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# The development of an Enterprise System Learning Environment (ESLE) for Laurea University of Applied Sciences

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The development of an Enterprise System Learning Environment (ESLE) for Laurea University of Applied Sciences.

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The goal of the ESLEL project was to create a learning environment for students at Laurea University of Applied Sciences (Laurea UAS). ESLEL is a unique blend of traditional and online learning system. In this project, we developed a powerful learning environment and enriched several functionalities where both students and tutors can be benefitted.

The learning environment combines two different platforms, SharePoint and Microsoft Dynamics NAV 2016. The SharePoint site will be used as a place of communication among tutors and students. All materials, manuals, micro-blogging and notifications regarding NAV will be saved in this site. Along with the creation of a functional SharePoint site for students, usage of Microsoft Dynamics NAV 2016 is a significant part of this project. Even though ERP courses have already been conducted at Laurea UAS, but some usability restrictions were noticeable (e.g. generic credentials for all users). By working in this project we could overcome some of those restrictions. More insights has been given to the users with individual authentication along with new companies. The individual authentication will give students the possibility to operate NAV more efficiently, also at the same time it will allow tutors to have an overview of the student's progress. The project has also focused on providing manuals to students. These manuals will not only help a student to learn NAV from a technical perspective, but also give more information in using the interface along with the application utility.

To support this project, theoretical knowledge along with project management skill has been applied. Under the guidance of our mentor and by using effective software tools we created functional project plans. Methodologies such as Agile, Scrum, and Systematic Test and Evaluation Process (STEP) have been used in this project.

Keywords: Microsoft Dynamics NAV 2016, SharePoint, environment, ERP, Agile, STEP, Scrum.

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## 1 Introduction

Enterprise Systems Learning Environment for Laurea (ESLEL) is a framework to introduce the concept of adaptive learning. This framework integrates the study of Enterprise systems, especially ERP-NAV. Learning environment is a unique blend of traditional and online learning studies. There is a high significance to teach in the domain Enterprise Systems-ERP systems as it is a combination of both industry and research. The teaching method is exclusive with illustrations, visualizations, and simulations of business and decision-making processes to students. Nowadays usage of learning environment is very common as it is flexible and beneficial. Many institutions and companies are adopting this practice and in this project, we have also decided to develop a learning site for students. The students are not only provided with adequate knowledge of the subject, but will also be given practical exposure. More specifically, the student is provided with all the materials related to Microsoft Dynamics NAV 2016 (NAV).

### 1.1 Aim

The aim of this project is to create a learning environment with SharePoint which will contain an insight of Microsoft Dynamics NAV 2016. More specifically, SharePoint site will be used as a means of communication among students and tutors where NAV is the software tool where students can practice and implement their knowledge about ERP.

### 1.2 Structure of ESLEL project

The project has been divided into three main areas:

1. Framework for IS project
2. Understanding SharePoint & NAV
3. Implementation

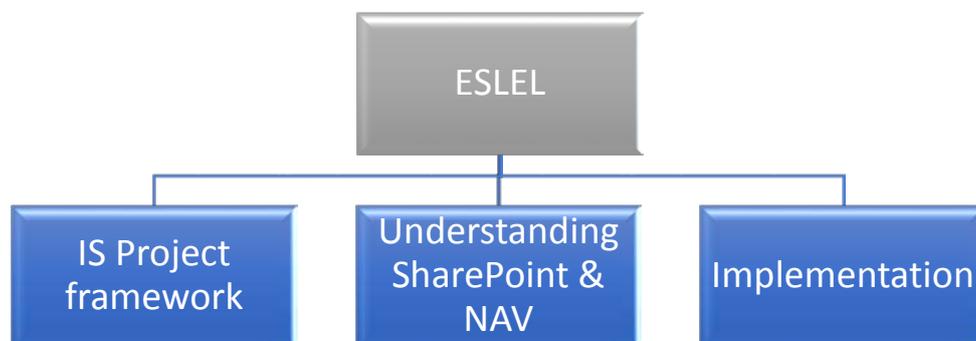


Figure 1: ESLEL project main structure

### 1.3 Framework for Information System (IS) project

This was the very initial phase of the project. The aim was to enhance knowledge on Information System related project. By conducting requirement analysis and literature review we were able to increase our knowledge in project management and its implementation. These tasks helped us to have a profound understanding of the subject. Throughout this entire project the literature review has been conducted depending on the necessity.

Creating a framework for an information system project imply on good knowledge of many software tools, project plans, scheduling activities, application of different methodologies which are some of the main aspects in this phase.

### 1.4 Understanding NAV & SharePoint

Our project is based on creating an online platform which includes both SharePoint and Dynamic NAV 2016. In order to achieve this goal a deep understanding of both the functionalities is important.

- Understanding SharePoint: Share point functionalities are vast. We have deepened our knowledge on SharePoint by making sites, folders, documentations, usage of metadata and versioning documents. At the end of the project an effective interface and all relevant documentations have been placed for student in the appropriate site.
- Understanding NAV: Dynamics NAV 2016 is one of the greatest feature developed by Microsoft. A complete understanding of this has not been covered in this project, however, we have experienced some of its features from technical point of view and in terms of interface functionality.

### 1.5 Implementation

This phase is focused more on the technical aspects of the project. All relevant software needed in order to implement the learning platform for Dynamic NAV 2016 are fixed in this stage.

This is the most important and crucial stage of the project. We focused on the usage of NAV from an administrator and as well as a student point of view. For the execution of this phase, the team has gone through a lot of subject and technical resources. The main objective of this phase is creating an environment where students and teachers can learn and teach. All details about SharePoint and NAV were documented.

## 2 Theoretical background

This section comprehends about the theoretical concepts which are used for implementation of the project. This section is further divided into Requirement analysis and Project Management.

### 2.1 Project Management

As mentioned in the book *Fundamentals of Project Management* (Lewis 2007), "A project is a problem scheduled for solution." For a successful completion of project, the application of knowledge, skills, specified tools and techniques are required. Apart from proper planning and scheduling, communication and coordination are also one of the key factors in good projects. As mentioned by Lewis (2007), "we need to follow a series of steps: Initiating, Planning, Executing, Monitoring and Controlling and Closing the project." In this project, Initiation of thesis has been done by identified the main aim, which is to create a learning environment for Dynamics NAV using SharePoint as a platform. In the Planning and Execution phase we have followed Agile and Scrum methodology. We had interaction with the client at regular time intervals. This helped the project to have timely intervention of the client suggestions. Monitoring and Controlling phases concentrate mainly on testing the works in different machines, testing is also very important part of STEP methodology. The end result of this project is to have a professional and user friendly environment. We have used the project planner to create the outline of the whole project and divided into small tasks using the work break down structure. The project has been considered closed while all relevant testing had been done and the environment were fully functional.

### 2.2 Requirement analysis

According to Greogor (2008, 5), "Requirement analysis is the process of studying and analyzing the customer and the user needs to arrive at a definition of the problem domain and requirements." Requirement analysis is used both in business as well as in computer engineering fields. The process aims to establish a communication with the stakeholders, understand the real problem and solve according to user's preferences.

While performing a Requirement analysis it is important to identify the followings:

- Functional and nonfunctional requirements- understanding whether the system can perform a certain activity and how to it can perform.
- Requirements modeling- all the requirements need to be structured well for best understanding of the problem. By structuring, it is also possible to know what information is missing or what else need to be added.

- Requirement validation- helps to know the feasibility of the project, also if the tasks have been done correctly, is it consistent and complete.
- Requirement review- At this point it will be possible to identify whether the goals have met the objectives. Software design, testing, deployment and maintenance are discussed in this phase.

Requirement analysis can include three types of activities: Requirement gathering, Analyzing and Recording (Greogor 2008).

- Requirement gathering- collecting information regarding the customers or user's necessity.

In this project our stakeholder's requirements were:

1. Create a SharePoint environment for students in Laurea.
2. Deploy a functional NAV in the virtual machine.
3. Use a different edition of SQL Server.
4. Create access to multiple users via web.
5. Access to users has to be flexible.
6. Create multiple companies.
7. Validate exercises of NAV 2013.
8. Documentation and user manuals.

- Analyzing requirements- understanding if the requirements are contradictory with the project. This activity can be achieved through stakeholder's interviews, observations, surveys and brain storming. During interviews software specification is one of the key elements to know from the stakeholders.

In this project through client interviews, we have understood that requirements were not contradictory compared to our knowledge. Although at the initial phase of the project we have taken time to comprehend client's need, however, later we have managed to proceed and execute the process. All software's specifications have been given in details.

- Recording requirements- All the requirements need to be recorded or documented in different forms. During weekly meetings with the client, the team members made notes of discussed issues. At the end of every meeting, main points were documented and uploaded to the SharePoint site. The SharePoint site was also used as a communication space among the client and team members. This helped us to avoid communication barrier and maintain transparency.

### 2.3 SharePoint

Nowadays team work is the main motive for effective projects. It is ideal to have a common platform to share ideas and communicate with in the team. SharePoint is an operative tool for communication and collaboration into a single web-based environment, which is closely integrated with desktop applications.

SharePoint sites provide an area to share ideas, information, communications, and documents. The site promotes a lot of team coordination and interaction in project oriented tasks, knowledge sharing spaces and microblogging. All the documents are automatically maintained according to the version control where security level is maintained as well. As mentioned in the book Microsoft SharePoint (Olga 2013) "Users can easily interact across the organization with key contacts and experts using email, instant messaging." Site's content is user friendly and is structured in a very simple fashion. We can search any existing document, get updated with newsfeed and latest information of uploaded documents. Customization of the page could be done for specific users and on detailed topics.

SharePoint site can also be divided into many subsites, which is similar to file folder system. The file storage concept of SharePoint is appropriate for team activities. All the members of the team could work on the same file at the same time and this would not affect the quality of the file. The files are saved as different versions with user reference to avoid confusion. SharePoint Online, can be also used from remote places as all the information is web-based, which is placed in the cloud. SharePoint Online is a cloud service which can be used to access information and to interact with your team from anywhere, on different types of devices.

### 2.4 Enterprise resource planning

Enterprise resource planning (ERP) is a unique tool which integrates different departments and their functionalities into a single process. All processes of the company such as operations, manufacturing, marketing and sales, financial planning are encouraged to use one application and interface. ERP software was initially used by large businesses, however using it in small and medium sized business have shown promising results. Customized solutions are being promoted to different sized companies. In this century, the origin of ERP, CRM, and Business Intelligence systems have enhanced the sharing of information to all levels in the industry. This also indicates that an effective communication and coordination is required not only between people but also within the processes (Sharan 2010).

A lot of ERP software's are available in the market depending on individual business requirements. A few of the leading software products are SAP, Oracle and Microsoft. QAD, Lawson, Epicor, Sage and IFS. Exact Globe, Syspro, NetSuite, Visibility, Consona and CDC Software. As mentioned earlier ERP is the connection between people and process, Microsoft NAV is one of

the business platform to connect these two. As mentioned by Oberoi and Sachdev in the book *Microsoft Dynamics NAV Administration*, "First is a seamless connectivity and integration among various technologies, embedding various pivotal points of personal productivity applications into process systems such as accounting applications or warehouse systems and vice versa. The second aspect is empowering people by giving them the right tools and information they need and making tasks simpler by removing unnecessary and overwhelming information they never use." To have effective business the ERP system should be structured well. In Dynamics NAV, this is achieved by providing a RoleTailored experience to users.

#### 2.4.1 NAV

In this thesis, we have developed a learning environment for the ERP Course-Microsoft Dynamics NAV. Dynamics NAV customizes different roles in the organization. The user role is structured well to perform daily tasks. The role center page is customized depending on the importance of each role. It gives insight into different functional areas. The access is restricted depending on the role of the employee in the company. As mentioned in the book *Implementing Microsoft Dynamics NAV 2013* (Laura et al. 2013) the following are the departments available in NAV:

- Financial Management: Under the finances category we can view functionalities such as accounting, G/L budgets, account schedules, financial reporting, cash management, receivables and payables, fixed assets, VAT reporting, intercompany transactions, cost accounting, consolidation, multicurrency, and intrastat.
- Sales & Marketing: Functionality includes customers, order processing, pricing, contacts, marketing campaigns.
- Purchase: Functionality includes vendors, order processing, approvals, planning, costing, and other such area.
- Warehouse: Under the warehouse area we can view the inventory, shipping and receiving, locations, picking, and assembly.
- Manufacturing: The manufacturing area includes product design, capacities, planning, execution, costing, subcontracting.
- Job: Within the job area you can create projects, phases and tasks, planning, time sheets, work in process.
- Resource Planning: This area includes resources, capacity.
- Service: Within the service area you can manage service items, contract management, order processing, planning & dispatching, service tasks.
- Human Resources: It allows to manage employees, absences.

Dynamics NAV can be used on different platforms such desktop, Web, SharePoint client, or an external application that connects to Dynamics NAV via the Web Services.

### 3 Methodologies

To create and implement a functional learning environment we need to have both technical and organizational skills. In order to accomplish this project, we have followed different methodologies. For best communication and implementation of the whole project we have followed Scrum an Agile methodology. To represent the timelines and important activities in the project, project planner has been used as well. During the implementation phase of the project the concepts of work based structure (WBS) has been developed.

#### 3.1 Agile and Scrum

In order to avoid insufficient communication, we have preferred to achieve best results by following the principles of Agile.

Agile is a combined form of practices which increase the coordination, communication, quality and flexibility. It is considered as one of common-sense approaches for applying the limited resources of a company to deliver low risk, high business-value software solutions. There are many strategies under the umbrella of agile methodology such as Scrum, the Dynamic Systems Development Method (DSDM), Feature Driven Development (FDD), the Agile Unified Process (AUP) and Lean Development

Scrum is an iterative project management methodology that is commonly used for project-based work. It provides a plan to identify and prioritize work. Each task of the project which could be worked in a time period of two-four weeks are considered and expected to be completed during the specified duration. This duration with a fixed time period is called as Sprint. The main success of Scrum is based on two activities as a part of each sprint:

- The sprint planning meeting is conducted in the initial phase of the project and all the key players are mainly involved in this process. Important tasks are mainly identified and discussed by the client.
- The sprint review is conducted at the end of each sprint; this summarizes the whole project and steps taken to complete it.

In this methodology, the team is encouraged for frequent interactions. Daily stand-up meetings are steered for a very quick session every day or every week to quickly review work and address any issues. In the whole process the stakeholders are updated by different dashboards such as Executive dashboard, Product backlog, Sprint backlog.

### 3.2 Communication Management

Communication management in this project has been based on the principles of Agile. Notebook is one of the very efficient feature of SharePoint, during the project this feature has been used as a platform to maintain internal communication. Team members have written their individual notes, important meetings and upcoming tasks in the Notebook. Notebook contains two important sections, Memos and Internal memos. Memos are used by both client and team where minutes of meeting has been updated accordingly. Internal memos are shared among the team members and it is used to divide the tasks and responsibilities.

Apart from the notebook we have also used the following features available in SharePoint:

- Taskbar: used for tracking important deadline, meeting agenda within the group and meetings with our client.
- Documents: Relevant documents, links and other useful materials that is beneficial for team has been saved in this section.

Throughout the whole processes team members have worked together or individually. We also communicated through video calls and another social media. Weekly sprints with the client facilitated for the timely closure of the project. Apart from the weekly meetings, timely exchange of emails was also part of the communication process. During these meetings group members had the possibility to clarify their doubts, ask questions and set objectives regarding the project.

We have considered communication as one of the key factors in this project. This helped us to enhance good coordination with the client and team members.

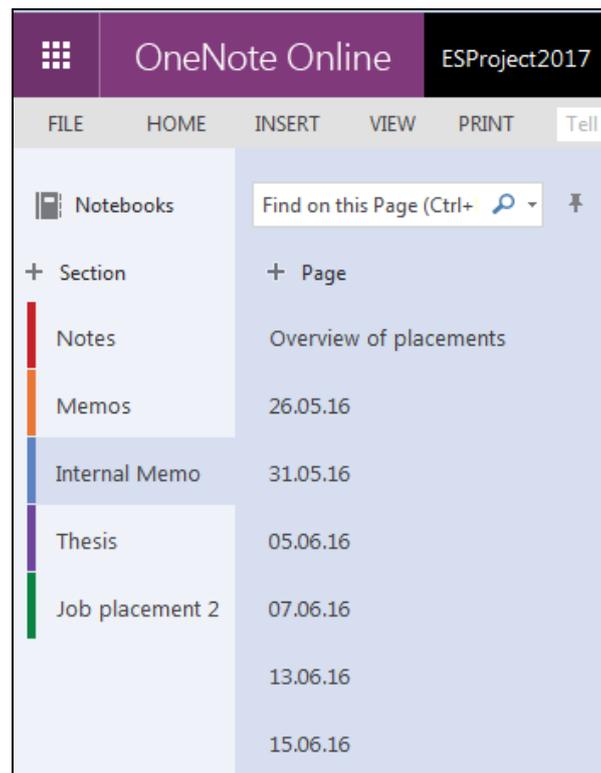


Figure 2: SharePoint section used for communication.

### 3.3 Work Break down Structure (WBS)

The entire process has been divided into small units and each unit is handled under each sprint session. WBS tool has been used to divide and arrange tasks involved in this project.

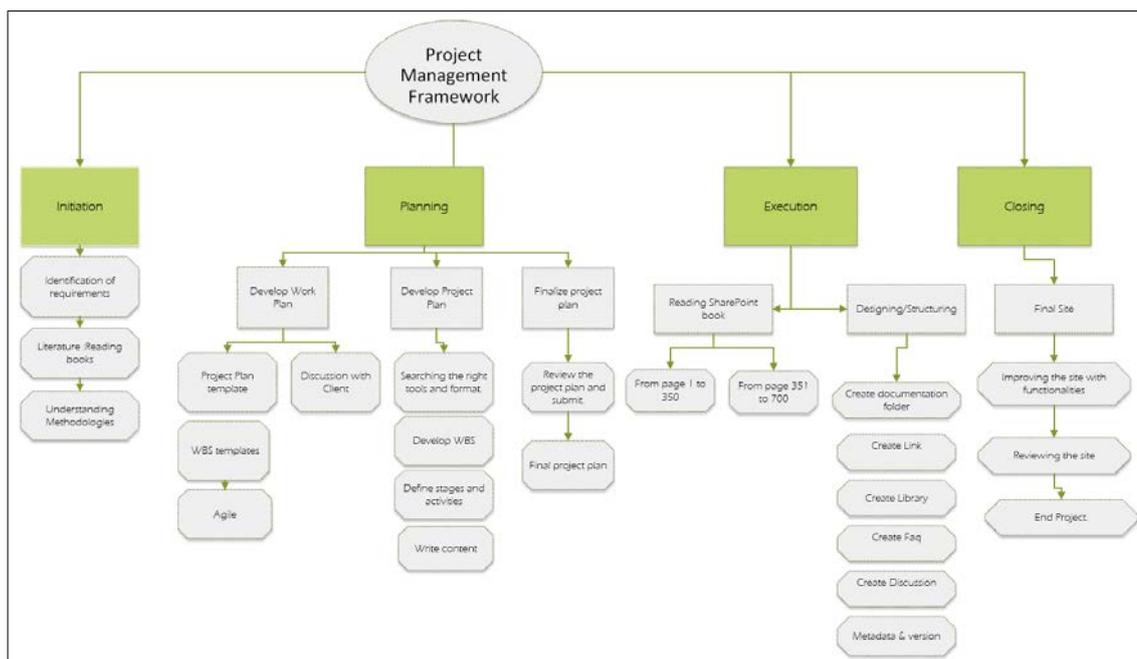


Figure 3: WBS Project management

A work breakdown structure (WBS) is a tool used to realistically display the tasks of the project in a more organized pattern. This is similar to a project planner, but here individual tasks are mentioned irrespective of the time line. There are no limitations to the number of levels in a WBS, but recommend would be not more than five or six levels as it would be getting into minute details. In the WBS structure, the first level is considered as the Goal of the project. The next level holds the major milestones of the project. The succeeding levels is further divided into tasks or groups of tasks. The milestones are defined in the scope statement, and the individual tasks in the task identification process. A work package is the lowest level of a WBS. At this level assignments, estimates, and resources are defined. Irrespective of the number of levels the last level would be a work package. Work packages include individual tasks, milestones, or subprojects. This helps to be more focused on the project to even have an idea about time, resources and costs. This concept is extensively used not only in the creation of learning environment but also in carrying on the whole project. To create the work break down structure we have used the Visio software tool (Lewis 2007).

#### 3.4 Project Planner.

To depict different tasks in details, being aware of the time frame and assign roles and responsibility the Project Planner tool has been used.

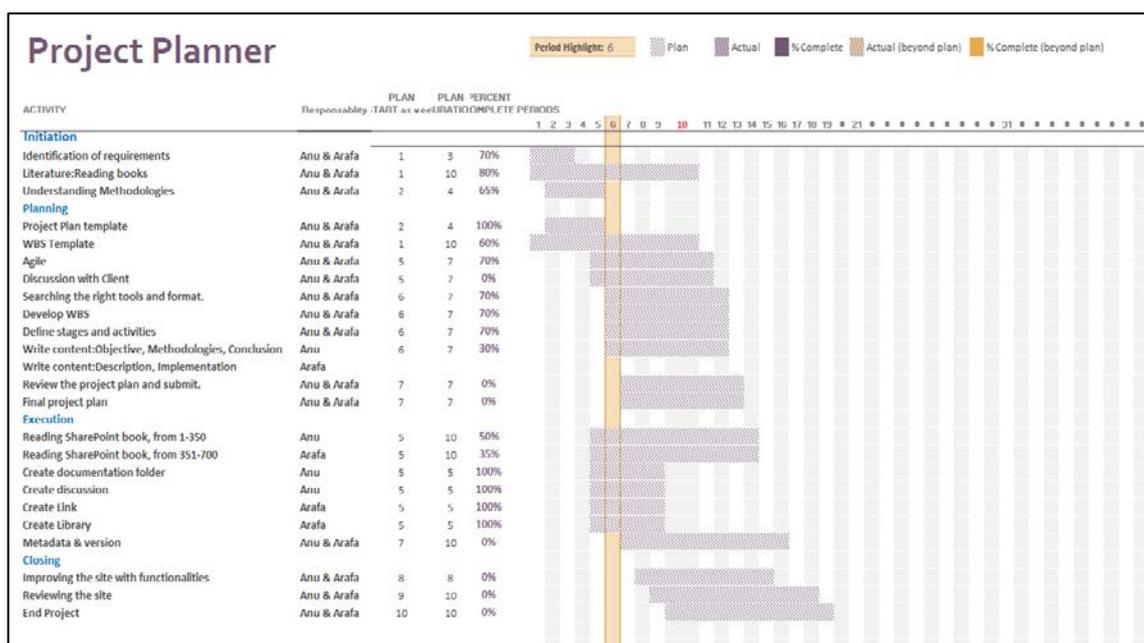


Figure 4: Project planner usage

### 3.5 Systematic Test and Evaluation Process

Systematic Test and Evaluation Process (STEP), is one of the methodology that enables companies and organizations to improve their software quality in great extent. Some of the major elements of STEP are analysis, review and testing. STEP methodology mostly focuses on testing, as it is the most intricate of the three, but as a key of success it coordinates all these processes along with detecting the defects of a deployment. During the testing phase, it is also important to determine the risks, setting objective, requirements, execution and maintenance. Before the test phase, a deep understanding and analyzing the process is very important (Rick et al. 2002).

The entire project is divided into levels, each level is considered as one testing phase and each level consist of three phases:

- Planning: A detailed plan is made with selected strategies and approaches.
- Acquire: Implement the plans and design.
- Measure: Execute the test and evaluate the testing process.

Each of these phases are further broken into activities which again are divided into tasks. Small projects, might consist of just one or two levels of testing whereas complex projects, might have more levels. Since our project is a simple project, we have limited to make only one level. Timing and sequence of tasks to be performed are also one of the great practices of this methodology. Work product such as documentation, data and support software along

with the different roles in each level can be also specified. Some common roles that can be included are Manager, Analyst, Technician and reviewer. The STEP methodology does not necessarily require that these roles must be filled by different individuals, in fact in small projects, it's possible that one person may just work and fulfill all these roles (Rick et al. 2002).

The STEP methodology is not tool dependent, neither depends on a specific organization or groups. Even though all the requirements and design in a project are not specified, this methodology can still be used to simplify software's requirements and design. This methodology differs from others, as the testing phase occur along with the development of a product and not after the development.

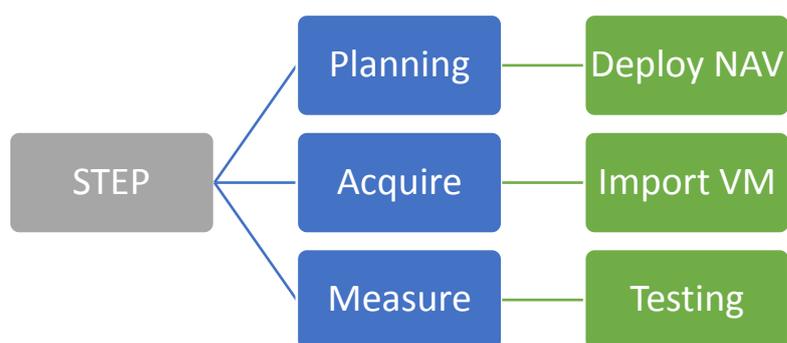


Figure 5: Applying STEP methodology

#### 4 Implementation

In this phase, we have focused in installing all the components required for a functional NAV environment. Implementation phase has been mainly divided into three main parts: Installation, Execution and Documentation. The entire structure is based on the concepts of work break down structure where only the Execution phase has been conducted by following the standard of STEP methodology.

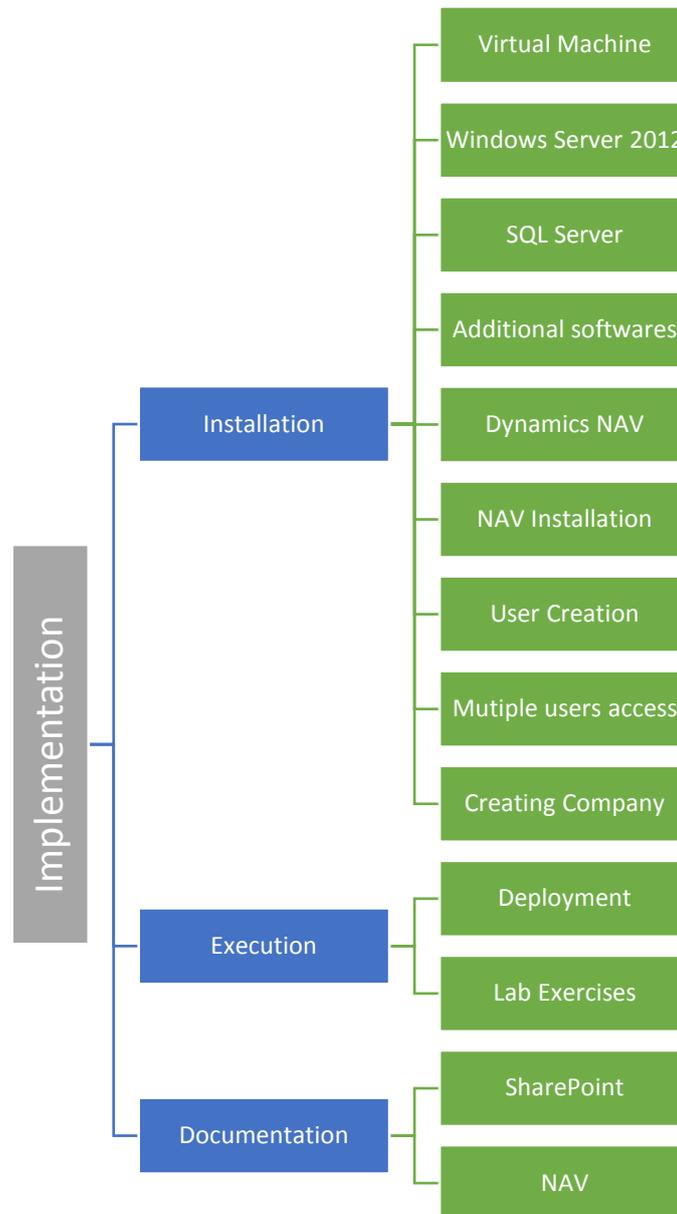


Figure 6: Implementation of NAV

#### 4.1 Installation

This part mainly consists of different software that have been used in the project. The below mentioned table is a summary of the specifications:

## REQUIRED SOFTWARE

HOST OPERATING SYSTEM	Windows 10 Educational
VIRTUAL MACHINE	Hyper-V Manager
GUEST OPERATING SYSTEM	Windows Server 2012 R2
STORAGE	RAM: 4096MB Virtual hard disk size:127GB
SUPPORTED BROWSERS	Internet Explorer
SQL SERVER	SQL Business Intelligent 2014
ADDITIONAL SOFTWARE	Dynamic NAV 2016, .NET Framework 3.5 Service Pack1, Visual Studio 2012 Premium

Table 1: Software requirement

## 4.1.1 Virtual Machine (VM)

- Hyper V

Virtual machine is a software that resembles any regular computer, it allows us to use other operating system and many other applications running all in one machine. When we run a virtual machine from our physical computer, the computer is named as a Host machine while the created virtual hardware becomes the Guest machine. It is possible to use several VM in one host machine depending on the availability of memory. There are many available virtual machines, some of those are Virtual Box, VMware Player and so on. Since we are working in Windows 10 Education, the default integrated VM is Hyper-V (Zhelezko 2014).

- Assign Memory

While creating a virtual machine, it is very important to assign the memory to it (Aidan 2015). Traditionally the amount that has always been given to virtual machine is 1GB which is 1024MB. In this case, since we are installing many components, we required more memory hence we used 4GB of RAM, wherein the host machine's total RAM is 12 GB.

- Connect to a network

Another important considered aspect, is the connection between the virtual machine to an existing network. In order to avoid any hassles while downloading the components from Internet we have connected the VM directly to an external network, this procedure will help for transaction of files, software and applications (Kets Tech 2016).

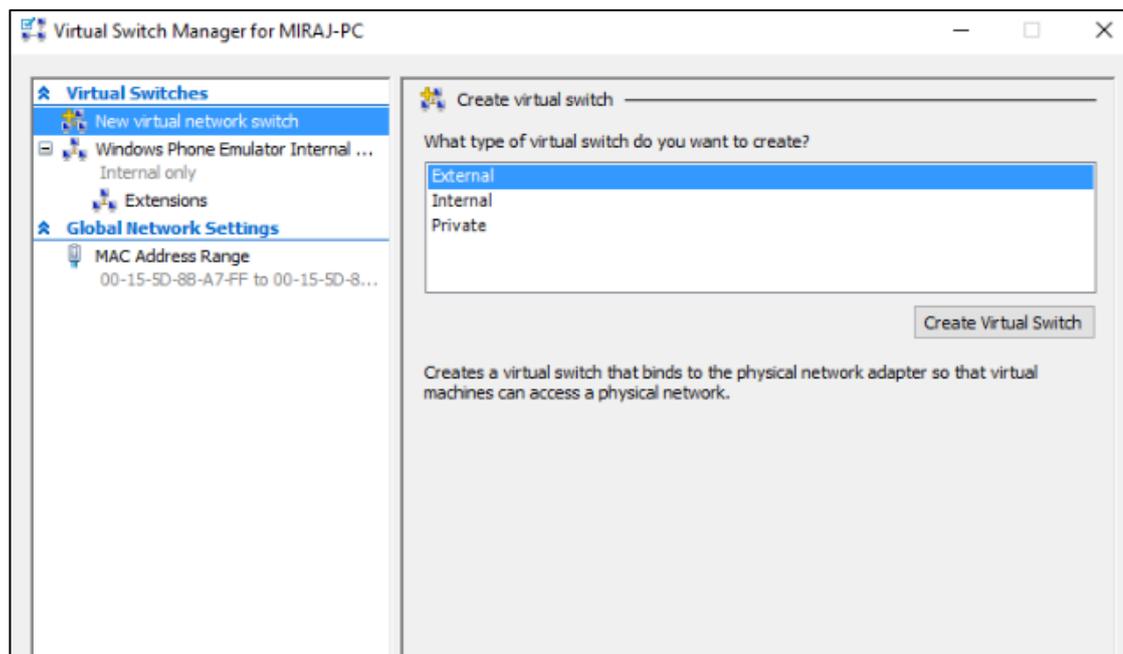


Figure 7: Connection with an external switch

#### 4.1.2 Windows Server 2012 R2

Windows Server 2012 is an Operating system that includes powerful features and applications. The server has a wide range of technologies over networking area, storage, virtualization, both public and private cloud computing. With the help of server 2012 edition, businesses are able to expand their operation at low costs. According to the guide Introducing Windows Server 2012 R2 offered by Microsoft, following are some of the enhancement done in Windows Server 2012:

- Hyper-V- an increase of scalability, storage migration and an improvement of Dynamic memory are some of the additional features.
- Storage- Several data can be stored without compromising the integrity. File and Storage Serviced role has been added in the Server Manager.
- Active Directory- New domain services such as AD DS, AD FS, and AD LDS can be deployed in Server Manager which allows organizations to manage users in more secure and simple way.

In our VM we have used Windows Server 2012 R2, the installation process of it, is very simple. Although it is possible to install the Operating System (OS) after the completion of VM, in this case we have installed during the process of creating the VM.

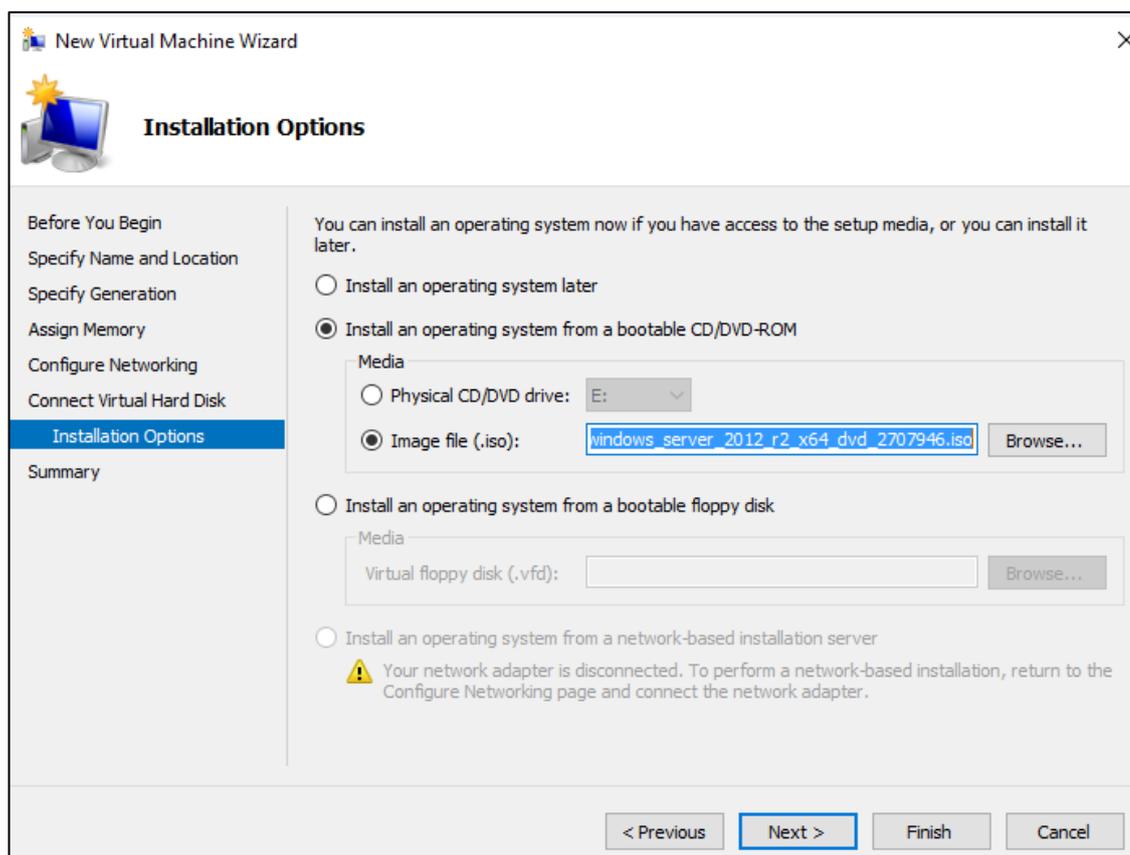


Figure 8: Selecting the .ISO file for installing OS

Once Windows Server 2012 has successfully installed it is recommended to change the name of the computer, the name of the computer will work also as a domain name. The name given to the guest machine by the system are sometime difficult to remember, moreover in this project we will need to use the name of the computer very often. In our project, we have given a test name, such as "NAV016"

#### 4.1.3 SQL Server

SQL Server has always been one of the finest invention developed by Microsoft. SQL Server 2014 edition, comes with the enhancement of some of the existing technology. Organizations all over the world seek for simple and efficient technology that can be adaptable over the time. As there are trending businesses, to with stand against the demand, SQL Server delivers critical-performance application yet maintaining security, scalability and availability of the data. Furthermore, the new Hybrid-cloud gives many innovative solutions for database applications. Following are the enhance features of SQL Server 2014 edition (Ross et al. 2014):

- Availability- includes a disaster-recovery feature, in case of failure of databases over a single unit. In order to recover data, the maximum number of secondary replicas can be extended up to 8. Moreover, these replicas can be set as read-only operations.

- Security- concern on protecting and backup data. SQL Server 2014 supports backup in Windows Azure and also through URLs. Moreover, data can now be secured by using an encryption algorithm.
- Scalability- improve performance and workloads. To increase transaction speed OLTP databases can now fit into memory. In order to scale the storage, frequently used data has been placed into the fastest tier whereas less utilized data are placed in the lower tier. Additionally, deployment for cloud has been enhanced through Sysprep functionality.
- Processing- on redefined engineering security, separation of duty, transparent data encryption, Windows Server Core Support are some of the enhancements done to secure more SQL Server and databases.

SQL Server comes with three main editions: Enterprise, Standard and Business Intelligent. Microsoft Dynamics NAV 2016 does include SQL Server i.e., SQL Server Express edition. However, in this project we have used the Business Intelligent version. This edition is focused on self- service proficiencies as well as corporate business intelligent capabilities such as PowerPivot and Power view (Ross et al. 2014).

#### 4.1.4 Additional software

- .NET

The .NET Framework is a technology that supports building and running the applications and XML Web services. The .NET Framework is designed to provide a consistent object-oriented programming environment. It is immaterial if the object code is stored and executed locally or executed remotely (Kevin 2013).

.NET Framework 3.5 Service Pack1, is one of the additional software we installed in our virtual system. The easiest way to download the package is to go on Server Manager and add a new roles and features, these steps are executed during the SQL Server installation.

- Visual Studio

Another important application we used in our project is the Visual Studio Blend 2012. Visual Studio is one of the most common and used integrated development environment (IDE) that gathers many features for web services (Visual Studio 2016). In this application, only Commands prompt tools have been used. The available version of Visual Studio in DreamSpark is the Premium one, which also include the Tools Commands prompt X64 application.

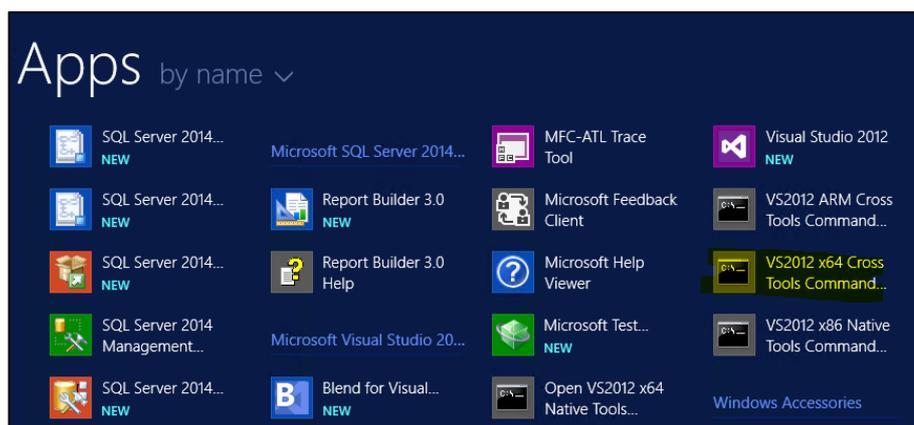


Figure 9: Visual Studio Tool Command Prompt

#### 4.1.5 Dynamics NAV

Microsoft Dynamics NAV 2016 architecture includes three fundamental components and hence called as Three-Tier Architecture. These components are: Client tier (RoleTailored client), Server tier (NAV Server) and data tier (SQL Server), apart from these there are also other components such as, Help Server, Microsoft Administrator tools, Microsoft Office Outlook Add-In etc. (Microsoft 2016).

##### Server Tier:

Microsoft Dynamics NAV Server can be installed individually by selecting the Server option in the NAV Setup, or it can be chosen from Custom installation.

The Server tier is based on .NET application, which manages the communication between NAV clients and SQL Server. The communication protocol that has been used is Windows Communication Framework (WCF). The Server can execute multiple user's requests without any security issues. In fact, the interface created with ADO.NET, improves the security and scalability of the software. A single connection between the SQL Server and clients will be enough to manage multiple client's connections. Additionally, NAV Server takes care of all the business processes that are being proceed in Role Tailored Client (Microsoft Dynamics NAV Server 2016).

Server Instance is an application, is used to manage the communication between the NAV Server and SQL Server. NAV Server can run many instances; multiple instances can be connected into the same database. While installing NAV, DynamicsNAV90-a default instance is already created.

Services that runs in the NAV Server are Client Services, OData web services, SOAP web services and NAS Services along with their respective default ports 7046, 7047, 7048, 7045.

