

## Workshop 3 - Creating Level 0 and Level 1 Data Flow Diagrams using Oracle Data Modeler

In this workshop, you will learn to create a data flow diagram using the **Process Model**

Specifically, this will involve the creation of:

- New Process
- New Information Store
- New Flows
- New Agent / Externals

### Process Model:

The **process model** represents a functional area of an information structures system. The process model, embodied graphically in one or more data flow diagrams, is an analysis technique used to capture the flow of inputs through a system (or group of processes) to their resulting output. The model shows the flow of information through a system, which can be an existing system or a proposed system.

All necessary elements for data flow diagramming are supported in the Data Modeler process model: primitive processes, composite processes with unlimited levels of decomposition, reusable transformation tasks, triggering events, information stores, external agents, record structure for describing external data elements, source-target mapping of data elements, and CRUD (create, read, update, delete) dependencies between primitive process and data elements.

The following are important concepts for the **process model**:

- A **process** is an activity or a function that is performed for some specific reason. Ultimately each process should perform only one activity.
  - A **primitive process** is a standalone process.
  - A **composite process** consists of multiple **outer processes**. The data flow model allows you to drill down to child processes through a composite process. This means that a top-level process can drill down to another full data flow model.
- A **trigger** is something that happens which initiates the execution of a process.
- A **data flow** reflects the movement of single piece of data or logical collection of information. Flows describe the sequence of a data flow diagram.
- A **data store** is a collection of data that is permanently stored.
- An **external agent** is a person, organization, or system that is external to the system but interacts with it. External agents send information to and receive information from processes.
- An **information store** is a passive object that receives or stores information as entities and attributes in the data model. Ultimately, an information store corresponds with one or more entities of the data model.

- A **transformation task**, including input and output parameters, is an execution unit that communicates with surrounding environment that will execute it. An input parameter might be a date for which processing should be done. An output parameter might be a code that indicates whether the operation was successful or not. Transformation itself might involve reading, transforming, and saving information, some of which may not be directly tied to the input and output parameters
- A **role** is a set of defined privileges and permissions. Primitive processes connected to information stores (processes that create, read, update, and delete data elements) can be attached to a defined role, thus defining collaboration between roles and data elements. Later, role definitions can be transferred to any particular physical model such that appropriate database roles with defined Select, Insert, and Update permission will be created.

## Data Flow Diagrams


A formal, structured analysis approach employs the data flow diagram (DFD) to assist in the functional decomposition process. A data flow diagram consists of the following components:

Icons for Data Flow Diagrams:




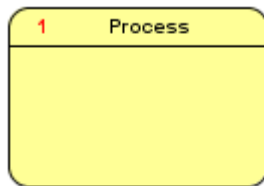
- **External interactors/agent** , which are represented by rectangles




- **Information Store** , which are represented by open rectangles

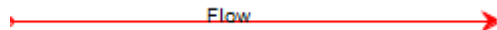


- **Processes** , which are represented by any rounded object (circle, oval, or square with rounded corners)



A process can represent a system function at one of various levels, from atomic through aggregate.

- **Data flows** , which are represented by arrows, and optionally with labels indicating their content.



## A Case Study for the Dataflow Diagram

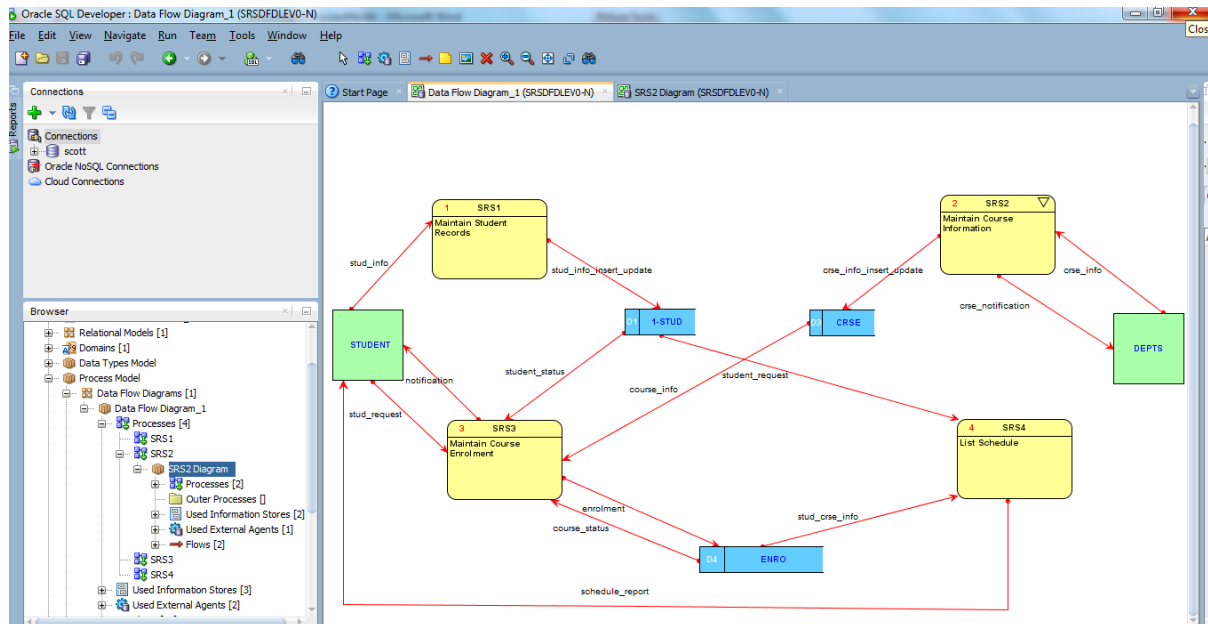
In this workshop, we will introduce a case study of simplified Student Registration System to learning the DFD technique. Let us assume that we have identified four main processes:

1. **Maintain student records**
2. **Maintain course information**
3. **Maintain course enrolment**
4. **List schedule.**

The process "maintain student records" accepts student information from students (say, during admission) and inserts the student information in the STUD information store. In addition, this process also handles changes in student information (including changes in address, majors, etc.). The process "maintain course information" is responsible for receiving information about courses to be offered by the university from respective departments, validate the proposed courses, and insert/update CRSE information store accordingly. If a proposed course is found to be invalid, a notification is sent to the concerned department. The "maintain course enrolment" process handles student requests for enrolment in a particular course. The process, first, checks the student status (e.g., whether full-time or part-time) from the 'STUD' information store. Next, the validity of the course (e.g., whether the course is being offered) is checked from the 'CRSE' database and the enrolment status (e.g., whether the course is full) is checked from the 'ENROL' database. Once all these have been verified, the student is enrolled by recording this information in the ENROL information store. If a student is not accepted into the requested course (due to whatever reason), a notification is sent to the concerned student. Finally, "list schedule" process draws on information stored in STUD, CRSE

and ENROL to generate the schedule that is sent to students. A graphical representation of the final DFD, which we will generate in this workshop, is shown below.

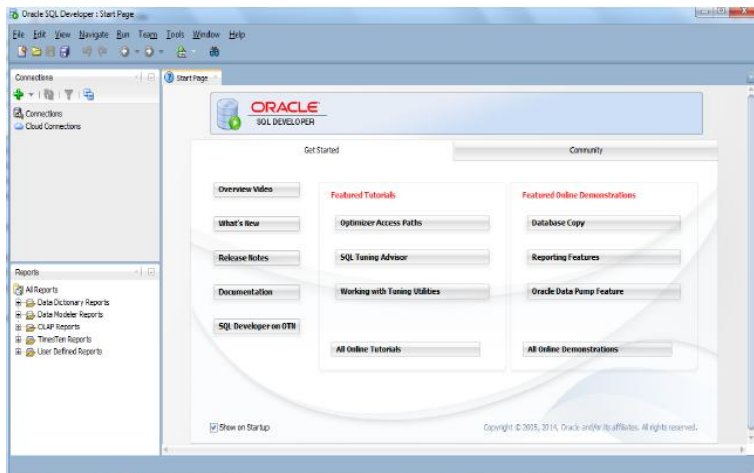
We will take you step by step to create **Level 0** and **Level 1** Diagram



# Creating a Dataflow Diagram using Process Model

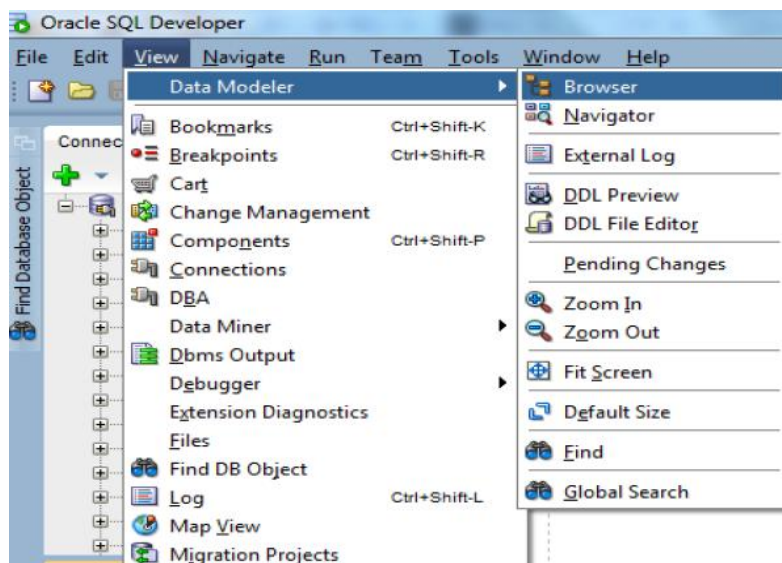
## Open the SQL Developer

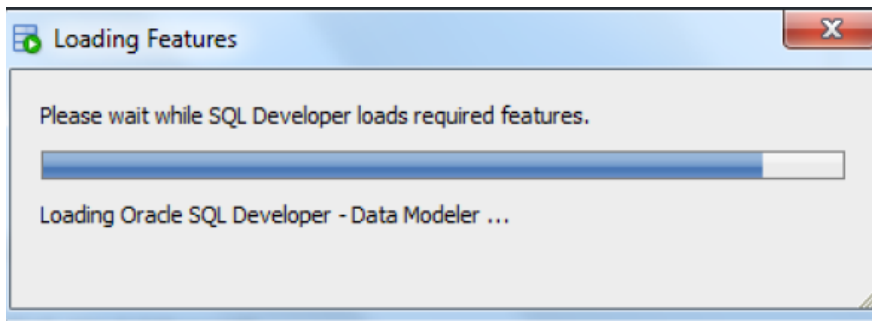
From **Start** ----->**Databases**----->**sqldeveloper** (click on sqldeveloper)



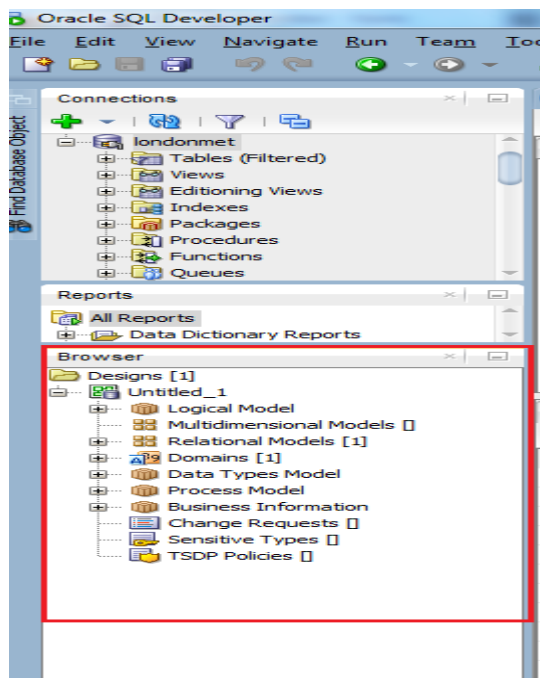
## Open Oracle SQL Developer Data Modeler

1. Go to the View menu
2. Expand the Data Modeler menu
3. Select the 'Browser'

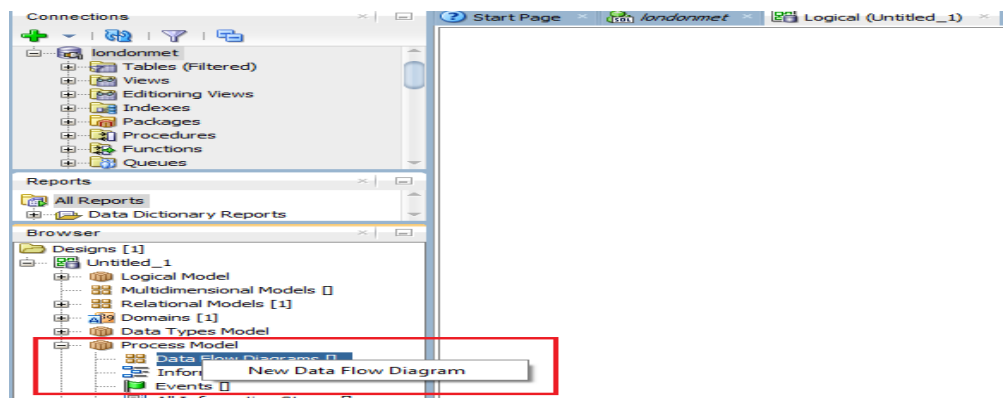




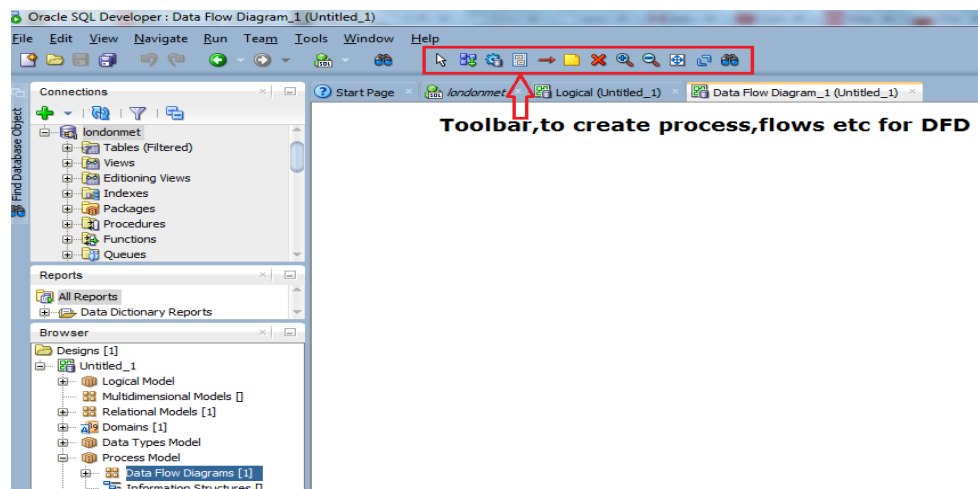
Now , a Browser object appears on the bottom left corner ,expand Untitled\_1



