# ChitChat Bot with Watson Assistant and IBM Functions

# HandsOn Lab


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# 1 Introduction

## *1.1 Lab Overview*

This Lab will give you an introduction on how a ChitChat Bot using **IBM Watson Assistant** (formerly Conversation Service), **IBM Functions** (OpenWhisk implementation of IBM) and a **REACT Javascript Application** can be build.

At first, you will deploy a Watson Assistant Service and build a basic conversation dialog. In the appendix you can additionally find out how the **Watson Discovery service** can be integrated which provides data collected document of a specific topic that extend the 'standard dialog' capabilities.

To invoke the Watson services, you will implement IBM Cloud Functions which are connected to an OpenWhisk Sequence.

A small React Application will build the user interface to interact with the user.

Moreover, a skeleton of training data for the Conversation and the Discovery Service will be provided also for the IBM Cloud Functions and React application. However, the skeleton can be extended so that you can build your own ChitChat flavour.

After the lap you will have a basic understanding of:

- The IBM Watson Assistant service and how training data is used to build a conversation dialog
- How to build IBM Functions actions and invoke Watson Services
- How to interact with a REACT User Frontend application based on JavaScript.

Advanced developer can extend the ChitChat e.g. to implement multilanguage support.

## 1.2 The Architectural overview Diagram of the Lap Application

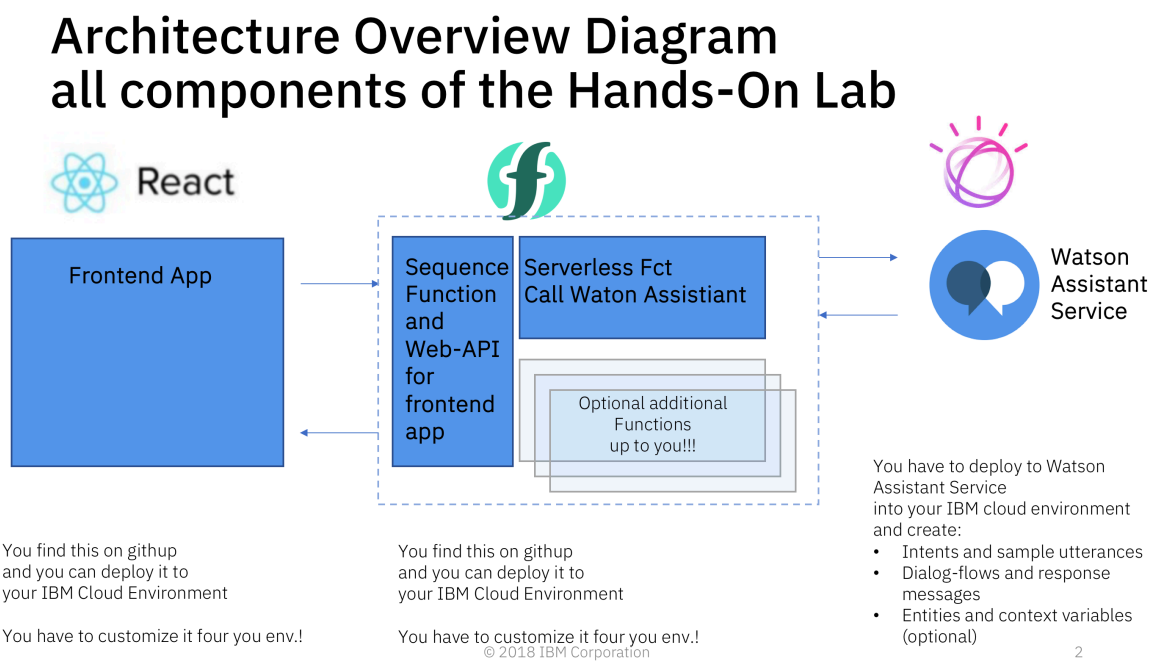



***Figure 1 Architecture Overview Diagram – All components of the Hands-On Lab***

The goal of this lab is to build an end-to-end application which can interact with the Watson Assistant Service
to get a basic understanding of a Chat-Bot Application and a user dialog with 'AI based service'.

Implementing all parts mentioned above will not be possible in the time available for this lab.

- Therefore, we recommend starting with the **Watson Assistant Service** which you can use to build a basic dialog. How to launch the tool and get started is described in the following chapter. After completing this part, you will have a basic understanding for the Watson Assistant Service and you can test different user dialogs directly in the Launch Tool environment.
  *For details see Chapter 2*

- To move forward we want to build an 'end-to-end' application for which you need an interface program to interact with the Watson Assistant passing questions from an end-user to the service and handling the return information of the service. This can be done by implementing a 'Serverless function'. In this lab we use **IBM Functions** (also part of IBM cloud) to interact with the Watson service.
  A sample function is available on Github which you can use to interact with your Watson Assistant Service from step one.
  *For details see Chapter 3*

- To enrich the two parts *'Watson Assistant Service – handling questions and responses'* and *'IBM Serverless Function to interact with the Watson Service'* you can use a front-end application based on NodeJS, JavaScript and **REACT** which is also available on Github.
  *For details see Chapter 4*

# 2 Let's start with the Watson Assistant Service

## 2.1 Watson Assistant Service Basics for this Session

The following diagram shows the overall architecture of a complete solution:

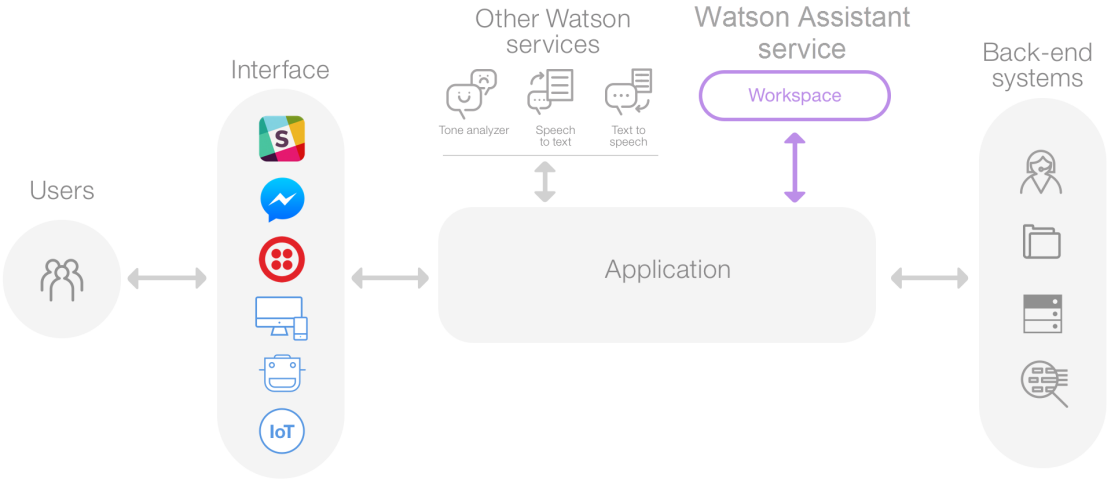
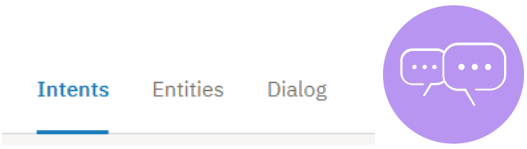



*Figure 2 Create a Service Instance of Watson Assistant on IBM Cloud*

https://console.bluemix.net/docs/services/conversation/index.html#about

Watson Assistant is an IBM Cloud service and consists of different workspaces. Each workspace consists of **intents**, **entities** and a **dialog**.




**Intents** are purposes or goals expressed in a customer's input, such as answering a question or processing a bill payment. By recognizing the intent expressed in a customer's input, the Conversation service can choose the correct dialog flow for responding to it. Intents are marked with a #.

**Entities** represent a class of object or a data type that is relevant to a user's purpose. By recognizing the entities that are mentioned in the user's input, the Conversation service can choose the specific actions to take to fulfil an intent. Entities are marked with a @.

**The dialog** uses the intents and entities that are identified in the user's input, plus context from the application, to interact with the user and ultimately provide a useful response.

The dialog flow is represented graphically in the tool as a tree. You can add a branch to process each of the intents that you want the service to handle. You can then add branch nodes that handle the many possible permutations of a request based on other factors, such as the entities found in the user input or information that is passed to the service from your application or another external service.

## 2.2 *The Watson Assistant Service for this Scenario*

To work with Watson Assistant Service, you need to prepare your data. After that you can define intents, sample utterances, and entities. You can then build a dialog and test your conversation service with the “Try Out” function.

### 2.2.1 How to prepare your Watson Assistant Service

**Step 1:** Create an account on IBM Cloud.
Sign-up for free: https://console.eu-gb.bluemix.net/registration/?target=%2Fdeveloper%2Fwatson%2Fdashboard
You'll receive an email to confirm and activate your account.

**Step 2:** After you activate your account and log in, click Watson Services from the Watson console.

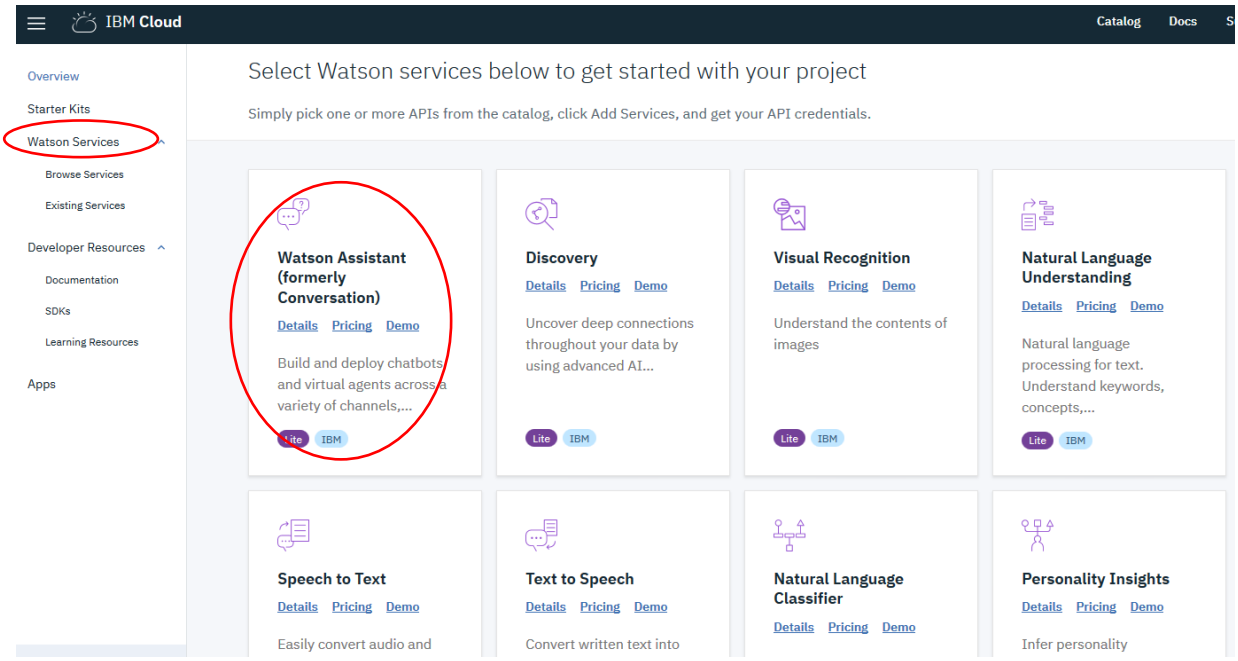



***Figure 3 Create a Service Instance of Watson Assistant on IBM Cloud***

**Step 3:** Create an instance of the Watson Assistant Service.

**Step 4:** Launch tool in the new created service in the Cloud Dashboard.

**Step 5:** Now you can get stated and create a workspace

**Step 6:** Import workspace:
Download from GitHub **'watson-assistant-workspace-starter.json'** to your local file system and import it in Cloud

