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# Intro to GraphQL for Database Developers

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# About me

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  - Focus on JavaScript and Oracle Database
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# Oracle Database for the Developer

| LANGUAGE | API |
|---|---|
| C | OCI, ODBC, ODPI-C |
| C++ | OCCI |
| Java | JDBC |
| .NET | ODP.NET |
| Node.js | node-oracledb |
| Python | cx_Oracle |
| PHP | OCI8, PDO_OCI |
| R | ROracle |
| Erlang | erloci |
| Perl | DBD::Oracle |
| Ruby | ruby-oci8, ruby-odpi |
| Rust | mimir, rust-oracle |
| Go | goracle, rana, mattn |

- Oracle Proprietary Drivers
- Oracle Open Source Drivers
- Third Party Open Source Drivers

… and Pro*C, Pro*COBOL, SQLJ, OLE DB, OLE DB for OLAP



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# Program Agenda


1. GraphQL Overview
2. GraphQL Demo with Oracle Database
3. Deeper into GraphQL

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# GraphQL Overview

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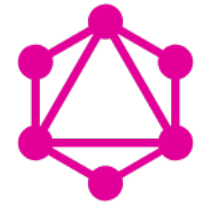
# GraphQL Overview in One Slide



- Alternative to REST
- Provides a single endpoint that responds to queries
  - Can parameterize queries without changing API or adding endpoints
  - This gives it more flexibility and efficiency than REST

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## REST GET

```
/farmer/2
```

## REST Response

```
{
  "farmer": {
    "id": 2,
    "name": "MacDonald",
    "age": "Old"
  }
}
```

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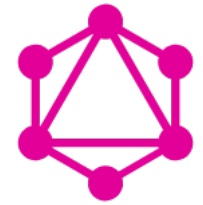

## GraphQL Query

```
{
  farmer(id: 2) {
    id
    name
    age
  }
}
```

## Response

```
{
  "data": {
    "farmer": {
      "id": 2,
      "name": "MacDonald",
      "age": "Old"
    }
  }
}
```

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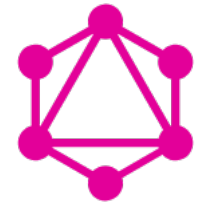

## GraphQL Query 2

```
{
  farmer(id: 2) {
    id
    name
  }
}
```

## Response 2

```
{
  "data": {
    "farmer": {
      "id": 2,
      "name": "MacDonald"
    }
  }
}
```

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# GraphQL Demo

## with Oracle Database

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# GraphQL Demo Technologies

**Queries and responses**

‘GraphiQL’ UI

**GraphQL requests over HTTP**

graphql, graphql-tools,
express, express-graphql,
and node-oracledb modules

**JSON**

Oracle Database SODA
Document Storage

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# Node.js GraphQL Modules

- graphql
  - JavaScript reference implementation for GraphQL
- graphql-tools
  - Generates and mocks GraphQL schema and resolvers

- express, express-graphql
  - Exposes a GraphQL HTTP server using Express
  - Optional interactive ‘GraphiQL’ interface

