

Tools and methods supporting automation – case Wärtsilä ERP landscape

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<p>The goal for this thesis was to collect information of Wärtsilä's ERP landscape related automation tools to understand how they are or could be utilized to serve business and IT processes better and in what kind of potential new use cases the tools are best fit for. The aim was to create a view to the automation topic overall, understand the existing limitations that prohibit the development of the tools and practices and to get the understanding of the level of automation, how the tools are linked to either business or IT processes. From those I concluded future development suggestions on both automation tools development side, enhancing the present processes the tools are closely linked to, some new potential use cases as well as on the methods to be used.</p> <p>The study was made by making observations based on chosen theoretical frameworks, Lean and ITIL. Lean is a way of thinking and acting for an entire organization with the aim on simplifying processes by focusing on the value adding activities and minimizing unnecessary work and delays. ITIL is the collection of the best practices based on the practical experience of organizations around the world and it is the most widely accepted approach to providing IT services. These two theories have similarities to complement each other in this study as both target to better flow efficiency in the organization.</p> <p>My approach to this study was a qualitative case study. Qualitative study is best applied in situations when there is no or very limited information of the subject, a need to have a deep understanding of the topic and to create new development suggestions or models based on findings. Case study method was utilized as I had delimited the target of the research to Wärtsilä's automation related ERP tools. The case study research usually starts from the problem in question, not only from the theories. This applied to this study as well as the theory foundation developed during the data collection phase. Both approaches, qualitative study and case study are applicable to the way I did the research, what was the studied subject and to what kind of end-result I was targeting at.</p> <p>The study achieved its goal as the development suggestions were introduced based on findings and problems discovered. However the findings didn't reach the amount and depth I was expecting. The findings could've include more information related to the process improvements and automation use cases. This can be due to the amount of studied tools prohibiting the comprehensive go through as the set time was limited for the interviews and also to the fact that there could've been more people interviewed per automation tool with different roles.</p>	
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1 Introduction

The automation of processes and tasks as well as working in a lean and transparent way across the divisions have been main themes in Wärtsilä's strategy over the past years. Simple and lean processes and working methods are constantly under work and business divisions and support functions, like IT, have been utilizing different automation related tools already for years. We aim for better productivity with less resources and changing the people's daily routines from repetitive tasks into more innovative work.

Wärtsilä is a global leader in advanced technologies and complete lifecycle solutions for the marine and energy markets. The company is focusing on sustainable innovation and total efficiency which help to maximise the environmental and economic performance of the vessels and power plants of its customers. In 2016, Wärtsilä's net sales totalled EUR 4.8 billion with approximately 18 800 employees. The company has operations in over 200 locations in more than 70 countries around the world. Wärtsilä is listed in Nasdaq Helsinki.

Wärtsilä's mission is to shape the marine and energy markets with advanced technologies and focus on lifecycle performance, to enhance the customers' business and benefit environment. Wärtsilä operates in four business areas, Marine Solutions, Energy Solutions, Services and Digital Development. Digital Development unit was established aside the business areas on October 2016 and IT department was moved to the new unit. The initial strategy of the Digital Development unit was presented to the Board of Management on December 2016 and the final organization was published on March 2017. Wärtsilä's digital transformation with different initiatives had already progressed well and the new strategy means building on the success of previous initiatives, to do more with scale, governance and consistency. The digital opportunities will increase the leverage across Wärtsilä's businesses.

The strategy is focused on the digital transformation of the entire Wärtsilä and covers several aspects of Wärtsilä's operations – how do we work together, with customers, suppliers and new partners. How to enhance our platforms and capabilities to be more open, more modular and more integrated. The core of Wärtsilä's digital strategy comprises of fundamental promises that will help Wärtsilä's to be more agile, having data and advanced analytics led business with different business models. One of the promises is to increase efficiency and productivity across the business processes, research and development and development of the core platforms by seeking possibilities to simplify and

expedite processes, utilize automation, smart technologies and innovation to enable the transformation and growth.

Wärtsilä IT strategy emphasizes the importance of the core platforms at Wärtsilä. SAP is one the core platforms and certain challenges were identified to be improved. The lifecycle management of the SAP platform and tightly linked ERP (Enterprise Resource Planning) services had been very scattered without common ways of working, transparency and clear targets. The work with SAP strategy framework was started on June 2016. It compiles an umbrella view for our SAP landscape with the set strategic goals and actions that will not only support leverage the operations, service lifecycle management and performance of the organization but focusing also on simplifying and rationalizing the ways of working and further utilizing the existing automation tools to support Wärtsilä's business processes.

The structure of this thesis has been built to retell the flow of the research. The introduction (chapter 1) contains the company introduction, research target and goal. Chapter 2 contains the Lean and ITIL theory overview with light comparison to support the thesis topic. The empirical phase (chapter 3) contains the research process with tools and methods utilized for data collection including the project phases with the schedule, project organizations and practicalities. The collected data, results, is presented in own section (chapter 4) with light analyses included. The final section (chapter 5) contains the conclusion of the findings overall, development suggestions for the future and my judgement of achieving the thesis goal.

1.1 Research Target and Goals

I have studied the automation related tools in connection or within SAP ERP landscape in Wärtsilä. ERP is an enterprise resource planning software and the core is with the several modules it provides with standard key business processes. I have studied the tools Wärtsilä currently has with main goal to understand how those tools are or could be utilized to serve business and IT processes better and in what kind of potential new use cases the tools are best fit for. The aim was to create a view to the automation topic overall in Wärtsilä's ERP landscape with SAP as the core system, understand the existing limitations that prohibit the development of the tools and practices and to get the understanding of the level of automation, how the tools are linked to either business or IT processes. From those I have concluded future development suggestions on both automation tools devel-

opment side, enhancing the present processes the tools are closely linked to, some new potential use cases as well as on the governance issues.

As the data collection happened during autumn 2016 and most of the conclusions and further development proposals are from early January 2017 some of the discovered enhancement opportunities have already been implemented.

1.2 Problem Description and Motivation

The automation tools are not seen as one service or as well identified service offerings at Wärtsilä and the understanding of the tools and for what those are best fit for is scattered around Wärtsilä IT personnel. A lot of automation is done via different legacy or new tools which enable also automation in relation to SAP but the big picture of the automation tools and their offerings is lost. There might be a risk of losing good automation opportunities if the automation tool portfolio is missing. The aim is to collect that information and have a comparable view to each of the tools and to the possibilities they bring along and to find further development items.

Another viewpoint is the business and IT processes and their linkage to the automation tools. As looking closer to different processes the process start and end can be in different depending on the user. For example the IT service management System tool can in theory cover the whole request fulfilment process but as the request has been recorded in the IT Service Management System and reaches the helpdesk the continued steps are done manually.

Two important main themes stands up from all Wärtsilä's business strategies, speed and agility. The work to simplify the processes is visible in both business processes and IT processes and the improvement activities take place constantly. The initiative to have the Robotic Process Automation (RPA) in place came from the finance management as there is a constant need for quicker and simpler ways to handle the work and free up employees time from repetitive tasks to more productive and innovative work. The first light evaluation of the RPA tools was made during spring 2016 in order to make a decision if a project proposal should be made over robotics process automation. Today the RPA tool, Ui-Path has been serving the robotized processes and the rapid movement in this area created a need to have a strategic approach towards RPA in Wärtsilä.

I find it very titillating to have the understanding of what is the new that is coming up on this area and what competences we need to have and how the technology decisions will

effect on the future technology choices. This cannot be achieved if the big picture of the automation tools is missing. I'm personally very interested in the automation overall and seeing the Wärtsilä rushing into enhancing the business and IT processes as lean as possible and with concentration also on automation possibilities.

2 Theoretical Framework

I have chosen the Lean as the main theory for my study but I have also touched the ITIL (Information Technology Infrastructure Library) framework as many of the IT automation related tools are linked with the IT processes. There are many books available that deal with Lean as an abstract concept, it can be referred to as an philosophy, company culture, principles or simply an approach in daily work, what methods, tools and techniques to use (Modig & Åhlström 2012, 83). ITIL is seen as a collection of best practices. In this study both Lean and ITIL are referred to as theories.

Lean is a way of thinking and acting for an entire organization with the aim on simplifying processes by focusing on the value adding activities and minimizing unnecessary work and delays which are called waste in Lean related literature. Torkkola (2016, 11) says “Lean means the shortening of the process throughput time and changing it to be predictable”. Bell & Orzen (2011, 16) emphasizes the importance of the lean principles embedded with the culture as the tool for the behavioural transformation towards Lean thinking. Modig & Åhlström (2012, 5) examine the Lean from the flow efficiency point of view, time spent to deliver and the influencing factors affecting the flow efficiency. Womack & Jones (2003, 15) are describing their view on Lean principles from the waste point of view, how Lean provides a way to do more with less resources while going gradually closer to meet the exact customer need.

The word Lean is used often where improvements are made to the existing ways of working, processes, procedures and tasks and organizational structures. It comprises any development where the focus is to improve the present state by eliminating non-value adding activities and continuously learn and find the better ways to work with the value-adding activities, balancing with the related process efficiency related factors. As an example the production amounts should always be derived from customer demands, service enhancement dead-lines should be met with appropriate time-line and the organization user satisfaction surveys should indicate the increase in satisfaction level of ways of working, communication or transparency in operations. Continual incremental improvements are a key to achieve a better process flow efficiency.

Wärtsilä tends to utilize different tools and techniques presented in Lean literature. Those are used for identifying problems and bottlenecks in processes and to identifying the value adding activities with customer’s need as a driving force. The various tools and techniques are used across Wärtsilä organizations with the focus on acting upon and correcting immediately any deviations found in the processes. As an example of Lean activities at

Wärtsilä the Services business line launched the Go Digital programme on October 2016 that consists of several projects improving the tools, process efficiency and customer offerings throughout the Wärtsilä business lines. The objective was to create the customer desired digital products, Lean services and strengthen the work culture towards customer centric way of working (Wärtsilä 2016f). This work continues following the new Digital strategy as the related functionalities were moved to the new Digital Development unit and the programs and projects continue with revised content.

The different techniques presented in some of the Lean materials like value-stream mapping, problem solving charts, five why analysis or fish bone problem statement chart are well-known tools used at Wärtsilä. Also the service design is utilizing more user-centric approach to really understand the customer need. As the IT department is constantly improving its IT services and IT processes the value-stream mapping is used in different forms to improve the processes or find the relevant, value-adding items the customers, Wärtsilä business-line users, need in future developments. The five why's is embedded to the problem management process and with the complex business needs of problem scenarios the fish-bone or other mind-mapping tools are in daily use. The identification of customer serving value adding development needs that produce rapid results are part of every IT unit's and IT service's goals and supported with simple and transparent approval process. The iteration work with possible failures are accepted within the new and innovative developments and the rapid development models to support the work have been taken into use and supported with the availability of the related development environments.

2.1 Lean Theory

2.1.1 History of Lean

Taiichi Ohno, who joined Toyota in 1932, has been said to be the father of TPS, Toyota Production System (Mådig & Åhlström 2012, 76). Taiichi Ohno was given a task after World War II, to improve Toyota's manufacturing process. His manager, Eiji Toyoda, had been visiting U.S plants, and learnt about mass production approach which was also needed for the Japanese market. The task was started from the shop floor and applying the principles of jidoka and one-piece flow (Liker 2004, 20-23.) Jidoka means an immediate problem recognition and correction and eliminating the root causes of defects (Liker 2004, 129-130.) Toyota has excelled by continuously developing the Toyota Production System (TPS) through decades and it is today seen as Toyota's people and customer-oriented philosophy (Toyota 2017).

The word “Lean” was first published in a MIT’s article “The Triumph of the Lean Production System” by John Krafcik in 1988. He wrote of the research of 70 car factories in which some of the factories were significantly more productive to others. One of these was Toyota where the key differentiating factors were the leadership and the corporation. Although the article described the research findings related to factories it was clearly pointing out the importance of the whole organizational functions as development, vendor management, customer support and the governance of the organization. As a marketing term the word “Lean” was taken in use for the research findings to represent the efficient production system (Torkkola 2016, 13; Mådig & Åhlström 2012, 76-77).

As a continuum for the research the book “The Machine that Changed the World” was published in 1990 by James P. Womack, Daniel T. Jones and Daniel Roos about the Lean production and in 1996 a book “Lean Thinking” was published by Womack and Jones with more developed Lean concept. The article “Decoding the DNA of the Toyota Production System” by Steven Spear and H. Kent Bowen is said to be a clear and simple illustration of rules for organizational improvements in design, operations, process improvements and process activities (Modig & Åhlström 2012, 77-79).

2.1.2 Five Lean Principles

I see Lean as a behaviour in every employee, code of conduct to follow by quickly taking actions with any improvement needs. It means eliminating the recognized malfunctions influencing the efficiency of the processes and with the set measurement following up the progress of the organization’s actions. According to Torkkola (2016, 13) applying Lean means transformation of how we think and behave and which can cause very strong feelings and resistance when truly breaking through the organization. It is therefore a continuous journey for an organization with no start nor end date to make improvements that increases the efficiency of the organization all the time. To introduce the reader to the Lean concept I have chosen to use the five principles listed below as a frame to go through the elements I see important learnings from the read material. These will be explained more in the following chapters:

- Flow efficiency
- Removing waste
- Value stream
- Continuous learning
- Lean operational strategy

Flow Efficiency

Flow efficiency is the key in Lean thinking. The flow is created in processes which are sequential actions to be done to reach the end-result. It is important to understand what is the start and end of the process, the system boundaries, and the real customer of the process as these are affecting the process throughput time (Modig & Åhlström (2012, 22). According to Modig and Åhlström (2012, 13) “flow efficiency is a measurement of how much a flow unit is processed from the time a need is identified to the time it is satisfied”.

Flow unit can be material, information or people (Modig & Åhlström 2012, 19-20). In this study point of view the processes handle mostly information, the information being the flow unit. A value transfer occurs when the flow unit receives value, with information being the flow unit it can mean enriching the information in each process activity. As an example a process could include an approval task where a waiting time is a wasteful activity which doesn't process the flow unit (Modig & Åhlström 2012, 24).

Modig & Åhlström (2012, 26) state “the flow efficiency is the sum of value-adding activities in relation to the throughput time”. Time savings are not always the indicator of the value when thinking about the customer needs. It is therefore important to carefully evaluate who are the real customers for the process and what are their needs. It is also important to realize that if aiming to have the full utilization of resources it can mean an increase of work for the resources which can lead to bottlenecks, people in the queue or system tasks waiting to be processed which leads to lower flow efficiency.

There are three laws existing that help in understanding what effects on the throughput time; Little's law, the law of bottlenecks and the law of the effect of the variation to the throughput time. The Little's law states that the throughput time is dependent on the cycle time of the flow unit in the process and the amount of flow units in the process. Cycle time is the pace how quickly the flow unit is processed (Mådig & Åhlström 2012, 34 – 35). For example the flow unit can be a process development request in the queue and the cycle time how fast the developed item is deployed to the production use.

The law of bottlenecks says that the more waiting there is for the flow unit to be processed the longer the throughput time. The bottlenecks prevent the flow efficiency according to Mådig and Åhlström (2012, 37 – 39.) as they can create a queue before the flow unit is processed. The bottlenecks can be sub-processes or human activities that limit the flow in the process. If the cause of the bottleneck has been too few resources, adding resources to only one part of the process might cause bottlenecks to another part of the process. Bottlenecks are likely to occur in a process where activities are needed to be done in sep-

arate step by separate resources in a certain sequence. It is quite rare that all the process related tasks could be fulfilled by one person in one location (Modig & Åhlström 2012, 39.)

The third law is about the effect of variation on processes. The law says that the throughput time increases when the variation in the process increases and when there is an attempt to increase the resource utilisation (Mådig & Åhlström 2012, 42-43). There are different kinds of variation affecting the efficiency of the process flow. The resources, either people, systems or facilities can cause variation. The systems can have maintenance down-time, upgrade needs or are simply broken and waiting for repairing. The people can have different skills and perform the activities with different speed. The facilities can be complex and taking time to process one task in one counter and the other in the next. The actual flow units like customers can have requests filled out differently or incorrectly or can simply have different needs for their requests (Mådig & Åhlström 2012, 40-41.) Especially with human work involvement in the processes the variation may differ a lot and cannot be avoided. If there is an attempt to focus in high resource efficiency it is more likely to cause delay in the process as the flow units might need to wait to be processed due to highly loaded personnel. With automated processes this hindering factor is put to a minimum but the other system dependent variations can still occur. The variations can be measured and monitored to find out the actual root cause to be eliminated. These can be for example system overload causing slowness in peak periods.

As a conclusion of the above laws the reasons why the process throughput time increases are listed below (Mådig & Åhlström 2012, 44; Torkkola 2016, 59):

- If the time to process one activity, e.g. serve a person in the queue or process a task in the system, increases (cycle time) and the number of persons waiting in the queue or tasks to be processed in the system increases (flow units to be processed) then the process throughput time increases. Average throughput time is in relation to the unfinished job items.
- If there are bottlenecks in the process then the throughput time increases.
- If the variation in the process increases it affects negatively to the throughput time.

When aiming towards high resource efficiency and high flow efficiency it is the variation that is prohibiting of reaching both high resource and high flow efficiency (Mådig & Åhlström 2012, 103). The following figure illustrates the same.