Use GitHub link:
https://github.com/HartmutSeitter/hs-rewire-ind-bus-chatbot/tree/master/assistant-ws

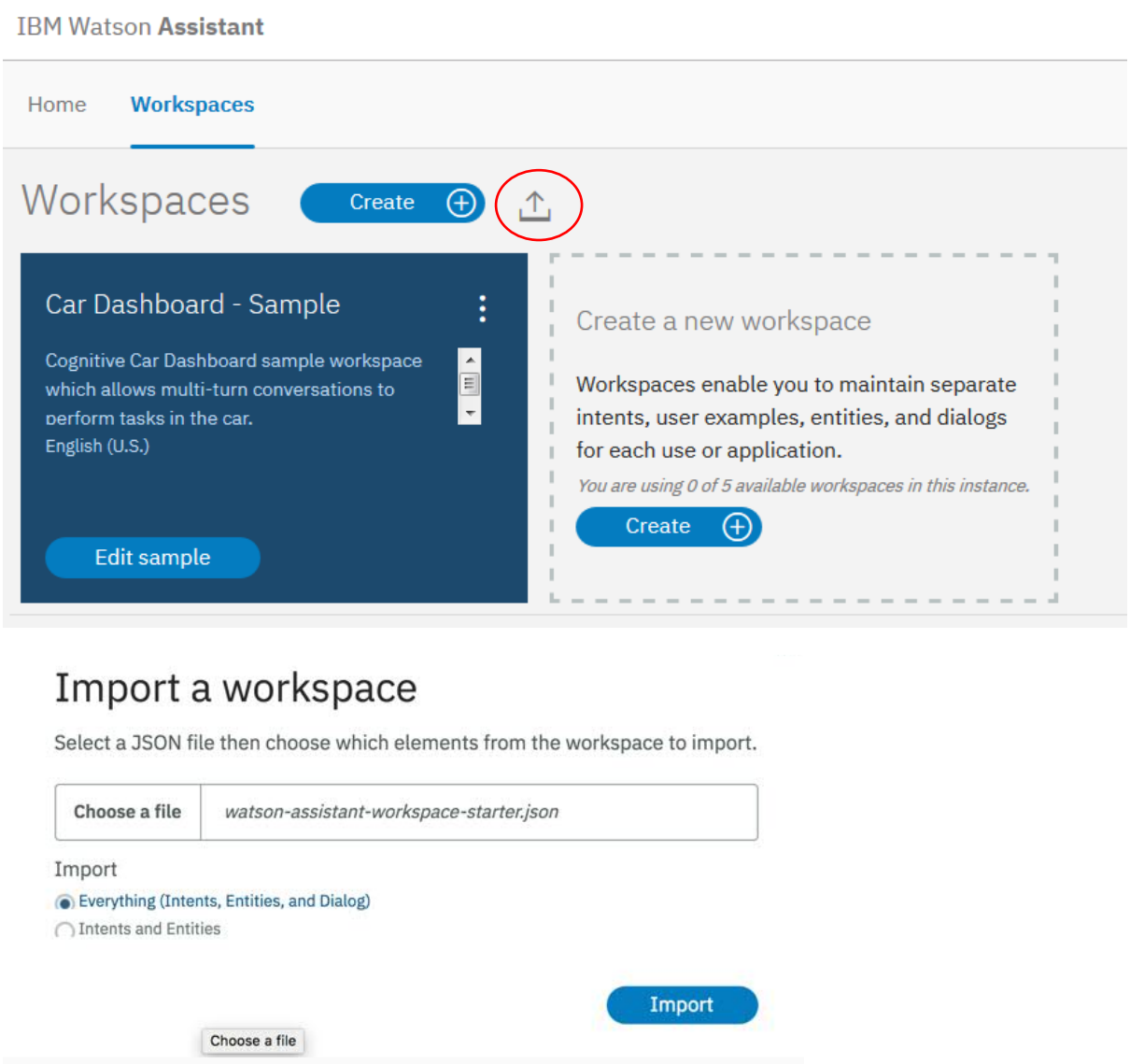



***Figure 4 Import workspace on IBM Cloud for Watson Assistance***

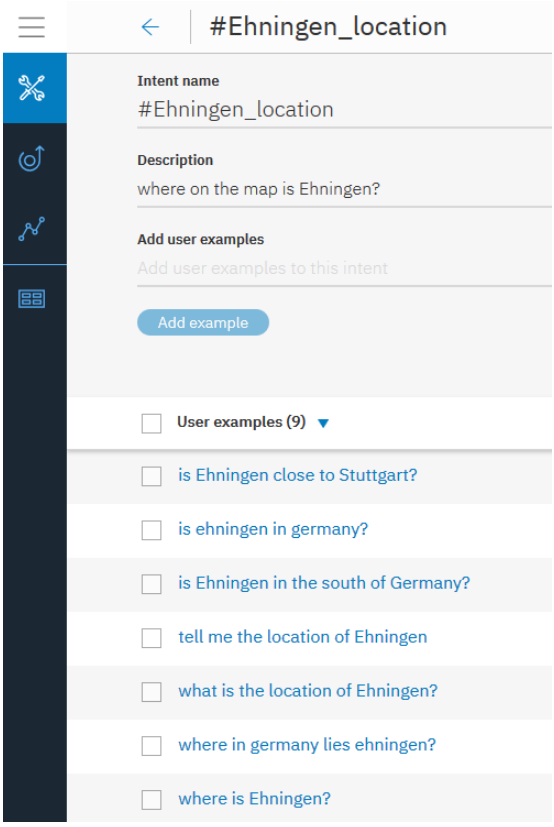
**Step 7:** Now you are ready to extent the workspace by your own intents, utterances and dialog.

### 2.2.2 Define Intents and Utterances

Determine what your virtual assistant will understand by providing training examples, so Watson can learn.

Define one intent for each goal that can be identified in a user's input such as #greetings and #goodby. For this lab we ask you to prepare three examples:

**First example: #Ehningen_location**



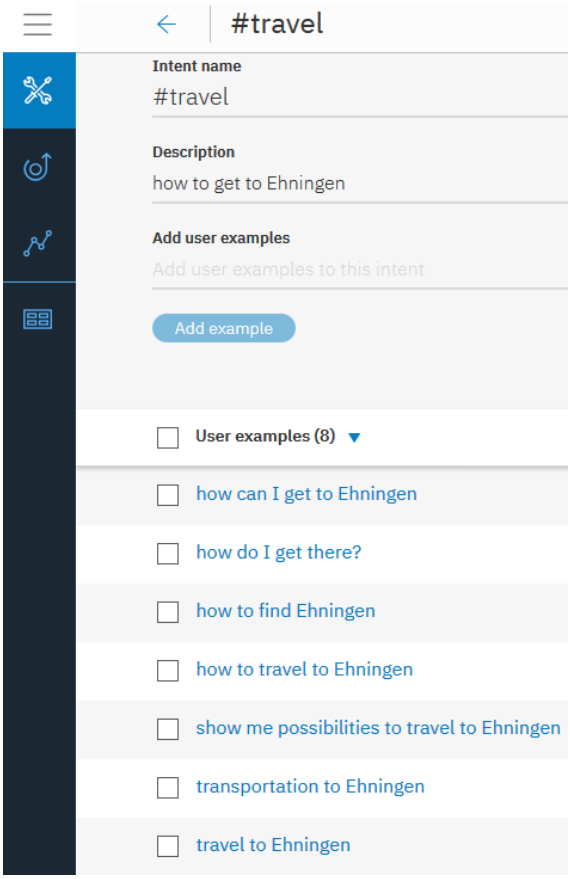

You might define an intent named: **'Ehningen_location'** that answers questions about where Ehningen is located.

For each intent, you add sample utterances that reflect the input customers might use to ask for the information they need, such as, **"Where on a map is Ehningen?"**.

***Figure 5 Define intent: First example***

The more user examples that are implemented, the better the response rate of the Conversation Service. It can be helpful to ask different people for their description of a topic and also dialects can be considered.

**Second example: #travel_to_Ehningen**




You now might define an intent named: **'travel_to_Ehningen'** that answers questions about how to travel to Ehningen.

Add user examples, such as, **"How can I get to Ehningen?"**.

In addition, add intents for three different options: #**car, #train, and #airplane**.

Again, add multiple user exemples, such as, **"I want to travel by car"** etc.

***Figure 6 Define intent: Second example***

### Third example: #yourownintent

Now you can get creative and create your own intent! Use as much user examples as you like.

### 2.2.3 Define Entities (optional)

Whereas intents point to a specific dialog flow, entities trigger the action or answer in the flow themselves.

Since there are many terms and descriptions that share the same meaning, synonyms can be added to each item. In our workspace 'Rewire Industrial Business' you can find the entity @date as example:

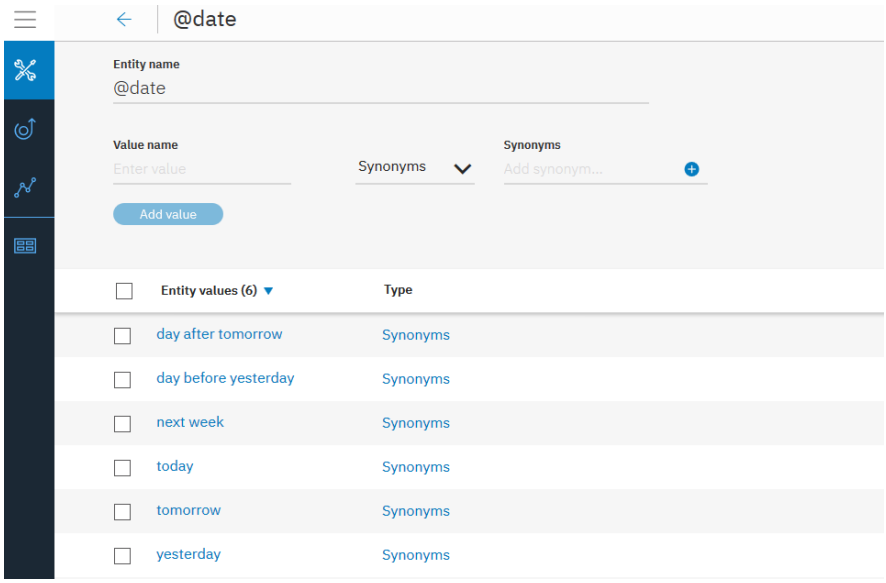



***Figure 7 Example entity***

Both intents and entities can also be imported from external sources and subsequently changed or deleted.

### 2.2.4 Define Dialogs

Utilize the intents and entities you created, so your virtual assistant responds appropriately. The dialog flow is represented graphically in the tool as a tree. You can add a node to process each of the intents that you want the service to handle. Each node consists of an **If-Then query**.

