Lab 6. Restaurant Search

In this lab, we are going to explore how a conversation management module can be built using an existing library---Bot Builder SDK. First, we will understand the MS Bot Framework that Bot Builder SDK is a part of. We will install the necessary software and libraries and learn to build chatbots using the SDK, test them on the emulator, and deploy them in the cloud. Next, we will learn about the rich presentation options, and the devices for which the conversational flow can be designed. We will then explore the Zomato service for restaurant data and integrate it into a chatbot built using the Bot Builder SDK. We will finally deploy it on Skype.

By the end of this lab, you will be able to:

- Understand the basics of MS Bot Framework
- Build a chatbot with the Botbuilder Node.js library
- Register the bot with Bot Framework
- Host the bot in the cloud
- Understand message types and card types
- Integrate the bot with Skype

MS Bot Framework

MS Bot Framework is a Microsoft product for chatbot development. It houses three products: Bot Builder SDK, Bot Framework Portal, and channels. Bot Builder SDK is the toolkit for building chatbots. It has libraries of classes and code that represent various elements of a conversation. These can be used in our development process to build chatbots at a faster pace than building them from scratch. The Bot Framework Portal is used to register the bot in order to manage it efficiently and there is a host of tools for analytics and diagnostics that can be used on this portal. Finally, the framework provides a unified approach to integrating with several channels.

There are a huge number of channels that you can integrate your bot with, including Skype, Facebook Messenger, Kik, Telegram, Slack, MS Teams, and Twilio. You can also create a web chat client using the portal that can be embedded on any website. In addition to the three tools, there are two other tools that are very useful during the development process: channel emulator and channel inspector.

Channel emulator

Before we begin, we need to install software called a channel emulator. We will be using this to emulate the channel (for example, Skype) to connect to the bot locally for development and testing purposes. You can chat with your bot as well as inspect the messages sent and received to identify any bugs.

To download it, go to the following page:

https://github.com/Microsoft/BotFramework-Emulator/releases/tag/v3.5.31

Download the version based on your needs and install it on your computer.

Building a bot

Let us now look at the steps to build a chatbot. Here we will use the botbuilder library and create a bot using Node.js:

1. Create a Node.js project called `foodie-bot`:

```
> npm init
```

2. Install the two libraries that we need to use:

```
> npm install botbuilder --save
> npm install restify --save
```

3. Create a file named `app.js`.
4. In `app.js`, paste the following code (from the Bot Framework tutorials):

```
var restify = require('restify');
var builder = require('botbuilder');

// Lets setup the Restify Server
var server = restify.createServer();
server.listen(process.env.port || process.env.PORT || 3978, function () {
   console.log('%s listening to %s', server.name, server.url);
});


// Create chat connector for communicating with the Bot Framework Service
var connector = new builder.ChatConnector({
    appId: process.env.MICROSOFT_APP_ID,
    appPassword: process.env.MICROSOFT_APP_PASSWORD
});


// Listen for messages from users
server.post('/foodiebot', connector.listen());

// Echo their message back.. just parrotting!
var bot = new builder.UniversalBot(connector, function (session) {
    session.send("You said: %s", session.message.text);
});
```

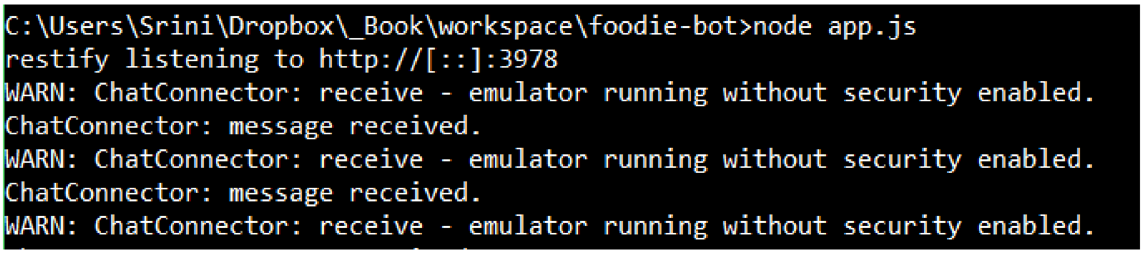
Notice that there are two classes, `UniversalBot` and `ChatConnector`, that the Bot Framework's Node.js SDK provides. `UniversalBot` is the class where we define the conversation flow, while the `ChatConnector` class connects the bot to the chat channel. In the previous code, we used the `session.send()` method to send text messages to the chat channel.

5. Save the file.
6. Run the emulator. In the address bar, type the following address and connect:

`http://localhost:3978/api/messages`

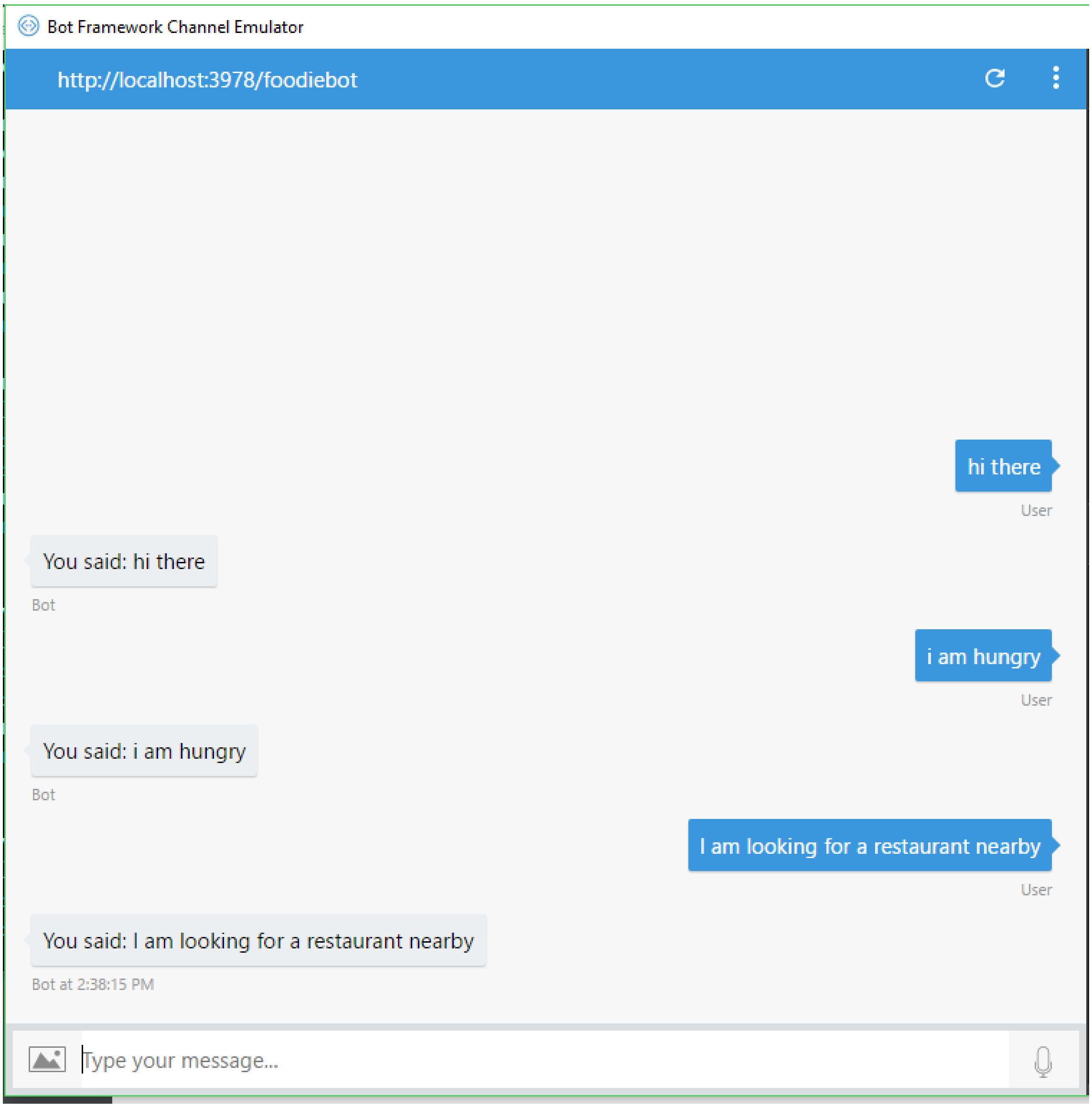
At this stage, you don't have to provide an app ID or password.

7. The emulator will connect to the bot (running in `app.js`). The app will start logging messages on the console, as shown here:



```
C:\Users\Srini\Dropbox\_Book\workspace\foodie-bot>node app.js
restify listening to http://[::]:3978
WARN: ChatConnector: receive - emulator running without security enabled.
ChatConnector: message received.
WARN: ChatConnector: receive - emulator running without security enabled.
ChatConnector: message received.
WARN: ChatConnector: receive - emulator running without security enabled.
```

8. In the emulator, in the following textbox, type a message to the bot and hit `SEND`. You will see that the bot repeats the message back to you:



Bot Framework Channel Emulator
http://localhost:3978/foodiebot

hi there

User

You said: hi there

Bot

i am hungry

User

You said: i am hungry

Bot

I am looking for a restaurant nearby

User

You said: I am looking for a restaurant nearby

Bot at 2:38:15 PM

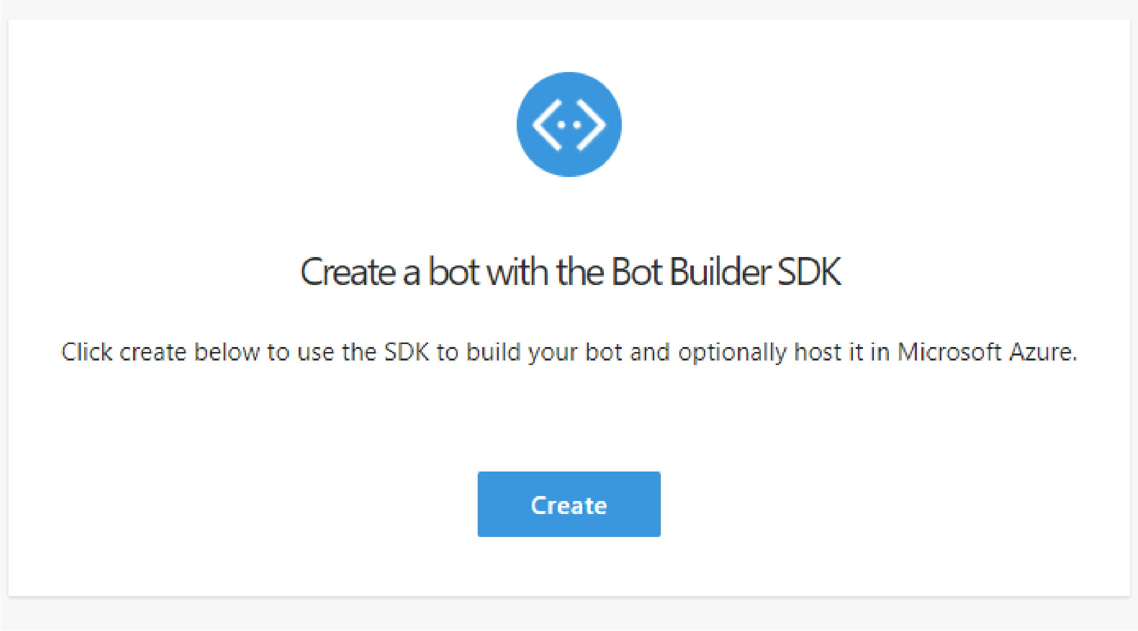
9. Congratulations! You have just created your first bot using Bot Framework.

Deploying your bot

For now, we have our bot running on a local machine and have interacted with it over the channel emulator. How about we push it further and get it talking to the user on a website. To do this, we need to register our bot in Bot

Framework's very own bot directory. To get your bot registered, perform the following steps:

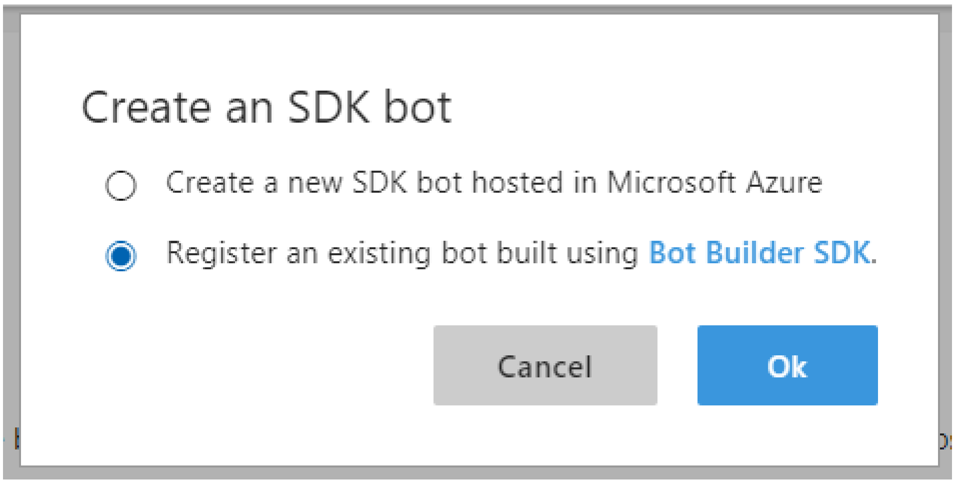
1. Go to the Bot Framework page at https://dev.botframework.com.
2. Create an account, if you don't already have one. Sign in.
3. Click the `My bots` tab.
4. Click `Create a bot` :



Create a bot with the Bot Builder SDK

Click create below to use the SDK to build your bot and optionally host it in Microsoft Azure.

