
AWS
re:Invent
NOV. 28 – DEC. 2, 2022 | LAS VEGAS, NV

CON327

Serving 4.8 billion railway customers a year: The story of Deutsche Bahn

Sascha Möllering (he/him)

Principal SA, AWS EMEA SaRL
Amazon Web Services

© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Agenda

- Why is application modernization important?
- The transformation of Deutsche Bahn
- Technical implementation
- Key takeaways and challenges

© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Why is application modernization important?

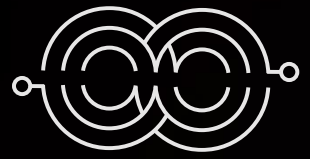
© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

CIOs say that **80%** of developers' time is spent on the **operations and maintenance of applications** and only **20%** of the time is actually spent on **innovation**

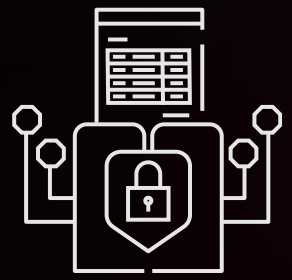
Source: Deloitte 2019

© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Symptoms of a legacy development culture



Long release cycles for new products and features



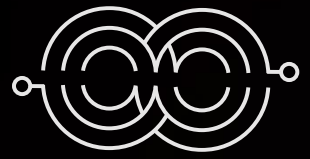
Operational inefficiencies resulting in overhead costs



Inability to support changing compliance, security regulations

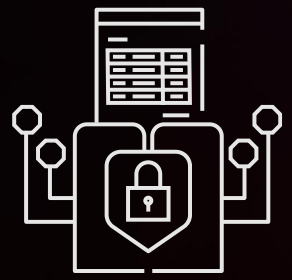
© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

This impacts the business



Long release cycles for new products and features

Lost revenue due to missed opportunity, loss of competitive edge



Operational inefficiencies resulting in overhead costs

Lost productivity or high costs for undifferentiated skills



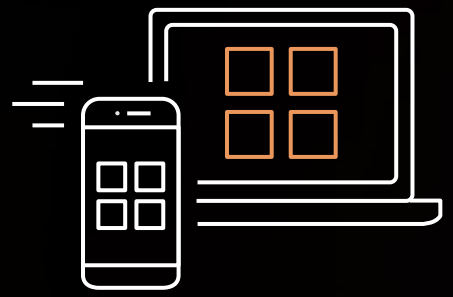
Inability to support changing compliance, security regulations

Fines for noncompliance, reputational impact, lost customer trust

aws

© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

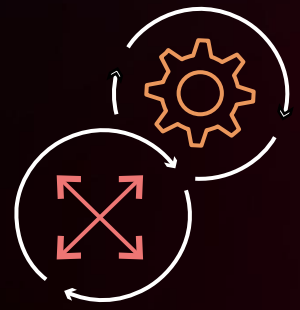
Customers want to innovate and deliver value to their customers



Getting to market faster



Lowering total cost of ownership



High performance and scalability



Security and isolation by design

aws

© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

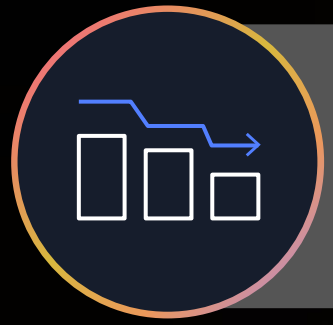
Benefits of building modern applications



Speed and agility



Security and operational resilience



Costs

aws

© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

What does success look like?

Challenge Solution

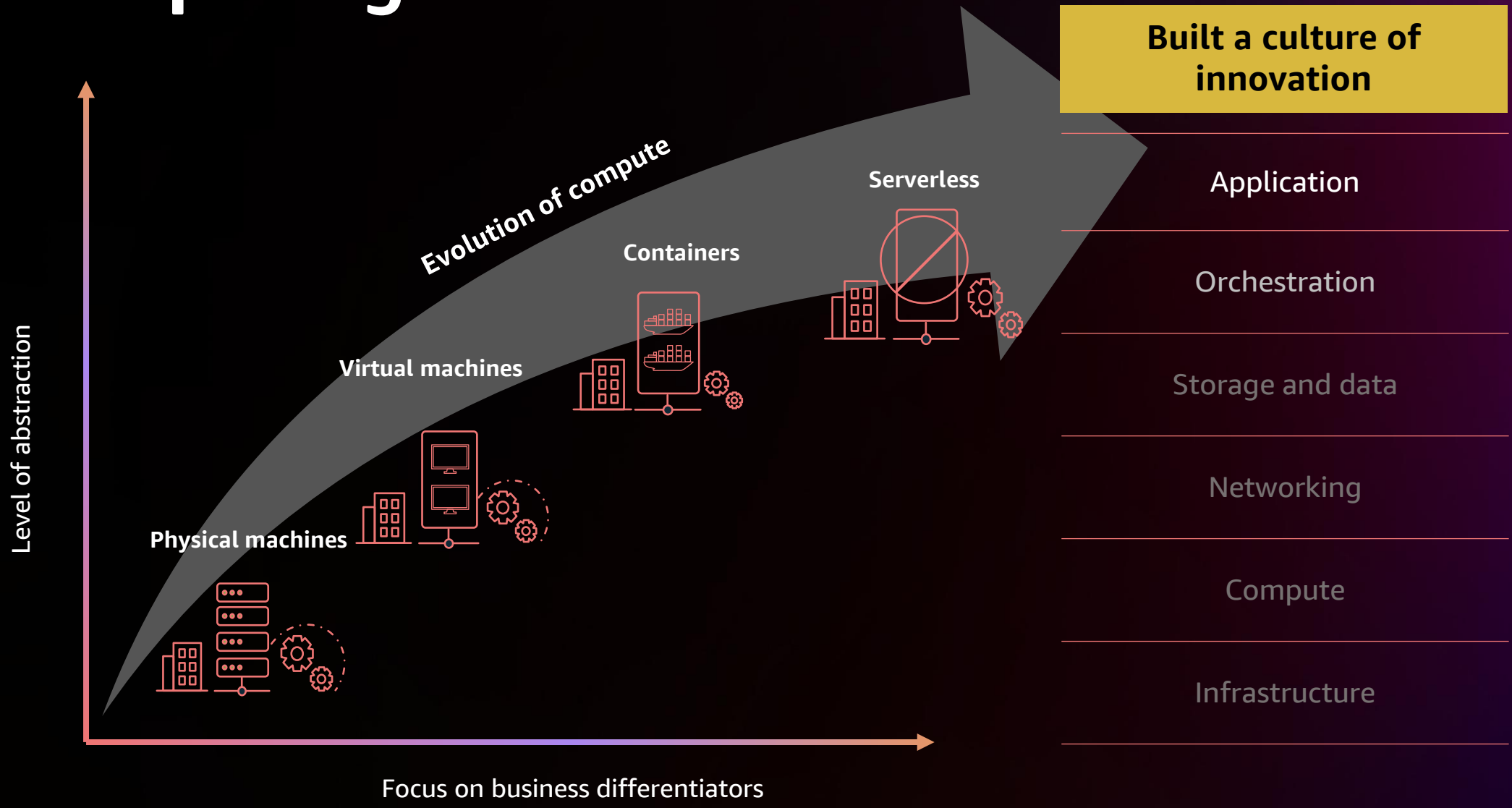
Challenge	Solution
Developers wait days/weeks for infrastructure to be provisioned	Developers provision infrastructure on demand and deploy in minutes
Software is manually deployed on an as-needed basis	Software delivery is automated via continuous delivery pipelines
Security is configured when required for each application	Security best practices are baked in to every application and service
Developers lack visibility into applications running in production	Applications are fully instrumented for metric and log collection
Tooling is inconsistent across teams and business units	Organizations standardize on tools and best practices



