Agent-based E-travel Agency

Agent Systems Laboratory
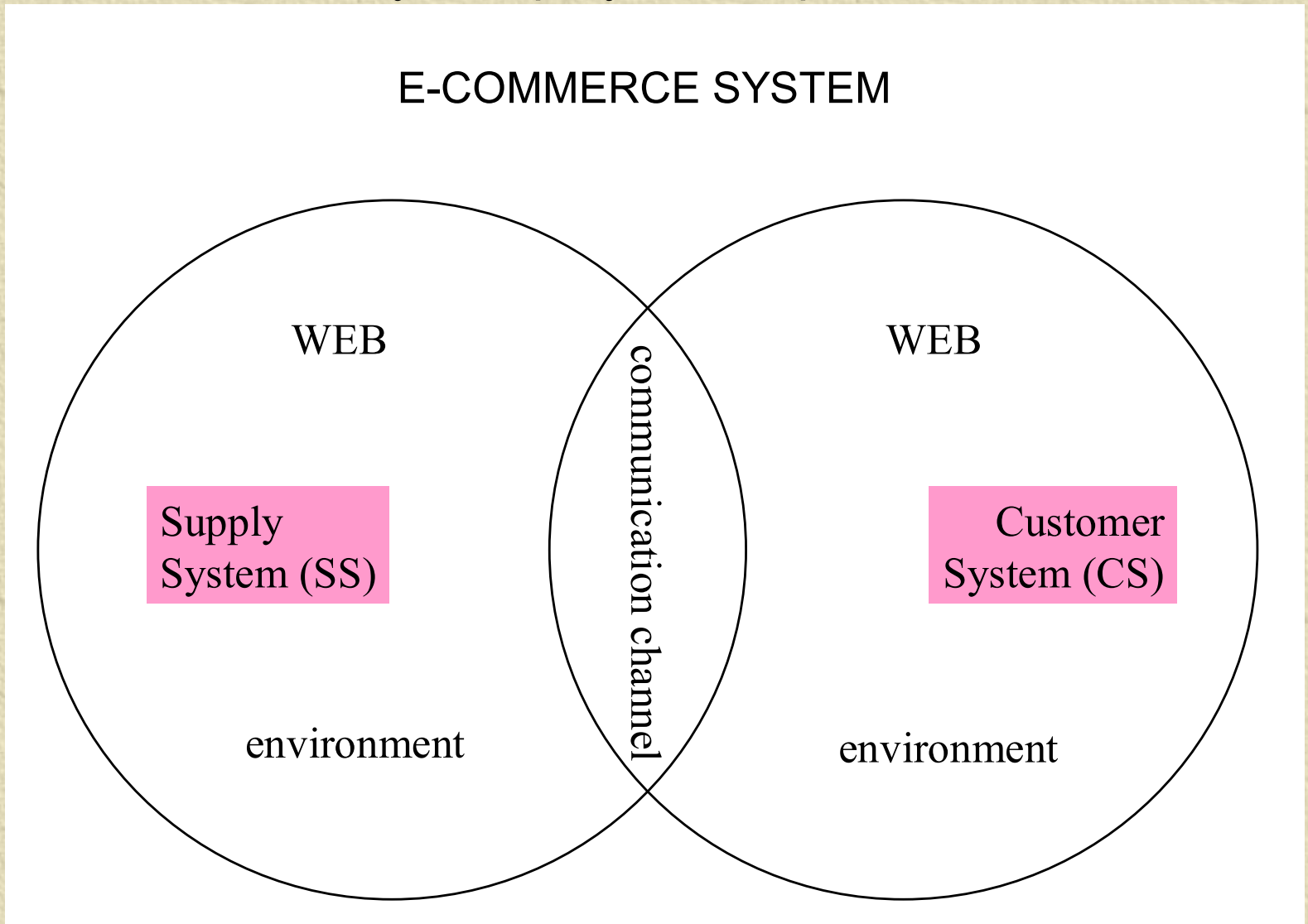### Oklahoma State University

http://www.agentlab.net

E-commerce System – Structure

* Galant, Jakubczyc, Paprzycki, Karpacz, 2002

E-COMMERCE SYSTEM

WEB

WEB

Supply System (SS)

Customer System (CS)

communication channel

environment

environment

Agents

- "Existence" since 1970's

- Rapid growth of interest in past decade

- Basic intuitions

  - based on human agents

    - travel agent

    - insurance agent

    - real-estate agent

    - personal assistant (aka secretary)

