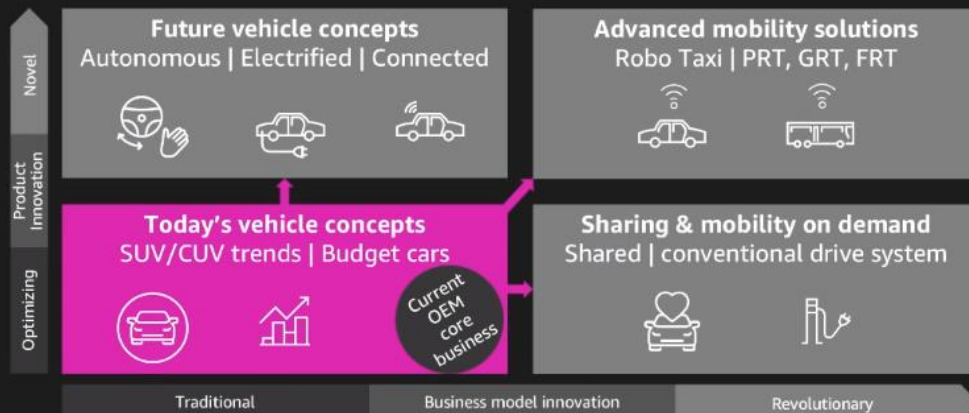Volkswagen Group, consisting of 12 global brands including Volkswagen, Audi, and Porsche, aspires to become a globally leading provider of sustainable mobility with their "TOGETHER - Strategy 2025" program. A key facilitator to achieve this vision is their **Volkswagen Group One Digital Platform (ODP) providing a holistic digital ecosystem connecting Volkswagen vehicles with customers, Volkswagen mobility services, and partners following an open platform approach**. Volkswagen Group is using AWS as a cloud service provider for transitioning the existing vehicle connectivity backend. In this session, learn how Volkswagen Group is accomplishing this from a technical and organizational standpoint, setting up a cloud platform as a landing zone in AWS, using **services** such as **AWS Direct Connect, AWS Lambda, Amazon RDS, and Amazon Route 53** for **migrating** and **re-platforming their existing on-premises backend**, **in-sourcing development**, empowering their internal teams, and transforming internal processes to enable greater agility and reduce time to market.

# The digital transformation is disrupting the traditional OEM business models



**Future vehicle concepts**
Autonomous | Electrified | Connected

**Advanced mobility solutions**
Robo Taxi | PRT, GRT, FRT

**Today's vehicle concepts**
SUV/CUV trends | Budget cars

Current OEM core business

**Sharing & mobility on demand**
Shared | conventional drive system

Novel

Product Innovation

Optimizing

Traditional | Business model innovation | Revolutionary

aws re:Invent

aws

---

# Volkswagen has started the biggest change process in its history
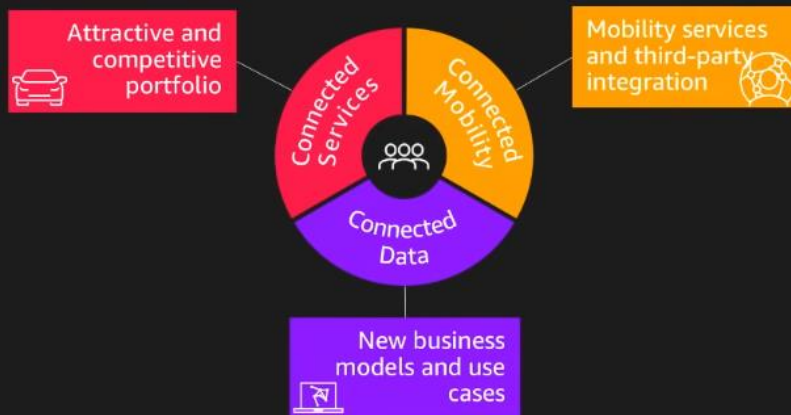
We believe in transforming the status quo of mobility

