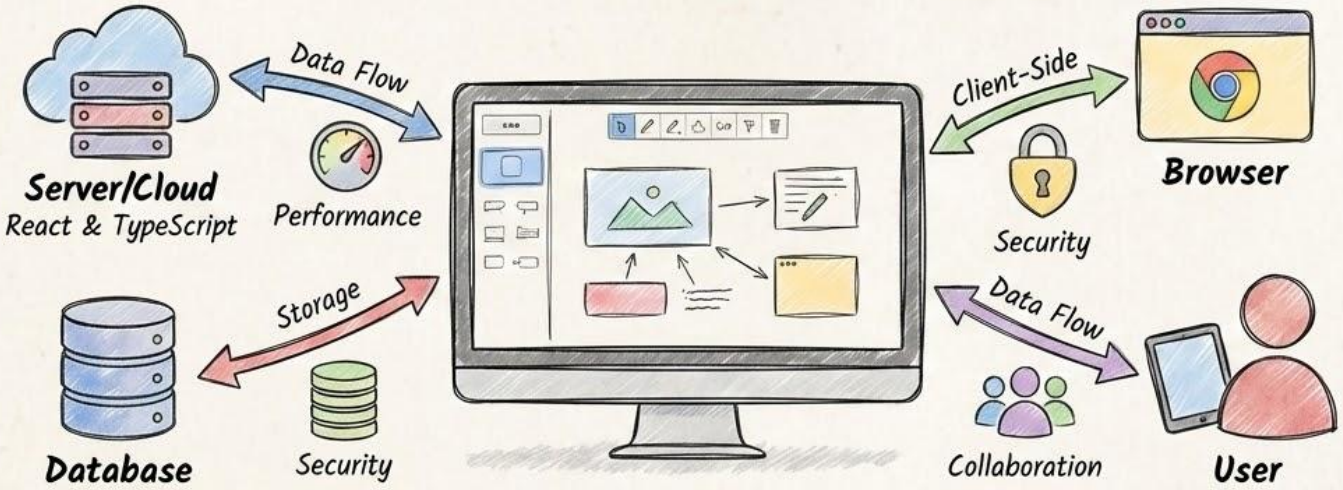
Excalidraw



Teknisk Arkitektur & Implementation

En djupdykning i modern webbutveckling

Vad är Excalidraw?

Webbaserad ritapplikation (whiteboard)

Skapar handritade diagram och skisser

Gratis och open-source

Ingen installation behövs

Möjlighet att samarbeta i realtid

+1000 automatiserade tester

Projektöversikt & Status

Hur gammalt är projektet

- Start: 1 jan 2020 (~6 år gammalt)
- Skapare: Christopher Chedeau (Meta)
- Ursprungligen för web.dev.

Aktivitetsnivå

- Mycket aktivt (Uppdat. 4 jan 2026)
- TypeScript, MIT-licens
- 110k+ Stjärnor, 11.5k Forking

Bidragsgivare

- Över 100 efter år 1
- Växande antal (Källa 2021: ~149)
- Högt deltagande

Kodens omfattning

- ~113 686 rader TypeScript (GitHub)
- Monorepo-struktur, flera npm-paket.

Stora företag/ organisationer som använder det

- Google Cloud, Meta, CodeSandbox, Obsidian, Replit, Slite, Notion, HackerRank, m.fl.

Kravspecifikation

- Ingen formell spec.
- Dev-dok. & Roadmap finns (GitHub)
- Rekommenderas för bidragsgivare.

Storlek på projektet

- Total files: 1708
- Total code lines: 741261
- Total comment lines: 8939
- Total blank lines: 31980

Sammanfattningsvis: Vältablerat, aktivt projekt med brett industristöd och växande community.

SLIDE 3: Tech Stack - Vad används?

