

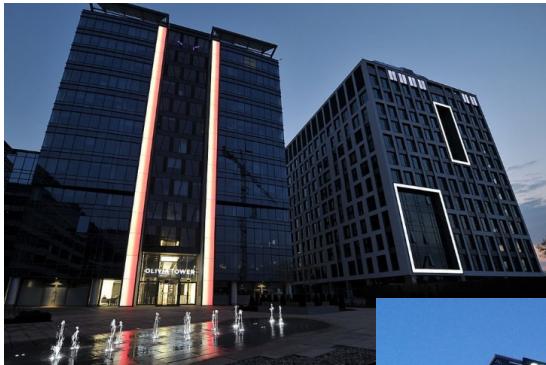


# Introduction to Build AI Chatbots using AWS LEX

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Amazon Alexa NLU



# Amazon Development Center in Gdańsk



- Text to Speech (TTS)
- Natural Language Understanding (NLU)
- Alexa Hybrid



# Agenda

- 17:30 – 19:30 Workshop
  - Part 1 – Build a chat bot
  - Part 2 – Build a useful chat bot
  - Part 3 – Build even more useful bot
- 19:30 - ... Networking pizza(s)

# MeetUp materials

- All materials are available on [aws-lex-chatbot GitHub project](#)
  - Lambda functions (+ tests)
  - Bot (definition + deployment)
  - This presentation (PDF)

mariusz-momotko	Delete a.txt	Latest commit a115b46 11 minutes ago
docs	Create a.txt	20 minutes ago
lambda	Delete a.txt	11 minutes ago
lex/chatbots	Delete a.txt	21 minutes ago
README.md	Initial commit	1 hour ago



On slides – this symbol indicates that you can use materials if you do exercises on your own.



## Part 1 – Build a AWS Lex chat bot

Specify requirements for a bot to support buying a train ticket for SKM

Create a bot

Define intent and slots



# A need – I want to buy a train ticket for SKM

Gdańsk Główny	Gdańsk Wrzeszcz	26-06-2019 18:00	Search
---------------	-----------------	------------------	--------

+ Add via station

## Connections Gdańsk Główny – Gdańsk Wrzeszcz

Departure	Arrival	Connection	Travel time	Price	
<a href="#">◀ Earlier</a>					
<u>26-06-2019</u>					
18:03	18:09		0:06	3,20 zł	<a href="#">Buy ticket</a>
18:13	18:19		0:06	3,20 zł	<a href="#">Buy ticket</a>
18:23	18:29		0:06	3,20 zł	<a href="#">Buy ticket</a>

[https://bilety.skm.pkpl/en/search/gdansk-glowny/gdansk-wrzeszcz/26-06-2019\\_18:00](https://bilety.skm.pkpl/en/search/gdansk-glowny/gdansk-wrzeszcz/26-06-2019_18:00)



# AWS Lex

## AWS Management Console

AWS services

Find Services  
You can enter names, keywords or acronyms.

Amazon Lex  
Build Voice and Text Chatbots

Alexa for Business   Amazon Lex  
Alexa for Business Provides Tools to Manage Alexa in Your Organization

MediaConnect  
Reliable, secure, and flexible transport for live video

aws Services Resource Groups ★

ConduitAccessClientRole-DO-N... Ireland Support

Amazon Lex

Bots

Create Actions ▾

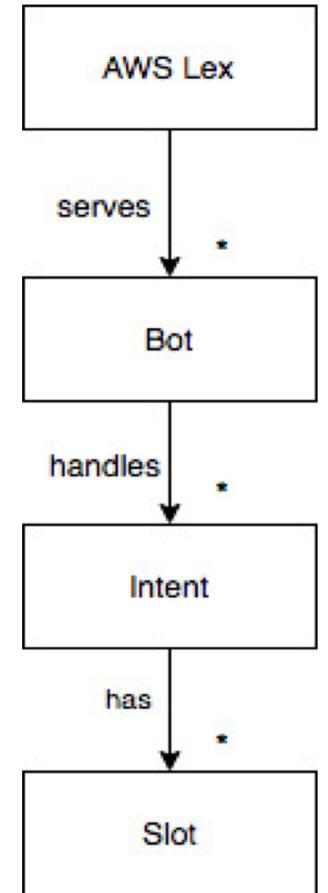
Filter: Filter by Bot name

Name	Status	Last updated	Date Created
OrderFlowers	READY	May 10, 2018 at 3:26:54 PM UTC+2	May 10, 2018 at 9:15:11 AM UTC+2
OrderFlowersMOBILEHUB	READY	May 11, 2018 at 10:31:19 AM UTC+2	May 11, 2018 at 10:30:37 AM UTC+2



# AWS Lex Bot – Bots, Intents & Slots

- Bot - a ro(bot) able to carry out conversation with a user (in a textual or voice enabled mode)
- Intent – a particular goal that the user wants to achieve
- Slot – data / parameters that the user need to fulfill in order to understand the goal
- Examples
  - *Play Hello by Adele*
    - Intent - PlayMusicIntent
    - Slots: [ArtistName="Adele"], [SongName="Hello"]
  - *Check the weather in Gdańsk*
    - Intent: ForecastedWeatherIntent
    - Slots: [place="Gdańsk"]





# Support in ordering a SKM ticket – Lex Bot

AWS Services Resource Groups ConduitAccessClientRole-DO-N... Ireland Support

**Bots**

Create Actions Filter by Bot name

Name	Status	Last updated	Date Created
OrderFlowers	READY	May 10, 2018 at 3:26:54 PM UTC+2	May 10, 2018 at 9:15:11 AM UTC+2
OrderFlowersMOBILEHUB	READY	May 11, 2018 at 10:31:19 AM UTC+2	May 11, 2018 at 10:30:37 AM UTC+2

**Create your bot**

Amazon Lex enables any developer to build conversational chatbots and dynamically adjusts the response. To get started, you can choose to create a custom bot or a pre-built template.

