

Corticon #2 Port Clearance (Refactored Solution)

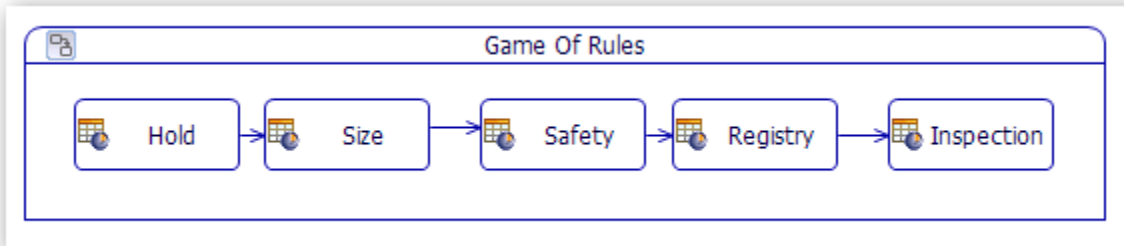
Contents

- Corticon #2 Port Clearance (Refactored Solution) 1
 - Refactoring the “As Specified” Decision model 1
 - Decision Structure 2
 - Hold Rules 2
 - Size Rules..... 2
 - Safety Rules 3
 - Registry 4
 - Inspection..... 4
 - Rule Sheet Dependency 4
 - Attribute Dependency 5
 - Combined Dependency Diagram..... 5
 - Test Cases..... 6
 - A Ship that may enter a Dutch port 6
 - A Ship that may not enter a Dutch port..... 7
- Appendix A The Rules (from RuleXpress) 9

Refactoring the “As Specified” Decision model

We’ll discuss how the original model can be refactored to make it simpler and we’ll also discuss how a couple of enhancements might affect the model.

Decision Structure



Below are each of the rules represented as decision tables (using the natural language view).

Hold Rules

A **ship's hold** contains **remainders of cargo** if the **residual cargo measurement** is higher than 0.5 mg dry weight per cm².

The **hold** of a **ship** must be considered clean if the **hold** does not contain **remainders of cargo**

Conditions	1	2
What is the residual cargo measurement in the hold?	<= 0.5	> 0.5
Actions		
Post Message(s)		
The hold is considered clean	<input checked="" type="checkbox"/>	<input type="checkbox"/>
The hold has no remainders of cargo	<input checked="" type="checkbox"/>	<input type="checkbox"/>
The hold is not considered clean	<input type="checkbox"/>	<input checked="" type="checkbox"/>
The hold has remainders of cargo	<input type="checkbox"/>	<input checked="" type="checkbox"/>

What if there are new reasons why the ship might have remainders? Where should we model that? e.g. radioactive. Additional factors could be added easily

Conditions	1	2	3
What is the residual cargo measurement in the hold?	<= 0.5	> 0.5	
Was radioactivity detected in the hold?			T
Actions			
Post Message(s)			
The hold is considered clean	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The hold has no remainders of cargo	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The hold is not considered clean	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
The hold has remainders of cargo	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Size Rules

A **ship** must be categorized as **small** if the **total length** of the **ship** is less than 80 meters

A **ship** must be categorized as **large** if the **total length** of the **ship** is at least 80 meters

Conditions	1	2	3
What is the length of the ship in meters?	< 80	>= 80	null
Actions			
Post Message(s)			
Classify the ship as	'small'	'large'	'unknown'

NOTE: We should consider the possibility of any attribute being null.


What if there is an overlap between small and large? Suppose the rules said small was under 80 but large was over 60? What size is a ship of length 70?

Conditions	1	2
What is the length of the ship in meters?	< 80	>= 60
Actions		
Post Message(s)		
Classify the ship as	'small'	'large'

Fortunately Corticon can detect this situation using its ambiguity checker

Conditions	1	2
What is the length of the ship in meters?	< 80	>= 60
Actions		
Post Message(s)	✉	✉
Classify the ship as	'small'	'large'

Progress Corticon Studio

 Total conflicts detected: 1

We might decide to resolve it this way and then we'd need to accommodate 'medium' in the safety rules below.

