



Building Digital Experience Platforms

A Guide to Developing Next-Generation
Enterprise Applications

—
Shailesh Kumar Shivakumar
Sourabh Sethi

Apress®

Building Digital Experience Platforms

**A Guide to Developing
Next-Generation Enterprise
Applications**

**Shailesh Kumar Shivakumar
Sourabh Sethi**

Apress®

Building Digital Experience Platforms: A Guide to Developing Next-Generation Enterprise Applications

Shailesh Kumar Shivakumar
Bangalore, Karnataka, India

Sourabh Sethii
Jammu, Jammu and Kashmir, India

ISBN-13 (pbk): 978-1-4842-4302-2
<https://doi.org/10.1007/978-1-4842-4303-9>

ISBN-13 (electronic): 978-1-4842-4303-9

Library of Congress Control Number: 2019931830

Copyright © 2019 by Shailesh Kumar Shivakumar, Sourabh Sethii

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

Trademarked names, logos, and images may appear in this book. Rather than use a trademark symbol with every occurrence of a trademarked name, logo, or image we use the names, logos, and images only in an editorial fashion and to the benefit of the trademark owner, with no intention of infringement of the trademark.

The use in this publication of trade names, trademarks, service marks, and similar terms, even if they are not identified as such, is not to be taken as an expression of opinion as to whether or not they are subject to proprietary rights.

While the advice and information in this book are believed to be true and accurate at the date of publication, neither the authors nor the editors nor the publisher can accept any legal responsibility for any errors or omissions that may be made. The publisher makes no warranty, express or implied, with respect to the material contained herein.

Managing Director, Apress Media LLC: Welmoed Spahr
Acquisitions Editor: Shiva Ramachandran
Development Editor: Laura Berendson
Coordinating Editor: Rita Fernando

Cover designed by eStudioCalamar

Cover image designed by Freepik (www.freepik.com)

Distributed to the book trade worldwide by Springer Science+Business Media New York, 233 Spring Street, 6th Floor, New York, NY 10013. Phone 1-800-SPRINGER, fax (201) 348-4505, e-mail orders-ny@springer-sbm.com, or visit www.springeronline.com. Apress Media, LLC is a California LLC and the sole member (owner) is Springer Science + Business Media Finance Inc (SSBM Finance Inc). SSBM Finance Inc is a Delaware corporation.

For information on translations, please e-mail rights@apress.com, or visit www.apress.com/rights-permissions.

Apress titles may be purchased in bulk for academic, corporate, or promotional use. eBook versions and licenses are also available for most titles. For more information, reference our Print and eBook Bulk Sales web page at www.apress.com/bulk-sales.

Any source code or other supplementary material referenced by the author in this book is available to readers on GitHub via the book's product page, located at www.apress.com/9781484243022. For more detailed information, please visit www.apress.com/source-code.

Printed on acid-free paper

I dedicate this book to . . .

My parents, Shivakumara Setty V and Anasuya T M who blessed me with their love and strength, My wife, Chaitra Prabhudeva and my son Shishir who shared their time and support, My in-laws, Prabhudeva T M and Krishnaveni B who provided help and courage, and to all my school teachers to bestow lots of love and knowledge.

—Shailesh Kumar Shivakumar

To lovers of books . . .

I hope this book aids you to get your work out to a wider audience. I would love nothing more than to see the book in the hands of people everywhere—students in the classroom, researchers, browsers in the bookstore, and professionals.

That's a great challenge, but it is certainly worth an attempt.

—Sourabh Sethi

Table of Contents

About the Authors	xvii
About the Technical Reviewers	xix
Acknowledgments	xxi
Introduction	xxiii
Part I: Requirements and Design	1
Chapter 1: Introduction to Digital Experience Platforms	3
Boundaryless Banking Enabled by Digital Technologies	4
Overview of DXP	4
Key Tenets of a DXP	5
DXP Reference Architecture	5
Evolution and Drivers for DXP	11
Overview of Banking Experience Platform.....	16
Key Tenets of Banking Experience Platform	16
High-Level Requirements of Banking Experience Platform.....	17
Three Ps of BXP	21
Sample Technical Capabilities of Banking Experience Platform.....	21
Sample Key Performance Indicators of Banking Experience Platform.....	24
Digital Imperatives for Modern Banks.....	25
Summary.....	26
Chapter 2: Gathering Requirements	27
Functional Requirements	32
Experience Requirements.....	36
Seamless Experience on All Supported devices.....	37
Seamless Experience on All Supported Browsers.....	38

