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# Analysing Volvo IT Belgium

## Incident- and Problem Management Data Using Automated Business Process Discovery

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*International Business Process Intelligence 2013 Competition*



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## Introduction

The purpose of this document is to answer the questions raised by Volvo IT Belgium in the International Business Process Intelligence 2013 competition. The scope of this analysis is the questions raised (described in the “Issues To Be Solved” section). Volvo IT Belgium has provided live data files with logged information from their incident management and problem management system VINST. Furthermore a manual for the VINST system and a description of the issues to solve has been provided.

## Tools Used

In order to solve the case the following tools has been user:

- Enterprise Architect 9.1 (Sparx Systems)
- Disco 1.3.0 (Fluxicon)
- Excel (Microsoft Excel for Mac 2011)
- Word (Microsoft Word for Mac 2011)



## Approach

The questions raised has been analysed and answered using the following approach:

1. Importing log files into Disco
2. Auto-generating As-Is processes using Disco
3. Getting to know the process – analysing As-Is processes in Disco, and documenting the As-Is processes in BPMN using ChangeGroup Business Process approach to ensure traceability and familiarity with the process
4. Verifying that manual process discovery was not needed in order to answer the questions in scope
5. Performing business process mining and discovery using Disco analysis and Excel

## Getting To Know The Process

In order to getting to know the process automatic process discovery has been used (by using Disco). This excludes manual processes such as for example Event Management or “Updating the knowledgebase” during problem management.

The identified process has been diagrammed using our team’s normal approach using BPMN notation – the reason for this and the business process documentation is outlined in Appendix1.

## Issues To Be Solved

### Push To Front – Issue

#### Push To Front Issue - Description

When an incident is raised, at first, the service desk captures it. If the incident can not be resolved by the 1<sup>st</sup> line support teams (mainly service desk) the incident is escalated to 2<sup>nd</sup> line and 3<sup>rd</sup> line support teams.

The goal of the incident management process is to solve the incidents, or at least most of the incidents by the first level support (teams mainly in the Service Desk). If this strategy is followed the handling of incidents will be much more efficient.



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The “push to front” works if the 1<sup>st</sup> line support team can set the SR to resolve without interference of a 2<sup>nd</sup> or a 3<sup>rd</sup> line support team.

The following questions are raised by the client and will be handled in the “Push To Front Analysis” section:

- 1) For what products is the push to front mechanism most used and where not?  
The product information is available in the ‘corrected structure’ field
- 2) Where in the organisation is the push to front process most implemented (field =involved organisation), specifically if we compare the Org line A2 with the Org line C
- 3) What functions are most in line with the push to front process?

### Push To Front - Analysis

#### *Ad 1)*

The incidents have been filtered so that only incidents resolved by 1<sup>st</sup> line support are kept in scope.

Furthermore incident cases that involves 2<sup>nd</sup> or 3<sup>rd</sup> line support teams are excluded from the analysis.

So, As it can be seen from the illustration below 40% (3012 cases) of all cases resolved by 1<sup>st</sup> level support have involved 2<sup>nd</sup> or 3<sup>rd</sup> line support at some point in the incident management process – which represents a “push-to-front” behaviour.

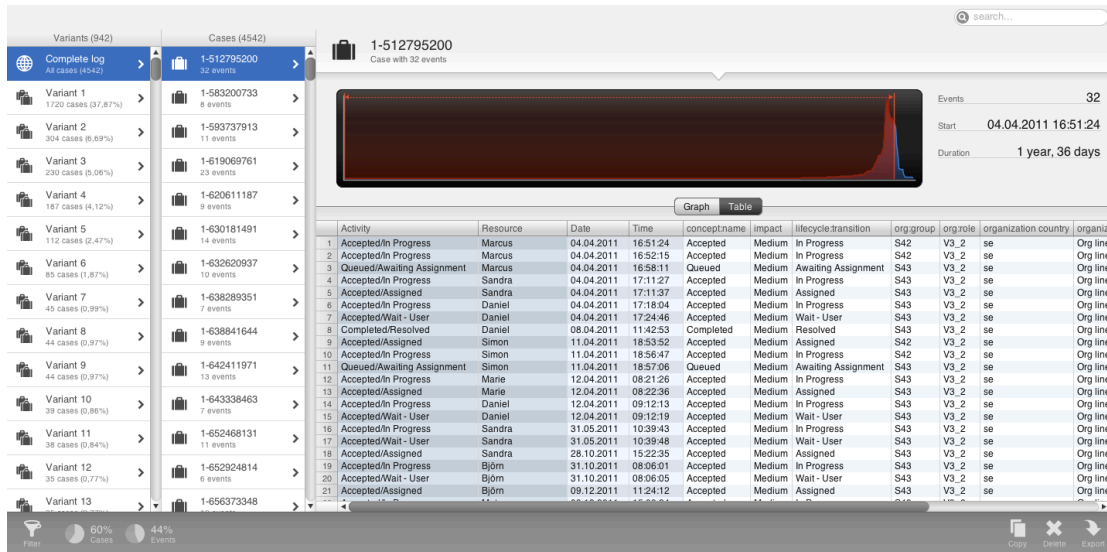


Figure 1 - 60% of All Cases Solved By 1st Line Support Does Not Involve 2nd Or 3rd Line Support

Product 424: PROD424 stands for 684 cases = 15,1 % of the cases where 2<sup>nd</sup> or 3<sup>rd</sup> line support is involved – and 9% of all cases.

The top products being involved in “Push To Front” based on relative event frequency are outlined below:

Value	Frequency	Relative frequency
PROD424	3674	10,05 %
PROD542	1675	4,58 %
PROD698	1186	3,24 %
PROD776	740	2,02 %
PROD494	683	1,87 %
PROD802	648	1,77 %
PROD697	586	1,6 %
PROD660	560	1,53 %
PROD253	538	1,47 %
PROD607	537	1,47 %
PROD401	478	1,31 %
PROD267	476	1,3 %
PROD325	446	1,22 %
PROD789	446	1,22 %
PROD236	443	1,21 %
PROD805	431	1,18 %
PROD158	418	1,14 %
PROD38	364	1 %

Figure 2 - "Push-to-front" Based on Relative Frequency of "Push-to-front" Related To Products

At first sight, it seems like especially PROD424 is involved in “Push To Front”.

The Top products not being involved in “Push To Front” based on relative event frequency are outlined below.

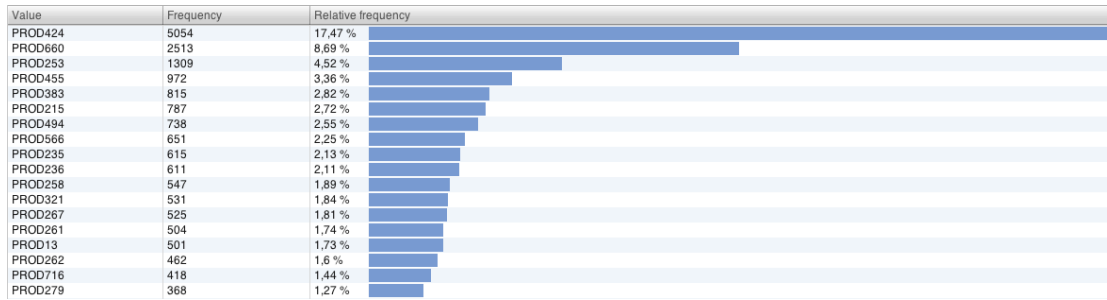


Figure 3 - Relative Frequency of Products Not Involved In "Push-to-front"

Ad 2)

Based on the 40% cases that are pushed to front the following organizational units are most frequent involved (based on event frequency):

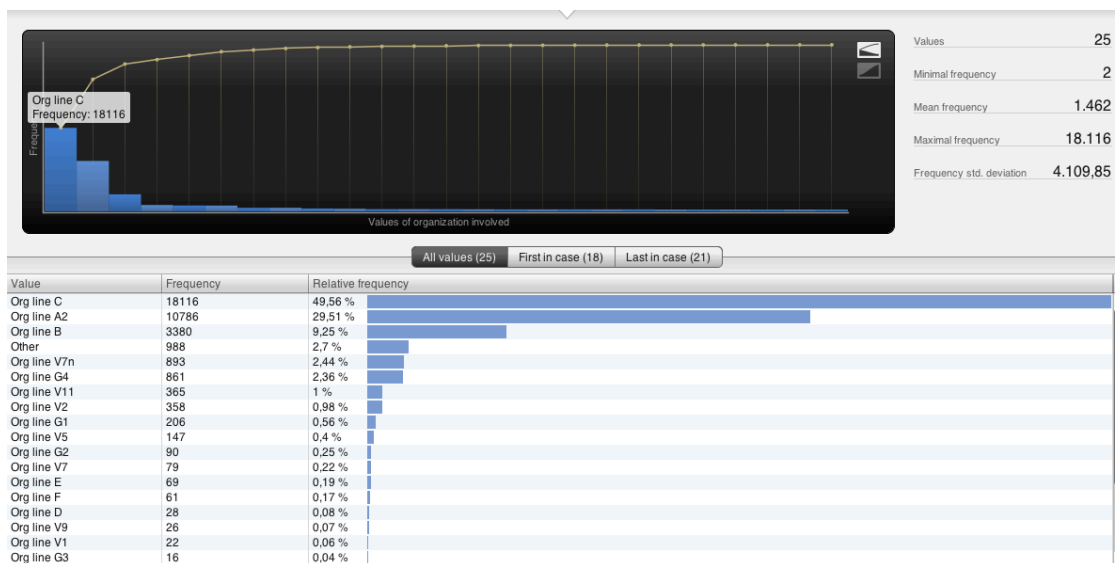


Figure 4 - Organisational Units Most Involved In "Push To Front"

Comparing "Org line C" with "Org line A2" gives the following picture:

Org Line A2 = Involved in 29,51% of the cases pushed to front, but in total of all involvement (no filter on data) shows that Org Line A2 is only involved in 19,09% of the time.

