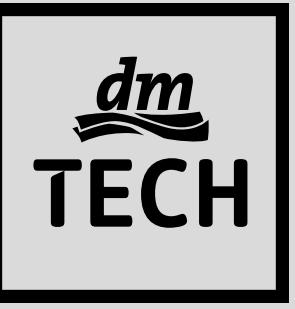
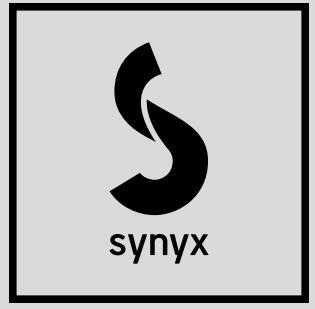


MICRO-FRONTENDS IN REACT



Denise Schäfer
[\(denise.schaefer@dm.de\)](mailto:denise.schaefer@dm.de)

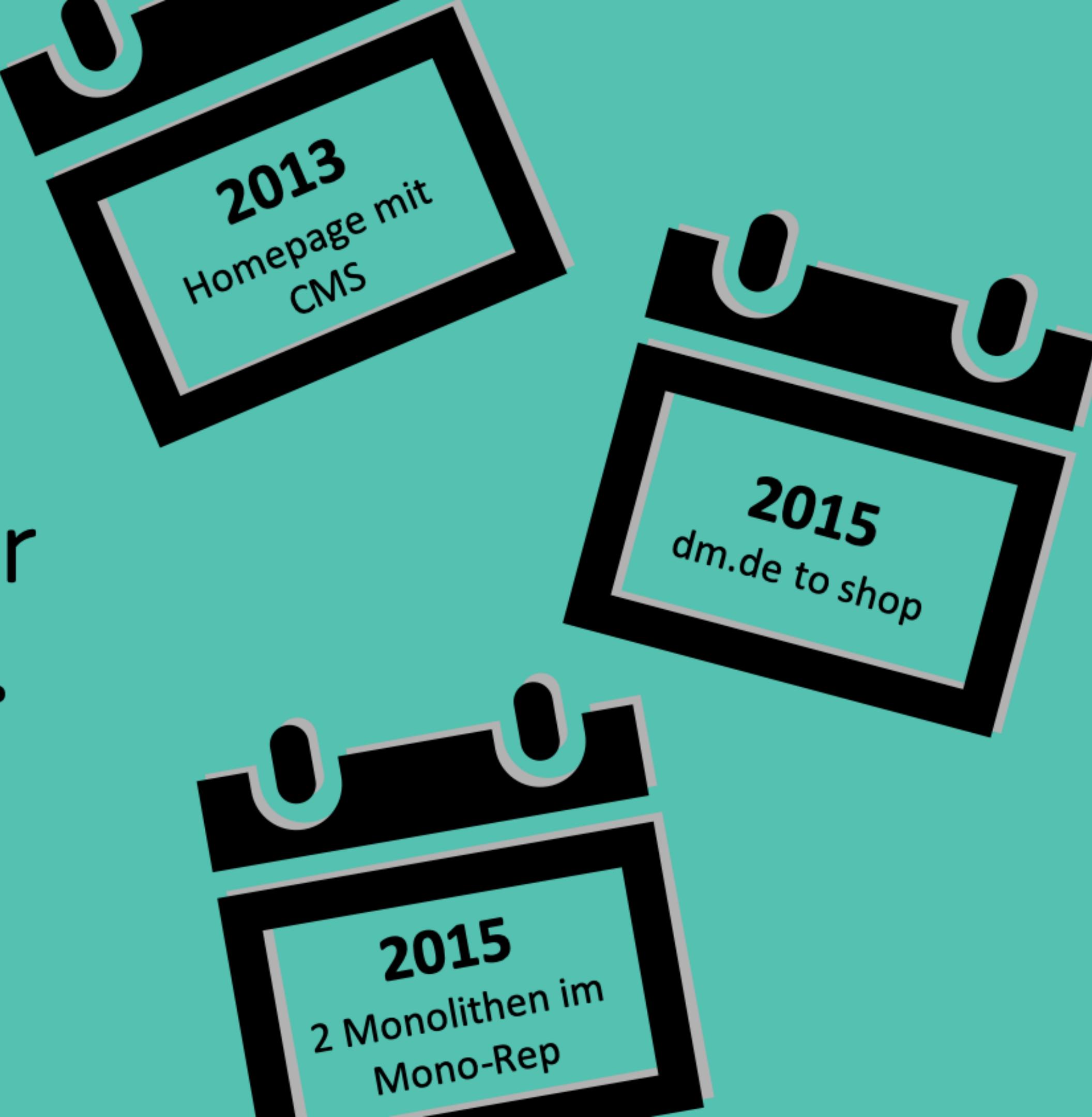


Benjamin Seber
[\(@_seebaer\)](https://twitter.com/_seebaer)



RÜCKBLENDE

Was bisher geschah...

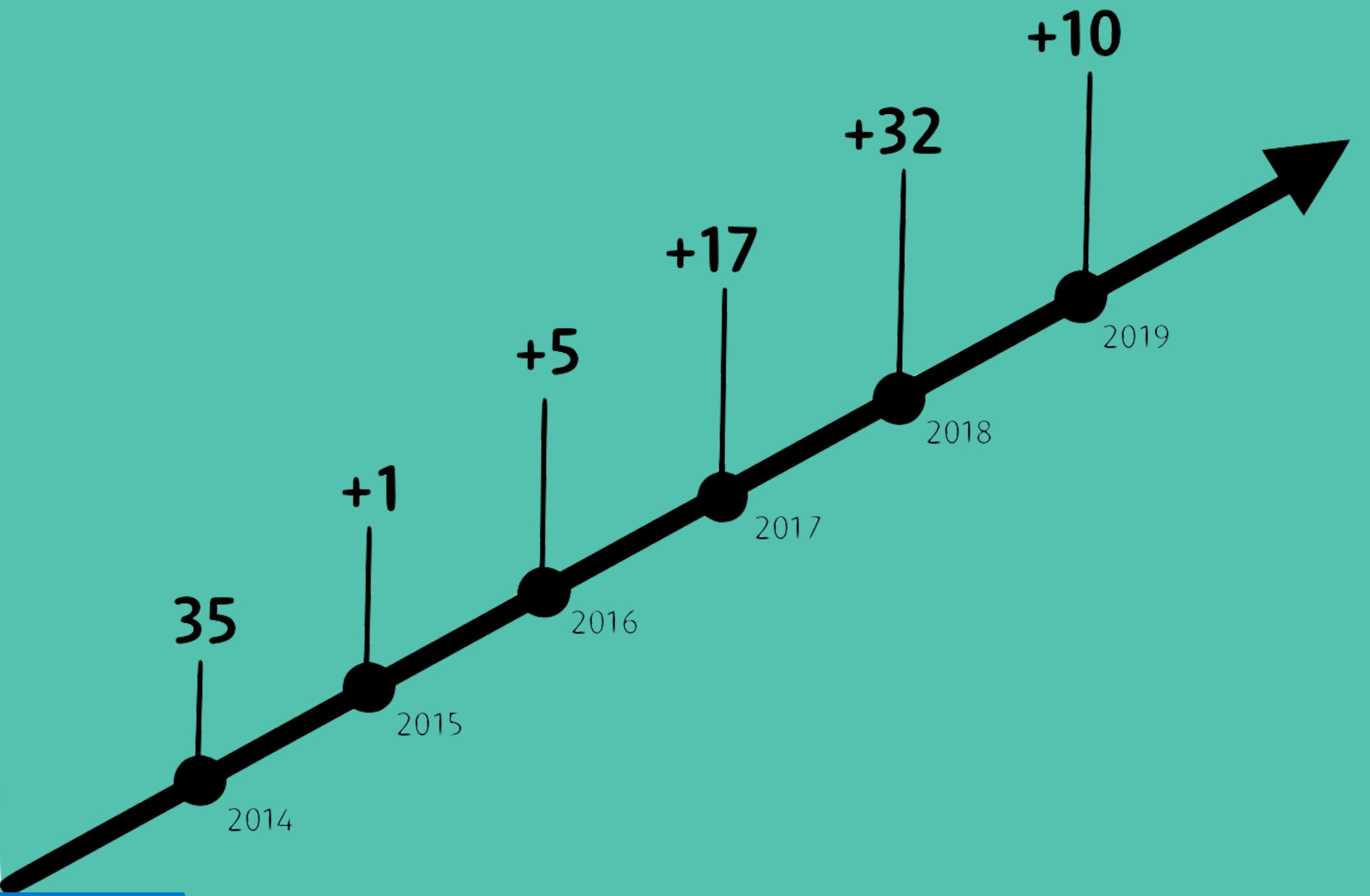


CMS Git Historie

- 2013



2013-05-14 - 13:17 36c12ee9120e0dcef5c43e1
2013-05-13 - 14:28 906b6be40bc01f17fcda2673fb
2013-05-13 - 14:23 c098905fdb1c17fd8dce9593fc74
2013-05-13 - 06:37 7f1bddbe57f5282a9239a0baacbae71
Sat May 2013-05-13 - 06:36 0e0275dd95646c9fc1321bf93648e82
May 2013-05-10 - 14:38 8964f525b9726a68428e596e55b01f0813
Tue May 2013-05-10 - 14:24 074c37b8d5d5abfb364d92725a344f87e2b
Fri May 2013-05-10 - 12:40 f66bc54c46d84f6665cd276cd8e2fb9a28
Thu May 2013-05-09 - 13:34 01a817ecf6f88d3c59aab69ac22f0a7a3f4ce
Wed May 2013-05-08 - 16:57 8d35cd896fba908835a8b5012d11966973e30a
Wed May 2013-05-08 - 09:34 2778dccadd8b015c17fd27b476fa5ea03716410
* Wed May 2013-05-08 - 08:26 44d132c640830dbdb0d4d94649ff0156f941064
* Tue May 2013-05-07 - 18:37 82ac7fc59309fccffd87379f0e2cdbacbb7d02e
* Mon May 2013-05-06 - 16:37 3b2dfa8f7c99c6b439f2b87fcaa11c885e518a
* Mon May 2013-05-06 - 16:08 e3156eb80840c8577e759ab21f55455701918e94
* Fri May 2013-05-03 - 17:19 e8a3eea664464e0fc09ebdb604d9e9d413dbb2cc
* Fri May 2013-05-03 - 17:16 b3d7d0c38d4ded5c56ba983ea38c07094f032021
* Fri May 2013-05-03 - 14:52 b8457c803b0e8430ab4838945867b16dd063bd0
Thu May 2013-05-02 - 17:53 4c190f4cae9346a634e6b61e118147f2d91176f
Thu May 2013-05-02 - 17:42 027f4f4a213b7b0e3b83dca239d5c637108b5a
Thu May 2013-05-02 - 14:27 d0241edc44460795ef7b1d66751f3441503a64
Sun Apr 2013-04-29 - 16:19 3215bc364646d79f36def6342a3eee3a6c0d5
Sun Apr 2013-04-29 - 16:18 e58c0d746dd86130d1767fe14fc5a36ae9f
Apr 2013-04-29 - 15:53 8d6bfe2415c32d9c338bad543535af68617
Apr 2013-04-29 - 15:00 23079093b029198af87944df37d38ee70
Tue 2013-04-29 - 14:57 dacaa810a76a1f237292a0443c0bb4e
2013-04-29 - 13:05 56f83a9a9bddae49c33341bae038f7
2013-04-29 - 10:05 b55583fa3f00f98f3599f307457
2013-04-29 - 08:31 c18407604b50b262a3ac7f87
2013-04-29 - 08:08 3985d98ecc7d781855674
2013-04-29 - 12:11 22c45649d19b2321



Anstieg der
Contributor

CMS Git Historie - 2016

A circular diagram with a black center and a white ring. The ring contains a list of git commit logs, each consisting of a date and time, a commit message, and a unique hash identifier. The commits are color-coded by date: blue for March, green for April, and orange for May. The commit list is as follows:

- Sat Mar 2016-03-09 - 14:10 8d3a2f3...
Tue Mar 2016-03-08 - 17:17 dd252e0...
- Mon Mar 2016-03-07 - 15:48 3df3504089e...
Mon Mar 2016-03-07 - 09:25 914f2148175cb...
Mon Mar 2016-03-07 - 09:01 e5d4e4ac7db9daed...
Fri Mar 2016-03-04 - 16:59 ed6cb2e9aa46ff6...
- Fri Mar 2016-03-04 - 16:39 6a1f69a62cddb89...
Fri Mar 2016-03-04 - 15:51 182d1bd2f98fcfc7665...
Fri Mar 2016-03-04 - 15:51 fb3164a570d91194ca7a...
Thu Mar 2016-03-03 - 13:44 b4a3c3d645b064fb13ee2...
Thu Mar 2016-03-03 - 11:06 711414ed8b11ae866d23a8...
Thu Mar 2016-03-03 - 10:21 fced47ec618256e9f2ce299...
Wed Mar 2016-03-02 - 17:27 f4f1bf96fb92ec2d0dc0a9f...
Wed Mar 2016-03-02 - 16:13 cbcf39849c8f7df784831d2a...
Wed Mar 2016-03-02 - 16:09 74211b9ae198b0852b08127b...
Tue Mar 2016-03-01 - 16:17 840745404d1a375b258ed5d1...
Tue May 2016-05-24 - 17:33 bcf20872da0509f4b96cb526...
Tue May 2016-05-24 - 17:26 47091090faa43d9690fb9a00...
Tue May 2016-05-24 - 17:19 ea1541eb3703b4e71f8eb7e4...
- Tue May 2016-05-24 - 09:38 a52ef03d79036a27ba3e628f1...
Tue May 2016-05-24 - 09:38 df886ce07c5610e4407837de...
Mon May 2016-05-23 - 17:06 3757246b187835f62f4d399...
Mon May 2016-05-23 - 17:06 6ac7f2a0b952394fd9bd39...
Mon May 2016-05-23 - 14:50 09b8bcdd23c25ae2b4b50...
Mon May 2016-05-23 - 14:12 b4b6e6361126cd3fe095...
Fri May 2016-05-20 - 12:19 9812c58a0530e1e9111...
Fri May 2016-05-20 - 12:19 fff2fac332c0032eb...
Fri May 2016-05-20 - 12:19 558d92606de8f66...
Fri May 2016-05-20 - 12:19 a2db692ec7c76...
Fri May 2016-05-20 - 09:29 3fd334436f...
Thu May 2016-05-19 - 17:00 5abbd1...

