
ORACLE®

Oracle Intelligent Bots Advanced Training

Advanced Dialog Flow Topics

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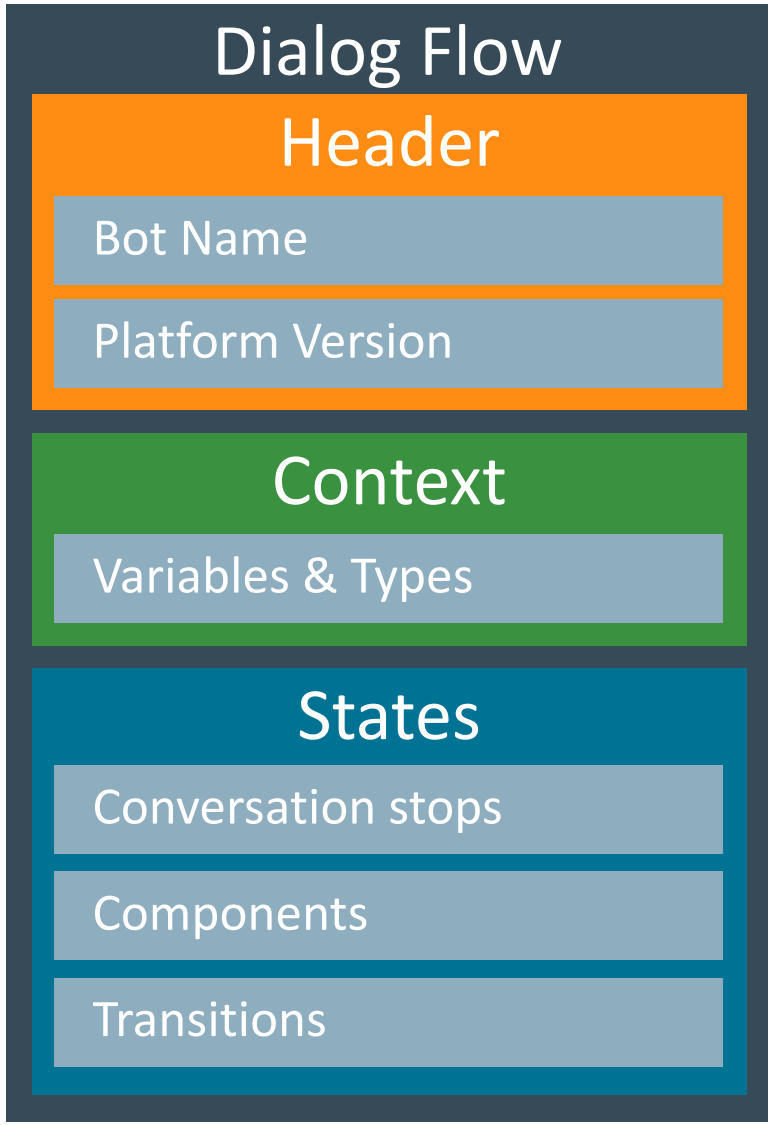


Dialog Flow

- Defines user-bot conversations as a sequence of state navigation
  - Invokes Components
    - Executes Logic
    - Receives User Input
    - Returns Bot Responses
  - Determines navigation
- Three sections
  - Header, Context, States
- Developed in BotML

Topic Agenda

1. Variables
2. Navigation
3. Entity Slotting
4. Apache FreeMarker
5. Hints & Tips

Dialog Flow

Variables

Variable Types

- Context Variable
  - Used for temporarily saving data
- User Variable
  - Defined at runtime using a name prefix of "user."
- Profile Variable
- System Variable
  - Set by system components
    - Manage internal state
    - Flag conditions

System Variables

- system.errorState
  - Name of state that caused an error
- system.invalidUserInput
  - Boolean flag set when users failed providing a valid user input
- system.processedUserMessage
  - Boolean flag whether the CR component processes the user message
- system.entityToResolve
  - Used with composite bag entity to track the current entity to resolve
- system.unexpectedAction / system.actualState*
  - Name of out-of-order action executed by a user
- System.expectedState*