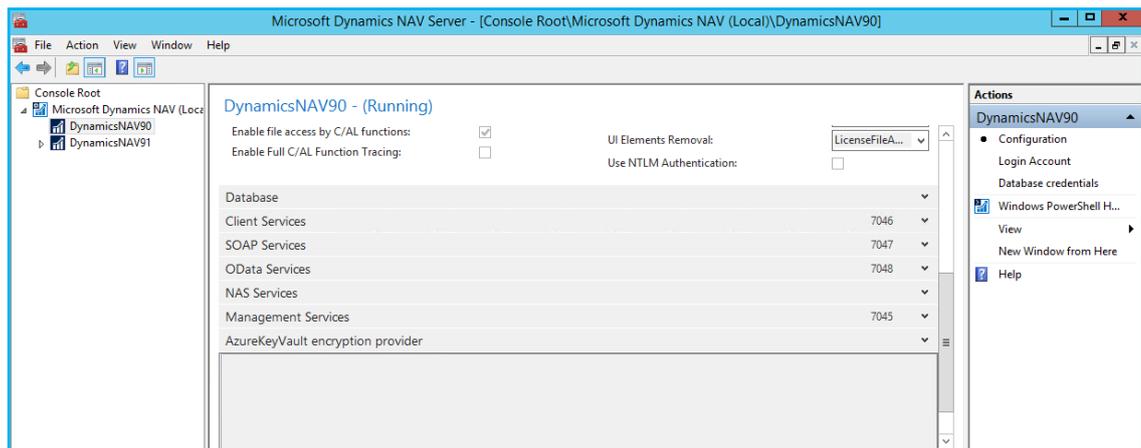


Figure 10: Microsoft Dynamics NAV Server

NAV Server can be managed by installing Server Administration Tool or from NAV Windows PowerShell API.

#### Client Tier:

The Client tier provides the interface to the NAV users. Microsoft Dynamics NAV have many types of clients, such as RoleTailored client, NAV Web Client and SharePoint client. These components interact with the database through the NAV Server (Client Types 2016).

- The RoleTailored client for Windows is a Windows form based client designed for developers, administrators and Super users. In the RoleTailored interface it is possible to create users, assign them to a specific role and manage data. Users assigned to a specific role will be able to operate in a specific section only. The RoleTailored client looks different when compared to Super User or a Basic user.
- NAV Web Client enables to use NAV from the web browser. It resembles the same interface as RoleTailored client for Windows with the difference that it is web based and not windows based.

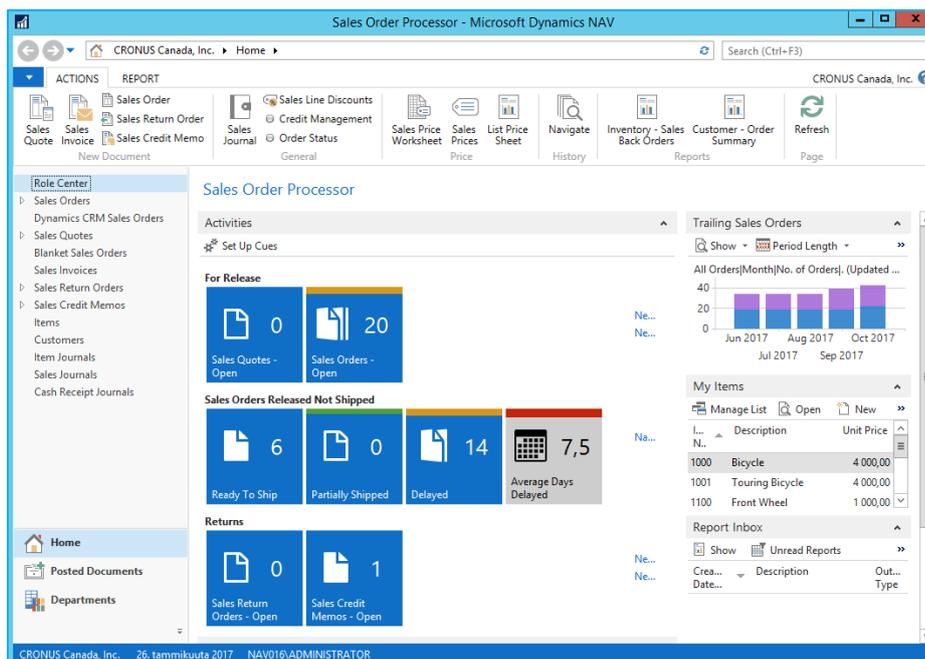


Figure 11: Microsoft Dynamics Role Tailored Client

#### Data Tier:

This tier basically consists of the SQL Server database which contains the Microsoft Dynamics NAV interacts and the Dynamics NAV database. By default, while setting up NAV the database's parameters are already inserted:

SQL Database name: Demo Database NAV (9-0)

SQL Server: the name of the computer where NAV is being installed-

SQL Server Instances: NAVDB

As it is not recommended to use in production environment the SQL Server Express edition, in our project we have used SQL Server 2014 Business Intelligent (BI) version, the above mentioned default parameters are adjusted according the settings.

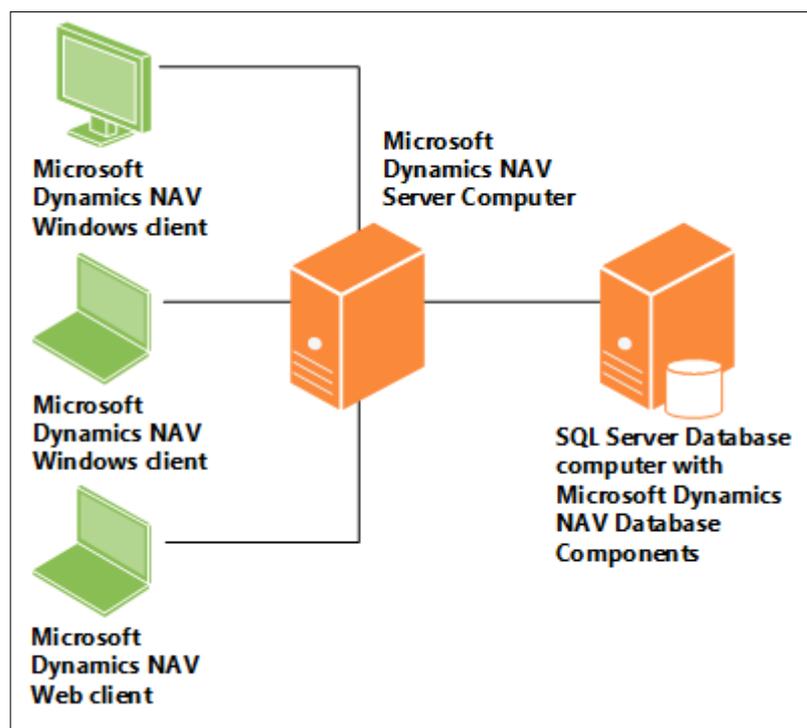


Figure 12: Three Tier architecture (Microsoft 2016)

#### 4.1.6 NAV Installation

Microsoft Dynamics NAV 2016 set up, starts by deciding the arrangement of its components. The Three-Tier Architecture can be deployed either by using only one machine, by using two different computers or by setting up all three components in three different computers. In our project, we have used the traditional setup, which is installing all components in one single virtual environment. Once we run the NAV, we need to choose among the following predefined options to install: Demo, Client, Server, Developer and Custom (Microsoft 2016). The standard procedure is configured in the Demo installation, however, we have used the Custom installation option. The main reason to use Custom installation is because, we are using the SQL Server 2014 BI instead of the predefined SQL Server, which is SQL Server 2012 Express edition.

Following are the NAV components which we have selected in our installation procedure:

1. Client
2. Development Environment (C/SIDE)
3. Administration Tool
4. Server
5. Web Server Components
6. Help Server

### *Connection to NAV Server with SQL Data base*

After the successful installation of NAV components we have to ensure the connection of it with the SQL Data base, otherwise the NAV Server will not run.

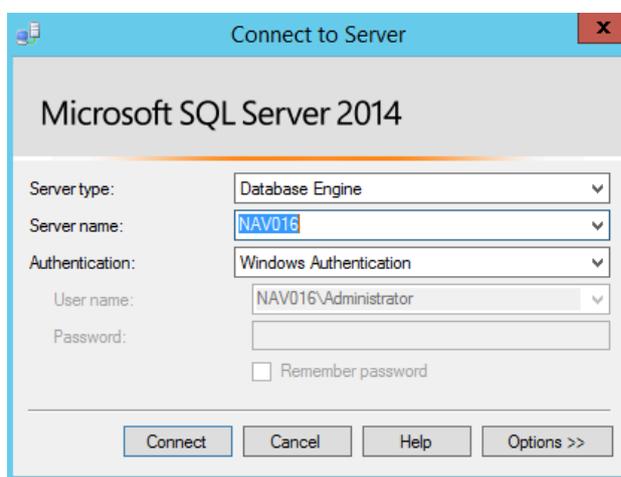


Figure 13: Connecting in SQL server

While accessing to the SQL Server it is very important to enter the right parameters. Server name is same as the domain name, and the authentication mode should be Windows.

### *Giving the permission to Administrator*

The establishment of the connection between NAV Server and SQL Server is not complete unless the Administrator is given rights and access to the Data base. On completion of this process we can run the Microsoft Dynamics NAV Server.

### *Change License*

While installing NAV components a demo license file is automatically uploaded. Due to restrictions and limitation of the demo license we were encouraged to upload a new license given by the client. The license file is uploaded by using Microsoft Dynamics NAV 2016 Development environment. Apart from managing license this feature is also used for managing databases and companies.

### *Role Tailored Client for windows*

After changing the license, we have checked if the Role Tailored client for Windows is functional. By clicking the NAV client icon we have to insert our credential. The default format is as follows:

Localserver: 7046/DynamicsNAV90→

NAV2016:7046/DynamicsNAV90

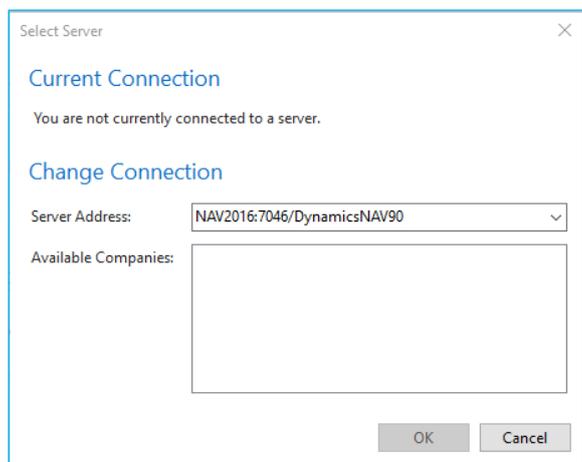


Figure 14: Access in NAV as desktop client.

#### *NAV Web Client*

Microsoft Dynamics NAV Setup can automatically enable IIS and the IIS features that are required for the Microsoft Dynamics NAV Web client. Our installation process includes the usage of web client as well. Access to NAV from web browser could be checked whenever the NAV Server runs properly. By default, the URL to access to NAV Web client is:

`http://localhost:8080/DynamicsNAV90/WebClient` →

`http://nav2016:8080/DynamicsNAV90/Web Client`

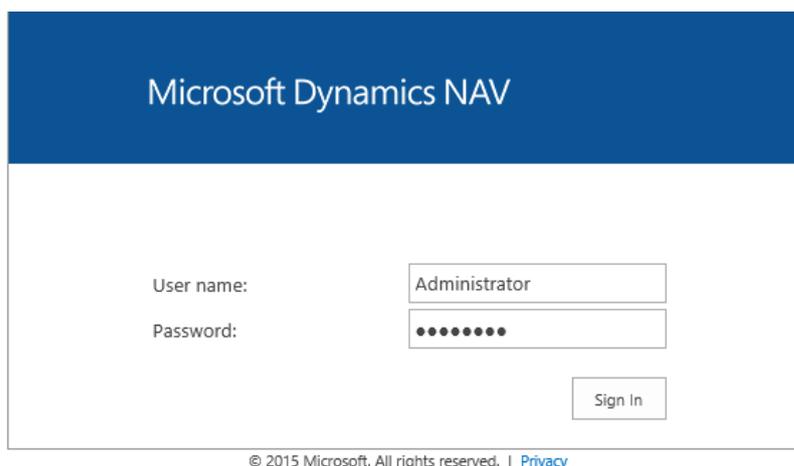


Figure 15: Access in NAV as Web client

At this point since all the components which are SQL Server, NAV Server, NAV desktop client and Web client are fully functional we can just deduce that NAV set up has been done properly.

#### 4.1.7 User Creation

User creation is one of the fundamental objective of this project. There are several ways of creating users in NAV such as Windows, NavUserPassword and Username. In our project, we have figured out two ways of authentications which are Windows and NavUserPassword.

A brief description about these methods are written below.

##### *Windows authentication*

Although this procedure is the easiest, it is not the convenient one. Before the user can access, two steps have to be followed:

- I. A new user needs to be created in the guest machine (windows user).
- II. A new user with the same user name and password (created in windows) need to be created in Role Tailored Client, where the authentication mode should be selected as a Windows.

User created by following this authentication can access NAV from desktop and also from web. The URL to access NAV from Web is: <http://nav016:8080/DynamicsNAV90/Web Client>

##### *NavUserPassword authentication*

In this procedure, we need to follow many steps where some of those might be used only once. However, we need not to create a Windows user and NAV user separately like Windows Authentication process, creating only NAV user would be enough.

One of the requirements of our client was to give easy access to users hence we have concentrated more on the user creation by following the NavUserPassword authentication mode. Although we have implemented both the authentication ways, in this thesis we are going to describe in details only about one authentication procedure, which is NavUserPassword. This method, allows users to access NAV from web browser without the necessity of creating additional Windows user, which makes the entire user creation process very feasible.

Steps involved on creating users by NavUserPassword authentication type, are divided as Creating a new instance and Certificate creation, a brief description of these steps are described as follows:

- 1) We have used the default instance, DynamicsNAV90 for Windows credential, hence we cannot create users with a different authentication method in the same instance. To fulfill our purpose, we have created in the NAV server another instance, DynamicsNAV91 with different port numbers. The assignment of ports are as follows:

Instance name	DynamicsNAV91
Credential type	NavuserPassword
Client Service	7049
Soap Service	7050
NAV Service	7051
OData Service	7052

Table 2: New instance and port number

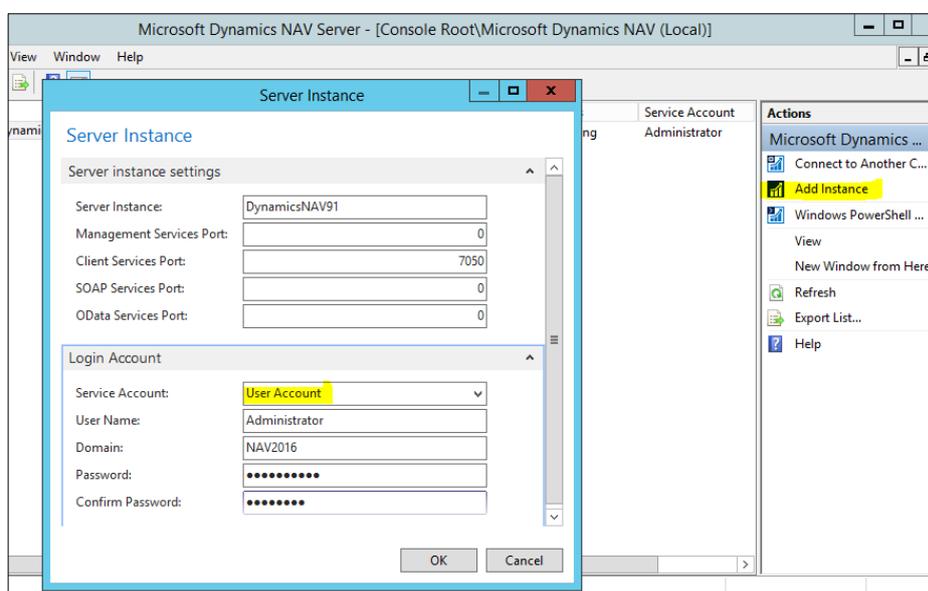


Figure 16: Creating a new server instance

- 2) Once the new instance has been created, it is necessary to activate this authentication mode. The activation procedure can be accomplished by creating certificates. The certificates are created by using Visual StudioX64 prompt commands and Microsoft Management Console (MMC). Certificate created by the system allows us to copy the thumbprint which is eventually replaced in the NAV Server. While setting up the thumbprint in the new instance, the credential type has to be changed in NavUserPassword.

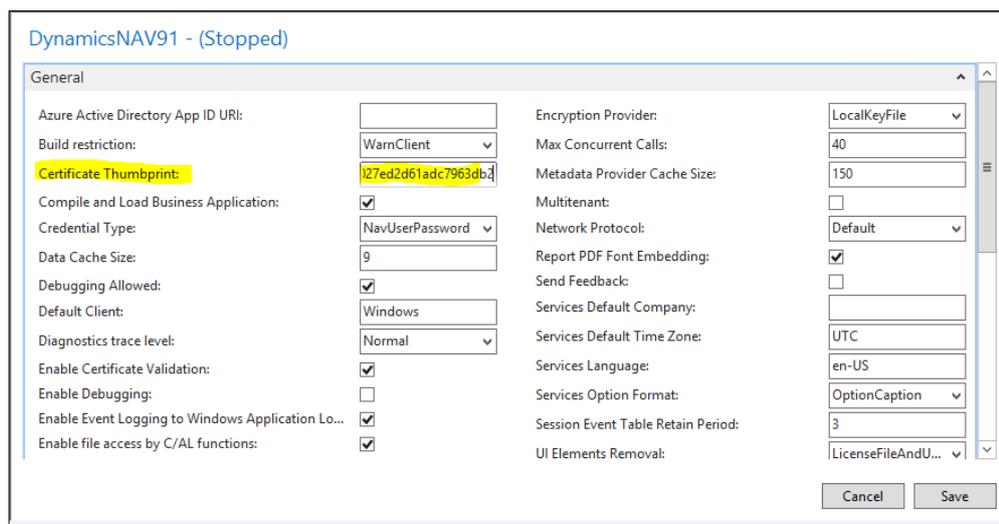


Figure 17: Copy the thumbprint

#### 4.1.8 Multiple users Access

Providing the administrator an easy way to give access to a large number of users were another fundamental prerequisite we needed to fulfill in our project. To accomplish this requirement, we have used PowerShell script.

The installation process of Microsoft Dynamics NAV includes a Windows PowerShell API, which helps us to administer the NAV Server. The scripting codes will be run to read a CVS file hence create multiple users.

In order to create multiple users with NavUserPassword authentication mode, we have to follow these steps:

- 1) Create a CSV file.
- 2) Import the CSV file.
- 3) Run the command in Dynamics NAV 2016 Administration Shell

As states in the B Support website, a CSV file is a comma separated values file, which allows data to be saved in a table structured format, every csv file ends with .csv extension. A csv file can be created with any note file such as Microsoft Excel, Word or even notepad.

We have created a CSV file containing three important entities, user's name, user's password and specific permissions. Dynamics NAV contains different type of permissions sets, (Special Permission Sets 2016) such as:

- BASIC- These users can use the fundamental tables and functions.
- SECURITY- users with this permission can access to table related to security information.

- SUPER- This user is similar to administrator. Only a super user can create further users and set permissions to them.

In our project, we have created some random user names, passwords and set the permissions as BASIC. The file is saved as navUsers.csv

	A	B	C
1	<b>Uname</b>	<b>Password</b>	<b>Permission</b>
2	navUser01	XXXXXXXXXXXX	BASIC
3	navUser02	XXXXXXXXXXXX	BASIC
4	navUser03	XXXXXXXXXXXX	BASIC
5			

Figure 18: Example of CSV file

After creating a CSV file, we have to create another file containing the following piece of codes. The file is saved as importNavUsers.ps1

```

1
2 $csv = import-csv navUsers.csv
3
4 foreach($record in $csv) {
5     $uname = $record.Uname
6     $password = $record.Password
7     $permission = $record.Permission
8
9     New-NAVServerUser DynamicsNAV90 -UserName $uname -Password (ConvertTo-SecureString $password -AsPlainText -Force)
10    New-NAVServerUserPermissionSet DynamicsNAV90 -PermissionSetId $permission -UserName $uname
11
12    Echo "$uname, $password, $permission"
13 }

```

Figure 19: Codes of importnavUsers.ps1

Below is a short description of the codes:

- I. \$csv = import-csv navUsers.csv

This line of commands states to import a file called navUsers.csv

- II. for each(\$record in \$csv) {
  - \$uname = \$record.Uname
  - \$password = \$record.Password
  - \$permission = \$record.Permission

Save all the records in new variables called uname, password and permission.

- III. New-NAVServerUser DynamicsNAV90 -UserName \$uname -Password (ConvertTo-SecureString \$password -AsPlainText -Force)

```
New-NAVServerUserPermissionSet DynamicsNAV90 -PermissionSetId $per-
mission -UserName $uname
```

In the 1<sup>st</sup> line of code we are stating to create a user in a specific NAV Server instance, we created a user name and a password for an individual user.

The 2<sup>nd</sup> line of code is needed to set the permission to a specific user name in a specific server instance.

```
IV. Echo "$uname, $password, $permission"
```

```
This last line allows to show the created users in the shell. }
```

After writing these codes, we will save this files (including the navUsers.csv) in a folder which is placed in the C drive of the virtual machine. From NAV Administrator Shell we run the following commands and the users will be created.

```
.\importNavUsers.ps1
```

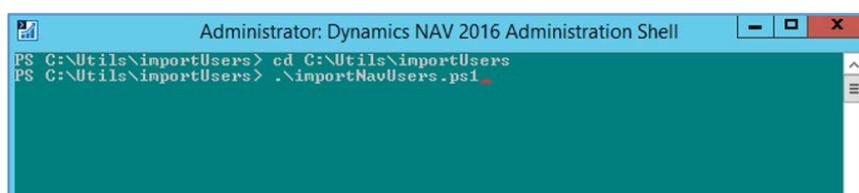


Figure 20: Inserting command on NAV Shell

The users created can now access NAV from web with the following URL:  
<http://nav016:8080/DynamicsNAV91/Web Client>

#### 4.1.9 Create company in NAV

A company can be setup using RapidStart Services in Microsoft Dynamics NAV. RapidStart Services is a tool which helps to reduce the deployment times, enhance the quality of implementation, and improve the productivity by automation and simplifying tasks. We can configure the tables, create questionnaire and collect data from the client in the configuration process. By using the RapidStart Services, the client can configure and migrate existing customer data, to the new company.

In this project, we did not change the setup to the existing companies which are CRONUS Usa, CRONUS Canada and CRONUS Mexico instead we have created some new. In Microsoft Dynamics NAV is also possible to copy the existing company and rename it (How to: Create Companies 2016).

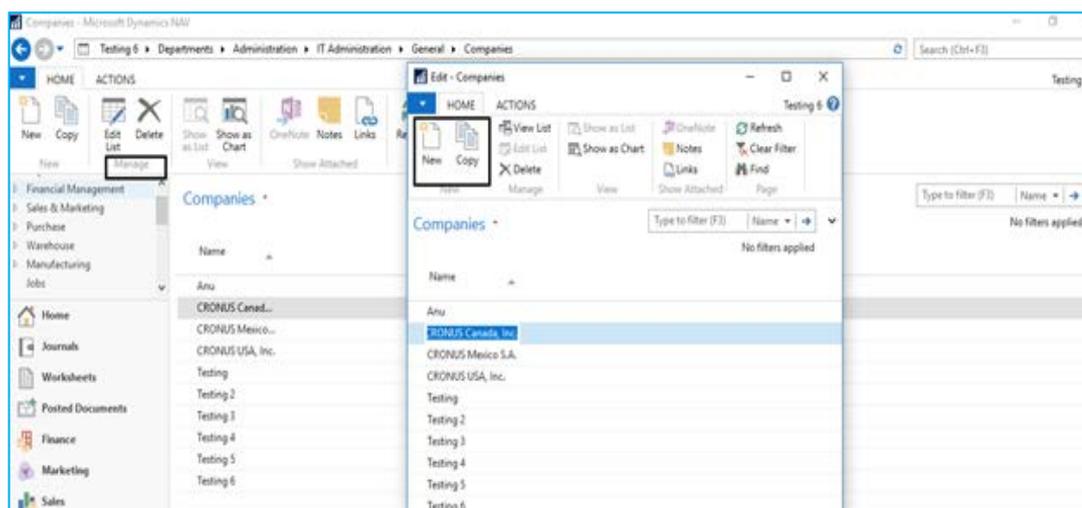


Figure 21: Create a new company

In this project apart using the RapidStart Services to create companies, we have used the PowerShell scripting as well. By using the scripting, we were allowed to assign every single user a unique company. A user with a specific username and password were able to access only to the assigned company. This was another requirement proposed by our client.

## 4.2 Execution

This is the very crucial phase of the implementation. In this phase, we are replicating the entire NAV environment into a live environment and validating the lab exercises.

### 4.2.1 Lab Exercises

Lab Exercises are one of the integral part of this project. For this project, we have validated the documents for a functional NAV. Our supervisor has been given documents of Dynamics NAV 2013, since they were related to the previous version of NAV, in order to use those papers proper checking and updating has to be done hence validating. After the validation, documents will be ready to be used by future students, tutors or whoever wish to learn about Microsoft Dynamics NAV 2016.

Due to time frame restrictions, we have concentrated only on few departments. Mainly validated departments are Trade and Warehouse. Trade department is more centric towards the Sales and Marketing, Purchase in NAV. It mainly concentrates on customers, order processing, pricing, contacts, marketing campaigns, approvals, planning and costing. Warehouse department is more specific to the inventory, shipping and receiving, locations, picking, and assembly.

#### 4.2.2 Deployment

The deployment phase is executed using the concepts of STEP methodology. As mentioned earlier STEP methodology focuses mostly on testing. After many days of trial a successful environment has been set up for future users. The deployment lasts several days since we had to solve many issues, below are some of those:

- The entire NAV environment has been installed in a new computer. This procedure took about one week as every time new errors were visible hence we took time to troubleshoot and solve them.
- After the successful installation, we changed the predefined license to a Master license. Then we created some users. Although the user creation went smoothly we noticed that if any random user changes its profile this effected also to other users as well. To solve this problem, we took another week. Later we solve this matter by PowerShell script, which assigns a specific user to its specific profile.
- Our supervisor at this point wanted to implement NAV in Microsoft Azure, although this was not planned in our project, we could realize that with Azure NAV environment could achieve a better performance. Azure is a very efficient cloud service capable to manage huge amount of data. Currently this innovative feature is managed in Laurea IT service. The idea was to create individual VM for student in the cloud so that every student has their own VM and own NAV incised. This will give students more flexibility in term of operation and discard the dependency of logins, companies, profiles and access.

The work with Azure is still in process so we were not able to write about the final implementation of it. Due to time restriction, our deployment considered end until NAV has been installed, user has been created, license has been changed and web access has been set up successfully.

#### 4.3 Documentation

User manuals have been made for SharePoint site and NAV installation.

The manuals are prepared for this project in such way that it is understood by both sequential and quick information retrieval readers (Andreas 2003). As mentioned in the book Agile Documentation, few important parameters need to be followed for a better documentation:

1. Provided documents should have a useful structure, which help the readers to go through the material and obtain information.

2. Meaningful diagrams help to understand the concepts in an easier pattern.
3. Inclusion of metadata helps the reader to have an idea about the material.

Even though many companies do not highlight the importance of documentation, an effective documentation can add more value to the project. Documentation is necessary for the persons who would work later in the project. Irrelevant of the size of the project, document such as Process, Product, Project, Team, Test and User Documentation may vary.

In this project, we have made a product type documentation, which includes all the papers related to the project. In the user manual information is given step-by-step. While creating documents more focus has to be given to the following points:

- Document's quality, the written document should be easily understood.
- Document's structure, the document has to follow a standard procedure, and should not be written in an ambiguous way.

In our project, documentation consist a very important role, in fact it is one of the important milestones. Though it is a very time consuming process, we have decided to make two different user manuals, SharePoint and NAV.

SharePoint user manual helps the user (student/tutors) to understand the layout and components of the site whereas, the NAV user manuals will help the users (student/tutors) to learn NAV from installation and technical point of view. Both the user manuals consist mainly of screen shots and pictures, rather than texts. We believe that a manual containing more visionary elements will help the reader to understand more. Following diagram reflects some of the contents of each the manuals:

<b>User Manuals</b>	<b>SharePoint</b>	Introduction
		Discussion
		NAV Task
		Notebook
		Books
		Nav
		<b>NAV</b>
		Virtual Machine installation
		Install Windows Server 2012
		Change machine's name
Share documents over Network		
.SQL Server Installation		
NAV installation		
Connection with NAV and SQL		
Chaing License		
Create Users		
Create companies		

Figure 22: Contents of user manuals

## 5 Challenges and recommendation

The following chapter describes about the challenges encountered during the ESLEL project along with some suggestions which can be applied in order to make the learning environment more efficient.

### 5.1 Challenges

ESLEL project has given us an opportunity to enhance our knowledge in the field of Enterprise Systems and in technical field as well, however in this process we have encountered a few challenges. Here are a few of them:

- Irregular functionality of VM- Traditionally the memory given to VM is 1GB, which is insufficient for this project as it has many components. In order to improve the functionality, we have increased the memory.
- License- Initially we worked using the student license, wherein we can only create company name that starts with Cronus. However, once the license has been upgraded we could test many companies with different names.

- SQL Server: We were suggested to install SQL Server BI edition. We had come across challenges to establish the connection between the SQL Server with NAV Server.
- Creating a new database: According to the information from the client we have spent a couple of weeks to create a new database instead of the existing Cronus data base. However, we did not create one as we could use the already existing.
- Web Access: In the previous ERP course, users were able to access NAV as a desktop client, but in this project, we had to give access using the web browser. To accomplish the need, we have used a different authentication mode.
- Creating users: A couple of weeks have been invested in the creation of users. It is a time taking process as it involves many steps such as certificate creation, giving access to multiple users and generate PowerShell script.
- Connecting users with companies: Creation of companies is a simple process, however connecting a specific user to a specific company to operate was challenging.
- Deployment in Azure: According to our client information the deployment had to be conducted in a Cloud service, Azure. However, due to the lack of access to Azure we were unable to implement.

## 5.2 Recommendation

According to Microsoft's web page it is stated that that "Windows Azure as a platform where anything can be done" (Tulloch 2013). Azure is a cloud service that offers small or large businesses to perform their operations. Businesses could use Azure to run servers, store data or even host a site. Azure speed up existing applications in our traditional machine while performance are improved without adding extra costs.

In the manual *Introducing Windows Azure for IT professionals (2013)*, cloud services are categorized into four types:

- Compute services: These services are categorized as Virtual Machines, Web site, cloud and mobile.
- Network services: These services are divided as Virtual and Traffic.
- Data services: Analyzing, reporting, managing data are spread into Data Management, Business Analytics, HDInsight and many other services.
- App services: Integrity, security and availability of apps are provided by Media, Messaging, Notification and other services.

During the deployment of our project we tried to function the NAV environment in Microsoft Azure, however due to time restriction we could not finish it. Because of the immense capability of Azure, it is highly recommended to pursue this implementation of NAV in the cloud platform.

As mentioned above, lab exercises were one of the milestone of ESLEL project, however, only two departments among many have been validated. NAV includes many other departments such as Finance, Purchase, Manufacture, Business Intelligent etc. Checking and validating remaining departments will give more exposure for students and tutors willing to learn about ERP-NAV.

## 6 Conclusion

In this technology age, we as students are encouraging to move from the traditional way of learning to the electronic environment. In this process, we have been encouraged and guided by our experienced mentor Lassi Tissari (Senior lecturer Laurea UAS). We have worked for this project during May, 2016-September, 2016.

We have divided the entire project into small components for feasible implementation. Initially we have worked on improving our skills sets in Information System project management and Dynamics NAV. Secondly, we started to apply our knowledge in the practical environment. We had come across many challenging situations and we have trouble shoot many of the issues. The learning platform is created by using SharePoint in the current Laurea environment. We have made a user-friendly interface to access all the documents related to Dynamics NAV 2016.

Finally, we created a functional Enterprise systems learning environment Laurea. This is a common place not only for a beginner, but also for anyone who would like to expertise.

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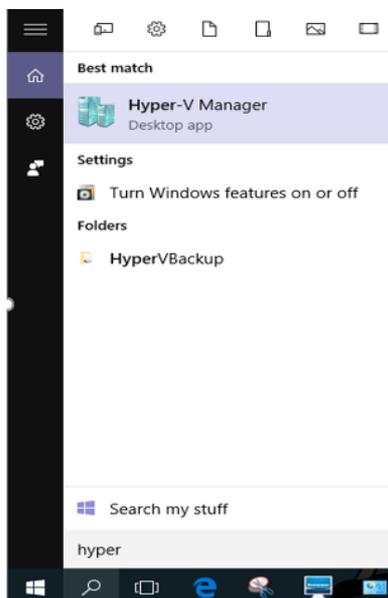
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## Appendix 1: NAV Installation User Manual

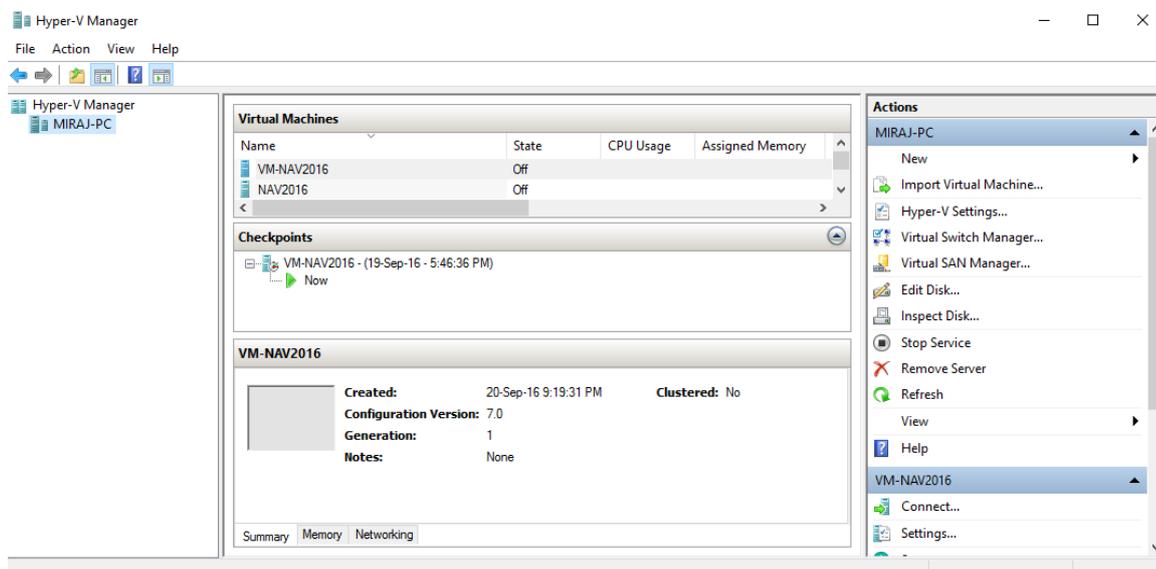
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## Virtual Machine installation

1) We have used Hyper-V Manager is required to create Virtual machine (VM).

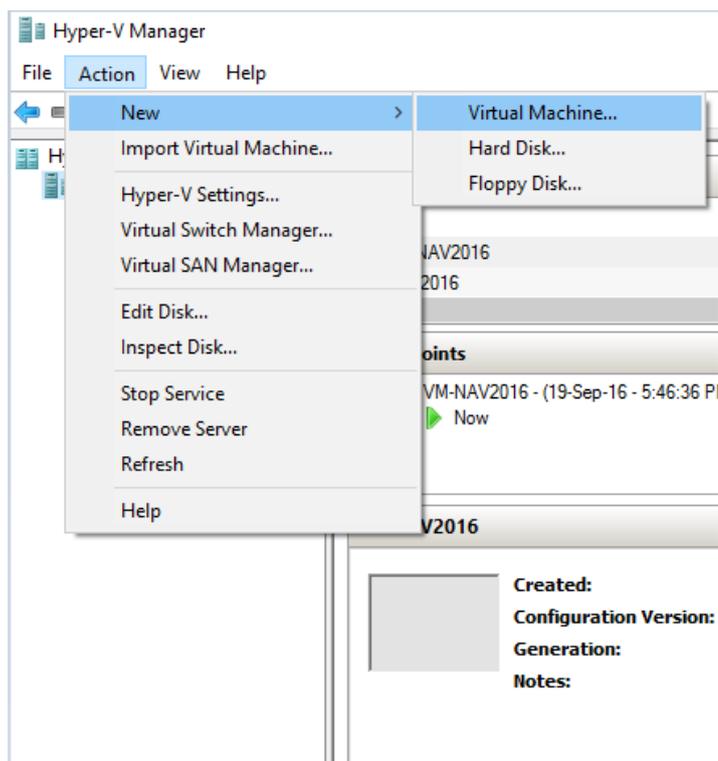


2) This is the overview that you can see after you have opened Hyper V Manager

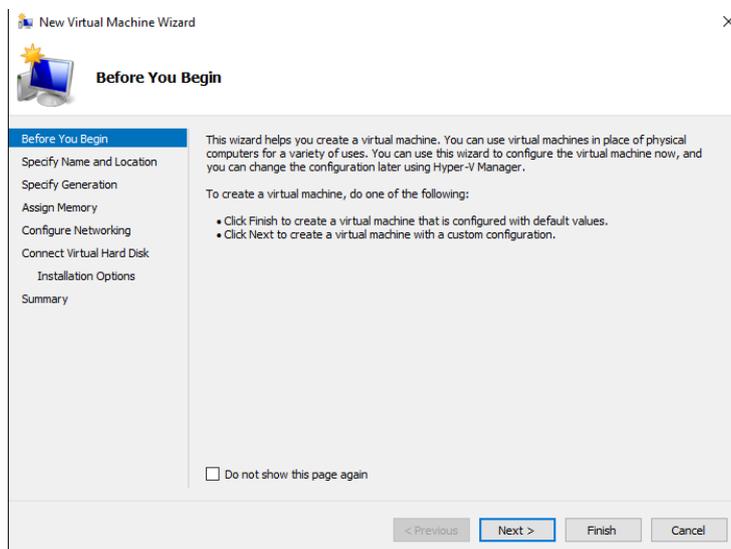


As you can see in this example already two virtual machines have been created.

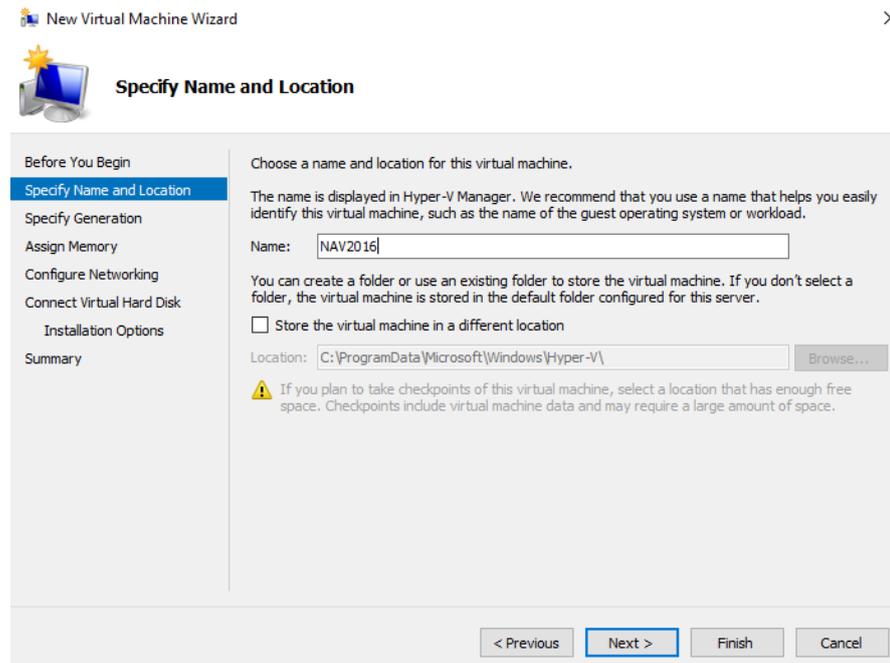
3) Now we will create a new (VM). Go to Action→New→Virtual Machine



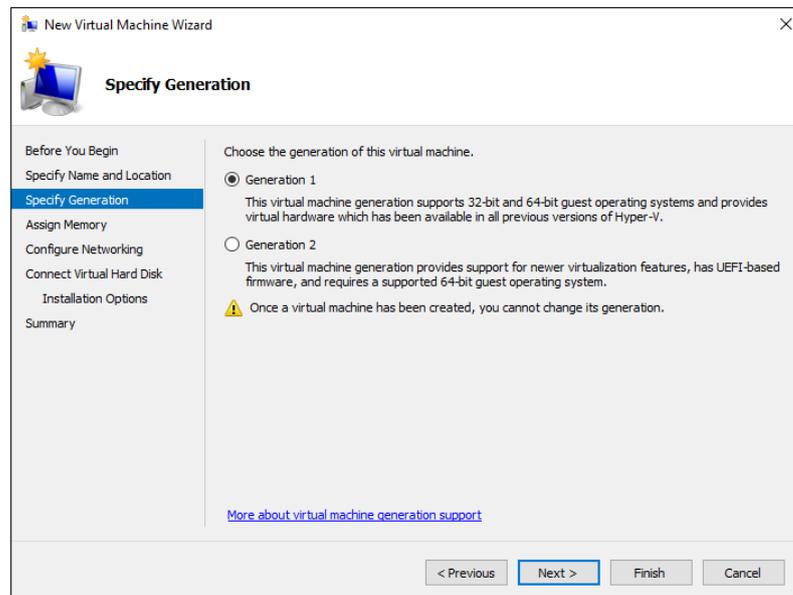
4) Click Next.



5) Choose a name to give to your virtual machine, in this example we have used "NAV2016"  
You can choose to save your virtual machine in any desired location of your computer, other way the virtual machine would be saved in C drive.

