

anatomy of modern web applications

Christian Cito / 06.06.2024

chrcit.com

who am i?

- web dev since 2011
- Jürgen's first student
- went to a HTL
- started freelancing while in school
- currently Lead Full-Stack Dev @ RegionalMedien Austria
- love doing side projects

website & guide for a museum



A screenshot of an audio guide interface titled "HOUSE OF STRAUSS". The top right corner shows a language selection dropdown set to "En". The main visual is a golden statue of Johann Strauss II playing a violin, set against a blue background with musical notes and figures. Below the image, the text reads "Welcome to the House of Strauss audio guide". A yellow control bar at the bottom contains a play button, the text "Abspielen", the duration "00:34", and a volume slider. Further down, the text "This tour lasts approximately 1 hour + musical samples" is displayed, followed by a note: "It works best if you use your smartphone's standard". At the bottom, there are two buttons: "QR-Scan" with a QR code icon and "Inhalte" with a list icon.

content aggregator for a streamer

Hasan Hub

Made by @chrcit | Buy me a coffee

< 3min 3-15min

15-30min > 30 min

React Andrew Tate

Ben Shapiro TikTok

Trump Elon Musk

Hogwatch Joe Rogan

Steven Crowder

Kanye West Twitch

Jubilee Police

Ludwig Ahgren

AustinShow

Tucker Carlson

Valkyrae

Jordan Peterson

Adin Ross JCS

Latest videos

25 of 15031 Videos shown

Date Popularity Asc Desc

Thumbnail	Published Date	Views	Category
	6/13/2023	10K	Hasanabi Productions
	6/13/2023	28K	Hasanabi Moments
	6/13/2023	777	Hasanabi's Witness
	6/13/2023	6.6K	AustinShow
	6/13/2023	19K	
	6/13/2023	123K	

apps for techno events

The image displays four screenshots of the Hausgemacht Vibe Checker app interface, arranged in a grid. The first screenshot shows a stylized illustration of a person with glowing green energy points on their body, with the text "HÄUSGEMACHT" and a "Go to Vibe Checker" button. The subsequent three screenshots show the app's main interface:

- Screenshot 1:** Shows the app's logo "HÄUSGEMACHT" and "VIBE CHECKER". It includes a toggle switch for "Battery Saver Off" and a message "Click on your name to start †vibe-checking†". A list of names with arrows: Christian, Fredi, Linda, Lisa, Markus.
- Screenshot 2:** Shows the same interface but with "Christian" highlighted. It includes a "Back to Scanner" button, a red "List:" box containing "Phase 1 Ticket", and details for "Christian": Name: Christian Cito, Pronouns: he/him - er/ihm.
- Screenshot 3:** Shows a "Checklist" section with five items: "Name on ID matches name on ticket?", "Photo on ID matches person?", "Person is over 18? (min. 06/01/2006)", and "Outfit matches dresscode?". It also includes a "Suggested Question" box with "question regarding the rules of the event", a "Check-in" button, and a "Reject Person" button.

apps for techno events

The screenshot shows the Hausgemacht app interface. At the top left is the logo "HAUSGEMACHT". At the top right are language buttons "DE" and "EN". Below the logo is a progress bar showing "1/5". The main title "FrüherKommen ZusammenKommen 14" is displayed, followed by "Die Daylight-Edition II". Below the title is a large image of the event poster, which features a blue and pink tropical-themed design with palm trees and the text "FRÜHER KOMMEN ZUSAMMENKOMMEN 14 Daylight Edition 29.06. POSITIVE PARTY BY". At the bottom is a green "Weiter" button.

The screenshot shows the Hausgemacht app interface. At the top left is the logo "HAUSGEMACHT". At the top right is a yellow notification icon with the number "7". Below the logo is a green "Stats" button. The main heading "Hi Christian!" is displayed, followed by the text "DU MUSST NOCH 38 TEXTE BEWERTET". Below this is a table with four rows, each representing a review to be rated. The columns are "Text Punkte", "Event", and "Beworben am". The data is as follows:

Text Punkte	Event	Beworben am
Bewerten	ZusammenKommen 14	22.5.2024
Bewerten	ZusammenKommen 14	22.5.2024
Bewerten	ZusammenKommen 14	22.5.2024

At the bottom right are "Page 1" and "Next" buttons.

voting information for internal SPÖ election

SPÖ Vorsitzbefragungs-Kabine

powered by  JUNGE GENERATION
IN DER SPÖ WIEN

Finde heraus welche*r Kandidat*in für die SPÖ
Vorsitzbefragung 2023 am Besten zu dir passt.

Die Vorsitzbefragungs-Kabine ist eine Initiative der Jungen Generation Wien.

→ Kabine starten



questionnaire:

SPÖ Vorsitzbefragungs-Kabine

Arbeit & Soziales

Frage 5:
Soll ein bundesweites Immobilien-Spekulationsverbot gesetzlich verankert werden?

[Überspringen](#)

Ich stimme:

Das ist mir:

result:



comparison:

SPÖ Vorsitzbefragungs-Kabine powered by JUNGE GENERATION IN DER SPÖ WIEN

Arbeit & Soziales

Frage 1:
Soll die 30 Stundenwoche gesetzlich festgelegt werden?

Hans-Peter Doskozil

▼ Zusätzliche Information

Ich stehe für die Einführung des Mindestlohnes von 2.000 € netto. Die ArbeitnehmerInnen sollen zuallererst angemessen für ihre Leistungen entlohnt werden. Wenn dieser Schritt geschafft ist, kann man die Verkürzung der Arbeitszeit diskutieren.

Pamela Rendi-Wagner

► Zusätzliche Information

Andreas Babler

► Zusätzliche Information

Frage 2:
Soll ein Mindestlohn gesetzlich festgelegt werden?

Arbeit & Soziales

andererzeits

Wahl-Checker EU 2024

DIE ZUKUNFT DER EU

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Frage 15:

Sollen die Westbalkan-Länder der EU beitreten?

