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Central printing management system: A case study of Contact Resolution Limited

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**Central printing management system: A case study of
Contact Solution Limited**

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At a period when all entry in the budget is under intense scrutiny, Organizations searches for a strategy to minimize cost. This necessitates Contact solution limited to actively give consideration to office printing as a significant opportunity. Advancement in technology and compliance to meet information security challenges in printing, faxing, email, scanning and device integrity drives the company to centralize, scrutinize and standardize office output.

The aim of this project is to design and implement a central printing management system (CPMS) for Contact Solution Limited in Nigeria, using window 2012 R2 server and uniFLOW server as an addendum to the print service, to drastically reduce the cost of running printing operations, improve workflow, rationalize print device and avoid unauthorized access to office print devices. This thesis report documents the practical and theoretical approach to research and deployment of the CPMS.

Keywords: Central printing management system, Information security, print server, scan, E-mail, windows server, uniFLOW software, Cost.

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1 Introduction

The IT investment is primarily driven by cost reduction and the current economic climate. The research conducted by the loud house, 2011 tagged “re-thinking printing research” on behalf of Kyocera, provides a view of the current printing behaviour and the ways organisations are responding to the development. The Figure 1 below illustrates the key statistics summary of the research. However, the prevalence of “green” idea policy within the organisation is not wholly sustainable because 25% of the organisation has formally written print policy (Kyocera 2011). Moreover, activities such as printing the wrong documents, forgetting to pick up printout from printers, multiple printing of a specific document, choosing to read on paper rather than on screen and printing documents single sided than double sided are characteristics of print wastage within the organisation. Furthermore, the attitude of employees printing personal documents is relatively high. Research has it that 73% of employees’ cartel away with personal printed documents (Kyocera 2011) thereby inflicting the cost on the organisation. However, this burden might be shifted towards a more centrally driven approach. That is; Implementation of a central- print management system (CPMS) to achieve a greener printing future and cost reduction. Organisation saves up to 30% of their total print cost if their printing devices are vigorously administered (Gartner 2004). This project takes into cognisant the consideration of a centrally managed approach to combat habitual waste and cost through the deployment of printing management system software.

	Average number of sheets
Total printed per year	6,000
... Of which wasted/unnecessary	3,720
... Could be printed double-sided	1,140
... Could be read onscreen	900
... Printed for proof-reading	660
... Unnecessary duplicates	420
... Wrong documents	300
... Left forgotten on the printer	300

Figure 1: Average no of sheets wasted/printed per year (Kyocera, 2014)

1.1 Background

In respect of the present Economic situation in Nigeria, a medium sized enterprise, Contact Solutions Limited needed to optimize it's printing device services presently characterized with technical problems, logistic issues in terms of consumables and functionality of the device, locally connected printing and scanning devices and most importantly, the cost incurred in the daily operation of the devices. This project is based on finding solutions to those challenges raised by organisation in alliance with the stakeholders. The task is to proffer a solution by designing, installing and configuring of a centralized printing management system (CPMS) to drastically reduce the cost of running printing services, monitor the print jobs and prevent unauthorized access to printing devices. A centralised assessment on print devices will facilitates the adjustment of fleet capability and location of devices within the organisation (Mark 2012).

The central printing management system will ultimately deliver an efficient and effective support for the business printing processes at a reduced cost. Furthermore, printing, faxing and scanning are essential day-to-day activities of a business process. Therefore, it must be adequately supported to enhance and maintain employees satisfaction.

1.2 Company's profile

Contact Solution Limited is located in Lagos, Nigeria. The company provides a world-class call/ contact Centre services and enterprise solutions. It is a medium sized company with three branches and has been in existence ten years ago. Its Clients are from both public and private sector within the country.

1.3 Objectives, scope, and limitations

The main aim of this project is to design and implement a central printing management system for contact solution limited. However, the realisation of this new system will initiate the following benefits:

- Cost reduction

One of the key goals of this project is to implement a central printing management system with the intention to reduce the cost incurred on its printing services on a daily basis within the organisation.

- Control and monitoring printing

The control will help the management to ensure that employees are using the services as intended. i.e. only authorised personnel are given access to print with the assigned pages and privileges. Also, the monitoring aspect will allow the management have a proper data for expansion of the printing services if needed. Furthermore, it will help the management to measure how successful its green IT policy is. i.e. reducing the impact of carbon dioxide (co2) emission in the office environment

- Choice of Printers

This intensifies the optimisation of printers by reviewing how the fleet printing device functions in the organisation. Each printer in the company has its capabilities. With the central printing system, the user can locate appropriate or right printer for the print job.

- One username per person

In the new printing system, each user will have an enterprise-wide account that can be used on any system on the company's network. As

against the old system, where there is a joint account that is used for printing.

1.3.1 Scope

The scope of this project are listed as follows:

- I. Analyse and extract relevant information and customer requirements from contact solution limited and its entire stakeholders as an input to be used in the design of central printing management system.
- II. Evaluate the existing printing system to identify weakness and configure the print server accordingly to checkmate such flaws where possible.
- III. Design and implement central printing management system using windows 2012 server R2 server print services and uniFLOW software platform for device management and control.
- IV. Training employee of contact solution limited on the use of the new system to create awareness of an innovative way of printing services within the organisation.

1.3.2 Limitation

One of the limitations faced during the execution of this project is the problem description and statement. Understanding the business strategy central printing management service (CPMS) will efficiently support requires the engagement of the stakeholders at the early stage. Also, time constraint experienced during scheduled interview with employees and stakeholders of contact solution limited is another obstacle towards the successful implementation of the project. Scheduled meetings were cancelled and rescheduled due to unavailability of the key personnel.

