

# **UBIQUITOUS SERVICE COMPOSITION CONSIDERING CONTEXT-AWARENESS**

**6 Sept. 2006**

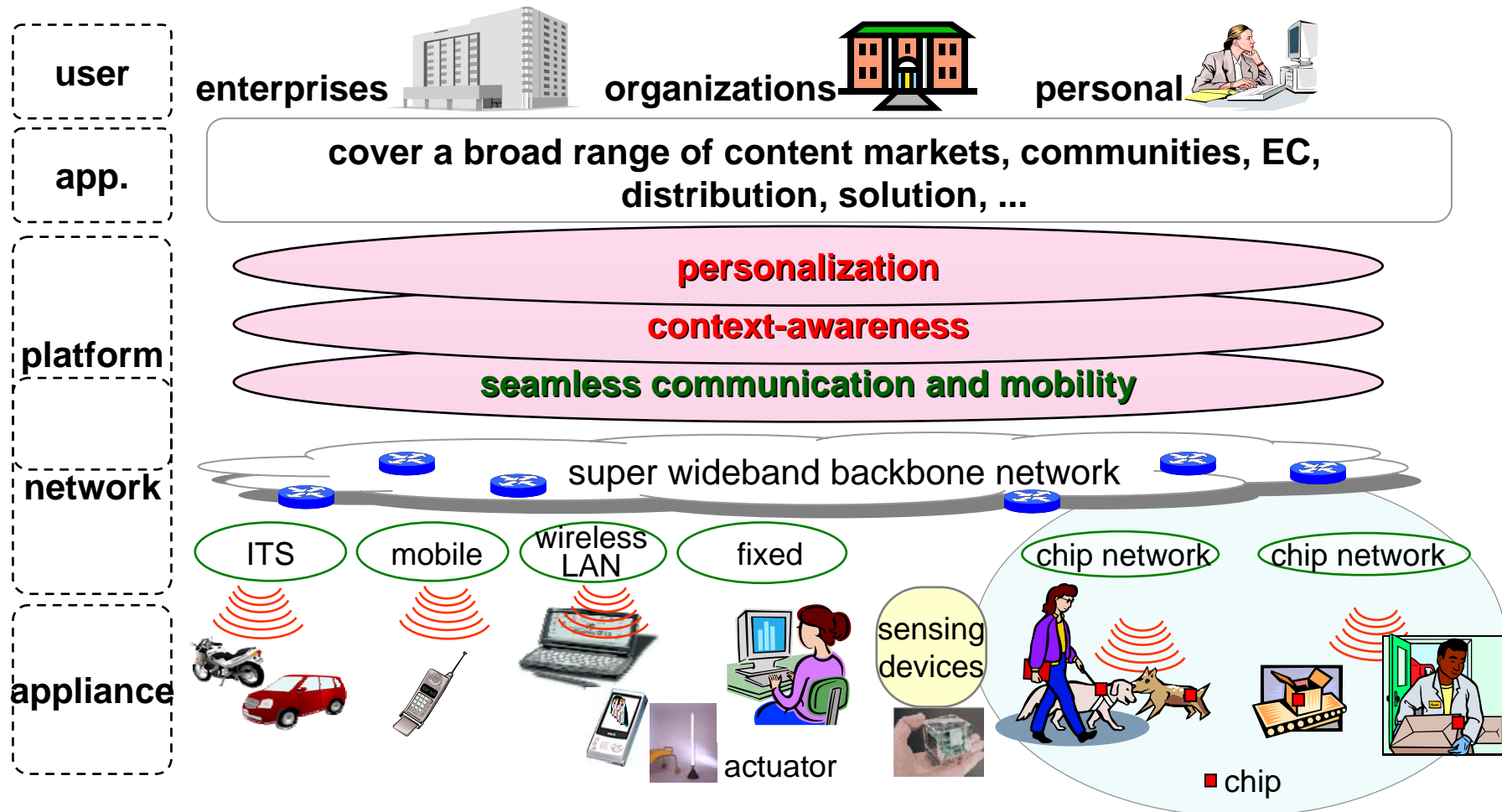
**NTT Network Service Systems Laboratories,  
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# Ubiquitous Network Society and Technologies

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In the forthcoming era, ubiquitous communication and computing technologies will support business activities as well as people's comfortable daily lives.