React (19.0.10)
UI Framework

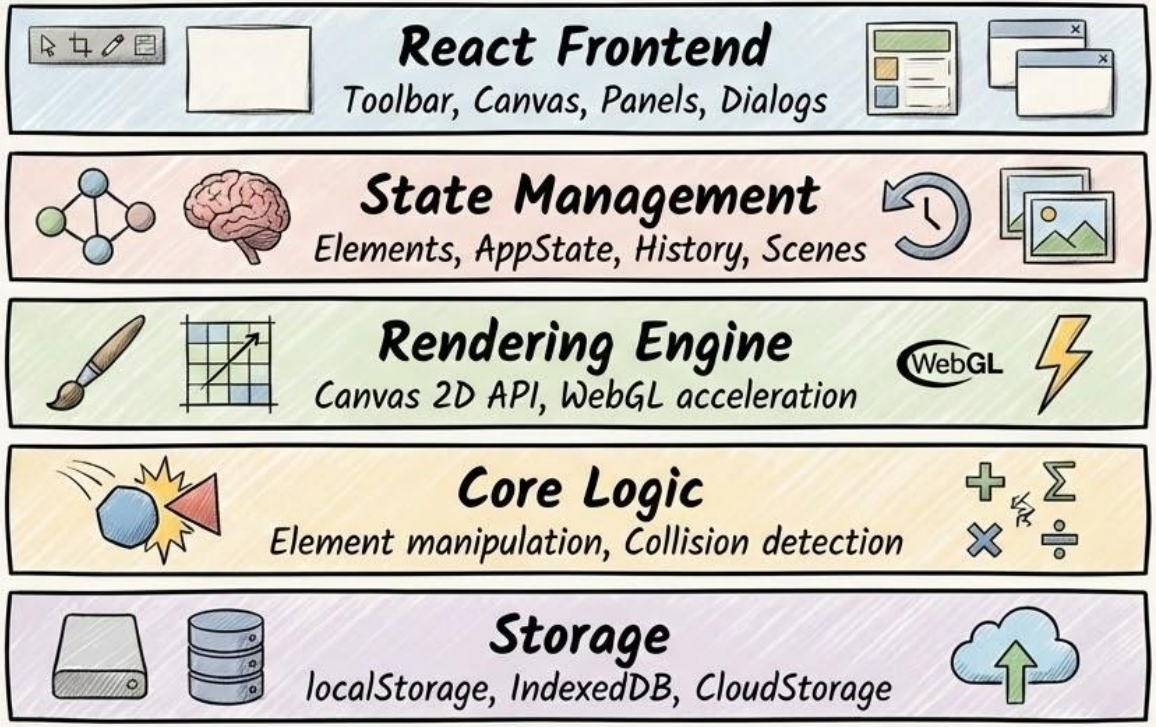
TypeScript (5.9.3)
Type Safety

Vite (5.0.12)
Build Tool

Canvas 2D
Rendering

Vitest (3.0.6)
Testing

SLIDE 4: Arkitektur - Lager

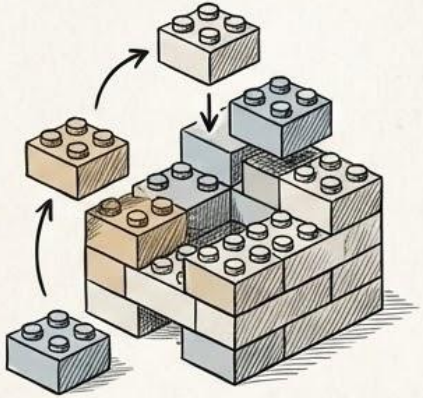


"**Varför lager?** Separation of concerns - varje lager gör en sak bra"

SLIDE 5: Varför React?

