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Development and Deployment of Enterprise Applications on SAP HANA Cloud Platform

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<p>Over the past few years, a vast evolution has taken place in the enterprise software industry. One of those emerging technology trends is the contrivance of cloud computing. Thus, the objective of this thesis is to thoroughly introduce cloud computing service models and deployments, and why it is important for any organization to consider moving to the cloud.</p> <p>Moreover, in order to prove the efficiency of using PaaS for software developers, this study introduces SAP HCP development environments and demonstrates the step-by-step process of getting started with the SAP HANA web-based workbench, as well as Eclipse. Moreover, it thoroughly illustrates for developers how to build, deploy, and run their first “Hello World!” application on the SAP HANA Cloud Platform.</p> <p>Additionally, the outcome of the thesis is a Graphical User Interface (GUI) design of the SAP CLM (Contract Lifecycle Management) web application that was developed and deployed on the SAP HANA Cloud Platform.</p> <p>This study could be beneficial for both business leaders as well as IT professionals (i.e. software developers), as it analyses all the aspects of adopting cloud, including its benefits and risks that the organizations should consider while making a business decision. In the meantime, it technically illustrates for readers how to get started with developing and running their very first application on a cloud platform.</p>	
Keywords	PaaS, SaaS, IaaS, Cloud, HANA

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1 Introduction

Nowadays, technologies can make the greatest contribution to business growth through enabling greater speed, scalability and real-time integration for diverse systems, applications, and platforms. One of those emerging technology trends is the contrivance of cloud computing. Many organizations tend to cut off unnecessary costs and limit the running operating expenditure through migrating to cloud computing.

Case Organization Background

SAP (Systems, Applications and Products in Data Processing) is a German multinational software corporation that produces enterprise software to manage business operations and customer relations. In 2016, SAP introduced SAP HANA, the in-memory computing platform that is deployable on premise or in the cloud. SAP HANA accelerates business processes, delivers more business intelligence, and simplifies the IT environment. [3]

Business Case

The IT costs in any organization, including data centres' hardware costs, the operating costs, the consumed wasted power on the inactive servers, as well as the hardware maintenance costs, are continuously rising and preventing organizations from boosting their profits. Thus, SAP HANA cloud platform (HCP) provides organizations with many services that enable them to do more for less, helping businesses to dramatically cut off unneeded costs, and just pay for the services that they get, without any commitments. Not only is migration to the cloud cost efficient, but it also provides organizations with many benefits like agility, improved team collaboration, time efficiency, as well as better worker mobility. [3]

Objective and Outcome

The objective of this thesis is to introduce thoroughly cloud computing service models and deployments, and why it is important for any organization to consider moving to the cloud. Moreover, this study aims specifically to demonstrate a step-by-step methodolo-

gy of building an application on the SAP HANA cloud platform, in order to prove the efficiency of using PaaS for software developers.

Scope and Structure

This study is written in seven chapters. Chapter 1 provides the Introduction. Chapters 2 and 3 provide the conceptual framework for the study; discussing cloud computing service models, cloud computing deployment models, and cloud platforms benefits and risks. Chapter 4 focuses on introducing the SAP HANA cloud platform as well as its services. Chapter 5 describes the methodology used in the project work including the development environments. Chapter 6 demonstrates the project work results and design pattern. Finally, chapter 7 provides the conclusions and future recommendations.

2 Cloud Computing

Cloud computing is also referred to as “on-demand computing”, as it enables users and enterprises to manage, store and provision their data remotely and easily through providing an omnipresent, internet-based access to a shared pool of computing resources of third-party data centres (e.g., servers, networks, services, applications), rather than using on-premise servers and hardware equipment, as shown in Figure 1. [5]

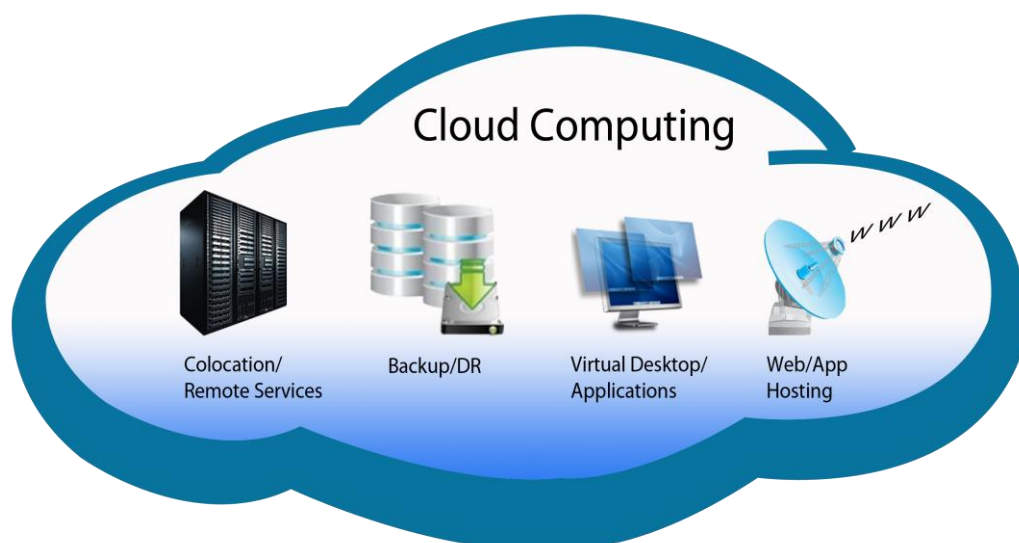


Figure 1: Cloud Computing Elements [13]

Figure 1 shows some of the computing resources that can be accessed by means of cloud computing. Definitely, cloud computing and sharing hardware resources' provides a significant long-run marginal cost reduction arising from unnecessary consumption of operating units, achieving what is called "economy of scale". [5]

2.1 Cloud Computing Service Models

Recently, and as a result of the exponential growth and massive popularity of cloud computing, several cloud services, models and deployment strategies have emerged, providing various levels of flexibility, control and management, in order to meet the requirements and needs of diverse users. Learning and analysing these cloud services (i.e., Infrastructure as a Service, Platform as a Service, Software as a Service) and understanding the differences between them, as well as considering the optimum deployment models that can be used, is important for proper services selection that matches customer needs. Figure 2 illustrates and compares the different types of cloud computing service models. [7]

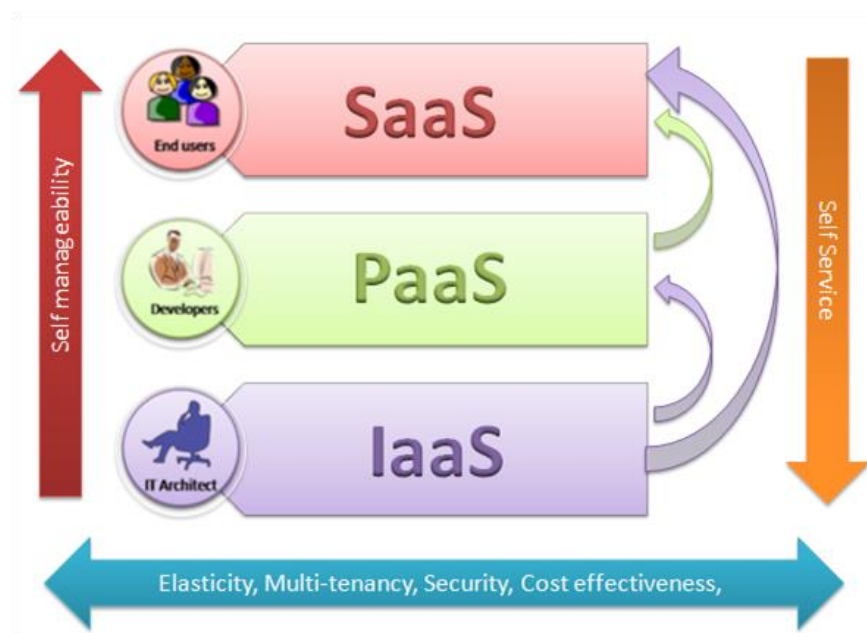


Figure 2: Cloud Computing Service Models [9]

As demonstrated in Figure 2, when ascending from Infrastructure as a Service (IaaS) to Software as a Service (SaaS) passing through Platform as a Service (PaaS), the self-manageability increases, and self-service decreases, but elasticity, multi-tenancy,

security, and cost effectiveness benefits are provided equally by all three service models. [9]

2.1.1 Software as a Service

Software as a Service (SaaS) can be defined as a software distribution and delivery method, where the software is managed centrally and delivered in a “one to many” model. In SaaS, applications are licensed and hosted commercially by a service provider to customers on a subscription basis. A single copy of the application or the software is then made available through a cloud-based access for customers over the internet via a web browser, as shown in Figure 3. [6] [8]



Figure 3: SaaS [14]

Figure 3 demonstrates examples of some applications that can be licensed and distributed using the SaaS service model. SaaS is considered particularly as a rapidly rising method of delivering technologies and is growing much faster than the traditional on-premise software market. Nevertheless, many organizations that are willing to migrate to the cloud are still differentiating applications that need to be initially moved to SaaS. Thus, the following solutions are considered to be the prime nominee for the foremost SaaS move. [6]

- Applications where there is a reciprocal interaction between the organization and external parties (e.g. email newsletter campaign software) [6]
- Applications that may require an extensive and frequent mobile or web access (e.g., mobile sales management software) [6]

- Applications that are only to be used for short term periods (e.g., project collaboration software) [6]
- Applications where demand spikes sporadically every now and then (e.g., tax or billing software) [6]

2.1.2 Platform as a Service

Platform as a Service (PaaS) is a cloud-based platform where customers (typically software developers) are empowered to create, run, and manage web applications smoothly and fast, eliminating the need for configuring the underneath infrastructure and the complexity of maintaining it. This is in addition to the presence of various services needed for development, testing, maintaining and deployment of the applications; all are integrated in the same development environment. The following services offer a seamless and fulfilled software development process. [6] [11]

- Web-based tools for creating, modifying, testing, and deploying various GUI scenarios [6]
- Multi-guest architecture where multiple users can utilize the same development environment synchronously [6]
- Built-in scalability of deployed software including load balancing and failover [6]
- Integration with web services and databases via common standards [6]
- Project planning and communication tools for team collaboration [6]
- Billing and subscription management tools [6]

PaaS is highly recommended whenever multiple developers are supposed to work on the same project, or when external parties are needed to reciprocally interact with different stages in the project development. It eliminates the challenges around rapid software development and iteration, achieving what is so called by “Agile Software Development”, a set of practices and methodologies, under which iterative and incremental development is evolved through the collaboration of cross-functional teams. [6] [11]

2.1.3 Infrastructure as a Service

Infrastructure as a Service (IaaS) is an on-demand service that offers cloud-based infrastructure resources like a virtual server space, network connections, bandwidth and

IP addresses. These resources are typically multi-tenant and might include more than one user on the same hardware. Clients outsource their infrastructure as an on-demand service instead of spending unneeded costs arising from building datacentres and purchasing network equipment. [6]

IaaS, in some scenarios, might not only significantly affect the way organizations grow, but also it might be the indispensable way for leveraging businesses. IaaS is particularly imperious in the following conditions. [6]

- When building start-up organizations, without having enough capital for hardware investments [6]
- When an organization is forced to reduce costs [6]
- When an organization is expanding and hardware scaling is problematic [6]
- When an organization needs the infrastructure temporarily or for trial purposes [6]
- When the demand of the infrastructure spikes unsteadily every now and then [6]

2.2 Cloud Computing Deployment Models

Cloud deployment models define various cloud types and natures. Each cloud environment is categorized based on the ownership, accessibility and size depending on the purpose of the cloud. Nowadays, many organizations tend to cut off unnecessary costs and limit the running operating expenditure through migrating to cloud computing. Whence, being the best among the rest requires profound cognition of the various types of deployment models, as well as thorough analysis of the business demands. Once the right selection is made, an organization then can achieve the business aims successfully. In the following sections, four types of cloud deployment models will be introduced; private cloud, public cloud, community cloud and hybrid cloud. [10]

2.2.1 Private Cloud

Private Cloud is a specific model of the cloud environment where the infrastructure belongs to a certain organization. Hence, the hardware resources are easily customizable. It is also called “internal cloud”, as it used only internally. Consequently, it could

be secured by a firewall in order to prohibit unauthorized users from accessing the cloud, which guarantees high efficiency and network performance. There are two models of adopting the private cloud: either the organization uses its own data centre, or it uses a cloud service provider's data centre. [15]

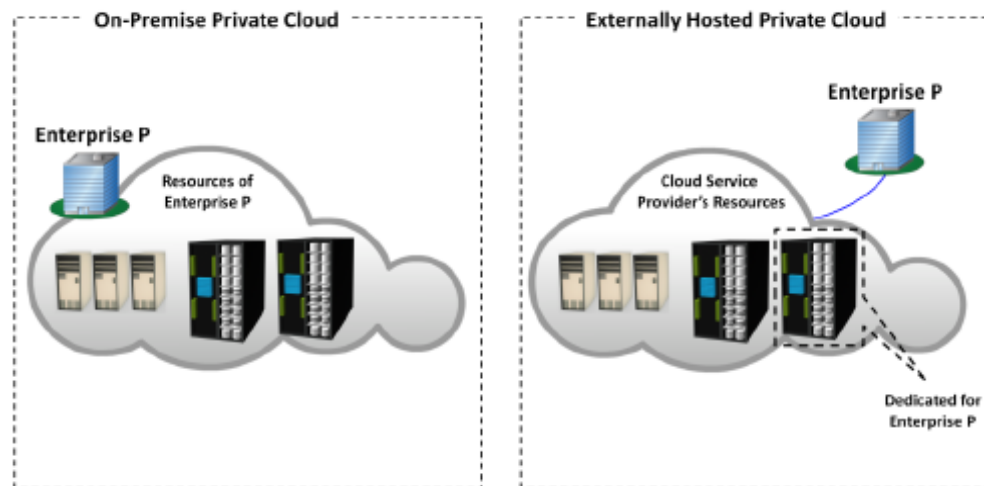


Figure 4: Private Cloud [16]

