GETTING STARTED WITH NoSQL

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ABOUT ME

- Shop.com / Market America
- Mobile Architect
- Kansas Jayhawks

TOPICS

- The problem with SQL
- History of NoSQL
- Database theories
- Modeling
- Patterns

THE PROBLEM WITH SQL

- Designed to run on large servers
- Built for Vertical Scaling
- Separated Models i.e. Tables

IN DEVELOPMENT

- We assemble objects as a whole
    - Cart
    - Order
    - Profile
    - Product
- Saving objects requires
    - Deconstructing
    - Multiple rows
    - Multiple tables

IMPEDANCE MISTMATCH

"The object-relational impedance mismatch is a set of conceptual and technical difficulties that are often encountered when a relational database management system (RDBMS) is being used by a program written in an object-oriented programming language or style, particularly when objects or class definitions are mapped in a straightforward way to database tables or relational schema." - Wikipedia

YOU CAN IGNORE SQL
AND TRUST THE ORM MAGIC
memegenerator.net

Google BigTable

Amazon DynamoDB

NoSQL

No SQL

Not only SQL

#nosql

WHAT IS NOSQL?

- non-relational
- cluster friendly
- generally open-source
- 21st century
- schema-less

TYPES OF NOSQL DATABASES

- Key-Value
- Column / Column-family
- Document
- Graph

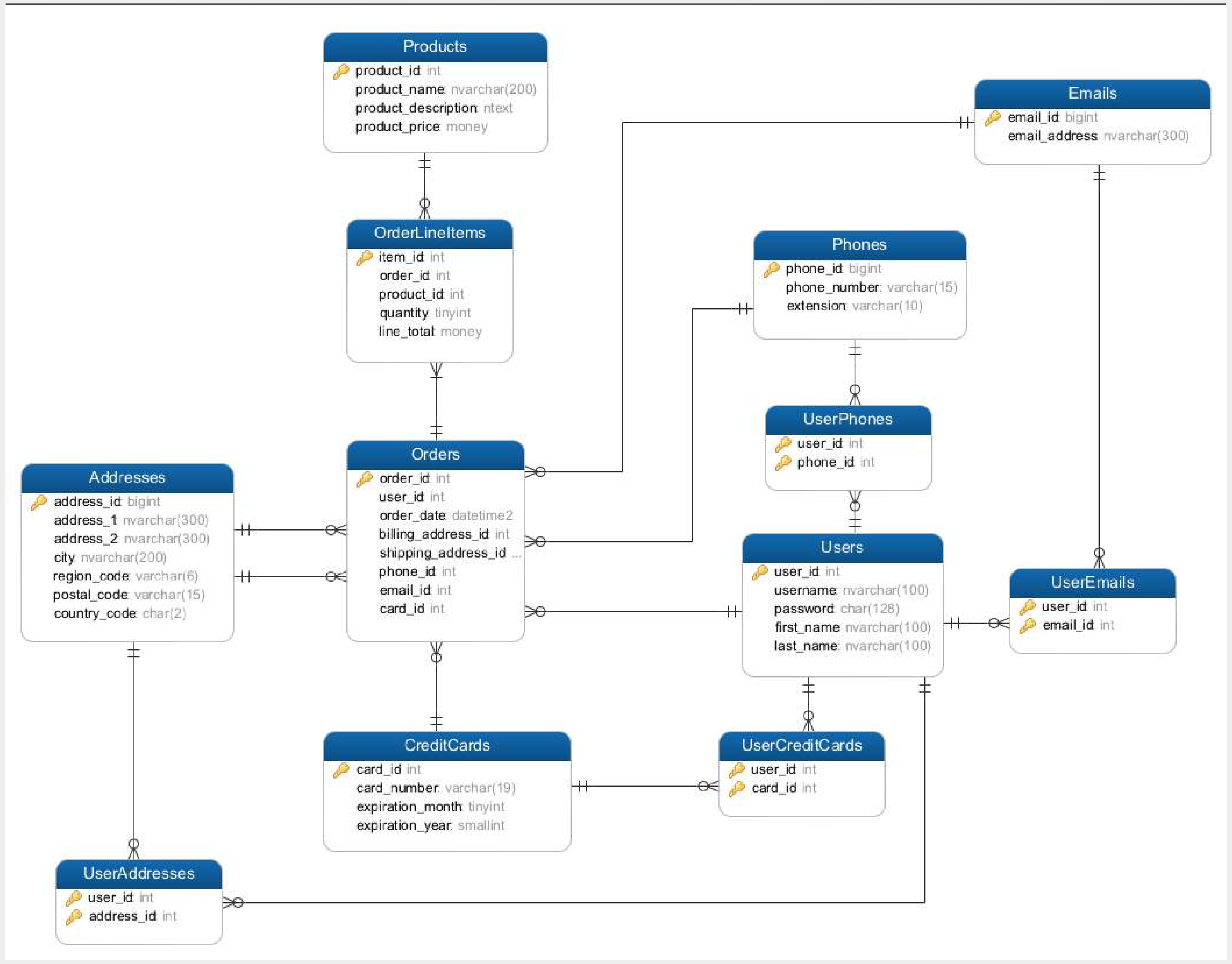
AGGREGATES

```
// Order.cfc
component accessors="true"{
        property="order_id" type="numeric";
        property="order_date" type="date";
        property="products" type="array";
        property="user_id" type="numeric";
        property="billing_address_1" type="string";
        property="billing_address_2" type="string";
        property="billing_city" type="string";
        property="billing_region_code" type="string";
        property="billing_postal_code" type="string";
        property="billing_country_code" type="string";
        property="shipping_address_1" type="string";
        property="shipping_address_2" type="string";
        property="shipping_city" type="string";
        property="shipping_region_code" type="string";
        property="shipping_postal_code" type="string";
        property="shipping_country_code" type="string";
        property="card_number" type="string";
        property="expiration_month" type="numeric";
        property="expiration_year" type="numeric";
}
```

```
// Order.cfc
component accessors="true"{
        property="order_id" type="numeric";
        property="order_date" type="date";
        property="products" type="array";
        property="user" type="User";
        property="billing" type="Address";
        property="shipping" type="Address";
        property="cc_info" type="CreditCard";
}
```

