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11 March 2025

Four Superbrains for the Neue Klasse: More intelligent, more efficient, more powerful.

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Concentration of computing power for key customer functions in four
"Superbrains" +++ Zonal wiring harness architecture 30% lighter and with 600
meters less wiring +++ Technology scales across all drivetrain variants +++
Future-oriented and flexible software architecture from the chip in the vehicle to
the cloud +++

Munich. The BMW Group is the first automotive manufacturer to launch a completely newly developed digital nervous system for all drivetrain variants and vehicle segments. It is more intelligent, more powerful and more efficient and will be rolled out for the first time in the models of the Neue Klasse. **Four high-performance computers**, also called "**Superbrains**", consolidate the computing power for the most important customer functions: infotainment, automated driving, driving dynamics, and basic functions such as vehicle access, climate control, and comfort. The four Superbrains provide more than 20 times the computing power compared to the current vehicle generation and are already designed for upcoming software and function updates, including AI-powered customer experiences.

"Technology openness is the key to BMW's success. Starting with the first model of the Neue Klasse, we will roll out the technologies of the Neue Klasse across the entire future model portfolio – across all segments and all drivetrains. This also applies to our completely newly developed electronic architecture made up of powerful 'Superbrains' and highly interconnected software platforms. This architecture allows us to decouple the development of the vehicle and software from each other. The advantage: More than ever before, all future BMW models will remain digitally up to date via over-the-air upgrades and will receive updates even from the next and subsequent vehicle generations," **says Frank Weber, Board Member for Development at BMW AG.**

A fundamental component of the digital nervous system is the radically simplified wiring harness. It is based on a so-called **zonal wiring harness**

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architecture, which uses 600 meters less wiring and brings **30% weight savings** compared to the previous generation. The wiring harness is divided into four zones: front end, center, rear and roof. The Superbrains are connected via high-speed data connections to smaller control units, the zonal controllers, which manage and consolidate the data flow of the electronics in and out of the zones. The wiring in the vehicle is therefore zone-related and can thus be shorter, thinner, and lighter.

A crucial prerequisite for thinner and lighter wiring are the so-called "**Smart eFuses**". These are digital fuses that replace up to 150 traditional fuses. Smart eFuses can be intelligently programmed for digitally controlled energy distribution to components. The selective activation of components allows for the design of **intelligent power modes** for various vehicle states such as driving, parking, charging, and upgrading, in which unnecessary consumers can be identified and switched off. Thus, the eFuses make a significant contribution to the **20% improved energy efficiency**.

The completely newly developed electronic architecture forms the basis for the next generation SDV. From the launch of the Neue Klasse, the upcoming BMW model generation will benefit from it. The first fully electric derivative of the Neue Klasse will go into series production later this year at the Debrecen plant (Hungary).

The **advanced software architecture** of the BMW Group builds on this new electronic architecture. With the multitude of digital functions in SDVs, it is crucial that functions can be continuously developed on stable software platforms rather than being newly developed for every new generation. This is precisely what is achieved with the Neue Klasse. In the vehicle the software platforms run on the respective Superbrains, and the vehicle functions run on top of them. The "Shared Service Layer" acts as a connecting element (middleware) and provides, among other things, state-of-the-art cybersecurity and flexible over-the-air updates. It also enables customer-

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relevant AI functions thanks to intelligent networking of cross-domain data sources.

"With the introduction of the Neue Klasse, we are entering a mode of software development where we achieve software continuity. This means we continuously develop software rather than starting from scratch each time," **says Christoph Grote, Senior Vice President BMW Group Electronics and Software.** "Based on our advanced software architecture and the fact that today our global development teams generate 130 times more software than ten years ago, we see ourselves in an excellent competitive position. More than ever, our software developers can focus on product innovations."

