

Device Coordination: From user intent satisfaction perspectives

Kangchan Lee (chan@w3.org)
Electronics and Telecommunication Research
Institute
(ETRI)

Introduction

- Layered Architecture for Device Coordination
 - Syntactic Level
 - Focuses on a structure and adherence to the standards that govern that structure
 - Semantic Level
 - Focuses on definitions and attributes of terms and the combined meaning of multiple terms
 - Pragmatic Level
 - Considers data use in relation to its structure and the context of application

Pragmatic View of Device Coordination

- Web of Everything
 - Device Coordination
 - Involves consideration of how to describe *user preferences*, device capabilities, and services as a basis for discovery.
 - Discovery and Binding
 - Defined as the process of describing *user's needs* and searching for a matching resource.
 - Binding Mechanism
 - Web applications need to be designed to be accessed without knowledge of their internals through well-defined *interfaces* that are readily *discoverable* and *composable*.

Pragmatic View of Device Coordination (con't)

- Application for Every-user
 - Use of Applications
 - The *clients' use* of the applications should determine the description mechanism, or ontology, used by servers.
 - Application Use Aspects
 - The *aspects* of an application that has to do with how the service provided by a device need to be considered.
 - Binding Mechanism
 - Provides a means of characterizing *a clients' use* of the application in addition to the conventional binding services.
 - Plays as a mediator for communication between devices.

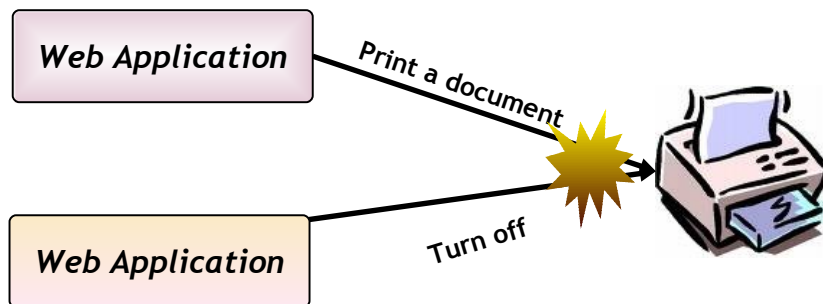
Conflict-Free Device Coordination: Introduction

- Multi-user and Multi-device Environment
 - There are multiple users and devices in a ubiquitous computing environment.
Environment Conflict.
 - One user(device) can interact with more than one device, and multiple users(devices) can interact with one device simultaneously.

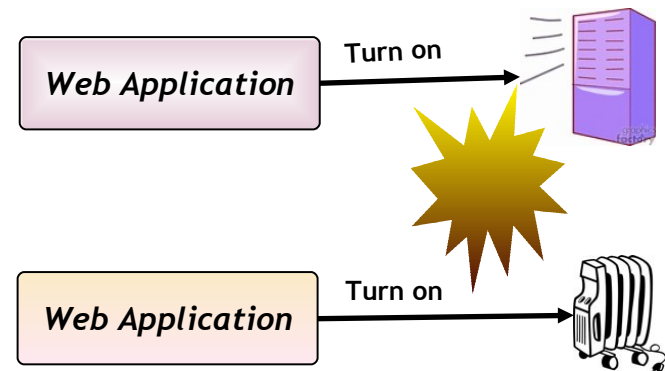
Conflict-Free Device Coordination: Conflict

- Conflicts
 - Resource Conflict
 - Different applications access a piece of resources requesting a conflicting service at the same time.
 - Environment Conflict
 - Applications invoke services in such a way that they change environmental properties in a conflicted manner.

