AUSTRALIAN COMPUTER SOCIETY

ACS RECOGNITION OF PRIOR LEARNING (RPL) FORM - 2017

This document is required to be completed for all **Recognition of Prior Learning (RPL)** applications and uploaded as a PDF to the application form.

IMPORTANT NOTICE:

Misleading and false information is viewed as a major breach of ethical behaviour and will seriously jeopardise your migration prospects.

It is your responsibility to indicate when you have drawn on the work of others. Other people's original ideas and methods should be clearly distinguished, and other people's words, illustrations and diagrams should be clearly indicated regardless of whether they are copied exactly, paraphrased, or adapted.

Failure to acknowledge your source by clear citation and referencing constitutes plagiarism. All plagiarism will be assessed as not suitable and reported to the Department of Immigration and Border Protection.

The ACS reserves the right to use software applications to screen your submitted work for matches either to published sources or to other submitted applications. In some cases, you may be asked to submit project reports and other written work submitted with the application for screening by plagiarism detection services.

If at any stage in the assessment process plagiarism is detected, the information may be provided to other Australian Government agencies. The assessment will be terminated and the outcome recorded as unsuitable. A refund of the application fee cannot be provided for cases assessed as containing false information or plagiarism.

Please complete the following 2 sections:

1. **The Key Areas of Knowledge – Section 1**
2. **The Project Report Forms – Section 2**

RPL applications are for those applicants who do **not** hold a recognised tertiary ICT qualification and who have a minimum of 6 years of closely related experience.

This document provides the opportunity for applicants to demonstrate the knowledge learnt throughout their professional experience.

Applicant Name	
Applicant Email Address	**XXXXXX**
Applicant Date of Birth	

SECTION 1 – KEY AREAS OF KNOWLEDGE

Section 1 is based and will be assessed on the following document. Please ensure you read and understand - The ACS Core Body of Knowledge for ICT Professionals (CBOK).

You must clearly explain how your experience and qualifications meet the selected Areas of Knowledge and specifically how and where you acquired the knowledge.

You are required to select one topic from the Essential Core ICT Knowledge (Topic 1 or Topic 2) and one topic from the General ICT Knowledge (Topic 3, Topic 4 or Topic 5).

Please ensure you address at least 2 subtopics from each of the topics chosen.

The ICT Key Areas of Knowledge:

Essential Core ICT Knowledge

Topic 1. ICT Professional Knowledge
Sub Topics are -
a. Ethics
b. Professional Expectations
c. Teamwork Concepts and Issues
d. Communication
e. Societal Issues

Topic 2. ICT Problem Solving
Sub Topics are -
a. Modelling Methods
b. Processes to understand problems
c. Methods and tools for handling abstraction

General ICT Knowledge

Topic 3. Technology Resources
Sub Topics are -
a. Hardware and Software Fundamentals
b. Data and Information Management
c. Data Communications and Networking

Topic 4. Technology Building
Sub Topics are -
a. Human Factors
b. Programming
c. Information Systems Development and Acquisition

Topic 5. ICT Management
Sub Topics are -
a. IT Governance and Organisational Issues
b. IT Project Management
c. ICT Service Management
d. Security Management

Important:

- **Identify the Area of Knowledge topic that you have chosen to explain by entering the name of the Area of Knowledge topic in the box.**
- **Explain, in the expandable typing area, how you have acquired the knowledge and illustrate the depth of that knowledge.**
- **You should NOT address all sub topics included in the Area of Knowledge in your explanation. Address at least TWO of the sub topics. Enter the sub topic name(s) in the box.**
- **Be clear and concise in your explanation.**
- **Limit each explanation to no more than one to one and a half pages.**

In the following expandable typing areas, explain **how you have acquired your in-depth knowledge** in these topic areas through your professional experience.

Essential Core ICT Area of Knowledge:
ICT Professional Knowledge
The story of my first taste of computer dates from my adolescence. In the year 9 of secondary school, I was taught a unit of credit as "an Introduction to Computer Basics", through which I gained a primary knowledge on DOS and Windows 98. My interest in computers was such that convinced my parents to buy me a computer; however, purchasing it was subject to be a top student, who I was. The following summer, I enrolled in the ICDL (International Computer Driving License) course, included seven skills of the Introductory Computer, and File System, Operation System, Word, Access, PowerPoint, Excel, and the Internet. Passing this course helped me a lot to gain a good understanding of computer basics. In secondary school, I studied in the field of humanities. After graduating, I decided to enter the job market, but I couldn't find the right job, despite a lot of searching. After much research, I found that the computer's job prospect is brilliant, and since I was interested in computers from childhood, and after consultation with one of my friends, I made the decision to enroll in the computer advanced courses. The first course I attended was the Network + that was a 30-hours course; in this course, I gained a good understanding of OSI model, network cables and types, network topology, switch, router, TCP / IP, windows server, IP structure, DHCP, DNS , Duplex, network types (LAN, WAN, MAN). Taking the course of Network+, which I considered as the base of learning computer networks, made me a good perspective on network training. Immediately after completing this course, I made the decision to start training Cisco; and after consultation with some of the professors, I enrolled in a CCNA Route and Switch course. In the CCNA course, I became more familiar with computer networks and I gained a good understanding of Hub, Switch, router, as well as OSI, TCP / IP models, Collision and Broadcast domains, CAM table, Spanning-tree protocol and its

types, PVST, RSTP and EtherChannel , also VLAN (Access, Trunk), VLAN Trunking Protocol, IP addresses, Subnet mask , Unicast, multicast, and broadcast. Furthermore, I gained good knowledge on the process of Boot, router and switch, the routing and protocols of OSPF, EIGRP, BGP, Access-list and NAT technology, as well as Port security.

Studying this course contributed to my knowledge of important technologies such as routing protocols, NAT and VLAN, and other important technologies used to make network and troubleshooting.

