
Spotify®

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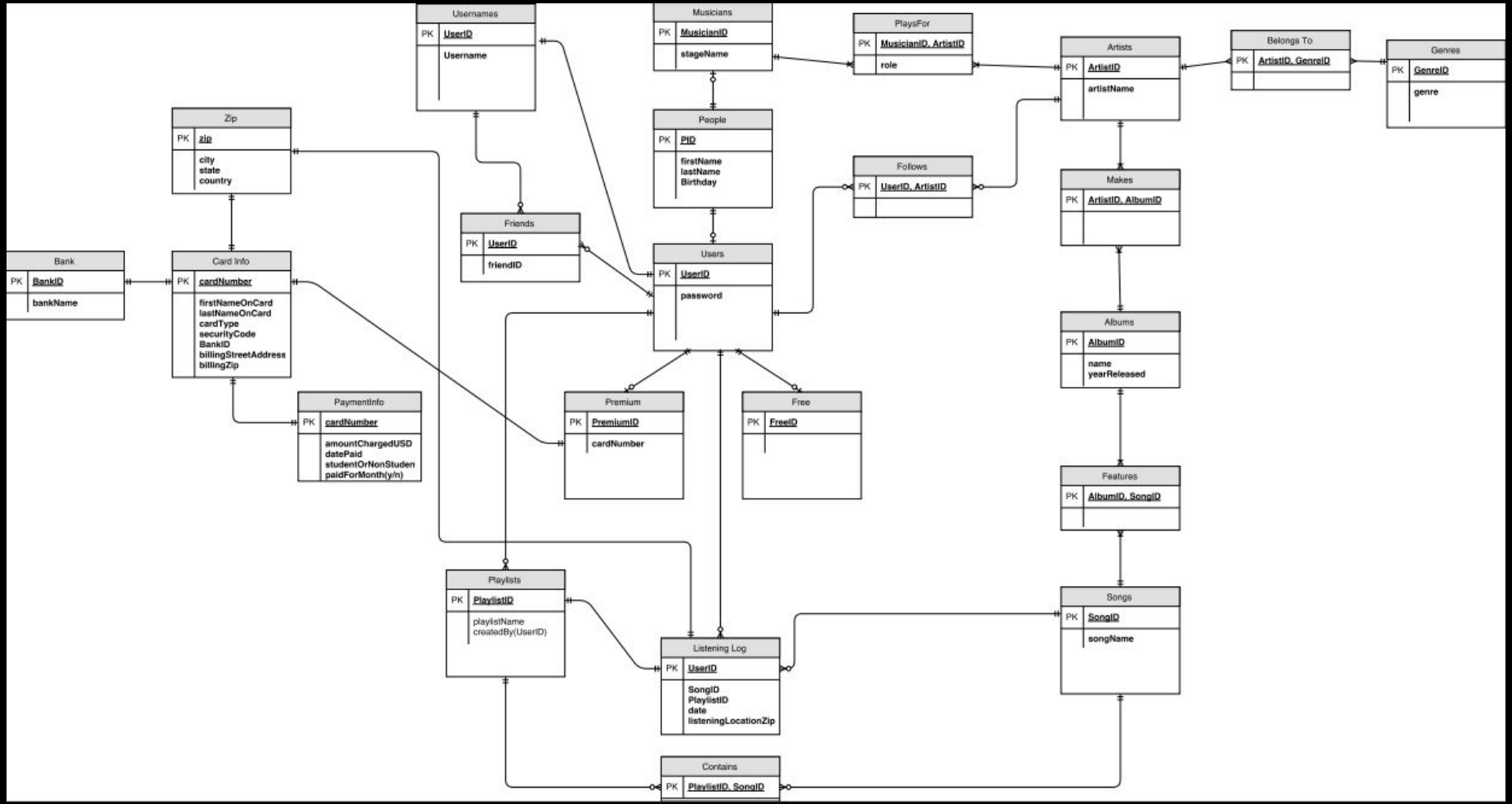
With millions of users worldwide, Spotify needs a precise and meaningful database to store and manage its data. This data combined with powerful queries will convey the information necessary for Spotify statistics, analytics, and storage. The purpose of this database is to show the relations between users, artists, songs and more to better Spotify's analysis in the inner workings of its data, to arrange the data more meaningfully, and to provide precise service to its users. This database helps in cataloging payment information for premium users, holding playlist information, keeping logs of what the user is listening to, and more. In the following slides, one will find an outline of the Entity-Relationship Diagram, its functional dependencies, the code used to make it, and some sample data to show how it runs. The slides also delve into stored procedures, triggers, views, security, problems, and future enhancements of the Spotify database.