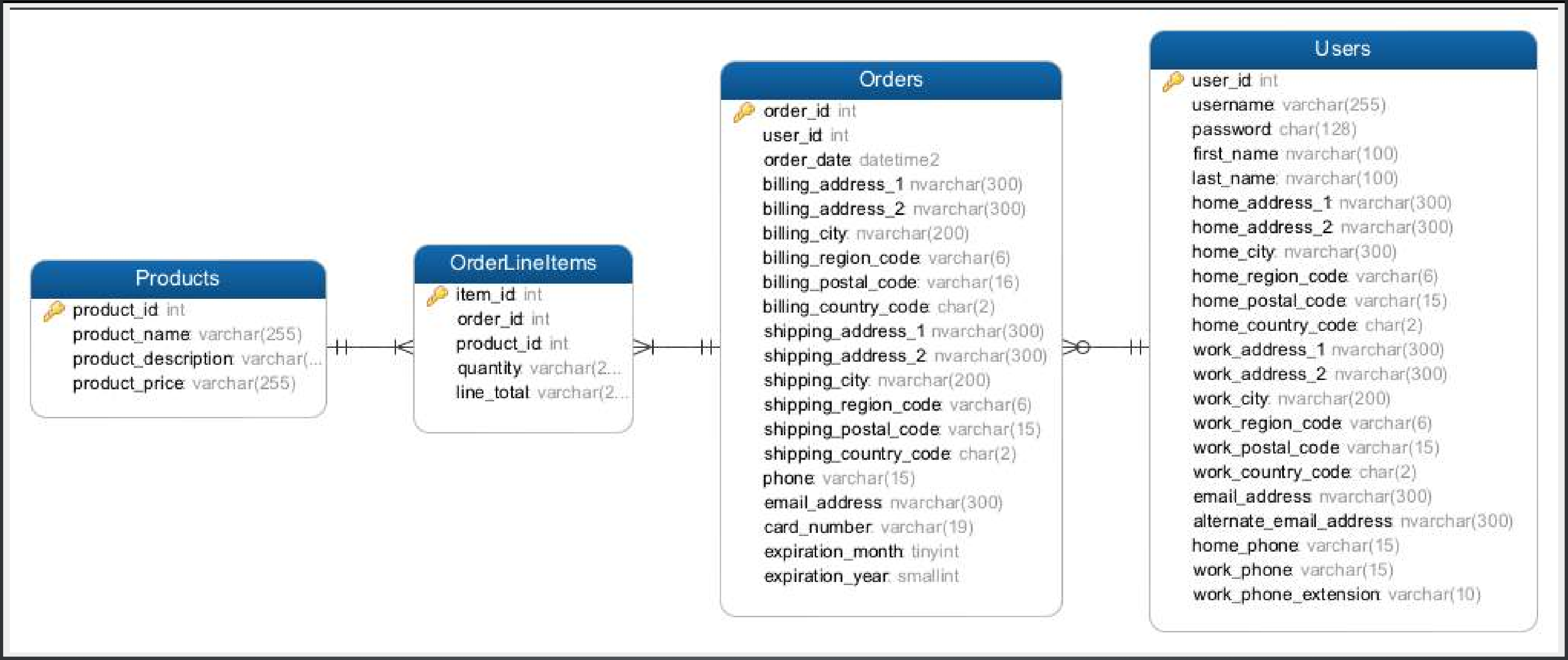
NORMALIZATION

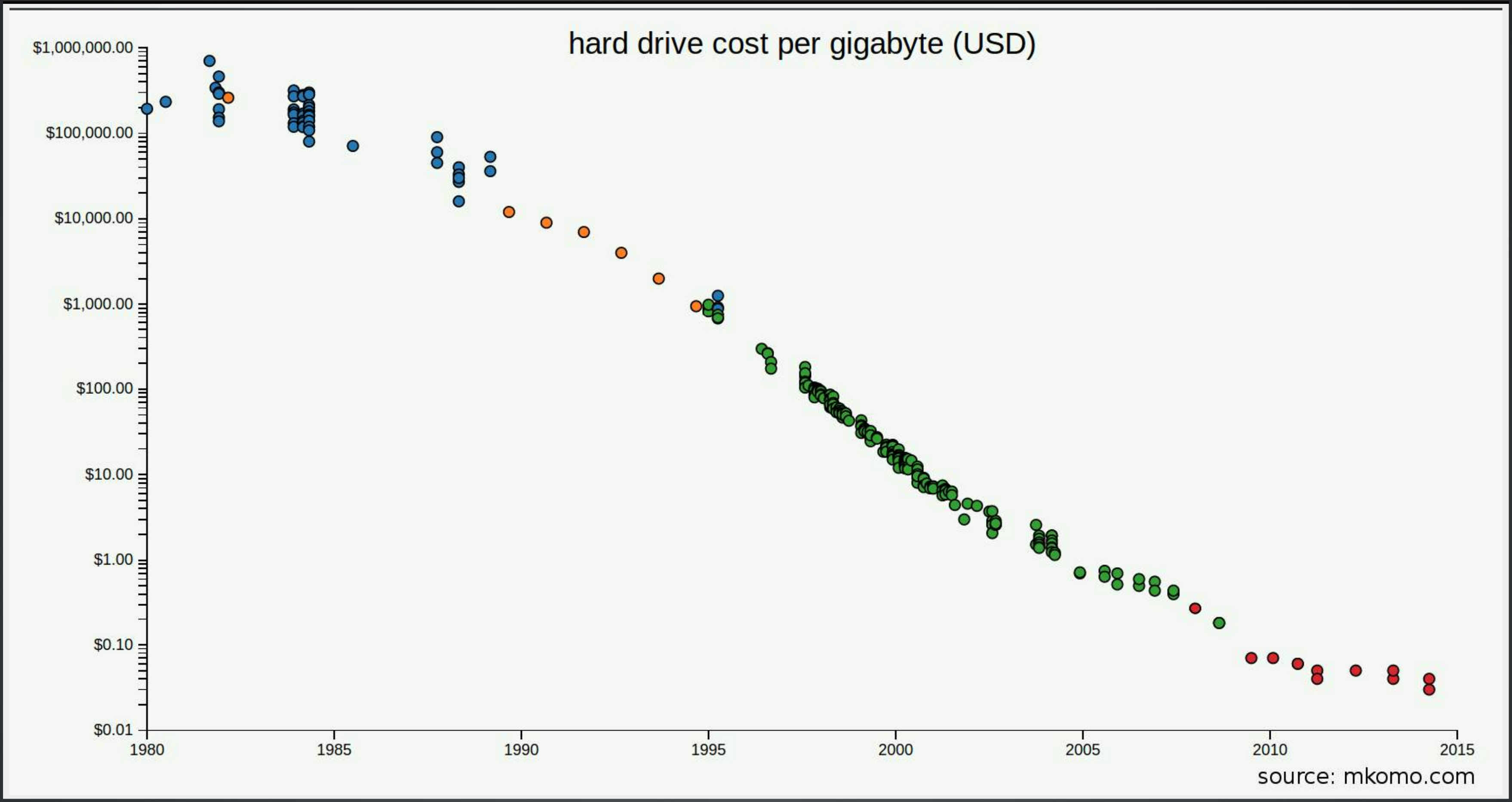
- Minimize data redundancy
- Structured models
- Logical queries
- Fast inserts / updates
- Less storage requirements