Our goal is to become a globally leading provider of sustainable mobility

We provide tailor-made mobility solutions for our customers

---

# One Digital Platform is empowering this transformation



ONE
DIGITAL PLATFORM

The One Digital Platform provides the digital ecosystem for Volkswagen's mobility solutions
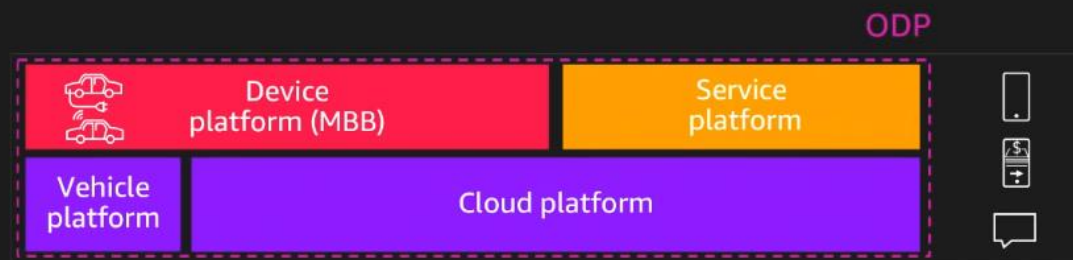


The One Digital Platform is based on a flexible, cloud-native architecture



With new vehicle architectures and edge computing, the ODP will extend its reach to the car

The vehicle will become an intelligent agent running logic at the edge

# Today Volkswagen Connectivity provides four different service packages around the car

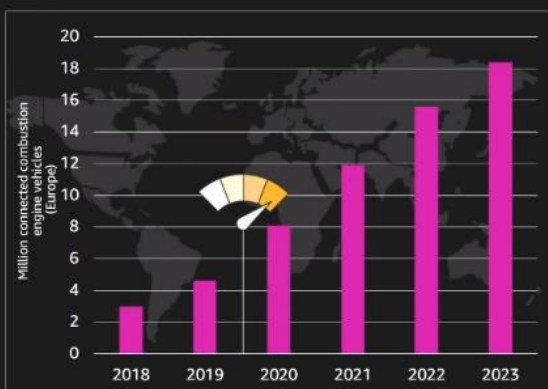| App Connect | Guide & Inform | Security & Service | E-Remote |
|---|---|---|---|
| Bring smartphone apps to your car | Be better informed while driving | Mobile access to vehicle functions plus functions that will make your journey even safer | Easy access to the main functions of your e-model |

# The Volkswagen "Modularer Backend Baukasten" (MBB) enables vehicle connectivity

**"Modularer Backend Baukasten" (MBB)**

- Launched in 2011
- 100+ applications
- Traditional data center environment
- x86 server infrastructure
- Java/ Tomcat application server
- Oracle RAC database
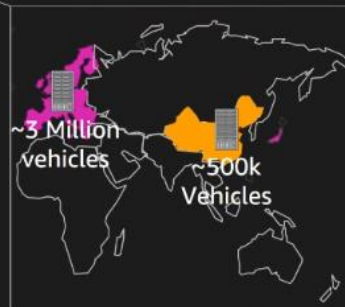
~3 Million vehicles

~500k Vehicles

# The growth of connected vehicles is going to be significant over the next couple of years

Million connected combustion engine vehicles (Europe)

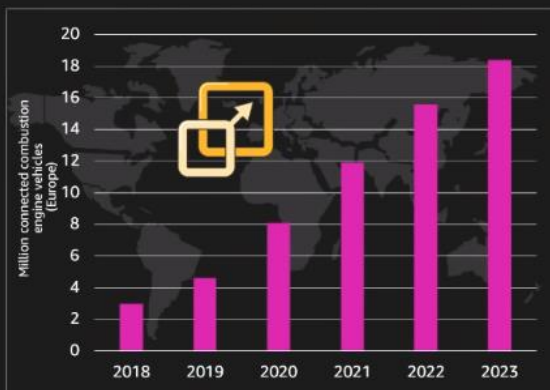| Year | |
|---|---|
| 2018 | |
| 2019 | |
| 2020 | |
| 2021 | |
| 2022 | |
| 2023 | |

