Modeling an Online Music Business

Zane Kansil
Loyola Marymount University
Database Systems

November 6, 2014

Contents

Chapter III

Description of the Enterprise

A friend of mine intends to put out an all-purpose site for his musical career. The site will be a hub for his online business and allow him to track sales and interactions with his fans.

The site will serve as a place to feature embedded music and video players for John's music. It will be necessary to monitor this hosted media in terms of listens and views. Some other metrics John is interested in are on-site plays (not a redirect), and redirects to his Soundcloud and YouTube accounts from their embedded players on his site. Videos and Songs are tracked separately due to their differing properties.

There is a sales aspect to the site, merchandise will also be sold under the same domain. Some merchandise will be physical, such as hats, headbands, wristbands and stickers. Other merchandise will be digital, such as a donation to download a mixtape (a non-album collection of John's music). Physical merchandise needs to be shipped, so appropriate data such as `shipping_status` and `destination` will need to be tracked. With physical merchandise, quantity and availability must be tracked. Digital merchandise is easier to manage as it is transmitted and there is less customer data to collect. Digital merchandise will also be infinitely available if listed, so there is no quantity related data to track.

JohnDB records data for Physical and Digital consumers separately.

As the main operator of his business, John wants to track of his sales and revenue. The most simple way to track this would be through a table of sales records. These records would detail everything necessary about the sale. A sale would correspond to a single type of product. If multiple products were purchased in the same transaction, then multiple sale entries would be logged.

III.1 Ten sample Questions John would ask

1. How many video plays today?
2. How many redirects to Soundcloud from embedded music players?
3. What is the redirect rate for videos?
4. Is “Black Silk Hooded Sweatshirt” sold out?
5. How many “Red Summer Beanie” items were sold in October 2014?
6. What physical goods are currently frozen? (sales prevented)
7. How many orders do I have to fill to the US?
8. What precentage of my digital consumers are from outside the US?
9. What is the average monthly revenue over the past six months?
10. What products have garnered zero sales in the past 14 days?

Chapter IV

Definition of Environment

IV.1 Input and Report forms

1. Video Metadata View

    - Video Name
    - Video (hosted at) URL
    - Number of plays
    - Total plays
    - Plays Today
    - Plays Yesterday
    - Total redirects to YouTube

2. Song Metadata View

    - Song Name
    - Song Artist
    - Song (hosted at) URL
    - Total plays
    - Plays Today
    - Plays Yesterday
    - Total redirects to SoundCloud

3. Add New Physical good

    - Name
    - Description Paragraph
    - Upload/Choose an Image
    - Color (optional)
    - Size (optional)
    - Price (in USD)
    - Current stock on hand

4. Add New Digital good

    - Name
    - Description Paragraph
    - Upload/Choose an Image
    - Price (in USD)

5. Physical Good Admin

    - Name (editable)
    - SKU (generated from original name, can re-generate)
    - Description Paragraph (truncated, editable)
    - Image (editable)
    - Color (editable)
    - Price (editable)
    - Quantity Available (editable, warning message)
    - Total sales

6. Digital Good Admin

    - Name (editable)
    - SKU (generated from original name, can re-generate)
    - Description Paragraph (truncated, editable)
    - Image (editable)
    - Price (editable)
    - Freeze sales (boolean, editable, default false)

7. Physical Consumer details entry

    - First Name
    - Last Name
    - Email
    - Phone (optional)
    - Address Line 1
    - Address Line 2 (optional)
    - Zip Code
    - Country (un-settable, value is US)
    - State (dropdown)

8. Digital Consumer details entry

    - First Name
    - Last Name (optional)
    - Email
    - Phone (optional)
    - Country

9. Sales table

    - Item id
    - Item SKU
    - Sale type (`digital` or `physical`)
    - Status (`received`, `shipped` or `fulfilled`)
    - Quantity
    - Unit Price
    - Total Order Cost
    - Date received

IV.2 Assumptions

1. Forms are used to add items to the site
2. Tables as opposed to graphs are the prefered way to view data
3. The Sales table functions as an Orders table as well, showing the status of each order in addition to transaction information
4. Only customers in the US are allowed to order physical goods

