Game Kit

iPhone and iPod touch Development
Fall 2009 — Lecture 22

Questions?

Announcements

- Assignment #8 (the last of the week-long assignments) out this past Saturday
  - Due next Monday

Today's Topics

- Game Kit Introduction
- Sessions and Peer Pickers
- Chat Demo
- In-Game Voice
- Voice Chat Demo

Notes

- I'm showing the relevant portions of the view controller interfaces and implementations in these notes
- Remember to release relevant memory in the -dealloc methods — they are not shown here
- You will also need to wire up outlets and actions in IB
- Where delegates are used, they too require wiring in IB
- You'd probably want to add some error checking to the code shown here if using it in a published application

Game Kit

Game Kit

- The Apple documentation states that "the Game Kit framework provides features designed for game developers who want to connect users of different iPhones together"
- However, the Game Kit framework can be useful for non-game related applications

Features

- Peer-to-peer connectivity — allows your app to create an ad-hoc Bluetooth network between multiple iPhone OS devices
- In-game voice — allows your app to handle voice communication between two iPhones or iPod touches

Classes & Delegates

- The Game Kit framework is a small (albeit powerful) framework consisting of just a few classes & delegates...
  - GKPeerPickerController
  - GKPeerPickerControllerDelegate
  - GKSession
  - GKSessionDelegate
  - GKVoiceChatService
  - GKVoiceChatClient

GKPeerPickerController & Delegate

- GKPeerPickerController — a UI for discovering and connecting to other iPhone OS devices
- GKPeerPickerControllerDelegate — delegate for handling GKPeerPickerController

GKSession & Delegate

- GKSession — provides capability to create and manage ad-hoc networks
- GKSessionDelegate — manages session events like connection requests and state changes

GKVoiceChatService & Client

- GKVoiceChatService — facilitates connecting of 2 iPhones into a voice chat
- GKVoiceChatClient — protocol which provides network connection, identifies peers and accepts/rejects voice chat requests

Device Support

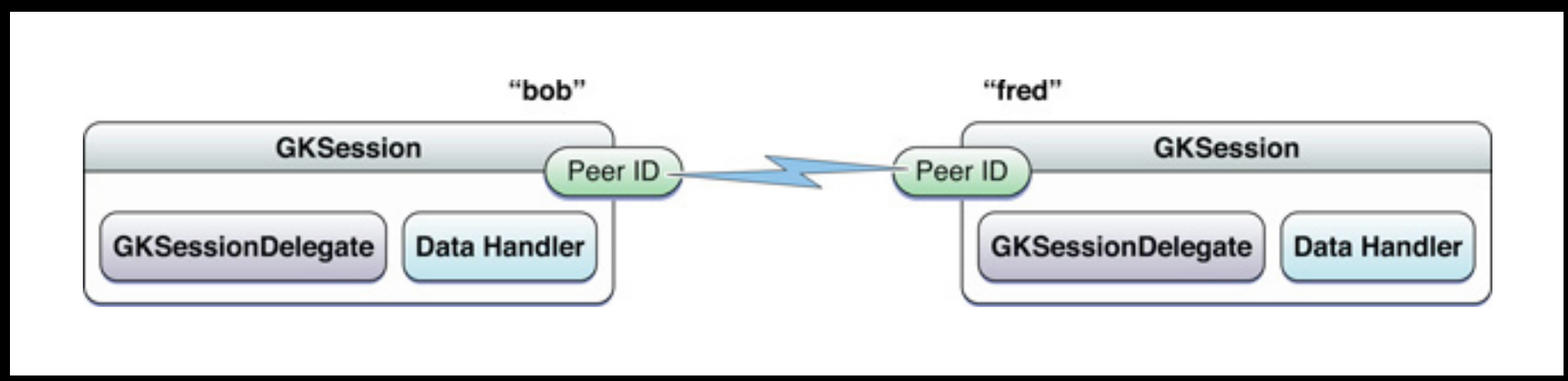
- Bluetooth networking is not supported on the original iPhone or the first-generation iPod touch
- Bluetooth networking is also not supported in the Simulator

Sessions

- When a session is created it connects to the network and discovers other sessions
- This session is used to transmit and receive data from other iPhone OS devices
- Your app implements a delegate to handle requests and receive data to hand off to your application

Peers

- iPhones connected to the ad-hoc network are known as peers
- Synonymous with a session running inside your application
- Each session creates a unique peerID used to identify the device on the network
- Communication between peers are done by using their peerID



Peer IDs and Names

- The peerID's are not intended to be exposed to end user's as they are just a long number like 1865470369
- This session method give you a user-friendly name for a peer...

```
- (NSString *)displayNameForPeer:(NSString *)peerID;
```

Peer Session States

- Peers may appear in a variety of states...

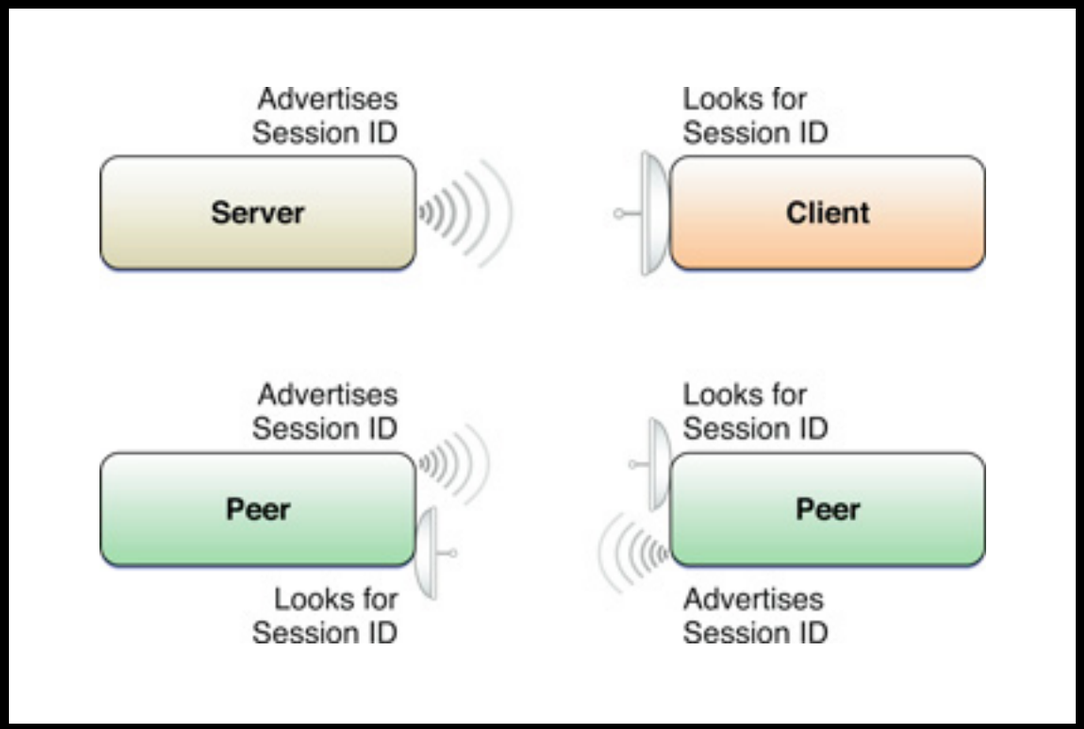
```
typedef enum {
  // not connected to session, but available
  // for connectToPeer:withTimeout:
  GKPeerStateAvailable,
  // no longer available
  GKPeerStateUnavailable,
  // connected to the session
  GKPeerStateConnected,
  // disconnected from the session
  GKPeerStateDisconnected,
  // waiting for accept, or deny response
  GKPeerStateConnecting,
} GKPeerConnectionState;
```

- These peer states are reported by the following delegate method...

```
- (void)session:(GKSession *)session
           peer:(NSString *)peerID
 didChangeState:(GKPeerConnectionState)state;
```

Discovering Peers

- Sessions discover other peers based on a session mode (set at initialization)
- Your app can configure the session to be...
  - A server — advertises a service type on the network
  - A client — searches for advertising servers
  - A peer, which advertises like both a server and a client



Implementing a Server

- An instance of your app acting as a server initializes a session by calling...

```
- (id)initWithSessionID:(NSString *)sessionID
                displayName:(NSString *)name
                sessionMode:(GKSessionMode)mode;
```

- Valid session modes are GKSessionModeServer or GKSessionModePeer
- Advertise the session by setting isAvailable property to YES

Implementing a Server

- Server is notified of client connection requests via a call to the delegate method...

```
- (void)session:(GKSession *)session
        didReceiveConnectionRequestFromPeer:(NSString *)peerID;
```

- Accept or reject the connection by calling...

```
- (BOOL)acceptConnectionFromPeer:(NSString *)peerID
                           error:(NSError **)error;
- (void)denyConnectionFromPeer:(NSString *)peerID;
```

- When successfully established, the following delegate method is called...

```
- (void)session:(GKSession *)session
           peer:(NSString *)peerID
 didChangeState:(GKPeerConnectionState)state;
```

Implementing a Client

- An instance of your app acting as a client initializes a session by calling...

```
- (id)initWithSessionID:(NSString *)sessionID
                displayName:(NSString *)name
                sessionMode:(GKSessionMode)mode;
```

- Valid session modes are GKSessionModeClient or GKSessionModePeer
- Your app then searches the network for advertised servers where isAvailable is YES

Implementing a Client

- When a client discovers an available server, it calls..

```
- (void)session:(GKSession *)session
           peer:(NSString *)peerID
 didChangeState:(GKPeerConnectionState)state;
```

- This method provides the peerID of the server, which you can use present a selection to the user
- Once the user selects a peer, the app then calls the following to actually open the connection...

```
- (void)connectToPeer:(NSString *)peerID
          withTimeout:(NSTimeInterval)timeout;
```

- When successfully established, it again calls -session:peer:didChangeState

Exchanging Data

- Data to be exchanged needs to be converted to an NSData
- Send data to all peers using...

```
- (BOOL)sendDataToAllPeers:(NSData *) data
                  withDataMode:(GKSendDataMode)mode
                         error:(NSError **)error;
```