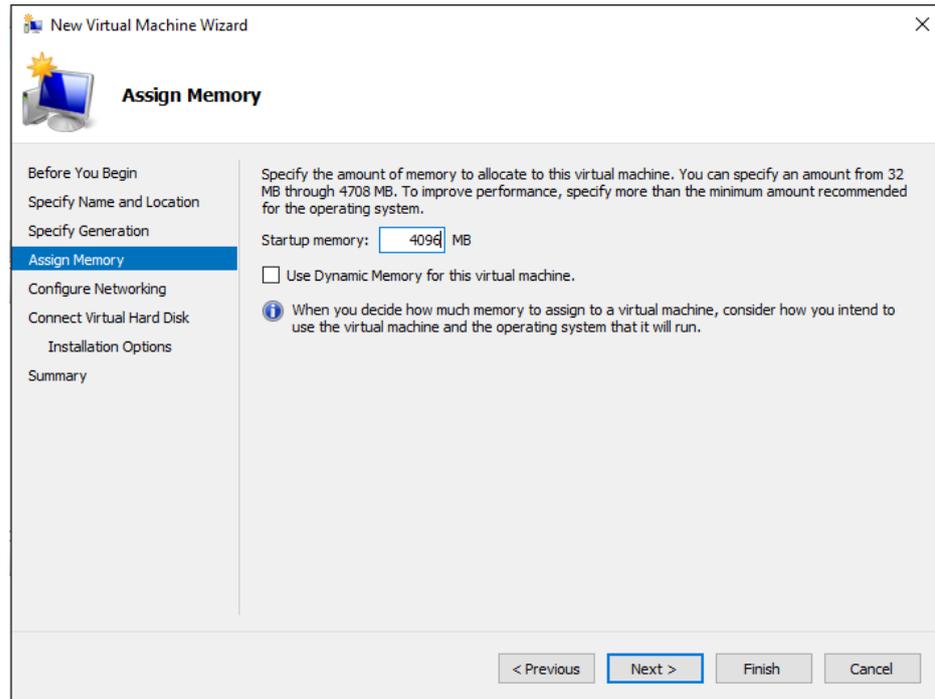


6) Choose Generation1 and click Next

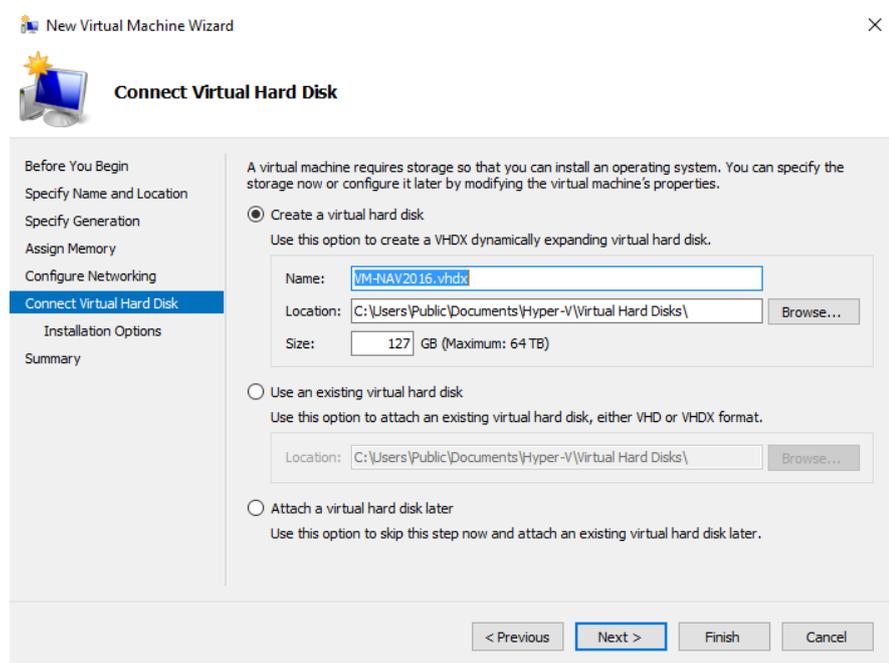


7) Assign memory to your VM, since we have many components to install, I have assigned 4GB.

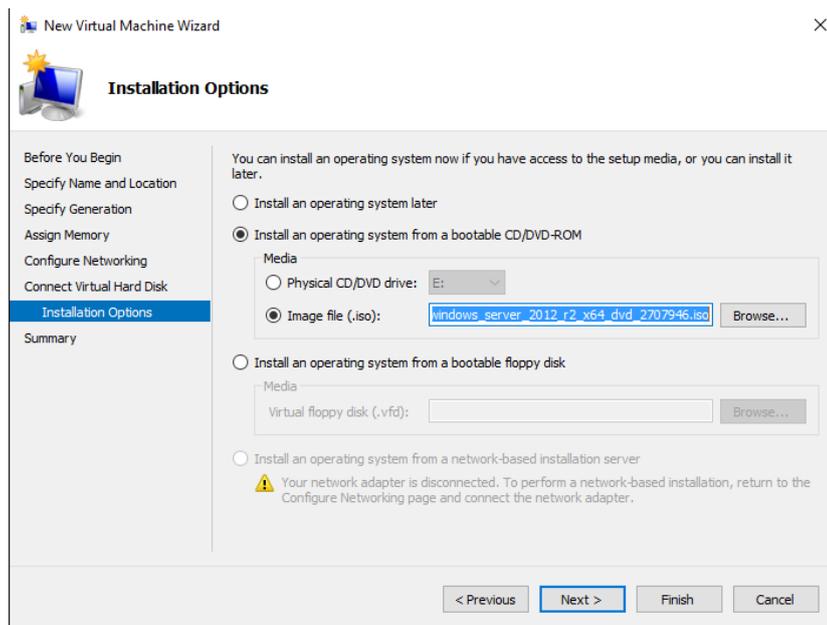
In case you do not have that much memory you can assign 1 GB, at least. In some case, due to small amount of memory, VM can cause some malfunctions. However, it is possible to change memory anytime during the process.



8) Create a hard disk, also here you can choose a specific location to save.



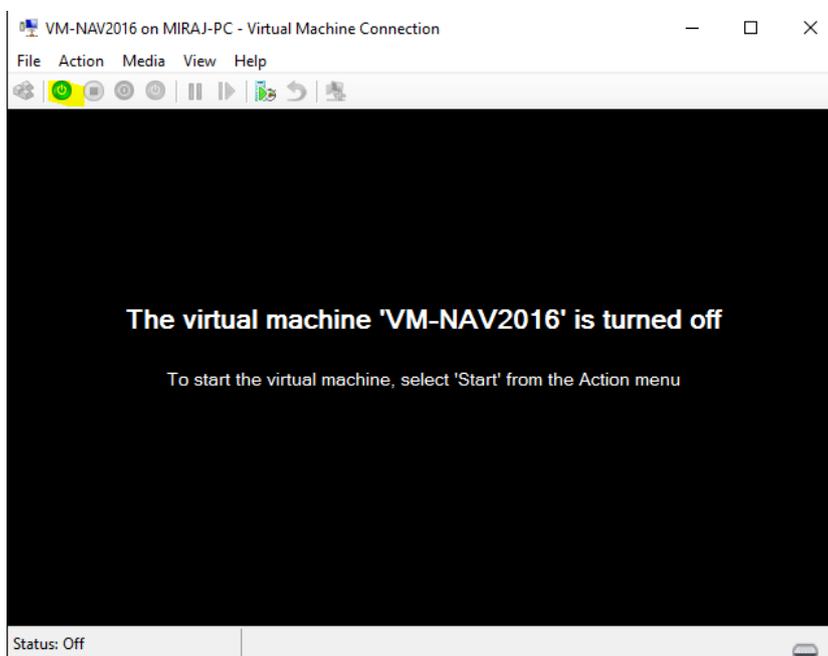
9) We are going to use the Operation System (OS) Windows Server 2012, which I have already preinstalled from Dream Spark and saved on my computer. In this step, I am going to select the path where my OS has been saved, the OS will be installed after the creation of VM.



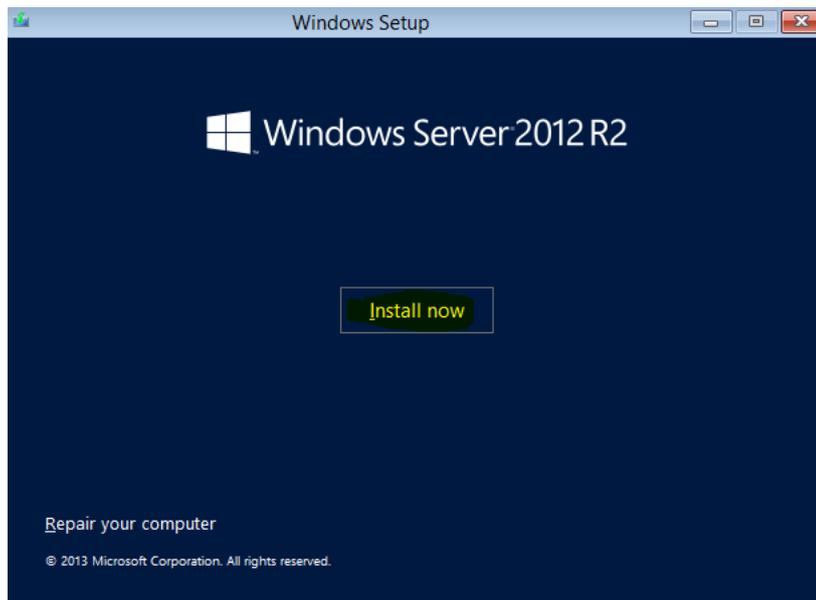
After this phase, you should have completed the installation of your virtual machine.

## Install Windows Server 2012

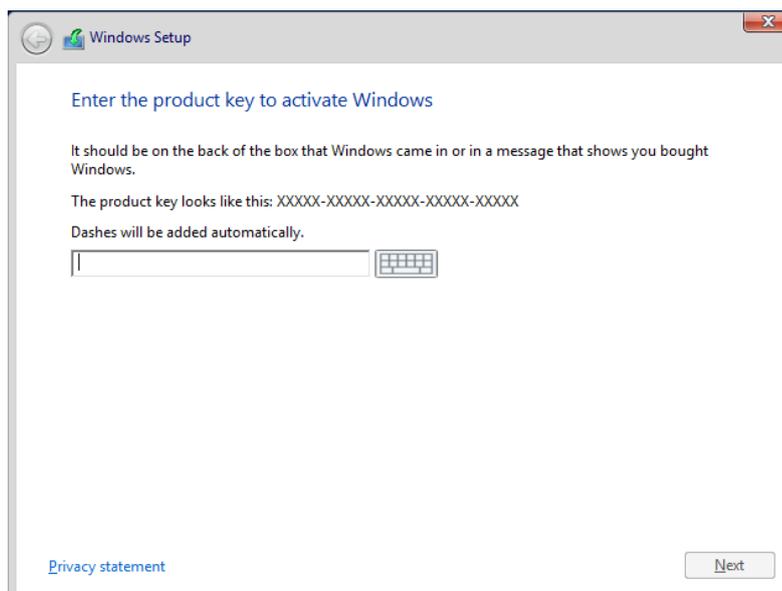
- 1) Turn on your VM.



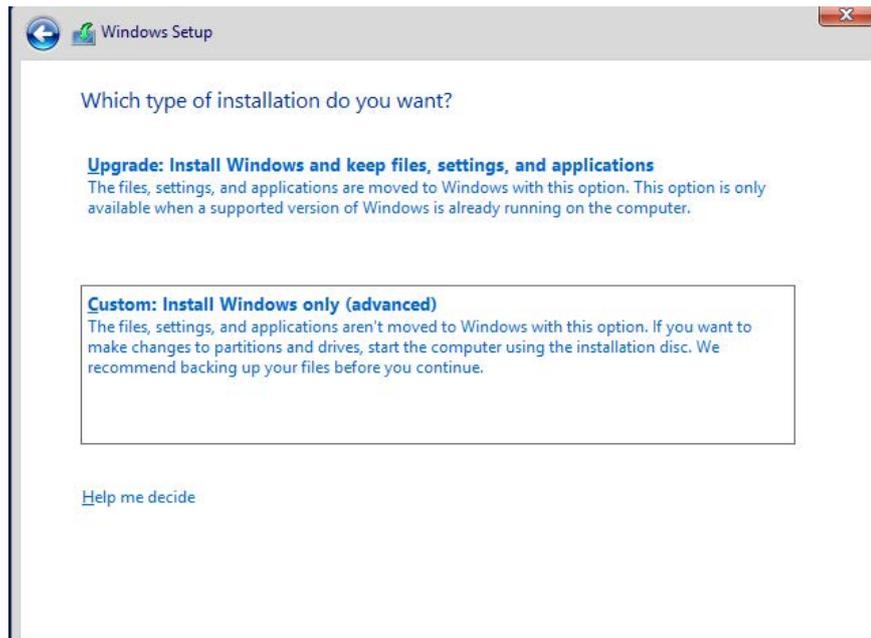
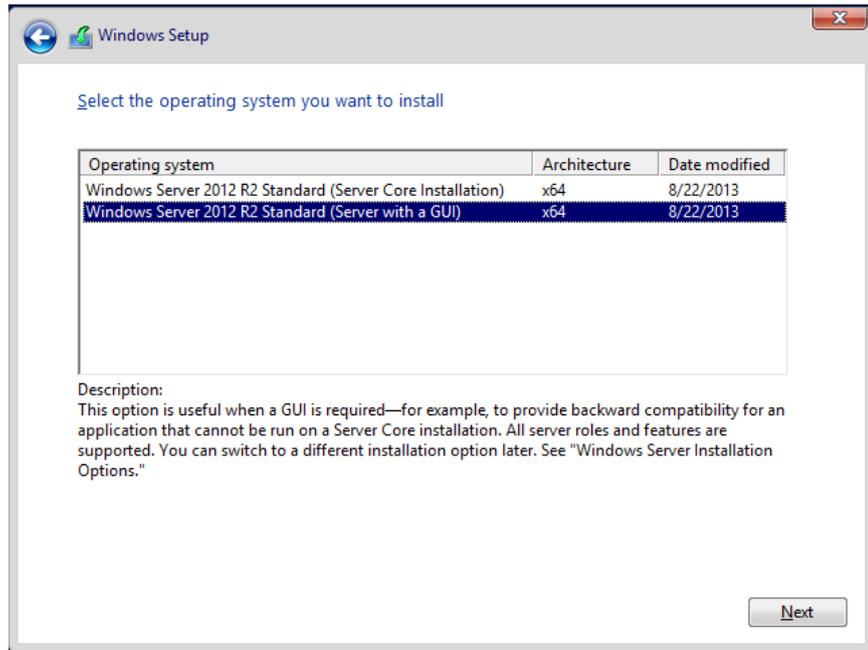
2) At this phase, you have to install Windows Server 2012.

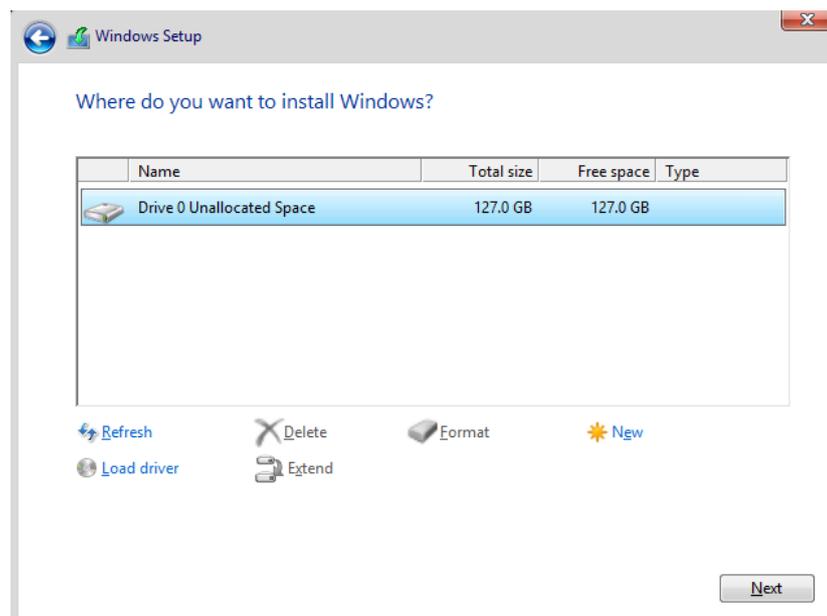


3) Insert your product key

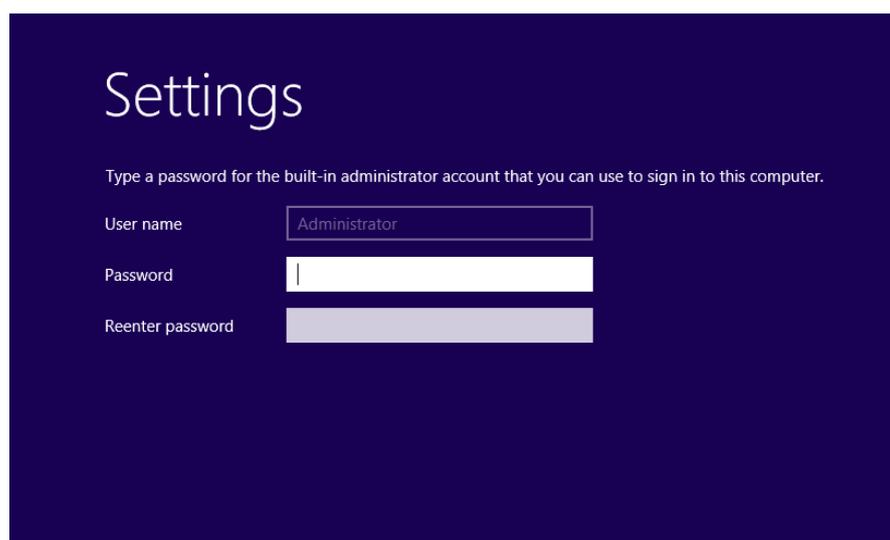


4) Choose the "Server with a GUI" option





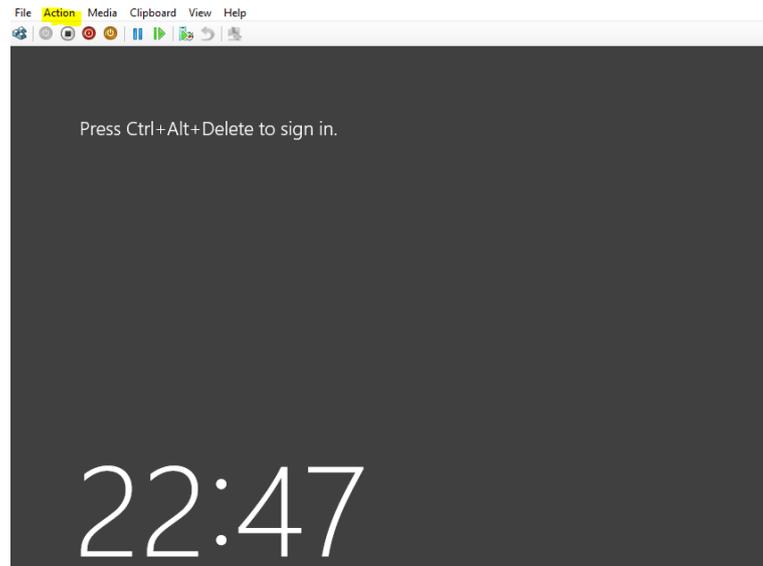
5) Choose a password.



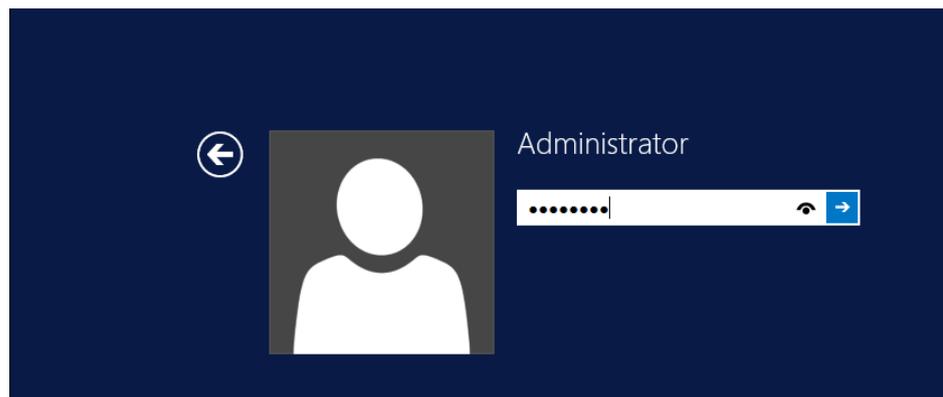
You have successfully Installed Widows Server 2012 R2.

Change machine's name

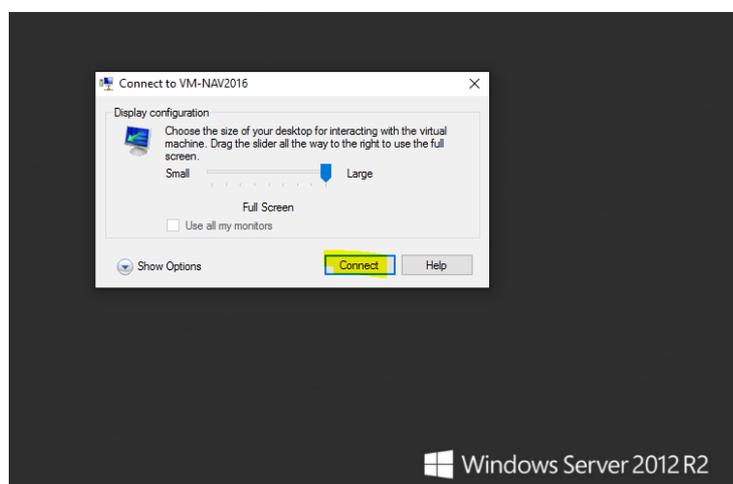
1) Enter to the VM



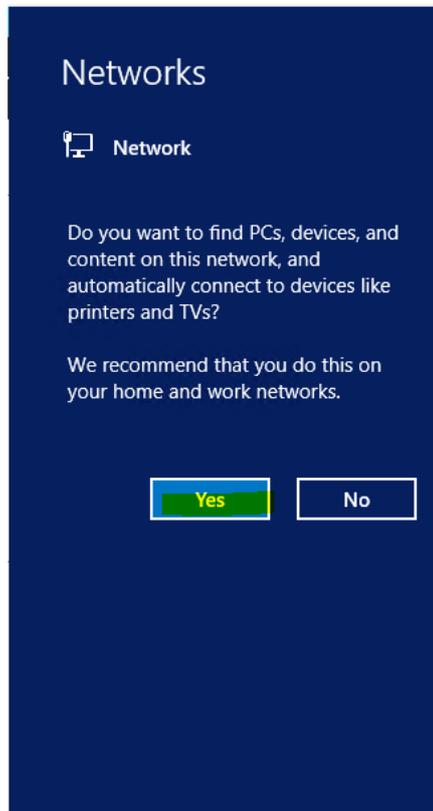
2) Type the password



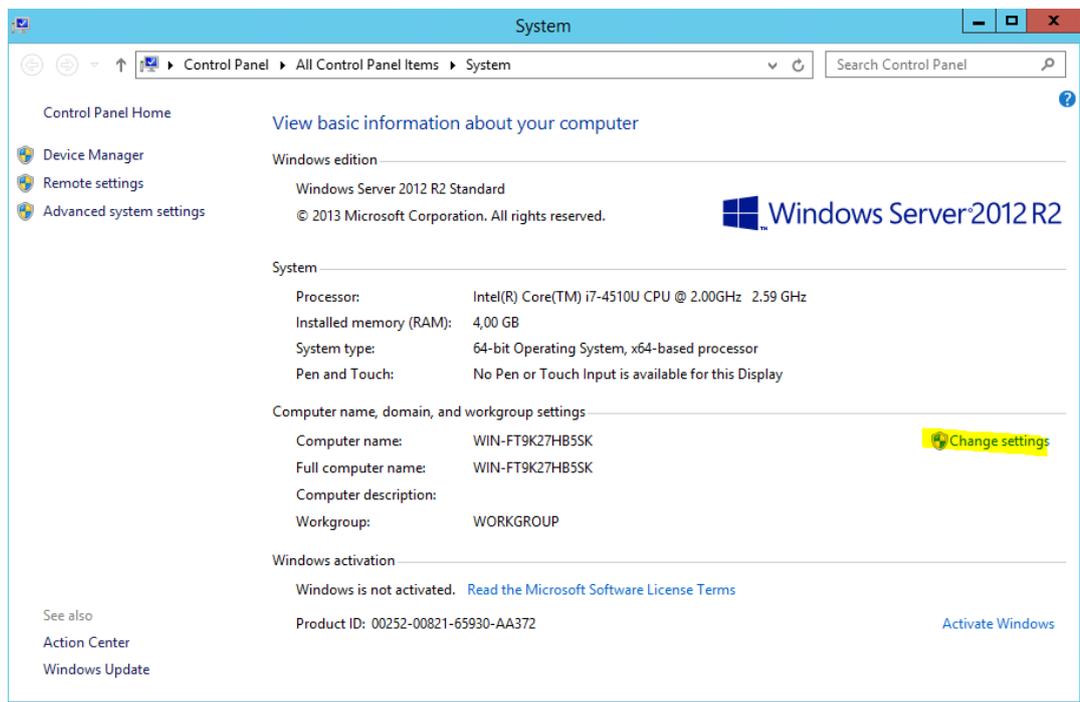
3) Choose the display configuration



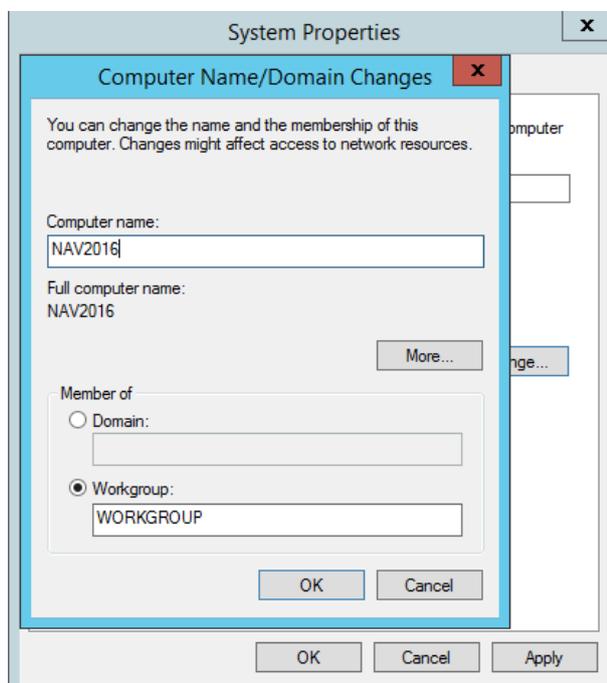
4) Connect to the network



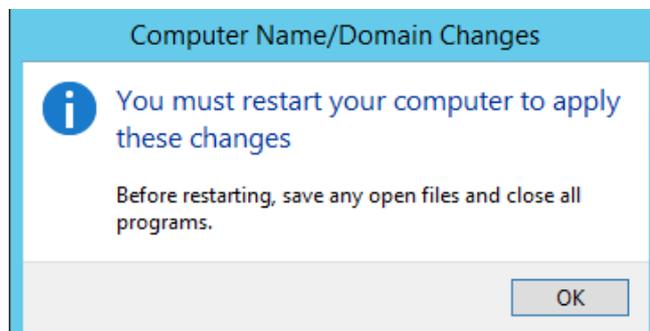
5) Go to Control Panel



- 6) Change the name of the computer. In this example, I have named as "NAV2016". Since the computer's name will also be used as a domain name it is recommended to change according to our preference, the default name given by the system might be difficult to recollect.



- 7) Remember to restart your machine.

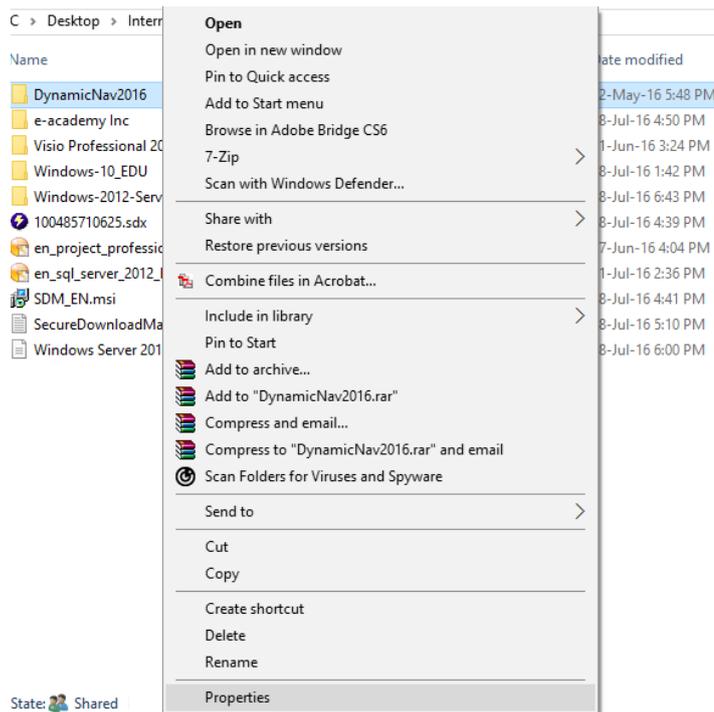


#### Share documents over Network

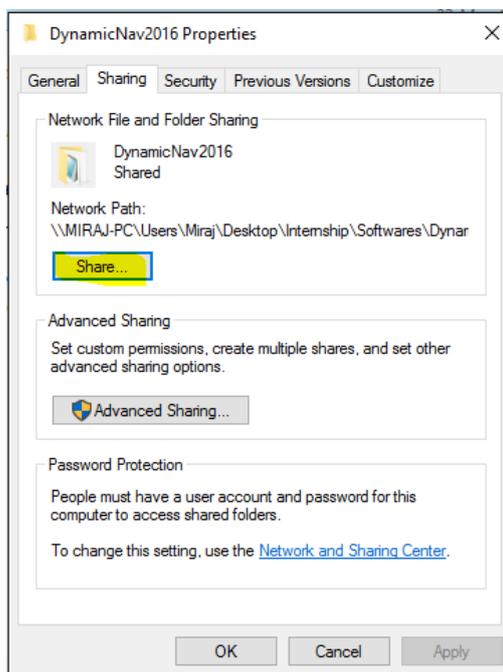
In this section I am going to explain how documents can be shared within a network. Since it is not possible to transfer files from host machine to VM with just copy pasting, we have to share our necessary software over network and then install that software in our VM.

- 1) Create a folder in your machine where all relevant software will be placed. In this example, I have a folder called "DynamicNav 2016"

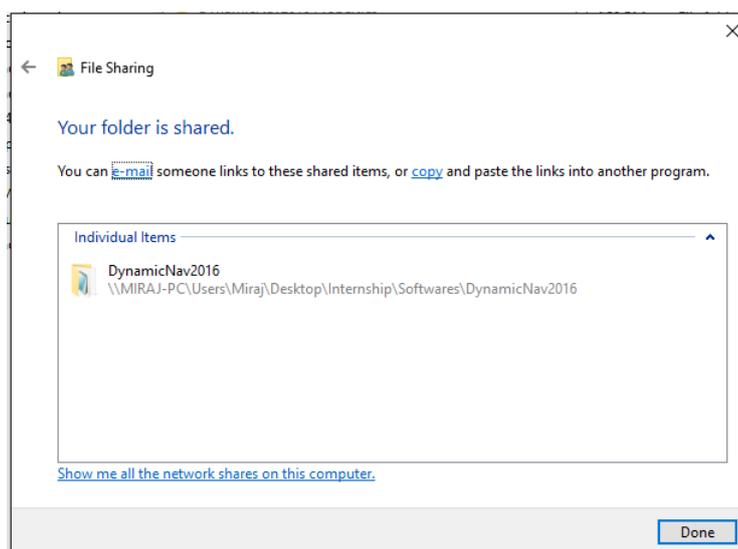
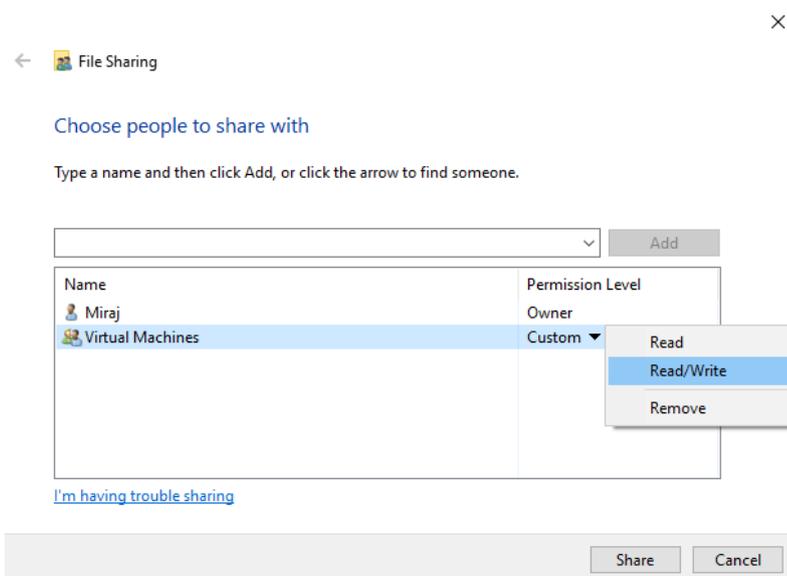
Right click the →Properties



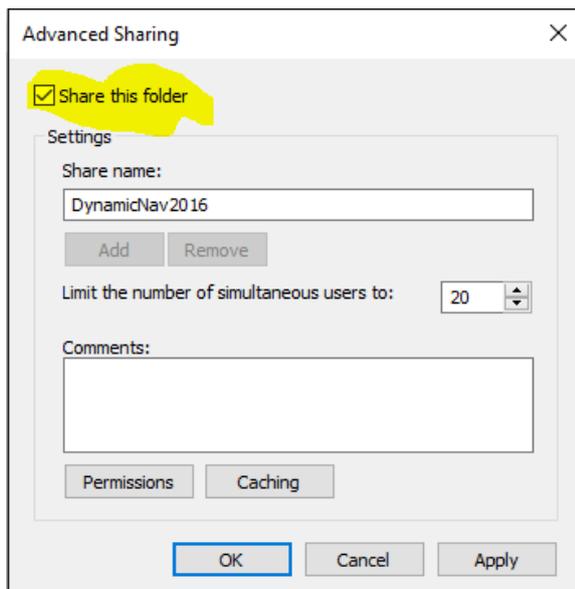
2) Properties → Sharing → click "Share"



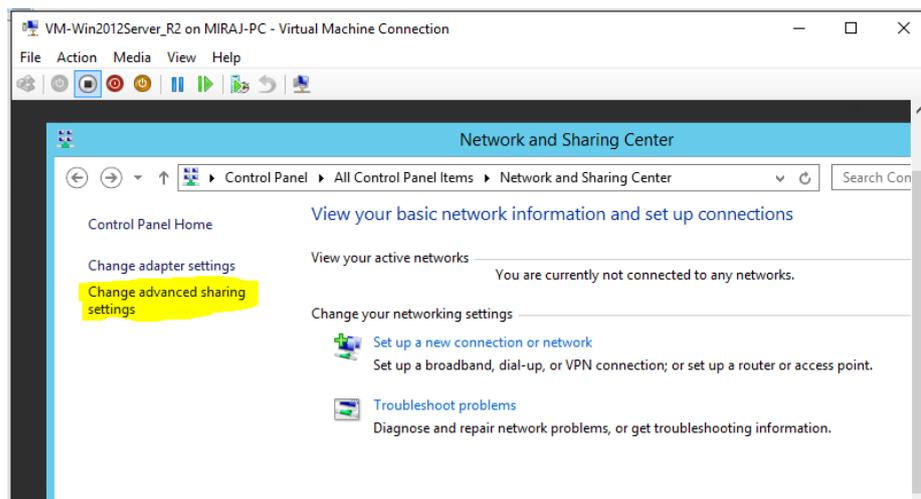
3) Virtual Machines → Custom → Read/Write → Share

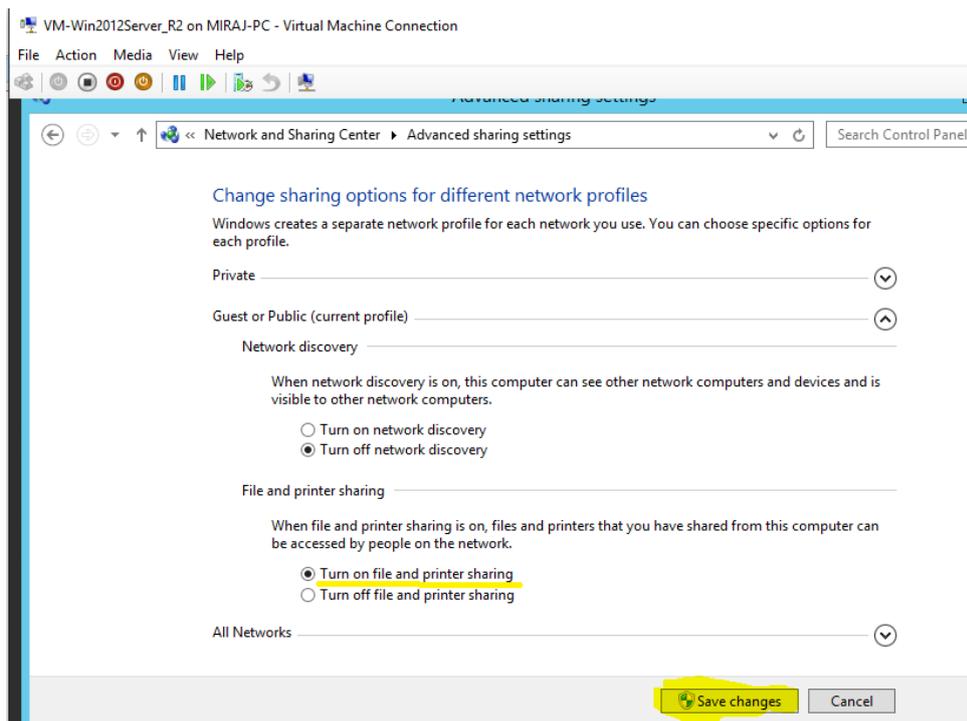


- 4) From the Properties window click also "Advance Sharing" and check the "Share this folder"

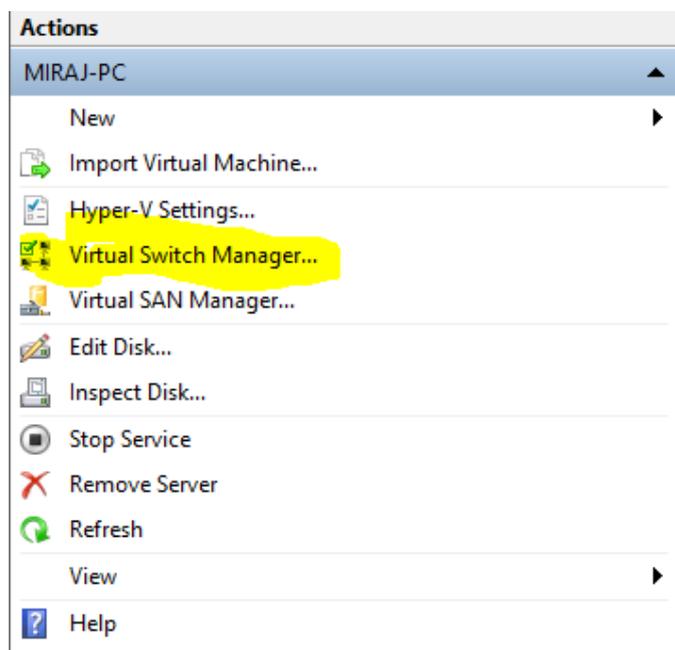


5) From you VM go to Network and Sharing Center

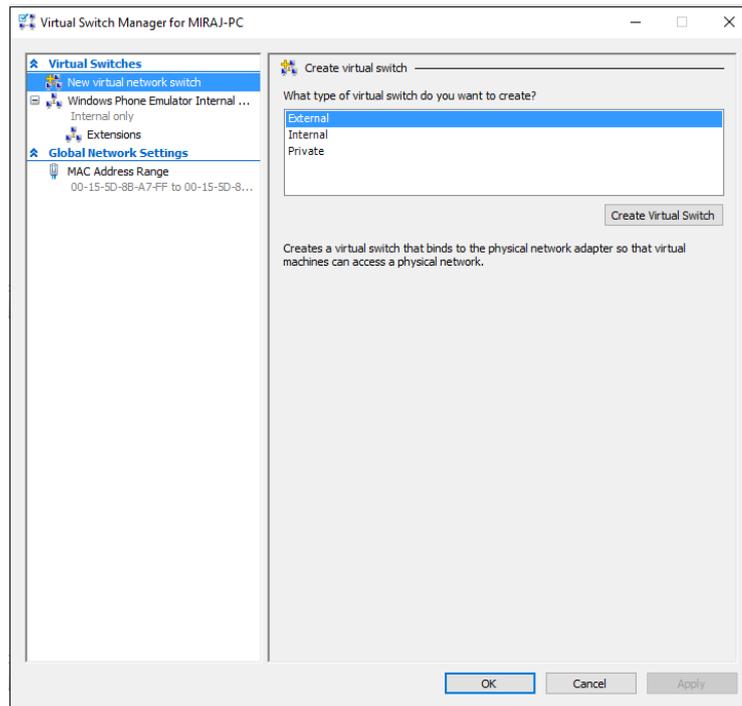




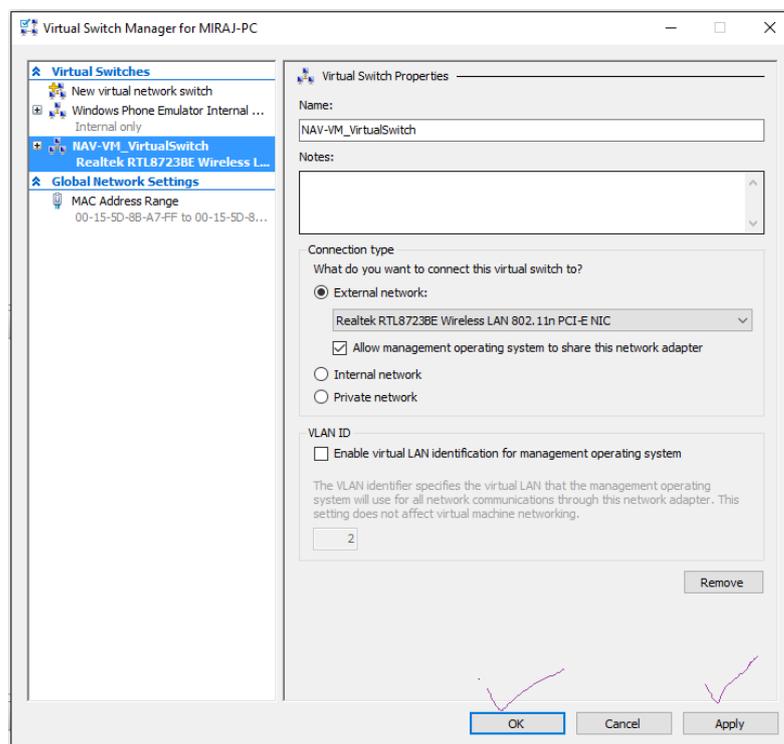
6) From you Hyper Manager we have to create switch



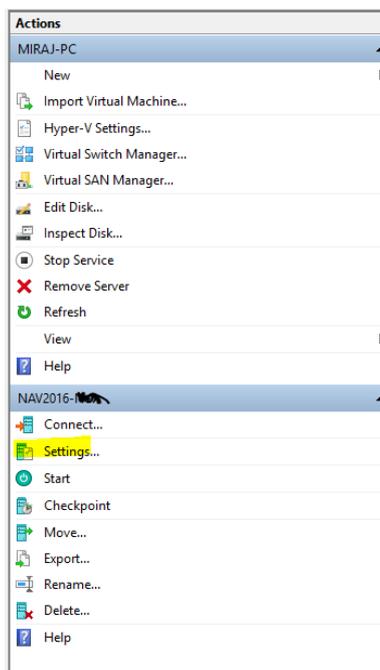
7) Create an External Virtual Switch



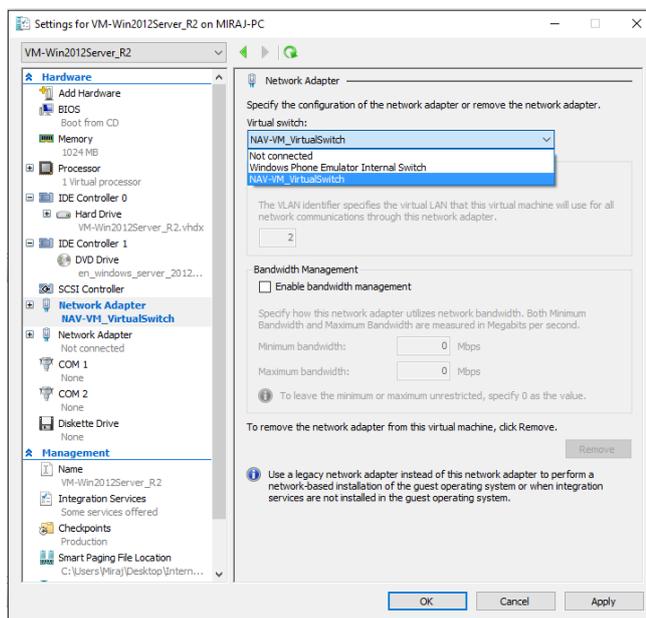
- 8) Choose a name for you switch, in this example I have “NAV-VM\_VirtualSwitch” also remember to click External network as Wireless.