Wir brauchen mehr Features!



Was war denn
Anfang 2016?

Einiges! Wo soll
ich anfangen?
Aaalso...



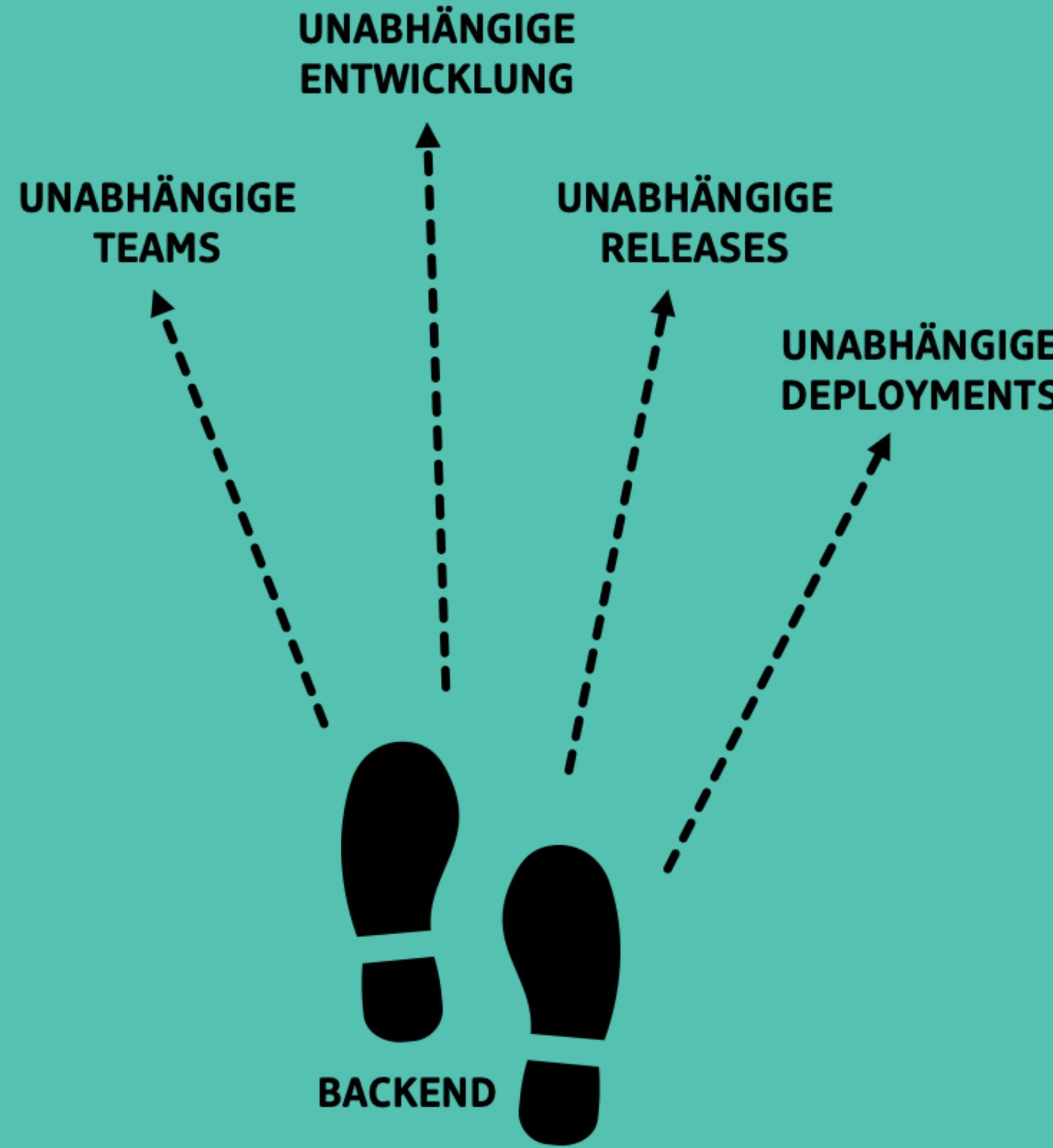


Micro-Services im Backend



<https://kurzelinks.de/monolith2microservice>

Unabhängigkeit nur im Backend



Skalierung im Backend

BACKEND



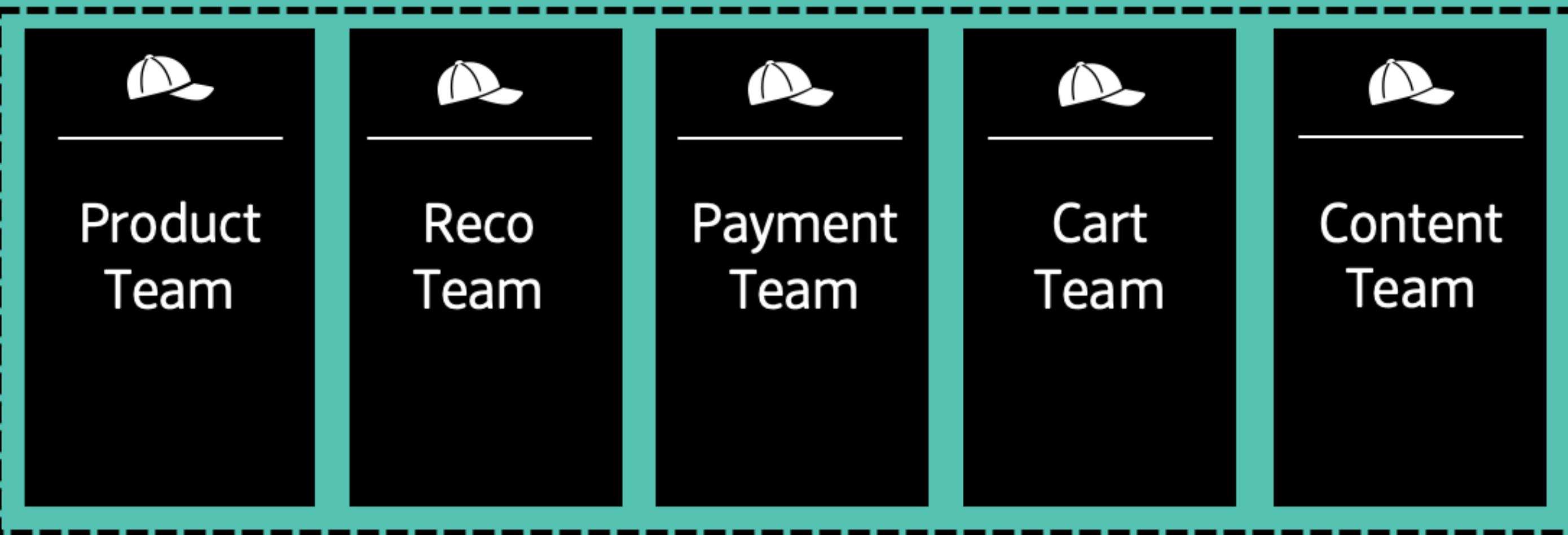
FRONTEND



Frontend-Team



Backend-Teams



Auswirkung für den Product Owner



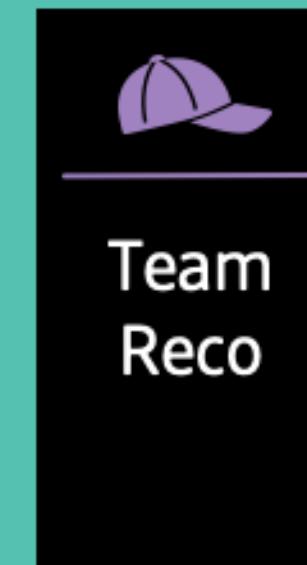


WANTED

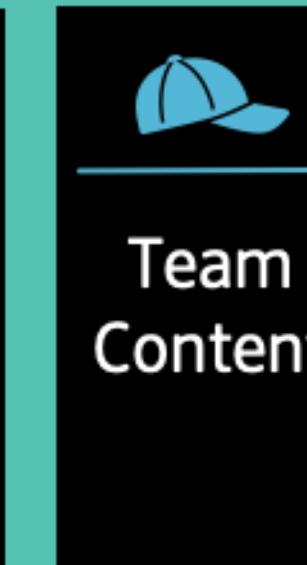
CROSS-FUNKTIONALE TEAMS



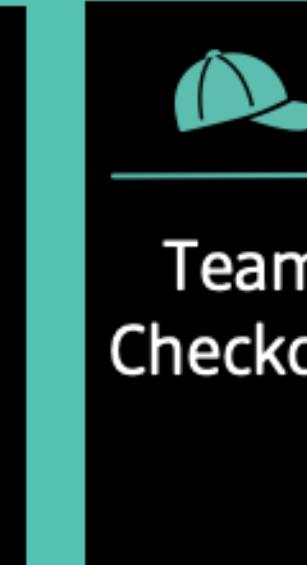
Team
Product



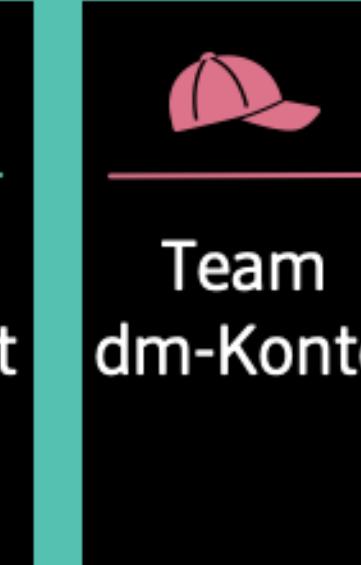
Team
Reco



Team
Content



Team
Checkout

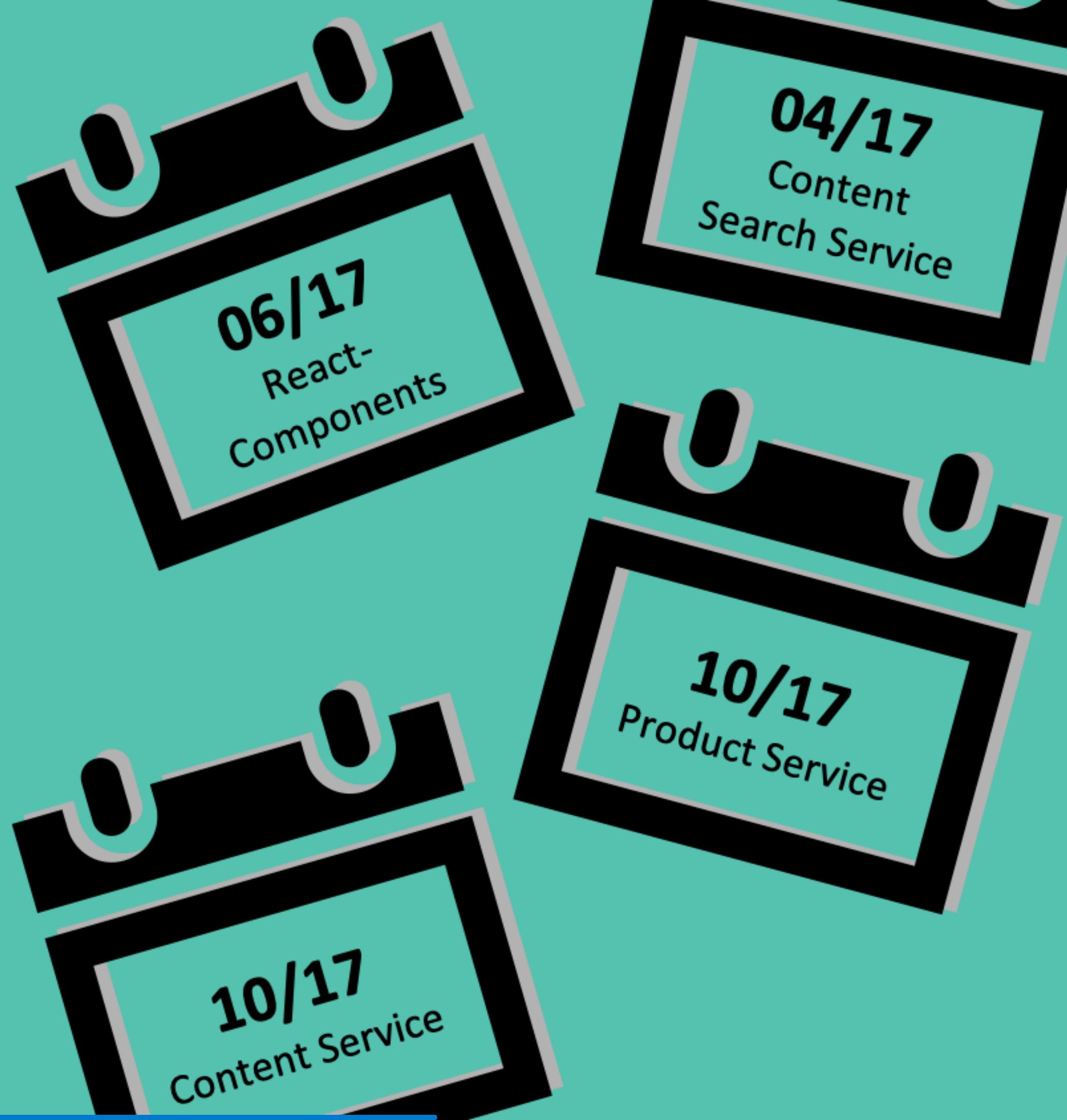


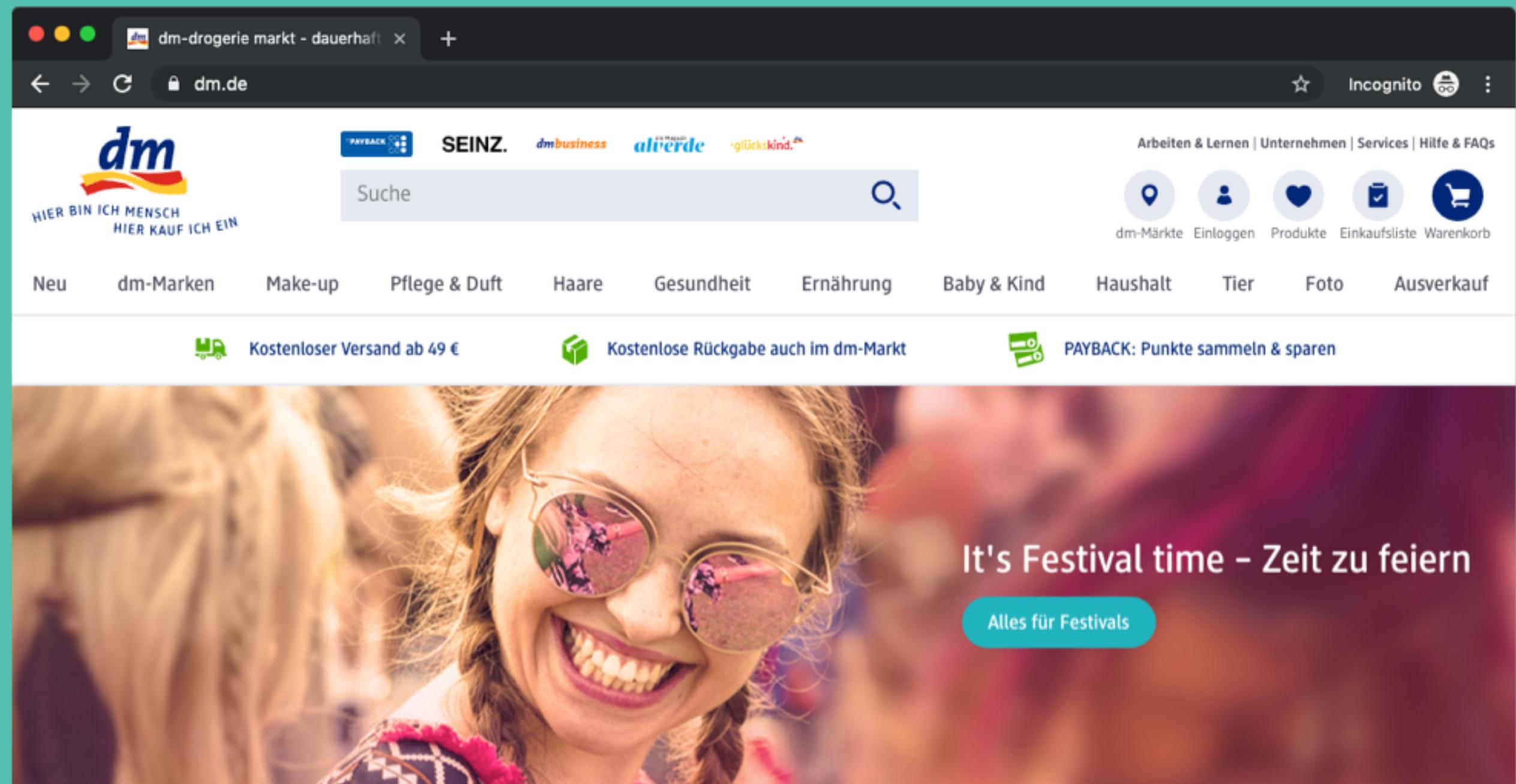
Team
dm-Konto

FRONT- & BACK-END



Versuche zur Eigenständigkeit





content-service



BABEL



ESLint

product-service



BABEL



ESLint

content-search-service



BABEL



ESLint

cms-index.jsp.html x

```
1 <script src="libraries.min.js"></script>
2 <script src="content.min.js"></script>
3 <script src="product.min.js"></script>
4
5 <div id="navigation-container"></div>
6 <script>
7   ReactDOM.render(
8     window.dm.content.Navigation,
9     document.getElementById('navigation-container')
10    );
11 </script>
12
13 <div id="product-grid-container"></div>
14 <script>
15   ReactDOM.render(
16     window.dm.product.ProductGrid,
17     document.getElementById('product-grid-container')
18    );
19 </script>
```

React Components

GitOverride: endlich hab ich die selectbox fertig

GitOverride: e(⌂ ⌂)đ

GitOverride: ganz schön viele extra features wieder...

GitOverride: nativ und gut is...

Front_Ende: was habt ihr denn gebraucht? wir hätten da was 😅

GitOverride: special styling unterschiedlich auf desktop und mobile versteht sich

The screenshot shows the homepage of the dm-drogerie markt website. At the top, there's a navigation bar with the dm logo, PAYBACK, SEINZ., dm business, alverde, and Glückskind. Below the navigation is a search bar with a magnifying glass icon. To the right of the search bar are links for 'Arbeiten & Lernen | Unternehmen | Services | Hilfe & FAQs'. Further right are icons for location, user profile, heart, shopping bag, and a cart, with labels 'dm-Märkte', 'Einloggen', 'Produkte', 'Einkaufsliste', and 'Warenkorb' respectively. A horizontal menu below the search bar includes 'Neu', 'dm-Marken', 'Make-up', 'Pflege & Duft', 'Haare', 'Gesundheit', 'Ernährung', 'Baby & Kind', 'Haushalt', 'Tier', 'Foto', and 'Ausverkauf'. Promotional banners at the bottom of the page mention 'Kostenloser Versand ab 49 €', 'Kostenlose Rückgabe auch im dm-Markt', and 'PAYBACK: Punkte sammeln & sparen'. A large banner features a smiling woman wearing sunglasses and the text 'It's Festival time - Zeit zu feiern' with a button labeled 'Alles für Festivals'.

content-service



BABEL



