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The Future Now

The Top Trends in Software Development

Jonathan “J.” Tower


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The Top Trends Right Now In Software Development

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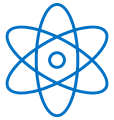
What We'll Cover

Low-Code/
No-Code

Edge Computing



Quantum
Computing

AI & ML

Cloud Native

Software
Architecture

Web

DevOps

Cross-Platform
Development

Tooling

Work Style

Q&A

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Hello!

Jonathan "J." Tower

Partner & Principal Consultant

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- 10-Time Microsoft MVP in .NET
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- jtower@trailheadtechnology.com
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BEER
CITY
CODE

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Low-Code/No-Code

Low-Code/No-Code

No-code: A development platform allowing **citizen developers** to **create applications** entirely through **visual interfaces** with **no code**.

Low-code: A development approach that allows **citizen developers** and professionals to **build applications** with **minimal coding** by using **pre-built components.**

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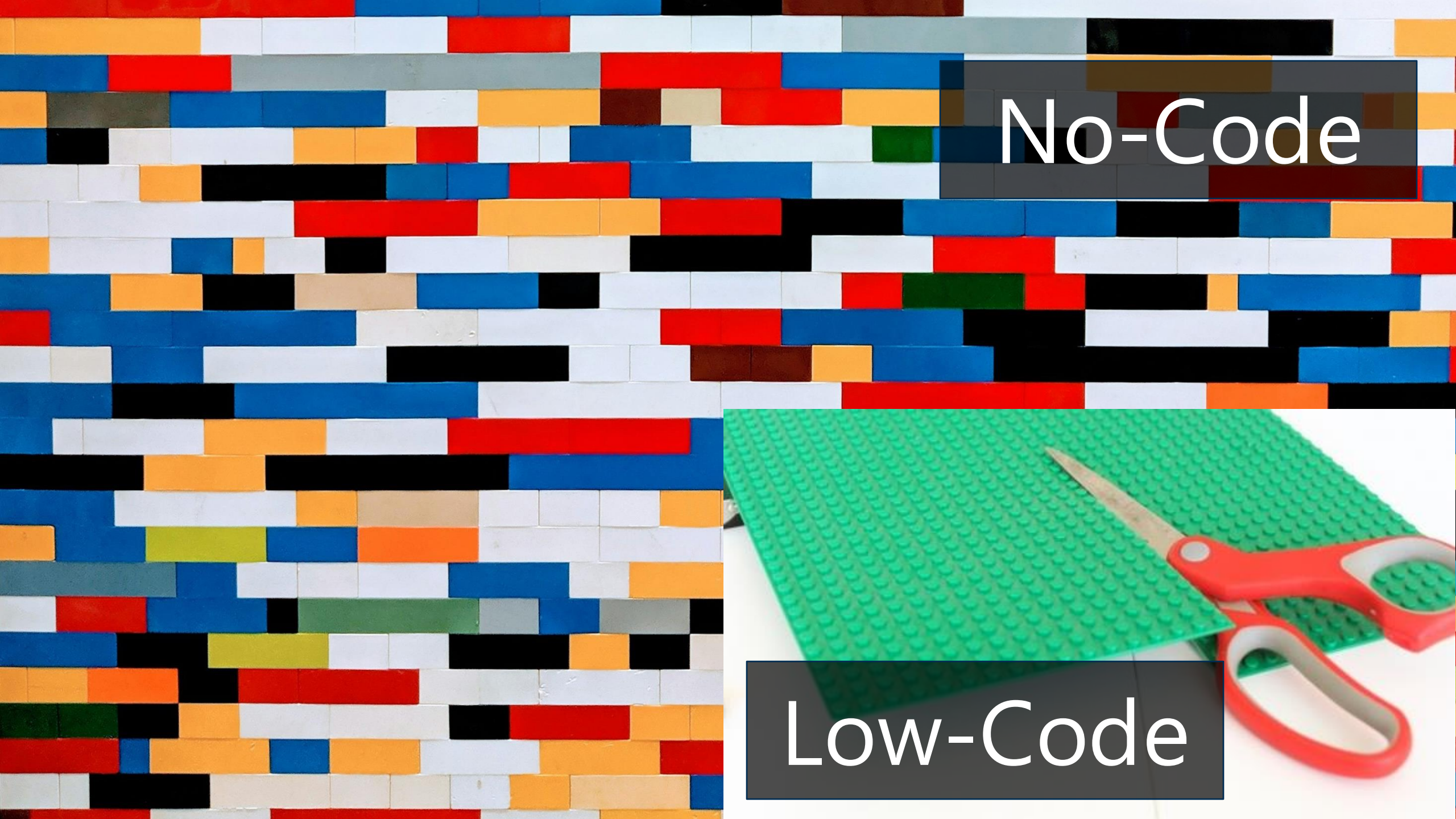
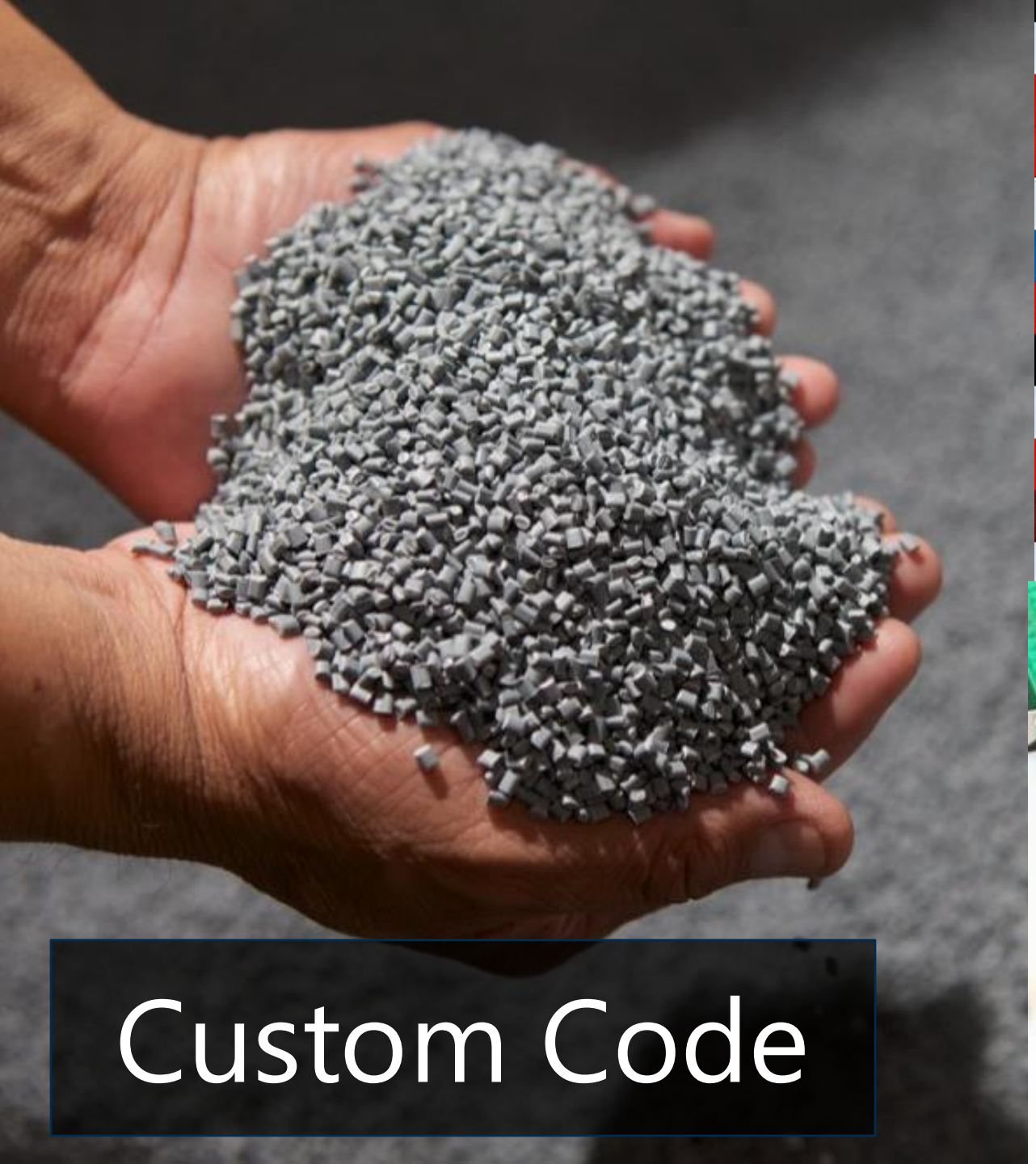
No-Code


No-Code
Low-Code


Custom Code


No-Code


Low-Code

4GL Resurrected!

- Fourth-generation programming language
- *Application Development Without Programmers* by James Martin (1981)
- Reborn 40 years later as Low-Code/No-Code
- Will it take off this time?

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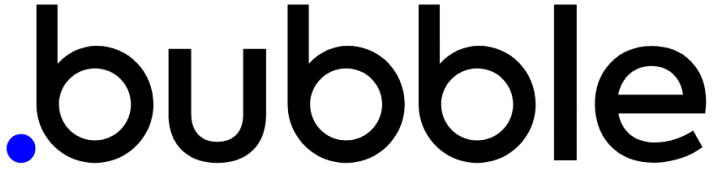
No-Code Platforms

Airtable



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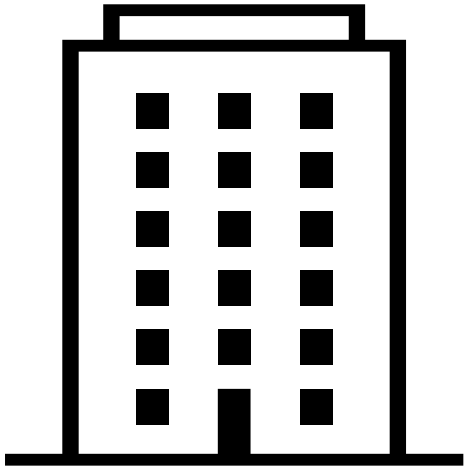
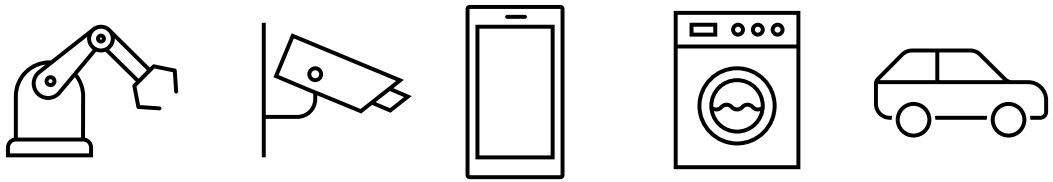
Low-Code Platforms

Edge Computing

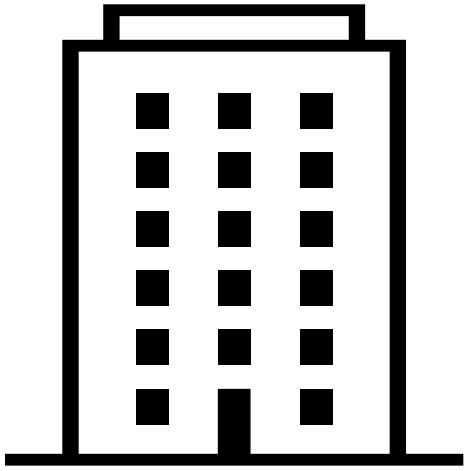
Traditional Deployments

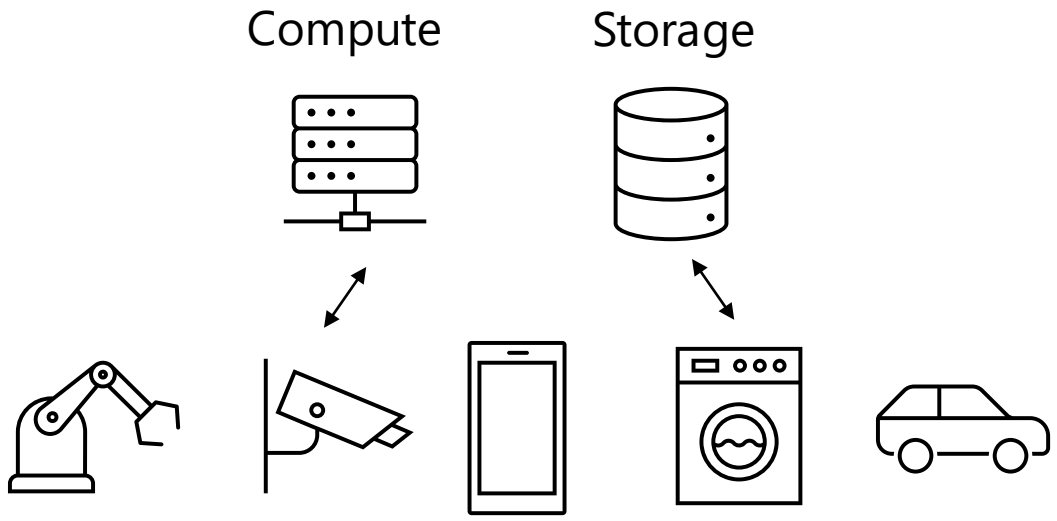




Machinery, robotics, IoT sensors, etc.

Traditional Deployments





Machinery, robotics, IoT sensors, etc.

Traditional Deployments

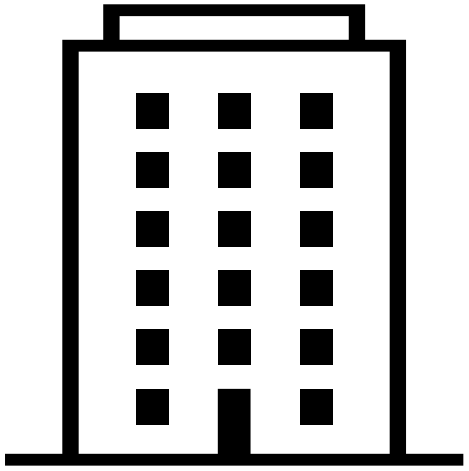
Traditional Deployments

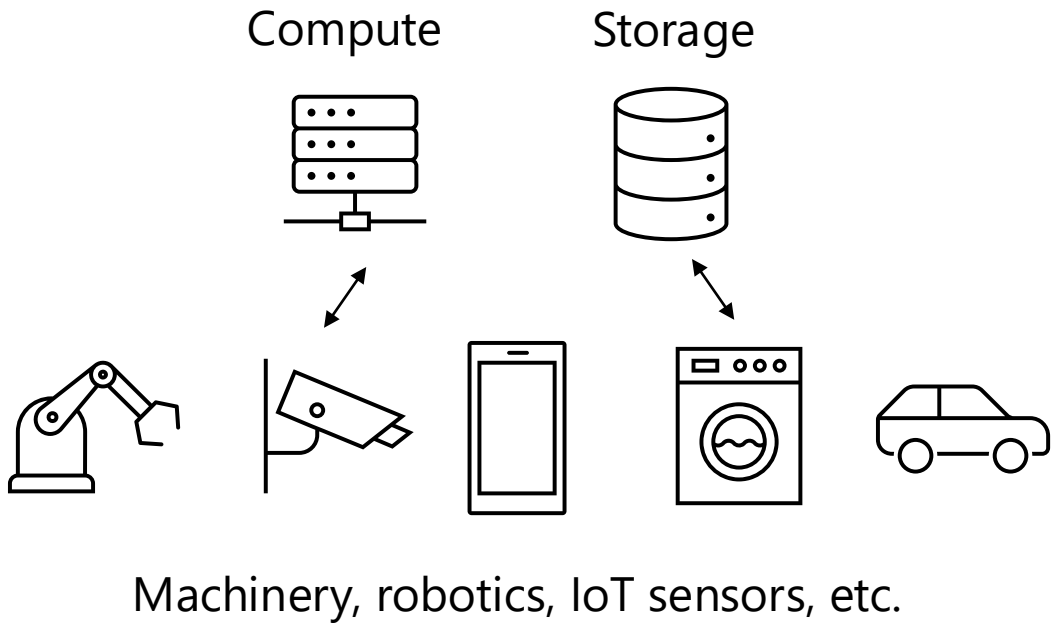
- Close to where data generated/used

Traditional Deployments

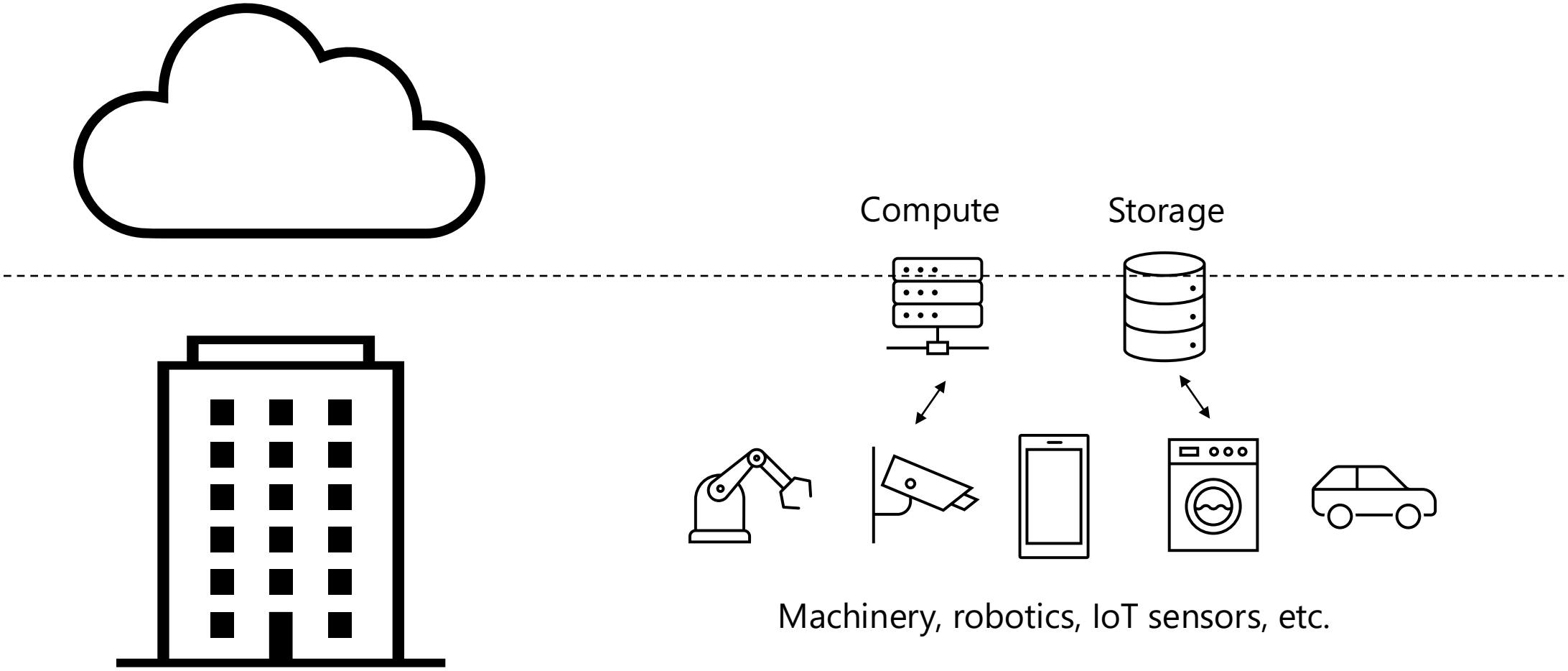
- Close to where data generated/used
- Self-managed

Cloud Deployments

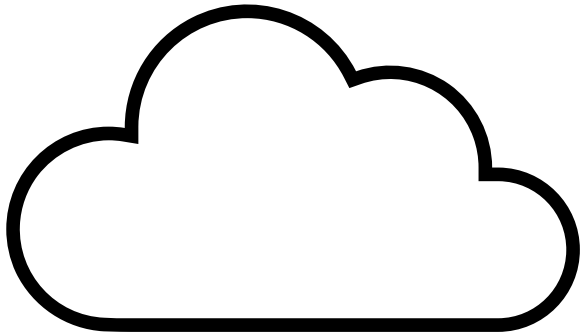


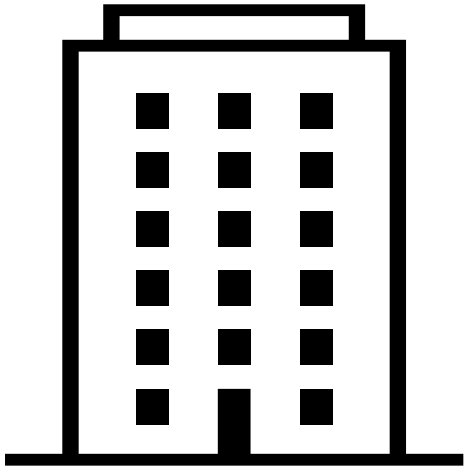


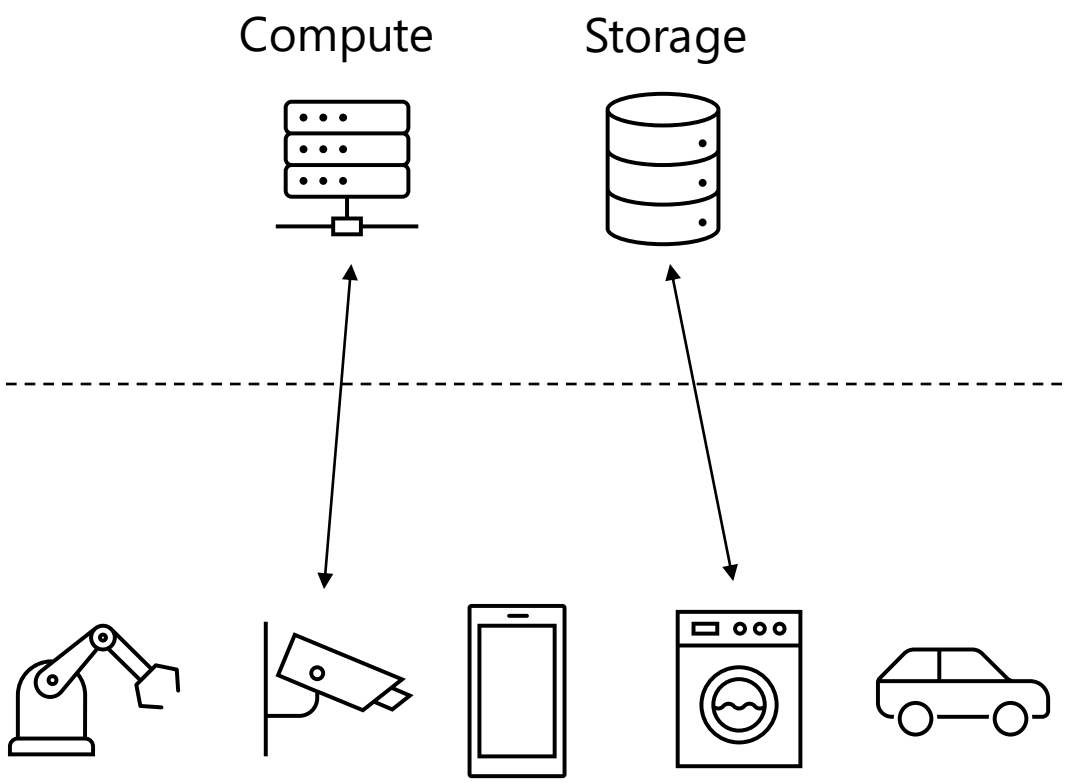
Cloud Deployments



Cloud Deployments







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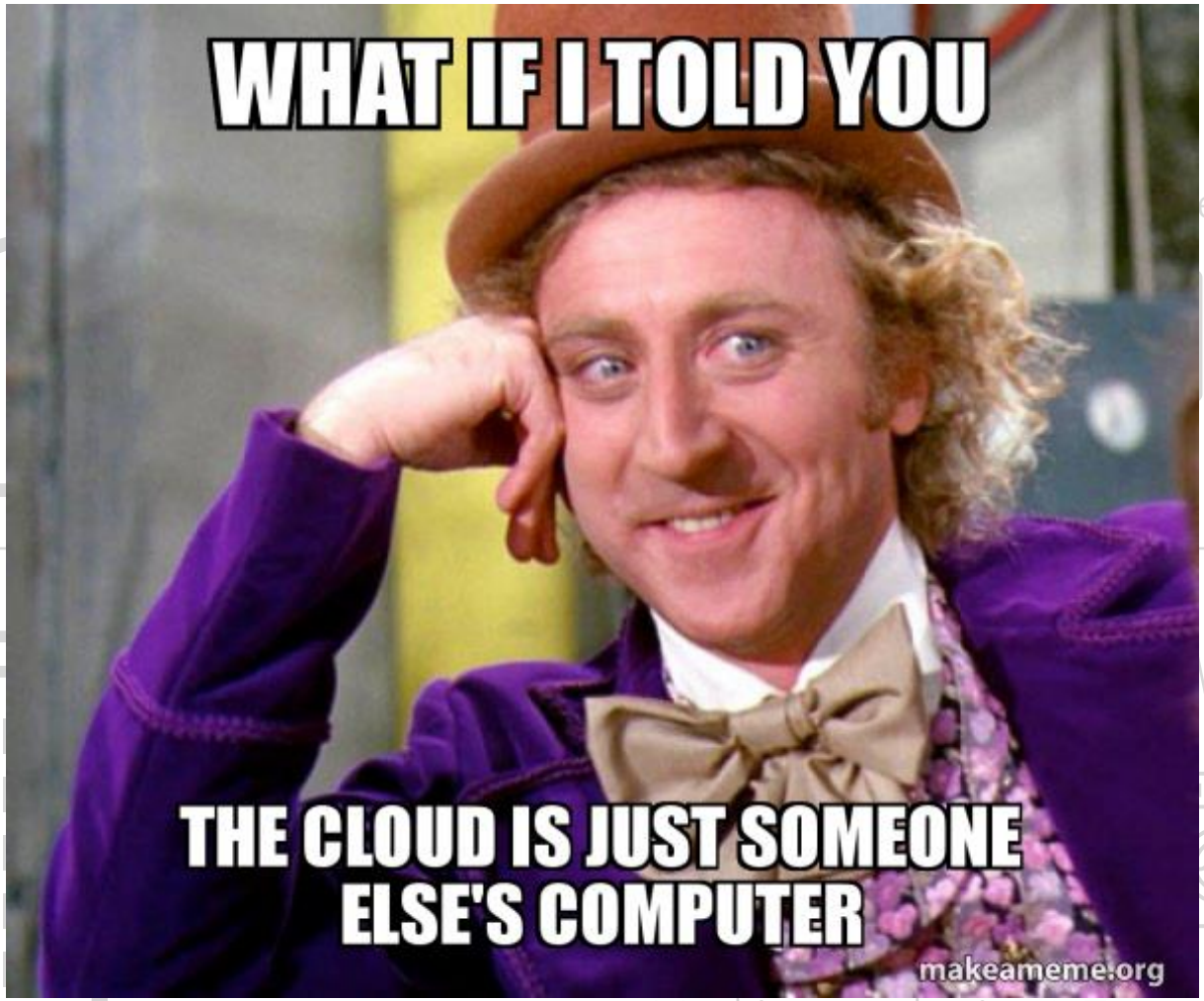
Cloud Depl



Machinery, robotics, IoT sensors, etc.

