Expertise
and insight
for the future

Jussi Huhtala

Improvement of Transition Data Centre Services Process

Metropolia University of Applied Sciences

Master of Engineering

Information Technology

Master's Thesis

1 September 2021

PREFACE

Writing this study had some challenges for me. I had previously very little experience on analysing or developing processes. Therefore, I needed to first read quite a lot of literature on the subject and even quite a lot that is not even used as a reference in this thesis. Also, it is quite hard to find time for writing thesis when there are small children in the family and when there is time it is usually late in the evening, and one is very tired. This brings its own challenges too. At some point I was not sure if I even have time to finish this thesis. This being said I need to thank my family for bearing with me during this writing process.

Even though it was quite laborious for me to write this thesis it has strengthened my understanding of myself as a person who likes to learn and find out new things, even the hard way. I also feel that it was very beneficial to write thesis on something that was not very familiar for me. I was able to learn something about process development along the way.

I need to also thank my colleagues that there was such a good documentation of the process. It made it much easier to study the process. I also need to thank my colleagues that they let me interview them for this thesis.

Kirkkonummi, 1 September 2021
Jussi Huhtala

Author Title Number of Pages Date	Jussi Huhtala Improvement of Transition Data Centre Services Process 75 pages + 12 appendices 1 September 2021
Degree	Master of Engineering
Degree Programme	Information Technology
Instructor(s)	Ville Jääskeläinen, Principal Lecturer

A case company which offers broad range of information technology services has developed a new production platform. All existing customers need to be transitioned to the new production platform. A team was put to together to handle the transition of customers and process for performing those transitions was developed by the transition team.

Process needs to transition customers faster than it is doing now for the transition team to reach target deadlines for all the transitions. It is important for the case company to get all the customers transitioned as fast as possible because it consumes resources to maintain two production platforms. It produces hardware and licensing costs to maintain two production platforms. Also, it is very inconvenient for people to work with two different production platforms.

This thesis investigates how could the process could be optimized to perform faster and keep errors to minimum. First process theory was studied which was used as a basis for process analysis. The process was investigated by conducting interviews of the transition team members, studying hundreds of pages of documentation created about the process and gathering notes from meetings and workshops.

Improvements for the process were suggested. Suggestions include automation of some parts of the process, rearrangement of tasks in the process, improvements to communication with customers, acquiring human resources outside the transition team for doing some labour-intensive tasks and delegating responsibilities.

The new production platform of the case company consists of both data centre services and network services. This thesis covers only a process that is responsible of transitioning data centre services. Also, there are many factors affecting the process from outside the process itself. These factors are outside the scope of improvement suggestions of the thesis as well.

The results of the thesis shows that many things that slow down the process come from outside the process itself and are out of scope of this thesis. Still many points that could be improved in the process itself was identified and improvements for those points were suggested.

Keywords	Process Development, Information Technology

Tekijä Otsikko Sivumäärä Aika	Jussi Huhtala Konesalipalveluiden siirtoprosessin parannus 75 sivua + 12 liitettä 1.9.2021
Tutkinto	Insinööri (YAMK)
Tutkinto-ohjelma	Informaatioteknologia
Ohjaajat	Yliopettaja Ville Jääskeläinen

Esimerkki yritys, joka tarjoaa laajasti erilaisia informaatioteknologiapalveluita on kehittänyt uuden tuotantojärjestelmän. Kaikki nykyiset asiakkaat pitää siirtää uuteen tuotantojärjestelmään. Siirrot on tarkoitus suorittaa mahdollisimman prosessinomaisesti. Transitio tiimi laitettiin kasaan tätä tehtävää varten ja tiimi loi prosessin, jolla siirtää asiakkaita uuteen tuotantojärjestelmään.

Prosessin täytyy pystyä siirtämään asiakkaita nopeammin mitä se tällä hetkellä tekee, jotta transitio tiimi saisi siirrettyä kaikki asiakkaat tavoite ajankohtaan mennessä. On tärkeää esimerkki yritykselle, että kaikki asiakkaat saadaan siirrettyä mahdollisimman nopeasti. Kahden tuotantojärjestelmän ylläpitäminen syö resursseja ja henkilöstön on epäkäytännöllistä työskennellä kahden eri tuotantojärjestelmän kanssa.

Tässä tutkielmassa tutkitaan miten prosessia voitaisiin optimoida, että prosessi toimisi nopeammin ja virheiden määrä saataisiin pysymään vähäisenä. Ensin teoria tietoa prosesseista on tutkittu, jota käytetään parannusehdotusten perustana. Prosessia on tutkittu suorittamalla transitio tiimin jäsenten haastatteluja, tutkimalla satoja sivuja prosessidokumentaatiota ja luomalla muistiinpanoja kokouksista ja workshopeista, joissa prosessin toimintaa on pyritty tehostamaan.

Prosessiin on ehdotettu parannuksia. Ehdotukset pitävät sisällään prosessin osien automatisointia, prosessin työvaiheiden uudelleen järjestämistä, parannuksia asiakasviestintään, lisä henkilöstön hankkimista muista osastoista työintensiivisten työvaiheiden toteuttamiseen ja vastuiden selkiyttämistä.

Esimerkki yrityksen uusi tuotantojärjestelmä palvelee sekä konesali- ja verkkoasiakkaita. Tässä tutkielmassa keskitytään vain prosessiin, joka siirtää konesali asiakkaita. Tämän lisäksi prosessiin vaikuttaa monet ulkoiset vaikuttimet, mutta nämä jäävät tutkielman parannus ehdotusten ulkopuolelle.

Tutkielman tuloksista selviää, että useat prosessia hidastavat asiat tulevat prosessin ulkopuolelta, mutta kuten mainittu rajautuvat ulos itse tutkielmasta. Tästä huolimatta prosessista itsestään löytyi useita kohtia, joissa on parannettavaa. Näihin kohtiin annettiin parannusehdotuksia.

Keywords	Prosessin kehittäminen, Informaatioteknologia

Contents

List of Abbreviations

BPMN	Business Process Model Notation
CMDB	Configuration Management Database
ERP	Enterprise Resource Planning
IPAM	IP Address Management
ITIL	Information Technology Infrastructure Library
ITSM	Information Technology Service Management
ITSMS	Information Technology Service Management System
SLA	Service Level Agreement

1 Introduction

This thesis covers a case company that is providing a wide range of information and communications technology services to private sector companies and government agencies. These services include information security services, networking services, cloud and data centre services, monitoring and controlling services, identity and access management services and consulting services.

The case company covered in this thesis has been developing its new production platform for few years now. The new production platform has reached such a maturity level that it is possible to start a transition of customer services from the old production platform to the new platform. The goal is that within two or three years all customer services are transitioned and running on the new production platform.

The production platform consists of systems and capacity that enable to run customer's virtual machines and offer several value-added services. Customers can manage their services to high extent independently and their services are monitored twenty-four hours a day. Service operations specialists are available any time of a day to respond automated alerts from monitoring system or customer contacts of any problems with their services. The new production platform is not only for customers but used internally by people in service operations who run the service. After transition of customers, service operations have more modern tools at their disposal to do their job.

1.1 Team

To reach the timeline goal of two to three years for the transitions a program was initiated, and a team put together. The first objective of this team was to gain a whole production platform wide understanding of how the platform as a whole and its subsystems really work. At the start of the transition program there was not many people who had understanding of the production platform as a whole. There were a lot of people who were experts on their specific section of the platform and only a handful who had understanding of the big picture. This why it was also important to increase the number of people who have understanding of the big picture. This knowledge was required to accomplish

the second objective which is to transition customer services to the new production platform. The target for the team was that it should be as self-sufficient as possible after all necessary trainings. It was also crucial to gain such a knowledge of the production platform that troubleshooting can be done within the team to a high extent, for example during a night-time transition there might not be specialists with better knowledge available. In ideal situation the team would be able to complete all tasks related to the transition of customer services without any resources from other teams or departments of the company. In reality this might not be possible, for example when the transition process gains such a maturity that transition of bigger customers can be started, they might have such large number of virtual servers to be handled that transition with just few specialists doing the transition might take weeks. In such cases volunteer specialists from other departments might be offered a chance to participate in transitions and they would get overtime compensation of participation. But being as self-sufficient as possible was a goal for the transition team.

The team was put together with some company internal and external recruitments. The team consist of people with several titles. Titles, job description and tasks for people in transition process are still little bit developing. When the team started its job, it consisted of Transition Program Manager, Service Transition Manager, Project Manager, two Service Transition Coordinators, three Service Transition Specialists and a consultant. Besides these two more people joined the team about five months after initiation of the transition program. These two were external consultants trained for ITSM system but had no prior job experience in information technology.

A rough division between different titles and their initial responsibilities in early stage of transition program was as follows. Transition Program Manager will lead the whole program, handle stakeholder management, facilitate trainings and tries to clear any obstacles that might block or slow down the program. Service Transition Manager will add new customers to roadmap for transition based on high level investigations of customers. Project Manager will lead transition of customers that are considered such size that it is feasible to start a project of the transition for that customer. Service Transition Coordinators will handle a more thorough investigation of customer's current services and special applications that need to be considered when technical migration is executed. Transition Coordinators also leads migrations that do not need a project manager. Service Transition Specialists will handle technical tasks that relate to transition of a customer. The consultant has a long experience in monitoring systems and products and mostly helps

the team with monitoring related issues. Two external consultants work mainly with ITSM system, but the goal is to train them to execute independently other tasks in the transition process as well.

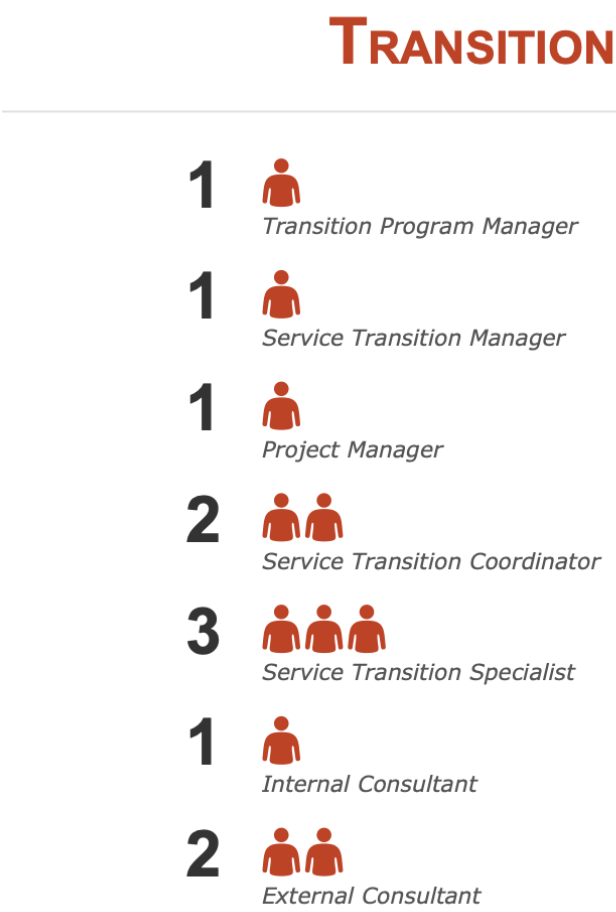


Figure 1 Transition Team Composition

The goal of the team is to transition all customers in a process-like manner. An early process was developed by the team for transitioning the first customers. The process was developed with a test customer which was configured to all systems to emulate a real customer, but no real customer had been transitioned when the initial process was created. For the team it is easiest to start transitions with customers that have data centre services. Therefore, first customers will be relatively small customers that buy capacity and possibly value-added services from shared data centre resources and are not purchasing resources dedicated just to their company. These customers have roughly ten to twenty virtual servers running in the case company data centre.

1.2 Scope and Business Problem

Even though the new production platform will be used to offer other services than just data centre services in the scope of this thesis is the process for transitioning data centre services of the customers. The process is studied, and the objective is to identify weak points in the process and suggest solutions on how to improve the process timewise and quality wise.

This study tries to decrease the time which it takes for one customer to go through the whole process as well as find out if it could be possible to improve performance by executing the process in parallel by having several customers at a same time in the process. In the lower level this means trying to add performance to customer onboarding tasks, decrease time it takes to migrate virtual machines and keep errors at minimum. Also trying to find ways to keep the process output as uniform as possible is one objective. This will help the job of Service Operations people.

The scope of the thesis is limited to the process of transitioning data centre customers because their needs are best met in the new production platform at the moment and the transition team first studied technologies and systems needed to transition these types of customers. That is why they are the first customer type that will be transitioned and most suitable for this thesis.

The most important reason to conduct this study comes from business reasons. From the business perspective it is important to get customer services in the new platform up and running as fast as possible and with as little defects as possible to save company resources.

The process that is studied in this thesis is completely unique and relates to case company's unique production platform. The process is also at a very early stage. Because of these reasons no one has yet properly studied it or made proper attempts to improve the process. It is important for the transition program to get customers transitioned as efficiently as possible to the new platform, but at the same time minimizing mistakes that could lead disruptions to customer business.

In this thesis study methods and material are covered in chapter two. Before analysis theoretical background information on process development was studied and chapter

number three focuses on information from written sources which were used as a basis for analysing the process and creating recommendations for process development and improvement. In fourth chapter current state of the transition process is described to the reader in a detailed level, so reader can understand all parts of the process. Fifth chapter contains improvement suggestions for the process. Chapter six contains interpretation of the results and conclusions of this study.

2 Method and Material

This study was conducted using qualitative methods. The author of the study has a position of Service Transition Specialist in the transition team. When conducting this study, the author was participating as much as possible to all stages of the process to get completely familiar with all tasks in the process and to get a complete overview of the process. Besides gaining own hands-on experience of the whole process where possible interviews of the team members was conducted to gain a more complete view and gather ideas for improving the process.

Also, background research of process development was conducted. Knowledge from reliable written sources was used to find best practices and techniques for identifying process weaknesses. Improvement suggestions was applied from this theory knowledge.

Table 1 below lists interviews conducted for gathering information for this study, Table 2 lists documents studied for gathering information for this study and Table 3 lists meetings and workshops where useful information was collected and generated.

Table 1 People Interviewed for the Study

Interviewee	Interview type	Date
Transition Program Manager	MS Teams video/chat interview	2021-01-29 13:00
Service Transition Specialist A	MS Teams video interview	2021-02-16 14:30
Service Transition Manager	MS Teams video interview	2021-02-19 13:00
External Consultant A	MS Teams video interview	2021-02-24 14:00
External Consultant B	MS Teams video interview	2021-02-25 09:30
Service Transition Specialist B	MS Teams video interview	2021-02-26 09:00
Service Transition Coordinator A	MS Teams video interview	2021-03-02 9:00
Service Transition Coordinator B	MS Teams video interview	2021-03-03 9:30

As shown in Table 1, eight persons were interviewed between January and March of 2021. These persons are members of the team who had most experience on developing and executing the process at that time.

Table 2 Documents investigated for the Study

Document	Short Description of document
Transitioprosessi	Written description of the process and how it is executed, and responsibilities distributed amongst team members.
Migraatio – palvelimen siirto ja import (workaround)	Instruction documentation for technical migration
Testaus suunnitelma	Testing plan for testing customer services after customer servers and services have gone through technical migration
Onboarding - palvelinautomaatio	Instructions for performing technical onboarding tasks to server automation backend systems
Onboarding – ITSMS onboarding lomakkeella	Instructions for onboarding customer to ITSM system

Documents in Table 2 is the documentation on which execution of the process heavily relies on. These include process description and technical instructions for executing the process.

Table 3 Meetings and Workshops

Meeting/Workshop	Description	Date
Customer transition debriefing meeting	Meeting where covered how customer technical migration went. Technical migration task order was discussed.	2021-03-22 09:00
Technical team meeting	Meeting where technical perspective of process is covered. New tool for automating part of technical migration was discussed.	2021-03-25 14:00
Workshop for pre-study and onboarding scheduling	Workshop for improving how scheduling and customer communication is handled during pre-study and onboarding subprocesses.	2021-03-29 12:00
Workshop for improving communication within team and within organization	Workshop for improving how information about customer transitions is shared within team and to stakeholder groups.	2021-04-28 13:00
Workshop for improving resourcing of technical migrations	Workshop for improving how to get all necessary resources for technical migrations.	2021-05-03 13:00
Workshop for optimizing the migration subprocess	Workshop for brainstorming how to optimize migration subprocess.	2021-05-06 9:00
Feedback of technical migration	Feedback from specialists outside the transition team during a technical migration.	2021-05-15 16:00

Meeting about possible automation of the process tasks	Meeting where discussed what would feasible and possible to automate in the process.	2021-05-31 13:00
Technical team meeting	Meeting where technical perspective of process is covered. More discussion about automating parts of the process.	2021-06-10 13:00

Table 3 has meetings and workshops where ideas for improvements have been discussed and brainstormed.

Information gathered using methods mentioned in above tables provided solid foundation for this thesis.

3 Process Theory

In this section theoretical knowledge of processes is covered which is applied to analyse the Transition Data Centre Services process. Improvement suggestions will be based on the analysis.

First subsection contains characteristics of a business process. Following subsections contain theory knowledge on methods that will be used in this thesis to analyse the process. After process characteristics subsection process scope and process flow documenting is covered and after that different ways of analysing process based on some process features.

3.1 Characteristics of Process

Process can be described as a set of activities and resources which are used to transform process inputs into process outputs. Outputs of a process are something that have value to the customer of the process. (1 p4) Transformation happening in the process is initiated by some event. (2) This kind of an event can for example be a customer requesting a quote for a new car from a car dealership. This event would initiate a process to sell a car at the car dealership.

One way to say what a process is that a process describes how something is done inside a company to produce something that has value when process is executed. (2)

There are two types of inputs that processes can take. Transformed resources and transforming resources. Transformed resources can be physical material of some kind that is transformed into products. Transformed resources can be information which is modified to create new data. Transformed material can be customers themselves as well, in this kind of situation process does some kind of transformation to the customer. (1 p11)

Transforming resource inputs can be either facilities or people. Facilities are the infrastructure that is needed to run the process. People are inputs that maintain and operate this infrastructure to keep the process running. (1 p11)

There are two types of outputs for a process. Output is either a product or a service. Sometimes it can be hard to make difference between these two outputs, but maybe most often the difference is that a product is something that can be physically touched when service does not have this feature. (1 p11)

Process outputs can be consumed by external or internal customer. (1 p4) As part of operations, processes are usually both internal customers and internal suppliers. A single process consumes outputs of its supplier process as inputs and produces outputs of its own which it supplies to some other process using those as input. This kind of a chain of internal suppliers and customers creates a network of processes that can be seen as a whole business. (1 p15)

Processes can be identified as being a core processes or a supporting process. Core processes are the ones that directly impact on producing the product that a business is offering to the market. Supporting processes are something that impact indirect way to the production of the product. (1 p6) Supporting process can be for example something that happens in the HR department. Process of recruiting more labour force or process for keeping employee skills up to date. These examples support producing core products by supplying skilled employees for the core processes.

Processes can be varying degree of complexity. Process complexity tells a lot about how the process can be executed. Is it something that can be automated, or does it require human interaction and to a what degree? Simple processes usually have tasks that have a lot of repetition and can be automated. These can also be quite easily documented precisely to a step-by-step instruction describing what happens in each stage of the process. (2) When moving to more and more complex processes more human interaction is required. When processes are very complex humans performing those processes need to be highly educated and they need to be creative since these complex processes are something that can't be performed in precise step-by-step order. Humans performing those complex processes need to have a broad knowledge on the field that process relates to. High level of complexity also makes it harder to document the process precisely since there is no clear steps which to follow for executing the process. (2)

When describing or documenting a process it is good to name the process. Common way of naming a process is to first state that what action does the process execute. Does it make, manufacture, deliver or modify something for example. Second part of the name

states what it is that the process is making, manufacturing, delivering, or modifying. (2) Example of a process name could be make toothpicks. This kind of a process would probably be quite simple one that makes toothpicks from wood. With this naming convention the process covered in this thesis is named as Transition Data Centre Services.

