

Solutions Architecture

**A Modern Approach to Cloud
and Digital Systems Delivery**

Wasim Rajput

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Solutions Architecture: A Modern Approach to Cloud and Digital Systems Delivery

Wasim Rajput
Trabuco Canyon, CA, USA

ISBN-13 (pbk): 978-1-4842-9656-1
<https://doi.org/10.1007/978-1-4842-9657-8>

ISBN-13 (electronic): 978-1-4842-9657-8

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Cover designed by eStudioCalamar

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*To my family, who have supported me throughout
all the projects of my life!*

Table of Contents

About the Authorxi

About the Technical Reviewerxiii

Introductionxv

Chapter 1: Understanding Digital Solutions..... 1

 Digitalization and Digital Transformation 2

 The New Digital Trends and Technologies..... 3

 Examples: Successful Digital Projects and Solutions 8

 Complexity of Digital Solutions 11

 Complexity Factors 11

 Complexity Framework..... 17

 The Need for Solutions Architecture 22

 Summary..... 27

 References 28

Chapter 2: The Digital Solutions Architecture Process and Activities.....31

 What Is Solutions Architecture? 31

 Solutions Architecture Activities vs. the Project Lifecycle 41

 Typical Project Lifecycle Activities..... 42

 Typical Solutions Architecture Activities..... 48

TABLE OF CONTENTS

Solutions Architecture vs. Enterprise Architecture	55
The Enterprise Architecture Process	55
The Difference Between Enterprise Architecture and Solutions Architecture	60
The Solutions Architect and the Other Architects in Organizations.....	64
Tailoring the Solutions Architecture Process	67
Example.....	69
Summary.....	70
References.....	71
Chapter 3: Fostering Digital and Business Alignment	73
Example: Misalignment of Technology and Business.....	74
The Solutions Architect's Role in Business Alignment	75
Using Business Strategy to Drive Solutions Architecture.....	76
The Intersection of Business Strategy and Solutions Architecture: Essential Dimensions and Components	78
Aligning Solutions Architecture with Business Architecture	82
Products and Services.....	84
Business Processes.....	85
Data and Information Related to Business Processes.....	86
Business Rules	87
An Organization's Stakeholders.....	87
Business Performance Metrics	88
Business Capabilities	88
The Importance of Business Use Cases in Solutions Architecture.....	90
Business Use Cases vs. Business Processes	91
Business Use Cases vs. Business Requirements	92
Business Use Case Examples.....	93
Business Use Cases for New Technologies	94

Gathering Solution Requirements	96
Gathering Functional Requirements	97
Gathering Non-Functional Requirements	105
Example: Non-Functional Requirements of an AR Application	108
Best Practices for Achieving Business and Technology Alignment	111
Acting As a Technical Mentor and Advisor to the Business	112
Establishing Higher-Level Strategic-Level Agreements	113
Engaging Closely with the Business Outcome Owners	114
Improving Communication and Collaboration Between Technical and Business Teams.....	115
Working Closely with the Product Owner	115
Project Deliverables (Business Alignment)	116
Summary.....	118
References	119
Chapter 4: Creating the Target Digital Technology Architecture.....	121
Example: Technical Architecture	122
Conduct a Current State Infrastructure and Technology Assessment	124
The Value of Performing Current Technology Assessment	125
Defining the Scope of the Technology Assessment	130
Example: Technology Assessment for an IoT-Based System	131
Selection of Technology Stacks	134
Examples of Technology Stacks	136
Considerations When Selecting a Specific Technology Stack	138
Conducting POCs and Technical Evaluation of Tools and Services	141
Solutions Alignment with Enterprise Architecture	145
Technology Architecture	148
Data Architecture.....	149

TABLE OF CONTENTS

Application Architecture 151

Summary 152

Developing the Solution’s Target Technology Architecture..... 153

Technology and Infrastructure Architecture 154

Creating the Application Architecture 157

Creating A Data Architecture 162

Creating the Security Architecture 168

Target Technology Architecture Risk Assessment..... 172

Examples: Technology Risk Assessment 172

Project Deliverables (Technology Architecture)..... 174

Summary..... 177

References 178

Chapter 5: Deciding on Digital Architectural Frameworks and Best Practices..... 181

