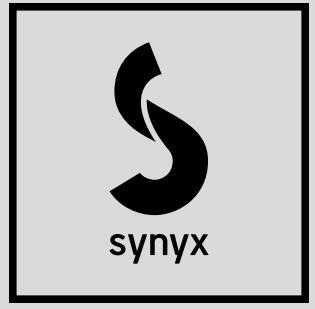


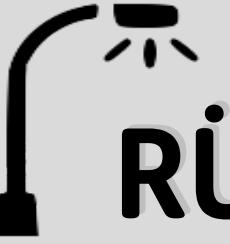
MICRO-FRONTENDS IN REACT



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

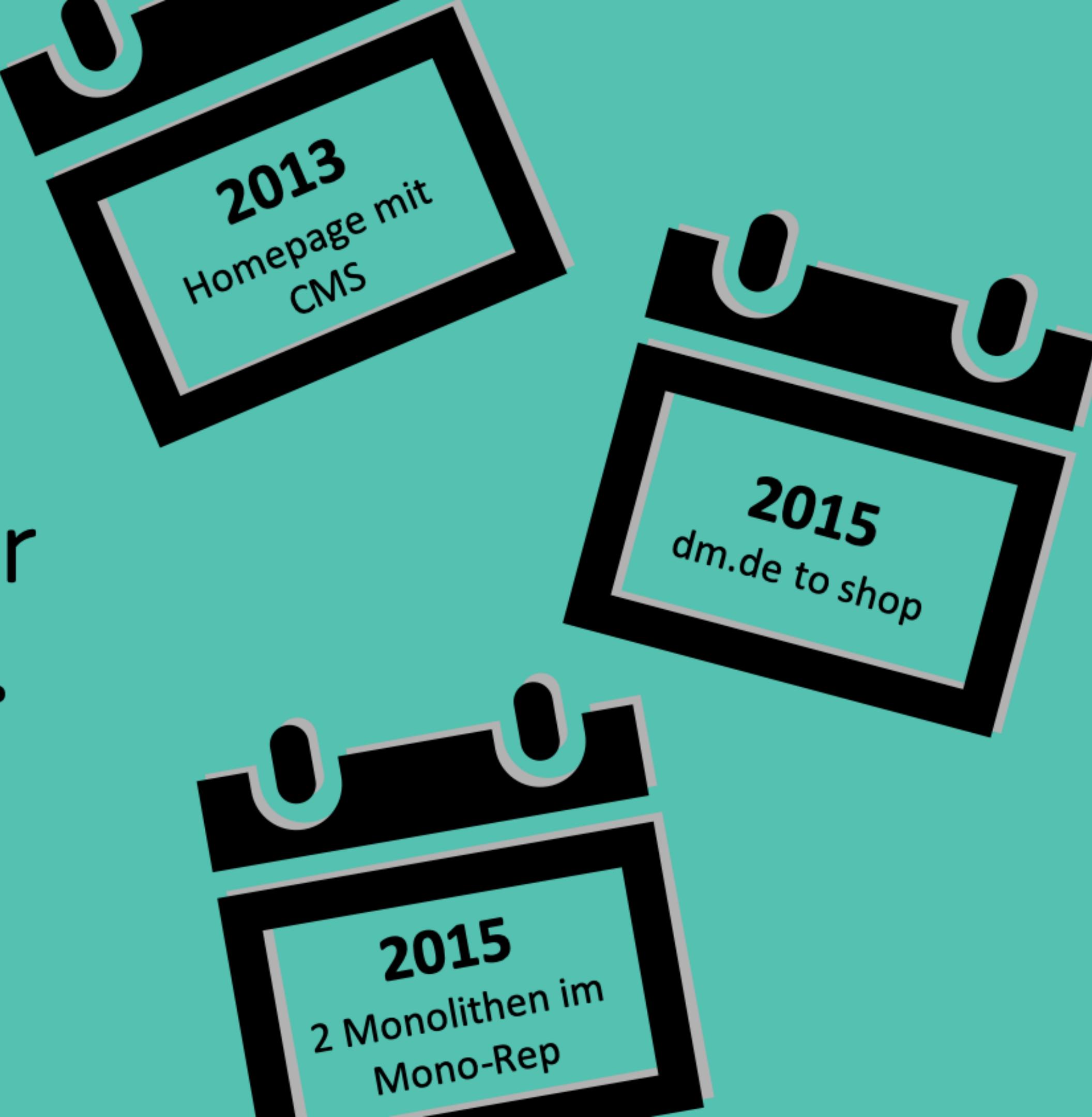


Benjamin Seber
[\(@_seebaer\)](https://twitter.com/_seebaer)



RÜCKBLENDE

Was bisher geschah...

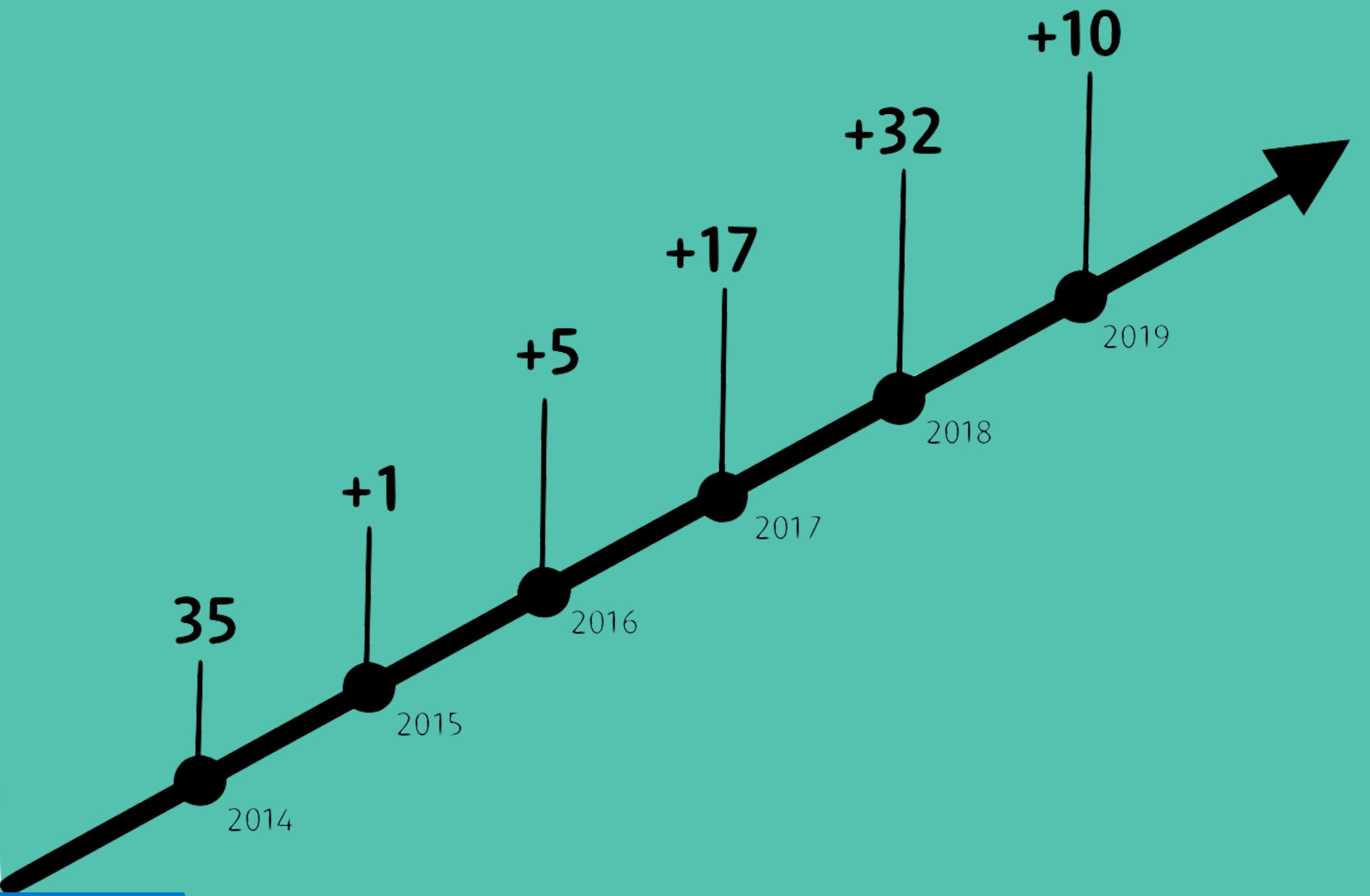


CMS Git Historie

- 2013



2013-05-15 - 18:46 0e66126f4f0b3cf30555003
2013-05-14 - 16:46 a6283da8901558b657cb5b20ed
2013-05-14 - 13:17 36c12ee9120e0dcef5c43e05d0b1
2013-05-13 - 14:28 906b6be40bc01f17fcda2673f0c93cd
* Mon May 2013-05-13 - 14:23 c098905fdb1c17fd8dce9593fc74a134
* Mon May 2013-05-13 - 06:37 7f1bddbe57f5282a9239a0baacbae7dc7b
* Mon May 2013-05-13 - 06:36 0e0275dd95646c9fcb1321bf93648e82494
* Fri May 2013-05-10 - 14:38 8964f525b9726a68428e596e55b01f081882
* Fri May 2013-05-10 - 14:24 074c37b8d5d5abfb364d92725a344f87e2b45
* Fri May 2013-05-10 - 12:40 f66bc54c46d84f6665cd276cd8e2fb9a28c1
* Thu May 2013-05-09 - 13:34 01a817ecf6f88d3c59aab69ac22f0a7a3f4ceb
* Wed May 2013-05-08 - 16:57 8d35cd896fba908835a8b5012d11966973e30a8
* Wed May 2013-05-08 - 09:34 2778dccadd8b015c17fd27b476fa5ea03716410
* Wed May 2013-05-08 - 08:26 44d132c640830dbdb0d4d94649ff0156f9410649
* Tue May 2013-05-07 - 18:37 82ac7fc59309fccffd87379f0e2cdbacbb7d02e8
* Mon May 2013-05-06 - 16:37 3b2dfae8f7c99c6b439f2b87fcaa11c885e518a0
* Mon May 2013-05-06 - 16:08 e3156eb80840c8577e759ab21f55455701918e9
* Fri May 2013-05-03 - 17:19 e8a3eea664464e0fc09ebdb604d9e9d413dbb2c
* Fri May 2013-05-03 - 17:16 b3d7d0c38d4ded5c56ba983ea38c07094f03202
* Fri May 2013-05-03 - 14:52 b8457c803b0e8430ab4838945867b16dd063bd
* Thu May 2013-05-02 - 17:53 4c190f4cae9346a634e6b61e118147f2d9117
* Thu May 2013-05-02 - 17:42 027f4f4a213b7b0e3b83dca239d5c637108b
* Thu May 2013-05-02 - 14:27 d0241edc44460795ef7b1d66751f3441503
* Apr 2013-04-29 - 16:19 3215bc364646d79f36def6342a3eee3a6c
* Apr 2013-04-29 - 16:18 e58c0d746dd86130d1767fe14fc5a36
* Apr 2013-04-29 - 15:53 8d6bfe2415c32d9c338bad543535aff
* Apr 2013-04-29 - 15:00 23079093b029198af87944df37d38
* Apr 2013-04-29 - 14:57 dacaa810a76a1f237292a0443c0
* Apr 2013-04-29 - 13:05 56f83a9a9bddae49c33341b
* Apr 2013-04-29 - 10:05 b55583fa3f00f98f3590
* Apr 2013-04-21 c18407604b50b20



Anstieg der
Contributor

CMS Git Historie - 2016



Wir brauchen mehr Features!