aws

© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Computing evolution



Built a culture of innovation

- Application
- Orchestration
- Storage and data
- Networking
- Compute
- Infrastructure

© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

We are witnessing a paradigm shift

Our goal is to **automate** and abstract away as much as possible so customers can focus on building applications for their business



aws
© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

The transformation of Deutsche Bahn

© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

DB Vertrieb – Central responsibility for the sales of DB Personenverkehr products

Ralf Gernhold

- CTO DB Vertrieb
- Program director, Vendo
- Until 2018, CIO Miles & More
- Until 2014, international consulting as division manager and project manager for various mobility projects

DB Vertrieb Portfolio



Travel centers



Internet



Vending machines



Mobile

DB Vertrieb KPIs

146 million monthly visits

350 million tickets (in 2019)

9 billion € revenue (in 2019)

20 million customer accounts

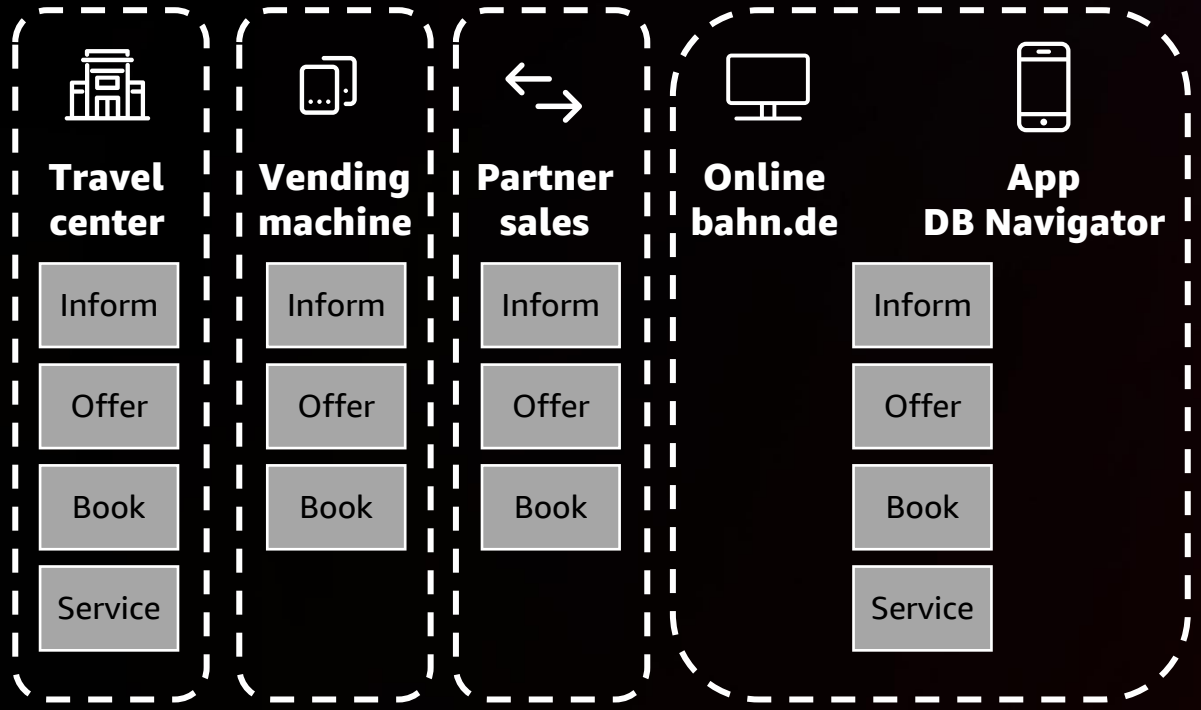
© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.



