

# Natural language processing based Services Composition for Environmental management

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# Outline

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- Convergent composition in the Environmental management domain
- Proposed architecture
- Request Analysis
- Context Analyzer
- Service Composer

# Convergent composition

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Convergence is:

Mobile & PSTN (Moyer, 2001)

NGN (Vrdoljak 2000)

- Convergent Composition (Lopez, 2007)
- Telco 2.0 (Yoon 2007)
- Unified Composition (Bond 2010)

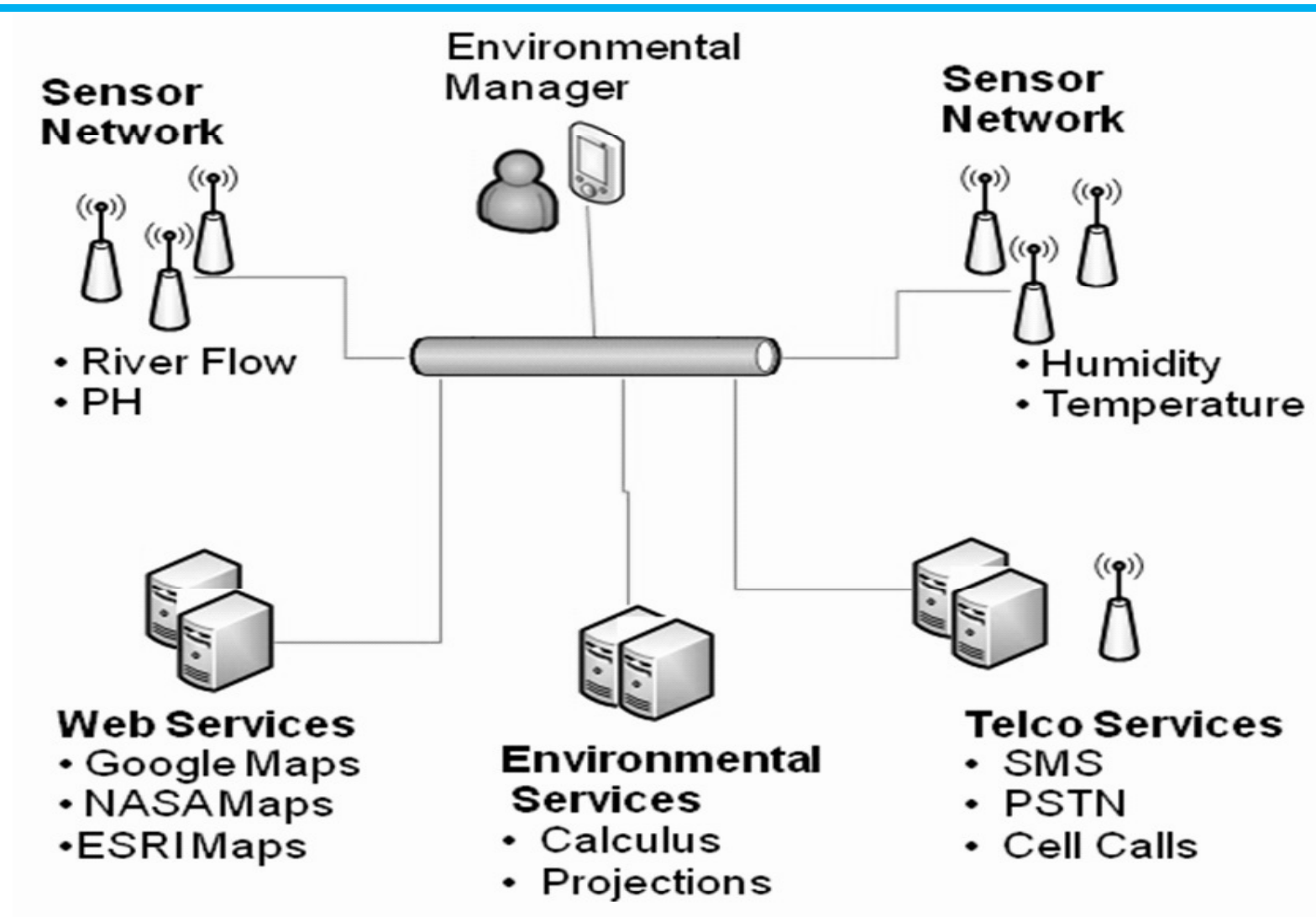


# Environmental management domain

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- Environmental manager is the decision-maker for saving crops from environment alarms (high/low temperature, floods)
- Information comes from sensor networks
- Available Telco and Web services process basic data and can send information to all the farmers and sensors
- Service Reuse is a very important issue for developing countries where budgets for technologies are limited