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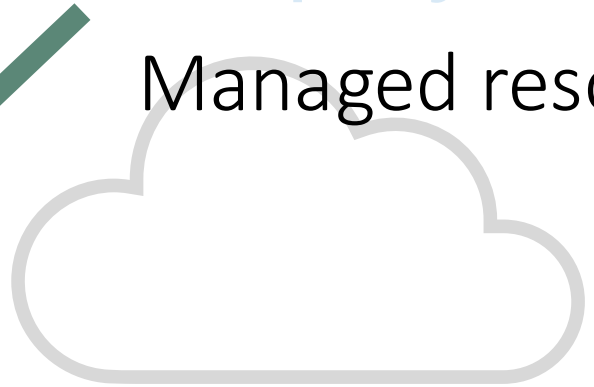
Cloud Deployments

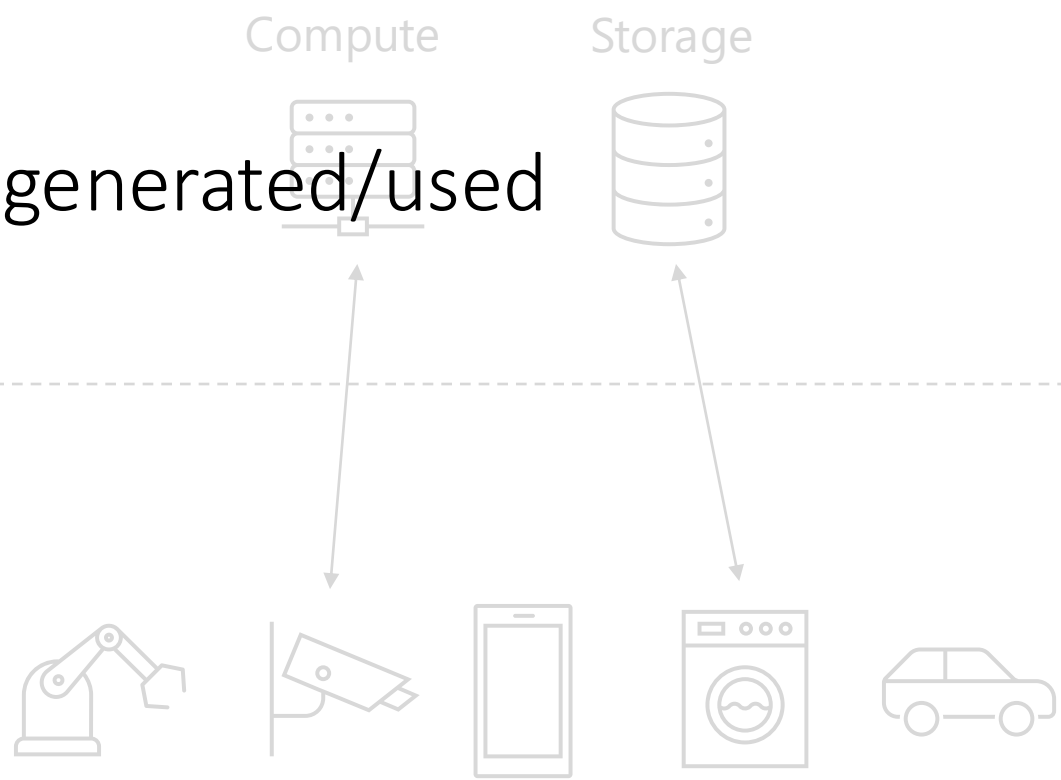
Cloud Deployments

- Managed resources



Cloud Deployments

- Managed resources
- Far from where data generated/used



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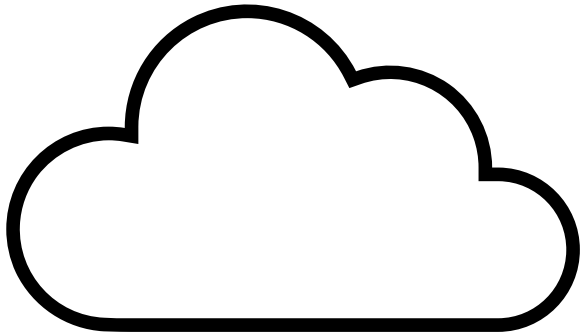
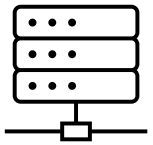
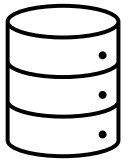
Edge Deployments

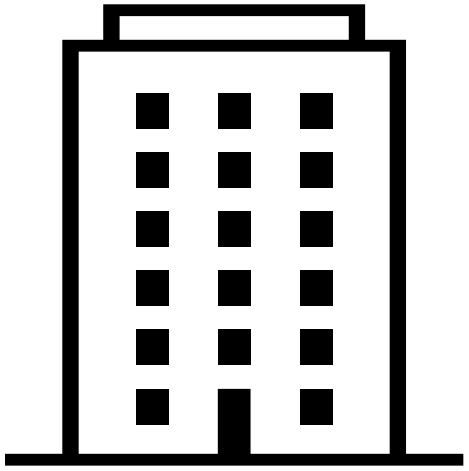


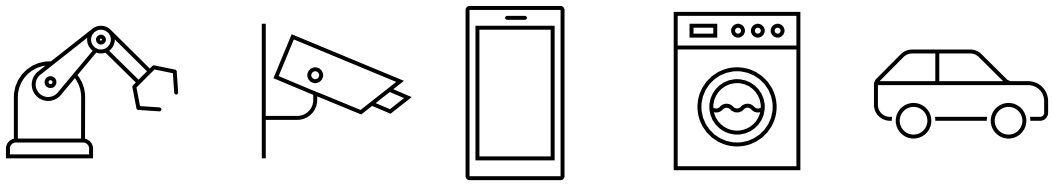
Compute



Storage







Machinery, robotics, IoT sensors, etc.

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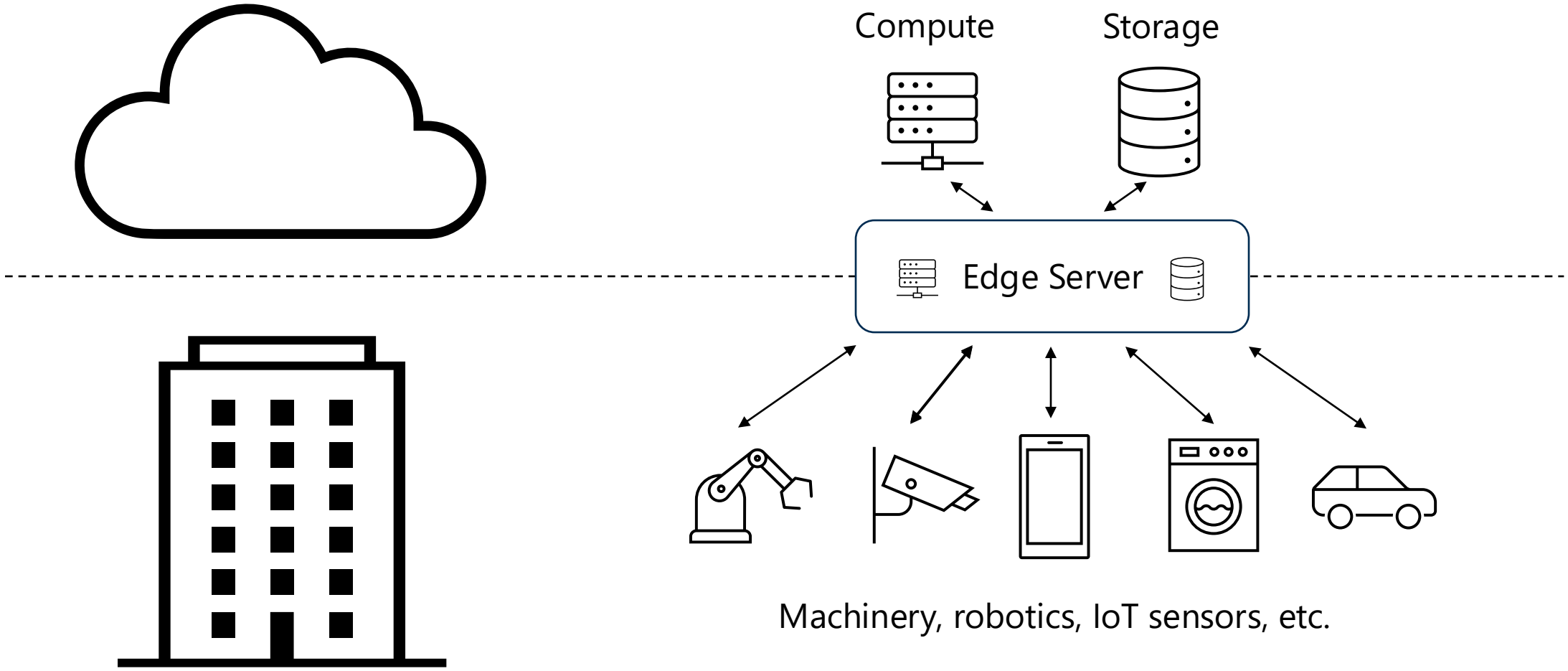
Edge Deployments



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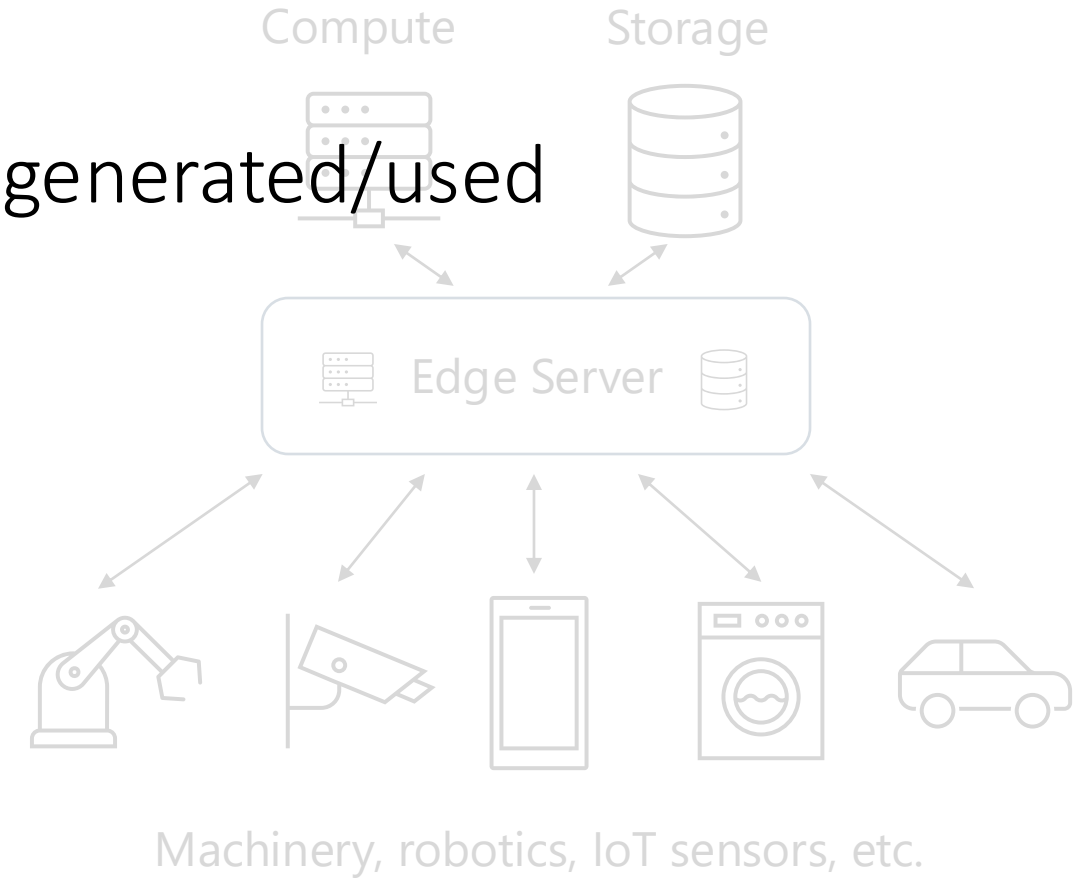
Edge Deployments

Edge Deployments

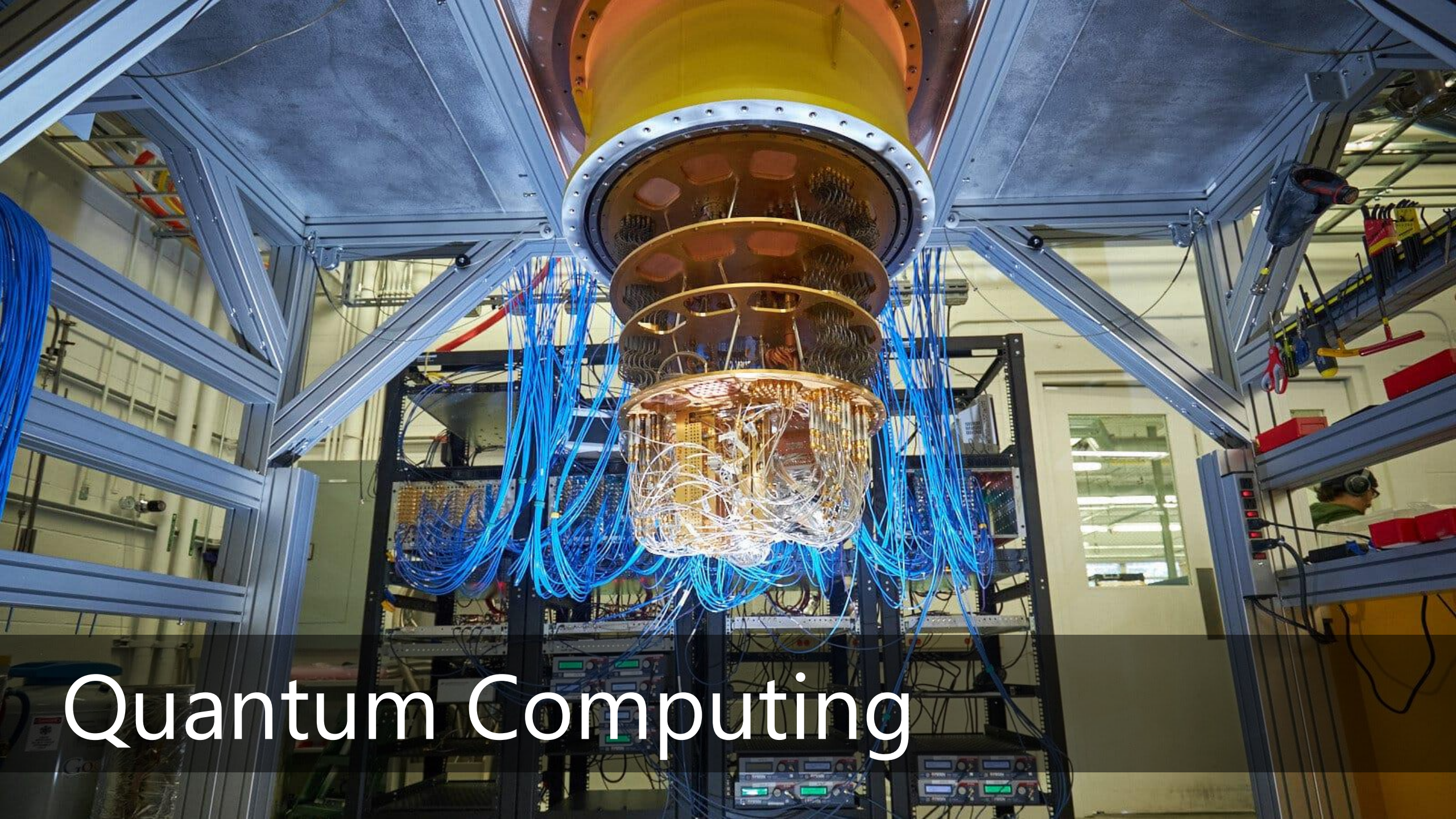
- Managed resources

Edge Deployments

- Managed resources
- Close to where data generated/used

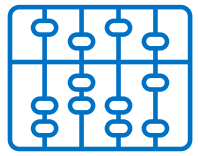


Quantum Computing

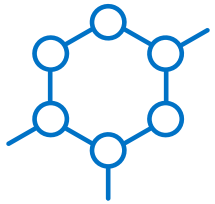


Quantum Computing

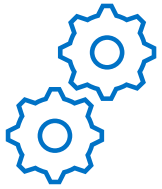
Best for Certain Problems



Factoring large numbers



Simulating Molecules and Chemistry



Optimization Problems

Search Problems

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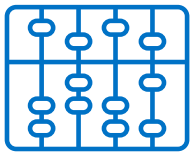
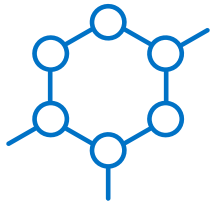
Best for Certain Problems

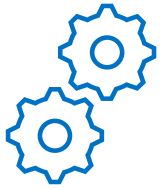
This one is problematic



Factoring large numbers



Simulating Molecules and Chemistry



Optimization Problems

Search Problems

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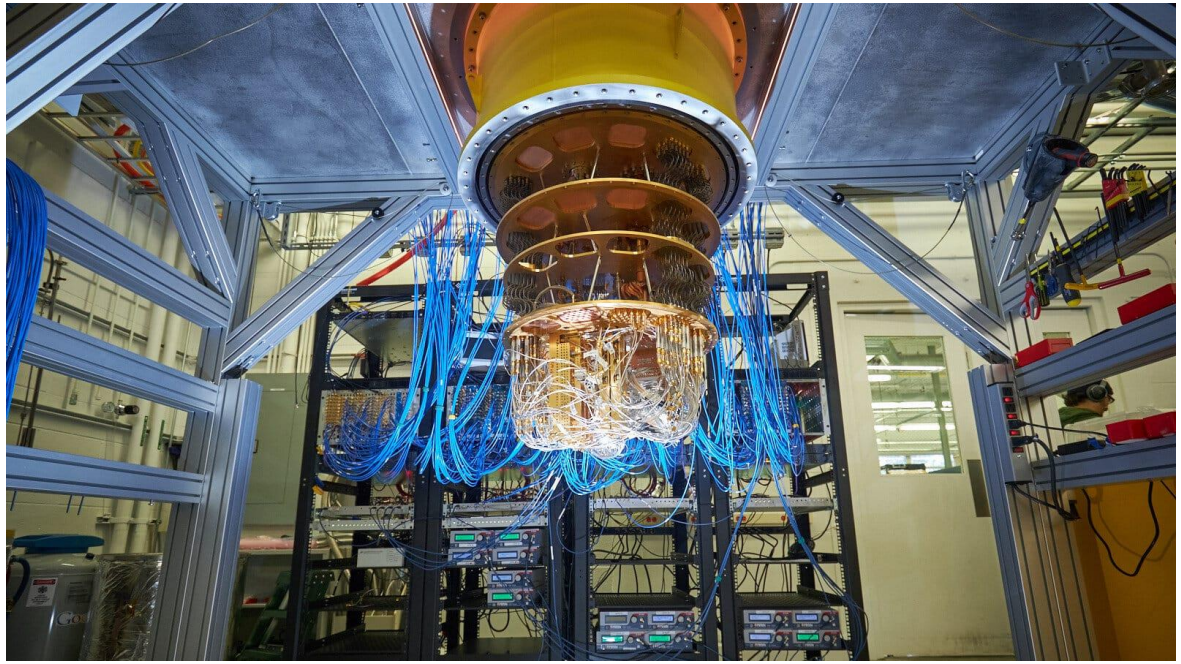
Security Implications

Most **encryption** algorithms in use today are based on **prime factorization**

- Brute force 1000s of years --> hours/minutes
- Harvest now, decrypt later (HNDL)



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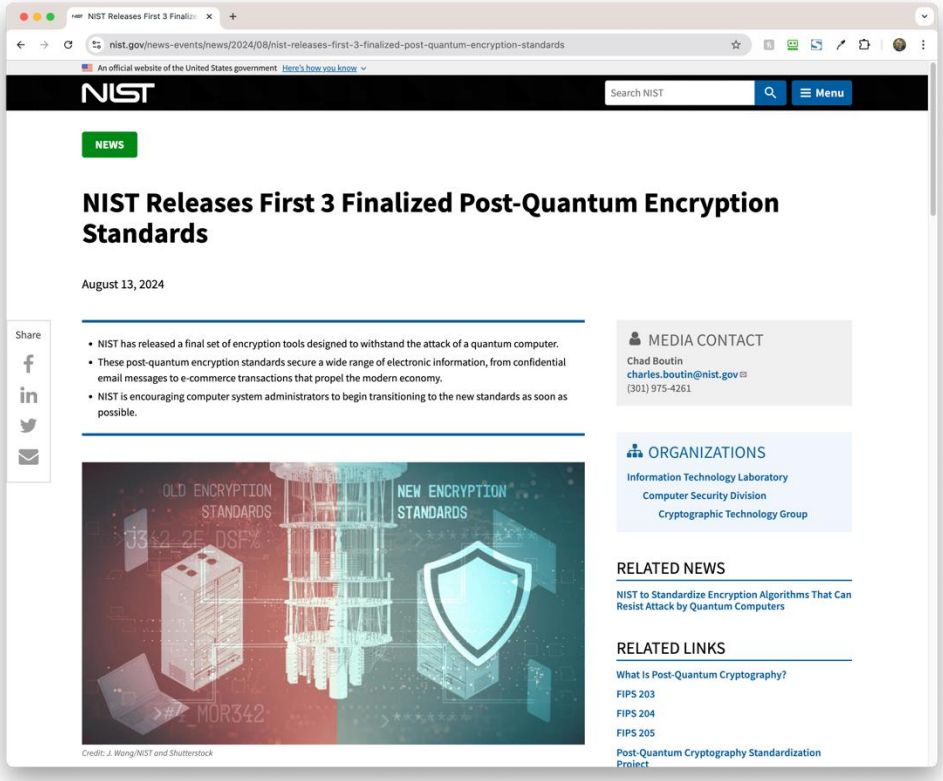
NIST to the Rescue

Public-key encapsulation

- CRYSTALS-KYBER

Digital signature schemes

- CRYSTALS-Dilithium
- FALCON
- SPHINCS+



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Artificial Intelligence & Machine Learning

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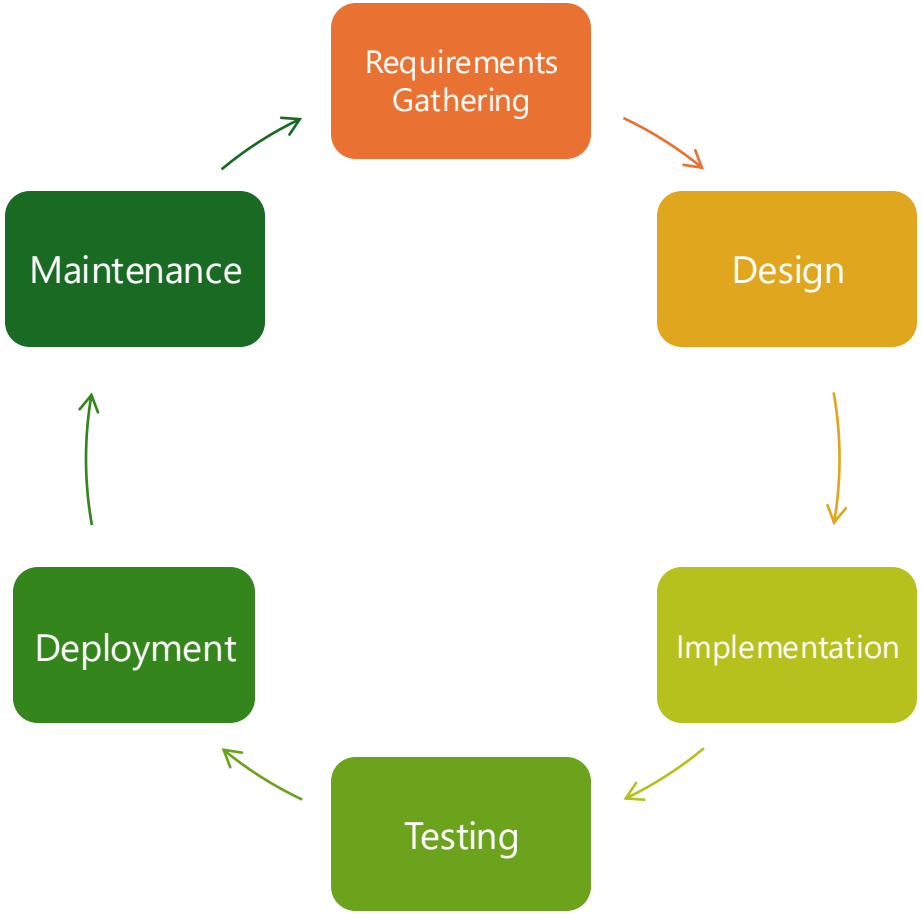
AI in the Development Lifecycle



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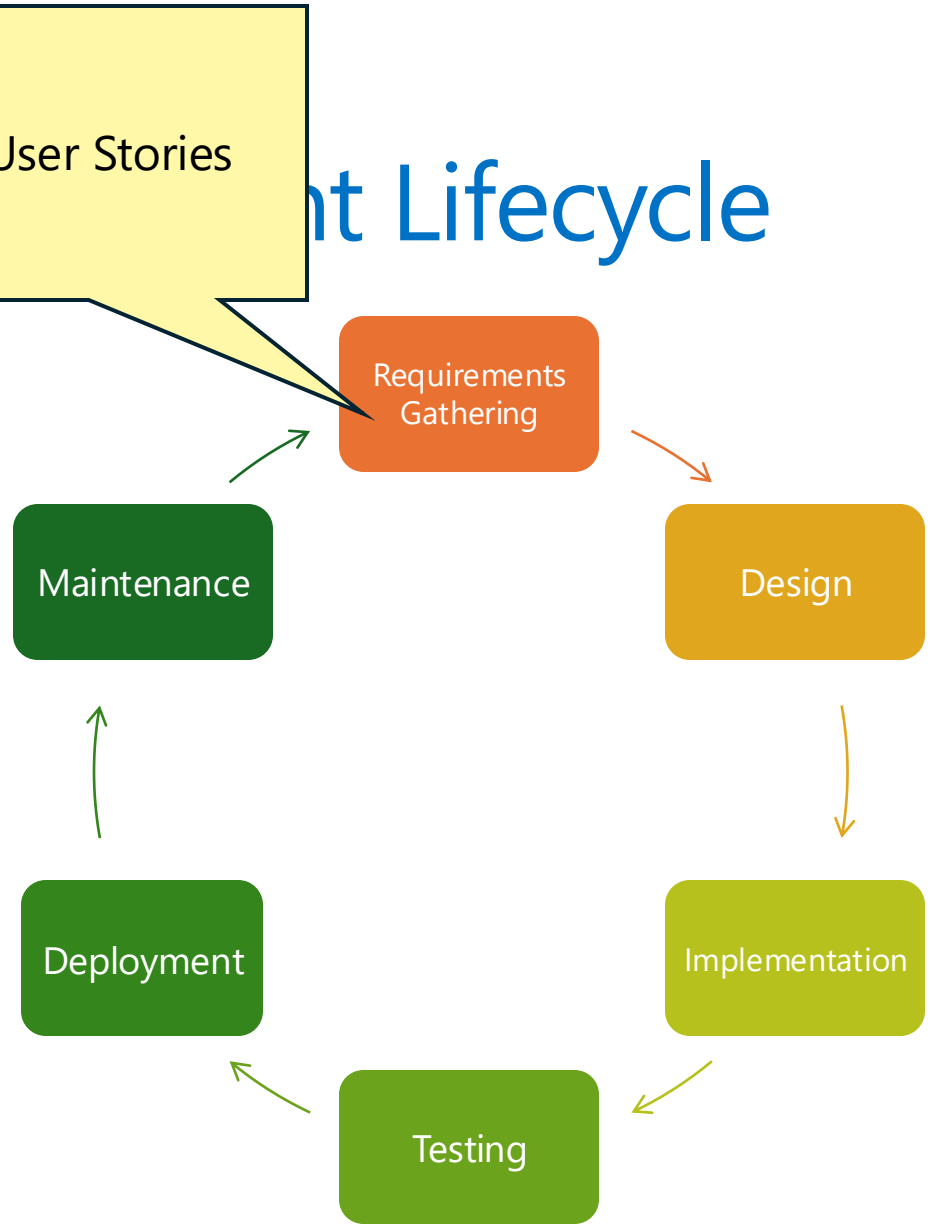
AI in the D nt Lifecycle