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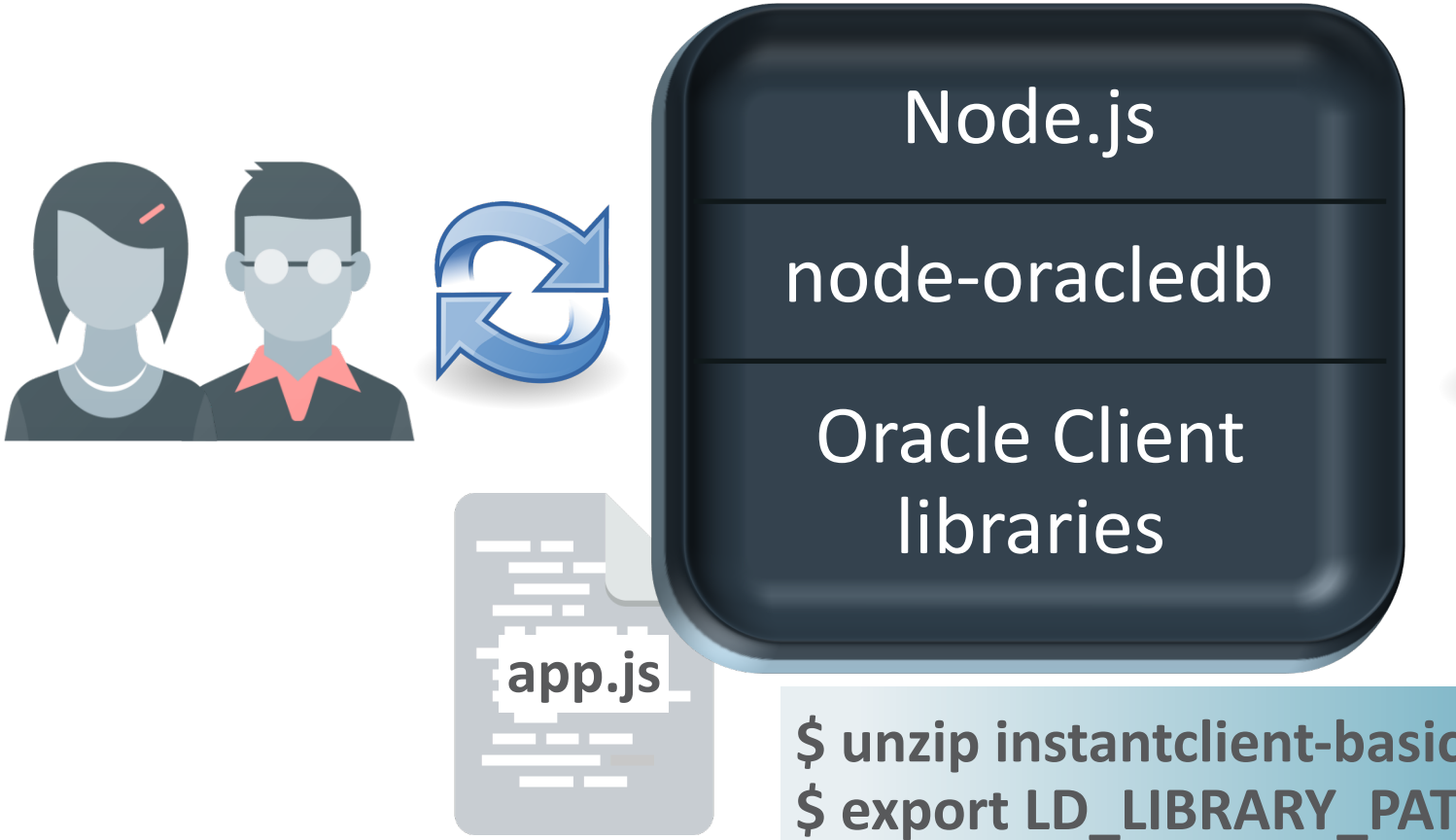
# node-oracledb Architecture – Stack View


```
$ unzip instantclient-basic-*.zip
$ export LD_LIBRARY_PATH=$(pwd)/instantclient_18_3
$ npm install oracledb
```

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# node-oracledb SODA Document Storage


**New in node-oracledb 3**

- Simple Oracle Document Access (SODA)
- NoSQL-style APIs in node-oracledb to create and access **documents**
  - Documents are often JSON
  - Query-by-example access makes data operations easy
  - **Preview** in node-oracledb 3 with Oracle Database 18.3
- SODA APIs also exist in Python, PL/SQL, C and Java

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# node-oracledb SODA Classes