- Or, just send data to select peers using...

```
- (BOOL)sendData:(NSData *) data
          toPeers:(NSArray *)peers
     withDataMode:(GKSendDataMode)mode
            error:(NSError **)error;
```

Exchanging Data

- For best performance, it is recommended that the size of the data objects be kept under 1k in length
- Larger messages (up to 95k) may need to be split and reassembled, incurring additional latency and overhead

Disconnecting Peers

- When you're ready to end a session, you should call...

```
- (void)disconnectFromAllPeers;
```

- You can disconnect a specific peer with the following...

```
- (void)disconnectPeerFromAllPeers:(NSString *)peerID;
```

- If a peer is unresponsive for a period of time its automatically disconnected
  - This duration can be set with the disconnectTimeout property
- You can detect peer disconnections using...

```
- (void)session:(GKSession *)session
           peer:(NSString *)peerID
 didChangeState:(GKPeerConnectionState)state;
```

Cleaning Up

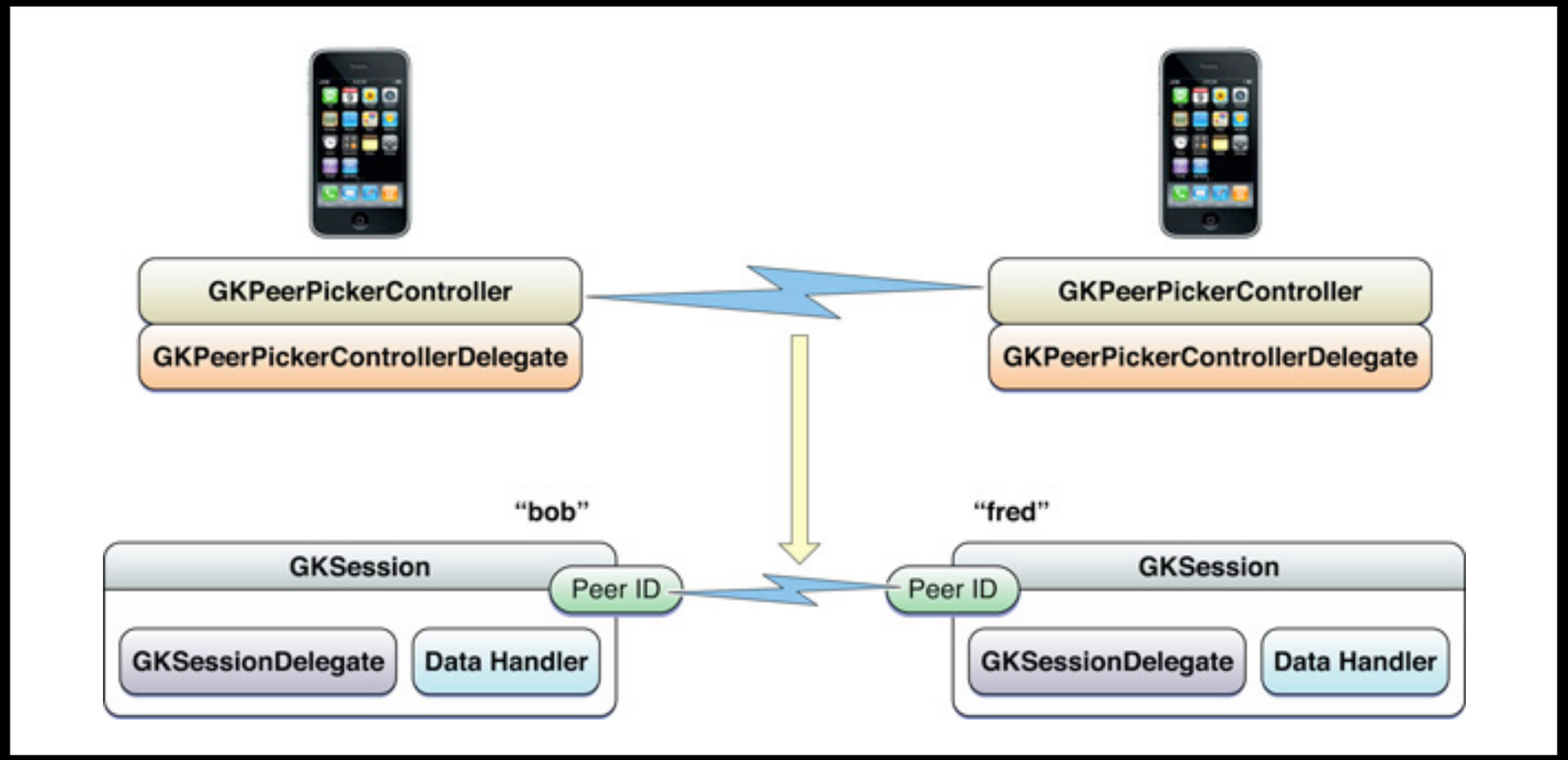
- When you are ready to end a session...
  - Disconnect from all peers
  - Set isAvailable to NO
  - Remove the data handler and delegate
  - Release the session

Peer Picker

- You may choose to implement your own UI using GKSession's delegate...
- Or, you may simply use Game Kit's provided UI for performing discovery and opening connections
- Game Kit's GKPeerPickerController class provides a common UI which may be used across apps

GKPeerPickerController

- Presents the user interface & responds to the user's actions
- Results in a fully configured GKSession that connects the two peers
- Customizable via GKPeerPickerControllerDelegate



GKPeerPickerController

- Needs to be configured with a connection mask using...

```
@property(nonatomic,assign) GKPeerPickerConnectionType connectionTypesMask;
```

- Can be one of.....

```
enum {
  // Online (Internet) based multiplayer connection
  GKPeerPickerConnectionTypeOnline = 1 << 0,
  // Nearby (Bluetooth) based multiplayer connection
  GKPeerPickerConnectionTypeNearby = 1 << 1
};
typedef NSUInteger GKPeerPickerConnectionType;
```

- The iPhone OS handles Bluetooth networking for you, however if you wish to do Internet networking, then you need to then perform whatever additional network setup, communication and tear-down that's required

GKPeerPickerController

- Once configured present the UI by calling the following controller method...

```
- (void)show;
```

- Once an item is selected, the following delegate method is called...

```
- (void)peerPickerController:(GKPeerPickerController *)picker
              didConnectPeer:(NSString *)peerID
                   toSession:(GKSession *)session;
```

- Your app then takes ownership of the session and should call the following to hide the dialog...

```
- (void)dismiss;
```

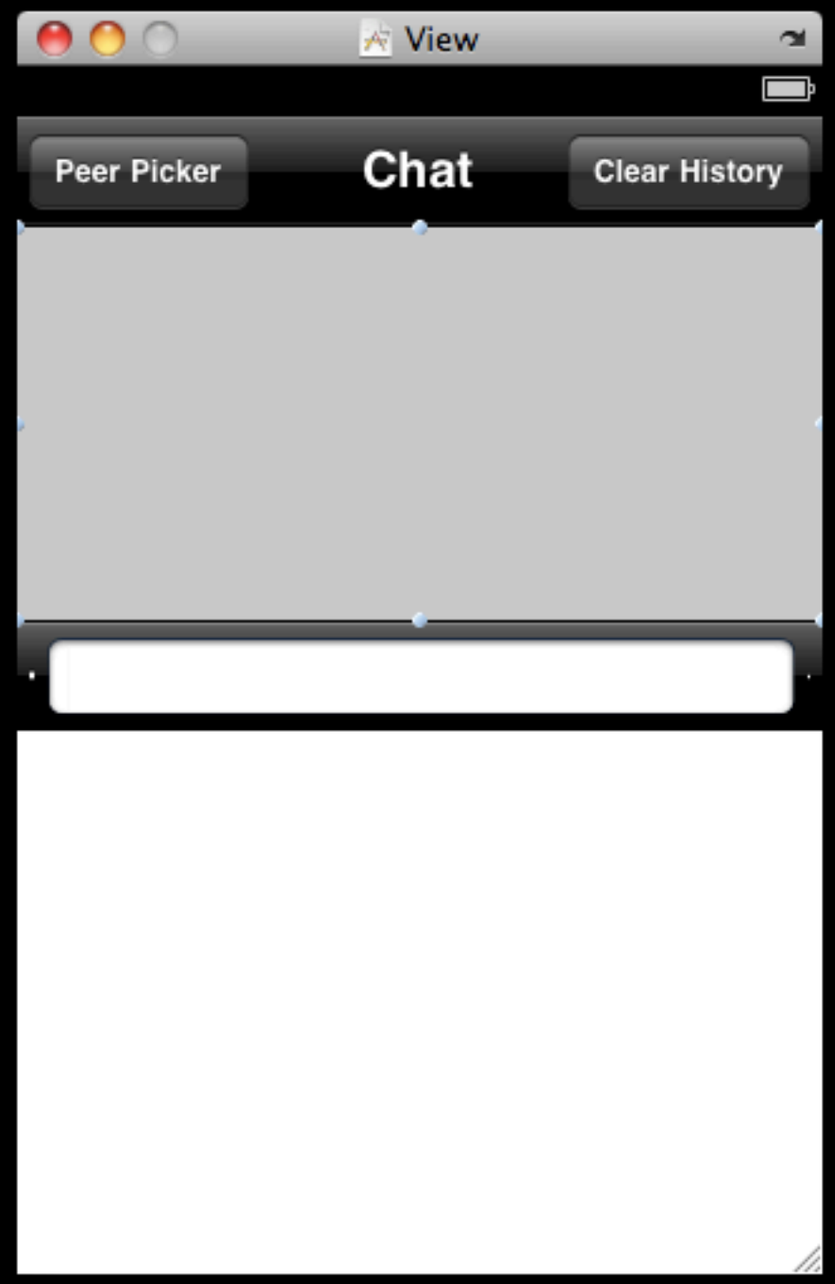
- If the user cancels, the following delegate method is called....

```
- (void)peerPickerControllerDidCancel:(GKPeerPickerController *)picker;
```