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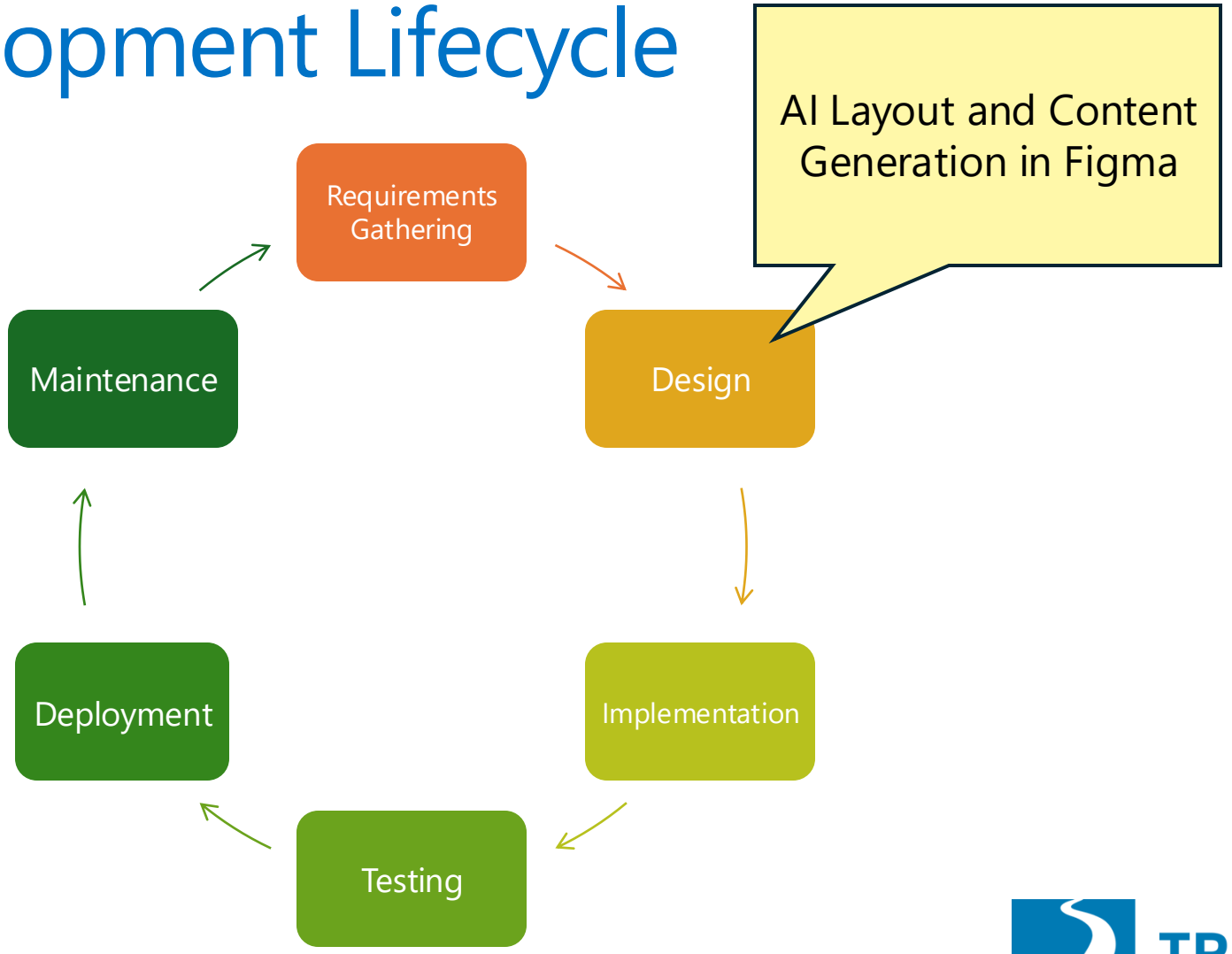
AI in the Development Lifecycle



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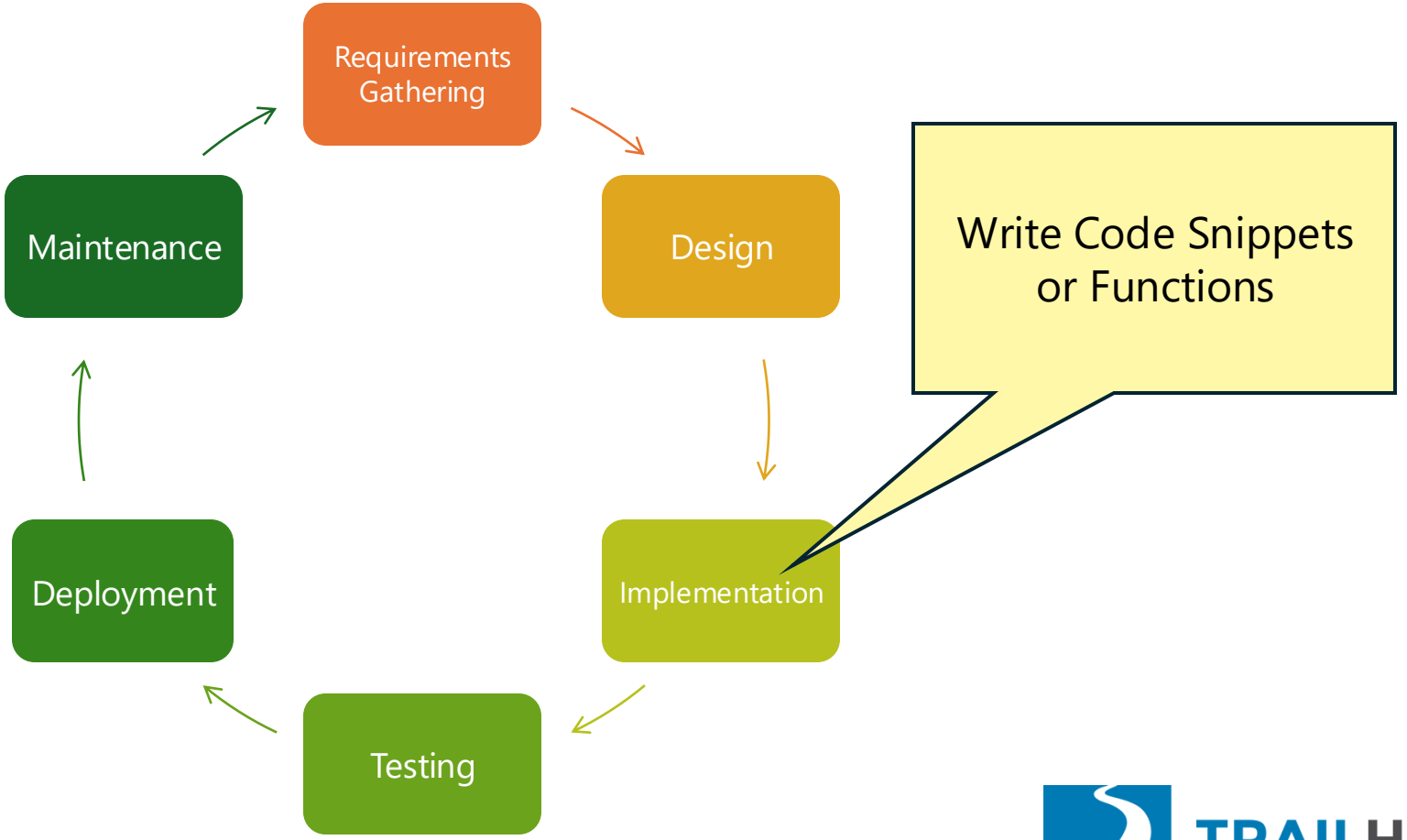
AI in the Development Lifecycle



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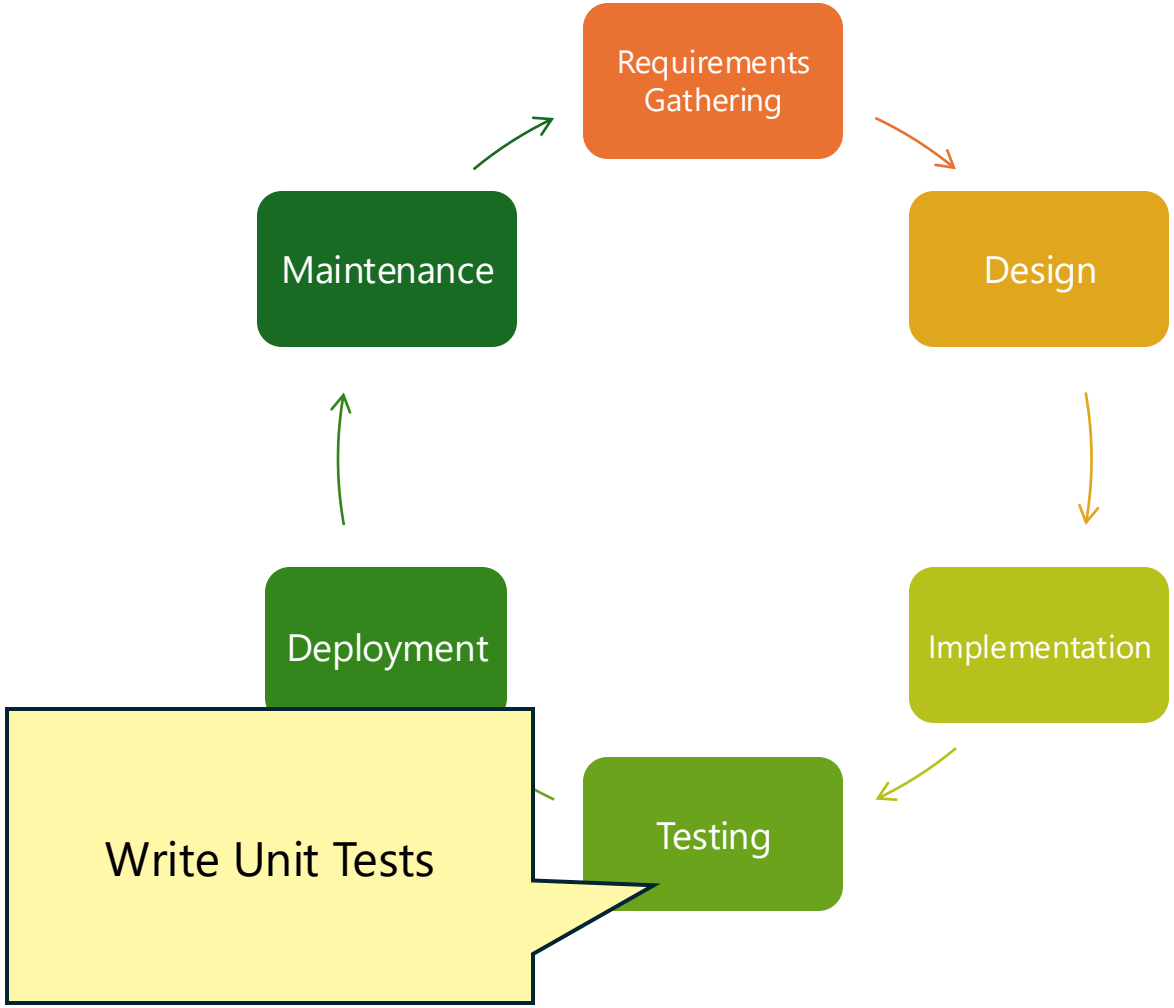
AI in the Development Lifecycle



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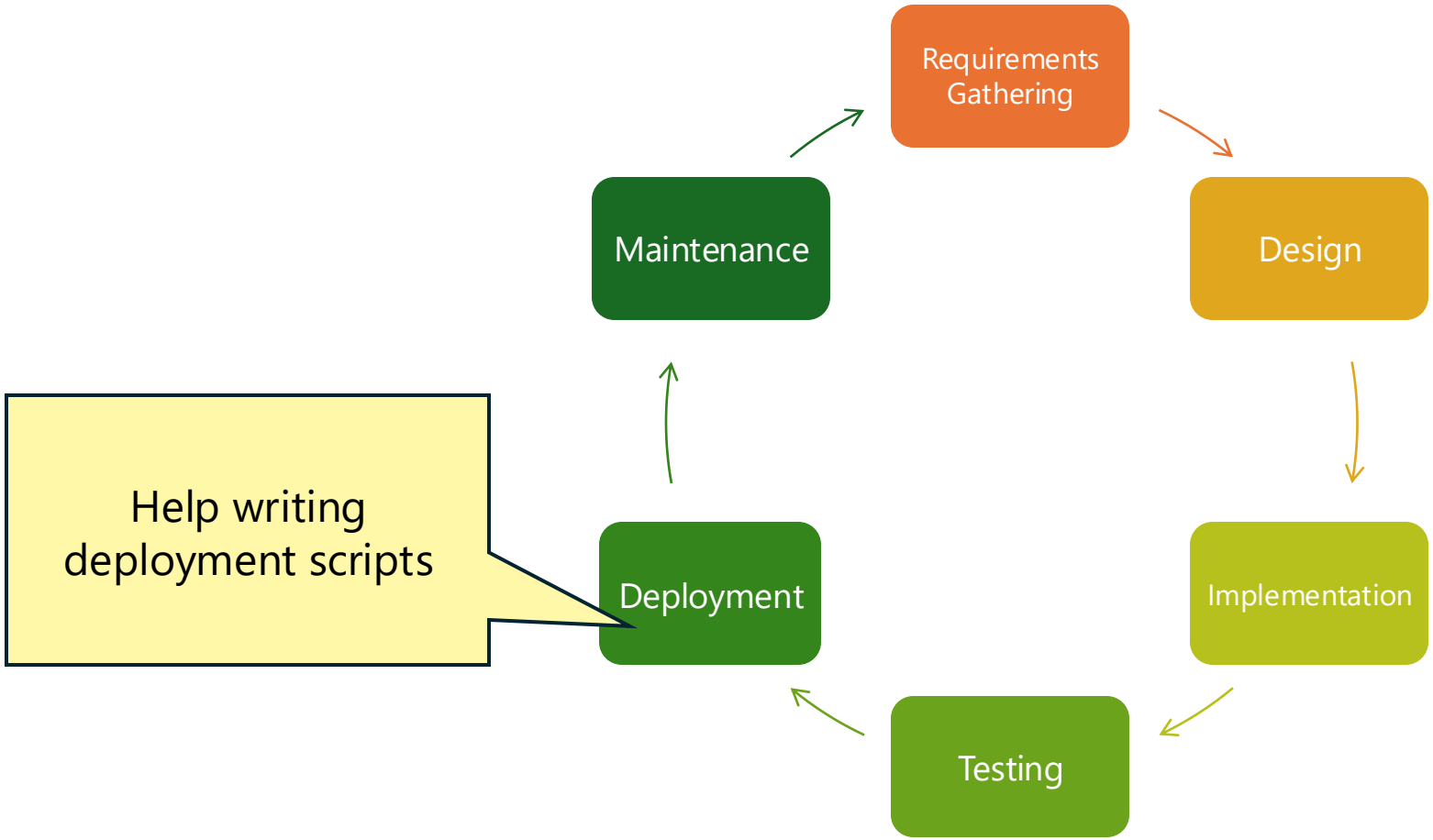
AI in the Development Lifecycle



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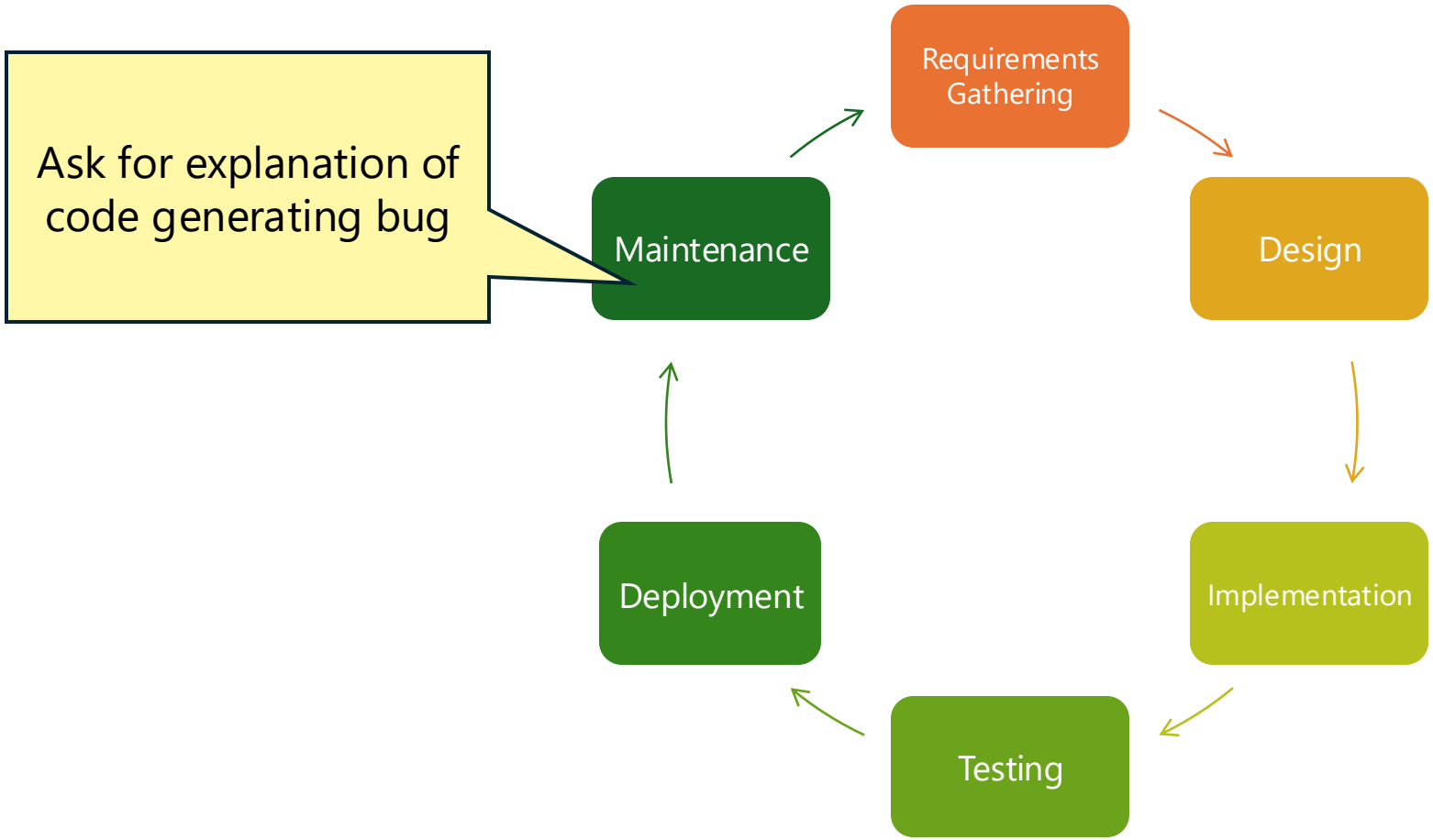
AI in the Development Lifecycle



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Code Completion

```
57      public function getStrings(){
58          return [
59              'en' ⇒ [
60                  'answer' ⇒ 'Answer',
61                  'question' ⇒ 'Question',
62                  'date' ⇒ 'Date',
63              ],    You, Moments ago • Uncommitted changes
64
65
66          ];
67      }
68  }
69
```

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Unit Tests

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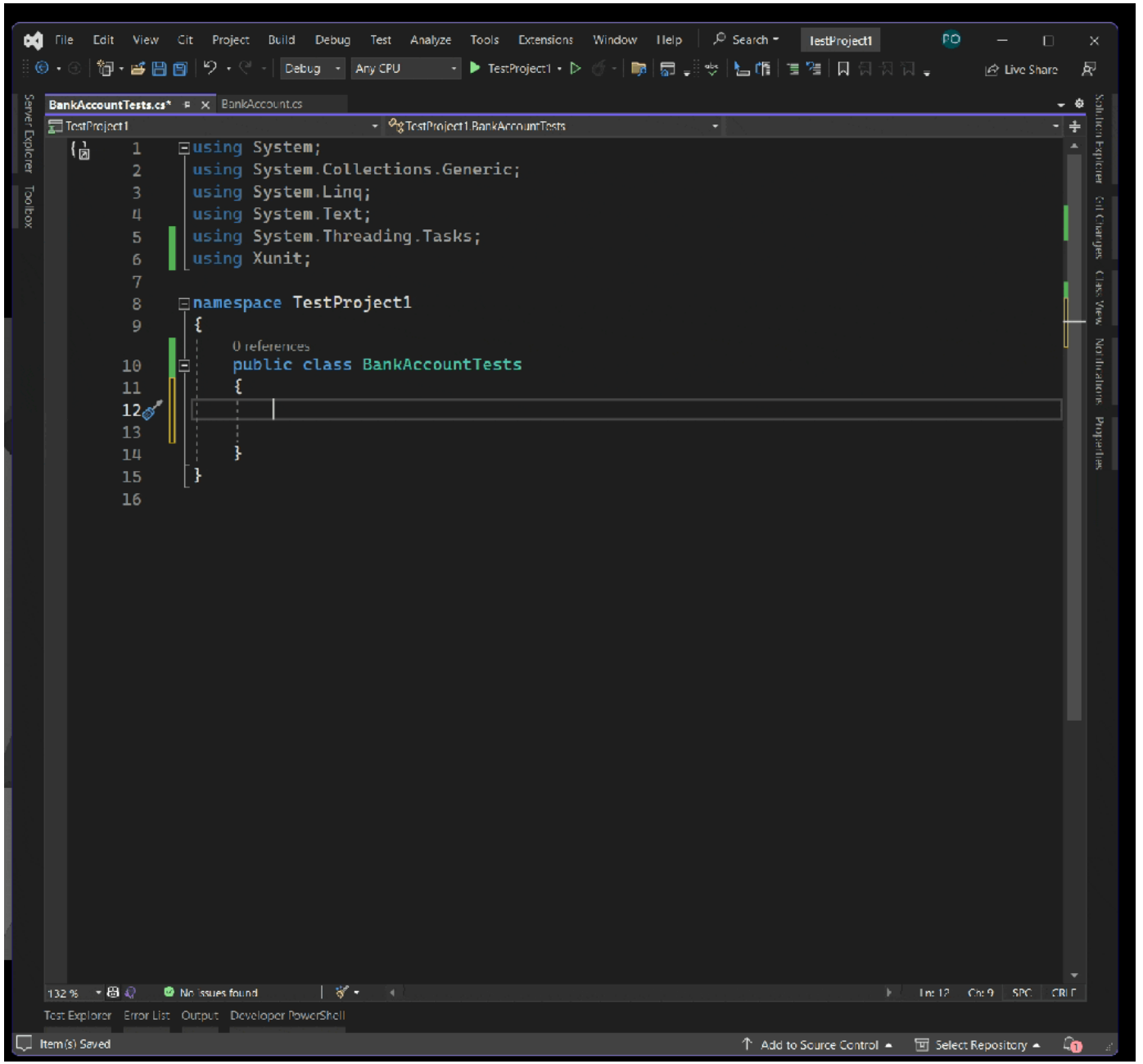
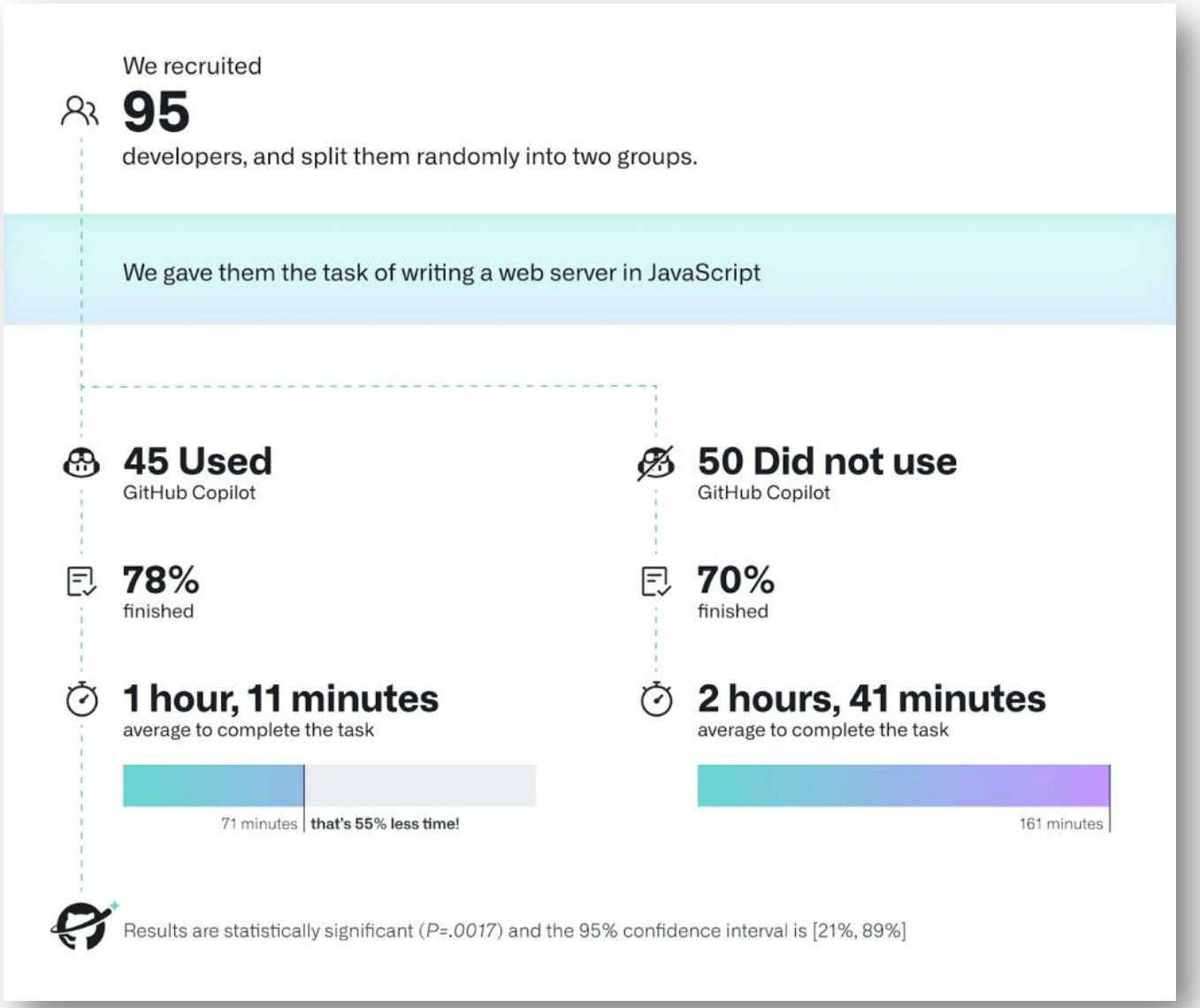


Github's Research



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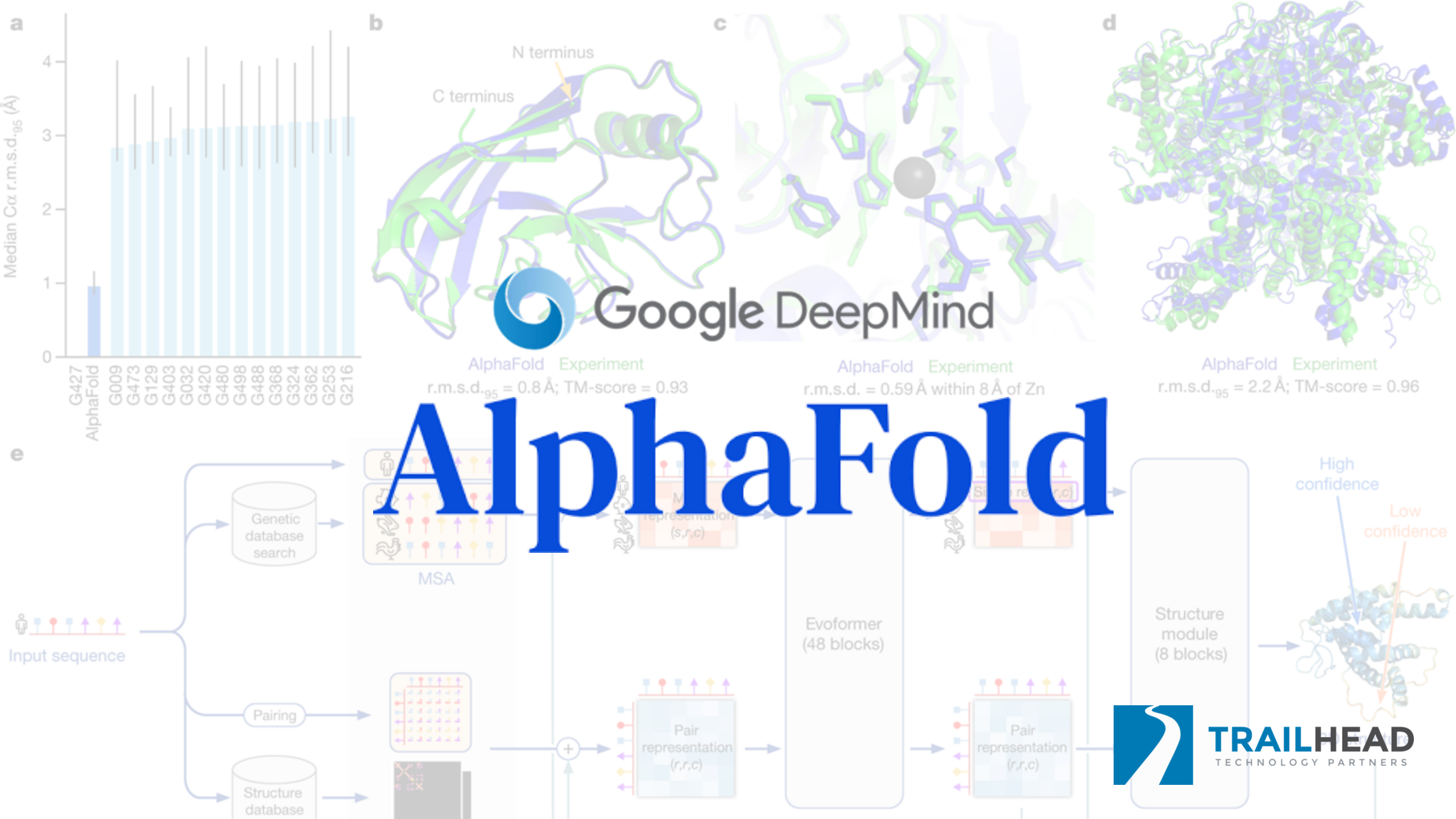
a
Median Cα r.m.s.d.95 (Å)
0
1
2
3
4
G427
AlphaFold
G009
G473
G129
G403
G032
G420
G480
G498
G488
G368
G324
G362
G253
G216
b
N terminus
C terminus
AlphaFold Experiment
r.m.s.d.95 = 0.8 Å; TM-score = 0.93
c
AlphaFold Experiment
r.m.s.d. = 0.59 Å within 8 Å of Zn
d
AlphaFold Experiment
r.m.s.d.95 = 2.2 Å; TM-score = 0.96
Google DeepMind
AlphaFold
e
Genetic database search
MSA
Input sequence
Pairing
Structure database
Pair representation (r,r,c)
Evoformer (48 blocks)
Pair representation (r,r,c)
Structure module (8 blocks)
High confidence
Low confidence
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TESLA
TRAILHEAD
TECHNOLOGY PARTNERS

VISA

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Cloud-Native

Cloud-Native

1. Containers

Containers and Orchestration

Containers are like lightweight, portable boxes that hold an app and everything it needs to run, so it works the same no matter where it's deployed.