Usernames
PK UserID
Username
Musicians
PK MusicianID
stageName
PlaysFor
PK MusicianID, ArtistID
role
Artists
PK ArtistID
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Belongs To
PK ArtistID, GenreID
Genres
PK GenreID
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PK UserID, ArtistID
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Friends
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Bank
PK BankID
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Card Info
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billingZip
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PK AlbumID
name
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PK cardNumber
amountChargedUSD
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Playlists
PK PlaylistID
playlistName
createdBy(UserID)
Songs
PK SongID
songName
Listening Log
PK UserID
SongID
PlaylistID
date
listeningLocationZip
Contains
PK PlaylistID, SongID

PEOPLE: lists all people and basic attributes

```
CREATE TABLE People (
      PID char(6) NOT NULL UNIQUE,
      firstName text NOT NULL,
      lastName text NOT NULL,
      birthDate DATE NOT NULL,
      PRIMARY KEY (PID)
);
```

Functional Dependencies
PID -> firstName, lastName, birthDate

	pid character(6)	firstname text	lastname text	birthdate date
1	001	Rafael	Marmol	1996-09-17
2	002	Bob	Bobberson	2000-05-02
3	003	Joe	Black	1985-08-13
4	004	James	Bond	1977-07-07
5	005	Jane	Doe	1994-10-31
6	000	Spotify	Spotify	2008-10-07
7	006	Saul	Hudson	1963-07-23
8	007	William	Rose	1962-02-06
9	008	Taylor	Swift	1989-12-13
10	009	Miley	Cyrus	1992-11-23
11	010	Corey	Taylor	1973-12-08
12	011	Farrokh	Bulsara	1946-09-05
13	012	Vladimir	Putin	1952-10-07

USERS: lists all users and basic attributes

```
CREATE TABLE Users (
      UserID char(6) NOT NULL UNIQUE references people(PID),
      pass char(12) NOT NULL,
      PRIMARY KEY (UserID)
);
```

Functional Dependencies
UserID -> pass

	userid character(6)	pass character(12)
1	001	pass1
2	002	chocolate
3	003	blanco
4	005	aerosmith
5	000	Spotify
6	004	Shaken
7	012	c0mmun1sm

USERNAMES: lists all usernames for user id

```
CREATE TABLE Usernames (
      UserID char(6) NOT NULL UNIQUE references Users(UserID),
      username char(28) NOT NULL UNIQUE,
      PRIMARY KEY (UserID)
);
```

Functional Dependencies
UserID -> username

	userid character(6)	username character(28)
1	001	Rafael Marmol
2	002	Bob Bobberson
3	003	MrBlack
4	005	JaniesGotAGun
5	000	Spotify
6	004	James Bond
7	012	VladMan42

FRIENDS: lists userid's and friendid's

```
CREATE TABLE Friends (
      UserID char(6) NOT NULL references Users(UserID),
      friendID char(6) NOT NULL references Usernames(UserID),
      PRIMARY KEY(UserID, friendID)
);
```

Functional Dependencies
UserID -> friendID

	userid character(6)	friendid character(6)
1	001	003
2	001	005
3	003	001
4	005	001

PREMIUM: lists all premium users and attributes

```
CREATE TABLE Premium (
      PremiumID char(6) NOT NULL UNIQUE references Users(UserID),
      cardNumber char(16) NOT NULL UNIQUE,
      PRIMARY KEY (PremiumID)
);
```

	premiumid character(6)	cardnumber character(16)
1	001	1111111111111111
2	005	2222222222222222
3	004	7777777777777777
4	012	6666666666666666

Functional Dependencies
PremiumID -> cardNumber

FREE: lists all people and basic attributes

```
CREATE TABLE Free (
      FreeID char(6) NOT NULL UNIQUE references Users(UserID),
      PRIMARY KEY(FreeID)
);
```

	freeid character(6)
1	002
2	003

Functional Dependencies
FreeiD ->

CARDINFO: lists all card information and attributes

```
CREATE TABLE CardInfo (
      cardNumber char(16) NOT NULL UNIQUE references Premium(cardNumber),
      firstNameOnCard text NOT NULL,
      lastNameOnCard text NOT NULL,
      billingStreetAddress char(25) NOT NULL,
      billingZip int NOT NULL,
      cardType text NOT NULL,
      securityCode char(3) NOT NULL,
      bankID char(6) NOT NULL,
      PRIMARY KEY (cardNumber)
);
```

Functional Dependencies

cardNumber -> firstNameOnCard, lastNameOnCard, billingStreetAddress, billingZip, cardType, securityCode, bankID

	cardnumber character(16)	firstnameoncard text	lastnameoncard text	billingstreetaddress character(25)	billingzip integer	cardtype text	securitycode character(3)	bankid character(6)
1	1111111111111111	Rafael	Marmol	123 Place Ave	12601	Visa	111	001
2	2222222222222222	Jane	Doe	234 Deer Place	11740	Mastercard	222	001
3	7777777777777777	James	Bond	7 Spy Rd	12601	American Express	777	002
4	6666666666666666	Vladimir	Putin	6 Communist Lane	107207	Visa	666	004