Products
product_id int
product_name nvarchar(200)
product_description ntext
product_price money
Emails
email_id bigint
email_address nvarchar(300)
OrderLineItems
item_id int
order_id int
product_id int
quantity tinyint
line_total money
Phones
phone_id bigint
phone_number varchar(15)
extension varchar(10)
UserPhones
user_id int
phone_id int
Addresses
address_id bigint
address_1 nvarchar(300)
address_2 nvarchar(300)
city nvarchar(200)
region_code varchar(6)
postal_code varchar(15)
country_code char(2)
Orders
order_id int
user_id int
order_date datetime2
billing_address_id int
shipping_address_id ...
phone_id int
email_id int
card_id int
Users
user_id int
username nvarchar(100)
password char(128)
first_name nvarchar(100)
last_name nvarchar(100)
UserEmails
user_id int
email_id int
CreditCards
card_id int
card_number varchar(19)
expiration_month tinyint
expiration_year smallint
UserCreditCards
user_id int
card_id int
UserAddresses
user_id int
address_id int

DENORMALIZATION

- Minimize JOINs
- Fast reads
- Repeated data
- More storage requirements


Products
product_id int
product_name varchar(255)
product_description varchar(...
product_price varchar(255)
OrderLineItems
item_id int
order_id int
product_id int
quantity varchar(2...
line_total varchar(2...
Orders
order_id int
user_id int
order_date datetime2
billing_address_1 nvarchar(300)
billing_address_2 nvarchar(300)
billing_city nvarchar(200)
billing_region_code varchar(6)
billing_postal_code varchar(16)
billing_country_code char(2)
shipping_address_1 nvarchar(300)
shipping_address_2 nvarchar(300)
shipping_city nvarchar(200)
shipping_region_code varchar(6)
shipping_postal_code varchar(15)
shipping_country_code char(2)
phone varchar(15)
email_address nvarchar(300)
card_number varchar(19)
expiration_month tinyint
expiration_year smallint
Users
user_id int
username varchar(255)
password char(128)
first_name nvarchar(100)
last_name nvarchar(100)
home_address_1 nvarchar(300)
home_address_2 nvarchar(300)
home_city nvarchar(300)
home_region_code varchar(6)
home_postal_code varchar(15)
home_country_code char(2)
work_address_1 nvarchar(300)
work_address_2 nvarchar(300)
work_city nvarchar(200)
work_region_code varchar(6)
work_postal_code varchar(15)
work_country_code char(2)
email_address nvarchar(300)
alternate_email_address nvarchar(300)
home_phone varchar(15)
work_phone varchar(15)
work_phone_extension varchar(10)


hard drive cost per gigabyte (USD)
$1,000,000.00
$100,000.00
$10,000.00
$1,000.00
$100.00
$10.00
$1.00
$0.10
$0.01
1980
1985
1990
1995
2000
2005
2010
2015
source: mkomo.com

TRANSACTION PROCESSING

ACID

- Atomicity
- Consistency
- Isolation
- Durability

BASE

- <u>B</u>asically <u>A</u>vailable
- <u>S</u>oft State
- <u>E</u>ventual Consistency

ATOMIC TRANSACTIONS

Aggregate Orientated == NoSQL - Graph

CONFLICT RESOLUTION

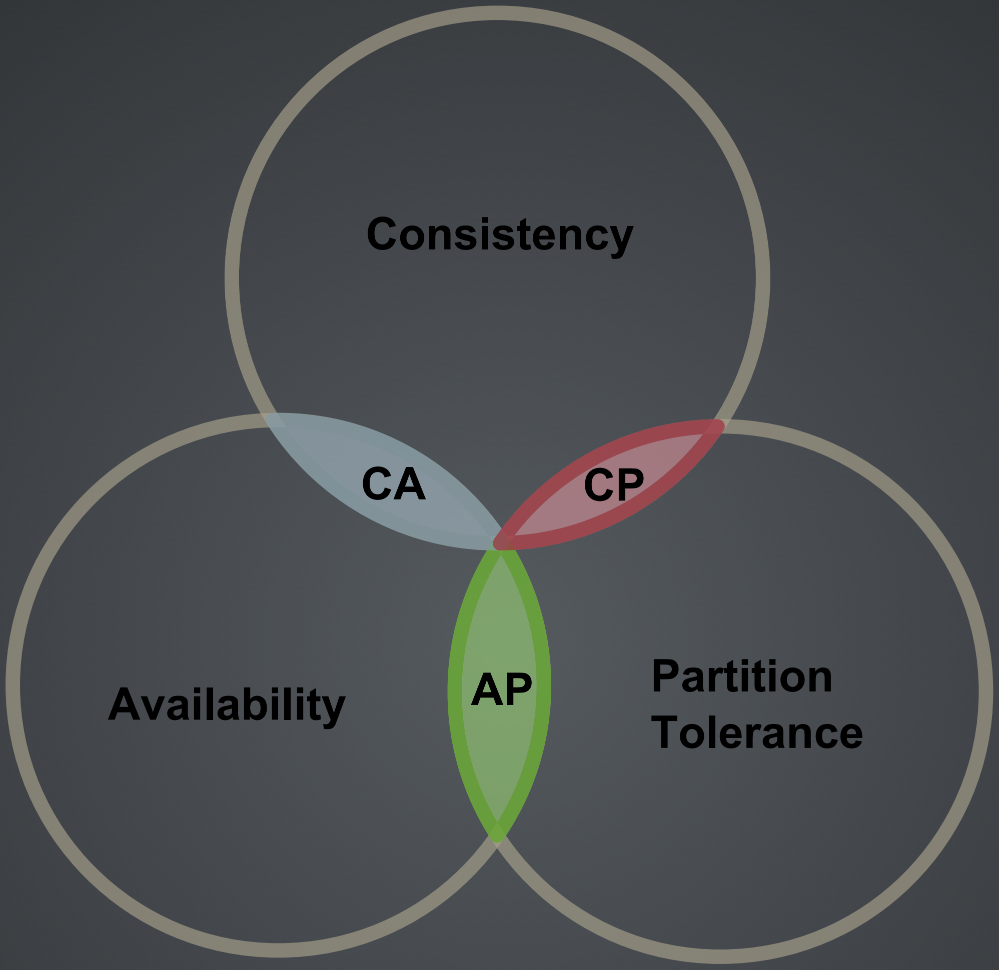
CONSISTENCY

SHARDING VS. REPLICATION

CAP THEOREM

- Consistency
- Availability
- Partition Tolerance

You can only provide 2 of the 3


Consistency
CA
CP
AP
Availability
Partition Tolerance

RDBMS SCHEMAS

- Known Models
- Fixed Fields
- Data types
- Database managed
- Change can be difficult