Org Line C = Involved in 49,56% of the cases pushed to front, but in total of all involvement (no filter on data) shows that Org Line C is involved in 64,38% of the time.



Even though Org Line C is most represented in the “Push-To-Front” then relatively seen Org Line A2 is more likely to do “Push-To-Front”.

Ad 3)

The teams most involved in “Push To Front” process based on event frequency involvement in the “push to front” cases, where an event is directly followed by an event in a 2<sup>nd</sup> or a 3<sup>rd</sup> line support team, are outlined below:

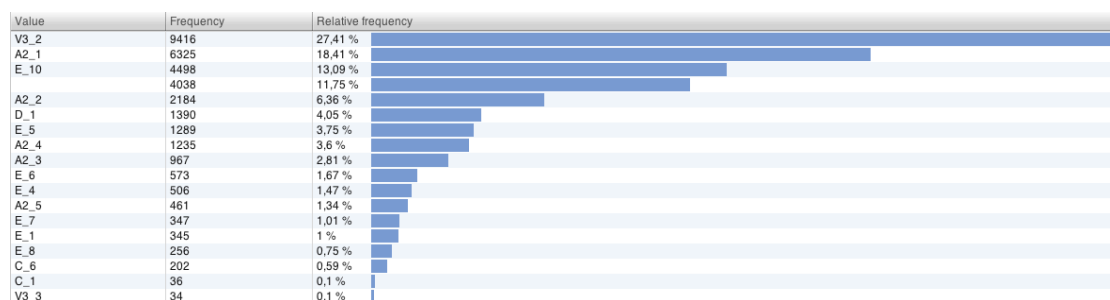


Figure 5 - Teams Most Involved In "Push To Front"

Notice that in this statistic the team receiving and completing the event without doing any push-to-front will also be “punished” however, it seems like all-other-things-equal that this gives the right picture.

A next-step action analyses could be done in order to filter out those events followed directly by the Level2 Completed process.

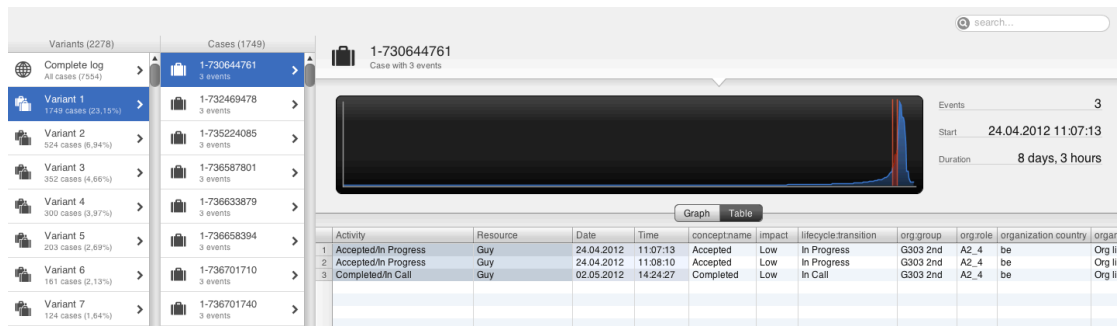
When this is not done here, it is mainly because it is “dangerous” in any way to jump to conclusions - for example, it could be that a team receiving an incident from another team is simply sending back the incident to the sender in order to stop this “push to front” behaviour. That action will statistically be punished even though it is a good action.

Therefore it has been decided that the analysis given is a true all-other-things-equal picture.

Push To Front - Conclusion

23,15% of all incidents runs through 3 core processes, as illustrated below, which is where calls are closed immediately in the call.





However, “Push To Front” is an issue.

40% (3012 cases) of all cases resolved by 1<sup>st</sup> level support have involved 2<sup>nd</sup> or 3<sup>rd</sup> line support at some point in the incident management process. Since those 40% cases bounce back to 1<sup>st</sup> line support it could indicate that the 2<sup>nd</sup> and 3<sup>rd</sup> line support are involved too early.

It seems like PROD424 is much involved in “Push To Front”. However, there is not a clear pattern that a certain Product is more likely to involve “Push-To-Front”.

Even though Org Line C is most represented in the “Push-To-Front” then relatively seen Org Line A2 is more likely to do “Push-To-Front”.

## Ping Pong Behaviour – Issue

### Ping Pong Behaviour – Description

In an ideal world an incident is solved quick and with interference of not too many support teams. However, it occurs that support teams start to send incidents to each other again and again (ping pong) which off course is an unwanted situation. There is definitely a correlation between the ping pong behaviour and the total life time of an incident.

The following questions are raised by the client and will be handled in the “Ping Pong Behaviour Analysis” section:



- 1) What are the functions, organisation, support teams responsible for most of the “ping pong”?
- 2) What products are most affected by it?

### Ping Pong Behaviour – Analysis

In order to analyse the “ping pong behaviour” the following assumptions have been made:

1. Support Teams are identified by column “org:group”
2. Only Use Cases involving a sequence of events where more than 1 support team is involved potentially have “ping pong” behaviour
3. Only Use Cases involving 6 or more events is potentially having “ping pong” behaviour. With fewer than 6 events it is unlikely that more than two support teams are involved and therefore no “ping pong” behaviour applies.
4. Only when an event is of the type “Accepted – In Progress”, Accepted – Assigned”, or “Queued – Awaiting Assignment” it is a potential “ping pong” action. The reasoning behind is that if the event is from level 2 “Completed” the support team handling the “Completed process is not, in that instance, participating in “ping pong” behaviour, but is actually handling the incident or problem.
5. Those organisation units most involved in events after filtering out cases and events as specified in bullet 1 – bullet 4 are most likely to be participation in “ping pong” behaviour.
6. Incidents reassigned to another person within the same team, is not considered “ping pong” but just a way of levelling the work load.
7. Problems (both open and closed) are not continued from Incidents regarding “ping pong” behaviour. Meaning if an Incident is not identified as “ping pong” behaviour, it does not become a “ping pong” behaviour based on the incident being transferred to Problem Management. When an incident is transferred to Problem Management the Incident Management process is ended.

#### Ad 1)

The process diagram below is the filtered Incidents process (filtered according to bullet 1 – bullet 4). The process diagram illustrates where the “ping pong” behaviour is involved. The “ping pong” behaviour is especially introduced by; queuing and reassigning the incident to another team or by assigning the incident to another Support Line.

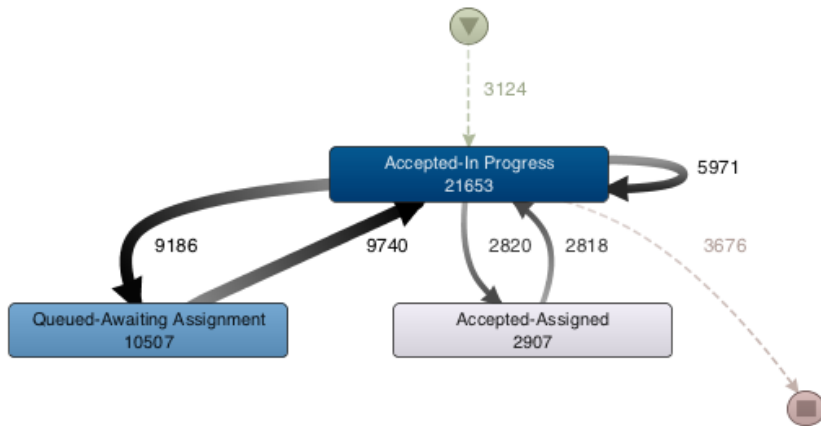


Figure 6 - Incident Management Process "Ping Pong" Behaviour

49% of the cases involve “ping pong” behaviour, so there is definitely evidence that the Incident Management process involve “ping pong” behaviour.