PAYMENTINFO: lists card numbers and payment history

```
CREATE TABLE PaymentInfo (
      cardNumber char(16) NOT NULL references CardInfo(cardNumber),
      amountChargedUSD decimal NOT NULL,
      studentOrNonStudent text NOT NULL,
      datePaid date NOT NULL,
      paidForMonth text NOT NULL,
      CONSTRAINT paidForMonth CHECK (paidForMonth = 'yes' OR paidForMonth = 'no'),
      CONSTRAINT studentOrNonStudent CHECK (studentOrNonStudent = 'student' OR studentOrNonStudent = 'non-
student'),
      PRIMARY KEY (cardNumber, datePaid)
);
```

Functional Dependencies

cardNumber-> amountChargedUSD, studentOrNonStudent, datePaid, paidForMonth

	cardnumber character(16)	amountcharged numeric	studentornonstudent text	datepaid date	paidformonth text
1	1111111111111111	4.99	student	2015-04-01	yes
2	1111111111111111	4.99	student	2015-03-01	yes
3	2222222222222222	9.99	non-student	2015-04-01	no
4	6666666666666666	9.99	non-student	2015-04-01	yes
5	6666666666666666	9.99	non-student	2015-03-01	yes
6	6666666666666666	9.99	non-student	2015-02-01	yes
7	7777777777777777	9.99	non-student	2015-04-01	no

ZIP: lists all zip codes and attributes

```
CREATE TABLE Zip (
      zip int NOT NULL,
      city text NOT NULL,
      state text NOT NULL,
      country text NOT NULL,
      PRIMARY KEY (zip)
);
```

	zip integer	city text	state text	country text
1	12601	Poughkeepsie	New York	USA
2	11740	Greenlawn	New York	USA
3	301031	Ackbarpur	Rajasthan	India
4	11763	Medford	New York	USA
5	90210	Beverly Hills	California	USA
6	75201	Dallas	Texas	USA
7	107207	Moscow	Moscow	Russia

Functional Dependencies
Zip -> city, state, country

BANK: lists all banks

```
CREATE TABLE Bank (
      BankID char(6) NOT NULL UNIQUE,
      bankName text NOT NULL,
      PRIMARY KEY (BankID)
);
```

	bankid character(6)	bankname text
1	001	TD Bank
2	002	Discover
3	003	Chase
4	004	Bank of Russia

Functional Dependencies
BankID-> bankName

PLAYLISTS: lists all playlists and basic attributes

```
CREATE TABLE Playlists (
      PlaylistID char(6) NOT NULL UNIQUE,
      playlistName text NOT NULL,
      createdBy char(6) NOT NULL references Users(UserID),
      PRIMARY KEY(PlaylistID)
);
```

Functional Dependencies
PlaylistID -> playlistName, createdBy

ARTISTS: lists all artists

```
CREATE TABLE Artists (
      ArtistID char(6) NOT NULL UNIQUE,
      artistName text NOT NULL,
      PRIMARY KEY (ArtistID)
);
```

Functional Dependencies
ArtistID -> artistName

	playlistid character(6)	playlistname text	createdby character(6)
1	001	Classic Rock	001
2	002	Fun times	005
3	003	Metallica Playlist	001
4	000	No Playlist	000

	artistid character(6)	artistname text
1	001	Metallica
2	002	Avenged Sevenfold
3	003	Foo Fighters
4	004	Taylor Swift
5	005	Skrillex
6	006	Blake Shelton
7	007	Blink-182
8	008	Nickelback
9	009	Slipknot
10	010	The Who
11	011	Elvis Presley
12	012	The Beatles
13	013	Night Moves
14	014	Night Moves
15	015	Queen
16	016	Guns n Roses
17	017	Pink Floyd
18	018	Miley Cyrus

MUSICIANS: lists musicians

```
CREATE TABLE Musicians (
      MusicianID char(6) NOT NULL UNIQUE references People(PID),
      stageName text NOT NULL,
      PRIMARY KEY (MusicianID)
);
```

	musicianid character(6)	stagename text
1	006	Slash
2	007	Axl Rose
3	008	Taylor Swift
4	009	Miley Cyrus
5	010	Corey Taylor
6	011	Freddie Mercury

