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## **Overview**

This document contains source codes and necessary steps to create and demonstrate a meeting room booking chat bot.

* use bot framework to create a chatbot
* considerations when creating a chatbot for enterprise
  + Timezone
  + Conversation Log
  + Dialog Box Control
  + User Cancel Conversation
  + Monitoring
* This Bot supports Azure AD authentication mechanism
* Cortana Channel

Cortana Skill currently supports only US Market, and not all languages are supported by Cortana. So the following steps are targeting English. You can change supported language by changing your LUIS model.

This Document does not contain Implementation details of Meeting Room API.

## **Prerequisites**

* Microsoft Account(@Hotmail.com、@Msn.COM…etc)
* Cortana Enabled Windows 10 devices (for Cortana Skill Only)
* An Active AZure Subscription
* Visual Studio 2015 or 2017 (Community+)

## **Required Cortana User consent**

* User NAme
* User Email
* Geo-Location
* User Profile

## **Designing a Chatbot**

#### Reference

* AutoBot: <https://github.com/MicrosoftDX/AuthBot>
* Meeting Room Bot Sample Code: <https://github.com/michael-chi/meetingroombotdemo>

#### Business Requirements

* To allow users book a meeting room with the following utterance

Book A901 tomorrow at 10 am for 1 hour

I need A902 next Monday at 10 am for 2 hours

* Or, allow user provide meeting details to allow Meeting Room API search an available room for the user

I need a room next Friday at 10 am

Book a room next Friday at 10 am for 1 hour for 2 people

* If user has a preferred meeting room, the Chatbot check if the room is available at specified time.
  + If it is available, book the room
  + If it is not available, tell the user room is not available
* If user did not specify preferred room
  + And he provided complete meeting information such as time, duration, capacity…etc
    - The Chatbot search for available room that meets criteria and let user choose one.
  + If user did not provide complete information
    - The Chatbot collects all required information and allow user to choose one.

#### Flow chat



#### Bot Design considerations

Users may provide full information in his first utterance, but also can provide only part of meeting information. So we will divide our conversation with users into several different dialog boxes



* MainDialog: Greeting users and identify what information are already included user’s utterances as well as unprovided required information.
* DetailDialog: Collect required information
* ConfirmDialog: Invoke Meeting Room API. If the room is confirmed booked, display a summary of the meeting to the user as well as provide a iCS file for users to download.

##### Design

* Collect required meeting room information
  + In order to book a meeting room, we need the following information
    - (Optional)MeetingRoomID
    - Meeting Date
    - Meeting Start Time
    - Attendee size (Optional if user specified MeetingRoomId)
    - Meeting Duration
  + We anticipate users may use following utterance to book meeting rooms
    - Book A901 next Monday at 10 am for 2 hours
    - Book a room tomorrow at 10 am for 1 hour for 2 people
    - Book a room next Monday at 10 Am
    - Book A902 for 1 hour
    - I need a room at next Friday 5 PM
  + If we need to collect additional information from users, in DetailDialog, we anticipate user use exact words to provide information, such as:

Bot: How many people would attend this meeting in person

User: 10

But not utterances like below

Bot: How many people would attend this meeting in person

User: There’re 10 people would attend this meeting

Although the later method is more close to nature, but this kind of free type answer would make our program complicated. Generally speaking, we focus on fulfill user’s needs – in this case – book a meeting room – in our first phase. And in later phases we try to make our Chatbot more intelligent.

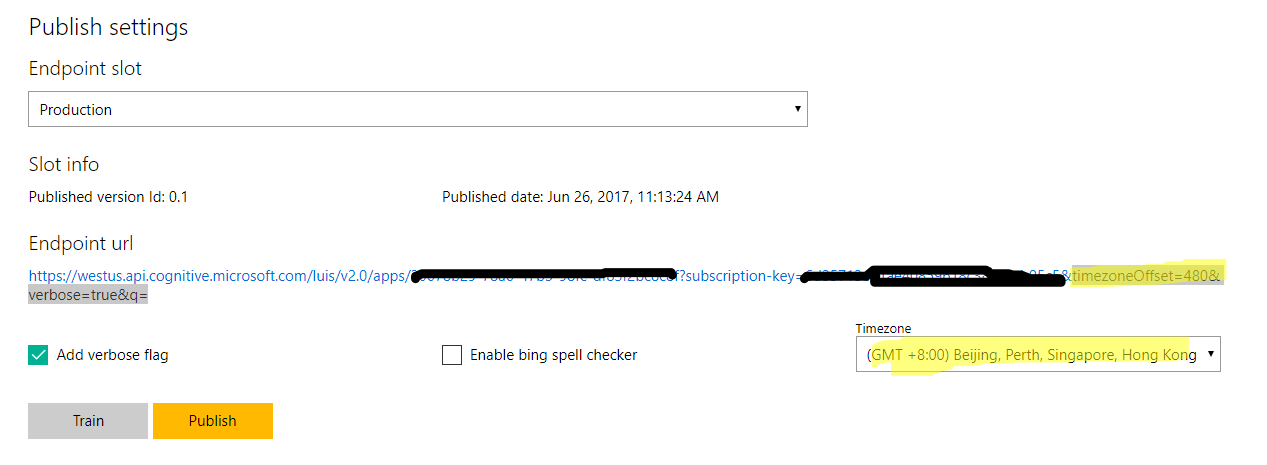
* FormFlow or LuisDialog

Bot Framework provide many ways to collect information from users. Most people may choose to use LUIS(Language Understanding Intelligence Service). Some may choose FormFlow, or mix of botth.

Considering of above conversation flow, we use LUIS in MainDialog, and use prompt dialog to collect additional information

* Bot Dialog Control
  + In Bot Framework, you an use IDialogContext::Forword() to “forward” user’s input to next dialog box. Or, sometimes you use IDialogContext::Call() to “invoke” another dialog to handle conversation with users
    - Forware, as the name suggests, “forward” user’s input to next dialog box. The dialog box receives whatever user said in it’s MessageReceived() method.
    - Call, on the other hands, does not receives user’s input. It waits until user says something else.
  + A dialog box call invoke next dialog, the later dialog can invoke another dialog. This forms a Dialog stack. It is important to manage dialog stack. Do invoke IDialogContext::Done() to complete current dialog box when you’ve done conversation with the user. When necessary, invoke IDialogContest::Reset() to reset all dialog stack.
* Authentication/Authorization
  + In this sample, we integrated with Azure AD. If your company has Office 365 and has implemented hybrid integration, then you can still use the same way to authenticate users against Azure AD.
    - In this sample, we use AuthBot that is developed by Microsoft TED team to help us simplified Azure AD authentication: <https://github.com/MicrosoftDX/AuthBot>
* Timezones
  + Users use their preferred IM app to communicate with our chatbot such as Skype, Slack…etc – which, in most case, are set to local timezone. When a user says “book a room tomorrow at 10 am”. The chatbot must be able to handle what “tomorrow” means correctly.
  + LUIS
    - Azure timezone defaults to UTC. LUIS as well. In LUIS, you can specify your preferred timezone in REST API URL while invoking LUIS API.

