



From a monolith to a microservice shop architecture

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Dein Online Supermarkt

About me

- Senior PHP Developer
- Linux, PHP, MySQL since 2001
- studied at TU München
- working for Bringmeister in Berlin



The Monolith

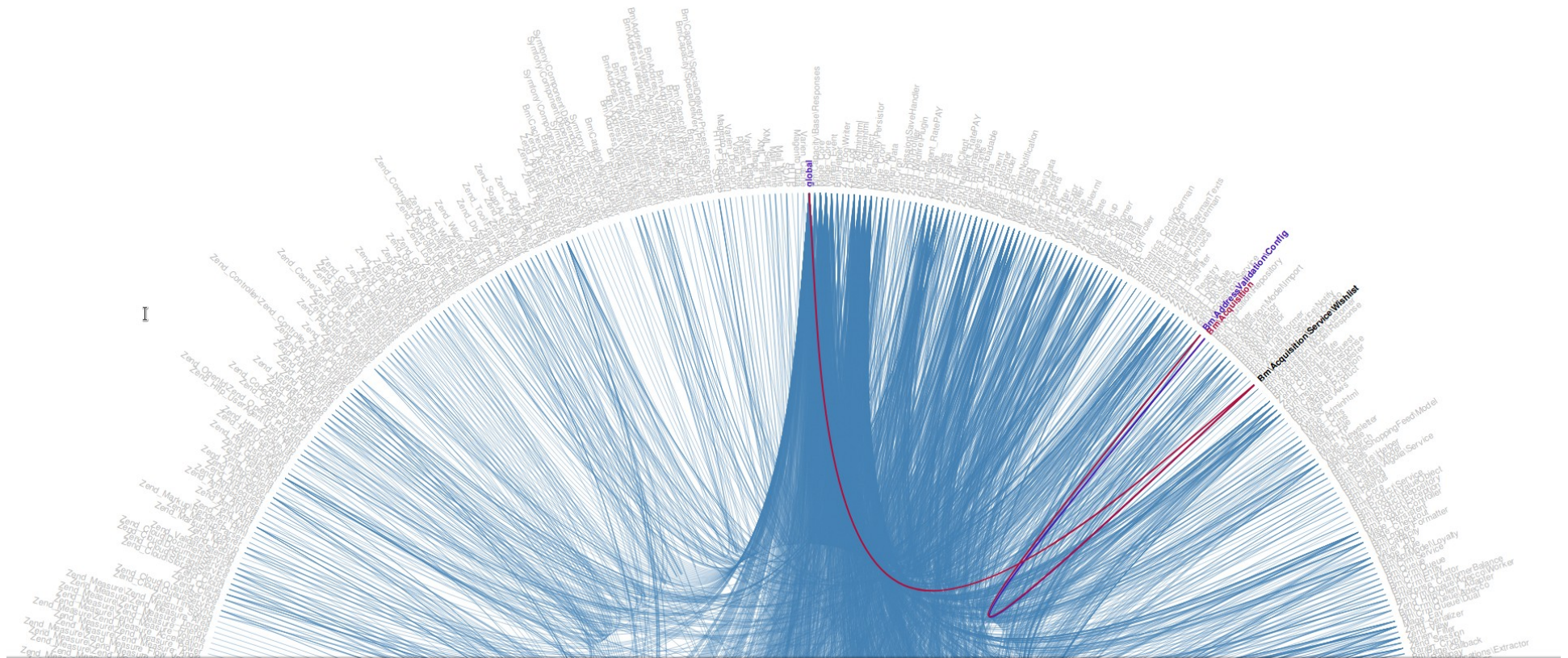
- Magento 1 Enterprise: support was discontinued by Adobe, license costs
 - Large codebase with **1.8 mloc**, developed over 10y years by 130 developers:
 - high complexity, strong coupling, multiple API layers
 - unused / unknown / bad code, hard to maintain, bugs
 - security issues, not designed for GDPR
 - many frameworks: Magento Varien, Zend Framework 1, Symfony 2, Laravel 5, ReactPHP, node.js
 - no Composer
 - Performance issues:
 - add product to cart 400 queries, **order placement 3.2k queries** (5 transactions)
 - slow queries, deadlocks, memory limit issues
 - Admin login >60s, single order search in Admin 15s
 - database designed by Entity-attribute-value model (big joins)
 - aggregation tables filled synchronously
- **difficult to scale the business**

