SOA from the trenches

Jordi Pradel

The project

13th Century Social Network of Deeds in France
(http://www.howweknowus.com/2008/07/23/great-work-lousy-title/)

The project

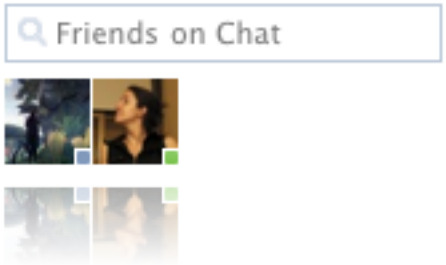
- Development of a new implementation of an existing social network:
  - Mobile and geolocation capabilities
  - Over 500K users
  - Mobile clients: iPhone, Java ME, Android
  - Backend
- Existing system not properly scaling
  - PHP backend

Main features

- Friendships
  - Friendship requests, accept, deny, block users
- Interests (moderated)
  - Subscribe to interests, create new interests, send mass messages to everyone that has an interest
  - Interests do have a profile picture
  - Aprox. 90k interests

Main features

- Profile picture (moderated)
- Online / Offline status



- Status: One line message of the current status of the user (moderated)
  - Connected to Twitter

Some complex features

- The messaging system as a chat wannabe
  - Mail like
  - Messages to interests (up to 30k users)
  - Notification of new messages to devices
  - Message sent by email as well
- List of everything every user did
  - Friendships, status changes, interests, messages, etc.

Some complex features

- (Almost) every list of users has some interesting tags:
  - Current status (one line message)
  - Distance in friendship graph to the logged in user
  - Number of friends in common with the logged in user
  - Friendship status to the logged in user (friends, pending friendship request, etc.)
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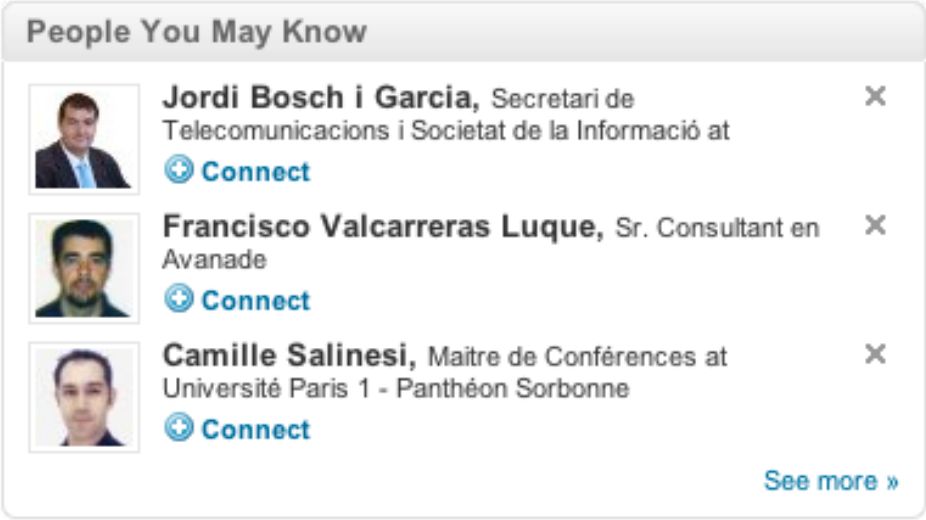
  - Online / Offline status
  - Profile picture