Expand the Process Model and right click on Data flow diagrams to create new DFD



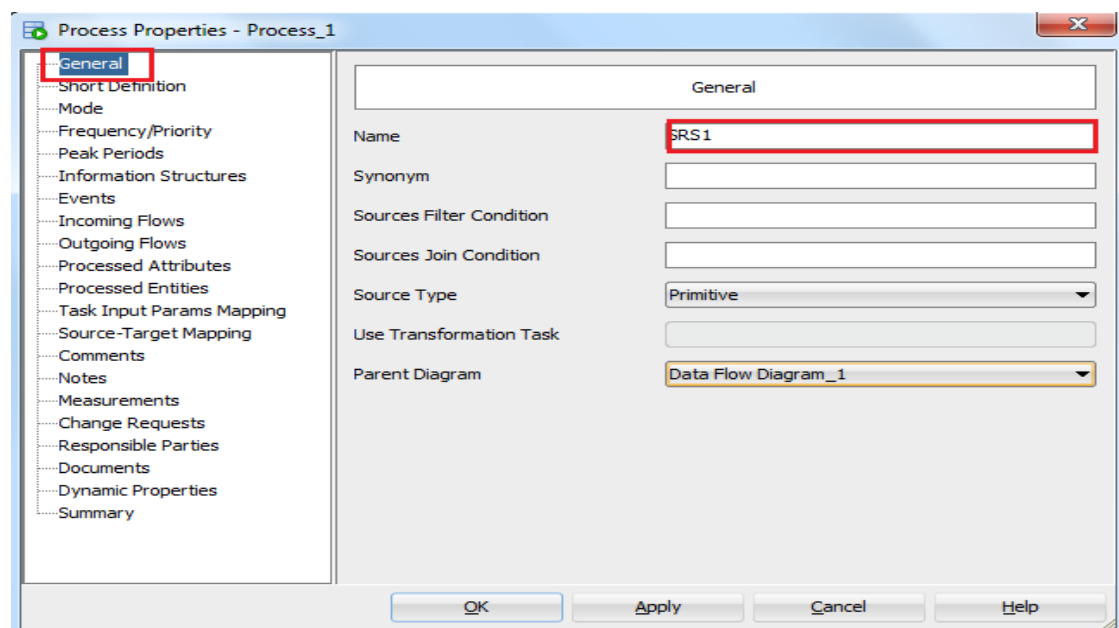
From here you can select and create **New processes, information stores and flows** using the **tools bar icons**



To create the New Process, click on the **New Process** icon  and then click on main working area.

Following **New Process** property will appear then enter

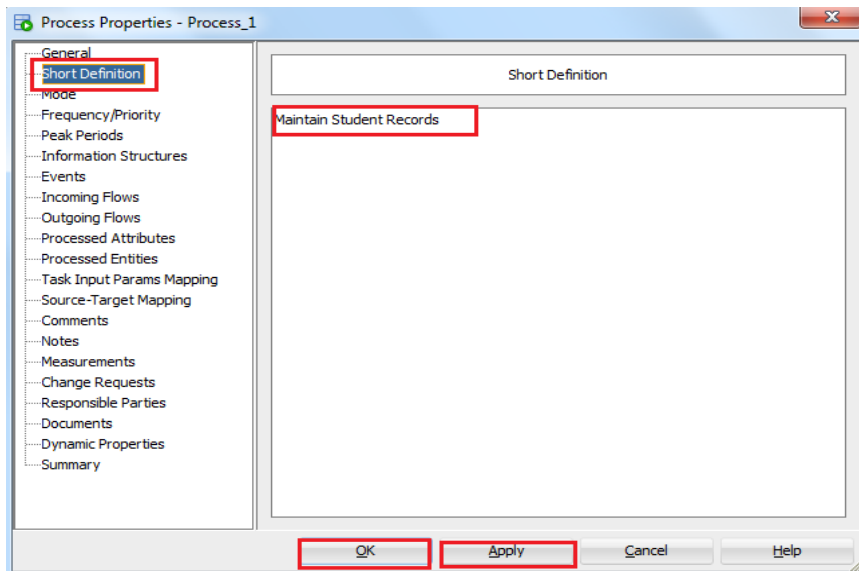
**Name : SRS1**



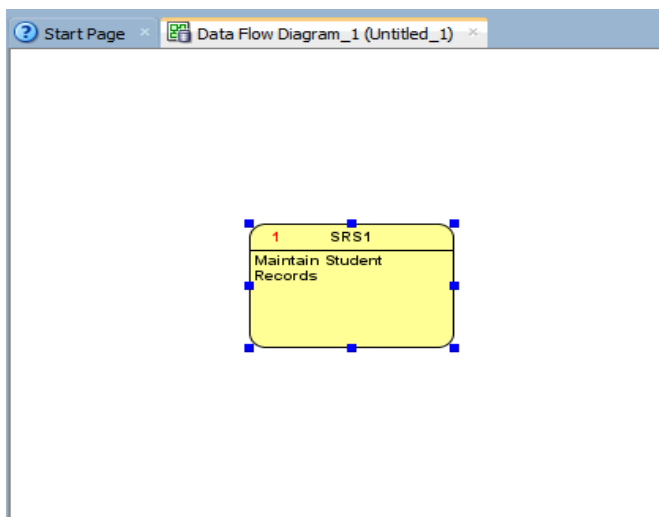
Select **Short Destination** tab from left side and Enter:

**Short Definition:** Maintain Student Records


Click Apply then OK



You will see following output in main working area

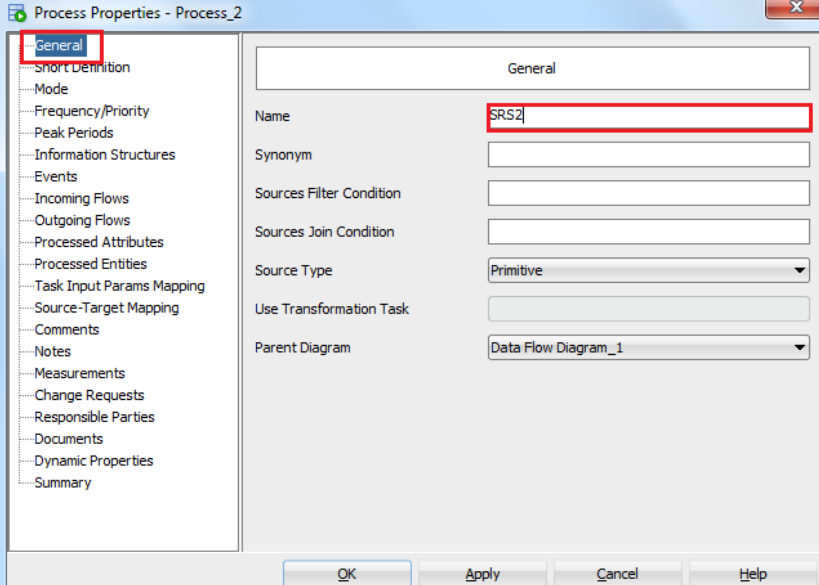




To create another New Process, click again on the **New Process** icon  and then click on main working area.

Following **New Process** property will appear then enter

**Name** : SRS2

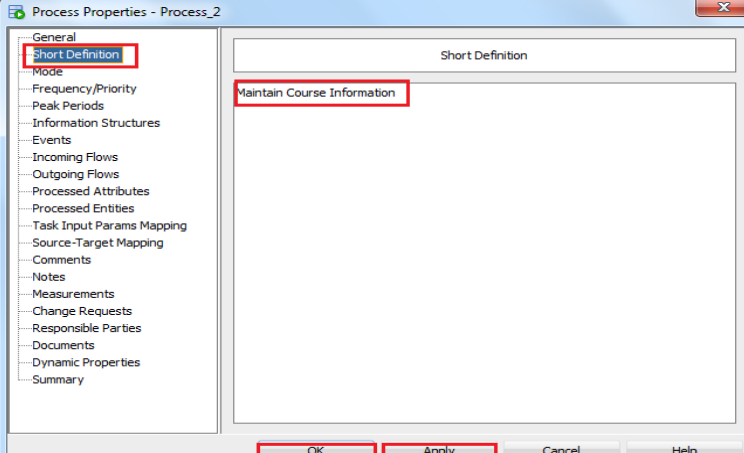


The image shows the 'Process Properties - Process\_2' dialog box with the 'General' tab selected. The 'Name' field is highlighted with a red box and contains the text 'SRS2'. Other fields include 'Synonym', 'Sources Filter Condition', 'Sources Join Condition', 'Source Type' (set to 'Primitive'), 'Use Transformation Task', and 'Parent Diagram' (set to 'Data Flow Diagram\_1'). The 'OK', 'Apply', 'Cancel', and 'Help' buttons are at the bottom.

Select **Short Destination** tab from left side and Enter:

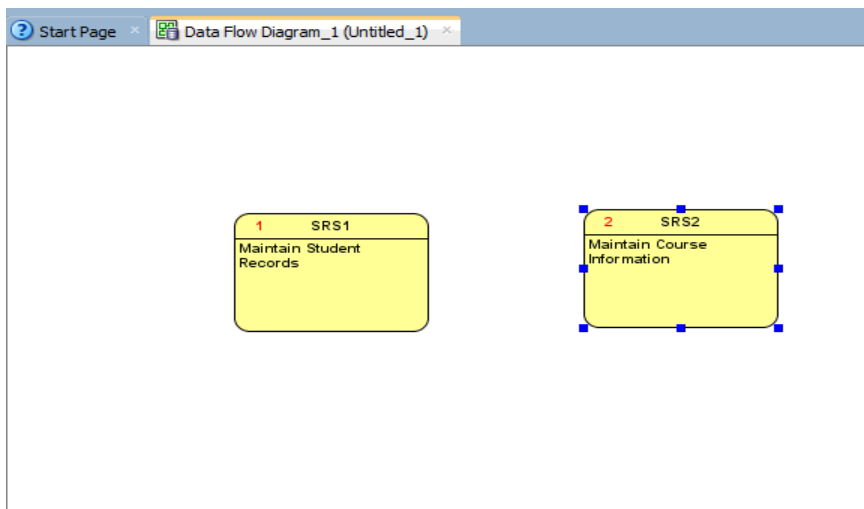
**Short Definition:** Maintain Course Information


Click Apply then OK



The image shows the 'Process Properties - Process\_2' dialog box with the 'Short Definition' tab selected. The 'Short Definition' field is highlighted with a red box and contains the text 'Maintain Course Information'. The 'OK', 'Apply', 'Cancel', and 'Help' buttons are at the bottom.

You will see following output in main working area



To create another New Process, click again on the **New Process** icon  and then click on main working area.

Following **New Process** property will appear then enter

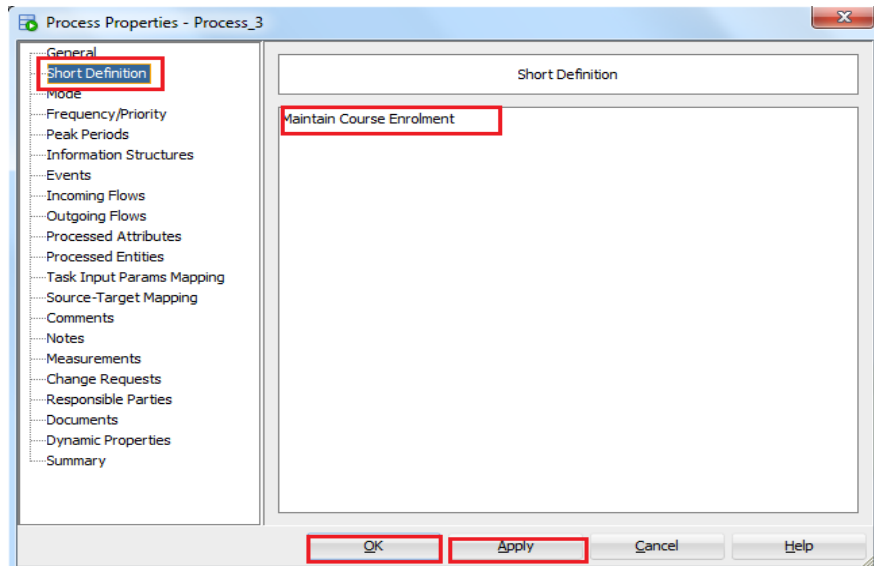
**Name :** SRS3

The screenshot shows the 'Process Properties - Process\_3' dialog box. The 'General' tab is selected in the left-hand tree view. The 'Name' field is highlighted with a red box and contains the text 'SRS3'. Other fields include 'Synonym', 'Sources Filter Condition', 'Sources Join Condition', 'Source Type' (set to 'Primitive'), 'Use Transformation Task', and 'Parent Diagram' (set to 'Data Flow Diagram\_1'). The dialog has 'OK', 'Apply', 'Cancel', and 'Help' buttons at the bottom.