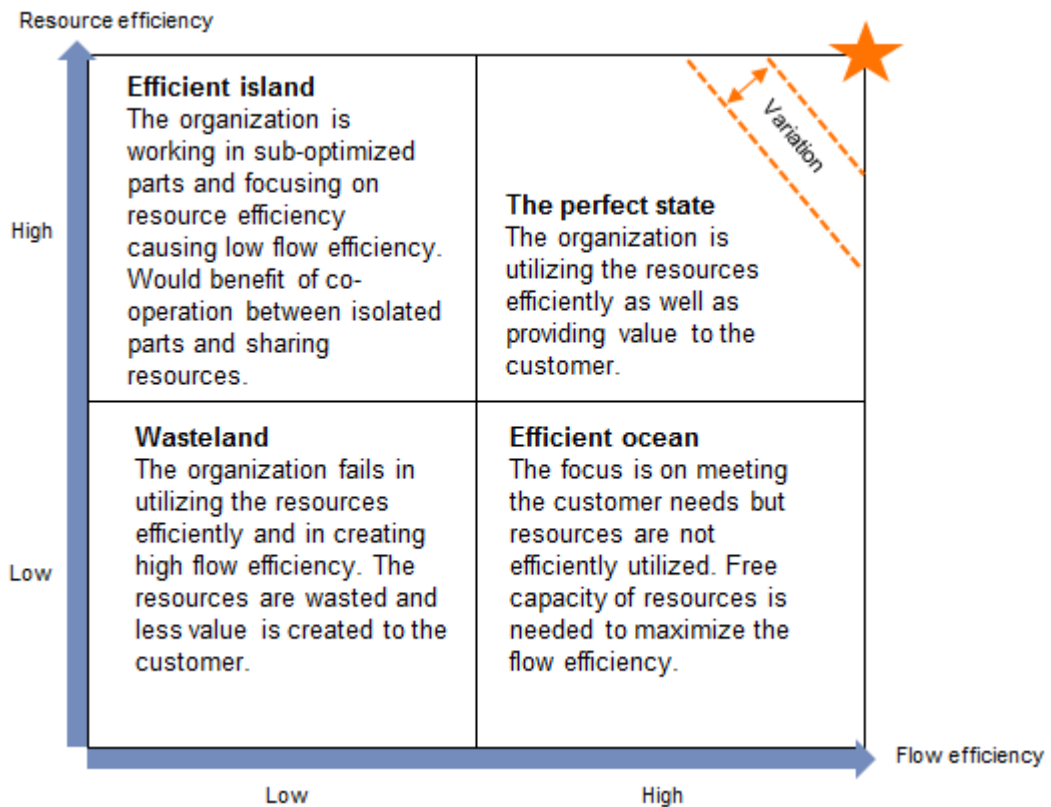


Figure 1. The efficiency matrix (Modig & Åhlström, 99-105)

If having both low flow efficiency and low resource efficiency the company is more likely to be out of business soon and there is no other way than trying to improve the situation. With high resource efficiency and low flow efficiency there are very resource efficient isolated teams. The focus is not in the customer but in the efficient use of resources. This can cause bottlenecks, waiting time which can then cause for example frustration amongst the customers and at the end losing the customers. By eliminating the causes for the bottlenecks by re-organizing the way of working and the teams it is possible to improve the flow efficiency. With high flow efficiency but low resource efficiency the focus is on meeting the customer needs but resources are not efficiently utilized. Free capacity of resources is needed to maximize the flow efficiency. If the company has been able to have both high flow efficiency and high resource efficiency it has reached so called "perfect state". Reaching the star, both the 100% resource efficiency and 100% flow efficiency is not possible, as there is always some amount of variation affecting the efficiency. The company can balance where they are in the efficiency matrix by managing, eliminating and reducing the variation. To eliminate, reduce, and manage the different forms of variation in the process requires operative efficiency in the organization. There needs to be transparency in the actions done in different teams affecting the same process to increase flow efficiency and agreed common way and order of working and finish the started work items. The variation needs to be understood and accepted but well measured and

followed up to recognize any abnormal situations. The aim is to add value from customer perspective (Modig & Åhlström 2012, 99-100.)

Removing Waste

There are three hindering elements affecting flow efficiency. Variation and bottlenecks which were described earlier, as well as waste (Torkkola 2016, 23-25). The following sections describe wasteful activities and possible ways to remove them.

Overproduction is the worst type of waste as is linked to overloading people and systems. For example the performance and availability management processes should cover the proactive system monitoring to prevent the system overloads. Overloading personnel often means sick-leaves, lack of motivation to work or learn new things. There should be a constant follow-up of the resource utilization and clear prioritization of work to prevent the overloading. The real customer needs should be known and the actions targeted only to provide what customer needs.

Unfinished job items are also one form of waste. These can be for example unanswered mails, unfinished project tasks or reports, empty rows in databases causing fragmentation and slowness of the IT system, accumulative service requests or simply customers waiting to be served. All this causes waiting time or work to pile up for the employees and we might need to wait for approvals, decisions or additional information from different parties (Torkkola 2016, 25-27.) This can be seen at Wärtsilä as long waiting times for any cost related approvals or for seeking product information from vendors or software provider support pages for example. This is an area that could need revision in both organizational way of working and in behaviour like finishing the started work and not making unreal promises, establishing such connections with different stakeholders where the expectations are met on both sides. Technology can help in for example utilizing the appropriate automation tools in speeding and formalizing different approval processes.

One relevant type of waste is also the additional tasks needed to be performed by the user. For example inputting data manually into the system is one example of this kind of waste. Also finding and sorting the information belongs to this category as well. In these kind of cases the automation could be considered. Failing and redoing are also one form of waste but can also be related to the continuous improvement and learning which will be described later in this chapter. One type of waste can also be neglecting the skills and competencies the people have in the organization. Therefore it is important to have such a

leadership in the organization which encourages the people to reach out of their comfort zones to utilize their hidden skills on new areas.

Repetitive transfer of work from one employee or unit to another is also wasteful activity. It takes time and can create errors if proper communication fails. In this kind of setup it can mean that one team or person is handling only tiny part of the activities related to the process and as soon the work is finished, it is passed on to the next team which might not be ready to start working immediately and thus causing waiting time. An organization working in silos can experience this kind of dilemma. One key strategic action in Wärtsilä ERP strategy is focusing in new organizational setup, ways of working, to enable working in bigger, situation dependent virtual teams in agile way to quickly start and finish a work item with effective communication across the organization.

Value Stream

Value stream means all the activities needed to deliver the service to the customer. In IT the value stream can start with the customer contact for example with the helpdesk. The provided end-result, solution is then offered to the customer by modifying the information via different work phases and teams. The end-result can be for example an enhancement delivered for a business process improvement. Value is always defined from the customer's point of view and what is the underlying need. If thinking on customer's need, and here the customer being any internal process user the process can consist of both information flow and one-to-one interaction with e.g. helpdesk. Both the direct and indirect needs should be considered. Being able to process any query fast is a direct need but experiencing a friendly helpdesk service can be indirect and equally important (Mådig & Åhlström 2012, 25.)

Value stream mapping is a useful tool for the evaluation of the present state of the process. The visualization of the value-stream map pre-requirements consist of description and narration of the process as-is state, process mapping containing detailed view of the tasks and decisions contained in a specific process. The process map does not contain information about the process flow, elapsed time, cost, or quality at the value stream level. Value stream mapping helps in capturing the flow of information, material, and work across different functions and identifies the wasteful activity, elapsed time and quality related observations (Bell & Orzen 2011, 37.)

The value stream mapping gives a view to value-adding activities, non-value adding but needed activities and non-value adding activities. Value-adding activities are adding value

work that modifies or changes the flow object, material or information. It is an activity recognized by the customer if not performed. Non value-adding but needed activities are such work that can for example lessen the financial risk, is needed for the legislation reasons or is needed in order to perform the value-adding work. It can also be such work that cannot be performed due to the limitations of technology or ways of working. Non value-adding, wasteful activity is such work that can be eliminated instantly with small or non-existent investment and without diminishing the value of the end-result.

There are different ways to improve the value streams, make the process flow more efficient. For example making changes in the process by eliminating wasteful activities, recognizing and handling the bottlenecks and variation, improving the monitoring of the process steps and the supporting activities and streamlining the value-adding activities where possible for example with the help of automation.

In our organization the focus should be in the activities that produce value to our customers, recognizing the information flow in business processes and the steps where IT and the automation tools can add value. We should be organized around these value-adding activities in such a manner which support the business process flow and establishing a formal way of working, where each individual is aware of the big picture. We should focus on training the principles at work, coaching the personnel in problem solving and agile iterative development methodologies to make fast incremental improvements and having an active dialogue of the value optimization. The focus should be in optimizing the whole entity of work and especially the relations between different functions and as a backbone emphasizing to continuously recognizing the improvement possibilities on own organization operations and in business processes. All other activities in the organization should support this work and the people adding direct value.

The following picture illustrates a simplified value-stream map of the enhancement process.

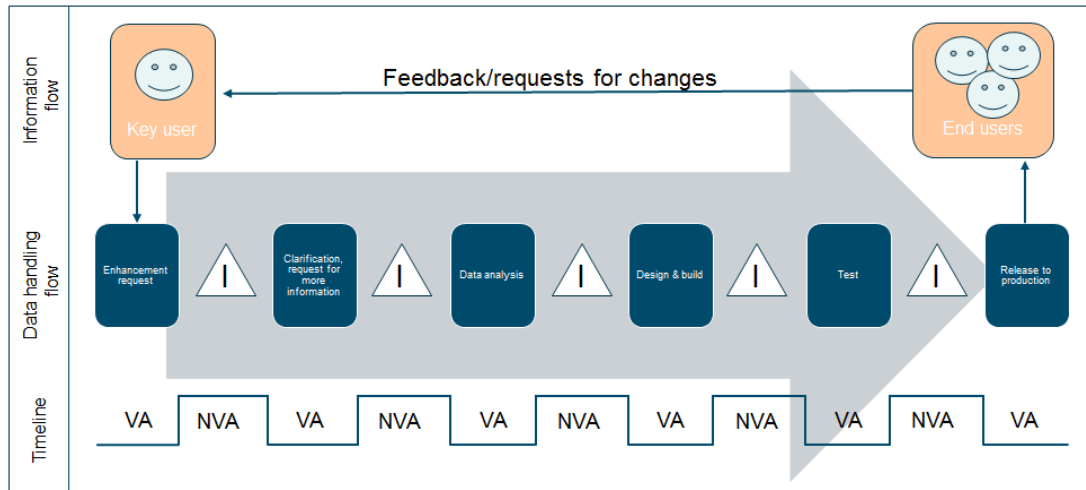


Figure 2. Value-stream map

The end-users will inform the process key-user of the improvement needed in the process. The Key user creates the enhancement request in the IT Service Management tool. The triangle with letter “I” symbolizes the inventory and can in this example mean the buffer, queue for next process phase. VA means time elapsed for the value-adding work, e.g. in first step could be ten minutes to create the request. NVA means time elapsed for the waiting time. The actual process steps would in more thorough map contain more detailed information of the actual steps, how it is performed and by whom and the indicators showing more information of different variations.

This kind of illustrative way to explain the process steps and the variations affecting the flow efficiency could be also utilized as an observation board available for all process people. It would give an easy way to see the big picture at one go, what is the effect to each process step and helps in optimizing the dependencies between different functions.

Continuous Learning

Torkkola (2016, 32) states that problem solving is the best way to learning and especially if done in teams. At Wärtsilä the saying “fail fast” indicates the importance of quick trials that are a key for innovative and rapid new developments. Failing is almost an essential part to reach towards new innovations but the work should be well managed and the objective, progress and results communicated to minimize any false interpretation of the development quality. Another saying is that “you may fail but don’t make the same mistake twice”. This is related to the continuous improvement in both in our own development and in services provided at Wärtsilä.

From the management point of view the problem solving skills of the whole personnel are the key for the continuous learning. The success in achieving a learning enterprise is often

related to the culture as well. Sharing and solving the problem with others might be interpreted as not having adequate skills to perform and problems are often solved in isolation thus not necessarily achieving the ideal result. In IT the working together, sharing information and communicating is in key position to the future success and should be emphasized in both personal and organizational level. The possibilities to work in teams, in brainstorming workshops are quite rare due to the hectic working days. Usually conducted only for bigger initiatives with bigger audience where instead could be taken as a daily scrum-like routine for the start of the day. Also very nourishing would be the brainstorming breaks with no urgent need to solve any customer facing problem, but to change ideas and find new innovative start-ups for services and ways of working.

In Wärtsilä the yearly development discussions include the target setting also for the learning and development and the learning by attending projects has been seen as one way to educate oneself. However this might restrict some of the employees of attending the project as the real agile project organizations are hard to establish as people are located in remote locations thus leaving the project member working alone with the problem at hand. There has also been cases where the planned solution hasn't been ideal after all and the success to deliver the solution has failed due to that fact that it had been done in isolation, not by brainstorming with a group of experts of the area.

For a learning organization the company's rapid strategical adjustments to meet the market demands create a challenge to change direction, innovate fast and adjust the ways of working efficiently. "To support this agility, every activity of the enterprise should be reinforced through continuous, rapid feedback cycle triggering instant, adaptive responses" (Bell & Orzen 2011, 231). One of the tools supporting learning and continuous improvements is the PDCA (Plan-Do-Check-Act) cycle. This mean the cycle of trials, proof of concepts, structured approach to problem solving (Bell & Orzen 2011, 37). It can also be used in testing new innovative ideas in an iterative mode. In Plan phase there is an improvement idea and planning means the specification of the to-be state and what is the success criteria for the improvement. Also typical project planning can be with the timelines and practicalities. In Do phase the improvement is done in practice in small scale and fast. The Check phase means the judgement of the improvement, was it successful, what failed and what new challenges were found. In Act phase the decision is made whether to utilize the tested improvement or not or should there be another iteration of the development (Torkkola 2016, 41-43.)

The PDSA principle and the way of thinking is seen in many Lean tools with the main idea to check if the done actions were successful and thinking how to improve in future. It is

essential to have such an organization of experts where every individual's ideas and views are taken into account, the common ways of working are questioned and new improvements are continuously tested. This is highly dependent on the organisation and how it is led. The focus should be in refining the processes and in people development (Torkkola 2016, 43.) The work across the team boundaries should be emphasized and supported by the organization strategy and the organization principles, methods and tools supporting the new way of thinking should be clear to all, and derived from the set company values (Modig & Åhlström 2012, 139).

Lean Operational Strategy

Organizational culture means principles and values that are followed but is more challenging to be changed. There are many reasons for this; Instead of what is written on paper can be different in practice due to the history of the company and how things have been done for years, what technology the company has, what kind of strategy is in place, who are the employees, how is the company led and what other cultures are influencing the company culture. To become a Lean organization requires transformation in both how we think and behave, small steps in changing the culture and enforced by a strong Lean operational strategy.

The focus in transformation is in refined processes and people development. The change can be tremendous taking a lot of effort from both management and the workers and as any change it can involve resistance and strong feelings. It requires assertiveness in organization to change the way of working to the new direction in a persistent manner. The organization strategy must support the Lean activities with the focus on customer value and short lead times, but without overloading the people or neglecting the individual differences. Learning and development should be continuous. Balancing the two extremes, short lead times and no overloading of people means constant measuring, right indicators to understand the variation, commonly agreed levels of variations that can be accepted. The Lean leader needs to focus on the fluency of the big picture, to coach the personnel, the customers and vendors. It is essential to understand how the work is done in order to coach and to regularly follow-up the actions to understand the implications. The leaders need to motivate and support the people to manage through the transformation which in many case involves new principles for work.

The starting point with the above, to create a Lean organization with a Lean operational strategy, is the company's values. They are derived from the consensus of important be-

liefs what is good and desirable in order to prosper and grow. Values explain important behavior and attitude and can be seen as a frame to act in all situations.

The principles realize the company values. They guide us in terms of how the decisions are made and what we should prioritise. They are built on pro-active behaviour enforcing continuous learning and improvement, to achieve flow efficiency and at the same time to understand the big picture in order to identify the possible hindrances and disturbances immediately (Mådig & Åhlström 2012, 128-134.)

Methods define how to do different tasks. As a simple example in order to realize the principle continuous improvement the visual screening could be utilized as a method to follow up the enhancements, requests and incident lead times in their separate steps to identify the deviations from the standards. In Wärtsilä the IT Service Management tool, Service-Now can be seen as a tool to realize this method and the IT Service Management practices, different follow-up forums and raising of improvement ideas, can be seen as activities.

The values, principles, methods, tools and activities are connected to each other and developed further. They are the means of realising a Lean operations strategy. "Integrating values reduces variation how we are. Applying principles reduces the variation related to how we prioritise and make decisions. Standardizing methods decreases the variation regarding what we do. Implementing tools reduces the variation in what we have" (Mådig & Åhlström 2012, 141.). It is dependent on the organization whether to focus on all levels or only some of those and where to place itself in the efficiency matrix described earlier. There is no right or wrong way in utilizing them but should aim for improving the flow efficiency in the Lean organization.

2.2 ITIL Theory

Another theory that facilitates Lean and simple and fast way of working within IT is ITIL (IT Infrastructure Library) framework. ITIL is the collection of the best practices based on the practical experience of organizations around the world and it is the most widely accepted approach to providing IT services. ITIL was developed by the Central Computing and Telecommunications Agency (CCTA), a government agency in Great Britain in 1980's. There was a need to achieve better quality with lower costs in IT services it provided (IT Process Wiki 2017a). The current version of ITIL is 2011 and it is formed of five service lifecycle phases consisting of 26 processes. The idea of ITIL is to understand the principles it describes and utilize the ideas and practices that seem to fit in organization's needs. The

processes it describes support the principles and are grouped to achieve a common goal (IT Process Wiki 2017b).

The five different lifecycle phases consist of Service Strategy, Service Design, Service Transition, Service Operation and Continual Service Improvement.

Service Strategy forms the core of the service lifecycle. Its Strategy Management for IT Services process helps in determining the needed steps from assessing the customer needs and the present situation with the IT organization and the system landscape, in order to understand what are the needed IT services and capabilities to be developed (IT Process Wiki 2017c). ITIL guides in thinking through customer value, what is the customer experience in service design and the importance of measuring the customer experience. The Business Relationship Management process helps in maintaining the customer relationship. Financial Management for IT Services process comprises of IT service budgeting, charge-back models and together with the Service Portfolio Management the management of the big picture of the services, the portfolio and the related costs for reaching the business goals. Demand Management is also linked to the strategy as understanding the pipeline of needs is essential in planning the possible implications to the portfolio and costs (IT Process Wiki 2017c.)

Service Design processes help in designing new services and in changing and improving existing services. Design Coordination Process helps in taking into account all the relevant activities needed for new, changed or improved services design. It covers the technology, linkages to the other processes, changes needed in internal service management systems, related information handling and the metrics to be followed (IT Process Wiki 2017d). Service Catalogue Management process ensures that the IT service related information is presented and up-to-date and that it contains the commonly agreed information of service. At Wäertsilä the value proposition is part of the service information together with the information of service offerings, support, orderable items and interdependencies to other services. Service Level Management process helps in negotiating the service levels for the service and overseeing that the services are designed per customer need. This covers all the functions needed to deliver the service as well as monitoring and reporting the service levels. Risk Management process identifies the possible threats and the vulnerability levels to the assets. Capacity Management process consists of all the resource needed to deliver the service and ensures that the capacity meets the agreed service levels (IT Process Wiki 2017d.) This is also linked to Demand Management as covers also the future capacity plans and typically the IT system monitoring is part of capacity management. Availability Management process takes a slightly broader role from

Capacity Management as it looks over the related processes and roles involved as well as the underlying IT infrastructure like networks to ensure the agreed availability targets. IT Service Continuity Management (ITSCM) process assesses possible risks affecting the IT service. This typically includes the assessment of the service security level and creating the service continuity plans to support the Business Continuity Management. Information Security Management process is usually part of organization's security management and it contains practices to ensure the company's data, information and IT services integrity, confidentiality and availability. Compliance Management process ensures that the IT services, IT systems and processes comply with the legal requirements and company policies. This can include audits and corrective action made to achieve the target levels. Architecture Management takes care of the future architectural landscape by following the technology development and the strategic goals for the organization and services. Supplier Management process ensures the frame agreements with the suppliers meet the organization and service level needs. It also follows the supplier performance and proactively makes adjustments to the vendor portfolio (IT Process Wiki 2017d.)