Growth in connected vehicles + increase in MBB services

Capacity limit of the MBB exceeded after 2019

# The growth of connected vehicles is going to be significant over the next couple of years



Million connected combustion engine vehicles (Europe)

2018, 2019, 2020, 2021, 2022, 2023

**Growth in connected vehicles + increase in MBB services**

**Capacity limit of the MBB exceeded after 2019**

**Re-architect our backend to become cloud native**

---

# Setting the pace: The project needs to deliver on a tight schedule to meet the launch of our new fleet

## Scope
100+ applications to the cloud

## Timeline
14 months to support the launch of the new Passat and other upcoming models (for example, Golf) in 2019

## Approach
Re-platforming including containerization of applications and Oracle DB replacement

## Team
120+ experts in a joint Volkswagen, Audi, and Porsche team

---

# Empowering the developers: How do we enable the development teams to use the cloud effectively?

**Distributed dev teams**  **MBB apps**

➡️|⬅️ Traditional "plan build run" separation of duties

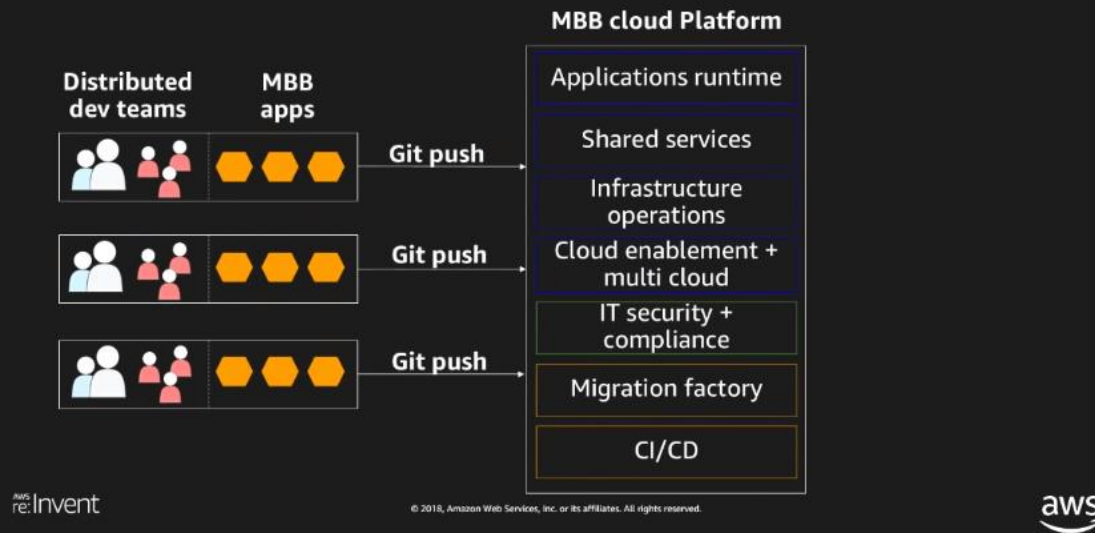➡️|⬅️ Multiple external partners

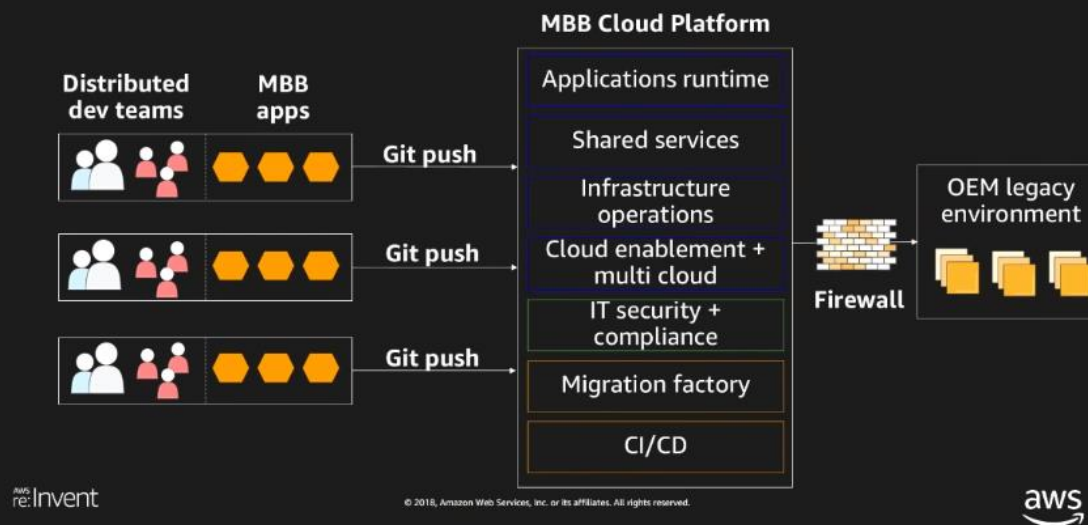➡️|⬅️ Capacity constraints

➡️|⬅️ Challenging feature backlog for new vehicles