Ich stimme:

Ja 

Ich weiß es nicht 

Nein 

Das ist mir:

sehr wichtig

wichtig

nicht so wichtig

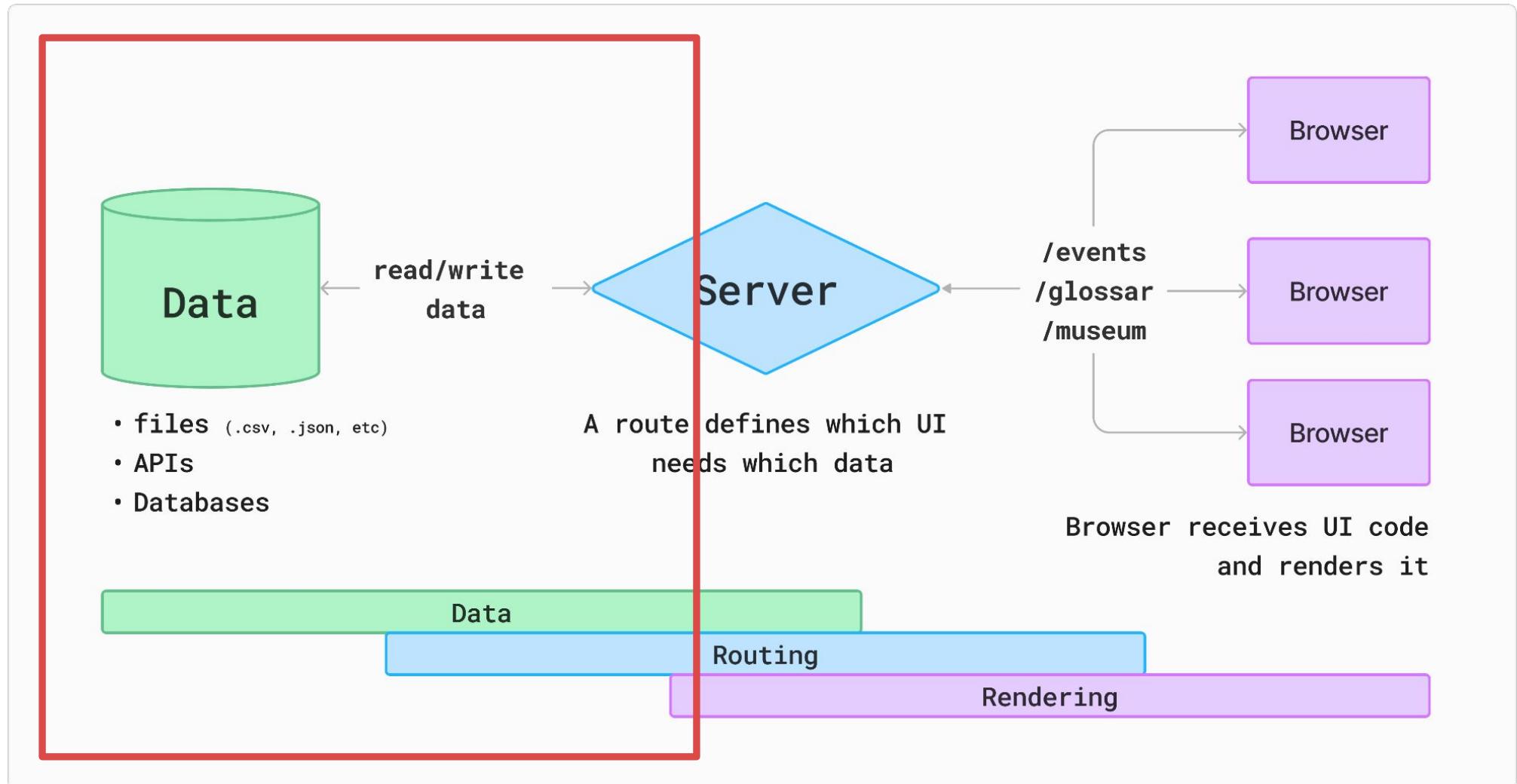
egal

 Zurück

15 / 15

Fertig 

anatomy of a web application



relational databases 101

Relational databases:

- developed in the 70s
- data is stored in **tables** which have **columns** and **rows**
- tables are connected/related via **foreign keys**
- data can be queried via SQL (Structured Query Language)

Popular relational databases:

- SQLite
- PostgreSQL
- MySQL

example database table

id	hash	age	gender	hasAcceptedTos	state	isPartyMember	createdAt
158	692a5afd	32	w	1	Wien	1	2023-04-21 10:01:32.836
157	fb6352a0	56	w	1	Wien	1	2023-04-21 10:01:32.836
156	1ee8f11d	25	w	1	Burgenland	1	2023-04-21 10:01:32.836
155	36b15678	28	w	1	Wien	1	2023-04-21 10:01:32.836
154	92c2642f	36	m	1	Niederösterreich	1	2023-04-21 10:01:32.836
153	e9482857	23	w	1	Niederösterreich	1	2023-04-21 10:01:32.836
152	23ffa5fd	33	m	1	Wien	1	2023-04-21 10:01:32.836
151	604d10da	20	w	1	Niederösterreich	1	2023-04-21 10:01:32.836
150	fa9ee18b	20	w	1	Niederösterreich	1	2023-04-21 10:01:32.836
149	e4393ce7	28	m	1	Wien	1	2023-04-21 10:01:32.836
148	d879ca9f	57	m	1	Niederösterreich	1	2023-04-21 10:01:32.836
147	aaf77a73	27	m	1	Wien	1	2023-04-21 10:01:32.836
146	29f418d7	21	m	1	Burgenland	1	2023-04-21 10:01:32.836
145	578c7e14	32	m	1	Wien	1	2023-04-21 10:01:32.836

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Ludwig Ahgren

AustinShow

Tucker Carlson

Valkyrae

Jordan Peterson

Adin Ross JCS

Latest videos

25 of 15031 Videos shown

Date Popularity Asc Desc

14:14 6/13/2023 10K views Hasanabi Productions Conservatives CRYING over Trump Prison Sentence Hasanabi reacts React Trump	12:54 6/13/2023 28K views Hasanabi Moments Conservative Women's Conference is AWFUL Hasanabi Reacts React	30:14 6/13/2023 777 views Hasanabi's Witness Austin Shows Up 2 The HasanAbi Broadcast AustinShow
43:50 6/13/2023 6.6K views IS REDDIT OVER? 6/13/2023	16:40 6/13/2023 19K views 6/13/2023	16:06 6/13/2023 123K views "You Didn't Use To Care About This!" 6/13/2023