1.4 Thesis structure

This thesis report comprises of five different chapters. Chapter one presents the projects, project clients, main objectives, scope and limitation of the project. The second chapter describes the research approach, methodology, knowledge base and theoretical background of the project. Chapter three describes the concept, components, network architecture and analysis of central printing management system (CPMS). The fourth chapter elaborates on the project implementation through key phases, project progression and the reason uniFLOW software was used. The fifth chapter will be the concluding parts of the project and it includes the project evaluation, training and suggestion for future development.

2 Research Approach and Methodology

According to Higher Education Funding Council for England (HECFC), research is defined as the original investigation undertaken in order to gain knowledge and understanding (RAE 2008). This thesis is project based and it involves the installation and configuration of a central printing management system using window server 2012 R2 and uniFLOW software as an addendum to the printer server for the purpose of solving a real life problem. (Sekaran 2013, 5) also defined research as an inquiry into a specific problem for the purpose of ascertaining solution to it. Constructive research approach will be used during the course of the thesis. This is because the project is aimed at creating a change to solve practical problems to achieve some set goals. “Constructive research approach is a procedural research for generating an innovative structure to resolve difficulties faced in the real world.” (Lukka n.d.). The description of this thesis projects substantiates the use of this research approach because it has the core features of a constructive approach. I.e. focuses on a real-world problems solved in practice, embraces an effort for implementing the developed solution for testing and obviously linked to prior theoretical knowledge.

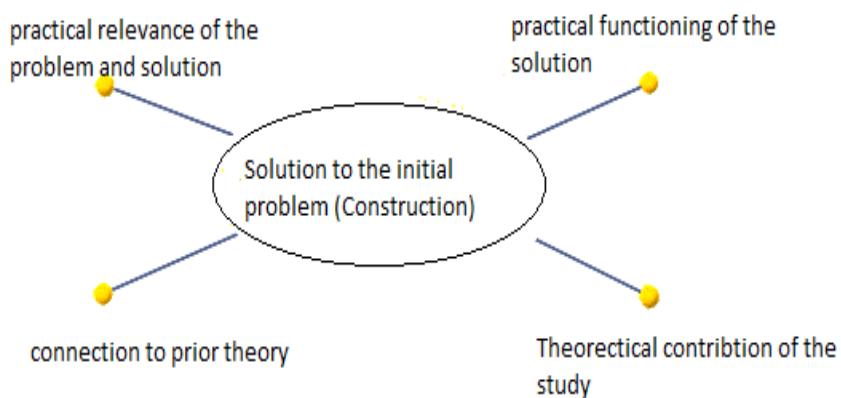


Figure 2: Elements of constructive research (Lukka n. d.)

2.1 Research Methodology

A selection of different methods ranging from qualitative (interview) and quantitative (Questionnaires) is been utilized in the development projects to extract data. This range of methods provides different types of data and point of views for the project. However, “mixed methods provide the opportunity for triangulation of data” (crouch & Pearce 2012, 129), which is advantageous to the development of this project. Therefore, the different methods used in the development of the project are described below.

2.1.1 Interview

The Interview is regarded as one to one conversation for gathering detailed information and collection of data about a particular thing. In other words, it is an open meeting to produce resources used for a particular research purpose. An Interview can be carried out in seven different ways. Namely; structured, semi- structured, one to one, group and focus group and open interview. Each of the interviews is designed for different purposes (Sekaran 2013,5). However, the success of interview research depends on the interviewer’s personal, professional and intellectual skills (Salmons 2010, 142).

In this project based thesis work, the author engaged in one to one and focused group interview with the personnel of the organisation to derive information on the position of printing in the organization. Stakeholders meetings were held for discussion before the implementation of the CPMS.

2.1.2 Survey

Survey methods are a useful tool to determine the requirement of a project at the initial stage or for accessing project result when accomplished. The aim of the current state survey is to identify factors that impede the efficiency of a business process. This method is suitable for situations where data gathered already exist but needed to be ascertained and verified. Mostly, survey can be a paper or electronic questionnaire used for planning before executing a project. Quantitative data are largely gathered by means of structured questions (Sekaran 2003, 5). In the course of this project, survey was conducted by means of questions to ascertain the potential requirements of the multifunctional device. Here are some of the questions conducted during the survey plan.

- 1) Approximately how many pages do you print in a month? 0-250, 250-500, 500-1000, more
- 2) What percentage of pages is printed duplex? 0%, 25%, 50%, 75%, 100%
- 3) How many pages do you scan per month? None, 1-250, 250-500, 500-1000, more.
- 4) Do you send and receive Internet faxing? Yes/No
- 5) Do you send and receive analogue faxes? Yes/No
- 6) Approximately how many pages do you print in colour documents in a month? 0-250, 250-500, 500-1000, more
- 7) Do you make colour photocopy documents? Yes/No

2.2 Knowledge base/Theoretical background

This project will be executed using print management software (PMS), which is a software package designed to provide an improvement in the control and efficiency of multi functional devices. There are different types of print management software e.g. Papercut, uniFLOW, omplus etc. The print management software been selected in this project is uniFLOW.

UniFLOW software is created by NT-Ware, a German company, considered as the world's leading software solution for organisation demanding to streamline printing workflow process, administer print & copy cost and increase a secure print (Loffler, 2013). UniFLOW software is modular and configurable (canon, 2013) hence; it can be adopted to fit the specific need of various businesses. The uniFLOW software and central printing management system in general will encompass the knowledge base for this project.