**Continue established software delivery model with external development teams**

# Our solution: The MBB Cloud Platform

**Distributed dev teams**  **MBB apps**

Git push →

Git push →

Git push →

**MBB cloud Platform**
- Applications runtime
- Shared services
- Infrastructure operations
- Cloud enablement + multi cloud
- IT security + compliance
- Migration factory
- CI/CD

aws

---

# Legacy integration: Enabling access to OnPrem

**Distributed dev teams**  **MBB apps**

Git push →

Git push →

Git push →

**MBB Cloud Platform**
- Applications runtime
- Shared services
- Infrastructure operations
- Cloud enablement + multi cloud
- IT security + compliance
- Migration factory
- CI/CD

**Firewall**

**OEM legacy environment**

aws

---

# Key platform concepts

# The MBB cloud platform decouples the applications from the underlying cloud provider

**Global rollout**
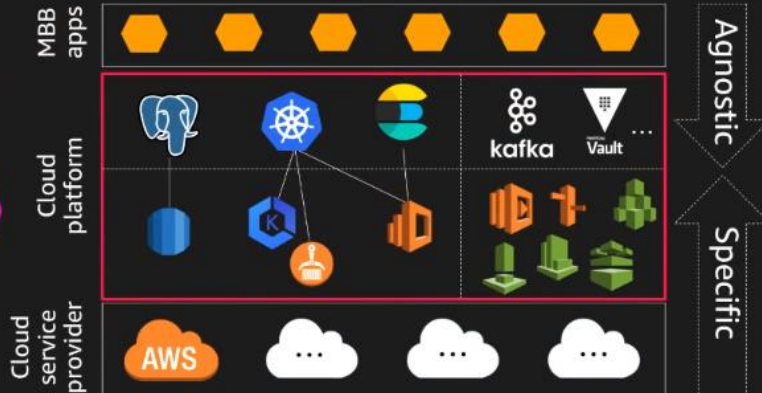Supports Volkswagen's global footprint

**Flexibility**
Avoid application dependency on cloud provider

MBB apps

Cloud platform

Cloud service provider

AWS

Agnostic

Specific

---

# With the Amazon Elastic Container Service for Kubernetes (Amazon EKS) generally available in Dublin in August 2018, we are currently evaluating switching from KOPS to Amazon EKS