Why Choose an Architectural Framework? 184

Industry Digital Architectural Frameworks 186

Amazon Web Services Well-Architected Framework..... 186

The Azure Well-Architected Framework 187

Google Cloud Architecture 187

Cloud Native Computing Foundation Cloud Native Landscape..... 188

CISA Internet of Things Acquisition Guidance..... 189

OpenStack Architecture..... 189

Kubernetes Architecture..... 189

Tanzu 190

Example: AWS Well-Architected Framework..... 191

About the AWS Well-Architected Framework 191

The Six Pillars of the AWS Well-Architected Framework..... 192

Design Principles..... 193

Best Practices.....	195
AWS Well-Architected Lenses.....	196
Deciding on a Custom Architectural Framework.....	197
Example: Selecting the Right Kubernetes Service.....	198
Self-Managed Kubernetes.....	198
Managed Kubernetes Services.....	198
Kubernetes as a Service.....	199
Hybrid Approach	200
Technical Debt Considerations in Solutions Architecture.....	200
Technical Debt and Its Relevance to Solutions Architecture.....	201
The Role of the Solutions Architect in Influencing Technical Debt	204
Example: Technical Debt-Related Decisions.....	205
Summary.....	208
References.....	209
Chapter 6: Concluding Remarks for CIOs and Solutions Architects	211
A Message to CIOs and CTOs	211
Ensuring Alignment Through the Domain of Solutions Architecture.....	212
The Role of Solutions Architects.....	213
Becoming a Solutions Architect	214
Definition of a Solutions Architect	215
Key Skills Needed to Become a Solutions Architect.....	216
Summary.....	222
Index.....	223

About the Author



As a digital and technology professional with many years of experience in both consulting and client organizations, **Wasim Rajput** has led multiple digital transformation projects and directed teams and technology vendors to deliver enterprise solutions. He has also managed multiple PMOs that were established to deliver large programs and projects. He has extensive program management and process improvement experience. He has worked with many technologies involving 5G, IoT, cloud technologies, AI/ML, and analytics, and he has extensive research and writing experience in the area of digital and information technologies.

About the Technical Reviewer

Van VanArsdale has spent most of his life working with technology.

His dad started teaching him to program at age 8 and it became a lifelong passion. He earned a B.S. degree in Computer Information Systems from the University of Massachusetts Lowell and a M.S. in CIS from Missouri State University. He has spent the last 30 years designing and building systems for educational and financial services companies.

Introduction

This book provides a comprehensive understanding of the end-to-end solutions architecture process and the crucial role that solutions architects play in designing digital solutions for modern organizations. Solutions architects are responsible for translating high-level business propositions into actionable steps that result in useful and effective digital solutions that meet organizational requirements. This book covers the various steps involved in achieving this objective, from understanding business needs to designing, implementing, and maintaining solutions that align with business goals.

A Technology-Agnostic Approach to the Solutions Architecture Process

As the focus of this book is mostly on the solutions architecture method and the overall process, it doesn't focus on architecting any specific type of digital technology or related solutions. Rather, it focuses on the general principles and best practices related to creating a solutions architecture for any type of digital system. It provides solution architects with a comprehensive guide to the solutions architecture process, enabling them to approach their work with a structured and adaptable mindset. By focusing on the general principles and best practices of solutions architecture, the book provides a foundation for architects to apply their skills and knowledge to a wide range of digital technologies and solutions, including cloud native applications and systems, mobile applications, AI/ML applications, enterprise software, Internet of Things (IoT) solutions, and others. In this context, the book offers various examples of digital

INTRODUCTION

systems architecture and design to illustrate key solutions architecture concepts and best practices. This can help architects to stay current and relevant in a rapidly evolving technological landscape, and to approach each new project with a structured and adaptable mindset.

The remainder of this introduction introduces the solutions architecture domain and provides a summary of the other chapters in this book to assist you in preparing for the topics covered later.

What Is Solutions Architecture and What Is It Not?

The solutions architecture process is a critical component of the digital system project delivery lifecycle, emphasizing activities that maximize business alignment and the creation of a target technology architecture for the solution. It is a strategic approach to designing and implementing technology solutions that align with business goals and objectives. It involves understanding the business context, identifying underlying problems, and designing a solution that meets the needs of the business while considering factors such as scalability, security, reliability, maintainability, and others. A successful organizational solutions architecture process thus ensures the delivery of digital and technology solutions that meet the needs of the business and are scalable, secure, reliable, and maintainable in the long term.

