Team FoodScape
“Find Your Food”

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Paul Cabasag, Adelle Driker, Bo Yan

DSE 203: Data Integration and ETL

Introduction

- What is “Find Your Food”?
    - “Find Your Food” is a comprehensive and easily accessible ontology about food, recipes, ingredients, restaurants as well as the diets, menus, seasons and occasions users may be suitable for.
    - We created a simple lightweight ontology that uses the shared terminology for types, properties and relationships about food concepts, and thus can help users to find the proper food.

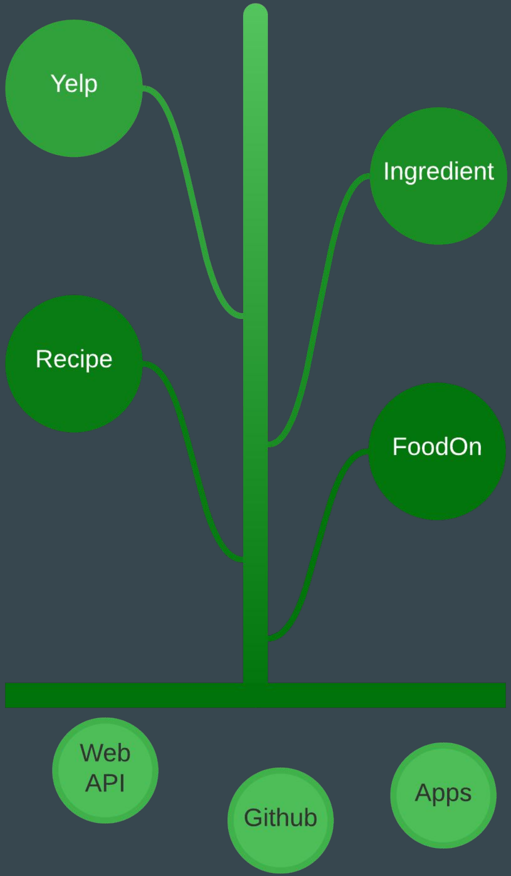
Information Integration Problem

- Eat-Out: Provide a restaurant recommendation query tool depending on personal nutrients, ingredients, dietary, instructions, and cost preferences.

- Eat-In: Provide “cookbook” recommendation queries based on food recipe/ingredient.

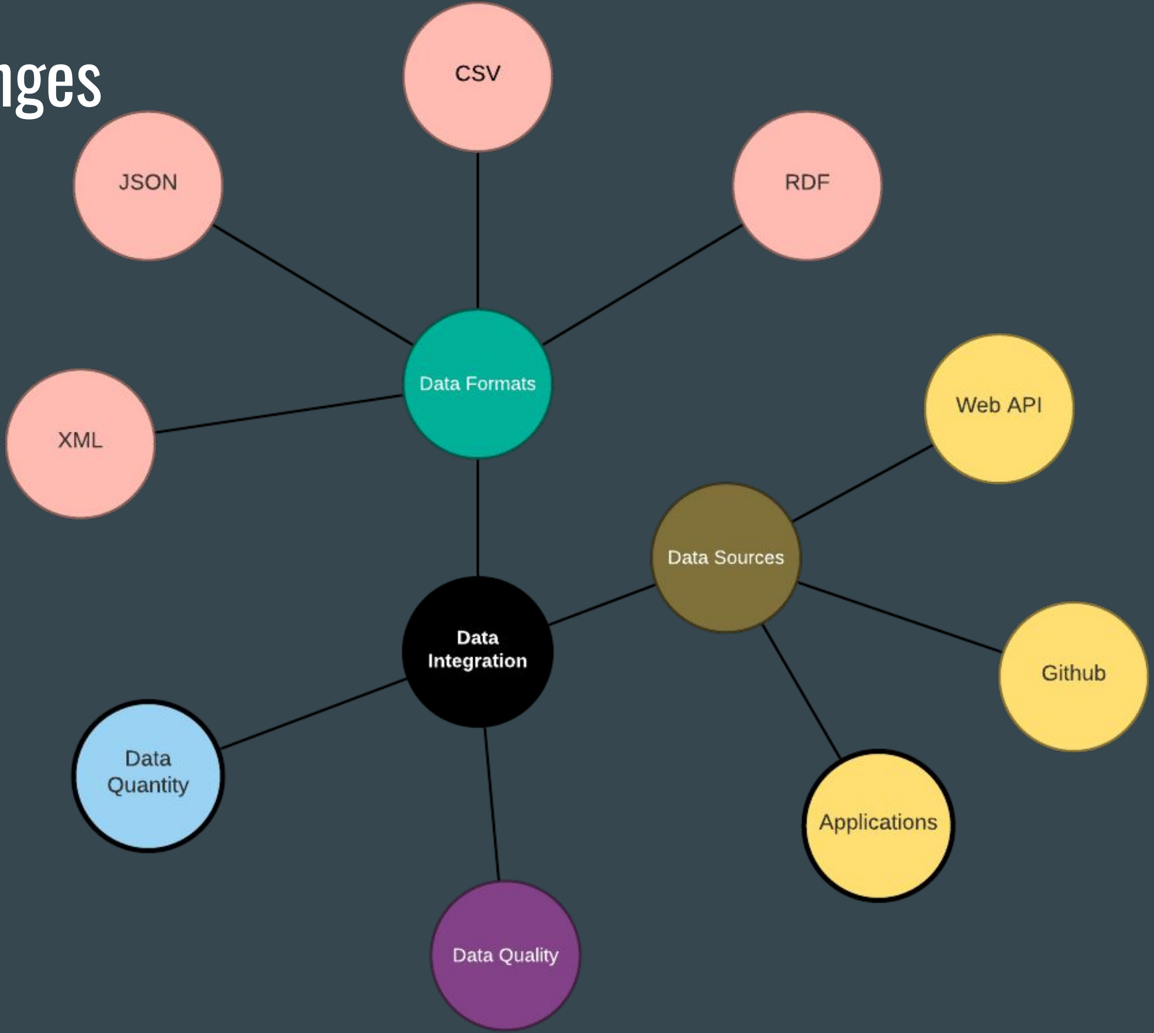
Data Sources

- FoodOn
  - https://github.com/FoodOntology/foodon
  - Based on a conversion of the LanguaL.org food indexing thesaurus
  - Over 9,000 food products available
  - Encompasses materials in natural ecosystems, food webs, and human-centric categorization and handling of food.
- Recipe
  - https://rapidapi.com/spoonacular/api/recipe-food-nutrition/
  - Over 1, 000 recipes data available
- Ingredient
  - https://raw.githubusercontent.com/foodkg/foodkg.github.io/master/ontologies/WhatToMake_Individuals.rdf
  - About 200 food ingredients data available
- Yelp
  - https://www.yelp.com/dataset/documentation/main
  - Over 160,000 restaurants data available