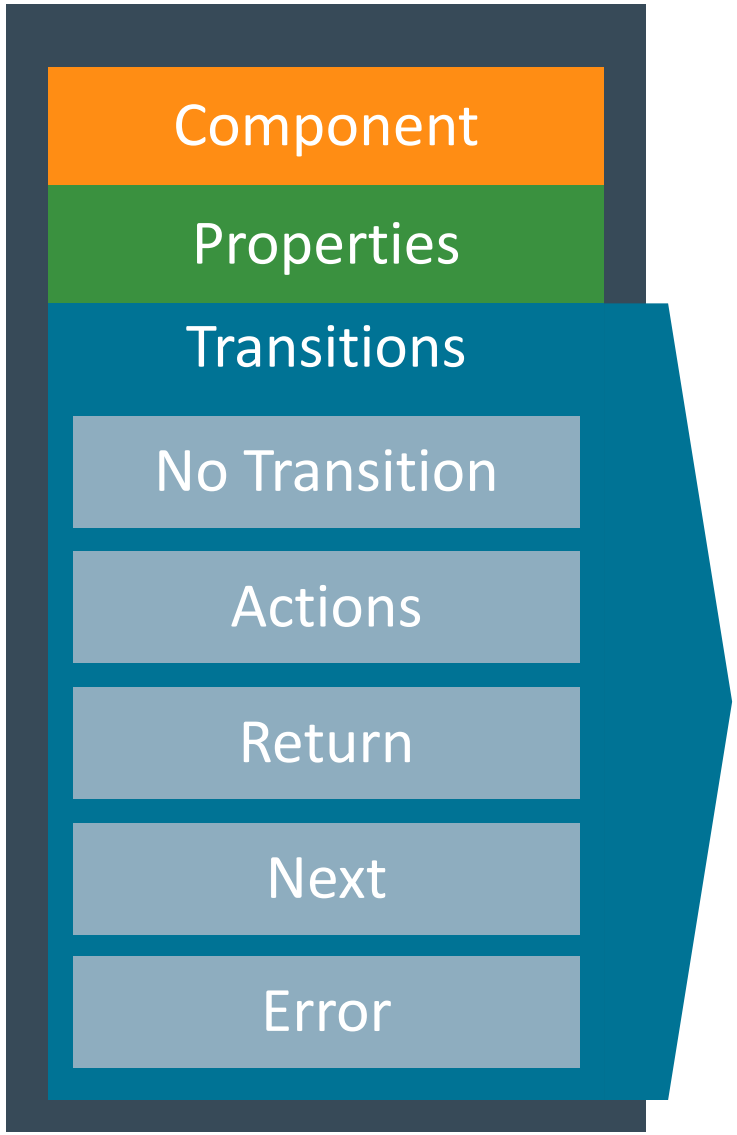
*version 18.3.4+

Dialog Flow

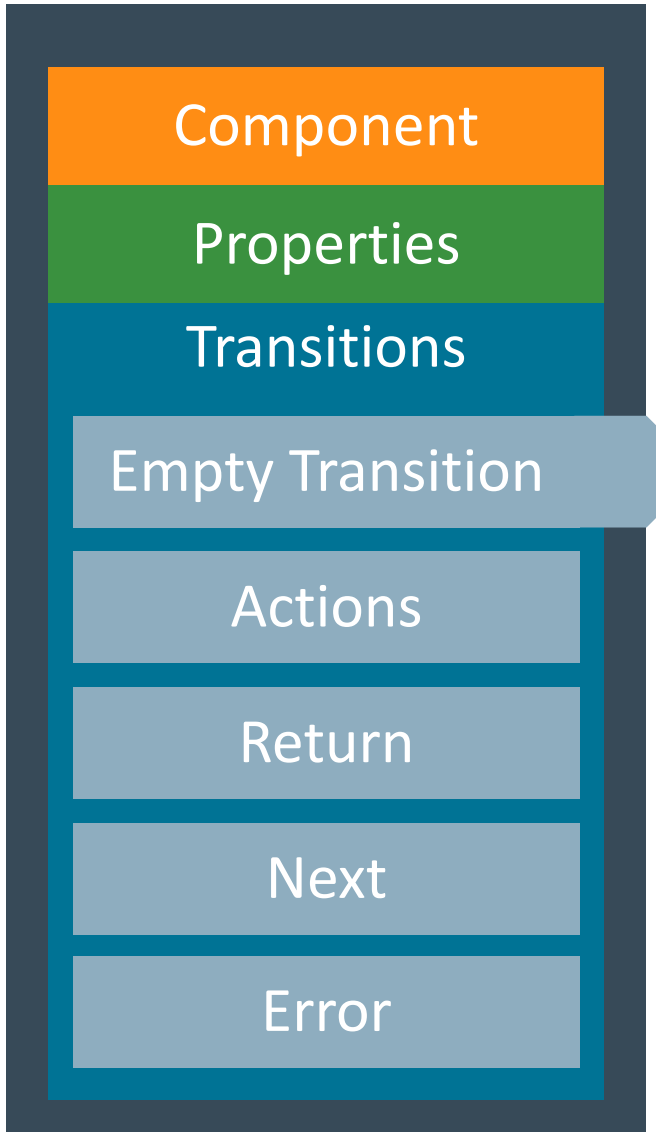
Navigation

Navigation may be hinted by the component but is **defined on the dialog flow state**

Image courtesy of Farbentek at FreeDigitalPhotos.net

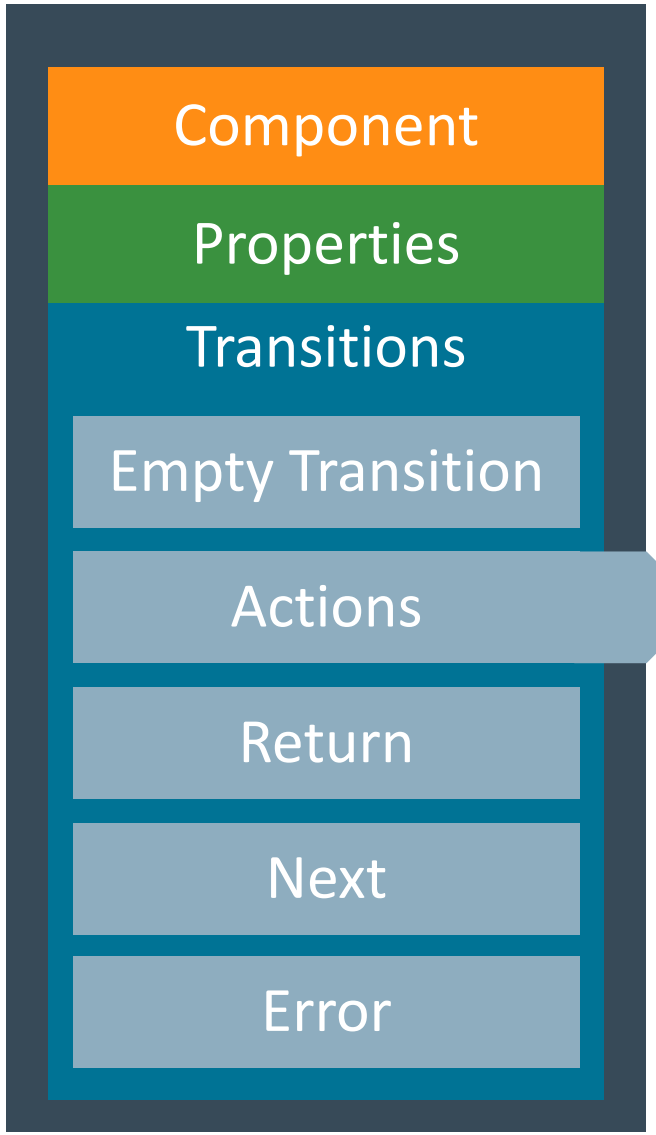


Every state may define zero or more directives to determine how navigation to a next state should happen.



