SCICOMP201 Database Management

Project 1-Databases for a Mars Habitat

Joanikij Chulev

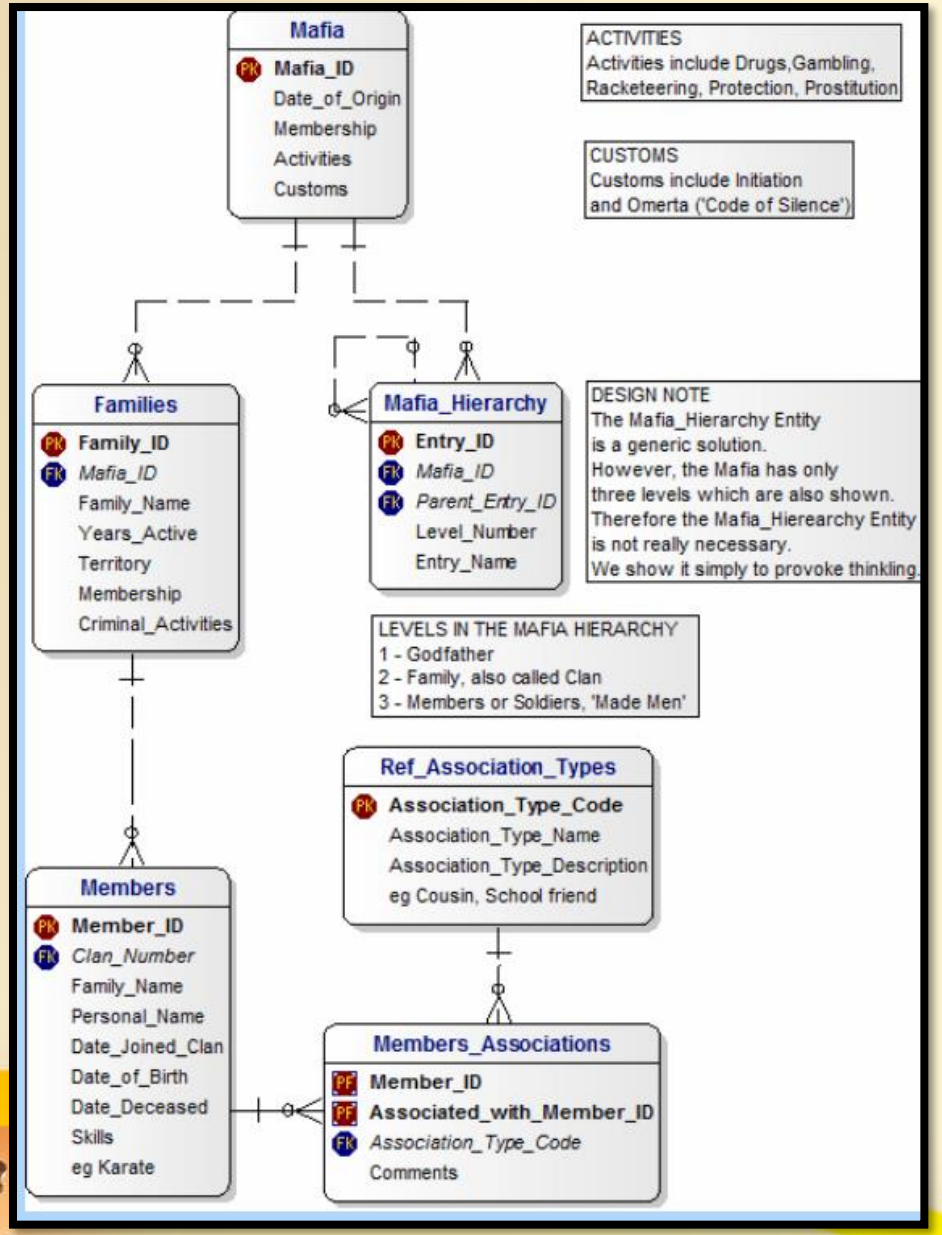
What is a DB Schema?

- A database schema **defines how data is organized within a relational database (definition by IBM).**