The teams, organisations, functions, and products most involved in “ping pong behaviour” are listed below:

Value	Frequency	Relative frequency
Org line C	21506	61,33 %
Org line A2	7810	22,27 %
Org line B	2296	6,55 %
Other	1030	2,94 %
Org line V7n	682	1,94 %
Org line V11	421	1,2 %
Org line V2	365	1,04 %
Org line G4	309	0,88 %
Org line G2	110	0,31 %
Org line E	102	0,29 %
Org line G1	90	0,26 %
Org line V5	79	0,23 %
Org line V7	66	0,19 %
Org line F	49	0,14 %

Figure 7 - Incidents "Ping Pong" Behaviour - Organisations Involved

Value	Frequency	Relative frequency
G97	4785	13,65 %
G96	2630	7,5 %
D4	1120	3,19 %
G230 2nd	1061	3,03 %
D5	997	2,84 %
D8	951	2,71 %
G92	793	2,26 %
S42	777	2,22 %
D2	650	1,85 %
S43	521	1,49 %
G179	509	1,45 %
S56	488	1,39 %
V37 2nd	476	1,36 %
N38	470	1,34 %

Figure 8 - Incidents "Ping Pong" Behaviour - Support Teams Involved

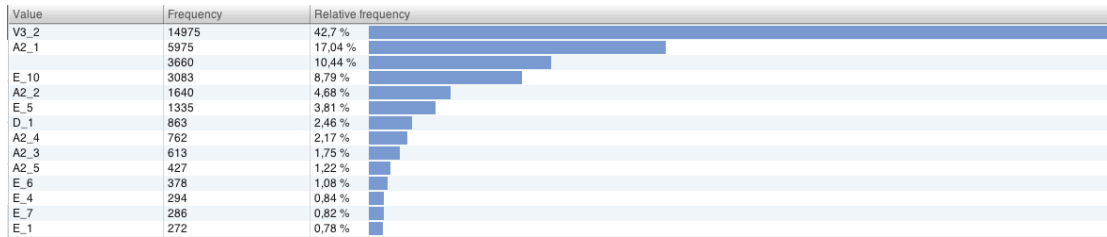


Figure 9 - Incidents "Ping Pong" Behaviour - Functions Involved

Another thing to consider is that sending an issue from one support level up to the next support level is not necessarily a bad thing (e.g. sending an Incident from Support Line 1 to Support Line 2, because escalation might be needed in order to close the Incident. However, that action will be punished in this analysis.

It has been decided that this is not changing the observations and conclusions – basically because, as it can be seen from the figure below, the majority of Incidents involved in “ping pong” behaviour are low or medium Incidents. This tells that it is probably the easy Incidents that are “ping pong’ed” and those should really be closed right away by the Support Team receiving it . Furthermore, it seems like the Incidents that should or could be escalated (the high impact Incidents) are in fact not involved very much in “ping pong” behaviour.

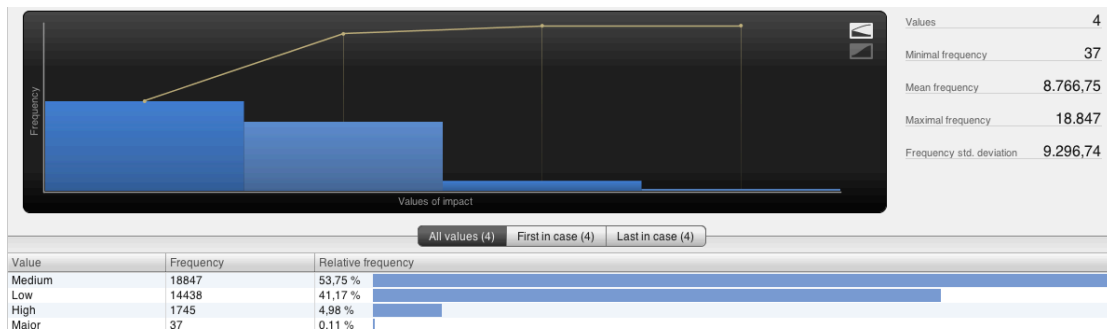


Figure 10 - "Ping Pong" Behaviour Related To Impact

**Ad 1) – Open Problems**

Only 2% of the Open Problem cases involve “ping pong” behaviour. As illustrated in the figure below the “ping pong” process is basically around the process “Queued – Awaiting Assignment”.



The “ping pong” behaviour is so low in Open Problem that it does not seem to be an issue. Overall, it seems like the Open Problems are handled correct according to the intended process.

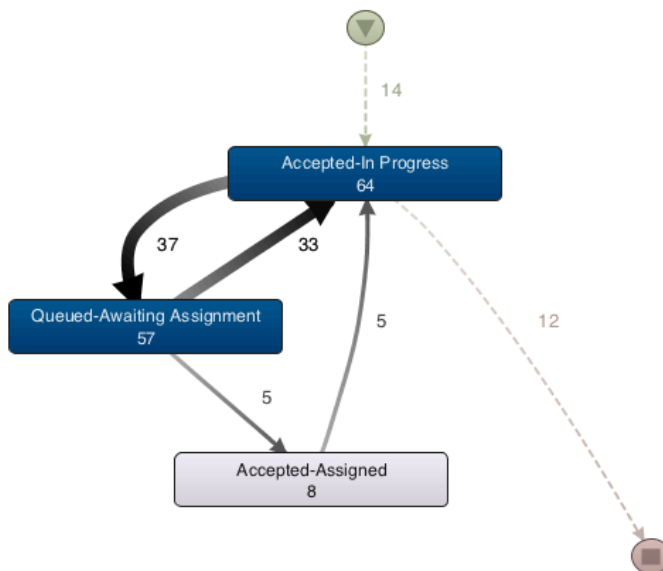


Figure 11 - Open Problems - "Ping Pong" Behaviour Process

### Ad 1) – Closed Problems

Total cases: 1487

6% of the cases involve “ping pong” behaviour

Only 6% of the Closed Problem cases involve “ping pong” behaviour. As illustrated in the figure below the “ping pong” process is basically around the process “Queued – Awaiting Assignment” and “Accepted – Assigned”.

The “ping pong” behaviour is so low in Closed Problem that it does not seem to be an issue. Overall, it seems like the Closed Problems are handled correct according to the intended process.

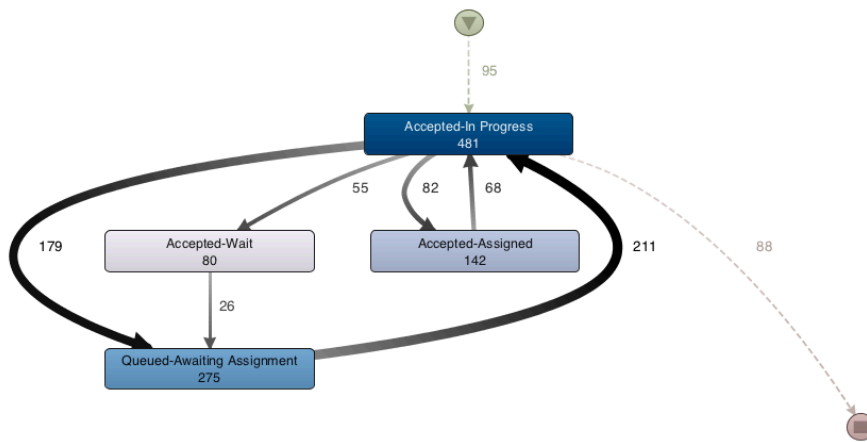


Figure 12 - Closed Problems - "Ping Pong" Behaviour Process

### Ad 2) "Ping pong" Behaviour Divided On Products

Since the "ping pong" behaviour is only an issue in the Incident Management process, the analysis on what products are most involved in "ping pong" behaviour is performed on Incidents only.

Value	Frequency	Relative frequency
PROD424	8728	13,32 %
PROD660	3073	4,69 %
PROD253	1869	2,85 %
PROD542	1675	2,56 %
PROD698	1494	2,28 %
PROD494	1421	2,17 %
PROD455	1060	1,62 %
PROD236	1054	1,61 %
PROD267	1001	1,53 %
PROD215	1000	1,53 %
PROD235	924	1,41 %
PROD383	890	1,36 %
PROD13	864	1,32 %
PROD802	809	1,23 %
PROD776	746	1,14 %
PROD321	739	1,13 %
PROD566	651	0,99 %

Figure 13 - Total Divided On Products

Value	Frequency	Relative frequency
PROD424	4361	12,44 %
PROD542	1317	3,76 %
PROD253	1113	3,17 %
PROD660	1106	3,15 %
PROD698	849	2,42 %
PROD236	728	2,08 %
PROD215	674	1,92 %
PROD455	672	1,92 %
PROD494	659	1,88 %
PROD267	594	1,69 %
PROD776	547	1,56 %
PROD802	540	1,54 %
PROD697	496	1,41 %
PROD235	472	1,35 %
PROD789	450	1,28 %
PROD401	415	1,18 %
PROD258	415	1,18 %
PROD38	404	1,15 %

Figure 14 - "Ping Pong" Based On Products



### Ping Pong Behaviour – Conclusion

“Ping pong” behaviour is an issue in the Incident Management process.

