

Deconstructing iCloud Drive

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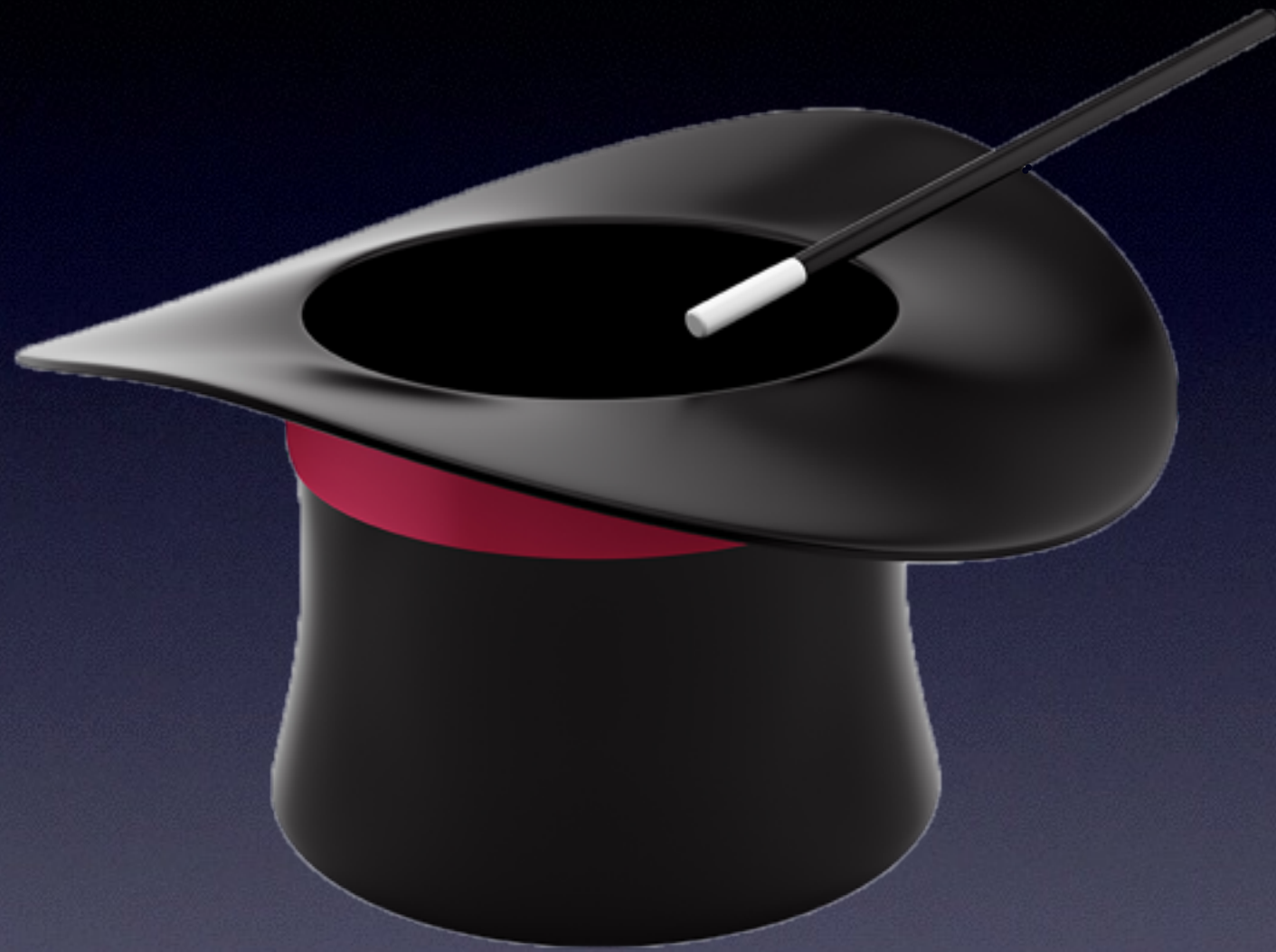


What is iCloud?



From the perspective of users, iCloud is a simple feature that automatically makes their personal content available on all their devices. To allow your app participate in this “magic,” you design and implement your app somewhat differently

When Apple Calls It Magic...

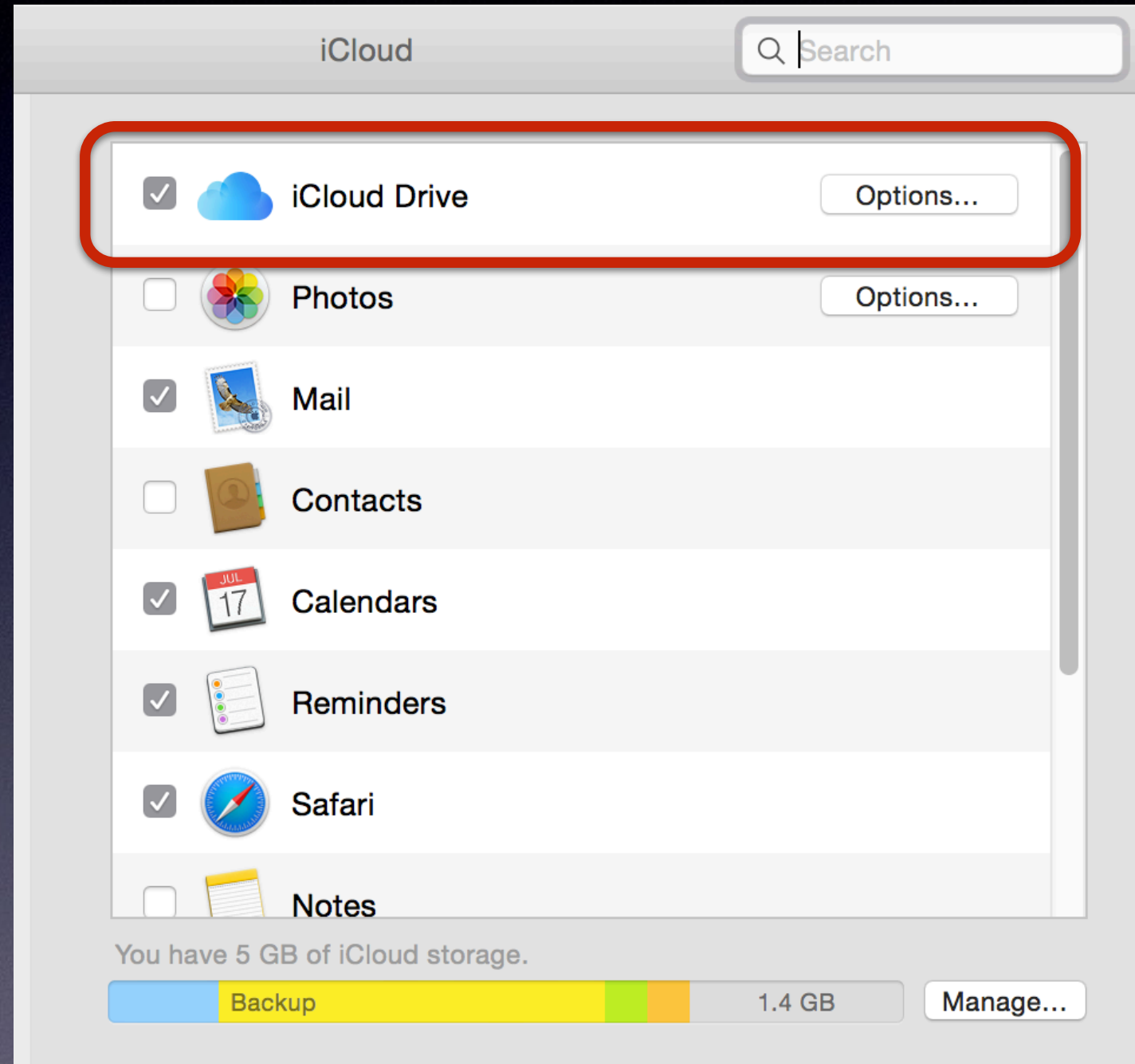


“Great magic is the result of confidence, practice,
good patter, and good style.”

iCloud Core Concepts

- *Lets users access their personal content on all their devices—wirelessly & automatically via Apple ID*
- *Eliminate explicit synchronization between devices*
- *Users never need to think about syncing*
- *Users can begin a workflow on one device and finish it on another*
- *Apps never interact directly with iCloud servers*

iCloud Drive



Requirements

- iPhone, iPad, or iPod touch with iOS 8
- Mac with OS X Yosemite
- Safari 6 or later, Firefox 22 or later, or Google Chrome 28 or later
- An active Internet connection



The Basics

*You can store any file as long
as it's smaller than 15 GB*

You have 20 GB of iCloud storage.