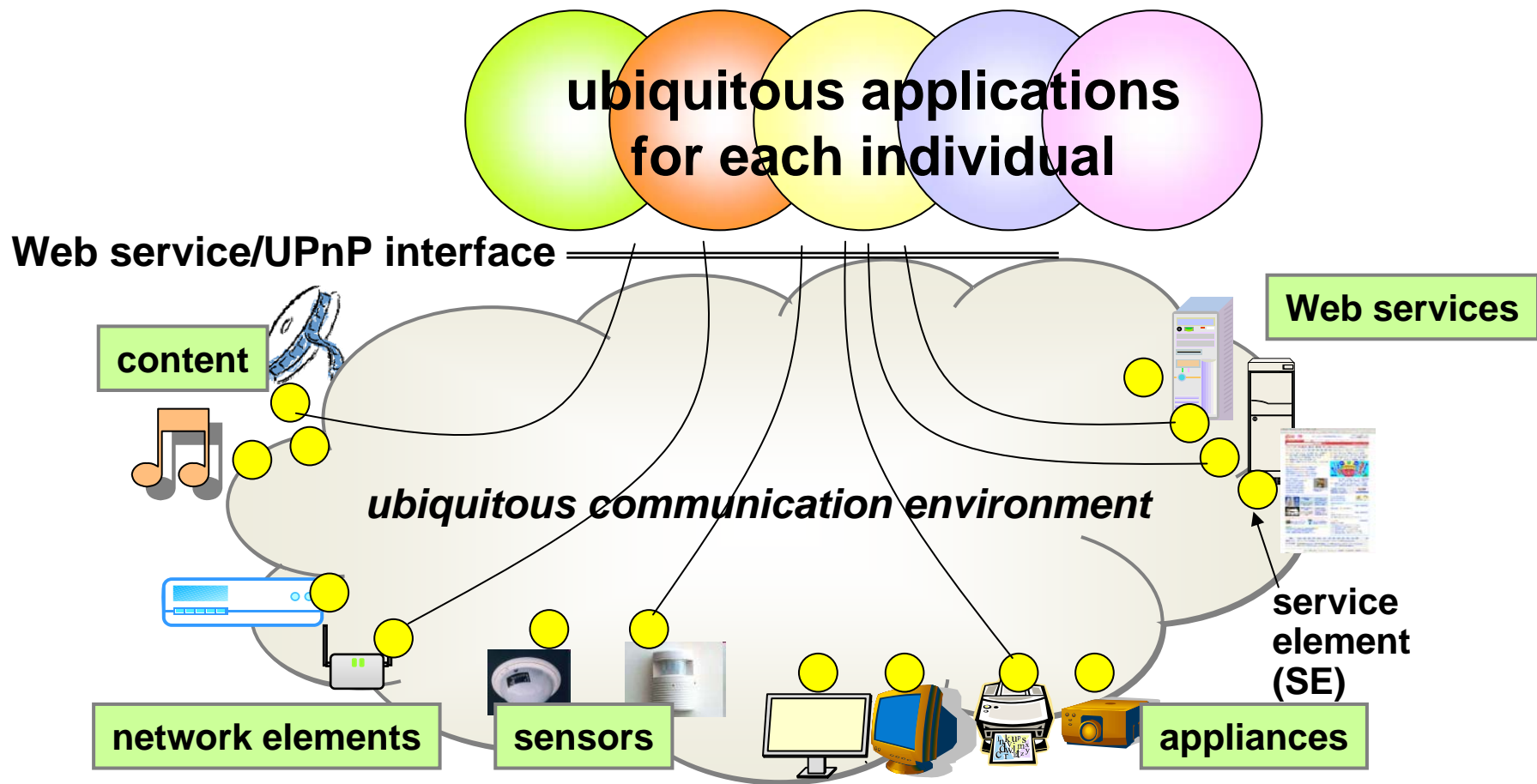


# Service elements in the ubiquitous network

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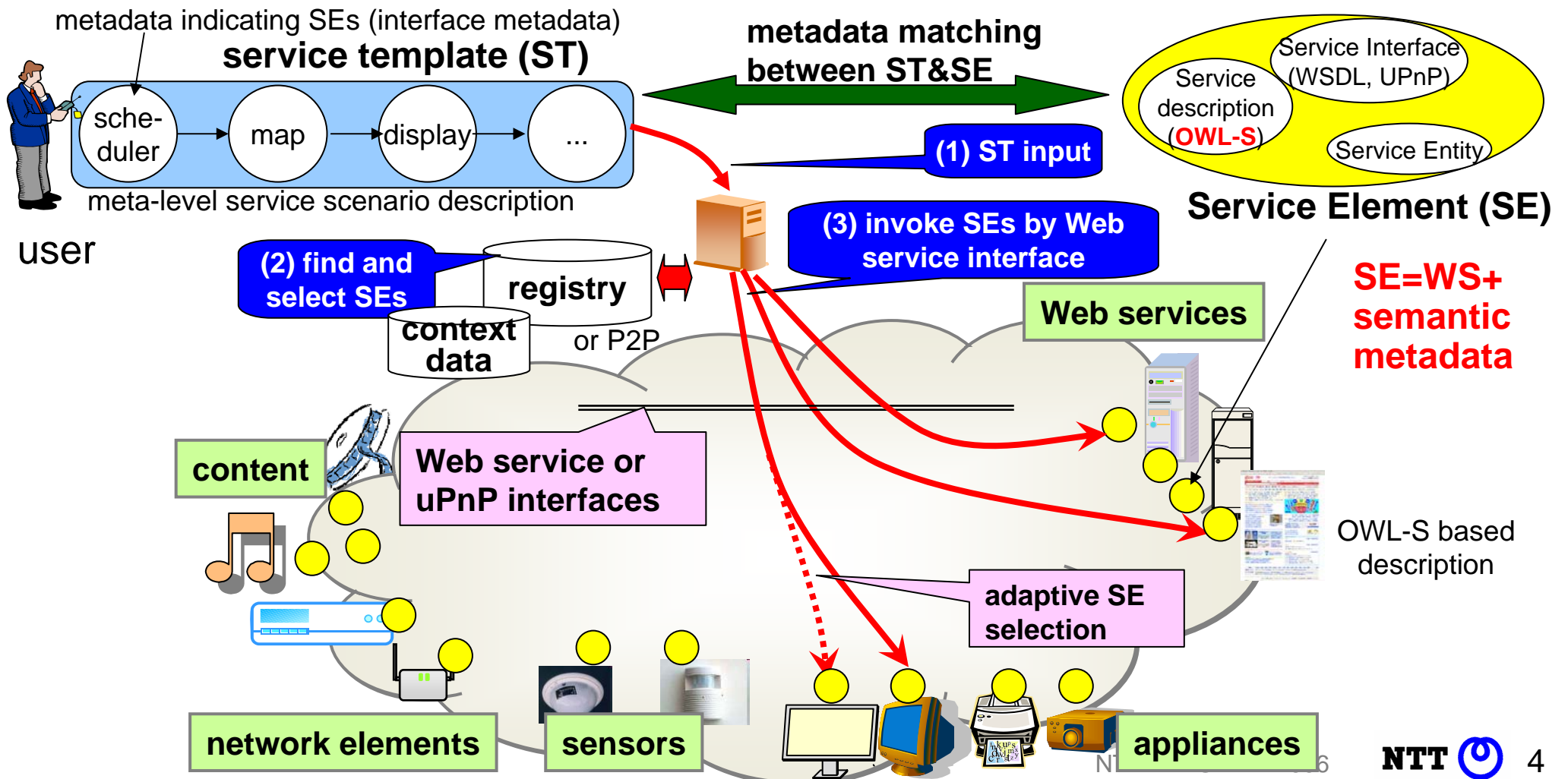
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In future ubiquitous networks, there are an enormous number of useful entities; content, network elements, sensors, appliance, Web-services, ... They should be used as materials to construct original and personalized services