5. Click `Create` . Choose `Register an existing bot built using Bot Builder SDK` :

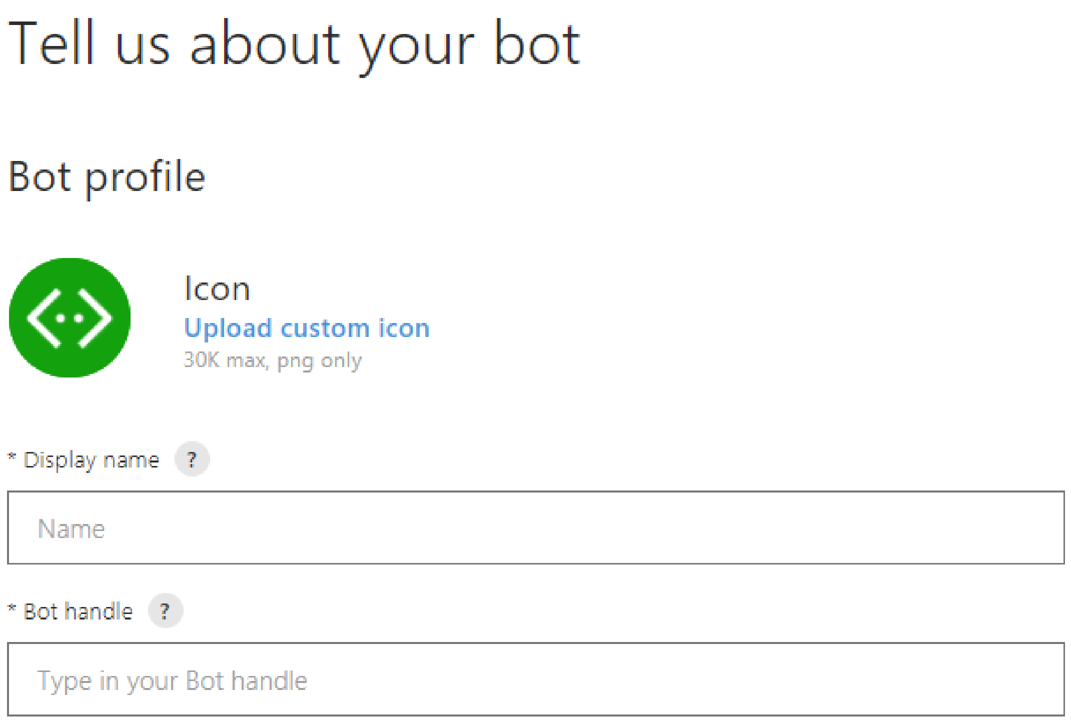


Create an SDK bot

○ Create a new SDK bot hosted in Microsoft Azure

● Register an existing bot built using Bot Builder SDK.

6. Scroll down to `Configuration` . Click `Create Microsoft App ID and Password` :



Tell us about your bot

Bot profile

Icon

Upload custom icon

30K max, png only

* Display name ?

Name

* Bot handle ?

Type in your Bot handle

Copy the app ID and password and hang on to it.

7. Go back to `app.js` and replace the app ID and password variable with these new values. Save it. Alternatively, we can set these as configuration parameters.
8. We are now ready to host our bot in the cloud and link it up to the Bot Framework register. In order to do that, we need to create `Procfile`. Create a file called `Procfile`, which tells Heroku how to start the app. Here is what goes into `Procfile`:

```
web: node app.js
```

9. Create a Heroku web app:

```
> heroku create foodie-bot-sj
```

10. We need a Git repository to store our bot code:

```
> git init
> git add .
> git commit -m initial-commit
```

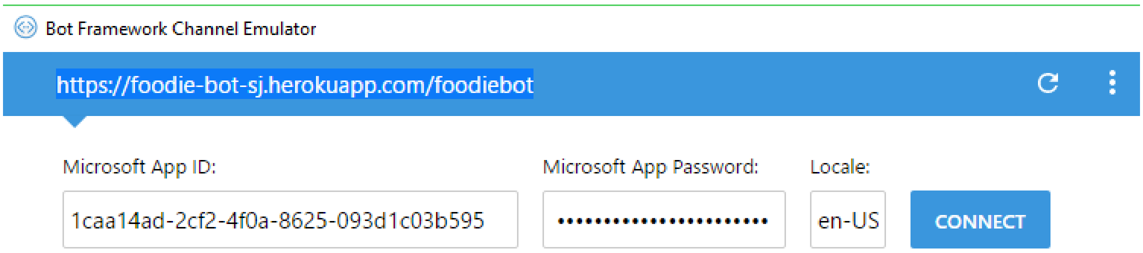
11. Finally, let's push the code:

```
> git push heroku master
```

Now we need to set the app ID and password as config variables in Heroku:

```
> heroku config:set MICROSOFT_APP_PASSWORD=<YOUR_APP_PASSWORD>
> heroku config:set MICROSOFT_APP_ID=<YOUR_APP_ID>
```

12. Having pushed the code onto the cloud, we can test it using the channel emulator. Type the URL of the bot, along with the app ID and password, and click `CONNECT` :



Bot Framework Channel Emulator

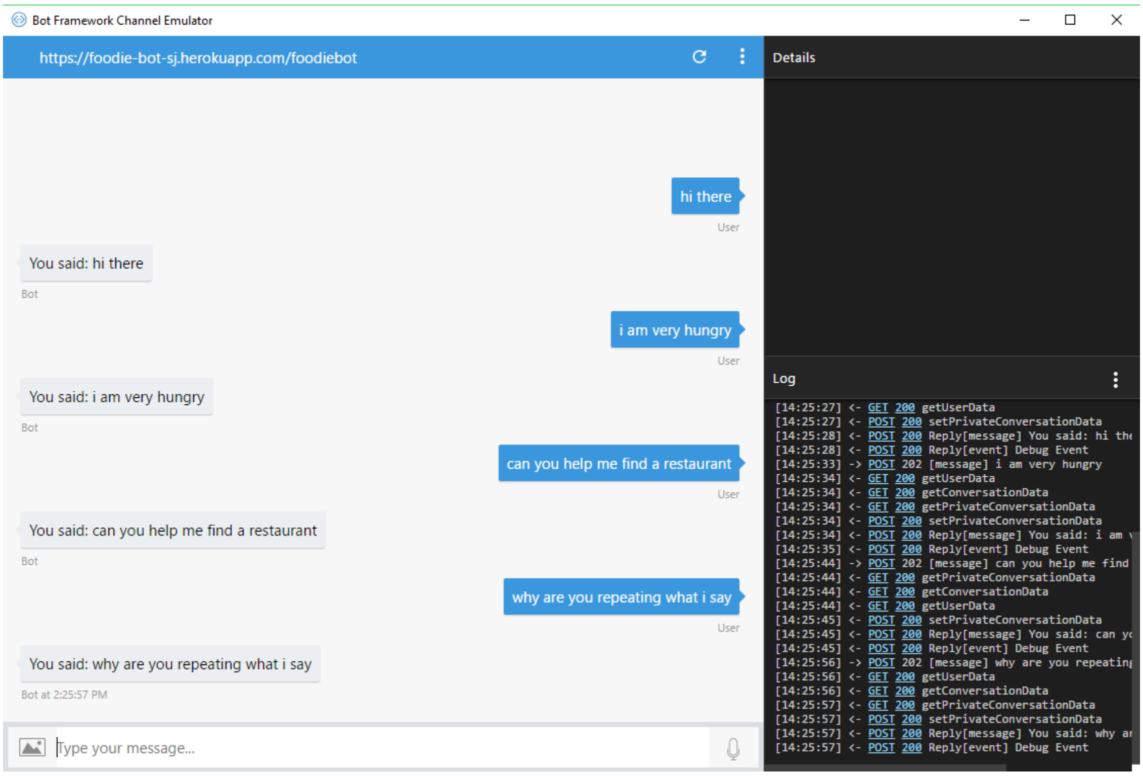
https://foodie-bot-sj.herokuapp.com/foodiebot

Microsoft App ID: 1caa14ad-2cf2-4f0a-8625-093d1c03b595

Microsoft App Password: ••••••••••••••••••••••

Locale: en-US

13. Once connected, type your message to the bot. You will see the bot parroting the messages that you send:



Bot Framework Channel Emulator

https://foodie-bot-sj.herokuapp.com/foodiebot

hi there
User

You said: hi there
Bot

i am very hungry
User

You said: i am very hungry
Bot

can you help me find a restaurant
User

You said: can you help me find a restaurant
Bot

why are you repeating what i say
User

You said: why are you repeating what i say
Bot at 2:25:57 PM

Type your message...

```
[14:25:27] <- GET 200 getUserData
[14:25:27] <- POST 200 setPrivateConversationData
[14:25:28] <- POST 200 Reply[message] You said: hi the
[14:25:28] <- POST 200 Reply[event] Debug Event
[14:25:33] -> POST 202 [message] i am very hungry
[14:25:34] <- GET 200 getUserData
[14:25:34] <- GET 200 getConversationData
[14:25:34] <- GET 200 getPrivateConversationData
[14:25:34] <- POST 200 setPrivateConversationData
[14:25:34] <- POST 200 Reply[message] You said: i am v
[14:25:35] <- POST 200 Reply[event] Debug Event
[14:25:44] -> POST 202 [message] can you help me find
[14:25:44] <- GET 200 getPrivateConversationData
[14:25:44] <- GET 200 getConversationData
[14:25:44] <- GET 200 getUserData
[14:25:45] <- POST 200 setPrivateConversationData
[14:25:45] <- POST 200 Reply[message] You said: can yo
[14:25:45] <- POST 200 Reply[event] Debug Event
[14:25:56] -> POST 202 [message] why are you repeating
[14:25:56] <- GET 200 getUserData
[14:25:56] <- GET 200 getConversationData
[14:25:57] <- GET 200 getPrivateConversationData
[14:25:57] <- POST 200 setPrivateConversationData
[14:25:57] <- POST 200 Reply[message] You said: why ar
[14:25:57] <- POST 200 Reply[event] Debug Event
```

Good work! Your bot is in the cloud and ready to be deployed on Skype and other channels, but we will explore that later in the lab.

More message types

Now that we have set up the chatbot and have the emulator to test it, let's try out more messaging options.

Sending more than one message per turn

First, we can send more than one message at a time. So when the chatbot gets its turn, it can send multiple messages using the `session.send()` method:

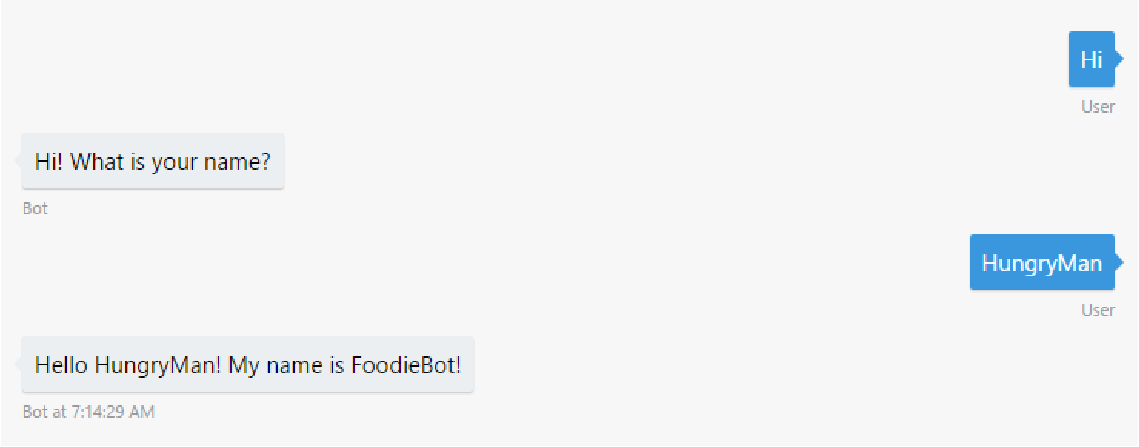
```
var bot = new builder.UniversalBot(connector, [
    function (session) {
        session.send('Hello there!');
        session.send('Welcome to New India restaurant!');
        });
    }
]);
```

Prompting users for information

To ask users for information, use the `builder.Prompts.text()` method, as shown here:

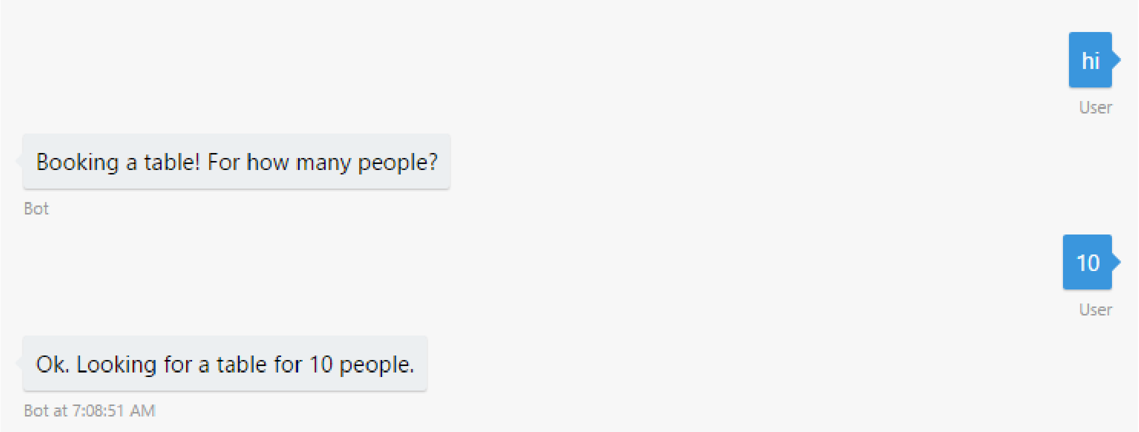
```
var bot = new builder.UniversalBot(connector, [
    function (session) {
        builder.Prompts.text(session, 'Hi! What is your name?');
    },
    function (session, results) {
        session.endDialog('Hello ' + results.response + '!
                            My name is FoodieBot!');
    }
]);
```

`builder.Prompts.text()` can be used to get text data such as the names of people and cities. The responses can be accessed using `results.response`. Try the preceding code by replacing the definition for the `bot` variable in the previous code for `app.js`:


Hi
User
Hi! What is your name?
Bot
HungryMan
User
Hello HungryMan! My name is FoodieBot!
Bot at 7:14:29 AM

You can get numeric data using `builder.Prompts.number()`:

```
var bot = new builder.UniversalBot(connector, [
    function (session) {
        builder.Prompts.number(session, 'Booking a table!
                                For how many people?');
    },
    function (session, results) {
        session.endDialog('Ok. Looking for a table for ' +
                            results.response + ' people.');
    }
]);
```



hi

User

Booking a table! For how many people?

