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Davids Achonu

LOCAL IT INFRASTRUCTURE ASSESSMENT METHODOLOGIES AND APPROACH IN LARGE ENTERPRISES

RESEARCH PROJECT SCOPE – BRANCH OFFICE CONSOLIDATION

TURUN AMMATTIKORKEAKOULU
TURKU UNIVERSITY OF APPLIED SCIENCES

BACHELOR'S THESIS | ABSTRACT

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Instructor: Riikka Kulmala

DAVIDS ACHONU

Local IT Infrastructure assessment methodologies and approach in large enterprises

The objective of this thesis is to develop a model for assessing information technology infrastructure in large enterprises/organisations. The key components of this thesis are: first, to develop a generic assessment process approach that can be applied in IT enterprises, and secondly, to evaluate the practical application of these assessment processes and methods within an infrastructure transformation project in a large enterprise.

The study covers theoretical research which gathers information regarding the computer servers and applications components of IT infrastructure, assessment techniques developed by using the Microsoft Assessment and Planning toolkit, research methods and corresponding enterprise beneficiaries. After the research methodology and literature, this thesis then presents the detailed study as it deeply relates to a case study – Branch Office Consolidation Project (BOC) project. The research undertaken depicts the practicalities in conducting assessment in an enterprise environment based on the information gathered during the infrastructural evaluation process.

The results of this thesis are targeted at specific IT components (i.e., computer server and applications) of an enterprise infrastructure within branch offices in the referenced BOC project. The implementation shows the feasibility and application of a modelled assessment process in the enterprise workspace.

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Terminology

Term	Description
BO	Branch Office - an office in another location
DC	Datacentre - facility used in housing computer systems and associated components
BOC	Branch Office Consolidation
PA	Platform Analyser - A tool designed for placing candidate servers on to target platforms i.e., DC or BO
MAP	Microsoft Assessment and Planning
IT	Information Technology
LAN	Local Area Network
WAN	Wide Area Network
ERP	Enterprise Resource Planning
EAI	Enterprise Application Integration
VMware	Provider of Virtualization technology
FQDN	Fully Qualified Domain Name
WMI	Windows Management Instrumentation
SNMP	Small Network Management Protocol
IP	Internet Protocol
BI	Business Information
FTP	File Transfer Protocol
HPCA	Hewlett Packard Client Automation Enterprise Software
SEP	Symantec Enterprise Protection
FEP	Microsoft Forefront Enterprise Protection
IQOQ	Installation Qualification, Operations Qualifications Manual
IC	Installation & Configuration Manual
AD	Active Directory
BYOD	Bring your own device
DHCP	Dynamic Host Configuration Protocol
CMIP	Common Management Information Protocol
ISV	Independent Software Vendor
SSR	System Supplementary Report
SAC	Site Assessment Compilation

1. Introduction

1.1 Thesis Overview

As enterprises struggle to meet up with today's business challenges such as competition, rapid demand for new services, efficient management, high availability of services, or security, the need for a robust and agile IT infrastructure optimization becomes the fundamental bedrock required to support businesses. The ability of firms to conform to certain pressures and strains placed on their back-end components (e.g., networks, servers, middleware, security) depends on the stability of the IT infrastructure in use. Despite this fact, investment towards infrastructure is a significant part facing capital expenditure. Enterprises must either optimize their IT infrastructure resources at higher utilization rate or scale down, in order to achieve a better ROI (Return on Investment) which refers to "money invested in a company and the returns realized on that money based on the net profit of the business" (Entrepreneur, 2011).

However, IT infrastructure optimization is a structured and systematic process for assessing enterprise IT facilities across capabilities in order to provide an optimization roadmap toward a dynamic IT (Wikipedia, 2011). IT infrastructure optimization helps companies define and implement optimization initiatives that will enable proactive IT management, deliver cost and risk reductions across the IT enterprise. These assessment initiatives also enhance user needs and user experience in order to increase productivity and amplify the impact of employees.

In order to meet up with the demands of their business model as well as the constantly changing customer needs (to better fit in modern competitive market space), enterprises tend to technically transform their IT infrastructure with the deployment of newer technology proven practices on the operating environment, either by *consolidating systems/services* – which provides a more efficient and stable foundation for growth and new solution development or by *upgrading delivery tools/process* - which sets up a platform to speed up business process executions. In any case, IT infrastructure

assessment solution becomes the first logical steps towards actualizing either of the stated IT transformation processes (Data-trend, 2011).

For instance, system consolidation is more than just replacing many smaller systems with a few larger ones. It is about simplifying and optimizing existing end-to-end IT infrastructures, including servers, storage, databases, applications, networks, and systems management processes. The goal is to reduce both cost and complexity of, for example, physical servers and other equipment littered in a typical IT environment (Ajay, M and Amitava, G. 2011). Other roadmaps, such as LAN/WAN upgrades, application packaging, application or desktop virtualization could lead to the new wave that has been a buzzword in the IT industry quite recently - cloud computing (Hrmagazine, 2011).

1.2 Aims and Objectives

The aims and objectives of this research are to:

1. Describe the content and purpose of the assessment activities that are required during any IT Infrastructural transformation project. This ensures that assessors understand the extent of the work stream and reasons for performing it.

2. Provide an assessment template that technical resources can adhere to when performing either of the IT infrastructural transformation process such as migration, system integration, deployment, or application optimization within the enterprise.

3. Provide delivery aids (tools) that help in structuring and collecting the data needed for an efficient assessment initiation. These tools will enable the performance monitoring of systems and also validating the capacity or efficiency of technical IT infrastructure components automatically.

4. Simplify the process of assessment complexity in the enterprise IT Infrastructure from a technical perspective. In order to apply consistency in assessment across varied infrastructure, this study provides guidance on how to approach and structure tasks in order to ascertain invaluable outcomes.

1.3 The Beneficiaries and Need for Assessment

The beneficiaries of an IT infrastructure assessment are not limited to only enterprises that render IT services, but all businesses that rely on IT systems for execution of their daily operations. This could either be large or small enterprises/businesses such as academic institutions, medical institutions, banking, military, commissions, corporations, training firms, research institutes, government-owned companies, trading companies, multinational companies etc. (Open methodology, 2011).

However, there is a number of scenarios that identify the need for assessment opportunities; below are situations that might trigger the implementation of an infrastructural assessment:

1. A situation where a high performance IT issue has been diagnosed within an enterprise and indicating the necessity for deeper infrastructural assessment.
2. A situation where an enterprise requires a thorough overhaul of its Information technology infrastructure. Some reasons for infrastructural overhaul might be due to:
    - Introduction/Implementation of new technology, e.g., ERP, EAI, Data warehouse, BYOD etc.,
    - Determination of root cause of known or unknown issues,
    - Altering enterprise IT strategy to enhance the ability to support her business,
    - Green IT - practice of using computers and IT resources in a more efficient and environmentally responsible way,
    - Pre/Post merger IT Integration, and
    - Development of business cases to rationalize applications. (Open methodology, 2011).

1.4 Structure of Thesis

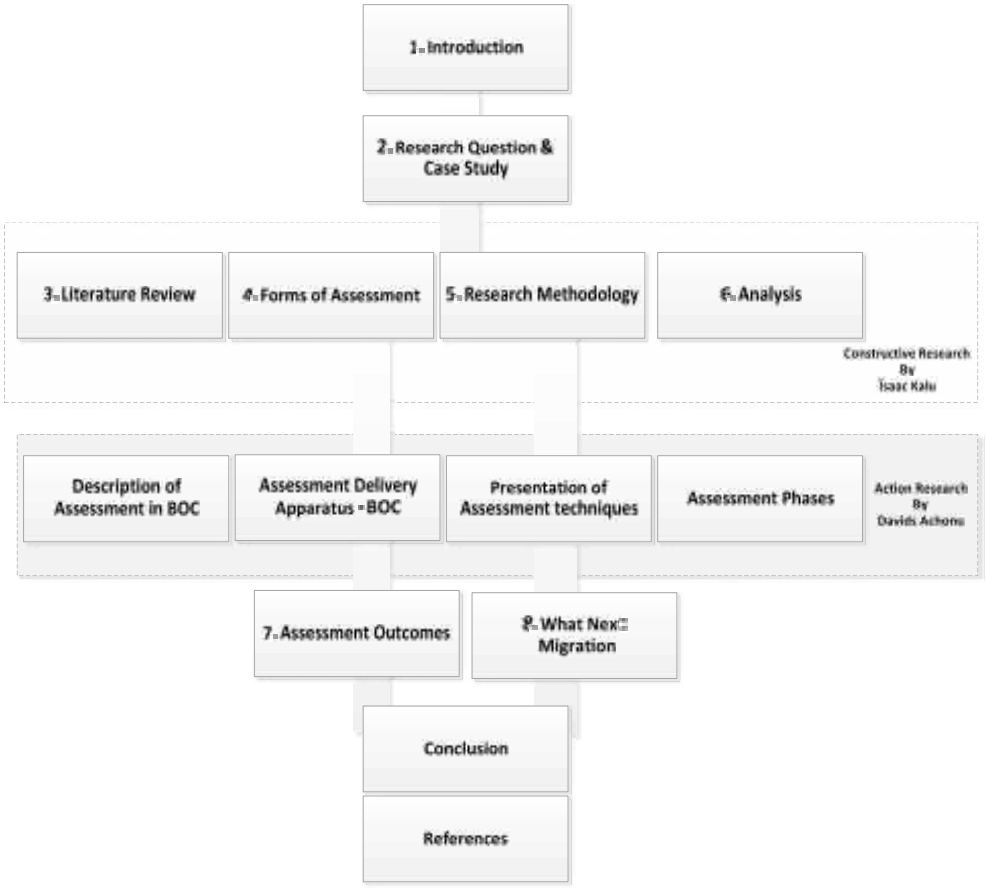

Figure 1.Thesis Structure

The structure of this thesis presents the main research questions in Chapter 2 and reflects on the project scope where an action research was carried out. A constructive piece of research was carried out by a colleague who reviews the research methodology, Literature and assessment strategy as it relates to the overall thesis work. Chapters 3, 4, 5 and 6 cover the practical application of the assessment techniques, tools, methods and processes within the project scope (Action research - China-doll Custom Journal, 2012) and how it aligns with the constructive research carried out earlier. Chapter 7 details the assessment outcomes and findings during the course of the project. A brief description of the next phase of the overall case study - BOC project (Section 2.2) is outlined in Chapter 8 before summarizing the research objectives.

