Bosch:MongoDB Business Value Realization Study

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BOSCH

Agenda

- About this Study
- Study Overview
- MongoDB at Bosch
- Bosch Technology Challenges
- Business Benefits Achieved
- How MongoDB Helps

Outlook

- Business Value Realization Result Details
- Professional Services Engagements

About this Study

This document is Proprietary and Confidential between MongoDB Inc. and Robert Bosch GmbH.

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Why this study has been created

Bosch's transformation to a leading software company

Bosch started as pioneer in the field of IoT with the development of the IoT Suite in 2015. MongoDB is an essential component for data management & analytics as well as device management and digital twin (available as the products IoT Insights, IoT Hub, and IoT Device Management). Bosch also has been an early adopter of MongoDB as of 2010 for multiple innovation projects.

With the strengthened focus on AIoT, software development and the migration to Azure, MongoDB sees a stronger adoption at Bosch than ever before with the strongest growth on our multi-cloud service Atlas on Azure, AWS and GCP.

To ensure we can build on our long-lasting partnership and focus our efforts best in supporting Bosch, we created this study with the following goals:

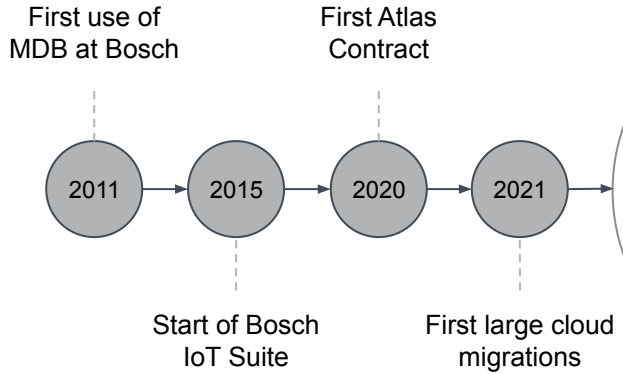
1. Understand the projects, current use and adoption rate of MongoDB within Bosch and its subsidiaries
2. Understand the benefits provided by the technology, but also the challenges and the risks
3. Have a common and shared understanding of the Current State to provide a number of recommendations that could lead to a better, riskless and more optimized use of the technology within the organization
4. Establish a long term and more strategic relationship between both companies
5. Share know how within Bosch and between business units
6. Align on strategic initiatives that could benefit most of using MongoDB and support in technical and business evaluation

Bosch - MongoDB Reference Story: Link MongoDB Company Website
Video Interview Bosch VP Dirk Slama with Mark Porter CTO of MongoDB on AIoT: YouTube Link

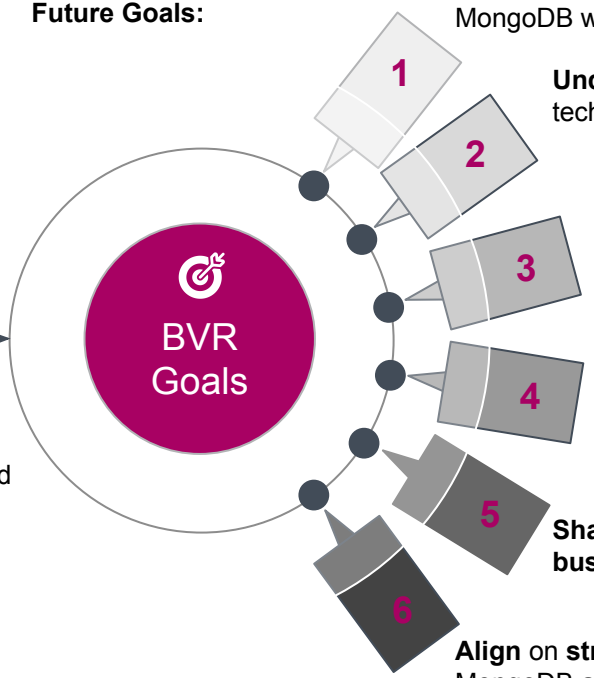
Why this study has been created

Support Bosch's transformation to a leading software company

Past Collaboration:



Future Goals:



Understand the projects, current use and adoption rate of MongoDB within Bosch and its subsidiaries

Understand the **benefits** provided by the technology, **but also** the **challenges and** the **risks**

Have a **common** and **shared understanding** of the **Current State** to **provide** a number of **recommendations** that could lead to a **better**, **riskless** and more **optimized use** of the **technology** within the organization

Establish a **long term** and more **strategic relationship** between both companies

Share know-how within Bosch and **across business units**

Align on **strategic initiatives** that could benefit most of using MongoDB and **support** in **technical and business evaluation**

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Interview Timeline - 12 Bosch projects in scope

Bosch IoT Things
Gerald Glocker

GSP
Jonas Gutjahr
Sergiy Kopchalyuk

OTA Vehicle Data
Frank Numrich

Track & Trace
Marc Siegel
Georg Deschler

Measurement Cloud
Jörn Babinsky
Fatih Salikutluk

DIY App
Simon Hartmann

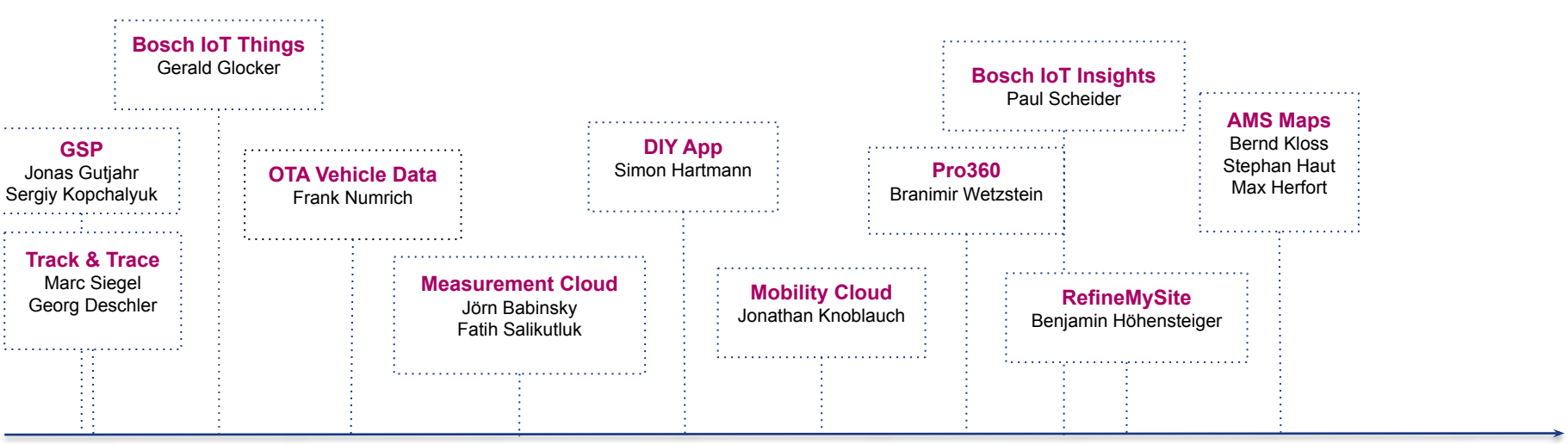
Mobility Cloud
Jonathan Knoblauch

Bosch IoT Insights
Paul Scheider

Pro360
Branimir Wetzstein

RefineMySite
Benjamin Höhensteiger

AMS Maps
Bernd Kloss
Stephan Haut
Max Herfort



Regina Wiese
Senior Customer Success Manager

Julian Storz
Regional Director - Automotive

Andreas Sailer
Principal Business Value Consultant

"Working as one Team: 14 Meetings, 21 People"

Study Overview

Executive summary

Customer facing and continuity critical applications benefit most

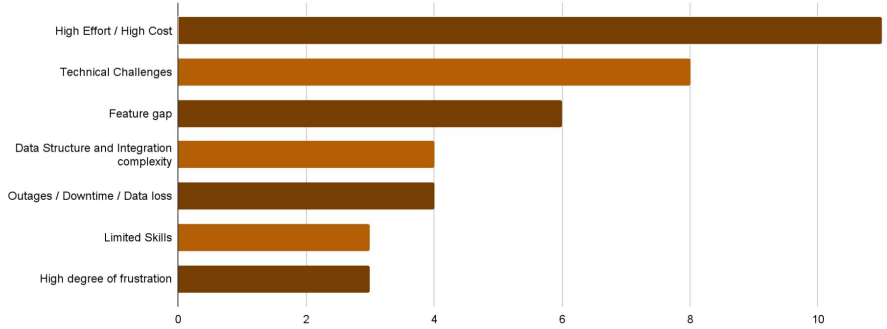
Key Business Drivers …

#1 - Developer Productivity:
Enhanced feature set and document data model allows for faster, more cost-efficient application development

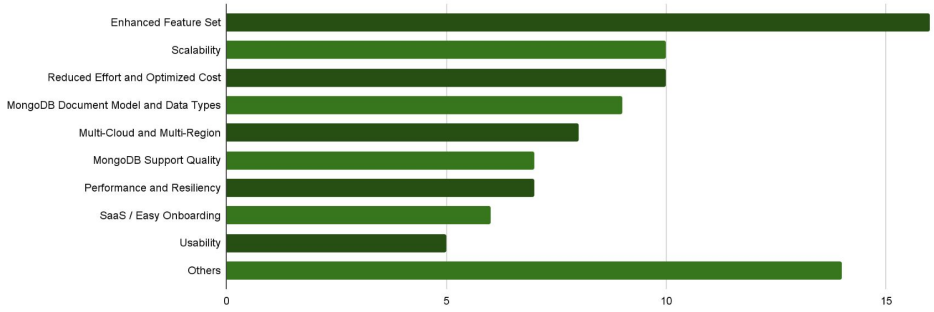
#2 - Reduce Application Risk:
Mitigate Risk by building more resilient and stable applications

#3 - Improve Customer Experience:
Drastically shortening Time to Market and providing a scalable high-performance foundation

Business Challenges*

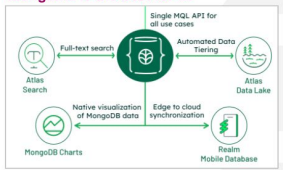


Business Benefits*



MongoDB Recommended Solution

MongoDB is the best for …



… modernizing legacy applications

- End of life or end of support
- Out of performance or capacity
- High complexity

Replacing relational and innovating

… remediating low-maturity NewDB pains

- High cost
- Missing features
- Low performance and resilience

e.g. CosmosDB: 67% - 72% of compatibility tests fail

… accelerating cloud transformation

- Application transformation on premise
- Easy zero downtime migrations
- Full burn-down of committed

Freedom to run anywhere

***Based on the interviews conducted with Bosch projects**

MongoDB at Bosch

MongoDB Team for Bosch

Account Team

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Solutions Architecture Team

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Bosch Lead Architect

Michael Gerstenberg
Solutions Architect

Adilet Sabyrbaev
Manager, Solutions Architecture

Consulting Team

Alexander Kusche
Sr. Engagement Manager

Sasha Titova
Named Technical Services Engineer - BIC

Ecosystem

Andreas Sailer
Principal Business Value Consultant

Quentin Duriez
Strategic Marketing Manager

Anirudh Kumar
Principal Partner Specialist

Sponsors

Gustavo Loewe
Area Vice President - Central & Eastern Europe

Anton Rau
Regional Vice President Central Europe

Julian Storz
Regional Director - Automotive

Product Management

Sahir Azam
Chief Product Officer

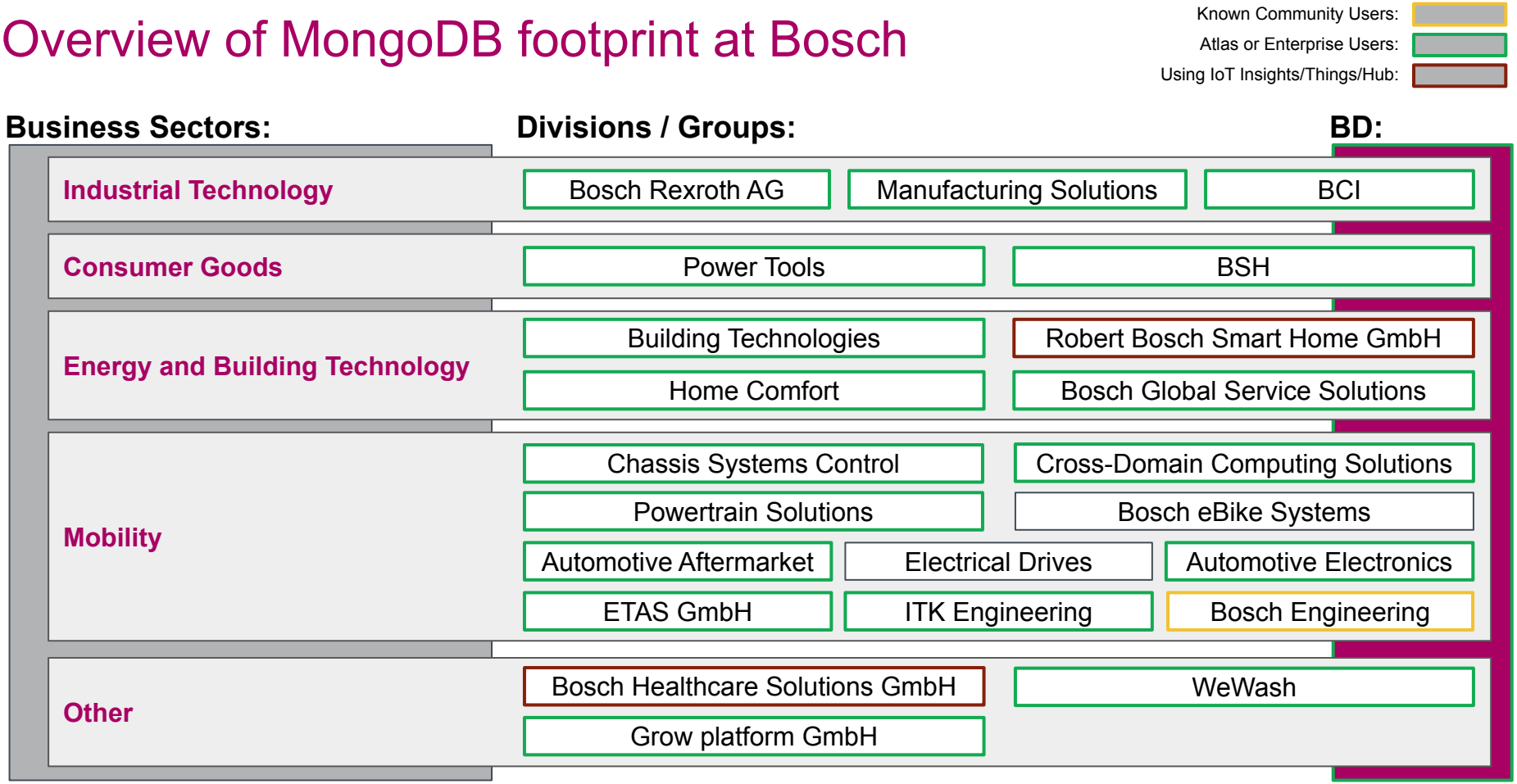
Michael Gargiulo
Sr. Product Manager
Time Series & Storage Execution

