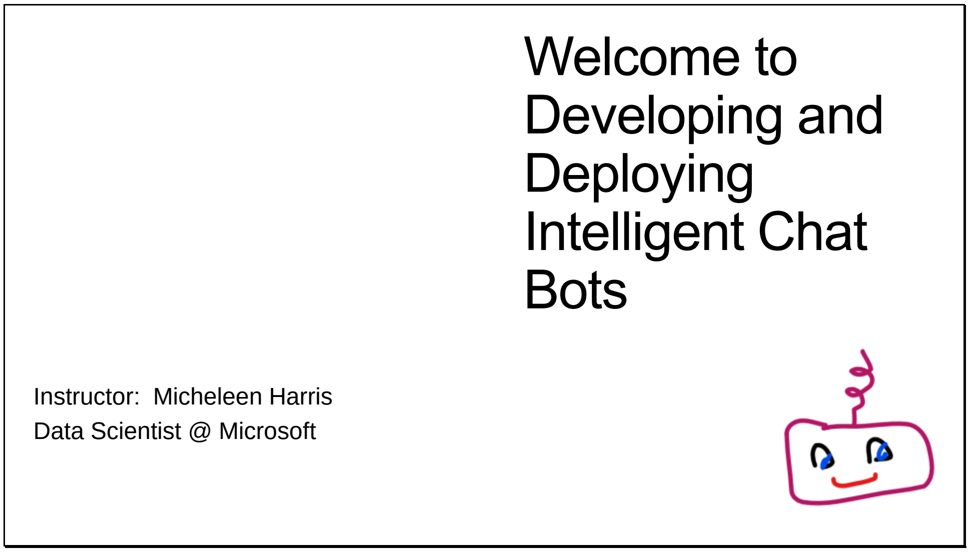
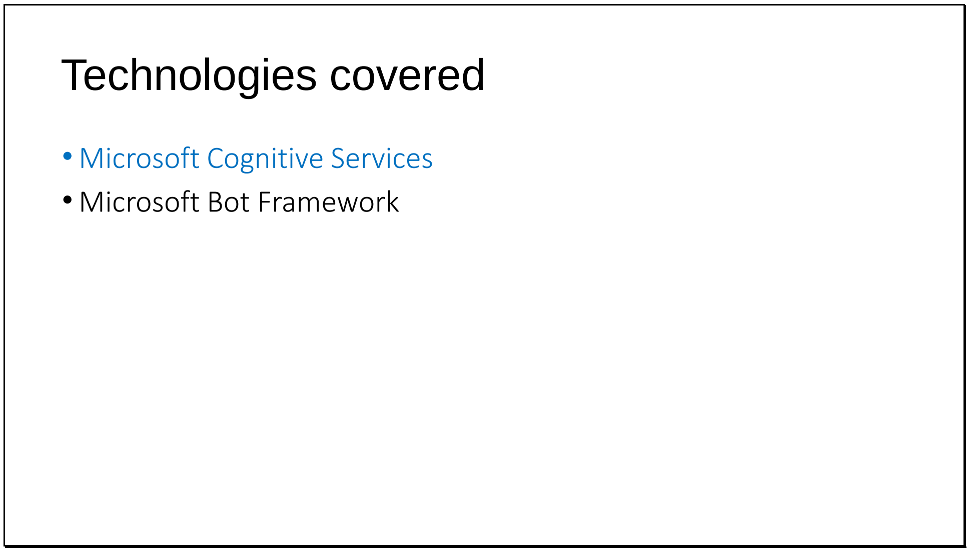
Slide 1



Welcome to Developing and Deploying Intelligent Chat Bots

Instructor: Micheleen Harris
Data Scientist @ Microsoft

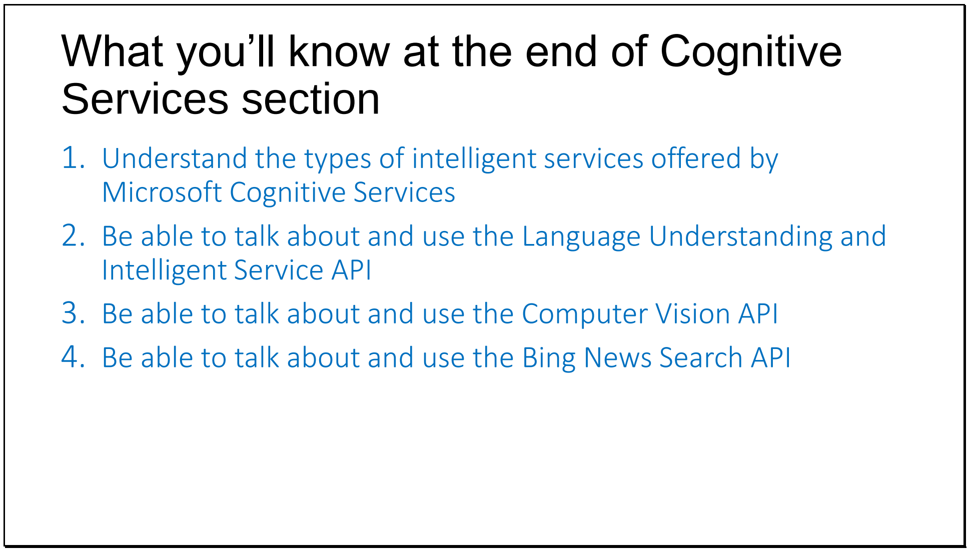
Slide 2



Technologies covered

- Microsoft Cognitive Services
- Microsoft Bot Framework

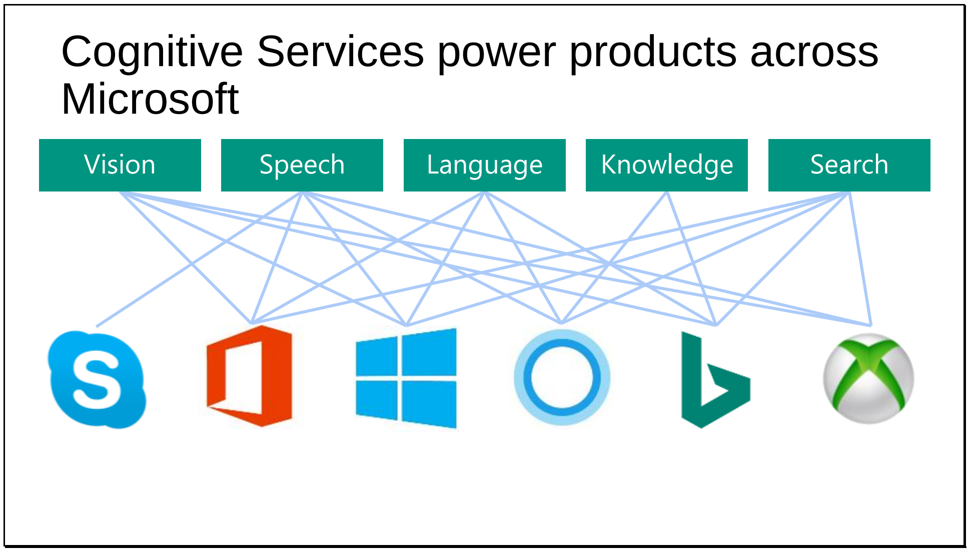
Slide 3



What you'll know at the end of Cognitive Services section

1. Understand the types of intelligent services offered by Microsoft Cognitive Services
2. Be able to talk about and use the Language Understanding and Intelligent Service API
3. Be able to talk about and use the Computer Vision API
4. Be able to talk about and use the Bing News Search API

Slide 4



Cognitive Services power products across Microsoft

Vision

Speech

Language

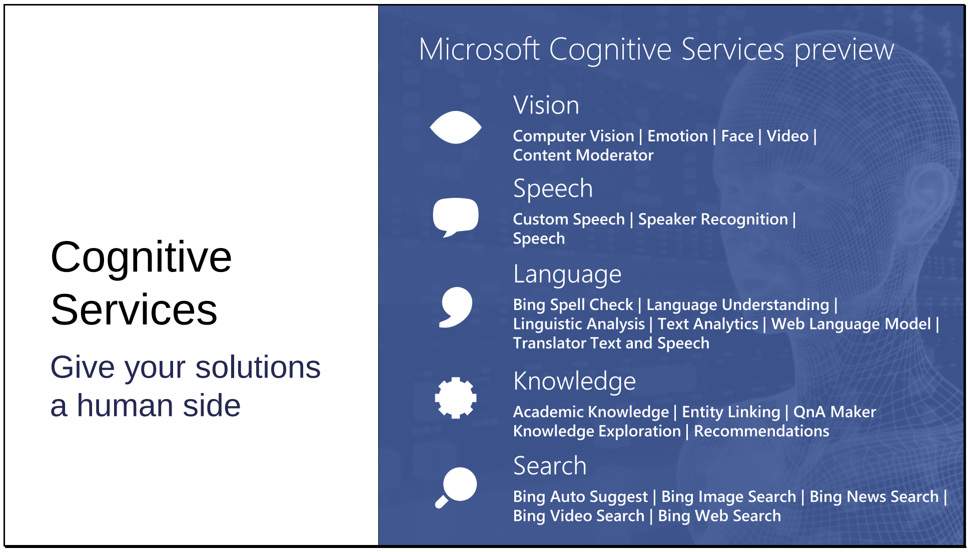
Knowledge

Search

Cognitive Services are coming out of as well as being consumed by groups across Microsoft including our products as well as Microsoft Research and engineering

e.g. Text Analytics under Language has come from engineers in Azure – Microsoft’s cloud offering
e.g. the Knowledge Exploration Service for building custom knowledge bases has come out of Microsoft Research
e.g. Speech to text has come out of Bing

Slide 5



Cognitive Services

Give your solutions a human side

Microsoft Cognitive Services preview

Vision

Computer Vision | Emotion | Face | Video | Content Moderator

Speech

Custom Speech | Speaker Recognition | Speech

Language

Bing Spell Check | Language Understanding | Linguistic Analysis | Text Analytics | Web Language Model | Translator Text and Speech

Knowledge

Academic Knowledge | Entity Linking | QnA Maker Knowledge Exploration | Recommendations

Search

Bing Auto Suggest | Bing Image Search | Bing News Search | Bing Video Search | Bing Web Search

At Microsoft, we've been offering APIs for a very long time across the company. In delivering Microsoft Cognitive Services API, we started with 4 at /build (2015); added 7 more December 2015, and today we have 24 APIs in our collection.

