

Institute of Systems Science
National University of Singapore

GRADUATE CERTIFICATE

INTELLIGENT REASONING SYSTEMS

Workshop Project (Continuous Assessment) Guide

Subject: *Machine Reasoning*

Agenda : Course Assessment & Grading

EEP & MTech Stackable

- **Paper Assessment** on last lecture day
 - [Individual 50 marks] 1 hour open book exam
 - **Workshop Project Deliverables** due last lecture day
 - [Individual 10 marks] An example reasoning system enhanced by knowledge discovery technique, e.g. home loan approval
 - [Individual 20 marks] A runnable standalone bespoke business reasoning system
 - [Individual 20 marks] A project report with relevant attachments, including
 - System Design / Knowledge Models
 - Use/Test cases

 MTech Thru-Train

- **Paper Assessment** on last lecture day
 - [Individual 50 marks] 1 hour open book exam
 - **Workshop Project Deliverables** due last lecture day + 14
 - [Individual 10 marks] An example reasoning system enhanced by knowledge discovery technique, e.g. home loan approval
 - [Group 15 marks] A runnable standalone bespoke business reasoning system
 - [Group 15 marks] A project report with relevant attachments, including
 - System Design / Knowledge Models
 - System Development & Implementation in tools, e.g. KIE suite
 - System User Guide
 - [Group 10 marks] A 5 minute video presentation, covering
 - System Design & Use Case Demo

- **Source impactful real life business scenario for workshop project.**
 - **Conduct comprehensive research and reference reading.**
 - **Make your own reasonable assumptions where necessary.**

Workshop 1 Guide

WORKSHOP RULE/PROCESS REASONING SYSTEM

- **Case Study of HDB BTO Recommender**

- Use case demo
- System analysis & exploration (homework)

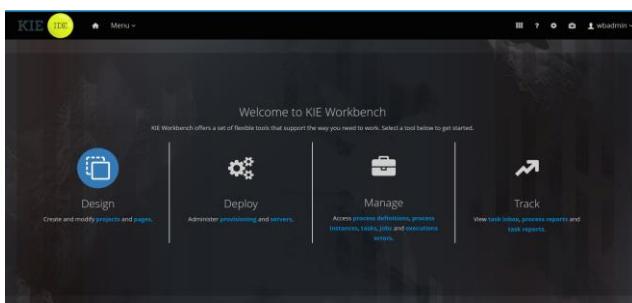
- **KIE Development Suite Tutorial**

- Access KIE "Knowledge Is Everything"
- KIE components: KIE Workbench, Rule Engine, and Server
- KIE Workbench development functions
- Reasoning system development using KIE Workbench

- **KIE Development – Individual Work**

- Example KIE reasoning systems

KIE: Installation & Familiarity



<http://www.kiegroup.org/>



<http://bit.ly/iss-vm>

Once you get KIE product suite installed, it's time to see some running use cases. The easiest way is to try one of the examples shipped with the platform, it will show typical path users take to design, build and execute business logic.

Workshop 1.1 [Individual]

KIE system: New user creation using admin user: *wbadmin*

Default User Names	Password	Role (Workbench roles)	Group (Task roles)
maciek	maciek	admin, analyst, user	HR, kie-server, PM
jack	jack	analyst	IT, kie-server
wbadmin	wbadmin	process-admin, admin, analyst, user	kie-server
john	john	analyst	Accounting, kie-server, PM
katy	katy	analyst	HR, kie-server
kie-server	kie-server1!		kie-server
krisv	krisv	process-admin, admin, analyst, user	kie-server
mary	mary	analyst	HR, kie-server
salaboy	salaboy	admin, analyst	Accounting, rest-all, HR, IT, kie-server
sales-rep	sales-rep	analyst	kie-server, sales
Add-on User Names	Password	Role (Workbench roles)	Group (Task roles)
sales-rep	sales-rep	analyst	iss-group-requester, kie-server, sales
iss-sam	iss-sam	analyst	iss-group-requester, kie-server
iss-barry	iss-barry	analyst, user	iss-group approver, kie-server
iss-mk	iss-mk	users, manager	iss-group-manager, kie-server
iss-hy	iss-hy	users, manager	iss-group-manager, kie-server
iss-cm	iss-cm	users, manager	iss-group-manager, kie-server
iss-admin	iss-admin	process-admin, admin, analyst, user	iss-group-manager, kie-server

Role controls user's access to KIE product suite (Workbench roles);

Group controls user's access to bespoke business system developed by KIE Workbench/product suit (Task roles);

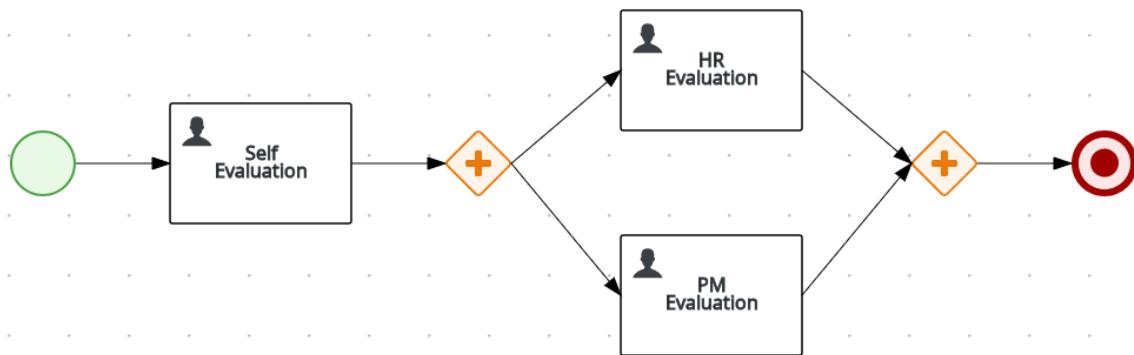
New user creation procedure:

- Step 1 Create all new users, and assign them relevant **Roles** (No new **Group** is ready).
- Step 2 Create new **Group**, and link created new users.

Reference <https://github.com/IRS-MR/S-MR-Workshop/blob/master/S-MR-Workshop1/KIE-Users.xlsx>

Workshop 1.2 [Individual]

KIE example system: Evaluation process



Evaluation process is a business process that is human centric (heavily uses human actors to perform work) that defines a complete flow of activities to perform employee evaluation. This examples shows:

- importing example project
- building and deploying project
- verifying deployment to execution server
- executing process instance and work with human tasks
- exploring reporting capabilities

Reference <https://www.youtube.com/watch?v=-fxL2ii0PRI>

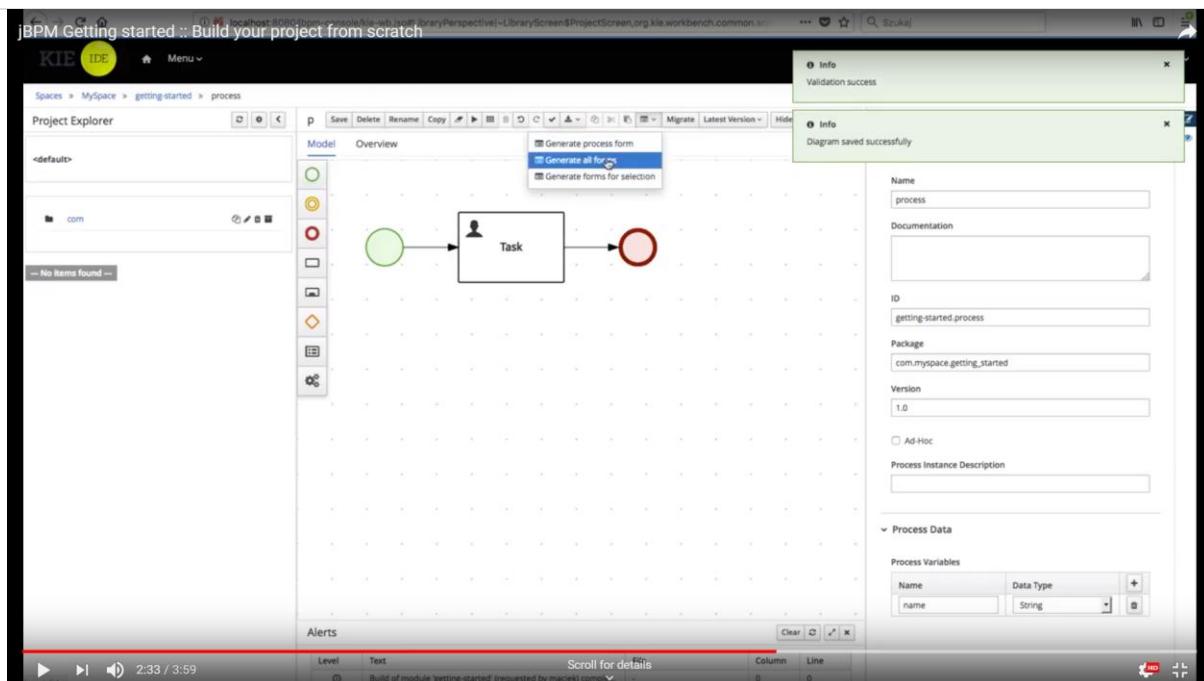
Workshop 1.3 [Individual]

KIE system development 1: Build your ‘*getting-started*’ project from scratch

Building new project from scratch can give you an option to have a clean start where you design your process or case to fit your needs. This example shows:

- creating new project
- creating new asset - business process
- build and deploy to execution server
- execute process instance

Reference https://www.youtube.com/watch?time_continue=3&v=pdgj0hrF5rc



KIE system development 2: Enhance above ‘*getting-started*’ project

Enhance above system by adding a *Staff* data object & an *UpdateStaffRole* machine reasoning business rule task to update staff role based on certain conditions:

- **When** staff role filed is empty, OR
- **When** staff name is e.g. ‘Sam’ AND staff number is e.g. ‘65674’
- **Then** update staff role to e.g. ‘Lecturer’

Reference <https://github.com/IRS-MR/S-MR-Workshop/tree/master/S-MR-Workshop1/project-io/getting-started.zip>

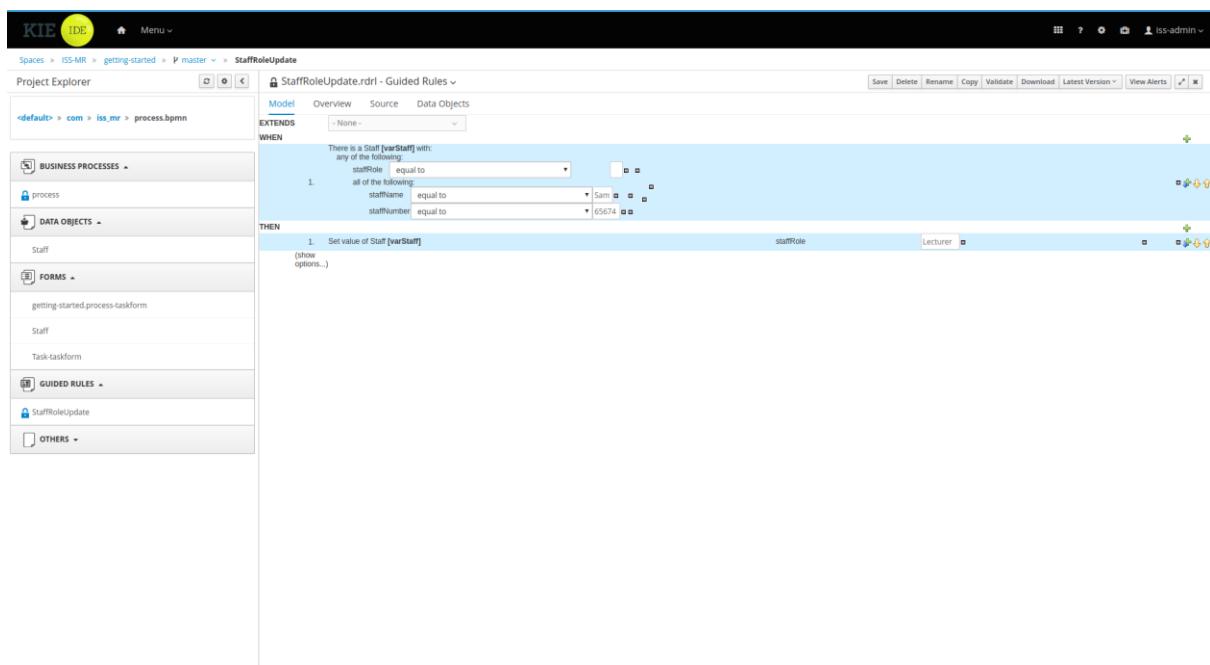
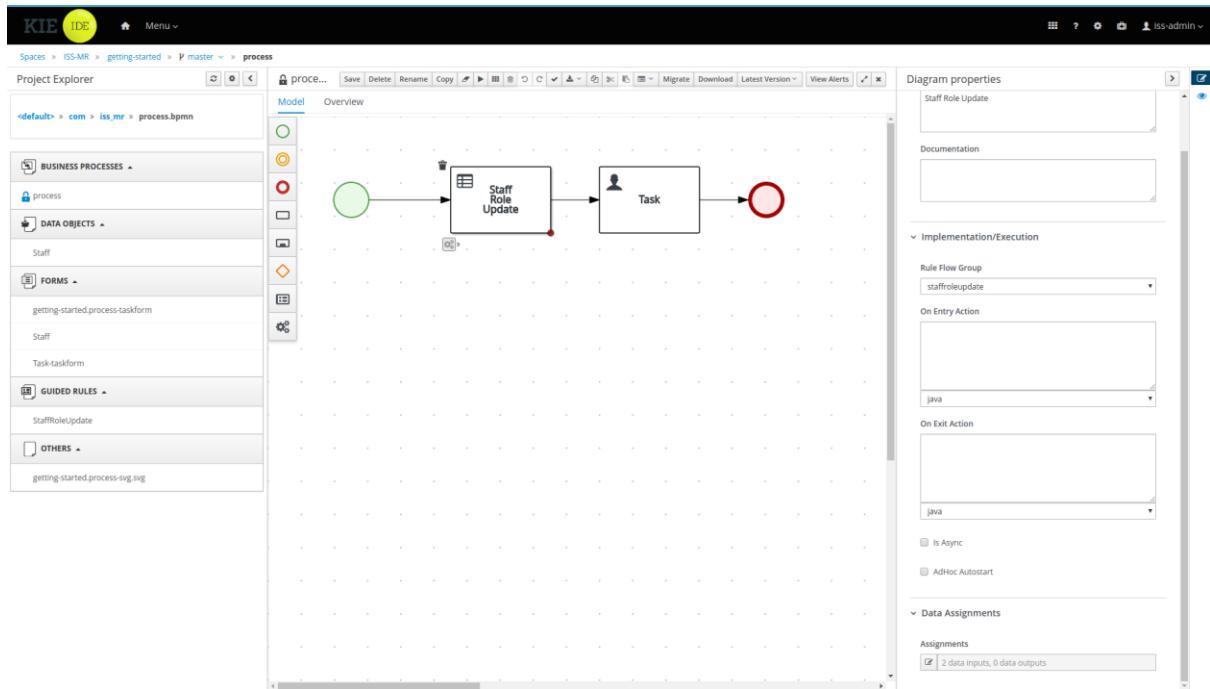
Evaluation_Process
Getting started Business P... 4

getting-started 7

Mortgages
Loan approval process aut... 19

getting-started

Asset	Type	Last modified	Created
getting-started.process-taskform	Forms	Last modified today	Created today
process	Business Processes	Last modified today	Created today
Staff	Forms	Last modified today	Created today
Staff	Data Objects	Last modified today	Created today
StaffRoleUpdate	Guided Rules	Last modified today	Created today
Task-taskform	Forms	Last modified today	Created today
WorkDefinitions	Work Item Definitions	Last modified today	Created today



