Career Development Planning System for Border Region

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1. Introduction

In the information economy today, companies are under constant pressure to cut their cost, to improve their delivery speed, quality and flexibility due to increased global competition. It considers knowledge systems and human capitals as the most important assets which play the critical roles to maintain the growth of the business. After analyzing the turnover and employment data, it has become clear that there is a career development issue at the public/private sectors in the border region. Without an effective career development planning system, company cannot offer training opportunity to its employee to improve the operational flexibility and tie the company goal with the personal loyalty of the employee together. This study intends to develop a career development planning system via state of arts model and applied to Human resource department at the public/private organization for career development planning. However, the career development planning system is highly complex due to a number of constrains such as training budgets, times and personal interests of career development.

In general, successful employees' career is a result of working for one company for many years and building upon experience and seniority. It is usually easier to move up the salary and promotional ladder at one company than to move and start at the bottom of the ladder at a new place of employment. When considering an internal move, the employee needs some measurable objectives to determine if the move is in his/her interest. In the meantime, the employer seeks the solution to provide affordable solution to help employee for their career moves including training and knowledge sharing.

Career development planning (CDP) system provides an array of technical knowledge and suggestions in the realm of an employee's desire to switch jobs internally, thereby promoting a healthy working environment for the employee. It is basically an in-

formation system designed specifically to promote necessary information while changing jobs internally. The greatest advantage with this system is that it develops a comparison study of the skills that the employee currently has and those that might be required for the new position that she/he is looking for. It enables an employee walk through the realm of changing job internally. Through the career development planning, especially cross-training, company can improve its operation flexibility. In addition, employee can seek internal opportunity through cross-training without seeking opportunities outside the company that leads to turnover. Thus the turnover rate can be reduced and the morality of the employee will be increased. In fact, today many global companies consider workforce cross-training as the key success factor to improve operational flexibility (see [**1-9**]). However, many employers in the border region encounter the difficulty of finding highly qualified applicants to vacant position while employee cannot find continues career development path within the company due to the lack of skills required by the higher level positions. The career development planning system in this study can provide solution to address these issues and help the company to plan the career development for its employee.

2. Research methodology and procedures

The career development planning system is highly complex and there are tangible and intangible benefit associated to its objectives. In this study, a new cross-training model is proposed as follows:

Definitions

j = employee index, (J is set of employee)
s = skill/courses index, (S is set of skill-type needed to be developed)
k = index for level of skill/course (e.g., $k = 1, 2$)
B_j = total budget allocated to employee j to develop some skill type in a level
B = total budget available for training
w_{sk} = weight given to skill s if performed at level k
A_{sk} = cost of training an employee to learn skill-type s at level k
t_s = minimum number of employee needed to have skill-type s
$x_{jsk} = 1$ if worker j is trained in skill s at level k, and 0 otherwise

$$
\begin{aligned}
Max \quad & \sum_j \sum_s \sum_k w_{sk} x_{jsk} \\
st. \quad & \sum_s \sum_k A_{jsk} x_{jsk} \le B_j, \quad \text{for all } j \\
& \sum_s \sum_k \sum_j A_{jsk} x_{jsk} \le B, \\
& \sum_s \sum_k x_{jsk} \le 1, \quad \text{for all } j \\
& \sum_j \sum_k x_{jsk} \ge t_s, \quad \text{for all } s
\end{aligned}
$$

The objective of the career development planning system is to achieve the quality of training in terms of the skills learned by the employee subject to the budget constrains. It is a NP-complete problem which is difficult to solve. Several efficient heuristics will be developed in this study based on the pivot interval approach and fast searching algorithm as follows:

HEURISTIC 1

Step 1: Training Sorting

Sort the trainings in descending order in set I based on their expected contribution P_i to compile

I^*. Set PM effectiveness $(PME) = 0$, and set $i = 1$.

Step 2: Total Training Required-Time Comparison

Select training i of set I^*. Compare the total required time of training i (TT_i) with the total time

available from all crafts (TC), if $TT_i < TC$, then go to Step 3; else go to Step 4.

Step 3: Individual Skill Required Time Comparison

Compare each training's required skill time with the related skill person's available time. If each of

them is satisfied, then compare two related skill persons' available time and reduce the available

time of the related-skilled person's time by subtracting the training required-skill time. Also, reduce

the total training available time by subtracting the total training required time, then go to Step 4; else, go

to Step 4.