# Service composition framework

Our service composition framework composes service elements (SE) accessible to the user. SEs having the Web-service or UPnP interface can be used. With a meta-level service scenario, necessary SEs are found, selected, and dynamically bound.



# Adaptive meta-level service scenario

BPEL, often used for legacy system integration, must designate specific operations and formats. Before invocation, specific Web Services satisfying given conditions must be found through the UDDI registry.

specific & unique

<sequence>

<invoke name="London-abc-RentalCar" operation="reserve4WD"/>

</sequence/>

= "reserveSedan"

In our method, rigid invoke/operation names are not used, but OWL-S based abstract description is used. From several candidates, the most appropriate one is selected considering the user situations, and the current one is switched over to another if user situations are changed.

<sequence>

<search name="rentalcarSE" attributeName=travelDestination/>

<invoke name="rentalcarSE" operation="reserveCar"/>

</sequence/>

interface metadata =  
OWL-S atomic process  
-> selects appropriate SEs

abstract expression  
(interface metadata)

e.g., Nottingham xyz rent-a-car

# Abstract description

## [abstract scenario]

```
<sequence>
  <invoke name="user property SE" operation="address"/>
  <search name="transportation SE" attributeName="address"/>
    <copy from="home" to="destination"/>
    <copy from="user@location" to current position"/>
  <invoke name="transportation info SE" operation="obtain transportation URL"/>
  <search name="monitor SE" attributeName="user@location"/>
    <copy from="transportation URL" to="monitor display URL"/>
  <invoke name="monitor SE" operation=monitor display/>
</sequence/>
```

This scenario informs timetable (url) to a shopping centre guest according to his/her domicile, and display it at the nearest monitor.

## [BPEL scenario]

```
<sequence>
  <invoke name="harrodsDB" operation="getUserAddress"/>
  <copy from="userAddress" to="deststation"/>
  <copy from="userCurrentPlace" = "startstation"/>
  <invoke name="YamateLine" operation="getTimeURL"/>
  <copy from="timeURL" to="displayURL"/>
  <invoke name="market1FMonitor" operation=displayInfo/>
</sequence/>
```

by train

per guest

```
<sequence>
  <invoke name="harrodsDB" operation="getUserAddress"/>
  <copy from="userAddress" to="destbusstp"/>
  <copy from="userCurrentPlace" = "startbusstp"/>
  <invoke name="KonanBus" operation="busTimeURL"/>
  <copy from="bustimeURL" to="displayURL"/>
  <invoke name="entranceMonitor" operation=displayInfo/>
</sequence/>
```

by bus

per guest

Currently being proposed in  
OGF (ex GGF)

```
<sequence>
  <invoke name="harrodsDB" operation="getUserAddress"/>
  <copy from="userAddress" to="destairport"/>
  <copy from="userCurrentPlace" = "startairport"/>
  <invoke name="JAL" operation="flightTimeURL"/>
  <copy from="flighttimeURL" to="displayURL"/>
  <invoke name="market2FMonitor" operation=displayInfo/>
</sequence/>
```