# Case Study: Environmental Management



# Domain features

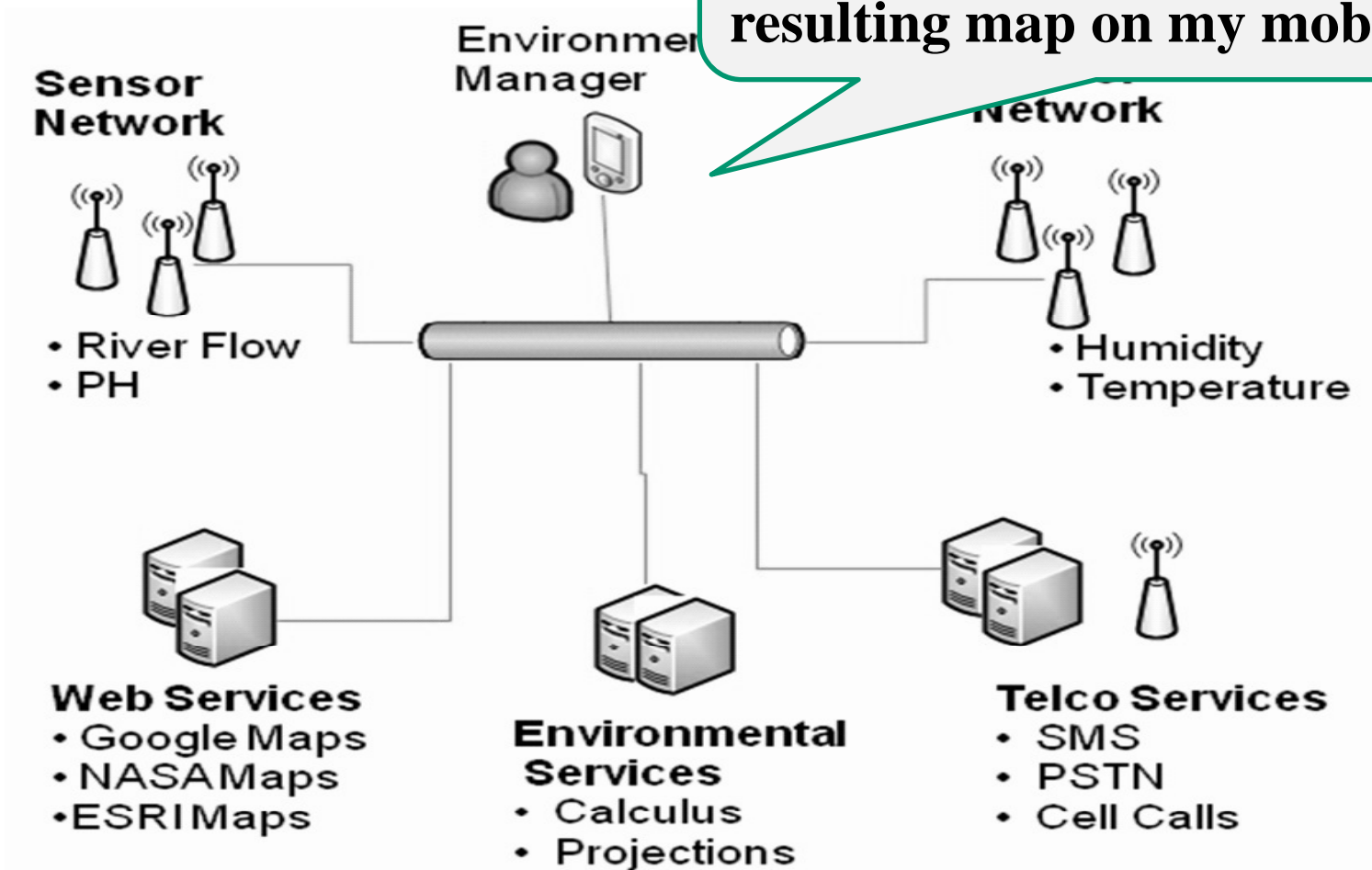
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- Convergent services
  - ◆ Composition of Web Services with Telecom features (Phone–Call, send SMS)
- Limited number of services
  - ◆ Environment Management is a very specific domain
- Environment Management
  - ◆ Standard Procedures for monitoring and management of emergencies
  - ◆ Services can be described with semantic annotations by domain–experts