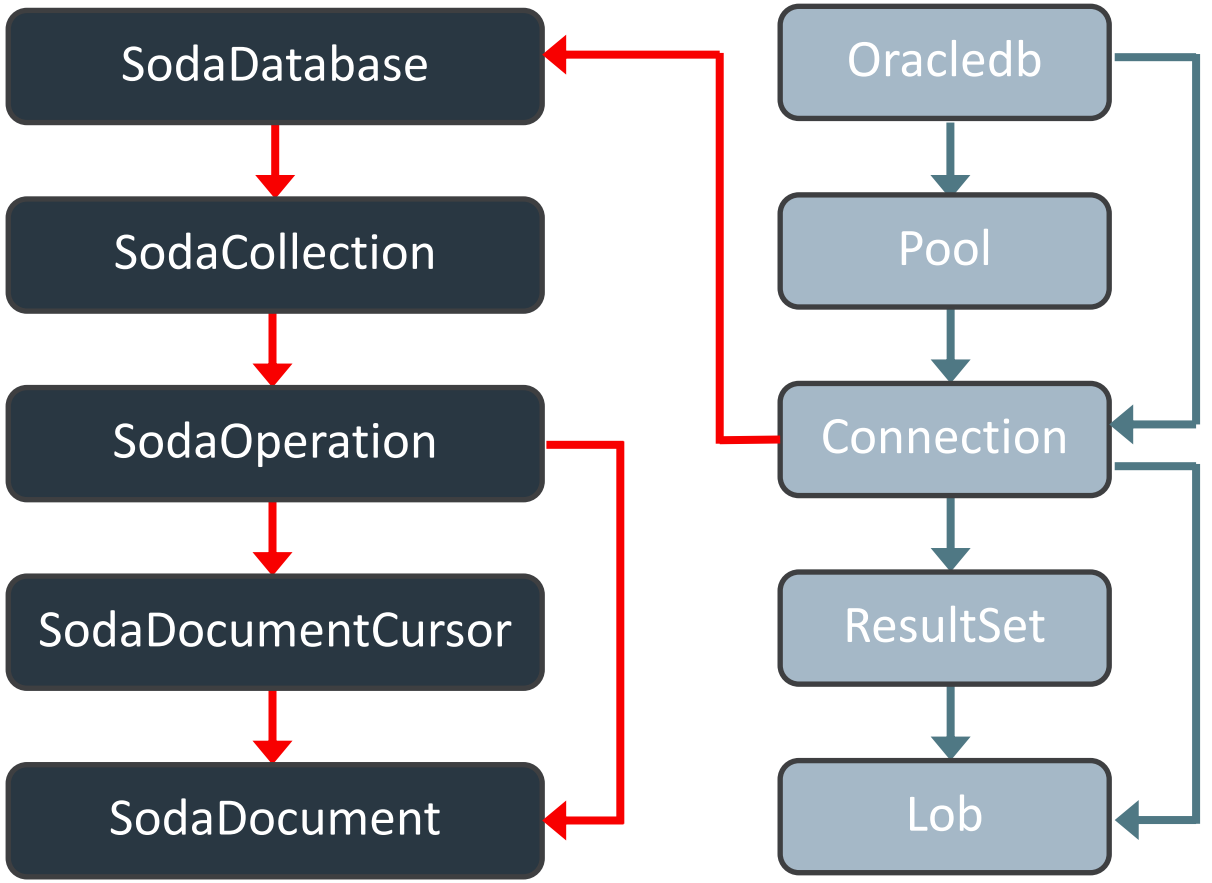

**Base SODA class**
- Get SODA database
- Manipulate SODA collections

**Set of Documents**
- Create and find documents

**Operation Builder**
- Filters and QBE
- Retrieve, replace and remove documents

**Document Cursor**
- Iterate over retrieved documents

**SODA Document**
- Document content and metadata
- Access as JSON, Object or Buffer

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# Using SODA in node-oracledb 3


```
SQL> grant SODA_APP to cj;
```

---

```
conn = await oracledb.getConnection({user:"cj", password:"mom",
                                     connectionString:"localhost/orclpdb"});

soda = conn.getSodaDatabase();
collection = await soda.createCollection("mycollection");

content = {name: "Anthony", address: {city: "Edmonton"}};
await collection.insertOne(content);
```

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# Using SODA in node-oracledb 3


```
// Or insert and get auto-generated key and version back
doc = await collection.insertOneAndGet(content);
console.log("Key is:", doc.key);
console.log("Version is:", doc.version);

// Also can insert JSON (or Buffer)
doc2 = soda.createDocument('{"name":"Venkat","city":"Bengaluru"}');
await collection.insertOne(doc2);
```

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| PHP | OCI8, PDO_OCI |
| R | ROracle |
| Erlang | erloci |
| Perl | DBD::Oracle |
| Ruby | ruby-oci8, ruby-odpi |
| Rust | mimir, rust-oracle |
| Go | goracle, rana, mattn |

- Oracle Proprietary Drivers
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… and Pro*C, Pro*COBOL, SQLJ, OLE DB, OLE DB for OLAP



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# Using SODA in node-oracledb 3


## Operation Builder – `find()`

```
doc = await collection.find().key(key).getOne(); // SodaDocument

content = doc.getContent();                      // JavaScript object
content = doc.getContentAsString();              // JSON string
content = doc.getContentAsBuffer();              // Buffer

doc = await collection.find().key(key).version(ver).remove(); // Gone!
```

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# Using SODA in node-oracledb 3


## Operation Builder – `filter()` Query-by-example (QBE)

```
// Find all documents with city names starting with 'S'

console.log("Cities starting with S");
documents = await collection.find()
  .filter({"address.city": {"$like": "S%"}})
  .getDocuments();

for (let i = 0; i < documents.length; i++) {
  content = documents[i].getContent();
  console.log('City is: ', content.address.city);
}
```

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# The Actual Live Demo…
## node-oracledb with GraphQL

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# Deeper into GraphQL

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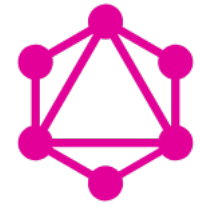
# GraphQL History