Here we should recognize that a solutions architecture process is a complex process that requires much more than just collecting business requirements and creating a technology architecture. It involves understanding the business context, strategy, and processes, and also identifying the underlying problems that need to be addressed. This requires a deep understanding of the business, the industry, and the technological landscape. Additionally, effective communication with stakeholders and the ability to balance technical considerations with business needs are critical to the success of the process.

Once the underlying problems have been identified and analyzed in light of an organization's business strategy, the solutions architect is tasked with finalizing the target technology architecture before the detailed design and then implementation can proceed. However, this process should not be rushed or done haphazardly. It involves conducting proof-of-concepts (POCs), evaluating different technologies and vendors, and aligning with enterprise architecture (EA) principles. This also involves ensuring that the chosen technologies are compatible with existing systems and meet the organization's standards for security, scalability, reliability, and maintainability.

The solutions architecture (blueprint) of a project, therefore, is much more than its technical components. It goes beyond just the technical aspects of the solution and includes how the overall solution will work in business terms and solve an organization's problems. The solutions architecture should align with the organization's goals and requirements and should provide a clear roadmap for achieving those goals. Therefore, solutions architecture is not just about technology. It is also about understanding the business needs and designing a solution that delivers business value.

Accordingly, it's important to recognize that the solutions architecture process is complex and requires a deep understanding of the business, the industry, and the technological landscape. Rushing through this process can lead to suboptimal solutions that may not meet the needs of the business, and may not be scalable, secure, or maintainable in the long term. This can result in additional costs and potentially disrupt the operations of the organization. Therefore, taking the time to carefully plan and execute the solutions architecture process is essential for delivering effective solutions that align with business goals and drive value.

How Solutions Architecture Contributes To Executing an Organization's Technology Strategy

As CIOs and technology executives strive to deliver innovative digital solutions quickly and efficiently, they face several technology strategy related challenges. A McKinsey report [1] highlights these key challenges:

- Modernizing IT systems for speed, security, resiliency, and reusability
- Reducing technical debt, which refers to the cost of additional work incurred due to shortcuts or suboptimal decisions during technology delivery
- Positioning the organization to fully benefit from constantly emerging technologies
- Enhancing productivity within technical teams
- Leveraging the evolving AI landscape and capitalizing on the decentralized market's available capabilities
- Combining multiple technology trends to create innovative solutions and unlock greater potential
- Integrating AI capabilities throughout the technology stack to improve applications and processes
- And more

A solutions architecture process can help address these challenges by providing a structured approach to designing and implementing technology solutions. This process ensures that the organization's technology investments are well aligned with business goals, optimized for performance, and adaptable to emerging trends. For example, in the context of the above, here's how a solutions architecture process can help address the challenges mentioned:

- **Modernizing IT systems:** A solutions architecture process can help identify the right technologies and design patterns that promote speed, security, resiliency, and reusability. It aids in assessing current systems and recommending improvements or replacements to align with modern architectural principles.
- **Reducing technical debt:** A solutions architecture process can enable a thorough analysis of requirements and trade-offs, promoting informed decision-making that minimizes shortcuts and suboptimal choices, thereby reducing technical debt.
- **Embracing emerging technologies:** As the solutions architecture process involves continuous research and evaluation of new technologies, it can help organizations understand the implications and benefits of integrating these technologies into their current systems and processes.
- **Enhancing productivity:** By providing a clear vision and roadmap for technology implementations, the solutions architecture process can help in the streamlining of development efforts, enabling technical teams to work more efficiently and effectively.
- **Leveraging AI and decentralized capabilities:** A solutions architect can guide the organization in understanding and incorporating AI and decentralized technologies into existing systems, ensuring the business stays competitive and capitalizes on these emerging trends.

INTRODUCTION

- **Combining multiple technology trends:** Solutions architects can identify opportunities for combinatorial innovation by analyzing various technology trends and devising strategies to integrate them effectively, unlocking greater potential and enabling innovative solutions.
- **Integrating AI capabilities:** The solutions architecture process helps organizations identify the best way to incorporate AI-driven intelligence throughout their technology stack, enhancing applications and processes and delivering greater value to the business.
- And more

As you go through the rest of this book, I will provide guidance on the processes, architectural parameters, best practices, and industry trends related to a solutions architecture process that can help address the above challenges.

