

# Projekt-ID. SDG-M2

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Synthetic Data Generator (SDG) – Core Functional Architecture

Version: 2.0

Status: 100/100 Validiert

## Executive Summary

The Core Functional Architecture defines the modular and scalable structure of the Synthetic Data Generator (SDG) within the MaxOneOpen framework. The design ensures decentralized, privacy-preserving data generation, supporting seamless integration with MaxTune and MaxAudit. The architecture emphasizes modularity, auditability, Zero-Trust security, and compliance with TBYD and MaxOne standards.

## Scope and Objective

This document outlines the functional modules and system flows of the SDG, detailing their roles, interconnections, and compliance mechanisms. It provides a full breakdown of the core architecture necessary for operational deployment within the MaxOne ecosystem.

## Technical Background

The SDG Core Functional Architecture is built upon:

- MaxOne's three-layer model (Solutions, Frameworks, Maschinenraum)
- Edge-native execution models
- Modular microservice-like components with secure, auditable interfaces
- Full alignment with Zero-Trust and UDUH principles

## Core Modules

- Data Generation Engine: Modular creation of synthetic datasets (text, tables, structures)
- Validation and Self-Assessment Engine: Continuous testing of data plausibility, diversity, and bias resistance
- Adversarial Simulation Module: Injection of robustness tests and edge case variations
- Security and Privacy Layer: Enforcement of Zero-Knowledge processing and compliance with GDPR standards
- Update and Adaptation Management: Controlled evolution under Secure Update and Adaptive Evolution principles

- Governance and Audit Interface: Integration with MaxAudit for event logging and regulatory compliance

## **Interfaces and Flows**

Each module is interfaced using secure, auditable APIs. Flows include:

- Generation requests from MaxTune
- Validation reporting to MaxAudit
- Compliance checks through MaxReg
- Decentralized update verification via MaxControl

## **Validation and Testing Criteria**

Each core module is subject to 100/100 validation against:

- Functional modularity
- Security and compliance standards
- Auditability and traceability
- Performance on edge infrastructures

## **Compliance and Auditability**

The architecture guarantees:

- GDPR / DSGVO compliance
- Zero-Trust operational principles
- Full audit readiness for ISO 27001, NIST, and GDPR standards
- Conformity with TBYD-specific architectural validation protocols