Some complex features

- Friendship connection

Some complex features

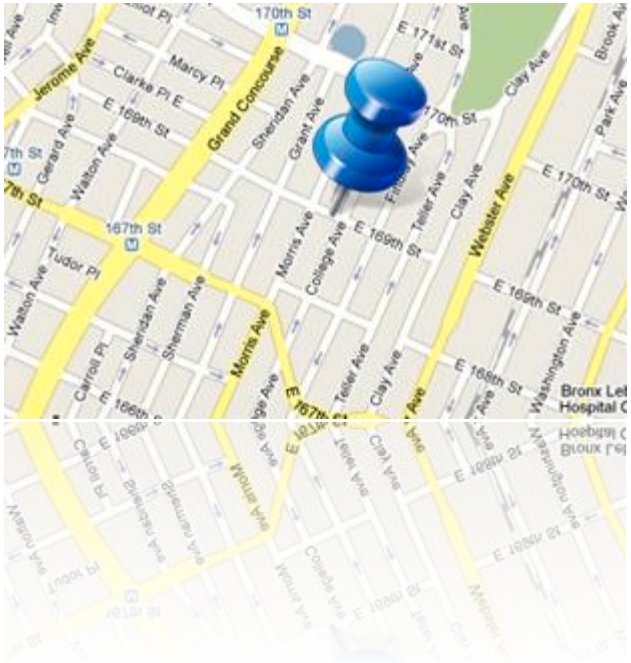
- Interesting people



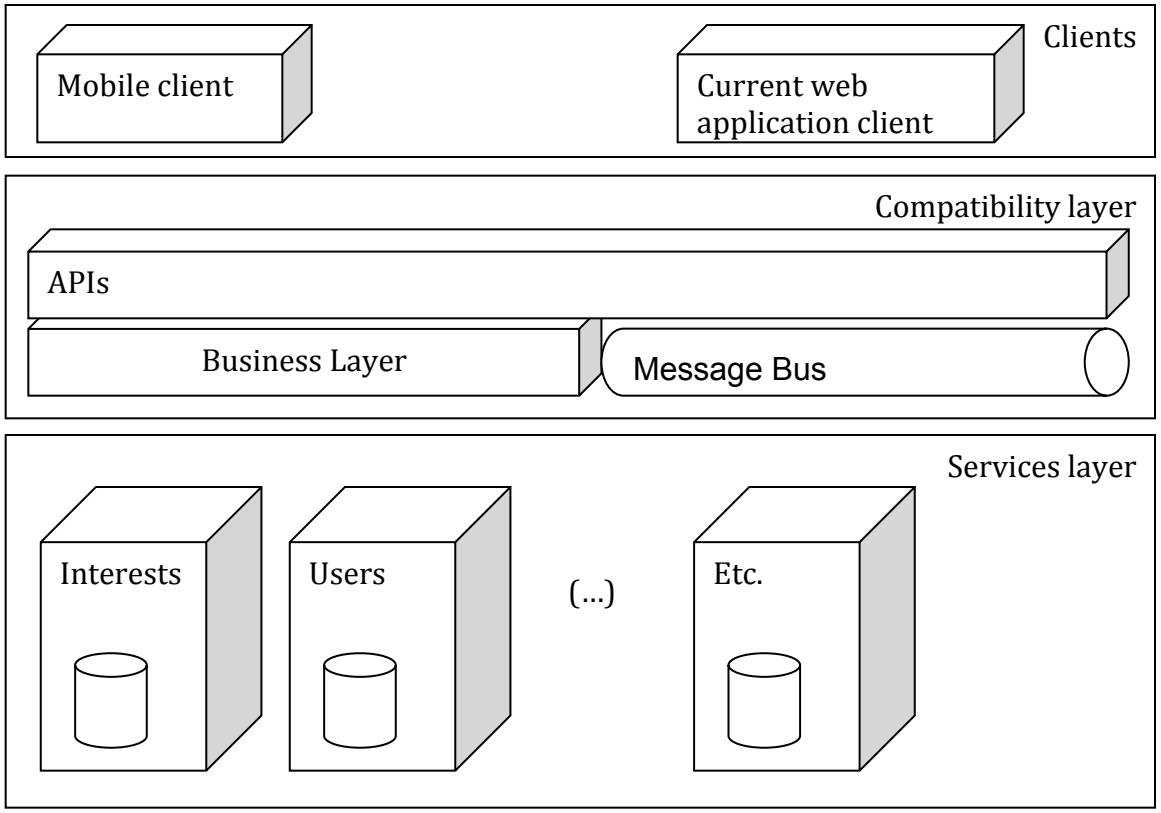
  – Interests in common
  – Contacts in common
  – Location

Encounters

- Locate the user device on each request
- Look for:
  - Users at bluetooth range
  - Users in a 2 km radius
  - Users in a 7 km radius
  - Users in a 50 km radius
- Create encounters
  - Directly and transitively