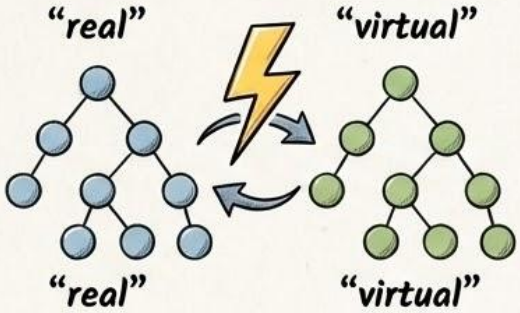
🧩 Komponentbaserad

Återanvändbar kod, enkel att organisera



⚡ Virtual DOM

Effektiv rendering av UI-ändringar

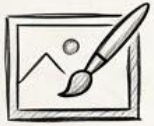
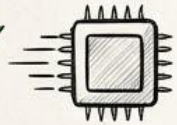


🌐 Community

Stor community, många bibliotek

SLIDE 6: Canvas vs SVG

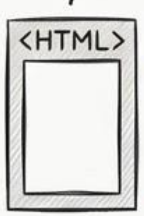
Canvas (Vald):

- ✓  Högt performance
- ✓  Perfekt för ritprogram
- ✓  GPU acceleration
- ✓  Handritad känsla

SVG (Ej vald):

- ✗  Långsammare med många element
- ✗  Svårt att implementera effekter
- ✓  Bättre för vektor-grafik
- ✓  Enklare manipulation

SLIDE 7: Canvas Rendering Pipeline



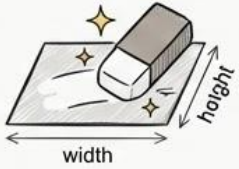

```
// 1. Hämta context
const ctx = canvas.getContext('2d');

// 2. Rensa
ctx.clearRect(0, 0, width, height);

// 3. Applicera transformationer
ctx.transform(...);

// 4. Rita alla element
elements.forEach(el => {
  ctx.fillRect(el.x, el.y, el.width, el.height);
});
```

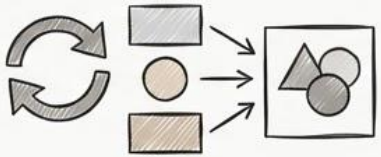
1. Hämta Context



2. Rensa

3. Applicera Transformationer

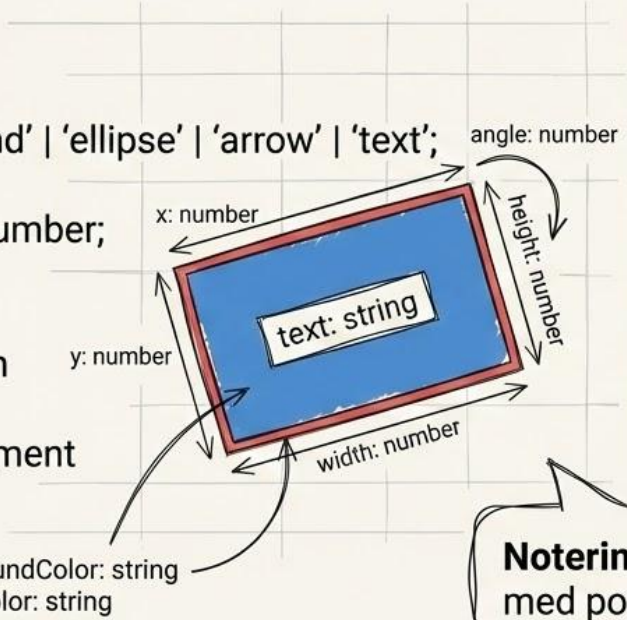
4. Rita Alla Element



Notering: Två canvas-lager: Interactive (musinteraktion) + Static (innehåll)