Orchestration is the process of automatically managing, scaling, and coordinating containers so they run smoothly across multiple computers or environments.

TRAILHEAD
TECHNOLOGY PARTNERS

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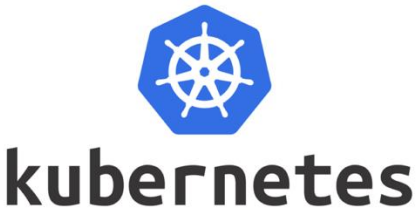

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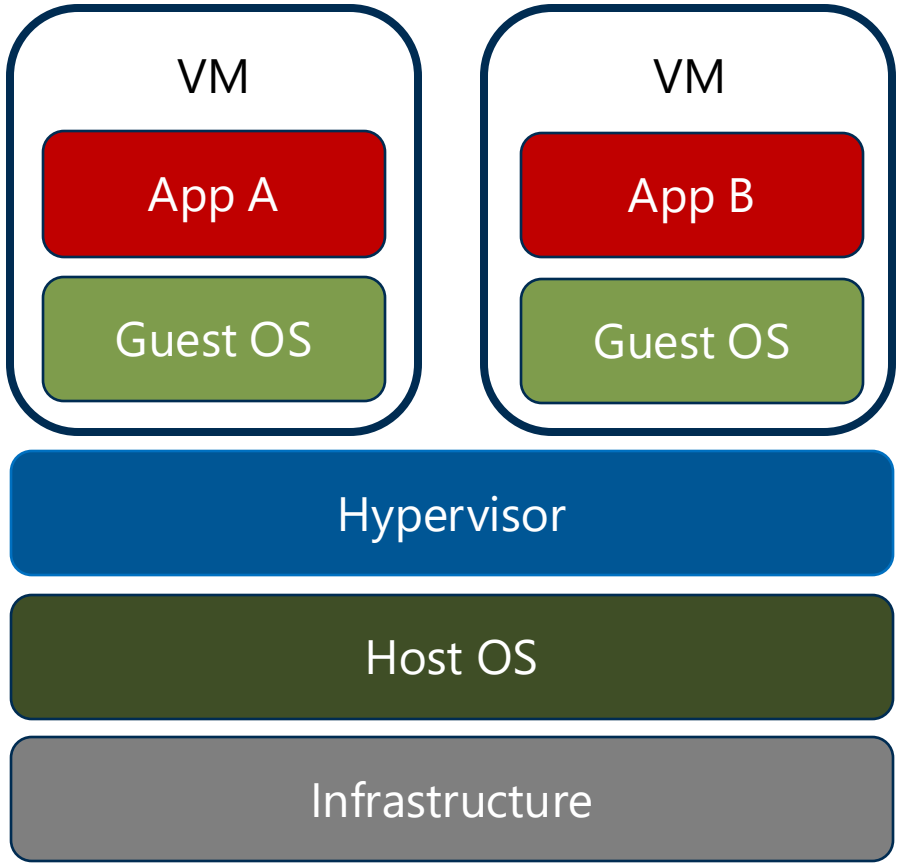
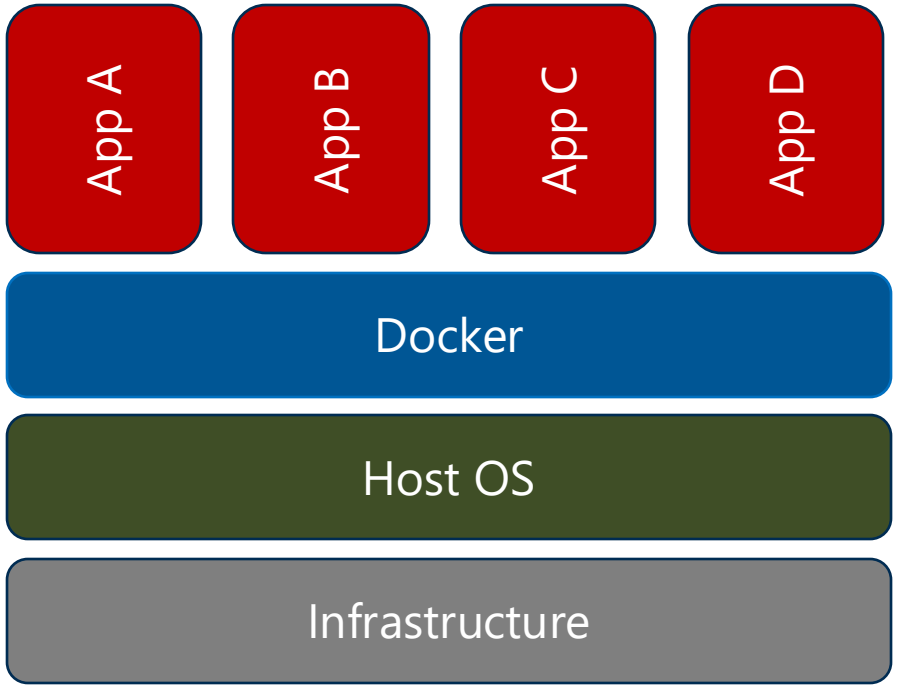
Containers and Orchestration

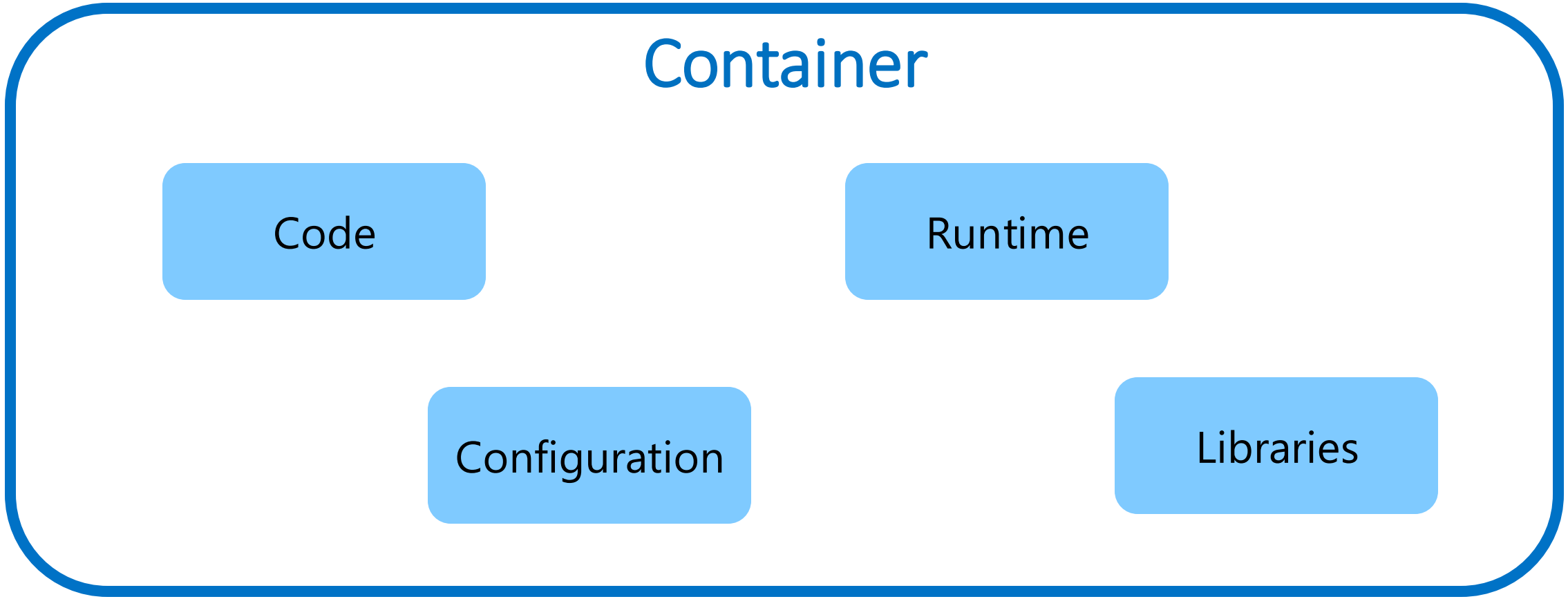


Virtual Machines

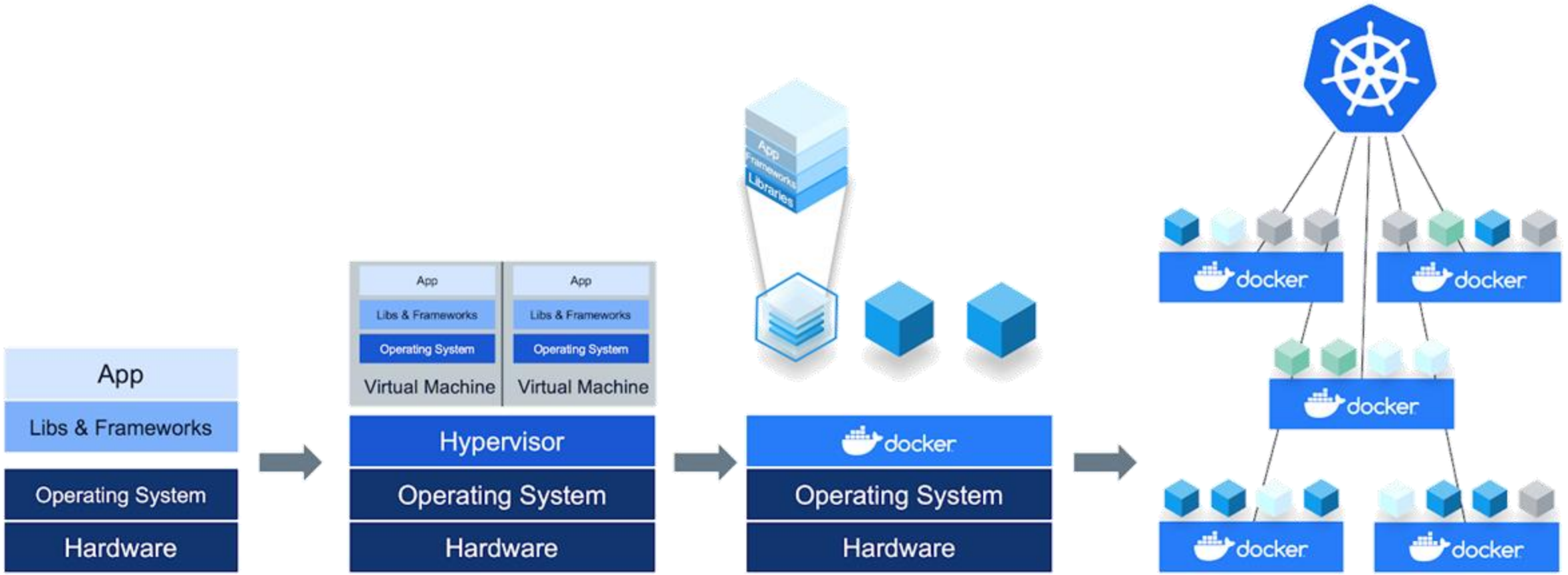


Containers

Containers and Orchestration



Kubernetes & Docker work together to build & run containerized applications



Source: https://www.docker.com/blog/top-questions-docker-kubernetes-competitors-or-together/

Containers and Orchestration

Load balancing

Self-healing

Multi-node deployment

Automatic scaling

Rolling updates

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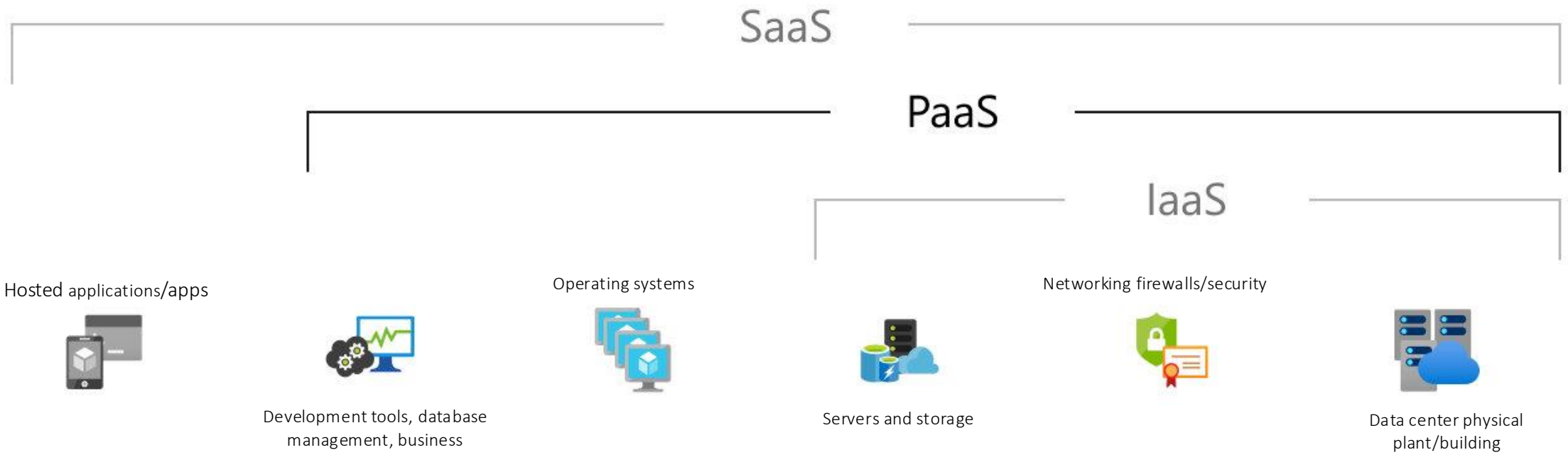
2. Serverless

Serverless

Serverless means you can **run your app in the cloud** without managing or worrying about servers—your **cloud provider handles all the infrastructure**, scaling, and maintenance for you, so you only **focus on the code**.

Serverless



Source: https://azure.microsoft.com/en-au/resources/cloud-computing-dictionary/what-is-paas

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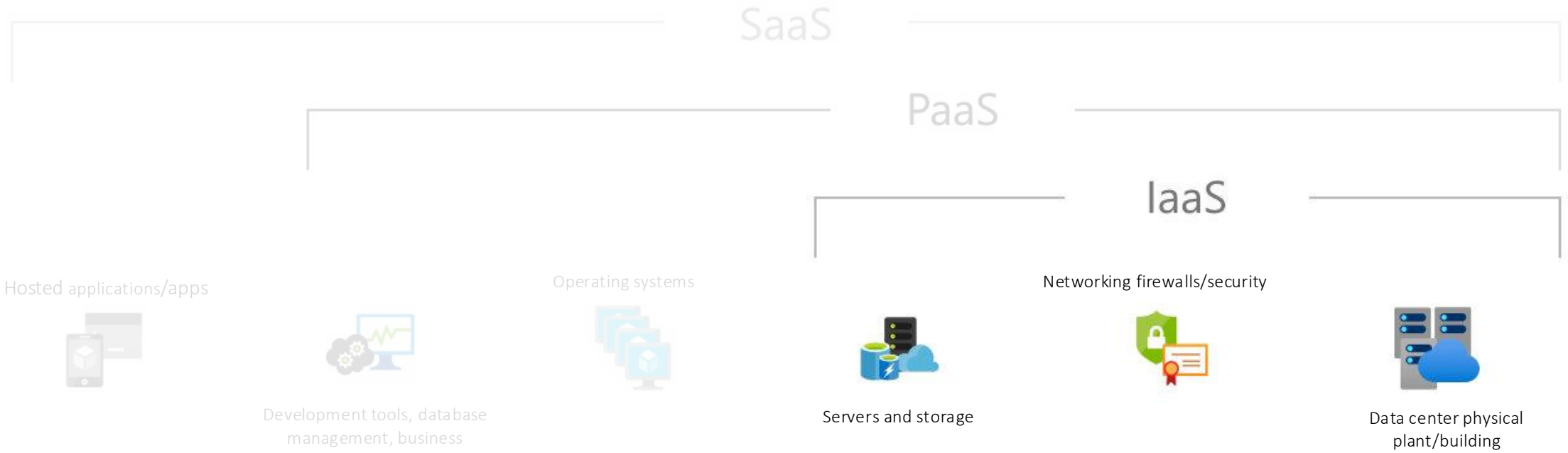
Serverless



Source: https://azure.microsoft.com/en-au/resources/cloud-computing-dictionary/what-is-paas

TRAILHEAD TECHNOLOGY PARTNERS

Serverless

SaaS

PaaS

IaaS

Hosted applications/apps

Development tools, database management, business analytics

Operating systems

Servers and storage

Networking firewalls/security

Data center physical plant/building

Source: https://azure.microsoft.com/en-au/resources/cloud-computing-dictionary/what-is-paas

TRAILHEAD TECHNOLOGY PARTNERS

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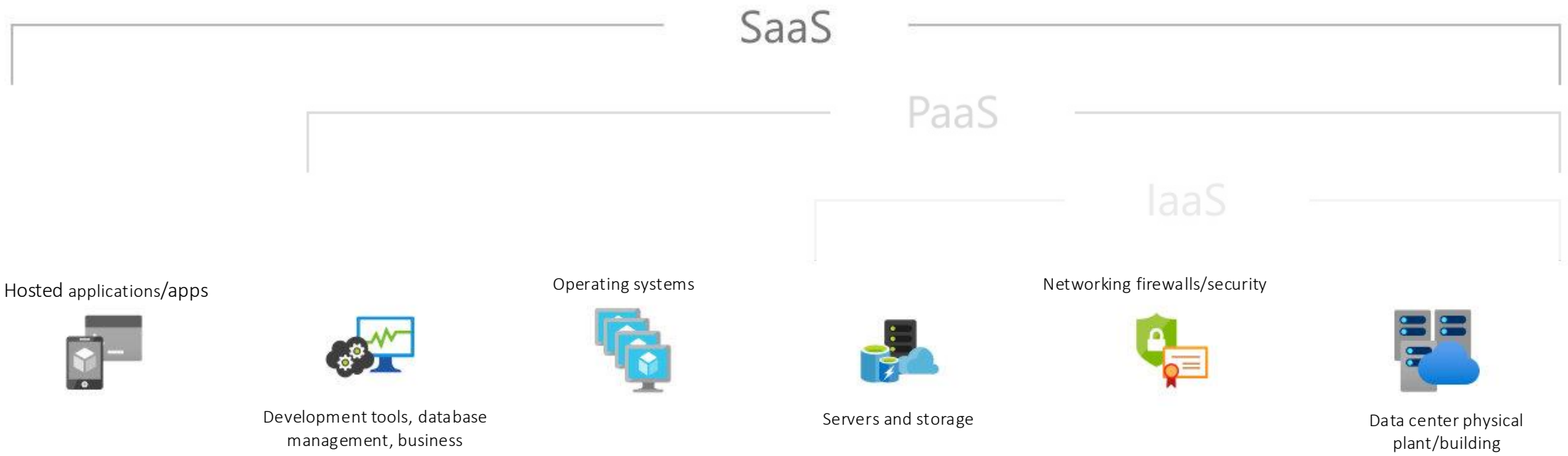

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Serverless


aws Lambda


AzureFunctions


Google
Cloud Functions


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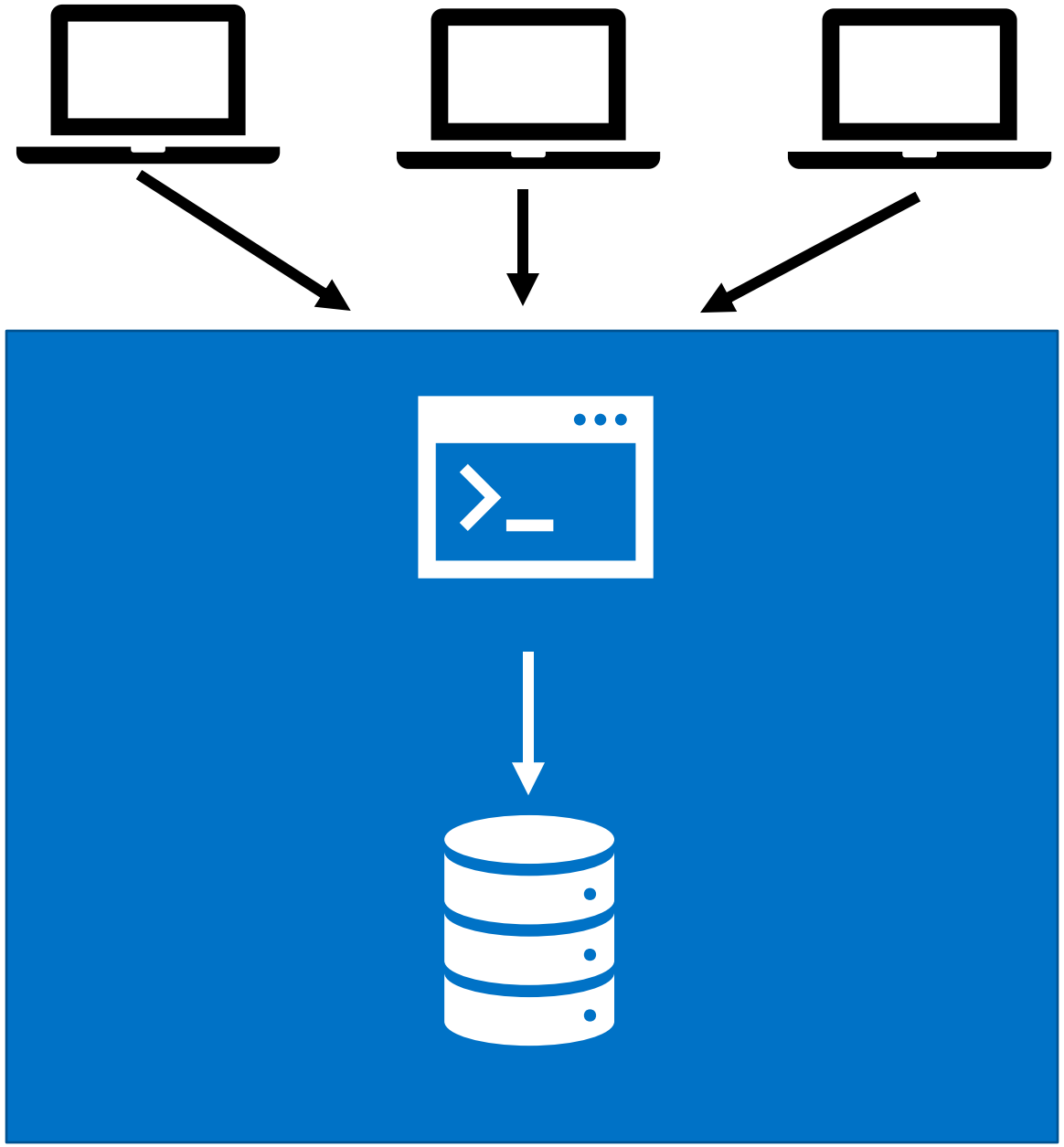
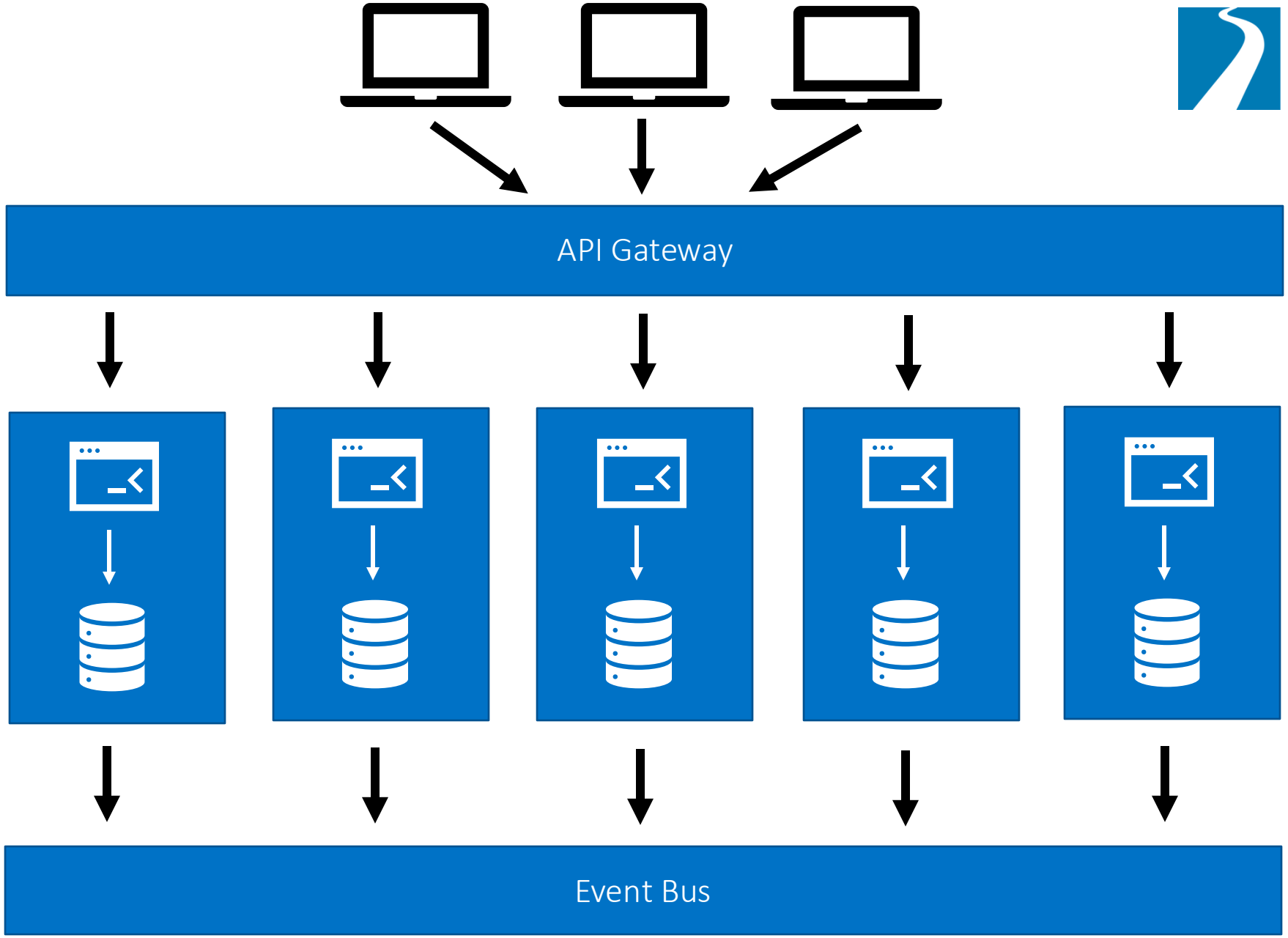
Software Architecture

Microservices

Microservices break an app into **small, independent pieces** that each handle a specific function, so they can be **developed, deployed, and scaled separately** from the rest of the app.