The Monolith #2

- Tests:
 - coverage <10%, require 7 GB database dump
 - many tests broken, only run locally, CI only used for deployment
 - mostly manual testing
- Productivity:
 - slow development of new features
 - analyzing production issues very complex
 - updates only applied manually
- Multiple sources for product data, mostly not in sync:
 - Database
 - Solr, Algolia
- Small team: 5 developers

Developers not happy, Management not happy, Customers not happy with the shop

How does the monolith look like?

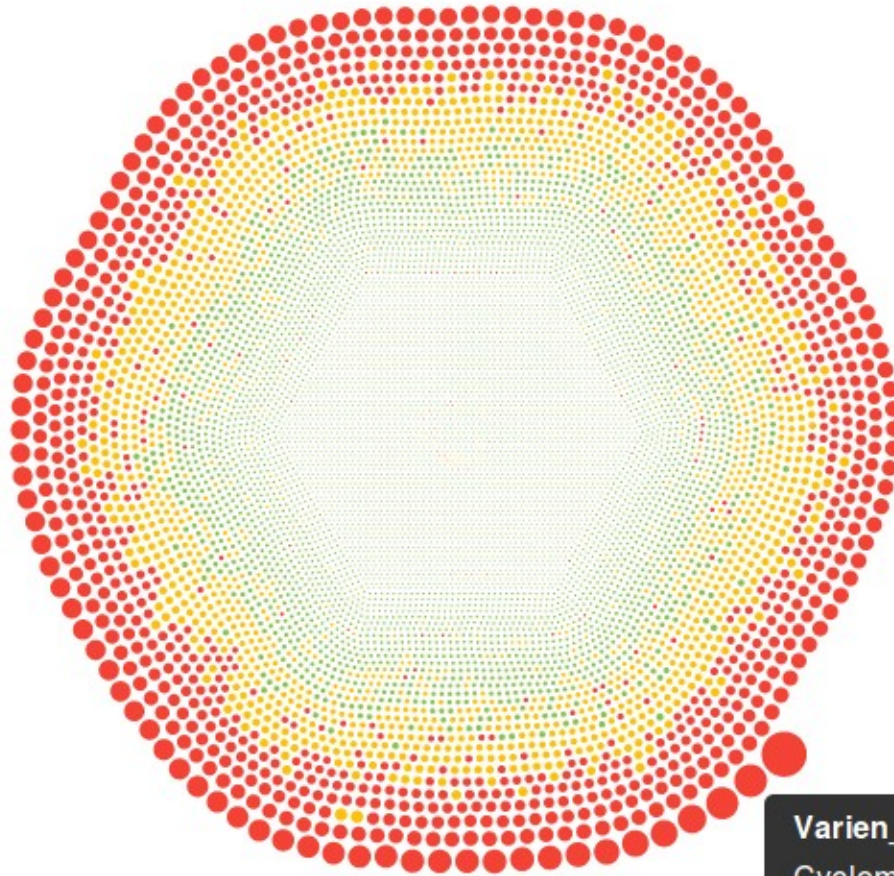


How complex is it?

Maintainability / complexity

Each file is symbolized by a circle. Size of the circle represents the Cyclomatic complexity. Color of the circle represents the Maintainability Index.

Large red circles will be probably hard to maintain.