  - have specialized knowledge

  - represent our interests

  - find / filter / customize information

Characteristics of software agents

- reactiveness
- ability to communicate
- capacity for cooperation
- reasoning based on collected knowledge
- capacity for reasoning
- intelligence
- adaptivity

- interactivness
- learning ability
- proactiveness
- goal orientation
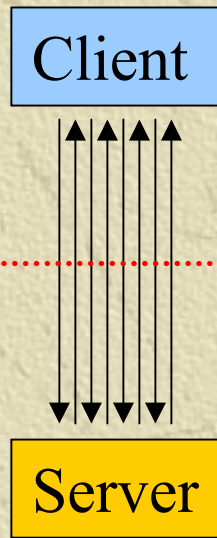- friendliness and reliability
- mobility
- autonomy

Why use agents?

* response to the rapid growth of information on the Internet $\rightarrow$ need for information personalization / filtering

* framework for bringing together AI techniques to build adaptive intelligent systems

* methodology for engineering complex distributed systems (Jennings):
    * decomposition
    * abstraction
    * organization

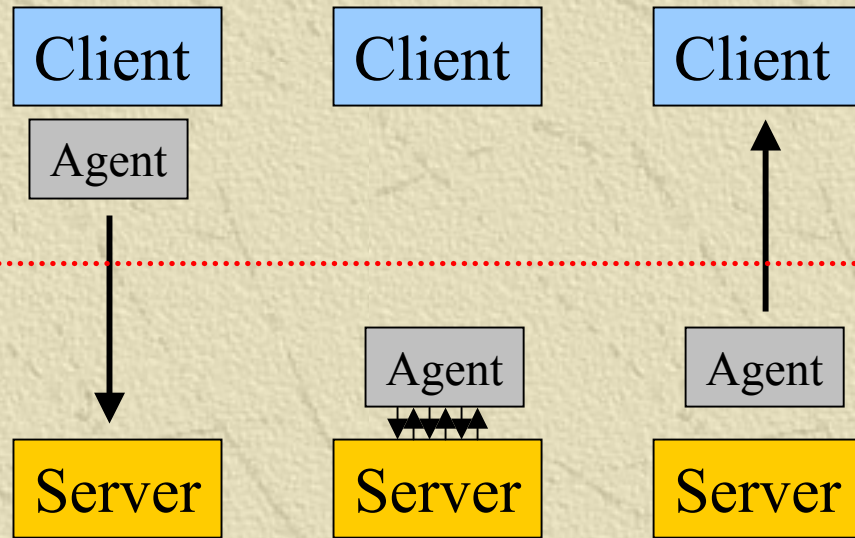* mobile software for mobile world (context-aware computing)

Client-Server vs. Mobile Agents

✳ Mobile agent → agent that:

- ◆ can move from one computer to another
- ◆ user-directed / autonomous / mixed

| Client | | Client | Client | Client |

Agent

Server

Traditional

Agent

Agent

Server   Server   Server

Mobile Agent-Based

Advantages of Mobile Agents

* Operate where data and/or computer resources are
  * use resources of multiple machines
    * improve load balancing
    * possible approach to GRID computing
* Disconnected operations and autonomy
  * short "on-line" times
    * low-power requirement devices
    * "immune" to network outages
  * redundancy / fail-safe behavior
    * "ensured" transfer across network
    * multiple agents can "back-up" each other
* Natural support for mobile systems
  * travel system support $\rightarrow$ agents follow travelers

Expert Criticisms

✳ Nwana H., Ndumu D. (1999) A perspective on software agents research, *The Knowledge Engineering Review*, 14 (2), pp. 1–18

- ◆ Information discovery problem
  - where the relevant information is and how to keep up with the dynamics of the Internet?
- ◆ Communication problem
  - how to make different systems to communicate with each other?
- ◆ Ontology problem
  - how to make different systems understand each other?
- ◆ Legacy software problem
  - how to make agents interact with legacy systems?
- ◆ Reasoning and coordination problem
  - how to reason about the retrieved data?
- ◆ Monitoring problem
  - travel specific problem of post-sale monitoring