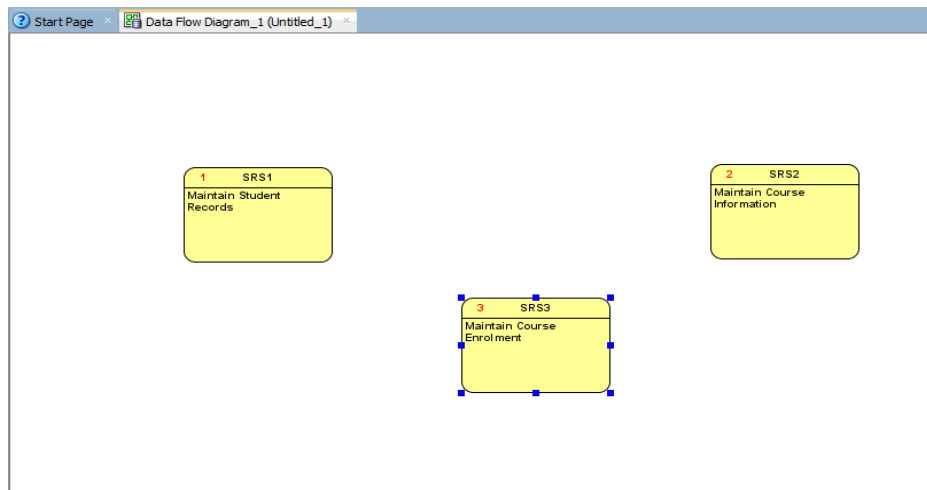
Select **Short Destination** tab from left side and Enter:


**Short Definition:** Maintain Course Enrolment

Click Apply then OK



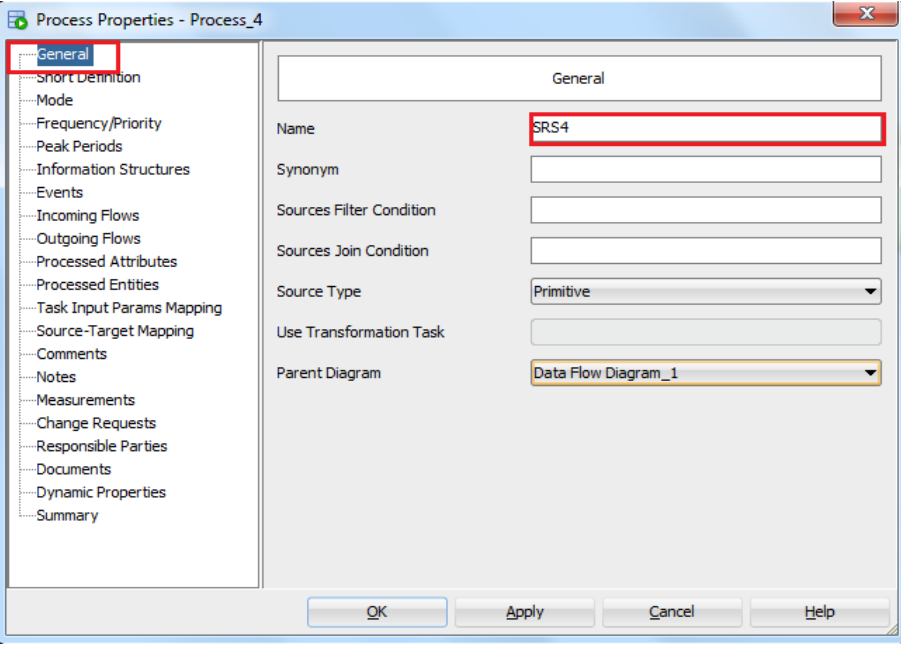
You will see following output in main working area



To create another New Process, click again on the **New Process** icon  and then click on main working area.

Following **New Process** property will appear then enter

**Name** : SRS4

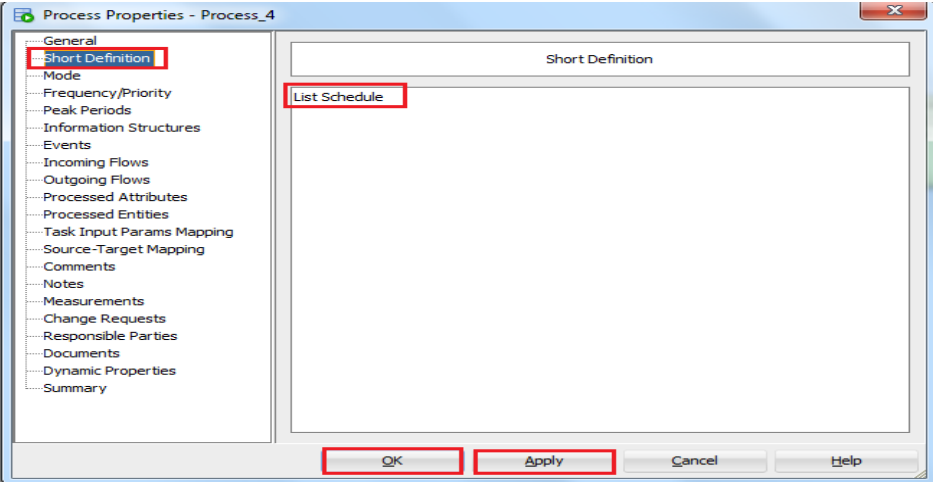


The image shows the 'Process Properties - Process\_4' dialog box with the 'General' tab selected. The 'Name' field is highlighted with a red box and contains the text 'SRS4'. Other fields include 'Synonym', 'Sources Filter Condition', 'Sources Join Condition', 'Source Type' (set to 'Primitive'), 'Use Transformation Task', and 'Parent Diagram' (set to 'Data Flow Diagram\_1'). The left sidebar lists various tabs, and the bottom has 'OK', 'Apply', 'Cancel', and 'Help' buttons.

Select **Short Destination** tab from left side and Enter:

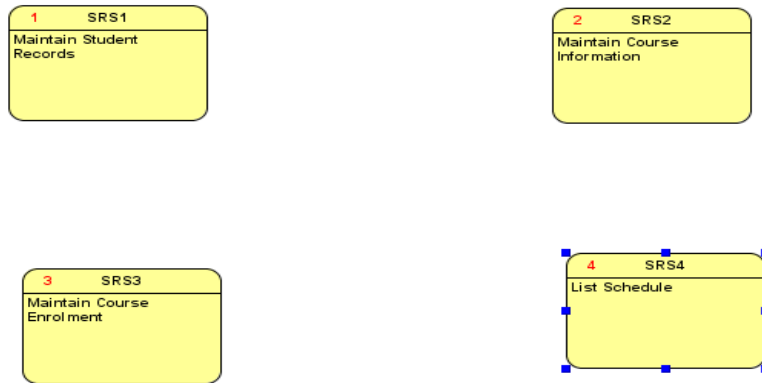
**Short Definition**: List Schedule

Click Apply then OK

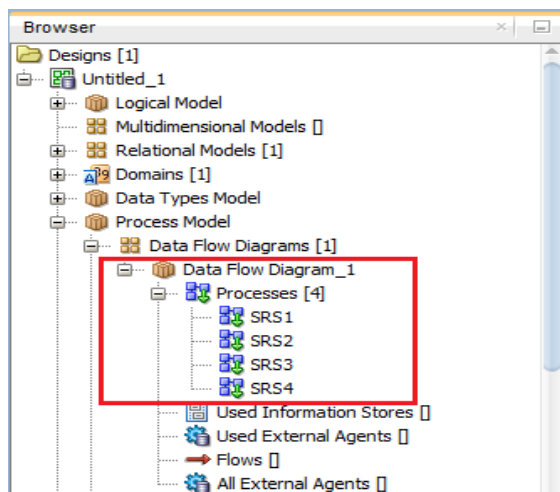


The image shows the 'Process Properties - Process\_4' dialog box with the 'Short Definition' tab selected. The 'Short Definition' field is highlighted with a red box and contains the text 'List Schedule'. The left sidebar shows the 'Short Definition' tab selected, and the bottom has 'OK', 'Apply', 'Cancel', and 'Help' buttons.

You will see all 4 processes in main working area




In Browser window you can see 4 added processes (Expand Data flow Diagram\_1 then Processes [4])



Now We will create 3 new Information Stores

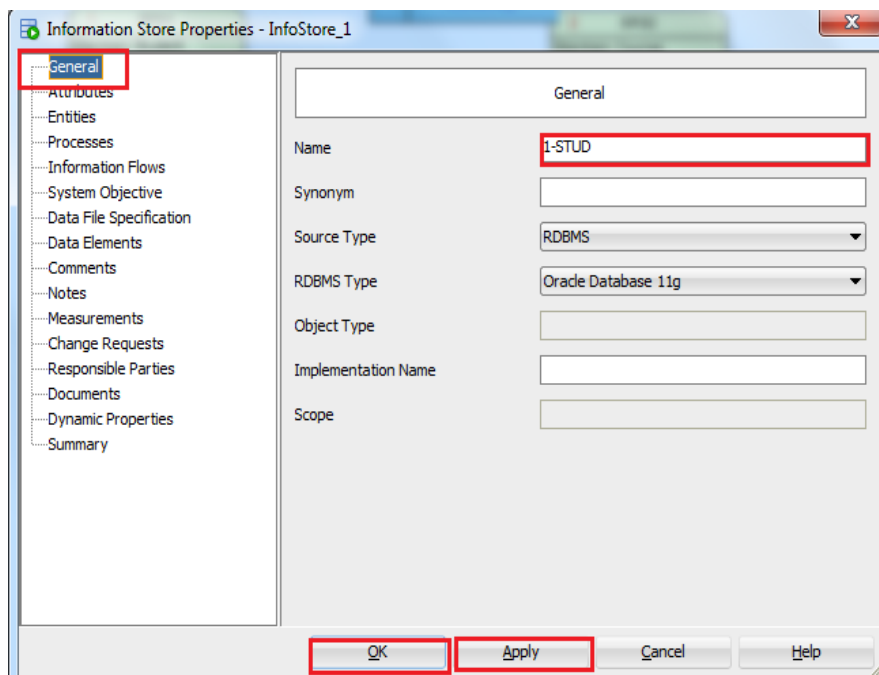
1. 1-STUD (to store student information)
2. CRSE (to store course information)
3. ENRO (to store enrolment information)

To create **1-STUD** information store ,click on New Information Store icon  and then click on main working area.

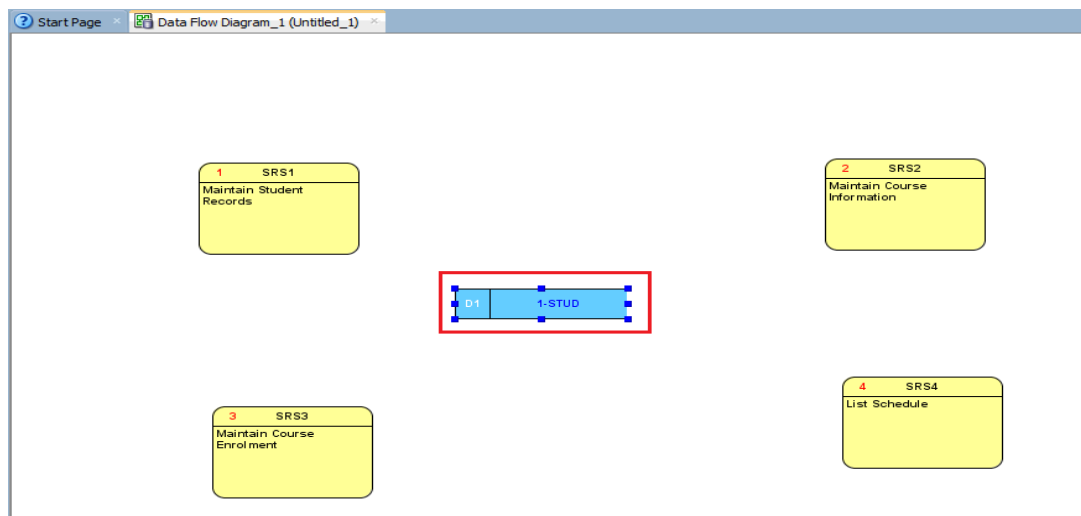
Following **New Information Store** property will appear then enter


**Name:** 1-STUD

Click Apply then OK



You will see newly created **1-STUD** information store in main working area



To create **CRSE** information store ,click again on New Information Store icon  and then click on main working area.

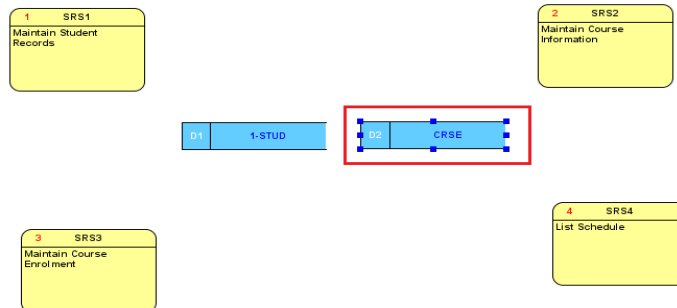
Following **New Information Store** property will appear then enter


**Name:** CRSE

Click Apply then OK

The dialog box 'Information Store Properties - InfoStore\_2' is shown. The 'General' tab is selected in the left-hand tree. The 'Name' field is highlighted with a red box and contains the text 'CRSE'. The 'Source Type' is set to 'RDBMS' and the 'RDBMS Type' is set to 'Oracle Database 11g'. The 'OK' and 'Apply' buttons at the bottom are also highlighted with red boxes.

You will see newly created **CRSE** information store in main working area

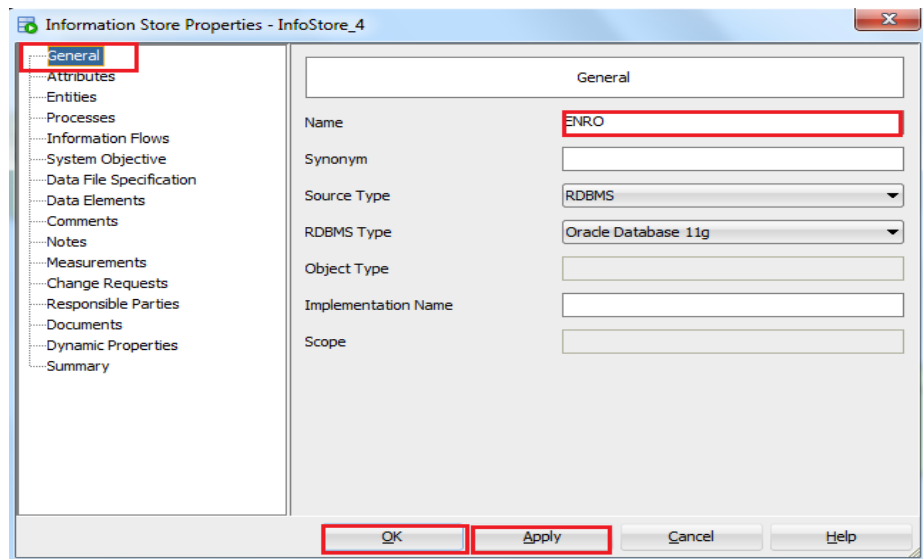


To create **ENRO** information store ,click again on New Information Store icon  and then click on main working area.