0:09

NOSQL SCHEMAS

- Any type of data
- Flexible
- Application managed
- Change is easy

0:14

IMPLICIT SCHEMA

~~SCHEMA-LESS~~

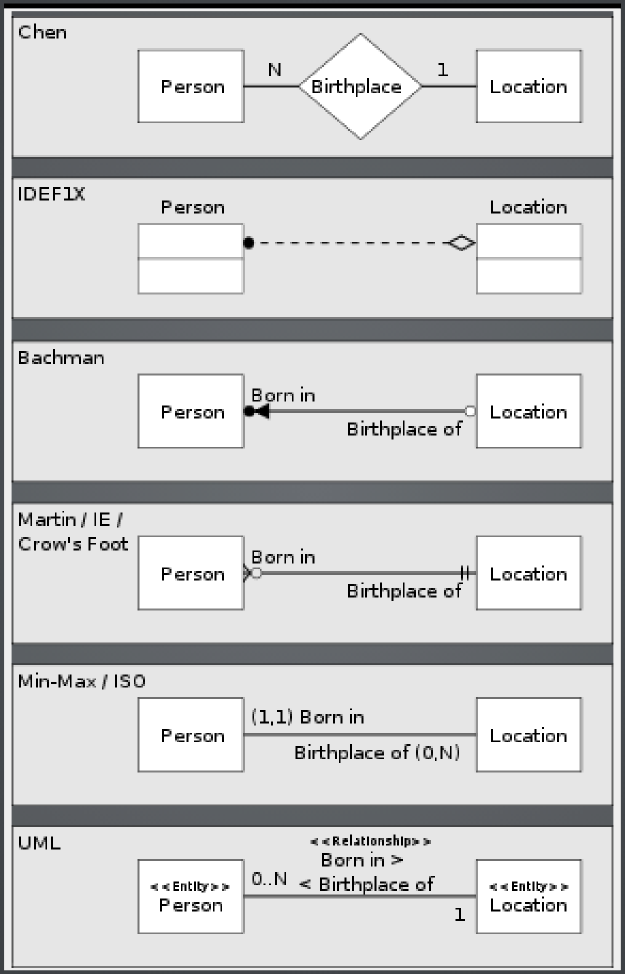
DATA / ENTITY RELATIONSHIP MODELING

- Conceptual Data Model
- Logical Data Model
- Physical Data Model

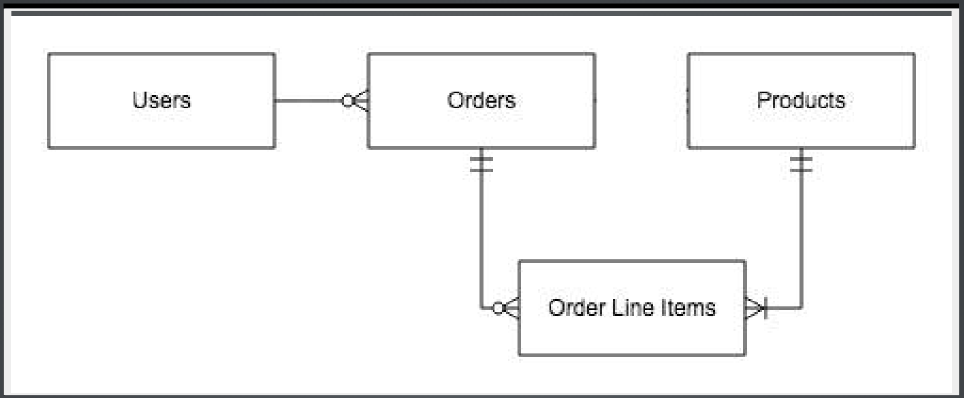
CONCEPTUAL DATA MODEL

- Entity Names
- Entity Relationships

MODELING NOTATIONS



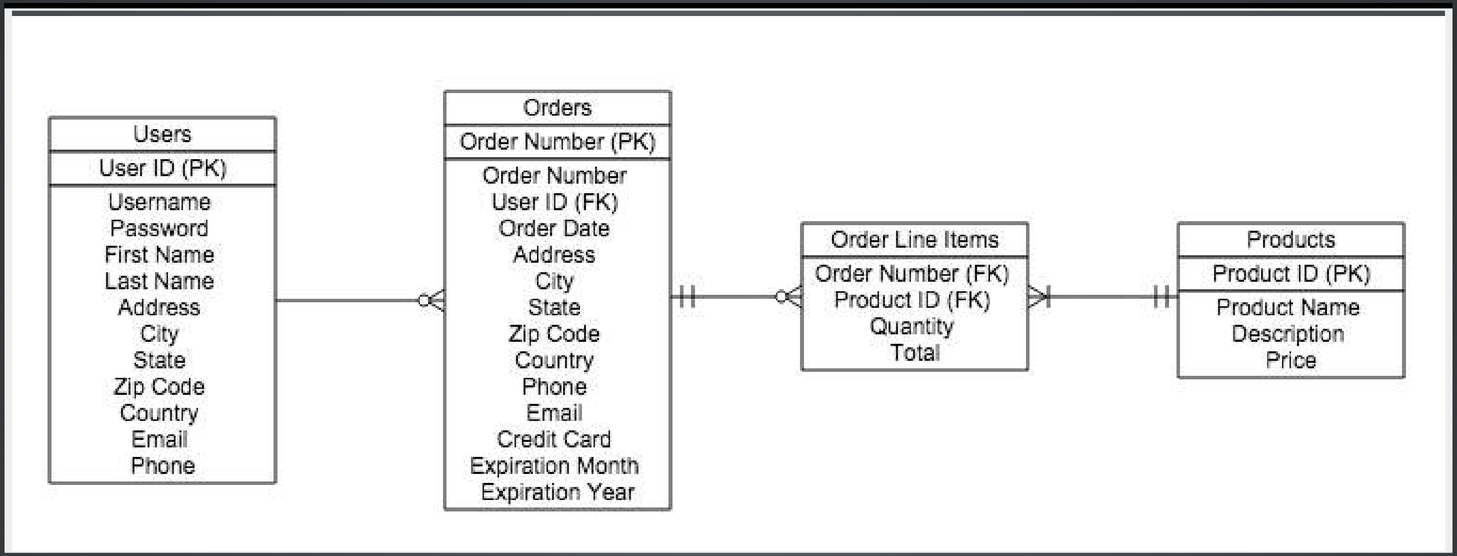
CONCEPTUAL DATA MODEL



LOGICAL DATA MODEL

- Entity Names
- Entity Relationships
- Attributes
- Primary / Foreign Keys

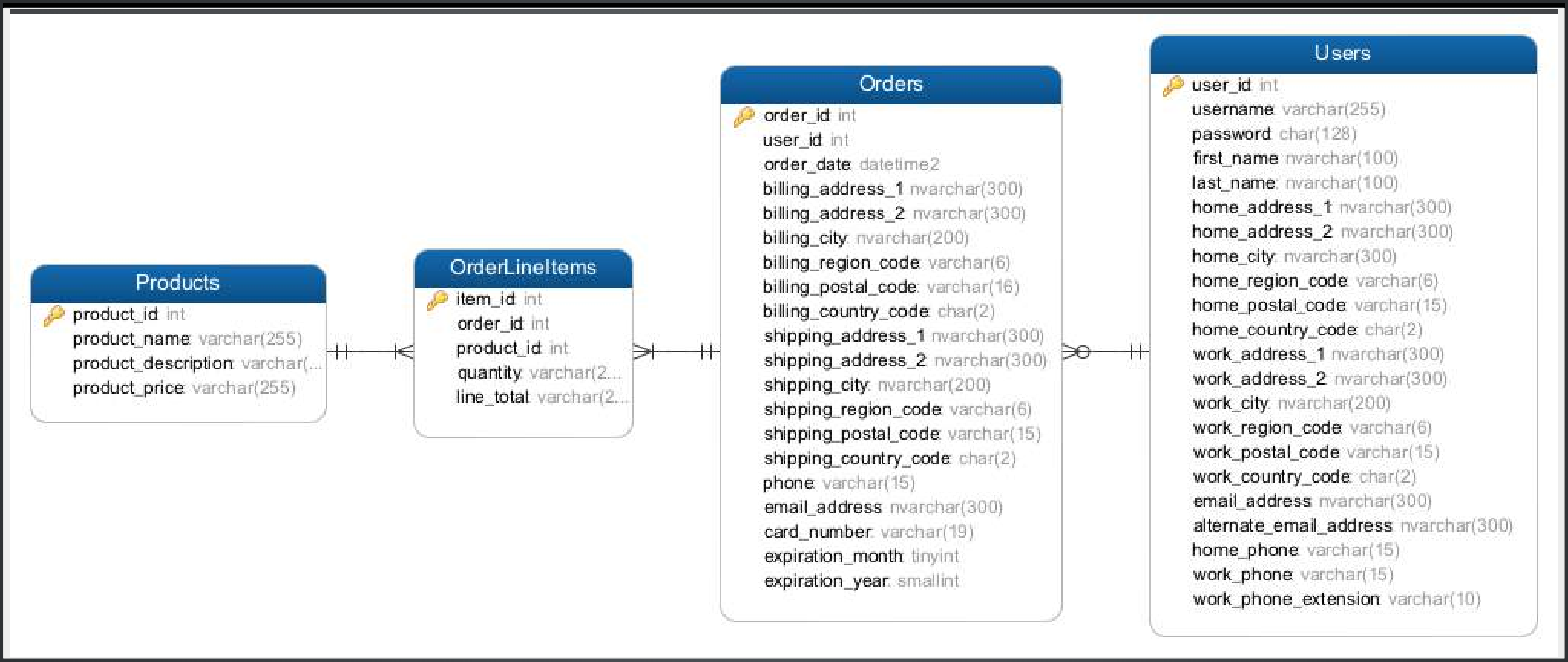
LOGICAL DATA MODEL



PHYSICAL DATA MODEL

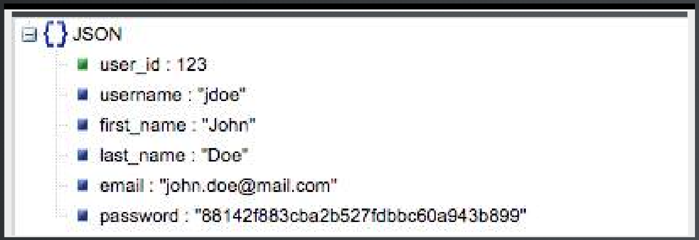
- Entity -> Table Names
- Attributes -> Field Names
- Keys -> Primary / Foreign Keys
- Data Types

PHYSICAL DATA MODEL



Products
product_id int
product_name varchar(255)
product_description varchar(...
product_price varchar(255)
OrderLineItems
item_id int
order_id int
product_id int
quantity varchar(2...
line_total varchar(2...
Orders
order_id int
user_id int
order_date datetime2
billing_address_1 nvarchar(300)
billing_address_2 nvarchar(300)
billing_city nvarchar(200)
billing_region_code varchar(6)
billing_postal_code varchar(16)
billing_country_code char(2)