Service Transition stage includes the implementations of service designs so that all the changes to the operations are carried out in a coordinated manner. Change Management and Change Evaluation processes are to control the changes with the minimal disruptions for the IT services. Evaluation is needed with the major changes and typically a separate Change Advisory Board can exist to assess the changes. Project Management process helps in planning the needed resources in a major change. Application Development includes the development activities needed to provide the new or revised functionality for the IT service. Release and Deployment Management process ensures that the release and deployment plans are aligned with the customer needs and follows up that the releases building, testing and deployment activities are done in schedule. It also monitors that the service levels are met after the changes are implemented and ensures that the appropriate knowledge transfer is done. This is tightly linked to the Service Validation and Testing process which makes sure that the needed activities are performed to meet the agreed service levels. Service Asset and Configuration Management process helps in defining the components of the IT services and the related infrastructure and the related information is maintained in an agreed level (IT Process Wiki 2017e.) Very often the organization has the Configuration Management Database (CMDB) which holds the configuration information as Configuration Items (CI) with the relations to other CIs. This helps to identify any dependencies to other systems and services when changes are planned. Knowledge Management is also listed as part of the Service Transition lifecycle phase and it covers the information and knowhow of the IT service specific details. The information can be stored in form of knowledge articles and to be accessed by the IT staff as

well as end-users. They are meant to help the reader with their issues thus minimizing the need for additional requests and improving efficiency.

Service Operation phase focuses on daily operative activities, delivery and support of the services to ensure the customer value is met. It is tightly linked with other service lifecycle stages as it for example sees the implications of changes through the Incident Management process, it monitors the services and the infrastructure to notice any implications to the service availability through IT Operations Control and is linked to the Information Security Management as applying the set policies in Access Management. Also The Event Management process is linked with the Asset and Configuration Management as it detects events related to CIs and services in order to determine possible control activities needed. Incident Management process goal is to restore the normal service operation when incidents occur to minimize the business impact. It is tightly linked with the Problem Management process where the focus is in preventing the occurrence of similar incidents happening by diagnosing the root cause of the incidents, ensuring that the corrective changes are done and maintaining the relevant information of solutions. Request Fulfillment process ensures that service requests are done. These are typically enquiries or minor changes in the system. Facilities Management process ensures that the physical environment where the IT infrastructure is located at is appropriate in means of space, security and electricity. Application Management process ensures that service related applications are managed throughout their lifecycle. Technical Management process ensure adequate support and expertise for the infrastructure management (IT Process Wiki 2017f.)

Continual Service Improvement (CSI) stage makes recommendations on improvement opportunities to enhance the IT services. It includes the Service Review process to regularly review the IT services to find improvement possibilities. Process Evaluation process objective is to detect those areas where the set service levels are not met. Definition of CSI Initiatives process objective is to form the proposals for service improvements based on the above findings from service reviews and process evaluations. And lastly the Monitoring of CSI Initiatives follows up the agreed CSIs are proceeding (IT Process Wiki 2017g.)

Although ITIL describes the best practices through lifecycle phases and defined processes to support the adaptation and implementation of different principles it has similarities to Lean methodology in many ways. Lean underlines the importance of continuous improvement and learning and the need for the organization to have such principles, methods and tools in place that support the Lean thinking. Similarly ITIL CSI supports the same

and also recommends similar tools, for example PDSA (Axelos 2016, 18-19). Also the customer value is one of the guiding principles of ITIL. All the actions done within IT Service Management needs to reflect back to the value for the customers (Axelos 2016, 12-14). In Lean this is touched more and could be strengthened more in ITIL as well. ITIL Problem Management introduces the 5 why's method which is one of the Lean problem solving tools. The Value-stream mapping could be used in ITIL CSI to pinpoint the problem areas and define the action plan with the right measurements. As the main goal is the same, to meet the customer needs, the Lean thinking and the tools utilized are very similar to what ITIL is describing. ITIL is often seen more bureaucratic with multiple terms to master whereas Lean can be seen more agile method. However also ITIL underlines the importance of utilizing the principles and methods that are best fit to the particular organization and Lean underlines the importance of culture and organization values and principles that govern the way of working.

3 Research Process

The target was to find out information relevant to the problem in question in its real environment from the people working with the case on a daily basis and to find profound and detailed information of the different ERP landscape related automation tools thus not limiting any other viewpoints to the subject. I realized that this approach gave me a tool to understand the problem more in depth and variety as my intention was not to find a strict and precise suggestion for the improvements on this area, tools and practices, in future but rather to understand the existing limitations that prohibits the development of the tools and practices and conclude the development suggestions from those.

3.1 Research Project

The research was governed through a light project mode. No heavy project documentation was setup but the project organization, resourcing and stakeholders as well as scheduling, project phases and project practices are shortly presented in the following chapters.

3.1.1 Project Organization and Reference Team

The project work was done by the thesis writer and the steering was done by the thesis coordinator from the university, Tero Karvinen, and Wärtsilä, Kati Helenius. Kati Helenius was also the client for the thesis work as in her role as SAP main architect in Wärtsilä. The reference team consisted of 11 Service Managers, Solution Managers and Solution Architects from Wärtsilä IT and were the interviewees throughout the project.

3.1.2 Schedule and Project Practices

The project was officially started on 13th September 2016 in a Gate 2 meeting in Haaga-Helia office together with the thesis coordinators Tero Karvinen from the university and Kati Helenius from Wärtsilä. One meeting preceded this with both coordinators separately. The status reports were sent to thesis coordinators at the end of each month for possible comments. I had two status sessions with Kati Helenius during September and November in 2016 and two sessions in February and March 2017. The final version was sent for commenting on 14th April and the final improvements made in the beginning of May. The project was officially closed on 4th May in the meeting with the thesis coordinators.

The communication with the thesis coordinators took place either in face-to-face meetings or via email. The Microsoft office tools were used in writing the thesis and the versions

were stored in internal document storage provided by Wäertsilä, Microsoft's OneDrive. The interviews were recorded with PowerPoint's recording option and the related transcriptions were done manually.

3.1.3 Project Phases

I chose to use Wäertsilä's project methodology to divide the work in phases with an estimated target date to have the majority of the phase related work finished. Overall the research and writing took place throughout the whole project in an iterative mode. The following picture illustrates those phases with sub-phases in in the horizontal arrows, gates as quadrangles (target date to finish one phase).

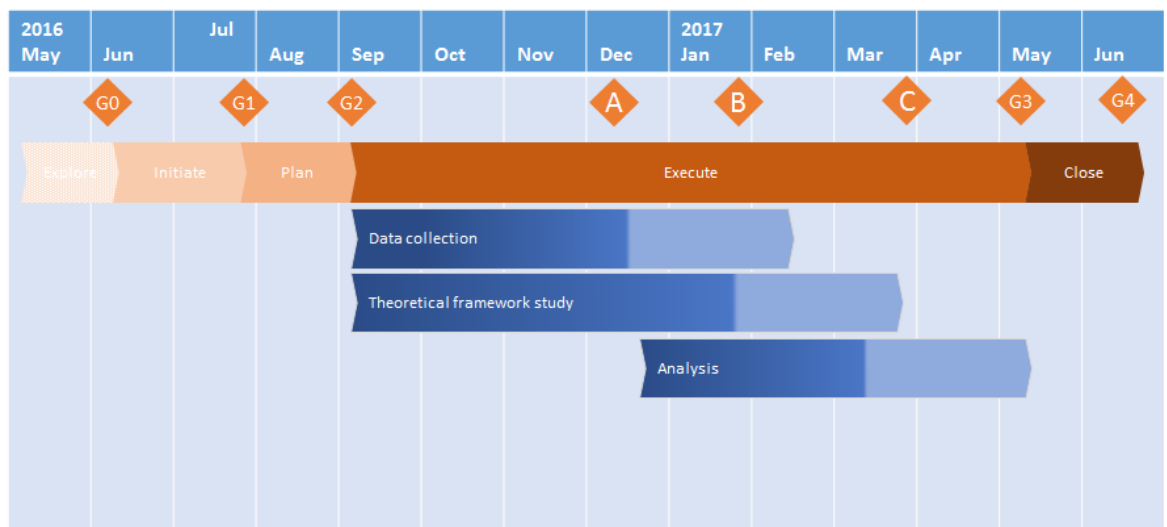


Figure 3. Project schedule with phases and gates

Explore, Initiate and Plan

I found the idea to the possible research topic later spring 2016 as the discussions over initial analysis work need on Robotics Process Automation (RPA) took place in Wäertsilä. I then created the first versions of the thesis plan and the idea was refined further during the summer and early autumn as I had a chance to test my idea with both the thesis coordinator from the work place and the university. The planning continued in detailing the schedule, data collections tools and methods as well as deciding major theory until the gate 2 when execution started.

Execute

The execute phase was the longest phase with three sub-phases; data collection, theoretical framework study and the analysis. Execute phase meant the thesis writing and the sub-phases the actual research work. The data collection and theoretical framework study were done in parallel in the beginning as I wanted to have more insight to the actual theory in order to have some of the questions created for my interviews to reflect the theory part. The data collection phase was finished by the end of December and the theory phase continued until end of February. The analysis phase which included conclusions and development suggestions had started already in January after finishing the results phase. The findings were mostly written during January and February in parallel with finishing the theory part but continued until mid-April together with the overall fine-tuning of the thesis.

Close

The closure of the thesis took place in early May preceding with the final iterations of the thesis and approval from thesis coordinator from Wärtsilä.

3.2 Research Approach and Methods

My approach to this study has been a qualitative case study. Both approaches, qualitative study and case study are applicable to the way I did the research, what was the studied subject and to what kind of end-result I was targeting at. The material used in data collection has been the interview material and software product information presented later in chapter 4. Related theories, Lean and ITIL were presented in chapter 2.

Qualitative study is best applied in situations when there is no or very limited information of the subject, a need to have a deep understanding of the topic and create new development suggestions or models based on findings. Another characteristic is that no statistical or quantitative methods are utilized (Kananen 2012, 29). I have described the situation of the automation in ERP landscape with the aim to understand the present state in order to have a meaningful analysis. Also I have reconsidered the findings based on the theory I have studied throughout the process.

I utilized the case study method as I had delimited the target of the research to Wärtsilä's automation tools within ERP landscape with SAP as the core system. The case study research usually starts from the problem in question, not only from the theories. This applies to this study as well as the theory foundation developed during the data collection phase. In case study the researcher can have some knowledge of the studied subject in before-

hand which makes it possible to create the preliminary research plan (Ojasalo, Moilanen & Ritalahti 2014, 54.) In this study I had a preliminary view towards the automation tools we have and knew some of the interviewees and their work beforehand. The case study can be well applied when there is a need to have a deep understanding of the subject and to provide new development suggestions. Case study also helps in investigating different levels of situations, how things are really done within the organization within atypical processes (Ojasalo, Moilanen & Ritalahti 2014, 53).

3.3 Research Material

I used both literature reviews, software product information and interviews as research methods for data collection. Literature reviews and software product information were essential to understand the topic before the interviews and also after the interviews when certain findings needed assurance from the right source.

3.3.1 Software Product Information

I had studied the tool related information from the software providers' web pages and available journals to increase the reliability of the data. The studying took place partly prior the interviews as I wanted to have such a basic understanding of the topic so that I could ask more in-depth question. I continued the work also during the thesis writing. The following list shows the software product vendors whose web pages were mostly used as source for the information:

- SAP
- Runbook
- WinShuttle
- UiPath
- ServiceNow
- Software AG

3.3.2 Interviews

I chose the interviewing method as the main data collection tool. I had prepared a structured questionnaire (appendix 1) which I had also sent to the interviewees before the interviews for the possible preparation needs. I allowed the frame of the questions to be enriched and changed based on the feedback and experienced interviews. I selected contextual interviewing as a method as I wanted the interviewee to discuss around the subject quite freely and be able to reflect the discussion to his/her own work. (Ojasalo, Moilanen & Ritalahti 2014, 106.)

The interview sessions were held at the normal working environment either by face to face or via Skype meetings. The typical time for one interview was one hour and the interviews were recorded and transcribed for later usage.

4 Results

This chapter gives an overview of the automation related tools mostly on technology point of view. The chapters 5 (Discussion) and 6 (Conclusion) describe more the key findings and challenges related to the tools also from the theory point of view.

4.1 Overview of the Tools

The first understanding of the automation tools fitting into ERP landscape came from the interview with the subscriber for the work, SAP main architect and thesis coordinator Kati Helenius. As the ERP landscape and the related tools are either within SAP, integrated to it or in other ways linked, for example serving as a target system in a process, it was important to show the relation as it can make it easier to follow the results and conclusions in later chapters. The following figure was then formed based on the interview.

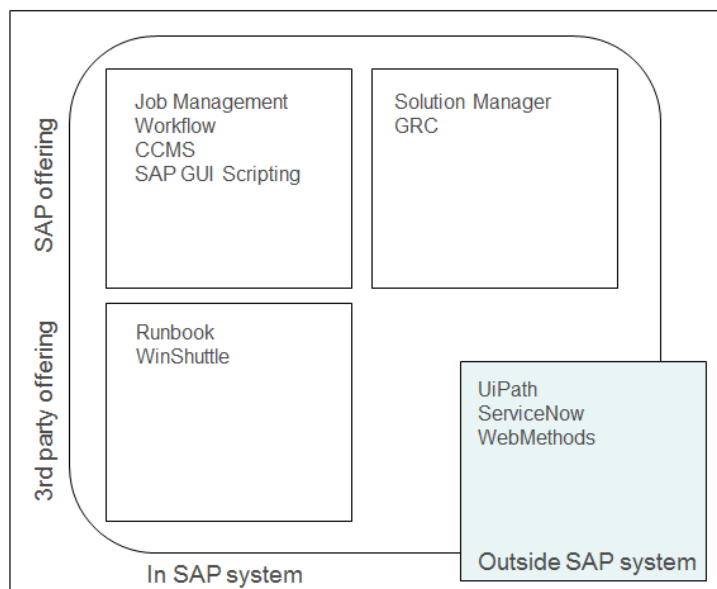


Figure 4. Automation tools in relation to SAP ERP

In the picture the top left hand side corner box lists those tools that are both SAP's own products as well inside the core SAP. The top right hand side box then has the tools that are provided by SAP but would need additional licences to run. The down left hand side box lists those tools which are closely integrated to SAP but require a separate license from the third party vendor, software provider. Third party tools can be accessed from the same SAP user interface as SAP systems. The down right hand side corner lists those third party tools that are not directly integrated to SAP but they are seen as tightly connected to the processes that utilize SAP. These tools require a separate licence.

Originally the list included also Xflow software but was left out as not serving more than only one business process, purchase invoicing. Also the SAP's standard tool for master data uploads LSMW (Legacy Server Migration Workbench) was left out as not seen a real automation tool fitting into this thesis due to its limitations. The APIs (Application Programming Interface) were not in the scope of this thesis, nor were other types of integration technologies although being lightly touched in some of the tool descriptions.

4.2 SAP Offerings

SAP EEC (ERP Central Component) is the core Enterprise Resource Planning (ERP) software which consists in several modules that provide control over Wärtsilä's key business processes. SAP EEC provides readiness for standard business processes and their monitoring. For example the standard SAP workflows form the core of the business processes but can be enhanced to fulfil the business process specific needs and Job Management allows certain tasks to be run on desired time at the background. These are more described in later chapters. SAP has been able to offer additional tools to supplement the core offerings like Solution Manager and GRC (Governance, Risk and Compliance) where the Solution Manager was still very limited five years back but has now many new functionalities to help in automation.

4.2.1 Job Management

Job Management is an end-to-end solution operations standard provided by SAP (SAP 2016f), and is technically implemented through Job Management Work Centre in SAP Solution Manager (SAP 2016d). Job Management is presented as a separate tool to Solution Manager due to the importance it plays in the process management within Wärtsilä SAP ERP. Also the tool has been able to be used prior the product SAP Solution Manager was launched as it had been one of the SAP ERP central components. Work centers are central work environments within Solution Manager that provide access to role-specific functions within SAP. The structure of a work center depends on user's role which can authorize the user to access relevant messages, alerts, reports, and documents. The number of work centers assigned to the user depends on the needed tasks to be done (SAP 2016g.)

Wärtsilä has several SAP modules in its SAP ERP environment which are here called applications. There are functional applications for example Financial Supply Chain Management (FSCM) or SAP Asset Accounting or technical applications like SAP Solution Manager or Government, Risk and Compliance (GRC). All SAP applications can be inte-

grated with each other with functionality which enables the comprehend solution for the business processes. Every SAP application has also the inbuilt functionality for running the background jobs. Background job means activities that can be automated to run at the background without user involvement and can be scheduled to run at specified time. Background jobs are ideal when certain activities are needed to be run without interfering the daily operations and when the system load is low. For example time consuming or resource intensive programmes during critical period-end-closing activities are one example of background job usage at Wärtsilä. In these jobs the user working with the closing activities can have the job run that fetches specific data for a report to be created. SAP offers also the standard background jobs which are those background jobs that should be run regularly in a production SAP System and are regularly used in Wärtsilä environment for system monitoring purposes. These jobs are usually jobs that clean up parts of the system, such as by deleting old spool requests (SAP 2016b.) The user can determine the time for the execution and once scheduled doesn't require the user's interactions as it runs seamlessly in the background. Also as the background jobs utilizes the variants the user doesn't have to worry about the value input in the field which reduces the possible confusion (Guru99, 2016).

The chapter 4.2.3 explains the automatic alert framework at Wärtsilä and how the frequent background jobs are monitored.

4.2.2 Workflow

The SAP Business Workflow is SAP's core functionality which enables the design and execution of business processes within SAP application systems. Those processes can be running through repeatedly, they can require tasks to be performed by the user or different triggering events. SAP Business Workflow can be seen as the central core of the SAP system. It enables the series of tasks being provided to the users at the right time and in right order. The process itself becomes transparent to all the users and automated flow of sequential tasks reduces manual errors. As we use the business process management system, SAP, for ready automated processes, the SAP Business Workflow enables transcending the different business processes in the system. It can contain a flow of tasks crossing through purchasing to manufacturing to material master to sales. In addition workflows can be used to surpass different SAP systems and external, non-SAP systems (Nagarajan 27 September 2016.)