KIE IDE □ Menu ▾

Spaces > ISS-MR > getting-started > master > StaffRoleUpdate

Project Explorer □ O C □ StaffRoleUpdate.rdrl - Guided Rules ▾

Model Overview Source Data Objects

```

1 package com.iss_mr.getting_started;
2 import java.lang.Number;
3 rule "Staff Role Update"
4 select "new"
5      staffRoleUpdate"
6      ruleFlow-group "staffRoleUpdate"
7      when
8          varStaff : Staff( staffName == "" || ( staffName == "Sam" && staffNumber == 65674 ) );
9      then
10         varStaff.setStaffRole("Lecturer");
11     end
12
13

```

Save Delete Rename Copy Validate Download Latest Version View Alerts □ X

Business Processes ▾

- Process

Data Objects ▾

- Staff

Forms ▾

- getting-started.process-taskform
- Staff
- Task-taskform

Guided Rules ▾

- StaffRoleUpdate

Others ▾

KIE IDE □ Menu ▾

Home > Task Inbox > Task: 13

13 - Task

Work Details Assignments Comments Admin Logs

Inputs:

Name

Outputs:

UpdatedName

Staff

Staff Number 65674

Staff Name Sam

Staff Role Lecturer

UpdatedStaff

Staff Number

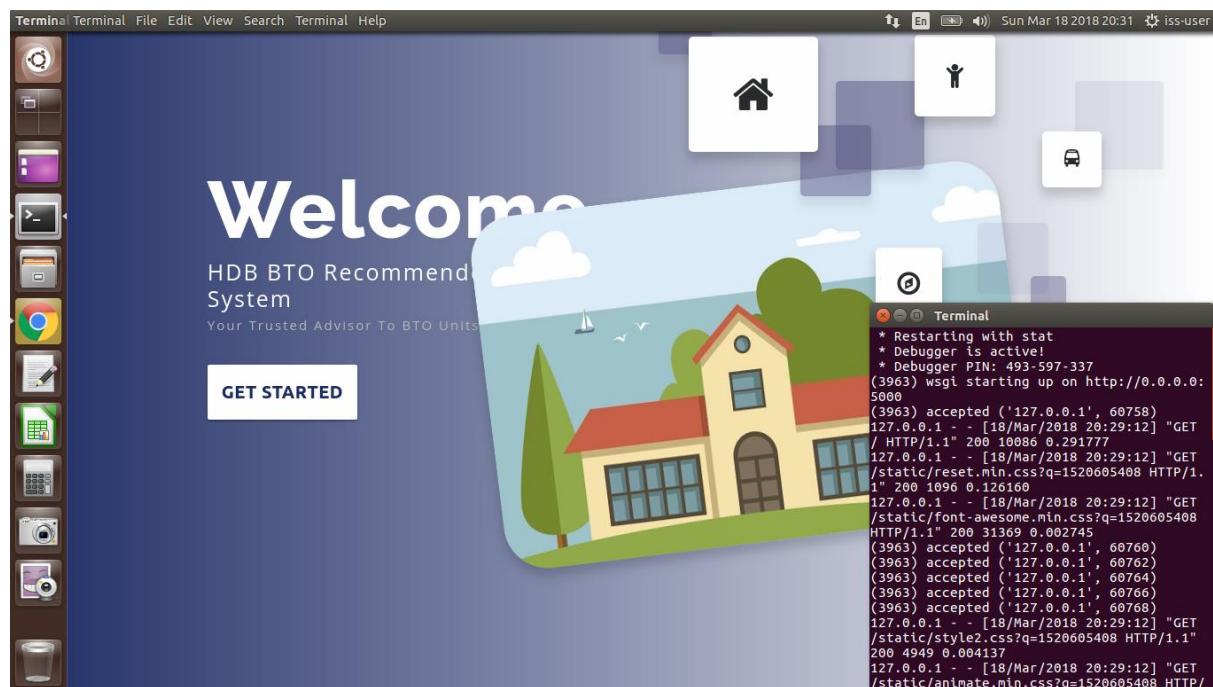
Staff Name

Staff Role

Workshop 1.4 [Individual]

Reasoning system analysis & exploration: Housing & Development Board Build-To-Order Recommender

Reference <https://github.com/IRS-MR/bto-recommender-system>



Workshop 2 Guide

WORKSHOP KNOWLEDGE MODELLING

- **KIE System Enhancement – Individual Work**

Enhance KIE home loan system using machine reasoning rule task

- Enhance: Data Model: Objects; Fields; Data Types
- Enhance: When-Then Guided Rules; Decision Table
- Enhance: Business Process, Task, Form
- Integrate, test, revise, deploy, and use

- **Knowledge Representation and Acquisition – Individual Work**

Construct knowledge models:

- Identify a business opportunity to use reasoning system
- Study online documented knowledge source as knowledge acquisition
- Compose knowledge models in spreadsheets

☺ Candidate Project: HDB BTO; Airport Gate Assignment System (AGAS); DoReMi

Workshop 2.1 [Individual]

KIE example system: Mortgage loan application process

Mortgage process is a business process that is a blended human actors and automated machine reasoning process that defines a complete flow of activities to perform home loan application and approval.

Reference <https://github.com/IRS-MR/S-MR-Workshop>

S-MR-Workshop2/project-io/example-Mortgage_Process.zip

Machine Reasoning Enhanced Mortgage loan application process

New Business Rule Task: MortgageMachineReasoning

Create a new new ' MortgageMachineReasoning' business rule task to replace 'Qualify' Human Task for automated mortgage loan in-limit checking.

Reference <https://github.com/IRS-MR/S-MR-Workshop>

S-MR-Workshop2/project-io/Mortgage_Process_ISS_MR.zip

Add new fields to Data Object Applicant: age, hasJob, ownHouse

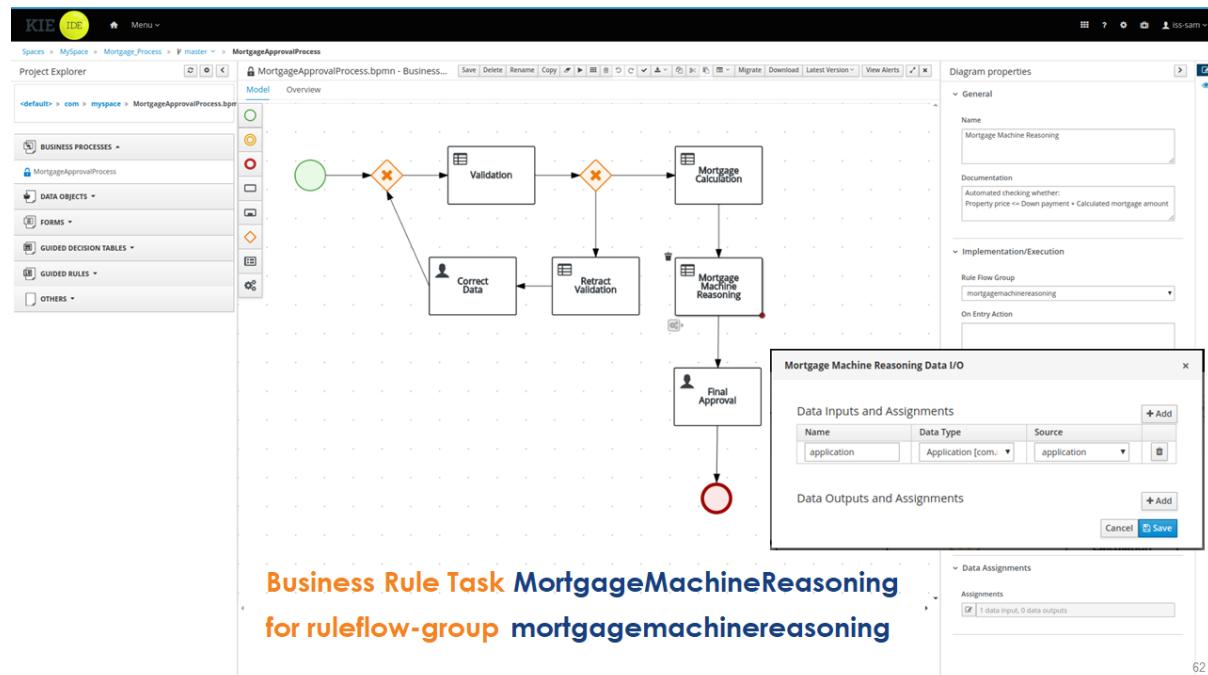
Add new Rules to MortgageDecisionTable, making the ruleset covering all possible loan application scenarios.

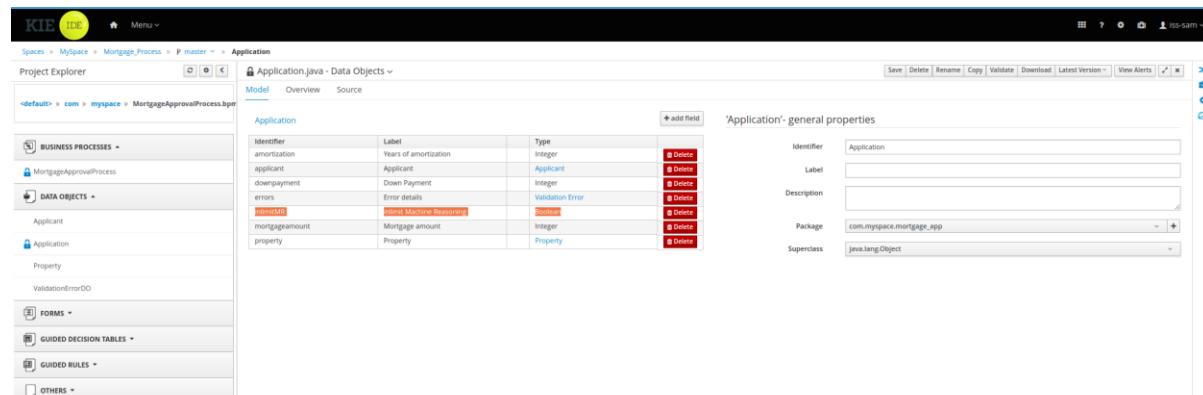
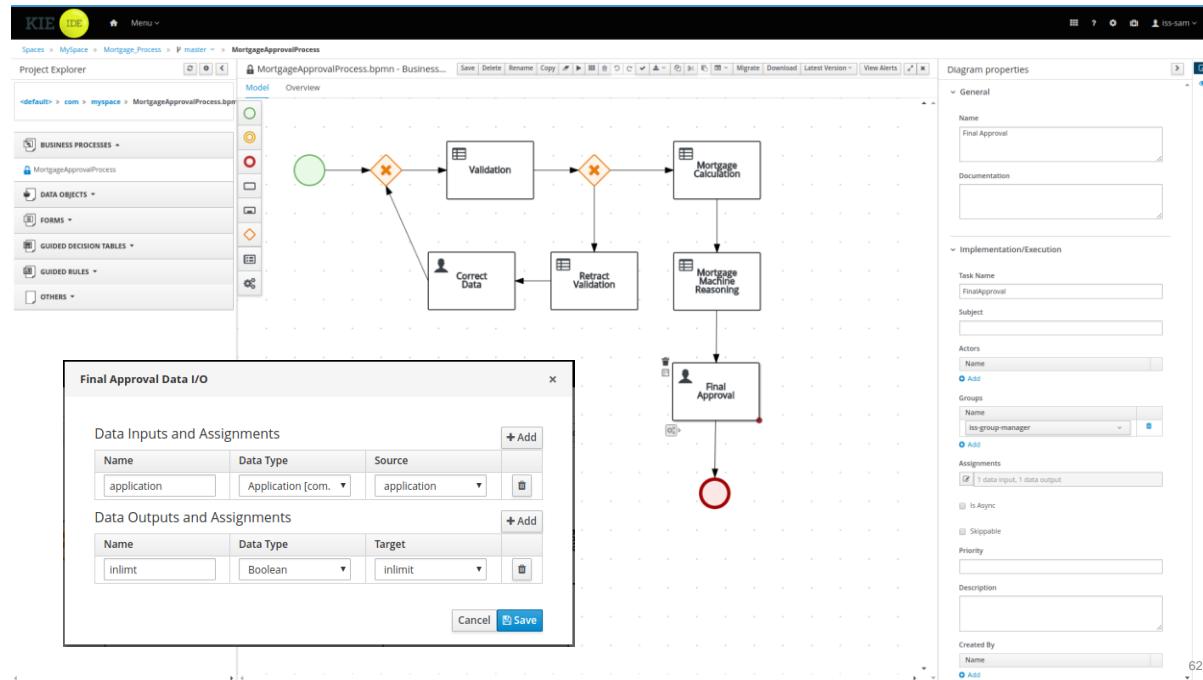
58

Add new fields to Form Applicant: age, hasJob, ownHouse, creditRating

59

Verify new fields in Form Application





Create “Machine Reasoning” inlimitMR flag in Data Object Application

63

Create "Machine Reasoning inlimitMR" flag in Form Application Mortgage

Create Guided Rule: MortgageMachineReasoning.rdl

To check whether:

mortgage amount >= property sale price - down payment

```

Model   Overview   Source   Data Objects
1 package com.myspace.mortgage_app;
2
3 import java.lang.Number;
4
5 rule "MortgageMachineReasoning"
6   dialect "nvel"
7   ruleflow-group "mortgagemachineReasoning"
8   when
9     app : Application( mortgageamount >= ( app.property.saleprice - app.downpayment ) )
10    then
11      app.setInlimitMR( true );
12  end
13

```

Create “Human Control inlimit” flag in Form FinalApproval-taskform

Spaces > MySpace > Mortgage_Process > P master > FinalApproval-taskform

Components > Model Fields > Form Controls

Model Overview

Form Modeler [FinalApproval-taskform]

Save | Delete | Rename | Copy | Download | Latest Version | View Alerts

Model Overview

Mortgage amount Inlimit Machine Reasoning

Down Payment Years of amortization

Down Payment Years of amortization

Applicant

Name

Age* Credit Rating* Has job (check)* Own House (check)*

Age in years Credit Rating (1, 2, 3)

Annual Income

SSN

Property

Age of property

Address of property

Locale

Sale Price

Inlimit - Check to approve this loan application

**• Build
• Deploy
• New process instance**

Home > Manage Process Instances

Filters

- State
 - Active
 - Aborted
 - Completed
 - Pending
 - Suspended
- Errors
 - With errors
 - Without errors

Filter By

Id

Filter By Process Instance Id...