shipping_address_1 nvarchar(300)
shipping_address_2 nvarchar(300)
shipping_city nvarchar(200)
shipping_region_code varchar(6)
shipping_postal_code varchar(15)
shipping_country_code char(2)
phone varchar(15)
email_address nvarchar(300)
card_number varchar(19)
expiration_month tinyint
expiration_year smallint
Users
user_id int
username varchar(255)
password char(128)
first_name nvarchar(100)
last_name nvarchar(100)
home_address_1 nvarchar(300)
home_address_2 nvarchar(300)
home_city nvarchar(300)
home_region_code varchar(6)
home_postal_code varchar(15)
home_country_code char(2)
work_address_1 nvarchar(300)
work_address_2 nvarchar(300)
work_city nvarchar(200)
work_region_code varchar(6)
work_postal_code varchar(15)
work_country_code char(2)
email_address nvarchar(300)
alternate_email_address nvarchar(300)
home_phone varchar(15)
work_phone varchar(15)
work_phone_extension varchar(10)

PHYSICAL DATA MODEL IN NOSQL



```
JSON
    user_id : 123
    username : "jdoe"
    first_name : "John"
    last_name : "Doe"
    email : "john.doe@mail.com"
    password : "88142f883cba2b527fdbbc60a943b899"
```

```
{
 "user_id": 123,
 "username": "jdoe",
 "first_name": "John",
 "last_name": "Doe",
 "email": "john.doe@mail.com",
 "password": "88142f883cba2b527fdbbc60a943
}
```