Following **New Information Store** property will appear then enter

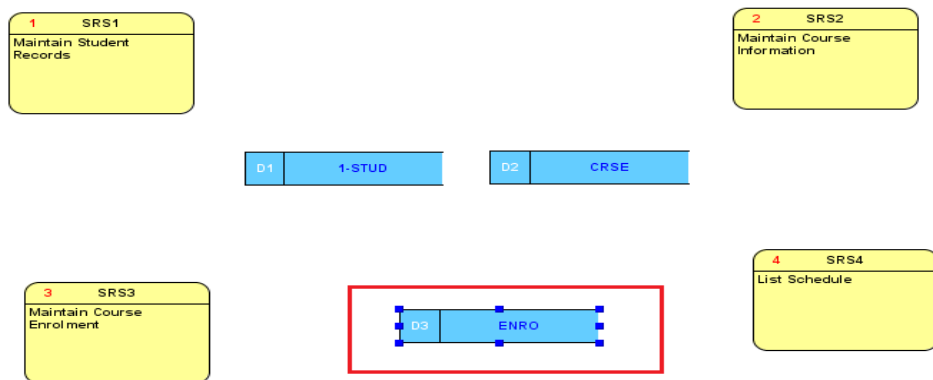
**Name:** ENRO


Click Apply then OK



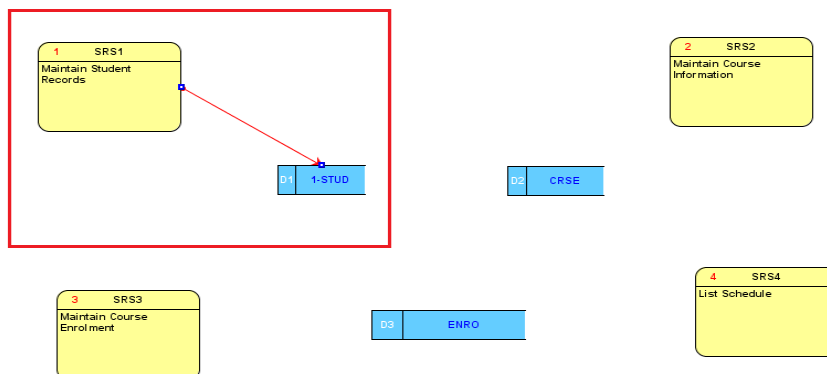


You will see newly created **ENRO** information store along with other information stores and processes in main working area

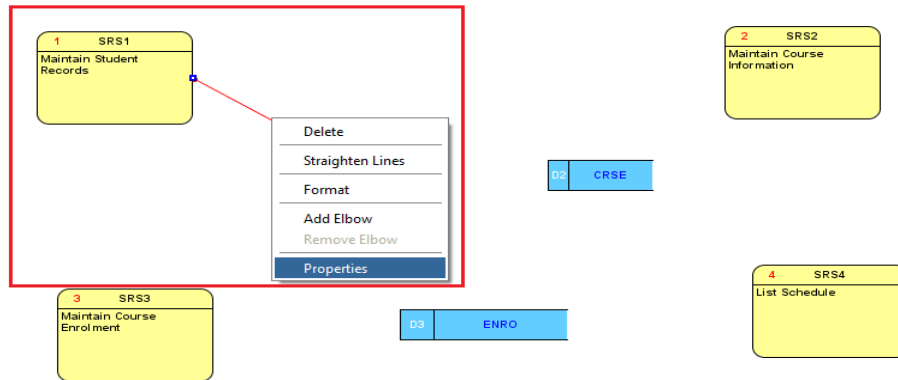


Now to create a **Dataflow**, click on the **New flow** icon  from the toolbar and then drag it from the **SRS1** process to the **D1** information store.

You will see flow between SRS1 and D1 as follow:



To enter the flow information. Highlight the flow then right click on flow and select properties.

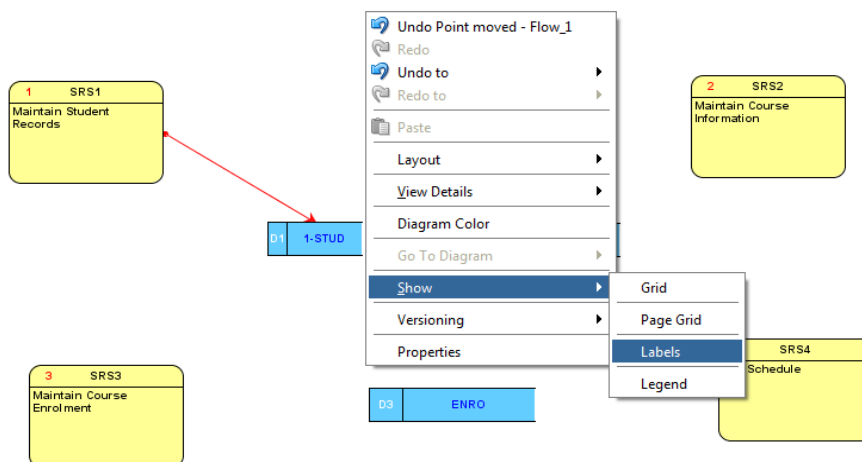


Flow's property will appear then enter

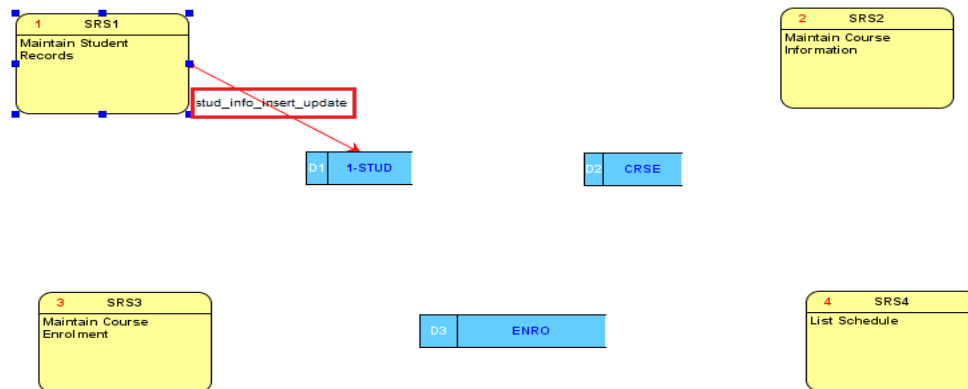
**Name:** stud\_info\_insert\_update

and click Apply then Ok

To show labels of flows. Right click on main working area ,select **Show** then click on **Labels**



Now you will see following output with added flow name (stud\_info\_insert\_update).



Now to create another **Dataflow**, click on the **New flow** icon  from the toolbar and then drag it from the **SRS2** process to the **D2** information store.

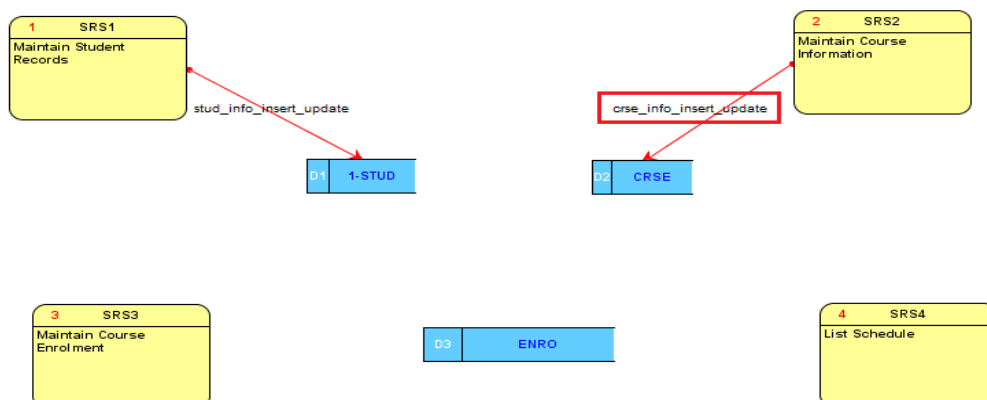
To enter the flow information. Highlight the flow then right click on flow and select properties


Flow's property will appear then enter

**Name:** stud\_info\_insert\_update

*(As you did in previous step----we are not showing screen shot here)*

You will see flow between SRS2 and D2 as follow:



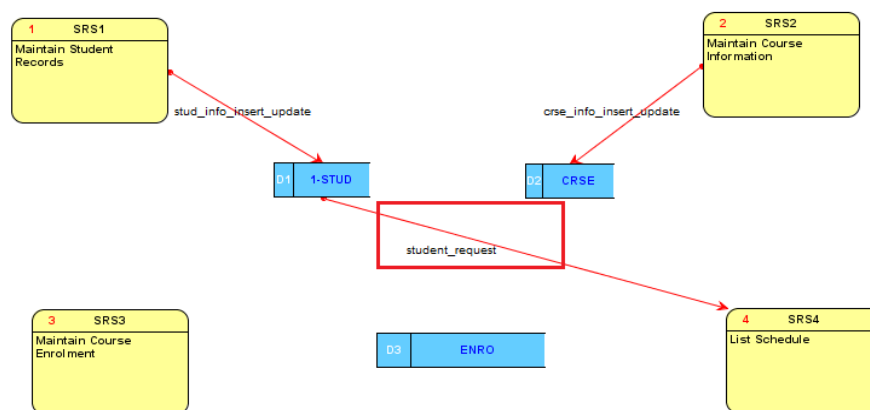
Now to create another **Dataflow**, click on the **New flow** icon  from the toolbar and then drag it from the **D1 information store** to the **SRS4** process.


To enter the flow information. Highlight the flow then right click on flow and select properties  
Flow's property will appear then enter

**Name:** student\_request

*(As you did in previous step----we are not showing screen shot here)*

You will see flow between D1 and SRS4 as follow:



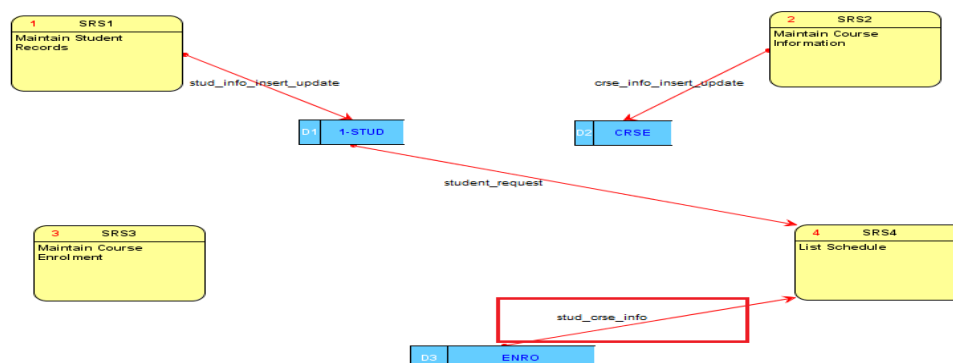
Now to create another **Dataflow**, click on the **New flow** icon  from the toolbar and then drag it from the **D3 information store** to the **SRS4** process.


To enter the flow information. Highlight the flow then right click on flow and select properties  
Flow's property will appear then enter

**Name:** stud\_crse\_info

*(As you did in previous step----we are not showing screen shot here)*

You will see flow between D3 and SRS4 as follow:



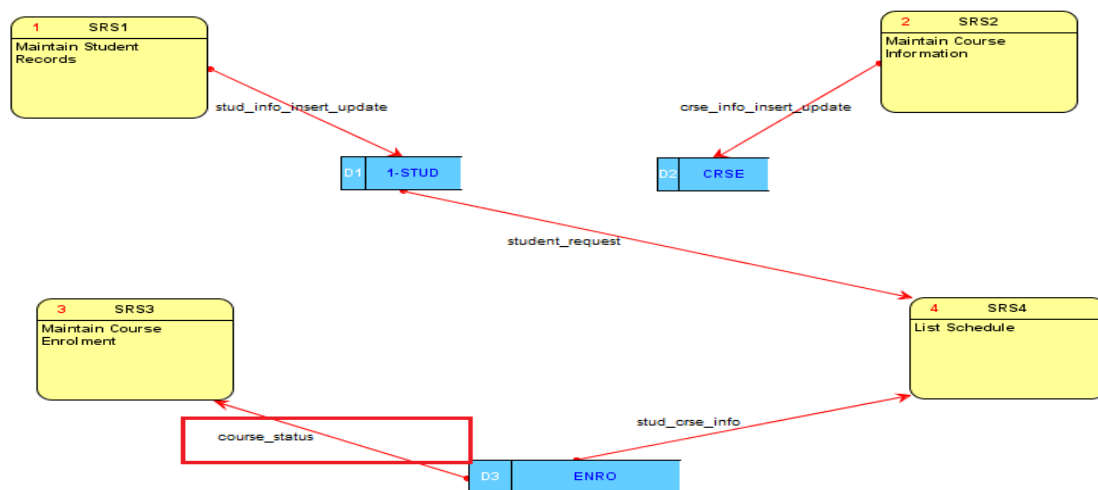
Now to create another **Dataflow**, click on the **New flow** icon  from the toolbar and then drag it from the **D3 information store** to the **SRS3** process.


To enter the flow information. Highlight the flow then right click on flow and select properties  
Flow's property will appear then enter

**Name:** course\_status

*(As you did in previous step----we are not showing screen shot here)*

You will see flow between D3 and SRS3 as follow:



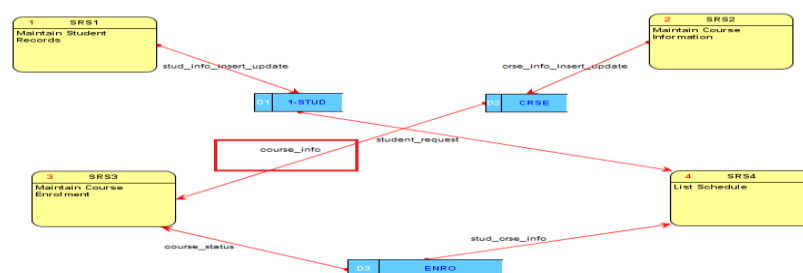
Now to create another **Dataflow**, click on the **New flow** icon  from the toolbar and then drag it from the **D2 information store** to the **SRS3** process.


To enter the flow information. Highlight the flow then right click on flow and select properties  
Flow's property will appear then enter

**Name:** course\_info

*(As you did in previous step----we are not showing screen shot here)*

You will see flow between D2 and SRS3 as follow:



Now to create another **Dataflow**, click on the **New flow** icon  from the toolbar and then drag it from the **D1 information store** to the **SRS3** process.