ESLint

product-service



BABEL



ESLint

content-search-service

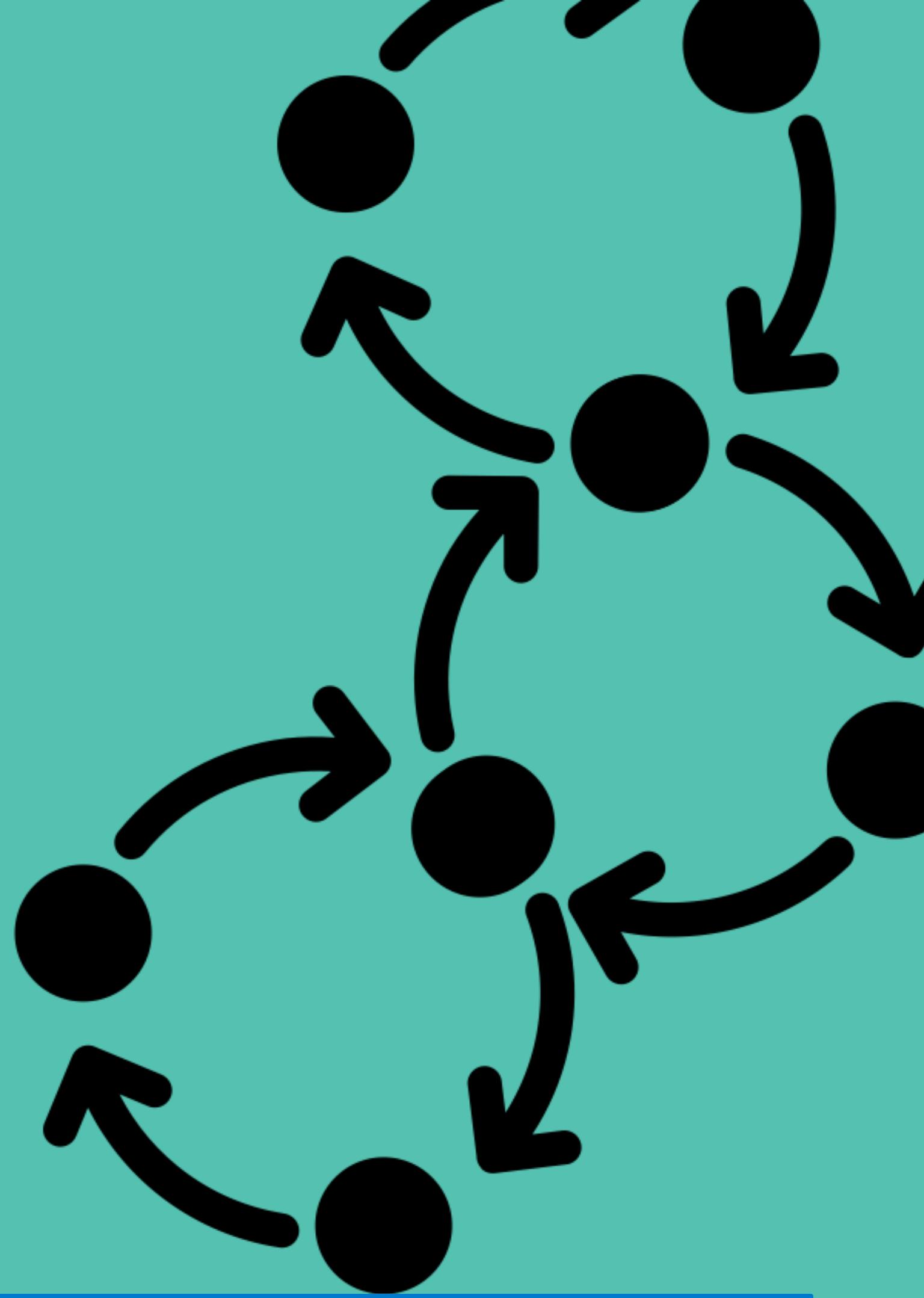


BABEL



ESLint

react-components



Aber erstes Zwischenergebnis:
Abhängigkeitszyklen
= verteilter Monolith

321 PUSH!



DAS RÄTSEL



**WIE TEILEN WIR
DAS FRONTEND AUF?**

- 1** Domain Produkt
- 2** Domain Shopping-List
- 3** Domain Warenkorb
- 4** Domain Suche
- 5** Domain Filial Verfügbarkeit
- 6** Domain Kundenkonto

The screenshot shows a product detail page for 'Balea MEN Duschgel arctic fresh, 300 ml'. Key elements include:

- 1**: Produktbeschreibung (Product Description) - Points to the product image.
- 2**: Auf die Einkaufsliste (Add to Shopping List) - Points to the button on the right side of the product card.
- 3**: In den Warenkorb (Add to Cart) - Points to the button below the shopping list button.
- 4**: Domain Suche (Search) - Points to the search bar at the top of the page.
- 5**: In welchen Filialen ist dieses Produkt verfügbar? (Where is this product available?) - Points to the search bar for store availability.
- 6**: Domain Kundenkonto (Customer Account) - Points to the user account icon in the top right corner.

Schauplatz Detailseite

Schauplatz Suche

Domain Suche (Rahmen) 1

Domain Produkt-Suche 2

Domain Content-Suche 3

1

dm SEINZ. dm business alverde glückskind.de

Balea

Arbeiten & Lernen | Unternehmen | Services | Hilfe & FAQs

dm-Märkte Einloggen Produkte Einkaufsliste Warenkorb

Neu dm-Marken Make-up Pflege & Duft Haare Gesundheit Ernährung Baby & Kind Haushalt Tier Foto Ausverkauf

Kostenloser Versand ab 49 € Kostenlose Rückgabe am Markt PAYBACK: Punkte sammeln & sparen

Alle Sortimente

Pflege & Duft (457)

Haare (162)

Baby & Kind (3)

Beliebte Filter Anzahl 24 ▾

Marke von dm 621

Vegan 379

Ohne Silikone 114

Für Männer 85

Neu 51

Medizinische Pflege 20

Sortieren nach Beliebtheit ▾

2

3

Suche nach „Balea“

Produkte (623) Beratung (206)

Balea FUSS HORNHAUT ENTFERNER SOCKEN Feel Well
3,95 €

Balea FUSSCREME UREA
1,25 €

Balea DUSCHÖL
1,85 €

Balea ERFRISCHENDES WASCH GEL
0,95 €

Balea COLORNIQUE
2 St (1,98 € je 1 St)

Balea MEN
100 ml (1,25 € je 100 ml)

Balea Balea Hornhaut
196

Balea Balea Urea Fußcreme,
100 ml (1,25 € je 100 ml)

Balea Balea Duschöl 250ml,
250 ml (0,74 € je 100 ml)

Balea Balea erfrischendes Waschgel
150 ml (0,63 € je 100 ml)

Balea Balea Hornhautentferner
10

Balea Balea Urea Fußcreme
10

Balea Balea Duschöl 250ml
31

Balea Balea erfrischendes Waschgel
31

Schauplatz Suche

Domain Suche (Rahmen) 1

Domain Produkt-Suche | 2

Domain Content-Suche 3

1

dm
HIER BIN ICH MENSCH
HIER KAUF' ICH EIN

SEINZ. dm business alverde glückskind.de

Balea 

Arbeiten & Lernen | Unternehmen | Services | Hilfe & FAQs

dm-Märkte Einloggen Produkte Einkaufsliste Warenkorb

Neu dm-Marken Make-up Pflege & Duft Haare Gesundheit Ernährung Baby & Kind Haushalt Tier Foto Ausverkauf