Figure 4 illustrates the two possible models of a private cloud. It is worth mentioning that optimizing the subscriptions of the hardware resources is important, in order to avoid the under-utilization of the servers, resulting in spending unneeded costs, or being in trouble of achieving the ceiling of the servers' capacity. To sum up, adopting a private cloud might be suitable for organizations that have dynamic business, high security demands and require a 24/7 uptime for the resources. [15]

2.2.2 Public Cloud

A public cloud is a cloud environment that is provided and available typically over the internet for diverse clients, whether with the PAYG (Pay As You Go) billing model or free of charge (e.g. Google Cloud). Correspondingly, accessing the services is immediate and easy, saving time. Also, the PAYG billing model doesn't bind the customer with any contract, thus, giving more flexibility, as shown in Figure 5. [15]

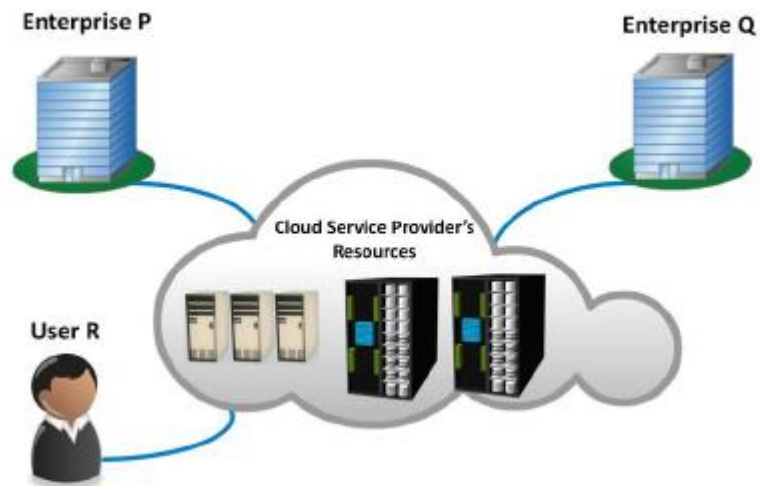


Figure 5: Public Cloud [16]

Figure 5 demonstrates the accessibility of the public cloud to all kind of users, either individuals or enterprises. Unlike the private cloud, the infrastructure in the public cloud belongs to a specific vendor who then distributes it on several tenants. Therefore, it is more economical, as an organization would save the initial costs of the hardware and the running costs of the hardware maintenance, as in that case the vendor is totally responsible for maintaining the hardware. Remarkably, the public cloud is mostly adopted by businesses that require managing SaaS-hosted applications that are utilizable by multiple users. [15]

2.2.3 Community Cloud

A community cloud is a multi-tenant environment where multiple organizations that belong to the same industry and have common business-related intents (i.e. banks and trading firms) share the same cloud features, including security degree, network performance, and privacy, as shown in Figure 6. [10]

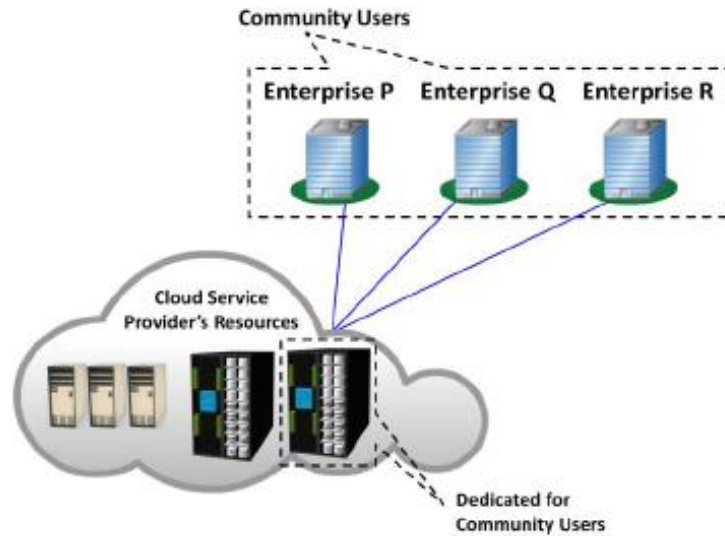


Figure 6: Community Cloud [16]

As shown in Figure 6, a CSP hosts and dedicates a part of the data centre for a community cloud that includes organizations from the same industry. The community cloud technically resembles the private cloud; it could be hosted in-house or externally (i.e. managed by a service provider). Accordingly, the deployment cost is shared between the member organizations, making the community cloud more economical than the private cloud from that perspective. The community cloud is quite convenient for organizations seeking a centralized cloud to be able to work jointly on the same ventures, tenders or researches. [10]

2.2.4 Hybrid Cloud

A hybrid cloud is integration between two or more cloud-hosting architectures (i.e. private cloud, public cloud, community cloud). The cloud servers in a hybrid cloud are linked together remotely and securely while remaining as individual entities through an IPsec VPN tunnelling. Thus, interoperability and aggregation of the benefits of various cloud deployment models in one hybrid cloud grants the customer the ability and high flexibility to customize capacity and security features through switching between multiple deployment models, depending on business needs. A hybrid cloud can be hosted internally or externally, and it is typically a merger among a private cloud and a public cloud, where the workload is split over both cloud hosting environments as per business demands, as shown in Figure 7. [17]

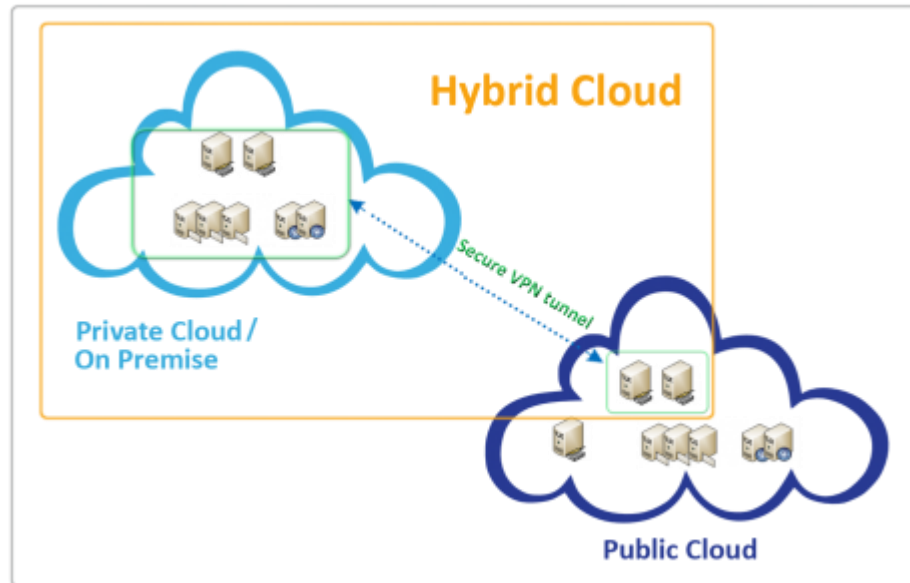


Figure 7: Hybrid Cloud [17]

Figure 7 shows the merging of private and public cloud that is done through secure VPN tunnelling in order to form the hybrid cloud. Ideally, non-critical workload (i.e. development or verification) can be migrated to a public cloud that is hosted externally, whereas sensitive business should be undertaken over the private cloud. For instance, online retail websites are most suited to adopt a public cloud, since the displayed commodity on the website does not require high security concerns. In that case, the public cloud would be much more cost-effective deployment model selection than the private cloud. In brief, the hybrid cloud is very beneficial for businesses that face capacity-demand spikes, as the extra cost is limited depending on the supplemental server capacity needed. This can be achieved through implementing the “Cloud Bursting” application deployment model, where applications normally run in a private cloud, yet burst to the public cloud when the demand spikes. [17] [18]

2.3 Reasons for Businesses to Move to Cloud Computing

Based on the above short study of different cloud service models and deployment models, an obvious inference has been reached of how leveraging from cloud computing is highly important for business upholding. The following cloud computing advantages will answer the question “Why should businesses move to cloud computing?” [4]

- **Higher Flexibility:** Cloud computing enables big organizations to scale up or down their functionalities fast and readily to come upon their business needs. [4]
- **Faster Deployment:** Although cloud computing does not improve the application performance, it enables the development team to deploy and run applications much faster, thus increasing their time-efficiency. [4]
- **Lower Costs:** Migrating infrastructure and applications to cloud computing reduces the organization data-centre expenditure. It reduces the number of servers, thus saving the wasted energy consumed as a result of the operating inactive servers, as well as hardware maintenance costs. Moreover, less hardware means less head counts (i.e. lower staffing costs). [4]

3 Cloud Platforms

Cloud platforms are a corner-stone in cloud computing migration. As mentioned in chapter 2, every organization should understand the business demands before moving to cloud, and the same goes with cloud platforms. What are the benefits of cloud platforms? How could cloud platforms impact the business? Do cloud platforms have risks? In this chapter, all these questions will be answered. Yet initially, the definition of a “Cloud Platform” will be introduced.

3.1 Defining a Cloud Platform

An application platform is a common idiom in the IT field. Generally, the application platform is an environment for developing and running software applications. The major difference between a normal application platform and a cloud platform is that the normal platform runs in the organization’s own data centre. The cloud platform is hosted in a service provider’s data centre (i.e. SAP HANA Cloud Platform), and it is accessible by the organization employees via a network, typically the internet, as shown in Figure 8. [2] [12]

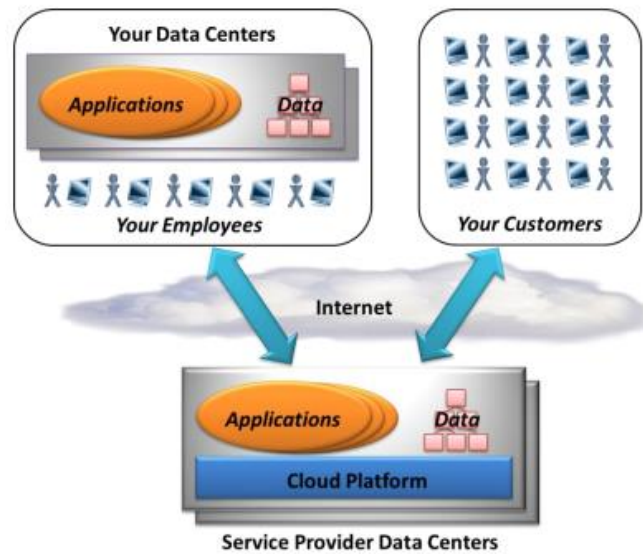


Figure 8: Cloud Platform [12]

As shown in Figure 8, not only the organization's employees could access the applications, but also customers. This is time-efficient, as making the applications and data available for the customer, could fasten and ease the feedback process between the client and the customer. Moreover, it gives more flexibility to the customer to use different platform technologies. It is clear also from figure 8 that the organization is free to have both, the in-house platform and the cloud platform, and is free to use any of them as per needed. [12]

3.2 Benefits of Cloud Platforms

While adopting and investing in a new technology, every organization should think of the business demands as well as the advantages to be gained from taking this technology into effect. This section will discuss three significant benefits of adopting cloud platforms.

1. Faster Deployment and Running of Business IT-based Applications

Development and deployment of business IT-based applications on a cloud platform can accelerate the outset of benefits' acquisition, as it enables the customer organizations to deploy and run the applications right away. Unlike normal cases, where organizations must have the application first ready for release, they can re-

quest for servers in order to run the application. Certainly, this delay wastes time which could have been invested to gain more profits. [12]

2. Lower Risk of New Business Ideas

Coming up with new ideas is the corner stone of any business' sustainability; it is mandatory in order to fulfil customer satisfaction and keep on track among other competitors. However, the more time and money investments that organizations put into innovative business ideas, the higher the risk they undertake. Cloud platforms help to minimize these risks through making the innovation attempts cheaper. Cloud platforms enable customers to pay only for the space of storage and the time of computing that their application will consume; this is achieved by the pay-as-you-go (PAYG) pricing model. Consequently, if the application attains success, the customer can buy more cloud services to expand and upgrade the application. On the other hand, if the attempt does not succeed, the customer turns off the application and stops paying for the services. [12]

3. Global Scalability and Reach

Assuming an organization offers a successful and adequate web application to its customers, scaling up this application while running it in the organization's local data centre might be hard and challenging. Cloud platforms mostly run in big data centres in various continents as they belong to large multinational corporates, enabling applications to synchronize data and run across different countries at the same time. Accordingly, deployment and running of web applications on cloud platforms can help small organizations to handle bigger loads, enlarge the scale of their business globally, and access new markets. [12]

3.3 Risks of Cloud Platforms

As cloud platforms have many outstanding benefits, they also hold some risks that any organization planning to adopt this booming technology should consider while making the business decision. In this section, some risks of adopting cloud platforms will be discussed.