Functional Dependencies
MusicianID -> stageName

PLAYSFOR: lists who's in a band and what their role is

```
CREATE TABLE PlaysFor (
      MusicianID char(6) NOT NULL references Musicians(MusicianID),
      ArtistID char(6) NOT NULL references Artists(ArtistID),
      role text NOT NULL,
      PRIMARY KEY (MusicianID, ArtistID)
);
```

	musicianid character(6)	artistid character(6)	role text
1	006	016	Lead Guitarist
2	007	016	Lead Singer
3	008	004	Lead Singer
4	009	018	Lead Singer
5	010	009	Lead Singer
6	011	015	Lead Singer

Functional Dependencies
(MusicianID, ArtistID) -> role

GENRES: lists all genres

```
CREATE TABLE Genres (
      GenreID char(6) UNIQUE NOT NULL,
      genre text NOT NULL,
      PRIMARY KEY(GenreID)
);
```

Functional Dependencies
GenreID -> genre

	genreid character(6)	genre text
1	001	Heavy Metal
2	002	Thrash Metal
3	003	Hard Rock
4	004	Metalcore
5	005	Alternative Rock
6	006	Post-grunge
7	007	Country
8	008	Pop Music
9	009	Dubstep
10	010	Punk Rock
11	011	Alternative Metal
12	012	Nu Metal
13	013	Classic Rock
14	014	Blues
15	015	Indie
16	016	Rock n Roll
17	017	Progressive Rock

BELONGSTO: lists artistid's and genreid's

```
CREATE TABLE BelongsTo (
      ArtistID char(6) NOT NULL references Artists(ArtistID),
      GenreID char(6) NOT NULL references Genres(GenreID),
      PRIMARY KEY (ArtistID, GenreID)
);
```

Functional Dependencies
(ArtistID, GenreID) ->

	artistid character(6)	genreid character(6)
1	001	001
2	001	002
3	002	001
4	002	003
5	002	004
6	003	003
7	003	005
8	003	006
9	004	007
10	004	008
11	005	009
12	006	007
13	007	005
14	007	010
15	008	003
16	008	006
17	009	001
18	009	011
19	009	012
20	010	003
21	010	013
22	011	007
23	011	014
24	011	016
25	012	008
26	012	013
27	013	007
28	013	015
29	014	015
30	014	009
31	015	013
32	016	001
33	016	003
34	017	017
35	018	008

MAKES: lists artistid's and albumid's

```
CREATE TABLE Makes (
      ArtistID char(6) NOT NULL references Artists(ArtistID),
      AlbumID char(6) NOT NULL references Albums(AlbumID),
      PRIMARY KEY (ArtistID, AlbumID)
);
```

Functional Dependencies
(ArtistID, AlbumID) ->

	artistid character(6)	albumid character(6)
1	001	001
2	001	002
3	004	003
4	004	004
5	015	005
6	016	006
7	015	007
8	013	008
9	014	009
10	009	010
11	012	011
12	017	012
13	001	013
14	015	013
15	016	013
16	017	013
17	009	014

ALBUMS: lists all albums and basic attributes

```
CREATE TABLE Albums (
      AlbumID char(6) UNIQUE NOT NULL,
      albumName text NOT NULL,
      yearReleased char(4) NOT NULL
);
```

Functional Dependencies
AlbumID -> albumName, yearReleased

	albumid character(6)	albumname text	yearreleased character(4)
1	001	Metallica	1991
2	002	Master of Puppets	1986
3	003	1989	2014
4	004	Bangerz	2013
5	005	Greatest Hits	1981
6	006	Greatest Hits	2004
7	007	A Night at the Opera	1975
8	008	Pennied Days	2016
9	009	TransDance GC1	2013
10	010	.5: The Gray Chapter	2014
11	011	With the Beatles	1963
12	012	The Dark Side of the Moon	1973
13	013	Greatest Rock Hits	2016
14	014	Single	2014

FEATURES: lists albumid's and songid's

```
CREATE TABLE Features (
      AlbumID char(6) NOT NULL references Albums(AlbumID),
      SongID char(6) NOT NULL references Songs(SongID),
      PRIMARY KEY(AlbumID, SongID)
);
```

Functional Dependencies
(AlbumID, SongID) ->

	albumid character(6)	songid character(6)
1	011	001
2	012	002
3	010	003
4	001	004
5	003	005
6	004	006
7	003	007
8	005	008
9	007	008
10	002	009
11	005	010
12	013	004
13	013	008
14	013	009
15	013	010
16	014	003

SONGS: lists songid and name

```
CREATE TABLE Songs(
      SongID char(6) UNIQUE NOT NULL,
      songName text NOT NULL,
      PRIMARY KEY(SongID)
);
```

Functional Dependencies
SongID -> songName

	songid character(6)	songname text
1	001	Money
2	002	Money
3	003	The Devil In I
4	004	Enter Sandman
5	005	Blank Space
6	006	Wrecking Ball
7	007	Shake It Off
8	008	Bohemian Rhapsody
9	009	Master of Puppets
10	010	We Will Rock You