 Kostenloser Versand ab 49 €  Kostenlose Rückgabe  Markt  PAYBACK: Punkte sammeln & sparen

Beitragstypen

<input type="checkbox"/> Redaktionelles	93
<input type="checkbox"/> Specials	79
<input type="checkbox"/> Downloads	15
<input type="checkbox"/> Produkt-Kategorien	9
<input type="checkbox"/> dm-Marken	2
<input type="checkbox"/> Beratung & Information	1
<input type="checkbox"/> Häufige Fragen	7

Anzahl 24 

Sortieren nach Relevanz 

2

3

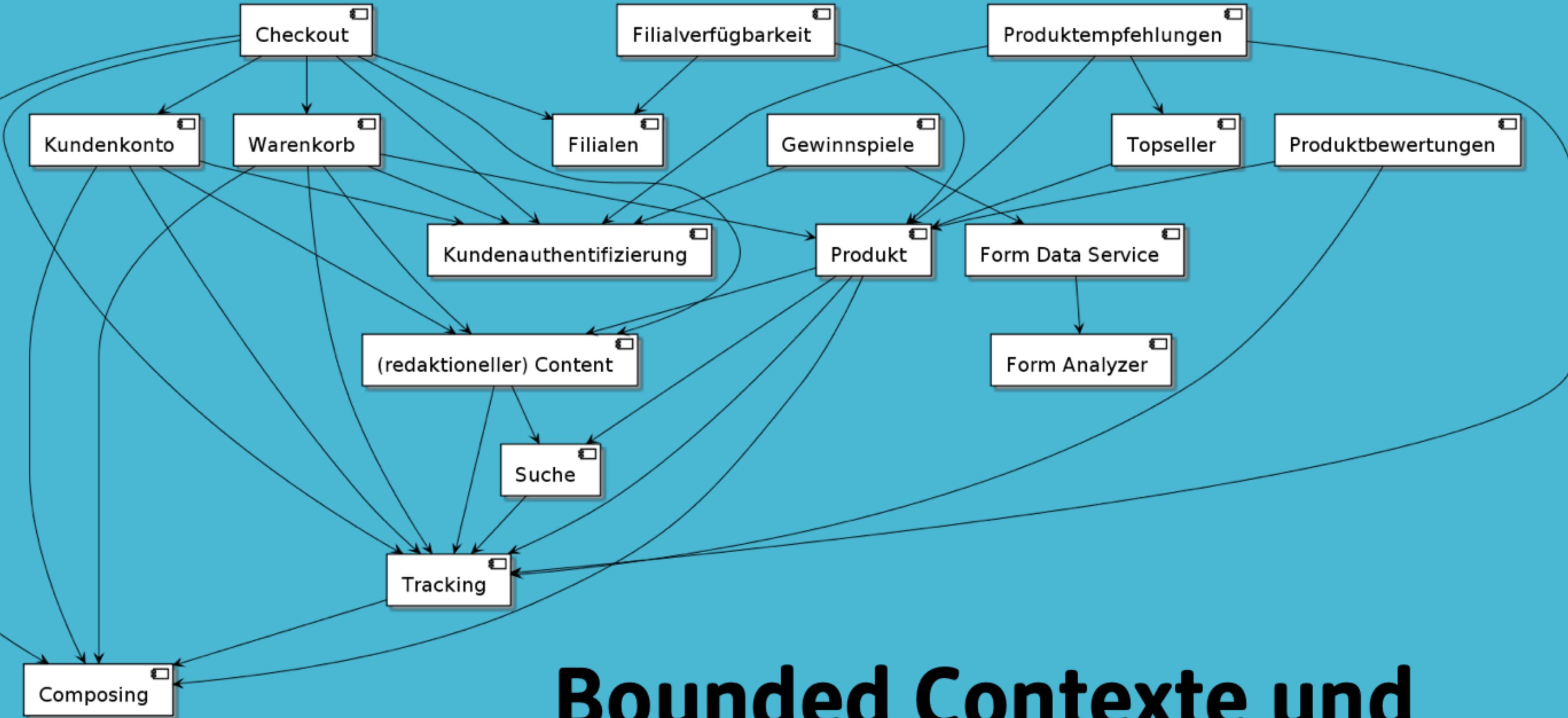
Suchantrag nach „Balea“

Produkte (623) Beratung (206)

**Balea Deo**
22.12.2017
Pflege & Duft
 Seite öffnen

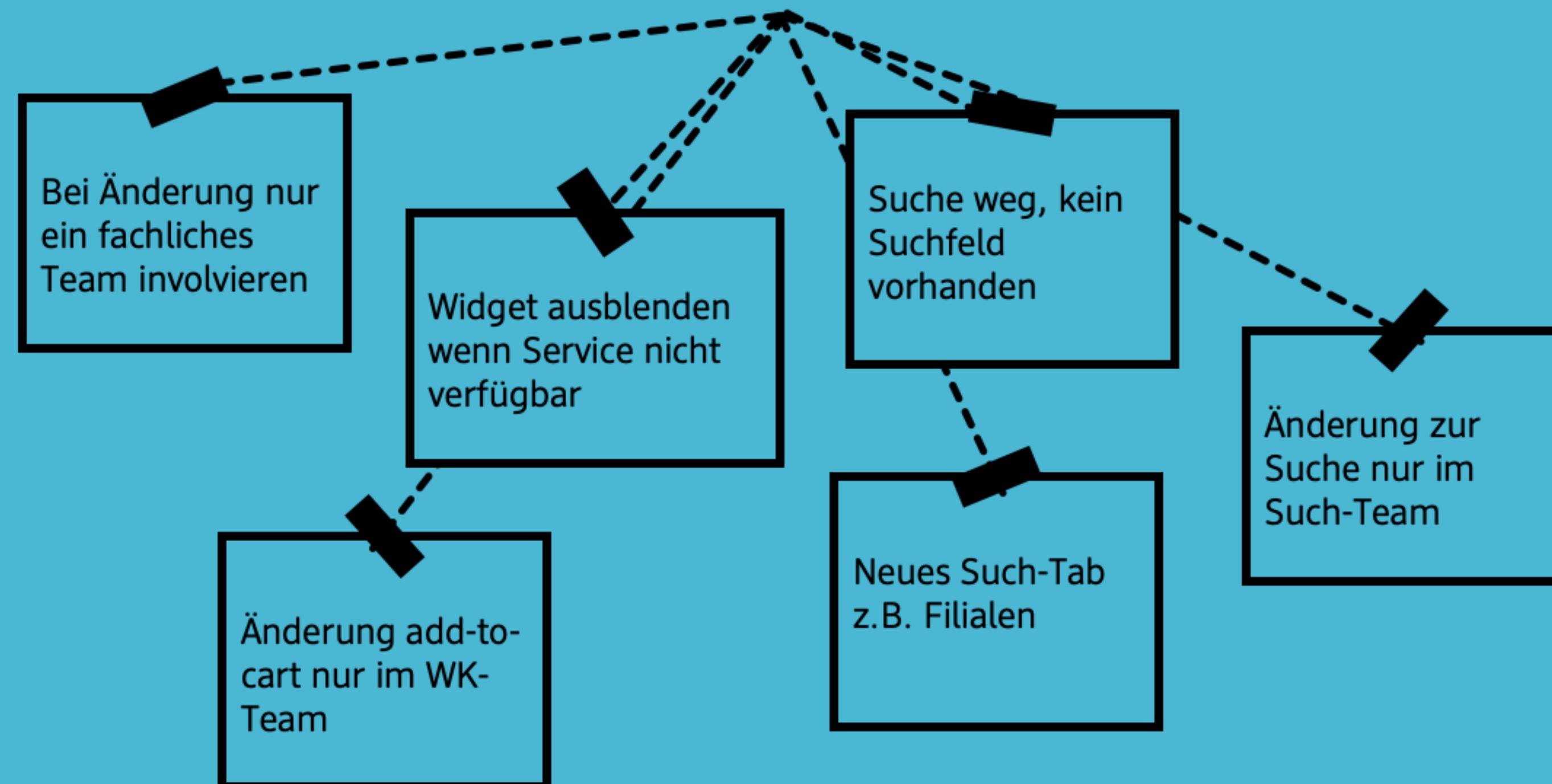
**Über Balea**
11.01.2016
Balea
 Seite öffnen

**Balea Winter**
25.10.2018
Limited Editions
 Seite öffnen

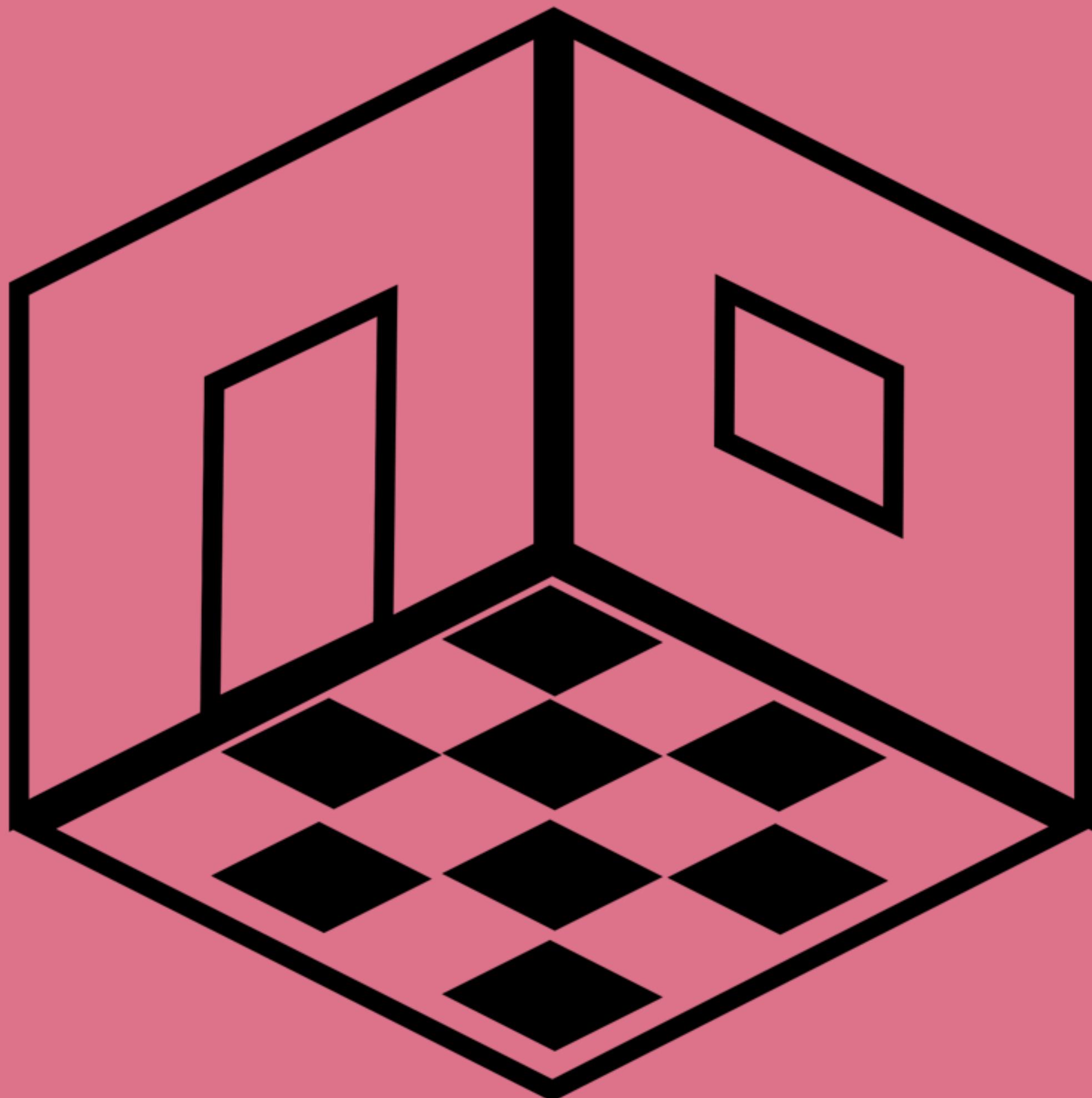


Bounded Contexte und Abhängigkeiten bei dm.de

Separations of Concerns



? ! DIE LÖSUNG



Lösungs- Rahmen

Überwiegend clientseitige
Integration

- Nur **eine** Technologie -  React
- aus Performance-Gründen nicht x Frameworks in die Seite laden
 - Synergien (Know-How, UX-Komponenten)