Backup

Mail

11.46 GB Available

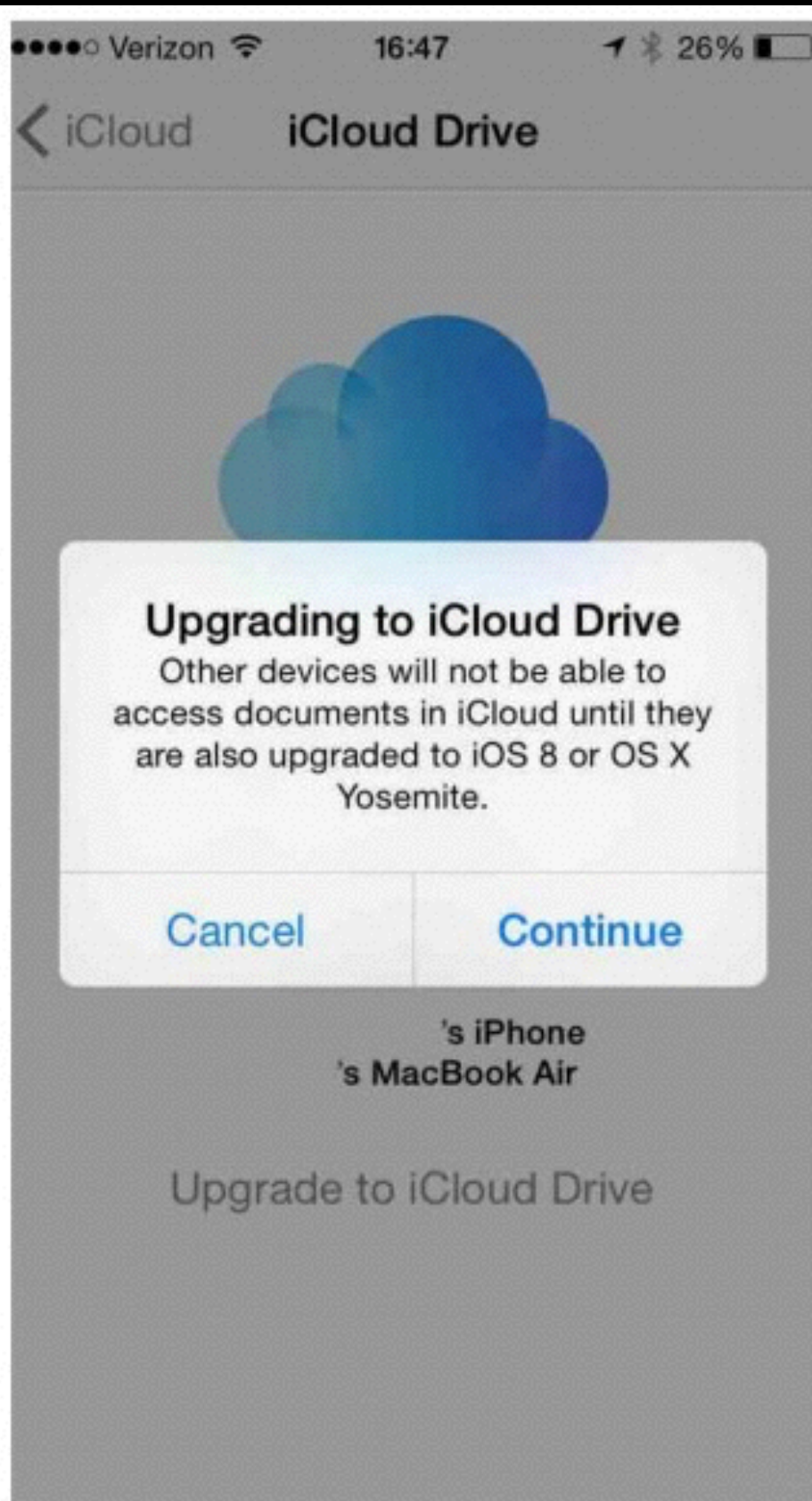
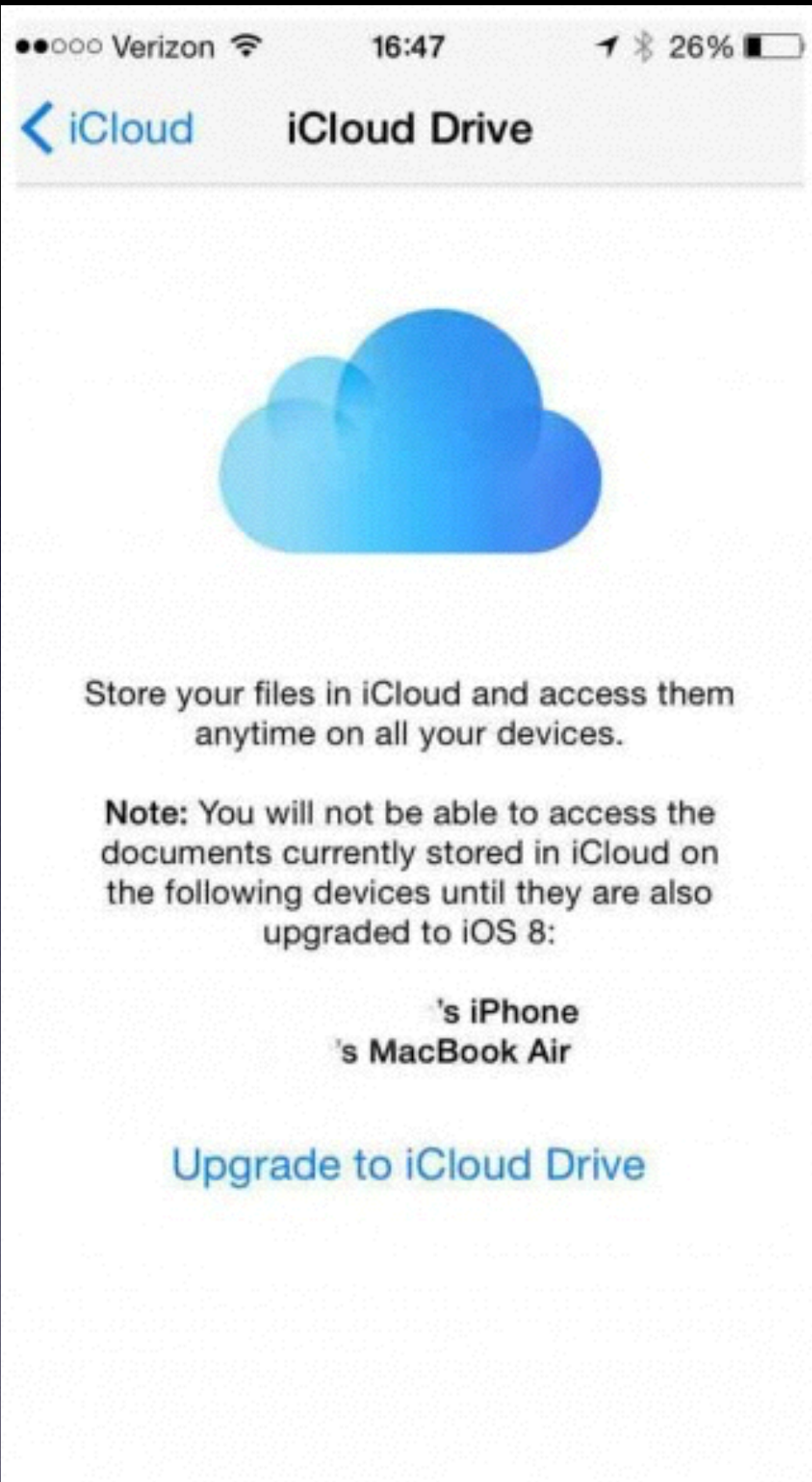
Manage...

Configuration

Setup Steps

- Meet requirements
- Upgrade to iCloud on iOS devices
- Configure iCloud system preference
- Sign into [iCloud.com](https://www.icloud.com)

<https://support.apple.com/en-us/HT204025>





Deconstructing iCloud

In the Cloud

Basic Concept

- No explicit synching
- No user interaction
- No interaction between apps and iCloud servers
- Apps autosave
- Apps manage conflicts on iOS
- System manages conflicts on OS X