**CREATE YOUR OWN**

**Custom bot**

**Bot name** OrderTicket

**Language** English (US)

**Output voice** Salli

Type text here to hear a sample

**Session timeout** 5 min

**IAM role** AWSServiceRoleForLexBots  
Automatically created on your behalf

**COPPA** Please indicate if your use of this bot is subject to the Children's Online Privacy Protection Act (COPPA). [Learn more](#)

Yes  No

**Bots**

Create Actions Filter by Bot name

Name	Status
OrderFlowers	READY
OrderFlowersMOBILEHUB	READY
OrderTicket	NOT_BUILT



# Ordering a ticket – Intent (1)

The screenshot shows the Amazon Alexa Skills Kit (ASK) console interface. At the top, there is a search bar with the placeholder "Search connections | Special Pass 2018". Below the search bar, there are three input fields: "Gdańsk Główny" (origin), "Gdańsk Wrzeszcz" (destination), and "26-06-2019 18:00" (date and time). To the right of these fields is a red "Search" button.

The main area is titled "OrderTicket Latest". It has tabs for "Editor", "Settings", "Channels", and "Monitoring". The "Editor" tab is selected. On the left, there are sections for "Intents" (No intents created) and "Slot types" (No slots created). In the center, there is a "Getting started with your bot" section with a "Create Intent" button. A modal window titled "Create intent" is open, asking for a unique name for the new intent. The input field contains "OrderTicketIntent". At the bottom of the modal are "Previous" and "Add" buttons.

- Intent – OrderTicket
- Built-in Intents
  - HelpIntent
  - CancelIntent
  - ...



# Ordering a ticket – Intent – Sample utterances

- Utterance – spoken or typed phrases that invoke the customer's intent

## ▼ Sample utterances ⓘ

e.g. I would like to book a flight.	<input type="button" value="+"/>
want a ticket	<input type="button" value="x"/>
buy ticket	<input type="button" value="x"/>



# Ordering a ticket – Intent – Slots

The screenshot shows the Alexa Skills Kit (SKM) interface. At the top, there is a search bar with the placeholder "Search connections | Special Pass 2018". Below the search bar are four input fields: "Gdańsk Główny", "Gdańsk Wrzeszcz", "26-06-2019 18:00", and a red "Search" button. Underneath these fields is a "Slots" section. This section has a table with the following data:

Priority	Required	Name	Slot type	Version	Prompt	Settings
		e.g. Location	e.g. AMAZON.US_CITY		e.g. What city?	<a href="#">+</a>
1.	▼	<input checked="" type="checkbox"/> fromStation	AMAZON.EUROPE_CITY	Built-in ▾	What is the station you are going from?	<a href="#">⚙️</a> <a href="#">✖️</a>
2.	^ ▾	<input checked="" type="checkbox"/> toStation	AMAZON.EUROPE_CITY	Built-in ▾	What is the station you are going to?	<a href="#">⚙️</a> <a href="#">✖️</a>
3.	^ ▾	<input checked="" type="checkbox"/> dateOfTravel	AMAZON.DATE	Built-in ▾	What is date of your travel?	<a href="#">⚙️</a> <a href="#">✖️</a>
4.	^	<input checked="" type="checkbox"/> timeOfTravel	AMAZON.TIME	Built-in ▾	What is time of your travel?	<a href="#">⚙️</a> <a href="#">✖️</a>

- Slot type
  - Built-in slots [Alexa Skills Kit](#)
    - Date, Time, Numbers, Cities
    - ...



Remember to save changes made for the intent.

## Slots

- fromStation
- toStation
- dateOfTravel
- timeOfTravel



# Ordering a ticket – a first try

- First try (after Build)
  - Interaction
  - Summary (ReadyForFulfillment)
  - Inspect response
- Bot which was built can be published
- Bot is versioned

Build   Publish   ?

> Test bot (Latest)   Ready. Build complete.

want ticket

What is the station you are going from?

Gdańsk Wrzeszcz

What is the station you are going to?