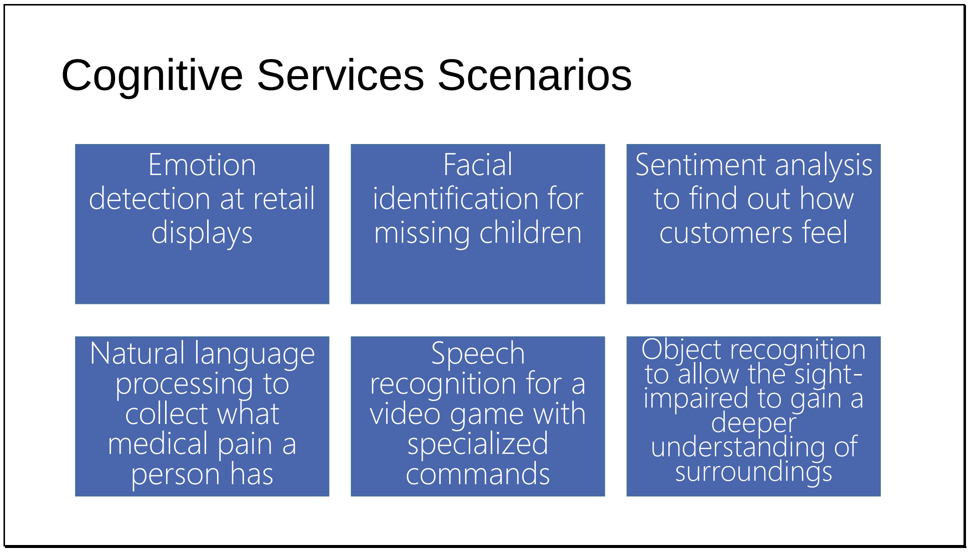
Cognitive Services are available individually or as a part of the Cortana Intelligence Suite, formerly known as Cortana Analytics, which provides a comprehensive collection of services powered by cutting-edge research into machine learning, perception, analytics and social bots.

These APIs are powered by Microsoft Azure.

Developers and businesses can use this suite of services and tools to create apps that learn about our world and interact with people and customers in personalized, intelligent ways.

Some great scenarios for all of the cognitive services can be found on this wiki: https://github.com/Azure/bot-education/wiki/Cognitive-Services-Scenarios

Slide 6

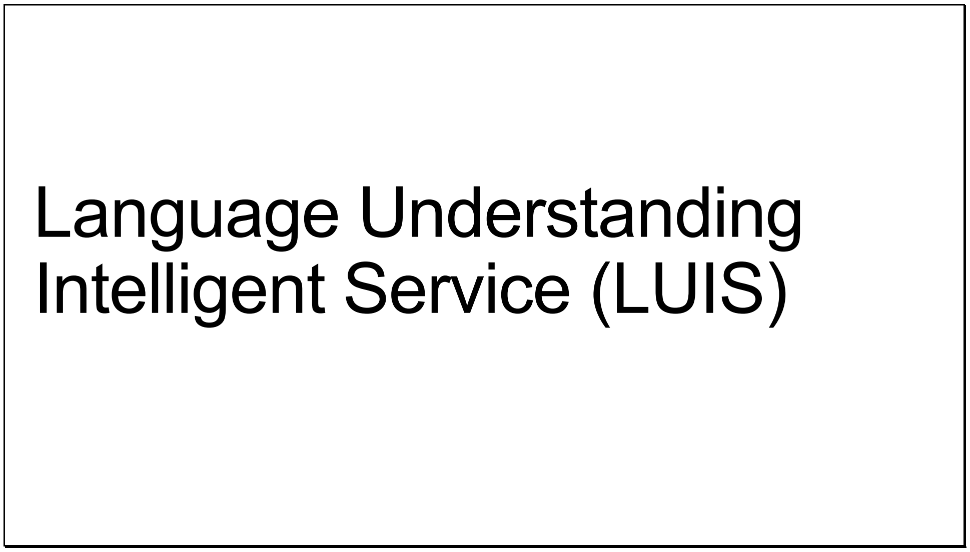


Cognitive Services Scenarios

- Emotion detection at retail displays
- Facial identification for missing children
- Sentiment analysis to find out how customers feel
- Natural language processing to collect what medical pain a person has
- Speech recognition for a video game with specialized commands
- Object recognition to allow the sight-impaired to gain a deeper understanding of surroundings

Slide 7

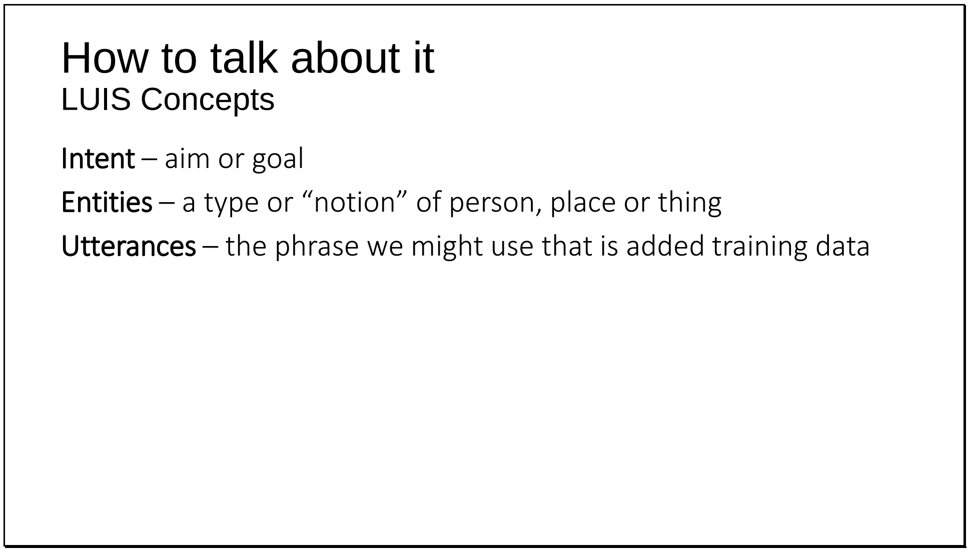
Slide 8



Language Understanding Intelligent Service (LUIS)

https://www.microsoft.com/cognitive-services/en-us/language-understanding-intelligent-service-luis

Slide 9



How to talk about it

LUIS Concepts

Intent – aim or goal

Entities – a type or “notion” of person, place or thing

Utterances – the phrase we might use that is added training data

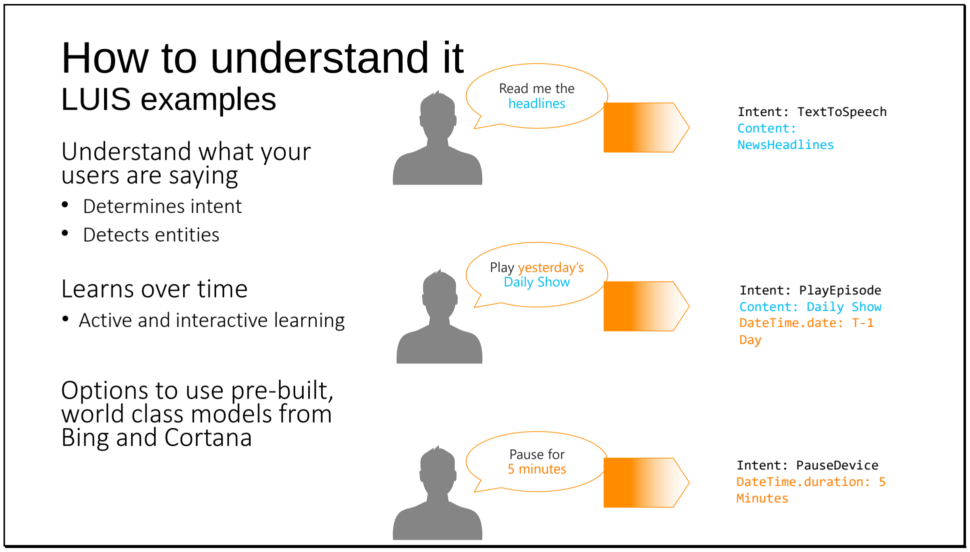
Example:
intent – find news on topic and possibly share with another person
entities - We'd like to be able to say what kind of news we are interested in, and also, for sharing, to say who we'd like to share a story with. In order to capture the notion of a news topic, and a recipient for sharing, let's create two entity types: "Topic" and "Recipient".
Utterence – “Get me the news on electric cars and share with Merinda”

We currently support (3/28/2017):

30 entities per application
80 intents per application

Over 2000 utterances per application.

Slide 10



How to understand it

LUIS examples

Understand what your users are saying

- Determines intent
- Detects entities

Learns over time

- Active and interactive learning

Options to use pre-built, world class models from Bing and Cortana

Read me the headlines

```
Intent: TextToSpeech
Content:
NewsHeadlines
```

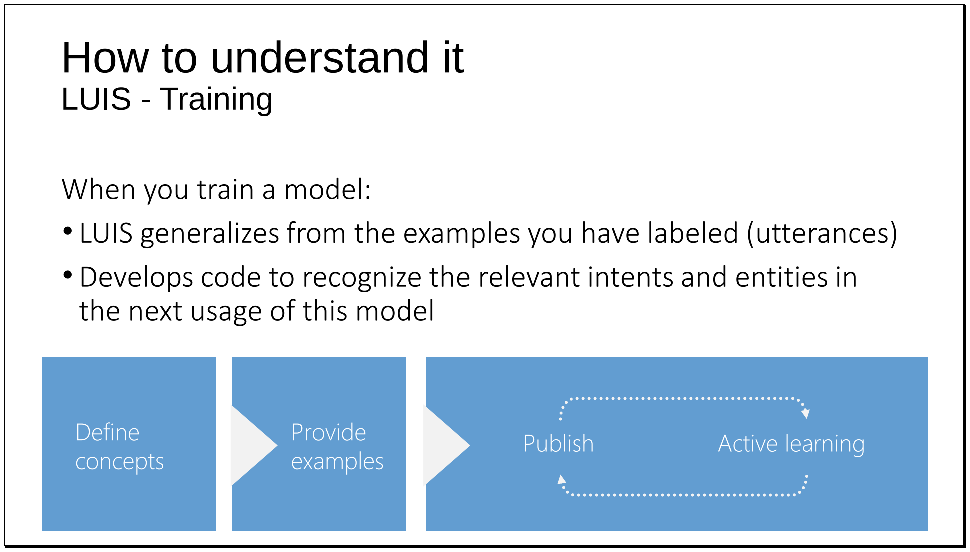
Play yesterday's Daily Show

```
Intent: PlayEpisode
Content: Daily Show
DateTime.date: T-1
Day
```