**Incidents:**

49% of the cases involve “ping pong” behaviour

**Open Problems:**

2% of the cases involve ping pong behaviour

**Closed Problems:**

6% of the cases involve ping pong behaviour

Another interesting fact is that most of the incidents involved in “ping pong” behaviour are mostly low or medium impact cases (see figure below). This indicates that cases are not ping-pong’ed due to difficulties in solution but rather due to speeding up own KPI’s and solution times.

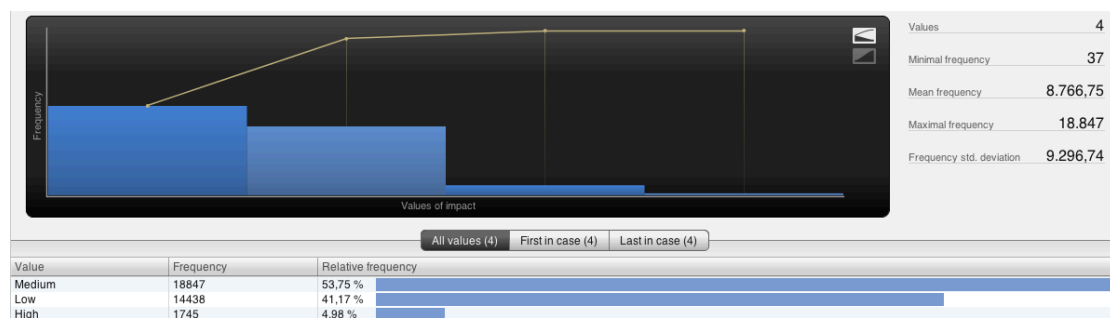


Figure 15 - Incidents Involved In "Ping Pong" Behaviour Based On Impact

### Wait User - Issue

Wait user - Knowing that there is a lot of KPI’s measuring the total resolution time of an incident people tries to find workarounds that stop the clock from ticking. One way of doing this is manually giving an incident the substatus ‘wait user’. Although there are guidelines not to use this substatus (unless someone is really waiting for an enduser of course), some people (action owners) are breaking this guideline.

The following questions are raised by the client and will be handled in the “Wait User Analysis” section:

- 1) Who is making most use of this substatus (action owner)?
- 2) What is the behaviour per support team, function, organisation etc?
- 3) (mis)-usage per location?

**Assumption:** Wait-User should only be used by system generated (by “Siebel”) issues, because those issues are just raised and waiting for user action and to be handled.

33% of the Incidents cases involve one or more events of “Accept – Wait User” where the event is not registered by the system (Siebel).

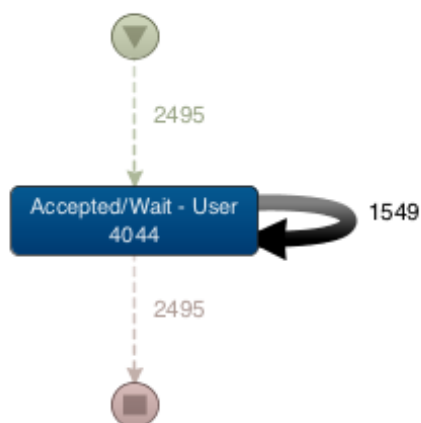


Figure 16 - Incidents "Accept - Wait User" Not Set By the System (Siebel)

An interesting observation is that the High impact cases are not frequently having Wait-User abuse (see figure below). This indicates that the Wait-User is indeed used as an abuse in order to stop the clock, because a real usage for “Wait-User” added from the action owner – for example asking for more background information – would probably be more relevant for High impact cases than for Low and Medium impact cases.





Value	Frequency	Relative frequency
Medium	1989	49,18 %
Low	1936	47,87 %
High	119	2,94 %

Figure 17 - Incidents - Cases With "Wait-User" Not Set By the System (Siebel). Distributed On Impact Level

Ad 1)

In the figure below the usage and abuse of “Wait-User” is outlined based on Resource Country. From that overview it seems like Sweden, Poland, and India are most likely to abuse the “Wait-User” status. However, from looking at the table below the figure where the “wait-user” abuse is related to the relative involvement from the country it is obvious that Sweden is high on the list because Sweden is involved in many cases in the first place, and therefore are involved in many “Wait-user” abuses – but Thailand and India are actually doing more “wait-user” abuse relatively seen.

Value	Frequency	Relative frequency
Sweden	1227	30,34 %
POLAND	1018	25,17 %
INDIA	787	19,46 %
Belgium	305	7,54 %
Brazil	225	5,56 %
USA	225	5,56 %
China	87	2,15 %
France	59	1,46 %
Japan	43	1,06 %
Canada	15	0,37 %
THAILAND	12	0,3 %
RUSSIAN FEDERATION	11	0,27 %
Korea	10	0,25 %
United Kingdom	7	0,17 %
Australia	6	0,15 %
MALAYSIA	3	0,07 %
South Africa	2	0,05 %
Netherlands	1	0,02 %

Figure 18 - Wait-User Usage Based On Resource Country

Value	Frequency	Wait-User Frequency	Percentage Wait-User Compared To Own Total Events
South Africa	13	2	15%
THAILAND	104	12	12%
INDIA	7528	787	10%
Japan	534	43	8%
Belgium	3816	305	8%
China	1102	87	8%
POLAND	13018	1018	8%
Sweden	18905	1227	6%
USA	3973	225	6%
RUSSIAN FEDERATION	216	11	5%
Korea	217	10	5%
Australia	139	6	4%
Canada	358	15	4%
Brazil	6036	225	4%
United Kingdom	198	7	4%



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MALAYSIA	86	3	3%
France	1800	59	3%

Ad 2)

“Wait-User” abuse based on team:

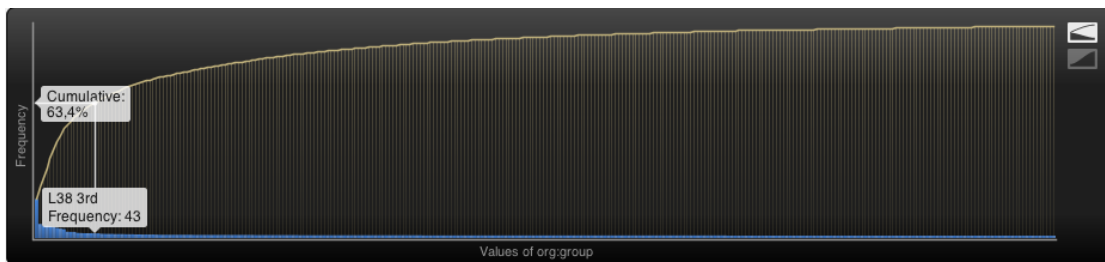


Figure 19 - The 18 Teams Most Involved In "Wait-User" Incident Management Abuse Are Registered For 63,4% Of The Events

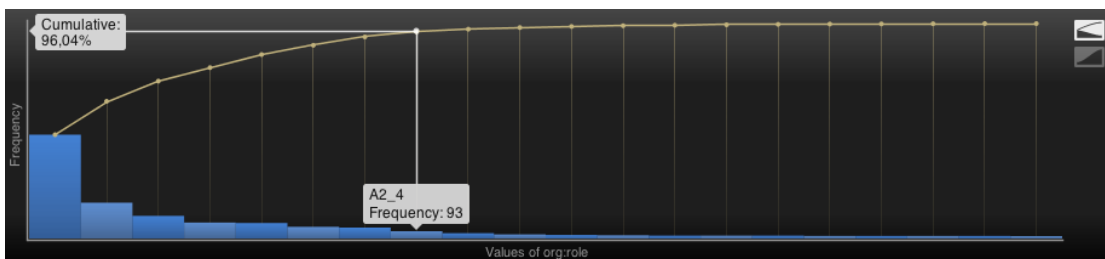


Figure 20 - The 8 Functions Most Involved In "Wait-User" Incident Management Abuse Are Registered For 96,04% Of The Events

Value	Frequency	Relative frequency
V3_2	1929	47,7 %
A2_1	636	15,73 %
E_10	383	9,47 %
E_5	258	6,38 %
A2_2	248	6,13 %
D_1	176	4,35 %
A2_4	161	3,98 %
A2_3	93	2,3 %
E_4	54	1,34 %
E_4	31	0,77 %
A2_5	20	0,49 %
E_8	15	0,37 %
C_6	9	0,22 %
E_7	9	0,22 %
E_1	9	0,22 %
E_2	4	0,1 %