3 Central printing management system (CPMS)

Central printing management system (CPMS) is an innovative technology specialising in the development of print and documents management solution. It is a service offered to streamline the use of printing device, minimise the cost associated with printing and control of printing to boost productivity. It also improves document security and environmental sustainability by drastically reducing the number of printing devices within the organisation. (Linton, 2016).

3.1 Components of central printing management system

The components of a central printing management system comprises of both hardware and software. Each of these components provides set of related functions in the system. The

Figure 3 (copied from IT freetraining.com) below describes the various components of a central printing management system.

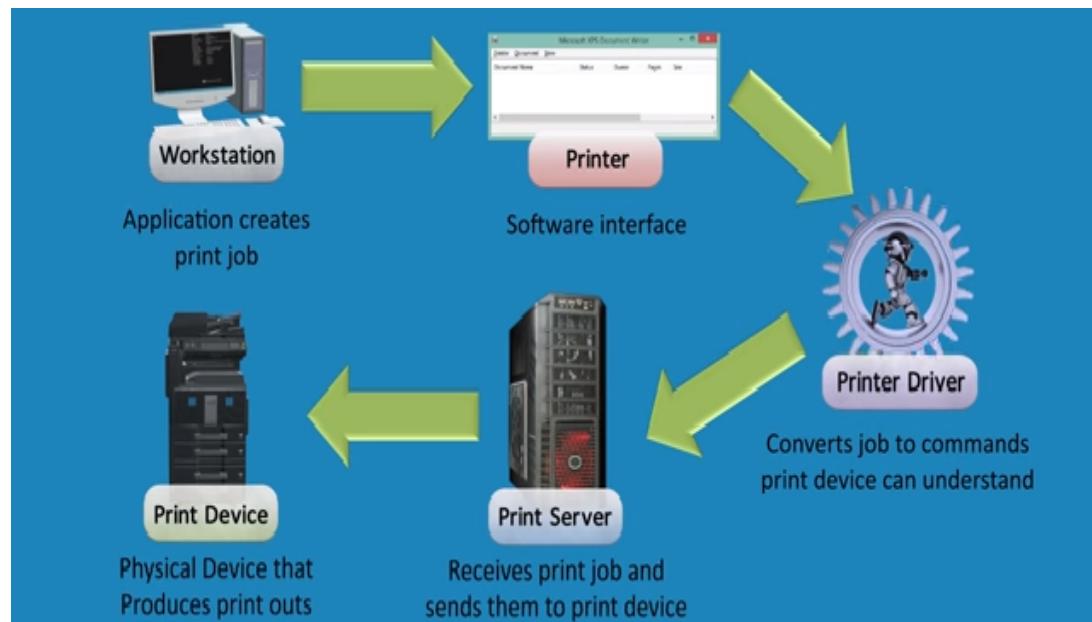


Figure 3: Components of a central printing management system

3.1.1 Multifunctional printing devices (network enabled)

A multifunctional print device is a hardware device that is used for printing purposes. It is the actual hardware that produces the hardcopy documents on paper or other printing media. It can either be locally or network connected. But for the purpose of this project, the print device is connected to the network using RJ45 cable. The resolution of print device is measure in dots per inch (DPI). The clarity of the printing device depends on the resolution. Hence, the higher the dots per inch (DPI), the greater the resolution. The print device is often referred to as multi function units. It has scan, Internet faxing (E-mails), G3 fax and photocopying features. It has capability to print colour and monochrome images. Typical example is a canon multifunctional device shown in Figure 4(copied from jmdprinterservice.com) below.



Figure 4: Network enabled multifunctional printing device

3.1.2 Print server

The print server is regarded as a network device, software application or a computer that connect printing device to the clients over a network to administer print request. It is a device that receives print jobs from clients and sends them to a print device. The print jobs from a client sending to a printer (software) is been received by the server and rendered to the appropriate print device (hardware). It allows for all computers within the network have access to the printing device within the network. The print device can either be locally attached to the clients or network connected. Alternatively, a print server could also be a dedicated device on the network with connection to one or more print device. It is used in both large, small or home office enterprise.

3.1.3 Print Driver

This is software that converts the print jobs generated by applications into an appropriate string of commands for a specific print device. The printer driver helps renders prints jobs into a language the print device can use to reproduce what one intend to print. Hence, it is often referred to as a translator or a print processor.

3.1.4 Print clients (work station)

A print client is an end users device or system that can initiate a print request to the print server. It could be a computer system, smart phones or other mobile devices connected via the Internet to the print server within the same Network as shown in

Figure 5 (copied from en.wikipedia.org/wiki/client-server-model) below.

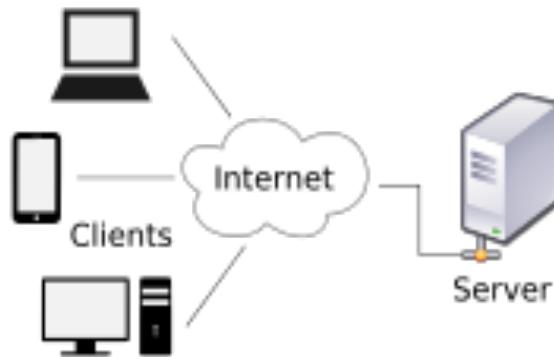


Figure 5: Print clients communicating with server

3.1.5 Printer

This is the software interface through which a computer or a client communicates with the print device. It is a software entity the client prints through. The installation of the printer depends on its intend purpose. In the case of a remote printing, the printer resides on the print server. However, if it is local

printing or print jobs redirected to a print device, the printer resides on the print client or workstation.