Demo

ChatViewController.xib

- Our UI consists of the following...
  - A toolbar with 2 buttons
    - One to bring up the peer picker
    - Another to clear the log
  - A large text view so we can log all of the chat messages
  - A text entry for sending messages
  - Some reserved space for the on screen keyboard



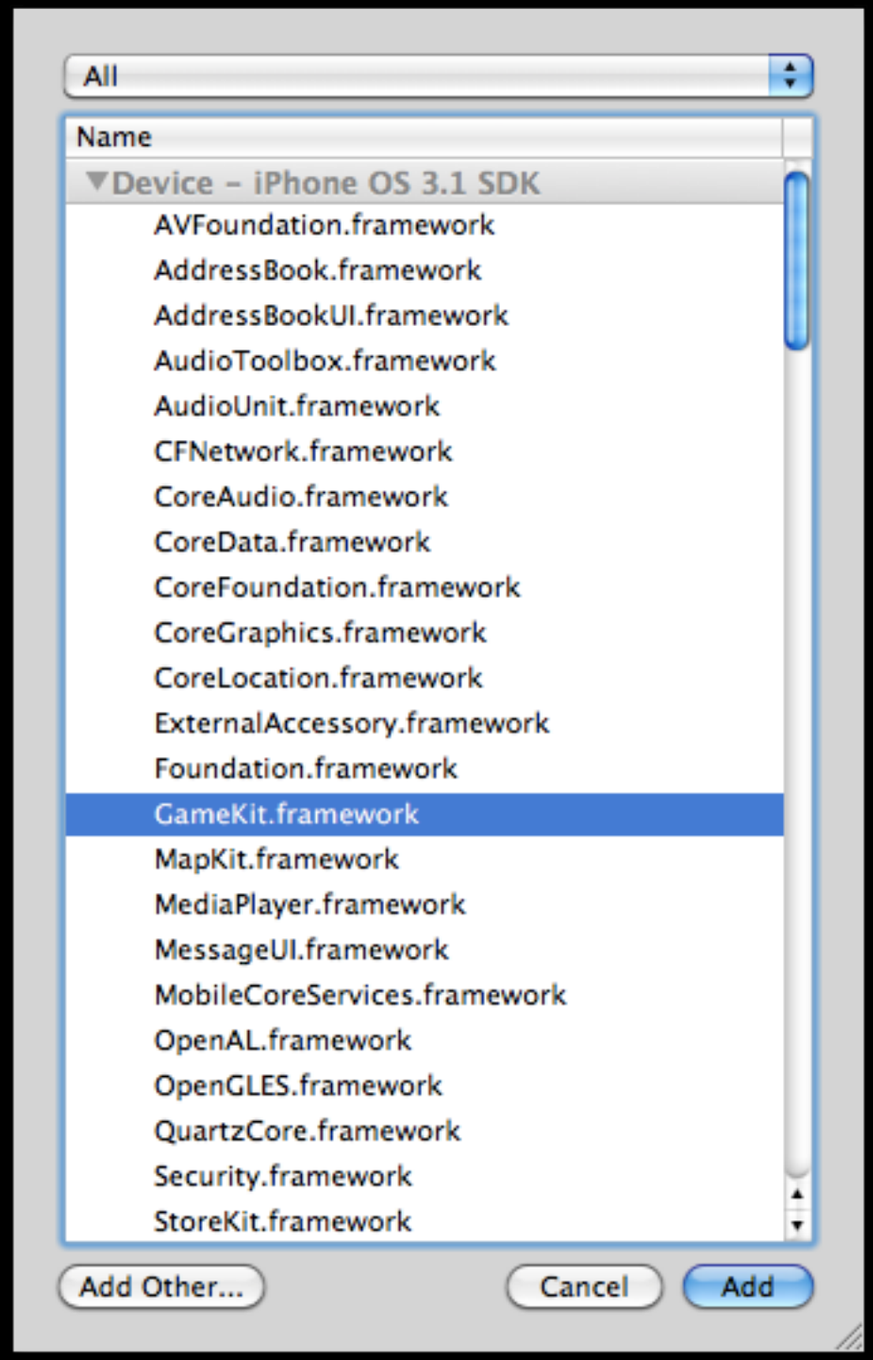
Changing the Status Bar Color

- The status bar style can be configured in the *-Info.plist file
- Simply add a field and select the “Status bar style” key and choose from one of the 3 options...

Key	Value
▼ Information Property List	(13 items)
Localization native development re	English
Status bar style ⇕	Opaque black style ⇕ +
Bundle display name	Gray style (default)
Executable file	Transparent black style (alpha of 0.5)
Icon file	Opaque black style
Bundle identifier	edu.umbc.${PRODUCT_NAME:rfc1034identifier}
InfoDictionary version	6.0
Bundle name	${PRODUCT_NAME}
Bundle OS Type code	APPL
Bundle creator OS Type code	????
Bundle version	1.0
Application requires iPhone enviror	☑
Main nib file base name	MainWindow

Adding the Game Kit Framework

- All of Game Kit's classes and delegates live within the Game Kit framework
- As such, it needs to be added to the project



ChatViewController.h

```
#import <GameKit/GameKit.h>
#import <UIKit/UIKit.h>

@interface ChatViewController : UIViewController <GKPeerPickerControllerDelegate,
                    GKSessionDelegate, UITextFieldDelegate, UITextViewDelegate> {

    UITextView *messagesView;
    UITextField *messageField;
    NSMutableArray *messages;
    GKPeerPickerController *picker;
    GKSession *session;
}

@property(nonatomic, retain) IBOutlet UITextView *messagesView;
@property(nonatomic, retain) IBOutlet UITextField *messageField;
@property(nonatomic, retain) NSMutableArray *messages;
@property(nonatomic, retain) GKPeerPickerController *picker;
@property(nonatomic, retain) GKSession *session;

- (IBAction)clear;
- (IBAction)disconnect;
- (IBAction)send;

@end
```

ChatViewController.m

```
#import "ChatViewController.h"

@implementation ChatViewController

@synthesize messagesView;
@synthesize messageField;
@synthesize messages;
@synthesize picker;
@synthesize session;
```

```
- (void)updateMessages {
  self.messagesView.text = [self.messages componentsJoinedByString:@"\n"];
  int contentHeight = self.messagesView.contentSize.height;
  int containerHeight = self.messagesView.bounds.size.height;
  if (contentHeight > containerHeight) {
    CGPoint bottom = CGPointMake(0, contentHeight - containerHeight);
    [self.messagesView setContentOffset:bottom animated:NO];
  }
}

- (IBAction)clear {
  [self.messages removeAllObjects];
  [self updateMessages];
}

// ...
```

ChatViewController.m

```
// ...

- (IBAction)connect {
  self.picker = [[[GKPeerPickerController alloc] init] autorelease];
  self.picker.delegate = self;
  [self.picker show];
}

- (IBAction)disconnect {
  [session disconnectFromAllPeers];
  session.available = NO;
  [session setDataReceiveHandler: nil withContext: nil];
  session.delegate = nil;
  self.session = nil;
  [self connect];
}

- (IBAction)send {
  NSData *data = [self.messageField.text dataUsingEncoding:NSUTF8StringEncoding];
  [session sendDataToAllPeers:data withDataMode:GKSendDataReliable error:nil];
  NSString *formatted = [NSString stringWithFormat:@"%@: %@", [self.session
                  displayNameForPeer:self.session.peerID], self.messageField.text];
  [self.messages addObject:formatted];
  [self updateMessages];
}

// ...
```

ChatViewController.m

```
// ...

- (void)viewWillAppear:(BOOL)animated {
  [super viewWillAppear:animated];
  [self.messageField becomeFirstResponder];
  [self connect];
}

- (void)viewDidLoad {
  self.messages = [NSMutableArray array];
}

- (void)peerPickerController:(GKPeerPickerController *)p
              didConnectPeer:(NSString *)peerID
                   toSession:(GKSession *) sess {
  self.session = sess;
  self.session.delegate = self;
  [self.session setDataReceiveHandler: self withContext:nil];
  [self.picker dismiss];
}

// ...
```

ChatViewController.m

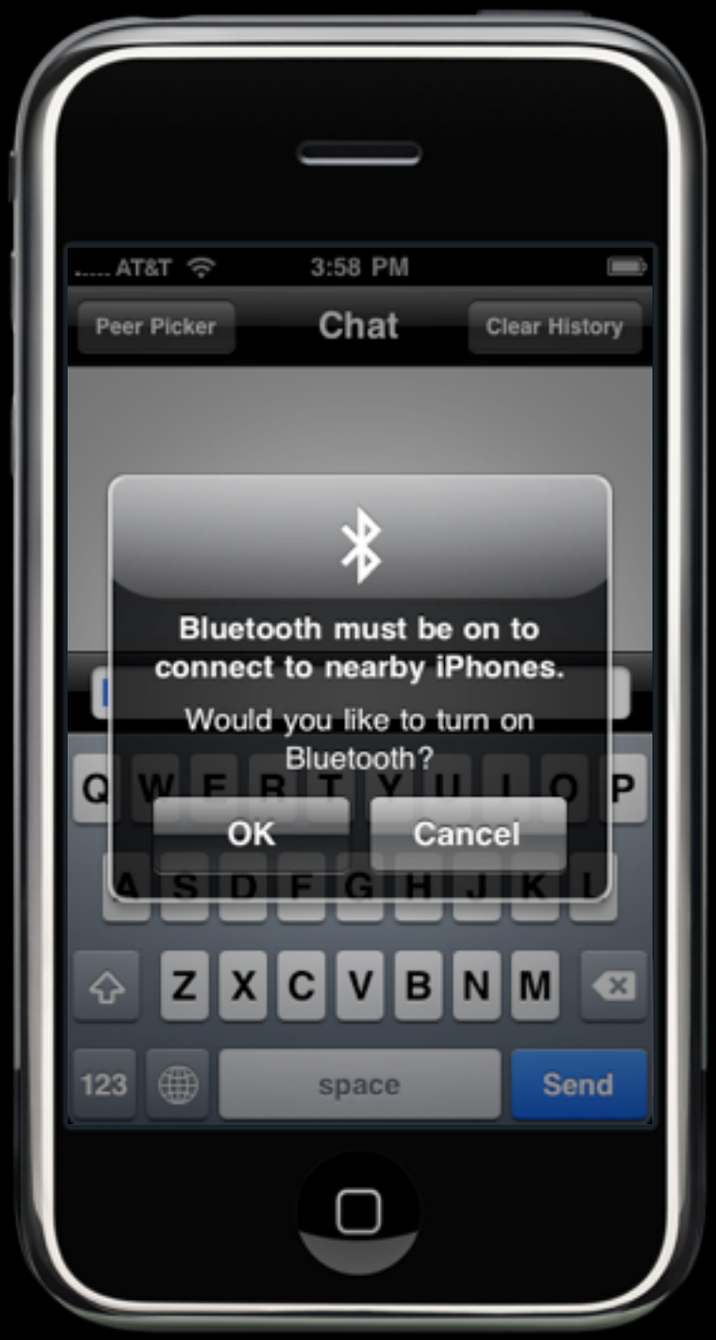
```
// ...

- (void)session:(GKSession *)session
           peer:(NSString *)peerID
 didChangeState:(GKPeerConnectionState)state {
  if (state == GKPeerStateDisconnected) {
    [self disconnect];
  }
}

- (BOOL)textFieldShouldReturn:(UITextField *)textField {
  [self send];
  self.messageField.text = @"";
  return YES;
}

- (BOOL)textView:(UITextView *)textView
shouldChangeTextInRange:(NSRange)range
 replacementText:(NSString *)text {
  return NO;
}

// ...
```