KEY DESIGN

- Prefixing
- Predictable
- Counter ID
- Unpredictable
- Combinations

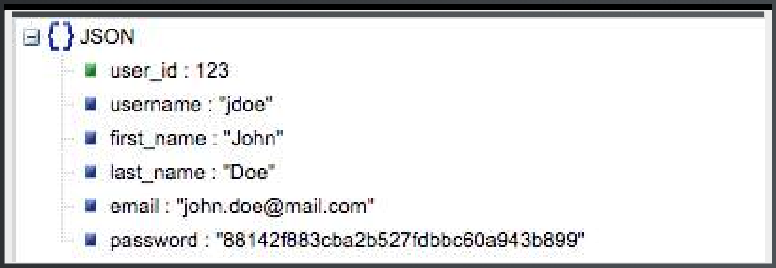
PREFIXING

- user_123
- u::john.doe@mail.com
- user-123
- user_123_orders

- order_123
- o::john.doe@mail.com
- product-123
- user_123_orders

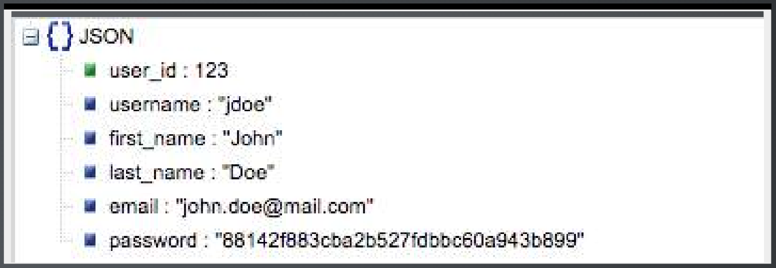
PREDICTABLE

Key: user_john.doe@mail.com



```
{} JSON
  user_id : 123
  username : "jdoe"
  first_name : "John"
  last_name : "Doe"
  email : "john.doe@mail.com"
  password : "88142f883cba2b527fdbbc60a943b899"
```

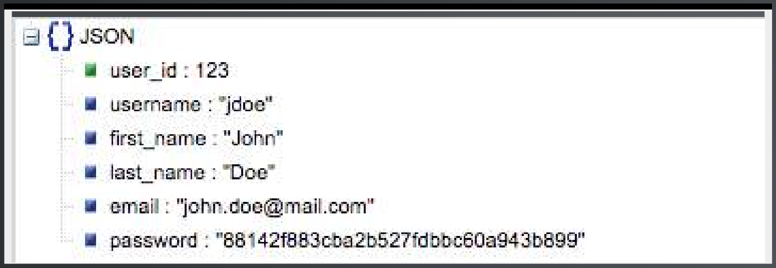
Key: user_jdoe



```
{} JSON
  user_id : 123
  username : "jdoe"
  first_name : "John"
  last_name : "Doe"
  email : "john.doe@mail.com"
  password : "88142f883cba2b527fdbbc60a943b899"
```

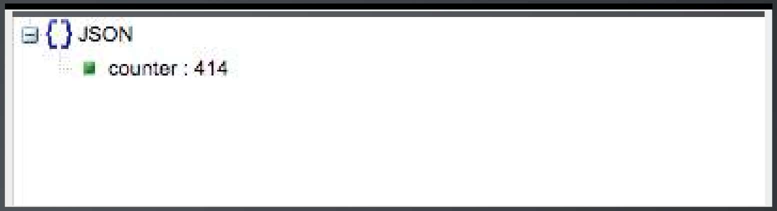
COUNTER ID

Key: user_123



```
JSON
  user_id : 123
  username : "jdoe"
  first_name : "John"
  last_name : "Doe"
  email : "john.doe@mail.com"
  password : "88142f883cba2b527fdbbc60a943b899"
```

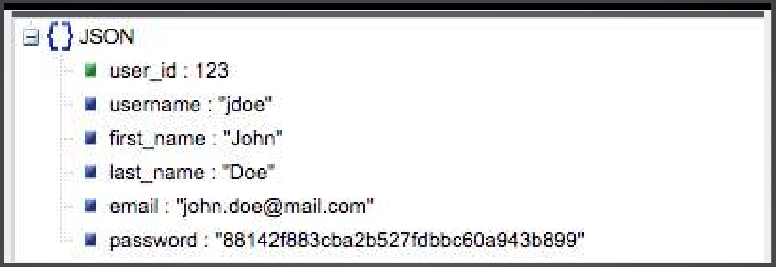
Key: user_counter



```
JSON
  counter : 414
```

UNPREDICTABLE

Key: 23ad6bac-7599-4874-af98-7af734027834



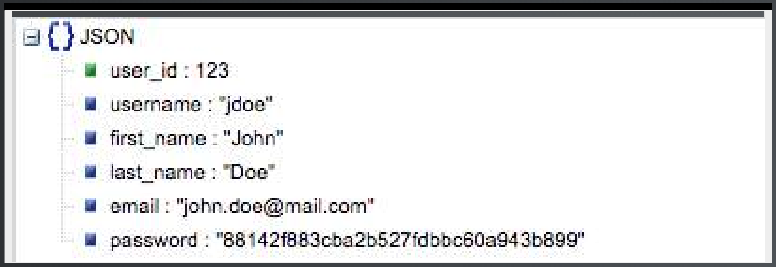
```
JSON
  user_id : 123
  username : "jdoe"
  first_name : "John"
  last_name : "Doe"
  email : "john.doe@mail.com"
  password : "88142f883cba2b527fdbbc60a943b899"
```

COMBINATIONS

- user_123_preferences
- user_jdoe_order_23ad6bac-7599-4874-af98-7af734027834
- user_john.doe@mail.com_comment_5664

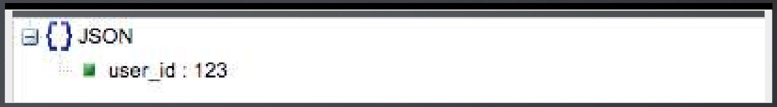
LOOKUP PATTERN

Key: user_123



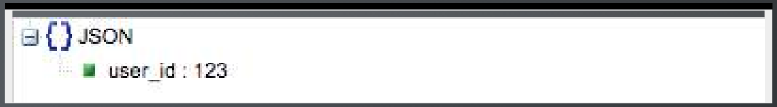
```
JSON
  user_id : 123
  username : "jdoe"
  first_name : "John"
  last_name : "Doe"
  email : "john.doe@mail.com"
  password : "88142f883cba2b527fdbbc60a943b899"
```

Key: user_john.doe@mail.com



```
JSON
  user_id : 123
```

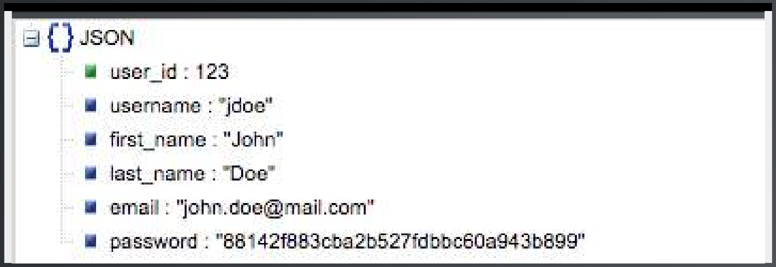
Key: user_jdoe



```
JSON
  user_id : 123
```

