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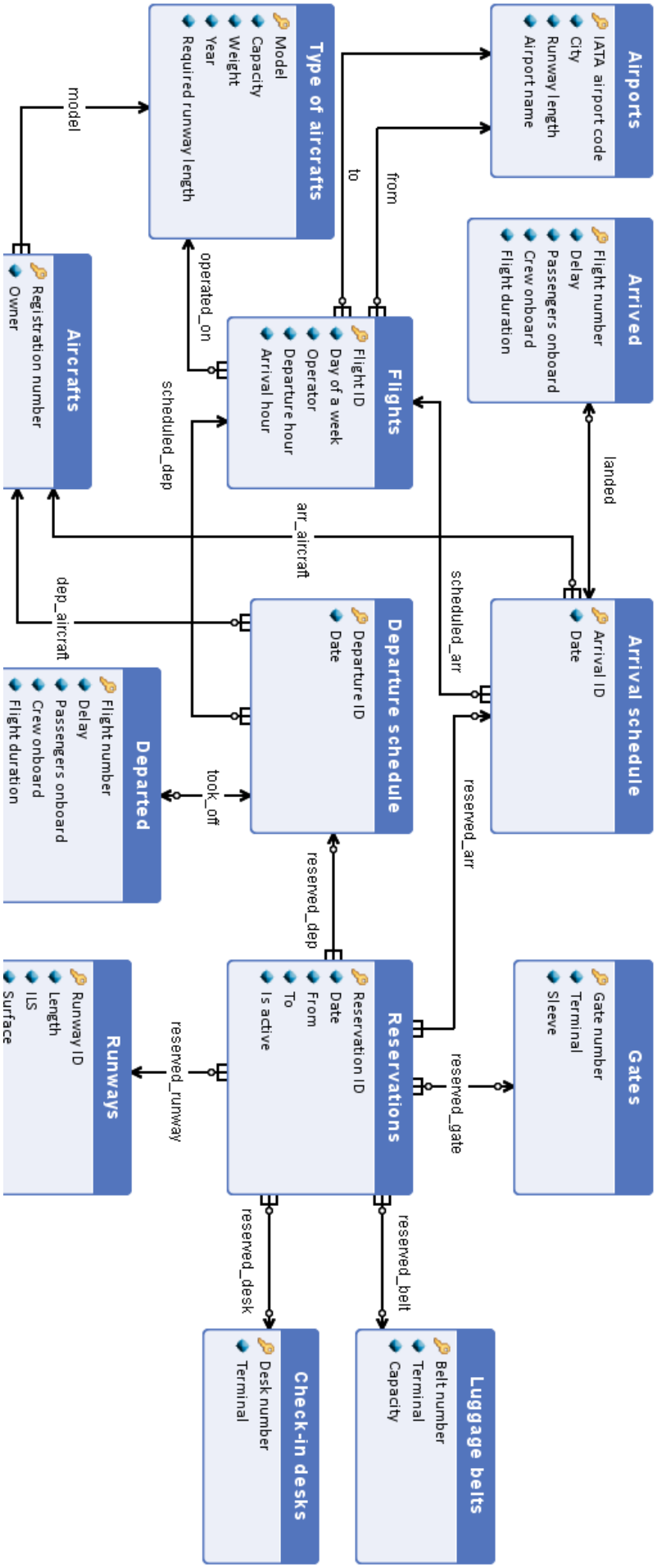
Topic: 15 Planes, producers, airlines.

Customer of my database would be an airport. To be precise, it would probably be a decision of a CEO/board meeting in case of an existing airport or architects/designers when the airport is under construction.
Potential users of the database are people working in logistics and analysis for the airport or companies in close relation with it.
Purpose of the database is to keep track of every flight that either departed or landed in the airport that the database is designed for. It has to give detailed information about those flights, especially airport infrastructure that was used and aircraft type.
Possible use scenario I would imagine as follows. Flying industry is heavily connected with statistics in order to accordingly predict the future. Airport could use historic data to make an accurate model on how many passengers will use the airport in the future. Also, the database allows us to spot inefficiency in the airport system. For example, higher chance of delay occurring could be linked with especially troublemaking operators, specific airplane type or some setup of check-in, gate and runway.
Assumptions and limitations: the database does not keep track of tickets sold, crew and pilots, it does not keep track of aircrafts that are parked at the airport
inquiries to the database:

- flights that took of on 28 march 2021
- connections operated by LOT
- which gate was used to board LOT flight 4321
- which type of aircraft is used by LOT
- does LOT flight 4321 that landed on 28 march 2021 used a runway with ILS

ERD description:


Airports
IATA airport code
City
Runway length
Airport name
Type of aircrafts
Model
Capacity
Weight
Year
Required runway length
Arrived
Flight number
Delay
Passengers onboard
Crew onboard
Flight duration
Aircrafts
Registration number
Owner
Flights
Flight ID
Day of a week
Operator
Departure hour
Arrival hour
Arrival schedule
Arrival ID
Date
Departure schedule
Departure ID
Date
Departed
Flight number
Delay
Passengers onboard
Crew onboard
Flight duration
Gates
Gate number
Terminal
Sleeve
Reservations
Reservation ID
Date
From
To
Is active
Runways
Runway ID
Length
ILS
Surface
Luggage belts
Belt number
Terminal
Capacity
Check-in desks
Desk number
Terminal
model
to
from
operated_on
scheduled_dep
landed
arr_aircraft
dep_aircraft
scheduled_arr
reserved_arr
took_off
reserved_dep
reserved_gate
reserved_runway
reserved_belt
reserved_desk

Set of entities 1: Airports			
Description			
Quantity: ~1100 Set of all airports that have or had a connection with our airport. A new entity is added when a connection is planned to operate. Entities can't be deleted unless any flights operate on that route.			
Attribute			
Name	**Primary key**	**Domain**	**Description**
IATA airport code	Yes	3 characters from the latin alphabet without special characters	Unique ID number of each airport
City	No	Set of characters and numbers, max size of 30, can contain spaces but no special characters	City where the airport is located in
Runway Length	No	Natural number between 1 000 and 25 000	Length of a runway described in feets
Airport name	No	Set of characters and numbers, can contain spaces but no other special characters, max size of 100	Name of an airport

Set of entities 2: Type of aircrafts			
Description			
Quantity: ~150 Set of all types of aircraft that are currently operated or were operated in the past by our airport. The entry is added when a new type of aircraft is scheduled to land or start from our airport. After adding a new entry, it can not be deleted unless there are no records using that aircraft type in our database.			
Attribute			
Name	**Primary key**	**Domain**	**Description**
Model	Yes	Set of characters and numbers, max size of 50, can contain spaces but no special characters	Name of the aircraft and its model
Capacity	No	Number in range between 1 and 1024	Number of passengers that can be seated in the given aircraft
Weight	No	Number between 1 and 1 milion	Number describing weight of an aircraft stated by the manufacturer
Year	No	DD-MM-YYYY format, day between 1 to31, moth 1 to 12 and year higher than 1960, dates can not be in the future	Date when the aircraft entered the service
Required runway length	No	Number between 1 000 and 50 000	Number in feets describing the length of the runway that is needed to operate given aircraft

Set of entities 3: Aircrafts			
Description			
Quantity: ~3000 Set of all aircrafts that landed or started from our airport. A new entry is added when a new aircraft is scheduled to land or start from the airport. After adding a new entry, it can be deleted only when there are no records using that aircraft in our database.			
Attribute			
Name	**Primary key**	**Domain**	**Description**
Registration number	Yes	Set of capital letters and numbers without special characters, max 30 characters	Registration number of a given aircraft
Owner	No	Set of max 30 characters, letters only, spaces but no other special characters	Name of the company owning the aircraft

Set of entities 4: Flights			
Description			
Quantity: ~10 000 Set of all flights from or to the airport. Flight means that there exists some airline operating flight on a given route (connection). A new entry is added when a new flight is scheduled to take place on a given route. Entries can be deleted when the flight was created but was never scheduled to depart or to land at our airport (or there are no records using that in our database).			
Attribute			
Name	**Primary key**	**Domain**	**Description**
Flight ID	Yes	Set of capital letters and numbers without special characters, max 30 characters	Number that distinguish flight from other
Day of a week	No	String that represents the day of a week (Monday, Tuesday, … , Sunday)	Day of a week that the flight is operated on
Operator	No	Set of characters without numbers with possible spaces, max length 30 characters	Name of the company that operates flights on a given route
Departure hour	No	HH:MM format of and hour, HH - number 1 to 24 MM - numer 0 to 60 “:” symbol between hours and minutes	Hour that the flight is planned to take off
Arrival hour	No	HH:MM format of an hour, HH - number 1 to 24 MM - numer 0 to 60 “:” symbol between hours and minutes	Hour that the flight is planned to land

Set of entities 5: Arrived			
Description			
Quantity: approx. +25 000 every year for small/medium sized airport like Lech Walesa, Gdansk Set of all flights that landed in our airport. A new entry is added as soon as the plane is registered landing in the airport and can be deleted after 5 years.			
Attribute			
Name	**Primary key**	**Domain**	**Description**
Flight number	Yes	Set of two capital letters and 1 to 4 numbers,separated with a space ex. BA 91	Number that distinguish flight from other
Delay	No	Number between 0 and 10 000	Number representing difference in minutes between scheduled touchdown time and actual one
Passengers onboard	No	Number of passengers that were present during given flight, range 0 - 1 000	Number represents amount of passengers that were flown from point A to point B on a given airplane
Crew onboard	No	Number of crew that were present during given flight, range 0 - 100	Number represents amount of crew that were flown from point A to point B on a given airplane
Flight duration	No	Number with a comma, range 0 - 24	Time in hours from the airplane departure to its arrival.