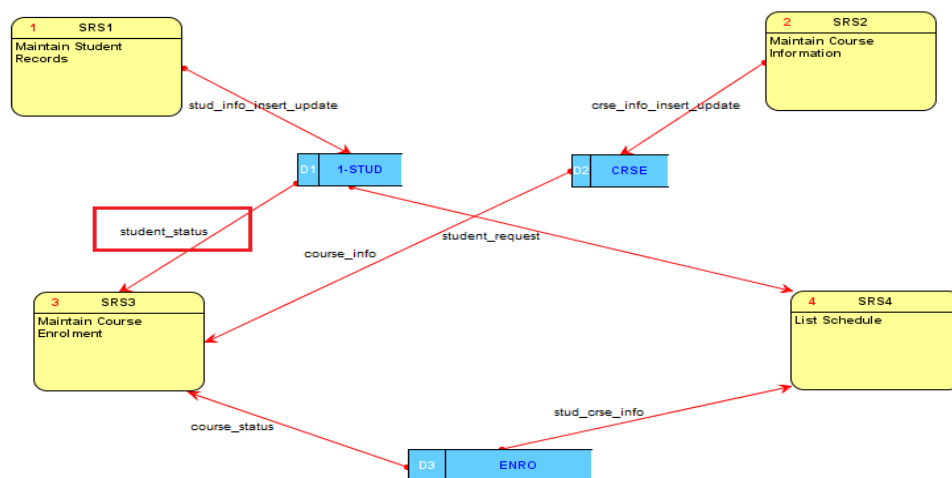
To enter the flow information. Highlight the flow then right click on flow and select properties


Flow's property will appear then enter

**Name:** student status

*(As you did in previous step----we are not showing screen shot here)*

You will see flow between D1 and SRS3 as follow:



Now to create another **Dataflow**, click on the **New flow** icon  from the toolbar and then drag it from the **SRS3** process to the **D3** information store.

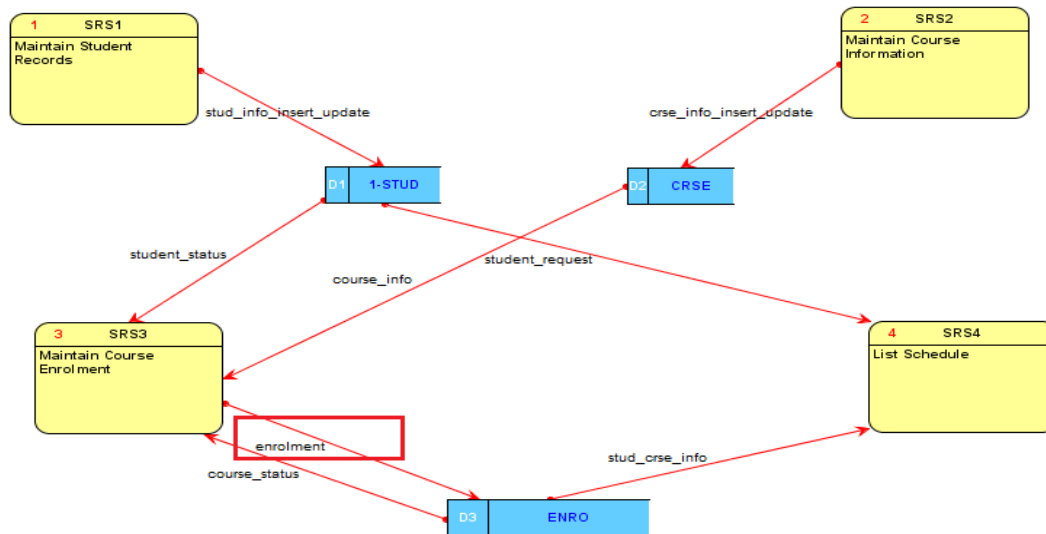
To enter the flow information. Highlight the flow then right click on flow and select properties


Flow's property will appear then enter

**Name:** enrolment

*(As you did in previous step----we are not showing screen shot here)*

You will see flow between SRS3 and D3 as follow:



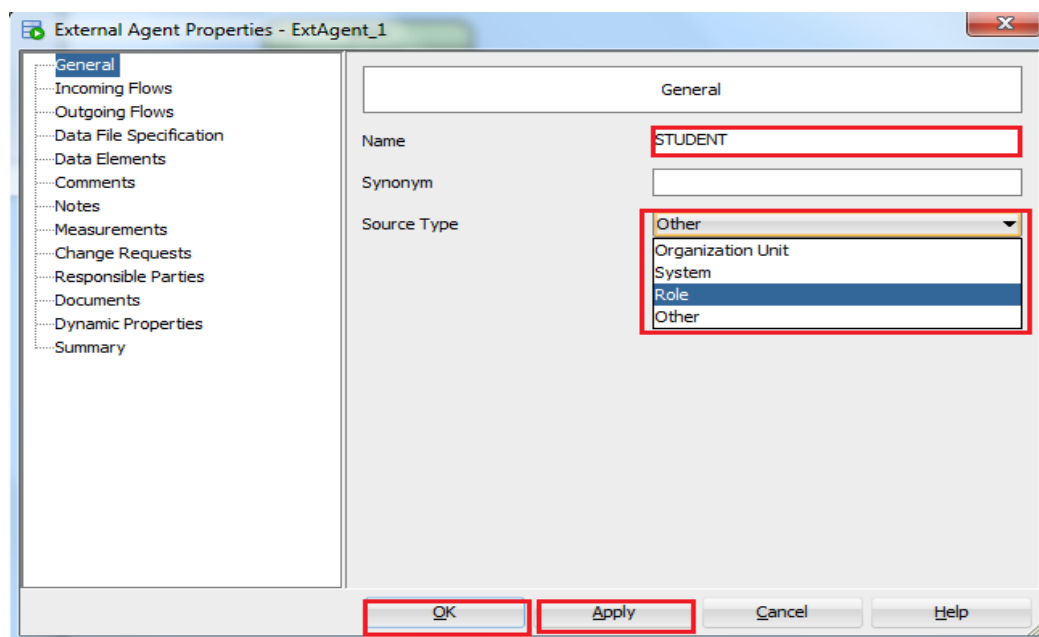
To create an **Agent**, click on the **New Agent** icon  from the toolbar, and then click on left corner between **SRS1** and **SRS3** processes.

Following **New Agent** property will appear then enter

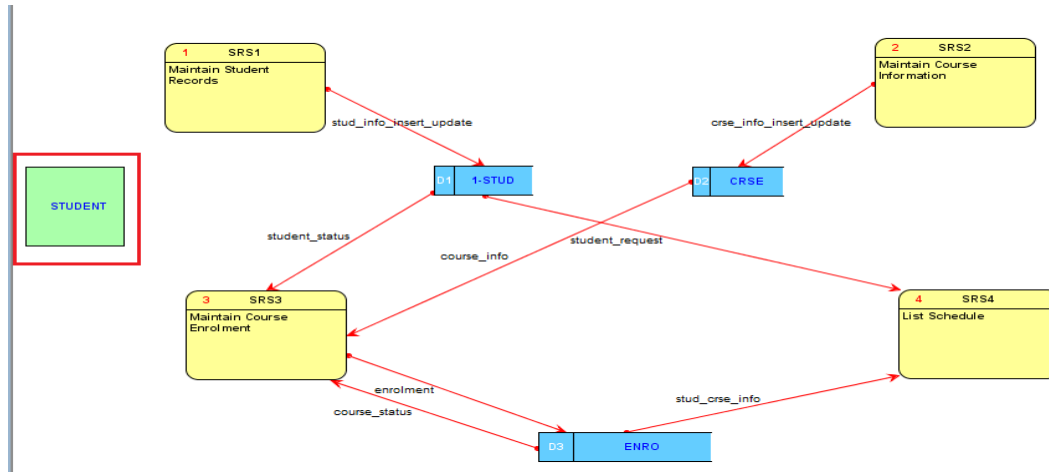
**Name** : STUDENT


**Source Type**: Role

and click Apply then Ok



You will see following output (added New Agent, STUDENT)



To create another **Agent**, click on the **New Agent** icon  from the toolbar, and then click on right corner between **SRS2** and **SRS4** processes.

Following **New Agent** property will appear then enter

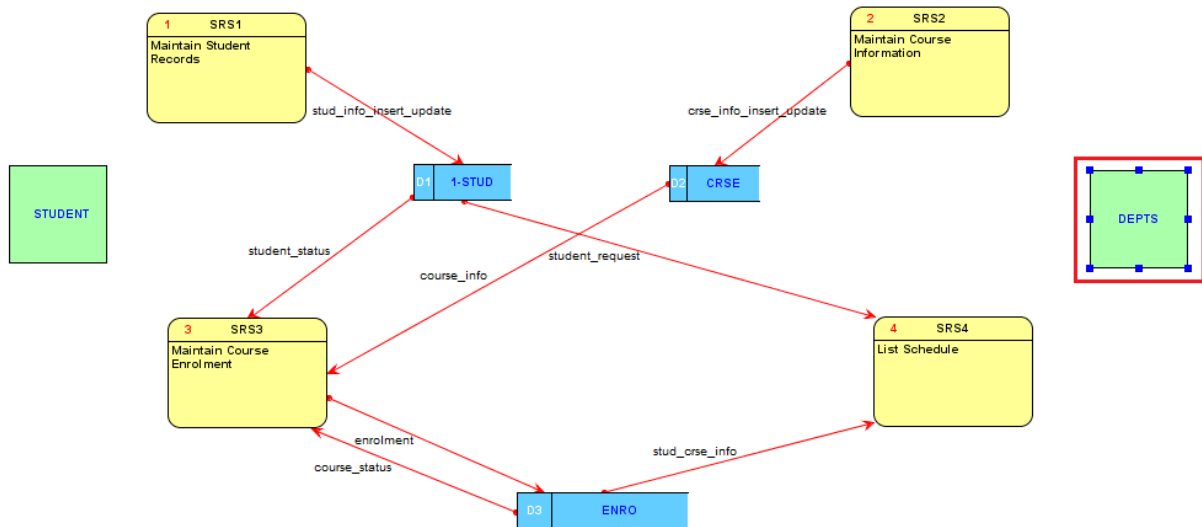
**Name :** DEPTS

**Source Type:** Organization Unit

and click Apply then Ok



You will see following output (added New Agent, DEPTS)



Now to create a **Dataflow**, click on the **New flow** icon  from the toolbar and then drag it from the **STUDENT** agent to **SRS1** process.

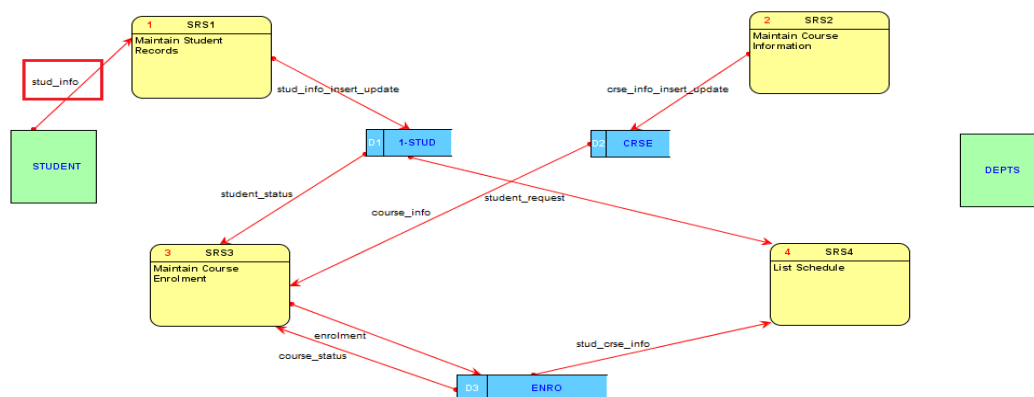
To enter the flow information. Highlight the flow then right click on flow and select properties


Flow's property will appear then enter

**Name:** stud\_info

*(As you did in previous steps----we are not showing screen shot here)*

You will see flow between STUDENT agent and SRS1 process as follow:



Create another **Dataflow**, click on the **New flow** icon  from the toolbar and then drag it from the **STUDENT** agent to **SRS3** process.

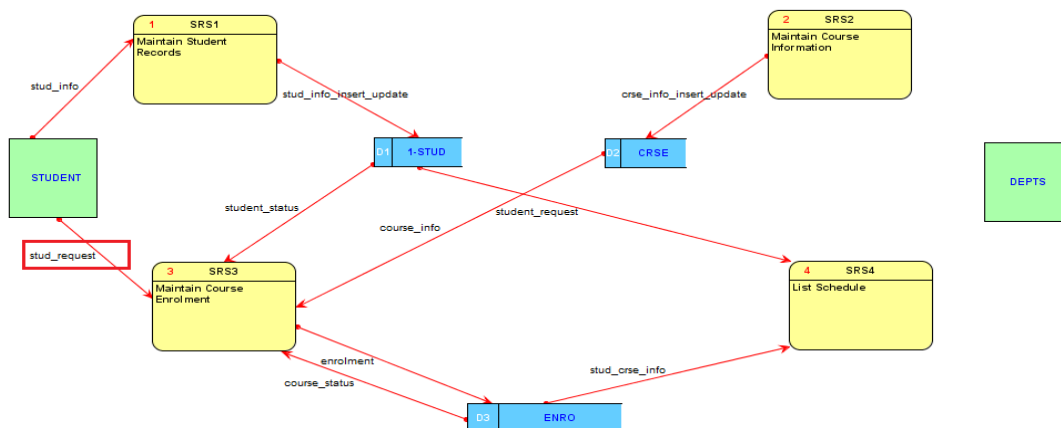
To enter the flow information. Highlight the flow then right click on flow and select properties


Flow's property will appear then enter

**Name:** stud\_request

*(As you did in previous steps----we are not showing screen shot here)*

You will see flow between STUDENT agent and SRS3 process as follow:



Create another **Dataflow**, click on the **New flow** icon  from the toolbar and then drag it from the **SRS3** process to **STUDENT** agent.