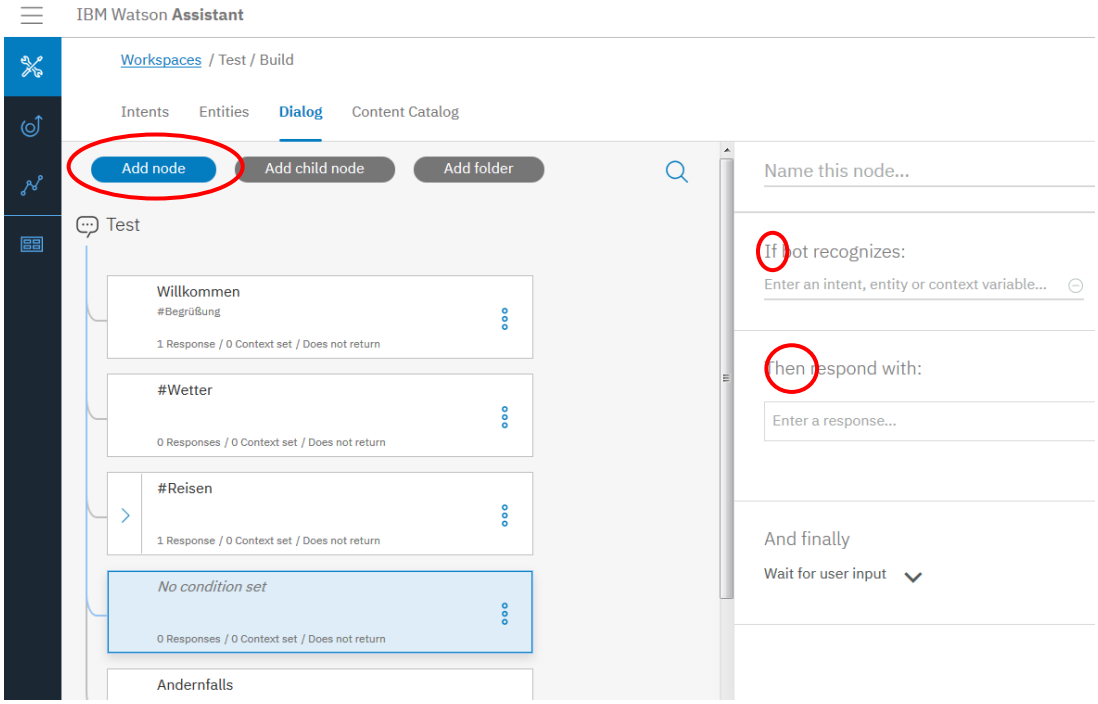
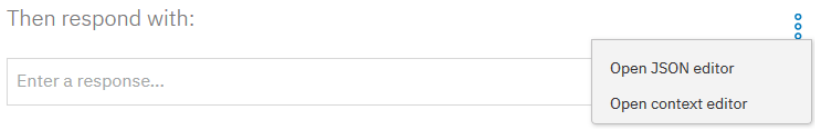



***Figure 8 Define dialogs by using the If-Then query***

In the **If** part, it is queried which input (intent, context variable or entity) must be recorded in order to jump into the node.

If the input matches the condition specified in the If part, it is called a trigger. If the value of the If part is true, the dialog flow jumps to the Then part of the query.

In the **Then** part of the node, an answer is assigned to the utterance. For simple questions, a response sentence can be implemented right away. You can also use the Context or the JSON editor to implement a response.




Now let's get started by using our 3 examples from above: #Ehningen_location, #travel_to_Ehningen, #yourownintent. Click 'Add node' to create a dialog for each example.

### First example: #Ehningen_location

For our fist example you can set variations of answer sentences. Watson then chooses one of the answers, either in a fixed order or randomly.

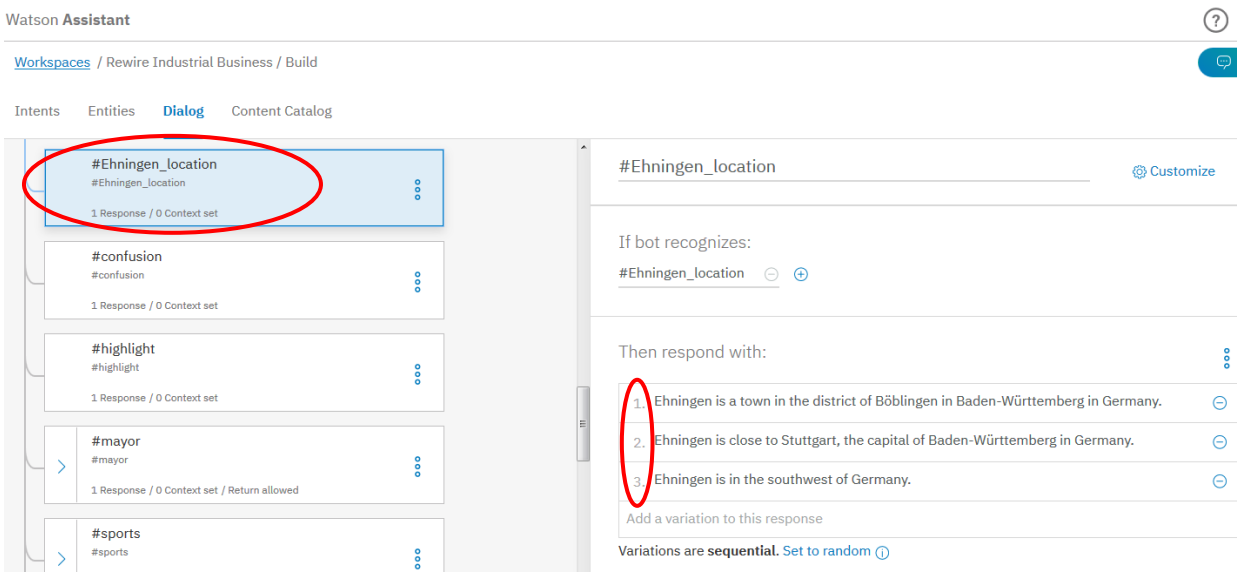



***Figure 9 Define dialog: First example***

## Second example: #travel_to_Ehningen

Often one simple answer is not enough, and it is necessary to start a more complex conversation. To implement this, the node can be connected to other nodes. The 'Then' part then answers with a counter question and the possible answers to it are again implemented in the attached nodes in their condition. The attached nodes are called child nodes.

Let's use this function for our intent #travel_to_Ehnigen and ask about the different options: car, train, airplane. First, create the node 'travel_to_Ehningen' and type in a counter question, such as, "Do you want to travel by car, train or airplane".

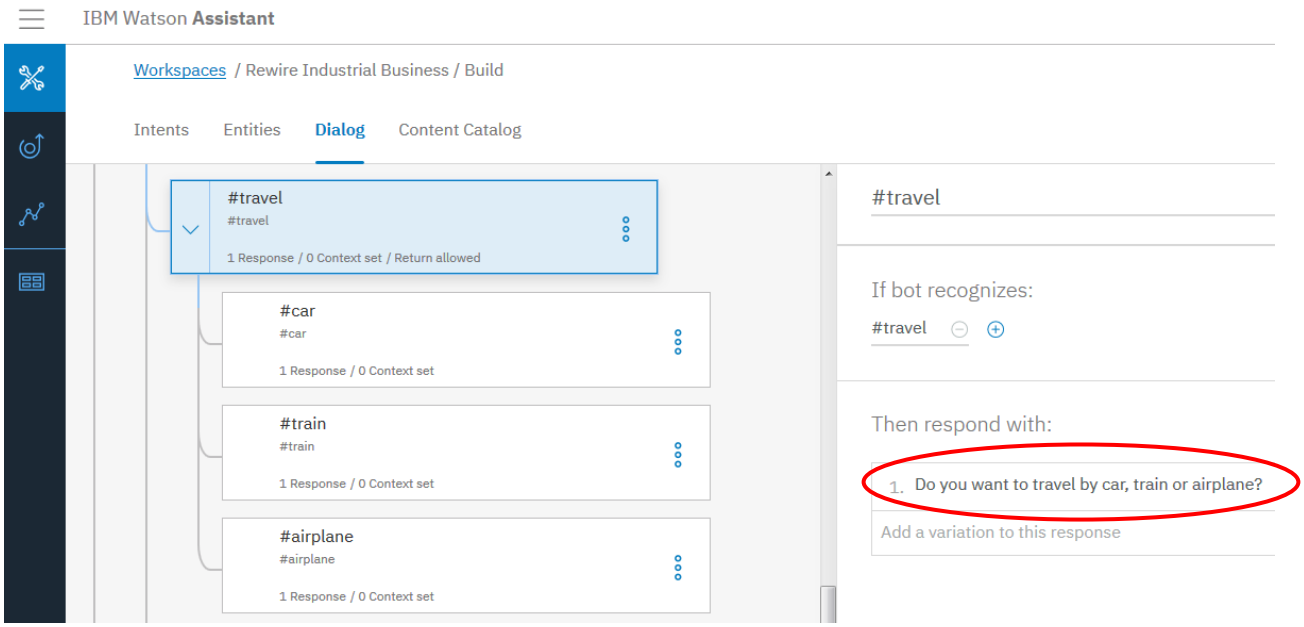



***Figure 10 Define dialog: Second example***

Now you can add child nodes for the three options: car, train, airplane, and type in a response sentence.

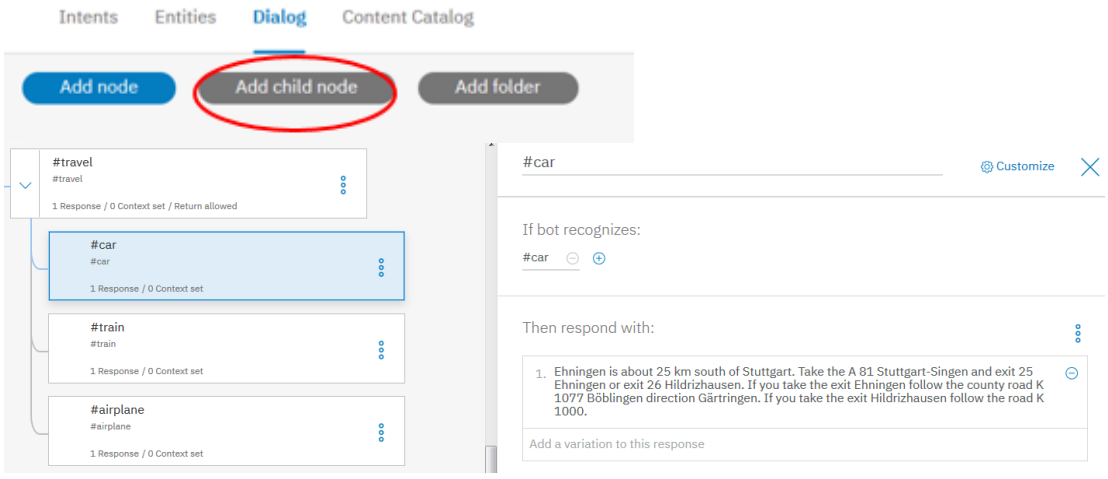



***Figure 11 Add child nodes for a more complex conversation***

This makes it possible to design a dialog flow with many different branches. The dialogue can quickly become complex, so it must be remembered that the flow of dialogue always goes from top to bottom. It jumps to the first node that matches the trigger. Nodes below, which would also match the trigger, are then ignored.

It is also possible to implement a link or picture to your response sentence. For the child node “train” we can, for example, add the link:
http://www.fahrplanauskunft.de/
To implement the link open the JSON editor:

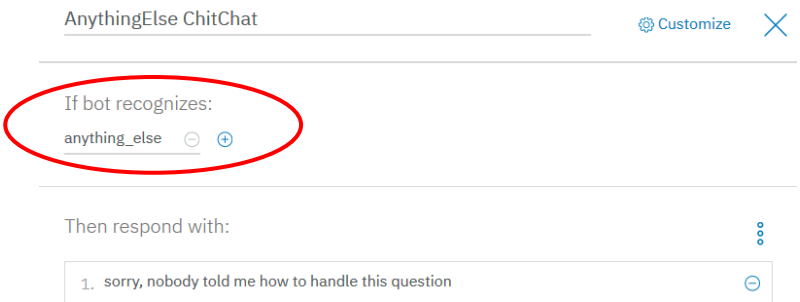

***Figure 12 How to use JSON editor for a response***

### Third example: #yourownintent

Let’s build a dialog flow for your own example.

## 2.2.5 Anything Else

The node "anything_else" is set to give an answer to input that is not intercepted in the other nodes. It should be set at the end of the dialog flow.



### 2.2.6 Jump to (optional)

For complex conversations, jumps between the various dialog strings are possible but must be explicitly stated.