SLIDE 8: Element Datastruktur

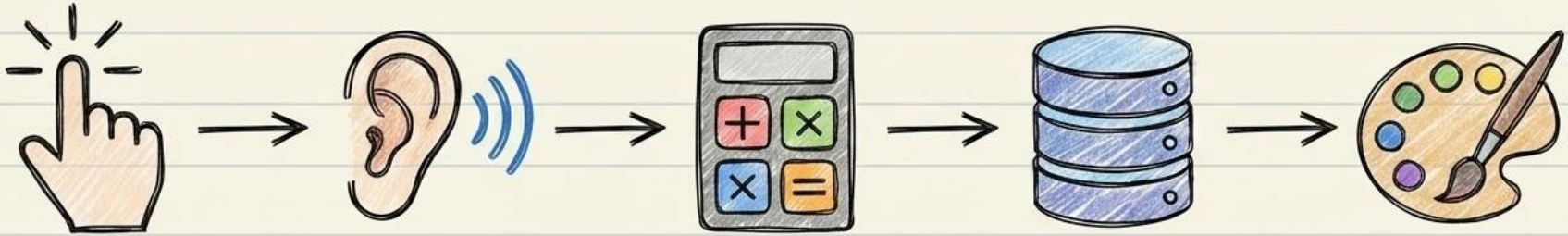
```
interface Element {
  id: string;
  type: ‘rectangle’ | ‘diamond’ | ‘ellipse’ | ‘arrow’ | ‘text’;
  x: number;  y: number;
  width: number;  height: number;
  backgroundColor: string;
  strokeColor: string;
  angle: number;  // rotation
  locked: boolean; 🔒
  text: string; // för text-element
}
```




```
interface Element {
  id: string;
  type: 'rectangle' | 'diamond' | ...;
  x: number; y: number;
  width: number; height: number;
  backgroundColor: string;
  strokeColor: string;
  angle: number; // rotation
  locked: boolean;
  text: string;// för text-element
}
```

Notering: Varje form är ett objekt med position, stil, och egenskaper

SLIDE 9: Interaction Event Loop



User Action
Klick, drag, tangent

Event Listener
onPointerDown, onPointerMove, onPointerUp

Calculate
Vad ändrade sig?

Update State
Element, AppState

Re-render
Rita på canvas

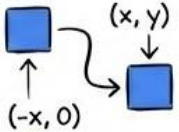
SLIDE 10: Exempel - Drag an Element

Pointer Down

```
onPointerDown = (event) => {
  state.draggedElement =
getElementAtPosition(event.x,
event.y);
}
```

Pointer Move

```
onPointerMove = (event) => {
  if (state.draggedElement) {
    state.draggedElement.x =
    state.draggedElement.y =
event.y - offset.y;
    render();
  }
}
```



Pointer Up

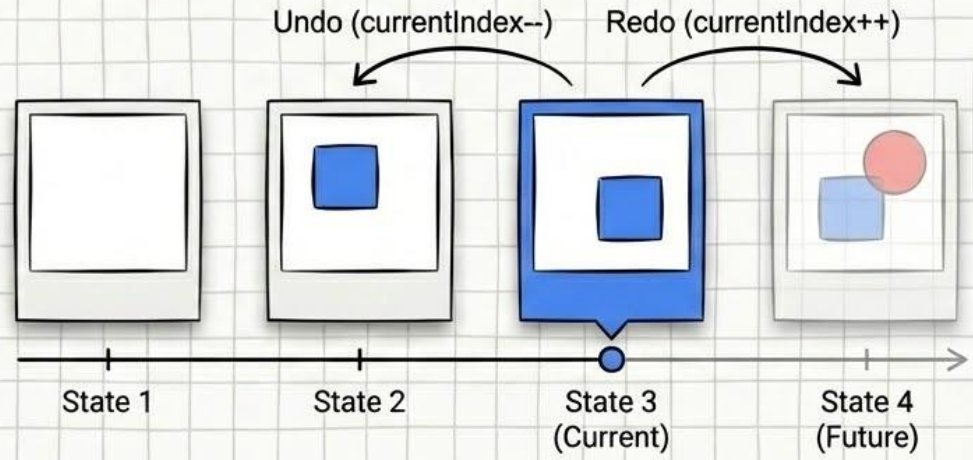
```
onPointerUp = () => {
  addToHistory(state); // För undo
}
```

SLIDE 11: Undo/Redo System

```
class History {
  entries = [];
  currentIndex = -1;

  addEntry(elements, appState) {
    this.entries = this.entries.slice(0,
this.currentIndex + 1);
    this.entries.push({ elements,
appState });
    this.currentIndex++;
  }

  undo() { this.currentIndex--; }
  redo() { this.currentIndex++; }
}
```



Notering: Spara snapshot av varje tillstånd → enkelt undo/redo

SLIDE 12: Storage & Persistence

localStorage

- 5-10MB.
- Snabb.
- Synkron.
- Lokalt.