Travel Support System

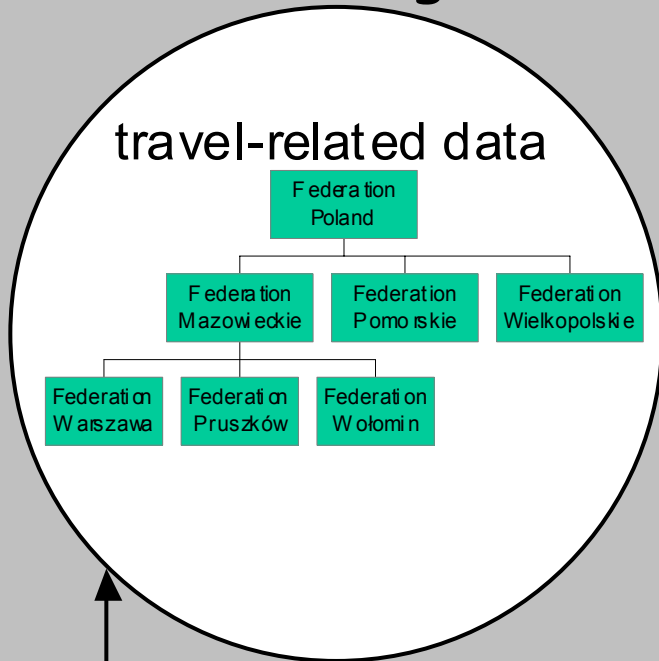* Geographical Information + Business Information
  * travel support core $\rightarrow$ map (geospatial data; *GIS*)
  * travelers demand geographical information combined with information about *services* (broad definition)
    * restaurants / pubs
    * movie theaters / museums
    * historical information
    * national parks, etc.
  * information about services should match **personal interests**
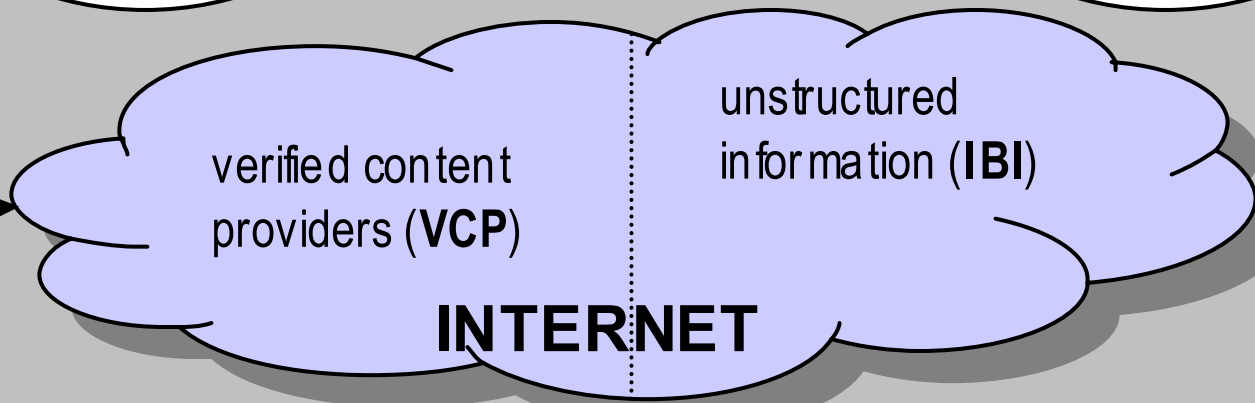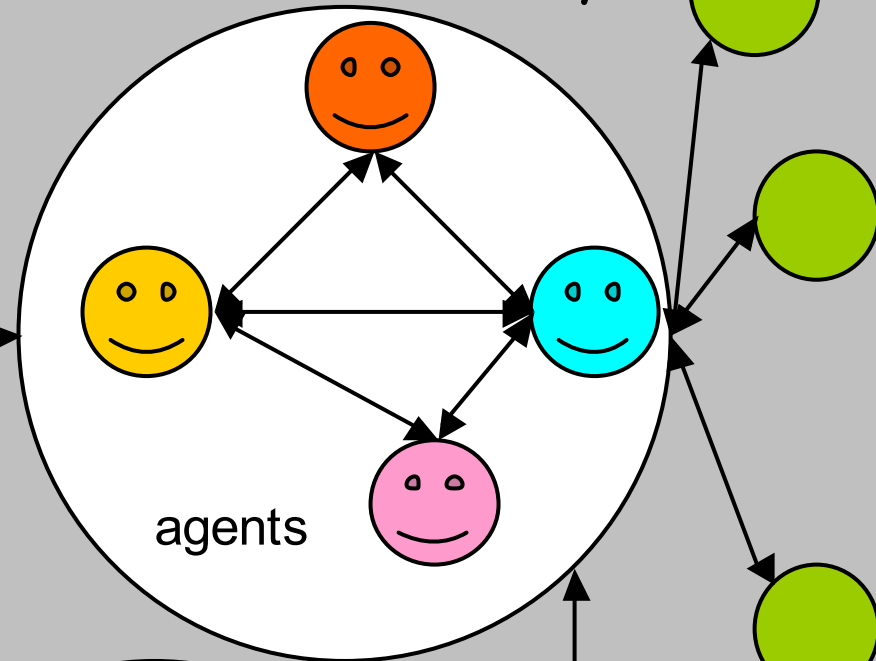
Proposed System Features