Was war denn
Anfang 2016?

Einiges! Wo soll
ich anfangen?
Aaalso...



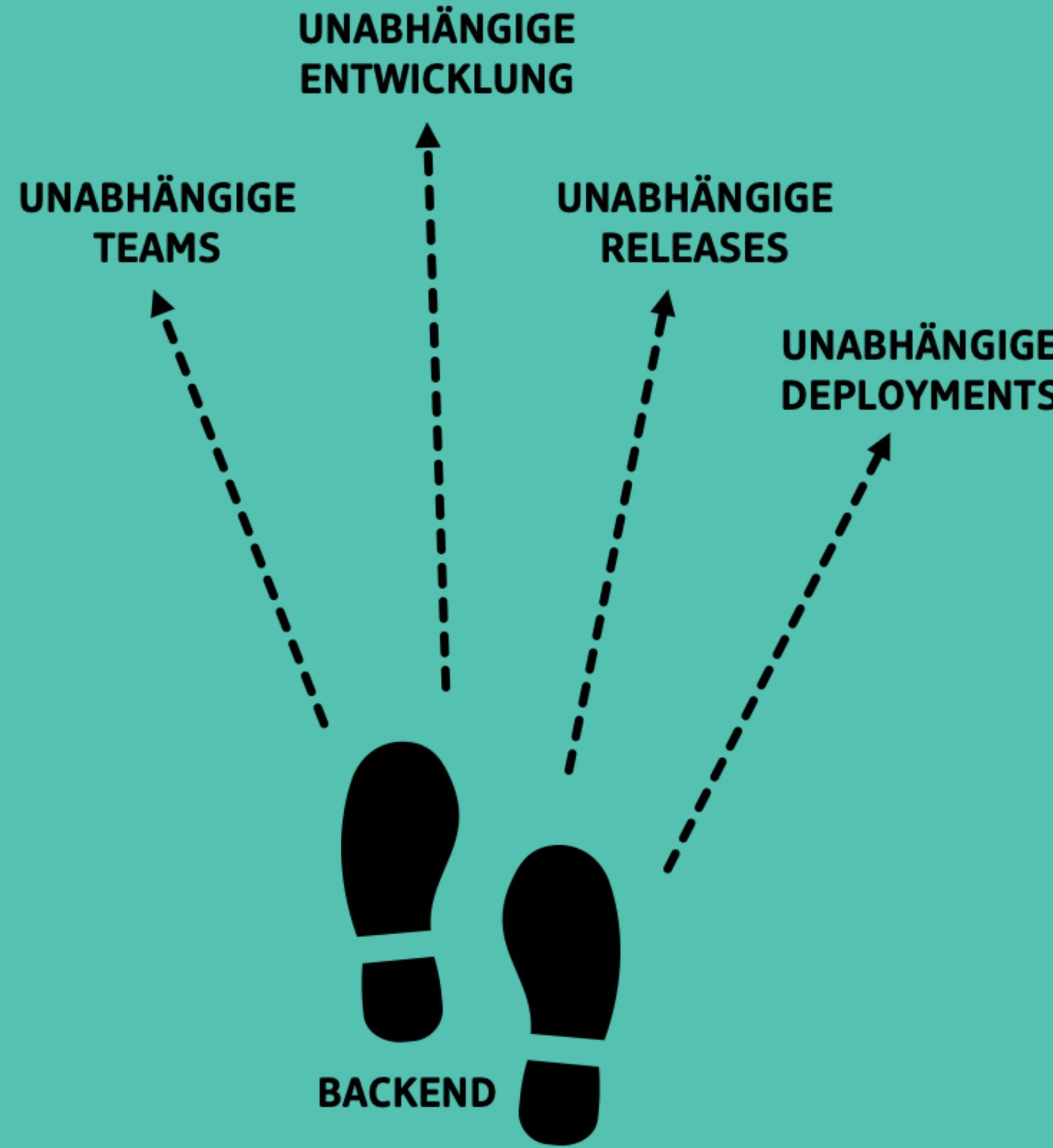


Micro-Services im Backend



<https://kurzelinks.de/monolith2microservice>

Unabhängigkeit nur im Backend



Skalierung im Backend

BACKEND



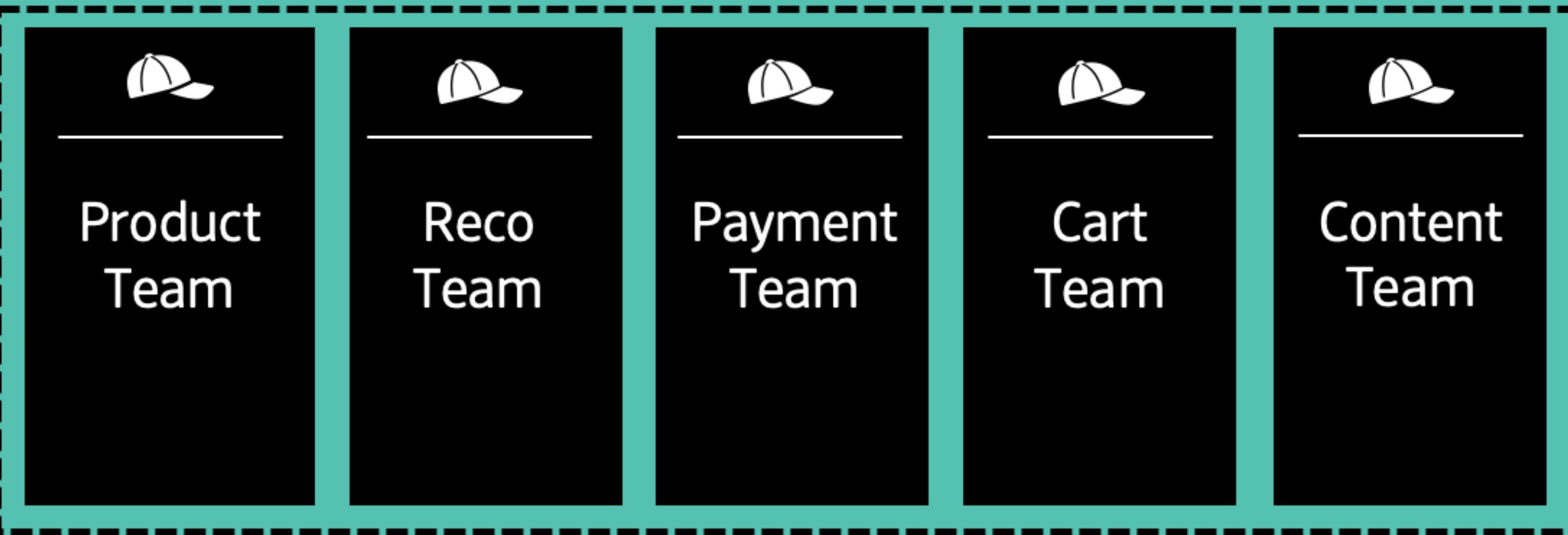
FRONTEND



Frontend-Team



Backend-Teams



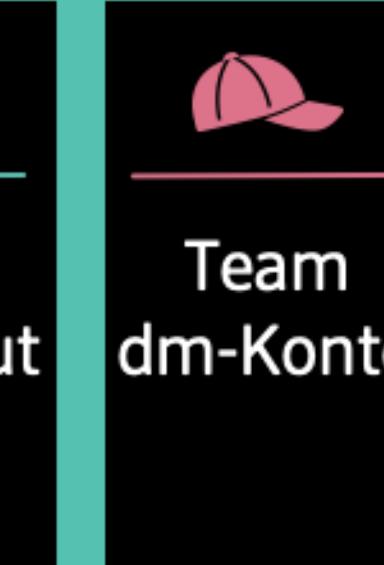
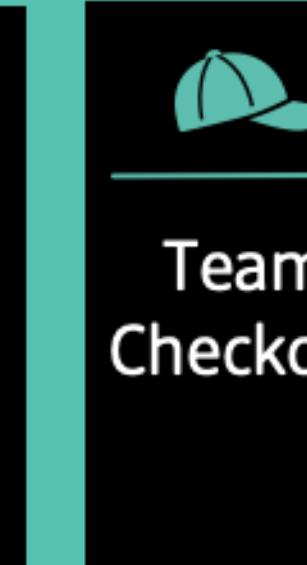
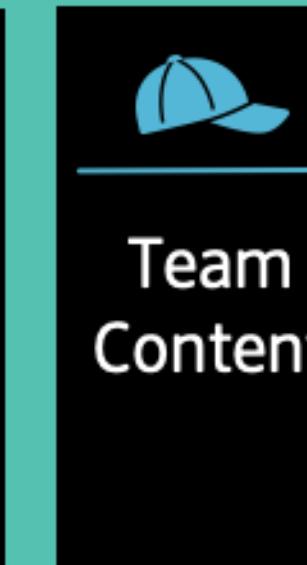
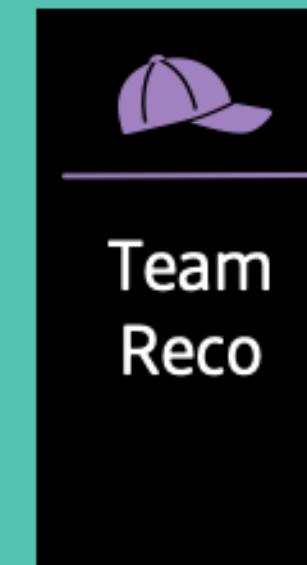
Auswirkung für den Product Owner