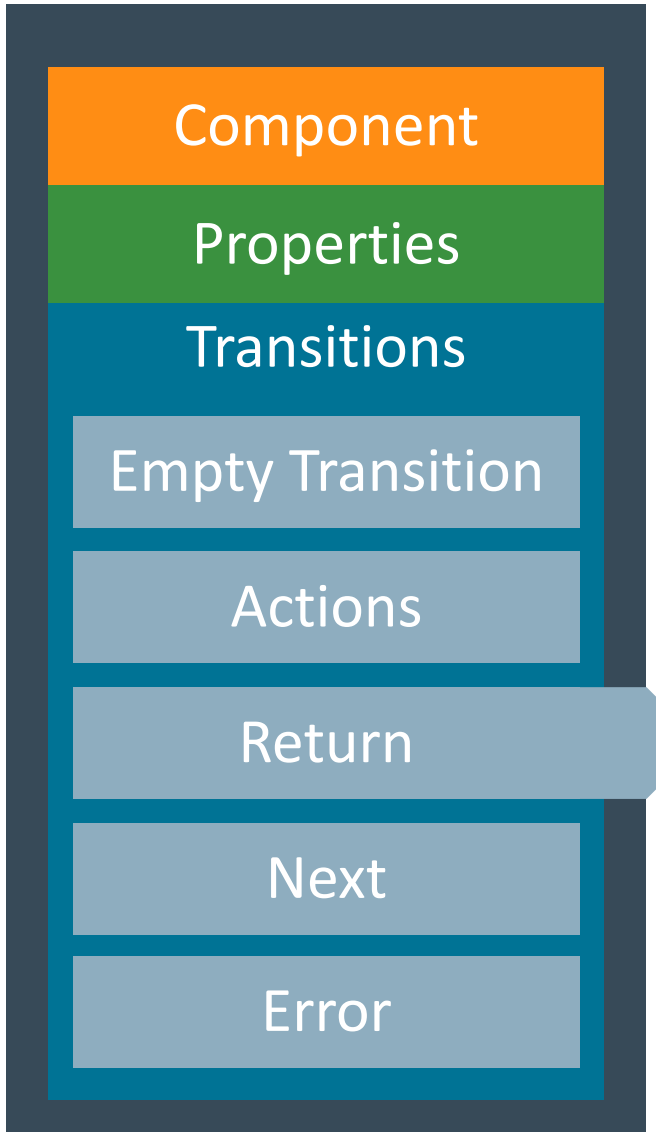

```
sayHello:
  component: "System.Output"
    properties:
       text: " ... "
     transitions: {}
```

- Performs default navigation
  - Top-to-bottom
  - Use for sequential navigation



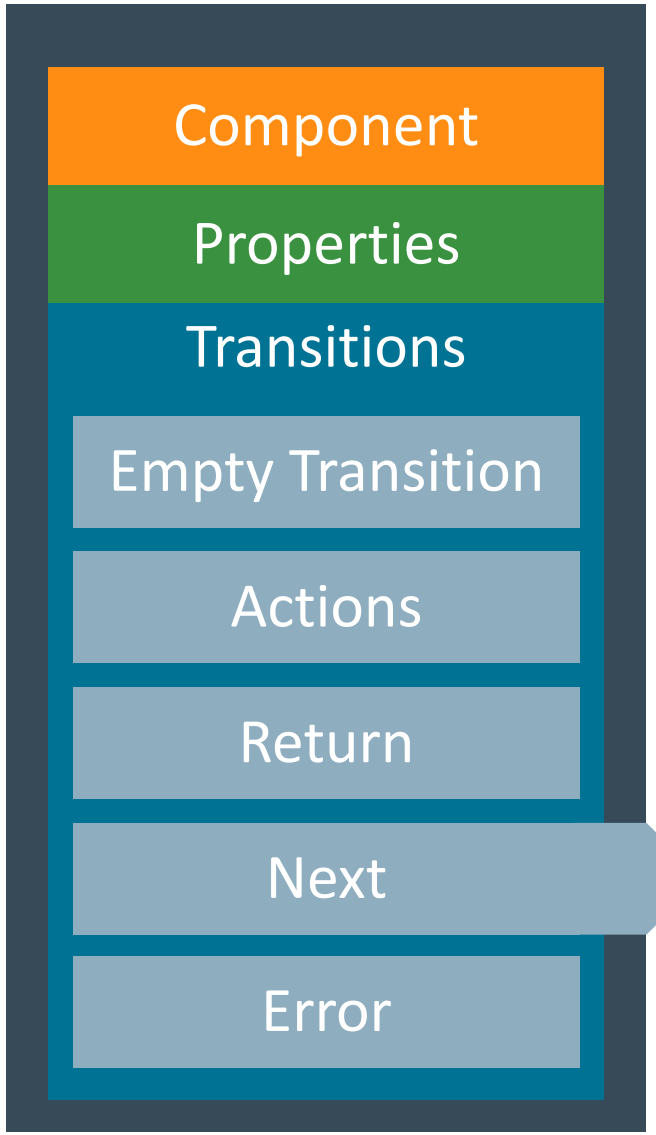

```
validateUserEntry:
  component: "System.MatchEntity"
    properties:
      …
    transitions:
      actions:
        match: "handleValidEntry"
        nomatch: "handleInvalidEntry"
```

- Actions are
  - Component outcome strings
  - Mapped to a state in the dialog flow