How Solutions Architecture Methods Vary Across Technologies

In general, the overall solutions architecture process should follow a general framework regardless of the type of digital technology or system being implemented. However, the specific steps plus business and technical considerations within each stage may differ depending on the nature of the technology and the specific requirements of the solution being designed.

Let's consider the following example. When gathering requirements for a cloud-based software solution, the focus may be on understanding the needs of the users who will be accessing the software through a web browser or mobile app. This may involve identifying the user personas,

understanding their workflows and tasks, and determining the features and functionalities they need to perform their work efficiently.

The requirements gathering process for an IoT solution, on the other hand, may involve identifying the specific sensors and devices that will be used to collect data from the physical world. This may include understanding the type of data that needs to be collected, the frequency of data collection, the accuracy and precision requirements for the sensors, and the communication protocols used to transmit the data to the cloud. In addition, the requirements gathering stage for an IoT solution may involve more stringent security and privacy requirements that are necessary to safeguard the data collected from the sensors.

As you can see, the focus of the requirements gathering stage differs depending on the technology being implemented. For a cloud-based software solution, the focus is on user needs and workflows, whereas for an IoT solution, the focus is on sensor and device requirements. By tailoring the requirements gathering process to the specific technology being implemented, architects can ensure that the solution meets the needs of the users and the business requirements.

Similarly, the implementation stage may involve different tasks and considerations depending on the technology being implemented. For example, implementing a blockchain solution may require a different approach to infrastructure and security than implementing a machine learning solution.

In conclusion, while the general framework for a solutions architecture process should remain the same regardless of the type of digital technology being implemented, the specific steps and considerations within each stage may vary depending on the technology and requirements of the solution being designed.

How the Solutions Architecture Process Can Vary Across Organizations and Teams

It's also important to recognize that although the overall process of solutions architecture, which typically involves collecting business requirements, evaluating technologies, and so on, may remain the same, it may differ due to the way it is executed across organizations and even within the same organization due to factors such as department cultures, structure, and governance. For example, a more hierarchical department or group may have a more formalized and structured process for solutions architecture, while another part of the organization may prefer a more decentralized approach and may allow for more flexibility and autonomy in the way solutions are developed and implemented.

This book focuses on each of the stages of the solutions architecture process, regardless of how it is executed within the organization. The aim of the book is to provide insights and guidance on each stage of the solutions architecture process, with a focus on identifying and promoting best practices for each stage. This ensures that the solutions architecture aligns with the business goals and delivers maximum value, regardless of the specific context in which it is executed.

How Has the Role of the Solutions Architect Changed Over Time?

The role of solutions architects has undergone a considerable transformation over the years, primarily due to the rise of digital and cloud technologies. This evolution has shifted the focus from a highly technical, software-centric role to a more comprehensive approach that considers the interplay of various technical elements. Today's solutions architects are not only tasked with integrating individual components but also with understanding the broader business context and aligning technical

solutions to overarching business strategies. This expanded role ensures that organizations effectively leverage technology to drive growth and innovation in an increasingly complex digital landscape.

To be effective in this role, solutions architects, therefore, need to do more than just understand technical requirements. They must also understand the larger business context and work to create solutions that are forward-looking and aligned with future business needs. This requires a deep understanding of the value proposition, as well as the ability to define and communicate it effectively.

Moreover, solutions architects need to have a comprehensive understanding of organizational processes and how proposed solutions will impact them. This is critical because the success of a digital solution often depends on its ability to integrate with existing business processes and systems. Therefore, solutions architects must be able to evaluate the impact of proposed solutions on various organizational functions and work to minimize any potential disruptions.

Example: From Traditional ERP Systems to Cloud-Based Digital Systems

Let's examine an example that contrasts the role of a solutions architect working on traditional ERP systems with that of a solutions architect tasked with designing a cloud-based digital system. Traditionally, solutions architects working on Enterprise Resource Planning (ERP) systems were primarily concerned with integrating business processes within a single, often monolithic, system. Their focus was on understanding business requirements, mapping them to ERP functionalities, and customizing the system as needed. They often worked with established, on-premises systems, and their decisions were largely influenced by the constraints of these systems. Scalability and flexibility were often challenging due to the limitations of the hardware infrastructure and the monolithic nature of the ERP system.