Industry Solutions Team

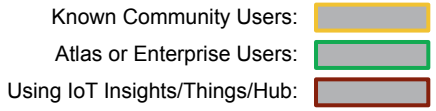
Boris Bialek
Field CTO, Industry Solutions & Market Intelligence

Raphael Schor
Principal Industry Solutions, Automotive & Manufacturing

Overview of MongoDB footprint at Bosch



Overview of MongoDB footprint at Bosch



Business Sectors:	Divisions / Groups:		BD:
Industrial Technology	AIoT, I4.0	Predictive Maintenance	I4.0
Consumer Goods	AIoT, Mobile, B2B, Search		Mobile, D2C, Single View
Energy and Building Technology	Digital Twin		Digital Twin, Data Analytics
	B2B, B2C Platform, AIoT		
Mobility	I4.0		Big Data, Search, Single View
	Predictive Maintenance, Analytics		
	Diagnostic, Search		QM
	VSS, Connected Car	I4.0, Single View	Analytics, Pred. Maint.
Other	Digital Twin, Data Analytics		IoT, Mobile
	IoT, I 4.0		

MongoDB Example Atlas Projects and Business Units

- **Bosch Softtec:** AMS Maps & Navigation, Air Quality Solution, Renzing, mySPIN, Tenzing
- **BSH:** Home Connect
- **CS - Bosch Connected Solutions:** EDS, MCS, VCC, VMS, Charge My EV
- **BCI - Bosch Connected Industry:** Nexeed
- **BT - Building Technologies:** Remote Portal
- **Bosch IO:** Product Area IoT Platform: Insights (analytics), Hub, Manager, Things (digital twin); Track and Trace, IoT Insights
- **PT - Bosch Power Tools:** RefineMySite, Contractor, DIY App, PRO360, GSP (Global Shared Platform), Measurement Cloud, Craftsphere Platform, Device Directory, JobSite, Shared Connectivity Platform, MeasureOn
- **Thermotechnology:** Remote Service Tool, HomeCom Pro
- **BSH:** bActive (Mobile App for service workers), D2C E-Commerce, New Agent Frontend
- **Bosch Smart Home GmbH:** IoT Things
- **Bosch Global Software Technologies:** Mahindra IoT, Mobility Cloud
- **XC - Cross Domain Computing Solution:** RideCare, Data Loop (PACE, Ford)
- **WeWash:** Usage Curve, Customer Backend
- **GS:** InTrack
- **Bosch India:** MPS (Mobility Platform Services), L.OS (Logistics Operating System)
- **Powertrain Systems:** Charging Services, Air Quality Solutions

> 100 Projects on Atlas

MongoDB Example On-Premise Projects

- **ATMO:** Monitoring, Predictive Maintenance, Multi-Database Platform, …
- **GROW:** 3D Printed individualized production
- **Powertrain Systems:** SMARD Guide, Xcellerator, Fuel-Cell Digital Twin
- **BD:** Product Area IoT Platform, Insights (Analytics), Hub, Manager, Things (digital twin)
- **RBEI:** IERO
- **Bosch Connected Industry:** AGV
- **Automotive Aftermarket:** Workshop Order Manager
- **CC - Chassis Systems Control:** Blaichach
- **PS - Powertrain Systems:** XCELLERATOR
- **AE - Automotive Electronics:** Quality Management IC
- …

> 200 Projects on EA

"Overall, **> 300** projects at Bosch are currently running on MongoDB"

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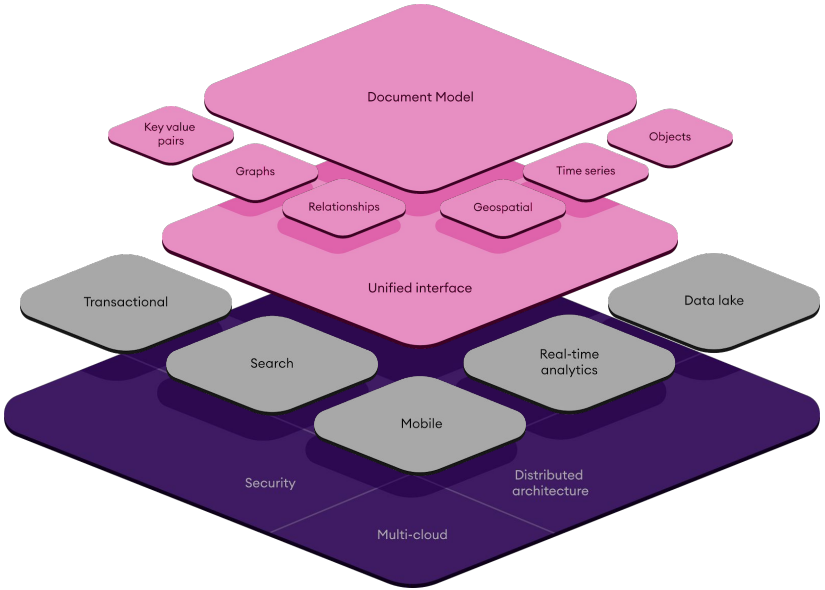
MongoDB Developer Data Platform

Runs anywhere: Bosch Hybrid Cloud to Azure, AWS & GCP



Available at BD: Marcel Martini (BD/ISA)
Product Page: https://inside-docupedia.bosch.com/confluence/x/5JCiXw
Order Page: https://rb-servicecatalog.apps.intranet.bosch.com/RequestCenter/website/Grunt/application/offer.html?id=4081

MongoDB Developer Data Platform

Runs anywhere: Bosch Hybrid Cloud to Azure, AWS & GCP

MongoDB Atlas address a range of application use cases and removes complexity

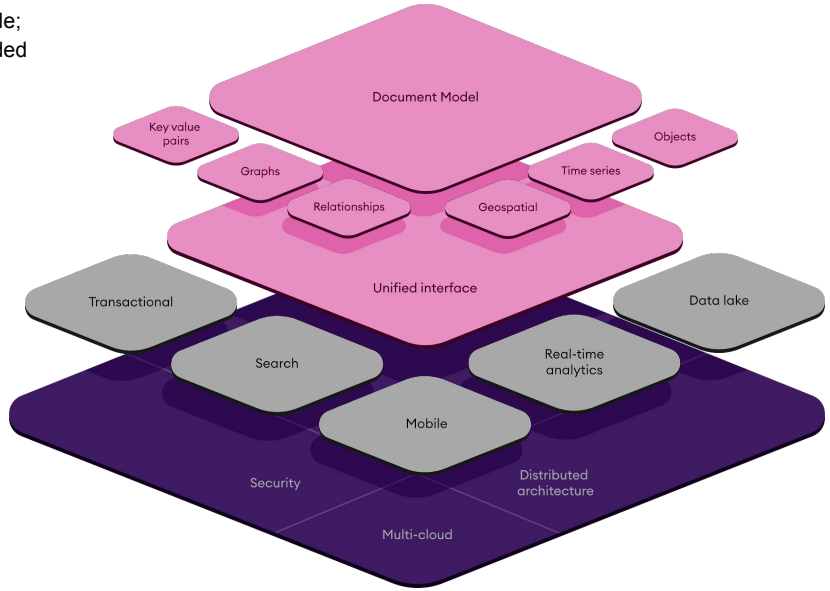
Data model that maps to how developers think/code; flexible while allowing data governance when needed

Strongly consistent, support for ACID transactions

Able to support full-text search functionality for delivering a great user experience

Able to support data on mobile devices at the edge w/o having to manually sync data

Able to deliver real-time analytics on live data w/o having to move data back & forth



MongoDB Atlas value proposition for the manufacturing industry

MongoDB leads digital twinning in IOT, IIOT and Industry 4.0: Seamless integrations from supplier (SAP interfaces etc) via manufacturing to maintenance

MongoDB leads consumer experience: vehicle, user integration without sync. Flexible from the phone to cloud to vehicle.

MongoDB leads value add applications: Fleet management, supplier MTBF, research, PIMs,...

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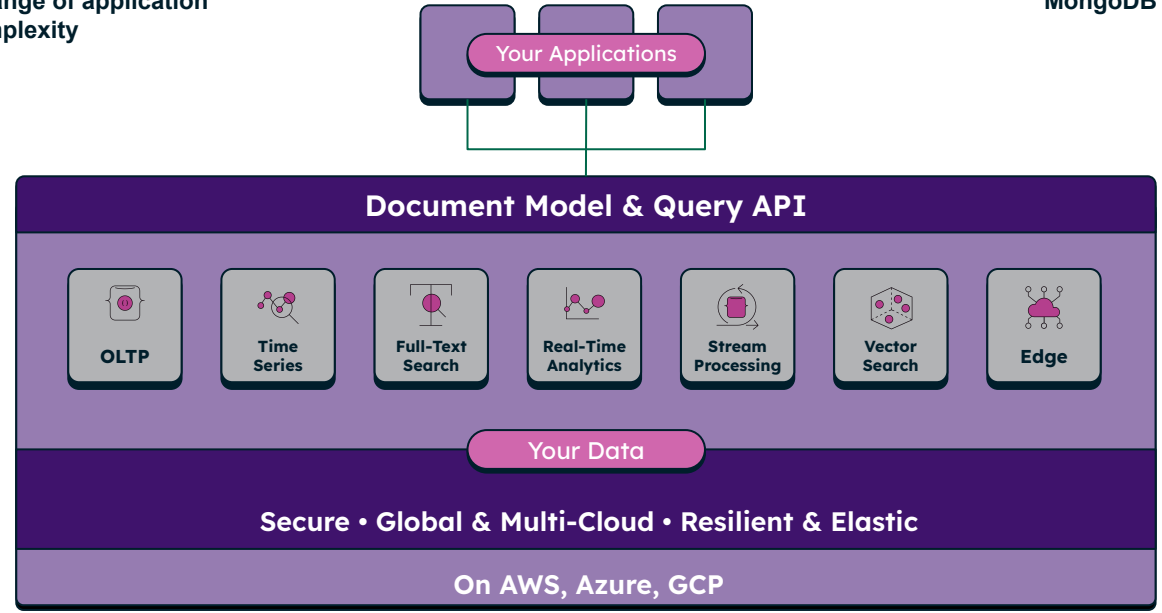

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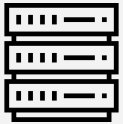
MongoDB as a Service on all infrastructures

BD provides all versions of MongoDB - Bosch compliant



On VMs as a Service:
Enterprise IT (EIT): Order in IT Service Portal (ITSP)

Running in K8s:
Service on Bosch Private Cloud (BPC)

MongoDB Atlas on:


Cloud onboarding completed by BD
SSO via Bosch AD

Available at BD: Marcel Martini (BD/ISA)
Product Page: https://inside-docupedia.bosch.com/confluence/display/MONGODBATLAS/MongoDB+Atlas+Implementation+Guide
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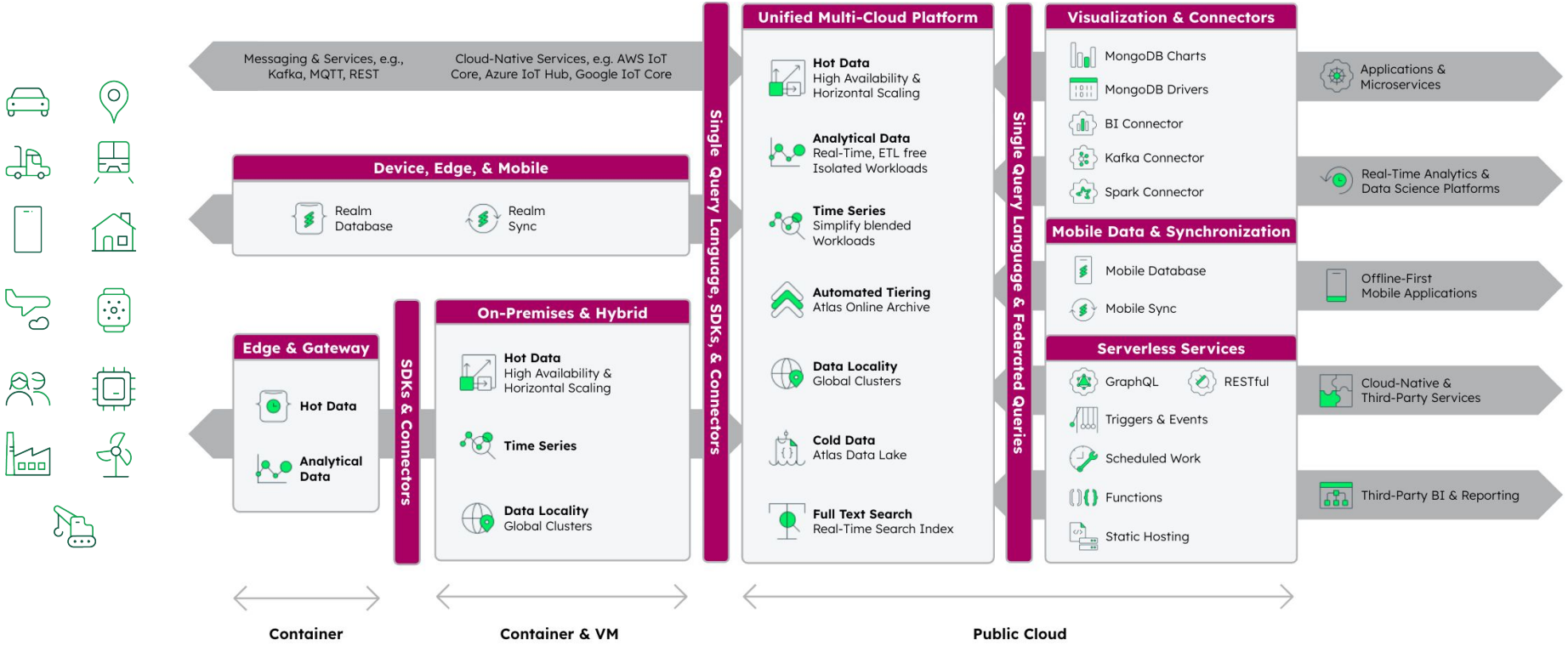
MongoDB University: https://learn.mongodb.com/

Fully integrated services from edge to cloud

MongoDB's application data platform simplifies development



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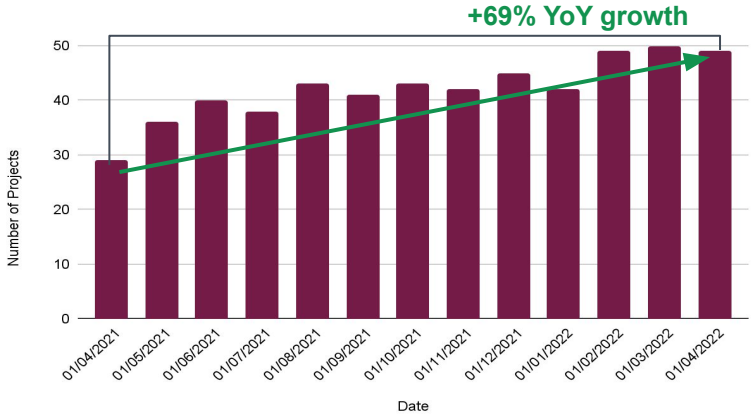
All KPIs have shown significant demand by developers