Architecture overview

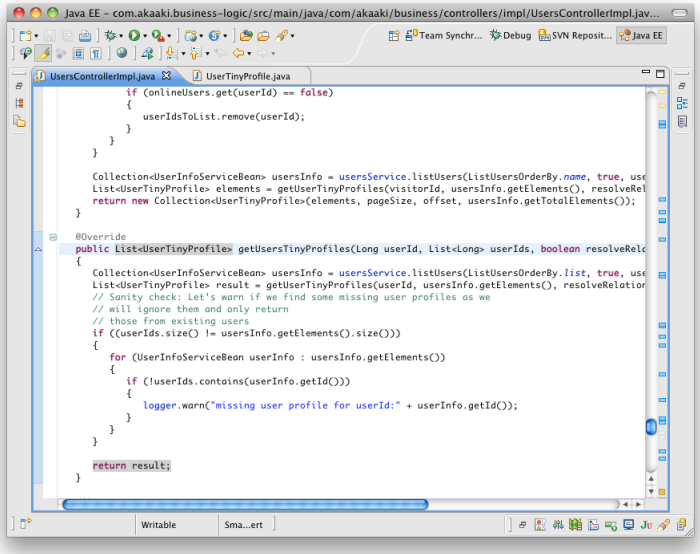


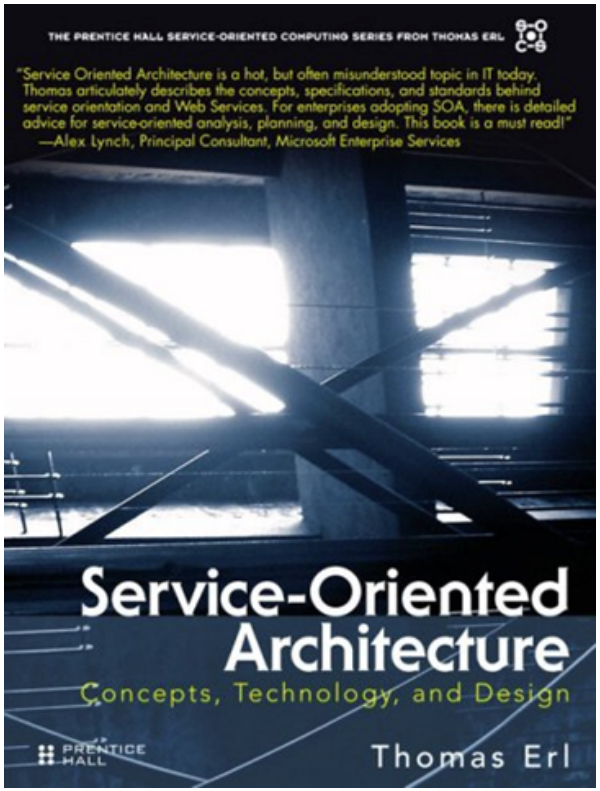
Projects

- apis
- business logic
- helper libraries
- device notification
- image storage

- activity
- session
- status
- settings
- interests
- users
- encounters
- friends
- location
- marketing
- messaging