* Decomposition of functionality $\rightarrow$ agents
  * everything is an agent
  * if something is not an agent (i.e. and expert system, data mining system) it will be wrapped in an agent
* Data indexed according to
  * ontological classification
  * geospatial extent
* Content derived from trusted sources and supplemented by Internet-based information
* Content personalization as an overarching concern during development (Angryk, Galant, Gordon, Paprzycki, 2002)
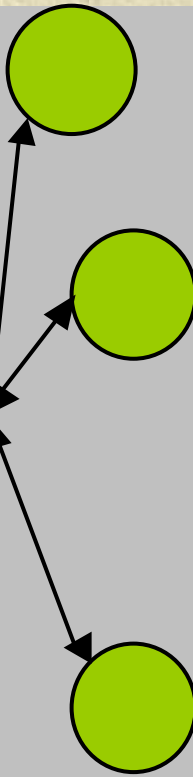
General System Architecture
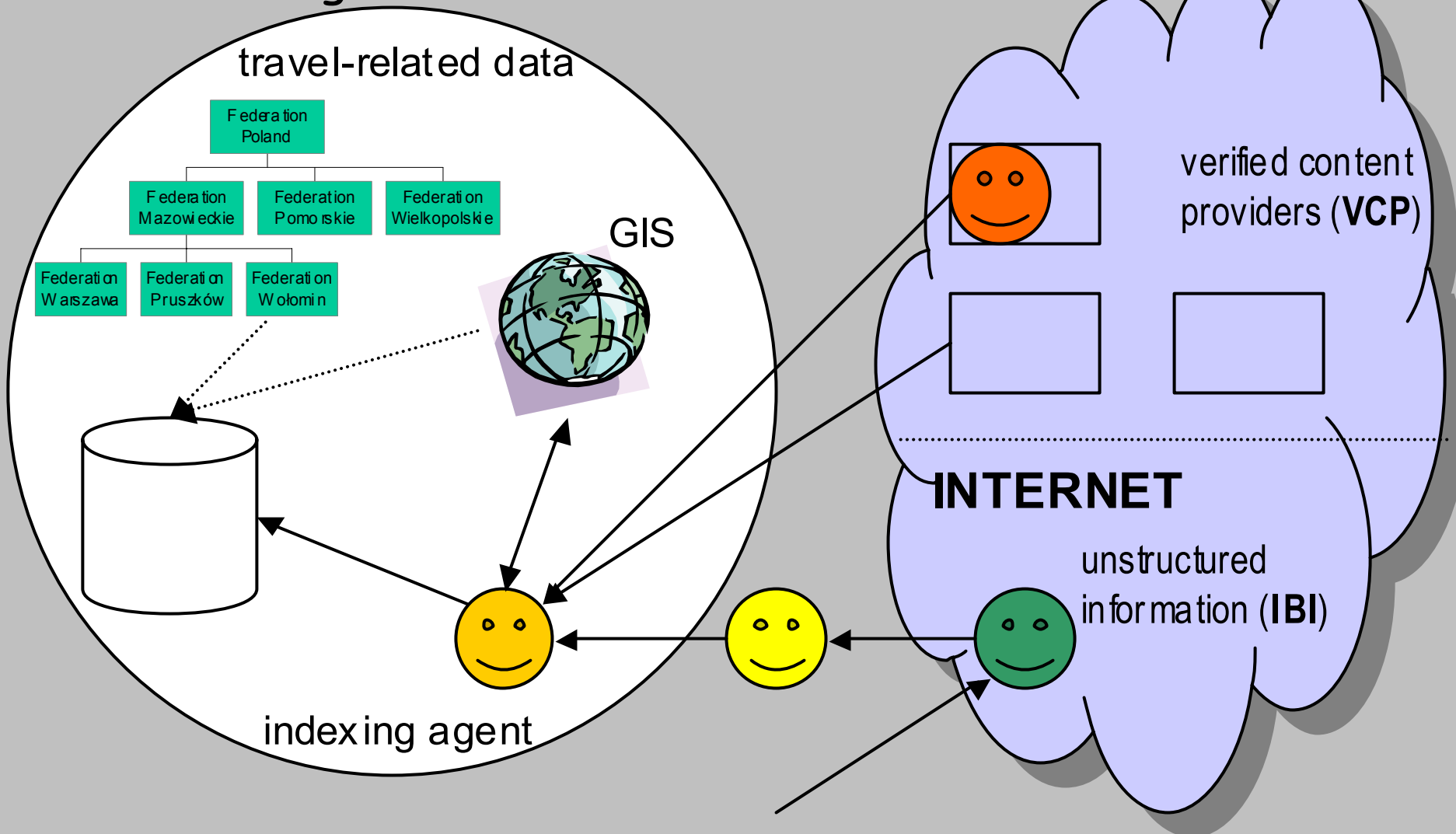
content management