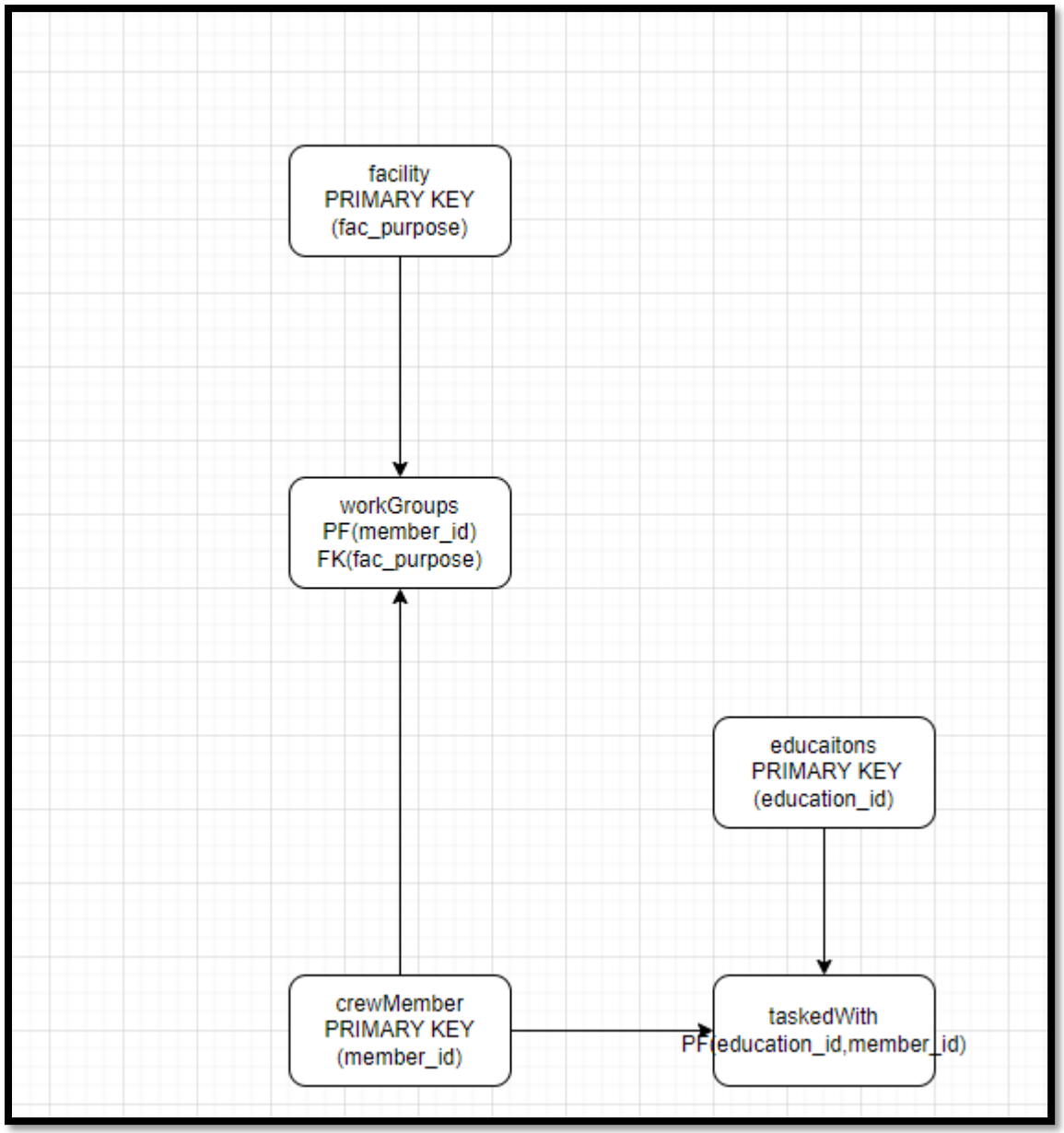
- **There are basically infinite schema models that you can create.**
- ***_Data generation has been used and implemented manually FROM https://generatedata.com/..._**

SCHEMA 1

-
- Data Model for Mafia Organized Crime.
- In this schema there is an organized crime list with affiliations to families and to mafias.
- I contrasted this to create a scheme where the crew is affiliated with their job on the mars project.
- In my database there are groups and defined facilities for each work type.



Database Schema Diagram



Snapshots

education_id	education
1	Chemistry
2	Physics
3	Ecology
4	Medicine
5	Robotics
6	General
7	Maths
8	Astronomy
9	IT
10	Managment

education_id	member_id	task
1	2	Research
1	15	Research
2	4	Research
3	1	Indoor Ecosystem control
3	3	Outdoor Ecosystem Evaluatoin
3	9	Outdoor Ecosystem Evaluatoin
3	12	Indoor Ecosystem control
4	6	Crew Health
4	7	Crew Health
4	11	Crew Health
5	13	Rover Maintnance
5	16	Rover Maintnance
6	17	Help
6	18	Help
7	5	Research
8	8	Research
8	10	Research
9	14	System Maintnance
9	19	System Maintnance
10	20	Team Managment