FOLLOWS: lists userid's and artistid's

```
CREATE TABLE Follows (
      UserID char(6) NOT NULL references Users(UserID),
      ArtistID char(6) NOT NULL references Artists(ArtistID),
      PRIMARY KEY(UserId, ArtistID)
);
```

Functional Dependencies
(UserID, ArtistID) ->

	userid character(6)	artistid character(6)
1	001	001
2	001	002
3	001	003
4	001	009
5	001	016
6	001	017
7	002	006
8	002	008
9	002	010
10	002	011
11	003	012
12	003	015
13	003	016
14	003	017
15	005	004
16	005	007
17	005	018

CONTAINS: lists playlistid's and songid's

```
CREATE TABLE Contains (
      PlaylistID char(6) NOT NULL references Playlists(PlaylistID),
      SongID char(6) NOT NULL references Songs(SongID),
      PRIMARY KEY(PlaylistID,SongID)
);
```

Functional Dependencies
(PlaylistID, SongID) ->

	playlistid character(6)	songid character(6)
1	001	001
2	001	002
3	001	004
4	001	008
5	001	009
6	001	010
7	003	004
8	003	009
9	002	005
10	002	006
11	002	007

LISTENINGLOG: lists all userid's and listening attributes

```
CREATE TABLE ListeningLog (
      UserID char(6) NOT NULL references Users(UserID),
      SongID char(6) NOT NULL references Songs(SongID),
      PlaylistID char(6) NOT NULL references Playlists(PlaylistID),
      dateListenedTo timestamp NOT NULL,
      listeningLocationZip int NOT NULL references Zip(zip),
      PRIMARY KEY (UserID, dateListenedTo)
);
```

Functional Dependencies

(UserID, dateListenedTo) -> SongID, PlaylistID, listeningLocationZip

	userid character(6)	songid character(6)	playlistid character(6)	datelistenedto timestamp without time zone	listeninglocationzip integer
1	001	003	000	2015-04-22 14:08:32	12601
2	001	004	003	2015-04-22 14:02:01	12601
3	001	007	000	2015-04-22 13:59:22	12601
4	001	007	000	2016-04-23 12:40:00	11763
5	004	010	000	2015-04-23 02:15:07	301031
6	005	001	000	2014-07-04 17:22:22	11763
7	005	006	002	2015-04-21 09:42:15	301031
8	012	007	000	2015-04-23 14:31:00	107207
9	012	007	000	2015-04-23 14:34:00	107207
10	012	007	000	2015-04-23 14:40:00	107207
11	012	007	000	2015-04-23 14:37:00	107207

VIEWS: a query that is set to a specific name so you can call it by the name instead of typing out the whole query each time

VIEW: `UserInfo` shows list of users' names, usernames, passwords, and credit card numbers

```
CREATE OR REPLACE VIEW UserInfo as
select u.userid, firstName, lastName, username, pass, cardnumber
from users u INNER JOIN people p ON u.userid = p.pid
          LEFT OUTER JOIN premium pr ON u.userid = pr.premiumid
          LEFT OUTER JOIN free f ON u.userid = f.freeid
          INNER JOIN usernames n ON u.userid = n.userid;
```

	userid character(6)	firstname text	lastname text	username character(28)	pass character(12)	cardnumber character(16)
1	000	Spotify	Spotify	Spotify	Spotify	<NULL>
2	001	Rafael	Marmol	Rafael Marmol	pass1	1111111111111111
3	002	Bob	Bobberson	Bob Bobberson	chocolate	<NULL>
4	003	Joe	Black	MrBlack	blanco	<NULL>
5	004	James	Bond	James Bond	Shaken	7777777777777777
6	005	Jane	Doe	JaniesGotAGun	aerosmith	2222222222222222
7	012	Vladimir	Putin	VladMan42	c0mmun1sm	6666666666666666

VIEW: `FriendsList` shows list of usernames and friends' usernames

```
CREATE OR REPLACE VIEW FriendsList as
select showusernamefor(u.userid) as User, showusernamefor(friendid) as Friend
from friends f INNER JOIN users u ON f.userid = u.userid
          INNER JOIN usernames n ON n.userid = u.userid
ORDER BY User ASC;
```

	user text	friend text
1	Rafael Marmol	MrBlack
2	Rafael Marmol	JaniesGotAGun
3	MrBlack	Rafael Marmol
4	JaniesGotAGun	Rafael Marmol