[https://westus.api.cognitive.microsoft.com/luis/v2.0/apps/{model-id}?subscription-key={subscription-key}&timezoneOffset=480&verbose=true&q=book%20a%20room%20tomorrow%2010%20am](https://westus.api.cognitive.microsoft.com/luis/v2.0/apps/%7bmodel-id%7d?subscription-key=%7bsubscription-key%7d&timezoneOffset=480&verbose=true&q=book%20a%20room%20tomorrow%2010%20am)



* + - If in Bot Framework you did not invoke LUIS API directly but uses LuisDialog, you can override ModifyLuisRequest to add additional query parameters to final URL.

protected override LuisRequest ModifyLuisRequest(LuisRequest request)

{

request.ExtraParameters =

"timezoneOffset=" +

this.TimezoneOffset?.TotalMinutes.ToString();

return request;

}

* + Bot Builder SDK
    - Bot Builder SDK 3.8.2 added a new property in Activity class called “localtimestamp”. When your app supports, this property has the local time in user’s device. However, not all app supports this property, you may still need some way to collect time zone information from users.
      * One way is to request geo-location from client devices then convert to time zone.
      * The other way can be ask users to provide time zone information.
    - In this sample, considering of cross-timezoen users. We leave LUIS timezone setting as UTC. We will check if localtimezone has value, if so we use localtimezone as user’s local timezone. Otherwise we read timezone from web.config
* Conversation Logs
  + We implement IActivityLog interface to log conversation history. General speaking we group each conversation by conversationId property. In some client App, the conversationId wouldn’t change.
* User cancel/terminate conversation
  + Image that while booking a meeting room, user may somehow change his mind and want to abort current conversation, or jump to another topic. We need a mechanism to allow users to “abort” from current conversation.

In Bot Framework, we implement IScorable interface and register global message handler to archive this.

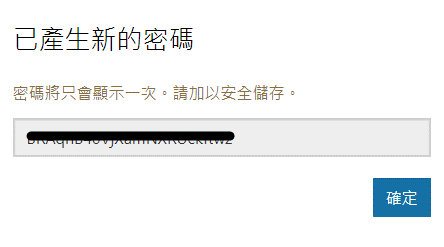
* System monitoring
  + Bot itself is just a REST API, we can leverage Application Insights to collect general activity logs. We can also implement our own custom matric and events to collect required information.

Once those information sent into Application insights, we can connect them to PowerBi to create our dashboard.

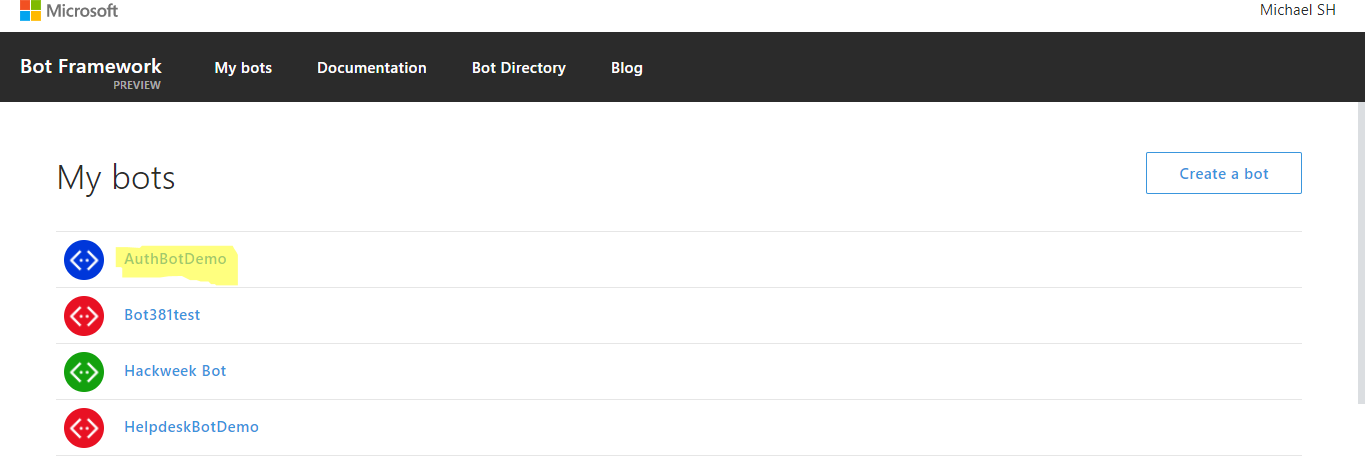
## Implementation

### Create and register Bot

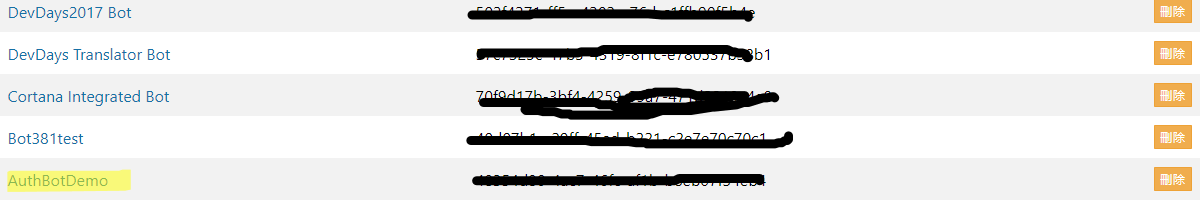
* login to <https://dev.botframework.com> with your Microsoft account (outlook.com, msn.com…etc)
* Create and register Bot
  + In test and developmet phase, you can set Bot API url to <https://localhost:3990/api/messages>
  + When deployed your bot to Azure, you must change the url to https://{your FQDN}/api/messages
* The registration process creates an app in App portal. Please record the App password, it only be shown once.