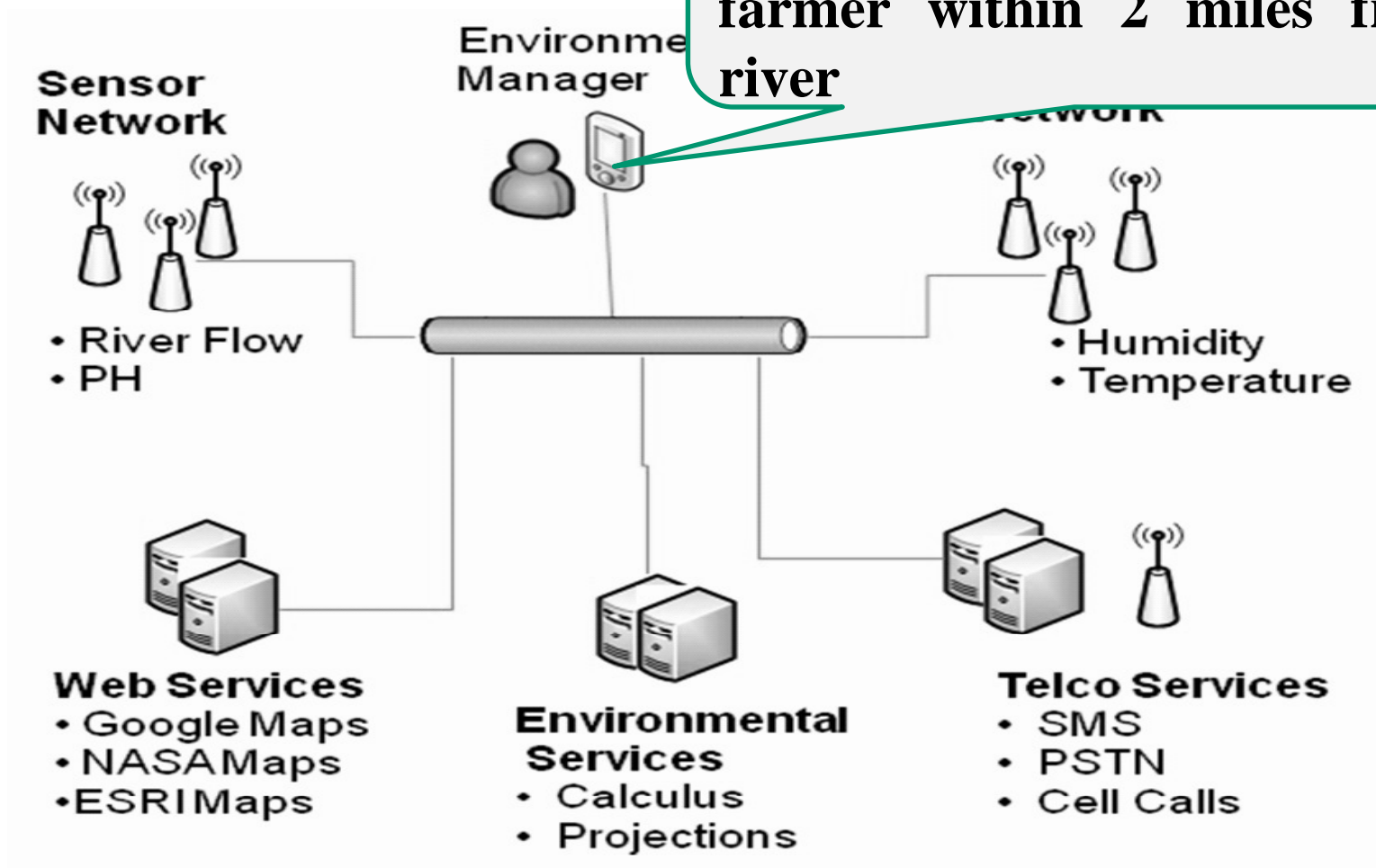
# Case Study: Environmental Management

I need to calculate hydrological balance of zone 1 and receive the resulting map on my mobile phone