3.2 Process Scope

When starting to think about possible problems in a process it is a good idea to analyse the scope of the process in question. (2) A process scope diagram is a good tool for this. Process scope diagram helps analysing external factors affecting to the process. (2) The process scope diagram is of rectangular form where the analysed process with its sub-processes is at the centre. To the left side of the process being analysed there are inputs of the process and to the right side of the process are outputs. Above the process is area for external factors that control the process. Below the process there is area for factors that are enablers for the analysed process. All four sides of the process area have space for marking information on their respective factors. Different symbols can be used to indicate these external factors that can be for example people, systems, other processes,

etc. In the picture below an example of empty process scope diagram can be seen. (2)

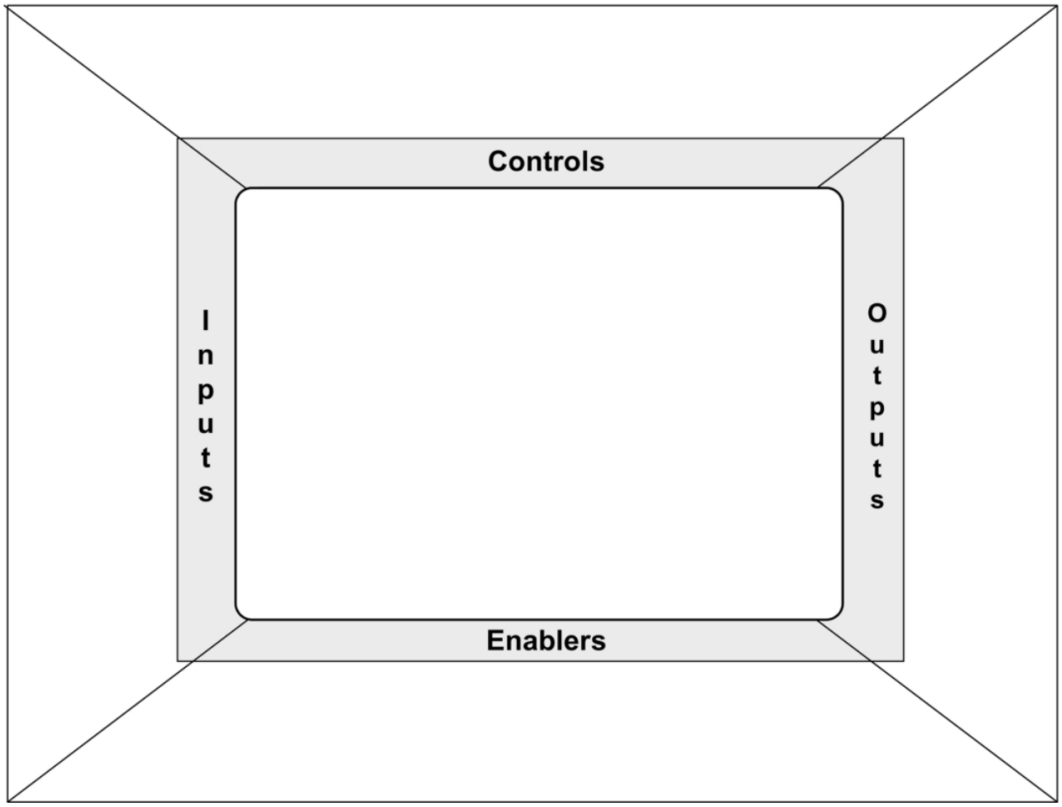


Figure 2 Process Scope Diagram Empty (2)

Next picture displays a process scope diagram with examples on how to use the diagram to document and analyse the process and external factors affecting it.

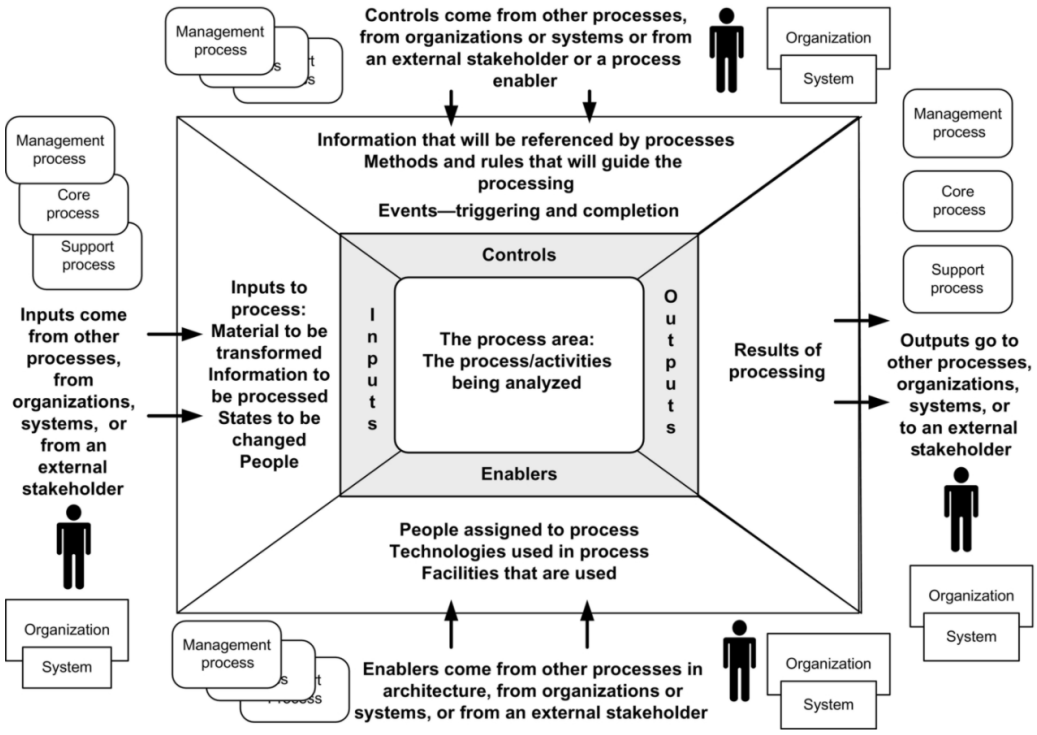


Figure 3 Process Scope Diagram Example (2)

Figure 3 shows example of what kind of factors for the process can be identified and how to mark those to the process scope diagram. There are other processes, organizations, people, systems etc.

3.3 Modelling Process

Processes can be modelled using some technique to visualize a process. This makes it easier to comprehend the process. It is also easy to see if the process can be divided in to a subprocesses and then do an individual analysis for those subprocesses. By gaining understanding of the process with visual diagrams can easily be used as a basis for deeper analysis for the process. There are several ways to model a process. (3 p99)

3.3.1 From As-Is Process to To-Be process

A process analysis usually starts with figuring out what is the exact problem with the process that needs to be improved. Next measures for solving the problem are considered. It can be stated that we have our as-is process and then we have our to-be process and a difference between these two processes is the problem. (2) Usually, the goals from management are something like increase the output rate of the process or decrease amount of defective output of the process. (2) These goals that management set are usually consequences of something happening in the process and analyst needs to go reverse direction in the process sequence to identify problems in the process. (2) When differences of as-is and to-be process measurements are compared this is referred to as performance gap and capabilities gap is discussed when comparing how things are done in as-is process and how things should or could be done in to-be process. (2)

To be able to model a process one needs to gather information on how the process currently works. This involves information on who owns the process, who executes the process, how is the process executed and so on. Not only information on a particular process is important, but also what kind of an infrastructure the process utilize and details on how the process function. Process functionality details include its obligations or contractual promises on how it delivers outputs. Also, statistics on how the process performs for example how long it takes to execute the whole process are functional details of the process. This information can be gathered for example by interviewing people relevant to the process or organizing workshops. One good way is also by observing how people are step by step executing the process. Also, existing documentation on the process or worklogs can be used to analyse the process and its performance. Basic idea is to gain enough information to identify any issues with the process. (3 p100-101)

To-be process is modelled based on data that is gathered when discovering as-is process. After identifying points of the process that can be improved one needs to start build a model for improved process. This is usually done by building multiple models to find an appropriate solution. (2) Solutions for improved process could be to automate parts of the process or the entire process or maybe give a customer more responsibility by offering some sort of self-service portal. (2) It is also possible to try and build a solution by using some well-known process framework as a base for improved process. In the

field of information technology for example, ITIL is popular framework for IT service management. (3 p102) Several different process configurations can be tested. Alternating the sequence of the process or maybe executing something in parallel. (3 p102)

It is often the case that processes are not well documented. This can lead to misinterpretations on how the process should be executed and different people might execute same tasks in different way which might lead to an inconsistent process output. Because of this it is vital to have a clear graphical representation of how the process should work and everyone executing the process understand the documentation. (1 p151)

When adequate data is gathered about the process alternative ways of executing the process can be modelled. These multiple alternative models are referred to as could-be process. (2)

Following subsections look at a process mapping and a business process model and notation way of visualizing and modelling processes.

3.3.2 Process Mapping

A process mapping visualises how different activities in a process link together. Goal of the process mapping is to recognise all activities in a process and visualise the flow of process inputs and their transformation to process outputs. Symbols used in process mapping can vary depending on mapping technique used. (1 p152)

Processes can be mapped at different levels of detail. Often processes are mapped several different levels. First starting from so called high level which includes practically no details of the process execution. Several process diagrams can be drawn from one process where each diagram goes more into detail of the execution of the process. Most low-level process diagrams can go even as far as describing individual motions in an activity. It depends on the process how low-level diagrams it is feasible to draw. Some processes can be modelled in a very detailed level when other it is impossible or there is no reason to do that. Some processes might be so complex or vary so much that person executing the process need to apply his or her knowledge so much that it is impossible to have detailed diagram and instructions for execution of the process. Some processes or subprocesses might be so simple that it is waste of time to model them in detail. (1 p153)

3.3.3 Business Process Model and Notation (BPMN)

The BPMN is a notation for modelling process diagrams. BPMN has been designed to be easily understandable by business, technology and operations people working with processes and a process design. The BPMN notation combines best practices of modelling business processes. (3 p106) The BPMN represents processes as graphical objects in a flowchart. These graphical objects represent different activities that process consist of as well as different controlling elements in a process. An Activity is some work performed in a process and a controlling element define how process is executed. (4 p1) The BPMN can be used to model processes in many different levels of detail, it can be used to model a whole end-to-end process or parts of a process. (4 p7)

Even though the BPMN can model complex business processes there are four main categories of graphical objects. These main types of objects can be enriched with additional information if it is needed by complexity of a process being modelled. (4 p2) For example it is possible to add an additional information on task element by adding a small symbol indicating the type of task in question to the upper left corner of the rounded-corner rectangle representing a task in the BPMN process diagram. (3 p111-112) Main categories of graphical objects in the BPMN are flow objects, connecting objects, swim lanes and artifacts. (4 p2)

Flow objects are the ones that describe the steps of a process. An event is used to represent something that happens in a business process. A Process often starts and ends with an event. Something happens and whatever it is that happen initiate the process execution. A Circle is used to represent an event in a BPMN diagram. Activity is something that is being done during the execution of a process. It basically describes work being done. Rounded-corner rectangle represents activity in a BPMN diagram. Gateways are used to indicate if a process divides into several branches. It can be a decision point or indication of tasks being run parallel in a process. When these parallel tasks are finished, and they join again into one flow gateways is used to merge these branches. Gateway is represented by a diamond shaped object. (4 p2)

Connecting objects connect together flow objects in the BPMN diagram. Sequence flow indicates in which order are activities of a process executed. Solid line combined with solid arrowhead is used to represent a sequence flow. A message flow is used to repre-

sent communication between two parties participating in a process. Dashed line combined with open arrowhead represents a message in a BPMN diagram. Association links artifacts with an additional information to flow objects. Dotted line combined with line arrowhead indicates association. (4 p3)

Swim lanes are used to distinguish between different entities participating in a process or two processes communicating with each other. Pool represents a business entity. If diagram has two pools, it usually means that they represent two different companies or a customer and a service provider. Lanes are inside pools and divide pools into smaller partitions. Lanes usually represent some function or a department of a company. There are limitations which connecting objects can cross borders of pools or lanes. Since pools are different businesses sequence flows cannot cross pool borders and message flows can only be used to indicate communication between two pools. Message flows cannot cross lane borders, they need to be used between pools. (4 p4-5)

Artifacts are used to add an additional information to a BPMN diagram. There are some predefined artifacts in the BPMN, but process designer can also create their own artifacts. Artifacts do not affect the flow of a process in any way, they only provide an additional information. A data object artifact is used to indicate that an operation is performed with a data. A data object is linked to activity with association connecting object. A group can be used to indicate something in the diagram. For example, it could indicate similarity of two tasks or their similar execution. An annotation can be used to provide an additional information in a simple text form. (4 p6)

3.4 Volume, Variety, Variation and Visibility of Process

There are four features of a process that have high impact on how a process should be managed. These features are volume, variety, variation, and visibility of a process. (1 p21) Next each of these features is covered in more detail.

Process having a high volume of output is usually a process that has lot of repeating tasks. Because of this it might be feasible that people specialise in certain tasks in the process. This kind of repeatable tasks can usually be well documented and refined into a step-by-step instruction manual. In many cases it might also be feasible to try and

automate high volume processes at least into some extent. Low volume processes usually require people to execute tasks that differ more from other tasks. This makes it harder to automate or create step-by-step instructions for a process. This often leads to a result that it is more costly to produce output of a low volume process than a high-volume process. (1 p21)

If a process is producing a wide range of different products or if a process has high variety in process output, it requires a wide range of different know-how or competence. Also, lot of different technologies might be needed to execute the process. In general, it can be said that processes with high variety output are more complex than low variety processes. High complexity usually leads to a more costly process as well. (1 p22)

Changes in how much output is expected from a process in a given time is called variation. If there is a lot of variation in the amount of output expected from a process it is much harder to plan and manage a process. When there is no variation or very little variation a process can be planned, and adequate resources reserved to a level that just meets the demand for the process output. With high variation processes resources need to adjust on the fly or there needs to be a reserve of resources by design for the process. For these reasons process with higher variation is also a more expensive process. (1 p22)

Visibility of a process means that how much a customer of the process can see or experience themselves what is happening inside the process. Some kind of face-to-face customer service processes are visible to the customer to a high extent. People executing high visibility processes need certain skills to keep their customers happy. High visibility processes interact more with their customers than low visibility processes and it is more acceptable to take more time for responses between parties when process is low visibility one. High visibility processes are more costly than low visibility ones since the need for staff that can give more immediate responses to customers. (1 p22)

These features all have high effect on costs of the process. This leads to the fact that processes with different levels of these features need to be managed differently. (1 p22-23)

3.5 Volume-Variety Position of Process

A volume and a variety are two important features that can be used as a pair of features to analyse process on conceptual diagram called a product-process matrix. A product-process matrix has volume-variety position in a horizontal axis and a process design characteristics in a vertical axis. So called natural diagonal travels from top left corner to bottom right corner. It is preferred that process would position close to the natural diagonal. (1 p121-122, 125)

If a process is way off from the natural diagonal it means that the process is either lacking flexibility that it needs to perform optimally or that the process could be standardised more, and it is currently spending more resources that is needed in an optimal situation. Which is the case depends on which side of the natural diagonal is the process situated in the diagram. (1 p124)

Processes that position themselves near the natural diagonal in different parts of the diagonal can be categorised as different process types. Service processes can be categorised for professional services, service shops and mass services. (1 p122)

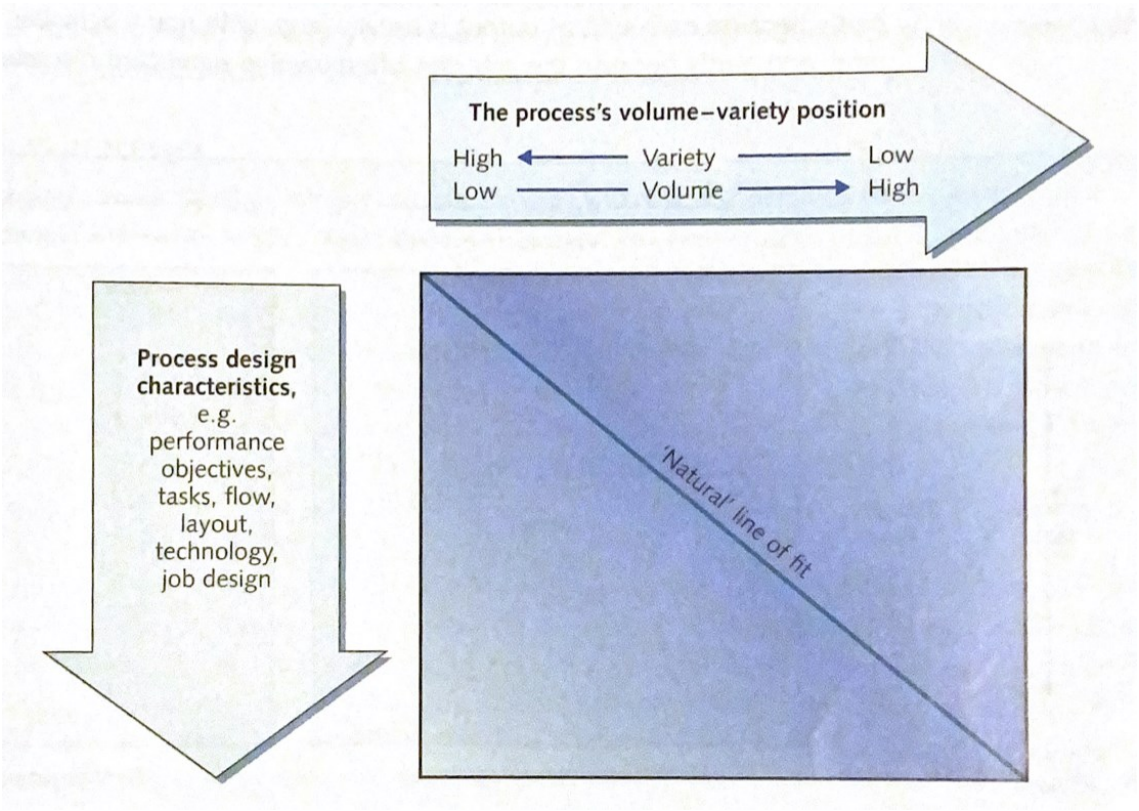


Figure 4 Product-Process Matrix (1 p121)

Professional services are something that have a low volume and a high variety in the process. The process can be modified to a high extent, and it takes a long time to execute the process. The Process is executed by humans to a high extent, because of possibility to modify process to a high extent there is not many possibilities for automating the process steps. Only a high-level process maps can be drawn from this kind of processes. Often process itself is as important to the customer as the product or an output of the process. (1 p124)

Service shops align in the middle of natural diagonal. Process is executed with activities both visible to customer and invisible to customer. Customer contact personnel in the process can provide some assistance to the customer. Product or the process output is quite standardised, but some customisation can be delivered based on customer needs. (1 p124)

Mass services are high volume and low variety processes. These processes have many customer events, but not really possibility for customising output of the process. Activities of these processes can be automated or be machine aided to quite a high extent. People

working on the customer visible parts of the process rarely have authority or power to effect on the flow or output of the process. Product is the most important thing in this type of process. (1 p124)

3.6 Process Layout

Volume-variety position of a process should have significant impact on what kind of a layout is selected for a process. There are four basic layout types that can be used as a base from which suitable layout can be modified if needed for a process. These four layout types can be placed on the product-process diagram natural diagonal to assess which type is suitable for a process that is being analysed. (1 p127) Correct layout for a process is important since it saves resources and gives visibility to the process for the people executing the process. (1 p129)

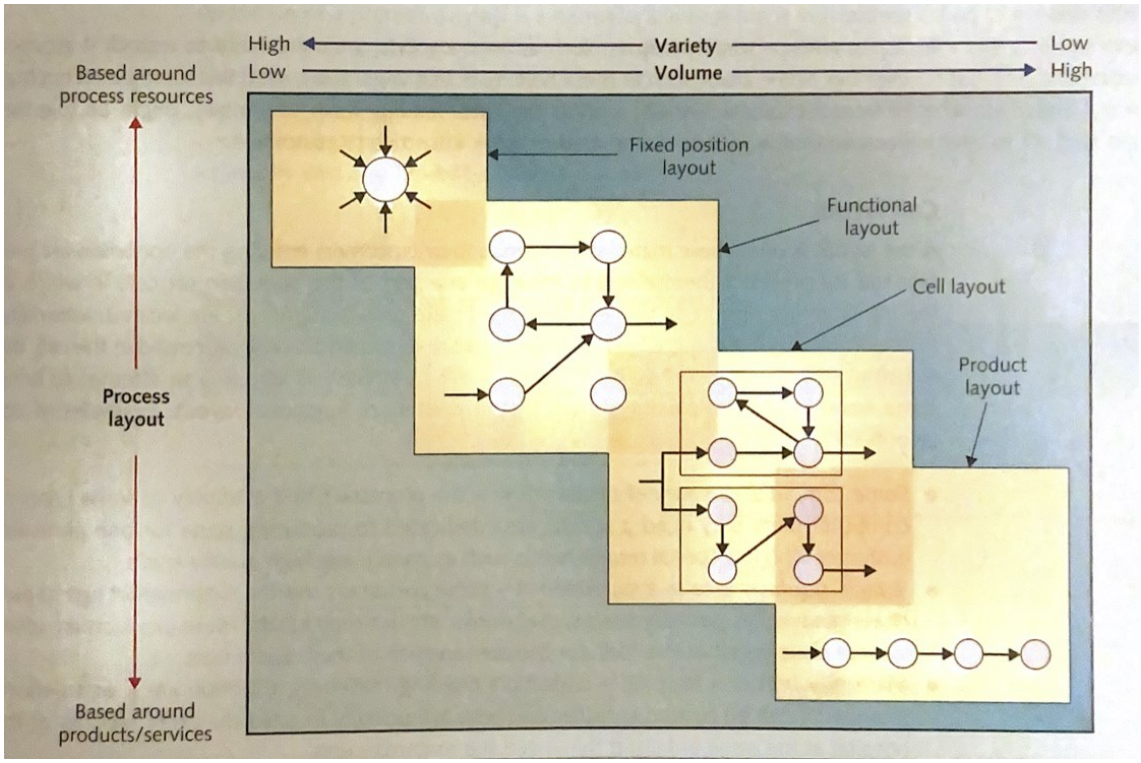


Figure 5 Process Layouts in Natural Diagonal (1 p127)

