

Deconstructing iCloud Drive

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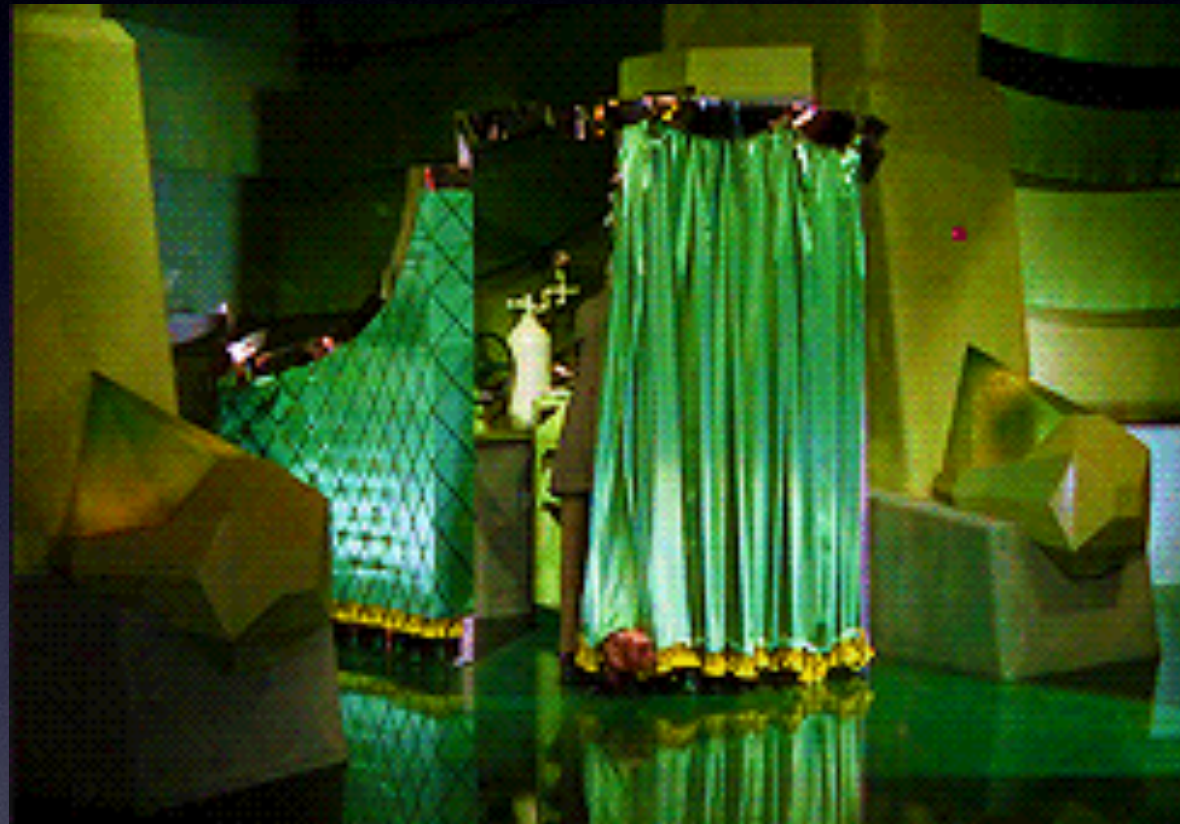


What is iCloud?



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

Apple May Call It Magic...



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

Magic depends on...

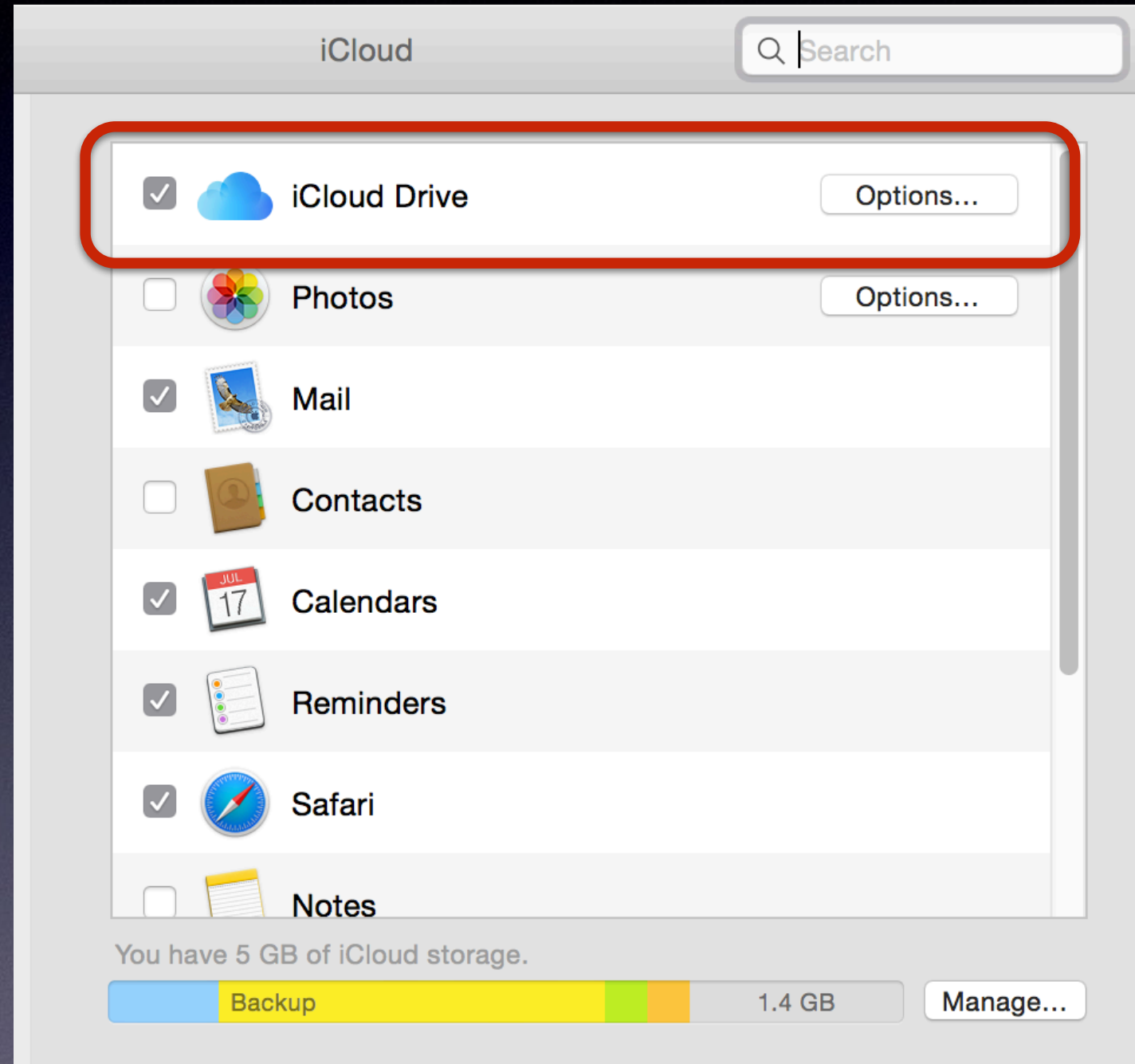
- ★ *Apple's ecosystem working*
- ★ *App developers following Apple's guidelines (rules)*
- ★ *Users being in the appropriate ecosystem*
- ★ *Users behaving properly for ecosystem*

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 El Capitan
- Safari 6 or later, Firefox 22 or later, or Google Chrome 28 or later
- An active Internet connection



The Basics

File < 15GB

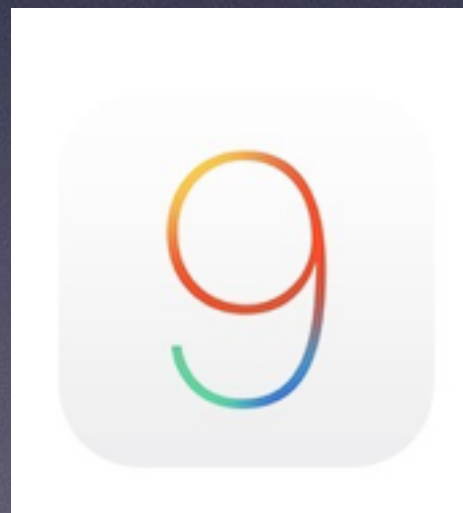
You have 20 GB of iCloud storage.