VIEW: `MusicLibrary` shows list of artists, albums, years, and songs in database

```
CREATE OR REPLACE VIEW MusicLibrary as
select distinct artistName, albumName, yearReleased, songName
from artists a INNER JOIN belongsto b ON b.artistid = a.artistid
            INNER JOIN genres g ON b.genreid = g.genreid
            INNER JOIN makes m ON m.artistid = a.artistid
            INNER JOIN albums al ON al.albumid = m.albumid
            INNER JOIN features f ON f.albumid = al.albumid
            INNER JOIN songs s ON s.songid = f.songid
ORDER BY artistName ASC;
```

	artistname text	albumname text	yearreleased character(4)	songname text
1	Guns n Roses	Greatest Rock Hits	2016	Bohemian Rhapsody
2	Guns n Roses	Greatest Rock Hits	2016	Enter Sandman
3	Guns n Roses	Greatest Rock Hits	2016	Master of Puppets
4	Guns n Roses	Greatest Rock Hits	2016	We Will Rock You
5	Metallica	Greatest Rock Hits	2016	Bohemian Rhapsody
6	Metallica	Greatest Rock Hits	2016	Enter Sandman
7	Metallica	Greatest Rock Hits	2016	Master of Puppets
8	Metallica	Greatest Rock Hits	2016	We Will Rock You
9	Metallica	Master of Puppets	1986	Master of Puppets
10	Metallica	Metallica	1991	Enter Sandman
11	Pink Floyd	Greatest Rock Hits	2016	Bohemian Rhapsody
12	Pink Floyd	Greatest Rock Hits	2016	Enter Sandman
13	Pink Floyd	Greatest Rock Hits	2016	Master of Puppets
14	Pink Floyd	Greatest Rock Hits	2016	We Will Rock You
15	Pink Floyd	The Dark Side of the Moon	1973	Money
16	Queen	A Night at the Opera	1975	Bohemian Rhapsody
17	Queen	Greatest Hits	1981	Bohemian Rhapsody
18	Queen	Greatest Hits	1981	We Will Rock You
19	Queen	Greatest Rock Hits	2016	Bohemian Rhapsody
20	Queen	Greatest Rock Hits	2016	Enter Sandman
21	Queen	Greatest Rock Hits	2016	Master of Puppets
22	Queen	Greatest Rock Hits	2016	We Will Rock You
23	Slipknot	.5: The Gray Chapter	2014	The Devil In I
24	Slipknot	Single	2014	The Devil In I
25	Taylor Swift	1989	2014	Blank Space
26	Taylor Swift	1989	2014	Shake It Off
27	Taylor Swift	Bangerz	2013	Wrecking Ball
28	The Beatles	With the Beatles	1963	Money

VIEW: `MostPopularSong` shows most popular song to date

```
CREATE OR REPLACE VIEW MostPopularSong as
select songName, count(songName) as timeslistenedto
from listeninglog l INNER JOIN songs s ON l.songid = s.songid
group by songName
order by count(songName) desc
limit 1;
```

	songname text	timeslistenedto bigint
1	Shake It Off	6

STORED PROCEDURES: These are functions that can be utilized to create statements or make calculations instead of going through the hassle of writing/rewriting queries

1. STORED PROCEDURE: `ReturnCountry` this automatically shows the country for a given zipcode (helps later with `PossibleCardTheft`)

```
create or replace function ReturnCountry(int) returns text as
$$
declare
   zip_input int       := $1;

begin
   return (
      select country
      from   zip
       where  zip = zip_input);

end;
$$
language plpgsql;
```

```
Select returnCountry(11763);
```

	returncountry text
1	USA

2. STORED PROCEDURE: `lastDateListened` this automatically returns the most recent date a user has listened to something (helps later with `possibledeadusers`)

```
create or replace function lastDateListened(text) returns date as
$$
declare
   user_input text       := $1;

begin
   return (
      select datelistenedto
      from   listeninglog
      where userid = user_input
      order by datelistenedto DESC
      limit 1

       );

end;
$$
language plpgsql;
```

```
Select lastDateListened('001');
```

	lastdatelistened date
1	2016-04-23

3. STORED PROCEDURE: `showUserNameFor(userid)` this automatically returns username for the given userid (helps later with `FriendsList` view)

```
create or replace function showUserNameFor(text) returns text as
$$
declare
   user_input text       := $1;

begin
   return (
      select username
      from   usernames
      where userid = user_input
       );

end;
$$
language plpgsql;
```

```
Select showUserNameFor('012');
```

	showusernamefor text
1	VladMan42

4. STORED PROCEDURE: `showDiscographyFor(artistName)` this automatically returns the given artist's albums

```
create or replace function showDiscographyFor(text) returns setof text as
$$
declare
   artist_input text       := $1;

begin
   return query(
      select albumName
      from   makes m INNER JOIN artists a ON m.artistid = a.artistid
                INNER JOIN albums al ON m.albumid = al.albumid
      where artistName = artist_input
       );

end;
$$
language plpgsql;
```

```
Select showDiscographyFor('Slipknot');
```