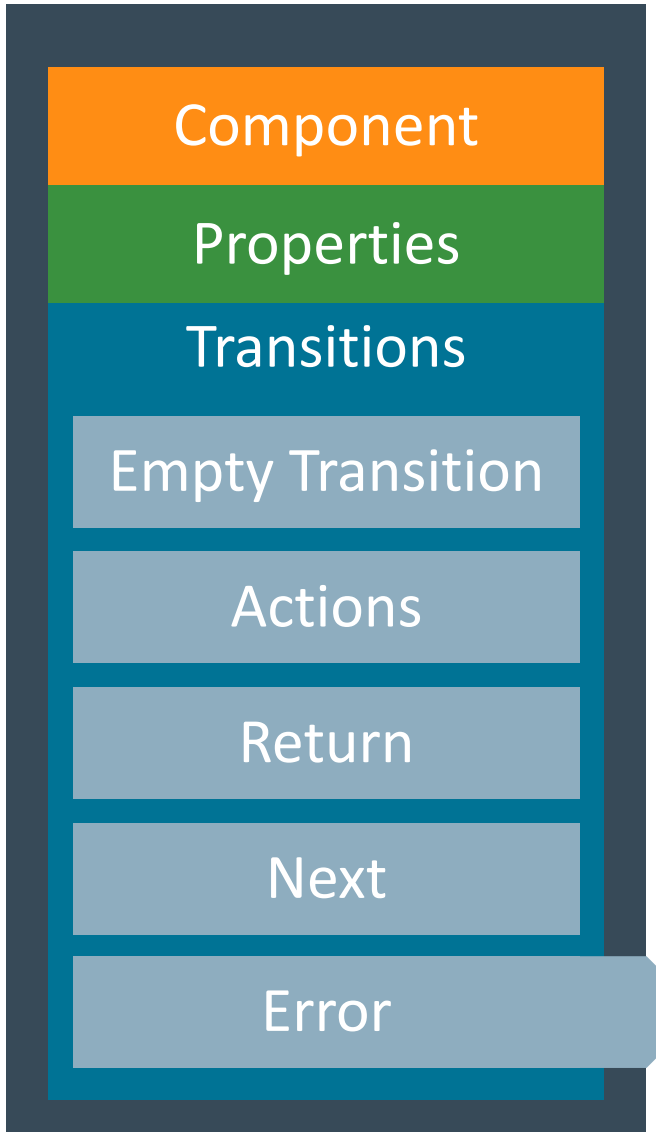

```
printBalance:
  component: "System.Output"
  properties:
    …
  transitions:
    return: "done"
```

- Exits the flow
- Reset all flow context variables
- Entry back into flow begins back at the top state




```
buyFlow:
  component: "System.SetVariable"
  properties:
    …
  transitions:
    next: "verifyCode"
```

- Proceeds to named state




```
type:
  component: "System.Intent"
  properties:
    …
transitions:
    error: "handleError"
```

- If an error occurs, proceeds to named state
  - Local error handling

Discussion

What if you use multiple transitions in a single configuration, e.g. using **actions** and **next**?

Discussion

What if no transition is configured
for a for a state?

Discussion

What if a component returns **three** action outcomes but only **two** are configured for a state?

Default Transitions

- Global transitions defined in dialog flow context
  - Optional (but useful)
- May be defined for
  - actions
  - *error* transition
    - No more "Uups …" messages
  - *next* transition
- Used as a fallback when local state does not handle a transition type

```
variables:
  …

defaultTransitions:
  error: "globalErrorHandler"
  next: "globalNextState"
  actions:
    unexpectedAction: "unhandledAction"
    ...

states:
  ...
```

Dialog Flow

Entity Slotting

Entity Slotting

Old 'SetVariable' Style

```
variables:
  orderId: "ORDER_ID"
  iResult: "nlpresult"
…
states:
  setOrderId:
    component: "System.SetVariable"
    properties:
      variable: "orderId"
      value: "${iResult.value.entityMatches['ORDER_ID'][0]}"
  handleOrder:
    component: "System.Text"
    properties:
      variable: "orderId"
```

Entity Slotting

New 'Component' Style

```
variables:
  orderId: "ORDER_ID"
  iResult: "nlpresult"
…
states:
  handleBooking:
    component: "System.Text"
    properties:
      prompt: "What is your Order Id?"
      variable: "orderId"
      nlpResultVariable: "iResult"
    transitions: {}
```

Discussion

In entity slotting, what is skipped
the state or the component?

And why does it matter?

Dialog Flow

Apache FreeMarker Expressions

About Apache FreeMarker

- Open source templating engine
- Used in BotML to access variables
  - ${variable_name.value}
- Built-in Expressions are appended to value expressions
  - ${variable_name.value?built-in-expression}
- Directive Expressions are scripts that conditionally assign values

Apache FreeMarker Built-In Reference

https://freemarker.apache.org/docs/ref_builtins.html

- Built-ins for strings
- Built-ins for numbers
- Built-ins for date/time/date-time
- Built-ins for boolean
- Built-ins for arrays

Working with Apache FreeMarker expressions **is like cooking**. A good cook can read any recipe. A master chef writes his own.

Image courtesy of Farbentek at FreeDigitalPhotos.net

Dialog Flow

Apache FreeMarker Expressions – String Built-Ins

String Built-In Examples

```
setStringValue:
  component: "System.SetVariable"
  properties:
    variable: "textVar"
    value: "Hello World"
```

FreeMarker Expression	Result
${textVar.value! 'empty'}	prints "empty" if no value set
${textVar.value?length}	11
${textVar.value?replace('World', 'Friends')}	Hello Friends

Apache FreeMarker expressions can be **chained** using the '?' character

String Built-In Examples

```
setStringValue:
  component: "System.SetVariable"
  properties:
    variable: "flight"
    value: "UA 1234"
```