WANTED

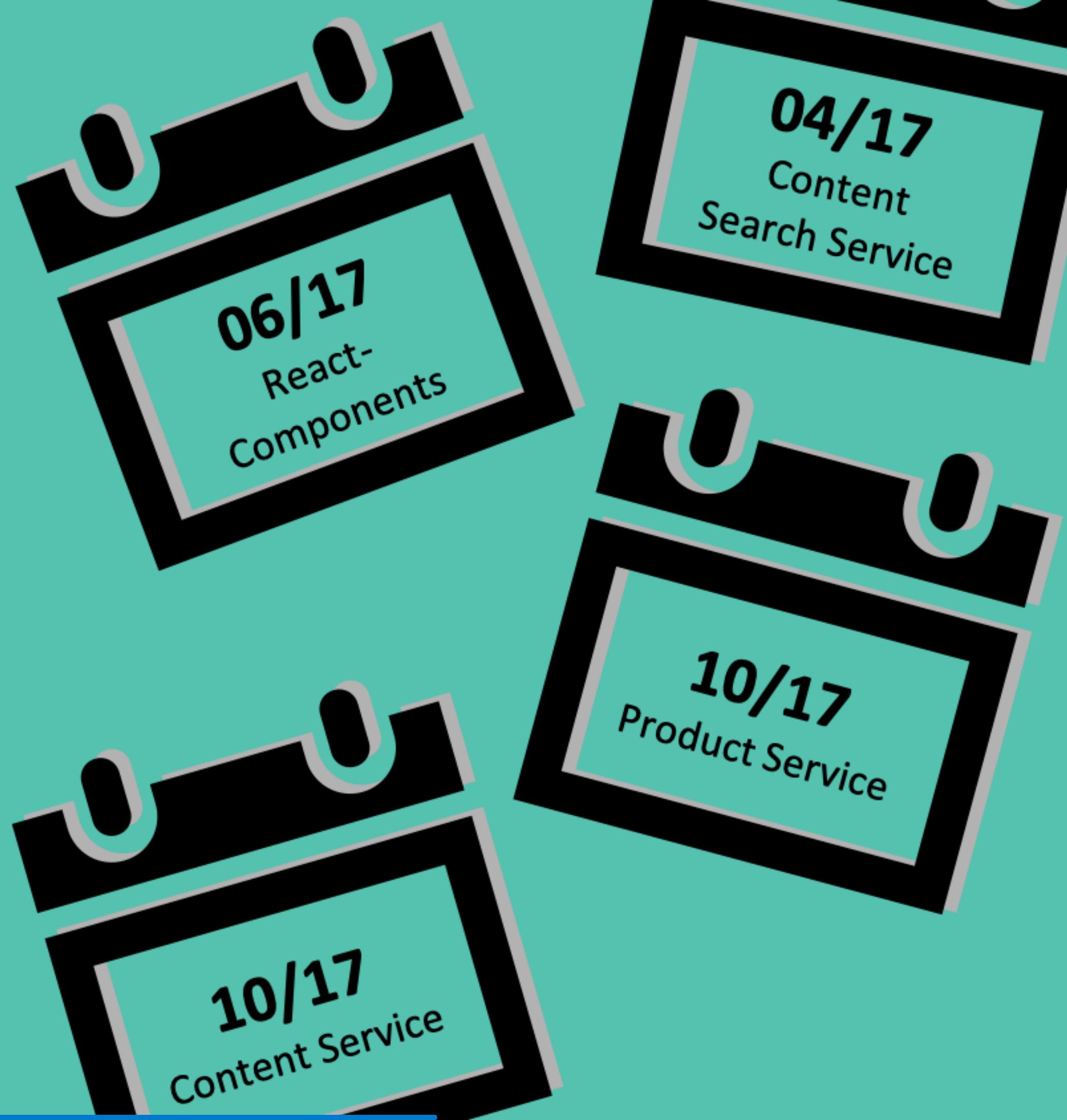
CROSS-FUNKTIONALE TEAMS

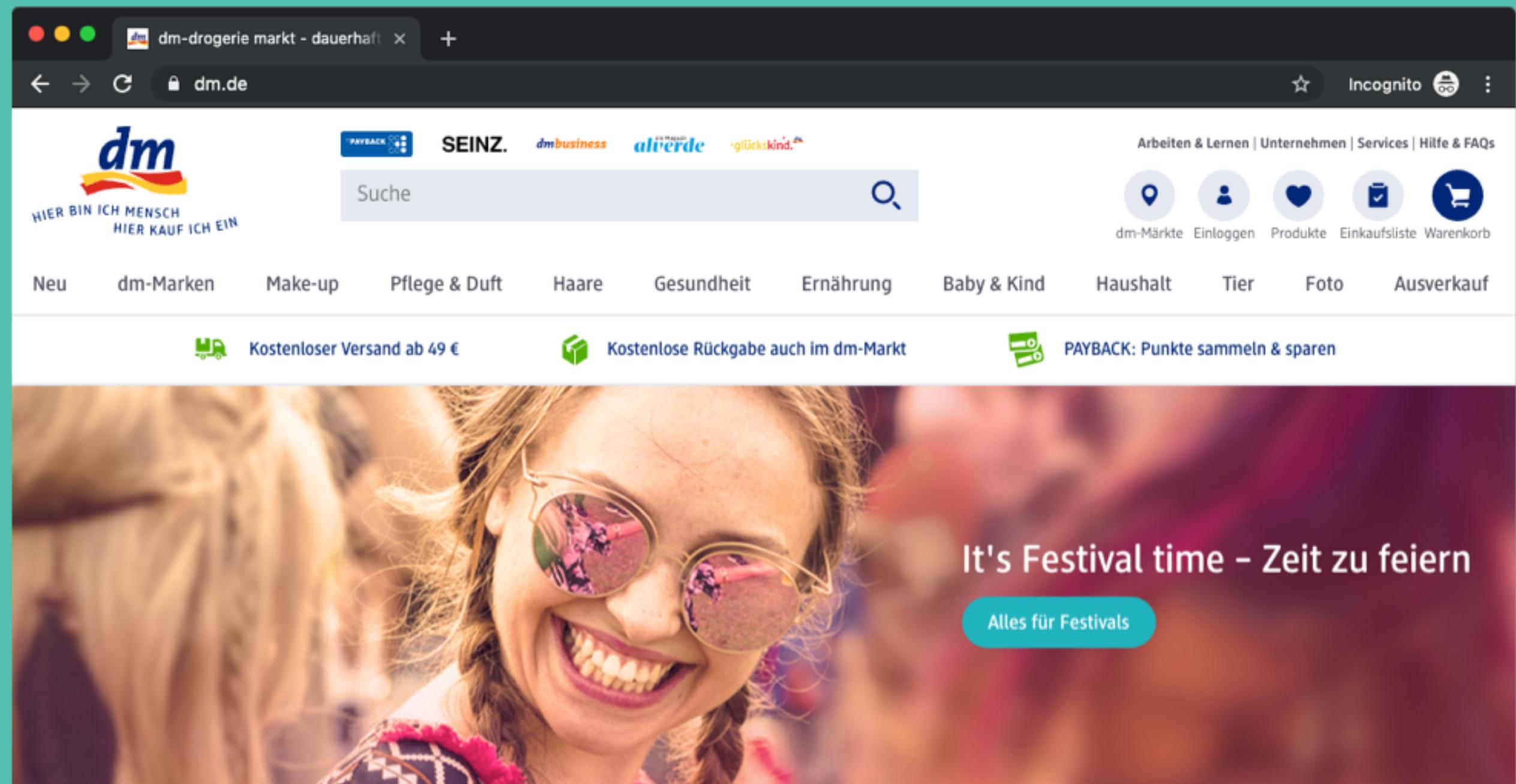


FRONT- & BACK-END



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 cart, and a link to 'dm-Märkte'. Below the main navigation are category links: 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 include '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

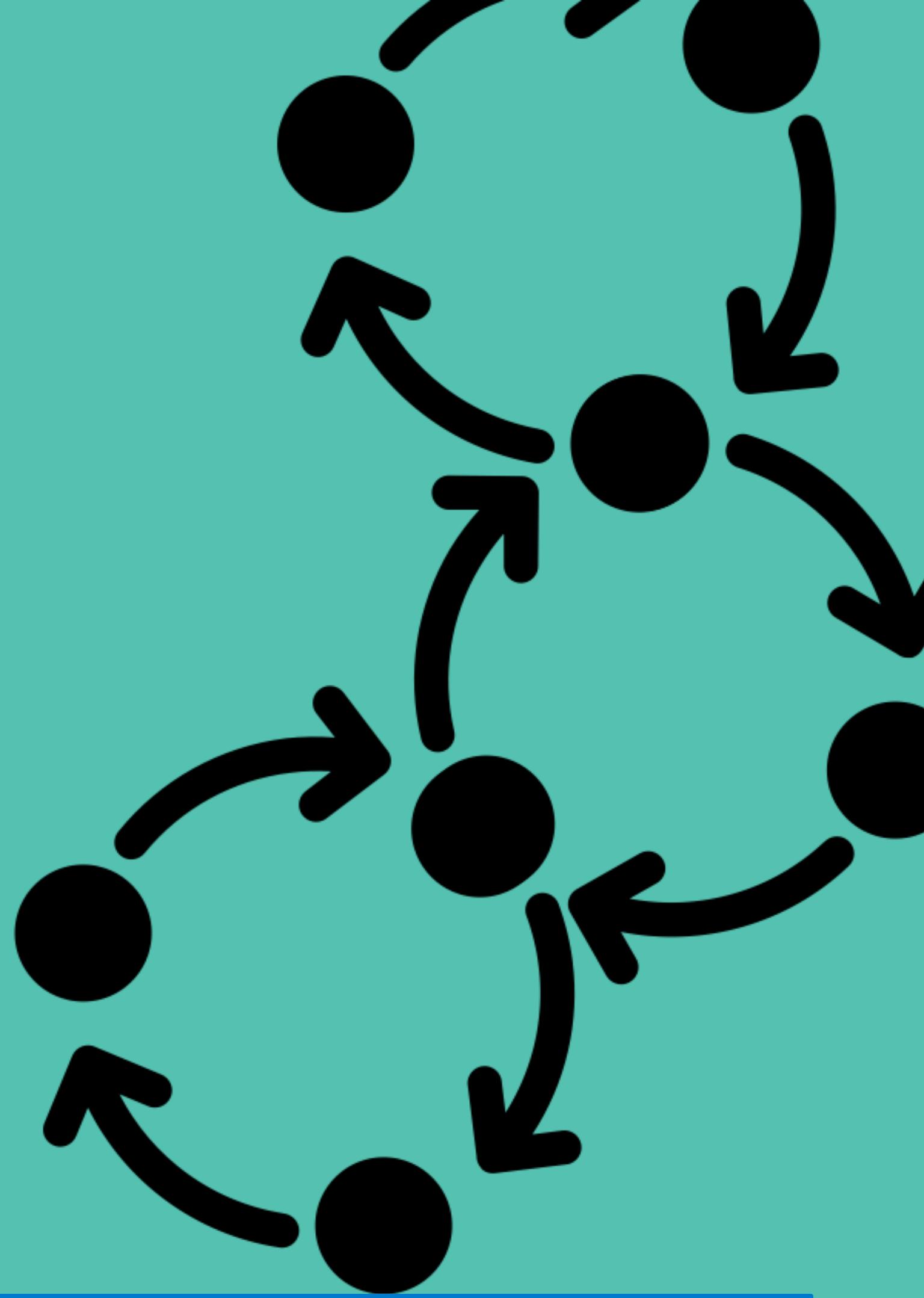


BABEL



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

Schauplatz Detailseite

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

- Header:** dm logo, navigation links (Neu, dm-Marken, Make-up, Pflege & Duft, Haare, Gesundheit, Ernährung, Baby & Kind, Haushalt, Tier, Foto, Ausverkauf), search bar, PAYBACK logo, glückskind logo.
- Product Information:**
 - Product image: Balea MEN Duschgel arctic fresh, 300 ml.
 - Product name: Balea MEN Duschgel arctic fresh, 300 ml.
 - Rating: ★★★★☆ 5.0 (2) reviews.
 - Price: 0,95 €.
 - Buttons: 'In den Warenkorb' (Add to Cart) and 'Auf die Einkaufsliste' (Add to Shopping List).
 - Product description: Cool down your body! mit kühlendem Menthol.
 - Dimensions: 300 ml (3,17 € je 1 l).
 - Availability: Lieferbar (Deliverable).
 - Delivery information: In welchen Filialen ist dieses Produkt verfügbar? Bitte PLZ / Ort angeben.
 - Payback information: Für jeden Euro Warenwert erhalten Sie 1 PAYBACK Punkt.
- Footer:** dm-Dauerpreis nicht erhöht seit 06.03.2015, PAYBACK logo, Balea MEN logo.
- Annotations:** Numbered callouts (1 through 6) point to various UI elements: 1 points to the product image, 2 points to the 'In den Warenkorb' button, 3 points to the price, 4 points to the search bar, 5 points to the delivery input field, and 6 points to the top navigation bar.