The business process developers are able to use standard ready-to-use workflows which can be modified for specific business process needs. SAP provides workflow templates

for over 200 use cases. SAP FICO (Finance and Controlling), SAP MM (Material Management) and SAP SCM (Supply Chain Management) are examples of SAP applications that provide standard ready-to-use workflows (Mihaylova 2013).

SAP Business Workflow contains the following components: Workflow Definition, Work Items, Triggering events and at the Receiving end the Organizational Structure. The workflow definition is a flowchart as in the below image. It can contain various steps that can be a task pointing to a transaction or a decision. A decision might contain specifications about agents and deadline monitoring for a step. The agent is the role within the system, like an end-user. The workflow agent starts workflows and processes work items and can appear as a triggering event (for example purchase order release) (SAP 2016s). Tasks or work items can refer to an automatic step or a manual step for which a task can send a notification to the user. Tasks refer to business objects, which are programmed and in Wäertsilä with ABAP (Advanced Business Application Programming) language. Once the workflow is started, the definition flowchart determines when and in what order work happens. Work items are then received and executed in SAP system (Nagarajan 27 September 2016). The below picture is an example of the flowchart with several triggering events as radio signals.

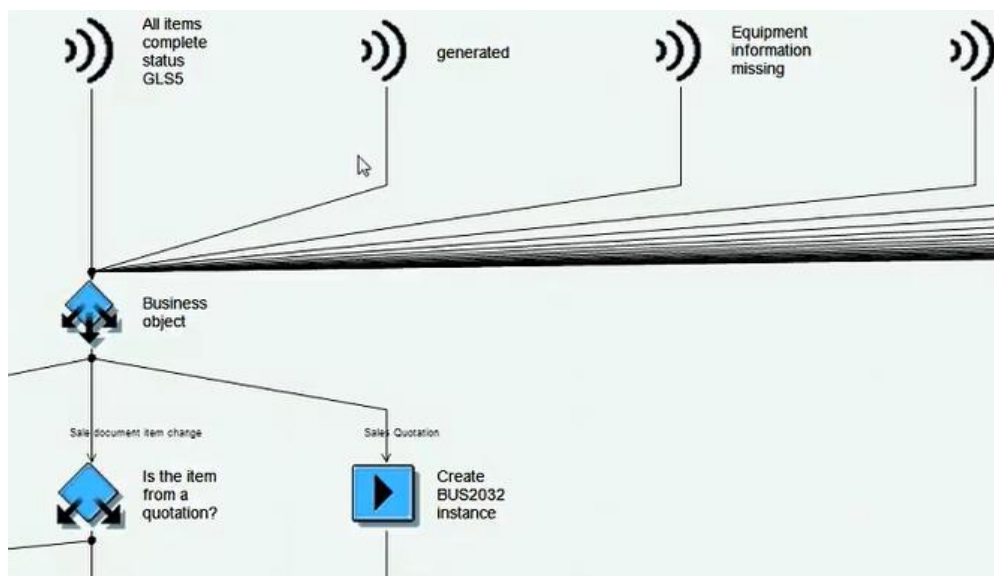


Image 1: Example of workflow flowchart

As a linkage to the Job Management there are standard SAP background jobs pertaining standard SAP Business Workflows. Those jobs are used to administering the workflows like deadline monitoring or work item error handling as examples. Workflows can be monitored and debugged with the workflow monitoring function in Solution Manager, the same application lifecycle management tool that has also the job management functionality embedded. Solution Manager enables the automatic triggering of the incident management

process with the determined triggering events but it is not used at Wärtsilä at the moment. The incident resolution of any workflow related problem happens when the user or administrator has discovered malfunction in the process and creates an incident ticket in the ITSM tool (Phutane 19 September 2016).

4.2.3 Computing Centre Management System

Wärtsilä uses Computing Centre Management System (CCMS) for system and business process monitoring. It is provided by SAP and later bundled with the Solution Manager. It is separately discussed here due to its importance within the operations of the SAP production systems. It is used for automatic alert framework at Wärtsilä in order to identify the most business critical background jobs and iDocs (Intermediate Document), have them configured in the CCMS and monitored with automatic alerts. IDoc is a standard data structure for electronic data interchange (EDI) between application programs within SAP. It can be also between an SAP application and an external program. As an example one of the monitored items is a background job for Runbook (see chapter 4.3.1). This job triggers all the jobs at the background which are generated from Runbook by the users and waiting in the buffer (Phutane 19 September 2016).

The following figure shows the automatic alert process today at Wärtsilä:

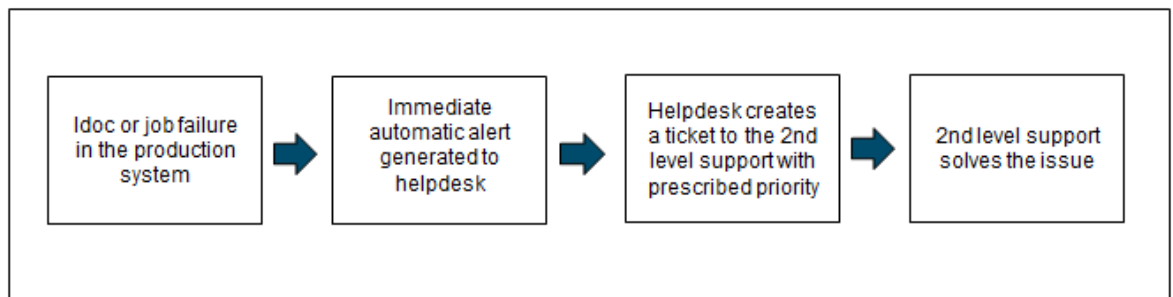


Figure 5. Wärtsilä automatic alert process

SAP Solution Manager captures the error and then triggers an email to service desk. The email is configured in Solution Manager via predefined distribution list. The configured Idocs and jobs are listed and categorized by their importance and affected SAP application and attached with the related support model and further working instructions. This guides the incident ticket creation in the ITSM tool and prioritization at helpdesk. The list is updated based on the added or deleted monitored objects and periodically reviewed with the responsible application owners at Wärtsilä. The downside with the manual job and idoc lists is that any human error also reflects to the content of the list (Thummapalli 31 October 2016.)

The CCMS can be configured to the monitored system meaning that alerts that occur in the monitored system's CCMS are passed to SAP Solution Manager via RFC (Remote Function Call) interface system which enables function calls between two SAP systems (SAP 2016t). Alerts can then be handled centrally, without having to switch to the local CCMS of the monitored system.

The automatic alerting is essential part of SAP application's management and overall business process management as it has reduced the number of the incident tickets created by the end users. The monitoring enables the ticket resolution faster without the user noticing any failures in the business process in majority of the cases.

4.2.4 SAP GUI Scripting

Wärtsilä's SAP release regression testing is partly automated by using SAP GUI Scripting tool. It doesn't require additional licences to run but is included in SAP GUI 6.20 and later versions. Scripting is useful when making repetitive tasks and SAP GUI Scripting tool adds the recording aspect to the work as well. The script can be created by simply starting the recording and stopping it when the work is done and it can fetch the data provided in MS Excel. The tool is not recommended to use in production system as every mistake made in scripting can create errors in production very quickly.

SAP GUI Scripting is written in Microsoft's VBScript language. In order for the VB scripts to access the SAP GUI and manipulate an API (Application Programming Interface) provided by SAP need to be used (SAP 2016j). API is a set of functions, procedures and protocols that allow the creation of applications which access the features or data of an operating system, application, or other service (Wikipedia 2016c). The scripting language needs to be understood in order to start a new script but the tool has built-in scripting facilities that helps in scripting. For example when you move the pointer across the SAP GUI, the agent displays the Type, Name and SubType property values for any objects it finds (SAP 2016k).

Each SAP major release calls for regression testing to see the impact on the existing business roads. As the release management process is very tight in schedule wise and the amount of business roads to be tested is big the SAP GUI Scripting has been used to automate the testing. It was a manual effort before but during 2016 most of the business roads tests have been automated. The regression testing scripts are stored in Solution Manager. The release manager creates a project for the testing in Solution Manager prior the regression testing and the related tests are linked to the project. Each business road

will be copied to the project. The scripts are then allocated to various people in the testing team by their application ownership. The tester opens the script which contains the necessary steps to complete the business road. All the scripts belonging to the specific business road need to be executed. The result sheet is updated of the completeness or status of the test and sent to the application owners. If any errors occur it will be investigated whether it is development related. According to the interviewee it has been possible to reduce the time of execution of business roads by 50%. As the work is still ongoing it is estimated that by automating the remaining business roads the duration of execution can be reduced to 40%. With the saved time the additional critical scenarios can be focused and added to scope to identify any issues in advance (Thummapalli 31 October 2016.)

ECATT (Extended Computer Aided Test Tool) is a free software testing tool provided by SAP to automate and test business scenarios. As the SAP QUI Scripting tool is quite limited it is not suitable for all the testing scenarios we have at Wärtsilä. QUI scripting is recording the SAP screen elements which we do not have in web-enabled applications. The tool is currently under evaluation whether it is suitable for the needed testing (Thummapalli 31 October 2016.)

4.2.5 Governance, Risk and Compliance

At Wärtsilä the risk management is an essential core competency. We are doing business which involves risks, and taking controlled risks is good and an essential part for creating opportunities for an organization to make profit and growth (Wärtsilä 2016a). Wärtsilä is accountable of doing business by the laws and regulations set by the governments of countries across the enterprise. The level of compliance shows the level of organisational accountability which is one of the key elements in building trust across the markets. Managing risks is a major business challenge and should be addressed with high importance on related activities it demands. The need to identify the risks is critical as the requirements are usually very complex and the fragmented and isolated ways to manage the work should be carefully examined from one central point. "Through better automation, centralization and by turning data into actionable insights, businesses can transform risk management from an operational and financial burden into an enabler for success" (Integrac 2016).

SAP Governance, Risk and Compliance (GRC) solution has been taken in use at Wärtsilä with the intention to cover the management of regulations and policy compliance related to SAP. The current licencing at Wärtsilä allows only the Access Control tool usage with limited functionalities to help in access governance (the list of GRC offerings is presented

later in this chapter) and the SAP Identity Management tool has been licenced to enable the Central User Administration.

SAP offers multiple capabilities within GRC with different functionalities. Of those capabilities Access Governance, Controls and Compliance Management, Enterprise Risk Management, Fraud Management and International Trade Management are explained more in the following chapters in relation to Wärtsilä. Those areas are currently either covered with one or more applications to support the work or there are plans to start strengthening the area in near future. The solution capability areas are listed below (SAP 2016m):

- Access Governance
- Audit Management
- Controls and Compliance Management
- Enterprise Risk Management
- Fraud Management
- International Trade Management

Access Governance

The automated administration and easier governance for access control is possible to attain with the access governance. SAP introduces several tools for this area which makes it possible to add preventative policy checks and enable monitoring of user access activities and automatically detect of risk violations across the system (SAP 2016b).

Wärtsilä has taken in use the Access Control and SAP Identity Management tool of this set. Only part of the Access Control tool is used via the standard edition acquired. This allows the usage of the functionalities of Access Risk Analysis like Rule set maintenance and Super User Privilege Management and Report and Dashboards like Security, Audit and Access Risk Analysis Reports. There are plans to acquire the full licence for the tool allowing functionalities for Access Request Management like User Password Self-Service and Automated User Provisioning as well as functionalities for Business Role Management. These would automate the authorization processes to a great deal and enable controlled management of the new business roles.

Wärtsilä has automated the interface between the Active Directory (AD) and SAP Central User Administration (CUA). CUA is a key function of SAP Identity Management for user and role administration. Active Directory is provided by Microsoft and developed for Windows domain networks. Wärtsilä maintains the network user identification information in Active Directory. When there are changes in Wärtsilä employee's profile in Human Resources the changes are automatically updated to the user profiles maintained in AD. The changes can occur with new personnel, change in the position or team. With the case of having a new people or termination of people the system automatically triggers a mail to

the helpdesk of new SAP user identification creation or deletion. As the Access Control tool isn't fully utilized today the changes regarding new teams and statuses are not automatically triggering change process for roles. The SAP authorizations, role-based authorizations are requested by utilizing the ITSM access request forms. The requests are handled manually by helpdesk, setting the rights and assigning the roles in SAP ((Jajala 20 September 2016).

Controls and Compliance Management

The aim not only to take use the remaining functionalities of Access Control but also Process Control functionality which helps in automating the internal control and compliance management enterprise-wide. It would get Wärtsilä SAP ERP access governance to the next level and give the real-time visibility into controls' status and responses to key compliance needs and risks. The business processes would become reliable and efficient, and Wärtsilä could easier ensure compliance with a broad range of regulations (SAP 2016p).

Fraud Management

SAP Fraud Management enables the company on improving detection strategies against future fraud. This is possible by making more effective alert investigations as the application is built to scan large volumes of data in real time and with greater accuracy (SAP 2016r). According to the interview (Jajala 20 September 2016) Wärtsilä does not have this tool at the moment but there has been discussion to build a proof of concept for the usage. As the tool requires a more powerful database to run effectively, SAP Hana, this has been proposed as one of the tested items on SAP Hana test environment. Wärtsilä has the SAP database migration to Hana database under planning.

International Trade Management

SAP Global Trade Services (SAP GTS) automates import and export processes, while ensuring that transactions comply with all customs and security regulations. SAP GTS helps companies standardize and streamline trade processes across their entire enterprise and business units thus reducing the risk of penalties and fines. It also fosters use of shared data and shared collaboration knowledge, replacing heavy manual processes. The Export Management part of GTS is used in Wärtsilä (Wärtsilä 2016b; SAP 2016q).

As stated in earlier chapters Wärtsilä has GRC implemented but only two modules of that within Access Governance has been licenced in addition to SAP GTS. The GRC tool was originally purchased in order to track risks effectively and in organized manner. The decision was to start from the Access Control point of view and then gradually enter other areas to improve the overall risk management of SAP related business processes. In the future plans the Access Control would be fully licenced and the Access Request Management would help in managing the authorization process automatically with no manual intervention. This way the process flow would be quicker and more functionalities of Access Control tool could be taken into use such as Risk Simulation. Risk Simulation can be used for example in situations when the user creates a request for getting a new role x and having already a role y. The simulation can automatically check if the role x has a Segregation of Duties (SoD) conflict with role y. This means the risk of having such authorizations to complete such sensitive transactions that in theory should be done by separate persons to avoid any possibilities for fraud. SoD conflict is a risk as it puts the organization in risk of failing to meet regulatory and compliance requirements (Jajala 20 September 2016.)

With fully automated access control process Wärtsilä also brings down the number of tickets which today go to the third party service desk. Every ticket has a price tag. Today the number of access requests is approximately 14500 per year. This number does not include for example password resets (Jajala 20 September 2016.)

4.2.6 Solution Manager

SAP Solution Manager is a central integrated end-to-end orchestration platform for managing the SAP solutions application lifecycle and adopting new developments (Wikipedia 2016b). It is seen as the single source of truth because if you need to know anything of your SAP landscape or SAP products you can simply log on to Solution Manager and find the information or if you need to have any new product of functionality taken into use the needed configuration is done in Solution Manager. Due to the wide variety of functionalities this tools provides, it also aligns business and technical aspects of the solution and strongly focuses on core business processes.

Wärtsilä has the Solution Manager 7.1 in use at the moment and the migration to 7.2 is under planning. The present version offers multiple applications to manage the application lifecycle. The following list shows the applications used mostly at Wärtsilä today. The usage is mainly on the operative and monitoring side of the Solution Manager offerings. The following list shows the most used functionalities:

- Business Process Operations: This functionality addresses monitoring of the business processes, improvement of the processes, background process management as well as Data Consistency Management (Schaefer 2016). Monitoring of the entire process flow is currently not used at Wärtsilä but would be beneficial to implement to strengthen the business process management concept. It is linked with the Business Process Improvement tool that helps to identify weaknesses in the business process (Phutane 19 September 2016). This could be seen as one of the Lean tools in this area.
- Custom Code Management: This tool is currently in use at Wärtsilä and used for getting full transparency of the custom codes within the systems. As the majority of the custom code is done by the external consultant there is a strong need to manage the custom codes to target on quality improvements (Phutane 19 September 2016).
- Change Management: The change management process is one of the processes currently handled via the ITSM tool at Wärtsilä. However all the changes implemented to the system are recorded in Solution Manager. The Change Management functionality would enable the workflow-based management of business and technology driven changes with integrated project management and synchronized deployment capabilities (SAP 2016t.) According to the interviewee (Phutane 19 September 2016) this would mean a real automation within change management which is today handled within the ITSM tool from where the needed changes are manually transported to the production systems.
- Configuration: This is used immediately after the Solution Manager installation or an upgrade and it guides the user on what steps to be taken to finish the installation.
- Data Volume Management: This functionality monitors the data volumes in system landscape. It is also possible to reduce the database sizes and the amounts of data.
- Implementation and Upgrade: This is used when a new solution is needed to be implemented. It gives a complete sequential view over all the needed steps and components for the implementation.
- Incident Management: This tool is for recording the raised incident. These can be raised by users or by the system monitoring itself. This is not used at Wärtsilä due to a global ITSM tool used for incident management but there are plans to automate the system triggered incident ticket creation to the ITSM tool (Phutane 19 September 2016.)
- Job Management: Described earlier in chapter 4.2.1.
- SAP Engagement and Service Delivery: This section gives information on different service reports from SAP system for example EWA (Early watch Alert), upgrade assessment and custom code maintainability check to name a few. These reports are used to correct the systems in various occasions.
- SAP Solution Manager Administration: This provides the view and access to all the functions and information within Solution Manager.
- Technical Administration: This helps in managing tasks and schedules to operate the Solution Manager (Phutane 19 September 2016.)
- Solution Monitoring: This allows to get an overview of the systems, all the instances of it and databases and host. It is possible to drill-down to get the detailed metrics of the data and allows mass-configurations and central maintenance (SAP 2016u).

In order to have the application data visible in Solution Manager the diagnostic agent, a software component, must be added to the remote technical systems and configured to connect to the Solution Manager. Today the SAP provided tools are added to Solution manager at Wärtsilä. These are SAP EEC, HR (Human Resources), SCM (Supply Chain Management), GTS (Global Trade Services) and Fiori (product line of SAP applications that have a device-agnostic user interface). It is also possible to add external, non-SAP

products but only archiving system has been configured by today. In the below high-level figure the grey boxes represent all the development, quality and production systems within SAP ERP. Those can be the GRC, GTS, SCM, HR or any other systems which can be configured to the Solution Manager. The LMDB (Landscape Management Database) is a component of the Solution Manager which is responsible for fetching all the technical information of different applications and supplying that information for different applications within Solution Manager. SLD (System Landscape Directory) receives the information from the technical system and frequently synchronizes with the LMDB (Phutane 19 September 2016.)