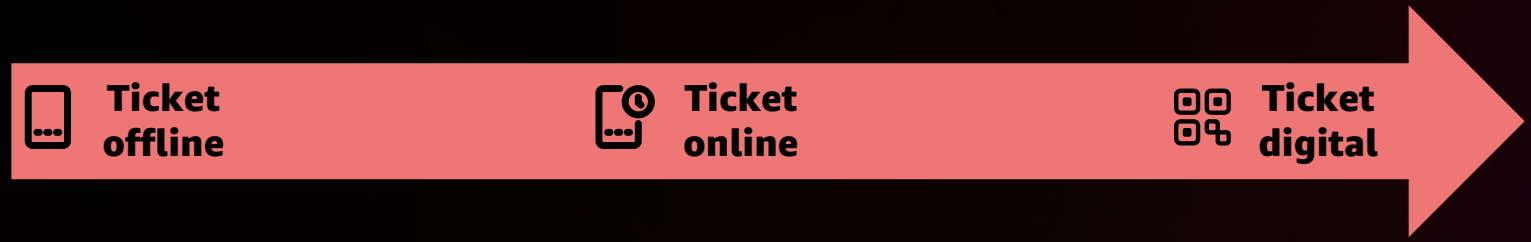
© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Legacy IT and the need for renewal

OUR IT SYSTEMS ARE SHAPED BY TIMES WHEN TICKETS WERE STILL BOUGHT DIFFERENTLY



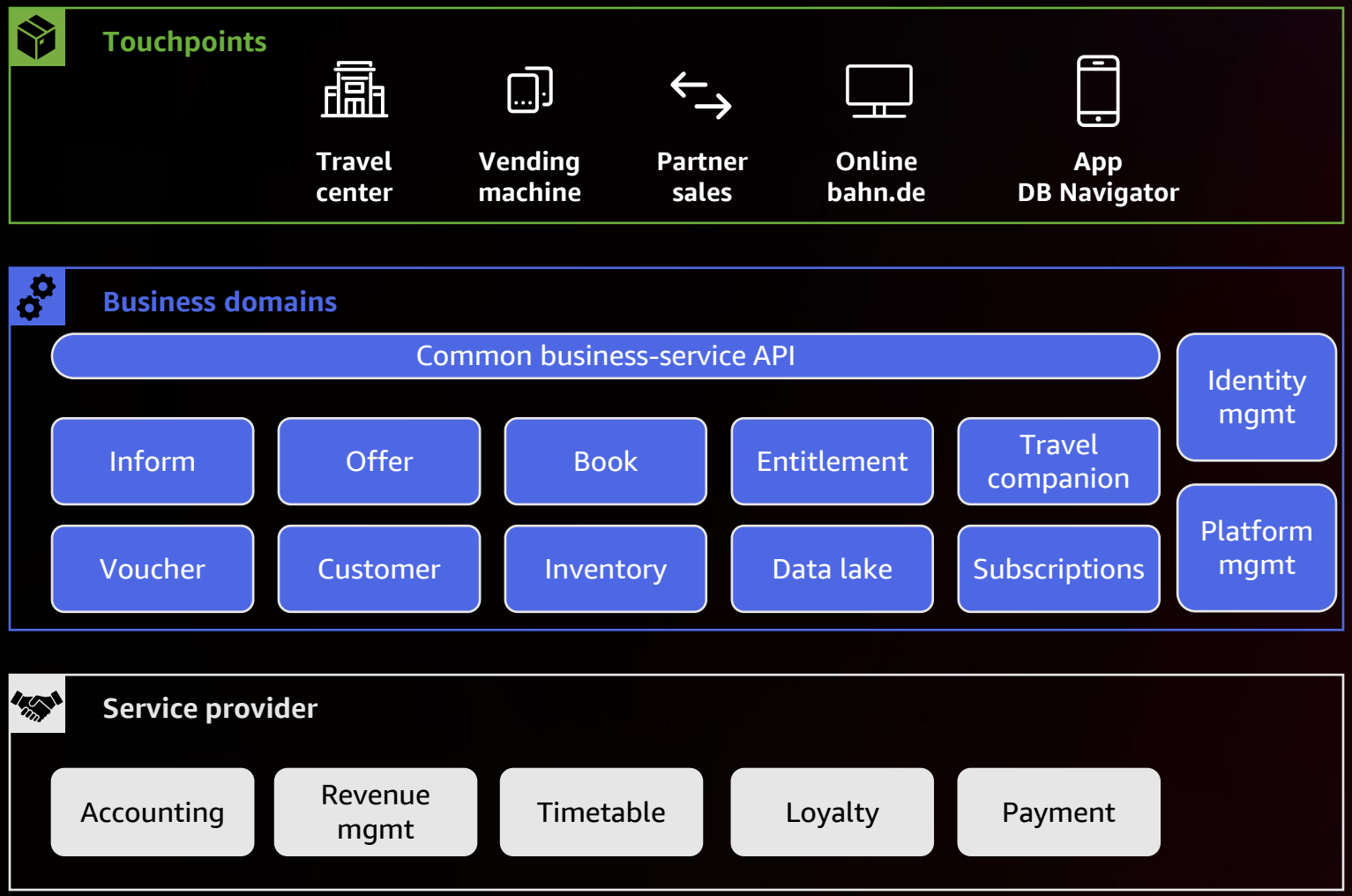
- System developed over up to **40 years**
- Long adjustment times
- **High** test **effort**
- **High** implementation and maintenance **costs**



© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

The new sales platform

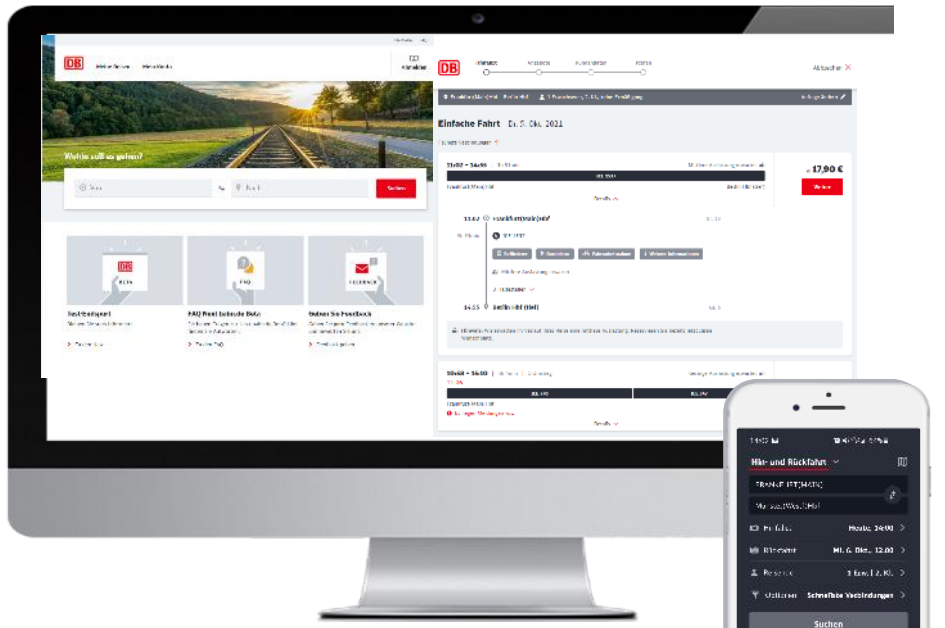
ENSURE THE DIGITAL FUTURE OF DB PERSONENVERKEHR