1. Unreliable External Provider

When an organization takes the decision to partner with a cloud platform provider and outsource its IT services, there is a probability that the level of service does not meet the organization's expectations. For instance, the cloud platform provider might not be able to support new application features and upgrades, resulting in frequent dropping off in the application. Also, the service provider might decide to shut down the business at any point of time, which might cause the customers to incur unneeded losses. Accordingly, the organization should review the partner's service level agreement (SLA) thoroughly, in order to make sure that all the agreement terms are fulfilled in order to minimize risks. [12]

2. Possibility of Data Breach

Storing confidential and important data outside the organization's data centres might incur great risks, as in many cases data leakages might lead to a business turn off. Accordingly, before initiating a partnership with any cloud platform provider, organizations first need to ensure their data security. Moreover, it is always recommended not to start a new technology and try it for the first time with applications that are extremely critical to a business. Thus, only running the applications on cloud platforms, but keeping the organizations' data in their data-centres might be a good approach at start. [12]

4 SAP HANA Cloud Platform

SAP has been known for its Enterprise Resource Planning (ERP) solution that has been provided since 1972. Recently, SAP has provided S/4 HANA enterprise management, and the “digital business framework” that starts from the core in the below Figure 9. [21]



Figure 9: SAP S/4 HANA Digital Core [21]

As shown in Figure 9, SAP S/4 HANA Digital Core is the way that the companies are running their daily businesses, thus keeping the lights on. In the recent years, SAP has acquired cloud companies; the first one was “Success Factors”, Human Capital Management (HCM) software for talent management, core HR, and HR analytics. The second part is that SAP needs to connect to suppliers; for that reason SAP has acquired a cloud company called “ARIBA”, a business network, so that the company can interchange business documents via one network. “ARIBA” enables suppliers to connect to one point so that they can get their sourcing. In addition, SAP has purchased “FIELDGLASS”, which is meant for external workforce managements (e.g. consultants). Also, SAP has acquired “CONCUR”, which is meant for travel expenses. Last but not least, SAP has introduced the SAP HANA Cloud Platform which is meant for extending all of the above solutions. [21]

Even if an organization has the digital business framework that is shown in figure 9 on premise, it will be capable of creating new functionalities, new types of applications, get better user experience for the end user and its partners. Also, one of the services that the platform is providing is the IoT, and this is the cornerstone that brings all the information into one platform which is SAP HANA Cloud Platform. [21]

Public cloud solutions typically run so that each customer is running the same version of the solution, and thus customization is very restricted. Customers can do configuration but cannot do customization, and that is why they need to have another cloud platform where they can do further customizations. With SAP HANA cloud platform, organizations can connect machines, devices and sensors into one platform combined together with the ERP data and CRM (Customer Relationship Management) data and create analytics or whatever type of application needed. Moreover it provides a development infrastructure for creating flexible applications with the best user experience. [21]

SAP HANA Cloud Platform Services

In the following, six services provided by SAP HANA Cloud Platform will be introduced. These services are integration, user experience, collaboration, security, mobile service and Internet of Things (IoT).

SAP HANA Cloud Platform **integration** service integrates processes and data between cloud applications, 3rd party applications and on-premises solutions. It is an open, flexible, on-demand integration system running as a core service on the SAP HANA Cloud Platform. [20]

SAP Cloud Platform API Management is an open-extension platform that simplifies **integration** with SAP and non-SAP solutions. Thus, it enables businesses to easily share digital assets with business partners to create business networks and cross-company collaboration. [20]

SAP HANA Cloud Platform cloud connector is a simple on-premises **integration** agent that allows highly secure and reliable connectivity between your cloud applications and on-premises systems. [20]

SAP HANA Cloud Platform empowers organizations to build and scale simple, personalized and responsive **user experience**. With SAP BUILD, customers can collaboratively develop prototypes with project team, engage end-users for feedback, or jumpstart designs with one of many prototype examples from the gallery. [20]

SAP HANA Cloud Platform provides **collaboration** by enabling organizations to bring employees together with secure access to shared business content, information, applications and processes - to drive results and increase team productivity. [20]

SAP HANA Cloud Platform's closely integrated **security** services include authentication, single sign-on, on-premises integration and self-services such as registration and password reset for employees, customers, partners and consumers. [20]

With SAP HANA Cloud Platform "Identity Authentication" **security** service, organizations can provide their employees, customers and partners with simple and secure cloud-based access to the business processes, applications, and data they need. [20]

SAP HANA Cloud Platform, **mobile service** is a full-featured mobile application platform delivered as-a-service that allows software developers to quickly create and operate mobile applications with full offline support, notification services, superior back-end integration and enterprise-grade security. [20]

SAP HANA Cloud Platform **Internet of Things** (IoT) service provides the ability to quickly develop, deploy, and manage real-time IoT and machine-to-machine (M2M) and remote data synch applications. With SAP HANA Cloud Platform, Internet of Things service, one can onboard and manage connected remote devices, get real-time predictive analysis to improve intelligence and decision-making at the edge of the network, and optimize business processes at the core of the business. [20]

5 SAP HANA Cloud Platform Development Environments

The objective of this chapter is to introduce SAP HANA Cloud Platform development environments and demonstrate the step-by-step process of getting started with SAP HANA web-based workbench, as well as Eclipse. Moreover, this chapter illustrates for developers how to build, deploy, and run their first “Hello World!” application on the SAP HANA Cloud Platform.

5.1 SAP HANA Cloud Platform Trial Account Setup

In order to use the SAP HANA Cloud Platform for the development of SAP applications, a user needs to have an active account that can be accessed from anywhere. In this section, the setup of a free developer’s account on the SAP HANA Cloud Platform will be illustrated. In order to register for a free SAP HANA Cloud Platform developer’s account, a user goes to the following URL:

<https://account.hanatrial.ondemand.com/register>

The user then will be presented with the following screen in Figure 10, and should click on the “Register Now” button. [21]

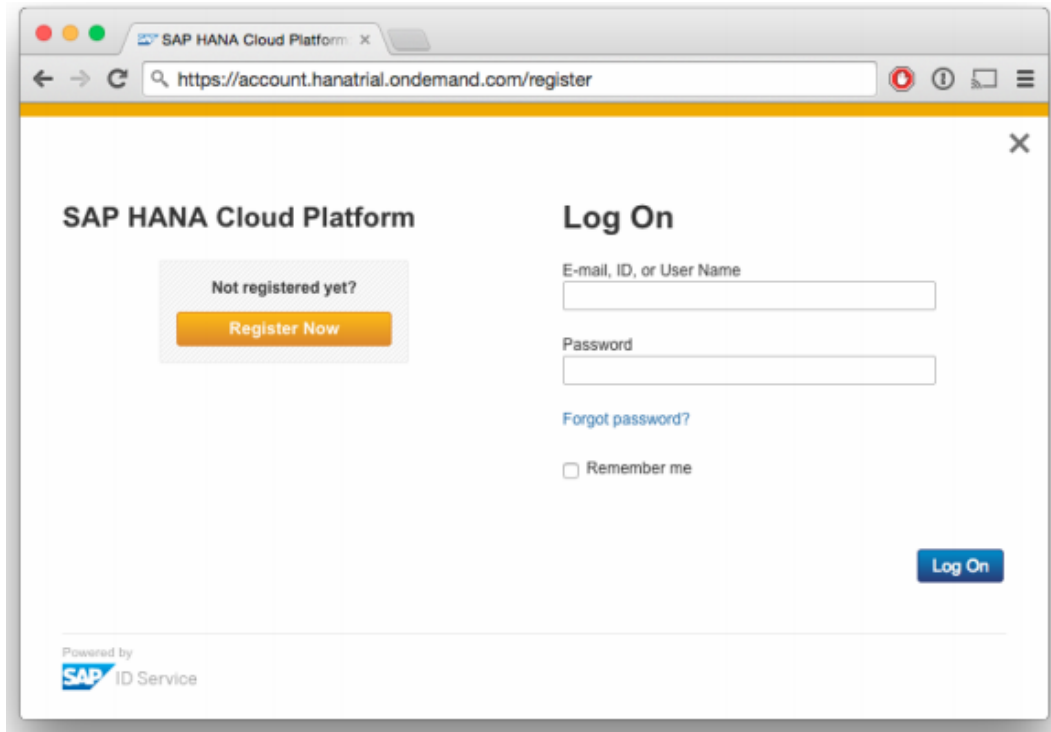


Figure 10: SAP HANA Trial Account Setup – Snapshot 1 [21]

The user then should fill in the registration form and make sure that an active e-mail account has been provided, as it will be used later to activate the account. After that, the user should scroll down to the bottom of the “Terms of Use” section and then check the two boxes in front of the statements that start with “I acknowledge” and “I have read” respectively, as shown in Figure 11. [21]

In addition to communications that will result from this registration, would you also like to receive news and event notifications from SAP that are specific to your interests?

By e-mail* Yes No

By telephone* Yes No

I acknowledge that I have read [SAP's Privacy Statement](#) and consent to the processing of my personal data in accordance with the terms of the Privacy Statement. This includes, without limitation, that SAP may collect, store and process any personal data voluntarily provided by me on this Web site and aggregate it with other personal data that I provided to SAP on earlier occasions by the [methods](#) and for the [purposes](#) described in the Privacy Statement and on this Web site. In accordance with the terms of the Privacy Statement and on this Web site, SAP may further track my use of SAP's Web sites and aggregate it with my personal data. I acknowledge that I can, at any time, request information on my personal data held by SAP and that I can have SAP update and correct such data and withdraw my consent given hereby by contacting SAP at accounts@sap.com.

Scroll to the bottom of the terms of use and click the box to accept.

and shall remain in SAP and its licensors. You acquire only the rights expressly set forth under section 2 above. Nothing in this Agreement shall in any way convey to You any ownership rights or title in or to the SAP Software, the Service or Tools. The SAP Software, the Service and Tools, may not be modified or altered in any way except by SAP.

8. TERM: The term of this Agreement for use of SAP River RDE begins on the date You accept the terms of this Agreement as stated above and ends when terminated by You or SAP as permitted in this Agreement.

I have read and understood the Terms and Conditions of SAP HANA Cloud Platform. Version 7

* Required

Register

Figure 11: SAP HANA Trial Account Setup – Snapshot 2 [21]

An activation e-mail will be sent to the provided email address, as shown in Figure 12. [21]

Thank you for registering with SAP.

✓ An e-mail with a link to activate your account has been sent to [redacted]

To activate your account with SAP, click the link contained in the e-mail. Note that it might take a few minutes for the e-mail to reach your inbox.

Close

Powered by
SAP ID Service

Figure 12: SAP HANA Trial Account Setup – Snapshot 3 [21]

The user then should log in to the email account and check that an activation email has been received, as displayed in Figure 13. [21]

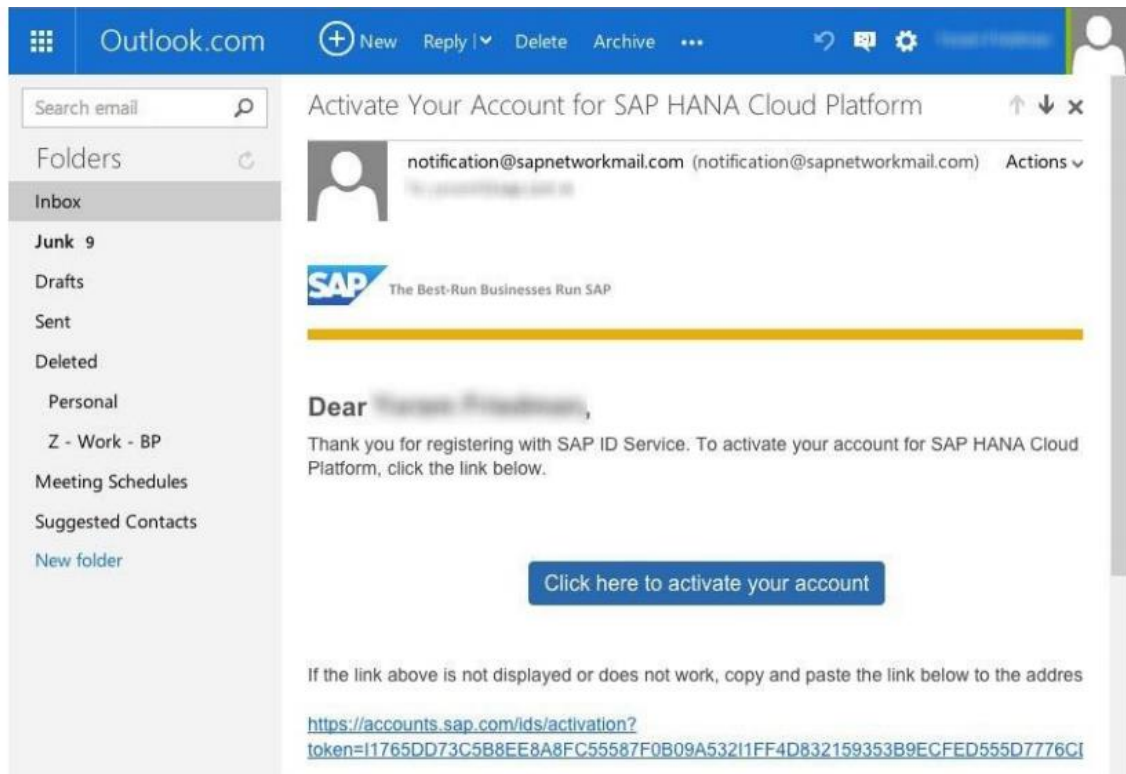


Figure 13: SAP HANA Trial Account Setup – Snapshot 4 [21]

As shown in the above figure, the user should click on the “Click here to active your account” button to finish the registration.