Figure 21 - The Functions Most Involved In "Wait-User" Incident Management Abuse

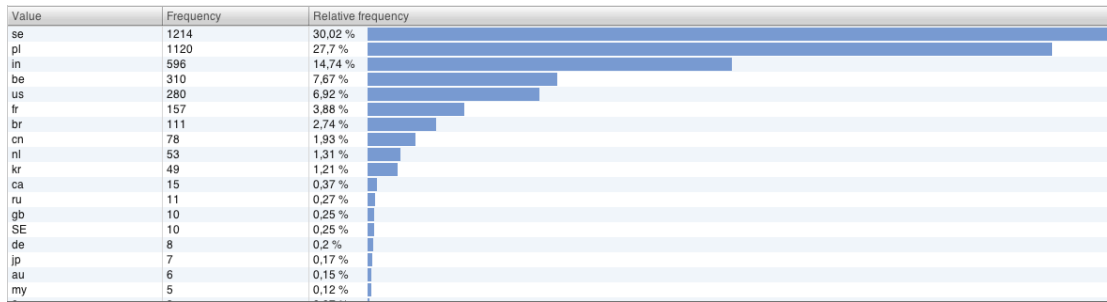


Figure 22 - Locations Most Involved In "Wait-User" Incidents Abuse

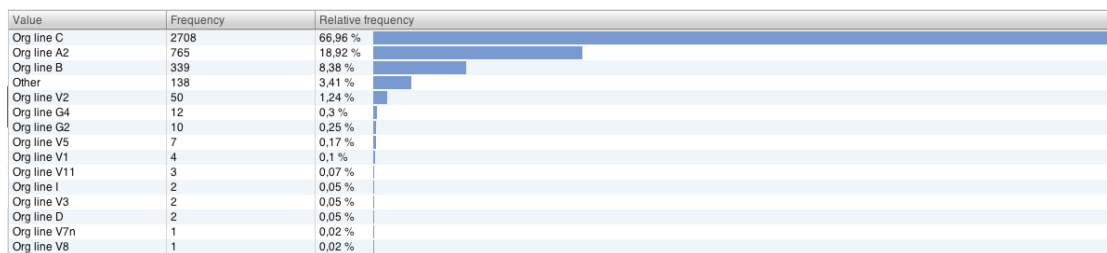


Figure 23 - Organisations Most Involved In "Wait-User" Incidents Abuse

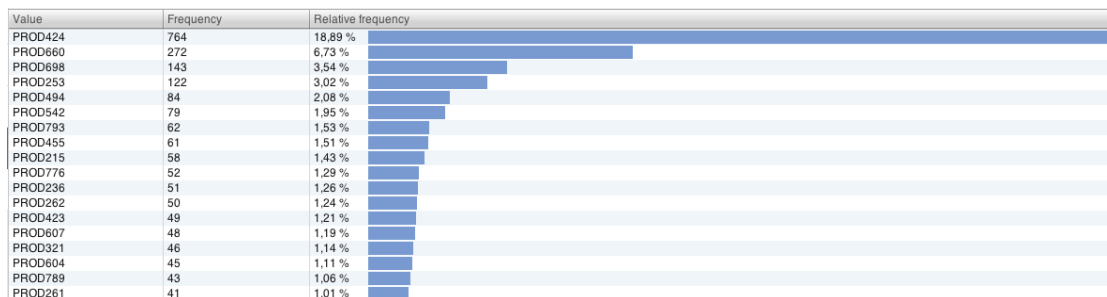


Figure 24 - Products Most Involved In "Wait-User" Incidents Abuse

### Process conformity per organisation - Issue

The following question is raised by the client and will be handled in the "Process Conformity Analysis" section:

In general the Volvo IT organisation is spread in two organisations : Org line A2 and Org line C. It would be interesting to see how conform or how much in line every organisation is with the incident and problem management processes.

## Process conformity per organisation – Analysis

### Conformity With Incident Management Process

The main process for Incident Management is outlined in “Incidents Management 1.0 Level2” where Level 2 is outlined and in the diagram below where the events has been filtered to exclude unwanted process flows: Queuing and “Ping pong” behaviour.

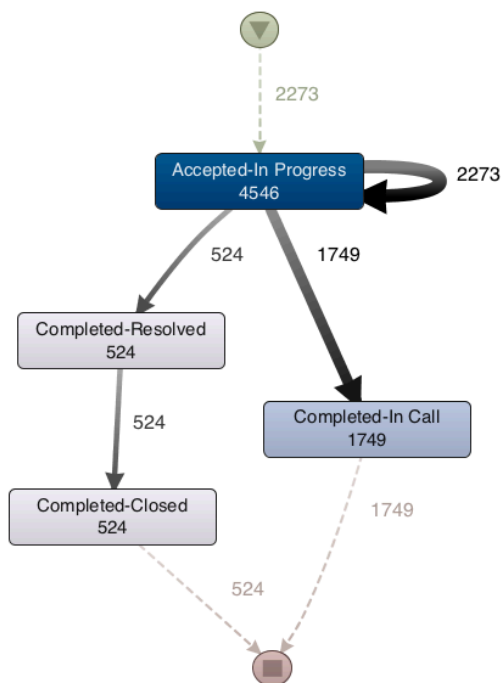


Figure 25 - Incidents Management Main Process Flow

30% of the Incidents Management cases follow the main process flow.

Value	Frequency	Relative frequency
Org line C	6075	82,73 %
Org line A2	539	7,34 %
Org line G4	398	5,42 %
Org line B	272	3,7 %
Org line V5	20	0,27 %
Org line H	20	0,27 %
Org line V2	11	0,15 %
Org line F	4	0,05 %
Org line G1	4	0,05 %

Figure 26 - Incidents Management - Organisations Following The Main Process



Value	Frequency	Relative frequency
Org line C	42189	64,38 %
Org line A2	12508	19,09 %
Org line B	4623	7,05 %
Other	2319	3,54 %
Org line V7n	893	1,36 %
Org line G4	861	1,31 %
Org line V2	605	0,92 %
Org line V11	480	0,73 %

Figure 27 - Incidents Management Total Cases

Based on the events involved in the main process compared to the total events involved Organisation Line C is most in line with the process (Org Line C is in line with the process with 14,4% of the events, while Org Line A2 is in line with the process with 4,3% of the events).

**Conformity With Problem Management Process**

The main process for Problem Management is outlined in “Incidents Management 1.0 Level2” where Level 2 is outlined and in the diagram below where the events has been filtered to exclude unwanted process flows: Queuing and “Ping pong” behaviour.

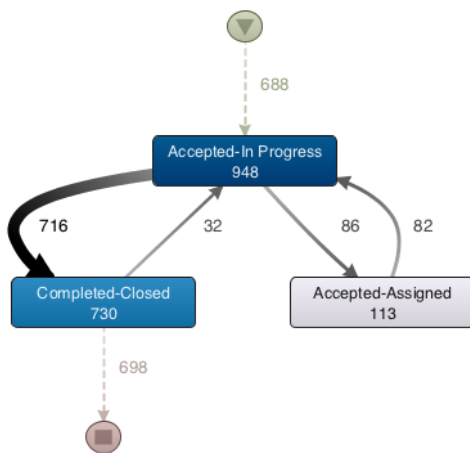


Figure 28 - Problem Management Main Process

46% of the cases follow the Problem Management Main Process. As it can be seen from the two figures below Org Line C seems to be most in line with the Problem Management process.

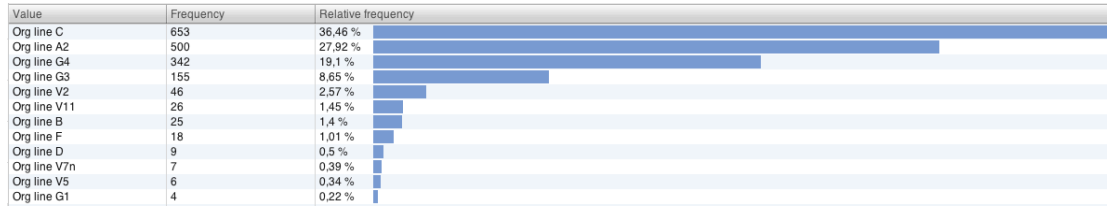


Figure 29 - Relative Events Following Problem Management Main Flow

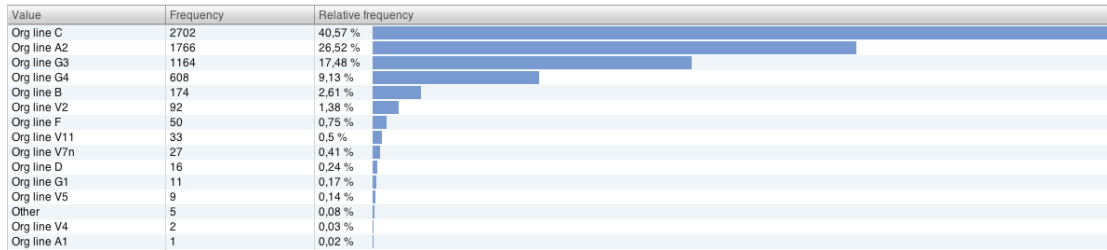
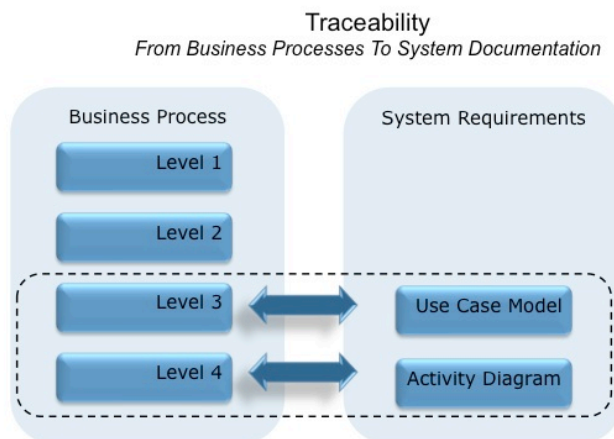


Figure 30 - Relative Events Distribution In All Cases



## Appendix 1 – Business Process Using ChangeGroup Business Process

ChangeGroup Business Modelling is based on BPMN<sup>1</sup> notation and is started from a Value-Chain<sup>2</sup> perspective. From the value-chain the processes are broken down into three or four layers where the lowest layer (usually Level3) contains processes that are equal to Use Cases<sup>3</sup> - that way traceability from all system implementations, all through system documentation and the business processes is ensured as illustrated in the figure below.