**Kubernetes**
Use AWS managed service for key runtime component while supporting development until EKS GA

v1.0

v2.0

---

# The MBB cloud platform has been designed along the AWS Well-Architected Framework principles

General design principles

Pillar-specific design principles

**AWS Well-Architected**
Implement AWS best practices in the platform design right from the start

Scale for multiple services and teams

Strong security and compliance baseline

Transparent, compliant, and auditable

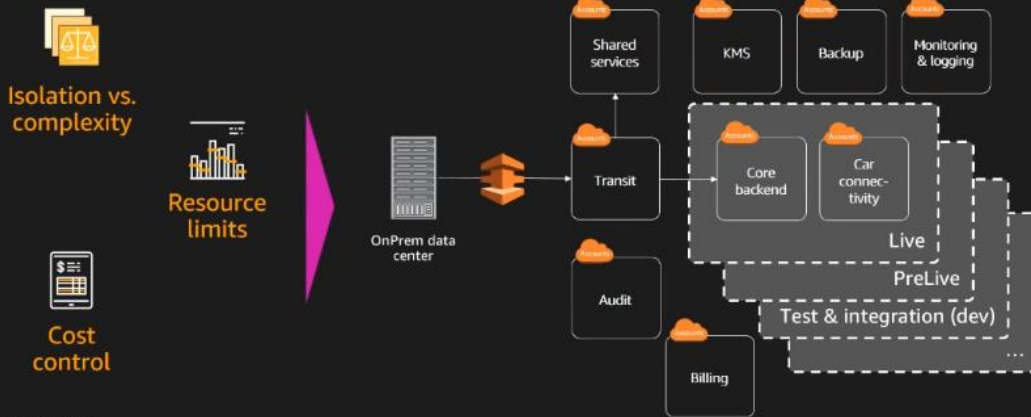Guardrails (not blockers)

Automation

Resilient and seamless network integration

Self service approach

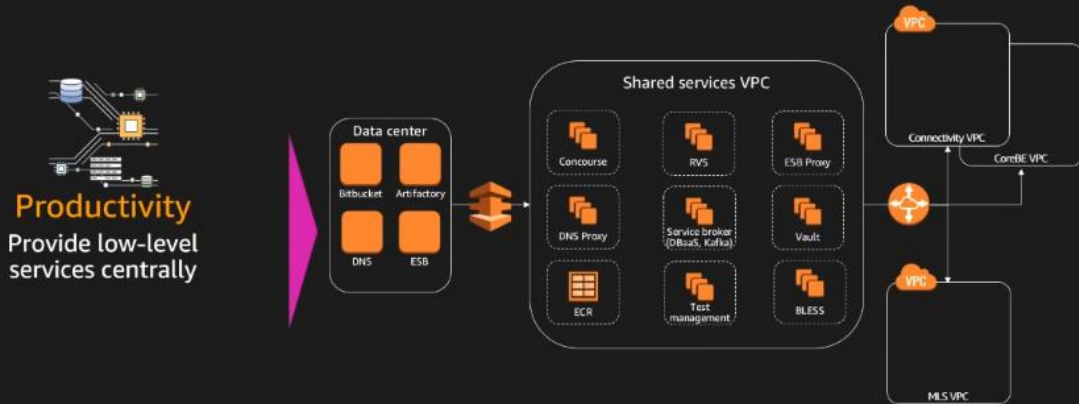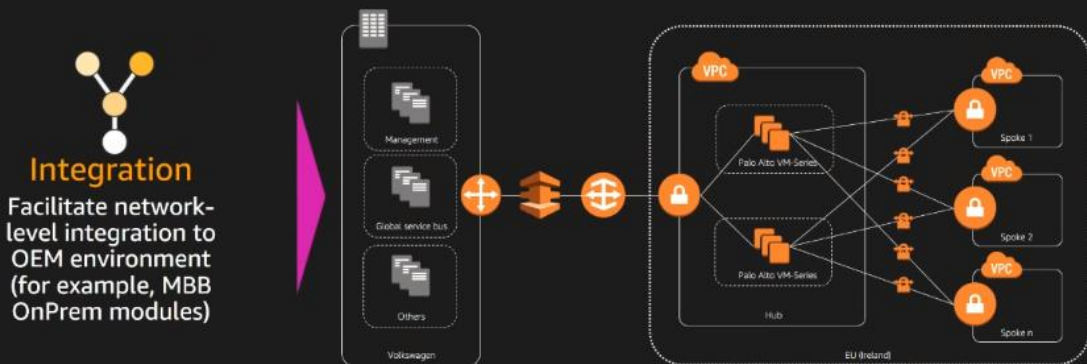# A multi-account design is based on separation of functional scope and stages