In a fixed-position layout transformed resources do not move from one transforming resource to another. Transforming resources come to the transformed resource and execute required process steps. (1 p127-128)

A Functional layout groups similar activities or resources together to optimise their usage. In functional layout transforming resources are the ones that dictate how transformed resources travel from one activity to another. (1 p128)

In a cell layout inputs for the process are selected beforehand to enter some part or cell of a process. A cell should include all the necessary transforming resources for successful transformation. Activities in a cell can be arranged in any way that serves best the purpose of the cell. Certain process inputs can go through several cells in the process. (1 p128)

A Product layout gathers transforming resources so that it is easy for transformed resources to follow a sequence of activities needed for producing a process output. Flow of activities are predetermined and easy to predict. This layout is common with highly standardised output and high volumes. (1 p129)

Table 4 Process types and possible layout types for process (1 p129)

Process type	Possible layout type
Professional service	Fixed-Position layout, Functional layout, Cell layout
Service shop	Functional layout, Cell layout
Mass service	Cell layout, Product layout

3.7 Technology of Process

This is the technology used for decreasing time it takes to execute the process, minimize errors in the process, minimize manual labour in the process etc. Volume and variety influence which kind of technology should be used for the process. General purpose technologies should be used for high variety and low volume processes. General purpose technologies can cope with more different kinds of processing. For a high volume and a low variety process it is more feasible to create more dedicated technology. Three things tend to vary depending on a volume and a variety of a process. These are introduced in following paragraphs. (1 p131)

An automation level of a process technology varies depending on a volume and variety of a process. There is always some level of human intervention needed, but this depends

on a process being executed. High variety and low volume processes can usually deploy less automation than high volume and low variety processes. (1 p132)

Technology can scale and depending on a volume and a variety of a process either small-scale or large-scale technologies are implemented. For example, process can use one large-scale processing unit or several smaller-scale processing units. These have their ups and downs. Large-scale technology can usually process with lower unit costs, but several small-scale technologies can produce several different outputs. When comparing one large-scale processing unit to several small-scale processing units it is good to remember that if processing units fail in other case production stops completely when on the other case only part seizes. Large-scale technologies are more suitable for high volume and low variety processes when small-scale processes are more suitable for high variety and low volume. (1 p132-133)

A Connectivity of a technology can be used to integrate different parts of a process to a processing system. Highly integrated system can usually provide a fast throughput and predictability for a process. Downside to high integration level is that integration is usually expensive and failure in one part of the integrated system can lead to failure in whole system. Highly integrated system has also difficulties in producing different kinds of process outputs. Highly integrated systems are more suitable for high volume and low variety processes than high variety and low volume processes. (1 p133)

3.8 Job Design

Volume and variety also effect greatly on how people working on a process should have their jobs designed. People working with a high variety and a low volume process do not have their jobs tightly defined. They have freedom of being creative and making decisions effecting the output of the process. On the other hand, people working on low variety and high-volume processes have quite strictly defined jobs. Three important things in job design to keep in mind are division of labour, job definition and job commitment. (1 p134)

Division of labour dictates how single person's job or responsibilities are defined in a process. What tasks are responsibility of a certain person. It is possible that one person can execute whole process by him or herself or the process can be sliced to smaller

chunks of labour divided between persons or teams. Especially high volume and low variety processes can have advantage on slicing tasks into smaller parts. This of course makes work repetitive to a high degree. This has both positive and negative effects on the process. (1 p134) Table below lists some positive and negative aspects of dividing tasks into smaller chunks.

Table 5 Division of Labour Positive and Negative Effects (1 p134-135)

Positive	Negative
Faster learning	Monotonous
Easier to automate	Can cause physical injury (in physical tasks)
Reduces non-productive work	Low flexibility
	Poor robustness

How accurately jobs can be defined or is feasible to define depends on the complexity of a job. Again, volume and variety should have an effect when considering this. When person executing a process with high variety and low volume it is common that the job cannot be very accurately defined since there is need to apply knowledge and experience of a person executing a process for making decisions effecting the output of a process. When executing a process with low variety and high-volume tasks have usually high degree of repetition and this makes it possible to document job steps more closely. (1 p135-136)

It is important to get people executing a process to commit to their jobs. There are several things that effect persons job commitment. Some of these things cannot be affected by adjusting how process is executed, but some can be. Usually processes with high variety and low volume have such tasks that solving those motivates people and make them committed to the job. Usually, it is low variety and high-volume processes that might have problems committing people to the process. (1 p136) Below table lists some measures that can be used to try and increase job commitment for processes that have lot of repetitive tasks.

Table 6 Job commitment measures (1 p136-137)

Measure	Description
Job enlargement	Giving more tasks to the person executing the process. New tasks are generally as demanding as existing ones.

Job enrichment	Giving more tasks to the person executing the process. New tasks are more demanding the existing ones.
Job rotation	People executing the process change between a set of tasks they that are their responsibility in the process.
Empowerment	Give person executing the process more freedom to decide how they execute their tasks.
Team-working	Persons executing the process collectively execute the process and make decisions regarding the process.

3.9 Performance of Process

A process needs to be designed in a way that process performance is suitable for the goal of the process. This means that if the process needs to create its output with low cost, then the process needs to design in a way that emphasizes low costs for executing the process. Or if quality of the output is the most important thing, then process needs to design in a way that prioritize quality of the process output even if it would be more resource hungry. There are strategic objectives for process performance that can be used to assess the process. These objectives are quality, speed, dependability, flexibility, and cost. (1 p149)

It is important to consider a process in a lower level than just strategic level when designing or re-designing a process. There are lower-level objectives to consider which relate to how process inputs travel the process and transform into process outputs. These objectives are called flow objectives and they measure the metrics of units going through the process. (1 p150) Below table describes these flow objectives.

Table 7 Flow Objectives (1 p150)

Flow Objective	Description
Throughput rate	The rate at which completed units come out from the process transforming those units.
Throughput time	Average time it takes to transform process inputs into process outputs.
Number of units in process	In average how many units to be processed are in the process during certain period of time.
Utilisation of process resources	Time that resources in the process are performing productive work.

Flow objective metrics are affected by design factors such as variability of input arrival, configuration of resources and activities within the process, capacity of the resources at each point in the process and variability of the activities within the process. (1 p150)

3.10 Process Configurations

A process configuration means how all tasks and activities in a process are placed, which task is performed first what comes after that or is it possible to perform some tasks at the same time with each other. At what point in process are certain resources needed and things like that. Process maps are good tool for analysing and finding suitable process configuration. (1 p156)

When considering process configurations, it is important to keep in mind that activities that need to be performed in a certain task of a process need to be performed in certain order. It is usually impossible to perform some activity before some other activity is first performed. When analysing tasks, it is good to document activities and their order. For analysing purposes, it is also good to document the time it takes to perform a certain activity. (1 p157)

An arrangement of activities in a process needs to be carefully considered. There are two different configurations to consider. How much the activities can be performed in sequential order or in parallel. It is helpful to divide activities in stages and arrange them into sequential or parallel configuration. If process has targeted or required cycle time it can be calculated how many stages would be feasible for process being configured. Different kind of configurations can be used if average cycle time target is met. Configuration extreme ends are all stages in sequential order or using all activities as a single stage and performing those in parallel. Of course, configuration can be anything between these two. (1 p157-160)

It is important to find out what is a cycle time for the process that is being investigated. Cycle time is the time that it takes for the process to produce its output. For example, a process might produce one complete output every 20 minutes. A Process needs to be designed in a way that it will be able to produce output with such a cycle time that is required from a process. When a required cycle time is known it is possible to find out

how much capacity is required by the process to keep up with the cycle time required. (1 p161-162)

If process activities are organised in stages, these stages have different amount of work allocated to them, except maybe in perfect world where every stage takes exactly the same amount of time. It is feasible to try and balance the work in different stages. Stage with most work can only have as much work as is the cycle time requirement for the process. If required cycle time for a complete output of the process is every 20 minutes, then stage with most work cannot take more time than 20 minutes to complete. If work of stages is unequally organised there will be balancing loss which is time that will be wasted because stages need to wait for the stage that takes longest to complete. An objective is to get balance loss as small as possible. (1 p162-163)

3.11 Process Variability

There is always some variability in a process that affect their performance. There are several factors that might introduce variability to a process such as human error, problem with technology, several different types of outputs that need to be produced and so on. Whatever is the reason for the variability usually it ends up creating two different kinds of variability in process stages. How much is demand for processing at a single stage or variation in how much it takes to complete a single stage. (1 p166)

It has great effect on variability of a process if processed unit movements from one stage to another are synchronised or not. Synchronising means that movement between stages happen all at the same time. For example, if there are four stages movement happens at the same time between all these stages. When synchronisation is used average time to complete a stage can no longer be used as a measure. Variation of completion times of stages need be taken into consideration. When variation considered, whichever stage might take the longest to complete comes the new cycle time. For example, if average completion time for stage is 13 minutes, but when variation is considered, it might take sometimes maximum of 16 minutes to complete the stage. In this case 16 minutes would be new cycle time for the process. This will of course introduce time that some stages are idle, and it decreases performance of the process. When unsynchronised option is used units in the process move to the next stage right after previous stage is complete. This usually means that following stages have more variation on their

demand because units being processed are passed along right after completion of a stage. So, it is about deciding whether variability is accepted in the time that processed units spend on one stage or is it acceptable to have variability in arrival of units to each stage. (1 p166-167)

When there is variability in times of processed units arriving to their next stage it will lead to some waiting time for units to be processed as well as some under-utilisation of the process. These both can occur at the same time in a process. In this situation some units need to wait at some stage some time before they can be processed, some stages need to wait for units from previous stage without doing anything and of course some units can be processed right after they arrive at the stage. Waiting times and low utilisation are dependent on each other in a way that if process utilisation is high then waiting times are longer or if utilisation is low then waiting times are shorter. Decision needs to be made if there is rather need for lower waiting times or higher utilisation. If goal is to improve both then variability in a process need to be decreased. This would probably require decreasing flexibility in process and limiting customisation options in process output. (1 p168-170)

4 Current State of the Transition Data Centre Services Process

This chapter contains current state of the Transition Data centre Services process. First overall process is covered and a section after that covers scope of the process. In this section process inputs, outputs, enablers, controls, and different stakeholders are identified. After this there is a subsection for all three subprocesses which are identified and analysis of the process, based theory that was covered in chapter three. Below diagram presents the transition data centre services process in high level.

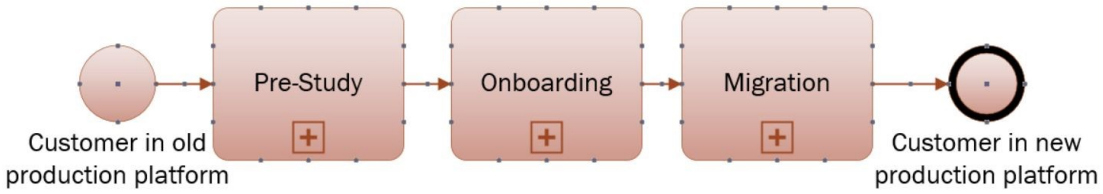


Figure 6 High Level Diagram of Transition Data Centre Service Process

The process has been tested with about five customers and a test customer at the time when conducting interviews and gathered information from documents. The process and the whole transition program are currently seen as being a very important for case company future since it is one of the main goals to get rid of the old production platform. At the moment company has to maintain and support two individual production platforms which is expensive since all extra software and licensing costs. This is also very insufficient and frustrating in the employer point-of-view. One needs to learn and keep up knowledge of two production platforms which can be very frustrating.

The process is still in very early stage and no optimisation has been performed for it. Still, it seems that biggest obstacles or things that slow down the process come from outside the process itself. Productization and development is not working as is hoped. When the team was put together to start building the process for transitions everybody in the team was under the impression that job of the team is to put together the process and pick customers in suitable order and transition customer services from the old production platform to the new production platform in a process like manner. This proved to be wrong assumption. Reality was that the new production platform was not ready to service customers in a standard way. There had been some bigger customers already in production in the new platform, but lot of customised solutions for those customers

had been developed and no standard way of doing things. Data centre value-added services had not been productised in the new platform. There was no information on how to produce those services in the new platform. For some of the services it is still the case.

The transition team has put a big effort on helping to productise data centre value-added services. They have been involved in defining and modelling those services for the new production platform. Transition Program Manager has taken lead and facilitated a lot of the productization work. This work is all outside the scope of the transition team, but it has been needed to be able to start executing the transition process. Lot of time and effort has been needed to use before preconditions were met to start transitions of simplest customers and more time and effort is still needed to meet preconditions of more challenging customers. The transition team is trying to help all stakeholder groups to accomplish their tasks that enable transition team to take more demanding customers into the transition data centre services process.

From the business perspective there is a wish that more and more customers would be taken into the process. And several customers have been taken into the process, but it has been found out in the pre-study subprocess that many customers cannot be taken further because of the reasons mentioned above. The transition team wants to test transition of all data centre value-added services with test customer that can be used to simulate transitions of real customer. These obstacles have been communicated to business unit and they have been understanding towards it for the time being.

The transition data centre services process although not yet optimised is considered working well for the smaller customers that have limited number of servers and services. Most parts the process internal communication works well. Technical instruction documentation is considered good.

A goal of the process is to transition roughly 3700 virtual servers by the end of year 2023. Many people in the team think that for this goal to be realistic help is needed for the virtual server migrations from other departments of the case company and besides this there would need to be increase of resources to the team itself via recruitments. In addition, it is clear that the process itself need to be optimised as well to get higher throughput of servers and reach the goal.

Also, customer contact and scheduling of technical migration of customer servers have proved to be somewhat challenging. Technical migration requires some downtime for customer servers, and it has been challenging to find suitable times for maintenance windows that are acceptable for customer. Sometimes it has been challenging to get any kind of answer from customer at all. Of course, maintenance windows need to be suitable for service transition specialists doing the migration which adds its own challenge to the scheduling. Server automation system has also introduced some delays to the process. Sometimes some parts of the automated import workflow for server automation have not worked and already scheduled migration maintenance window has been cancelled or some part of server automation import workflow is not working and it adds manual work to the technical migration part and takes more time to complete all migration tasks.

There are some fears inside the transition team that problems like server automation technical challenges, productization delays or lack of sufficient human resources might even put a temporary stop to the execution of the transition data centre services process. This stop could become true if there is technical problem in server automation which prevents running automated import workflow. If there are only customers with such services that have not being productized. Or if transition specialists have used all their legal overtime hours and no more work can be done outside office hours or even worse that overtime work exhaust transition specialists.

In principle all these problems are outside factors of the process. Still as mentioned above the transition team has helped in productization and recruitment permits can be requested to hire more hands to execute process. Also process optimisation can help with resources problems.

4.1 Scope of Transition Data Centre Services Process

A process scope diagram is used to identify factors affecting the transition data centre services process. Below there is a picture of a process scope diagram with all identified factors.

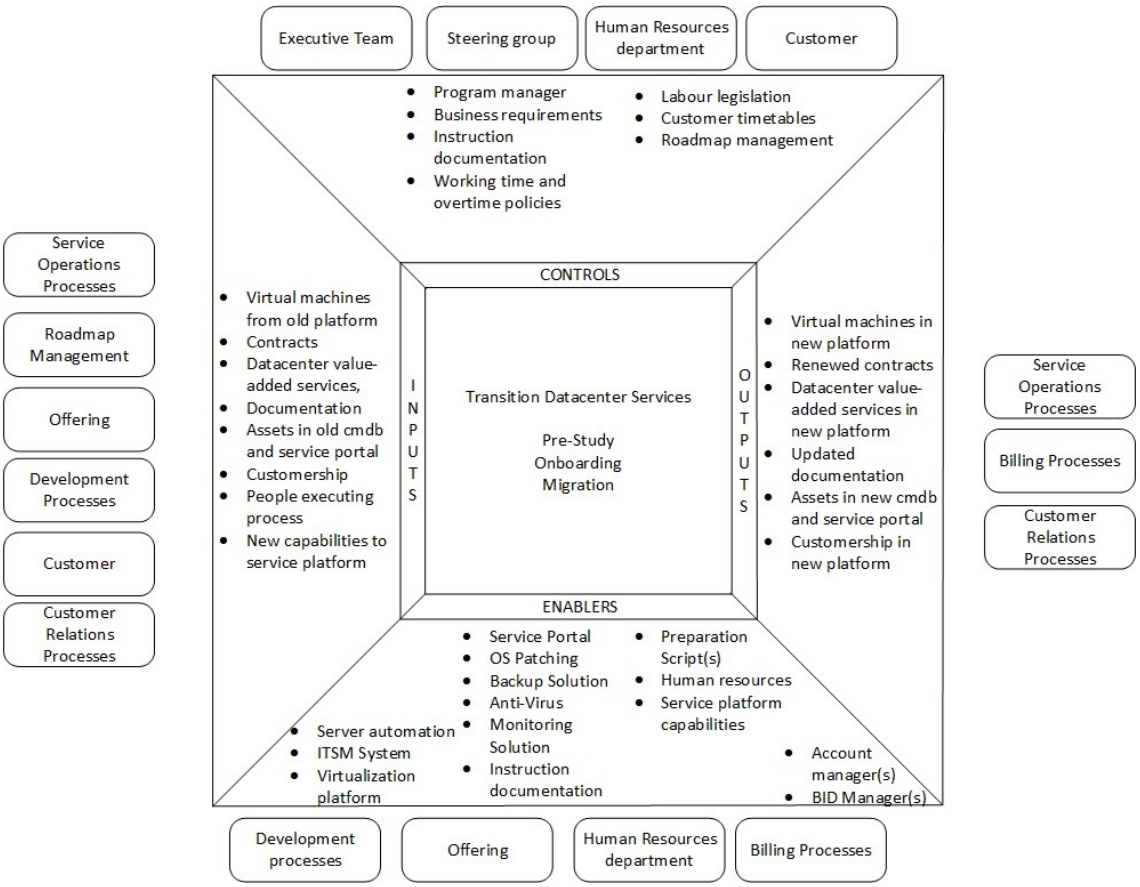


Figure 7 Process Scope Diagram of Transition Data Centre Service Process

Below there is also Table 8 where information from process scope diagram is extracted and presented clearly.

Table 8 Transition Datacenter Services Process Scope

Inputs	Outputs	Enablers	Controls
Virtual machines (in old platform)	Virtual machines (in new platform)	Server automation	Program manager
Contracts	Renewed contracts	ITSM system	Business require-ments
Datacenter value-added services	Datacenter value-added services in new platform	Virtualization plat-form	Instruction documen-tation
Documentation	Updated documenta-tion	Service portal	Working time and overtime policies
Assets in old cmdb and service portal	Assets in new cmdb and service portal	Operating System patching	Labor legislation
Customership	Customership in new platform	Backup solution	Customer's timeta-bles
People executing process		Anti-virus	Roadmap manage-ment

New capabilities to service platform		Monitoring solution	
		Instruction documentation	
		Preparation script(s)	
		Human resources	
		Service Platform capabilities	
		Account manager(s)	
		BID manager(s)	

4.1.1 Inputs and Outputs

Inputs and outputs of the process are transformed and transforming resources. Transformed resources in the transition data centre services process are information technology assets that are transformed from being compliant with the old production platform to become compliant with the new production platform. Transforming resources here are the transition team members that perform transitions and capabilities that help transform assets.