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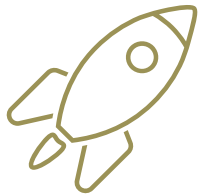
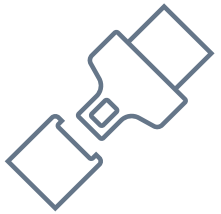
Microservices

More Scalability Options



Independent Deployability



Isolate Surface Area of Failure

Independent Teams

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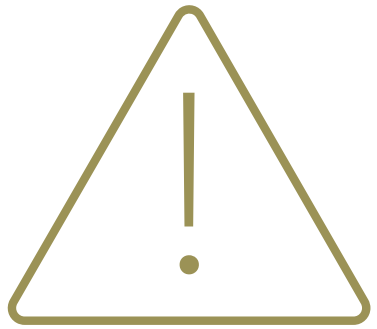
Microservices



Microservices are *hard* to do well

Wrong reasons create distributed monoliths

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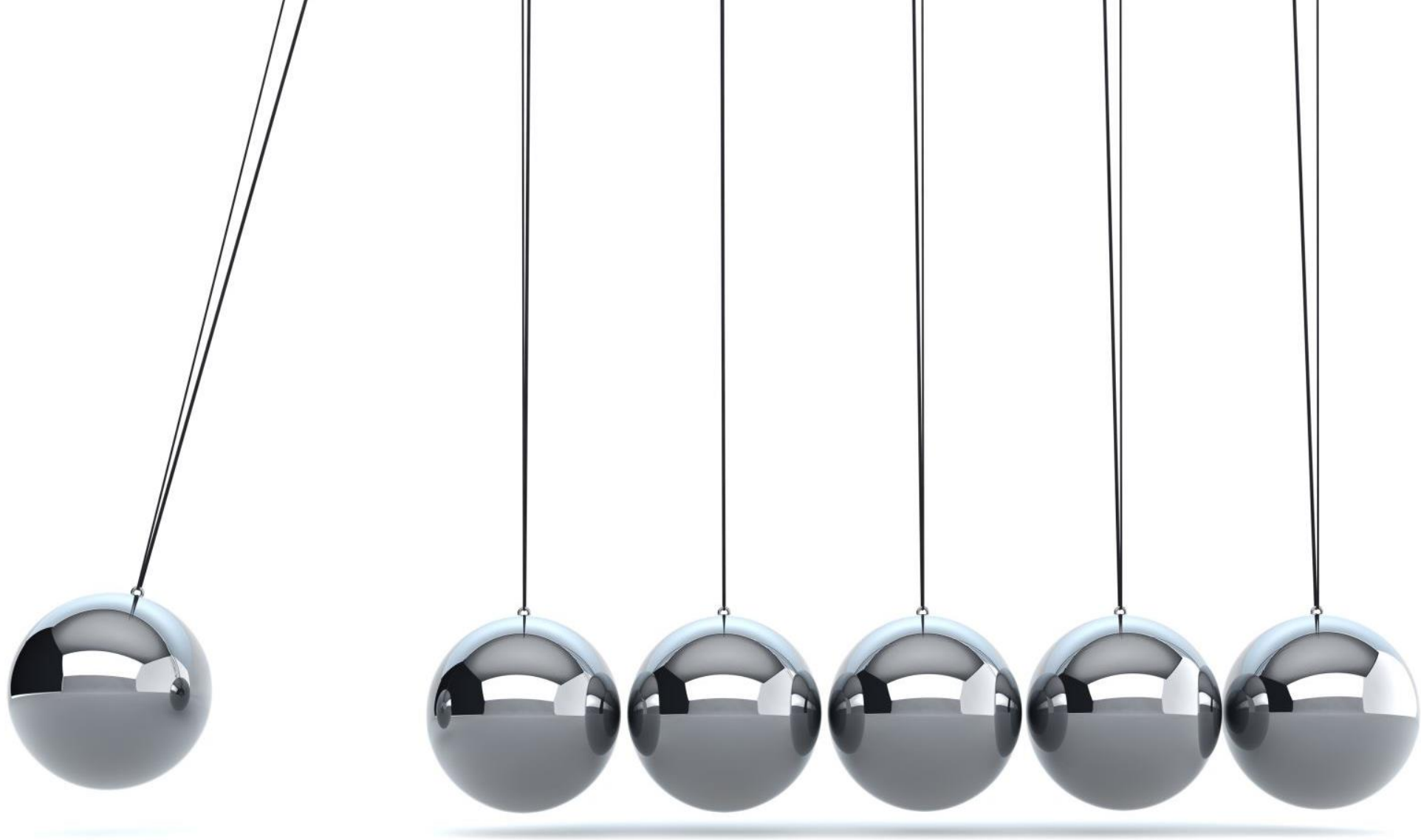
TECHNOLOGY PARTNERS



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Modular Monolith

A **modular monolith** is a **single app** that's built in a **structured way**, with **clear modules** or components, so it's easier to develop and maintain like microservices, but **without the complexity of managing separate services**.

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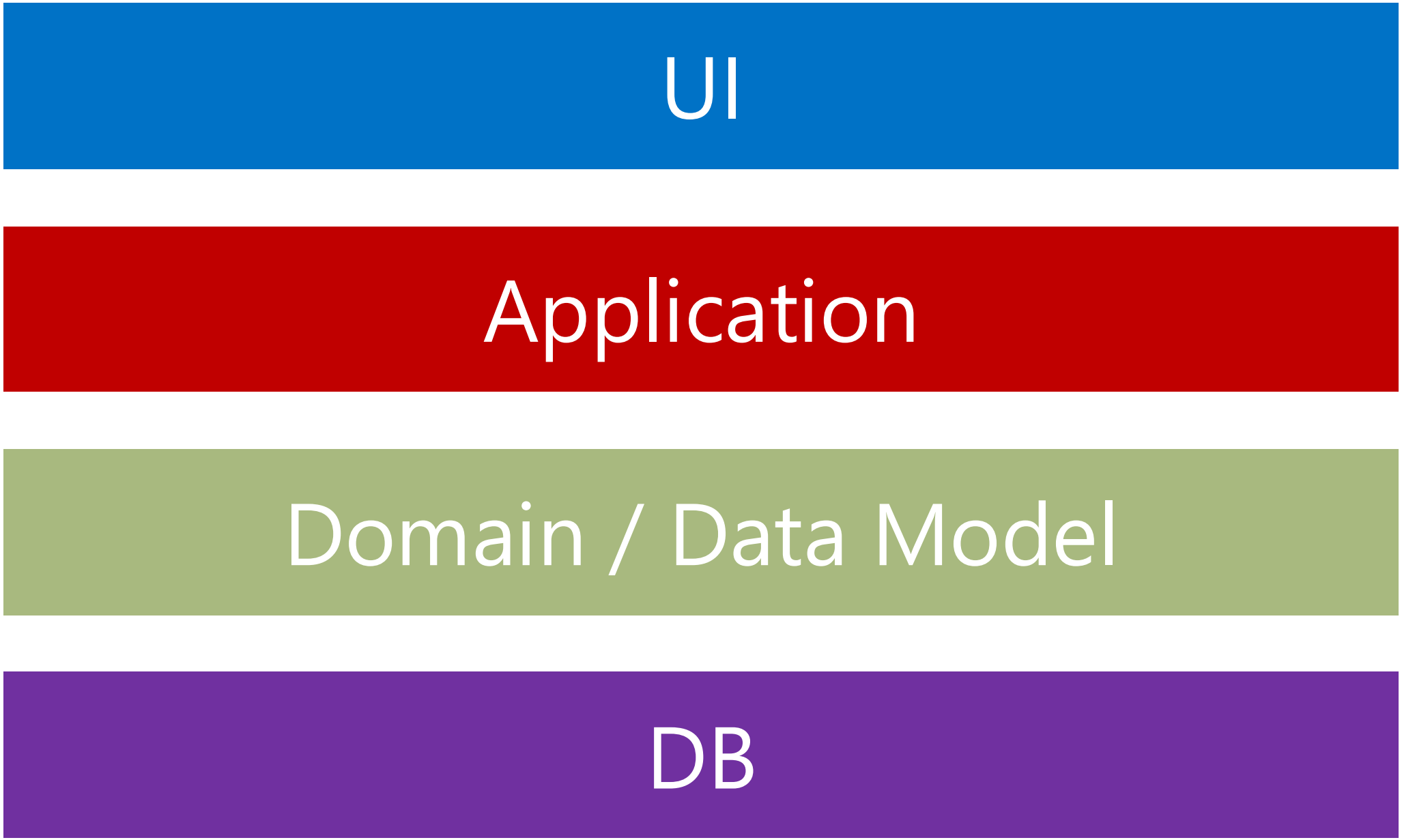
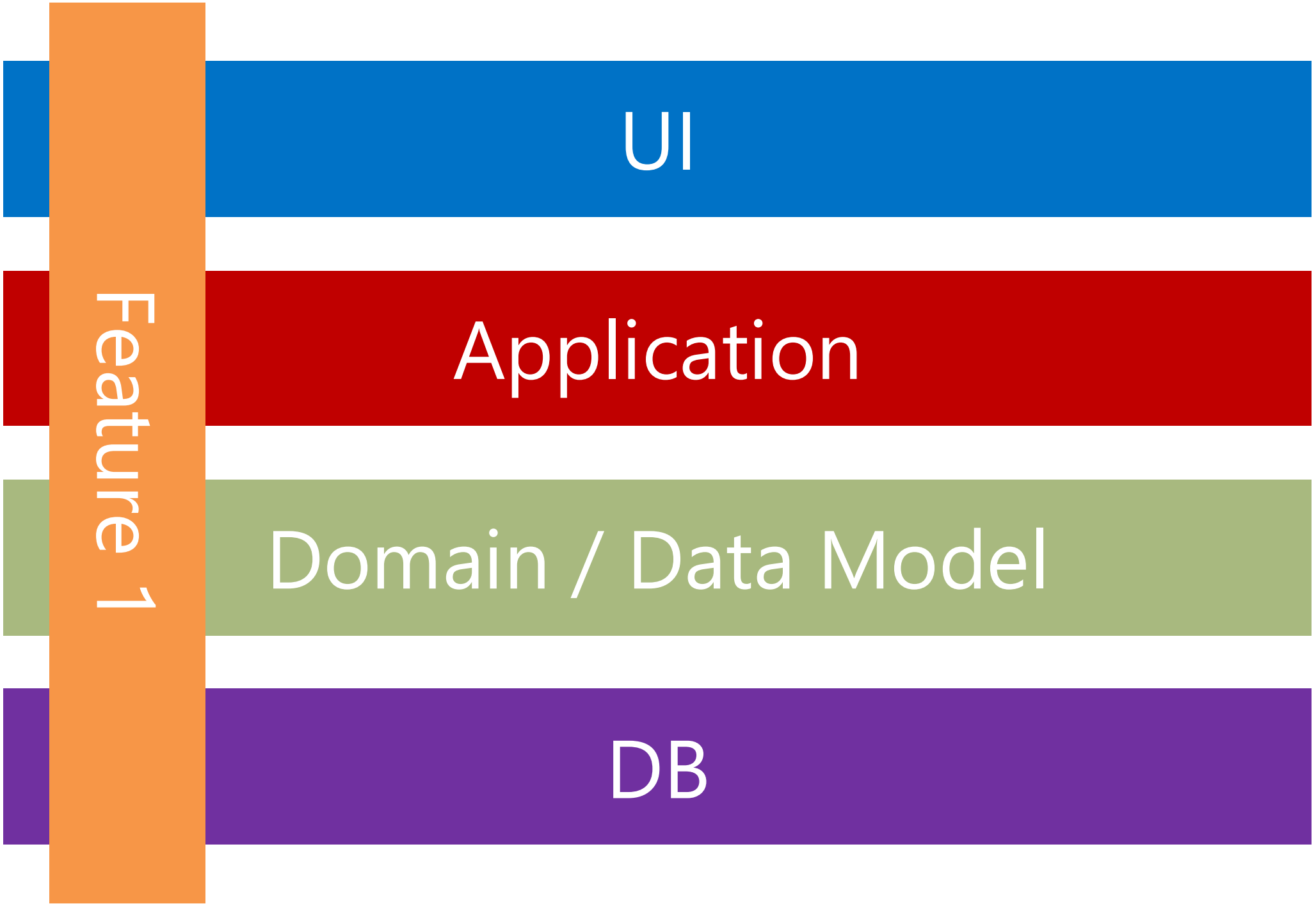
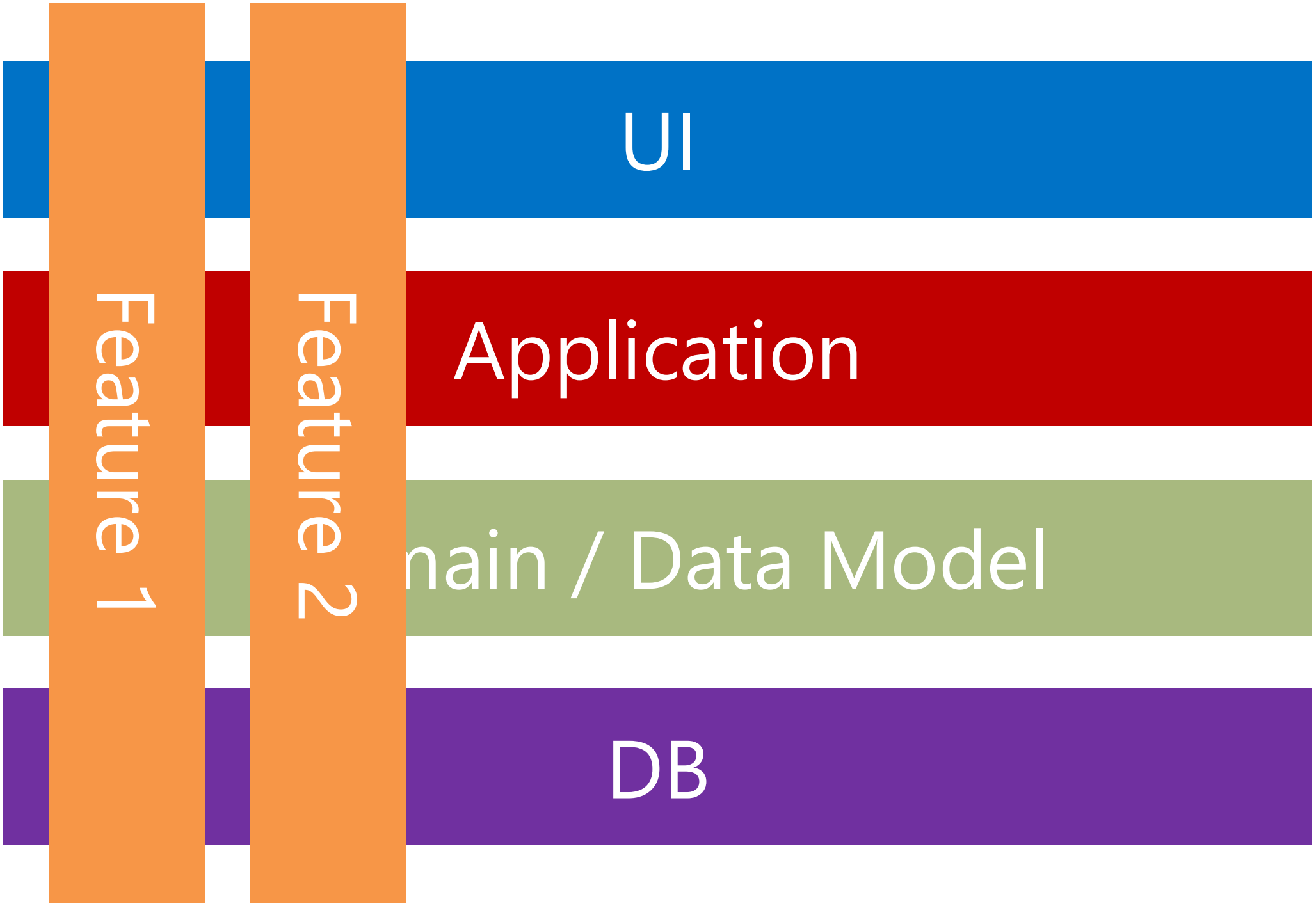
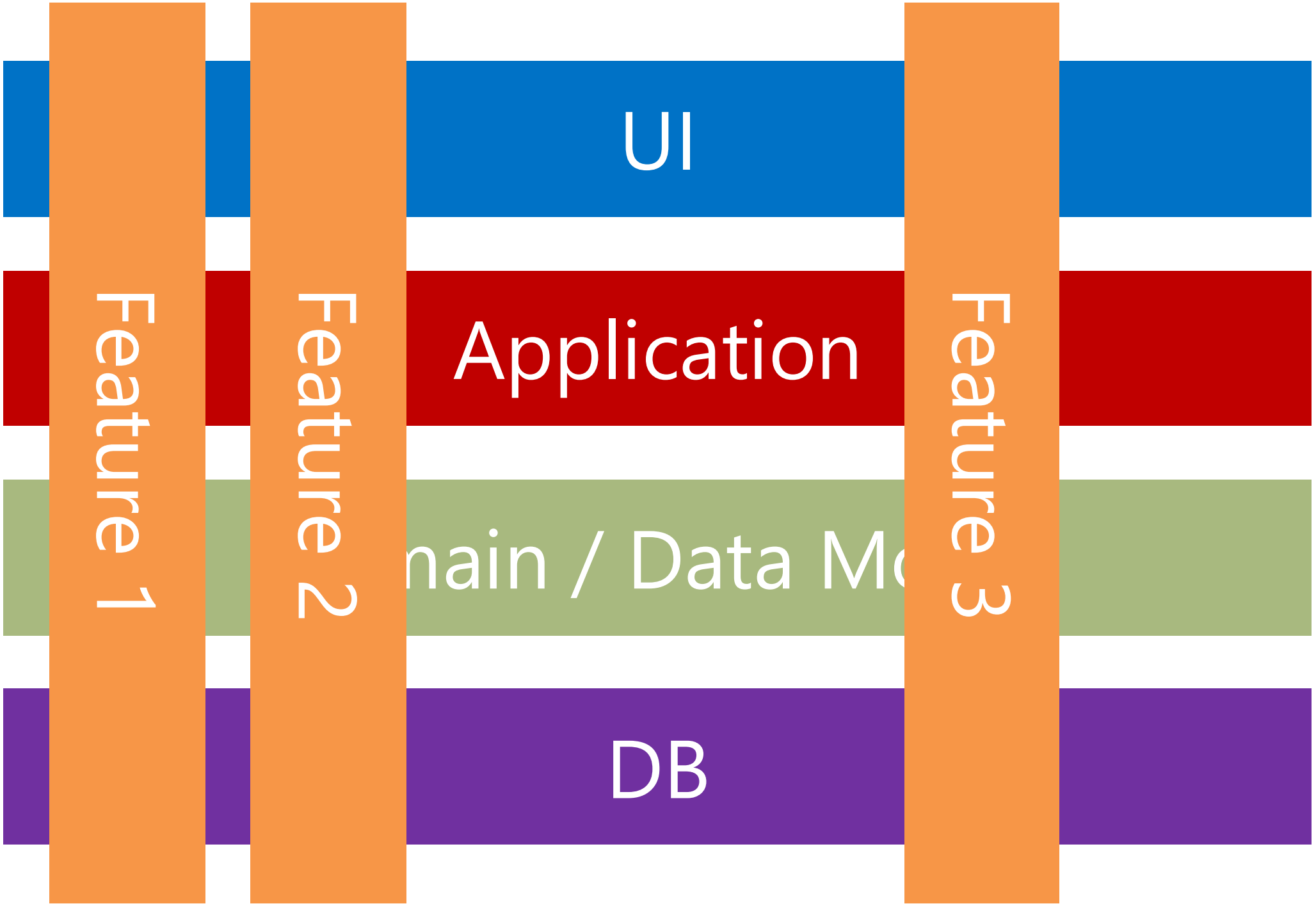
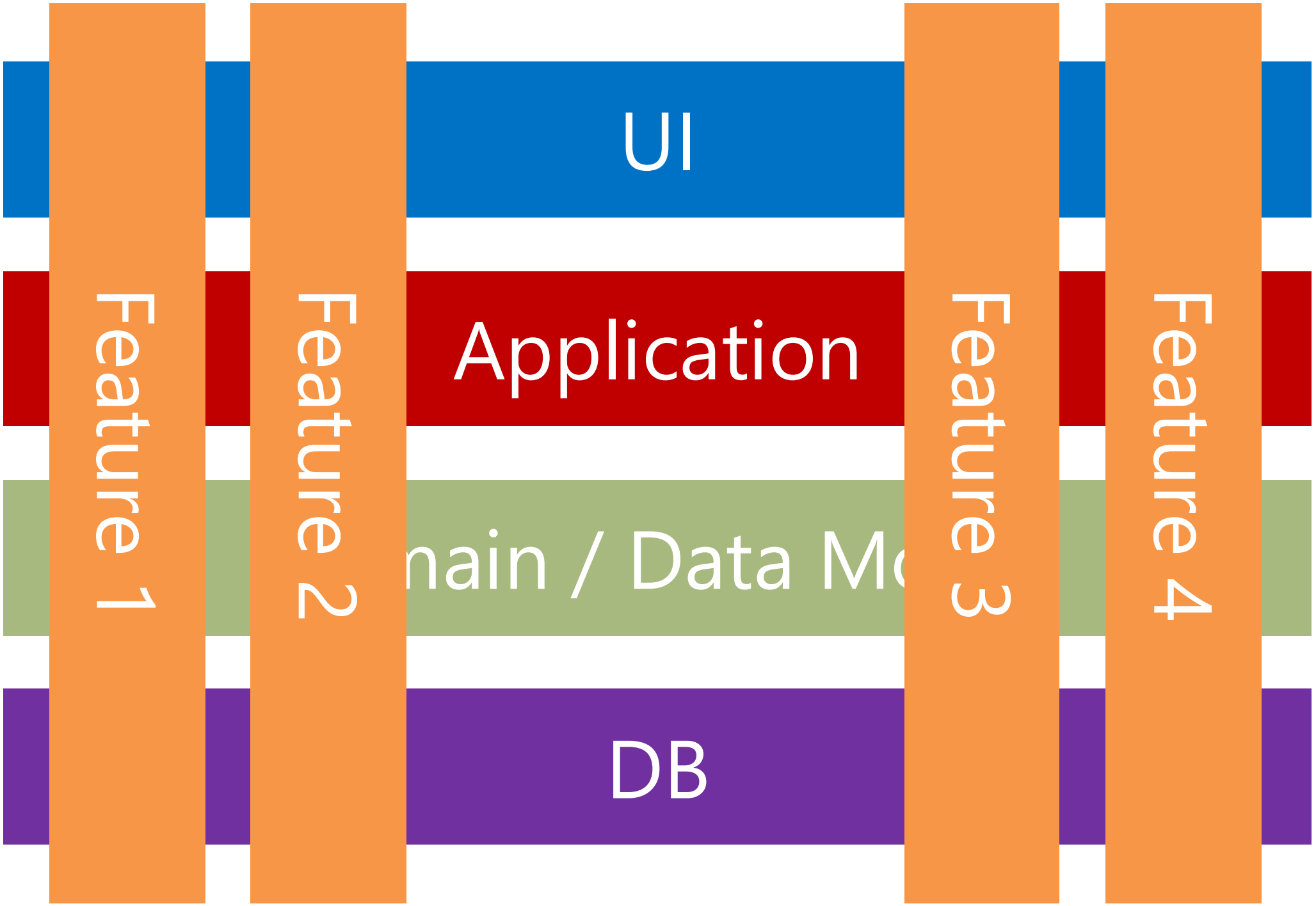
Vertical Slice Architecture