member_id	name	country	novice_astronaut	age
1	Chantale	Philippines	Yes	41
2	Josephine	China	No	55
3	Nigel	Belgium	No	63
4	Candace	Turkey	No	65
5	Emery	Ukraine	No	40
6	Leilani	Canada	Yes	64
7	Prescott	Russian Federation	No	66
8	Berk	Nigeria	No	22
9	Emi	New Zealand	Yes	48
10	Hashim	Norway	No	23
11	Courtney	Russian Federation	No	27
12	Reece	Sweden	No	25
13	Aphrodite	Spain	Yes	29
14	Alma	Vietnam	Yes	27
15	Miranda	Spain	No	33
16	Christopher	Australia	No	36
17	Kelly	Sweden	Yes	23
18	Lucian	Ukraine	No	37
19	Evan	Italy	No	34
20	Chastity	Australia	No	60

group_id	member_id	fac_purpose
3	3	Research Centre 2
2	4	Research Centre 1
2	5	Research Centre 1
1	6	Hospital
1	7	Hospital
4	8	Research Centre 3
3	9	Research Centre 2
4	10	Research Centre 3
1	11	Hospital
2	12	Research Centre 1
5	13	System Mainframe
5	14	System Mainframe
2	15	Research Centre 1
5	16	System Mainframe
5	19	System Mainframe

facility_whereabouts	distance_to_base	fac_purpose
1	0	Hospital
1	0	Living Space 1
1	0	Living Space 2
1	0	Research Centre 1
2	6	Research Centre 2
2	10	Research Centre 3
2	1	Rover Storage
2	12	Storage Unit 1
2	15	Storage Unit 2
1	0	System Mainframe

Examples

- /*The Computer scientist hasn't seen his crew in a week working on the system software, and he forgot who the youngest doctor was! This is the query */

SELECT group_id,age,name FROM workGroups NATURAL JOIN crewmember WHERE fac_purpose='Hospital' AND age<30;

```
134    /*The Computer scientsit hasnt seen his crew in a week working on the system software, and he forgot who the youngest doctor was!
135    This is the query */
136 •  SELECT group_id,age,name FROM workGroups NATURAL JOIN crewmember WHERE fac_purpose='Hospital' AND age<30;
```

Result Grid | Filter Rows: | Export: | Wrap Cell Content:

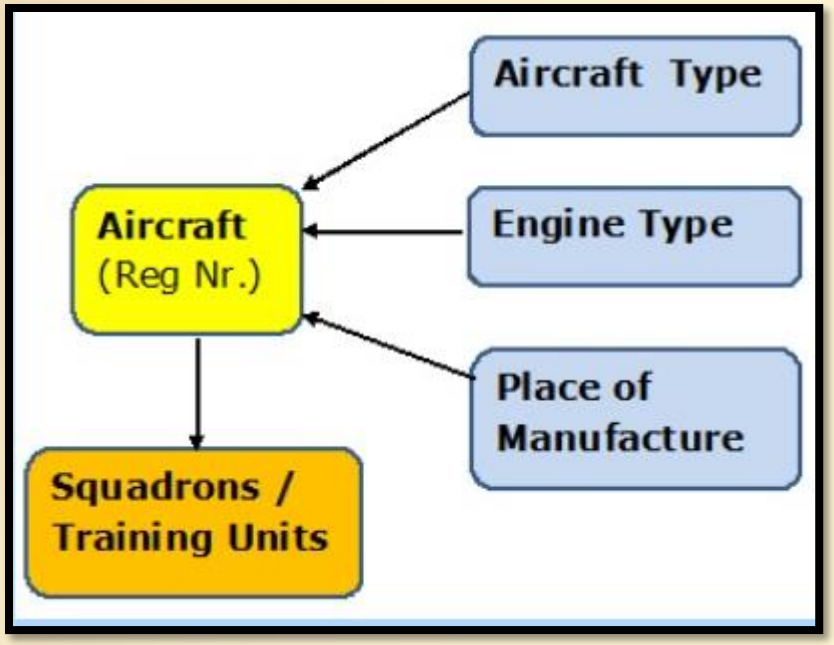
group_id	age	name
1	27	Courtney

SCHEMA 2

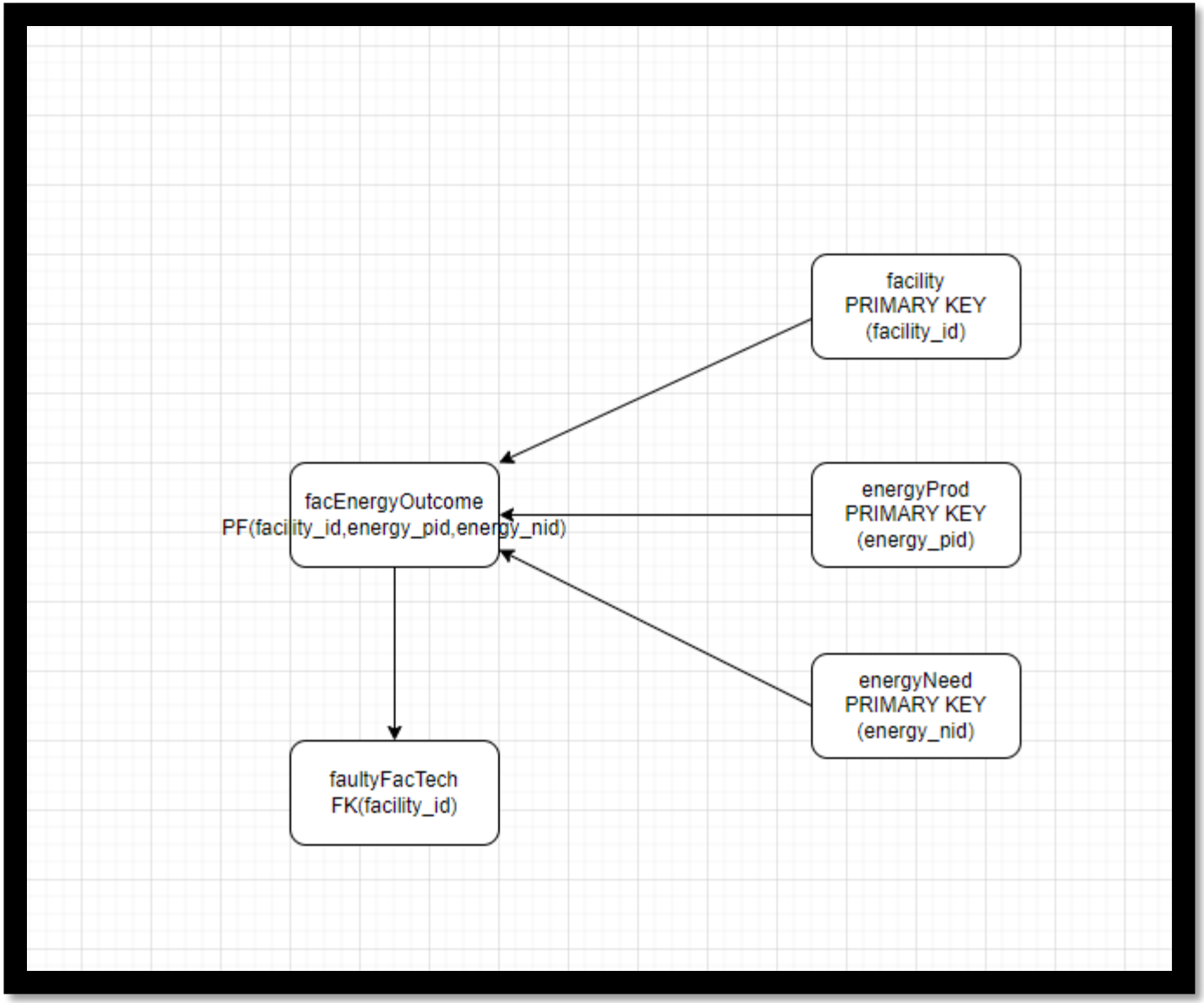
- Data Model for Aircraft from WW2.
- Steps in the Approach/How the Model works!

- Step 1. Identify the 'Things of Interest' within Scope of the Data Model.
- Step 2. Determine how they are related.
- Step 3. Establish what else we know about them.
- Step 4. Look for occurrences of Design Patterns.

- THE MARS SCHEMA SHOWS THE ENERGY DB.



Database Schema Diagram



Snapshots

facility_id	facility_whereabouts	distance_to_base	fac_purpose
1	2	12	Storage Unit 1
2	1	0	Resarch Centre 1
3	1	0	Living Space 1
4	2	1	Rover Storage
5	1	0	Hospital
6	1	0	System Mainframe
7	2	15	Storage Unit 2
8	2	6	Resarch Centre 2
9	2	10	Research Centre 3
10	1	0	Living Space 2

energy_pid	energy_amount	energy_type
1	17	Nuclear
2	7	Nuclear
3	1	Wind
4	13	Nuclear
5	20	Nuclear
6	0	Wind
7	2	Wind
8	17	Nuclear
9	20	Nuclear
10	2	Solar

energy_nid	energy_need
1	8
2	11
3	11
4	1
5	5
6	7
7	10
8	8
9	7
10	11

facility_id	energy_pid	energy_nid
3	1	2
1	2	9
4	3	6
2	4	3
5	5	4
7	6	1
10	7	5
6	8	10
9	9	8
8	10	7

facility_id
4
7
10
8

Examples

- /*The chemist wants to know which facilities need >10% of the total energy to fucntion!*/
- SELECT DISTINCT facility_id FROM facenergyoutcome NATURAL JOIN energyneed WHERE energy_need>10;

```
87        /*The chemist wants to know which facilities need >10% of the total energy to fucntion!*/
88 •      SELECT DISTINCT facility_id FROM facenergyoutcome NATURAL JOIN energyneed WHERE energy_need>10;
```

