Abstracting databases access in Titanium Mobile

Xavier Lacot – September 2011

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- Open Source convinced and contributor
- Titanium enthusiast and developer since 2009
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Summary

1. Using databases in Titanium Mobile applications
2. Who said "pain"?
3. The ORM concept
4. Various js ORMs available
   - Titanium Mobile compatibility chart
5. A focus on joli.js
   - Main use
   - Joli API extension

Using databases in Titanium Mobile applications

- Titanium provides a complete Database API :
  - Titanium.Database
  - Titanium.Database.DB
  - Titanium.Database.ResultSet
- Access to SQLite databases
- The way to go when manipulating data in mobile applications!

Databases are very common in mobile applications

- Traveling guides (non-connected mode);
- News apps,
- Todo lists,
- Etc.

Using databases in Titanium Mobile applications

```
// create a connection
var db = Titanium.Database.open('database_name');

// execute a SQL query
var rows = db.execute(
  'SELECT short_url FROM urls WHERE long_url = ?',
  Longurl
);

// get a result
if (rows.isValidRow() && rows.fieldByName('short_url')) {
  result = rows.fieldByName('short_url');
}

// close the resultset
rows.close();

// close the database connection
db.close();
```

Using databases in Titanium Mobile applications

- Some details to care to:
  - Never forget to close() resultsets, or:
    - you will get memory leaks;
    - The app will unexpectedly close
  - You will have to accept the mix of "view code" and "database code"... javascript and SQL in the same code pages...

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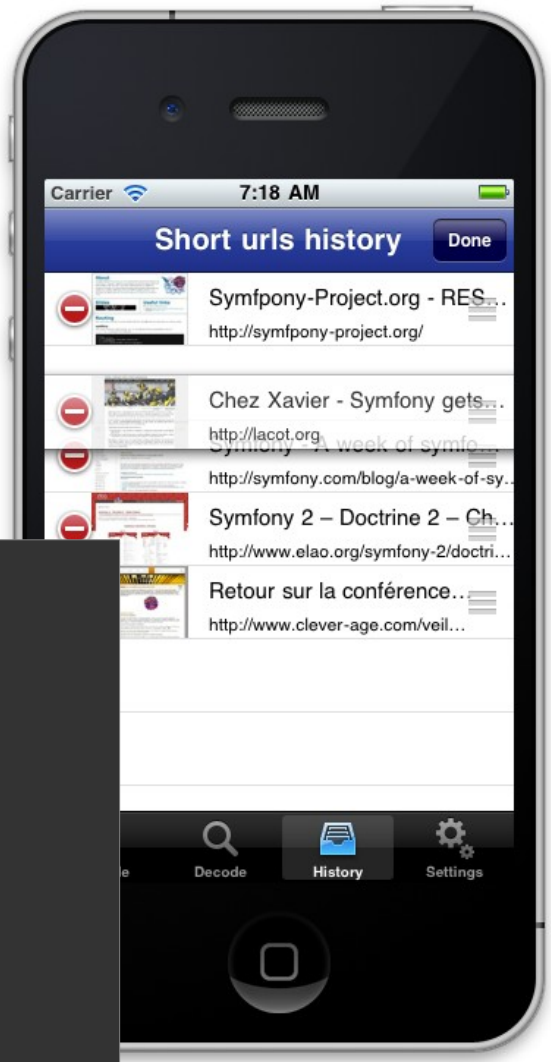
Who said "pain"?

- Titanium.Database is ok for a few requests
- It is limited in large scale applications:
  - Imagine a 10 tables model, each with 20 fields
- Some questions:
  - Why write SQL queries yourself?
  - How to ensure data consistency / related entries retrieval?
  - How to deal with database migrations in your app?
  - How to avoid writing again and again the same queries?

A pain-in-the-ass sample

- Remove an item from an ordered list
  - Remove the item from the database
  - Update the other items positions




```
// add delete event listener
tableview.addEventListener('delete', function(e) {
  var db = Titanium.Database.open('database_name');

  // delete the item
  db.execute(
    'DELETE FROM short_url WHERE id = ?',
    e.row.children[0].text
  );
```

A pain-in-the-ass sample

```
  ...

  // update the other items positions
  var rows = db.execute('SELECT * FROM short_url ORDER BY position ASC');
  var position = 1;

  while (rows.isValidRow()) {
    db.execute(
      'UPDATE short_url SET position = ? WHERE id = ?',
      position,
      rows.fieldByName('id')
    );
    position++;
    rows.next();
  }

  // be a good boy
  rows.close();
  db.close();
});
```

A pain-in-the-ass sample

- Wait oh wait
  - Our business-code is cluttered with database manipulation code
  - Why not simply write:

```
// add delete event listener
tableview.addEventListener('delete', function(e) {
  // assume short_url is an object which represents the short_url table
  short_url.get(e.row.children[0].text).remove();
};
```

- A todo-list application
  - Only display, count, get stats about the tasks of the currently selected category
  - Will you always write the « `WHERE category_id = '12'` » condition?
  - A better idea:

```
category.get(12).listArticles();
category.get(12).countArticles();
// etc
```

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What is an « ORM »?