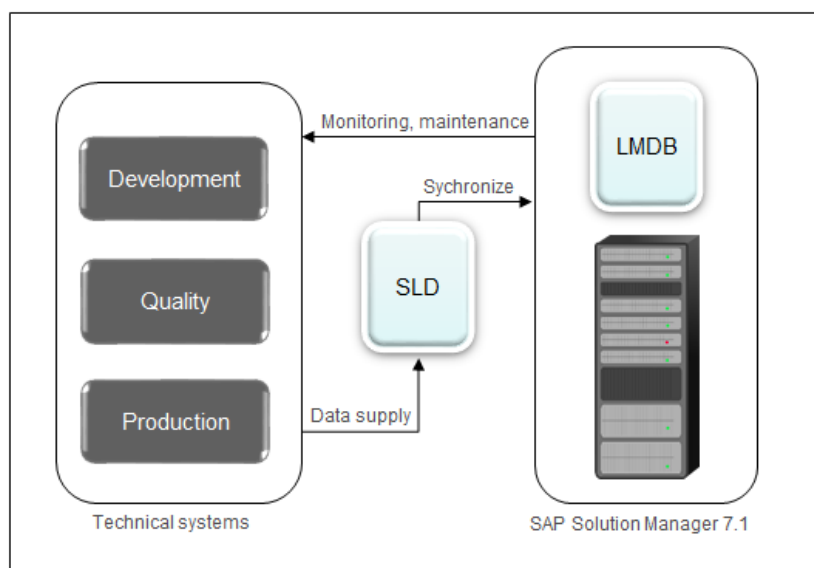


Figure 6. Solution Manager landscape

SAP develops the Solution Manager constantly with new functionalities. As described earlier there are vast possibilities to utilize the Solution Manager more, have more applications to be configured to the Solution Manager, being able to monitor business process performance related to the SAP workflows, background jobs and overall system performance as well as have better control over changes, recurring incidents.

4.3 Third Party Offerings

4.3.1 Runbook

Wärtsilä uses Runbook software to coordinate, execute and monitor financial closing processes in SAP for all Wärtsilä companies using SAP. It is also used to control outgoing payments and generate internal control reporting. The software is using Excel interface technology and is provided by company BlackLine. Runbook is a solution that ensures the

coordination and execution of general flow charts or individual checklists along with integrated planning, support and control activities in cycles (Leskinen 3 October 2016.)

The software was taken in used in 2010 at Wärtsilä and was first configured to improve the end to end period closing process. As an end result the complexity of the processes was reduced and the process documentation was improved. The automated control of the closing tasks reduced human errors and improved the audit trail and enhanced the checks on internal controls. Global task list defined includes all task to be executed during the closing process and it is considered as core data for the closing process (Leskinen 3 October 2016.)

In the Runbook context, a scenario is any process which requires a number of steps to be performed in a particular sequence. As such it could also be described as a task list describing exactly what needs to be done, who is the responsible person, where the task needs to be performed at and by what timeline. In defining a scenario, you must specify the following (Wärtsilä 2016d):

- which part of the organization (Runbook area) it is associated with
- description of the process
- who is responsible for the process (the scenario owner)
- base date against which step start and end dates and times are computed
- frequency with which the periodic scenarios are executed.

Having decided which steps need to be performed and in which sequence and by whom, the steps can be added to the scenario. For each step there are multiple of descriptive and controlling items to be specified (Wärtsilä 2016d):

- a four-digit step number
- a description of the step
- transaction code, program, etc. is to be used to perform the step
- authorized party to execute the step
- step(s) needed to be executed before this one
- additional text describing the step in more detail
- an internal control note describing the outcome of the step (entered on completion)
- an execution type to specify the periodic interval for execution of the step
- an absolute start and end dates/times or (if a base date has been entered) relative start and end dates/times
- a step classification enabling improved management reporting
- a note if a reminder messages should be sent if the step is late
- a note on completion if a notification should be sent to those responsible for the following steps.

Having created the scenario, it is ready for execution, but before doing so a unique identification number needs to be entered in order to distinguish each different occurrence of the scenario. When execution of a scenario is finished, it is archived for future reference. Users can execute all the specified steps within Runbook, without having to look up the necessary transactions, programs, variants, etc. During the process, each step has one of

three statuses: open, currently in progress or completed. Details of the execution of each step are recorded in a log file for future reference (Wärtsilä 2016d.)

Shared Service team (SSC) handles the Runbook operations and maintains the global template, task lists at Wärtsilä. If any updates are needed to the global template or any local report needs to be created the SSC will do it. For example the payments team in SSC handles the payment related scenarios maintenance and updates and the closing team the closing scenarios. Shared Service team maintains also the Runbook access rights. SAP authorization gives only access to the Runbook transaction but the authorizations to specific Runbook areas are given by Shared Service Centre. The information is transparent across the organization. The closing managers and controllers of the divisions can follow up the process from the Runbook portal. Group Control team receives the relevant KPI information related to the process and can perform the financial consolidation activities in time (Leskinen 3 October 2016.)

The only required application to run Runbook is SAP and the connected content servers as illustrated in the high-level landscape figure below. These content servers are globally utilized within Wärtsilä by different services and not installed for Runbook purpose only.

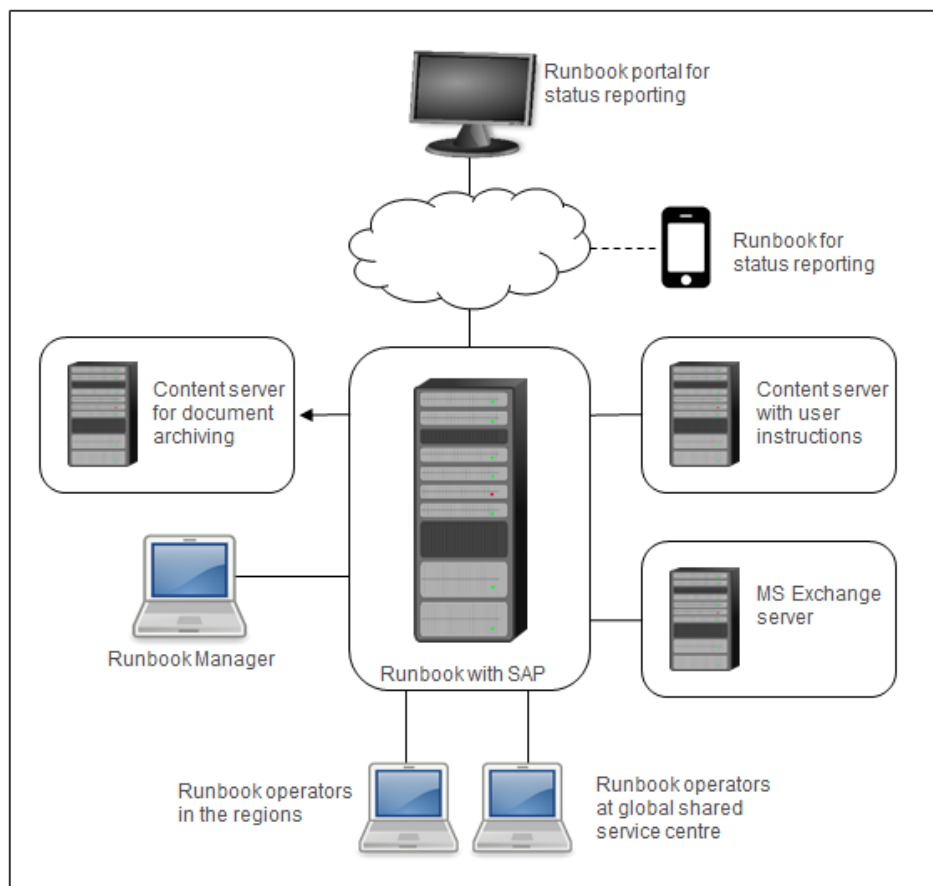


Figure 7. Runbook landscape (Wärtsilä 2016d)

In the above figure Runbook reaches out to the content server for user instruction, this means a single point of maintenance for user instructions. This connection can be either via SAP or via the intranet. The archiving system is used to store SAP reports and other compliance documentation (Wärtsilä 2016d.)

Runbook can interact with every relevant period-end closing application that is connected to SAP. Non-SAP applications can be connected to Runbook via a remote function call when required. Process status update can be retrieved from the Runbook itself or via intranet portal. Milestone process status updates are sent via Runbook automatically by email to the subscribers, like finance managers and/or group controllers. This email subscription is controlled within Runbook (Wärtsilä 2016d.)

4.3.2 WinShuttle

Wärtsilä uses WinShuttle Transaction and Runner tools for master data uploads. The provider is a third party company, WinShuttle. There is also SAP standard program LSMW (Legacy Server Migration Workbench) available and in use but not further discussed in this thesis due to its limited functionality as not providing real automation features like data validation or possibilities to have different fields defined. Master data is the core data that is essential to Wärtsilä business units and agreed across the company. What is treated as master data differs between businesses but it can include data for example about clients and customers, equipment, employees and suppliers. Master data is typically shared by multiple users and groups across the business division and can be stored on different systems (Kane 20 September 2016.)

WinShuttle Transaction tool enables update and creation of transactional and master data in SAP from Microsoft Excel and Access without programming (WinShuttle 2016). Transactional data means data which is grouped with associated master data and reference data. Reference data can be for example currencies and currency codes or positions of employees. Winshuttle Runner is a desktop solution where it is possible to work with SAP data through an Excel add-in or through the Windows desktop Studio application. All SAP security authorizations are respected and all SAP data validation rules still apply when creating or updating SAP data (WinShuttle 2016.)

It is possible to create background jobs to carry out periodic uploads of data. The end user will save an excel file containing the needed data in a predefined format to the content server and WinShuttle will fetch the data and import that to SAP. It is also possible to set validations to the upload so that the erroneous data will be detected and cleaned. For ex-

ample if the user is providing a value which is not available in SAP the system will give an error message. The data is then checked and cleaned and re-uploaded. The checking of data quality is dependent on the availability of the rules defined by related business line. For example in the equipment master data validation rules have been defined for the upload. This validation needs to be done manually and it checks if the data in the excel file is defined by the validation rules set. If errors occur the file is sent back to the business data owner. An automatic email notification is configured to WinShuttle which will automatically send a summary of the periodic mass data uploads to the user in case of errors (Kane 20 September 2016.)

Not all the businesses are utilizing the WinShuttle's capabilities fully and are not creating for example the data validation rules. The data is then sent to the master data management team for minimum cleaning activities like duplicate checking and uploaded to SAP without further validations performed. Duplicate checking is missing from the WinShuttle tool and therefore done with the Fuzzy Logic software provided by Exis, LLC which is a software company specializing in Microsoft technologies (Kane September 2016.) The tool is not further explained in this thesis as handling only a small part of the data cleaning but needed to mention in order to create the view of the tools landscape overall. WinShuttle is the main centrally provided tool for master data management but business lines have been able to purchase own data management tools suitable for their specific data cleaning needs (Kane 20 September 2016). Example of such tools is DupeBlocker which is a data de-duplication tool that was developed to complement the existing Salesforce data quality tools by a company CRMfusion (CRMfusion 2016). In Wärtsilä Customer Relationship Management (CRM) is running on Salesforce platform and the DubeBlocker is used to instantly carry out all the validation checks whenever a user is creating a customer in CRM. WinShuttle is at the end used for data uploads to the SAP even if any cleaning activities are first performed by the business's own tools (Kane 20 September 2016).

Wärtsilä's Master Data Management program (MDM) was established to improve the data quality and setup a cross-divisional governance model to continuously maintain the quality of the master data. The program concentrates on finding the best solutions and ways of working for the data cleaning and that the data quality is continuously maintained and improved. The expected benefits are the overall efficiency and speed through accurate data, less non-conformities and better business intelligence as well as clear responsibilities with rules and procedures to enhance the communication and transparency (Kane 20 September 2016).

4.3.3 UiPath

UiPath is a complete software solution environment provided by the company UiPath and currently used at Wärtsilä in providing the Robotic Process Automation (RPA) service. Robotic Process Automation is the new recognized possibility at Wärtsilä for process development and automation. UiPath was chosen as the RPA software based on the test results made with few RPA software tools prior to the pilot project in 2016. UiPath is a software which is able to use other software similarly as a human user and is an alternative to heavy and costly tool developments. It is best suitable for rule based front and back office processes with large volumes and processes involving various systems and tools.

For piloting purpose the project implemented RPA in Shared Services payments, selected Treasury related activities and selected business process tasks in order to prove the potential of RPA generally in Wärtsilä. The project ended at the end of 2016 and the expected benefits have already been realized. By implementing RPA it had been able to increase the scope of work with same resources. Clear savings of time had been achieved by reducing human intervention in the process as well as automating the execution regardless of the time of the day. The pilot included five different processes from Treasury, Shared Service Centre (SSC) and selected business line and altogether the time saving had been 659 hours in the project, above the expectations. The users have been able to focus on to more value adding work. The processes have become more efficient and there has been no manual errors affecting quality and accuracy.

The UiPath environment components are UiPath Studio, UiPath Orchestrator and Elastic Search with Kibana. These can be seen from below picture. UiPath Development Studio enables developers, process experts and business users to design and develop process automation using inbuilt activities and tools bundled by UiPath in development studio environment. Users can model end-to-end business processes into a process diagram with simple drag-and-drop functionality. UiPath Back Office Robot is a software robot programmed to execute processes with UiPath Studio and controlled by UiPath Orchestrator. It runs unattended, independent from human interaction. UiPath Orchestrator is a browser based server application that manages robots and processes. By using orchestrator web console it is possible to deploy, start, stop, and schedule processes and monitor process execution by the robots. Kibana is an open source data visualization tool for Elastic Search. It is used to modulate and view UiPath logs in real-time. It is however lacking automatic alerting or centralized view to the system performance in its present version (Redekar 9 November 2016.)

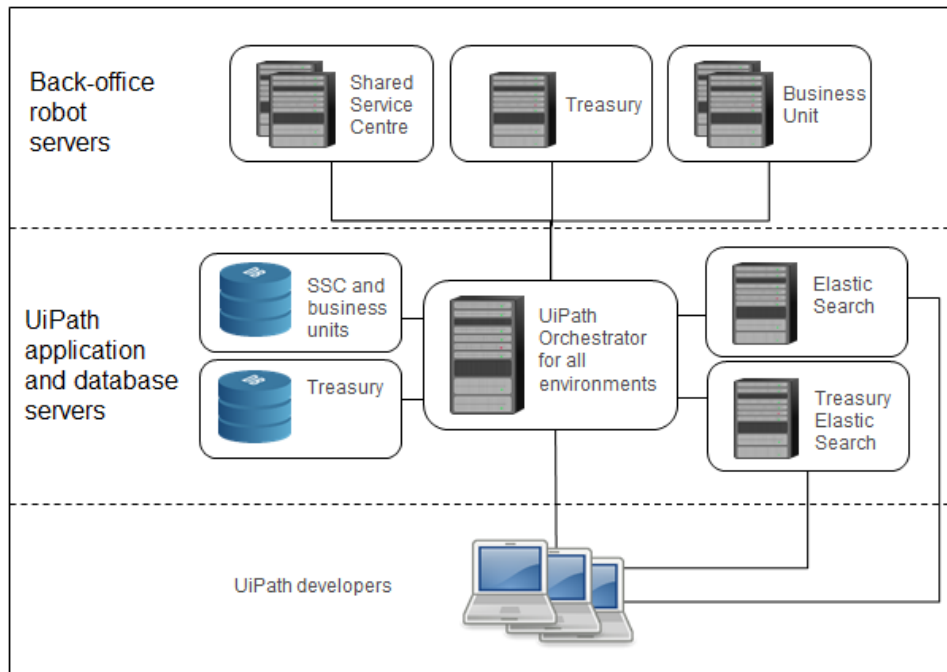


Figure 8: UiPath landscape

The robots can be developed with the UiPath Studio by recording the user's actions on a screen or by utilizing earlier created objects. It can be seen like an extension to macros. While macros can perform certain functions automatically once they've been programmed, robots can respond to external stimuli and the functions can be reprogrammed (UiPath 2016a). Functions can be separately saved for later usage to the object library. Each function can be further automated by using scripting languages if needed. Whereas scripting alone can be prone to coding errors the RPA software secures the development by utilizing sequences and tasks thus making the process development modular and reusable. Also the testing process at Wärtsilä ensures that no erroneous robots are executed in production environment (Redekar 9 November 2016.)

UiPath utilizes Microsoft technology and .net framework. Visual Basic.NET (VB.NET) is used as a scripting language mostly at Wärtsilä but other scripting languages like Visual C# can be used. UiPath has built-in activities to interface with any application regardless of technology. It can utilize XML (Extensible Markup Language), CSV (comma-separated values), XPS (XML Paper Specification), Connect DB, FTP (File Transfer Protocol), SOAP (Simple Object Access Protocol), HTTP (Hypertext Transfer Protocol) and Microsoft Mail &Exchange to name a few. For example UiPath has a set of tools dedicated for SAP. They are specifically designed to integrate and automate with SAP because SAP user interface is different than normally in applications (Redekar 9 November 2016.)

“RPA software also deploys technology far beyond macros and scripts. At UiPath, customers are able to incorporate both sequential and parallel workflows by using “If”, “Dowhile”, “ForEach”, “While” & “Switch” branching arguments to support highly complex business logic. While macros and scripts are limited to presentation layer

integration, the UiPath software product will automate workflows on several other levels, specifically: application layer; storage layer; OS layer and Network layer.” (UiPath 2016b.)

Strong point for the RPA tools is that it is based on most widely used technology, Microsoft technology stack. But it is not limited to that, works also with java and other technologies as well. UiPath’s core is based on .net framework and it also uses some open source software like Kibana and Elastic Search and works very well with SAP and java as well. The robotized processes can therefore be as good as what technology the underlying applications is using. As for the downsides UiPath does not have cognitive processing capabilities in its present version. It is not able to do any machine learning, decision making with it. We are able to make decision making if it can be made by functions if-else but UiPath hasn’t focused to AI at the moment in their roadmap. UiPath lacks also some of the enterprise level maintenance and application maintenance level practices. If you need to have an audit trail you need to go through logs to manually generate an audit trail report as no ready report is available. There is no centralized monitoring system to manage the whole system landscape and no notification possibilities in case of incidents that would alarm for example via mail or text message. Those functionalities do exist in the environment but in multiple places. For example on a process level the user needs to go to the specific process log and run the debugging function. As having no automatic alerting functionality the system logs need to be checked manually (Redekar 9 November 2016.)