Set of entities 6: Departed			
Description			
Quantity: approx. +25 000 every year for small/medium sized airport like Lech Walesa, Gdansk Set of all flights that departed from our airport. A new entry is added as soon as the plane is registered starting from the airport and can be deleted after 5 years.			
Attribute			
Name	**Primary key**	**Domain**	**Description**
Flight number	Yes	Set of two capital letters and 1 to 4 numbers,separated with a space ex. BA 91	Number that distinguish flight from other
Delay	No	Number between 0 and 10 000	Number representing difference in minutes between scheduled touchdown time and actual one
Passengers onboard	No	Number of passengers that were present during given flight, range 0 - 1 000	Number represents amount of passengers that were flown from point A to point B on a given airplane
Crew onboard	No	Number of crew that were present during given flight, range 0 - 100	Number represents amount of crew that were flown from point A to point B on a given airplane
Flight duration	No	Number with a comma, range 0 - 24	Time in hours from the airplane departure to its arrival.

Set of entities 7: Arrival schedule			
Description			
Quantity: +25 500 every year Set of all present and past flights that are or were scheduled to arrive at our airport. A new entry is added when the airline gets permission to land its airplane on a given day. Entry can be removed after 5 years.			
Attribute			
Name	**Primary key**	**Domain**	**Description**
Arrival ID	Yes	A set of characters and numbers without special characters, max length 30	Number that distinguish flight from other
Date	No	Date in format DD-MM-YYYY where day is natural number from 1 to 31, month is natural number from 1 to 12 and year is higher than 2000	Date on which the airplane was scheduled to land

Set of entities 8: Departure schedule			
Description			
Quantity: +26 000 every year Set of all present and past flights that were scheduled to depart from our airport. A new entry is added when the airline gets permission to take off one of its airplanes on a given day and on the given hour. Entry can be removed after 5 years.			
Attribute			
Name	**Primary key**	**Domain**	**Description**
Departure ID	Yes	A set of characters and numbers without special characters, max length 30	Number that distinguish flight from other
Date	No	Date in format DD-MM-YYYY where day is natural number from 1 to 31, month is natural number from 1 to 12 and year is higher than 2000	Date on which the plane was scheduled to take off

Set of entities 9: Reservations			
Description			
Quantity: +50 000 every year + delayed flights that needed a new reservation (+15 000) Set off all reservations of airport infrastructure that were made for every flight scheduled to land or take off from the airport. A new entry is added when a flight is scheduled to leave or arrive at the airport and reservations take place. Entries can be deleted after 5 years.			
Attribute			
Name	**Primary key**	**Domain**	**Description**
Reservation ID	Yes	A set of characters and numbers without special characters, max length 30	Number that distinguish reservations from other
Date	No	Date in format DD-MM-YYYY where day is natural number from 1 to 31, month is natural number from 1 to 12 and year is higher than 2000	Date when the reservation was made
From	No	HH:MM format of and hour, HH - number 1 to 24 MM - numer 0 to 60 ":" symbol between hours and minutes	Hour when the reservation starts for a given flight
To	No	HH:MM format of an hour, HH - number 1 to 24 MM - numer 0 to 60 ":" symbol between hours and minutes	Hour when the reservation ends for a given flight
Is active	No	TRUE or FALSE	Was / Is a reservation active for a given flight

Set of entities 10: Gates			
Description			
Quantity: ~100 Set of all gates at the airport. A new entry is added when a new gate is constructed. Entry can be deleted after 5 years of not using a gate.			
Attribute			
Name	**Primary key**	**Domain**	**Description**
Gate number	Yes	A natural number, range 1-100	Number that distinguish gate from other
Terminal	No	Number 1, 2 or 3	Terminal at which the gate is located
Sleeve	No	Yes/No	Determine whether the gate is equipped with sleeve (the tunnel that you use to board a plane)

Set of entities 11: Luggage belts			
Description			
Quantity: ~15 Set of all luggage belts at the airport. A new entry is added when a new luggage belt is constructed. Entry can be deleted after 5 years of not using a belt.			
Attribute			
Name	**Primary key**	**Domain**	**Description**
Belt number	Yes	A natural number, range 1-15	Number that distinguish belt from other
Terminal	No	Number 1, 2 or 3	Terminal at which the belt is located
Capacity	No	Natural number, range 100-500	How many pieces of luggage can fit on a given belt