content delivery

travel-related data

Federation Poland

Federation Mazowieckie | Federation Pomorskie | Federation Wielkopolskie

Federation Warszawa | Federation Pruszków | Federation Wołomin

channel

agents

verified content providers (**VCP**)

unstructured information (**IBI**)

INTERNET

clients

Content Management

content management

travel-related data

Federation Poland

Federation Mazowieckie | Federation Pomorskie | Federation Wielkopolskie

Federation Warszawa | Federation Pruszków | Federation Wołomin

GIS

indexing agent

verified content providers (**VCP**)

INTERNET

unstructured information (**IBI**)
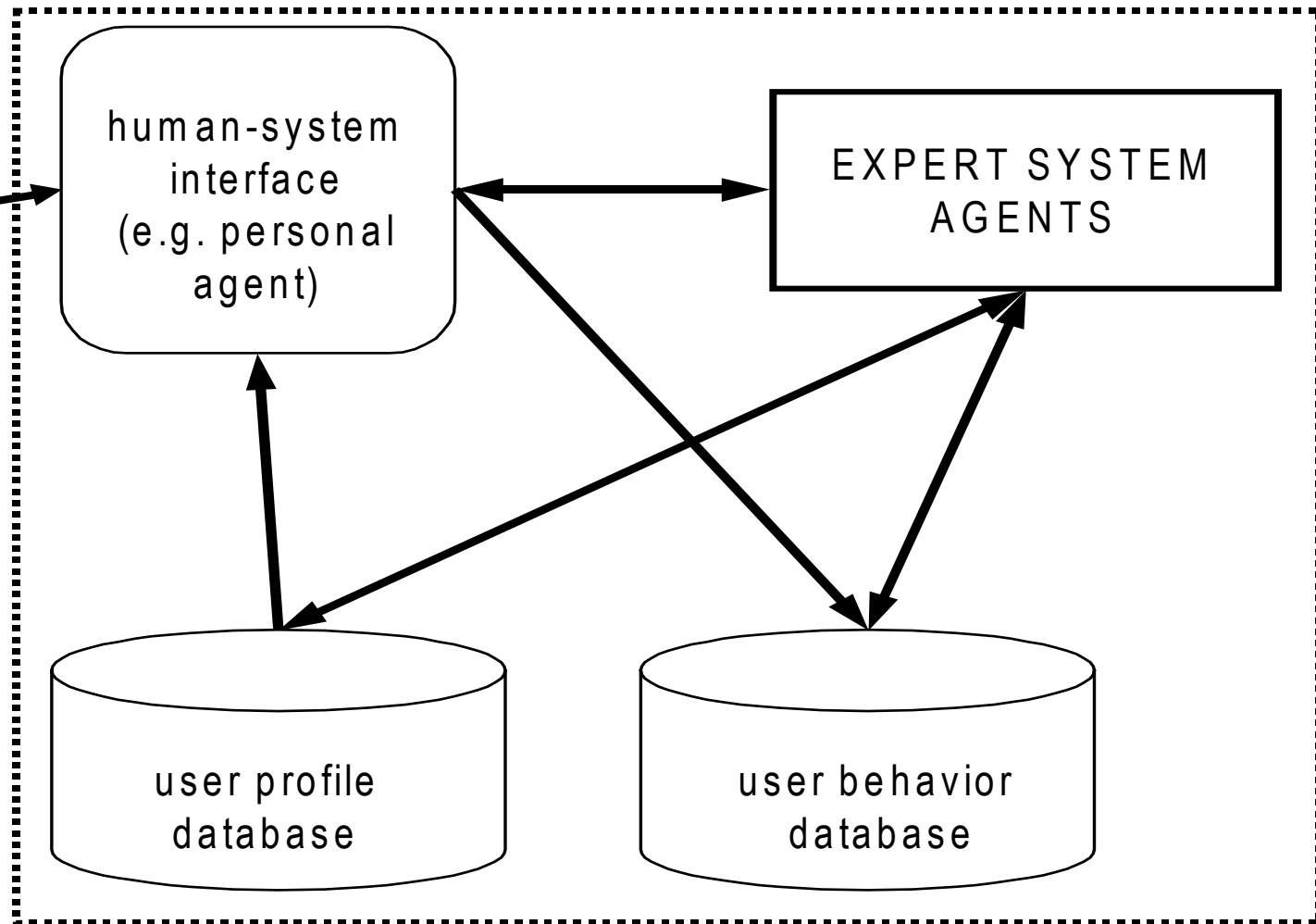
Content Delivery