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

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

Balea Hornhaut Entferner Socken
★★★★★ (196)

Balea Urea Fußcreme, 100 ml
★★★★★ (12)

Balea Duschöl 250ml, 250 ml
★★★★★ (10)

Balea erfrischendes Waschgel 150 ml
★★★★★ (31)

Balea

Schauplatz Suche

Domain Suche (Rahmen) 1

Domain Produkt-Suche | 2

Domain Content-Suche 3

1

dm SEINZ. dm business alverde glückskind.de

Arbeiten & Lernen | Unternehmen | Services | Hilfe & FAQs

Balea

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 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**

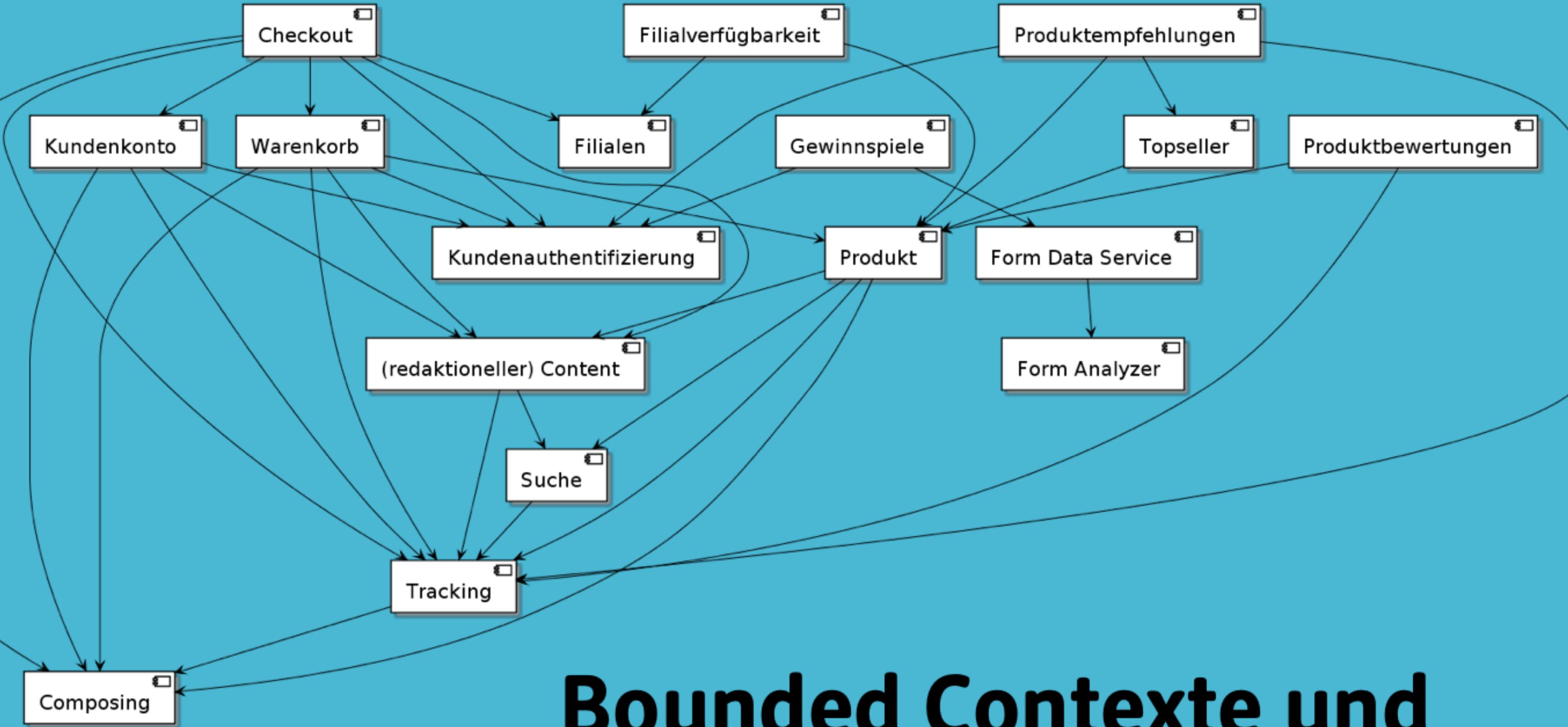
Suchantrag nach „Balea“

Produkte (623) Beratung (206)

Balea Deo
22.12.2017
Pflege & Duft
[Seite öffnen](#)

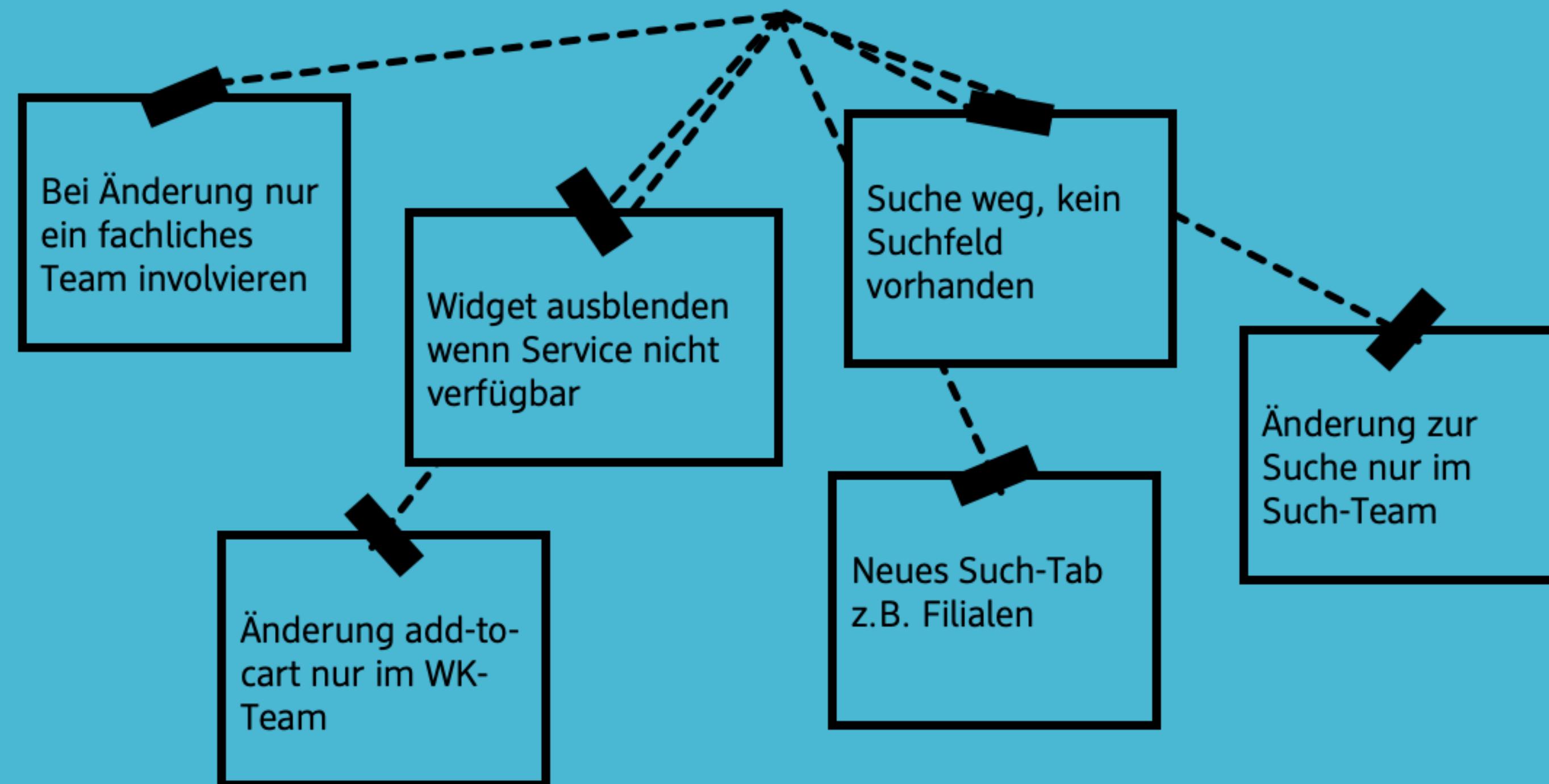
Über Balea
11.01.2016
Balea
[Seite öffnen](#)

Balea Winter
25.10.2018
Limited Editions
[Seite öffnen](#)