Set of entities 12: Check-in desks			
Description			
Quantity: ~40 Set of all check-in desks at the airport. A new entry is added when a new check-in desk is opened. Entries can be deleted after 5 years of not using a desk.			
Attribute			
Name	**Primary key**	**Domain**	**Description**

Desk number	Yes	A natural number, range 1-40	Number that distinguish desk from other
Terminal	No	Number 1, 2 or 3	Terminal at which the desk is located

Set of entities 13: Runways			
Description			
Quantity: 2 Set of all runways at the airport. A new entry is added when a new runway is opened. Entries can be deleted after 5 years of not using a runway.			
Attribute			
Name	**Primary key**	**Domain**	**Description**
Runway ID	Yes	Double digit, natural number followed by a capital letter R, L or C without space	"Name" of the runway
Length	No	Natural number between 1 000 and 40 000	Length of a runway described in feets
ILS	No	Yes/No	Presence of a radar system on a given runway
Surface	No	A set of characters and numbers without special characters other than space, max length 30	Surface of the runway

Relations

Relations name	Entity group		Intervals	Description
	Entity 1	Entity 2		
model	Aircrafts	Type of aircraft	1..n : 1	There can be many aircrafts of the same type.
operated_on	Type of aircraft	Flights	1 : 0..n	Aircraft of a given type can be operated on multiple flights or at any. Flight has to be operated by an aircraft.
from	Airports	Flights	1 : 0..n	Connections operated from our airport. There could be many flights flying on one route. A route (airport in our database may not have any flights to it).
to	Airport	Flights	1 : 0..n	Connections operated to our airport. There could be many flights flying on one route.
landed	Arrived	Arrival schedule	0..1 : 1	When a flight lands, it creates one entry in Arrived. A flight can be diverted and despite it being scheduled to land it won't land (exception).
scheduled _arr	Flights	Arrival schedule	1 : 0..n	One flight can be scheduled to land at different dates, scheduled flight has to exist in order to do so.
scheduled _dep	Flights	Departure schedule	1 : 0..n	One flight can be scheduled to take off at different dates, scheduled flight has to exist in order to do so.
took_off	Departed	Departed schedule	0..1 : 1	When a flight takes off, it creates one entry in Departed. A flight can be canceled and despite it being scheduled to take off it won't do so (exception).
reserved_arr	Arrival schedule	Reservations	0..1 : 1..n	When a flight is scheduled to land it has to have appropriate reservations. There could be multiple reservations for one flight for ex. when it is delayed.
reserved_dep	Departure schedule	Reservations	0..1 : 1..n	When a flight is scheduled to take off it has to have appropriate reservations. There could be multiple reservations for one flight for ex. when it is delayed.
reserved_gate	Reservations	Gates	0..n : 0..1	A gate can be reserved multiple times. It may not be reserved at all in ex. for private flights.
reserved_belt	Reservations	Luggage belts	0..n : 0..1	A belt can be reserved multiple times. It may not be reserved at all in ex. for private flights.
reserved_desk	Reservations	Check-in desks	0..n : 0..1	A desk can be reserved multiple times. It may not be reserved at all in ex. for private flights.
reserved_runway	Reservations	Runways	0..n : 1	A runway has to be reserved for every flight
arr_aircraft	Aircrafts	Arrival schedule	1 : 0..n	When there is an aircraft scheduled to land it has to exist in the database.
dep_aircraft	Aircraft	Departure schedule	1 : 0..n	When there is an aircraft scheduled to take off it has to exist in the database.

Relational database schema:

Type of aircrafts(Model, Capacity, Weight, Year, Required runway length)
Aircrafts(Registration number, Owner, Is-Type REF Type of aircraft)
Flights(Flight ID, Day of a week, Operator, Departure hour, Arrival hour, Air-Type REF Type of aircrafts, Other-Air REF Airport)
Airports(IATA airport code, City, Runway length, Airport name)
Arrival schedule(Arrival ID, Date, Arr-air REF Aircraft, Arr-fli REF Flights)
Arrived(Flight number, Delay, Passengers onboard, Flight duration, Arr-scheduled REF Arrival schedule)
Departed(Flight number, Delay, Passengers onboard, Flight duration, Dep-scheduled REF Departure schedule)
Departure schedule(Departure ID, Date, Dep-air REF Aircraft, Dep-fli REF Flights)
Reservations(Reservation ID, Date, From, To, Is active, Arr-sch REF Arrival schedule, Dep-sch REF Departure schedule, Gat REF Gates, Lug REF Luggage belts, Desk REF CHeck-in desks, Run REF Runways)
Gates(Gate number, Terminal, Sleeve)
Luggage belts(Belt number, Terminal, Capacity)
Check-in desks(Desk number, Terminal)
Runways(Runway ID, Length, ILS, Surface)