Conditions	1	2	3
What is the length of the ship in meters?	< 60	60..80	> 80
Actions			
Post Message(s)	✉		✉
Classify the ship as	'small'	'medium'	'large'

Safety Rules

A **ship** only meets the **safety requirements for large unloaded ships** if the **ship** complies with all of the following:

- the **ship** is categorized as **large**
- the **hold** of the **ship** is clean
- the **hold** of the **ship** is double hulled.

A **ship** only meets the **safety requirements for small unloaded ships** if the **ship** complies with all of the following:

- the **ship** is categorized as **small**
- the **hold** of the **ship** is clean

A **ship** only meets the **safety requirements for unloaded ships** if the **ship** complies with at least one of the following:

- the **ship** meets the **safety requirements for small unloaded ships**
- the **ship** meets the **safety requirements for large unloaded ships**.

Incidentally Corticon can compress this by merging rules 2 and 4 since their outcome is the same:

Conditions	1	2	3	4	5
What is the size of the ship?	'small'	'small'	'large'	'large'	'large'
Is the ship's hold clean?	T	F	T	F	-
Is the ship double hulled?	-	-	T	-	F
Actions					
Post Message(s)	✉	✉	✉	✉	✉
The ship does meet the safety requirements	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The ship does not meet the safety requirements	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Conditions	1	2	3	4
What is the size of the ship?	'small'	{'large', 'small'}	'large'	'large'
Is the ship's hold clean?	T	F	T	-
Is the ship double hulled?	-	-	T	F
Actions				
Post Message(s)	✉	✉	✉	✉
The ship does meet the safety requirements	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
The ship does not meet the safety requirements	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Registry

A ship's **certificate of registry** must be considered valid if the **date up to which the registration is valid** of the **certificate of registry** is after the **current date**

Conditions	1	2
Is the expiry date of the certificate of registration after today?	T	F

Actions		
Post Message(s)	✉	✉
The ship has a valid certificate of registration	<input checked="" type="checkbox"/>	<input type="checkbox"/>
The ship does not have a valid certificate of registration	<input type="checkbox"/>	<input checked="" type="checkbox"/>

Inspection

A ship must comply with the **requirements of the Inspection** for **unloaded ships** if the ship complies with all of the following:

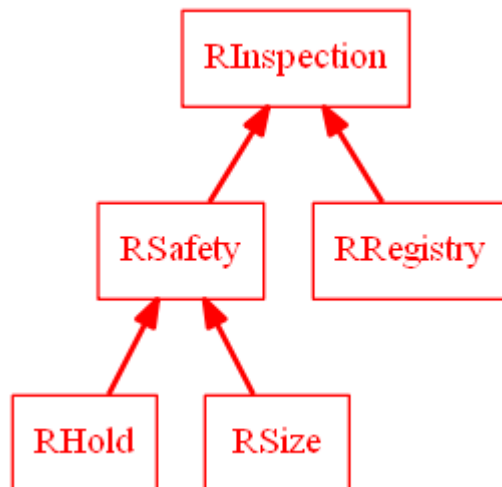
- the ship meets the **safety requirements** for **unloaded ships**
- the ship has a **certificate of registry** that is valid.

An **unloaded ship** may only enter a **Dutch port** if the ship complies with the **requirements of the Inspection** for **unloaded ships**.

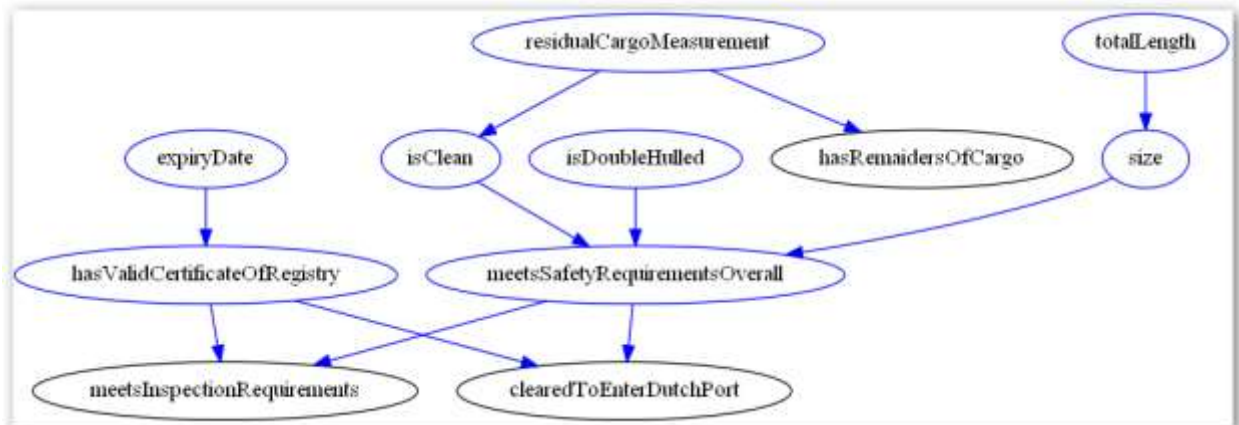
Conditions	1	2	3
Does the ship meet safety requirements?	T	F	-
Does the ship have a valid certificate of registry?	T	-	F