by flight

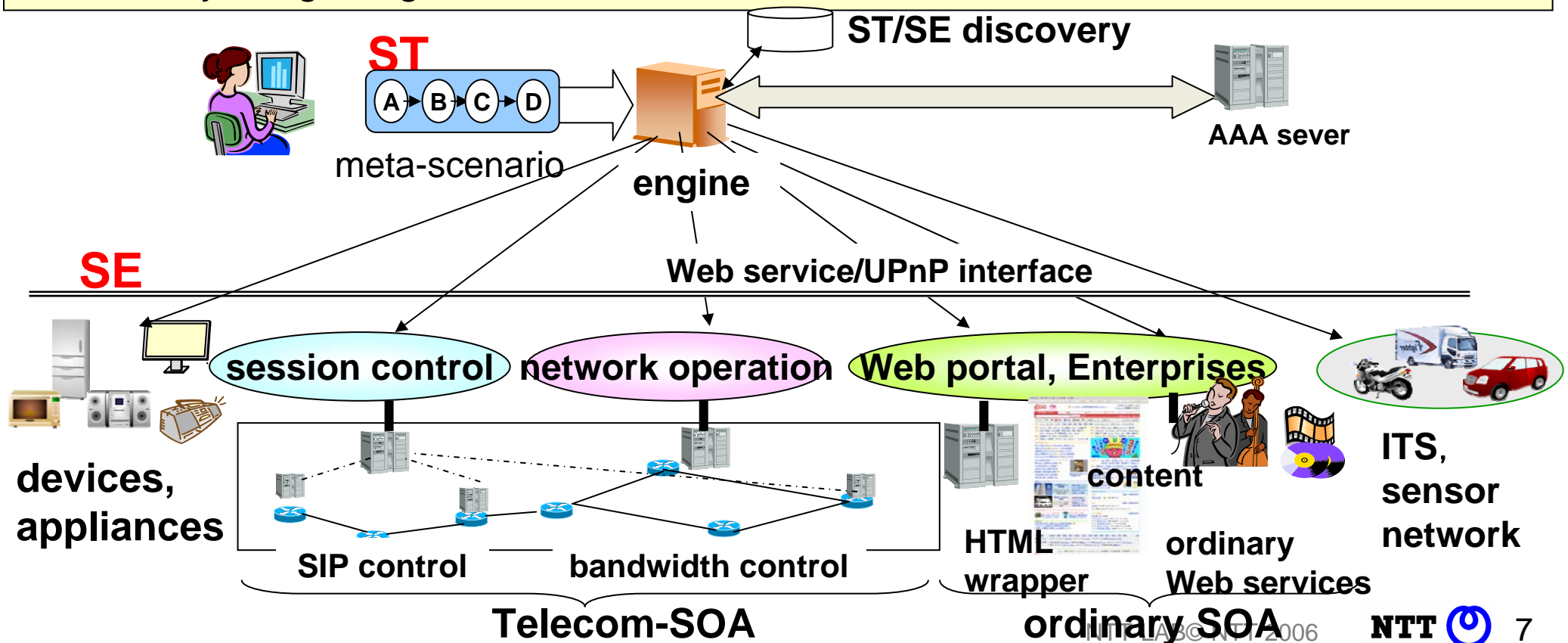
per guest

# Ubiquitous service integration platform

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- Our ubiquitous service integration platform provides composition capabilities using appliances, sensors, telecom-SOA elements as well as ordinary SOA elements.
- Network operation functions, session control functions, and ordinary Web page functions are provided directly or through Web-service conversion wrappers.
- Application service providers, and even ordinary people, can provide application services by integrating SEs in the network.

