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# The Ubiquitous Web as a model to lead our environment to its full potential

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- Nowadays people cannot take advantage of the full potential of their environments, despite these being populated by an increasing number of “intelligent” devices.
- We envision the Ubiquitous Web (UW) as a **pervasive web infrastructure in which all physical objects are resources identified by URIs, providing information and services that enrich users experiences in their physical context as the web does in the cyberspace.**
  - Every physical resource should be addressable, through a URI, in order to make available its information/services.
  - The Web provides universal access to resources, but users carry out their activities in concrete places/locations. UW user agents should be more location-aware than traditional web browsers, yet allowing the experience of universal access.
  - Any resource should be context-aware, especially user-aware.

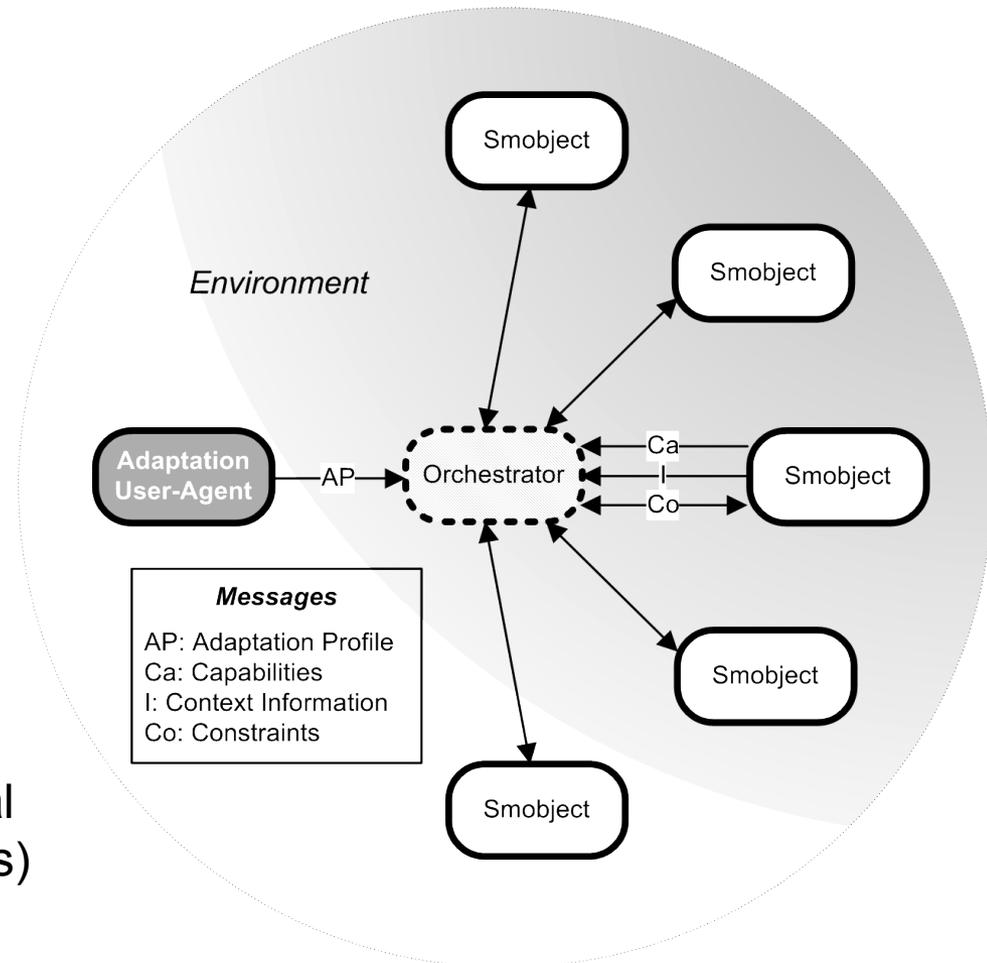
- Possible definitions:
  - Approach 1: the ubiquitous use of web technologies
  - Approach 2: a **new web** emerging from the participation of existing resources around the user.
    - Example: if I am at a railway station, my PDA takes part in a “local web” where location-aware information and services are available.
- Similarity?
  - Network  $\leftrightarrow$  MANET (Mobile Ad Hoc Network)
  - Web  $\leftrightarrow$  “MAWEB (Mobile Ad Hoc Web)” = Ubiquitous Web
- Features:
  - Dynamic participation: resources come and go continuously
  - Emerging  $\rightarrow$  dynamic link creation  $\rightarrow$  dynamic web generation