Inputs to the process come from several different sources. Some of these sources can be considered as enablers and control for the process as well and are there for marked in more than one place in the process scope diagram. From the process scope diagram, it can be seen that there are six sources identified that provide some sort of input for the process that either transform or is transformed. Customers communicate their own needs and wishes for the transition process and those can be considered an input for the process. From offering department comes guidelines how everything should look like for the customer especially in a service portal and according to that customer assets are added to CMDB. Other input sources are explained in following paragraphs in this section. Outputs of the transition data centre services process go mainly to three following processes. Service operations processes, billing processes and customer relations processes. Following paragraphs contain some more information on why outputs go to these three processes.

As can be seen from the process scope diagram and Table 8 there are several inputs identified for the process. Virtual machines that are run on the old virtualization platform are coming from service operations support processes to the transition data centre services process to be migrated to the new virtualization platform and imported to new server automation system. Virtual machines are output of the process as well and they go back to service operations processes.

Customer contracts are taken into the process as an input as well and they are renewed before customer services are transitioned from the old production platform to the new platform. After renewal these contracts are standardised, and all customers get same quality service. Updated contracts are outputs of the process as well.

Data centre value-added services are applications that case company offers as managed service to its customers. These applications can include Microsoft Active Directory, Microsoft Exchange, Citrix Desktop environment etc. These applications are running on virtual servers and are transitioned with the virtual servers but need to be supported by the new production platform. Data centre value-added services in the new platform are an output of the transition data centre services process and after successful transition service operations support processes take care of these outputs.

In the transition data centre services process customer documentation is updated to reflect the current state of the customer environment. Updated documentation is an output of the transition data centre services process.

During process CMDB assets are imported to a new CMDB and after successful import old CMDB is cleared of assets no longer in the old production platform. Customer is now able to view their assets in a new service portal and depending on asset also control them from the new service portal. Old CMDB assets are input of the transition data centre services process and output is assets in the new CMDB and service portal. Data from the new CMDB also goes to billing processes where it is made sure that customer are always correctly billed for services they are using.

Customership itself is an input of the process as well. All the above inputs can be considered as being part of customership, but here it means that during transition customer is taken care of by transition team personnel and they handle communication with customer and do their best to keep customer happy and make transition as positive experience as possible for the costumer. After transition customership is in the new production platform and it is returned to account manager and service manager who normally handle customer relations processes. Hopefully customer feels that in the new platform they get better service than before. Customership can be considered an input coming from service operations processes, customer relations processes and from transition program

roadmap management. Roadmap management is handled by Transition Program Manager and Service Transition Manager, and they decide which customerships will be taken next into the process.

All the above inputs can be considered as transformed resources. Personnel executing the transition data centre services process can be considered as transforming resources. They are vital input for the process since they do all the work needed to get customer services transitioned from the old production platform to the new platform.

New capabilities to the production platform come from development processes and these are inputs to the process that need to be updated to the instruction documentation or personnel might need training to be able to transition assets with those new capabilities. These inputs provide updates to enabling systems and bring support for new data centre value-added services in the new production platform.

4.1.2 Enablers

Enablers make it possible to execute the transition data centre services process. They are systems and people who are needed by the transition team to execute the process.

Server automation is aggregate of systems that makes it possible for customers to control their server capacity from service portal. In transition customer servers are imported to the server automation system. Virtualization platform is vital part of this system and that is where customer virtual servers are running.

ITSM system handles ticketing and has CMDB in the new production platform. Service portal where customers can control their server capacity is part of ITSM system, so it is integrated to several systems as part of server automation.

Operating system patching, backup solution, anti-virus and monitoring solution are server value-added services, and these are offered to customers for their servers. Updates to operating systems can be installed on customer chosen schedule. Backups of customer servers can be taken based on SLA plan chosen by customer. Anti-virus protection can be installed for servers. Customer can choose a monitoring plan for their servers and automated tickets are created for service operations in case of any failures on servers.

The transition data centre services process has hundreds of pages of instruction documentation that describes how to perform technical tasks needed to onboard and migrate plus import customer assets to the new production platform.

Preparation scripts prepare virtual server's operating system for an import to server automation. They change and make sure that certain settings on operating system are set in a certain way.

Human resources department enables getting qualified personnel to do the transitions and execute tasks in the process. Offering department creates specifications for services that need to be productized for the new production platform. Development handles implementation of these services or capabilities. This needs to be done before customers with those services are transitioned.

Account managers and BID managers help transition team to create a quote for the new standardised contract that is compliant with billing processes.

4.1.3 Controls

Transition Program Manager leads the transition team and makes day to day decisions concerning the transition data centre services process. Program manager reports to a steering group which is responsible for setting wider goals for the transition team based on business requirements coming from executive team. Any risks or bigger problems are also brought to attention of steering group for them to decide how to deal with identified risks.

As well as instruction documentation is considered an enabler it can be seen as a control. Process should be executed in a way it is instructed in the documentation. Documentation should be up to date, and everyone should follow documentation for process output to be uniform.

Case company human resources department make sure that labour legislation and company working time policies are followed. This controls the transition data centre services process mainly because many of the transitions must be done outside normal working hours. There are many restrictions on when and how long employees are allowed to work. These restrictions come from labour legislation and company working time policies.

Goal of the restrictions is to make sure wellbeing and ability for employees to cope with their workload.

Customer timetables control when customer service transitions can be performed. Customer needs to provide a maintenance window during which their services are unavailable short periods of time multiple times.

Roadmap management which is conducted by Transition Program Manager and Service Transition Manager control which customer are taken into the process in quarterly basis.

4.2 Pre-study

The Pre-study subprocess is where a customer is thoroughly studied. A goal is to find out everything relevant about the customer that can affect later subprocesses of the transition data centre services. How challenging customer is in a technical point-of-view does not seem to affect a lot on how hard it is to conduct pre-study. It just seems to be more time consuming.

Appendix 1 show a process flow diagram of the pre-study subprocess. As can be seen from the diagram the pre-study subprocess is heavily responsibility of Service Transition Manager. Only filling of pre-study form task is sometimes performed by others and hand over meeting to onboarding requires presence of personnel participating in transition of customer services.

First thing to do when starting the process is to choose a customer to process. Roadmap management creates rough quarterly schedule of which customers to transition on which quarter. Following quarterly schedule Service Transition Manager choose customer based on high level analysis of customers. High level analysis of customers was performed when transition program started. High level analysis document is an excel-sheet containing a rough high-level description of customer services. When initial decision has been made first thing is to communicate with sales and make sure that customer in question is not customer that is leaving for some reason. To continue further processing customer, services mentioned in high level analysis for the customer need to be in most parts ready for production in the new production platform. Some small development

needs can be communicated to Offering department and Offering department can delegate to development teams. At this point customer is added to Kanban board where it's status through the whole process can be tracked.

Next task is to fill out the pre-study form. This task is conducted by Service Transition Manager or external consultants. General idea is to find out all technical challenges affecting transition of a customer as well as to recognise if there are any additional sales opportunities. One doing research on a customer need to go through billing to see customer services, cross-check with CMDB and customer documentation. One needs to check and make sure some certain things from technical systems like firewalls and load balancers. One needs to check from virtualization platform management console and cross-check capacity with billing and CMDB that everything is up to date. Any anomalies on billing should be reported to billing department. Tickets from the old ITSM system can be searched to find explanations for some anomalies. Besides filling the pre-study form an excel-sheet of server information is conducted which contains all necessary information needed in technical migration of servers. When server information form is filled by the person doing pre-study it is later sent to customer for them to add some required information from their side. At the moment pre-study form is something that could be made more logical. It has even sections that are considered pointless or have same information for every customer. Existing customer documentation can also be insufficient or hard to find. Filling of the pre-study form does not have such comprehensive instructions as other subprocesses have which might be one reason why there are more challenges for other personnel than Service Transition Manager who has designed the pre-study form. Sometimes people with less experience working with customer information can document some information way too detailed than what is needed or something relevant might be missing.

Based on the information that was gathered to the pre-study form Service Transition Manager reports any deficiencies or anomalies to correct stakeholders. The new platform needs to be capable of producing all services customer has. If there is some application or services that has not been transitioned before it needs to be trained with the test customer if possible. If there are any anomalies in the old production platform like insufficient documentation this needs to be dealt with service operations.

Service Transition Manager communicates with Account Manager and Technical Service Manager responsible for the customer if there are any business-related challenges. Service Transition Manager tries to find out how customer relation has been handled and what is best way to proceed to customer contact. Also, any additional sales possibilities are recognised.

After contacting sales Service Transition Manager contacts a customer. Sometimes this is done in cooperation with Account Manager responsible for a customer and sometimes Service Transition Manager can handle customer contact alone. When a customer contact has been established meeting is scheduled with a customer. This is usually Microsoft Teams meeting. Here the new production platform is presented. A demo of customer portals is held using the test customer. Things like customer satisfaction to current service or some needs they have can be discussed here briefly. Service Transition Manager tries to get verbal consent from a customer that contract negotiations for transitioning to the new production platform can be started. If there are challenges in this Service Transition Manager should contact Account Manager responsible for the customer.

Renewal of a customer contract is next task and Service Transition Manager needs help from Account Manager and BID-Manager. A new contract should be as standard as possible. A goal is to have a standard contract almost for all customers. A goal is to have the new production platform produce services in such standardised manner that there would be no need or at least very little need for any customisation per customer. This would also enable creating standardised contracts where reporting and service level agreements for example can be similar if not for all at least for majority of customers.

Last task before handing over a customer to the onboarding subprocess is hand over meeting with the transition team. Service Transition Manager schedules this meeting. Here the team goes through what services customer has, do they have some customisations and if there are any anomalies. Documentation and CMDB is reviewed if there are something special that need to be considered. According to interviews this meeting has not always been held and sometimes it has been held so that several customers have been dealt with in one meeting. There is strong opinion that this kind of meeting is very good to have, and it helps proceeding to onboarding. Especially Service Transition Coordinators like if there would be besides this some important points in written. E-mail or at the start of the pre-study form where one can easily spot those pointers.

After meeting customer is handed over to onboarding and Service Transition Coordinator takes lead in taking process further. With customers that have lots of different services, number of servers is large and technical implementation is more complex Project Manager takes the lead.

There have been customers that have been taken into the process and due to findings in the pre-study subprocess it has not been possible to progress customer to next subprocesses. In pre-study it has been discovered that customer has some service that the new production platform is not yet ready and there for it cannot be transitioned yet. These customers have been left to pending state. When capabilities to produce all services that customer have in the old production platform have been developed to the new production platform customer can be progressed to the onboarding subprocess. Also, there has been cases where the whole pre-study subprocess was performed and then found out that customer was soon terminating their contract. For this reason, communication with sales was added to customer selection task. Account Manager can tell if customer is leaving, and transition team doesn't have to do futile work.

4.3 Onboarding

Onboarding is where technical capabilities for providing service to customers in the new production platform is enabled. Clear instructions for performing onboarding tasks have been composed. Inside the transition team instructions are considered high quality since external consultants with no prior experience in IT field can complete onboarding tasks using those instructions with little or no help at all from more experienced personnel. Though all seem to agree that the instructions are good there are some small differences of opinion on quality of the instructions. Service Transition Specialists with more experience on IT consider instructions very explicit. External Consultants and Service Transition Specialist with less IT experience feel that there are some details that need clarification. They feel that those details are probably clear if one has experience in IT field.

From a technical point-of-view the onboarding subprocess is considered working very smoothly. It takes roughly a half workday for a person to onboard customer to ITSM system and server automation. Although tasks are manual configuration tasks automation of tasks is not considered necessary at the moment. It has been recognised by some

team members that there are things that could be automated, but it would require resources outside the transition team. Since with good instructions a person with no prior IT experience can quite quickly learn to perform onboarding tasks automation for onboarding is not considered top priority according to interviews. Onboarding tasks are similar for all customers, and it does not affect difficulty of onboarding whether a customer is a very small customer with only buying capacity or if a customer is a big customer with several different services running on their servers. There are only some factors that might mean that for some customers there is more work than others to onboard, but these are just repetitive tasks which take more time.

Coordination of onboarding subprocess works fairly well, but there are somethings that were mentioned in interviews that could be better. Delegation of tasks work mainly well, but according to interviews some feel it could be better. Often tickets are only mentioned in teams chat or briefly in a meeting to a person performing tasks in the ticket. Some feel that they should be more clearly assigned to a person responsible. Also, it might not always be so clearly marked to tickets if task is completed or not. There are three different systems where tickets need to be kept up to date which creates some confusion.

Appendix 2 show a process flow diagram for the onboarding subprocess. Customer is handed from the pre-study subprocess to onboarding in a hand over meeting. Service Transition Manager hand over customer to Service Transition Coordinator or in case of bigger customer to Project Manager.

After customer is handed over to Service Transition Coordinator or Project Manager ticket for onboarding server automation with relevant tasks is created and Kanban board with customer progress in process is updated. All necessary tasks are prioritised and delegated to Service Transition Specialists or External Consultants. After delegation Service Transition Specialists or External Consultants can perform technical onboarding tasks and Service Transition Coordinator or Project Manager can coordinate progress of the process.

First task for Service Transition Specialist or External Consultant is onboarding of ITSM system. This is performed using an automated form that can be found from the system. Service Transition Specialist or External Consultant fills in the form based on information that is gathered during the pre-study subprocess. Automated form creates customer company record to ITSM system and creates some necessary user groups for customer.

Service Transition Specialist or External Consultant should check that company record was correctly created. Next Service Transition Specialist or External Consultant configures knowledge base ready for knowledge articles and creates test user that can be used to test configurations made for a customer.

After successful ITSM system onboarding server automation onboarding is performed. It requires precision from person handling onboarding configuration. One little mistake can break some service or automated import workflow which is used in technical migration to import customer servers to the new production platform. Appendix 3 show a process flow diagram with tasks needed to accomplish for successful server automation onboarding. First needed networks are configured to network switches and other necessary infrastructure to enable networks for customer virtual servers. Customer IP address ranges are configured for IP Address Management system. Orchestration system for virtual servers is configured ready for customer virtual servers. Backend systems offering backup service for servers, anti-virus protection and monitoring need configuration tasks to be production ready for a customer. Software delivery for Linux as well as server management and Windows patching only need configuration in special cases, but it is good make sure there are no special cases. Remote access and auditing for servers is used to record what case company specialists do on customer servers. Using API calls some IDs from virtual machine orchestration is fetched. One needs to configure these IDs to ITSM system for a server automation related requests done from service portal to work. After these configurations of technical server automation onboarding tasks are done.

After server automation onboarding tasks are completed, configurations must be tested. Testing is performed by provisioning new virtual servers from the service portal using test user that was created during ITSM system onboarding. Several servers should be provisioned with different server configurations to test all services that are offered to a customer. Automated import workflow that is used during technical migration needs to be tested as well. This should be tested with all operating systems that will be imported using automated workflow.

In parallel with External Consultant or Service Transition Specialist performing onboarding tasks Service Transition Coordinator or Project Manager has several tasks to complete. Documentation in the old production platform needs to be reviewed and updated. This is done in cooperation with service operations personnel. All exceptions found in the pre-study must be covered with service operations. Documentation is updated and

transitioned to the new production platform. Documentation in the old production platform must be marked with information that up-to-date documentation is now in the new production platform. If documentation is inadequate in the old production platform it is responsibility of service operations to bring documentation up to date. Usually, service operations have updated the documentation, but sometimes the transition team members have had to update documentation themselves when it has seemed that service operations have no one to spare for updating the documentation.

Scheduling of maintenance windows for technical migrations is performed during the onboarding subprocess. Based on the server information excel-sheet sketching of schedule for maintenance windows can be started. It needs to be analysed how many servers in one maintenance window can be migrated. A customer must be asked if they have servers that can be migrated during business hours or if all servers need to be migrated during weekend or night-time. Also, if there is something that a customer needs to test after migration, they need to have resource for testing. Maintenance windows need to be scheduled so that all participating personnel get resting times required by labour legislation and company policies. Maintenance windows need to be coordinated internally, so that all systems needed for technical migration are online and not for example going through maintenance or update. Customers have been relatively understanding regarding maintenance windows. Even if sometimes a little longer maintenance windows have been needed customer has been forthcoming and showed understanding attitude towards migrations.

Next adequate resources for technical migrations need to be reserved. It must be made sure that no one else is doing technical migrations or at least they are such a small scale that available technical resources can accommodate needs of both migrations. Human resources must be reserved. Primarily transition team own Service Transition Specialists are used, but in case it is not possible IT professionals from other departments can be used. When migrating servers running some special application it might be required that level three specialist for this application is participating migrations with transition team or this specialist is available via phone if needed during migration. After resources are reserved final schedule for a maintenance window is locked and communicated to a customer. Now that maintenance window is locked, ticket to the old production platform ITSM system can be created, and service operations can be informed about the schedule of technical migrations.

It has been relatively easy to find human resources for technical migrations either from inside transition team or professionals from other departments if needed. From a customer side it has presented some challenges if a customer has for example some 3rd party service provider providing an application support for a customer. If this 3rd party needs to perform something to a customer services before migration getting resource from this 3rd party has presented some challenges. Also, it is sometimes hard to find out if there is some maintenance to company internal systems that might affect technical migrations. Or there might be information available that maintenance is scheduled, but no certainty how it affects technical migration or does it affect at all.

Updating documentation, scheduling technical migrations, and acquiring resources does not need be made in sequential order by any means. These tasks can be accomplished in parallel and overlapping which they often do.

When ITSM and server automation onboarding tasks are completed training for customer portals for customer representatives can be held. There are knowledge base articles to support training and links to those articles are sent for customer representatives. Training can also be held after the migration is performed if that suits customer better. It is not critical to have training at this point. Customer portal training is responsibility of Account Manager responsible for customer, but Service Transition Coordinators have conducted trainings for all customers transitioned.

If customer has some customisations and those are something that are needed in the new production platform as well it is last task of the onboarding subprocess for Service Transition Coordinator or Project Manager to make sure that those customisations have been made available in the new production platform as well. A goal is that there would be no need to make any per customer customisation and that all customers could use standardised service offered by the new production platform, but sometimes this is just not possible. Next customer progress to the migration subprocess.

It has been recognised that customer communication from initial customer contact made by Service Transition Manager until point where maintenance windows for technical migrations are scheduled by Service Transition Coordinator or Project Manager can take longer than desired. It is noted that customers don’t always remember what is discussed with Service Transition Manager in the first meeting. This results in lots of e-mail with questions regarding topics already covered. Service Transition Coordinator or Project

Manager then answers these questions during the onboarding subprocess, and this often adds day or two reply delays because the nature of e-mail. Also, it usually takes some time for customer to fill their part of server information form. This might be because there are things unclear for customer, or it is just not a priority for them. This communication issues considered to cost too much time.

4.4 Migration

The migration subprocess is where the actual technical migration of customer servers and services from the old production platform to the new production platform happen. It contains some preparative and post technical migration tasks, but the technical migration is the most labour-intensive part of the migration subprocess. Probably it is the most labour-intensive part in the whole transition data centre services process. Technical migrations are usually performed outside office hours because customer servers and services are business critical, and a customer wants to schedule downtime caused by the migration usually night-time or weekends. Since there are 90 customers and some need several maintenance windows for migrations, help from other departments is needed in this part of the process. This is also the part that arises concerns that migration team own specialists run out of legal overtime hours or exhaust themselves. More sustainable solution than overtime every weekend need to be found with human resources department.

According to interviews technical migration is considered most challenging part of the whole transition process. It requires that the pre-study and the onboarding has been thoroughly performed. If there are mistakes made earlier in the process it will cost time in migration and sometimes there is not lot of extra time.

Instruction documentation for the technical migration is considered good for basic Windows and Linux servers that won't have any special data centre value-added services running on them. It should be possible with this documentation for external consultants and other personnel with little prior technical IT experience to perform migrations to those basic virtual servers. Although more practise with test customer and some improvements to instructions have been requested to get more confident with the tasks. Unexpected problems are something that rise concerns amongst personnel with less prior IT experience since it is not possible to write instructions for every exceptional occurrence.

Appendix 4 shows the process flow diagram for the migration subprocess. The starting event is successfully onboarded customer. When customer is successfully onboarded and can be taken into the migration subprocess firstly CMDB data is created manually for assets that automation won't create during technical migration. Service Transition Coordinator or Project Manager is responsible that this gets done, but configuration is handled by teams' external consultants or specialist trained for the ITSM System.

Next task is called start technical migrations which is where Service Transition Coordinator or Project Manager make sure that all tickets concerning customer migration is up to date and that customer related documentation has mention that migrations are ongoing and customer servers and services will be on the new platform once migrations are completed. Also, at this point it needs to be clear what will be done to the open tickets concerning customer assets that will be transitioned.