After completing this course, I enrolled in a CCNP Route and Switch course to deepen my knowledge of the CCNA course and learn more technologies such as Policy base routing, IPV6, Private VLAN, VLAN ACL, Layer 3 high availability, etc. By taking this course, especially Troubleshooting, and through its practical scenarios, I was able to find the networks' problems and troubleshoot them. After completing this course, I implemented many scenarios in collaboration with my classmates and searching the Internet, which contributed to deepening what I was learned in this course.

In 2011, I was admitted to the university to a bachelor's degree in industrial management; of course, I tried hard to change the field to computer science, but the university rejected it. At university, I decided to find a part-time job and finally, I found it when I was freshman; I hired as a network trainee of Ghaem Hospital Karaj. In this position, I dealt practically with many learned concepts during the CCNA and CCNP courses. The tasks I did under the supervision of a network senior were configuring switches, routers, running network services (enterprise email, Active Directory, Web server) running VLAN as well as VTP, working with various routing protocols and much more another.

In 2013, I attended a VMware introductory course, where I gained a good understanding of starting up and configuring ESX, VCenter servers, starting up and configuring vNetworking and vStorage platform on VMware ESXi, installing, starting up, and managing the virtual machines, using vCenter to manage virtual machine resources.

After graduating from university, I worked full time at Ghaem Hospital Karaj since 2014 and in addition to my prior tasks, the responsibility of monitoring communications and network resources, troubleshooting WAN and LAN connection, monitoring the securing access to network resources and equipment, creating the necessary platform to virtualize network services, was assigned me.

During eight years of working as a network expert, in addition to learning many concepts empirically, I have always tried to learn new technologies by searching the Internet and consulting with more experienced experts. In recent years, I've gained a good understanding of the concepts of Wireless, configuration of Mikrotik equipment empirically and by self-study; and now I have the ability of starting up WIFI coverage, as well as VPN, DHCP, DNS, NTP, etc., and nearly all available techniques in Mikrotik

equipment by studying documents and doing practical scenarios.
Teamwork Concepts and Issues
Over the last years, I have played many roles in IT projects, from Network trainee, documentary maker, and project expert to the project manager. In these projects, I learned many things: as a trainee, I tried to listen carefully the suggestion and advice of project managers and senior experts to learn project participation skills; as a documentary maker, I tried to record all stages of the project exactly, which this helped me to fully learn the project documentation skills, give the final report and the proper presentation of the project results; as a project expert, I was trying to carry out the tasks assigned me by the project manager, which was a good exercise to strengthen my responsibility; and in my role as a project manager, I tried by dividing the project into small, manageable tasks, and assigning them to personnel, and discuss with them, reinforce their sense of project participation, and through ongoing reporting control the project direction and enhance the personnel accountability; and by holding project progress meetings, and reporting, I was trying to strengthen the empathy of team members; however, there are not always positive aspects in teamwork; for example, sometimes I found deliberate mistakes, which were done to misdirect the project from the right path; and at that time, I was trying to correct the wrongdoer by hinting him/her; and by getting daily reports, I was trying to deal with forces who were either not performing their assigned tasks properly or spending too much time to do them.
General ICT Area of Knowledge: [Technology Resources, 1- Hardware and Software Fundamental, 2- Data Communication and Networking]
1- Hardware and Software Fundamental
I gained my knowledge on computer by learning the concept of hardware and software; I found that hardware is components and tangible and physical parts of the computer, and any IT-related device, from the keyboard, mouse, and CPU to server, Switch, Router, storage, access point, etc.; in recent years, I've worked with the network hardware such as Cisco 2960 (TCL, TTL, TSL), Cisco 3750 and 3850 switches, and Cisco 2811, 1841, routers, 1941, 3845, 7200 and Mikrotik RB 750 and 950, CSR routers, and DL380 and DL 380 G8 servers, as well as Microsoft-based software such as the company's e-mail server, Active Directory, and techniques such as VMware to Virtualization; installed IOS on the Cisco equipment and also installed OS on Mikrotik routers, and I am able to troubleshoot different network hardware and software.
2- Data Communication and Networking
By taking the ICDL course I gained a good understanding of the primary skills of the computer. The most important concepts I learned in this course are: Operation System: In fact, it is the platform of running applications, and make possible the interaction between the user and the hardware, and running applications.

Examples of operating systems: Windows 98, Windows XP, Linux, Windows Server.
File System: it is used to save and organize information on storage systems such as Flash Driver, Hard Disks, etc.; in fact, the file system is considered as an index or database of the physical situation of each data on the storage media, such as Flash or Hard Disk.
NTFS: it is the New Technology File System, and is used as the New Windows File System. In the Network+ course, I gained a good understanding of the basic concepts of computer networks.
Computer Network: it is a set of computers equipment including Servers, Switches, Routers, Printers, etc. that are interconnected to specific purposes, in particular, sharing data.
Network Topologies: it is the model of connecting this equipment together. Types of topologies are Bus, Ring, Mesh, and Full Mesh.
OSI Model: it is a standard model, consists of seven layers (Application, Presentation, Session, Transport, Network, Datalink, Physical), which has introduced to describe the relationship between two computers on the network, or any other device of the network.
TCP / IP model: There is a lot of similarity between the OSI and the TCP / IP models, but it uses the Application, Transport, Network, Datalink, and Physical Layers instead of 7 layers to describe the connection of networks.
Types of Network Cables: Network Cables are divided into two major categories of Cross and Straight:
Cross cable: twisted pair cable that consists of four pairs of cables (8-strand), which are used to connect the similar network devices such as two computers.
Straight cable: like the cross cable, it consists of a twisted pair cable that consists of four pairs of cables (8-strand), and is used to connect two different types of devices.
Switch Vs Hub: the switch, by making a Mac table, identifies MAC address and device connected to the network ports and insert in this table, and after completing the information of this table to send traffic to each port uses Unicast Traffic, whereas the Hub has not this table and sends received traffic to all its ports.
IP Structure: an IP address consists of a 32-bit structure and is divided into two general categories of Valid, which are routable on the Internet and Invalid, which are used on the internal network.
Windows Server: in fact, Windows Server is used as a platform to install network services such as Active Directory, DHCP, DNS, NTP, etc.
DHCP Server: network administrators use and manage DHCP Services to organize network IP addresses and to prevent problems such as IP conflict.
After the successful pass of the Network + course and consultation with the professors and some reviews, I decided to pursue the CCNA route and switch course. By taking the CCNA course, I learned many basic concepts of cisco-based networks.