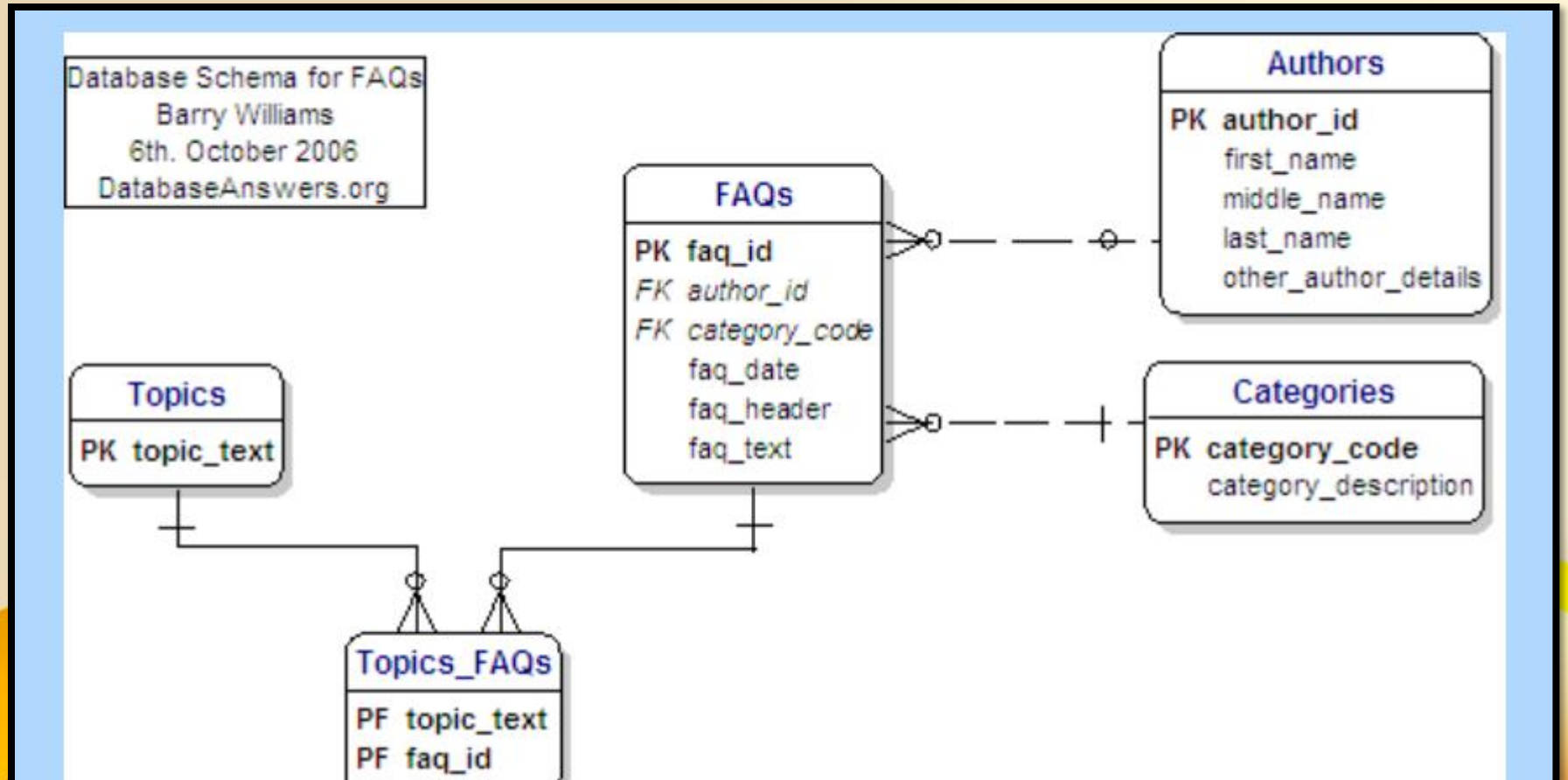
esult Grid | Filter Rows: | Export: | Wrap Cell Content:

facility_id
3
2
6

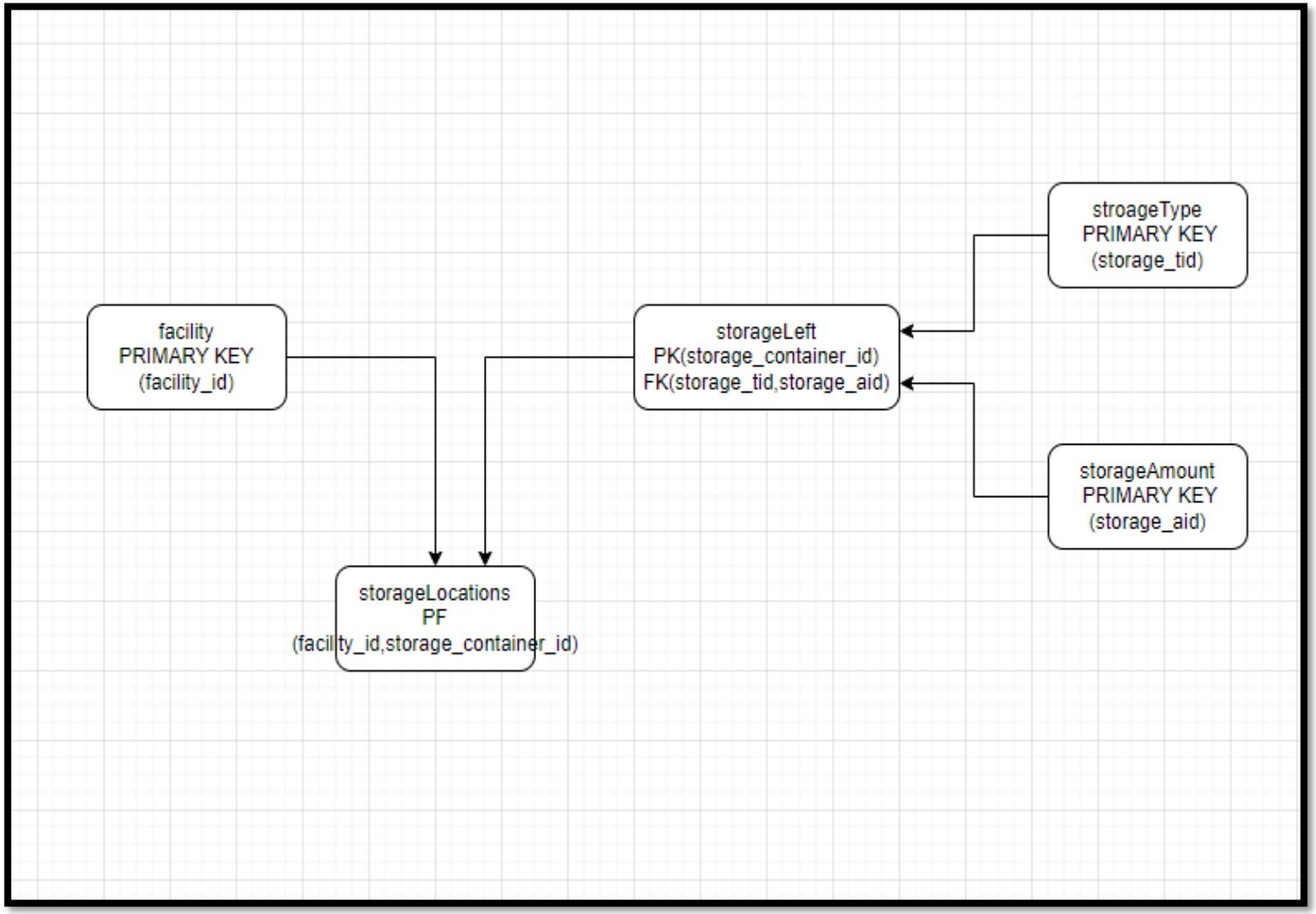
SCHEMA 3

- A model for FAQ.

- THE MARS SCHEMA SHOWS THE STORAGE AND RESOURCES DB.



Database Schema Diagram



Snapshots

storage_tid	storage_type
1	Fuel
2	Food
3	Hardware Parts
4	Fuel
5	Substances
6	Water
7	Water
8	Research Tools
9	General Storage
10	Biomedical Storage

storage_aid	storage_amount
1	5
2	3
3	1
4	3
5	9
6	2
7	2
8	2
9	3
10	3

facility_id	storage_container_id
7	1
7	2
1	3
1	4
1	5
1	6
3	7
7	8
1	9
7	10

facility_id	facility_whereabouts	distance_to_base	fac_purpose
1	2	12	Storage Unit 1
2	1	0	Resarch Centre 1
3	1	0	Living Space 1
4	2	1	Rover Storage
5	1	0	Hospital
6	1	0	System Mainframe
7	2	15	Storage Unit 2
8	2	6	Resarch Centre 2
9	2	10	Research Centre 3
10	1	0	Living Space 2

storage_container_id	storage_tid	storage_aid	resources_left
1	1	9	4
2	5	5	2
3	7	6	1
4	2	4	2
5	6	7	5
6	9	2	2
7	3	1	2
8	4	3	1
9	8	10	3
10	10	8	3

