

Vorwissenschaftliche Arbeit

Monolithic vs. Microservices: a comparison based on the frameworks Flask and Django

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Abstract

{Text}

Vorwort

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# Introduction

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# Monolithic Architecture

## Definition

Monolithic architecture in general describes software where the user interface (UI) and the business logic are combined on a single platform. Similarly, in webdevelopment terms it referes to a model for the design of software in which the application is composed all in one piece. The UI is generated as a so called “View” on the server and sent out finished in one piece to the user. Typically, the components are interconnected and all of these components need to be present for code to be executed or compiled. A framework is not required but it greatly eases the development so for this paper I have chosen to uses Django, developed and maintained by the Django Software Foundation.

## Historical Perspective

The first applications to be developed for mainframes in the early 50’s up to the 70’s were monolythic. Only with the standardisation of TCP wide spread networking became possible and with that microservices as we know them.

# Microservices Architecture

## Definition

Microservice architecture describes the logical structure and design of a software application which consists of modular, loosely coupled components. These Services should be lightweight, independent and simple. From a web development point of view the key difference, compared to a monolithic architecture, is the separation of the presentation layer and the business logic, that means that the UI is composed in the browser on the client’s machine instead of the server. Applications like Netflix use this to reduce server load which dramatically reduces costs for the company. As with Monolithic architecture there are many different frameworks to ease the development process and for this paper I have chosen to use Flask which is open source and can be found on Github.

## Historical Perspective

The term Microservice was first used to describe this style of application design in 2011 by a workshop of software architects near Venice and has since gained popularity.

{I need to do further research on the topic as there are a lot of conflicting sources out there}

# Monolithic and Microservice Architectures in Practice

In order to compare Monolithic and Microservice Architectures I have decided to get some first-hand experience and write my own Application. To highlight the differences, I will go through a call for the movies which are currently showing with each of the two methods.

## Cinema Seat Reservation Application

As a practical real-world example, I have created a web app for reserving seats in a cinema using both approaches. Their user interface is almost identical and kept as simple as possible.

### Requirements

The User should be able to pick a Movie from a List and then reserve seats for a specific Time and Date. The System should also support adding and the removal of movies by an administrator. For simplicity, the authentication and authorization were ignored.

### Structure



{Explain Structure? And reference to source}

### Problems

{Include Section?}

### Implementation

#### Database

{Insert Entity diagram}

For this application, I have chosen to keep the database as simple and straight forward as possible. I am using a Postgres database structured as seen in {Picture of entity diagram}

#### Userstories

## Get showing movies

I will go through an example request, using both approaches, which gets all movies currently showing in a cinema.

### Microservices

For the client-side I am using the JavaScript and the jQuery library, the server-side coded in Python using the Flask and Connexion Frameworks.

#### Client-side

1. $.ajax({
2. url: "http://127.0.0.1:5000/movies",
3. success: **function**(result) {
4. **for** (**var** i = 0; i < result["showing\_movies"].length;i++) {
5. **var** movie = result["showing\_movies"][i];
6. paint\_movie(movie);
7. };
9. }, error: **function**(xhr) {
10. alert("Error (" + xhr.status + ") :  " + xhr.statusText);
11. }
12. });

The initial request is triggered upon loading of the webpages with the jQuery *ready()* function which executes once the whole document has been loaded in the browser. The *$.ajax()* function shown above is nested within this function. This ajax function performs a http request to *http://127.0.0.1:5000/movies* which is a request to the server, localhost in this case, on port 5000 which it is listening on. The function given as the *success* parameter is executed as the name suggests after a successful request, same with the *error* parameter. In the success function, we process the received *json* data and paint it on the website. The Error function alerts the user of an error should one occur.

#### Server-side

1. /movies:
2. get:
3. tags: [movies]
4. operationId: controllers.movies.showing\_movies
5. summary: Gets all of the showing movies
6. responses:
7. 200:
8. description: Returns showing movies
9. schema:
10. type: array
11. items:
12. $ref: '#/definitions/Movie'
13. 404:
14. description: No movies

On the server-side the request is first caught by connexion, it filters for the request type and has fixed returns. Connexion then calls the *showing\_movies()* function in controllers/movies.

1. **def** showing\_movies():
2. movies = get\_movies\_showing()
3. **if** (movies **is** None):
4. **return** "No movies found", 404
5. **else**:
6. **return** {'showing\_movies': movies}

This takes the return of the *get\_movies\_showing()* function from the dao and sends it back to Connexion which converts it to json and sends it out.

1. **def** get\_movies\_showing():
2. with get\_db\_cursor() as cursor:
3. cursor.execute("""select \* from movie where id in (select movie\_id from screening);""")
4. **return** cursor.fetchall()

This function performs the actual operation on the database, in this case fetching all the showing movies and returning them.

### Monolithic

Here I am using the Django framework and showing a function from the *views* file. In this case there is no need for routing as there are no requests from outside coming in.

#### Client-side

1. **def** index(request):
2. showing\_movies\_list = (Movie.objects.filter(
3. id\_\_in=[s.movie\_id **for** s **in** Screening.objects.all().distinct()]))
4. context = {'showing\_movies\_list': showing\_movies\_list}
5. **return** render(request, 'cinema/index.html', context)

In the *index()* function, which is one of the views, the showing movies are fetched from the database and passed to the render function, which renders the template, as the context for painting the view.

## Microservices

### Database Operations

### Rest Server

### Open API with connexion

### Client-side

### Design

## Monolithic

### Database Operations with Django Database API

### Integrating Legacy Database in Django

### Views

### Forms and working with Django Framework

### Design

# Comparitive Advantages and Disadvantages

## Monolithic Architecture

### Development concerns

#### Learning curve

Learning monolithic programming might seem simple in the beginning especially with a framework like Django but that can be deceiving because even though you might be able to write a simple application quickly, you’ll most likely lack an understanding of the processes going on under the hood which will eventually lead to problems down the road when you have to scale up the application or customize it further. ☹

#### Teamwork

#### Development Time and

### Production concerns

#### Performance

#### Scalability

#### Security

#### Upgradeability

#### Crossplatform

## Microservices Architecture

### Development concerns

#### Learning Curve

#### Teamwork

### Production concerns

#### Performance

#### Scalability

#### Security

#### Upgradeability

#### Crossplatform

# Conclusion

# Sources

<http://whatis.techtarget.com/definition/monolithic-architecture>

<https://en.wikipedia.org/wiki/Monolithic_application>

<http://flask.pocoo.org>

<https://www.djangoproject.com>

<https://github.com/benedict-armstrong/VWA>