Actions			
Post Message(s)	✉	✉	✉
The ship does meet inspection requirements	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The ship does not meet inspection requirements	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
The ship is cleared to enter a Dutch port	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The ship is NOT cleared to enter a Dutch port	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

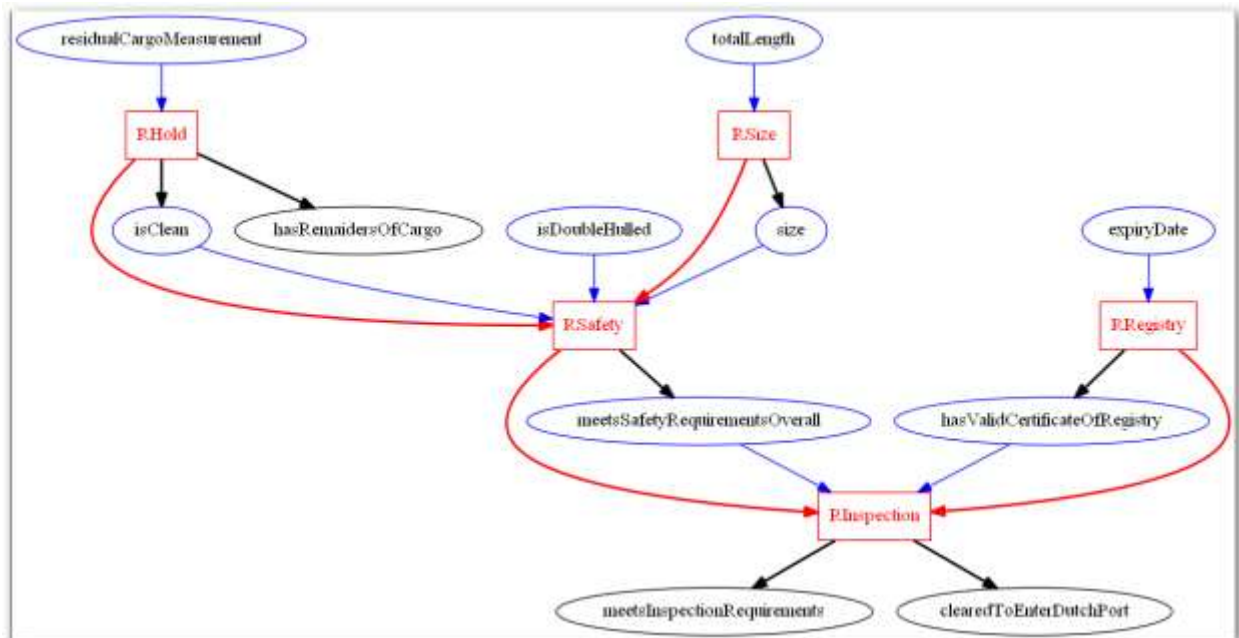
Rule Sheet Dependency



Attribute Dependency



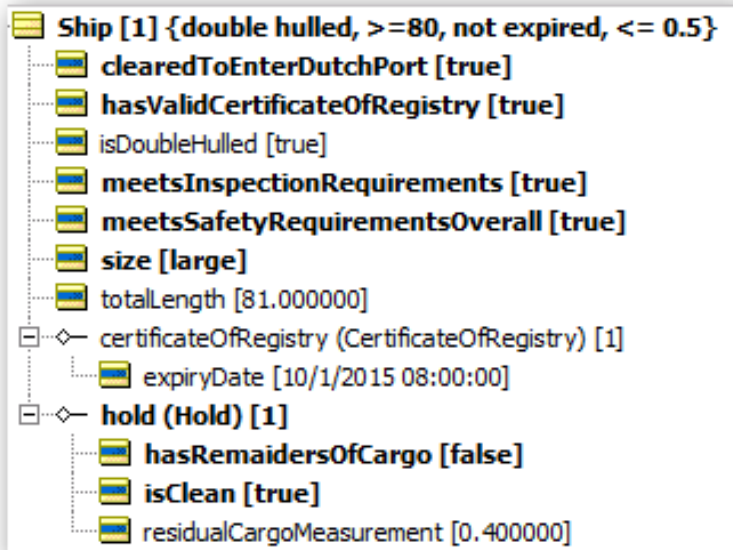
