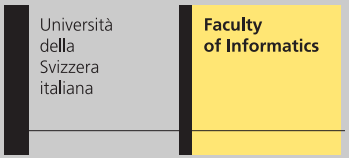
Visual Modeling of RESTful Conversations with RESTalk

Ana Ivanchikj, Cesare Pautasso
Università della Svizzera italiana (USI)
Lugano, Switzerland

Silvia Schreier
innoQ Deutschland GmbH
Monheim, Germany

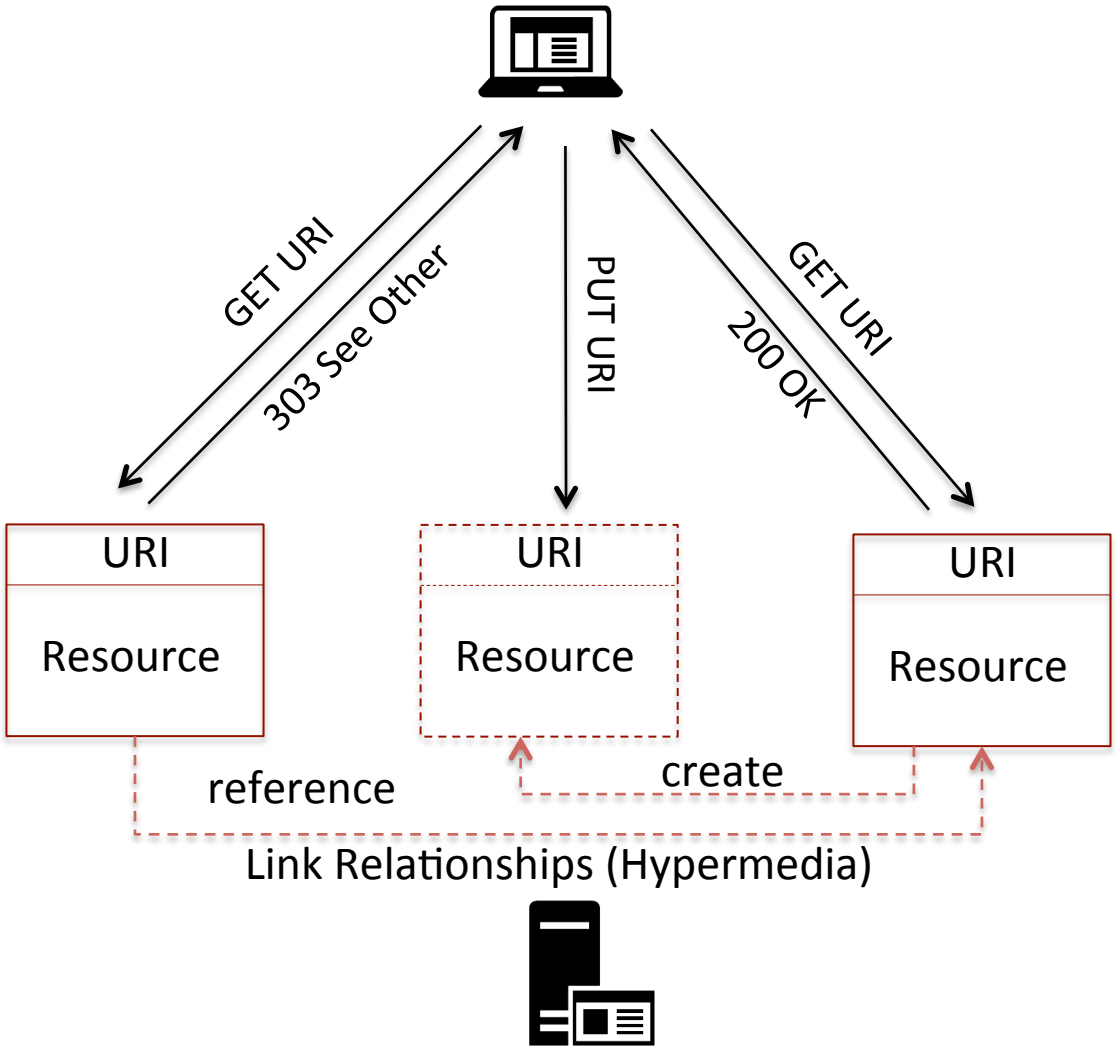


MOTIVATION

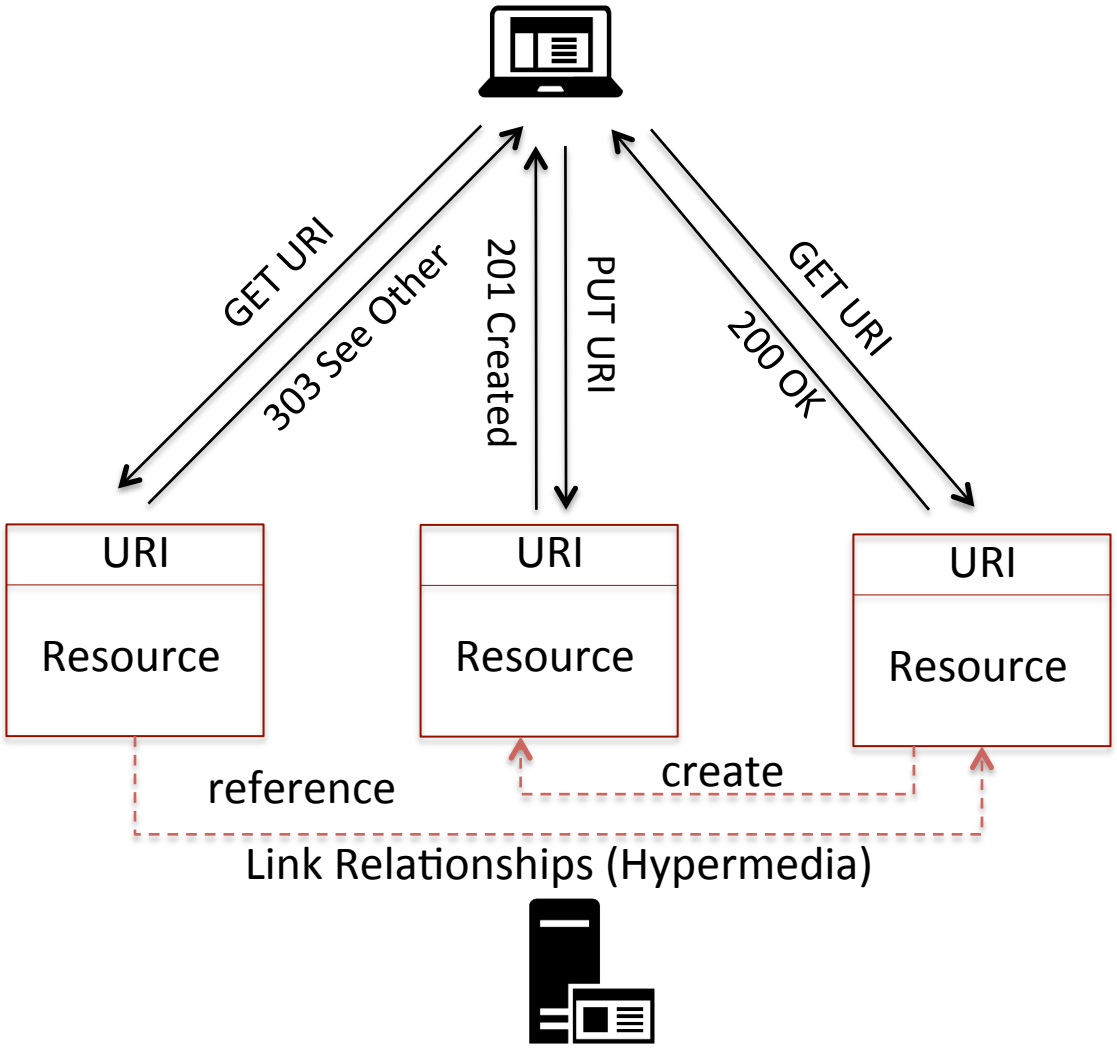
What is a RESTful conversation?

Why do we need a Domain Specific Language to model it?

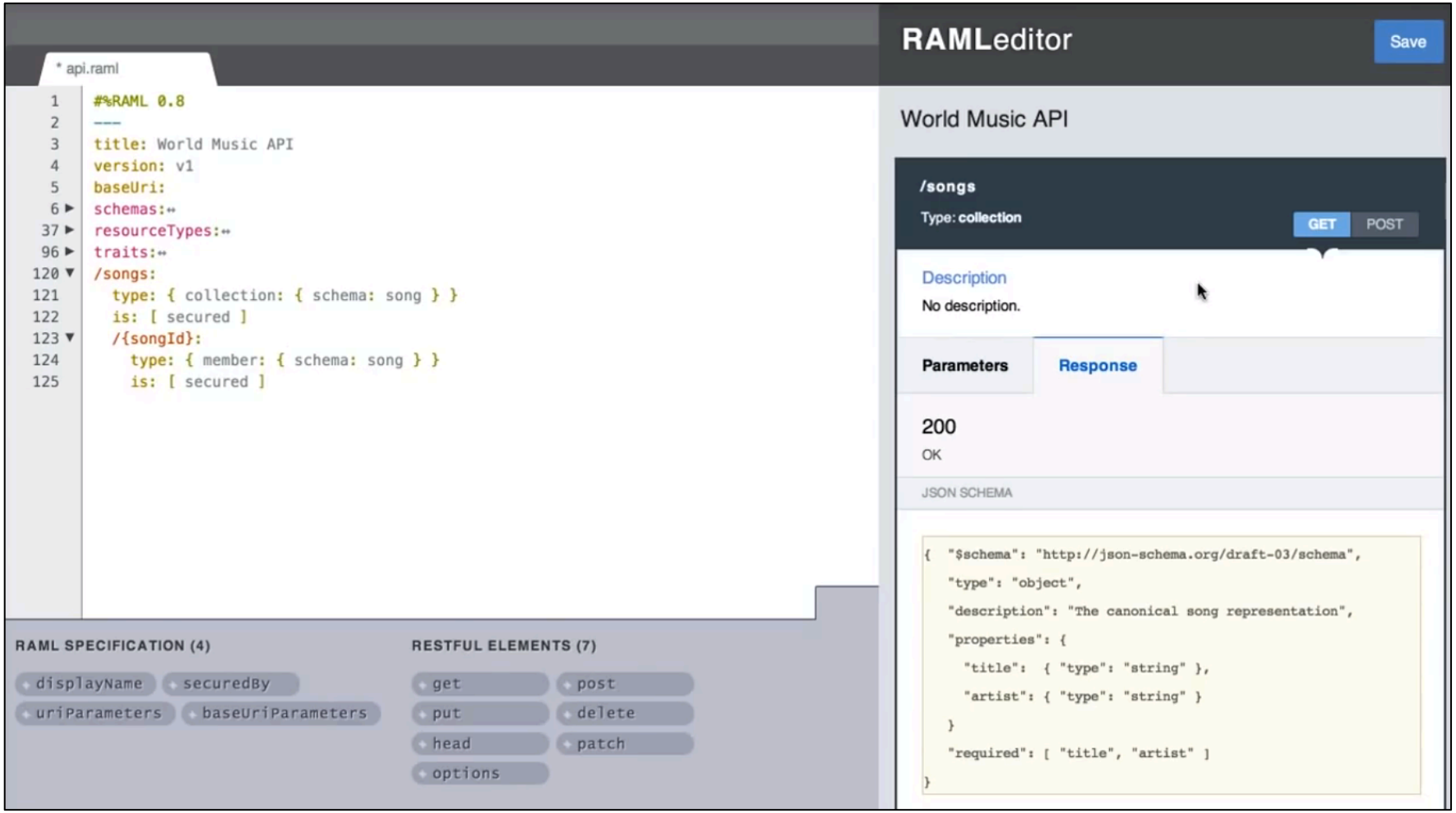
RESTful conversation



RESTful conversation



REST API structure - RAML



REST API structure- Swagger

POST /pet — Add a new pet to the store

OFF

Parameters

Parameter	Value	Description	Parameter Type	Data Type
body	{ "id": 0, "category": { "id": 0, "name": "string" }, "name": "doggie", "photoUrls": [	**Pet object that needs to be added to the store**	body	Model | Model Schema

Parameter content type: application/json

```
{
  "id": 0,
  "category": {
    "id": 0,
    "name": "string"
  },
  "name": "doggie",
  "photoUrls": [
    "string"
  ],
  "tags": [
    {
```

Click to set as parameter value

Response Messages

HTTP Status Code	Reason	Response Model	Headers
405	Invalid input		

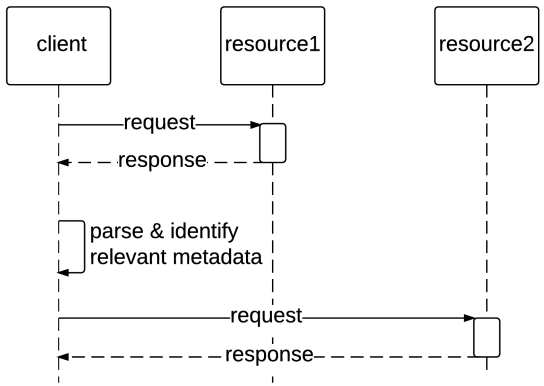
Try it out!