Practice and theory



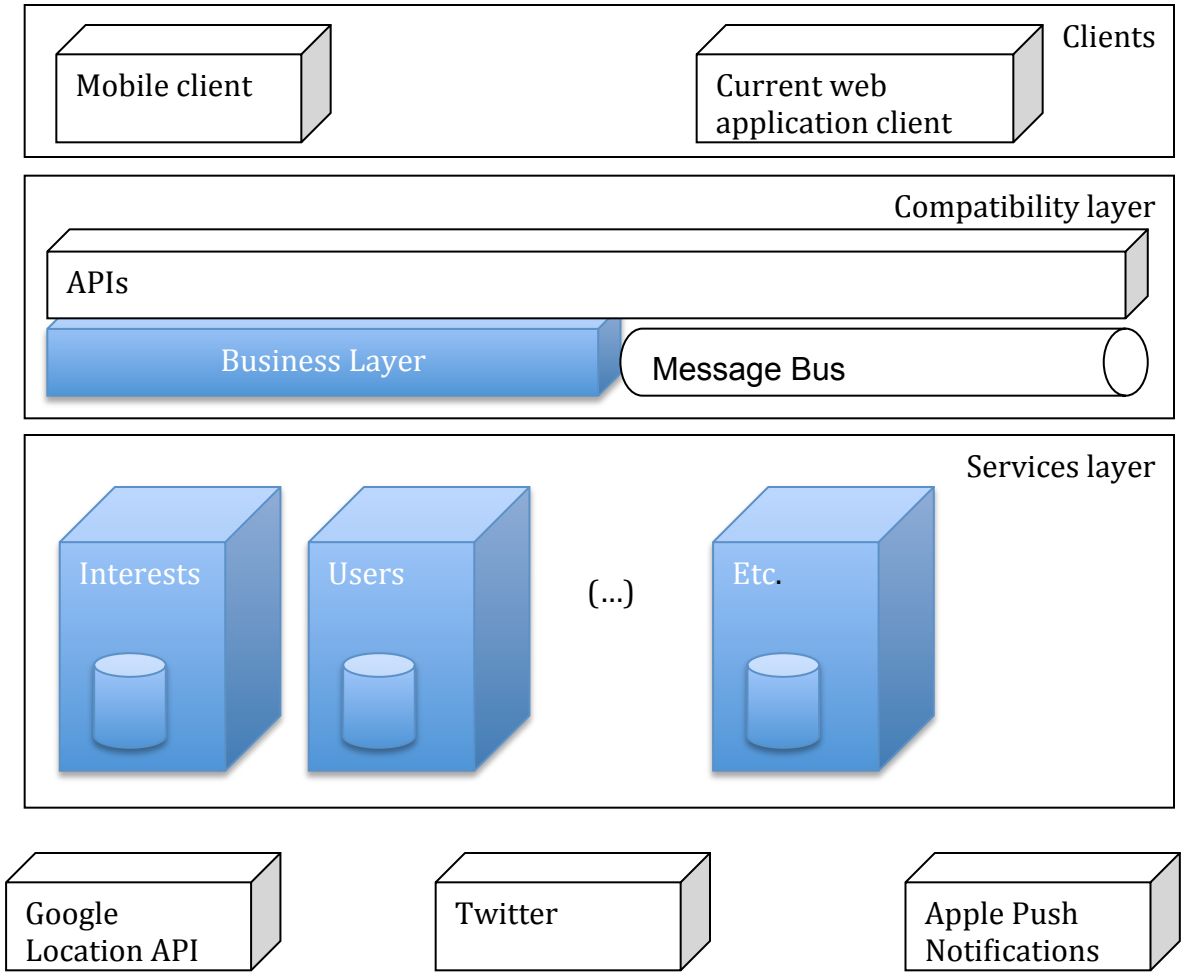


In theory, there is no difference between theory and practice
(attributed to Jan L.A. van de Snepscheut, Yogi Berra, Chuck Reid…)

Fundamentals: How services relate

- Services can be used by other services or programs as far as they are aware of the service they want to use
  - Service description:
    - Name
    - Location
    - Data exchange requirements
  - Messaging
    - Messages as independent units of communication

Fundamentals: How services relate



Fundamentals: How services relate

```
public class UsersController {
  private UsersService usersServiceM
   ...
}

@Produces(MediaType.APPLICATION_JSON)
@Consumes(MediaType.APPLICATION_JSON)
public interface UserService {
   @POST  @Path("/")
   public Long createUser();

   @GET @Path("/name/{userName}")
   public UserDTO getUserByName(@PathParam("userName") String
     userName);
}
```

Fundamentals: How services are used

- How should we design…
  - Services
    - Web Services
    - REST like
  - Service descriptions
    - Based on a Java Interface
  - Messages
    - Translated to REST + JSON parameters & return types
  - Relationships between services
    - Only from Business Layer to other services

Fundamentals: Principles of SO

- ✓ Low Coupling
- ✓ Service Contract
- ✓ Autonomy
- ✓ Abstraction
- ~ Reusability
- ✓ Composability
- ✓ Statelessness
- ✗ Discoverability