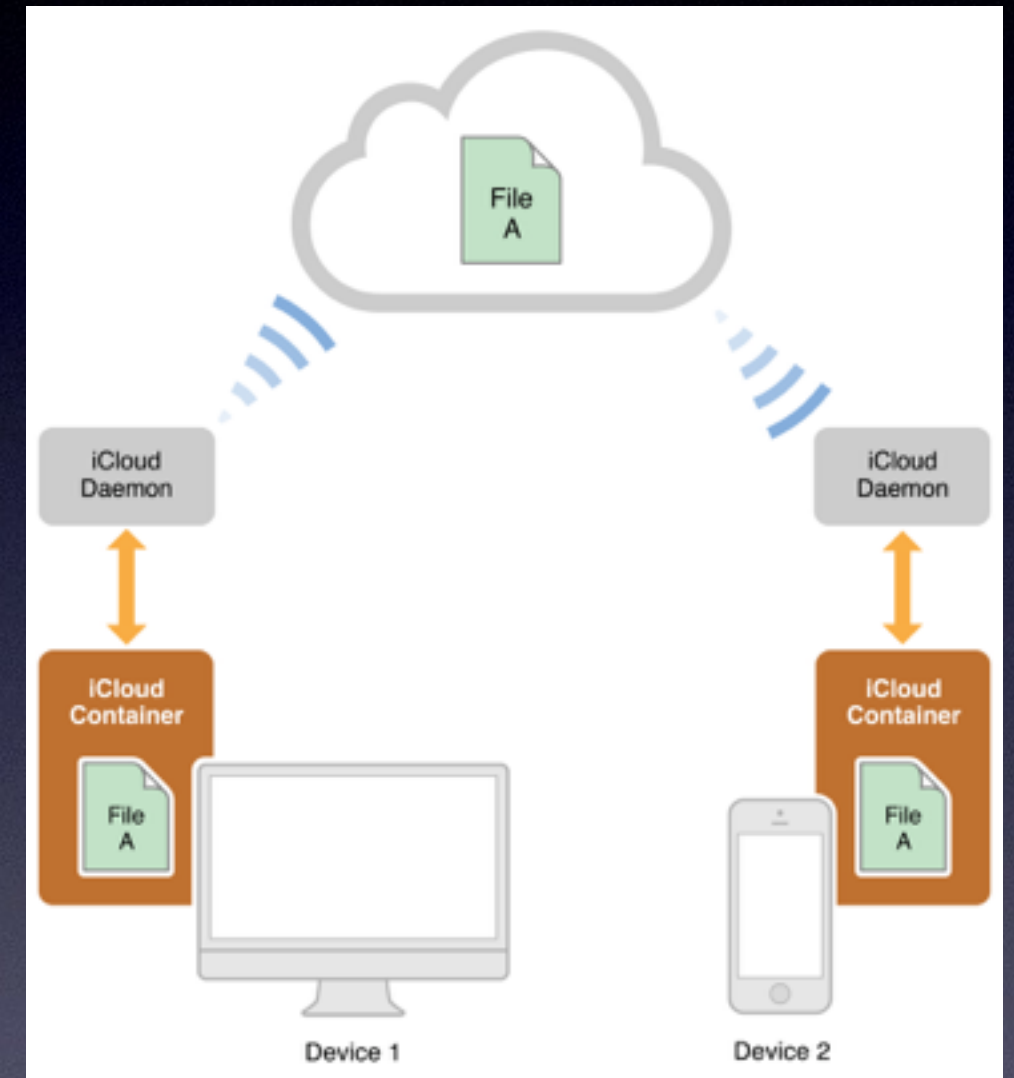


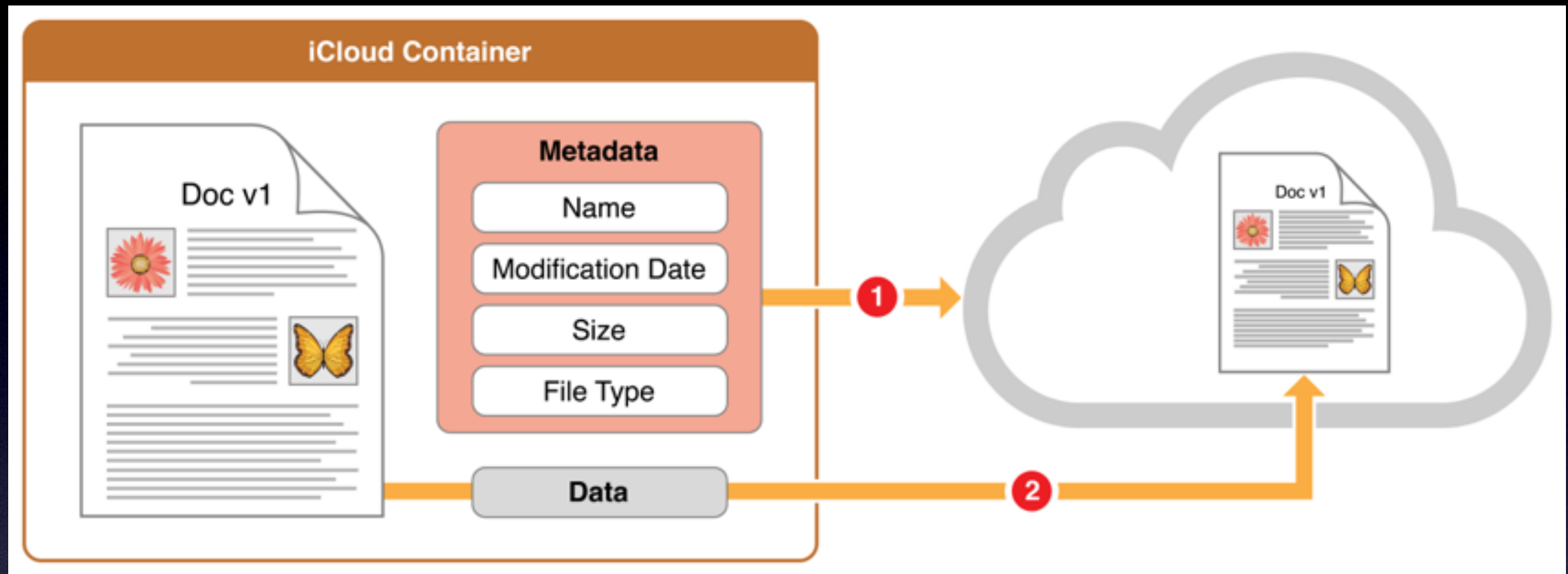
Ubiquity Containers

- *Changes automatically uploaded*
- *Peers download changes*
- *Core Data can handle either small or complex data sets*
- *Apps built with de-duplication to manage multiple peers, data changes*

Local Caching

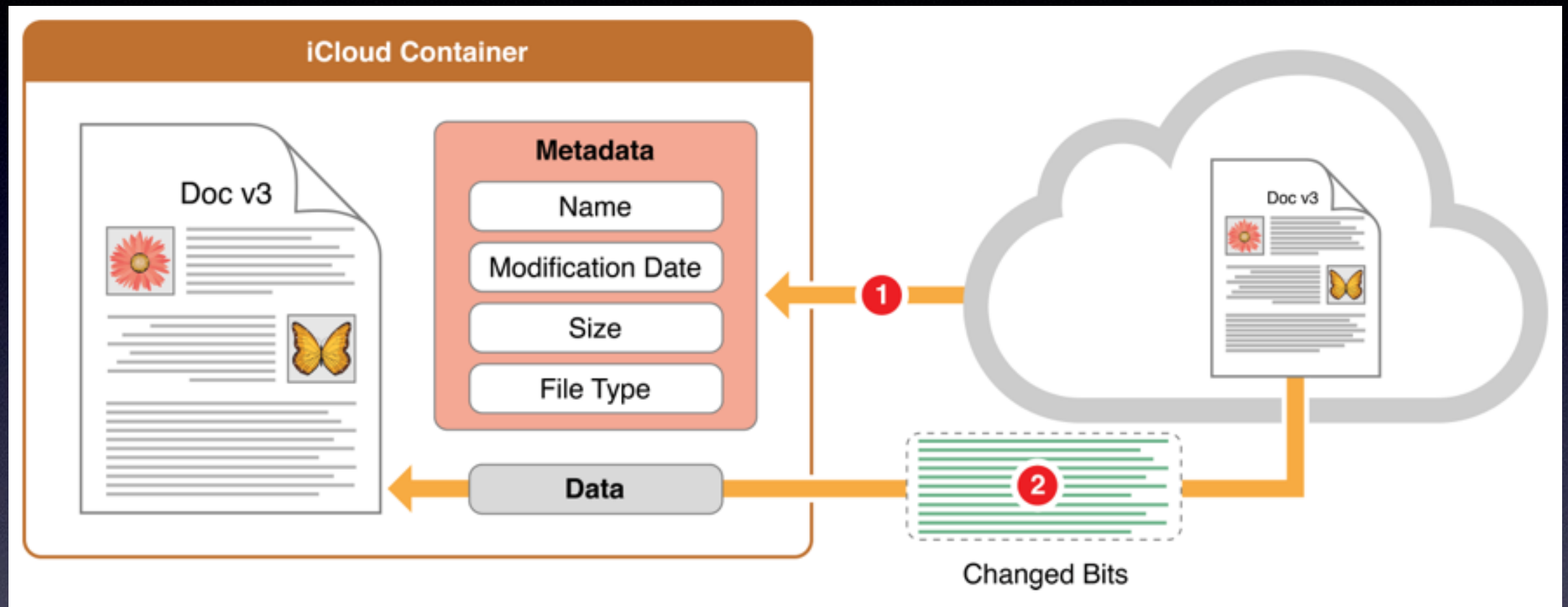
- iCloud data lives on Apple's iCloud servers
- System maintains a local cache of data on each of the user's devices
- Airplane Mode: iCloud becomes inaccessible while current iCloud account remains signed in.
- User signs out of iCloud, such as by turning off Documents & Data in Settings.
- Apps designed to monitor this activity





First upload

Changes to files



- Only portions of files that change are downloaded
- iOS changes are pulled when the app is active
- OS X changes are pulled immediately

On the Mac


```
Jeffs-Retina-MacBook-Pro:~ jeff$ ls -lA Library/Mobile\ Documents/
total 96
-rw-r--r--@ 1 jeff  staff  47108 Sep 28 17:38 .DS_Store
-rw-r--r--  1 jeff  staff    0 Oct 20 2011 .localized
drwxr-xr-x  7 jeff  staff   238 Feb 23 2014 243LU875E5~com~apple~movietrailers
drwxr-xr-x  3 jeff  staff   102 Dec 19 2012 2BMBRVJB24~com~ftponthego
drwxr-xr-x  3 jeff  staff   102 Oct 23 2013 2BUA8C4S2C~2BUA8C4S2C~com~agilebits
~onpassword-osx-helper
drwxr-xr-x  3 jeff  staff   102 Dec 19 2012 2BUA8C4S2C~com~agilebits~onpassword
d
drwxr-xr-x  3 jeff  staff   102 Dec  6 2014 2J4A3VM775~com~playmous~godoflight
drwxr-xr-x  3 jeff  staff   102 Dec 19 2012 356QY8883U~com~melodis~soundhound~f
ree
drwxr-xr-x  4 jeff  staff   136 Dec 19 2012 3JJX9QL35J~com~sega~sonic4ep2
drwxr-xr-x  3 jeff  staff   102 Feb 28 2014 3L68KQB4HG~com~readdle~CommonDocume
nts
drwxr-xr-x  3 jeff  staff   102 Dec 19 2012 3L68KQB4HG~com~readdle~Scanner
drwxr-xr-x  3 jeff  staff   102 Jan 20 2015 3N3RG282KZ~com~indeeo~iDraw
drwxr-xr-x  3 jeff  staff   102 Dec 19 2012 3YRPP5KTT5~efusion~jp~VoiceRecorder
HD
drwxr-xr-x  4 jeff  staff   136 May  1 06:48 4R6749AYRE~com~pixelmatorteam~pixel
mator
drwxr-xr-x  3 jeff  staff   102 Nov 23 2013 4Y68272LN8~com~readdle~ReaddleDocsI
Pad
drwxr-xr-x  3 jeff  staff   102 Feb 25 2014 57T9237FN3~net~whatsapp~WhatsApp
drwxr-xr-x  3 jeff  staff   102 Oct 29 2013 5HA97Z5P9Q~com~silverware~flightupd
atepro
drwxr-xr-x  4 jeff  staff   136 Feb 17 2013 5RZBHDMRK8~com~DefiantDev~SkiSafari
drwxr-xr-x  3 jeff  staff   102 Dec 19 2012 5U8NS4GX82~com~dayoneapp~dayone
drwxr-xr-x  3 jeff  staff   102 Jan 20 2015 6372P8EH2J~com~boinx~iStopMotion~i0
S
drwxr-xr-x  3 jeff  staff   102 Feb 23 2014 6372P8EH2J~com~boinx~iStopMotion~i0
S~iStopMotionExports
drwxr-xr-x  3 jeff  staff   102 Jan 16 2015 64A5CLJP5W~com~hogbaysoftware~Plain
Text
```