Pause for 5 minutes

```
Intent: PauseDevice
DateTime.duration: 5
Minutes
```

Slide 11



How to understand it

LUIS - Training

When you train a model:

- LUIS generalizes from the examples you have labeled (utterances)
- Develops code to recognize the relevant intents and entities in the next usage of this model

Define concepts

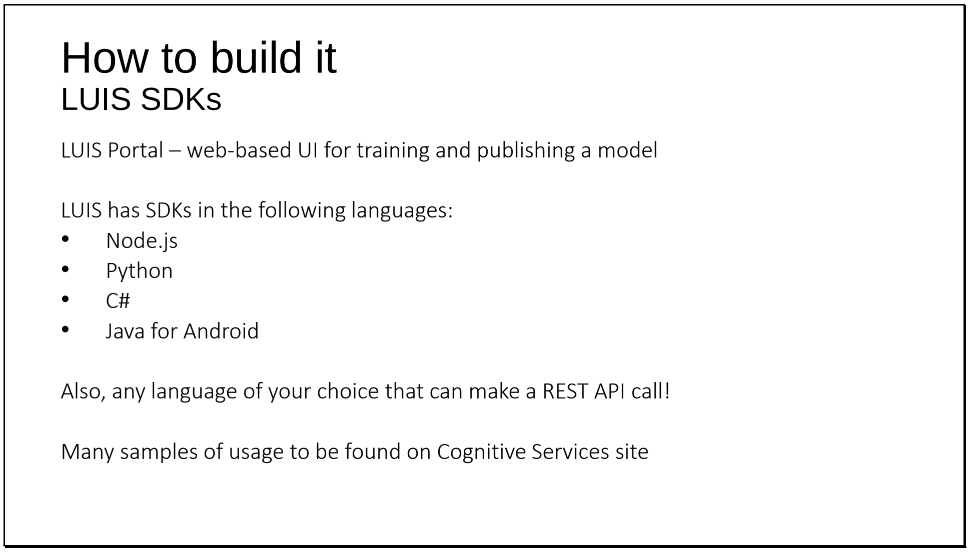
Provide examples

Publish

Active learning

Internally, LUIS uses logistic regression classifiers to determine intents, and conditional random fields (CRFs) to determine the entities. The training process results in optimized classifiers and CRFs, referred to as models, that LUIS can use in the future.

Slide 12



How to build it
LUIS SDKs

LUIS Portal – web-based UI for training and publishing a model

LUIS has SDKs in the following languages:

- Node.js
- Python
- C#
- Java for Android

Also, any language of your choice that can make a REST API call!

Many samples of usage to be found on Cognitive Services site

Note on Utterances
If you have unlabeled utterances that your application should handle, they will be available when you edit the application under the "Search" and "Suggest" tabs.

Can link intents to actions in your custom code (consuming the API)

Exporting LUIS app
Can download your work into a JSON file. This lets you share you application with other developers, or check your LUIS application into your version control.

Pre-Built:
LUIS also provides access to pre-built LUIS applications that use many of the same models found in Microsoft Cortana.

SDKs
https://github.com/Microsoft/Cognitive-LUIS-Node.js
https://github.com/Microsoft/Cognitive-LUIS-Python
https://github.com/Microsoft/Cognitive-LUIS-Windows
https://github.com/Microsoft/Cognitive-LUIS-Android

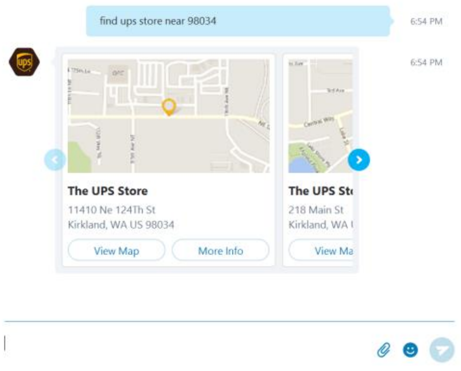
SDK/Samples site:

https://www.microsoft.com/cognitive-services/en-us/SDK-Sample

Slide 13

How to consume it

LUIS API scenario



find ups store near 98034 6:54 PM

6:54 PM

The UPS Store
11410 Ne 124Th St
Kirkland, WA US 98034

The UPS St
218 Main St
Kirkland, WA

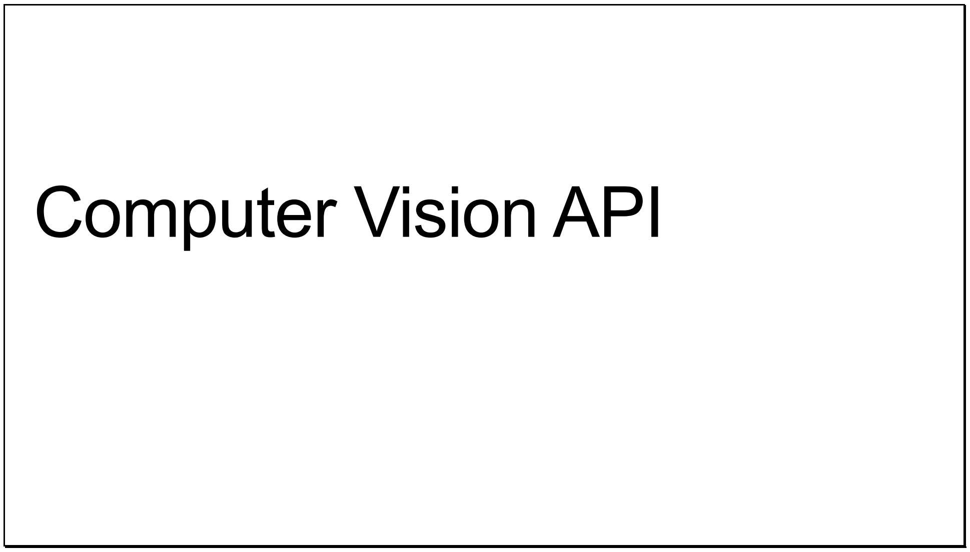
Use a bot to find UPS locations or track your UPS package…

UPS Bot – uses natural language to help a user find what they need along with other APIs
https://bots.botframework.com/bot?id=UPSBot

More
Bot: (Node.js) https://github.com/Microsoft/BotBuilder-Samples/tree/master/Node/intelligence-LUIS
Bot: (C#) https://github.com/Microsoft/BotBuilder-Samples/tree/master/CSharp/intelligence-LUIS
Cognitive Services site demo: https://www.microsoft.com/cognitive-services/en-us/language-understanding-intelligent-service-luis
See LUIS help at https://luis.ai for more

Slide 14

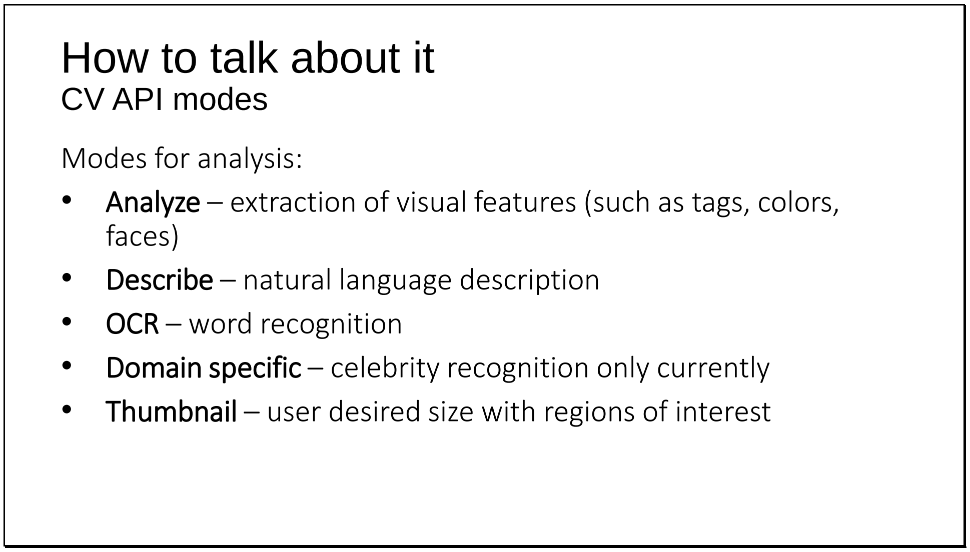
Slide 15



Computer Vision API

https://www.microsoft.com/cognitive-services/en-us/computer-vision-api

Slide 16



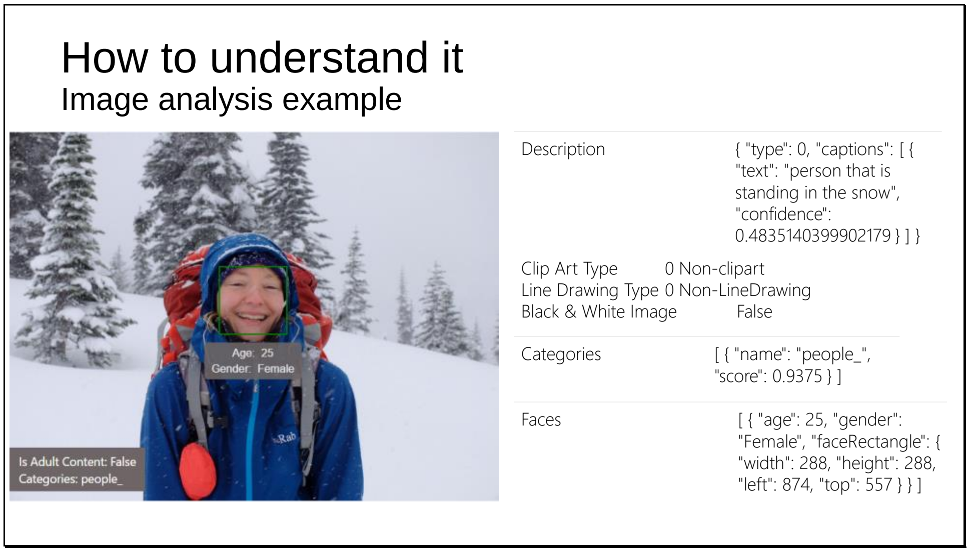
How to talk about it
CV API modes

Modes for analysis:

- **Analyze** – extraction of visual features (such as tags, colors, faces)
- **Describe** – natural language description
- **OCR** – word recognition
- **Domain specific** – celebrity recognition only currently
- **Thumbnail** – user desired size with regions of interest

https://www.microsoft.com/cognitive-services/en-us/Computer-Vision-API/documentation -> details in API Reference

