

# Setting Your Data Free: Thoughts on Information Interoperability

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# CAUTION

## CAVEAT EMPTOR:

- Research guy talking...
- Contains personal opinions
- Use at your own risk!

# Game plan

Interoperability? Huh?

Ubiquitous Computing

# Game plan

Interoperability? Huh?

Semantic Web

Ubiquitous Computing

# Interoperability?

- **Getting systems (or devices) to “work together”**
- **Approach: standardization**
  - anticipate everything about the future, or...
  - limit the world somehow
- **Are there other approaches?**
- **Current applications are very restrictive wrt. data**
  - data schemata have (mandatory) features you do not need & do not have features you do need
  - applications are often little more than ways of editing/managing certain kinds of data
  - getting applications to talk to each other is hard

What if we shifted from  
“information **PROCESSING**”  
to  
“**INFORMATION** processing”?

# Semantic Web

- **Hailed as the next generation of the World Wide Web**
- **Origins in metadata (for Web resources)**
  - digital libraries
  - content rating
- **Strong motivation: automation**
  - WWW was built for humans, thus automating tasks is hard
  - particularly hard to automate unforeseen situations
  - possible answer: “machine-friendly” content

# Semantic Web

- **Approach: formal logic as a universal language**
  - use reasoning (logical inference)
- **Makes use of results from Knowledge Representation (KR) research**
  - KR for the Web, on a “Web-wide” scale
  - KR using technologies developed for the Web
    - compatible with the existing infrastructure