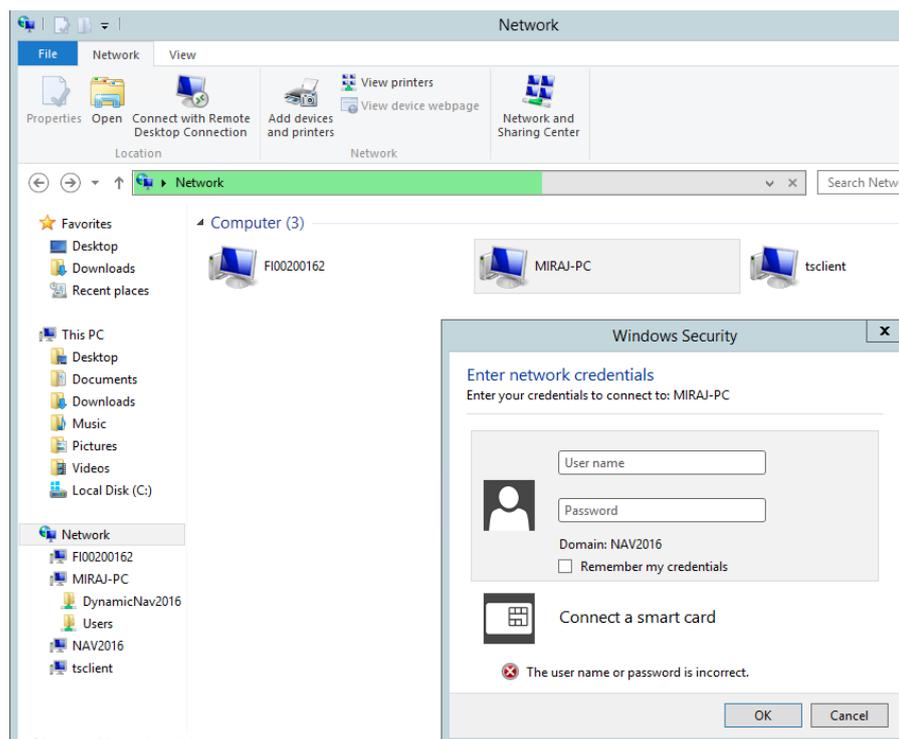
- 9) Again, from Hyper Manager go to settings



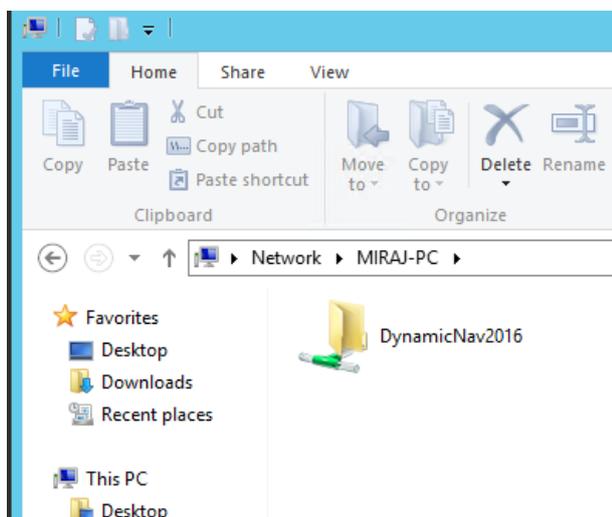
10) From Network Adapter NAV-VM\_VirtualSwitch choose the switch you just created.



11) Now from your VM go to Network, and you will be able to see your host computer. Click and insert the host computer's credentials.

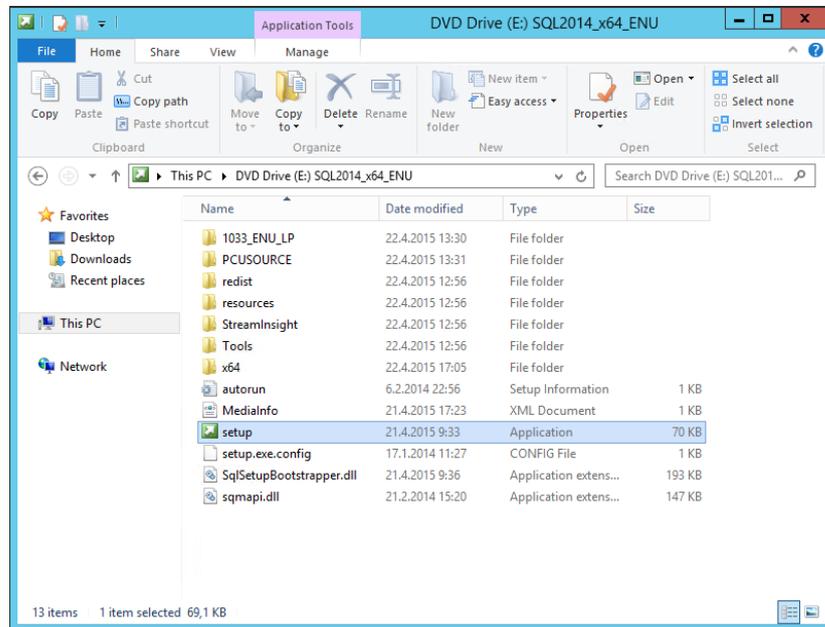
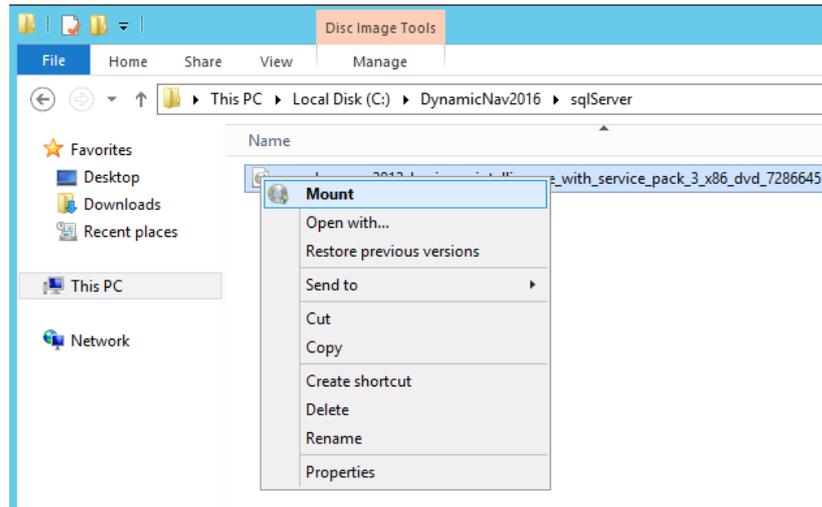


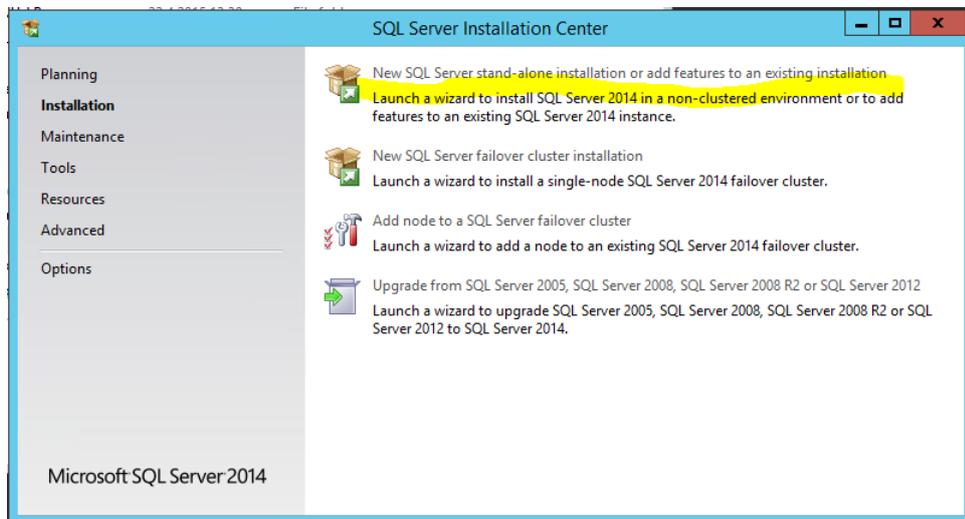
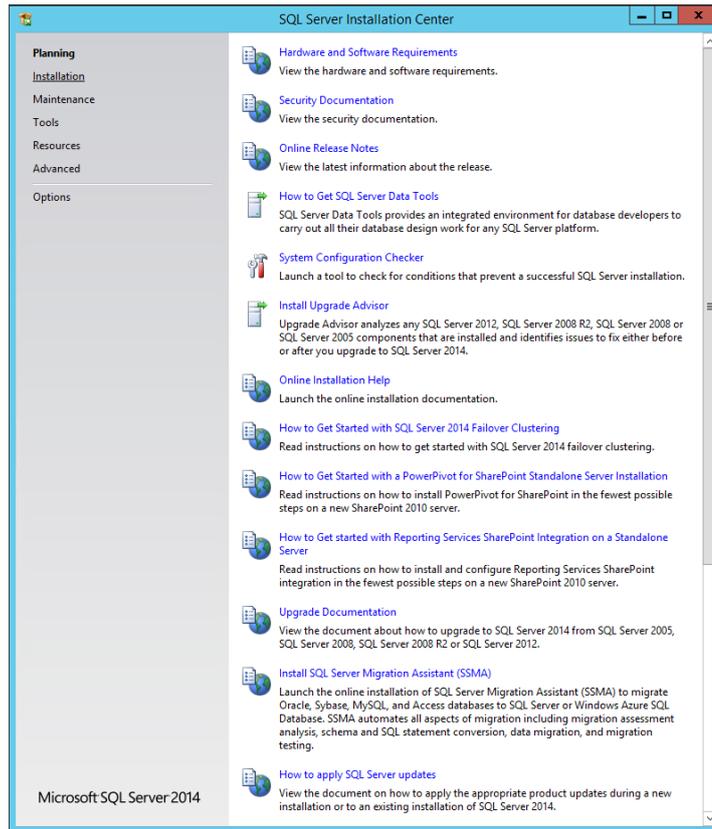
You will be now able to see from your VM all files contained in the folder DynamicNav2016. Every time you require any additional software for VM, you will place those on DynamicNav2016 folder or download from your VM's Web.

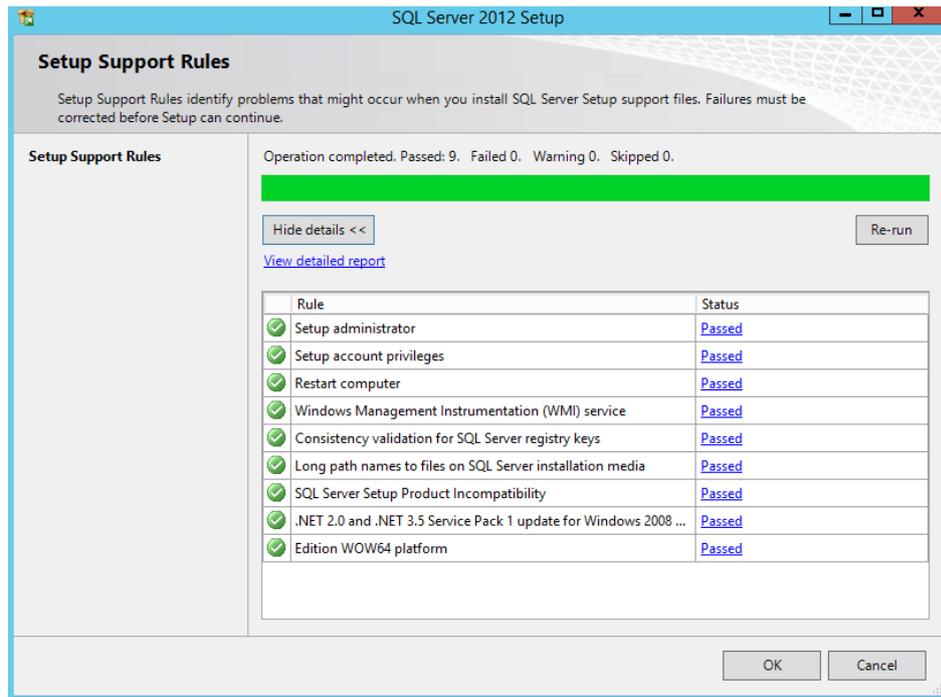


## SQL Server Installation

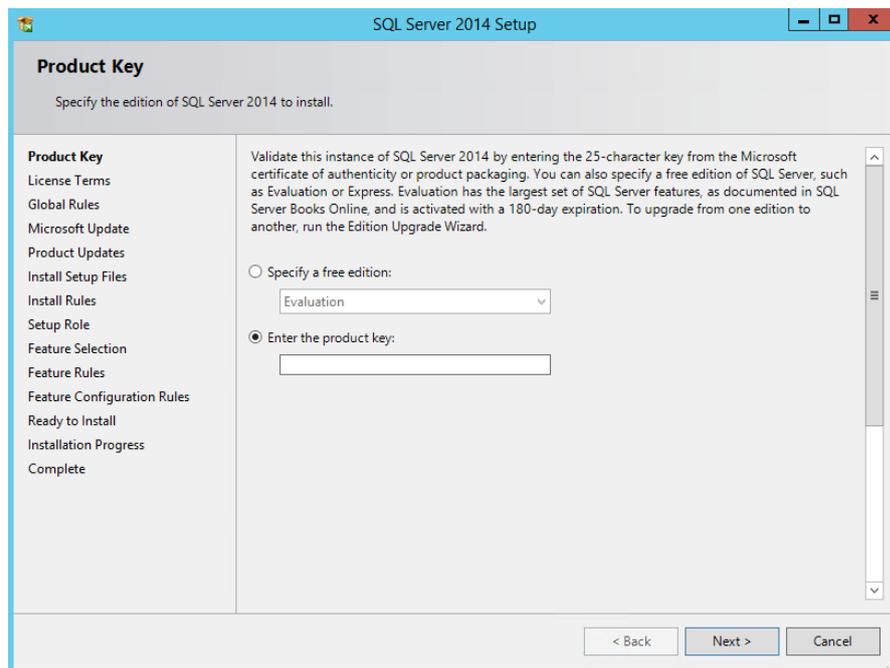
- 1) Start the installation.

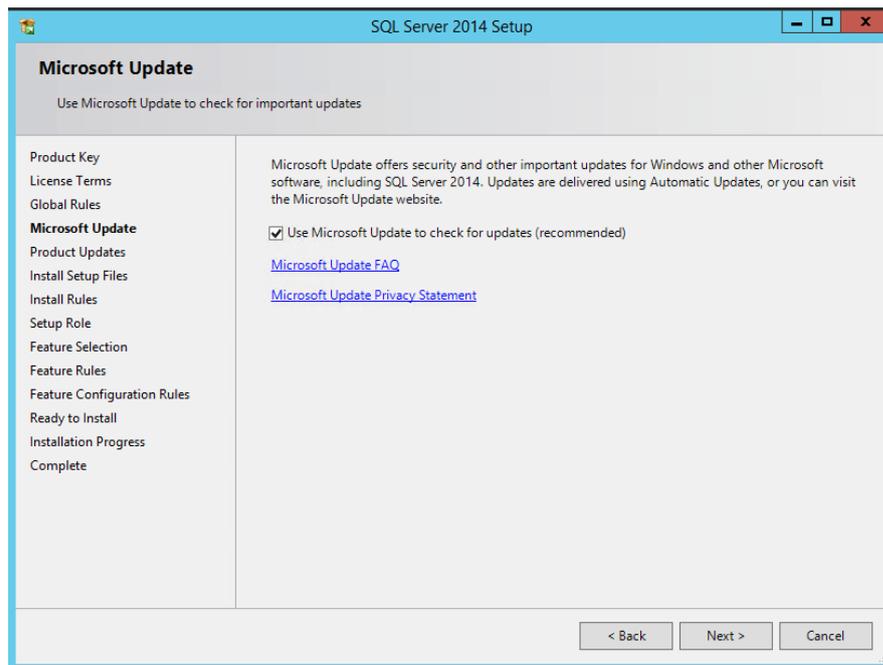
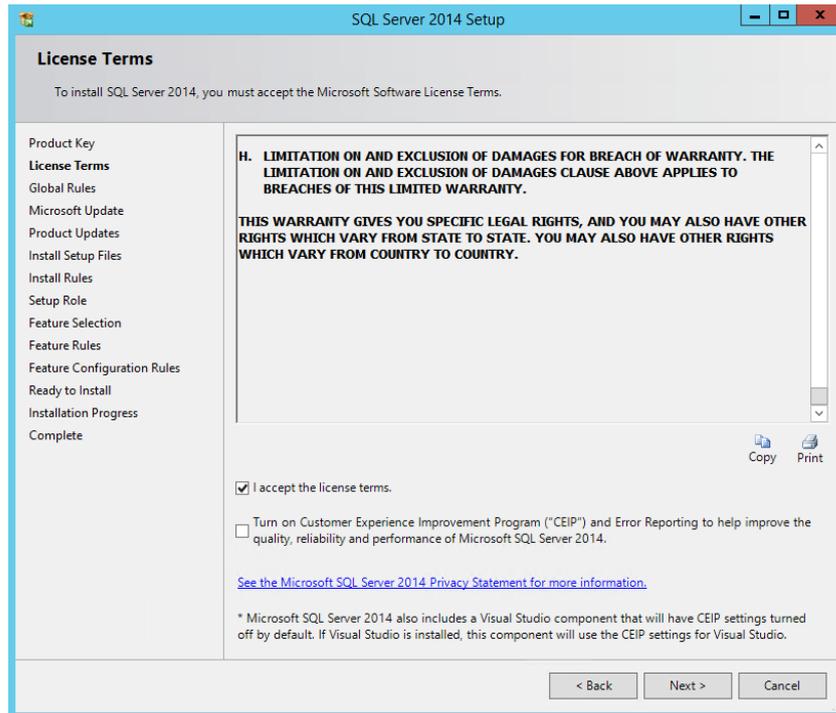


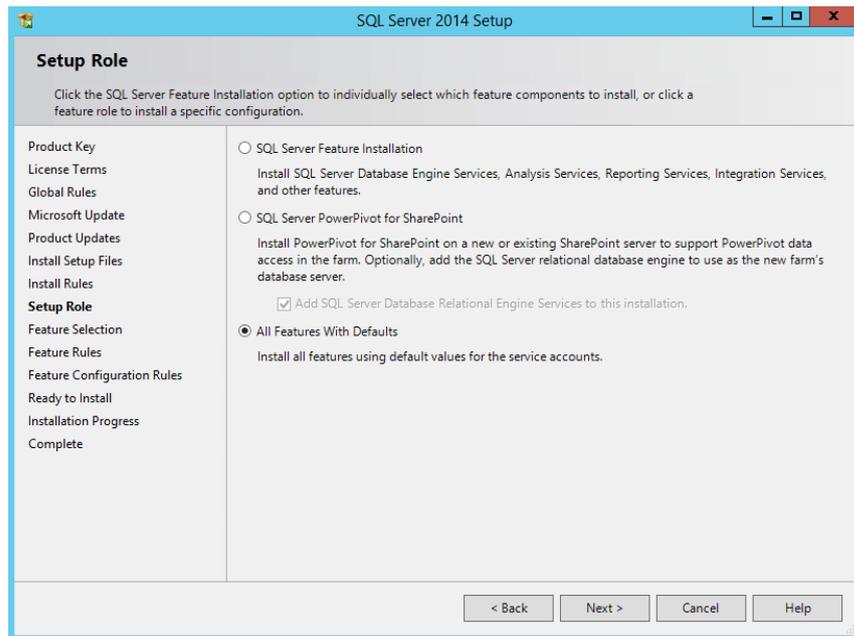
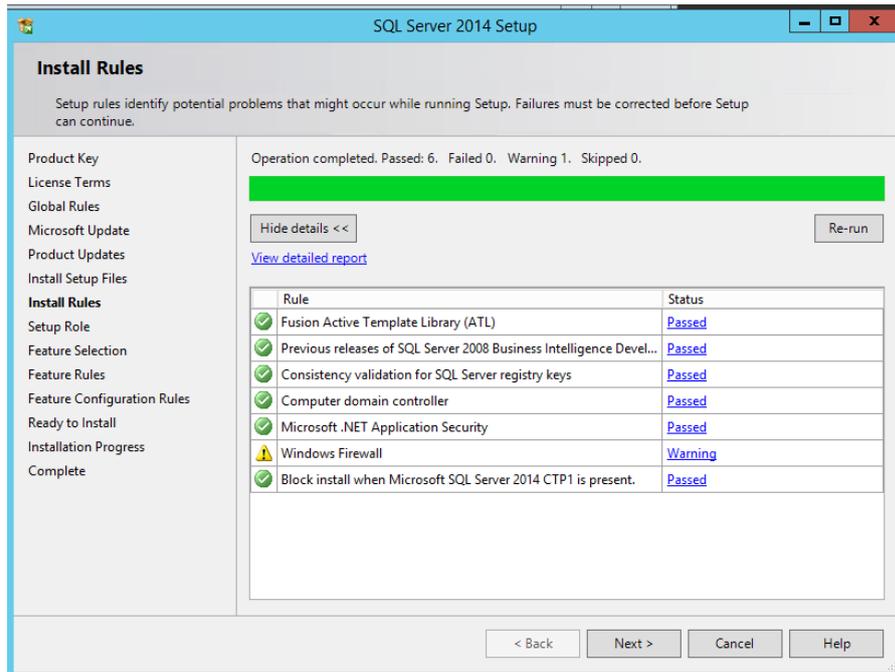


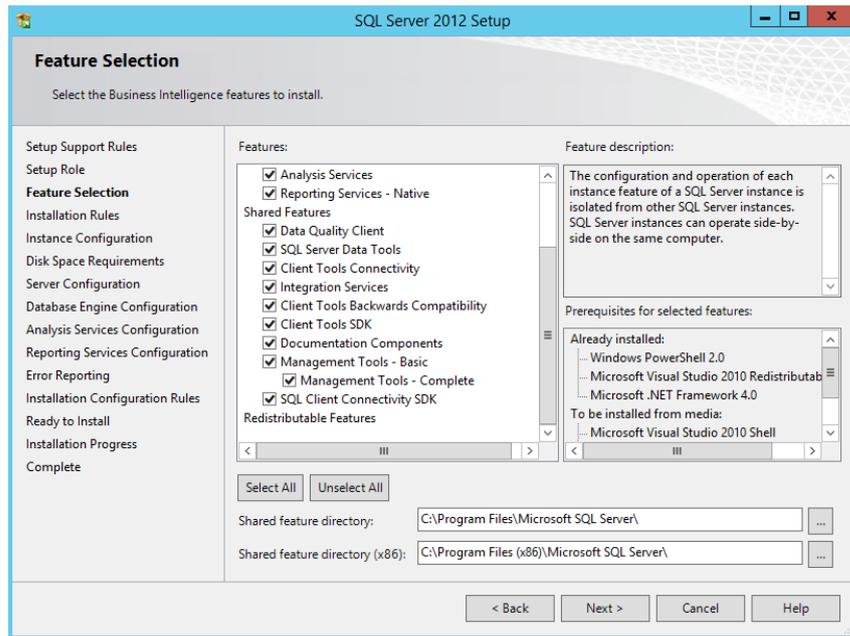


2) Enter the product key. Usually it is entered by default.

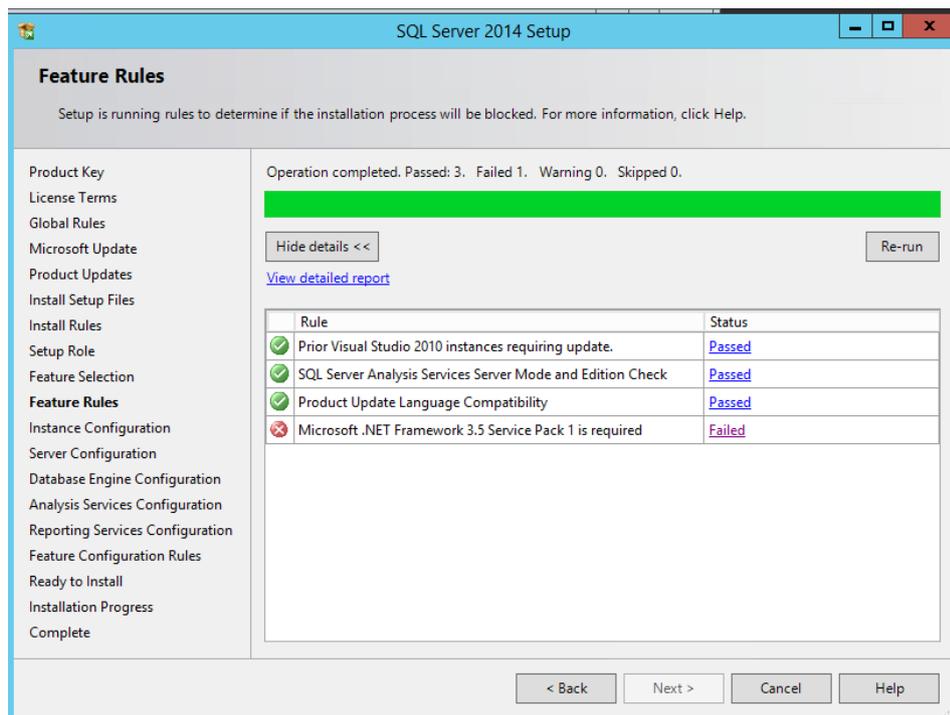




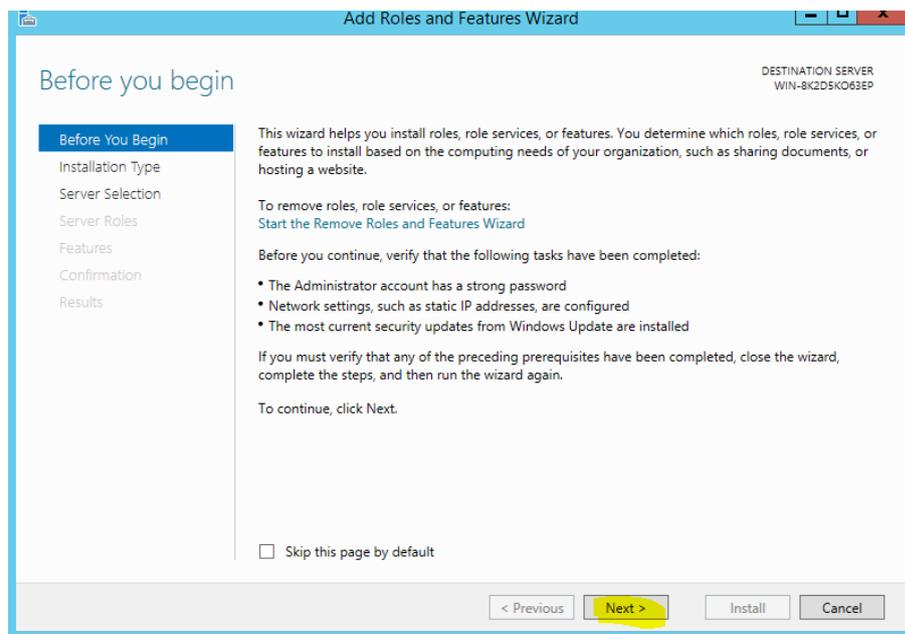
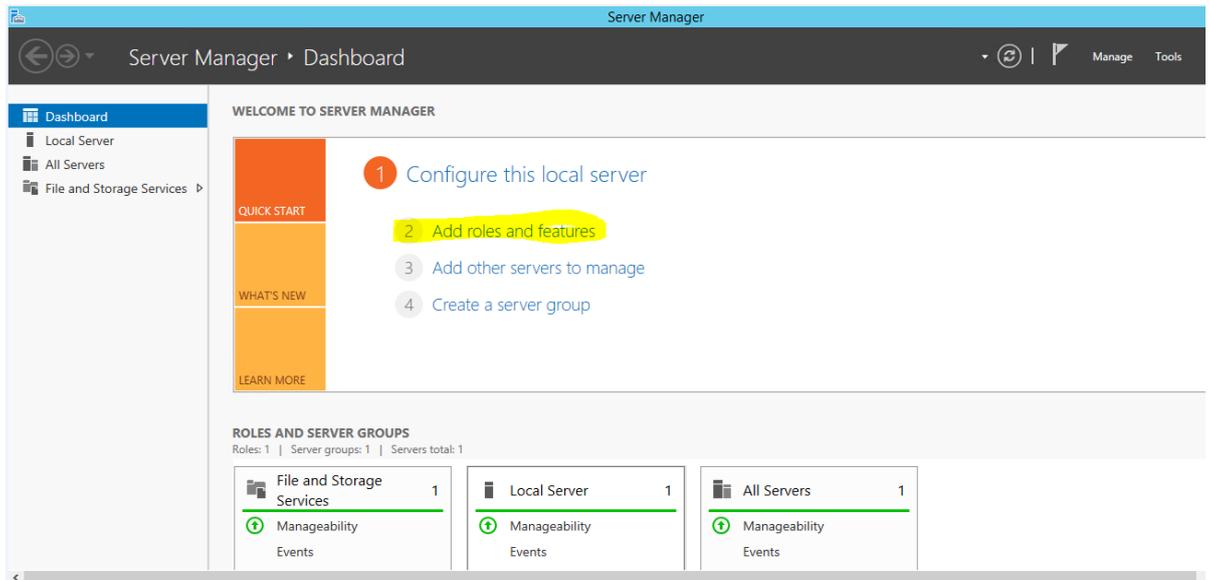


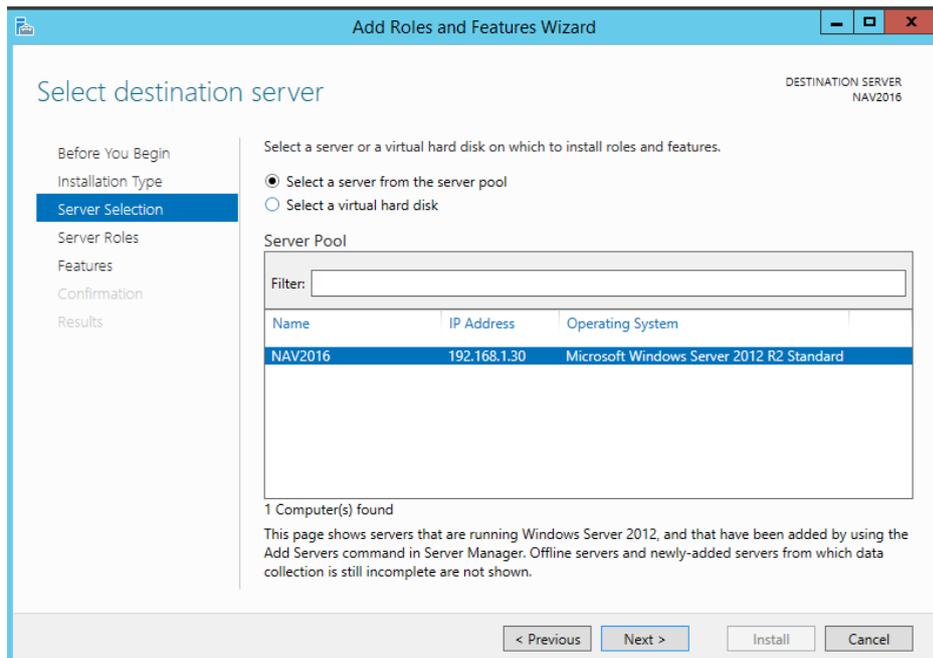
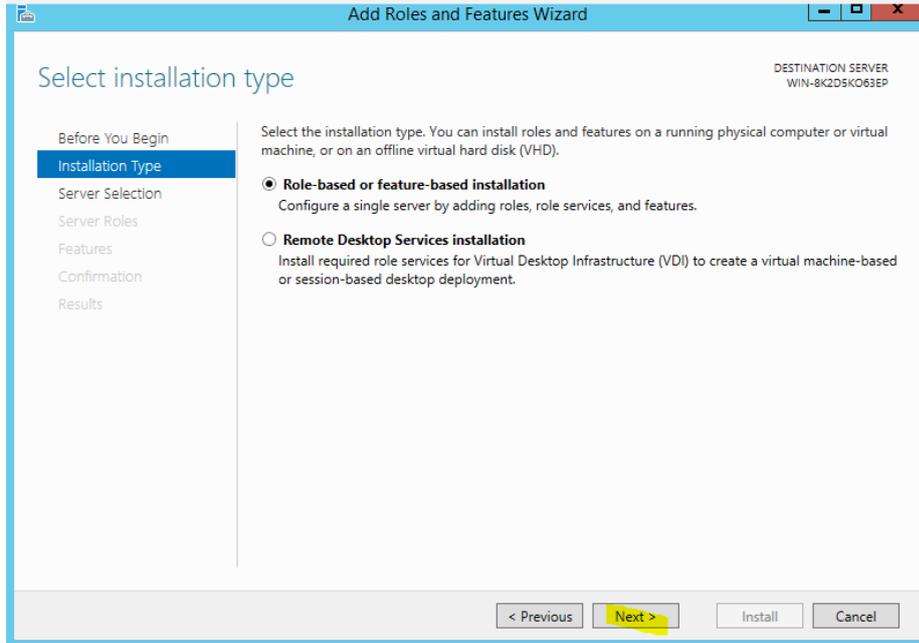


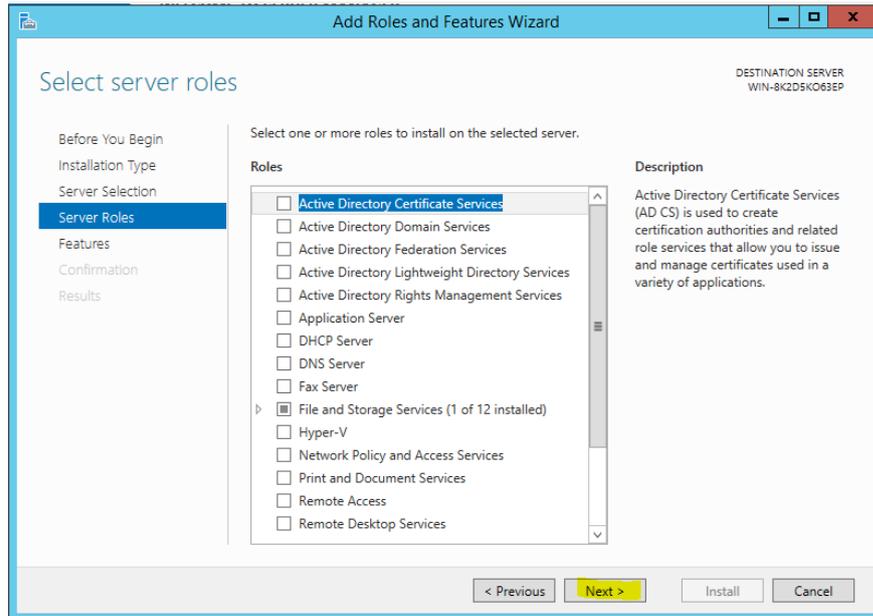
- 3) As you may notice, the installation process requires .NET Framework. Click the Back button, install the .NET Framework and then proceed again.



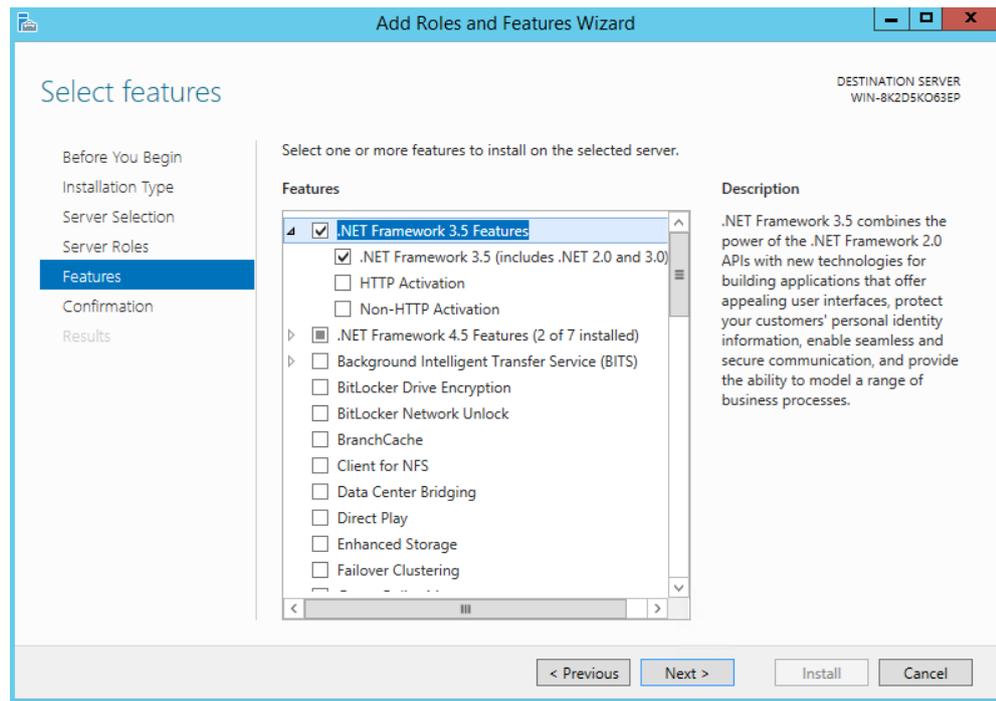
- 4) In order to install .NET Framework, you have to go to Server Manager and add a role.