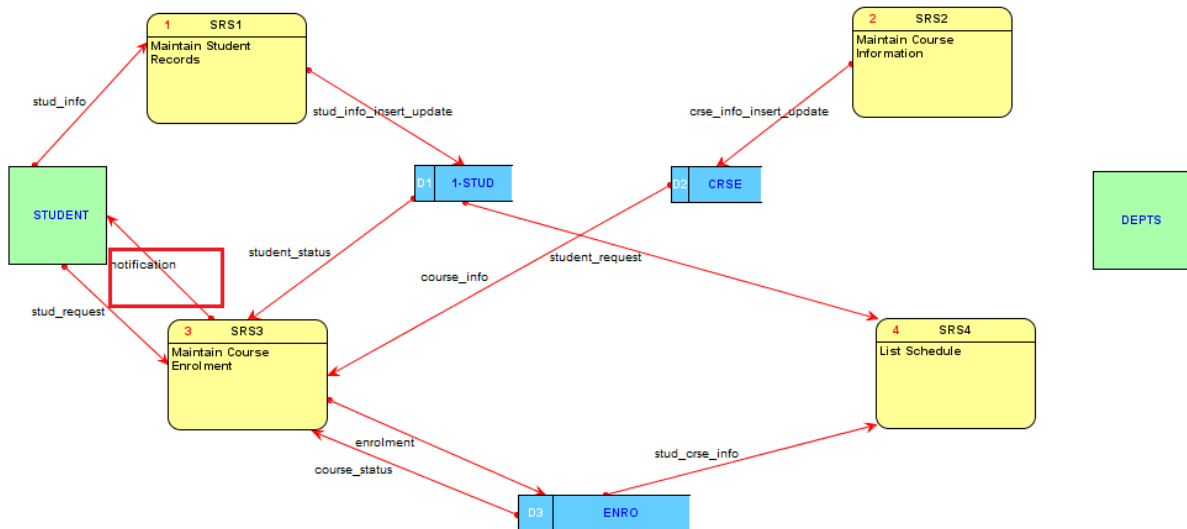
To enter the flow information. Highlight the flow then right click on flow and select properties


Flow's property will appear then enter

**Name:** notification

*(As you did in previous steps----we are not showing screen shot here)*

You will see flow between SRS3 process and STUDENT agent as follow:



Create another **Dataflow**, click on the **New flow** icon  from the toolbar and then drag it from the **SRS4** process to **STUDENT** agent.

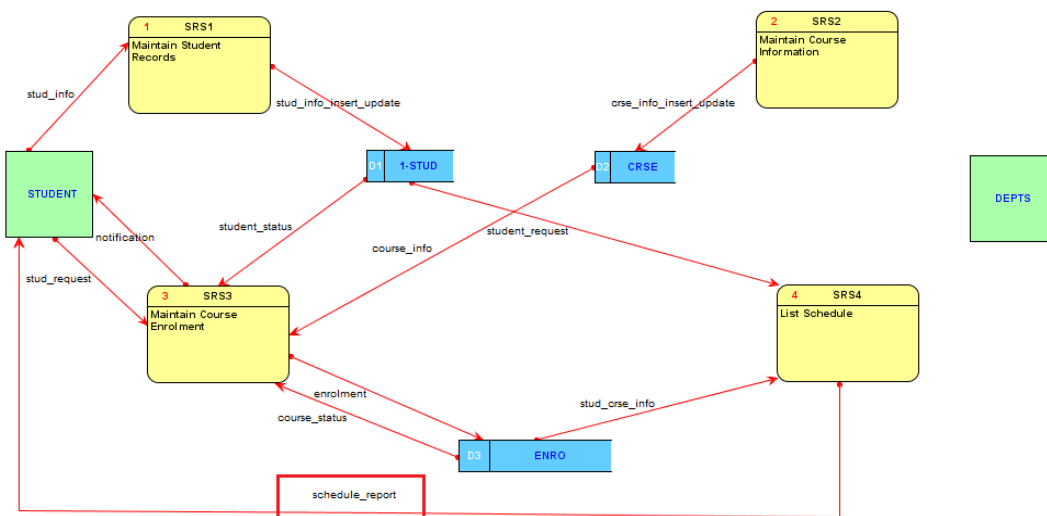
To enter the flow information. Highlight the flow then right click on flow and select properties  
Flow's property will appear then enter


**Name:** schedule\_report

*(As you did in previous steps----we are not showing screen shot here)*

Note: Right click on flow and select **Add Elbow** to move the flow according to requirements

You will see flow between SRS4 process and STUDENT agent as follow:



Now to create a **Dataflow**, click on the **New flow** icon  from the toolbar and then drag it from the **DEPTS** agent to **SRS2** process.

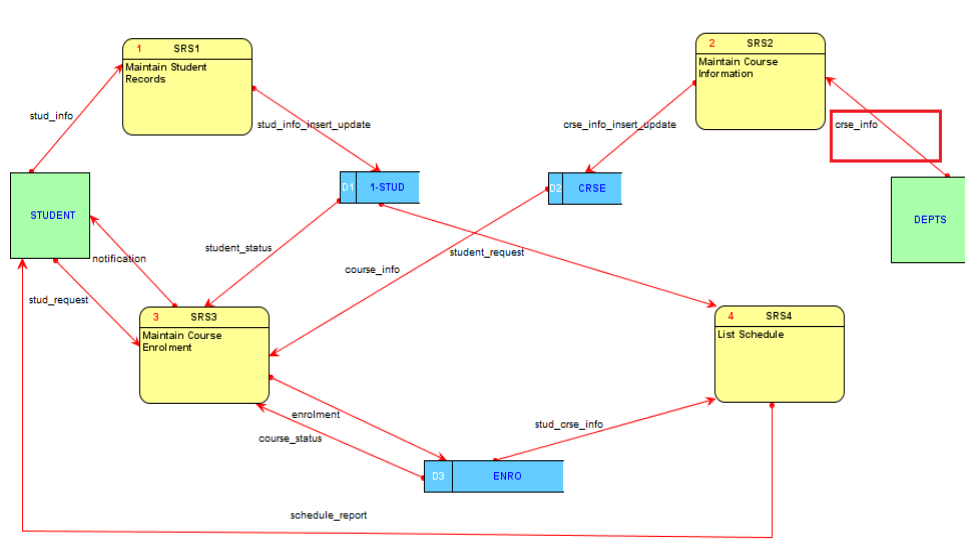
To enter the flow information. Highlight the flow then right click on flow and select properties


Flow's property will appear then enter

**Name:** crse\_info

*(As you did in previous steps----we are not showing screen shot here)*

You will see flow between DEPTS agent and SRS2 process as follow:



Now to create a **Dataflow**, click on the **New flow** icon  from the toolbar and then drag it from the **SRS2** process to **DEPTS** agent

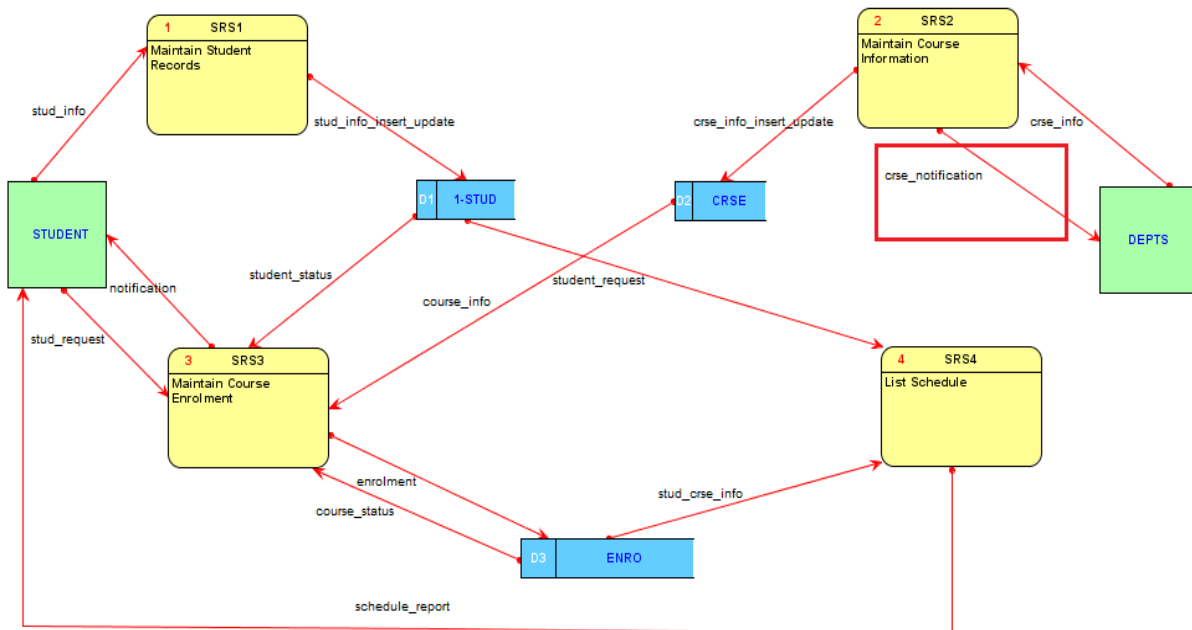
To enter the flow information. Highlight the flow then right click on flow and select properties

Flow's property will appear then enter

**Name:** crse\_notification

*(As you did in previous steps----we are not showing screen shot here)*

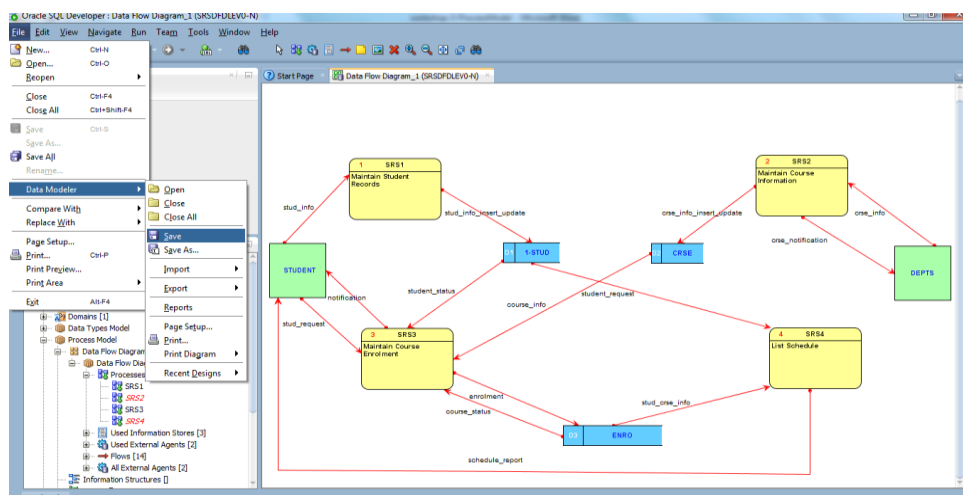
You will see flow between SRS2 process and DEPTS agent as follow:



Your dataflow diagram is now complete, and should look like the above.

Save the diagram: **File** -----> **Data Modeler** -----> **Save**

Save as **SRSDFDLEVO**



# Creating a Level 1 Data Flow Diagram

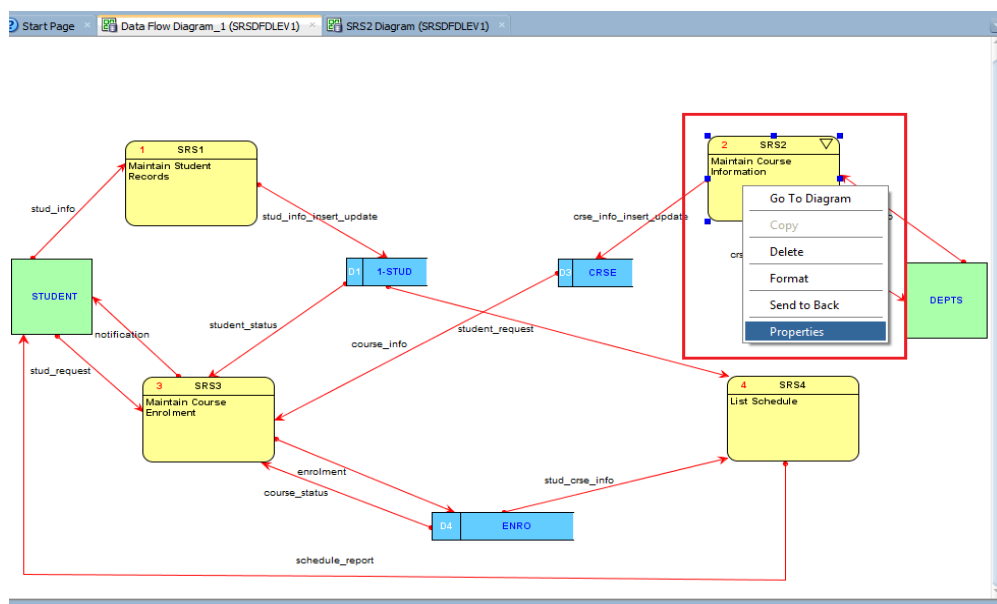
Having completed our level 0 diagram embedded within the context diagram, we will now attempt to create a level 1 diagram. Specifically, we will decompose one of the four functions (say, **SRS2 - Maintain Course Information**). Let us assume that maintaining course information involves:

- 1) Validating the course information sent by the departments by comparing this information with a valid course list; and
- 2) updating the list of courses to be offered with information pertinent to this particular course.