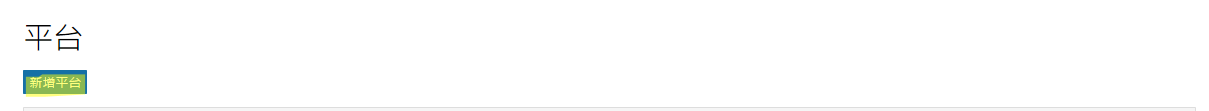
* You should see your bot listed after creation



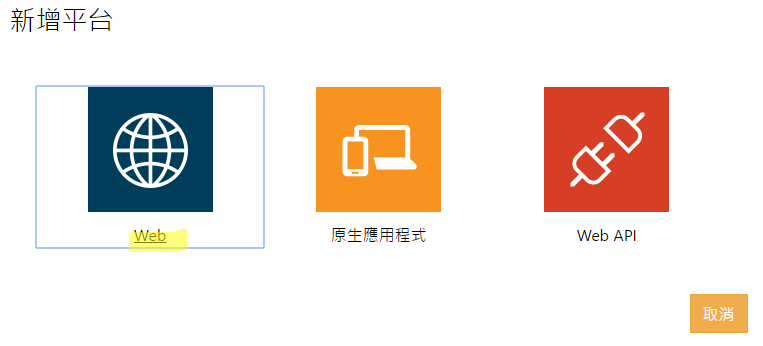
* Now, login to <https://apps.dev.microsoft.com/#/appList> with your MSA account
* Find the newly registered Bot，ex, AuthBotDemo



* Click on AuthBotDemo，and enter the configuration page，add a new platform



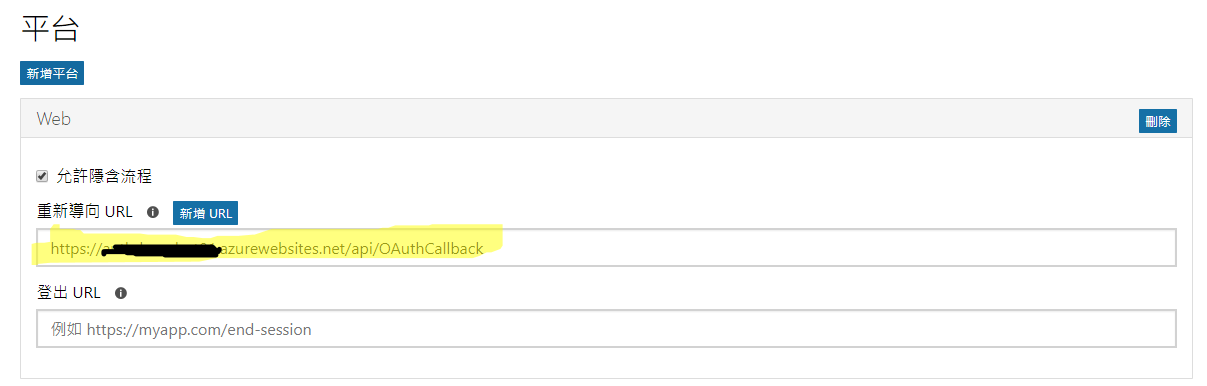
* Add new Web platform



* Set Redirect URL to <https://www.bing.com/agents/auth>



* If you want to use Cortana and other channels at same time, set redirect url to Bot’s OAuthCallback URL



* If our meeting room is integrated with Office 365, we can use Microsoft Graph API to search available rooms and book rooms. In that case, we need to request delegate permission as below.



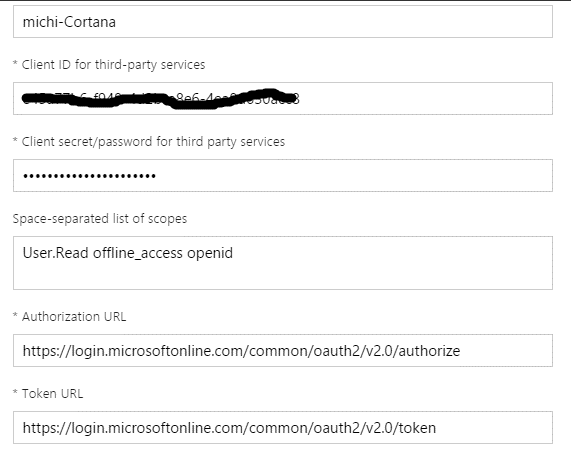
* Save settings

### Cortana Channel Settings

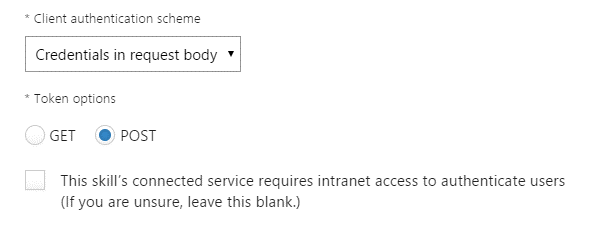
* Login to <https://dev.botframework.com> with your MSA account
* Enable Cortana Channel
* Client ID and Client Secret are App Id and Password you generated in above steps.

Authorization Url and Token Url as below

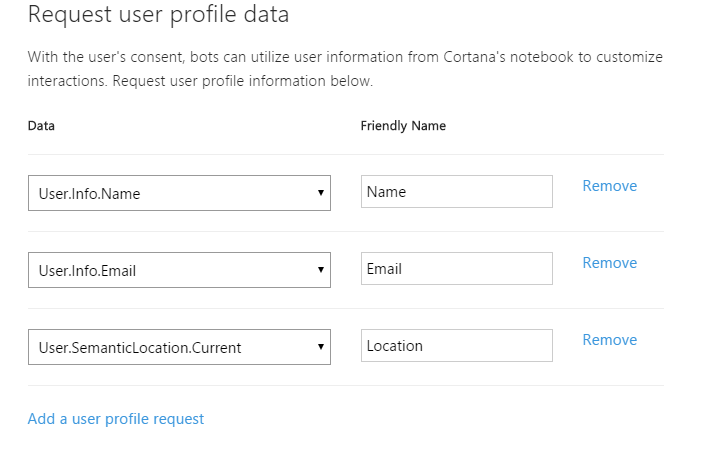
* + Configure scope as：User.Read offline\_access openid。