For the Neue Klasse, the development teams are working on well over 1,000 software modules, over 20 GB of software, and over 500 million lines of code, which will ultimately be integrated into the Superbrains and the rest of the electronic architecture in the vehicle. To achieve this, the BMW Group has established a solid foundation for future-proof and highly effective vehicle software development in recent years. Innovative methods and tools have been anchored in the continuously growing global developer network. At the heart of vehicle software development is the integrated developer environment: a tailored tool-chain called "CodeCraft." The speed and quality of development have been enhanced with the use of a variety of tools that support the software developer with generative AI. CodeCraft runs in the cloud on up to 75,000 virtual CPUs, supports the simultaneous work of well over 10,000 software developers, and records up to 200,000 software builds per day at peak times. This corresponds to a productivity increase of more than 130 times compared to ten years ago.

ADDITIONAL INFORMATION.**Concentration of computing power for essential customer functions in four "Superbrains."**

The first **Superbrain** carries the joy of electric driving into the future and is therefore named "**Heart of Joy**". In fully electric BMWs of the Neue Klasse, the first completely BMW-developed driving dynamics control system will be used: BMW Dynamic Performance Control. It enables the most precise driving experience to date, efficient energy recuperation, impressive smoothness even at low speeds, and perfect traction for dynamic acceleration. Engine and chassis control are combined in a single control unit for the first time and respond with a delay of less than one millisecond, ten times faster than the previously used control units.

The **second Superbrain for automated driving** controls the latest generation of automated and highly automated driving functions. It integrates what was previously distributed across four control units into one powerful computing unit and has twenty times the computing power compared to the previous generation.

The third **Superbrain controls BMW Panoramic iDrive** and thus the digital experience in the vehicle with the infotainment operating system **BMW Operating System X**. It orchestrates all content in the BMW Panoramic Vision, 3D Head-Up Display, and central display, as well as voice interaction, entertainment, and navigation. This Superbrain ensures the intuitive customer experience of BMW Panoramic iDrive and expands it with intelligent, AI-supported, and cloud-based functions.

The fourth **Superbrain** is responsible for **basic functions** and acts as the control center for managing vehicle states. It controls fundamental functions such as **vehicle access, climate and comfort, interior and exterior lighting, data flow and processing, as well as remote software upgrades**. Up to 100

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vehicle functions are integrated into this single unit, and it is connected to up to 50 sensors.

Intelligent preprocessing of data by the Superbrains in the vehicle enables optimized data exchange with the BMW Cloud.

Long-standing and proven strategy for software development.

The BMW Group is managing the digital transformation with a consistent and long-term strategy. With the founding of BMW CarIT over 20 years ago, software development began in-house. Since then, the company has expanded its development teams in a global network. In total, the BMW Group employs around 10,000 IT and software experts worldwide.

Despite a high level of internal expertise, the BMW Group has always believed that developing the complete vehicle software in-house would never be sensible. Therefore, the company consistently pursues a strategic "Make-or-Buy" approach. This means on the one hand, that brand-defining and differentiating software is developed in-house. This includes, for example, the infotainment operating system, which has now been developed by BMW in its tenth generation. Crucial software layers for executing over-the-air updates or the control software for the driving experience are also developed internally. Basic functionalities on the other hand, for which leading solutions already exist and which do not significantly shape customer experience are sourced from leading companies in the industry or covered through open-source solutions.

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The BMW Group

With its four brands BMW, MINI, Rolls-Royce and BMW Motorrad, the BMW Group is the world's leading premium manufacturer of automobiles and motorcycles and also provides premium financial and mobility services. The BMW Group production network comprises over 30 production sites worldwide; the company has a global sales network in more than 140 countries.

In 2023, the BMW Group sold over 2.55 million passenger vehicles and more than 209,000 motorcycles worldwide. The profit before tax in the financial year 2023 was € 17.1 billion on revenues amounting to € 155.5 billion. As of 31 December 2023, the BMW Group had a workforce of 154,950 employees.

The success of the BMW Group has always been based on long-term thinking and responsible action. The company set the course for the future at an early stage and consistently makes sustainability and efficient resource management central to its strategic direction, from the supply chain through production to the end of the use phase of all products.

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