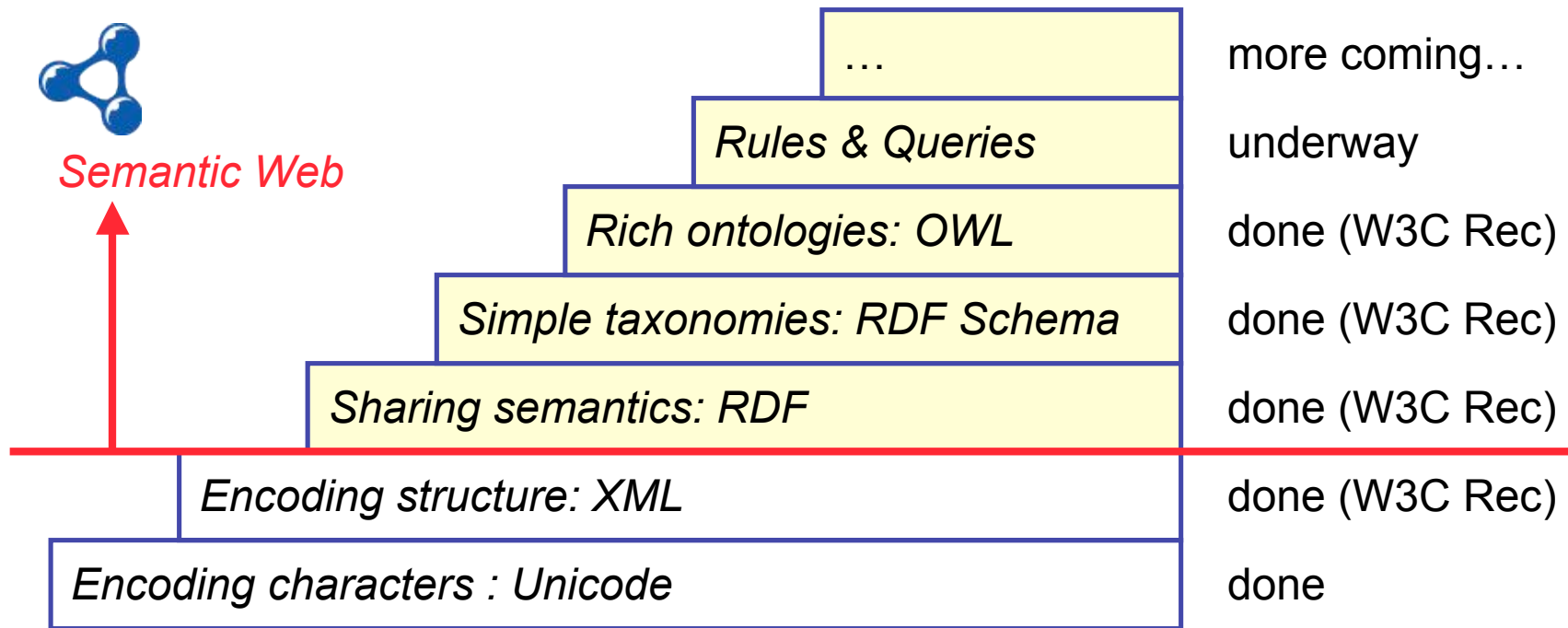
# Semantic Web standards

- **Resource Description Framework (RDF)**
  - data model based on directed, labeled graphs
  - vocabulary for building simple ontologies (“RDF Schema”)
  - comes with an XML-based transfer syntax
- **Web Ontology Language (OWL)**
  - more expressive ontology language
  - builds on RDF
- **SPARQL**
  - query language for RDF
  - uses a relational model (!)
  - (almost completed)

# Semantic Web standards

- **Rule Interchange Format (RIF)**
  - language (and a semantic model) for describing rules
  - work underway
- **CC/PP (from W3C) and UAProf (from OMA)**
  - RDF-based vocabularies (etc.) for describing device characteristics
- **OWL-S (and others like it...)**
  - using Semantic Web formalisms to describe Web Services  
⇒ “Semantic Web Services”
- ...

# Layered view of the Semantic Web



- **Not everybody needs all the layers...**

# Semantic Web vision

- **Full “Semantic Web vision” was articulated in 2001**
  - Berners-Lee, Hendler & Lassila: “The Semantic Web”, Scientific American, 284(5):34–43, May 2001
  - popular article, highly cited
    - Google Scholar counts over 4000 citations...
- **HOWEVER:**
  - responses to the article (over the years):
    - “Smacks of AI...”
    - “This is all science fiction”
    - “Can’t I do this with XML?”
    - “Here’s how to do it using JavaScript”

# Problematic technology to evangelize

- **Most problems, once you articulate them, will have a non-Semantic Web solution**
- **Why (and how) to use reasoning**
  - some people don't...
- **Semantic Web is an interoperability technology**
  - good for “future-proofing”
  - but: what is the monetary benefit of interoperability?
- **Relationship to “Web 2.0” needs to be elaborated**
  - complementary, not adversary
  - “microformats” can be a good source of data
  - how do we connect ontologies and folksonomies?

# Semantic Web vision revisited

- **Many views of what the current vision is:**
  - from “open data”
    - compare: HTML + HTTP vs. RDF + SPARQL
    - data integration as a use case
  - to an enabling technology for autonomous agents
    - (shift from “tools” to systems that work on our behalf...)
- **Most people would agree that flexible data representation is a Good Thing**

# My \$0.02

**“Smacks of AI...”**

Absolutely!

**“This is all science fiction”**

Not if we work on it (and we have made a lot of progress)

**“Can’t I do this with XML?”**

You are doing with XML (not that it matters...)

**“Here’s how to do it using JavaScript”**

You are missing the point

# Semantic Web and Interoperability

- **Currently, data semantics is embodied in the applications processing the data**
  - black boxes
- **Semantic Web techniques allow us to have more of the data semantics actually in the data itself**
  - accessible, declarative semantics
- **Possible outcomes:**
  - data of application X processed by application Y
    - even if the design of X (or Y) didn't consider this
  - more flexibility, fewer *a priori* commitments
  - diminished emphasis on applications themselves