In order to stay loyal to the custom business process modelling used in our team the business processes are diagrammed using the ChangeGroup Business Process approach, even though to answer the questions raised by Volvo IT Belgium within the scope of this case just using process mining techniques would have been sufficient. However, sticking to the normal approach gives confidence, ensures traceability, and enables process flaw workshops if that would be required as a next step.

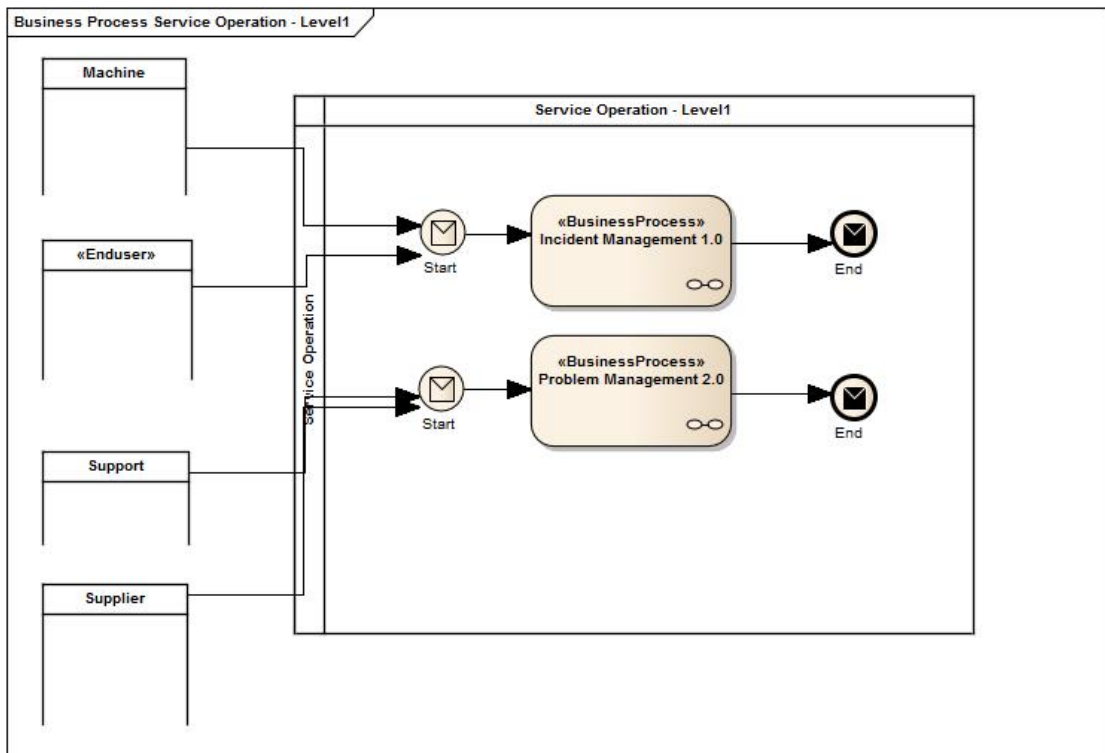
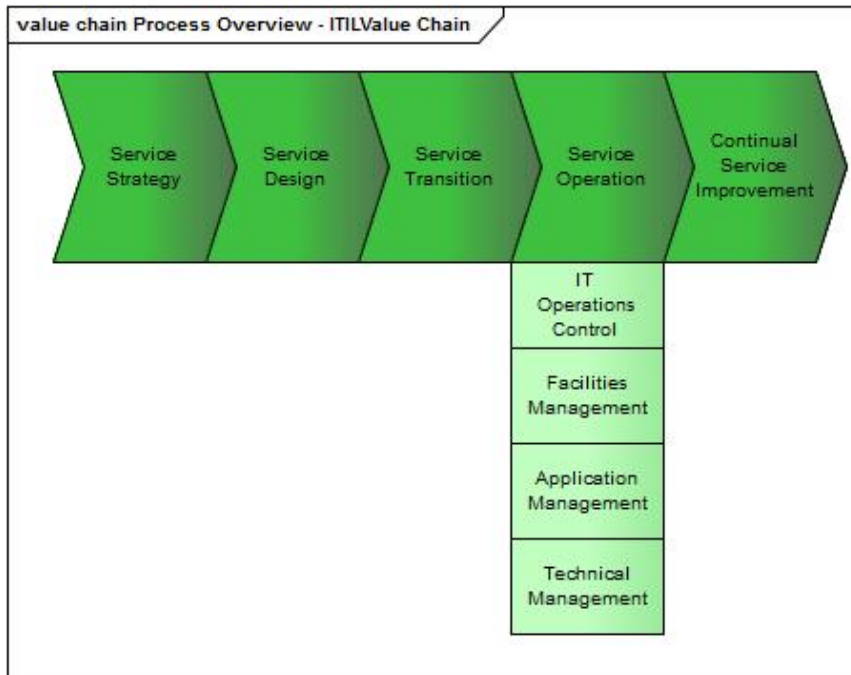
All processes are numbered to ensure traceability.

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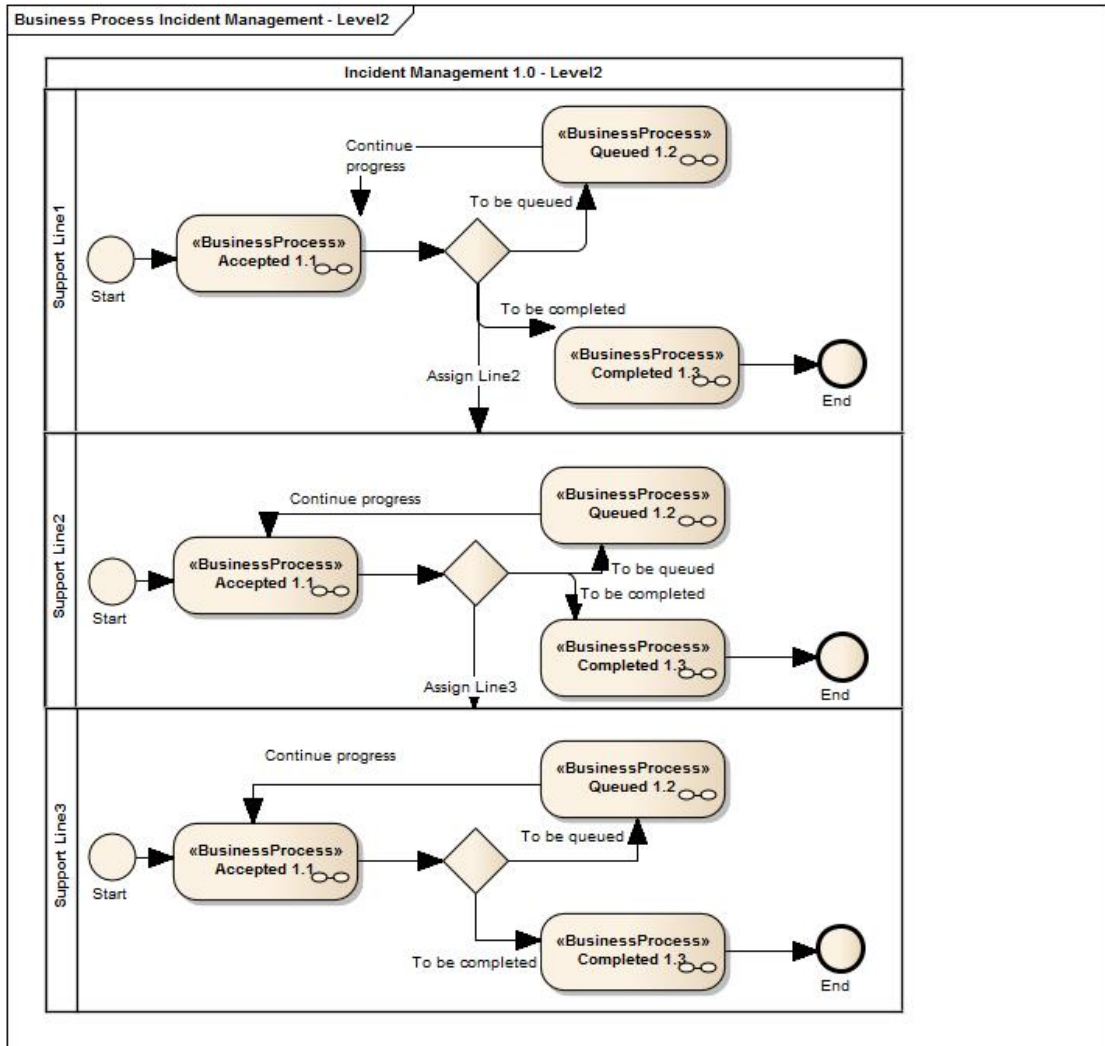
<sup>1</sup> <http://www.bpmn.org>