* Configure Credentia as below



* Request user profile data



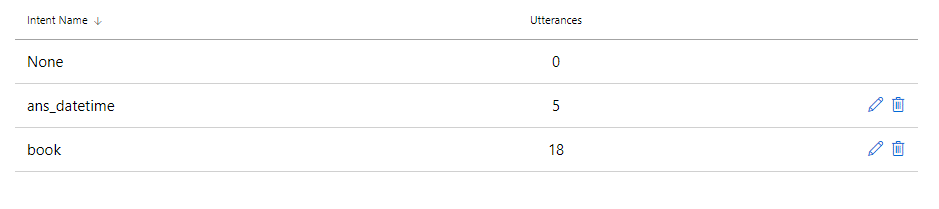
* Save

### LUIS model design

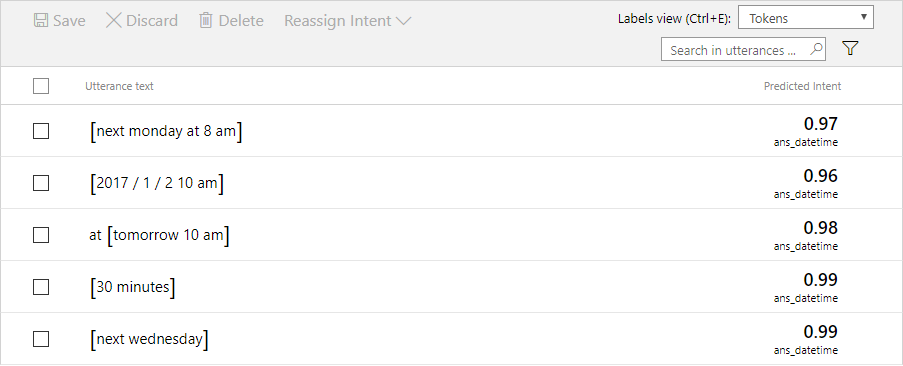
* We use LUIS to identify user’s intents and entities. Beside meeting room information, in order to better identify time and date, we use built-in LUIS datetimeV2 entity to help us understand user’s utterance. Here we create two intents – book and ans\_datetime.
  + Book: meeting room booking intent
  + Ans\_datetime: used in customize prompt dialog for users to input date time such as tomorrow, next Monday…etc
* Create below entities in LUIS
  + datetimeV2 is the meeting date and time
  + roomid is the room id, if we have a meeting room id list, we can configure it as a “list” entity and manually inputs all room ids.
  + Size is the number of attendees of this meeting.



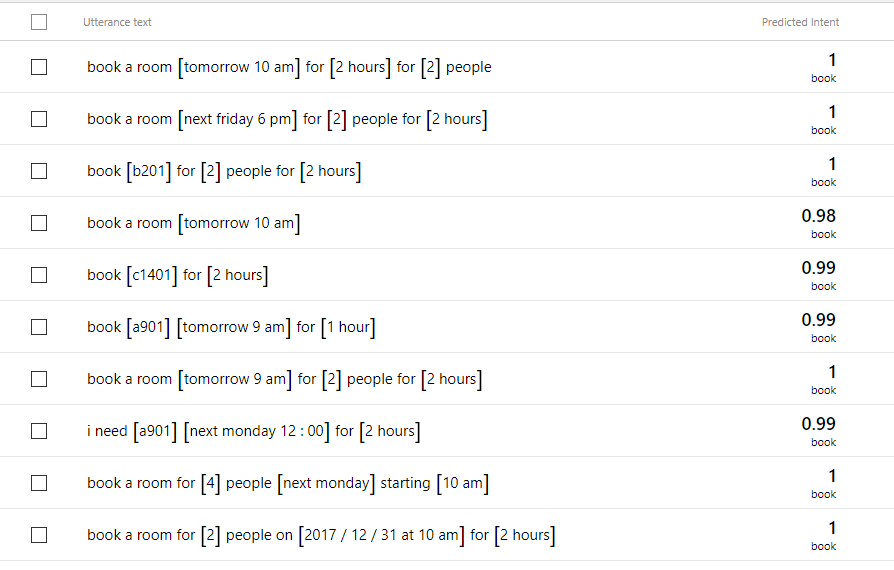
* Intent



* + ans\_date



* + Book

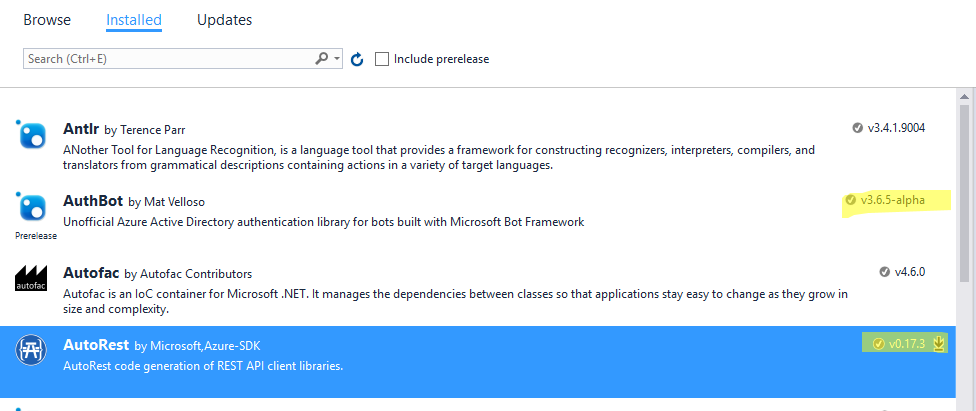


### Implement Bot Application Authentication mechanism

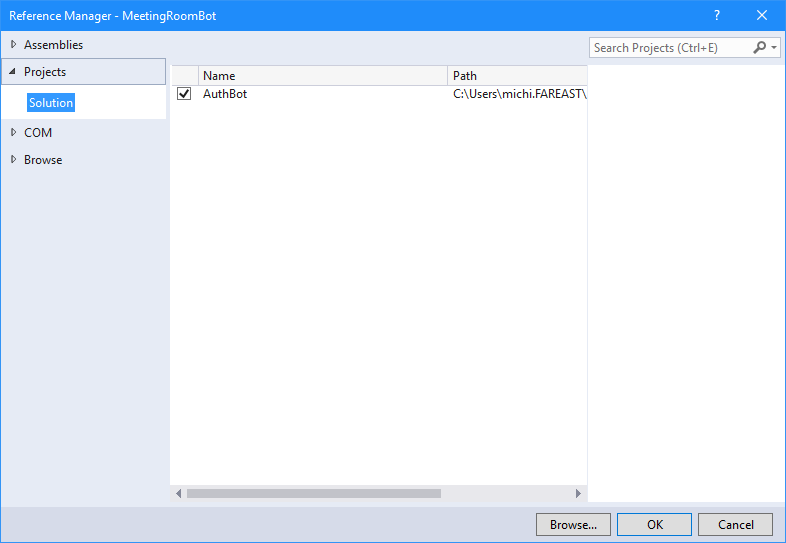
Source Code：<https://github.com/michael-chi/meetingroombotdemo>

Below we only explain some important parts of the codes.