database model – hasanhub.com



apps for techno events

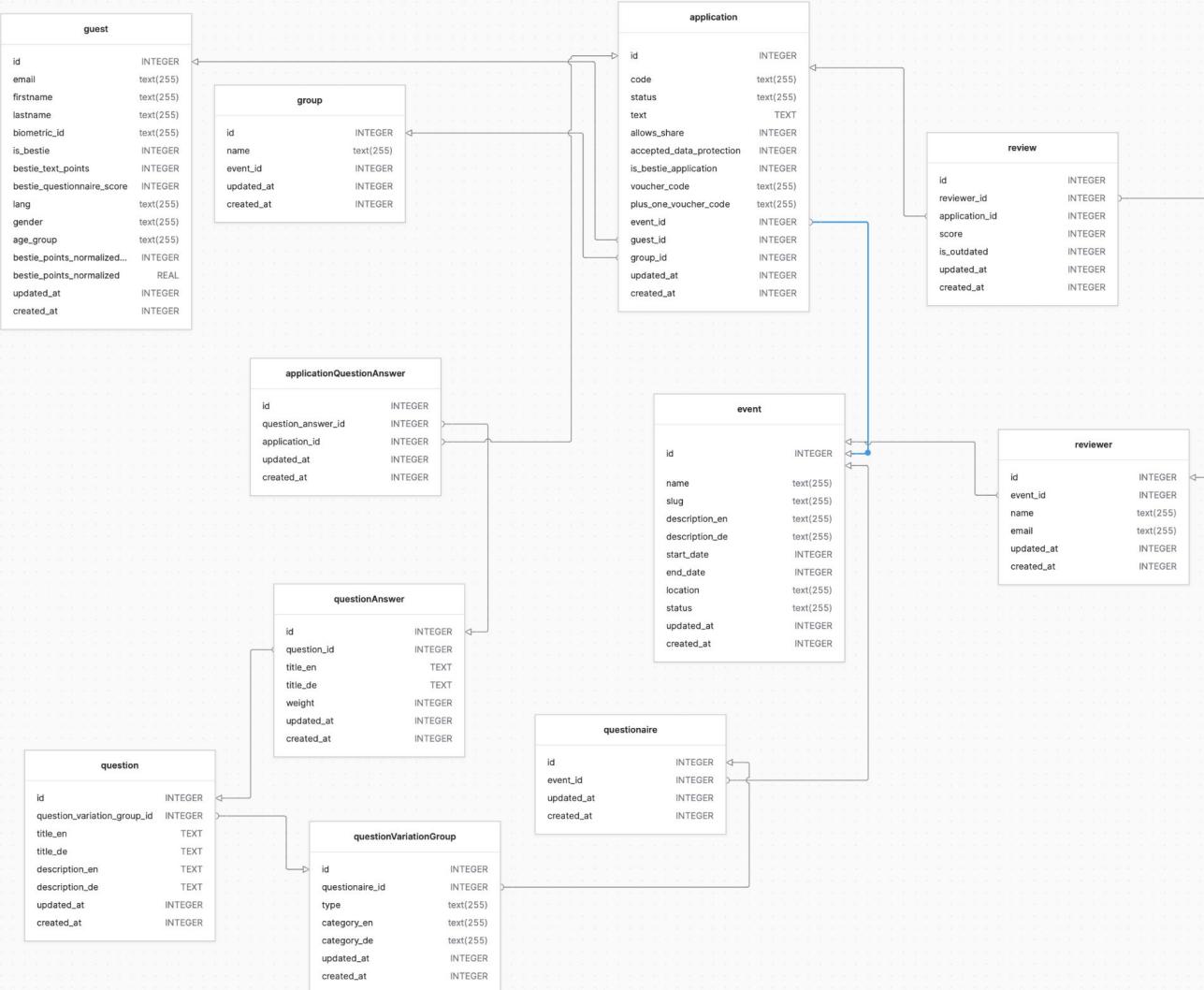
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The screenshot shows the Hausgemacht app interface. At the top left is the logo "HAUSGEMACHT". At the top right is a yellow notification icon with a small number. Below the logo is a green "Stats" button. The main heading "Hi Christian!" is displayed, followed by the text "DU MUSST NOCH 38 TEXTE BEWERTET". Below this is a table with four rows, each representing a review to be rated. The columns are "Text Punkte", "Bewerten", "Event", and "Beworben am". The data for each row is as follows:

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2.	Bewerten	ZusammenKommen 14	22.5.2024
3.	Bewerten	ZusammenKommen 14	22.5.2024
4.	Bewerten	ZusammenKommen 14	22.5.2024

At the bottom right of the table is a "Next" button.

database model – zk.hausgemacht.org



andererzeits

Wahl-Checker EU 2024

DIE ZUKUNFT DER EU

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Frage 15:

Sollen die Westbalkan-Länder der EU beitreten?

Ich stimme:

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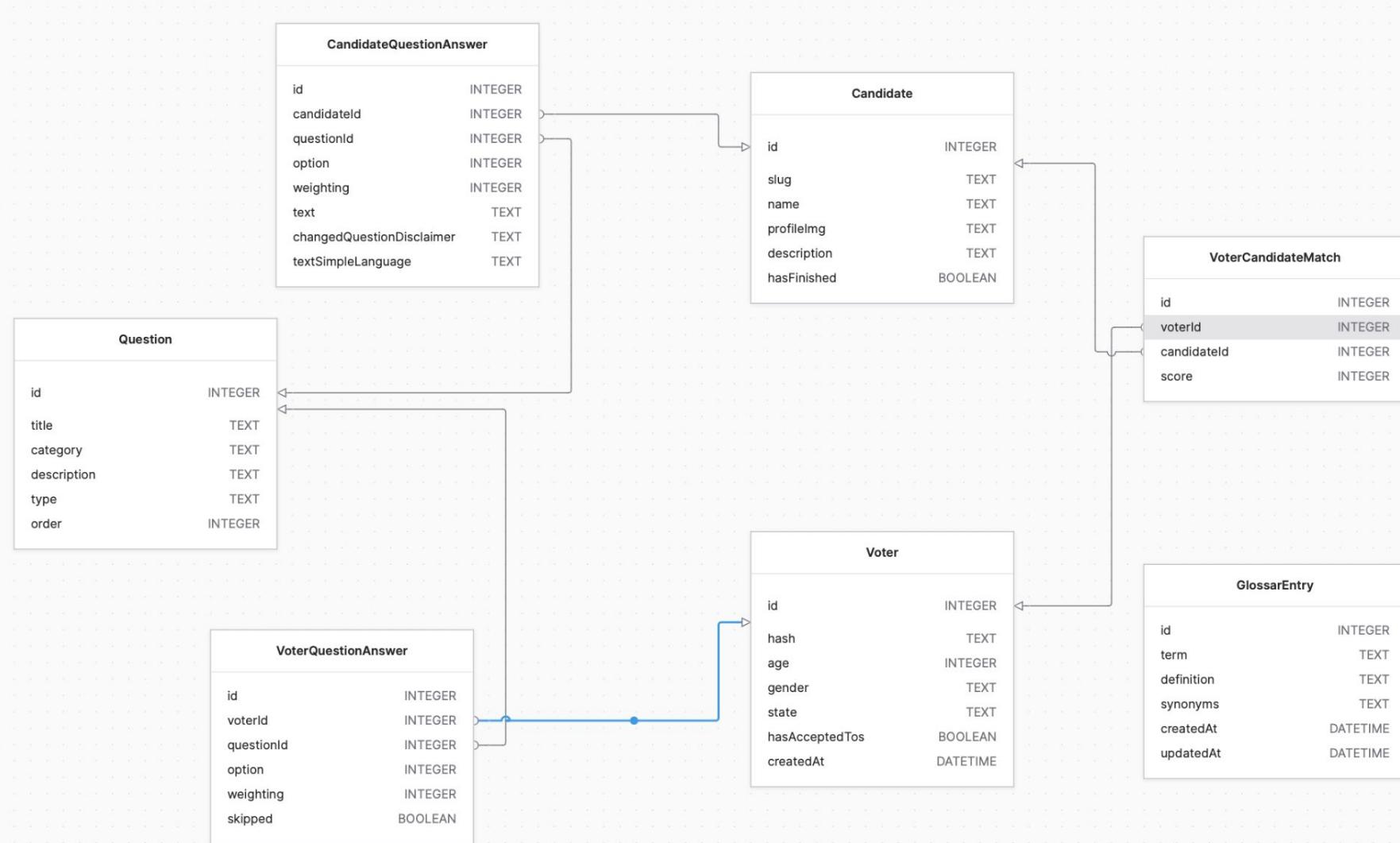
egal