Varien_Db_Adapter_Pdo_Mysql
Cyclomatic Complexity : 411
Maintainability Index: 41.01

CI/CD, Operations

Was wir **haben**



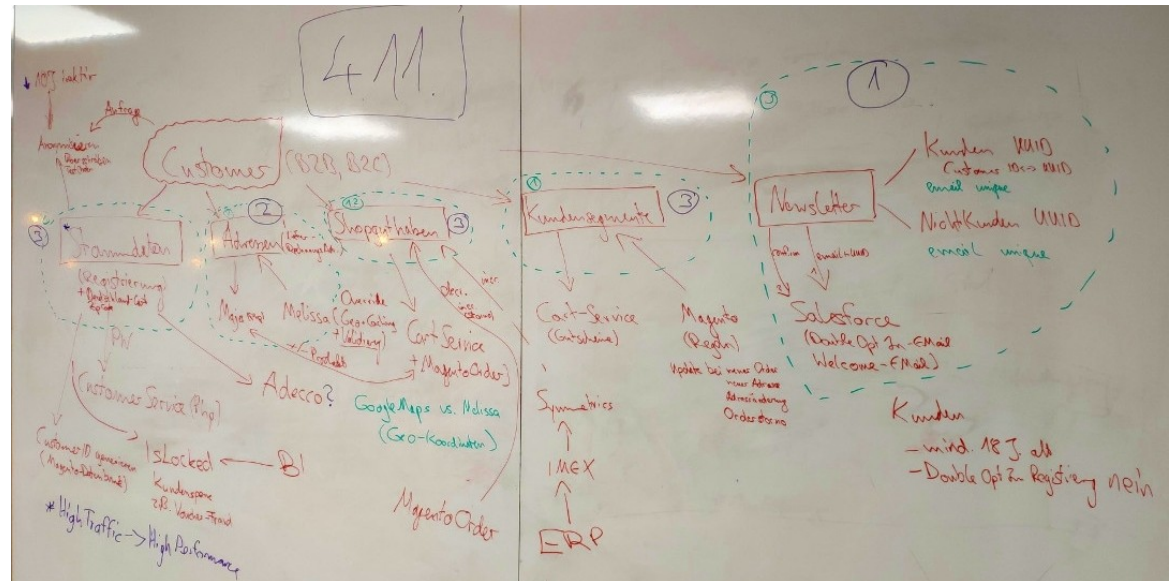
Was wir **brauchen**



Why microservices?

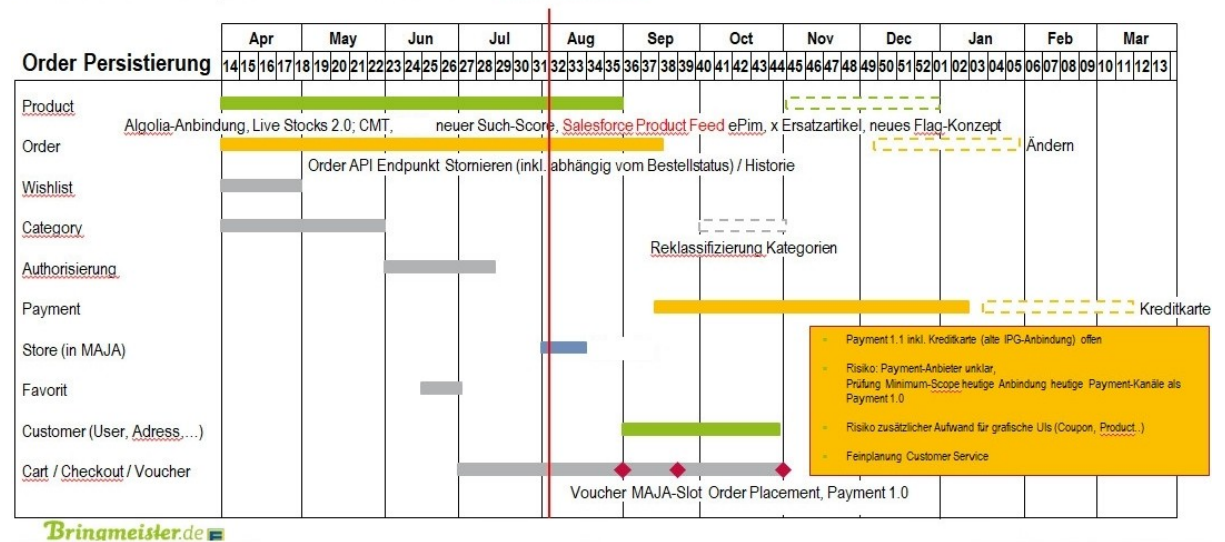
- Smaller code base to work on
 - easier to develop, easier to change, easier to maintain
 - less complexity, focus on problem solving
- More options for databases and programming languages
- Easier to split work on multiple teams
- Hard system boundary with standard communication between services
- Limit impact of bugs and failures
- Isolation of data
 - less complexity in data storage
 - more complexity to join data