You can use the “Jump to” functions to guide questions to a different node, for example to the mother node, as you can see in this example:

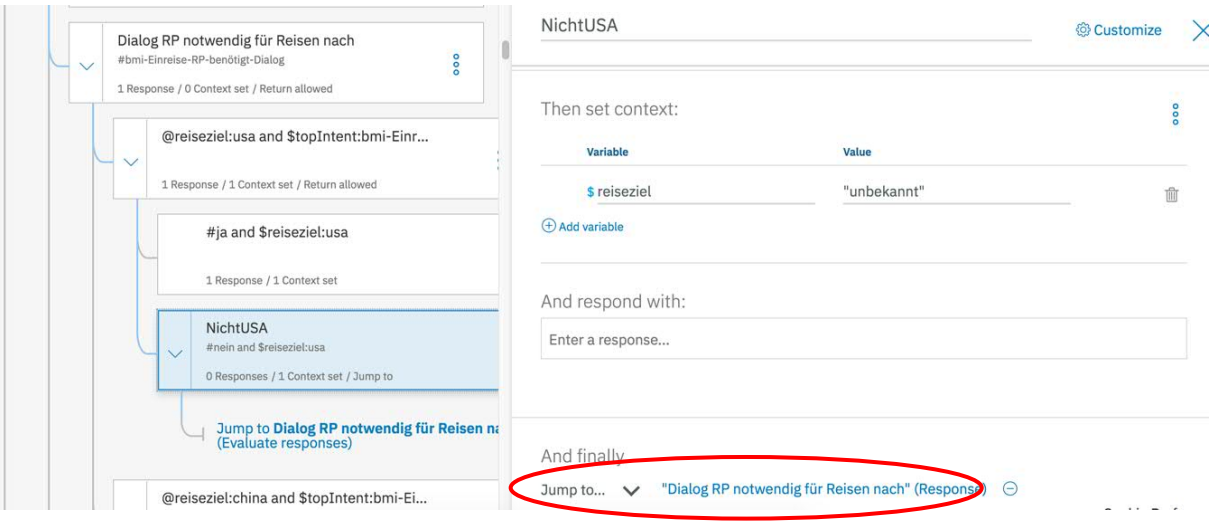



***Figure 13 How to implement a Jump to function***

### 2.2.7 Test the conversation using IBM Watson Assistant

Test your virtual assistant in the ‘Try it out’ section of the tool to see how it recognizes the intents and entities and how it responds first-hand.

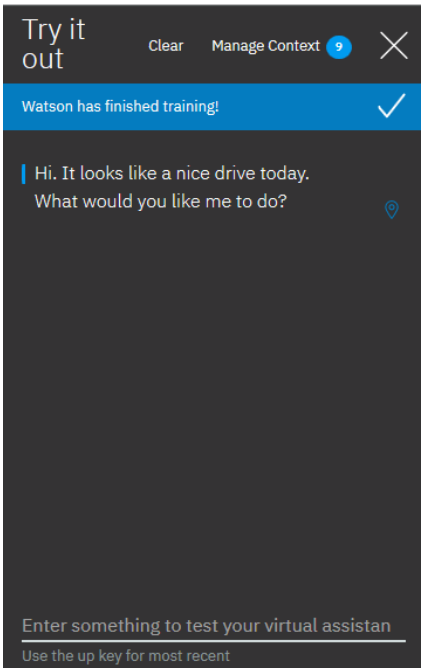



***Figure 14 Use the Try it our function to test your conversation service***

# 3 Now you need a Backend Application Functions

## 3.1 IBM Serverless Functions Basics for this Session

IBM Cloud Functions (based on Apache OpenWhisk) is a Function-as-a-Service (FaaS) platform which executes functions in response to incoming events and costs nothing when not in use.

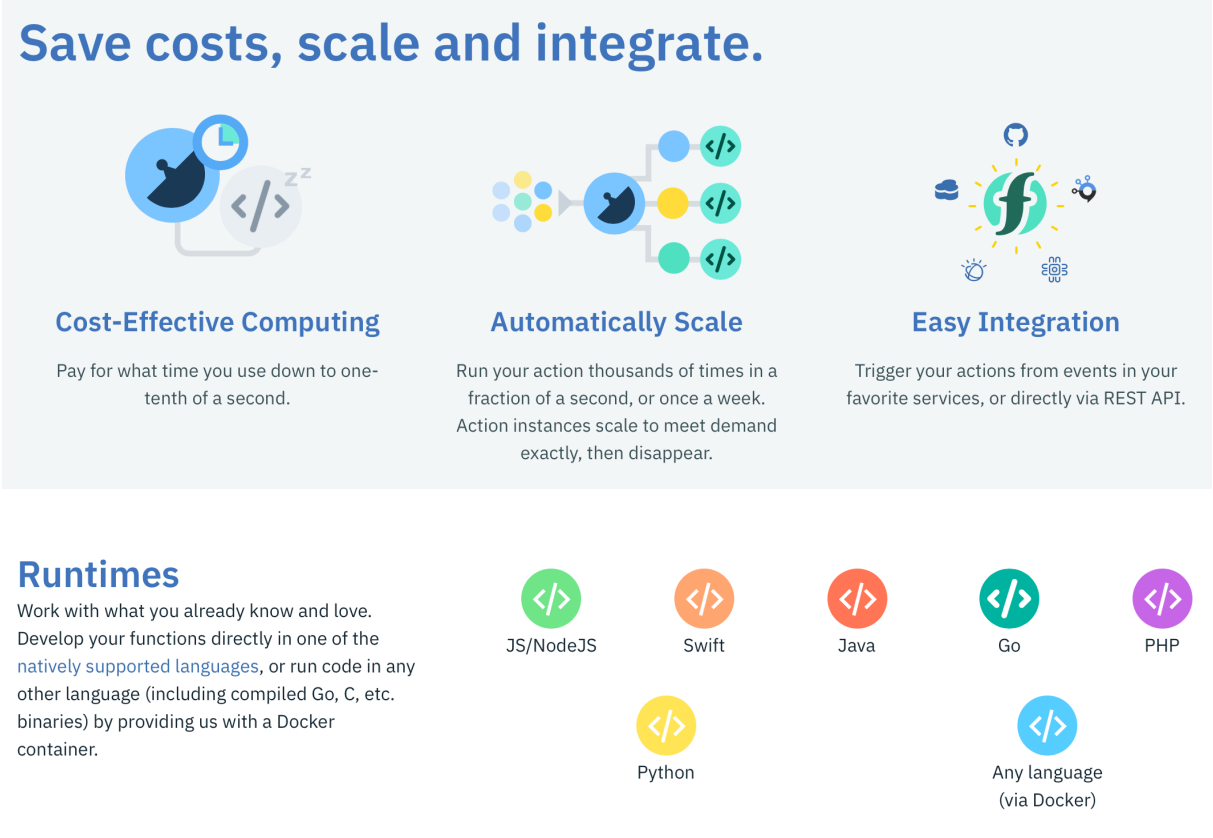



***Figure 15 IBM Cloud Functions to save costs, scale, integrate***

See also Getting started with IBM Cloud Functions

In this Lab we use the JS/NodeJS runtime environment and the 'watson-developer-cloud' library to build the interface for the Watson Services.

## 3.2 IBM Watson Assistant API Reference Basics for this Session

The complete API reference for the Watson Assistant Services is listed here:
Watson Assistant API reference

In this session, however, we only use the Message API request to get a response to the user input.

Example request

```
var watson = require('watson-developer-cloud');

var assistant = new watson.AssistantV1({
  username: '{username}',
  password: '{password}',
  version: '2018-02-16'
});

assistant.message({
  workspace_id: '9978a49e-ea89-4493-b33d-82298d3db20d',
  input: {'text': 'Hello'}
},  function(err, response) {
  if (err)
    console.log('error:', err);
  else
    console.log(JSON.stringify(response, null, 2));
});
```

***Figure 16 Watson Assistant API Reference Sample - Message***

## *3.3 Build a Conversation Service for this Session*

As you can see from the example above, the interface used to communicate with the Watson Assistant Service is very simple and only a view parameters and lines of code are needed to pass information to the service and to get back the response.

### 3.3.1 Collect the Parameters you need

Parameters you need:

- Username and password of the Watson Assistant Service which you can find here:

  Go to the dashboard of IBM Cloud and select the Watson Assistant Service you deployed in chapter 2

  You should get something similar to this:

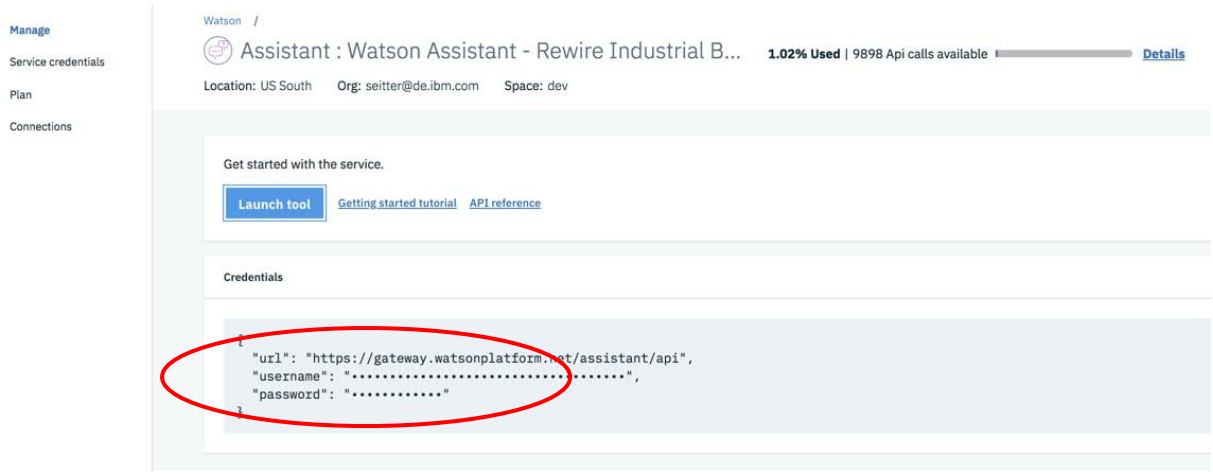



***Figure 17 Watson Assistant Service credentials***

- The workspace ID from the Watson Assistant Service which you can find here:

  Go to the dashboard of the Watson Assistant Service and select Launch tool, click on the 'three dots to display additional options'

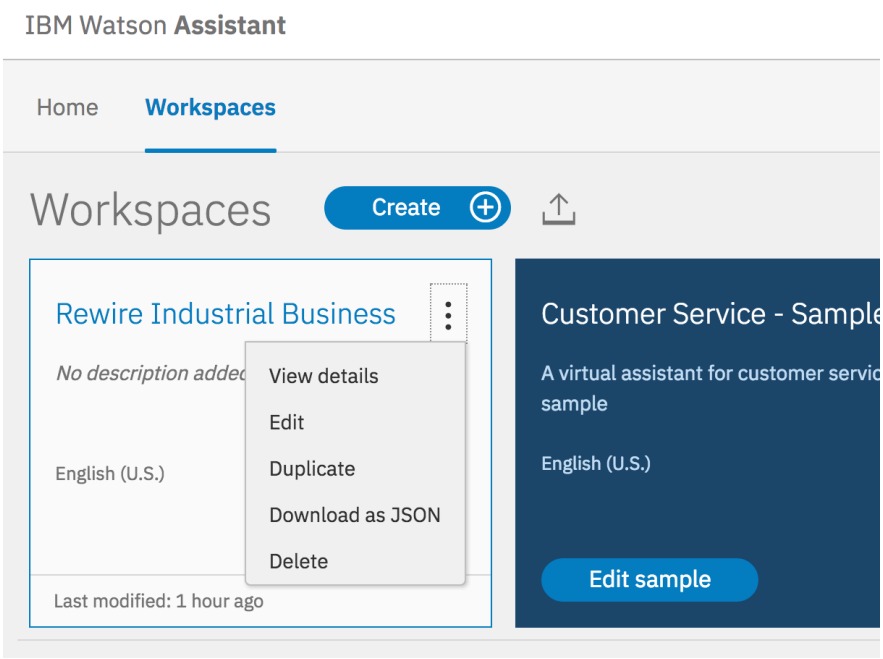



***Figure 18 Watson Assistant Workstation ID-1***

And now select view details: here you can find the workspace ID

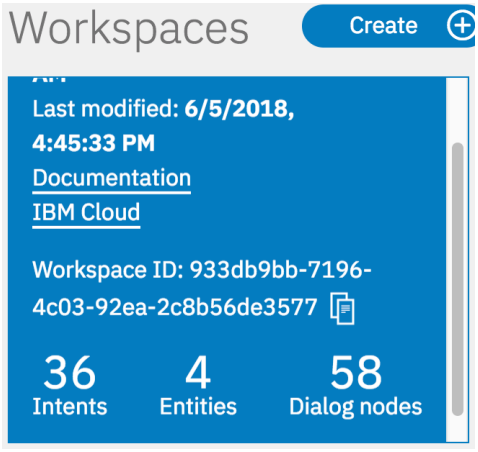



*Figure 19 Watson Assistant Workstation ID-2*

Now that we have all parameters available, let's create an 'Action in IBM Functions' to invoke the API.