Apply

Name

Start Date

Last update

Manage Process Instances

Active filters: Static: Active

Correlation key

Form

Application

Down Payment Years of amortization

Applicant

Name Sam GU Zhan

Age* Credit Rating* Has job (check)* Own House (check)*

Age in years Credit Rating (1, 2, 3)

Annual Income 123456

SSN

Property

Age of property 3

Address of property 25 Heng Mui Keng Terrace, Singapore 119015

Locale Urban

Sale Price 250000

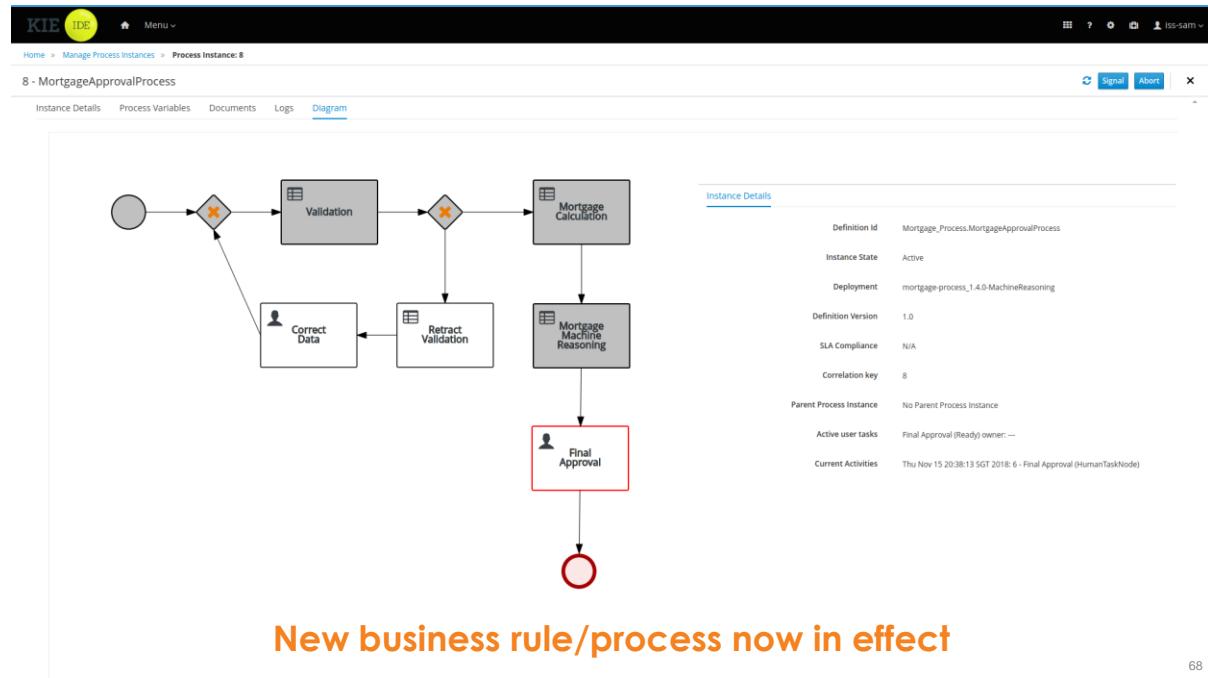
New Process Instance

Save Filters | Clear All

Bulk Actions

Actions

0 of 0



68

Task Inbox

Task	Process Definition Id	Status
Final Approval	Mortgage_Process.MortgageApprovalProcess	InProgress

11 - Final Approval

Address: 20 Ang Mo Keng Terrace, Singapore 119655

Salary: 250000

Locality: Urban

Age: 31

of: MinimMR

Management: 200000

Amortization: 200000

Errors:

Applicant:

Address: ADDRESS

CreditRating: 3

Health:

Name: Sam Gu Zhen

Overhouse:

Age: 21

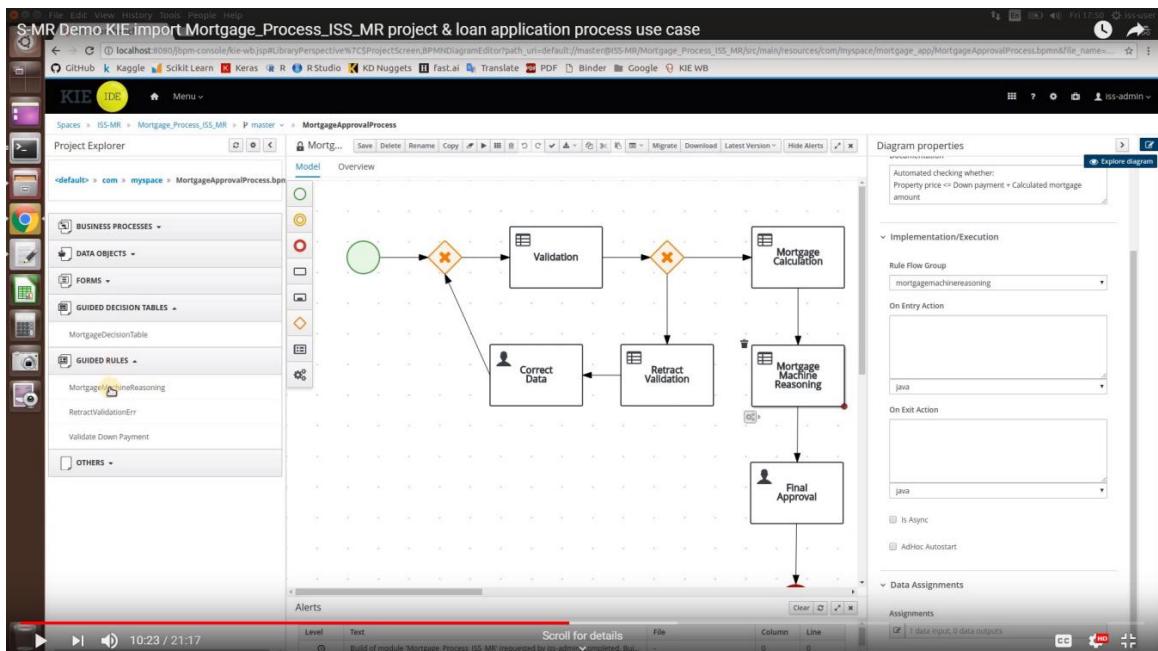
AnnualIncome: 100000

San: 0

Outputs:

Save | Release | Complete

69



Reference https://www.youtube.com/watch?v=s_8rct45b84

This screenshot shows a GitHub repository page for "S-MR-Workshop". The repository was forked from "telescopeuser/S-MR-Workshop". The main branch is "master". The commit history shows several commits, including one from "Gu Zhan" and another from "telescopeuser". The repository has 1 star and 1 fork. The GitHub interface includes standard navigation buttons like "Code", "Pull requests", "Projects", and "Insights".

Commit	Author	Date
Mortgage_Process_ISS_MR.zip	Gu Zhan	Latest commit 329503c 23 hours ago
Mortgage_Process_ISS_MR.zip	S-MR-Workshop3/Mortgage_Process_ISS_MR.zip	23 hours ago
Mortgage_Process_ISS_MR.zip	S-MR-Workshop2	a day ago
example-Mortgage_Process.zip	S-MR-Workshop2	a day ago

Reference <https://github.com/IRS-MR/S-MR-Workshop/tree/master/S-MR-Workshop2>

Workshop 2.2 [Individual]

Knowledge Modeling

Identify a business opportunity to use reasoning system

Study online documented knowledge source as knowledge acquisition

Compose knowledge models in spreadsheets

Candidate Project: HDB BTO; Airport Gate Assignment System (AGAS); DoReMi; and alike

Reference

Workshop 1.3 [Individual] <https://github.com/IRS-MR/bto-recommender-system>

ANNEX 1 WORKSHOP PROJECT CANDIDATE

Workshop 3 Guide

WORKSHOP KNOWLEDGE DISCOVERY EEP & MTech Stackable

- **Knowledge Discovery – Individual Work**

- Extract business rule from data using inductive reasoning, e.g. bank loan example
- Enhance KIE home loan system using the discovered knowledge
- Export enhanced KIE system and prepare for individual submission

- **KIE Development – Individual Work**

- Refer to individual's business question & knowledge models derived from Day 2 workshop: **Knowledge Representation and Acquisition – Individual Work**
- Create business use/test case scenarios; Design System
- Follow SDLC to start developing bespoke system using KIE tools

- **Project Submission Tutorial**

- Refer to [Project Submission Template](#)

☺ Candidate Project: HDB BTO; Airport Gate Assignment System (AGAS); DoReMi

WORKSHOP KNOWLEDGE DISCOVERY MTech Thru-Train

- **Knowledge Discovery – Individual Work**

- Extract business rule from data using inductive reasoning, e.g. bank loan example
- Enhance KIE home loan system using the discovered knowledge
- Export enhanced KIE system and prepare for individual submission

- **KIE Development – Group Work**

- Form a project team of 4-6 members, choose a team name, appoint a team leader.
- Discuss within team each individual's business question & knowledge models derived from Day 2 workshop: **Knowledge Representation and Acquisition – Individual Work**
- Select one business question/problem and extend the scope for group project
- If there is an domain expert team member, conduct an interview with him/her
- Extend knowledge models; Create business use/test case scenarios; Design system
- Follow SDLC to start developing bespoke system using KIE tools

- **Project Submission Tutorial**

- Refer to [Project Submission Template](#)

☺ Candidate Project: HDB BTO; Airport Gate Assignment System (AGAS); DoReMi

Workshop 3.1 [Individual]

Data-Mining Enhanced Mortgage loan application process

Data mining / Rule induction / Orange3 decision tree



Extract business rule from data using inductive reasoning, e.g. bank loan example

Enhance KIE home loan system using the discovered knowledge, based upon:

- Workshop 2.1 [Individual] Machine Reasoning Enhanced Mortgage loan application process

