Multipeer Networking

Rob Stearn

History
Overview
Code
!
Future

History


Chooser
AppleShare
Select a file server:
Macintosh mcbx
OK
User Name:
mcbx
AppleTalk
Active
Inactive

Overview

Multipeer networking

sends data *from one device to many*

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bridges across interfaces

Consider 3 iOS devices...

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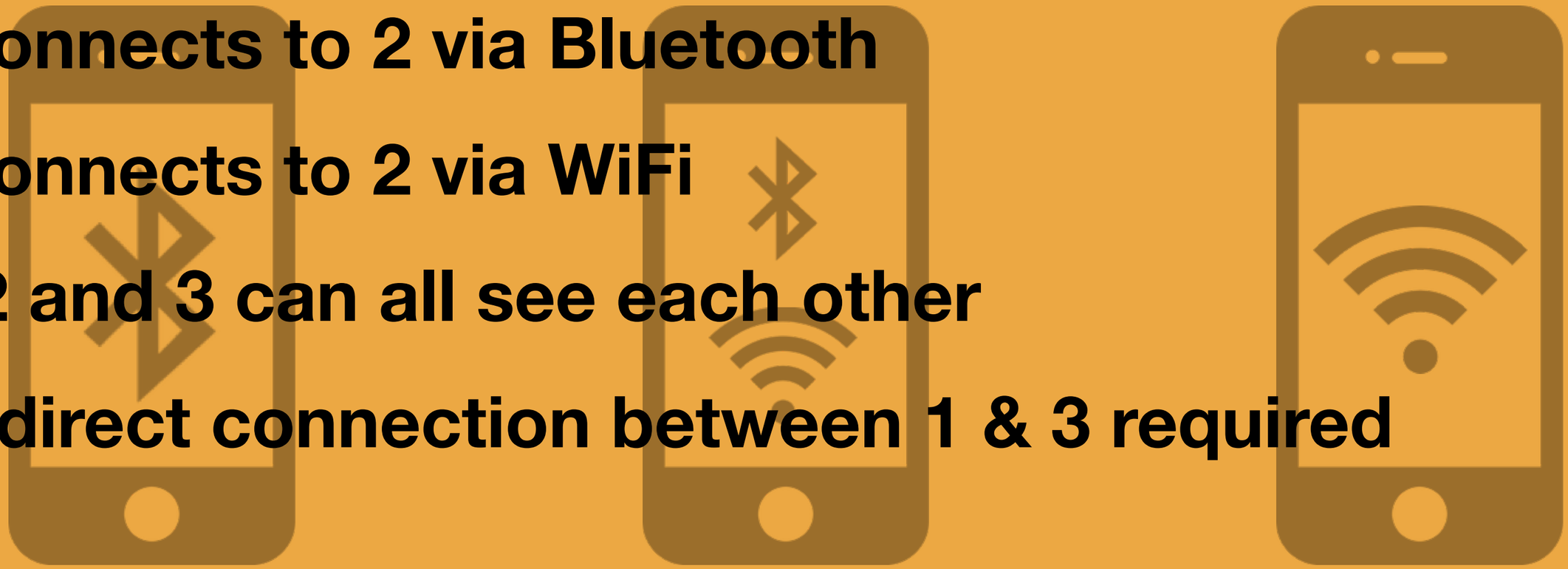
1 connects to 2 via Bluetooth

3 connects to 2 via WiFi

1, 2 and 3 can all see each other

no direct connection between 1 & 3 required



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API requires iOS7+

Discovery

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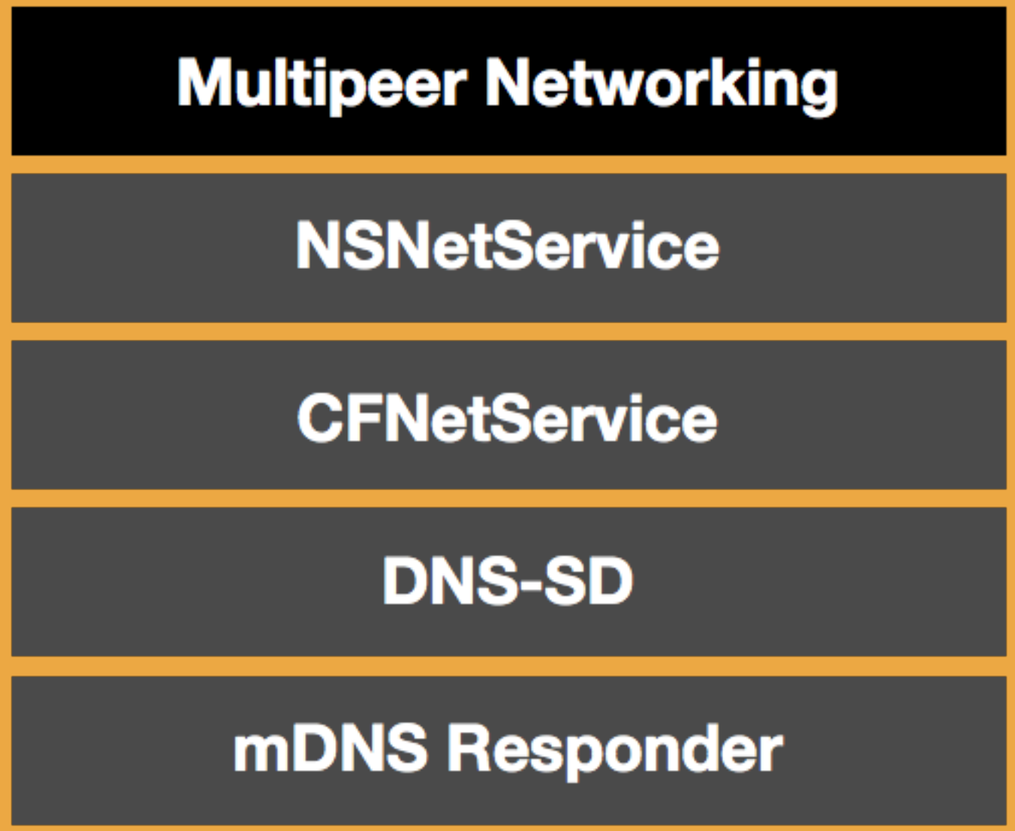
Every peer acts as a DNS for itself

Uses URLs with with the .local domain

Uses multicast DNS to discover services

Peers self-assign an IP in the `169.254.xxx.xxx` range

Discovery APIs



Code

3 Objects:
Session
Browser
Advertiser

Session, Browser and Advertiser

Session, Browser and Advertiser

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Session, Browser and Advertiser

Session, Browser and Advertiser

kMCSessionMaximumNumberOfPeers

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Bluetooth: 8

kMCSessionMaximumNumberOfPeers

Bluetooth: 8

Wi-fi: 8?

Session

Browser

Advertiser

Sending data

Session / MCPeerID

```
MCPeerID *peerID =
[[MCPeerID alloc]
initWithDisplayName:@"cocoad
elica"];
```

Session / Initialize

```
self.session = [[MCSession alloc]
initWithPeer:peerID securityIdentity:nil*
encryptionPreference:
MCEncryptionRequired**];
```

Session / Initialize

```
self.session = [[MCSession alloc]
initWithPeer:peerID securityIdentity:nil*
encryptionPreference:
MCEncryptionRequired**];
```

* **optional Array with** `SecIdentityRef` **and** `SecCertificateRef` **items**

Session / Initialize

```
self.session = [[MCSession alloc]
initWithPeer:peerID securityIdentity:nil*
encryptionPreference:
MCEncryptionRequired**];
```

* **optional Array with** `SecIdentityRef` **and** `SecCertificateRef` **items**

** **choose from** `MCEncryptionRequired`, `MCEncryptionOptional` **or** `MCEncryptionNone`

Session / Delegate

```
didChangeState:
didReceiveCertificate:
didReceiveData:
didStartReceivingResourceWithName:
didFinishReceivingResourceWithName:
didReceiveStream:
```

Session / Details

Foreground operation only

Session / Details

Foreground operation only

Disconnects on breakpoints

Session / Details

Foreground operation only

Disconnects on breakpoints

Good candidate for a singleton*

Browser / Initialize

```
MCBrowserViewController *bvc =
[[MCBrowserViewController alloc]
initWithServiceType:(NSString
*)serviceType session:(MCSession
*)session];
```