 Zurück

15 / 15

Fertig 

database model – wahlchecker.at



querying data via SQL

SQL query:

```
SELECT
    c.name,
    q.title,
    cqa.`option`,
    cqa.weighting
FROM
    Candidate c
    JOIN CandidateQuestionAnswer cqa ON c.id = cqa.candidateId
    JOIN Question q ON cqa.questionId = q.id
WHERE
    c.name = 'Andreas Babler'
```

querying data via SQL

data returned:

	name	title	option	weighting
1	Andreas Babler	Sollen EU-Bürger*innen ein Wahlrecht auf Bundesebene bekommen?	-3	1
2	Andreas Babler	Soll der Besitz der Doppelstaatsbürgerschaft in Österreich erlaubt werden?	3	1
3	Andreas Babler	Bist du für eine verpflichtende Volksabstimmung, wenn ein Volksbegehren von 10% all...	3	0
4	Andreas Babler	Bist du für eine Sanktionierung jener Bundesländer, die weniger Geflüchtete aufnehmen...	3	2
5	Andreas Babler	Findest du es legitim, dass sich Jugendliche für ihre Überzeugungen auf die Straße kle...	3	1
6	Andreas Babler	Tempo 100 km/h auf der Autobahn?	3	1
7	Andreas Babler	Sollten Kurzstreckenflüge eingeschränkt werden? (unter 1000 km, Bsp.: Wien - Hambu...	3	1
8	Andreas Babler	Die Klimakrise ist das größte Problem dieses Jahrhunderts.	2	3
9	Andreas Babler	Um das Klima zu schützen, müssen unpopuläre Entscheidungen getroffen werden.	-2	1
10	Andreas Babler	Um den Herausforderungen unserer Zeit (Klimakrise, Armut, Vermögenskonzentration,...	2	3
11	Andreas Babler	Solltest du Bundeskanzler*in werden, würde deine Regierung zu 50% aus Frauen beste...	3	3

what is an ORM

An **Object Relational Mapper** is a library pattern where you can:

- define a database schema
- handle database changes via migrations
- query, update, delete and insert data

Why use an ORM:

- Types can be inferred from the db schema
- Raw SQL can become very messy to work with

Every major language has at least 1 popular ORM library.

Drizzle ORM

Drizzle is a minimal JS/TS ORM which focuses on

- simplicity
- extensibility
- SQL like syntax

```
27
28  const reviewer = await db.query.reviewers.findFirst({
29    where: (reviewers, { eq }) => eq(reviewers.id, 2),
30    columns: {
31      id: true,
```

querying data with Drizzle

Drizzle query:

```
const event = await db.query.events.findFirst({
  where: (events, { eq }) => eq(events.slug, eventSlug),
  with: {
    questionnaires: {
      limit: 1,
      orderBy: desc(questionnaires.id),
      with: {
        questionVariationGroups: {
          orderBy: asc(questionVariationGroups.id),
          with: {
            questions: {
              orderBy: asc(questions.id),
              with: {
                questionAnswers: {
                  orderBy: asc(questionAnswers.id),
                  columns: {
                    questionId: true,
                    id: true,
                    titleDe: true,
                    titleEn: true,
                  },
                },
              },
            },
          },
        },
      },
    },
  },
});
```

generated SQL:

```
1 select "id", "name", "slug", "description_en", "description_de",
"start_date", "end_date", "location", "status", "updated_at",
"created_at", (select coalesce(json_group_array(json_array("id",
"event_id", "updated_at", "created_at", (select coalesce(json_group_array
(json_array("id", "questionnaire_id", "type", "category_en",
"category_de", "updated_at", "created_at", (select coalesce
(json_group_array(json_array("id", "question_variation_group_id",
"title_en", "title_de", "description_en", "description_de", "updated_at",
"created_at", (select coalesce(json_group_array(json_array("question_id",
"id", "title_de", "title_en")), json_array()) as "data" from (select *
from "questionAnswer"
"events_questionnaires_questionVariationGroups_questions_questionAnswers"
where
"events_questionnaires_questionVariationGroups_questions_questionAnswers".
"question_id" = "events_questionnaires_questionVariationGroups_questions".
"id" order by
"events_questionnaires_questionVariationGroups_questions_questionAnswers".
"id" asc)
"events_questionnaires_questionVariationGroups_questions_questionAnswers"))
), json_array() as "data" from (select * from "question"
"events_questionnaires_questionVariationGroups_questions" where
"events_questionnaires_questionVariationGroups_questions".
"question_variation_group_id" =
"events_questionnaires_questionVariationGroups"."id" order by
"events_questionnaires_questionVariationGroups_questions"."id" asc)
"events_questionnaires_questionVariationGroups_questions"))
), json_array() as "data" from (select * from "questionVariationGroup"
"events_questionnaires_questionVariationGroups" where
"events_questionnaires_questionVariationGroups"."questionnaire_id" =
"events_questionnaires"."id" order by
"events_questionnaires_questionVariationGroups"."id" asc)
"events_questionnaires_questionVariationGroups")
), json_array() as "data" from (select * from "questionnaire"
"events_questionnaires" where
"events_questionnaires"."event_id" = "events"."id" order by
"events_questionnaires"."id" desc limit 1) "events_questionnaires") as
"questionnaires" from "event" "events" where "events"."slug" = "zk14"
limit 1
```