# Case Study: Environmental Management

If the river flow of zone 2 is greater than 15% of average, alarm each farmer within 2 miles from the river



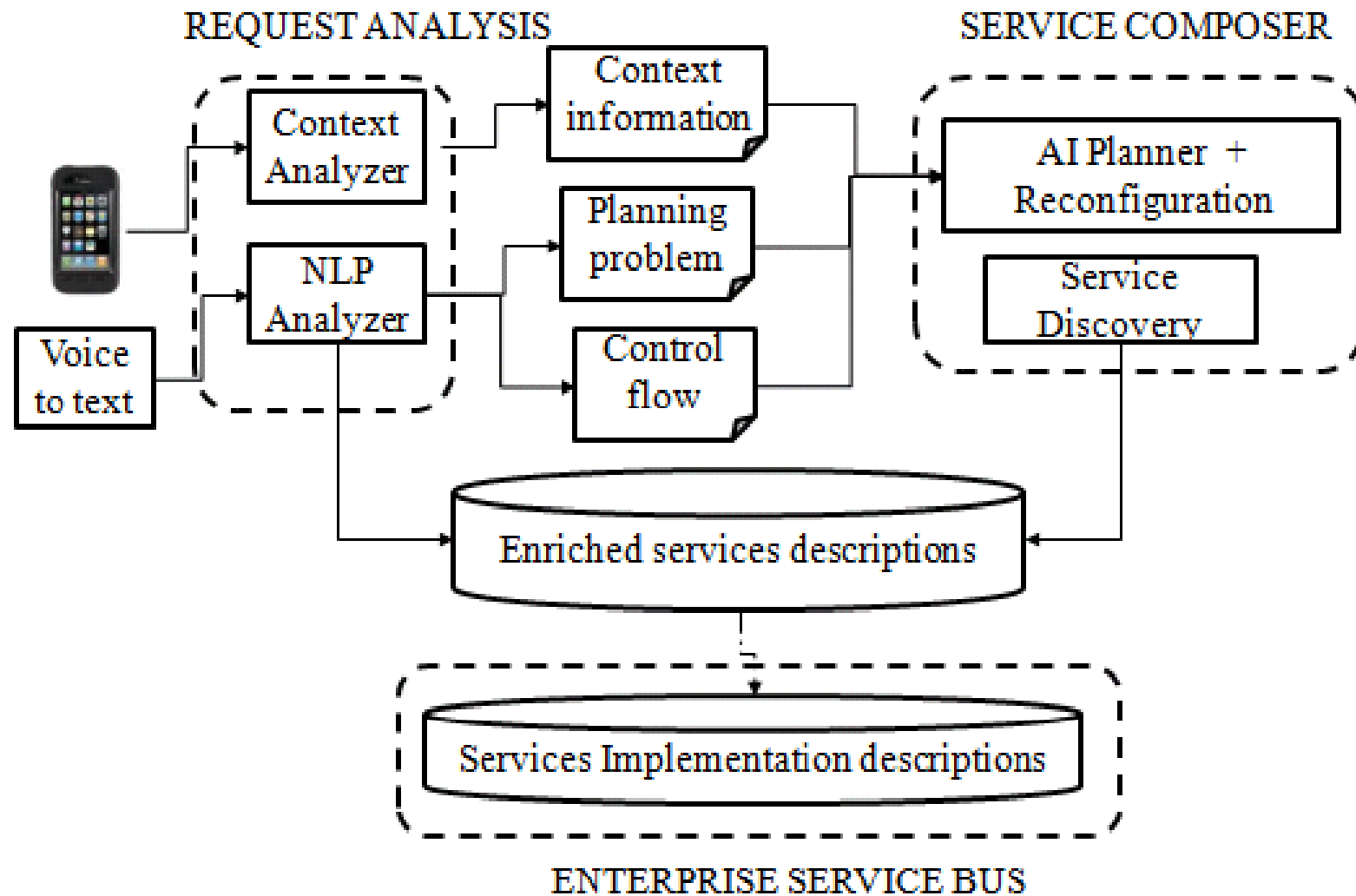


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# Proposed Architecture



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# Request analysis

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- It is made of two sub components:
  - ♦ *Context Analyzer*
  - ♦ *NLP Analyzer*

$$Q = \langle R;P \rangle$$

- Q: is a request made by an environmental manager from a mobile phone
  - ♦ *P: User Context: Cell phone reference and network capabilities.*
  - ♦ *R: Request: "I need calculate hydrological balance of zone one and receive the resulting map to my mobile".*