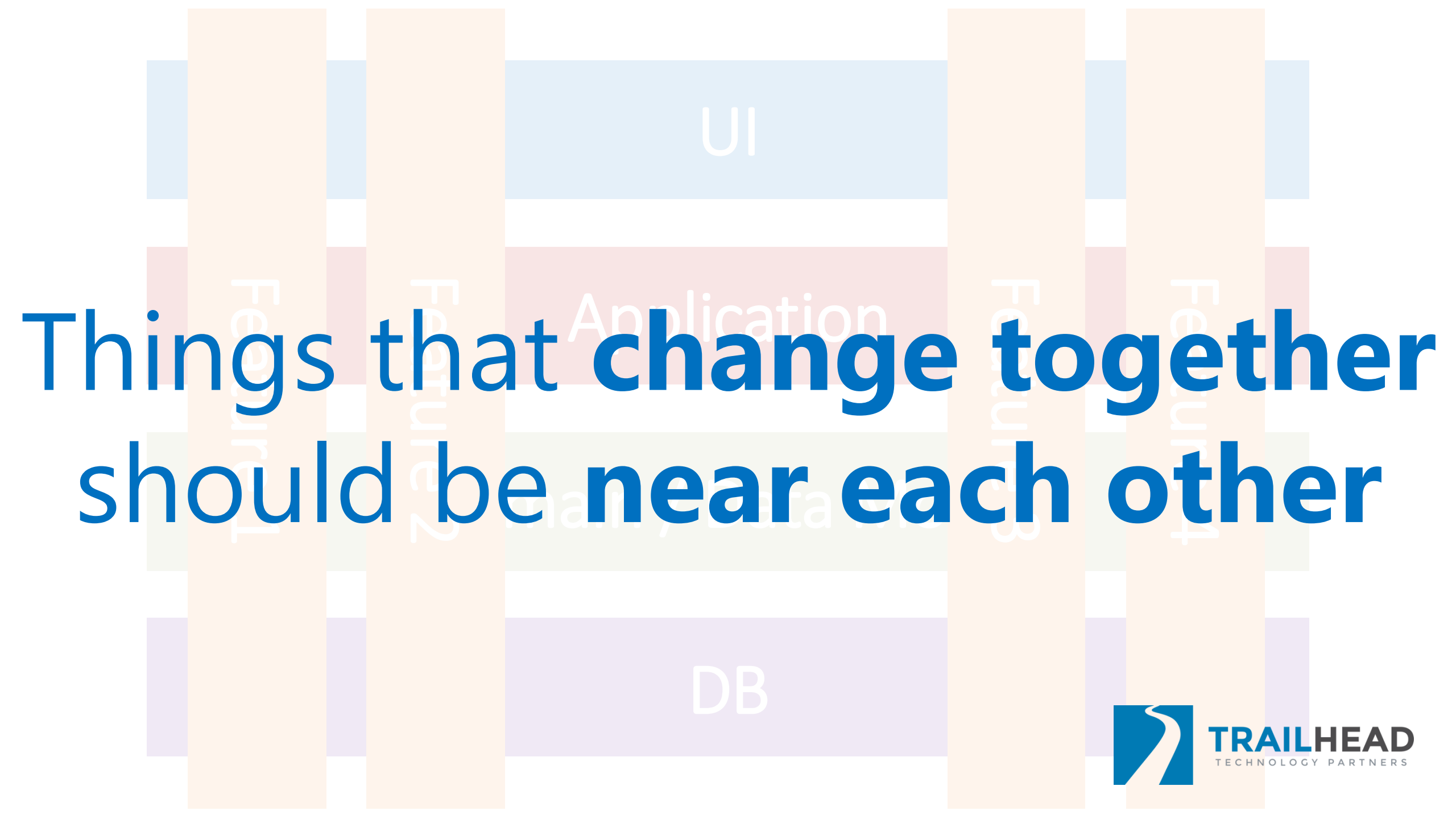

UI
Application
Domain / Data Model
DB


UI
Application
Domain / Data Model
DB
Feature 1


UI
Application
main / Data Model
DB
Feature 1
Feature 2


UI
Application
main / Data M
DB
Feature 1
Feature 2
Feature 3


UI
Application
main / Data M
DB
Feature 1
Feature 2
Feature 3
Feature 4

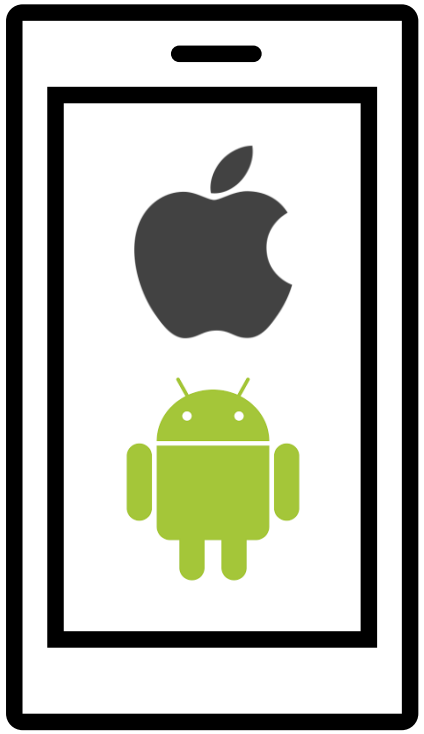


Things that **change together** should be **near each other**

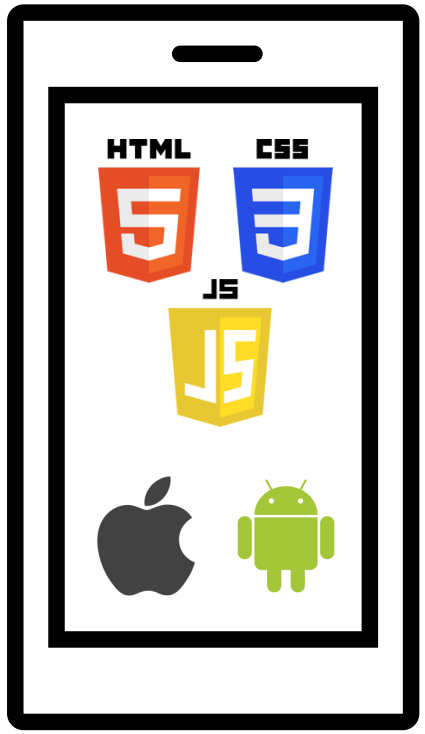
TRAILHEAD
TECHNOLOGY PARTNERS

Web and Mobile

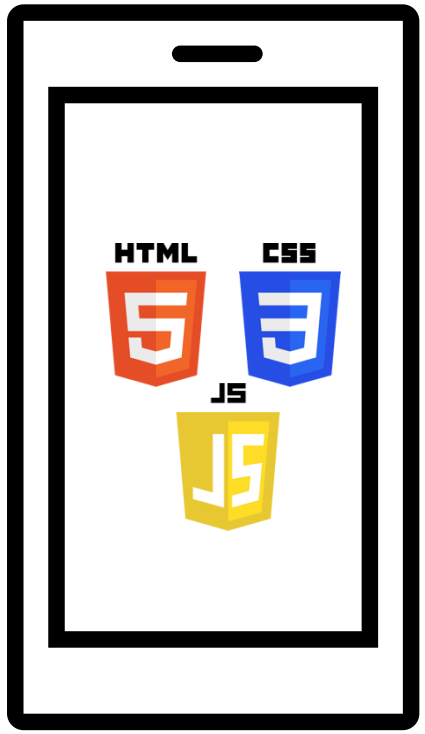
Hybrid & Progressive Web Apps



Native



Hybrid



PWA

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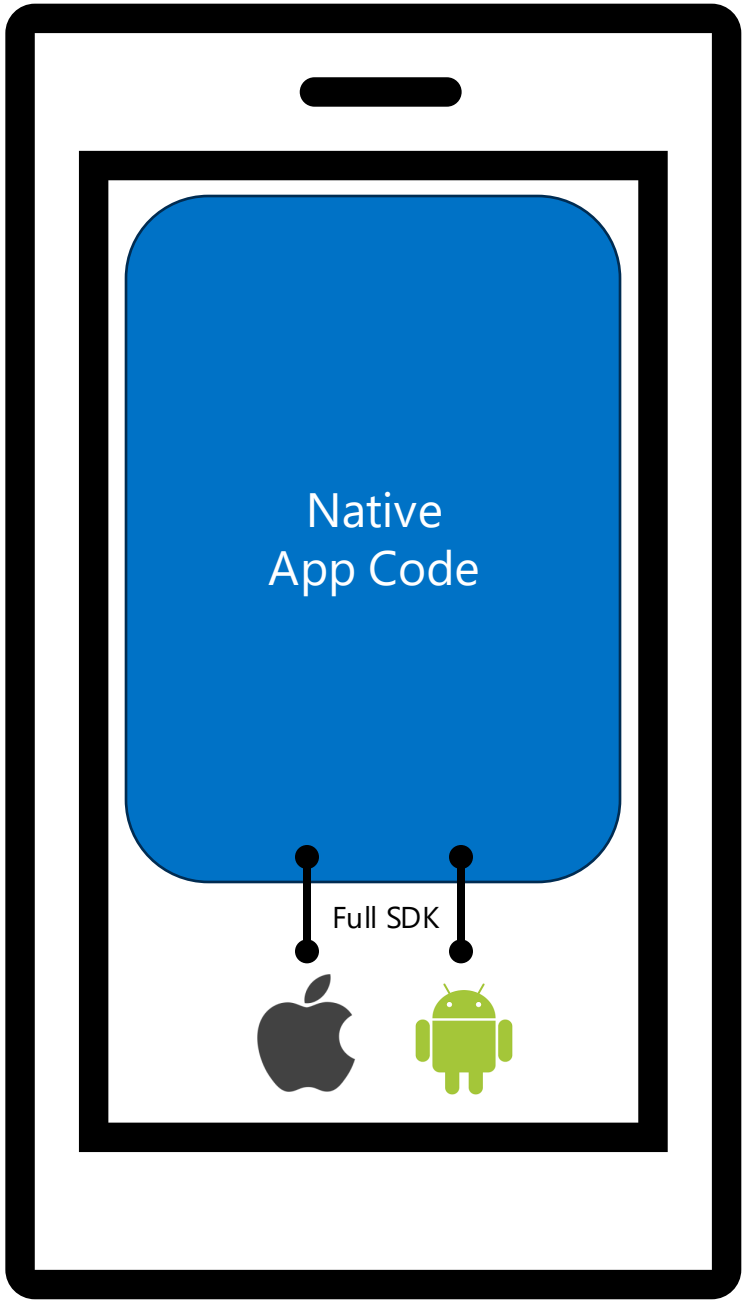
Native Apps



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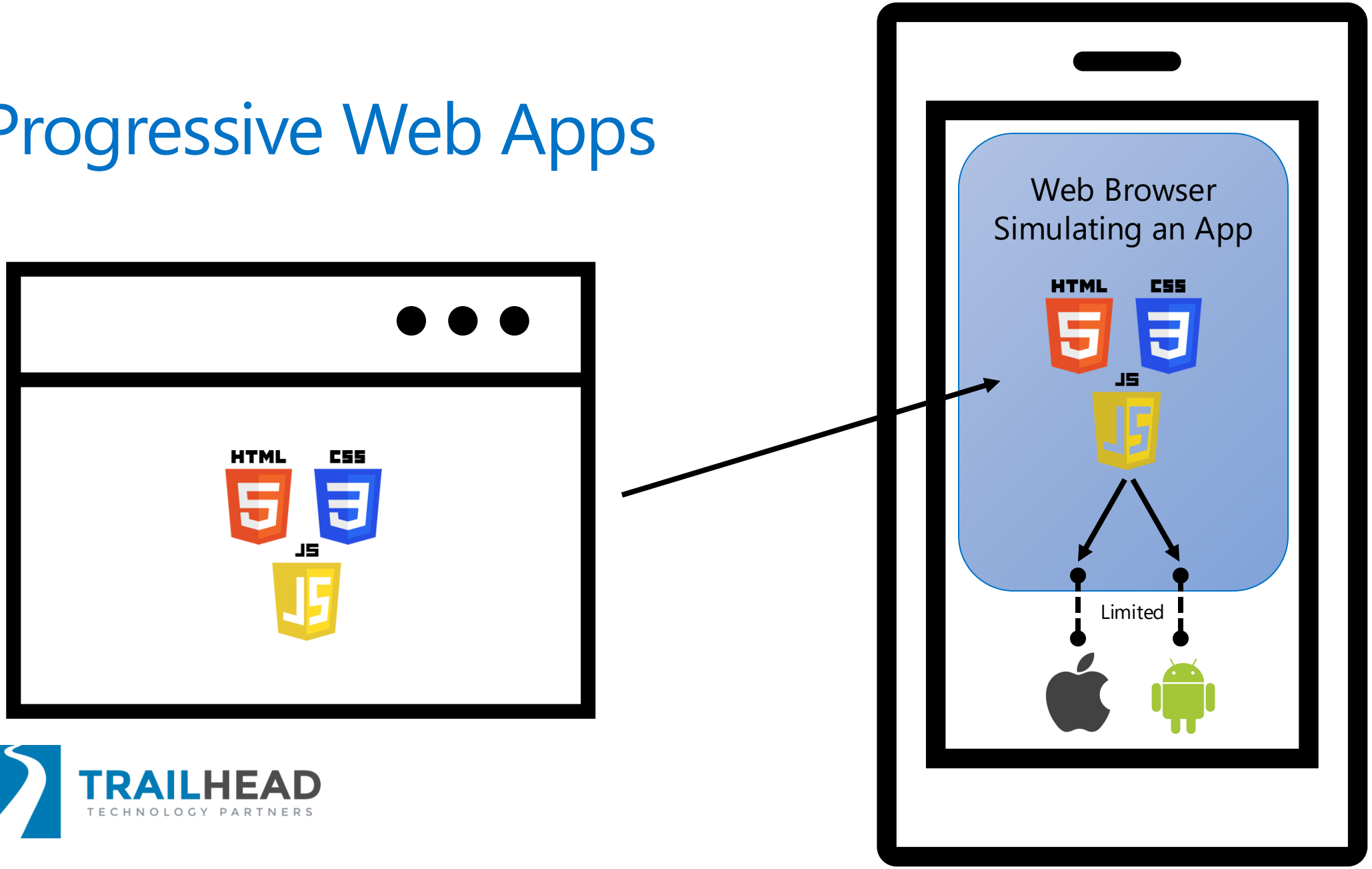
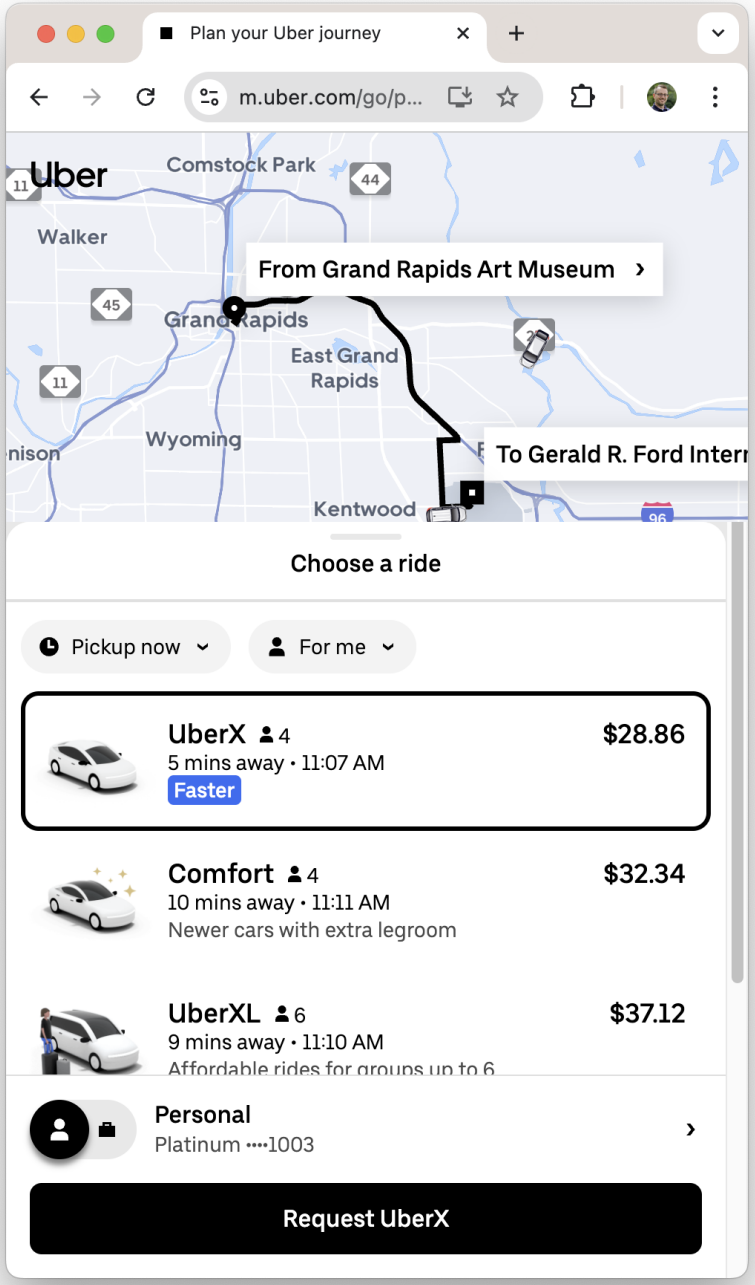
Progressive Web Apps



TRAILHEAD
TECHNOLOGY PARTNERS

Web App to PWA

1. Enable HTTPs
2. Create App Manifest
3. Implement Service Worker



TRAILHEAD
TECHNOLOGY PARTNERS

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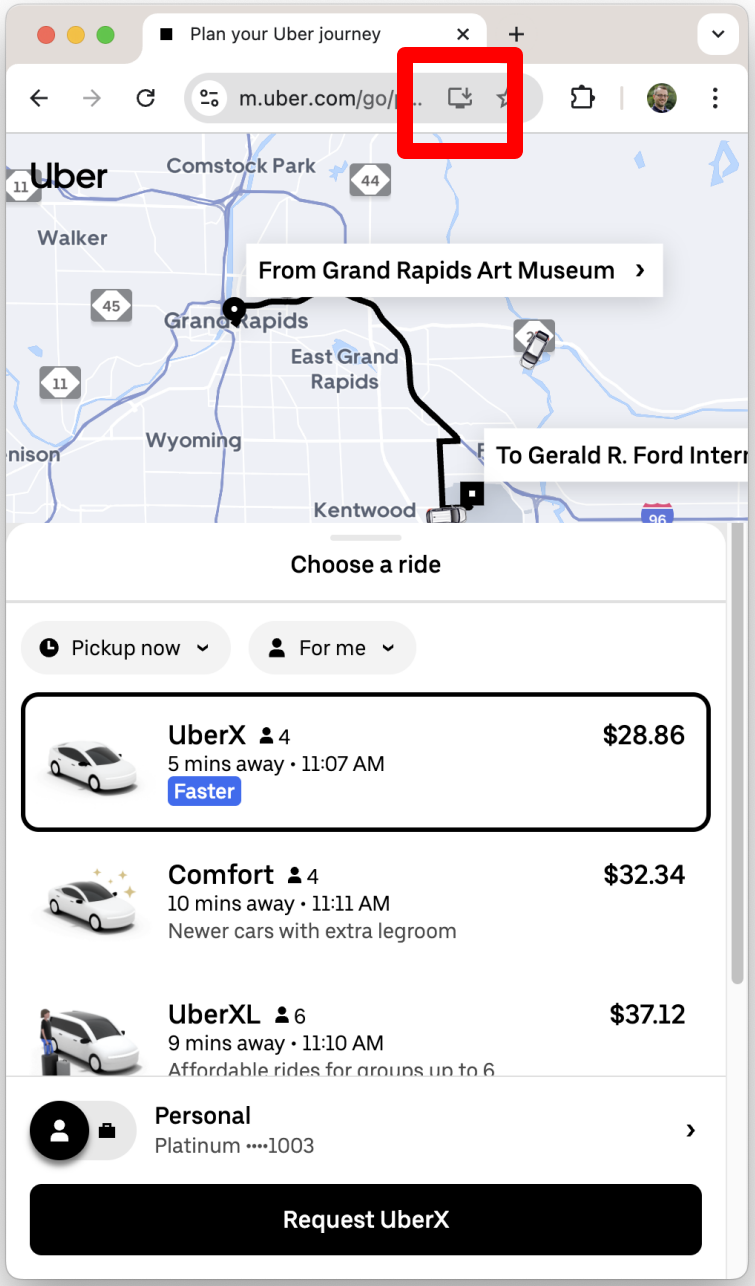

TRAILHEAD
TECHNOLOGY PARTNERS

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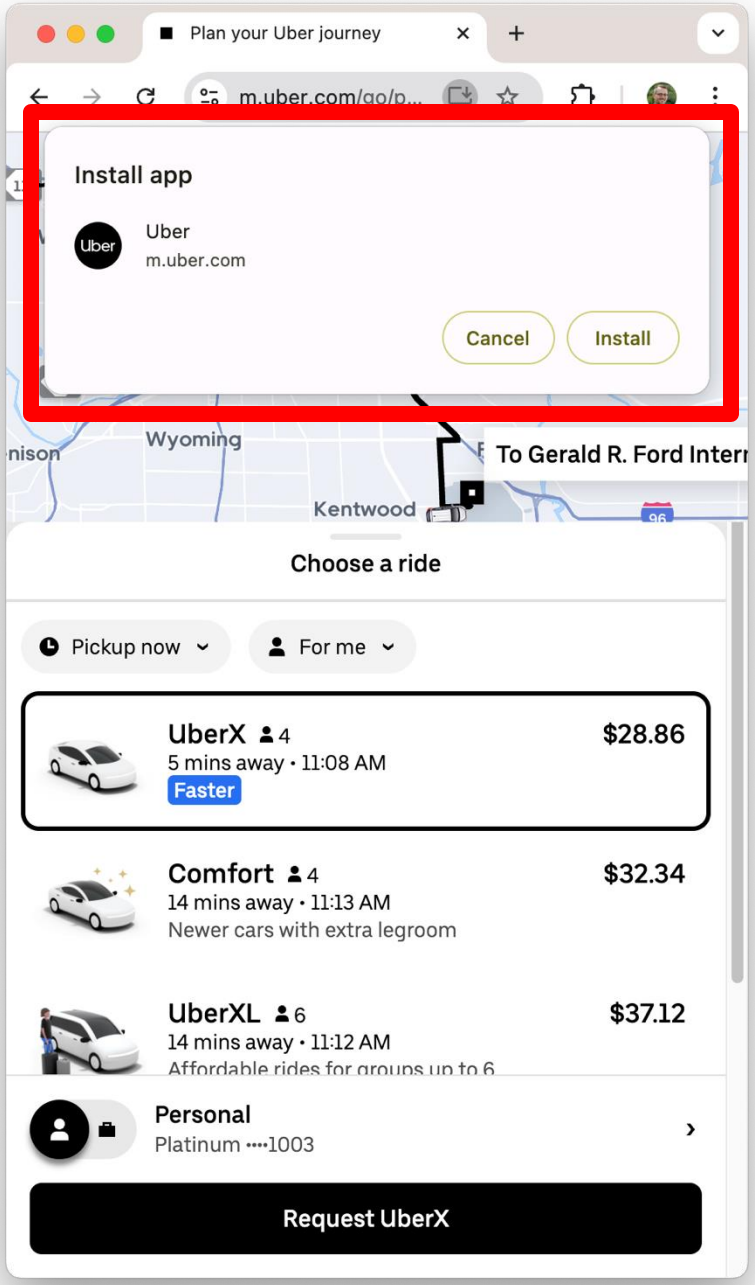

TRAILHEAD
TECHNOLOGY PARTNERS

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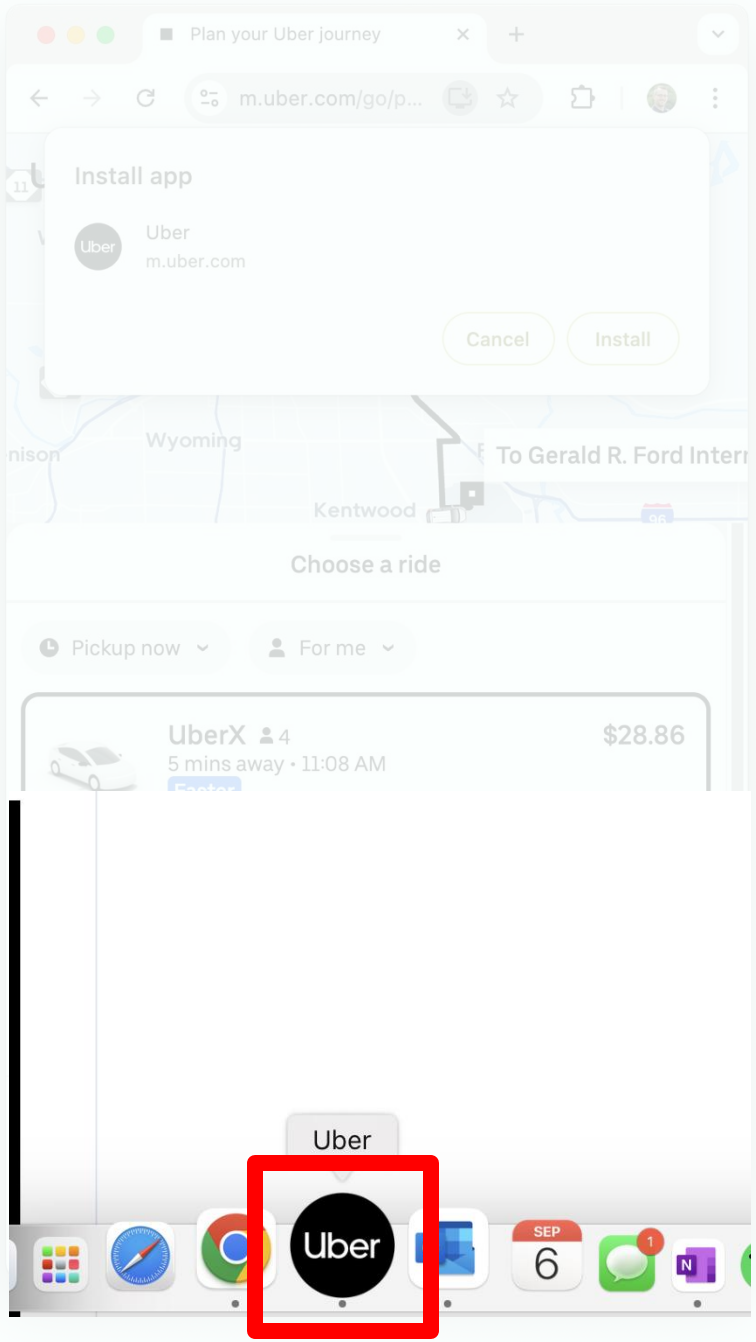

TRAILHEAD
TECHNOLOGY PARTNERS

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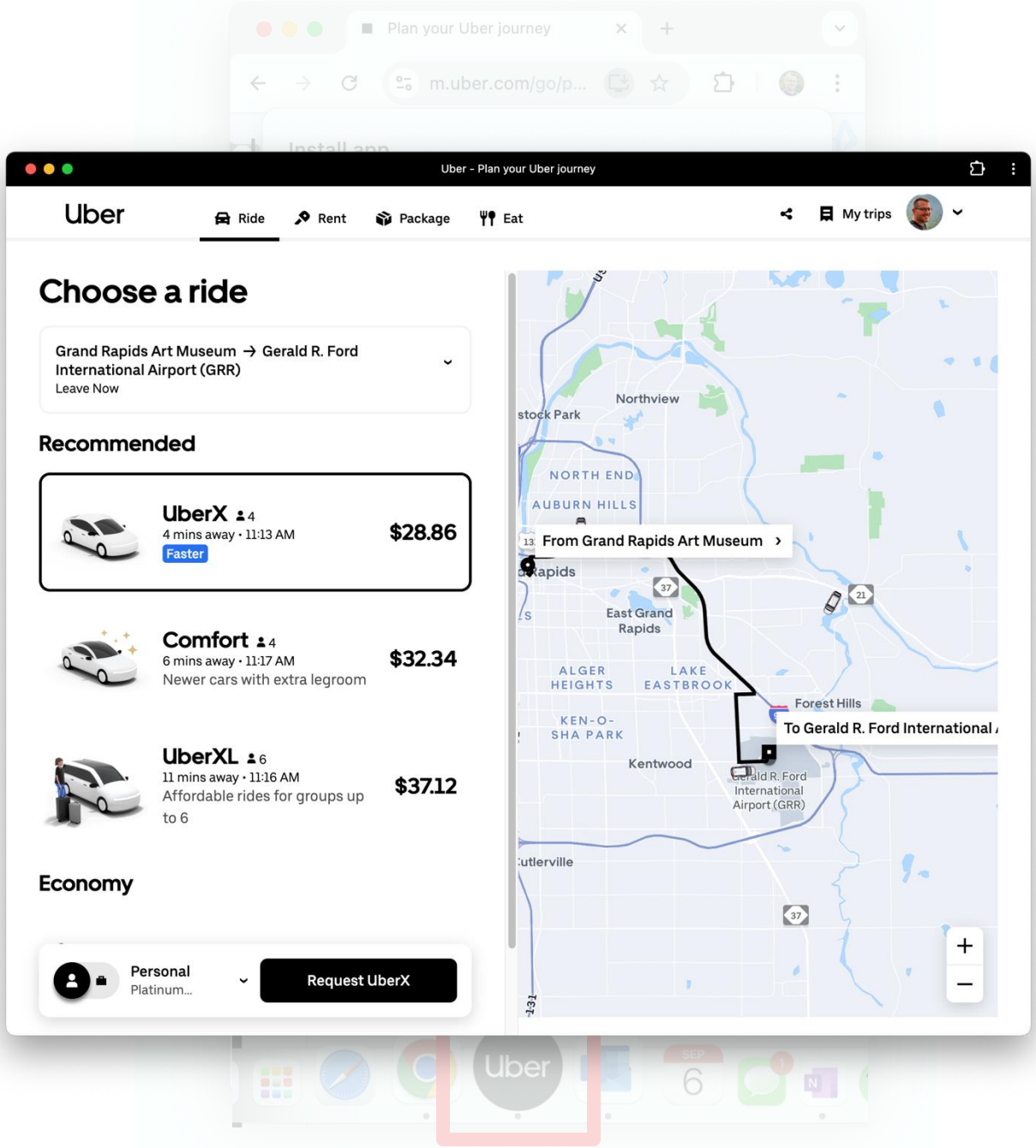