Explaining the project to developers



Explaining the project to management

Meilensteinplan – Backend - BestCase



Define the future architecture

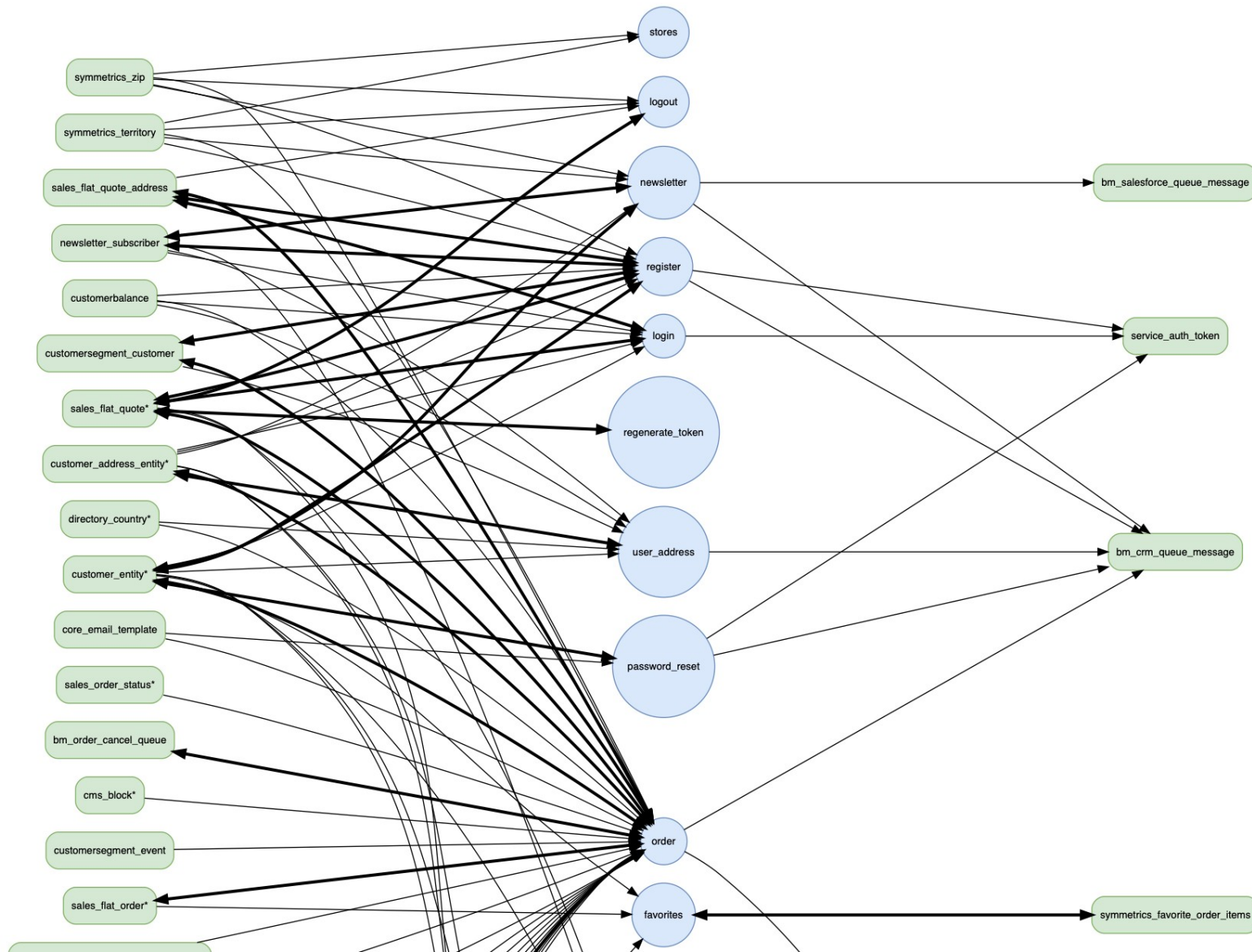
- We decided to stay with PHP and MySQL
most experience, all required libraries and SDKs available, easier to port from PHP to PHP
- Keep existing server infrastructure
- No fullstack framework
→ use our own mini-framework (200 loc)
- Write queries and schema definitions directly in SQL, no ORM, reduce joins by using JSON columns, no foreign keys
- Use JWT instead of sessions
- Single Monorepo for all services, each service with own code base, own database, own composer.json, etc.
- All product data in Algolia
- SOLID, Kiss