querying data with Drizzle

**data
returned:**

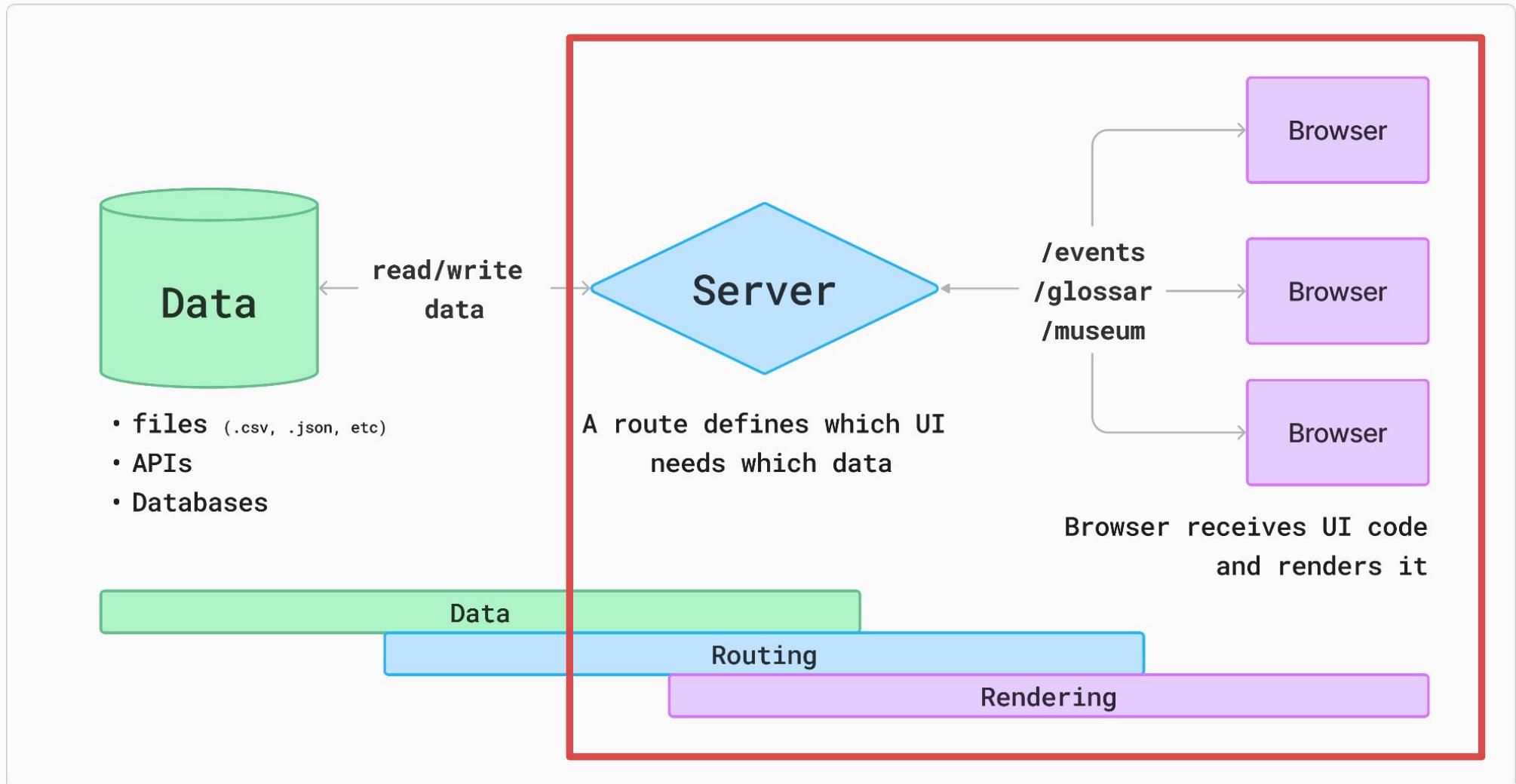
```
1  {
2    "event": {
3      "id": 3,
4      "name": "ZusammenKommen 14",
5      "slug": "zk14",
6      "descriptionEn": "The Daylight-Edition II",
7      "descriptionDe": "Die Daylight-Edition II",
8      "startDate": "2024-05-15T22:00:00.000Z",
9      "endDate": "2024-06-13T21:59:59.000Z",
10     "location": "Exil",
11     "status": "public",
12     "updatedAt": null,
13     "createdAt": null,
14     "questionnaires": [
15       {
16         "id": 1,
17         "eventId": 3,
18         "updatedAt": "2024-05-21T17:50:07.000Z",
19         "createdAt": "2024-05-21T17:50:07.000Z",
20         "questionVariationGroups": [
21           {
22             "id": 571,
23             "questionnaireId": 1,
24             "type": "",
25             "categoryEn": "General",
26             "categoryDe": "Allgemein",
27             "updatedAt": "2024-05-21T17:50:07.000Z",
28             "createdAt": "2024-05-21T17:50:07.000Z",
29             "questions": [
30               {
31                 "id": 997,
32                 "questionVariationGroupId": 571,
33                 "titleEn": "Which things about the status of LGBTQIA+ communities are true (as of 2024)?",
34                 "titleDe": "Welche Dinge zum Status von LGBTQIA+ Communitys treffen (Stand 2024) zu?",
```

querying data with Drizzle

**data
returned:**

```
2   "event": {  
14     "questionnaires": [  
15       {  
20         "questionVariationGroups": [  
21           {  
22             "createdAt": "2024-05-21T17:50:07.000Z",  
29             "questions": [  
30               {  
31                 "id": 997,  
32                 "questionVariationGroupId": 571,  
33                 "titleEn": "Which things about the status of LGBTQIA+  
communities are true (as of 2024)?",  
34                 "titleDe": "Welche Dinge zum Status von LGBTQIA+  
Communitys treffen (Stand 2024) zu?",  
35                 "descriptionEn": "",  
36                 "descriptionDe": "",  
37                 "updatedAt": "2024-05-21T17:50:07.000Z",  
38                 "createdAt": "2024-05-21T17:50:07.000Z",  
39                 "questionAnswers": [  
40                   {  
41                     "questionId": 997,  
42                     "id": 3985,  
43                     "titleDe": "In über 60 Ländern ist konsensueller Sex  
zwischen gleichgeschlechtlichen Erwachsenen verboten  
"  
23               ]  
24             ]  
25           ]  
26         ]  
27       ]  
28     ]  
29   ]  
30 }
```

anatomy of a web application



routing and rendering

a route defines at which **URL** what **data** gets fetched and what **view_code** should render with the **data**.

rendering means executing the **view code** with the **data** to create an **user interface**.

rendering and routing can happen
on the server **and/or** the browser
depending on the strategy used

history of web rendering

- **static files**

- request HTML like files on a remote server

- **dynamic servers**

- backend code dynamically generates HTML based on route

- **client-side rendering**

- server returns static “empty” HTML + JS bundle
 - Client executes JS which handles routing, fetches data and renders HTML

history of web rendering

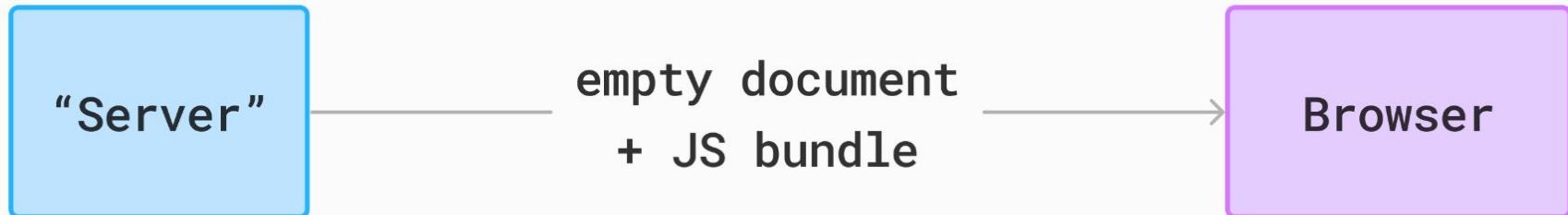
- **server-side rendering**

- server returns fully rendered HTML + JS bundle
- client shows rendered HTML
- client executes JS bundle to take over HTML