Tczew

What is date of your travel?

today

What is time of your travel?

now

Intent OrderTicketIntent is ReadyForFulfillment:  
dateOfTravel:2019-06-24  
fromStation:Gdańsk Wrzeszcz  
timeOfTravel:09:13 toStation:Tczew

Inspect response

Dialog State: ReadyForFulfillment

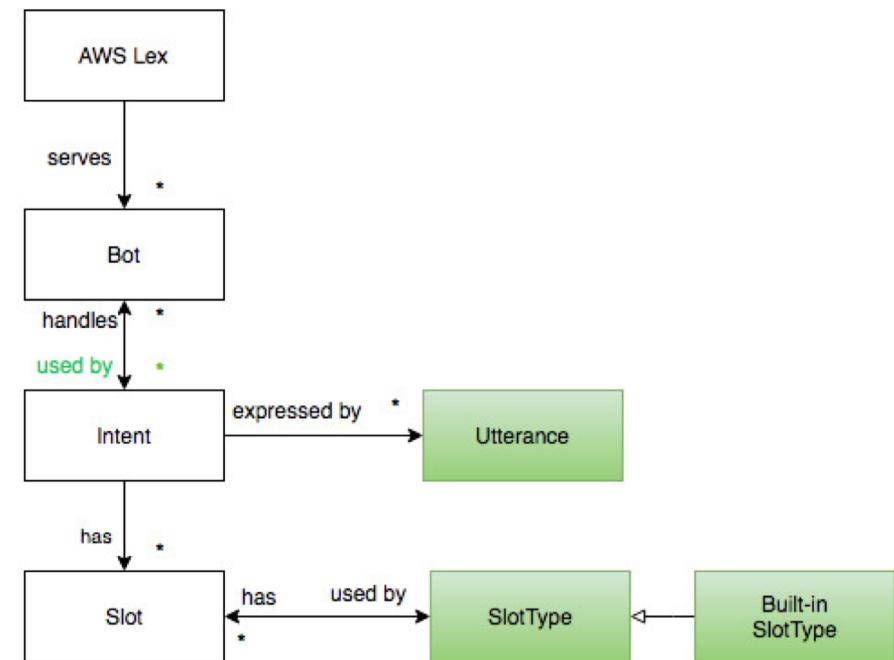
Summary    Detail

Intent: OrderTicketIntent

Slots	(4/4)
dateOfTravel	2019-06-24
fromStation	Gdańsk Wrzeszcz
timeOfTravel	09:13
toStation	Tczew

# Part 1 - Summary

- We have a working chat bot
  - Recognize customer utterances
  - Ask for customer choices (slots)
  - Provide final response
- BUT
  - Customer can provide incorrect train stations, we cannot validate them
  - It is not possible to cancel customer order
  - Final information is not readable enough





## Part 2 – Build a useful AWS Lex chat bot

Adding confirmation prompts

Validation via customized slot type

Formatting the bot's response

Error Handling



# Adding confirmation prompts

- Confirm – a question to confirm your intent and choices (slots). It appears at the end of the conversation.
- Cancel – a message which will appear when you cancel your intent.

▼ Confirmation prompt ⓘ

Confirmation prompt

Confirm

Are you sure to order this ticket? ⚙️

Cancel (if the user says "no")

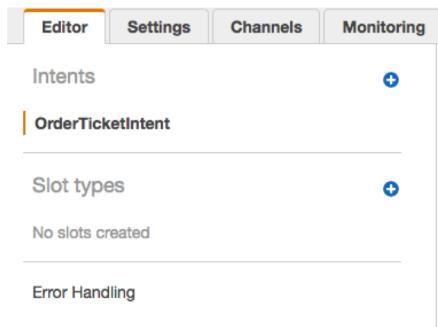
Okay, your order will not be placed. ⚙️



Before testing - remember to save the intent definition and build it.

# Define new slot type for SKM stations

- Customized slot type for SKM stations
  - Via Lex GUI (synonyms only in English)
  - Via Export/Import feature



Edit slot type

SKMStationType Latest ▾

List of all SKM stations.

Slot Resolution

Expand Values ⓘ

Restrict to Slot values and Synonyms ⓘ

Value ⓘ

e.g. Small Enter Synonym +

Press Tab to add a synonym

sopot-kamienny-potok	Sopot Kamienny Potok,	x
gdynia-chylonia	Gdynia Chylonia, Chylonia	x
gdynia-orlowo	Gdynia Orlowo, Orlowo	x
sopot-wyscigi	Sopot Wyścigi, Wyścigi	x
gdansk-politechnika	Gdańsk Politechnika, Gdańsk	x

```
{
    "metadata": {
        "schemaVersion": "1.0",
        "importType": "LEX",
        "importFormat": "JSON"
    },
    "resource": {
        "description": "List of all SKM stations.",
        "name": "SKMStationType",
        "version": "1",
        "enumerationValues": [
            {
                "value": "gdansk-srodmiescie",
                "synonyms": [
                    "Gdańsk Śródmieście",
                    "Gdansk Śródmieście",
                    "Śródmieście"
                ]
            },
            {
                "value": "gdansk-glowny",
                "synonyms": [
                    "Gdańsk",
                    "Gdansk"
                ]
            },
            {
                "value": "gdansk-politechnika",
                "synonyms": [
                    "Gdańsk Politechnika",
                    "Gdansk Politechnika",
                    "Politechnika"
                ]
            }
        ]
    }
}
```

⚠ Remember to select proper version of the slot type in slots definition.

🐱 To import already defined features for this slot type – use [this file](#).

