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DropSmack: How cloud synchronization services render your corporate firewall worthless

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Feedback Surveys

- Please complete the Speaker Feedback Surveys.
- This will help speakers to improve and for Black Hat to make better decisions regarding content and presenters for future events.

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Why should you trust me?

- Why should you trust me?
  - More than a decade of work in systems engineering, network defense, malware reverse engineering, penetration testing and forensics
  - Conducing PhD level research in new techniques for botnet detection
  - Two time winner of the DC3 Forensics challenge
  - Developed a course on Cloud Forensics for a client
    - So I've had a LOT of time to research this
  - Blah, blah, blah…
    - Cut the crap, show me the hack!

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What's this about anyway?

- In case you might be in the wrong room…
  - Security of Cloud Synchronization services (Dropbox)
  - How to use Dropbox to own a protected corporate network while completely bypassing network defenses
  - How to use DropSmack malware to establish C2 and data exfiltration over Dropbox
  - How to stop someone from doing it to you
- Dan Kaminsky is (probably) speaking somewhere else…

Giant Honking Disclaimer

- We pick on Dropbox in this research
  - And our proof of concept implant uses Dropbox
- Dropbox provides a command and control (C2) channel ***by design***
- **Mad props** to Dropbox developers
  - They **set the standard** in client side security among the products we tested
  - Anything we demo with Dropbox can be done **more easily** to most other products
- We are **not** releasing zero-day attacks here
  - The media will spin it that way though…

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Cloud Synchronization

- Implies more than just online backup
- Files placed in a folder on one participating machine are synchronized to all machines
  - Via the cloud
- Infecting files destined for a backup site would be interesting too
  - We can't get C2 from that
    - But there's nothing like repeat infections from a single attack ☺

History of Insecurity

- Dropbox authentication horribly broken (2011)
  - More on this later
- Dropbox ‘no password day’ (2011)
- Dropbox Mobile file metadata in the clear (2011)

- Why aren’t other products up here?
  - Nobody was looking at the lower tier providers
  - Don’t worry, we are now…
    - Stay tuned for more fun!

Foundational Work

- Dark Clouds on the Horizon (2011) detailed the idea of using cloud synchronization software for covert data exfiltration
- Frank McClain and Derek Newton (2011) researched the Dropbox database format and published the details
  - Dropbox promptly changed them
- Ruff and Ledoux (2012) reverse engineered Dropbox software to analyze security
  - Again, Dropbox quickly changed internal details

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A Little Case Study

- Our client, Massive Dynamic, requests a no holds barred penetration test
  - Act like APT they said
    - No problem, got that covered
  - Long engagement time
  - Completely black box

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Standard Methods Fail

- Web portals
  - No go
- Outdated patches on public facing services
  - No go
- Social engineering
  - Gets some basic IT info
  - Campaign cut short by astute employees who inform security of the attempted trickery

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Standard Methods Fail (2)

- Physical security is military grade
  - And guys with big guns scare us…

This guy looks **WAY** too jumpy to try any physical pen testing approaches

His thousand yard stare is a little disconcerting…

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Standard Methods Fail (3)

- Spam fails too
- We get some quick hits back to our BeEF server
  - Some users are even running slightly older browsers
    - But we never are able to establish any real C2 channel
    - It's like something in the network is cutting out connections to our server
- Continue spamming campaign
  - In case we get lucky
- Time for Plan B

Plan B

- No, not ***THAT*** PlanB!
  - $25 and a college campus vending machine aren't getting us out of ***this*** mess…

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Social Network Analysis

- We find this guy's personal email address

- He's the CIO
- Facebook tells us he helps organize fundraising for his kid's PTA
  - Nothing like exploiting children to p0wn a target

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Spam @ Home

- We email him some fundraising information at home and win
  - Own the laptop
- Looking for VPN software on the laptop
  - FAIL!
- Confidential corporate documents on the laptop
  - Check
- WTF? These documents aren't really moving by email or USB drive are they?