- Object-Relational Mapper
  - Data access and manipulation abstraction
  - Classes represent tables, objects represent their content

table Human	
id	integer
lastname	text
firstname	text
city_id	integer
born_at	timestamp
is_alive	boolean
dead_at	timestamp

```
// say Human is a mapping class
var john = new Human();

john.set('lastname', 'Doe');
john.set('firstname', 'John');

// persist it
john.save();
```

Goals of an ORM

- Manipulate records
  - Never create or delete a record manually
  - Use behaviors (timestampable, taggable, etc.)
  - Clean user entries
- Execute queries
  - Abstract queries as objects
  - Pass it to several methods
- Create your data model and manage it with migrations

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ORMs in javascript

- There are lots of javascript ORMs
  - Suited for various Database access APIs
    - Browsers
    - Node
    - Titanium
    - Etc.
  - Not every is convenient for Titanium
    - Leaks, incompatibility, not tested, etc.
    - Not using Titanium.database

Some of them, designed for Titanium

- ActiveJS Titanium fork - https://github.com/sr3d/activejs-1584174
- AppceleratorRecord - https://github.com/wibblz/AppceleratorRecord
- JazzRecord - http://www.jazzrecord.org/
- TiStore - https://github.com/jcfischer/TiStore
- yORM - https://github.com/segun/yORM
- Joli.js - https://github.com/xavierlacot/joli.js
- Maybe others?

... That's a nice list!

ORMs chart

	Iphone	Android	Doc	License	Comments	Watchers (Forks)
ActiveJS Titanium fork	Yes	No	Light	unknown	Migrations not working Not maintained ?	7 (2)
Appcelerator Record	No	No	Light	unknown	Few functionalities Code not clean Not maintained ?	48 (5)
JazzRecord	No	No	Extensive	MIT	Not only for Titanium (Air, etc.) Broken on Titanium since 2010/07 Not maintained ?	75 (11)
TiStore	Yes	No	None	Apache	Not packaged Few functionalities	41 (5)
yORM	Yes	Yes	Light	unknown	Few functionalities Recent project	1 (1)
joli.js	Yes	Yes	Medium	MIT		99 (14)

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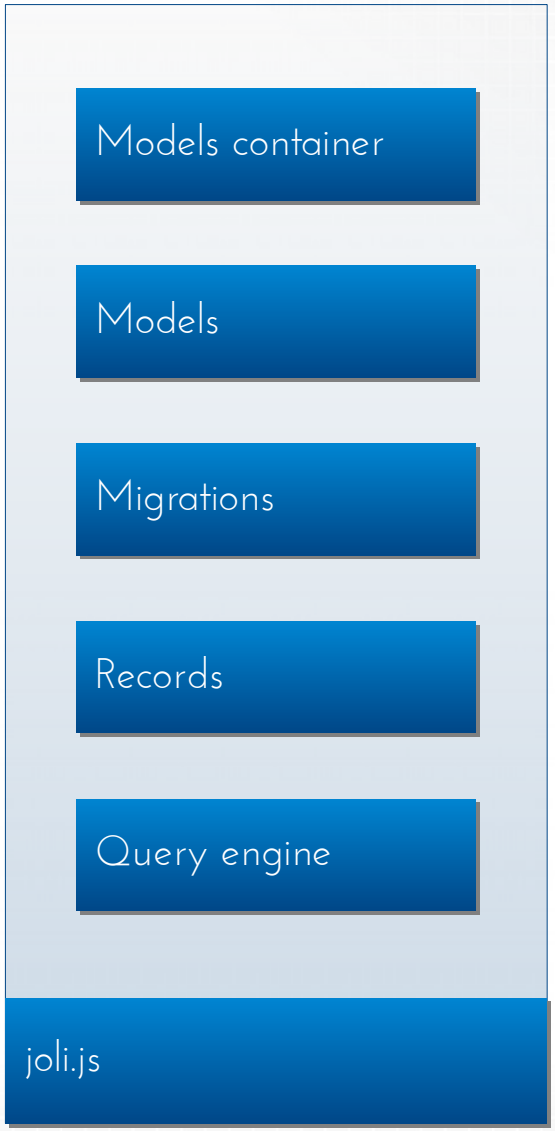
- Why joli.js
  - I could not find what I was looking for in the other ORMs
  - I wanted an abstract query API
  - I wanted something short, simple and efficient
- Some facts
  - Much inspired by JazzRecord (js) and Doctrine (PHP)
  - First release was written in 3 nights