Browser / Initialize

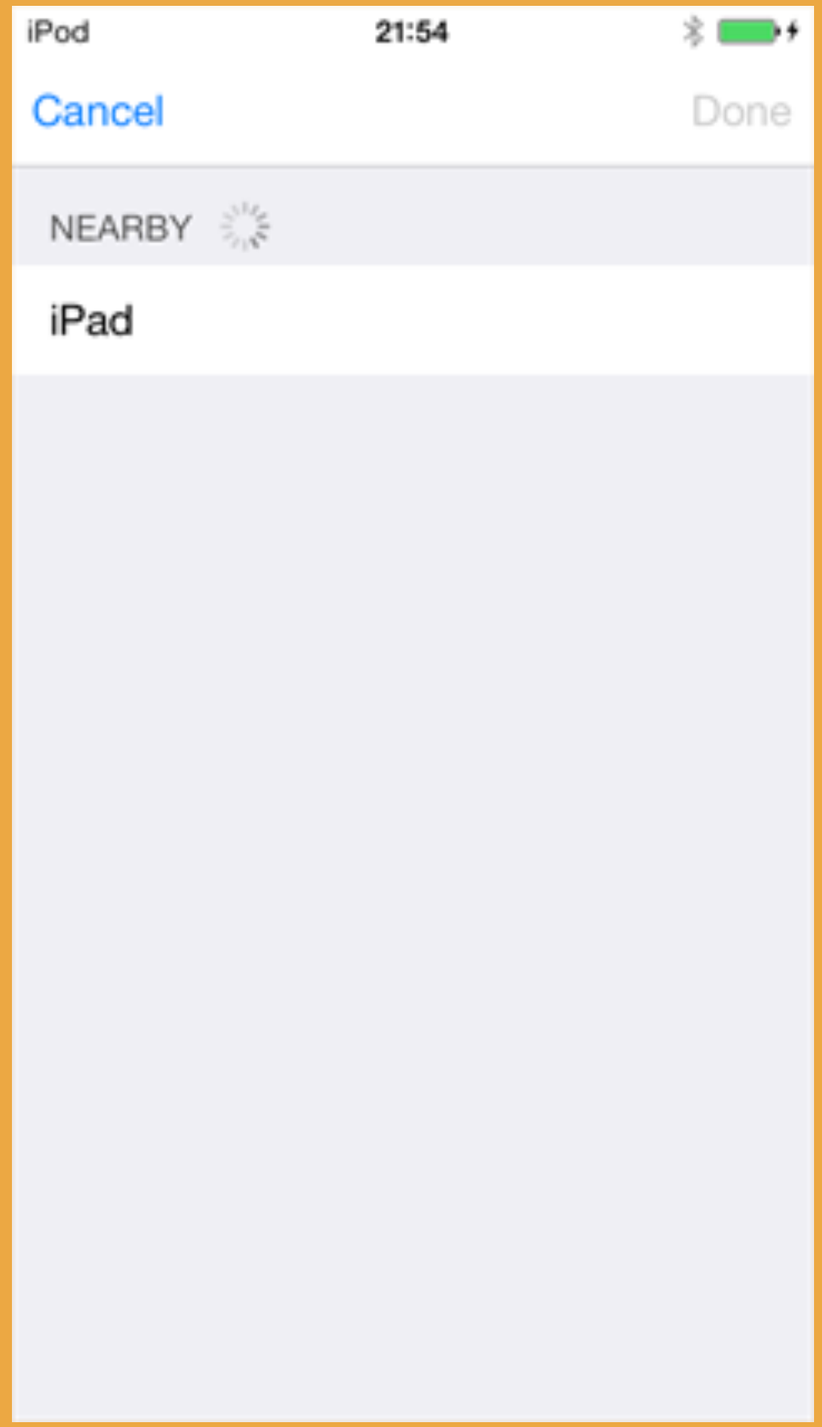
```
MCBrowserViewController *bvc =
[[MCBrowserViewController alloc]
initWithServiceType:(NSString
*)serviceType session:(MCSession
*)session];
```

Use a 1-15 character string for service type

Check IANA domain naming conventions

Browser

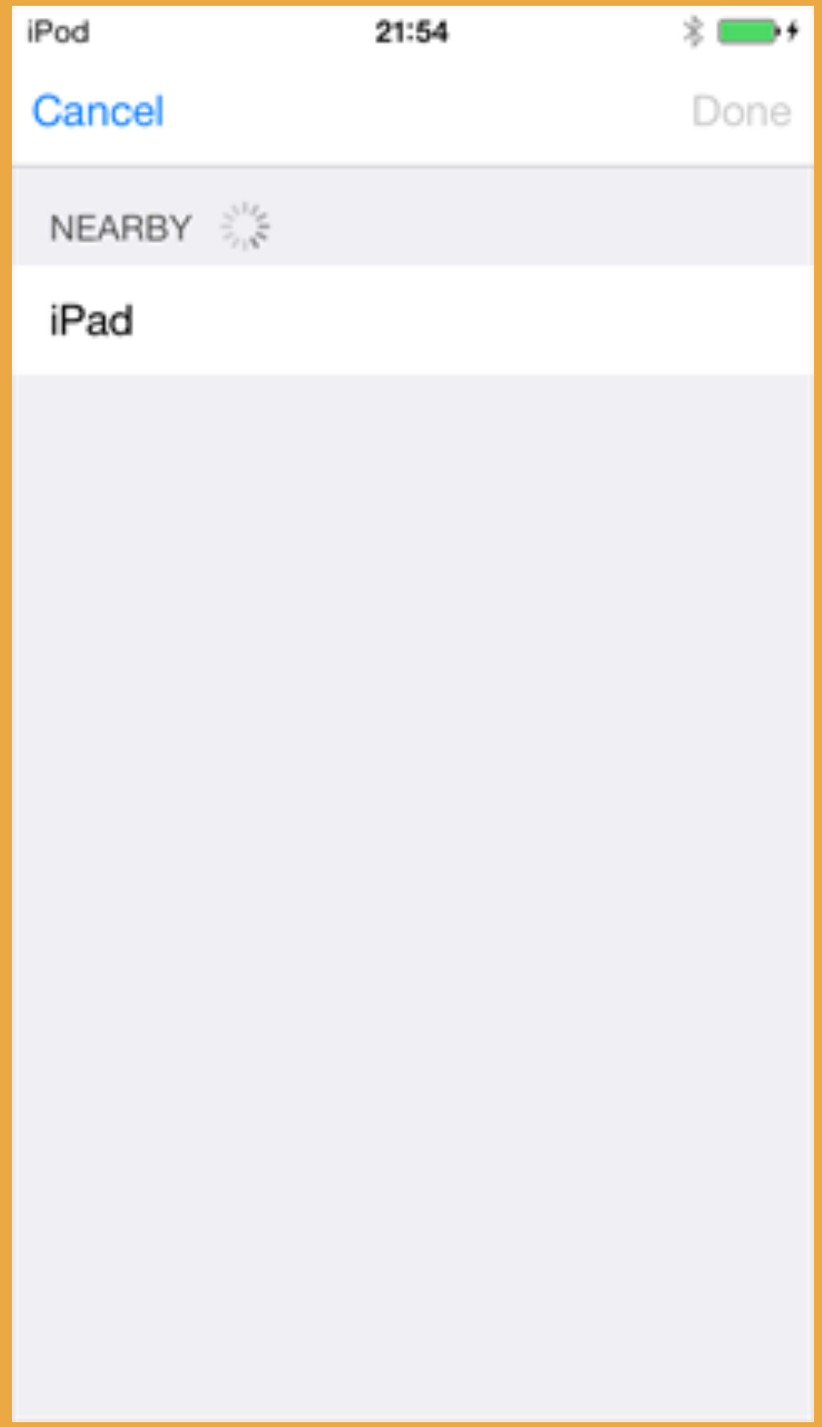
"Easy mode"