To create a level 1 diagram you will continue to use the level 0 diagram that we just created

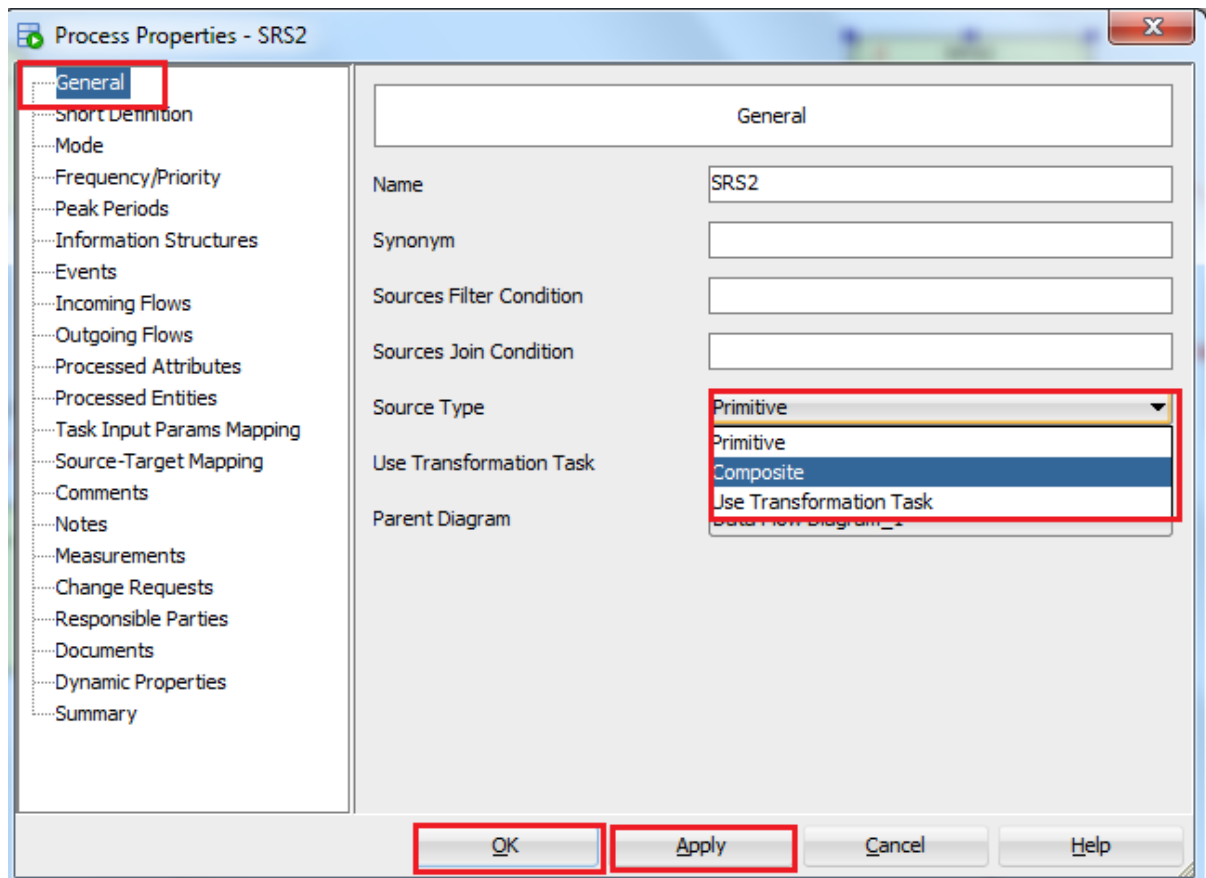
First, **Right click** on the Process on which we will construct a level 1 diagram by clicking on it. In this case it will be **SR2, Maintain Course Information**. Then select properties and change **Source type** Primitive to **Composite**

Click Apply then OK

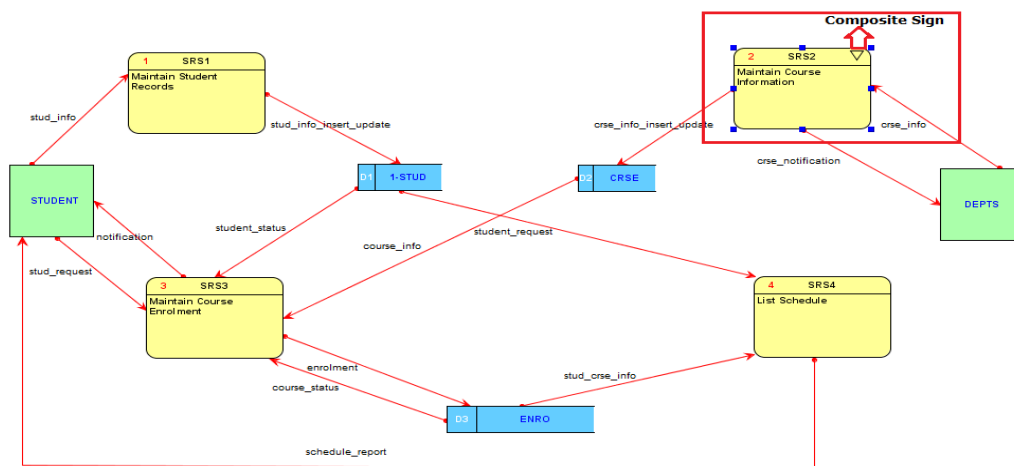


change **Source type** Primitive to **Composite**

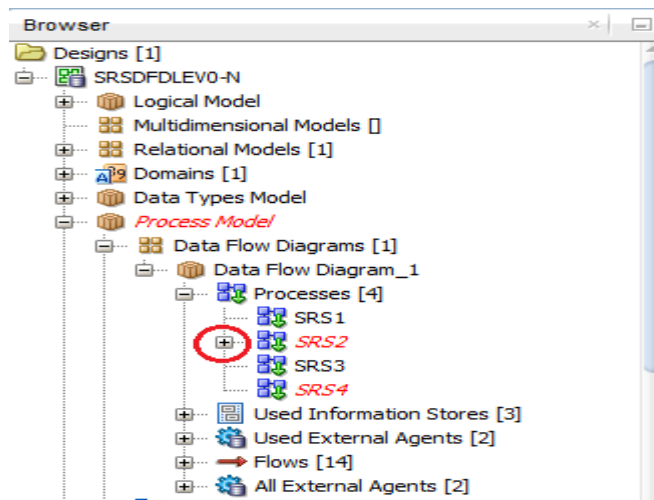
Click Apply then OK



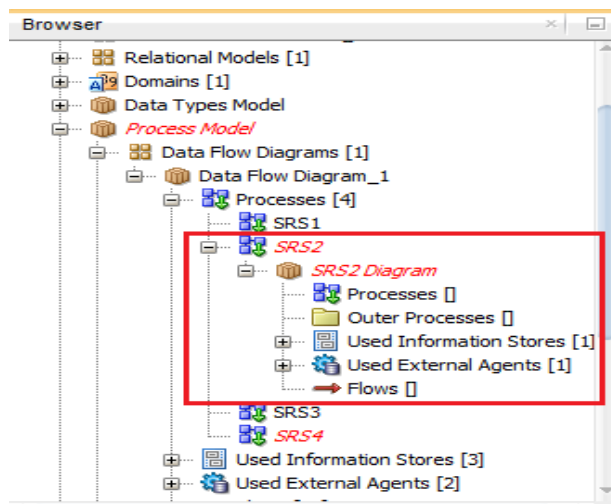
You will see added **Composite** symbol in **SRS2** process



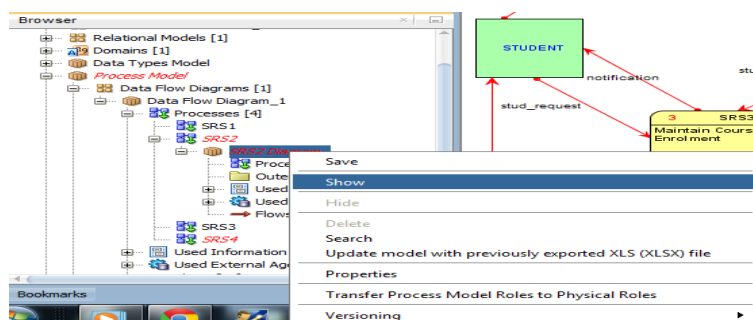
Expand the **SRS2** then **SRS2 Diagram** from Browser window



After Expanding



Right click on **SRS2 Diagram** and select **Show**





Now you will see **SRS2 process** diagram area , where you can add sub processes, agent and flows for **SRS2** process



We will now create our new process, **SRS2.1** under SRS2 Diagram

To create the New Process, click on the **New Process** icon  and then click on main working area.

Following **New Process** property will appear then enter

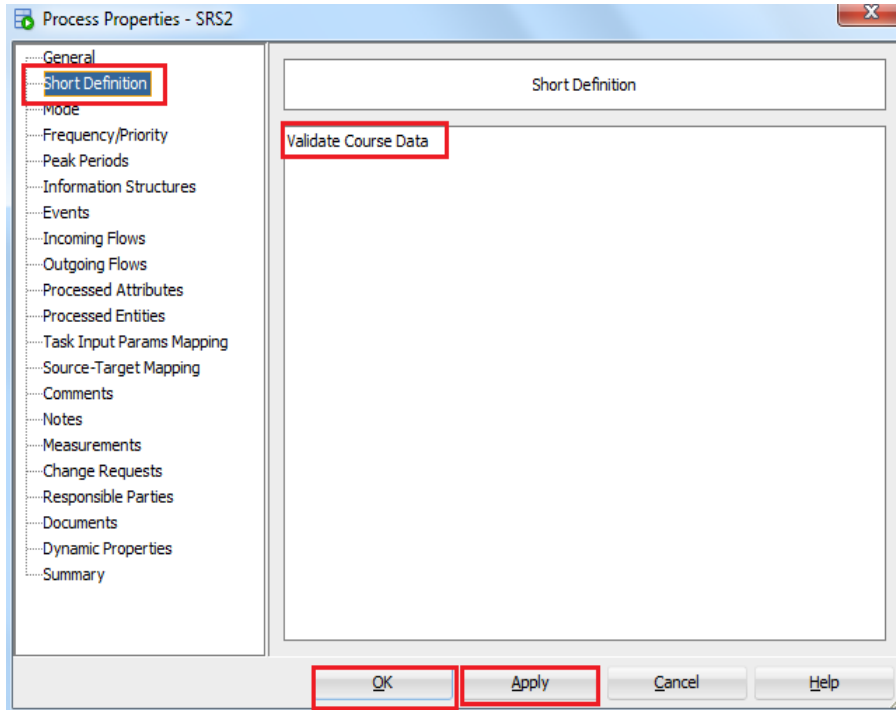
**Name :** SRS2

The screenshot shows the 'Process Properties - SRS2' dialog box. On the left is a tree view with 'General' selected and highlighted with a red box. The right pane shows the 'General' tab with the following fields: 'Name' (containing 'SRS2' and highlighted with a red box), 'Synonym', 'Sources Filter Condition', 'Sources Join Condition', 'Source Type' (set to 'Primitive'), 'Use Transformation Task', and 'Parent Diagram' (set to 'SRS2 Diagram'). At the bottom are 'OK', 'Apply', 'Cancel', and 'Help' buttons.

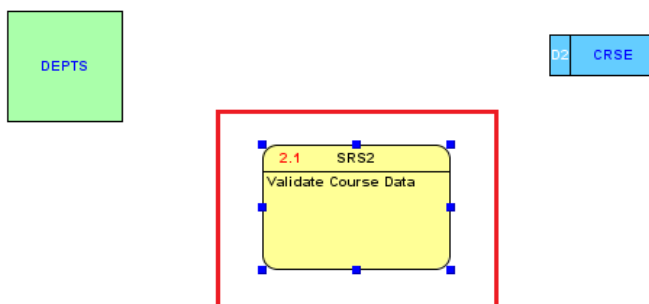
Select **Short Destination** tab from left side and Enter:

**Short Definition:** Validate Course Data

Click Apply then OK



You will see following output in SRS2 diagram area

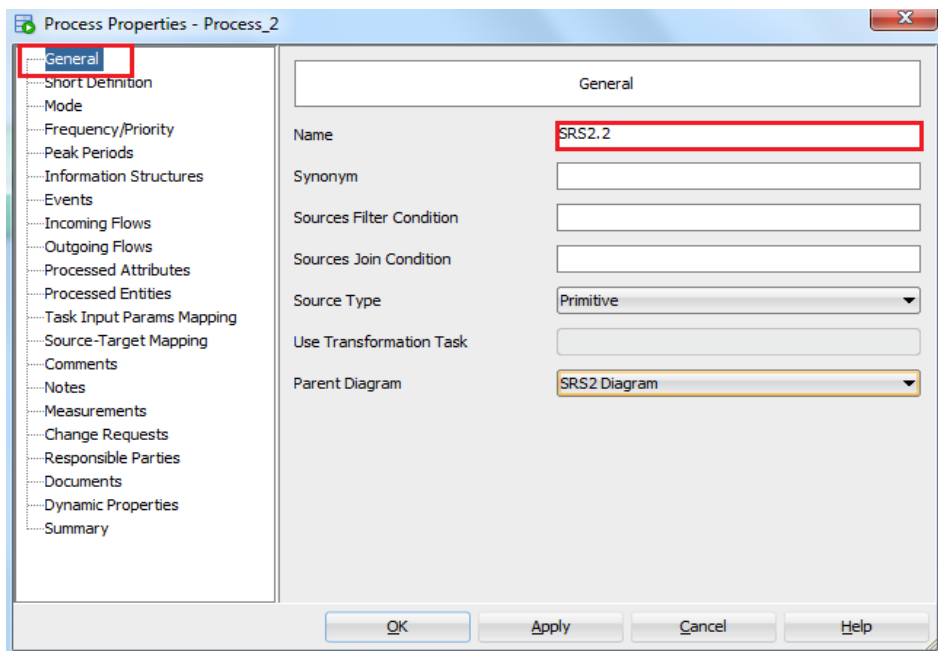


Create another process, **SRS2.2** under SRS2 Diagram

To create the New Process, click on the **New Process** icon  and then click on main working area.

Following **New Process** property will appear then enter

**Name** : SRS2.2

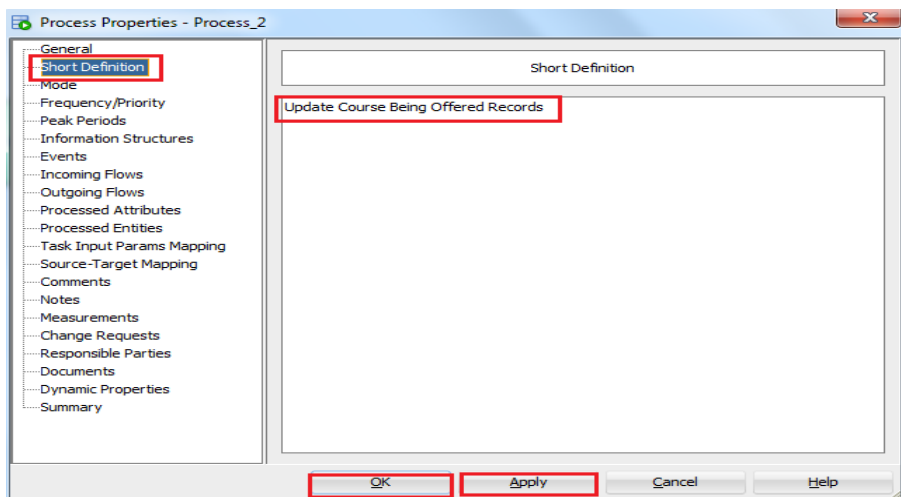


The screenshot shows the 'Process Properties - Process\_2' dialog box. The 'General' tab is selected in the left sidebar. The 'Name' field is set to 'SRS2.2'. The 'Parent Diagram' dropdown is set to 'SRS2 Diagram'. Other fields like 'Synonym', 'Sources Filter Condition', 'Sources Join Condition', 'Source Type' (set to 'Primitive'), and 'Use Transformation Task' are empty.