Examples

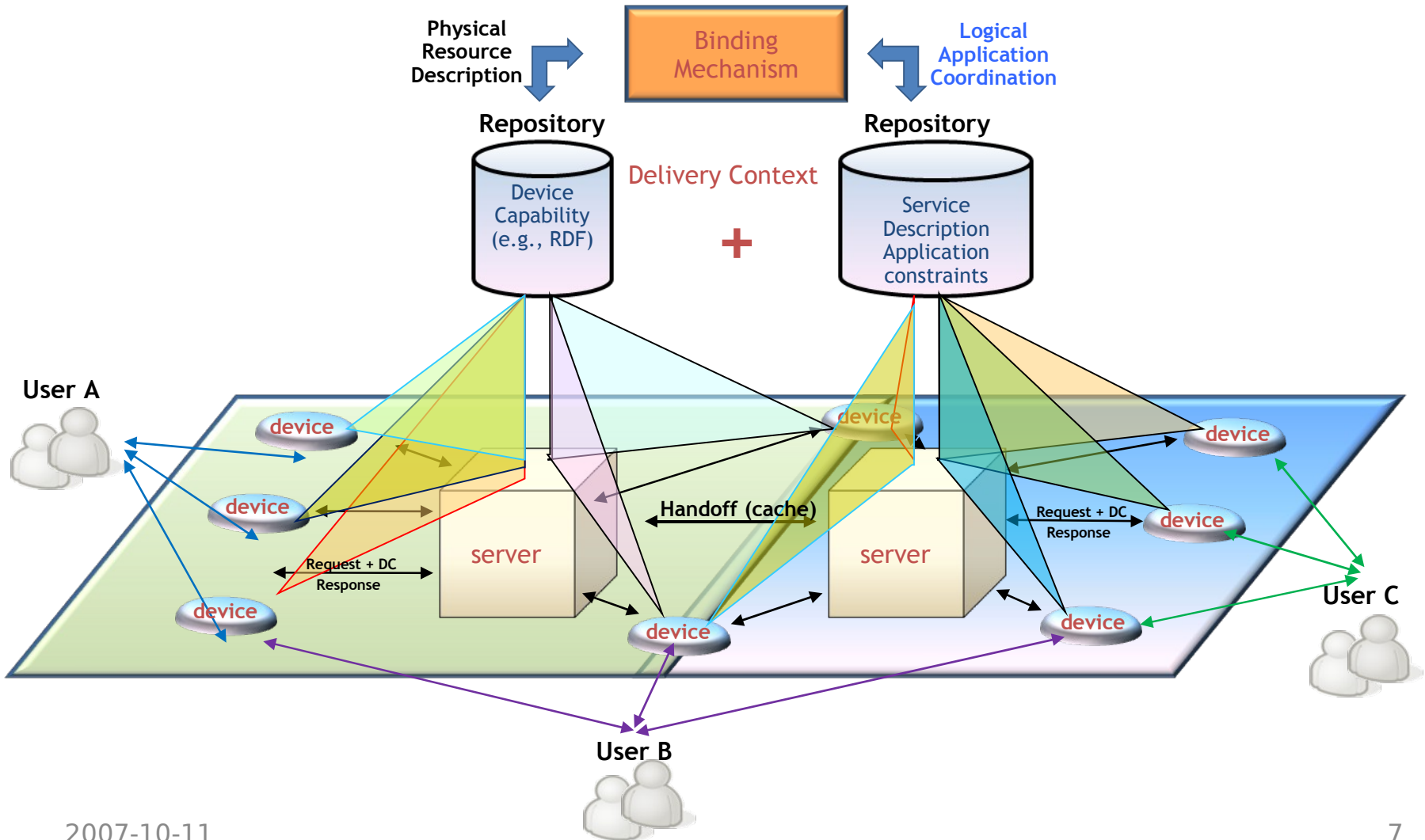


Resource conflict



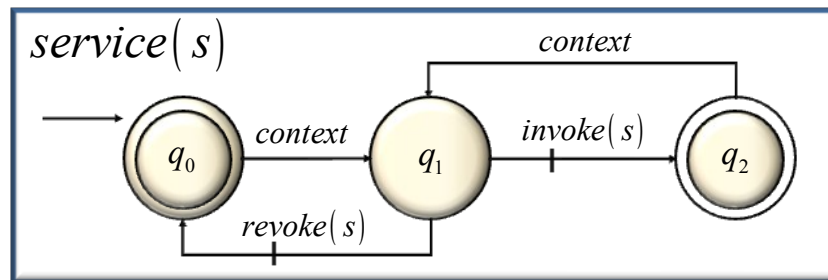
Environment conflict

Conflict-Free Device Coordination: Structure



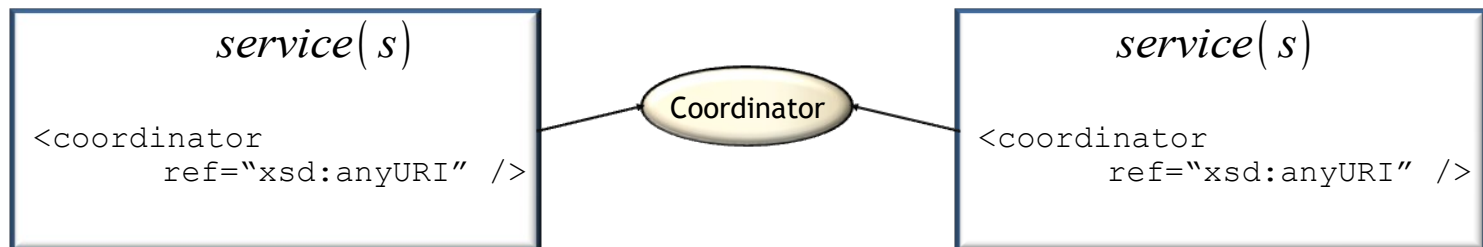
Conflict-Free Device Coordination: Model

- Service Transition Description
 - Devices need to provide services adapted to the context of a request.
 - It is necessary to describe the state transitions of a web application service.