# Formatting the bot's response

- Response
  - final element of a bot's intent, and are displayed to users after the fulfillment of the intent is complete
- Textual response
  - Slot values: {slotName}, e.g. {fromStation}
  - Session attributes value [attribute] (will discuss it a bit later)



The screenshot shows two sections of the Amazon Lex console:

- Message:** A section where you can add messages. It includes a "Preview" button, a radio button for "Message" (which is selected), and a "Custom Markup" option. Below these are two message boxes:
  - "e.g. Thank you. Your {Drink\_Name} has been ordered." with a plus sign to add more.
  - "Thank you. If you want to order a SKM ticket use this link: https://... with a close button (X).
- Response:** A section titled "Response" with a "Preview" button, a "Refresh response" button, and an "Exit preview" button. It displays a single message box containing:

Thank you. If you want to order a SKM ticket use this link:  
[https://bilety.skm.pkpl/en/search/{fromStation}/{toStation}/{dateOfTravel}\\_{timeOfTravel}](https://bilety.skm.pkpl/en/search/{fromStation}/{toStation}/{dateOfTravel}_{timeOfTravel})



# Error handling

## Error handling

### Clarification prompts

e.g. Sorry, can you please repeat that?



Sorry, can you please repeat that?



### Maximum number of retries

5

### Hang-up phrase

e.g. Sorry, I could not understand. Please contact customer support.



Sorry, I could not understand. Goodbye.





# Publish the bot

Publish OrderTicket

Your bot is published! You can now connect to your mobile app or continue to chatbot deployment.

Bot Name	OrderTicket
Bot Version	1
Alias	OrderTicket

**What to do next?**

Here are some resources to help you progress once your bot is published.

[How to connect to your mobile app](#)  
Learn how to connect to your bot to your mobile app.  
[Download connection info](#)

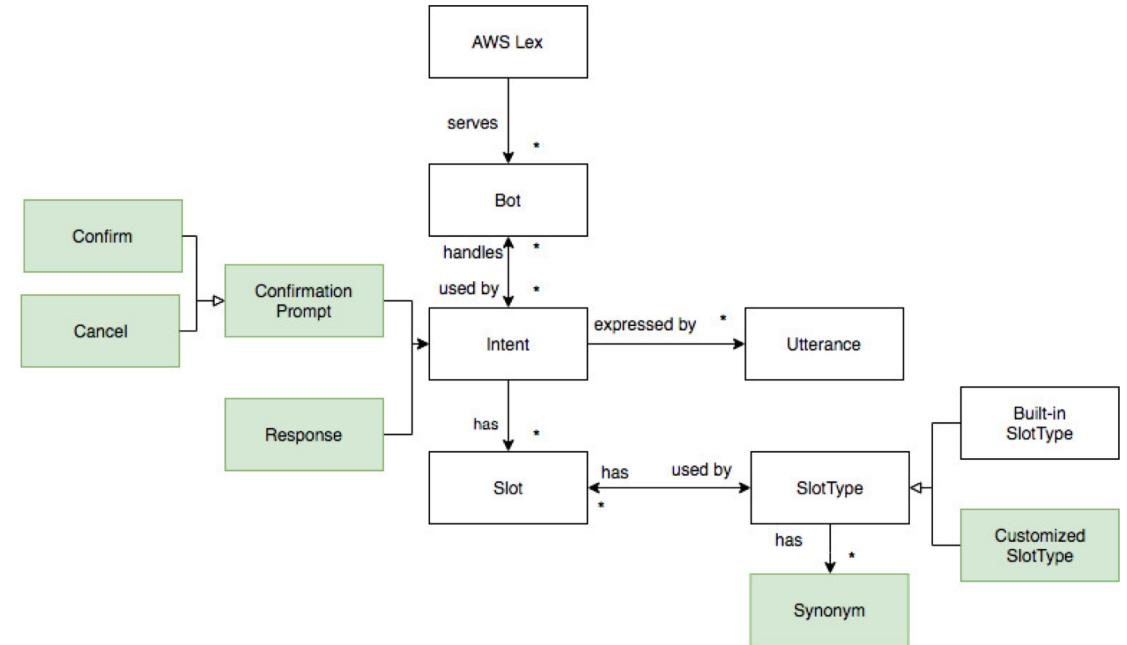
[Integrate with Mobile hub.](#)  
Please create a project and choose the Conversational Bots feature in Mobile Hub

[How to deploy your bot to other services](#)  
Learn how to deploy your bot to other services like Facebook Messenger, Slack, Twilio, and Kik.  
[Go to channels](#)

[Close](#)

## Part 2 - Summary

- We are able to:
  - provide proper from / to SKM stations
  - ask for the final confirmation of the customer intent
  - Provide final message (SKM url)
  - handle errors
- BUT
  - Customer may provide the same from and to stations
  - The final url is not correct (date format)