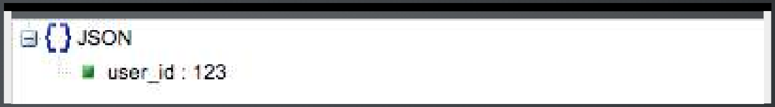
LOOKUP PATTERN FOR AUTH

Key: user_123



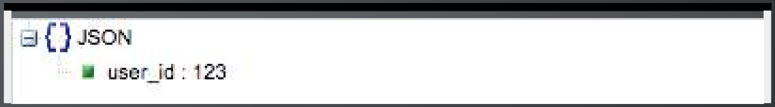
```
{} JSON
   user_id : 123
   username : "jdoe"
   first_name : "John"
   last_name : "Doe"
   email : "john.doe@mail.com"
   password : "88142f883cba2b527fdbbc60a943b899"
```

Key: user_john.doe@mail.com_
88142f883cba2b527fdbbc60a943b8



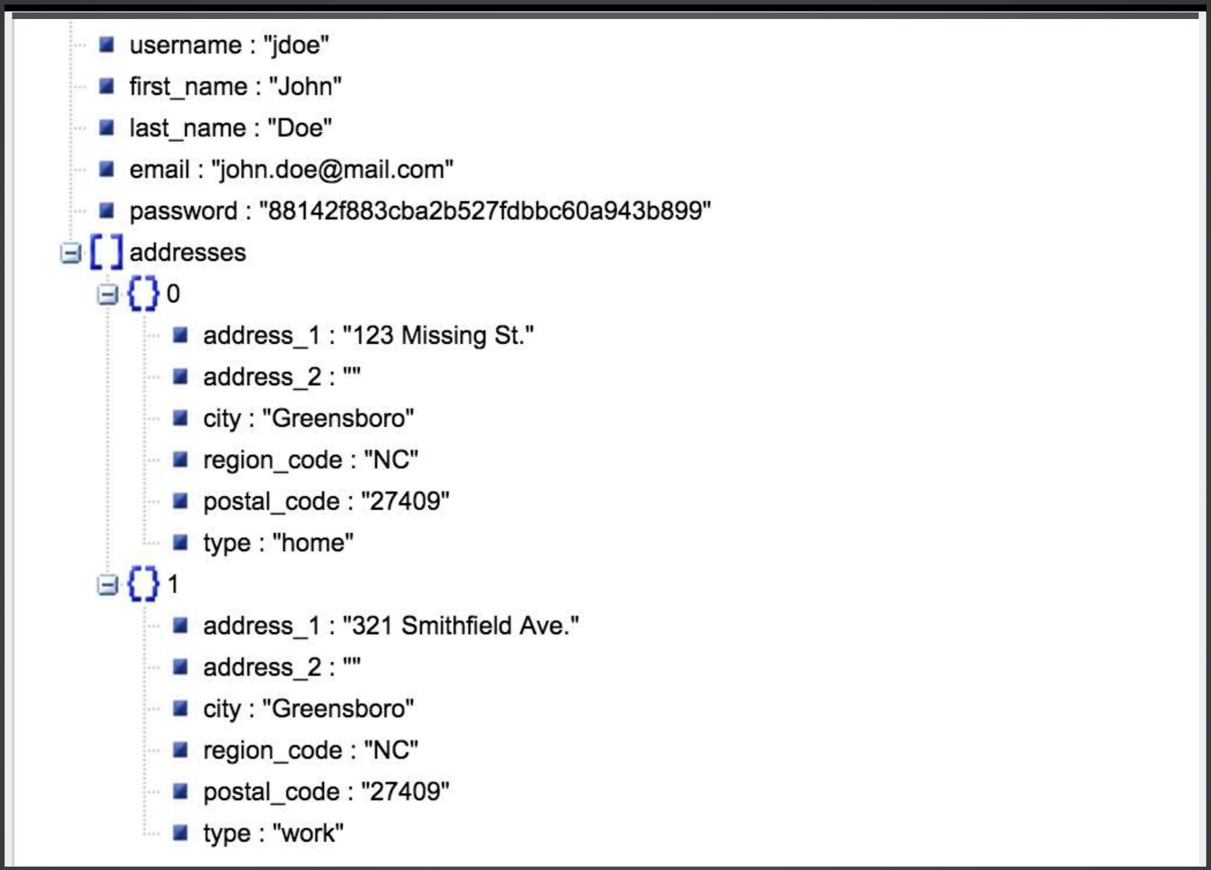
```
{} JSON
   user_id : 123
```

Key: user_jdoe_
88142f883cba2b527fdbbc60a943b8



```
{} JSON
   user_id : 123
```

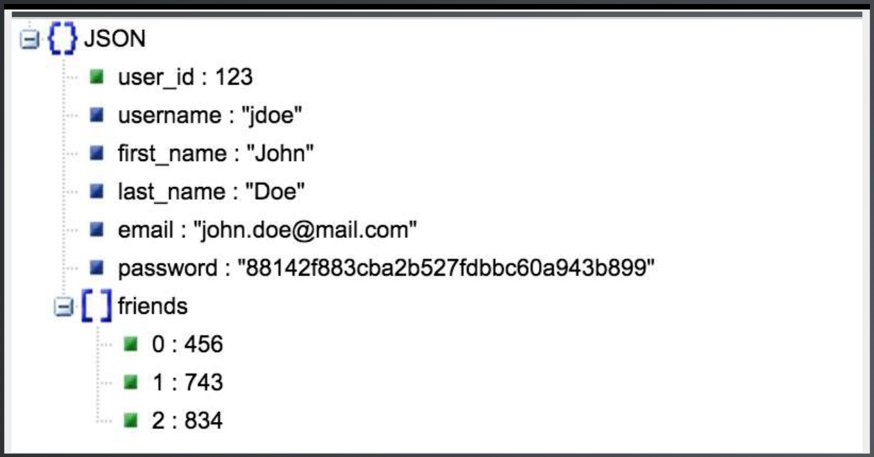
EMBEDDING



```
username : "jdoe"
first_name : "John"
last_name : "Doe"
email : "john.doe@mail.com"
password : "88142f883cba2b527fdbbc60a943b899"
[ ] addresses
  { } 0
    address_1 : "123 Missing St."
    address_2 : ""
    city : "Greensboro"
    region_code : "NC"
    postal_code : "27409"
    type : "home"
  { } 1
    address_1 : "321 Smithfield Ave."
    address_2 : ""
    city : "Greensboro"
    region_code : "NC"
    postal_code : "27409"
    type : "work"
```