- Agile delivery approach with more than **500 project participants** and approx. **1.6 million lines of code**
- Fully automated delivery approach based on **CI/CD**
- Platform was built cloud native to aim for
  - Highest **availability**
  - Automatic **scalability**
  - Consistent **performance**

© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Vendo is the backbone for DB's strategic growth initiative "Starke Schiene"



Vendo

- **Digitization program** of DB Vertrieb, DB Fernverkehr, DB Regio
- **New construction and replacement of the existing system structures** and a **uniform customer interface** for bahn.de and DB Navigator, among others

1	**Time to market factor 5**	Shorter innovation cycles through modular microservice architecture
2	**Omni-channel**	Consistent customer experience through cross-touchpoint processes
3	**Cloud**	Efficient, dynamic scaling of required IT resources
4	**UX**	Quantum leap in user experience (UX)

aws

© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Technology adoption and trust

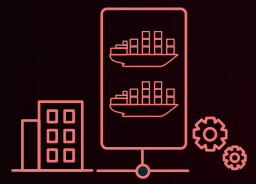
Physical machines



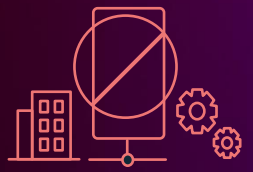
Virtual machines



Containers



Serverless



1 2 3

2016

Christa Koenen, CIO DB AG:

"Cloud first" strategy

Lift and shift

- All existing DB workloads and apps are shifted to the cloud
- DB sells all datacenters

Cloud native

- New applications are built "cloud native"
- Workloads get containerized
- New way of operating IT

Cloud trust

- With usage comes experience
- With experience comes trust
- Trying even more and new services

aws

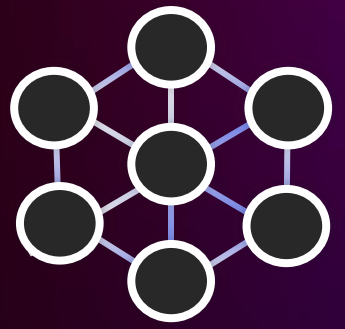
© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Technical implementation

© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

The “Vendo” project

- Started with microservices, DDD, and OSS
- Scalability, flexibility, and reduced operational overhead
- Kubernetes and Amazon EKS best fit