## Part 3 – Building even more useful bot

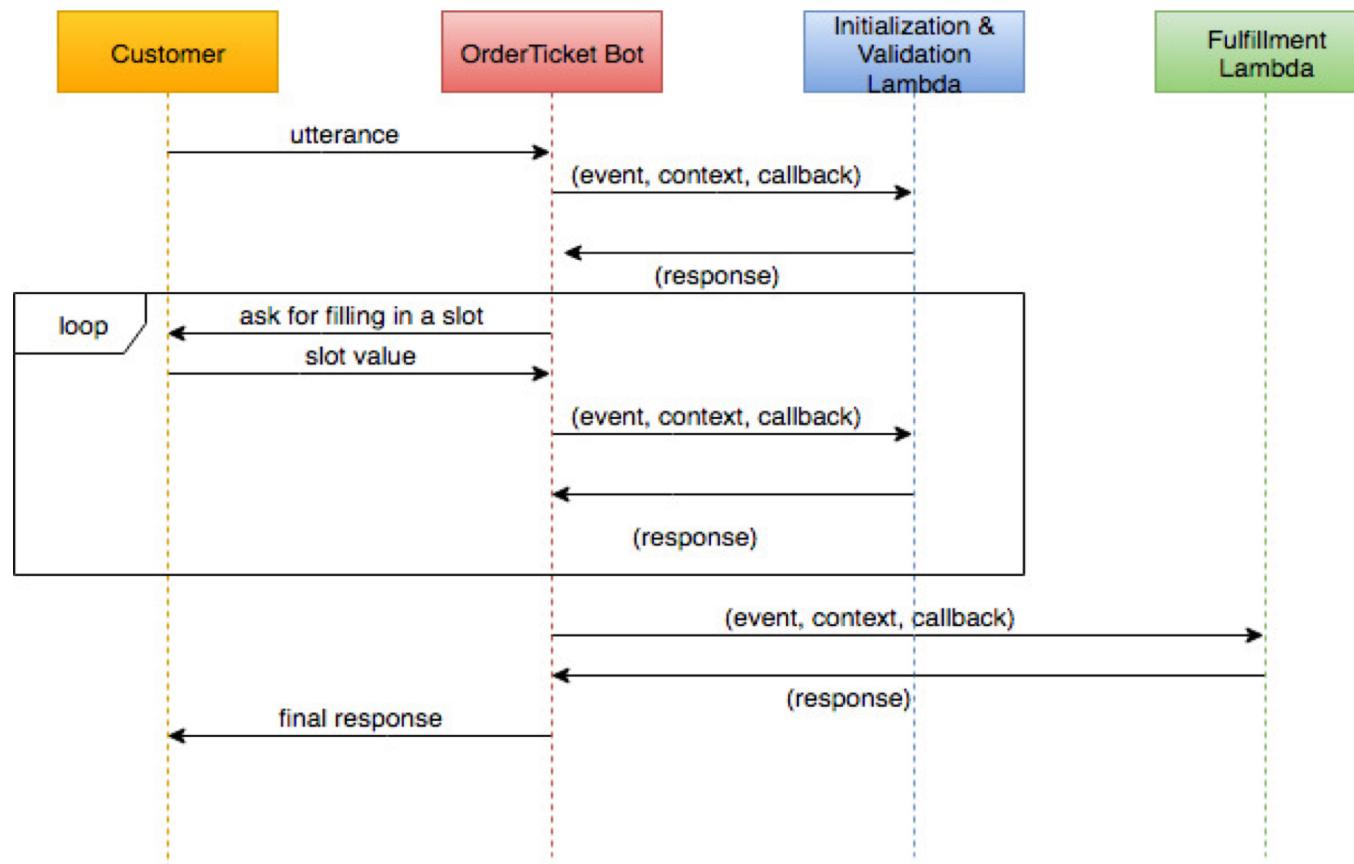
Advanced validation (lambda)

Advanced response formatting (lambda)

Deploy a demo application



# Lex Bot Interaction Model



# Lex Data Structures - Input

- CurrentIntent
  - Slots – if not filled in → empty
- Bot metadata
- Request metadata
- Session attributes
- Request attributes

```
{
  "currentIntent": {
    "name": "intent-name",
    "slots": {
      "slot name": "value",
      "slot name": "value"
    },
    "slotDetails": {
      "slot name": {
        "resolutions" : [
          { "value": "resolved value" },
          { "value": "resolved value" }
        ],
        "originalValue": "original text"
      },
      "slot name": {
        "resolutions" : [
          { "value": "resolved value" },
          { "value": "resolved value" }
        ],
        "originalValue": "original text"
      }
    },
    "confirmationStatus": "None, Confirmed, or Denied (intent confirmation, if configured)"
  },
  "bot": {
    "name": "bot name",
    "alias": "bot alias",
    "version": "bot version"
  },
  "userId": "User ID specified in the POST request to Amazon Lex.",
  "inputTranscript": "Text used to process the request",
  "invocationSource": "FulfillmentCodeHook or DialogCodeHook",
  "outputDialogMode": "Text or Voice, based on ContentType request header in runtime API request",
  "messageVersion": "1.0",
  "sessionAttributes": {
    "key": "value",
    "key": "value"
  },
  "requestAttributes": {
    "key": "value",
    "key": "value"
  }
}
```