Export enhanced KIE system and prepare for individual submission

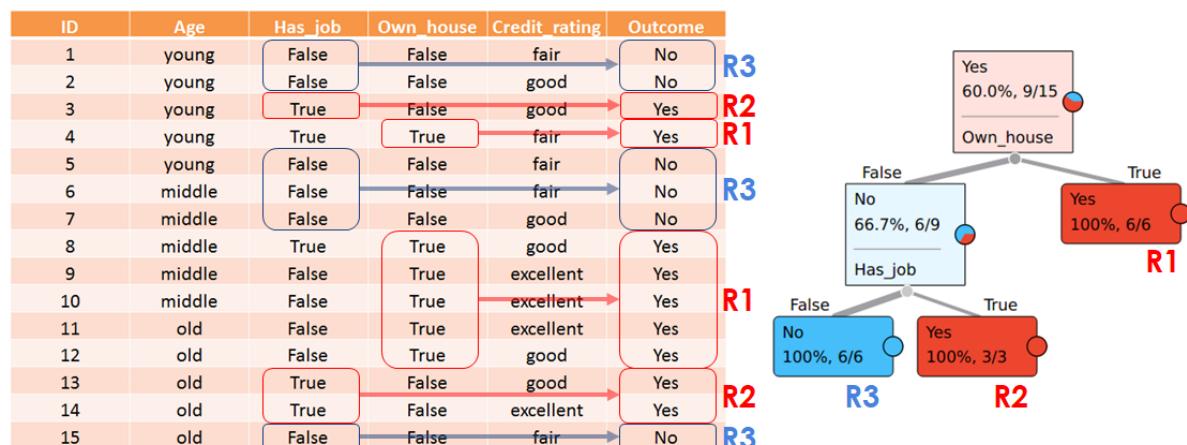
Reference

Guided Decision Tables <https://www.youtube.com/watch?v=qBgxVoc2qfw>

<https://github.com/IRS-MR/S-MR-Workshop/tree/master/S-MR-Workshop3>

ANNEX 2 PROJECT CODE EXPORT & IMPORT USING KIE WORKBENCH

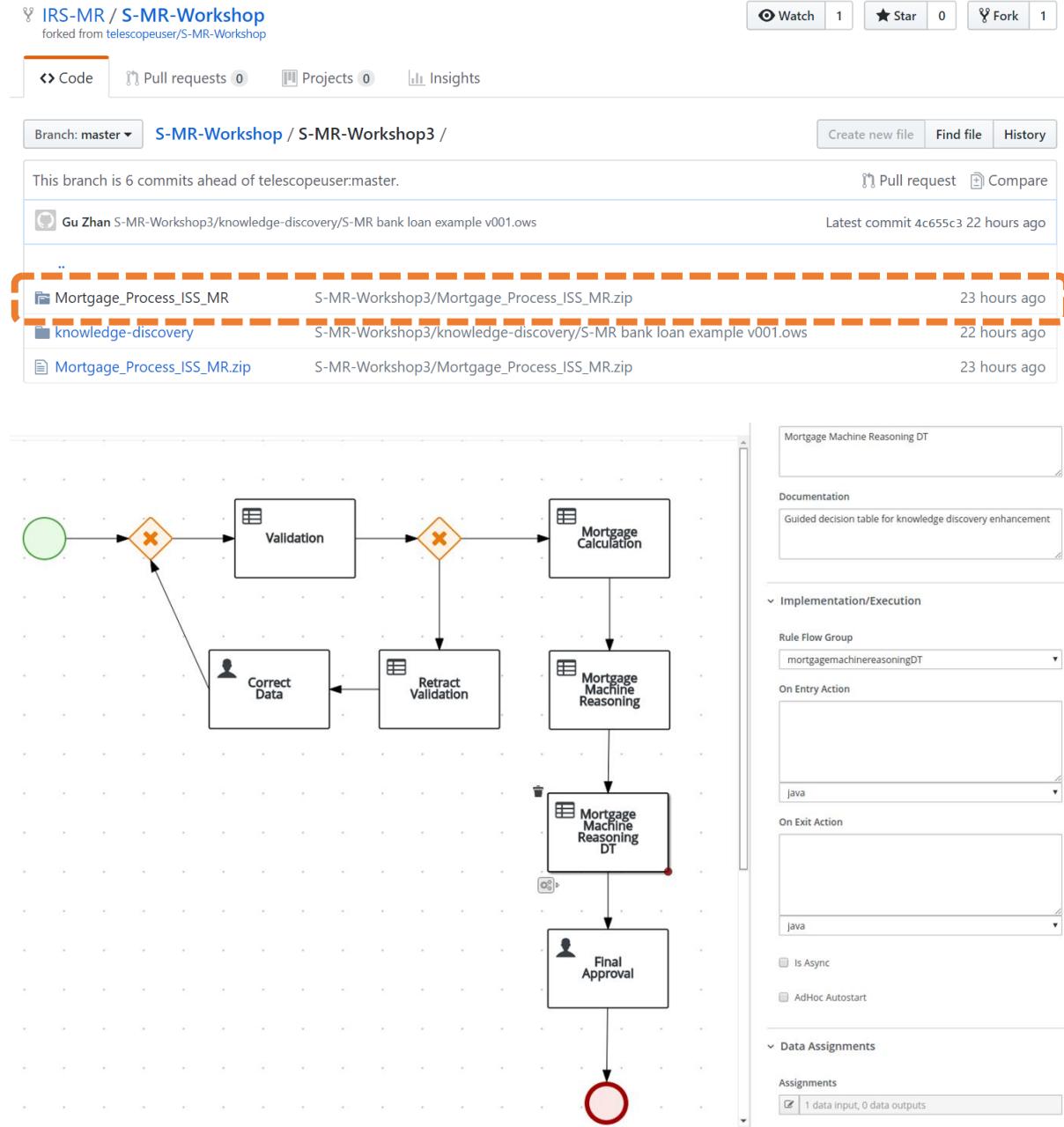
ANNEX 3 WORKSHOP PROJECT SUBMISSION



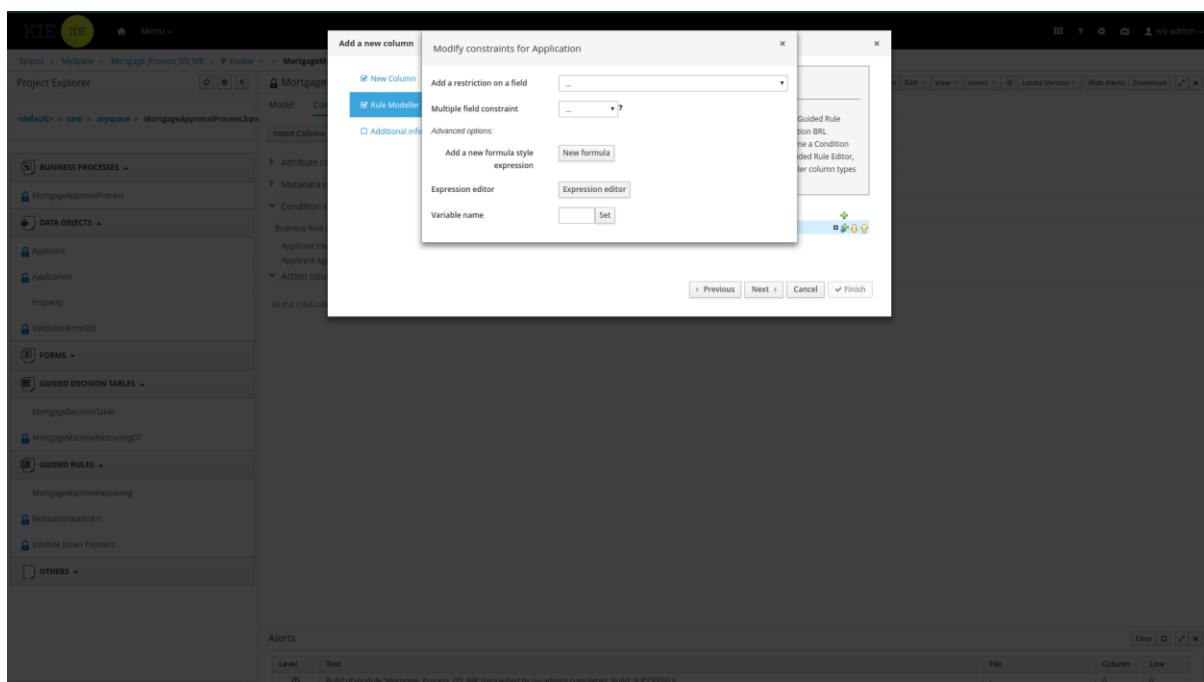
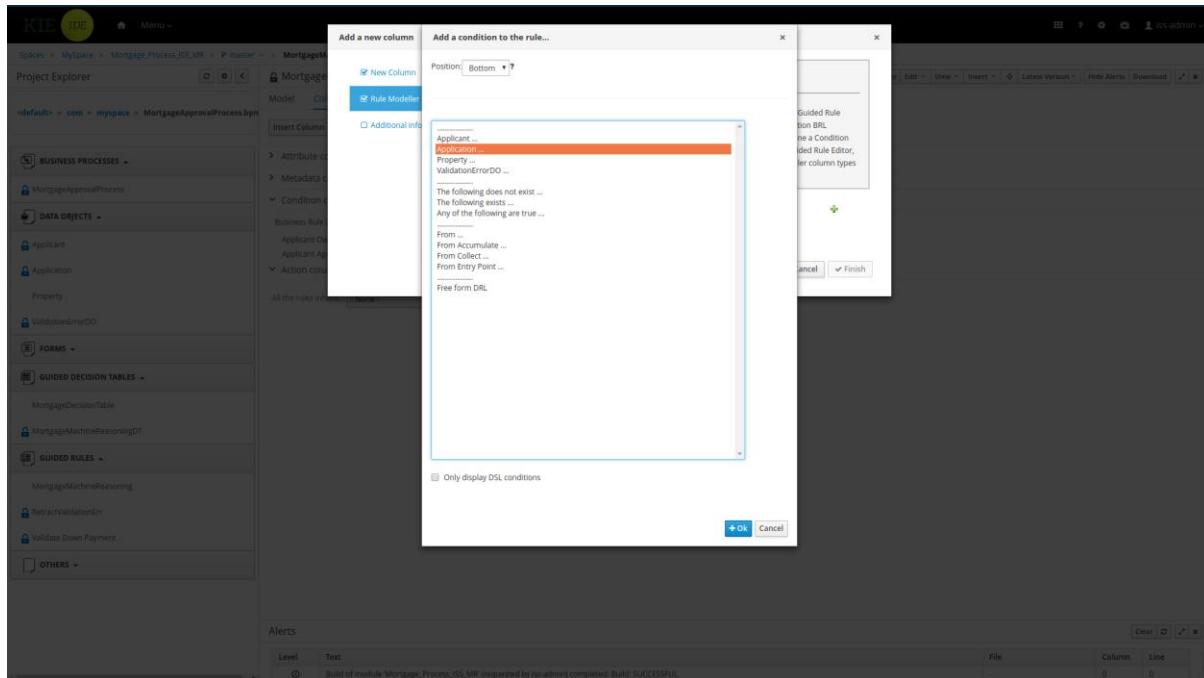
[Example solution] Data-Mining Enhanced Mortgage loan application process

https://github.com/IRS-MR/S-MR-Workshop/blob/master/S-MR-Workshop3/Mortgage_Process_ISS_MR.zip

- New Business Rule Task : Mortgage Machine Reasoning DT
- New Guided Decision Table : mortgagemachinereasoningDT

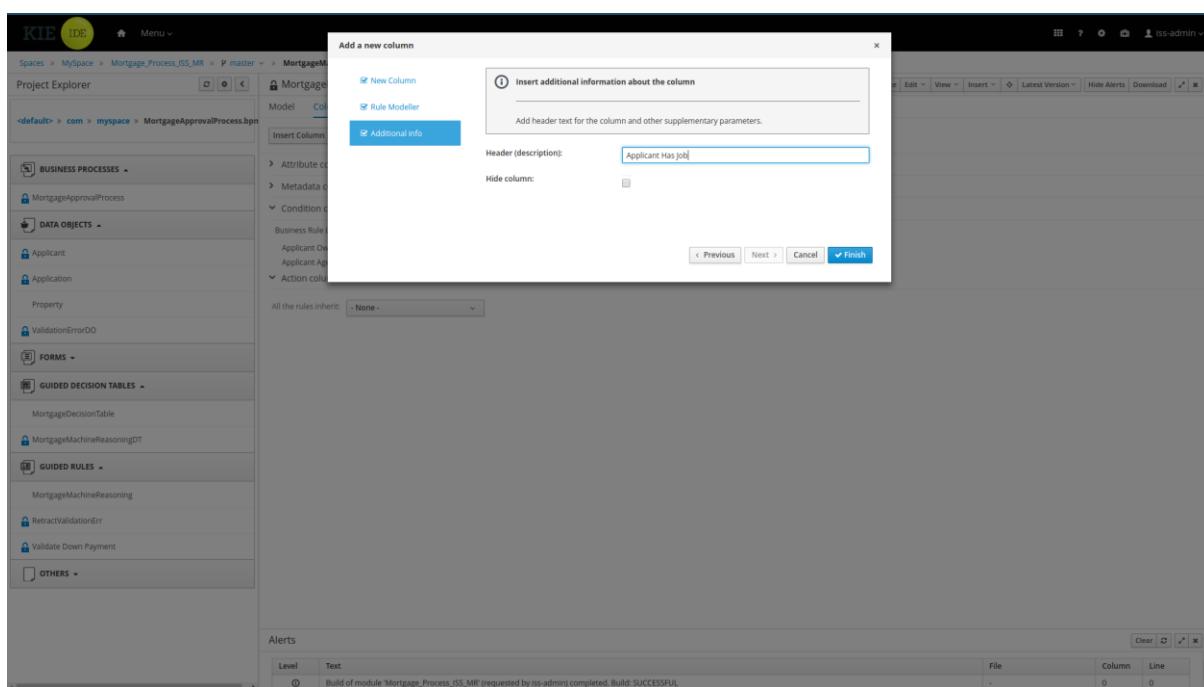
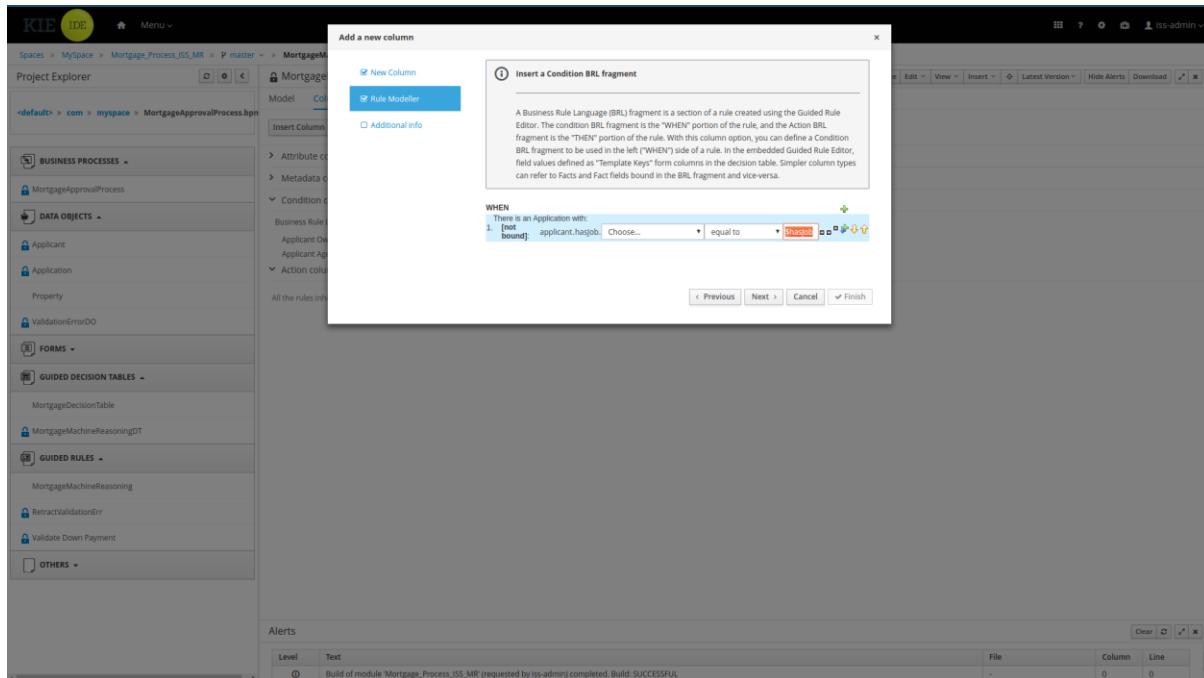


MortgageMachineReasoningDT		ruleflow-group	Applicant Own House		Applicant Age		Applicant Credit Rating/Applicant Has Job		application	
#	Description		\$ownHouse	\$ageLess	\$ageGE	\$creditRating	\$hasJob	Approval In Limit		
1		mortgagemachinereasoningDT	<input checked="" type="checkbox"/>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> <-- R1		
2		mortgagemachinereasoningDT	<input checked="" type="checkbox"/>				<input type="checkbox"/>	<input checked="" type="checkbox"/> <-- R1		
3		mortgagemachinereasoningDT	<input type="checkbox"/>				<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> <-- R2		
4		mortgagemachinereasoningDT	<input type="checkbox"/>				<input type="checkbox"/>	<input type="checkbox"/> <-- R3		



The screenshot shows the KIE IDE interface for a Mortgage Approval Process. The left sidebar lists various project components like Business Processes, Data Objects, and Guided Decision Tables. The main area displays a 'New Column' dialog for 'Rule Modeler'. This dialog is specifically for inserting a Condition BRL (Business Rule Language) fragment. The 'WHEN' section contains the condition: '[test bound] applicant.hasjob: Choose... equal to'. Below this, the 'Field value' section provides options to define the condition further using Literal value, Template key, A formula, or Expression editor. Navigation buttons at the bottom allow users to move through the steps of defining the rule fragment.

This screenshot shows the same 'Add a new column' dialog for 'Rule Modeler' as the previous one, but it is focused on the 'Field value' section. It includes options for Literal value, Template key, A formula, and Expression editor. An 'Advanced options' section is also present, containing 'Condition editor' and 'Expression editor' buttons. The overall layout is identical to the first screenshot, with the main focus being the configuration of the field value for the rule fragment.

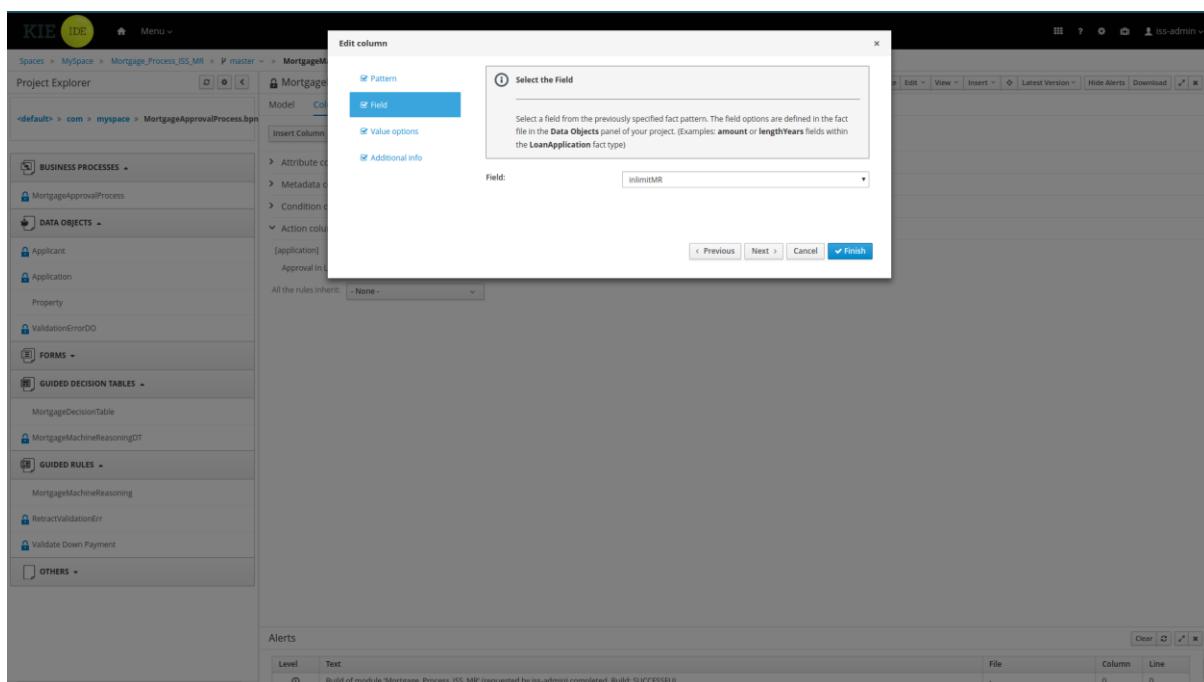
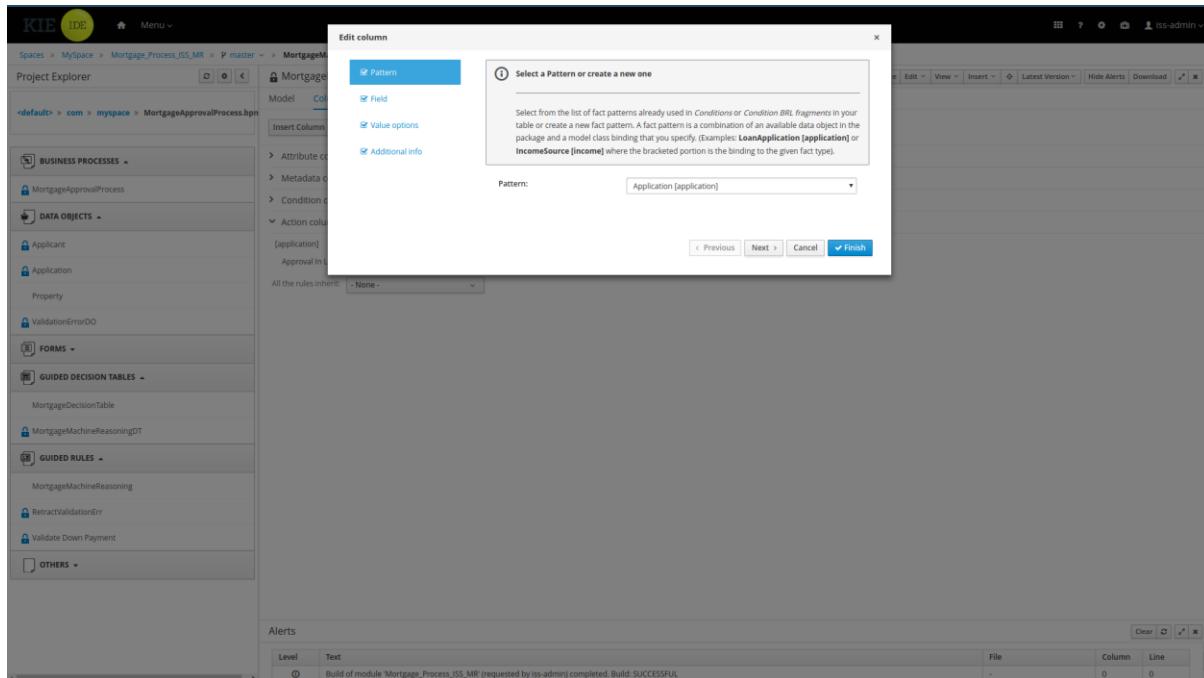


The screenshot shows the KIE IDE interface. A central dialog box is open, titled "Add a new column". Inside the dialog, under the "Rule Modeler" tab, there is a section for "Insert a Condition BRL fragment". The condition is defined as "WHEN [test bound] applicant.credrating Choose... equal to credRating". Below the condition, there are buttons for "Previous", "Next", "Cancel", and "Finish". The background of the IDE shows a "Project Explorer" pane with categories like "BUSINESS PROCESSES", "DATA OBJECTS", "GUIDED DECISION TABLES", and "GUIDED RULES". An "Alerts" pane at the bottom right shows a successful build message.