In order to start and use your free SAP HANA Cloud Platform developer’s account, the user then goes to the following URL:

<https://account.hanatrial.ondemand.com/cockpit>

A registration and login screen will then be presented, and the user should enter the email address as the username and the password, in order to access his/her SAP HANA Cloud Platform account cockpit homepage, as shown in Figure 14. [21]

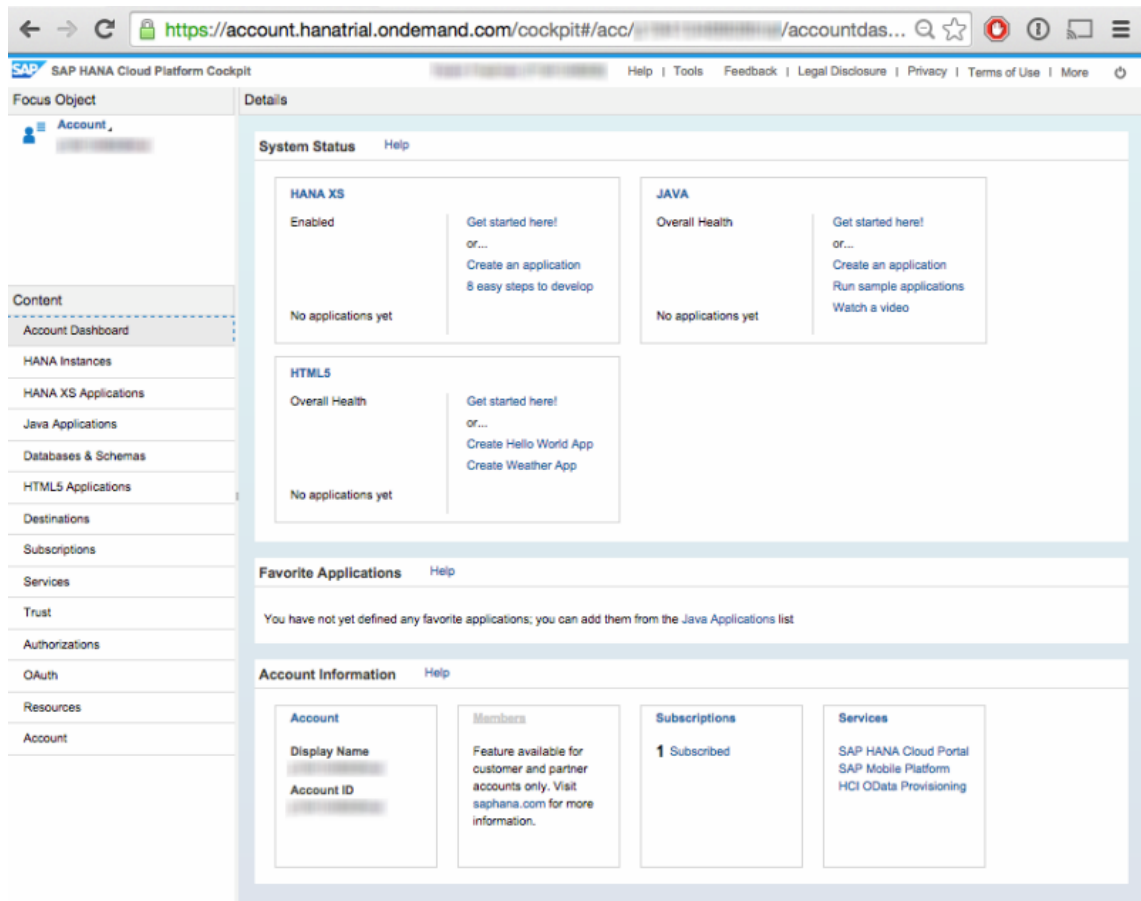


Figure 14: SAP HANA Trial Account Setup – Snapshot 5 [21]

Upon accomplishment of the previously mentioned steps, and reaching out the above shown cockpit homepage in Figure 14, the user then has a fully functional developer's account on the SAP HANA Cloud Platform. [21]

5.2 Developing an Application using SAP HANA Workbench

This objective of this section is to show graphically the step-by-step process of building, deploying and running a very basic "Hello World!" application on the SAP HANA Web-based Development Workbench.

The SAP HANA Cloud Platform Developer Edition offers users to get their own instance to test-drive HANA fast and at no cost via the SAP HANA Cloud Cockpit. The user can start developing on this instance either using the SAP HANA Web-based Development Workbench or the SAP HANA Tools for Eclipse. [21]

First, the user opens the SAP HANA Cloud Cockpit in the browser, clicks on Log On button to login to the SAP HANA Cloud Cockpit with the free developer edition account, chooses Databases & Schemas, and then chooses New, as shown in Figure 15. [21]

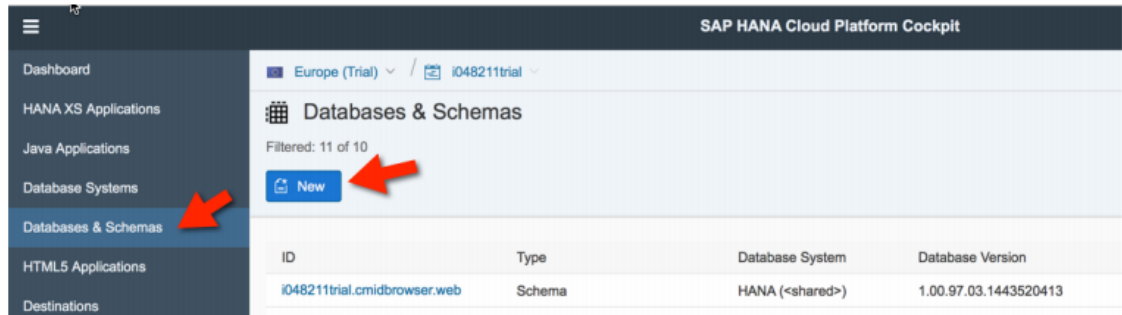


Figure 15: SAP HANA Web-based Development Workbench – Snapshot 1 [21]

The user then provides a name for the HANA Instance (e.g. hana), and chooses HANA XS (<shared>) as Database System, and finally clicks on the Save button, as shown in Figure 16. [21]

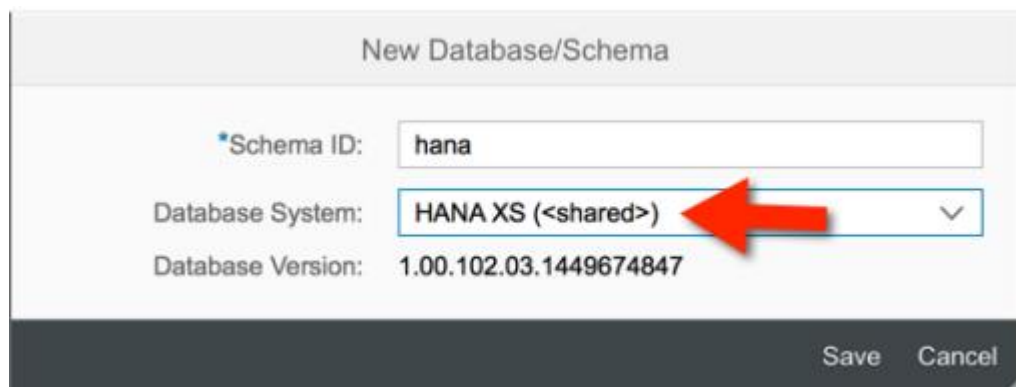


Figure 16: SAP HANA Web-based Development Workbench – Snapshot 2 [21]

The user then should open the just created “hana” database and choose the SAP HANA Web-based Development Workbench, as shown in Figure 17. [21]

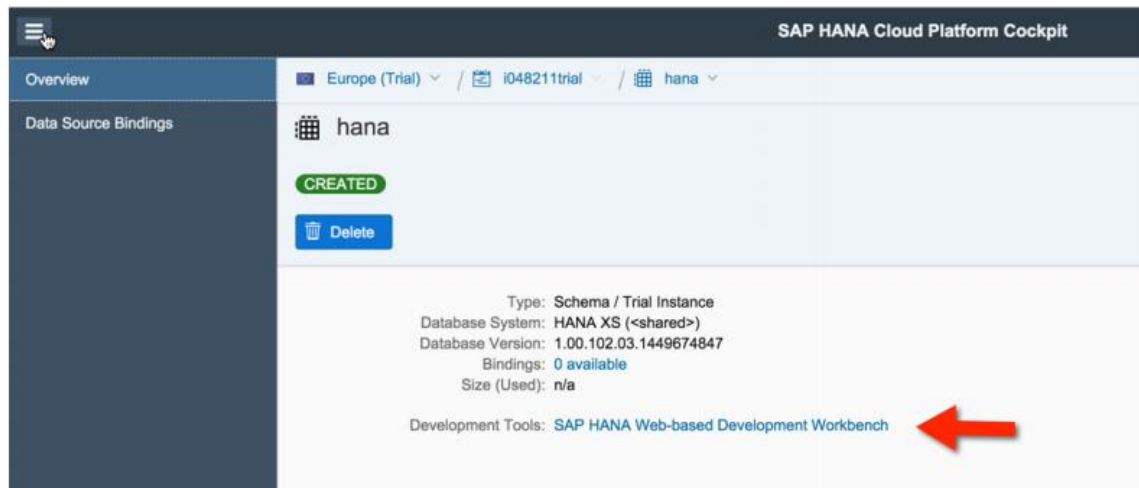


Figure 17: SAP HANA Web-based Development Workbench – Snapshot 3 [21]

The user then will be navigated to the Editor and can immediately start developing in HANA. The first step to start developing a SAP HANA application with SAP HANA Web-based Development Workbench is to create a new package for the application. The user opens the first package in the Content folder that is named like their account, e.g. p1234567890trial. Then the user selects the package that is named like the HANA trial instance (e.g. hana), as shown in Figure 18. [21]

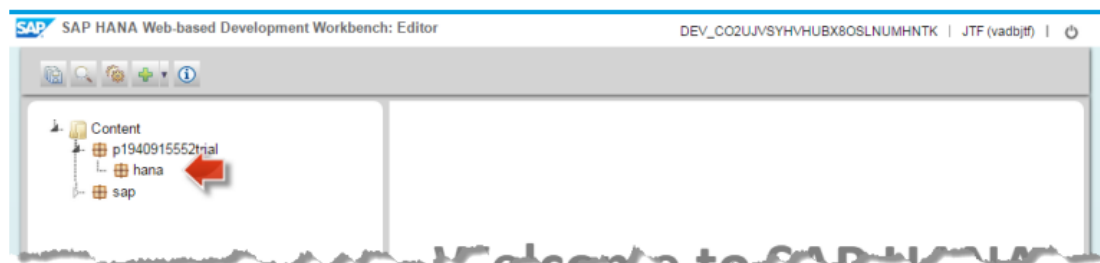


Figure 18: SAP HANA Web-based Development Workbench – Snapshot 4 [21]

The user should right-click on the selected package of their SAP HANA trial instance and choose New and Package, then enter “helloworld” as new package name and save, as shown in Figure 19. [21]

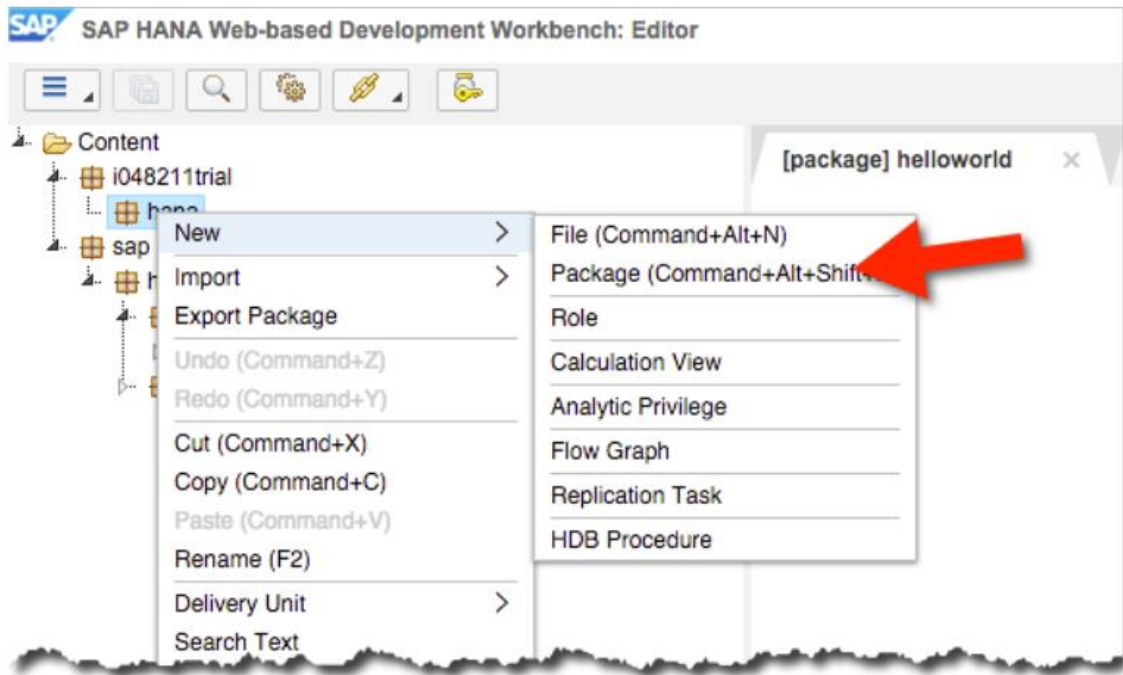


Figure 19: SAP HANA Web-based Development Workbench – Snapshot 5 [21]

In SAP HANA, an empty .xsapp file indicates that a package is containing a HANA XS application. In order to create an application, the next step is to create such a file. First, the user opens the context menu of the just created “helloworld” package by right-clicking on the name and choosing New and File. Then, enter .xsapp as file name and save, as shown in Figure 20. [21]

