SAP HANA: The Evolution from a Modern Main-Memory Data Platform to an Enterprise Application Platform

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ABSTRACT

SAP HANA is a pioneering, and one of the best performing, data platforms designed from the ground up to heavily exploit modern hardware capabilities, including SIMD and large memory and CPU footprints. As a comprehensive data management solution, SAP HANA supports the complete data life cycle encompassing modeling, provisioning, and consumption. This extended abstract outlines the vision and planned next step of the SAP HANA evolution growing from a core data platform into an innovative enterprise application platform as the foundation for current as well as novel business applications in both on-premise and on-demand scenarios. We argue that only a holistic system design rigorously applying co-design at different levels may yield a highly optimized and sustainable platform for modern enterprise applications.

Figure 1: The SAP HANA platform

1. THE BEGINNING: SAP HANA DATA PLATFORM

A comprehensive data management solution has become one of the most critical assets in large enterprises. Modern data management solutions must cover a wide spectrum of additional data structures ranging from single key-values models to complex graph structured data sets and document-centric data stores. Complex query and manipulation patterns are issued against the database reflecting the algorithmic side of complex enterprise applications. Additionally, data consumption activities with analytical query patterns are no longer reserved for decision makers or specialized data scientists but are increasingly becoming an integral part of complex operational business processes requiring support for analytical as well as transactional workloads managed within the same system [4].

Dealing with these challenges [5] demanded a complete re-thinking of traditional database architectures and data management approaches now made possible by advances in hardware architectures. The development of SAP HANA accepted this challenge head on and started a new generation
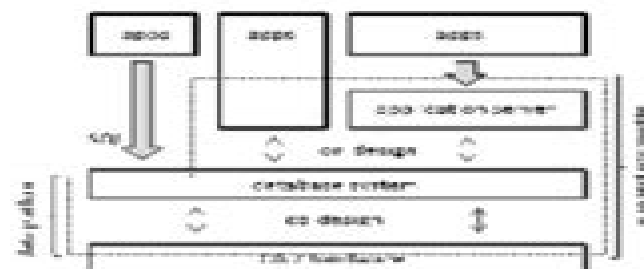
of database system design. The SAP HANA database server now comprises a centrally, and tightly, orchestrated collection of different processing capabilities, e.g., an in-memory columnar relational store, a graph engine, native support for text processing, comprehensive spatial support, etc., all running within a single system environment and, therefore, within a single transactional sphere of control without the need for data replication and synchronization [2].

Secondly, and most importantly, SAP HANA has triggered a major shift in the database industry from the classical-disk-centric database system design to a groundbreaking main-memory centric system design [3]. The mainstream availability of very large main memory and CPU footprints within single compute nodes, combined with SIMD architectures and sophisticated cluster systems based on high speed interconnects, was and remains, the central design guideline of the SAP HANA database server. SAP HANA was the first commercial system to systematically reflect, and exploit, the shift in memory hierarchies and CPU architectures in order to optimize data structures and access paths. As a result, SAP HANA has yielded orders of magnitude performance gains thereby opening up completely novel application opportunities. Most of the core design advances behind SAP HANA are now finding their way into main-stream database system research and development, thereby reflecting its pioneering role.

As a foundational tenet, we are rigorous application of Hardware/Database co-design principles as the main success factor to systematically exploit the underlying hardware platform. Literally every core SAP HANA data structure and routine has been systematically inspected, redesigned