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Dropbox…

- We notice that all of the company documents are in the Dropbox folder
  - And Dropbox.exe is in the process list
  - Now we're getting somewhere…
- Pull Dropbox databases to see what we can see
- Databases are encrypted
  - Fail
- Could reverse engineer the Dropbox software to read the databases
  - But…

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Ain’t nobody got time for that!

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Where are we?

- What we have so far
  - A way to send files over Dropbox to devices the CIO uses
- What we want
  - A running implant (with command and control) in the corporate network

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Time to brainstorm

- This will require lots of beer….

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Time to brainstorm…

- No, I said **LOTS** of beer!

- That's more like it

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Brainstorming complete

- With a blood alcohol level of .12 and a dose of inspiration, it hits me
- Dropbox can be used to infect the internal network **AND** be our C2 channel
  - If the CIO has Dropbox installed on his corporate machine (behind the firewall)
  - Since we have confidential corporate docs in the Dropbox folder, lets work from that assumption

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First, we'll need new malware

- We could just deliver a standalone meterpreter
- But nothing else we delivered has been able to call out of the network
- We need malware that can use the Dropbox file synch service instead of traditional network based C2
  - Kind of like a dead drop

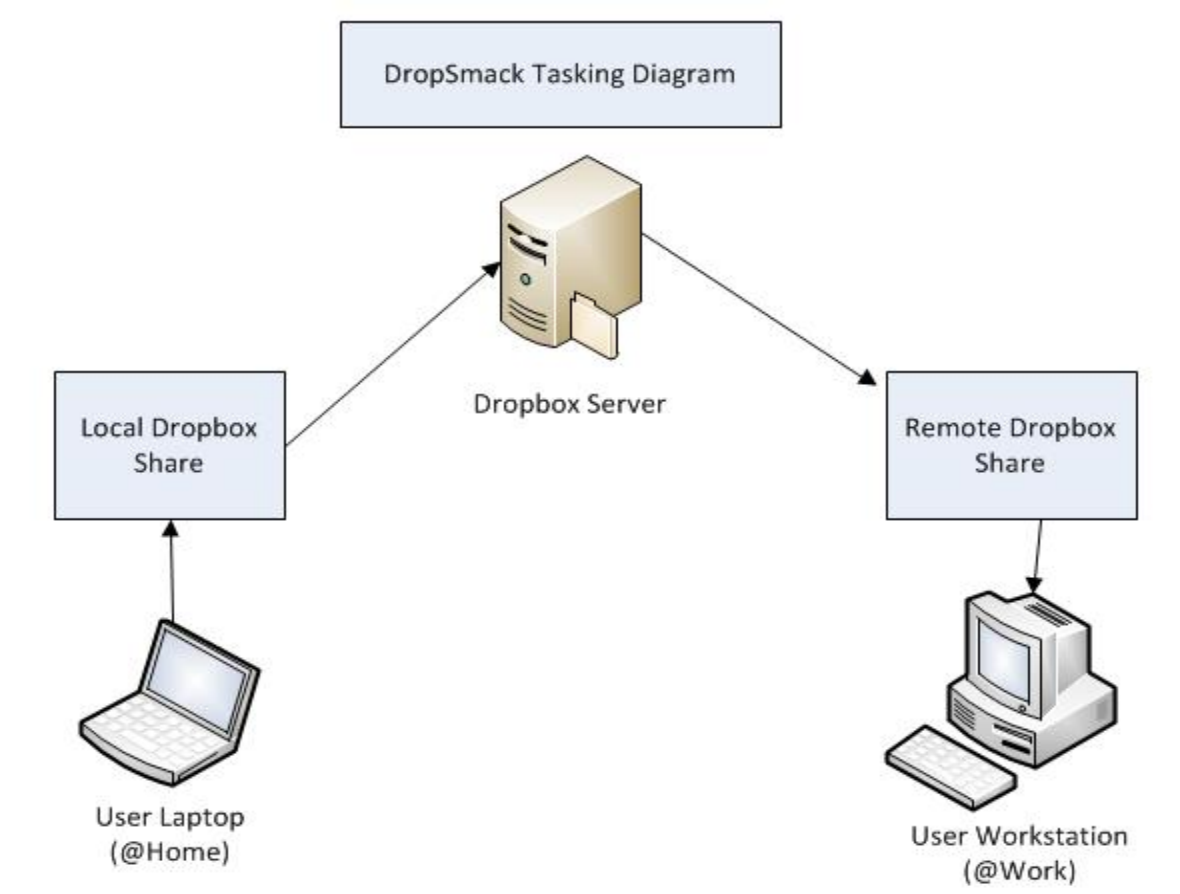
    *Pun **definitely** intended

DropSmack FTW

- So DropSmack was born
- DropSmack is new proof of concept malware designed to use files synchronized by Dropbox for C2
  - Guess what? This isn't fast
- Data exfiltration and command output are also sent via Dropbox synchronization
  - Not surprisingly exfil isn't fast either
    - Thanks to a recent Dropbox change, it's a lot faster
    - Thanks Dropbox development team!

DropSmack Comms

- For the benefit of those that prefer a picture…



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DropSmack for long term use?

- DropSmack is slow and kludgy
  - I'd prefer not to use it long term
- Now that we have bi-directional C2, we can figure out how to get a more traditional C2 channel past the corporate firewall
  - Being able to observe results from failures always helps
  - Watch legitimate traffic leave the network from the inside

DropSmack Features

- DropSmack implements the following commands:
  - PUT
  - GET
  - DELETE
  - EXECUTE
  - SLEEP
  - MOVE