Step 4: Updating

Set $PME = PME + P_i$. If $i =$ the total number of training in set I, then stop; else,

set $i = i + 1$, and go to Step 2.

HEURISTIC 2

The only difference between heuristic 2 and heuristic 1 is training sorting. We sort the trainings from the descending order of P_i / PM total required time for training i. The remaining steps are the same as the heuristic 1.

HEURISTIC 3

Step 1: Sort the training in descending order by their expected contributions;

Step 2: Choose workers as rows and skills as columns in a matrix;

Step 3: Assign each required skill hours to the cell of matrix with corresponding workers and skills;

Step 4: Repeat search from row $1,\ldots,n$ in column $1,\ldots,m$;

Step 5: Calculate the sum of required hours from total skills;

Step 6: If the sum equals to the total required hours, then select the course-combination; else, go back to

Step 3 until all searches are finished.

Step 7: Compute the residual resource ratio for every possible course-combination. The residual resource

ratio equals the sum of each training's remaining percentage of craft j if we schedule training i by possible course-combination m.

Step 8: Select the training with the maximum residual resource ratio. Then repeat step 2.

HEURISTIC 4

The only difference between heuristic 4 and heuristic 3 is training sorting. We sort the trainings from the descending order of P_i / PM total required time for training i. The remaining steps are the same as the heuristic 3.

3. Implementation

A web-based system will be built to accept the input such as budget constrains and set of skills/courses to provide decision support to HR manager on planning career development in terms of cross-training.

The design of this system begins with the administrator. Even before an employee can start using this application, it is the responsibility of the administrator to create and/or update all the information concerning a particular job. This information includes the skills required for each job designation along with the details of the company policies and norms. Implementing the proposed system reduces employee/manager labor, decreases human errors and increases flexibility.

The events that take place in the proposed CDP are listed as follows:

- Administrator logs into the system using his/her account information
- Administrator creates/updates employee's details.
- Administrator creates/updates the requirements for all jobs.
- Employee logs into the system using his/her access id and password.
- Employee searches for the desired job position.
- Employee refers to the current job skill set.
- Employee compares them to the skill set required for the new job.

The CDP system is designed and implemented via object-oriented approach and the design diagrams are described in Appendix.

4. Conclusion

Through the career development planning, especially cross-training, company can improve its operation flexibility. In addition, employee can seek internal opportunity through cross-training without seeking opportunities outside the company. Thus the turnover will be reduced and the morality of the employee will be increased. In fact, today many global companies consider workforce cross-training as the key success factor to improve operational flexibility. In fact, many employers encounter the difficulty of finding highly qualified application to vacant position while employee cannot find continues career development path within the company due to the lack of skills required by the higher level positions.

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Appendix

Event Table for Career Development Planning

Event Number	Event Description	System Input	Actor Providing Input	System Output	Actor Receiving Output
1.	Administrator logs into the system.	Administrator's login details.	Administrator	Administrator's home page.	Administrator
2.	Administrator creates/updates employee details.	Employee Details	Administrator	Employee Details are added/updated.	Administrator
3.	Administrator creates/updates requirements for each job position.	Company specified information	Employee	Job requirements are created/updated.	Administrator
4.	Employee logs into the system.	Employee Login Details	Administrator	Employee is directed to his home page.	Employee

5.	Employee searches for the desired job position.	Information uploaded by the administrator.	Employee	Available job positions are shown up.	Employee
6.	Employee refers to the skill set of the current job position.	Information uploaded by the administrator.	Administrator	Skill set concerning his current job is shown.	Employee
7.	Employee looks up for the requirements of the new job position.	Information uploaded by the administrator.	Administrator	Requirements are listed to the employee.	Employee
8.	Employee compares them and analyzes.	Information uploaded by the administrator.	Administrator	A comparison chart showing various skills set.	Employee