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Beginning SAP HANA Stabak Ghosh,Balwant Singh,2015-12-29 In the internet era and in a world of various enterprise information software organizations have wide access to a variety of data The challenge for organizations is to convert this data into information and then into insights Today s competitive world calls for real time business decisions that impact the bottom line positively Proper understanding of various key performance indicators architecting scalable data mart and data models with real time accessibility is the mantra for successful differentiation in our digitalized world Beginning SAP HANA shows how to unleash the full potential of business intelligence with fact based decisions aligned to business goals using the in memory computing power of HANA The book provides a complete updated coverage of the latest BI platform SAP HANA Version 73 Beginning SAP HANA gives insights into solving challenging business decision making problems with the data modelling processing and analytical capabilities of SAP HANA You ll gain a thorough understanding of real time provisioning in HANA using various replication tools and exposing HANA objects to various external reporting packages You ll see how SAP BW seamlessly fits on top of HANA leveraging its efficient in memory processing of data and learn how HANA optimizes BW objects something that substantially enhances the performance Along with the fundamentals of HANA you ll also learn about UI5 a framework for creating engaging user interfaces and Fiori like analytical applications that have been integrated to the architecture using OData KPI Modeller with HANA Beginning SAP HANA will serve as a guide for data architects who need to leverage the modelling capabilities of HANA to deliver better key performance indicator reporting Solution integration architects will learn how to integrate HANA with various IT tools and platforms as per the requirements of the organization The simple and lucid language backed with real time case studies will help the audience to connect better with the content of the book Extensive hands on exercises quizzes and question sets following every chapter will help in performing a quick check on the level of understanding and assist in preparation for certifications on SAP HANA Beginning SAP HANA by Singh and Ghosh will enhance your skills and professional prospects and become the sought after expert on SAP HANA **Learn HANA in 1 Day** Krishna Rungta,2017-05-04 SAP Hana is popular due to its large main memories and massive parallel job processing capabilities It makes SAP Hana real fast The motive of this book is to develop a good understanding of how SAP Hana is used The book doesn t need any experience with SAP HANA or software development It s a self learning guide that even beginners can use Everything about SAP HANA is explained like architecture modeling reporting SQL script and so on This book is full of information hands on and real life project experience learning In this edition you will identify various components of SAP HANA and its working process Though the book size is small it tried to justify almost all important topics of SAP HANA with examples and images These includes SLT the connection between SAP system and HANA Data services etc You will also learn how to use SQL script in HANA By the end of this book you will be able to integrate SAP HANA pretty much with any platform Over a time you can use this edition as a handbook and harness

your SAP Hana skills So all and above this edition will save a lot of your expenses spend behind other courses and learning resources Table Content Chapter 1 Introduction Introduction SAP HANA Why to choose SAP HANA SAP HANA In Memory Strategy SAP HANA Advantages SAP HANA Compare to BWA Business Warehouse Accelerator Chapter 2 Hana Architecture SAP HANA Architecture SAP HANA Landscape SAP HANA Sizing Chapter 3 SAP HANA Studio Pre Requisite for SAP HANA Studio Supported Platform Download Install SAP HANA Studio Add System in SAP HANA Studio Work With SAP HANA Studio Chapter 4 SQL Script Data Type Trigger Sequence Operator Function Expression Identifiers What is SAP HANA SQL SAP HANA Identifiers SAP HANA Data Type SAP HANA Operator SAP HANA SQL FUNCTIONS SAP HANA SQL EXPRESSIONS SAP HANA SQL Stored Procedure SAP HANA Create Sequence SAP HANA Create Trigger Chapter 5 Data Provisioning Overview of Replication Technology SLT SAP Landscape Transformation Replication Server SAP DS SAP DATA Services SAP HANA Direct Extractor Connection DXC Flat file Upload to SAP HANA Chapter 6 Modeling SAP HANA Modelling Overview Join Method in SAP HANA SAP HANA Best Practices for Creating Information Models SAP HANA Attribute View SAP HANA Analytic View SAP HANA Calculation View SAP HANA Analytic Privileges SAP HANA Information Composer SAP HANA Import and Export SAP HANA Performance Optimization Technique Chapter 7 Security SAP HANA Security Overview SAP HANA Authentication SAP HANA Authorization SAP HANA User and Role Administration SAP HANA License Management SAP HANA Auditing Chapter 8 Reporting Reporting In SAP BI Business Intelligence Overview Reporting In Webi of SAP Business Objects BO on HANA Reporting In Crystal Report Reporting In SAP Lumira Reporting In Microsoft Excel **SAP Data Intelligence** Dharma Teja Atluri,Devraj Bardhan,Santanu Ghosh,Snehasish Ghosh,Arindom Saha,2021 Manage your data landscape with SAP Data Intelligence Begin by understanding its architecture and capabilities and then see how to set up and install SAP Data Intelligence with step by step instructions Walk through SAP Data Intelligence applications and learn how to use them for data governance orchestration and machine learning Integrate with ABAP based systems SAP Vora SAP Analytics Cloud and more Manage secure and operate SAP Data Intelligence with this all in one guide In this book you ll learn about a Configuration Build your SAP Data Intelligence landscape Use SAP Cloud Appliance Library for cloud deployment including provisioning sizing and accessing the launchpad Perform on premise installations using tools like the maintenance planner b Capabilities Put the core capabilities of SAP Data Intelligence to work Manage and govern your data with the metadata explorer use the modeler application to create data processing pipelines create apps with the Jupyter Notebook and more c Integration and Administration Integrate manage and operate SAP Data Intelligence Get step by step instructions for integration with SAP and non SAP systems Learn about key administration tasks and make sure your landscape is secure and running smoothly Highlights include 1 Configuration and installation2 Data governance3 Data processing pipelines4 Docker images5 ML Scenario Manager6 Jupyter Notebook7 Python SDK8 Integration9 Administration10 Security11 Application lifecycle management12 Use cases **SAP HANA Cookbook**