Select **Short Destination** tab from left side and Enter:

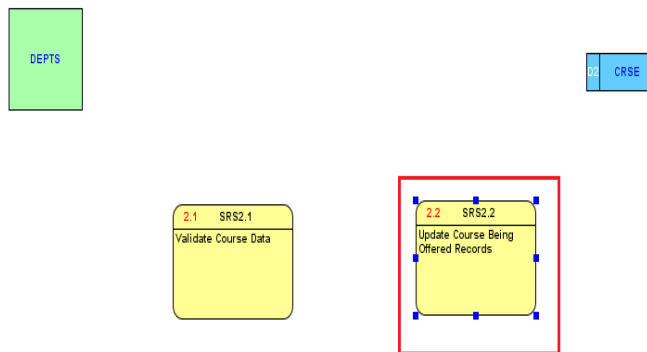
**Short Definition:** Update Course Being Offered Records

Click Apply then OK




The screenshot shows the 'Process Properties - Process\_2' dialog box with the 'Short Definition' tab selected. The 'Short Definition' field contains the text 'Update Course Being Offered Records'. The 'OK' and 'Apply' buttons are highlighted with red boxes.

You will see following output in SRS2 diagram area



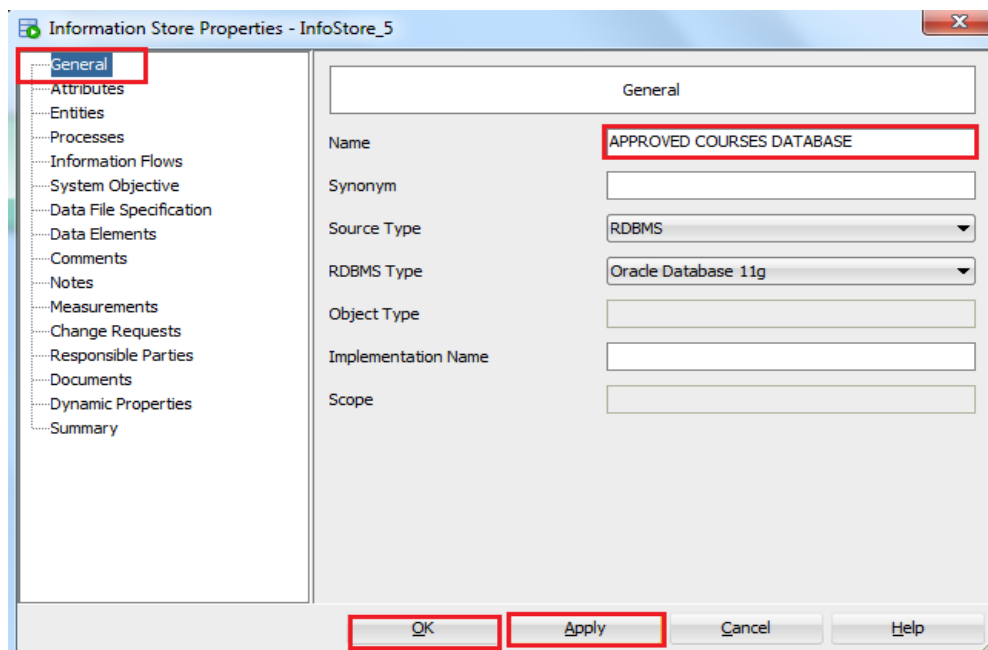
We will now create a information store within the **SRS2** diagram

To create **APPROVED COURSES DATABASE** information store ,click on New Information Store icon  and then click on main working area.

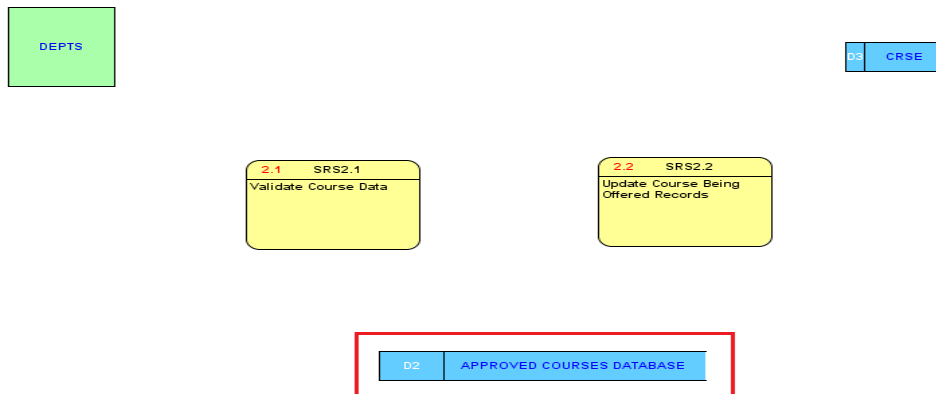
Following **New Information Store** property will appear then enter


**Name:** APPROVED COURSES DATABASE

Click Apply then OK



You will see newly created **APPROVED COURSES DATABASE** information store in main working area



Now to create a **Dataflow**, click on the **New flow** icon  from the toolbar and then drag it from the **SRS2.1** process to **SRS2.2** process

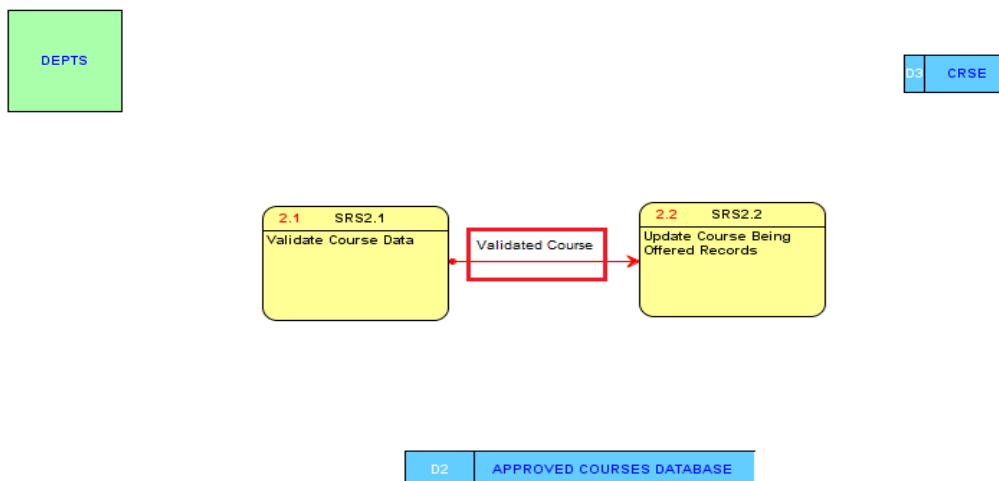
To enter the flow information. Highlight the flow then right click on flow and select properties


Flow's property will appear then enter

**Name:** Validated Course

*(As you did in previous steps----we are not showing screen shots here)*

You will see flow between SRS2.1 process and to SRS2.2 process as follow:



Create another **Dataflow**, click on the **New flow** icon  from the toolbar and then drag it from the **D2** information store to **SRS2.1** process

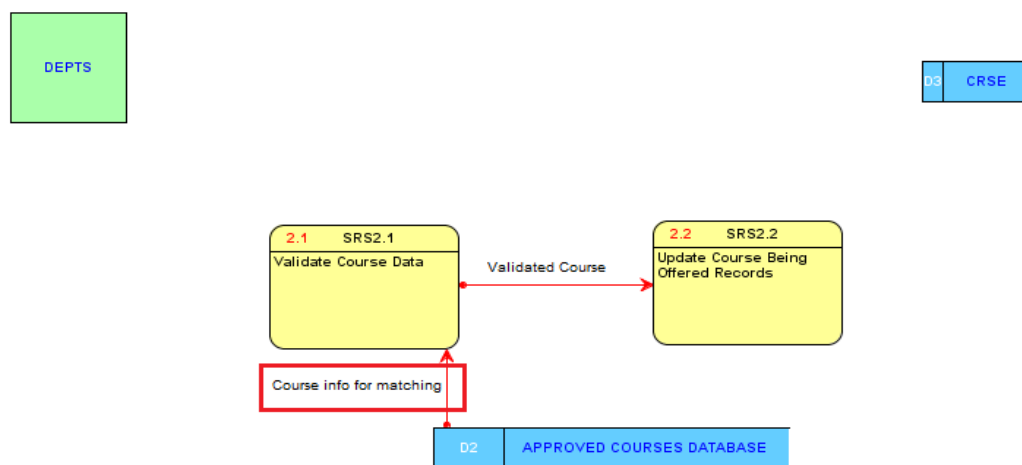
To enter the flow information. Highlight the flow then right click on flow and select properties

Flow's property will appear then enter


**Name:** Course info for matching

*(As you did in previous steps----we are not showing screen shots here)*

You will see flow between **D2** information store and **SRS2.1** process as follow:



Now we will make flow between **DEPT** agent and **SRS2.1** process and **SRS2.2** process to **CRSE** information store to complete our **level 1** diagram

Now to create a **Dataflow**, click on the **New flow** icon  from the toolbar and then drag it from the **DEPTs** Agent to **SRS2.1** process

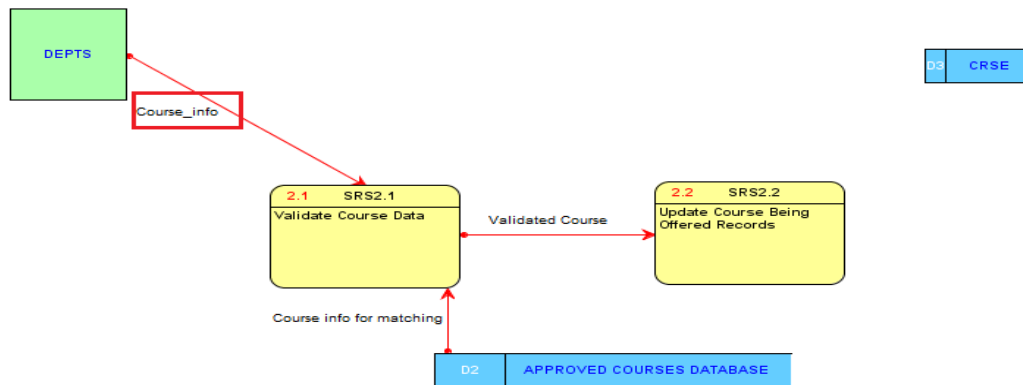
To enter the flow information. Highlight the flow then right click on flow and select properties


Flow's property will appear then enter

**Name:** Course\_info

*(As you did in previous steps----we are not showing screen shots here)*

You will see flow between **DEPTs** Agent and **SRS2.1** process as follow:



To create another **Dataflow**, click on the **New flow** icon  from the toolbar and then drag it from the **SRS2.1** process to **DEPTs** Agent

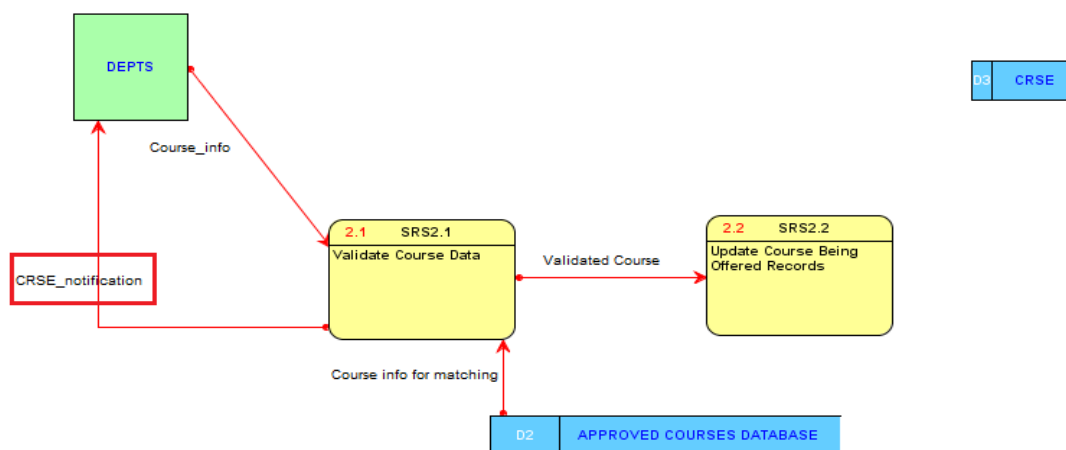
To enter the flow information. Highlight the flow then right click on flow and select properties


Flow's property will appear then enter

**Name:** CRSE\_notification

*(As you did in previous steps----we are not showing screen shots here)*

You will see flow between **DEPTs** Agent and **SRS2.1** process as follow:



To create another **Dataflow**, click on the **New flow** icon  from the toolbar and then drag it from the **SRS2.2** process to **D3** information store

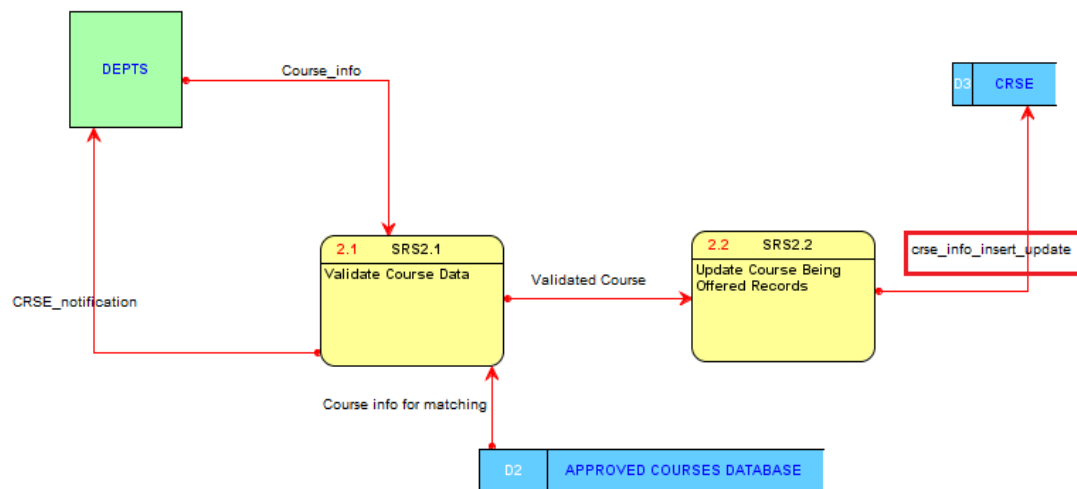
To enter the flow information. Highlight the flow then right click on flow and select properties

Flow's property will appear then enter

**Name:** crse\_info\_insert\_update

*(As you did in previous steps----we are not showing screen shots here)*

You will see flow between **SRS2.2** process and **D3** information store as follow:



Congratulation, we have created our **Level 1** diagram

Save the diagram as **SRSDFDLEV1**