*~/Library/
Mobile
Documents*

Managed Docs

- *Represented as a file package*
- *Ubiquity container to persist in iCloud*

Processes

- *bird*
- *brctl*
- *ocspd*
- *ubd*
- *ubcontrol*
- *cloudd*

Jul 31 11:04:05 Tenaya.local bird[296] <Notice>: sending 1 items to the cloud for com.apple.Keynote

Jul 31 11:04:07 Tenaya.local bird[296] <Notice>: received 0 edited items and 1 deleted items from the cloud for com.apple.Keynote

Jul 31 11:04:13 Tenaya.local bird[296] <Notice>: scheduled 1 items for upload in com.apple.Keynote

Jul 31 11:04:19 Tenaya.local bird[296] <Notice>: sending 1 items to the cloud for com.apple.Keynote

Jul 31 11:04:22 Tenaya.local bird[296] <Notice>: received 1 edited items and 0 deleted items from the cloud for com.apple.Keynote

Jul 31 11:04:55 Tenaya.local bird[296] <Notice>: scheduled 1 items for upload in com.apple.Keynote

Jul 31 11:04:58 Tenaya.local bird[296] <Notice>: sending 1 items to the cloud for com.apple.Keynote

Jul 31 11:05:01 Tenaya.local bird[296] <Notice>: received 3 edited items and 0 deleted items from the cloud for com.apple.Keynote

Jul 31 11:05:01 Tenaya.local bird[296] <Warning>: Bounced itemID 44E633DB-C56D-4D83-9E9E-93CF4D175CA3 from "150812-MTPro-NewYork-01-DeconstructingCloud-Shelley-Watson.jpg" to "150812-MTPro-NewYork-01-DeconstructingCloud-Shelley-Watson 2.jpg" because it clashes with CACD4CB3-2EA9-43E6-8149-3F1713A4507A

Jul 31 11:05:01 Tenaya.local bird[296] <Notice>: sending 1 items to the cloud for com.apple.Keynote

Jul 31 11:05:02 Tenaya.local bird[296] <Notice>: received 0 edited items and 1 deleted items from the cloud for com.apple.Keynote

Jul 31 11:05:13 Tenaya.local bird[296] <Notice>: scheduled 1 items for upload in com.apple.Keynote

Jul 31 11:05:20 Tenaya.local bird[296] <Notice>: sending 1 items to the cloud for com.apple.Keynote

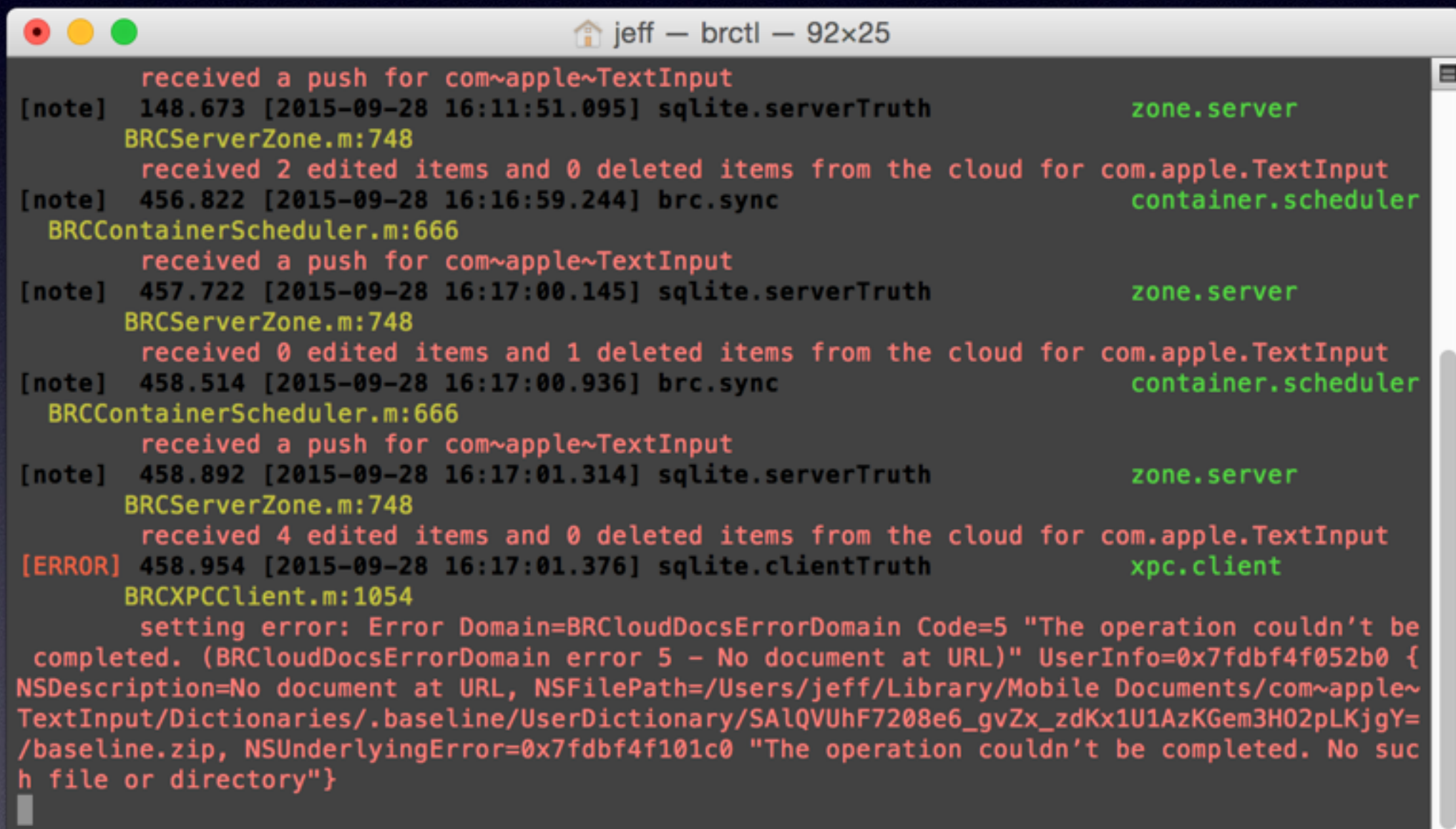
Jul 31 11:05:22 Tenaya.local bird[296] <Notice>: received 1 edited items and 0 deleted items from the cloud for com.apple.Keynote

Monitor Connections

- nettop
- Little Snitch
- brctl log -w

Monitor Connections

brctl log -w



```
received a push for com~apple~TextInput
[note] 148.673 [2015-09-28 16:11:51.095] sqlite.serverTruth      zone.server
      BRCServerZone.m:748
received 2 edited items and 0 deleted items from the cloud for com.apple.TextInput
[note] 456.822 [2015-09-28 16:16:59.244] brc.sync              container.scheduler
      BRCTContainerScheduler.m:666
received a push for com~apple~TextInput
[note] 457.722 [2015-09-28 16:17:00.145] sqlite.serverTruth      zone.server
      BRCServerZone.m:748
received 0 edited items and 1 deleted items from the cloud for com.apple.TextInput
[note] 458.514 [2015-09-28 16:17:00.936] brc.sync              container.scheduler
      BRCTContainerScheduler.m:666
received a push for com~apple~TextInput
[note] 458.892 [2015-09-28 16:17:01.314] sqlite.serverTruth      zone.server
      BRCServerZone.m:748
received 4 edited items and 0 deleted items from the cloud for com.apple.TextInput
[ERROR] 458.954 [2015-09-28 16:17:01.376] sqlite.clientTruth      xpc.client
      BRCTXPCClient.m:1054
      setting error: Error Domain=BRCloudDocsErrorDomain Code=5 "The operation couldn't be
      completed. (BRCloudDocsErrorDomain error 5 - No document at URL)" UserInfo=0x7fdbf4f052b0 {
      NSDescription=No document at URL, NSFilePath=/Users/jeff/Library/Mobile Documents/com~apple~
      TextInput/Dictionaries/.baseline/UserDictionary/SAlQVUhF7208e6_gvZx_zdKx1U1AzKGem3H02pLKjgY=
      /baseline.zip, NSUnderlyingError=0x7fdbf4f101c0 "The operation couldn't be completed. No suc
      h file or directory"}
```



```
[note] received 2 edited items and 0 deleted items from the cloud for com.apple.Keynote
368.905 [2015-07-31 13:12:57.681] brc.sync sync.up BRCSyncUpOperation.m:422
sending 1 items to the cloud for com.apple.Numbers
[note] 370.850 [2015-07-31 13:12:59.626] sqlite.serverTruth zone.server BRCServerZone.m:748
received 0 edited items and 1 deleted items from the cloud for com.apple.Numbers
[note] 412.420 [2015-07-31 13:13:41.196] brc.sync sync.up BRCSyncUpOperation.m:422
sending 1 items to the cloud for com.apple.Numbers
[note] 414.626 [2015-07-31 13:13:43.402] sqlite.serverTruth zone.server BRCServerZone.m:748
received 0 edited items and 1 deleted items from the cloud for com.apple.Numbers
[note] 427.234 [2015-07-31 13:13:56.010] reachability reachability-monitor BRReachabilityMonitor.m:77
Network reachability changed to reachable [R -----]
[note] 442.622 [2015-07-31 13:14:11.398] reachability reachability-monitor BRReachabilityMonitor.m:77
Network reachability changed to unreachable [R tc-----]
[note] 442.622 [2015-07-31 13:14:11.398] brc.system-resources resources BRCSystemResourceManager.m:199
Network really becomes unreachable
[note] 490.004 [2015-07-31 13:14:50.070] sqlite.clientTruth fs.uploader BRCFSUploader.m:1001
scheduled 3 items for upload in com.apple.Numbers
[note] 493.005 [2015-07-31 13:15:01.001] brc.sync sync.up BRCSyncUpOperation.m:422
sending 1 items to the cloud for com.apple.Numbers
[note] 516.215 [2015-07-31 13:15:24.991] sqlite.clientTruth fs.uploader BRCFSUploader.m:1001
scheduled 1 items for upload in com.apple.Keynote
```