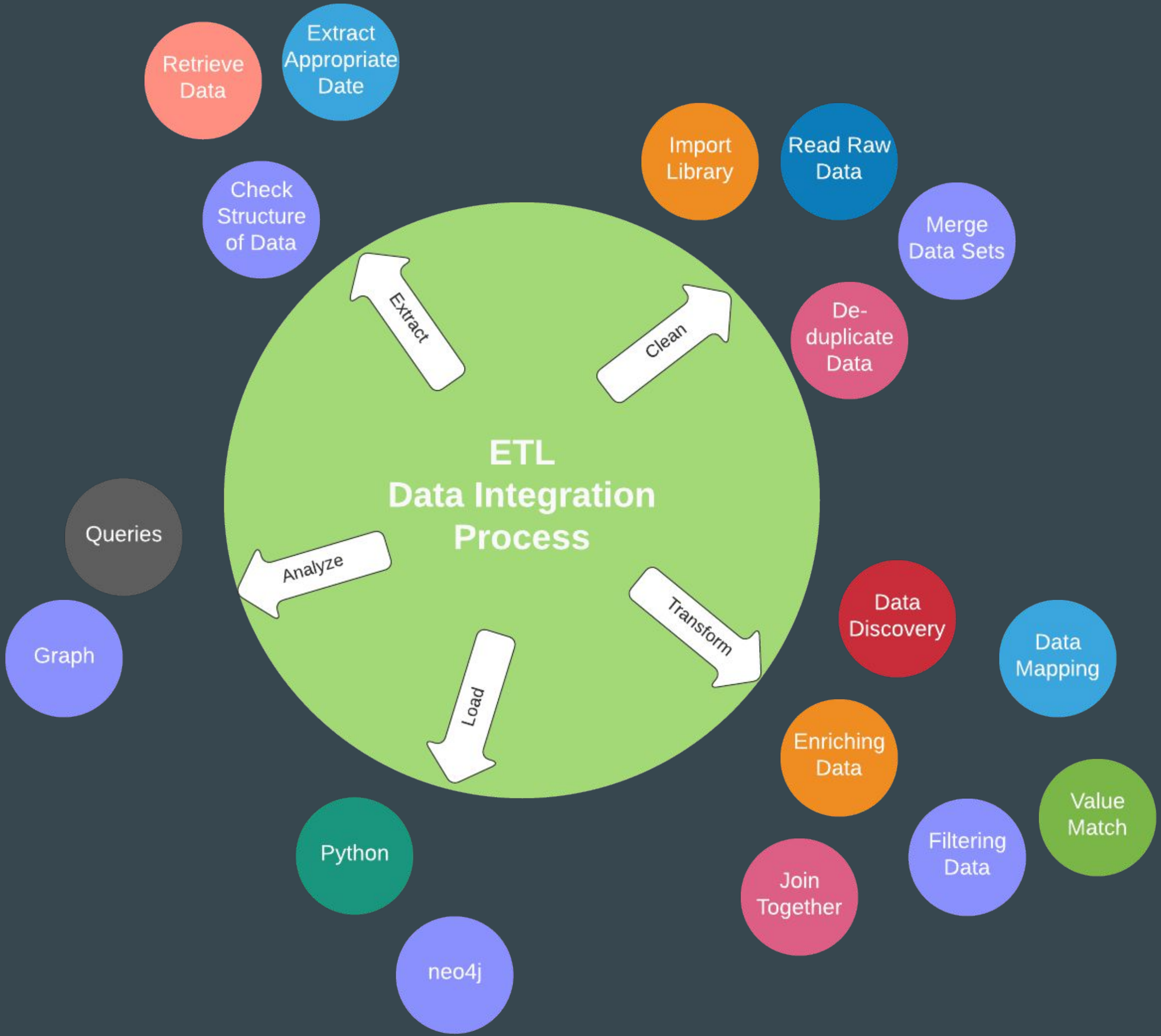


Data Integration Challenges

- Data sources
- Data formats
- Data quality
- Data quantity



Approach


Retrieve Data
Extract Appropriate Date
Check Structure of Data
Import Library
Read Raw Data
Merge Data Sets
De-duplicate Data
Extract
Clean
ETL
Data Integration Process
Analyze
Transform
Load
Queries
Graph
Data Discovery
Data Mapping
Enriching Data
Value Match
Filtering Data
Join Together
Python
neo4j

Data Extraction and Cleaning

- Modules Used
  - Py2Neo
  - NLTK
- Data Preparation
  - Clean FoodOn Labels to exclude inedible items (plastic, metal, chemicals), scientific/Latin names
- Noun Extraction
  - All foods/ingredients are assumed to be Nouns
  - Utilize NLTK's text preprocessing functions
  - E.g. "The steak and salad hit the spot!" → ['steak', 'salad', 'spot']

Data Transformation and Combining

- String Matching
  - For all Nouns in a Yelp Tip or Recipe Summary
    - Compare against list of FoodOn or Ingredient items
  - E.g. [‘steak’, ‘salad’, ‘spot’] → [‘steak’, ‘salad’]
- Attribute Construction (Update Node Properties)
  - Create a new property that contains a list of matched foods → used to create new edges
- Data Combining
  - Use Append, Merge, and Join to combine data

Structure of Knowledge Graph: Nodes

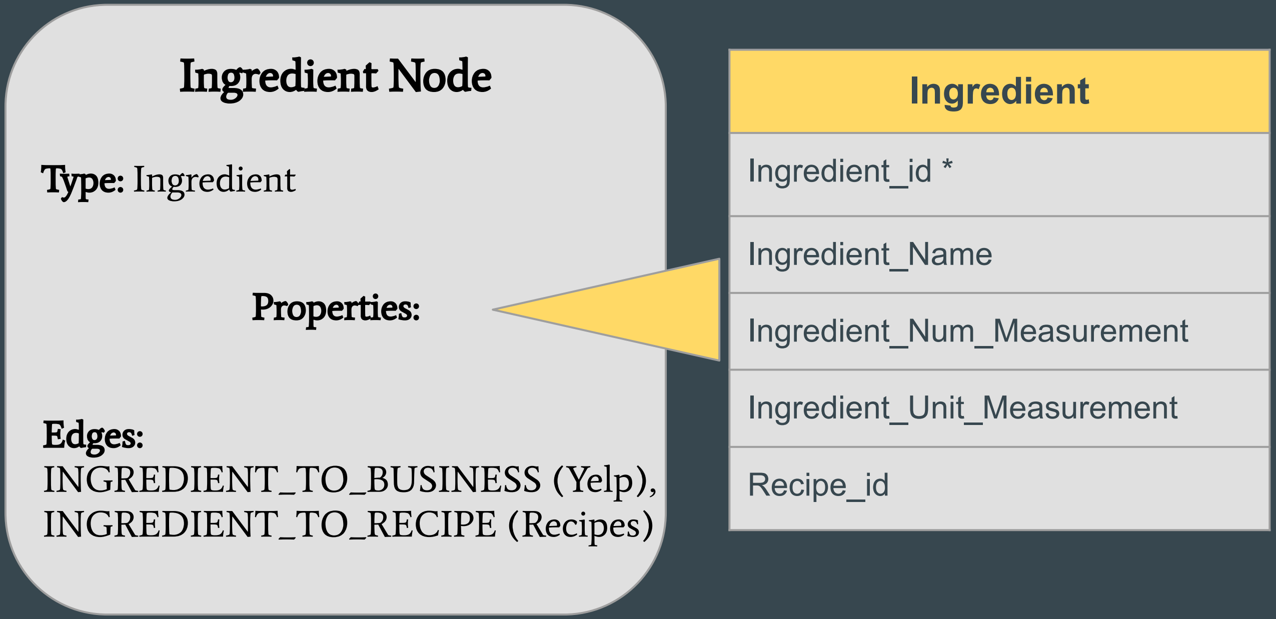
FoodOn Node

Type: owl__class

Properties: rdfs__label

Edges:
FOODON_TO_BUSINESS (Yelp),
FOODON_TO_RECIPE (Recipes)