Use Case Diagram for the system

A. List of Use Cases:

1. Login

2. Create Skill set

3. Create Jobs

4. Edit Jobs

5. Select Current Job.

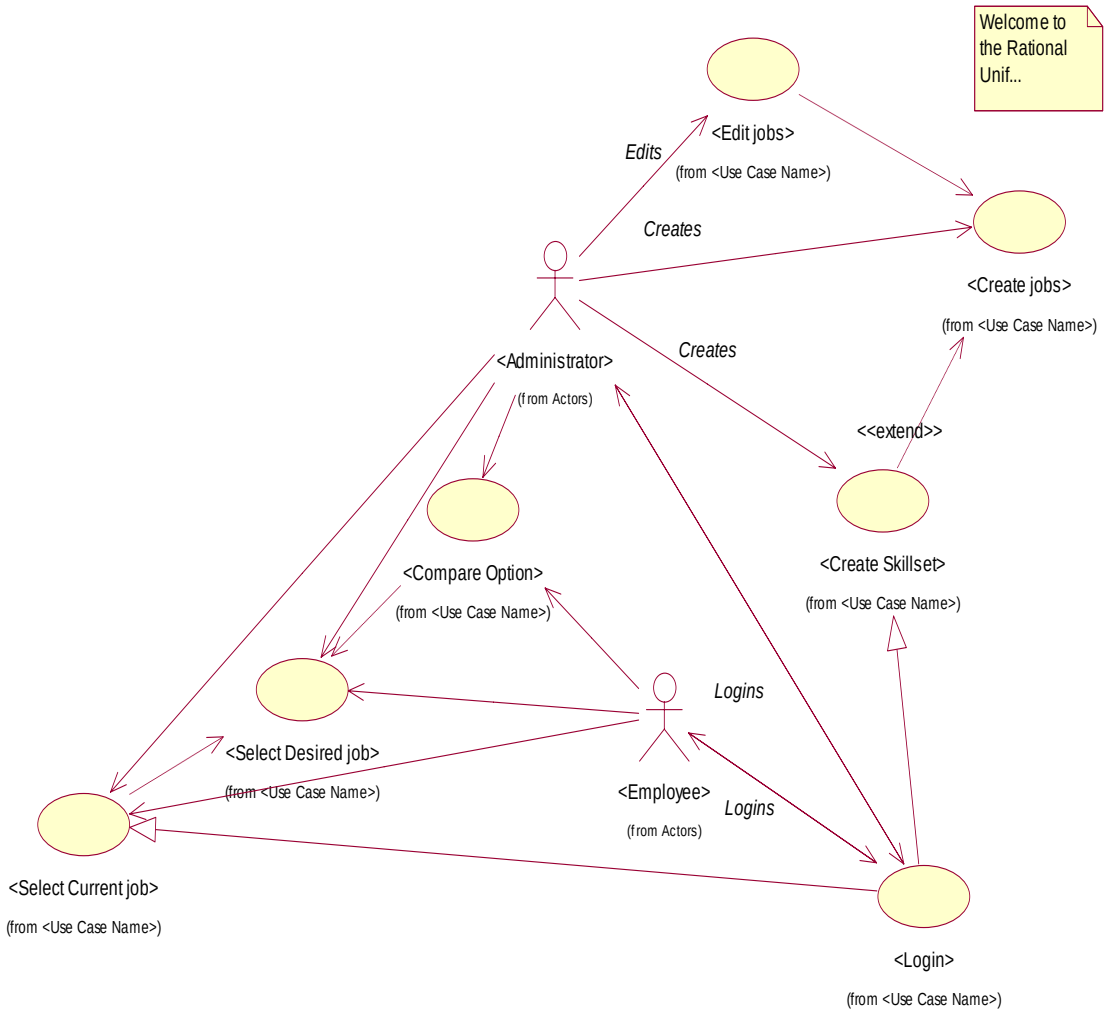
6. Select Desired Job.

7. Compare options

B. List of Actors:

1. Employee
2. Administrator

C. **Use Case Diagram**



Use Case narratives to each business events

1.Use Case	Login
Actor:	Employee, Administrator
Purpose:	To login into the system, the CDP system.
Overview:	Employee and the Administrator enter into the CDP using this use case, they need to have a username and a password to enter into the system.
Type:	Essential.
Precondition:	Employee and Administrator should be in the company and must have a valid username and password.
Post condition:	Employee and the Administrator logs into the CDP system
Special Requirements	Employee must get the system response within 30 seconds.
Actor Action	**System Response**
1.This use case begins when employee and the Administarator wants to log into the system to perform the tasks.	
2. Employee and the Administrator enters the username and the password and logs into the system	3.System after the login allows the Employee and the Administrator to do their tasks.
Alternative Events:	
Line 2: If employee and the administrator details already exists, system inform the employee, go to step 2 or if employee types in wrong ID, system informs the employee that details are not available, go to login	