2. Research Question and Case study

2.1 Research Question

The method and approach in carrying out an assessment in heterogeneous environment found in large enterprise IT infrastructure is the foundation of this paper. The generic assessment approaches are:

- Identify the IT components to be assessed, e.g. computer hardware such as servers, desktops, networks and hosted applications,
- Collect data on sites by manually developing an inventory report,
- Crosscheck the collected data validity with IT stakeholders, and
- Generate a final assessment report.

The primary research question was concerned with answering the question: "***Is there a preferred method/approach used in assessing IT infrastructure component in large enterprises***"?

With reference to the four research objectives stated in Chapter 1.2 above, the research question was developed in to the following research questions:

1. Why is it necessary to conduct IT infrastructure assessment in enterprises?
2. What guidelines can an assessor adhere to while conducting IT infrastructure assessment?
3. Are there relevant industry standard-efficient tools used in taking IT infrastructure assessment within enterprises?
4. Is there a preferred method/approach used in assessing IT infrastructure components within enterprises?

A bridge of the theoretical and practical concept is detailed in this research so as to outline the preferred approach in a logical manner that any skilled IT assessor can apply within IT infrastructure. The content of this thesis clearly details the outcome of these research

questions with regards to the importance of IT infrastructure assessment using third-party tools, methods developed within a real-world project.

The solution is intensely practical because it focuses on the IT components of the infrastructure which involves hardware and software. However, the application of these methods can be used in smaller IT infrastructures, as well. A presentation of assessment techniques is offered in Chapter 5. With the right tools in place, the methods/approaches stated in this thesis are easy to follow and flexible to use.

2.2 Branch Office Consolidation - Project overview

The specific goal of the BOC project is to deliver a strategy towards a full standardization of IT infrastructure environments across 35 branch offices (BO) in different geographic locations within a large enterprise. Conceptually, this means to:

- Provide a flexible classification scheme that supports the needs of both current and future branch offices around the world.
- Provide a modular branch office architecture that enables standardisation and consolidation as well as unified treatment and management of all IT-related aspects in the branch offices.

On the more tangible side, the specific goals are to provide a solution that:

- Supports hosting of all local services/applications in terms of enhanced scalability and reliability options, as well as service placement guidelines.
- Provides integrated operational and disaster recovery, including protection of unique data, predictable and well-defined bare metal recovery.
- Enables admin-less branch offices, meaning fully centrally managed solution with a high degree of automation and availability of local field service-type personnel (only for physical tasks).
- Supports dynamic expansion as branch offices grow and demands increase.

Overall, there are four high level phases of the project (*Figure 2*): Plan & Assessment, Migration, Test and Deploy/Handover.

Plan & Assessment: At this phase of the project, the specific hardware and software components (such as servers, systems, applications and networks) are accessed in order to gain an in-depth overview of the IT Infrastructure across local branch offices. A knowledgeable team of infrastructure analysts and project managers discuss and plan the strategy to be used in collecting these assessment data using manual or automated tools in alignment with the agreed project timelines. After collection, the data are then analysed in order to select the hardware/software components that will either be migrated to a new environment, decommissioned or "left as is" in its current environment.

This phase of the project is where our action research is implemented as the other phases of the project described below are out-of-scope for this thesis.

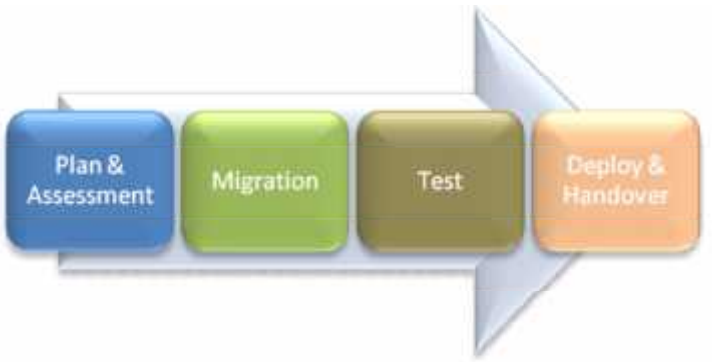

Figure 2. BOC Project Phases

Migration: At this phase of the project, analysed and selected hardware/software candidates are migrated to an entirely new development environment/platform, while legacy components are either decommissioned or "left-as-is".

Test: At this phase of the project, the migrated IT components are tested and evaluated against reliability, security and availability to affirm their functionality as required by the transformed business standards.

Deploy/Handover: The activities in this phase of the project covers the transition of migrated IT components from a development environment on to a production environment. This also involves the hand-over of the IT operations to IT managers or service responsible.

3. Description of Assessment in BOC project – case reference

3.1 Before Initiating the Assessment Process

Prior to deep diving into the assessment process in regards how, when, what tools we used and execution responsibilities within the BOC project, it is quite important to note that a number of enterprises might have local IT staff that are accountable for the technical management of various branch office IT components and their stability, e.g., they are tasked with the diverse activities such as updating application servers, print configuration, network monitoring etc. These IT staff should be well pre-informed about all the assessment activities that will be carried out during the process *(Cyberciti, 2012).* A formal presentation displaying the tools, methodologies, requirements, and phases involved in the scheme is required to give further clarity on the process. This aids in getting positive responses and assistance from these staff during the implementation of assessment technical tasks, when needed. It is expected to receive constructive criticism as well as technical-related questions from local IT staff; therefore it is advisable to be really acquainted with the basics of assessment beforehand.

Reciprocally, local IT staff could verbally provide an insight of what their current IT environment looks like. This routine is to ensure that a comprehensive agreement is made before start. These stated primary procedures should be adhered to, prior to the start of the main technical assessment of the branch office IT infrastructure.

3.2 BOC Assessment

BOC - Assessment Expanse

In taking the assessment, the entire physical branch office IT environment will be covered. This refers to the interfaces between all technical infrastructure components such as server matrix (hardware) application/system functionality (software), operating system, services, resource utilization *(Educause, 2012).*

The scope of the BOC assessment does not apply to Human IT Infrastructure or

Shared IT services *(Byrd and Turner, 2000).* Nevertheless, during the different phases, some of the components within the entire IT infrastructure were borrowed in order to facilitate the efficiency of the activities required to complete the project, e.g., using the competences of skilled staff, adhering to corporate standards set by the enterprise (as related to SLA with external vendors or service providers).

BOC - Assessment Expectation

On completion of each BO assessment, it is expected to collect and have a defined documented summary of the assessed infrastructure components in the following order:

Server Metrics (for each servers in scope) – refers to the core components that models each functioning server *(webperformance, 2012).*

- Server names (FQDN) – fully qualified domain names assigned to each server.
- Role of server - Enabled roles that each server is expected to play.
- Server function - specific functionalities that each server is expected to perform.
- System environment – existing environment where the servers are installed, e.g., virtualized or physical environment.
- Domain type and membership – domain which the server is a member.
- Summary of applications & system – existing applications/systems running on the server.
- IP Address utilization – internet protocol address allocated to the server.
- Operating system summary – operating system installed on the server.
- Service placements – enabled services on the servers.

Performance Metrics – this refers to the measure of core performance component utilization of each server *(Windows networking, 2012)*:

- Processor Utilization & Summary,
- Memory Utilization & Summary,
- Network Utilization & Summary,
- Storage Utilization & Summary,
- Disk Utilization & Summary, and
- Overall Server Workload Summary.

BOC - Assessment Challenges

When doing the assessment on each BO, there is a number of related issues to ponder about, such as using the best practice third party tools, approach/methods or procedures. With this in mind, it is easier to handle the different challenges as seen in each BO. Some of these issues are:

Tools

1. Using a highly complicated tool - It might take time for other members of the assessment team to understand and deploy an assessment tool that is not easy to use, which makes it difficult to apprehend with during the assessment phase.
2. The impact of the chosen tools on target servers and network bandwidth - It is necessary to have an understanding of this, because a tool that negatively affects the performance of servers/networks will influence the production activities within the BO. Assessment will typically be done on business/working hours, to avoid interruptions of business activities while running any assessment tool.
3. Effectiveness of the tool - is the tool efficient enough to complete a major phase in the assessment process?

It is worth running the selected tool on a development (test) environment for a couple of days prior to its implementation on BO infrastructure, for example, testing the tool on the

discovery of servers, monitoring, network impact, performance metric scans and reporting of load data *(Development sandboxes, 2012).*

Methods

1. What kind of approach will be taken during the assessment? A chosen approach goes a long way in structuring the focus of the assessment. (Diverse assessment proven approaches are discussed in subsequent sections of this thesis)
2. Is the method qualified enough to cover every aspect of the assessment process? An inadequate method would lead to an incomplete assessment.
3. Is the method perceived as a breach to the enterprise “Service Level Agreements”? *(SLA Toolkit, 2012)*

Organizing the Collected data

1. How will collected data be reported, stored and/or correlated?
2. What data is relevant to the assessment scope of the project?

Note - Not all gathered data are relevant to specific projects; therefore it is important to focus on only relevant data so as to save time.

Responsibilities and Communication

Searching for the right responsible personnel (i.e. system owners, network associates or technicians and technical liable personnel) to communicate with, in regards to the verification of the assessed IT components on BOs is a common issue in large enterprises. These personnel are often not available due to job calls, or are external consultants that manage the IT affairs of the company and are not always accessible.