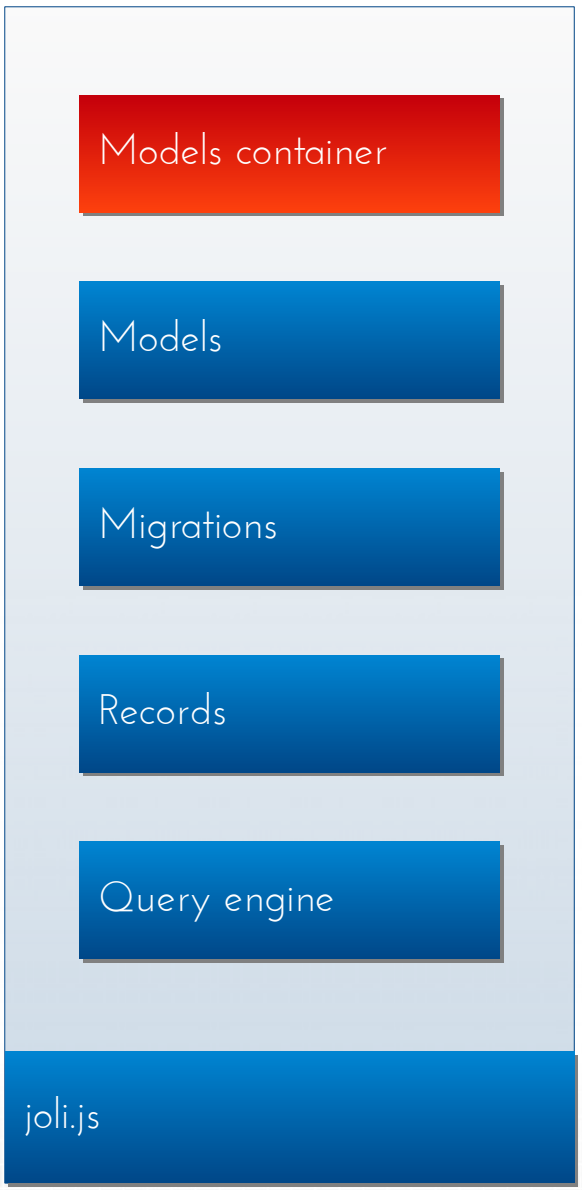
Features

- Models container
- Models declaration
- Abstract query language
- Record lifecycle management
- Performance analysis
- Extensible

- All this in a single ~850 lines file!

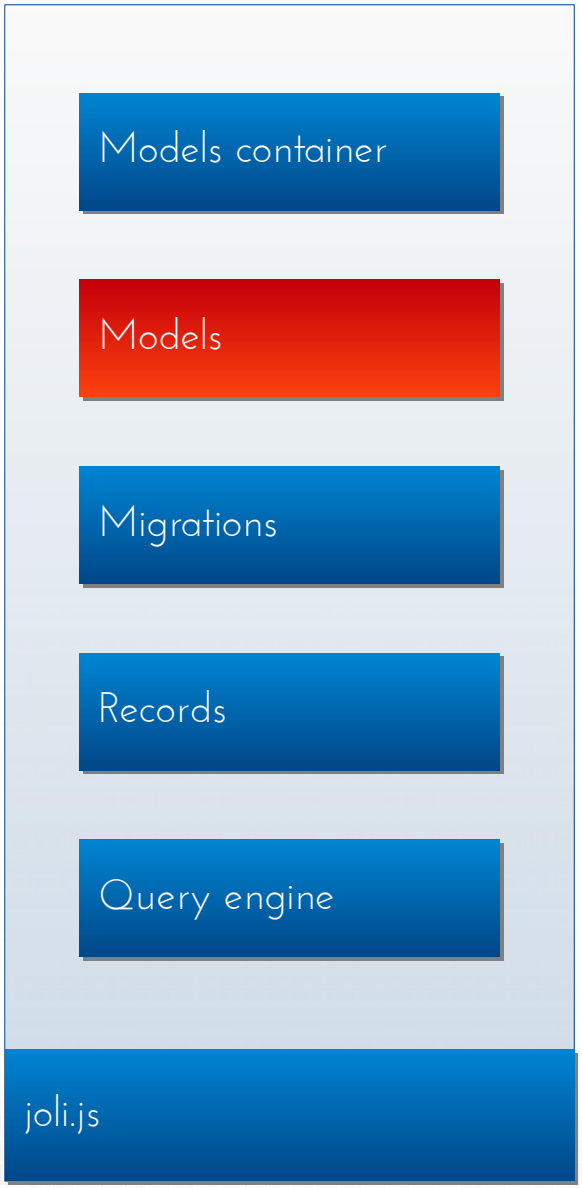


Models container



- Easy access to the model classes
  - get()
  - has()
  - Etc.
- Able to launch the migrations