# Lex Data Structures - Output

- (selected) Dialog actions
  - Close – not expecting a response from the user
  - ConfirmIntent
  - Delegate – continue conversation with the user
  - ElicitSlot – the user is expected to provide a value for a given slot

```
{  
    "sessionAttributes": {  
        "key1": "value1",  
        "key2": "value2"  
        ...  
    },  
    "dialogAction": {  
        "type": "ElicitIntent, ElicitSlot, ConfirmIntent, Delegate, or Close",  
        Full structure based on the type field. See below for details.  
    }  
}
```



# Lambda function implemented in Node.js

- Handler – the method in Lambda function that processes events
  - Types
    - Async handler
    - Non-async handler (recommended by [Lex](#))
  - Inputs
    - Event – chatbot data compliant with the Lex input structure
    - Callback – a handler to call Lex
  - Output
    - Chatbot command and other chatbot data compliant with the Lex output structure



# Create a Lambda function

The screenshot shows the AWS Lambda service page. At the top, there's a navigation bar with 'Services' and 'Resource Groups'. Below it is a sidebar with links like 'Console Home', 'History', 'Lambda', 'Amazon Lex', 'Amazon SageMaker', 'S3', and 'EC2'. The main area is titled 'Lambda' and contains several service links: 'Lambda' (Run Code without Thinking about Servers), 'Amazon Lex' (Build Voice and Text Chatbots), 'CodeBuild' (Build and Test Code), and 'IoT 1-Click' (Trigger AWS Lambda functions from simple devices). At the bottom right of this section is a large orange 'Create function' button. Below this, another 'Create function' button is located on the Lambda service page itself.

This screenshot shows the 'Create function' wizard. The title is 'Create function' with an 'Info' link. A sub-instruction says 'Choose one of the following options to create your function.' There are two options: 'Author from scratch' (selected, indicated by a blue border and a radio button) and 'Import code from GitHub'. The 'Author from scratch' section includes a 'Hello World' example icon and a brief description: 'Start with a simple Hello World example.' Below this is a 'Basic information' section with fields for 'Function name' (containing 'OrderTicketValidation'), 'Runtime' (set to 'Node.js 10.x'), and 'Permissions' (with a note about creating an execution role).



# Initialization and validation using Lambda OrderTicketValidation

- Step 1 - Import lambda function – OrderTicketValidation.zip
- Step 2 – analyze validation rule for checking from/to stations
  - Get the request
  - Get *fromStation* slot value (empty)
  - Get *toStation* slot value (empty)
  - Compare from/to stations
  - Return proper action
    - Delegate – if everything is OK
    - ElicitSlot – if *toStation* slot needs to be corrected
- Step 3 – test the function



To import lambda code of this function – use [this file](#).  
Tests can be imported separately – they are available [here](#).

▼ Lambda initialization and validation ⓘ

Initialization and validation code hook

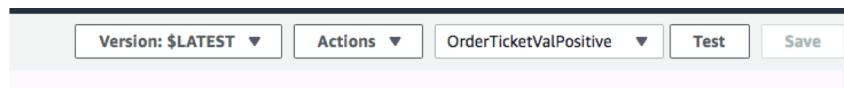
Lambda function OrderTicketValidation ▾

[View in Lambda console](#) ↗

Version or alias Latest ▾

# Test the function

- Provide input with slots
- Verify the result



### OrderTicketValidation:\$LATEST

Execution result: succeeded ([logs](#))

Details

The area below shows the result returned by your function execution.

```
{
  "sessionAttributes": {},
  "dialogAction": {
    "type": "Delegate",
    "slots": {
      "fromStation": "gdansk-glowny",
      "toStation": "gdynia"
    }
  }
}
```

Configure test event X

A function can have up to 10 test events. The events are persisted so you can switch to another computer or web browser and test your function with the same events.

Create new test event  
 Edit saved test events

Saved test event G

OrderTicketValPositive

```

1 - {
2   "messageVersion": "1.0",
3   "invocationSource": "DialogCodeHook",
4   "userId": "John",
5   "sessionAttributes": {},
6   "bot": {
7     "name": "OrderTicket",
8     "alias": "$LATEST",
9     "version": "$LATEST"
10 },
11 "outputDialogMode": "Text",
12 "currentIntent": {
13   "name": "OrderTicketIntent",
14   "slots": {
15     "fromStation": "gdansk-glowny",
16     "toStation" : "gdynia"
17   },
18   "confirmationStatus": "None"
19 }
20 }
```

Delete Cancel Save



# Formatting the result using Lambda OrderTicketFulfillment

To order SKM ticket we need to generate proper url, an example:

[https://bilety.skm.pkpl/en/search/gdansk-glowny/gdansk-wrzeszcz/26-06-2019\\_18:00](https://bilety.skm.pkpl/en/search/gdansk-glowny/gdansk-wrzeszcz/26-06-2019_18:00)

The expected pattern:

`https://bilety.skm.pkpl/en/search/<fromStation>/<toStation>/<DD>-<MM>-<YYYY>_<HH:MI>`