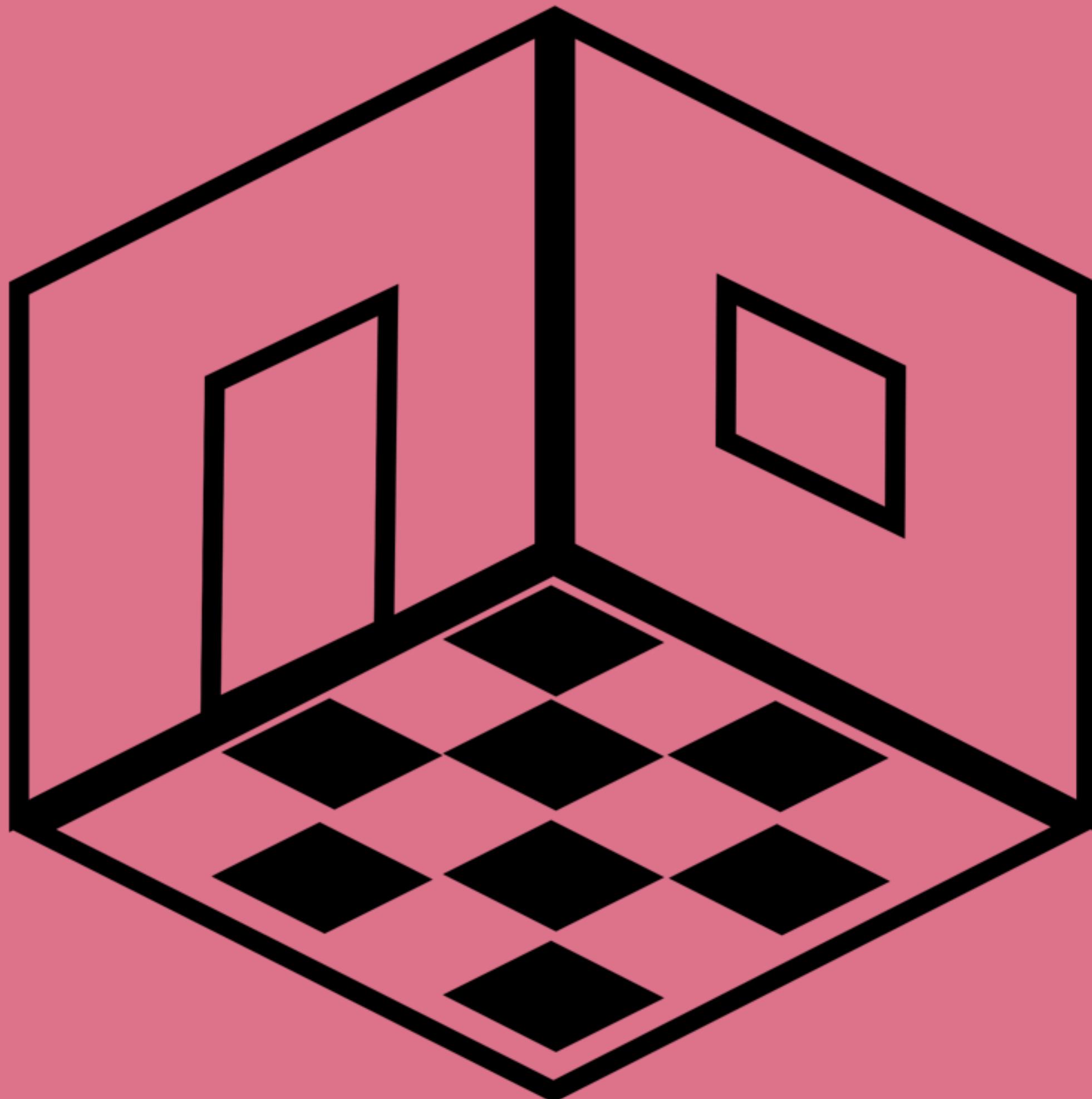


Bounded Contexte und Abhängigkeiten bei dm.de

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>

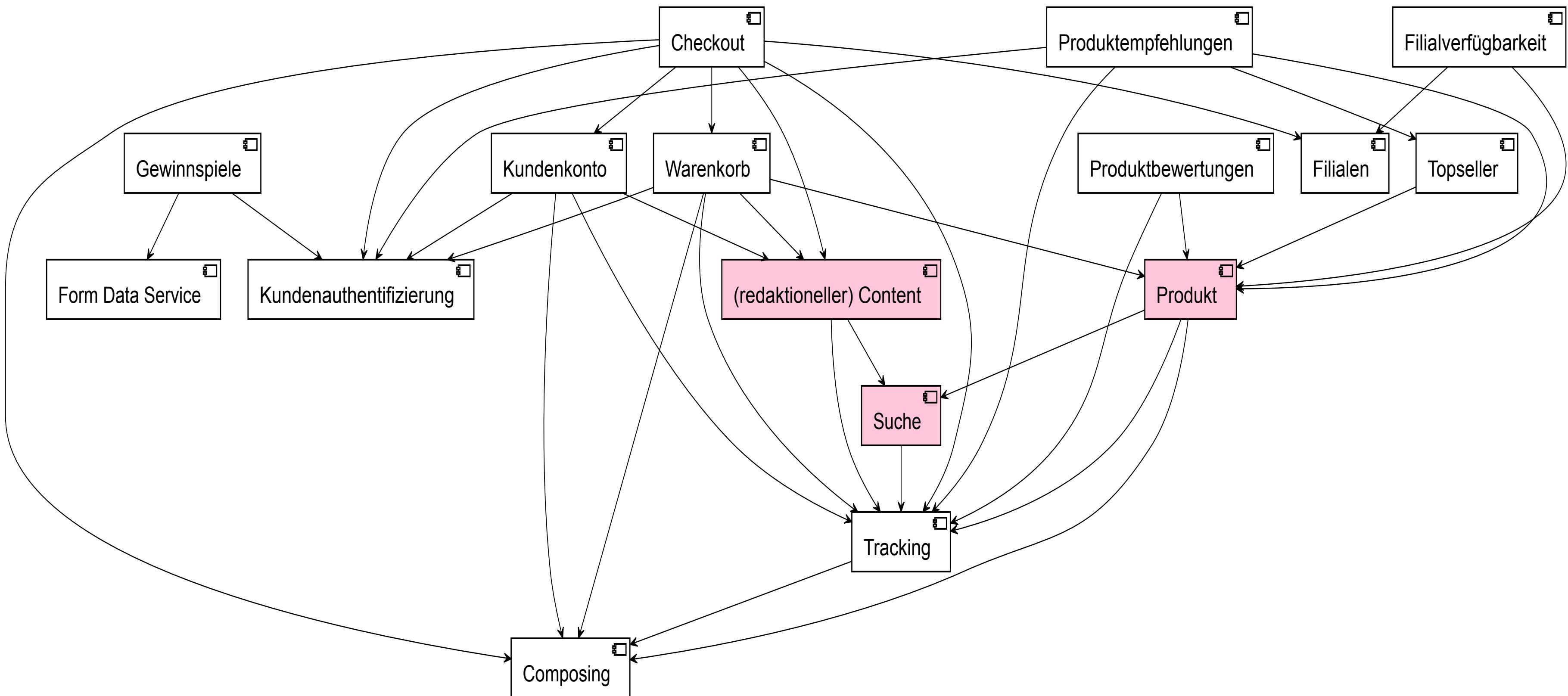


**< DEPENDENCY
INVERSION />**

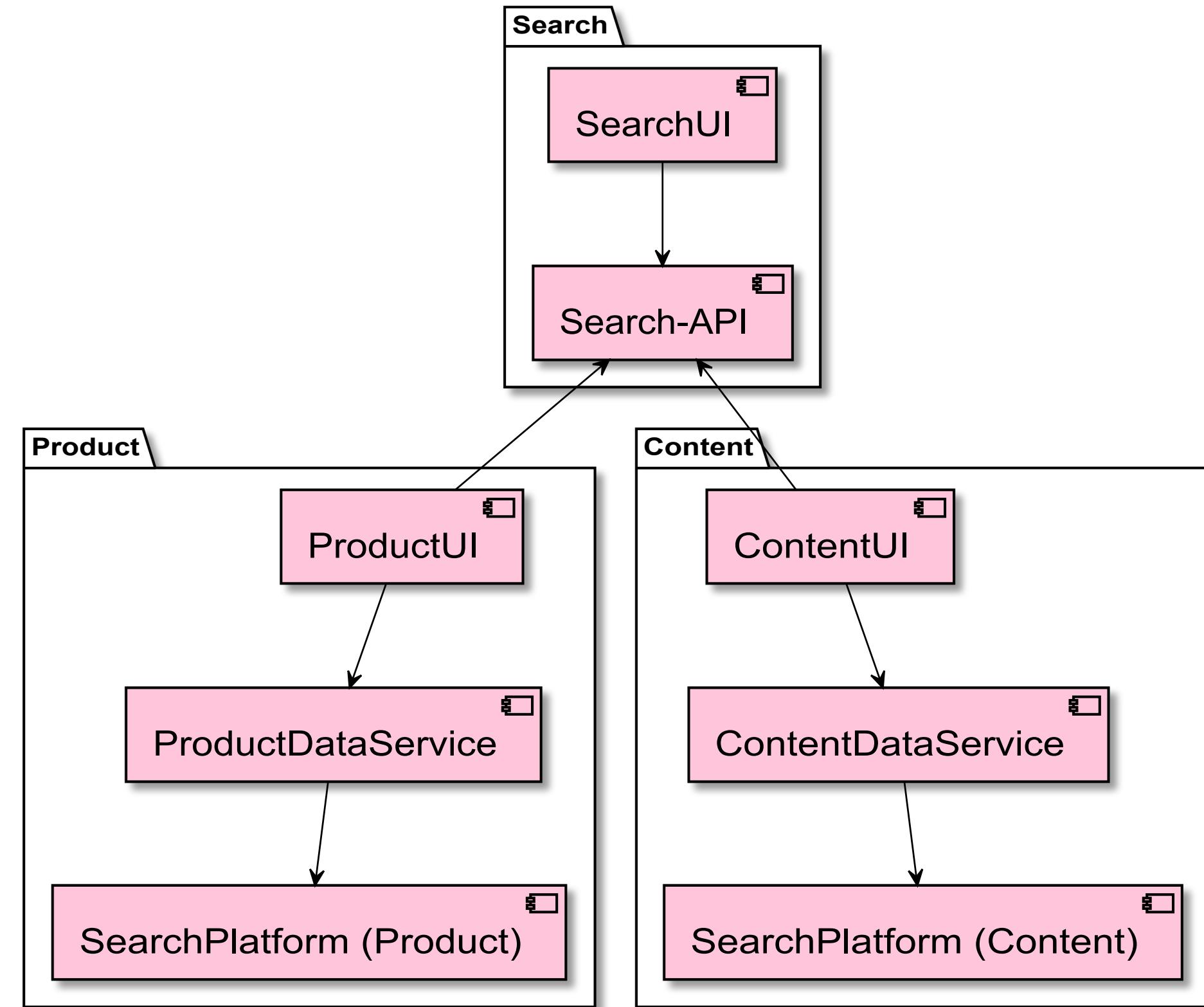
Allgemeine Module
hängen nicht von
speziellen Modulen
ab.