ChatViewController.m

```
// ...

- (void) receiveData:(NSData *)data
            fromPeer:(NSString *)peer
           inSession:(GKSession *)session
             context:(void *)context {
  NSString *message = [[[NSString alloc] initWithData:data
                                             encoding:NSUTF8StringEncoding] autorelease];
  NSString *formatted = [NSString stringWithFormat:@"%@: %@",
                                 [self.session displayNameForPeer:peer], message];
  [self.messages addObject:formatted];
  [self updateMessages];
}

- (void)dealloc {
  self.messagesView = nil;
  self.messageField = nil;
  self.picker = nil;
  self.session = nil;
  self.messages = nil;
  [super dealloc];
}

@end
```

The Resulting App

- If using the Peer Picker and Bluetooth services are turned off, the API is smart enough to ask the user if they with to turn it on



The Resulting App

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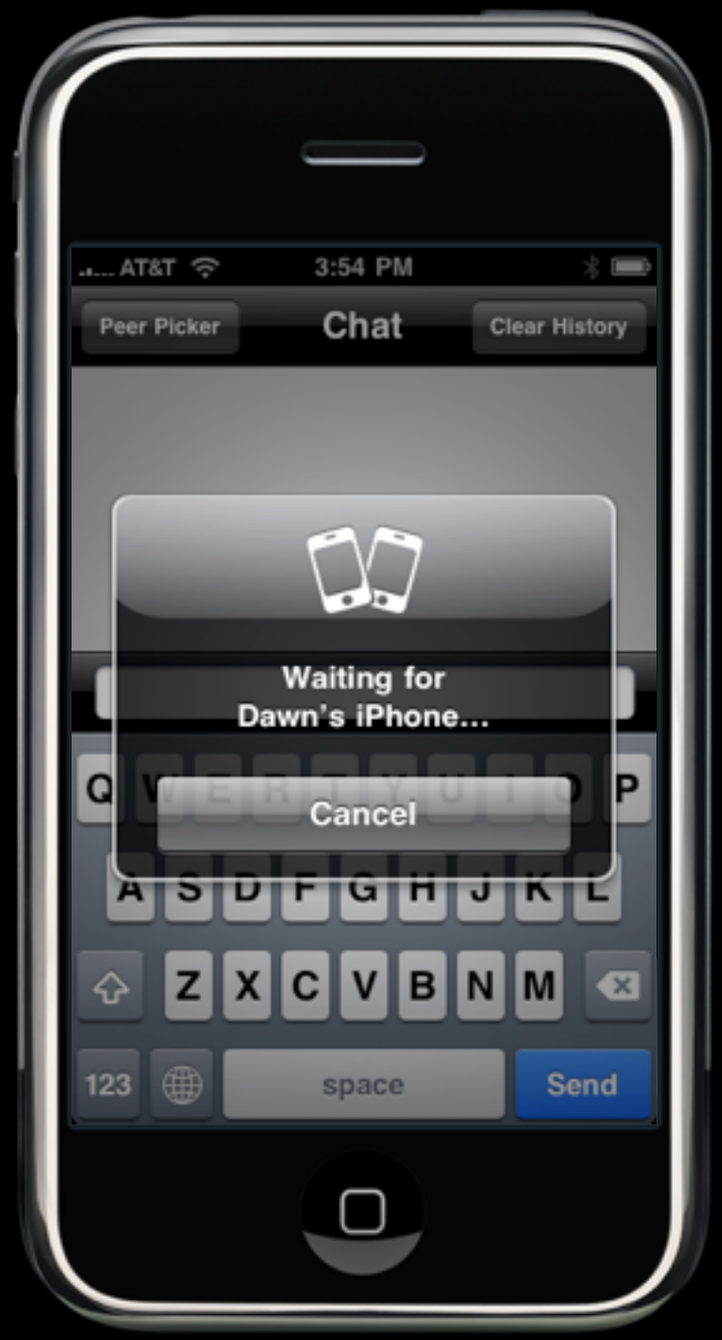
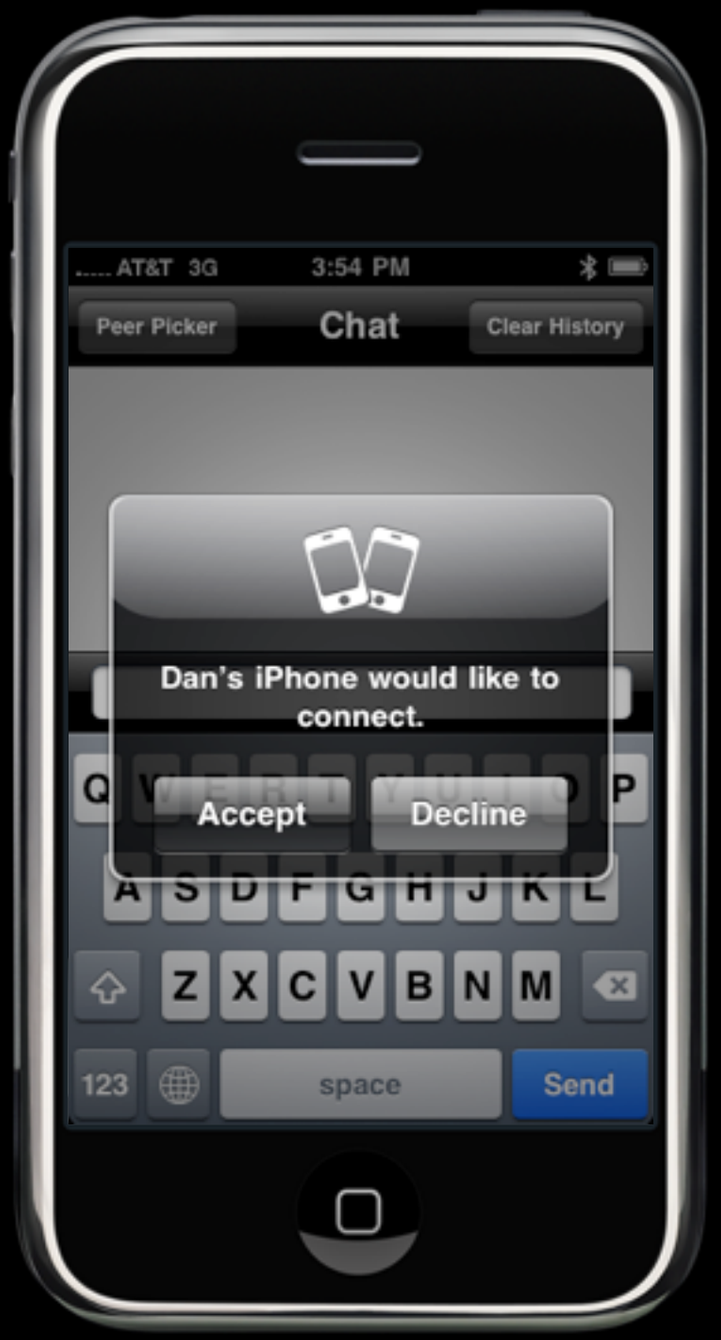
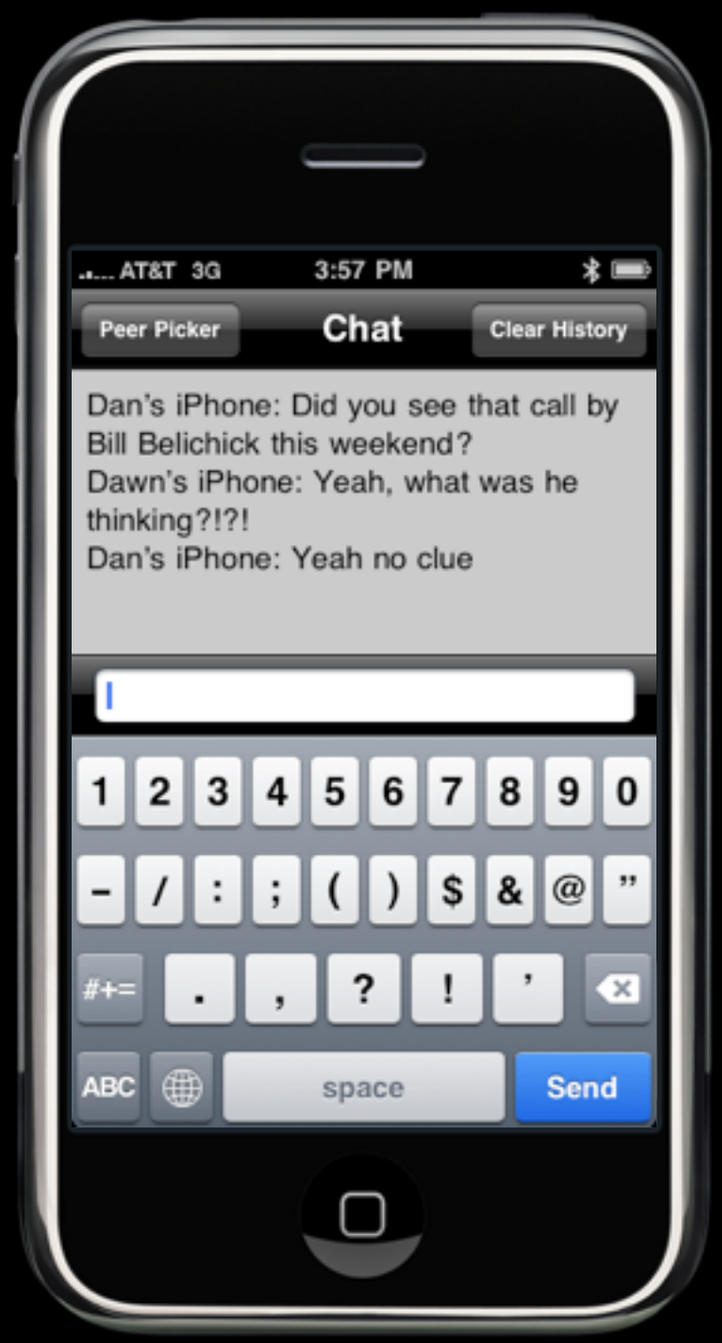
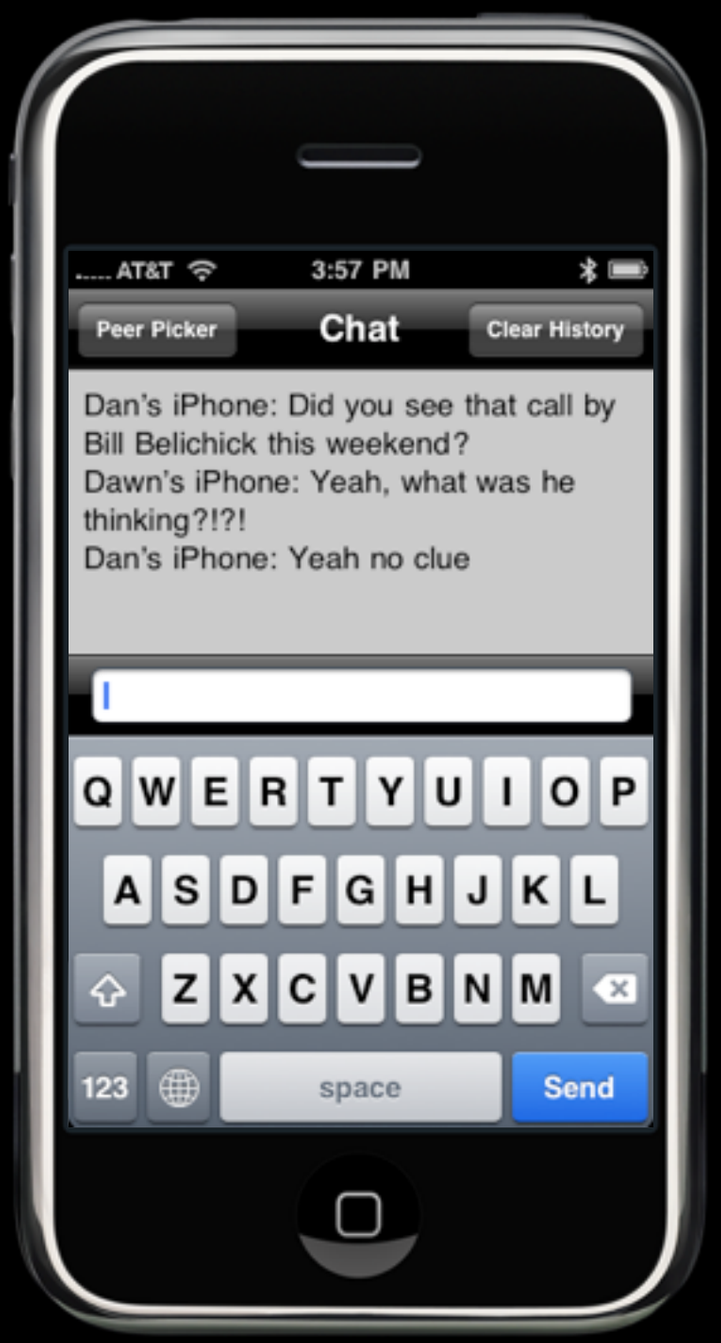