- Some Web flavours:
  - Traditional/Browsing: user-oriented
  - SOA: service-oriented, interprocess communication
  - Semantic Web: knowledge and reasoning oriented
- The UW can adopt all of these flavours:
  - Ubiquitous traditional web to browse current location information + services
  - Ubiquitous Service-oriented Web to interprocess communication within the same location
  - Pervasive Semantic Web to create location-related knowledge webs where more intelligent behavior can be carried out.
- This poses new challenges, but before that...

- SOAM: first results
- Ubiquitous folksonomies: proposal

- SOAM: Smart Objects Awareness and Adaptation Model
- A **Pervasive Semantic Web** model for automatic environment adaptation based on user preferences.
  - Further or manual control is always permitted
- UPnP devices augmented to exchange semantic information.
- Basically:
  - We represent the state of the environment as an RDF Graph (triples)
  - We represent user preferences as a desired state of the environment (equivalent to RDF triples) under certain conditions
  - A special entity, called Orchestrator, tries to change the state based on devices' declared capabilities.

- Messages:
  - Adaptation Profiles
  - Capabilities
  - Context Information
  - Constraints
- Entities
  - Adaptation User-Agent
  - Smobjects
  - Orchestrator
- Phases:
  1. Discovery
  2. Adaptation-Profiles Injection
  3. Capabilities retrieval
  4. Context Information Retrieval
  5. Reasoning (DL, domain rules)
  6. Constraints injection



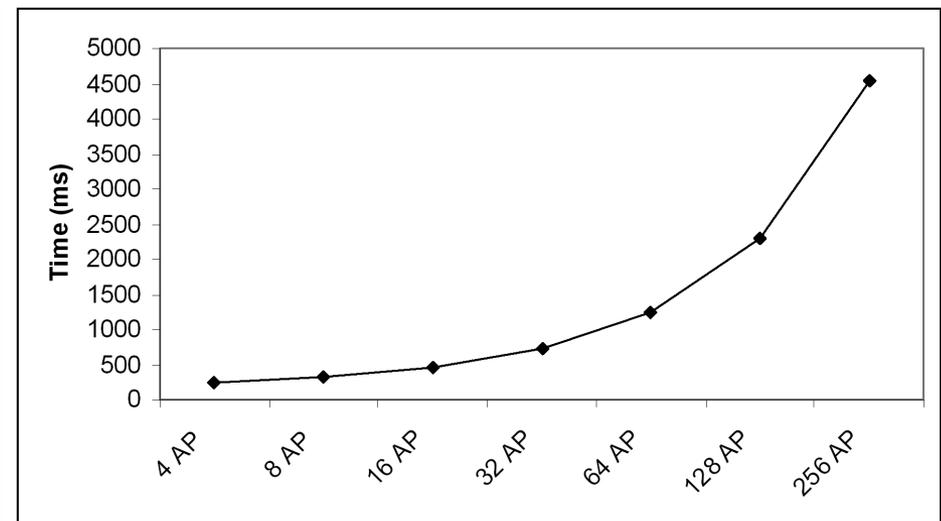
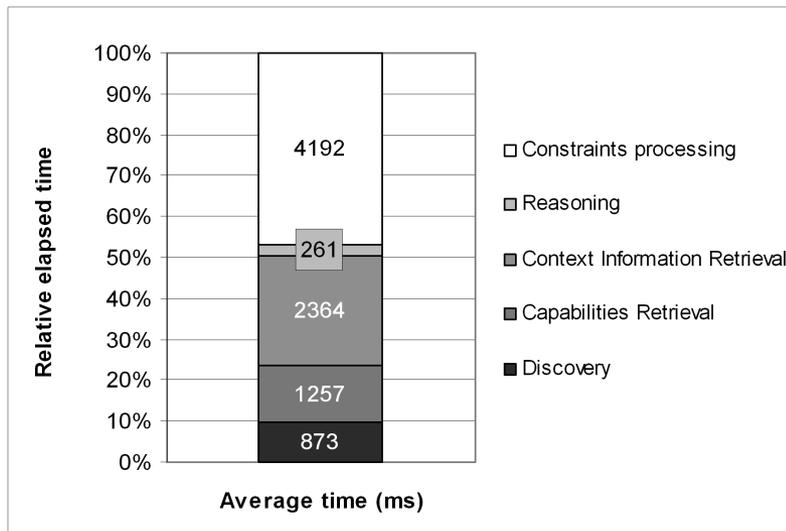
## ■ Example 1:

- AP: “I would like to listen classical music when I am working with my laptop”
- HiFi system’s capabilities: “I can operate on the music domain”
- Laptop’s capabilities: “I can perceive who is working with me”
- Orchestrator:
  - Retrieves Context Information (from Laptop)
  - If preconditions are true
    - Send to the HiFi system: “play classical music”

## ■ Example 2:

- AP: “If I am at location x of type HotelRoom, I would like x’s temperature to be 24°C”
- Room: I can perceive my type
- Presence Control System: I can perceive whether the guest is in.
- Temperature control system’s capabilities: I can perceive the temperature of the present location, I can operate the temperature of the present location
- Orchestrator:
  - Retrieves Context Information (from Presence control system)
  - If preconditions are true
    - Send to the TempControlSystem: “make temperature to 24°C”

- Smobjects: ARM7-based 55 MHz with uClinux and a Java VM simulating devices (Hi-Fi, TV, lights, temperature control, microphone, ...).
- Orchestrator: Pentium-M 1.86 GHz.
- A working example of the Ubiquitous Web concept? (semantic web flavor)



- Social annotation is becoming popular: del.icio.us, technorati, tagzania, wikipedia...
- Can we annotate the world? Augment surrounding objects' information via social participation
  - Devices
  - Buildings
  - Everyday objects
- Can we extract interpretations from the annotations? (Social knowledge)
  - Common definitions, categorizations, judgements
  - Common uses/functionality of objects/object types
- Can we even generate ontologies from annotated data (col.lonb.us project 2005-07, Collaborative Ontology Building System), to come.
- Similarity:
  - Web → Web2.0 (Social web)
  - UW → Social UW

- Based on our research:
  - Ubiquitous Web as a context-aware (especially, location- and user-aware) knowledge and communication model to augment users experience in their physical context as the web does in cyberspace. “To lead our environment to its full potential”
  - The need to explore mechanisms for the transmutation of physical objects into UW-enabled smart resources.
    - Automatic adaptation of the environment to user preferences as a means to increase user’s experience.
    - Social tagging of those resources as a means to increase user’s experience.
- Recommendations:
  - Probably existing web technologies are reusable and adaptable, but UW also features new exciting mechanisms.
  - New resources: any object, real or virtual, attached to my location
  - Dynamic participation of resources → Management, ubiquitous discovery, capabilities description?
  - Context Information representation (Context Awareness), because UW happens here
  - Zero-configuration for the user (during discovery, capabilities, coordination,...). Autonomic computing.
  - Definition of the UW architecture? Is it a P2P Web?
  - New browsing models in UW. Context-dependant URIs. <http://mylocation>