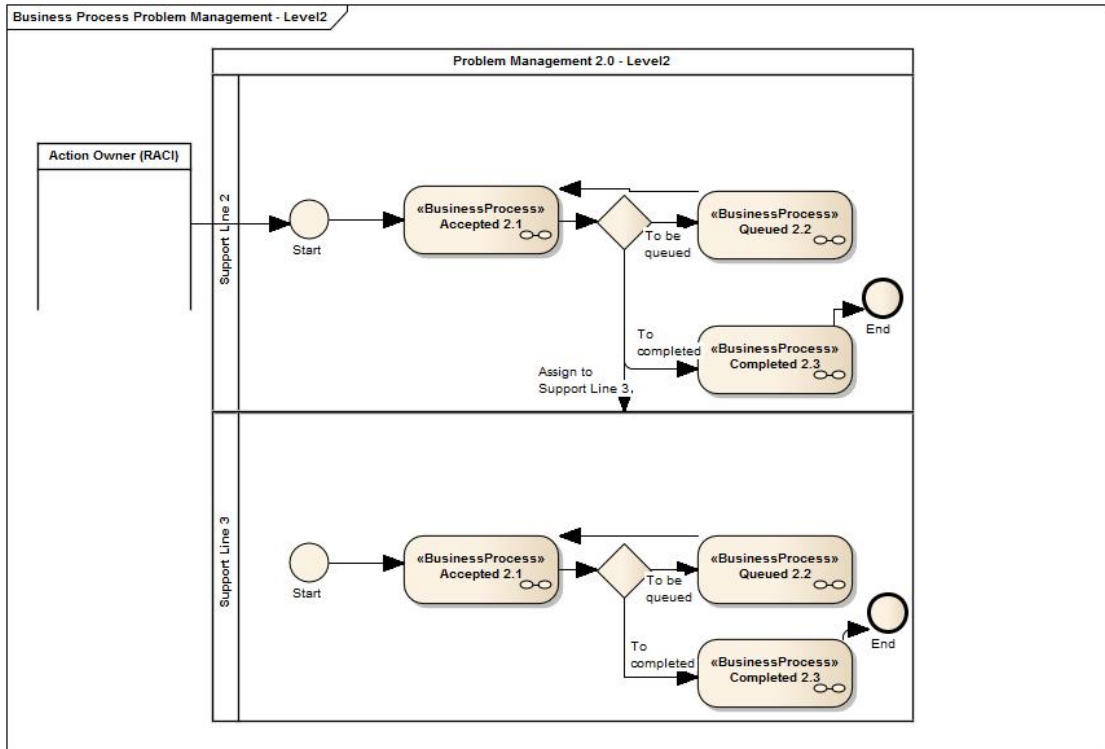
<sup>2</sup> [http://en.wikipedia.org/wiki/Value\\_chain](http://en.wikipedia.org/wiki/Value_chain)

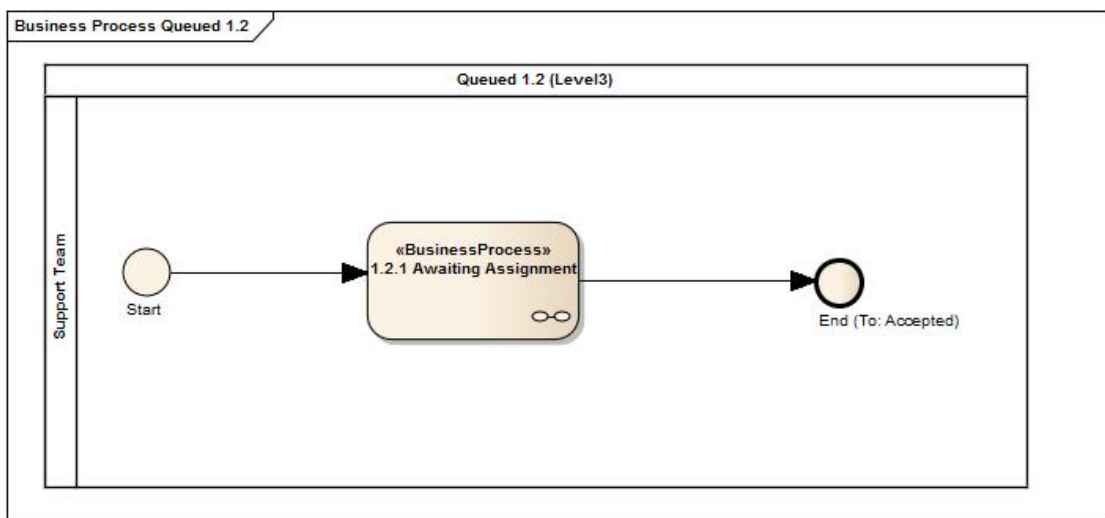
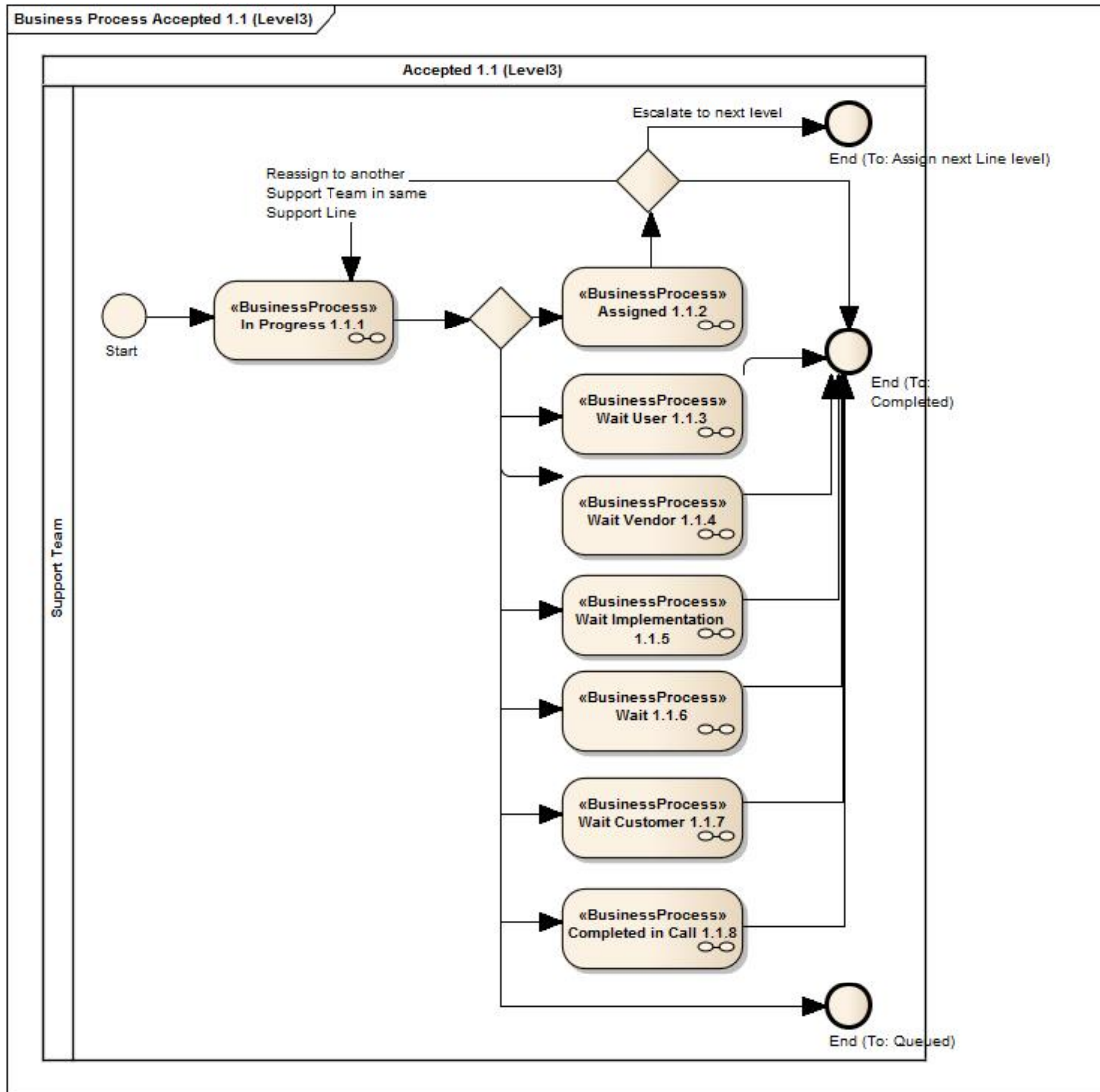
<sup>3</sup> <http://www.uml.org>