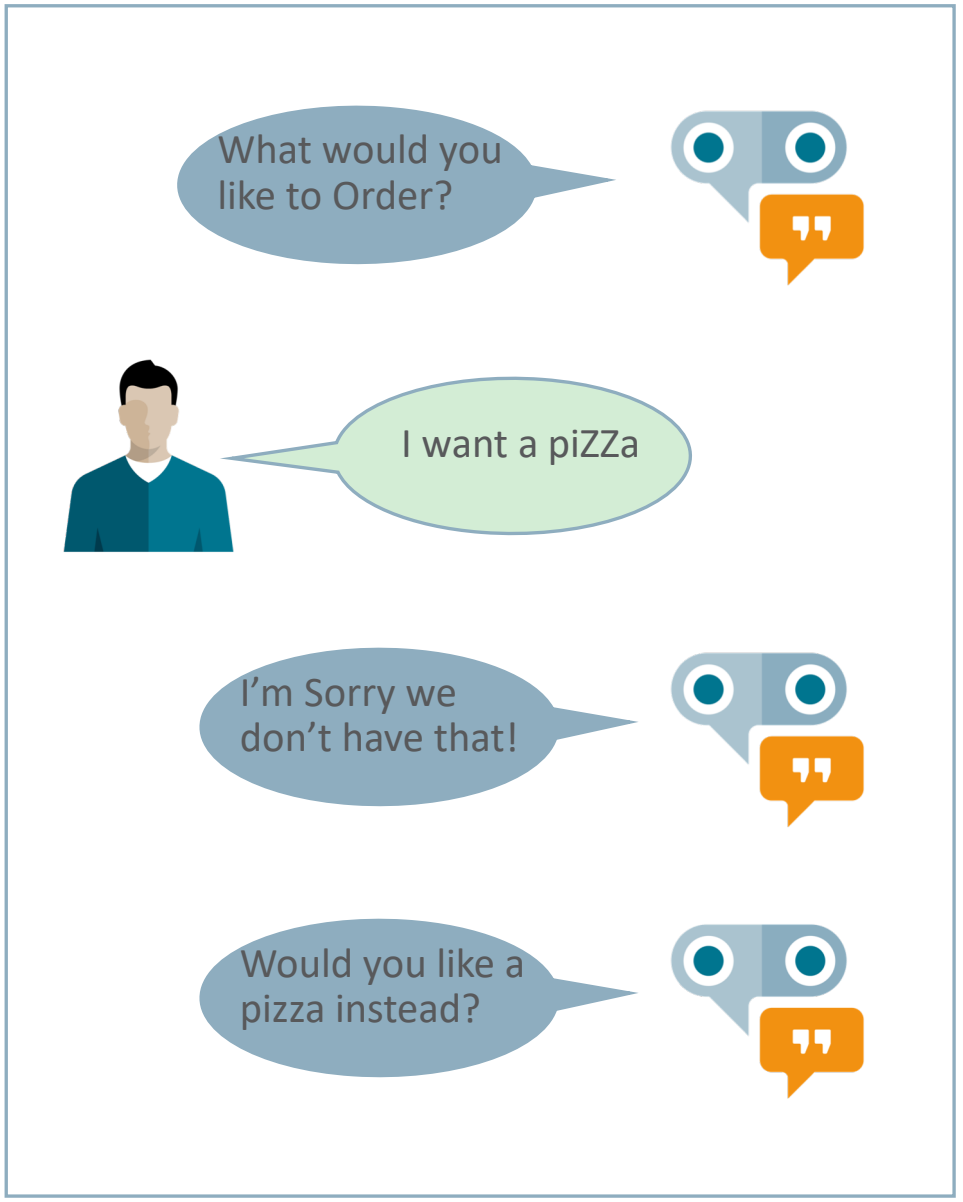
FreeMarker Expression	Result
${flight.value?contains('ua')?string('UA flight','other')}	UA flight
${flight.value?trim?lower_case?remove_beginning('ua ')}"	1234

Controlling User Input

Simple Example

```
component: "System.SetVariable"
properties:
  variable: "orderVar"
  value: "${userInputVar.value}"

 component: "System.Switch"
    properties:
      variable: "orderVar"
      values:
      - "PIZZA"
      - "PASTA"
   transitions:
      actions:
        PIZZA:  "OrderPizza"
        PASTA: "OrderPasta"
        NONE: "Sorry"
```