2.Use Case	Create Skills sets
Actor:	Administrator
Purpose:	To create a skill set for a job and for a resource unit.
Overview:	The Administrator enters into the CDP system after the login, and he has a option and authority of creating new skills sets, using the skills for a particular job in a resource unit in the organization.
Type:	Essential.
Precondition:	The Administrator must be logged in the system with valid id and password and must create a new skill set.
Post condition:	Creates the skill sets using all the skills and the weight age for the job position.
Special Requirements	The weight age of the skills must be total of 100, and the skill must be created within 30 seconds
Flow of Events:	
Actor Action	**System Response**
1. The use case begins when the administrator logs into the system with valid username and password.	
2. Administrator creates a new skills sets assigns it a skill set id and allows the administrator to create a job later on, after he creates a skill set id.	3. System allows the administrator to create new skill sets with all the available skills with the choices too.
Alternative flow of event:	
Line 2: If the skills already exist then, create another skill set.	

3. Use Case	Create Jobs
Actor:	Administrator
Purpose:	To create new job from new skill sets.
Overview:	Administrator can create new jobs with new skills sets or with already created skill sets with the skill set id's and the RU id's.
Type:	Essential.
Precondition:	Administrator should create a skill set
Post condition:	The job must be created with a job id in a RU with a RU id
Special Requirements	Skill set must be created.
Flow of Events:	
Actor Action	**System Response**
1. The use case begins when the administrator wants to create jobs with the skill sets existed.	
2. Administrator after viewing the skill sets looks to create new jobs.	3. System gives a choice of skill sets to the administrator to create the new job.
4. Administrator chooses the required skill sets and creates the jobs.	5. The system saves new created job on to the system.
Alternative Events:	
Line 2: If the job exists with the same skill sets, create a new job.	

4. Use Case	Edit jobs
Actor:	Administrator
Purpose:	To edit the current job with new job from skill sets.
Overview:	Administrator can edit existing jobs with with already created skill sets with the skill set ids and the RU ids.
Type:	Essential.
Precondition:	The job must be already existing which is created by the administrator.
Post condition:	The job must be edited which is already created by the details and descriptions.
Special Requirements	Skill set must be created.
Flow of Events:	
Actor Action	**System Response**
1. The use case begins when the administrator wants to edit already existing jobs.	
2. Administrator after looking at the skill sets and job description he edits the job.	3. System gives a choice of skill sets to the administrator to edit the existing job.
4. Administrator chooses the required skill sets and edits the jobs.	5. The system saves new edited job on to the system.
Alternative Events:	
Line 2: If the job already exists with the new skill sets, edit the job.	

5. Use Case	Select current job.
Actor:	Employee, Administrator
Purpose:	To select the current job with new job from skill sets.
Overview:	Employee can select current job with already created skill sets with the skill set ids and the RU ids.
Type:	Essential.
Precondition:	The job must already exist, and the job family role and bands must be exist.
Post condition:	The employee should select desired job based on the current job which he is currently in.
Special Requirements	Skill set must be created.
Flow of Events:	
Actor Action	**System Response**
1. The use case begins when the employee wants to select current job.	
2. Employee selects the current job.	3. System gives a choice of jobs to the employee to select the current job he is in.
Alternative Events:	
Line 2: If the job already exists with the new skill sets, edit the job.	