Structure of Knowledge Graph: Nodes



Ingredient Node

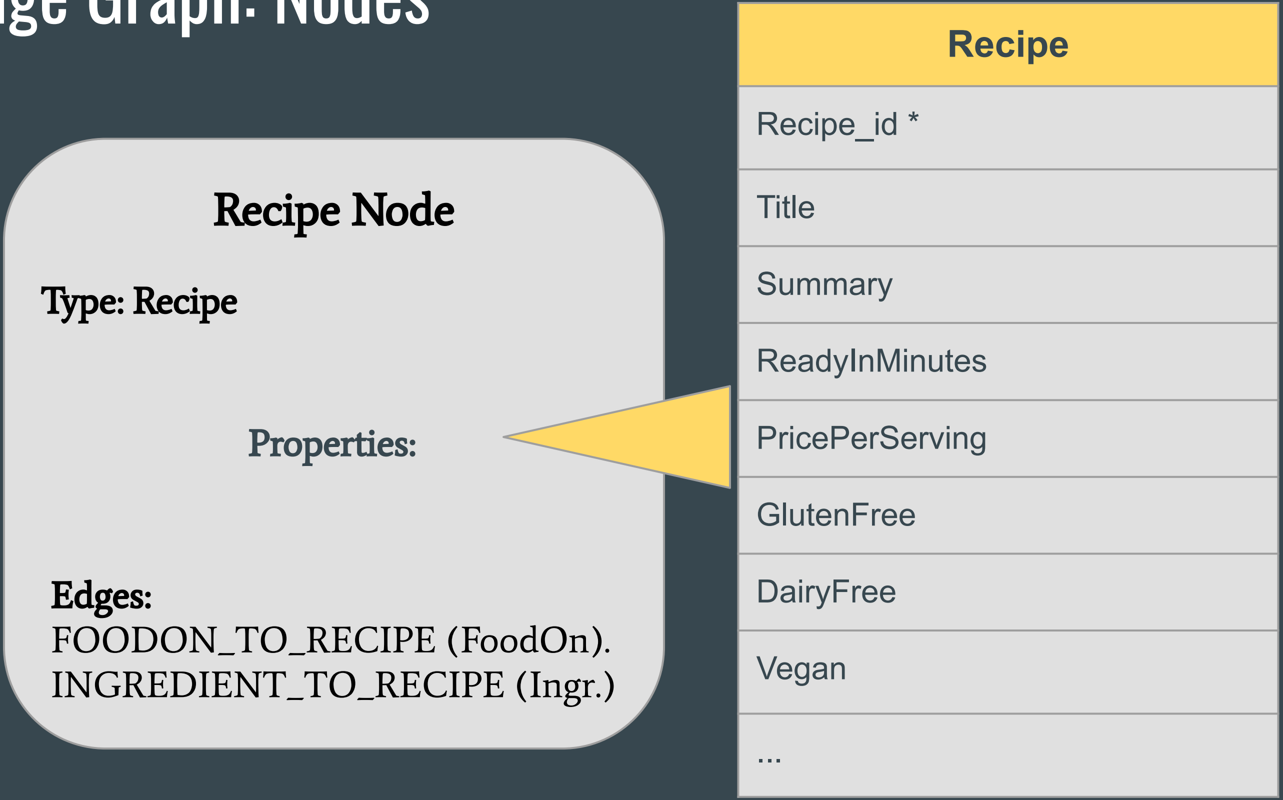
Type: Ingredient

Properties:

Edges:
INGREDIENT_TO_BUSINESS (Yelp),
INGREDIENT_TO_RECIPE (Recipes)

Ingredient
Ingredient_id *
Ingredient_Name
Ingredient_Num_Measurement
Ingredient_Unit_Measurement
Recipe_id

Structure of Knowledge Graph: Nodes



Recipe Node

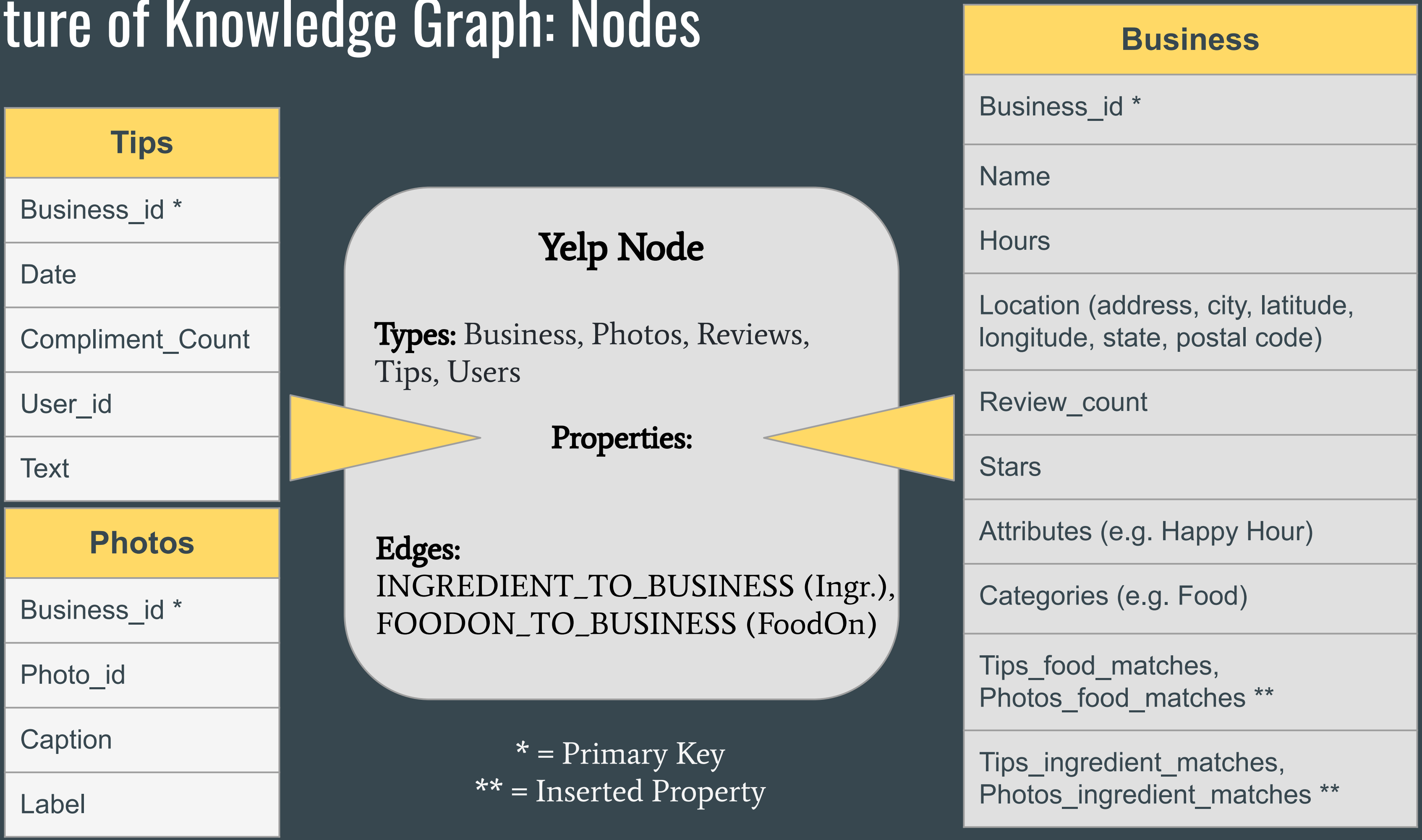
Type: Recipe

Properties:

Edges:
FOODON_TO_RECIPE (FoodOn).
INGREDIENT_TO_RECIPE (Ingr.)