REST API dynamics

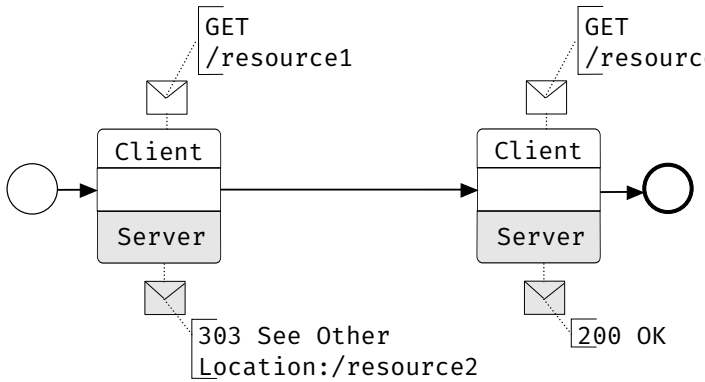
- Redirect -

GET /resource 1 HTTP/1.1	
HTTP/1.1 Location:	303 See Other /resource2
GET /resource2 HTTP/1.1	
HTTP/1.1	200 OK

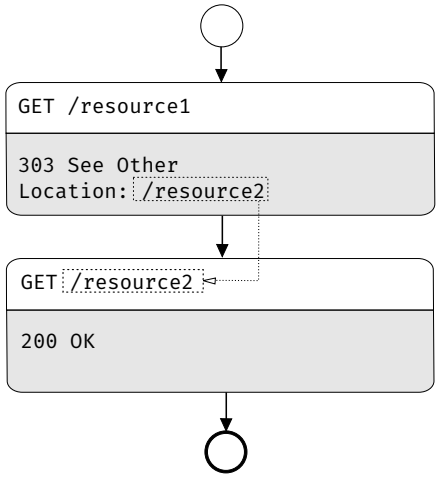
UML Sequence diagram



BPMN Choreography diagram



RESTalk

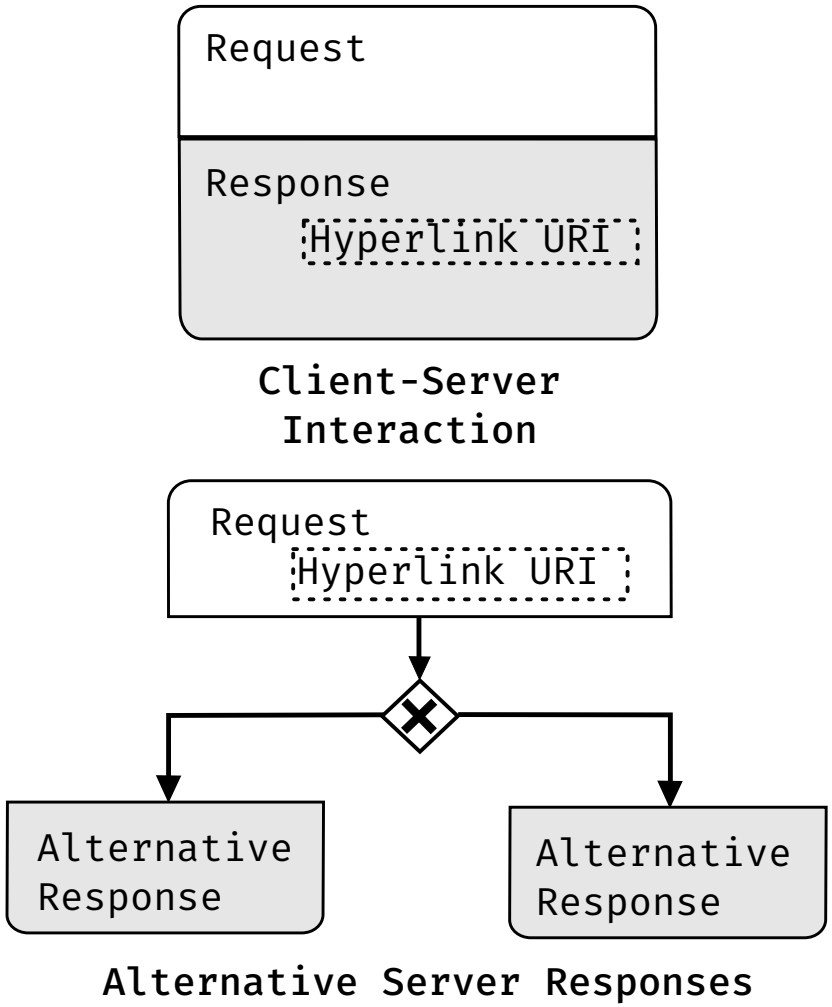


RESTalk

RESTalk constructs

Long-running request modeled with RESTalk

RESTalk



Events

- Start event
- End event
- Timer event

Flows

- Sequence flow
- Hyperlink flow

Gateways

- Parallel AND gateway
- Exclusive XOR gateway
- Inclusive OR gateway

Long-running Request

-RESTful Conversation Pattern Example-

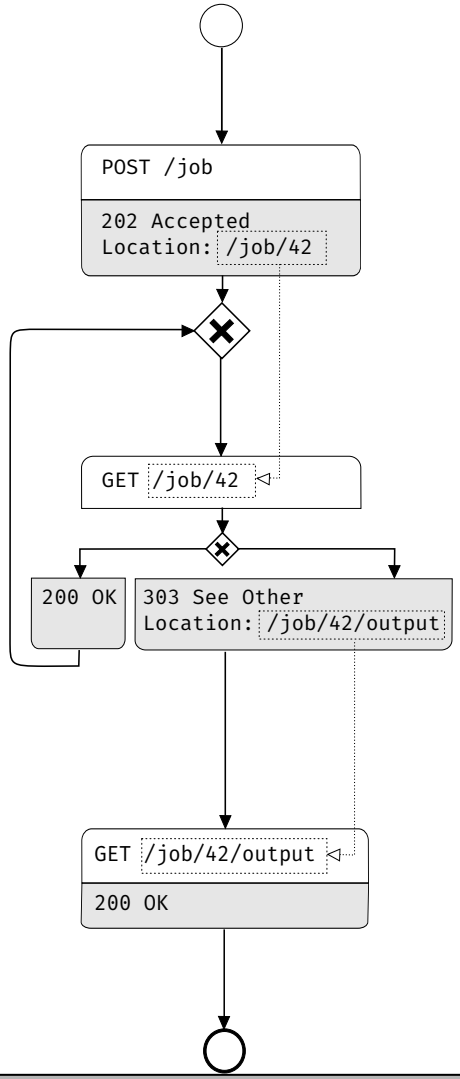
-Visualized with RESTalk-

e.g.: http://docs.aws.amazon.com/amazonglacier/latest/dev/job-operations.html

Long-running Request

- Happy path -

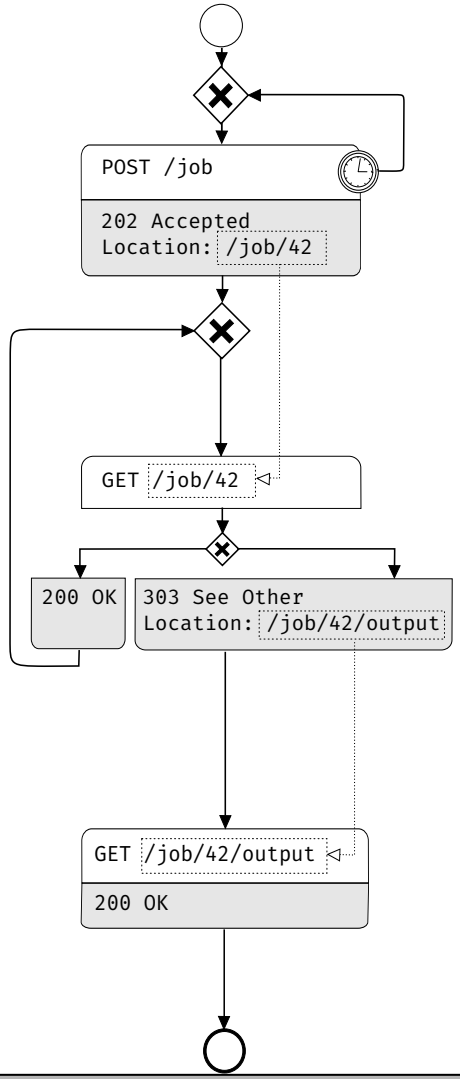
Create job	POST / job HTTP/1.1
	HTTP/1.1 202 Accepted Location: / job / 42
Poll	GET / job / 42 HTTP/1.1
	HTTP/1.1 200 OK
	GET / job / 42 HTTP/1.1
	HTTP/1.1 303 See Other Location: / job / 42 / output
Read results	GET / job / 42 / output HTTP/1.1
	HTTP/1.1 200 OK



Long-running Request

- Resending the request -

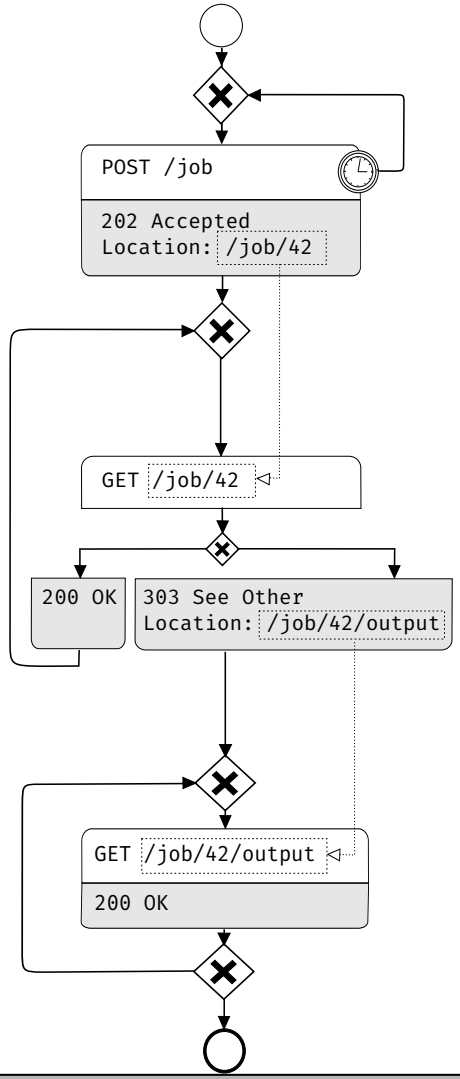
Create job	POST / job HTTP/1.1
	POST / job HTTP/1.1
	HTTP/1.1 202 Accepted Location: / job / 42
Poll	GET / job / 42 HTTP/1.1
	HTTP/1.1 200 OK
	GET / job / 42 HTTP/1.1
	HTTP/1.1 303 See Other Location: / job / 42 / output
Read results	GET / job / 42 / output HTTP/1.1
	HTTP/1.1 200 OK