TRAILHEAD
TECHNOLOGY PARTNERS

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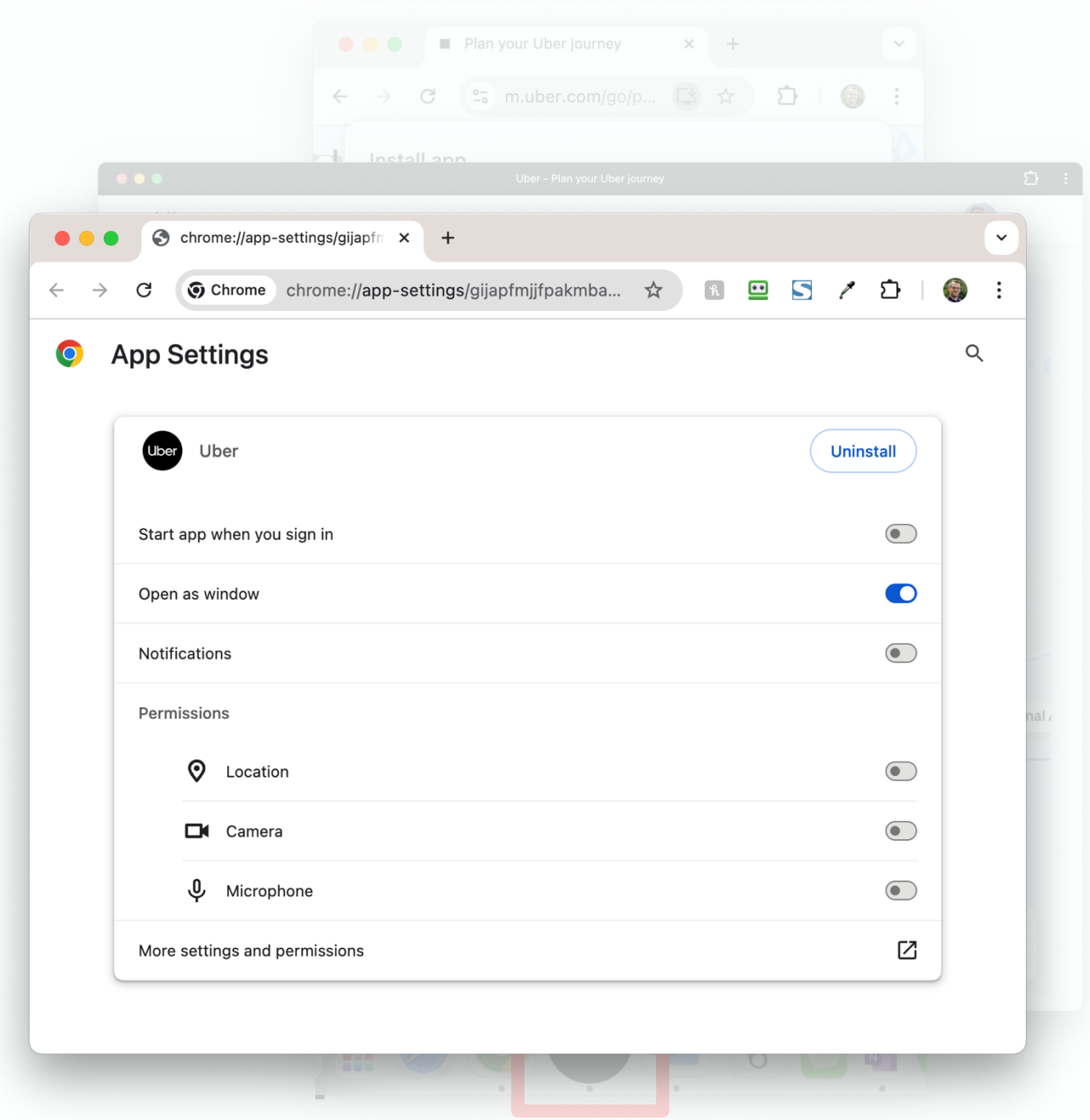
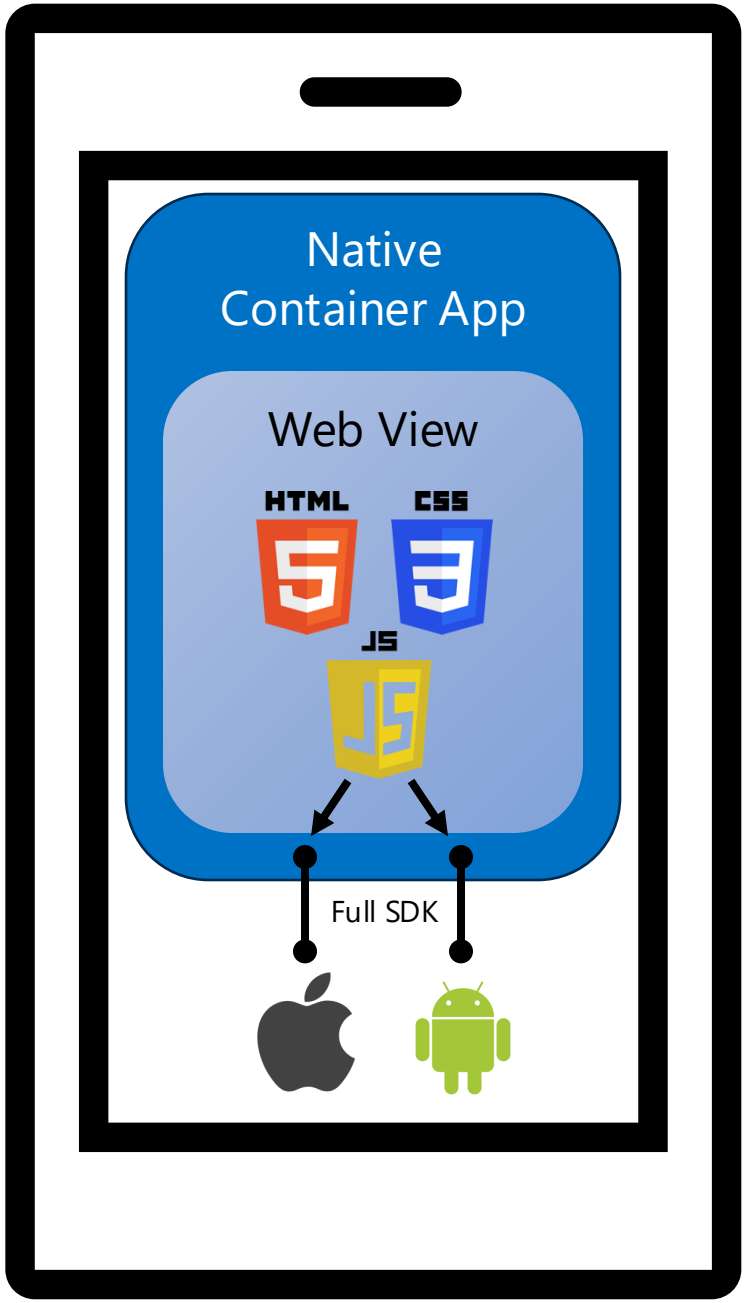


TRAILHEAD
TECHNOLOGY PARTNERS

Hybrid Mobile



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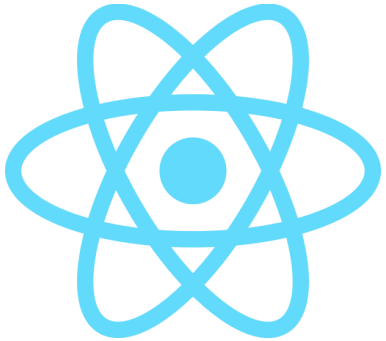
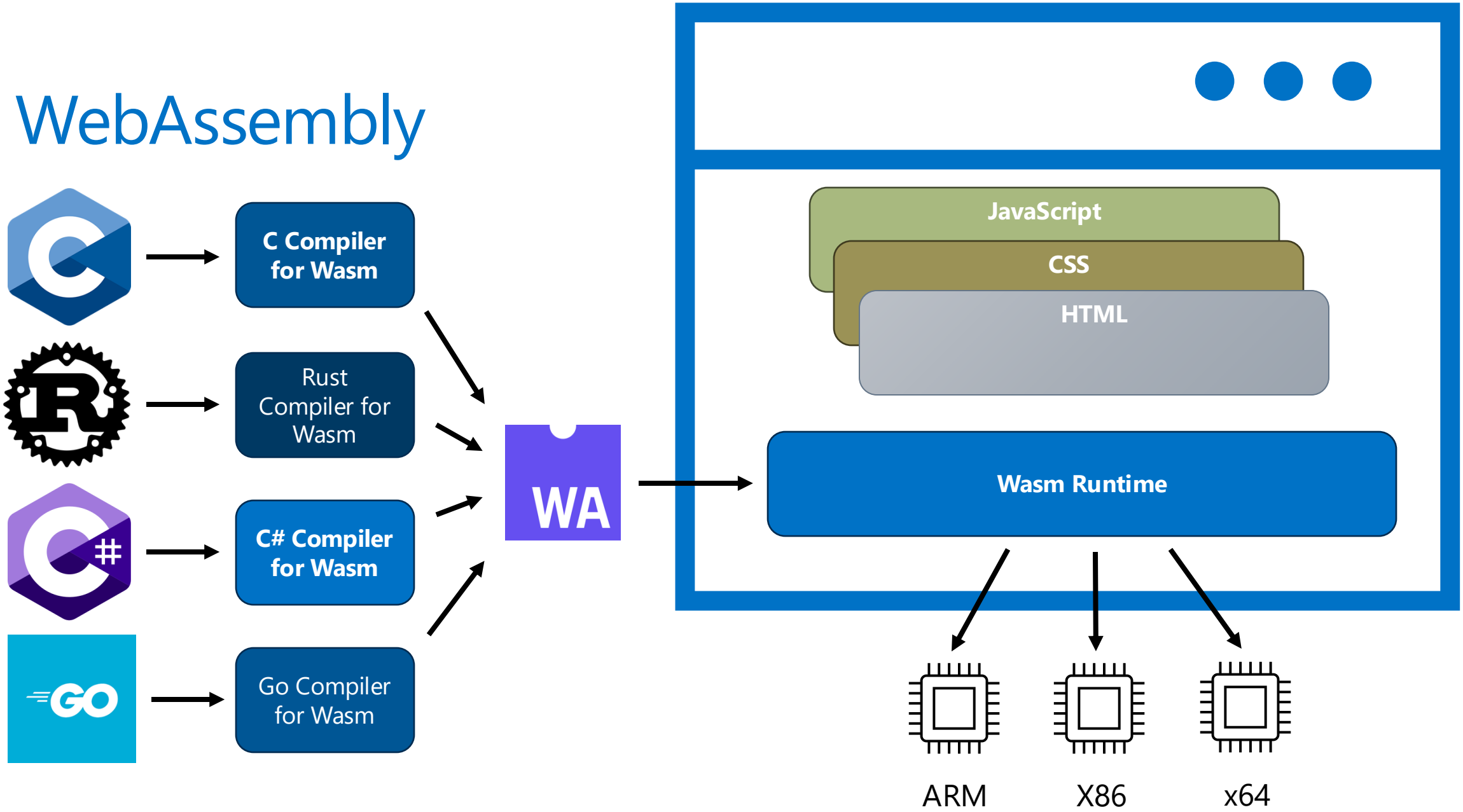
Hybrid Mobile

	React Native	Flutter	Ionic with Capacitor
			
LANGUAGE	JavaScript	Dart	JavaScript
UI	Native UI via JSX	Proprietary Widgets	HTML & CSS
REUSE	70%	80%	98%
CREATOR	Facebook	Google	Outsystems

WebAssembly

WebAssembly (Wasm) is a **binary instruction format** that allows code written in other languages to run in the browser at **near-native speed**, providing **faster performance than JavaScript**, especially for computation-heavy tasks.

WebAssembly



WebAssembly Support

WebAssembly - OTHER

Usage % of all users ?

Global 96.02%

WebAssembly or "wasm" is a new portable, size- and load-time-efficient format suitable for compilation to the web.

Current aligned | Usage relative | Date relative | Filtered | All

Chrome	Edge *	Safari	Firefox	Opera	IE	Chrome for Android	Safari on iOS *	Samsung Internet	Opera Mini *	Opera Mobile *	UC Browser for Android	Android Browser *	Firefox for Android	QQ Browser	Baidu Browser	KaiOS Browser
			2-46													
4-50	12-14		1 47-51	10-37												
2 51-56	3 15	3.1-10.1	4 52	2 38-43			3.2-10.3	4-6.4								
57-127	16-127	11-17.4	53-129	44-110	6-10		11-17.4	7.2-24		12-12.1		2.1-4.4.4				1 2.5
128	128	17.5	130	111	11	128	17.5	25	all	80	15.5	128	127	14.9	13.52	3.1
129-131		17.6-TP	131-133				17.6-18.0									

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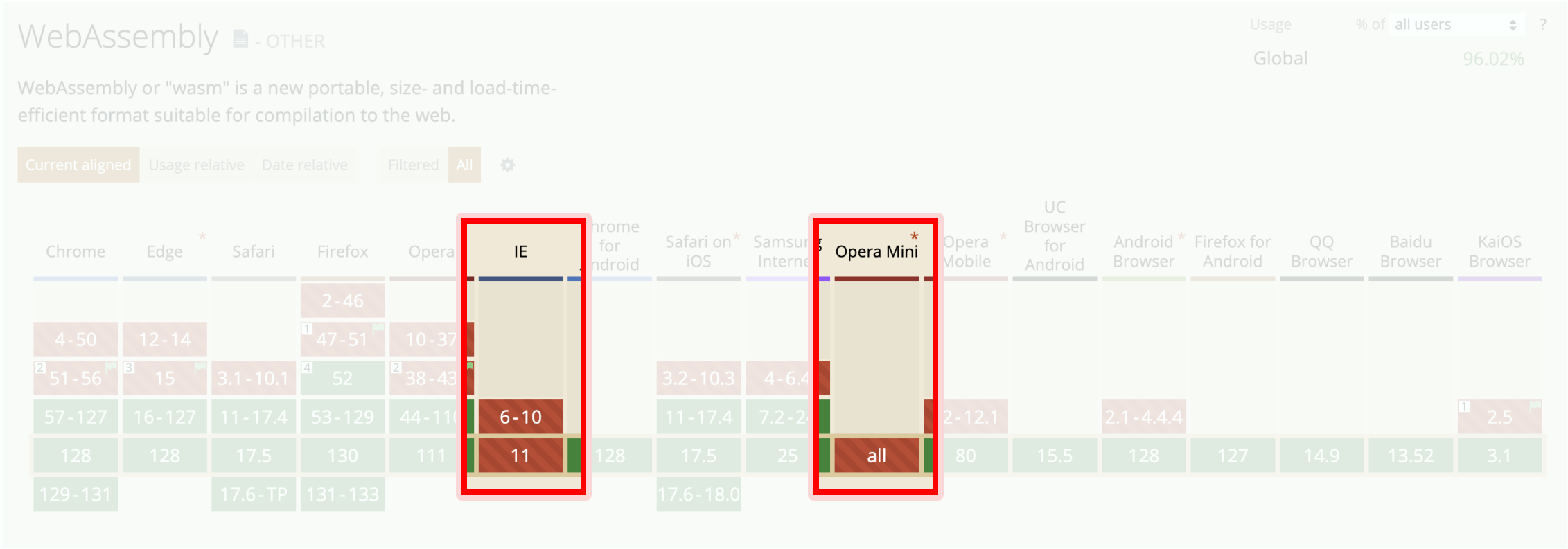
WebAssembly Support



TRAILHEAD TECHNOLOGY PARTNERS

WebAssembly vs JavaScript

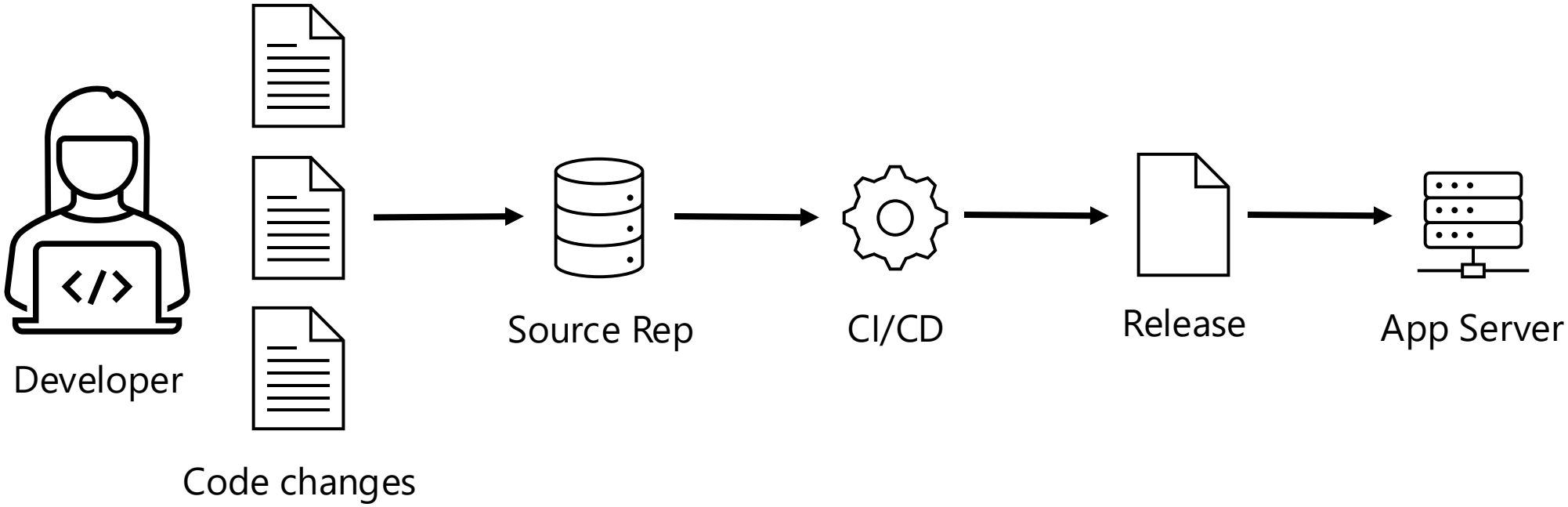
	WebAssembly	JavaScript
Speed	Uses binary files and ahead-of-time compilation, so it **works faster** than JavaScript	Works quick for small tasks, but **slower** for larger, more complex tasks
Support	Supported in all **modern browsers**	Long history means that **more devices and browsers support** it
Security	Executes in a sandbox, giving users **better security** than JavaScript	**Less secure** than Wasm
Memory Management	Requires **manual memory management** (or a garbage collection framework)	Has **garbage collection** built-in
Debugging	Uses a compiler, with **improves debugging** before deployment	Debugging is **more complex**
DOM	Accesses DOM **through JavaScript** interop calls	Accesses DOM **directly**

DevOps

DevSecOps

DevSecOps is an extension of **DevOps**, and is the practice of **integrating security** into every step of the software development process, ensuring that **security is considered from the start**, not just at the end.

DevSecOps



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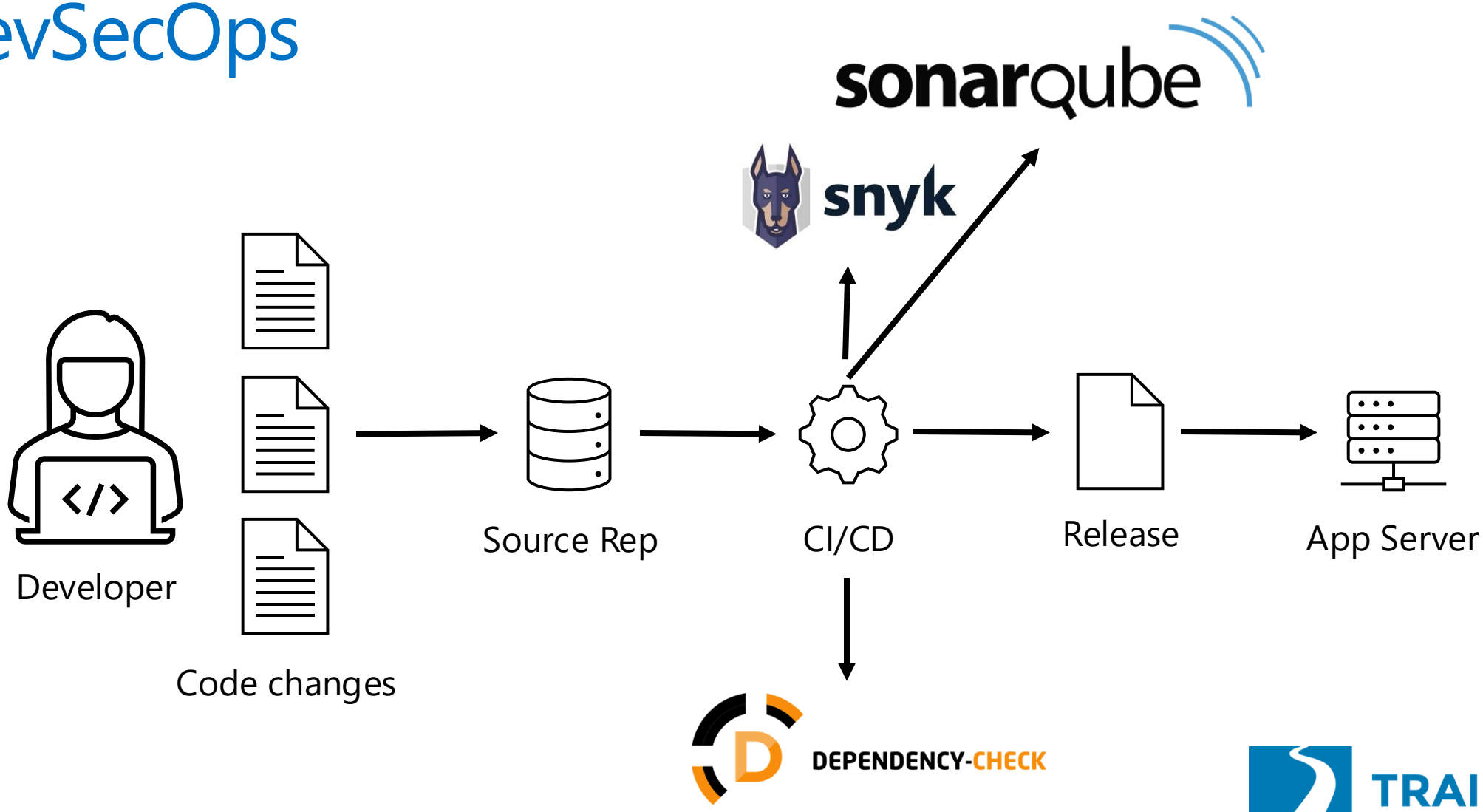
DevSecOps



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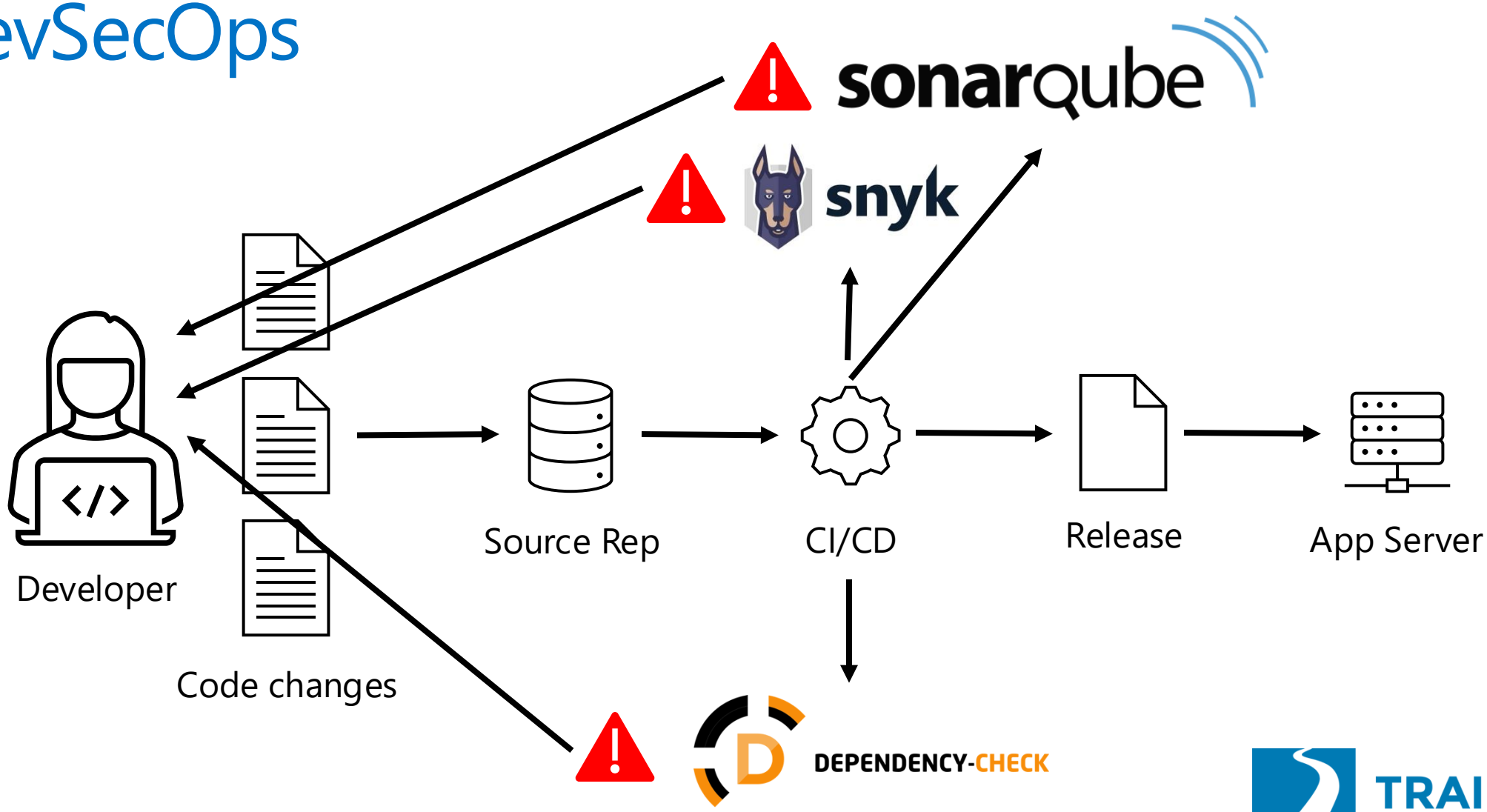
DevSecOps



TRAILHEAD
TECHNOLOGY PARTNERS

Infrastructure as Code

Infrastructure as Code (IaC) is a way to manage and set up **IT infrastructure** (like servers or networks) using **code instead of manually** so everything is faster, more flexible, more repeatable, and more reliable.