Bot

10

User

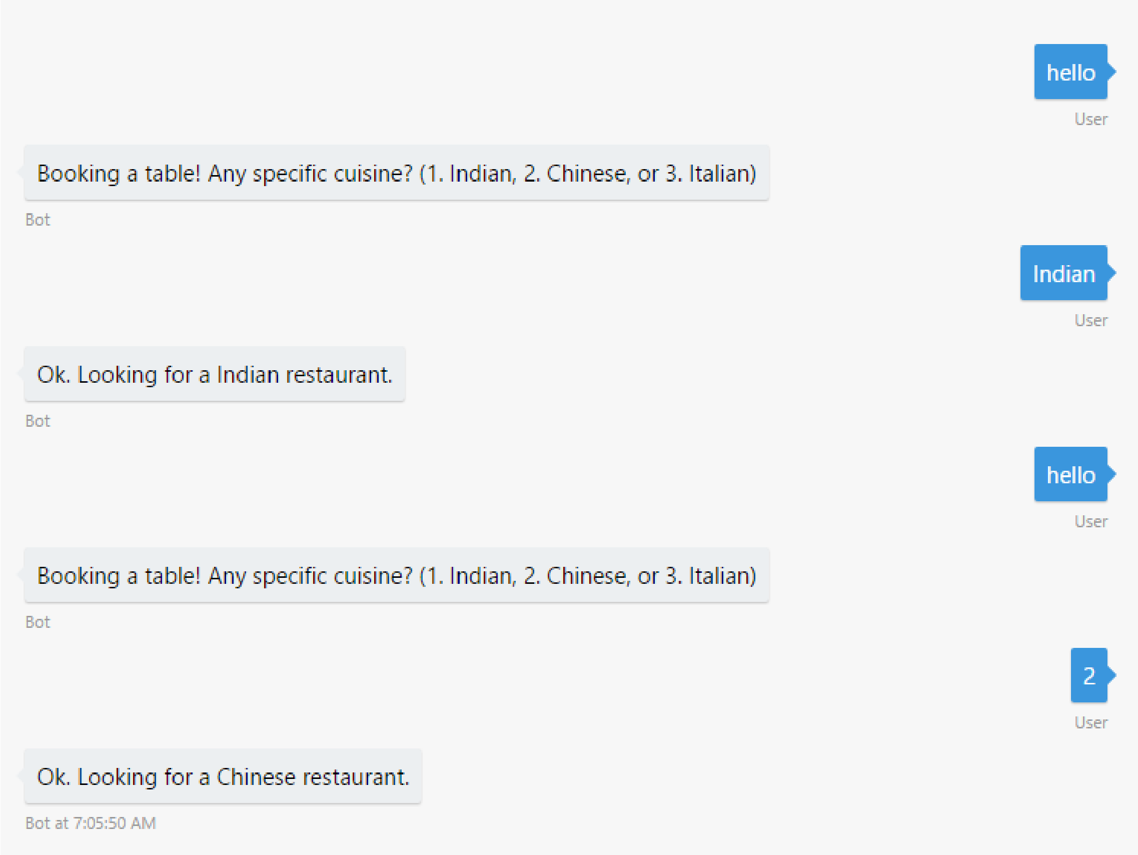
Ok. Looking for a table for 10 people.

Bot at 7:08:51 AM

You can also ask users to choose one of the given options using the `builder.Prompts.choice()` method:

```
var bot = new builder.UniversalBot(connector, [
    function (session) {
        builder.Prompts.choice(session, 'Booking a table!
        Any specific cuisine?', ['Indian', 'Chinese', 'Italian']);
    },
    function (session, results) {
        session.endDialog('Ok. Looking for a ' +
        results.response.entity + ' restaurant.');
    }
]);
```

Notice that the label for the choice (for example, `Indian`) is stored in `results.response.entity`:



hello

User

Booking a table! Any specific cuisine? (1. Indian, 2. Chinese, or 3. Italian)

Bot

Indian

User

Ok. Looking for a Indian restaurant.

Bot

hello

User

Booking a table! Any specific cuisine? (1. Indian, 2. Chinese, or 3. Italian)

Bot

2

User

Ok. Looking for a Chinese restaurant.

Bot at 7:05:50 AM

You can also provide choices in the following format, instead of an array, as shown here:

```
builder.Prompts.choice(session, 'Booking a table! Any specific cuisine?',
'Indian|Chinese|Italian');
```

You can also prompt for date and time and parse varied inputs such as `tomorrow at 2pm`, `Saturday at 8`, or `next Friday` using the `EntityRecognizer` class, as follows:

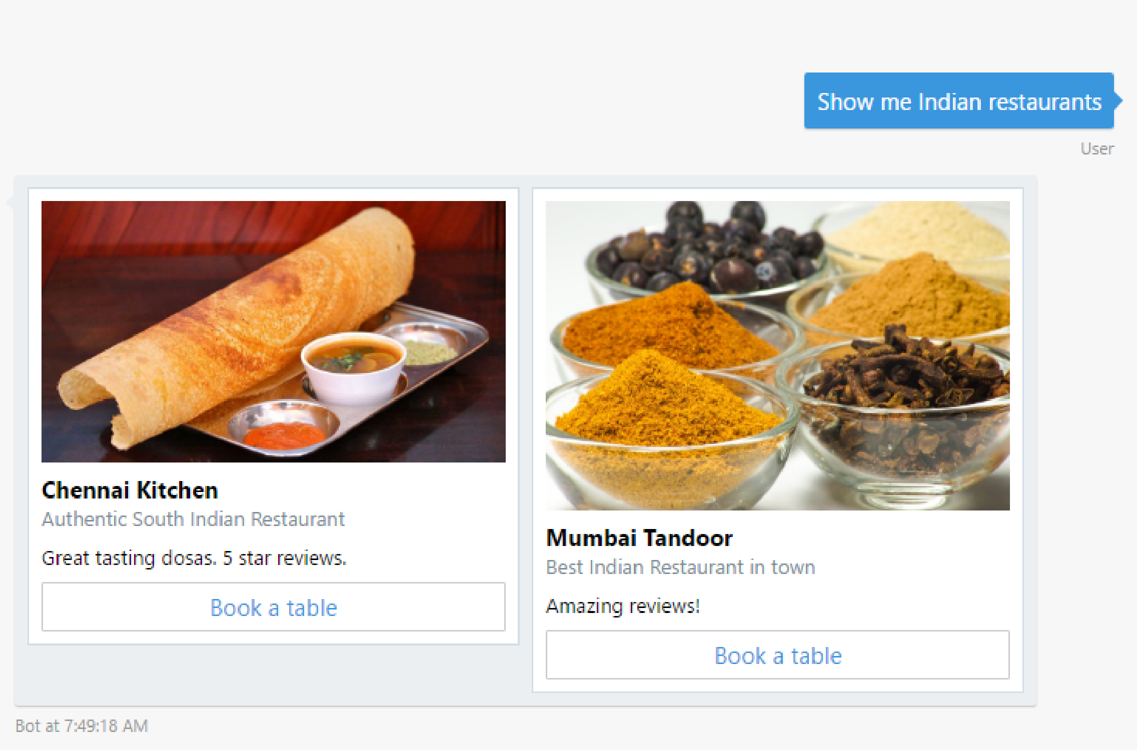
```
builder.Prompts.time(session, "So when is the party?");
....
session.dialogData.partyDate =
builder.EntityRecognizer.resolveTime([results.response]);
```

Rich messages

Now that we know how to serve messages and prompts, let's dig a little deeper to learn how to make it look more visually appealing by adding images and cards. To do this, we will use Hero card. Hero card is a template for presenting information in a rich format using images, URLs, and so on. Here is an example:

```
var bot = new builder.UniversalBot(connector, [
    function (session) {
        var msg = new builder.Message(session);
        msg.attachmentLayout(builder.AttachmentLayout.carousel)
        msg.attachments([
            new builder.HeroCard(session)
                .title("Chennai Kitchen")
                .subtitle("Authentic South Indian Restaurant")
                .text("Great tasting dosas. 5 star reviews.")
                .images([builder.CardImage.create(session,
                       'https://images.pexels.com/photos/221143/
                       pexels-photo-221143.jpeg?
                       w=940&h=650&auto=compress&cs=tinysrgb')])
                .buttons([
                    builder.CardAction.imBack(session,
                    "book_table:chennai_kitchen", "Book a table")
                ]),
            new builder.HeroCard(session)
                .title("Mumbai Tandoor")
                .subtitle("Best Indian Restaurant in town")
                .text("Amazing reviews!")
                .images([builder.CardImage.create(session,
                        'https://images.pexels.com/photos/45844/
                        spices-white-pepper-nutmeg-45844.jpeg?
                        w=940&h=650&auto=compress&cs=tinysrgb')])
                .buttons([
                    builder.CardAction.imBack(session,
                    "book_table:mumbai_tandoor", "Book a table")
                ])
        ]);
        session.send(msg)

    }
]);
```



Show me Indian restaurants

User

Chennai Kitchen

Authentic South Indian Restaurant

Great tasting dosas. 5 star reviews.

Book a table

Mumbai Tandoor

Best Indian Restaurant in town

Amazing reviews!

Book a table

Bot at 7:49:18 AM

For each Hero card, a title, subtitle, text, image, and button response can be specified. In the preceding example, the buttons have been programmed to send response messages back to the bot using the `imBack()` method. However, you can also program it to open a web page using the `openUrl()` method, as follows:

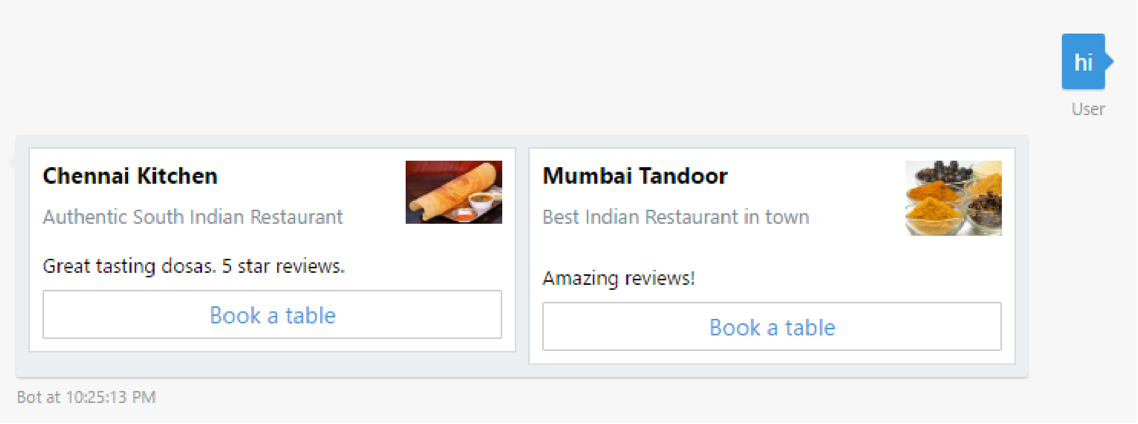
```
builder.CardAction.openUrl(session, 'https://mumbaitandoor.com/bookTable','Book a
table');
```

There are other types of cards as well: Thumbnail card, Adaptive card, Audio card, and Animation card, for example. For a complete list of cards, please refer to the Bot Framework documentation at https://docs.microsoft.com/en-us/bot-framework/nodejs/bot-builder-nodejs-send-rich-cards.

Thumbnail cards are similar to Hero cards but smaller. You can create Thumbnail cards using the `ThumbnailCard` class, as shown here:

```
new builder.ThumbnailCard(session)
                .title("Chennai Kitchen")
                .subtitle("Authentic South Indian Restaurant")
                .text("Great tasting dosas. 5 star reviews.")
                .images([builder.CardImage.create(session,
                       'https://images.pexels.com/photos/221143/
                       pexels-photo-221143.jpeg?w=940&h=650&
                       auto=compress&cs=tinysrgb')])
                .buttons([
                    builder.CardAction.imBack(session,
                    "book_table:chennai_kitchen",
                    "Book a table")
                ])
```

Let's run the preceding code on the emulator:



Chennai Kitchen

Authentic South Indian Restaurant

Great tasting dosas. 5 star reviews.

Mumbai Tandoor

Best Indian Restaurant in town

Amazing reviews!