Fulfillment

AWS Lambda function    Return parameters to client

Lambda function: OrderTicketFulfillment

View in Lambda console

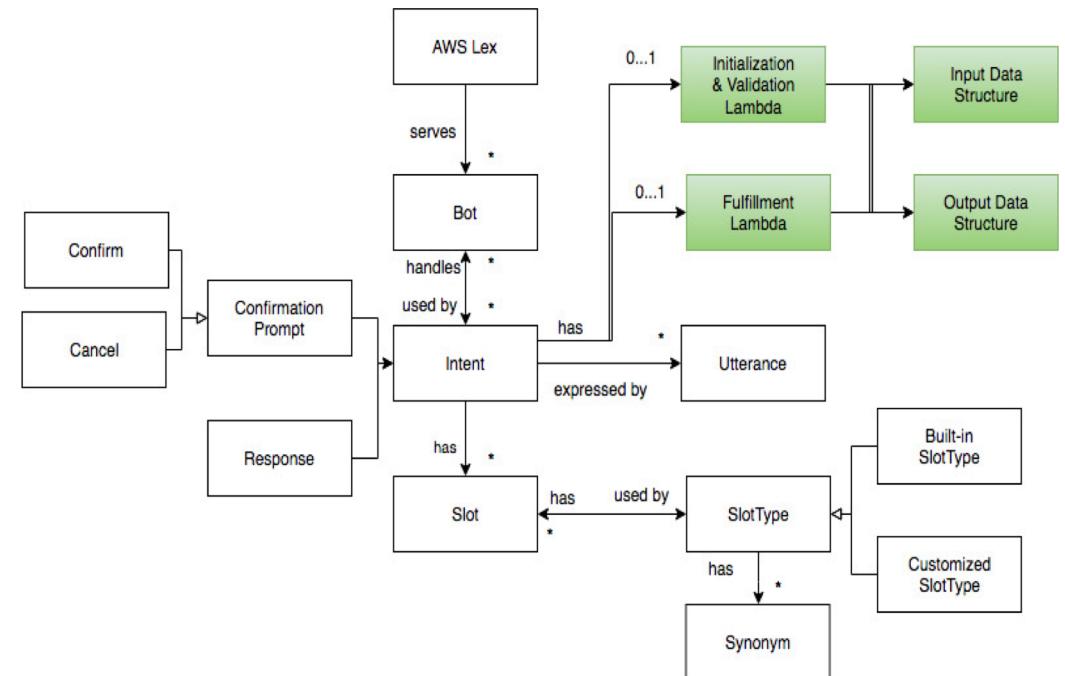
Version or alias: Latest



To import lambda code of this function – use [this file](#).  
Tests can be imported separately – they are available [here](#).

## Part 3 - Summary

- We are able to
  - Provide data and validate them
  - Get proper url that routes us to SKM web page
- BUT
  - This work for a single ticket only
  - Still there are many parts of ticket ordering which have to be done manually





# CloudFormation - Deploy a WebUI application

## Create stack

**Prerequisite - Prepare template**

**Prepare template**  
Every stack is based on a template. A template is a JSON or YAML file that contains configuration information about the AWS resources you want to include in the stack.

Template is ready    Use a sample template    Create template in Designer

**Specify template**  
A template is a JSON or YAML file that describes your stack's resources and properties.

**Template source**  
Selecting a template generates an Amazon S3 URL where it will be stored.

Amazon S3 URL    Upload a template file

Amazon S3 URL  
`https://s3.amazonaws.com/aws-bigdata-blog/artifacts/aws-lex-web-ui/artifacts/templates/master.yaml`

Amazon S3 template URL  
`S3 URL: https://s3.amazonaws.com/aws-bigdata-blog/artifacts/aws-lex-web-ui/artifacts/templates/master.yaml`

[View in Designer](#)

**Lex Bot Configuration Parameters**

**BotName**  
Name of an existing Lex Bot to be used by the v  
`OrderTicket`

**WebAppConfBotInitialText**  
First bot message displayed in the chatbot UI  
`You can ask me for help ordering a SKM ticket. Just type "Buy tickets" or click on the mic and say it.`