TABLE OF CONTENTS

- Multilingual Requirements 38
- Navigation Elements, Menus, and Search 39
- Mobility Requirements 41
- Nonfunctional Requirements 43
- Scalability Requirements 44
- Performance–Response Time, Throughput, Utilization, Static Volumetric..... 46
 - Performance Requirements..... 46
 - Page Hits Analysis 48
- Maintenance Requirements 50
- Versioning 52
- Rollout..... 52
- Security Requirements..... 53
- Disaster Recovery Requirements..... 57
- Accessibility Consideration 58
- Chapter Summary 59
- Chapter 3: Design 61**
 - Building an Experience Platform..... 61
 - Digital Platform Strategy 65
 - Platform Design Phases 69
 - Design of Various Layers..... 70
 - Presentation Layer 72
 - Scripting Framework 74
 - UI Management 75
 - UI Deployment 76
 - Integration Layer 77
 - Loosely Coupled Integration and Highly Coupled Integration 78
 - Business Layer 84
 - Data Layer 86
 - Middleware Layer 87
 - Social and Collaboration Design 89

IoT Integration Design.....	93
IoT Case Study.....	95
Blockchain Design	96
What is Blockchain?	96
What Is a Distributed Ledger?	97
Smart Contract	97
Blockchain Platforms.....	98
DXP and Blockchain Network	98
Blockchain Components.....	99
Blockchain Case Study	100
Big Data and NoSQL Design.....	102
Big Data and NoSQL Integration	102
Big Data and NoSQL Case Study	105
AI Automation Design.....	106
Determine Automation Goals.....	106
Steps to Build AI Automation Model	106
Chatbot Case Study	107
Enterprise Search Engine.....	109
Augmented – Virtual Reality Integration	111
Presentation Layer.....	111
Integration Service Layer	112
Recent Trends in DevOps	113
Containerization.....	113
DevOps – Continuous Integration (CI), Continuous Deployment (CD)	114
Chapter Summary	115
Part II: Development of the Banking Experience Platform	117
Chapter 4: User Interface Design.....	119
Key Features	119
Simplified Approach	119
Intuitive Architecture	120

TABLE OF CONTENTS

- Dashboard 120
- Responsive Interface 120
- Personalization 121
- Internationalization and Localization 122
- Preferences 122
- Integrated Analytics 122
- Search Engine Optimization 123
- User Interface Components 123
 - Pages 123
 - Layouts 123
 - Navigational Router or Navigation Menu 124
 - Presentation Component 125
 - Design Goals 125
 - Communication Between Presentation Components 126
 - Hooks 127
- Development Process 127
- Development Life Cycle 129
- Architecture 130
- DXP UI Technology Stack 132
- Angular Technology Stack 133
- Angular Core 134
 - Angular Support Library 135
- React Technology Stack 137
 - React 137
 - React Support Library 137
- Evaluating UI frameworks 139
 - Data Flow 139
 - Language 139
 - Performance 139
- Best Practice 140
- BXP – Case Study 141

Consistency Across Locations	141
Consistency Across Application	141
Unified and Collaborative Approach	142
BXP UI Layouts/Containers	142
BXP Dashboard	142
Chapter Summary	147
Chapter 5: Designing the Integration Layer	149
Integration Consideration	150
Data Formats	153
Integration Services	155
Integration Styles, Protocols, Systems, and Patterns.....	157
Integration Styles	157
Integration Protocols	158
Integration Systems.....	161
Integration Patterns.....	162
Data Standards	164
Flexible Integration Middleware.....	165
EAI vs. SOA vs. ESB vs. Microservices	165
Mutual Memorandum of Understanding (MOU)	167
Service Protocol and Data Format.....	167
API Management	167
Why Do We Need Data Transformation Capabilities in DXP?.....	167
Integration Technology Stack and Architecture.....	168
Monolithic.....	168
Microservices	170
ESB and API Gateway.....	170
Integration Security.....	171
Authentication and Authorization	171
Protocols.....	171
Frameworks.....	171