Long-running Request

- Reading the results -

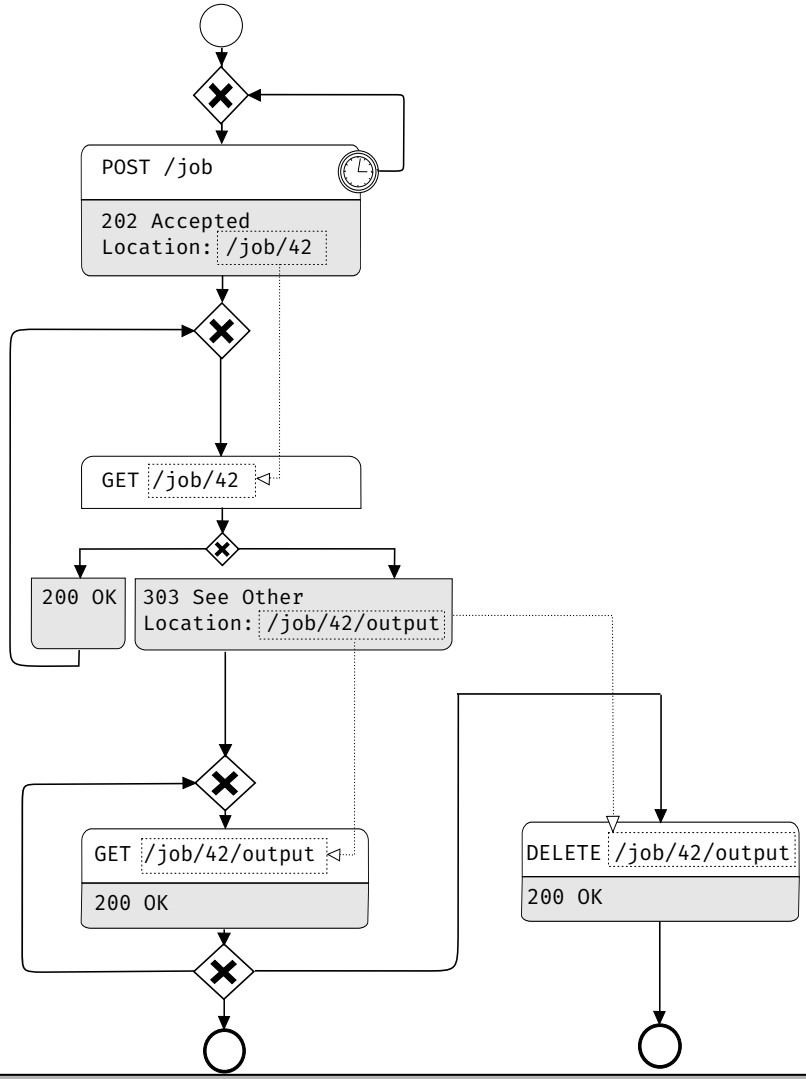
Create job	POST / job HTTP/1.1
	POST / job HTTP/1.1
	HTTP/1.1 202 Accepted Location: / job / 42
Poll	GET / job / 42 HTTP/1.1
	HTTP/1.1 200 OK
	GET / job / 42 HTTP/1.1
	HTTP/1.1 303 See Other Location: / job / 42 / output
Read results	GET / job / 42 / output HTTP/1.1
	HTTP/1.1 200 OK
	GET / job / 42 / output HTTP/1.1
	HTTP/1.1 200 OK



Long-running Request

- Deleting the output resource -

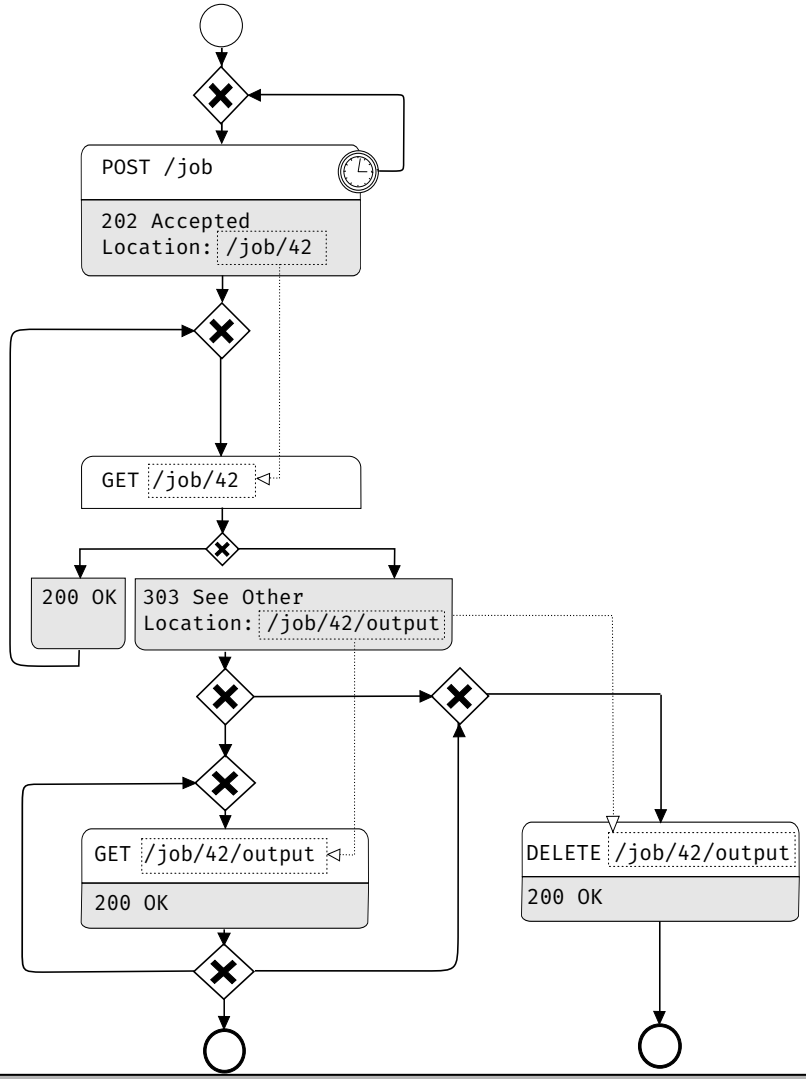
Create job	POST / job HTTP/1.1
	POST / job HTTP/1.1
	HTTP/1.1 202 Accepted Location: / job / 42
Poll	GET / job / 42 HTTP/1.1
	HTTP/1.1 200 OK
	GET / job / 42 HTTP/1.1
	HTTP/1.1 303 See Other Location: / job / 42 / output
Read results	GET / job / 42 / output HTTP/1.1
	HTTP/1.1 200 OK
	GET / job / 42 / output HTTP/1.1
	HTTP/1.1 200 OK
Delete output	**DELETE / job / 42 / output HTTP/1.1**
	HTTP/1.1 200 OK



Long-running Request

- Deleting the output resource -

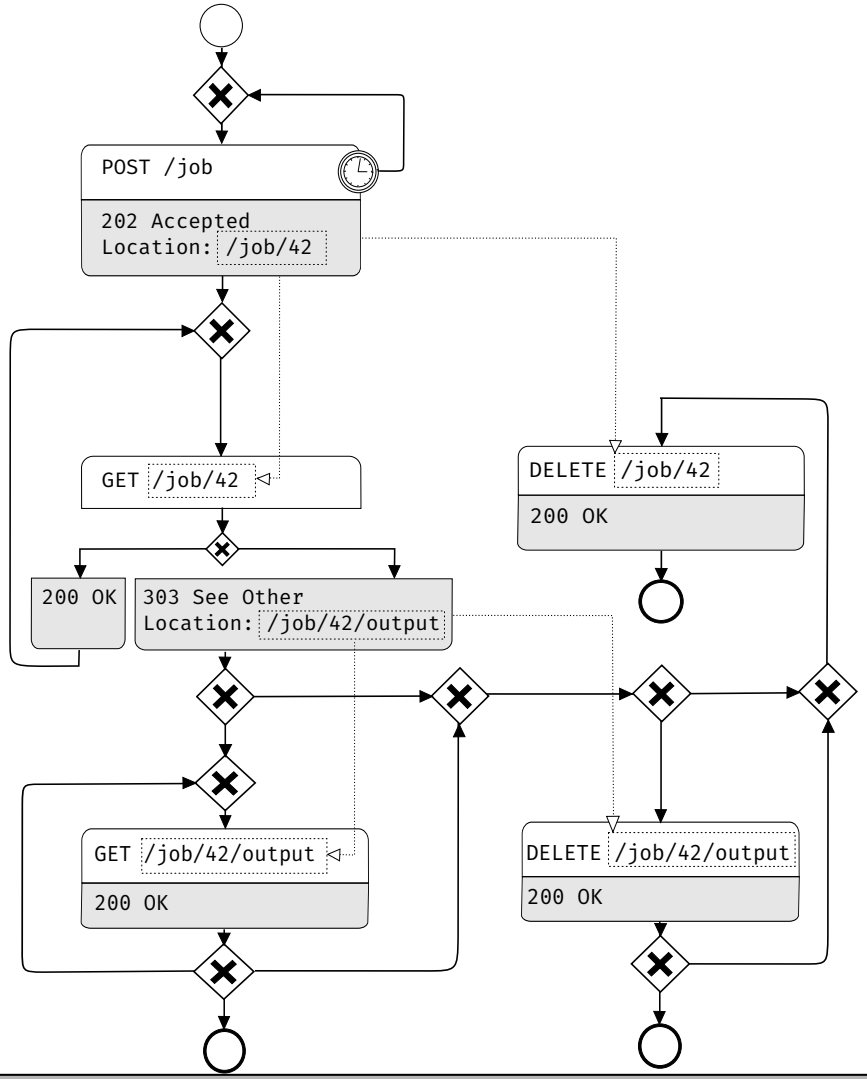
Create job	POST / job HTTP/1.1
	POST / job HTTP/1.1
	HTTP/1.1 202 Accepted Location: / job / 42
Poll	GET / job / 42 HTTP/1.1
	HTTP/1.1 200 OK
	GET / job / 42 HTTP/1.1
	HTTP/1.1 303 See Other Location: / job / 42 / output
Delete output	**DELETE / job / 42 / output HTTP/1.1**
	HTTP/1.1 200 OK



Long-running Request

- Deleting the job resource -

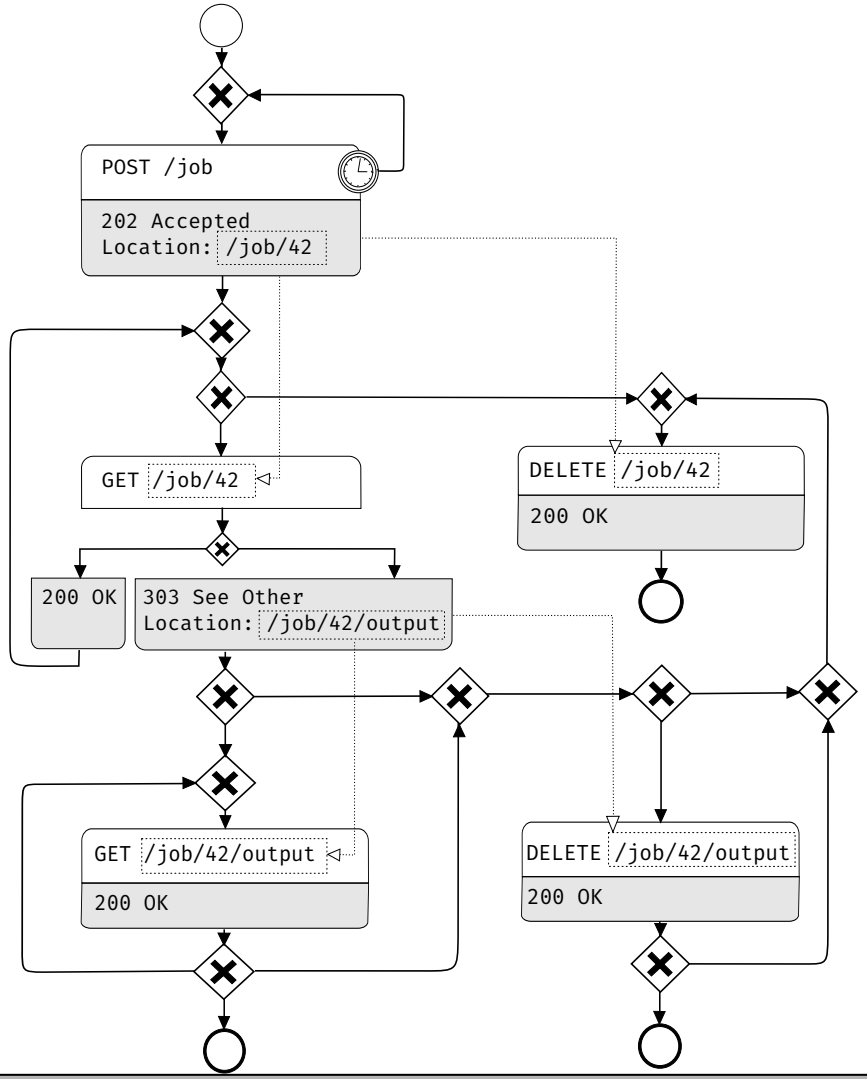
Create job	POST / job HTTP/1.1
	POST / job HTTP/1.1
	HTTP/1.1 202 Accepted Location: / job / 42
Poll	GET / job / 42 HTTP/1.1
	HTTP/1.1 200 OK
	GET / job / 42 HTTP/1.1
	HTTP/1.1 303 See Other Location: / job / 42 / output
Delete output	DELETE / job / 42 / output HTTP/1.1
	HTTP/1.1 200 OK
Clean up	**DELETE / job / 42 HTTP/1.1**
	HTTP/1.1 200 OK