The Resulting App

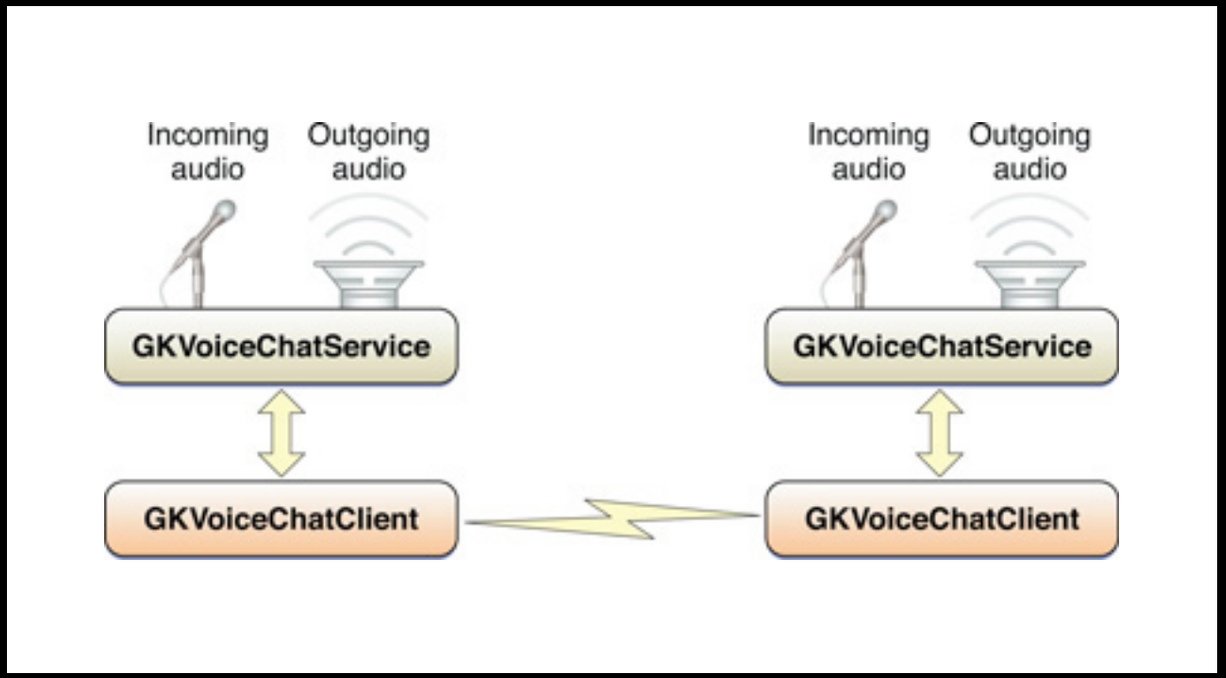




In-Game Voice

GKVoiceChatService

- Allows your app to create a voice chat between two iPhone OS devices
- The voice chat service samples the microphone and plays audio received from the other peer



GKVoiceChatClient

- In-game voice requires your app to provide a client (can be the view controller like other delegates) to implement the GKVoiceChatClient protocol
- The primary responsibility of the client is to connect the two participants together so that the voice chat service can exchange configuration data

Participant Identifiers

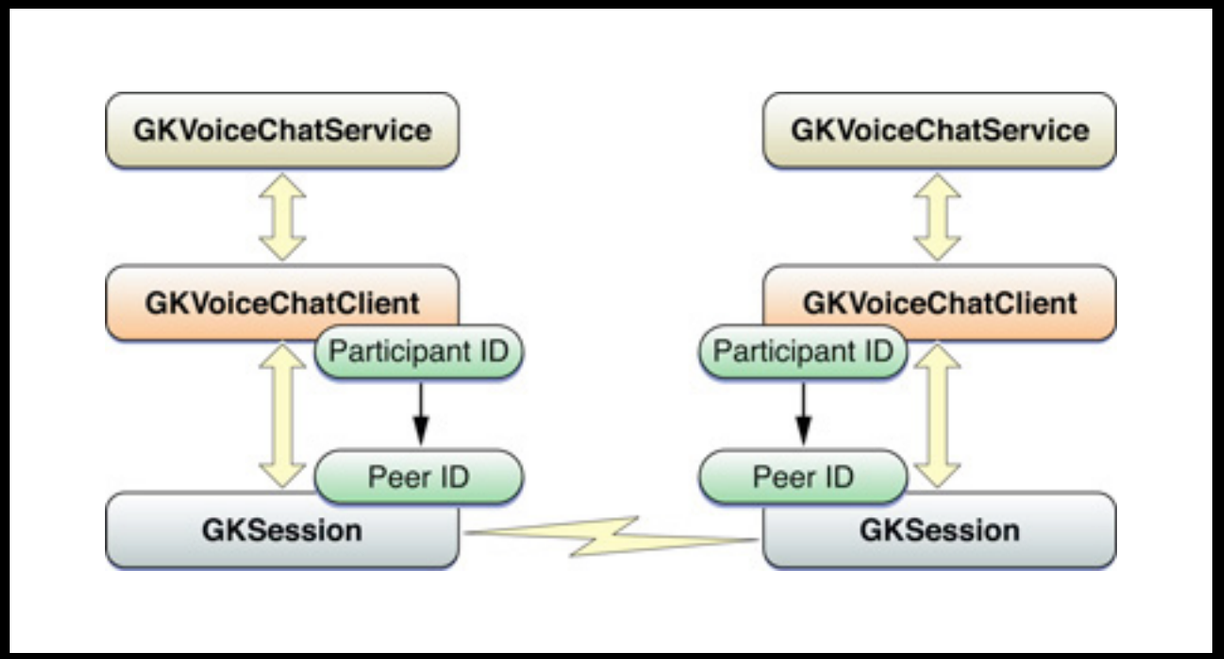
- Each participant in a voice chat is identified by a unique participant identifier string provided by your client
- The format and meaning of a participant identifier string is left to your client to decide