- We considered adding more, but this combination gets you everywhere you need to go
  - Everything else is just gravy
    - Yummm, gravy…

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Deploying DropSmack

- We can't do everything for you
- General steps (suggested):
  - Embed DropSmack in a file the victim has already sync'd
  - Add some macro goodness
  - Load file back to the machine you can access
  - File automatically synchronizes
- Now all you have to do is wait for the victim to open the file on the internal network
  - But…

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Ain’t nobody got time for that!

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Social Engineering (redux)

- Social engineering is much more likely to be successful when you have lots of background information
- Remember:
  1. You know the file contents
  2. The victim thinks **they** created the file
- It doesn't get much easier than that…
  - If you *can't* convince the subject to open the file, get out of the business!

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DropSmack Demo

- Play video here….

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Detecting this Tom Foolery

- IDS
  - Worthless
- Firewall
  - Mostly worthless*
- Antivirus
  - Do I really need to say it?
- DLP Software
  - Worthless too
    - But for a whole lot more than just this…
- Whitelisting Software
  - Won't let the new application (DropSmack) execute

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Next Generation Firewalls (NGFW)

- I can hear the CISO now:
  - "Certainly the shiny new next generation firewall will save us from this horror"
    - Sort of.
- In a 2012, more than 75% of respondents using NGFWs said that their workloads increased due to the installation of the firewall
  - This sounds like IDS in the 90's
- Still a black and white decision on whether to allow Dropbox
  - Can't surgically filter content with an NGFW

Do you allow synch software?

- All of the detection methods we'll cover focus on finding ***illicit*** synchronization software installations
- Remember, this channel exists ***by design***
- If you allow the software, you are implicitly allowing the covert channel with it

Detection strategies that mostly suck

- Dropbox uses LanSync
  - TCP and UDP port 17500
- Look for DNS requests to servers related to synchronization services
  - Let me know how this works
- Block access to Amazon S3 (Dropbox back-end)
  - This isn't really feasible, breaks other stuff
- Scan user profile directories for illicit synchronization software installations
  - Remember, these programs install into user profiles so no UAC

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Better detection strategies?