* To add AuthBot to our project
  + Open Meeting Room Bot project, add Autorest NUGET package
  + In Meeting Room Bot project, add Authbot NUGET package



* + Cortana channel can use Connected Service to authenticate users. When using connected service, every messages sent from Cortana app to Bot contains an JWT token in“AuthenticationToken” entity in its message body. By parsing the token we have user’s credential and information.
  + Download and add AuthBot project to Meeting Room Bot solution, then remove AuthBot’s assembly reference from Meeting Room Bot projet.
  + Then add Authbot project as a reference in Meeting Room Bot project.



* We need to check if use has logged in when he send messages to our bot. we do this by checking a flag in BotState. AuthBot automatically does this for us. However, Authbot does not support Cortana’s connected service AutenticationToken yet. So we will need to add some codes to it.
* Open ContextExtension.cs in Authbot project, add a new method GetCortanaAccessToken()

private static string GetCortanaAccessToken(IBotContext context)

{

string token = string.Empty;

Activity activity = context.Activity as Activity;

if (activity.ChannelId.Equals("cortana",

StringComparison.InvariantCultureIgnoreCase))

{

var msg = activity as IMessageActivity;

{

var tokenEntity = msg.AsMessageActivity().Entities.Where(e => e.Type.Equals("AuthorizationToken")).SingleOrDefault();

if (tokenEntity == null)

{

//Debug mode

token = string.Empty;

}

else

{

token = tokenEntity?.Properties.Value<string>("token");

}

}

}

else

{

token = string.Empty;

}

return token;

}

* Modify existing GetAccessToken() method, add Cortana channel checks

if (context.Activity.ChannelId.Equals("cortana",

StringComparison.InvariantCultureIgnoreCase))

{

string token = null;

if (context.UserData.TryGetValue(ContextConstants.AuthResultKey,

out authResult))

{

//we have credential

}

else

{

token = GetCortanaAccessToken(context);

var jwt = new JwtSecurityToken(token);

authResult.AccessToken = token;

long tick = long.MinValue;

long.TryParse(jwt.Payload.Claims.Where(

c => c.Type.Equals("exp",

StringComparison.InvariantCultureIgnoreCase))

.SingleOrDefault()?.Value, out tick);

authResult.ExpiresOnUtcTicks = tick;

InMemoryTokenCacheMSAL tokenCache =

new InMemoryTokenCacheMSAL(Encoding.ASCII.GetBytes(token));

authResult.TokenCache = tokenCache.Serialize();

context.StoreAuthResult(authResult);

}

return authResult.AccessToken;

}

* When user is on other channels like Skype or Slack, we will use Authbot to handle user login. Once user successfully logged in. Azure AD will callback to the registered URL (https://{your FQDN}/api/OAuthcallback}. In this handler, Authbot extracts user information and store in BotState.
* In Visual Studio, open Meeting Room Bot project and open settings.config, you’ll see below settings.

<appSettings>

<!-- update these with your BotId, Microsoft App Id and your Microsoft App Password-->

<add key="BotId" value="YourBotId" />

<add key="MicrosoftAppId" value="{your app id}" />

<add key="MicrosoftAppPassword" value="your password" />

<add key="StorageName" value="storage account"/>

<add key="StorageKey" value="storage key"/>

<add key="MeetingRoomApiUrl" value="meeting api url"/>

<add key="LuisModel" value="luis model id"/>

<add key="LuisKey" value="luis key"/>

<add key="ActiveDirectory.Mode" value="v2" />

<add key="ActiveDirectory.Scopes" value="User.Read Calendars.Read Calendars.Read.Shared Calendars.ReadWrite Calendars.ReadWrite.Shared" />

<add key="ActiveDirectory.EndpointUrl" value="https://login.microsoftonline.com" />

<add key="ActiveDirectory.Tenant" value="common" />

<add key="ActiveDirectory.ClientId" value="{your app id}" />

<add key="ActiveDirectory.ClientSecret" value=" your password " />

<add key="ActiveDirectory.RedirectUrl" value="https://localhost:3990/api/OAuthCallback" />

</appSettings>

* + Here you need to change MicrosoftAppId and ActiveDirectory.ClientId to the newly registered Bot Id
  + Change MicrosoftAppPassword and ActiveDirectory.ClientSecret to the password you generated in registration process
  + ActiveDirectory.RedurectUrl Is the call back url that Azure AD invokdes after user successfully login to Azure AD; you can use a local url such as <https://localhost:3990/api/OAuthCallback>during test and development phase. Once deployed to the cloud, you need to change this configuration to cloud url
  + Change LuisModel and LuisKey to newly created Luis App id and App key
  + Change Storage Account and Storage Key. We will store ics file in the storage for users to download.
  + You can leave other configuration settings as is.
* Add below codes to Global.aspx.cs so that Authbot reads configuration settgins from settigns.config

AuthBot.Models.AuthSettings.Mode = ConfigurationManager.AppSettings["ActiveDirectory.Mode"];

AuthBot.Models.AuthSettings.EndpointUrl = ConfigurationManager.AppSettings["ActiveDirectory.EndpointUrl"];

AuthBot.Models.AuthSettings.Tenant = ConfigurationManager.AppSettings["ActiveDirectory.Tenant"];

AuthBot.Models.AuthSettings.RedirectUrl = ConfigurationManager.AppSettings["ActiveDirectory.RedirectUrl"];

AuthBot.Models.AuthSettings.ClientId = ConfigurationManager.AppSettings["ActiveDirectory.ClientId"];

AuthBot.Models.AuthSettings.ClientSecret = ConfigurationManager.AppSettings["ActiveDirectory.ClientSecret"];

AuthBot.Models.AuthSettings.Scopes = ConfigurationManager.AppSettings["ActiveDirectory.Scopes"].Split(' ');

### Handle Cortana channel’s user info

* In Cortana channel, we can request Cortana to send user’s geo-location to Bot. This information is stored in an UserInfo entity and will be sent to the Bot in every messages

{

"type": "UserInfo",

"Name": {

"GivenName": "GivenName",

"FamilyName": "FamileName"

},

"Email": "xxxx@msn.com",

"Location": {

"StartTime": "2017-06-18T05:37:05Z",

"EndTime": "2017-06-18T13:51:57Z",

"Hub": {

"Id": "xxxx-xxxx-4404-9652-77b4e95a2ac3",

"Type": "Home",

"Name": "home",

"Latitude": 225.0225,

"Longitude": 221.0221,

"Address": "Some Addresses"