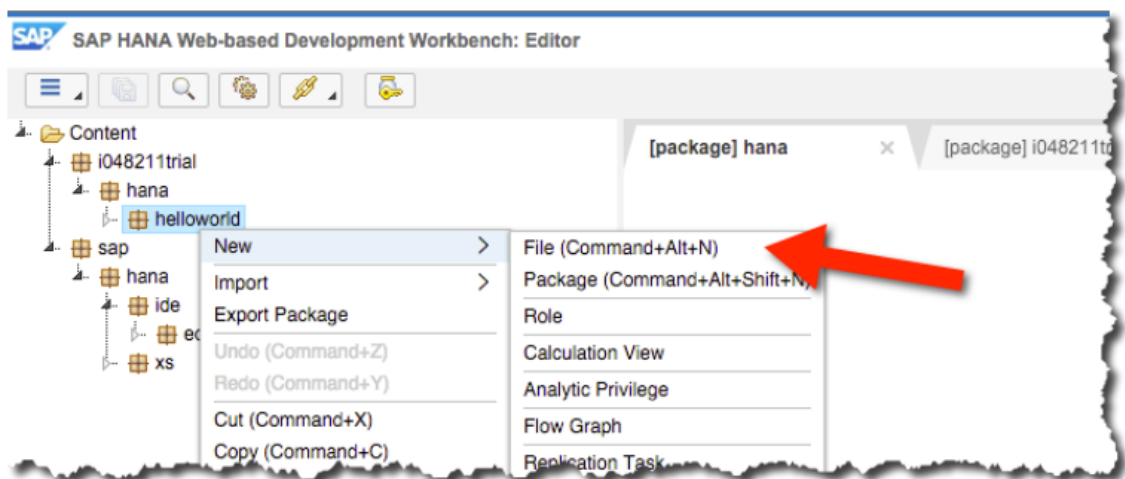


Figure 20: SAP HANA Web-based Development Workbench – Snapshot 6 [21]

The new file will open in the Editor, and the user should then save the empty file using the Save button. The successful save is confirmed in the console, as shown in Figure 21. [21]



Figure 21: SAP HANA Web-based Development Workbench – Snapshot 7 [21]

In SAP HANA XS application code is essentially a JavaScript code provided in .xsjs files. In order to create this file, the user needs to open the context menu of the “helloworld” package one more time by right-clicking on the name and choosing New then File. Enter “helloworld.xsjs” as file name and save. The new empty file will then open in the Editor. The user then should copy the below code to the just created “helloworld.xsjs” file, and save using the Save button, as shown in Figure 22. [21]

```
$.response.contentType = "text/html";
$.response.setBody("Hello World!");
```

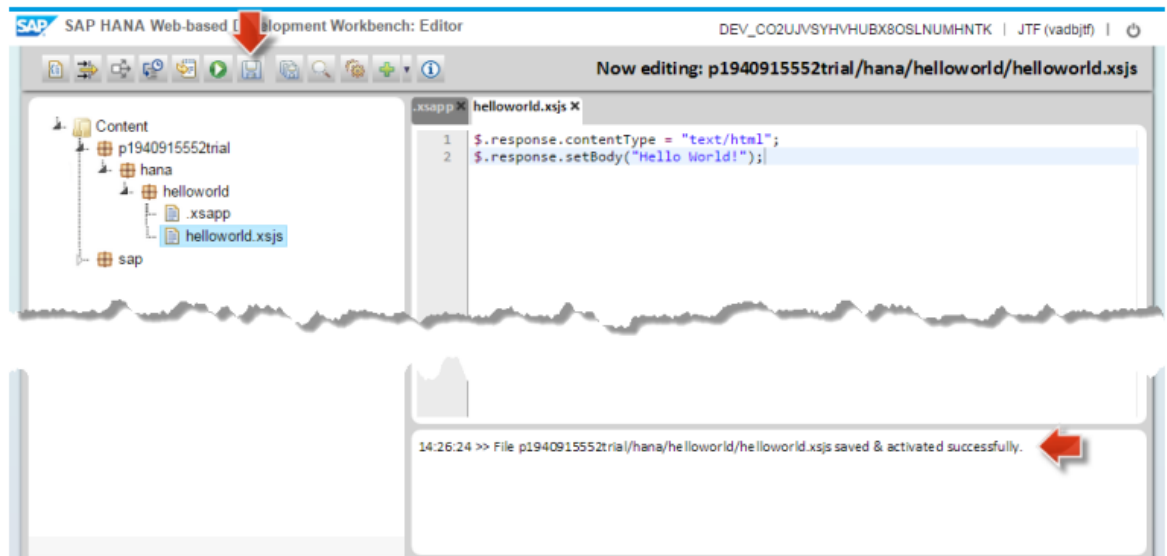


Figure 22: SAP HANA Web-based Development Workbench – Snapshot 8 [21]

The just developed application cannot be accessed yet. For this, it must be declared with a `.xsaccess` file that the application shall be accessible. In order to create this file, the user should open the context menu of the “helloworld” package by right-clicking on the name and choosing New and File. The user then should enter “.xsaccess” as file name and save it. The new empty file will open in the Editor. The user then should copy the below code to the just created `.xsaccess` file, and save using the Save button, as shown in Figure 23. [21]

```
{
"exposed": true
}
```

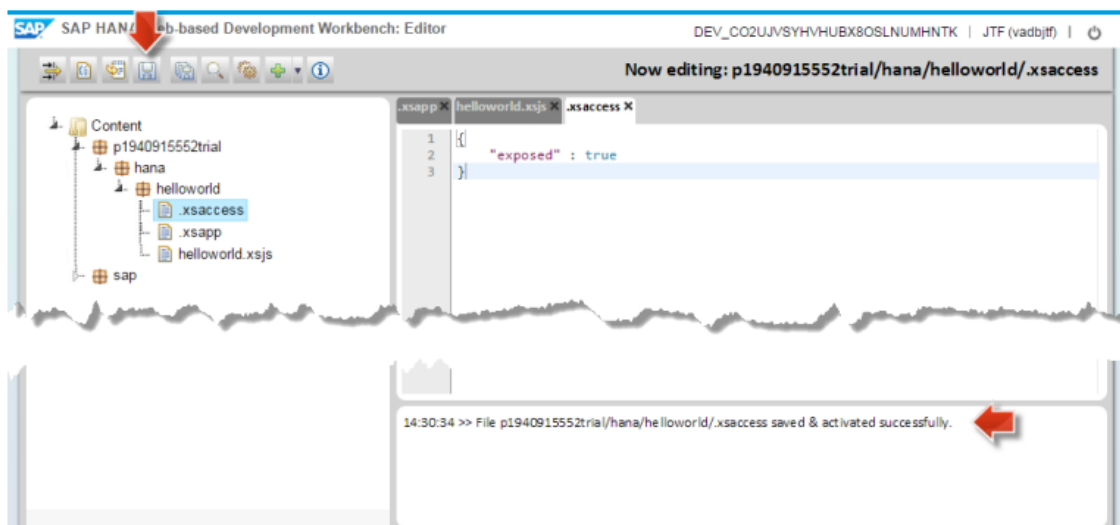


Figure 23: SAP HANA Web-based Development Workbench – Snapshot 9 [21]

As the user is developing with the SAP HANA Web-based Development Workbench, the application is already deployed and activated to the SAP HANA Trial Instance. So the user can immediately continue to test it. So, for the application to be run and tested, the user should select the helloworld.xsjs file to enable the Run on Server in the toolbar, and click the Run on Server button, as shown in Figure 24. [21]



Figure 24: SAP HANA Web-based Development Workbench – Snapshot 10 [21]

The application will then open in the browser and greet with “Hello World!”, as shown in Figure 25. [21]



Figure 25: SAP HANA Web-based Development Workbench – Snapshot 11 [21]

Upon accomplishment of the above mentioned steps, the user will have his/her own native SAP HANA application running on SAP HANA Cloud Platform. [21]

5.3 Getting Started with SAP HANA on Eclipse

This section will demonstrate how to install and make use of SAP HANA Tools for Eclipse. First, in order to have a supported version of Eclipse Luna, the user needs to go to the following URL:

<http://www.eclipse.org/downloads/packages/eclipse-ide-java-ee-developers/lunasr1>

The user then should choose the operating system that you will be used to run Eclipse, choose the preferred download site, and start the download, as shown in Figure 26. [21]

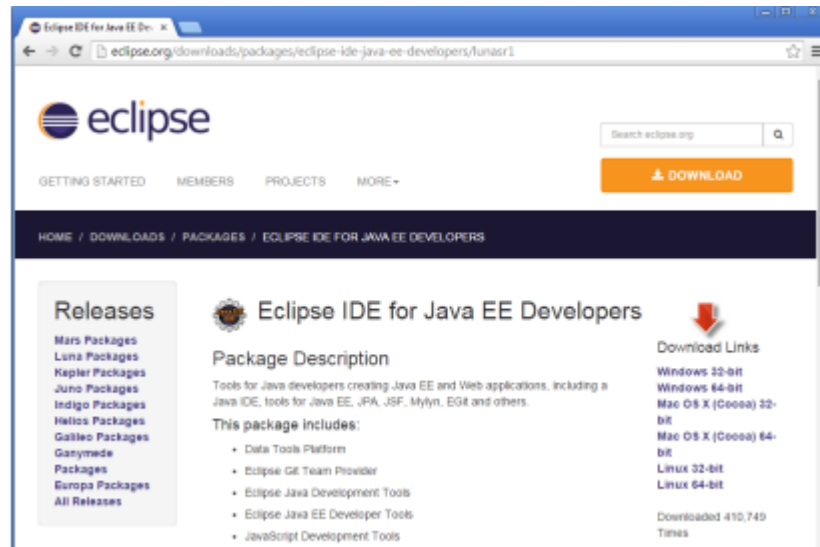


Figure 26: Adding SAP HANA Tools on Eclipse – Snapshot 1 [21]

Once the download has been finished, the user then extracts the archive to a local folder of their choice and clicks on the eclipse.exe file to start Eclipse, as shown in Figure 27. [21]

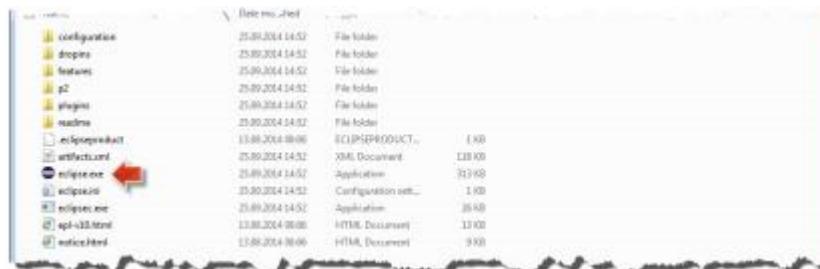


Figure 27: Adding SAP HANA Tools on Eclipse – Snapshot 2 [21]

Eclipse will first show a Workspace Launcher dialog to choose the workspace. The user should replace the suggested workspace path with `c:\dev\eclipse_workspace`, and confirm with OK, as shown in Figure 28. [21]

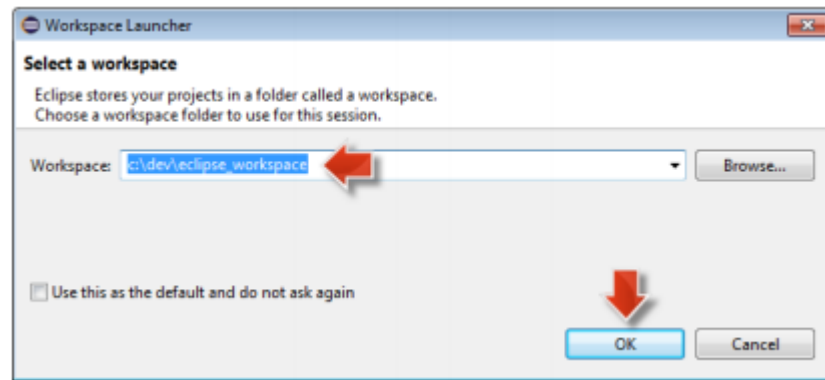


Figure 28: Adding SAP HANA Tools on Eclipse – Snapshot 3 [21]

Now, the user has a new Eclipse installed and just started. The user then has to close the Eclipse welcome homepage and start installing the SAP HANA tools required to develop HANA applications with the SAP HANA Cloud Platform; which is done through following the standard approach of Eclipse to install plugins. First, from the Eclipse menu, the user should choose “Help”, then “Install New Software...” as shown in Figure 29. [21]

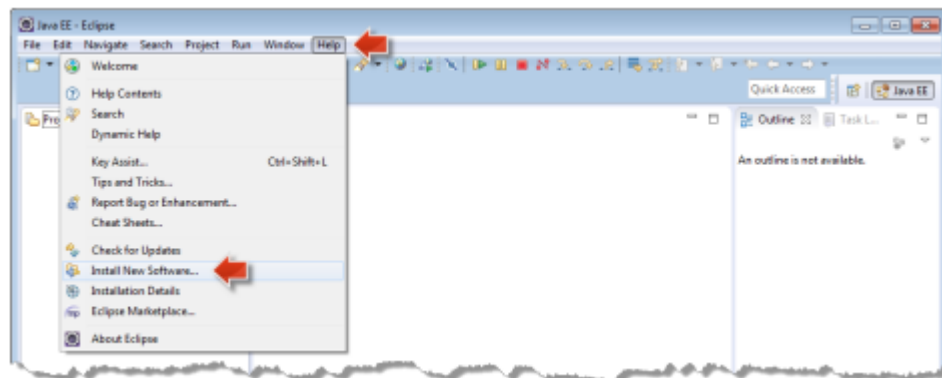


Figure 29: Adding SAP HANA Tools on Eclipse – Snapshot 4 [21]

The user then should copy the URL <https://tools.hana.ondemand.com/luna> and paste it in the Work with field and then press Enter, as shown in Figure 30. [21]