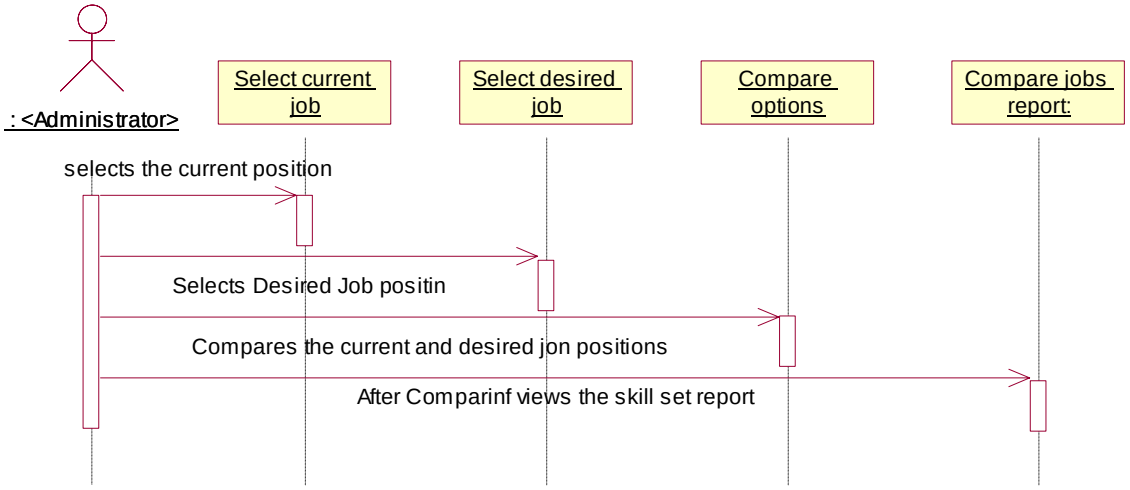
6. Use Case	Select desired job.
Actor:	Employee, Administrator
Purpose:	To select the desired job.
Overview:	Employee can select desired job with already created skill sets with the skill set ids and the RU ids.
Type:	Essential.
Precondition:	The job must already exist, and the job family role and bands must be exist.
Post condition:	The employee must compare the current job he is in with the desired position he wants to acquire.
Special Requirements	Skill set must be created.
Flow of Events:	
Actor Action	**System Response**
1. The use case begins when the employee wants to get into the desired position.	
2. Employee selects the desired job.	3. System gives a choice of jobs to the employee to select the desired job he wants to acquire.
Alternative Events:	
Line 2: If the job already exists with the new skill sets, edit the job.	

7. Use Case	Compare options.
Actor:	Employee, Administrator
Purpose:	To compare the current position with the desired Position.
Overview:	Employee can compare the current job with the Desired job with already created skill sets with the skill set ids and the RU ids.
Type:	Essential.

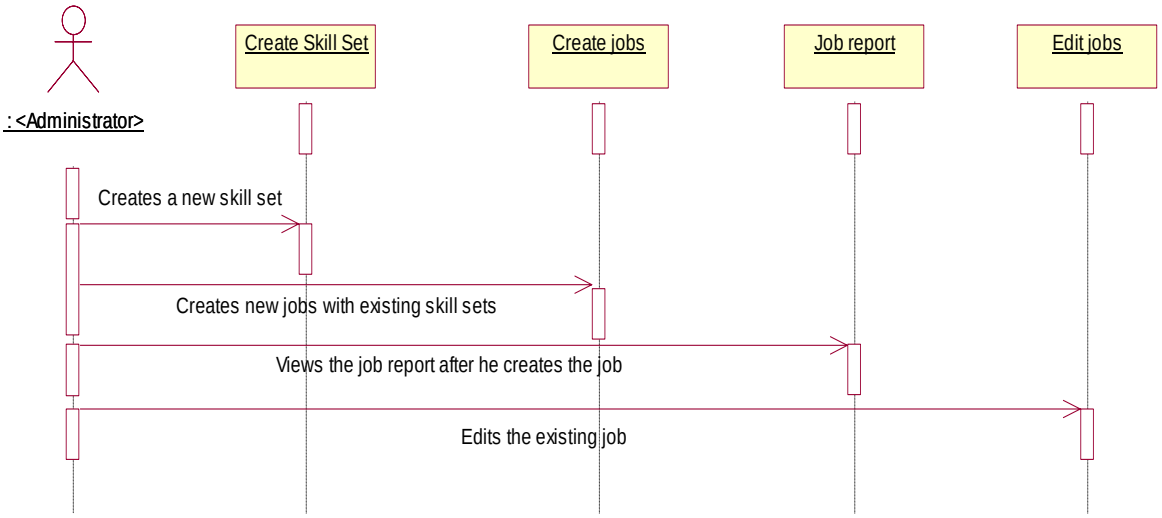
Precondition:	The current job and desired job must be selected And the skillsets must be existing.
Post condition:	It gives a detailed job report.
Special Requirements	Skill set must be created.
Flow of Events:	
Actor Action	**System Response**
1. The use case begins when the employee compares current position with the desired position.	2. The system gives a detailed job report summary for the positions being compared.
Alternative Events:	
Line 2: If the job already exists with the new skill sets, edit the job.	