- **server-side rendering w/ partial hydration**

- server returns fully rendered HTML + JS bundle for specific components
- client shows rendered HTML
- client executes JS bundle to take over parts of the HTML

client-side rendering



serves static HTML/CSS/JS

downloads empty HTML w/ JS =>
shows empty page =>
executes JS bundle =>
JS matches route =>
JS fetches data =>
JS generates HTML =>
Browser renders UI

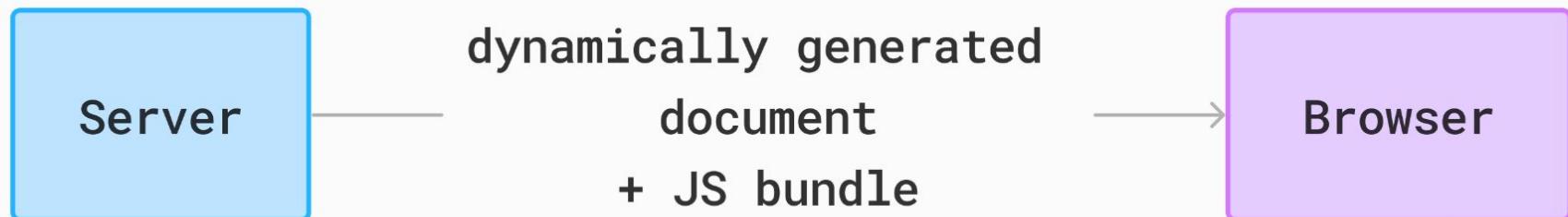
pros:

- offload all rendering to browser
- simple mental model

cons:

- can't access private data directly
- data fetching happens after all JS is executed
- not optimized for search engines

server-side rendering



=> find matching route
=> fetch data
=> execute JS bundle w/ data
=> send rendered HTML

download HTML w/ JS =>
show UI =>
execute JS bundle =>
JS matches route =>
JS takes over HTML which hydrates the page

pros:

- fast initial response with actual data
- optimized for search engines
- access private data directly

cons:

- more complex mental model
- needs actual servers for rendering

routing & rendering with Remix

HAUSGEMACHT

```
✓ app
  ✓ routes
    _index.tsx
    [robots.txt].tsx
    admin._index.tsx
    admin.dashboard.applications._index.tsx
    admin.dashboard.reviewers_.$reviewerId_.reviewed.tsx
    admin.dashboard.reviewers_.$reviewerId.tsx
    admin.dashboard.reviews_.$reviewId.tsx
    admin.dashboard.stats.tsx
    admin.dashboard.tsx
    admin.login.tsx
    admin.tsx
    TS api.assign-reviews.ts
    events.($lang_).$event.tsx
    events.($lang)_._index.tsx
    events.$lang_.$event_.$application.tsx
```

```
export const loader = async ({ params, request }: LoaderFunctionArgs) => { ... };

export const action = async ({ request, params }: ActionFunctionArgs) => { ... };

export default function ReviewApplicationPage() { ... }

export const headers = {
  "cache-control": cacheHeader({
    public: true,
    maxAge: "30s",
    sMaxage: "1min",
  }),
};
```

routing & rendering with Remix

a route is a file which exports certain functions/objects:

- loader (GET data)
- React component (render UI)
- action (POST/PUT/PATCH/DELETE)
- meta (meta tags)
- headers (HTTP headers)

route:

/events/de/zk14/ABCD-WXYZ

file:

/app/events.\$lang_.\$event_.\${application}.tsx

```
--  
19 export const loader = async ({ params }: LoaderFunctionArgs) => {  
20   const eventSlug = params.event;  
21   const lang = params.lang === "en" ? "en" : "de";  
22   const applicationCode = params.application;  
23  
24   try {  
25     invariant(eventSlug, "params.event is required");  
26     invariant(applicationCode, "params.application is required");  
27  
28   >   const application = await db.query.applications.findFirst({  
54     where: { code: applicationCode }  
55   });  
56  
57   if (!application) {  
58     throw applicationNotFound(lang);  
59   }  
60  
61   return json({ application }, { headers });  
62 } catch (e) {  
63   console.error(e);  
64   throw unknownError(lang);  
65 }  
66  
67 export default function ApplicationPage() {  
68   const { application } = useLoaderData<typeof loader>();  
69   const lang = useLang();  
70   const params = useParams();  
71   const { code, reset } = useApplicationProcessStore(s => {  
72     code: s.code,  
73     reset: s.reset,  
74   });  
75 }
```