### 3.3.2 Create an Action in IBM Function to invoke the Watson Assistant API

**Step1:** Select Functions in your IBM Cloud Dashboard

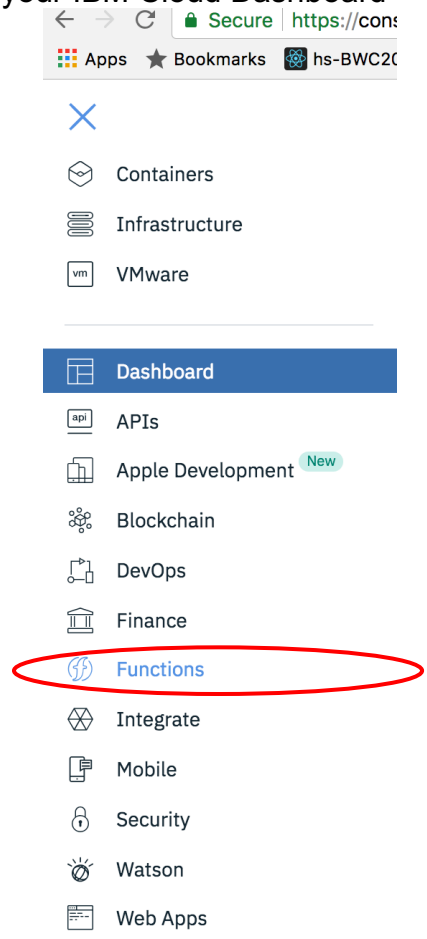



*Figure 20 IBM Functions – create it*

## **Step 2:** Select Create Action

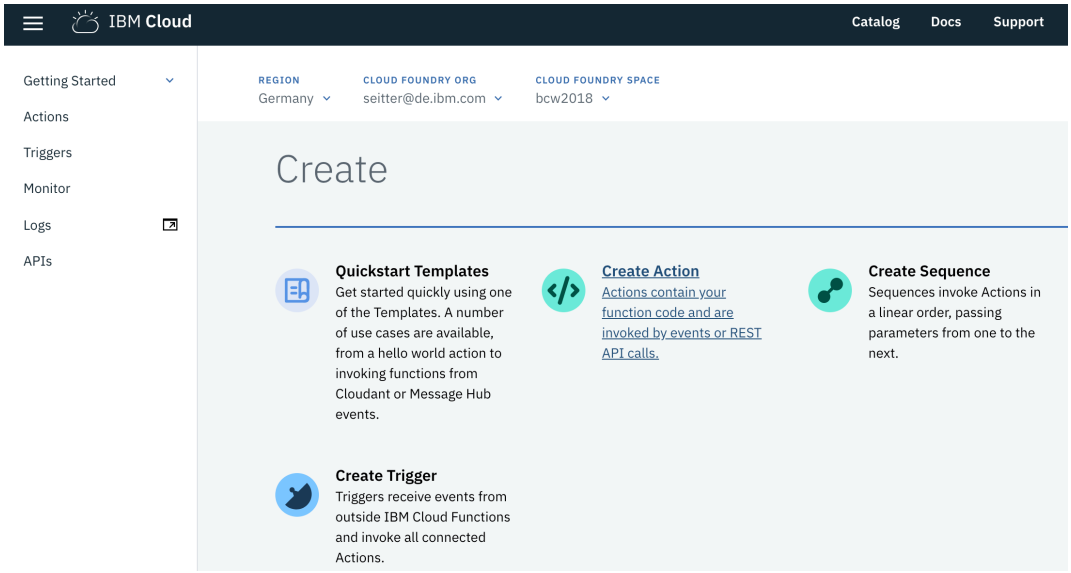



***Figure 21 IBM Functions – create Action***

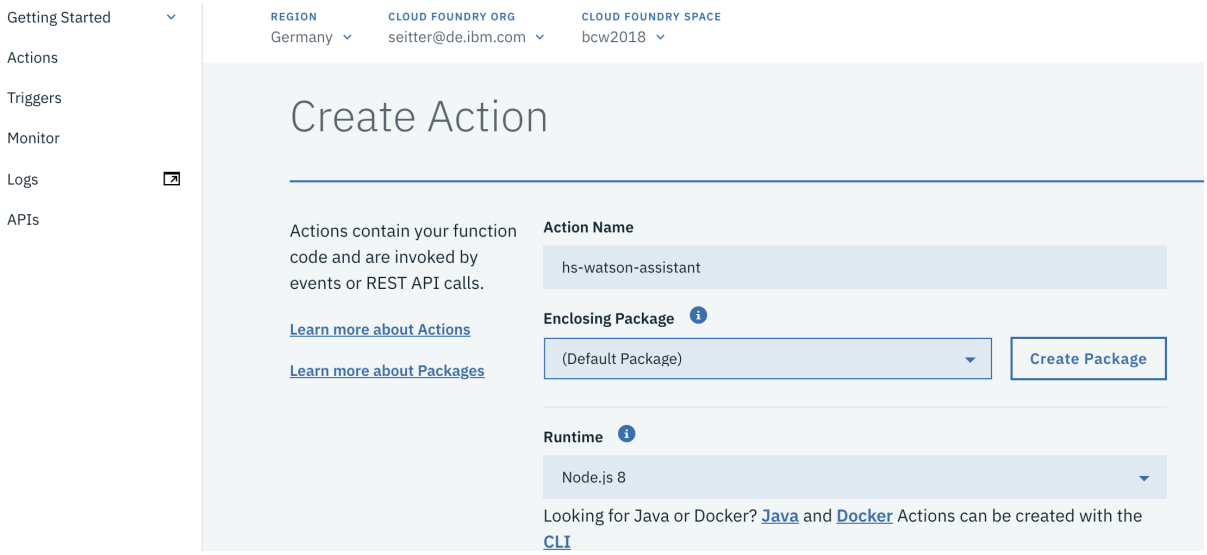



***Figure 22 IBM Functions – create Action-2***

## **Step 3:** Now select parameters and define the parameter values (username, password and workstation ID) to avoid ‘hard coding’ it in the program code.

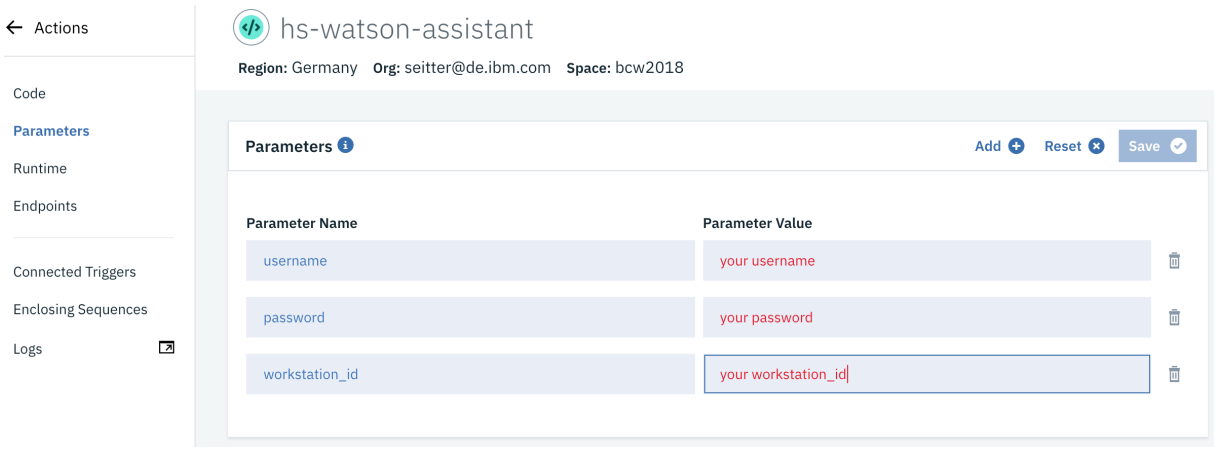



***Figure 23 IBM Functions – Action – define the parameter needed to interact with Watson Service***

**Step 4:** Coding. The program code itself is quite simple and very similar to the example mentioned above. It should look like this one here:

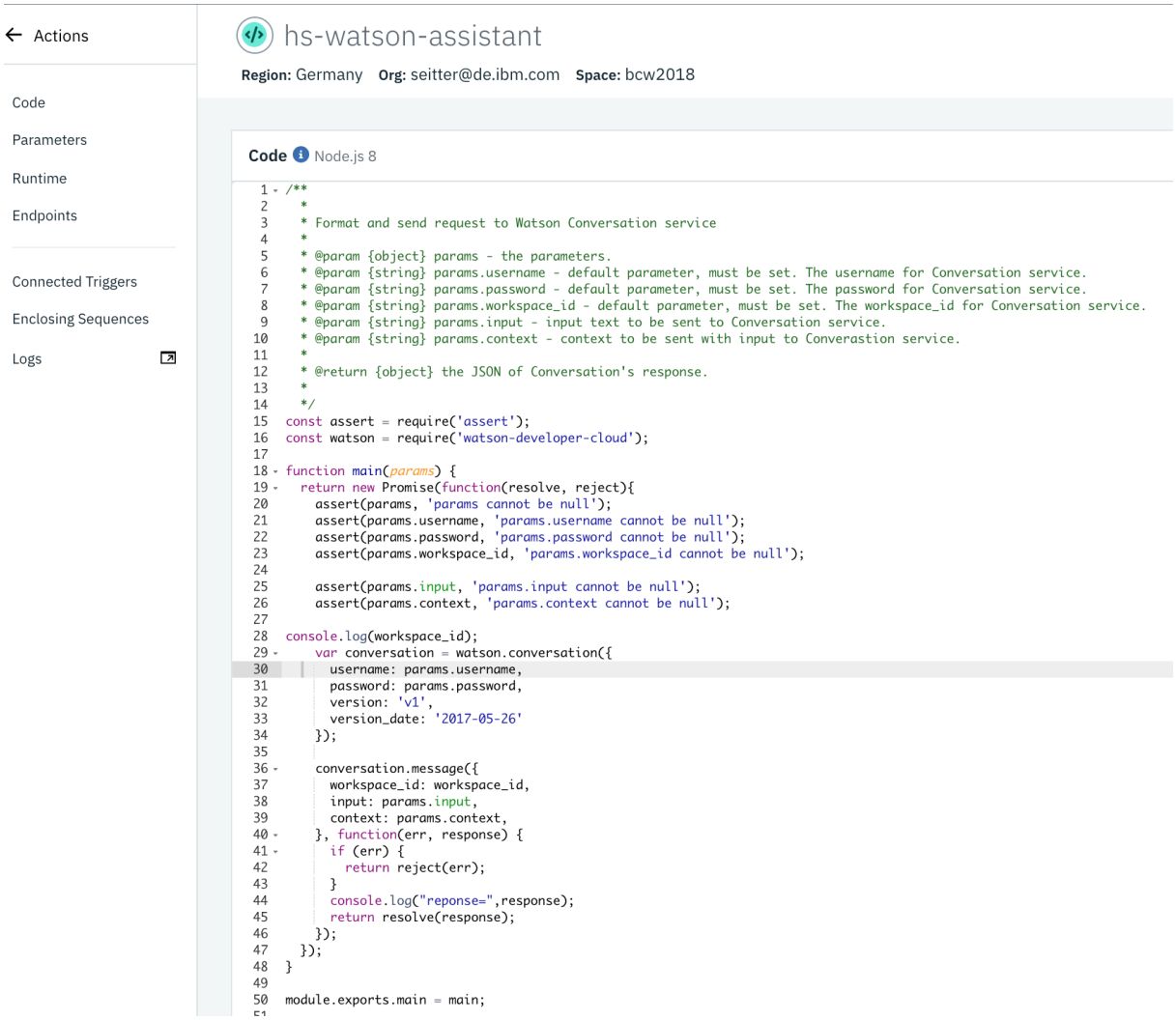



***Figure 24 Coding***

A sample can be retrieved from Github:

https://github.com/HartmutSeitter/hs-rewire-ind-bus-chatbot/blob/master/actions/hs-watson-assistant.js