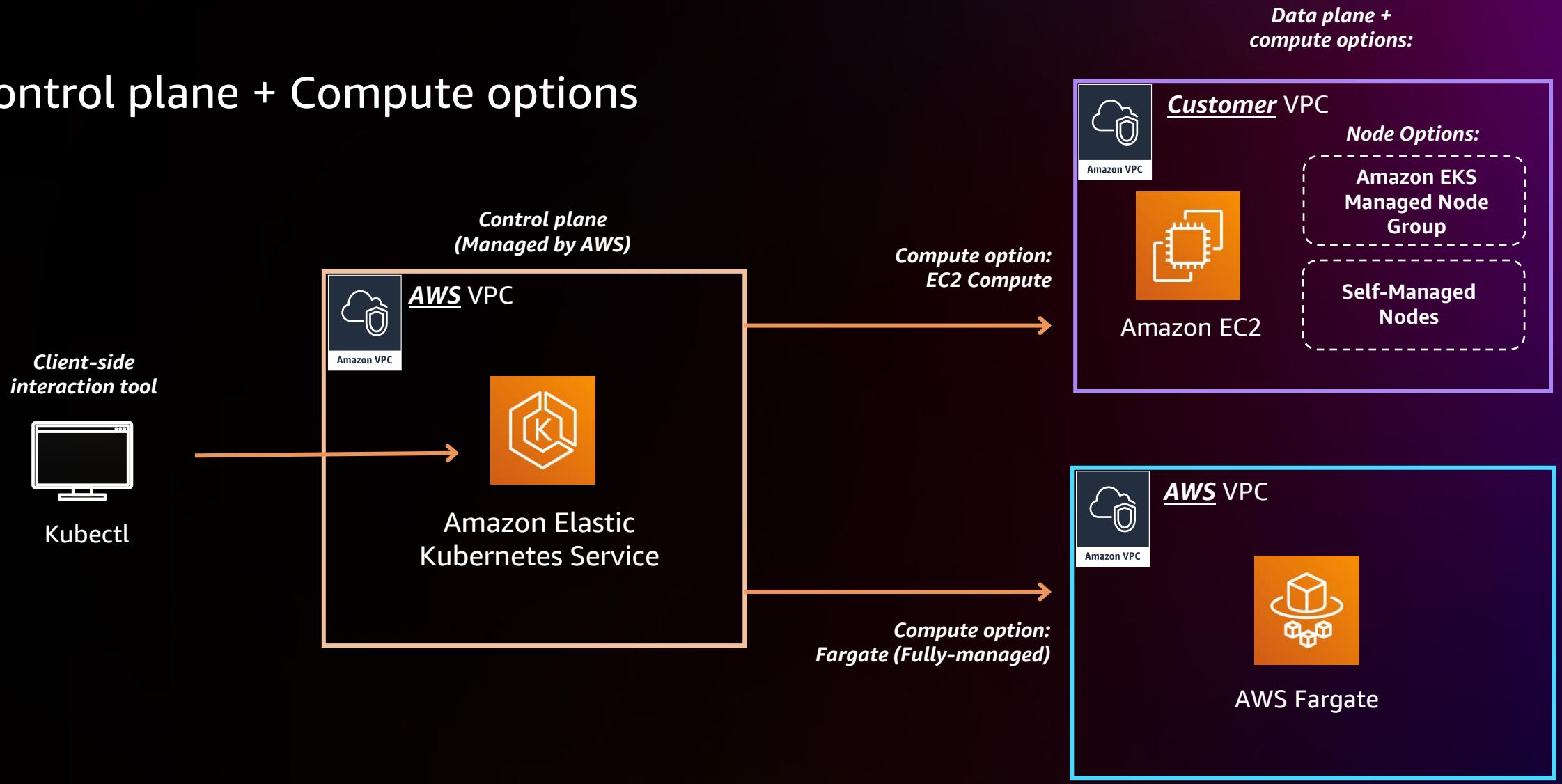


Microservices

© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

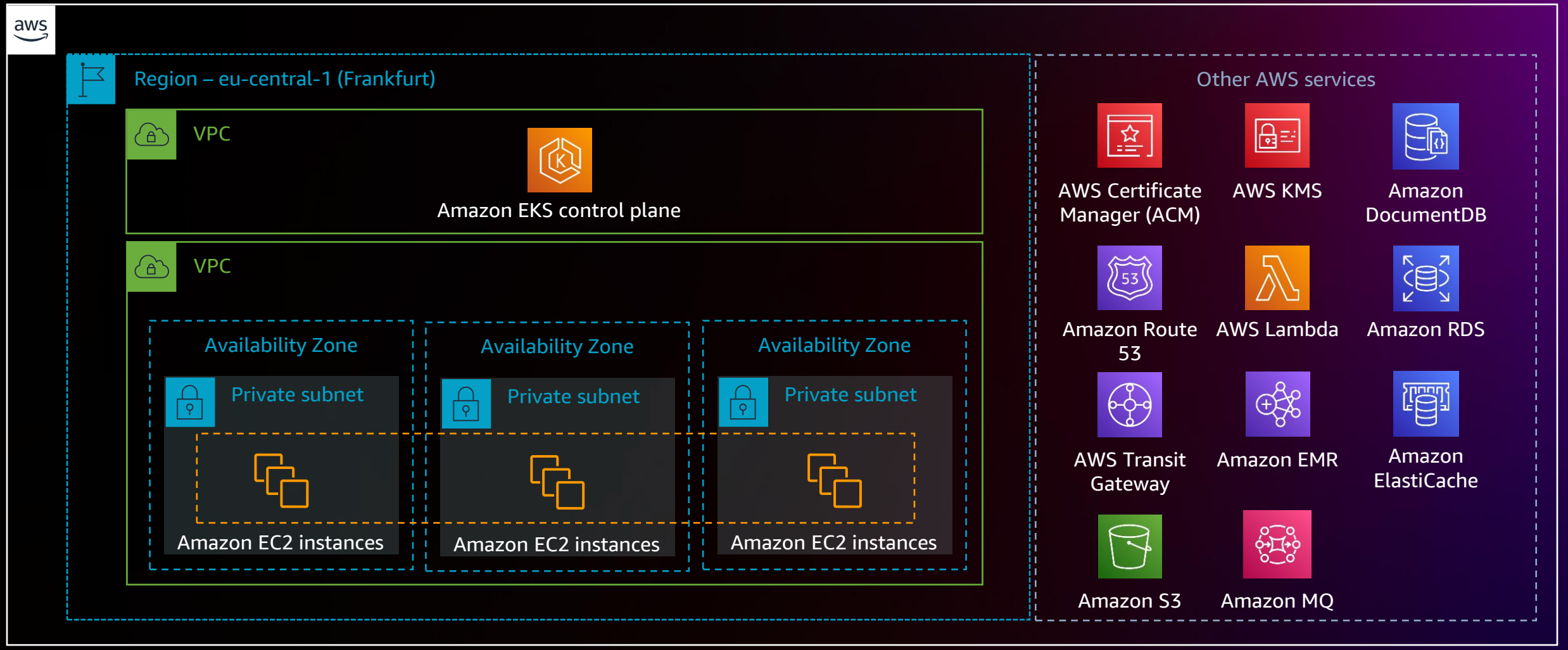
Amazon Elastic Kubernetes Service (EKS)