It is a good rule of thumb to make an inquiry within the enterprise and have a drafted contact list of the responsible personnel at the start of the assessment process. This helps to avoid delays which could arise due to inappropriate search for information.

BOC – Assessment Pre-planning

Assessment pre-planning is an important aspect to consider. This is because of the duration of the set timeline for the particular project that is been facilitated. It is irrational to assume that a short specific completion time can be scheduled for the assessment of a local site (whether large or small).

To ensure that the next phase (i.e., Migration - which is dependent on the assessment phase) of the project is started within reasonable time, assessment should be carried out well in advance – given at least eight weeks for the initial stages of the entire process. The assessment schedule below was developed following a three stage high level process, i.e., *prepare, execute*, *review and signoff*. The time duration specified below was based on preliminary test and activities carried out on the basis of pilot execution of the entire planned process. A 24-hour overhead is added to each anticipated completion date in case of unforeseen circumstances such as delays, availability or dependencies. The activities in each of these stages are well dependent on the methods, tools and techniques used during the preliminary execution of the process and are cited in the timelines.

Information/data retrieved within the schedule are specific to the expected outcome from the overall BOC project (which entails the analyses of servers to be consolidated within each BO infrastructure). Although this process also applies to other projects that require the assessment of IT infrastructure, it will require slight modification of the preparation stage which directly focuses on the overall project outcome. This is due to the existence of core infrastructure similarities in the most enterprises.

The execution of task within this schedule worked out perfectly on approximately 80% of the BOs in which the process was conducted, whereas some delays were experienced in some 20% of the BOs due to human dependencies. A breakdown of the schedule and task plan can be seen below.

Note: There could be changes depending on the number of BOs to be assessed, and that could extend the estimated time as seen in *Table 1.*

Table 1. Approximate scheduled time & task plan for BO Assessment – High level overview

Typical Site Analysis Plan - BOC			Duration(days)
	Prepare		
		Assess server inventory assessment data gaps	10
		Prepare BO systems list	2
		Request/receive current systems documentation	2
		Assess systems architecture gaps (such as system related dependencies)	2
		Prepare SSR	2
		Develop BO specific questionnaire	2
		Identify stakeholders in BO	1
		Schedule interview (including travel logistics if needed)	1
	Execute Analysis		
		Conduct interview(s) with local stakeholders	1
		Intensify gaps (link all system related dependencies)	1
		Conduct 2nd round of interview(s) with local stakeholders	1
		Deploy and execute assessment tool in BO Infrastructure (e.g. using MAP 5.0 and PA tool)	2
		Verify completeness of data collected	1
		Retrieve inventory data for future mode of operation	1
		Update SSR	1
	Review and signoff		
		Internal review	2
		External review	2
		Signoff and Handover	1
Total			35

Production Sites

There is a number of validated systems *(see Chapter 4, Current IT infrastructure components)* hosted in these sites, and it not necessary to collect much data from these systems because they might partially be out of scope due to the fact that they are installed with specialized applications and are critically dependent on the production activities within the enterprise. A basic inventory of the servers within this site was collected and updated in the BO classification data sheet.

Remote Sites

Most remote sites currently do not have any servers or systems to be assessed because there are no local /office users existent on these sites. These sites were out of scope for the BOC project as there were no remote BOs within the enterprise.

Data Sites

These sites are only relevant for assessment if the enterprise has a managed/outsourced data-center which accommodates most servers that require high availably, management control, security and otherwise. These sites are out of scope for assessment as the BOC project was limited to branch offices, but they are intended destinations for migrated servers.

Action Sites

All servers and systems in these sites should be analysed except for some validated systems that are indicated as out of scope by the local IT managers/system owners. Assessment was carried out in this as the primary focus of the BOC project.

In event of the above listed sites/servers, assessment pre-planning should be flexible enough to accommodate all sub processes within the phases as described in the subsequent section.

BOC - Assessment Quality

The updates made for the overall assessment will be based on the data collected during the assessment primary phases up to completion. Therefore, it is important that the data gathered are accurate and provide a transparent view of the BO Infrastructure being analysed, otherwise its effect will deteriorate other aspects of the project that are highly dependent on it *(Data Quality Assessment, 2012).*

To ensure that all gathered information is correct, the following simple rules are used to validate the process:

- Be thorough and double check all collected information.
- Consult existing assessment documentation from other related projects previously carried out in the enterprise, and validate that all information are correct and up to date.
- If using the third party tool, be sure of the accuracy of the administrative credentials, because any typographic or invalid inputs will result to

inaccessibility of data on target servers.

- If using the tools that support various features, it is a suggestion to apply different methods while collecting data, e.g., data retrieval via Active directory, IP Scan and FQDN.

4. Assessment Delivery Apparatus - BOC

The assessment delivery apparatus is focused on the measures that were taken throughout the duration of assessing each BO infrastructure. Although there are other approaches towards the assessment of an IT infrastructure not discussed in this thesis, for the purpose of the BOC project, we successfully implemented the delivery apparatus on designated production and action sites throughout the BOC project period and recommend that this should be perceived as a "Proof of Concept".

In observing the assessment pre-planning schedules mentioned before, the delivery apparatus has to be tightly adhered to, as it mitigates the detailed step by step practicalities of the core activities conducted within the assessment phase.

Firstly, we outlined the details of the current infrastructure components to be assessed, reviewed the expected assessment challenges as it refers to tools, methods, data collection and responsibilities. Furthermore, we analysed the features that are required prior to selecting an assessment tool and then delved into the execution approach of assessment, enumerated in the "Process flow checklist" (within the Platform Analyzer).

4.1 Current IT Infrastructure components

A deep view of all BO's current infrastructure shows the list of IT Components (e.g., printing systems, routers, modem, displays, dongles, scanners etc.), but for the purpose of this project, a limited magnitude of these components will be in focus:

- Local Systems,
- Validated Systems, and
- Standard Systems.

Local Systems

Local systems represent a special challenge during the assessment as they are often non-standard application that varies in configuration from site to site. The following are examples of local systems:

- EAI,
- ERP (local or central/external),
- Sales force (mostly connect to central service from provider),
- Warehousing,
- Production planning system,
- Physical access control / time control / video surveillance,
- SMTP servers / firewalls / Internet access,
- Internal web servers,
- Hosted web / FTP presence,
- Sales portals / reporting systems,
- IP telephony,
- Non-infrastructure Helpdesk systems,
- Remote control SW, and
- Backup /archiving systems.

The above systems have some common characteristics. They are often highly adapted to the local environment, play a critical role for the local business and often require special knowledge regarding setup and configuration. It is essential that all local systems are covered in detail during the assessment as they are not assigned by corporate IT management and are, therefore, as such unknown to the assessment team.

The local systems are fully in scope in the BOC project and were intensively assessed, because while affecting the consolidation scheme, candidate local systems will be migrated to a virtual environment in the BO, decommissioned or left AS-IS. Therefore, it is necessary to identify the most critical information for each hosted local system as well as dependencies.

Validated Systems

Validation is the process of documenting that a specific computer system meets critical functional and non-functional user requirements, and that provisions are made to ensure continuous fulfilment of these requirements throughout its complete lifecycle. This means that every validated system requires its IT infrastructure services and platforms to adhere to defined processes which ensure proof that the infrastructure works and delivers expected results. Validated systems are mostly located on productions sites due to the custom functionalities and customer focused designs. They are very special systems that require expert skills set for operation.

The assessment phase can benefit by requesting the existing documentation for any validated systems or qualified infrastructure. This will save valuable time when collecting information about the branch office IT environment. Another point to take into consideration about validated systems is that if these systems are not working as expected, it can have a severe effect on the business and will often have economic consequences.

In most cases, external local IT managers are assigned to BOs for the coordination of IT activities. This person is a good entry point when collecting information about validated systems. It is of great importance that project management office is informed about any upcoming activities or changes that might affect validated systems. As mentioned before, a basic inventory was collected on validated systems within production sites.

Standard Systems

These systems are configured/installed on the each BO Infrastructure. Basically, these systems render a number of standard services that is required for most corporate networks. Services hosted on different servers are:

- Client Automation Services (e.g. HPCA),
- Enterprise Antivirus (e.g. SEP, Microsoft FEP),
- Domain Controllers (DC),
- Domain Name Service (DNS),

- Active Directory (AD),
- Dynamic Host Configuration Protocol (DHCP),
- File/Print Service,
- Managed Desktop Service, and
- Backup/Restore Service.

This makes it necessary to take a detailed assessment of the systems (virtual) currently running on each candidate physical host, so as to be able to scale the hardware according to resource utilization during the consolidation of servers after the initial assessment phases. Data were collected from all standard systems in each BO, as they represent a majority of the target servers to be consolidated.

4.2 Assessment Tool Expectation

An efficient assessment tool should have all or more of the following required features:

1. Should be able to support automation.
2. Should be easy to Install (minimal input from regional IT/technical support staff) with options of installation via AD group policy and otherwise.
3. Should be compatible with default monitoring system services/protocols of major operating system vendors e.g. WMI, SNMP and CMIP.
4. Should be able to support Network discovery and system configuration (IP, hardware, virtual, middleware, and databases).
5. Should be able to collect storage inventory.
6. Should have Asset/Software Inventory and configuration (applications and operating systems settings) by default.
7. Should be able to identify services rendered by each server (e.g DHCP, DNS, and AD) within the IT environment.