Let's create a card to show GIF images. The `AnimationCard` class can be used to display animated images:

```
newbuilder.AnimationCard(session)
        .title('Microsoft Bot Framework')
        .subtitle('Animation Card')
        .image(builder.CardImage.create(session,
        'https://makeYourOwnCurry.com/curryAnimation.jpeg'))
        .media([
            { url:'http://i.giphy.com/Ki55RUbOV5njy.gif' }
        ])
```

Audio and Video cards can be used to present audio and video information:

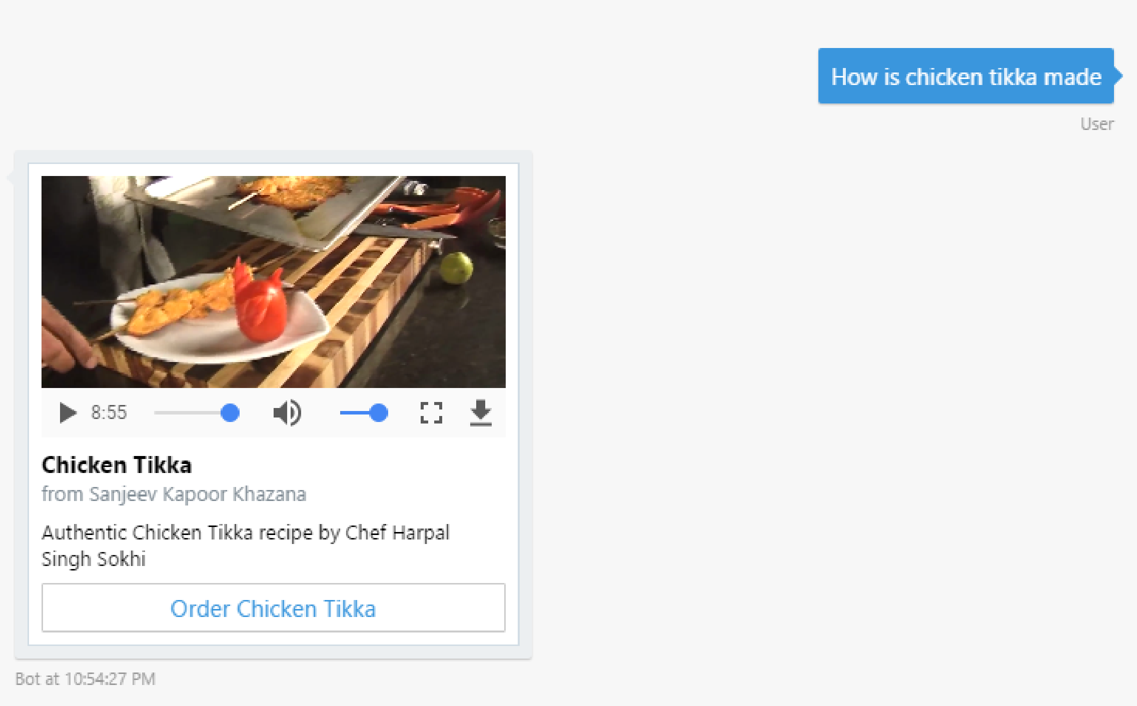
```
//Video card
newbuilder.VideoCard(session)
        .title('Chicken Tikka')
        .subtitle('from Sanjeev Kapoor Khazana')
        .text('Authentic Chicken Tikka recipe by Chef
               Harpal Singh Sokhi')
        .image(builder.CardImage.create(session,
               'https://commons.wikimedia.org/wiki/
               File:Chicken_Tikka_(1).jpg'))
        .media([
            { url: 'http://fakevideourl.com/makingofchickentikka.mp4' }
        ])
        .buttons([
            builder.CardAction.imBack(session, "order:chicken_tikka", "Order Chicken
Tikka")
])
```

```
//Audio card

newbuilder.AudioCard(session)
   .title('Delicious Chicken Tikka')
   .subtitle('Must have at Mumbai Tandoor')
   .text('User')
   .image(builder.CardImage.create(session,
          'https://commons.wikimedia.org/wiki/
```

```
           File:Chicken_Tikka_(1).jpg'))
    .media([
          { url:'http://fakeaudiourl.com/reviews1.wav' }
    ])
    .buttons([
     builder.CardAction.imBack(session, "order:chicken_tikka",
     "Order Chicken Tikka")
])
```

Let's see how it looks on the emulator:



How is chicken tikka made

User

Chicken Tikka

from Sanjeev Kapoor Khazana

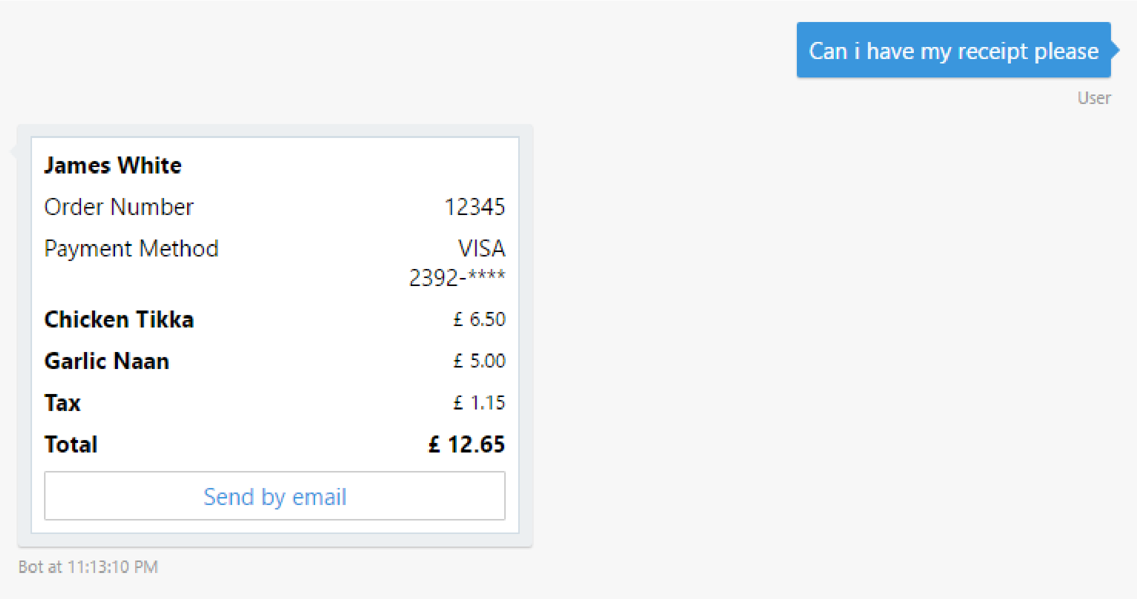
Authentic Chicken Tikka recipe by Chef Harpal Singh Sokhi

Bot at 10:54:27 PM

In addition to these cards, there is a special card called the Receipt card which will present information in a receipt format. It can be used to present an itemized bill with payment information, as follows:

```
new builder.ReceiptCard(session)
    .title('James White')
    .facts([
        builder.Fact.create(session, '12345', 'Order Number'),
        builder.Fact.create(session, 'VISA 2392-****',
                            'Payment Method')
    ])
    .items([
        builder.ReceiptItem.create(session, '£ 6.50', 'Chicken Tikka')
            .quantity(1),
        builder.ReceiptItem.create(session, '£ 5.00', 'Garlic Naan')
            .quantity(2)
    ])
    .tax('£ 1.15')
    .total('£ 12.65')
    .buttons([
        builder.CardAction.imBack(session, 'sendemail',
                                  'Send by email')
    ])
```

Let's run it on the emulator:



Can i have my receipt please

User

James White

Order Number 12345

Payment Method VISA 2392-****

Chicken Tikka £ 6.50

Garlic Naan £ 5.00

Tax £ 1.15

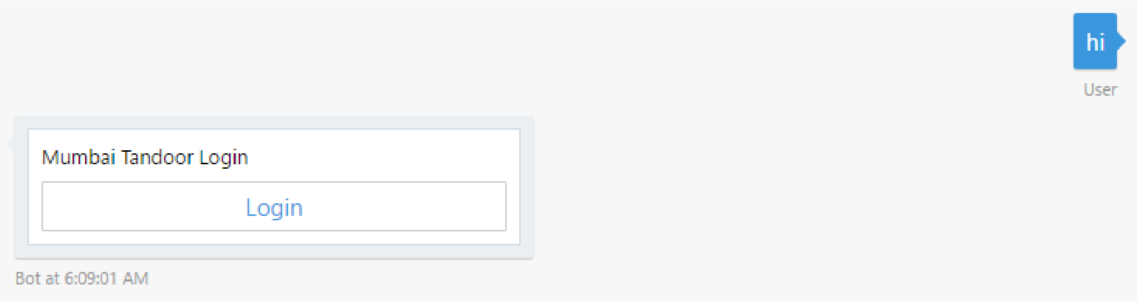
Total **£ 12.65**

Bot at 11:13:10 PM

Finally, there is a card that can be used to authenticate the user by asking them to sign in. This flow can be initiated using the SignIn card:

```
new builder.SigninCard(session)
        .text('Mumbai Tandoor Login')
        .button('Login', 'https://mumbaitandoor.com/login')
        ]);
```

Clicking the SignIn card takes the user to the web page where the user can be authenticated:



hi

User

Mumbai Tandoor Login

Bot at 6:09:01 AM

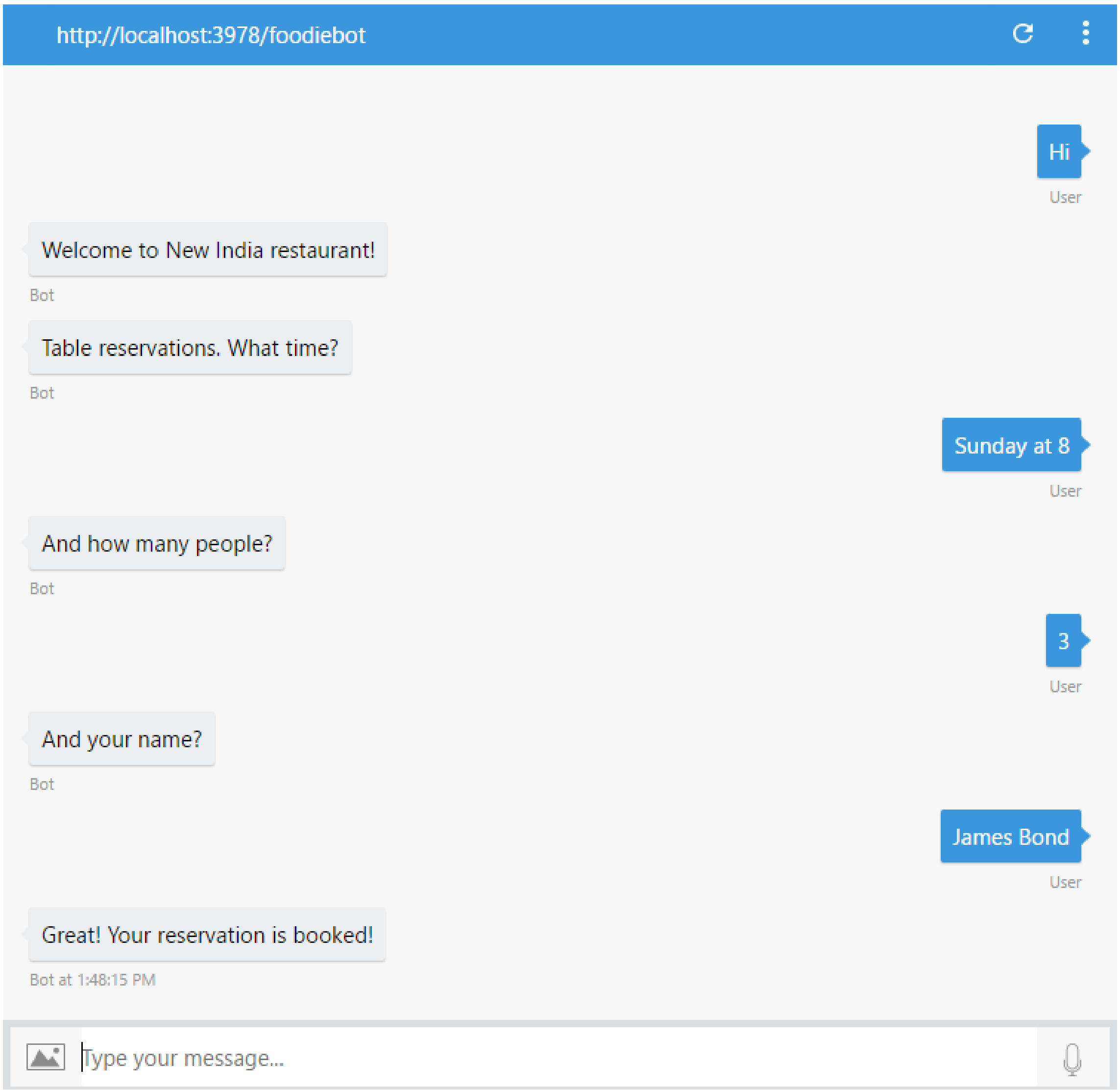
Now that we have explored the cards, let's move on to implementing the conversation flow.

Conversation flow

Now that we have a setup to test the chatbot and have explored a variety of ways information can be presented to the user, let's examine the ways in which conversation flow can be managed. The basic model available to us is the waterfall model, where the conversation is composed of a sequence of steps. Let's take the example of booking a table at a restaurant where the conversation proceeds in the following way: get the time of reservation, the number of people at the table, and the name of the user:

```
// Bot Dialogs
var bot = new builder.UniversalBot(connector, [
    function (session) {
        session.send('Welcome to New India restaurant!');
        builder.Prompts.time(session, 'Table reservations.
                             What time?');
    },
    function (session, results) {
        session.dialogData.timeOfReservation =
        builder.EntityRecognizer.resolveTime([results.response]);
        builder.Prompts.number(session, "And how many people?");
    },
    function (session, results) {
        session.dialogData.numberOfPeople = results.response;
        builder.Prompts.text(session, "And your name?");
    },
    function (session, results) {
        session.dialogData.nameOnReservation = results.response;
        session.send('Great! Your reservation is booked!');
    }
]);
```

Let's try this out on the emulator:



http://localhost:3978/foodiebot

Hi

User

Welcome to New India restaurant!