Strong growth and adoption of Atlas during the last year

Number of projects on Atlas



Number of clusters on Atlas

The number of **Projects on Atlas** have **grown** at a **69% rate year over year** - with an additional 20 projects created in from April 2021 to April 2022

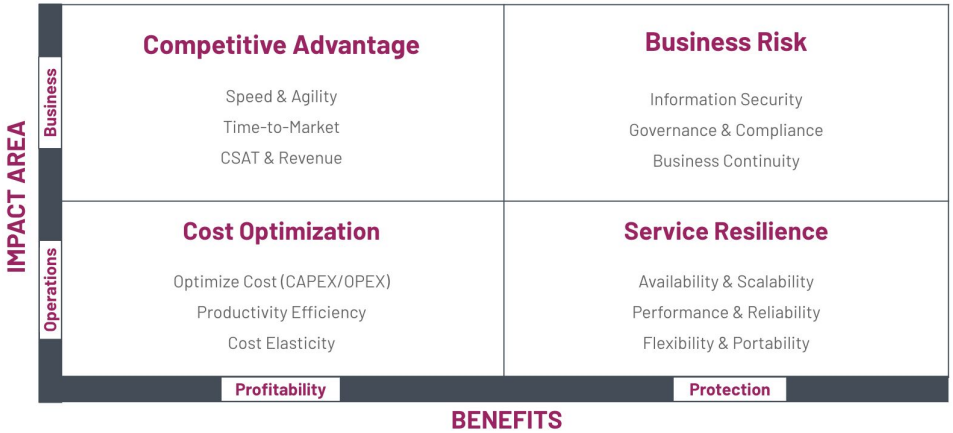
Similar growth visible for the number of **dedicated clusters** running on Atlas for Bosch - showcasing the **active utilization of Projects** created

Strong demand for Atlas across business units showcased in all KPIs, number of projects, users, clusters

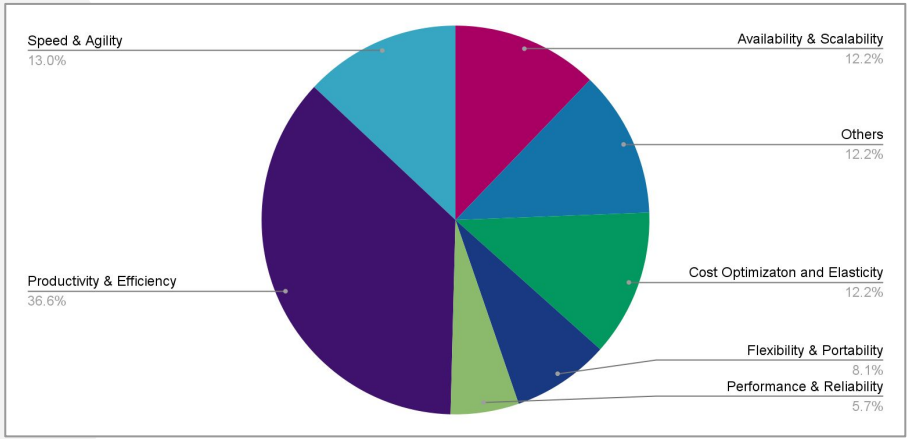
Categories of value drivers and overview

Most projects have experienced significant benefits in productivity

Impact Area / Benefits Matrix



Most important Value Drivers



This is what projects said

Statements made regarding different beneficial dimensions

MongoDB Speed & Agility

"If you work with JSON, it is totally easy using MongoDB. That's why it is so popular"

“Migration to MongoDB Atlas was a piece of cake (couple of days). For SQL migrations it usually takes 2-3 weeks”

"Easy project setup and onboarding - Team structures were established within 1-2 weeks "

MongoDB Enhanced Capabilities

“Auto-Scaling was a big advantage for us”

“Our Management was excited about 1 min RPO capability”

“It helped us a lot that MongoDB supports Transactions”

MongoDB vs. Imitators

"In combination with our scalability requirements CosmosDB cost have scared us"

"CosmosDB is not MongoDB Atlas - it is just an old imitation"

"We achieved between 25% and 30% cost savings" - up to 70% at Bosch Power Tools

Options to enable Bosch on MongoDB

Developer enablement is one of the key asks by projects

Common challenges:

- Relational Mindset
- Unknown Capabilities
- Missing Best Practices

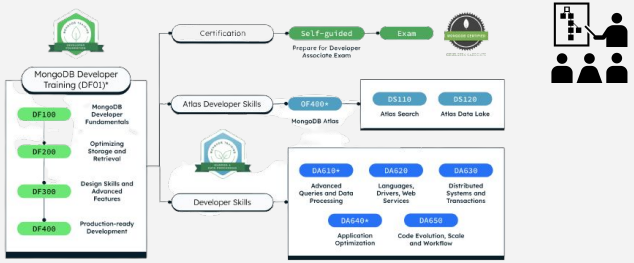
MongoDB University

- Self paced learning
- Defined learning paths
- On-Demand
- Free of charge for Bosch
- Accessible via Bosch AD Credentials
- Option to get officially certified

Developer learning path

Instructor led trainings

- Project-specific examples
- Trainer lead enablement (on-prem.)
- Collaborative hands-on experience
- Ability discuss approaches
- Modular structure, optimized paths
- Highly specialized training available

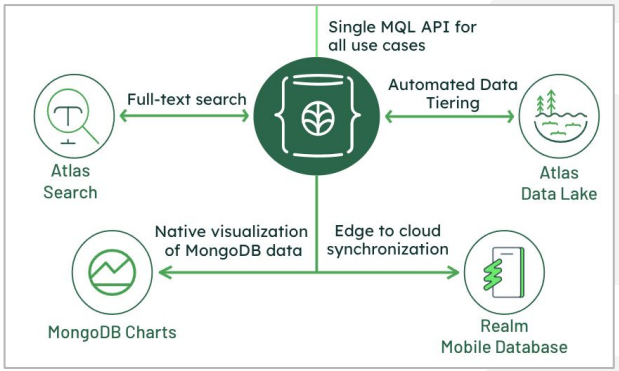


*In addition, we offer office hours, workshops and plan a joint Teams channel

MongoDB is a developer data platform for critical workloads

Three use cases have been identified for Bosch during BVR study

MongoDB is the best for …



… modernizing legacy applications

- End of life or end of support
- Out of performance or capacity
- High complexity

Replacing relational and innovating

… remediating low-maturity NewDB pains

- High cost
- Missing features
- Low performance and resilience

e.g. Cosmos DB: 67% - 72% of compatibility tests fail

… accelerating cloud transformation

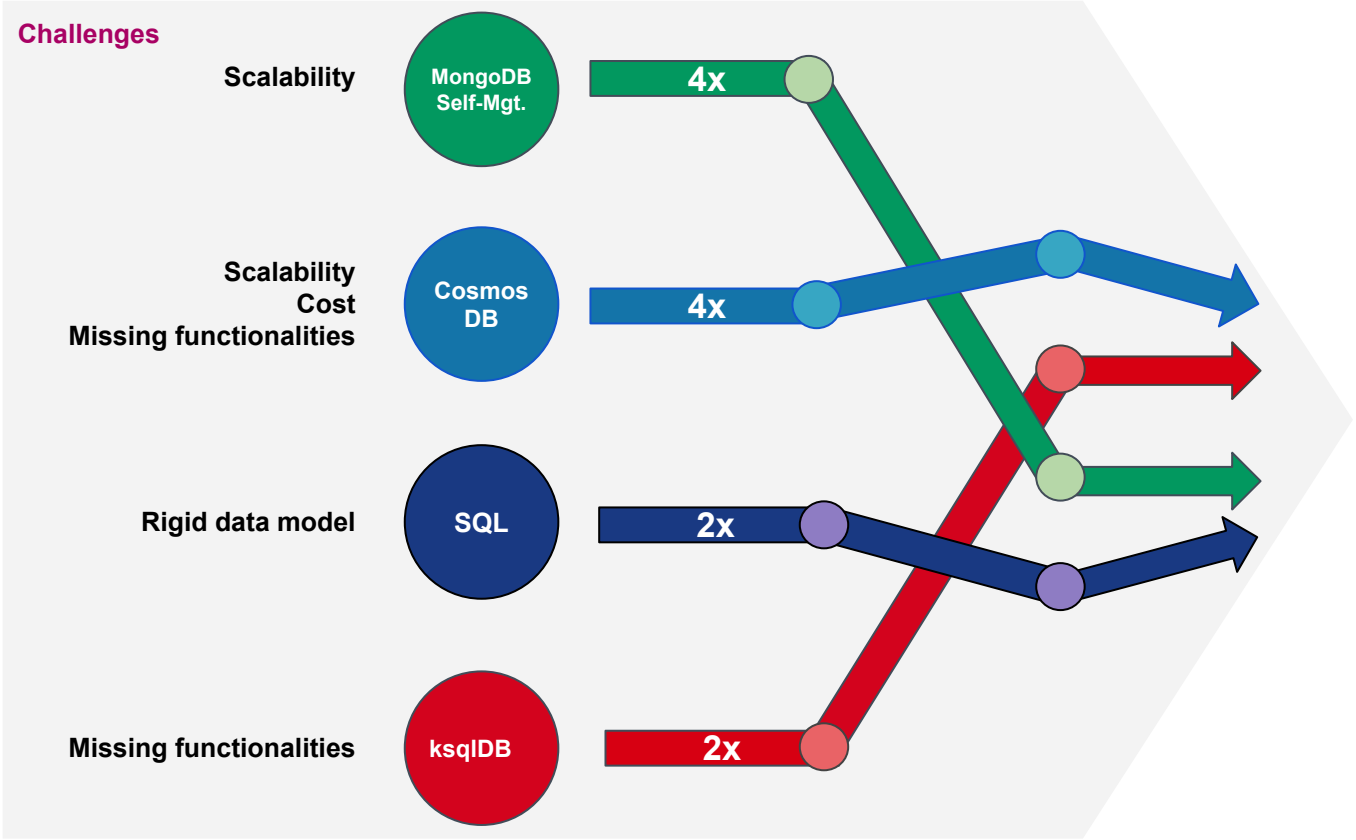
- Application transformation on premise
- Easy zero downtime migrations
- Full burn-down of committed

Freedom to run anywhere

Bosch Technology Challenges

Projects had different technology background

Multiple scenarios and migrations paths covered in this study

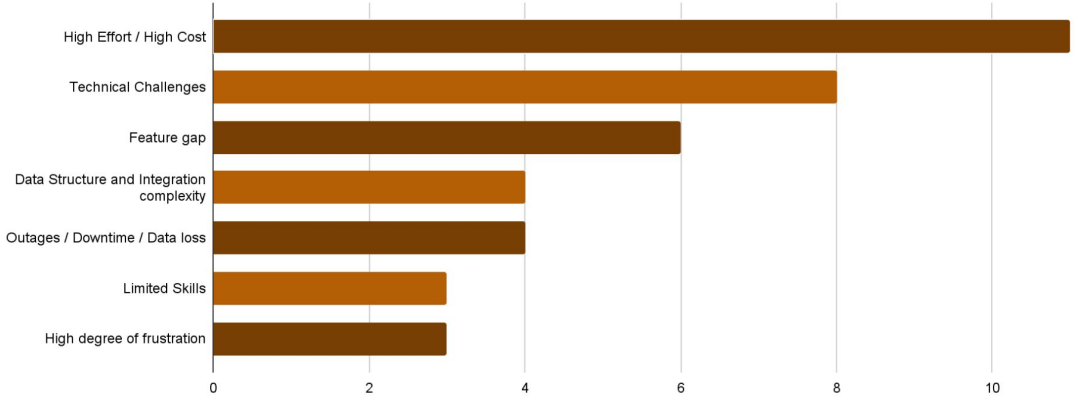


12 Projects

1 Solution

Key challenges observed

Across all projects and paths certain challenges were common



High Effort / Cost:

- “Changing the data model took two and a half months - something that otherwise could have been done in just one (150% higher effort)”
- “Costs way to high at scale”
- “Complex non-transparent cost models, making budget planning inaccurate and laborious”
- “kSQL data structure complexity caused 20 additional tickets per month to solve developer requirements”

Technical Challenges:

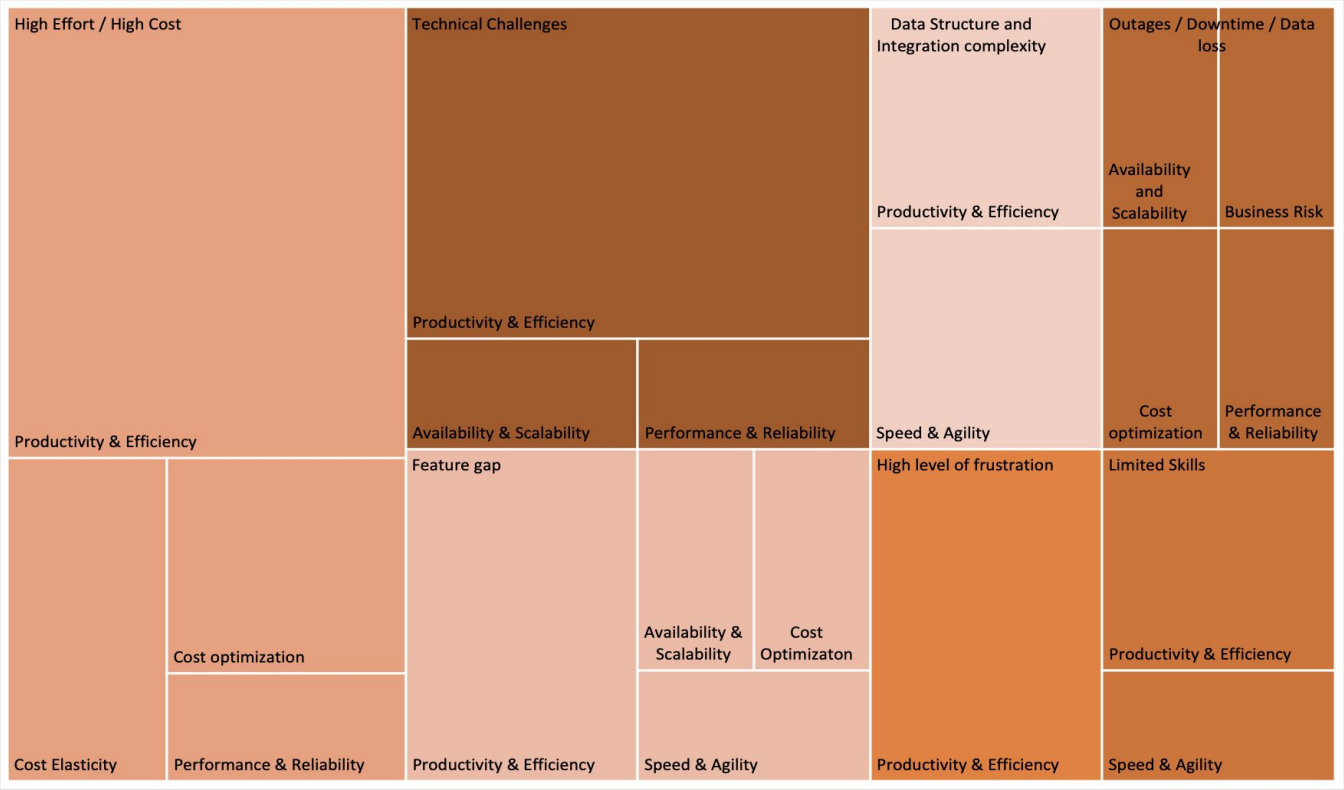
- “Reaching scalability limits”
- “Some queries simply did not work despite provisioning more RUs”
- “Many additional architecture components and ETLs necessary” i.e. CosmosDB, Azure Search, Azure Functions and Datalake Gen II