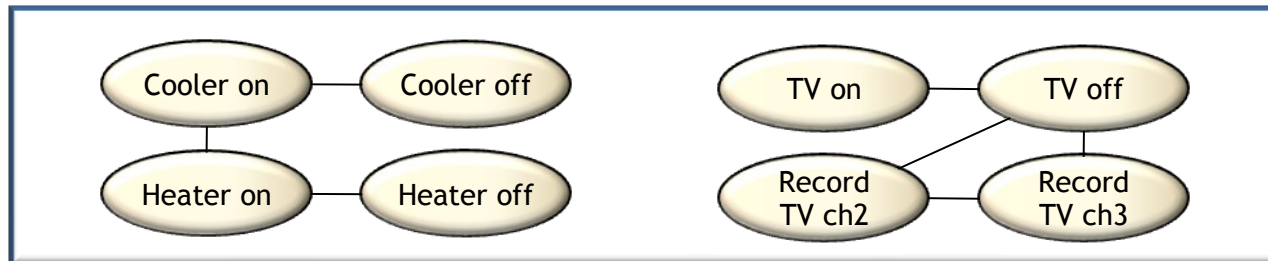
Conflict-Free Device Coordination: Model (Cont')

- DOM Representation of a Service
 - Each service is described with DOM.
 - Coordination mechanisms for a service can be embedded within DOM representation using `links`.
 - Events triggered by a service can be notified and used to coordinate devices involved in the service.
 - Services can be managed by manipulating the states of a services.