Recipe
Recipe_id *
Title
Summary
ReadyInMinutes
PricePerServing
GlutenFree
DairyFree
Vegan
...

Structure of Knowledge Graph: Nodes



Tips
Business_id *
Date
Compliment_Count
User_id
Text

Photos
Business_id *
Photo_id
Caption
Label

Yelp Node

Types: Business, Photos, Reviews, Tips, Users

Properties:

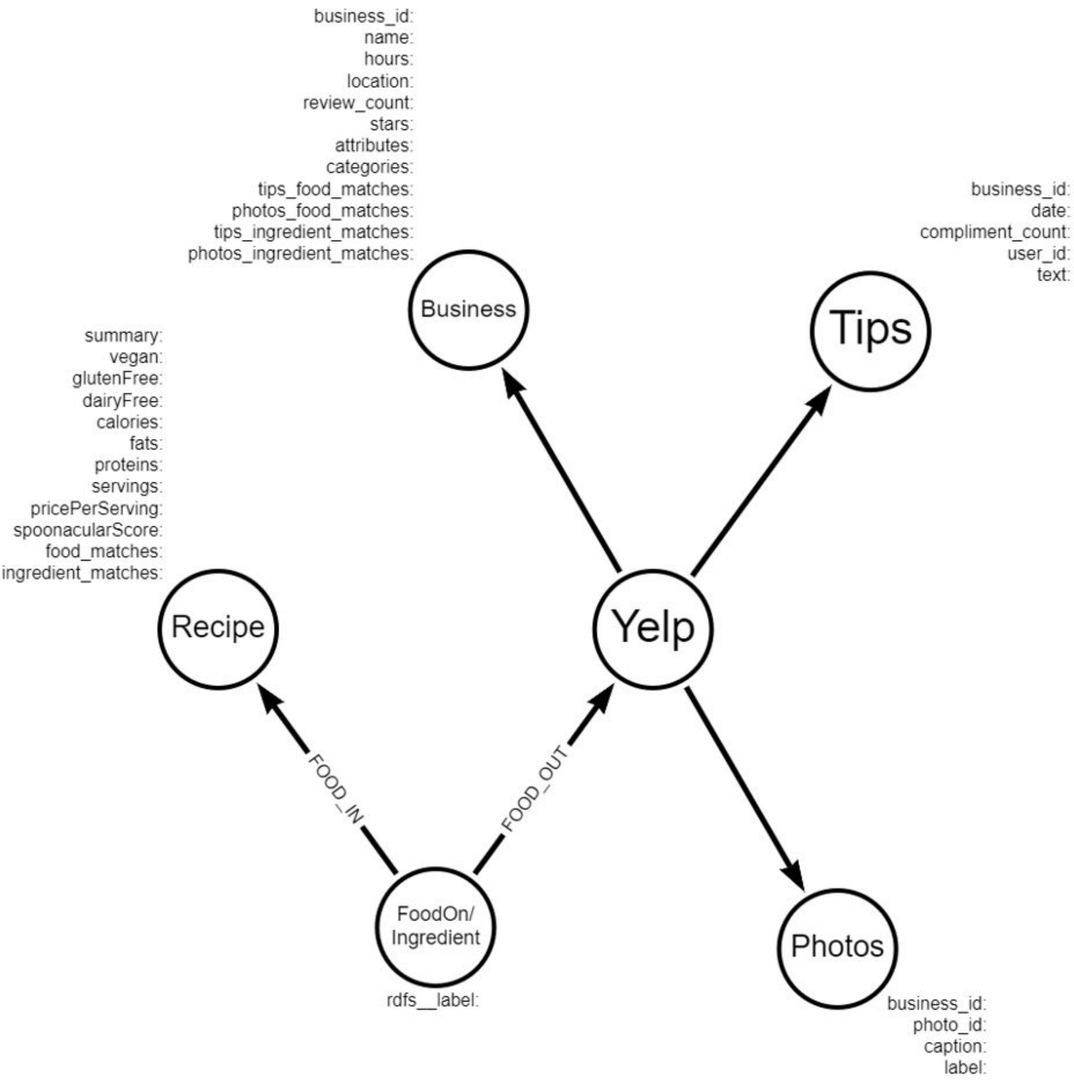
Edges: INGREDIENT_TO_BUSINESS (Ingr.), FOODON_TO_BUSINESS (FoodOn)

Business
Business_id *
Name
Hours
Location (address, city, latitude, longitude, state, postal code)
Review_count
Stars
Attributes (e.g. Happy Hour)
Categories (e.g. Food)
Tips_food_matches, Photos_food_matches **
Tips_ingredient_matches, Photos_ingredient_matches **

* = Primary Key

** = Inserted Property

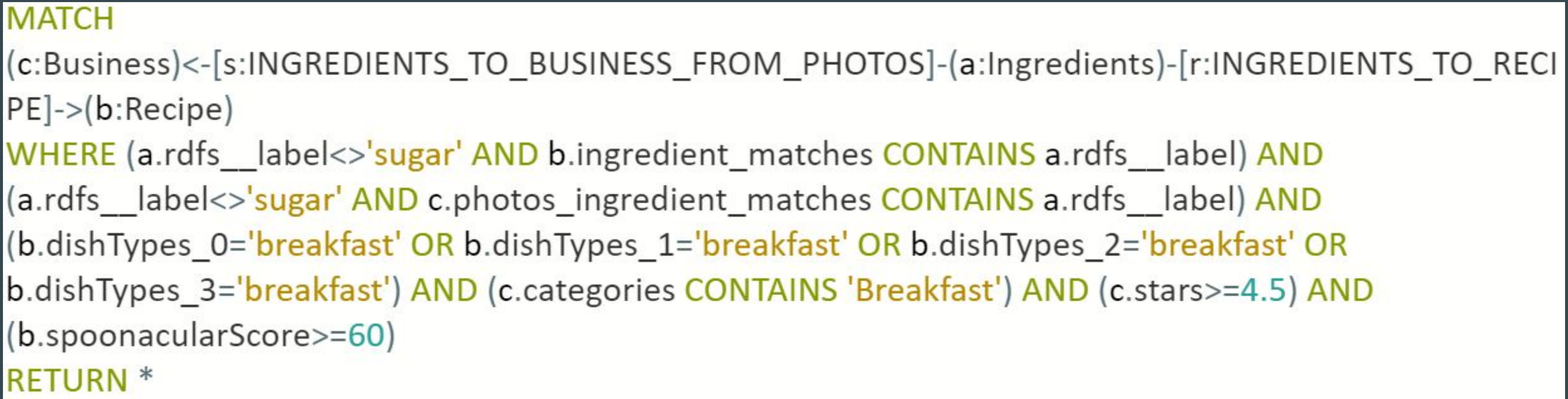
Structure of Knowledge Graph (Connected)



Query 1 (Cypher):