IV.3 User-oriented data dictionary

Datum	Form or Screen								
	Video Metadata View	Song Metadata View	Add New Physical good	Add New Digital good	Physical Good Admin	Digital Good Admin	Physical Consumer details entry	Digital Consumer details entry	Sales table
dc_country						x		x	
dc_first_name						x		x	
dc_id						x			
dc_last_name						x		x	
dc_phone						x		x	
dg_description				x					
dg_image				x					
dg_is_available				x					
dg_name				x					
dg_price				x					
dg_sales				x					
dg_sku				x					x
mv_plays	x								
mv_plays_today	x								
mv_plays_yesterday	x								
mv_redirects	x								
mv_title	x								
mv_upload_date	x								
mv_url	x								
pc_address_line_1					x		x		
pc_address_line_2					x		x		
pc_country					x		x		
pc_email					x		x		
pc_first_name					x		x		
pc_id					x				
pc_last_name					x		x		
pc_phone					x		x		
pc_state					x		x		
pc_zip_code					x		x		
pg_color			x						
pg_description			x						
pg_image			x						

pg_name			x						
pg_price			x						
pg_quantity_available			x						
pg_sales									
pg_size			x						
pg_sku			x						x
sa_digital_sale									x
sa_filfill_date									x
sa_id									x
sa_physical_sale									x
sa_price									x
sa_quantity									x
sa_sku									x
sa_status									x
sa_timestamp									x
sa_total_cost									x
so_artist		x							
so_plays		x							
so_plays_today		x							
so_plays_yesterday		x							
so_redirects		x							
so_title		x							
so_upload_date		x							
so_url		x							

IV.4 Cross-reference table

Incomplete?

Chapter V

Enterprise Database Design

V.1 Logical model of the Enterprise

V.1.1 List of Entities and Attributes

1. Media
    - m_id
2. Music Video
    - mv_title
    - mv_url (url video is hosted at)
    - mv_upload_date
3. Song
    - so_title
    - so_artist
    - so_url (url song is hosted at)
    - so_upload_date
4. Interaction
    - i_date
5. Play
6. Redirect
    - to ("YouTube" or "SoundCloud")
7. Consumer
    - c_id
    - c_firstname
    - c_lastname
    - c_email
8. Physical Consumer
    - pc_address_line_1

- pc_address_line_2
- pc_country
- pc_state
- pc_phone

9. Digital Consumer

    - dc_phone (for confirmation, optional)
    - dc_country (optional)

10. Purchase

    - sale_id
    - sale_date (datetime)
    - sale_status is Received, Shipped or Fulfilled

11. Line Item

    - quantity

12. Good

    - g_sku
    - g_name
    - g_description
    - g_price

13. Digital Good

    - dg_is_frozen (boolean, used to prevent ordering)

14. Physical Good

    - pg_color
    - pg_size
    - pg_quantity_available

* - A datetime is an instant in time. Has date information and time-of-day information. Example: 2014-09-06T15:35:58+00:00 (September 6, 2014, 3:35:58pm)