Chandrasekhar Mankala,Ganesh Mahadevan V.,2013-12-24 An easy to understand guide covering topics using practical scenarios and live examples and answering all possible questions If you are a solution architect developer modeler sales leader business transformation managers directors COO or CIO this book is perfect for you If you are interested in other technologies and want to jump start into SAP this book gives you the chance to learn SAP HANA Basic knowledge of RDBMS concepts enough is to get you started **The SAP HANA Project Guide** , SAP HANA is the SAP product for in memory computing It streamlines transactions analytics planning and data processing on a single in memory database allowing businesses to operate in real time Over the course of the last few years the authors have led many diverse SAP HANA projects with extraordinary success resulting in 10 000 or in some cases even 100 000 times improvement of system performance In this book the authors share their findings from SAP HANA projects to help ensure the success of your SAP HANA project The SAP HANA project guide will also help you identify suitable scenarios for your company to get started with in memory computing while sketching out a long term plan to provide innovation to your entire business using SAP HANA We ll cover the following key topics Delivering innovation with SAP HANA Creating a business case for SAP HANA Thinking in memory Managing SAP HANA projects   SAP HANA Penny Silvia,Dr. Berg,Rob Frye,2016   **SAP Cloud Platform** Gairik Acharya,Govind Bajaj,Avijit Dhar,Anup Ghosh,Asidhara Lahiri,2018-12-28 Learn to build cloud applications from the ground up using SAP Cloud Platform Explore the Neo and Cloud Foundry development environments pick your backend language from a selection including Java Node js and ABAP and create a frontend with SAPUI5 and SAP Fiori and more Once your app is ready to run secure test and monitor it before delivery and implementation Then find out how to integrate essential SAP Cloud Platform services like the SAP Leonardo toolset Take your apps to the next level a Application Development Learn the ins and outs of application development from Java Node js Python SAP HANA XS SAP HANA XSA and ABAP in the backend For the frontend explore SAPUI5 SAP Fiori and SAP Web IDE b Lifecycle Management Secure and monitor applications set up a continuous delivery and continuous integration pipeline and implement DevOps best practices c Microservices Integrate your applications with SAP Cloud Platform microservices like Internet of Things 4 0 machine learning and blockchain from the SAP Leonardo toolset 1 SAP Cloud Platform 2 Neo Environment 3 Cloud Foundry 4 Microservices 5 Frontend and backend development 6 Application lifecycle management 7 SAP Leonardo 8 Java 9 SAPUI5 10 CI CD 11 DevOps   *SAP/ABAP HANA Programming* Sudipta Malakar,2019-09-18 Enrich your skill set with Open SQL and CD5 views DESCRIPTION The book has been written in such a way that the concepts are explained in detail giving adequate emphasis on examples To provide clarity on the programming examples logic is properly explained and discussed by using comments in program itself The topics covered in this book include starting the software using snapshots of the same and writing programs Simple to complex SAP ABAP HANA examples are provided in detail considering the requirement of IT consultants the basic idea of developing projects in it The examples provided in this book are user focused and are provided through