Backup

Mail

11.46 GB Available

Manage...

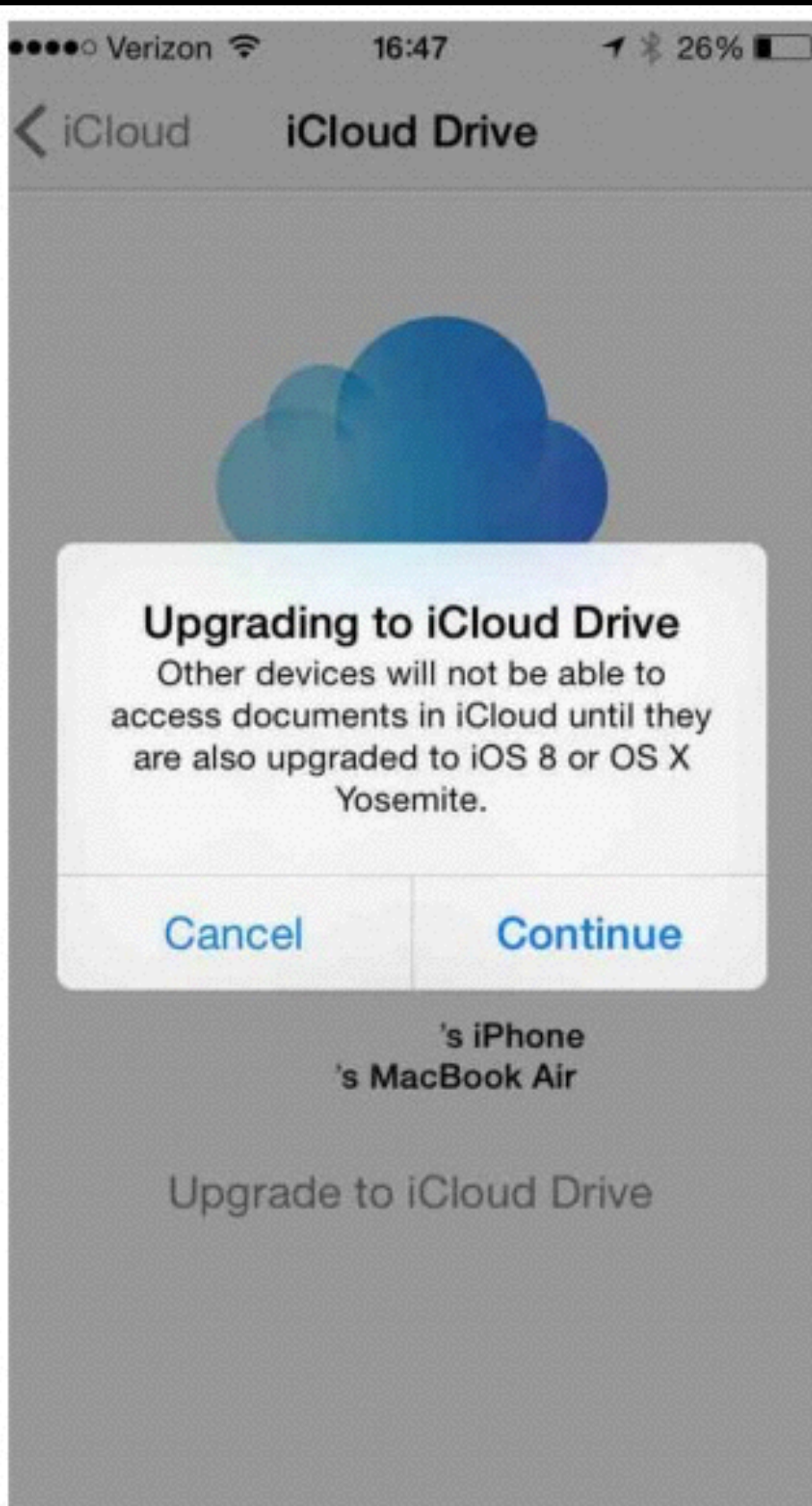
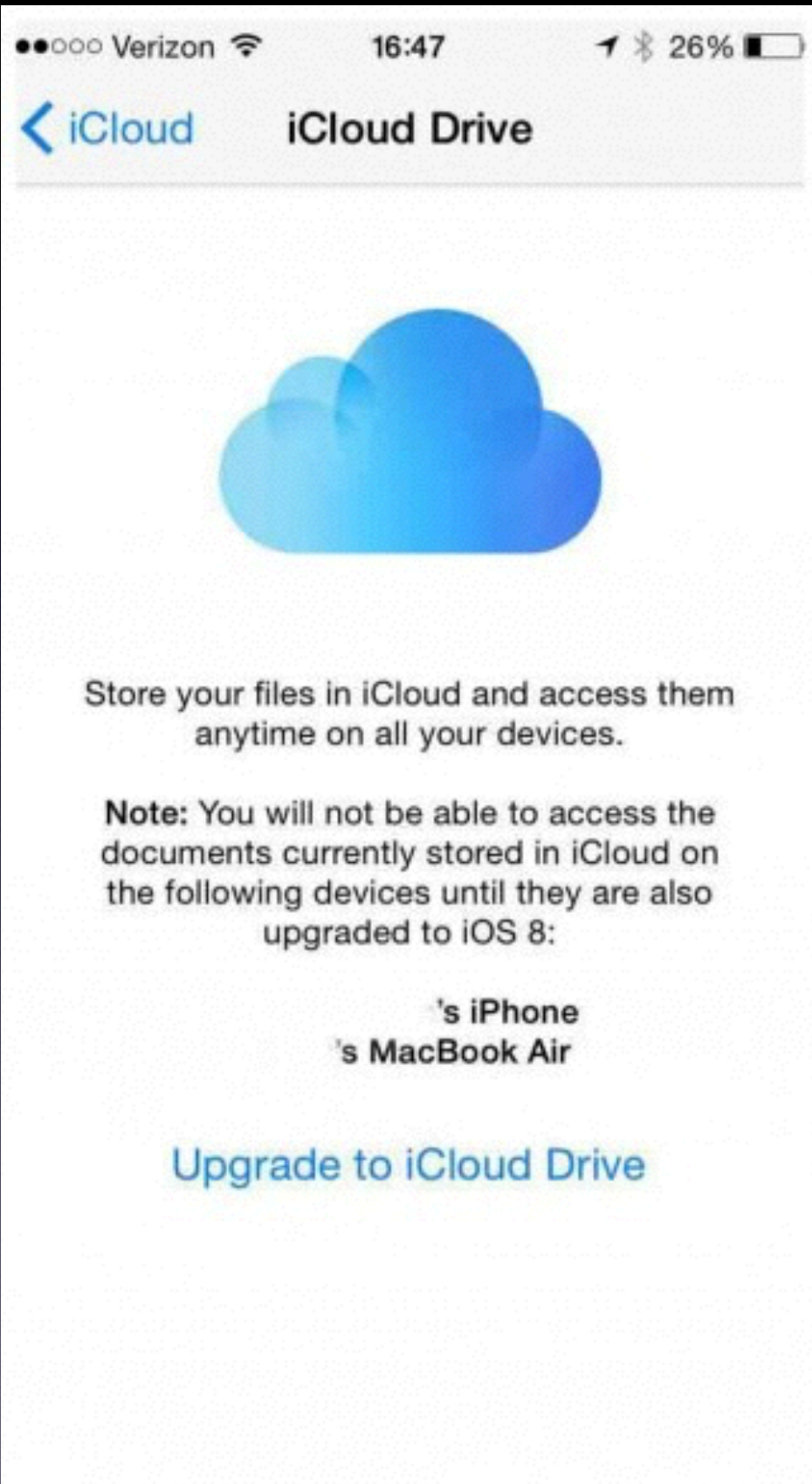