Bot

Table reservations. What time?

Bot

Sunday at 8

User

And how many people?

Bot

3

User

And your name?

Bot

James Bond

User

Great! Your reservation is booked!

Bot at 1:48:15 PM

Let us dissect the code a little to understand what is happening. We start by constructing a bot using the `UniversalBot` class. As we build the bot, we specify the steps of the waterfall conversation as an array of functions. This is the root dialogue. Each function is a step in the conversation. At each step, the bot says or prompts the user with a message. In case of prompts, it expects the user to respond. The response is stored in `results.response`, which is updated to the dialogue state managed in `session.dialogData`. This assignment happens in the subsequent steps, the bot makes the next utterance or prompts for more information. As we have discussed previously, there are a variety of ways information can be prompted and verified.

It is not always possible to map out the entire conversation as an array of functions. What if there are parts of the conversation that repeat? As programmers, we handle these situations using functions and methods. A method would be a well-defined piece of code performing a specific task and can be called for whenever it is required by the `main` method or another method. Let's take, for example, the task of payment when placing an order. Whether you are at the table or ordering takeout, you will have to make payments the same way. The same set of questions will be asked: paying by card or cash, the card number, the name on the card, the CVV number, and so on. Imagine a payment dialogue between the user and the bot. Will this dialogue be used in more than one scenario? Wouldn't it be nice to keep the conversational step of the payment dialogue separate and call the process whenever a payment needs to be taken? This is what we can accomplish using the `dialog()` method.

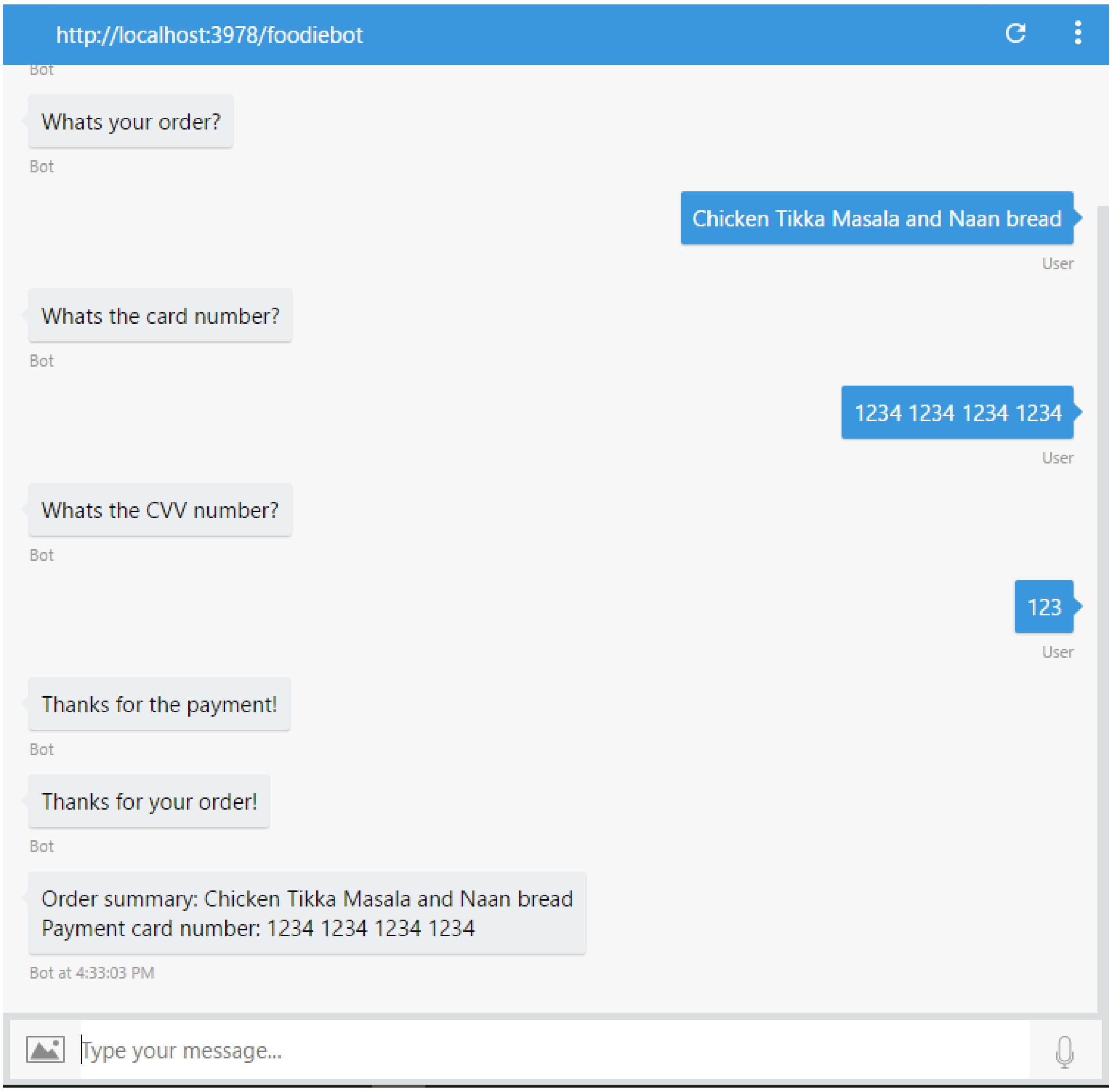
The bot that we create using the `UniversalBot` class can be provided conversational skills to carry out a variety of tasks, such as payments and product listing, using the `dialog()` method. These can then be called upon when necessary from the root dialogue. Each `dialog()` method can be used to define a sub-dialogue, and structurally will be an independent waterfall dialogue. Let's now build a root dialogue and embed within it two sub-dialogues asking for the order and asking for payment:

```
//Main dialogue
var bot = new builder.UniversalBot(connector, [
    function (session) {
        session.send("Welcome to New India restaurant.");
        session.beginDialog('askForOrder');
    },
    function (session) {
        session.beginDialog('askForPayment');
    },
    function (session) {
        session.send('Thanks for your order!');
        session.send(`Order summary:
        ${session.conversationData.order}<br/>`+
            `Payment card number:
        ${session.conversationData.cardNumber}<br/>`);
        session.endDialog();
    }
]);

// Ask for Order
bot.dialog('askForOrder', [
    function (session) {
        builder.Prompts.text(session, 'Whats your order?');
    },
    function (session, results) {
        session.conversationData.order = results.response;
        session.endDialog();
    }
]);

// Ask for payment
bot.dialog('askForPayment', [
    function (session) {
        builder.Prompts.text(session, 'Whats the card number?');
    },
    function (session, results) {
        session.conversationData.cardNumber = results.response;
        builder.Prompts.text(session, 'Whats the CVV number?');
    },
    function (session, results) {
        session.conversationData.cardCVVNumber = results.response;
        session.send('Thanks for the payment!');
        session.endDialog();
    }
])
```

In the preceding code, you can see three dialogues: root, asking for the order, and asking for payment. Within the root dialogue, we use the `session.beginDialog()` to call upon the sub-dialogues:



http://localhost:3978/foodiebot

Bot

Whats your order?

Bot

Chicken Tikka Masala and Naan bread

User

Whats the card number?

Bot

1234 1234 1234 1234

User

Whats the CVV number?

Bot

123

User

Thanks for the payment!

Bot

Thanks for your order!

Bot

Order summary: Chicken Tikka Masala and Naan bread
Payment card number: 1234 1234 1234 1234

Bot at 4:33:03 PM

Also, notice that we have been using `session.dialogData` to store information from user utterances so far. But now, we are using `session.conversationData`. We will explore the difference between them later.

At this point, we need to understand the concept of [**dialog stack**]. In the beginning, the dialog stack contains the root dialogue. As sub-dialogues get called from the root, these are stacked on top of the root dialogue. Sub-dialogues can themselves call other sub-dialogues. These, in turn, get stacked over them. When a sub-dialogue is finished, the bot returns the next dialogue in the stack and continues doing so until there are no more.

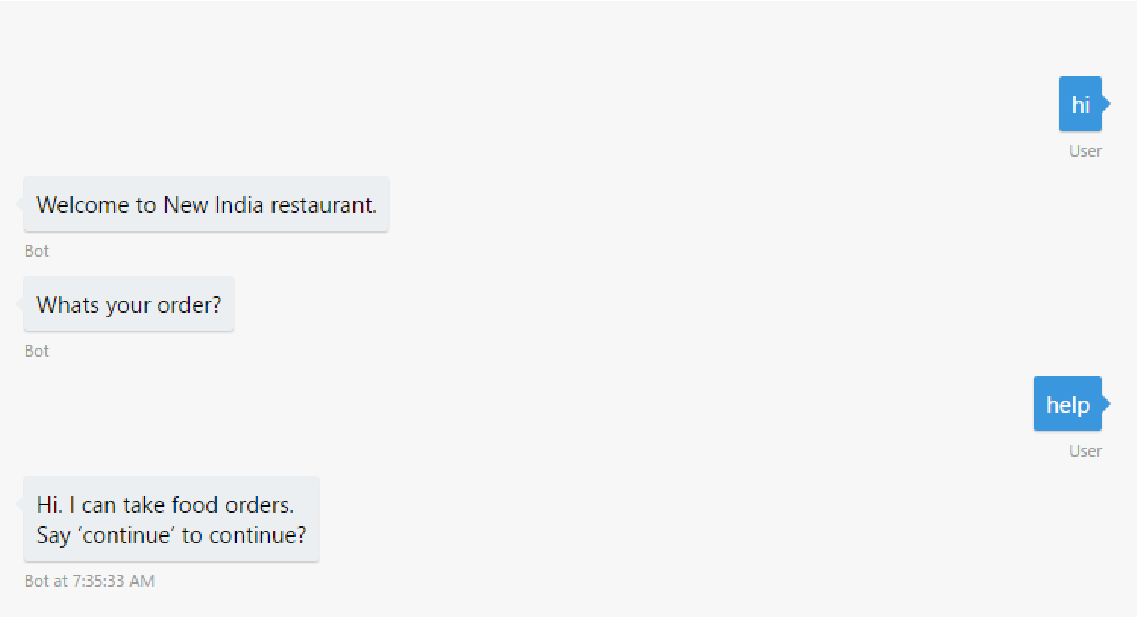
Responding to user utterances

What we have now is a default conversation that starts the same way no matter what the user says. You could say `hi`, or `help`, or any other utterance and the bot would answer with a welcome message. Another way in which a conversation can get started is based on what the user says.

Let us now explore how to respond when the user says `help` in the middle of the conversation:

```
bot.dialog('help', function (session, args, next) {
    session.endDialog("Hi. I can take food orders.<br/>
                      Say 'continue' to continue?");
})
.triggerAction({
    matches: /^help$/i,
});
```

Responding to user utterances can be done by adding `triggerAction()` with utterances specified as regular expressions in the `matches` clause. Add the preceding code to `app.js` and restart the server. Now the conversation may go as follows:



hi

User

Welcome to New India restaurant.

Bot

Whats your order?

Bot

help

User

Hi. I can take food orders.
Say 'continue' to continue?

Bot at 7:35:33 AM

The code we added allows the bot to respond to the `help` user utterance. Notice how this overrides the current expectation of order information that the bot is waiting for.

There are two other ways of interpreting user utterances: a custom recognizer and using NLU services such as LUIS. Let us try the custom recognizer first. To your bot, attach the following recognizer:

```
bot.recognizer({
  recognize: function (context, done) {
        var intent = { score: 0.0 };
        if (context.message.text) {
            switch (context.message.text.toLowerCase()) {
                case 'help':
                    intent = { score: 1.0, intent: 'get-help' };
                    break;
                case 'goodbye':
                    intent = { score: 1.0, intent: 'say-goodbye' };
                    break;
            }
        }
        done(null, intent);
```

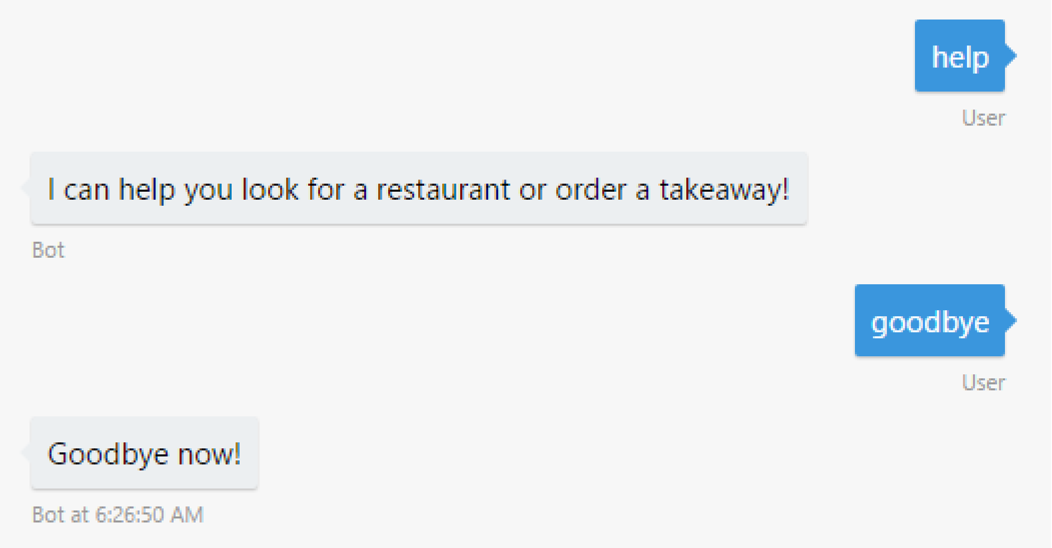
```
    }
});
```

And create appropriate sub-dialogues for the intents:

```
bot.dialog('help', [
    function (session) {
        session.send('I can help you look for a
                     restaurant or order a takeaway!');
        session.endDialog();
    }
]).triggerAction({
    matches: 'get-help'
});

bot.dialog('goodbye', [
    function (session) {
        session.send('Goodbye now!');
        session.endConversation();
    }
]).triggerAction({
    matches: 'say-goodbye'
});
```

While utterance patterns can be specified using the matches option for each sub-dialogue, it is even better to organize them as intents using a global recognizer for all sub-dialogues. This is to ensure that we do not have to duplicate the regular expressions. Once the intents are identified, they can be used to trigger appropriate sub-dialogues, as shown here:



help

User

I can help you look for a restaurant or order a takeaway!