TABLE OF CONTENTS

Integration Best Practices..... 173

BXP Case Study..... 176

 Case Study Conclusion 179

Chapter Summary 179

Part III: Securing the Banking Experience Platform 181

Chapter 6: DXP Security 183

 DXP Security Framework 183

 DXP Layer-Wise Security 184

 Common Security Scenarios of DXP 187

 Password Standards..... 187

 Session Management 188

 Information Management 188

 Data Validation..... 189

 Service Security Management 189

 Security Vulnerabilities and Best Practices of DXP 190

 Security Testing Framework for DXP..... 192

 Secure Code Scanning 193

 General Web Security testing 194

 Application-Specific Security Analysis 195

 Threat Profiling of Transaction Management in Banking DXP 195

 Threat profiling of Fund Management in Banking DXP 196

 DXP Security Checklists..... 196

 DXP Architecture and Design Phases Security Checklist 196

 DXP Information Management Security Checklist..... 197

 DXP Authentication and Session Management Checklist..... 197

 DXP Network Communication Management Security Checklist..... 198

 DXP Input Validation Security Checklist..... 198

 DXP Security Auditing and Logging Security Checklist 199

Chapter Summary 199

Chapter 7: DXP Information Security	201
Information Security in DXP Solutions	201
Implementing Defense in Depth.....	202
Firewalls and Proxies	202
Server Hardware Level Protection.....	202
Monitoring Infrastructure	202
Backup Jobs and Synch Jobs.....	203
Disaster Recovery and Business Continuity Plan	203
Implementing Information Security Policies	203
Information Access Policies.....	203
Protecting Private Data.....	207
Information Security Best Practices.....	208
Privacy Best Practices	208
Authentication and Authorization	208
Auditing and Logging.....	209
File Management.....	209
Error Handling	209
Secure Software Development Life Cycle	209
Secure Incident Management.....	210
Database Level Security.....	210
Sharing the Data with External Systems.....	210
Security Awareness and Training	210
Security Testing	211
Cloud Testing	211
Chapter Summary	212
Part IV: Infrastructure and NFR for the Banking Experience Platform	213
Chapter 8: Quality Attributes and Sizing of the DXP	215
Key Quality Attributes of DXP	215
Quality Attributes Deep Dive	217
Usability Requirements.....	217
Security Requirements	218

TABLE OF CONTENTS

- Reliability Requirements..... 219
- Scalability Requirements..... 219
- Availability Requirements..... 220
- Archival and Retention Requirements 221
- Logging and Auditing Requirements 221
- Performance Requirements..... 222
- Infrastructure Sizing of DXP 222
- Cloud Hosting of DXP Solution 224
 - Tiered Architecture 224
 - Cloud Deployment Considerations..... 225
 - Cloud Deployment Model..... 226
- Disaster Recovery and Business Continuity for DXP Applications 228
 - DR Planning 229
 - DR Implementation 230
 - DR Maintenance 231
 - DR Strategy Document 232
- Chapter Summary 233
- Chapter 9: DXP Performance Optimization 235**
 - DXP Performance Optimization of Presentation Layer 235
 - User Experience..... 235
 - Performance Testing for DXP 238
 - Performance Testing Activities 238
 - Key Performance Metrics 243
 - Performance Testing Framework 244
 - Identify Critical Transactions 245
 - Document Workload Model..... 245
 - Qualitative Assessment 245
 - Quantitative Assessment 246
 - Predict 247
 - Performance Debugging Framework 247
 - Identify the Root Cause 247

Optimize the Component/System/Layer	251
Common Performance Problem Pattern	252
Performance Case study	254
Application Context and Background	254
Performance Analysis	254
Recommendations and Improvements	256
Chapter Summary	258
Chapter 10: Transforming Legacy Banking Applications to Banking Experience Platforms	261
Key Tenets of a Banking Experience Platform	262
Attributes of a Next-Generation Digital Bank	263
DXP Features for Next-Generation Digital Bank	265
Main Trends in Digital Banking	268
Technology-Related Trends	268
Business Process-Related Trends	269
Digital Transformation of Traditional Banks to Digital Banks	269
Reference Technology Architecture for a Digital Bank	269
Reference Functional View of Digital Bank	273
Main Digital Transformation Methods	278
Digital Transformation Road Map	288
Reimagining the Digital Banking Experience	288
Chapter Summary	294
Part V: End to End Case Study	297
Chapter 11: End to End DXP Case Study	299
Drivers and Key Requirements of the Dealer Platform Case Study	299
Architecting the Next-Generation Dealer platform	300
Pain Point Analysis in Current Systems and Processes	300
Solution Tenets of Next-Generation Dealer Platform	302
Solution Design Principles	304
Persona-Based Information Architecture	307