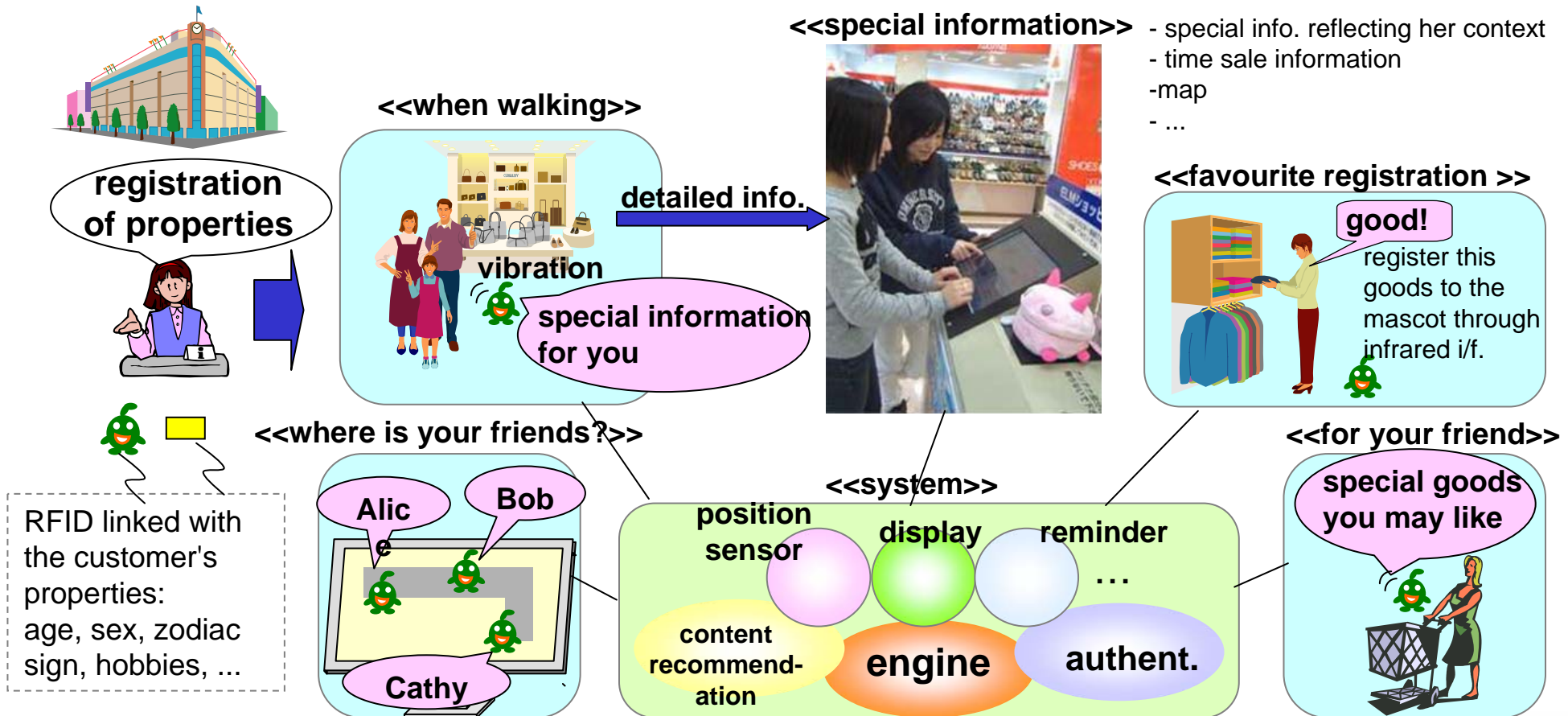


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# Ubiquitous service field trial