Browser

"Easy mode"

boxed solution



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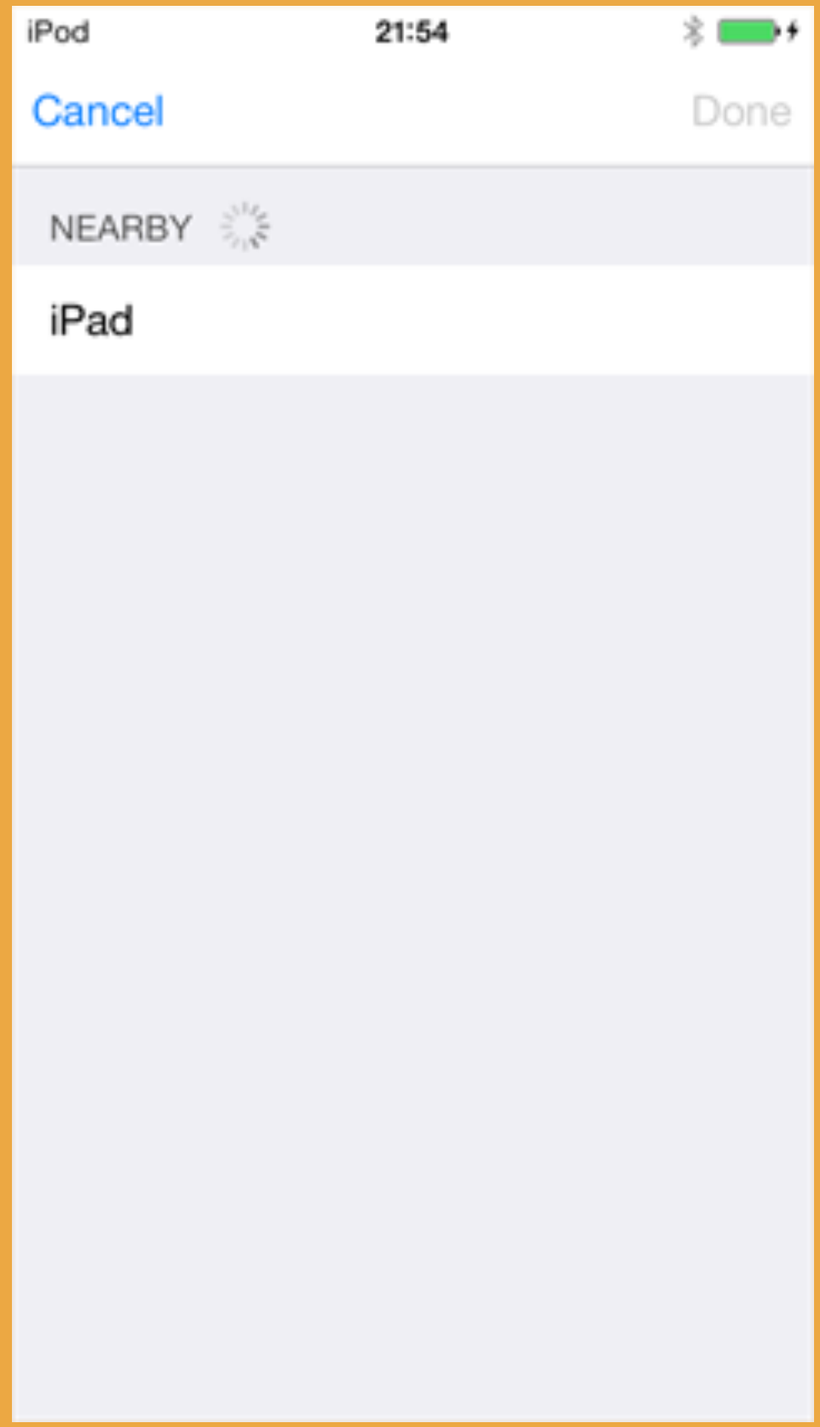
minimal styling



Browser

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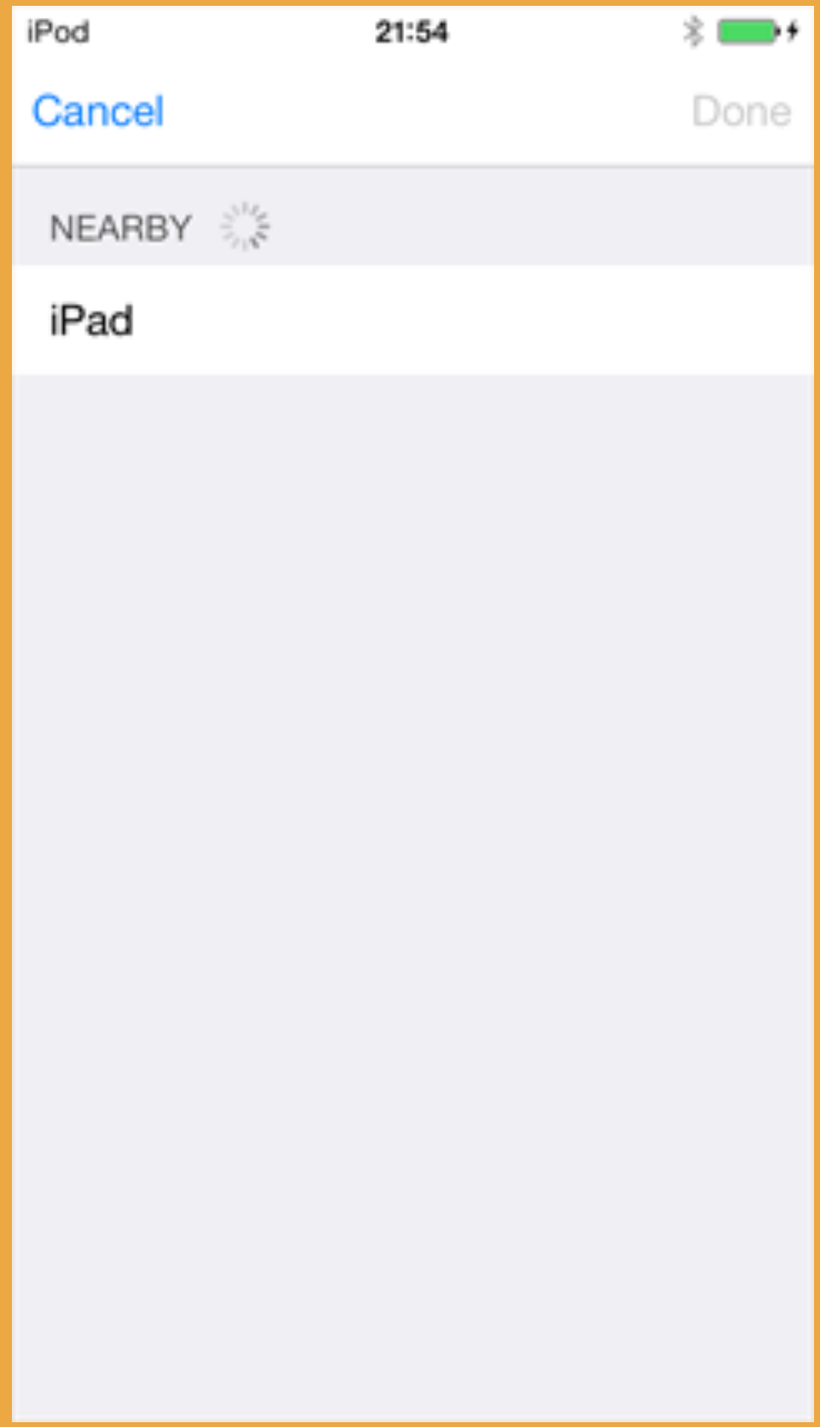
minimal styling

awesome!