Bot

goodbye

User

Goodbye now!

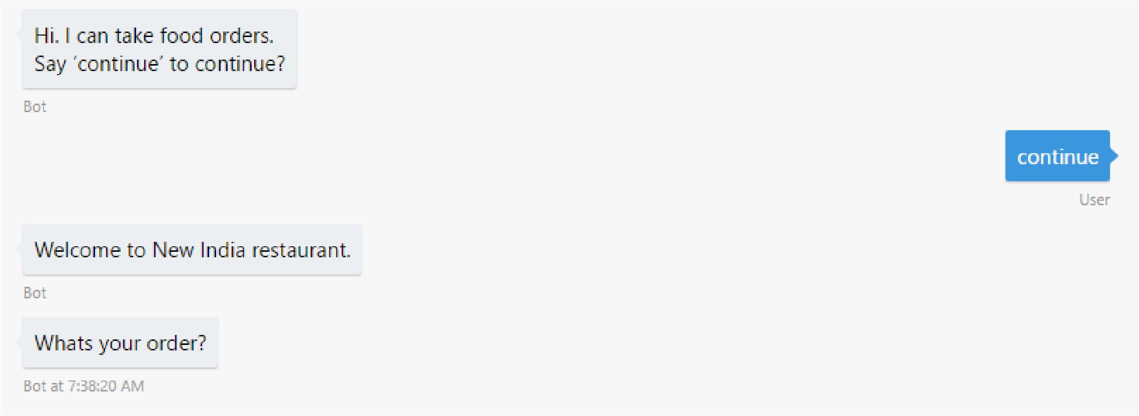
Bot at 6:26:50 AM

Note

LUIS is Microsoft's natural language understanding service. It is similar to Google's API.AI and Amazon's Lex. Any of these tools can be integrated with the bot to provide NLU services if custom recognizers ,such as the preceding, are not adequate. To explore this option further, consult the official documentation at https://docs.microsoft.com/en-us/bot-framework/nodejs/bot-builder-nodejs-recognize-intent-luis.

Keeping context intact

Processing user utterances using sub-dialogues can take the conversation out of context:



Hi. I can take food orders.
Say 'continue' to continue?

Bot

continue

User

Welcome to New India restaurant.

Bot

Whats your order?

Bot at 7:38:20 AM

What happened to the conversation when the user typed `continue`, as mentioned in the help message? Does the conversation continue? No, it doesn't. The bot seems to have completely forgotten what it was doing before. This is because the dialog stack is cleared when user utterances are processed. It may be ideal to clear the stack when the user wants to change the topic of the conversation, but not when the user is asking for help.

There is a way to keep context intact even when users interrupt with questions and remarks. This can be done by adding the `onSelectAction` option to the sub-dialogue that gets invoked. This will keep the dialog stack intact and not clear it:

```
bot.dialog('help', function (session, args, next) {
    session.endDialog("Hi there. I can take food orders.");
})
.triggerAction({
    matches: /^help$/i,
    onSelectAction: (session, args, next) => {
        session.beginDialog(args.action, args);
    }
});
```

So it is actually part of the design decision to designate where the dialogue stack needs to be cleared and where it should not be. For instance, when the user asks for help, it is better not to clear the context as the help request could be related to the context. However, if the user seems to be switching to another task (for example, asking for a table booking when they are actually ordering food), it may be a good idea to clear the context as it is not appropriate to return to taking the food order once the table has been booked.

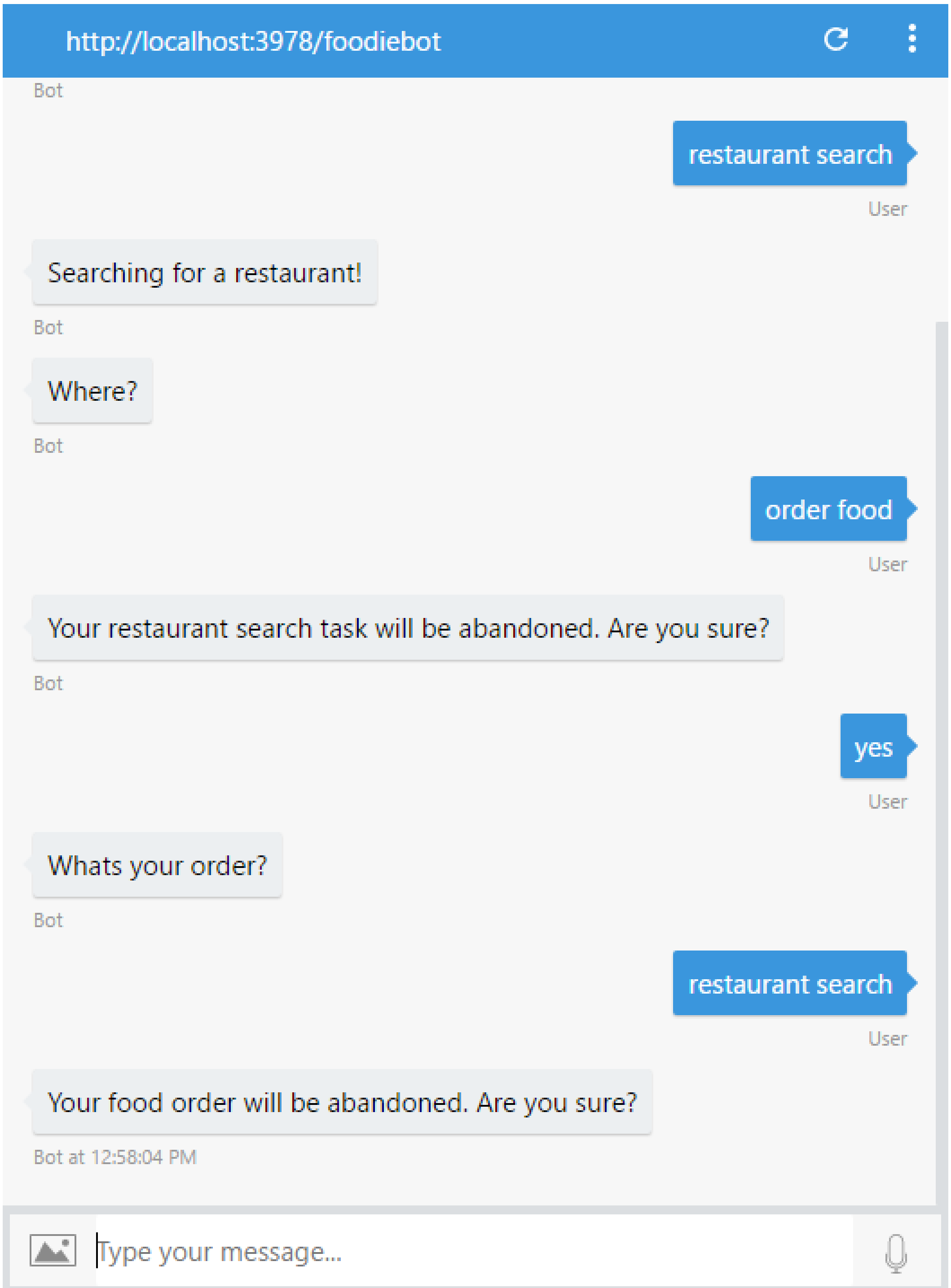
Context switching

However, there may be cases where the user wants to switch from one task to another. In such cases, we do not want to keep the dialog stack intact. By not using the `onSelectAction` option, we can wipe out dialog stack. However, it is also a good idea to let the user know that the bot is going to abandon the current task to take up the next task. This can be done using the `confirmPrompt` option in the `triggerAction()` method:

```
bot.dialog('askForOrder', [
    ...
])
.triggerAction({
    matches: /^order food$/i,
    confirmPrompt: "Your food order will be abandoned. Are you sure?"
});

// Search for a restaurant
bot.dialog('searchRestaurant', [
    function (session) {
        session.send('Searching for a restaurant!');
        builder.Prompts.text(session, 'Where?');
    },
    function (session, results) {
        session.conversationData.searchLocation = results.response;
        session.endDialog();
    }
])
    .triggerAction({
    matches: /^restaurant search$/i,
    confirmPrompt: 'Your restaurant search task
    will be abandoned. Are you sure?'
});
```

By appending the `triggerAction()` method to the `askForOrder` dialogue, we will be able to respond to user requests to order food at any point in the conversation. However, the bot will proactively prompt them that any other task being done (for example, booking a table) will be abandoned:



Bot

restaurant search

User

Searching for a restaurant!

Bot

Where?

Bot

order food

User

Your restaurant search task will be abandoned. Are you sure?

Bot

yes

User

Whats your order?

Bot

restaurant search

User

Your food order will be abandoned. Are you sure?

Bot at 12:58:04 PM

Notice how the confirm prompts are invoked when the user switches from one task to other.

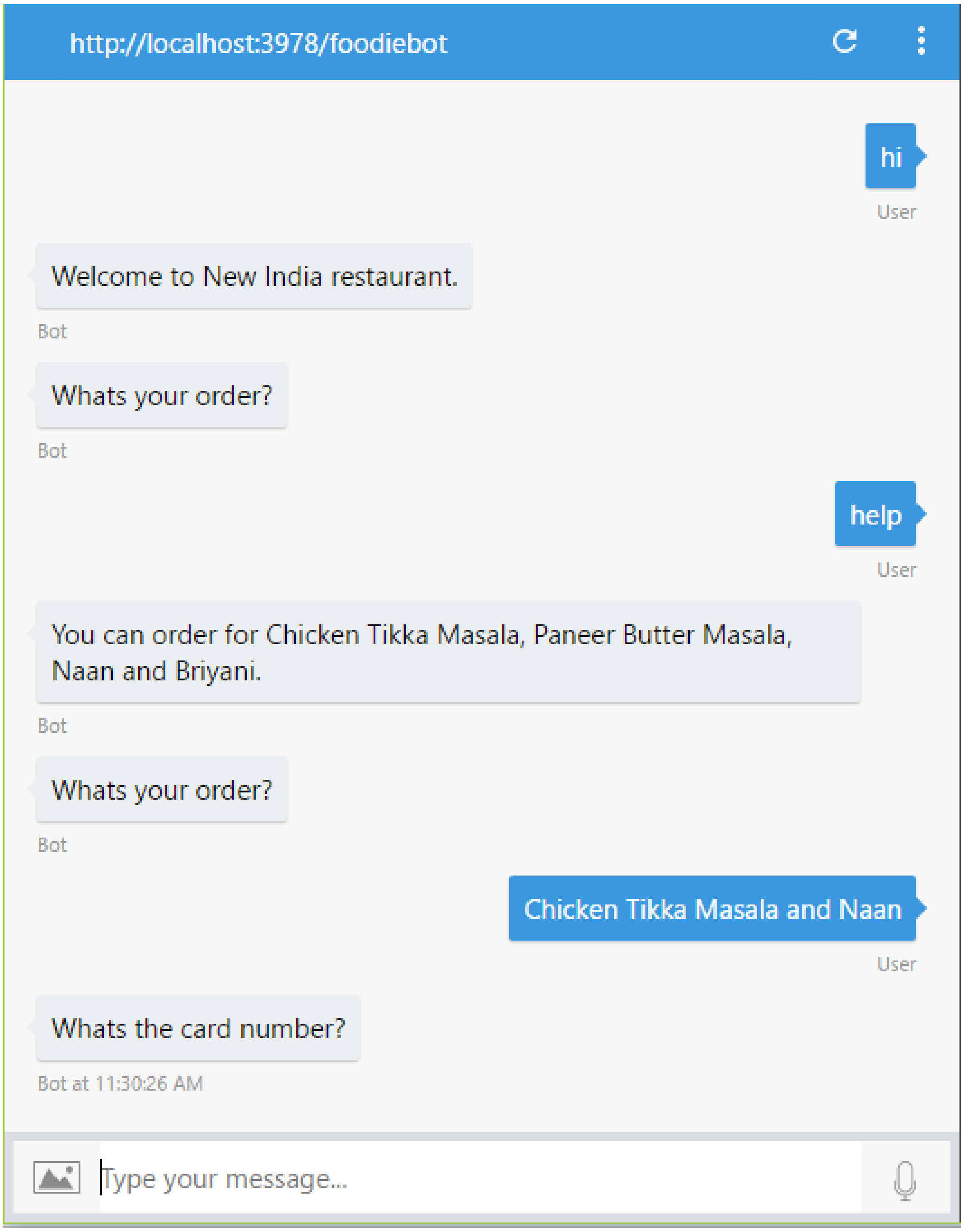
Contextual NLU

It may also be ideal to provide help in a contextual way. For instance, provide the user with a menu when they ask for help while ordering. Let us see how utterances can be processed contextually. To do this, we need to create a `help` sub-dialogue and append it to an existing dialogue so that it can trigger when what the user says matches the template provided:

```
 // Ask for Order
bot.dialog('askForOrder', [
    function (session) {
        builder.Prompts.text(session, 'Whats your order?');
    },
    function (session, results) {
        session.conversationData.order = results.response;
        session.endDialog();
    }
])
.beginDialogAction('orderHelpAction', 'orderHelp',
                   { matches: /^help$/i });

// Contextual help for ordering
bot.dialog('orderHelp', function(session, args, next) {
    var msg = "You can order for Chicken Tikka Masala,
    Paneer Butter Masala, Naan and Briyani.";
    session.endDialog(msg);
})
```

Notice how we use the `beginDialogAction()` method to link the `orderHelp` sub-dialogue. `orderHelp` gets triggered when the user says `help` during the food ordering step:



http://localhost:3978/foodiebot

hi

User

Welcome to New India restaurant.