Last thing before actually starting to migrate servers and services is to change customer state to "in production" at the ITSM system of the new platform. There are couple of settings that need to be configured to do this and communicate to service operations that customer is now in production. This is in principle Service Transition Coordinator's or Project Manager's task, but some configuration requires more privileged credentials than they have. It seems that it varies a bit when this task is actually done. It seems that sometimes it is actually performed at the end of technical migrations.

Appendix 5 shows the technical migrations workflow on a high level. There are mainly three different types of virtual servers that are transitioned to the new platform. Servers running version of a Windows server operating system that is still supported by Microsoft. Servers running few different Linux distributions that are quite common and are still supported by vendor. Then there are other operating systems that are transitioned. These are either older Windows servers, older or some uncommon Linux distributions, virtual appliance machines or servers running some applications which conflict with settings required for server automation and therefore cannot be imported to the server automation and are only migrated to capacity of new virtualization platform. These other types of virtual servers are considered a bit of a challenge since they can basically be anything and require lot of applying of knowledge during technical migration maintenance window.

Appendices 6, 7 and 8 show steps to complete transition of above-mentioned operating system types. As can be seen from the diagrams there are lot of manual tasks. These

are something that specialist need to perform mostly from graphical user interface. Instructions for completing these tasks are quite detailed for Windows server and Linux. If specialist follows instructions carefully transition usually goes well. For other type of operating systems transition needs more manual configuration since configuration tasks of automated import workflow needs to be performed manually for these types of virtual servers. Although it is not possible to offer all server value-added services for all these types of servers because all of them cannot be configured to all backend systems, which limits a bit of the extra manual labour.

For Windows server and Linux transitions specialist can do two servers so that their transitions overlap a bit. First specialist does first server to a point where he or she initiates automated import workflow and then start new server from the beginning. Automated workflow takes some time so specialist should be able to initiate the workflow for the second server some time before first server has completed the automated workflow. After the automated workflow is complete for the first server specialist can perform last steps to complete transition of the first server and start executing transition tasks for third server. When third server hits the point where it is added to automated import workflow specialist can execute finishing tasks for the server two which has most likely completed the automated import workflow by the time when third was added to automated import workflow. There are lot of detailed configurations to perform. If one tries to do too many things at a time it can easily lead to mistakes that might not fail the transition of server right away but later. This costs time and effort when one needs to start troubleshooting why something is not working. Besides this there are also problems that are caused by technical systems and need troubleshooting as well.

When maintenance windows for the technical migrations are scheduled, there are factors that affect how long maintenance windows are needed. Experience has shown that it is good to have one hour for preparing before actual work with server migrations start. It is good to reserve two hours for troubleshooting. If Maintenance window is estimated over six hours there should be lunch break. How much it takes time to migrate a one server depends on how experienced specialist is doing the migration, operating system of virtual server, which server value-added services are installed and how much hard drive is provisioned to the virtual server. For a server with couple of hundred gigabytes of provisioned hard drive it takes around three hours to complete whole technical migration for specialist who already has experience in several maintenance windows. This is if no problems are encountered.

During the technical migration Service Transition Coordinator or Project Manager has established a Microsoft Teams meeting with a customer, so that a customer can be kept informed when individual servers are transitioned, and a customer can test that everything works as it should. If some problems are noticed either by a customer or the transition personnel group call in Teams can be initiated and a troubleshooting with a customer can be performed. Service Transition Coordinator or Project Manager also, keeps service operations up to date of migration status if there are any problems during migration that might be concern of service operations. At the end of maintenance window Service Transition Coordinator or Project Manager also communicates the status of customer servers and services to service operations that they are up to date of customer status and can start to produce normal service to customer in the new production platform. Communication with both customer and service operations during technical migration has worked well.

Even though there are usually surprises during technical migrations, people involved think that performing technical tasks is something that has been working well. Customers have still been relatively easy, since they have been mainly customers buying just capacity and no complicated services. In the future when more challenging customers are taken into the process it also sets more challenges for performing technical tasks.

After the technical migration is completed for the servers scheduled for the maintenance window Service Transition Coordinator or Project Manager gathers list of migrated servers and delivers it to personnel familiar with the ITSM system which means external consultants or Service Transition Specialist with the ITSM system training. Based on this list correct CMDB relations are created for these servers during next business day. Some point this task was performed right after migration of servers, but it was decided that it can be done during next business day since there are no affects for customer services. Also, everyone participating migrations are tired at the end and there is bigger chance for error when tired.

A one thing to perform right after the technical migration is to configure the ITSM system customer portal ready for a customer to start using service such as ordering new virtual servers or creating service requests to service operations. This task is for Service Transition Coordinator or Project Manager to perform, but sufficient privileges have not been granted for them and therefore this task needs to be performed by Service Transition Specialist with sufficient privileges.

Rest of the migration subprocess tasks can be performed during following business days. First thing next business day for Service Transition Coordinator or Project Manager is to create a ticket for removal of any test servers used to test customer services in the new platform before migrations, and removal of workarounds configured to backend systems if any needed. Test servers need to be removed from a capacity as well as from the CMDB. Usually, Service Transition Specialists have performed these tasks, but sometimes Service Transition Coordinators might have removed test servers themselves.

Customer services in the new platform need to be tested after a successful migration of servers. This is conducted by following a test plan documentation. This has mainly been responsibility of Service Transition Coordinator or Project Manager, but where needed Service Transition Specialists help. In this task it is made sure that the customer portals work. A customer can access portals, reporting works, correct catalogue items are visible, a customer can provision new virtual servers, backups, and their reporting work, patching and their reporting work. Basically, everything a customer needs for controlling their assets and service is tested. It must also be made sure that billing works correctly. Some challenges for performing this task have introduced the fact that Service Transition Coordinators lack some privileges to the ITSM system that would make testing much easier.

After testing there is a transition check with service operations personnel. In this check many of the same things are covered that were tested in earlier task. Now there is also service operations point-of-view in the play. Service operations have made some remarks that there have been some problems with the documentation that is transitioned from the old platform to the new platform. This is partly because these transitions are new to everyone, both the transition team and the service operations. There has been some confusion in who is responsible of certain documentation and where and how it should be saved, or something need to be defined more clearly. There have not been any complaints in transition checks about how everything works on a technical point-of-view. It has been discussed that when more experience is gained on transitions whether a transition check is necessary or if it could be made more lightweight, maybe conducted with only e-mail. Some feel that for the easiest customers which several have gone through the process transition check is no more needed.

The old production platform is cleaned up of customer data when it is established that transitions have been successfully carried out. Customer assets are cleared from the old

CMDB. Customer “in production” status in the old CMDB is changed to false. A comment with a big red font is added to the old documentation that customer has been transitioned to the new production platform. All portals from the old production platform will be disabled for customer. Lastly transition ticket in the old ITSM system is updated with latest information and closed.

When a customer is successfully transitioned, and everything has been tested working Service Transition Coordinator or Project Manager facilitates a debriefing meeting. In this meeting it is discussed what went well, what did not go so well and what needs to do differently next time. The purpose is to try and refine knowledge how to execute the whole process better in the future. These meetings are considered useful for improving future technical migrations.

4.5 Volume, Variety, Variation and Visibility of Transition Data Centre Services Process

Volumes of processed units in the Transition Data Centre Services process could be measured in customers transitioned or maybe even better measure could be virtual servers transitioned. Customers might not be so feasible measure because some customers have around ten virtual servers and some have several hundred of virtual servers. Transition program was initiated early of April 2020 and during first 12 months of transition program four customers were completely transitioned. Besides these four there are two customers whose technical migrations have been carried out, but minor problems found out in transition check need fixing or customer is still waiting for a portal access or a portal training. If positive thinking is exercised here total transitioned customers is considered being six. It means one customer per two months. In numbers of transitioned servers this means 49 virtual servers and one physical server. 49 divided to 12 months means little over four virtual servers per month.

As mentioned earlier transition program did not get a flying start. Because of this October 2020 was the month when first customer transition was completed. If we start counting from October this means six customers in six months. Which is one customer per month. In numbers of virtual servers this means little over eight virtual servers per month.

These are not very high volumes. Much more is expected from Transition Data Centre Service process. There are around 90 customers and approximately 3700 virtual servers

to transition. With the same speed that transitions were completed from October 2020 to end of March 2021 it would take roughly 462 months to complete the transition program. To transition all the remaining servers between April 2021 and end of 2023 which was the initial goal for the completion of the transition program would require transition team to transition over 110 virtual servers per month. Besides this there are small amounts of physical servers to transition. Much higher volumes are expected while process evolves.

According to interviews easiest customers are something that have only bought capacity and they have standalone servers running in case company virtualization platform. They have no support bought from case company to any special applications and have no clustering solutions. On the other hand, customers that are from hardest end of the spectrum might have some applications with dedicated clusters or virtualization platforms that are customer specific. Customer might have big Citrix environment or database clusters. Transition of these is something that require more know-how and planning. In general, it can be said that there is a lot of variety in the output that Transition Data Centre Services process should be able to produce. Most affects variety has for resourcing and planning in the onboarding subprocess and the whole migration subprocess.

Six customers transitioned until end of March 2021 have been customers from the easy end of spectrum. Mostly just customers that have their virtual servers running on case company capacity and some server value-added services bought for those servers. This means that for now variety of the process has not yet been high. Same as with volume, process must be able to handle more variety in the future.

There is not lot of variation in Transition Data Centre Services process. All customers with their services should be transitioned as fast as it is possible. Customers can be taken into the process one after another. There is no seasonality or any other similar factor that would affect demand for the process. April 2021 there are several customers that have been taken into the process, but during pre-study it has been discovered that before customer can advance in the process some capabilities in the production platform need to improve before this can happen. There is a constant queue of customers to process. Only thing that can be considered introducing a variation is the fact that transition program had a slow start and if initial goal of transitioning all customers by the end of 2023 is kept then there is need to increase demand constantly for the rest of the transition program.

Customers do not have a very high degree of visibility into the process. During the pre-study subprocess Service Transition Manager has meeting with a customer where he tells in high level what will be done during process and what changes for the customer. Customer is informed that new contract will be drafted, and they get new service description documentation. During the onboarding subprocess Service Transition Coordinator or Project Manager might also go through with a customer what happens in the technical migration maintenance window from the customer point-of-view. Downtime for customer services and what is needed from a customer before or during technical migration is communicated to the customer. Technical migration maintenance windows are agreed with a customer during the onboarding subprocess as well. A lot of Service Transition Coordinator or Project Manager communication is conducted via e-mail and therefore is not very immediate and does not offer a whole lot more visibility into the process.

When Project Manager handles customer, it is sort of a customer that has more challenge and need more planning meetings held with Microsoft Teams which is more immediate communication and offer some more visibility for a customer inside the process. Also, a customer with more complicated services needs more information about how their services are transitioned, but no details of actual technical tasks is revealed to a customer.

During the technical migration possibility for a customer representative to participate in Microsoft Teams meeting and get real time information on how migrations progress is offered. Not always a customer representative participates. In this case status information is usually delivered either via e-mail or phone. This does add visibility to a customer what is status of their services but does not reveal what is actually happening in the migration technically.

After a customer has gone through the whole transition process, they have better visibility to their services through the new service portals, but this is no longer in scope of transition. This visibility is offered by service operations processes. Overall customers get general view what will happen in the process and why, but they don’t really get to see much how it happens and when it happens excluding few exceptions.

In general, it can be said that variation and visibility of the process are something that will stay quite the same until rest of the transition program. Volume and variety are both something that will need to increase for the Transition Data Centre Services process to

fulfil its purpose and transition all customer services from the old production platform to the new production platform. Below picture illustrates state of the process based on these four variables in April 2021 and estimated state of where process needs develop. Picture is based on figure 1.10 on Operations and Process Management (Slack et all., 2015). Since volumes need to be high and variety moderately high as well process must be flexible and able to adjust.

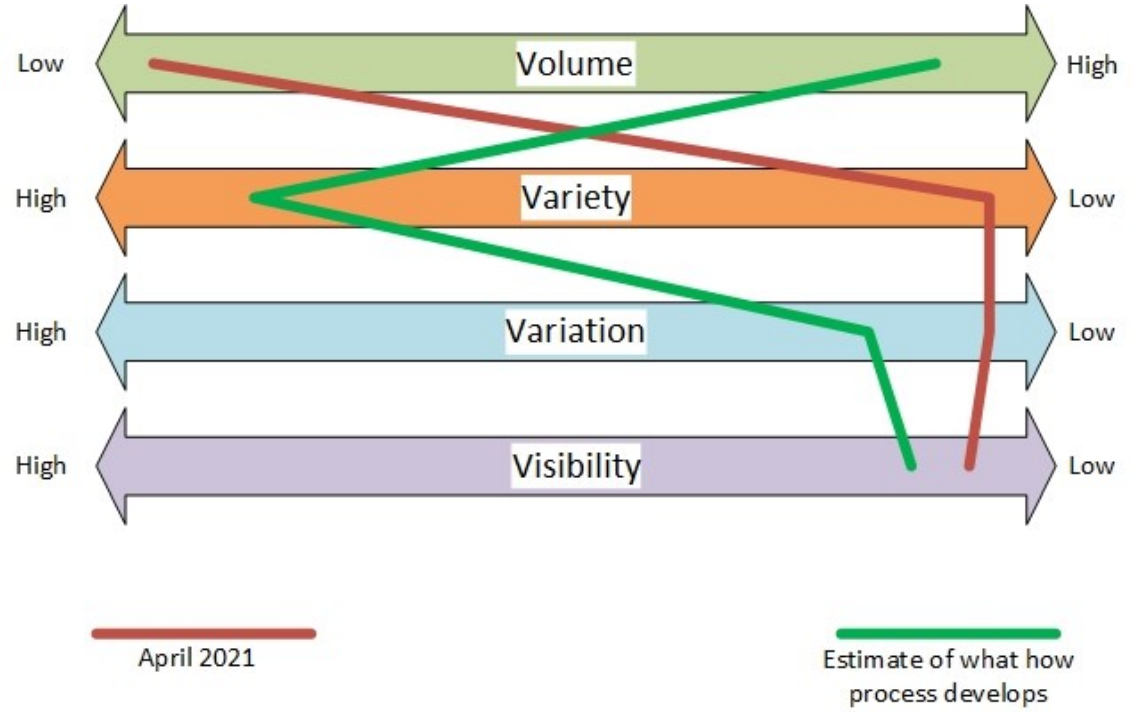


Figure 8 Analysis of Process Volume, Variety, Variation and Visibility

4.6 Process Type

With the Transition Data Centre Services process, it is somewhat difficult to determine the volume-variety position for the process. When comparing to current human resources volume of the process is quite high or at least expectations for the volume are high. Technical difficulty level of customers varies significantly. Easiest customers having only bought a capacity from the case company and hardest being a customer with customisations to services, some integrations developed, several data centre value-added services bought from the case company, a customer has some clustered applications and besides this customer can have several hundred of virtual servers.

Hardest customers are taken through the process as a project led by Project Manager. When considering process type for this kind of a customer it can be said that it falls under professional services. On the other hand, easiest customers can be considered mass services since their servers can be transitioned in very standard way with minimal planning. Customers to be transitioned are everything between these extremes and that's why there are customers with difficulty level where process type can be considered service shop as well.

Considering the above, flexibility is something that is needed from the process. For customers transitioned until April 2021 process has most likely been much more flexible than is needed, but in the near future when customer difficulty level start to rise flexibility is one of the most important factors for the process.

4.7 Layout

In high level the Transition Data Centre Services process resembles functional layout. On the other hand, subprocesses or some subprocesses in third level have layouts that resemble other layouts. The pre-study subprocess has a task of filling the pre-study form which is so labour intensive that it could be considered a third level subprocess. It might be a good idea to implement a functional layout for filling the pre-study form and arrange the form in a way that all the information gathered from one system can be easily gathered before moving on to gathering information from a next system.

Server automation onboarding is labour intensive in way similar as filling of pre-study form in the Pre-study subprocess that it could be considered a third level subprocess. Server automation onboarding is similar to all customers to a very high extent no matter what kind of services a customer has and has clearly defined steps and instructions manual for performing those steps. This clearly resembles product layout, and it is working well for server automation onboarding.

Technical migration on the Migration subprocess has three different main process flows to follow depending on some factors of a virtual server being migrated. An operating system being main factor. A correct process flow route is predefined by mainly an operating system type and its version. This very much resembles cell layout.

As mentioned above several different layout types can be identified from the Transition Data Centre Services process. These types vary from being typical to mass service all the way being typical to professional service types of processes.

4.8 Technology

The Transition Data Centre Service process utilize to a high extent technology that needs manual operating from humans. In the Pre-study subprocess tasks are such that it would be very hard to automate those tasks. Tasks involve lot of communication between case company internal stakeholders and some meetings with customer. Communication is handled via Microsoft Teams, e-mail, or phone. This is a very general-purpose technology and tasks are something that cannot be automated. Pre-study form where relevant information of customer services is gathered using Microsoft OneNote. Search of the information is quite manual labour as well, only search tools of individual systems like ERP or CMDB are used. It can be stated that the Pre-study subprocess uses general-purpose technology, but it can be scaled to use no matter if a small or a big customer is processed.

The Onboarding subprocess utilize quite manual technology as well. The Onboarding subprocess has also several communication tasks which cannot be automated. Of course, measures to minimize unnecessary communication can be developed. These can be something like better instructions for portal usage for customer or standardised forms to request information from customer. Onboarding of the ITSM system is handled by automated form.

The Server automation onboarding has several configuration tasks for backend systems. These are mostly performed using a graphical user interface of these individual backend systems. So again, lot of manual activities even though server automation tasks are highly similar for a every customer no matter what kind of services customer has, which means that there could be possibilities for automation. On the other hand, server automation tasks are well instructed and people with minimal experience from IT field can start executing those tasks. Technology used in onboarding subprocess also scale easily to all size customers.

The Migration subprocess has some tasks that are automated. Still a level of automation is quite low. Technical migration is something that has most potential for automating tasks according to interviews conducted for the study. An automated workflow which imports servers to the server automation is one example. This is quite dedicated technology and cannot be used for all servers that are migrated. There are also couple of scripts that prepare server for the import workflow. These are even more dedicated than the import workflow since different operating systems need different kind of scripts. Technical migration is something where it would be feasible to save time and therefore using dedicated technology to save this time would be beneficial.

In general, the Transition Data Centre Services process has lot of manual tasks using general purpose technology and due to nature of many tasks it is good for those tasks. On the other hand, there are especially some technical tasks that might introduce possibility for saving time when those tasks are automated using dedicated technology for automation.

4.9 Job Design

To execute the whole Transition Data Centre Services process, several different people execute tasks in different subprocesses. Some jobs in the process can be more closely defined than others. The Transition Data Centre Services process is documented, and it is written down what tasks should be performed, when and who should perform them. Some tasks are by nature such that they require person performing the task to apply their knowledge and experience. For example, customer communication related tasks which are responsibility of Service Transition Manager, Service Transition Coordinator and Project Manager to a high extent. Many of the technical tasks can be instructed to a high extent and one performing those should not deviate from instructions. Good example of this is the server automation onboarding. On the other hand, technical migration is also instructed with an instruction manual, but experience has shown that there are so much different kind of applications, operating system versions and configurations on servers that Service Transition Specialist needs to exercise creative thinking and apply knowledge and experience one has.

Technical migrations are something that would need more resources and optimizing. Division of labour might be something that would benefit performing of technical migrations. External consultants or Service Transition Specialist with less previous experience from IT field could participate more easily into technical migrations if they would not need to perform a whole migration, just part of it. Starting with easier tasks that do not tend to vary depending on a virtual server. It would be ideal that the team could utilize as much as possible their own resources for the technical migrations.

Majority of the team members are satisfied with their work content. This is the case when process is still quite early in its evolution. Roughly half of the people feel that they might need some sort of measures to keep interest towards process during the transition program. Other half feels that process gets more interesting to them because customers get more and more challenging from a technical point-of-view. Before the team reached maturity to perform the actual transitions there were situation that there was Project Manager who did not have projects to lead and Service Transition Coordinators who did not have anything to coordinate. So, for some roles there has most likely been times when tasks might not have been most motivating.

4.10 Performance

Flexibility is one of the most important performance objectives of the process. The transition team members need to be able to adjust to changes sometimes quickly and be prepared for surprises especially during the technical migrations. This requires good ability to apply knowledge acquired from the new production platform as well as a general knowledge of IT systems.

Quality must be kept high as well, and this has direct effect on service operations. If the Transition Data Centre Services process is unable to deliver high quality homogeneous output, it will cause more work for service operations personnel when they run day to day services for customers after the transition. This will increase costs which of course is the opposite what the case company is trying to achieve by transitioning services to the new production platform.