TABLE OF CONTENTS

Persona-Based Design and Information Architecture 308

Functional View of the Next-Generation Dealer Platform 310

Seamless and Optimized Business Process 312

Open-Source-Based Next-Generation Deal Digital Platform 313

Innovations and Next-Generation Technologies in Dealer Platform 318

Chapter Summary 320

Appendix A: Open-Source Tools and Frameworks 321

HTTP Accelerator..... 321

Web Server 321

CSS Framework 322

Scripting Framework 322

User Interface Management..... 323

Integration..... 324

Application Server..... 324

Server-Level Cache 325

Content Management Systems 325

CMIS..... 326

SQL Database..... 326

NoSQL Database 326

IoT Framework 327

Distributed Data Streaming..... 327

Analytics Engine..... 327

Distributed Processing..... 328

Machine Learning Library and Framework 328

Blockchain Frameworks 329

Augmented and Virtual Reality..... 329

Enterprise Search Engine..... 330

Containerization 330

Containerization Orchestration 331

Source Code Management.....	331
Continuous Integration and Continuous Delivery.....	331
Appendix B: Sample Code.....	333
User Interface	334
Integration.....	335
Data Mocking	336
Implementation and Logic	336
Deployment.....	337
Development.....	337
Production.....	338
Prerequisite.....	338
API Specification and API Mocking	339
Swagger-UI	339
Swagger-Editor	340
Swagger-Server	342
UI Screen Mocking on Node-RED.....	342
Apache Camel	346
Build Automation System.....	347
Run the Integration Application.....	354
Angular.....	355
Microservices Architecture	357
Microservices Components.....	358
Docker.....	363
Components	363
Summary.....	364
Appendix C: Further Reading.....	365
Index.....	367

About the Authors



Shailesh Kumar Shivakumar is an author, inventor and working as Practice Lead & Senior Technology Architect at Digital Practice of Infosys Limited. He is an award-winning digital technology practitioner with skills in technology and practice management and has experience in a wide spectrum of digital technologies, including enterprise portals, content systems, enterprise search, and other digital technologies. He has more than 17 years of industry experience and was the chief architect in building a digital platform that won the “Best Web Support Site 2013”

global award. His areas of expertise include digital technologies, software engineering, performance engineering, and digital program management. He is a Guinness world record holder of participation for successfully developing a mobile application in a coding marathon.

Shailesh is deeply focused on enterprise architecture, building alliance partnerships with product vendors, and has a proven track record of executing complex, large-scale digital programs. He successfully architected and led many engagements for Fortune 500 clients of Infosys and built globally deployed enterprise applications. He also headed a center-of-excellence for digital practice and developed several digital solutions and intellectual property to accelerate digital solution development. He led multiple thought-leadership and productivity improvement initiatives and was part of special interest groups related to emerging web technologies at his organization.

Shailesh was awarded the prestigious “Albert Nelson Marquis Lifetime Achievement Award 2018” for excellence in technology and has received numerous honors and awards. He has won multiple awards including the prestigious Infosys Awards for Excellence 2013-14 “Multi-talented thought leader” under the “Innovation – Thought leadership” category, “Brand ambassador award” for MFG unit, “Best employee award”, delivery excellency award and multiple spot awards, and received honors from executive vice chairman of his organization. He is featured as an “Infy star” in the Infosys Hall of fame and recently led a delivery team that won the “best project team” award at his organization.

ABOUT THE AUTHORS

Shailesh holds a Bachelor in Engineering in Computer Science and Engineering and is currently pursuing a doctoral degree in Computer Science. Shailesh has completed an executive management program from the Indian Institute of Management, Calcutta. Shailesh holds numerous professional certifications such as TOGAF 9 certification, Oracle Certified Master (OCM) in Java EE5 Enterprise Architect certification, IBM Certified SOA Solution Designer, and IBM Certified Solution Architect Cloud Computing Infrastructure. He is the sole author of four technical books on digital technologies, which were published by reputed publishers, and has published twelve technical white papers related to digital technologies. Shailesh is the sole inventor of two granted US patents (US9613341 and US10108601) and holds two more patent applications, and is a frequent speaker at events such as IEEE conferences and Oracle JavaOne. Shailesh has also published more than 10 research papers in various international journals.



Sourabh Sethii is a Technology Analyst at Infosys Technologies Limited. His areas of expertise include Blockchain, Internet of things (IoT), machine learning (ML), Java enterprise technology, front-end frameworks, and integration technology. He has hands-on experiences with many technologies like database integration, continuous integration, and security, along with performance analysis and web frameworks like Angular and Node. Sourabh has worked on multiple domains such as banking, finance, and manufacturing. He has achieved multiple honors like “Most Valuable Player,” “Insta Awards,” and “Best Employee Award”

from the heads of his unit in Infosys. He has published many technical white papers.

Sourabh holds Master degree in Software Systems specialized in Data Analytics from Bits Pilani, Rajasthan, India.