	Network really becomes reachable		
[note]	1063.863 [2015-07-31 13:24:32.640] reachability Network reachability changed to reachable [R -----]	reachability-monitor	BRReachabilityMonitor.m:77
[note]	1083.048 [2015-07-31 13:24:51.824] brc.sync sending 2 items to the cloud for com.apple.Numbers	sync.up	BRCSyncUpOperation.m:422
[note]	1083.051 [2015-07-31 13:24:51.827] sqlite.clientTruth scheduled 2 items for upload in com.apple.Numbers	fs.uploader	BRCFSUploader.m:1001
[note]	1083.144 [2015-07-31 13:24:51.920] sqlite.clientTruth scheduled 1 items for upload in com.apple.Keynote	fs.uploader	BRCFSUploader.m:1001
[note]	1083.148 [2015-07-31 13:24:51.924] brc.sync sending 1 items to the cloud for com.apple.Keynote	sync.up	BRCSyncUpOperation.m:422
[note]	1085.892 [2015-07-31 13:24:54.668] sqlite.clientTruth scheduled 1 items for upload in com.apple.Keynote	fs.uploader	BRCFSUploader.m:1001
[note]	1089.037 [2015-07-31 13:24:57.814] sqlite.serverTruth received 2 edited items and 0 deleted items from the cloud for com.apple.Keynote	zone.server	BRCServerZone.m:748
[note]	1089.056 [2015-07-31 13:24:57.832] brc.sync sending 1 items to the cloud for com.apple.Keynote	sync.up	BRCSyncUpOperation.m:422
[note]	1089.398 [2015-07-31 13:24:58.174] sqlite.serverTruth received 4 edited items and 0 deleted items from the cloud for com.apple.Numbers	zone.server	BRCServerZone.m:748
[note]	1089.425 [2015-07-31 13:24:58.202] brc.sync sending 1 items to the cloud for com.apple.Numbers	sync.up	BRCSyncUpOperation.m:422
[note]	1090.382 [2015-07-31 13:24:59.158] sqlite.serverTruth received 0 edited items and 1 deleted items from the cloud for com.apple.Keynote	zone.server	BRCServerZone.m:748
[note]	1091.663 [2015-07-31 13:25:00.439] sqlite.serverTruth received 2 edited items and 0 deleted items from the cloud for com.apple.Numbers	zone.server	BRCServerZone.m:748

technodiva — nettop — 133x28						
	interface	state	bytes in	bytes out	rx dupe	
racocon.78449			1612 B	1312 B	0 B	
udp6 fe80::6e40:8ff:feb6:fc9c%en0.4500<->*. *	en0		0 B	0 B		
udp6 fe80::6e40:8ff:feb6:fc9c%en0.500<->*. *	en0		0 B	0 B		
udp4 192.168.200.38:4500<->*. *	en0		1264 B	584 B		
udp4 192.168.200.38:500<->*. *	en0		348 B	728 B		
udp6 fe80::f4c2:5fff:fe84:18b%awdl0.4500<->*. *	awdl0		0 B	0 B		
udp6 fe80::f4c2:5fff:fe84:18b%awdl0.500<->*. *	awdl0		0 B	0 B		
Messages.78456			0 B	0 B	0 B	
tcp4 *:*<->*: *		Closed				
udp4 10.253.254.207:16402<->*: *	ppp0		0 B	0 B		
udp4 192.168.200.38:16402<->*: *	en0		0 B	0 B		
cloud.78769			7058 B	4936 B	1228 B	
tcp4 10.253.254.207:61866<->17.248.128.183:443	ppp0	LastAck	6036 B	2017 B	1228 B	
Keynote.78778			0 B	0 B	0 B	
tcp6 *.61725<->*. *		Listen				
tcp4 *:61725<->*: *		Listen				
syncdefaultsd.78835			12 KiB	1997 B	9255 B	
tcp4 10.253.254.207:62148<->17.172.208.30:443	ppp0	Established	12 KiB	1997 B	9255 B	
Safari.78905			111 KiB	15 KiB	0 B	
tcp4 127.0.0.1:62014<->localhost:49170	lo0	Established	3433 B	1591 B	0 B	
tcp4 127.0.0.1:62015<->localhost:49170	lo0	Established	57 KiB	1727 B	0 B	
tcp4 127.0.0.1:62016<->localhost:49170	lo0	Established	4499 B	1389 B	0 B	
com.apple.WebKi.78907			540 KiB	27 KiB	0 B	
tcp4 127.0.0.1:62073<->localhost:49170	lo0	Established	276 KiB	12 KiB	0 B	
tcp4 127.0.0.1:62117<->localhost:49170	lo0	Established	8379 B	1102 B	0 B	
tcp4 127.0.0.1:62118<->localhost:49170	lo0	Established	75 KiB	1715 B	0 B	
tcp4 127.0.0.1:62121<->localhost:49170	lo0	Established	4727 B	2077 B	0 B	

GREAT EXPECTATIONS



CHARLES DICKENS

Remember:

File sync
is not
backup

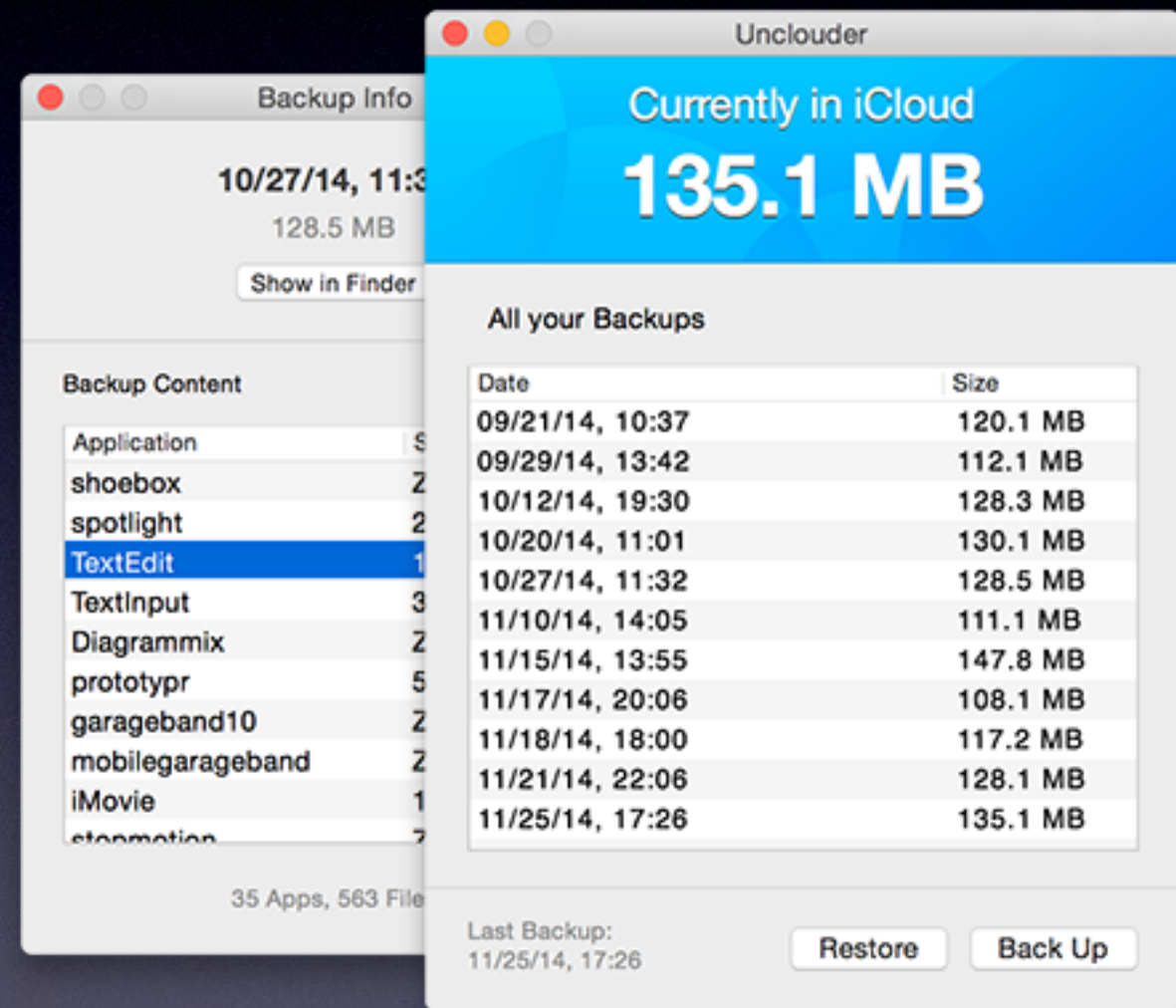
Interesting Results

- *Numbers file in Numbers folder with Numbers*
- *Excel file in Numbers folder with Excel*
- *Excel opens in root of iCloud & custom folder*
- *Numbers only sees in Numbers folder*