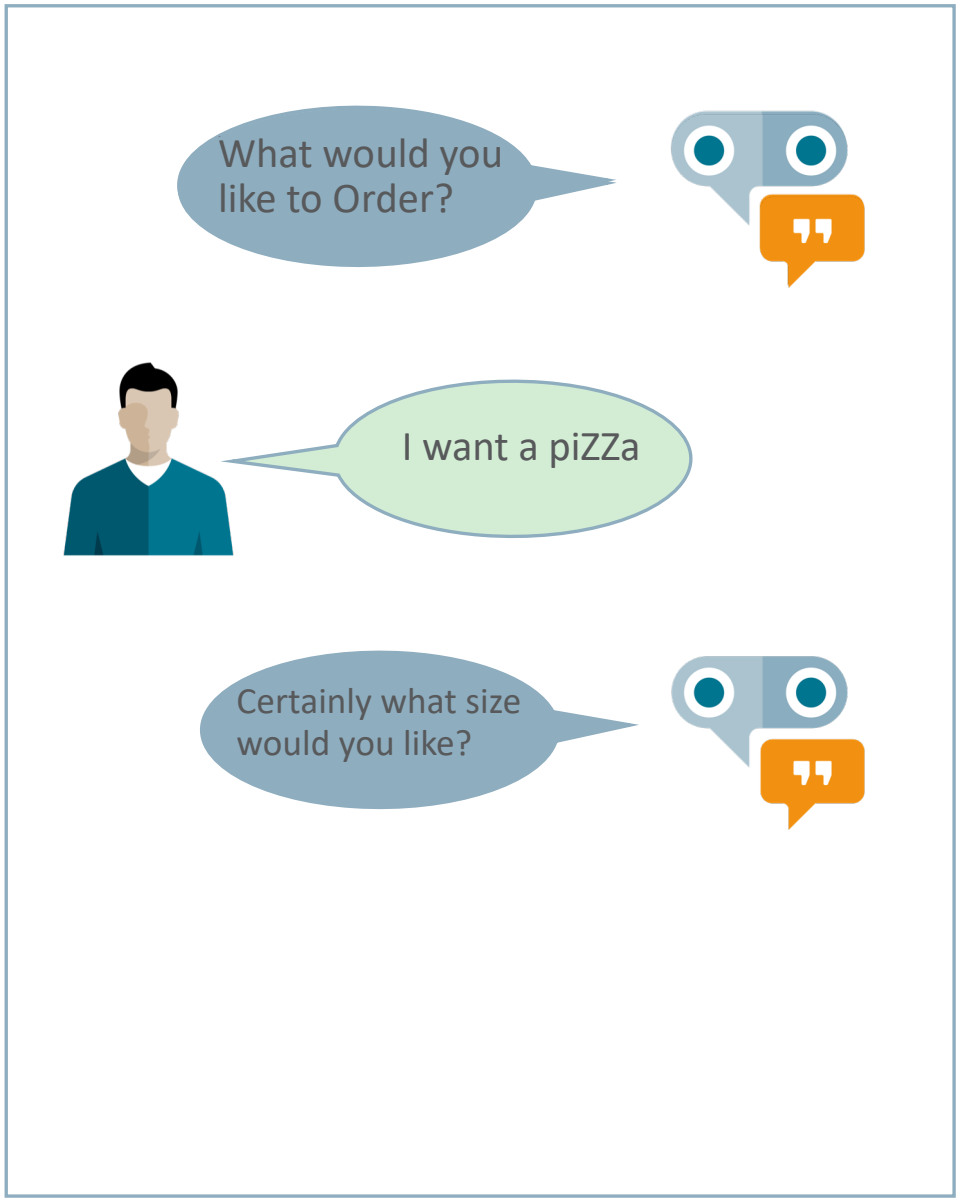


Controlling User Input

Simple Example

```
component: "System.SetVariable"
properties:
  variable: "orderVar"
  value: "${userInput?upper_case}"

 component: "System.Switch"
    properties:
      variable: "orderVar"
      values:
      - "PIZZA"
      - "PASTA"
   transitions:
      actions:
        PIZZA:  "OrderPizza"
        PASTA: "OrderPasta"
        NONE: "Sorry"
```



Text Built-In Overview

- boolean
- capitalize
- contains
- date, time, datetime
- ends_with
- ensure_ends_with
- ensure_starts_with
- index_of
- keep_after
- keep_after_last
- keep_before
- keep_before_last
- last_index_of
- left_pad
- length
- lower_case / upper_case
- number
- match
- replace
- right_pad
- remove_beginning
- remove_ending
- slice
- split
- starts_with
- string
- switch
- trim

Dialog Flow

Apache FreeMarker Expressions – Number Built-Ins

Number Built-In Examples

```
setNegativeValue:
    component: "System.SetVariable"
    properties:
      variable: "negativeValue"
      value: -2.512
```

FreeMarker Expression	Result
${negativeValue.value?abs}	2.512
${negativeValue.value?round}	- 2
${negativeValue.value?floor}	- 3
${negativeValue.value?string['###.##']}	- 2.51
${negativeValue.value?abs?string['###.##\u00A3']}	2.51 £

Number Built-In Overview

- abs
  - returns positive number
- round
  - rounds to the nearest whole number
  - ≥ n.5 rounded upwards
- floor
  - rounds the number downwards
- ceiling
  - rounds the number upwards

- lower_abc
  - converts 1, 2, 3, etc., to "a", "b", "c"
- upper_abc
  - converts 1, 2, 3, etc., to "A", "B", "C"

- string
  - converts a number to string
- <number>?string['###.##']
  - formatted string output
  - rounds to nearest neighbor
- Use utf-8 for currency
  - ?string['###.##\u00A4'] $
  - ?string['###.##\u20AC'] €
  - ?string['###.##\u00A3'] £

Dialog Flow

Apache FreeMarker Expressions – Date Built-Ins

Date Built-In Examples

```
variables:
  dateVar: "DATE"
…
getNLPDate:
  component: "System.SetVariable"
  properties:
    variable: "dateVar"
    value: "${iResult.value.entityMatches['DATE'][0]}"
```

FreeMarker Expression	Result
${dateVar.value.date}	Date in milliseconds UTC
${dateVar.value.date?long?number_to_date?string.short}	4/13/18
${dateVar.value.date?long?number_to_date?string.medium}	April 13, 1:29:54 PM
${dateVar.value.date?long?number_to_date?string.long}	April 13, 1:29:54 PM UTC

Date Built-In Examples

```
variables:
  dateVar: "DATE"
…
getNLPDate:
  component: "System.SetVariable"
  properties:
    variable: "dateVar"
    value: "${iResult.value.entityMatches['DATE'][0]}"
```

FreeMarker Expression	Result
${dateVar.value.date?string['dd.MM.yyyy, HH:mm']}	13.04.2018, 13:29
${dateVar.value.date?long?number_to_datetime?iso_local}	2018-04-13T13:29:54Z
${dateVar.value.date?time}	1:29:04

Setting a Default Value to a DATE Entity

```
variables:
  dateVar: "DATE"
  now: "string"
 …
  setNow:
    component: "System.SetVariable"
    properties:
      variable: "now"
      value: "${.now}"

  setDateVariable:
   component: "System.MatchEntity"
   properties:
     variable: "dateVar"
     sourceVariable: "now"

  print:
    component: "System.Output"
    properties:
      text: "${dateVar.value.date}"
    transitions:
      return: "done"
```

- Apache FreeMarker expression ${.now} sets "now" variable to current datetime
- System.MatchEntity
  - sets current date to dateVar context variable
- Entity "DATE" variable has "date" property
  - Milliseconds UTC

Dialog Flow

Apache FreeMarker Expressions – Array Built-Ins

Arrays in Oracle Intelligent Bots

- System arrays
  - ${iResult.value.entityMatches['name of entity']}
  - ${iResult.value.intentMatches.summary}
- Variable arrays
  - Context variable of type string
    - Custom Components
    - Apache FreeMarker Template Expression

Building Arrays with Apache FreeMarker

Array of Objects

```
variables:
  fruits: "string"
  …
states:

  fruitArray:
    component: "System.SetVariable"
    properties:
      variable: "fruits"
      value:
      - name: "Apple"
        color: "green"
      - name: "Banana"
        color: "yellow"
```

Simple Array

```
variables:
  colors: "string"
  …
states:
  colorsArray:
    component: "System.SetVariable"
    properties:
      variable: "colors"
      value:
      - "red"
      - "green"
      - "blue"
      - "yellow"
```

Array Built-In Examples

```
fruitArray:
    component: "System.SetVariable"
    properties:
      variable: "fruits"
      value:
      - name: "Apple"
        color: "green"
      - name: "Banana"
        color: "yellow"
```

FreeMarker Expression	Result
${fruits.value?size}	2
${fruits.value[0].name}	Apple
${fruits.value[0].name !'unknown'}	Same as above, but prints "unknown" if name is missing
${fruits.value?sort_by('color')?reverse[0].name}	Prints "Banana"