Setup Steps

- 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>





iWork & iCloud Drive



Pages



Numbers



Keynote

<https://support.apple.com/en-us/HT201385>



Let's Deconstruct 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

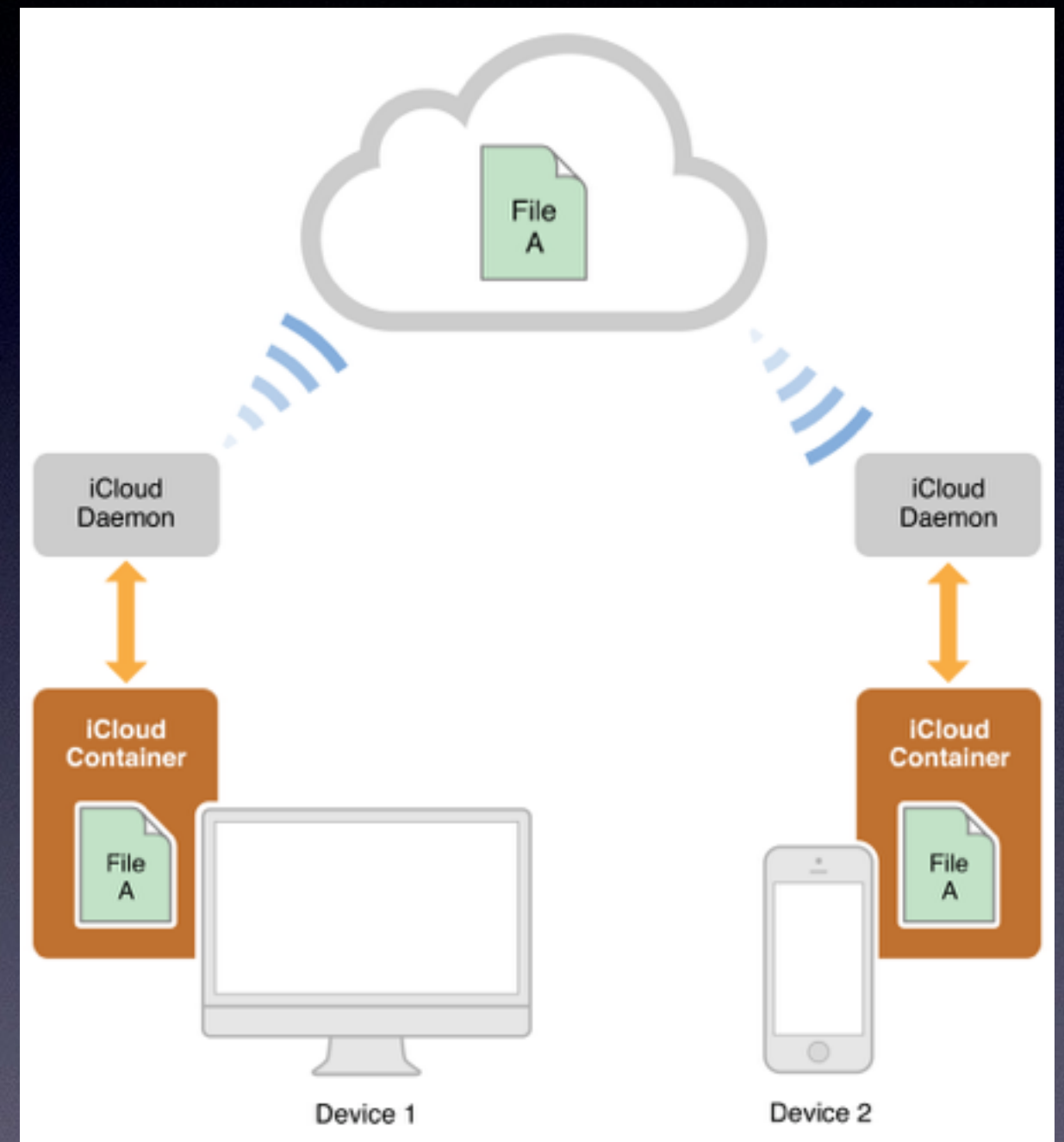


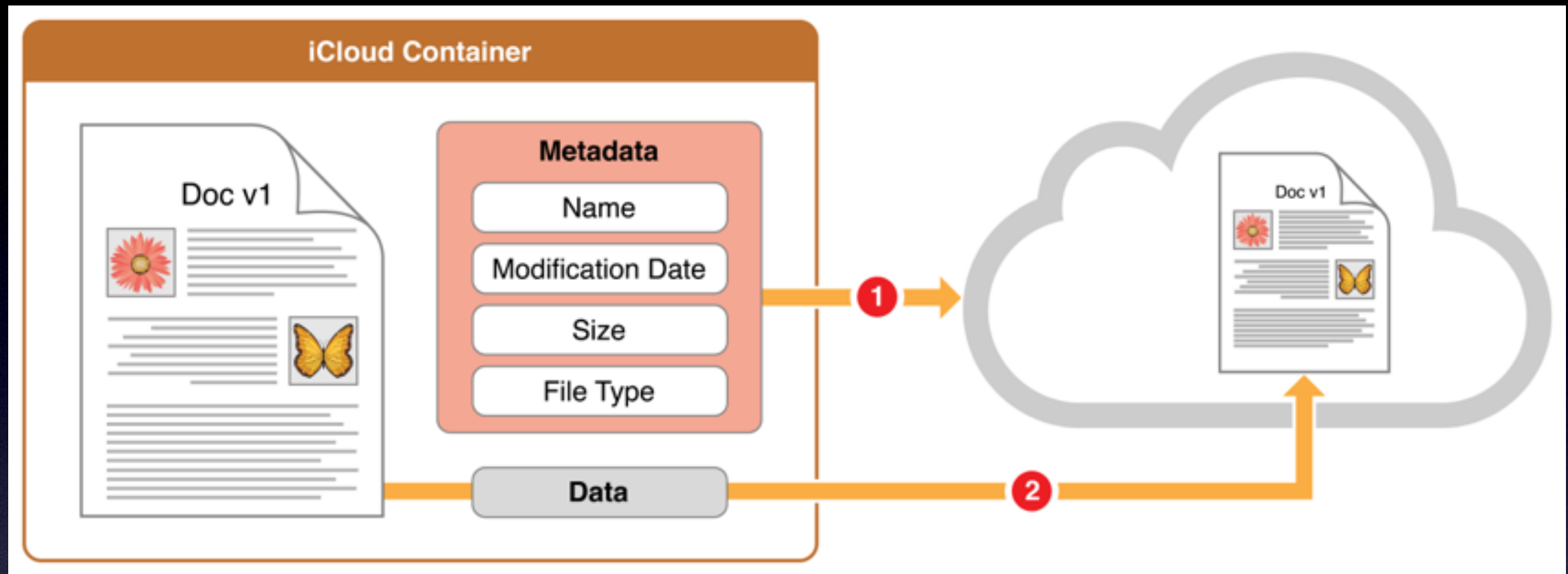
Ubiquity Containers

- *Changes automatically uploaded*
- *Peers download changes*
- *Handles either small or complex data sets*
- *Apps built with deduplication to manage multiple peers, data changes*