},

"VenueName": "",

"Away": false

}

},

### Conversation log and User abort

* In Global.aspx.cs, we register ActiveLog and Global Message Handler with the following codes

var builder = new ContainerBuilder(); builder.RegisterType<CancelScorable>().AsImplementedInterfaces().InstancePerLifetimeScope(); builder.RegisterType<ActivityLogger>().AsImplementedInterfaces().InstancePerDependency();

builder.Update(Conversation.Container);

* We implement ActivityLogger.cs to log conversations. In this sample we send conversation to Application Insights via its SDK

public async Task LogAsync(IActivity activity)

{

if (activity.ChannelData != default(dynamic))

{

Trace.TraceInformation("[Channel Data]" + JsonConvert.SerializeObject(activity).Replace(Environment.NewLine, ""));

}

try

{

var tokenEntity = activity.AsMessageActivity().Entities.Where(e => e.Type.Equals("AuthorizationToken")).SingleOrDefault();

var token = tokenEntity?.Properties?.Value<string>("token");

if (token != null)

{

var jwt = new JwtSecurityToken(token);

var log = string.Join(" | ", jwt.Payload.Claims.ToArray().Select(c => c.Type + ":" + c.Value).ToArray());

Trace.TraceInformation("[Token]" + log);

}

}

catch(Exception exp)

{

Trace.TraceError($"[Exception]{exp.ToString()}");

}

* Also we implement CancelScorable.cs to handle user cancel by detecting the keyword “cancel”

protected override async Task<string> PrepareAsync(IActivity item, CancellationToken token)

{

var message = item as IMessageActivity;

if (message != null && !string.IsNullOrWhiteSpace(message.Text))

{

if (message.Text.Trim().Equals("cancel", StringComparison.InvariantCultureIgnoreCase))

{

return "cancel";

}

}

return null;

}

### Detecting missing information

* In MainDialog.cs, we created a field “RequiredParameters” to track required information field names.

public readonly string[] RequiredParameters = new string[]

{

"size","startDate","startTime","duration"

};

* In book intent handler, we check provided information via LUIS. In our case, if use provided roomId, then size is not required

var duration = TryFindEntity(result, "builtin.datetimeV2.duration",

"duration")?.SingleOrDefault();

var startDateTime = TryFindEntity(result, "builtin.datetimeV2.datetime",

"datetime")?.ToArray().FirstOrDefault();

var startDate = TryFindEntity(result, "builtin.datetimeV2.date",

"date")?.ToArray().FirstOrDefault();

var startTime = TryFindEntity(result, "builtin.datetimeV2.time",

"time")?.ToArray().FirstOrDefault();

var roomId = TryFindEntity(result, "roomid")?.SingleOrDefault();

var size = TryFindEntity(result, "size")?.SingleOrDefault();

bool requireMoreInfo = false;

requireMoreInfo = (startDateTime == null && startTime == null) ||

(size == null && roomId == null) ||

(duration == null);

* Then we collect additional information required, and send required information to DetailDialog by calling IDialogContext::Forward()

await context.Forward<object>(new DetailInfoDialog()

{

RequiredInformation = queue,

StartDate = startDate?.ToDateTime(TimezoneOffset),

StartTime = startTime == null ?

startDateTime?.ToDateTime(TimezoneOffset) :

startTime?.ToDateTime(TimezoneOffset),

Duration = duration?.ToTimeSpan(),

Size = size?.ToInt64(),

RoomId = roomId?.Entity,

Offset = TimezoneOffset

},

ResumedFromDetailForm,

(Microsoft.Bot.Connector.Activity)context.Activity);

* Once we have all information, we forward information to ConfirmDialog

private async Task Book(IDialogContext context, DetailInfoDialog detail)

{

var confirmDialog = new BookingConfirmDialog(

new MeetingRoomSuggestionConstrain

{

Attendees = new List<string> { Requestor },

Location = detail.RoomId,

Start = detail.StartTime.Value.DateTime,

End =

detail.StartTime.Value.DateTime

.AddMinutes(detail.Duration.Value.TotalMinutes),

Size = (int)(detail.Size.HasValue ? detail.Size.Value : 0),

MeetingOrganizer = Requestor,

MeetingRoomIds = string.IsNullOrEmpty(detail.RoomId) ? null :   
new string[] { detail.RoomId },

LocationDisplayNames = null,

TimezoneOffset = TimezoneOffset

});

await context.Forward<object>(confirmDialog,

ResumedFromConfirmationDialog,

context.Activity.AsMessageActivity());

}

* Here we use Forward instead of Call because we want to DetailDialog to handle user’s input immediately without waiting for another user input.
* Once we collected all required information in DetailDialog, we pass all information back to its caller - MainDialog

if (StartDate.HasValue && StartTime.HasValue)

{

StartTime = new DateTimeOffset(StartDate.Value.Year,

StartDate.Value.Month,

StartDate.Value.Day,

StartTime.Value.Hour,

StartTime.Value.Minute,

StartTime.Value.Second,

StartTime.Value.Offset);

}

ctx.Done<object>(this);

* If we are collecting date and time, we use PromptDialog to collect those information. We implemented our own TimeRelatedPromptDialog to help us collect those information. This dialog will invoke LUIS and check ans\_datetime intent to get date and time

TimeRelatedPromptDialog.cs

LuisService luis = new LuisService(new LuisModelAttribute(

modelID: ConfigurationManager.AppSettings["LuisModel"],

subscriptionKey: ConfigurationManager.AppSettings["LuisKey"],

apiVersion: LuisApiVersion.V2

));

* override TryParse() to check if it is valid date/time

protected override bool TryParse(IMessageActivity message, out string result)

{

result = ((Activity)message).Text;

T item = Task.Run(() => GetResultDate(((Activity)message).Text)).Result;

bool hasResult = false;

if (EqualityComparer<T>.Default.Equals(item, default(T)))

{

result = null;

hasResult = false;

}

else

{

Result = item;

OnCompleted?.Invoke(Result);

hasResult = true;

}

return hasResult;