This screenshot is similar to the one above, showing the KIE IDE with the "Edit column" dialog open. The dialog is titled "Insert a Condition BRL fragment" and shows a condition "WHEN [test bound] applicant.ownHouse Choose... equal to \$ownHouse". The background Project Explorer shows categories such as "BUSINESS PROCESSES", "DATA OBJECTS", "GUIDED DECISION TABLES", and "GUIDED RULES". An "Alerts" pane at the bottom right displays an error message related to the knowledge base.

The screenshot shows the KIE IDE interface for a MortgageApprovalProcess.bprn project. A modal window titled 'Edit column' is open, specifically for a 'Condition columns' type. The 'Rule Modeler' tab is active. Inside the modal, there's a 'WHEN' section with a condition fragment: '[not bound] applicant.age. Choose... less than SageLess'. Below it is a 'THEN' section with a condition fragment: '[not bound] applicant.age. Choose... greater than or equal to SageGE'. At the bottom of the modal are 'Previous', 'Next', 'Cancel', and 'Finish' buttons.

The screenshot shows the KIE IDE interface for a MortgageMachineReasoningDT table. The 'Columns' tab is selected. Under the 'Condition columns' section, there is one entry: 'Approval In Limit'. To the right of this entry are 'Edit' and 'Delete' buttons. The 'Model' tab is also visible at the top of the table editor.



KIE IDE | Menu ▾

Spaces > MySpace > Mortgage_Process_ISS_MR > P master > MortgageMachineReasoningDT

Project Explorer Save Delete Rename Copy Validate Edit ▾ View ▾ Insert ▾ Latest Version ▾ Hide Alerts Download

MortgageMachineReasoningDT.gdst - Guided Decision Tables ▾

Model Columns Overview Source Data Objects

MortgageMachineReasoningDT

#	Description	ruleflow-group	Applicant Own House	Applicant Age	Applicant Has Job	Applicant Credit Rating	application
			\$ownHouse	\$ageLess	\$ageGE	\$creditRating	\$hasJob
1	mortgagemachineReasoningDT		<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>
2	mortgagemachineReasoningDT		<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input checked="" type="checkbox"/>
3	mortgagemachineReasoningDT		<input type="checkbox"/>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
4	mortgagemachineReasoningDT		<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>

Alerts

Level	Text	File	Column	Line
Info	Build of module 'Mortgage_Process_ISS_MR' (requested by iss-admin) completed. Build: SUCCESSFUL	-	0	0

KIE IDE | Menu ▾

Spaces > MySpace > Mortgage_Process_ISS_MR > P master > MortgageMachineReasoningDT

Project Explorer Save Delete Rename Copy Validate Edit ▾ View ▾ Insert ▾ Latest Version ▾ Hide Alerts Download

MortgageMachineReasoningDT.gdst - Guided Decision Tables ▾

Model Columns Overview Source Data Objects

MortgageMachineReasoningDT

#	Description	ruleflow-group	Applicant Own House	Applicant Age	Applicant Credit Rating	Applicant Has Job	application
			\$ownHouse	\$ageLess	\$ageGE	\$creditRating	\$hasJob
1	mortgagemachineReasoningDT		<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2	mortgagemachineReasoningDT		<input checked="" type="checkbox"/>			<input type="checkbox"/>	<input checked="" type="checkbox"/>
3	mortgagemachineReasoningDT		<input type="checkbox"/>			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
4	mortgagemachineReasoningDT		<input type="checkbox"/>			<input type="checkbox"/>	<input type="checkbox"/>

Alerts

Level	Text	File	Column	Line
Info	Build of module 'Mortgage_Process_ISS_MR' (requested by iss-admin) completed. Build: SUCCESSFUL	-	0	0

KIE IDE

Spaces > MySpace > Mortgage_Process_ISS_MR > master >

MortgageMachineReasoningDT

Project Explorer

Model Columns Overview Source Data Objects

```

1 package com.myspace.mortgage_app;
2
3 //from row number: 1
4 rule "Row 1 MortgageMachineReasoningDT"
5 ruleflow-group "mortgagemachineReasoningDT"
6 dialect "mvel"
7 when
8     application : Application( applicant.ownHouse == true )
9     Application( applicant.hasJob == true )
10    then
11        application.setInlimitMR( true );
12    end
13
14 //from row number: 2
15 rule "Row 2 MortgageMachineReasoningDT"
16 ruleflow-group "mortgagemachineReasoningDT"
17 dialect "mvel"
18 when
19     application : Application( applicant.ownHouse == true )
20     Application( applicant.hasJob == false )
21    then
22        application.setInlimitMR( true );
23    end
24
25 //from row number: 3
26 rule "Row 3 MortgageMachineReasoningDT"
27 ruleflow-group "mortgagemachineReasoningDT"
28 dialect "mvel"
29 when
30     application : Application( applicant.ownHouse == false )
31     Application( applicant.hasJob == true )
32    then
33        application.setInlimitMR( true );
34    end
35
36 //from row number: 4
37 rule "Row 4 MortgageMachineReasoningDT"
38 ruleflow-group "mortgagemachineReasoningDT"
39 dialect "mvel"
40 when
41     application : Application( applicant.ownHouse == false )
42     Application( applicant.hasJob == false )
43    then
44        application.setInlimitMR( false );
45    end
46

```

BUSINESS PROCESSES ▾

- MortgageApprovalProcess**

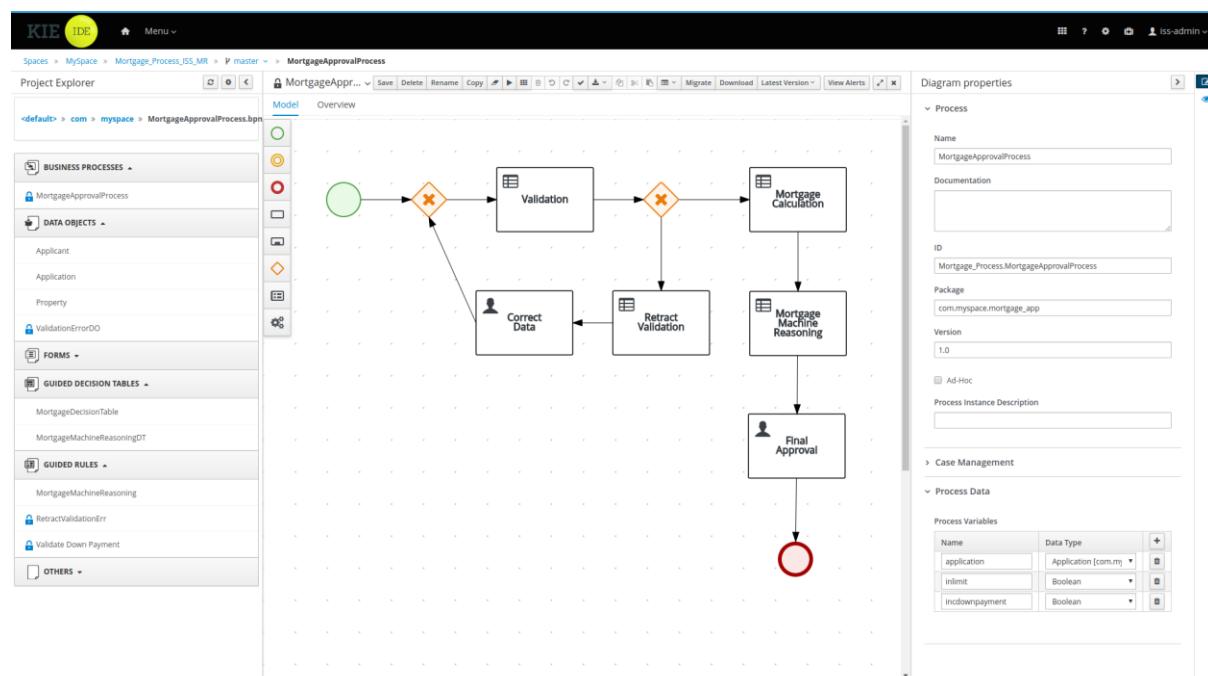
DATA OBJECTS ▾

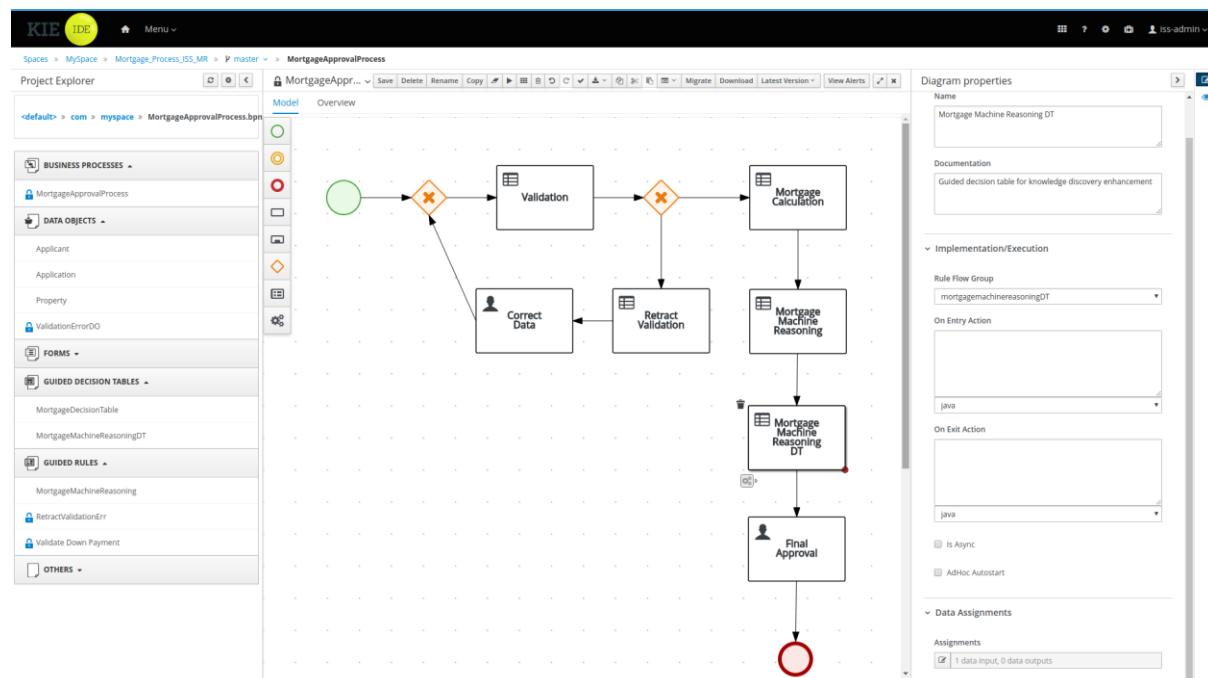
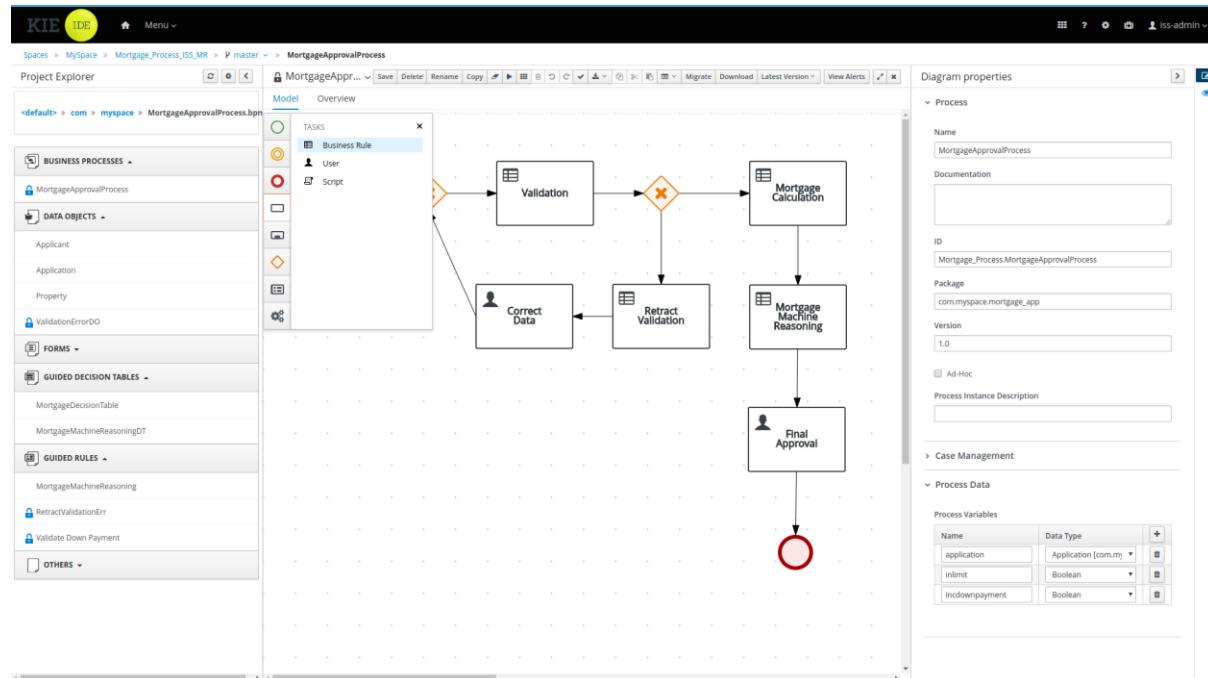
- Applicant**
- Application**
- Property**
- ValidationErrorDO**