V.1.2 List of Relationships and Attributes

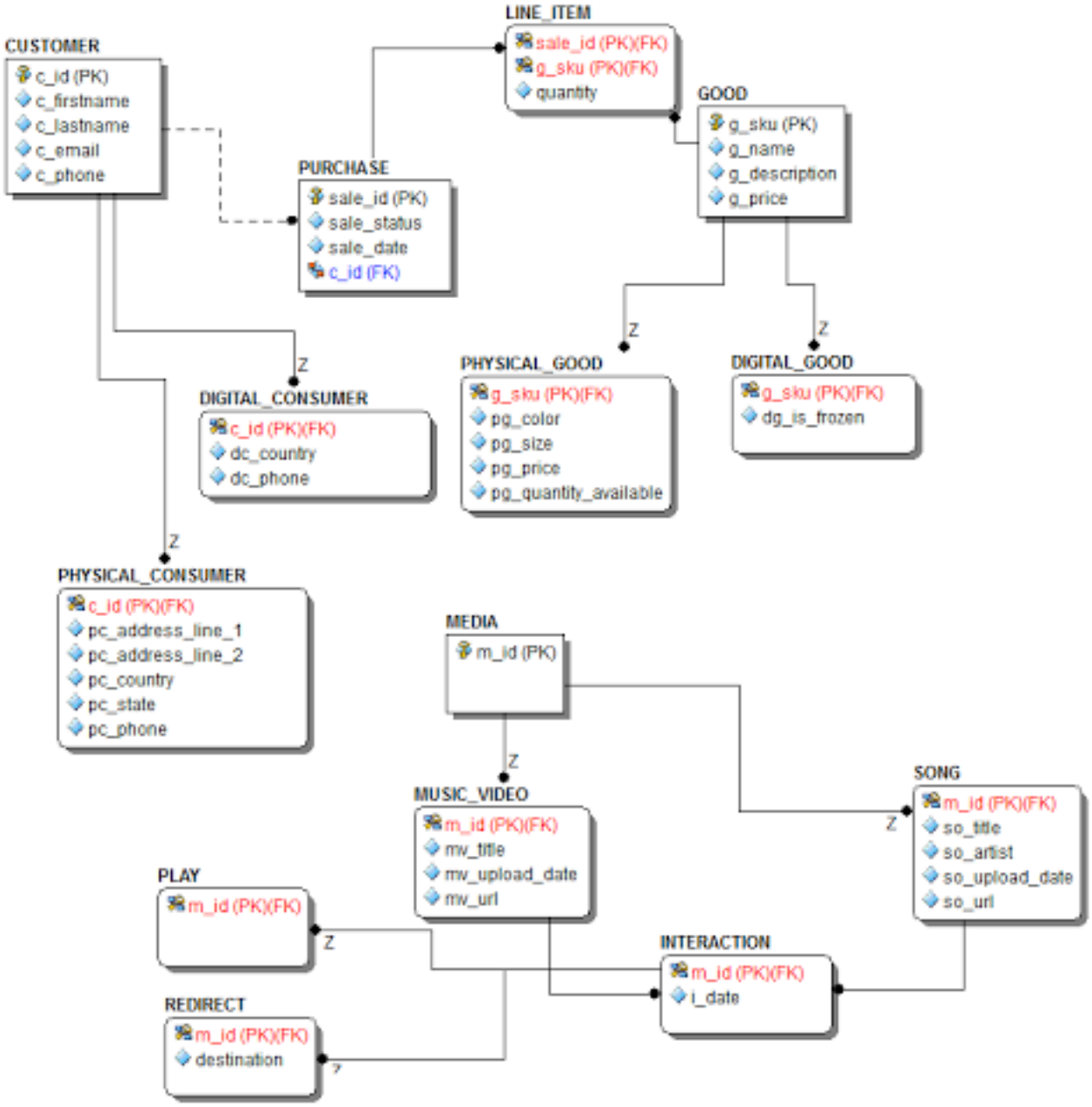
Media Relationships

1. MUSIC_VIDEO has many INTERACTION
2. INTERACTION has 1 MUSIC_VIDEO
3. SONG has many INTERACTION
4. INTERACTION has 1 SONG
5. INTERACTION is a PLAY
6. INTERACTION is a REDIRECT

Sales Relationships

1. CONSUMER is a PHYSICAL_CONSUMER
2. CONSUMER is a DIGITAL_CONSUMER
3. CONSUMERS make many PURCHASE
4. PURCHASE has 1 CUSTOMER
5. PURCHASE has many LINE_ITEM
6. PURCHASE has 1 STATUS
7. STATUS is applicable to 1 PURCHASE
8. LINE_ITEM belongs to 1 PURCHASE
9. LINE_ITEM has 1 GOOD
10. GOOD can appear in many LINE_ITEM
11. GOOD is a DIGITAL_GOOD
12. GOOD is a PHYSICAL_GOOD

V.1.3 Entity-Relationship diagram of the Enterprise



-ZK: will upgrade resolution next time...