**Auf den
zweiten Blick...**

Bildquelle: <https://www.sehtestbilder.de>

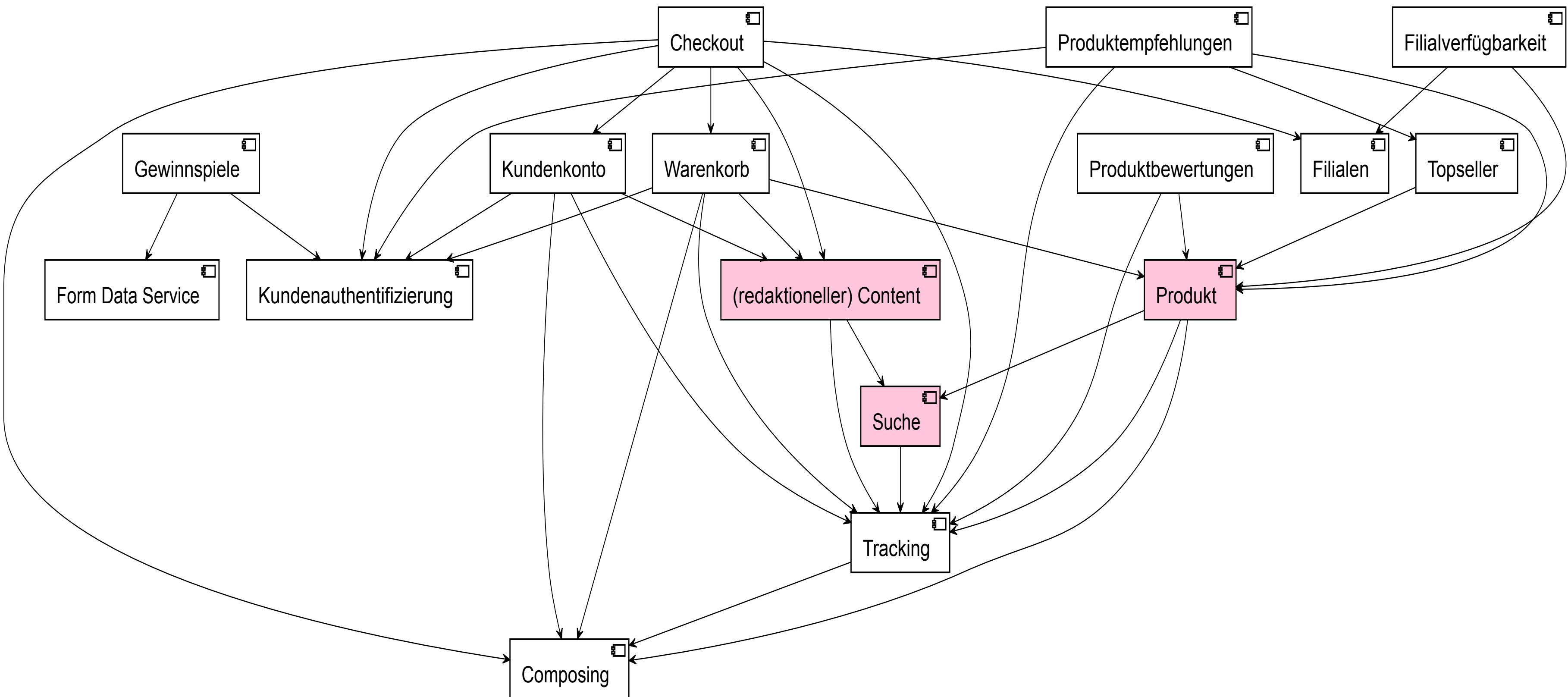


**< DEPENDENCY
INVERSION />**

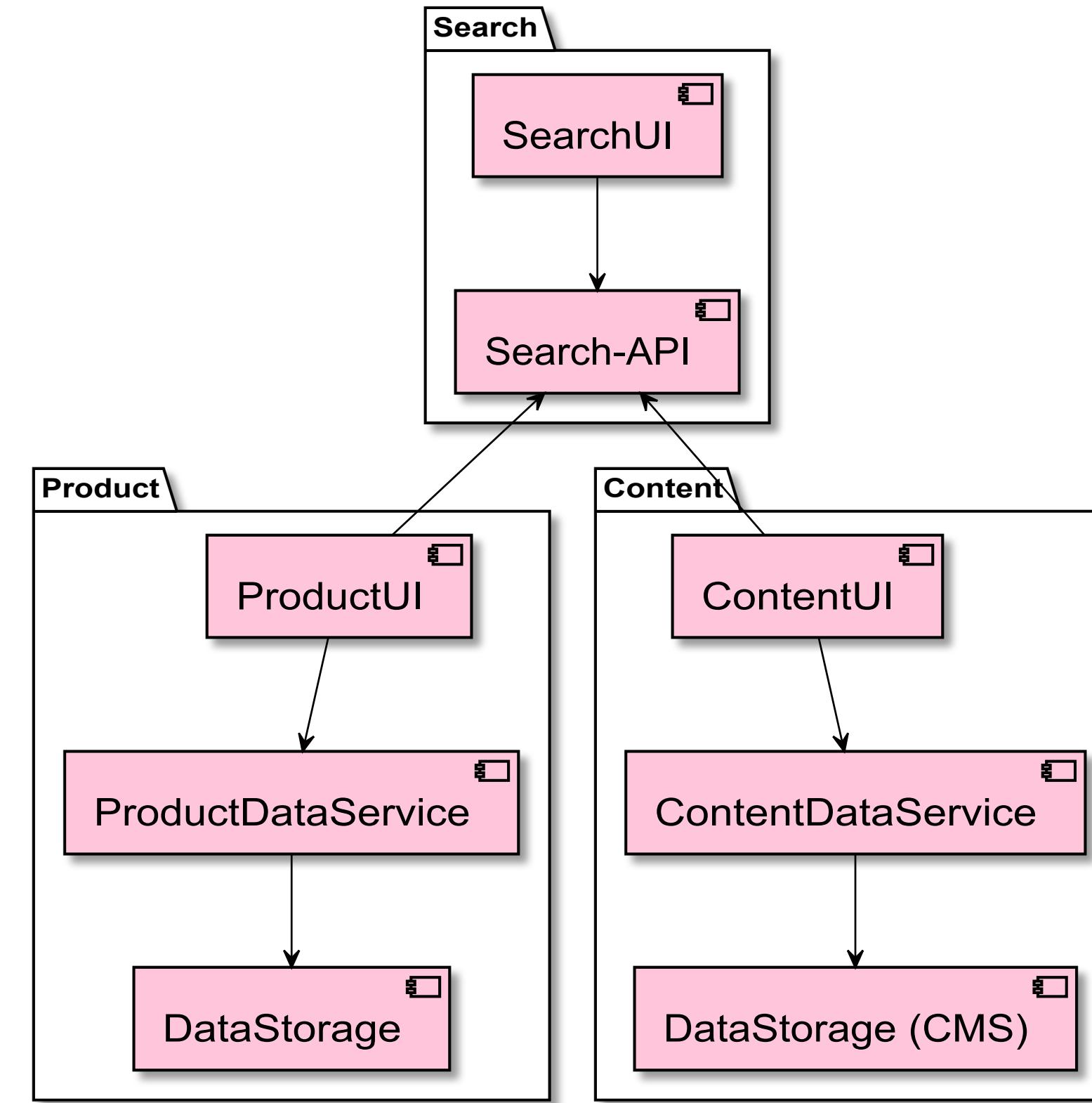
Allgemeine Module
hängen nicht von
speziellen Modulen
ab.

Spezielle Module
hängen von
allgemeinen
Modulen ab.

Dependency Inversion am Beispiel der Suche auf dm.de



Dependency Inversion - nur eine Abhängigkeitsrichtung



Demo Suche

https://www.dm.de/search/468652.html?type=product&q=make-up

make-up

dm-Märkte Produkte Warenkorb Menü

Suche nach „make-up“

Produkte (2226) Beratung (4)

Sortieren Filtern

MARKE von dm EXKLUSIV

Präzisions Make-up Ei 2,45 €

Make-up HD Liquid Coverage Foundation Light Beige 10 6,95 €

Augen-Make-Up Entferner ölhaltig 1,45 €

Make-up Anti-Aging Foundation 9,95 €

We setzt technisch notwendige Cookies und Webanalyse-Technologien auf Grundlage unserer berechtigten Interessen ein. Wenn Sie uns hier darüber hinaus Ihr Einverständnis geben, nutzen wir bestimmte Marketingcookies, um Ihnen personalisierte Services und Angebote anzubieten. Ausführliche Informationen finden Sie in unserer [Datenschutzerklärung](#).

http://localhost:8080/?query=make-up&searchType=product

Suche nach "make-up"

Produkte (6)

Suche nach "make-up": 6 counts

make-up product 1
3,95 €

make-up product 2
1,99 €

make-up product 3
8,65 €

make-up product 4
2,95 €

make-up product 5
8,65 €

make-up product 6
2,95 €

Composition vs. Dependency Inversion

1 Domain Suche

2 Domain Produkt

3 Domain Content

red yellow green code ~ code

composition.js x

1

```
1 <SearchContainer>
2   <div id="search-tabs">
3     <ProductTab count="130" />
4     <ContentTab count="42" />
5   </div>
6   <ProductResult active/>
7   <ContentResult />
8 </SearchContainer>
9
10 // --- everything in one repository ---
```

2

3

2

3

red yellow green code ~ code

dependencyInversion.js x

```
1 registry.registerSearchProvider({
2   ID: 'product',
3   order: 1,
4   execute_search: query => executeProductSearch(query),
5   getTabComponent: data => <ProductTab data={data} />,
6   getResultComponent: (query, data) => (
7     <ProductResult query={query} data={data} />
8   ),
9 });
10
11 // ----- ↑ Product ↑ -----
```

```
12 // --- loosely coupled micro-frontends ---
```

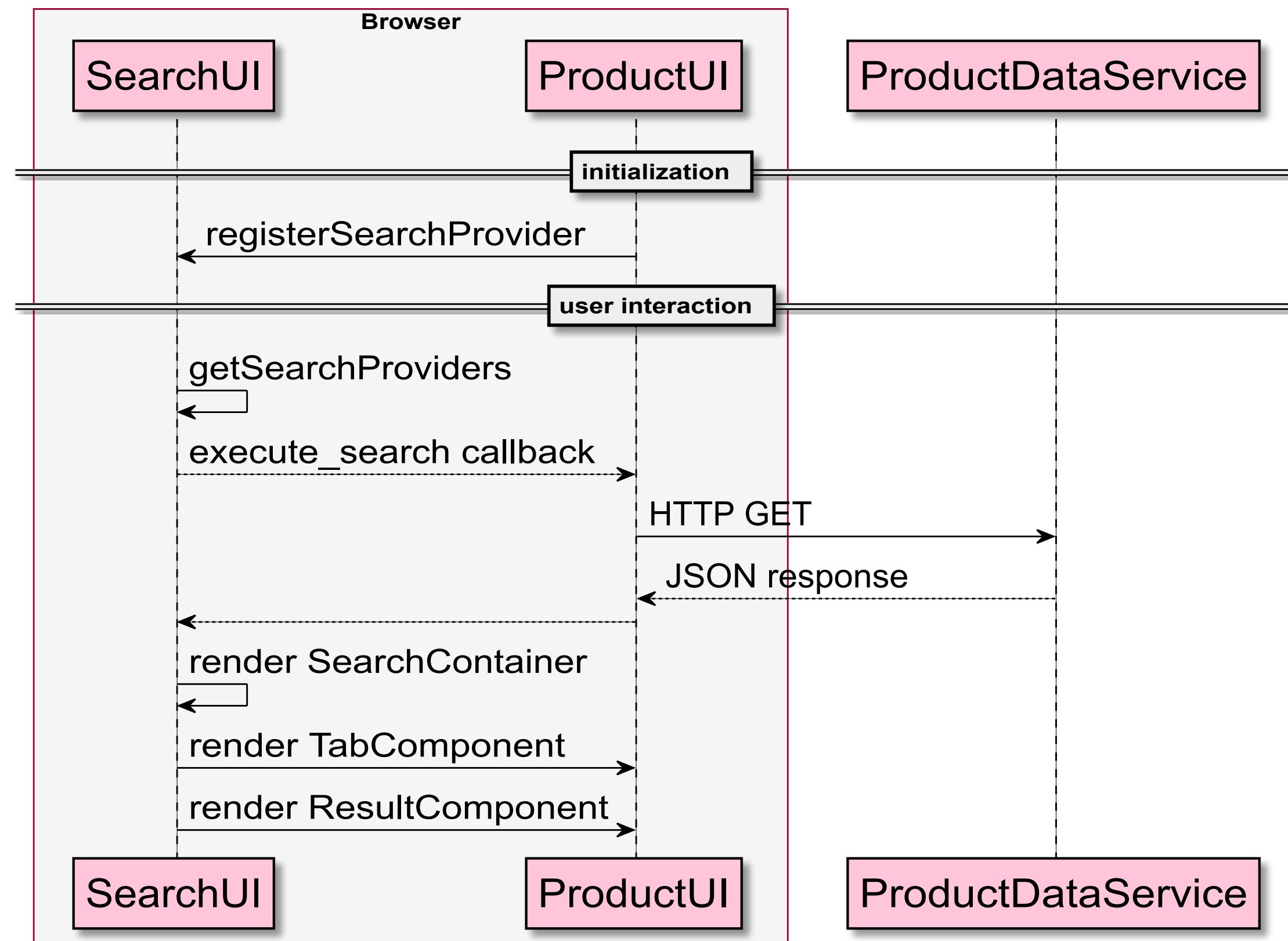
```
13 // ----- ↓ Search ↓ -----
```

```
14
15 const searchProviders = registry.getSearchProviders()
16 <SearchContainer>
17   <div id="search-tabs">
18     {searchProviders.map(provider => getTabFor(provider)) }
19   </div>
20   {activeProvider.getResultComponent(query, data)}
21 </SearchContainer>
```

