Defining Property Graph Schemas using the GraphQL Schema Definition Language

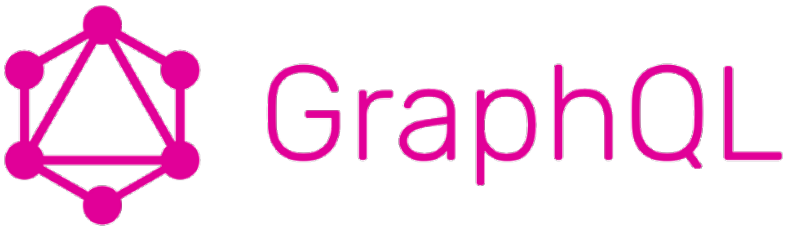
Olaf Hartig

@olafhartig

LINKÖPING UNIVERSITY

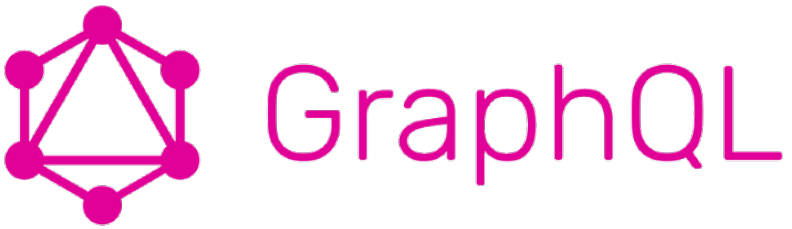
What is GraphQL?

- State-of-the art approach to create Web APIs to retrieve data for Web and mobile applications
- Alternative to the notion of REST-based Web APIs
- Developed and used by Facebook since 2012
- Made available to the public (open source) in 2015
  - Spec and reference implementation
- Based on a simple, JSON-like query language



GraphQL Schema Definition Language (SDL)

- Language to define *GraphQL schema*
- Specifies the types of objects that can be queried when accessing a specific GraphQL Web API



GraphQL SDL Example

declaration of an object type with its fields and their types

argument

declaration of an interface type and an implementation

declaration of a union type

declaration of the query type (possible root fields of queries)

```
type Starship {
  id: ID!
  name: String!
  length(unit: String): Float
}

interface Character {
  id: ID!
  name: String!
  friends: [Character]
  appearsIn: [Episode]!
}

type Droid implements Character {
  id: ID!
  name: String!
  friends: [Character]
  appearsIn: [Episode]!
  primaryFunction: String
}

type Human implements Character {
  id: ID!
  name: String!
  friends: [Character]
  appearsIn: [Episode]!
  starships: [Starship]
  totalCredits: Int
}

union SearchResult = Human | Droid | Starship

enum Episode { NEWHOPE, EMPIRE, JEDI }

type Query {
  hero(episode: Episode!): Character
  droid(id: ID!): Droid
  node(id: ID!): SearchResult
}
```

Can we use this language to define schemas for Property Graphs?

Property Graph Schemas with GraphQL SDL

Example Property Graph schema defined using the GraphQL SDL

```
type person {
  name: String!
  age: Int
  knows(weight:Float!): [person]  @distinct @noloops
  created(weight:Float!): [software]  @distinct @requiredForTarget
}

type software {
  name: String!
  lang: Language
}

enum Language {
  java
  javascript
  python
}
```