Collision Domain: the definition of a collision domain is actually a part of the network, in which packets are likely to collide, and this will be solved using the CSMA / CD mechanism, which the mechanism listens to media while sending packets, and in the case of busy lines there will be delays to deliver packets.
Spanning-tree: it is implemented in the Ethernet network to take advantage of the Redundancy feature, and by recognizing the alternate route, as long as the route is not needed (the original link works in normal mode) holds it disabled and activates the backup link as soon as the original link is disconnected and keeps active the data transfer stream.
CST: it is one of the STP versions that run an STP for the entire network.
PVST+: it is another STP version that runs one STP protocol per VLAN (per VLAN). For example, if we have one hundred VLANs, one hundred STPs will be run.
VLAN (Access and Trunk): it is actually a Virtual LAN, which contains a number of switch ports located in a broadcast domain.
Etherchannel: we use it to enhance the data transfer capacity between two switches and to increase the tolerance of this connection.
Routing and Routing Protocols: we use routing to connect two independent networks, and the routing protocol is responsible for selecting the best route and is divided into two categories: Dynamic and Static; the Routes in static routing protocol are written manually by the network administrator, whereas the routing table in dynamic routing protocols is actually created by the router per se; and routers by sending update try to update each other's routing table.
Dynamic Routing Protocols Categories: dynamic routing protocols are divided into three categories: Link state such as OSPF, distance vector such as RIP and Hybrid such as EIGRP.
Administrative Distance: each routing protocol has one AD; the smaller AD, the higher the routing protocol priority; for example, OSPF has AD110 while EIGRP has AD 90; thus, if we have two similar routes of these two routing protocols in the routing table, EIGRP is preferred; it should be noted that the AD of static Route is one.
Passing the CCNA course helped me a lot to identify the essence of cisco based networks, and after learning this course, I enrolled in a CCNP Route and Switch course to complete what I learned in this course; by taking this course I gained good understanding some subjects as:
TCP & UDP: the TCP protocol actually is a connection-oriented protocol, and by sending on each packet, receives an ACK from the mini destination upon a complete packet, while the UDP is a Connectionless Protocol, and in contrast with TCP, it does not receive packets after sending ACK from the receiver. The most important TCP protocols are FTP, SMTP, POP3, and the most important TCP protocols are Voip, video.

CAM Table: it is one of the most important switches, in which the Mac address

corresponds to port numbers.
MST: it is a method of implementing STP, in which there is an STP (instance) per group of VLANs, and since the number of STP instances is lower than the number of VLANs, its convergence speed is better.
DTP: Dynamic Trunk Protocol is using to trunk between switches, which has two well-known protocol: ISL (Cisco-created protocol) and 802.1q (standard protocol).
Policy-Based Routing: using this feature, network administrators can make conditional routing or packet forwarding operations, and, in short, if the packet reaches the router and complies with one of the PBR policies, this packet will send regardless of the routing table, according to the policy created in the PBR.
GLBP: Cisco's proprietary protocol is to implement the First Hop Redundancy Protocol, in which by using the Gateway load balancing mechanism, a router will be selected as AVG; each time that clients send ARP packets to access the Virtual IP address, AVG introduces a mac address to one of the forwarders, which lead to the load balance feature between the gateways.
CDP (Cisco Discovery Protocol): this protocol act on the data link layer, and provides information on Cisco devices that are connected to our Cisco switch and router, information such as connected Port to a neighboring device, IP address router, or neighbor switch and etc.
NAT (Standard and Extended): this protocol was provided once IP was limited due to the limitation of the number of IPv4 in the IT world, and using it we can NAT many invalid IPs into an IP valid so that they could use the Internet. There are two NAT classes: static NAT, in which an IP invalid NAT to an IP valid. Dynamic NAT, in which there is an IP pool of valid IPs, and any request can use one of these IPs at any time.
Private VLAN: using Private VLAN we can isolate the connection of multiple nodes' layer two in a single VLAN without using a separate subnet or ACL.
After completing the CCNP route and switch course, I enrolled in the VMware course; some of the concepts I learned in this course are:
Vswitch: in fact, its task is connecting Virtual machines and the Virtual Network.
Vcenter: by Vcenter we can control servers and monitor the hardware of all servers. We can also create users with different access levels.
Vsphere: it is a set of software and tools provided by VMware to launch virtualization and virtualization-based structure management.
I gained a good understanding of various Microsoft Services and policies by self-study and due to my working experience; for example, I know:
Group policy: is a centralized way to manage and configure all computers on the network.
Domain controller: it is, actually a server that responds to authorization requests in the Windows domain.
WSUS: is an updating freeware provided by Microsoft, and make possible managing

Microsoft operating system updates.
In recent years, I have dealt with many monitoring software such as Solarwinds, WhatsUp, PRTG, etc., and have the ability to add various network equipment, from the router and switch to a variety of servers by using SNMP protocol.

SECTION 2 - RPL PROJECT REPORTS

A project report is a clear written description of a project or engagement that provides you with the opportunity to show how you perform as an ICT Professional.

Each report is to relate to a significant project or work episode undertaken by you during your professional ICT career.

The purpose of these reports is to enable you to demonstrate your command and implementation of the Areas of Knowledge described in Section 1 of this application.

Please Note: You are required to provide two project reports.

Of the two reports, one must apply to a project undertaken within the last three years, and the other for a project within the last five years.

Projects over two years long may be used for both reports under either of the following conditions:

- **The project has clearly-defined work efforts which took place in parallel, each with their own solution development and design activities and their own deliverables.**
- **The project had clearly-defined phases that were executed in succession, each with its own solution development and design activities and deliverables. Note that a second project phase that constructs and implements the solution developed by the first phase does not meet this requirement.**

Depending on the nature of your role in each project, the Project Report should cover an appropriate selection of factors.