Local Caching

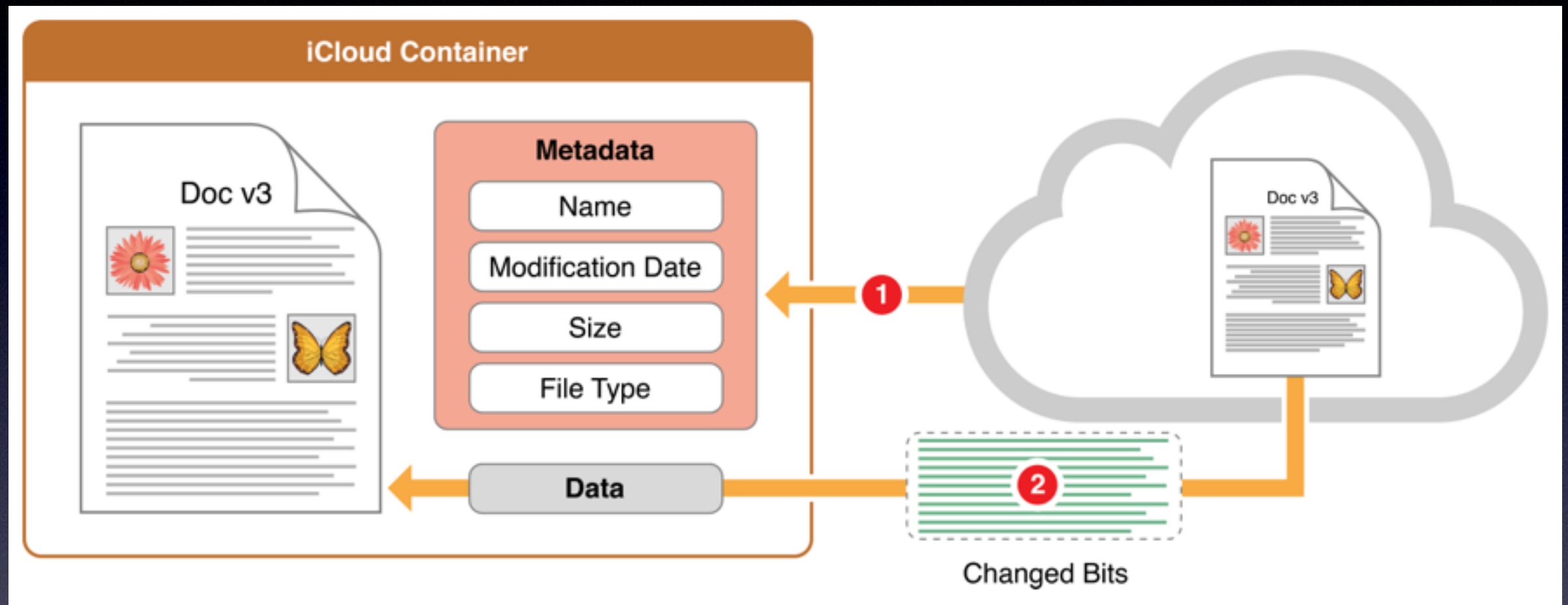
- iCloud data lives on Apple's iCloud servers
- System maintains a local cache of data on each of the user's devices
- User signs out of iCloud, such as by turning off Documents & Data in Settings.
- Airplane Mode: iCloud becomes inaccessible while current iCloud account remains signed in.
- Apps designed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



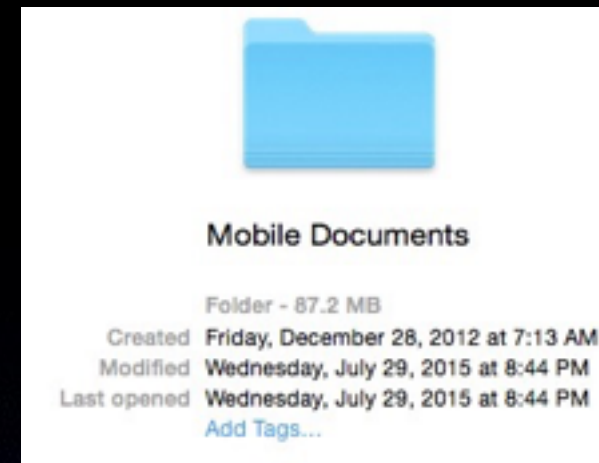

```
Tenaya:~ technodiva$ ls -lA Library/Mobile\ Documents/
```

```
total 48
-rw-r--r--@ 1 technodiva staff 22532 Jul 31 12:22 .DS_Store
-rw-r--r-- 1 technodiva staff      0 Jul  1 2012 .localized
drwxr-xr-x 3 technodiva staff 102 Jun  7 21:44 2575734FW8~com~aws~weatherbug~pro
drwxr-xr-x 2 technodiva staff  68 May 16 18:56 2BUA8C4S2C~com~agilebits~onepassword
drwxr-xr-x 3 technodiva staff 102 Jun  7 21:44 4LE234656Y~com~wordwebsoftware~WordWeb
drwxr-xr-x 3 technodiva staff 102 May 11 2014 57T9237FN3~net~whatsapp~WhatsApp
drwxr-xr-x 3 technodiva staff 102 Apr 16 2013 5HCL85FLGW~com~brother~iPrint-Scan
drwxr-xr-x 3 technodiva staff 102 Jun  7 21:44 6HB5Y2QTA3~com~hp~iprint~photo
drwxr-xr-x 3 technodiva staff 102 Jun  7 21:44 7PKJ6G4DXL~com~smileonmymac~PDFpen
drwxr-xr-x 3 technodiva staff 102 Sep 24 2013 7PKJ6G4DXL~com~smileonmymac~PDFpen~iOS~OCR
drwxr-xr-x 3 technodiva staff 102 Jun  7 21:44 7QXYLT27C4~fm~overcast~overcast
drwxr-xr-x 3 technodiva staff 102 Dec 25 2012 7X7N3X6Y79~jp~co~bandainamcogames~NBGI0069
drwxr-xr-x 3 technodiva staff 102 Jul 29 20:44 83CX4CU3RC~com~imagam~ifiles
drwxr-xr-x 4 technodiva staff 136 Feb 20 2014 8482Q6EPL6~com~codeux~irc~textual
drwxr-xr-x 3 technodiva staff 102 Feb  9 2014 DA33APV56V~com~aetrn~history~ios~watch
drwxr-xr-x 3 technodiva staff 102 Jun  7 21:44 F3LWYJ7QM7~com~apple~garageband10
drwxr-xr-x 3 technodiva staff 102 Jun  7 21:44 F3LWYJ7QM7~com~apple~mobilegarageband
drwxr-xr-x 3 technodiva staff 102 Jun  7 21:44 F6266T9T75~com~apple~iMovie
drwxr-xr-x 3 technodiva staff 102 Jun  7 21:44 H7Q2ABTU9D~com~buzzfeed~buzzfeed
drwxr-xr-x 3 technodiva staff 102 Jun  7 21:44 J84J654MKE~com~lightplaces~baiboard-ipad
drwxr-xr-x 3 technodiva staff 102 Sep  8 2012 KL2F7S68N3~com~espn~ScoreCenter
drwxr-xr-x 3 technodiva staff 102 May 30 2012 RWR56DABHQ~com~albertogh~MemeGenerator
drwxr-xr-x 3 technodiva staff 102 Jun  7 21:44 UBHRZCX4PE~com~foodcom~everydayisafoodholiday
drwxr-xr-x 3 technodiva staff 102 Jan  1 2013 VDZ8PCF9YD~com~Halfbrick~Fruit
drwxr-xr-x 3 technodiva staff 102 Aug 22 2012 VDZ8PCF9YD~com~halfbrick~FNHDLite
drwxr-xr-x 3 technodiva staff 102 Jan  1 2013 VDZ8PCF9YD~com~halfbrick~FruitNinjaLite
drwxr-xr-x 3 technodiva staff 102 Jun  7 21:36 com~apple~Automator
drwxr-xr-x 4 technodiva staff 136 Jul 31 11:45 com~apple~CloudDocs
drwxr-xr-x 10 technodiva staff 340 Jul 29 21:34 com~apple~Keynote
drwxr-xr-x 3 technodiva staff 102 Jan 15 2013 com~apple~Notes
drwxr-xr-x 8 technodiva staff 272 Jul 11 20:30 com~apple~Numbers
drwxr-xr-x 11 technodiva staff 374 Jul 11 20:30 com~apple~Pages
drwxr-xr-x 3 technodiva staff 102 Dec 28 2012 com~apple~Preview
drwxr-xr-x 3 technodiva staff 102 Jun  7 21:36 com~apple~QuickTimePlayerX
drwxr-xr-x 3 technodiva staff 102 Jun  7 21:44 com~apple~ScriptEditor2
drwxr-xr-x 4 technodiva staff 136 Jul 11 20:30 com~apple~TextEdit
drwxr-xr-x 4 technodiva staff 136 Jul  8 20:16 com~apple~TextInput
drwxr-xr-x 4 technodiva staff 136 Dec 28 2012 com~apple~mail
drwxr-xr-x 4 technodiva staff 136 Oct 10 2012 com~apple~shoebox
drwx----- 4 technodiva staff 136 Jun  7 21:44 com~apple~system~spotlight
```