Browser

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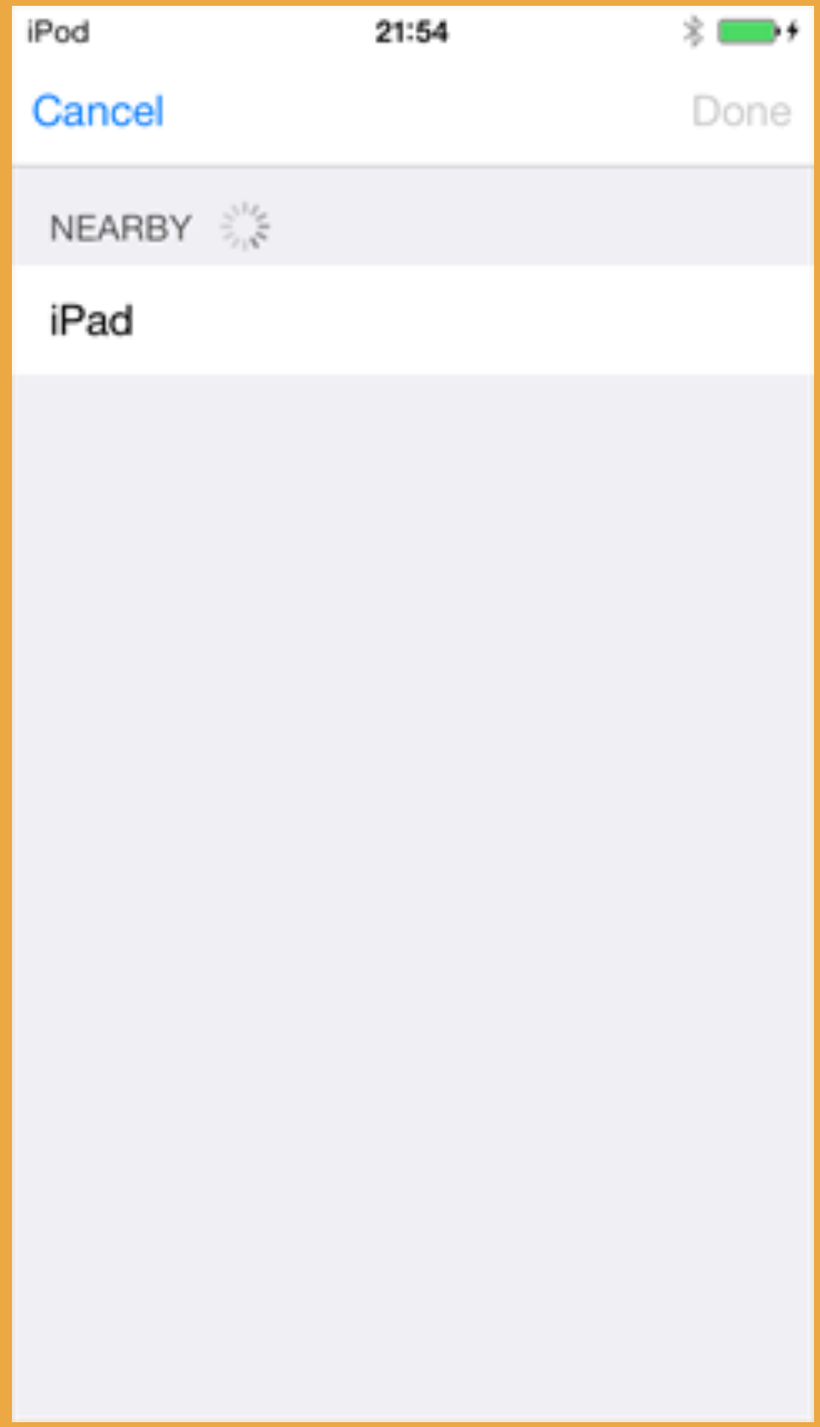
minimal styling

awesome!

a bit dull



Browser / Delegate

`MCBrowserViewControllerDelegate`

browserViewController:shouldPresentNearbyPeer:withDiscoveryInfo:

browserViewControllerDidFinish:

browserViewControllerWasCancelled:

Browser / Details

"Hard Mode"

Build a custom UI

Use `MCNearbyServiceBrowser` **for data and callbacks**

Browser / 'Hard Mode'

`MCNearbyServiceBrowserDelegate`

didNotStartBrowsingForPeers:

foundPeer:withDiscoveryInfo:

lostPeer:

Advertiser / Initialize

```
[[MCAdvertiserAssistant alloc]
initWithServiceType:service
discoveryInfo:discoveryDict
session:mySession];
```

Advertiser / Initialize

```
[[MCAdvertiserAssistant alloc]
initWithServiceType:service
discoveryInfo:discoveryDict
session:mySession];
```

`discoveryInfo` **is your opportunity to add additional info and context about your user.**

Advertiser / discoveryInfo

NSDictionary

Keys and Values must be of type NSString

Max size per key/value pair of 256 bytes

Advertiser / Details

"Hard Mode"

Build a custom UI for invitations

Use `MCNearbyServiceAdvertiser` **advertising & callbacks**

Advertiser / 'Hard Mode'

```
MCNearbyServiceAdvertiserDelegate

advertiser: didNotStartAdvertisingPeer:

advertiser:
didReceiveInvitationFromPeer:
withContext: invitationHandler:
```

Sending data

Messages

Resources

Streams

Messages

Data with known bounds, serialized into `NSData` objects, sent atomically

```
sendData: toPeers: withMode: error:
```

```
session: didReceiveData: fromPeer:
```

Messages can be sent as either:

`MCSessionSendDataReliable` **which guarantees delivery and order**

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`MCSessionSendDataUnreliable` **which does not**

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`MCSessionSendDataUnreliable` **which does not**

Analogy to TCP/UDP

Resources

Text files, File URLs or Web URLs

```
sendResourceAtURL: withName: toPeer:
withCompletionHandler:
```

Callbacks to start and finish transfer, uses `NSProgress`

Streams

Unbounded data, uses NSStreams

`startStreamWithName: toPeer: error:`
returns an `NSOutputStream`

`session: didReceiveStream: withName: fromPeer:` **gives an** `NSInputStream`

Streams

For both input and output streams:

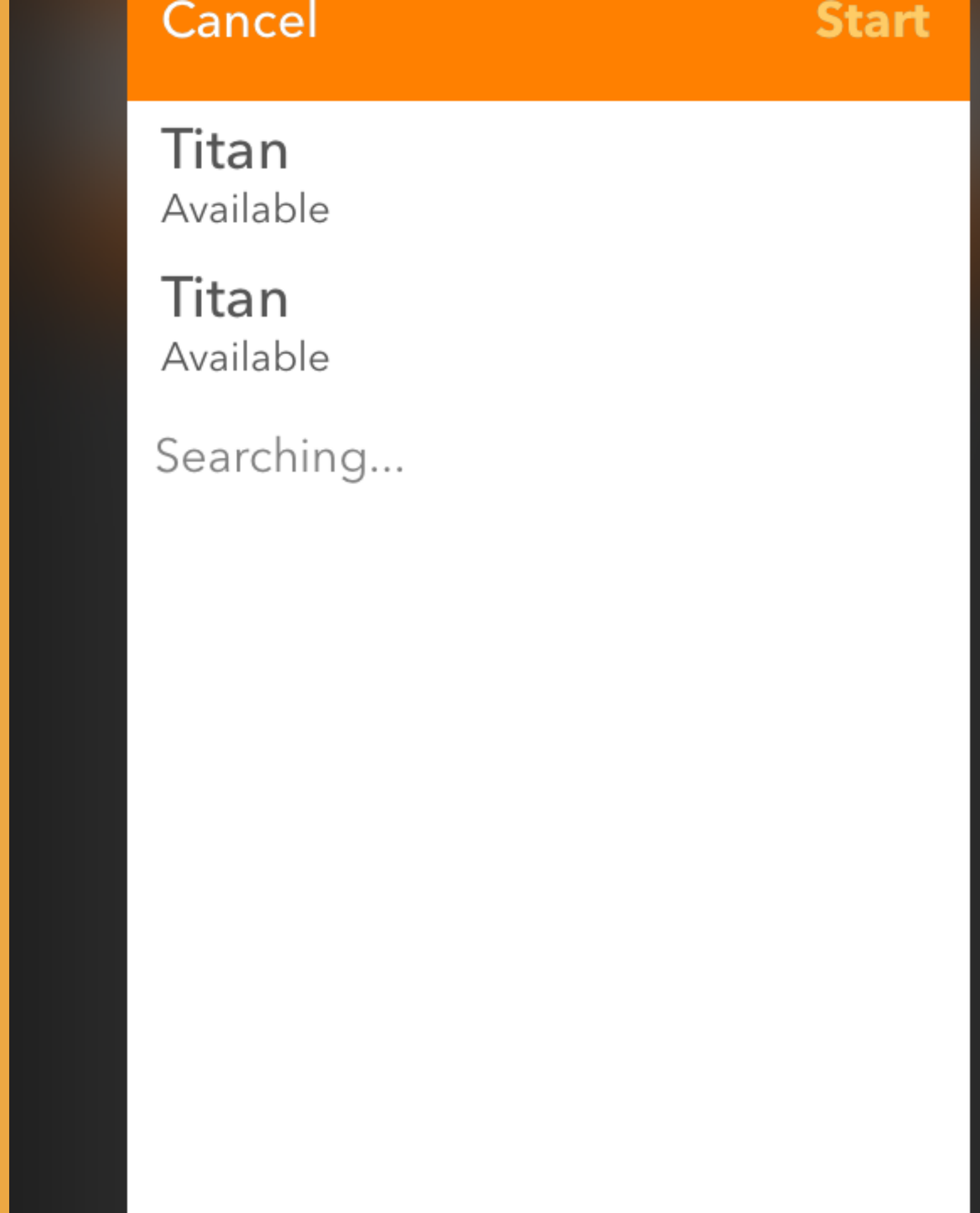
> Add stream to a run loop

> Open the stream

> Set a delegate and respond to `stream:handleEvent:` **callback**

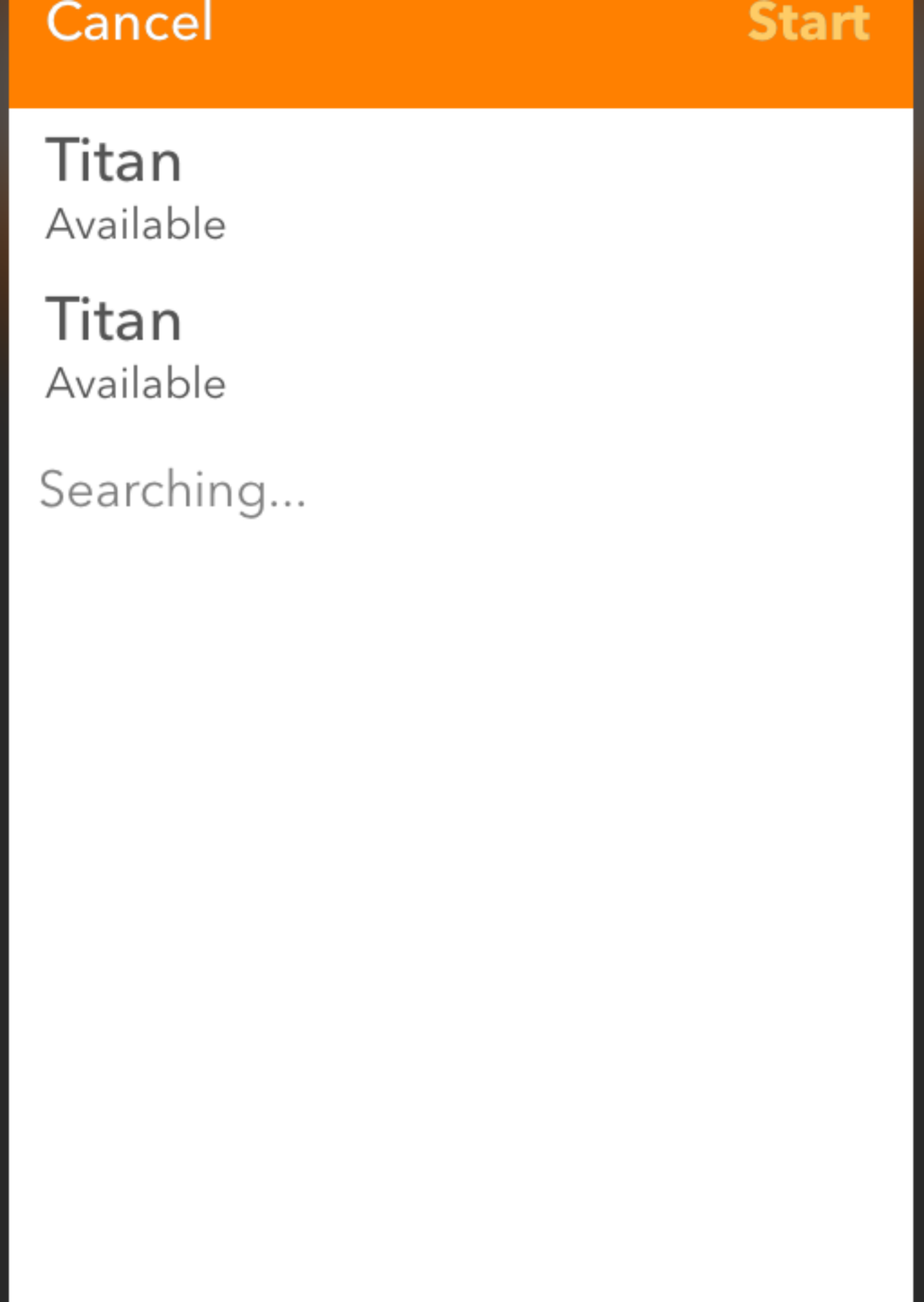

AppleACPIPlatformExport/PC1000/AppleACPIPCI/SATA@1F,2/AppleIntelPchSeriesAHCI/PR1000/IOAHCIDevice@0/Apple
driver/SAMSUNG SSD 830 Series Media/IOGUIDPa
Return Address
backtrace:
com.apple.CoreStorage(274.7)[5A5DC088-8553-3485-B461-B7B95A7ED734]0xffffff7fa221e000->0xffffff7fa22d5fff
dependency: com.apple.iokit.IOStorageFamily(1.8)[5BA4CD36-E96D-3A9E-ADFF-A863B8D63BC7]0xffffff7fa15c5000
Sat Aug 25 00:48:52 PDT 2012; root:xnu-2050.18.24~1/RELEASE_X86_64
MacBookPro8,1 (Mac-942459F5819B171B)

Duplicates in the browser



Duplicates in the browser

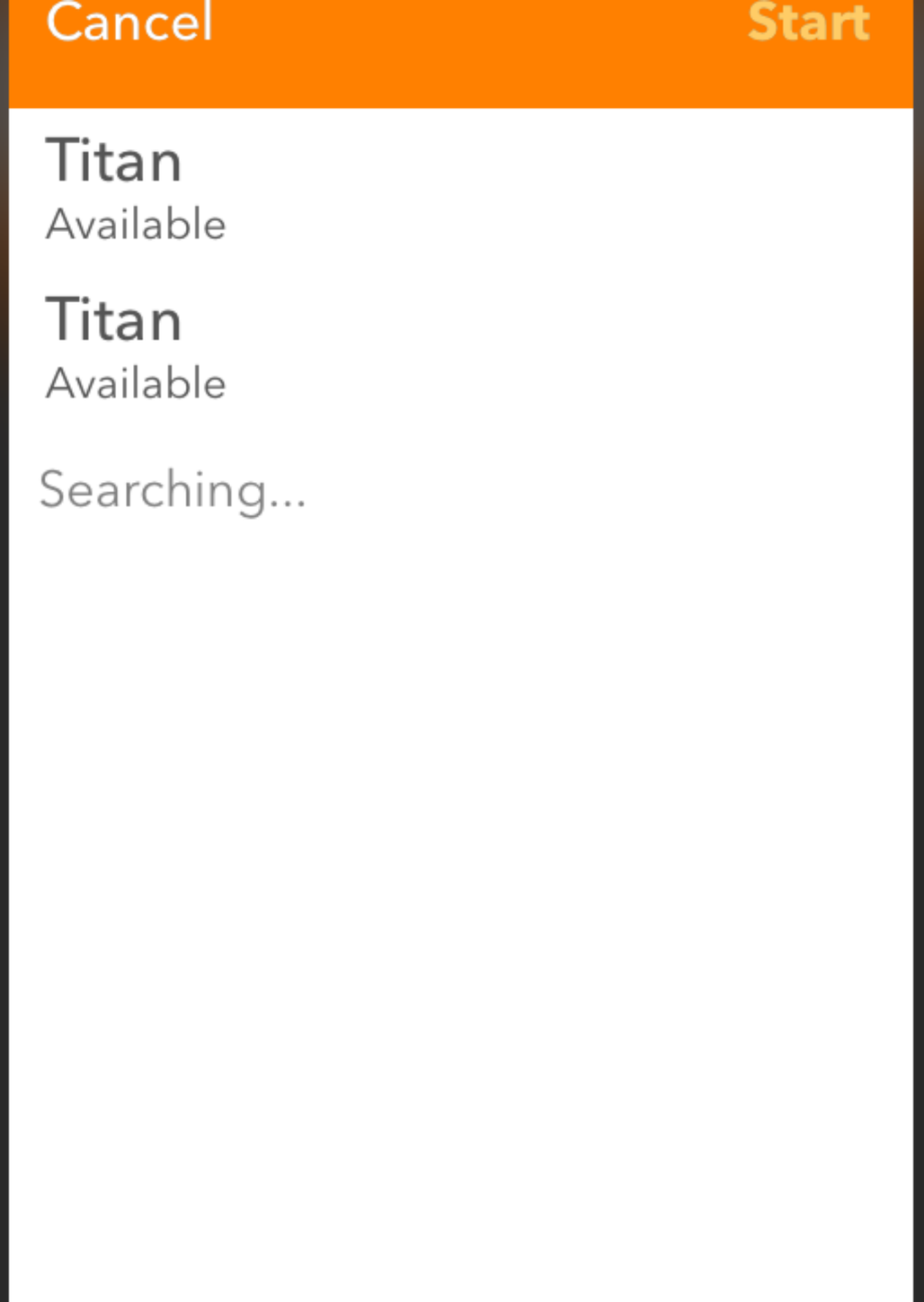
Issue: `MCPeerID` **created each time** `MCSession` **is instantiated**