Bot

Whats your order?

Bot

help

User

You can order for Chicken Tikka Masala, Paneer Butter Masala, Naan and Briyani.

Bot

Whats your order?

Bot

Chicken Tikka Masala and Naan

User

Whats the card number?

Bot at 11:30:26 AM

In the preceding conversation, asking for `help` does not yield the standard response. Instead, we get a contextual one.

Ending the conversation

Finally, it is a good practice to end the conversation when the tasks are finished. This is done by informing the user that the tasks are finished, clearing out the dialogue stack, and resetting the `session.conversationData` object. To do this, use the `session.endConversation()` method. So, let us rewrite our root dialogue with the `session.endConversation()` method:

```
//Main dialogue
var bot = new builder.UniversalBot(connector, [
    function (session) {
        session.send("Welcome to New India restaurant.");
        session.beginDialog('askForOrder');
    },
    function (session) {
        session.beginDialog('askForPayment');
    },
    function (session) {
        session.send('Thanks for your order!');
        session.send(`Order summary: ${session.conversationData.order}<br/>`+
            `Payment card number:
        ${session.conversationData.cardNumber}<br/>`);
        session.endConversation();
    }
]);
```

You can also set a default dialogue that gets triggered when the user says `Goodbye` and ends the conversation:

```
bot.dialog('endConversation', [
    session.endConversation("Goodbye!")
])
.endConversationAction(
    "endTasks", "Ok. Goodbye.",
    {
        matches: /^goodbye$/i,
        confirmPrompt: "Cancelling current task. Are you sure?"
    }
);
```

Now let's have a look at how we can store the context of the conversation.

Conversational state

The state of the conversation can be stored in the form of key/value pairs. There are four data stores that are available to do this. These are housed within the `session` object:

- `dialogData`: Remember, the conversation is divided into dialogs (the root dialogue and sub-dialogues initiated with `beginDialog()`). Within each dialog, the state can be maintained separately. This is done using `session.dialogData`, which we have used in the previous examples. It stores data pertaining to the current sub-dialogue, and each sub-dialogue has its own copy of the `dialogData`. When the dialogue finishes (that is, `endDialog()` is executed) and is removed from the dialog stack, this data is deleted.
- `conversationData`: This stores data pertaining to the whole conversation and is shared among all members (that is, users) in the conversation. It gets cleared when the conversation ends or when `endConversation()` is executed. This data can be accessed using `session.conversationData`.
- `privateConversationData`: This stores data pertaining to the whole conversation as `conversationData`, but is private to every individual member of the conversation. This is not shared with other members participating in the conversation. It gets cleared when the conversation ends or

when `endConversation()` is executed. This data can be accessed using `session.privateConversationData`.

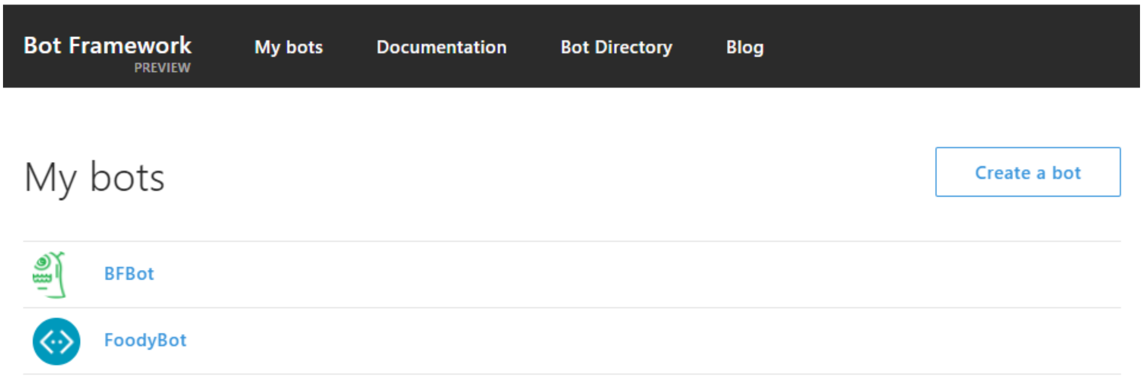
- `userData`: Private data pertaining to a user can be stored here. This is persistent across conversations. Data such as the user's name, age, gender, address, phone number, email, and payment info can be stored here and be used in conversations. This data can be accessed using `session.userData`.

So far, we have covered a number of concepts in the Bot Builder toolkit with examples worked out. We have examined how to set up a root dialogue and take the conversational flow into sub-dialogues. We have explored how to handle user utterances locally and globally, as well as the use of various data objects to store user and conversation data. Let us now proceed to building a bot with restaurant data.

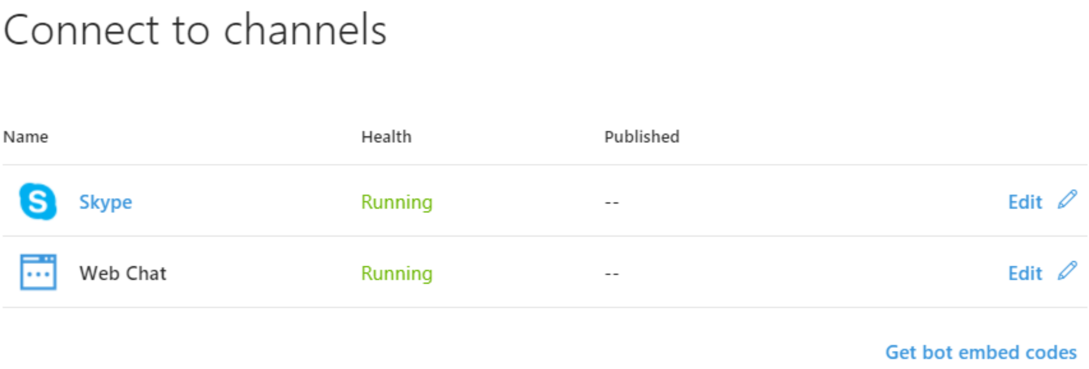
Connecting to Skype

Now that we have a chatbot to search for restaurants, push it back on to Heroku cloud as before. Remember to change the `Procfile` as we need to run `index.js` and not `app.js`. Having set up the chatbot as a web app in Heroku, we are all set to deploy the bot on Skype and other channels.

1. Go to your dashboard on Bot Framework at https://dev.botframework.com/bots:

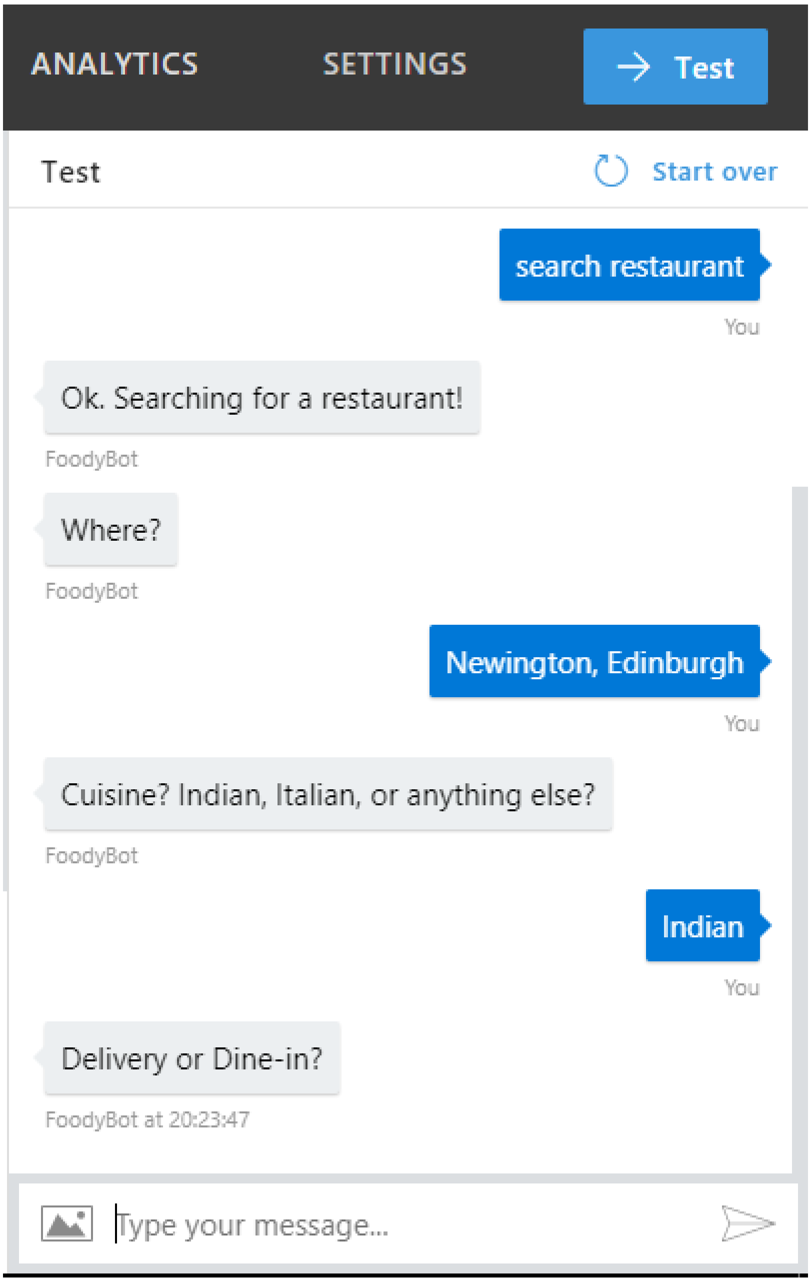


2. Choose your bot. You will see that your bot is already connected to two channels, **`Skype`** and **`Web Chat`**:


Connect to channels

Name	Health	Published	
Skype	Running	--	Edit
Web Chat	Running	--	Edit

3. You will also be able to see the chat client on the right side. If you do not see one, you should be able to open it by pressing the **`Test`** button. This is similar to the emulator. So go on and say `Hi` to the bot:



search restaurant

You

Ok. Searching for a restaurant!

FoodyBot

Where?

FoodyBot

Newington, Edinburgh

You

Cuisine? Indian, Italian, or anything else?

FoodyBot

Indian

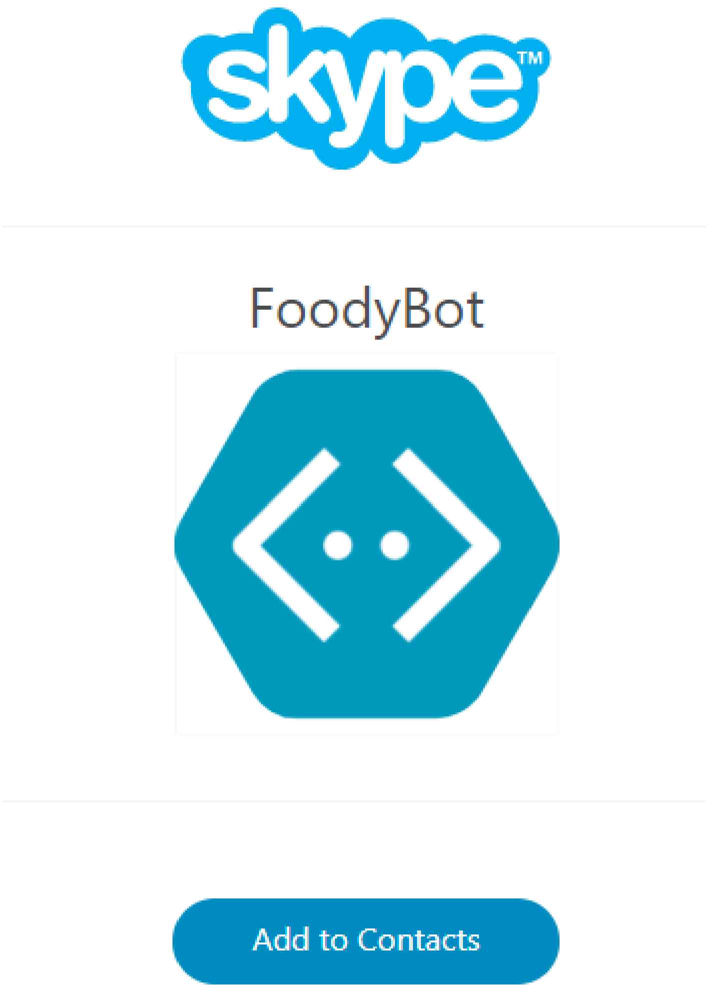
You

Delivery or Dine-in?