Speed is something that must be increased by the transition team to meet their goal of transitioning all customers by the end of 2023. Customer throughput times must be decreased, number of customers in in-process inventory must be decreased. Some parts of the process could also utilise better transition team own resources.

Dependability of the process requires some improvement. Customers in general doesn't seem to be that concerned when they are transitioned to the new production platform, and they don't even know when they enter the process. A customer is contacted first time after already in the process. But even when informed they don't seem to rush it, it is opposite of that and sometimes it is hard to maintain contact with a customer for transition related issues. When getting to stage where the technical migrations are performed dependability gets important because if timetables do not hold and process does not deliver on time it does not look very professional. This effect the image of the whole case company. Internally it makes scheduling for the technical migrations very hard if the process cannot deliver on time. There have been some issues that not all servers scheduled to maintenance window have not been migrated due to some problems. Not all the problems are result of the transition team actions. There have been problems with technical systems that are not a responsibility of the transition team. If there are these dependability problems, then customer is trapped between two services platforms longer than needed which is not an ideal situation. This makes everything harder for service operations personnel running everyday service.

The process is still very young and can for sure be developed to perform better and take costs down in terms of a process waste. There is no excess capacity, quite the opposite the transition team will need help from other case company departments in the future. There are also not too many capabilities in the process that would make unnecessary cost. The transition team still need to develop their capabilities and knowhow to be able to transition all customers. Problems with input cause some delays to process, but this is not really a fault of the input since all customers need to be transitioned. This delay is usually something that in the pre-study is discovered that customer has some service that is not yet ready in the new production platform and customer then needs to wait in-process inventory until support for that service is developed to the new production platform. To minimize costs of the process it needs to be constantly developed. Process description needs to be kept up to date, so that all responsibilities are clear even if process and environment around changes. Instruction manuals should be kept up to date and clear to minimize human errors. This is especially important when getting help from

other departments that instruction manuals are very clear, and everybody execute the process same way.

4.11 Configurations

Most labour-intensive tasks in Transition Data Centre Services such as fill out of pre-study form, onboard server automation and technical migrations of individual server are now configured for long and thin configuration where one person executes all activities in a task. These have shaped in such a way just naturally and it would be feasible to view these configurations critically. It might be beneficial to arrange them to two or more stages and divide activities to a several people.

Now there is no cycle time in terms of how many customers in given time is transitioned that is required from the whole process and this would not be very feasible even to have since customers are different in size and technical challenge that transition of some customers just take much longer than others. It would be more feasible to set a cycle time of one server for technical migrations even though this would not be without problems either since three different main types of virtual servers to migrate, quite common intermittent problems with technical systems, different data centre value-added services, surprises found from customer servers and different sized hard drives. Besides afore mentioned factors duration of the automated import workflow varies depending on which server value-added services customer select for each server. When maintenance window duration and number of servers in one maintenance window is decided it is based on previous experience and factors mentioned above. Although it is possible to make rough calculations for cycle time and capacity for individual maintenance window.

Table 9 has timing data for activities needed to perform the technical migration for Windows server and Table 10 for Linux.

Table 9 Execution Time for Windows Server Migration Tasks

Task	Time consumed (Windows Server)
Prepare VM	1min 20s
Create VM Backup and snapshot	4min 23s (+5min for actual backup processing)
Remove old software agents	4min 36s
Migrate VM to temporary storage	2min 5s (+11min 9s / 100GB for actual migration process)

Power off VM	1min
Remove VM from old virtualization platform	53s
Add VM to new virtualization platform	1min 25s
Update VM Virtual Hardware	37s
Configure network for VM	1min 2s
Power on VM	1min 29s
Update VM virtual hardware drivers	1min 54s
Reserve production IP address from IPAM	1min 2s
Reserve management IP address from IPAM	0s
Configure management IP to VM OS	0s
Install management agent and create management credential	2min 3s
Fetch VM ID information	51s
Configure VM ID information to server automation	1min 23s
Test management credential	47s
Import server to server automation (automated import workflow initiation)	3min 19s
Automated import workflow	1h 11min 44s
Restart server	1min 20s
Verify VM is correctly added to backend systems	8min
Verify that CMDB is coherent	1min 38s
remove VM snapshot	7min 20s (including processing time of deletion)
Migrate VM to final storage	6min 15s (100GB Hard Drive)
Total	2h 22min 35s

Virtual server used for timing of activities in Table 9 is a Windows server with default configurations of the old production platform and it is imported to the new platform with all server value-added services. Appendix 6 show activities in a process flow diagram that correspond to ones in Table 9.

Table 10 Execution Time for Linux Migration Tasks

Task	Time consumed (Linux)
Prepare VM	1min 17s
Create VM Backup and snapshot	4min 12s (+3min for actual backup processing)
Migrate VM to temporary storage	2min 31s (+2min 58s / 50GB for actual migration processing)
Power off VM	36s
Remove VM from old virtualization platform	49s
Add VM to new virtualization platform	1min 59s
Update VM Virtual Hardware	51s
Configure network for VM	1min 8s
Power on VM	1min 33s
Reserve production IP address from IPAM	1min 34s
Reserve management IP address from IPAM	0s
Configure management IP to VM OS	0s

Install management agent, create management credential, and remove old software agents	6min 12s
Fetch VM ID information	1min 11s
Configure VM ID information to server automation	1min 6s
Test management credential	1min 8s
Import server to server automation (automated import workflow initiation)	2min 46s
Automated import workflow	1h 6min 16s
Restart server	1min 8s
Verify VM is correctly added to backend systems	9min 32s
Verify that CMDB is coherent	1min 43s
remove VM snapshot	42s (including processing time of deletion)
Migrate VM to final storage	2min 54s (50GB Hard Drive)
Total	1h 57min 6s

Virtual server used for timing of activities in Table 10 is a Linux server with default configurations of the old production platform and it is imported to the new platform with all server value-added services. Appendix 7 show activities in a process flow diagram that correspond to ones in Table 10.

As described in chapter 4.4 one can do two servers in parallel. The way this parallel execution of process is done makes it feasible to divide migration into three sections. First one is activities before automated import workflow, second one is automated import workflow and third one is activities after automated workflow. Table 11 show Windows Server completion times for three sections mentioned and Table 12 completion times for Linux.

Table 11 Completion Times for Three Sections of Windows Server Migration

Section	Time consumed (Windows Server)
Section 1	46min 18s
Section 2	1h 11min 44s
Section 3	24min 33s

As can be seen one has time to finish section 1 and section 3 during section 2 when migrating Windows Server.

Table 12 Completion Times for Three Sections of Linux Migration

Section	Time consumed (Linux)
Section 1	34min 51s
Section 2	1h 6min 16s

Section 3	15min 59s

As can be seen one has time to finish section 1 and section 3 during section 2 when migrating Linux.

Figure 9 is a rough graphical presentation of how sections are executed in a way described in chapter 4.4.

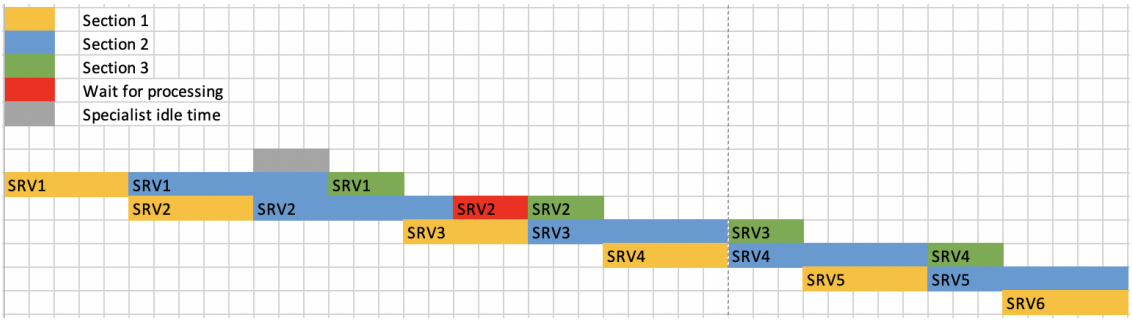


Figure 9 Graphical Presentation of Technical Migration

As can be seen from Figure 9 way the technical migration is performed now does introduce some idle time for specialists performing the activities and sometime where server 2 needs to wait for processing. This way of executing activities starts to perform optimally when server 3 automated import workflow is initiated. Experience tells that four servers per maintenance window for one specialist is a maximum, so at no point does the process reach utilization that it would be capable starting from server 4 if the process would continue with several more servers.

Graphical representation is obviously rough. It does not take into consideration brakes required by specialists; it is not minute accurate and using that model one cannot mix between Windows and Linux server. Anyhow it does indicate points with low utilization which might suggest that something could be done more efficiently.

Based on the model a rough cycle time for first three servers can be calculated as well as a rough cycle time for servers starting from server 4. For Windows Server with values based on Table 11 it would take total of 4 hours 45 minutes and 10 seconds for one specialist to complete his or her first three virtual servers. By dividing this with three gives us rough cycle time of 1 hour and 35 minutes. Starting from server 4 it can easily be seen

from Figure 9 that cycle time is roughly the same time that it takes automated import workflow to complete. Roughly 1 hour 11 minutes.

Same calculations for Linux based on Table 12 give for first three servers rough cycle time of 1 hour and 18 minutes. Starting from server 4 it is roughly 1hour and 6 minutes.

This model is better for Windows Server than it is for Linux since for Windows Server section 1 plus section 3 are much closer to the time it takes to complete section 2. For Linux it will suffer for some underutilization since section 1 plus section 3 falls short over ten minutes from time it takes to complete section 2. Although with current model there is not really tasks to fill those ten-minute gaps with anything.

These measurements and calculations could be used as a rough base when estimating how long maintenance windows are proposed to the customer or if customer has strict requirement for the length of maintenance window, it could be used to calculate how many specialists is needed. This also suggest that changing configuration for technical migration might improve throughput times for servers. As said model is rough since it does not take variability into account.

4.12 Variability

There are factors that introduce variability to the Transition Data Centre Services process. Different types of services and environments that customers have require the process to produce many kinds of output. Technology malfunctions have caused delays for the process. Sometimes there are problems with processing particularly in technical migrations. If one makes mistake in certain activity, it might mean that one must repair damage that has happened and go back several activities for new attempt for correct processing. These all introduce variability to the Transition Data Centre Services process and are result of technology failures or human error.

Failures in technology are something that the transition team cannot have direct effect on. Of course, proactive dialog with development teams can ease the problems. Human errors most likely happen in technical tasks. These are something that just require precision, patience or possibly automation where possible. Also, instruction documentation should be reviewed and updated regularly.

Process and subprocesses are such nature that using synchronization does not seem feasible. There is not constant flow of customers one after another trough whole process, most likely there is buffer of customers gone through pre-study. Customers don't and can't always progress in same order they first entered the process. Several customers can also be onboarded and ready for migration but must wait for available resources to perform the migration subprocess. The technical migration is task where constant flow of units is being processed. Although here the number of units to the process is known and until there is units to process the utilization of the process can be kept relatively high. Persons performing migration can just keep processing a next unit when they have finished previous one until all is processed. Due to factors that transition team has no control over the Transition Data Centre Services process needs to cope with variability.

5 Improvement Suggestions for Process

This chapter contains improvement suggestions for the Transition Data Centre Services process. First there are some general improvement suggestions that affect the whole process. After that some improvement suggestion that are specific for subprocesses are presented. Most optimisation needs seem to be in the Migration subprocess, and biggest improvement suggestions concern the Migration subprocess. Suggestions are based on interviews, documentation researched, workshops, team internal meetings and own experiences of the author.

The Transition Data Centre Services process evolves rapidly with more challenging customers. Due to this it would be beneficial to check all the subprocesses at least once in half a year to see that the way the process is executed is still valid. And, to make sure that the process description is up to date. The Process description easily falls behind when people find out better ways of doing things in a daily work. These better ways should be updated to the process description.

All the existing instruction documentations for the processes should be updated regularly. There are often changes to technical systems that alter the way how some configurations are performed. Team members need to be able to trust that they do configurations correctly when they follow the instruction documentation. This is especially important if a team member has not performed some configuration for a long time and has no fresh recollection of the configuration. To ensure this a document owner should be assigned to each instruction document. Responsibility of a document owner would be to make sure the document is up to date and if not he or she will make sure it is updated. Updater does not necessarily need to be the document owner. Updater can be a person who knows best what needs to be updated. Responsibility of the document owner is to make sure that documents are updated no matter who from the transition team updates them.

To be able to meet the demand for increasing number of migrations specialists outside the transition team need to be used for technical migrations. Specialists who want to participate need to be obligated to thoroughly read through all necessary technical instructions. This obligation should be agreed in co-operation with the supervisor of the specialist participating. List of systems and sufficient privileges to those systems should be drafted. Specialist participating the migrations needs to make sure that he or she has

those sufficient privileges. If not, it is responsibility of the specialist to apply for all necessary privileges. Specialist participating also need to adhere to schedules possibly month or two in the future.

5.1 Pre-study

Pre-study form should be renewed. It should be rationalised to resemble functional process layout. Information gathered for the pre-study form should be grouped together so that information can be gathered system by system and not randomly as it is now performed. This does not necessarily mean that field order in the form is changed. Colour coding for the form to indicate different system with different colours would help gathering of information in systematic order. Table 13 represent number and order of systems needed when gathering information to pre-study form.

Table 13 Order of Different Systems Needed for Gathering Pre-study Information

Required information	Information source	Colour code
Piece of information #1	Intra	
Piece of information #2	CMDB	
Piece of information #3	Billing system	
Piece of information #4	ERP	
Piece of information #5	Billing system	
Piece of information #6	Parent Company ERP	
Piece of information #7	Billing system	
Piece of information #8	Intra	
Piece of information #9	Virtualization Platform	
Piece of information #10	Documentation	
Piece of information #11	Billing system	
Piece of information #12	Billing system (customer portal side)	
Piece of information #13	Reporting portal	
Piece of information #14	Billing system	
Piece of information #15	Virtualization Platform	
Piece of information #16	Billing system	
Piece of information #17	Documentation	
Piece of information #18	Billing system	
Piece of information #19	Documentation	
Piece of information #20	ITSM system	
Piece of information #21	Excel sheet	

Piece of information #22	Billing system	
Piece of information #23	CMDB	
Piece of information #24	Documentation	
Piece of information #25	Monitoring system	
Piece of information #26	Backup system	
Piece of information #27	Patching system (Windows)	
Piece of information #28	Patching system (Linux)	
Piece of information #29	CMDB	

As can be seen from Table 13 there is plenty of information to gather from several systems and jumping between these systems. A Colour coding would ease the task so that with one quick glimpse one can see for which fields information can be found from same system. No more unnecessary logins and logouts and timed-out sessions.

More detailed instructions for gathering the pre-study information would be beneficial. Instructions on how to find relevant information from all the needed systems similar ways as server automation onboarding and technical migration have been instructed. This way anyone could start performing pre-study task. Even if resource for doing this task would be someone outside the transition team.

Lengthy customer communication times could be decreased with an information package that is delivered to the customer after Service Transition Manager has had a first meeting with the customer. Information package should contain from the customer point-of-view what does the transition mean. What is required from the customer to complete the transition? What does the customer benefit from the transition? How does the technical transition affect customer services? Material should include frequently asked questions as well. This way customer could reference the material for the most common issues related to the transition instead of lengthy e-mail conversation. Also, when communicating that something is needed from customer a deadline should be communicated. Even though of course the transition team cannot order customer to obey those deadlines it still might speed up things since there is some deadline.

5.2 Onboarding

Improving the customer communication with information package mentioned above is probably even more improvement to the onboarding subprocess than it is to the pre-

study subprocess. This would help Service Transition Coordinator or Project Manager who is responsible of discussing matters with customer that this information package should contain.

More clear visibility of schedules is required for the transition team. This could be accomplished with simple shared calendar where all migrations are added. All team members should have right to modify the calendar. Here Service Transition Specialists could also mark time when their personal life prevents them from participating in weekend, evening, or night-time technical migrations.

A weekly meeting where schedules of future technical migrations is covered. Service Transition Coordinators and Project Manager go through customers they are handling. Any preliminary schedules or confirmed schedules as well as Service Transition Specialist personal life schedules should be covered so that everybody has understanding when it is possible to perform migrations.

Delegation of work should be improved by assigning ticket in the ITSM system to person who is responsible for completing task or tasks in the ticket. Very good example of scenario where this should be used is onboarding of server automation.

Although technical side of the onboarding subprocess is considered working well there are tasks that would be feasible to automate. Automation here reduces risk of errors and makes sure that everybody performs these tasks in a same way. From the Appendix 3 one can see that all tasks are manual configurations. Configuration of virtual machine orchestration should be automated. The other task that should be automated is configuring ITSM system for server automation. These two have most configuration steps and would save most time and reduce most errors. Table 14 shows how much time it takes to perform the configuration of each technical onboarding task. Tasks have been timed by a person who is most familiar with performing the tasks. In this example two different networks had to be configured and customer servers are in one data centre. Linux Software Delivery and Server Management and Windows Patching use shared systems so there was no need to do any configuration for them which is case for majority of customers. Therefore, it took zero minutes to perform those tasks.

Table 14 Timed Values for Performing Technical Onboarding Tasks

Task	Duration
Configure VLANs for Network Switches	15 min
Configure Networks for Virtualization Platform	4 min
Configure Networks for Virtualization Platform Hosts	15 min
Configure IPAM for Customer networks	16 min
Configure Virtual Machine Orchestration	16 min
Configure Backup Value-added Service	16 min
Configure Anti-Virus Value-added Service	1 min
Configure Monitoring Value-added Service	3 min
Configure Linux Software Delivery	0 min
Configure Server Management and Windows Patching	0 min
Configure Server Remote Access Management and Auditing	3 min
Fetch IDs from Virtual Machine Orchestration for Later Use	3 min
Configure ITSMS for Server Automation	48 min

The configuration of virtual machine orchestration took 16 minutes. Configuring IT Service Management System for server automation took 48 minutes. According to interviews virtual machine orchestration should be automated by script. User enters required information according to script prompts or adds required information to a file where script reads the information and then user runs the script. For IT Service Management System, a form can be created where user enters required information and based on that information correct configuration is created by automation in IT Service Management System. This should save time and reduce errors and different ways of doing configuration. Rough estimate is that after automation it would take five minutes to complete each automated task.

5.3 Migration

Communication to internal stakeholder groups about progress of technical migration should be improved. Server information excel sheet drafted during the pre-study subprocess could be used to communicate almost real-time status of individual customer servers to internal stakeholder groups. Status of the customer server should be clearly presented in the server information sheet. Server information sheet should be made public inside case company and links to the server information sheet should be shared to all

communication channels. Excel sheet needs to be password protected so that only transition team members can modify excel sheet and all others can only read the file.

To clarify communication about customers inside the transition team and clearly separate discussion about different customers there should be Microsoft Teams channel created for every customer. Naming should be “INTERNAL [Customer Name]”.

It would be feasible to change the way that human resources are used for technical migrations. Transition team’s two more experienced Service Transition Specialists should take a lead role in technical migrations. In one technical migration maintenance window there is one lead specialist from transition team and the other personnel is from other departments of case company or possibly transition team external consultants. A Lead specialist can perform troubleshooting if problems appear and communications with customer during maintenance window. Service Transition Coordinator is participating maintenance windows only for customer communication reasons and these duties could easily be handled by lead specialist. Lead specialist could also transition one server that is type other. Transition for this other type of server is presented in Appendix 8. Server types can be seen from Appendix 5. Lead specialist should not perform more than one transition that he or she has time for trouble shooting and customer communication. In theory this would double the amount of maintenance windows that can be performed compared to way that both more experienced specialists are always working in the same maintenance windows. Also, when customer communication is given to lead specialist Service Transition Coordinator or Project Manager doesn’t need to participate and overtime compensation is saved.

Some changes to task order in the migration subprocess would be reasonable as well. There are tasks in the technical migration that could be performed before the technical migration, during previous business day. This would save time in a maintenance window and possible allow more virtual servers to be processed in a one maintenance window. These tasks are “prepare vm”, “migrate vm to temporary storage” and “reserve production IP address from IPAM”. Appendix 9 shows a migration subprocess with a new task. This task is technical preparation activities. This contains activities from the afore mentioned tasks. There is one exception which is silencing alarms of server to be transitioned. This activity is moved as a task to be performed early in technical migration. This is done by one specialist for all servers. Appendix 10 shows when this happens.