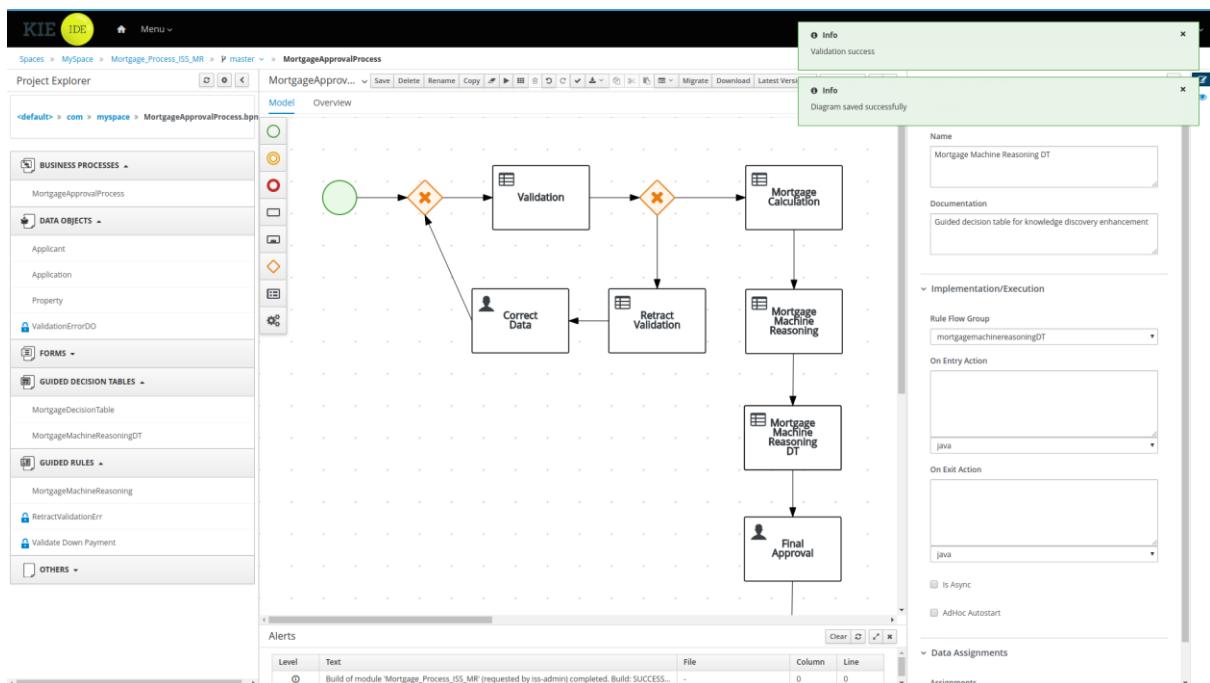
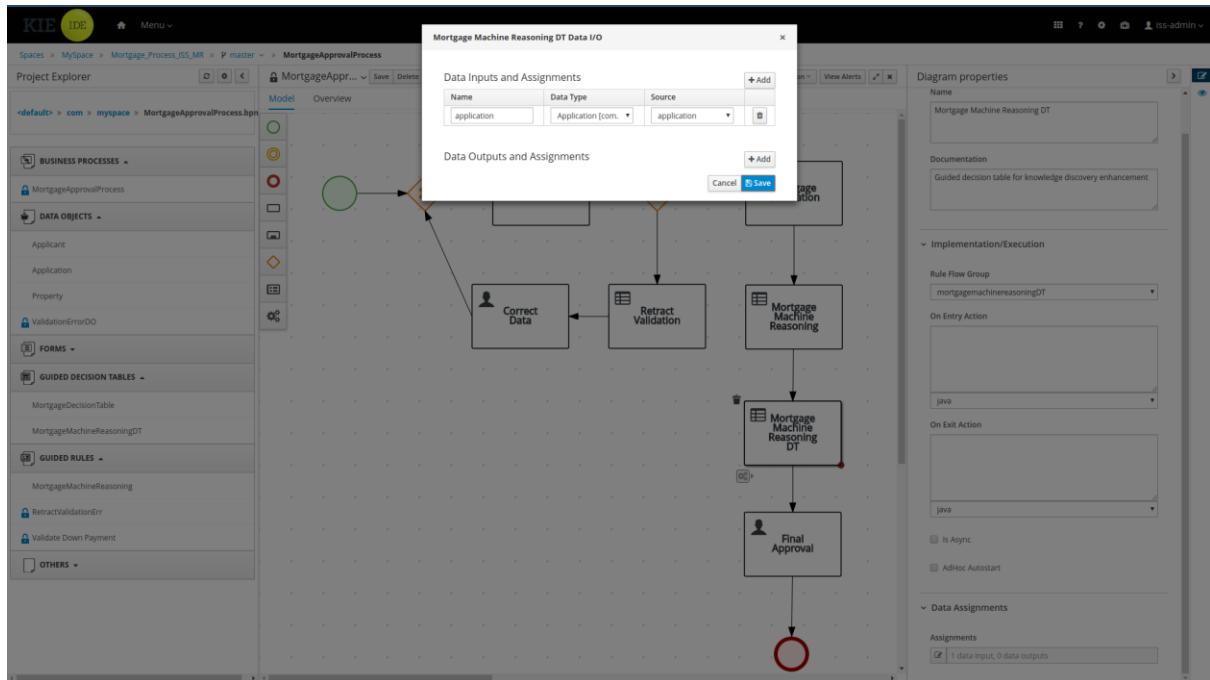
FORMS ▾

GUIDED DECISION TABLES ▾

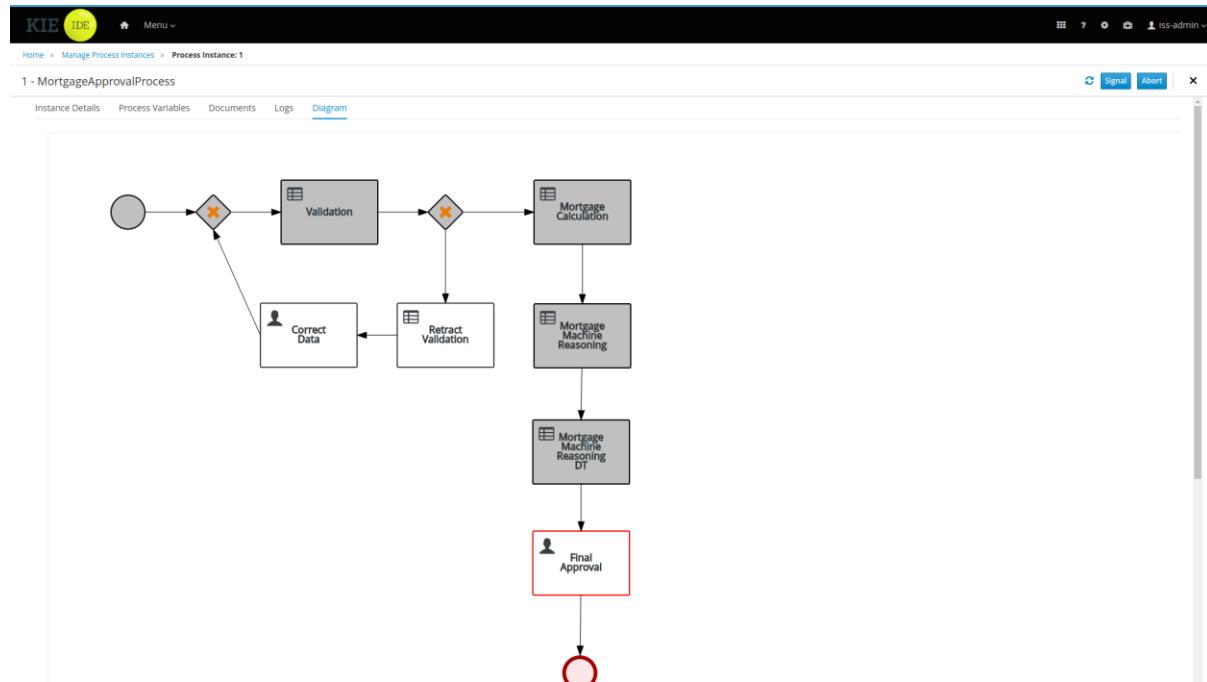
- MortgageDecisionTable**
- MortgageMachineReasoningDT**







Build & Deploy



Use/Test Case 1

1st stage Approved: \$200,000 Mortgage Amount: within limit *mortgage amount 200,000 >= property sale price 250,000 – down payment 50,000*

2nd stage Approved: InLimitMR checked: applicant has job

The screenshot shows the KIE IDE interface with the 'Start process instance' dialog open. The dialog is titled 'Start process instance' and contains sections for 'Correlation key' and 'Form'. The 'Form' section is divided into 'Application' and 'Property' sections. In the 'Application' section, fields include 'Down Payment' (5000), 'Years of amortization' (20), 'Name' (Sam GU Zhan), 'Age*' (18), 'Credit Rating*' (3), 'Has job (check)*' (checked), and 'Own House (check)*' (checked). In the 'Property' section, fields include 'Age of property' (3), 'Address of property' (25 Heng Mui Keng Terrace, Singapore 119615), 'Locale' (Urban), and 'Sale Price' (250000). A 'Submit' button is at the bottom right of the dialog.

The screenshot shows the KIE IDE interface with a task titled '1 - Final Approval' in the 'Task Inbox'. The task details an application for a mortgage. It includes fields for 'Address' (25 Heng Mui Keng Terrace, Singapore 119615), 'Saleprice' (250000), 'Locale' (Urban), 'Age' (3), 'InlimitMR' (checked), 'Mortgageamount' (200000), 'Amortization' (20), and 'Errors' (Error: Downpayment: 50000). The task also lists 'Downpayment' (50000) under the errors section.

Use/Test Case 2

1st stage Approved: \$200,000 Mortgage Amount: within limit **mortgage amount 200,000 >= property sale price 250,000 – down payment 50,000**

2nd stage Approved: InLimitMR checked: jobless applicant owning a house

Use/Test Case 3

1st stage Approved: \$200,000 Mortgage Amount: within limit **mortgage amount 200,000 >= property sale price 250,000 – down payment 50,000**

2nd stage Disapproved: InLimitMR unchecked: jobless applicant not owning a house

The screenshot shows the KIE IDE interface with the 'Start process instance' dialog open. The dialog is divided into sections: Application, Applicant, and Property. The Application section has fields for Down Payment (5000) and Years of amortization (20). The Applicant section includes Name (Sam GU Zhan), Age (18), Credit Rating (3), and checkboxes for Has job (unchecked) and Own House (unchecked). The Property section contains fields for Annual Income (123456), SSN, and Address (25 Heng Mui Keng Terrace, Singapore 119615). A 'Submit' button is at the bottom right.

The screenshot shows the KIE IDE interface with the 'Task Inbox' for task 3 - Final Approval. The task form is divided into sections: Application, Errors, and Applicant. The Application section contains fields for Address (25 Heng Mui Keng Terrace, Singapore 119615), Saleprice (250000), Locale (Urban), and Age (3). The Errors section lists an error for Downpayment (50000). The Applicant section includes fields for Address and Creditrating (3).

Workshop 3.2 [EEP Individual / MTech Group]

Identify a relevant business scenario/problem. Propose and create a knowledge-driven machine reasoning system.

The proposed grand workshop project must develop, integrate, and demonstrate at least two out of following three technique groups:

1. Business knowledge/rule based reasoning techniques
2. Business knowledge/process based reasoning techniques
3. Knowledge Discovery **OR** Data Mining techniques

The submitted runnable system should have a graphical user interface for end user to input or update data to execute different business use cases, e.g. Web or KIE form based user interface. And to display system output results in a user friendly manner. (Output console log is not considered user friendly.)

Grand project phase 1: Initialization

Form team (MTech Thru-Train: 4 to 6 persons per project team)

Solicit business scenario / MVP

Design knowledge models

[Workshop 4] System Development / SDLC

[Workshop 4] MVP delivery & Documentation

Reference

ANNEX 1 WORKSHOP PROJECT CANDIDATE

Workshop 2.2 [Individual] Knowledge Modeling

Workshop 4 Guide

WORKSHOP CREATING REASONING SYSTEM

EEP & MTech Stackable

- **KIE Test & Deployment – Individual Work**

Integrate, test, and deploy bespoke reasoning system components using KIE tools:

- Continue from Day 3 workshop: **KIE Development – Individual Work**
- Integrate, test, and deploy bespoke reasoning system components using KIE tools

- **KIE Minimum Viable Product (MVP) – Individual Work**

Deliver bespoke reasoning system as MVP:

- Prepare project report, e.g. Knowledge models; Use/Test cases
- Export developed system
- Submit project deliverables. Refer to [Project Submission Template](#)

😊 Candidate Project: HDB BTO; Airport Gate Assignment System (AGAS); DoReMi

WORKSHOP CREATING REASONING SYSTEM

MTech Thru-Train

- **KIE Test & Deployment – Group Work**

Integrate, test, and deploy bespoke reasoning system components using KIE tools:

- Continue from Day 3 workshop: **KIE Development – Group Work**
- Integrate, test, and deploy bespoke reasoning system components using KIE tools

- **KIE Minimum Viable Product (MVP) – Group Work**

Deliver bespoke reasoning system as MVP:

- Prepare project report and user guide
- Prepare system demo for video presentation
- Submit project deliverables. Refer to [Project Submission Template](#)

😊 Candidate Project: HDB BTO; Airport Gate Assignment System (AGAS); DoReMi

Workshop 4.1 [EEP Individual / MTech Group]

Grand project phase 2: Development

[Workshop 3] Form team (MTech Thru-Train: 4 to 6 persons per project team)

[Workshop 3] Solicit business scenario / MVP

Design knowledge models

System Development / SDLC

MVP delivery & Documentation

Reference Workshop 3.2 Grand project phase 1: Initialization

Grand project phase 3: MVP Delivery

EEP & MTech Stackable: Submission due by 23:59 on last lecture date

MTech Thru-Train: Submission due by 23:59 on last lecture day + **14**

Reference

ANNEX 2 PROJECT CODE EXPORT & IMPORT USING KIE WORKBENCH

ANNEX 3 WORKSHOP PROJECT SUBMISSION

ANNEX 1 WORKSHOP PROJECT CANDIDATE

Workshop Project Candidate One

Airport Gate Assignment System (AGAS)

Faced with intense competition from major airports in the region, **The Best Airport (TBA)** needs to enhance the quality and efficiency of its airport services so that planes can have a faster turn-around. This improved throughput will definitely make its customers (the airlines) happy and to be firmly rooted to TBA. With some 5,000 flight arrivals each week, the assignment of aerobridges (or simply “gates”) is becoming increasingly complex and time consuming. Efficiency in gates assignment is crucial for TBA to remain as the airport of choice for all major airlines. You are a TBASU (TBA Strategic Unit) project specialist who is tasked to work on this important assignment.

The following is a transcript from your interview with Mr. Lim, the domain expert in gates scheduling:

You: Mr. Lim, what is the first step in the assignment of a gate to an incoming flight?

Mr. Lim: Well, flight information sends me a schedule of all incoming and outgoing flights for a particular day, at least 24 hours in advance for me to assign gates and service units to all flights. My first step is to prioritize all the flights, according to type - international or domestic, number of passengers and refueling needs. The number of passengers and refueling needs will determine how much time is needed, and thus how long the gate will be occupied. Another constraint is the amount of time before the plane has to depart. The top priority flight will be taken care of first. My job is to match a gate to an incoming flight for disembarkation of passengers and providing services for the aircraft.