	showdiscographyfor text
1	.5: The Gray Chapter
2	Single

5. STORED PROCEDURE: `showGenres` this automatically returns a table of genres that the input artist falls under (helps later with `showRelatedArtistsFor` function)

```
create or replace function showGenres(text) returns setof text as
$$
declare
   artist_input text       := $1;

begin
   return query(
      select genre
      from   belongsTo b INNER JOIN artists a ON b.artistID = a.artistID
                INNER JOIN genres g ON b.genreID = g.genreID
     where artistName = artist_input
       );

end;
$$
language plpgsql;
```

```
Select showGenres('Guns n Roses');
```

	showgenres text
1	Heavy Metal
2	Hard Rock

6. STORED PROCEDURE: `showRelatedArtistsFor` this automatically returns a table of artists that fall under the same genres as the input artist

```
create or replace function showRelatedArtistsFor(text) returns setof text as
$$
declare
   artist_input text       := $1;

begin
   return query(
      select distinct artistName
      from   belongsTo b INNER JOIN artists a ON b.artistID = a.artistID
                INNER JOIN genres g ON b.genreID = g.genreID
       where  genre IN (select showgenres(artist_input))
       );

end;
$$
language plpgsql;
```

```
Select showRelatedArtistsFor('Metallica');
```

	showrelatedartistsfor text
1	Avenged Sevenfold
2	Metallica
3	Guns n Roses
4	Slipknot

7. STORED PROCEDURE: `getPremiumID(char)` this automatically returns the premiumid that matches the cardnumber in paymentinfo (used later in `checkPayment()`)

```
create or replace function getpremiumid(character) returns character as
$$
declare
   char_input character(16)       := $1;

begin
   return (select distinct premiumid
          from premium p INNER JOIN cardinfo c ON p.cardnumber = c.cardnumber
                    INNER JOIN paymentinfo pi ON c.cardnumber = pi.cardnumber
               WHERE pi.cardnumber = char_input);

end;
$$
language plpgsql;
```

```
Select getpremiumid('1111111111111111');
```

	getpremiumid bpchar
1	005

8. STORED PROCEDURE: `checkPayment` this automatically deletes a premium user and information from premium and adds them as a free user if they have not paid for the month (sample on trigger)

```
CREATE OR REPLACE FUNCTION checkPayment() RETURNS trigger AS
$$
declare
yn text;
card char(16);
id char(6);
    BEGIN

        IF TG_OP = 'INSERT' then
       yn = NEW.paidformonth;
       card = NEW.cardnumber;
       id = (Select getpremiumid(card));

          IF (yn = 'no') THEN
              DELETE FROM paymentinfo
              WHERE cardnumber = card;
              DELETE FROM cardinfo
              WHERE cardnumber = card;
              DELETE FROM premium
              WHERE premiumid = id;
              INSERT INTO free (freeid)
              VALUES (id);
              return new;
              END IF;
          END IF;
        return null;

    END;
$$
    LANGUAGE plpgsql;
```

9. STORED PROCEDURE: `replaceBandMember` this automatically deletes a member in the band that has the same role as the member being added (sample on trigger)

```
CREATE OR REPLACE FUNCTION replaceBandMember() RETURNS trigger AS
$$
    BEGIN
        IF TG_OP = 'INSERT' then

            IF ( NEW.role IN (select role from playsfor where artistid = NEW.artistID) ) then
            DELETE FROM playsfor
            WHERE artistid = NEW.artistid
            AND role = NEW.role
            AND musicianid != NEW.musicianid;
            return new;
            END IF;


        END IF;
        return null;

    END;
$$
    LANGUAGE plpgsql;
```

TRIGGERS: activated at insert, update, or delete and runs a specific function

TRIGGER: `checkPayment` whenever a premium user has not paid for the month, they are deleted from premium and added to free

```
CREATE TRIGGER checkPayment AFTER INSERT OR UPDATE ON paymentinfo
    FOR EACH ROW EXECUTE PROCEDURE checkPayment();
```

```
INSERT INTO PaymentInfo (cardNumber, amountCharged, studentOrNonStudent, datepaid, paidformonth)
     VALUES('1111111111111111', '9.99', 'non-student', '2016-04-01', 'no');
```

	freeid character(6)
1	002
2	003
3	001

	premiumid character(6)	cardnumber character(16)
1	005	2222222222222222
2	004	7777777777777777
3	012	6666666666666666

BEFORE

	freeid character(6)
1	002
2	003

	premiumid character(6)	cardnumber character(16)
1	001	1111111111111111
2	005	2222222222222222
3	004	7777777777777777
4	012	6666666666666666

