

# Integration “In the Large”

*Position paper for the W3C Workshop on Data and Services Integration*

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# Some background...

- This is a **position paper**, mostly about questions, not answers
- Our main goals are the following:
  - A. to present some **observations** about system and data integration (based on both our own research<sup>1</sup> as well as product development<sup>2</sup> experience)
  - B. incite some **discussion** on how to move forward and produce solutions to what (at least) we perceive as problems

1. *at Nokia Research Center*

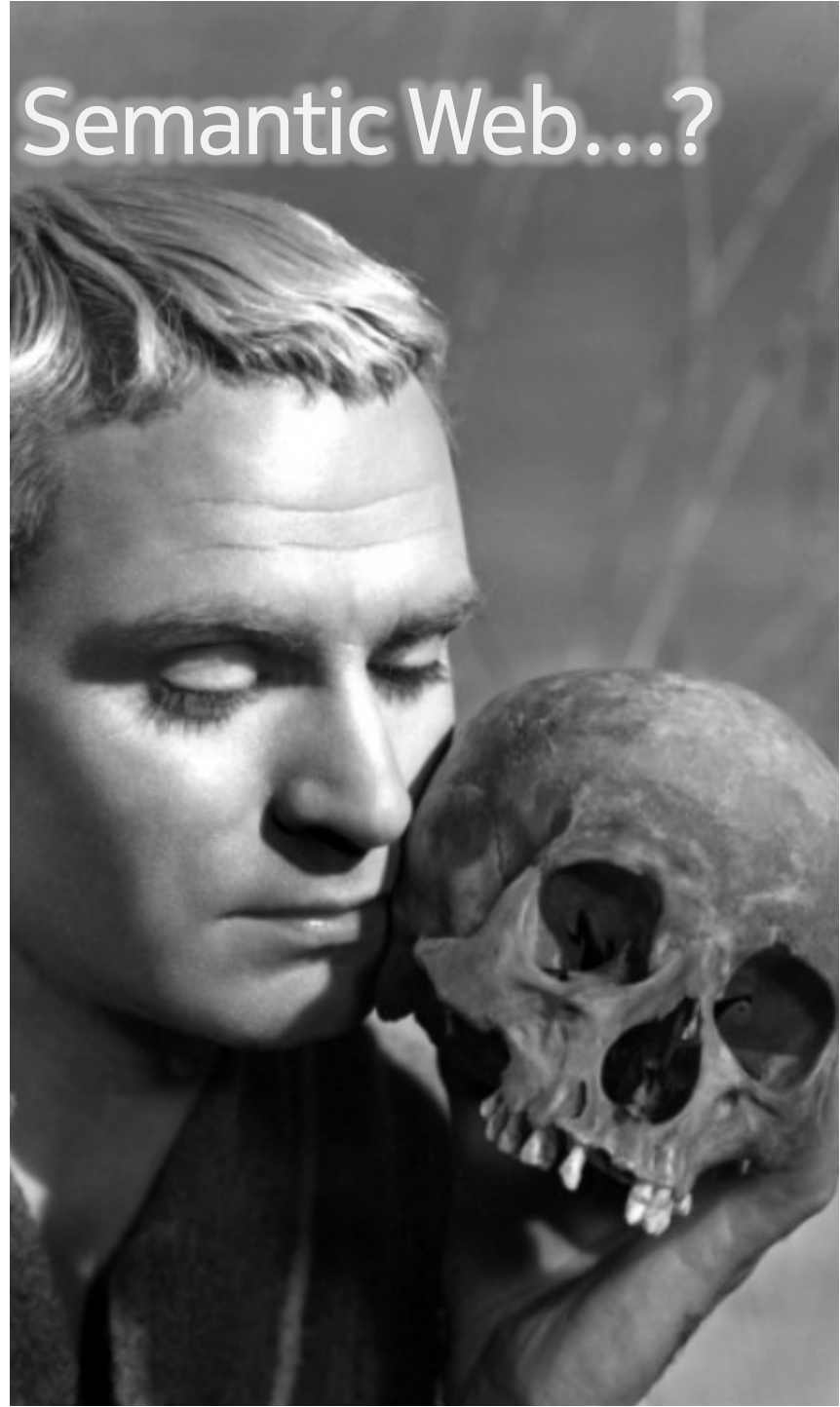
2. *as part of the team developing the platform for Nokia's "Ovi Services", a suite of mobile online services*

# “Existential Crisis” of the Semantic Web...?

- Semantic Web was conceived as “integration and interoperability” technology
- It is all grown up now: The main technical pieces are in place

BUT...