Appropriate factors will be determined based on the type of ICT project selected. Possible factors include:

- System Analysis and Design and Software Engineering methodologies used;
- Contribution to the processes involved in the design and implementation of enterprise-wide computing systems;
- Programming languages, design paradigms and implementation procedures adopted;
- Database and/or file design and management techniques employed;
- Network topologies, including size, distribution and security facilities installed;
- Project Management and quality assurance techniques followed;
- Internet application design, including database interactivity and security measures implemented;
- ICT managerial activities, demonstrating the nature and extent of responsibilities

Project Summary:			
	Project Name	**Start Date**	**End Date**
Project 1	WLC configuration and Implementation	02/2019	06/2019
Project 2	DMVPN configuration and Implementation	04/2018	08/2018

Instructions

The following pages provide a template for your reports.

When writing your reports please provide your own thoughts – do not just copy project documentation.

Please use the first person in your discussion, so it is clear to the assessor what you did versus what others did – say "I did X" rather than "X was done".

Diagrams from the project documentation may be helpful, but the text should be in your own words. Please ensure that diagrams are relevant, readable, and help the assessor to understand what you did as a member of the project team.

If sections of the Project Report template (see below) are not relevant to your participation in the project, then leave the section blank.

Focus on quality rather than quantity. **Each Project Report should be no more than four or five pages in length.**

SPECIAL NOTE:

By submitting this RPL Knowledge and Project Report form as a component of your ACS skills assessment application, you agree with the following statement:

The applicant confirms that the explanation of their knowledge and project reports submitted in this application truthfully and accurately describe the applicant and the applicant's personal involvement in the projects. The applicant is aware that plagiarism by the applicant will automatically invalidate this application, will jeopardise any future applications from the applicant and will be reported by the Australian Computer Society to the Australian Department of Immigration and Border Protection.

Project 1: WLC configuration and Implementation

1. Project Summary

1.1. Identification

Client's Company Name		
Business Address		
Contact Numbers		

Web Address	
Email Address	
Nature of project	WLC configuration and Implementation
Location of project	
Name of your employer	

1.2. Duration

	From	To
Total project duration	02/2019	06/2019
Your involvement	02/2019	06/2019

1.3. Resources

	Number
Your team size	2
Total project team size	4

1.4. Personal Involvement

Please list the phases of the project in which you were personally involved

Start	Completion	Phase Description
02/2019	03/2019	Phase I – Analyzing the organization needs and techniques, choosing a technique
03/2019	03/2019	Phase II - Project Implementation Plan
03/2019	04/2019	Phase III - Designing Access Point Locations — Configuring WLC and ACS — Creating Groups in Active Directory — creating Address Pool Groups in DHCP Server — trial Operation
04/2019	05/2019	Phase IV - Final Implementation and Troubleshooting
05/2019	06/2019	Phase V - Documentation and Reporting

1.5. Describe your role(s) and responsibilities in the project.

In this project, I, as the project manager assigned by the technical manager, should, in addition to reviewing the needs of organization on a WIFI connection, identify the available techniques in company with other team members, and select the best one by consultation with the technical manager. I should also prepare the project implementation plan in consultation with the technical manager, and in association with other team members design the access points, configure the Wireless LAN Controller (WLC), and make address pool groups in the DHCP server; as well as Cisco ACS configuration and making

user groups in Active directory to trial use of them. In the final implementation, I should resolve any potential defects by the contribution of other team members, and, finally, provide a detailed documentary on project implementation phases, and a complete project implementation report, including all project implementation details from the design phase to the defects.

2. Business Opportunity or Problem

2.1. Describe the business opportunity or problem(s) this project addressed.

Accessing smartphones, tablets, laptops and other devices with a wireless network card, which intended to connect the hospital's internal network and the internet via WIFI, and distinguishing those who have access to internal network and the internet and those who just have access the internet by right classification have been the technical manager's concerns.
Prior to the project implementation, we did not have a very complete and reliable WIFI connection at the hospital using several access points with different brands.
The purpose of the project implementation was to providing a hospital-wide WIFI connection, with the separation of different groups in terms of access to the Internet and network resources; in addition, creating a MAC addresses database for network-connected equipment and using ACS by using Active Directory was used to authentication, authorization, and accounting of users.
Providing temporary internet access for the gusts of hospital managers was another goal of the project.

3. Solution

3.1. Discuss your contribution to the solution, project or engagement.

I participated in the project implementation as follows:
In addition to the exact analysis of the needs notified by the technical manager, I managed to hold meetings with the technical manager and the hospital's stakeholders regarding WIFI coverage.
In collaboration with other team members, various solutions and techniques including the use of MikroTik access points, the use of Cisco's wireless capability, and other solutions were examined and the best one was selected by searching the Internet.
In consultation with the technical manager, I tried to determine the project implementation plan, including all Tasks and Resources, which was a complete roadmap to implement the project.
In collaboration with team members, I configured a wireless LAN controller and Cisco

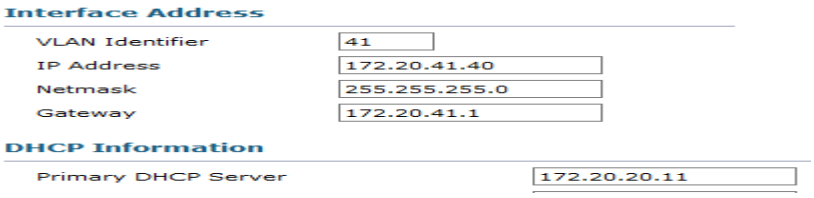
Access Points; as well as, after configuring WLC we launched one of the Access points to test.
In collaboration with team members, I made guest user groups (for guests), as well as user groups (for users who have access to the internet and internal network at the same time) and the VIP group, with high-speed access to internet and internal network (managers of the organization).
I contributed to the make a separate Address Pool for each group of DHCP server.
In collaboration with team members, I configure Cisco ACS.
In collaboration with team members, I participated in the project final implementation, i.e. connecting the Access Points to the internal network of the company, and testing their communication and removing any defects such as WIFI coverage or internal network connectivity problem.
I prepared the project documentation and final report, which included full details of doing the project, location of the access points.