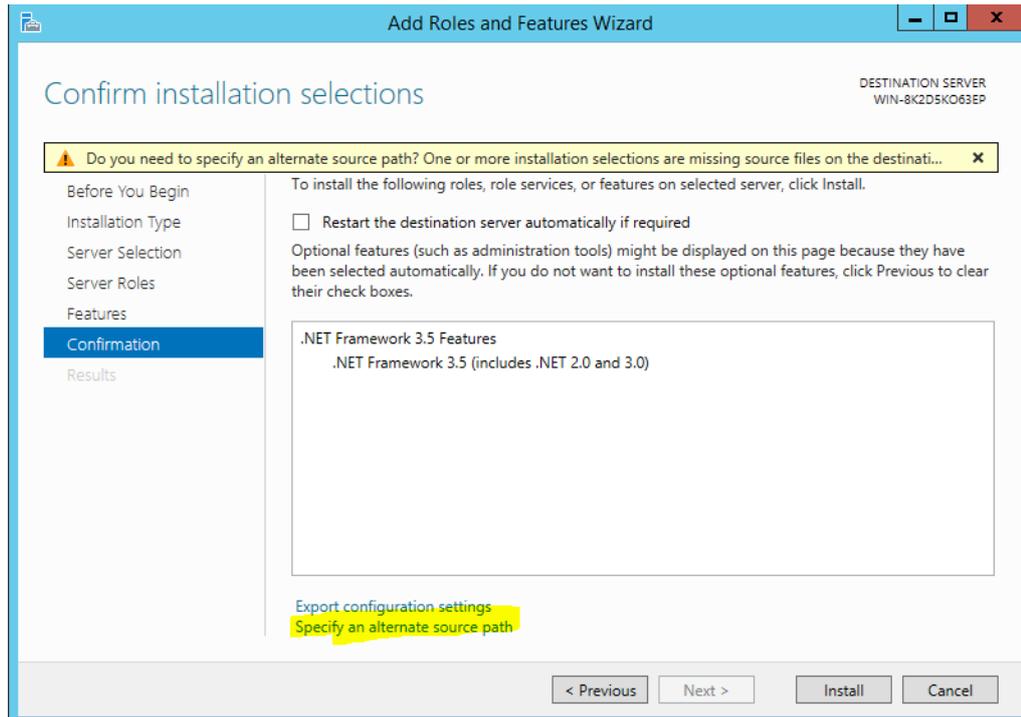




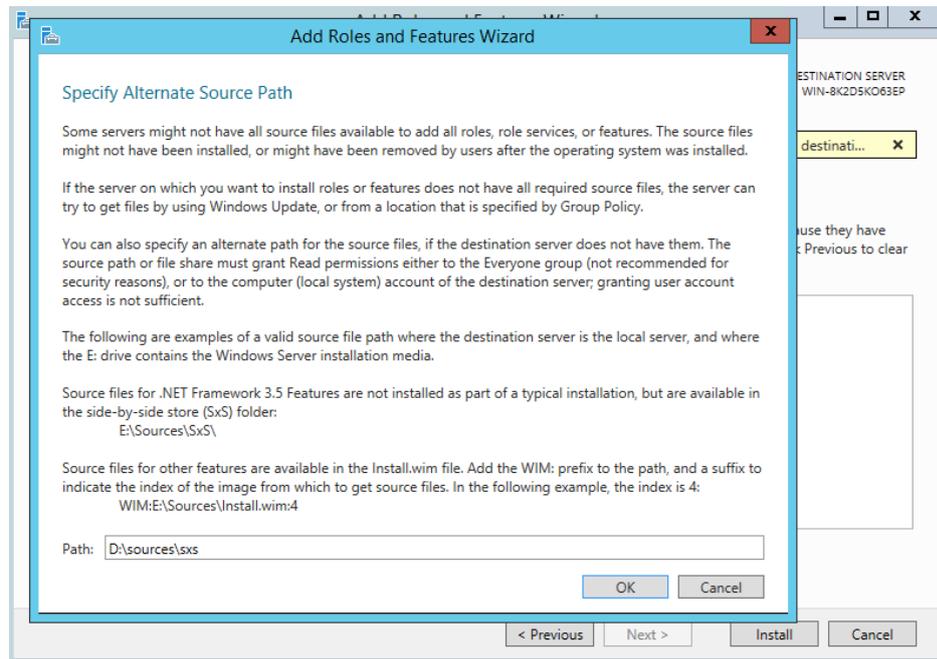


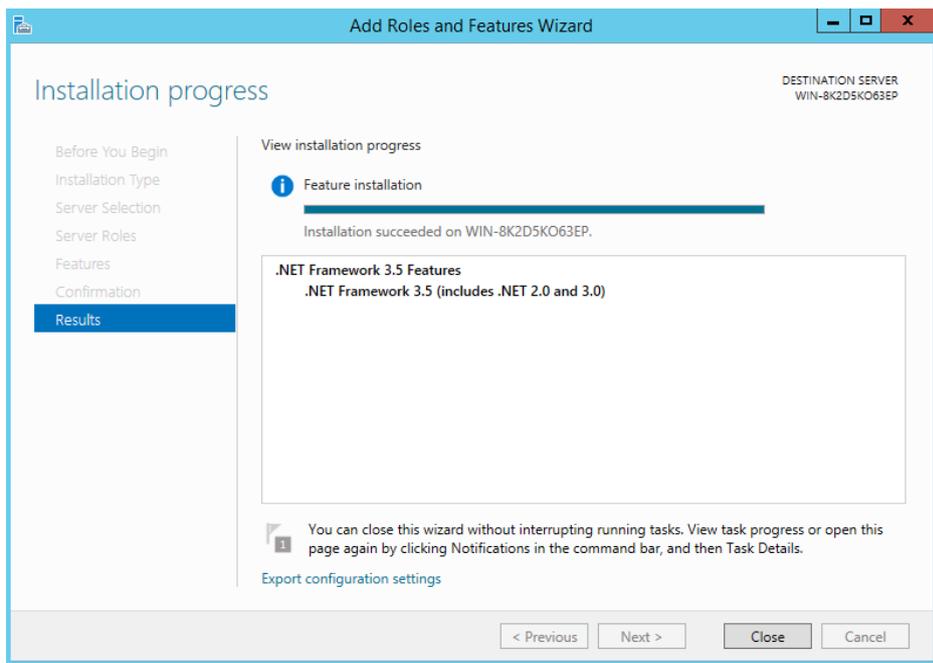
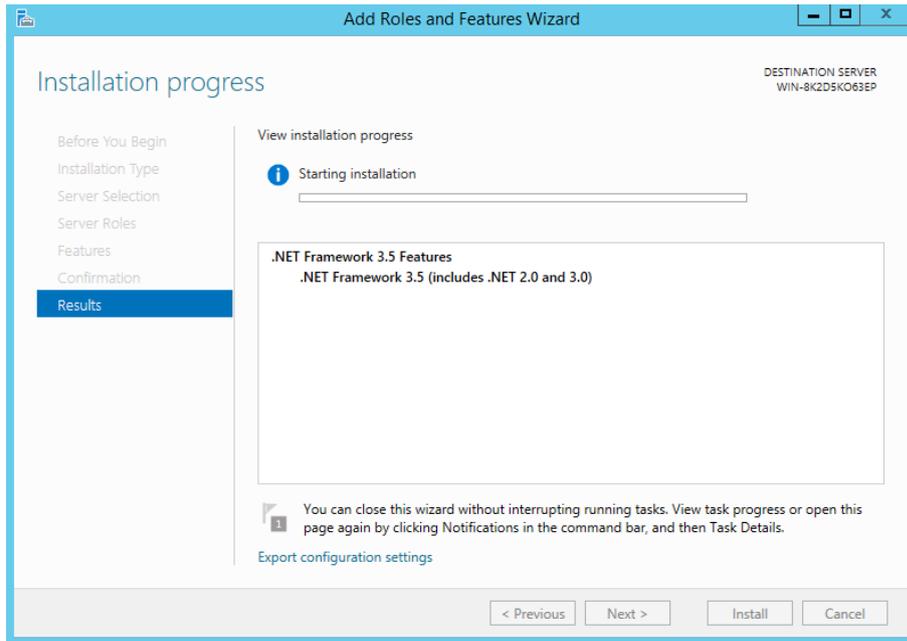
5) Check the .NET Framework 3.5 Features



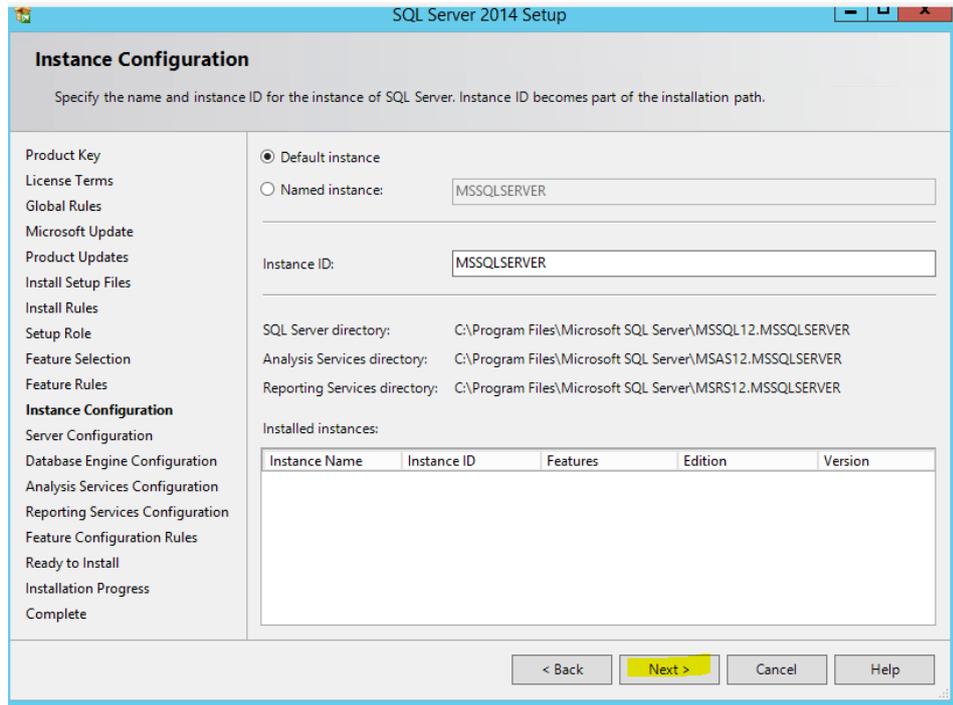
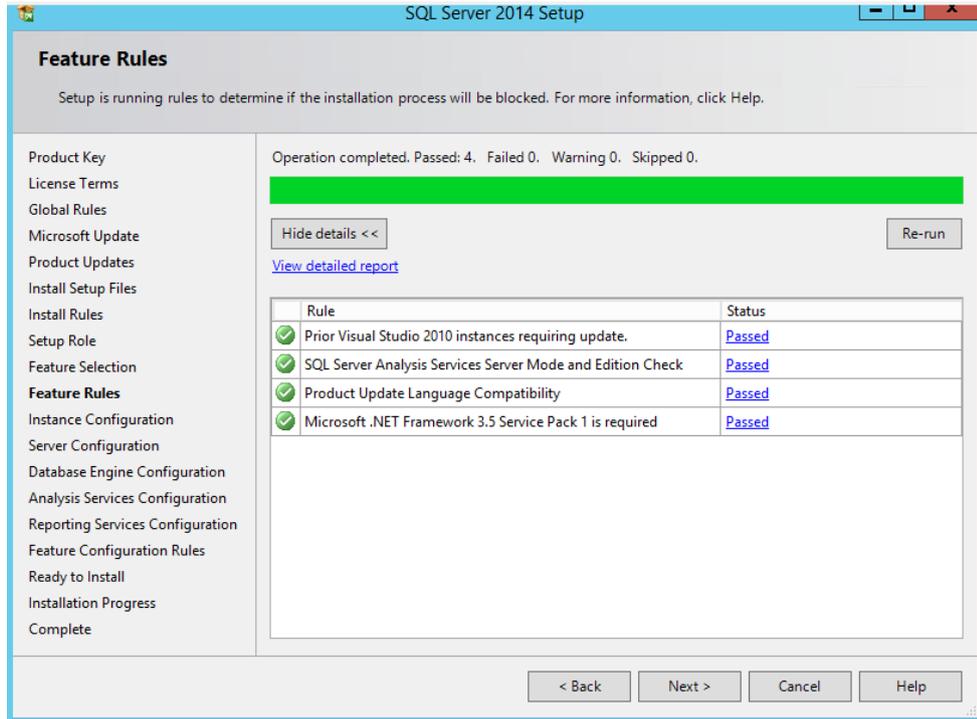


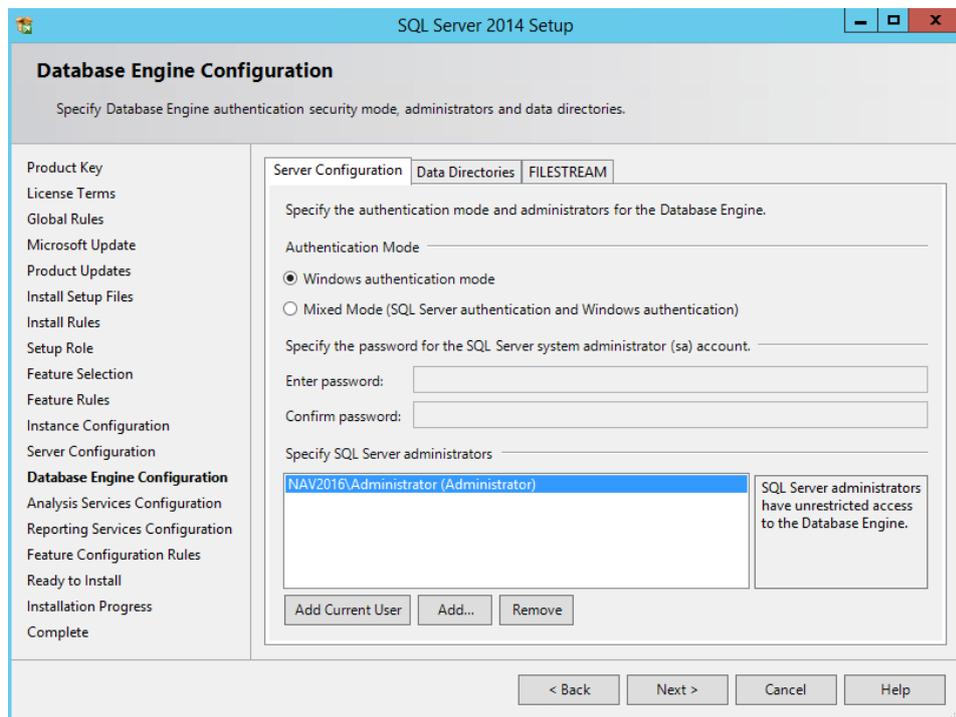
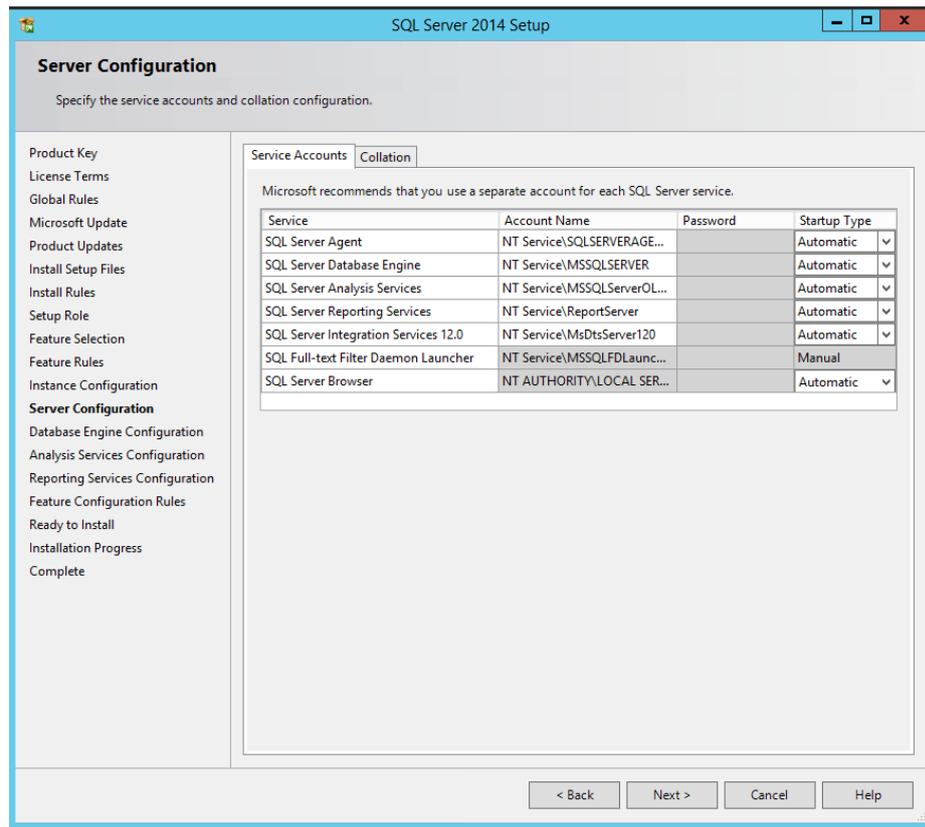
6) The following path should be written D:\sources\sxs



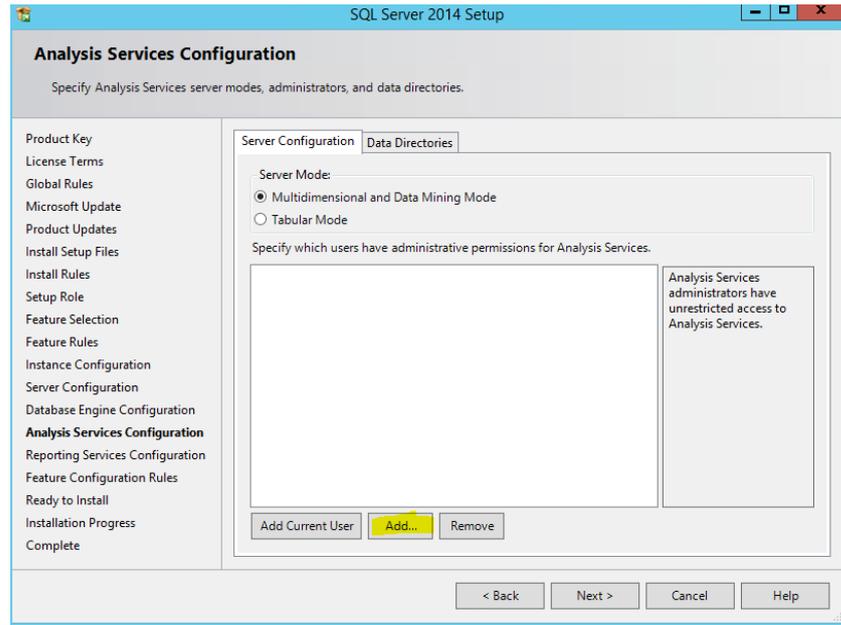


7) After the .NET has been installed, go back to your SQL installation process and continue.

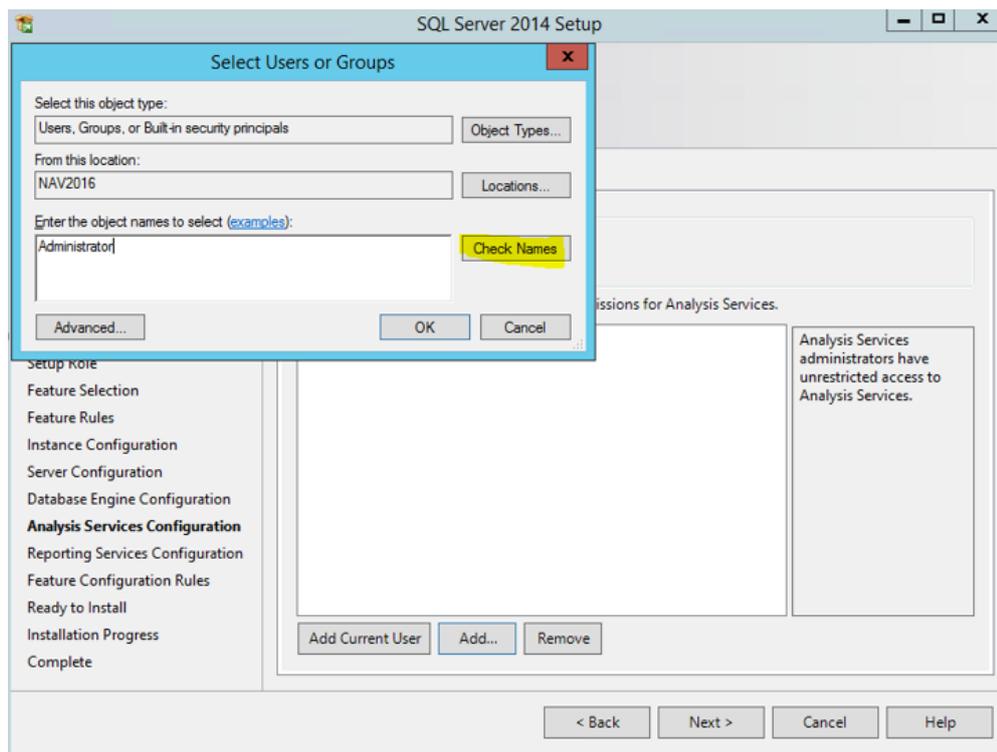


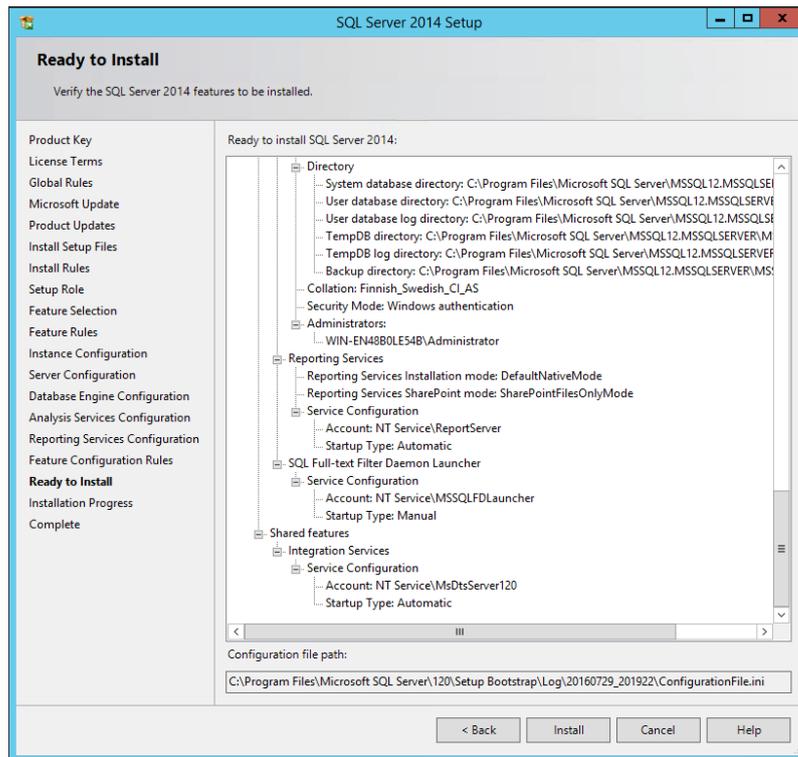
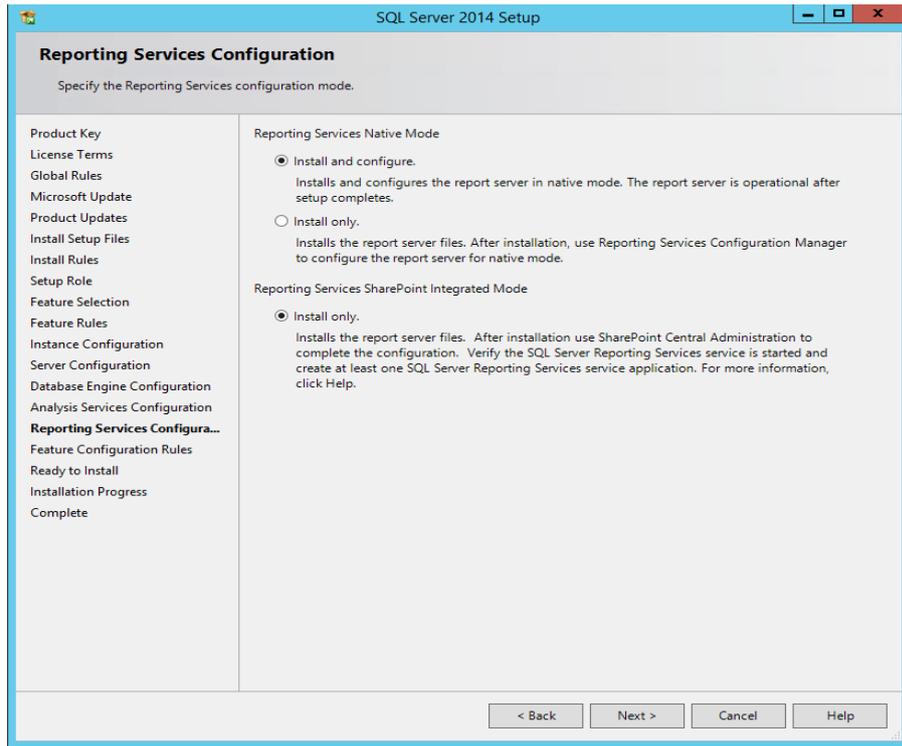


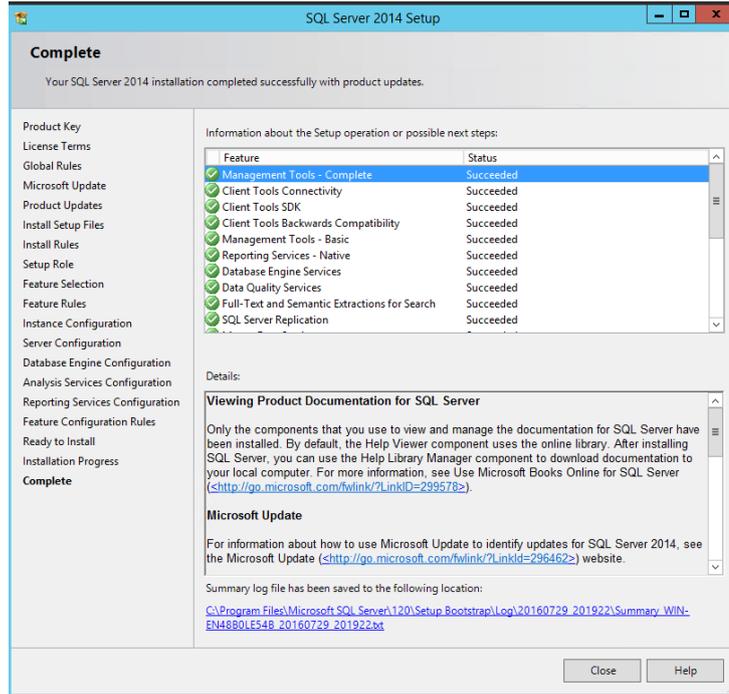
8) Click Add to give the permission to Administrator.



9) Type Administrator and then Check Names→OK→Next.



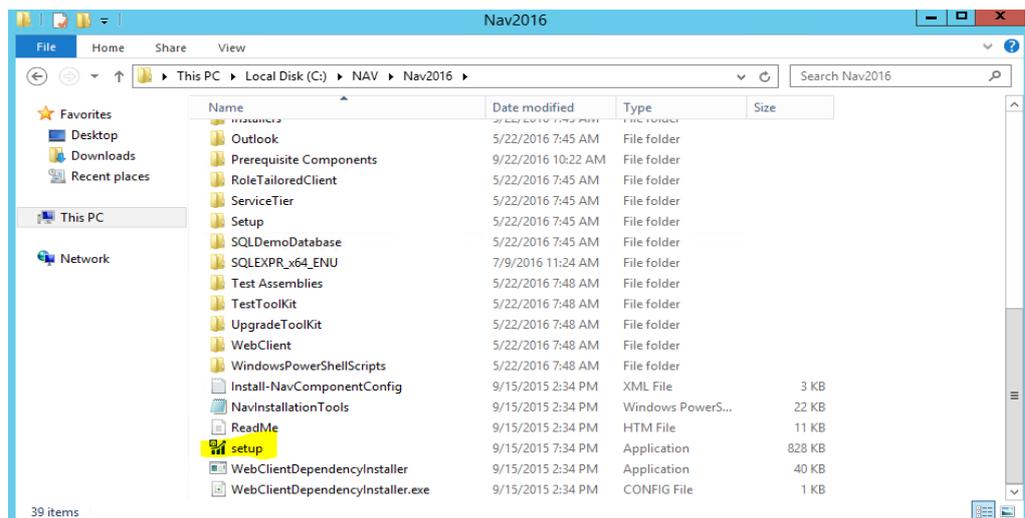


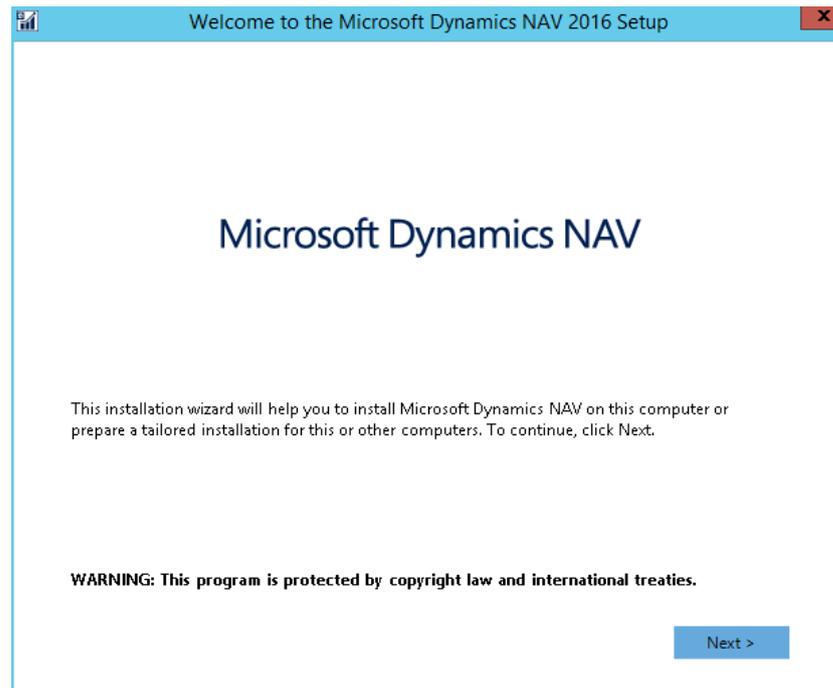


The installation process might take a while. At this point you have installed SQL Server 2014 BI.

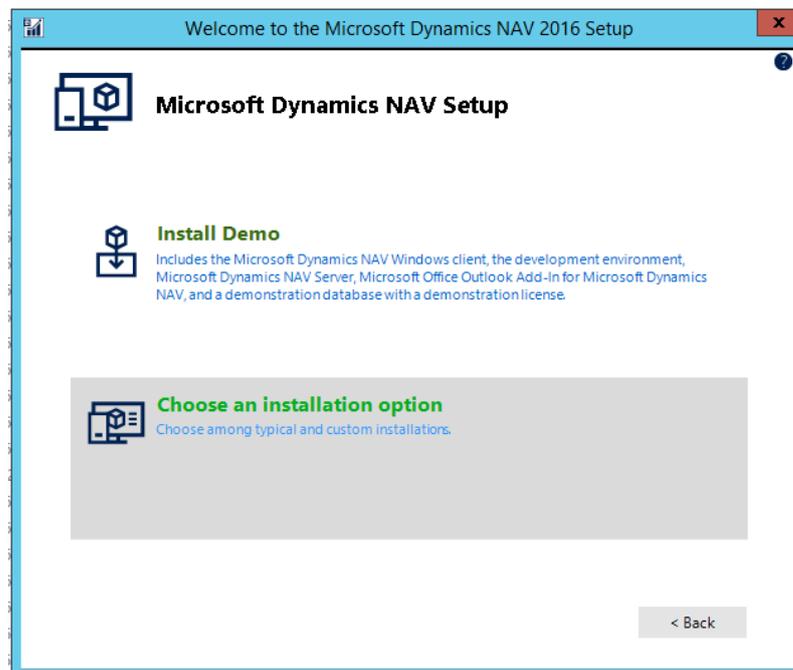
### Dynamics NAV Installation

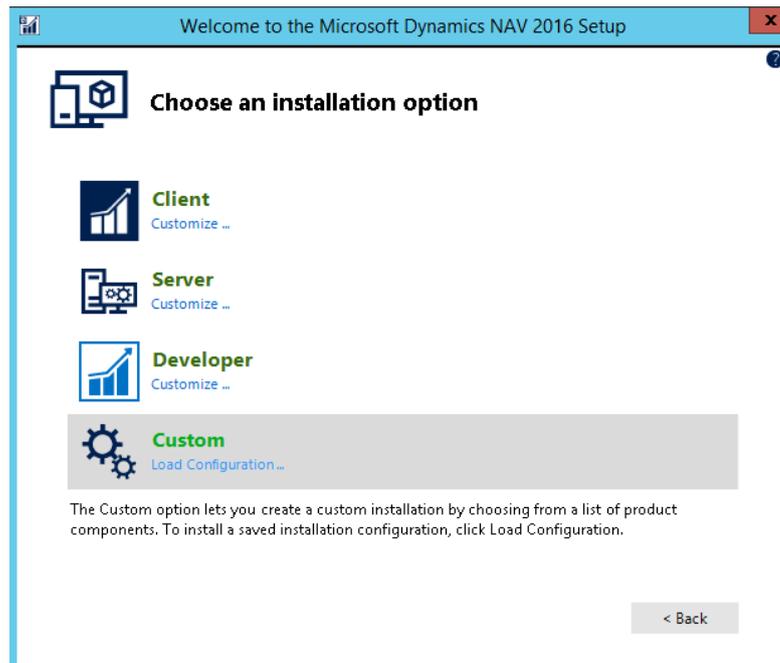
- 1) Go to the Dynamics NAV 2016 installation folder and click Setup.



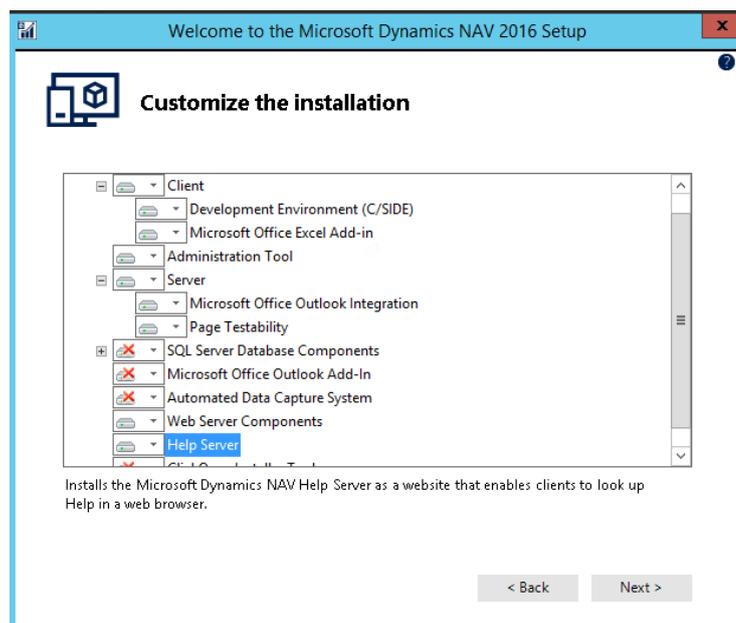


2) Choose the Custom installation option.

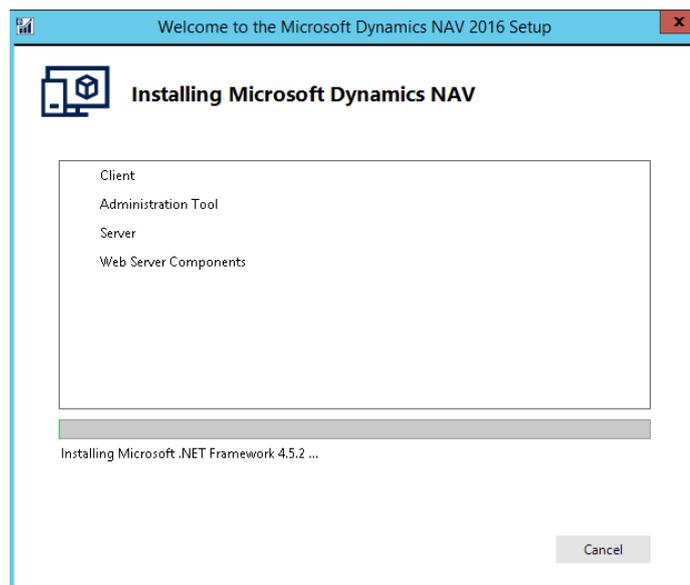
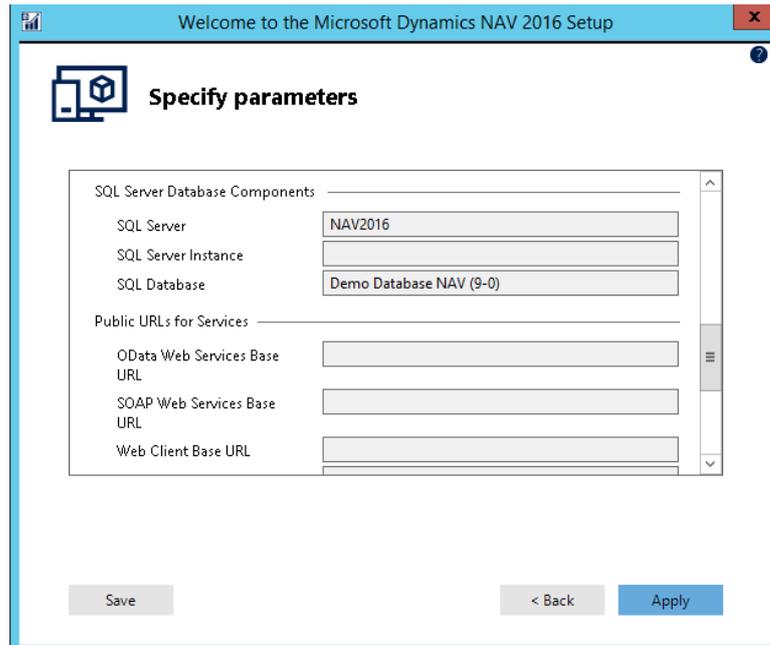




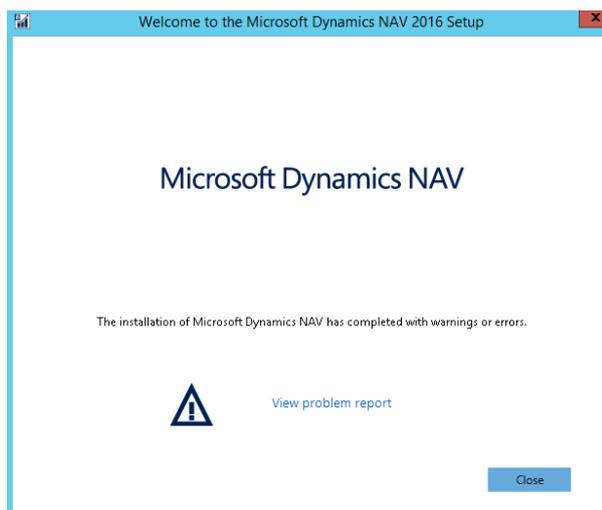
- 3) Client, Administration Tool, Server, Web Server Components, Help Server need to be checked.



- 4) *It is very important to leave blank* the SQL Server Instance field.



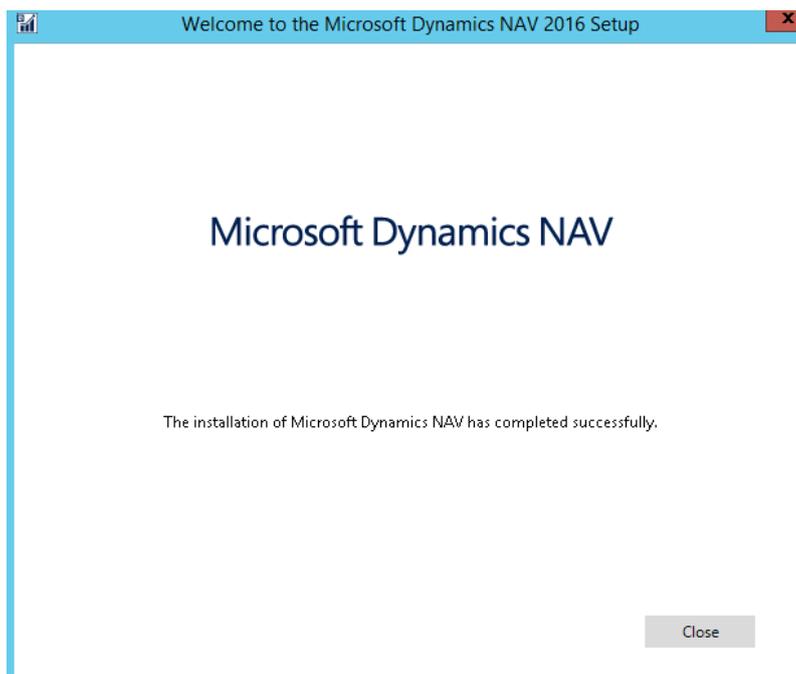
At this point, it might be possible that the installation shows some errors.



To fix these errors following steps might be relevant:

- I. Go to Server Manager and refresh
- II. Restrat the VM
- III. Try to install NAV again

5) The above steps will help to install NAV components successfully.