4.3.4 ServiceNow

ServiceNow software is a software provided by company ServiceNow and was named a Gartner Magic Quadrant leader in the IT service support management for the third year in a row in 2016 (Gartner 2016). The purpose of the application is to support, orchestrate and automate IT service management processes and the related data necessary to efficiently manage IM services. It is treated as a single source of record for IT service management processes at Wärtsilä and in its extended enterprise. The tool is available on the internet and accessible through web browser on both PCs and mobile devices.

The need to improve the IT service management at Wärtsilä started on 2011 by identifying the improvement areas. The first improvement area was the people and processes. ITIL based IT processes were designed, introduced and trained to the identified roles within Wärtsilä IT, business divisions and the selected suppliers. The second improvement area was the IT service management related tools supporting the processes. It was soon discovered via internal surveys after the deployment of new IT processes that the tools to support the new way of working were missing or scattered. Based on the findings IT ser-

vice management tool roadmap was defined during spring 2012. The roadmap work started by capturing all the different tools the IT teams were using at that time and the experienced challenges with them. It was concluded that the current architecture with different tools among teams and suppliers were not aligned with IT service delivery model and IT strategy. The need was to improve the user experience of IT services and provide better visibility to the IT performance. There were then three cornerstones defined for the new ITSM tool scope in order to achieve the goals (Wärtsilä 2016e.):

- better IT process management
- full understanding of the IT environment, IT services and the related applications
- possibility for the end-to-end application performance management

The work to establish the new centralized IT service management tool for Wärtsilä started on summer 2012. It consisted of centralized management of service requests, incidents, problems and changes among all the IT teams and suppliers, supported by adequate level of detail in asset and configuration management and real-time visibility to end-to-end service performance through APM (Application Performance Management) (Wärtsilä 2016e). The project ended in November 2015 and had by then integrated all the IT processes to the new ITSM tool.

Today the ITSM platform is managed via an IT service and the configurations for integrated processes are constantly developed to be streamlined, simpler and faster. According to the interview (Karppinen 17 October 2016) the platform is used for various purposes in addition to the preliminary implementations:

- It provides a service portal for the users to create incidents and different kinds of requests and follow up their status. Incidents and service requests are passed through the predefined support path via the workflow mechanism. Enhancement requests have also the approval workflows embedded but serve as a communication tool of the related development and test phase.
- The IT services and their offerings are visible through the Service Catalogue providing structured format with general and IT specific information and links.
- It enables the effective IT service management for incidents, problems, changes, releases, configurations and continual service improvements through service specific views.
- It allows better management of service requests to internal and external service providers with automated workflow mechanism which seeks for the needed approvals. Some of the requests could be further automated like AD password resets are done as a self-service already now. Along with the development of the SAP Access Control concept also SAP authorizations could be fully automated.
- The external service desk uses the tool to handle some of the service requests, incidents and the related communication.
- Provides management of IT service related knowledge articles
- Enables the asset management
- Provides service reporting capabilities
- Gives view to the IT service components and configuration items

The ITSM service is constantly developed and new items have been identified to the roadmap. The following list shows some of the possibilities that the ServiceNow tool and the built infrastructure around it brings (Karppinen 17 October 2016):

- Personalized service catalogue
- Mobile user interface
- SAP purchase order integration
- Push notifications
- Business service management maps
- Real-time service dashboards
- Test management
- Optimized configuration management database and assets
- Analytics and machine learning capabilities integrated
- Vendor performance reporting and management
- Enterprise Service Management (various business specific workflows) automation

The following figure illustrates the architectural view of the ServiceNow landscape. ServiceNow is provided to Wärtsilä as a platform service from the company ServiceNow. It is split over two data centers for high-availability purpose (Wärtsilä 2017.)

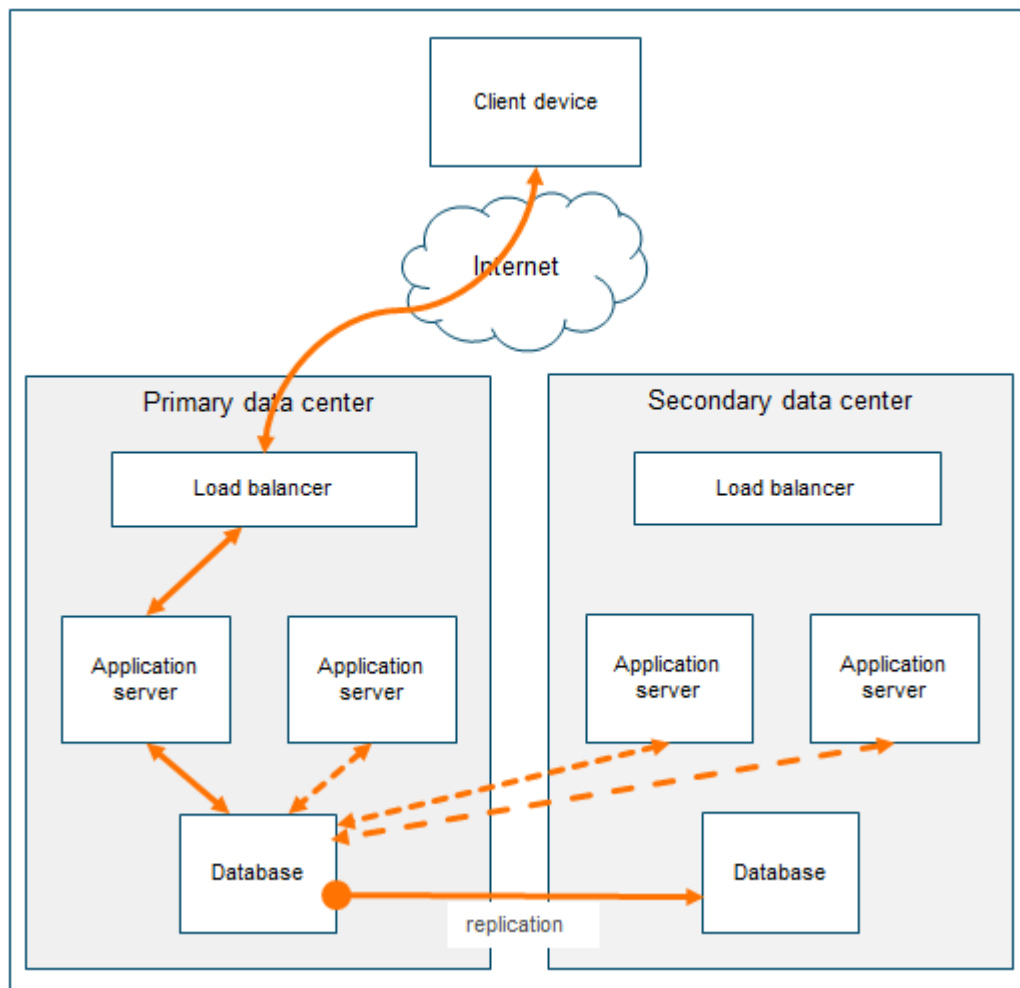


Figure 9: Wärtsilä ServiceNow architecture (Wärtsilä 2017)

ServiceNow platform consists of several application and database servers or nodes. At each data center, there are generally at least two application nodes, each running a copy of the ServiceNow tool and working together to share load. Additionally, there may be worker nodes installed to process non-interactive jobs, such as sending out e-mails or handling integrations. There is only one active database server that is running on a separate physical server. It has a redundant pair hosted in the remote data center (data is replicated between the locations) (Wärtsilä 2017.)

4.3.5 WebMethods

WebMethods Enterprise Service Bus (WESB) is a platform used for integrating various internal and external applications related to different business processes at Wärtsilä. Integrations are being implemented and supported through WESB which is built with Software AG WebMethods components. The integrations are implemented with required business logic along with data exchange, transformations and enrichments between various applications.

Transactions are handled in different data formats like XML (Extensible Mark-up language which defines a set of rules for encoding documents in a specific format), Flat files (files with no structured characters), IDOCs (Intermediate DOCuments to transfer data to SAP and other systems), and some specific formats preferred by applications. WebMethods can be used to develop interfaces for SAP ERP by Standard Adapter (Out-of-band component, OOB) which will facilitate interaction with SAP by both RFCs/BAPIs and IDOCs (Inbound & Outbound), and ftp-files to SAP backend. Interfaces are built in WESB by extending standard functionality, built-in services in WebMethods and existing interfaces for business requirements. Web services are already implemented in WESB but not as direct Web service interface (Web service is a service offered by an electronic device to another and communicates via HTTP protocol over the intranet using a standardized XML messaging system). API related interfaces can be implemented in WESB which is depending on the type of API provider (for example internal document management system interfaces are implemented with Kronodoc API). Software AG provides API Portal which needs a separate license. API portal is used to expose and consume APIs. It is a web-based, self-service portal through which WESB can securely expose APIs to external developers, partners, and other consumers for use (Chandra 18 October 2016.)

The integration needs at Wärtsilä cover all the business lines including most of the SAP modules. Especially some business critical integrations with Warehouse management,

Finance, Customer operations, and some standalone applications are typical areas demanding integration. Key systems and applications which are integrating using WESB in Wärtsilä are SAP, Customer Relationship Management (CRM), Product Data Management (PDM), third party partner's systems, financials services systems like different banking systems and also internal document management systems, key databases and file servers (Chandra 18 October 2016.) The automated integrations can be built based on integration patterns built for different business needs. Pattern is a general reusable solution to a commonly occurring problem within a given context in software design (Wikipedia 2016d.)

To safeguard the availability of the integration environment and the solutions running in it, the integration platform is separated into three logically and physically separated environments. Also the WESB technical architecture is a redundant environment with a separate set of stand-by nodes for failover purposes (Wärtsilä 2016c). From the system landscape point of view the environment is presented in four layers, Gateway layer, Application layer, Messaging layer and Connectivity layer. The Gateway layer provides an entry point into the integration platform and is designed for low overhead and high availability. Application layer provides a runtime for business and technical services that can be used and reused to construct integration solutions for transformation and manipulation of data. This layer is the heart of the integration platform and is built for stability, reliability and performance. Messaging layer provides a transport function for data within the integration platform and towards external components capable of sending and receiving messages. This layer manages most communication between components and is designed for high performance, high volume and high throughput. Connectivity layer provides connectivity with internal and external information systems and data sources (Wärtsilä 2016c.)

The Integration platform, WESB, is seen as a reliable and stable environment with an effective governance supporting fast reaction of any new changes, incidents or new developments. It remains being the core integration platform and no new integrations are to be planned without consultation from the WESB team. The below listed benefits sums up the reasons for implementing and integration solution through WESB at Wärtsilä (Chandra 18 October 2016):

- Easy to implement and easy to maintain.
- Reduce time and errors by automating manual interfaces between systems.
- Gain access to comprehensive, up-to-the-minute business information.
- Reduce data latency by automating the flow of data from one system to another.
- Keep information synchronized across multiple data stores.

5 Discussion

The following table gives a summary of the presented tools with proposed usage, users and observation information. The tools are part of the offerings within IT services and each of the services are managed following the best practices of ITIL and using the established IT processes in their operations. Automation is a natural aspect of all the tools described in this thesis and further automation possibilities always considered. Lean provides a systematic way of thinking and observing any improvement needs in the processes and is heavily linked with the ITIL practices already used in service management and how the operations are led. The last column in the table, observations, includes also the thesis writer's own judgement of the related ITIL process or Lean principle. In general the Lean principles help in overall governance and the way of working in the organization where as ITIL guides the work from a more process oriented approach.

Table 1. Tool Chart

Tool	Proposed usage	Users	Observations and linkage to theories
Job Management	Scheduling of background jobs within SAP for system monitoring as well as end users' tasks taking long processing time.	All	Tied to Solution Manager upgrade. Would benefit from centralized concept and scheduling tool. ITIL: IT Operations Control as inked to the need to monitor the background jobs, services and the infrastructure to notice any implications to the service availability. ITIL: Capacity Management as consisting of all the resource needed to deliver the service, e.g. to avoid performance issues. LEAN: The need for a centralized concept is linked to Lean operations strategy.
Workflow	Creating business process logic with either standard templates or customized workflows.	Developers	Tied to Solution Manager upgrade and would benefit from enhanced monitoring capabilities as well as stricter customer code management concept. ITIL: Service Review and Service Evaluation processes are included in Continual Service Improvement activities. These can be applied to CSI activities in code improvements as well. ITIL: Linked to IT Operations Control as has the constant business process monitoring need. LEAN: Automation of process tasks through workflows are to maximize the process flow efficiency.
Computing Centre Management System	System and business process monitoring within automatic alert framework with selected idocs and background jobs at present.	Administrators	Tied to Solution Manager upgrade which will provide more possibilities on monitoring side. The current developments will become obsolete in the new version and need to be re-configured. ITIL: IT Operations Control as inked to the need to monitor the services and the infrastructure to notice any implications to the service availability. ITIL: Capacity Management as consisting of all the resource needed to deliver the service, e.g. to avoid performance issues. LEAN/ITIL: Any possible implications to performance and defects are monitored and eliminated. Business process monitoring to be further developed to detect and eliminate the possible bottlenecks in the processes.
GUI Scripting	Automation of SAP regression tests.	All	Easy to administer. Any changes to the master data need to be reflected to the scripts. The scripts need to be re-created as per the change in the business process. Changes do not require

			<p>big effort.</p> <p>ITIL: Change Management and Change Evaluation Processes are helping to minimize disruption for the IT services.</p> <p>ITIL: Release and Deployment processes control e.g. testing.</p> <p>LEAN: Removing from manual testing to automatic testing improves the flow efficiency, increases the quality and minimizes the defects in the system.</p>
Governance, Risk and Compliance	Management of regulations and policy compliance related to SAP.	Key users, administrators	<p>The current licencing Wäertsilä allows only the Access Control tool usage with limited functionalities to help in access governance. The SAP Identity Management tool has been licenced to enable the Central User Administration.</p> <p>ITIL: Tied to Risk Management as identifies the possible threats and the vulnerability levels.</p> <p>ITIL: Tied to IT Service Continuity Management as can include service security level assessments.</p> <p>ITIL: Information Security Management process contains practices to ensure the company's data, information and IT services integrity, confidentiality and availability.</p> <p>LEAN: Any vulnerabilities in the system can be seen as waste causing unnecessary delay in operations. Also variations in processes e.g. in providing access rights are affecting the flow efficiency and can be minimized with automation.</p>
Solution Manager	Management of SAP solutions application lifecycle.	Administrators	<p>a central integrated end-to-end orchestration platform to facilitate technical support for distributed systems – with functionality that covers all key aspects of solution deployment, operation, and continuous improvement.</p> <p>ITIL: Solution Manager functionalities complies with all ITIL processes.</p> <p>ITIL: IT Operations Control processes as linked to the need to monitor the services and the infrastructure to notice any implications to the service availability.</p> <p>ITIL: Capacity Management as consisting of all the resource needed to deliver the service, e.g. to avoid performance issues.</p> <p>LEAN/ITIL: Any possible implications to performance and availability are monitored and eliminated. The need for a centralized concept is linked to Lean operations strategy.</p>
Runbook	Coordination, execution and monitoring of financial closing processes in SAP for all Wäertsilä companies using SAP. Controlling outgoing payments and generating internal control reporting.	Key users	<p>The automated control of the closing tasks reduces human errors and improves the audit trail and checks on internal controls.</p> <p>ITIL: Service Review and Service Evaluation processes are included in Continual Service Improvement activities. These can be applied to CSI activities on improving the financial closing process activities. Also linked to IT Operations Control with the constant business process monitoring need.</p> <p>LEAN: Automation of process tasks through Runbook functionalities are to maximize the process flow efficiency.</p>
WinShuttle	Uploading and validating SAP master data with data validation rules.	Administrators	<p>Other tools also available like traditional SAP LSMW (Legacy Server Migration Workbench) with the restriction of using fixed fields in data uploads and with no data validations.</p> <p>ITIL: Information Security Management process contains practices to ensure the company's data, information and IT services integrity, confidentiality and availability.</p> <p>LEAN: Data inconsistency in the system can be seen as waste causing unnecessary delay in operations and affecting the flow efficiency and can be minimized with automation. Clear master data management concept with clear data ownership can minimize the unnecessary delay with master data management activities is linked to Lean operations strategy.</p>

Uipath	Development and automation of business and IT processes.	Developers, administrators	Clear savings of time have been achieved by reducing human intervention in the process as well as automating the execution regardless of the time of the day. Vulnerable to any dependent system changes. ITIL: IT Operations Control processes as linked to the need to monitor the bots to notice any implications to the service availability. ITIL: Service Asset and Configuration Management process helps in defining the components of the IT services and the related infrastructure. Configuration Management Database (CMDB) holds the configuration information as Configuration Items (CI) with the relations to other CIs. This helps to identify any dependencies to other systems and services when changes are planned. LEAN: By reducing the human factor from the processes is shown as an increase in process flow efficiency.
ServiceNow	Support, orchestration and automation of IT service management processes and the related data.	All	The tool is not seen serving only IT processes, For example Finance function has planned to use ServiceNow or similar tool for their own service request creation and follow-up needs. ITIL: Wärtsilä's IT Service Management tool implementation has helped to improve efficiency, effectiveness, control, and insight to IT process performance. LEAN: By reducing the human factor from the processes is shown as an increase in process flow efficiency.
WebMethods	WebMethods Enterprise Service Bus (WESB) is a platform used for integrating various internal and external applications related to different business processes at Wärtsilä.	Developers, administrators	WESB is a reliable and stable environment with an effective governance supporting fast reaction towards any new changes, incidents or new developments. It is the core integration platform. ITIL: The tool is managed within an IT service which governs the whole lifecycle management of WESB.

5.1 Key Findings

It was noticed based on the interviews that there wasn't any immediate needs to make bigger changes in the existing tools but clear views for improvements in near future existed to improve the current way of working in the processes. This was visible in either planned tool upgrades supporting the better governance or desire for concepts. The urge to achieve and constantly improve own solution area was seen but somehow the progress was lacking behind due to discovered bottlenecks, such as resourcing. Some of the findings are more described below and in some extent with relation to either Lean or ITIL. Findings are based on the interview results and thesis writer's own observations.

At Wärtsilä some of the standard processes used within SAP are for example Invoice Approval and Purchase Order Release which have needed only small amount of customization to meet the business process needs. The need to customize the standard workflows or build any new ones depends on the business process to be followed. In Wärtsilä the technology is seen as the enabler in the business process automation and despite the fact that the processes are built to serve the business need it is done with the attempt to utilize the ready functionalities and the processes the technology offers with the minimum

amount of customization as possible. Wärtsilä does have more complex processes where extensive customization of workflows have been made. That is done for example for the General Logistics process workflows as the standard SAP processes haven't been adequate for the business process. The customization always requires careful consideration and requires structured coding methods, a thorough understanding of the code, comprehensive technical documentation with the dependencies clearly described, and it is also very strongly linked to the automated testing practices. Wärtsilä's IT processes are built following the best practices of ITIL and any changes to the production go through predefined steps from approval's to development and testing with the standard procedure and documentation required. The enhancement process has been built to ensure a secure way to deploy changes to the production systems and is linked to other ITIL processes defined; release management, incident management and problem management. Any defects found in production are linked to possible changes made in order to track the release quality and discover improvement possibilities for development or testing. The enhancement process end-to-end lead time is measured and the biggest variations are more examined with the aim to eliminate any bottlenecks or wasteful activities in the process.