**Step 5:** But before invoking the action, let's specify the input parameter.?

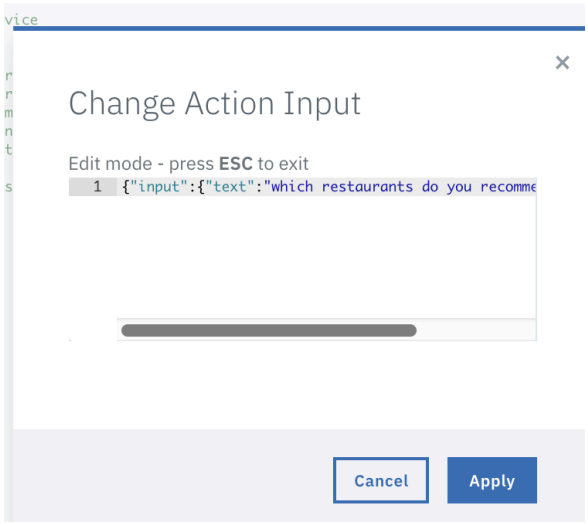



***Figure 25 Change action input***

**Step 5:** After saving your code, you can test it and verify the result you retrieve form Watson Assistant.

You can also find the Input data on Github:

https://github.com/HartmutSeitter/hs-rewire-ind-bus-chatbot/blob/master/actions/input-data.json

### 3.3.3 Create a Sequence to be prepared to invoke more than one Action in this scenario

Even if is not really necessary to create a sequence to invoke a single action, let's do so.
Just in case you would like to extend the function of this application (e.g. to invoke other Watson services) or to save the conversation in a Cloudant database a sequence function will be very helpful.

**Step 1:** Select 'Create Sequence'

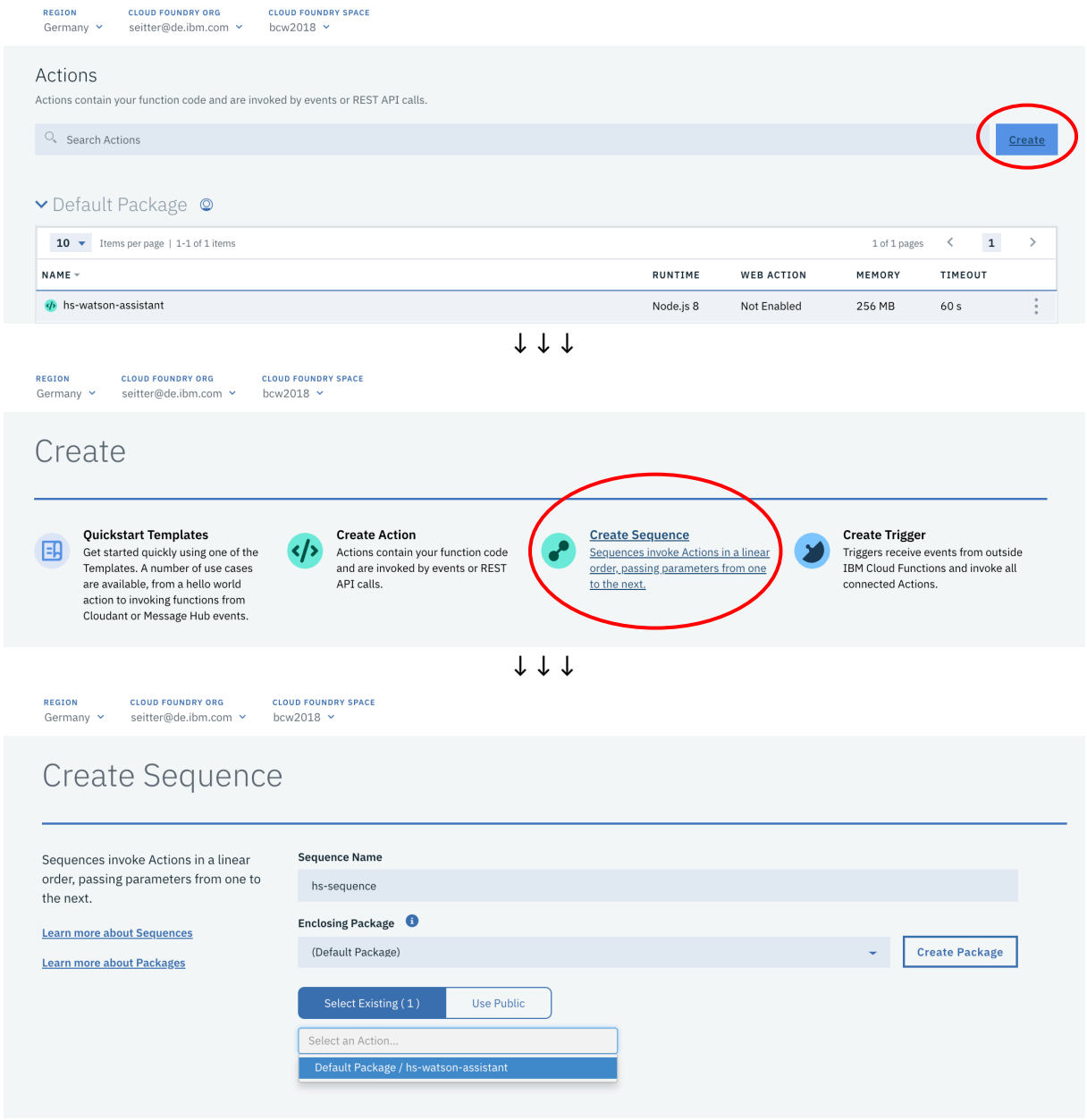



***Figure 26 IBM Functions – create a sequence***

**Step2:** Now enable this sequence as a Web Action. This is necessary to call this sequence from the front-end application which we will deploy in the next chapter (you have to specify this address in the App.js file), or to use e.g. postman or curl command to interact with it.

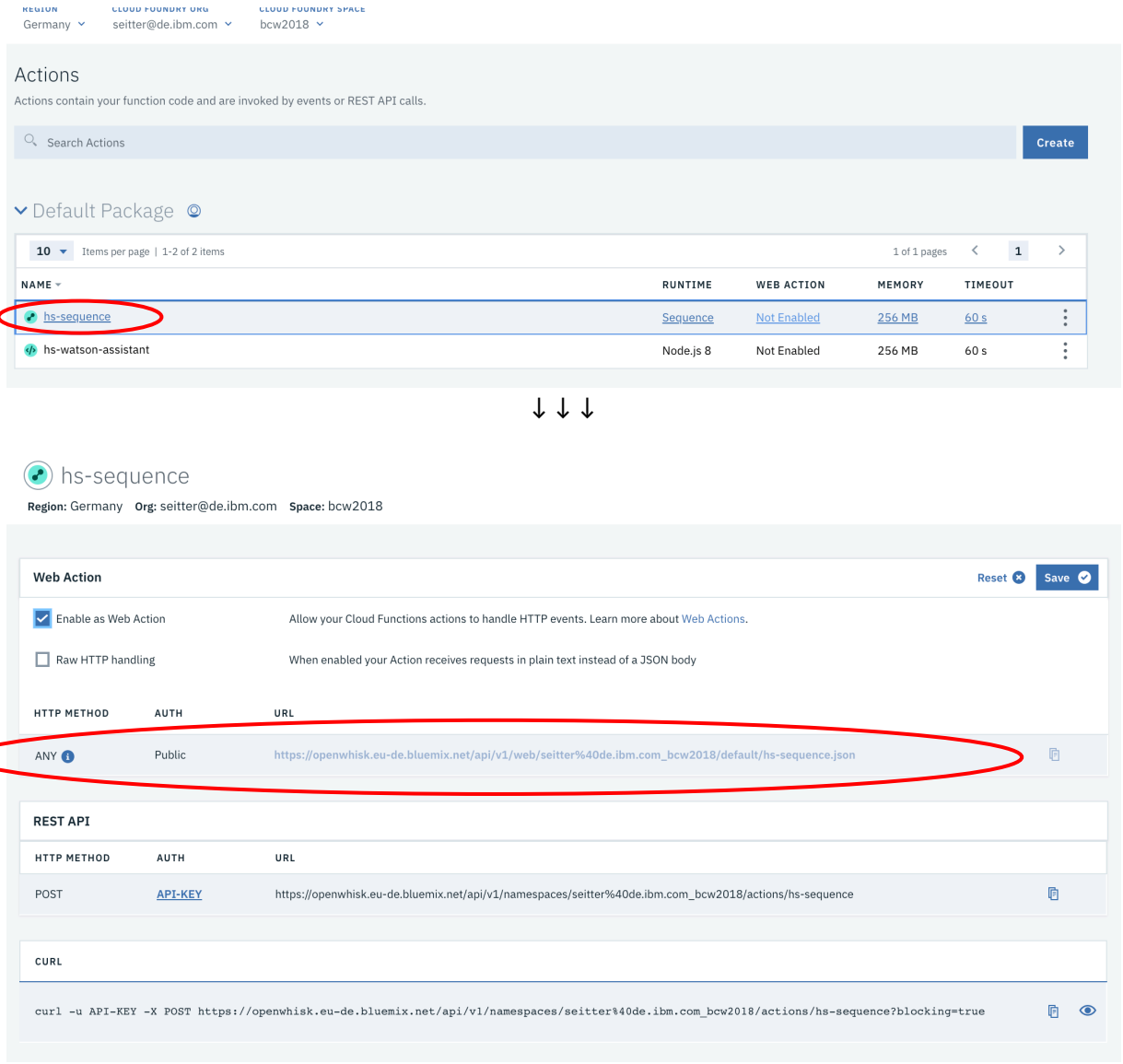



***Figure 27 IBM Functions – Enable Web Action of the sequence***

# 4 Now you need a Frontend Application

There are different ways to implement a Frontend Application or Web Application and you should choose an environment which you are familiar.

For this session we have prepared a NodeJS – REACT application which can be used.

The complete application is available on Github and you can directly (more or less) deploy it to IBM Could.