Slide 17



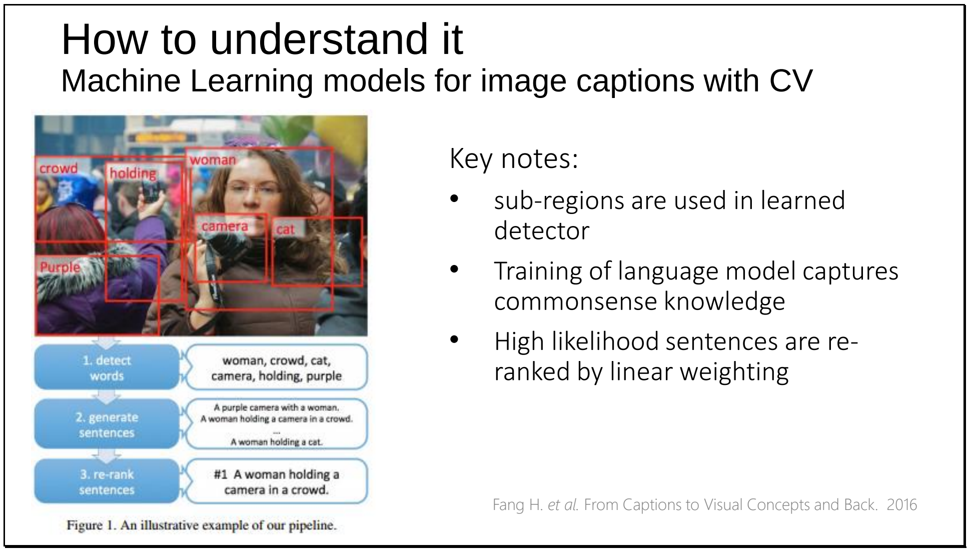
How to understand it

Image analysis example

Description	{ "type": 0, "captions": [{ "text": "person that is standing in the snow", "confidence": 0.4835140399902179 }] }
Clip Art Type	0 Non-clipart
Line Drawing Type	0 Non-LineDrawing
Black & White Image	False
Categories	[{ "name": "people_", "score": 0.9375 }]
Faces	[{ "age": 25, "gender": "Female", "faceRectangle": { "width": 288, "height": 288, "left": 874, "top": 557 } }]

Image analyzed with the demo found at https://www.microsoft.com/cognitive-services/en-us/computer-vision-api

Slide 18



How to understand it

Machine Learning models for image captions with CV

crowd
holding
woman
camera
cat
Purple
1. detect words
woman, crowd, cat, camera, holding, purple
2. generate sentences
A purple camera with a woman.
A woman holding a camera in a crowd.
...
A woman holding a cat.
3. re-rank sentences
#1 A woman holding a camera in a crowd.

Figure 1. An illustrative example of our pipeline.

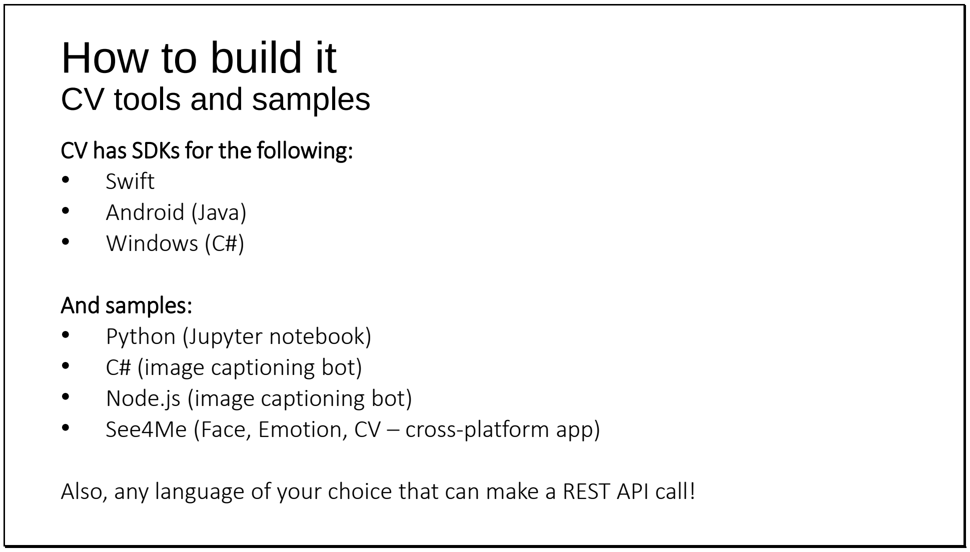
Key notes:

- sub-regions are used in learned detector
- Training of language model captures commonsense knowledge
- High likelihood sentences are re-ranked by linear weighting

Fang H. *et al.* From Captions to Visual Concepts and Back. 2016

See paper here: https://www.microsoft.com/en-us/research/wp-content/uploads/2016/02/CVPR15_0866.pdf

Slide 19



How to build it
CV tools and samples

CV has SDKs for the following:

- Swift
- Android (Java)
- Windows (C#)

And samples:

- Python (Jupyter notebook)
- C# (image captioning bot)
- Node.js (image captioning bot)
- See4Me (Face, Emotion, CV – cross-platform app)

Also, any language of your choice that can make a REST API call!

SDKs:
https://github.com/DanilaVladi/Microsoft-Cognitive-Services-Swift-SDK
https://github.com/Microsoft/Cognitive-vision-android
https://github.com/Microsoft/Cognitive-vision-windows

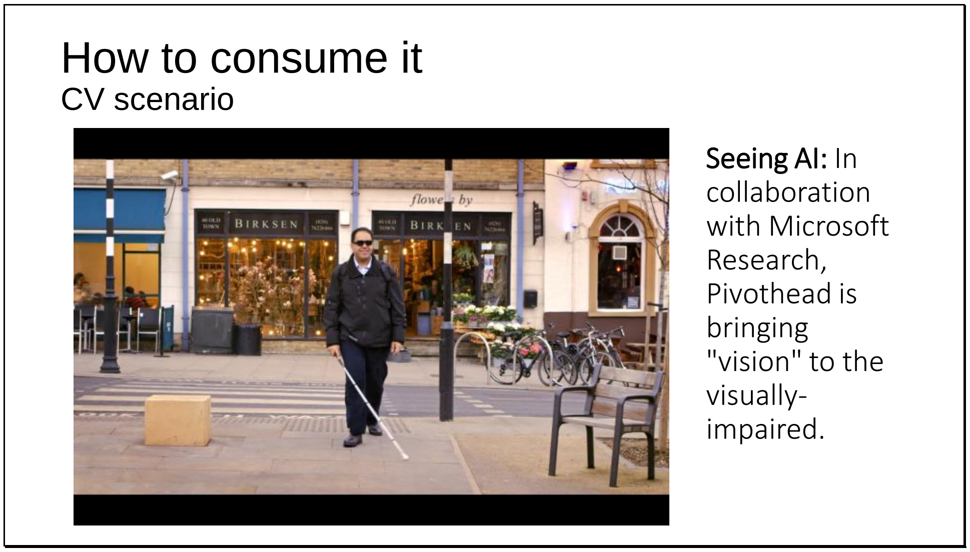
Notebook:
https://github.com/Microsoft/Cognitive-vision-python

Bots:
https://github.com/Microsoft/BotBuilder-Samples/tree/master/Node/intelligence-ImageCaption
https://github.com/Microsoft/BotBuilder-Samples/tree/master/CSharp/intelligence-ImageCaption

See4Me:
https://github.com/DotNetToscana/See4Me

Demos also on CV landing page at: https://www.microsoft.com/cognitive-services/en-us/computer-vision-api

Slide 20



How to consume it

CV scenario

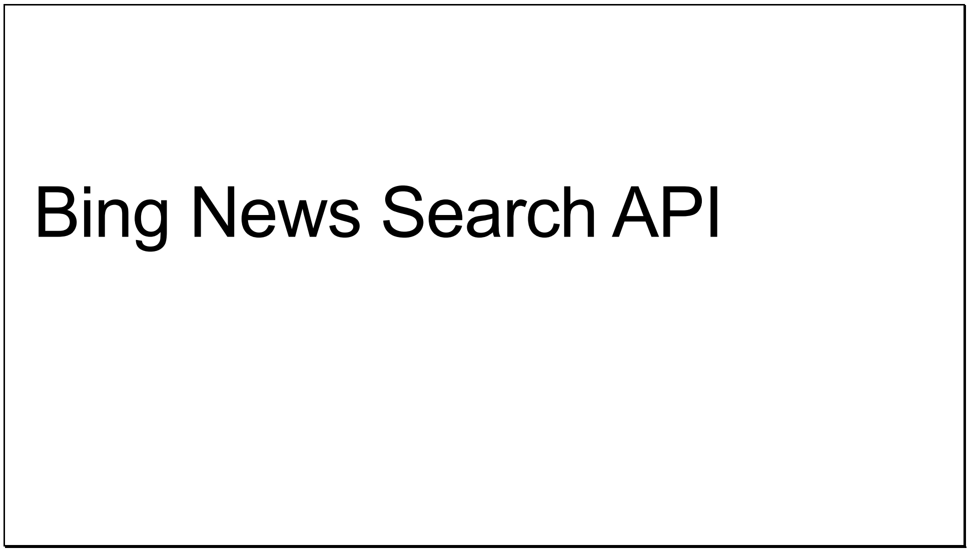
Seeing AI: In collaboration with Microsoft Research, Pivothead is bringing "vision" to the visually-impaired.