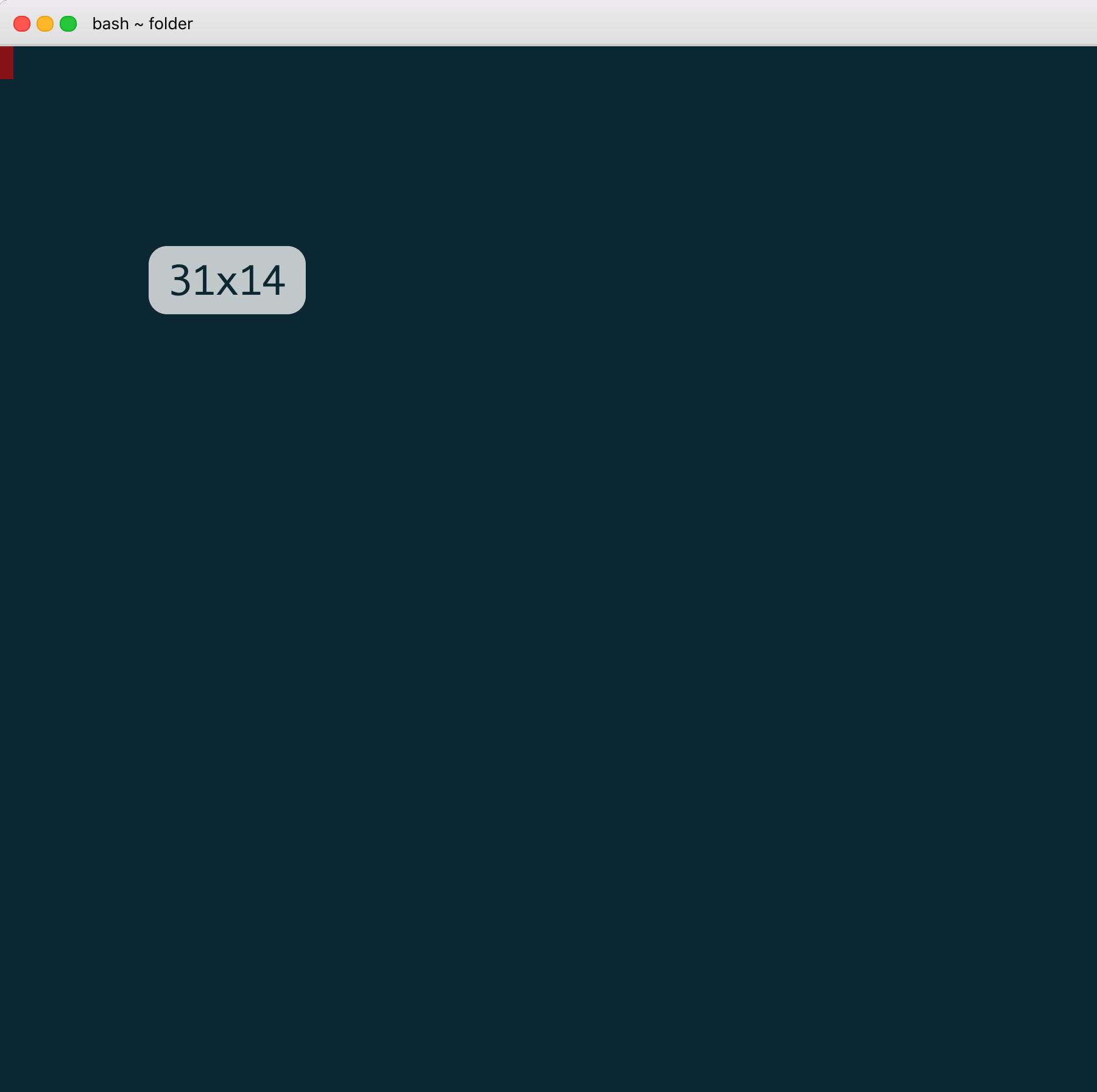
1



Suche mit einem Provider für Produktsuche



Suche mit einem Provider für Produktsuche

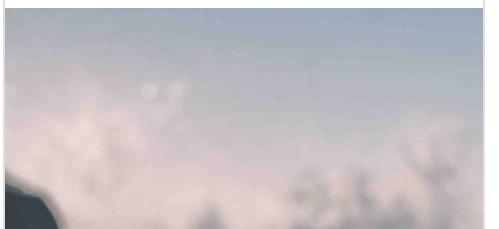
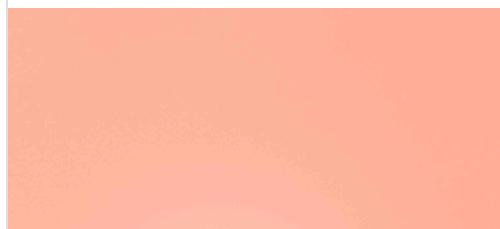
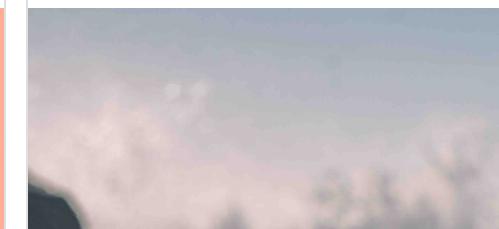


http://localhost:8080/?query=make-up&searchType=product

Suche nach "make-up"

Produkte (6)

Suche nach "make-up": 6 counts

make-up product 1 3,95 €  Lorem ipsum dolor sit amet	make-up product 2 1,99 €  Lorem ipsum dolor sit amet	make-up product 3 8,65 €  Lorem ipsum dolor sit amet
make-up product 4 2,95 € 	make-up product 5 8,65 € 	make-up product 6 2,95 € 

Dependency Inversion - Search-API

code ~ sources

search-api/src/api/registry.js x

```
1 import byOrder from './util/sort';
2 import isEmpty from './util/isEmpty';
3
4 const searchProviders = {};
5
6 export const registerSearchProvider = provider => {
7   searchProviders[provider.ID] = { ...provider };
8 };
9
10 export const getSearchProviders = () => {
11   if (isEmpty(searchProviders)) {
12     throw new Error('No SearchProvider registered!');
13   }
14   return Object.keys(searchProviders)
15     .map(key => searchProviders[key])
16     .sort(byOrder);
17 };
18
19 export const removeSearchProvider = ID => {
20   delete searchProviders[ID];
21 };
```

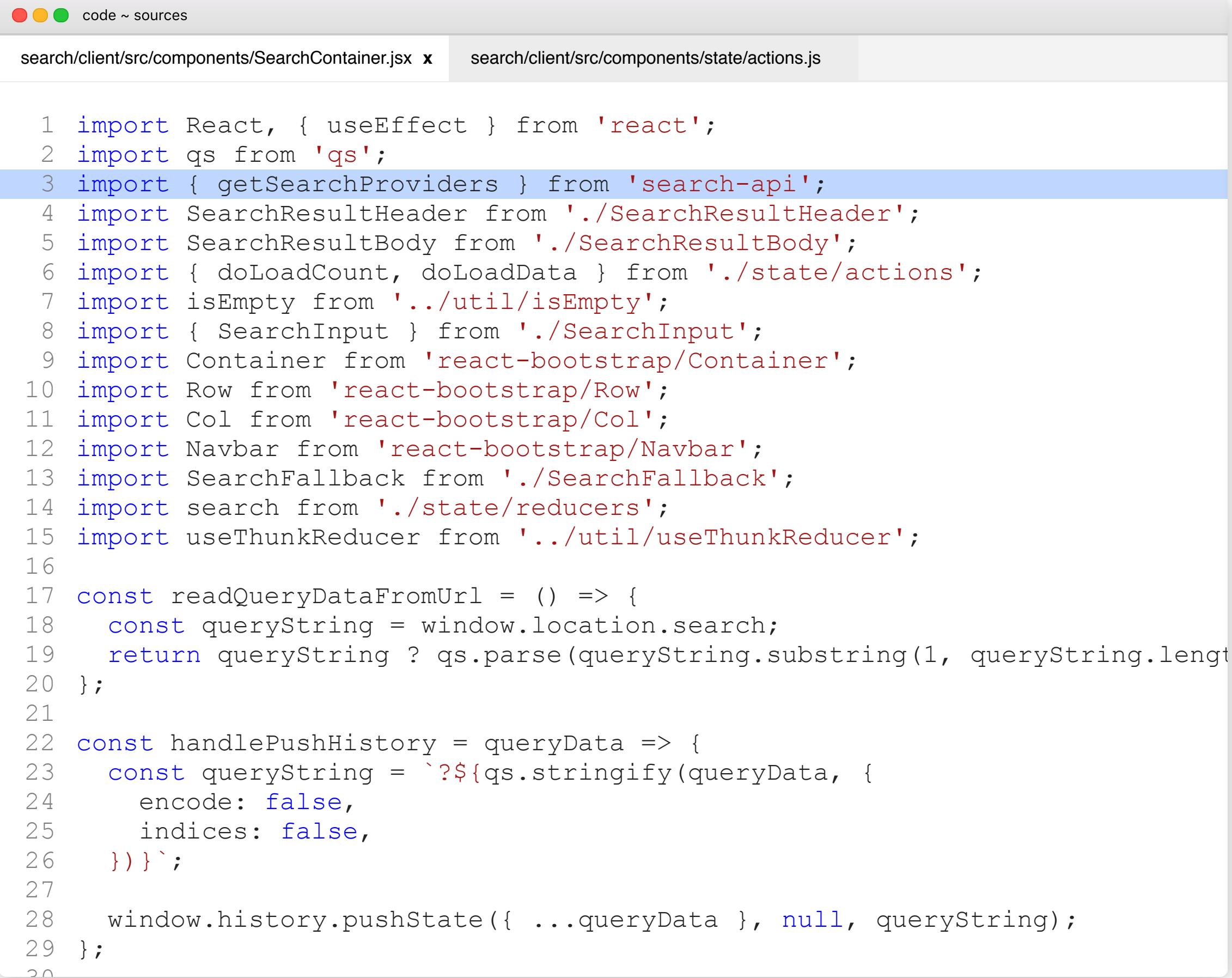
Dependency Inversion - Produkt

code ~ sources

product/client/src/ProductSearchInitializer.jsx x

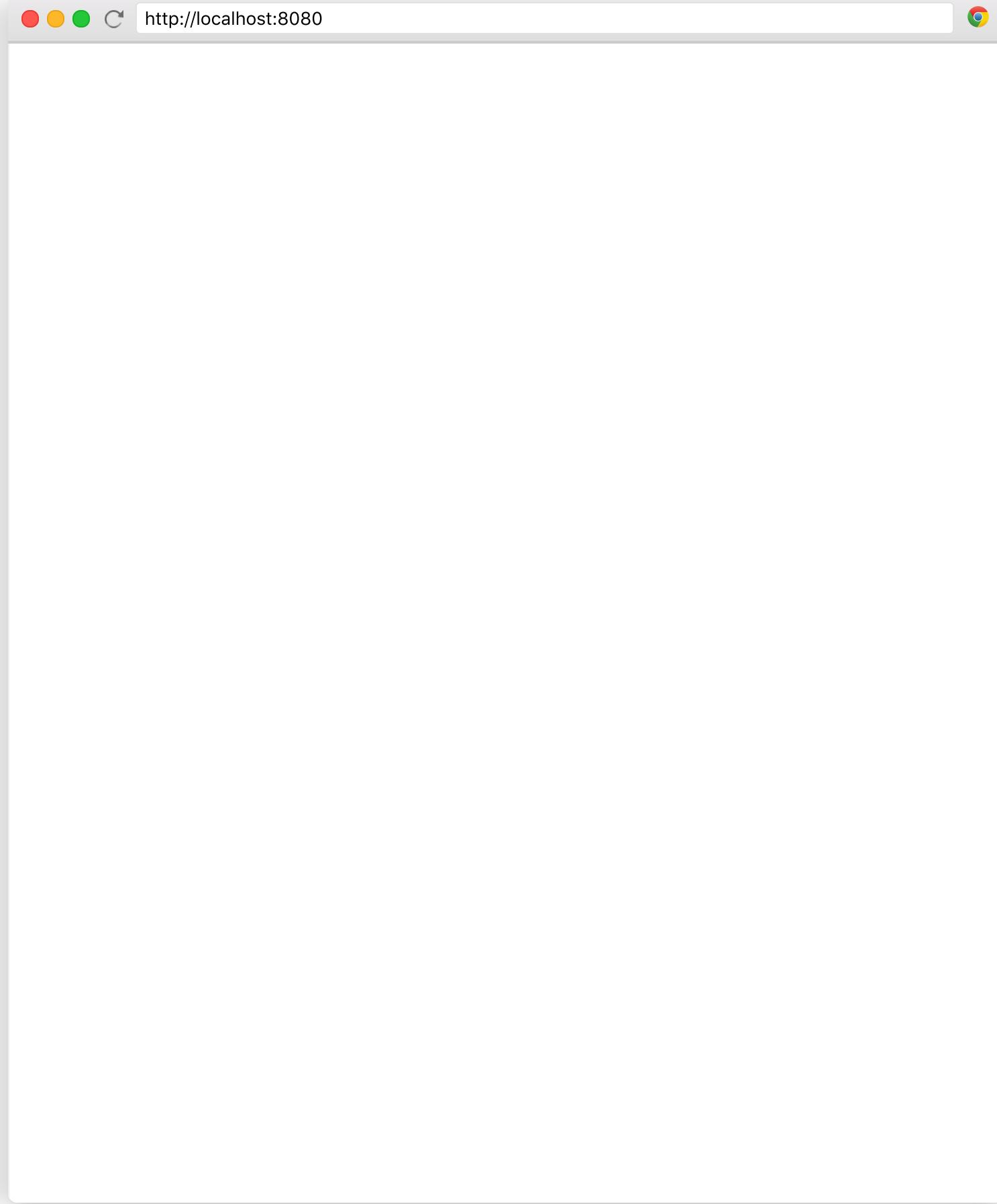
```
1 import React from 'react';
2 import { registerSearchProvider, removeSearchProvider } from 'search-api';
3 import { executeProductCount, executeProductSearch } from './search';
4 import ProductSearchTab from './ProductSearchTab';
5 import ProductSearchResult from './ProductSearchResult';
6
7 export const SEARCH_PROVIDER_ID = 'product';
8 const ORDER = 1;
9
10 export const initialize = () => {
11   registerSearchProvider({
12     ID: SEARCH_PROVIDER_ID,
13     order: ORDER,
14     execute_search: queryData => executeProductSearch(queryData),
15     execute_count: queryData => executeProductCount(queryData),
16     getTabComponent: data => <ProductSearchTab data={data} />,
17     getResultComponent: (queryData, data, fetchData) => (
18       <ProductSearchResult queryData={queryData} data={data} fetchData={fetchData} />
19     ),
20   );
21 };
22
23 // as soon we have health checks, we can remove search provider in case of errors
24 // search provider will disappear in search tabs
25 export const shutdown = () => {
26   removeSearchProvider(SEARCH_PROVIDER_ID);
27 };
```

Dependency Inversion - Suche



The screenshot shows a code editor with two tabs: 'search/client/src/components/SearchContainer.jsx' and 'search/client/src/components/state/actions.js'. The 'SearchContainer.jsx' tab is active, displaying the following code:

```
1 import React, { useEffect } from 'react';
2 import qs from 'qs';
3 import { getSearchProviders } from 'search-api';
4 import SearchResultHeader from './SearchResultHeader';
5 import SearchResultBody from './SearchResultBody';
6 import { doLoadCount, doLoadData } from './state/actions';
7 import isEmpty from '../util/isEmpty';
8 import { SearchInput } from './SearchInput';
9 import Container from 'react-bootstrap/Container';
10 import Row from 'react-bootstrap/Row';
11 import Col from 'react-bootstrap/Col';
12 import Navbar from 'react-bootstrap/Navbar';
13 import SearchFallback from './SearchFallback';
14 import search from './state/reducers';
15 import useThunkReducer from '../util/useThunkReducer';
16
17 const readQueryDataFromUrl = () => {
18   const queryString = window.location.search;
19   return queryString ? qs.parse(queryString.substring(1, queryString.length));
20 };
21
22 const handlePushHistory = queryData => {
23   const queryString = `?${qs.stringify(queryData, {
24     encode: false,
25     indices: false,
26   })}`;
27
28   window.history.pushState({ ...queryData }, null, queryString);
29 };
30
```



The screenshot shows a browser window with the URL 'http://localhost:8080'. The page displays a search interface with a header, a search input field, and a list of search results.