# Natural Language Analyzer

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## 1. Tokenizing Text

- ◆ Use dictionary to separate words in a sentence
- ◆ Stemming
  - reduce words to their root (e.g. checks => check)
- ◆ Spell-checking

## 2. Detect which words are:

- ◆ verbs (possible **actions** -> services )
- ◆ nouns (possible parameters -> **input/ output**)
- ◆ Prepositions - AND, OR (**control flow** information)

## 3. Produce a PDDL description



# Request analysis: example

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- Request R is decomposed in Sentences  $\{s_1, s_2 \dots s_n\}$  and Flow Information F
  - s1: “calculate hydrological balance of zone one”
  - s2: “receive the resulting map to my mobile”
  - F: AND (sequence of actions)
- Analysis of  $s_1$ : “*calculate hydrological balance of zone one*”
  - ***Input*** = *Zone ONE* (A system variable, geo-coded location or a set of coordinates)
  - ***Output*** = *Hydrological balance map*
  - ***Action*** = *Calculate hydrological balance service*

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# Context analyzer

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- Extracts user context information
  - ◆ mapped to services criteria problem in PDDL
- Context analysis is made of two tasks:
  - ◆ User profile analysed looking for preferences
  - ◆ Device references are checked in capabilities repositories
    - Wireless Universal Resource File (WURFL)
    - Composite Capability/Preference Profiles (CC/PP)





# User context criteria

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	<b>User Criteria</b>	<b>Values</b>
<b>User context</b>	Network	GPRS/ WLAN/ GSM
	Device	Cell phone, Laptop
	Location	Outdoor, indoor
<b>User preferences</b>	Data subscription	Yes/No
	Only Free services	Yes/No
	Voice subscription	Yes/No
	Delivery quality	low, medium, high

# Outline

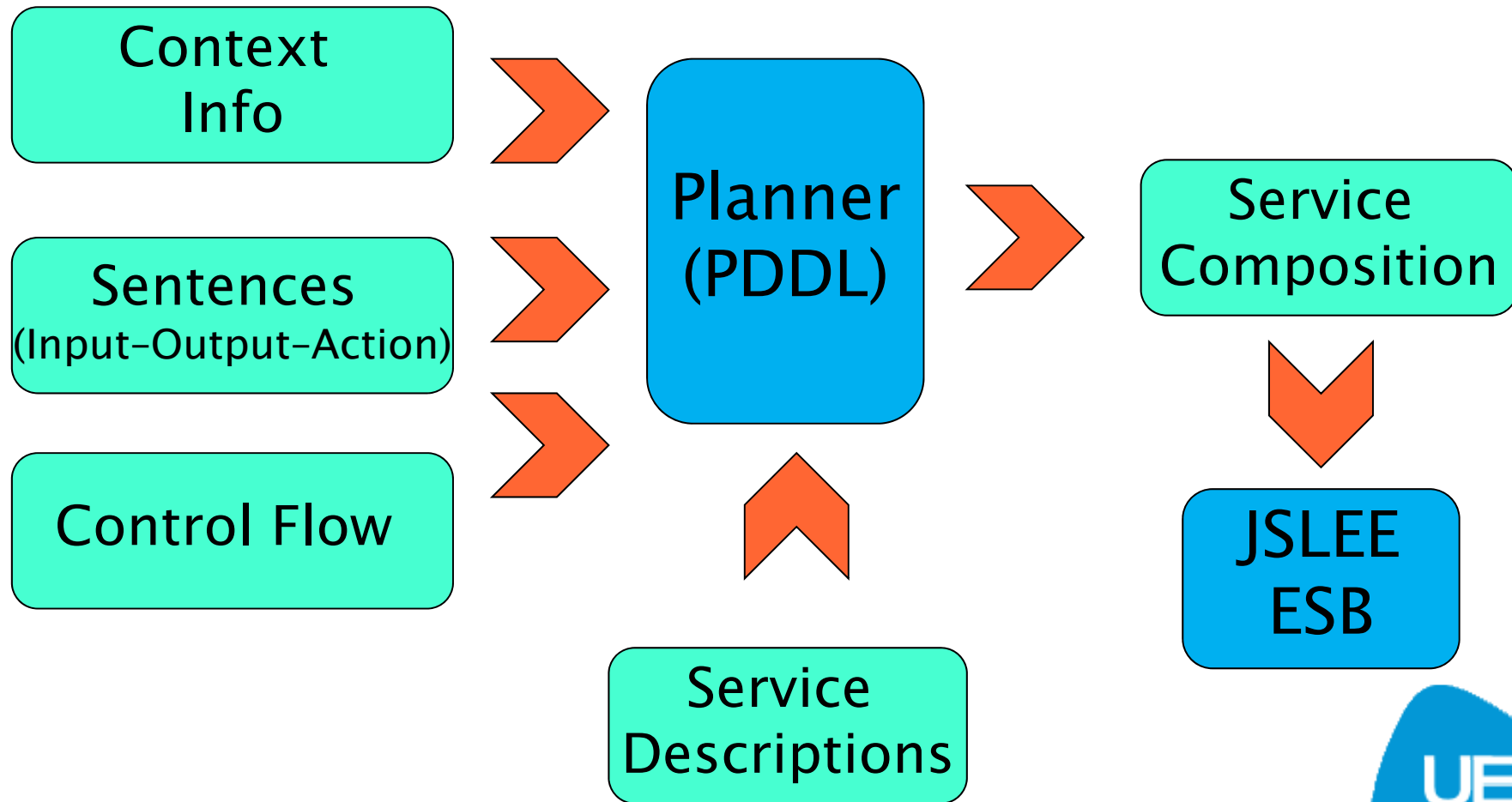
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# Service Composer