V.2 Conceptual model of the enterprise

```
MEDIA(m_id)

MUSIC_VIDEO(m_id, mv_title, mv_url, mv_upload_date)
    PK/FK: m_id
    CK: m_id, mv_title, mv_url

SONG(m_id, so_title, so_artist, so_url, so_upload_date)
    PK/FK: m_id
    CK: m_id, so_title, so_url

PLAY(m_id, i_datetime)
    PK/FK: m_id
    CK: m_id

REDIRECT(m_id, m_to)
    PK/FK: m_id
    CK: m_id

CONSUMER(c_id, c_firstname, c_lastname, c_email)
    PK: c_id
    CK: c_id, c_email

PHYSICAL_CONSUMER(
  c_id
, pc_address_line_1
, pc_address_line_2
, pc_country
, pc_state
, pc_phone
)
    PK/FK: c_id
    CK: c_id, pc_phone

DIGITAL_CONSUMER(
  c_id
, pc_phone
, pc_country
)
    PK/FK: c_id
    CK: c_id, pc_phone

PURCHASE(p_id, c_id, p_date)
    PK/FK: p_id
    CK: p_id, c_id
```

```
LINE_ITEM(p_id, g_id, quantity)
    PK: p_id
    CK: p_id
    FK: p_id, g_id

GOOD(g_name, g_description, g_sku, g_price)
    PK: g_sku
    CK: g_name, g_sku

DIGITAL_GOOD(g_sku, dg_is_frozen)
    PK: g_sku
    CK: g_sku

PHYSICAL_GOOD(g_sku, pg_color, pg_size, pg_quantity_available)
    PK/FK: g_sku
    CK: g_sku
```

