on their cell or office phones--there were simply no available lines.

Once the twin towers fell, things got even worse as Verizon's downtown switch got knocked out. Even more local landlines stopped working, as the switch served a large percentage of the lines in Manhattan. Cell phones worked rarely.

Later in the afternoon, as the Verizon headquarters began to fall over, power was turned off for the entire downtown region. This took out the cell towers downtown, as well as all office phones and email systems--all electrical communications that were not battery powered. Some buildings had backup generators, but as the power outage stretched into days, the generators ran out of fuel, and any systems based in lower Manhattan were taken totally out of commission.

The experience of the staff of Upoc was affected directly by these breakdown phases. After the first plane, we were in landline communications with each other, but the ability to get through got worse and worse. After the towers fell, the landlines were useless; in my home in Manhattan, the local Verizon switch was so overloaded that I couldn't even get a dialtone--it was as if everyone was picking up their phones at once, and there wasn't even enough bandwidth for a dialtone, let alone an actual call.

We immediately switched to other realtime or near realtime, non-voice communications. Before we were evacuated from the building, PC-based instant messenger and email were working well, as the internet connection to our office seemed to be holding up fine, even after the first building fell. The whole time, we also used our own technology to communicate via SMS text messages, in groups and one-to-one, on our cell phones.

Once we were evacuated, we used two key wireless technologies: RIM's Blackberry wireless email pagers, that are connected to our email systems, and Upoc's text messaging platform over SMS. Both worked perfectly, but once power went out to our building, the email servers on which the Blackberries depend shut down, and we stopped using them. At that point, SMS text messaging was all we had left, and we used it *almost exclusively* for communications between employees, family and friends for the next week, as phones lines still gave busies and our office remained off limits and without power.

Failures

Because of obvious dependencies on the physical infrastructure, anything in the downtown area requiring a wireline network connection or power was at risk of

failure. This means that everything from office phones and servers, to payphones and trading terminals, were unusable.

The inability to handle call load in the general voice telecom networks was due to systems that the telcos simply never built for such capacity. In fact, it would be financially unwise to build a voice network with the amount of overcapacity that would be required to support the Sept. 11th level of calls, since it is such a rare occurrence.

What Worked

The key communications technologies that continued functioning on 9/11 were based on 4 factors: 1) battery powered network devices like cell phones connected via 2) wireless links to 3) packet based redundant networks using resources on 4) remotely collocated servers. More detail on each of these 4 factors is in the written testimony [see the end of this document]. The Upoc application continued to work during the attack and aftermath because it leverages all of these factors. But it could not work without something called SMS.

Short Message Service, or SMS

Today, every digital cell phone in the US is capable of receiving SMS messages. These are up to 160 character text messages that travel across the same network as voice calls, but in a different channel. In Europe and parts of Asia, it has become extremely popular to send SMS messages between cell phones, but it has yet to really catch on in the US.

SMS runs over the SS7 layer of the telephony network. This is a packet-based, but non-internet, technology that handles tasks such as call set up and caller ID. Imagine, for example, when you get called on your cell phone: you see the caller ID of the person calling you. This is a tiny piece of data, delivered to your phone right when it first rings, over the SS7 layer. Once the Caller ID packet is delivered, you don't need to get any more packets, so you are no longer using any of the capacity of the SS7 portion of your carrier's cellular network. Once you pick up and start talking, you have grabbed a circuit on your carrier's network, and it is one of a limited number of circuits--if enough people in your cell tower coverage area are on their phones, no one else can receive or make any more calls, because all the voice lines are taken.

However, even when all the voice lines are taken, the SS7 packet-based portion is there, available to transmit packets to other cell phones in the coverage area, but more or less unused, as no new calls are coming in, so no Caller ID packets need to be delivered.

That SS7 bandwidth can be used to deliver text messages to phones, even when no

calls can be made, and it does so dependably. Even if a cell tower goes down, if your phone can get the tiniest bit of signal from another nearby tower--not even enough for you to make a call--the SMS text message can be delivered to your phone.

Upoc's platform takes the 1-to-1 aspects of SMS, and extends it to groups. One SMS message can be sent, from a cell phone, through Upoc's service and it can go out to a group of any size, reaching each group member on their cell phone wherever they are. It was our own technology that allowed us to track down all of our employees after the attack to confirm everyone was OK, and it allowed us to begin planning for temporary office space and coordinate employees immediately, even with all our office email and voice systems down.

Any wireless data based system will be the best bet for communications survival during an attack or catastrophe. Many cellular carriers are rolling out new wireless data networks now, called GPRS and CDMA 1XRTT, that will improve availability for packet-based, battery powered, wireless devices. However, these new devices have yet to be purchased in most cases. SMS is already on every digital cell phone, on every digital cellular network.