By combining APIs from Microsoft Cognitive Services with the imaging performance and power of Pivothead SMART, a person who is visually-impaired can better understand who and what is going on around them.

http://www.pivothead.com/seeingai/

Slide 21

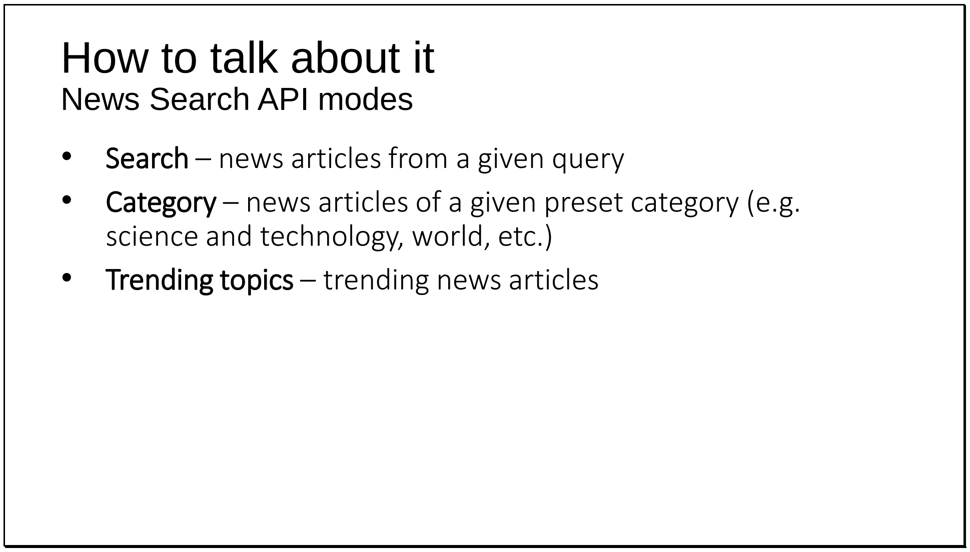
Slide 22



Bing News Search API

https://www.microsoft.com/cognitive-services/en-us/bing-news-search-api

Slide 23

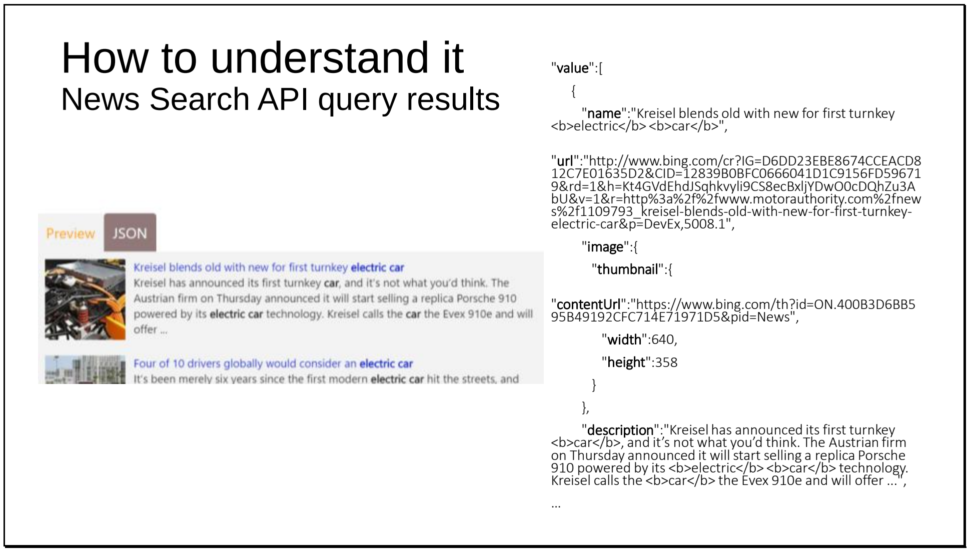


How to talk about it

News Search API modes

- **Search** – news articles from a given query
- **Category** – news articles of a given preset category (e.g. science and technology, world, etc.)
- **Trending topics** – trending news articles

Slide 24



How to understand it

News Search API query results

Kreisel blends old with new for first turnkey electric car
Kreisel has announced its first turnkey **car**, and it's not what you'd think. The Austrian firm on Thursday announced it will start selling a replica Porsche 910 powered by its **electric car** technology. Kreisel calls the **car** the Evex 910e and will offer ...

Four of 10 drivers globally would consider an electric car
It's been merely six years since the first modern **electric car** hit the streets, and

```
"value":[
    {
        "name":"Kreisel blends old with new for first turnkey
<b>electric</b> <b>car</b>",

"url":"http://www.bing.com/cr?IG=D6DD23EBE8674CCEACD8
12C7E01635D2&CID=12839B0BFC0666041D1C9156FD59671
9&rd=1&h=Kt4GVdEhdJSqhkvyli9CS8ecBxljYDwO0cDQhZu3A
bU&v=1&r=http%3a%2f%2fwww.motorauthority.com%2fnew
s%2f1109793_kreisel-blends-old-with-new-for-first-turnkey-
electric-car&p=DevEx,5008.1",
        "image":{
          "thumbnail":{

"contentUrl":"https://www.bing.com/th?id=ON.400B3D6BB5
95B49192CFC714E71971D5&pid=News",
            "width":640,
            "height":358
          }
        },
        "description":"Kreisel has announced its first turnkey
<b>car</b>, and it’s not what you’d think. The Austrian firm
on Thursday announced it will start selling a replica Porsche
910 powered by its <b>electric</b> <b>car</b> technology.
Kreisel calls the <b>car</b> the Evex 910e and will offer ...",
...
```

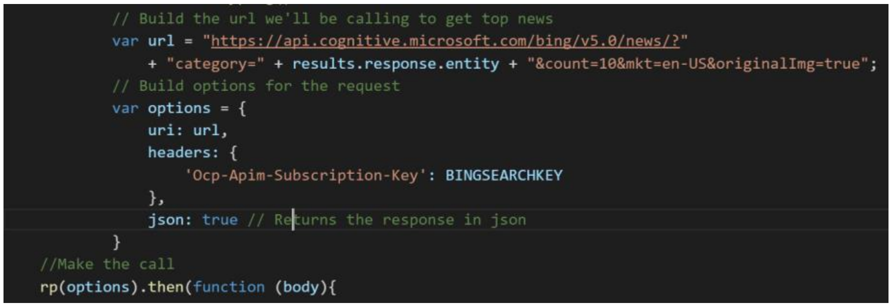
Search the web for news articles. Results include details like authoritative image of the news article, related news and categories, provider info, article URL, and date added.

Slide 25

How to build it

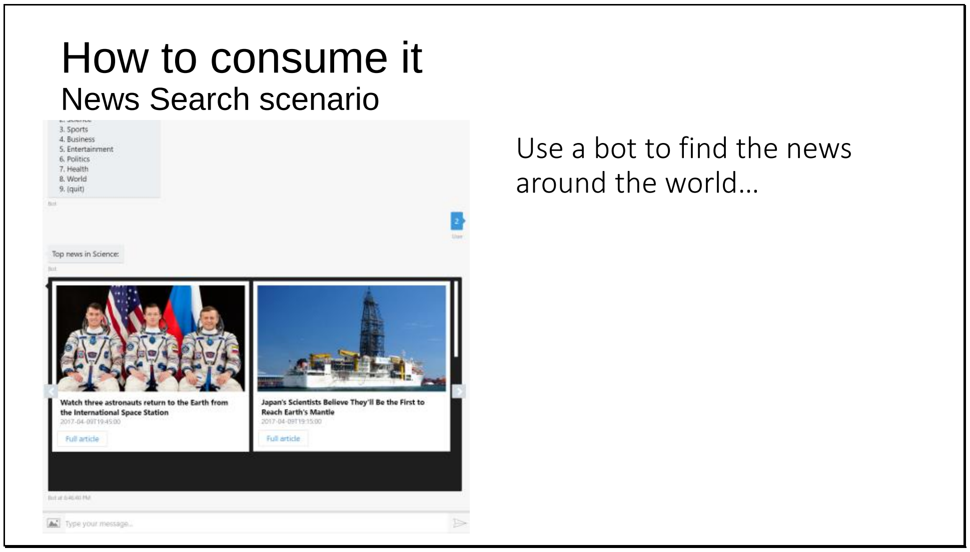
News Search API call

Call the News Search REST API endpoint in a few lines of code…



```
        // Build the url we'll be calling to get top news
        var url = "https://api.cognitive.microsoft.com/bing/v5.0/news/?"
            + "category=" + results.response.entity + "&count=10&mkt=en-US&originalImg=true";
        // Build options for the request
        var options = {
            uri: url,
            headers: {
                'Ocp-Apim-Subscription-Key': BINGSEARCHKEY
            },
            json: true // Returns the response in json
        }
//Make the call
rp(options).then(function (body){
```

Slide 26



How to consume it

News Search scenario

3. Sports
4. Business
5. Entertainment
6. Politics
7. Health
8. World
9. (quit)

2

Top news in Science:

Watch three astronauts return to the Earth from the International Space Station
2017-04-09T19:45:00
Full article

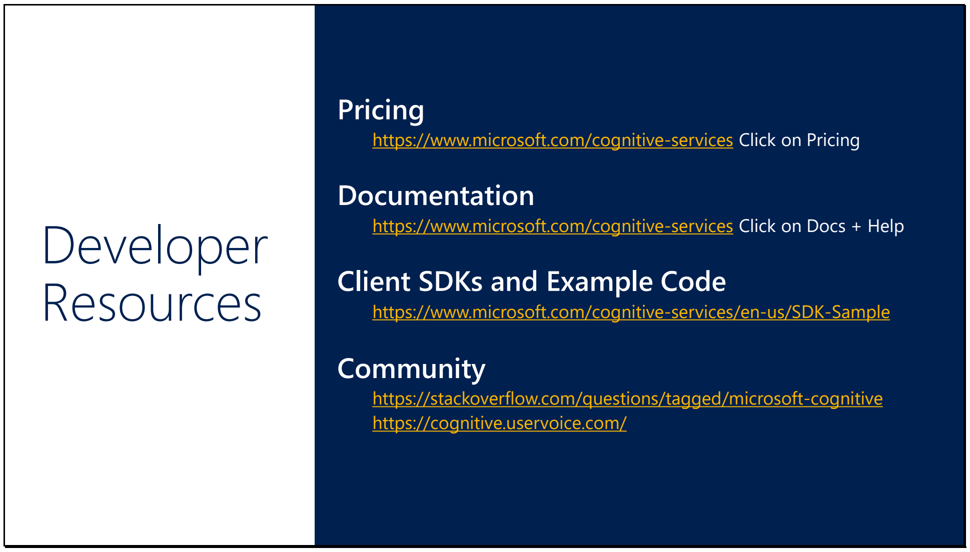
Japan's Scientists Believe They'll Be the First to Reach Earth's Mantle
2017-04-09T19:15:00
Full article

Use a bot to find the news around the world…

Bot: (C#) https://docs.botframework.com/en-us/bot-intelligence/search/#example-trending-news-bot
Bot: (Node.js) https://github.com/alyssaong1/HOL-NewsBot
Cognitive Services Bing News site demo: https://www.microsoft.com/cognitive-services/en-us/bing-news-search-api
Intelligent kiosk application: https://github.com/Microsoft/Cognitive-Samples-IntelligentKiosk
See the API Reference for more details on REST API calls