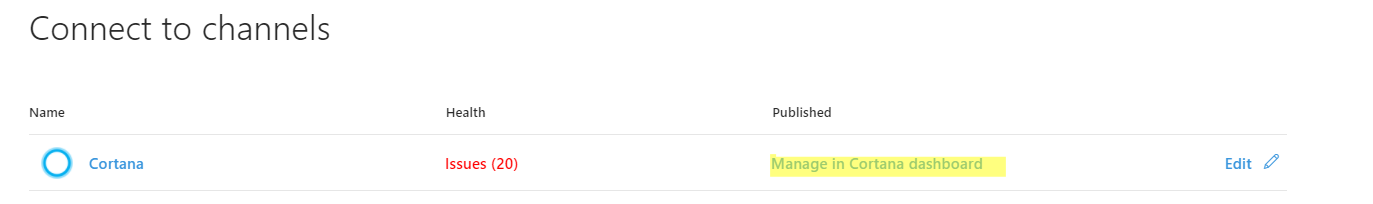
}

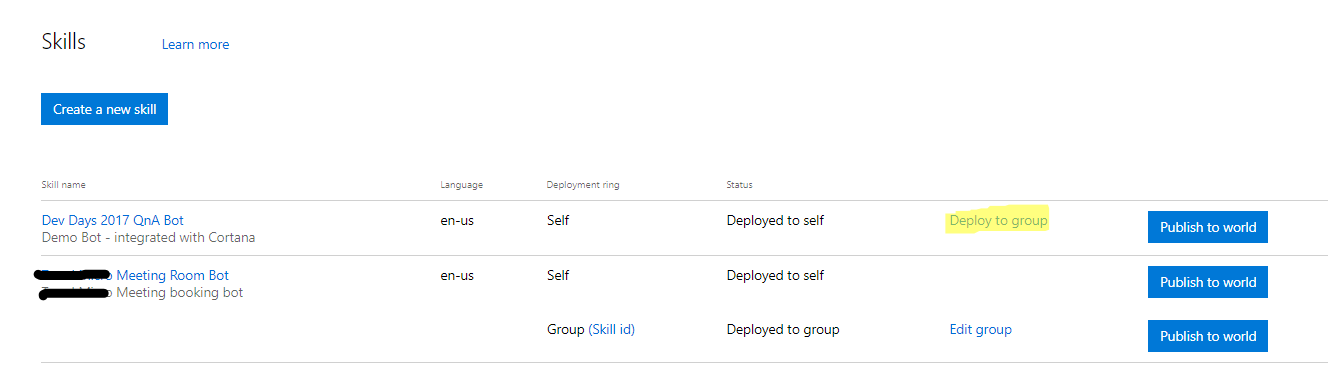
* Finally, when we booked a room. The bot generates an vCalendar file for user to download. And summarize meeting info to the user via a HeroCard.

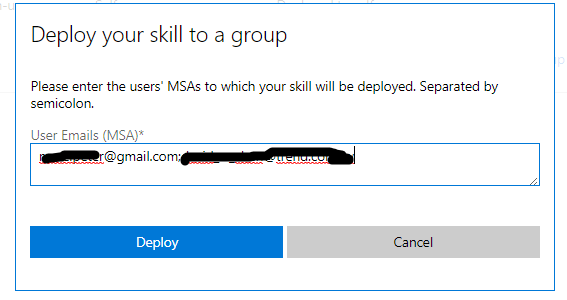
## **Deploy**

### Cortana Channel

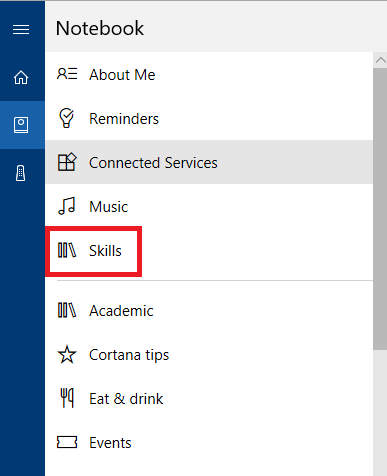
* In testing phase, you publish Cortana Skill to users through Cortana Management Dashboard

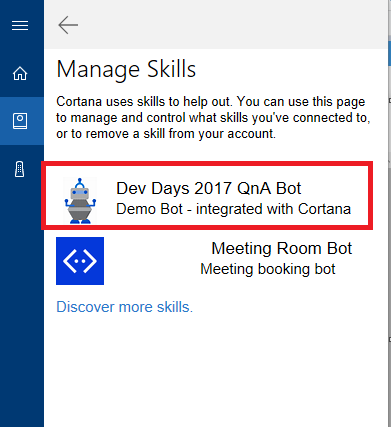






* Selected user will receive an invitation, once user click the link included in the invitation, Cortana skill should be deployed and associated with his MSA
* User can check Cortana Skill in Cortana -> Notebook -> Skills