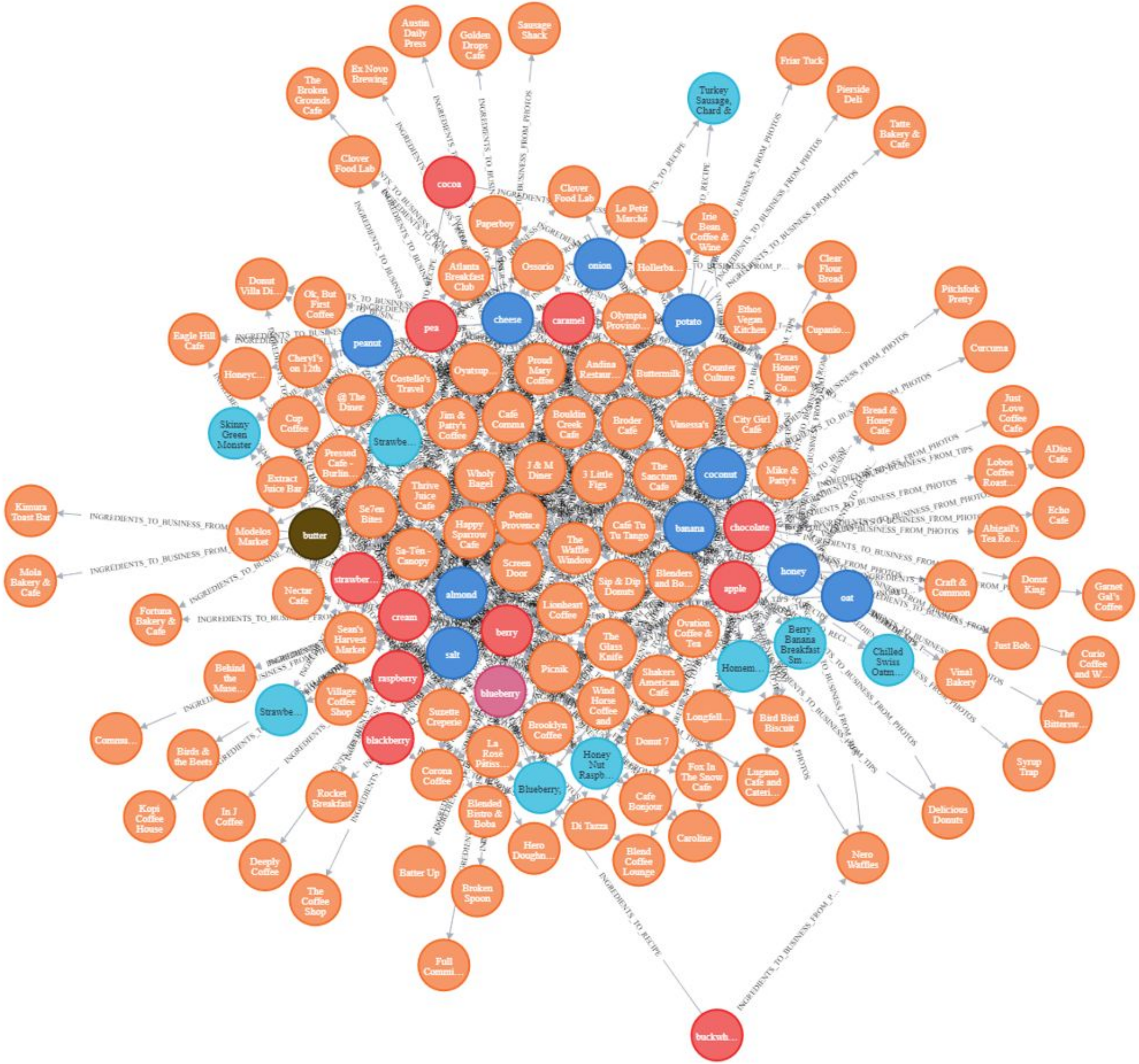
Question: What are the highly-rated restaurants (at least 4.5 stars) and recipes (at least 60%) allowed for people that are diabetic (no sugar) and are available as a breakfast?

Cypher:



```
MATCH
(c:Business)<-[s:INGREDIENTS_TO_BUSINESS_FROM_PHOTOS]-(a:Ingredients)-[r:INGREDIENTS_TO_RECI
PE]->(b:Recipe)
WHERE (a.rdfs__label<>'sugar' AND b.ingredient_matches CONTAINS a.rdfs__label) AND
(a.rdfs__label<>'sugar' AND c.photos_ingredient_matches CONTAINS a.rdfs__label) AND
(b.dishTypes_0='breakfast' OR b.dishTypes_1='breakfast' OR b.dishTypes_2='breakfast' OR
b.dishTypes_3='breakfast') AND (c.categories CONTAINS 'Breakfast') AND (c.stars>=4.5) AND
(b.spoonacularScore>=60)
RETURN *
```

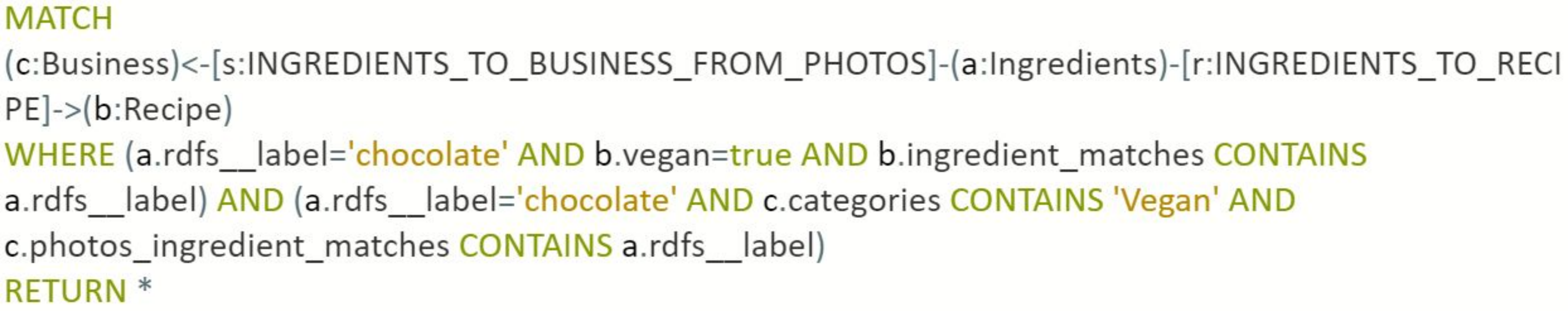
Query 1
(Knowledge Graph):



Query 2 (Cypher):