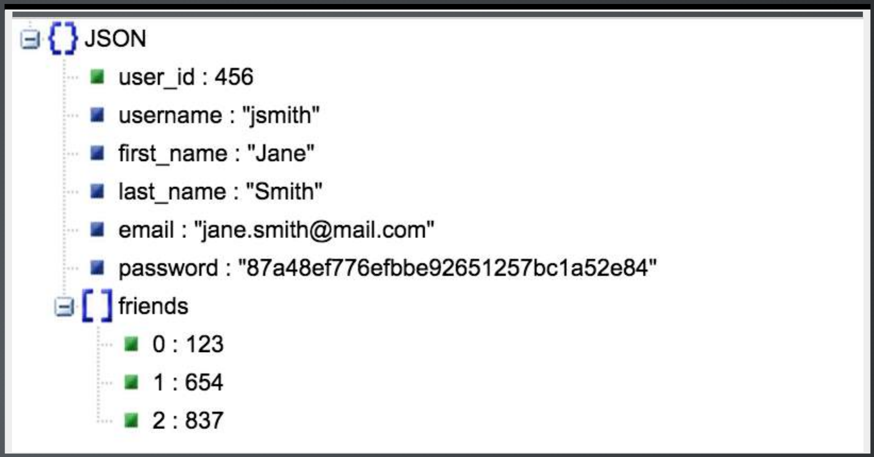
REFERRING / LINKING

Key: user_123



```
JSON
  user_id : 123
  username : "jdoe"
  first_name : "John"
  last_name : "Doe"
  email : "john.doe@mail.com"
  password : "88142f883cba2b527fdbbc60a943b899"
  friends
    0 : 456
    1 : 743
    2 : 834
```

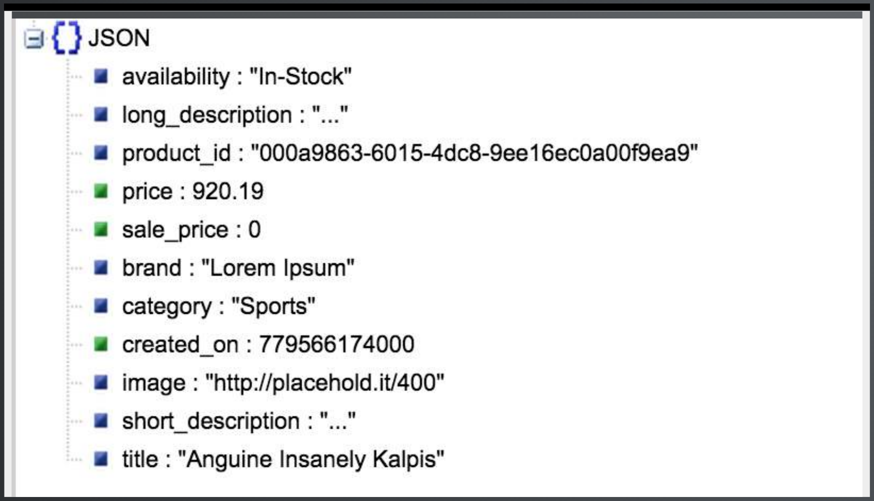
Key: user_456



```
JSON
  user_id : 456
  username : "jsmith"
  first_name : "Jane"
  last_name : "Smith"
  email : "jane.smith@mail.com"
  password : "87a48ef776efbbe92651257bc1a52e84"
  friends
    0 : 123
    1 : 654
    2 : 837
```

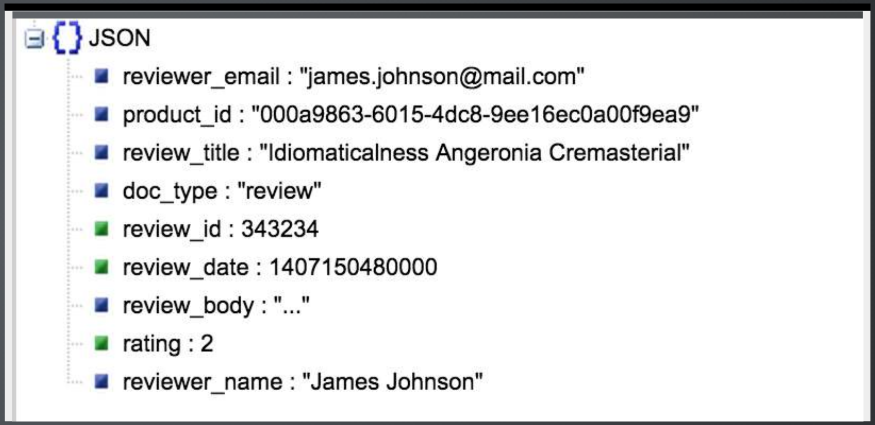
PARENT-REFERENCING

Key: product_000a9863-6015-4dc8-9ee16ec0a00f9ea9



```
{} JSON
   availability : "In-Stock"
   long_description : "..."
   product_id : "000a9863-6015-4dc8-9ee16ec0a00f9ea9"
   price : 920.19
   sale_price : 0
   brand : "Lorem Ipsum"
   category : "Sports"
   created_on : 779566174000
   image : "http://placehold.it/400"
   short_description : "..."
   title : "Anguine Insanely Kalpis"
```

Key: product_000a9863-6015-4dc8-9ee16ec0a00f9ea9_review_343234



```
{} JSON
   reviewer_email : "james.johnson@mail.com"
   product_id : "000a9863-6015-4dc8-9ee16ec0a00f9ea9"
   review_title : "Idiomaticalness Angeronia Cremasterial"
   doc_type : "review"
   review_id : 343234
   review_date : 1407150480000
   review_body : "..."
   rating : 2
   reviewer_name : "James Johnson"
```

Is SQL Going Away?

NO

CONSIDERATIONS

- How do you work with your data?
- Do you work with the same aggregates all the time?
- What are you trying to achieve?
- Where are you starting at?
- Do you need finite data and highly complex relationships?
- Is the tabular structure working for you?
- Do you want to scale vertically or horizontally?
- Does your data need to be data centralized or decentralized?

HIRING

- ColdFusion Developers
- iOS Developers
- Android Developers
- Hybrid Developers
- UI/UX Developers
- UI/UX Designers
- Project Managers

hrrecruiter@marketamerica.com

QUESTIONS?

SLIDES AVAILABLE AT:

https://goo.gl/NhrsYm

RESOURCES

- Introduction to NoSQL by Martin Fowler
- Relationships are Hard NoSQL Data Modeling by Curt Gratz
- Workshop: NoSQL Data Modelling by Jan Steemann
- CAP Twelve Years Later: How the "Rules" Have Changed by Eric Brewer
- NoSQL Databases: An Overview by Pramod Sadalage