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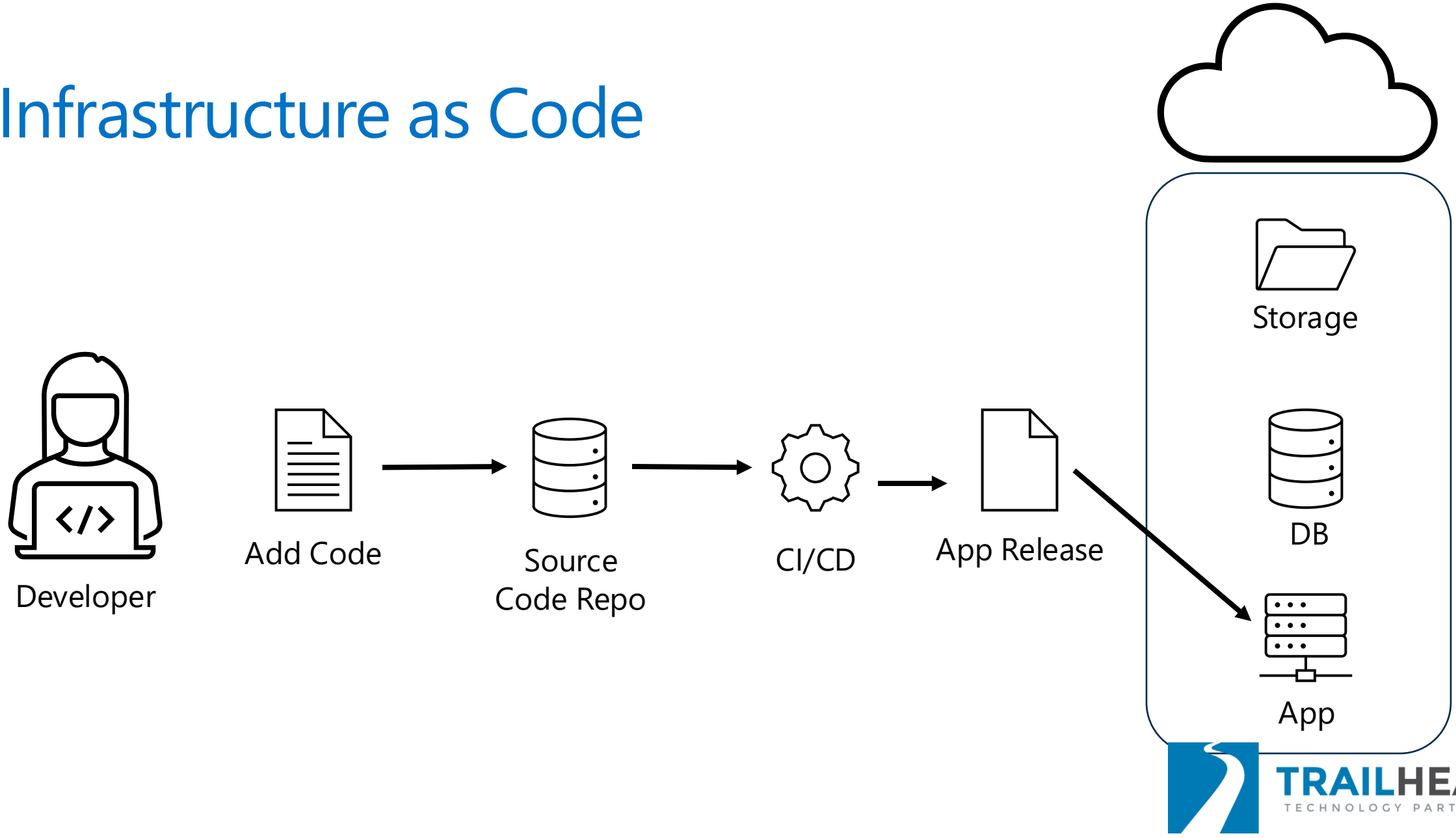
Infrastructure as Code



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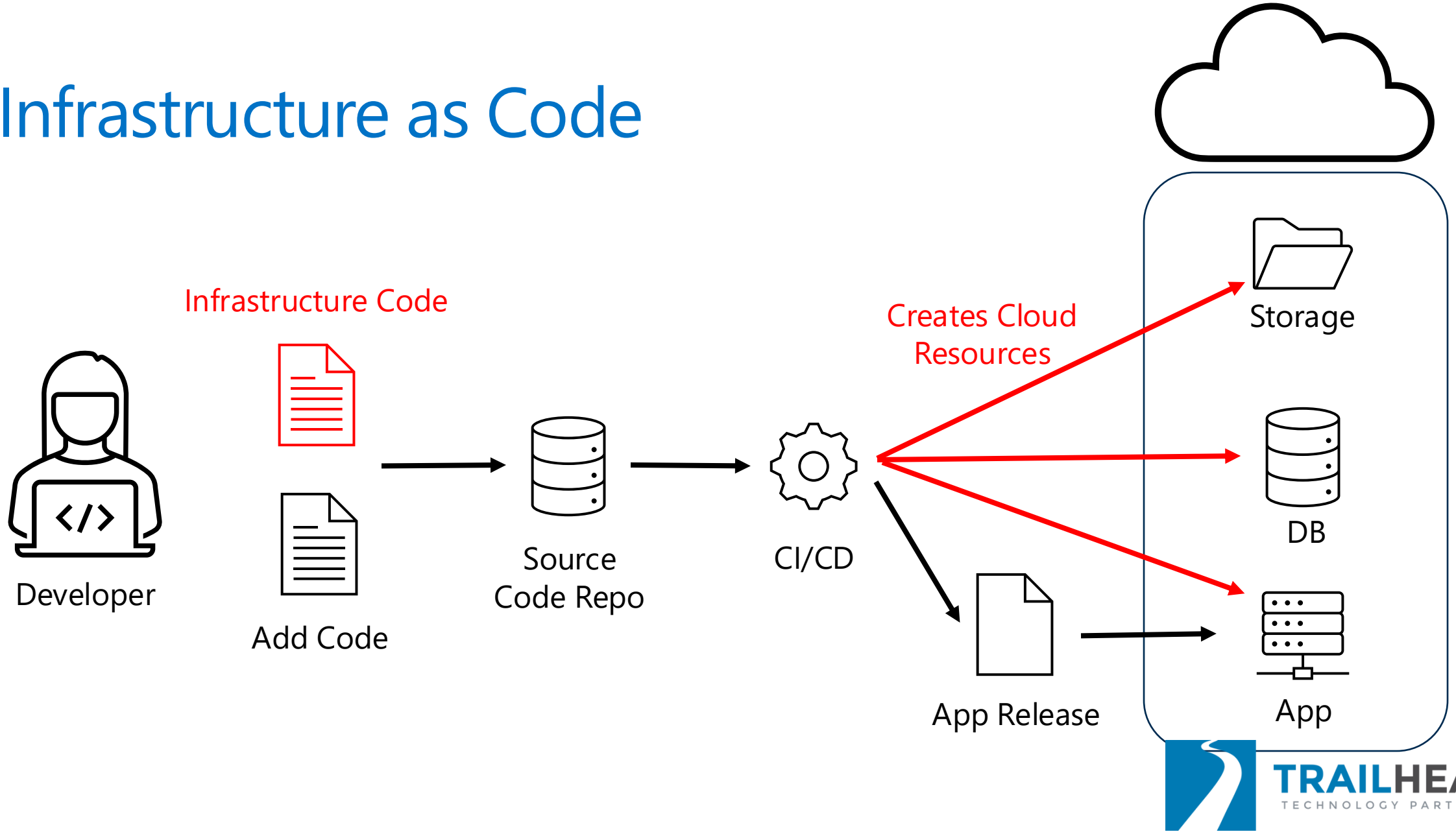
Infrastructure as Code



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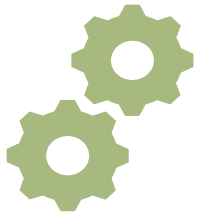
Infrastructure as Code



Automation and consistency

Speed and efficiency

Version control

Scalability

Collaboration

Cost savings

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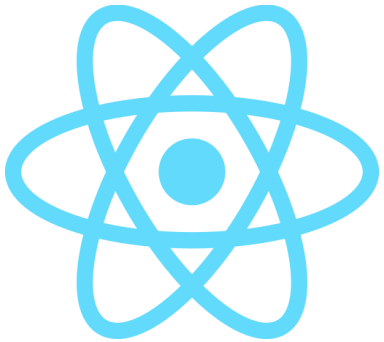
Cross-Platform

Cross-Platform Development



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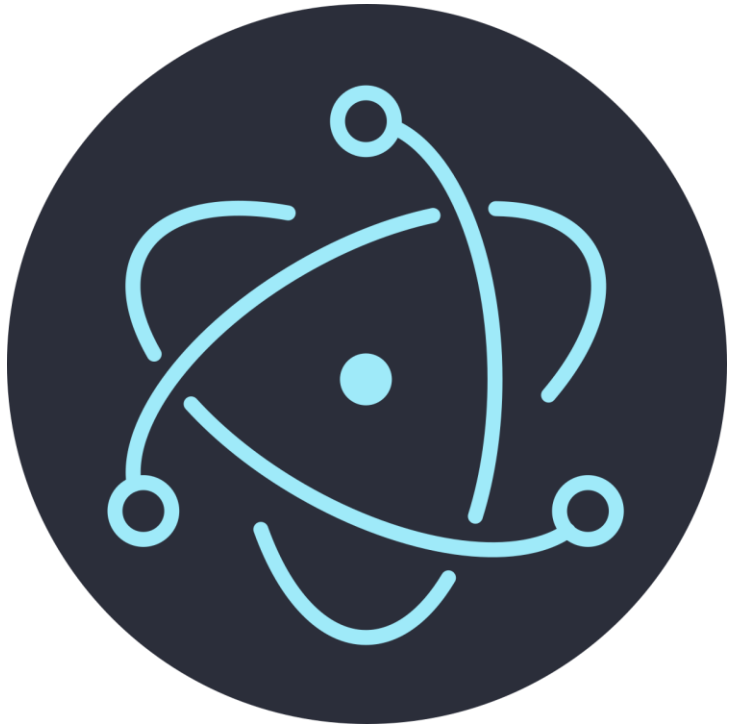
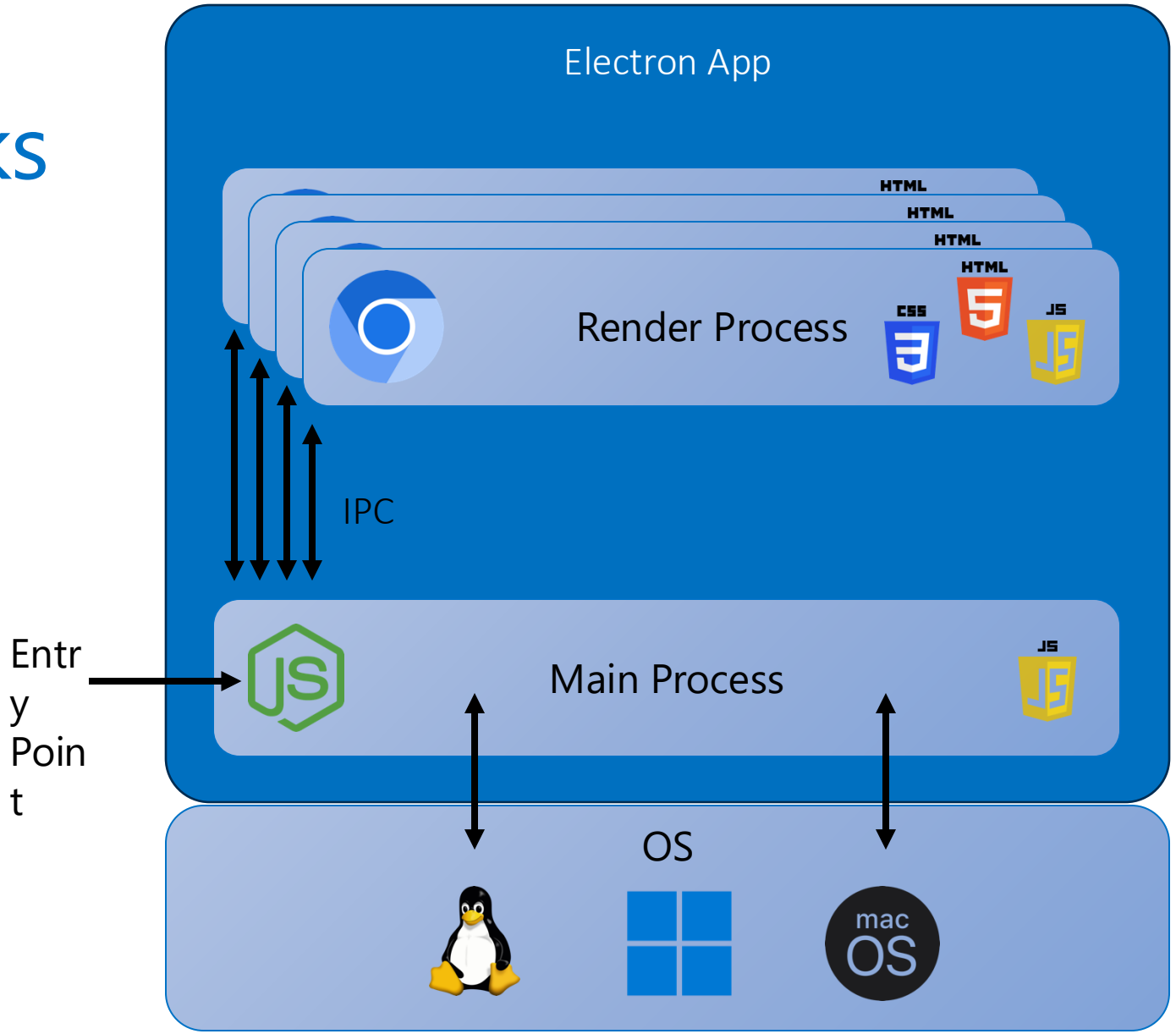
How Electron Works





Apps That Use Electron

Tooling

Notebooks

A **notebook** is an **interactive tool** where you can **write** and **run** code, **see the results** immediately, and **add notes** or explanations all in one place.

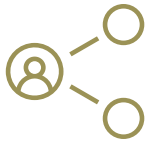
Notebooks


```
[*]: var fruitOutput = display("Let's get some fruit!");
var basket = new [] {
    "apple", "orange", "coconut", "pear", "peach"
};

foreach (var fruit in basket)
{
    System.Threading.Thread.Sleep(1000);
    fruitOutput.Update($"I have 1 {fruit}.");
}

System.Threading.Thread.Sleep(500);

fruitOutput.Update(basket);
```

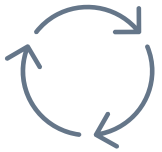
Source: https://github.com/dotnet/interactive/blob/main/docs/display-output-csharp.md

Notebooks Are Good At

Learning



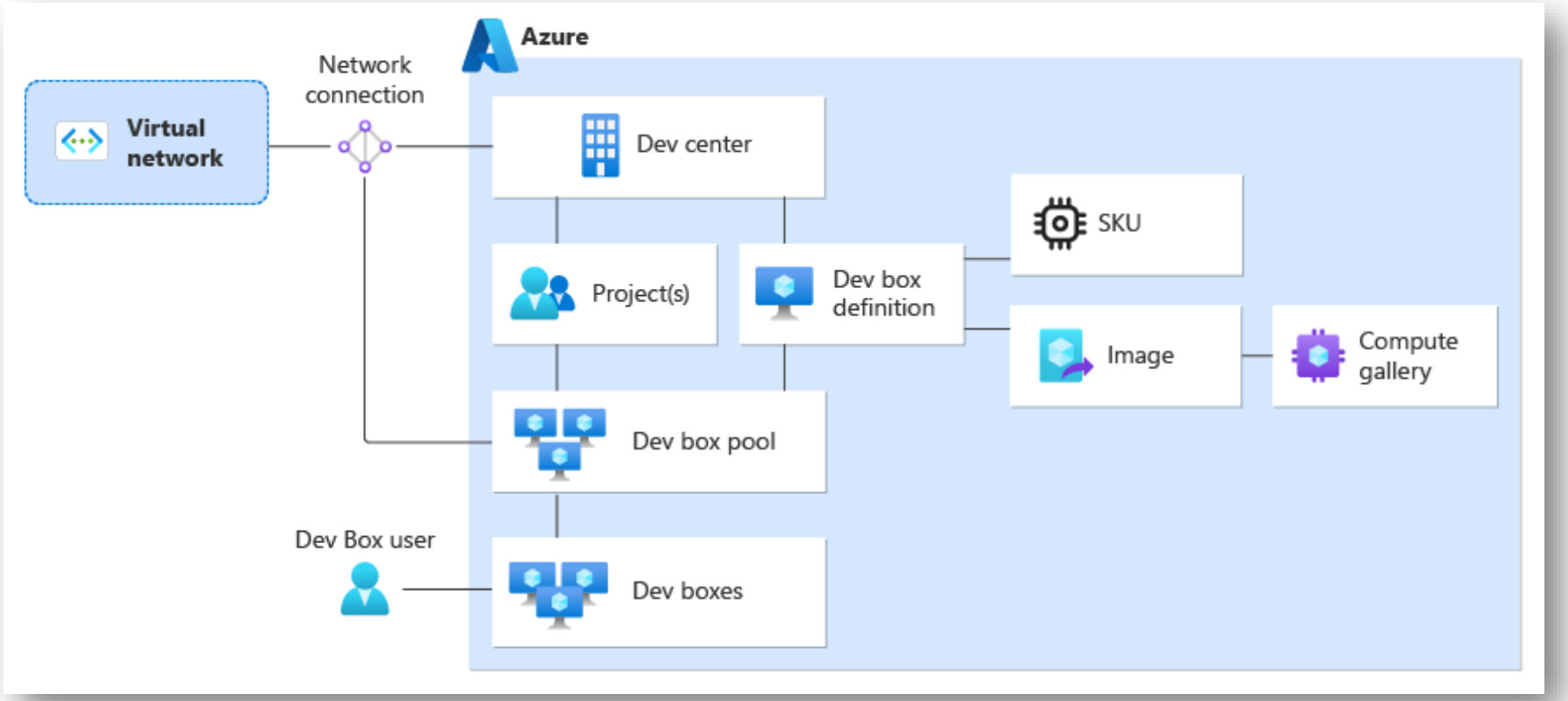
Sharing and documentation



Iteration and experimentation

Scratch pad

Remote Development Environments



Source: https://learn.microsoft.com/en-us/azure/dev-box/concept-dev-box-architecture

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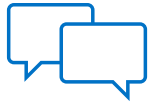
Collaboration Tools

Work Style

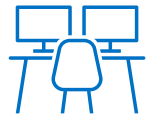
Emphasis on metal health

Exploration of neuro-diversity



Ubiquity of collaboration tools

Localized compensation



Remote, Return-to-office, and Hybrid

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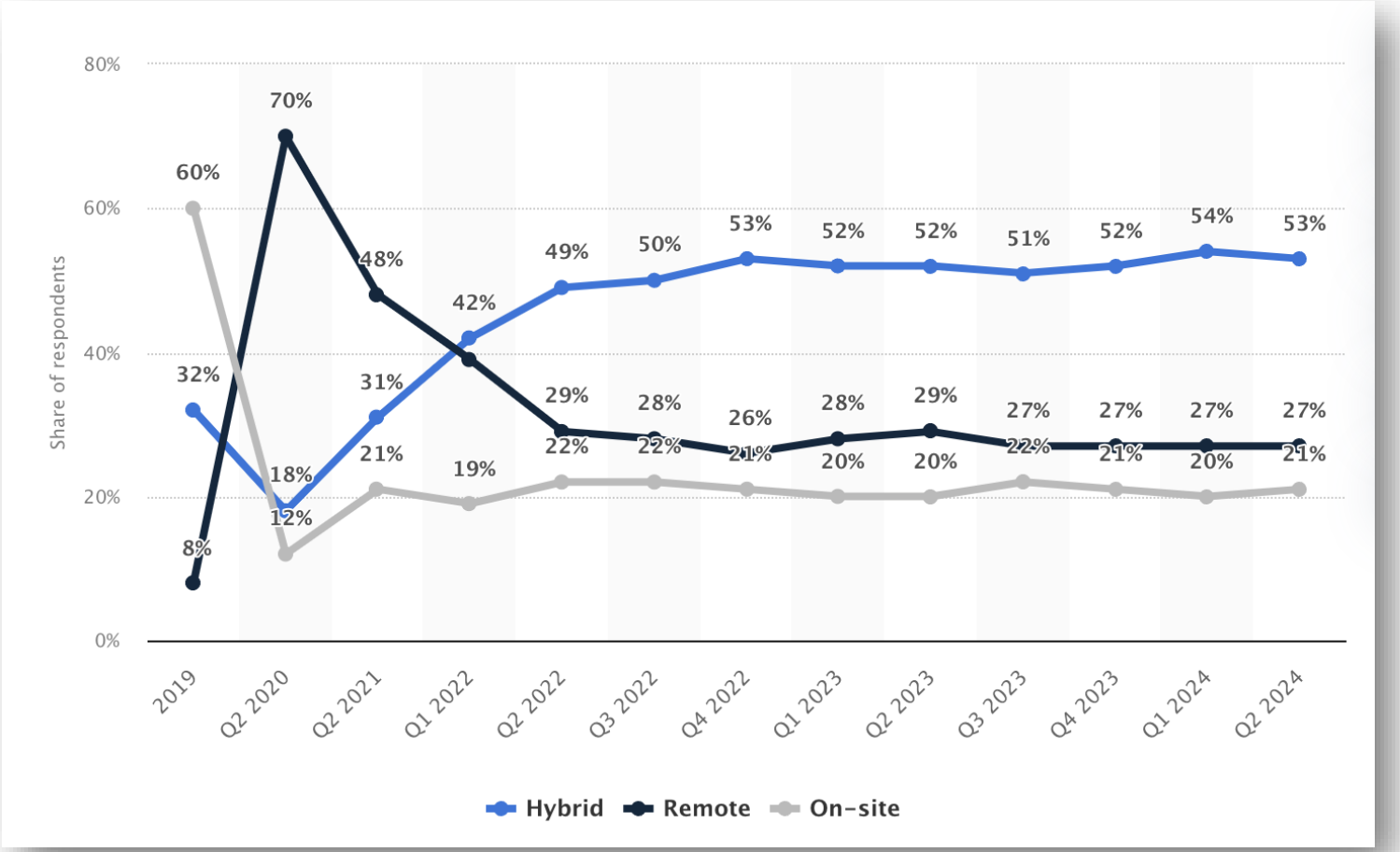
Remote Workers



Source: https://www.statista.com/statistics/1356325/hybrid-vs-remote-work-us/

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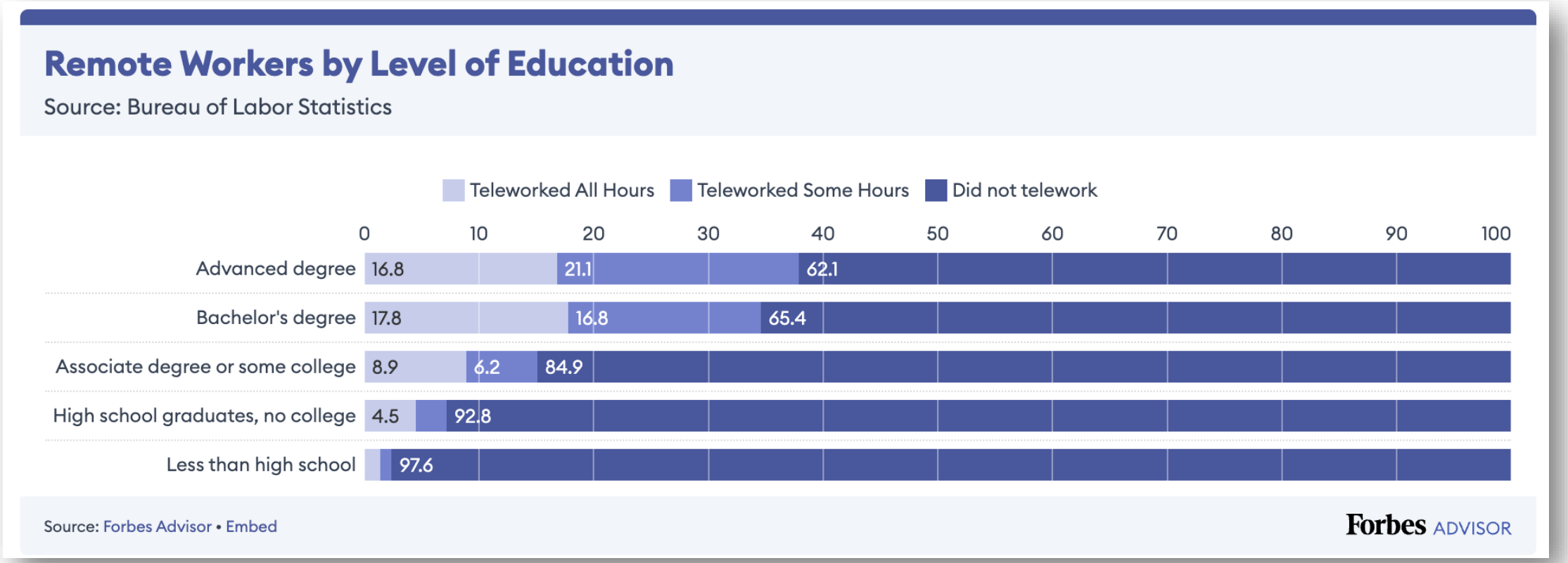
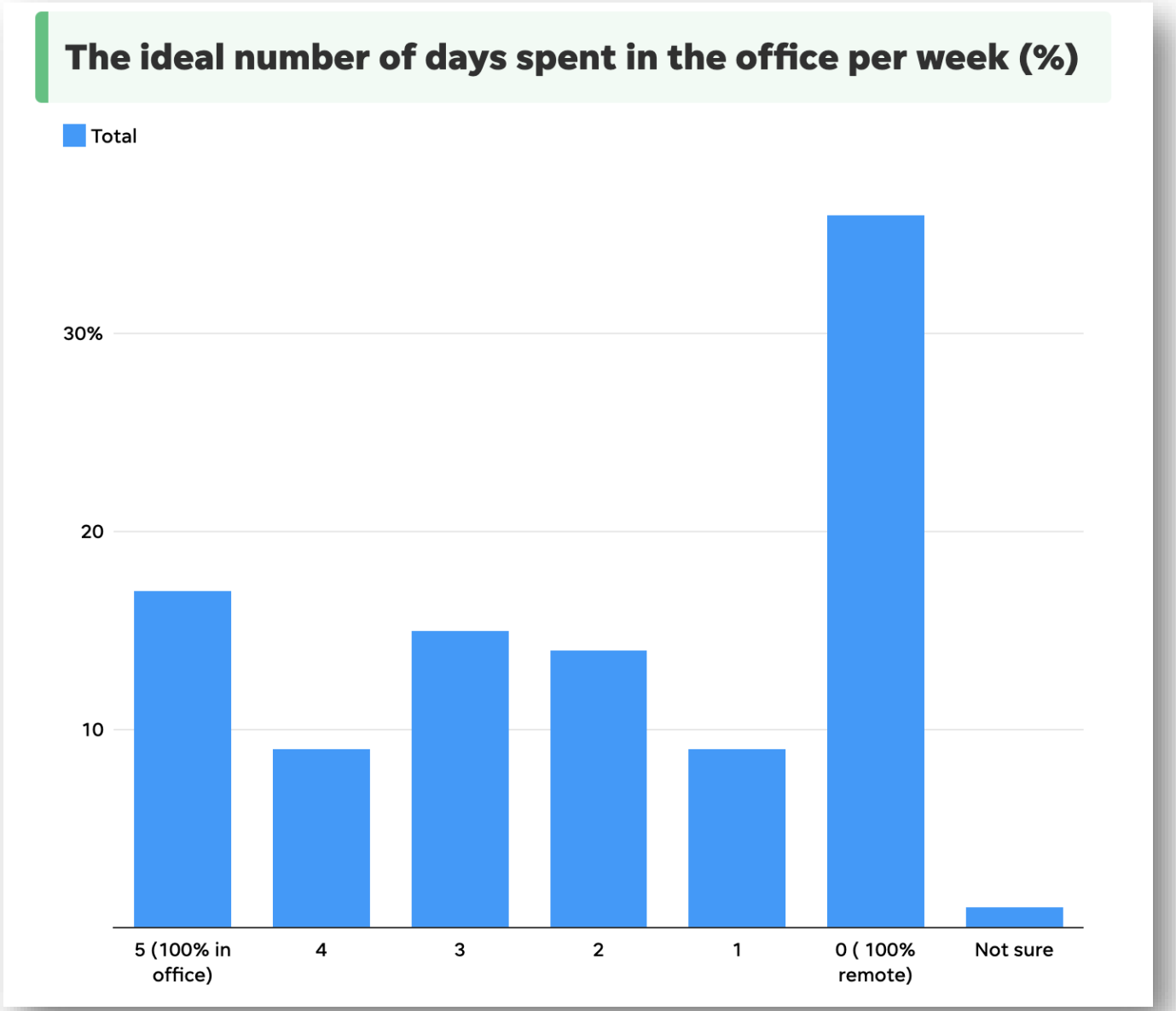
Remote Workers



Source: https://www.forbes.com/advisor/business/remote-work-statistics/

Remote Workers



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Source: https://www.usatoday.com/money/blueprint/business/hr-payroll/remote-work-statistics/

Summing Up

1. Citizen developers through low-code
2. Cloud and on-prem mixed as edge
3. Quantum solves difficult problems, upsets encryption
4. AI & ML *everywhere*
5. Cloud-Native is a new, modular way to build software
6. Microservices and modular monoliths
7. Web Assembly poised to upset JavaScript's monopoly
8. DevOps integrating security and IaC
9. Cross-Platform development
10. Developer tooling is evolving quickly
11. Our work style will continue to change

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Thanks! Questions?

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