Slide 27

Slide 28



Developer Resources

Pricing

https://www.microsoft.com/cognitive-services Click on Pricing

Documentation

https://www.microsoft.com/cognitive-services Click on Docs + Help

Client SDKs and Example Code

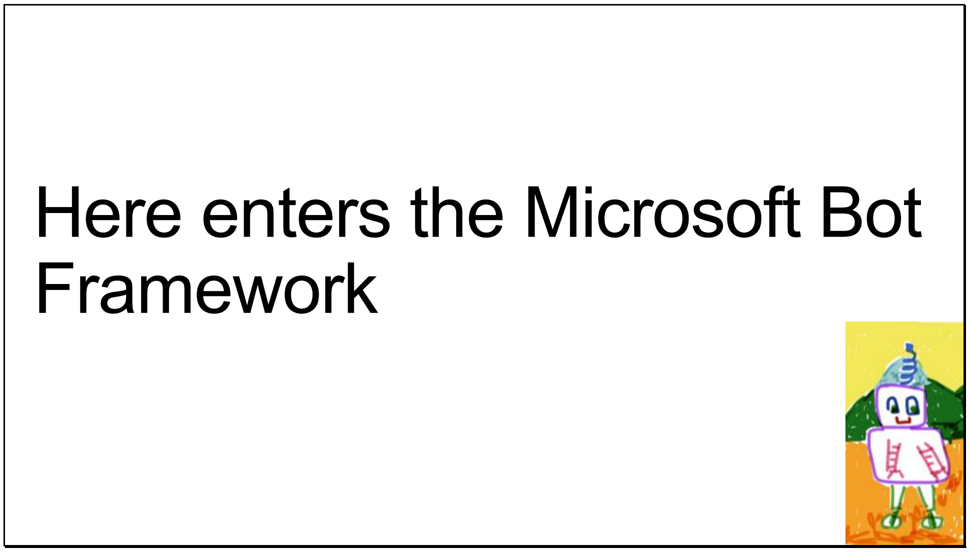
https://www.microsoft.com/cognitive-services/en-us/SDK-Sample

Community

https://stackoverflow.com/questions/tagged/microsoft-cognitive
https://cognitive.uservoice.com/

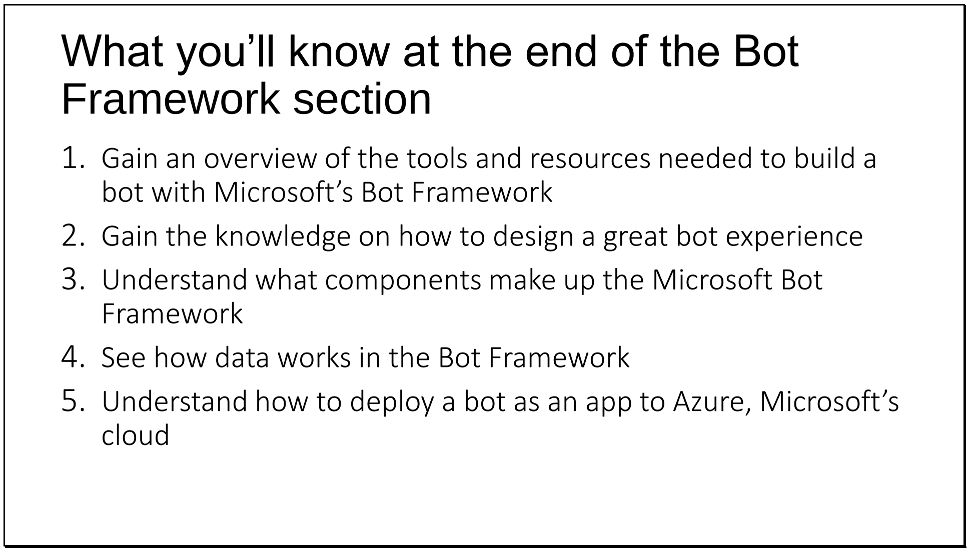
Slide 29

Slide 30



Here enters the Microsoft Bot Framework

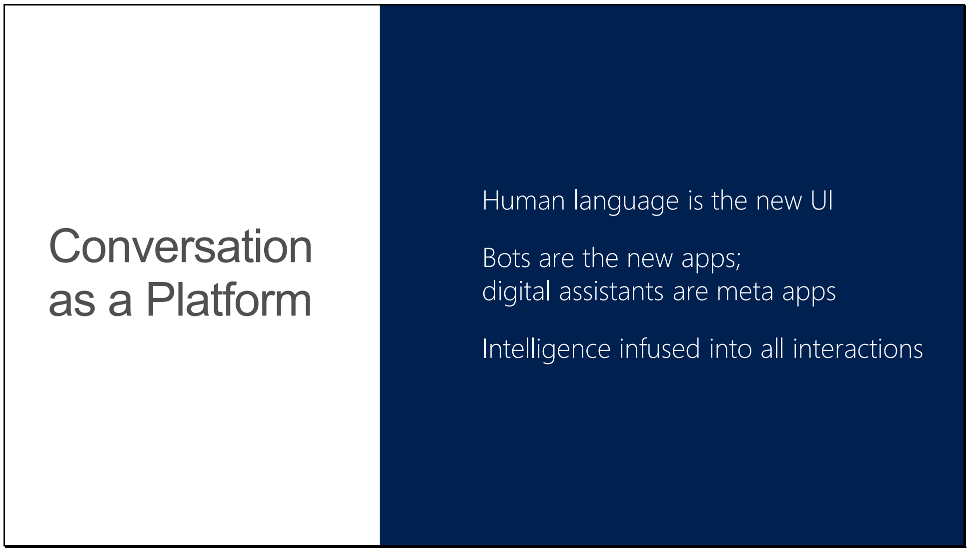
Slide 31



What you'll know at the end of the Bot Framework section

1. Gain an overview of the tools and resources needed to build a bot with Microsoft's Bot Framework
2. Gain the knowledge on how to design a great bot experience
3. Understand what components make up the Microsoft Bot Framework
4. See how data works in the Bot Framework
5. Understand how to deploy a bot as an app to Azure, Microsoft's cloud

Slide 32



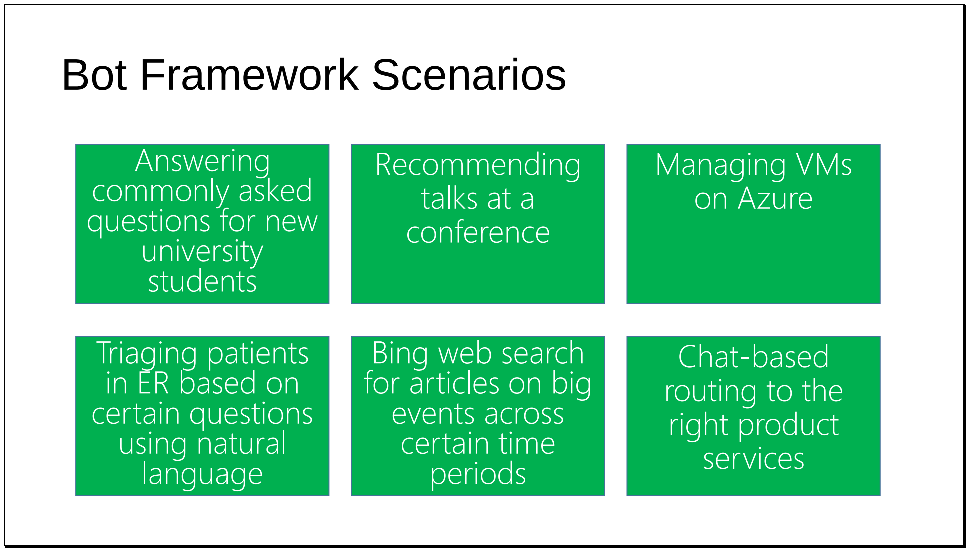
Conversation as a Platform

Human language is the new UI

Bots are the new apps;
digital assistants are meta apps

Intelligence infused into all interactions

Slide 33



Bot Framework Scenarios

Answering commonly asked questions for new university students

Recommending talks at a conference

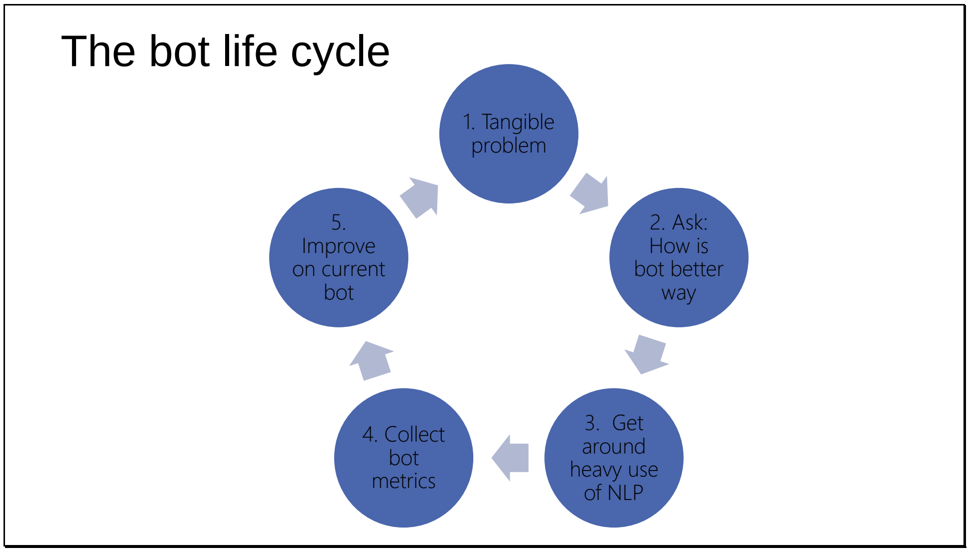
Managing VMs on Azure

Triaging patients in ER based on certain questions using natural language

Bing web search for articles on big events across certain time periods

Chat-based routing to the right product services

Slide 34



The bot life cycle

1. Tangible problem

2. Ask: How is bot better way

3. Get around heavy use of NLP

4. Collect bot metrics

5. Improve on current bot

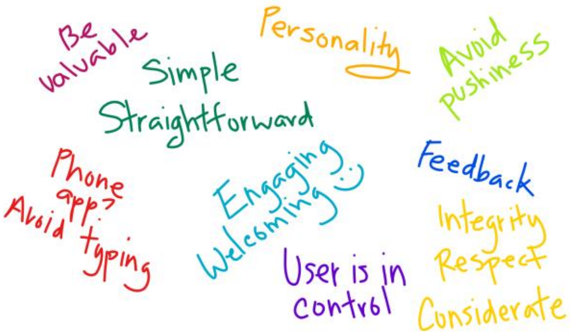
- Start by asking what problem are we trying to solve. Refine until it looks like a tangible problem and not “magic”
- Ask how a bot will be a better experience. User experience is EVERYTHING
- Avoid too much natural language. Careful with unrealistic expectations. Natural language recognition is limited. Menus work great. Commands work great. Buttons, etc.
- You can only analyze and improve your bot if you’re collecting metrics for it
- Iterate, improve