Examples

- /* The Italian astronaut is very hungry, but he knows he must be conservative on food, so he checks how much kg of food they have!*/

- SELECT resources_left,storage_type FROM storageleft NATURAL JOIN stroageType WHERE storage_type='food';

```
11
12 •    SELECT resources_left,storage_type FROM storageleft NATURAL JOIN stroageType WHERE storage_type='food';
```

esult Grid | Filter Rows: | Export: | Wrap Cell Content:

resources_left	storage_type
2	Food

. Evaluation of Schema 1

- 1. How many foreign keys (FK) are there in the schema? 4.
- 2. How deep is the referential tree? 1.
- 3. How many tables have no primary key (PK) or an attribute designated as UNIQUE? 0.
- 4. How many attributes have too short a name (3 or fewer characters)? 0.
- 5. How many tables have too short a name (3 or fewer characters)? 0.
- 6. Is attribute naming inconsistent with a mix of styles in use. NO.
- (e.g. HighTemp, Hightemp, highTemp, High_Temp)
- 7. Is table naming inconsistent with a mix of styles in use? NO.
- (e.g. HighTemp, Hightemp, highTemp, High_Temp)
- 8. What is the nullable rate of attributes in the schema?
- 9. How many tables have more than 40 attributes? 0.
- 10. How many tables have a composite PK? 1.

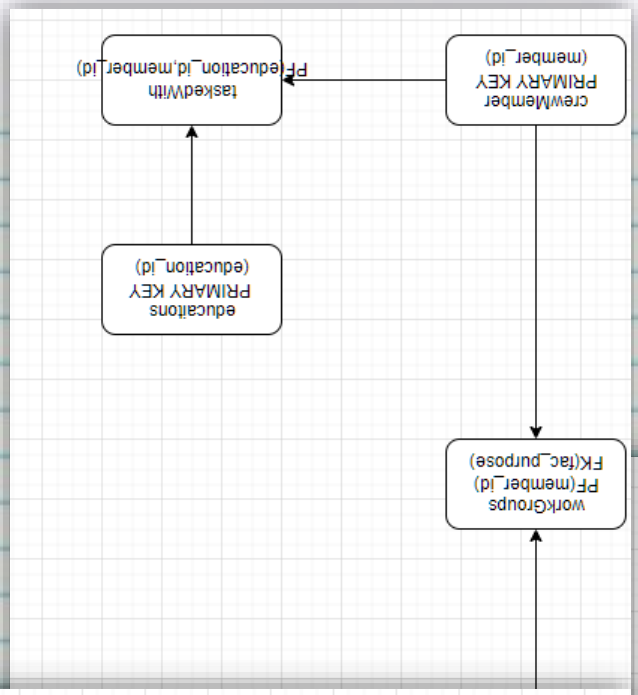
Evaluation of Schema 2

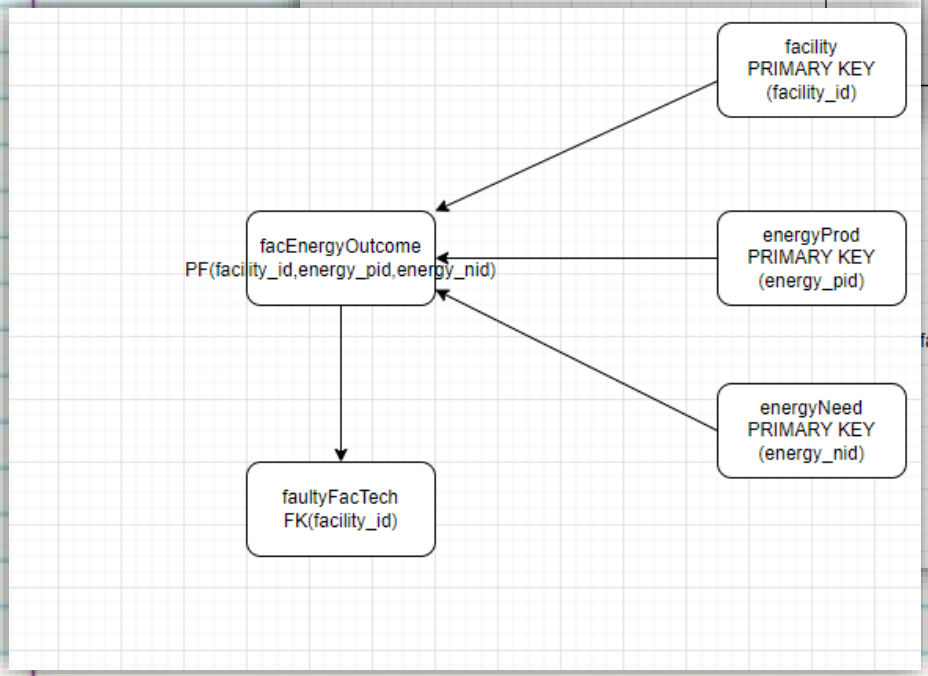
- 1. How many foreign keys (FK) are there in the schema? 4.
- 2. How deep is the referential tree? 2.
- 3. How many tables have no primary key (PK) or an attribute designated as UNIQUE? 0.
- 4. How many attributes have too short a name (3 or fewer characters)? 0.
- 5. How many tables have too short a name (3 or fewer characters)? 0.
- 6. Is attribute naming inconsistent with a mix of styles in use. NO.
- (e.g. HighTemp, Hightemp, highTemp, High_Temp)
- 7. Is table naming inconsistent with a mix of styles in use? NO.
- (e.g. HighTemp, Hightemp, highTemp, High_Temp)
- 8. What is the nullable rate of attributes in the schema?
- 9. How many tables have more than 40 attributes? 0.
- 10. How many tables have a composite PK? 1.