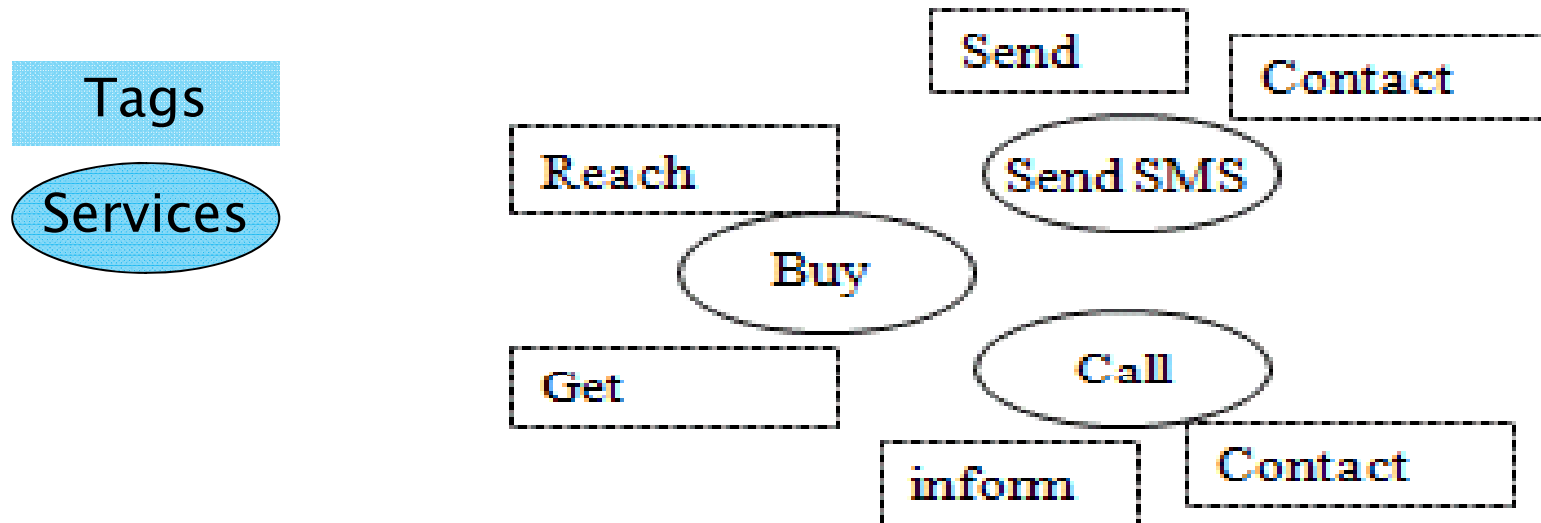
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# Service Descriptions generation