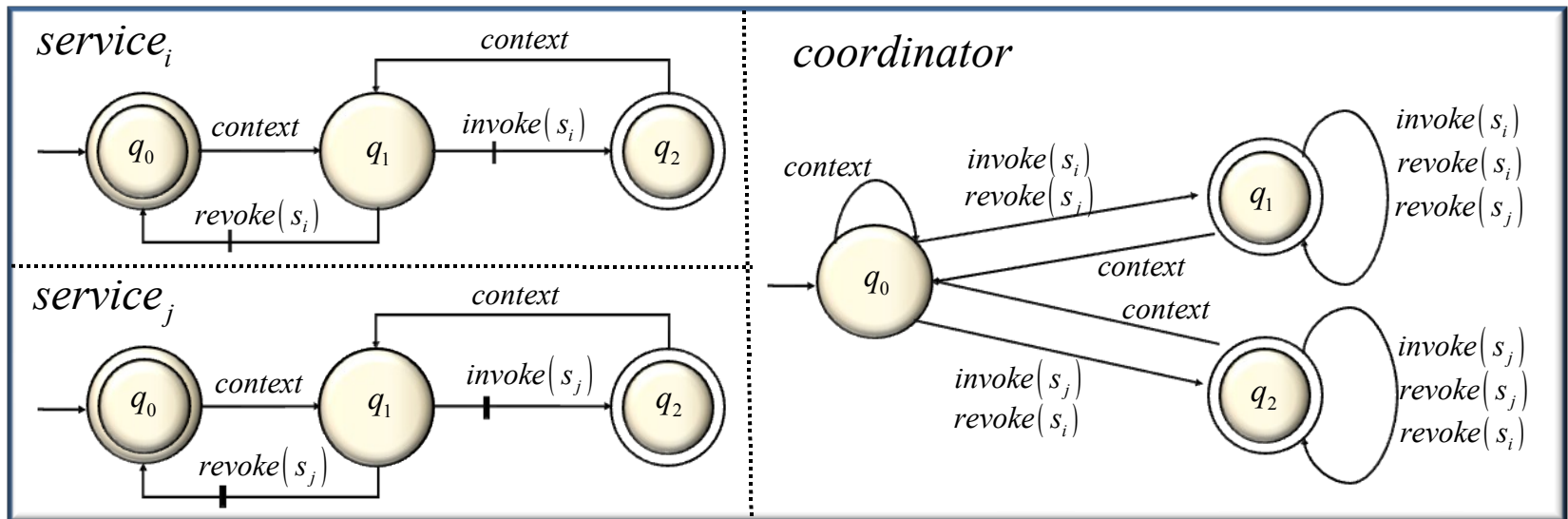
Conflict-Free Device Coordination: Model (Cont')

- Action Constraints
 - Determine whether two services are conflicted with each other.
 - There are coordinators as many as action constraints.