3.2. Describe any design or problem solving methods you used on this project.

In order to start up the enterprise WIFI project, we first configure WLC:
The first measure was setting the IP address of the Interface Management, as well as the VLANs that in fact, in our project, each user group had a separate VLAN (VLAN Stuff (41), VLAN VIP (42), VLAN Guests (43)



In the header Advance, in the Controller menu, interface sub-menu was selected, and setting the IP addresses was as follow:



In the IP address settings of the VLANs, we also declare the DHCP server address so that users who connect to each VLAN can find their IP from the DHCP server:
After setting up IP management, the WLC web access will be provided via its IP and using HTTPs port; then, we configured the SNMP protocol to WLC monitoring; to this end, we used the management menu, SNMP, and in the General header, we configured

SNMP. Then, in order to set up NTP server, we used the Controller menu, the NTP submenu, and set up NTP:



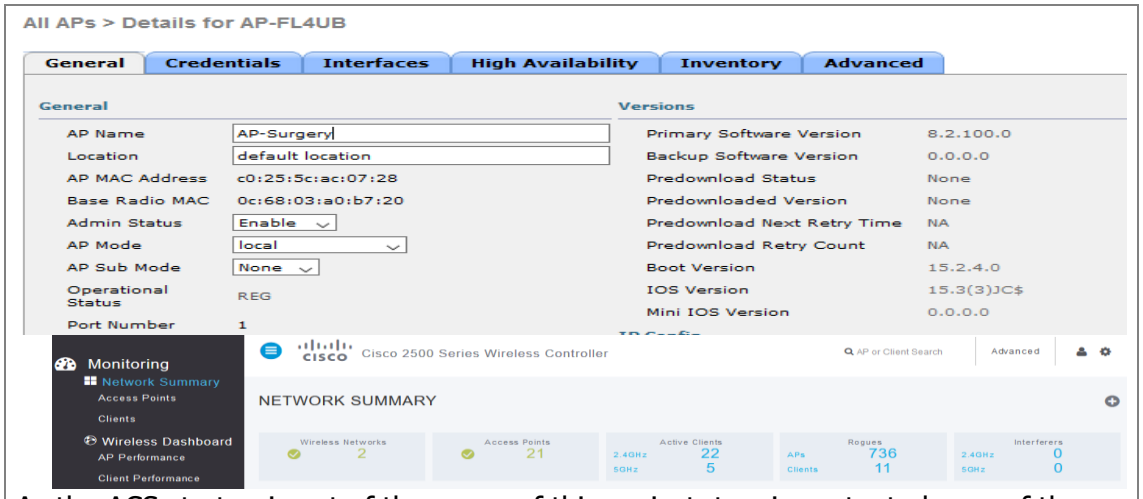
After this phase, we configured the WLAN; to do this enters the WLAN field and selected the WLAN submenu, and creates the WLAN for each user group (stuff, Guest, VIP); in this part, in addition to setting SSID, some other parts, such as Interface (VLAN) should be set up.



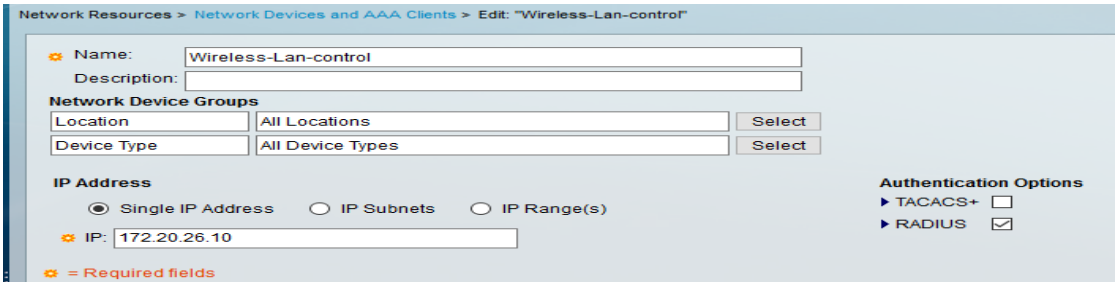
In the security section, the security method should be selected; we select WPA + WPA2 and the AES encryption method; however, we can also set up QOS in the QOS part.
After this phase, in order to authenticate users, we direct them toward the Radius server, which in our complex is Cisco ACS; of course, ACS also takes advantage of Active Directory server to authenticate users.



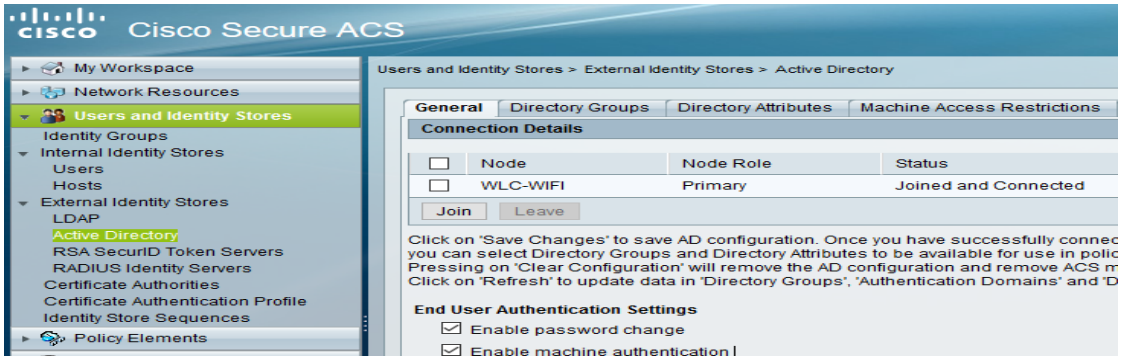
In order to add access points to the Controller, we did not need a particular configuration; we put an access point in the corresponding VLAN switch port; first, they got the DHCP IP address, and then the Controller configured the AP itself, and we just changed the AP name:



As the ACS startup is out of the scope of this project, two important phases of the server configurations are presented. In order to configure ACS, we first add the IP address of the Controller in the Network:



And then, in order to connect this server to the Active Directory, select the Active directory submenu from the User and Identity, and then set it up; the important point in the Directory group is determining the WLC user groups In ACS settings, which refers to groups that are set up in Active directory (Stuff, Guest, and VIP).