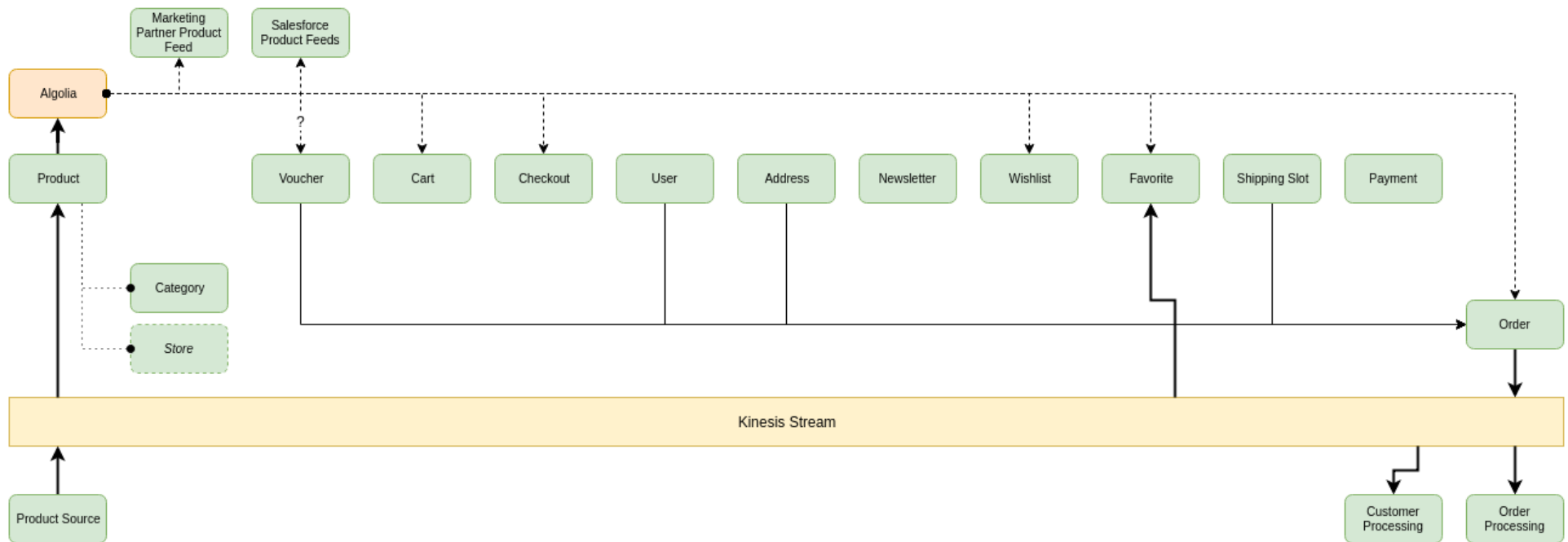
source: https://www.youtube.com/watch?v=fCt2_AsCWKI

- 100% test coverage, keep Behat tests
- Static code analysis with Psalm
- Enforce coding styles with PHP-CS-Fixer
- new CI/CD with Bitbucket Pipelines