sections figures and examples KEY FEATURES Comprehensive coverage of SAP ABAP HANA with emphasis on real time case studies Practical examples along with Screen personas SAP Fiori cloud OPEN SQL Native SQL ADBC CDS support in SAP NW ABAP 7 4 SP5 SAP HANA Studio performance enabler Rules guidelines Simple language crystal clear approach straight forward comprehensible presentation Concepts are duly supported with examples Topic coverage with the aim to fill the skill gap among industry and academia SAP Business Suite powered by SAP HANA are helpful for developing projects for IT consultants WHAT WILL YOU LEARN Gaining Customers by adopting and implementing SAP HANA in organisations projects programs Facilitating to maintain Customer Relationships as the core of all successful working relationships are two essential characteristics trust and commitment To demonstrate their trustworthiness and commitment to customers progressive suppliers periodically provide evidence to customers of their accomplishments Help in delivering Superior Value and Getting an Equitable Return as understanding value in business markets and doing business based on value delivered gives suppliers the means to get an equitable return for their efforts This document is a compilation of SAP ABAP 4 coding and efficiency standards and will provide guidance in creating readable maintainable code It is intended for all developers in the SAP R 3 system This document is based primarily on ABAP 4 WHO THIS BOOK IS FOR Person from IT domain having software background preferably with SAP technical or techno functional or functional or domain knowledge Table of Contents 1 Introduction 2 General Programming Standards 3 ABAP Internal Names 4 ABAP 4 Dictionary 5 Security Authorisations considerations 6 ABAP 4 Coding Techniques   **SAP BW on SAP HANA** Christian Savelli,   **SAP BW/4HANA and BW on HANA** Frank Riesner,Klaus-Peter Sauer,2017 SAP BW 4HANA has introduced a new era in data warehousing at SAP Further steps towards simplification flexibility and performance are now possible with SAP HANA as the proven technological basis SAP BW 4HANA offers modern concepts for data management operation and modeling and thus opens the door for fully innovative application scenarios This book will show you how the SAP HANA database influences the Business Warehouse and how you can optimize your system As a practical guide the book is aimed at experienced SAP BW experts as well as decision makers who need a well grounded overview The authors address the versions SAP BW 4HANA 1 0 and SAP BW 7 5 in equal measure highlighting new functions and differences The book also focuses on the migration options and conversion tools for moving to SAP BW 4HANA Use this reference book to enter the world of SAP BW with SAP HANA as the database platform Migration sizing operation data management with SAP BW 4HANA and SAP BW 7 5 on HANA The new central source Systems SAP HANA and ODP New modeling options mixed scenarios LSA and differences compared to SAP BW 7 5 The role of BW in operational SAP reporting   Software Development on the SAP Hana Platform Mark Walker,2013-01-01 Software Development on the SAP HANA Platform is a general tutorial guide to SAP HANA This book is written for beginners to the SAP HANA platform No knowledge of SAP HANA is necessary to start using this book   *SAP Hana Modeling Practical World* Narayana Varma,2018-04-16 This book provides various insights on the overall HANA

modeling process which essentially involves the activities such as requirement analysis for the KPIs solution design creating information models views implementing SQL Script based solutions performance optimization of the models testing and validations It will help the learners in understanding the practical application of various SAP HANA modeling concepts to achieve complex reporting requirements The contents of this book includes various building blocks of HANA modeling solutions Key features and use cases of SAP HANA platform to address various requirements related to analyticsProject planning approaches such as requirement analysis implementation methodology and solution design aspects related to native HANAImplementing Calculation views for different reporting requirements Modeling Concepts and practical examplesSQL Script programming concepts and applications Data validation and debugging techniques related to HANA modelsBest practices for modeling HANA views managing the changes and transportsPerformance analysis tools and optimization methods for HANA modelsCase studies and solution approaches using graphical modeling and SQL script   *Real Time Analytics with SAP HANA* Vinay Singh,2015-10-30 Enhance your SAP HANA skills using this step by step guide to creating and reporting data models for real time analytics About This Book This book will help you to process analytical and transactional data in real time with the help of SAP HANA Walk through the steps of the data modeling process and build various data models and artifacts in SAP HANA Studio Packed with rich examples and use cases that are closely focused on developing real time applications Who This Book Is For If you are a SAP HANA data modeler developer implementation migration consultant project manager or architect who is responsible for implementing migrating to SAP HANA then this book is for you What You Will Learn Get to grips with the basic building blocks of Analytics Data models in the SAP HANA environment Discover various schemas modeling principles Joins and the architecture of the SAP HANA engine Build data models and artifacts in Sap HANA Studio Design decision tables and understand the concept of transport management in the SAP HANA landscape Work with the different views in SAP HANA Studio Explore full text search and fuzzy search in SAP HANA Create your own scenarios and use cases using sample data and code In Detail SAP HANA is an in memory database created by SAP SAP HANA breaks traditional database barriers to simplify IT landscapes eliminating data preparation pre aggregation and tuning SAP HANA and in memory computing allow you to instantly access huge volumes of structured and unstructured data including text data from different sources Starting with data modeling this fast paced guide shows you how to add a system to SAP HANA Studio create a schema packages and delivery unit Moving on you ll get an understanding of real time replication via SLT and learn how to use SAP HANA Studio to perform this We ll also have a quick look at SAP Business Object DATA service and SAP Direct Extractor for Data Load After that you will learn to create HANA artifacts Analytical Privileges and Calculation View At the end of the book we will explore the SMART DATA access option and AFL library and finally deliver pre packaged functionality that can be used to build information models faster and easier Style and approach This is an easy to follow step by step rapid guide to help you learn analytics in SAP HANA through ample hands on