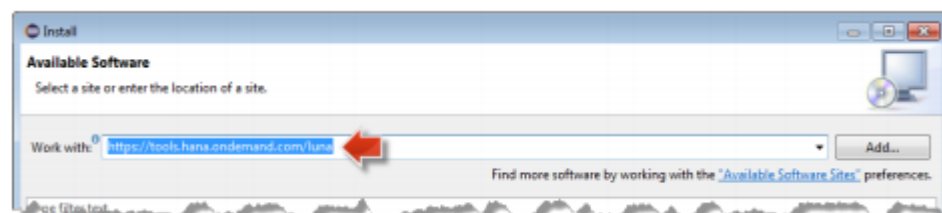


Figure 30: Adding SAP HANA Tools on Eclipse – Snapshot 5 [21]

Then, select SAP HANA Tools and click Next, as shown in Figure 31. [21]

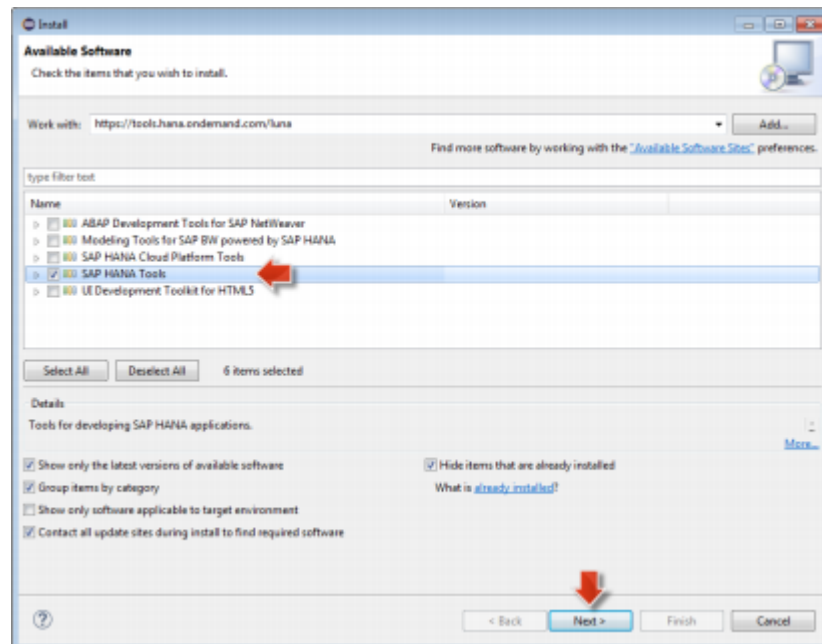


Figure 31: Adding SAP HANA Tools on Eclipse – Snapshot 6 [21]

On the Install Details page, the user should choose again Next, as shown in Figure 32. [21]

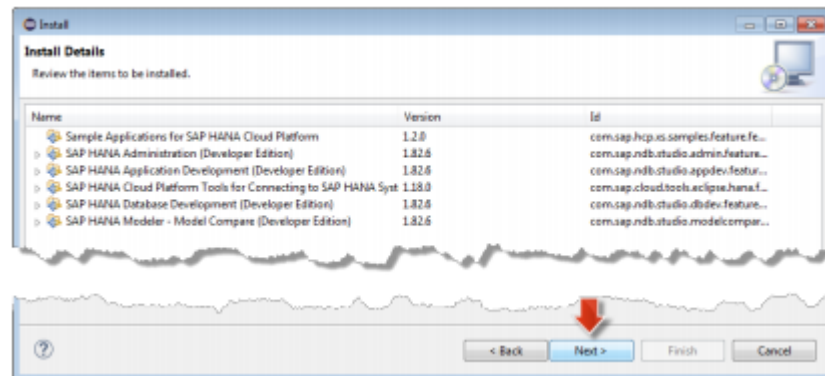


Figure 32: Adding SAP HANA Tools on Eclipse – Snapshot 7 [21]

Then the user should read and accept the license agreement and choose Finish. Installation will start immediately, and during the installation, a Security Warning dialog box will appear stating that the software contains unsigned content; the user should then confirm with OK to continue the installation. At the end of the installation, the Eclipse will ask to restart. With this, SAP HANA Tools are successfully installed in Eclipse. [21]

To start developing SAP HANA, the user needs to enable the SAP HANA Development Perspective. First, the user goes to Eclipse main menu choose Window then Open Perspective then Other..., as shown in Figure 33. [21]

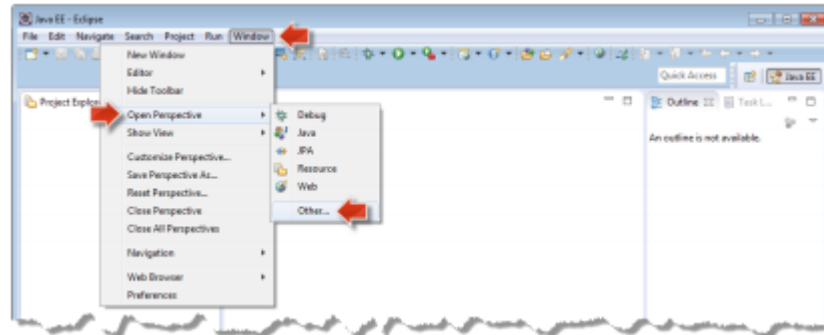


Figure 33: Adding SAP HANA Tools on Eclipse – Snapshot 8 [21]

Choosing the SAP HANA Development Perspective and clicking OK, the user will have the SAP HANA Tools with the SAP HANA Development Perspective active, as shown in Figure 34. [21]

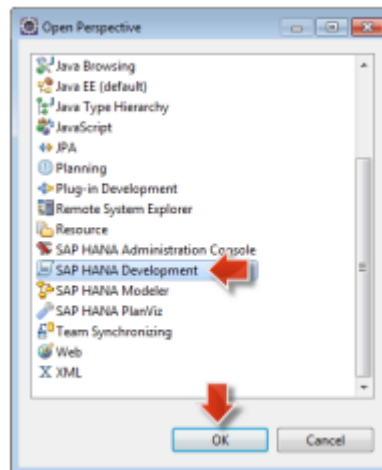


Figure 34: Adding SAP HANA Tools on Eclipse – Snapshot 9 [21]

The user now is ready to connect to their HANA trial instance, through selecting the Systems Tab (which is part of the SAP HANA Development Perspective), choosing the Add System... button, and then choosing Add Cloud System..., as shown in figure 35. [21]

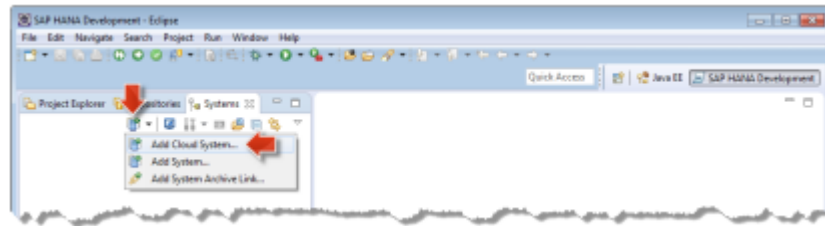


Figure 35: Adding SAP HANA Tools on Eclipse – Snapshot 10 [21]

In the Add Cloud System wizard, the user needs to provide the login information for SAP HANA Cloud Platform account to connect to their HANA instance. For the Landscape Host, the user should choose hanatrial.ondemand.com; and then enter their SAP HANA Cloud Platform account name, login username, and password, the click Next, as shown in Figure 36. [21]

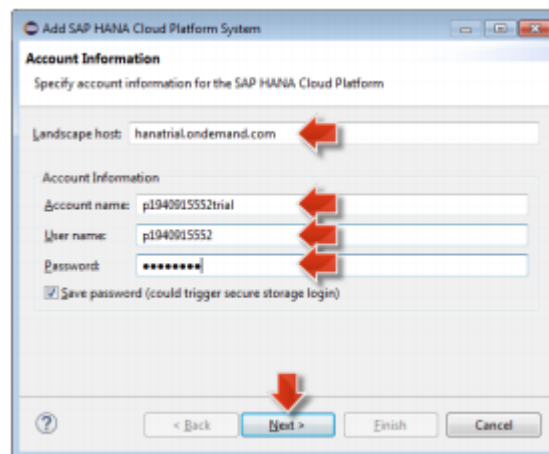


Figure 36: Adding SAP HANA Tools on Eclipse – Snapshot 11 [21]

SAP HANA Cloud Platform will then check if the user has a HANA trial instance in their account. The user should then choose their HANA Trial Instance and click Finish, as shown in Figure 37. [21]

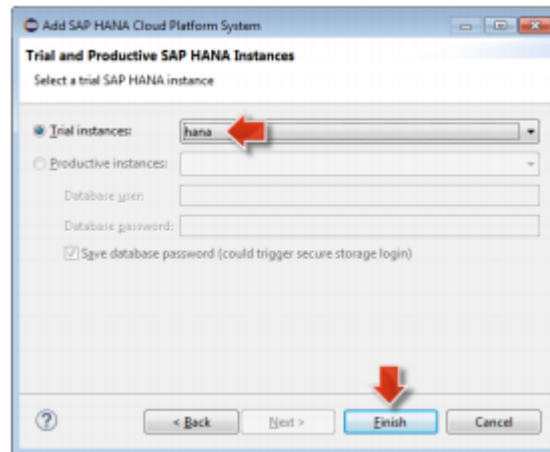


Figure 37: Adding SAP HANA Tools on Eclipse – Snapshot 12 [21]

The SAP HANA Tools will then connect to the HANA trial instance in the cloud and show it in the Systems Tab, as shown in Figure 38. [21]

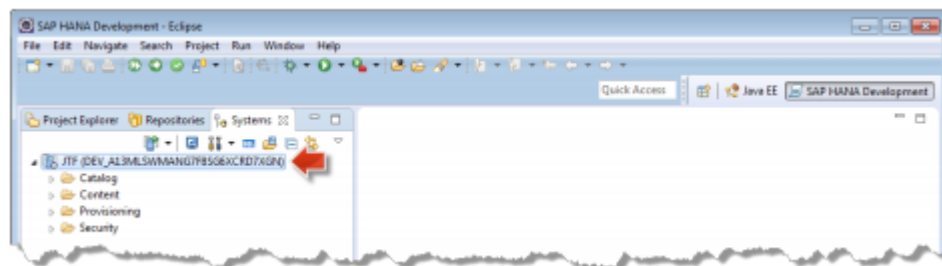


Figure 38: Adding SAP HANA Tools on Eclipse – Snapshot 13 [21]

To start development on SAP HANA, a Repository needs to be created. For this, the user opens the Repositories tab of the SAP HANA Development Perspective, chooses the Create Repository Workspace button, as shown in Figure 39. [21]

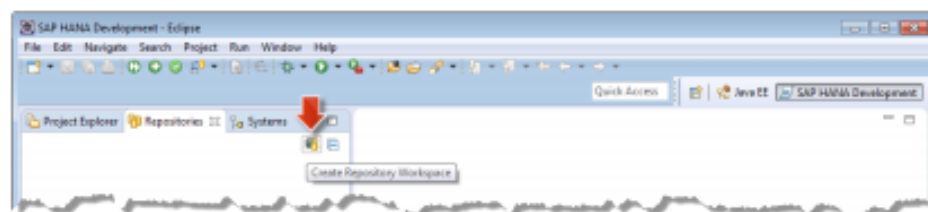


Figure 39: Adding SAP HANA Tools on Eclipse – Snapshot 14 [21]

For the new workspace, the user defines the Workspace Root to be `c:\dev\hana_workspace` and choose Finish, as shown in Figure 40. [21]

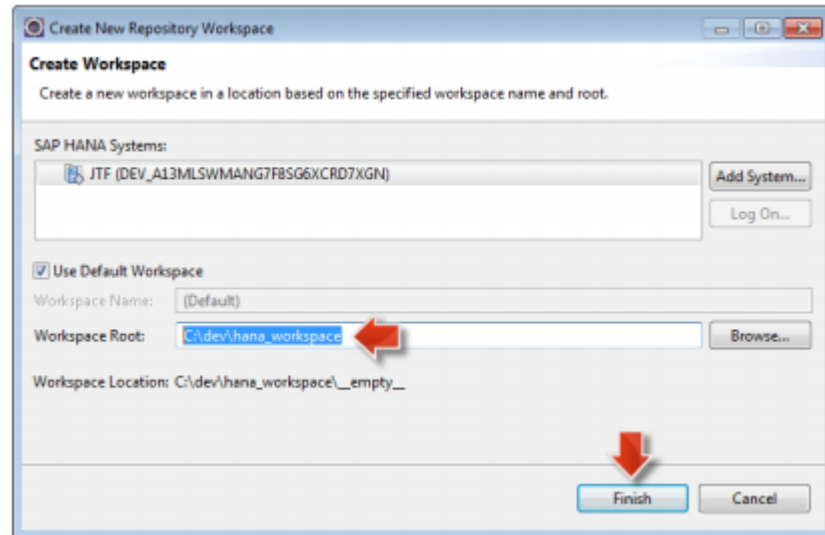


Figure 40: Adding SAP HANA Tools on Eclipse – Snapshot 15 [21]

The new Repository will then be ready and will be shown in the Repositories Tab, as shown in Figure 41. [21]



Figure 41: Adding SAP HANA Tools on Eclipse – Snapshot 16 [21]

Upon accomplishment of the above mentioned steps, this user will be able to start their first SAP HANA project with Eclipse. [21]

6 GUI Development and Design Approach

The objective of this chapter is to discuss the design approach, as well as to demonstrate some parts of the Graphical User Interface (GUI) design of the SAP CLM (Contract Lifecycle Management) web application that was developed and deployed on the SAP HANA cloud platform.

6.1 Development Environments

The SAP CLM web application was developed on SAP Web IDE, as well as Eclipse with the SAP HANA plugs and add-ons. JavaScript was used as a scripting language of the project, as well as the framework used was the SAP in-house framework. Moreover, SQL (Structured Query Language) was used in the backend to select and insert data from/to tables in the database.