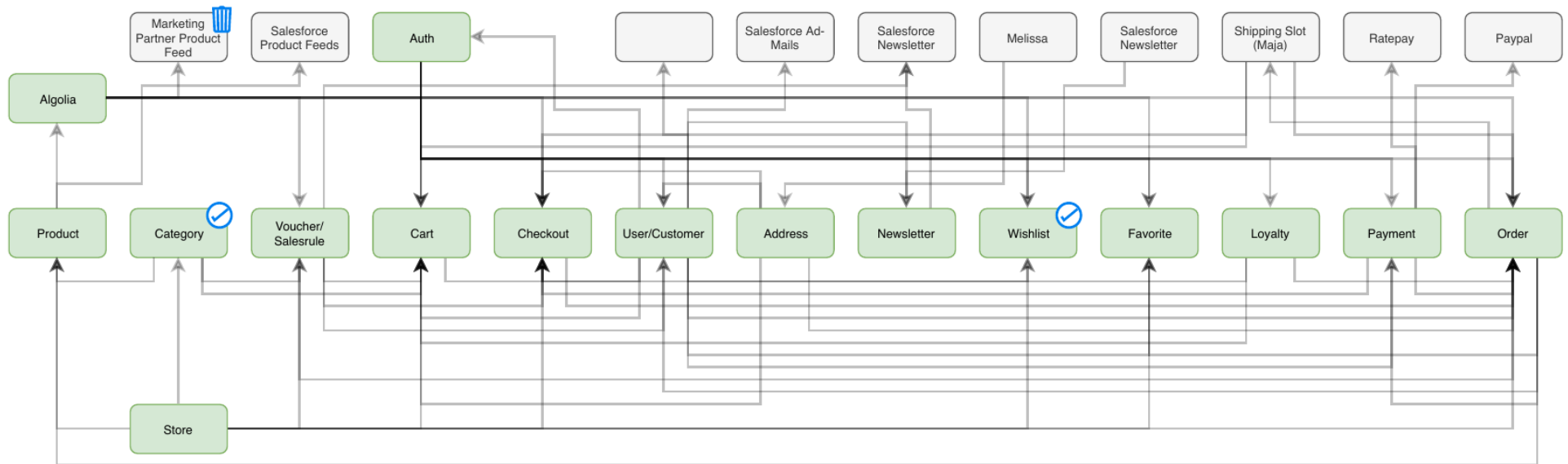
Analyze dependencies on database level



Identify services

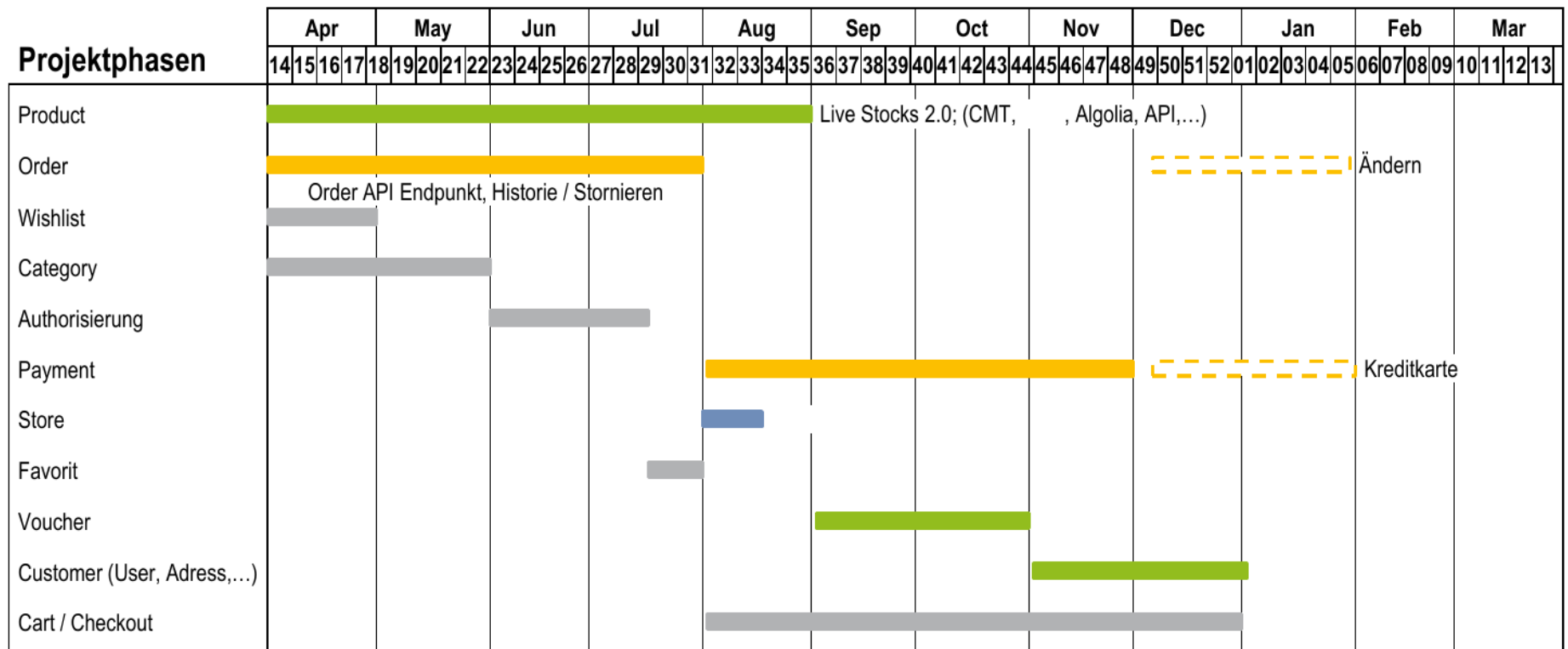


Start with easy services



Implement and launch one by one