3.2 Overview of Network Architecture of CPMS

The central print management system is a printing service that will be activated on a server i.e print server. This printing service depends on other coexisting services that are been run on the server. These various services or servers that must exist for print server to function properly are:

3.2.1 Lightweight Directory Access protocol server (LDAP)

Lightweight Directory Access protocol (LDAP) is a standard application protocol used over an Internet Protocol (IP) Network for managing and accessing the distributed directory information services (The free dictionary, 2014). This services has largely worked outside of the windows operating system structure i.e. Linus/Unix. However, Active directory is a directory services implemented by Microsoft for windows users, devices and applications. (James B, 2015). It is a database system that provides authentication, policy in a windows environment and support LDAP to query it's data. Active directory (AD) has the information about all the objects (e.g. users, computers and resources like printers, shared folders/files) in an organisation's Network. It's basically software to arrange the stored information into logical hierarchical groupings, provide access and permission based on those information.

3.2.2 Domain name System server(DNS)

In computing every computer has an IP address, which is fundamentally, a unique string of numbers separated by full stops that identifies computers over a network. Domain name system is a network service that translates computer "names" (domain names i.e. .com, .net, .org and host names i.e. family-pc) to IP address. It is a hierarchy based distributed database that allow computers to find services on the Internet and local area network (The

free dictionary, 2015). Basically, DNS provides for forward and reverse look up queries. Hence; it resolves an IP address to a computer name and the host-name to an Internet protocol (IP) address respectively as it was described in the Figure 6 (Copied from najcolabs.com/?tag=networking) below.

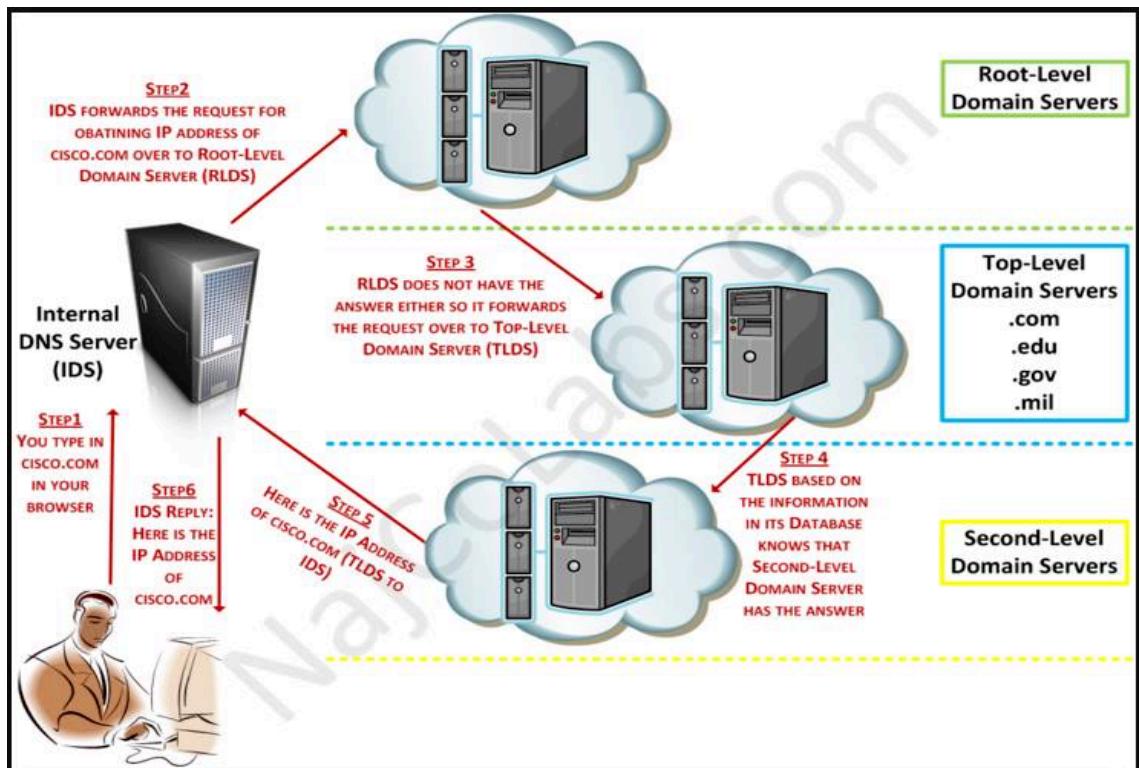


Figure 6: Operations of a Domain name server

3.2.3 Dynamic Host Configuration Protocol (DHCP)

This is another auxiliary service that must exist for printing services to functions properly within the network. Dynamic host configuration protocol (DHCP) is a network protocol that automatically provides a host, which communicates within a network with Transmission control protocol (TCP) /Internet protocol (IP), with its IP address, subnet mask, default gateway and DNS server configured for a given network (William 2014, 807) as described in the

Figure 7 (copied from windowsdevcenter.com) below. The host could be a workstation, printers, servers and routers and have in common a computer name and an IP address. The IP address could either be static (by specifying an IP address to reserve and the media Access control address of the computer that will grip the IP) or dynamic. Dynamic host configuration protocol is a client /server protocol (Wikipedia, 2015). DHCP clients is a computer that gets its configuration from Dynamic host configuration protocol while DHCP server is a computer that provides DHCP services to the client.