Models



- Models represent the tables
  - Model declaration
  - Tables creation
  - Mass-records management
  - Fast selection methods (aka « Magic getters »)

Declaring a model

- Include joli.js
- Declare a connection to your database:

```
joli.connection = new joli.Connection('your_database_name');
```

- Describe the model

```
var city = new joli.model({
  table:    'city',
  columns:  {
    id:                 'INTEGER',
    name:               'TEXT',
    description:        'TEXT'
  }
});
```

- call

```
joli.models.initialize();
```

Declaring a model

- Several models? Put them in a bag!

```
var models = (function() {
  var m = {};

  m.human = new joli.model({
    table:    'human',
    columns:  {
      id:                   'INTEGER PRIMARY KEY AUTOINCREMENT',
      city_id:              'INTEGER',
      first_name:           'TEXT',
      last_name:            'TEXT'
    }
  });

  m.city = new joli.model({
    table:    'city',
    columns:  {
      id:                   'INTEGER PRIMARY KEY AUTOINCREMENT',
      name:                 'TEXT'
    }
  });

  return m;
})();
```

table- and object- methods

```
var human = new joli.model({
  table:    'human',
  columns:  {
    ...
  },
  methods: {
    countIn:  function(cityName){
      // do something
  }
  },
  objectMethods: {
    moveTo:  function(newCityName){
      // do something
  }
  }
});

// use a table-method
var habitantsCount = human.countIn('San Francisco');

// use an object-method
john.moveTo('Paris');
```

Mass records management

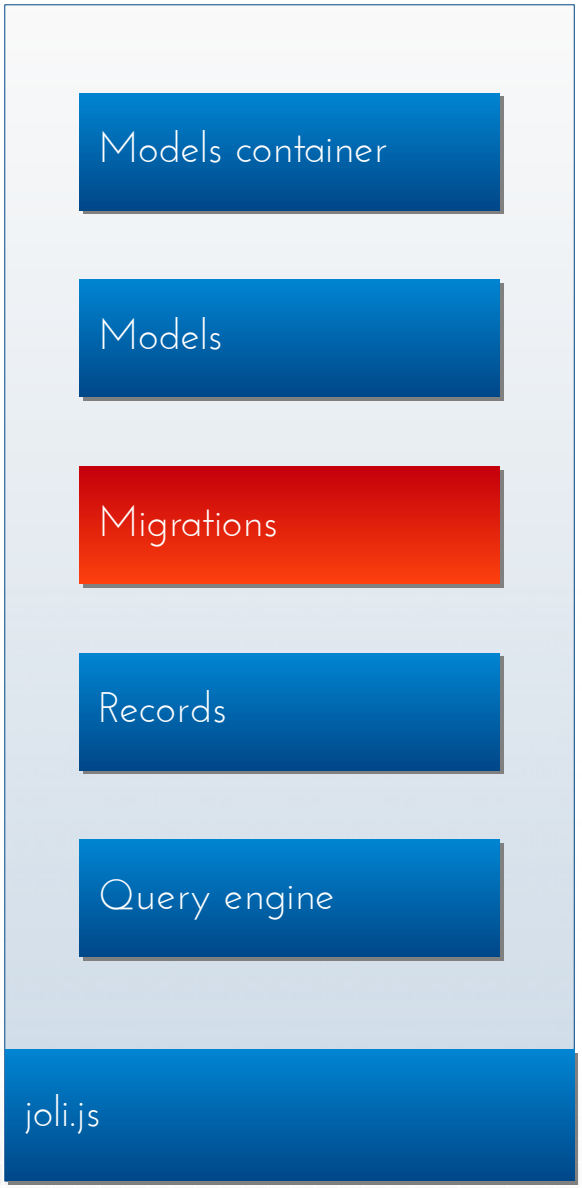
```
var table = models.human;

table.truncate();                       // remove all humans
table.deleteRecords([1, 7, 12]);        // remove some records
table.exists(118);                      // test existance, based on "id"

// count entities
var allCount = table.count();
var DoesCount = table.count({
  where: {
    'last_name = ?': 'Doe',
    'age >= ?': 21
  }
});

// get all the ones matching criterions
var Does = table.all({
  where: {
    'last_name = ?': 'Doe',
    'age >= ?': 21
  },
  limit:  12
});
```