V.3 Table dictionary

V.4 Attribute dictionary

Chapter VI

Database and Query Definition

VI.1 Database Definition

```
--
-- ER/Studio Data Architect 9.6 SQL Code Generation
-- Project :      zk-online-music-business.DM1
--
-- Date Created : Tuesday, November 04, 2014 21:18:16
-- Target DBMS : MySQL 5.x
--

--
-- TABLE: CUSTOMER
--

CREATE TABLE CUSTOMER(
    c_id           VARCHAR(20)    NOT NULL,
    c_firstname    VARCHAR(20)    NOT NULL,
    c_lastname     VARCHAR(20)    NOT NULL,
    c_email        VARCHAR(20)    NOT NULL,
    c_phone        VARCHAR(20)    NOT NULL,
    PRIMARY KEY (c_id)
)ENGINE=INNODB
;



--
-- TABLE: DIGITAL_CONSUMER
--

CREATE TABLE DIGITAL_CONSUMER(
    c_id          VARCHAR(20)    NOT NULL,
    dc_country    VARCHAR(20)    NOT NULL,
    dc_phone      VARCHAR(20)    NOT NULL,
    PRIMARY KEY (c_id)
)ENGINE=INNODB
```

```
;



--
-- TABLE: DIGITAL_GOOD
--

CREATE TABLE DIGITAL_GOOD(
    g_sku           VARCHAR(20)    NOT NULL,
    dg_is_frozen    BIT(1)         NOT NULL,
    PRIMARY KEY (g_sku)
)ENGINE=INNODB
;



--
-- TABLE: GOOD
--

CREATE TABLE GOOD(
    g_sku            VARCHAR(20)    NOT NULL,
    g_name           VARCHAR(20)    NOT NULL,
    g_description    VARCHAR(20)    NOT NULL,
    g_price          VARCHAR(20)    NOT NULL,
    PRIMARY KEY (g_sku)
)ENGINE=INNODB
;



--
-- TABLE: INTERACTION
--

CREATE TABLE INTERACTION(
    m_id      VARCHAR(20)    NOT NULL,
    i_date    DATETIME       NOT NULL,
    PRIMARY KEY (m_id)
)ENGINE=INNODB
;



--
-- TABLE: LINE_ITEM
--
```

```
CREATE TABLE LINE_ITEM(
    sale_id     VARCHAR(20)    NOT NULL,
    g_sku       VARCHAR(20)    NOT NULL,
    quantity    INT,
    PRIMARY KEY (sale_id, g_sku)
)ENGINE=INNODB
;



--
-- TABLE: MEDIA
--

CREATE TABLE MEDIA(
    m_id    VARCHAR(20)    NOT NULL,
    PRIMARY KEY (m_id)
)ENGINE=INNODB
;



--
-- TABLE: MUSIC_VIDEO
--

CREATE TABLE MUSIC_VIDEO(
    m_id              VARCHAR(20)     NOT NULL,
    mv_title          VARCHAR(50)     NOT NULL,
    mv_upload_date    DATETIME        NOT NULL,
    mv_url            VARCHAR(100)    NOT NULL,
    PRIMARY KEY (m_id)
)ENGINE=INNODB
;



--
-- TABLE: PHYSICAL_CONSUMER
--

CREATE TABLE PHYSICAL_CONSUMER(
    c_id                VARCHAR(20)     NOT NULL,
    pc_address_line_1   VARCHAR(255)    NOT NULL,
    pc_address_line_2   VARCHAR(255),
    pc_country          VARCHAR(20)     NOT NULL,
    pc_state            VARCHAR(20)     NOT NULL,
    pc_phone            VARCHAR(20)     NOT NULL,
    PRIMARY KEY (c_id)
```

```
)ENGINE=INNODB
;



--
-- TABLE: PHYSICAL_GOOD
--

CREATE TABLE PHYSICAL_GOOD(
    g_sku                   VARCHAR(20)    NOT NULL,
    pg_color                VARCHAR(20),
    pg_size                 VARCHAR(20),
    pg_price                FLOAT(8, 0)    NOT NULL,
    pg_quantity_available   INT            NOT NULL,
    PRIMARY KEY (g_sku)
)ENGINE=INNODB
;



--
-- TABLE: PLAY
--

CREATE TABLE PLAY(
    m_id    VARCHAR(20)    NOT NULL,
    PRIMARY KEY (m_id)
)ENGINE=INNODB
;



--
-- TABLE: PURCHASE
--

CREATE TABLE PURCHASE(
    sale_id        VARCHAR(20)    NOT NULL,
    sale_status    VARCHAR(20)    NOT NULL,