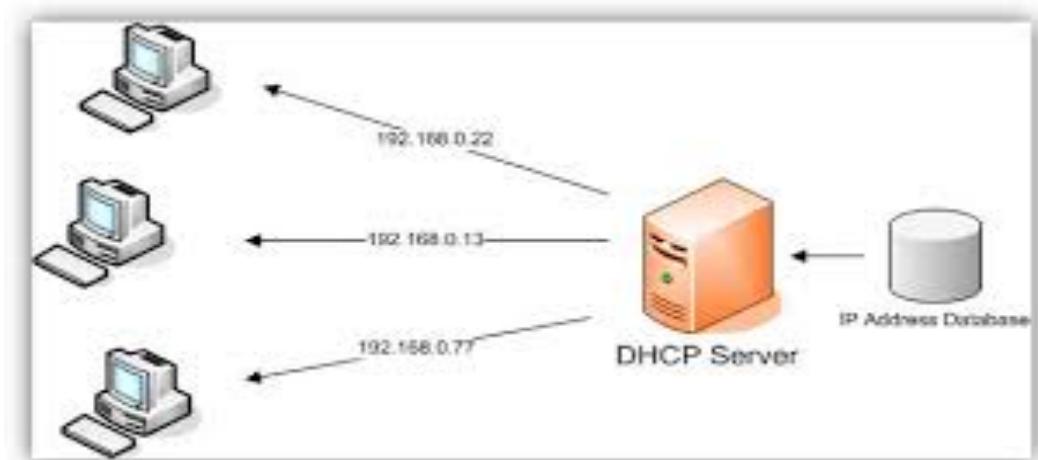


Figure 7: DHCP server communicating with DHCP client

3.3 Pros and cons of CPMS

There are various noticeable advantages and disadvantages associated with central printing management system initiation in a particular organisation. During the execution of this project, the author identifies the under-listed points as the noticeable advantages and disadvantages of central printing management system. This could be taken into consideration for further development.

3.3.1 Advantages of CPMS

- I. The possibility of finding the appropriate printer that is available and defined to central printing management system within the network is easier.
- II. The central print server provides the user workstation with the appropriate print device driver.
- III. Help desk support staff can administer print device on the central facility.
- IV. Data maintained on print device activities can be reviewed for future needs in determining the replacement of the print device or the best location for printers within the organisation.

3.3.2 Disadvantages of CPMS

I. Risk

The entire organisation will experience a print facilities failure if the printer server is down or unavailable due to maintenance.

II. Network impact

There is a heavy demand on the network due to the processes involved in the central printing management system. Data generated from large print jobs over the network are first transmitted to the print server then to the print device. Thereby having a double impact on the network.

3.4 Overview of network printing process

The Figure 8 below shows the interconnectivity between the print server and other auxiliary services within the network. On boot up, the DHCP client (Workstation) request for an IP configuration, subnet mask default gateway, DNS server configured for the network. The DHCP server will acknowledge

those requests. Also, the DNS client sends a request to resolve the computer name to IP address. Meanwhile, the system administrator creates a username account and gives privileges and roles. On logging on to the domain, the active directory authorises the users to inherit this roles to functions within the network. The user sends a print job to the print server through the software interface and the print server in-turn reply when the job has been printed. User log into the network print device, active directory authenticates the user and forward reply to the print server. Print server forward queue job for the print device to release or pull the print jobs.