- In short, no
- Again, you take the vulnerability with the convenience

- Time to talk to management and find out what the policy on these services really should be

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Future work

- Need to be able to read and extract information from Dropbox configs
  - Those damn encrypted databases again…
- DropSmack currently assumes a default synchronization folder location
  - Changing the default breaks this version of DropSmack

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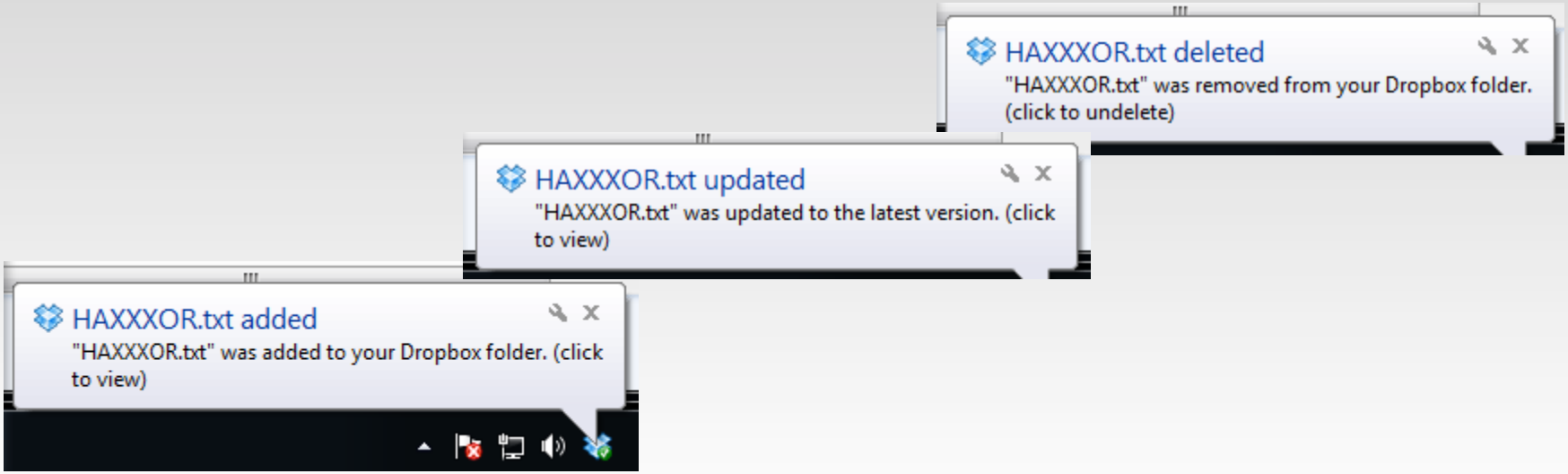
Future work (2)

- Dropbox issues popup notifications when new files are added, deleted, or changed remotely
  - Users probably appreciate this
  - I don't
- Need to adopt strategies to get rid of these popups since we create a lot of them



Future work (3)

- Build proof of concept malware that uses other synchronization services
  - Dropbox users shouldn't have all the pain
- Most other services we've looked at don't use encrypted databases
  - Takes away all the challenges we have with Dropbox
- Note to vendors: **Encrypt your databases**
  - It makes my job much harder

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Future work (4)

- Extract login information for web front ends from client side databases
  - This would allow us to take the laptop out of the loop after the initial compromise
  - Or entirely if we got credentials some other way
- This is an active research area for us

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Conclusion

- DropSmack isn't rocket science
  - Almost anyone could have written it
  - If you are a pen tester who finds this useful, glad I could be of help
- The real point is to demonstrate the vulnerability that file synchronization applications represent
  - If you are comfortable with the vulnerability, fine
  - This started out as a project to help our clients make an informed decision about risk

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Questions?

Thanks for your time and attention

I'm happy to answer any questions you may have

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