Task “migrate vm to temporary storage” is something that might not always be possible to perform during previous business day if customer has some application that is sensitive to even slightest increase in latency. If the customer does not allow migrating to temporary storage before maintenance window, then this task should be performed where it was previously done. For vast majority of servers this task should be possible to perform during previous business day.

One activity for the technical preparation activities should be added that was not earlier part of the process. This is to locate and test credentials for the servers.

Besides these changes it would be possible to automate with scripts “create vm backup and snapshot” task and “remove old software agents” task for Windows. For Linux this is already automated.

Technical migration for Windows server and Linux should be divided to two stages. Stage one is more challenging and more likely to have problems. It contains tasks that are needed to transition server into the new production platform. Stage two contains tasks that are needed to check that a server is successfully added into new backend systems and migrating a server to a final storage. Stage one is more demanding and therefore should be performed by specialist with previous experience in information technology. Stage two would be good for transition team less experienced specialist or external consultant. Appendix 11 shows these stages for Windows server and Appendix 12 for Linux.

Table 15 shows duration of stages for Windows server and Linux virtual servers. Values are derived from data that can be found from Table 8 and Table 9. Times of tasks that were moved somewhere else in the process are removed from the total time of the stage. Tasks that were suggested to be automated have been given estimated duration of two minutes of preparing the script and running it.

Table 15 Completion Times for Migration Stages

Stage	Time
Stage one (Windows Server)	25min 43s
Stage two (Windows Server)	24min 33s
Stage one (Linux)	24min 19s
Stage two (Linux)	15min 59s

From Table 15 it can be seen that stage one and stage two for Windows server take roughly the same time. For Linux stage two is little over eight minutes shorter. This of course varies based on hard drive size of the server. But if there is lot of Linux servers in maintenance window it might be feasible to analyse if there is no need for as many stage two performers as there is for stage one performers. Stage two performers can start their work roughly one and half hours after stage one performers have started since there won't be anything to process for Stage two before first servers have gone through the automated import workflow. Personnel performing stage one can finish work when they have added virtual server to automated import workflow and there are no more servers to process. Lead specialist is the only one of more experienced specialists who should stay until stage two personnel are finished as well. He or she performs trouble-shooting and customer communication during maintenance window.

Dividing technical migration to two stages is a way of trying to get rid of specialist idle time and time that server need to wait for processing that was discussed in chapter 4.11 and visualised in Figure 9. It should also improve the use of the transition team own resources.

6 Discussions and Conclusions

Objective of the thesis was to find ways of improving the Transition Data Centre Services process by decreasing the time it takes to execute the process and minimize errors in the process. As a result, this thesis contains suggestions for improving the process.

Information for improvement suggestions is gathered with authors hands-on experience of the process, going through hundreds of pages of process documentation, conducting interviews of several transition team members, and gathering information during some meetings and workshops.

Many of the factors that slow down the Transition Data Centre Services process are factors outside of the process itself and are therefore also outside the scope of this thesis. It might be a good idea to conduct a study of the whole development of the new production platform and the transition program together. This would need a mandate from a manager higher in the organization than just Transition Program Manager. The new production platform and getting customers to the new platform being top priority for the case company would easily justify this kind of a study. Hopefully it would find ways to increase collaboration between offering, development and transition teams and help prioritize the needs of the transition team.

Problems and slow start with the transition program makes wonder if the program was initiated too early. Maybe it would have been feasible to develop the new production platform capabilities a bit further before initiating the transition program. On the other hand, the transition team was able to help with many issues regarding the production platform.

Improvement suggestions in this study for the process are all concrete suggestions on how to decrease the time it takes to process customer's servers. And, how to decrease the number of errors occurring in the process.

The Transition Data Centre Services process is demanding and does set challenges for managing it since it has quite high requirements for both volume and variety. Every customer and almost every server to transition being different requires flexibility from the process. It seems quite clear that with current model the Transition Data Centre Services process cannot achieve its target deadline.

The biggest bottleneck is clearly how much technical migrations can be performed with the resources that the transition team has. This can be improved by rearranging how the transition team own specialists are utilized and by acquiring more resources from other departments. This brings flexibility on human resource wise. The improvements proposed in chapter 5.3 would hopefully nearly double the amount of technical migration maintenance windows that could be booked. Hopefully proposed improvements also increase the number of transitioned servers in one maintenance window. For future improvements if there prove to be eager and capable specialists in other departments it might be a good idea to train lead specialists from those individuals as well which would enable even more scheduled maintenance windows.

If the measures suggested for the migration subprocess are not enough more technical personnel to the team should be recruited or case company needs to reconsider the target deadline of the transition program. There are some minor tasks that could still be automated later after the ones suggested in this study, but they are smaller tasks that might not decrease the overall processing time significantly. On the other hand, automation of those tasks might reduce number of errors.

Automation suggestion for the onboarding subprocess does not necessarily affect time wise in a big picture a lot. With the remaining customers maybe roughly two weeks' worth of work when there is two and a half years until target deadline. Decreased number of errors and uniform configurations might give more advantageous benefits from these automation improvements.

Improvement suggestion for customer communication during the pre-study and the onboarding subprocesses hopefully ease the job of Service Transition Coordinator and Project Manager as well as decrease the time it takes to explain customer what it is that transition team is actually doing. Information package for customers should be constantly updated with answers to frequently asked questions. Information package could be further developed by making a survey to customers after the whole transition for an individual customer is over. What kind of information, they feel would have been useful for them before the transition? Customer might have some good ideas after the transition.

Since there is so much variety in the Transition Data Centre Service process all the improvement suggestions cannot generalise to all customers and servers being transitioned. This concerns mostly the migration subprocess. Sometimes it is not possible to

use all the improvements suggested. It should be carefully analysed for each customer which improvements can be used. This being said the improvements found in this study are valid for majority of customers. The Pre-study subprocess and the Onboarding subprocess are very similar for all customer and therefore improvements for these subprocesses should generalise very well.

References

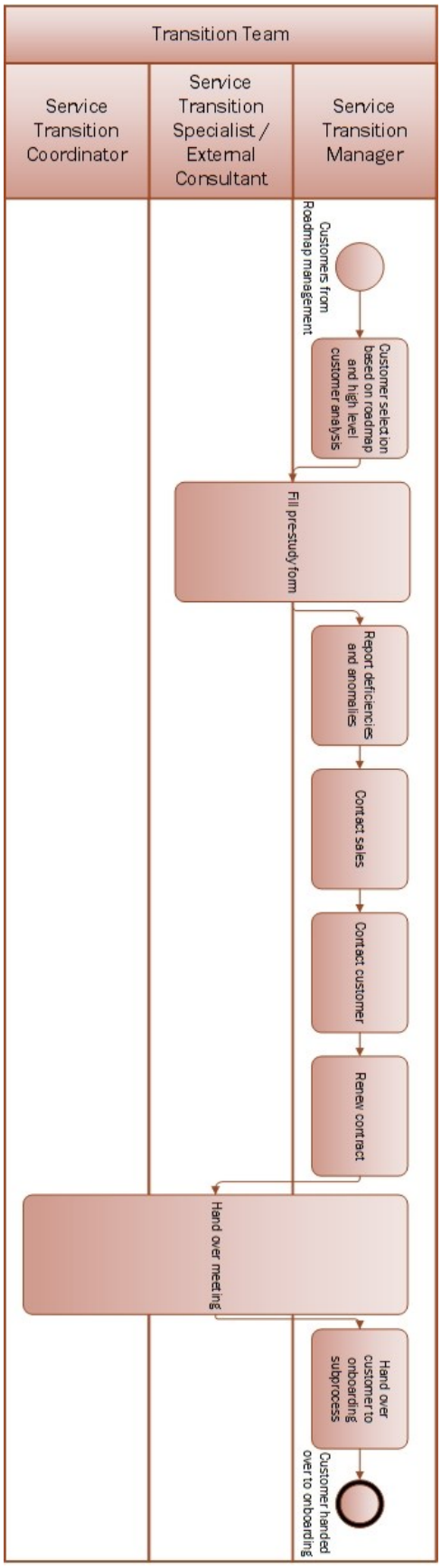
1 Slack N, Brandon-Jones A, Johnston R, Betts A. Operations and process management. 4th ed. Harlow: Pearson Education Limited; 2015.

2 Harmon P. Business Process Change [Internet]. 4th ed. Cambridge: Morgan Kaufmann; 2019 [cited 6 September 2020]. Available from: https://learning.oreilly.com/library/view/business-process-change/9780128158487/

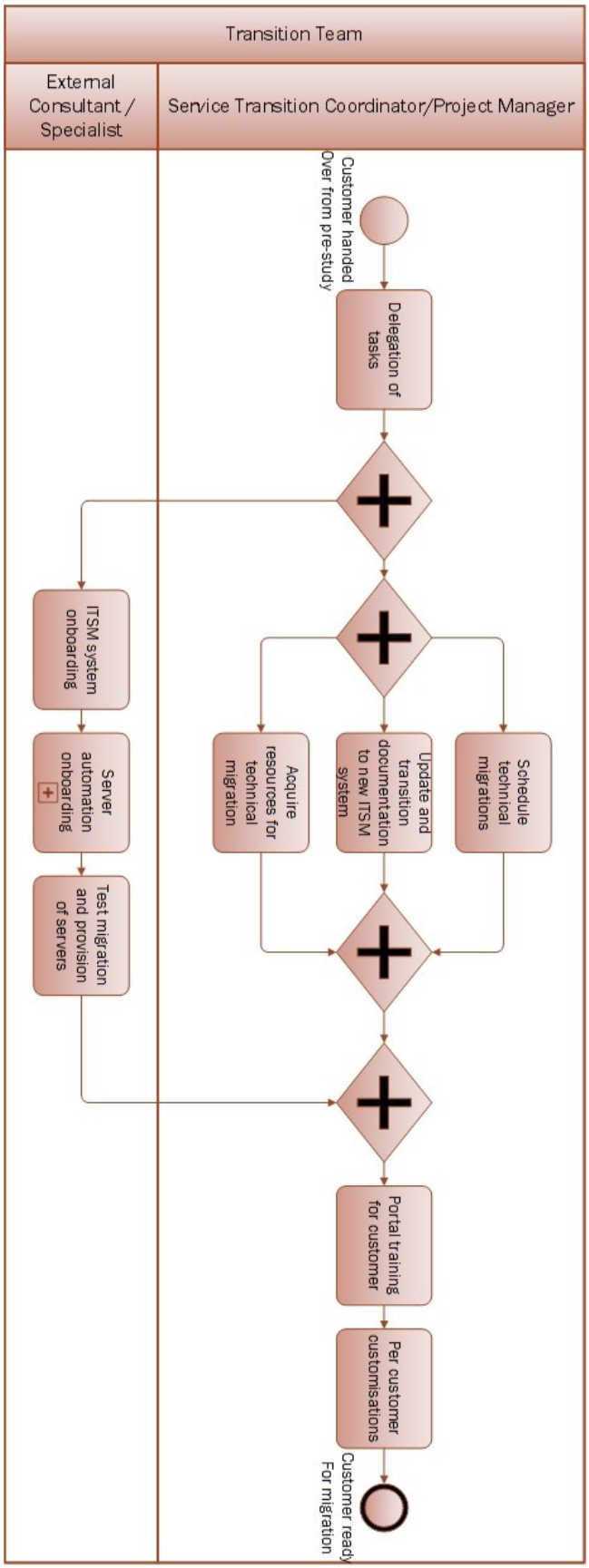
3 Sharma C. Business Process Transformation [Internet]. New Delhi: Springer India; 2015 [cited 6 September 2020]. Available from: https://link-springer-com.ezproxy.metropolia.fi/book/10.1007/978-81-322-2349-8

4 White S. Introduction to BPMN [Internet]. BPTrends; 2004 [cited 2 September 2020]. Available from: https://www.bptrends.com/bpt/wp-content/publication-files/07-04%20WP%20Intro%20to%20BPMN%20-%20White.pdf

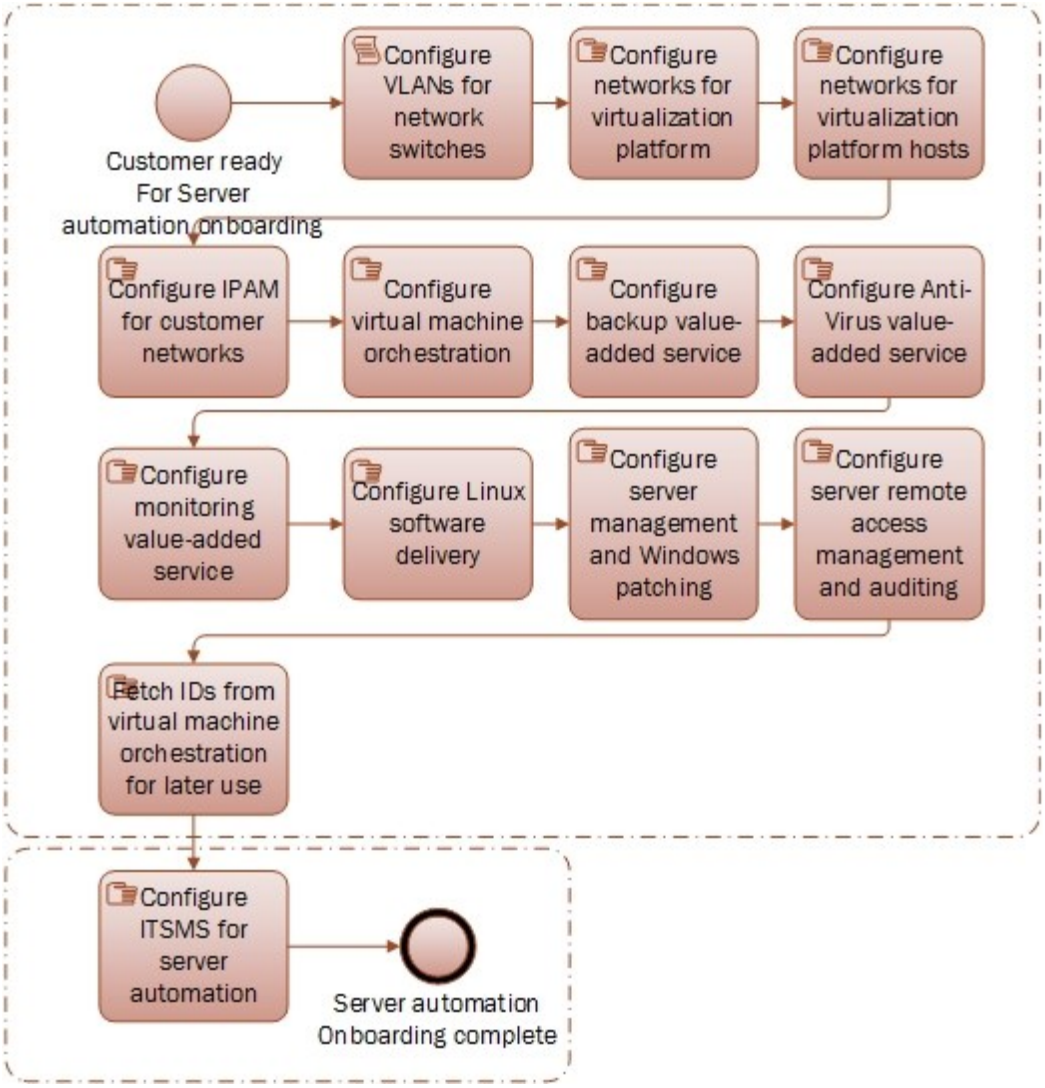
Pre-study Process Flow Diagram



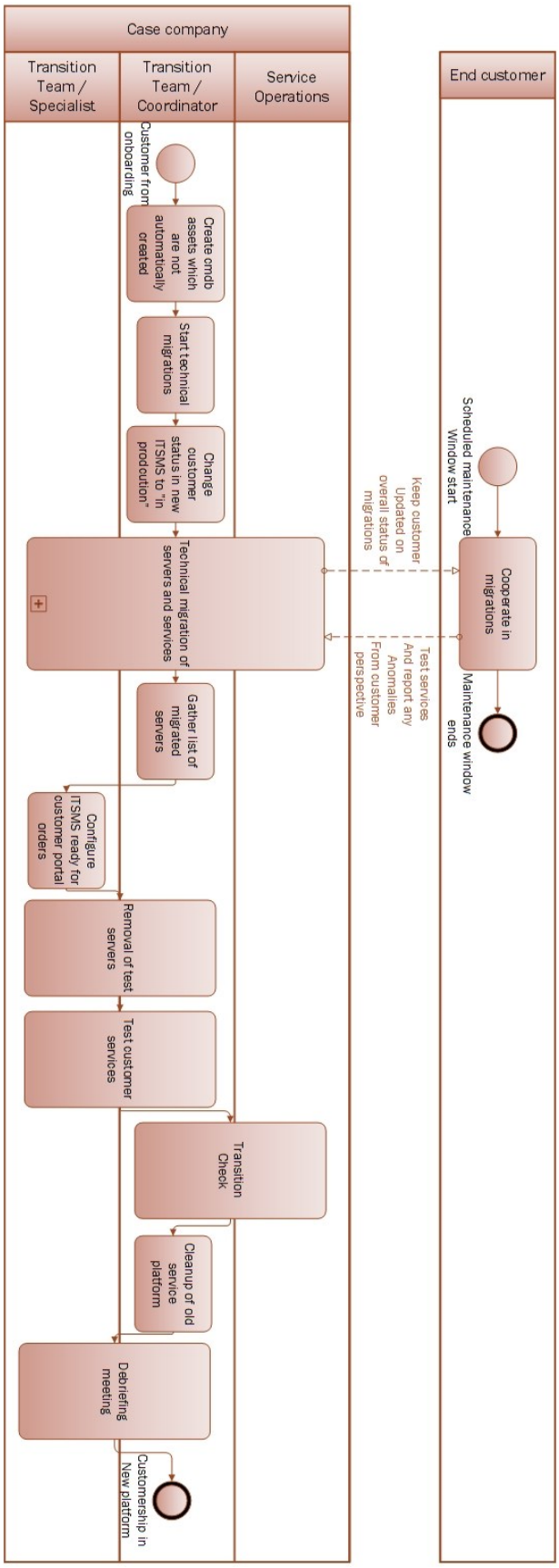
Onboarding Process Flow Diagram



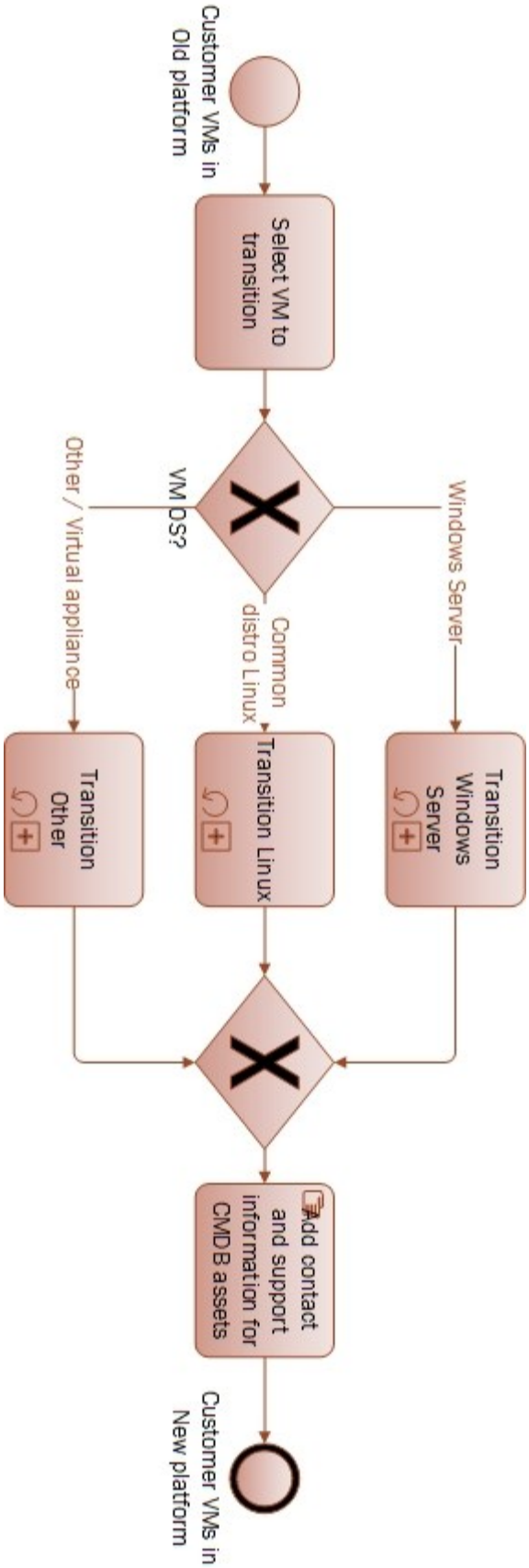
Server Automation Onboarding Process Flow Diagram