Control plane + Compute options



© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

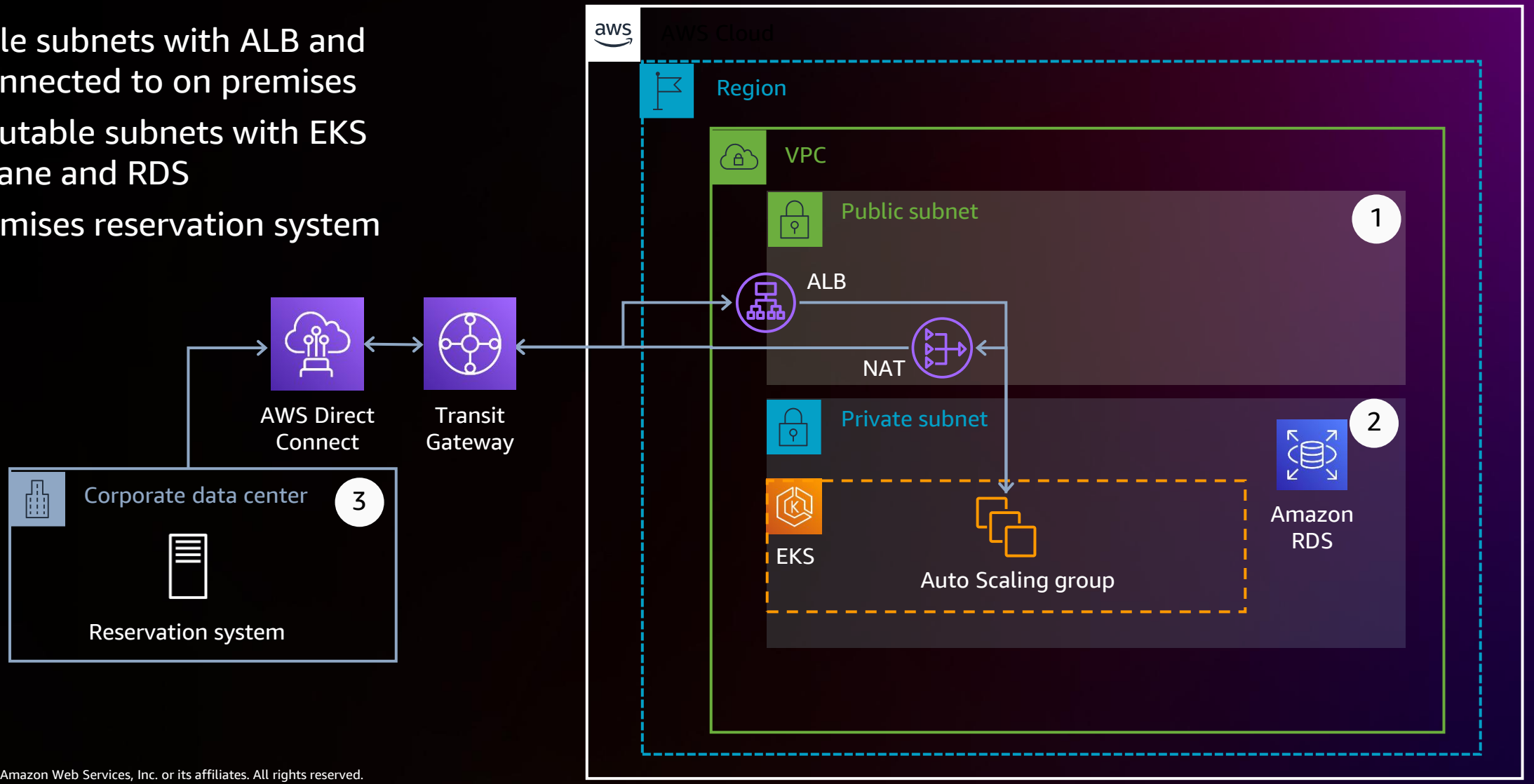
Vendo AWS architecture



aws
© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Vendo AWS architecture

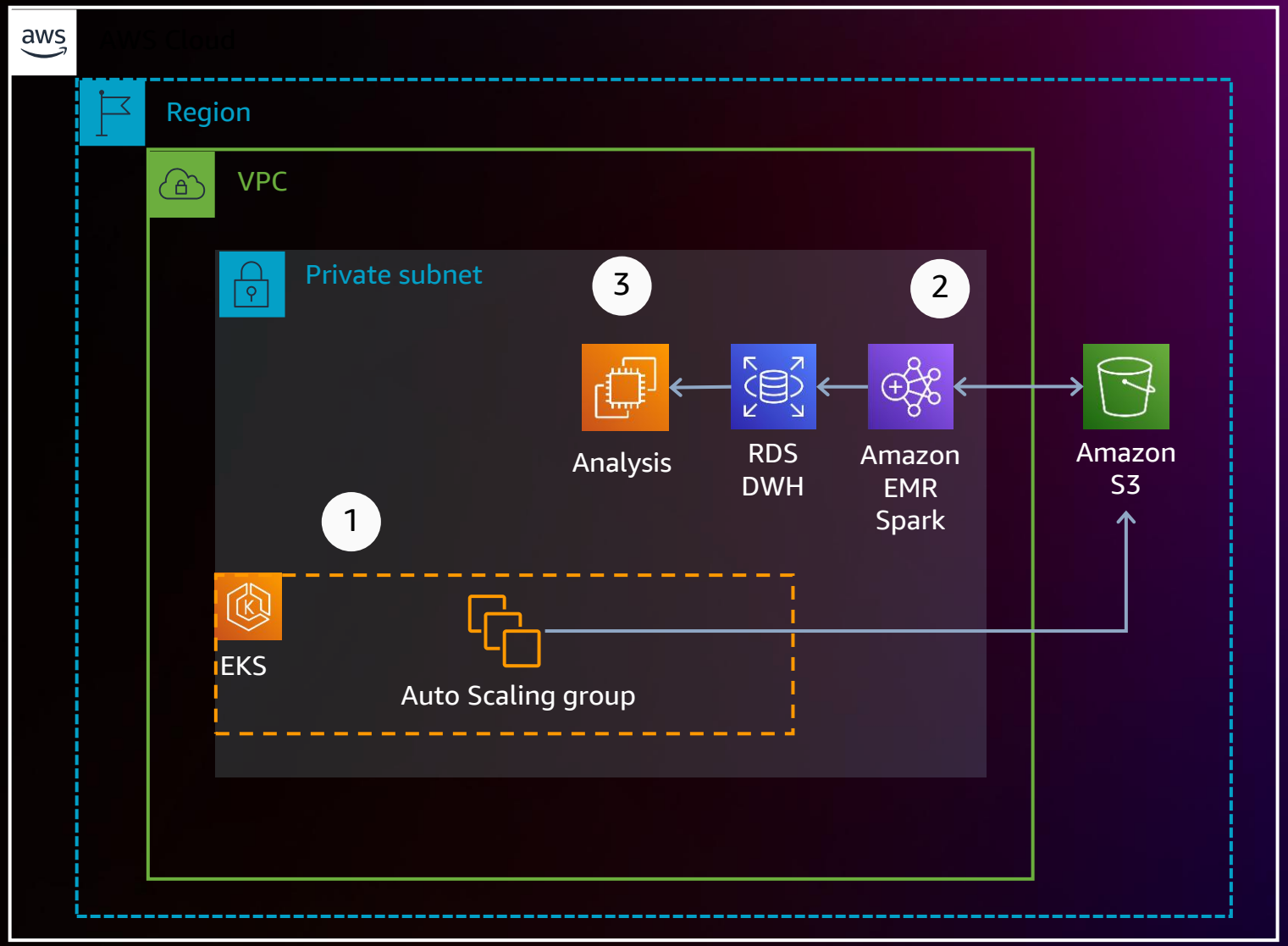
1. Routable subnets with ALB and NAT connected to on premises
2. Non-routable subnets with EKS data plane and RDS
3. On-premises reservation system



© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Vendo AWS architecture

1. Non-routable subnets with EKS data plane
2. Data lake with Amazon S3, Amazon RDS, and Amazon EMR with Spark
3. EC2 instances running a data service for analysis



© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

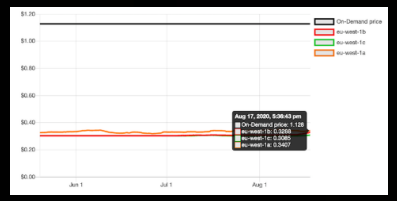
How DB takes advantage of EC2 Spot Instances

LEVERAGE SPARE CAPACITY ON DEMAND WITH STEEP DISCOUNTS, PAY BY THE SECOND



Spare Amazon EC2 capacity

Same infrastructure as On-Demand



Save up to 90% compared to On-Demand pricing

Spot price is based on long-term supply and demand trends



Interruptible

Spot Instances can be interrupted by a 2-minute warning if Amazon EC2 needs the capacity back

Leveraging advantages of EC2 Spot Instances over various environments

- Development workloads
- Test environment (esp. load tests)
- Production: currently under assessment

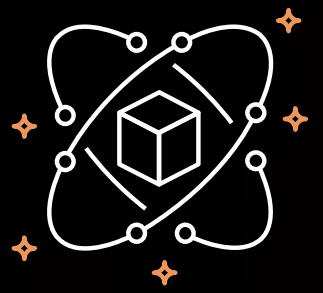
Further advantages

- Strong reduction of dev and testing cost
- Expecting interruptions and handling them helps build resilience

aws

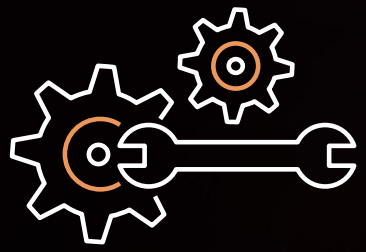
© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Amazon EKS managed node groups with EC2 Spot Instances



Automatic node provisioning

- Support for **mixed instance types**
- Amazon EC2 Auto Scaling group provisioning with **capacity-optimized** allocation strategy
- Automatically configures **Kubernetes labels** and **AWS tags** (e.g., Cluster Autoscaler)



Managed node update and termination

Managed **node draining** during node termination and updates



Spot Instance lifecycle management

Managed Spot Instance draining integrated with **Amazon EC2 Auto Scaling Capacity Rebalancing**



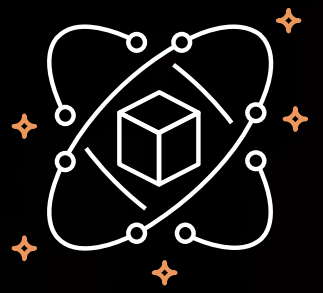
Launch template support

Custom configuration and custom AMIs for your Kubernetes nodes

aws

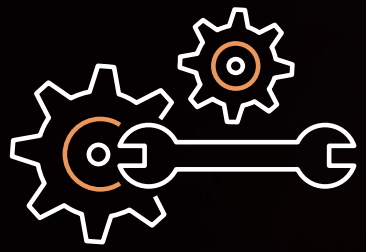
© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Amazon EKS managed node groups with EC2 Spot Instances



Automatic node provisioning

- Support for **mixed instance types**
- Amazon EC2 Auto Scaling group provisioning with **capacity-optimized** allocation strategy
- Automatically configures **Kubernetes labels** and **AWS tags** (e.g., Cluster Autoscaler)



Managed node update and termination

Managed **node draining** during node termination and updates



Spot Instance lifecycle management

Managed Spot Instance draining integrated with **Amazon EC2 Auto Scaling Capacity Rebalancing**



Launch template support

Custom configuration and custom AMIs for your Kubernetes nodes

aws

© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Configuring managed node groups



my-cluster-definition.yaml

Attribute-based configuration

```
apiVersion: eksctl.io/v1alpha5
kind: ClusterConfig
metadata:
   name: my-eks-cluster
   region: us-west-2
managedNodeGroups:
 - name: my-spot-managed-node-group
   desiredCapacity: 2
   spot: true
   instanceSelector:
      vCPUs: 2
      memory: 2GiB
      cpuArchitecture: x86_64
```

https://eksctl.io/usage/instance-selector/

OR

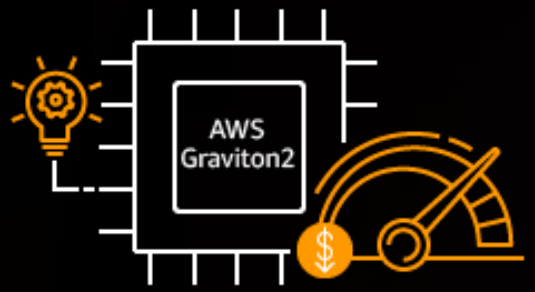
Instance type–based configuration

```
apiVersion: eksctl.io/v1alpha5
kind: ClusterConfig
metadata:
   name: my-eks-cluster
   region: us-west-2
managedNodeGroups:
 - name: my-spot-managed-node-group
   desiredCapacity: 2
   spot: true
   instanceTypes:
    - m5.xlarge
    - m5d.xlarge
    - m4.xlarge
```

https://github.com/aws/amazon-ec2-instance-selector

$ eksctl create nodegroup -f my-cluster-definition.yaml

© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.