Dependency Inversion - Suche

code ~ sources

search/client/src/components/SearchContainer.jsx x search/client/src/components/SearchResultHeader.jsx search/client/src/components/Se...

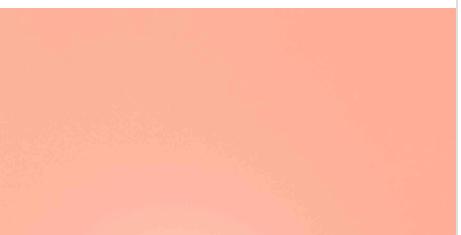
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1 import React, { useEffect } from 'react';
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25     indices: false,
26   })}`;
27
28   window.history.pushState({ ...queryData }, null, queryString);
29 };
30
```

http://localhost:8080/?query=make-up&searchType=product

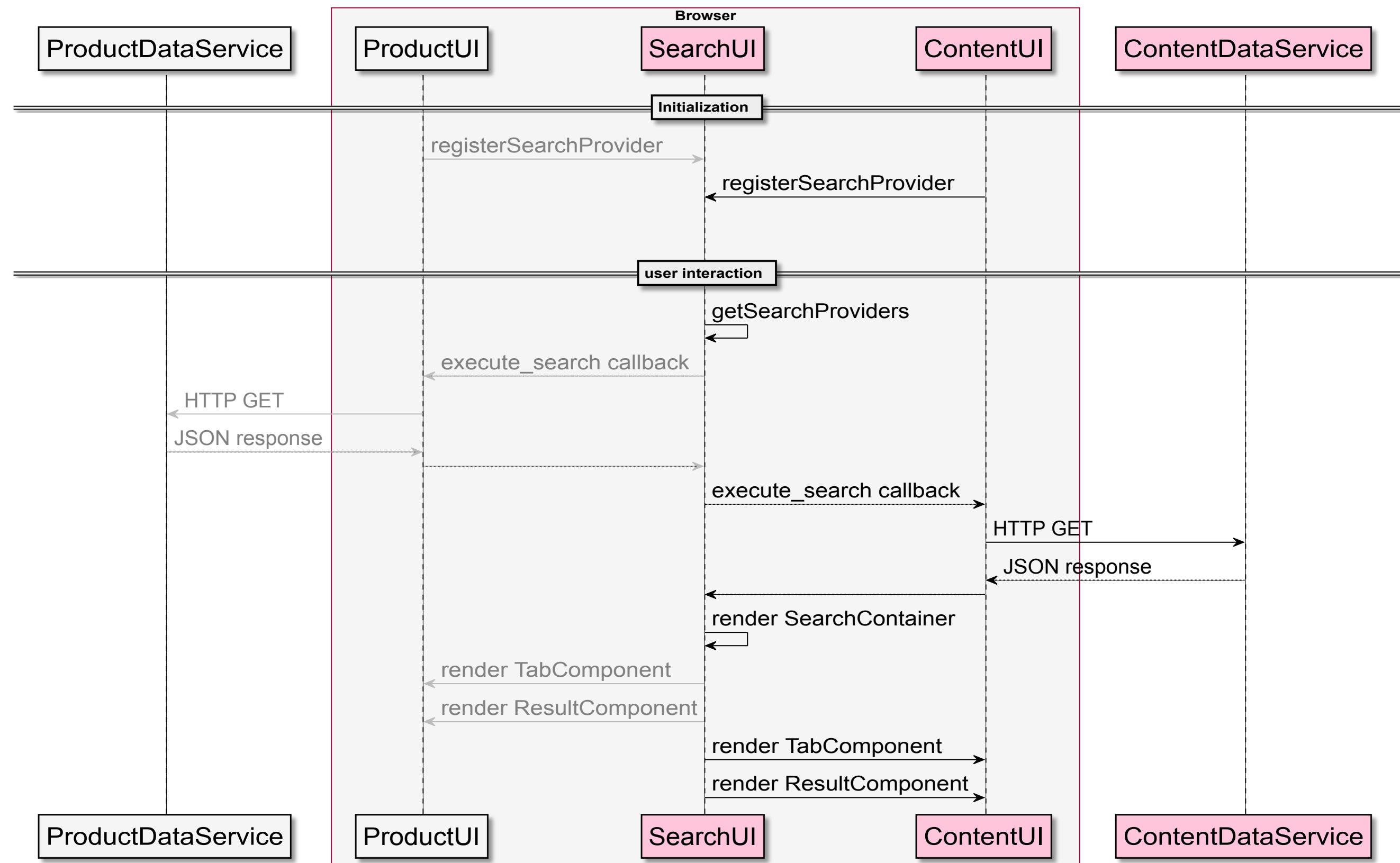
Suche nach "make-up"

Produkte (6)

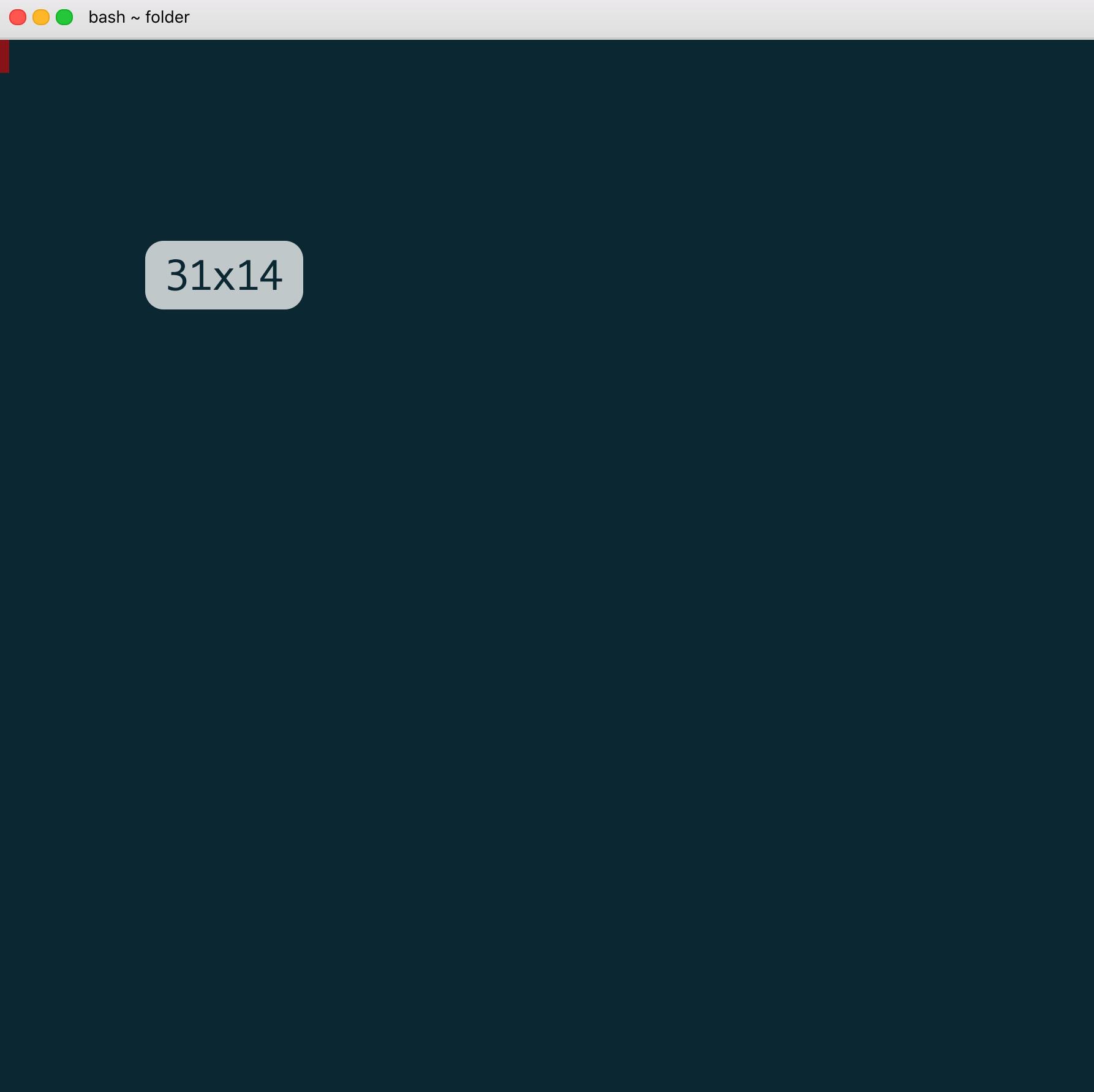
Suche nach "make-up": 6 counts

<p>make-up product 1 3,95 €</p>  <p> Lorem ipsum dolor sit amet</p>	<p>make-up product 2 1,99 €</p>  <p> Lorem ipsum dolor sit amet</p>	<p>make-up p... 8,65 €</p>  <p> Lorem ipsum</p>
<p>make-up product 4 2,95 €</p>  <p> Lorem ipsum dolor sit amet</p>	<p>make-up product 5 8,65 €</p>  <p> Lorem ipsum</p>	<p>make-up p... 2,95 €</p>  <p> < ></p>

... und jetzt noch mit Provider für Contentsuche



.. und jetzt noch mit Provider für Contentsuche



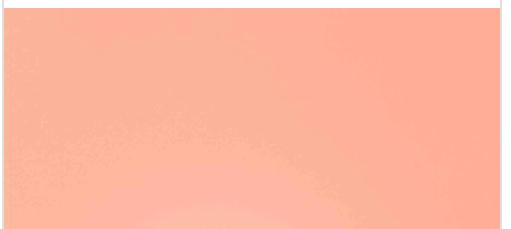
bash ~ folder

http://localhost:8080/?query=make-up&searchType=product

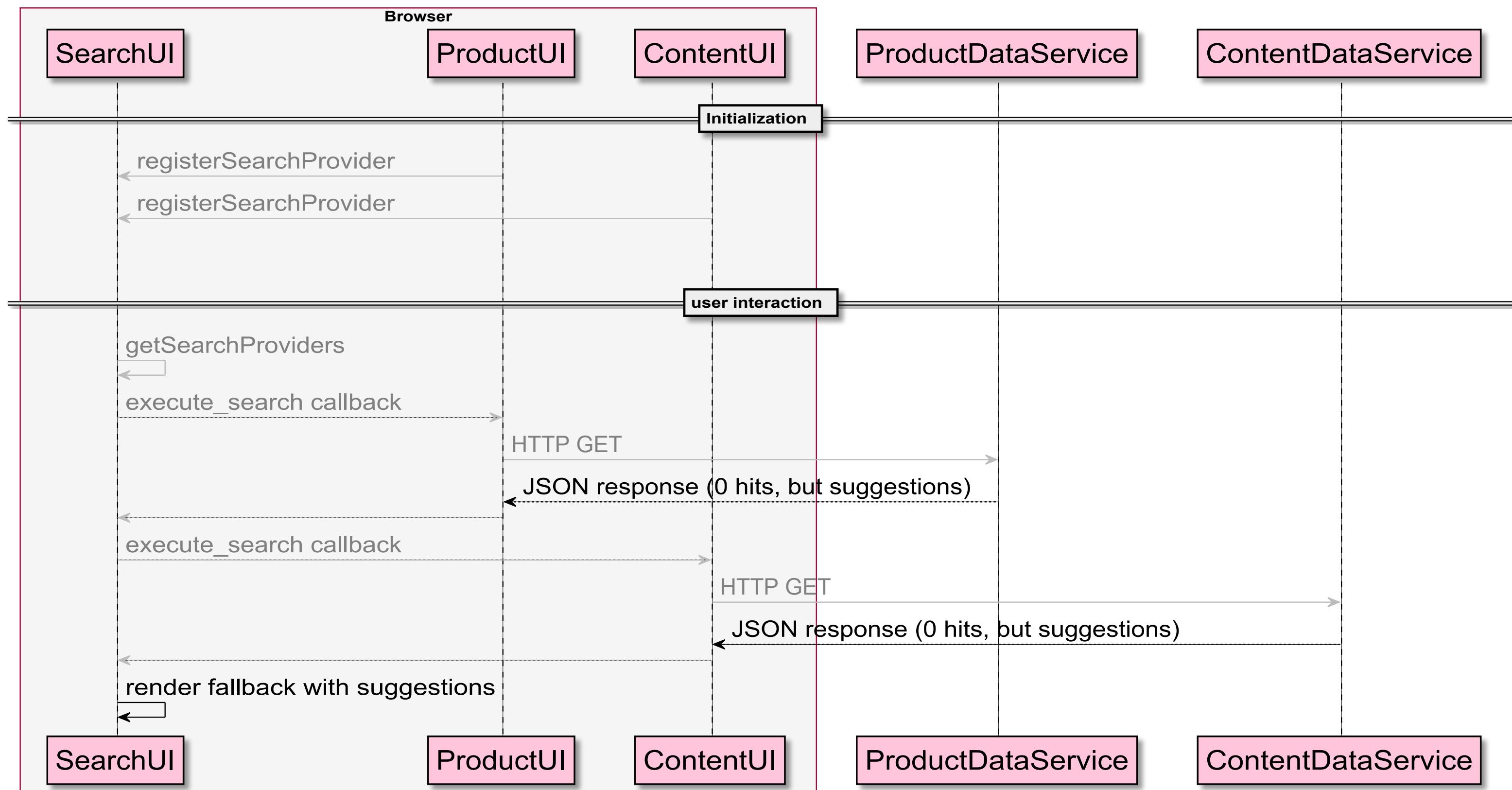
Suche nach "make-up"

Produkte (6)

Suche nach "make-up": 6 counts

make-up product 1 3,95 €  Lorem ipsum dolor sit amet	make-up product 2 1,99 €  Lorem ipsum dolor sit amet	make-up product 3 8,65 €  Lorem ipsum dolor sit amet
make-up product 4 2,95 € 	make-up product 5 8,65 € 	make-up product 6 2,95 € 

... 0-Treffer -> Fallback und Suchvorschläge

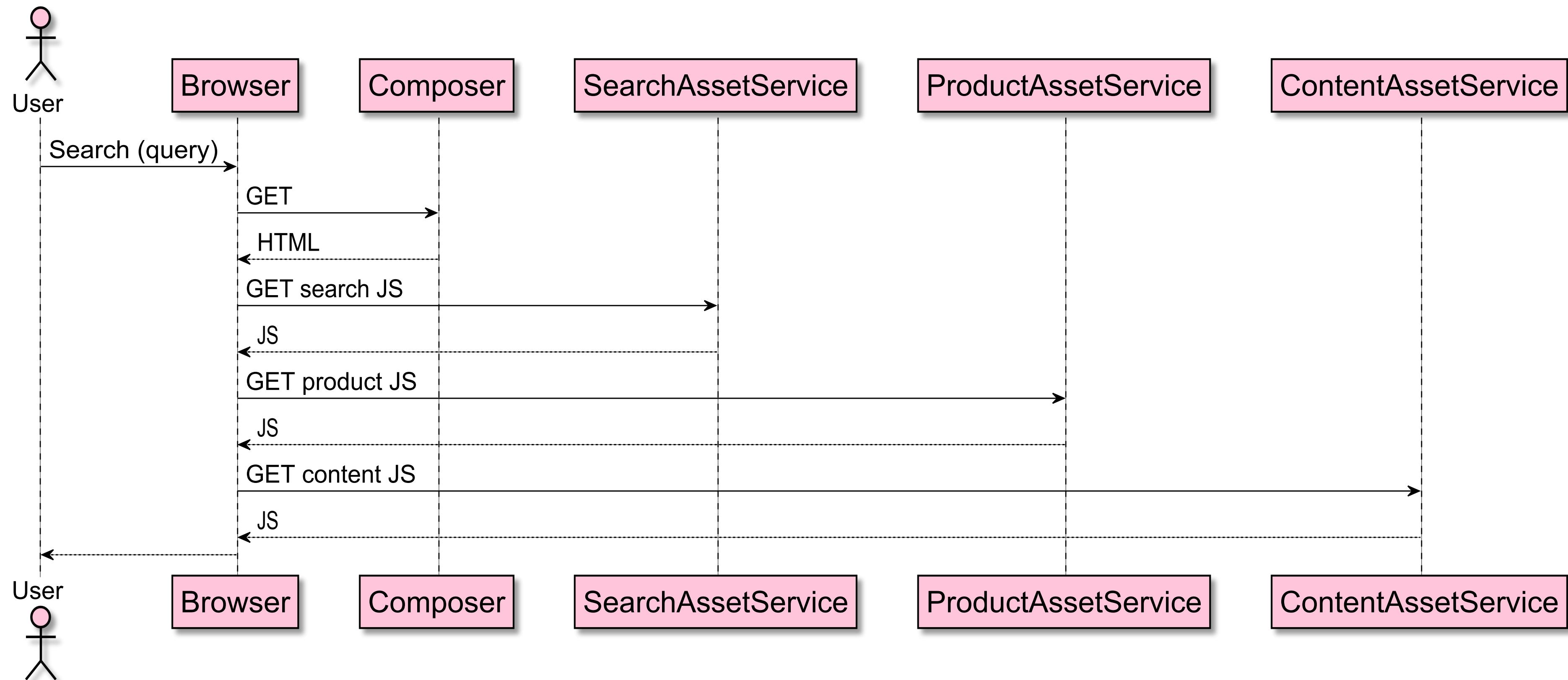


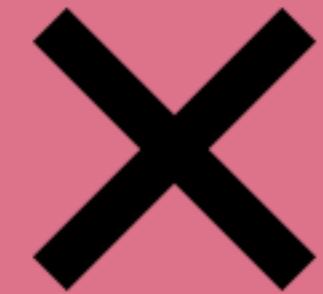
Github Repo

<https://github.com/denise-schaefer/micro-frontends>