INTRODUCTION

Contrastingly, a solutions architect working on modern, cloud-based systems operates in a significantly different landscape. They still need to understand the business requirements and map them to functionalities, but the flexibility, scalability, and vast service offerings of the cloud broaden their possibilities. They can design architectures that leverage microservices, serverless computing, AI, and big data analytics, to name a few. Cloud solutions architects also need to be proficient in managing and integrating multiple cloud services and vendors, ensuring data privacy and security in the cloud, and optimizing cloud service costs.

Furthermore, the advent of DevOps and Agile methodologies has changed the role of the solutions architect. They are now expected to work closely with development teams throughout the software development lifecycle, facilitating continuous integration and delivery. They also need to be aware of the latest trends and best practices in cloud architecture and stay updated on the rapidly evolving cloud service offerings.

In conclusion, the transition from traditional ERP systems to cloud-based digital systems has fundamentally reshaped the role of the solutions architect. No longer confined to a system-specific, integration-focused role, solutions architects now hold strategic, holistic, and continuous responsibilities in the design, development, and maintenance of flexible, scalable, and cost-effective cloud solutions. This expanded role goes beyond its technical roots, necessitating a deep understanding of both technical and business requirements and the ability to align technical solutions with broader organizational strategies. Modern solutions architects must also be future-oriented, anticipating upcoming business needs and architecting solutions that are scalable, flexible, and seamlessly integrated with existing processes. By doing this, solutions architects can support organizations in achieving their objectives while driving innovation and growth.

Understanding Solutions Architecture vis-à-vis Other Technical Architectures

When designing and developing digital solutions, it's crucial to take into account several sub-architectural domains, including application architecture, data architecture, and infrastructure architecture, among others. Additionally, each digital technology, such as IoT and AI, as well as their associated products and services, may bring unique architectural considerations that need to be addressed. This is where solutions architecture becomes essential, adopting a holistic approach that integrates all these architectural domains and digital technologies, as illustrated in Figure 1-1. As can be seen, the primary aim of solutions architecture is to harmonize the various architectural aspects while ensuring that the comprehensive solution remains aligned with business requirements and integrates smoothly with the organization's technical infrastructure and overarching architecture. Essentially, solutions architecture focuses on the bigger picture, making sure all components work together effectively to deliver the desired outcomes.

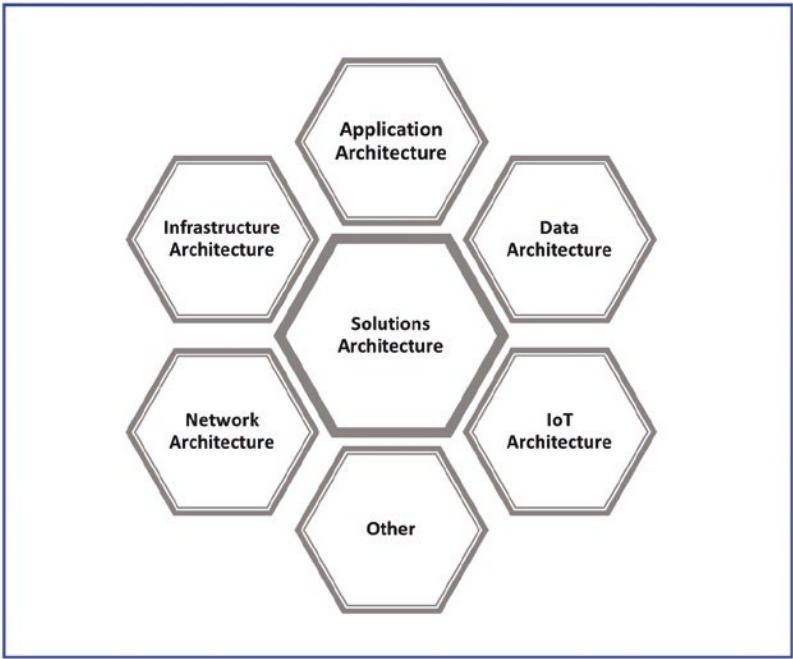


Figure 1-1. *The relationship of solutions architecture to other architectural domains*