3.3. List the major deliverables of the project that you were responsible for or contributed to.

My participation in the project implementation was as follows:

- Examining the organization's needs (hospital) by holding the meeting with the technical manager and stakeholders
- Examining the available solutions and techniques and selecting the right one by consulting the technical manager and other team members
- Designing the place of access points by a field analysis
- Wireless LAN controller configuration
- Cisco ACS configuration
- making VLAN wireless in VTP core switch
- making separate pools for each user group on the DHCP server
- Experimental implementation
- Final implementation of the project and solving antenna and network connection defects
- Final project report and documentation

4. Results

4.1. Was your solution implemented? If so, describe the role, if any, you had in the implementation.

To implement the project, I proposed the following suggestions that some of them have been confirmed:
The suggestion of using the Cisco Wireless LAN Controller, AIR-CT2504-K9, which was confirmed.
The suggestion of using the access point, Cisco 702i, which was confirmed.
The suggestion of analyzing WIFI coverage field by using WIFI analyzer software, which was confirmed.
The suggestion of using cisco ACS and Active directory to authorization, which was confirmed.
The suggestion of using separate VLAN to connect the access points and the network, which was confirmed.
The suggestion of establishing different user groups, including user groups, guests and managers, which were confirmed.
The suggestion of making different group address pool on DHCP server, which was confirmed.
The suggestion of making Mac address archive of network-connected equipment to use in other projects, which were confirmed.
The suggestion of using the EAP method to authenticate users, which was enhancing the connection security, which was confirmed.

4.2. *Assess the overall success or failure of the project*.

According to the evaluators and the technical manager, the project implementation was considered a success that led to the following achievements:
The achievement I: wireless coverage throughout the hospital; all users could move to the hospital without any WIFI connection.
The achievement II: establishing different working groups, with different IP addresses, and different accesses, which increased the security of access to hospital resources.
The achievement III: providing a Mac address archive to all equipment connected to the company's WIFI Network, which could be used in other projects.
The achievement IV: the establishment of an Access Points monitoring mechanism through the company's Wireless LAN Controller managerial panel, which facilitated the monitoring of APs.
The achievement V: the use of EAP to encrypt the connection, which ensured the secure connection of the WIFI Network.
The achievement VI: using a user-friendly panel, provided by WLC, which could easily add users' MAC addresses and their teamwork.

4.3. Lessons Learned

In retrospect, what you might have done differently on this project?

After the project was implemented, we obtained very important results in regard to the different phases from the examination of the solutions to the documentation by analyzing the implementation steps of the project.
Firstly, if I wish to carry out the project again, I will definitely think of a solution for coverage of the outdoor spaces in the hospital building, so that Wi-Fi coverage is provided also in the hospital yard and its open spaces. The problem was of course fixed a few month after the implementation of the project through purchase of outdoor access points, but it would have been better to consider the issue in the initial design.
Another defect in the project was the lack of an instructional document for instruction of how the users can be connected to the Wi-Fi network. We should have provided documents appropriate to different operating systems (Windows, Android, and iOS), so that the users could connect to the Wi-Fi network easily by reading it.
Another problem with the project implementation was the failure to employ a powerful advisor for selection of the appropriate access point and wireless LAN controller brands (WLC), which caused us to lose plenty of time for that purpose.
Another problem was that the contractor in charge of access point installation was not instructed correctly, and that no cabling plan was available for the network, which was resolved through the development of a cabling plan in the documentation step.

Project 2: DMVPN configuration and Implementation

5. Project Summary

5.1. Identification

Client's Company Name	
Business Address	
Contact Numbers	
Web Address	
Email Address	
Nature of project	DMVPN configuration and Implementation
Location of project	
Name of your employer	

5.2. Duration

	From	To
Total project duration	04/2018	08/2018
Your involvement	04/2018	08/2018

5.3. Resources

	Number
Your team size	4
Total project team size	9

5.4. Personal Involvement

Please list the phases of the project in which you were personally involved

Start	Completion	Phase Description
04/2018	04/2018	Phase I — Initial Needs Assessment — reviewing the application submitted by the Ministry of Health – holding the meeting with ministry network experts, to review techniques, and selecting the right technique - holding meeting with health center IT officials, and reviewing the network facilities of these centers
04/2018	05/2018	Phase II - Developing the project schedule, coordination with the project team
05/2018	05/2018	Phase III – Designing new network - the configuration of routers and hospital equipment and health centers
05/2018	07/2018	Phase IV - Final Implementation and testing connection - adding network nodes to monitoring

07/2018	08/2018	Phase V - project Reporting

5.5. Describe your role(s) and responsibilities in the project.

As executive director, I participated in all phases of implementing this project from the initial needs assessment to submit the final report:
In the first phase, in the initial needs assessment, I played roles to analyze the order of Ministry of Health to connect family health offices to the hospital, to hold expert meeting with the Ministry of Health's network expert and the hospital's technical manager, as well as to examine the hardware infrastructure of family health offices and the hospital; in the second phase, in addition to scheduling the phase of project implementation, I assigned the task of implementing each phase to team members, as well as coordinated with the IT expert at the family health offices. In the third Phase, I participated to design network and configure Cisco Routers of Health Home and Hospital Offices; in Phase Four, we implemented and tested the final connection and added new nodes to the monitoring software, and finally, I submitted the final report to the technical manager.