Slide 35

Notes on designing an experience users will adopt

Slide 36

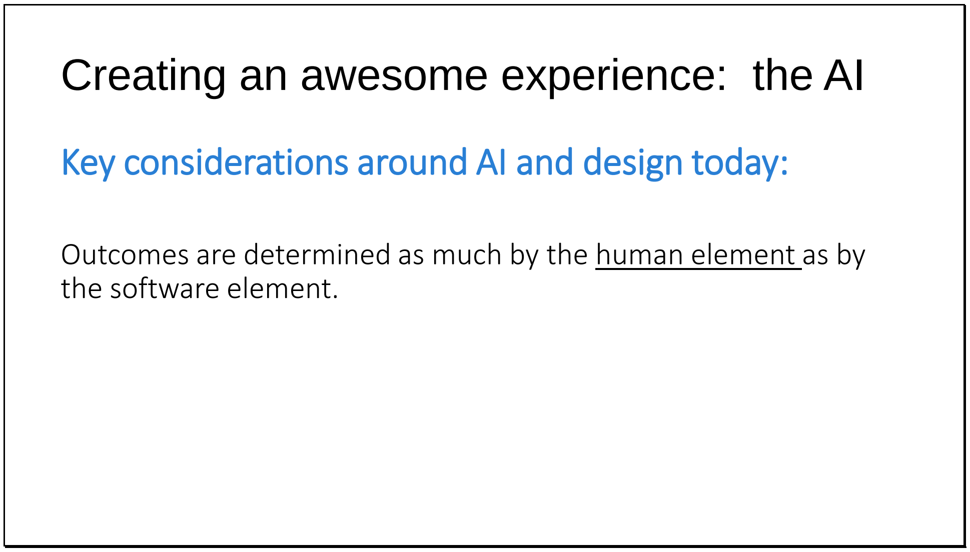
Design aims



From: https://docs.botframework.com/en-us/directory/best-practices

This may have been in your mind before this tutorial. Ethical and societal considerations as well in an article by Satya Nadella: https://www.linkedin.com/pulse/partnership-future-how-humans-ai-can-work-together-solve-nadella

Slide 37



Creating an awesome experience: the AI

Key considerations around AI and design today:

Outcomes are determined as much by the human element as by the software element.

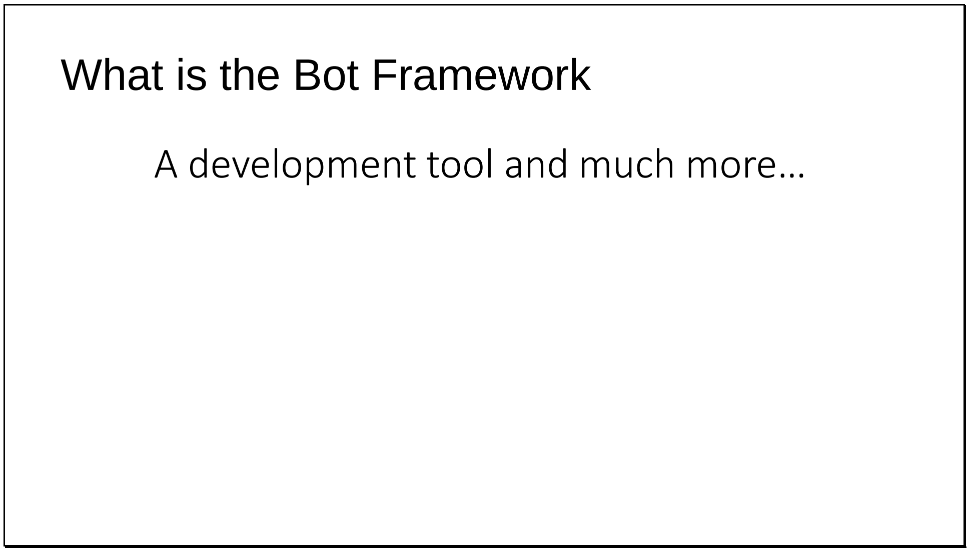
What does this mean?

The quality of the user experience determines both the usefulness of the product and its rate of adoption, and this is why [it is believed] design is the next frontier of AI.

Credit for paraphrased quotes Manoj Saxena: https://www.fastcodesign.com/3068005/whats-still-missing-from-the-ai-revolution

Slide 38

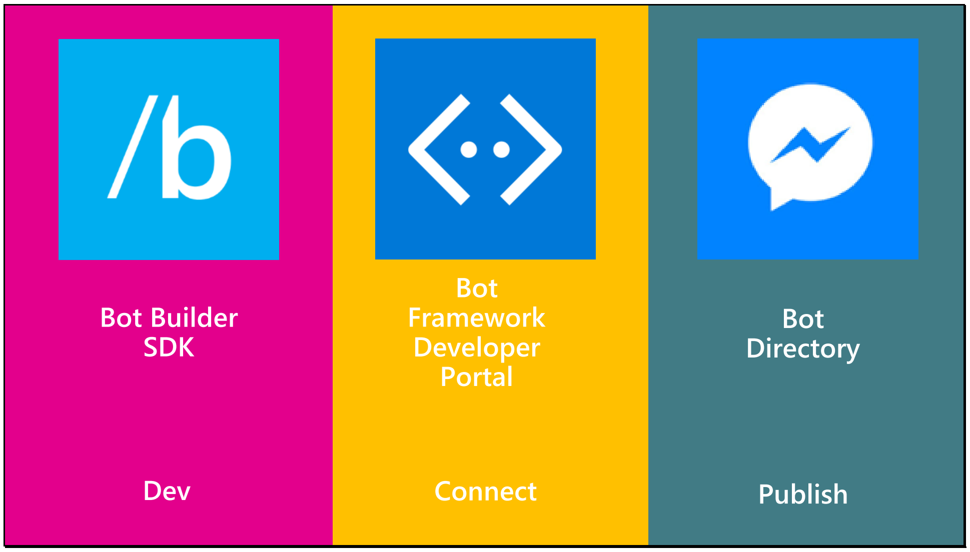
Slide 39



What is the Bot Framework

A development tool and much more…

Slide 40



Bot Builder SDK

Dev

Bot Framework Developer Portal

Connect

Bot Directory

Publish

Bot Builder is itself a framework for building conversational applications (“Bots”).

The Bot Builder SDK is an open source SDK hosted on GitHub that provides everything you need to build great dialogs within your Node.js-, .NET- or REST API-based bot.

The Bot Framework Developer Portal lets you connect your bot(s) seamlessly text/sms to Skype, Slack, Facebook Messenger, Kik, Office 365 mail and other popular services. Register, configure and publish.

The Bot Directory is a public directory of all reviewed bots registered through the Developer Portal.

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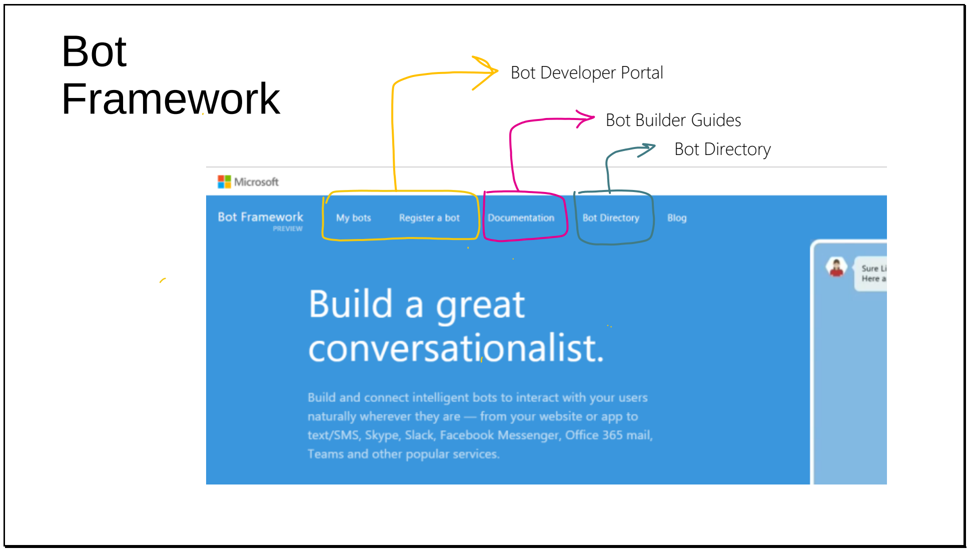

Bot Framework

Bot Developer Portal

Bot Builder Guides

Bot Directory

Build a great conversationalist.

Build and connect intelligent bots to interact with your users naturally wherever they are — from your website or app to text/SMS, Skype, Slack, Facebook Messenger, Office 365 mail, Teams and other popular services.

Main page: https://botframework.com

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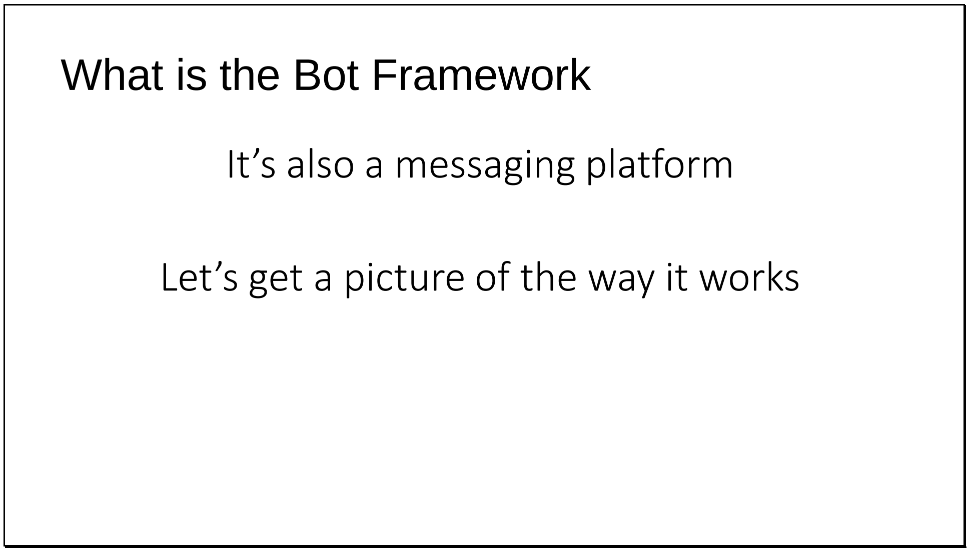