Feature Gap:

- “Scripts stopped working - every time leading to one sometimes two additional days of work”
- “Missing statements in CosmosDB force developers to build workarounds - i.e. faulty implementation of change streams or TTL - causing overhead and additional maintenance cost”
- “Outdated versions in cloud services cause difficulties”

Detailed overview of Bosch technology challenges

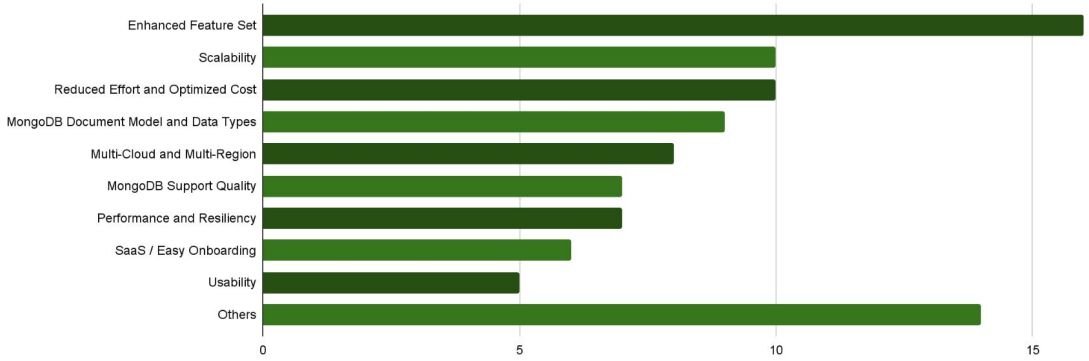
Key challenge lies in developer productivity and missing features



Business Benefits Achieved

Key benefits of MongoDB observed

Main drivers for productivity are enhanced features and integration



Enhanced Feature Set:

- “Rather than just being told to scale up, the profiler shows how to actually optimize the application”
- “2-3 years worth of data got simply archived with a couple of clicks” (while still being accessible)
- “Integrated out-of-the-box services with limited effort to configure”
- “Real competitive advantage - best platform for best tools”
- “Management has been delighted by 1 min RPO”
- “ACID transaction support is really helpful”

Scalability:

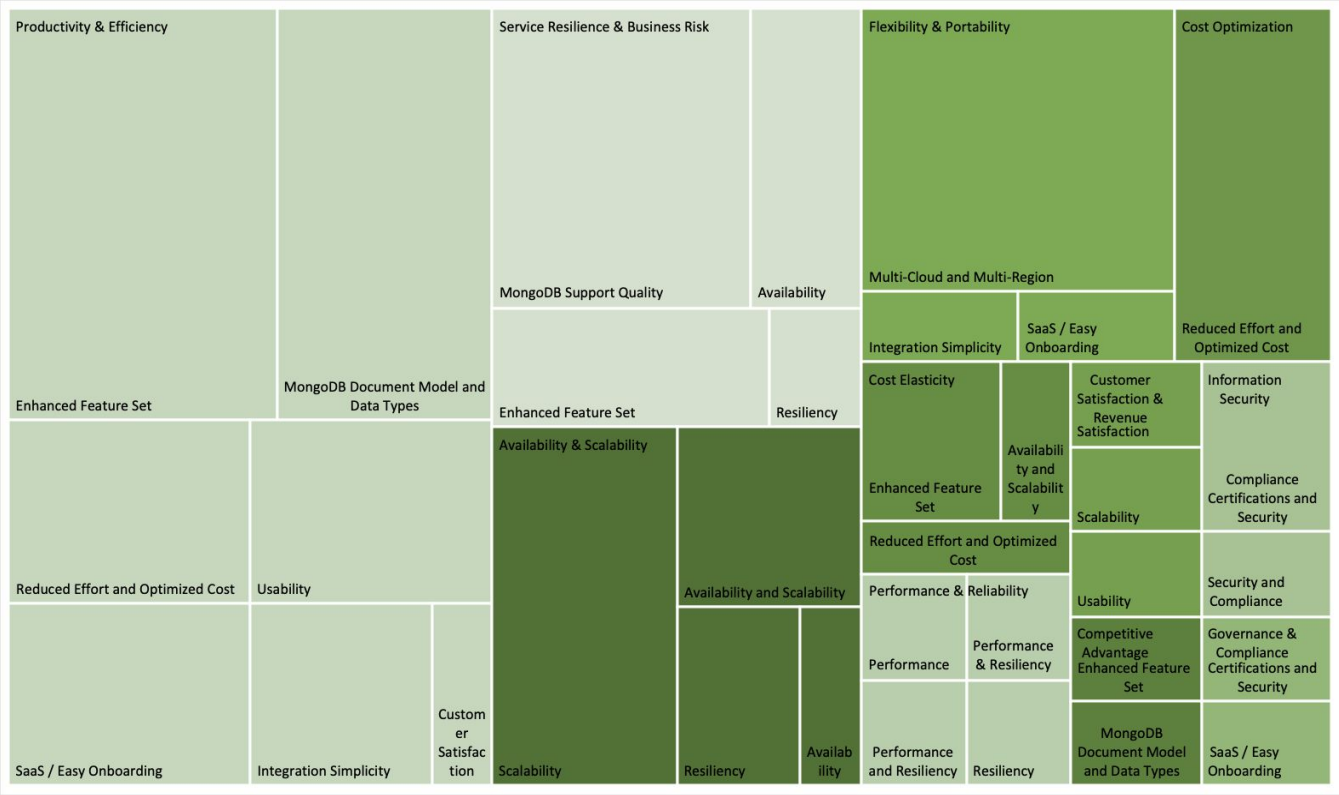
- “Using Sharding / Re-sharding and Auto-Scaling functionality for elastic scalability (up/down/out) to reach consistent and stable performance based on business requirements”
- “Autoscaling provides great value to us”
- “Started deploying MongoDB on our own, but with scaling the operations efforts increased and so we decided to go with Atlas”
- “Multiple customers request large data volumes >50 TB - Atlas provides a secure, scalable and proven solution for customers to grow”

Reduced Effort and Optimized Cost:

- “Cost was the main driver for the management”; “25-30% cost reduction”; “more than 60% savings”; “about 70% lower cost”
- “Reduce cost and improve margin of the platform at scale by further leveraging automation features and data tiering capabilities”
- “Started working with domain oriented microservices in various ways, soon moved everything to MongoDB”
- “>15% increased developer productivity”

Detailed overview of achieved business benefits

Benefits can be observed in all dimensions of a software projects



12 Projects interviewed with 100% satisfaction

Collaboration with MongoDB is seen as high value add by projects

Our satisfaction survey approach

Questions we have asked:

- How satisfied are you with our Support?
- Any challenges you faced with Atlas?

Feedback we received:

- “We are super happy”
- “Questions get answered fast by MongoDB”
- “We are satisfied”
- “Your support is really good”
- “No complaints”
- “No outages or other issues”
- “It’s great that somebody is following up proactively”
- “MongoDB works pretty well. We get the performance we need”

*All interviewed projects were happy with provided Bosch Service, MongoDB as a product as well as collaboration with account team

How we collaborate with Bosch

Technology Evaluation:

- Technical Feasibility Workshop
- Business Value Assessment
- Proof of Value

Customer Success Management:

- Helps project onboarding and planning
- Link to product management
- Link to support organization

Professional Services:

- Project-specific advisory consulting
- Training and enablement
- Dedicated consulting resources

Proactive Technical Product Support:

- 24/7/365 follow the sun
- Named technical support engineers
- Up to 15 min response time SLA

Daimler production issue support

External Inbox ×

FIXED-TERM Kinanov Aleksandar (IOB/OPS4)
to brian.blevins@mongodb.com, jack.alder@mongodb.com, me, Schmidt, Raychev, Hinov, Niklas, Zimniewicz

12:49 PM (10 minutes ago)

Hello everybody,

On behalf of our team, I want to express the appreciation and gratitude for Jack's support yesterday regarding the production outage, affecting millions of devices, we had been fighting with.

His insanely fast and adequate support helped us bring our production environment back on track even faster than we anticipated.

In just about 2 hours, with Jack's help, we managed to take actions that resolved the problem as well as outline a plan for future steps that would prevent such incidents and also improve our existing infrastructure.

All in all, if professionalism and technical expertise had human embodiment, that would be somebody like Jack.

Thanks A LOT, Jack! You rock!

Mit freundlichen Grüßen / Best regards

Aleksandar Kitanov

Operations 4 Bulgaria (IOB/OPS4)
Robert Bosch GmbH | Postfach 10 60 50 | 70049 Stuttgart | GERMANY | www.bosch.com
Tel. +359 2 9061227 | fixed-term.aleksandar.kitanov@bosch.io

Studies with other customers have shown similar results

MongoDB provides significant benefits for application developers

	Cost	Effort	Performance
RDBMS	TCO savings of **55%-75%**	**50%** Effort reduction **70%** increase in DevOps Productivity	Up to **20x** better Response Times
Other NoSQL	DB cost savings of **30% - 90%**	**20% - 50%** Effort reduction **40%** increase in DevOps Productivity	**13x** faster Ingest Rates at same cost
MongoDB Community	TCO savings of **10% - 30%**	Up to **12x** Effort reduction **80%** DevOps Productivity	Up to **50%** improvement through automated Performance Advisor
Heterogeneous Tech-Stacks	Depends on the Technology Stack	Depends on the Technology Stack	Depends on the Technology Stack

*All numbers are taken from implemented customer projects and vary depending on the amount of data and type of requirements.

Innovation Tax Avoidance - Example Bosch

Potential cost avoidance by leveraging MongoDB Atlas upfront

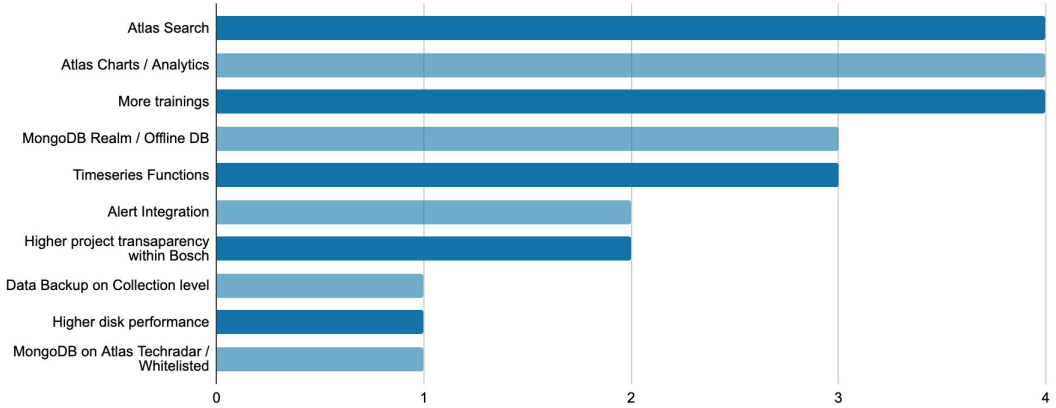
Cost reduction	DB Cost reduction	**$ 173 k** of DB cost savings over next 12 months (w/o growth)* *30% (range of cost reduction realised has been between 30% and up to 60%)
Cost avoidance	Migration Cost	**$ 60 k** of one-time migration cost (1 week of effort for 2 FTEs / project)
Cost avoidance	Productivity and Efficiency	**$ 480 k** of negative impact on productivity and efficiency per year (10 days per quarter for workarounds and bug fixing / project)

12 projects could avoid **$ 713 k** of annual cost → **100 projects***: **$ 6 Million p.a.**

How MongoDB Helps

Demands identified during interviews

Projects have raised demands in dimensions product and training



Atlas Search:

- “Continuously face challenges with growing complexities of search requirements”
- “Atlas search *could* be a solution / simplification for us”
- “Azure search has some limitations and increases the complexity of the application”

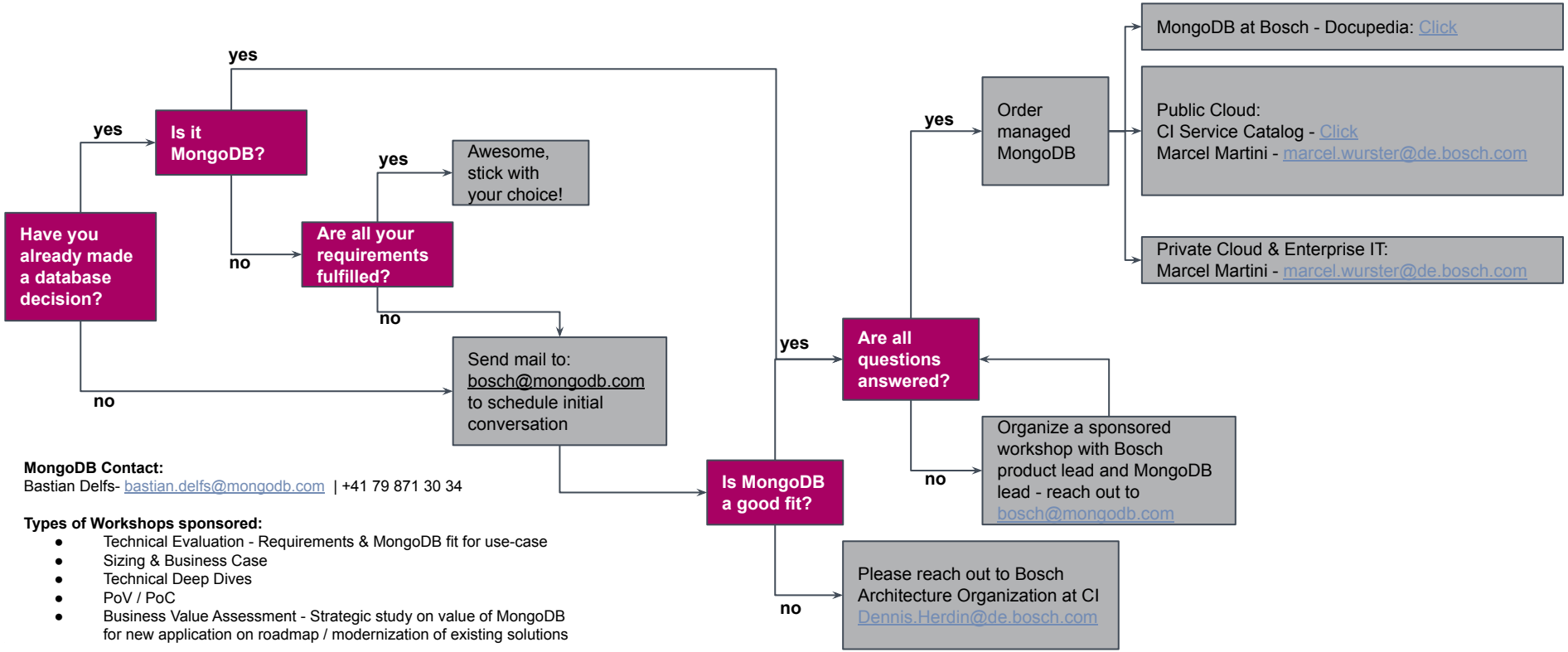
Atlas Charts / Analytics and Time-Series:

- “Time series collections can simplify this”
- “Reporting has been a big challenge to us before”
- “Are running first tests with Charts for new devices”
- “Workload isolation is helpful” (MongoDB allows to separate analytical and operational workloads on the same cluster)

More Trainings:

- “Incident could not be resolved caused due to lack of knowledge - now after training this would not have happened anymore”
- “Feeling much better through training to learn how I can achieve better performance and improve data structures”

Are you in a technology evaluation process?
Overview Bosch:MongoDB collaboration model



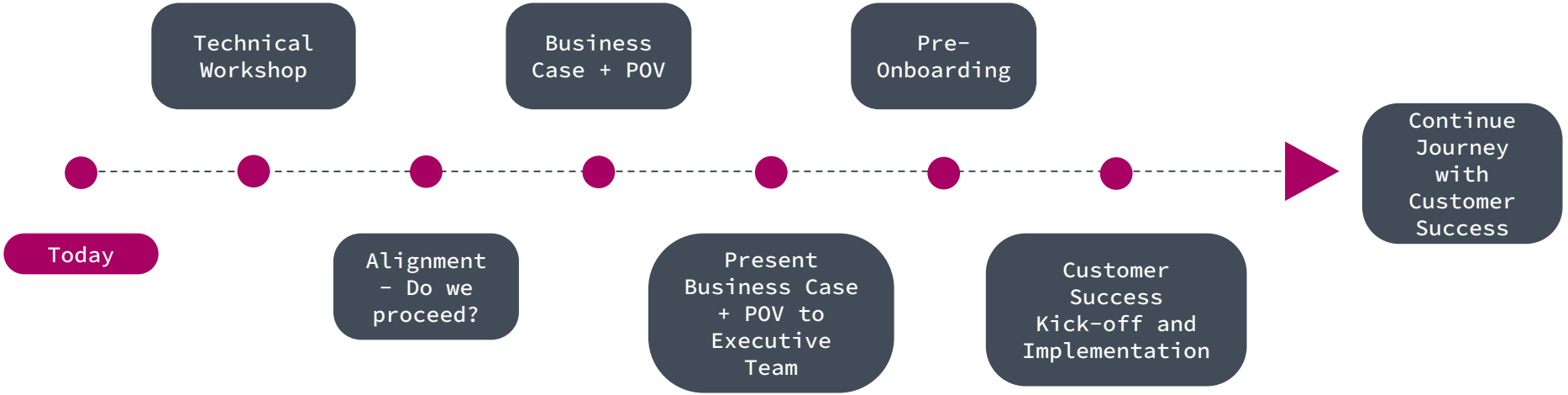
MongoDB Contact:
Bastian Delfs- bastian.delfs@mongodb.com | +41 79 871 30 34

Types of Workshops sponsored:

- Technical Evaluation - Requirements & MongoDB fit for use-case
- Sizing & Business Case
- Technical Deep Dives
- PoV / PoC
- Business Value Assessment - Strategic study on value of MongoDB for new application on roadmap / modernization of existing solutions

Our Investment In Our Partnership: Project Evaluation

Proven, efficient engagement to evaluate MongoDB fit for project



Projects unaware of Atlas and enhanced platform capabilities

Strategic collaboration on key initiatives, highly beneficial for Bosch

Key Learnings:

Most common factors for technology choice:

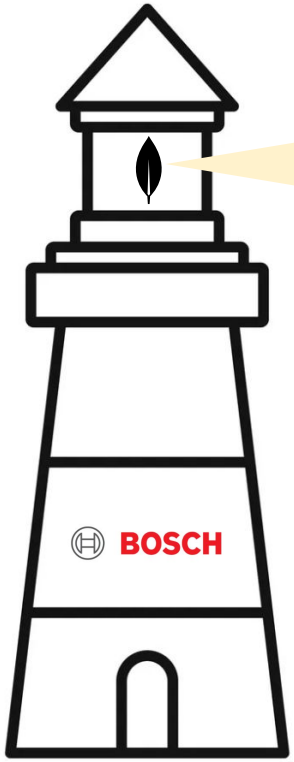
- Ease of access
- Used in previous projects

Why MongoDB was not chosen in the cloud

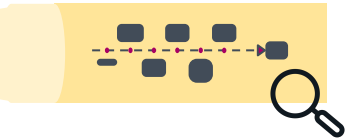
- No awareness for central Atlas contract
- >50% of projects didn't know that MongoDB Atlas is available to them

Most common ask:

- Projects would love to learn more about the work of projects in other business units



Create Lighthouse Projects:



Identify Suitable Projects

- High Impact
- Top of mind
- High Urgency

Joint evaluation and realization

Benefits from more strategic collaboration with MongoDB:

All 12 projects would have avoided:

- Higher TCO
- Migration cost
- Challenges

MongoDB can provide a free of charge outside-in perspective

How to Support Developer Community at Bosch?
MongoDB provides support along Bosch transformation strategy

Bosch has set IEEE as a framework for digital organizational culture
How MongoDB can support in the various dimensions

Inspire	Provide a simple clear and relevant vision	• Share Bosch internal success stories with business value and advantages achieved • Bosch specific weekly office hours with MongoDB technical expert • MongoDB to participate and be part of COE(I) cloud and databases
Enable	Assist teams with specialized capabilities, become proficient in MongoDB	• Architecture reviews for projects with our developer relations team • On-Premise MongoDB days with Account and developer relations team • Webinars on new technical capabilities of MongoDB - related to Bosch Use-Cases • Provide / Co-Develop blueprints for technology challenges at Bosch / Business-Unit
Engage	Motivate and drive enthusiasm for new development projects with MongoDB	• Individual workshops for specific projects - evaluate new development or migration • Support the evaluation of business value of MongoDB for project / initiative • Bosch specific Teams-/ Community channel to engage with experts on questions
Empower	Provide access to all relevant resources and information to become fully self sufficient	• Get people trained via MongoDB University and instructor led trainings • Get developers and architects certified on MongoDB • Simplify access to MongoDB team for Bosch & support channel for support • Simplify access to MongoDB Atlas and Bosch on premise services with Bosch CI

For requests on support along these lines - please reach out to bosch@mongodb.com

Further aspects of collaboration

Bosch & MongoDB are long lasting partners - Joint Positioning

Original Software Vendor	Access to original state of the art MongoDB Atlas platform and best practises from proven experts and official support
Joint Go-To-Market	Bosch & MongoDB local marketing campaigns
Technology Assurance	Exclusive access to roadmap, MongoDB executives and customer advisory council
MongoDB .live Keynote	MongoDB .live Keynote with Bosch
Global Competence, Local Presence	With MongoDB, Bosch has a partner with both scale and agility

MongoDB Data Platform
Value Alignment - Level 2

- **Fastest** way to innovate
- **Multi-cloud, global** freedom & flexibility
- **Unified data platform** for modern apps

Business Value

- **Business:** Revenue, Innovation/Time-to-Market, CSAT
- **Cost & Productivity:** Optimization, Productivity Efficiency
- **Resilience & Risk:** SLA (DR/BCP), Security, Compliance

Plan → Code → Build → Test → Release → Deploy → Operate → Monitor

Data Flexibility: Schema, Joins, Change Capture, Graph, REST API, Data Lake, Search

Data Variety: Multimedia, Geospatial, Decimal Precision, Archive / Queries

Developer Efficiency: Rich Query, Search, Device Sync / Mobile

Data Quality: Schema Validation, ACID, Safe Writes

BI, Analytics & Reporting: Real-Time Analytics, Data Visualization, Connectors

Encryption: in-flight, at-rest, client field-level

Access: LDAP and RBAC granularity (org, users)

Ingest Rate

Performance Advice

Automation:
Auto-Deploy, Rolling Update, CI/CD, Terraform, Kubernetes

Workload Placement:
Locality, Data Isolation

Change Flexibility:
In-Place Schema Changes

Hosting Flexibility:
Portable, Migratable
(on-premise, any cloud)

High Availability:
Automated, Multi-Region / Geo

Scalability:
↑ / ↓ / Out / Elastic / Automated

DR/BCP:
Partial/Full Recovery RPO, RTO

Monitoring 100+ KPIs

Alerts & Triggers

Auditing & Compliance

Key Performance Indicators (KPIs)

Sprint Velocity (story points, work hrs)
Lead Time - Develop to Deploy

Deployment Frequency
Change Fail Rate (%)

Availability (incidents, SLA %, MTRS)
Performance (response time)

Outlook

Business Value Realization Results Details

MongoDB Data Platform
Value Alignment - Level 1

- **Fastest** way to innovate
- **Multi-cloud, global** freedom & flexibility
- **Unified data platform** for modern apps

Business Value

- **Business:** Revenue, Innovation/Time-to-Market, CSAT
- **Cost & Productivity:** Optimization, Productivity Efficiency
- **Resilience & Risk:** SLA (DR/BCP), Security, Compliance

Plan | Code | Build | Test | Release | Deploy | Operate | Monitor

Data Flexibility
Data Variety
Developer Efficiency
Data Quality
BI, Analytics & Reporting

Security & Compliance

Speed & Performance

Automation
Workload Placement
Change Flexibility
Hosting Flexibility

High Availability, DR & BCP
Scalability
Analytics & Reporting

Monitoring
Alerts & Triggers
Audit Compliance

Key Performance Indicators (KPIs)

Sprint Velocity (story points, work hrs)
Lead Time - Develop to Deploy

Deployment Frequency
Change Fail Rate (%)

Availability (incidents, SLA %, MTRS)
Performance (response time)

XC: MDM (Measurement Data Management)

Why MDM:

Automated Driving Alliance (ADA) backbone

Project: ADAS capabilities jointly developed with CARIAD (level 2 + 3, potentially further), 1,800 developers

MDM: Management of vehicle measurement + metadata

Goal: Provide relevant data for functional development to deliver algorithms for ADAS level 2/3

Process: Store vehicle measurement data in Azure >> index + catalogue >> accessible via API/UI

How does MDM use MongoDB

- Used as backend data platform for all MDM microservices
- Storing vehicle metadata in file catalogue from various teams >> schemaless + high flexibility

Before State with Cosmos DB

- 2023: Few million measurement files in file catalogue >> small set of namespaces (metadata per team/service) leading to total of 10-100 million records
- Initial limitations: “name-contains-problems” + availability/stability issues + missing features: e.g. multi-document transactions + custom sharding
- Biggest challenges: Scaling & billing model with Request Units >> once data set grows you’re in for a surprise >> poor performance + exponential cost increase

Today with MongoDB Atlas:

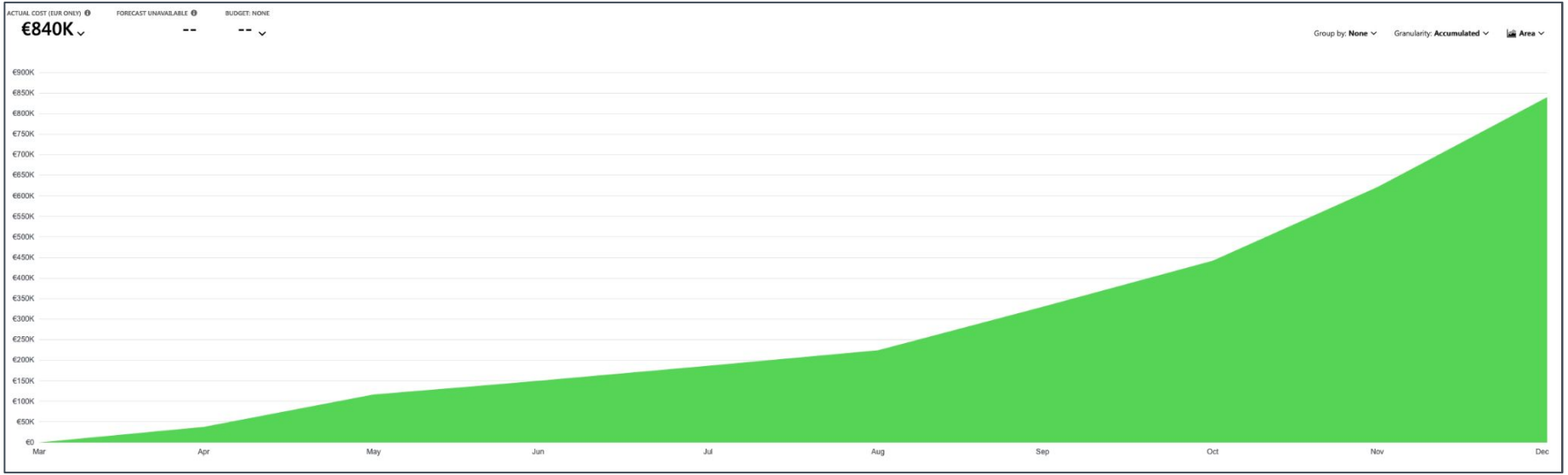
- Secures future stability & scalability of ADA dataloop
- Massive performance boost: **85% reduction in API response times** + overall performance (>1 mio. req/min)
- Major financial benefits: **67% cost reduction**