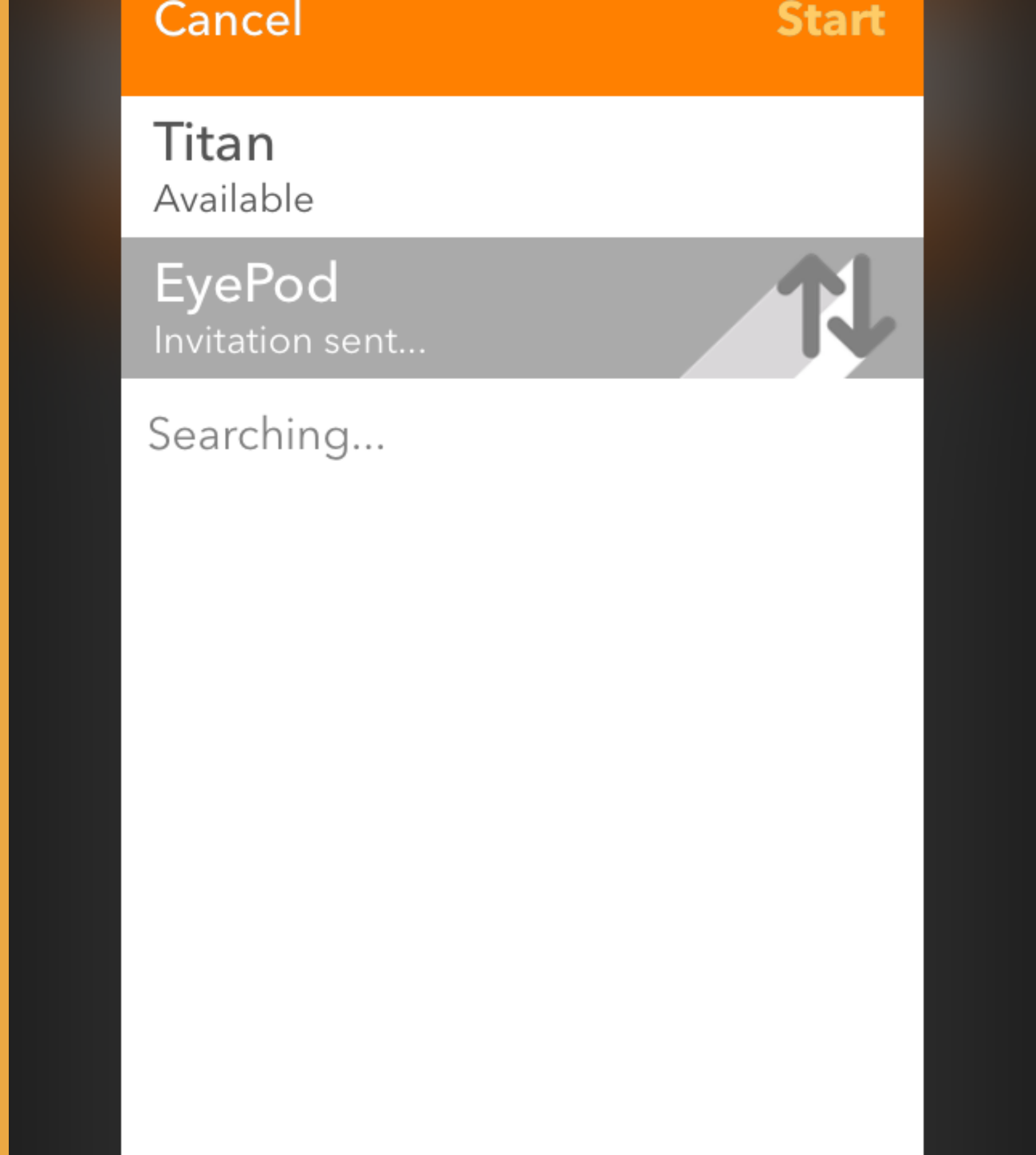
Duplicates in the browser

Issue: `MCPeerID` **created each time** `MCSession` **is instantiated**

Solution: Each peer should serialize its own `MCPeerID` **with** `NSKeyedArchiver`**, save it to disk and reuse for each new session.**