8. Should be able to collect events information from sources such as SNMP, WMI or Syslog.
9. Should be able to display performance and availability report (system capacity, resource utilization), as well as custom & schedule reports

Amongst the various third party assessment tools developed by leading IT vendors, a number of tools has been identified to be very efficient in monitoring and data collection for precise analysis. In the course of this project, we tested 3 different tools namely; VMware Capacity Planner, MAP 5.0 and AVA Magic Inventory Tool. We finally chose the MAP 5.0, because it is a “catchall” tool for computer servers’ assessment. For this reason the tool inventories of the entire IT infrastructure automatically generate reports about hardware and device readiness for the migration phase of the project. The specific invaluable details are, e.g., the identification of underutilized server resources that would be good candidates for migration to a virtualized platform as well as the usage simplicity. More so, a majority of servers deployed in the infrastructure run Microsoft operating systems and applications (i.e., Microsoft Windows Server 2003, Server 2008), which makes the integration of MAP 5.0 quite easy. This verification was done by building a development/test environment, where we simulated a large scale IT infrastructure and deployed the different tools mentioned above and tested the capabilities, efficiencies and performances. After all, the MAP tool was found to be preferable. In addition, we created a specific tool (Platform Analyzer) for the BOC project which aids in analysing data collected from the MAP tool as detailed in further chapters. Below are lists of ISV assessment tools available for use within the IT industry.

- Microsoft Assessment and Planning Toolkit – MAP (implemented in the BOC Project),
- VMware Capacity Planner,
- AVA Magic inventory Tool,
- N-Central,
- Plate spin, and

- Kaseya.

The following action research part of this thesis will be focus on the implementation and use of MAP 5.0 and Platform Analyzer tools within the BO infrastructure.

4.3 Microsoft Assessment and Planning Toolkit 5.0

The Microsoft Assessment and Planning (MAP) Toolkit is an agentless third party tool designed to simplify and streamline the IT infrastructure planning process across multiple scenarios through network-wide automated discovery and assessments. Amongst other functions, MAP performs an inventory of heterogeneous IT environments and provides usage information for servers running different windows operating systems as well as services needed for migration assessment. It also performs server discovery and assessment for consolidation, server virtualization scenarios to help identify underutilized resources and the hardware specifications needed to successfully consolidate servers using Hypervisor technology (MAPT, 2010).

MAP 5.0 key features utilized in BO – Assessment

Heterogeneous Infrastructure Inventory:

MAP performs a network inventory of IT assets remotely without the use of agents, identifying heterogeneous server environments consisting of Windows Servers, Linux operating systems, and LAMP application stack, including those running in a virtual environment.

Figure 3. Inventory with MAP tool

Server Consolidation Assessment:

MAP 5.0 provides infrastructure knowledge for planning migration exercise. Using the performance metrics & server utilization data in MAP, identify server placements, and perform virtualization candidate assessments.

Figure 4. Server Placement wizard

For more technical information about the MAP 5.0 tool, refer to Appendix A – Enterprise Infrastructure Assessment with MAP 5.0 Tool

4.4 Platform Analyzer Tool

The Platform Analyzer tool (a tool developed during the BOC project) suggests a target platform for all currently analysed local application servers. This tool is used in collaboration with the MAP tool in order to carry out major assessment sub-processes, such as target platform analyses and virtual host hardware scaling.

Figure 5. Platform Analyzer Tool [Appendix C]

Most of the analyses done by the PA tool are based on:

1. Data collected on each BO during the assessment by the MAP tool such as:
    - Server resource utilization (performance measurement).
    - Detailed inventory of hosted systems/server.
        - Roles of server,
        - Server environment (virtual/physical), and
        - Hardware properties of server.
2. Placement criteria that affect the choice of platform on which a system is hosted.
    a. Dependencies to other systems,
    b. Simple web clients & Citrix compatibility,
    c. Validated system,
    d. Offline availability.
    e. Primary user location, and
    f. Virtual host compatibility.

Features of PA Tool

The PA tool has 3 main features namely:

- Process Flow checklist,
- Front & Back End analysis, and
- Target Platform summary.

Process Flow Checklist

This is a diagrammatic checklist for the entire Assessment process. It helps the assessor to track completion of tasks in the different phases of the process. It plays an important

role, such that it is a definite model for the assessment of each BO. (Also discussed in subsequent sections).

Figure 6. Process Flow Checklist - Appendix C

Front & Back End Analyzer

Based on the placement criteria, this PA feature logically analyses local application servers and suggests a target platform. This saves project time when analysing a large number of servers in BOs and making effective decisions on where the hosted systems should be placed.

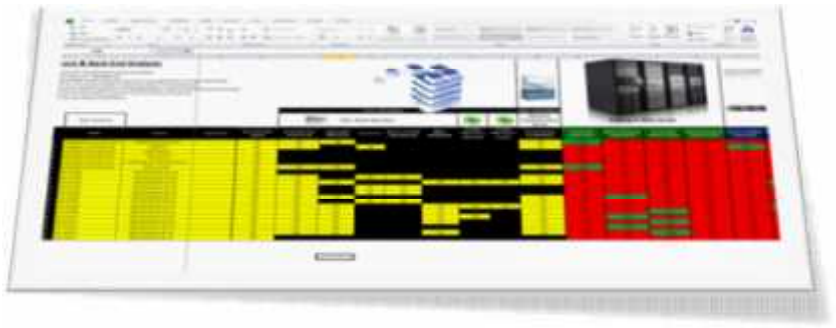

Figure 7. Front & Back End Analyzer - Appendix C

Target Platform Summary

This feature basically displays an overview of the BO Consolidation analysis that was completed by the Front&Back End Analyzer. It gives an overall clarification of the outcome of the assessment for currently analysed BO.

Figure 8. Target Platform Summary - Appendix C

For more technical information about the PA tool, review Appendix C – MAP Collaboration with PA Tool.

5. Presentation of Assessment Techniques

Following the paradigm of the two primary types of computing solutions for businesses, which includes Centralized and Distributed computing (Computerized Business Solution, 2007); we developed different techniques towards the assessment of a BO infrastructure. The following is a detailed presentation of these assessment techniques that were tested during the assessment phase of the BOC project. However, based on the comparative project benefits (advantages stated below), the centralized approach was implemented during the Assessment of the BOC Project. The MAP 5.0 tool (Microsoft Assessment and Planning Toolkit) which was evaluated and chosen for the entire assessment phase of the BOC project is then used to clarify the different approach.

5.1 Centralized Assessment

In contrast, there several third party tools that could also be used to drive this approach, such as VMware capacity planner, AVAmagic inventory tool and Platespin Recon 3.7. This technique simply describes the installation of an agentless network management tool within the enterprise corporate domain in order to perform some of the data collection & analysis (as described in the following sections) on the targeted servers in each site. In relation to the BOC project, *Figure 9* depicts the application of MAP 5.0 tool within a selected BOs infrastructure.

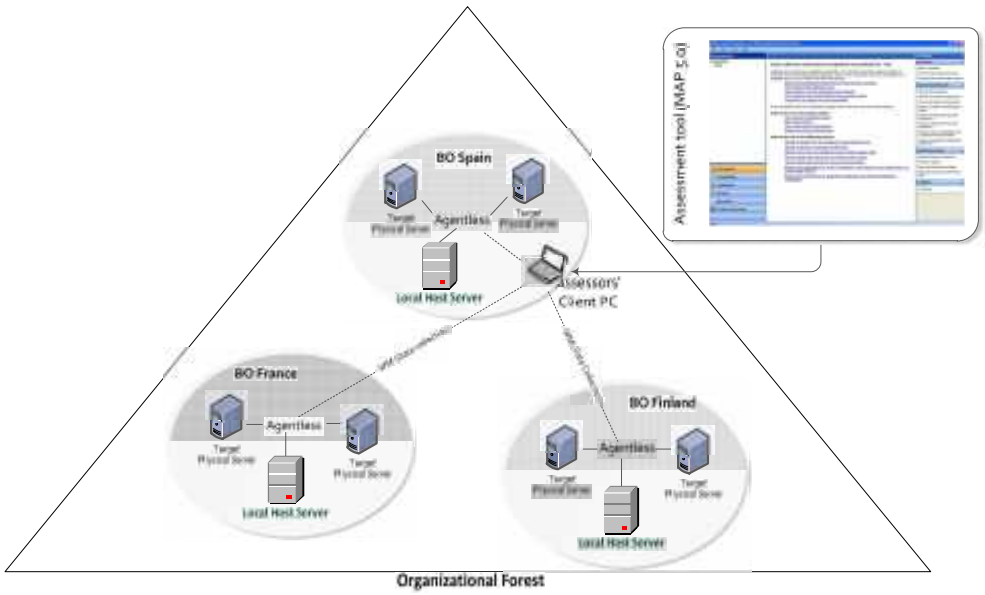

Figure 9. Centralized Approach 1

In *Figure 9*, MAP 5.0 tool (manager) is installed on a client desktop that is a member of the corporate domain in one of the BOs site, i.e., BO Spain. Domain administrative rights are then granted to the assessor in order to communicate with the target servers on other sites within the domain. The MAP tool is then allowed to run for a certain period of time, so as to collect data and other system activities as required by the assessment profiling.
Another visual percept of the centralized approach can be seen below.

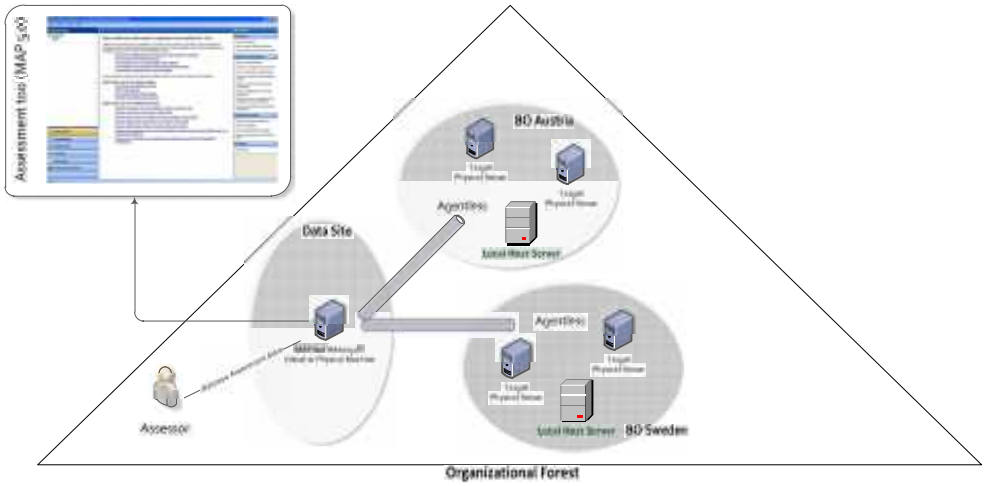

Figure 10. Centralized Approach 2

Figure 10 above shows the configuration of the MAP tool (manager) on a physical or virtual machine in the data site. Administrative access is then granted to the assessor in order to remotely monitor the data collection activities by the MAP 5.0 tool. On completion of assessment, the collected data is transferred to the location where the assessor carries out further analysis on the data.