Combined Dependency Diagram



You can see in the refactored model which attributes are not used (black with no exit line)

Test Cases

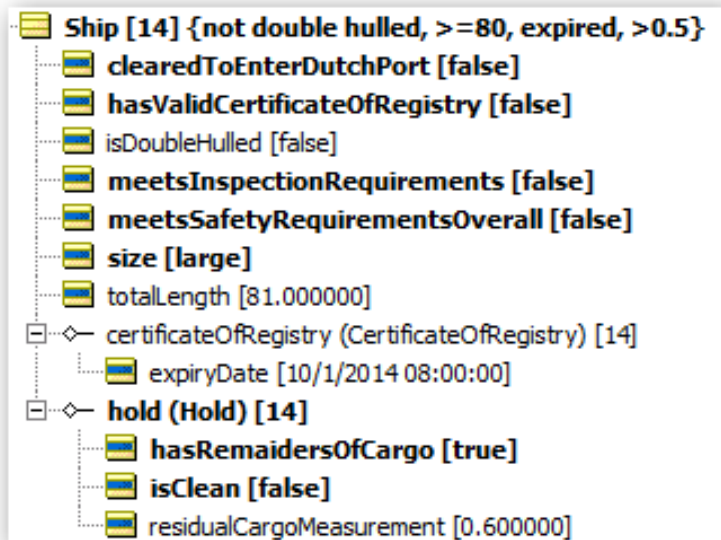
A Ship that may enter a Dutch port



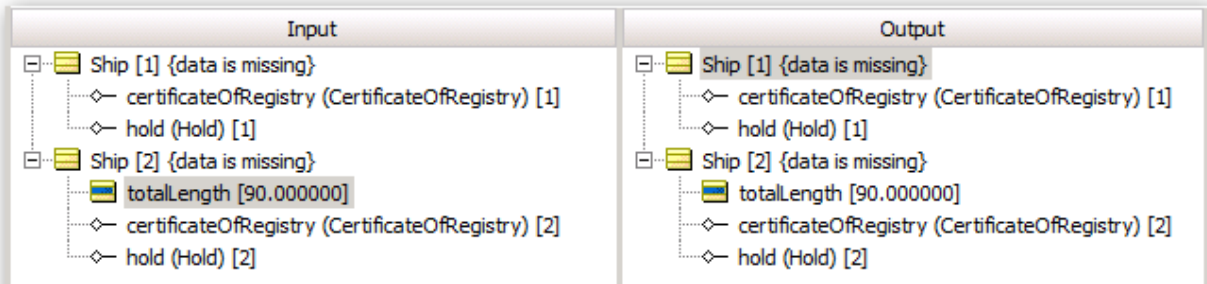
Notice that the rule statements have been slightly changed to read as statements of fact about the ship being considered along with an explanation. The notes in [] indicate the rule sheet and rule that produced the message. These messages become the decision audit trail. In some cases actual values have been inserted.