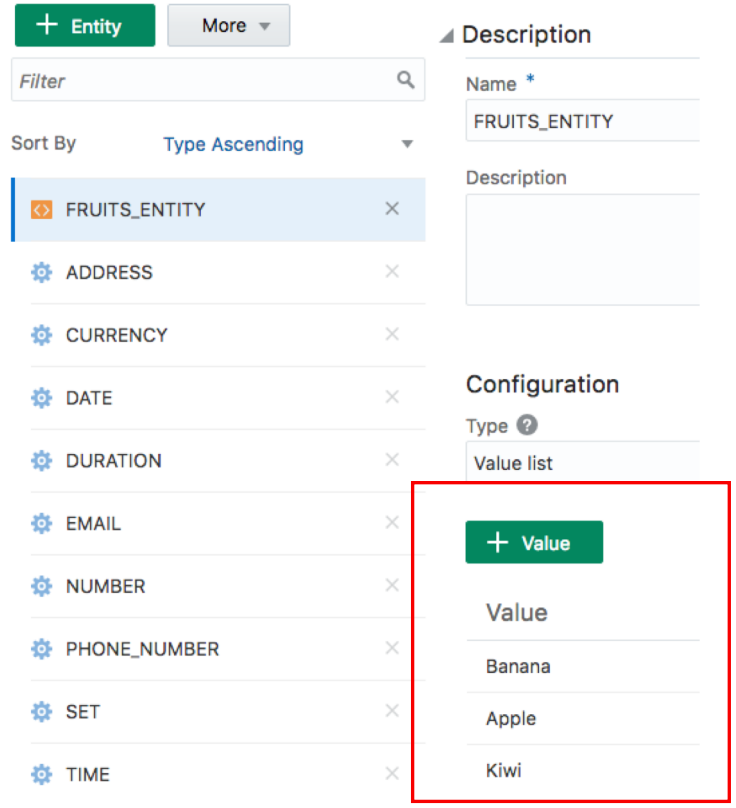
Array Built-Ins

- first.<attribute>, last.<attribute>
  - Returns first or last element's attribute
- seq_index_of(value)
  - Works with simple arrays
- seq_last_index_of(value)
  - Works with simple arrays
- join('delimiter_char')
  - Returns simple array as strings delimited by delimiter_char
- seq_contains(value)?string('yes','no')
  - returns yes or no string
- min, max
  - For simple arrays of type number or datetime
  - Returns min or max value
- sort
  - Sorts simple array
- sort_by(attribute)
  - Sorts object array by named attribute

Accessing Values from a "Value List" Entity

- Apache FreeMarker expressions to access values from a List entity
  - ${entityFruits.type.enumValues?split(',')?size}
    - Returns number of items = 3
  - ${entityFruits.type.enumValues?split(',')?sort[0]}
    - Returns first value in sorted array = Apple
  - ${entityFruits.type.enumValues?split(',')?seq_index_of('Kiwi')}
- Use cases
  - Access specific element in entity value list
  - Loop over entity value list
  - Detect if entity value list contains specific value

```
context:
  variables:
    entityFruits: "FRUITS_ENTITY"
```



Dialog Flow

Apache FreeMarker Directives

Apache FreeMarker directives are allow you to conditionally **assign content** to component properties

Example: <#if >, <#else>

```
<#if condition>
  ...
<#elseif condition2>
  ...
<#elseif condition3>
  ...
...
<#else>
  ...
</#if>
```

- Conditionally skip sections of a template
- Conditions must evaluate to boolean
- <#if> </#if> encloses <#elsif> and <#else>
  - The "if" tag can contain any number of "elseif" and optionally one "else"tag

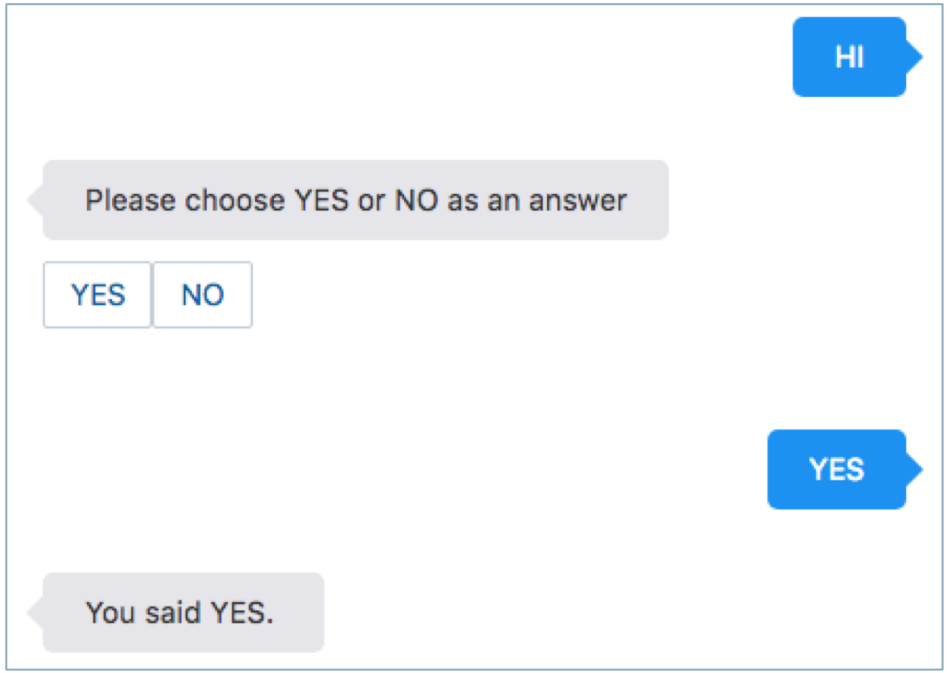
<#if >, <#else> Example 1

Conditional Messages

```
context:
  variables:
    yesNo: "string"

states:
  ...
  yesNoPrint:
    component: "System.Output"
    properties:
      text: "<#if yesNo.value?lower_case?matches('yes') >
             You said YES. <#else> You said NO. I am sorry. </#if>"
    transitions:
      return: "done"
```