Isolation vs. complexity

Resource limits

Cost control

OnPrem data center

Transit

Shared services

KMS

Backup

Monitoring & logging

Core backend

Car connectivity

Live

PreLive

Test & integration (dev)

Audit

Billing

---

# A comprehensive set of shared services can be consumed across all MBB applications



Productivity
Provide low-level services centrally

Data center

Bitbucket  Artifactory

DNS  ESB

Shared services VPC

Concourse  RVS  ESB Proxy

DNS Proxy  Service broker (DBaaS, Kafka)  Vault

ECR  Test management  BLESS

VPC

Connectivity VPC

CoreBE VPC

VPC

MLS VPC

---

# A transit VPC facilitates seamless network level integration between MBB cloud and OnPrem



Integration
Facilitate network-level integration to OEM environment (for example, MBB OnPrem modules)

Management

Global service bus

Others

Volkswagen

VPC

Palo Alto VM-Series

Palo Alto VM-Series

Hub

Spoke 1

Spoke 2

Spoke n

EU (Ireland)

# Security and compliance controls are baked into the platform

**Security / compliance**

Use a fully automated approach to stay in full control of the environment

**Comprehensive baselines applied to enforce standards across accounts**

| Pre-provisioned security audit/ remediation access | Data encryption controls | Hardened machine images | Config change tracking | Centralized logging and security event monitoring |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |

---

# Data from the security controls actively drives automated remediation of findings and risks

**Security / compliance**

Use a fully automated approach to stay in full control of the environment

100+ AWS accounts

100s of resources across multiple AWS regions

50+ security packages and thousands of rules applied

AWS

AWS Config | AWS CloudTrail | Amazon CloudWatch | AWS Trusted Advisor | Amazon GuardDuty | Amazon Inspector

AWS

Amazon SNS (All/Aggregated events) → AWS Lambda (Notifications & remediations)

Amazon CloudWatch (Event Bus and Rules) | Cloud Custodian

Amazon GuardDuty | AWS Config | AWS CloudTrail

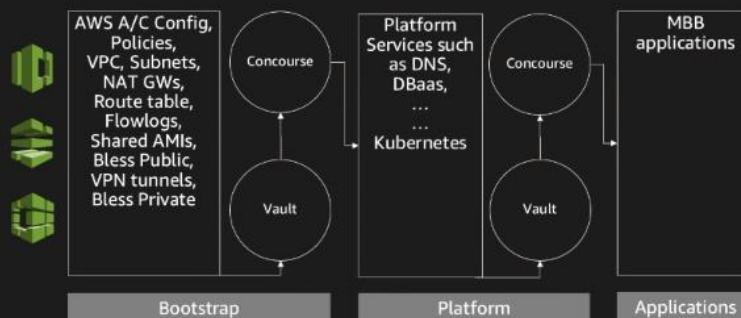(Multi-account, multi-region data aggregation)

aws

---

# A fully automated deployment process is in place to ramp up new environments quickly

**Deployment**

Apply "everything as code" paradigm from end to end to facilitate maximum stability