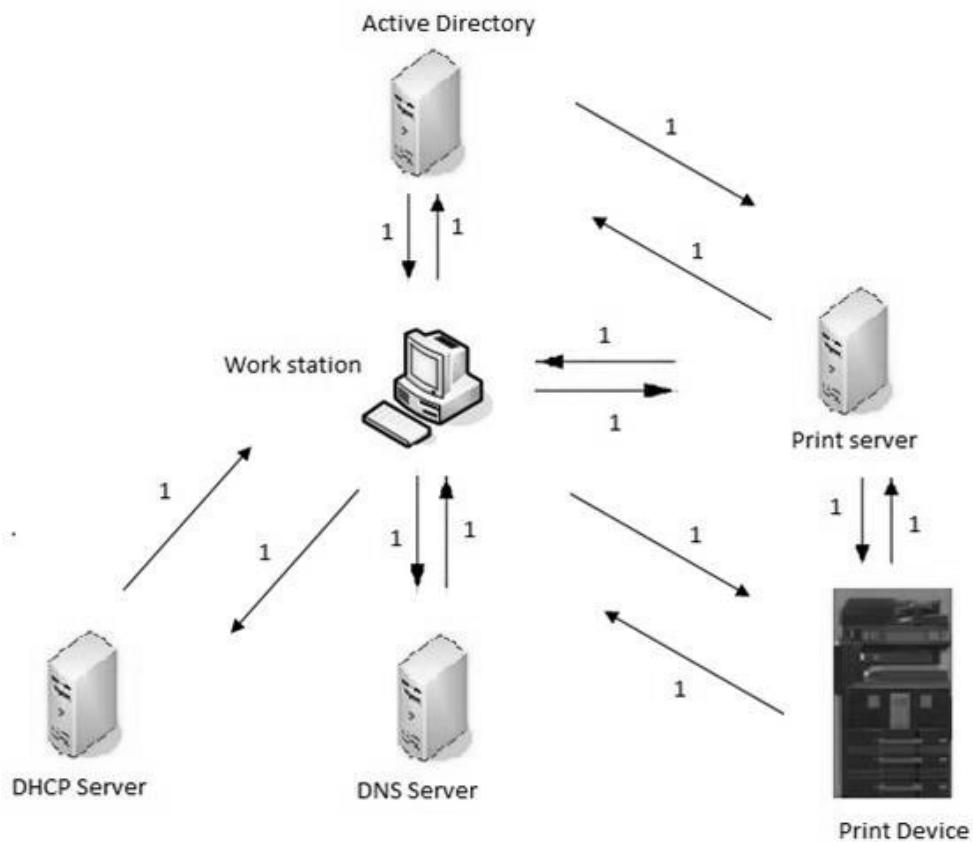


Figure 8: Network architecture of CPMS

4 Implementation.

The physical implementation of the project applies both theoretical research and customer requirement as the vital ideas for the successful execution of the project. However, the achievement of this project is done in the following phases.

4.1 Customer requirements

The purpose of this project phase is to have an understanding of customer expectation in the final deliverable. In view of the series of interview held with the major stakeholders of contact solution limited, the author came up with the desired goal and aspirations for the project. However, the main descriptions for the proposed integration of central printing management system (CPMS) during consultation were:

- I. Available Print device: The customer requires that three industrial canon multi-functional printing device located strategically on each floor across the three floors occupied by the organisation to replace the thirty-five small laser jet printer of different models, manufacturers and locally connected printing system presently executed in the organisation.
- II. Accessibility: only authorised users are given the opportunity to operate the printing device. Hence, an individual password and username (logging-in) measures must be initiated to access the device.
- III. Features: The proposed print device must have the capability to perform copying, printing, scanning and I-faxing operations. Also, additional features such as double-sided printing, colour and sorting must also be embedded in the device.

4.2 Hyper-v (Virtualisation Environment)

This is a Microsoft product that allows for the creation of virtual machine. During the course of this project, the author complied with the company's policy to separate server to avoid complication during troubleshooting. The hyper-v server was installed on the windows 2012-R2 servers i.e. a virtualisation environment was initiated which allows for the creation of virtual machine (regarded as software computers that run an operating system). The author took into consideration the minimum system requirements for uniFLOW server installation stated below in Table 1. Furthermore, the virtual machine created provides a separate operating system where the UniFLOW installation was carried out.



Figure 9: Hyper-v installation

4.3 Installation

UniFLOW is web based solution software for optimising, registering and accounting print jobs. Hence, the print management software (UniFLOW) installation was done on a dedicated server. The following procedure was taking into consideration.

4.3.1 Preparation

The following information was required from the client (System administrator) prior to the installation process and some key points to note.

- Device IP addresses: Static IP address of canon multi-functional device (MFD) 1, 2 and 3 with their corresponding device serial number.
- LDAP Information: The LDAP server name, username and password of user with LDAP access and name of LDAP organisation unit (OU) storing user details.
- Timing: The maximum age (hours) of print jobs required
- UniFLOW software: Obtain the latest uniFLOW mom.exe file.
- Internet information services (IIS) 8.0 were installed on the server (prepared for a uniFLOW installation).
- Anti-virus software: The anti virus software installed on the uniFLOW server is configured not to scan the uniFLOW installation folder, windows spool folder and the SQL server data folder during the day to avoid errors. Instead it is enabled for a scheduled scan during the night.

4.3.2 System Requirements

The system requirement for UniFLOW server installation is sub divided into two. Namely:

I. Software Requirement

The uniFLOW server system installation on the client operating system is supported since uniFLOW V5.3 with windows 7 or higher (NT-ware 2016). For the Widows server 2012 R2 used in the course of this project, we must have:

- Standard installation with GUI
- Internet information services (IIS) 8.5 that is prepared for uniFLOW installation
- Internet Explorer 11 or higher version

II. Hardware Requirement

The actual hardware requirement varies based on the system configuration and the features and application one choose to install (NT-ware 2016). Because of the demand for processing power and CPU circle, the recommended hardware requirements by canon for uniFLOW server installation are described in the Table 1 (copied from nt-ware.com) below.

Hardware	Minimum Requirements	Recommended requirements
Central processing unit (CPU)	Single core - x86/x64 with a minimum dock speed of 2.5 GHz	Multi core - x86/x64 with a minimum dock speed of 1.5 GHz
Random Access Memory (RAM)	4GB	4GB
Hard Disk Drive	50GB	80GB

Table 1: Hardware Requirements

The

below shows the initial installation process for the uniFLOW set up after gathering the relevant information form the clients. At the end of the installation, it is necessary to reboot the server. Then, the configuration continues by logging on to the server to access the uniFLOW server page.