IndexedDB

- 50MB+.
- Asynkron.
- Ingen blockering.

Cloud

- Obegränsad.
- Samarbete.
- Synk mellan enheter.

Notering: Excalidraw använder: localStorage för små diagrams, IndexedDB för större

SLIDE 13: Testing - 1079

Tests!

Test-resultat:

964 tests passar

68 snapshot mismatches (ej kritiskt)

46 skipped

Vitest

Test runner (snabb, moderna)

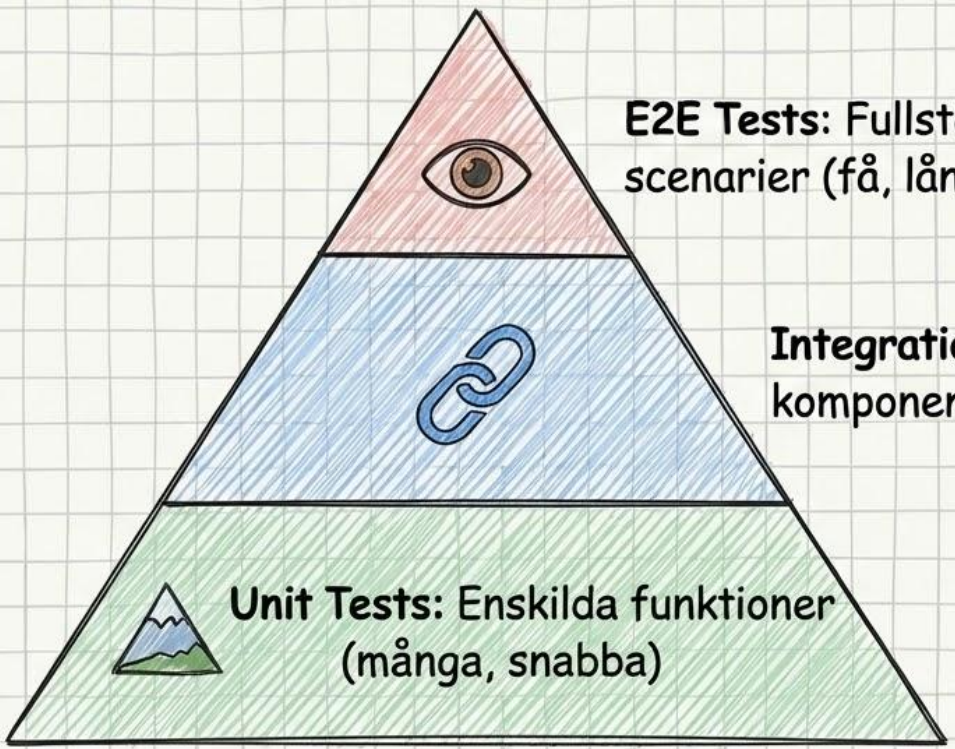
@testing-library

Test som användare gör

vitest-canvas-mock

Mock Canvas API för tests

SLIDE 14: Test Pyramid

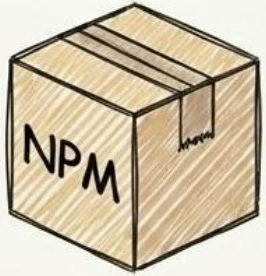


Notering: Excalidraw fokuserar på: Integration + Unit (viktigast för UI)