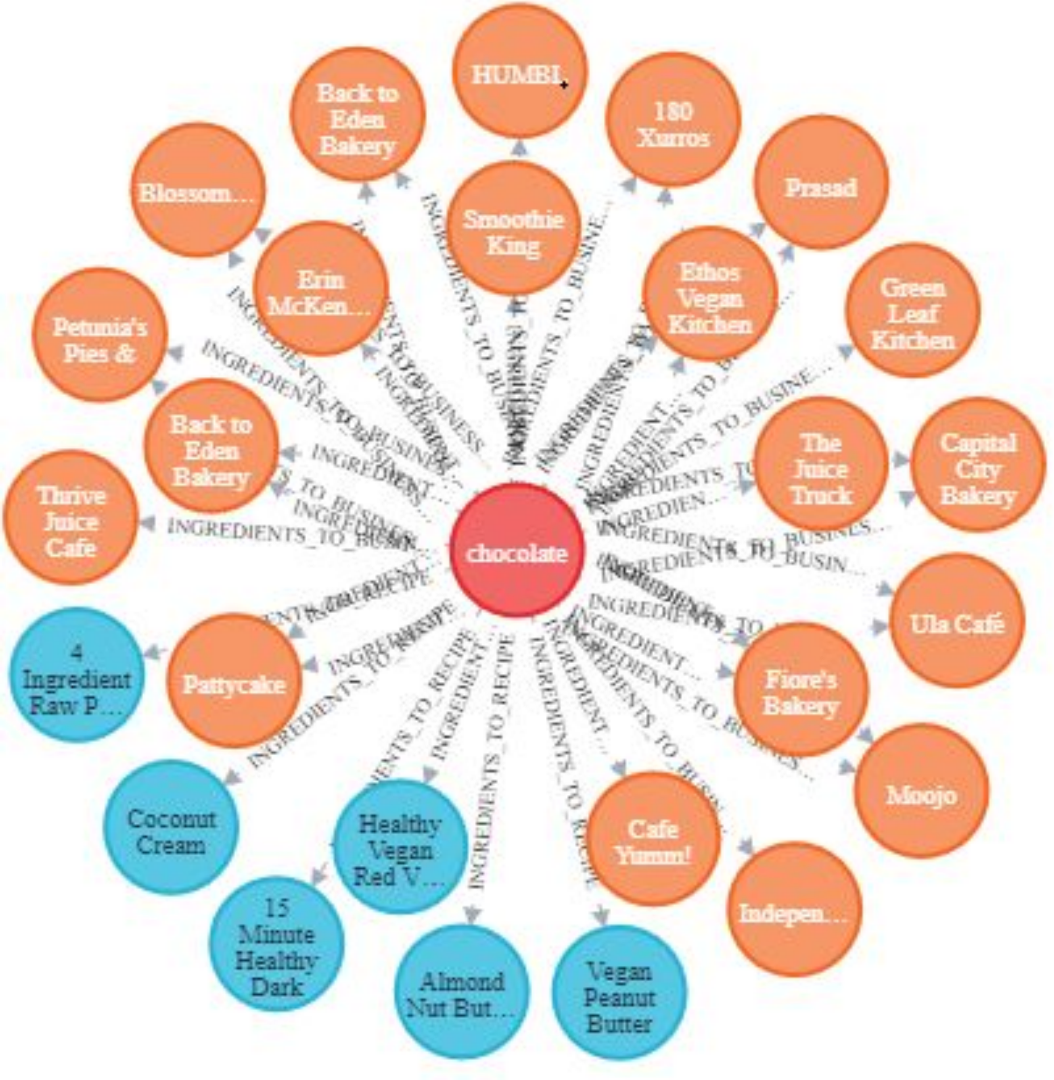
Question: What are the restaurants and recipes that are suitable to vegans and also contain chocolate?

Cypher:



```
MATCH
(c:Business)<-[s:INGREDIENTS_TO_BUSINESS_FROM_PHOTOS]-(a:Ingredients)-[r:INGREDIENTS_TO_RECI
PE]->(b:Recipe)
WHERE (a.rdfs__label='chocolate' AND b.vegan=true AND b.ingredient_matches CONTAINS
a.rdfs__label) AND (a.rdfs__label='chocolate' AND c.categories CONTAINS 'Vegan' AND
c.photos_ingredient_matches CONTAINS a.rdfs__label)
RETURN *
```

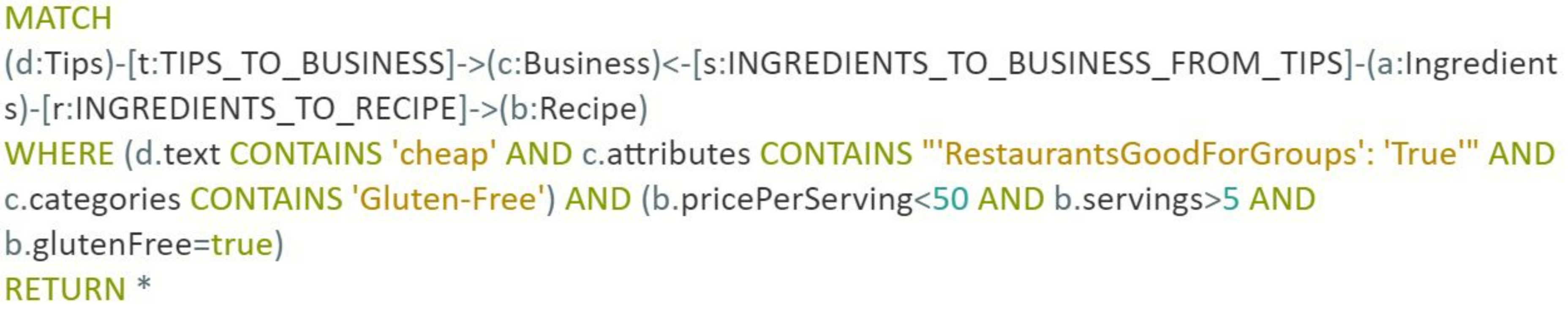
Query 2 (Knowledge Graph):



Query 3 (Cypher):

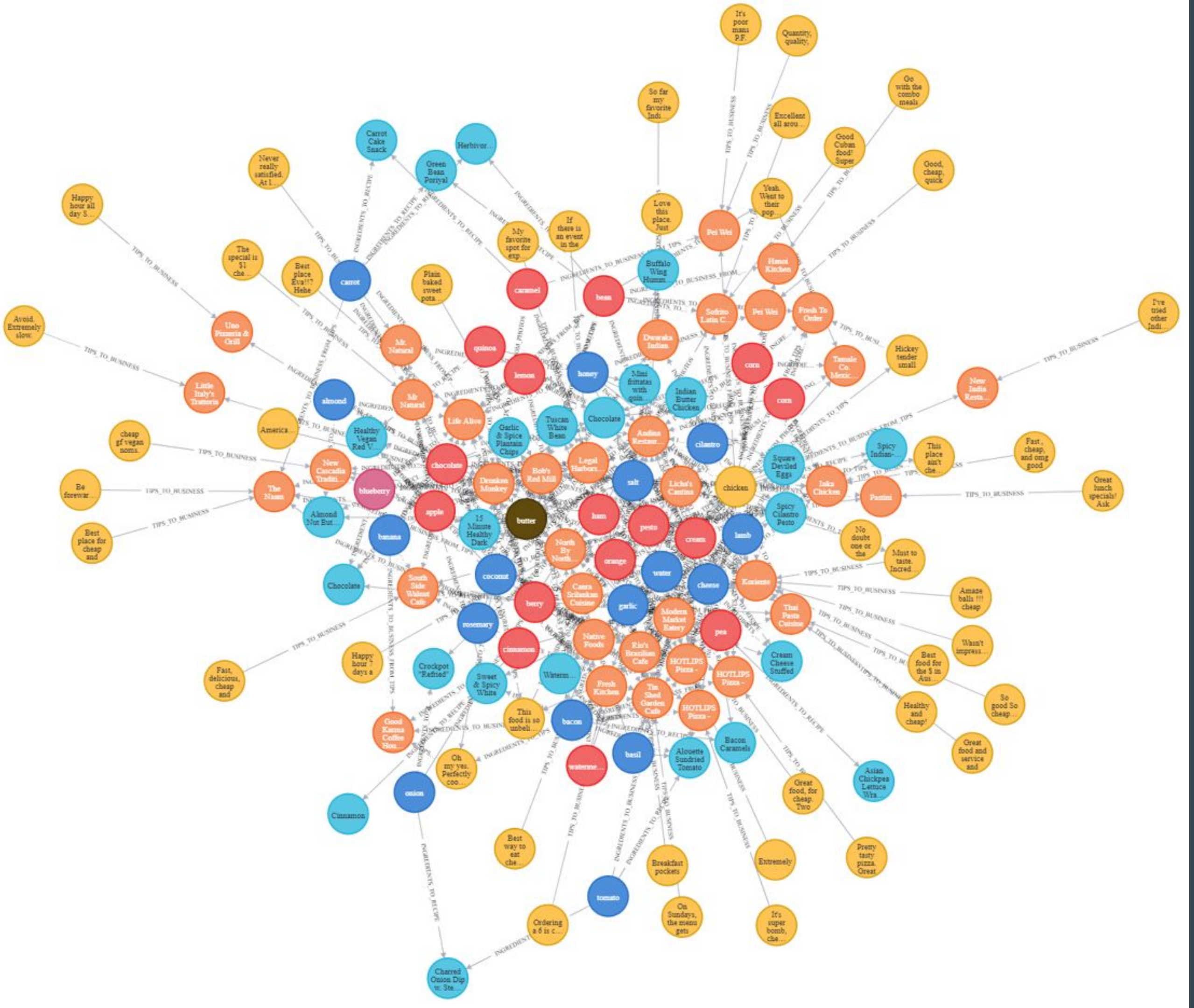
Question: What are the cheap restaurants (cheap tips) and recipes (cost less than $50), with more than 5 servings or good for groups, and gluten-free?