System sequence diagrams for each use case

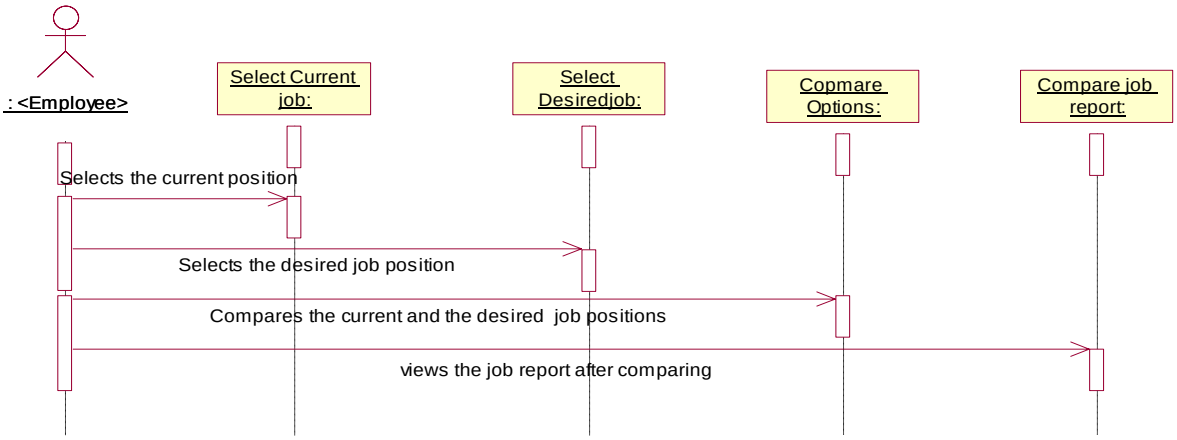
1. **Sequence diagram for the administrator in selecting current job, selecting desired job and comparing them :**