SLIDE 15: Deployment - 3 Alternativ

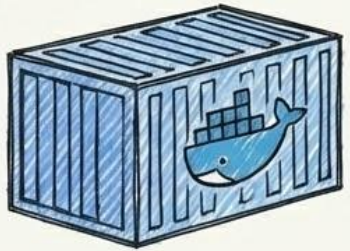
1 Web App

- Deploy till GitHub Pages, Netlify



2 NPM Package

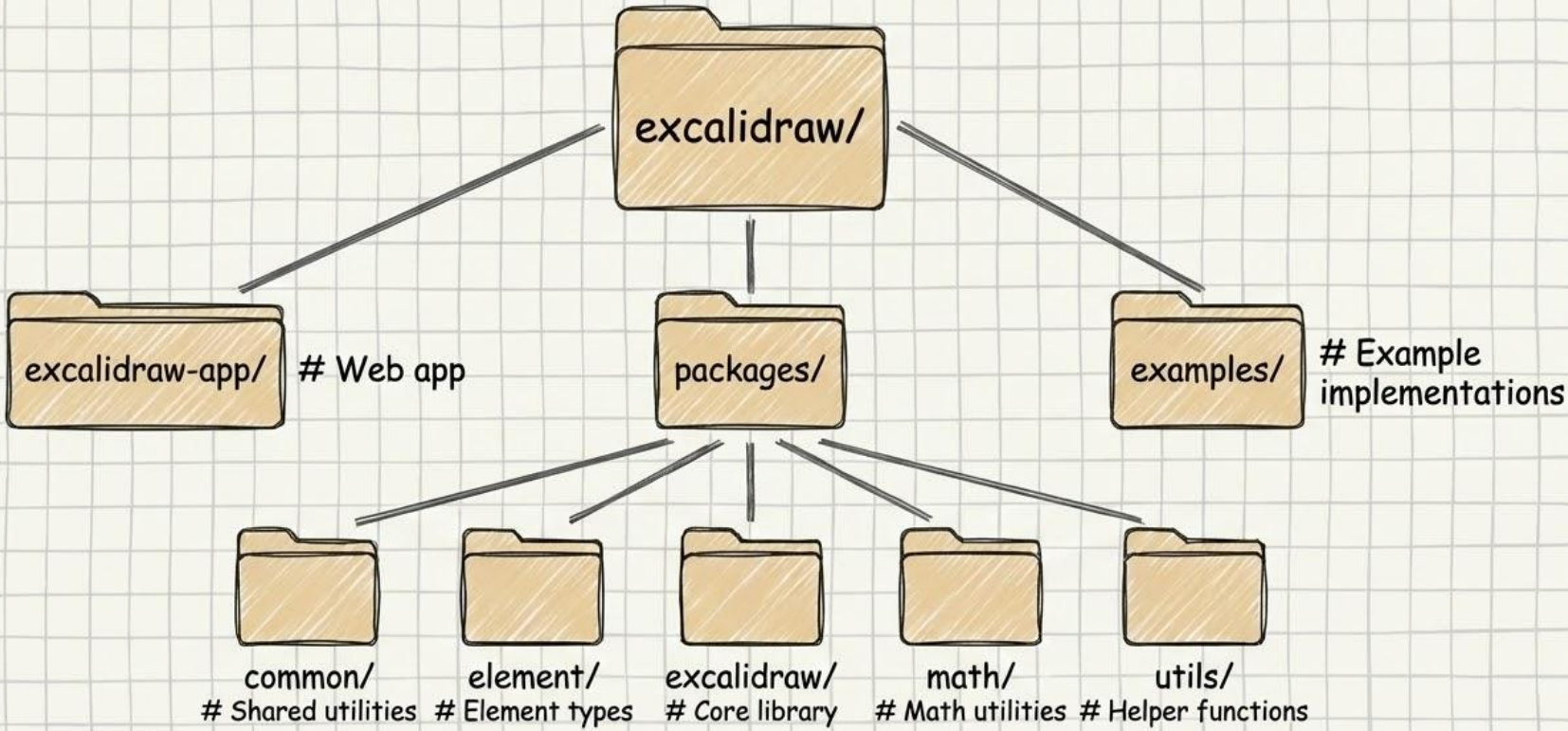
- Andra appar kan importera det



3 Docker

- Container, server-deployment

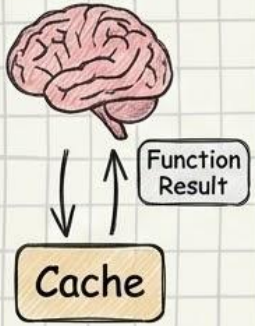
SLIDE 16: Monorepo - Projektstruktur



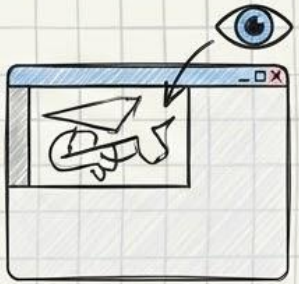
Notering: Fördel: Shared code, coordinerad versionering

SLIDE 17: Performance Optimizations

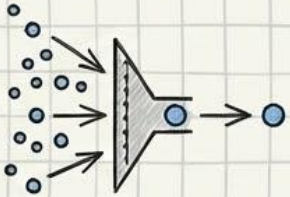
Memoization: Cache funktions-resultat



Selective Rendering: Rita bara synliga element

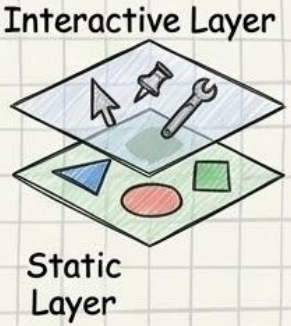


Event Debouncing: Begränsa event-frekvens



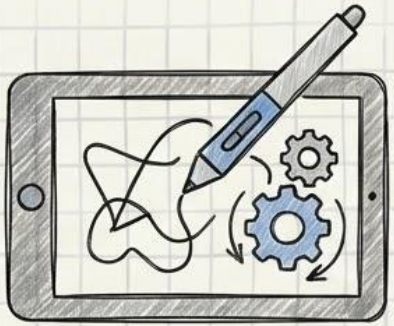