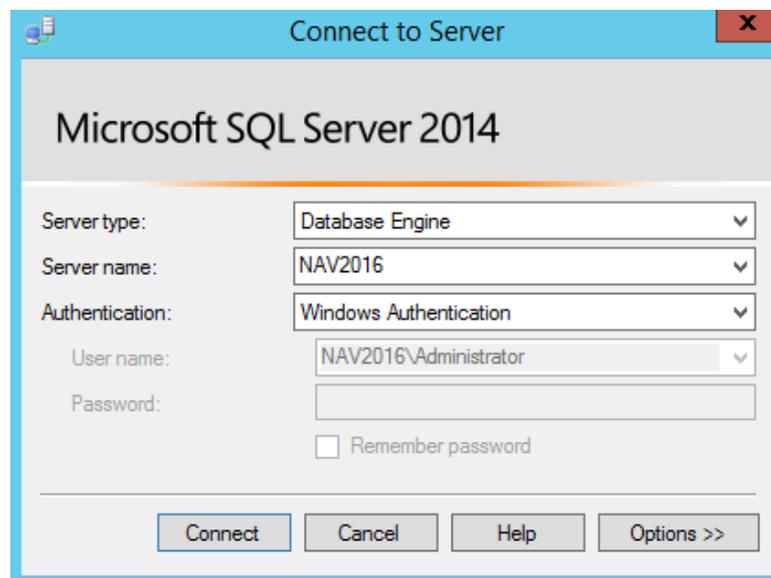


Connection SQL Server with NAV Database

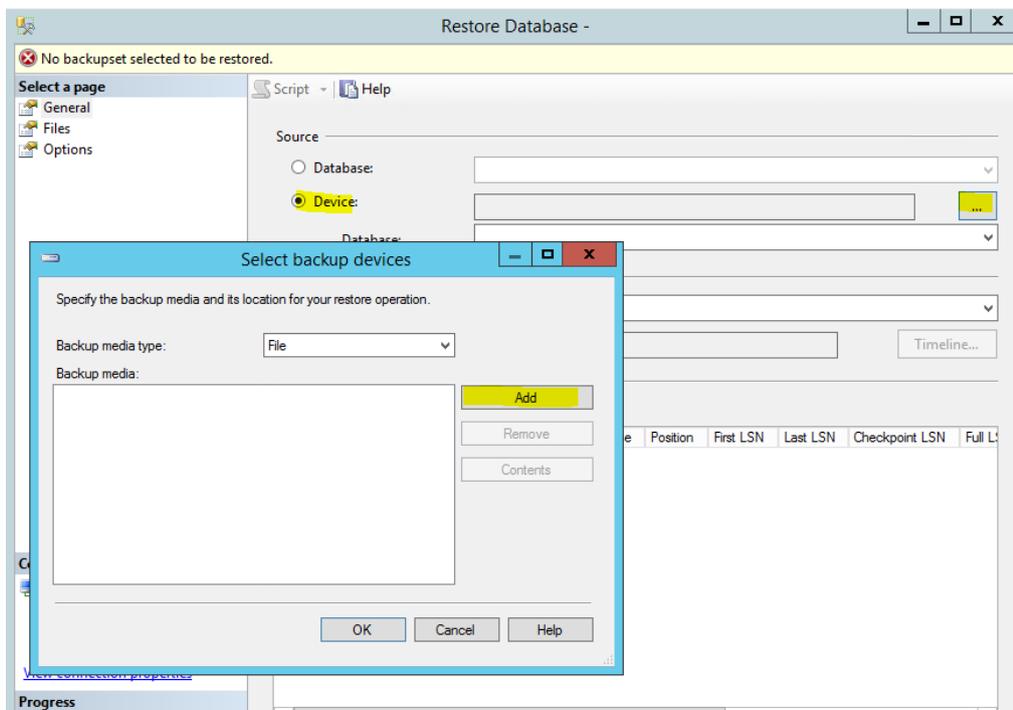
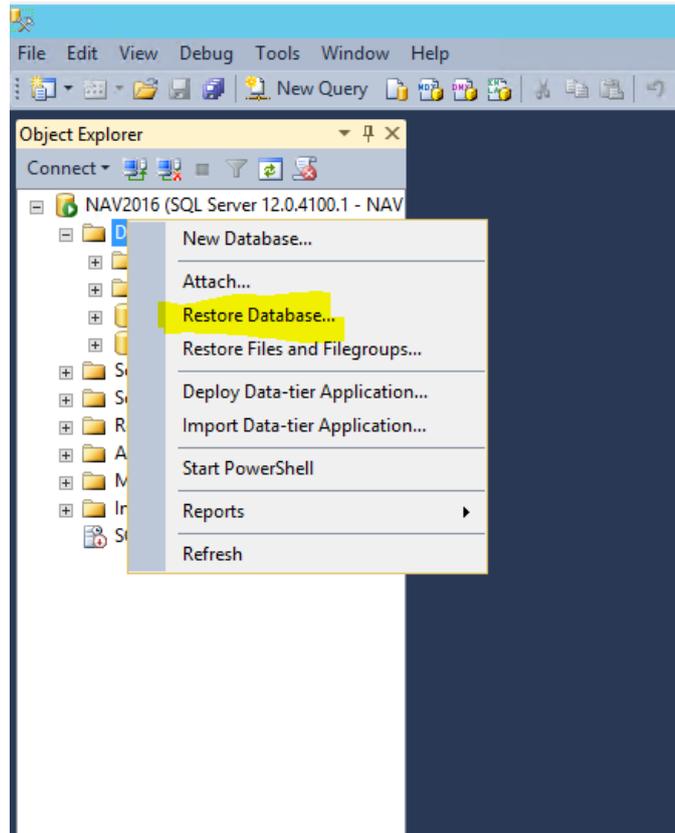
- 1) Open SQL Server Management Studio.



2) Connect with the following credentials.

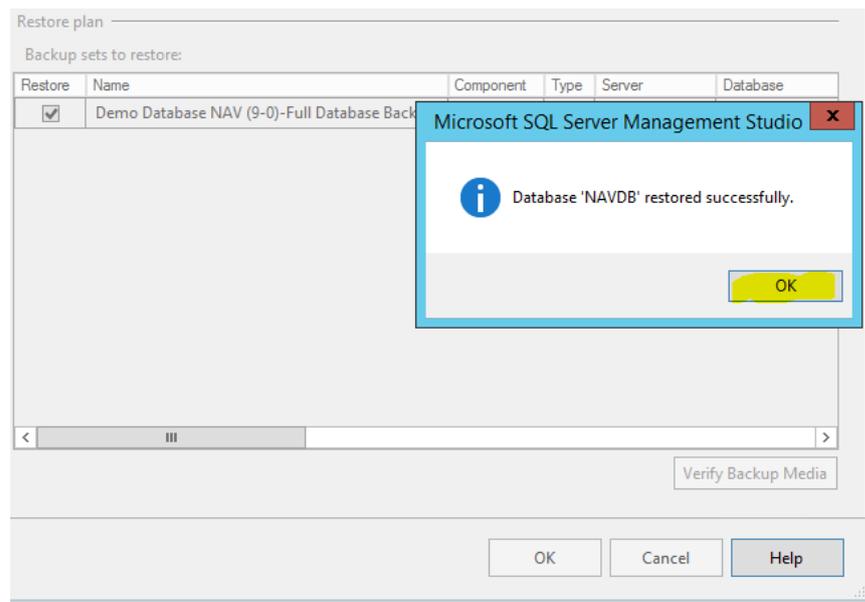
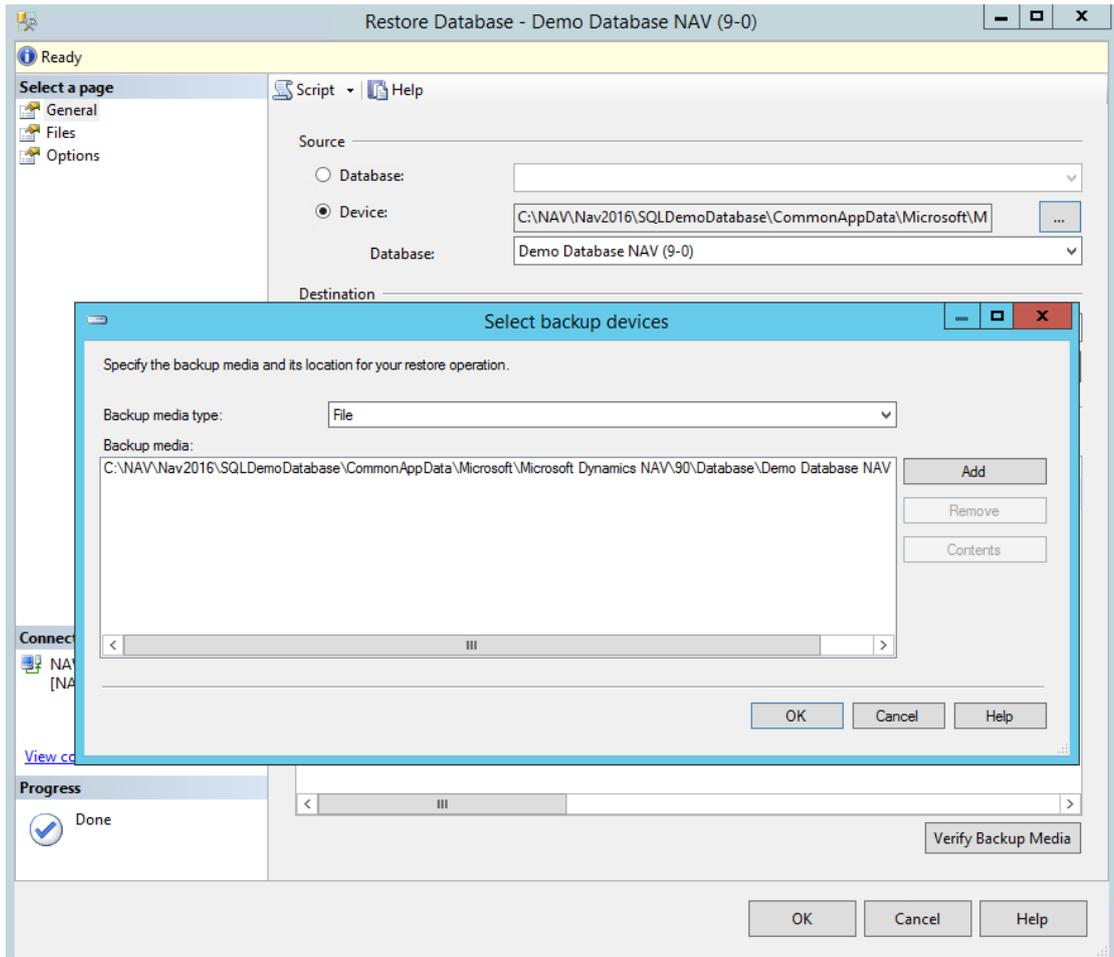


3) We have to restore the Data base. Go to NAV2016→Databases→Restore Database.



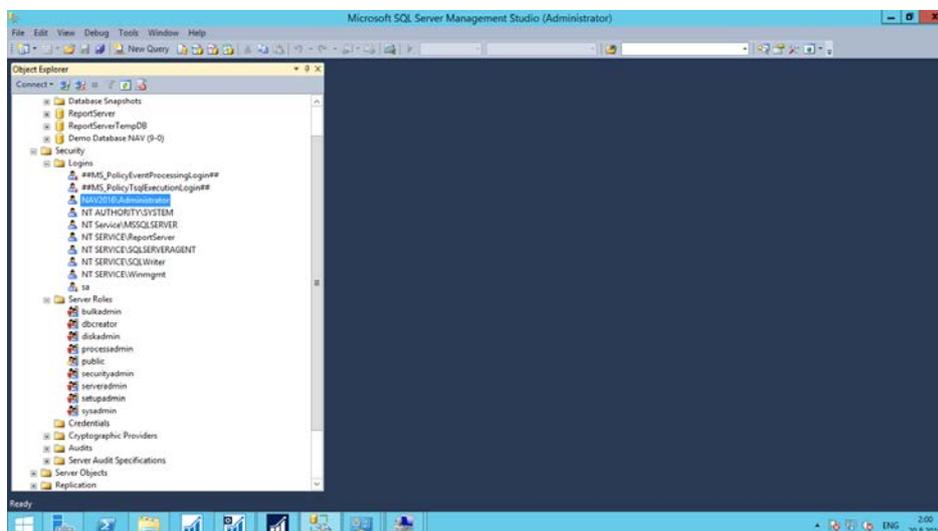
- 4) From the location where NAV has been saved choose the database. Since I have saved my NAV application in a separate folder in C, the location of the Data base is :



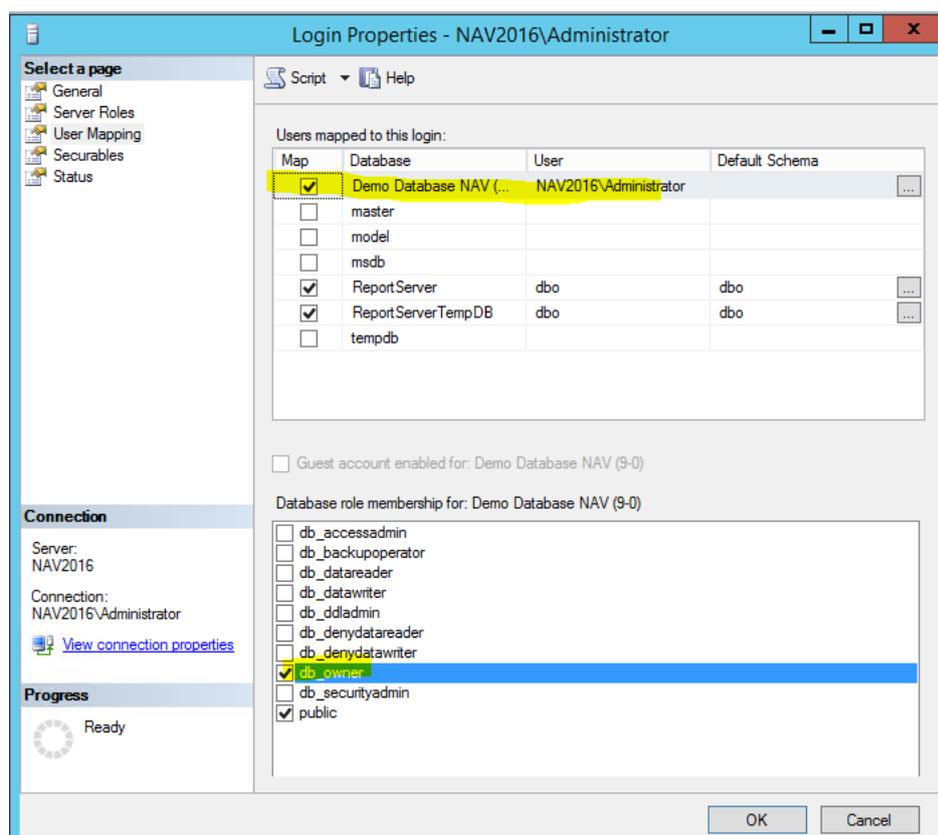


## Permission to the Administrator

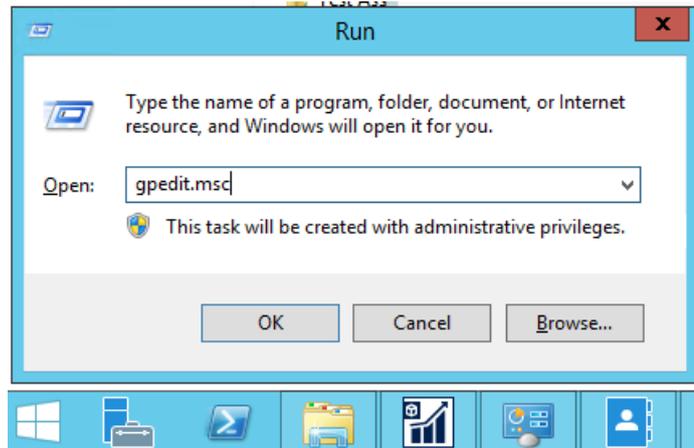
- 1) Among Logins choose Administrator



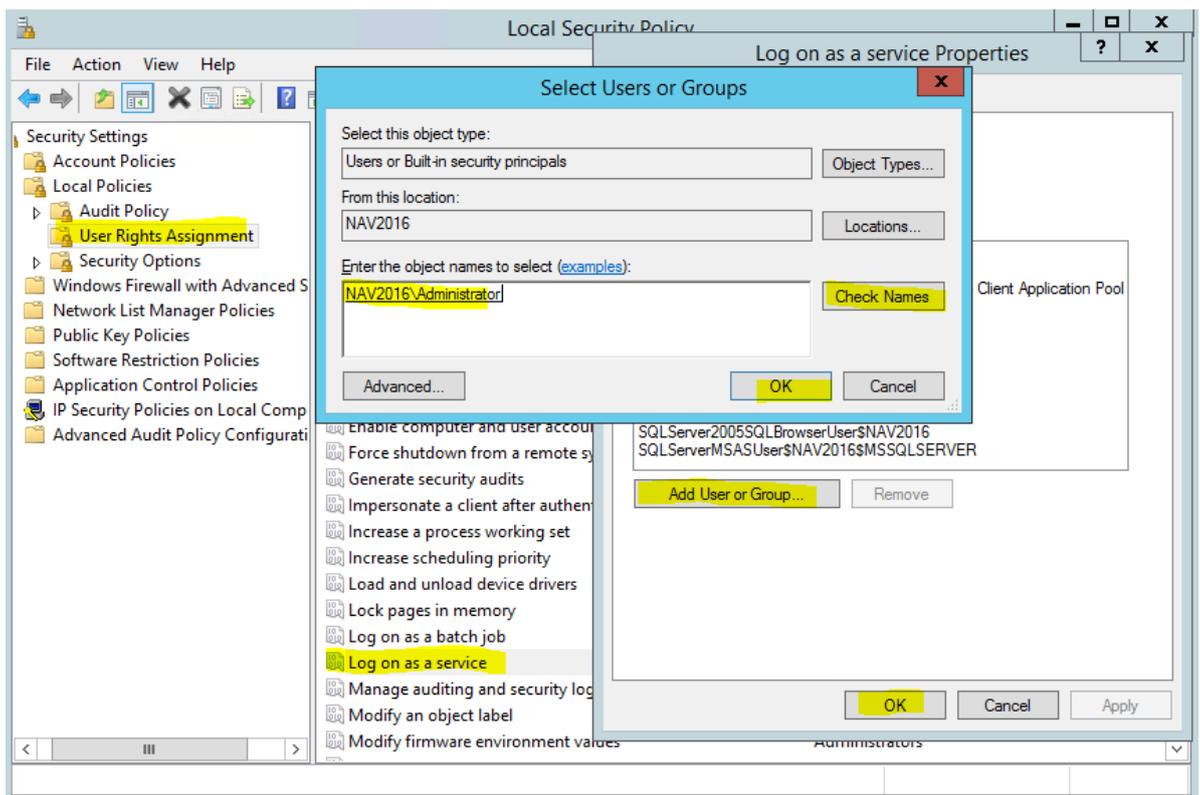
- 2) Go to User Mapping.



- 3) After that run the following command from your VM.



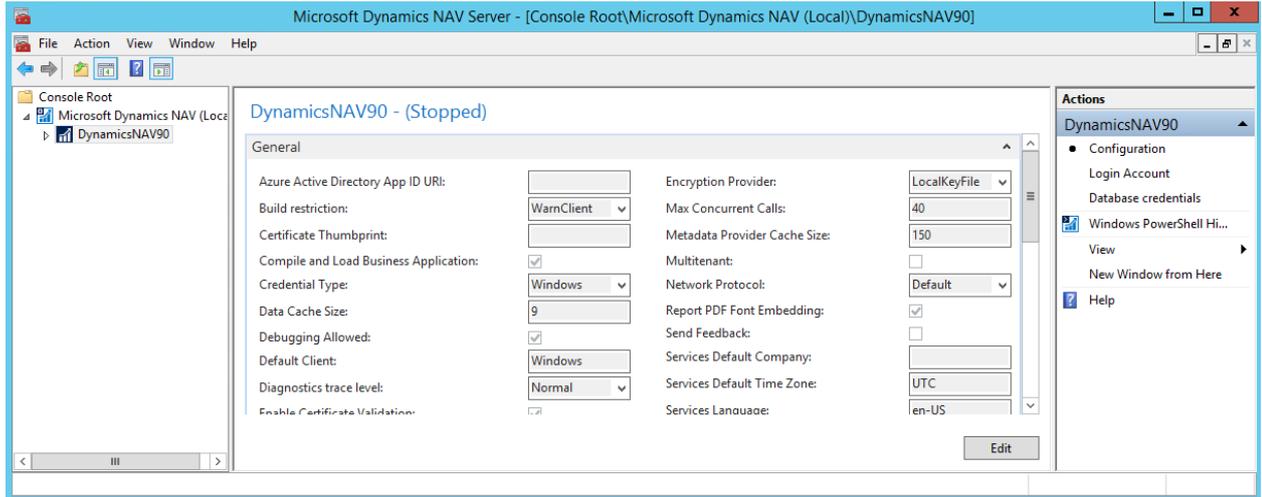
- 4) Local Security Policy→Security Settings→Local Policies→User Rights Assignment→Log on as service→Add User or Groups→Type Administrator→Check names→OK



All rights to Administrator has been added.

Start NAV Server

- 1) Open the NAV Server.

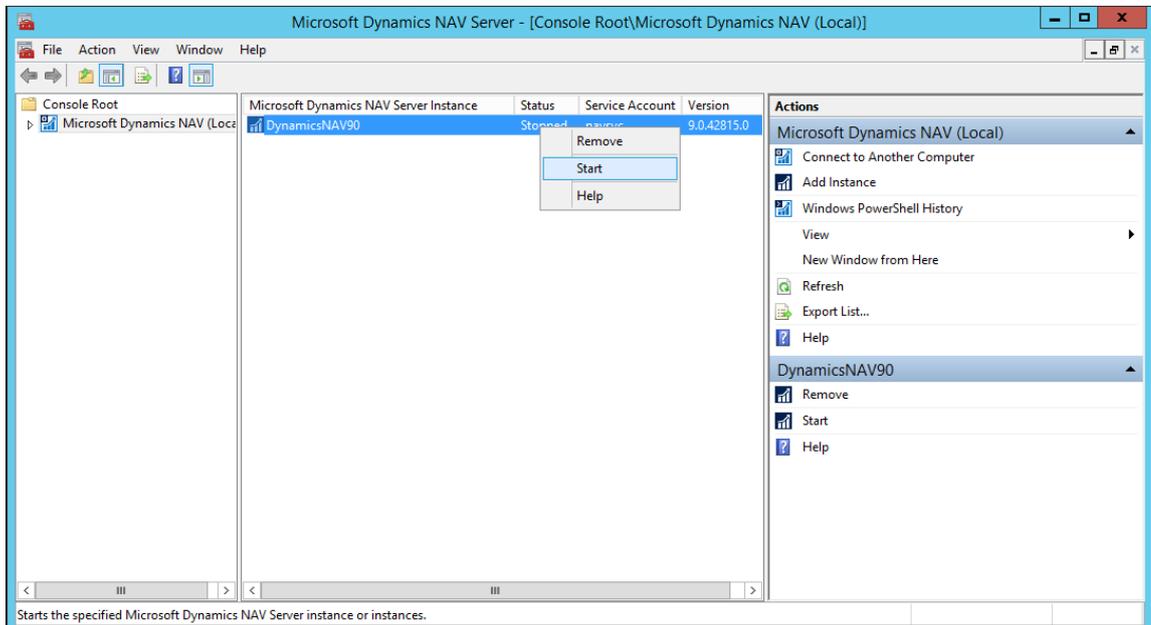


2) Change the account configuration.

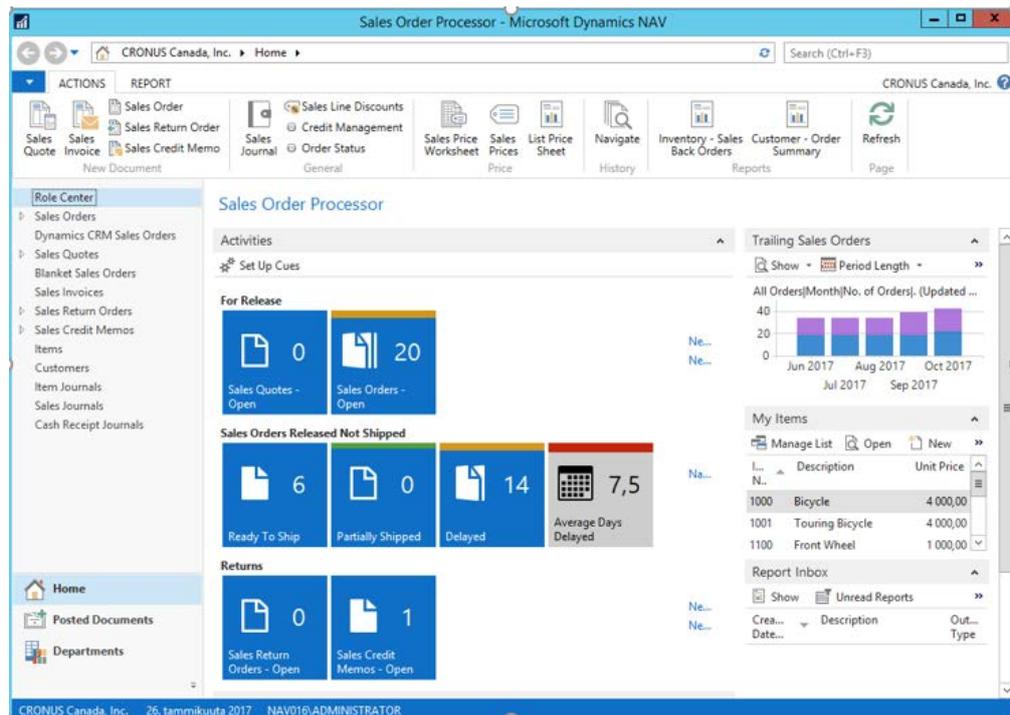
DynamicsNAV90 - (Running)



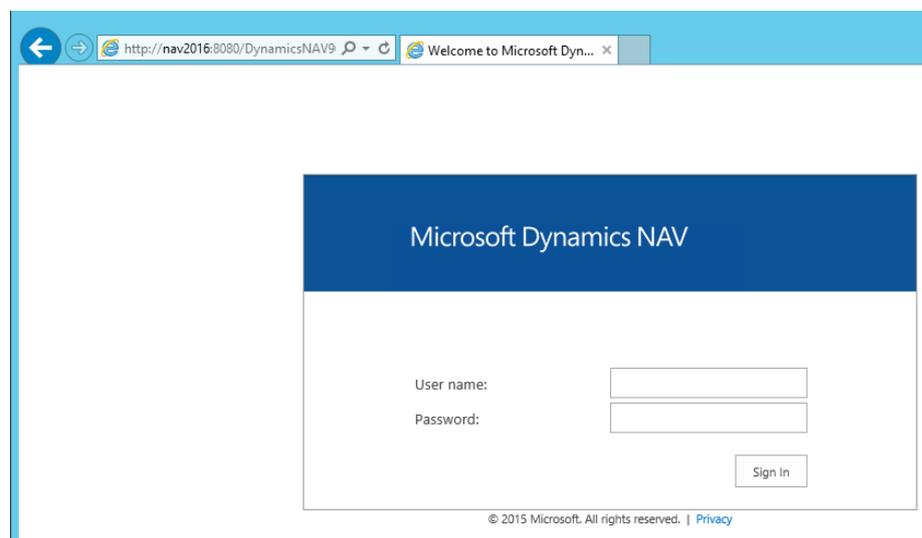
3) You can now start the server.



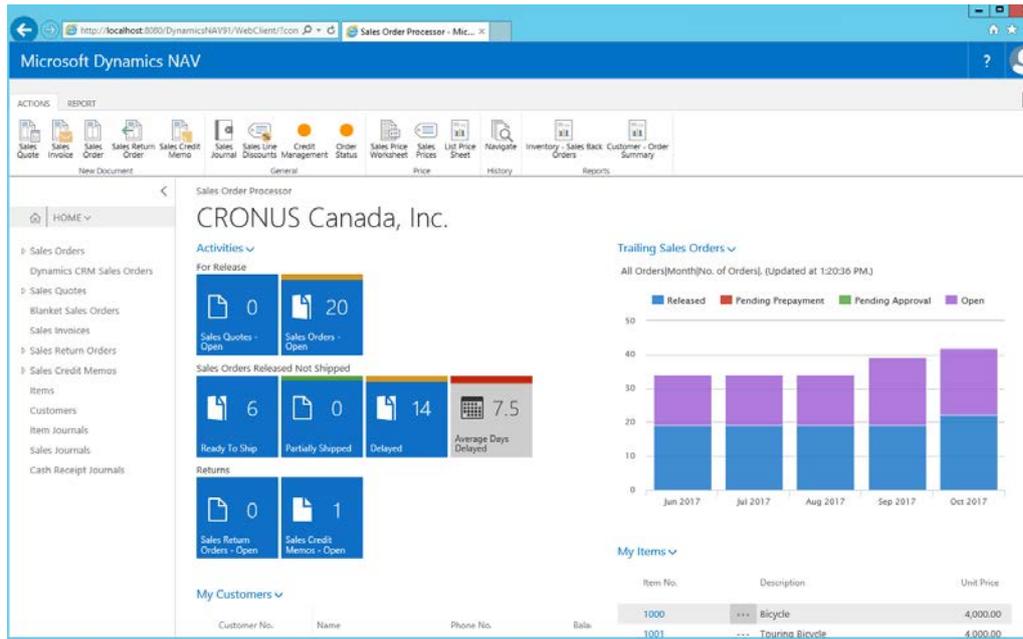
4) After that your Server has started to run, click NAV client from your desktop.



- 5) At this point it is also possible to check whether the Administrator can log in NAV from the browser. The default link to access NAV via web is:  
<http://localhost:8080/DynamicsNAV90/WebClient>  
 According to our configuration the URL will be:  
<http://nav2016:8080/DynamicsNAV90/WebClient>



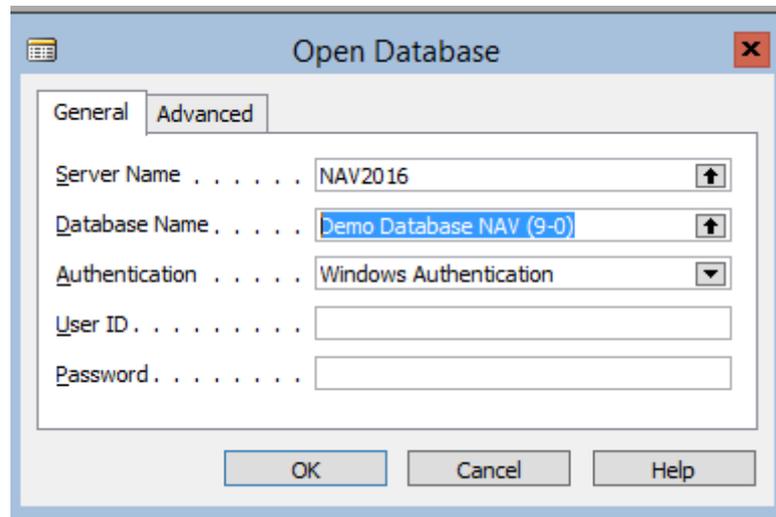
- 6) Dynamics NAV from web browser



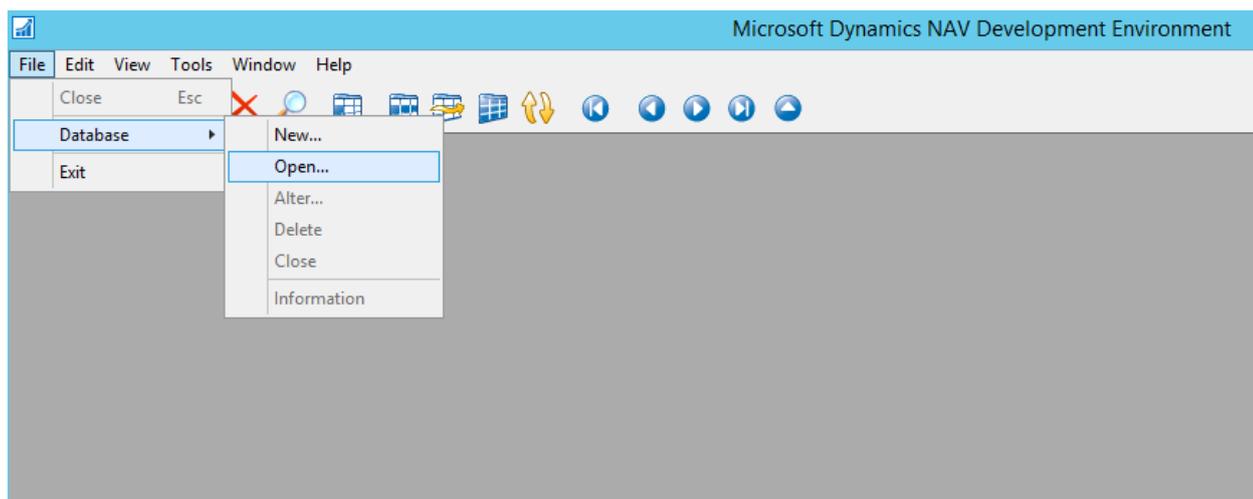
### Change License

Changing license is a task that can be performed in case you have a license to replace, or you are working in a production environment, other way this section is not needed to be performed.

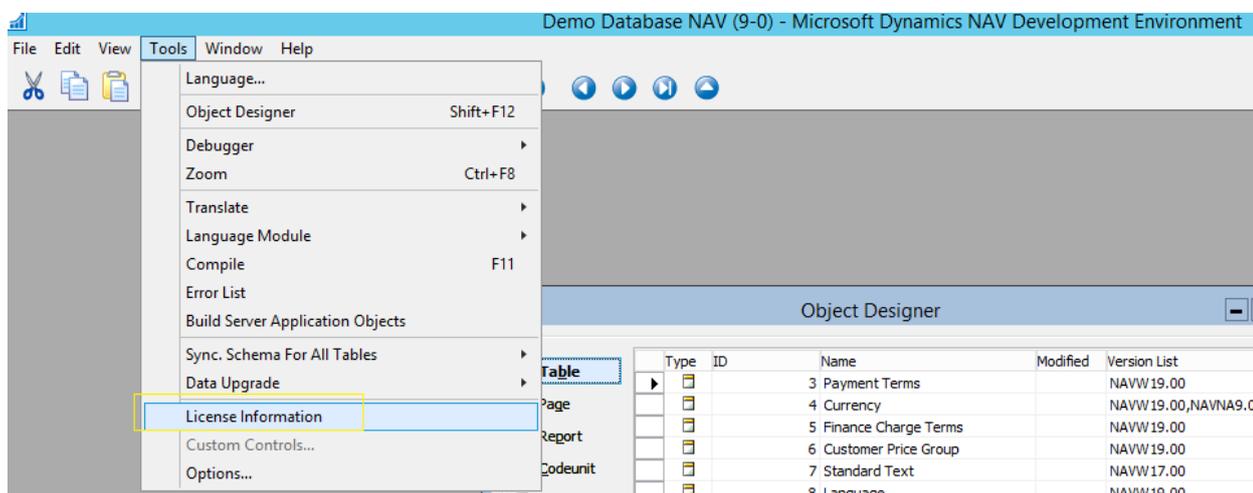
- 1) Connect in the NAV Development environment with the following credentials



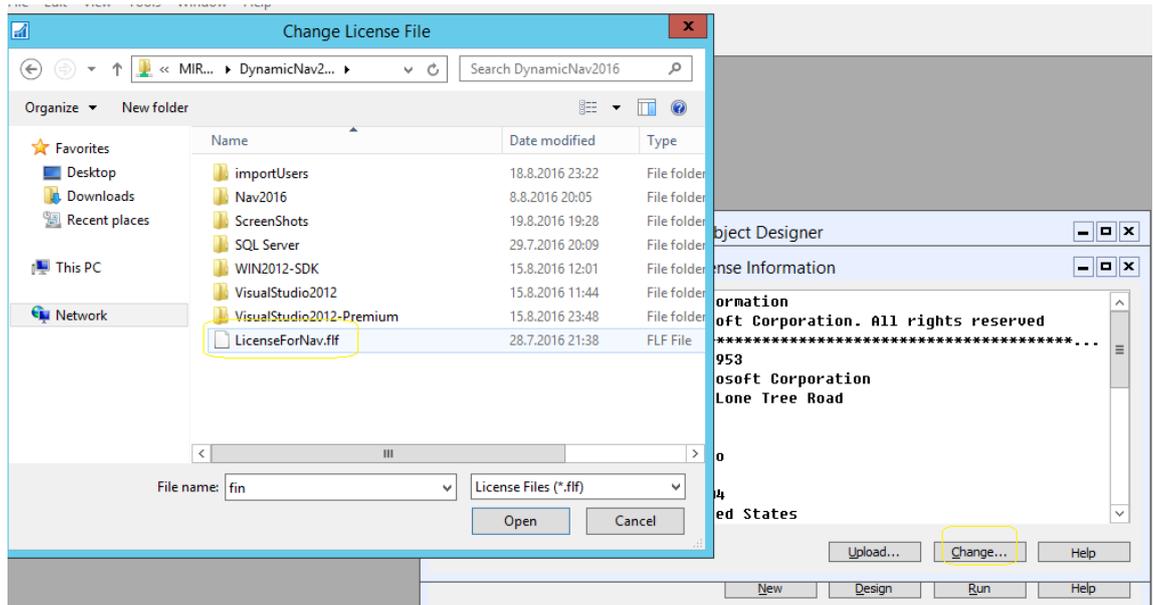
- 2) From the menu select Database and Open.



3) Upload the license you have been provided.



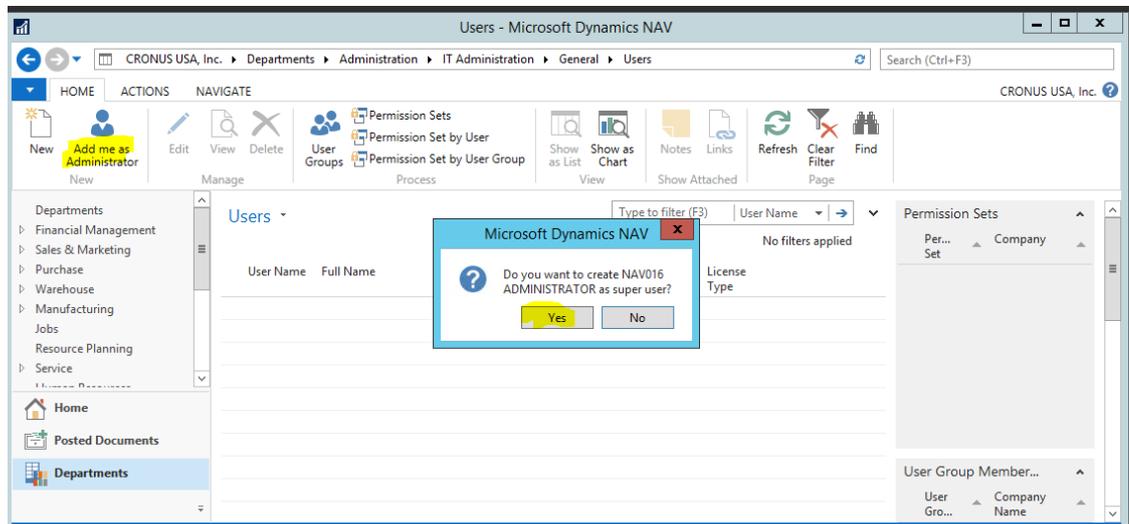
4) Change button, allows to change the new license only temporarily, for permanent changing Upload button needs to be clicked.



Close the application and the process of changing license will be completed.

### Create Windows User

- 1) Before creating any user, it is important to give the Administrator the permission as Super user. Only a Super User can create and manage other users.



- 2) Since this user creation is done by Windows authentication mode, before creating any users in NAV we have to create a user in Windows. Later we will demonstrate the creation of users without creating a Windows user.

From Control Panel of your Virtual System create a new user and set a password. In this example the user name is "wino01"

**Add a user**

Choose a password that will be easy for you to remember but hard for others to guess. If you forget, we'll show the hint.

User name

Password

Reenter password

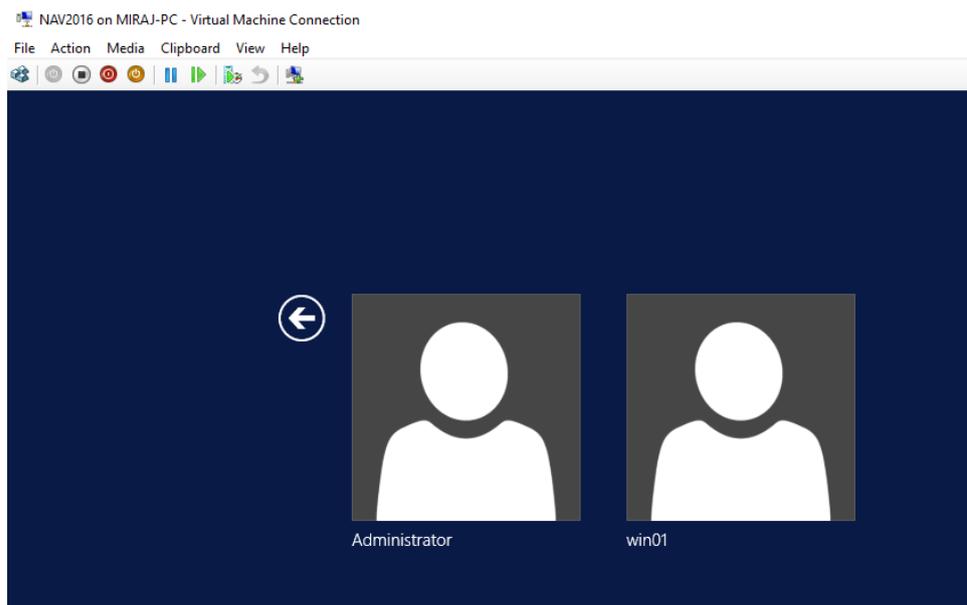
Password hint

**Add a user**

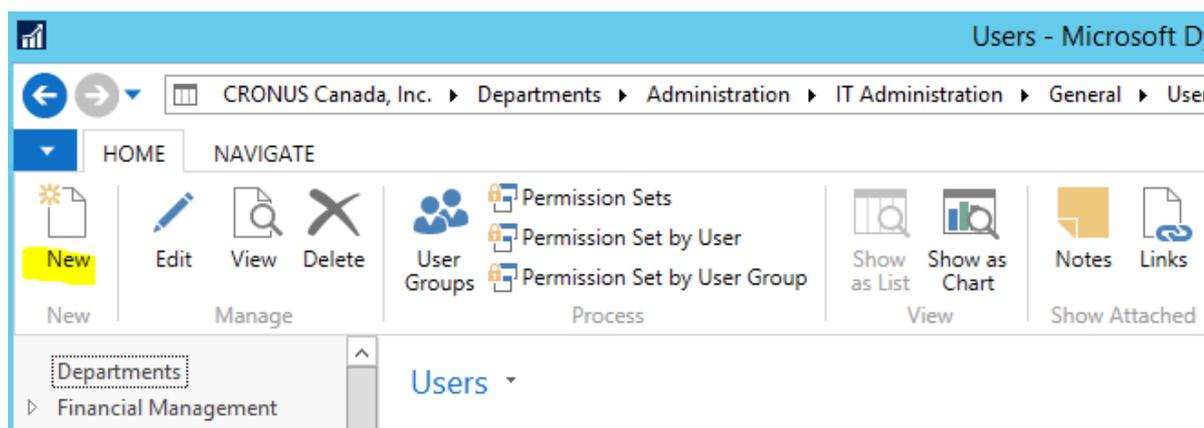
The following user will be able to sign in to this PC.

 win01  
Local account

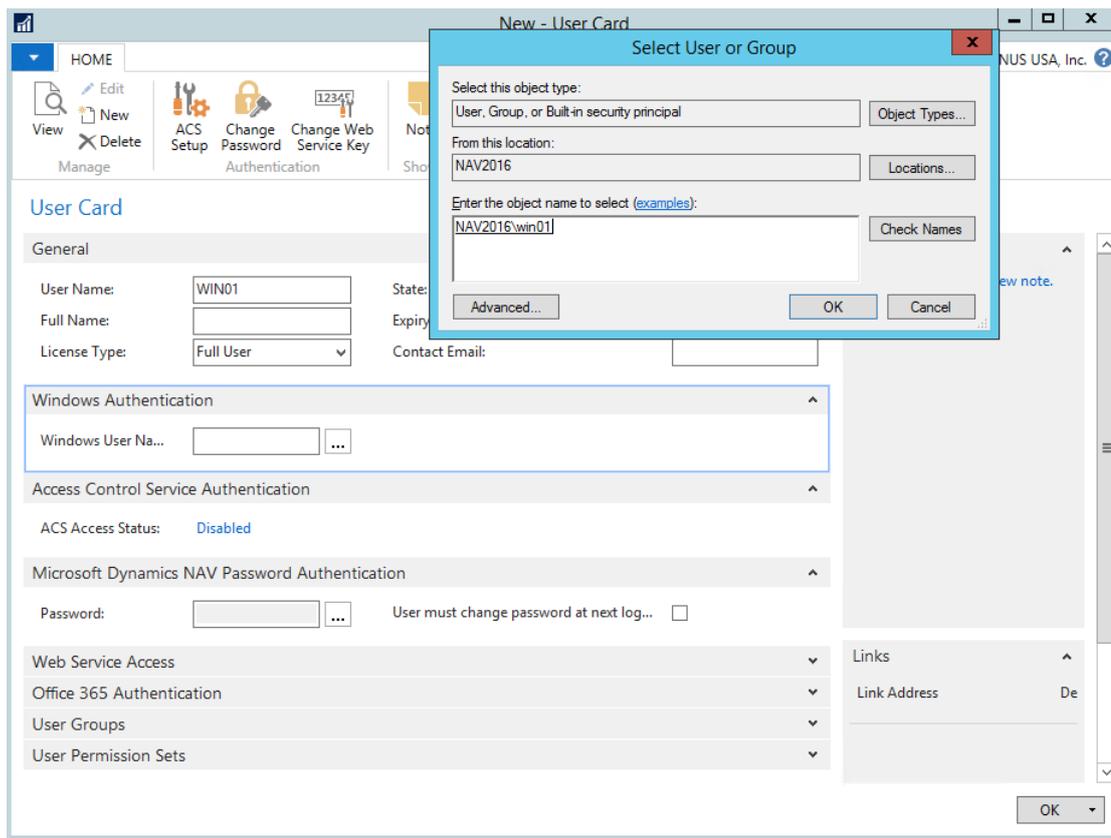
3) You can see the new created account reflecting in the log in page



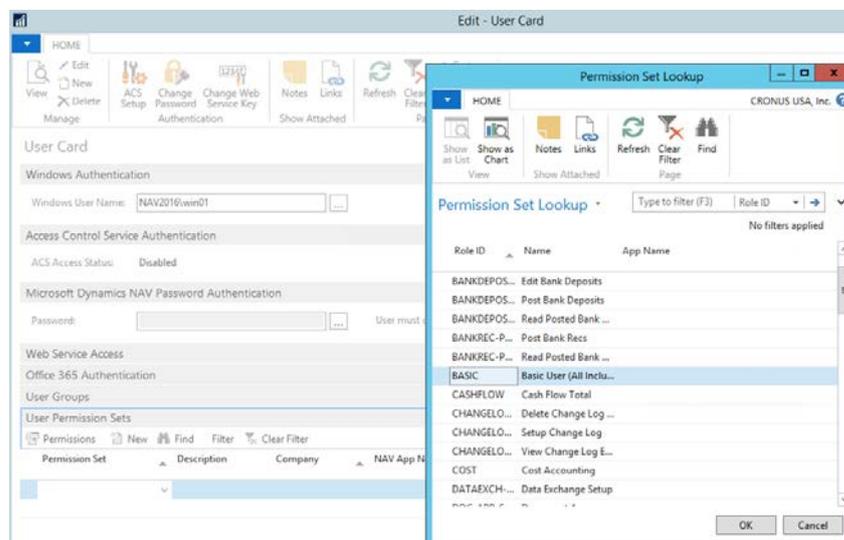
4) Now from NAV go to the Users and start creating a new User.