AFTER

TRIGGER: `replaceBandMember` whenever a member is added to the band that has the same role as an older member, they are replaced by the new one

```
CREATE TRIGGER replacebandmember AFTER INSERT ON playsfor
    FOR EACH ROW EXECUTE PROCEDURE replacebandmember();
```

```
INSERT INTO playsfor (musicianid, artistid, role)
VALUES ('010', '016' ,'Lead Singer');
```

	musicianid character(6)	artistid character(6)	role text
1	006	016	Lead Guitarist
2	007	016	Lead Singer
3	008	004	Lead Singer
4	009	018	Lead Singer
5	010	009	Lead Singer
6	011	015	Lead Singer

BEFORE

<- is replaced

With ->

	musicianid character(6)	artistid character(6)	role text
1	006	016	Lead Guitarist
2	008	004	Lead Singer
3	009	018	Lead Singer
4	010	009	Lead Singer
5	011	015	Lead Singer
6	010	016	Lead Singer

AFTER

REPORTS: Interesting Queries - shown below are queries that exemplify the true analytical power of the database

1. Query to show list of users who most likely aren't using Spotify anymore (checks if user's last listening date is >= 1 year and if so, they are listed)

```
SELECT distinct firstName, lastName, username, lastDateListened(u.userid)
FROM listeninglog l INNER JOIN Users u ON l.userid = u.userid
          INNER JOIN people p ON p.pid = u.userid
          INNER JOIN usernames n ON u.userid = n.userid
WHERE (DATE_PART('year', current_date::date) - DATE_PART('year', lastdatelistened(l.
userid)::date)) >= 1
AND (DATE_PART('month', current_date::date) - DATE_PART('month', lastdatelistened(l.
userid)::date)) >= 0
AND (DATE_PART('month', current_date::date) - DATE_PART('month', lastdatelistened(l.
userid)::date)) <= 11;
```

	firstname text	lastname text	username character(28)	lastdatelistened date
1	Jane	Doe	JaniesGotAGun	2015-04-21
2	Vladimir	Putin	VladMan42	2015-04-23
3	James	Bond	James Bond	2015-04-23

2. Query that shows list of users and credit cards that might be stolen. Compares country of billing zip code to that of the listening location zip code and if they're different, than it comes up as possily stolen)

```
CREATE OR REPLACE VIEW PossibleCardTheft AS
SELECT firstname, lastname, username, p.cardNumber, ReturnCountry(listeningLocationZip)
as DifferentCountryThanBilling, datelistenedTo
FROM listeninglog l  INNER JOIN users u ON l.userid = u.userid
          INNER JOIN premium p ON u.userid = p.premiumid
          INNER JOIN cardinfo c ON p.cardNUmber = c.cardnumber
          INNER JOIN people pl ON pl.pid = u.userid
          INNER JOIN usernames n ON n.userid = u.userid
WHERE ReturnCountry(listeningLocationZip) != ReturnCountry(billingZip)
```

	firstname text	lastname text	username character(28)	cardnumber character(16)	differentcountrythanbilling text	datelistenedto timestamp without time zone
1	Jane	Doe	JaniesGotAGun	2222222222222222	India	2015-04-21 09:42:15
2	James	Bond	James Bond	7777777777777777	India	2015-04-23 02:15:07

SECURITY: grants specific select, insert, update, delete commands to different users

DATABASE ADMIN - can change, update, and maintain database

```
create role database_admin
grant select,insert,update on all tables in schema public
to database_admin
```

PREMIUM USER - can view artists, albums, and songs; can change their card information; can add/delete friends, playlists, following

```
create role premium_user
grant select paymentinfo, friends, usernames, playlists, artists, albums, songs
to premium_user
grant update cardinfo
to premium_user
grant insert, update, delete friends, follows, playlists, contains
to premium_user
```

FREE USER - can view artists, albums, and songs; can add/delete friends, playlists, following

```
create role free_user
grant select friends, usernames, playlists, artists, albums, songs
to free_user
grant insert, update, delete friends, follows, playlists, contains
to free_user
```

The implementation went well with only few minor issues. The sample data used was generic, but held up extremely well with playing around with some interesting queries. One issue would probably be not accounting for free users having to listen to advertisements and premium users not having to. Also, when it comes to showing which artist made the song on an album with multiple artists, each song shows every collaborator as its artist instead of its particular one. In addition, these problems could be fixed with future enhancements by perhaps making another ads entity and directly connecting songs to artists as well without having to many artistID's throughout the other tables. One would also want to populate the database with much more data to implement it to its full potential in future use. Overall, I am satisfied with the database I created and I believe it holds up in real world application.