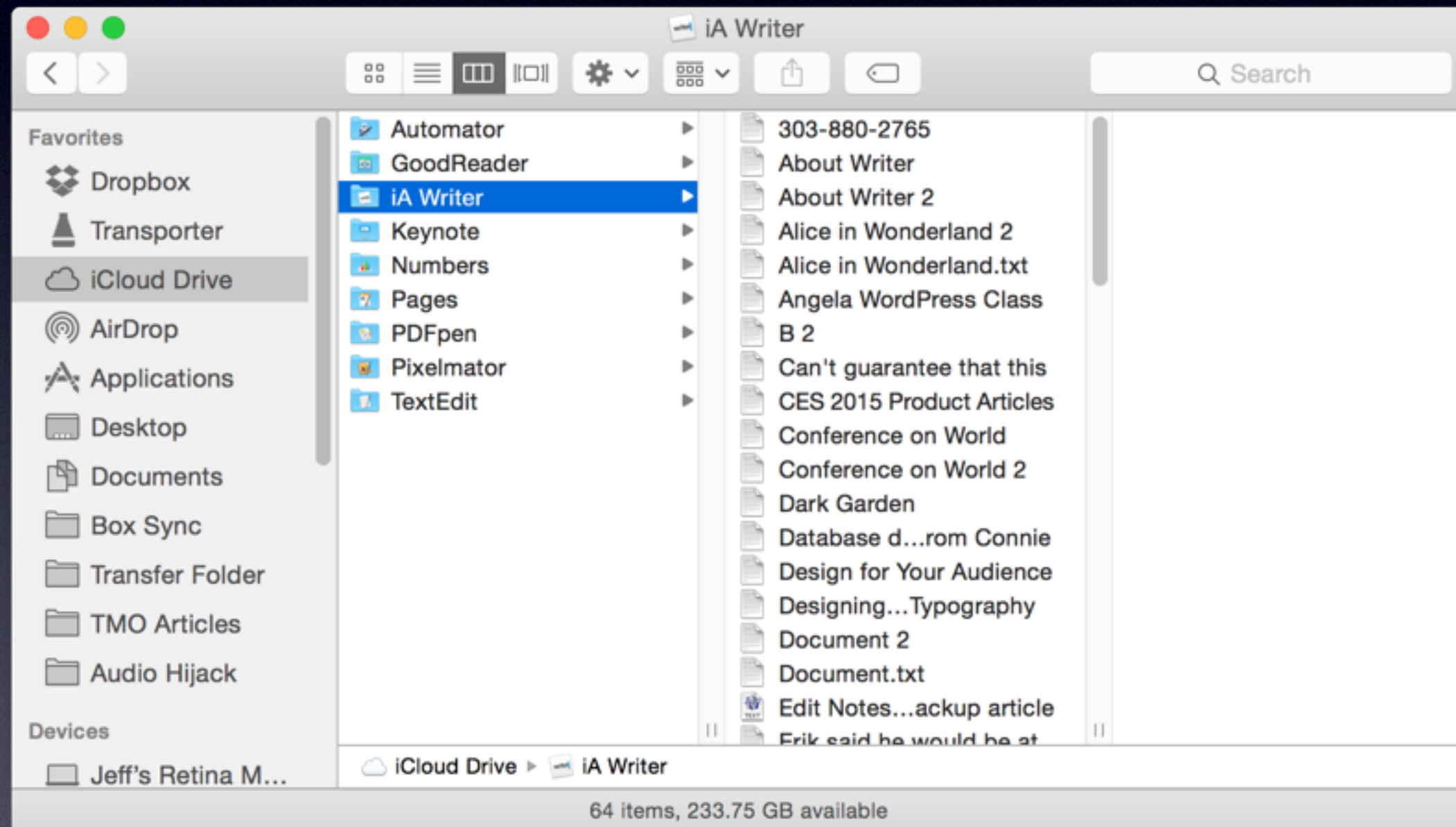
Cloud Opener



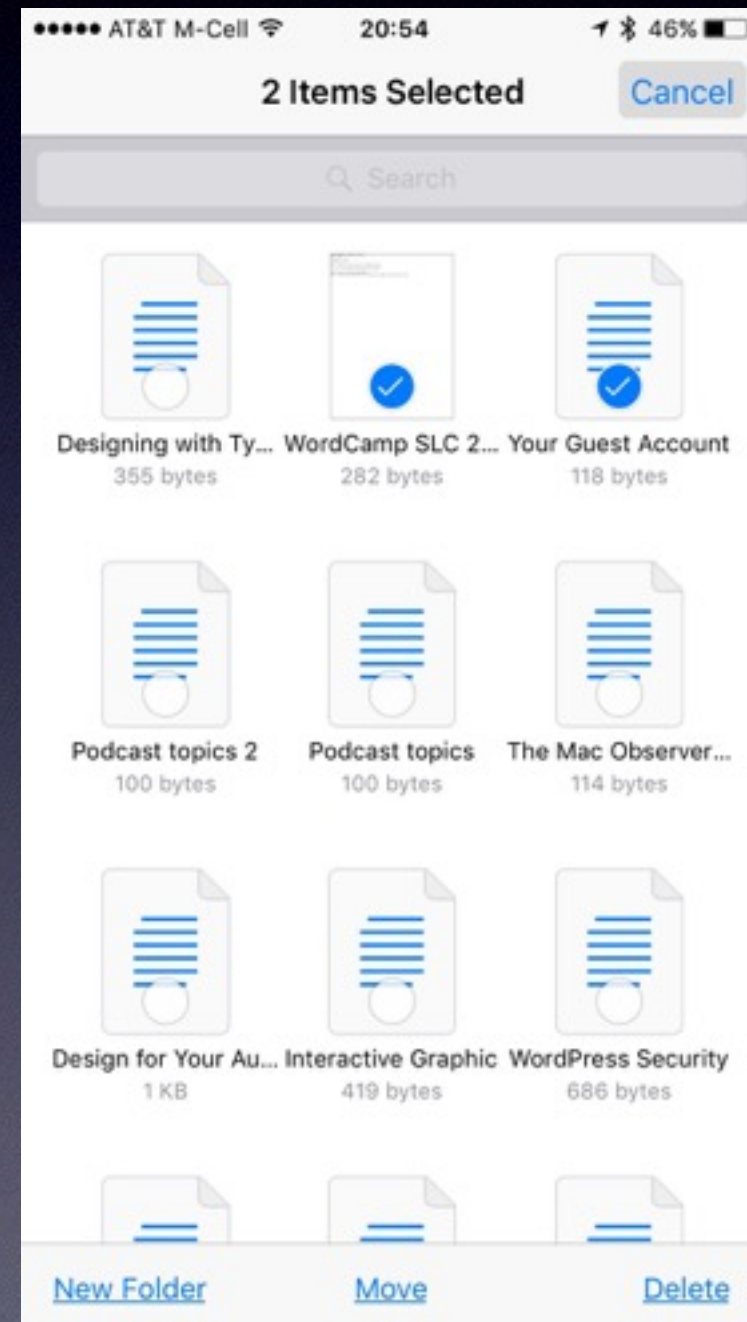
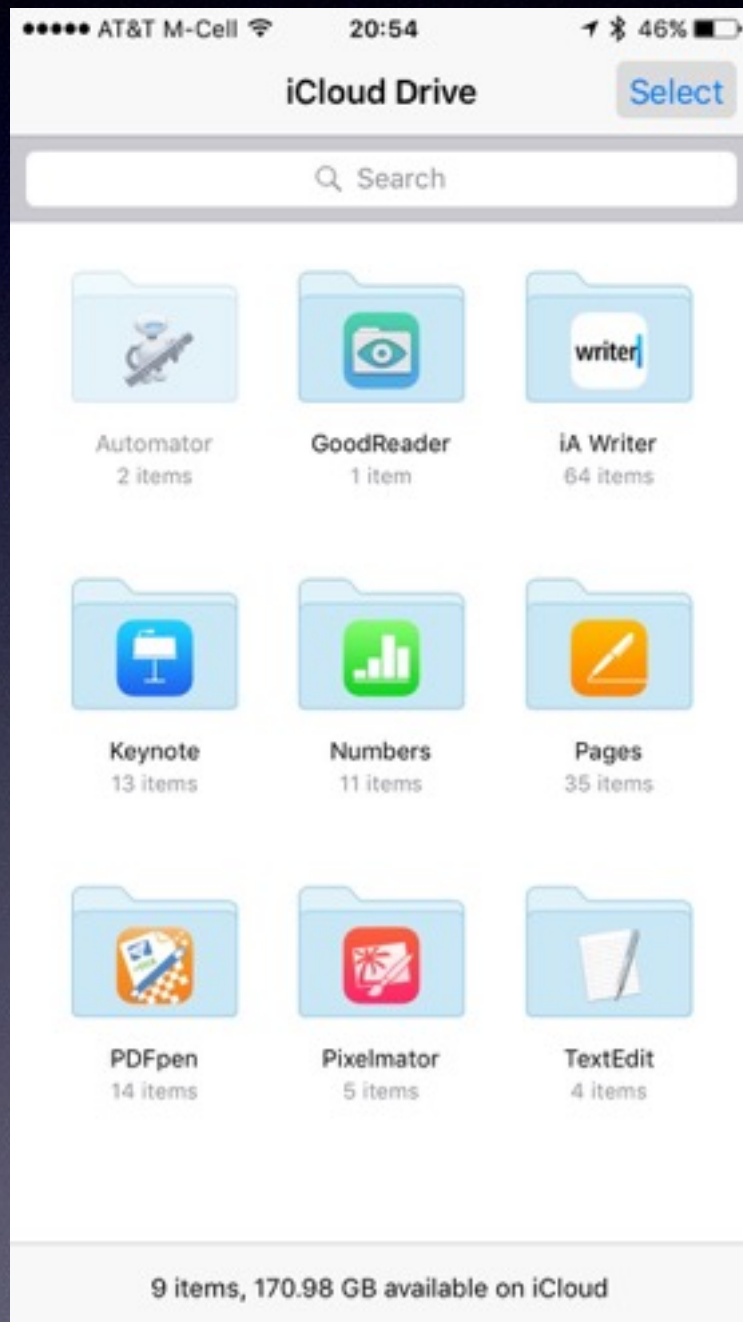
Unclouder



iCloud Drive



iCloud Drive



Conflicts



The document “150812-MTPro-NewYork-01-DeconstructingiCloud-Shelley-Watson.key” could not be autosaved. The file has been changed by another application.