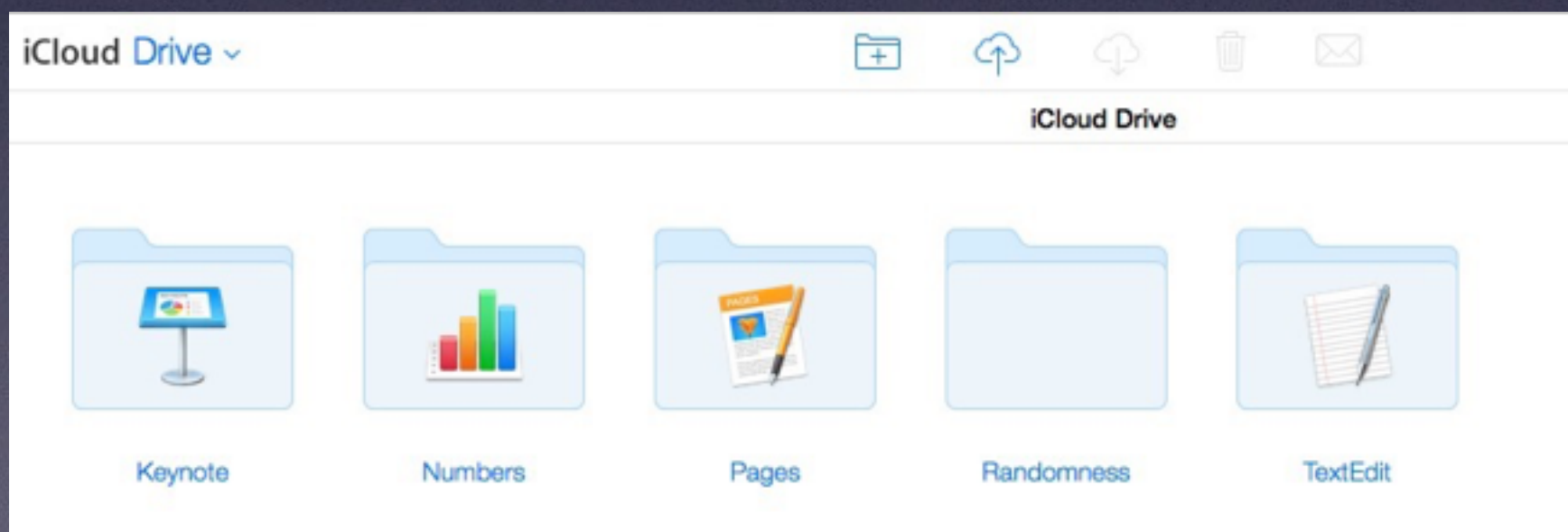
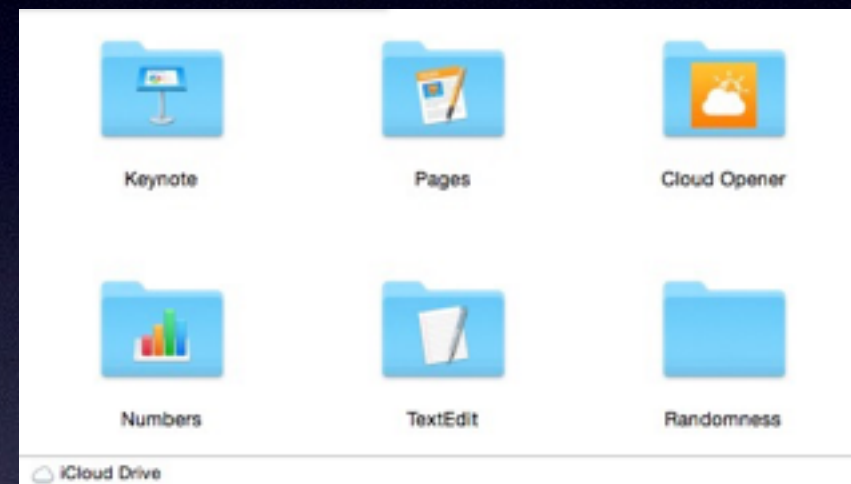
*~/Library/
Mobile
Documents*