Magic getters

- Goal: Have an easy way to select the records of one table matching a given criteria.
  - findOneById()
  - findOneBy()
  - findBy()

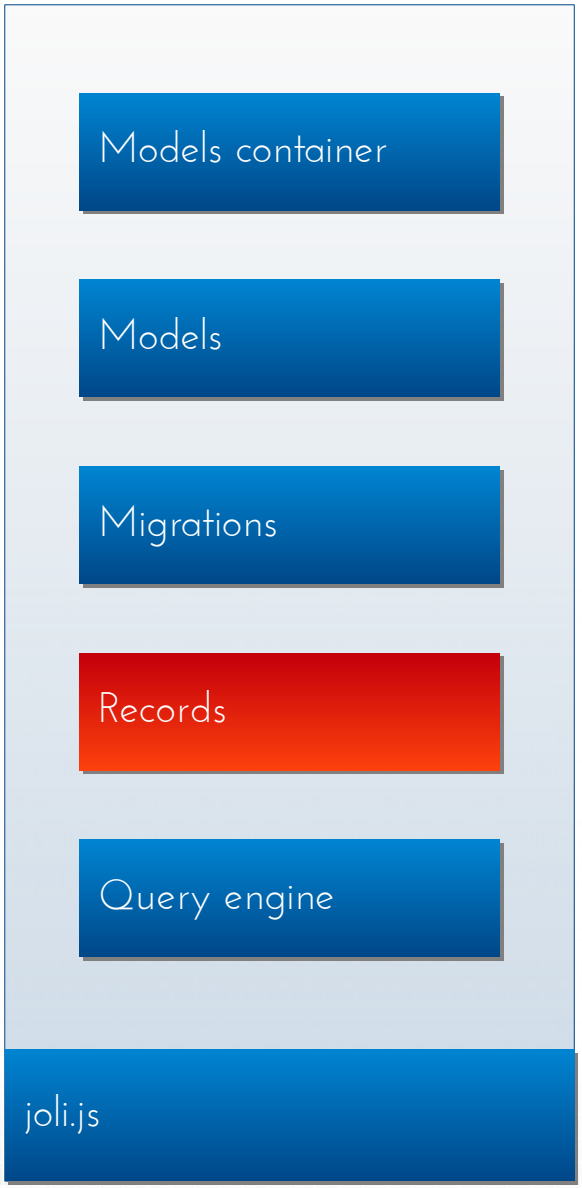
```
var table = models.human;

// returns all the inhabitants of the city n°12
var parisians = table.findBy('city_id', 12);

// returns one "human" record only (not sorted)
var michel = table.findOneBy('first_name', 'Michel');

// returns the human of id "118"
var human = table.findOneById(118);
```

Migrations



- Update the database layout when updating the application
- Allows to run other operations (callbacks available)

Records



- Records are objects related to a row in the database
  - Record creation
  - Record access
  - Record update
- Records can be used even while not persisted

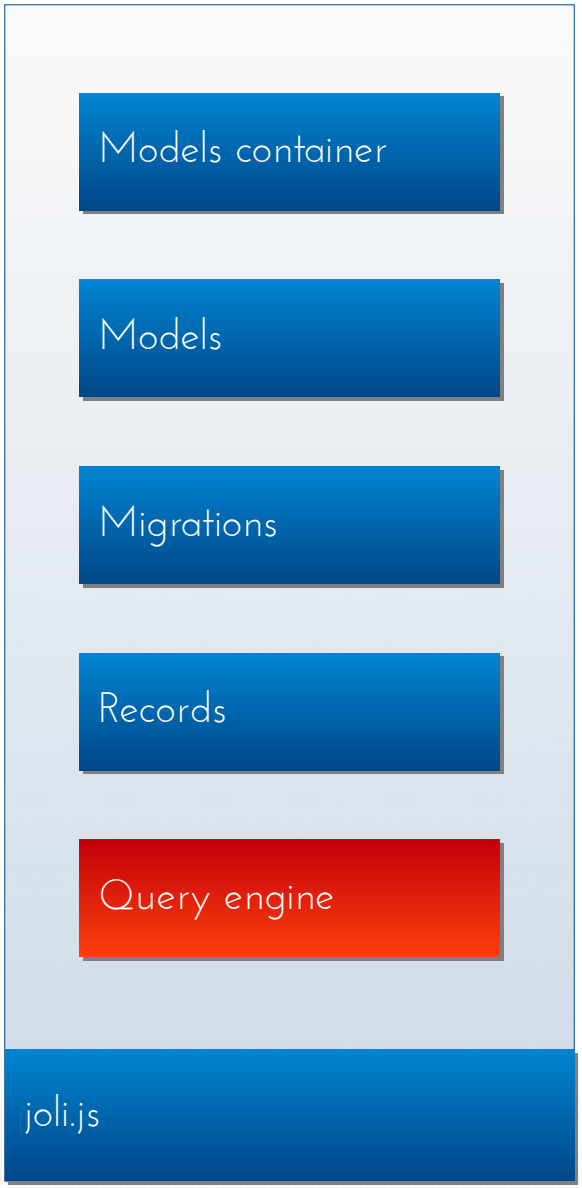
Create new records

```
// first method
var john = models.human.newRecord({
  first_name: 'John',
  last_name: 'Doe'
});


// second method
var john = new joli.record(models.human);
john.fromArray({
  first_name: 'John',
  last_name: 'Doe'
});


// third method
var john = new joli.record(models.human);
john.set('first_name', 'John');
john.set('last_name', 'Doe');
```