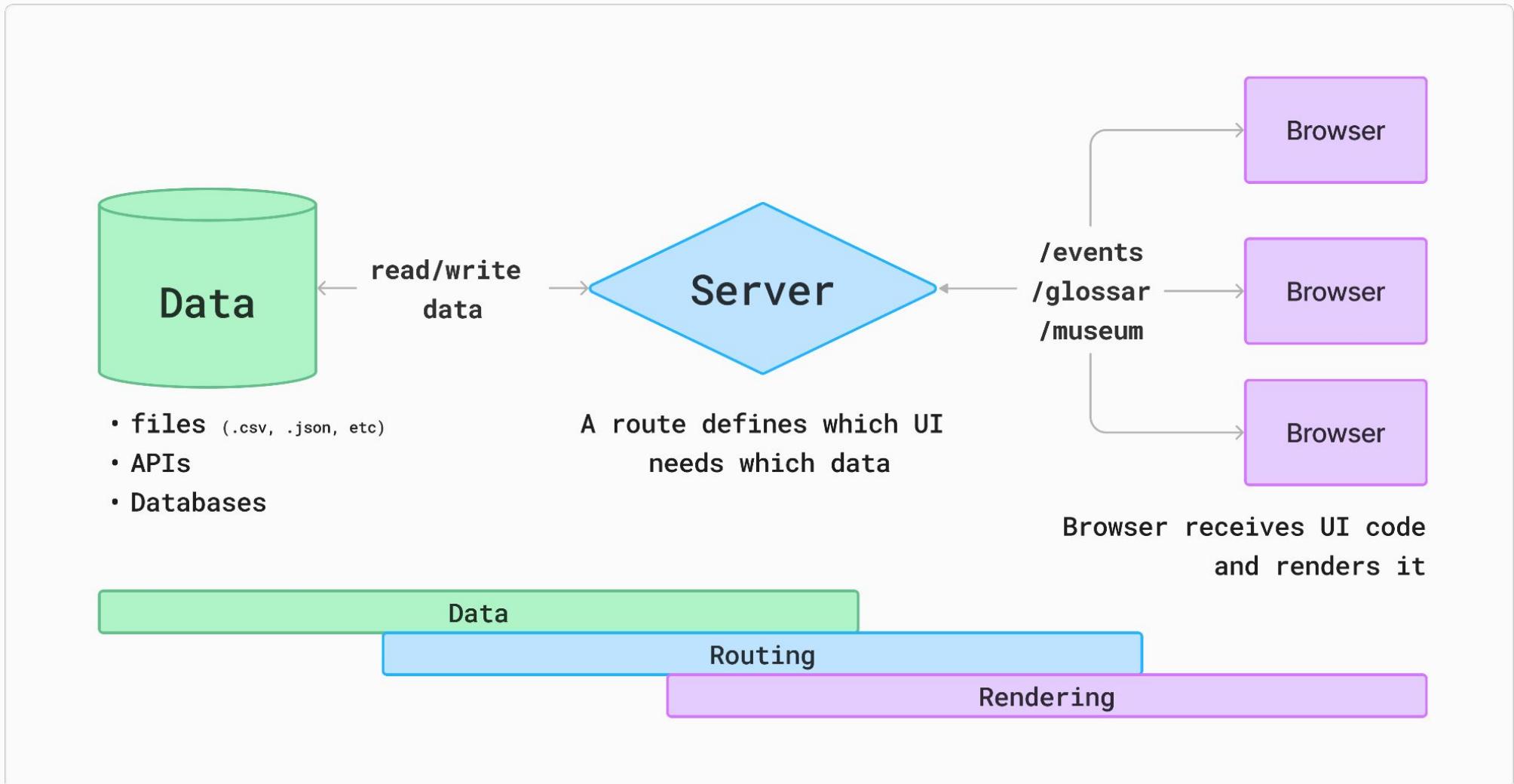
caching

ABC = always be caching

Caching can be multi-layered:

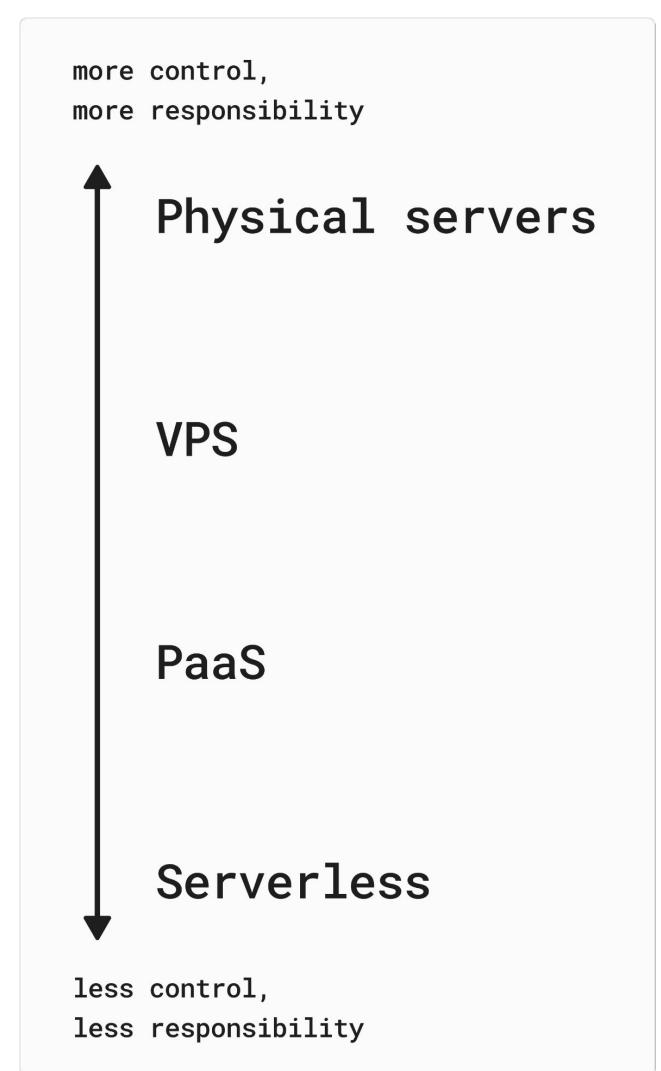
- Browser HTTP
- Server HTTP (nginx, CDN, etc)
- Server (in-memory, filesystem, Redis, etc)
- Database

deployment – from localhost to the internet



history of web deployment

- **on-site/physical servers**
 - manage everything (hardware, networking, OS, updates, etc)
- **virtual private servers (VPS)**
 - rent virtualized hardware in a datacenter
- **platform as a service (PaaS)**
 - hardware is abstracted away -> only think about code/data/server
- **serverless (functions)**
 - server is abstracted away -> only think about code/data



how do serverless functions work?

serverless functions spin up temporary compute environments for every request which execute your code

after the request is handled the function shuts down again

pro: use exactly the amount of compute needed

-> **scale-to-zero** and **scale-to-millions**

con: no long-running tasks, higher costs after hitting certain limits, cold-starts