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 €

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 €

Lorem ipsum dolor sit amet

make-up product 5
8,65 €

Lorem ipsum dolor sit amet

make-up product 6
2,95 €

Lorem ipsum dolor sit amet

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 ---
```

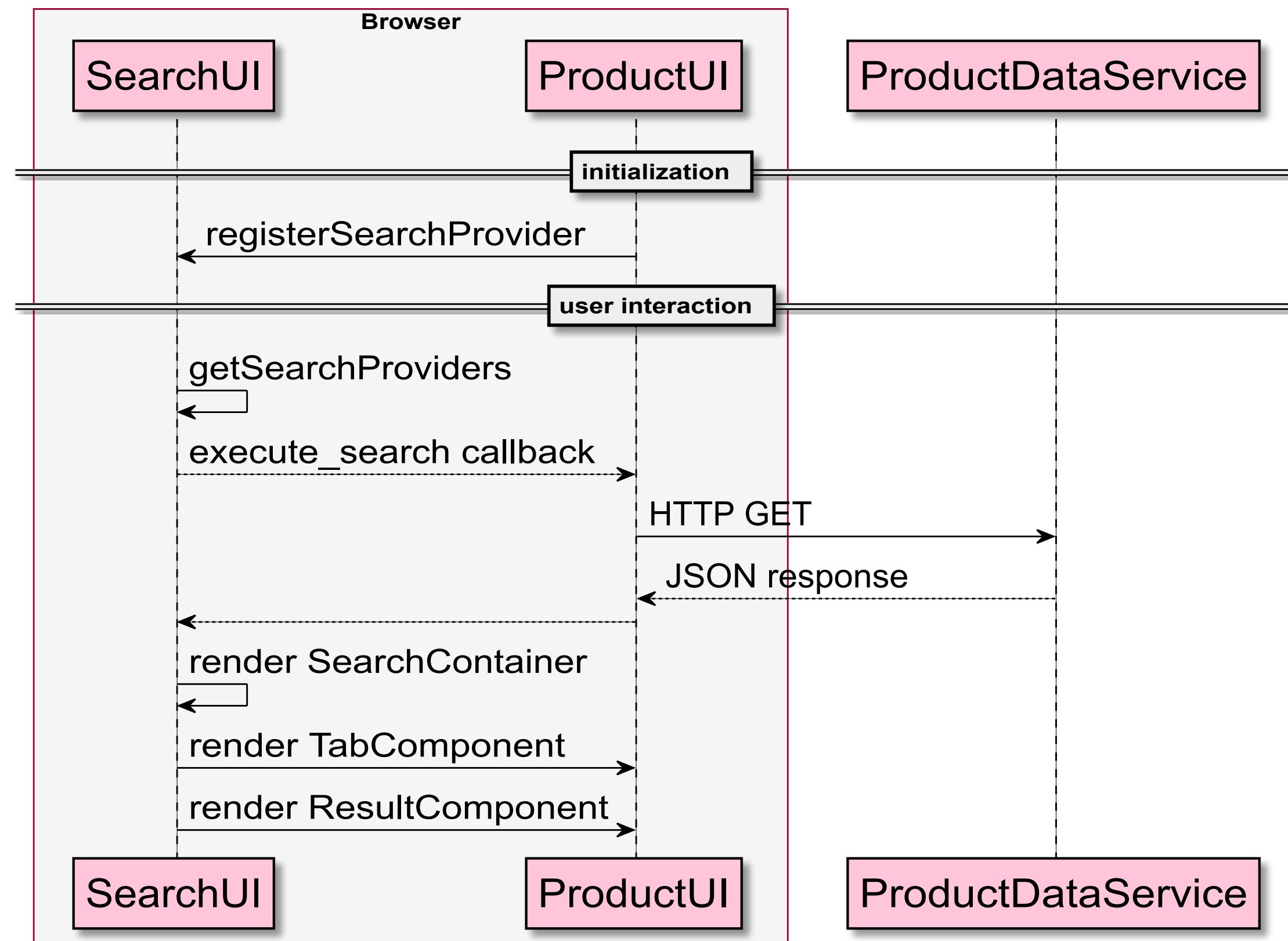
```
13 // ----- ↓ Search ↓ -----
```