You: Is there a systematic procedure that you use for gate assignment?

Mr. Lim: I'm not sure what you mean by systematic, but what I do is, I determine the services required by an aircraft, and assign a service unit (SU) which is able to provide those services, to a gate. Obviously, both the SU and the gate must be free or available. I get this information from the Gates Operation System which is updated in real-time. But this assignment is not as simple as it sounds. Each gate has a max passenger handling capacity, so we need to know the number of passengers coming in. A gate is also reserved for either domestic or international flights. A gate is also limited by its capability of supporting the required services.

You: Could you clarify this further with an example?

Mr. Lim: OK, suppose that an aircraft needs catering and cleaning. Then we must look for a gate that is capable of supporting those 2 services. However, we also try to minimize wastage, in the sense that we do not want to assign a gate which is

capable of supporting all 3 services, when only 2 are needed. We should try to save that gate for the time when all 3 services are needed.

You: Let me recap: An SU can provide one or more services, like cleaning, catering and refueling depending on the needs of the aircraft. And the gate must be able to support the chosen SU.

Mr. Lim: Correct.

You: So you are assigning SUs to a gate, and a gate to an aircraft?

Mr. Lim: You got it!

You: Do all aircraft need the same services?

Mr. Lim: No. But if a particular service is needed, then it is mandatory that a gate providing that service is assigned to the aircraft.

You: Can you give me an example?

Mr. Lim: Certainly. Suppose that cleaning, refueling and catering are needed. The ideal situation would be to assign SU-101, for example, which provides all 3 services. But suppose SU-101 is not available, then we need to look for free SU, say SU-104 which provides catering and cleaning, and SU-105 which provides refueling and cleaning. SU-104 would be assigned to provide the catering and cleaning, but refueling can come from SU-105. In this case there is a redundancy, which cannot be avoided. An SU can only be assigned to one flight and hence one gate only at any one time.

You: How do you find out what services are required by an incoming flight?

Mr. Lim: Cleaning is always needed. Refueling is determined by the remaining fuel level, and catering of meals depends on the duration of the next outgoing flight.

You: And how do you compute how much fuel the aircraft needs for the flight out?

Mr. Lim: We have a set of tables (pointing to the laminated papers) to refer to. We also use the tables to determine catering needs as well as to do the prioritization of flights that I mentioned earlier.

You: I think I've taken too much of your time. Can I come back to you tomorrow to verify my understanding of what we discussed today? Thank you, Mr. Lim.

[End of Interview]

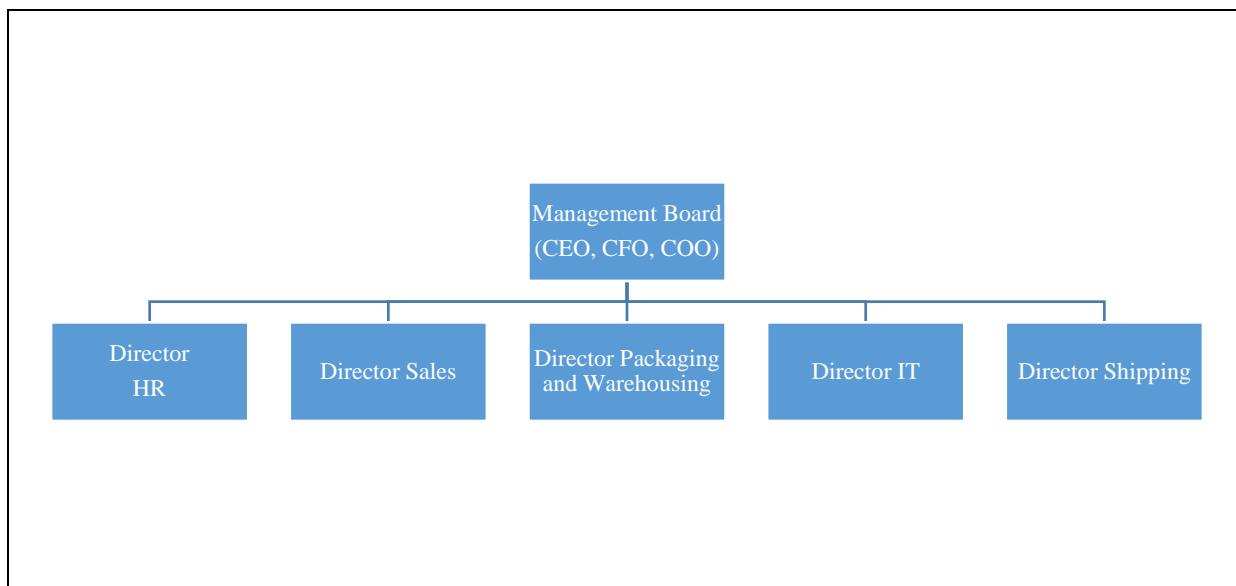
Workshop Project Candidate Two

DoReMi Books Inc.

1. Background

DoReMi Books is a company that specializes in the supply and sale of classical music scores and music books in the USA with subsidiaries in the major cities of each of the 50 states. An important line of business for the company is the supply of music books to music schools. These schools buy books in bulk for their students and are given special bulk-package discounts. Sales to music schools constitute 30% of the annual revenue of **DoReMi**.

The organization structure of the company is shown below.



2. Business Process & Improvement

As the company started in 1955 (and is now 57 years old), some of its business processes are manual and rather traditional. The company is now facing strong competition from its competitors (both new and old), who have embraced online and internet sales as the new way of interacting and transacting with their customers.

In response to the new challenges brought on by online sales transactions, the Chief Executive Officer (CEO), Peter Lee, asked a consultant to conduct a business process improvement exercise to revamp their music books sale transaction and order handling process as well as introduce improved stock and inventory planning and management capabilities. One of the key outcomes of this exercise was a new order handling process and the introduction of an internet sales transaction system, including an advanced business intelligence module for optimal stock inventory and warehousing forecasting.

After a period of process analysis and redesign, a new streamline process for online purchase from individual customers were defined. For bulk purchase, an automated workflow with automated inventory checks and approval was also established that can simplify the sales orders from music schools ordering in bulk. The process for handling orders from this client segment is simpler to implement as they have standard needs and also credit facilities already well established with **DoReMi**. The company is now ready to implement the new process and system.

3. Planning Implementation and Rollout

In considering the plans for the implementation and rollout of the new process and system, the CEO asked all his department heads (Directors) to gather some informal feedback on this major business process change initiative. The following feedback was shared in the weekly management board meeting:

HR Director:	I am sensing some discomfort among the staff. The union has also mentioned about some talk of a rumour going around that the company is going on a down-sizing exercise and people will be made redundant once the new process and system is operationalised. This revamp thing that we are planning needs to be handled with care. I am hearing of head-hunters enquiring about our top-performing sales people.
Director Sales:	I am not aware about the rumour. But in my informal checks with my team leaders, some are asking why are we doing this? We are in the music books industry, and as you know, this is a rather niche area, with our product being mainly in the classical genre and highly specialized stuff. Why should we be bothered with this online talk? Our customers are likely to be in the adult age-group and would not be keen in online transactions anyway.
Director Packaging and Warehousing:	A high proportion of our workers in my department are of the older generations and they are also some of our most loyal and experienced workers. As you know, we do need some classical music background knowledge in our business. The new IT-enable process and business intelligent system may pose a technology challenge to my people. There is worry that the high-tech stuff will actually slow them down.
Director IT:	We have a lean team in our IT department and it is a constant struggle to keep up with the demands and expectations of the business units across the various geographically dispersed subsidiaries. Any introduction of new large IT systems will need to be carefully planned as it may cause a degradation of the IT support service. On a more positive note, the IT staff members are actually looking forward to learning and working with new tools and technologies. They are asking how they can find out more on process improvement and redesign concepts and methodologies.

4. DoReMi Books Order Handling Process

1. The customer service representative receives a call from the customer.
2. Determine if the customer has an existing account.
 - 2.1. If the customer has an existing account:
 - 2.1.1. Record the account number.
 - 2.1.2. Record the order information.
 - 2.1.3. If the order is not within the auto-approval limit, send the order to Account Department for review. Otherwise, approve the order.
 - 2.2. If the customer does not have an account:
 - 2.2.1. Record customer information.
 - 2.2.2. Assign account number.
 - 2.2.3. Record order information.
 - 2.2.4. If the order is not within the auto-approval limit, send the order to Account Department for review. Otherwise, approve the order.
3. If the order is auto-approved, the followings activities are performed in sequential order.
 - 3.1. Send the order information to the packaging department in warehouse.
 - 3.2. Packaging department packages the goods.
 - 3.3. Packaging department arranges for delivery.
 - 3.4. Packaging department informs the customer service representative.
4. If the order is sent for review:
 - 4.1. Account Department reviews the order manually.
 - 4.2. Determine if the order is an acceptable credit risk.
 - 4.2.1. If the order is an acceptable credit risk:
 - 4.2.1.1. Send the order information to the packaging department in warehouse.
 - 4.2.1.2. Packaging department packages the goods.
 - 4.2.1.3. Packaging department arranges for delivery.
 - 4.2.1.4. Packaging department informs the customer service representative.
 - 4.2.2. If the order is not an acceptable credit risk:
 - 4.2.2.1. Account Department cancels the order.
 - 4.2.2.2. Notify the customer about the cancellation through the customer service representative.

5. Business Issues to Be Considered in System Design

- A. **DoReMi** have an existing logistics application system but the users are not sure of the details of the process it carries out. This is because the logistics system is a *black box* since there is no documentation and the original IT/user project managers have left the company.
- B. There are many common tasks across the different departments in **DoReMi**. For example, there are common tasks to collect customer particulars, to collect their orders, to check their credit worthiness etc. Currently, the different departments in **DoReMi** do not always carry out these tasks in the same manner. **DoReMi** management would like to standardise and streamline these tasks so that they are carried out in the most productive way.
- C. **DoReMi** have many HR internal forms that need to be automated. Some have simple processes, e.g. fill in by applicant, and review by his supervisor and approval by the supervisor's manager. Others were more complicated, e.g. fill in by applicant, and then route to different approving persons depending on the dollar amount.
- D. **DoReMi** is thinking of implementing a *Print-On-Demand* business process for the school bulk ordering of music scores (e.g. for music band use). This new business process will not need to keep an inventory of music scores. Instead, the Print-on-Demand process will perform high-volume in-house printing of the music scores as and when orders come in. This will help reduce warehouse storage space and costs.
- E. Many of the **DoReMi** managers gave the requirement that they wanted a tool that could help them with delegation of tasks and tracking of the task status for the various small projects that they need to manage.
- F. For music books, **DoReMi** purchases books from many different publishers. The processing of the publisher's invoices currently takes a lot of manual effort and **DoReMi** management is hoping to automate this process.
- G. There are many sales promotions (such as Christmas Sale, New Year Sale etc.) and the price of the books can change often depending on many factors. The IT department currently takes too long to make the changes to the system to cater for the frequent price changes.
- H. During peak hours, the cashier is not able to cope with the large number of customers as each payment takes some time (eg: credit card slip printing and signing) and this adds up when there are many customers.

Workshop Project Candidate Three

Housing & Development Board Build-To-Order Recommender

Convert and implement HDB BTO system using KIE product suite, e.g. Drools, jBPM, Task, Form user interface, and other relevant programming modules.

ANNEX 2 PROJECT CODE EXPORT & IMPORT USING KIE WORKBENCH

Example: export KIE project **Mortgage_Process_ISS_MR** from work space **MySpace**

Review project settings to obtain project URL link

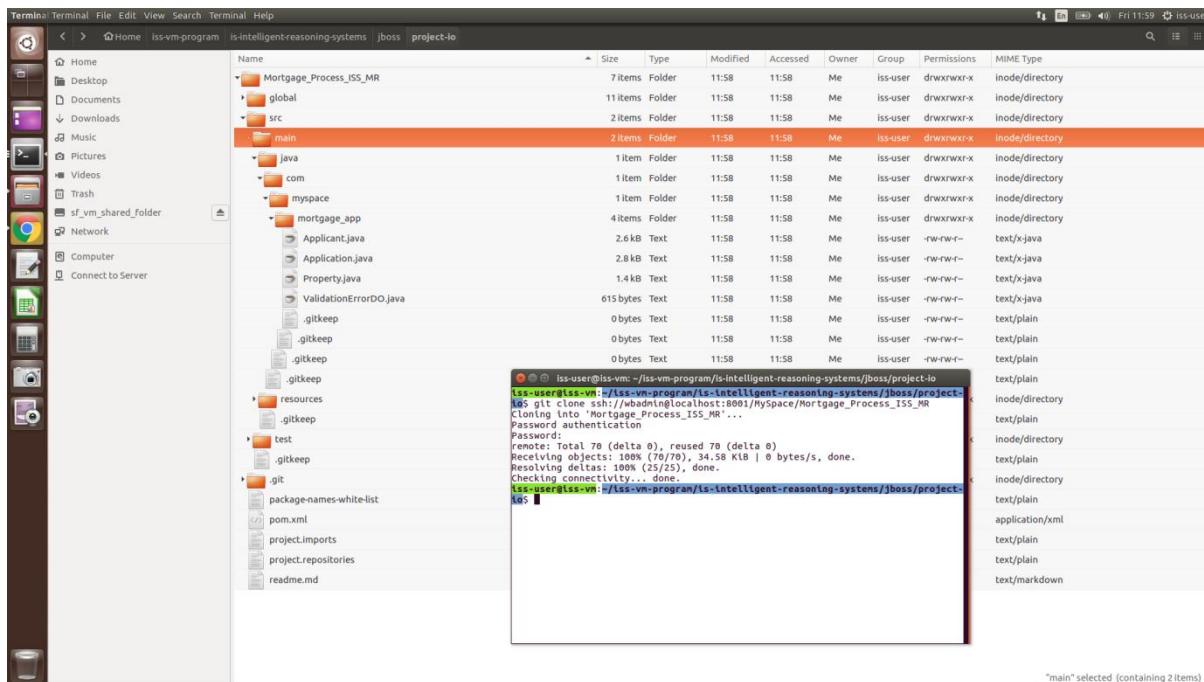
The screenshot shows the 'General Settings' tab of the KIE Workbench interface. The left sidebar lists categories: General Settings, Dependencies, KIE bases, External Data Objects, Validation, Deployments, Persistence, Save, and Reset. The main panel displays the following configuration:

- Name:** Mortgage_Process_ISS_MR
- Description:** Getting started loan approval process in BPMN2, decision table, business rules, and forms.
- URL:** ssh://localhost:8001/MySpace/Mortgage_Process_ISS_MR
- Group ID:** mortgage-process
- Artifact ID:** Mortgage_Process_ISS_MR
- Version:** 1.0.0-SNAPSHOT

Checkboxes for 'Disable GAV conflict check' and 'Allow child GAV edition' are present. Buttons for 'Save' and 'Reset' are at the bottom left.