AWS Graviton2 & Graviton3

Custom AWS silicon with 64-bit Arm cores

Targeted optimizations to reduce costs

Rapidly innovate, build, and iterate

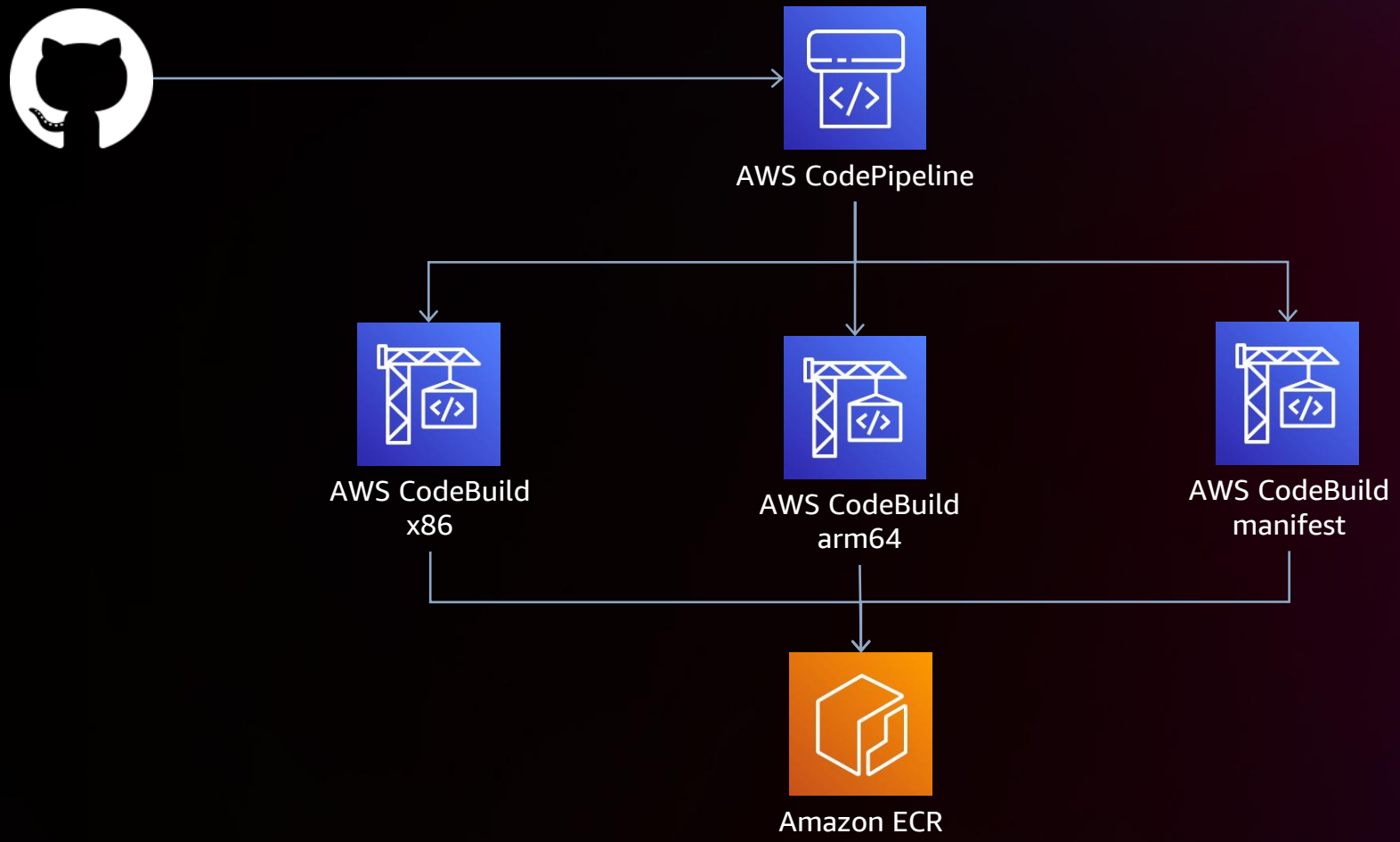
Range of instance types

Same AWS Nitro building blocks

Best performance per watt of energy use in Amazon EC2

© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Multi-architecture container images



© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Key takeaways and future plans

© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Key takeaways

MODERNIZATION IS A JOURNEY THAT IMPACTS THE WHOLE BUSINESS

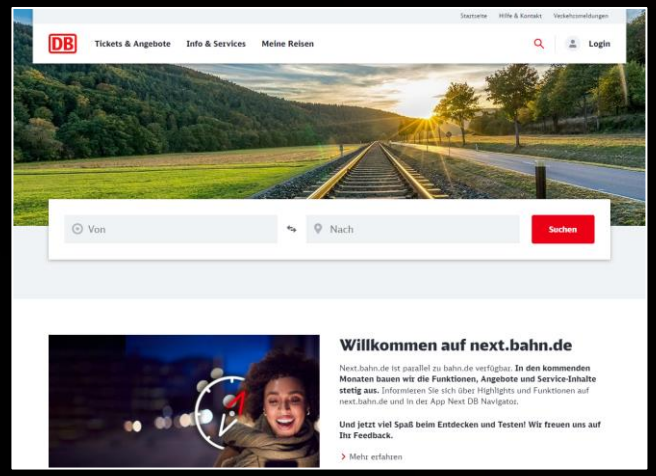
1. Automate and iterate processes

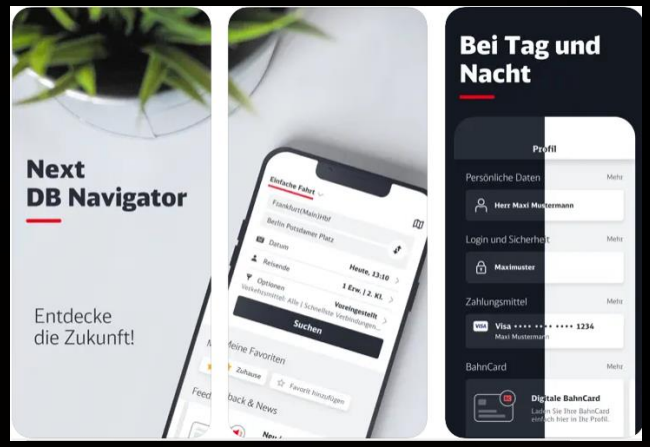
2. Technology adoption and trust

3. Reduced time to market

© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

We are live, but the best is yet to come . . .





next-bahn.de

SCAN ME

Backup and resiliency

- Cluster separation
- Multi-Region backup
- Amazon S3 Glacier and Amazon S3

Cost and resource optimization

- Cost transparency to dev teams
- Spot Instances and Graviton
- Carbon footprint

© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.

Thank you!



Please complete the session survey in the **mobile app**

© 2022, Amazon Web Services, Inc. or its affiliates. All rights reserved.