With the SAP Access Control the enterprise level handling of SAP authorizations can become fast, secure and any access risk violations can be easily detected. This real-time visibility would allow the organization to make preventative actions towards any risk violations by understanding the risk position, making prompt actions to reduce any unauthorized access and ultimately reduce possibility for fraud and the cost of compliance (SAP 2016n). The work to clean up the authorization roles from the systems has been started by defining the authorization needs business line by business line. A lot of effort is demanded to first have the business roles defined to an optimal level by reducing any unauthorized accesses from the roles and defining a precise governance for any new authorization approvals. According to the interviewee (Jajala 20 September 2016) the feedback has been very promising; not only the business users themselves feel that they are more on top of their own business process authorizations but it also brings more clarity on how to operate with any ambiguous request to the IT administration side. The full coverage of Access Control tool would allow controlled administration of the business roles by automatically detecting and remediating access risk violations across SAP and non-SAP systems, embed compliance checks and mandatory risk mitigation into business processes. It would also empower users with self-service and having workflow driven access requests and approvals, automating reviews of user access, role authorizations, risk violations and control assignments as well as creating comprehensive audit trail and user and role-based access control activities (SAP 2016n.) Changes are coordinated by the IT service management and the established practice, regular development forums are guiding and priori-

tizing and improving the work. In addition the forum gathers and follows up of any underlying factors for the SoD violations as in some functions the same person must do double roles with a conflicting interest and these cases must be recorded and followed.

The management of the financial period-end process was possible after implementing the Runbook as the complexity of manually managing the process dependencies between countries no longer existed and the progress of the closing process could be seen from one tool. Monitoring of activities became easy, taking in new tasks to the automated scenarios became fast, communication and transparency within the organization improved tremendously. Overall the closing process time was reduced from two weeks to five days. Runbook is today the single application at Wärtsilä that controls the period-end closing process and the satisfaction is high among the users. The tool is also used for other controlled activities such as the outgoing payments. As Wärtsilä doesn't currently have many programmers with SAP workflow knowledge the usage of workflows to further automate the closing activities have been minimal. If example an acknowledgement is needed from the user the Runbook sends a notification to the user who signs out the step manually in Runbook. This has been acceptable as the overall benefits are realized and the users are receiving the desired value by using the tool. There are no immediate needs for further automation. From Lean point of view the tool has reduced the variation in the closing process tremendously. The automation has eliminated the human factor in many control points, the flow efficiency is high as more value adding activities are done in less time and the quality has increased as all the steps are controlled either automatically or manually.

Collecting and validating master data is done either manually or automatically at Wärtsilä. Entering data is done centrally but overall can be done with different interfaces across multiple channels. Business lines are facing data growth, variety of data sources have been identified and the lack of real data ownership creates uncertainty and complexity which create room for errors and delays. This can lead to lack of planning, waste of resources, even regulatory risks. As to do nothing is not an option as there are high demands for the success of the master data management program. Accelerating continuous improvement initiatives and eliminating waste will reduce the data management costs. Low priority is often assigned to data quality. Ensuring data quality is widely recognized as a valid and important activity, but in practice few people list it as a top priority (Tayi & Ballow 1998, 3). At Wärtsilä the master data program work has increased the visibility of the importance of thorough master data management governance. It is not only concentrating on data cleaning activities and the related tools but also on data ownership, the importance on data validation and the transparency of the related activities at Wärtsilä. IT

plays an important role as the centralized tool provider for automatic mass data uploads but can also help with the data cleaning activities.

The business processes might involve many different IT systems that have no automatic interfaces between each other. For example Wärtsilä uses SAP ERP which does integrate various processes but it doesn't cover fully the automated process flow. Possibilities for using for example workflows within SAP do exist but creates complexity if large customizations needs to be done. Manual tasks and human reasoning is usually needed to have the full end-to-end process flow working, even within one ERP system itself. As the tools have evolved the next step has been to take into use more sophisticated Intelligent Business Process Management Systems (iBPMS) and characteristics of those are for example real-time analytics, complex event processing (CEP) and business activity monitoring (BAM), also mobility and social and collaborative capabilities are usually embedded. However this development either is lacking the complete automation. As companies have seen the enormous amount of human labour needed in various functions, tasks and steps to be accomplished the outsourcing of such activities have easily been taken place but it is not so clear to say anymore whether the business benefits from outsourcing are greater than costs involved with the contract deal with the BPO (Business Process Outsourcing) provider. Shared Service Centre activities are a typical case for outsourcing but Wärtsilä has taken another path for running the activities itself with internal workforce and tools. With the active process improvements RPA has been the next step to automate activities further. The provided tools for RPA are not necessarily new but been used in IT process automation by BPO companies for years. We may call Wärtsilä SSC as our internal BPO provider. The increase in flow efficiency, having more value-adding activities in shorter throughput time was well realized in Wärtsilä's Robotic Process Automation (RPA) pilot project results. As a prerequisite for the piloted processes each process needed to go through the value-stream mapping exercise in order to clean the process of any unnecessary, non-value adding tasks, wasteful activities. With utilizing the RPA software, Ui-Path, the 15 robotized processes saved nearly 900 hours in labour. The new way of working, having a firm process of pre-activities done for the process before approved to the RPA development, is today in use and well absorbed by the Wärtsilä business lines.

Since the implementation of ServiceNow and configuration of the existing IT processes to it the IT service management has improved tremendously. Different process workflows are easy to follow via the ITSM tool. Different service request, changes or incidents are created in the tool and automatically processed for the helpdesk. The visual user interface allows the personalized view to user's own tickets and the reporting serves both the IT service management, business end users as well as the KPI (Key Performance Indicator)

follow-up defined for the services. The tool is not seen serving only IT processes but any interested business process. For example Finance function has planned to use this or similar tool for their own service request creation and follow-up needs. If thinking of SAP Solution Manager automatic alert framework the automatic incident ticket creation is the next step to consider, also the several requests made in the ITSM tool could be further automated like with the job management request case explained earlier.

It was also seen that there seems to be a tendency to introduce the development initiatives in an isolated manner to our management. We might need to configure some new functionalities to be used within Solution Manager but because an overall concept of utilizing these tools for different purposes is missing or in one individual's mind no actions are done or only for one case at the time in a scattered manner. Also we might for example need more programming understanding in order to manage complex workflows but without a responsible party to take care of the resource management, and here meaning the owner for the automation service not existing today, this skill has been missing for a long time and only brought up whenever there is a related incidents happening.

Despite the fact that we deal with information in the processes the people are the key to successfully managed services and projects and are an important part of the strategy. People's unique behaviour, differences in skills and working methods and work load introduce an element of variation that is almost impossible to avoid but is at the same time a tremendous asset when handled with care and with the respect to individuals. We need to have means that help to eliminate, reduce, and manage the variation in order to realise a Lean operations strategy (Mådig & Åhlström 2012, 141). We need to govern our work with coherent governance principles, policies and roles to decide how to prioritize and make decisions to avoid isolated working silos. The strong governance applies to other fundamental processes as well that support the Lean transformation. These are according to Bell & Orzen (2011, 235) the demand management, business process management and project portfolio management.

6 Conclusion

The purpose of this study was to gather information of the main automation tools currently used in Wärtsilä ERP environment, what those are and for what purposes they are used for and to find out whether there could be any better ways to further automate the processes and what are the main pain points needing attention. At first, it was necessary to comprehend the technology overall and understand the current working day's problems and issues preventing the full coverage of recognized automation possibilities but at the same time to discover the possible bottlenecks preventing the improvement of the situation. Gradually also different ways or working, methods, started to play an important role with the tool usage.

Wärtsilä IT strategy emphasizes the importance of the core platforms the SAP ERP being one of those. The umbrella view for this core platform had been missing. As a result, a working group was formed to create the SAP strategy framework with set goals and actions to combine the activities from the technical, functional, performance and development, vendor and stakeholder management point of view. The framework was introduced to Wärtsilä IT and business lines on January 2017 having automation nominated as one of the strategic actions. This thesis and the findings serve as a basis for the SAP strategy's automation related actions. The following chapter lists the discovered challenges related to the automation tools and suggestions for future developments.

6.1 Suggestions for Future Developments

The following table lists the challenges discovered from the interviews and the suggested future developments briefly. The table includes information also of the related IT service as it was important to show that linkage as the overall responsibility of the management of the tools are within the IT services. The column Development suggestion also refers to the sub-chapters where the challenge and the development suggestion is more described.

IT service challenges				
No.	Related IT service	Related tool	Challenge	Development suggestion
1.0	Master Data Management (MDM)	WinShuttle	No centralized service offerings available for handling transactional data validations – done with business managed applications.	To continue to work in close cooperation with the set MDM program by enforcing the setup of company wise MDM concept with clear direction with centralized and localized services and tools. (6.1.2 Quality Control)
2.0	Master Data Management (MDM)	WinShuttle	Only some parts of business lines provide the data validation rules for their data – this helps in getting accurate master data uploads.	Along with the MDM program to agree on clear roles for data ownership with set responsibilities and nominate the data owners from business lines. (6.1.2 Quality Control)

3.0	SAP Technical Services, ITSM Service, SAP business process services	GUI Scripting	Divided responsibilities within actions related to SAP release testing causing no accountability for the successful test management.	The SAP release and test management should be centralized to work under one IT service as a whole or working group with clear lead. Responsibilities with reporting lines defined. (6.1.2 Quality Control)
3.1	SAP Technical Services, ITSM Service, SAP business process services	GUI Scripting	SAP service managers not able to create a complete view of the possible release implications as being accountable for their own service.	
4.0	SAP Technical Services	Solution Manager	SAP system monitoring done with the need basis and the selected idocs and background jobs centralized monitoring is created and administrated by the vendor.	The system monitoring should be improved to be more visible and important as well as to cover all the business processes with the focus on full-scale configurations and set monitoring function with roles and responsibilities. Establishing the Business Process Management functionalities with new Solution Manager version. (6.1.3 Business Process Monitoring)
5.0	SAP Technical Services	Job Management	Users can freely run and schedule the background jobs which might cause performance issues during business critical times.	The Job management concept should be established with centralized scheduling tool. (6.1.1 Centralized Job Management & 6.1.5 IT Process Integration)
6.0	SAP Technical Services	Governance, Risk and Compliance	No fully automated user access provisioning with self-service password resets and role assignments based on HR data.	The importance of company risk management and the related tools should be leveraged. (6.1.4 Security Governance)
7.0	SAP Technical Services	Workflow	Customized workflows often with long and complex coding chains causing challenges in maintenance and incident resolutions.	More focus should be put to the whole custom code management with thorough concept covering the code reviews, code libraries and ensuring the knowledge transfers to the supporting organization. (6.1.2 Quality Control)
8.0	Robotic Process Automation	UiPath	Administration challenging due to incomplete monitoring tools.	Install the newest version of the UiPath that provides more stability and better monitoring capabilities. (6.1.2 Quality Control)
9.0	Robotic Process Automation	UiPath	Robotized processes managed within the RPA platform vulnerable for any dependent application upgrades – RPA process dependencies challenging to keep documented and followed/updated for any upgrade.	Technical service forum with the attendees from all interface applications to follow up the new developments/upgrades implications. New CMDB to have robotized processes as CIs with dependent applications with change information available for any CI. (6.1.5 IT Process Integration)

6.1.1 Centralized Job Management

Every SAP application's different operative installations, production, development and quality environments have different jobs in the system. Tools and functionalities, like Job management are accessed via unique transaction code within SAP application. Each separate application in each operative environment requires a separate logging in to the application and transaction in order to manage these jobs. This is time-consuming and creates delays in issue resolution from an administrative point of view as requires either manual checking of the background jobs logs or additional reporting to be created in order to get one view to the whole SAP ERP system's background job processing status. In Wärtsilä environment the users have been able to execute their own background jobs freely which has caused performance problems where background processing has taken

a lot of system capacity. The effect on performance hasn't been severe so far but seen a high risk in delaying time-critical period-end closing activities. In order to minimize the risks affecting performance actions should be taken to implement a proper concept for administering background processes. As the workload for the people working with the SAP system administration is high and only two people are working to administer the whole Wärtsilä SAP ERP landscape only minimum amount of functionalities are taken in active use from the Solution Manager. Even as the tool would provide a lot of possibilities from the system administration point of view it is not enough to only configure the functionality into use but also necessary to have a controlled way of working regarding the functionality, rules, roles and follow-up of every action done when working with background jobs.

The concept could follow the SAP standard for Job Scheduling Management (SAP 2014, 10) to establish standardized, formal process in order to support the management of centralized end-to-end solution, SAP ERP wide background operations. The following items are listed in SAP standard for Job Scheduling Management standard and further described in relation to Wärtsilä.

- Job request process.
- Job documentation.
- Job scheduling.
- Job monitoring.
- Job scheduling reports.

By establishing a formal concept several aspects of job management can be taken under control. The concept should instruct how the background jobs can be requested or changed. How those should be planned and tested, approved and documented as well as run and monitored. The following picture illustrates the conjunction between the business operations and IT in relation to the concept of administration of background processes.

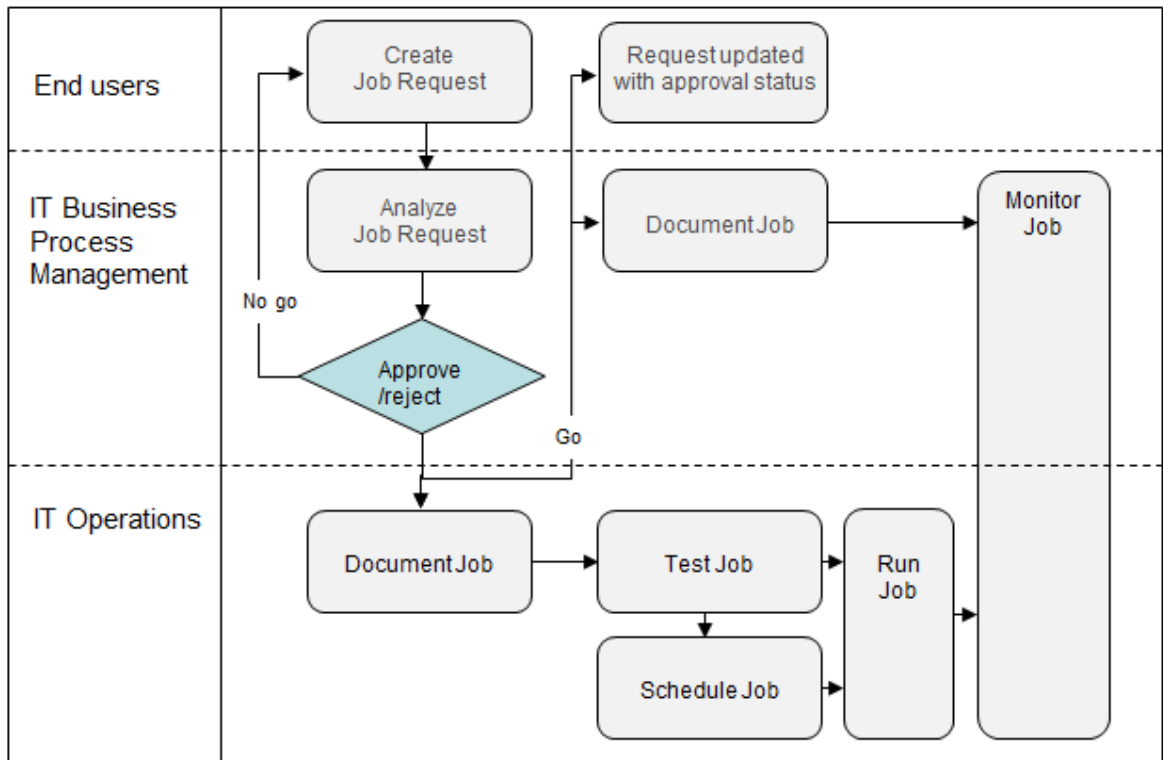


Figure 10. Job Request process. Adaptation from reference (SAP 2014, 11)

Some of the identified critical jobs are monitored already today by configuring the monitored items in SAP Computing Centre Management System (CCMS). As Wärtsilä has currently used so called classic business process monitoring it will no longer work when the Solution Manager version upgrade takes place later year 2017. Due to this and the fact of not having a centralized concept with controlled way of creating and handling the background job requests both the existing monitoring needs to be reconfigured and to be linked with the centralized concept.

Job request process

In Wärtsilä the regular end-users of SAP have a possibility to execute background jobs freely at any time. As the amount of background processing seem to increase, as people are busy in getting tasks done quickly, the effect can be seen negatively on the performance side of the SAP environment. Instead of giving the users possibility to execute the background jobs freely a standardized job request process could be established to manage the changes more effectively. As discussed with the interviewee (Phutane 19 September 2016) the aim should not be to fully remove the possibility to execute from all the users but eventually move from end-user-controlled job scheduling to a centralized concept. The centralized concept enables the central IT team to assess user-controlled jobs and cancel them if necessary.

The requesting of jobs could be done by utilizing the Wärtsilä's IT Service Management tool (ITSM) as it is the central tool at Wärtsilä for creating requests related to Wärtsilä's IT offerings. For example the SAP authorizations are requested via the ITSM tool. However today the helpdesk is processing the requests manually in the target systems and the possible automation scenarios between the ITSM tool and SAP Solution Manager could take place. Despite this foreseen gap in automated request process the use of central ITSM tool is recommended as not all the users know well all the SAP applications and might not have regular needs for background job scheduling.

Job documentation

The concept should also include careful documentation of jobs or job chains in the landscape. The documented error-handling procedures, responsibilities, and escalation procedures should be part of the job management to help in incident resolution. The basic information could be part of the background job request process in ITSM, obligatory information to be filled in by the user before the job can be taken within the centralized Job Management and error-handling-procedures should then include instructions how to document a job specific incidents or to have a linkage to the ITSM tool incidents so that effective root causes analyses can be done with any occurred incident and possible problems can be detected in an early phase.

In Wärtsilä the job documentation isn't done in a structured manner and the information related to jobs is scattered in the organization. As the job documentation can be reused for example for scheduling, monitoring, and issue resolution, the IT team should have the means to assure that the information is available and up to date, the strong concept, interface with the ITSM tool and administration resources would enable that.