6.2 Methodology and Design Pattern

The project was carried out using MVC (Model-View-Controller) software design pattern, in which the Controller receives all requests for the application and then works with the Model to prepare any data needed by the View. The View then uses the data prepared by the Controller to generate a final presentable response. Figure 42 graphically represents the MVC design pattern abstraction. [19]

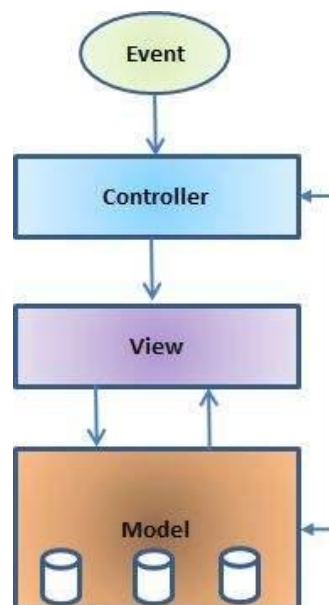


Figure 42: MVC Software Design Pattern [19]

As shown in Figure 42, the model is responsible for managing the data of the application, so it responds to the request from the view and it also responds to instructions from the controller to update itself. The view is a presentation of data in a particular format, triggered by a controller's decision to present the data. Lastly, the controller receives the user input, validates the input and then performs the business operation that modifies the state of the data model. [19]

6.3 GUI Design of the CLM

CLM is a web tool that enables organizations to keep all customer/business contracts in a central visible place to prevent potential risks. Moreover, it lets organizations access any contract and track any important data in order not to miss any leads. CLM also consistently manages the entire contract lifecycle across the enterprise, realizing the full value of contracts, resulting in higher profits, lower legal and financial risks. [1]

Figure 43 demonstrates the SAP Contract Lifecycle Management web application home page, and describes the different forms and requests that the SAP user can select.

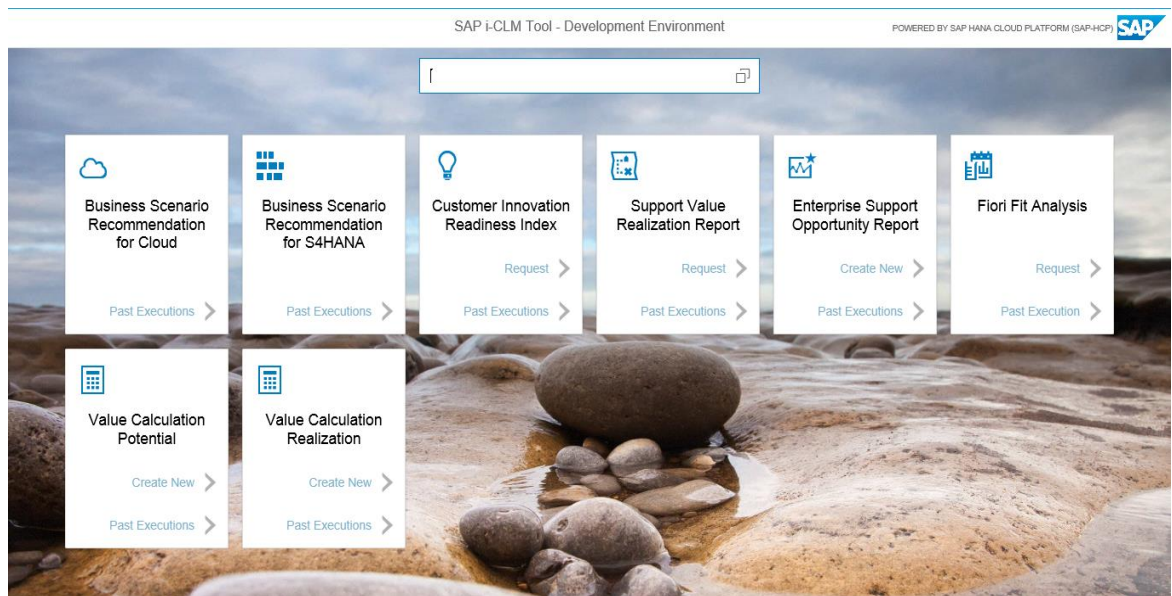


Figure 43. CLM Home Page

As shown in Figure 43, the CLM home page with the application header indicating that it is powered by the SAP HANA cloud platform. In addition, the CLM home page includes different forms and requests in which the SAP user can select. In each

form/request there are two tabs where the SAP user can click in order to be redirected to either check past executions or to create a new request. Also, there is a text box with the search icon, where the SAP user can search directly for the needed customer ID number. Also, the background picture was developed using HTML5 styling.

Among the various forms/requests, there is the Support Value Realization (SVR) Report; in which the second part of the GUI design was carried out. The purpose of the SVR report is to let the organization know the value extracted from a customer project shown over time.

Figure 44 displays the first snapshot of the SAP CLM Support Value Realization (SVR) Report, including a number of flex boxes that include a variety of text fields and combo boxes. Flex boxes, combo boxes and text fields are designed with different attributes. These attributes can be checked from Appendix 1.

Figure 44. Support Value Realization Report – Snapshot 1

As shown in Figure 44, the SVR Report has the same GUI styling as the CLM homepage, including the header and background picture. It also includes three flex boxes placed in the middle of the web page. For instance, the first flex box includes three text fields and two combo boxes. The first two text fields include the customer ID number and the customer name. The second two combo boxes include the list of countries and industries that are connected to the database in the backend and directly get the user selected item using an SQL query. The last item in the first flex box is a text field,

where the user should enter a certain ID numerical value. It is worth mentioning that each text field and combo box has a “text type” attribute that could be a “Number” or a “Text”. If the user tries to enter a numerical value in a text field with an attribute of “text type: Text” or vice versa, the text field will turn to the red colour and an error message will be displayed.

In order to measure value realization, KPIs (Key Performance Indicators) need to be established before any changes or transitions take place. These KPIs may include factors such as key measures baseline, target, and the potential economic benefit.

Figure 45 represents the second snapshot of the SVR Report, including KPIs table and the web page footer. The table consists of four columns and three rows, while the page footer includes two buttons.

Support Value Realization Report

POWERED BY SAP HANA CLOUD PLATFORM (SAP-HCP) ? SAP

SVR Requestor

Support Advisor

E-mail Address

ESO Number to Collect 3 KPIs Info

	KPI Name	Baseline	Target	Potential Economic Benefit
KPI 1				
KPI 2				
KPI 3				

Back Home

Submit

Figure 45. Support Value realization Report – Snapshot 2

As shown in Figure 45, there is a combo box above the KPIs table. When the user selects a specific number from this combo box, three KPIs’ information including KPI name, baseline, target and potential economic benefit will be collected from the database and appear on the screen. In addition, the page footer consists of two green coloured buttons. Clicking on the left corner button “Back Home”, the User will be navigated to the CLM home page. However, when the user presses the “Submit” button on the right corner, he/she will receive a confirmation e-mail that the SVR report request

has been successfully sent. Figure 46 displays the content of the SVR confirmation e-mail.

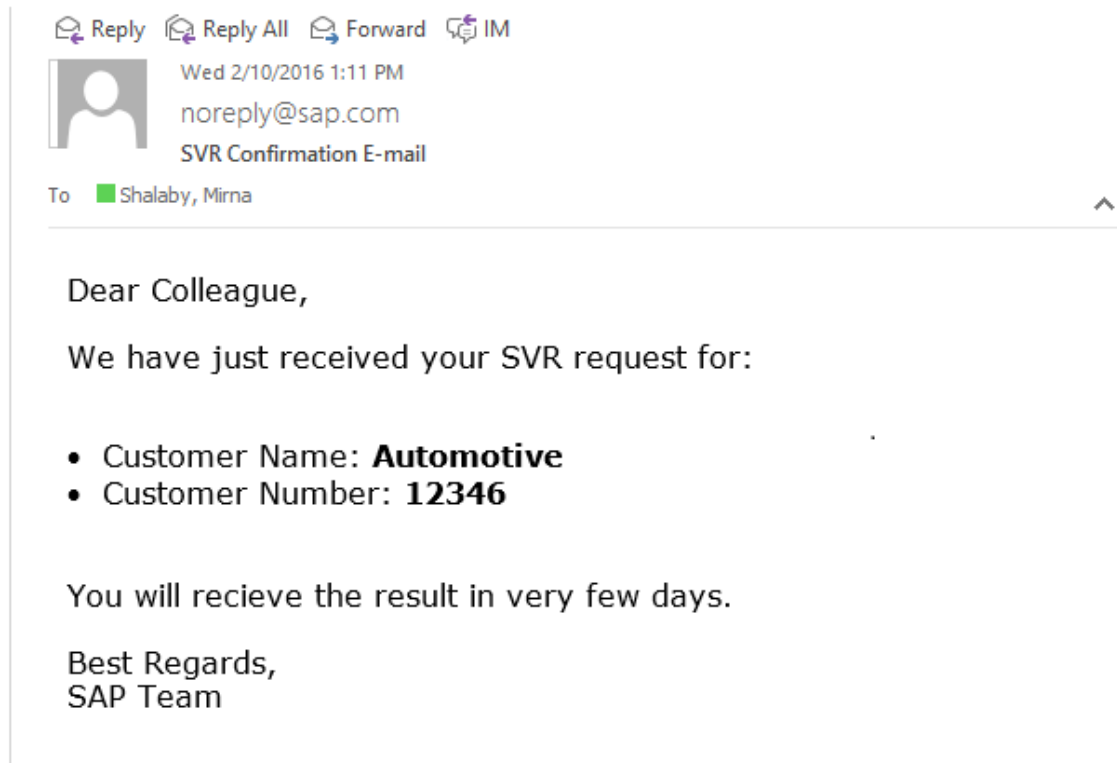


Figure 46. SVR Confirmation E-mail

As shown in Figure 46, the SVR confirmation e-mail was written and styled using HTML, and was sent by means of a mail web service with an http request. The parameters in the mail are automatically requested from the database such as the customer name, customer number, and the user e-mail address.

7 Conclusion and Future Recommendations

As indicated throughout the study, the adoption of cloud computing has been massively growing throughout the past few years, as many organizations are in need to save money and time, and in the meantime increase their profits and margins. Thus, the use of cloud platforms provide organizations with many services that enable them to do more for less, helping businesses to dramatically cut off unneeded costs and reduce wasted time, through software development agility, improved team collaboration, time efficiency, as well as better worker mobility.

The goal of the study was to first introduce the various cloud computing deployment models and service models. In addition, the study aimed to illustrate the step-by-step methodology of getting started with different SAP HANA Cloud Platform development environments. The goal of the study was successfully met, and an outcome was achieved. The study outcome is a GUI interface of the SAP CLM (Contract Lifecycle Management) web application that was developed and deployed on SAP HANA cloud platform. The SAP CLM web application manages the entire contract lifecycle across the enterprise, realizing the full value of contracts, resulting in higher profits, lower legal and financial risks.

This study could be beneficial for both business leaders as well as IT professionals (i.e. software developers), as it contains analysis for all the aspects of adopting a cloud, including the benefits and risks that the organizations should consider while making a business decision. It also illustrates how to get started with developing and running one's first application on a cloud platform.

Recommendation for future study could be more investigation on Artificial Intelligence (AI) services as well as cloud machine learning platforms that enable the analytical data and pattern building automation.