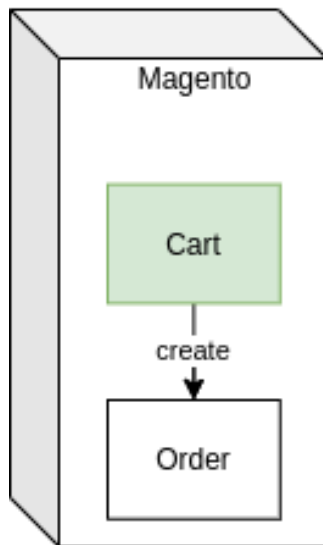
Meilensteinplan – Backend - BestCase



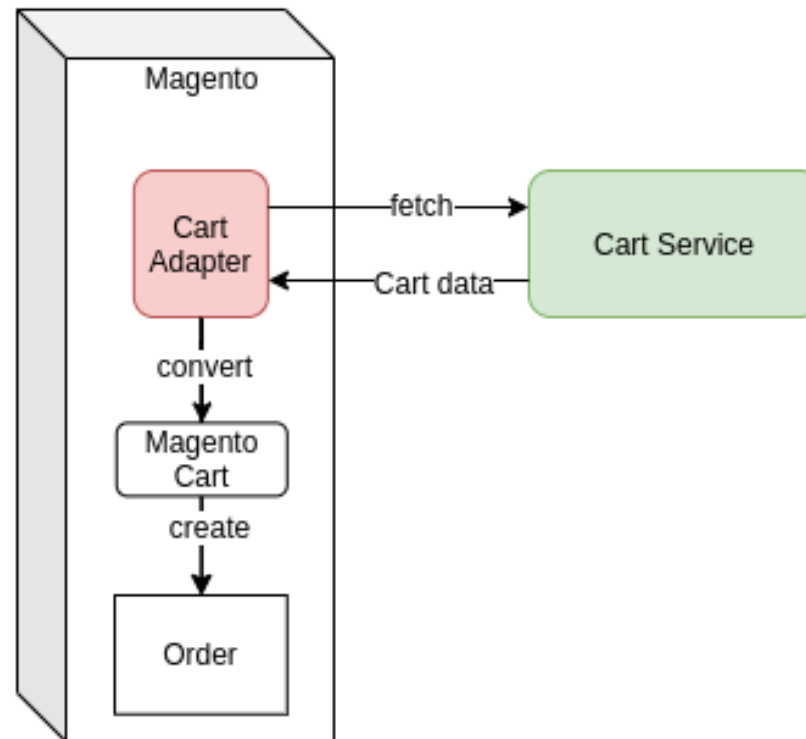
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Build adapters to cut out components with strong dependencies