5) The **name** and **password** of the user should be exactly the same as the windows account you created in step 2.  
Click on **Windows Authentication** to insert the password.



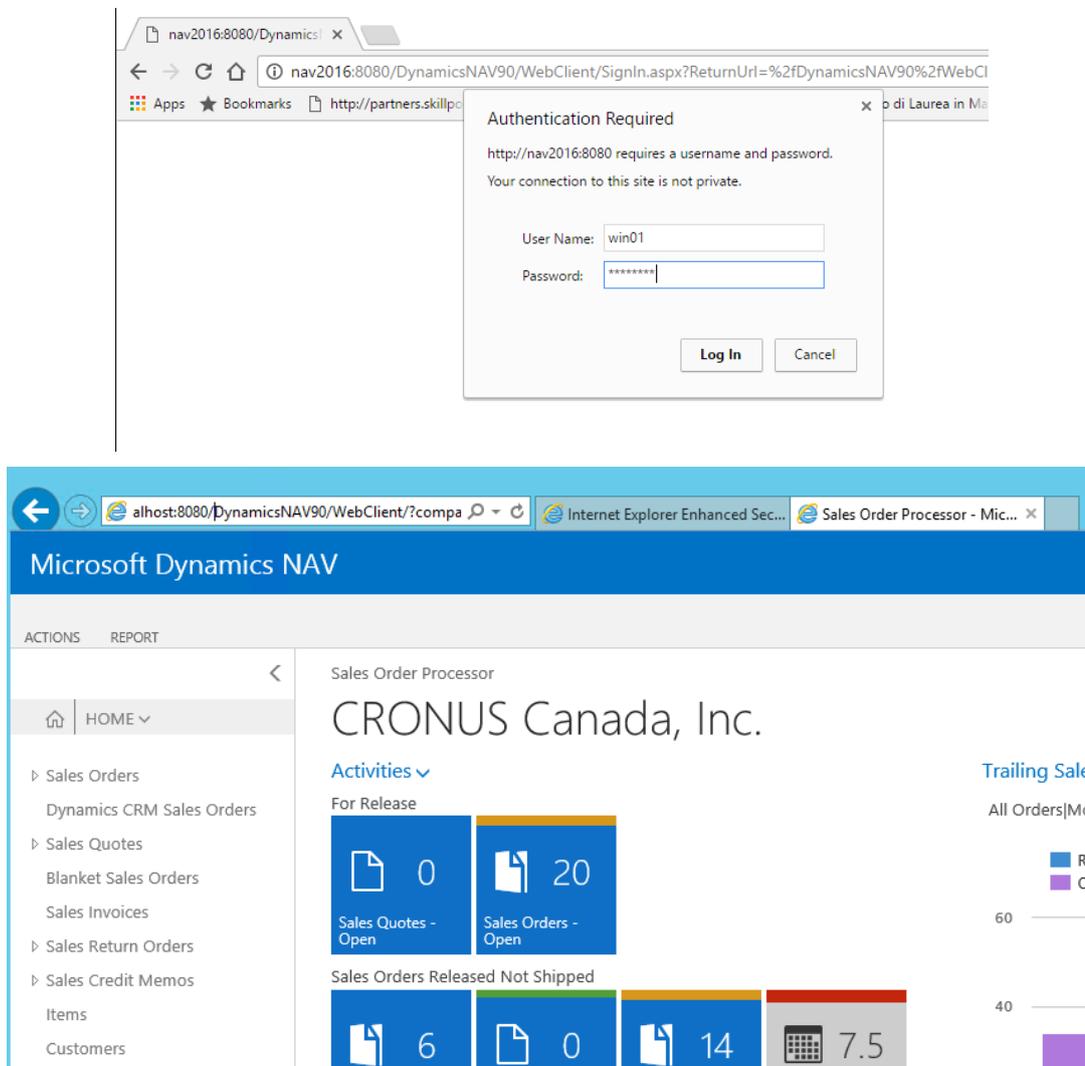
- 6) It is also possible to assign a specific permission to the user. Microsoft Dynamics NAV provides different permission sets. In this example I have used BASIC.



User creation has been completed.

Creation of a user in NAV by following the Windows Authentication method allows to log in the user from any machine having NAV client installed into it. In other words, win01 can log in from any machine, only if the machine has NAV client installed and an account reflecting the same name and password as win01.

Furthermore, users created by Windows Authentication method are allowed to log in NAV also from the web. The URL is the same when we logged as Administrator :  
<http://nav2016:8080/DynamicsNAV90/WebClient>

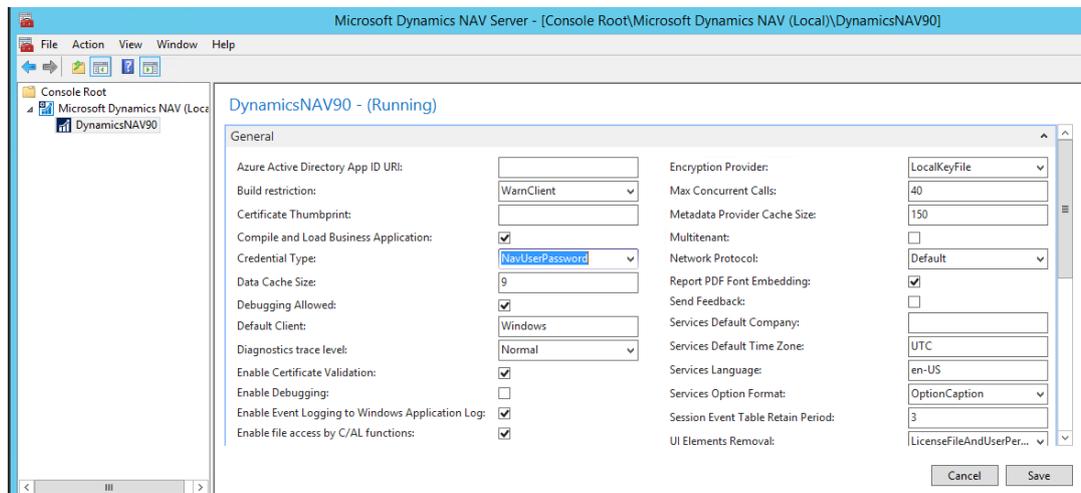


### Change Authentication

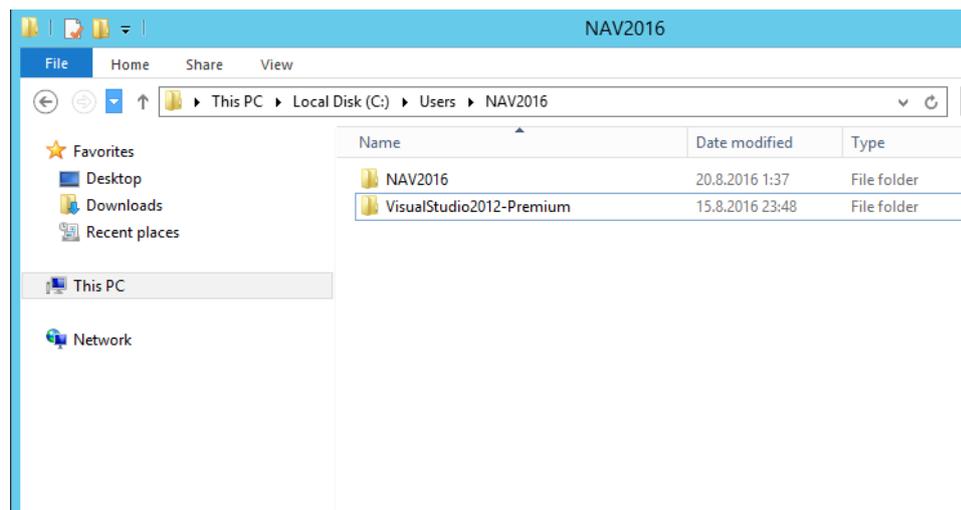
This section describes the change of authentication from “Windows” to “NavUserPassword” method. This authentication type stands out from windows type for the fact that you do not require to create both Windows account and a NAV user. Creation of the NAV user will be enough in order to operate Microsoft Dynamics NAV, which reduces the work load.

The setting made in this section **will not allow** the NAV users to access NAV from desktop, which means user will access NAV only from web. However, later we will enable both way of authentications so that users access NAV either from Web or from Desktop.

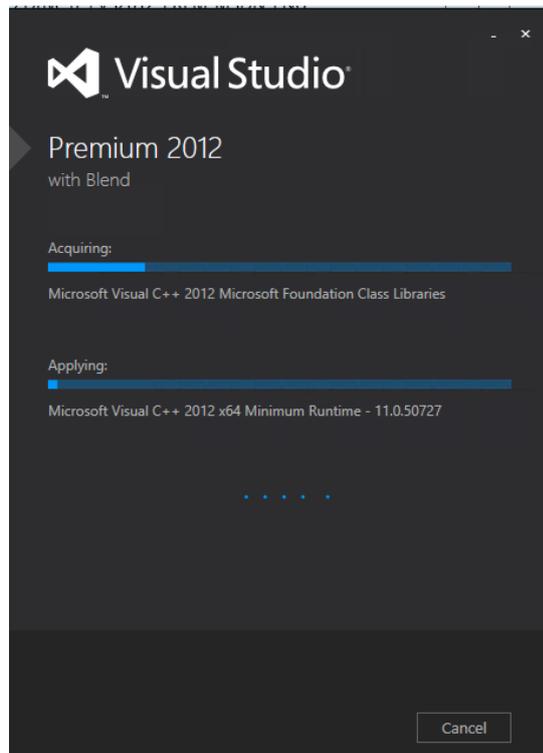
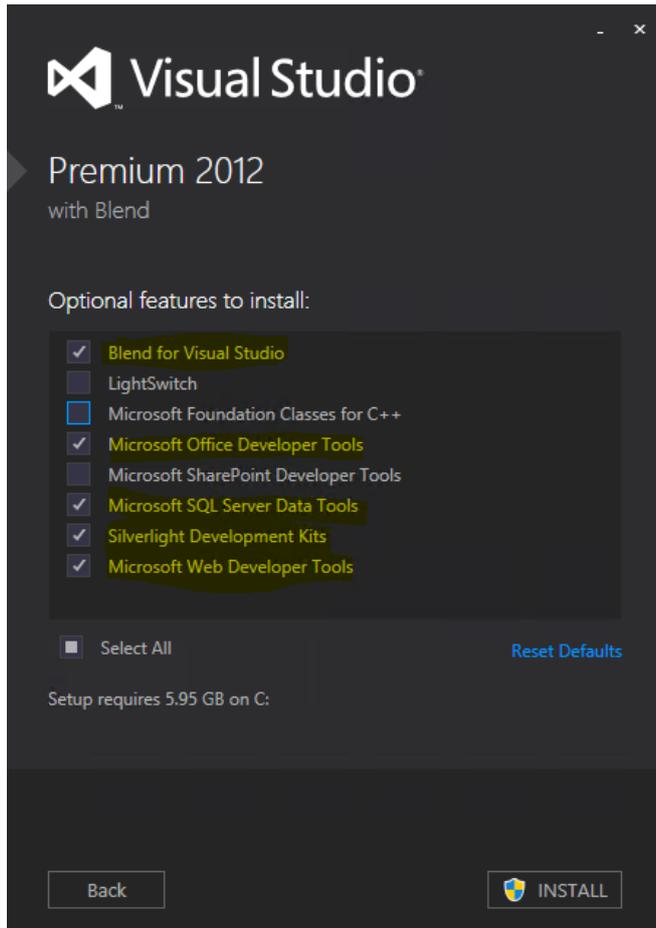
1) From NAV Server change credential type to NavUserPassword



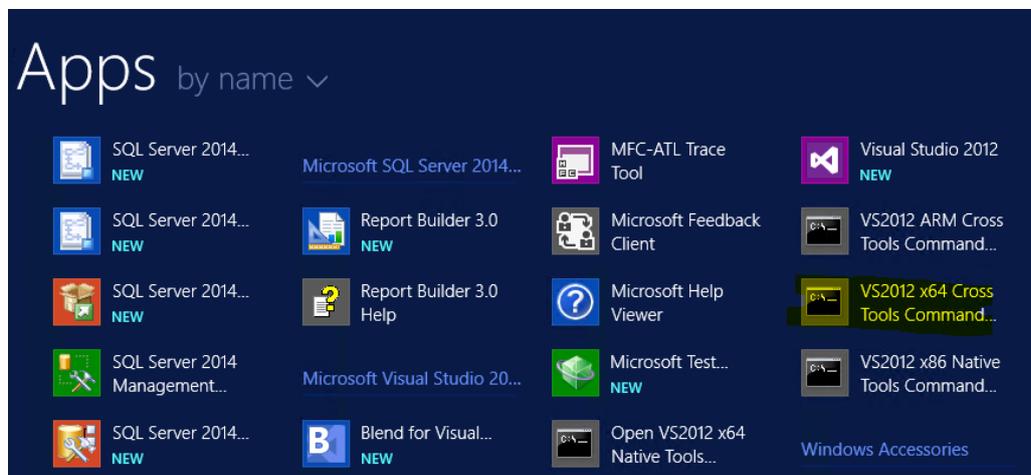
2) Install Visual studio. In my case, I have installed the Premium version.



3) You might not need to install every component of Visual Studio.

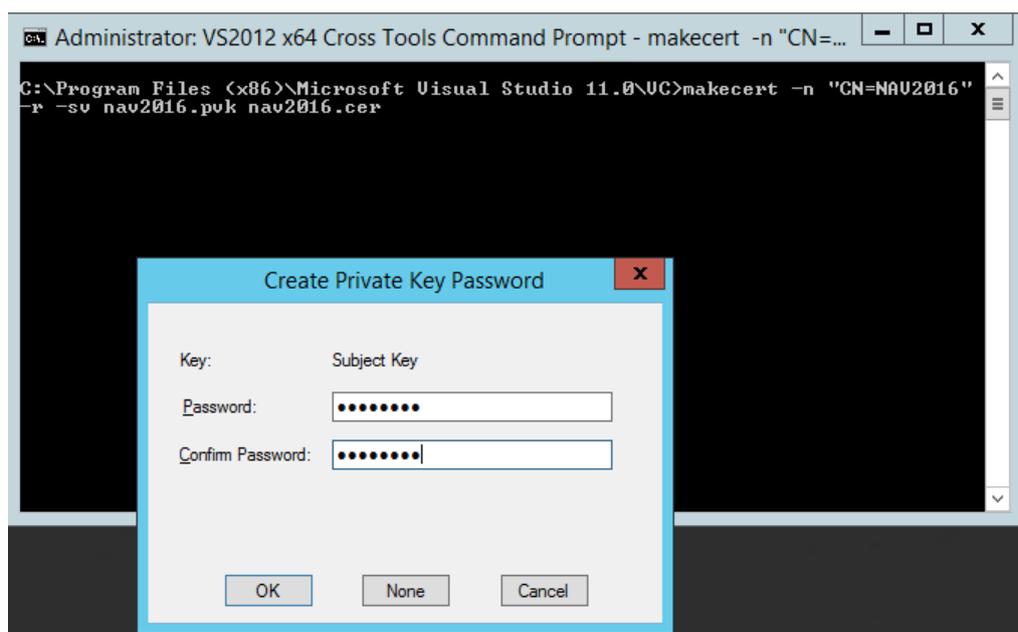


- 4) After that Visual Studio 2012 has been installed, you can go to programs and search for the VS2012 x64 Command Prompt



- 5) When the shell will appear type the following command:  
`makecert -n "CN=NAV2016" -r -sv nav2016.pvk nav2016.cer`

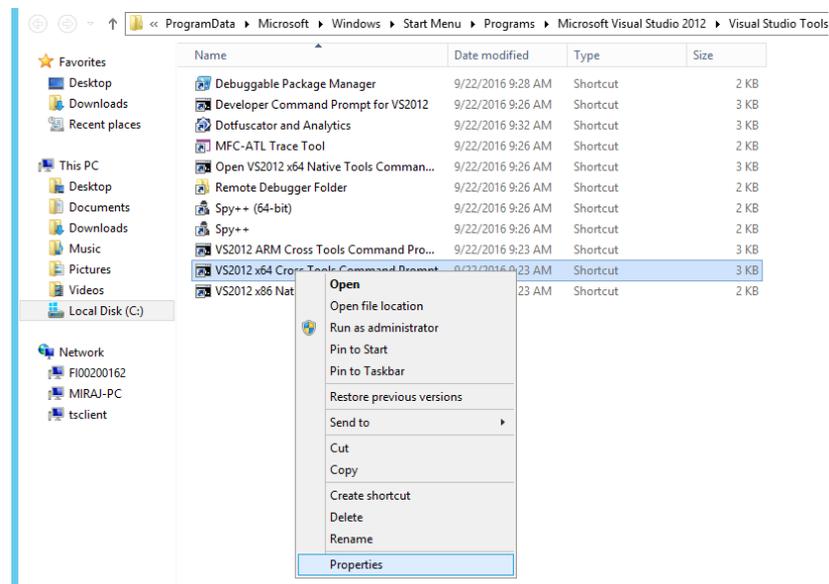
- 6) A window asking a security password will appear. Enter the password. I have used the same password of Administrator.



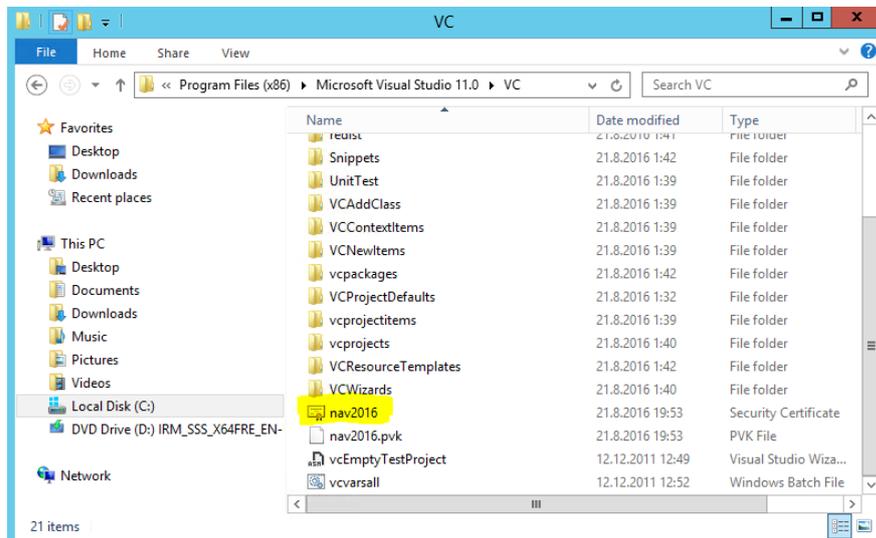
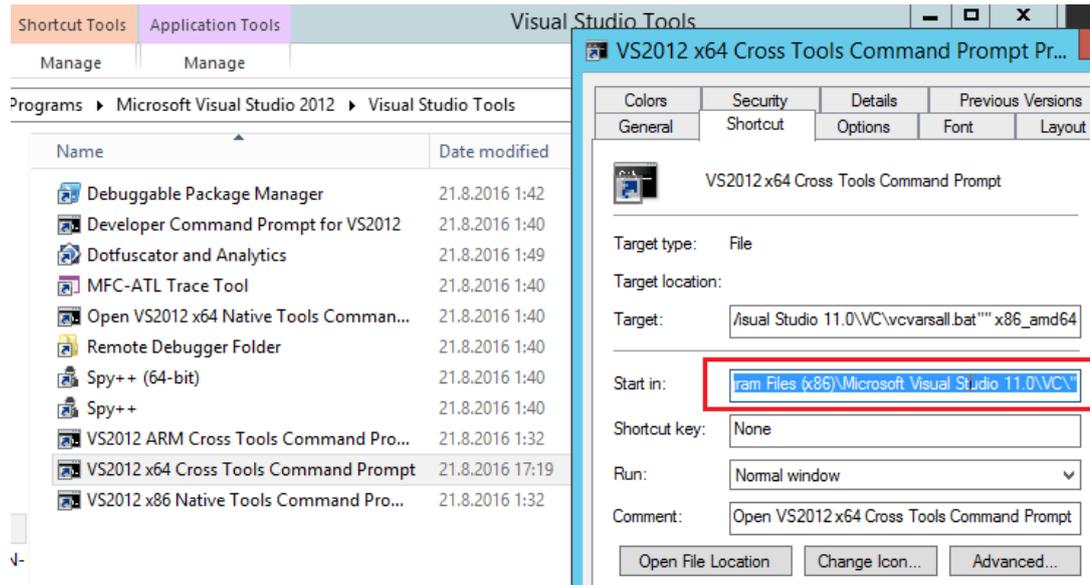
- 7) This command has created a certificate called **nav2016**. You need this certificate, which you can find in the same folder where this prompt command software is saved. To find the certificate go to the properties and copy the location file.



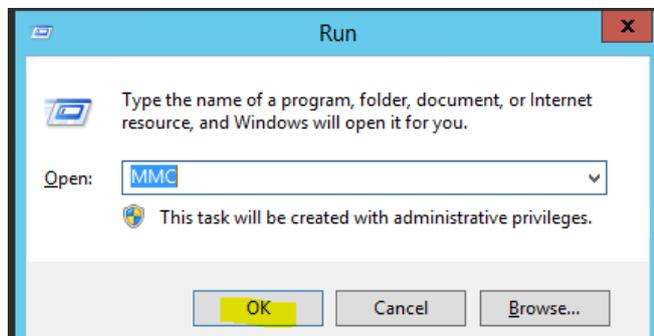
- 8) Choose the VS2012 x64 Command Prompt and go to properties.



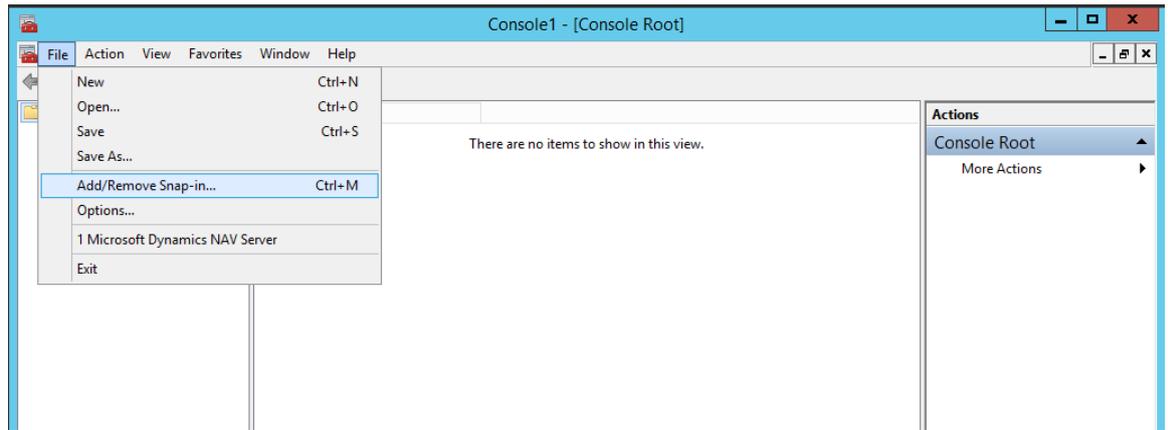
- 9) Copy the file location from Start in field.



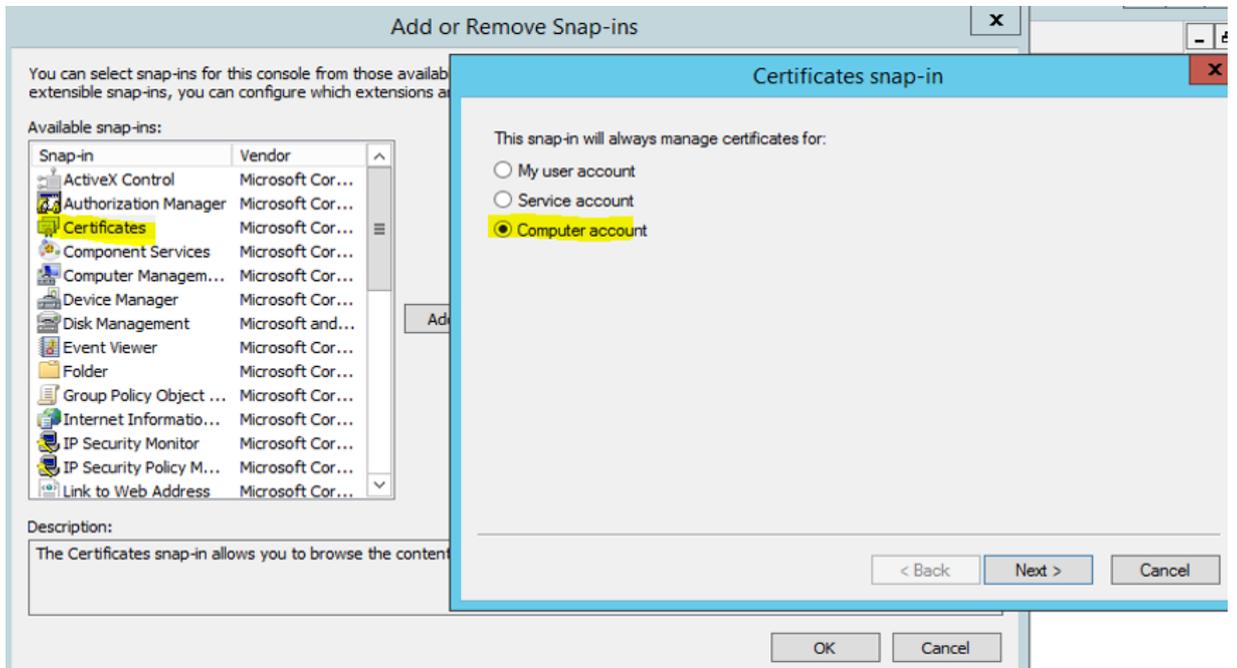
10) Run with the command MMC



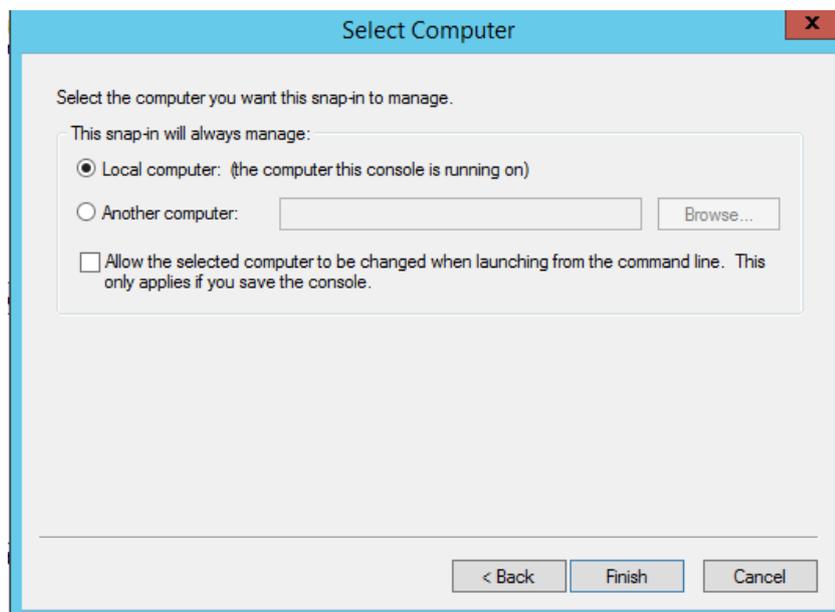
11) A console log will appear. From File→Add/Remove Snap-in



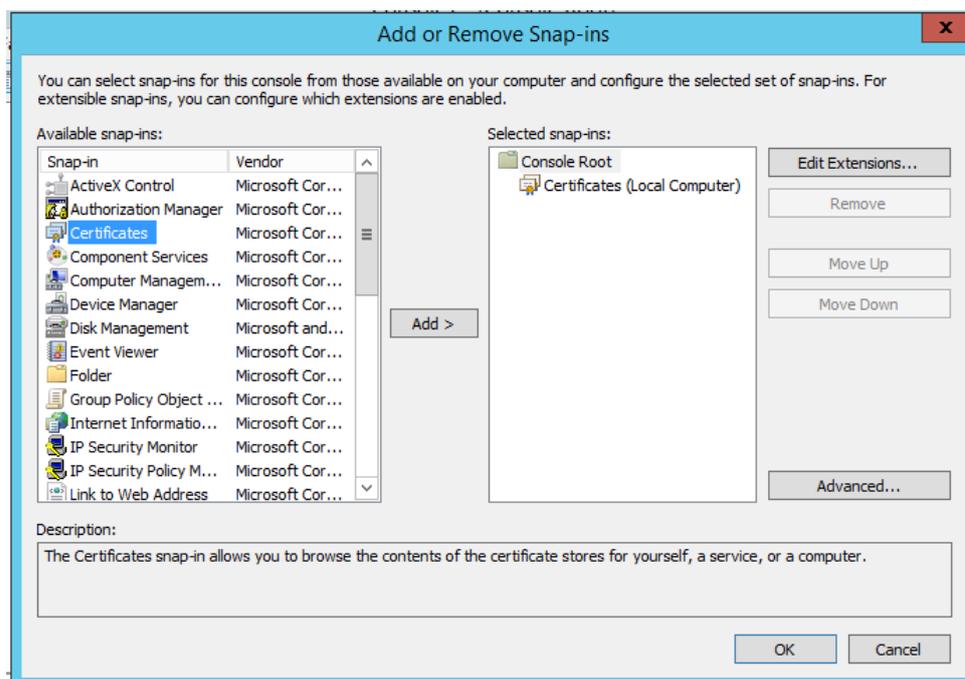
12) Click the Certificates.



13) Click Finish

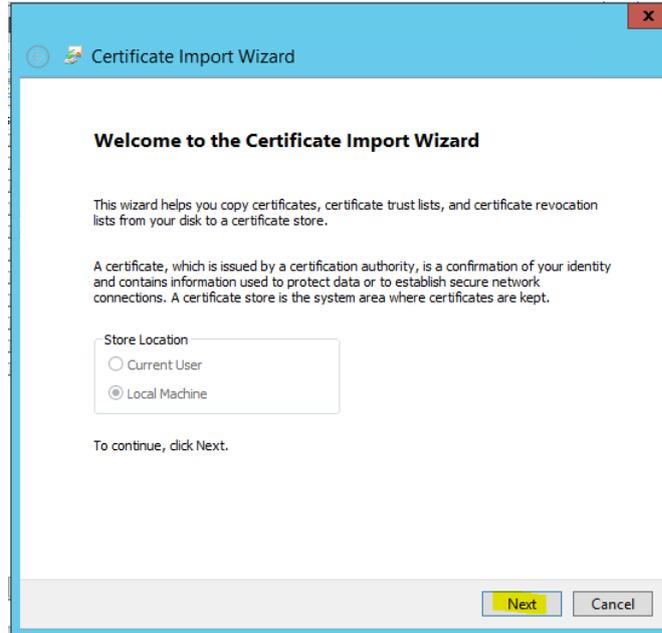


14) Click OK

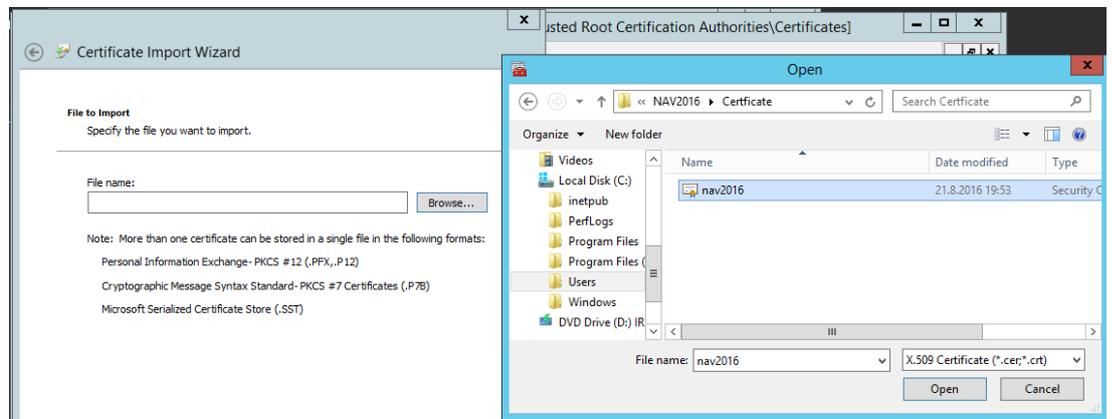


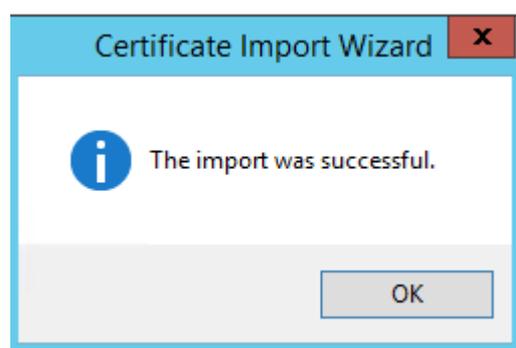
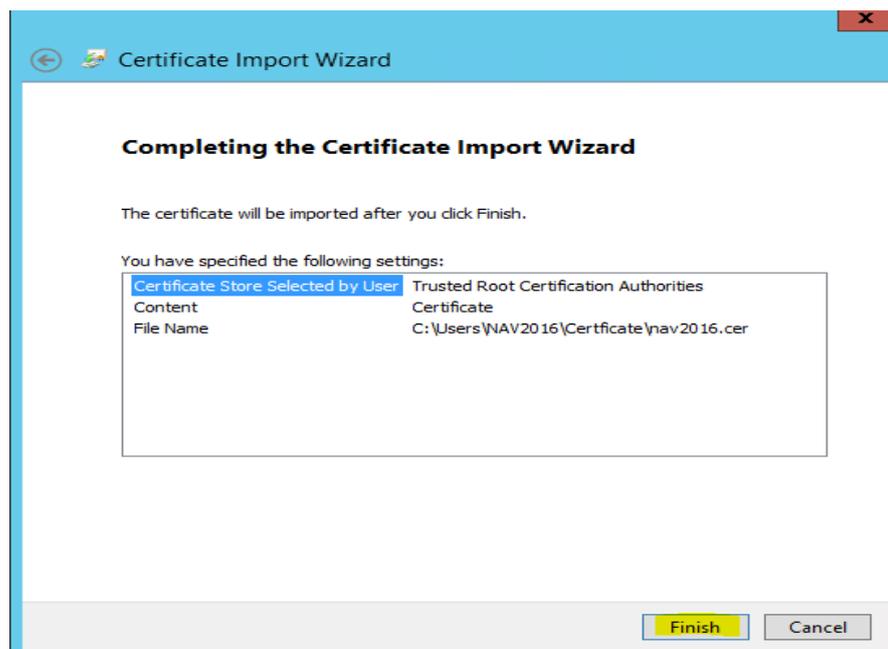
15) You will see that under Console Root a Certificate folder has been added.





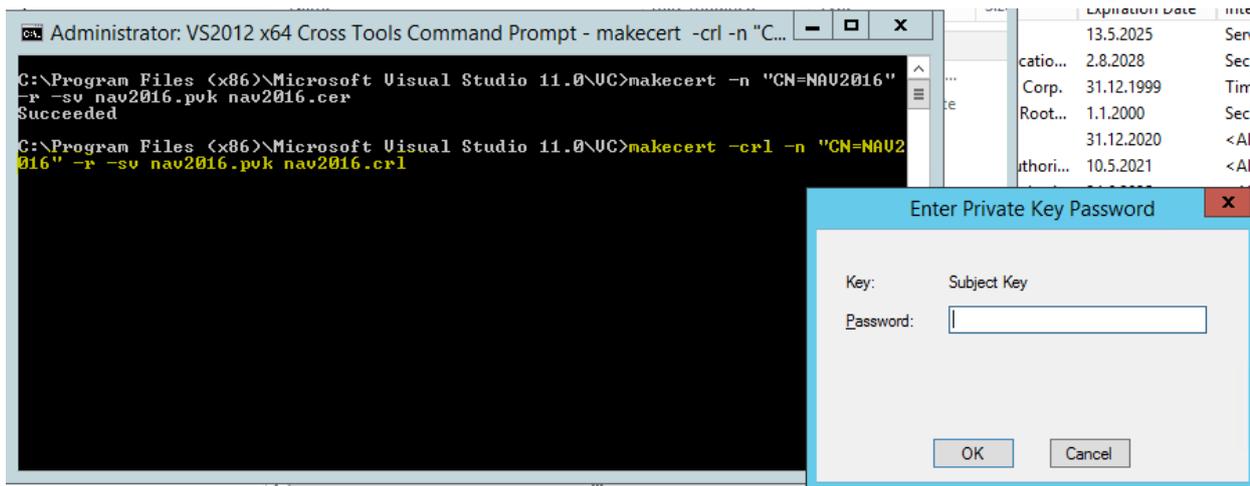
- 17) For my own convenience, I have copied these certificates files and placed in my VM into another folder called, Certificate. In this step, I just import from that folder the nav2016 certificate which I have previously created.