```
.
├── composer
│   └── server
├── content
│   ├── client
│   └── server
├── product
│   ├── client
│   └── server
├── search
│   ├── client
│   └── server
└── search-api
    ├── lib
    └── src
```

HTML und JS laden





Composition

Kein unabhängiges Deployment

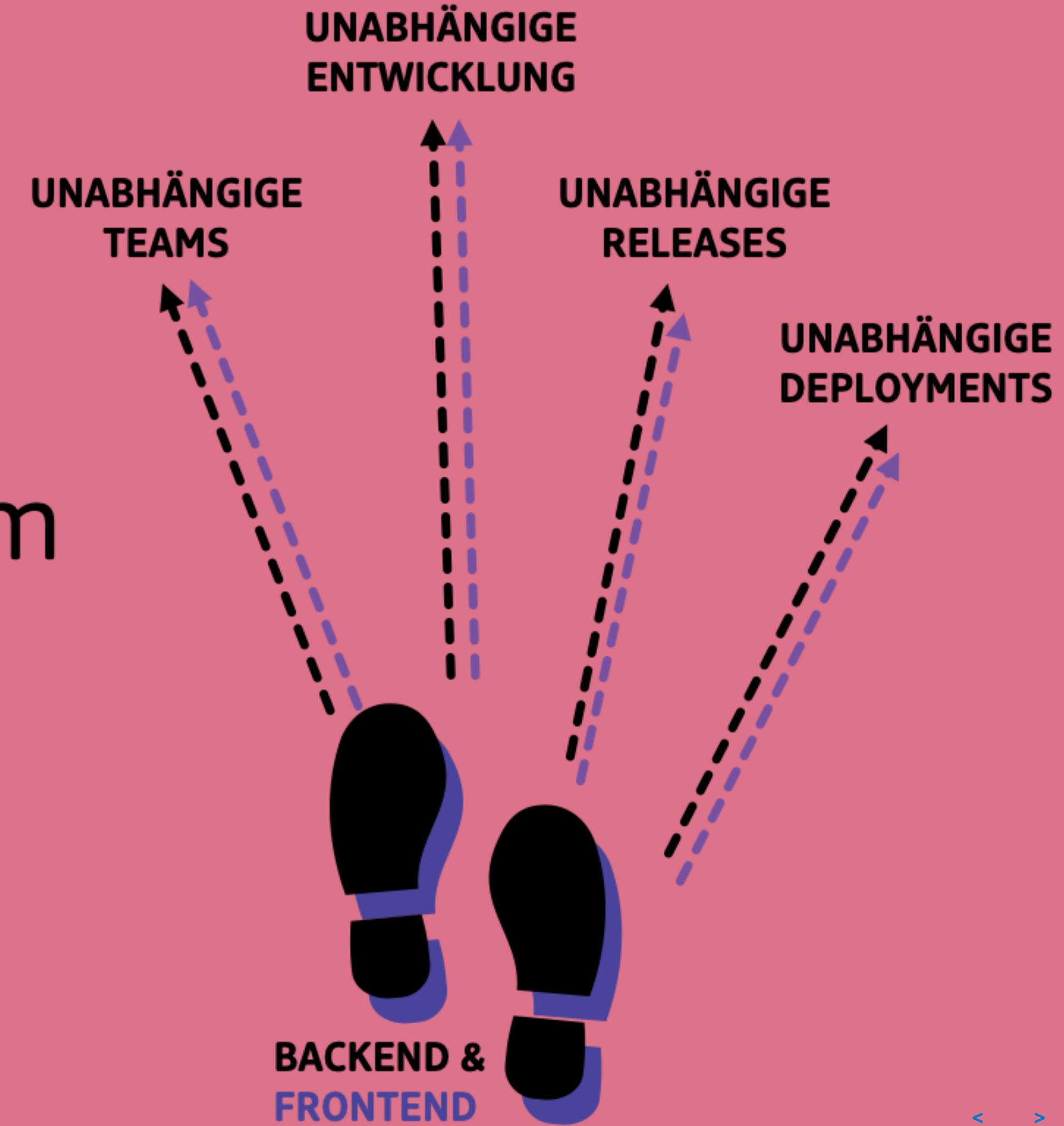


Dependency Inversion

Unabhängiges Deployment

Runtime Composition

Unabhängigkeit im Back- & Frontend





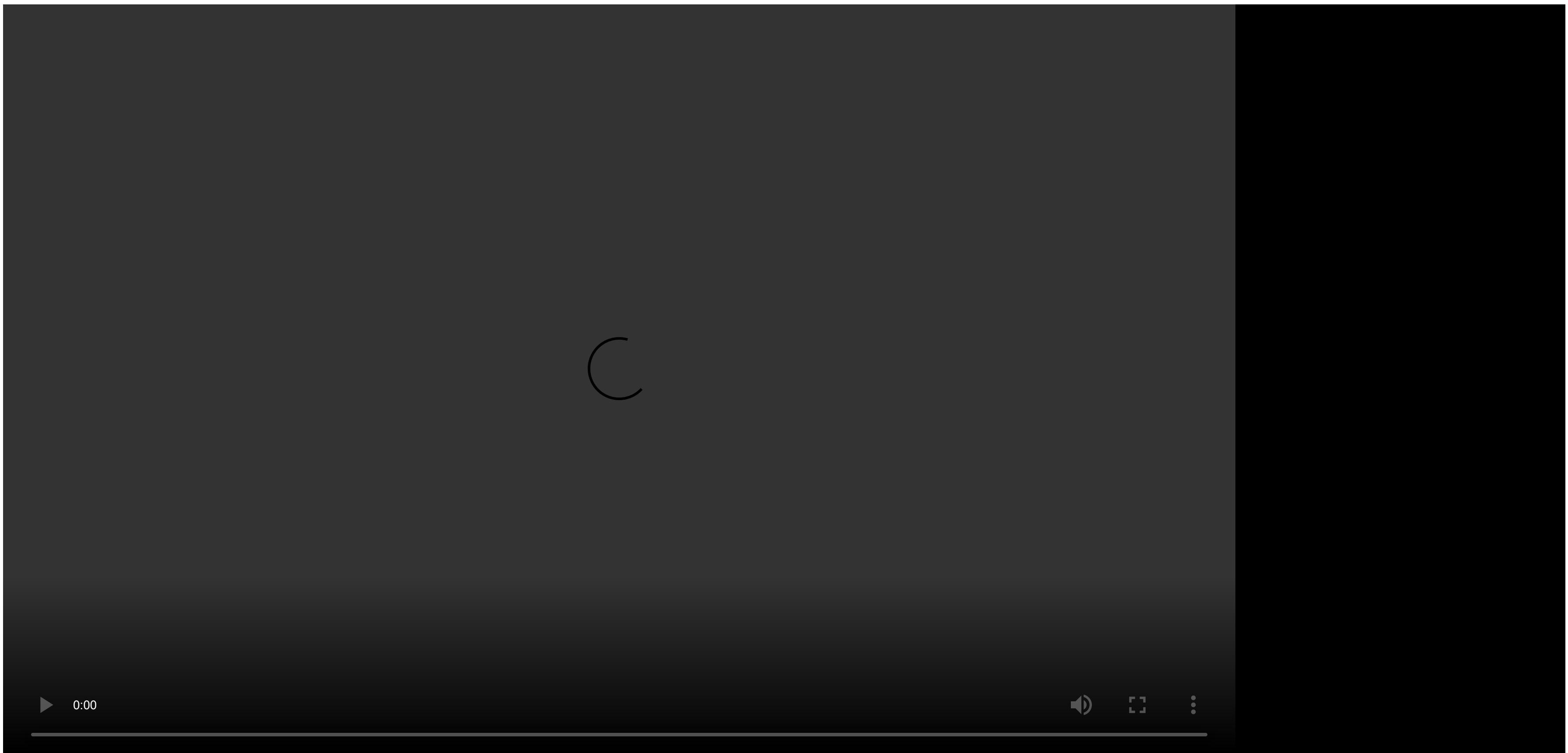
Lessons Learned

Vorteil umso größer, **je größer** das Projekt

Schnittstelle **technologiefrei** halten, z.B. kein Redux

Umdenken im Programmierparadigma fällt oft schwer

Einfache Skalierung, auch für weitere Apps - SEINZ.



Wie geht's weiter?

Ablösung CMS als Composer

SSR für ersten Seitenaufruf

Frontend-seitiges Routing für alle
Uls von dm.de

DANKE!