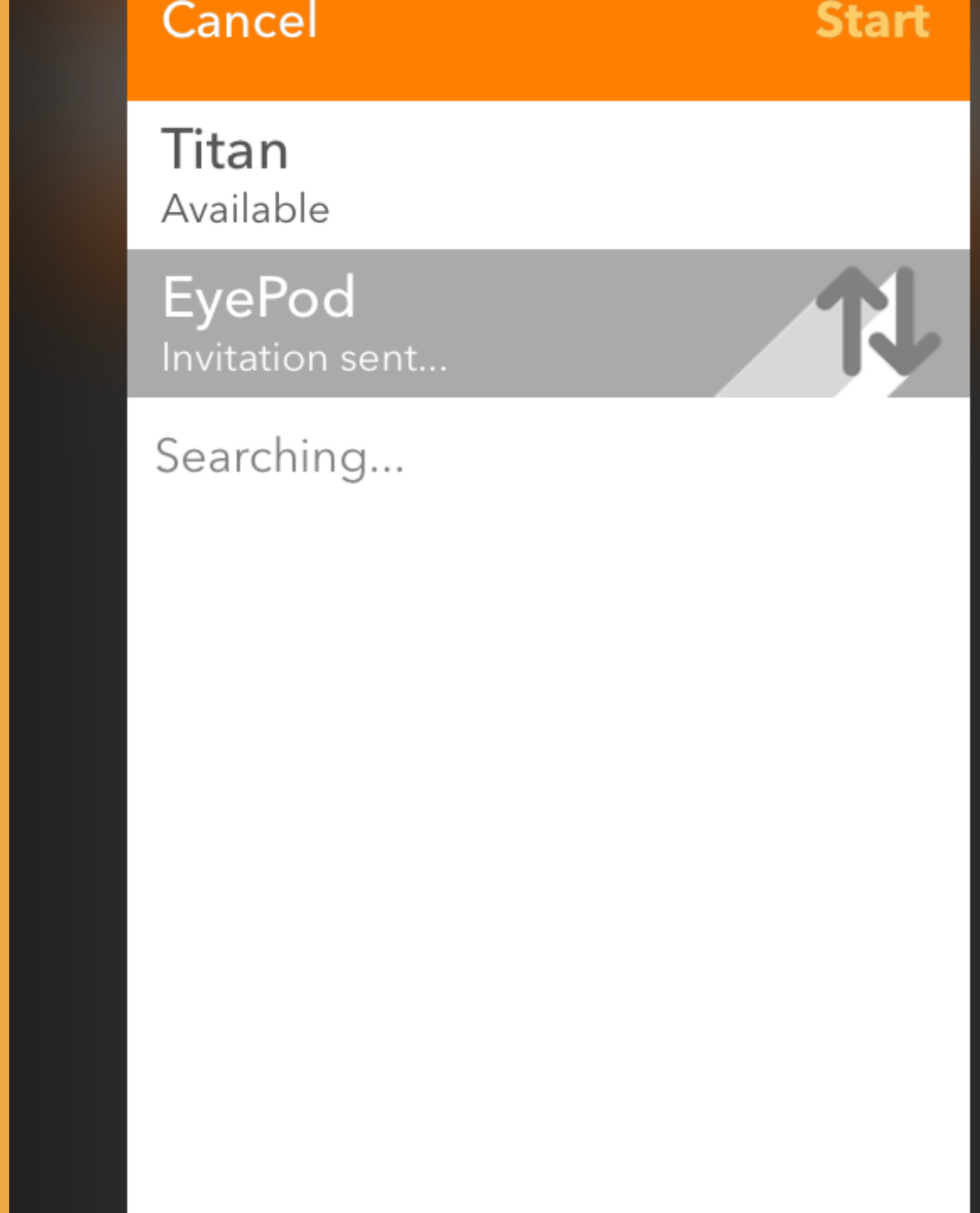


Invitation response times



Invitation response times

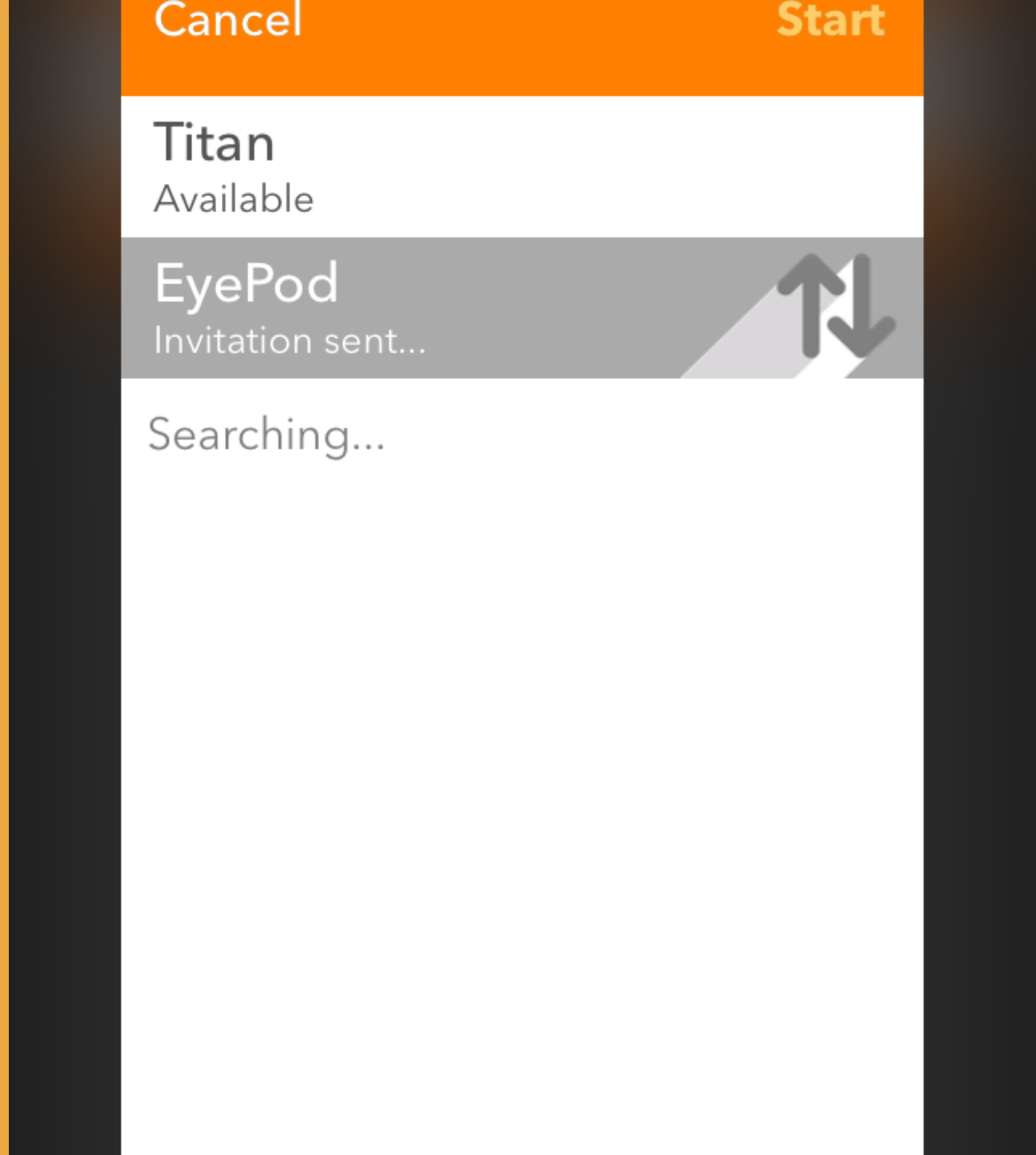
Issue: Once an invitation is accepted there's a delay before connecting



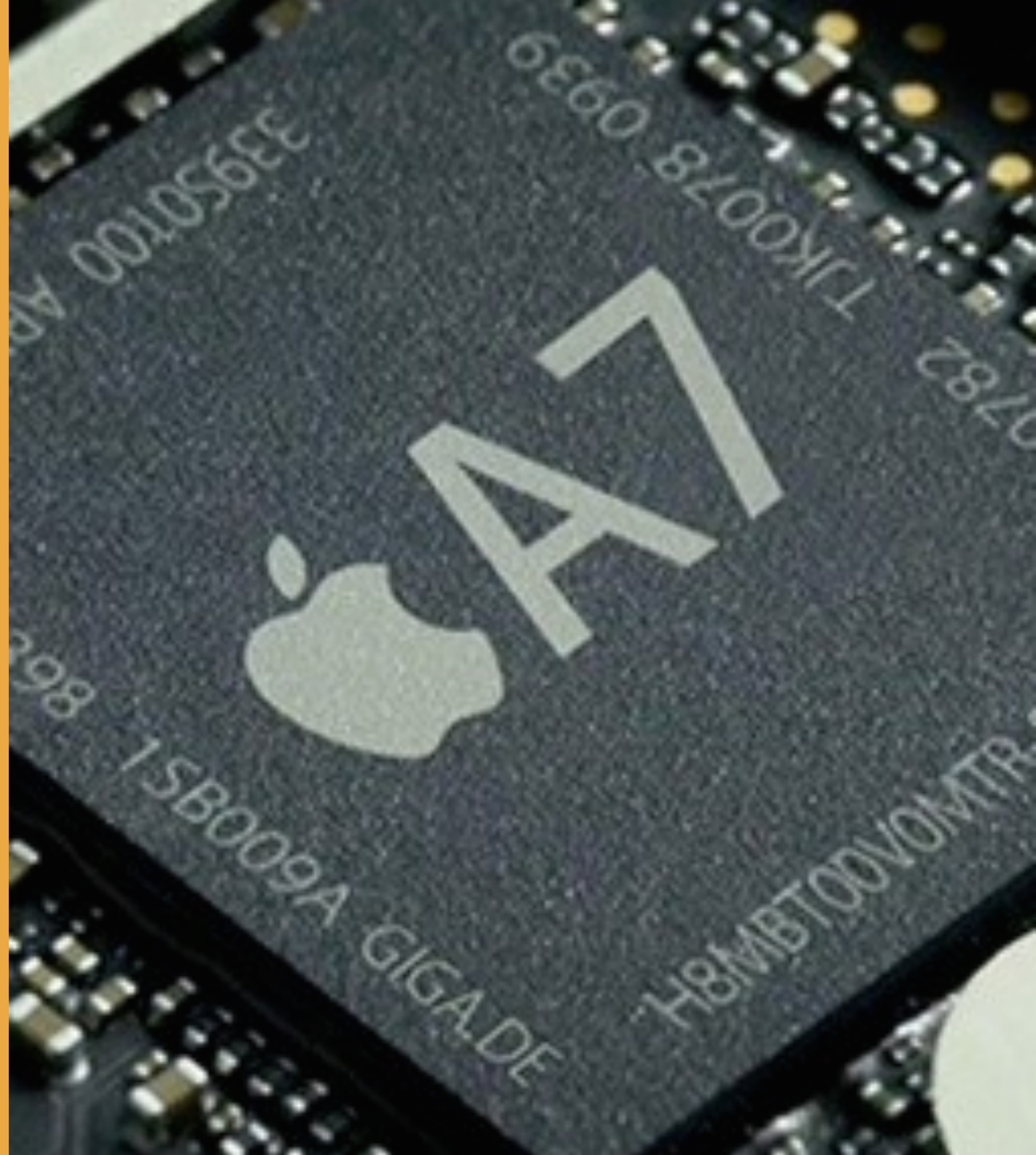
Invitation response times

Issue: Once an invitation is accepted there's a delay before connecting

Solution: Encryption is on by default which adds overhead to initial connections. Consider using `MCEncryptionNone`