Mobile Documents



is really iCloud Drive



which is also
iCloud Drive

Processes

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

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
Jul 31 11:05:35 Tenaya.local bird[296] <Notice>: scheduled 1 items for upload in com.apple.Keynote
Jul 31 11:05:38 Tenaya.local bird[296] <Notice>: sending 1 items to the cloud for com.apple.Keynote
Jul 31 11:05:41 Tenaya.local bird[296] <Notice>: scheduled 1 items for upload in com.apple.Keynote
Jul 31 11:05:41 Tenaya.local bird[296] <Notice>: received 3 edited items and 0 deleted items from the cloud for com.apple.Keynote
Jul 31 11:05:41 Tenaya.local bird[296] <Warning>: Bounced itemID CACD4CB3-2EA9-43E6-8149-3F1713A4507A from "150812-MTPro-NewYork-01-DeconstructingCloud-Shelley-Watson.jpg" to "150812-MTPro-NewYork-01-DeconstructingCloud-Shelley-Watson 2.jpg" because it clashes with D3A071FD-8BA7-43AC-90CC-B0BC0FA49321
Jul 31 11:05:41 Tenaya.local bird[296] <Notice>: sending 1 items to the cloud for com.apple.Keynote
Jul 31 11:05:43 Tenaya.local bird[296] <Notice>: received 0 edited items and 1 deleted items from the cloud for com.apple.Keynote
Jul 31 11:05:48 Tenaya.local bird[296] <Notice>: sending 1 items to the cloud for com.apple.Keynote
Jul 31 11:05:50 Tenaya.local bird[296] <Notice>: received 1 edited items and 0 deleted items from the cloud for com.apple.Keynote
Jul 31 11:20:28 Tenaya.local bird[296] <Notice>: scheduled 1 items for upload in com.apple.Keynote
Jul 31 11:20:32 Tenaya.local bird[296] <Notice>: sending 1 items to the cloud for com.apple.Keynote
Jul 31 11:20:33 Tenaya.local bird[296] <Notice>: scheduled 0 items for upload in com.apple.Keynote




```
technodiva — brctl — 91x21
[note] 260.550 [2015-07-31 13:11:09.326] sqlite.clientTruth fs.uploader
      BRCFSUploader.m:1001
      scheduled 1 items for upload in com.apple.Keynote
[note] 263.817 [2015-07-31 13:11:12.593] brc.sync sync.up
      BRCSyncUpOperation.m:422
      sending 1 items to the cloud for com.apple.Keynote
[note] 266.430 [2015-07-31 13:11:15.206] sqlite.serverTruth zone.server
      BRCServerZone.m:748
      received 3 edited items and 0 deleted items from the cloud for com.apple.Keynote
[WARN] 266.431 [2015-07-31 13:11:15.207] sqlite.serverTruth zone.server
      BRCServerZone.m:250
      Bounced itemID A1736975-6DB5-4490-88F3-2A36729B30B5 from "150812-MTPPro-NewYork-01-Deconstructing iCloud-Shelley-Watson.jpg" to "150812-MTPPro-NewYork-01-Deconstructing iCloud-Shelley-Watson 2.jpg" because it clashes with C26BA18B-BF91-48B8-A16F-10581FF5B2D1
[note] 266.577 [2015-07-31 13:11:15.353] brc.sync sync.up
      BRCSyncUpOperation.m:422
      sending 1 items to the cloud for com.apple.Keynote
[note] 267.965 [2015-07-31 13:11:16.741] sqlite.serverTruth zone.server
      BRCServerZone.m:748
      received 0 edited items and 1 deleted items from the cloud for com.apple.Keynote
```

Monitor Network State
brctl log -w



AutoSave

Apple stresses
AutoSaves

Explicit saves
possible...




```
technodiva — brctl — 136x22

received 2 edited items and 0 deleted items from the cloud for com.apple.Keynote
[note] 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 BRCSyncUpOperation.m:422
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 BRCSyncUpOperation.m:422
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 BRCSyncUpOperation.m:422
Network reachability changed to reachable [R -----]
[note] 442.622 [2015-07-31 13:14:11.398] reachability reachability-monitor BRCSyncUpOperation.m:422
Network reachability changed to unreachable [R tc-----]
[note] 442.622 [2015-07-31 13:14:11.398] brc.system-resources resources BRCSyncUpOperation.m:422
Network really becomes unreachable
[note] 490.094 [2015-07-31 13:14:58.870] sqlite.clientTruth fs.uploader BRCFSUploader.m:1001
scheduled 3 items for upload in com.apple.Numbers
[note] 493.085 [2015-07-31 13:15:01.861] 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
```

Who turned the Internet off?



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

Never mind, it's back!



technodiva

nettop

133x28

	interface	state	bytes in	bytes out	rx dupe
racocon.78449					
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			
syncdefaults.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





SYNC
IS
NOT
BACKUP



Interesting Results

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

We who support users...



Cloud Opener



Conflicts



The document “150812-MTPPro-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 (myfile.txt = MyFile.txt)*



User issues

What device are you asking about?

Have you restarted the device?

Is your device connected to power?

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?

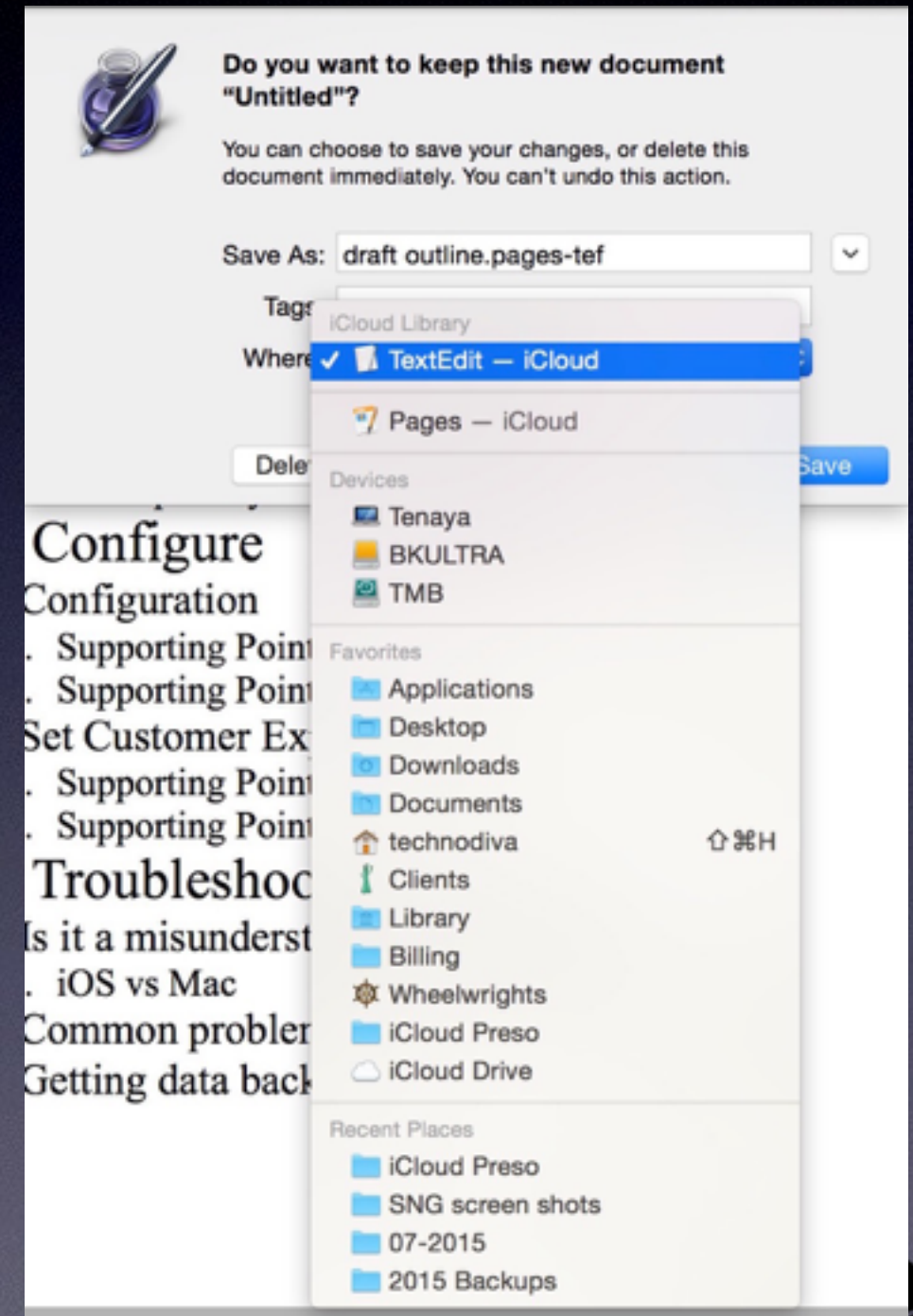
Do you allow cellular access to the app?