    sale_date      DATETIME       NOT NULL,
    c_id           VARCHAR(20)    NOT NULL,
    PRIMARY KEY (sale_id)
)ENGINE=INNODB
;



--
```

```
-- TABLE: REDIRECT
--

CREATE TABLE REDIRECT(
    m_id           VARCHAR(20)    NOT NULL,
    destination    VARCHAR(20)    NOT NULL,
    PRIMARY KEY (m_id)
)ENGINE=INNODB
;



--
-- TABLE: SONG
--

CREATE TABLE SONG(
    m_id              VARCHAR(20)     NOT NULL,
    so_title          VARCHAR(50)     NOT NULL,
    so_artist         VARCHAR(20)     NOT NULL,
    so_upload_date    DATETIME        NOT NULL,
    so_url            VARCHAR(100)    NOT NULL,
    PRIMARY KEY (m_id)
)ENGINE=INNODB
;



--
-- INDEX: Ref22
--

CREATE INDEX Ref22 ON DIGITAL_CONSUMER(c_id)
;
--
-- INDEX: Ref97
--

CREATE INDEX Ref97 ON DIGITAL_GOOD(g_sku)
;
--
-- INDEX: Ref148
--

CREATE INDEX Ref148 ON INTERACTION(m_id)
;
--
-- INDEX: Ref84
--
```

```
CREATE INDEX Ref84 ON LINE_ITEM(sale_id)
;
--
-- INDEX: Ref95
--

CREATE INDEX Ref95 ON LINE_ITEM(g_sku)
;
--
-- INDEX: Ref1610
--

CREATE INDEX Ref1610 ON MUSIC_VIDEO(m_id)
;
--
-- INDEX: Ref21
--

CREATE INDEX Ref21 ON PHYSICAL_CONSUMER(c_id)
;
--
-- INDEX: Ref96
--

CREATE INDEX Ref96 ON PHYSICAL_GOOD(g_sku)
;
--
-- INDEX: Ref1312
--

CREATE INDEX Ref1312 ON PLAY(m_id)
;
--
-- INDEX: Ref23
--

CREATE INDEX Ref23 ON PURCHASE(c_id)
;
--
-- INDEX: Ref1313
--

CREATE INDEX Ref1313 ON REDIRECT(m_id)
;
--
-- INDEX: Ref1611
--
```

```
CREATE INDEX Ref1611 ON SONG(m_id)
;
--
-- TABLE: DIGITAL_CONSUMER
--

ALTER TABLE DIGITAL_CONSUMER ADD CONSTRAINT RefCUSTOMER2
    FOREIGN KEY (c_id)
    REFERENCES CUSTOMER(c_id)
;


--
-- TABLE: DIGITAL_GOOD
--

ALTER TABLE DIGITAL_GOOD ADD CONSTRAINT RefGOOD7
    FOREIGN KEY (g_sku)
    REFERENCES GOOD(g_sku)
;


--
-- TABLE: INTERACTION
--

ALTER TABLE INTERACTION ADD CONSTRAINT RefMUSIC_VIDEO8
    FOREIGN KEY (m_id)
    REFERENCES MUSIC_VIDEO(m_id)
;

ALTER TABLE INTERACTION ADD CONSTRAINT RefSONG9
    FOREIGN KEY (m_id)
    REFERENCES SONG(m_id)
;


--
-- TABLE: LINE_ITEM
--

ALTER TABLE LINE_ITEM ADD CONSTRAINT RefPURCHASE4
    FOREIGN KEY (sale_id)
    REFERENCES PURCHASE(sale_id)
;

ALTER TABLE LINE_ITEM ADD CONSTRAINT RefGOOD5
    FOREIGN KEY (g_sku)
    REFERENCES GOOD(g_sku)
```

```
;


--
-- TABLE: MUSIC_VIDEO
--

ALTER TABLE MUSIC_VIDEO ADD CONSTRAINT RefMEDIA10
    FOREIGN KEY (m_id)
    REFERENCES MEDIA(m_id)
;


--
-- TABLE: PHYSICAL_CONSUMER
--

ALTER TABLE PHYSICAL_CONSUMER ADD CONSTRAINT RefCUSTOMER1
    FOREIGN KEY (c_id)
    REFERENCES CUSTOMER(c_id)
;


--
-- TABLE: PHYSICAL_GOOD
--

ALTER TABLE PHYSICAL_GOOD ADD CONSTRAINT RefGOOD6
    FOREIGN KEY (g_sku)
    REFERENCES GOOD(g_sku)
;


--
-- TABLE: PLAY
--

ALTER TABLE PLAY ADD CONSTRAINT RefINTERACTION12
    FOREIGN KEY (m_id)
    REFERENCES INTERACTION(m_id)
;


--
-- TABLE: PURCHASE
--

ALTER TABLE PURCHASE ADD CONSTRAINT RefCUSTOMER3
    FOREIGN KEY (c_id)
```

```
    REFERENCES CUSTOMER(c_id)
;


--
-- TABLE: REDIRECT
--

ALTER TABLE REDIRECT ADD CONSTRAINT RefINTERACTION13
    FOREIGN KEY (m_id)
    REFERENCES INTERACTION(m_id)
;


--
-- TABLE: SONG
--

ALTER TABLE SONG ADD CONSTRAINT RefMEDIA11
    FOREIGN KEY (m_id)
    REFERENCES MEDIA(m_id)
;
```