Discovering Other Participants

- The chat service uses the client's network connection to exchange config data between the peers in order to create a direct connection between the two
- The voice chat service does not provide a mechanism to discover the participant identifier of other participants
  - Typically piggy-back on an already established connection
- Your app is responsible for providing the participant IDs of other peers and translating these identifiers into connections to other participants

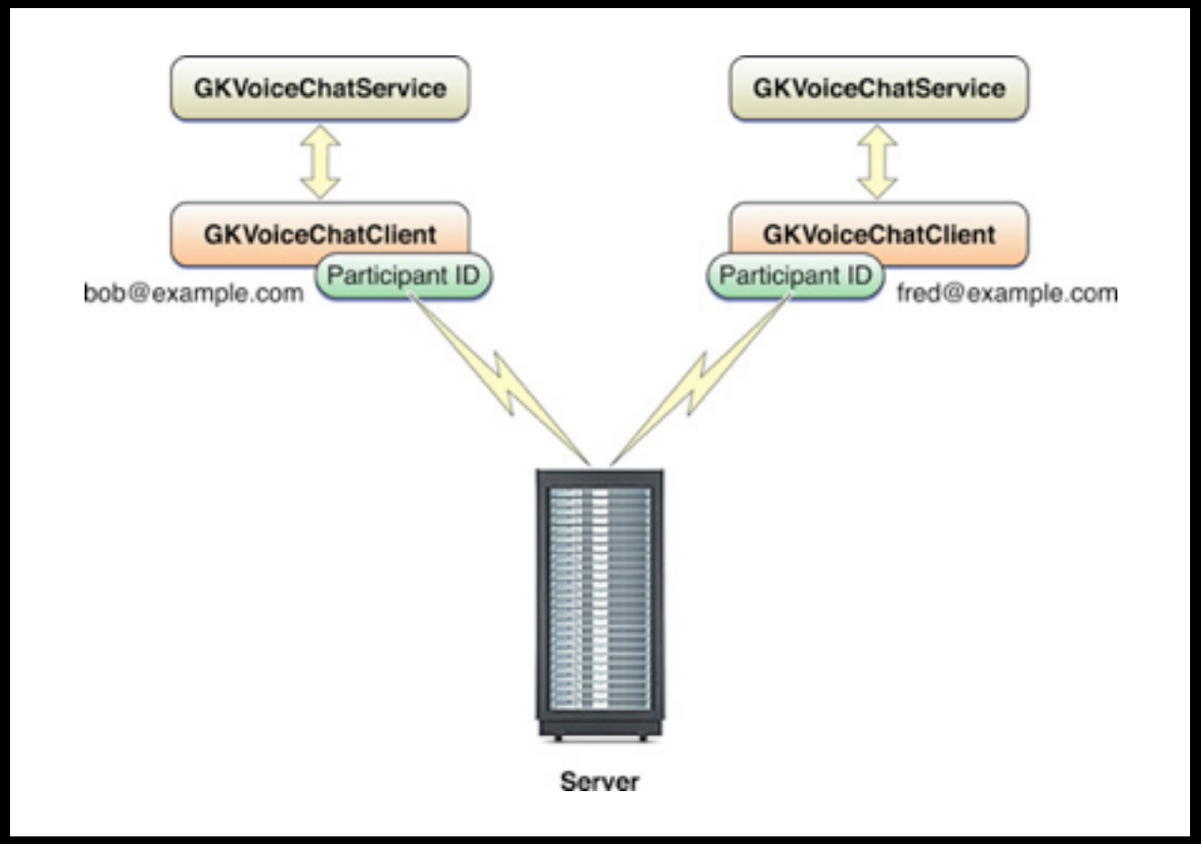
Using an Existing Session

- If your application is already connected to another device through a GKSession object, then each peer on the network is already uniquely identified by a peerID
- The client could simply reuse each peer's ID as the participant identifier and use the session to send and receive data...



Server Based Discovery

- If the 2 devices are not directly connected, your app needs another service to facilitate the cross-discovery of the two participants to provide connectivity
- For example, you might use a directory server to lookup other devices and provide connectivity



Starting a Chat

- To start a voice chat, one of the participants calls the following voice chat service's method specifying the ID of the other participant

```
- (BOOL)startVoiceChatWithParticipantID:(NSString *)participantID
                                  error:(NSError **)error;
```

- When a service receives a connection request, the following client method is called to handle it...

```
- (void)voiceChatService:(GKVoiceChatService *)voiceChatService
didReceiveInvitationFromParticipantID:(NSString *)participantID
                              callID:(NSInteger)callID;
```

Starting a Chat

- The client can accept the chat request by calling the following service method...

```
- (BOOL)acceptCallID:(NSInteger)callID
                error:(NSError **)error;
```

- Or the client can reject the connection by calling...

```
- (void)denyCallID:(NSInteger)callID;
```

- Once a connection is established, the following client method is invoked...

```
- (void)voiceChatService:(GKVoiceChatService *)voiceChatService
didStartWithParticipantID:(NSString *)participantID;
```

Stopping a Chat

- To stop a chat, your app should call the following service method...

```
- (void)stopVoiceChatWithParticipantID:(NSString *)participantID;
```

- Your app should also stop the chat if it discovers that the other user is no longer available

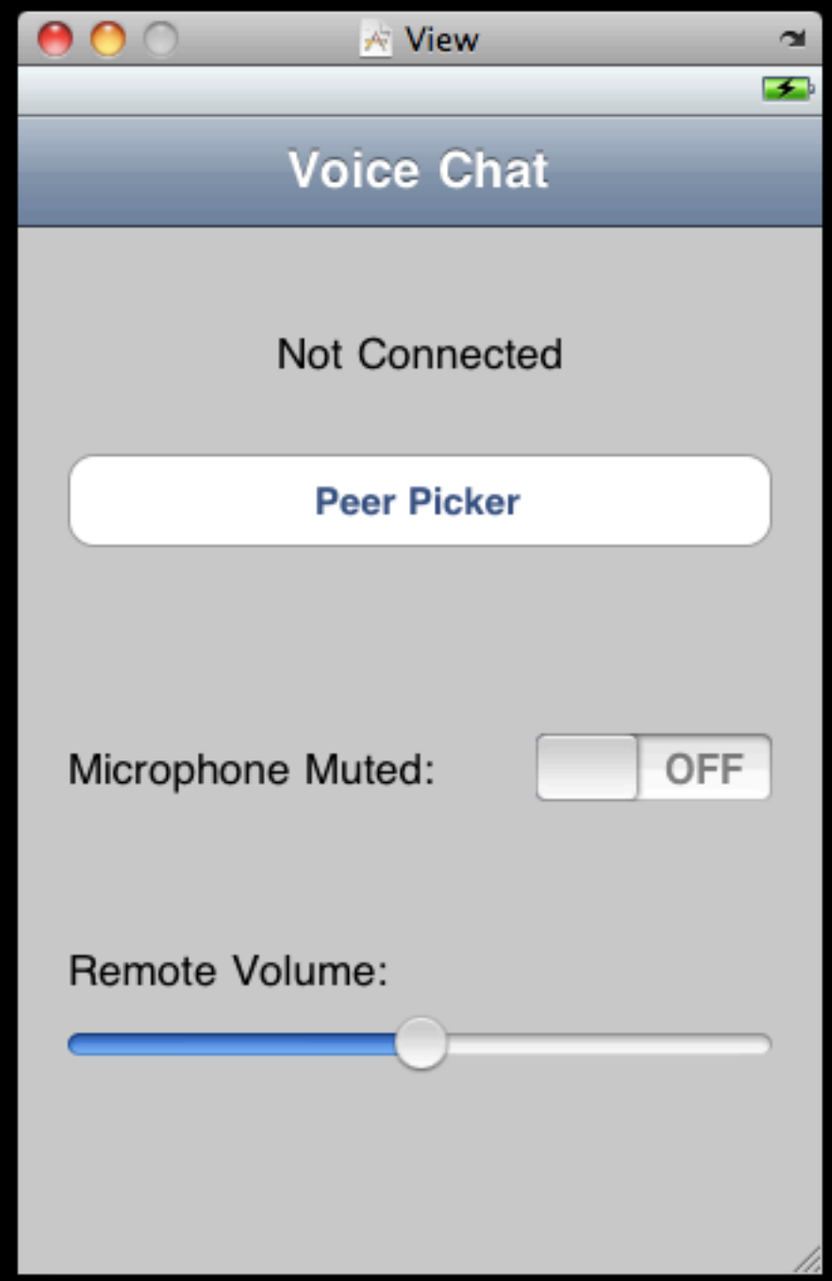
Controlling the Chat

- Once the participants are connected, speech is automatically transmitted between the two iPhones OS devices
- Your application can control certain characteristics of the chat including...
  - Muting the device's microphone by setting the service's microphoneMuted property
  - Adjust the volume of the remote participant by setting the service's remoteParticipantVolume property
  - Ability to get monitoring data for both local and remote voice streams