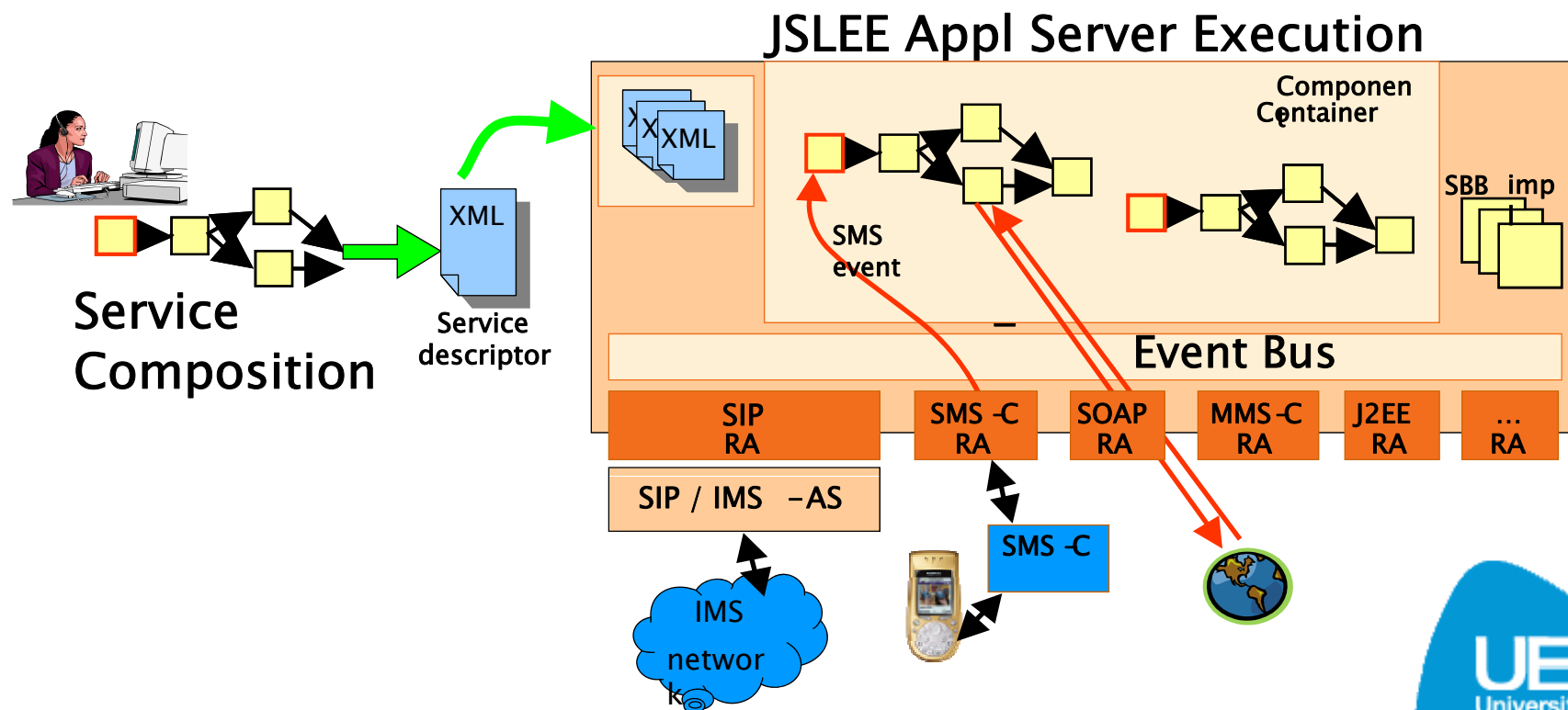
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- Service Descriptions in PDDL are annotated with tags by domain-experts.
- Tags should correspond to tokens in sentences
- Tags used to map user goals to available services



# Deployment on JSLEE ESB

- Event-based Java Application Server
- Service: Composition of Service Building Blocks
- Resource Adapters bridge to different networks



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# Q & A

