CLOUD NATIVE@BMW GROUP
TECHNOLOGY FOR THE AGILE TRANSITION.
BMW GROUP – OVERVIEW 2016.

126.013 employees worldwide

2.367.603 sold vehicles worldwide in 2016
ENSURING OUR POSITION AS TECHNOLOGY LEADER.
THE IMPLEMENTATION OF THE STRATEGY NUMBER ONE > NEXT LEADS TO A TRANSFORMATION PROCESS TOWARDS A TECH COMPANY.

"Die Wertschöpfung verschiebt sich von der Hardware in Richtung Software und Services."
Harald Krüger, 16.03.2016
BMW Group Bilanzpressekonferenz

Digital customer experience, connected and automated driving and digitalized business processes lead to a transformation of the BMW Group towards software and services (Tech).
BMW CONNECTED DRIVE HISTORY.
MORE THAN 40 YEARS OF EXPERIENCE.

Milestones

- BMW Turbo (radar technology).
- First use of telemetry in Formula 1.
- First on-board computer displaying outside temperature.
- World’s first Park Distance Control.
- First integrated navigation system.
- First e-call from BMW Assist in USA.
- Europe’s first telematics offer by BMW Assist.
- BMW Online: first internet-based in-car portal.
- First European manufacturer with Head-Up Display.
- First offer of Google™ services in a vehicle.
- First in-car internet access.
- First offer of third-party apps in a vehicle.
- First premium car manufacturer with in-car store.
- First premium car manufacturer with in-car store.

More than 15 years of telematics offers


More than 40 years of connected mobility
BMW CONNECTED DRIVE.
44 ESTABLISHED MARKETS WORLDWIDE.
BMW CONNECTED DRIVE. CONSISTING OF “SOFTWARE” AND “HARDWARE”.

BMW CONNECTED DRIVE

**DIGITAL SERVICES**

- Update and upgrade capable “software”

**DRIVER ASSISTANCE**

- Prefitted “hardware” and sensor technology
SELECTED USE CASES.

Electric Cars

Service Calls

Real-Time Traffic

Driving Assistance

Autonomous Driving
FACTS AND NUMBERS.

- **15** Years
- **8 Mio.** ConnectedDrive Cars
- **4 Mio.** Lines of Code (Backend)
- **30%** Yearly Growth
- **300** Microservices (Planned)
- **1100** Jenkins Jobs
CHALLENGES AND SOLUTIONS FOR CONNECTED CARS.

- More Cars are sold
- More Features in each car
- Traditional Development Cycles
- Traditional Service Delivery

Growth

Enterprise

Time to Market

Cars

Conway's Law

Standardization

> 10 years of support

Planning ahead

Changeing (old) cars is hard
CLOUD NATIVE.
SERVICE DELIVERY IN THE PAST.

Manual Processes + Silos = Long Processes

We need to gain agility back

WHICH ELEMENTS REGARDING ARCHITECTURE AND TECHNOLOGY ARE MOST RELEVANT WHILE MOVING INTO AN AGILE WORLD?

**Requirements:**
- Short Time to Market
- Short Cycle Times
- Continuous Delivery
- Maintainability
- Stable Operations

**Innovation:**
- Integration and adoption of modern technologies
- Durability and fast reaction times
- Long term cost efficiencies

**Requirements:**
- Rapid integration of market available services (e.g. IoT, AI)
- Integration of Cloud based services (e.g. Robotics Predictive Maintenance)

**Micro Service Architecture**
Fast, flexible and independent realization of requirements with a Micro Service Architecture.

**Continuous Integration**
Early detection of integration issues and a constant availability of a "current" build with continuous integration.

**Cloud**
Easy access to innovations and global deployment with cloud based services.
MODERN SOFTWARE ARCHITECTURES BASED ON MICRO SERVICES.

Monolithic/Layered

Project/System

Code & Data

Changes

Java

DB

Additional SW

WebSphere MQ

Additional SW

Server

NAS

Micro Services

PaaS enables

Micro service

Application Code & Data

Cloud Native Application Platform

PaaS requires
- Focus on your existing systems for **quick wins**
- Full polyglot is now always the best way: **Try and Learn**
- Make switching easy by provide the „**old way“** in the „**new world“**
- **Standardize**
- Use analysis **tools** to support your teams
- Prepare early for questions regarding **session replication**
Don’t replace old monsters by new ones.

Cloud monoliths will soon also cause pain.

Rather go „standard“ than „product“.
CLOUD NATIVE. MIGRATION APPROACH.

- Overprovision when necessary, don’t even try to auto scale a monolith
- Don’t ignore the economic aspects (price model)
Hybrid means **outsourcing**
- Same code / containers inside and outside
- There's always a better offer, **be ready to switch**, and then stay
- **Compliance, Privacy, Security**
CLOUD NATIVE.
CLOUD BASED SERVICE DELIVERY.

Technology Stack

Cloud Native Platform

- payara
- kafka
- cassandra
- joynr.io
- PostgreSQL
- HiveMQ
- node.js
- Spark Streaming
- Docker
- Kubernetes
- Red Hat OpenShift

Connecting the dots.
**Enterprise PaaS**

- **Continuous Integration**: Source code based deployment, automatic builds/deployments, staging
- **Tool completeness**: user management, multi tenancy support, monitoring, log-file access, operational tools
- **Security**: removes docker security risks: no root execution, project isolation (vLANs), authorization for docker registry and log-access

**Cluster Management for Containers**

- **Powerful Technology**: Google Kubernetes is derived from Google’s cluster management tool BORG and brings cluster management for Docker containers.
- **Features**: HA-Scheduling, namespace separation, auto-scaling, rolling-updates, self-healing
- **Flexibility**: Can span a cluster across nodes in mixed infrastructures (local servers, public clouds, multiple locations)

**Container Virtualization**

- **Standards**: De facto standard for container virtualization, packaging standard for applications, tools, infrastructure
- **Run anywhere**: Applications packaged in Docker Containers run everywhere (OpenShift, Linux, Amazon, Azure, ….)
- **Extendability**: Docker Hub provides thousands of docker packaged PaaS components
BMW CLUSTER BLUEPRINT. HA-SETUP.
MINIMUM CONFIGURATION: 15 BARE METAL SERVERS

Availability
Zone 3
Master 01
EFK 01

Availability
Zone 2
Master 02
Infra 01
EFK 02
Compute 01
Compute 03
Compute 05

Availability
Zone 1
Master 03
Master 04
Infra 02
EFK 03
Compute 02
Compute 04
Compute 06
BMW CLUSTER BLUEPRINT. HA-SETUP. MINIMUM CONFIGURATION: 15 BARE METAL SERVERS

- Spare servers for compute and master/infra
- Covers risk of hw damage
- Not part of „sold“ capacity
BMW CNAP CLUSTER BLUEPRINT.
STORAGE USE.

Masters use local disk for etcd

Infra uses NAS for Metrics (Casandra) DB and Docker Registry

EFK requires SAN for elastic search

Compute:
- Launch scope: only NAS
- Object storage
SOME TAKEAWAYS.

- Shift of responsibilities to developers: DevOps!
- Training of: developers, architects, operators required!
- Shift from instance operations to platform operations!
- Scale Architecture first but don't forget the Infrastructure!
- Capacity Management!
- Change is normal, still be ready to stick with your decisions!
- Share, communicate, educate!
- Don’t forget pricing!