Demo

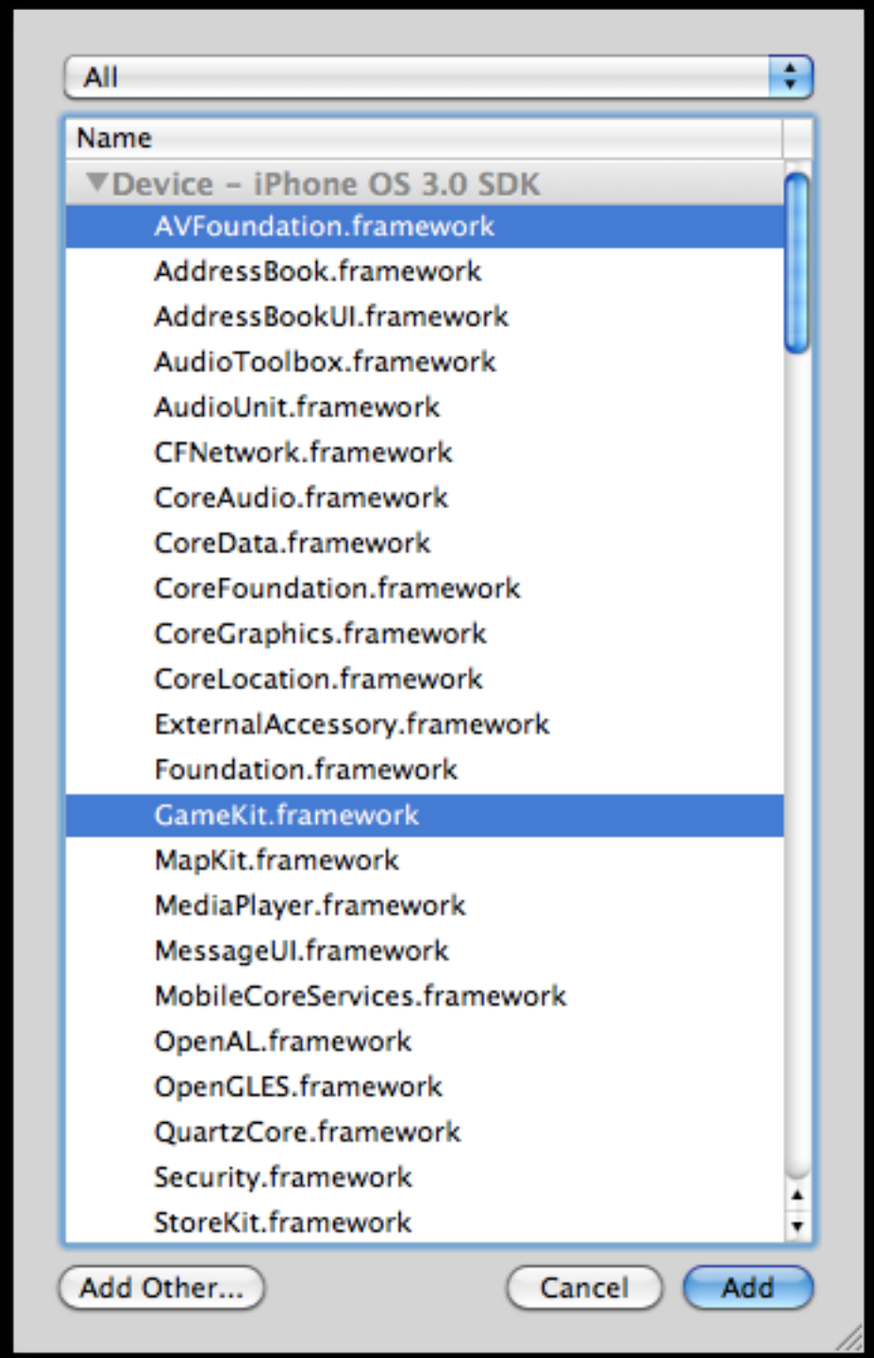
VoiceChatViewController.xib

- Our UI consists of the following...
  - A status label to tell what peer (if any) we're connected to
  - A button to bring up the peer picker
  - A switch to toggle the microphone's mute on and off
  - A volume slider to adjust the remote volume level



Adding the Necessary Frameworks

- For this app, we need to include the following frameworks
  - Game Kit
  - AVFoundation



VoiceChatViewController.h

```
#import <GameKit/GameKit.h>
#import <UIKit/UIKit.h>

@interface VoiceChatViewController : UIViewController
            <GKPeerPickerControllerDelegate, GKSessionDelegate, GKVoiceChatClient> {

  GKPeerPickerController *picker;
  GKSession *session;
  UISwitch *microphoneToggle;
  UILabel *status;

}

@property(nonatomic, retain) GKPeerPickerController *picker;
@property(nonatomic, retain) GKSession *session;
@property(nonatomic, retain) IBOutlet UISwitch *microphoneToggle;
@property(nonatomic, retain) IBOutlet UILabel *status;

- (IBAction)disconnect;
- (IBAction)toggleMute;
- (IBAction)setVolume:(id)sender;

@end
```

VoiceChatViewController.m

```
#import "VoiceChatViewController.h"

@implementation VoiceChatViewController

@synthesize picker;
@synthesize session;
@synthesize muteMicrophone;
@synthesize status;

- (void)connect {
  self.picker = [[[GKPeerPickerController alloc] init] autorelease];
  self.picker.delegate = self;
  [self.picker show];
}

// ...
```

VoiceChatViewController.m

```
// ...

- (IBAction)disconnect {
  self.status.text = @"Not Connected";
  [session disconnectFromAllPeers];
  session.available = NO;
  [session setDataReceiveHandler: nil withContext: nil];
  session.delegate = nil;
  self.session = nil;
  if (self.muteMicrophone.on) {
    [self toggleMute];
  }
  [self connect];
}

- (IBAction)toggleMute {
  [[GKVoiceChatService defaultVoiceChatService]
    setMicrophoneMuted:self.muteMicrophone.on];
}

// ...
```

VoiceChatViewController.m

```
// ...

- (IBAction)setVolume:(id)sender {
  UISlider *slider = sender;
  [[GKVoiceChatService defaultVoiceChatService]
   setRemoteParticipantVolume:slider.value];
}

- (void)peerPickerController:(GKPeerPickerController *)p
              didConnectPeer:(NSString *)peerID
                   toSession:(GKSession *)sess {
  self.session = sess;
  self.session.delegate = self;
  [self.session setDataReceiveHandler: self withContext:nil];
  [self.picker dismiss];
}

// ...
```

VoiceChatViewController.m

```
// ...

- (void)session:(GKSession *)session
           peer:(NSString *)peerID
 didChangeState:(GKPeerConnectionState)state {
  switch (state) {
    case GKPeerStateConnected:
      [GKVoiceChatService defaultVoiceChatService].client = self;
      [[GKVoiceChatService defaultVoiceChatService]
       startVoiceChatWithParticipantID:peerID error: nil];
      self.status.text = [NSString stringWithFormat:@"Connected to %@",
                          [self.session displayNameForPeer:peerID]];
      break;
    case GKPeerStateDisconnected:
      [[GKVoiceChatService defaultVoiceChatService]
       stopVoiceChatWithParticipantID:peerID];
      [self disconnect];
      break;
    default:
      NSLog(@"%s - state = %d", __FUNCTION__, state);
  }
}

// ...
```

VoiceChatViewController.m

```
// ...

- (NSString *)participantID {
  return session.peerID;
}

- (void)voiceChatService:(GKVoiceChatService *)voiceChatService
                sendData:(NSData *)data
         toParticipantID:(NSString *)participantID {
  [self.session sendData:data toPeers:[NSArray arrayWithObject: participantID]
   withDataMode:GKSendDataReliable error: nil];
}

- (void) receiveData:(NSData *)data
            fromPeer:(NSString *)peer inSession:(GKSession *)session
             context:(void *)context {
  [[GKVoiceChatService defaultVoiceChatService] receivedData:data
   fromParticipantID:peer];
}

// ...
```

VoiceChatViewController.m

```
// ...

- (void)viewDidLoad {
  [super viewDidLoad];
  [[GKVoiceChatService defaultVoiceChatService] setRemoteParticipantVolume:.5];
  [self connect];
}

- (void)dealloc {
  self.picker = nil;
  self.muteMicrophone = nil;
  self.session = nil;
  self.status = nil;
  [super dealloc];
}

@end
```

Audio Sessions

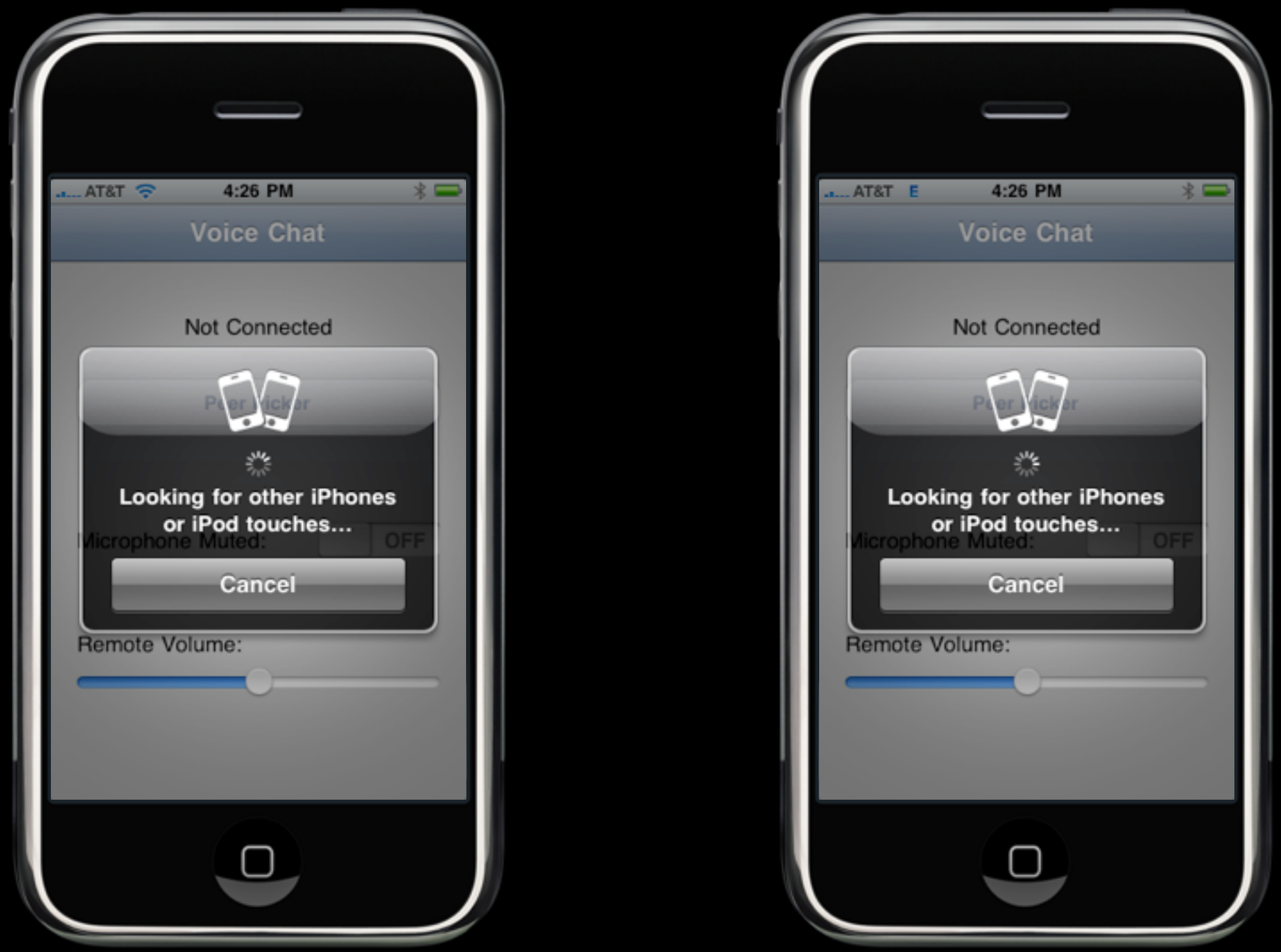
- We want to make sure we disable currently playing audio (such as the iPod app) when our app starts
- We can use the AVAudioSession which has different categories that define the audio behavior of our app
  - For example, if we declare our app as being capable of playing and recording, we can disable the iPod app when we start up
- The app delegate has good lifecycle points to hook into