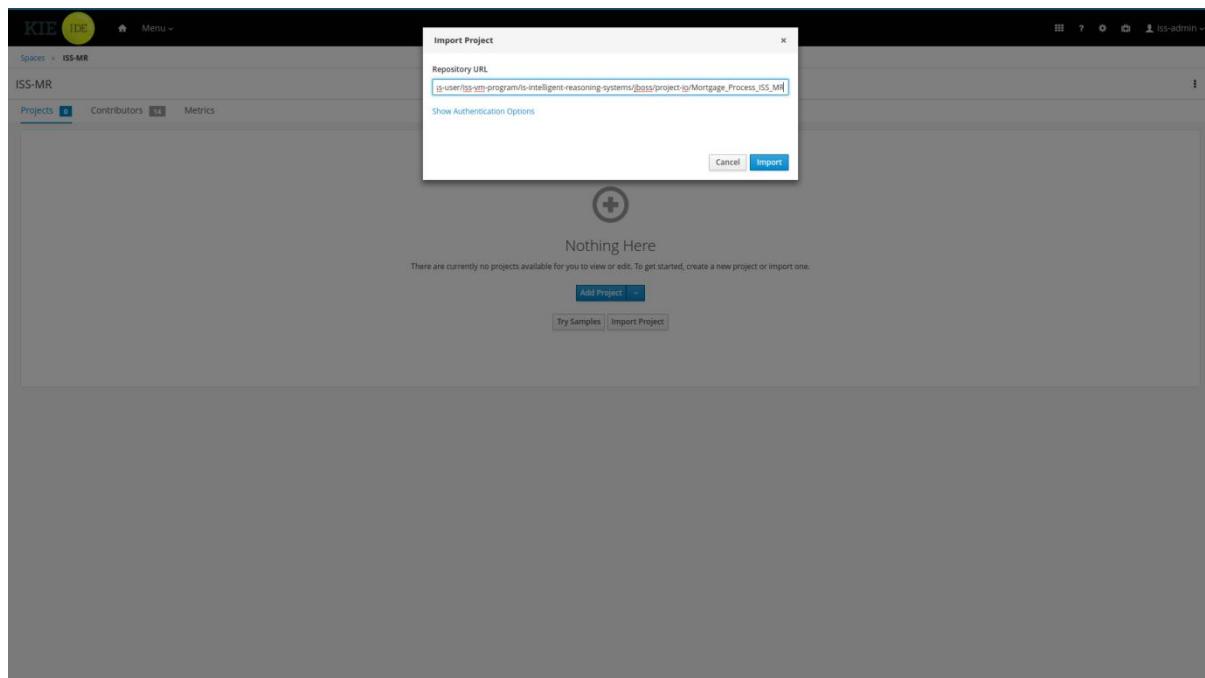
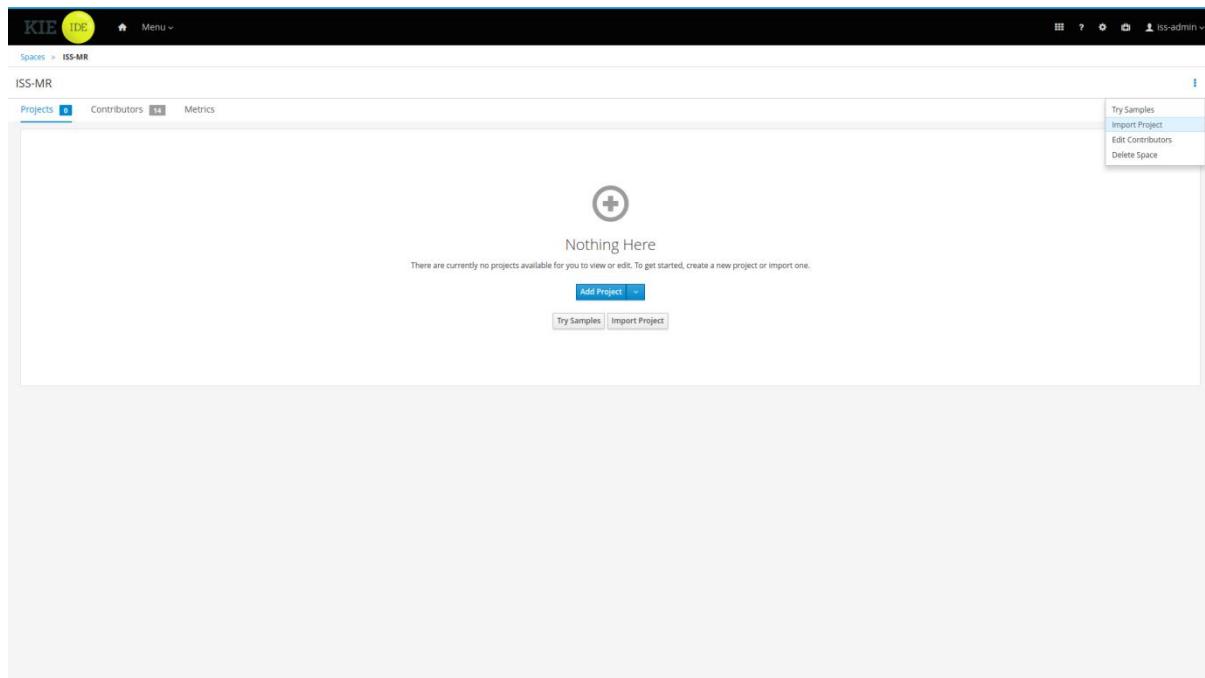
Export project from KIE Workbench

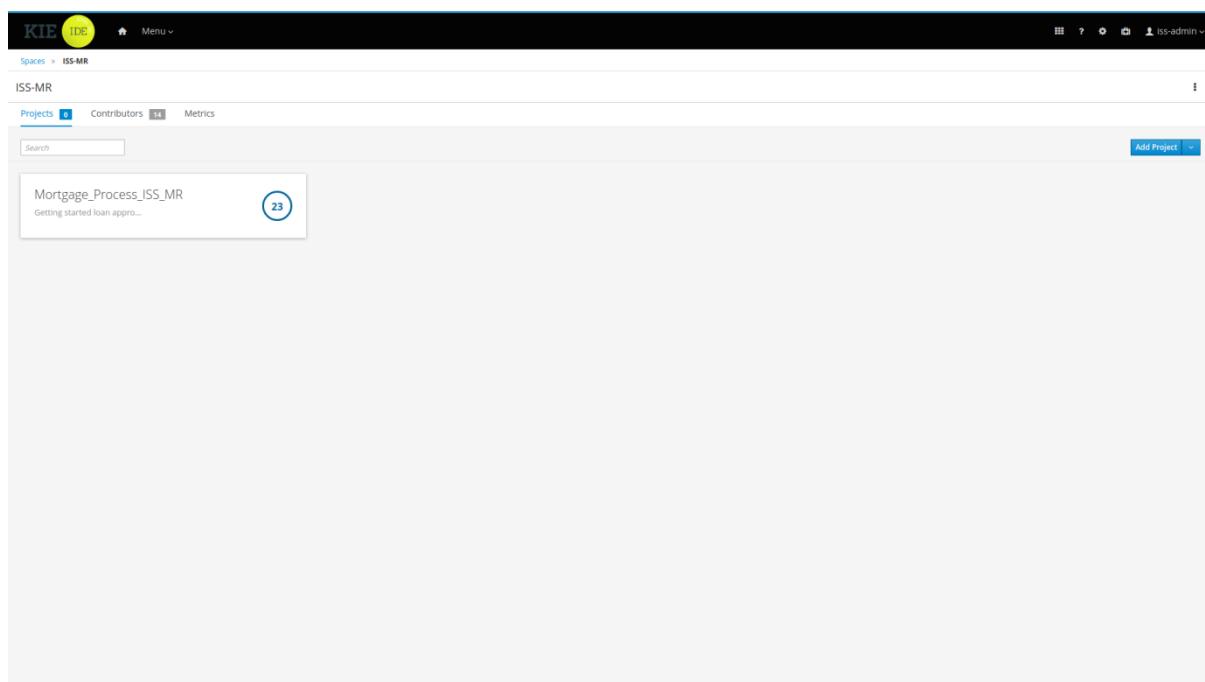
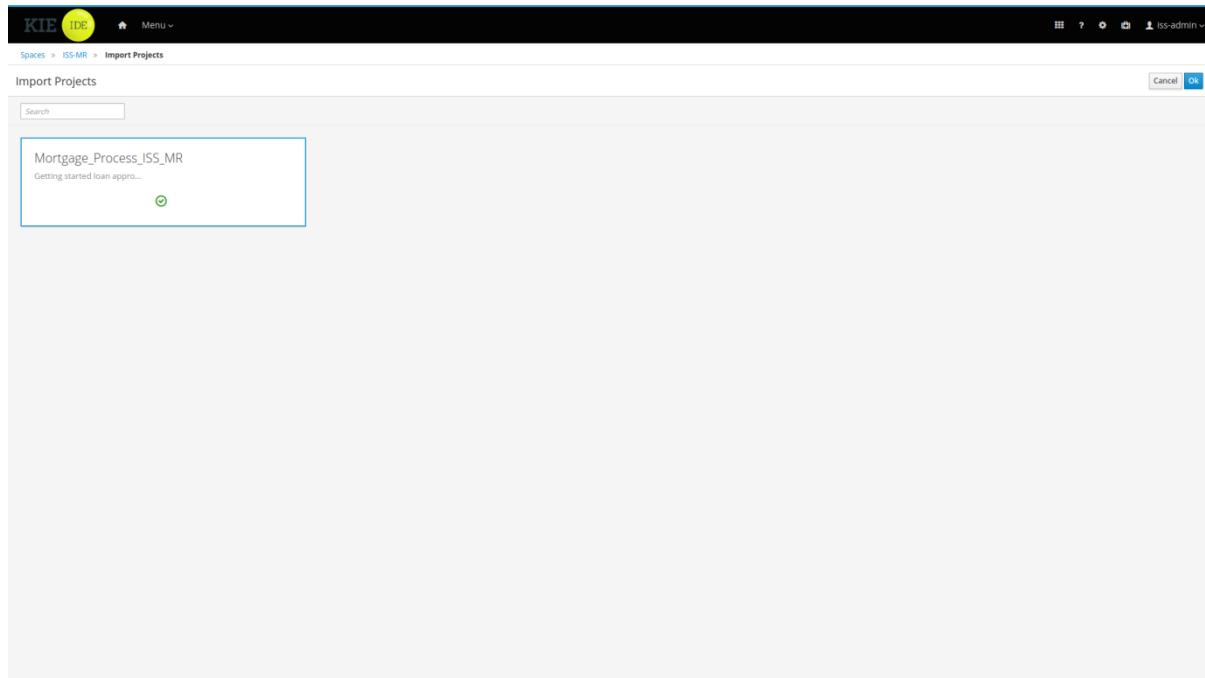
1. Select a folder for exporting, example here uses **/home/iss-user/iss-vm-program/is-intelligent-reasoning-systems/jboss/project-io**
2. Start a Terminal there, key in command **git clone ssh://wbadmin@localhost:8001/MySpace/Mortgage_Process_ISS_MR**
3. Key in password ‘**wbadmin**’ for user wbadmin

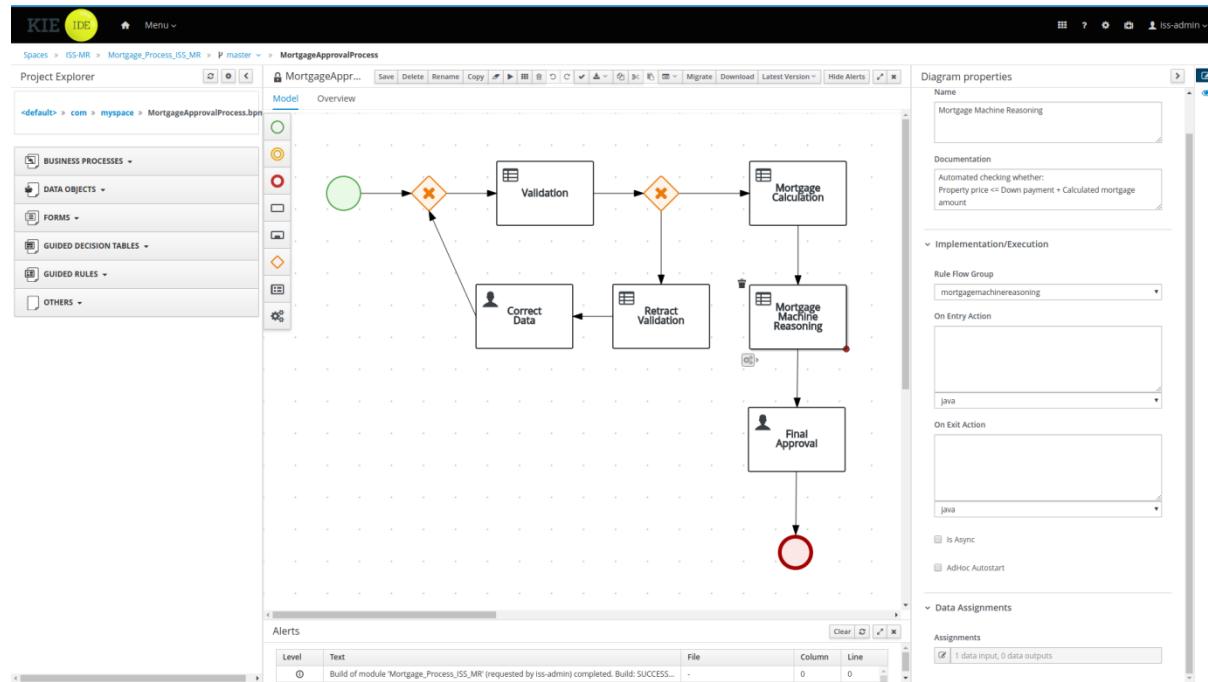


Import project into KIE Workbench

1. In KIE workbench, select/create a project Space, example here uses **ISS-MR**
2. Click menu function '**Import Project**'
3. For Repository URL, key in `file:///home/iss-user/iss-vm-program/is-intelligent-reasoning-systems/jboss/project-io/Mortgage_Process_ISS_MR`







Reference

- <https://developer.jboss.org/thread/269991>
- <https://developer.jboss.org/thread/237411>
- <https://developer.jboss.org/thread/252588>

ANNEX 3 WORKSHOP PROJECT SUBMISSION

**Submission due by 23:59 on last lecture date (+ 14)
One delayed day = 10 marks deduction**

1. [MTech & EEP] Create Github repository for project submission
2. [MTech] Download Github repository as a ZIP file, then upload to NUS LumiNUS / IVLE

Reference <https://github.com/IRS-PM/Workshop-Project-Submission-Template>

The screenshot shows a GitHub repository page. At the top, it displays the repository name 'IRS-PM / Workshop-Project-Submission-Template' and a brief description: 'forked from telescopeuser/Workshop-Project-Submission-Template'. It shows 11 commits, 1 branch, 0 releases, and 1 contributor. There are buttons for 'Code', 'Pull requests', 'Projects', 'Wiki', 'Insights', and 'Settings'. Below this, there's a note: 'No description, website, or topics provided.' with an 'Edit' button. A 'Manage topics' link is also present. The main content area shows a list of files: 'Miscellaneous', 'ProjectReport', 'SystemCode/clips', 'UserGuide', and 'README.md'. The 'README.md' file has a 'Clone with HTTPS' button highlighted in blue. A note below says: 'This branch is even with telescopeuser:master.' and provides the URL 'https://github.com/IRS-PM/Workshop-Proje'. There are buttons for 'Create new file', 'Upload files', 'Find file', 'Clone or download', 'Open in Desktop', and 'Download ZIP'. A note at the bottom says: 'Workshop Project Submission Template: Github Repository & Zip File' and '[Naming Convention] CourseCode-StartDate-BatchCode-Group_or_Individual-TeamName_or_PersonName-ProjectName.zip'.

The End of Workshop Project Guide