types of serverless functions

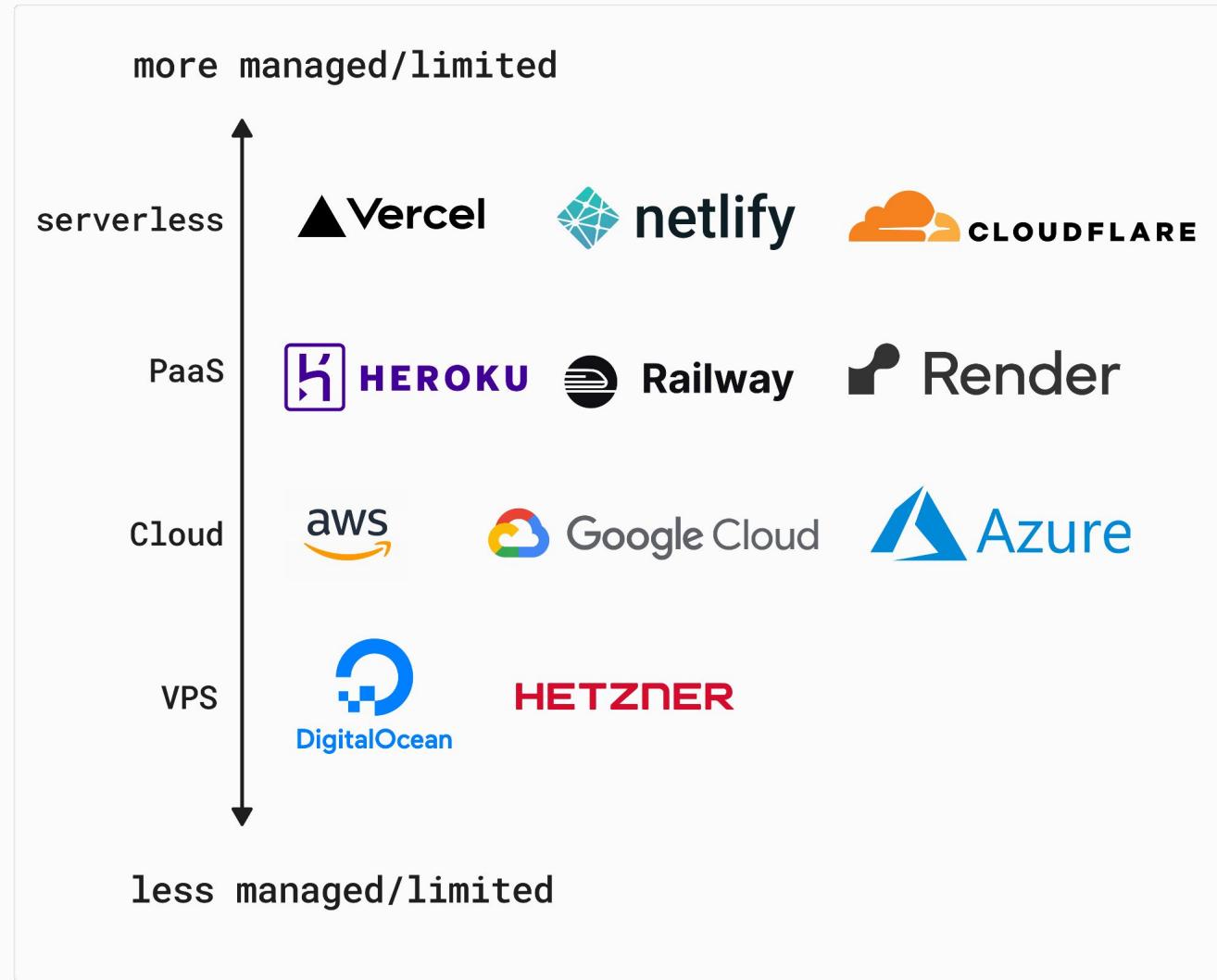
- **lambda function**

- boots full virtualized containers
- works with many languages like Javascript, Python, Ruby, Java
- takes ~100-500 ms to boot

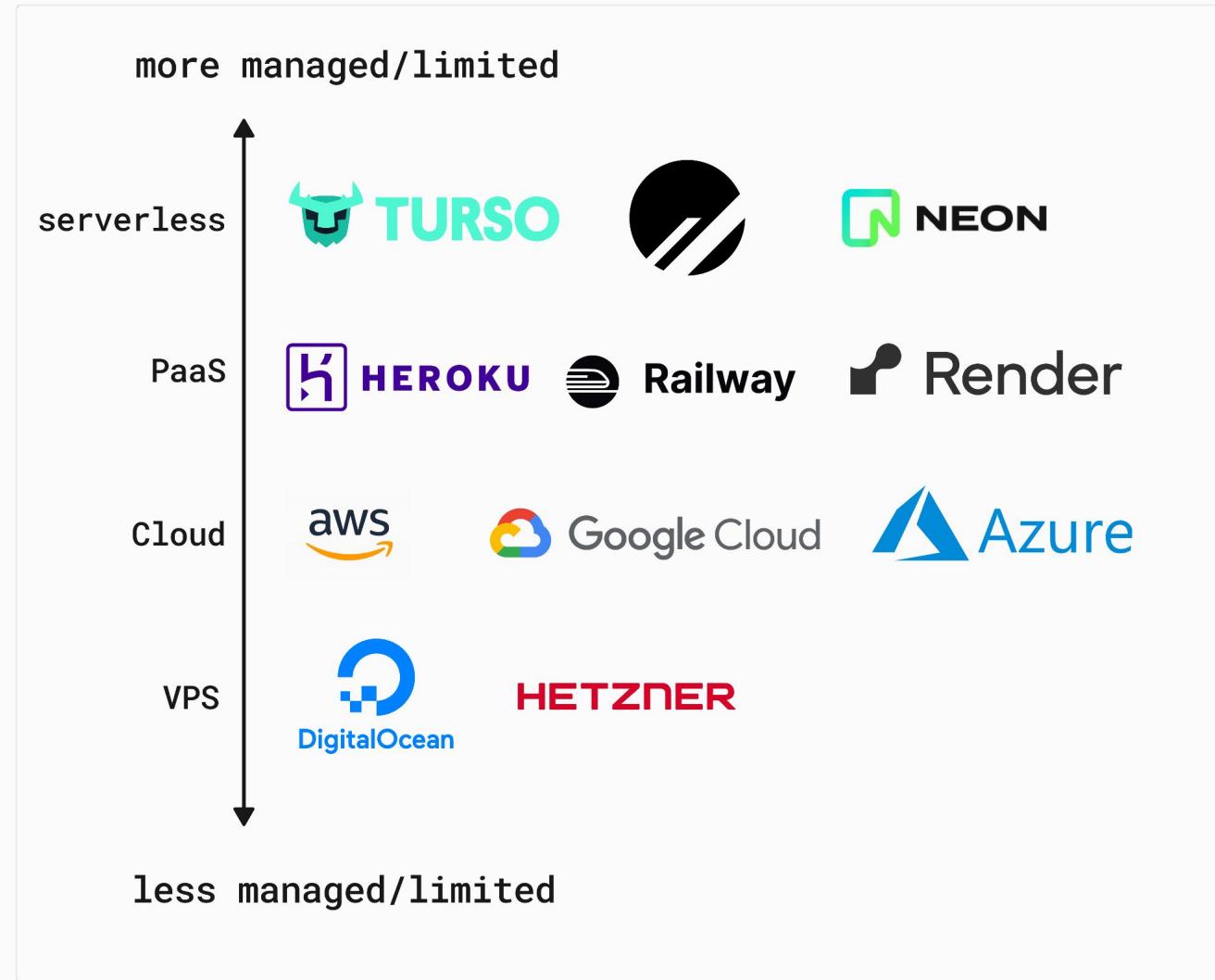
- **edge functions**

- boots a lightweight runtime similar to the browser
- works just with Javascript
- takes 50-100ms to boot
- distributed world-wide

deployment/hosting



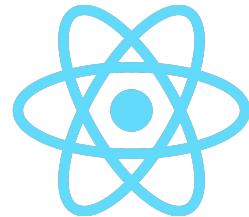
deployment/hosting



✨ stack(s) ✨

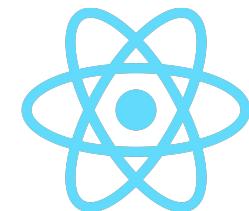
2023

NEXT.js



2024

Remix



so how much €€€?

mostly 0€

you can do this too!

tip #1:

build things – it's fun!

find problems in your daily life
you want to fix with software

great tools you can use for free

- **full-stack frameworks**

- Next.js, Remix for React
- Nuxt for Vue

- **serverless hosting**

- Vercel, Netlify, Cloudflare

- **databases**

- Planetscale, Supabase, Neon, Render, Railway, Sanity (headless CMS)

- **repository / project management**

- Github, Linear, Trello, Slack

web development resources

- **twitter:** 300+ developers you can follow
- **youtube/twitch**
 - Fireship
 - Theo - t3.gg
- **local meetups**
 - vienna.js
 - React Vienna
- **follow me on twitter:** @chrcit

thx!

twitter.com/chrcit

github.com/chrcit