Advantages

1. Data security is enhanced during assessment
2. Concurrent assessment of data in all BO infrastructures.
3. Less reliability on local IT staffs (during implementation) – requires only domain administrative rights.
4. Assessment is taken a flexible manner.
5. Faster results are achieved, which saves project time.
6. Effective on very large heterogeneous corporate IT Infrastructures.

Disadvantages

1. The effect of WAN bandwidth limitations – i.e. if assessment tools' are installed on sites with very high latency WAN bandwidth, there might be intensive effects on the networks due to packet loss during data transfers.
2. Requires advance knowledge in network management for tool configuration.
3. Possible issues with enterprise "service level agreement" (with inter-network service providers).

5.2 Distributive Assessment

In this technique, BOs are assessed separately (i.e., data is locally collected on each BO using an agent-based tool), and must be installed on-premise. This means that the backend (manager) of the assessment tool will be installed on a server in the same LAN as its agents (which are also installed on each target servers).The process is coordinated with the local IT staff responsible for each site, and all collected data are uploaded on a centralized document management portal on the intranet, e.g., Microsoft SharePoint, where the assessor retrieves the data for further analysis. In other cases, an agentless tool (such as MAP tool) can also be deployed within the BO infrastructure as seen in *Figure 11*.

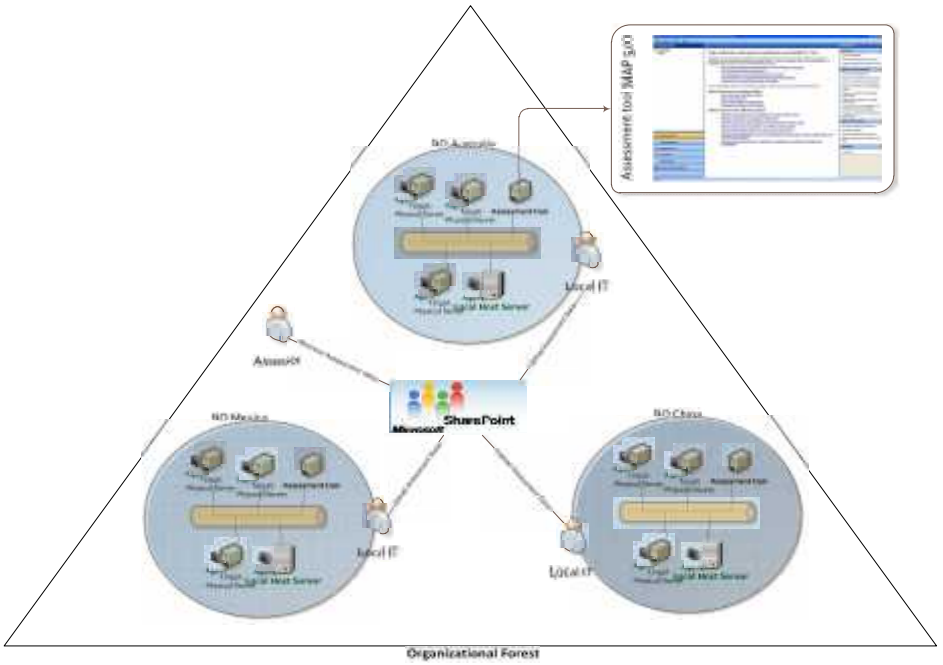

Figure 11. Distributive Approach

Advantages

1. Overcomes all forms of WAN limitations on BO's.
2. Scales up to large or small Enterprises.
3. More pragmatic assessment approach on data collection.

Disadvantages

1. Consumes overall project time because of the dependency on local IT staffs for initial assessed data output.
2. Possible issues with enterprise "service level agreement" (with inter-network service providers).

6. Assessment Phases

There are a number of phases that an assessor needs to go through while carrying out a complete assessment on any IT infrastructural projects e.g. BOC project. In the overall assessment overview, some of the phases are categorized into one, even though it involves a few activities that need to be rightly done and are quite dependent on others.

It is assumed that the assessor has conducted the preliminary interviews and presented the assessment techniques to the responsible local IT staff and system owners in the BO (in which the activities are to be carried out) prior to the implementation of the work stream. This gives an understanding of what responsibilities will be required from each party during the assessment process.

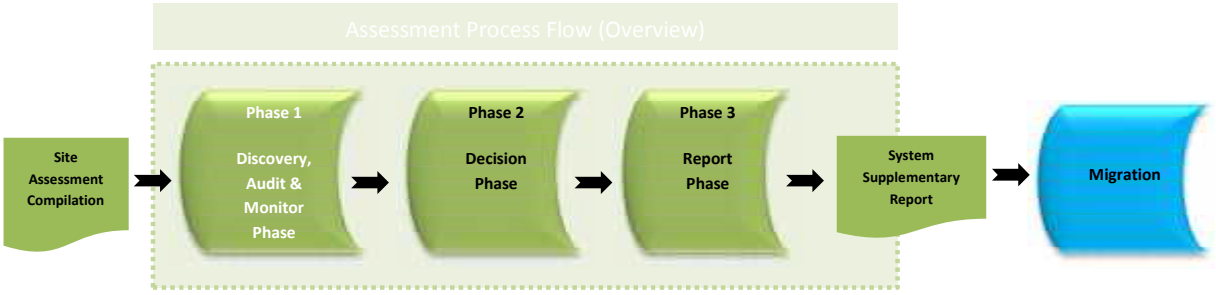

Figure 12. Assessment Process Flow

There are two documented deliverables that are very vital throughout the above phases. These documents apart from the raw data collected while taking inventory and performance metrics with the assessment tool, but have tangible updates from actions carried out during the assessment process.

Site Assessment Compilation (SAC): - This document contains preliminary IT component data collected from verbal interview with local IT responsible for the various assessed BOs within the corporate IT Infrastructure. A lot of data from this document can be re-used while doing the thorough assessment with the aid of specialized tools.

System Supplementary Report (SSR) – This document is sub divided into 2 drafts.

- System Supplementary Report (First Draft),
- System Supplementary Report (Final Draft).

1. **SSR (First Draft)** – will initially be updated with data from the SAC sheet and edited to fit with the assessment project scope. Throughout the assessment phases, it will be updated and used as reference by other preliminary phases within the entire BOC project.

2. **SSR (Final Draft)** – Contains the final updates made in the first draft and will include necessary data needed for the migration exercise (next phase of the project).

6.1 Phase 1

This is the first phase in the assessment process, and it requires that certain measures are in place before start, such as:

- Readiness of assessment tools,
- Assessment approval from technical project lead/BO local IT staff.

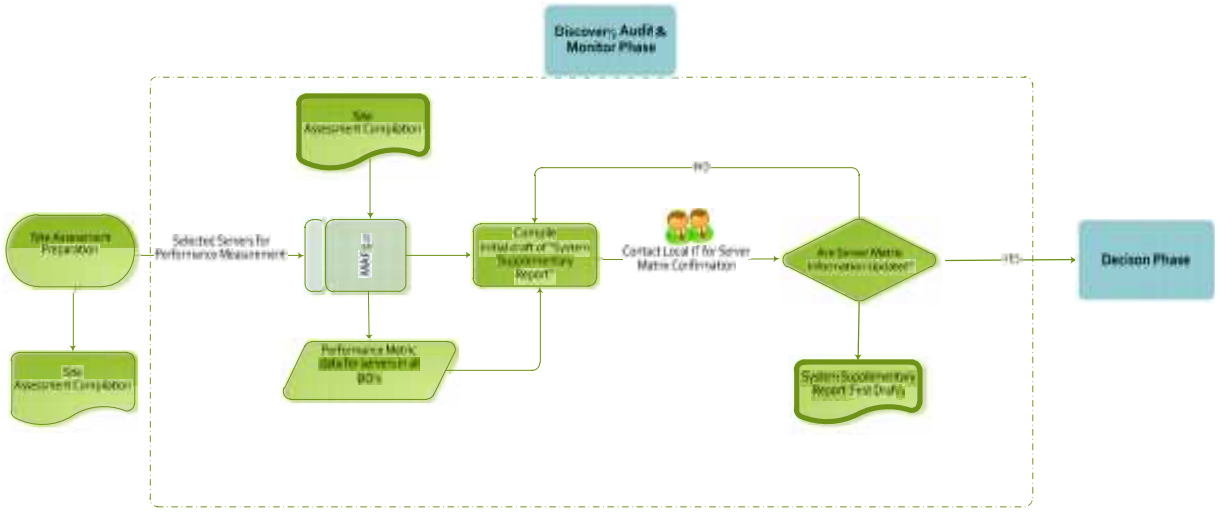

Figure 13. Phase 1(Discovery, Audit & Monitor Phase) with Pre- Assessment data

There are 3 sub-phases within Phase 1, which will be described in the subsequent sections, namely:

- Discovery Phase,
- Monitor Phase, and
- Audit Phase.