20x growth

~250 TB data

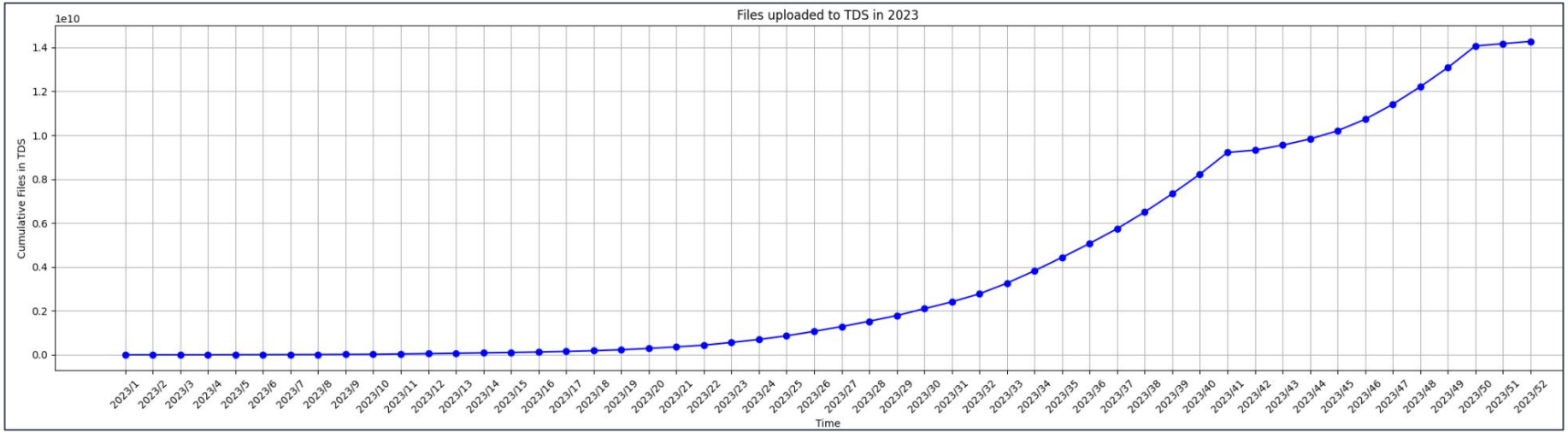
67% Lower Cost

Cosmos DB: Exponential Cost Growth



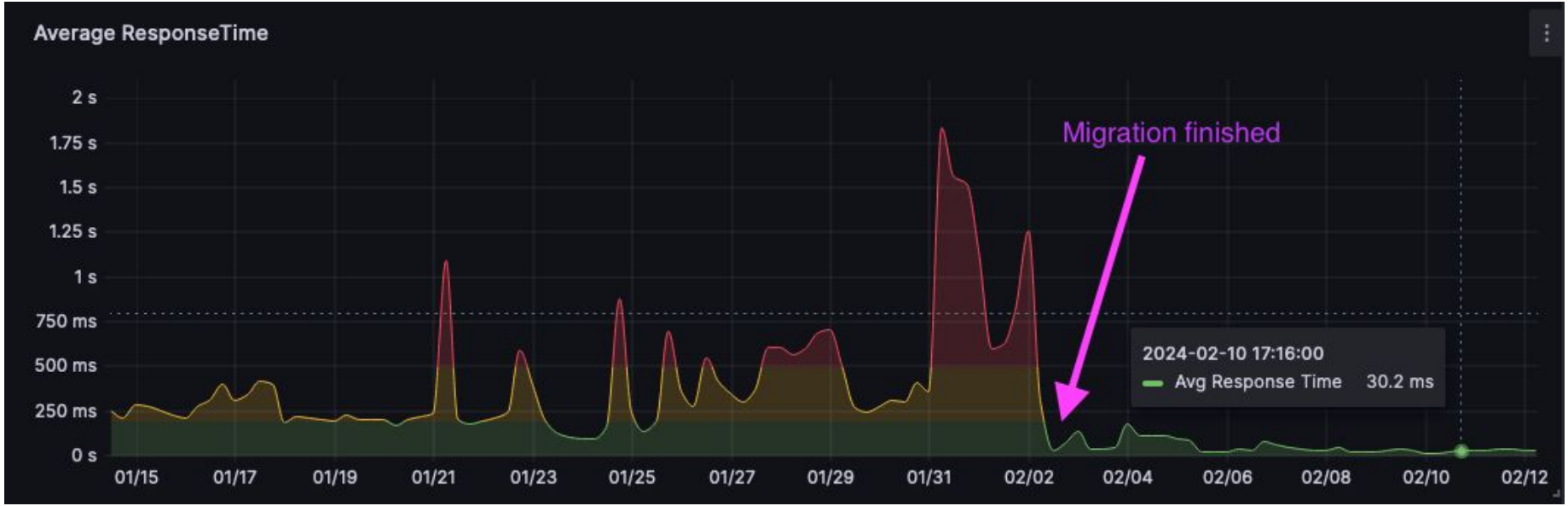
Extreme Data Growth

From 0 to 4B Documents within 12 Months

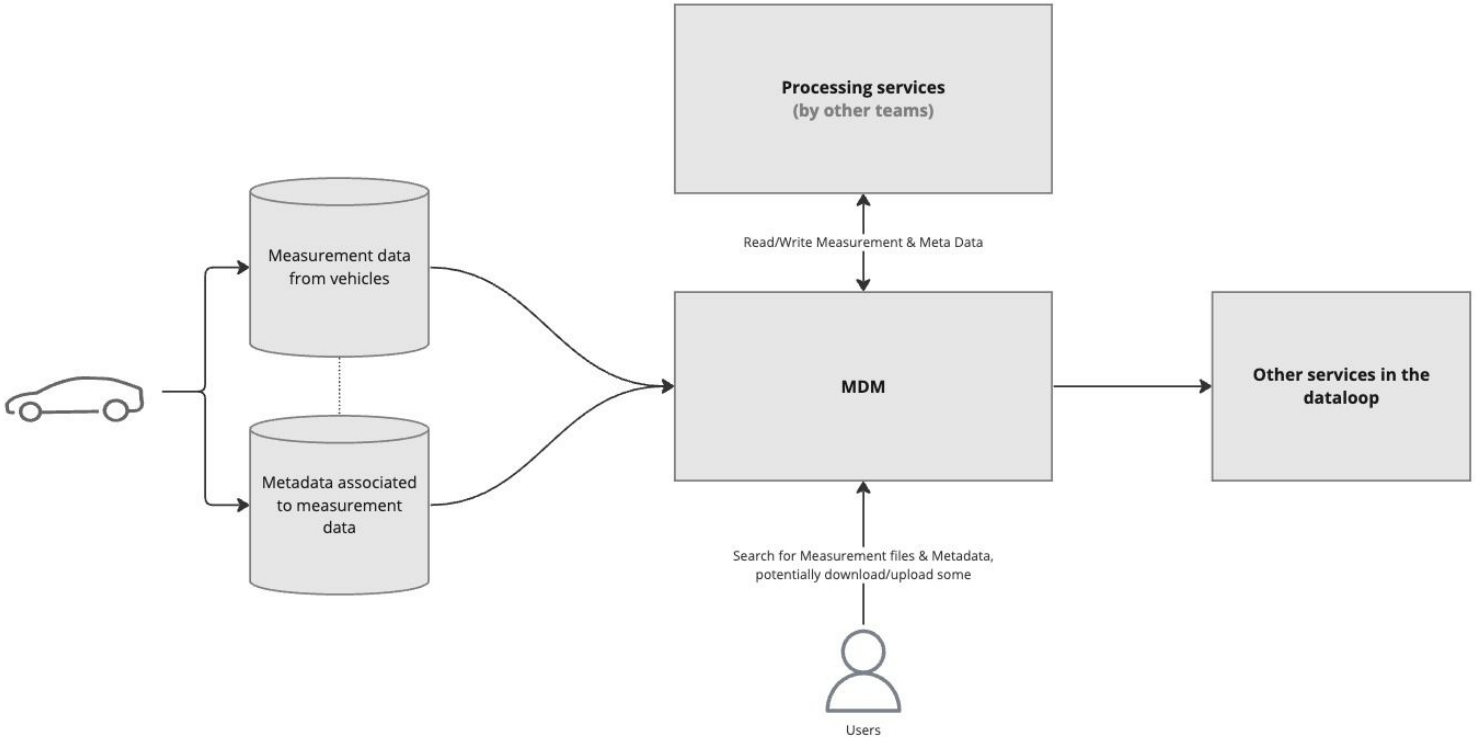


7x Performance Improvement

From ~200ms to ~30ms Roundtrip



XC: MDM (Measurement Data Management)
Architecture



Global Logistics Cloud | InTrack

Why InTrack:

Next generation global logistics & supply chain

- InTrack Driver App, T&T Web Service,
- E2E solutions: Automatic time slot allocation, live ETA-data, just in time dock reservation, parking gate registration, security checks, loading and unloading asset management, management of the yard traffic

Successful migration from Cosmos DB to MongoDB Atlas on Azure saving >97% of database cost

How does InTrack use MongoDB

- Incoming messages of forwarding agents and transport planners (JSON) are stored and processed in the Track and Trace DB.
- Data gets processed and forwarded to downstream systems for further applications

Before State:

- Started with MongoDB in Bosch IoT Cloud and migrated to Azure in 2021 to Cosmos DB
- Cosmos DB caused outages as partitions did not scale similar to MongoDB which led the database to crash
- Complex pricing led to issues with cost projection and high cost - cost rose drastically from ~10.000 € per month in December to ~100.000 € per month in June

Today:

- Migrated to MongoDB Atlas on Azure within one week
- **Reduced cost from 1.2 Million € on Cosmos DB to ~30k € per year on Atlas**

~500GB of data

Processing 2.5 M orders per month

https://connect.bosch.com/blogs/1d50157e-458d-49ff-afba-3f6391bdb841/entry/Case_study_Cost_explosion_on_Azure_Cosmos_DB_Project_InTrack?lang=en_us

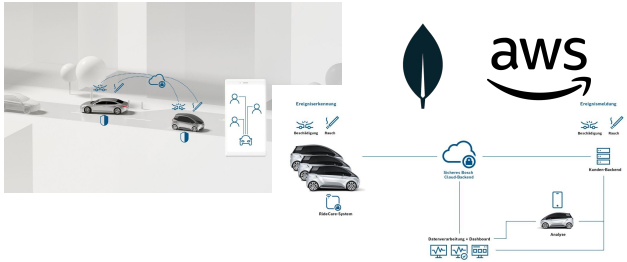
Mobility Solutions: Global Logistics Cloud | InTrack

Atlas enabled >97% cost reduction and provides new abilities

	Before MongoDB Atlas	With MongoDB Atlas
Time to Value	• Increased development times due to incomplete Support of MongoDB API with Cosmos DB	• Migration from Cosmos DB to MongoDB Atlas in 1 week
Business Risk	• Outages caused by technical limitations (partition sizes) • Backups and monitoring for individual partitions complex	• Support questions always answered very fast • Alarming works very well
Competitive Advantage	• Local testing impossible due to feature gap between MongoDB and Cosmos DB	• Ability to rollout the application cross regional in a cost effective manner
TCO	• **1.200.000 EUR database cost per year on Cosmos DB**	• 30.000 EUR database cost per year with MongoDB Atlas on Azure • **>97% costs saved**

XC - Cross Domain Computing Solutions: Top89 - RideCare

Why RideCare:



Enabling the future of shared mobility

- Ridecare services from Bosch detect damage to and smoke in the vehicle for the first time with just one sensor box.
- Data evaluation is performed using artificial intelligence methods.
- Market volume currently 127 billion $ in Europe, 17 billion in Germany alone. Sales potential expected to quadruple across Europe to 549 billion $ by 2035, according to Strategy&.

How does RideCare use MongoDB

1. MongoDB is used as the core database for the data loop to continuously train the ML models of Ride Care. Voxel is used as a software for label management. After the training, the models are deployed on the device in the car.
2. For RideCare Cloud, is the central backend in AWS for the live data - events generated by hardware box for user interface / notifications.

Before State:

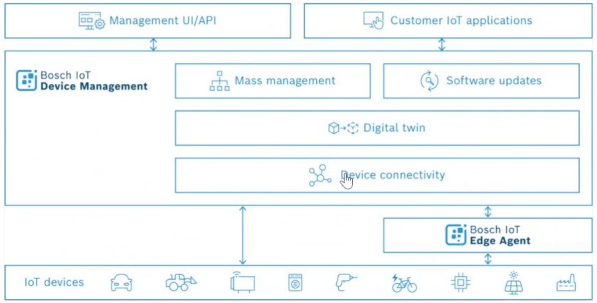
- Self Managed MongoDB was used for the label management - lagging scalability caused issues in processing the increasing amounts of data (>200GB in the initial load)
- Project used Document DB due to missing accessibility of MongoDB Atlas
  - Only 50% of aggregation features needed were implemented in DocumentDB - project requirements could not be implemented
  - Development team lost time to implement workarounds
  - No horizontal scalability

Today:

- Project can scale up and down based on current needs with Atlas as opposed to self managed Community version of MongoDB - jump between M10 and M80 continuously for the various workloads in the data loop for model Training
- Document DB has been replaced with MongoDB Atlas enabling the development of features requested by their customers and gained the ability to scale to the needed dimensions

Bosch.IO : IoT Suite | IoT Device Management - Digital Twin

Why Bosch IoT Things:



Controlling and keeping your devices up to date:

- Manage and organize digital twins of your things: register, read, and update via HTTP API or Java client
- Find things based on dynamic or static properties like temperature or humidity
- Communicate with things based on bidirectional interactions with a secure connection - to configure devices or execute commands

How IoT Things uses MongoDB Atlas:

- Bosch IoT Things is based on the Eclipse Ditto project where Bosch is a major contributor - This project is based on MongoDB (https://www.eclipse.org/ditto/)
- The cloud service offered by Bosch is provided in multiple clouds like AWS and Azure - here Bosch.io leverages the cloud-agnostic deployment options
- The high (horizontal) scalability of MongoDB allows processing huge amounts of data while maintaining consistently high performance - continuous updates of devices <15 min - more than 17,500 update operations only per second
- The flexibility of the MongoDB data model allows to easily store all potentially relevant information of a device and provides the possibility to alter the data model over time while providing the query and index capabilities of a relational database

Gerald Glocker: It is not only about persisting data, moreover value is generated by working with the data! MongoDB is capable to persist data in a flexible manner, but at the same time the query language provides all the capabilities known from relational databases and more.