Is your date & time correct?



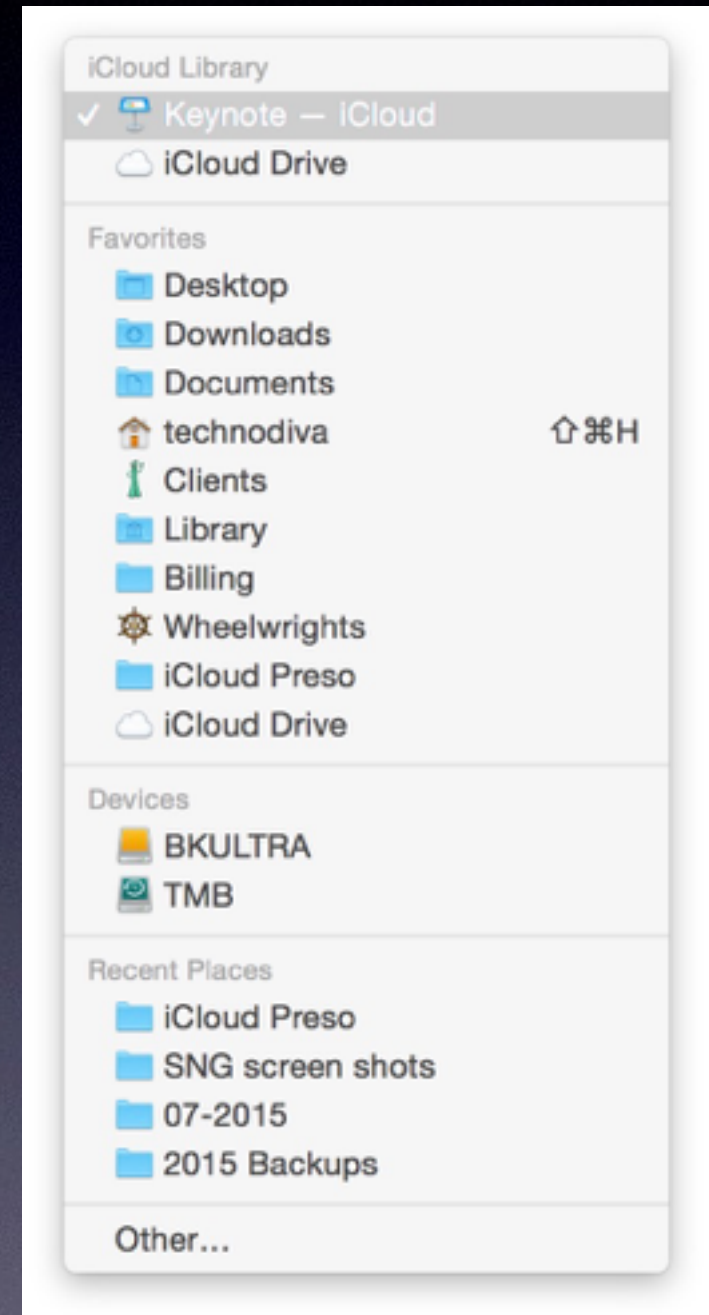
Save & Open

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



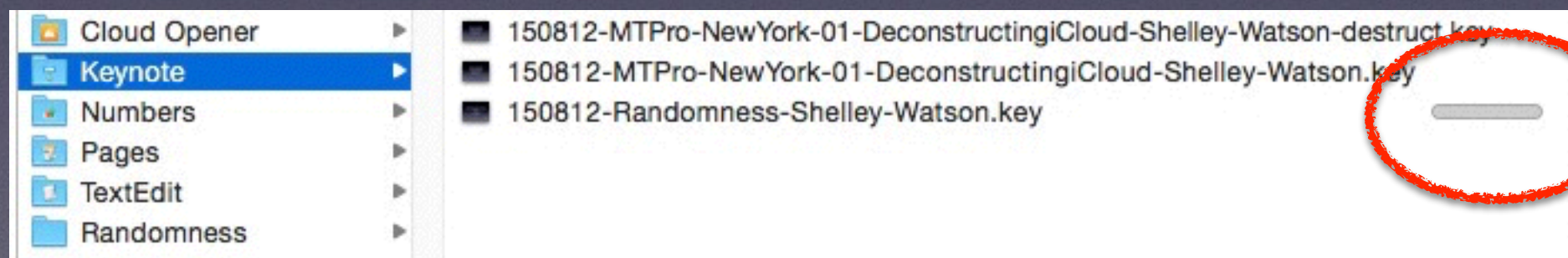
More Save & Open

- Did you save the file to your computer or iCloud?
- Did you create a file that can be stored in iCloud?



Unexpected Results

- You add a file or folder to iCloud Drive
- You want to move the file or folder from iCloud to your Mac
- You just drag it to the new location
- If it didn't sync before you moved...
- It's gone



Backup



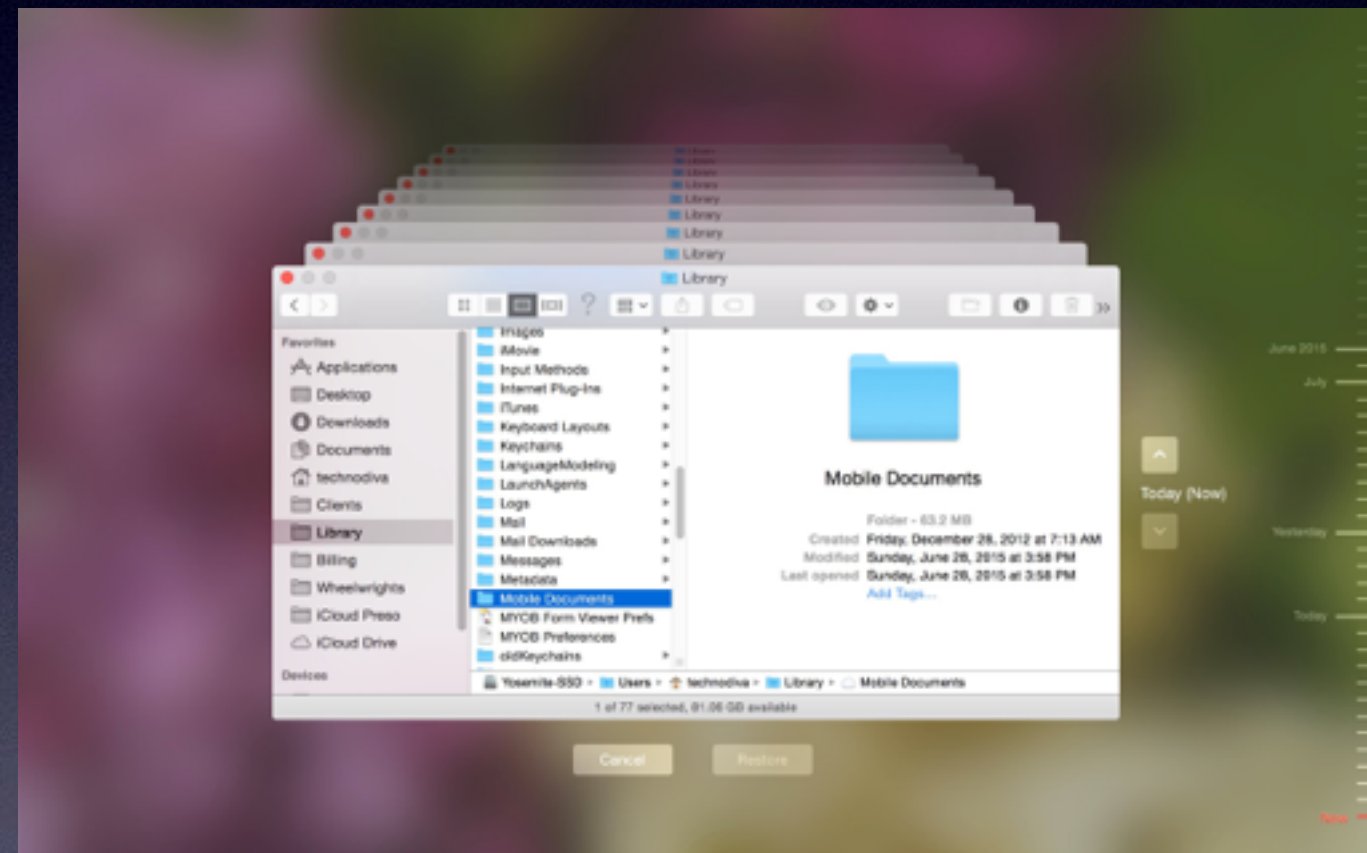


Sync is like backup, right?