The overall concept of Phase 1 is to take an inventory and performance measurement of target computer servers in scope on all BO's. The gathered data will further be validated by local IT manager using the SSR (First Draft) documentation. This action makes it easier to cross-check the list of discovered servers against the existent BO environment, as some of the servers may not respond to pings from assessment (MAP 5.0) tool. A detailed description of the sub-phases is covered later.

However, in *Figure 13* above, the SAC is re-used as a pre-assessment resource to supplement the data gathered by the MAP tool. The document basically contains some information that could have been retrieved by the MAP tool in the discovery and Audit phases (explained in next section). In cases where the pre- assessment data is not available, the MAP tool should be used to execute these phases as seen in *Figure 14* below:

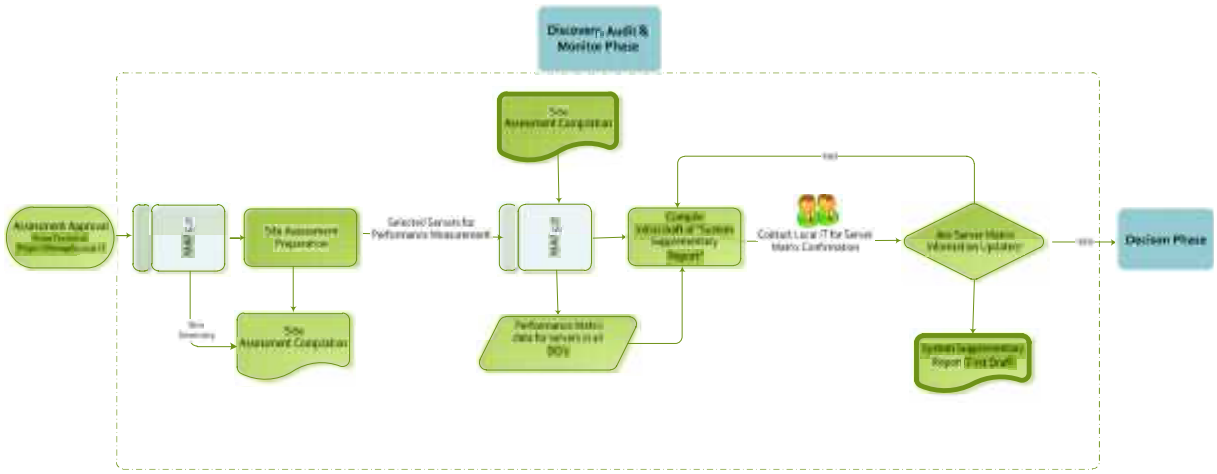

Figure 14. Phase 1(Discovery, Audit & Monitor Phase)

Discovery Phase

The MAP tool will be used to discover specific IT components in all BO infrastructures respectively. As stated previously in regards the BOC project scope, the IT components are limited to computer servers only.

During the discovery phase, a number of questions need to be addressed in order to have a defined structure.

- What servers are in the network and how many are they?,
- Where are they located? Country and BO name,
- What are the IP addresses of the servers?
- What platforms are they installed on? Physical or Virtual?, and
- What are the FQDN's of server?

Audit Phase

The MAP tool will be used to take an in-depth inventory of all hardware and software properties of servers in the BO's, where the outcome of this phase will provide the answers to the following questions.

- What applications/systems are hosted one each server?,
- What service roles are executed by each server?,
- What operating systems are installed?, and
- What are the hardware properties of the servers? Manufacturer, product name, CPU, memory, disk, network adapter etc.

Monitor Phase

The monitor phase is an essential part of Phase 1, as the outcome will be used for the hardware scaling of the new platform. In this phase, resource utilizations of all target servers will be measured over a period of time (at least 2 days) with consideration of both peak and off-peak periods.

Peak periods are significant in this assessment as server resources are assumed to have measurable (maximum) utilization or workloads within this time, whereas during the off-peak periods, there are minimal or no critical workloads on servers.

The MAP tool collects the performance metrics of each target server in the BO over the duration of the monitor phase and the results are stored in an SQL database that was

previously configured with the MAP tool. These collected data of candidate local application servers are used afterwards, when sizing the systems with the MAP Tool. Some of the retrieved load data of servers are then updated in the SSR for reference objectives.

Before moving to the next phase, collected (server) data validation has to be made with local IT staff in order to re-authenticate that all data retrieved by the MAP tool is correct and there is no missing information about each BO currently assessed. This is done by arranging a meeting with local IT staff and having them cross-check the SSR (First Draft). If the provided data are invalid or not up to date, it is mandatory that Local IT staff correct them before proceeding. Some of the issues stated below could be encountered in this phase after the initial assessment of servers:

1. Servers might exist, but cannot be found due to invalid administrative credentials,
2. Some legacy servers do not respond to WMI, SNMP pings,
3. Servers might be decommissioned/disconnected from the network and incommunicable,
4. Server might exist in BO, but configured for external clients, and
5. Servers might be part of a non-existent domain or workgroup and require additional administrative credential.

6.2 Phase 2

This phase typically relates to the constructive decision that is made on all local application servers currently assessed, using the validated load data from the previous phase and placement criteria agreed with the local IT staff. The only input to this phase is the updated SSR (First Draft) from phase 1. It also has one sub-phase, i.e., decision phase, which is detailed in the following section.

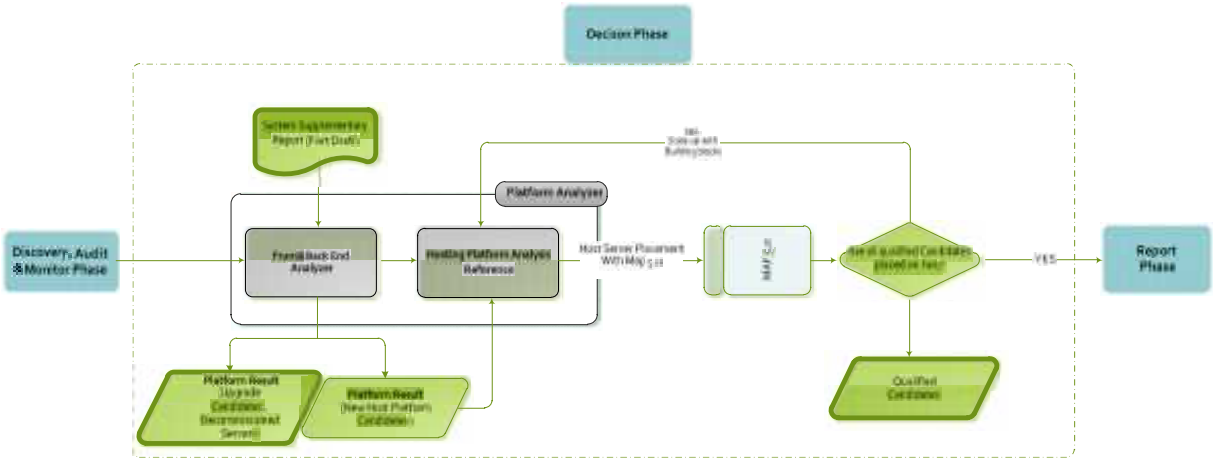

Figure 15. Phase 2 (Decision Phase)

Decision Phase

The MAP and PA tools are used in this phase collaboratively because targets servers are analysed by the PA tool to suggest a target host platform for each system and afterwards, all qualified candidates are sized on the host server using the MAP tool.

In the decision phase, the Front & Back end Analyzer feature of the PA tool is used to analyse the data input from the SSR (first draft) where the specific analysis is based on the platform criteria, updated by system owners/local IT staff. The outcome of the analysis will either suggest that a system be hosted on a physical/virtual environment in BO, decommissioned or leave AS-IS. All servers that are qualified for virtual environment will undergo further sizing analysis with the MAP tool. Servers are to be placed intermittently using the hardware building blocks until the BO virtual host is completely sized.

The final outcomes of these decisions are updated in the SSR before proceeding to the next phase.

6.3 Phase 3

This phase essentially represents a report compilation of all data collected and analysed in the previous two phases. It is a complete report preparation document for other aspects of the project.

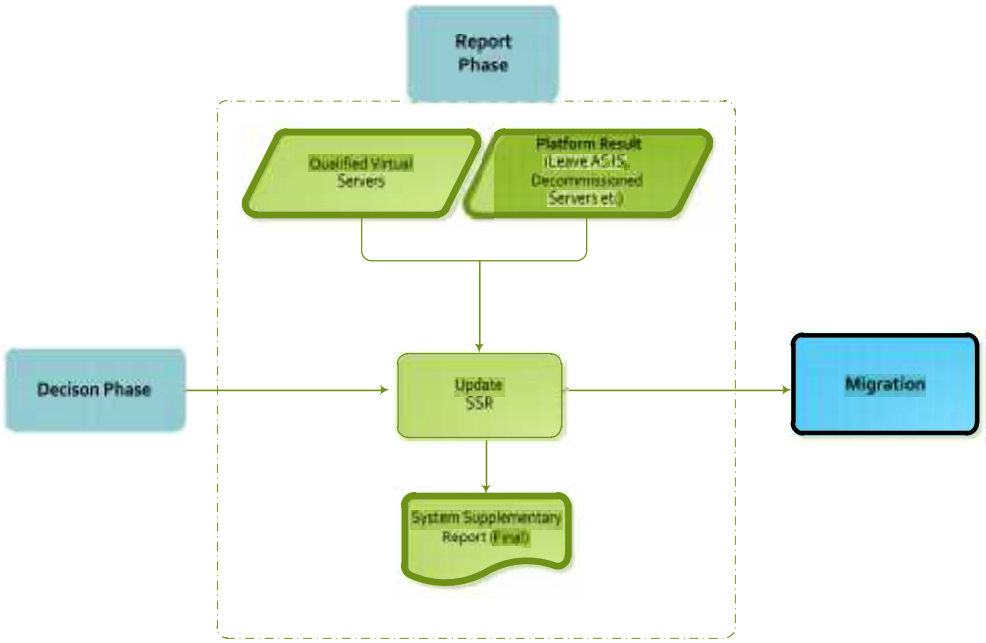

Figure 16. Phase 3 (Report Phase)

Report Phase

It basically depicts the final updates of the SSR. All collected data from previous phases are simply formatted for ease of use in the next phases within the BOC project.