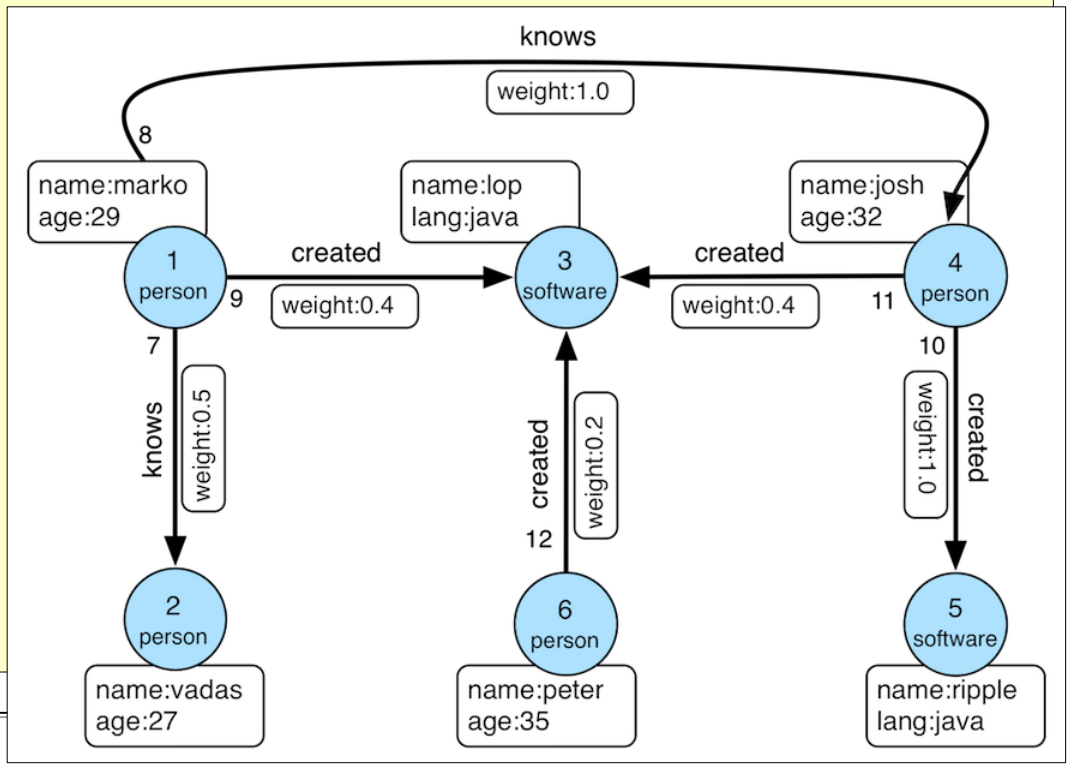


Image source: http://tinkerpop.apache.org/docs/3.4.0/tutorials/getting-started/

Node Types and Node Properties

```
type UserSession {
  id: ID!
  user: User!
  startTime: Time
  endTime: Time
}

scalar Time

type User {
  id: ID!
  loginName: String!
  name: String
}
```

(Outgoing) Edges

```
type A {
  name: String!
  favoriteB: B
  relatedA: [A]
}

type B {
  favoriteA: A!
  otherA: [A!]
}

type C {
  otherC: [C!] @distinct @noloops
  b: [B]  @distinct
}

type D {
  a: [A]  @uniqueForTarget
  b: [B]  @requiredForTarget
  c: [C]  @uniqueForTarget @requiredForTarget
}
```

Cardinality Restrictions

- 1:1 relationship

```
rel: B  @uniqueForTarget
```

- 1:N relationship

```
rel: B
```

- N:1 relationship

```
rel: [B]  @uniqueForTarget
```

- N:M relationship

```
rel: [B]
```

Multiple Types of Target Nodes 1/2

```
type Person {
  id: ID!
  name: String!
  favoriteVehicle: Vehicle
}

union Vehicle = Car | Motorcycle

type Car {
  brand: String!
  color: String
}

type Motorcycle {
  brand: String!
}
```

Multiple Types of Target Nodes 2/2

```
type Person {
  id: ID!
  name: String!
  favoriteVehicle: Vehicle
}

interface Vehicle {
  brand: String!
}

type Car implements Vehicle {
  brand: String!
  color: String
}

type Motorcycle implements Vehicle {
  brand: String!
}
```

Multiple Types of Source Nodes

```
type Car {
  brand: String!
  color: String
  owner: Person
}

type Motorcycle {
  brand: String!
  owner: Person
}

type Person {
  name: String!
}
```

Edge Properties

```
type UserSession {
  id: ID!
  user(certainty:Float! comment:String): User!
  startTime: Time
  endTime: Time
}
```

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