## *4.1 Create from GitHub the Frontend Application*

Go to Github and on the README.md you find this blue button – Deploy to IBM Cloud:

https://github.com/HartmutSeitter/hs-rewire-ind-bus-chatbot

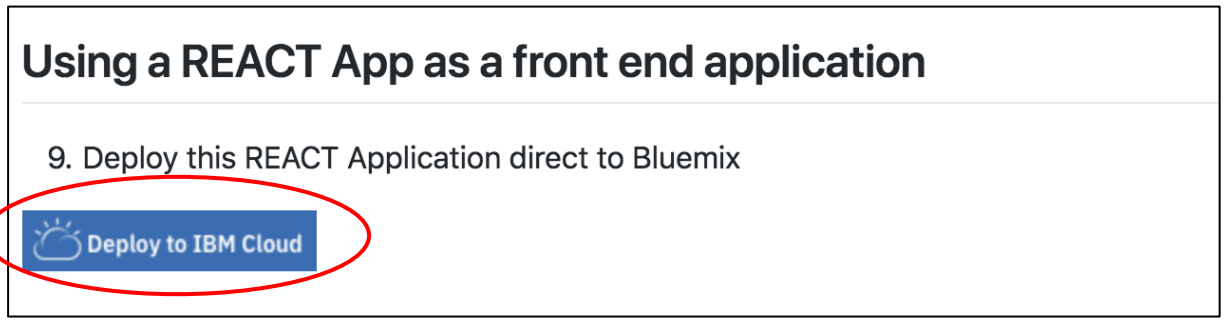



***Figure 28 Deploy REACT App to IBM Cloud***

This will generate a DevOps toolchain in IBM Cloud and copy the source code to an IBM Cloud git repository

### 4.1.1 DevOps Toolchain

Check the setting so the Deployment screen looks like this:

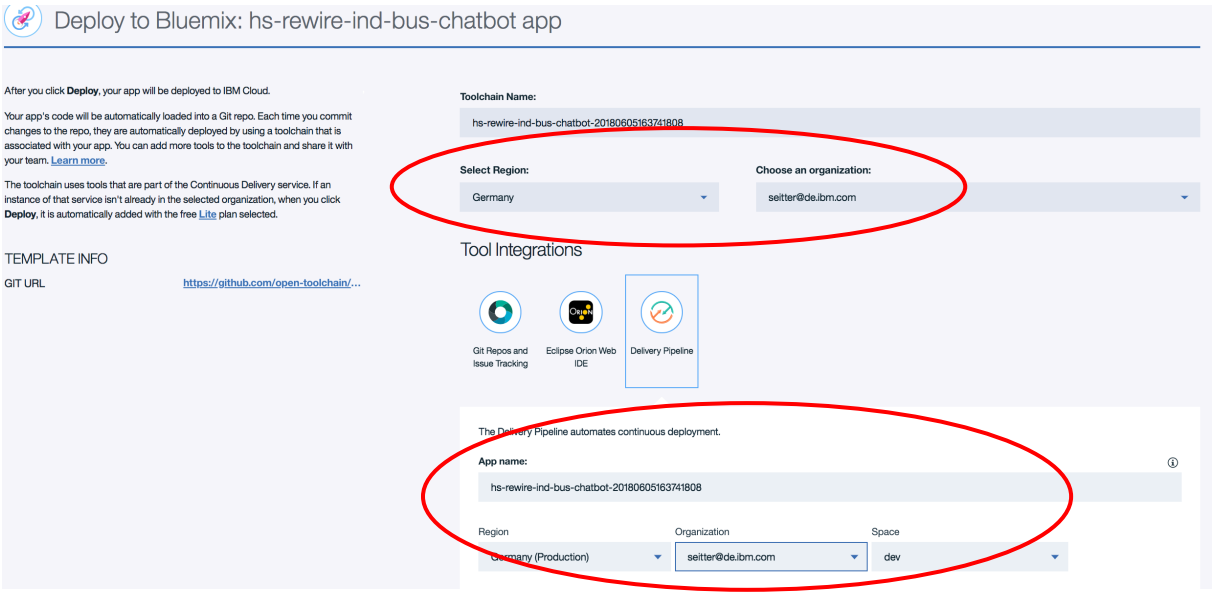



***Figure 29 Devops Toolchain***

Then select deploy.

### 4.1.2 Before you continue – Change App.js in the IBM Cloud Git

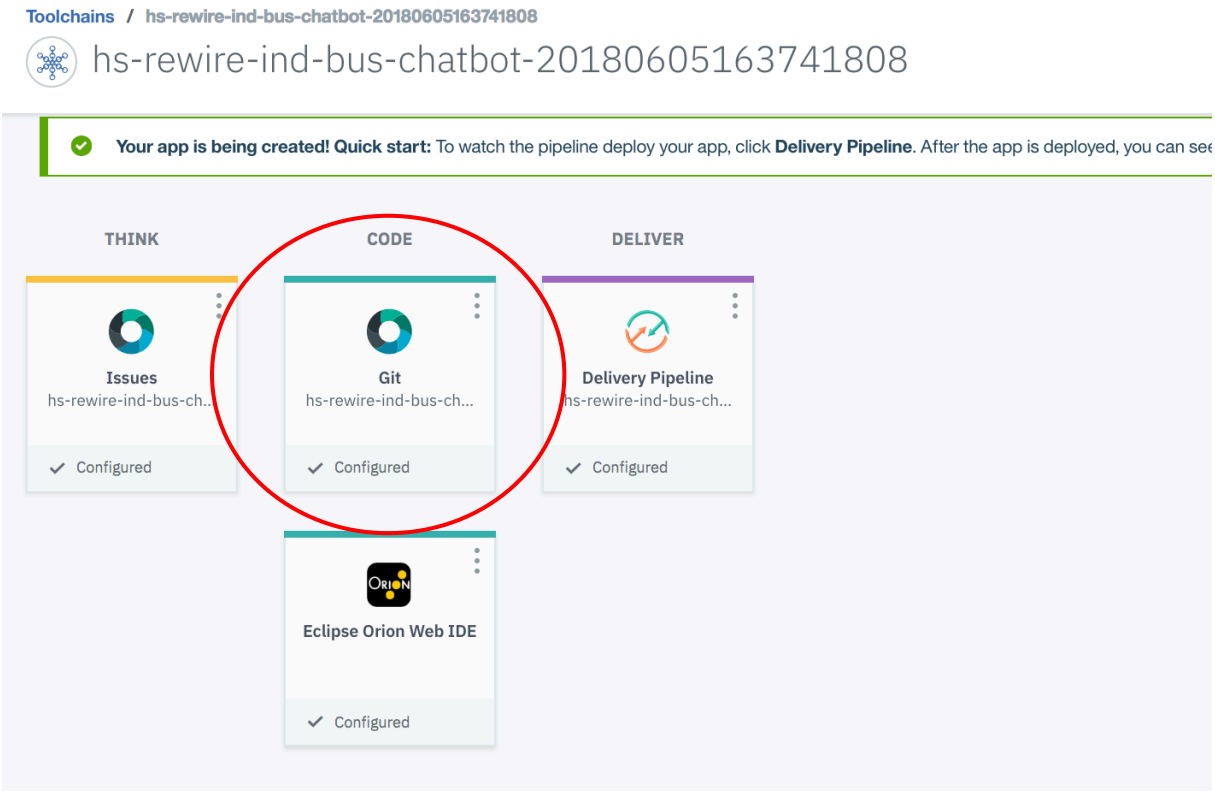



***Figure 30 Devops Toolchain Git repository***

```
  }
  this.handleClick = this.handleClick.bind(this);
  this.handleSubmit = this.handleSubmit.bind(this);
}

callWatson(message) {
    /*** */
    //
    // here you have to specify the RESTAPI End point of your Function to invoke Watson Assistant
    //
    /*** */
  const watsonApiUrl = "put here your IBM Function sequence Endpoint address";

  const requestJson = JSON.stringify({
```

*Figure 31 REACT Application – Apps.js WatsonApiUrl*

Here you must copy the link from chapter 3.3.3 (the https address of the Function sequence – web enable)

Save and commit the App.js file to Git.

### 4.1.3 Specify the build and deployment script to the REACT Application

**Step1:** Select delivery pipeline:

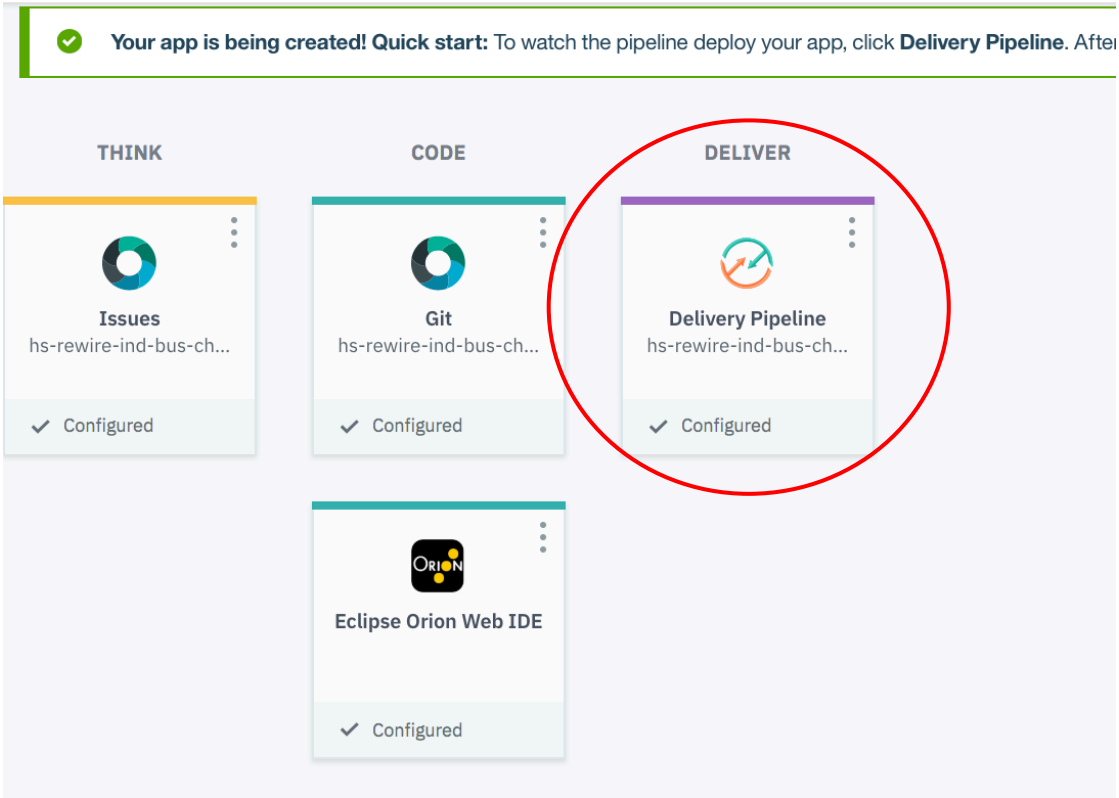



*Figure 32 IBM Devops Toolchain Delivery Pipeline*

**Step2:** Select configure stage. You have to specify a Build script in the Build stage. You can find the Build script on GitHub: devops-toolchain-script/build-script.txt