6.4 Assessment Checklist (BOC Assessment Model)

To ensure that the assessment is done in a structured way and that all parts of its process are covered, a process flow checklist was created and can be found in the PA tool. An instruction on how to use this tool can also be found there, as well. This checklist provides reference guides on complete/incomplete task during the assessment process.

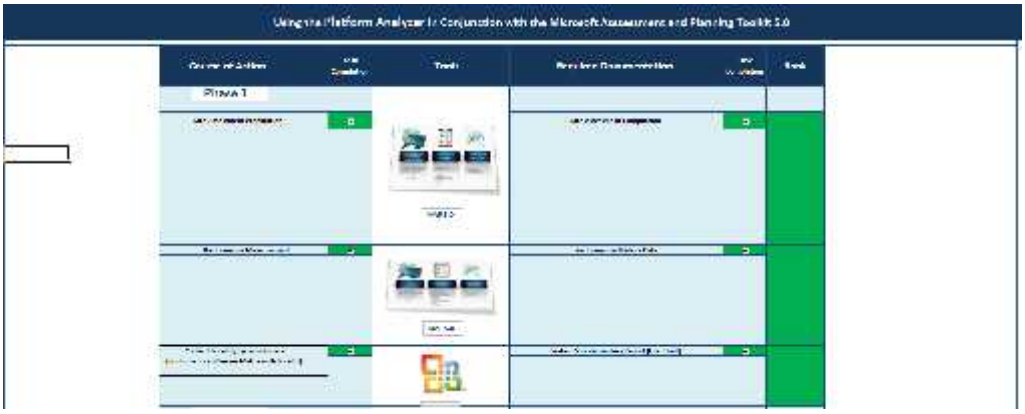

Figure 17. Phase 1 Process Flow Checklist

The major tasks to be completed in Phase 1 are:

1. Site assessment preparation,
2. Performance measurement, and
3. Contact local IT/System owners.

Figure 18. Phase 2 Process Flow Checklist

The tasks to be completed in Phase 2 are:

1. Migration analysis,
2. Scaling of virtual host platform, and
3. Virtual host server placement with Map 5.0.

Figure 19. Phase 3 Process Flow Checklist

The tasks to be completed in Phase 3 are:

1. Updating SSR, and
2. Additional documentation.

7. Assessment Outcome

The assessment outcome is focused on the action research which covers a major part of this thesis work and is inherently based on the BOC Project. The content of the constructive work was also analysed and re-evaluated to check for significant matches with the action work; Transcripts were then used to obtain feedbacks from interviewees in order to ascertain data validation (Bryman 2001) using an assessment process checklist to track the completed components as required. This comparison of collected data gives the research members an in-depth understanding of real world practices as it relates to requirements and assessment standards of the theoretical research. Furthermore, the results from the action work, i.e., analysis of the specific infrastructure components (computer servers and applications), is denoted and forwarded to the resource responsible for the next phase of the BOC project - Migration.

8. What Next? Migration

The primary scope of the Migration exercise is to consolidate the back-end part of candidate system/servers on to a new environment, i.e., virtual or physical platform.

As mentioned before, Migration activities are out of scope for this thesis, but the detailed summaries of focus are:

- Collect required/available documentation for system,
- Develop migration plan and create first draft of “System Migration Plan/Report” for system,
- Review done by migration team,
- Agree with “system owner” on migration plans,
- Complete “System Refresh Plan/Report” for system,
- Create checklist about functionality of the system,
- Run test protocol to verify test protocol before migration starts,
- Create IC and IQ/OQ for adaption,
- Backup system if required for rollback,
- Migrate systems by using "migration method(s)",
- Document migration results in “System Migration Plan/Report”,
- Sign-off migration report,
- Decommission servers, and
- Archive migration report.

Conclusion

Technical IT Infrastructure assessment is fundamental for all IT infrastructure transformation programs within large enterprises as it deals specifically with providing an in-depth insight of the entire IT components existent in the enterprise infrastructure. This is because enterprise businesses competitiveness in the market today depends heavily on the ability and flexibility of enterprises to scale her IT infrastructure in regards to the demands of the target customers, constantly changing economies or market fluctuations, which rouse the relevance of the transformation necessity of upgrading or consolidating IT infrastructure accordingly. Assessment becomes vital as it correlates with the allocated IT budget of the enterprise as it needs to extensively know the related cost of overhauling their IT infrastructure aligned with TCO (Total Cost of Ownership - estimate whose purpose is to help enterprise managers determine direct and indirect costs of a product or system).

This assessment model which was based on an on-going BOC project within an enterprise, has not only specified tools used for technically collecting data of IT components, but has also provided a concise process within which an assessment could be efficiently implemented in a large enterprise.

Contrast and Future Research Objectives

Nevertheless, our study has one limitation. The practical process was based on a particular project (BOC) as compared to investigating various IT projects, which would have been preferable. Yet, we believe that the research and interviews carried out by a distinctive respondent (who had the knowledge and experience within their companies to address our survey questions) has been worthwhile, as it aided in crafting out major facts within this research.

A future research within IT infrastructure assessment scope should be focused on analysing other aspects of the structure of the IT Infrastructure, i.e., human IT Infrastructure, shared IT services, or shared/standard IT application, so examine their distinct impact on enterprise IT transformation.

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Appendix A – Enterprise Infrastructure Assessment with MAP 5.0 Tool

MAP 5.0 tool is a powerful inventory, assessment, and reporting tool that securely inventory small or large BO IT environments without requiring the installation of agent software in the environment. The data and analysis that the MAP tool provides significantly simplify the planning for BOC assessment process.

Before taking assessment on the BO infrastructure, be sure to fulfil all of these steps. This is dependent on how activities are being carried out in the enterprise.

- Request domain administrative credentials (Access Rights).
- Document the WAN bandwidth utilization for all BOs.
- Choose an appropriate approach for data collection with MAP Tool.
- Prepare the computer on which the MAP tool will be configured.
- Acknowledge the approval from responsible technical personnel before proceeding with the MAP Tool Installation.
- Schedule an appropriate time for start and end of the load data collection with the MAP Tool.

Basic prerequisite for deploying the MAP Tool

Installing the MAP 5.0 Tool

Install the MAP Toolkit on a single computer that has access to the network on which you want to conduct an inventory and assessment. The “Microsoft Assessment and Planning” toolkit setup wizard guides you through the installation of application files and “Microsoft SQL Server® 2008 R2 Express Edition”.

The MAP Toolkit requires a non-default instance of SQL Server 2008 R2 Express. If the computer is already running another instance of SQL Server 2008 R2 Express, the setup wizard must still install a new instance. This instance is customized for exclusive use by the MAP Toolkit wizards and should not be modified. By default, access to this instance

is blocked from remote computers. Access to the instance on the local computer is only enabled for users who have local administrator credentials.

If you encounter a problem during installation, refer to the installation log files. The log files are located in the path specified in the %TEMP% environment variable on the local computer. You can find additional troubleshooting information by examining the application and system event logs.

Preparing the BO Environment

In preparation to use the MAP Toolkit in the BO environment, you first need to make certain configurations to remote computers.

Remote Computer Configurations

In order to run the MAP Toolkit wizards, the only required configuration is to edit the Windows Firewall (where appropriate) to enable remote access to WMI. This section describes this and other configurations that might need to be completed before using the MAP Toolkit. (MAPT, 2010)

a) Windows Management Instrumentation

WMI is used to collect hardware, device, and software information from the remote computers. This inventory method is required for all assessment scenarios and must be enabled on all remote computers. The Inventory and Assessment Wizard will not provide an option to enable WMI. It must be enabled via Group Policy settings, logon scripts, or manually on each computer.

To connect remotely and perform the WMI inventory, you will need to provide accounts that are members of the local Administrators group on the computer being inventoried. For most networks, the network administrator will have a domain or local account that is a member of the local administrators group on all of the computers in the environment. These are the accounts you should enter on the Active Directory credentials page in the Inventory and assessment wizard to perform the WMI inventory. By default in windows domain environments, the Domain Admin security group is added to the local

administrators group on a computer when it is joined to a domain (Microsoft Assessment and Planning Toolkit).

The following table describes all of the common WMI considerations for the “Inventory and Assessment Wizard” (Microsoft Assessment and Planning Toolkit).

Table 2. WMI Considerations

Configuration	Description
Enable Remote Administration exception	The Remote Administration exception needs to be enabled for computers when the Windows Firewall is enabled. This exception opens TCP port 135. If you have another host firewall installed, you will need to allow network traffic through this port. **To allow for remote administration** 1. Click ***Start***, click ***Run***, type ***gpedit.msc*** and then click ***OK***. *2.* Under ***Console Root***, expand ***Computer Configuration***, expand ***Administrative Templates***, expand ***Network***, expand ***Network Connections***, expand ***Windows Firewall***, and then click ***Domain Profile****.* 3. Right-click ***Windows Firewall: Allow remote administration exception***, and then click ***Properties***. 4. Click ***Enabled***, and then click ***OK***.
Enable File and Printer Sharing exception	The File and Printer Sharing exception must be enabled for computers when the Windows Firewall is enabled. This exception opens TCP ports 139 and 445, as well as UDP ports 137 and 138. If you have another host firewall installed, you will need to allow network traffic through these ports.
Other WMI connectivity information	Many host-based and software-based firewall products will block DCOM traffic across the network adapters on the computer. For example, remote WMI connections will likely fail when attempting to connect to a computer running the Microsoft Internet Security and Acceleration (ISA) firewall service. To enable remote WMI access, you need to make sure that the TCP/UDP ports mentioned previously for the Remote Administration and File and Printer Sharing exceptions are open on the computer running the software firewall.