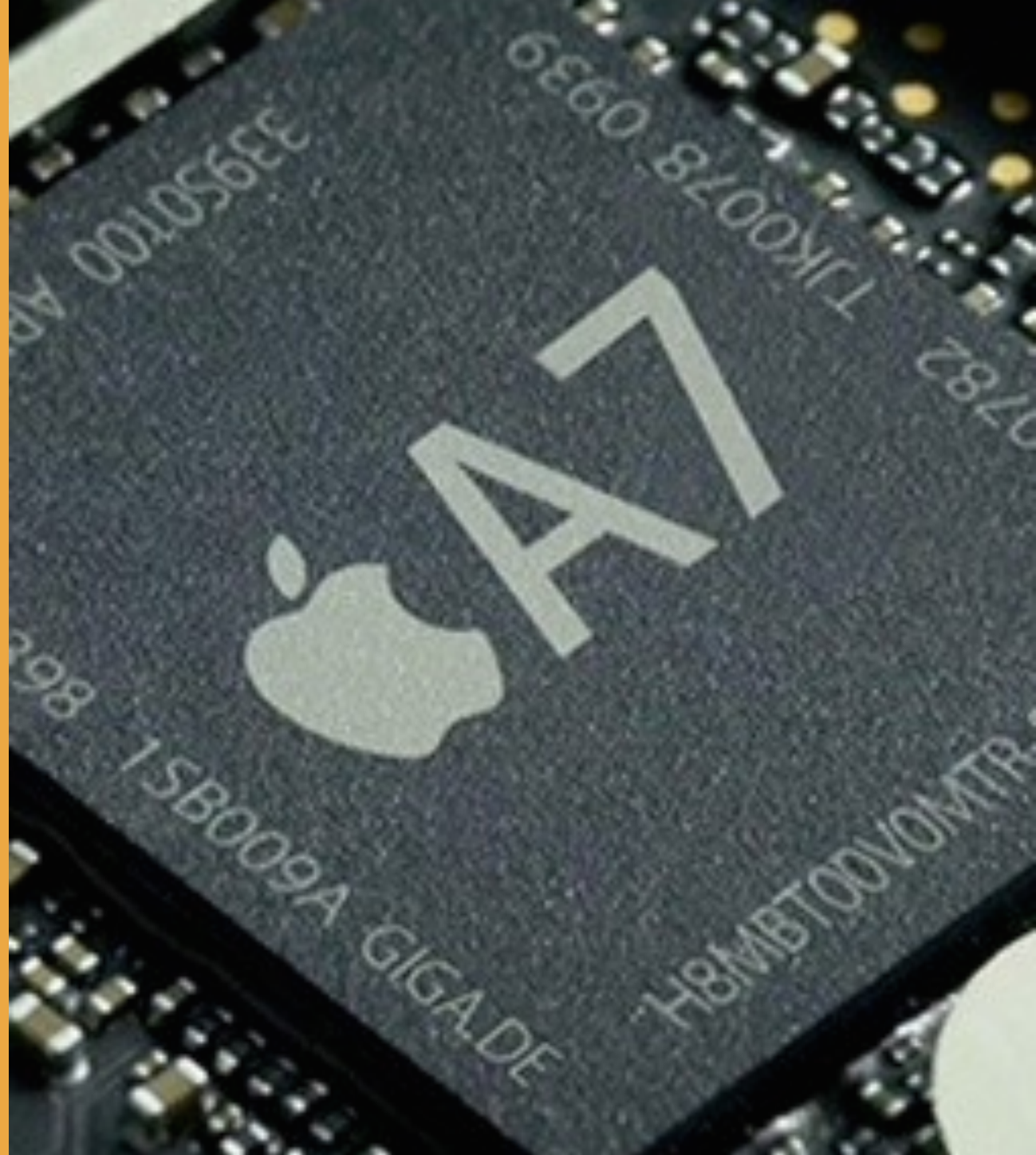


Comparing MCPeerIDs



Comparing MCPeerIDs

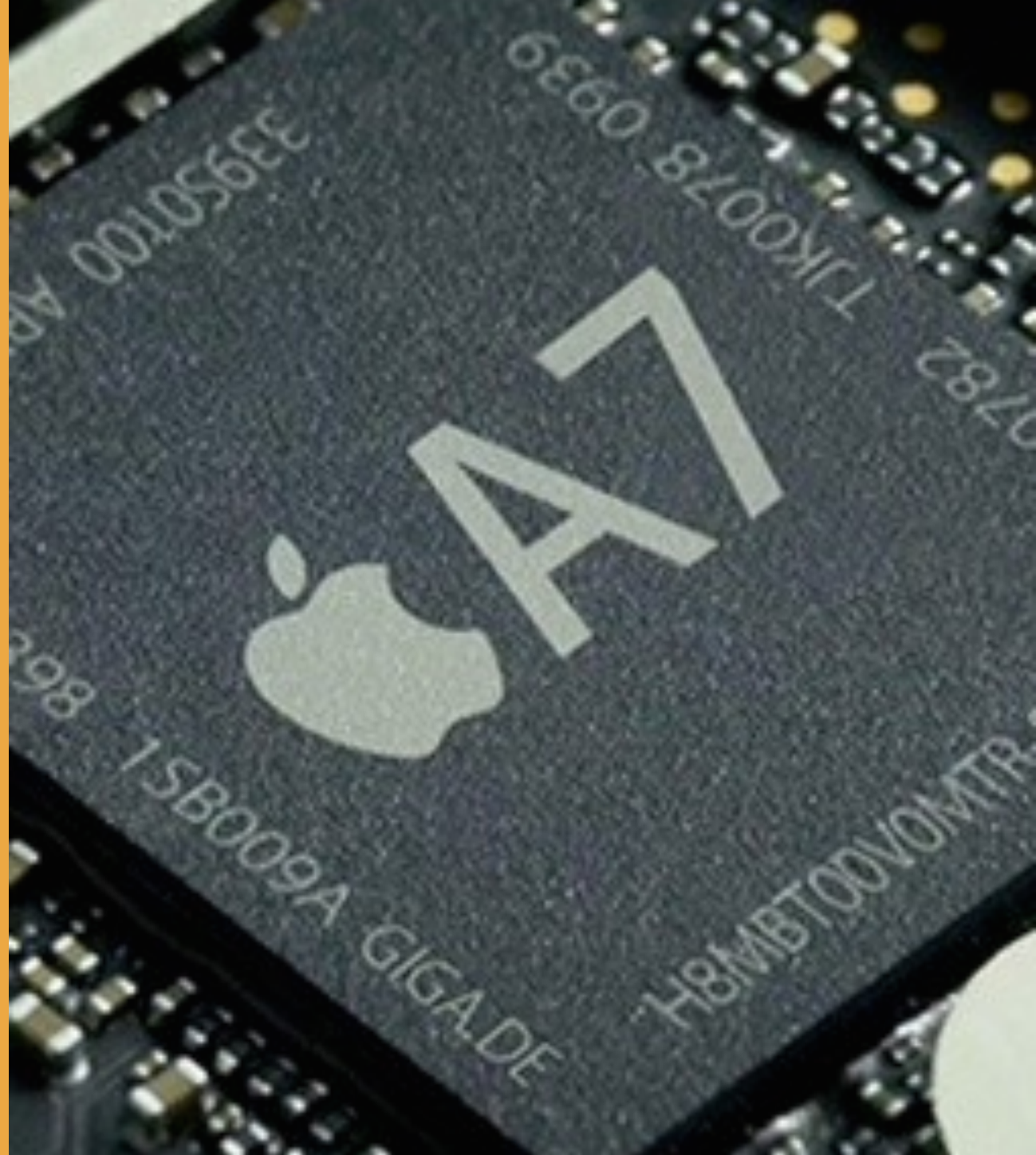
Issue: MCPeerID `hash` **method returns it's unique ID number, as an** `NSUInteger`**.**



Comparing MCPeerIDs

Issue: MCPeerID `hash` method returns it's unique ID number, as an `NSUInteger`.

Solution: Truncate the returned `hash` to 32-bit for comparison.




Demo

LocalTalk

on the app store

update in progress for iOS 8

OS X version to follow

free!


Future

Multipeer for Mac

Multipeer for Mac

Common API with iOS

Multipeer for Mac

Common API with iOS

But! Supports background operation

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Common API with iOS

But! Supports background operation

However! Not Bluetooth

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AirDrop rebuilt to use the new API

Multipeer for Mac

Common API with iOS

But! Supports background operation

However! Not Bluetooth

AirDrop rebuilt to use the new API

OS X <-> iOS AirDrop. *Finally*.

End

created with Deckset

http://www.decksetapp.com

icons made with Sketch

http://bohemiancoding.com/sketch/

Questions?

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WWDC 2013 Session 708
WWDC 2014 Session 709
IANA service type list
Bonjour Overview
Multipeer Networking Reference
NSNetServices & CFNetServices Programming Guide
MultipeerGroupChat sample code
Forums