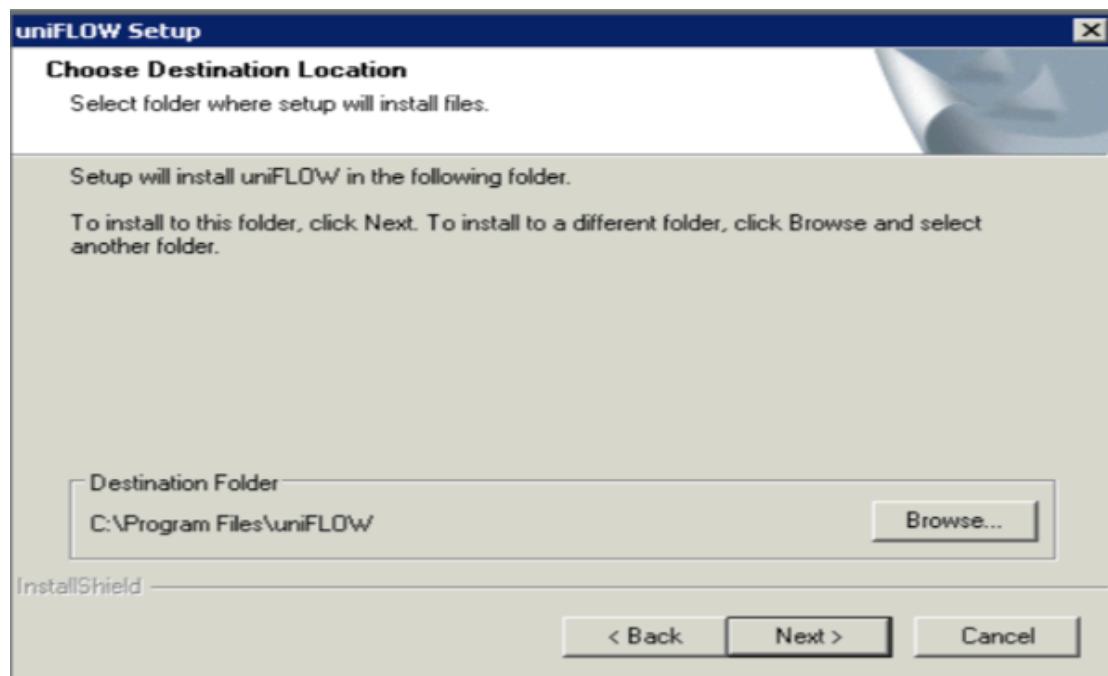


Figure 10: uniFLOW set up installation process

4.4 Configuration

After the successful installation of the uniFLOW software by double clicking the file mom.exe to initiate the installer and complete execution of the installation procedural steps. The uniFLOW quick start page appears for activation, configuration of the user account, LDAP server and general settings as described in the Figure 11 below. The under-listed configuration was successfully accomplished.



Figure 11: uniFLOW graphic user interface

4.4.1 Activation

The uniFLOW software activation is achieved by providing the license code obtained during the purchase of the print management software. Also, the information about the customer name, the market sector of the contact solution limited, country of usage and the channel through which the installation is being carried out are needed for the successful activation of the software.

4.4.2 User configuration

The user configuration is necessary to ensure that users (Employees) can print. It initiates connection between the uniFLOW server and the company LDAP system. The customer LDAP server name, username and password for a

user that has access to the server are required for this connection. The uniFLOW server connection is confirmed by testing the connection, which indicate a green “ok” if connection has been established.

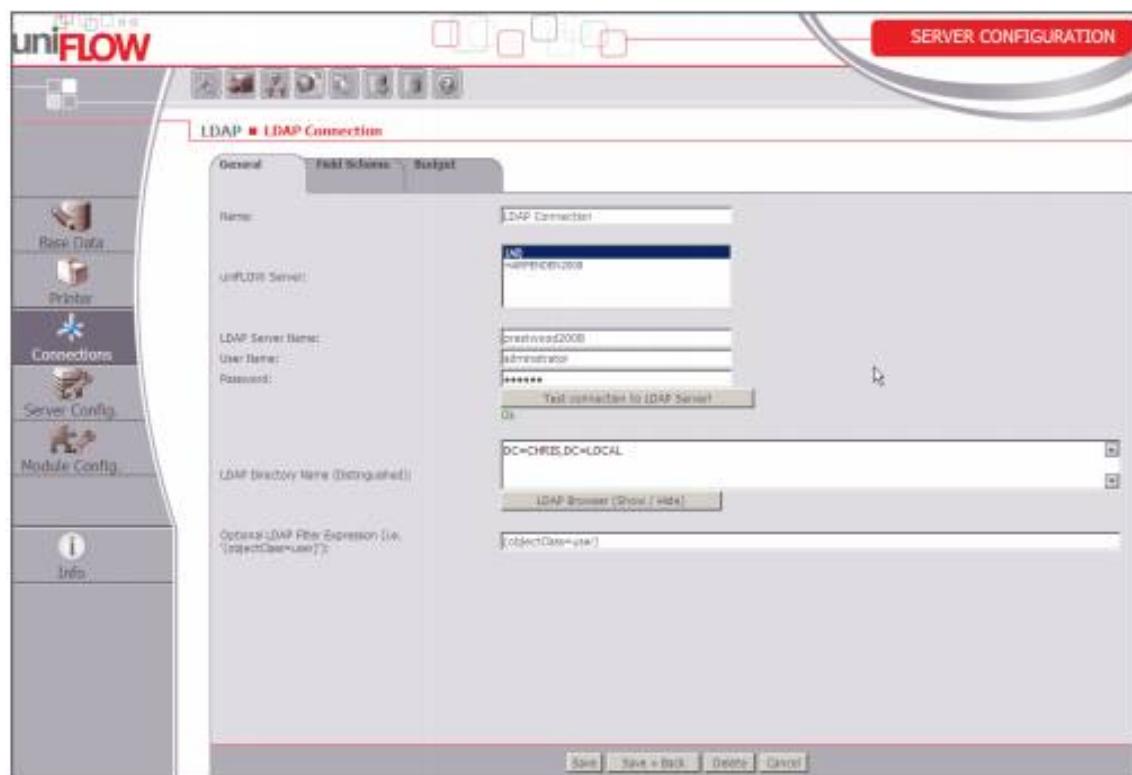


Figure 12: LDAP connection configuration

4.4.3 General Settings

The setting for maximum hours of print jobs is configured in this section. For the purpose of this project, the clients recommend a period of seven (7) hours to be used. Hence; print jobs will be automatically deleted if the users do not pull them from the uniFLOW server by authenticating themselves through the multifunctional print device.