Computers that are running Windows Firewall introduce some challenges to the inventory process. By default, Windows Firewall is configured to block remote requests to

authenticate and connect to the computer via WMI. The following sections describe how to enable the required exceptions using Group Policy and scriptable commands.

b) Active Directory Environments

Use the Group Policy Editor or the Group Policy Management Console (GPMC) to edit Group Policy for the organizational units that contain the computers on which you will perform the assessment.

To enable Windows Firewall exceptions using Group Policy

1. Using the Local Group Policy Editor, click ***Computer Configuration***, click ***Windows Settings***, click ***Security Settings***, click ***Local Policies***, and then click ***Security Options***.
2. In the ***Network access*****:** ***Sharing and security model for local accounts*** section, click ***Classic – local users authenticate as themselves***.
3. Using the Local Group Policy Editor, click ***Computer Configuration***, click ***Administrative Templates***, click ***Network***, click ***Network Connections***, click ***Windows Firewall***, and then click ***Domain Profile***.
4. In the ***Windows Firewall*****:** ***Allow remote administration exception*** section, click ***Enabled***.
5. In the ***Allow unsolicited incoming messages from*** text box, type the IP address or subnet of the computer that will be performing the inventory.
6. In the ***Windows Firewall*****:** ***Allow file and print sharing exception*** section, click ***Enabled***.
7. In the ***Allow unsolicited incoming messages from*** text box, type the IP address or subnet of the computer performing the inventory.

After saving the policy changes, you will need to wait for up to two hours for the Group Policy settings to be applied to the client computers.

c) Remote Registry Service

The Remote Registry service is used to find the roles installed on a server. It is also required for running the Performance Metrics Wizard. This service is installed on Windows-based clients and servers, but the following conditions must exist for this inventory method to be successful:

- The Remote Registry service must be started. By default, it is configured to start automatically.
- The Windows Firewall Remote Administration exception must be enabled.
- You must authenticate using local Administrator equivalent privileges.

If the Remote Registry service is disabled on a server, you need to enable it before performing the inventory. You can either manually enable the service or configure it to start via Group Policy and wait until the servers are rebooted (and the service starts) before starting the Windows Server® 2008 Hardware Assessment or Performance Metrics Wizard.

To manually enable the Remote Registry service

1. On the computer on which you want to access Reliability Monitor data, click ***Start***, right-click ***Computer***, and then click ***Manage***.
2. Microsoft Management Console (MMC) starts.
3. In the navigation pane, expand ***Services and Applications***, and then click ***Services***.
4. In the console pane, right-click ***Remote Registry***, and then click ***Start***.

Computer Discovery Methods

MAP can discover computers in the environment or you can specify which computers to inventory using one of the following methods:

- Active Directory Domain Services (AD DS)

- Windows networking protocols
- Import computer names from a file
- Scan an IP address range
- Manually enter computer names

Active Directory Domain Services (AD DS)

This method allows you to query a domain controller via the Lightweight Directory Access Protocol (LDAP) and select computers in all or specific domains, containers, or organizational units (OUs). Use this method if all computers and devices are in Active Directory.

It is recommended that you not use the AD DS method together with the standard Windows networking protocols inventory method. Using only the AD DS method can significantly improve the time required to complete the inventory. Computers that have not been logged onto the Active Directory domain for more than 90 days will not be inventoried.

This inventory method has the following characteristics:

- ***Scope***: This inventory method identifies all computers running Microsoft operating systems that are managed by Active Directory.
- ***Process***: Active Directory queries return a list of computer objects defined in Active Directory, which Windows Management Instrumentation (WMI) then uses to perform a detailed inventory.
- ***Limitations***: This method supports up to 120,000 computer objects per domain per run of the AD DS inventory method. If there are more than 120,000 computers, the additional objects will not be reported in the inventory results.
- ***Credentials required***: The wizard requires a domain account that is to be used to query Active Directory. At a minimum, this account should be a member of the Domain Users group in the domain. For each computer to be included in the WMI

inventory process, the wizard also requires an account that is a member of the local Administrators group on that computer.

Windows Networking Protocols

This method uses the WIN32 LAN Manager APIs to query the Computer Browser service for computers in workgroups and Windows NT® 4.0–based domains. If the computers on the network are not joined to an Active Directory domain, use only the Windows networking protocols option to find computers.

If you are inventorying computers in workgroups or Windows NT 4.0 domains and there are also computers joined to an Active Directory domain, use this inventory method and also select the option to find computers using AD DS.

If the Windows networking protocols page of the wizard does not provide a list of workgroups, Windows NT 4.0 domains, or Active Directory domain NetBIOS names, ensure that the computer browser and server services are running on the computer performing inventory. For help, see *"**Troubleshooting the Microsoft Computer Browser Service**"* (Microsoft Support).

This inventory method has the following characteristics:

- ***Scope**:* This inventory method identifies the computers on a network that are running Microsoft operating systems. If the enterprise has multiple LAN segments, you must run the wizard on each LAN segment to find all workgroups.
- ***Process**:* The computer browser broadcasts a message on the network to which most Windows-based computers will respond, which identifies the computers running on the network. For each computer on the network that supports WMI, the WMI collector gathers detailed hardware and software inventory from each identified computer.
- ***Limitations***: There are no limits to the number of WMI clients that can be scanned. However, WMI inventory collects a lot of information on each client and inventory of a large number of WMI clients takes additional time. (MAPT, 2010)

Import Computer Names from a File

Using this method, you can create a text file with a list of computer names that will be inventoried. Each computer name should be on a new line and the file should not use delimiters, such as comma, period, or tab. Use this method if you have a list of up to 120,000 computer names that you want to inventory. The imported file can contain computer names, NetBIOS names, or fully qualified domain names (FQDN). Only one file can be imported each time you run the wizard. (MAPT, 2010)

Scan an IP Address Range

This method allows you to specify the starting address and ending address of an IP address range. The wizard will then scan all IP addresses in the range and inventory only those computers. The IP address range computer discovery method is limited to scanning only 100,000 IP addresses at one time. If you have more addresses than the limit, run the wizard multiple times, specifying different IP address ranges each time you run the wizard.

The following recommendations are provided for the IP address range computer discovery method:

- Use this method to specifically target a set of computers in the BO or specific subnets when you only want inventory performed on those computers.
- Use this method to find devices and computers that cannot be found using the computer browser service or AD DS.
- Limit the size of the IP address range provided. This will reduce the time required to perform inventory. (MAPT, 2010)

Manually Enter Computer Names

This method enables you to test and inventory a few computers at a time. Use this method if you want to inventory a small number of specific computers. You can manually enter computer names, NetBIOS names, or FQDNs. For each computer, you will need to provide credentials that have local administrator access. (MAPT, 2010)

Inventory Methods with MAP 5.0

The MAP Toolkit uses multiple inventory methods. For each computer in a network that is to be included in the inventory and assessment process, you must specify an account that is a member of the local administrators group on that computer. To inventory domain controllers in your network, you need to specify domain administrator credentials (MAPT, 2010). The inventory methods used include:

- ***Windows Management Instrumentation (WMI:*** This inventory method is used to collect hardware, device, and software information from the remote computer.
- ***Remote Registry service****:* The Remote Registry service is used to find the roles installed on a server. The "Remote Computer Configurations" section of this document describes in detail how to enable configurations on remote computers.
- ***VMware Web service****:* This method is used to inventory hosts running VMware ESX, VMware ESXi, and VMware Server in your environment.

Collecting Performance Metrics with MAP 5.0

You can use the Performance Metrics Wizard to gather information about the CPU, memory, disk, and network utilization of computers for a duration you specify. The MAP tool will provide better consolidation recommendations if peak utilization data is gathered. If you know when peak utilization will occur, start capturing data with a leading hour before the peak and set the duration to include an hour after the peak utilization is expected to end. If peak utilization periods are unknown, collect performance data for longer periods of time. If you are attempting to capture utilization information for computers with different peak utilization periods, it is recommended to gather this information over a longer period of time to capture all peak periods or to gather utilization information for each set of computers in different performance metric gathering runs.

Performance counters are collected from each computer in five-minute intervals. The number of computers from which the MAP tool can collect performance counter data successfully depends upon factors such as network latency and the responsiveness of servers. If you want to collect performance data for a large number of computers, it is recommended to split the targets into batches of up to 150 computers. (MAPT, 2010)

Note If you have previously gathered performance data, you will be prompted on subsequent performance counter gathering runs to either delete existing data or to append the newly gathered data to what was collected previously. If you split up your target computers, to improve performance, make sure to select **No** in the **Performance Data Exists** dialog. ´

Appendix B - Possible issues with MAP

One of the possible issues with the MAP tool is the migration of an inventoried database from one computer (MAP manager) to another. Normally, installing the MAP tool (on destination computer) and copying a database to this computer will not work as expected. This is because the MAP database system does not recognize the schema of the newly copied database in its field. The workaround solution of moving databases from one computer to the other can be found below.

Migrating the MAP Database to another Computer

If you have completed inventory and performance metrics collection from a server a BO using MAP, and you want to migrate the database to another computer e.g. a different workstation, follow these simple steps:

1. Install the MAP tool on the computer you want to move the database to.
2. Create a database with the **same name** as the database you want to migrate.
3. Stop the MAP service and close the MAP application.
4. Go to the Computer that has the database you want to migrate.
5. Locate the **.mdf** and **.ldf** files in C:\Program Files \Microsoft SQL Server\MSSQL10.MAPS\MSSQL\DATA.
6. Copy the files (2) to similar location in the intended computer i.e. C:\Program Files \Microsoft SQL Server\MSSQL10.MAPS\MSSQL\DATA.
7. Restart the MAP service and the MAP application.
8. Select the database that you created earlier and you are done.

Appendix C – MAP Collaboration with PA Tool