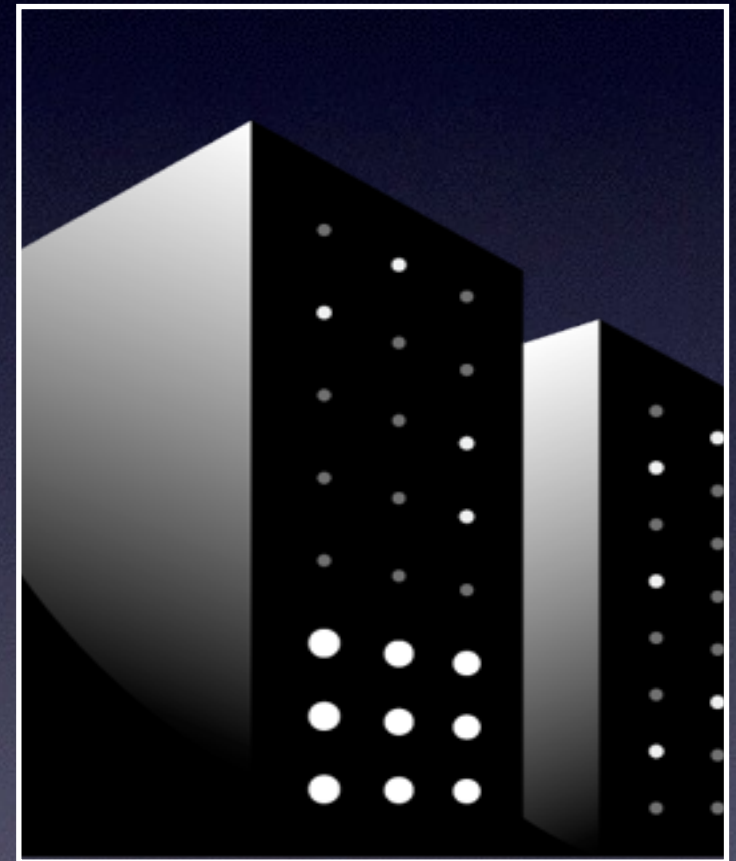
Time Machine

- 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



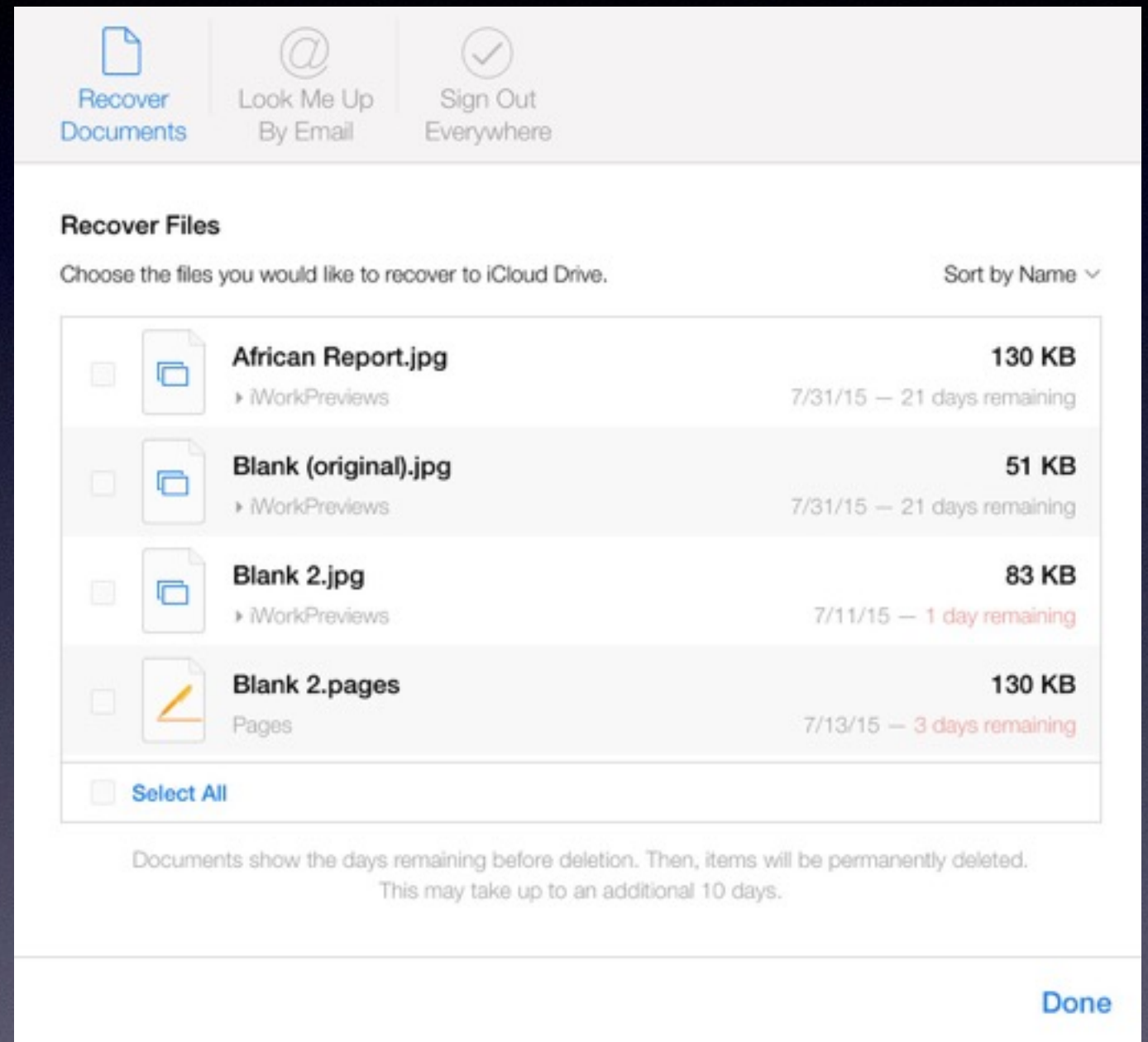
Unclouder

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



iCloud Drive

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



Ecosystems



Current
Ecosystem

We hate _____

Cost

App Pref

Security

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 whatsit
- Location sharing
- iCloud Keychain
- Photos

Here's the thing about magic...

- *Magic depends on dev adoption of Apple's guidelines*
- *Magic depends on client expectations*
- *Magic depends on YOUR situational awareness*

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>
- <https://support.apple.com/en-us/HT201385>



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>
- *Ports in use by Apple*
<https://support.apple.com/en-us/HT202944>

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/>