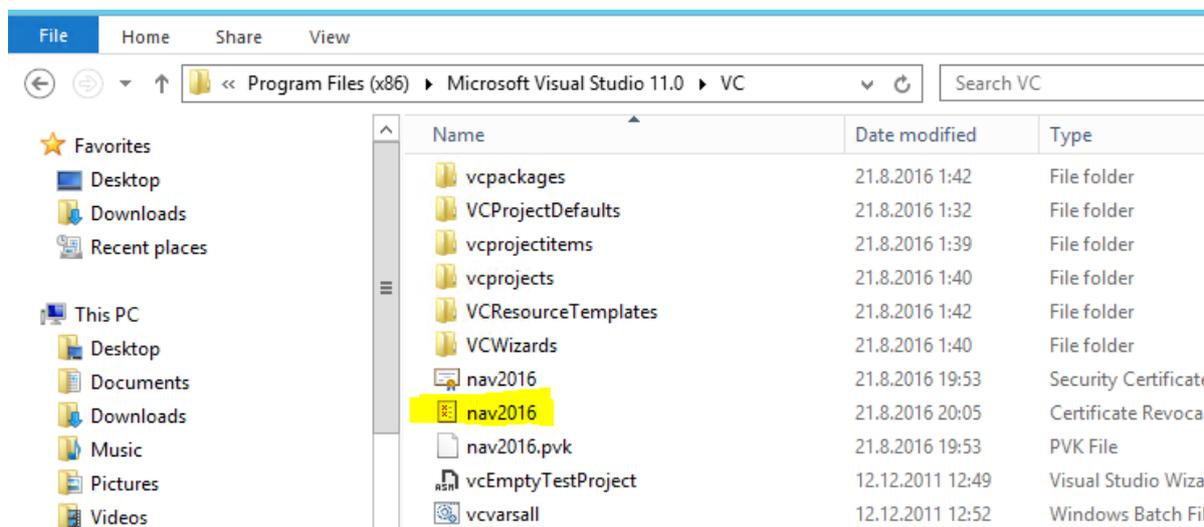


- 18) Now we have to make another file and do similar procedure like we did before, but this time we have to import the revocation file. So, from command prompt type the following command:  
`makecert -crl -n "CN=NAV2016" -r -sv nav2016.pvk nav2016.crl`

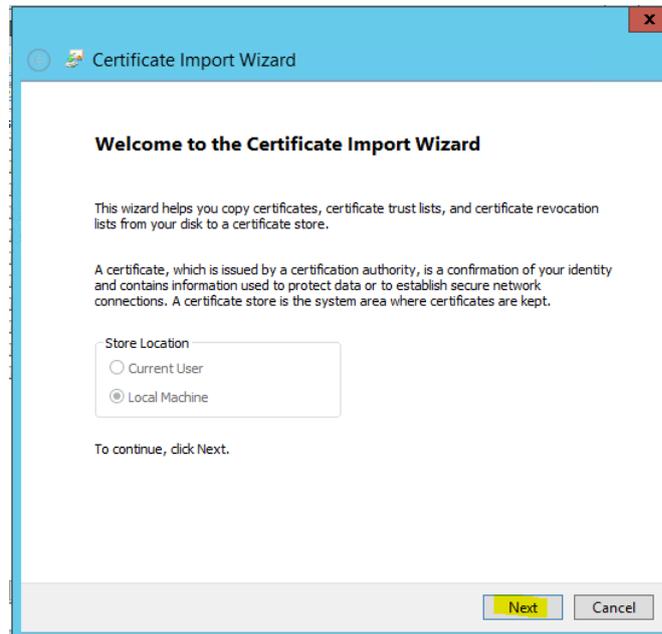
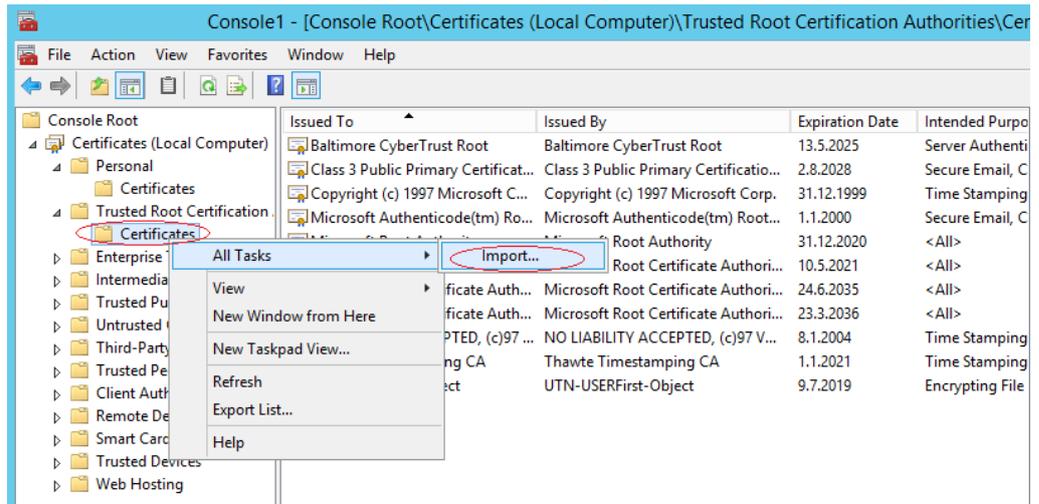
- 19) Use the same password you have given earlier.



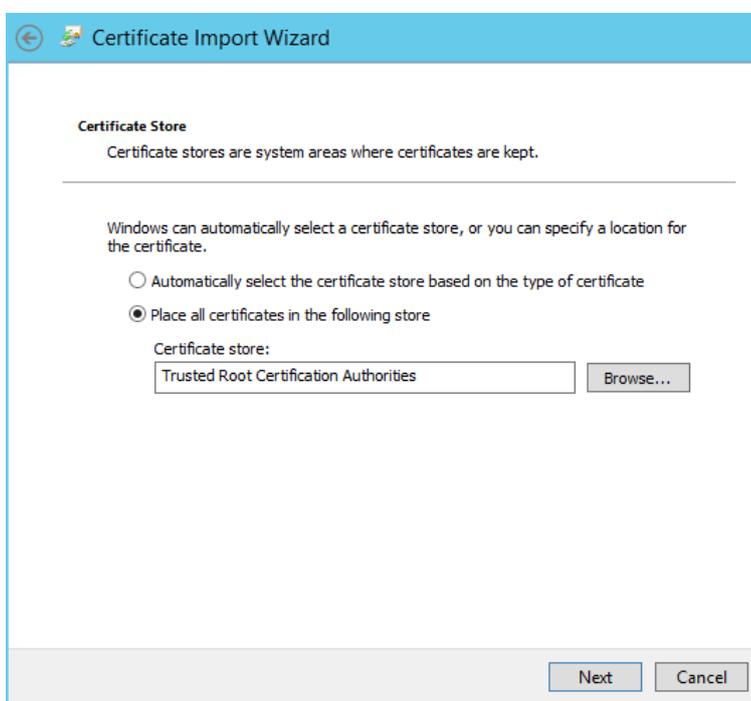
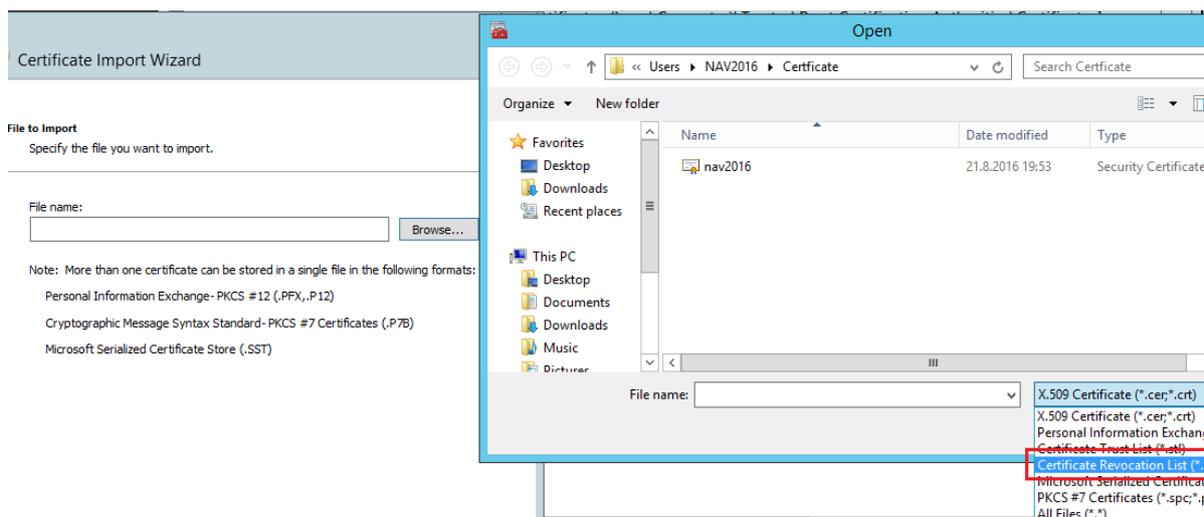
20) Go to the same folder where the nav2016 file was saved and you will find a new revocation file.



21) We will import this file like we did before. So, from Console  
Root→Certificates→Trusted Root Certification→Certificates→All Tasks→Import



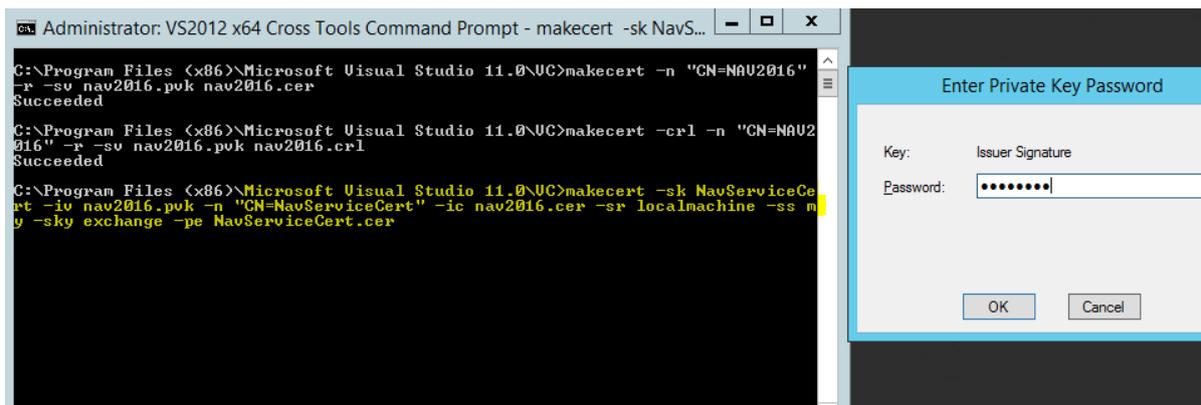
22) Remember to change the file extension to Certificate Revocation List



23) We have to run another command, and this time we will create another file called NavServiceCert. Go to command prompt and type the following command:

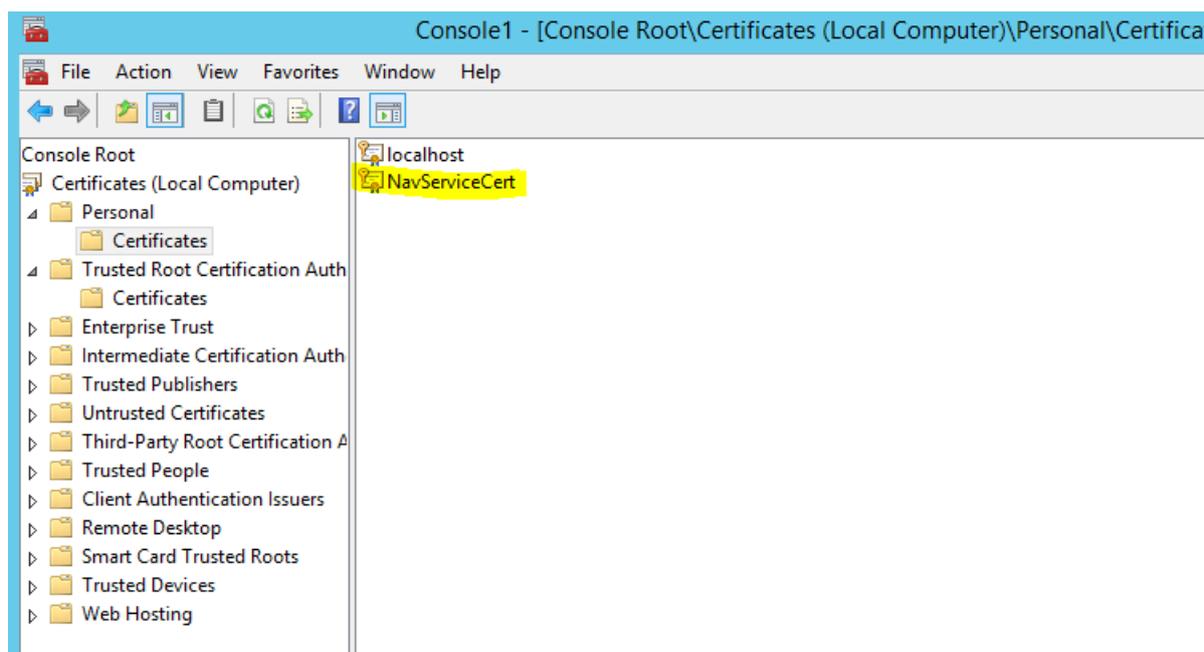
```
makecert -sk NavServiceCert -iv nav2016.pvk -n "CN=NavServiceCert" -ic
nav2016.cer -sr localmachine -ss my -sky exchange -pe NavServiceCert.cer
```

You will again need to insert the password.

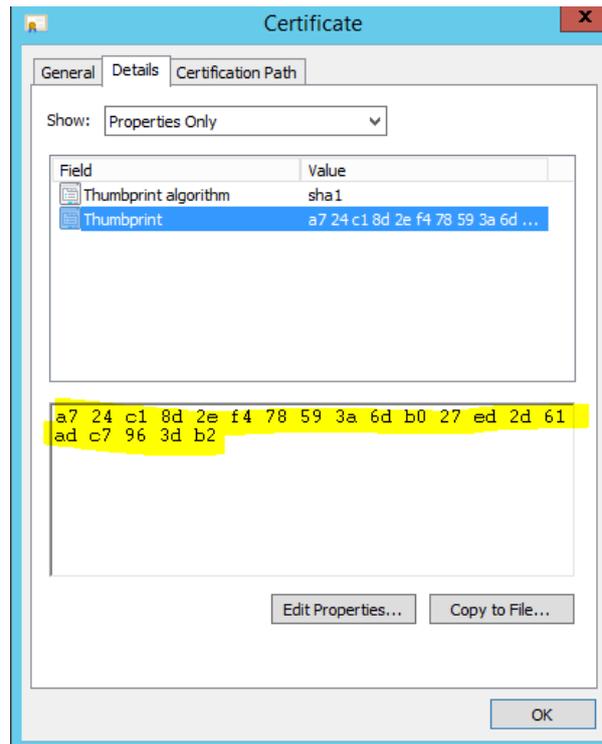


24) Go to Console Root→Personal→Certificates→You can find a file called NavServiceCert

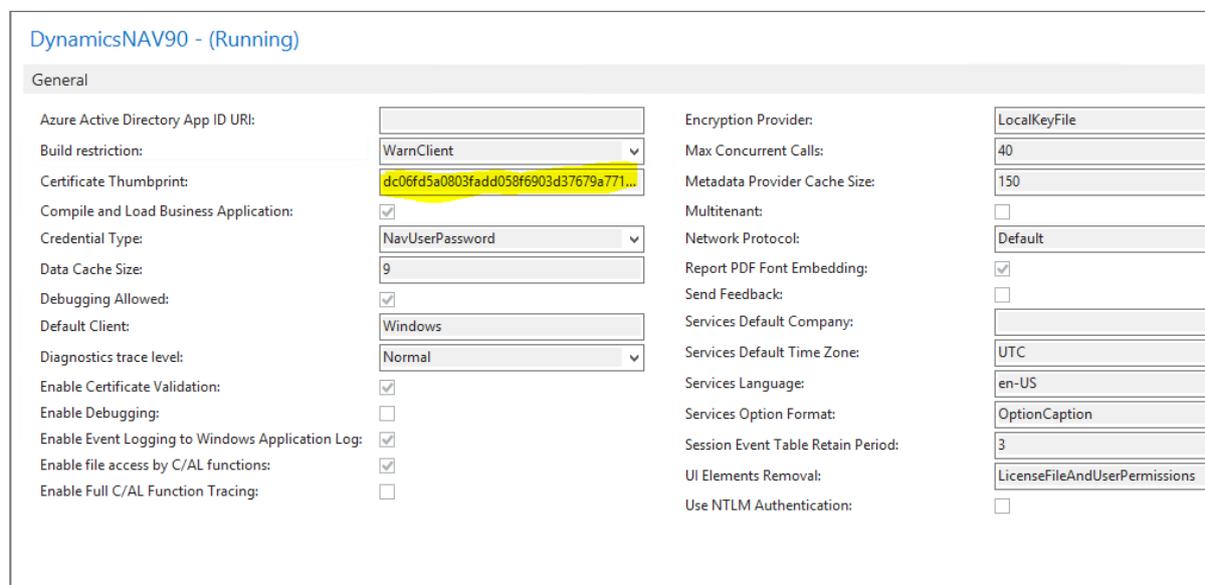
**Note:** In case you do not see the file refresh the page.



25) Double click the file and go to Details, on the bottom of list you can find the Thumbprint. Copy the characters without the spaces.



- 26) Go to the NAV Server and paste the Thumbprint you copied, into the Certificate Thumbprint of your server instance.



- 27) Go to C:\inetub\wwwroot\DynamicsNAV90\WebClient and open the web.config file.

Change the following properties:

```
<add key="ClientServicesCredentialType" value="NavUserPassword"/>
<add key="DnsIdentity" value="NavServiceCert"/>
```

```

Typically the client will ask for these credentials and pass them to the serv
Certificates are used to protect the passing of credentials.
This mode is used in hosted environments e.g. Azure where the list of allowed
are maintained by NAV and not based on windows users.
AccessControlService - Authentication for the Web Client is handled by Windows Azure Access Control
An ACS namespace needs to be set up before. Also the Identity Providers need
as well as the Relying Party representing the NAV Web Client.
To support ACS, you need to specify the ACS WS Federated authentication endpo
-->
<add key="ClientServicesCredentialType" value="NavUserPassword" />
<!--
The listening TCP port for the Microsoft Dynamics NAV Server. This is part of the server's URL. Valid ran
-->
<add key="ClientServicesPort" value="7046" />
<!--
Specifies whether the connection to the Dynamics NAV Server instance requires an SPN.
If true, the connection will only be made to a service with an SPN <ServerInstance>/<Server>:<ClientServi
If false, the connection will be attempted to a service with or without an SPN.-->
<add key="ServicePrincipalNameRequired" value="false" />
<!--
Specifies the amount of time that a connection between the Dynamics NAV Web client and the Dynamics NAV S
Time span format: [dd.]hh:mm:ss[.ff]
dd: days
hh: hours
-->
<add key="SessionTimeout" value="00:20:00" />
<!--
Specifies whether the Report Viewer options for saving a report as an Excel, Word, or PDF are visible.
Enabling this parameter might require changing security settings on the server.
For more information, see the documentation for configuring the Report Viewer.
-->
<add key="ShowReportViewerExportOptions" value="false" />
<!--
Specifies whether to show the search action for finding a page or report.
The action appears in the ribbon and navigation pane of the web client.
-->
<add key="ShowPageSearch" value="true" />
<!--
Specifies the connection to the server.
-->
<add key="UnknownSpnHint" value="(net.tcp://localhost:7046/DynamicsNAV90/Service)=NoSpn" />
<!--
The DNS or subject name from the server certificate.
-->
<add key="DnsIdentity" value="NavServiceCert" />
<!--
Specifies the sign-in page that Microsoft Dynamics NAV redirects to when configured for Single Sign-On.

```

Save the file

- 28) After that the web.config file has been saved, you have to go to your NAV Server and restart the DynamicsNAV90 instance.

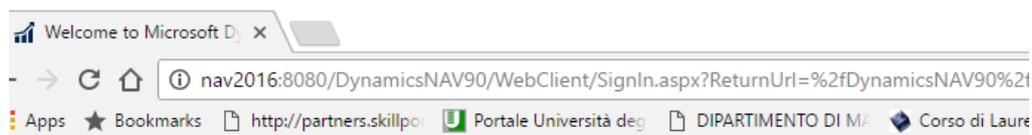
- 29) You may now create a new user. Go to User card and insert any name. This time the passwords need to be insert in the **Microsoft Dynamics NAV password Authentication** field

The screenshot shows the 'User Card' form in Microsoft Dynamics NAV. The form is titled 'User Card' and is divided into several sections:

- General:** Contains fields for 'User Name' (value: WEB01), 'Full Name', 'License Type' (value: Full User), 'State' (value: Enabled), 'Expiry Date', and 'Contact Email'.
- Windows Authentication:** Contains a 'Windows User Name' field.
- Access Control Service Authentication:** Shows 'ACS Access Status' as 'Disabled'.
- Microsoft Dynamics NAV Password Authentication:** Contains a 'Password' field (masked with dots) and a checkbox for 'User must change password at next login'.

The top of the form features a navigation bar with a 'HOME' tab and various action buttons such as 'View', 'Edit', 'New', 'Delete', 'ACS Setup', 'Change Password', 'Change Web Service Key', 'Notes', 'Links', 'Refresh', 'Clear Filter', 'Go to', 'Previous', and 'Next'.

- 30) The user now can access NAV from web.



### Multiple user creation along with companies

In this section, we are going to use PowerShell script. This procedure is very useful for an Administrator who might need to create a huge number of users. In this section, a CSV file containing the users' name and passwords has been created.

Additionally, we have introduced also the way to assign every user a specific role and company.

- 1) Create a CSV file containing the parameters shown in the below screen shot.

	A	B	C	D	E
1	Uname	Password	Permission	CompanyName	
2	web02	Password.1234	BASIC	Company02	
3	web03	Password.1234	SUPER	Company03	
4					

The file has been saved as: `navUsersWithCompanies.csv`

- 2) Create another file containing the following codes and save the file with `.ps1` extension

```
$csv = import-csv navUsersWithCompanies.csv

foreach($record in $csv) {
    $company = $record.CompanyName
    $uname = $record.UserName
    $password = $record.Password
    $permission = $record.Permission

    New-NAVCompany -ServerInstance DynamicsNAV90 -CompanyName $company

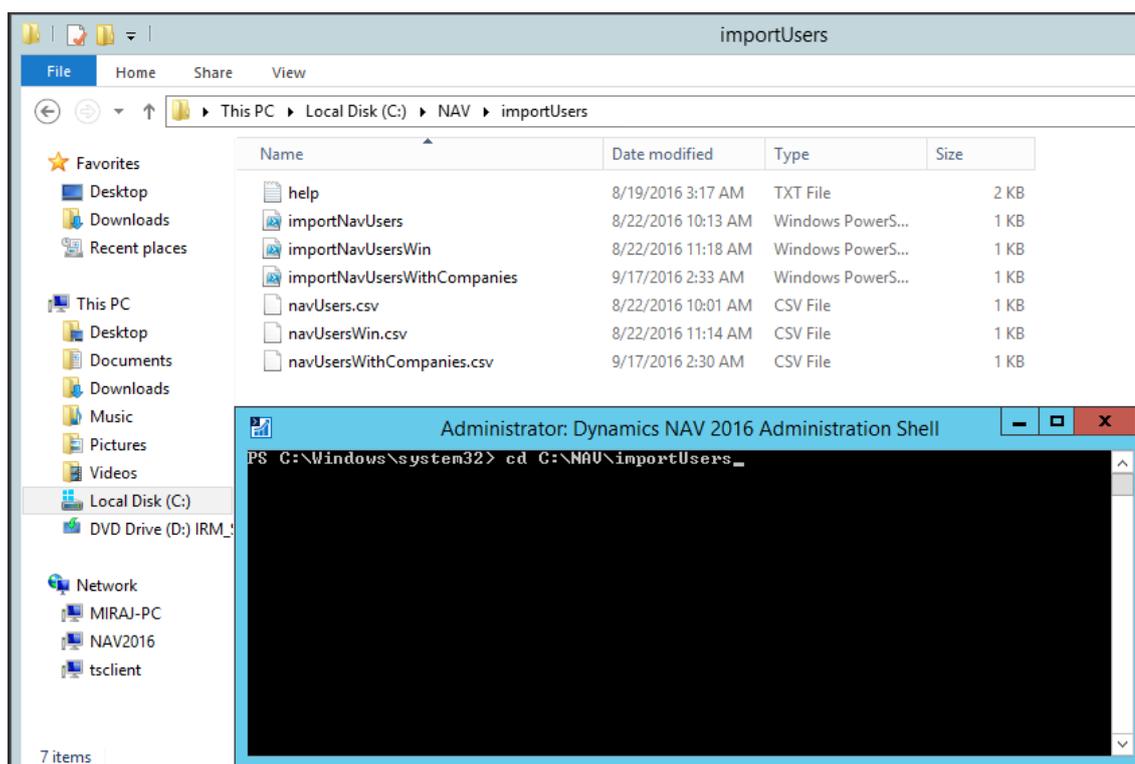
    New-NAVServerUser DynamicsNAV90 -UserName $uname -Password (ConvertTo-SecureString $password -AsPlainText -Force)
    New-NAVServerUserPermissionSet DynamicsNAV90 -PermissionSetId $permission -UserName $uname -CompanyName $company

    Echo "$uname, $password, $permission, $company"
}
```

The file has been saved as: navUsersWithCompanies.ps1

- 3) Open Dynamics NAV 2016 Administration Shell and paste the location where the above files have been saved.

It is recommended to save the files in C drive.



- 4) Type .\importNavUsersWithCompanies and enter

```

Administrator: Dynamics NAV 2016 Administration Shell
PS C:\NAU\importUsers> cd C:\NAU\importUsers
PS C:\NAU\importUsers> .\importnavUsersWithCompanies_

```

5) This process may require some time.

```

Administrator: Dynamics NAV 2016 Administration Shell
PS C:\Windows\system32> cd C:\NAU\importUsers
PS C:\NAU\importUsers> .\importNavUsersWithCompanies
New-NAUserverUser : The user name must be unique.
At C:\NAU\importUsers\importNavUsersWithCompanies.ps1:12 char:4
+ New-NAUserverUser DynamicsNAU90 -UserName $uname -Password <ConvertTo-SecureS
+ ~~~~~
+ CategoryInfo          : NotSpecified: (0:Int32) [New-NAUserverUser], FaultExce
+ FullyQualifiedErrorId : MicrosoftDynamicsNavServer$DynamicsNAU90,Microsoft.Dyn
web02, Password.1234, SUPER, Company02
New-NAUserverUser : The user name must be unique.
At C:\NAU\importUsers\importNavUsersWithCompanies.ps1:12 char:4
+ New-NAUserverUser DynamicsNAU90 -UserName $uname -Password <ConvertTo-SecureS
+ ~~~~~
+ CategoryInfo          : NotSpecified: (0:Int32) [New-NAUserverUser], FaultExce
+ FullyQualifiedErrorId : MicrosoftDynamicsNavServer$DynamicsNAU90,Microsoft.Dyn
web03, Password.1234, BASIC, Company03
PS C:\NAU\importUsers>

```

(Please ignore the red lines)

Users along with companies has been created.

From NAV Users section, the above created users are visible.

User Name	Full Name	Windows User Name	License Type
WEB03			Full User
NAV2016\WIN02		NAV2016\win02	Full User
NAV2016\WIN01		NAV2016\win01	Full User
NAV2016\ADMINISTRATOR		NAV2016\Administrator	Full User
WEB02			Full User
WEB01			Full User

## Add another instance

In the previous section, we have learnt how to change the authentication type so that the work load for an administrator on creating users will be reduced, however, with that setting users including Administrator will not be able to access NAV from desktop. Since RoleTailored Client is visible from Desktop only, it might be inconvenient for an Administrator or Super user not being able to use such feature. That is why in this section we are creating another instance, **DynamicsNAV91**.

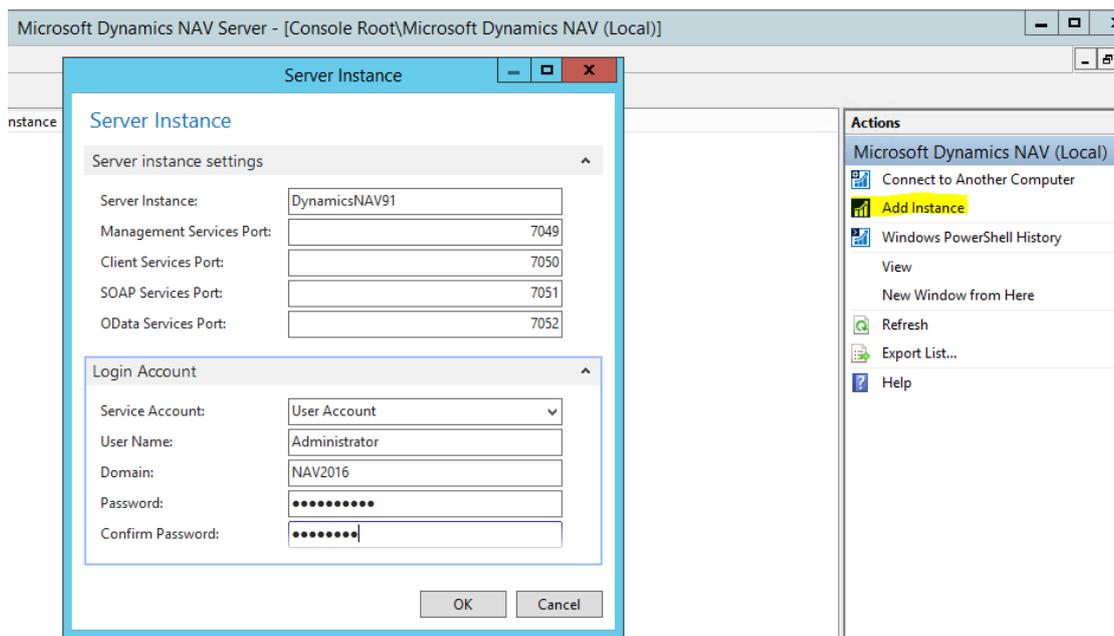
The authentication type for DynamicsNAV91 will be **Windows**, so that users will be able to access NAV from desktop and also from web.

It is important to notice that the instance name will be changed depending on the authentication mode. Below there is a table which might be useful for a better understanding:

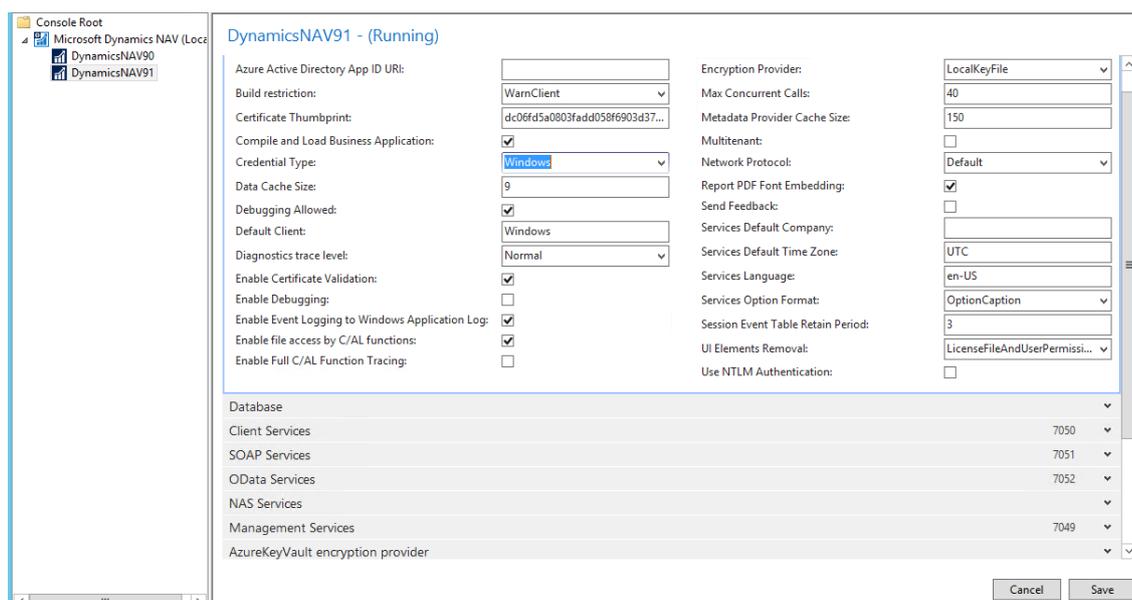
Instance name		
	DynamicsNAV90	DynamicsNAV91
Credential Type	NavUserPassword	Windows
Access via Web	YES	YES
URL	http://nav2016:8080/DynamicsNAV90/WebClient	http://nav2016:8080/DynamicsNAV91/WebClient
Access via Desktop	NO	YES
Desktop link	-----	NAV2016:7050/DynamicsNAV91

The above settings have been made in this document only. This is not the one and standard implementation for Microsoft Dynamics NAV 2016. Authentication type, user creation, instances can be set up in many other ways.

- 1) Go to NAV Server and Add Instance. The instance name and ports name have to change as well.



2) Change the credential type to Windows for the instance DynamicsNAV91.



3) Save the changes and restart the Server.

4) Go again to Dynamics NAV 2016 Administration Shell and type the following command:

```
New-NAVWebServerInstance -WebServerInstance DynamicsNAV91 -Server
NAV2016 -ServerInstance DynamicsNAV91 -ClientServicesCredentialType Windows
```

```

PS C:\Windows\system32> Get-NAVServerInstance

ServerInstance : MicrosoftDynamicsNavServer$DynamicsNAV90
DisplayName    : Microsoft Dynamics NAV Server [DynamicsNAV90]
State          : Running
ServiceAccount : NAV2016\Administrator
Version       : 9.0.42815.0
Default       : True

ServerInstance : MicrosoftDynamicsNavServer$DynamicsNAV91
DisplayName    : Microsoft Dynamics NAV Server [DynamicsNAV91]
State          : Running
ServiceAccount : NAV2016\Administrator
Version       : 9.0.42815.0
Default       : False

PS C:\Windows\system32> New-NAVWebServerInstance -WebServerInstance DynamicsNAV91 -Server NAV2016 -ServerInstance DynamicsNAV91 -ClientServicesCredentialType Windows
PS C:\Windows\system32>

```

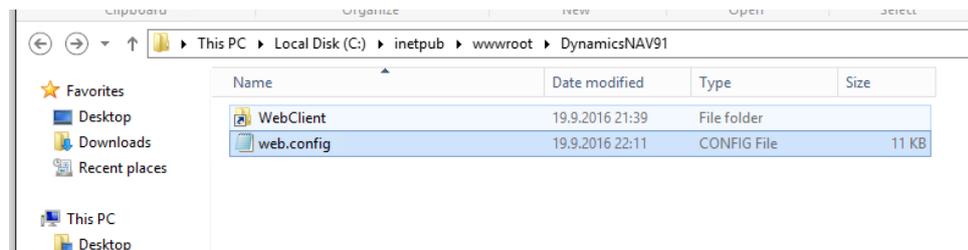
5) Go to C→inetub→wwwroot→DynamicsNAV91 and open the web.config file.

Change the following properties:

```
<add key="ServerInstance" value="DynamicsNAV91"/>
```

```
<add key="ClientServicePort" value="7050"/>
```

```
<add key="UnknownSpnHint" value="(net.tcp://localhost:7050/DynamicsNAV91/Service)=NoSpn"/>
```



```
-->
```

```
<add key="ServerInstance" value="DynamicsNAV91" />
```

```
<!--
```

The type of client credential used for authentication.

Possible values:

Windows

- Windows authentication is used, and client will connect using this user. This user is expected to be the same as the user used on the server. This is the default mode and is typically used on a local network. In this mode X.509 certificates are not used and only Windows authentication is used.

UserName

- Windows authentication on the server. Client is expected to identify a Windows user known (created) on the server. Typically the client will ask for these credentials. Certificates are used to protect the passing of credentials. This is typically used when only the server is part of a trusted network and the client is not trusted, e.g. connection over the Internet.

NavUserPassword

- Authentication is managed by the server but not based on Windows authentication. Client is expected to present username/password. Typically the client will ask for these credentials. Certificates are used to protect the passing of credentials. This mode is used in hosted environments e.g. Azure. Certificates are maintained by NAV and not based on Windows authentication.

AccessControlService

- Authentication for the Web Client is handled by Windows Authentication. An ACS namespace needs to be set up before. Also the client needs to be configured as well as the Relying Party representing the NAV Web Client. To support ACS, you need to specify the ACS WS Federation URL.

```
-->
```

```
<add key="ClientServicesCredentialType" value="Windows" />
```

```
<!--
```

The listening TCP port for the Microsoft Dynamics NAV Server. This is part of the configuration file.

```
-->
```

```
<add key="ClientServicePort" value="7050" />
```

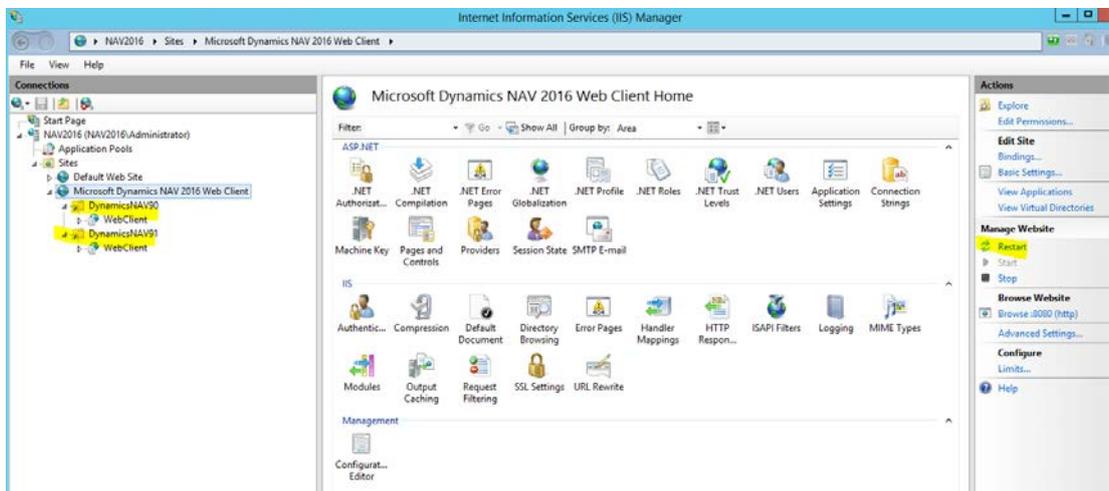
```

<add key="ShowPageSearch" value="true" />
<!--
  Specifies the connection to the server.
-->
<add key="UnknownSpnHint" value="(net.tcp://localhost:7050/DynamicsNAV91/Service)=NoSpn" />
<!--
  The DNS or subject name from the server certificate.
-->
<add key="DnsIdentity" value="" />

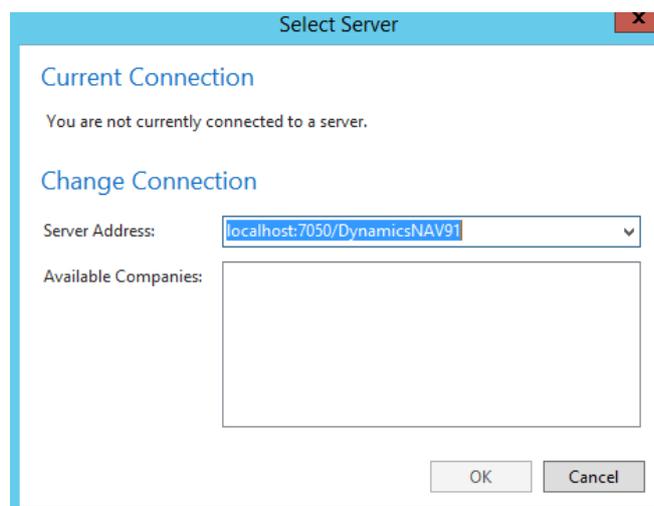
```

Save the file.

- 6) Go to the IIS Manager and Restart both sites.



- 7) You can now try to log in NAV from desktop by using the following link:  
NAV2016:7050/DynamicsNAV91



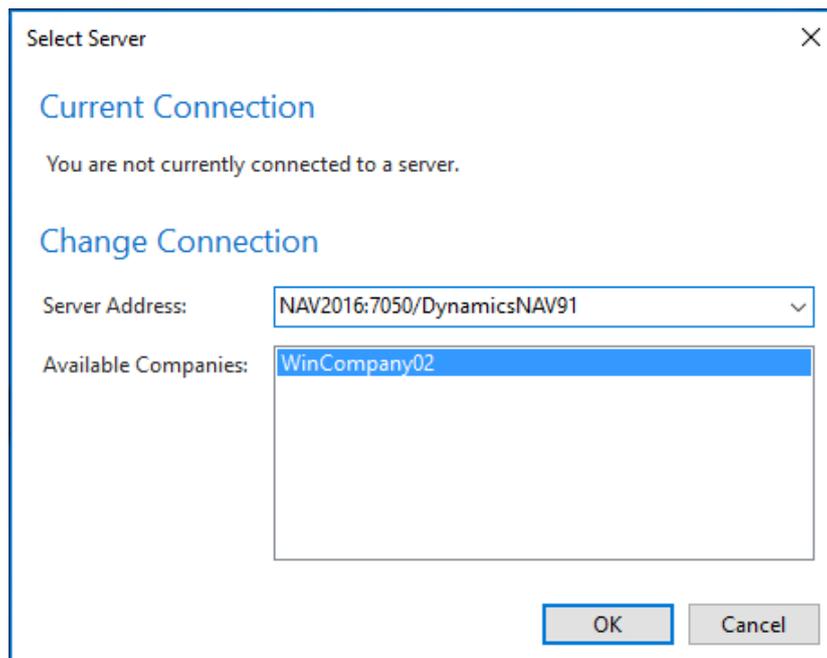
- 8) From NAV Client you can now create users with Windows authentication mode, the same way as we created the user win01.  
This time I have assigned to win02 a specific company, WinCompany02

### User Card

General			
User Name:	<input type="text" value="NAV2016\WIN02"/>		
Full Name:	<input type="text"/>		
License Type:	Full User <span>▼</span>		
Windows Authentication			
Windows User Name:	<input type="text" value="NAV2016\win02"/>		<input type="button" value="..."/>
Access Control Service Authentication			
ACS Access Status:	Disabled		
Microsoft Dynamics NAV Password Authentication			
Password:	<input type="password"/>		<input type="button" value="..."/>
Web Service Access			
Office 365 Authentication			
User Groups			
User Permission Sets			
<input type="button" value="Permissions"/>	<input type="button" value="New"/>	<input type="button" value="Find"/>	<input type="button" value="Filter"/> <input type="button" value="Clear Filter"/>
Permis... Set	Description	Company	NAV App Name
SUPER	This role has all per...	WinCompany02	

- 9) User win02 will also be able to access NAV from either from desktop (remember to create a windows account before) and also from web.

Earlier I have created in my computer a windows account named win02 and given the same password as I gave for NAV user. As you can see win02 user can access NAV from its desktop and access to the specific company assigned to it.



Following screenshot illustrates how user web02 can access NAV also from web. The URL to log from web should be:  
<http://nav2016:8080/DynamicsNAV91/WebClient>