VoiceChatAppDelegate.m

```
#import <AVFoundation/AVFoundation.h>

#import "VoiceChatAppDelegate.h"
#import "VoiceChatViewController.h"

@implementation VoiceChatAppDelegate

@synthesize window;
@synthesize viewController;
```

```
- (void)applicationDidFinishLaunching:(UIApplication *)application {
  [window addSubview:viewController.view];
  [window makeKeyAndVisible];
  AVAudioSession *audioSession = [AVAudioSession sharedInstance];
  [audioSession setCategory:AVAudioSessionCategoryPlayAndRecord error:nil];
  [audioSession setActive:YES error:nil];
}

- (void)dealloc {
  [viewController release];
  [window release];
  [super dealloc];
}

@end
```

The Resulting App



The Resulting App

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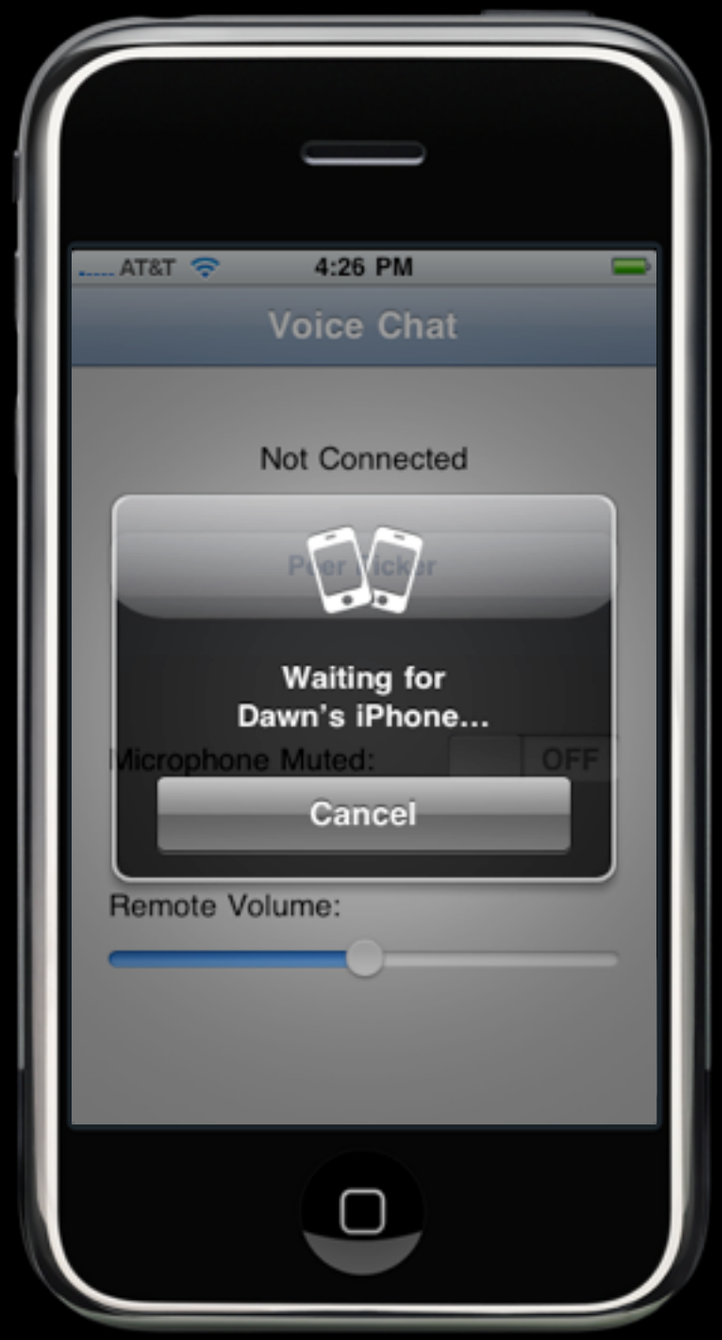
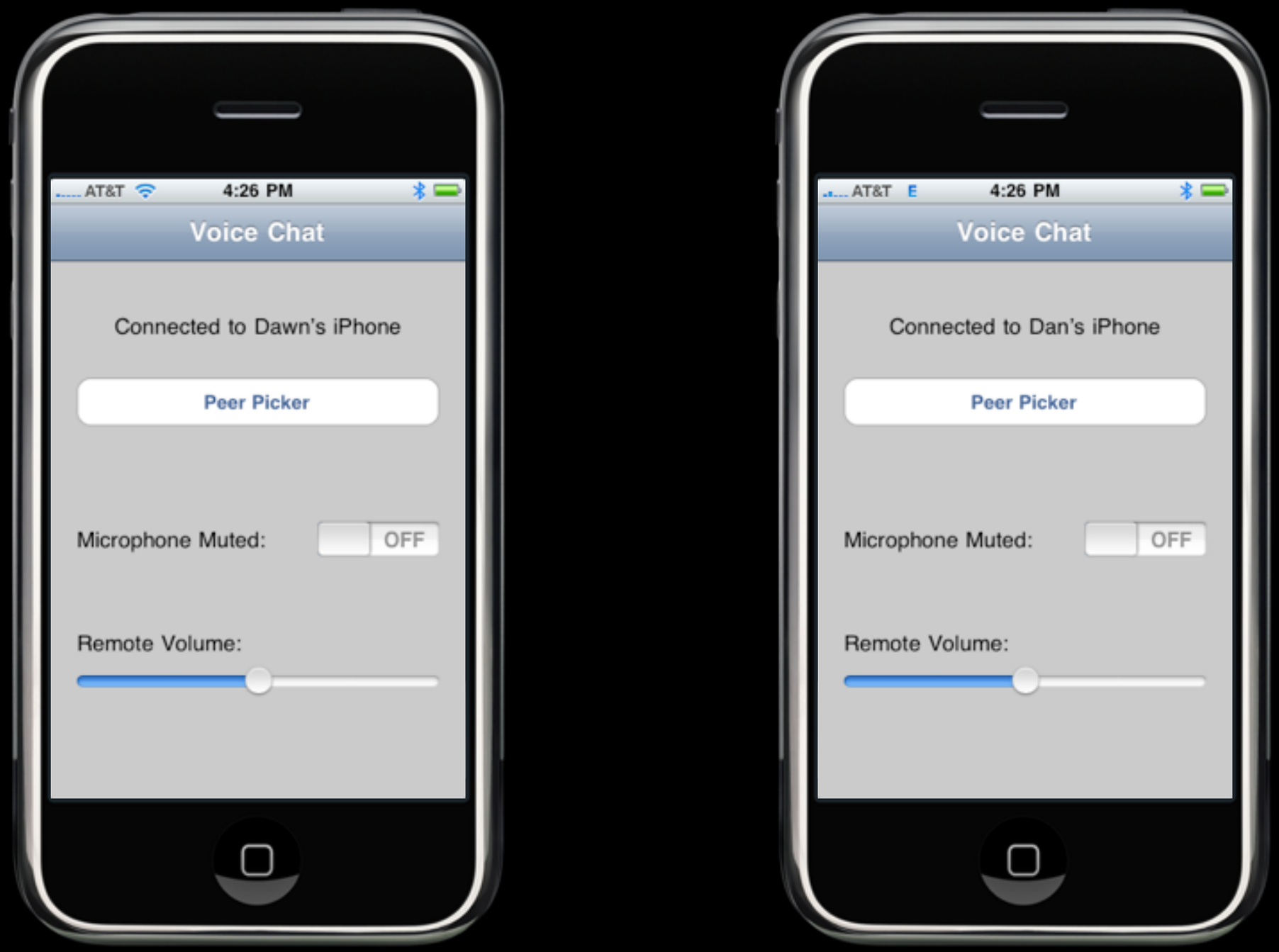


The Resulting App



Additional Resources

- Game Kit Programming Guide
  - http://developer.apple.com/IPhone/library/documentation/NetworkingInternet/Conceptual/GameKit_Guide/

For Next Class

- "iPhone Application Programming Guide" sections...
  - Playing Media Items with iPod Library Access
  - Using Video in iPhone OS
  - Taking Pictures with the Camera
  - Picking a Photo from the Photo Library
- "Address Book Programming Guide for iPhone OS"
  - http://developer.apple.com/iphone/library/documentation/ContactData/Conceptual/AddressBookProgrammingGuideforiPhone/