Manipulate records

```
// persist a record
john.save();


// destroy it
john.destroy();


// get a property
var name = john.get('last_name');


// export to an array
var johnArray = john.toArray();
var json = JSON.stringify(johnArray);
// {"id":"110","lastname":"Doe","firstname":"John","company_name":"ACME"}
```

Query engine



- Abstract the way queries are run against the database
- Stop writing SQL
- Use chained method calls « à la jQuery »
- Have hydratation facilities

Querying the model

- No more SQL queries
- Let's introduce an OOP querying model
  - Queries are objects
  - They can be `execute()` 'd

```
// create the query object
var q = new joli.query()
  .select()
  .from('human')
  .where('last_name = ?', 'Doe');

// let's execute it
var humans = q.execute();
```

A complete SQL-like vocabulary

- Several methods for building queries:
  - count()
  - destroy()
  - from()
  - groupBy()
  - insertInto()
  - join()
  - limit()
  - order()
  - set()
  - update()
  - values()
  - where()
  - whereIn()

Progressive query construction

```
api.getActiveQuery = function(q) {
  if (!q) {
    q = new joli.query()
      .from('news');
  }

  q.where('active = ?', true);
  return q;
};

api.getLastPublished = function() {
  return api
    .getActiveQuery()
    .limit(1)
    .orderBy('created_at desc')
    .execute();
}

api.getPublished = function() {
  return api
    .getActiveQuery()
    .orderBy('created_at desc')
    .execute();
}
```

- Queries as objects are easy to handle
- No matter the order in which you call the query methods!

Let's talk about hydration

- Calling execute() will:
  - Build the query string;
  - Send it to joli.Connection() for its execution;
  - And create a bunch of record objects (one per result).
- This last step is called « hydration »
- It can cost time. A lot.
- Joli.js offers a way to hydrate plain arrays, not complete joli.js records.

Let's talk about hydratation

```
var people = new joli.query()
  .select()
  .from('people')
  .execute();
// people is an array of objects

var people = new joli.query()
  .select()
  .from('people')
  .execute('array');
// people is a simple plain array
```

- An ORM as a cost, sure, but you can make it invisible to the user
- Save you app, take care to the performances

Querying useful methods

- getSqlQuery() returns the string that will be generated when executing the query

```
var q = new joli.query()
  .select()
  .from('view_count')
  .where('nb_views between ? And ?', [1000, 2000]);

var queryString = q.getSqlQuery();
// select * from view_count where nb_views between "1000" and "2000"
```

- All the queries go through `joli.Connection.execute()`. Possibility to log things here and see what is happening.

Unit tests

- Joli.js is unit-tested using titanium-jasmine
  - 90+ tests and growing
  - See https://github.com/xavierlacot/joli.js-demo for the test suite