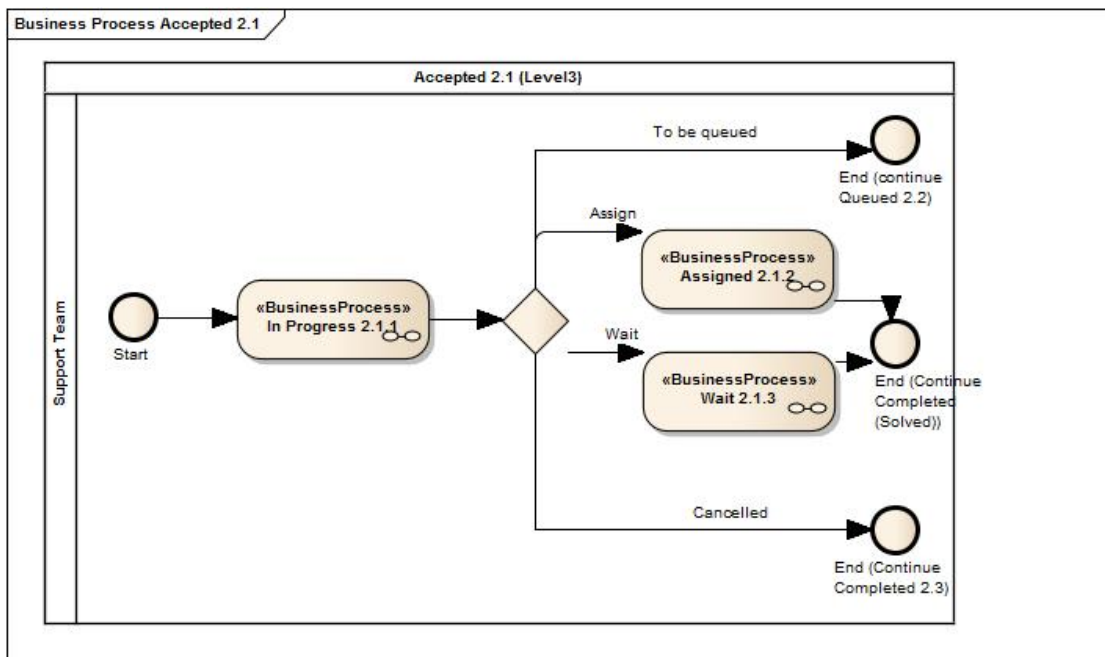
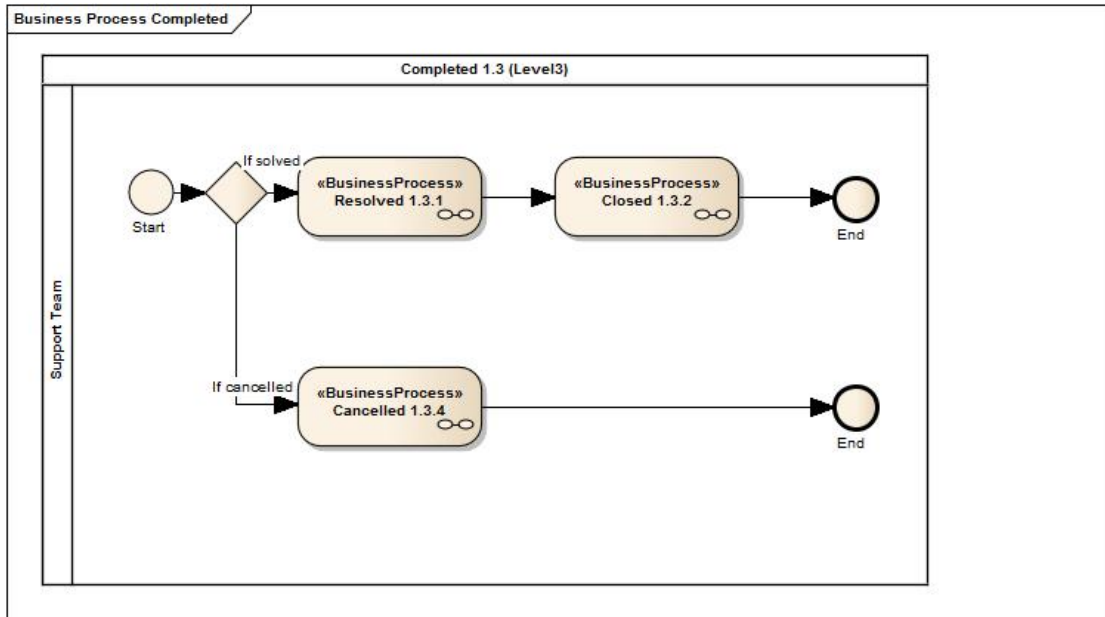


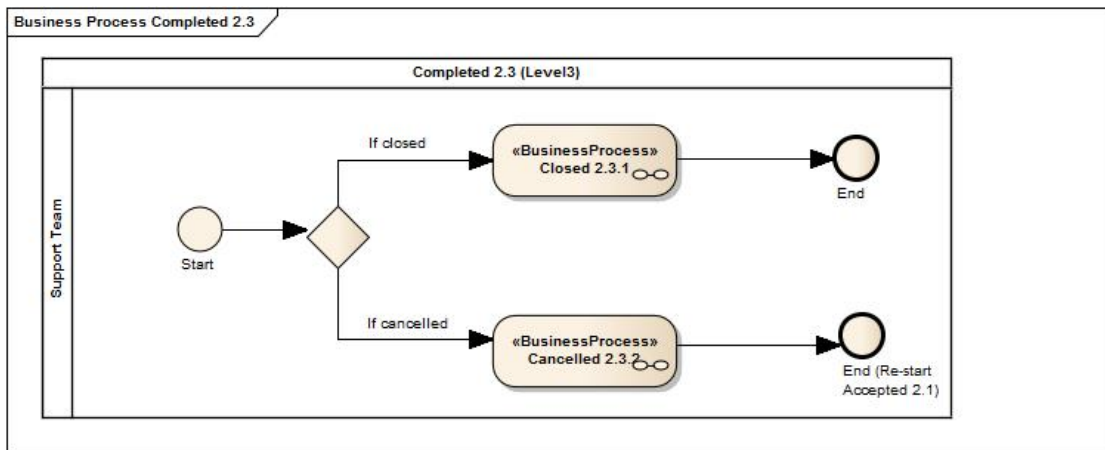
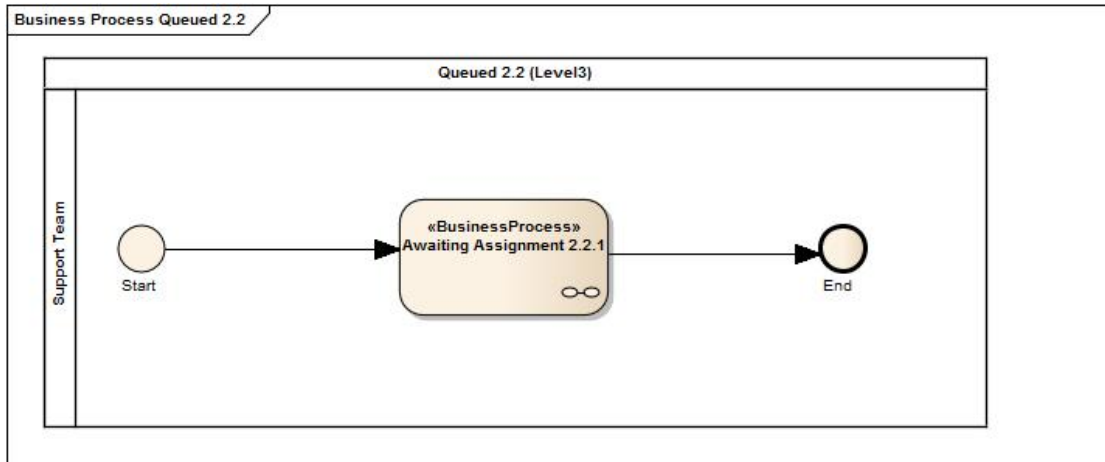














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