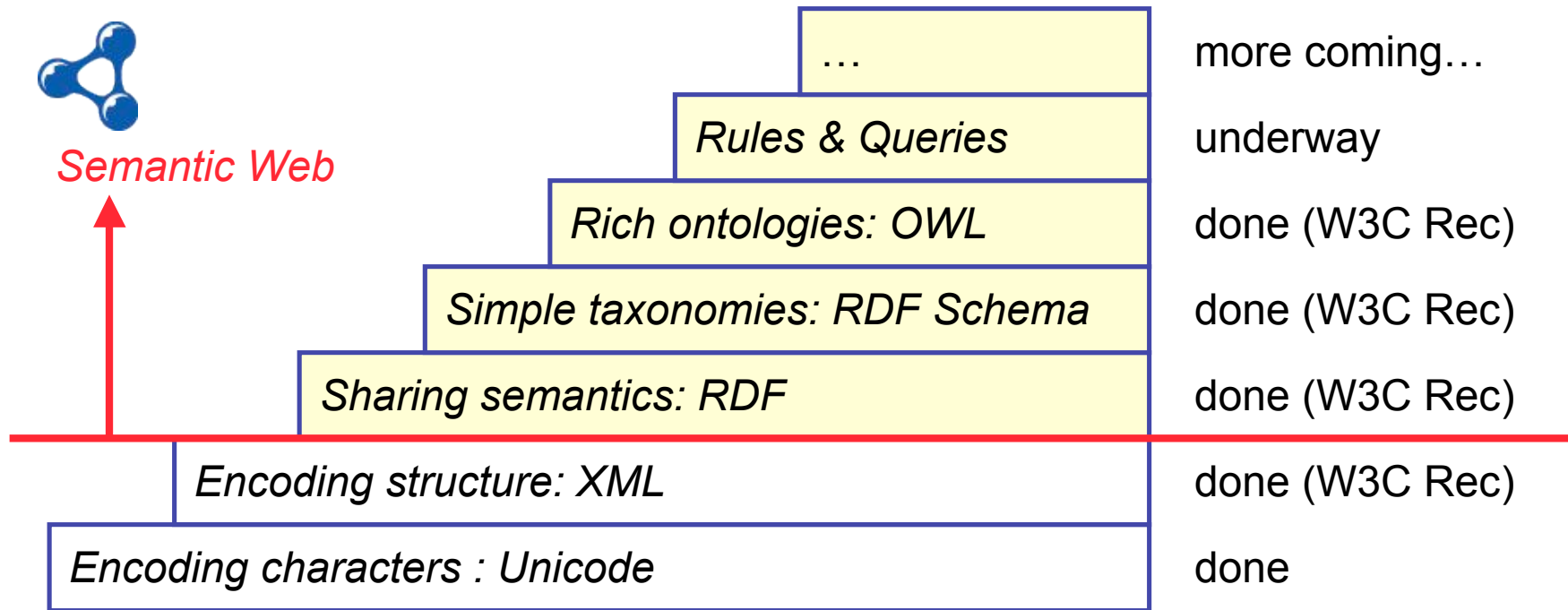


The Semantic Web vision  
is actually about  
ubiquitous computing

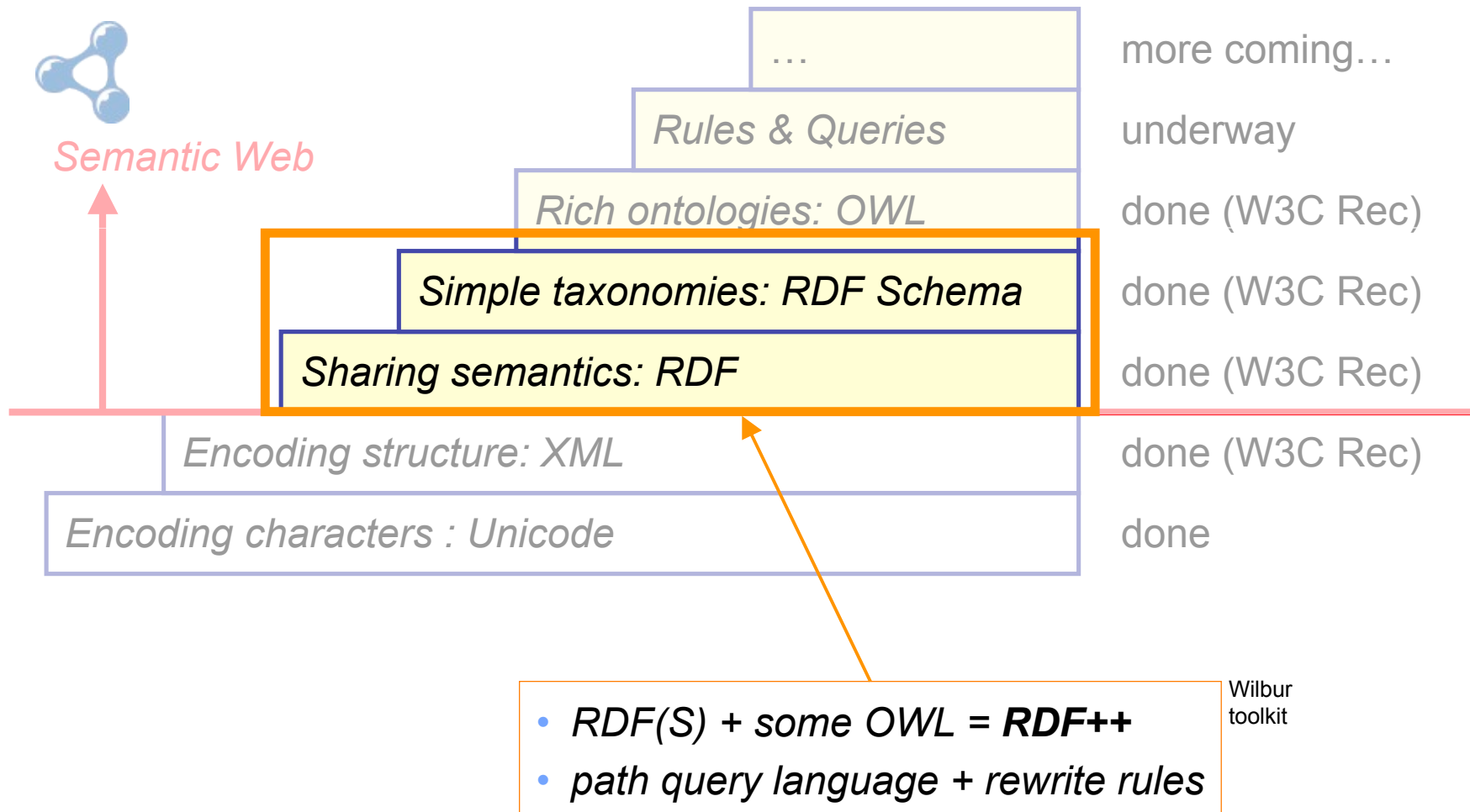
# Why are we (NRCC) interested in this?

- **Focus on Ubiquitous Computing**
  - we (Nokia) already make ubiquitous computing devices...
  - ubiquitous computing is an interoperability nightmare
  - important to build “future-proof” systems
  - moving from tools to systems that work on our behalf
- **Current work:**
  - identifying user activity, understanding context
  - flexible means for user to create “data” (w/ interpretation)
  - flexible means for presenting data and building user interfaces, allowing users themselves to be in control
  - (+ machinery needed to process Semantic Web data)