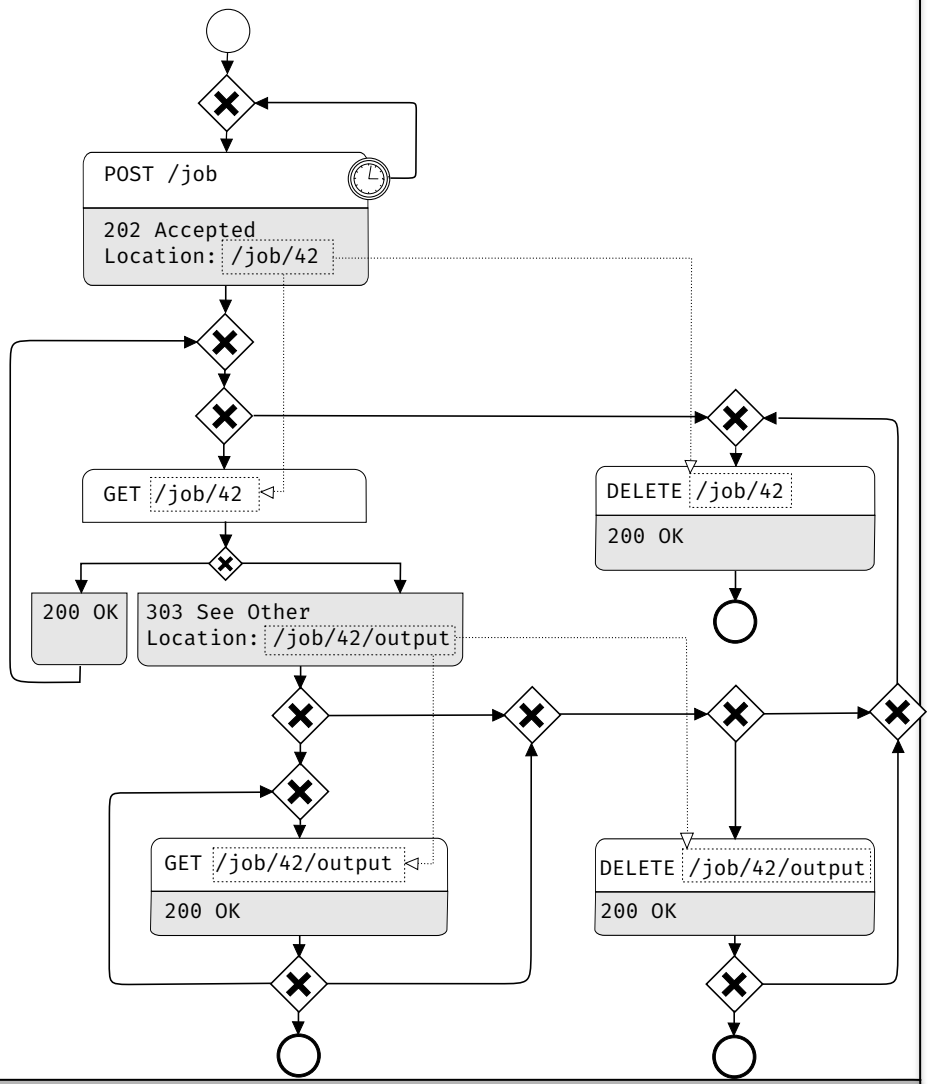
Long-running Request

- Deleting the job resource -

Create job	POST / job HTTP/1.1
	POST / job HTTP/1.1
	HTTP/1.1 202 Accepted Location: / job / 42
Delete job	**DELETE / job / 42 HTTP/1.1**
	HTTP/1.1 200 OK



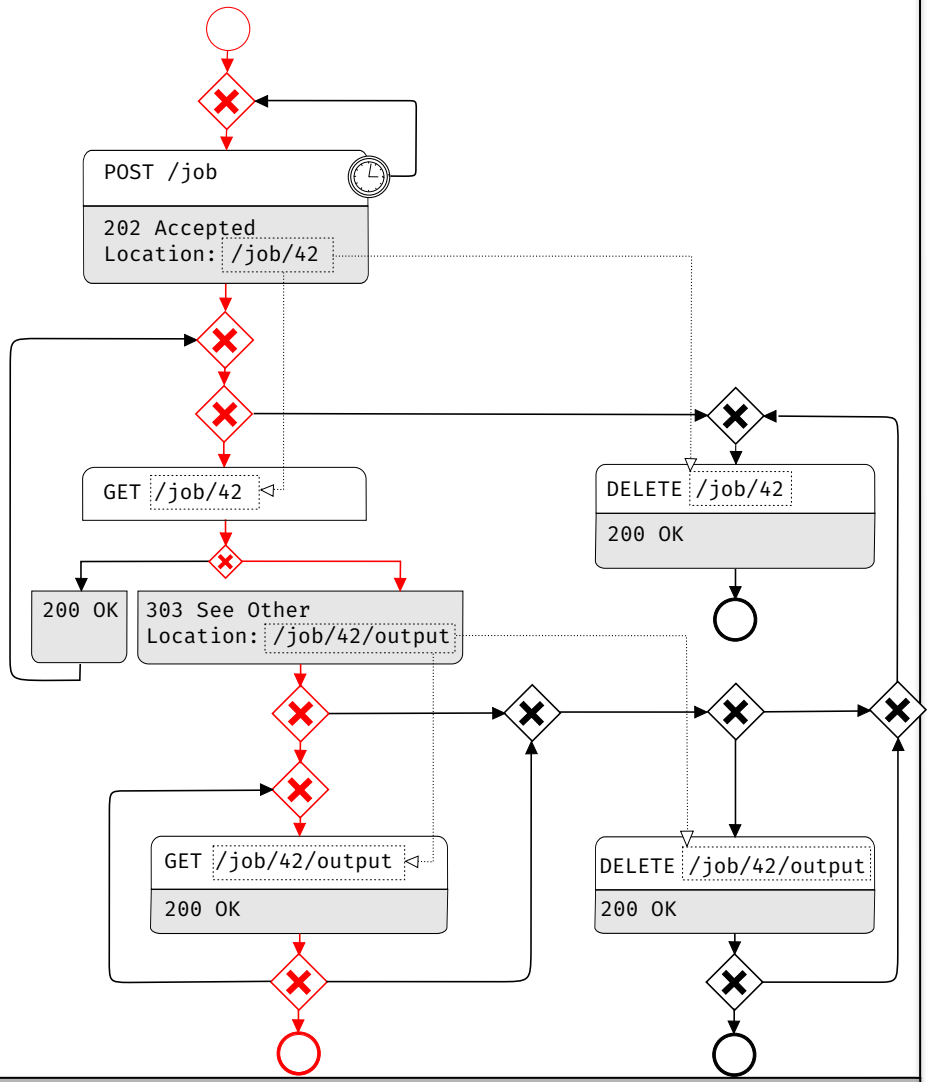
Long-running Request



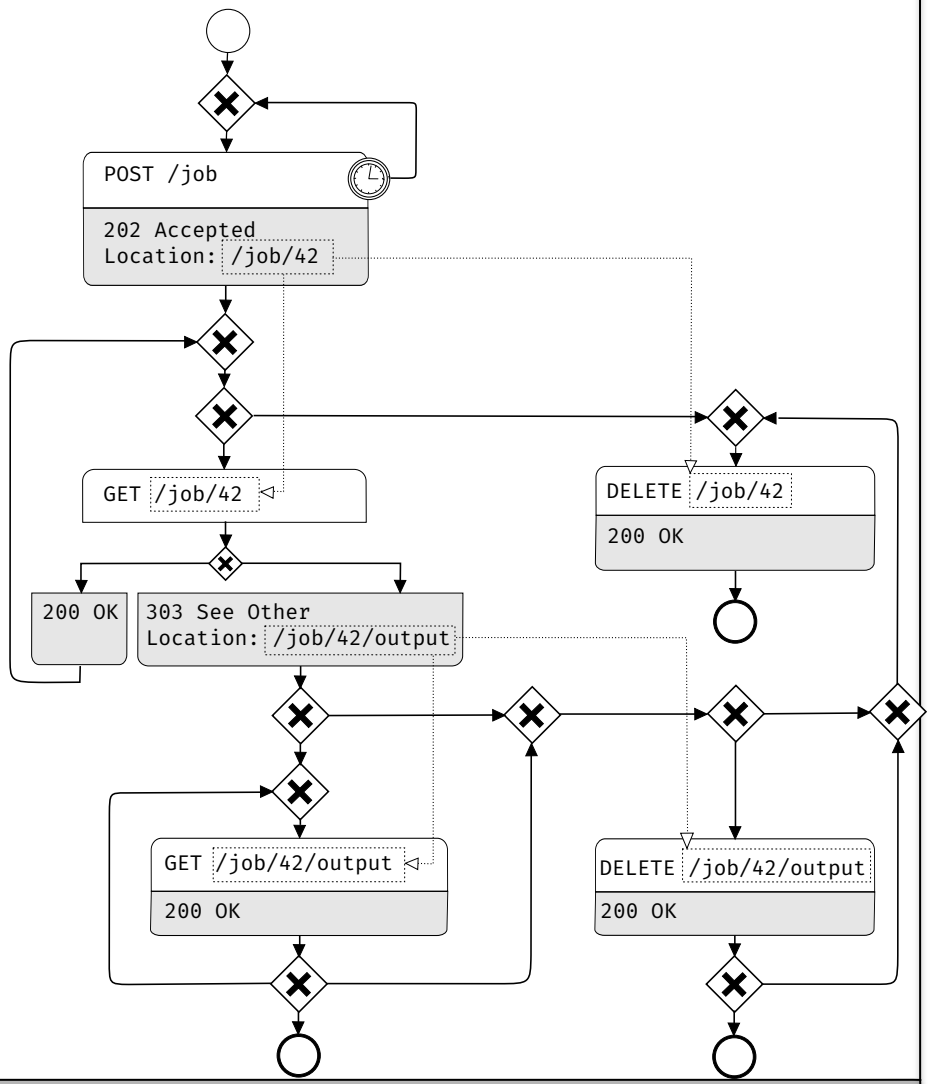
Long-running Request

- Short happy path -

Create job	POST / job HTTP/1.1
	HTTP/1.1 202 Accepted Location: / job / 42
Poll	GET / job / 42 HTTP/1.1
	HTTP/1.1 303 See Other Location: / job / 42 / output
Read results	GET / job / 42 / output HTTP/1.1
	HTTP/1.1 200 OK