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# Questions?

```
<adaptationProfile id="urn:uuid:prof2" expires="PT2M">
  <variable id="x"/>
  <variable id="y"/>
  <precondition id="" predicate="http://www.awareit.com/onto/task#isDoing" subject="urn:uuid:Bob">
    <objectResource ref="http://www.awareit.com/onto/task#WorkingWithLaptop"/>
  </precondition>
  <precondition id="" predicate="http://www.awareit.com/onto/location#isLocatedIn"
subject="urn:uuid:Bob">
    <objectVariable ref="x"/>
  </precondition>
  <precondition id="" predicate="http://www.awareit.com/onto/sound#hasSound" subject="x">
    <objectVariable ref="y"/>
  </precondition>
  <postcondition id="" predicate="http://www.awareit.com/onto/sound#volume" subject="y">
    <objectLiteral datatype="http://www.w3.org/2001/XMLSchema#int">3</objectLiteral>
  </postcondition>
  <postcondition id="" predicate="http://www.awareit.com/onto/sound#style" subject="y">
    <objectResource ref="http://www.awareit.com/onto/sound#ClassicalMusic"/>
  </postcondition>
</adaptationProfile>
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<capabilitiesCollection owner="urn:uuid:hifi1" xmlns="http://www.awareit.com/soam"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation="http://www.awareit.com/soam
  soamdt.xsd">
  <perceptionCapability id="urn:uuid:hifi1_pcap1">
    <subject resource="urn:uuid:hifi1"/>
    <predicate resource="http://www.awareit.com/onto/sound#hasSound"/>
  </perceptionCapability>
  <perceptionCapability id="urn:uuid:hifi1_pcap2">
    <subject resource="urn:uuid:hifi1"/>
    <predicate resource="http://www.w3.org/1999/02/22-rdf-syntax-ns#type"/>
  </perceptionCapability>
  <perceptionCapability id="urn:uuid:hifi1_pcap3">
    <subject resource="urn:uuid:hifi1_sound"/>
    <predicate resource="http://www.awareit.com/onto/sound#volume"/>
    <predicate resource="http://www.awareit.com/onto/sound#style"/>
  </perceptionCapability>
  <operationCapability id="urn:uuid:hifi1_ocap1">
    <subject resource="urn:uuid:hifi1"/>
    <predicate resource="http://www.awareit.com/onto/sound#hasSound"/>
  </operationCapability>
  <operationCapability id="urn:uuid:hifi1_ocap2">
    <subject resource="urn:uuid:hifi1_sound"/>
    <predicate resource="http://www.awareit.com/onto/sound#volume"/>
    <predicate resource="http://www.awareit.com/onto/sound#style"/>
  </operationCapability>
</capabilitiesCollection>
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<rdf:RDF
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns="http://www.awareit.com/onto/examples/example1#">
  <rdf:Description rdf:about="urn:uuid:hifi1"
    xmlns:sound="http://www.awareit.com/onto/sound#">
    <rdf:type rdf:resource="http://www.awareit.com/onto/sound#SoundSystem"/>
    <sound:hasSound>
      <sound:Sound rdf:about="urn:uuid:hifi1_sound">
        <sound:volume
          rdf:datatype="http://www.w3.org/2001/XMLSchema#int">8</sound:volume>
        <sound:style
          rdf:resource="http://www.awareit.com/onto/sound#RockMusic" />
        </sound:Sound>
      </sound:hasSound>
    </rdf:Description>
  </rdf:RDF>
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<constraint id="urn:uuid:xxx" requester="urn:uuid:Bob"  
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  <objectLiteral  
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</constraint>
```

```
<constraint id="urn:uuid:xxx" requester="urn:uuid:Bob"  
subject="urn:uuid:hifi1_sound"  
predicate="http://www.awareit.com/onto/sound#style">  
  <objectResource  
ref="http://www.awareit.com/onto/sound#ClassicalMusic"/>  
</constraint>
```