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Appendix 1: Frontend Code

```
sap.ui.jsview("views.clmviewsvtcreate", {

  getControllerName : function() {
    return "views.clmviewsvtcreate";
  },

  createContent : function(oController) {
    var text1 = new sap.m.Text({
      text : "POWERED BY SAP HANA CLOUD PLATFORM (SAP-HCP)",
      wrapping : true, // boolean
      textAlign : sap.ui.core.TextAlign.End,
    });
    text1.addClass("powered");

    var sViewTitle = "Support Value Realization Report";
    var oView = new sap.m.Page({
      title : sViewTitle,
      headerContent : [ text1, new sap.m.Button({
        icon : "sap-icon://sys-help",
        press : function() {
          app.to("idclmviewhelp");
        },
      }), new sap.m.Image({
        src : "img/SAP-logo.jpg",
        width : "60px",
        height : "30px"
      }) ]
    });

    var flexBox1 = new sap.m.FlexBox({
      direction : sap.m.FlexDirection.Column,
      justifyContent : sap.m.FlexJustifyContent.Center,
      alignItems : sap.m.FlexAlignItems.Center
    });
    oView.addContent(flexBox1);

    var input1 = new sap.m.Input(this.createId("CustomerNumber"), {
      width : "400px",
      value : "12346",
      // placeholder : "ERP Customer Number",
      enabled : false,
      type : sap.m.InputType.Number,
      valueStateText: "Please insert a proper customer number"
    });
    flexBox1.addItem(input1);

    var input2 = new sap.m.Input(this.createId("CustomerName"), {
      width : "400px",
      value : "Automotive",
```

```
        // placeholder : "Customer Name",
        enabled : false,
        type : sap.m.InputType.Text,
        valueStateText: "Please insert a proper customer name"
    });

    flexBox1.addItem(input2);

    var comboBox2 = new
    sap.m.ComboBox(this.createId("SelectCountry"), {
        width : "400px",
        placeholder : "Select Country",
        items : {
            path : "oModelCountriesTable>/items",
            template : new sap.ui.core.Item({
                text : "{oModelCountriesTable>Country}"
            })
        },
        type : sap.m.InputType.Text,
        valueStateText: "Please insert a proper country name"
    });
    flexBox1.addItem(comboBox2);

    var comboBox1 = new
    sap.m.ComboBox(this.createId("SelectIndustry"), {
        width : "400px",
        placeholder : "Select Industry",
        items : {
            path : "oModelIndustriesTable>/items",
            template : new sap.ui.core.Item({
                text : "{oModelIndustriesTable>SAP_Mastercode}"
            })
        },
        type : sap.m.InputType.Text,
        valueStateText: "Please insert a proper industry name"
    });
    flexBox1.addItem(comboBox1);

    var input5 = new sap.m.Input(this.createId("ERP"), {
        width : "400px",
        placeholder : "Leading SAP ERP System ID",
        enabled : true,
        type : sap.m.InputType.Text,
        maxLength: 3,
        valueStateText: "Please insert a proper system ID"
    });

    flexBox1.addItem(input5);

    var Text = new sap.ui.commons.TextView();
    Text.setText("\n" + "\n");
```



```
flexBox1.addItem(Text);

    var flexBox2 = new sap.m.FlexBox({
        direction : sap.m.FlexDirection.Column,
        justifyContent : sap.m.FlexJustifyContent.Center,
        alignItems : sap.m.FlexAlignItems.Center,
        width : "400px"
    });

oView.addContent(flexBox2);
flexBox1.addItem(flexBox2);

var input6 = new sap.m.Input(this.createId("SVRRequestor"), {
    width : "400px",
    placeholder : "SVR Requestor",
    enabled : true,
    type : sap.m.InputType.Text,
    valueStateText: "Please insert a proper SVR requestor"
});

flexBox2.addItem(input6);

var input7 = new sap.m.Input(this.createId("SupportAdvisor"), {
    width : "400px",
    placeholder : "Support Advisor",
    enabled : true,
    type : sap.m.InputType.Text,
    valueStateText: "Please insert a proper support advisor"
});

flexBox2.addItem(input7);

var input9 = new sap.m.Input(this.createId("e-mail"), {
    width : "400px",
    placeholder : "E-mail Address",
    enabled : true,
    type : sap.m.InputType.Email,
    valueStateText: "Please insert your e-mail Address"
});

flexBox2.addItem(input9);

    var Text2 = new sap.ui.commons.TextView();
Text2.setText("\n" + "\n");

flexBox2.addItem(Text2);

var flexBox3 = new sap.m.FlexBox({
    direction : sap.m.FlexDirection.Column,
    justifyContent : sap.m.FlexJustifyContent.Center,
```

```
        alignItems : sap.m.FlexAlignItems.Center
    });
    oView.addContent(flexBox3);
    flexBox1.addItem(flexBox3);

var comboBox3 = new sap.m.ComboBox(this.createId("ESONumber"), {
    width : "400px",
    placeholder : "ESO Number to Collect 3 KPIs Info",
    enabled : true,
    type : sap.m.InputType.Number,
    valueStateText: "Please insert a proper ESO Number",
    items : {
        path : "oModelESOTable>/items",
        template : new sap.ui.core.Item({
            text : "{oModelESOTable>ESOID}"
        })
    },
});

flexBox3.addItem(comboBox3);

var Text4 = new sap.ui.commons.TextView();
Text4.setText("\n" + "\n");

flexBox3.addItem(Text4);

var flexBox4 = new sap.m.FlexBox({
    direction : sap.m.FlexDirection.Column,
    justifyContent : sap.m.FlexJustifyContent.Center,
    alignItems : sap.m.FlexAlignItems.Center
});
oView.addContent(flexBox4);
flexBox1.addItem(flexBox4);

flexBox4.addItem(oTable2);

// Value Factors Table
var fTableFactory2 = function(sId, oContext) {
    var columnListItem = new sap.m.ColumnListItem({
        vAlign : "Middle",
        cells : [new sap.ui.commons.TextView({
            text : "{oModel>KPI_No}",
            textAlign : "Center",
            design: sap.ui.commons.TextViewDesign.Bold
        })],
    });
}
```

```

        /*new sap.m.Text({
            text : "{oModel>KPI_No}",
            textAlign : "Center",

        })*,*/new sap.m.Input({
            value : "{oModel>KPI_Name}",
            textAlign : "Left"
        }), new sap.m.Input({
            value : "{oModel>Baseline}",
            textAlign : "Left"
        }), new sap.m.Input({
            value : "{oModel>Target}",
            textAlign : "Left"
        }),
        new sap.m.Input({
            value : "{oModel>Potential_Economic}",
            textAlign : "Left"
        })
    ]
});

    return columnListItem;
};

    var oTable2 = new sap.m.Table({
        width : "100%",

// backgroundDesign : sap.m.BackgroundDesign.Transparent,
        mode : sap.m.ListMode.None,
        columns : [new sap.m.Column({
            hAlign : "Center",
            width : "70px"

        }),
        new sap.m.Column({
            hAlign : "Center",
            header : new sap.m.Label({
                text : "KPI Name",
                design : sap.m.LabelDesign.Bold
            })
        }), new sap.m.Column({
            hAlign : "Center",
            header : new sap.m.Label({
                text : "Baseline",
                design : sap.m.LabelDesign.Bold
            })
        }), new sap.m.Column({
            hAlign : "Center",
            header : new sap.m.Label({
                text : "Target",
                design : sap.m.LabelDesign.Bold
            })
        })
    ],
};

```

```
        new sap.m.Column({
            hAlign : "Center",
            header : new sap.m.Label({
                text : "Potential Economic Benefit",
                design : sap.m.LabelDesign.Bold
            })
        })
    ]}];
oTable2.bindItems("oModel>/KPI_Values", fTableFactory2);

oView.addContent(oTable2);

oView.addContent(new sap.m.Text({text : "{oModel>/ERP_Customer_Number}"}))

// Toolbar & Buttons

var toolbar1 = new sap.m.Toolbar();

var oButtonBack = new sap.m.Button({
    text : "Back Home",
    type : sap.m.ButtonType.Accept,
    width : "10rem",
    icon : "sap-icon://home",
    iconFirst : true,
    visible : true
});
oButtonBack.attachPress(oController.goBack, oController);
toolbar1.addContent(oButtonBack);

var toolbarSpacer1 = new sap.m.ToolbarSpacer();
toolbar1.addContent(toolbarSpacer1);

var oButtonSubmit = new sap.m.Button("buttonSubmit", {
    text : "Submit",
    type : sap.m.ButtonType.Accept,
    width : "10rem",
    icon : "sap-icon://action",
    iconFirst : false
});

oButtonSubmit.attachPress(oController.doSave, oController);
toolbar1.addContent(oButtonSubmit);

oView.setFooter(toolbar1);

return oView;
}
});
```

Appendix 2: Backend Code

```

$.response.contentType = "application/json";
$.response.status = 200;
$.import("SVR.docservice", "DocRepository");
var DocRepository = $.SVR.docservice.DocRepository.DocRepository;
// Implementation of GET call
function fnHandleGet(){
  /*try {
        var jsonModel = {
            returnMessage : null
        };

        var conn = $.db.getConnection();
        var pstmt = null;
    var rs = null;

    /*      var IFirstName = $.request.parameters.get('FirstName');
            var ILastName = $.request.parameters.get('LastName');*/
        //      var IEmail = $.request.parameters.get('Email');
    /*      var IPhone = $.request.parameters.get('Phone');
            var ICity = $.request.parameters.get('City');
            var ICountry = $.request.parameters.get('Country');
            var ILanguage = $.request.parameters.get('Language');
            var ISystemID = $.request.parameters.get("SystemID");
            var ICompany = $.request.parameters.get("Company");
            var IIndustry = $.request.parameters.get("Industry");
            var IRelationship =
$.request.parameters.get("Relationship");
            var IInstallationNo =
$.request.parameters.get("InstallationNo");
            var IFileName = $.request.parameters.get("FileName");
            var ICustomerNo =
$.request.parameters.get("CustomerNo");

            var ICustomerName =
$.request.parameters.get("CustomerName");
            var IEmailMe = $.request.parameters.get("EmailMe");
            var IPhoneMe = $.request.parameters.get("PhoneMe");*/
            //var ICreationDate = "";
            //      var IRequestID = null;

            //GET DATE
            /*      pstmt = conn.prepareStatement("SELECT CUR-
RENT_DATE FROM DUMMY");

            rs =
pstmt.executeQuery();

            if (rs.next()) {

```

```

tionDate = rs.getDate(1);
}
rs.close();
pstmt.close();

// GET REQUEST ID
/*
conn.prepareStatement("SELECT \"CLM\".\"CLM.data::CLM_RequestID\".NEXTVAL
FROM DUMMY");
pstmt.executeQuery();
questID = rs.getInteger(1);
}
rs.close();
pstmt.close();

pstmt = conn.prepareStatement("INSERT INTO
\"CLM\".\"CLM.data::CLM_Request\"
(\"RequestID\",\"CustomerNumber\",\"SystemID\",\"CustomerName\",\"Country\",\"City\"
,\"Installation Number\",\"FirstName\",\"Last
Name\",\"email\",\"CompanyName\",\"Phone\",\"Industry\",\"Language\",\"Relationship\",
\"Contactbyemail\",\"Contactbyphone\",\"FileName\",\"CreationDate\") VAL-
UES(?,?,?,?,?,?,?,?,?,?,?,?,?,?,?,?,?,?);
pstmt.setInteger(1, parseInt(IRequestID, 10)); // RequestID
pstmt.setInteger(2, parseInt(ICustomerNo, 10)); // Customer Number
pstmt.setNString(3, String(ISystemID)); // System ID
pstmt.setNString(4, String(ICustomerName)); // Customer Name
pstmt.setNString(5, String(ICountry)); // Country
pstmt.setNString(6, String(ICity)); // City
pstmt.setInteger(7, parseInt(IInstallationNo, 10)); // Installation Number
pstmt.setNString(8, String(IFirstName)); // First Name
pstmt.setNString(9, String(ILastName)); // Last Name
pstmt.setNString(10, String(IEmail)); // Email
pstmt.setNString(11, String(IGCompany)); // Company
pstmt.setNString(12, String(IPhone)); // Phone
pstmt.setNString(13, String(IIndustry)); // Industry
pstmt.setNString(14, String(ILanguage)); // Language
pstmt.setNString(15, String(IRelationship)); // Relationship
pstmt.setNString(16, String(IEmailMe)); // Contact by Email
pstmt.setNString(17, String(IPhoneMe)); // Contact by Phone
pstmt.setNString(18, String(IFilename)); // Filename
pstmt.setDate(19, ICreationDate); // Creation Date

pstmt.executeUpdate();
pstmt.close();

conn.commit();
conn.close();*/

```

```

// SEND MAIL TO CUSTOMER
    var jsonModel = {
        returnMessage : null
    };
    var ICustomerNo = $.request.parameters.get('CustomerNumber');
var ICustomerName = $.request.parameters.get('CustomerName');
    var ISVRRequestor = $.request.parameters.get('SVRRequestor');
    var IEmail = $.request.parameters.get('Email');
//    var ICustomerName = $.request.parameters.get('CustomerName');
    try {

        var IHtmlText = "<html><body>" +
            "<p><font face=\"verdana\"> Dear Colleague"+
            "," + "<br>" + "<br>" +
            "We have just received your SVR request for:"
+
            "<br>" + "<br>" + "<br>" + "<li>Customer
Name:</li> " + "<b>" + ICustomerName + "</b>" +
            "<br>" + "<li>Customer Number:</li> " + "<b>"
+ ICustomerNo + "</b>" + "<br>" + "<br>" + "<br>" +
            "You will recieve the result in very few days." +
"<br>" +
            "<br>" + "Best Regards," + "<br>" + "SAP
Team" + "</font></p>" + "</body></html>";

        var mail = new $.net.Mail({
            sender : {address: "noreply@sap.com"},
            to : [{ address : IEmail}],
            subject : "SVR Confirmation E-mail",
            parts : [ new $.net.Mail.Part({
                type : $.net.Mail.Part.TYPE_TEXT,
                text : IHtmlText,
                contentType : "text/html"
            })]
        });

        var returnValue = mail.send();

        $.response.status = $.net.http.OK;
        $.response.contentType = "text/html";
//*****
/* var mail = new $.net.Mail({
    sender : {address: "noreply@sap.com"},
    to : [{ address : IEmail}],
    subject : "Confirmation E-mail",
    parts : [ new $.net.Mail.Part({
        type : $.net.Mail.Part.TYPE_TEXT,
        text : "Dear " + ISVRRequestor + "," + "\n" + "\n" + "We have just received your
SVR Request for:" + "\n" + "Customer Name: " + ICustomerName + "\n" + "Customer
Number: " + ICustomerNo + "\n" + "You will recieve the result in very few days." + "\n"
+ "\n" + "Best Regards," + "\n" + "SAP Team",
        contentType : "text/plain"
    })]
});

```

```

    })
  });

  var returnValue = mail.send();

  $.response.status = $.net.http.OK;
  $.response.contentType = "text/html"; */
  /*******
}
catch (e) {

    // sap.m.MessageBox.show("Failed to send request.",
sap.m.MessageBox.Icon.ERROR, "Error");
    //
sap.m.MessageBox.show(SendmailJSON.responseJSON.returnMessage,
sap.m.MessageBox.Icon.ERROR, "Error");
    // $.response.setBody("Failed to execute action: " + e.toString());
    throw e;
}

    return jsonModel;
}

/* catch (err) {
  if (rs !== null && !rs.isClosed()) {
      rs.close();
  }
  if (pstmt !== null && !pstmt.isClosed()) {
      pstmt.close();
  }
  if (conn !== null && !conn.isClosed()) {
      conn.close();
  }
  jsonModel.returnMessage = "ERROR WHILE LOADING. No
Data Loaded.\n" + err.toString();
  return jsonModel;
}

}*/
try {
    $.response.setBody(JSON.stringify(fnHandleGet()));
} catch (err) {
    $.response.setBody("Failed to execute action: " + err.toString());
}
}

```