# Semantic Web at NRC Cambridge

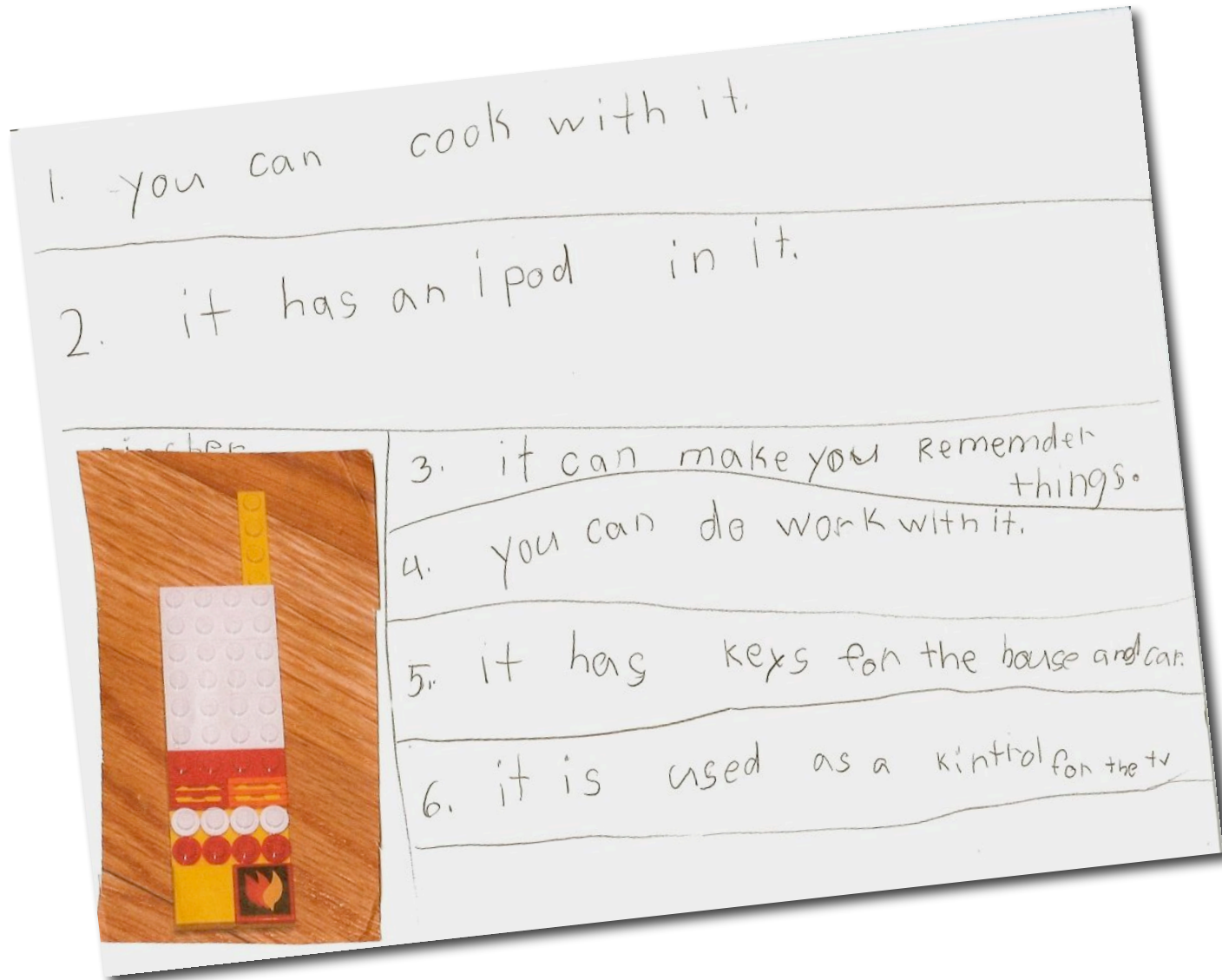


# Semantic Web at NRC Cambridge



# Epilogue

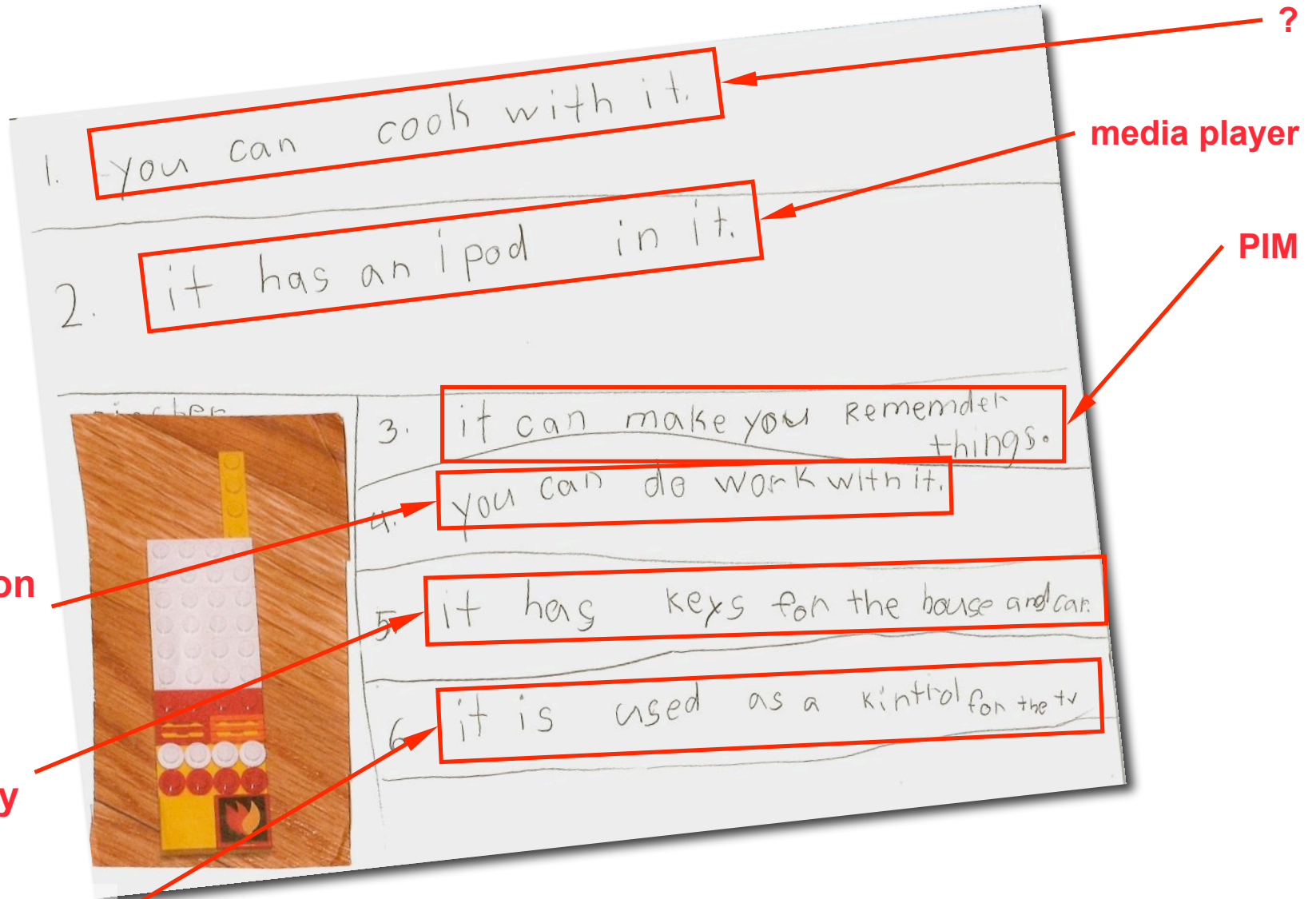
# Ubiquitous computing (by a 6-year old)



by Lauren Lassila

**NOKIA**  
Connecting People

# Ubiquitous computing (by a 6-year old)



application platform

identity & security

remote control

by Lauren Lassila

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Connecting People

# Thank You

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