40% growth

MongoDB chosen for high availability

>15 Million devices connected

https://www.youtube.com/watch?v=qXt6QnrK3Uw

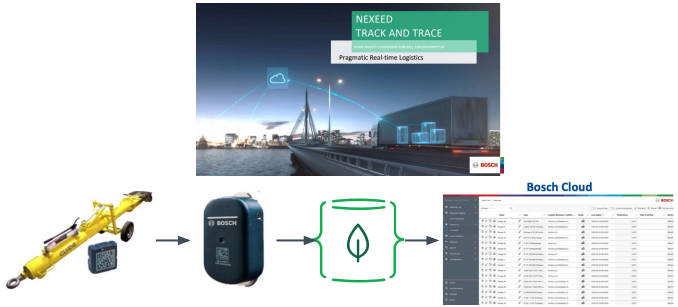
Bosch.IO - IoT Things / IoT Device Management

MongoDB's flexibility and scalability enables digital twins

	Before MongoDB Atlas	With MongoDB Atlas
Time to Value	• Customer Onboarding could take weeks	• New environments can be provided within minutes globally • Planned >40% growth YoY
Business Risk	• No availability SLA • Customers request Bosch, AWS, Azure as infrastructure	• 99.995% uptime SLA on Atlas • MongoDB runs anywhere and Atlas is true multi-cloud service
Competitive Advantage	• Missing query power made it hard to get the most out of the raw data	• High flexibility of data structure allowed for fast development and diverse representation of devices
TCO	• Infrastructure overhead for managing MongoDB	• Reduced development cost thanks to multi-cloud capabilities of Atlas

Bosch.IO : Track and Trace

Why Track and Trace:



Real-Time High-Value Asset and Material Tracking:

- Up to 75% reduction in search, inventory, book, and scanning efforts
- 25% higher utilization of logistic assets
- 25% Increase in availability of circulating load carriers: no new investments required
- 50% time savings in collecting status information and coordinating material flow processes

How Track and Trace uses MongoDB Atlas:

- MongoDB has been chosen in 2016 / 2017 for TraQ / Sensor Cloud which was a foundation for Connected Solutions at Bosch - Later transformed to Bosch Connected Industry
- Track and Trace is the continuous development of the core service of this platform that iterated over time and now focuses mainly on asset management
- MongoDB allows for flexible and fast development of new features and management of diverse datasets
- Atlas as a simple cloud-based database solution reduces the management efforts of the team
- Today Track and Trace is processing the data of ~100.000 Assets and plans to scale to more than 300.000 in 2022
- The 100.000 Assets tracked so far have produced more than 3 TB of compressed data on disk

Georg Deschler: SQL is oftentimes the default choice for databases, as people have learned how to structure databases this way. But this comes at the cost of complex data migrations and low flexibility. With MongoDB, what has been complex with relational becomes effortless and allows for incremental schema evolution

500%
growth planned

3 TB
data on disk

100.000
assets tracked

Bosch.IO - Track and Trace

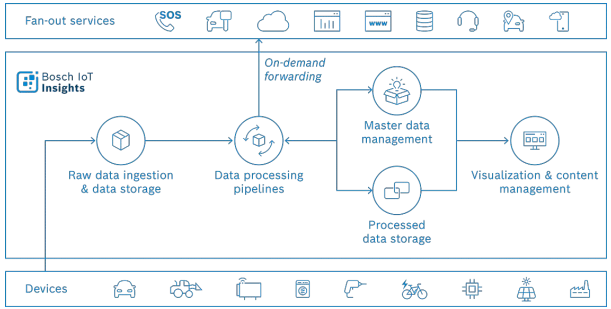
The Technology can do much more, mindset shift needed

	Before MongoDB	With MongoDB Atlas
Time to Value	• One microservice with MS-SQL had inadequate performance • Complexity in definition of data structures	• Service re-written in one-week • High degree of flexibility allows for faster development • Easy, incremental migrations
Business Risk	• Migration of databases into the cloud comes with high efforts and risk - MS-SQL took three weeks with multiple retries	• Migrating MongoDB from BIC to Azure was a “piece of cake”
Competitive Advantage	• Pre-Atlas, limited to Bosch infrastructure	• Ability to deploy in any cloud region of Azure, AWS or GCP • Ability to scale up and down and high automation
TCO	• On-Premise all data needed to be in hot storage	• ~80% of data can be archived in cloud object store while maintaining accessibility via Atlas

Bosch.IO : IoT Suite | IoT Insights

https://www.mongodb.com/presentations/transform-binary-data-inside-vehicles-to-information

Why Bosch IoT Insights:



End-to-end service solution for IoT data management:

- Fully managed cloud service that collects, processes, and stores your IoT data for further analytics
- Data storage, processing and visualization capabilities
- Supporting mission-critical use cases of more than 250 projects of internal and external customers from OEMs to agricultural use cases

How IoT Insights uses MongoDB / MongoDB Atlas:

- IoT Insights has two data stores; Object storage for raw data and MongoDB for processed data
- Due to the high variety of data stored in the system, MongoDB has been chosen as data store due to its flexibility to cope with high complexity of potential data structures
- For analytical purposes, customers can access the processed data via MongoDBs powerful aggregation framework for a variety of use-cases like time-series, calculations of KPIs, relations, …
- The high (horizontal) scalability of MongoDB allows storing and processing huge amounts of data while maintaining consistently high performance - customers need ability to process more than 50 TB in IoT Insights
- With the move to Atlas, IoT Insights gains higher flexibility and elasticity in the deployment of new instances while reducing TCO by tiering data into cloud object stores while maintaining access with Atlas Data Lake

250+
Global customers

>20 TB
data on disk

Ability to serve new, large customers with Atlas

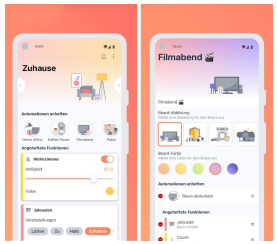
Bosch.IO - IoT Insights

IoT data at scale requires an enterprise grade distributed database

	Before MongoDB Atlas	With MongoDB Atlas
Time to Value	• Customer Onboarding could take weeks	• New environments can be provided within minutes globally
Business Risk	• New large-scale customers >50 TB pose risk to architecture • Existing customers are limited in growth	• Flexible scale out and data tiering satisfy customer demands • Directly supporting the 30-40% per year growth target
Competitive Advantage	• Global availability of the service restricted to Bosch DCs	• Global availability across all Azure, AWS, GCP DCs
TCO	• All process data in hot storage • Coordination efforts ~0.4 FTE	• Data Tiering provides 33% cost savings potential • True self-service and automation

Consumer Goods : Residential IoT GmbH | Home Connect Plus

Why Home Connect Plus:



One App for all smart home devices:

- One App for the smart home - providing access to devices of more than 50 brands
- Allows predefining actions and routines for higher standard of living also across brands
- Single login to all partners via Single Key ID

Successful migration from CosmosDB to MongoDB Atlas on Azure saving >35% of database cost

“Before” state:

- Developers faced challenges due to incomplete implementation of the MongoDB API in Cosmos DB - lost about 30 days per year in developing workarounds
- Missing transparency into the database made it difficult to provision optimally - lead to outages (RU exhausted exception) as a result the decision was made to go elastic leading to higher cost (50% uplift) for RUs consumed elastic
- Growing costs due to increased usage of the app were seen as a risk for the profitable growth of the service

Today:

- Migration in just one week
- Fully migrated to MongoDB Atlas having access to real MongoDB
- Full elasticity with no uplift in cost and better scalability (up to 4 TB per replica) as well as additional sharding strategies
- Cost-effective read scaling via Read-Only secondaries is an option for the future
- Deterministic, plannable costs and granular monitoring
- Direct support from MongoDB

300%
growth planned

14
Microservices

>750.000
Devices Connected

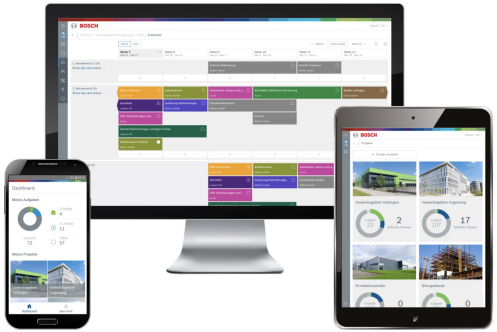
Residential IoT GmbH - Home Connect Plus

Massive productivity increase and cost reduction for RIoT-App

	Before MongoDB Atlas	With MongoDB Atlas
Time to Value	• Needed to develop workarounds for shortcomings in functionality • Application optimizations to reduce cost	• Time can be used to develop new features, saving 1-2 weeks per quarter • Migration in just one week
Business Risk	• Cost could not be determined - low provisioning lead to outages • Limited scalability 20 GB per partition	• Uptime even during high load periods • High scalability 4 TB per replica set
Competitive Advantage	• Impacted productivity - No able to fully focus on innovation because of required workarounds and non-working query analysis	• Microservices architecture allows for highest possible flexibility, stability and scalability
TCO	• Continuously growing cost with CosmosDB - High efforts in estimating consumption - auto-scaling with 50% uplift	• Transparent cost model and free of charge auto-scaling, saving days of operations efforts • >35% cost savings on service

Consumer Goods : Power Tools (PT) | RefinemySite

Why RefinemySite:



Lean Management on Job-Sites:

- Simplification of planning process on construction sites by enabling lean management on job sites
- Reducing waste and maximize value creation, leading to faster project completion at lower cost
- Vision of the product is to create full transparency during the construction and beyond - goal is the integration of the BIM model creating an end to end documentation of buildings in the future
- Bosch CDO lighthouse project

RefinemySite on BIC (MongoDB):

- Started on MongoDB to store data in document structure (activities, notifications,...)
- Challenges with MongoDB on BIC, due to restricted access on the database

Migration to Azure (Cosmos DB)

- Strategic decision to move to Azure - Cosmos DB with MongoDB API was the easiest solution - Atlas was not yet onboarded by CI at this time
- Massive challenges with Cosmos DB MongoDB API - incompatibilities lead to investments of development resources to revoke implementations lead to high developer cost in external developer team

Migration to Atlas on Azure

- No need for extra cloud onboarding due to central contract
- Developers are happy - no further complaints or issues reported since switch to Atlas

Benjamin Hoehensteiger: Almost stopped using MongoDB API due to frustration with Cosmos DB; Since switch to Atlas no further database challenges and significant cost reduction

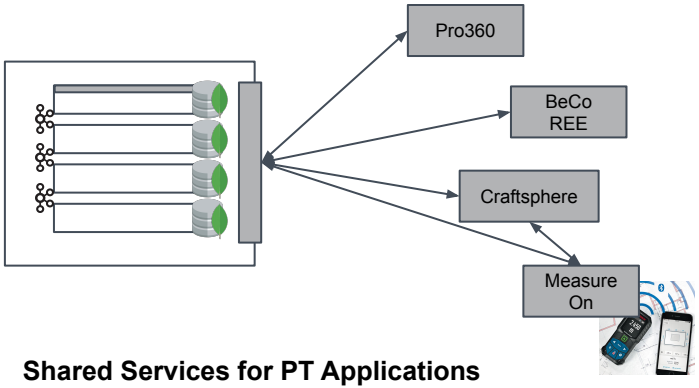
Power Tools (PT) | RefinemySite

Atlas provides the best way to run MongoDB on Azure

	Before MongoDB Atlas	With MongoDB Atlas
Time to Value	• High frustration level • Problems identified on Cosmos DB	• Low Atlas onboarding effort • MongoDB Atlas easy to use
Business Risk	• Functions were not working properly	• High resiliency • No problems
Competitive Advantage		• User Experience is key • Regular performance optimizations
TCO	• High Break/Fix effort • High Cosmos DB cost	• Significant cost reduction

Consumer Goods : Power Tools (PT) | GSP

Why Global Shared Platform:



Shared Services for PT Applications

- One platform to provide foundational services for all applications throughout power tools, i.e. Accounts, Inventory, Products, Guarantee, ...
- Reduction of development efforts and increase service quality be minimizing redundant efforts for shared application requirements
- Distributed infrastructure to ensure the best possible customer experience globally

“Before” state:

- Complex architecture based on KAFKA for both streaming and persistence caused high overhead for platform team and developers using the system, resulting in ~20 additional tickets per month
- High complexity also lead to prolonged project timelines - changing data structure took 2 ½ months rather than 1 with other stores
- Business reporting almost impossible, every report required the export in a separate stream leading to high efforts and cost
- In memory state stores in KAFKA crashed resulting in outages and application downtime

Today:

- KAFKA is used as event stream between the services which persist the data via Connector in MongoDB Atlas leading to a simple, scalable and stable architecture that is easy to use for developers
- Strong query capabilities allow for easy reporting and new use cases, i.e. full-text search directly in one technology
- Significant increase in developer productivity and cost reduction

1000 new users and 500 new companies per day

5 million power tools registered

Power Tools (PT) | GSP

Double-Digit Productivity Improvement for Developers

	Before MongoDB Atlas	With MongoDB Atlas
Time to Value	• Complex Data Structure • High complexity and effort to provide reporting capabilities	• Easy onboarding • 1 month instead 2,5 months to change the data model
Business Risk	• Outages and Downtime • 20 tickets per month to solve developer requirements	• No outages
Competitive Advantage	• Slowed down developer productivity • Hard to find skilled developers for Kafka Streams	• Out of the box services with limited effort to deploy and configure
TCO		• Reduced cost • Reduced effort

Consumer Goods : Power Tools (PT) | Measurement Cloud

Why Measurement Cloud:

Central Platform for all Measurement Apps

- UseCase specific mobile app touchpoints: MeasureOn, Thermal App, 3D Scanner App
- All require a centralized cloud storage for 2D and 3D scanner as well as X-Ray information
- Data is used for customer applications as well as a service for other software vendors, manager deals offers and marketing activities

Before State:

- Shared backend running on Cosmos DB as central persistence
- Backup process has been complex and limited in capabilities without customization options
- Change stream implementation of MongoDB API incomplete, causing complexities in development process for the 10 developers working on the project

Today:

- Migrated in less than 1 month from decision-making to completed transfer from Cosmos DB towards MongoDB Atlas to overcome technical limitations
- Leveraging the full capabilities of the Atlas data platform and utilizing the integrated full-text search capabilities - reducing the necessary architecture components
- Build a future-proof environment to support the planned scale of connectivity for the 2.5 Million sold devices

25x Growth Potential

10 GB of data per day

100.000 Devices

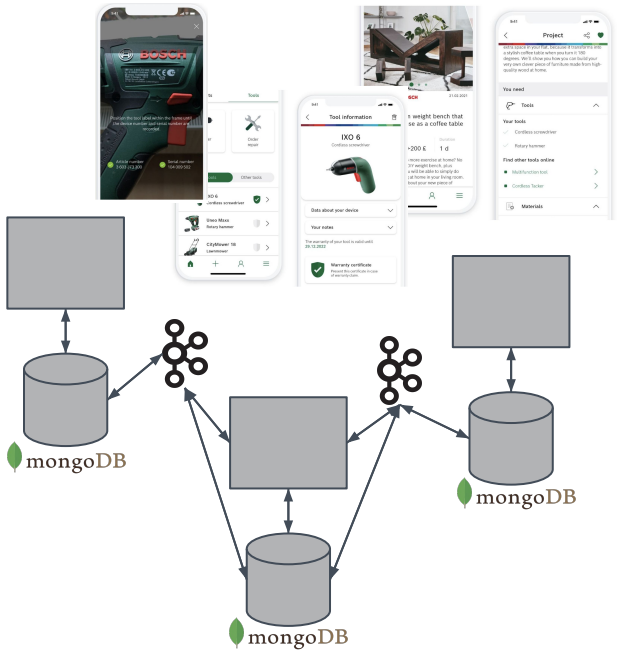
Power Tools (PT) | Measurement Cloud

The best platform for best tools

	Before MongoDB Atlas	With MongoDB Atlas
Time to Value	• Dependency on Database provider • High ops and maintenance effort	• Better performance • No major issues
Business Risk	• Hard to integrate with other solutions	• Certificate key management • Role-based access
Competitive Advantage	• Disadvantages with GSP integration • Best platform for best tools	• Easy setup and onboarding • High stability
TCO	• Higher cost	• 25% -30% Cost reduction

Consumer Goods : Power Tools (PT) | DIY App

Why DIY APP:



Successful migration from Cosmos DB to MongoDB Atlas on Azure saving >70% of database cost

“Before” state:

- Event-driven architecture - evaluated ksql - “imploded”
- Need for flexible data store ⇒ went cloud native with Cosmos DB
- Costs have risen fast - daily initial bulk load needed ~10.000 RUs for one collection alone
- Were forced to over provision as the team faced availability issues due to the database shutting down
- Invested 25-50 days to try to find a workaround for this issue
- In addition the faulty change stream implementation caused many problems for the team - deletes did not work

Today:

- Fully migrated to MongoDB Atlas
- Automated infrastructure via Terraform and now Pulumi
- Highly scalable microservices architecture using KAFKA for inter service communication and MongoDB as persistence for each service
- Designed blueprint for further applications (GSP, PRO360)
- Simplified maintenance - sprints not needed to fix issues but develop new features
- Saved weeks of time just for testing