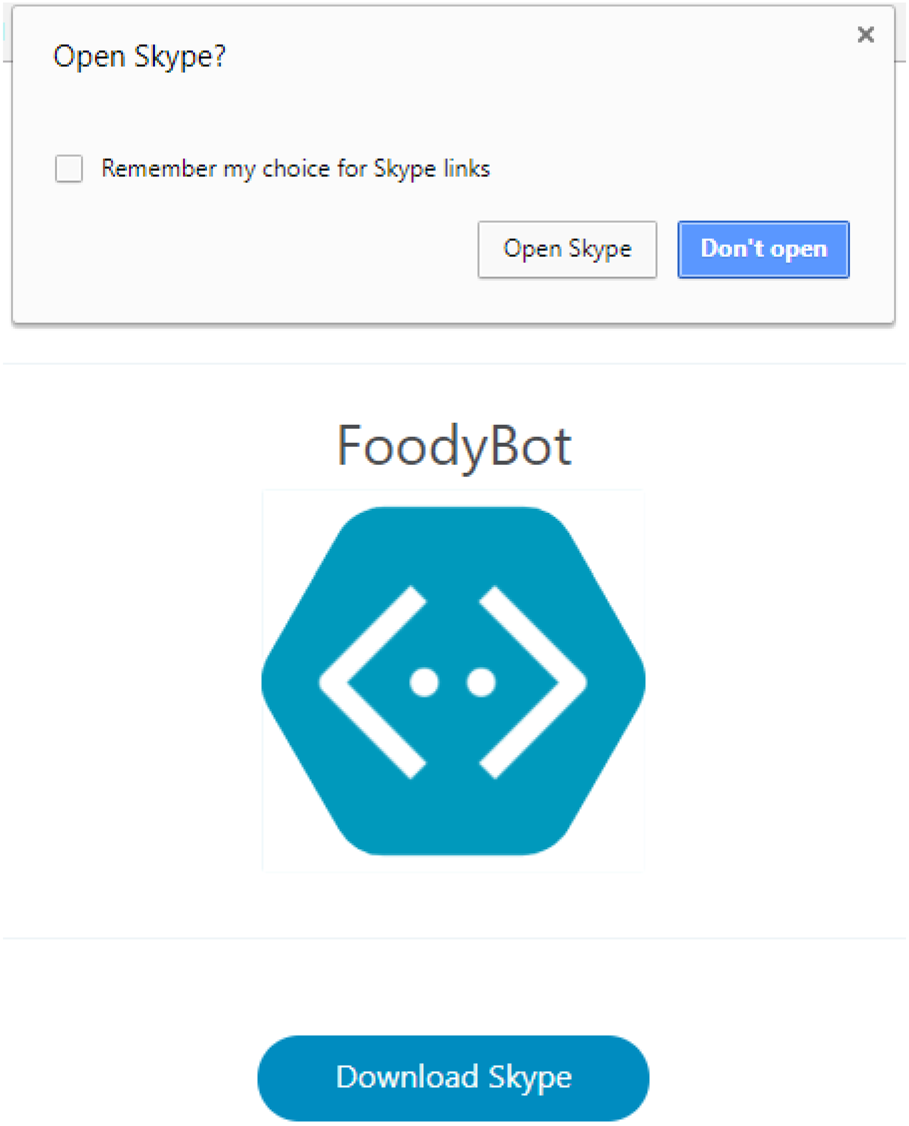
FoodyBot at 20:23:47

You should be able to chat with the bot here as it is in the cloud and not on localhost.

4. Click `Skype` :



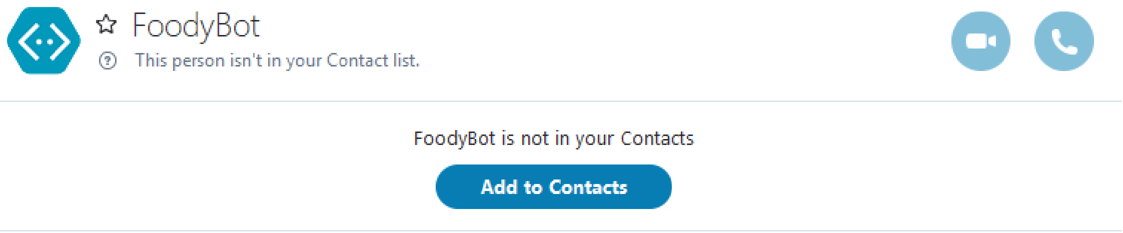
5. Click `Add to Contacts`:



Open Skype?

□ Remember my choice for Skype links

6. Click `Open Skype` :

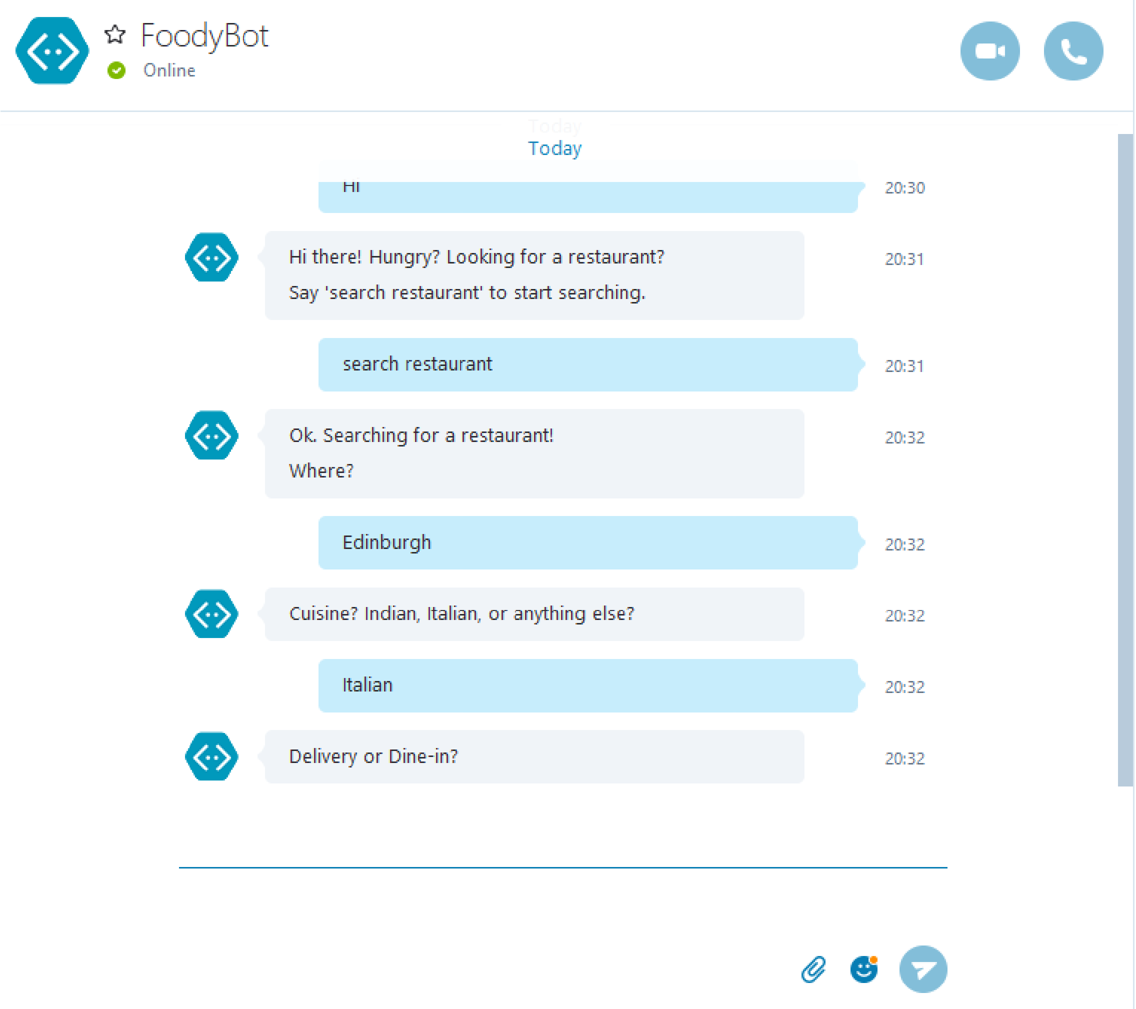


FoodyBot

This person isn't in your Contact list.

FoodyBot is not in your Contacts

7. Add the bot to your contacts and start chatting:



Today

Hi 20:30

Hi there! Hungry? Looking for a restaurant?
Say 'search restaurant' to start searching. 20:31

search restaurant 20:31

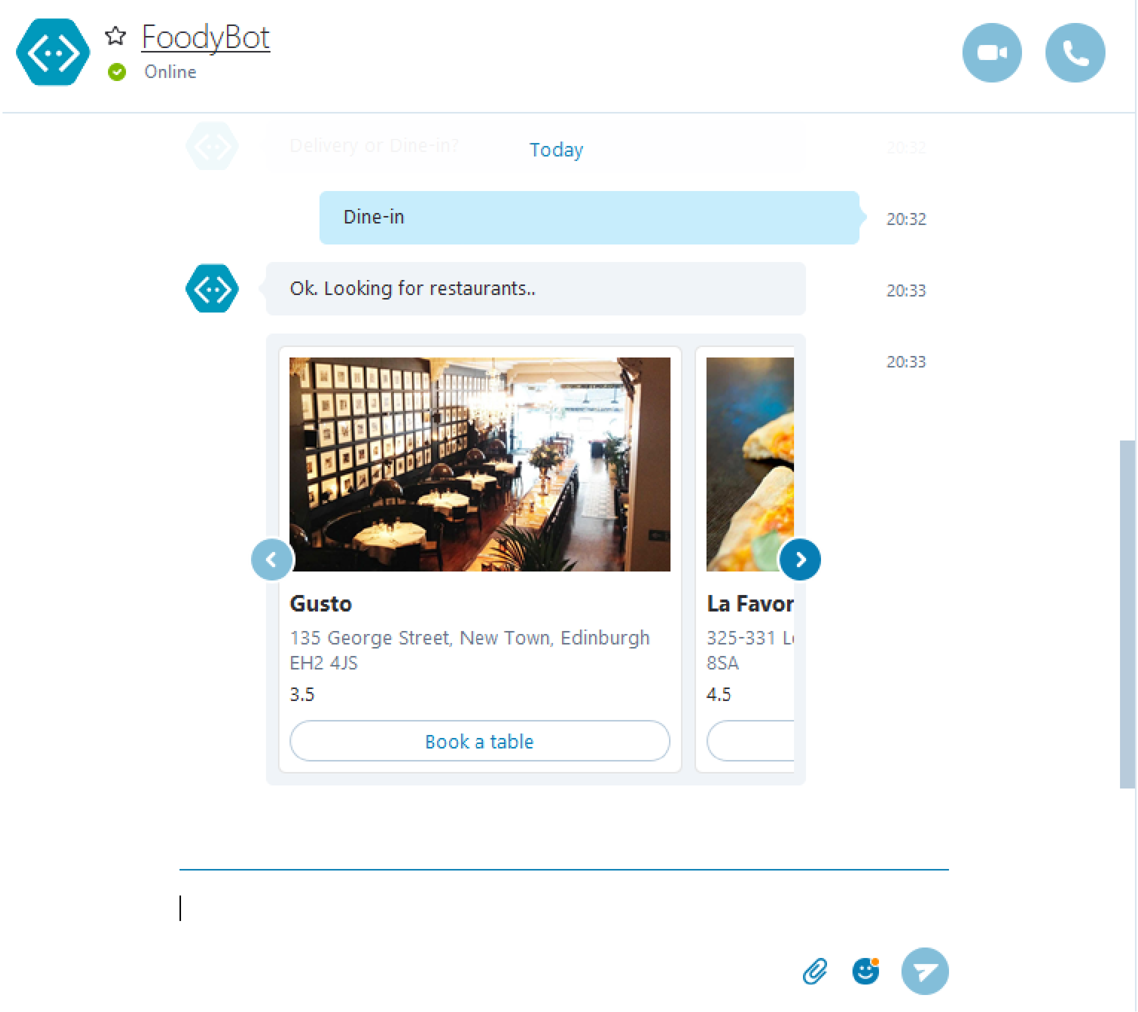
Ok. Searching for a restaurant!
Where? 20:32

Edinburgh 20:32

Cuisine? Indian, Italian, or anything else? 20:32

Italian 20:32

Delivery or Dine-in? 20:32



Delivery or Dine-in? 20:32

Dine-in 20:32

Ok. Looking for restaurants.. 20:33

20:33

Gusto
135 George Street, New Town, Edinburgh EH2 4JS
3.5

La Favor
325-331 L
8SA
4.5

Congratulations on your new bot in Skype. Now that we have created a bot using Bot Builder SDK and deployed it on Skype, go explore all the other options that we learned about but did not get to experiment with. Add a user-profiling dialogue where the bot learns about the user's preferences. Extend the restaurant search dialogue by asking follow-up questions based on reviews, ratings, and price range once the restaurants are found and need further sorting. Try to add natural language support so that the user can switch between tasks easily.

Summary

In the previous labs, we explored and learned about how to build a chatbot using a variety of tools. These include development environments such as Chatfuel, natural language processing tools such as API.AI, and channel-specific SDKs such as Messenger SDK. However, when it comes to coding the conversational flow to manage the conversation, we either used form-based tools or built it from scratch. However, there is a middle path. MS Bot Framework offers the Bot Builder SDK that can be used to develop conversation management modules that manage how the dialogue flows between the bot and the user. The SDK models the elements of conversations in an elegant manner allowing developers to build chatbots quickly and easily. This gives developers greater flexibility than drag-and-drop tools, and it saves time and effort compared to building the bot from scratch.

In this lab, we learned how to built a bot with the Bot Builder SDK and deploy it on the Skype channel. In the next lab, we will move on to more advanced bots that are drastically different from those that we have explored so far---the Twitter bot!