Print conditional statement



Comparison Operator Encoding

Making Directives work in BotML

Operator	Encoding
>	>
<	<
>=	>=
<=	<=

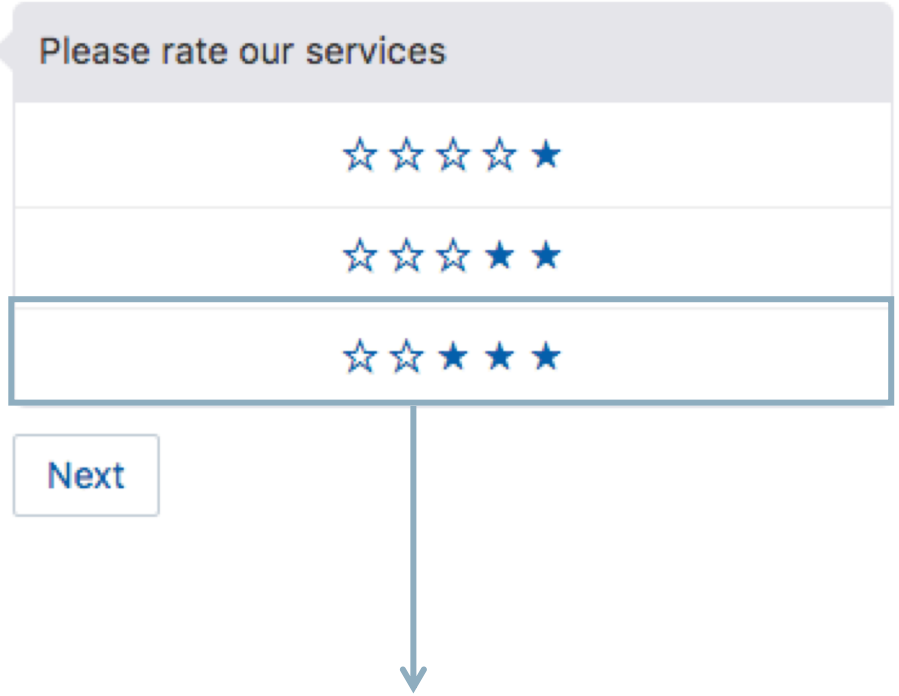
<#if >, <#else> Example 2

Pagination

```
component: "System.CommonResponse"
   properties:
     …
     metadata:
      responseItems:
      - type: "text"
        …
        actions:
        - label: "${starbars.label}"
          type: "postback"
```

rendered: "<#if starbars?index < (rangeStart?number + rangeSize?number)
&& starbars?index >= rangeStart?number>true<#else>false</#if>"

Conditional display rendering



<#if … > <#else></#if> expressions **can be nested**.

Yes, I know.

Dialog Flow

Apache FreeMarker <#list > Directive

<#list> … </#list> Example

```
states:
  setValues:
    component: "System.SetVariable"
    properties:
      variable: "data"
      value: {"FirstName":"John","LastName":"Doe","RegistrationId":"1234" }
```

```
print:
    component: "System.Output"
    properties:
      text: "<#list data.value?keys as k> \"${k}\" has a value of \"${data.value[k]}\"\n</#list>"
    transitions:
      return: "done"
```

"FirstName" has a value of "John"
"LastName" has a value of "Doe"
"RegistrationId" has a value of "1234"

Real Word Example

Find the value of an Attribute in an Array of Objects: E.g. the price for Audi

```
SetArray:
  component: "System.SetVariable"
  properties:
    variable: "listvar"
    value:
    - product: "BMW"
      price: 20000
    - product: "Audi"
      price: 21000
    - product: "Porsche"
      price: 22000


PrintPriceForAudi:
  component: "System.Output"
  properties:
    text: "<#list listvar.value as k> <#if k['product'] == 'Audi'> ${k['price']} <#break> </#if> </#list>"
  transitions:
    return: "done"
```

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Dialog Flow

Hints & Tips

How to Access User Input from Expressions in BotML

- There are two strategies
  - Use `System.Text` to save user input to context variable
    - Reference variable from System.Intent, System.TranslateInput, Custom Component etc.
    - `${userInputVar.value}`
  - Access user input from iResult (nlpresult type) variable
    - Requires `System.Intent` to handle user input
    - `${iResult.value.query}`

Accessing a List of Resolved Entities

Using iResult as the variable of type nlpresult

I like a pizza salami, a pizza cheese, a lemonade, a coke and a beer

- How many Entities?
  - ${iResult.value.entityMatches?size} → 2
- Name of first entity?
  - ${iResult.value.entityMatches**?keys**[0]} → PIZZA
- How many drinks?
  - ${iResult.value.entityMatches['DRINKS']?size} → 3
- Name of second drink?
  - ${iResult.value.entityMatches['DRINKS'][1]} → Coke

Accessing Intents

Using iResult as the variable of type nlpresult

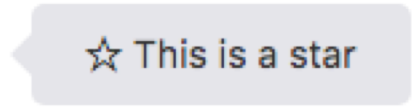
I like a pizza salami, a pizza cheese, a lemonade, a coke and a beer

- How many intents?
  - ${iResult.value.intentMatches.summary?size} → 1
- What is the intent name?
  - ${iResult.value.intentMatches.summary[0].intent} → OrderPizza
- What is the intent's score
  - ${iResult.value.intentMatches.summary[0].score} → 1 (= 100%)
- What is the name of the intent with the highest score?
  - ${iResult.value.intentMatches.summary**?sort_by('score')?reverse**[0].intent} → OrderPizza

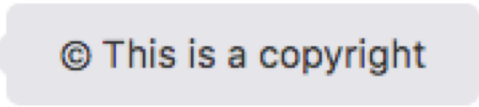
How-to Add Symbols to Bot Responses

Using Unicode Characters

```
printStar:
  component: "System.Output"
  properties:
    text: "\u2606 This is a star"
  transitions:
    return: "done"
```



```
printCopyright:
  component: "System.Output"
  properties:
    text: "\u00A9 This is a copyright"
  transitions:
    return: "done"
```



Advanced Bot Training Hands-On

Lab 3a: Critique Our Dialog Flow

Integrated Cloud

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