Virtual Scrolling: Rendera bara synliga i listor

Two Canvas Layers: Separate interactive och static



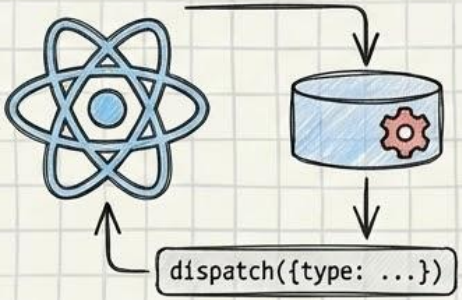
SLIDE 18: Architecture Decisions & Tradeoffs

Canvas: Performance



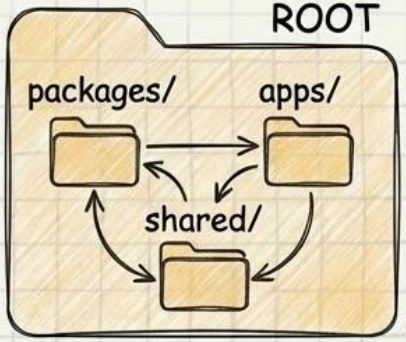
Tradeoff: Svårare att implementera vissa features

useReducer: Modern React



Tradeoff: Inte optimerad för mycket stora states

Monorepo: Shared code



Tradeoff: Mer komplext setup

SLIDE 19: Development Workflow

Setup & Install

Installera

```
yarn install
```

Development Loop

Starta dev-server

```
yarn start
```

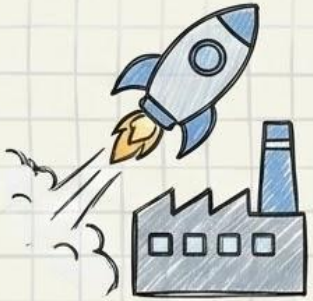
Köra tester

```
yarn test:app
```

Code quality

```
yarn test:code # ESLint
yarn test:typecheck
yarn test:all  # Allt
```