Sev...	Message
Info	[Hold, 1] The ship's hold does not contain remainders of cargo since the residual cargo measurement is not over 0.5 mg dry weight per cm ² .
Info	[Hold, 1] The hold of the ship is considered clean since the hold does not contain remainders of cargo
Info	[Size, 2] The ship is categorized as large since the total length of the ship (81.000000) is at least 80 meters
Info	[Safety, 3] The ship meets the safety requirements for large unloaded ships since the ship complies with all of the following:- the ship is ca...
Info	[Registry, 1] The ship's certificate of registry is considered valid since the date (10/1/2015 08:00:00) up to which the registration is valid ...
Info	[Inspection, 1] the ship meets the safety requirements for unloaded ships
Info	[Inspection, 1] the ship has a certificate of registry that is valid.
Info	[Inspection, 1] The ship may enter a Dutch port since the ship complies with the requirements of the Inspection for unloaded ships: safety...

A Ship that may not enter a Dutch port



Warning	[Hold,2] The ship's hold contains remainders of cargo since the residual cargo measurement is higher than 0.5 mg dry weight per c...	Ship[14]
Warning	[Hold,2] The hold of the ship is considered NOT clean since the hold does contain remainders of cargo	Ship[14]
Info	[Size,2] The ship is categorized as large since the total length of the ship (81.000000) is at least 80 meters	Ship[14]
Warning	[Safety,4] The hold is not clean so does not meet the safety requirements	Ship[14]
Warning	[Safety,5] The ship is not double hulled so does not meet the safety requirements (for large ships)	Ship[14]
Warning	[Registry,2] The ship's certificate of registry is considered NOT valid since the date (10/1/2014 08:00:00) up to which the registra...	Ship[14]
Warning	[Inspection,2] The ship does not meet inspection requirements since it does not meet the safety requirement	Ship[14]
Violation	[Inspection,2] The ship may not enter a Dutch port since it does not meet the inspection requirements	Ship[14]
Warning	[Inspection,3] The ship does not meet inspection requirements since it does not have a valid certificate of registry	Ship[14]



[Properties](#)
[Problems](#)
[Error Log](#)
[Search](#)
[Rule Messages](#)
[Natural Language](#)
[Rule Statement](#)

Severity	Message	Entity
Warning	[Inspection,6] Ship length is missing	Ship[1]
Warning	[Inspection,7] Ship residual cargo measurement is missing	Ship[1]
Warning	[Inspection,9] Ship certificate date is missing	Ship[1]
Warning	[Port_Clearance,3] It cannot be determined whether the ship may enter a Dutch port.	Ship[1]
Warning	[Inspection,7] Ship residual cargo measurement is missing	Ship[2]
Warning	[Inspection,8] Ship isDouble Hulled is missing (required when ship is large)	Ship[2]
Warning	[Inspection,9] Ship certificate date is missing	Ship[2]
Warning	[Port_Clearance,3] It cannot be determined whether the ship may enter a Dutch port.	Ship[2]

Appendix A The Rules (from RuleXpress)

1. Clean

***Statement** The hold of a ship must be considered clean if the hold does not contain remainders of cargo.

2. Clearance Dutch Port

***Statement** An unloaded ship may only enter a Dutch port if the ship complies with the requirements of the Inspection for unloaded ships.

3. Inspection requirements

***Statement** A ship must comply with the requirements of the Inspection for unloaded ships if the ship complies with all of the following:

- the ship meets the safety requirements for unloaded ships
- the ship has a certificate of registry that is valid.

4. Large ship

***Statement** A ship must be categorized as large if the total length of the ship is at least 80 meters.

5. Reminders of cargo

***Statement** A ship's hold contains remainders of cargo if the residual cargo measurement is higher than 0.5 mg dry weight per cm².

6. Safety requirements

***Statement** A ship only meets the safety requirements for unloaded ships if the ship complies with at least one of the following:

- the ship meets the safety requirements for small unloaded ships
- the ship meets the safety requirements for large unloaded ships.

7. Safety requirements large

***Statement** A ship only meets the safety requirements for large unloaded ships if the ship complies with all of the following:

- the ship is categorized as large
- the hold of the ship is clean
- the hold of the ship is double hulled.

8. Safety requirements small

***Statement** A ship only meets the safety requirements for small unloaded ships if the ship complies with all of the following:

- the ship is categorized as small
- the hold of the ship is clean.

9. Small ship

***Statement** A ship must be categorized as small if the total length of the ship is less than 80 meters.

10. Valid certificate of registry

***Statement** A ship's certificate of registry must be considered valid if the date up to which the registration is valid of the certificate of registry is after the current date.