2. **Sequence Diagram for Create skill set, create jobs, edit jobs:**

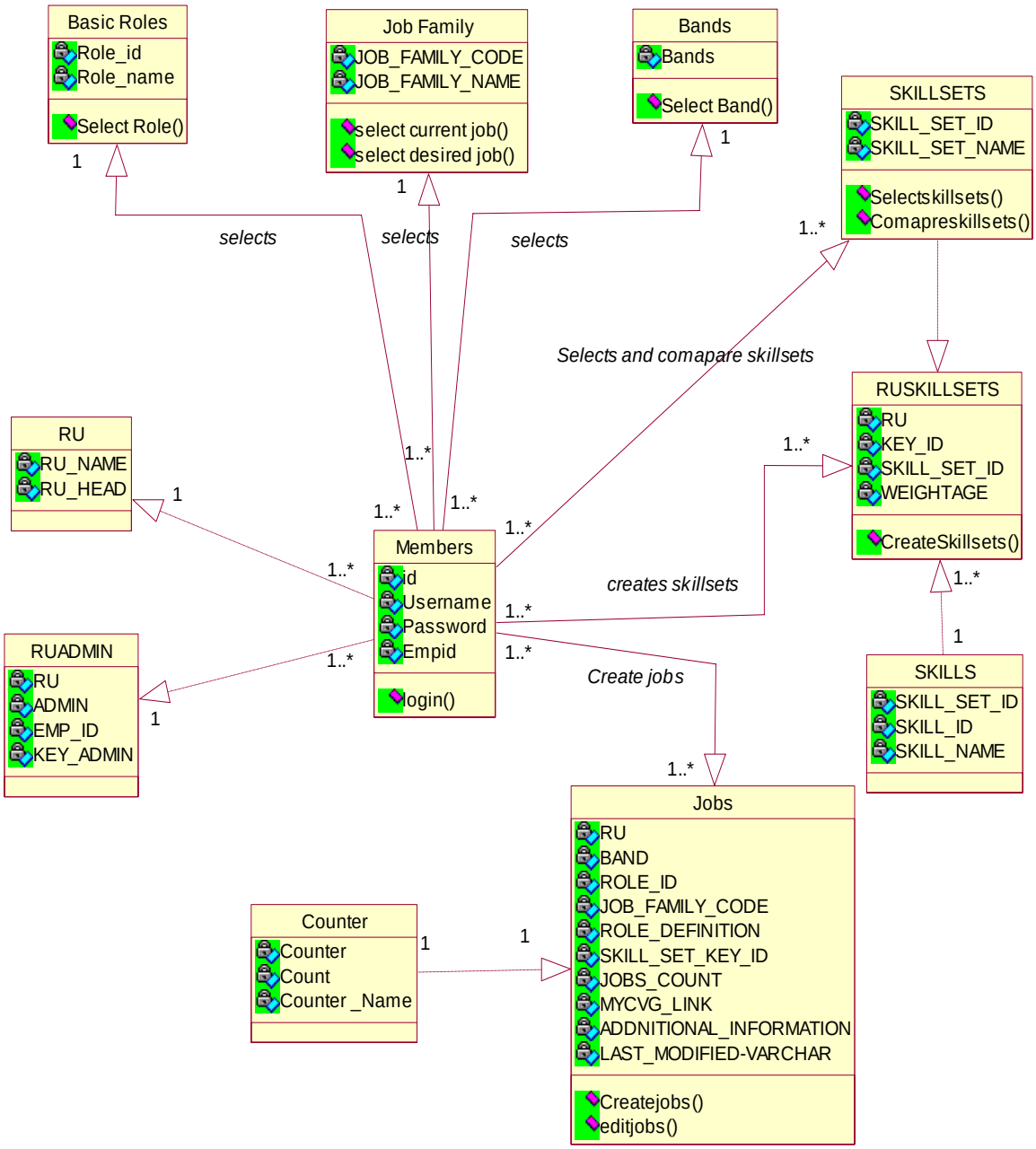


3. **Sequence diagram for the employee in selecting current job position, desired job position and comparing the options:**



Domain Model

A domain model showing the concepts, attributes, and associations in the problem domain of the system is done in the Analysis Phase.



Contracts for each system operation:

Use Case:	Login
Contract Name:	Enter Search Criteria(Employee ID)
Responsibilities:	Check for the availability of employee

Type:	System
Exceptions:	Employee ID does not exist
Output:	No employee
Preconditions:	Employee and the Administrator should have a valid id and password.
Post conditions:	Employee and the Administrator logs into the CDP system

Use Case:	Create skill sets
Contract Name:	Administrator
Responsibilities:	Check for the availability of Administrator
Type:	System
Exceptions:	No Skill set exist.
Output:	No Skill set.
Preconditions:	The Administrator must be logged in the system with valid id and password and must create a new skill set.
Post conditions:	Creates the skill sets using all the skills and the weight age for the job position

Use Case:	Create jobs
Contract Name:	Administrator
Responsibilities:	Check for the availability of Administrator
Type:	System
Exceptions:	No job exists
Output:	No Skill set and no new job created.
Preconditions:	Administrator should create a skill set.
Post conditions:	The job must be created with a job id in a RU with a RU id

Use Case:	Edit jobs
Contract Name:	Administrator
Responsibilities:	Check for the availability of Administrator
Type:	System
Exceptions:	No job exists
Output:	No job created.
Preconditions:	Administrator should create a job
Post conditions:	The job must be edited which is already created by the details and descriptions

Use Case:	Select current job
Contract Name:	Employee, Administrator
Responsibilities:	Check for the availability of jobs families, roles and bands.
Type:	System
Exceptions:	No position exists.
Output:	No position created.
Preconditions:	The job must already exist, and the job family role and bands must be existing.
Post conditions:	The employee should select desired job based on the current job which he is currently in.

Use Case:	Select desired job
Contract Name:	Employee, Administrator
Responsibilities:	Check for the availability of jobs families, roles and bands.
Type:	System
Exceptions:	No position exists.

Output:	No position created.
Preconditions:	The job must already exist, and the job family role and bands must be exist.
Post conditions:	The employee must compare the current job he is in with the desired position he wants to acquire.

Use Case:	Select desired job
Contract Name:	Employee, Administrator
Responsibilities:	Check for the availability of jobs families, roles and bands.
Type:	System
Exceptions:	No position exists.
Output:	No position created.
Preconditions:	The current job and desired job must be selected and the skill sets must be existing
Post conditions:	It gives a detailed job report