Suppose a company wants to develop a smart agriculture solution that uses IoT devices to monitor crop health and AI to analyze the data and make recommendations. In this scenario, the solutions architect needs to consider the application architecture for the software that collects and displays the data, the data architecture for how the data from the IoT devices will be stored and accessed, and the infrastructure architecture for the servers and networks that will support the solution. They also need to consider the unique architectural aspects of the IoT devices and AI algorithms being used. The goal is to ensure that all these elements integrate seamlessly and that the final solution aligns with the company's technical infrastructure and meets the business objectives of improving crop yield and reducing waste. In this way, the solutions architect focuses on the bigger picture and ensures that all the parts work together effectively.

Focus of This Book

The focus of this book is to provide a comprehensive and holistic view of digital solutions architecture. While there are sub-domains such as application, data, and network architectures, the objective of this book is not to delve into the specifics of each of these disciplines. Instead, the book aims to provide a clear and concise overview of the end-to-end process of digital solutions architecture, covering the methods, processes, and deliverables that bring all these sub-domains together to deliver a cohesive and effective target architecture. By taking a high-level approach, you will gain a deeper understanding of how these different components work together to create a successful digital solution.

While technical knowledge at a high level is assumed, the book does not require a deep technical background. Instead, it provides a practical and accessible guide for anyone involved in building digital solutions for organizations, including new and experienced solutions architects, CIOs, and other organizational stakeholders. To help you better understand the solutions architecture process, the book offers numerous examples related to the architecture of digital systems such as AI/ML, IoT, analytics, cloud systems, and others. These examples illustrate key concepts and best practices, making it easier for you to apply them to your own projects and solutions. By reading this book, you can gain a better understanding of the end-to-end solutions architecture process and how to create effective solutions that meet the needs of modern digitalized organizations.

Introduction to Book Chapters

Chapter 1: This chapter begins by exploring the latest digital trends and technologies and how they are shaping the landscape of modern organizations. It takes a closer look at successful digital projects and solutions, including real-world examples of how organizations

INTRODUCTION

have leveraged digital technologies to achieve their business goals. Additionally, it examines the complexity of digital solutions and the challenges they pose, such as security, scalability, and usability. Finally, the chapter discusses the need for solutions architecture and how it can help organizations address these challenges and design effective digital solutions that meet their business requirements.

Chapter 2: This chapter provides you with an understanding of the solutions architecture domain, including its process, activities, and integration with the project lifecycle and the organization's enterprise architecture (EA) process. The purpose of this chapter is to shed light on how solutions architecture fits into the overall project plan, how it aids in achieving project objectives, and how it interacts with other project activities.

Chapter 3: This chapter delves into the significance of business alignment, its advantages, and how solutions architecture can assist in its attainment. I also examine the essential considerations and best practices for solutions architects to design and implement digital solutions that fulfill the business requirements and align with the broader organizational objectives.

Chapter 4: This chapter focuses on creating the technology architecture for digital solutions. It covers several essential steps, including conducting a current state infrastructure and technology assessment, selecting technology stacks, conducting POCs and technical evaluations of tools and services, ensuring solutions alignment with the enterprise architecture framework, developing the solution's target technology architecture, assessing its risks, and documenting the project deliverables related to technology architecture. Each of these steps is crucial for designing effective technology architecture that aligns with the business requirements and the broader technology strategy of the organization.

Chapter 5: This chapter provides an overview of architectural frameworks for designing digital solutions. It discusses the importance of selecting an architectural framework, outlining the benefits of

promoting consistency, best practices, and effective communication. The chapter explores several industry digital architectural frameworks that organizations can use. It also examines the process of deciding on a custom architectural framework that fits the specific needs and requirements of the organization.

Chapter 6: In conclusion, this chapter provides a brief summary for CIOs and CTOs, highlighting the critical role of solutions architecture in delivering high-performing digital solutions that align with the organization's business goals and objectives. It is vital for technology executives to appreciate the value of this domain and how solutions architects can assist in achieving their organization's digital transformation objectives. Additionally, the chapter reviews some of the essential skills and knowledge required to become a successful solutions architect.

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