- Internal Facebook project since 2012
- First specification released publicly in 2015
  - regular updates
- Implementations exist in multiple languages
- Conferences and meetups happen around the world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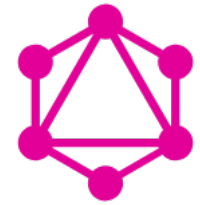
# REST vs GraphQL



| REST | GraphQL |
| --- | --- |
| Can send over HTTP | Can send over HTTP |
| Can return JSON | Can return JSON |
| Endpoint is the object identity | Object identity is part of the query |
| Resource is determined by the server | Server declares what is available, client requests what it needs |
| May require loading from multiple URLs | Gets all the data in a single request |
| GET or POST to same URL | query{} and mutation{} use same URL |
| Calls are stateless | Query and mutation operations are stateless |

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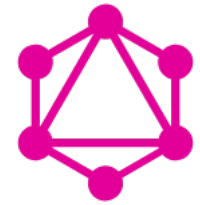
# GraphQL



- Schema Definition Language expresses the shape of the GraphQL schema and its types
- APIs are organized in terms of types and fields
  - Using types avoids apps having to have manual parsing code
  - New fields and types can be added without affecting existing apps
  - Fields can be marked deprecated
  - Apps get continuous access to new features
- GraphQL provides API documentation
- GraphQL validation provides readable errors

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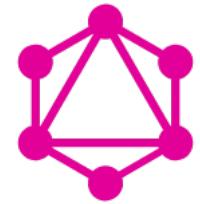
# Types



- Scalar types
  - String, Int, Float, Boolean, and ID
- `String!` - non-null String
- `[String]` – array with 0 or more elements
- `String @deprecated(reason: "Field is deprecated!")`
- GraphQL services have a Query type and optional Mutation type
  - entry points for accessing and changing data

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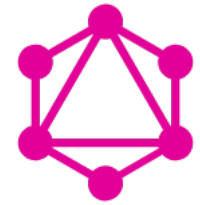
# Queries



- Named queries, arguments, defaults

```
query myName($v: Int = 2)
{
  blog(id:$v) {
    id
    content
  }
}
```

Variable:

```
{"v": 1}
```

- Also have Fragments, Directives, __typename

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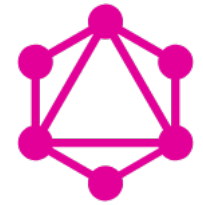
# Resolvers



## Schema

```
type farm {
  id: Int!
  farmer: farmer
}
type farmer {
  id: Int!
  name: String!
  age: Int!
}
type Query {
  farm(id: Int): farm
  farms: [farm]
}
```

## Query

```
{
  farms {
    id
    farmer {
      name
      age
    }
  }
}
```

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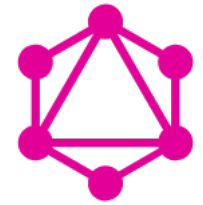
# N + 1 Problem



**Each sub type does a DB query to instantiate itself**

```
{
  farms {
    id
    farmer {
      name
      age
    }
  }
}
```

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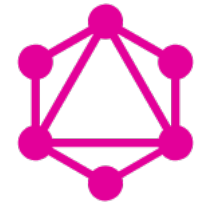
# N + 1 Problem



## DataLoader Module for data batching and caching

```
farmerloader = new DataLoader(keys => {
  return getfarmersloaderhelper(keys);
});

async function getfarmersloaderhelper(idArray) {
  . . .
  let document = await sodaColl.find().keys(idArray).getDocuments();
  . . .  // construct ja
  return ja;
}
```

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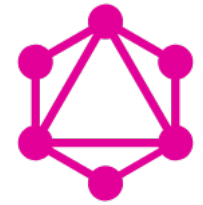
# GraphQL Notes



- JSON compresses well, so use gzip with HTTP
- Choose field names wisely
  - avoid breaking changes in your API v2, v3, …
- API Versioning
  - Generally don’t break compatibility
- Security and authentication
- Keeping GraphQL and DB Schema in sync

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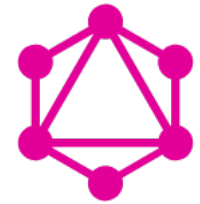
# I’m using REST - how do I get to GraphQL?



- GraphQL resolvers can call existing REST endpoints
- Provide an incremental adoption path
  - Let's you try things out and do what works

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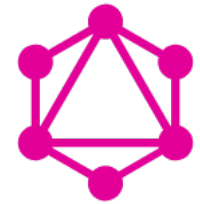
# Future investigation



- Subscriptions
  - Use with Continuous Query Notification (CQN) in node-oracledb?

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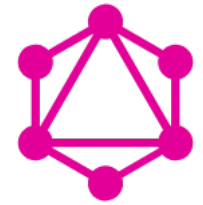
# Reading



- https://graphql.org/
  - Tutorials etc
- https://facebook.github.io/graphql/
  - Specification
- https://github.com/prisma/prisma/issues/1644
  - Show support (contribute?) for adding Oracle support to this data abstraction layer

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