About the Technical Reviewers



George Koelsch is a retired system engineer who resides in West Virginia, after 33 years in the DC metro area. He started system engineering 42 years ago while in the US Army, and had continued that work for an additional 33 years as a contractor for the Federal Government. With a five-year stint as an Industrial Engineer at Michelin Tire Corporation, he learned to become an efficiency expert, which he then applied to system engineering and project management to tailor the lifecycle development process before his contemporaries in the DC area were doing it. In his spare time, he authored ten nonfiction articles on computers, coin collecting, stamp collecting, and high-energy physics. Apress published his book titled *Requirements Writing for System Engineering* in October 2016. He now focusses on writing, all his hobbies, and other projects he has time to work on now.



Venkata Kakarlapudi is a Senior Technology Architect at Infosys Limited, with over 15 years of industry experience. His areas of expertise include Java, enterprise portals, and Web content management systems. He has experience of implementing multiple large-scale enterprise applications for Fortune 500 companies across geographies. He previously headed a center of excellence for enterprise portals at the digital experience practice in his organization and is part of the core architecture team. He holds an engineering degree in Mechanical Engineering and has completed an executive management program for IT executives from the Indian Institute of Management, Bangalore.

Acknowledgments

Shailesh would like to acknowledge and thank Verma V.S.S.R.K for their valuable inputs and review comments. Shailesh would also like to recognize and thank Dr. P. V. Suresh for his constant encouragement and immense support.

Sourabh would like to thank his parents (Ritu Sethi and Sat Dev Sethi) and brother (Shrey Sethi), who were the guiding light behind him.

The authors also like to immensely thank Mr. George Koelsch for his technical review; his feedback has added great value to the book.

The authors want to sincerely acknowledge and thank profusely the Infosys team that includes the managers Jitin Singla, Saumitra Bhatnagar, Vivek Rastogi, Sarweshwar Panda, Sumit Arora, Aditya Kumar Soni, our colleagues and our friends who have facilitated us in accomplishing this task. Special thanks to Rahul Krishan for precious guidance and support. The authors would also like to convey sincere thanks to our mentor and friend Jasleen Khokhar, who read the manuscript at different stages as it evolved from shoot to bud, from flower to fruit. The authors would like to extend thanks to Anchit Madaan (Blockchain Core Team), Deepak Garg, Himanshu Arora, Jaskirat Singh, Babu Krishna Murthy, Kiran Korke, Nishant Satija (Digital Experience Team), and Arpit Kulshrestha.

Our special thanks to Shivangi Ramachandran, Rita Fernando, and the editors, technical team, designers, and publishing team at Apress for providing all necessary and timely support in terms of review, guidance, and regular follow-ups.

Introduction

As enterprises embark on their digital transformation journey, they define the vision, road map, and objectives of the digital transformation programs. Digital transformation involves legacy modernization, reimagining digital experiences, implementing cloud-first and mobile-first models. Such digital transformation involves various challenges and risk factors including but not limited to niche technology stack, unavailability of skilled resources, long time to market, and such. Enterprises need to carefully evaluate technology trends and future outlook, and invest in the technology stack that caters to their current digital transformation goals as well as their long-term digital vision.

Digital experience platforms (DXPs) are an integrated set of technologies and tools that provide best-of-breed modern digital technologies for enterprises. A DXP has a preintegrated set of technology stacks that addresses the risk related to a niche/unproven technology stack and risky integrations. DXPs are designed on the platform philosophy so that they can be easily extended and scaled to meet future demands of scalability and onboard new innovations. A DXP is one of the most popular approaches for building an enterprise grade digital platform. A DXP provides a set of capabilities to quickly develop a personalized, secure, and scalable enterprise platform. DXPs are designed in such a way that they can incorporate modern digital technology to build next-generation enterprise applications.

You can develop your own digital experience platform. The book looks at various open-source tools, technology, and frameworks that can be used for building DXPs. This book covers core concepts to build enterprise grade DXPs. Readers get a holistic view to build DXPs and will be able to transform existing applications to a DXP that is capable of incorporating emerging technologies in near future.

DXPs are not just limited to a few commercial products. Enterprises can build their own experience platforms to meet their needs. This book discusses the methods and technology frameworks across various layers to design a DXP.

We divided this book into five parts: requirements and design, development, security, infrastructure/NFR, and a case study to cover end-to-end DXP lifecycle scenarios. We discuss proven best practices, design methods, and technology frameworks along with contextual real-world case studies for each of the chapters.