What is the Bot Framework

It’s also a messaging platform

Let’s get a picture of the way it works

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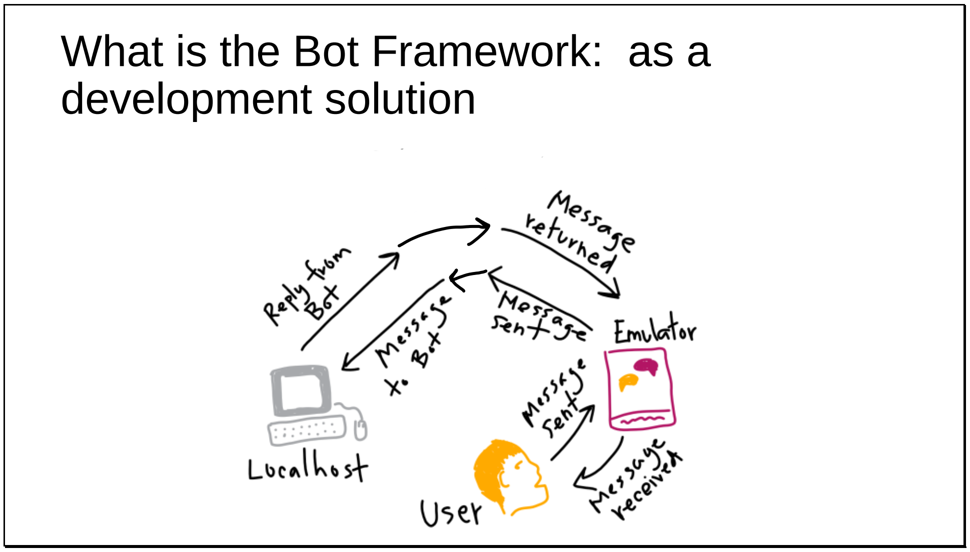

What is the Bot Framework: as a development solution

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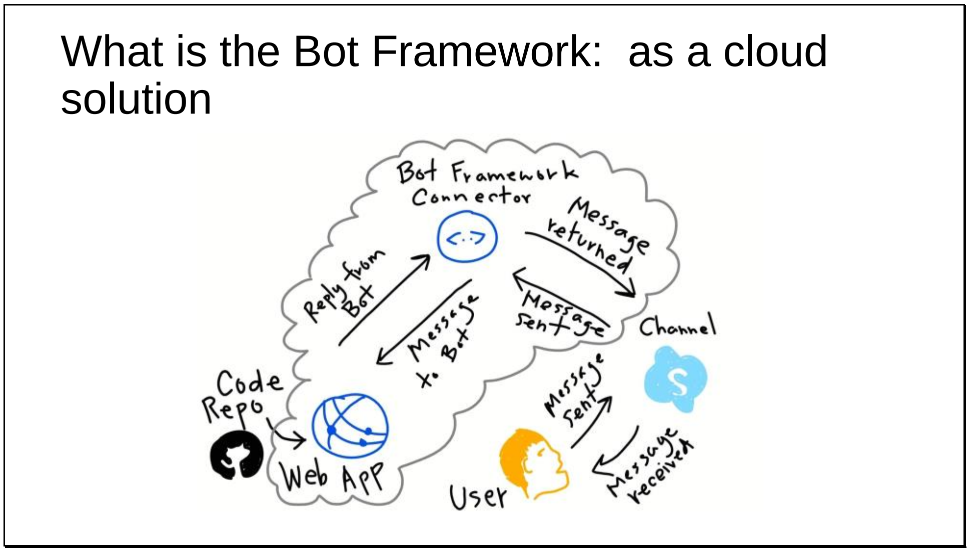

What is the Bot Framework: as a cloud solution

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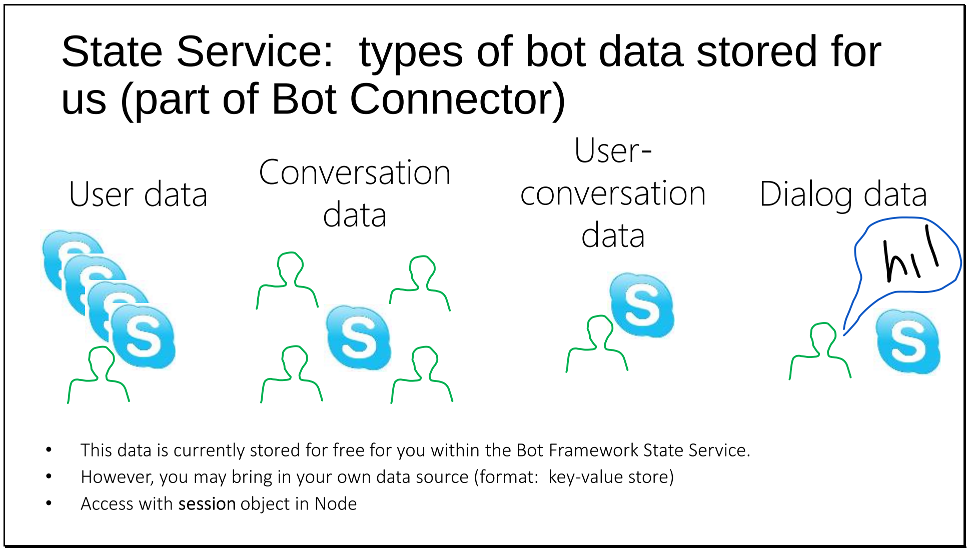

State Service: types of bot data stored for us (part of Bot Connector)

User data

Conversation data

User-conversation data

Dialog data

- This data is currently stored for free for you within the Bot Framework State Service.
- However, you may bring in your own data source (format: key-value store)
- Access with **session** object in Node

User data – globally available for user across all conversations

conversation data – stores globally for a single conversation (many users could be involved)

User-conversation data – stores globally conversation data for a user (But private to just that user)

Dialog data as well – persists for a single dialog (helpful for temp data in a waterfall set of steps)

If I have a bot that plays Blackjack with me, my stats would be stored in user data (would follow me around from game to game), the deck information and stats in the conversation data (i.e. other players could use the same deck), and my hand in a game would be in user-conversation data (my immediate game's data).

The dialog data persistence ensures that the dialogs state is properly maintained between each turn of the conversation. Dialog data also ensures that a conversation can be picked up later and even on a different machine.

Anything can be stored in these data stores or bags, however it should be limited to data types that are serializable like primitives.

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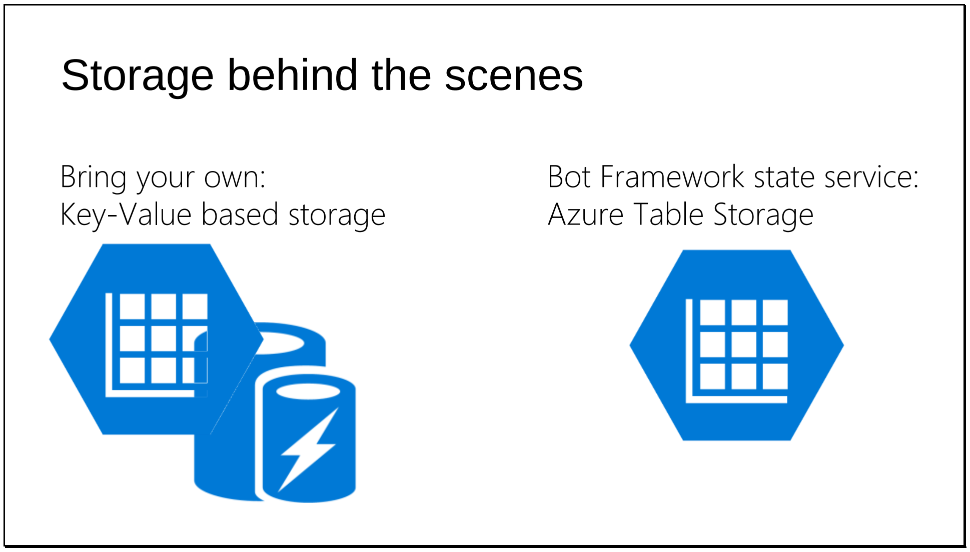

Storage behind the scenes

Bring your own:
Key-Value based storage

Bot Framework state service:
Azure Table Storage

The State REST API has wrappers built around Azure Table Storage. NB, you can bring your own storage in the form of a key-value store like Redis Cache, Table Storage etc. The Bot Framework manages this default storage for you so you can maintain a stateless bot experience and if you bring your own, you'll need to maintain that store and make sure it scales.

Adding your own state example
https://github.com/Microsoft/BotBuilder-Samples/tree/master/Node/core-CustomState

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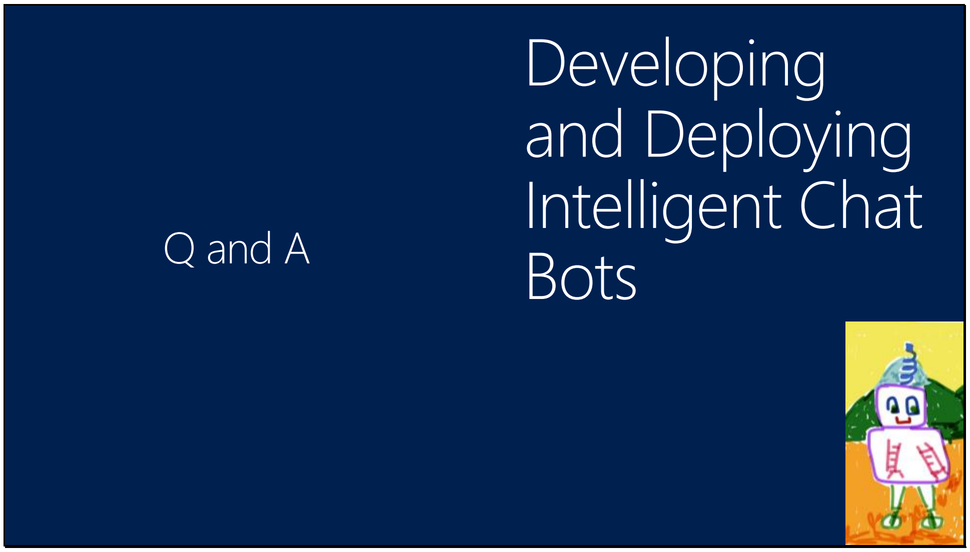

Q and A

Developing and Deploying Intelligent Chat Bots