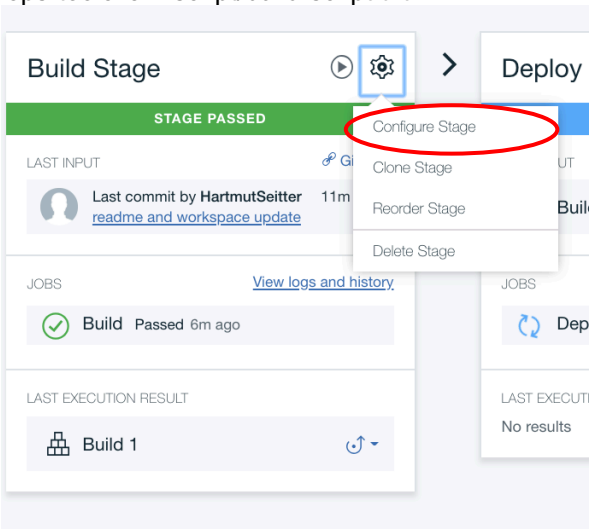



***Figure 33 IBM Devops Toolchain Build Stage***

**Step 3:** Select npm in Builder type, copy paste the Build script and specify in Build archive directory build.

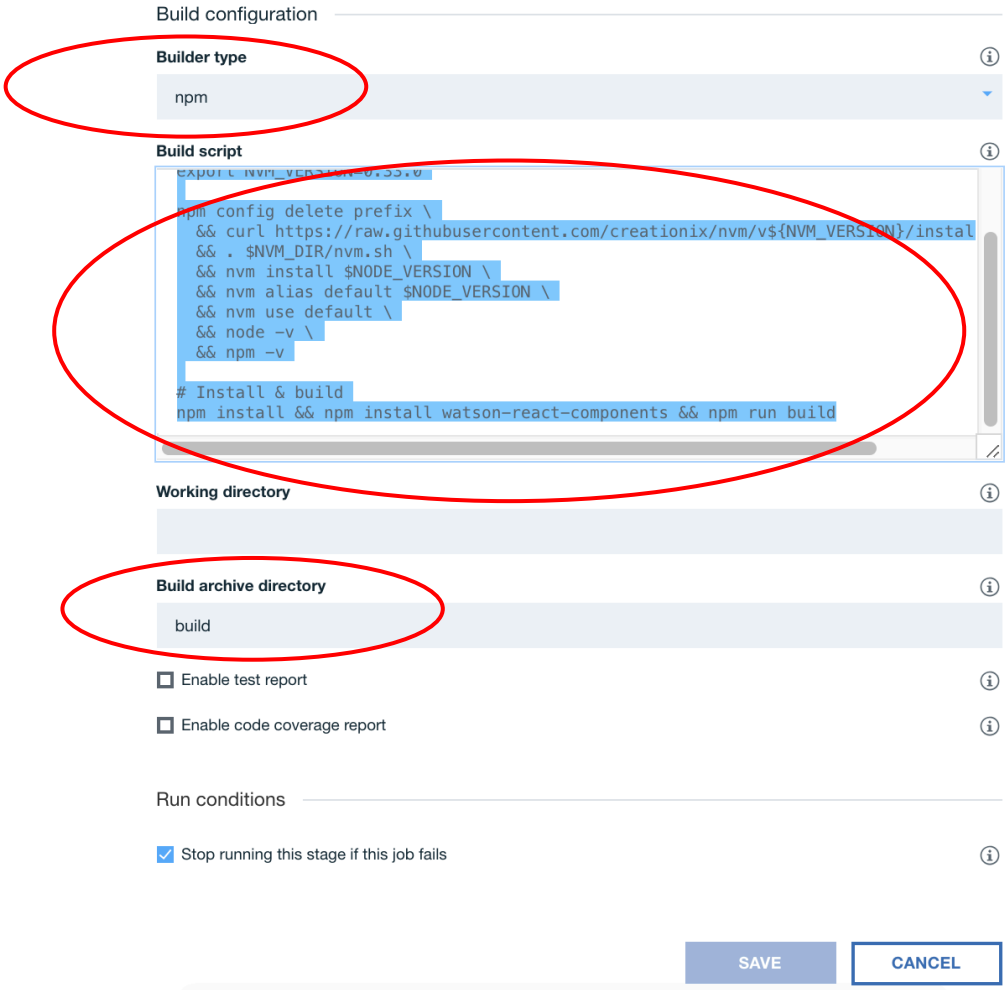



***Figure 34 IBM Devops Toolchain Build parameter***

Click save.

**Step4:** Deploy stage. Click configure stage:

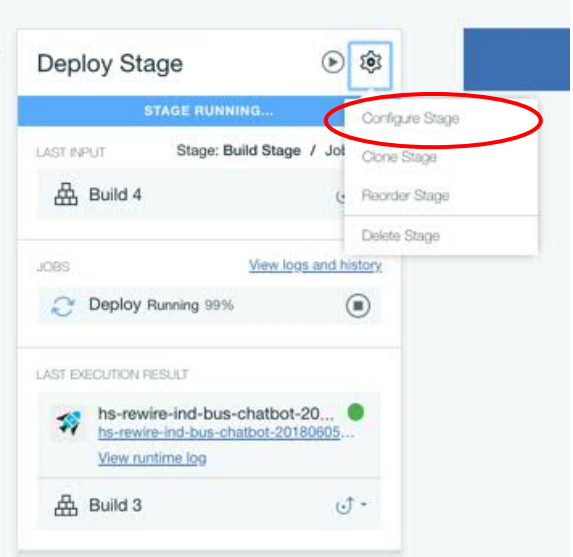



***Figure 35 IBM Devops Toolchain Deploy stage***

**Step 5:** Check parameters (Deploy type, Cloud region, Organization, Space…) if they correspond to your Cloud environment settings.

**Step 6:** Copy paste the Deployment script into the Deploy script box and save changes:

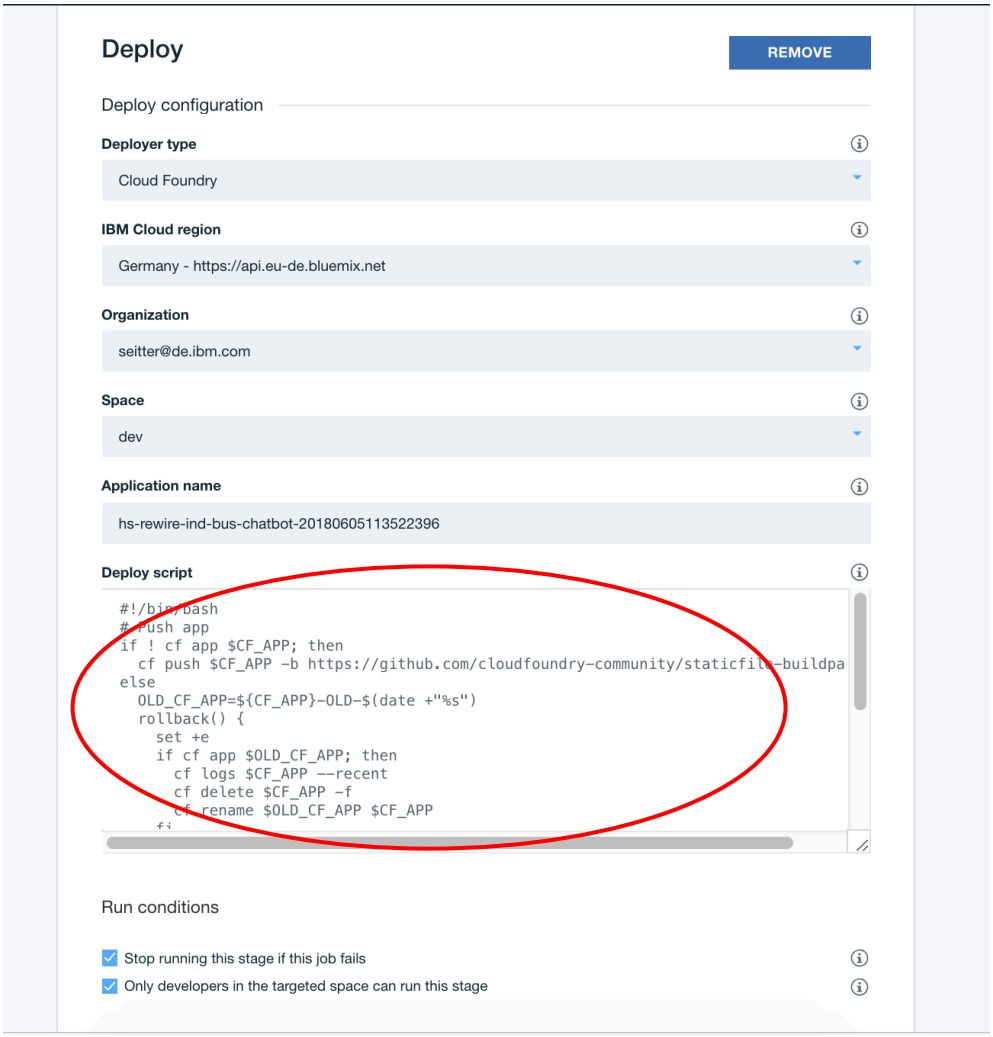



***Figure 36 IBM Devops Toolchain Deploy script***

**Step 7**: To build and deploy everything in IBM Cloud will take some minutes, if it completed successfully you should be ready and you can invoke that application.
Open the application by clicking the following link:

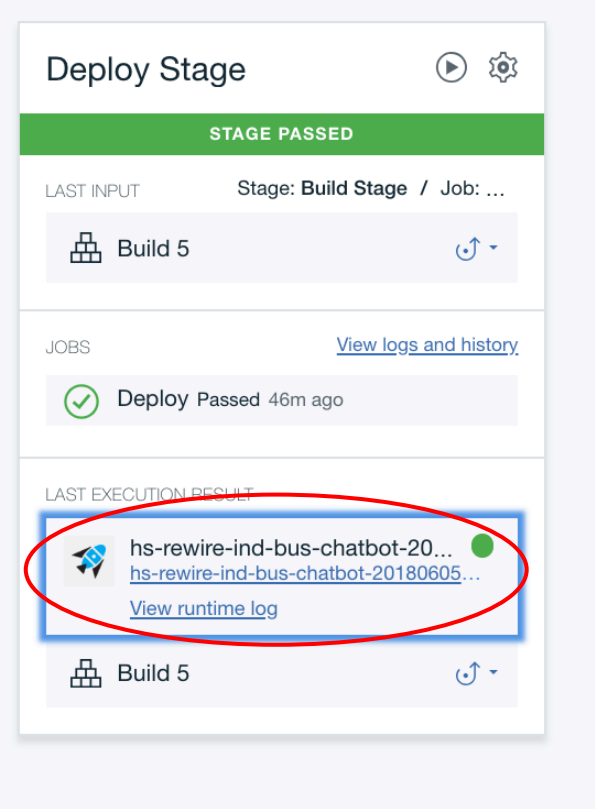



***Figure 37 IBM Devops Toolchain Launch Application***

It should look like this:

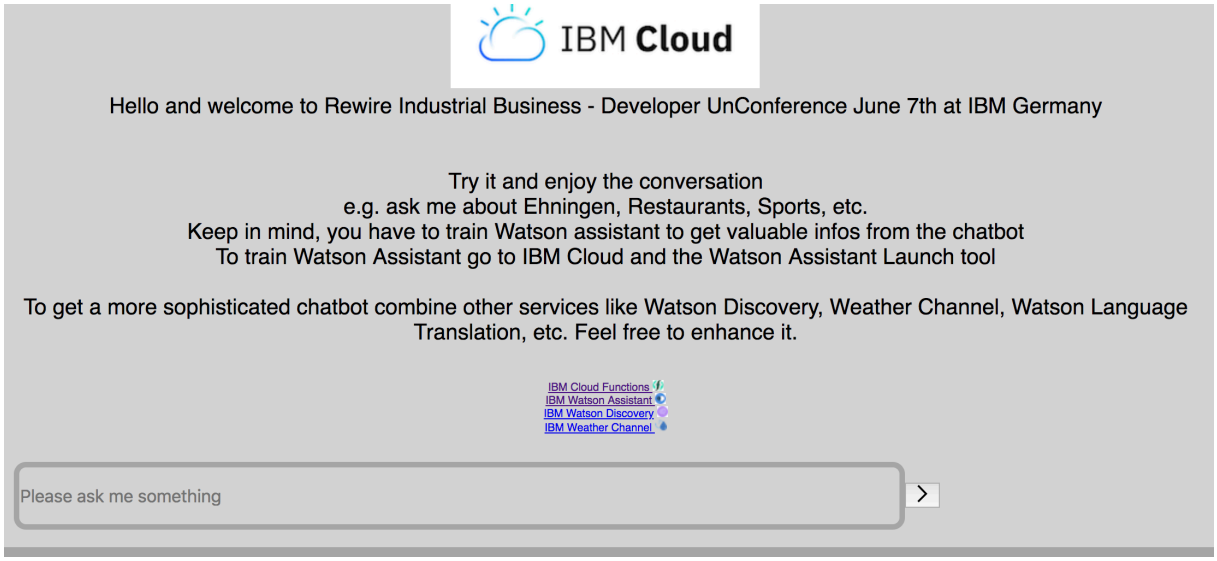



***Figure 38 Final Application***

# Appendix