```
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>
```

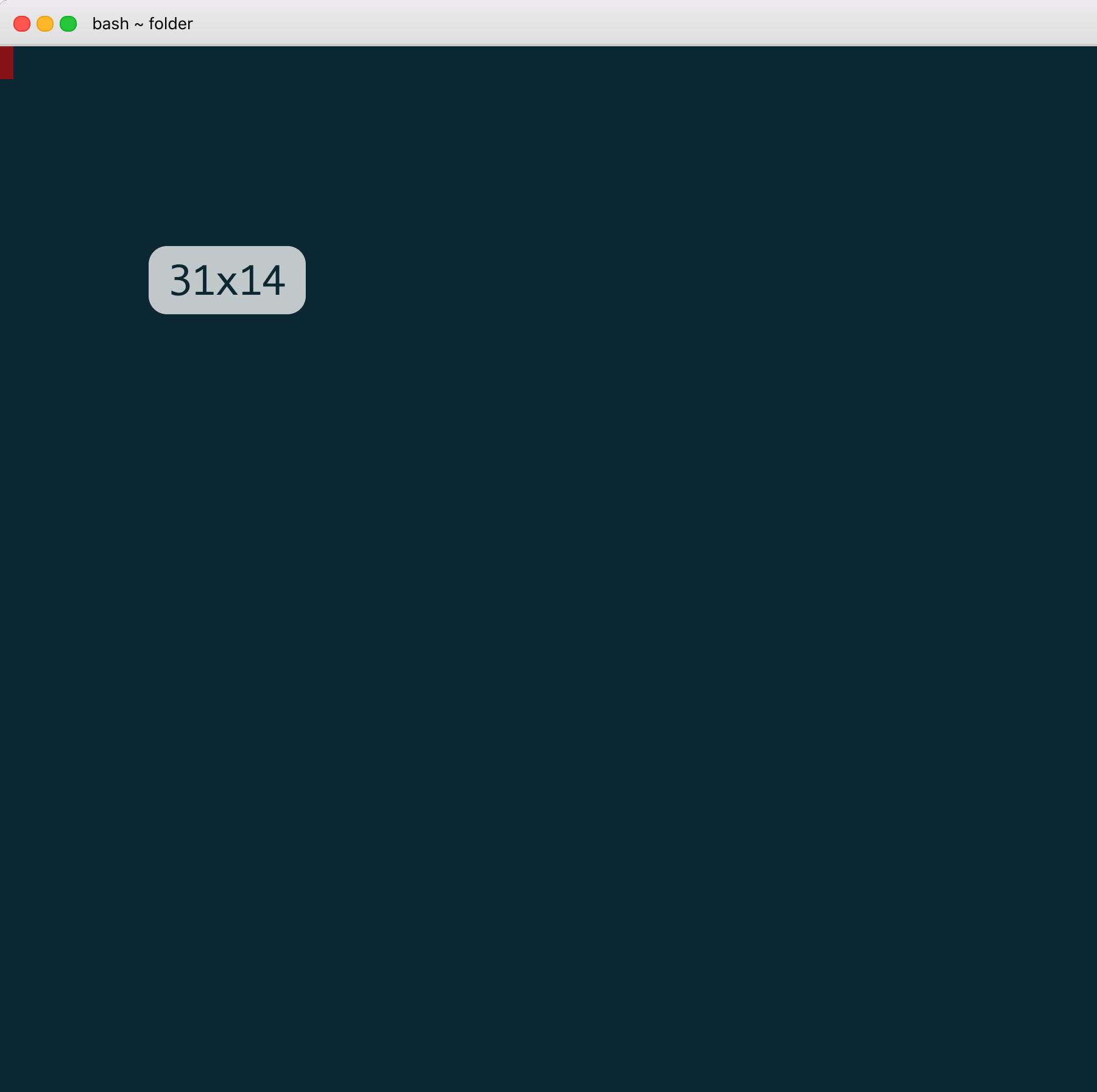
1



Suche mit einem Provider für Produktsuche



Suche mit einem Provider für Produktsuche

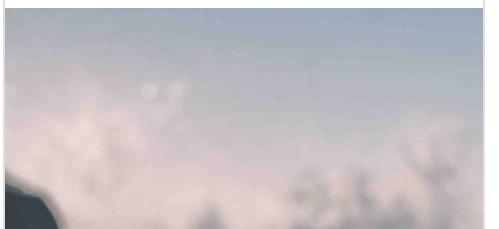
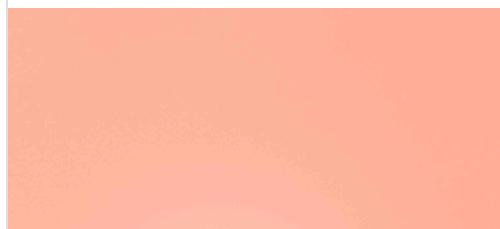
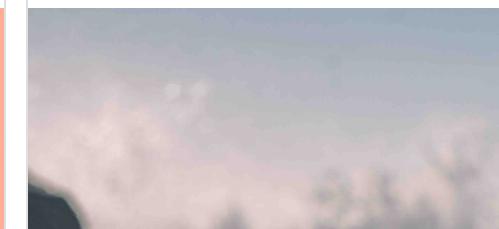


http://localhost:8080/?query=make-up&searchType=product

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 two tabs in a code editor: '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, body, and footer components.

Dependency Inversion - Suche

code ~ sources

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

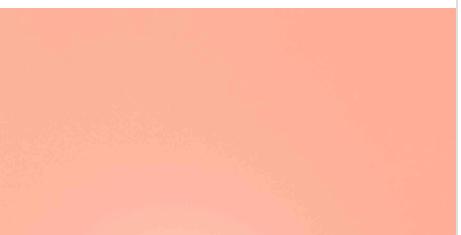
```
1 import React, { useEffect } from 'react';
2 import qs from 'qs';
3 import { getSearchProviders } from 'search-api';
4 import SearchResultHeader from './SearchResultHeader';
5 import SearchResultBody from './SearchResultBody';
6 import { doLoadCount, doLoadData } from './state/actions';