Fundamentals: Contemporary SOA

- Generally
  - Based on open standards
    - Pragmatism over heavy standards: REST
  - Architecturally composable
  - Capable of improving QoS
    - **INDEED!**
    - One of the main reasons in adopting SOA

Fundamentals: Contemporary SOA

- Support, foster and promote
  - ✓ Vendor diversity
  - ✓ Intrinsic interoperability
  - ✗ Discoverability
  - ✗ Federation
  - ~ Inherent reusability
  - ✓ Extensibility
  - ✗ Service-Oriented business modelling
  - ✓ Layers of abstraction
  - ✓ Enterprise-wide loose coupling
  - ✓ Organizational agility

Message Exchange Patterns

- Request-response
  - Single destination, synchronous
  - Main MEP
- Fire-and-forget
  - Single destination, no response
  - Could have been used, but wasn't (see pub&subs)
- Publish-and-subscribe
  - Asynchronous, JMS based
  - Event system to avoid waiting for a response

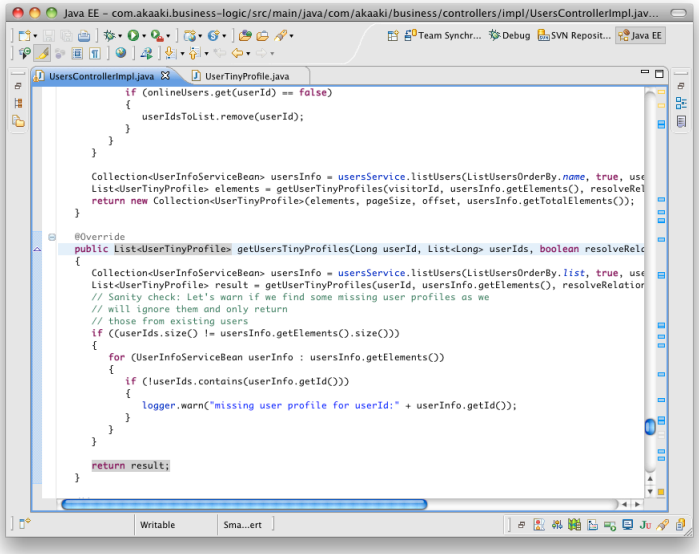
Activity Management & Composition

- ✗ Atomic transactions: Compensation instead
- ✗ Business activities: There aren't
- ✗ Coordination
- ✗ Orchestration
- ✗ Addressing
- ✗ Reliable messaging
- ✗ Correlation
- ✗ Policies
- ✗ Metadata exchange
- ✓ Security: Ad-hoc
- ✓ Notification and eventing: Internally

Activity Management & Composition

- Services
  - Internal:
    - Choreography written in Java
    - No need for discoverability neither mgmnt activities
  - External
    - Choreography written in Java
      - Java is easier to use than WS choreography tools
    - Twitter, APN, Google location API
    - Fixed providers: No need for disoverability
    - Ad-hoc security on each one

Reality strikes!



Listing users

- (Almost) every list of users has some interesting tags:
  - Current status (one line message)
  - Distance in friendship graph to the logged in user
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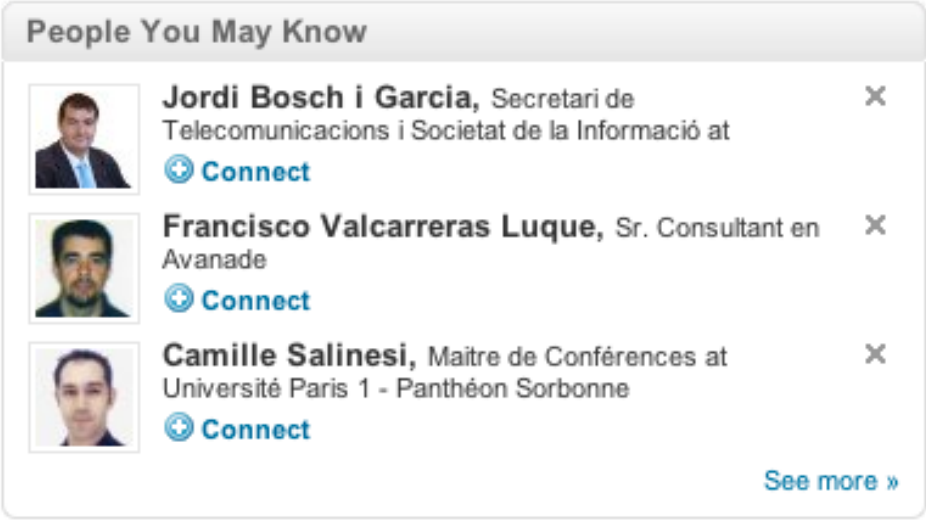
  - Number of interests in comon with the logged in user
  - Online / Offline status
  - Profile picture