- What about our dream, our vision of being able to ontologically model the world? Has it been realized, can it be realized?



# “Existential Crisis” of the Semantic Web...?

- Prescriptive approaches to the world are known to fail
  - rather, the Semantic Web is very much intended to be **descriptive**
- “Global ontology” not achievable
  - the broader the scope, the **weaker** or more complex the ontology
  - (some of us always knew that)
- Not just a technical challenge...



# Hierarchy of information scales (cf. mapping)

- |  |   |
|--|---|
| <p>1. Mapping <b>scalar objects</b>, units of measure, etc.</p> <ul style="list-style-type: none"><li>• e.g., UNIX date → ISO 8601 date</li></ul>                                  | <p>Mostly syntactic, yet often offered as “semantic transformations”</p> <p><b>THIS IS NOT A PROBLEM!</b></p>   |
| <p>2. Mapping <b>structured objects</b></p> <ul style="list-style-type: none"><li>• e.g., ovi:Person → facebook:Person</li></ul>   | <p>Doable, particularly if semantics on both sides are <b>already a good match</b>, still this may lead to “subsetting”, making round-trips difficult</p> |
| <p>3. Mapping <b>application data models</b> (or ontologies) onto other applications’ models</p> <ul style="list-style-type: none"><li>• e.g., Ovi Services → Facebook</li></ul>   | <p>Achieving bijective and transitive mappings much harder, also much of the semantics is embodied in applications’ “business logic”</p>                  |
| <p>⋮</p>   |   |
| <p><b>N</b> Mapping entire <b>cultural “contexts”</b></p> <ul style="list-style-type: none"><li>• e.g., US → France → Finland</li><li>• note: finland:Café ≠ france:Café</li></ul> | <p>Is it even possible...? Very difficult, but perhaps not entirely hopeless [Lassila 2006]</p>   |

# Attempts to solve the problem

- Many attempts to formalize information flow, mapping of semantics, etc. (unsurprisingly often based on category theory)
  - Barwise & Seligman, Goguen, Gärdenfors, Sowa, etc.
  - provides the mathematical basis in that it clearly allows us to understand why things are hard...
  - **unclear how the real world fits in**
- Perhaps more close to Semantic Web technologies, work on ontology mapping and ontology matching is promising
  - translating ontologies is one of the key mechanisms that allows Semantic Web to work in the first place
  - **unclear how this works “in the large”**

# Integration experiment: M3 [Oliver 2009]

- Larger systems constructed from **very loosely** coupled smaller components
  - components have their own local semantics, own logic
  - free to “interpret” data from other sources using own local semantics (M3’s notion of “semantic mapping”)
    - ⇒ not “**real data integration**” in the commonly accepted sense
- No notion of an “application”, just data
  - however, data (and its semantics) not enough, we also need formalization of “actions” (i.e., processing)
- This is possibly a more natural way of developing “semantically aware systems” (cf. Goguen, Barwise, Seligman, et al.)

# Where do we go from here?

- Current Web architecture, especially the “Semantic Web stack”, offers a good basis for building a higher-level framework
  - representation: RDF, OWL
  - mapping: RIF, SPARQL, GRDDL
  - what about “services” ...?
- Can a formal framework be defined that addresses issues of semantic mapping and reconciliation of differences in semantics?
  - ostensibly, “yes” – the mathematics is difficult, though
  - also practical problems (social, organizational, etc.)



# One final question...

- (The most important one, in my mind)
- Can we move information systems closer to how **humans** behave?
  - partial “understanding” between parties, middle ground between complete interoperability and catastrophic failure
  - local spaces, local understanding, partial information interchange?