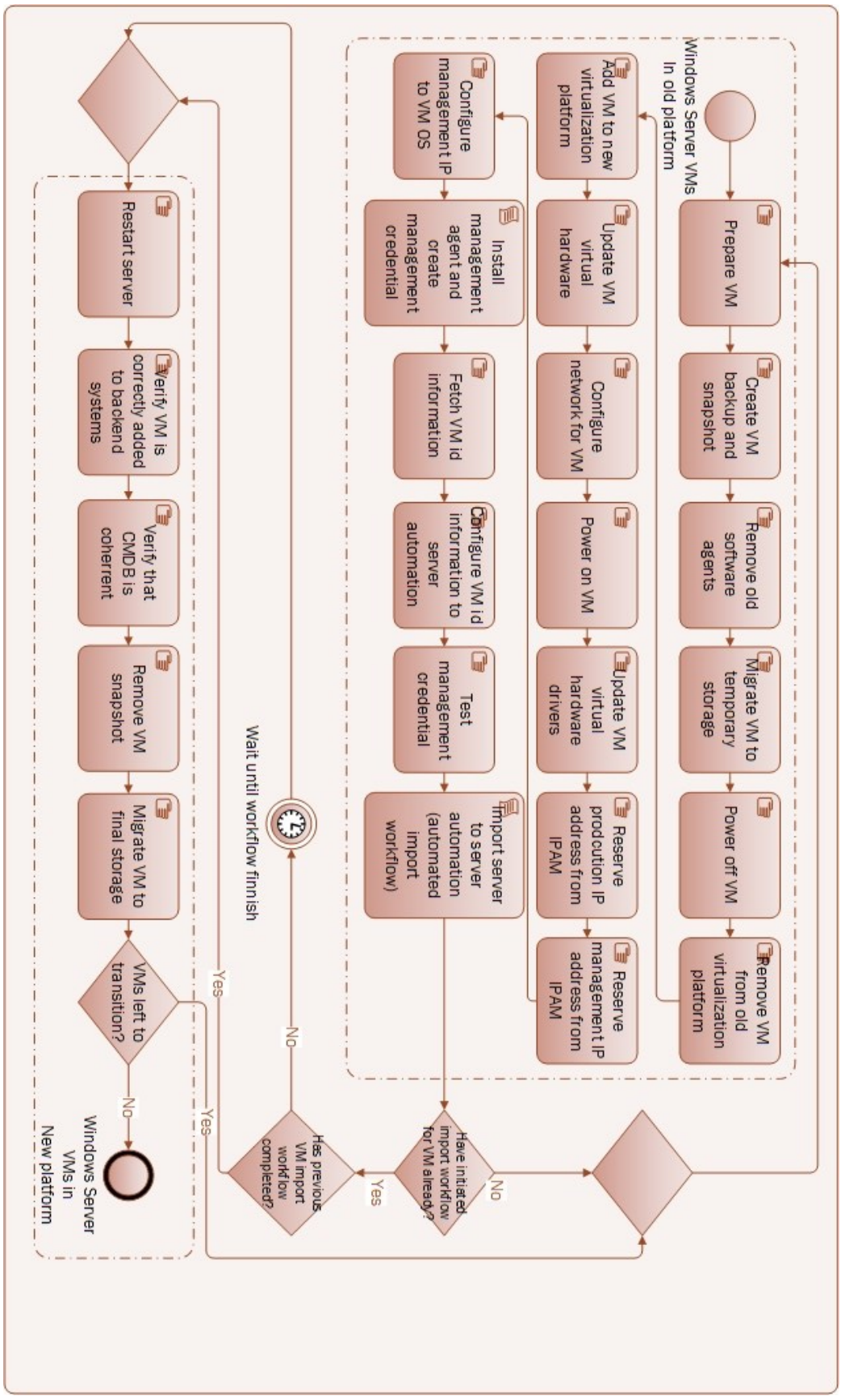
Migration Process Flow Diagram



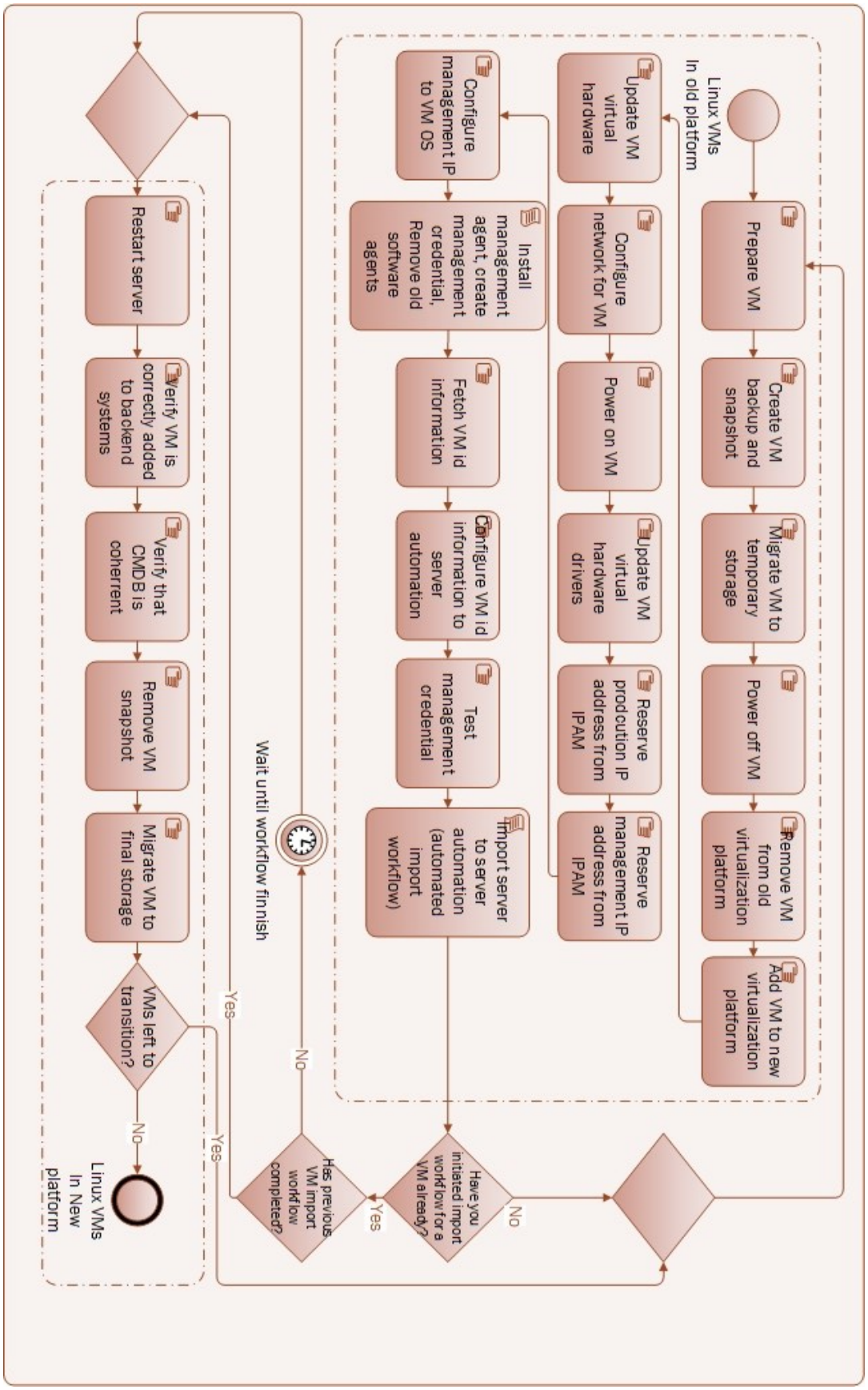
Technical Migrations High Level Process Flow Diagram



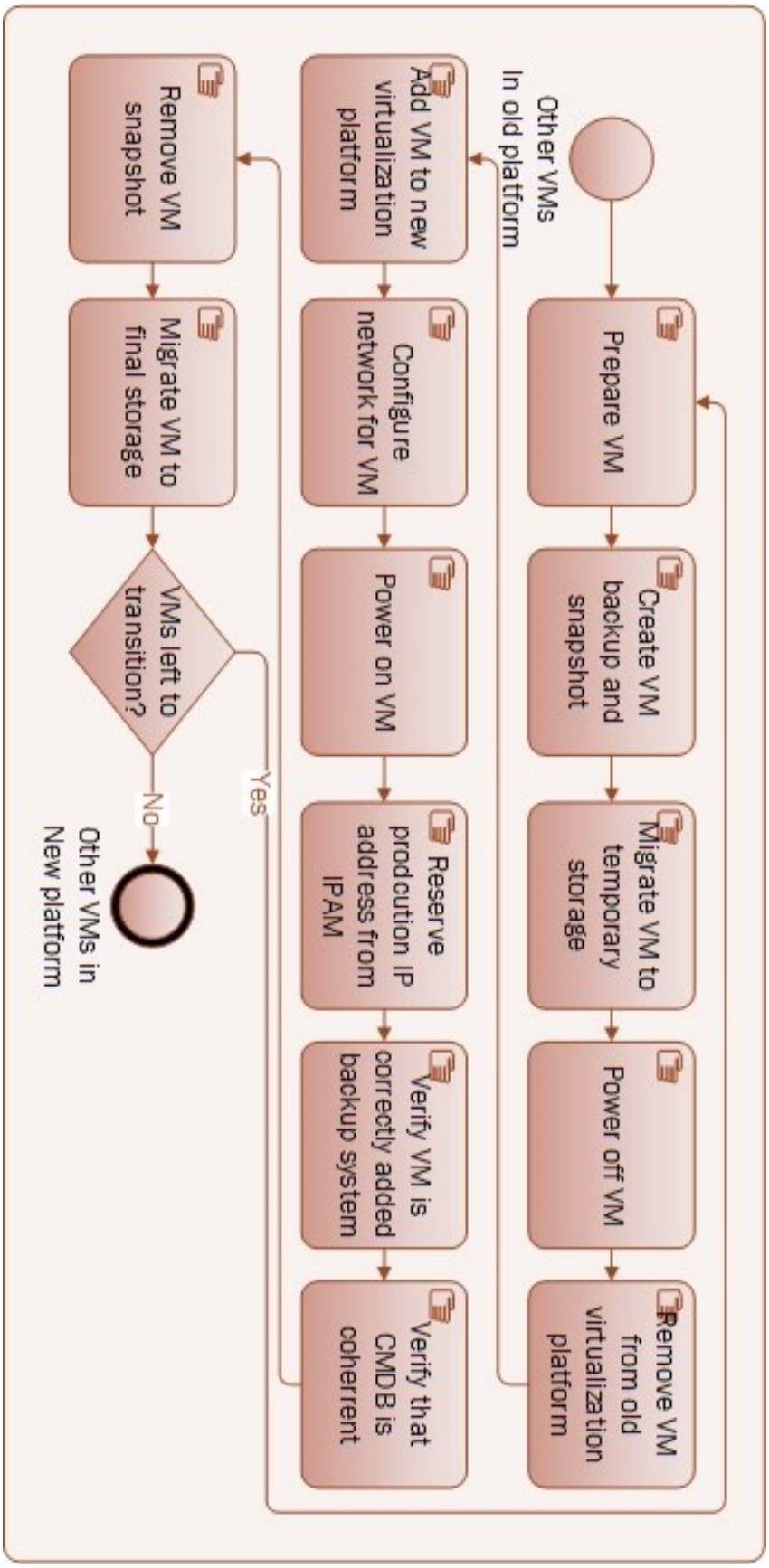
Windows Server Migration Process Flow Diagram



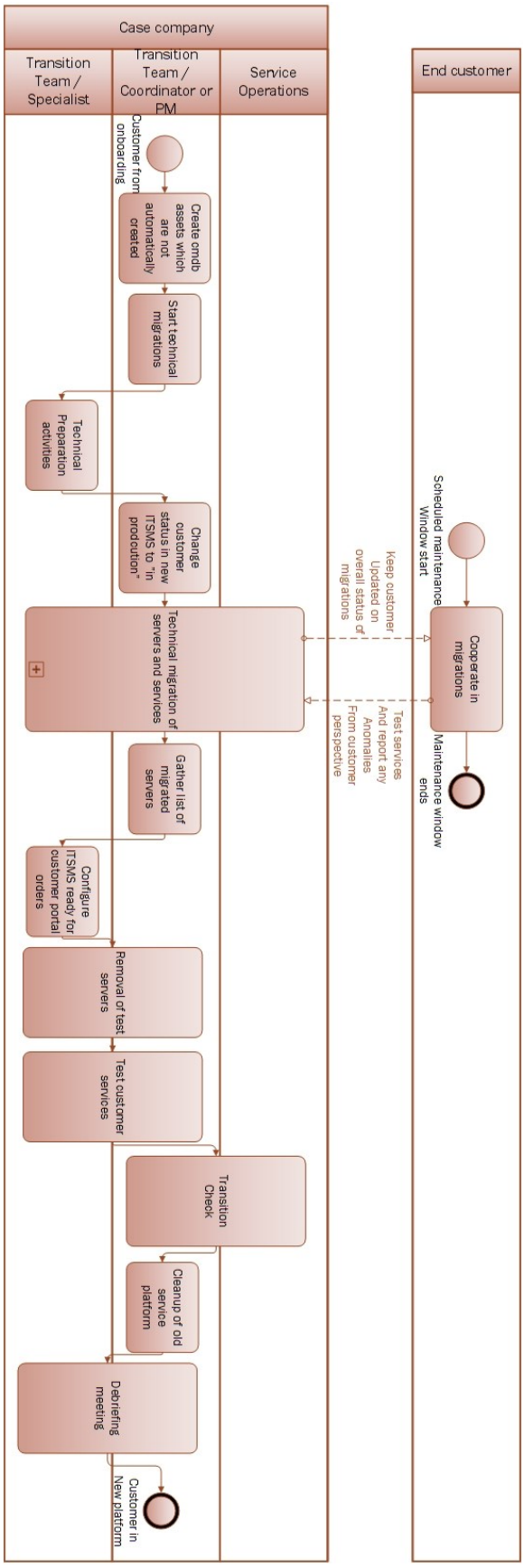
Linux Migration Process Flow Diagram



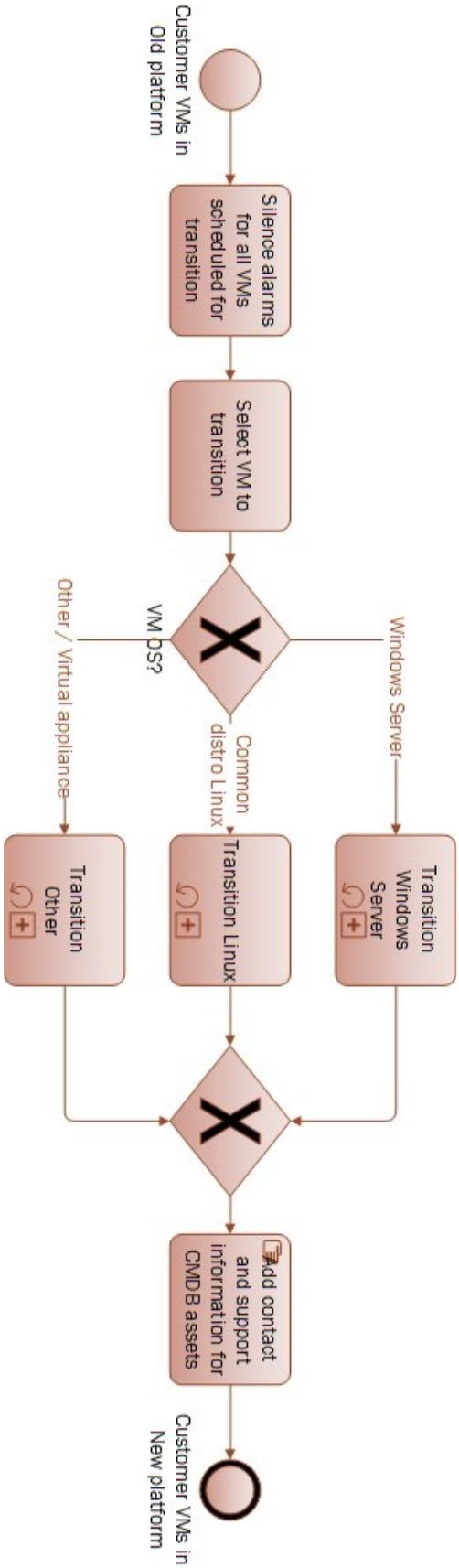
Other Type VM Migration Process Flow Diagram



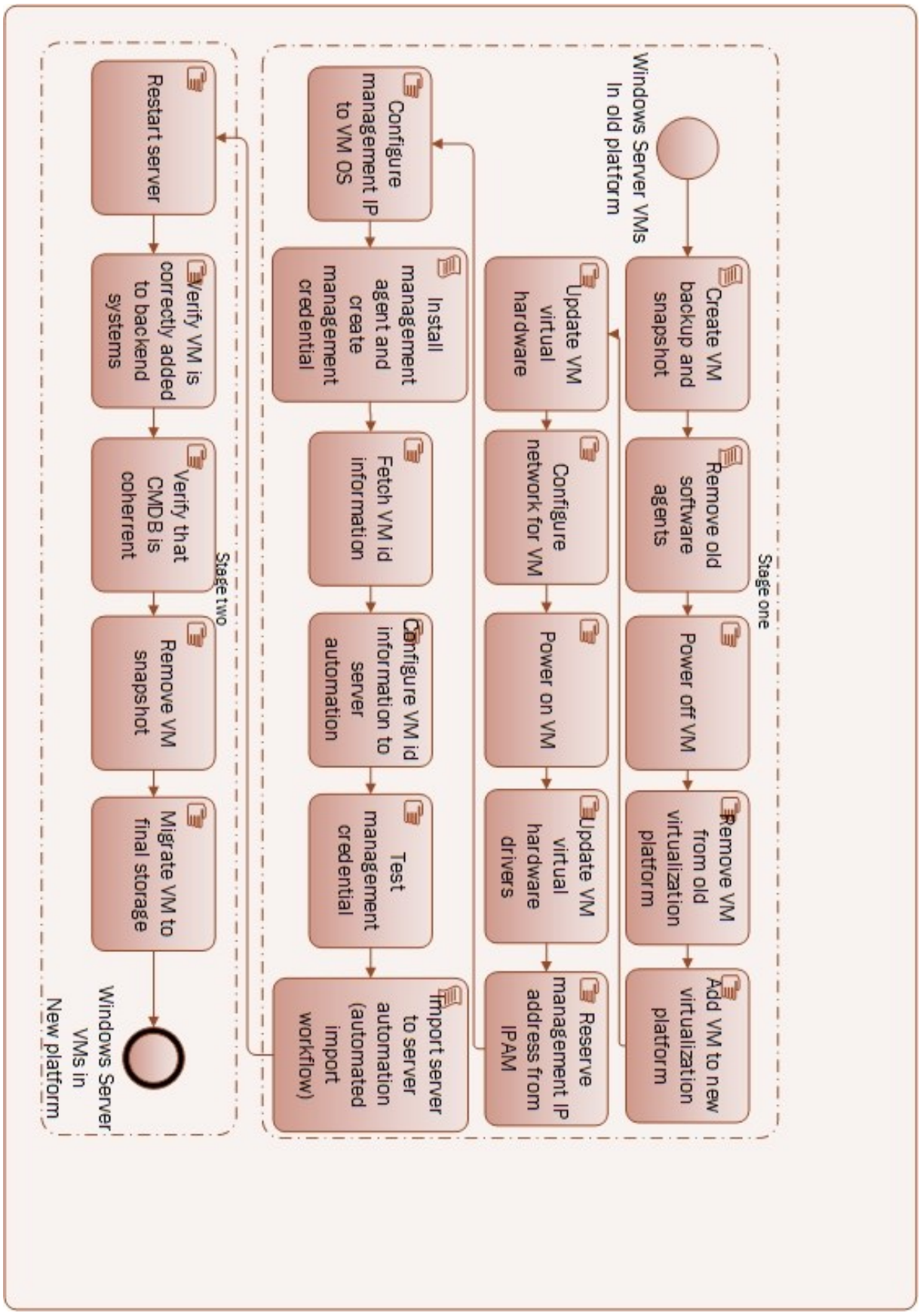
Migration Process Flow Improved



Technical Migrations High Level Process Flow Diagram Improved



Windows Server Migration Process Flow Diagram Improved



Linux Migration Process Flow Diagram Improved