Click Save Anyway to keep your changes and save the changes made by the other application as a version, or click Revert to keep the changes from the other application and save your changes as a version.

Revert

Save Anyway

Well-behaved apps



Provide user warnings:

- Data deletion
- Storage quota
- All devices affected

Potential Issues

- *Explicit save vs. autosave*
- *Document conflict*
- *Over-used storage*
- *State retention vs. content changes*
- *Case sensitive file names*



Customer issues

- What device are you asking about?
- Is your device connected to power?
- Have you restarted the device?
- Have you uninstalled and reinstalled the app?



and more...

How's your internet connection?

Do you have multiple iCloud accounts?

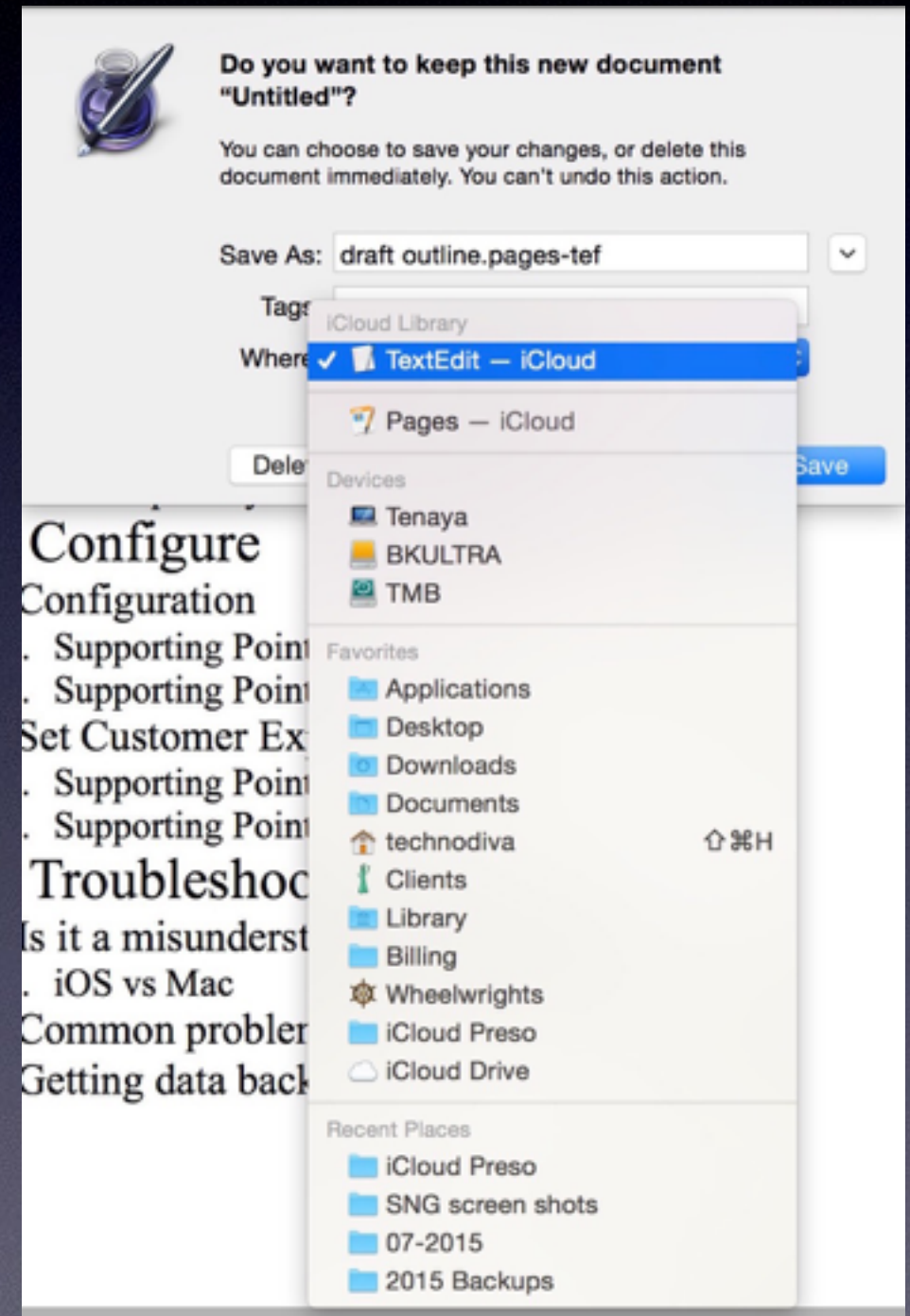
Is iCloud enabled for the app/account?

Do you allow cellular access to the app?

Is your date & time correct?

Save & Open

- Where did you save it?
- Does the application support iCloud Drive?
- Can you save it in a different format?

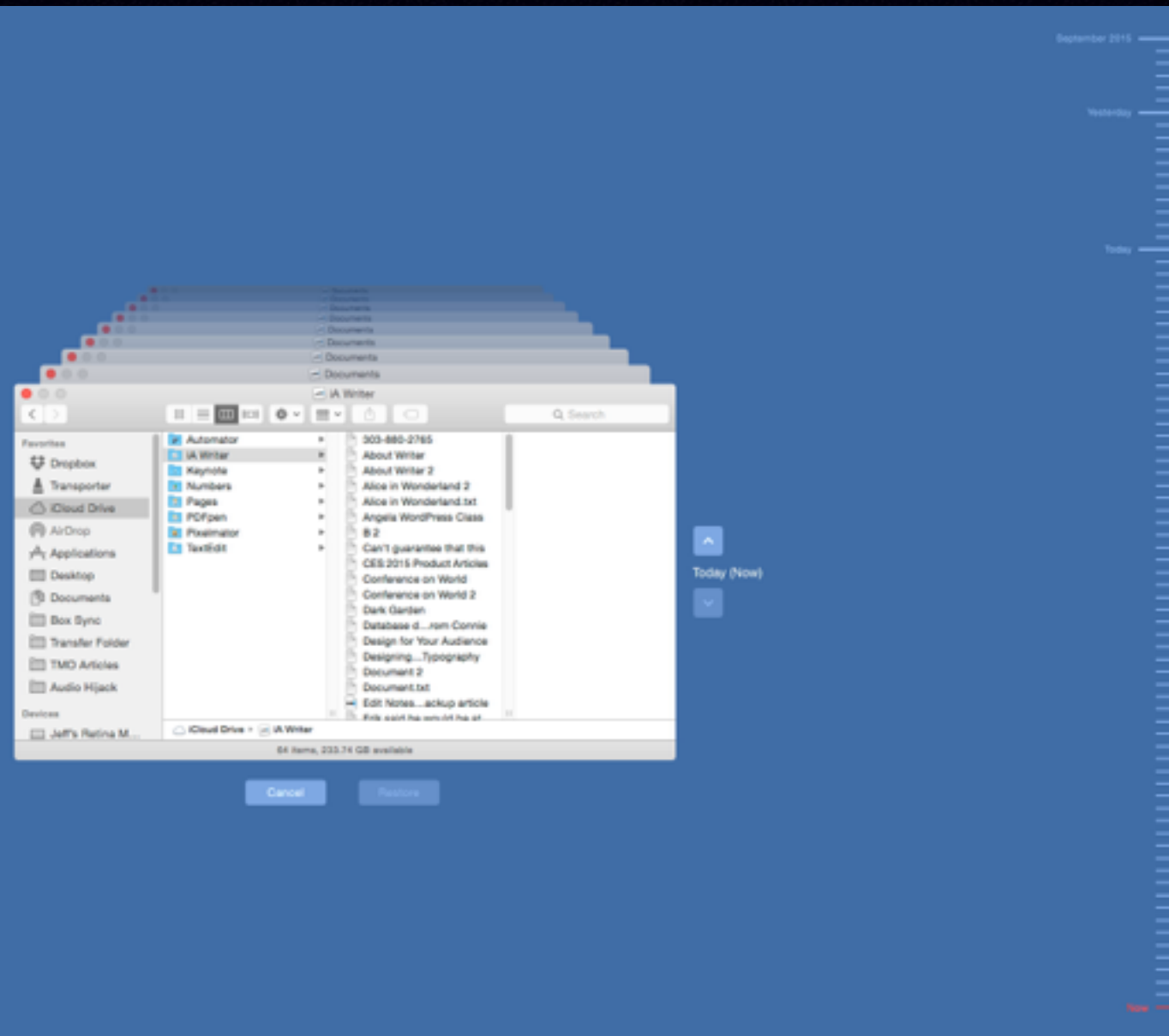


Backup



Time Machine

- Mobile Documents gets backed up but you can't inspect contents.
- Can't navigate to ~/Library unless you have it in your Sidebar, or other shortcut.
- Can navigate to iCloud Drive if it's in the Sidebar
- No restore location options: replace, keep both, keep original.