exercises and use case scenarios **SAP HANA Project Guide** Brenckmann Ingo,MATHIAS POHLING. INGO BRENCKMANN, *Learn HANA in 24 Hours* Alex Nordeen,2020-04-02 SAP Hana is popular due to its large main memories and massive parallel job processing capabilities It makes SAP Hana real fast The motive of this book is to develop a good understanding of how SAP Hana is used The book doesn t need any experience with SAP HANA or software development It s a self learning guide that even beginners can use Everything about SAP HANA is explained like architecture modeling reporting SQL script and so on This book is full of information hands on and real life project experience learning In this edition you will identify various components of SAP HANA and its working process Though the book size is small it tried to justify almost all important topics of SAP HANA with examples and images These includes SLT the connection between SAP system and HANA Data services etc You will also learn how to use SQL script in HANA By the end of this book you will be able to integrate SAP HANA pretty much with any platform Over a time you can use this edition as a handbook and harness your SAP Hana skills So all and above this edition will save a lot of your expenses spend behind other courses and learning resources Table Content Chapter 1 Introduction 1 Introduction SAP HANA 2 Why to choose SAP HANA 3 SAP HANA In Memory Strategy 4 SAP HANA Advantages 5 SAP HANA Compare to BWA Business Warehouse Accelerator Chapter 2 Hana Architecture 1 SAP HANA Architecture 2 SAP HANA Landscape 3 SAP HANA Sizing Chapter 3 SAP HANA Studio 1 Pre Requisite for SAP HANA Studio 2 Supported Platform 3 Download Install SAP HANA Studio 4 Add System in SAP HANA Studio 5 Work With SAP HANA Studio Chapter 4 SQL Script Data Type Trigger Sequence Operator Function Expression Identifiers 1 What is SAP HANA SQL 2 SAP HANA Identifiers 3 SAP HANA Data Type 4 SAP HANA Operator 5 SAP HANA SQL FUNCTIONS 6 SAP HANA SQL EXPRESSIONS 7 SAP HANA SQL Stored Procedure 8 SAP HANA Create Sequence 9 SAP HANA Create Trigger Chapter 5 Data Provisioning 1 Overview of Replication Technology 2 SLT SAP Landscape Transformation Replication Server 3 SAP DS SAP DATA Services 4 SAP HANA Direct Extractor Connection DXC 5 Flat file Upload to SAP HANA Chapter 6 Modeling 1 SAP HANA Modelling Overview 2 Join Method in SAP HANA 3 SAP HANA Best Practices for Creating Information Models 4 SAP HANA Attribute View 5 SAP HANA Analytic View 6 SAP HANA Calculation View 7 SAP HANA Analytic Privileges 8 SAP HANA Information Composer 9 SAP HANA Import and Export 10 SAP HANA Performance Optimization Technique Chapter 7 Security 1 SAP HANA Security Overview 2 SAP HANA Authentication 3 SAP HANA Authorization 4 SAP HANA User and Role Administration 5 SAP HANA License Management 6 SAP HANA Auditing Chapter 8 Reporting 1 Reporting In SAP BI Business Intelligence Overview 2 Reporting In Webi of SAP Business Objects BO on HANA 3 Reporting In Crystal Report 4 Reporting In SAP Lumira 5 Reporting In Microsoft Excel *Implementing SAP HANA* ,2013 **SAP HANA Advanced Data Modeling** Anil Babu Ankisettipalli,Hansen Chen,Pranav Wankawala,2016 Practical Guide to SAP HANA and Big Data Analytics Dominique Alfermann,Stefan Hartmann,2018-12-20 In this book written for SAP BI big data and IT architects the authors expertly provide clear recommendations for building modern

analytics architectures running on SAP HANA technologies Explore integration with big data frameworks and predictive analytics components Obtain the tools you need to assess possible architecture scenarios and get guidelines for choosing the best option for your organization Know your options for on premise in the cloud and hybrid solutions Readers will be guided through SAP BW 4HANA and SAP HANA native data warehouse scenarios as well as field tested integration options with big data platforms Explore migration options and architecture best practices Consider organizational and procedural changes resulting from the move to a new up to date analytics architecture that supports your data driven or data informed organization By using practical examples tips and screenshots this book explores SAP HANA and SAP BW 4HANA architecture concepts Predictive Analytics and Big Data component integration Recommendations for a sustainable future proof analytics solutions Organizational impact and change management   *SAP Hana Starter* Mark Walker,2012-11-21 Written as a practical guide SAP Hana Starter will show you all you need to know to build your first reporting application utilizing SAP s new in memory database technology SAP HANA Starter is aimed at SAP consultants and users of competing database technologies as well as anyone curious as to what all the fuss concerning SAP HANA is about No previous SAP ERP BW or database programming experience is necessary though notions of how SQL and table joins work will be advantageous Access to a SAP HANA box is necessary to follow the examples locally   *Implementing SAP HANA* Jonathan Haun,Don Loden,Chris Hickman,Roy Wells,2013

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