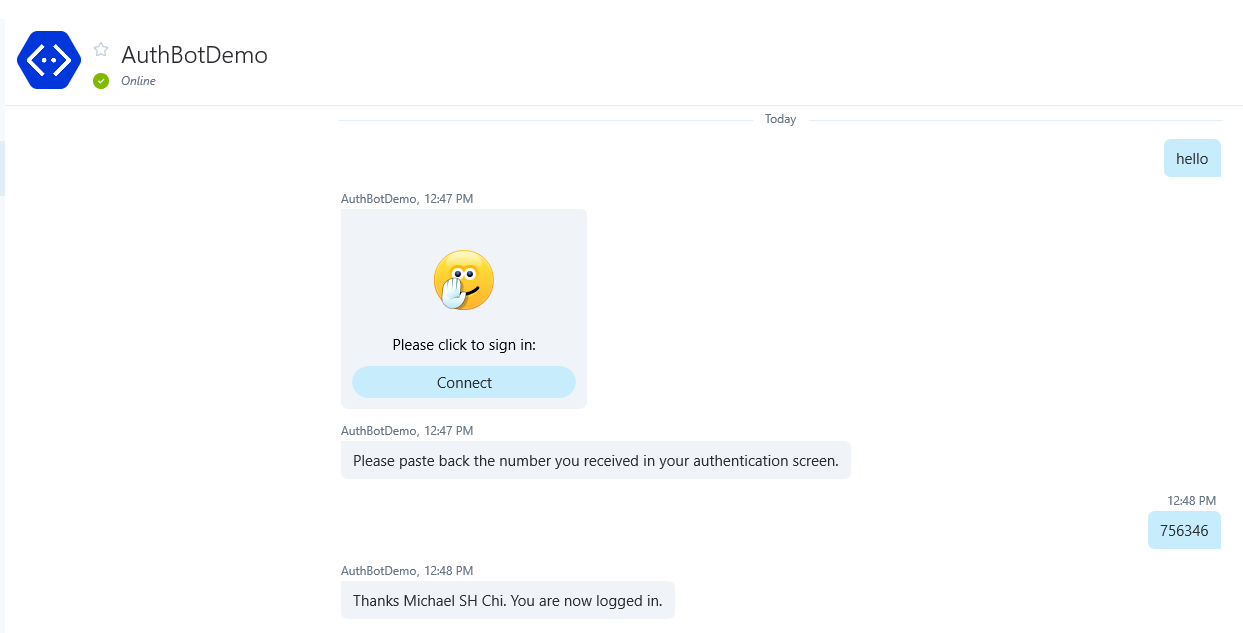


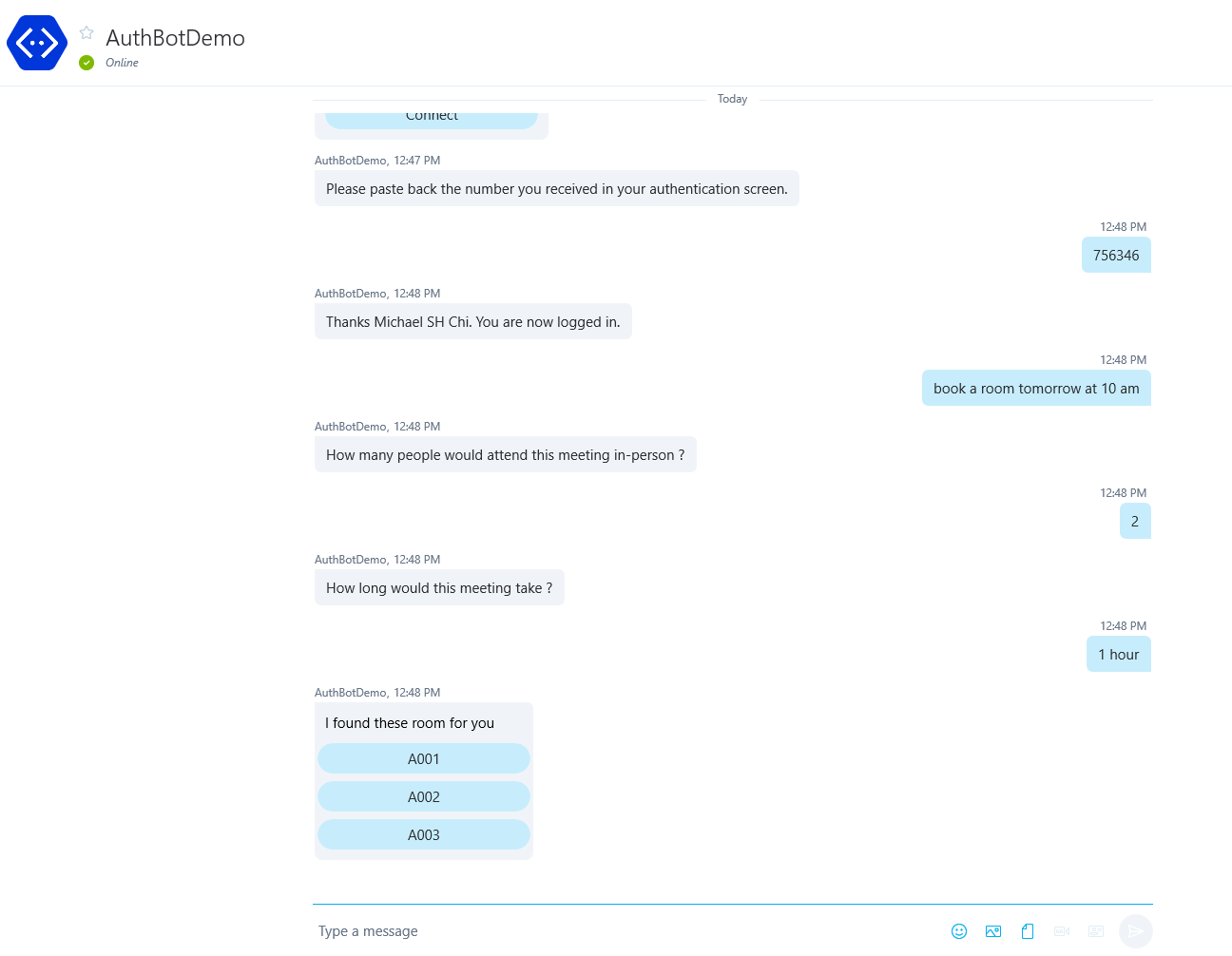


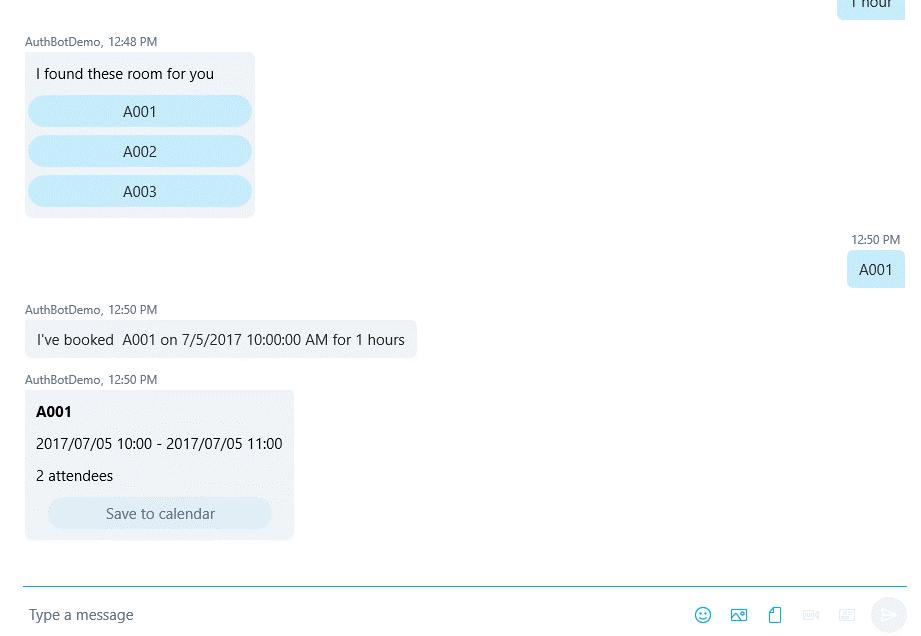
* Once you deploy the Cortana Skill world-wide, everyone can searchyou’re your skill at <https://www.microsoft.com/en-us/windows/cortana/cortana-skills/>

### **Bot in Action**

### **Skype Channel**







## **Cortana Skill**

* Wake up Cortana，And say “tell Meeting Room Hi”，or “Ask Meeting Room book a room tomorrow” to connect to Cortana Skill
* Cortana will require you to login if this is the first time you use the skill. Input your Azure AD credential to login