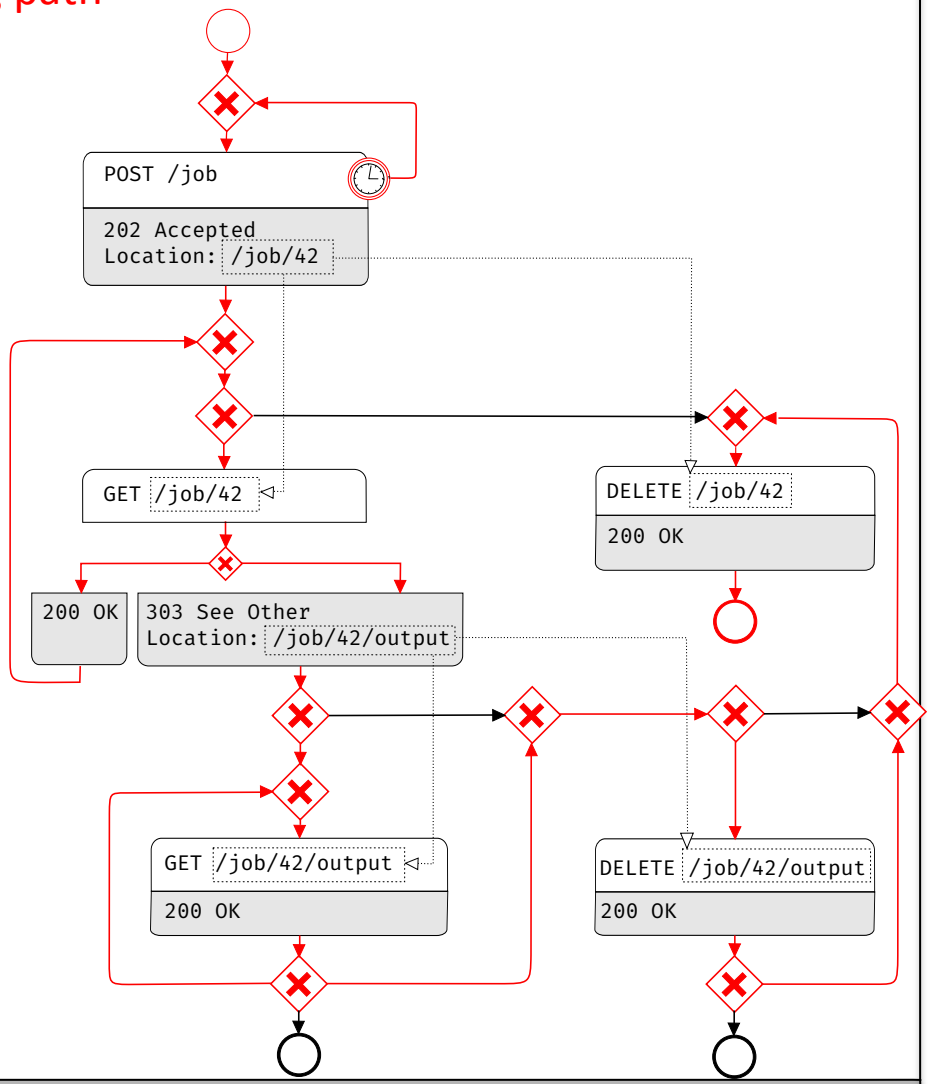
Long-running Request



Long-running Request

- Long path -

Create job	POST / job HTTP/1.1
	POST / job HTTP/1.1
	HTTP/1.1 202 Accepted Location: / job / 42
Poll	GET / job / 42 HTTP/1.1
	HTTP/1.1 200 OK
	GET / job / 42 HTTP/1.1
	HTTP/1.1 200 OK
	GET / job / 42 HTTP/1.1
	HTTP/1.1 303 See Other Location: / job / 42 / output
Read results	GET / job / 42 / output HTTP/1.1
	HTTP/1.1 200 OK
	GET / job / 42 / output HTTP/1.1
	HTTP/1.1 200 OK
Delete output	DELETE / job / 42 / output HTTP/1.1
	HTTP/1.1 200 OK
Delete job	DELETE / job / 42 HTTP/1.1
	HTTP/1.1 200 OK



RESTalk Exploratory Survey

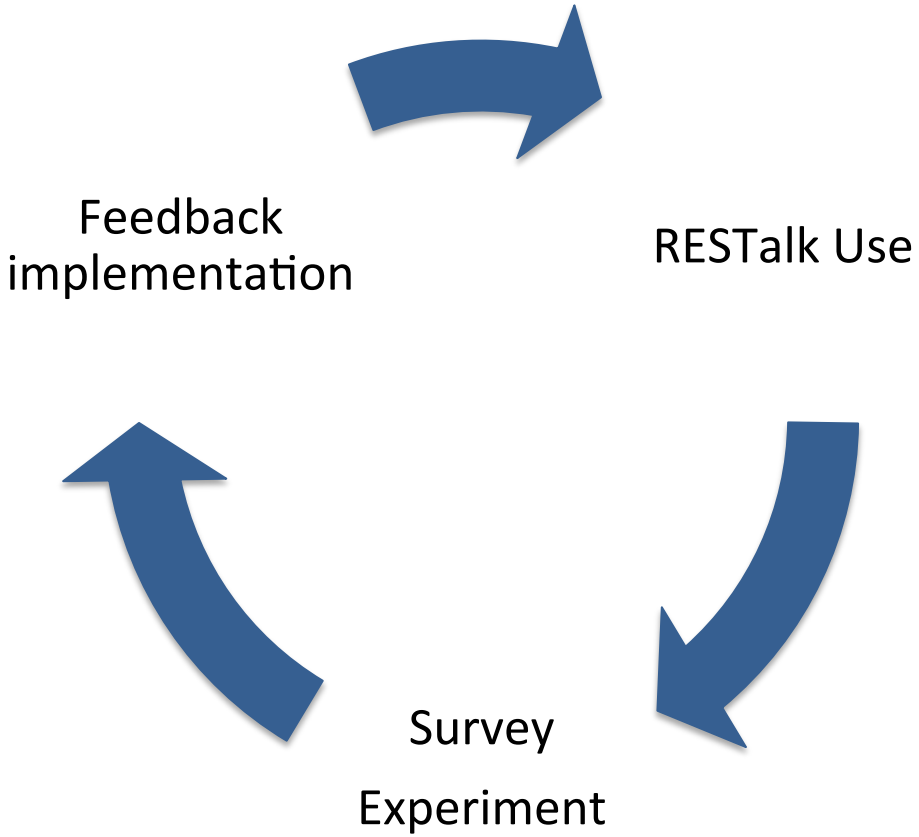
Motivation

Goals

Design

Results

Approach: Agile DSML Design



Final Goal:

Increase acceptance and dissemination of RESTalk

Explorative Survey Goals

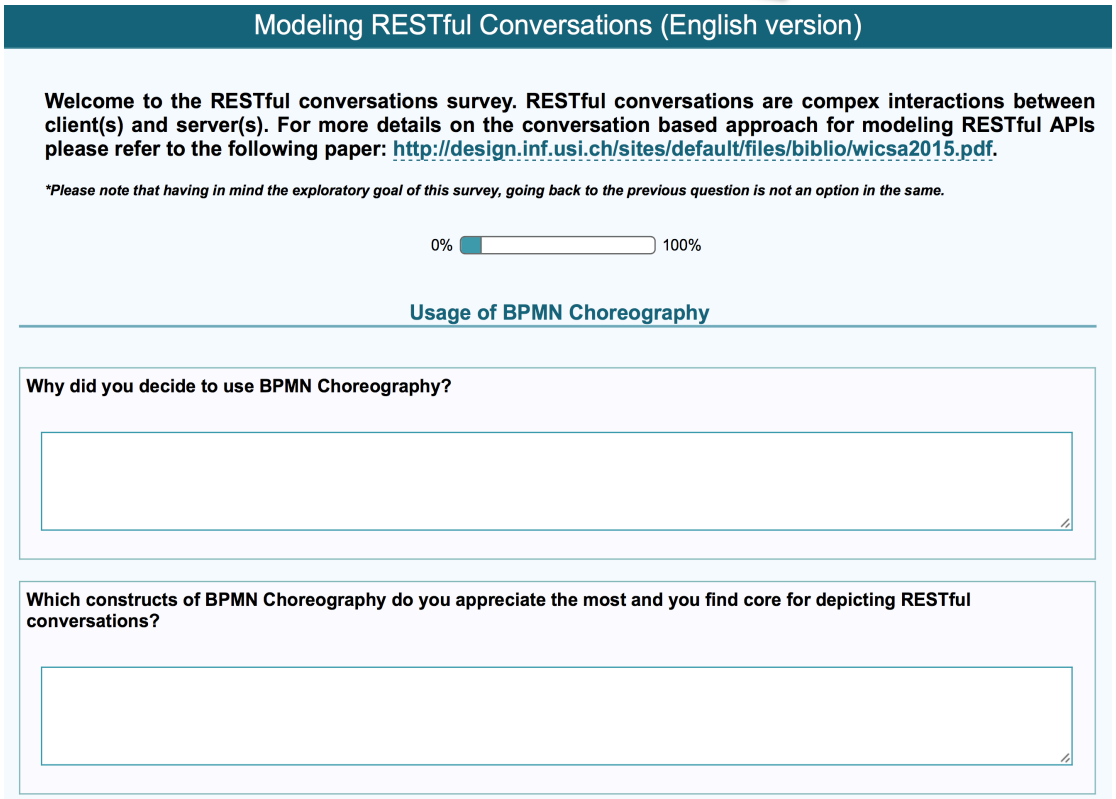
- **Goal 1:** Evaluate the need in industry for a domain specific language for modeling RESTful conversations

- **Goal 2:** Evaluate the cognitive characteristics of RESTalk

***Qualitative research technique => No statistical inference**

Explorative Survey Design

English + German



Mainly open ended optional questions

7 question groups:

- demographic data
- background on used notations in practice
- RESTalk's intuitiveness
- RESTalk vs. standard BPMN Choreography
- reading task
- modeling task
- RESTalk's evaluation

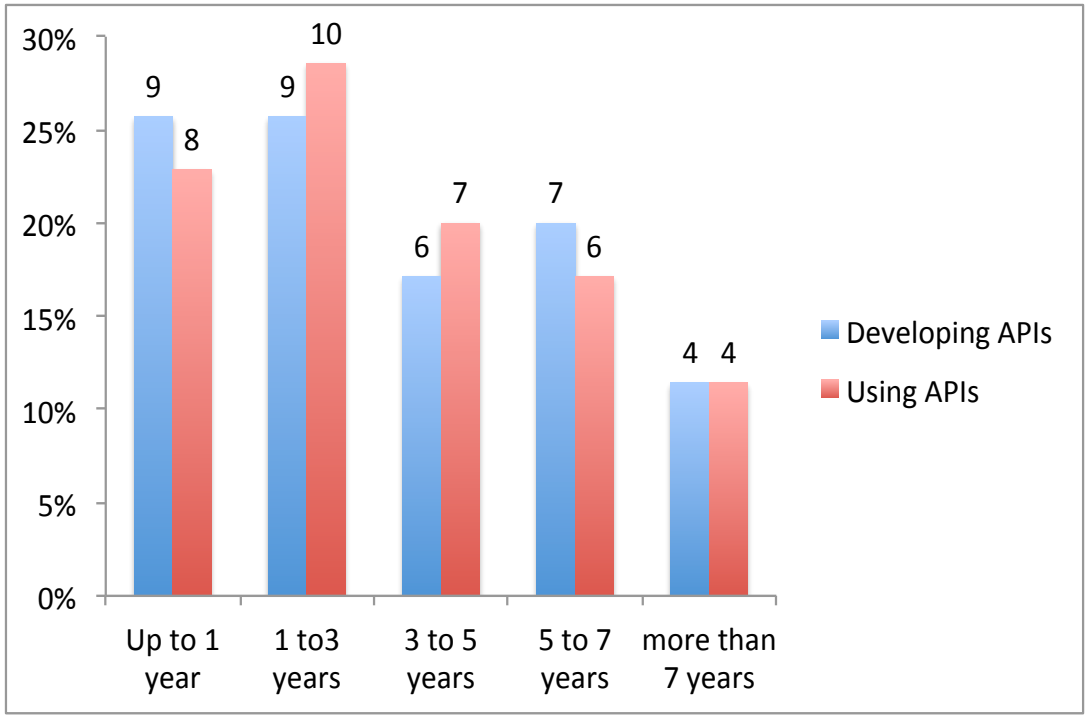
Respondents' Demographic Data

35 respondents:

- 74% industry
- 26% academia

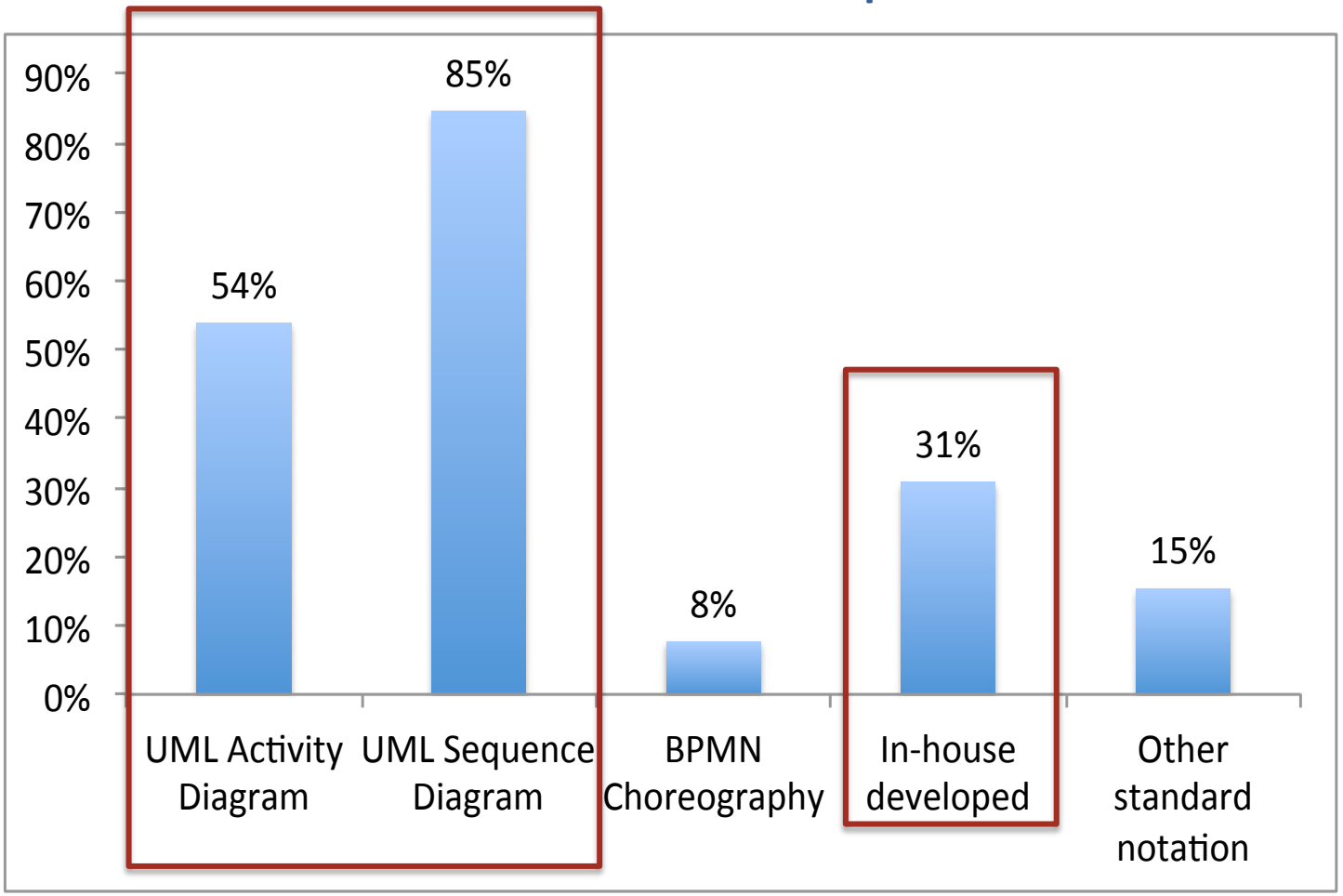
Profile:

- IT consultants
- SW quality engineers
- SW developers
- SW architects
- a CTO
- researchers

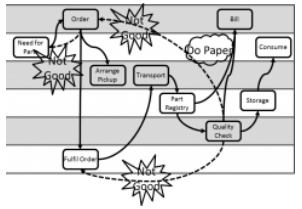


Used notations in practice

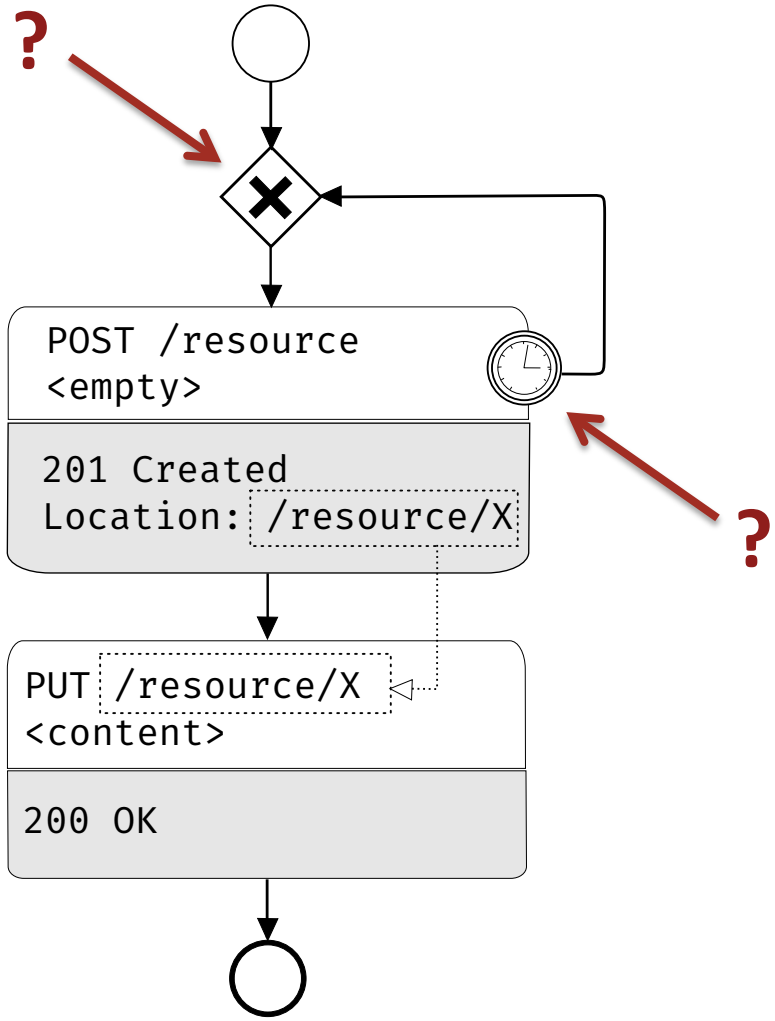
-38% of respondents-



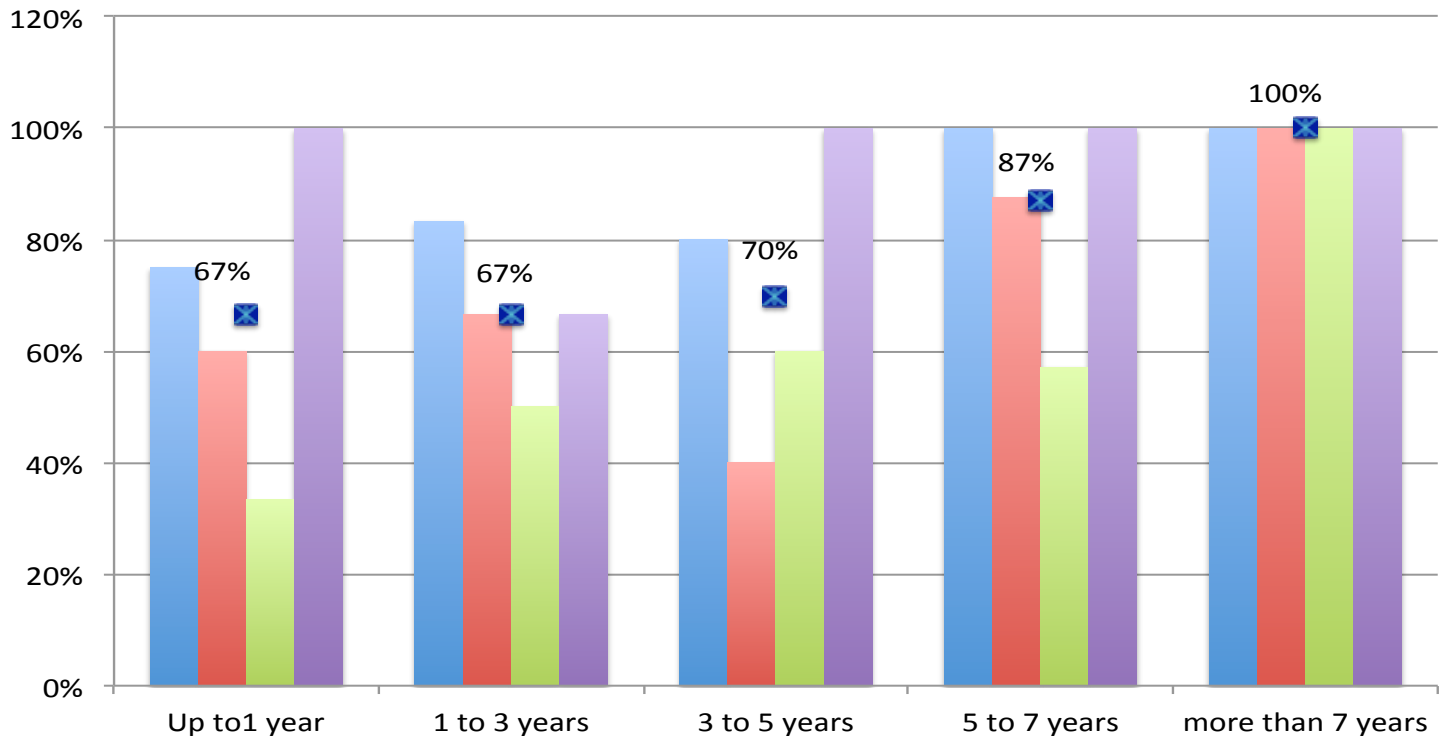
UNIFIED MODELING LANGUAGE™



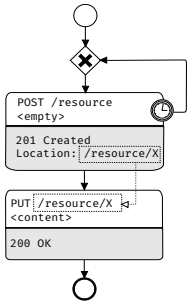
RESTalk's intuitiveness



RESTalk's intuitiveness



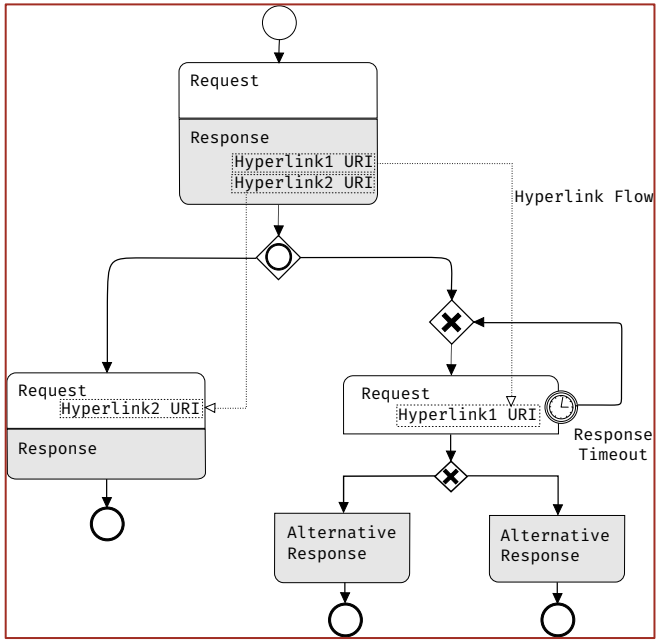
- The goal of this RESTful conversation is creating a new resource
- The client can send the POST request multiple times



- By sending multiple POST requests multiple resources are being created
- The client knows the link to the created resource before the start of the conversation
- Average correct answers