7 import 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
```

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

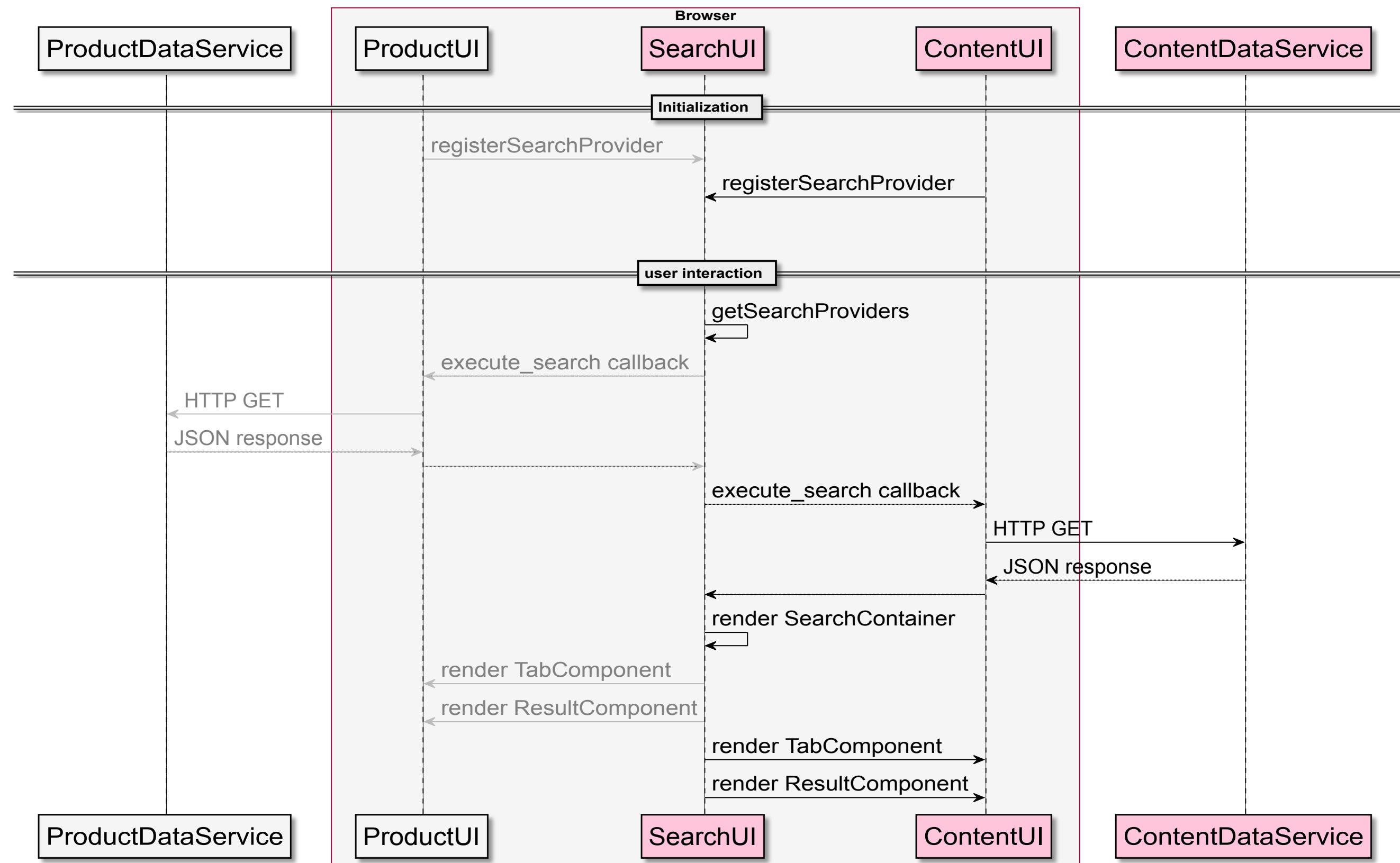
Suche nach "make-up"

Produkte (6)

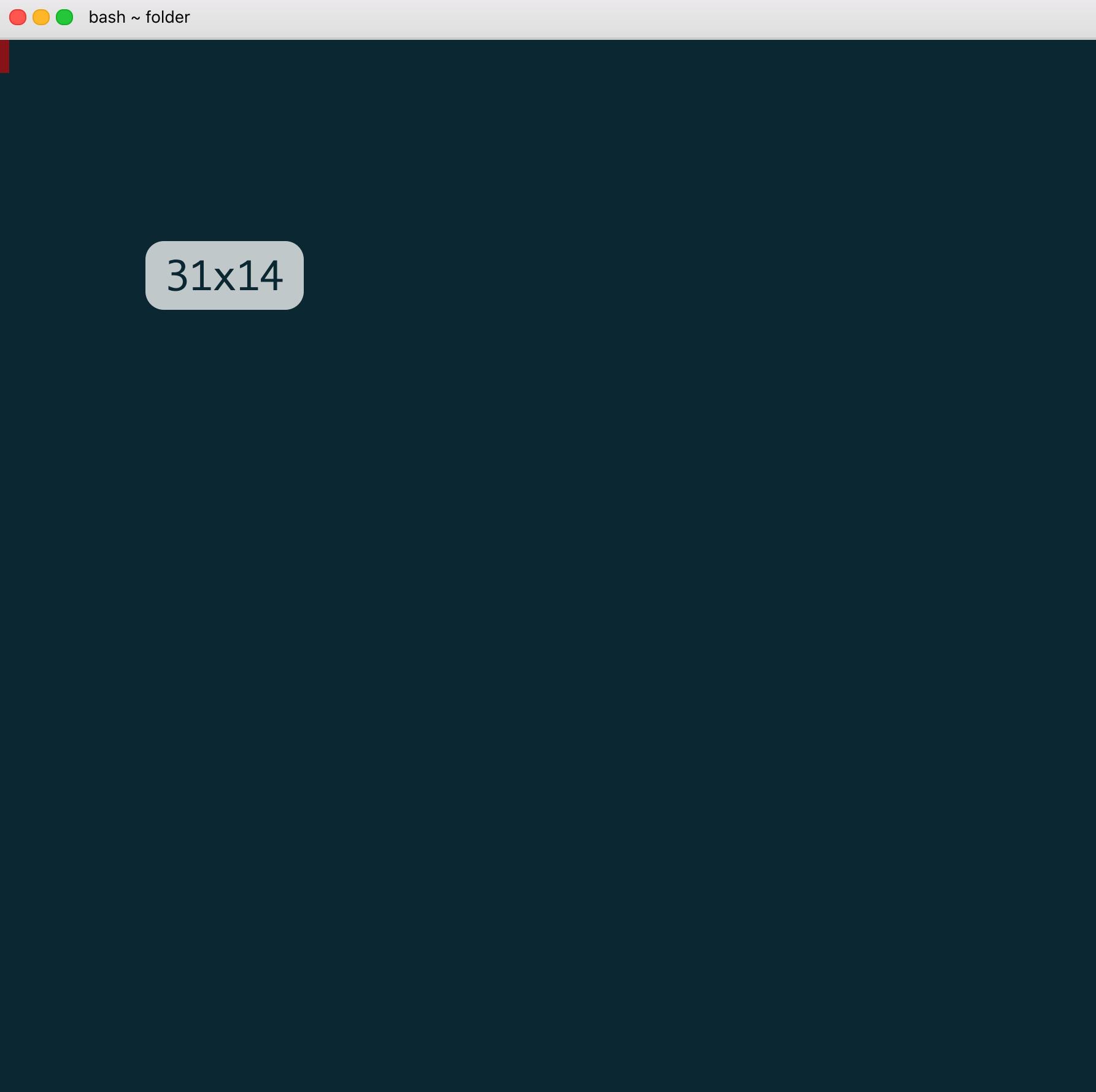
Suche nach "make-up": 6 counts

<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



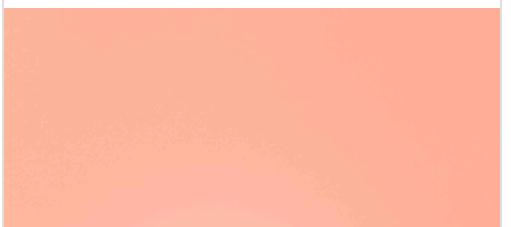
bash ~ folder

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

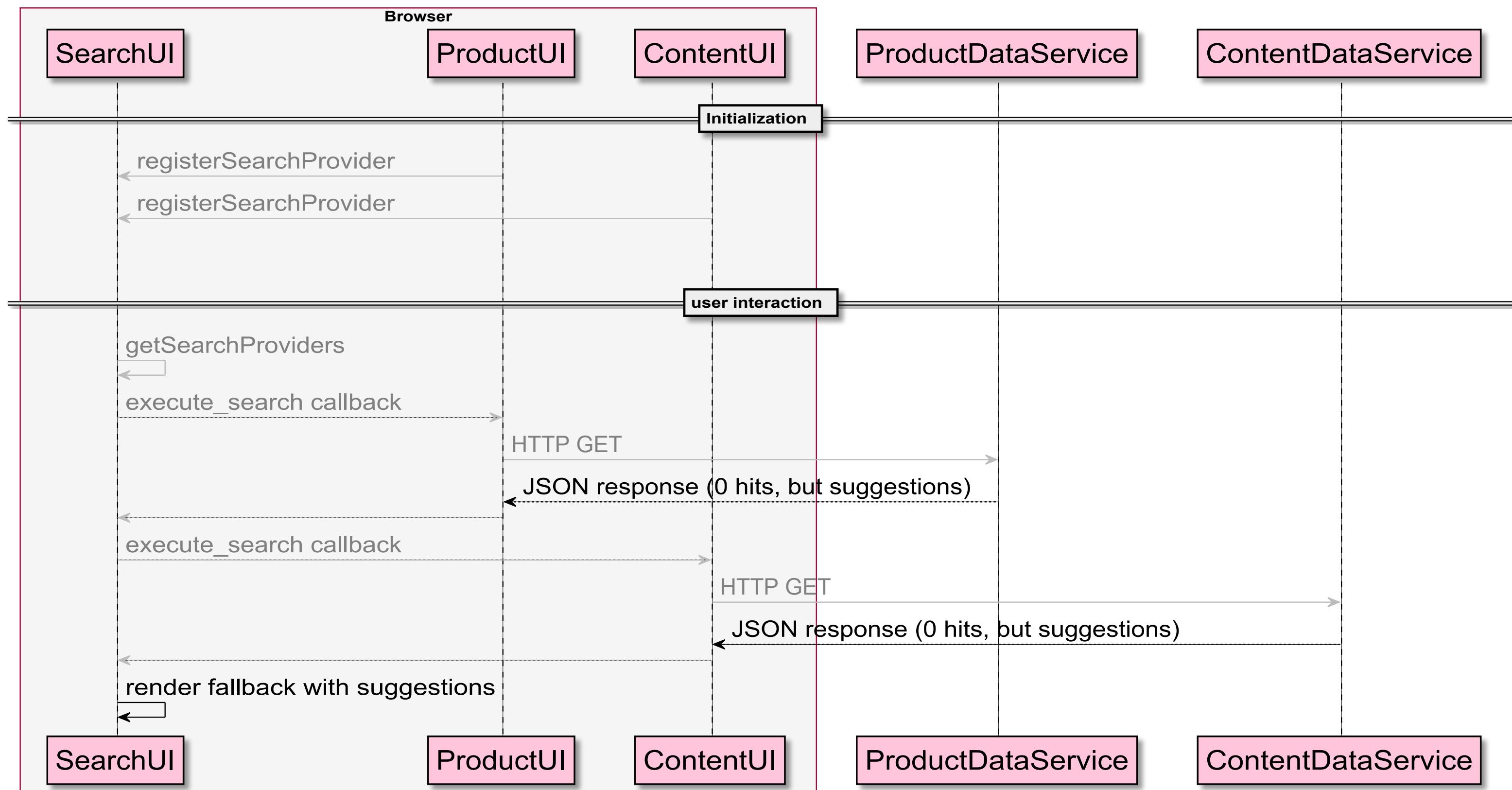
Suche nach "make-up"

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

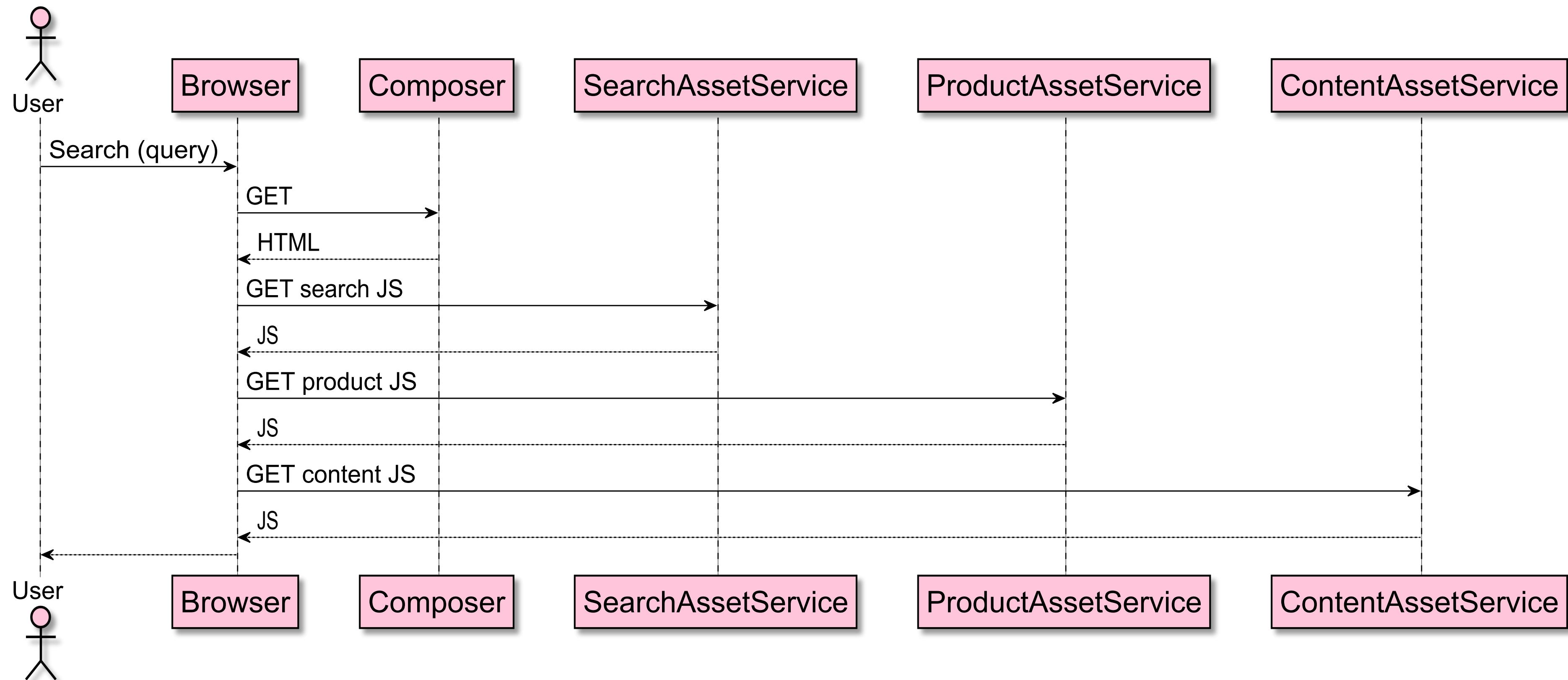


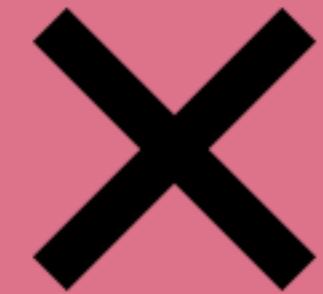
Github Repo

<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

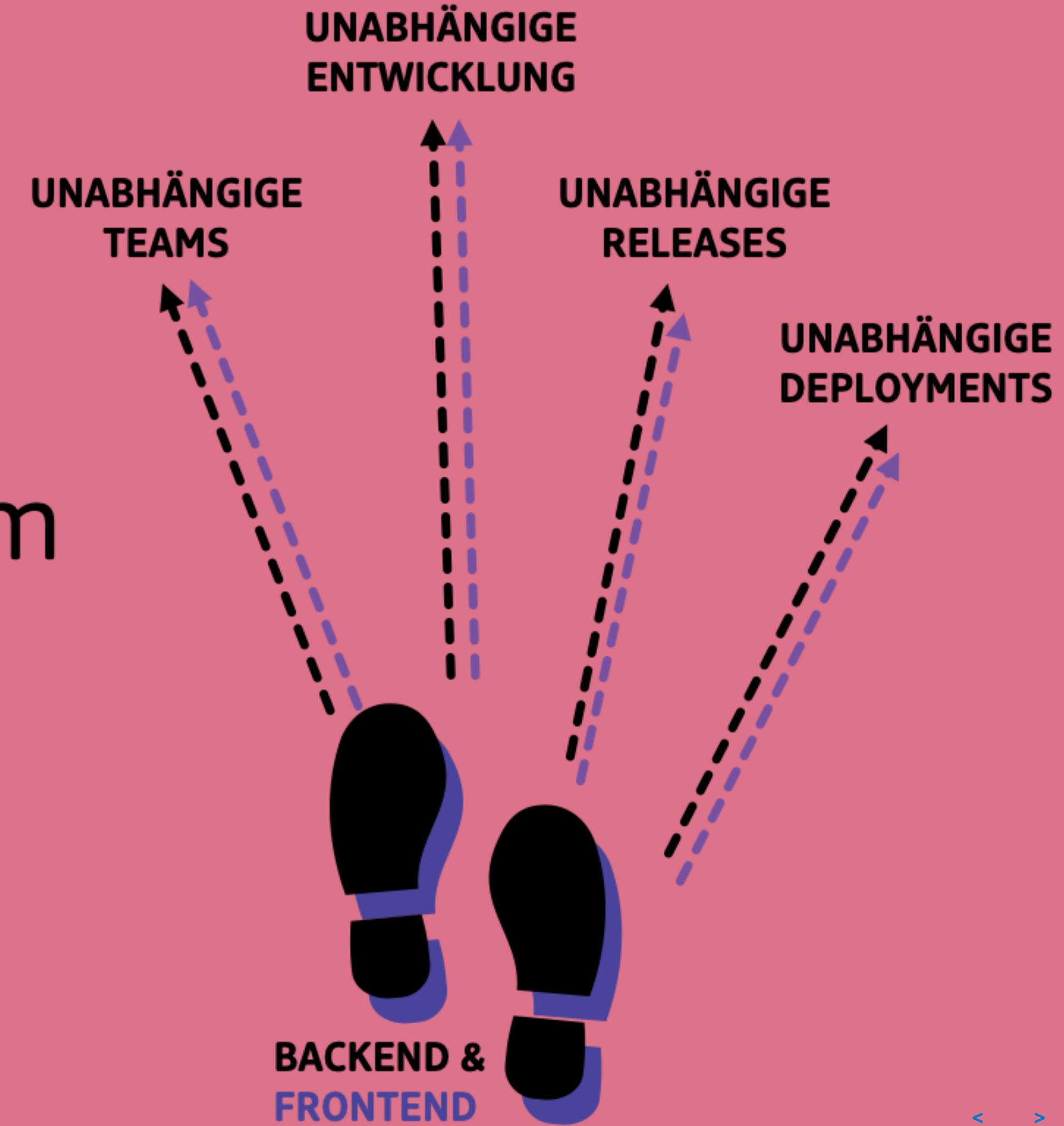


Dependency Inversion

Unabhängiges Deployment

Runtime Composition

Unabhängigkeit im Back- & Frontend





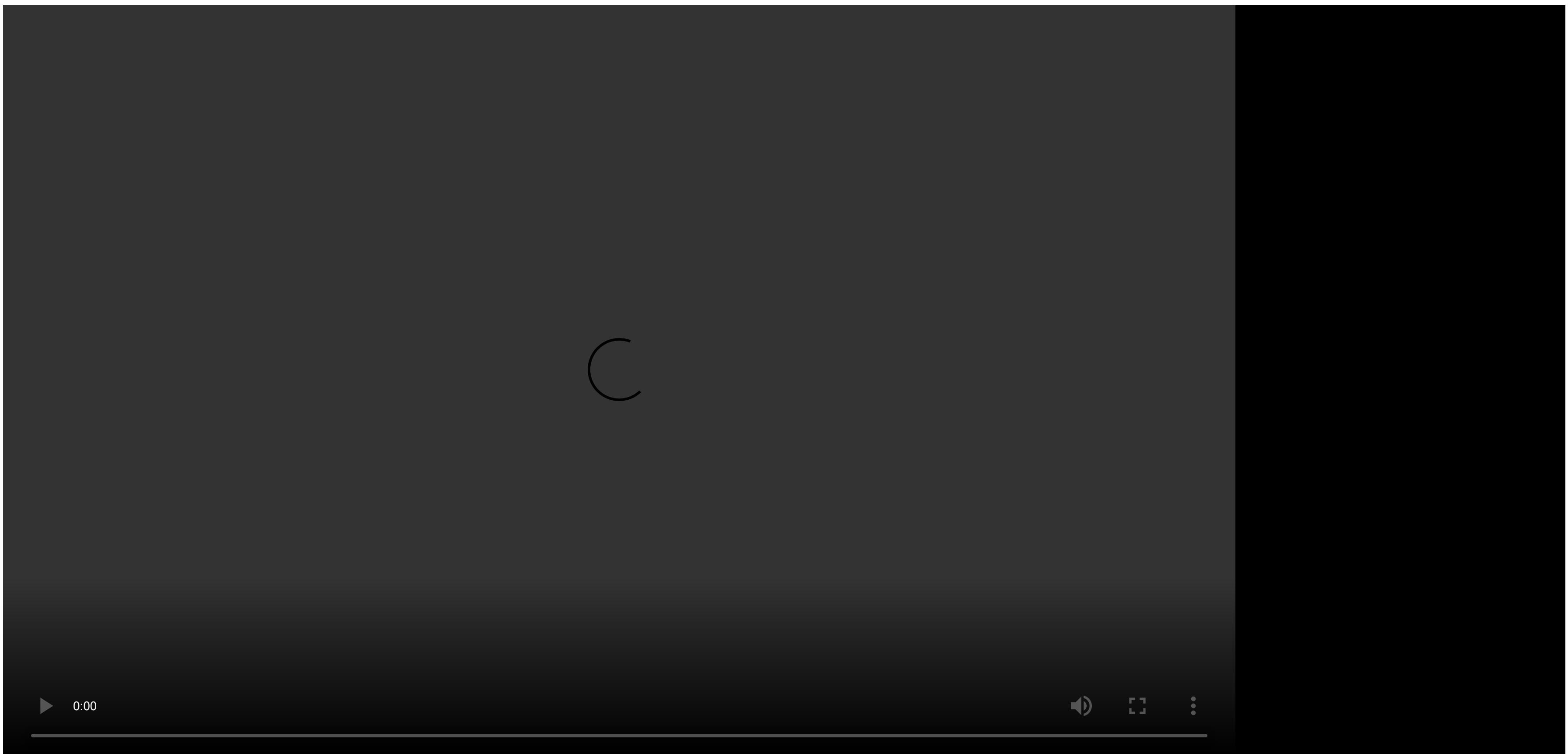
Lessons Learned

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!