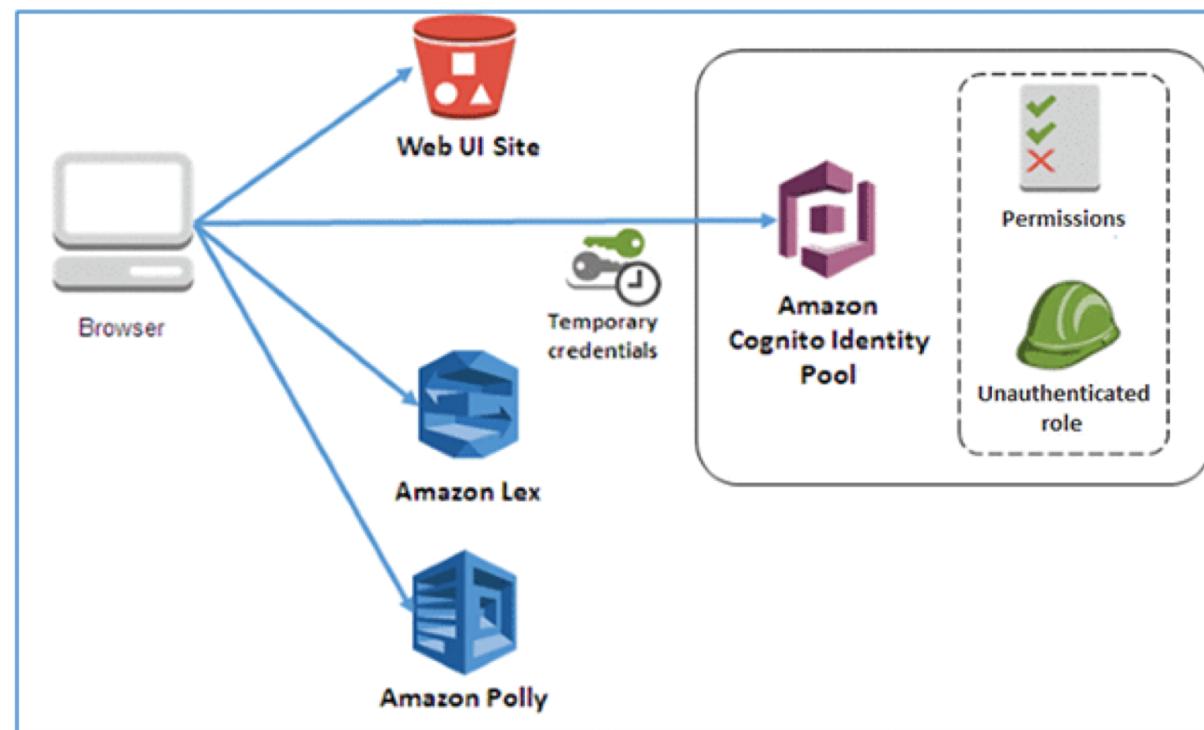
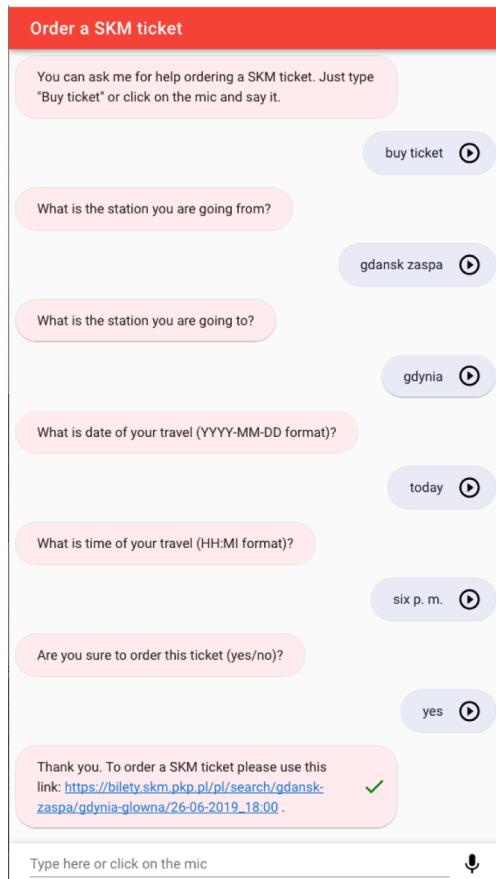
**WebAppConfBotInitialSpeech**  
Message spoken by bot when the microphone is first pressed in a conversation  
`Say 'Buy tickets' to get started.`

**WebAppConfToolbarTitle**  
Title displayed in the chatbot UI toolbar  
`Order a SKM ticket`



A preconfigured template is available [here](#).

# Demo - voice and textual interfaces





## Part 3 - Summary

- We are able to:
  - Understand the intent and all required slots
  - Validate the provided slots
  - Provide final message (SKM url)
  - Handle errors
- BUT
  - We do not cope with other types of train tickets (e.g. seasons tickets)
  - We do not have a mobile interface
  - ...

BUT for today – the plan we had for this workshop has been implemented ☺



# Amazon Development Center in Gdańsk

## We are hiring!

Currently, there are 15 positions open on Software Development

- Software Development Engineers
- Technical Program Managers
- Check this page [Amazon Hiring page](#)

Showing 1 - 10 of 15 jobs

Sort by: Most relevant ▾

Job Title	Posted	Details
Graduate Software Development Engineer - Poland (Gdansk)	September 12, 2018 (Updated 4 months ago)	PL, Gdansk   Job ID: 716653 SDE Graduate At Amazon, we are working to be the most customer-centric company on earth. To get there, we need exceptionally talented, bright, and driven people. Amazon is continually evolving and is... <a href="#">Read more</a>
Speech Scientist	December 17, 2018 (Updated 20 days ago)	PL, Gdansk   Job ID: 765492 As a speech scientist, you will work with talented peers to develop novel algorithms and modelling techniques to advance the "state-of-the-art" in spoken language generation. Your work will directly impact... <a href="#">Read more</a>
Senior Software Development Engineer	June 4, 2019 (Updated 22 days ago)	PL, Gdansk   Job ID: 870438 Want to work on one of the coolest and most innovative pieces of technology in the recent years? We built the Amazon Alexa, the Amazon cloud service that powers devices such as Amazon Echo, FireTV, Amazon... <a href="#">Read more</a>
Software Development Engineer	May 17, 2019 (Updated 9 days ago)	PL, Gdansk   Job ID: 860899 Amazon Development Center Poland is the place where we build the state-of-the-art Text-to-



Thank you for your attention