Listing users

- by last activity (online only / all)
- by signup date
- by interest
- visitors of a user profile
- friends of a user
- by country
- interesting people
- …

Listing users: Interesting people

- Interesting people



  – Interests in common
  – Contacts in common
  – Location

Listing users

1. Query users service to get users info
   - Name, sex, age, city, country, signup date, etc.
2. Query interests service to get users interests
3. Query friendship service to get users friends
4. Query activity service to get users activities

Listing users

- Lists are paginated
- Over 500K users in the DB
- Therefore:
  - Order&filter criteria is really important!
  - e.g. List friends of mine (from friends service) whose interests include interest I (from interests service) ordered by signup date (from users service)
  - None of the services can paginate and filter by itself
    - We need to paginate and filter across services

Caching

- Some service requests are easy to cache at the service level
  - GET /users/profile/23
- Others are really difficult
  - GET /users/profile?id=23&id=34&… (hundreds of ids)
- So, service requests were cached at the client level by hand
  - Ugly, I know, but efficient

Low coupling

- How could we maintain low coupling between services?
  - Services never use other services
  - They are like DBs on steroids
  - Only the Business layer is coupled to every other service (which is quite a high coupling)

Eventing

- Some business processes are better modeled with eventing in mind
  - When a user sends a request from a mobile device…
    - The request must be served
    - The device must be located
      - Then, encounters with other users must be triggered
    - In case the request is interesting to marketing, the event must be recorded in a marketing DB
    - In case an Apple device is interested (e.g. someone who has been encountered), the device must be notified
    - Similar for bluetooth devices found
  - Therefore: An event is generated and multiple components subscribe to it

Eventing

```
public void onEvent(UserLocated event)  {
    Map<Long, Float> users =
    locationController.getUsersNearLocation(...);
    for (Long encounteredId : users.keySet())  {
        triggerEncuntounter(event.getUserId(), encounteredId);
    }
}
```

Performance & Scalability

- **Greatly improved!**
- Attending a request is a matter of coordinating N services
  - e.g. Many services to list users
  - e.g. Many services when the device provides a location
- But we can serve partial results

Performance & Scalability

- Bottlenecks are located in a single service, which may not be critical
  - e.g. Marketing was executing huge queries against he production DB
    - e.g. Total number of users per month and country
    - Marketing is only stressing the marketing DB now
    - Which contains information originated in events marketing is listening to
  - Every service can be fine-tuned to its usage scenarios
    - DB
    - Caching
    - etc.
  - Some services could use different DB technologies

Performance & scalability

- We needed bulk requests
  - e.g. Listing users requires the online/offline status of hundreds of users
  - We can't query it one by one
    - e.g. 1 request –> 1 ms
    - 500 requests –> 0.5s
- Transactions?
    - 1 tx -> 10ms
    - Are they really needed?

Conclusions & Lessons learned

Jean-Honore Fragonard – The Music Lesson

Conclusions & Lessons learned

- Partitioning into services is **critical**
- Test & measure to find bottlenecks before optimizing blindly
- Need for an application layer which uses services and composes a rich functionality
  - **Very high cohesion** of services
  - Services tend to be quite simple
  - This layer has an important level of coupling
- Good architecture in technical terms
  - Solves performance & scalability issues
- Diagnosis gets worse
  - We need to identify a request across all the services

Thanks!

jpradel@essi.upc.edu