INTRODUCTION

In the requirements and design part, we introduce various concepts of DXPs and elaborate on requirements elaboration methods. We also provide an in-depth discussion of various design elements of DXPs such as UI design, integration design, and such. The chapters in this part cover the requirement gathering phases, functional requirements, and sample use case to develop your own DXP application; user experience requirements to develop your own user interface and mobility requirements to develop your own mobile experience; nonfunctional, social and collaboration, security, infrastructure, disaster recovery, and rollout requirements to develop your own digital experiences platform. This is the first step to develop and analyze the requirements to build an enterprise DXP. The design chapter covers the patterns and architectural strategy along with various layers of the DXP. This chapter also briefly discusses the integration of various emerging technologies such as IoT integration design, Blockchain design, big data, and NoSQL design, and AI automation design along with chatbot case studies, enterprise search engine capabilities, and introduction of augmented reality with DXP applications, along with recent trends in CICD (continuous integration and continuous deployment) using application containerization technique.

The development part mainly discusses the detailed design and development of DXP layers such as the user interface layer and integration layer. The chapters in this part cover each and every aspect of developing the user interface using open-source web frameworks, modular UI components and key features, integration of UI components using open source ESB and integration frameworks, UI development lifecycle and best practices, along with a BXP (Banking experience platform) case study.

In the security part, we provide an elaborate discussion of information security and overall security of DXPs. The chapters in this part cover the concepts and best practices while developing an application's security, along with information security policy and principles.

The infrastructure/NFR part discusses various quality and nonfunctional attributes such as performance, infrastructure sizing, and such. The chapters in this part cover the NFR(nonfunctional requirements), that is, scalability, availability, performance, modularity, extensibility, and security of the DXP's application along with quality attributes such as usability, configurability, stability, interoperability, efficiency, flexibility, and maintainability of the platform.

Finally, we wrap up with an elaborate digital transformation case study of a legacy system in the last chapter. The case study chapter provides insights into the digital transformation of a legacy application to a Digital experience platform. It covers concepts

like gamification, predictive analysis, dashboards, and chatbots; and technologies like artificial intelligence, Blockchain, and augmented reality are discussed in brief.

The book can be used as a reference while using any existing DXP tools or for developing a new DXP from the ground up. Digital practitioners, web developers, and digital architects can leverage the best practices, methods, and technology frameworks discussed in this book.

PART I

Requirements and Design

CHAPTER 1

Introduction to Digital Experience Platforms

The digital strategy of all organizations primarily focuses on providing rich and engaging user experience. Customer experience-focused strategy leads to increased customer engagement, which in turn increases key success metrics such as site traffic, repeated visits, conversion rate, and such.

Digital experience platforms (DXPs) provide an integrated set of technologies built on platform philosophy to engage users throughout their journey. DXPs provide seamless user experience across all user touch points. A DXP is a convergence of all customer-centric technologies such as content management systems, portals, analytics, campaigns, targeting, search, mobile apps, and such.

Industries dependent on digital technologies are undergoing rapid disruption mainly fuelled by changing tech-savvy customer expectations, disruption in digital technologies, and due to widespread popularity of mobile devices. Incumbent organizations are undertaking digital transformation exercises to meet the customer expectations and to stay competitive.

Organizations can increase their online revenue through user engagement. User engagement also increases cross-sell and upsell opportunities, and increases user retention and lifetime value of a customer.

Boundaryless Banking Enabled by Digital Technologies

Tech-savvy banking customers expect the banking experience to match or surpass the best experience of social media platforms, hence it is imperative for banks to understand the trends and enhance the banking experience. Digital banks enable a boundaryless and physical branchless experience supporting these features:

- Mobile-first strategy enabled through mobile apps or mobile web platforms
- Omnichannel experience (a seamless user experience on all supported devices and browsers) to provide optimal user experience on all access devices
- Seamless and simplified processes across all touch points throughout the user journey
- Relationship oriented by rewarding loyalty and sustaining long-term partnership with customers
- Responsive to market disruptions, changing customer demands, and other requests
- Digitized business models to foster the innovation
- Rapid innovation in adding digital capabilities

In the subsequent section we will briefly discuss DXPs.

Overview of DXP

DXPs are primarily user-centric engagement platforms that provide a unified view, with rich user interface for enhanced end-user experience. DXPs provide a platform-based approach to enable all the needed digital capabilities. In this book we explore various aspects of a digital experience platform such as user experience design, integration, security, and such. In this regard we will explore the concepts of DXP in understanding the background for using a DXP to build a banking experience platform.

In this section we will provide details of the DXP.