AWS A/C Config, Policies, VPC, Subnets, NAT GWs, Route table, Flowlogs, Shared AMIs, Bless Public, VPN tunnels, Bless Private

Concourse

Vault

**Bootstrap**

Platform Services such as DNS, DBaas, ...
...
Kubernetes

Concourse

Vault

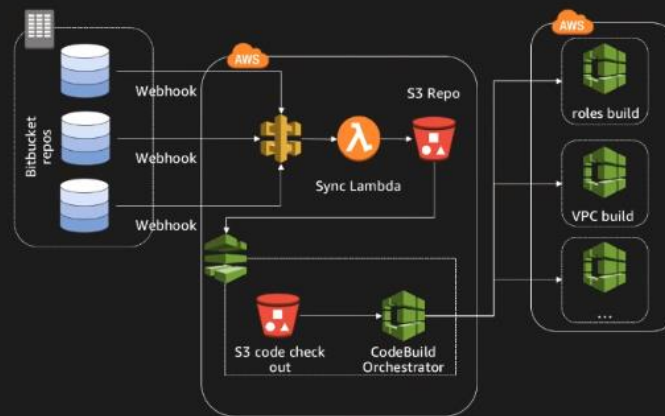**Platform**

MBB applications

**Applications**

# Automated bootstrapping accelerates a multi-region rollout

## Bootstrap

Automate new environment bootstrapping by implementing a standardized modular pipeline
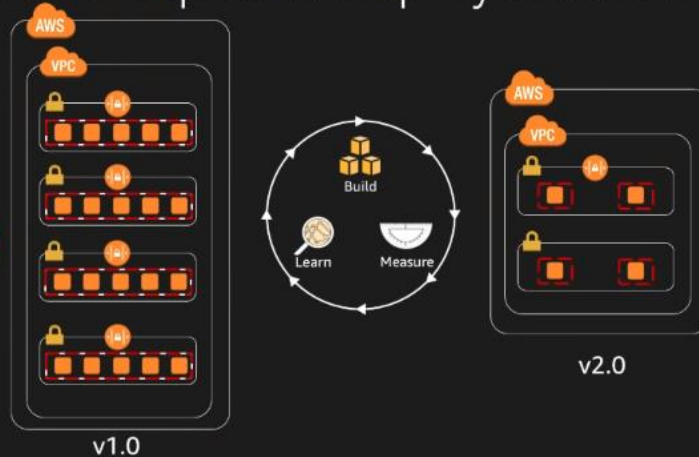


# Through learnings in cross functional teams the VPC design evolved from complex to simple yet effective

## X Functional Teams

Facilitate joint learning to build the best solution



v1.0

v2.0

aws re:Invent

aws

# Lessons learned

## Cloud != infrastructure

Accept evolutionary approach for software defined infrastructure and start as early as possible!
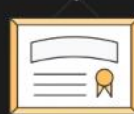
## Driven by demand

Tightly align application migration and platform implementation!

## Everything as code

Frequently set up new environments from scratch and improve automation!
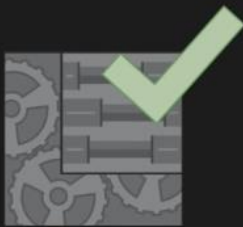
## Invest in skillset

Invest time and money into development of new skillsets like platform engineering!

## Acceptance needed

Spend time to develop a joint mindset with IT governance functions!

# As a next step the MBB will be iteratively refactored and extended to scale for 15 million connected vehicles

**Migrate**
MBB successfully migrated

**Modularize**
Modularize monolithic MBB modules

**Scale**
Scale MBB + cloud platform for 15 million vehicles

---

## Looking for new opportunities?

**VOLKSWAGEN**
AKTIENGESELLSCHAFT

Career @
Volkswagen

aws

---

# Thank you!

Ulrich Petri
Head of Business Technology Platforms
Volkswagen AG

Thomas Reske
Solution Architect
Amazon Web Services

aws