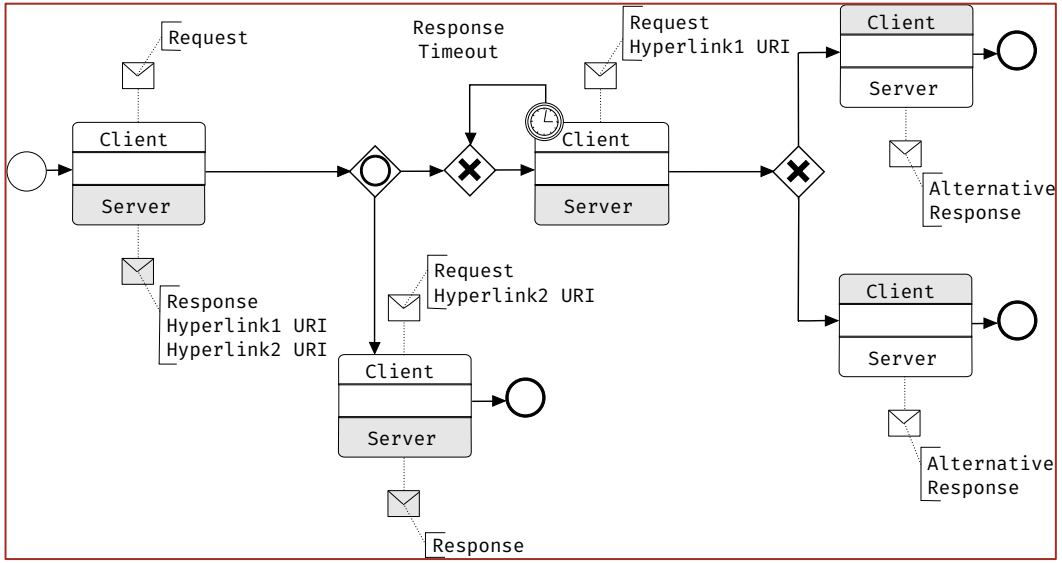
RESTalk vs. Standard BPMN Choreography

-41% of respondents-



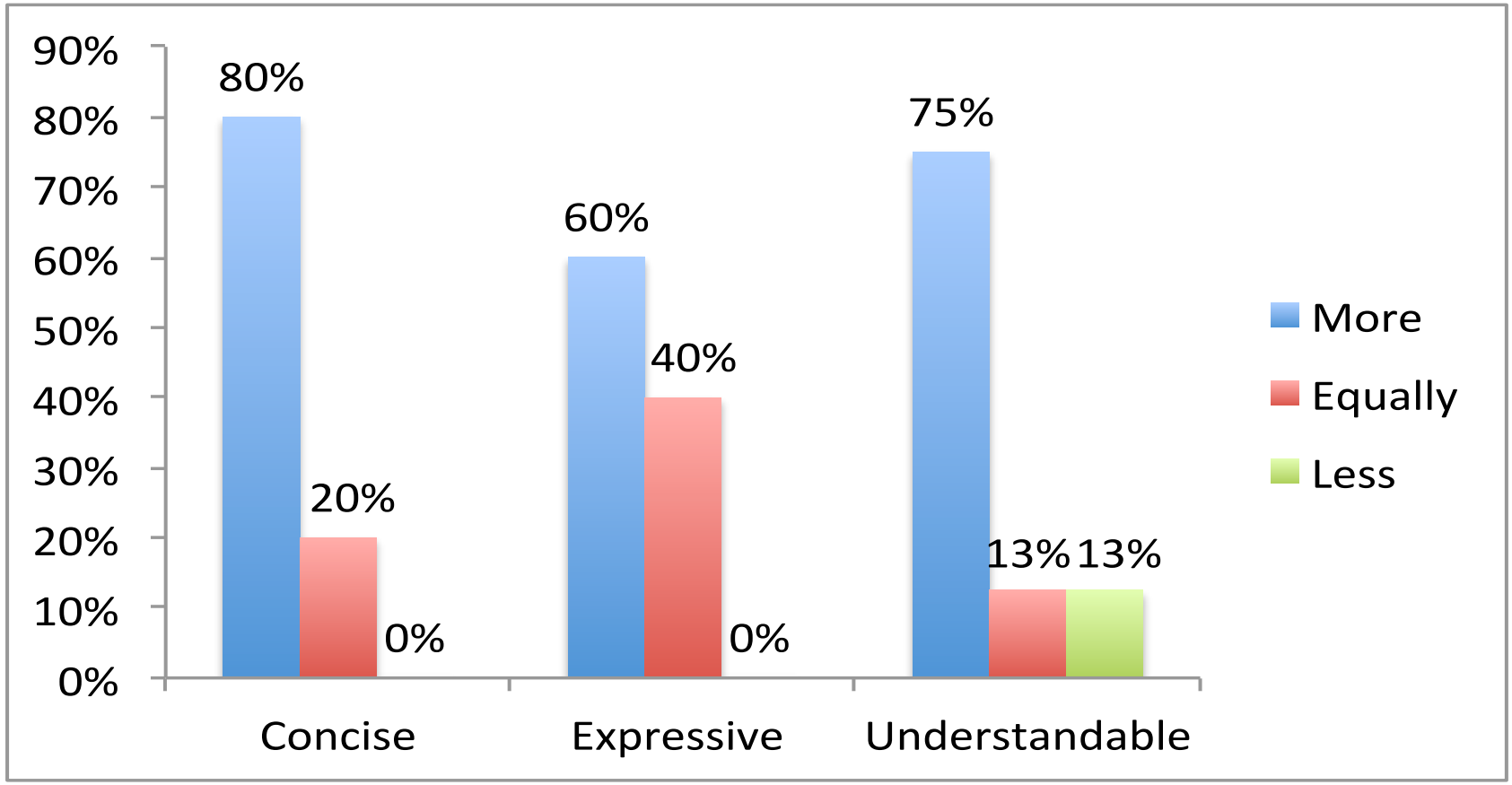
RESTalk

Standard BPMN Choreography



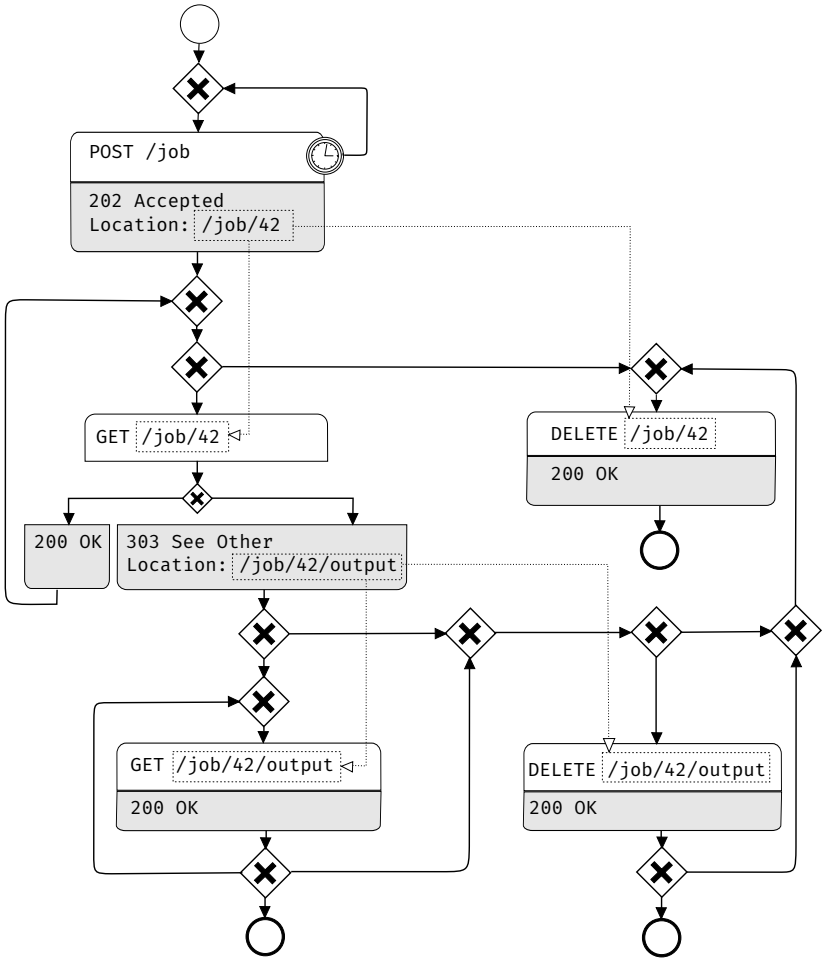
RESTalk vs. Standard BPMN Choreography

-41% of respondents-



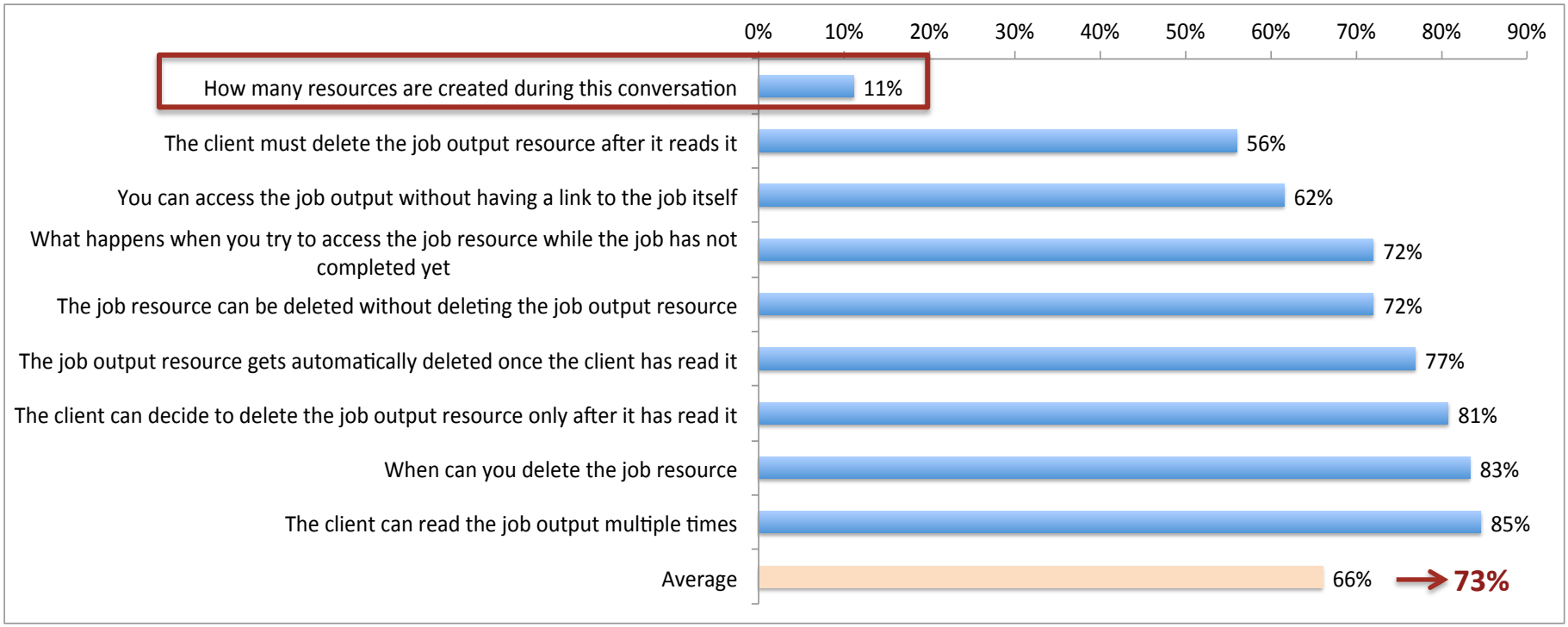
Reading task

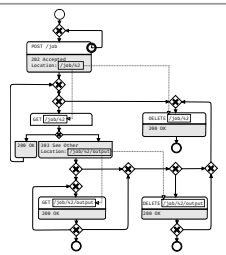
-Long Running Request-



Reading task

-Long Running Request-

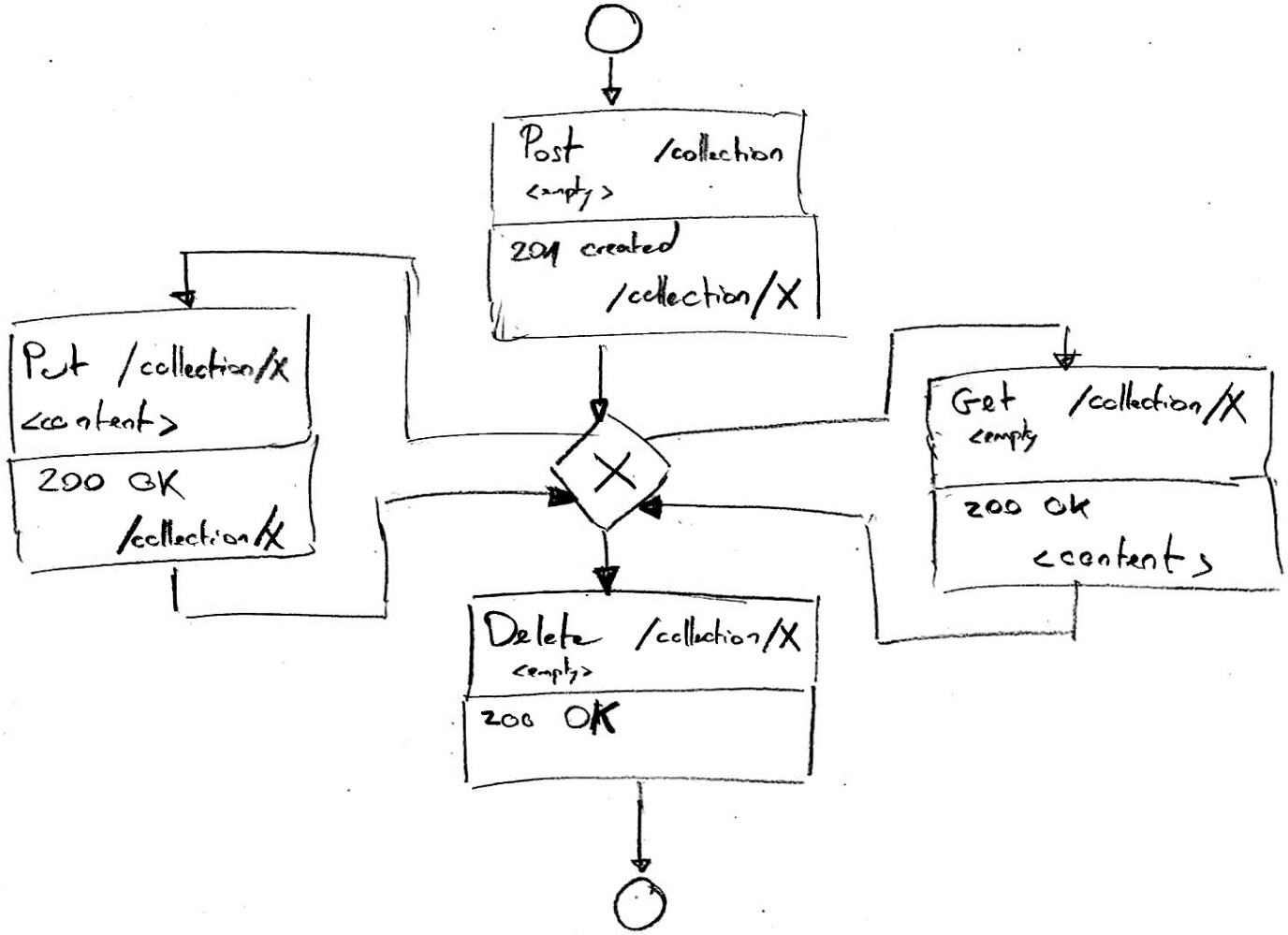




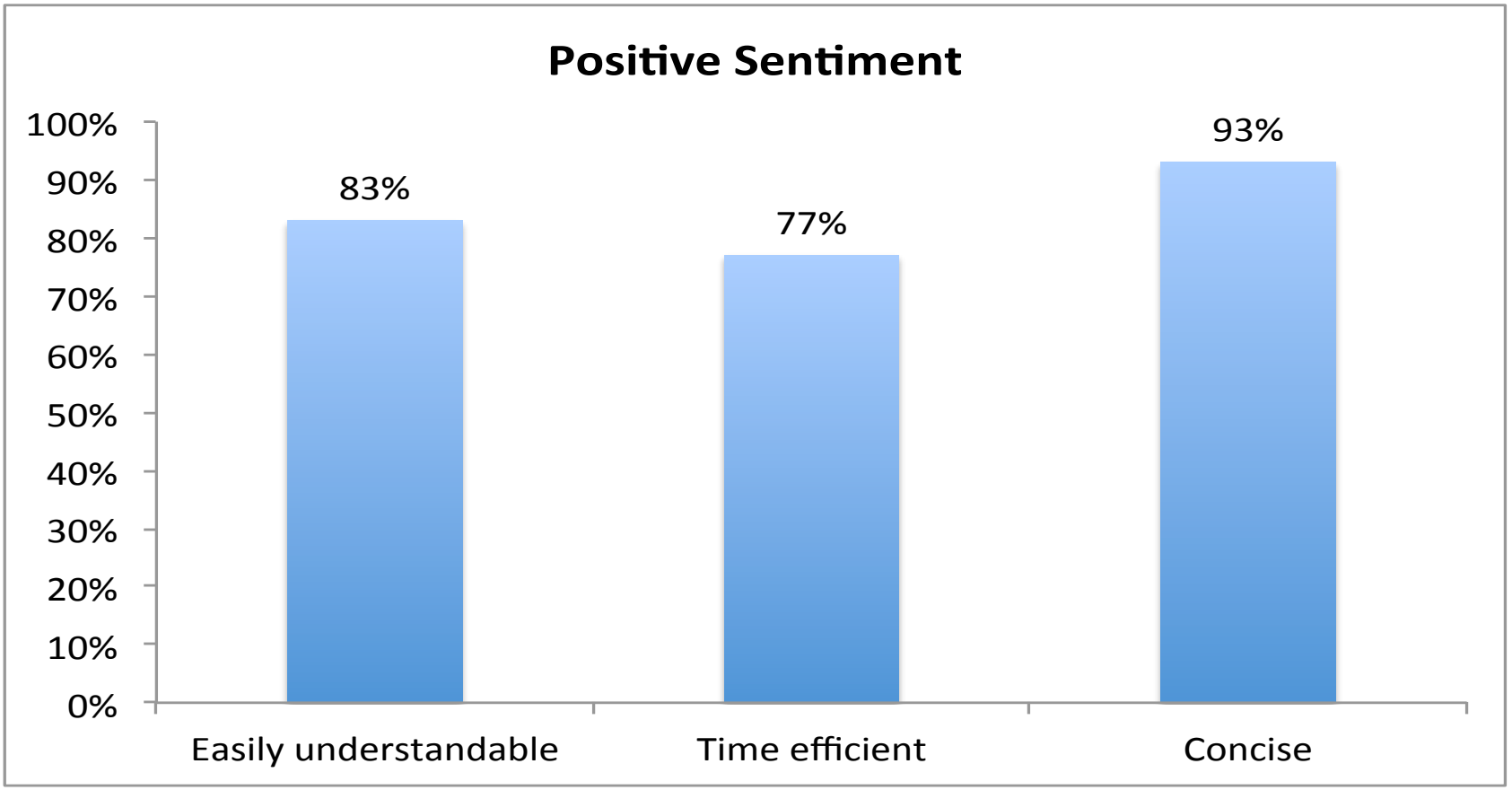
Correct answers by sector:
86% in academia and 68% in industry

Modeling task

-CRUD operations on a resource-



RESTalk's evaluation



Would use RESTalk – 78%
Would prefer a tool – 69%

Conclusions

Take-Aways

Further existing work

Future work

Explorative Survey Goals

- **Goal 1:** Evaluate the need in industry for a domain specific language for modeling RESTful conversations

- **Goal 2:** Evaluate the cognitive characteristics of RESTalk

***Qualitative research technique => No statistical inference**

Take away

-Goal 1: Evaluate the need in industry for a DSML-

38% already using some notation
78% willing to use RESTalk

Take away

-Goal 2: Evaluate the cognitive characteristics of RESTalk-

Intuitiveness:

77% correct answers without prior RESTalk knowledge

Feedback: include the rationale behind server's decisions at XOR gateways