6. Business Opportunity or Problem

6.1. Describe the business opportunity or problem(s) this project addressed.

The Ministry of Health had declared the hospital that all of our hospital's subordinate health home offices should be connected to the hospital via the Internet. Health Homes in Iran are small complexes to do tasks of vaccination, screening the common diseases and prenatal care. These Health Homes were intended to use physicians' consulting services by connecting to the nearest hospital, and by completing online questionnaires, and receiving specialist physician feedback guide patients in future referrals.
The purpose of the project was, in fact, to establish a Point-to-Point connection between the hospital and its subordinate health centers in order to achieve the above goals, in which the hospital's IT manager assigned me the responsibility of implementing the project and it was intended to design a network and to implement a right technique to safe connection between health homes and the hospital by using hardware and software needs and association of Network colleagues in health homes and Hospital.

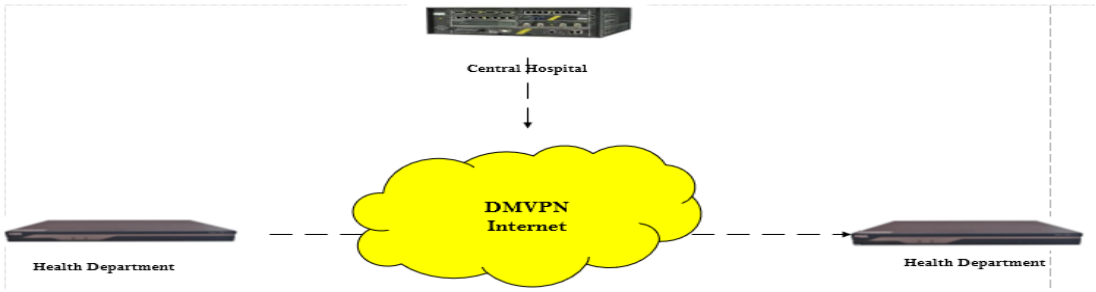
7. Solution

7.1. Discuss your contribution to the solution, project or engagement.

I played a role in all phases of the project as follows:
In the first phase, in addition to analyzing the order of the Ministry of Health, I held a technical meeting with the ministry's technical experts and reviewed possible techniques with the ministry's experts, and then the hospital's IT, manager, and selected the right DMVPN solution and technique by consultation with other team members and the IT manager; I also reported the available network infrastructure (switches, routers, and servers...) at home health centers.
In the next phase, I formulated the project implementation schedule in coordination with the IT manager; I also coordinated the project team at the hospital and the family health centers.
In the third phase, I designed the communication network between health homes and hospital, as well as configured hospital-based and home-based routers in collaboration with other project team members.
In the fourth phase, in collaboration with project team members, I configured the final implementation of the project and tested the connection between health homes and the hospital and with each other; we also added new network nodes to the monitoring software.
In the last phase, I provided a project implementation report along with a map on new connections between health homes and hospitals.

7.2. Describe any design or problem solving methods you used on this project.

The following figure is a simple example of a DMVPN implementation map between the Health Homes and Hospital, and the difference is that in the main implementation, seven Health Homes were connected to the hospital via the Internet and using the DMVPN Tunnel.



DMVPN technology is simply a Hub and spoke technology or in a simple word, it is a Client/server mechanism; when we intend to connect the central office and several branches, instead of providing a point to point tunnel for each connection, by creating a tunnel per branch, the central router, in fact, plays the role of the NHS (Next Hop

Server); the routers in the branches, or the same Spokes, play the role of the NHC (Next Hop Client); And all spoke routers are connected to the NHS, and the NHS actually plays the role of the hub, and if it is a Spoke to Spoke connection, the NHS, as a hub, establishes this connection directly between the NHCs by the DMVPN Tunnel.

To configure the DMVPN, we first configure the installed router 7200 at the hospital(Hub), then configure the routers at health homes:
Routers' Configuration:
IP address: it is IP address tunnel of center and health centers.
IP mtu 1400: We have set the maximum size of IP packets 1400.
IP nhrp authentication: it is used to authenticate between the NHS and NHC.
Ip nhrp map multicast dynamic: This command makes the NHRP table in the NHRP client router.
Ip nhrp network-id 123: In fact, it defines the function scope of the NHRP protocol that must be the same across all routers.
Ip nhrp nhs: Specifies the NHS server address.
Ip tcp adjust-mss: This value can be set between 500 and 1460 and is actually the maximum size of the segment.
Tunnel key: In fact, it's the tunnel identification number.
Tunnel mode gre multicast: this command can set the encapsulation type for mGRE.
Tunnel source dialer1: This command in the health centers router specifies the source address that the router receives after connecting to the Internet.
The following figure shows the DMVPN tunnel settings of hospitals and health centers, as well as the output of the show ip nhrp command, which shows the tunnel status of the spoke tunnel:

```
interface Tunnel2
 ip address 10.0.2.1 255.255.255.0
 no ip redirects
 ip mtu 1400
 ip nhrp authentication DMvpn
 ip nhrp map multicast dynamic
 ip nhrp network-id 123
 ip nhrp holdtime 600
 ip nhrp nhs 10.0.2.1
 ip nhrp registration timeout 30
 ip tcp adjust-mss 1360
 tunnel source 5.160.24.135
 tunnel mode gre multipoint
 tunnel key 5616
end
```

Central Hospital

```
interface Tunnel213
 ip address 10.0.2.213 255.255.255.0
 ip mtu 1400
 ip nhrp authentication DMvpn
 ip nhrp map 10.0.2.1 5.160.24.135
 ip nhrp map multicast 5.160.24.135
 ip nhrp network-id 123
 ip nhrp holdtime 600
 ip nhrp nhs 10.0.2.1
 ip nhrp registration timeout 30
 ip tcp adjust-mss 1360
 tunnel source Dialer1
 tunnel destination 5.160.24.135
 tunnel key 5616
end
```

Health Department

```
Health-Department-1#sho ip nhrp 10.0.2.1
10.0.2.1/32 via 10.0.2.1
   Tunnel213 created 5w0d, never expire
   Type: static, Flags:
   NBMA address: 5.160.24.135
```