Production Build



Build för production

```
yarn build
```

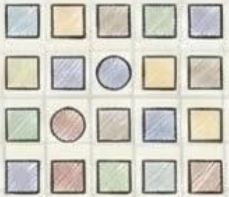
Scaling - 10,000+ Element

Problem:

- Långsam rendering
- Memory leak
- Laggy interaktion

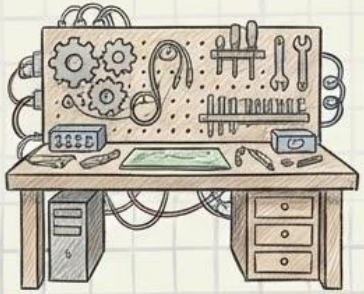
10,000+ ELEMENT

Lösningar:

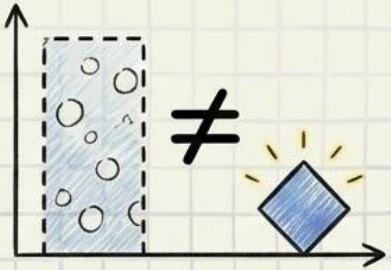


- Spatial indexing
- Culling (rita bara synliga)
- Throttling
- Worker threads

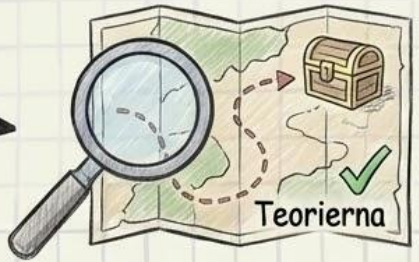
SLIDE 21: Key Learnings



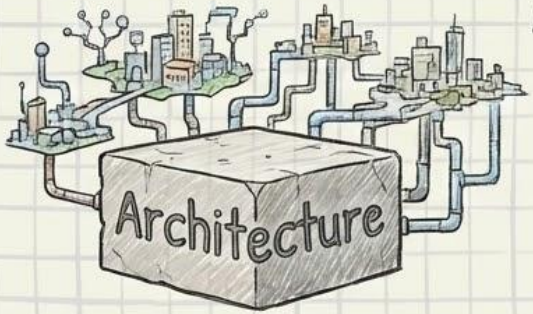
Test-setup är kritiskt



Coverage ≠ Quality



Exploratory testing bekräftar teorierna

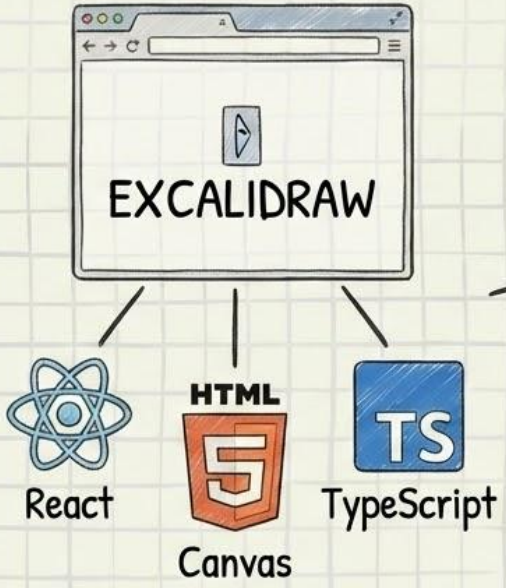


Architecture decisions påverkar allt

Performance kräver konstant focus

Open-source = högt kodkvalitet

Sammanfattning



Byggt på moderna web-teknologier

Fokus på performance, testning, och user experience

Ett utmärkt exempel