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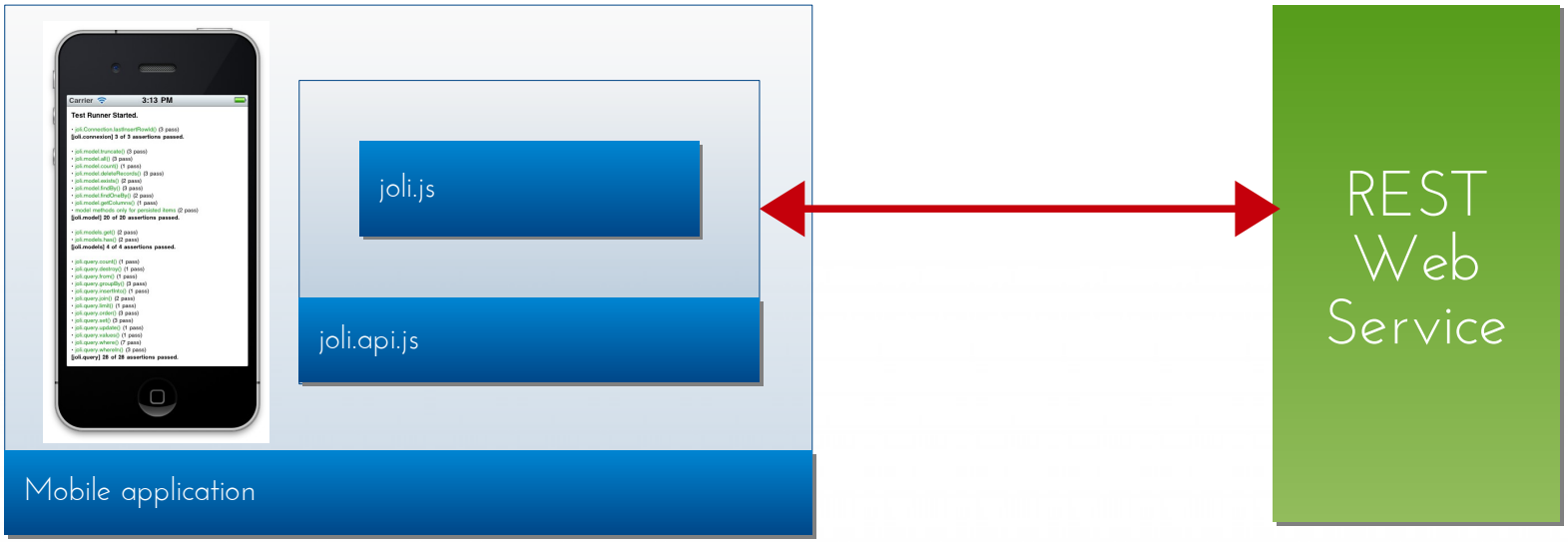
Joli API extension

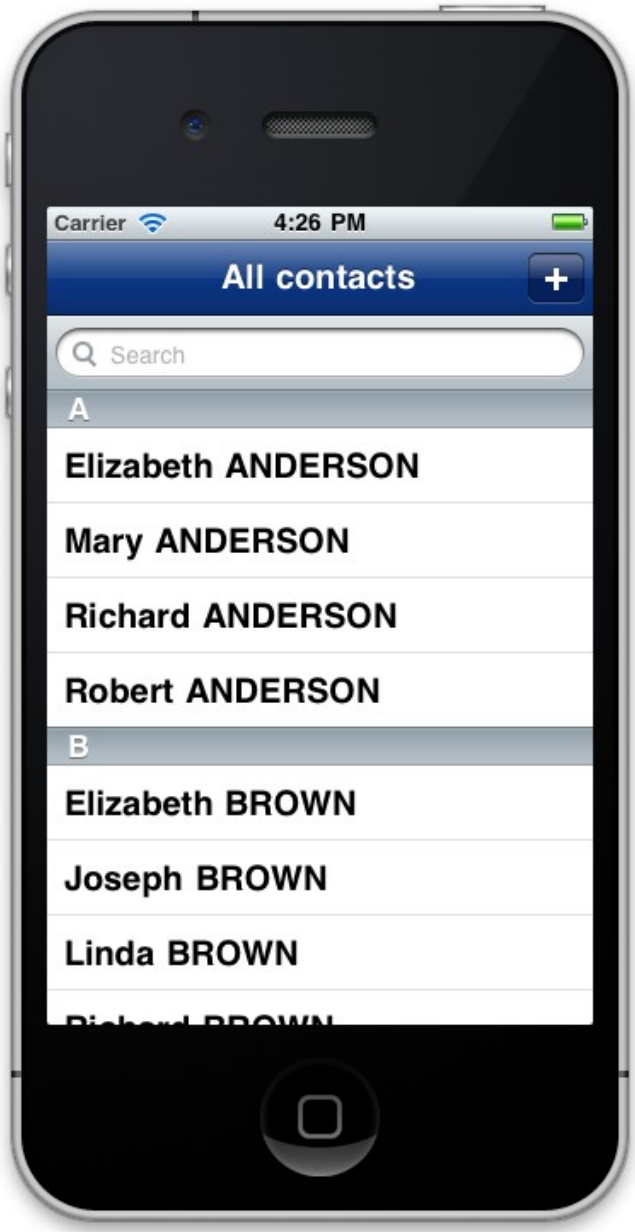
- We often need to synchronize data from/to the Web
- Case sample : an online address book
  - We want the contacts to be available on the phone even when not connected
  - The contacts list must also be available online
- Here comes joli.api.js, the little brother to joli.js