In order to make a dialer on the routers, after receiving the user/password, we

connected the DSL from the modem ADSL to one of the router ports and did as follow:

```
interface Dialer1
 ip address negotiated
 ip mtu 1492
 ip nat outside
 ip virtual-reassembly in
 encapsulation ppp
 dialer pool 1
 ppp authentication chap pap callin
 ppp chap hostname 8633690378
 ppp chap password 7 00574354540A5B56
 ppp pap sent-username 8633690378 password 7 15415B5E547B7B74
!
```

After configuring the equipment, we tested the connection between points using the ping command; we also used the following commands to analyze the connection:
Show ip nhrp tunnel2 brief: it shows us all the active tunnels, along with their status.
Show ip nhrp traffic: it displays the send and receives traffic of the Tunnel interface.

```
Internet-DMVPN#sho ip nhrp tunnel 2 brief
   Target            Via             NBMA           Mode    Intfc   Claimed
10.0.2.10/32         10.0.2.10       incomplete
10.0.2.192/32        10.0.2.192      89.165.82.100   dynamic  Tu2     <   >
10.0.2.193/32        10.0.2.193      31.59.17.222    dynamic  Tu2     <   >
10.0.2.194/32        10.0.2.194      79.127.108.40   dynamic  Tu2     <   >
10.0.2.195/32        10.0.2.195      37.27.223.1     dynamic  Tu2     <   >
nternet-DMVPN#sho ip nhrp traffic
unnel2: Max-send limit:100Pkts/10Sec, Usage:2%
  Sent: Total 75989911
        0 Resolution Request  0 Resolution Reply  0 Registration Request
        75989911 Registration Reply  0 Purge Request  0 Purge Reply
        0 Error Indication  0 Traffic Indication
  Rcvd: Total 76003221
        0 Resolution Request  0 Resolution Reply  76003221 Registration Request
        0 Registration Reply  0 Purge Request  0 Purge Reply
        0 Error Indication  0 Traffic Indication
```

7.3. List the major deliverables of the project that you were responsible for or contributed to.

The following tasks were assigned to me during the project implementation:

- Examining the Ministry of Health's order to establish a direct connection between health centers and hospitals
- Holding the meeting with technical experts of the Ministry of Health and technical manager to review the available techniques to connect the hospitals and the health home
- Responsibility for selecting the DMVPN solution to make a connection between the mentioned points
- Preparing the project implementation schedule by the contribution of the technical manager

- Coordinating project team members (hospital IT team and health homes)
- Designing the communication network based on DMVPN technology
- Configuring the edge routers of the hospital and the health home
- Testing the connection of health homes and hospitals
- Documenting and submitting reports

8. Results

8.1. Was your solution implemented? If so, describe the role, if any, you had in the implementation.

In order to implement the DMVPN project between hospitals and Health Home, I proposed the following suggestions:
I suggested documenting the network equipment deployed in Health Home, which was facilitating selecting the final technique, which was accepted by the technical manager.
I suggested using the DMVPN Tunnel, which is a Hub and Speech Tunnel based and was connecting the hospitals and Health Home and made possible the direct connection of the Health Home centers, which was accepted by the technical manager.
I suggested designing a new IP address to use in Point to Point connection, as well as IP addresses used in health home, which was accepted by the technical manager.
I suggested staff training and using health-care staffs, who like IT, as a technical interface, which was accepted by the technical manager as it reduced the cost of project implementation.
I suggested using an ISP's capacity to the internet connection of Health Centers that acted as a connection platform between these centers and hospitals; it was accepted by the technical manager because it made easier troubleshooting and analyzing connection problems.
I suggested using IPsec, to securing the DMVPN, which was accepted by the technical manager because it is a well-known method.
I suggested using the MPLS platform to connect health home centers and hospitals that rejected due to its high cost.

8.2. Assess the overall success or failure of the project.

The final implementation of the project was very successful, and it was decided that this type of implementation would be used to connect other hospitals with their subsidiary health centers:

- After the final implementation of the project, the hospital was connected to the health centers, the health centers to each other, so that these centers

could serve effectively patient by completing the questionnaire form and referring suspects to the hospital physicians.

- The cost of implementing the project, due to using the low-cost Internet platform, was much lower than what was predicted before implementing project.
- Due to training the personnel of health centers, we could take advantage of their assist to install equipment and to provide remote access to equipment.
- Training this personnel was highly effective to troubleshooting after the final implementation of the project so that they were highly useful to IT team by monitoring the connection status through simple commands such as Ping.
- Using IPsec protocol made ensure administrators of the Ministry of Health and Technical managers on the security of the connection between hospitals and health home centers.
- Optimal use of available network equipment at health centers reduced the costs of implementing the project.
- Using an auxiliary ISP service was the facilitator across all health home and hospital and prevented confusion of IT staffs in hospital and home health centers.
- Proper design of the IP address accelerated the process of troubleshooting the connection and reduced the confusion of the hospital IT staff.
- At the end of the project, it was decided to use the provided communication platform to connect VOIP of health centers and hospitals, which was leading to saving telephone bills and facilitating the connection of personnel in health home and the hospital.
- By adding a connection to the monitoring software, monitoring the connection status of the IT unit became possible.

8.3. Lessons Learned

In retrospect, what you might have done differently on this project?

Usually, after the final implementation of the projects, by analyzing the project's achievements and shortcomings, there are some points that the project executers think doing them in other ways was better or there are some ignored points should be considered because doing them was more useful to the success of implementing the project. Some of these points in the project of connecting the health homes and our hospital are:
In my opinion, it was better to insist on using MPLS as a connection platform because of its higher reliability and stability.
Moreover, simultaneous using two ISPs, by setting up two tunnels and using one of them as a back-up tunnel was better to minimize the possibility of disconnection, which was unlikely to be accepted due to its high cost.
The provision and installation of a manageable cisco switch were better than available unmanaged switches at health home centers, which make possible taking advantage of its capabilities, such as VLAN, port security, etc., which was unlikely to be accepted due to its high cost.

Anticipating the possibility of VOIP connection of the health home center and the hospital during the design and implementation phases was better than proposing it after its final deployment.