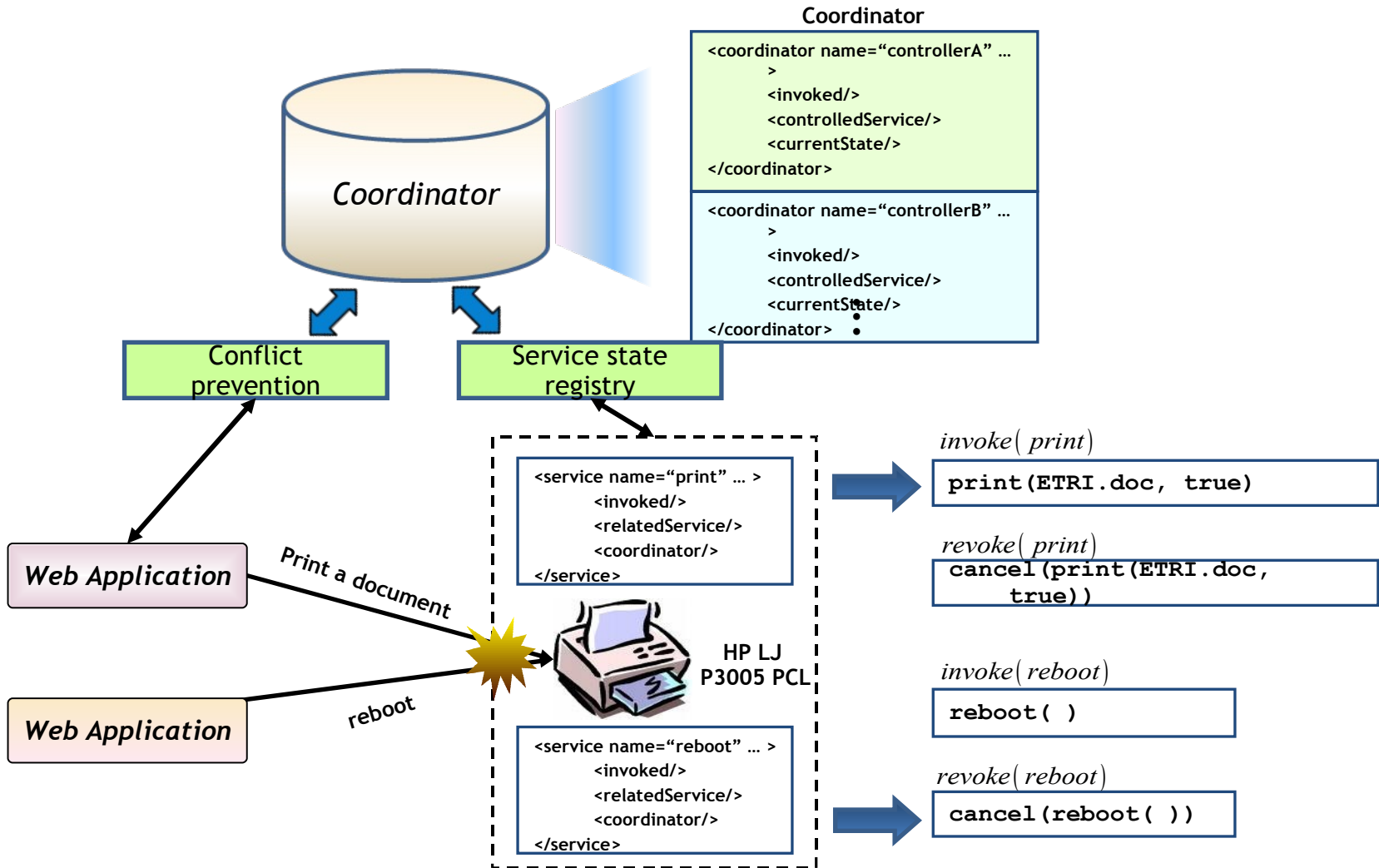


Conflict-Free Device Coordination: Model (Cont')

- Coordination Mechanism
 - A coordinator determines whether the service is invoked or revoked.
 - The coordinator refers to the constraints and prevents the conflicted situation.
 - The model guarantees the coordinator to be a theoretically proved supervisory controller.



Conflict-Free Device Coordination: example



Conflict-Free Device Coordination: example (Cont')

A Device Capability Description

```
<?xml version="1.0" encoding="utf-8"?>
<device xmlns="http://www.etri.re.kr/uwa/devicecoordination">
  <name>deviceName</name>
  <service name="ncname" href="xsd:anyURI">
    <invoked>
      <duration>xsd:duration</duration>
      <requestedby>xsd:anyString</requestedby>
      <input> xsd:any </input>
    </invoked>
    <relatedService>
      <requiredService>
        <service name="ncname" href="xsd:anyURI"/>
        <service ... />+
      </requiredService>
      <alternativeService>
        <service name="ncname" href="xsd:anyURI"/>
        <service ... />+
      </alternativeService>
    </relatedService>
    <coordinator ref="xsd:anyURI"/>
  </service>

  <service ... />+
</device>
```

Conflict-Free Device Coordination: example (Cont')

Current State Description of a Coordinator

```
<?xml version="1.0" encoding="utf-8"?>
<coordinators xmlns="http://www.etri.re.kr/uwa/devicecoordination">

  <coordinator name="ncname" href="xsd:anyURI">
    <description>
      Service state-based coordination mechanism
    </description>

    <controlledService>
      <service inner_id="sc01" href="xsd:anyURI"/>
      <service inner_id="sc02" href="xsd:anyURI"/>
    </controlledService>

    <bcurrentState>idle|sc01|sc02</bcurrentState>
  </coordinator>

  <coordinator ... />+
</coordinators>
```

Conclusion

- Device Coordination for Pragmatic Services
 - Related Current works in W3C : SCXML, DCCI, RDF/OWL, Web Services, DOM, etc
 - Extended Binding Mechanism
 - Considers application use aspects (context) in discovering and binding resources.
 - Can be used to a proxy among devices.
 - Conflict-free Device Coordination
 - When a service is requested, it needs to be provided without any conflicts in terms of resources and environment.
 - Coordination mechanism operates with service provision process simultaneously.
 - Device Coordination Mechanism
 - Constructed by means of mutually exclusiveness among conflicting services.

Proposal

- It is necessary to make
 1. UWA vocabulary : including the definition of Device Coordination, Discovery and Binding, etc
 2. Ubiquitous Web Application Framework
 - e.g.
 - Phase 1 : Contents for Ubiquitous Web (DIAL, DSelect, CC/PP2 etc),
 - Phase 2 : Interaction among devices (device coordination, etc)
 - Phase 3 : etc.