Key Tenets of a DXP

The key tenets of DXPs are defined as follows:

- Platform orientation with an integrated set of technologies that provides capabilities for presentation, content management, commerce, marketing search, analytics, campaigns, and such. The platform model should also support future extensibility.
- Lean and agile platforms with lightweight integration components. A lean model includes lightweight user experience integrated with lightweight service components.
- An integrated and personalized view to provide a holistic view of all customer activities across all touch points. This can be achieved by information aggregation from multiple information sources and delivering personalized experiences.
- Provide software as a service (SaaS) and cloud deployment option to provide the digital experience as a service.
- Provide an integrated experience catering to various business channels such as marketing, sales, and services.
- Self-service for end users and for business stakeholders to improve user experience and productivity.
- Agility in developing new features and implementing changes for responding to changing market demands.

DXP Reference Architecture

The reference architecture provides the core services and components that are used in a typical digital experience platform. The services and components enable the needed business capability for the application using the DXP; we will elaborate each of these components in detail shortly.

DXP reference architecture is shown in [Figure 1-1](#).

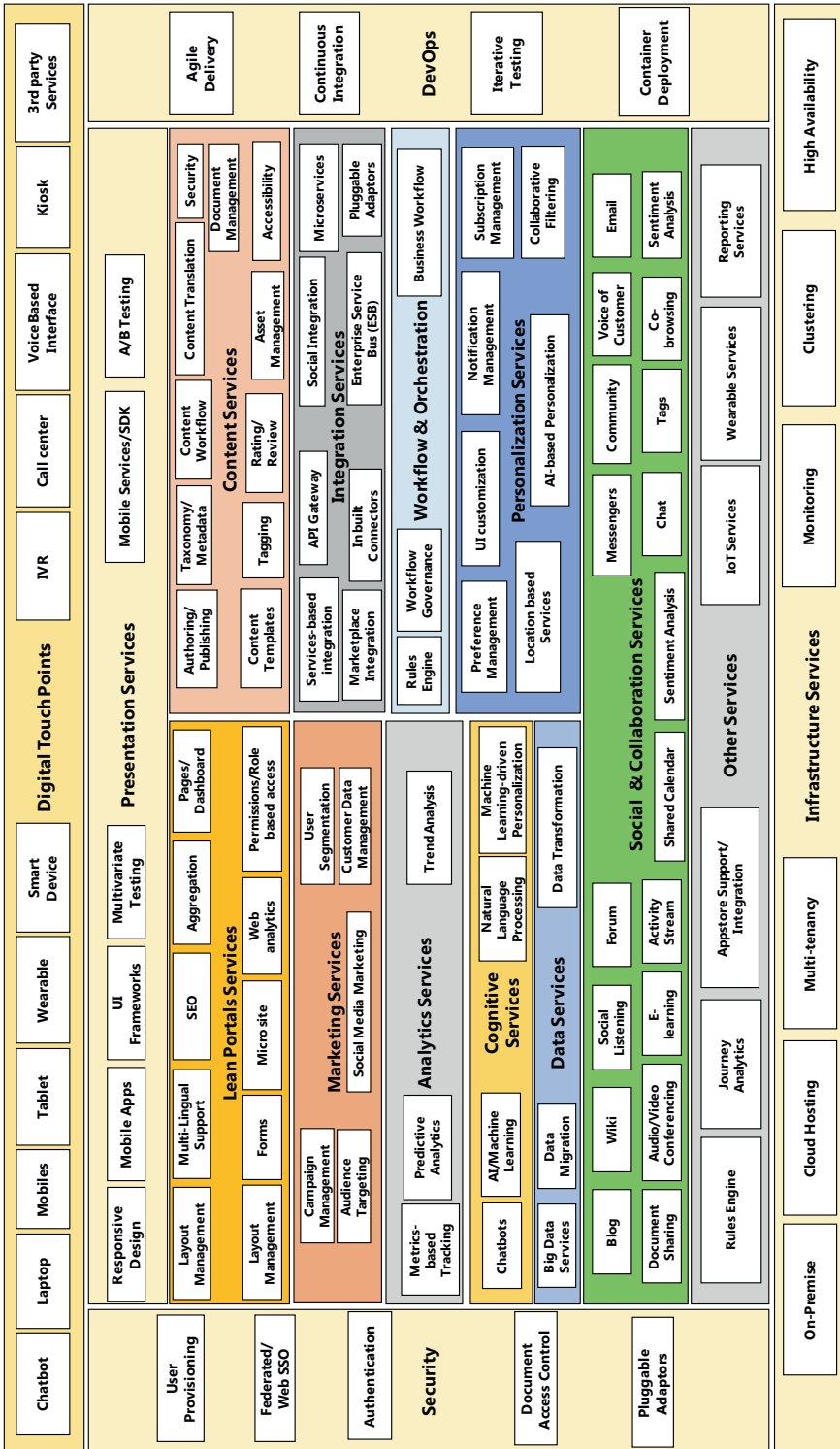


Figure 1-1. DXP reference architecture

The core components of a typical DXP platform are as follows. We have identified the core components in each of the layers:

- *User touch points*: This layer consists of various digital touch points the end user uses during the journey. The end user could use smartphones, desktops, tablets, third party services, or wearable and such devices to access the DXP services. Users expect device-optimized, seamless and personalized information access across all digital channels. All user access channels and devices come in this layer.
- *Presentation services*: The DXP provides various presentation services to cater to a wide variety of digital touch points. This includes mobile apps for smartphones, UI frameworks, and responsive design for mobile web applications, web services for third party consumer, and A/B testing for presentation testing. Presentation services are mainly responsible for defining the user interface and user experience. We elaborate presentation services and user touch points in Chapter 4.
- *Lean portal services*: In this category, the portal provides various complementary presentation capabilities such as personalized experience (user experience based on end user preferences and past history), consistent branding, unified view, forms (for user registration, queries, and such), search engine optimization (SEO) (to make web pages more visible), multilingual presentation, and such.
 - Lean portal services provide business-friendly controls to manage pages (page creation, layout, web analytics, navigation) and brands.
 - Lean portal services provide a single-stop-shop view of personalized content by aggregating information from various sources.
 - Web analytics provide vital real-time customer insights, and help in understanding customer activities and interests. These insights can be used for customer segmentation, trend analysis, and targeted content delivery/contextual recommendations.

- *Content services:* In this category, the DXP provides various content management services such as content authoring, content tagging, content publishing, content translation, and such. As the DXP provides an integrated set of features, support for various content types, content administration, content templates, content metadata, and other content related services will also be provided by the DXP. Other complimentary functionality such as document management services, digital asset management (DAM) services, content workflows, and metadata management are also included in this category.
 - Content services provide content lifecycle management features (content creation, content updates, content publishing, content translation) and support a wide variety of content.
 - Content services provide other features such as rich text editor, content workflows, and such.
- *Campaign and marketing services:* One of the core features of a DXP is to enable digital marketing campaigns. To provide this, the DXP includes features such as campaign management (defining, launching, and monitoring campaigns), audience targeting (sending targeted information to the relevant audience), social media marketing, user segmentation (grouping users based on their interests, access patterns, and such), and customer data management (unified management of customer data across all customer touch points).

A DXP provides campaign management features (campaign creation, campaign targeting) and user segmentation (categorizing end users based on demographics, interests and such) in this category. Customer data management (profile data, preferences data, transaction data, and navigation data) is used for understanding customers and provides targeted content. Customer data is used to provide a single view of customer data (activities, preferences, transactions, feed, etc.) in the dashboard. Other marketing functionality such as social media marketing is included as well.

- Campaign and marketing services mainly deliver targeted content based on user attributes, preferences, analytics, and such.

- *Analytics services:* This includes web analytics-based tracking using predefined metrics, trend analysis, and predictive analytics.
- *Integration services:* Enterprise integration is the most significant component of a DXP. In order to aggregate information from various information sources to provide a unified view, a DXP should support a variety of integration formats and should provide flexible and extensible integration features. Hence a DXP offers standards-based integration methods such as API support, modular services, services support, and plugin support. Most of the DXPs offer built-in support for microservices, REST (Representational State Transfer) and JSON (JavaScript Object Notation)-based services and adaptors for most popular enterprise interfaces (such as databases, enterprise resource planning [ERP], etc.)
 - The in-built adaptors and integrators improve the productivity of end users and optimize the return on investment (ROI) of the DXP.
 - DXPs provide standards-based integration options (such as REST-based integration, web services, and such), which can be leveraged for integrating with new products and technologies.
- *Social and collaboration services:* In this category, a DXP provides various collaboration features such as forums, blog, wiki, chat, knowledge base, messengers, communities, calendars, email, and such. These features enable end users to share the information and facilitate a self-service model. The social capabilities enable users to collaborate, harness collective intelligence, socialize, and improve productivity.
 - Social and collaboration enable users to collaborate and engage customers at social touch points.
- *Workflow and orchestration:* DXPs enable designing and implementing agile, automated, and dynamic business processes through workflow modeling, a configurable rules engine, and workflow governance.