Before:



After:



Communication between Microservices and external providers

- Synchronous using REST, load balancer (strong consistency)
 - Customer master data, addresses
 - Cart, Vouchers
 - Product data
 - Payment providers
- Synchronous using SOAP (strong consistency)
 - Legacy systems (tour planning)
- Asynchronous using Events (Kinesis)
 - Orders, Logging
- Asynchronous using REST and queues
 - external providers (CRM, Customer Support systems, etc.)
- Forward customer's JWT token between services

Data migration (EAV → JSON)

Using SQL to copy data from old schema to new schema:

```
INSERT INTO customers.customer (email, attributes, created)
SELECT * FROM magento.customer_entity
LEFT JOIN magento.customer_entity_varchar as firstname on
    firstname.entity_id = customer_entity.entity_id and firstname.attribute_id = 5
LEFT JOIN magento.customer_entity_varchar as lastname on
    lastname.entity_id = customer_entity.entity_id and lastname.attribute_id = 7
LEFT JOIN magento.customer_entity_datetime as birthdate on
    birthdate.entity_id = customer_entity.entity_id and birthdate.attribute_id = 11
SET email = customer_entity.email,
    attributes = json_object(
        'first', firstname.value,
        'last', lastname.value,
        'birth', date(birthdate.value),
        'orders', (select count(*) from magento.sales_flat_order
                    where customer_id = customer_entity.entity_id)
    ),
    created = customer_entity.created_at;
```


Data anonymization

Using a separate database and views to provide anonymized production data:

```
SELECT * FROM customers.customer WHERE id = 1234;
```

id: 1234

email: foo.bar@baz.com

attributes: {"first": "Thomas", "last": "Bley", "birth": "1930-02-01", "orders": 42}

created: 2021-05-06 12:41:11

```
CREATE or REPLACE VIEW customers_anonymized.customer AS
```

```
SELECT id,
```

```
    concat('invalid_', id, '@bringmeister.de') AS email,           # invalid_1234@bringmeister.de
```

```
    json_object(
```

```
        'first', concat('first_', id), 'last', concat('last_', id), # first_1234, last_1234
```

```
        'birth', '1980-01-02', 'orders', attributes->>"$.orders"    # 1980-01-02, 42
```

```
    ) AS attributes,
```

```
    created
```

```
FROM customers.customer;
```

Results

- Project finished **in time and in quality** (Mar - Nov 2019)
- 10 microservices, 3 admin interfaces
- 99.99% test coverage with unit and integration tests
- Code size reduced to **100 kloc** (coming from 1.8 mloc)
- Data size in database reduced by 80%
- System performance and revenue significantly increased
- Hardware costs reduced by 50%
- External security audit passed
- Tests, Build and Deployment in < 10 minutes
- Development of new features and maintenance much quicker and easier

Developers happy, Management happy, Customers happy with the shop

Implement microservices like a monolith?



source: twitter.com/ddprtt/status/1425418538257428488

Learnings

- Smaller is better
- Don't ignore or delay problems
- Requirements
- Documentation
- Rewriting is a lot of work, but it's worth to do it
- Management support is important
- Monitoring (esp. external service providers, we use Datadog)
- Testing, testing, testing (PHPUnit, Psalm, Trivy, manual, etc.)
- Performance, performance, performance (build a 10x system)

Thanks for listening!

Questions?

download slides:

github.com/thomasbley/talks

follow me:

twitter.com/thbley