Closeness of mapping to the problem world:

61% found RESTalk more concise than what they are using

Feedback: make state transitions and looping limits explicit in RESTalk

Abstraction gradient:

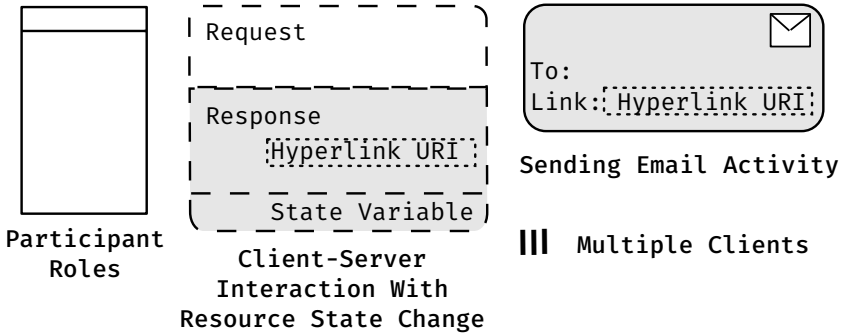
83% found RESTalk easy or somewhat easy to understand

Feedback: use end events only after a DELETE method and make dependencies among resources explicit

Further Existing Work

RESTalk Extension

- roles
- state transitions
- asynch email interactions
- multiparty

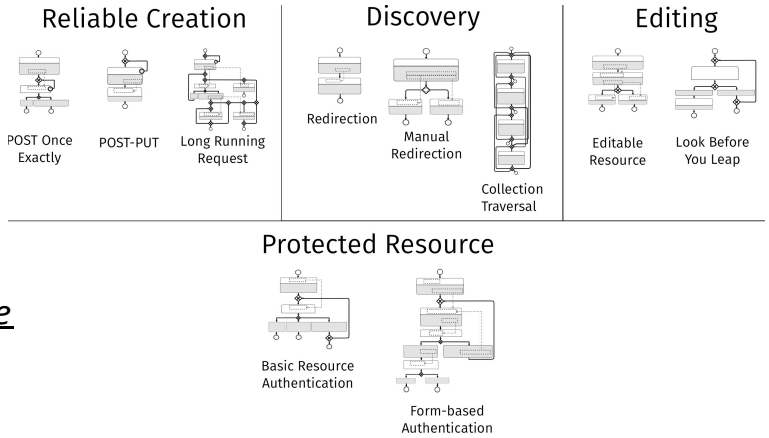


A. Ivanchikj. RESTful Conversation with RESTalk –The Use Case of Doodle-. In Proc. of ICWE. Springer, 2016

RESTalk Pattern Language

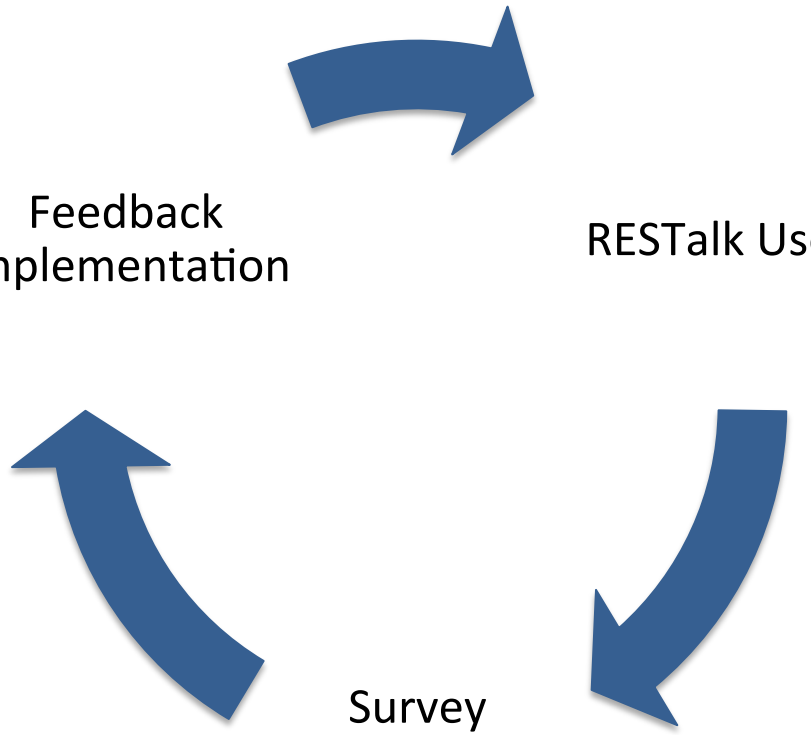
http://restalk-patterns.org

C. Pautasso, A. Ivanchikj, and S. Schreier. A Pattern Language for RESTful Conversations. In Proc. Of EuroPLoP. ACM, 2016.



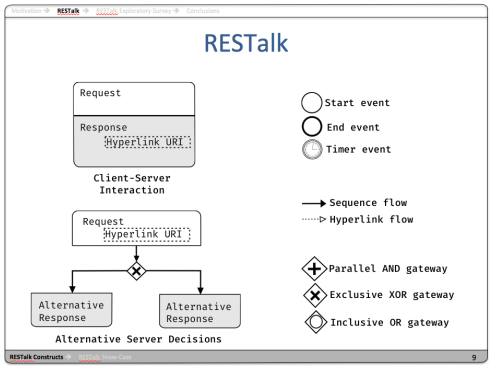
Future Work

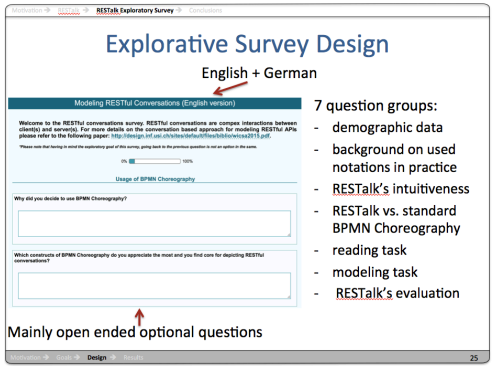
Tool development:
- natural language
- graphical modeling
- code generation

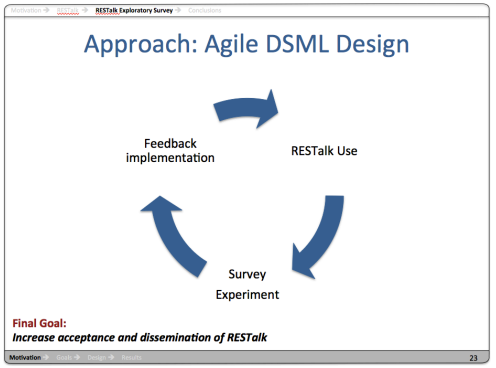


Applied:
- on patterns
- on real APIs
- by practitioners

With statistical relevance







Contribute to our research on RESTful conversation patterns!
http://restalk-patterns.org/contribute.html

Contact us at:
ana.ivanchikj@usi.ch
c.pautasso@ieee.org
silvia.schreier@innoq.com