Joli API extension

- joli.api.js is a wrapper to joli.js, which makes synchronization to REST web services easy



- All CRUD operations are available : GET / POST / PUT / DELETE



Let's have a small demo

- A Titanium-powered synchronized AddressBook
- Code will be available at https://github.com/xavierlacot/joli.api.js-app-demo
- Uses REST APIs built in PHP with the Symfony framework

API synchronized model declaration

joli.apimodel

```
var people = new joli.apimodel({
  table: 'people',
  columns: {
    id:                 'INTEGER PRIMARY KEY AUTOINCREMENT',
    firstname:          'TEXT',
    lastname:           'TEXT',
    company_name:       'TEXT',
    email:              'TEXT',
    phone:              'TEXT',
    picture_url:        'TEXT'
  },
  updateTime:           86400,
  url:                  'http://local.example.com/api/people.json'
});
```

The REST endpoint url

- Minor changes compared to joli.js

The exact same method

```
// selects from the database
// if no result and the updateTime is gone, checks the API
var peoples = joli.models.get('people').all({
  order: ['lastname asc', 'firstname asc']
});


// creates the record and saves it to the REST endpoint
joli.models.get('people')
  .newRecord(values, true)
  .save();
```

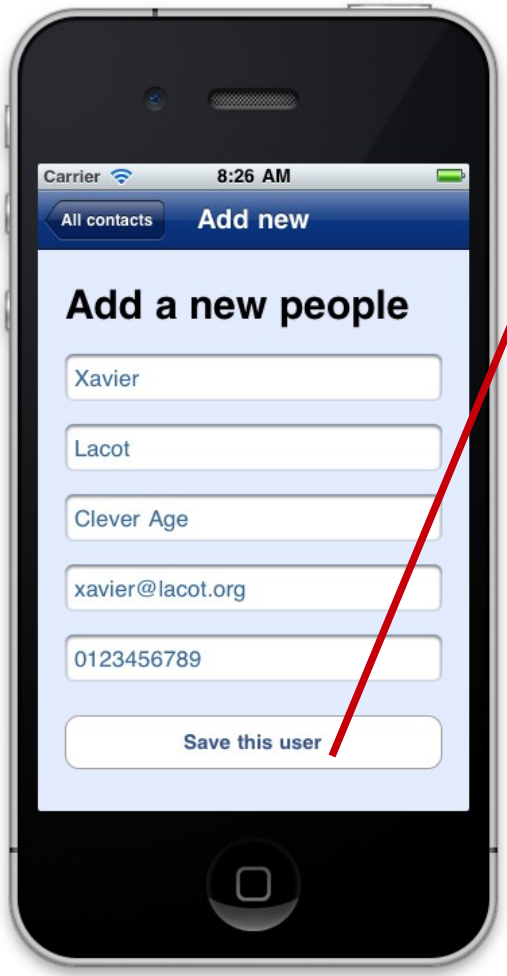
Should the record be synchronized?

This is Free and Open Source Software...

- All the code is here :
  - joli.js - https://github.com/xavierlacot/joli.js
  - joli.api.js - https://github.com/xavierlacot/joli.api.js
  - joli.js test suite - https://github.com/xavierlacot/joli.js-demo
  - joli.api.js demo application - https://github.com/xavierlacot/joli.api.js-app-demo

Let's have a small demo

- This app was built completely while I was in the plane. Less than 4 hours coding!




```
// persist the values of the form
button.addEventListener('click', function() {
  // extractValues() builds an associative array of the form values
 save(extractValues(container));
  win.close();
});

var save = function(values) {
  joli.models.get('people').newRecord(values, true).save();
};
```

```
[INFO]  POST request to url http://local.example.com/api/people.json
[INFO]  Received from the service:
[INFO]   {"id":"111","lastname":"Lacot","firstname":"Xavier", ...}
[INFO]  1 new record(s), 0 record(s) updated.
[DEBUG] fire app event: joli.records.saved
```

Roadmap and whishlist...

- Joli.js:
  - Abstract the configuration
    - Logging enabled or not, default hydration model
    - Easy support for several databases
  - Improve migrations, add more unit tests
- Joli.api.js
  - Support for all the HTTP methods
  - Make it possible to map the Data model to different REST services formats

Keep all this fun, short and efficient


Gracias por su visita