Conclusion

SMS is then an ideal transport for emergency messaging, available now. Cell phones are battery powered and wirelessly connected to a packet-based network that is sitting on a redundant core, speaking to a remote server. All the key factors for catastrophe survivability are in place.

However, there is not a very high level of awareness in the US about SMS Text Messaging. As Upoc's story shows, and as, I hope, the arguments I outlined explain, SMS was an invaluable communications tool in a very dire communications situation on and after September 11th. We believe that there is a need and an opportunity for the government, carriers, and messaging providers like Upoc, to make US citizens, 120 million of whom own cell phones, aware of this already existing technology. I would like to thank the subcommittee for this opportunity to discuss our experience, and I look forward to answering any questions you might have.

<u>Key factors</u>:

1. Batteries

   Sure it is obvious, but when the power goes out, you need communications to run on some sort of supplemental power. Although generators and uninterruptible power supplies kept servers running for

some time, they could only last for a brief period, as none of these things, in everywhere but the most emergency-oriented facilities, were supposed to keep systems running for a week. Servers and other machines designed to be plugged into wall outlets are rarely designed to conserve power effectively, and they drain batteries very quickly. They also tend to depend on physical wire connections to voice and data networks.

Cell phones and pagers are ideal devices when power is out, since they were designed from the start to run off batteries. They also work wirelessly. So they form the most straightforward foundation to any emergency communications planning.

2. Wireless links

Wireless links are a clear way to avoid having lines “cut” by explosions or attacks, since there are no lines to cut. However, cell towers can lose power or be destroyed, rendering the area around that tower incommunicado for the customers of that cellular provider. Since the core of wireless carriers' networks are generally redundant, if the tower does keep power it is generally going to continue providing service. Cell towers are then one of the most reliable communications points since they sit on redundant core networks and connect from there to cell phones through unseverable wireless links.

This is in contrast to wireline switches, which might still be running, but if their copper trunks are destroyed they have no one to provide service to: the core on which they sit might be redundant, but the clients they serve have only one point-to-point connection, which fails completely when severed.

Wireless data links have the most promise, since they do not suffer from the circuit-switched hard limit that cellular voice does.

3. Packet-Based Redundant Networks

Voice networks have a hard limit on the number of people that can use them at one time. This is because every voice call requires a full circuit to be opened between callers, and it is held open for the duration of the call--they are circuit-switched. If all lines going in and out of a region-say downtown Manhattan, or a long distance access tandem, or even a cellular base station-are in use, that's it: no more calls can be made.

Data networks work on the principle of packets. Data, like an email message, is broken into little pieces that are transmitted across a network in an almost arbitrary fashion and reconstituted at the other end;

as such, there isn't any hard limit on the number of messages or number of people served by a data network. Congestion can occur, and messages will arrive more slowly, but as long as the network remains intact, the message will get through. In the case of Sept. 11th, intact data networks rerouted their packets around the failed networks at WTC and essentially allowed continued operation throughout, so email and instant messages to New Yorkers got through when calls did not. In many cases, voice *worked*, but was so overloaded that most attempted calls resulted in busy signals. Not so with packet based data.

However, it is critical that a network remain *intact.* Most of the cores of New York's network providers are based on SONET rings. These are fiber loops that carry the bulk of the network's data from one point to another. Because of their ring topology, they allow a cut to occur, and can still connect between any remaining points on the network. Unlike the telephone lines that were connected to Verizon's WTC switch, which were point-to-point and simply died after a cut, the cores of both data and voice networks' SONET architecture allowed for continued operation.

4. Remote Co-location of Servers

In a disaster, we now see that we need battery powered wireless communications devices, and packet-based, redundant core networks, to maintain connectivity. The last component for success is the survival of the servers that handle the data, the machines through which the communications devices reach each other.

Our RIM Blackberry pagers fit my first 3 criteria: they were battery powered, and kept working after power was cut; the data is delivered in packets, which kept working, albeit a bit more slowly due to all the traffic. However, once the power to our email servers failed, the Blackberries became useless, because they had been set up for email only. In fact, Blackberries can be set up to communicate directly through the core of RIM and Cingular's networks (called “PIN-to-PIN”), but few people had set that up, since most Blackberries are installed with email functionality only.

Upoc's servers are located in New Jersey, quite far from Manhattan. As a result, communications that depended on Upoc's application kept working: the servers were in a remote location, far from likely attack targets, the devices were battery powered and as long as the data networks between the devices and Upoc's servers were redundant and stayed up and available, the Upoc application kept working for us and our customers.