VI.2 Database Queries

```
-- (1) How many video plays today?

SELECT count(‘p‘.‘i_date‘)
FROM       ‘MUSIC_VIDEO‘ AS ‘mv‘
INNER JOIN ‘PLAY‘        AS ‘p‘
ON         ‘mv‘.‘m_id‘   =  ‘p‘.‘m_id‘
WHERE      ‘p‘.‘i_date‘  >= curdate()
AND        ‘p‘.‘i_date‘  <= curdate()
;

-- (2) How many redirects to Soundcloud from embedded music players?

SELECT count(‘r‘.‘to‘)
FROM       ‘SONG‘     AS ‘s‘
INNER JOIN ‘REDIRECT‘ AS ‘r‘
ON         ‘s‘.‘m_id‘ =  ‘r‘.‘m_id‘
WHERE      ‘r‘.‘to‘   =  "soundcloud"
;

-- (3) What is the redirect rate for videos?

SELECT count(‘p‘.‘m_id‘), count(‘r‘.‘m_id‘)
FROM       ‘MUSIC_VIDEO‘ AS ‘mv‘
INNER JOIN ‘PLAY‘        AS ‘p‘
ON         ‘mv‘.‘m_id‘   =  ‘p‘.‘m_id‘
INNER JOIN ‘REDIRECT‘    AS ‘r‘
ON         ‘mv‘.‘m_id‘   =  ‘r‘.‘m_id‘
;

-- (4) Is Black Silk Hooded Sweatshirt sold out?

SELECT ‘pg‘.‘pg_quantity_available‘
FROM   ‘PHYSICAL_GOOD‘ AS ‘pg‘
;

-- (5) How many Red Summer Beanie items were sold in October 2014?

SELECT count(‘s‘.‘sale_id‘)
FROM  ‘PURCHASE‘      AS ‘s‘
WHERE ‘s‘.‘sale_date‘ >= "2014-10-1"
AND   ‘s‘.‘sale_date‘ <= "2014-10-31"
;

-- (6) What physical goods are currently frozen? (sales prevented)

SELECT ‘pg‘.‘pg_name‘
FROM   ‘PHYSICAL_GOOD‘     AS ‘pg‘
```

```
WHERE  ‘pg‘.‘pg_is_frozen‘ =  1
;

-- (7) How many orders do I have to fill to the US?

SELECT count(‘pg‘.‘sale_id‘)
FROM       ‘PHYSICAL_CUSTOMER‘ AS ‘pc‘
INNER JOIN ‘PURCHASE‘          AS ‘sale‘
ON         ‘pc‘.‘c_id‘         =  ‘sale‘.‘c_id‘
WHERE      ‘pc‘.‘pc_country‘   =  "US"
;

-- (8) What precentage of my digital consumers are from outside the US?
SELECT count(‘dg‘.‘c_id‘), count(‘foreign‘.‘c_id‘)
FROM   ‘DIGITAL_CUSTOMER‘     AS ‘dg‘
   ,   ‘DIGITAL_CUSTOMER‘     AS ‘foreign‘
WHERE  ‘foreign‘.‘dc_country‘ != "US"
;

-- (9) What is the average monthly revenue over the past six months?

#  INCOMPLETE

-- (10) What products have garnered zero sales in the past 14 days?

SELECT DISTINCT ‘g‘.‘g_name‘
FROM            ‘LINE_ITEM‘      AS ‘li‘
LEFT JOIN       ‘GOOD‘           AS ‘g‘
ON              ‘li‘.‘g_sku‘     =  ‘g‘.‘g_sku‘
WHERE           ‘li‘.‘sale_date‘ >= DATE_SUB(curdate(), INTERVAL 2 WEEK)
AND             ‘g‘.‘g_sku‘      IS NULL
;
```

VI.3 Design Tradeoffs and Limitations

Not too many limitation currently. I recently added a parent `MEDIA` entity for videos and songs.

Chapter VII

Database Integrity and Security

VII.1 Functional Dependencies

A list of the functional dependencies that hold on your database.

VII.2 Adjustments for Normalization

An explanation of the changes needed to normalize your database.

VII.3 Integrity and Security

A list (in English) of the integrity and security constraints which are to hold on your database.

Chapter VIII

Implementation Notes

VIII.1 Indices

A list of the indices used by your database, with a justification for each.

VIII.2 Data

The data used to populate your database.

VIII.3 Query Trace

A trace of the execution of each of your queries.

VIII.4 Implementation Assessment

An assessment of how smoothly your implementation went

Chapter IX

Lessons Learned