Goal: From 250.000 installations towards 1 Million

Power Tools (PT) | DIY App

Further expansion through marketing and globalization

	Before MongoDB Atlas	With MongoDB Atlas
Time to Value	• 25 - 30 days of bugfix documentation • Peak outages	• Migration to Atlas was easier than expected • Ease of Development
Business Risk	• Data loss • Risk of data inconsistency	• Fast MongoDB support Response times
Competitive Advantage	• Activity Feed problems	• MongoDB API • Multi-Cloud and Multi-Region
TCO	• Pricing model complexity	• 70% Cost Savings

Consumer Goods : Power Tools (PT) | Pro360

Why Pro360:

Pro360 allows customers to register all their power tool devices to receive a prolonged warranty and targeted offers (ProDeals). The goal is to build brand loyalty and provide upsell opportunities

“Before” state:

- Kafka and Cosmos DB were used as main persistence layers
- Kafka has been used with Kafka streams, the complexity has limited developer productivity and flexibility due to the tabular and asynchronous nature of the architecture
- With Cosmos DB they started to shift queries back into a database to simplify the architecture - limited change stream implementation caused problems
- Cosmos DB only supports old MonogDB APIs, which caused incompatibility to documentation, local deployments and meant missing features

Today:

- Migrated from Cosmos DB towards MongoDB Atlas to overcome current technical limitations
- Team shifts from using MongoDB for complex queries and reads to making MongoDB the single source of truth for their application
- Guaranteeing disaster proof deployment with continuous backups
- Looking into Atlas Search to consolidate and simplify current architecture further

Wetzstein Branimir: We did not have a single issue in the last 12 months since moving to Atlas

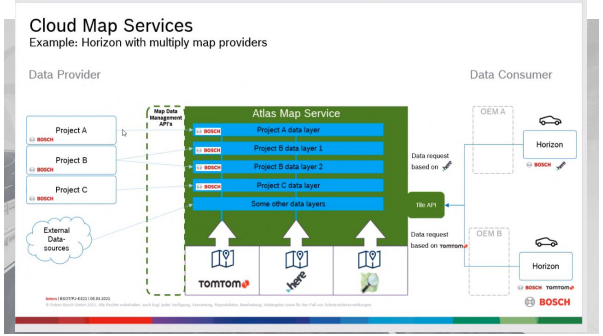
Power Tools (PT) | PRO 360

We wanted the original - Cosmos DB was lagging behind

	Before MongoDB Atlas	With MongoDB Atlas
Time to Value	• Kafka Streams and Cosmos DB complexities • Limited data transparency	• Easy schema changes • Intuitive user interface
Business Risk	• Limited change stream implementation caused problems	• We never had issues within the last 12 months • Continuous backup is top
Competitive Advantage	• Limited kSQL skills • Technical limitations	• JSON format - the natural way working with data
TCO	• Higher development effort	• Development more efficient now

Mobility Solutions: Bosch Softtec GmbH | AMS Maps

Why AMS Maps:



Closed Loop Data Collection for Future Mobility

- Provide granular map data to vehicles
- Cars send information to backend where it is processed and used to enrich map data
- Swarm intelligence therefore provides the latest information of speed limits, weather or street conditions
- This is the foundation for modern driver assistance systems like break assistance, automatic speed control or autonomous driving

How AMS Maps uses MongoDB Atlas:

- MongoDB is the main persistence layer of the service storing all layers of maps data which are consolidated from multiple map data providers like HERE or TomTom - initially SD now also HD maps
- The storing of HD maps comes with high storage volumes - which can be easily handled thanks to the scalability of MongoDB and Atlas
- Using MongoDBs versatile query language to access GEO-JSON data stored in the database in a multitude of ways including spatial queries in combination with further conditions
- Cloud based map data is retrieved by cars on the street to provide information with accuracy of a couple centimeters - therefore MongoDBs high performance is a necessity
- Future use cases will also require the replication of data globally which will be supported with the build option of read only secondaries in Atlas

TBs of data

Global Scale
Currently Europe, NA and Japan are coming soon

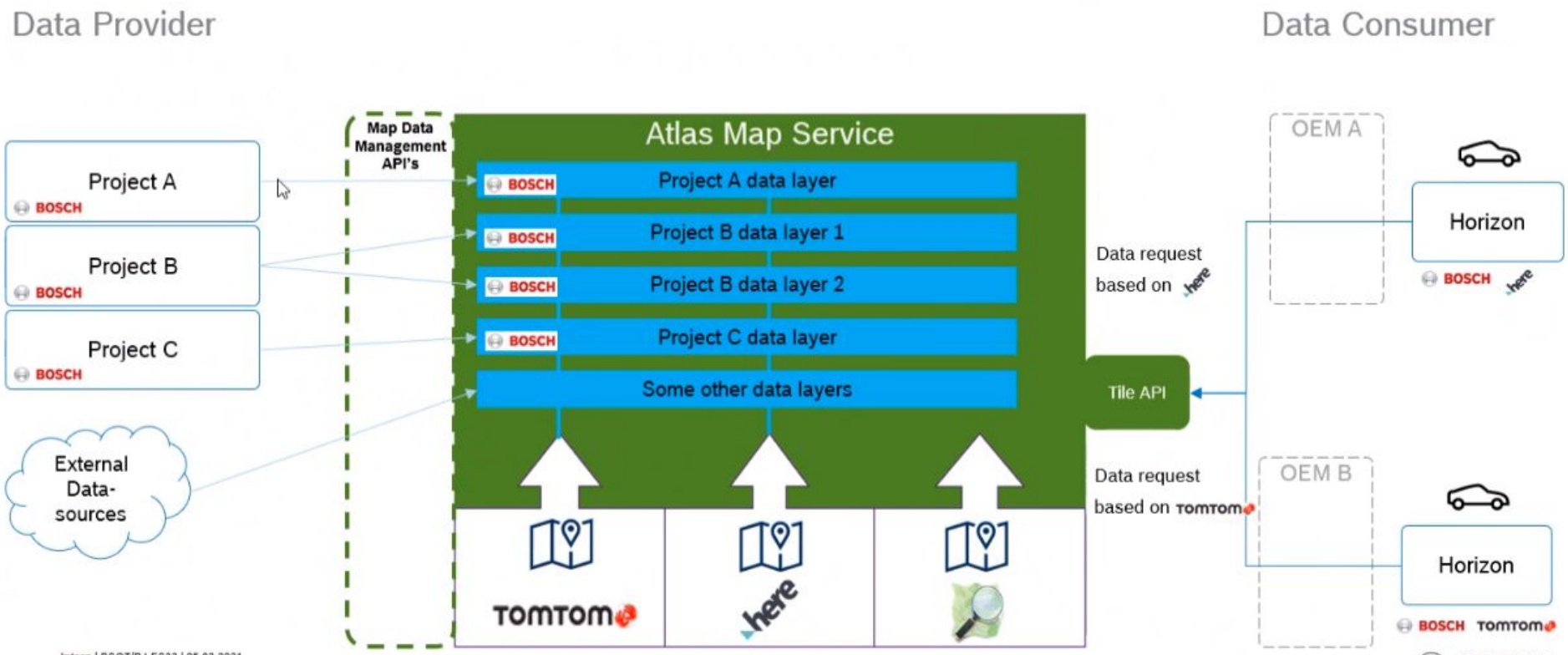
Bosch Softtec GmbH | AMS Maps

MongoDB Atlas works well - we get the performance we need

	Before MongoDB Atlas	With MongoDB Atlas
Time to Value	• Scalability issues	• Available springboot library • MongoDB Query Language • A unified data interface
Business Risk	• Business critical incidents	• Support questions always answered very fast • Alarming works very well
Competitive Advantage	• No out-of-the-box Multi-region deployments	• Geo-Spatial queries • JSON/BSON format
TCO	• High maintenance effort (MongoDB self-managed and interfaces)	• Automated deployment functions will reduce the effort to build and maintain global and multi-region configurations

Cloud Map Services

Example: Horizon with multiply map providers



BOSCH

Mobility Solutions: CS | OTA Vehicle Data (VMS) | Mobility Cloud

Why OTA Vehicle DATA:

Configure and execute remote measurements:

- The OTA Vehicle Data service enables flexible configuration of data acquisition, data processing, enrichment and delivery
- Enables a user to configure measurements based on different protocols that are remotely executed in a vehicle
- The results are send back and can be found in the Backend or are forwarded/exported to any 3rd party application
- https://inside-docupedia.bosch.com/confluence/display/MC/01_OTA+Services

How OTA Vehicle Data uses MongoDB Atlas:

- Started with Bosch-hosted MongoDb inside BIC, moved to Atlas on Azure
- Great benefit for controlling and monitoring due to the Atlas-provided metrics and auto-scaling options

- MongoDb as the single source of thruth for all involved microservices while separating the collections by microservices for decoupoling
- No need for complex queries but for high throughput (> 1000 inserts/sec)

- MongoDB benefits
  - No Object-Relational-Gap
  - No schemas
    - No development barriers
    - No technical barriers when data models envolve
  - Great support by Spring Data

OTA Vehicle Data as part of the Mobility Cloud is right in the start with the first productive customers in place with plans to quickly grow the size of perstisted entities (devices, vehicles, measurements, ...)

4 Atlas Cluster (EU & NA)

~ 2.400 Collections in prod clusters

4x Growth Potential until end of 2022

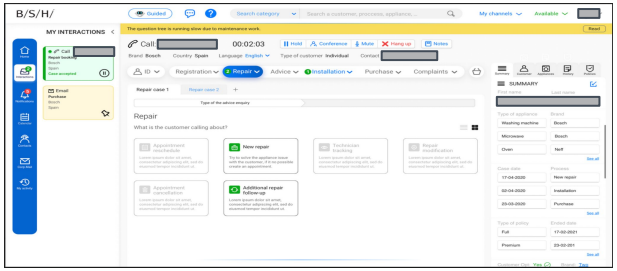
CS - SDV - Mobility Cloud

Don’t think too much about the data model - just do it

	Before MongoDB Atlas	With MongoDB Atlas
Time to Value	• Multi-Region would have required a lot of manual build effort	• Auto-scaling is a big advantage • Don’t think too much about the data model - just do it
Business Risk	• Support and Backup limitations	• MongoDB support is really good • Disaster Recovery solution is a big advantage
Competitive Advantage	• CosmosDB is not MongoDB. It’s just an old imitation	• Multi-Region and Multi-Cloud • Support of Transactions is a big advantage
TCO	• In combination with our scalability requirements CosmosDB cost have scared us	• Auto-scaling will keep costs down to the requirements

Consumer Goods: BSH | New Agent Frontend

Why New Agent Frontend:



Increase satisfaction for customer services:

- Increase E2E customer service experience by providing a single interface to plan, book and reschedule appointments and generate cross / upsell opportunities
- 360° view on customer and owned appliances, including error logs for troubleshooting
- Increase efficiency / productivity of call center agents by providing a guided screen flow
- Reduce reliability on existing SAP backend and increase availability of the service

“Before” state:

- SAP frontend did not provide a sufficient user interface for the requirements set for a modern call-agent workspace
- SAP backend did not allow implementing new capabilities easily like the sales application components
- Scaling of single application components was not possible - only SAP as a whole can be scaled
- Data scattered across various systems, which leads to complex data flows that are hard to manage.
- The necessity to reschedule jobs due to technical problems leads to low customer satisfaction and additional costs for back office and logistics.

Today:

- New Agent frontend as a modern web-based application based on Angular drastically increases the productivity of the call-center agent's daily work
- To ensure high system stability and uptime. MongoDB is by built as a distributed database - this guarantees high availability out of the box with a 99.995% uptime SLA on Atlas.
- Pre-load sensitive customer data with predefined retention time
- Full-Text search of question tree-based information, i.e. washing machine, problem description, error code identification

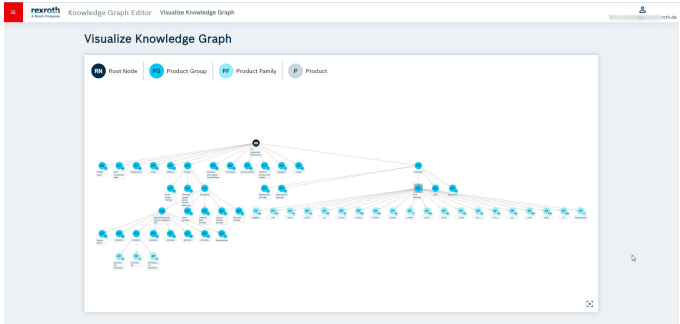
Professional Services Engagements

rexroth
A Bosch Company

Phase 1 – Q4 2023

gravity 9 Professional Services

MongoDB Professional Services supported Bosch Rexroth AG with building a knowledge graph editor (KGE) application based on MongoDB Atlas, using Cluster-to-Cluster Sync. KGE is allowing Rexroth technicians to compare, correct and update technical product data on existing parts and components between different BW systems, which will help for a better customer service.



MongoDB **ramped an implementation team within 4 weeks** for the implementation of the KGE MVP build out to keep the critical project timeline

7 weeks
Total project time

End-to-end solution delivery by a team of MongoDB experts to setup Atlas Clusters and implement KGE

5 roles
UX & UI Design, MongoDB Consulting Engineer, Application Architect, Lead Developer

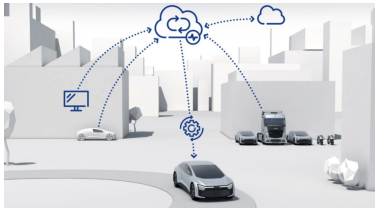
KGE application is supporting the **analysis and update of a huge amount of products**

>470k Products
>2,5k Product families
>300 Product groups

Application Spotlight: **Knowledge Graph Editor**

- Graphical navigation and overview of product groups, product families and products
- Search and identify products where data are incorrect or incomplete
- Adaptation and extension of existing data coming from different central systems (BW).
- Adaptation and adding of new product information and relations
- Batch update of larger number of products

ETAS GmbH: Remote Measurement | Performance Tuning



MongoDB Professional Services assisted ETAS with a two days Performance Evaluation and Tuning engagement, to analyze and help remediate the performance issues of the “Remote Measurement” application.

Explained how to create **optimally indexed queries**

Optimized indexed fields and gave recommended best practices for preventing unused & duplicated indexes

Recommended **schema design changes** to documents

Optimized document model by inlining measurement job results (MJRs) in TestSteps, counting documents more efficiently and preventing storing of false values

Improved design of most strained collections

4 x increased the amount of measurement jobs per second with same Cluster size after optimization (from 300 to 1,200 MJRs)

Application Spotlight: **Remote Measurement**

- As part of the “PANTARIS” platform, which consists of several services to manage components of trucks remotely, “Remote Measurement” is an end-to-end solution to measure data on vehicles over the air.
- “Remote Measurement” connects the backend services at Robert Bosch with the devices in the vehicles (Connectivity Control Unit, mainly in trucks, currently roughly 60.000 vehicles monitored).
- By the end of 2022 the systems were processing around 300 measurement job results (MJR), which are a series of configuration & test steps, per second. In the existing setup this was causing very high IOPS, high CPU load, increasing DB processing time and partial time-outs in the services
- MongoDB Professional Services conducted a performance tuning exercise with the team and helped to optimize the document model, the indexes and gave recommendations around best practices for an efficient use of MongoDB.

Rexroth
Jumpstart