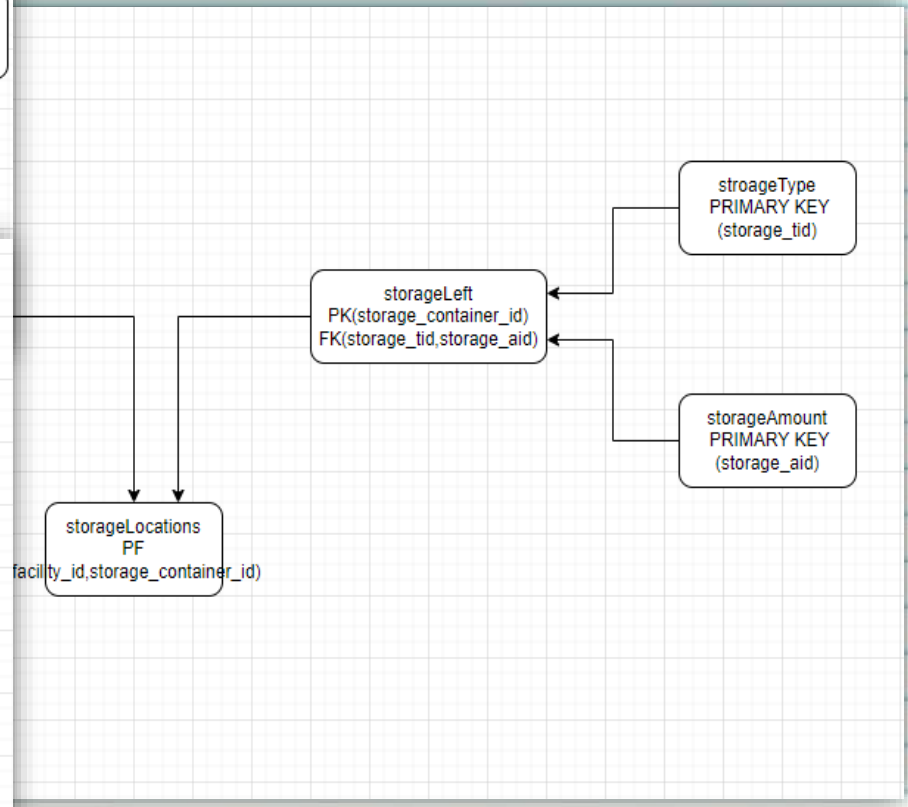
Evaluation of Schema 3

- 1. How many foreign keys (FK) are there in the schema? 3.
- 2. How deep is the referential tree? 1.
- 3. How many tables have no primary key (PK) or an attribute designated as UNIQUE? 0.
- 4. How many attributes have too short a name (3 or fewer characters)? 0.
- 5. How many tables have too short a name (3 or fewer characters)? 0.
- 6. Is attribute naming inconsistent with a mix of styles in use. NO.
- (e.g. HighTemp, Hightemp, highTemp, High_Temp)
- 7. Is table naming inconsistent with a mix of styles in use? NO.
- (e.g. HighTemp, Hightemp, highTemp, High_Temp)
- 8. What is the nullable rate of attributes in the schema?
- 9. How many tables have more than 40 attributes? 0.
- 10. How many tables have a composite PK? 2.

Unify SCHEMAS 1,2,3







Conclusions

- This was an excellent exercise to learn about how schemas may work.
- The choice of schemas I think was good.
- DISCLAIMER: It was a bit hard to have all the concepts in mind to unify tables when translating the schema model, thus an excessive use of ID attributes was needed in my case.
- As we can see when you start working with schemas with a lot of tables and relations, things can get really complicated really quick.