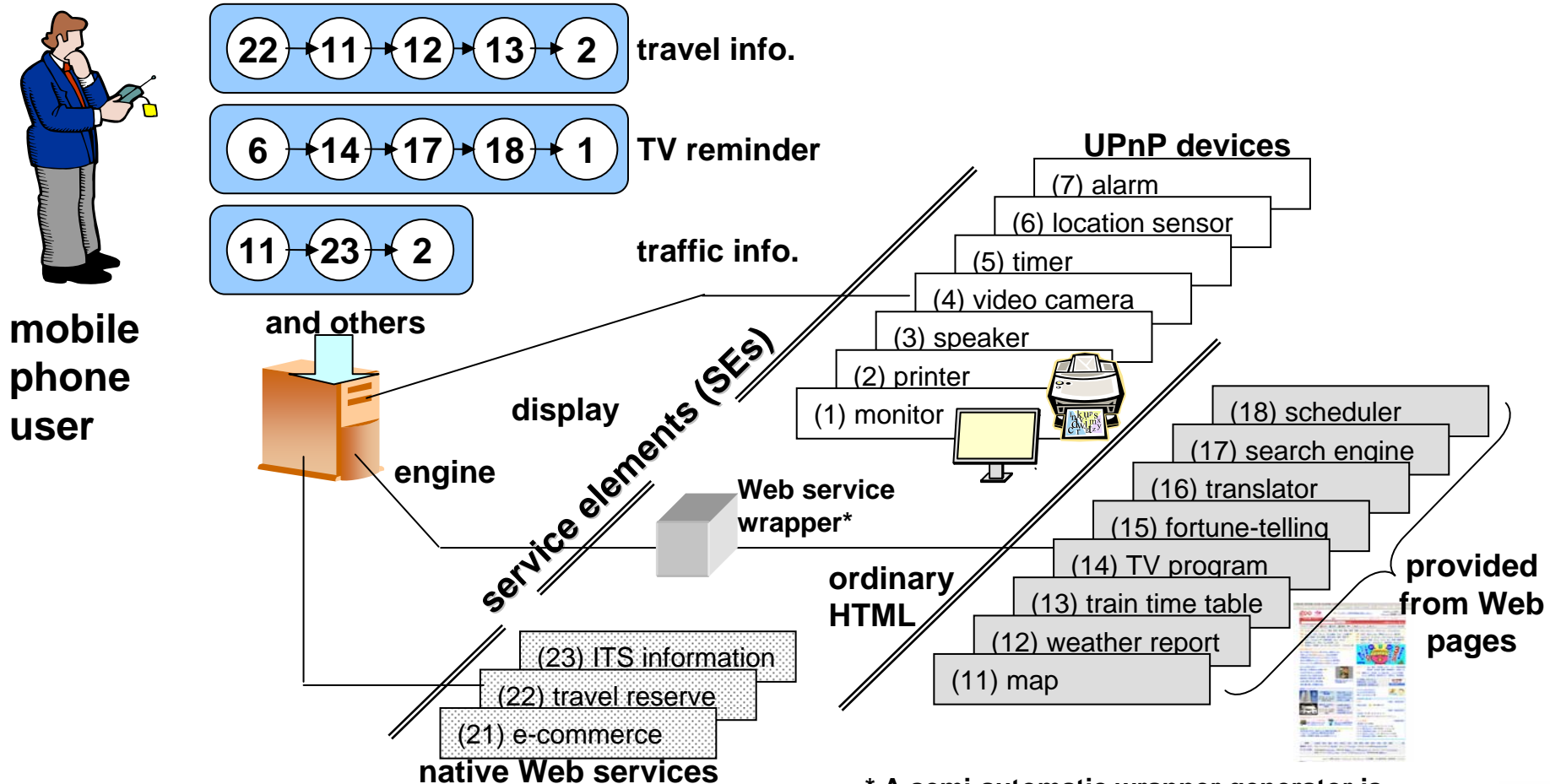
Ubiquitous shopping support system:

This system informs customers of information appropriate for them considering their context, such as time, place, properties, and preferences in a shopping mall. A mascot with an active tag notifies them of the existence of special information.



# Application using Web pages

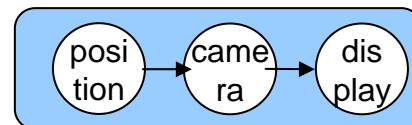
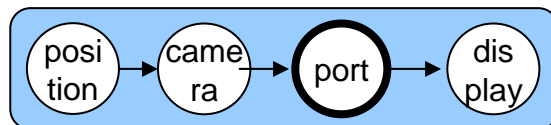
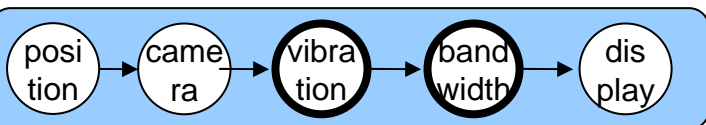
Ordinary web page functions can be used as SEs through Web service wrappers. In conjunction with ordinary Web services and UPnP devices nearby the user, interesting and useful services can be composed.