The Figure 13: uniFLOW workflow below shows the entire network structure of contact solution printing architecture after installing and configuring the uniFLOW server.

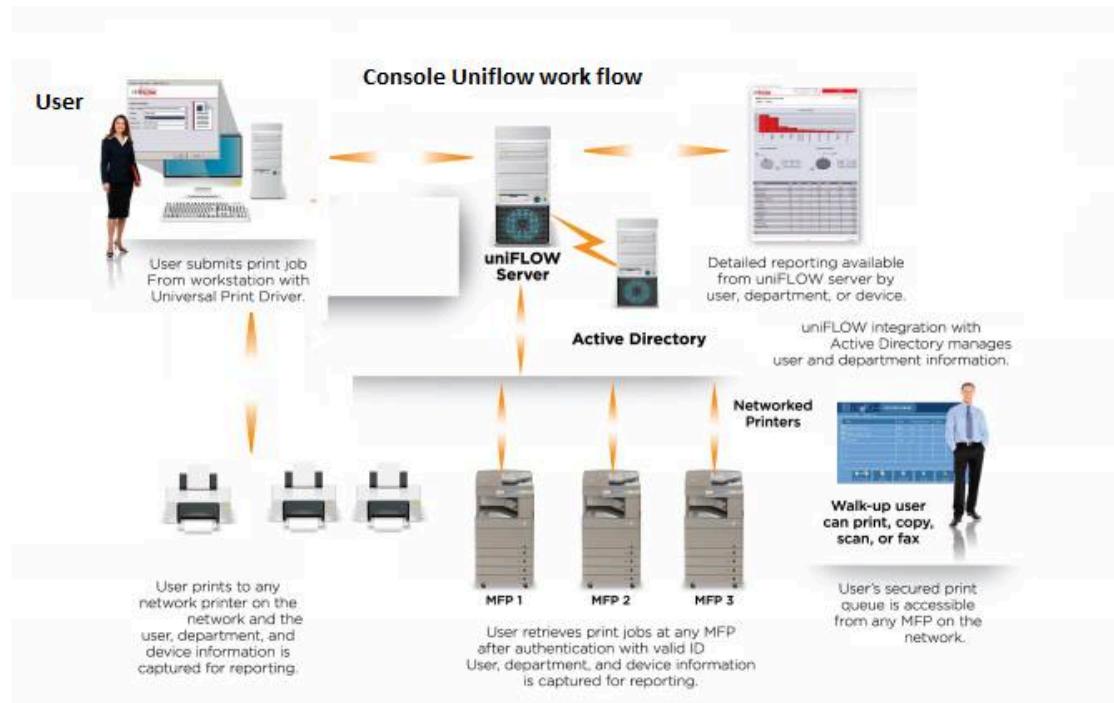


Figure 13: uniFLOW workflow

5 Conclusion

Sequel to the final testing of the integration of central printing management system (CPMS) into the old system (Direct printing), the printing devices were powered on to be fully operational. The additional features of the print devices such as scan, Internet faxing and copy were also configured and tested. Some other aspect tested includes:

- Creation of different user account to verify that roles and permission granted are functioning properly.
- Sending print jobs from different pc within the organisation to a particular printer in the organisation to ensure print jobs goes to a selected print device.
- Ensure individual authentication is required to operate the device

5.1 Training

The successful implementation of the central printing management system (CPMS) was completed with the training of personnel of contact solution limited (Consol). This training is intended to allow basic users to be conversant with the operation of the printing device in the new system as against the old system. This training involves a documentation of simple guidelines on how to log on to the printing device to carry out the daily activities on the multifunctional print device. Also, in a few hourly sessions, there were hands-on exercises and oral instructions enabling personnel to work smarter. The area covered includes,

- Accessing the printing device with different username and password (LOG IN)
- Printing and copy privileges granted to be conscious and conversant with each users.
- General operational procedures of print device selection and utilisation of various print device features. i.e. Scan, I- Fax, copy, 2- sided functions, automatic document feeder and finisher.

5.2 Project Evaluation

The main purpose of this project was to reduce the cost incurred in printing and initiate control to reduce unauthorised access to print device, have a standard method for tracking volume and print device usage, eradicate service delay and eliminate the multi vendor printing environment in contact solution limited. Furthermore, The clients desired print management software (uniFLOW) to optimize print device (from thirty five small printers to three industrious multi functional print device), manage documents and account for print jobs. The major stakeholders had valuable input during the phases of the project.

There has been an instructive lesson in the skills of software installation and configuration during the course of this project. Problem solving skills, time management and effective communication in work related activities within an organisation were also achieved.

5.3 Further Development

This project was based on the implementation of central printing management system (CPMS) to enhance printing configuration and activities within the organisation. The present system does not account for or allow personnel with mobile systems like tablets, mobile phones and laptops to send print job to the CPMS. Furthermore, a high availability printing can be initiated by a two-cluster windows 2012 server system. This allows client access to the print service from other available cluster server in the event of failure, maintenance requirements and outages. That is, it will mitigate against the risk of the primary print server being down. In future, this features and development could be implemented into the system.

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