Cypher:



```
MATCH
(d:Tips)-[t:TIPS_TO_BUSINESS]->(c:Business)<-[s:INGREDIENTS_TO_BUSINESS_FROM_TIPS]-(a:Ingredient
s)-[r:INGREDIENTS_TO_RECIPE]->(b:Recipe)
WHERE (d.text CONTAINS 'cheap' AND c.attributes CONTAINS "'RestaurantsGoodForGroups': 'True'" AND
c.categories CONTAINS 'Gluten-Free') AND (b.pricePerServing<50 AND b.servings>5 AND
b.glutenFree=true)
RETURN *
```

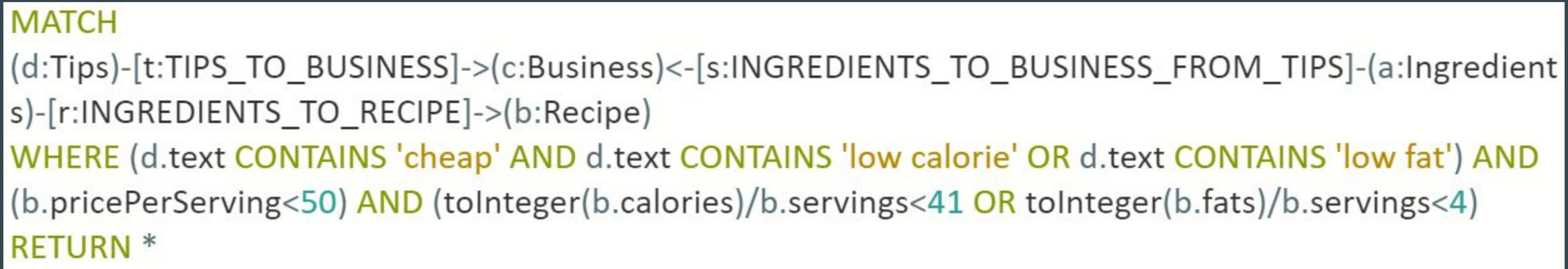
Query 3 (Knowledge Graph):



Query 4 (Cypher):

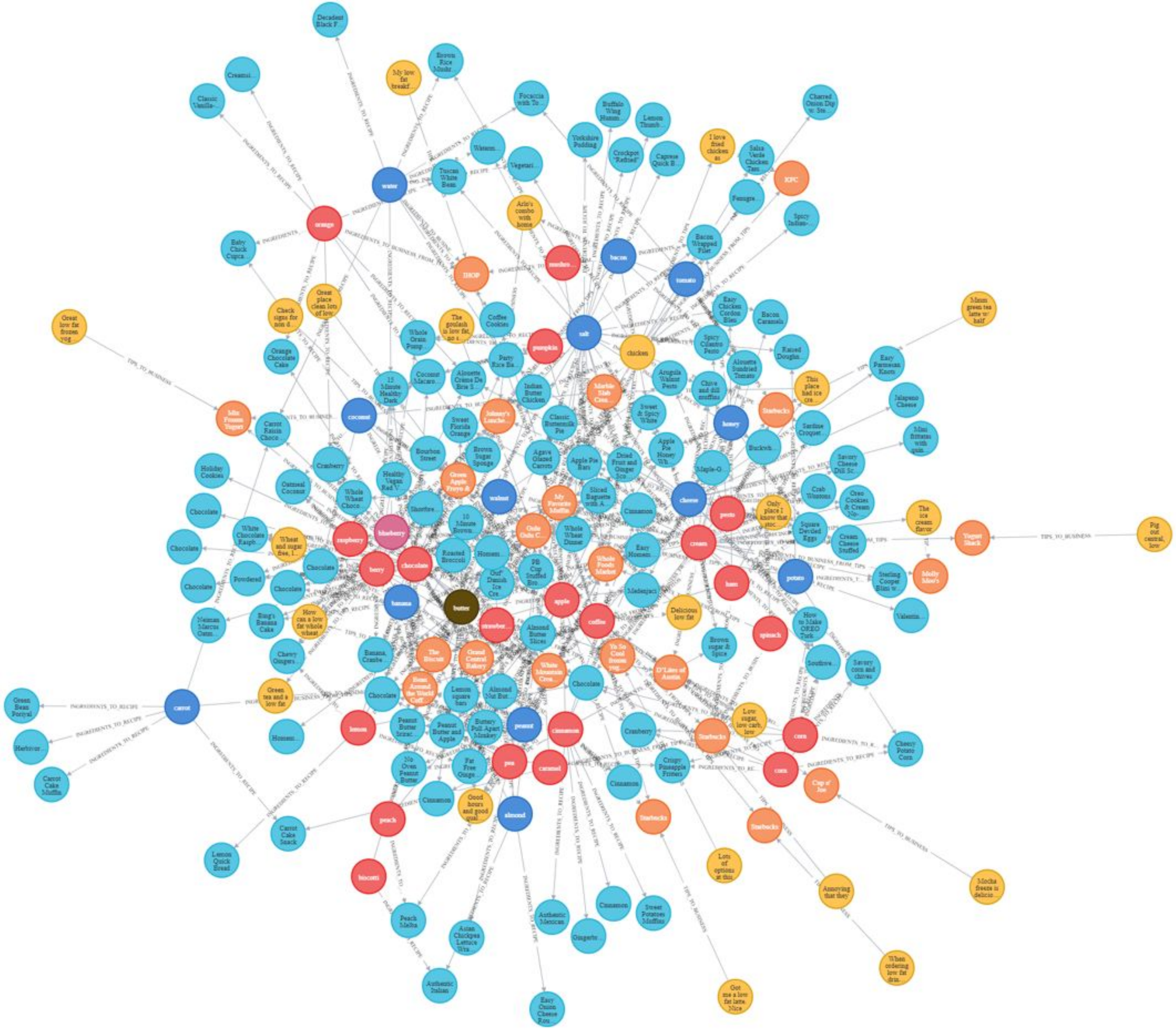
Question: What are the cheap restaurants (cheap tips) and recipes (cost less than $50) that are low-calorie or low-fat?