\* A semi-automatic wrapper generator is now being studied and prototyped.

# Application for home use

The father with a position sensor is traced by video cameras all round the house. This basic scenario can be enhanced by adding a port control SE to guard illegal access over the home gateway, or by a vibration sensor and a bandwidth control SEs to observe the house more carefully when something happens.



```
<OnMessage name="vibration">
  <search name="camera">
    <invoke name="bandwidth up">
    <invoke name="display">
  </OnMessage>
```

```
<OnMessage name="position change">
  <search name="camera">
    <invoke name="port open">
    <invoke name="display">
  </OnMessage>
```

```
<OnMessage name="position change">
  <search name="camera">
    <invoke name="display">
  </OnMessage>
```

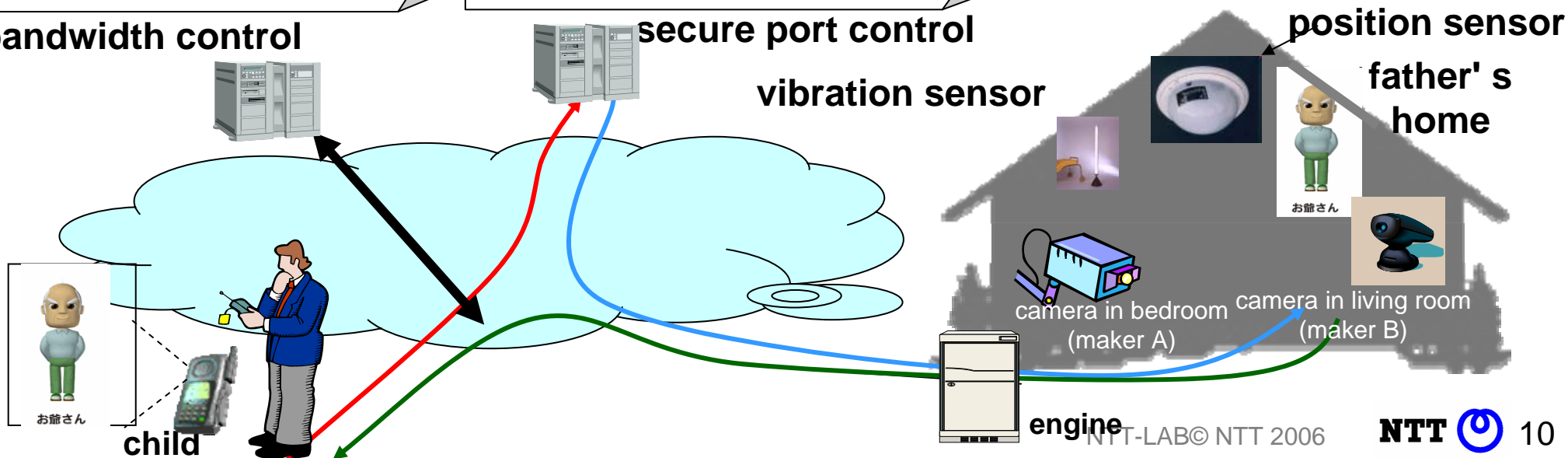
bandwidth control

secure port control

vibration sensor

position sensor

father's home



# Conclusion and future work

- a novel service composition framework for creating useful and tailored capabilities in our active lives in the ubiquitous computing and communication era.
- various types of ubiquitous services to be provided timely and effectively.
- further study: techniques for attaining higher performance, efficient ontology translation, effective wrapper generator, fault tolerance, ...
- creation of ubiquitous applications reflecting each individual's life style in the near future.

## <Acknowledgement>

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# References

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