CrashPlan

- Allows restore from folders nested inside Mobile Documents
- No need for visible shortcuts
- Restored folder provides a local copy of the file
- Select your own location



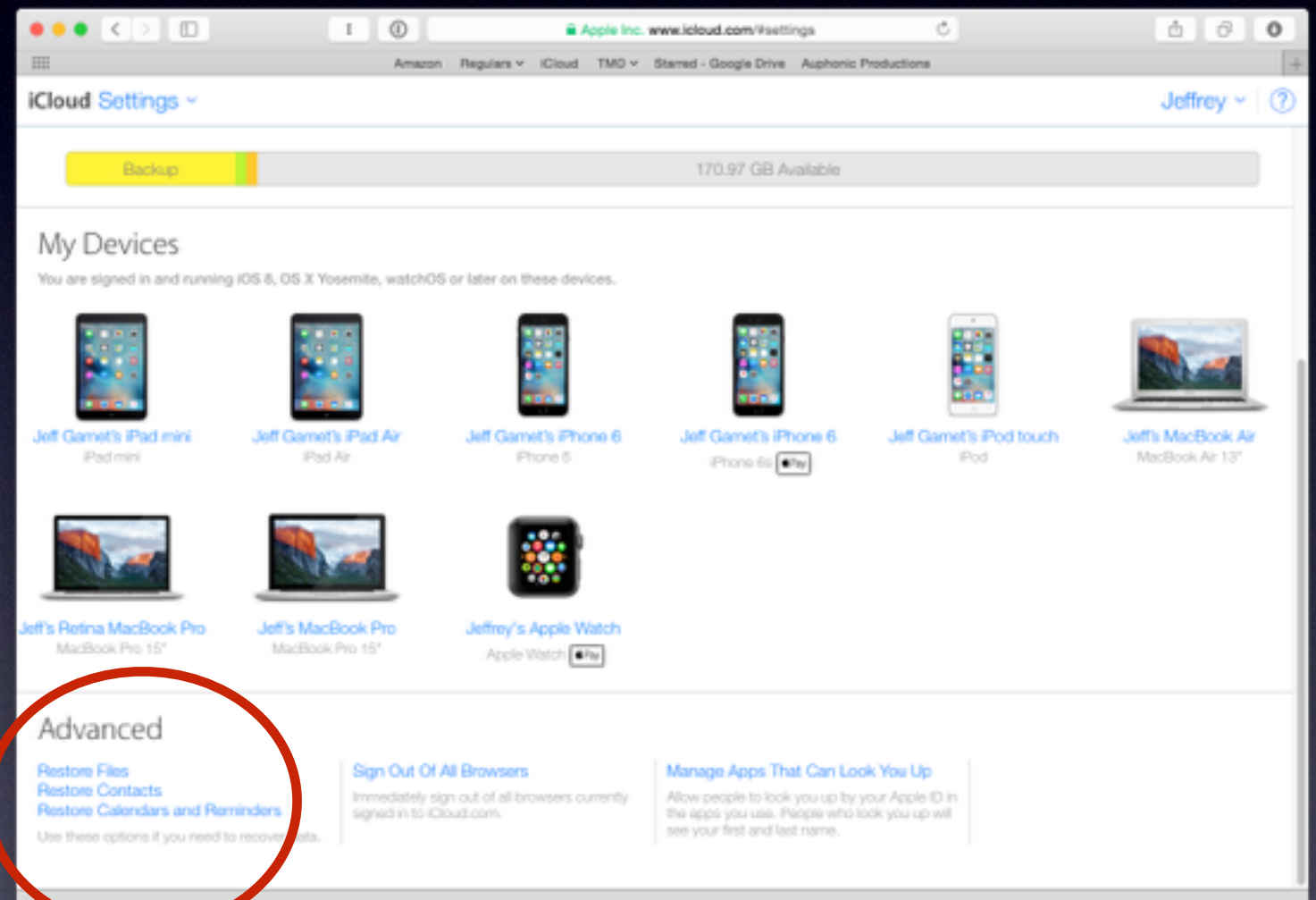
Unclouder

- iCloud Drive local backup
- Examine backups
- Restore selected files
- Restore deleted files

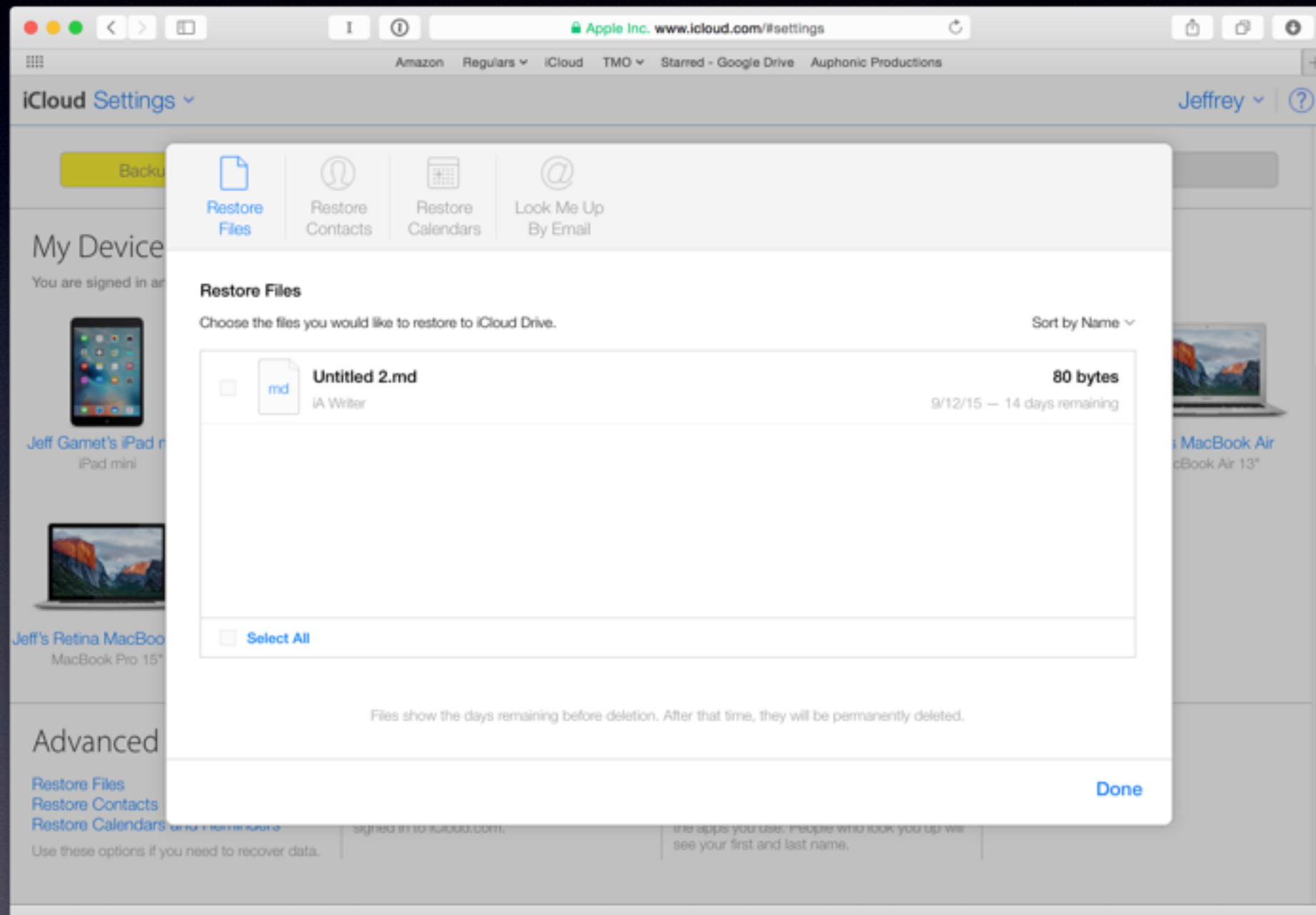


iCloud Drive Online

- Download files, if they exist
- Restore deleted files within 30 days
- iCloud.com > Settings > Data & Security > Recover Documents



iCloud Drive Online



Cloud Ecosystems



Privacy & Security

- 128 bit encryption on the server and in transit
- iCloud Keychain uses 256 bit encryption
- iCloud.com sessions encrypted with SSL
- iCloud services use secure tokens
- Strong passwords
- Two-step verification
- Find my iPhone
- Location sharing
- iCloud Keychain
- Photos

Resources

- iCloud developer docs:
https://developer.apple.com/library/ios/documentation/General/Conceptual/iCloudDesignGuide/Chapters/iCloudFundamentals.html#//apple_ref/doc/uid/TP40012094-CH6-SW1
- iCloud requirements (by service):
<https://support.apple.com/en-us/HT204230>
- Set up iCloud Drive on all your devices:
<https://support.apple.com/en-us/HT204025>
- Ports in use by Apple
<https://support.apple.com/en-us/HT202944>

Resources

- https://developer.apple.com/library/ios/documentation/General/Conceptual/iCloudDesignGuide/Chapters/Introduction.html#//apple_ref/doc/uid/TP40012094-CH1-SW1
- <https://support.apple.com/en-ca/HT202303>
- <https://support.apple.com/en-us/>

Resources

“Great magic is the result of confidence, practice, good patter, and good style.” from falseshuffle.com (How To Be A Magician, by John Kurlak)

Manual Pages:

<https://developer.apple.com/library/mac/documentation/Darwin/Reference/ManPages/>

Cloud Opener:

<http://www.jacks-apps.com>

Resources

Unclouder:

<http://mac.eltima.com/backup-icloud.html>

Privacy

<https://www.washingtonpost.com/news/the-switch/wp/2014/10/30/how-one-mans-private-files-ended-up-on-apples-icloud-without-his-consent/>