According to SAP (SAP 2014, 13) it is possible to use SAP's own Job Monitoring tool, SAP Central Process Scheduling by Redwood tool (SAP CPS), or a document handling tools provided by the company for storing the documented information. The following business-related information should be covered in the job documentation in addition to the technical information. This would ensure an appropriate scheduling, clean up of unnecessary jobs as well as quick communication to the end user when incidents occur (SAP 2014, 13):

- Error handling procedures
- Points of contact
- Escalation procedures
- Scheduling restrictions and dependencies

- Validity date

Job scheduling

Job scheduling covers the separate tasks related to scheduling and technically managing jobs in job chains. The business requirements need to be met with the scheduling thus not jeopardizing the system performance. SAP provides following for the scheduling (SAP 2014, 14.):

- Job Management Work Centre in SAP Solution Manager where using the Schedule Background Job tool through a BC-XBP interface. BC-XBP (eXternal interface for job Background Processing) interface allows external process schedulers access to CCMS (R/3's internal Computer Centre Management System) Background Processing components of SAP Systems (SAP 2016c.)
- Connected scheduling tool like SAP Central Process Scheduling by Redwood (SAP CPS) through Solution Manager Scheduling Enabler (SMSE) interface.

Job monitoring

Job monitoring is more of a post activity at Wärtsilä today. The actual issue resolution happens by logging into a specific SAP application and checking the status on job logs in case any incident has been created by a user or by the automatic alert framework. It is very time consuming with the present way of handling the jobs as the automated monitoring has been utilized only for separately requested jobs. Many jobs are still executed or scheduled directly by the end users. Centrally handled scheduled jobs could be monitored by utilizing SAP Solution Manager's alerting infrastructure, technical monitoring work centre. It would require the system administration personnel to know the jobs in order to have those configured to the system monitoring. The job monitoring can be configured so that it alerts to critical situations and enables the responsible people are notified accordingly, for example the business process owners or IT service managers during period-end closing times. Background jobs have been used but not in very orderly manner from administration point of view. Not only we could have a centralized monitoring in place by having a concept around the Job Management but it would also secure minimum downtime for the business process specific jobs failures. With the help of the Job monitoring it is possible to centrally check if the scheduled jobs were run correctly, the runtime behaviour, with the documented information it is possible to decide if jobs have to be rescheduled or activated manually, if they have to be run again, and whom to alert if jobs were cancelled. For jobs that can have a substantial effect on a system's performance or that are a crucial part in business process execution it is possible to install the automatic notification function (Weidmann & Teuber 2010, 71).

Job scheduling reports

The reporting of job execution data, the logs, is essential for optimizing the concept for managing the scheduled jobs. Today we do not have any specified way agreed for the reporting and it is usually done by looking at specific applications logs but it could be possible to utilize The Simple Job Selection function within System Monitoring which stores job execution data centrally for long-term trend analysis. The selections can be done by looking at jobs based on desired combination of job attributes and the report would contain only the jobs that meet the selection criteria (SAP 2016h).

Recommended system landscape and tools

As looking deeper into the job request process and the task Plan Job Request in the below picture there are tools available to help to evaluate the validity of the request and eventually run it. SAP provides a tool SAP Central Process Scheduling by Redwood (CPS). This tool is not used by Wärtsilä at the moment for the job management and would require licensing and further studying but a similar tool would be needed to help in centralizing the scheduling and monitoring of background jobs. Redwood is interesting as a provider as it is also listed as one of the vendors for Robotic Process Automation (RPA) software. (SAP 2014, 12.) Generally these tools, Solution Manager and CPS for example allow the user to request the background jobs, schedule and monitor them from one central point with a standardized SAP workflow. These tools can be used to monitor selected background jobs from one view, no separate logging in to the separate application is needed. And as the administration is performed from one location by the IT team, they can get a transparent view what activities are scheduled by whom, where and when and can easily suggest the best timings for the job scheduling. The following image illustrates the possible infrastructure platform. For Wärtsilä purposes the ITSM request form should be integrated with the SAP Solution Manager Job Request form so that the documentation is stored within SAP Solution Manager. With the help of centralized scheduling tool like SAP CPS the centralized scheduling would be possible and the mentioned tool also enables pushing the monitored information to Business Process Monitoring. Business Process Monitoring would enable the proactive issue resolution by identifying the events affecting the business process flow (SAP 2016i.) We don't have this functionality used in Wärtsilä but with gradual steps to improve the whole Solution Manager usage with the additional tools to improve the capabilities the overall Business Process Monitoring could be taken in use.

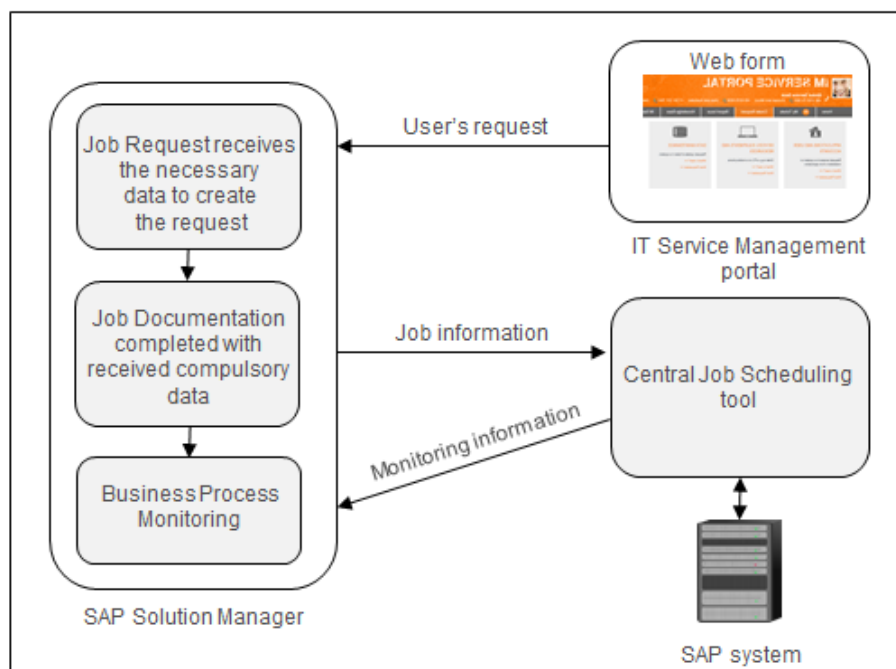


Figure 11: Job Scheduling Management platform. Adaptation from reference (SAP 2014, 17)

6.1.2 Quality Control

According to the interview (Nagarajan 27 September 2016) the workflows that do not require large customizations don't usually cause any incidents in the system and are easily followed in the possible debugging situations. However the complexity of the workflow creates a challenge especially if the design is lacking details and the possible programmed steps are poorly documented. As Wärtsilä has only few skilled programmers working on SAP area coding work has been created usually by an external consultants and the created coding has lacked internal judgement due to lack of understanding of the related business process which can be very complex in many cases. More focus should be put to the whole custom code management with thorough concept covering the code reviews, code libraries and ensuring the knowledge transfers to the supporting organization.

This complexity relates also to the test management in SAP development. No process has been agreed on triggering the updates for the testing scripts even though the third party vendor providing the monitoring ensures the updates are regularly done. The amounts of enhancements done per month is high and the related updates are not always done to the business road documentation in time. Crucial steps can be missed from the testing and the consequences can be seen as high numbers of incidents occurring from defects. The test scripts done with SAP GUI Scripting tool do work and help in getting the work done

quicker. However there are limited administration possibilities built in to the tool. The management of scripts need to be done manually and today it is not visible what is the maintenance cycle for the scripts, how the information of the new business roads changes flow to the test script administrator. This could be avoided with centrally managing the testing, assessing the present testing process and implementing needed changes to the process and tools.

SAP test management is linked to the overall SAP release management process. The ownership is divided between the Wärtsilä's IT Service Managers, IT Release Management Process owner, SAP system administrators and 3rd party vendor system administrator as well as Wärtsilä's SAP application managers who today are the gatekeepers of any changes going to the production on their own application area. This ownership should be with one function with clear concept built around it. As the responsibility is decentralized there isn't a strong party to oversee that the releases are of good quality, well tested and communicated. Every individual is doing the best they can but any improvement findings don't have one single owner who could have the holistic view over the SAP releases and strongly develop the process forward.

Although the Master Data Management Program is ongoing there are still shortages to be fixed. IM is not providing centralized service offerings for handling transactional data validations. These are currently done by business with business managed applications. This isn't necessarily a wrong way but should be more centrally influenced to guarantee the Wärtsilä's interest in cost-efficiency. Also only some parts of business lines provide the data validation rules for their data which helps getting accurate master data uploads. The recommendation is to continue to work in close co-operation with the set MDM program by enforcing the setup of company wise MDM concept with clear direction with centralized and localized services and tools and clear roles for data ownership with set responsibilities.

6.1.3 Business Process Monitoring

A clear advantage could be received with the SAP's Business Process Monitoring. This can be gradually achieved after the Solution Manager upgrade as Wärtsilä's current so called classic business process monitoring will no longer work in version 7.2. As the businesses are gradually entering towards leaner processes this tool would show even more the specific bottlenecks to be eliminated in the process. The development of the alerting framework is waiting for the current Solution Manager version upgrade. It is suggested to clearly plan the renewal of the alerting framework and have it built readily after the

Solution Manager upgrade. The following figure illustrates the possibilities coming with fully configured alerting framework with the Solution Manager 7.2. In addition to the automatic collection of alerts from the monitored systems and automatic incident ticket creation it is possible to view the business process specific alerts to see which part of the business processes they are impacting (SAP 2016i.) The automatic ticket creation however needs to be integrated with the existing ITSM tool to ensure the IT process information resides in one system.

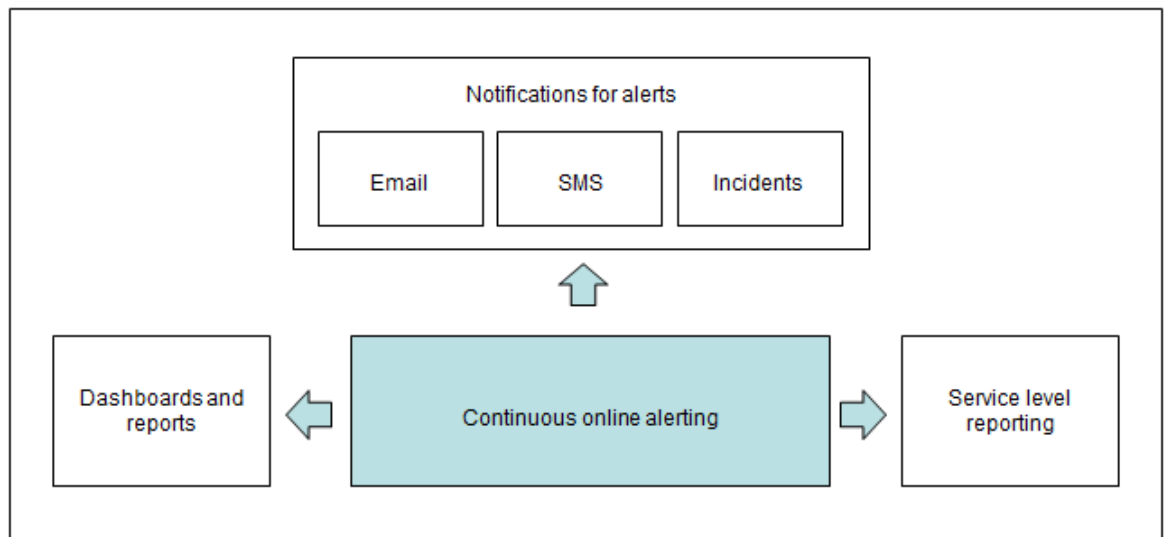


Figure 12: Business Process Monitoring. Adaptation from reference (SAP 2016i)

6.1.4 Security Governance

The progress is quite slow with getting approvals for implementing new applications the existing GRC tool to strengthen the risks management. The activities could be more tied to the Cyber Security unit with common governance including also the financial aspect. The first steps have been taken already towards that direction where the business case of full licenced Access Control was presented. As stated in the article of Risk Mitigation Management (Shea, Stone, Baechtold, Haug & Evans 2005, 40) the variety of risks the businesses face today must be managed through comprehensive and fully consistent framework. IT and management of the IT environments risks is tied to this. The article also states that the failure in aligning with the Corporate Risk Management is the variety of tools to be integrated to gain a comprehensive view towards risk assessment metrics, key risk and performance indicators. If not having a strong framework with overall governance to different technologies and the risk management tools there is a high risk to fail.

6.1.5 IT Process Integration

In addition that the Solution Manager offers a variety of functionalities to be used in managing the SAP application landscape, it also aligns with all the fifteen ITIL (Information Technology Information Library) IT processes. SAP Solution Manager has been re-certified from PinkVERIFY to comply with ITIL processes that are currently available for certification (SAP 2016b). PinkVERIFY is a service offered by company Pink Elephant that makes assessments of products features against ITIL best practices. Alignment means that it would be possible to manage for example the incidents, changes and problems within the system directly. Wärtsilä has an enterprise wide ITSM tool in use all the IT services and products are utilizing it. This means that for example any incidents detected via Solution Manager the ticket needs to be either manually logged to the ITSM system or an integration to be built from Solution Manager to ITSM tool. This is not yet in place in Wärtsilä but seen as one area which should be investigated further.

An additional discovery was the definition of the IT process, the request fulfilment process as an example, what is the real ending point of the process and the lack of described sub-processes. The clearly described sub-processes would help in discovering the most time-consuming steps in the real end-to-end process. As an example many requests done with the IT Service Management tool are today handled further by service desk personnel. There could be opportunities for further automation for example in automatically assigning access rights or by integrating the ITSM tool information with the SAP Solution Manager enhancement process enabling the better coverage of the data for example for monitoring purposes.

6.2 Appreciation

Overall this study achieved its goal as the automation tools were discovered and presented in the requested manner and the development suggestions were introduced based on the findings and problems discovered. Also this work acts as a basis for the SAP strategy work in relation to automation. Already today some actions have been taken in place. Alongside or based on this work, the UiPath tool has been upgraded to the newer version having better monitoring capabilities, Solution Manager version upgrade is under planning and preceding other dependent developments and test process assessment is under planning as well. However the findings didn't reach the amount and depth I was expecting. The findings could've include more information related to the process improvements and automation use cases. This conclusion can be due to the amount of studied tools prohibiting the comprehensive go through as the set time was limited for the interviews and also

to the fact that there could've been more people interviewed per automation tool with different roles. If it would've been possible to link the right theories right from the beginning of the thesis work to the topic it would've helped in formulating the interview questions more towards process thinking than technology and that would've given more insight to process development possibilities.

The chosen theories were appropriate for the study as especially Lean helped to link the interviewees' comments to more organizational and conceptual challenges and it was eye-opening to see how much ITIL and its best practices are in large extent following the Lean thinking. I also discovered that my organization seems to be well on track in creating a Lean organization as I could identify Lean thinking in many of our developments. We are rather following the organization's ability to continuously improve with dynamic goals than concentrating on a certain static goal and measuring the success based on that.

7 Abbreviations

ABAP	Advanced Business Application Programming
AI	Artificial Intelligence
API	Application Programming Interface
AD	Active Directory
BAM	Business Activity Monitoring
BC-XBP	eXternal interface for job Background Processing
BPO	Business Process Outsourcing
CMS	Computing Centre Management System
CEP	Complex Event Processing
CI	Configuration Item
CMDB	Configuration Management Database
CPS	Central Process Scheduling
CSI	Continual Service Improvement
CSV	Comma-Separated Values
CRM	Customer Relationship Management
CUA	Central User Administration (CUA)
EEC	ERP Central Component
ECATT	Extended Computer Aided Test Tool
EDI	Electronic Data Interchange
ERP	Enterprise Resource Planning
EWA	Early watch Alert
FICO	Finance and Controlling
FSCM	Financial Supply Chain Management
FTP	File Transfer Protocol
GRC	Governance, Risk and Compliance
GUI	Graphical User Interface
GTS	Global Trade Services
HR	Human Resources
HTTP	Hypertext Transfer Protocol
iBPMS	Intelligent Business Process Management Systems
iDoc	Intermediate Document
IT	Information Technology
ITIL	IT Infrastructure Library
ITSM	IT Service Management tool
ITSCM	IT Service Continuity Management
KPI	Key Performance Indicator

LDAP	Lightweight Directory Access Protocol
LMDB	Landscape Management Database
LSMW	Legacy Server Migration Workbench)
MM	Material Management
OOB	Out-of-band component
PC	Personal Computer
PDM	Product Data Management
RFC	Remote Function Call
RPA	Robotic Process Automation
SCM	Supply Chain Management
SCCM	System Centre Configuration Manager
SoD	Segregation of Duties
SLD	System Landscape Directory
SSC	Shared Service Centre
SMSE	Solution Manager Scheduling Enabler
SOAP	Simple Object Access Protocol
XML	Extensible Markup Language
XPS	XML Paper Specification
VB	Visual Basic
WESB	WebMethods Enterprise Service Bus

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Appendix

Appendix 1. Interview Questions

All the questions might not be suitable for separate interviews and the related tools but work as a frame for the discussion
<ul style="list-style-type: none">▪ Describe the automation tool briefly, related technology and the provider
<ul style="list-style-type: none">▪ Why is this technology needed at Wärtsilä?<ul style="list-style-type: none">▪ To which automation scenario this technology is needed for?<ul style="list-style-type: none">▪ What is the business need? Please list couple of examples (processes in this case), e.g. what data is fetched, how it is modified/used and where this end-result is sent.▪ Who are the present customers?▪ What are the applications the tool is interfacing with?▪ Do you see this is the right tool for the scenario?<ul style="list-style-type: none">▪ If not what other tools/technology could be used? (if you could decide)
<ul style="list-style-type: none">▪ How is the tool interfacing with SAP ERP (e.g. API (Application Programming Interface), WS (Web Services))
<ul style="list-style-type: none">▪ How is the security taken care in this technology?
<ul style="list-style-type: none">▪ What are the limitations of this technology?<ul style="list-style-type: none">▪ Are there any experienced faults in this technology?▪ Are there any risks associated to those?▪ Is there any feature/functionality that would be needed?
<ul style="list-style-type: none">▪ What is the future roadmap for this technology and tool?
<ul style="list-style-type: none">▪ What is the governance model for the tool?<ul style="list-style-type: none">▪ Linkage to IT Service Management
<ul style="list-style-type: none">▪ What is the cost for the Wärtsilä user?
<ul style="list-style-type: none">▪ What new use cases can be seen in the roadmap?<ul style="list-style-type: none">▪ Are there any considerations to link this tool with the IT processes?▪ What kind of benefits and risk it could mean?