Cypher:



```
MATCH
(d:Tips)-[t:TIPS_TO_BUSINESS]->(c:Business)<-[s:INGREDIENTS_TO_BUSINESS_FROM_TIPS]-(a:Ingredients)-[r:INGREDIENTS_TO_RECIPE]->(b:Recipe)
WHERE (d.text CONTAINS 'cheap' AND d.text CONTAINS 'low calorie' OR d.text CONTAINS 'low fat') AND
(b.pricePerServing<50) AND (toInteger(b.calories)/b.servings<41 OR toInteger(b.fats)/b.servings<4)
RETURN *
```

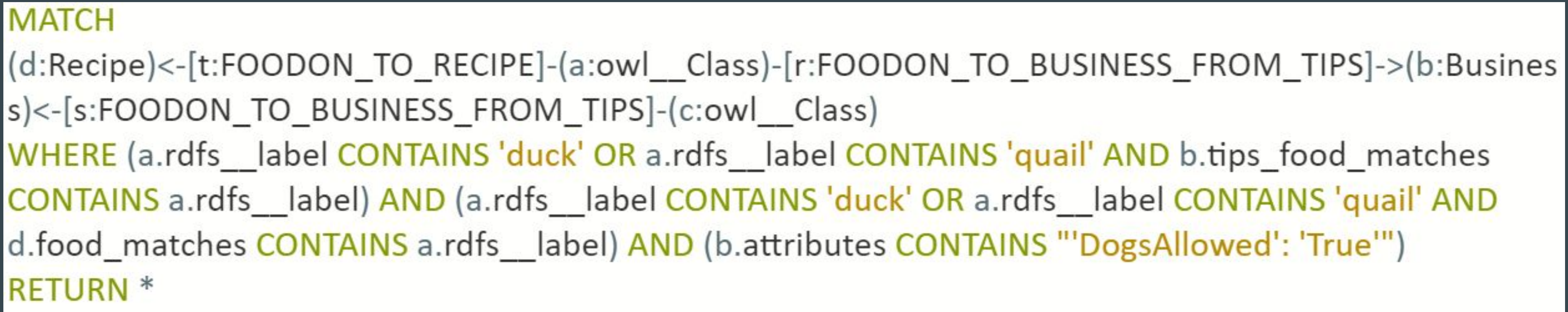
Query 4 (Knowledge Graph):



Query 5 (Cypher):

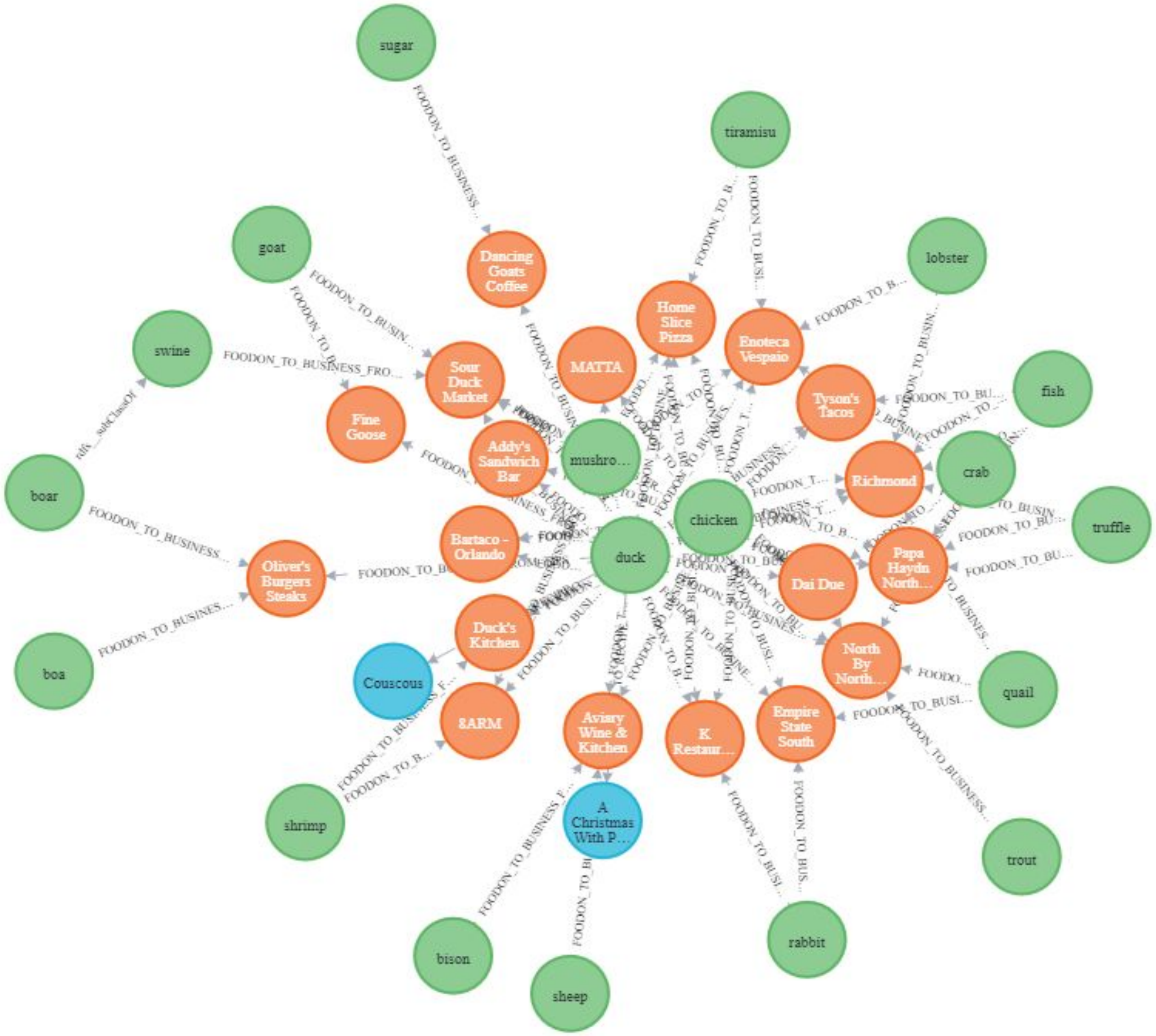
Question: What are the restaurants and recipes that serve duck or quail that allow for dogs, and what other ingredients can be found?

Cypher:



```
MATCH
(d:Recipe)<-[t:FOODON_TO_RECIPE]-(a:owl__Class)-[r:FOODON_TO_BUSINESS_FROM_TIPS]->(b:Busines
s)<-[s:FOODON_TO_BUSINESS_FROM_TIPS]-(c:owl__Class)
WHERE (a.rdfs__label CONTAINS 'duck' OR a.rdfs__label CONTAINS 'quail' AND b.tips_food_matches
CONTAINS a.rdfs__label) AND (a.rdfs__label CONTAINS 'duck' OR a.rdfs__label CONTAINS 'quail' AND
d.food_matches CONTAINS a.rdfs__label) AND (b.attributes CONTAINS "'DogsAllowed': 'True'")
RETURN *
```

Query 5 (Knowledge Graph):



Demo

Lessons Learned

- Create graphs with different data sources
- Identify reasonable associations between different data sources
- Extract information from varying text properties
- Apply value matching methods
- Dataset preprocessing acceptable for graph creation
- Creating edge relationships with graphs
- Creating new properties on existing nodes

Conclusion and Future Work

- Conclusion
  - Given a set of Yelp reviews
  - Successfully performed data integration between Yelp, FoodOn/Ingredients, and Recipe graphs.
  - Successfully query outside and inside food options from food or ingredient inputs.
- Future Work
  - Implementing knowledge graphs using Python graph visualizer.
  - Creating queries involving Users and Reviews subgraphs from the Yelp graph.
  - Connecting actual photos from id per restaurant.

References

- https://www.cancer.org/healthy/eat-healthy-get-active/take-control-your-weight/understanding-food-labels.html

- https://www.healthline.com/nutrition/how-much-protein-per-day

Thank you!