Experts in the System

* Domain-specific expert systems

  * Post-sale agent

  * User profile initialization expert system

  * Travel expert system

  * Advertising expert system

  * Meta-experts

    * responsible for **mining the data** available in the user behavior database

Personalization Infrastructure

Knowledge Acquisition

✳ Knowledge about

- individuals

- groups

- population

- trends (time-oriented analysis)

- profiles pertinent to new features

- all of the above interact with each other

✳ Knowledge acquisition → source of **adaptivity** in a dynamical web-based system

The System

- We are implementing a demonstrator system
  - JADE as the agent environment
  - JESS as the expert system framework
  - OTA – "ontology with verbs"
  - heterogeneous databases
  - heterogeneous network of computers
- Initial results
  - agent infrastructure
  - client–agent interaction
  - available in December

Client – Agent Communication

INTERNET

TRAVEL SUPPORT SYSTEM

HTTP listener

Web browsers

clients
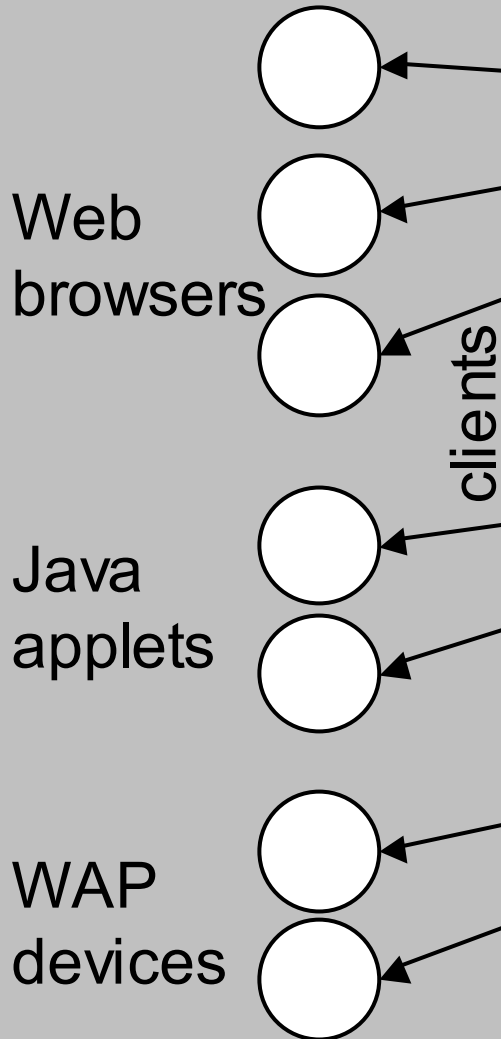
application listener

Java applets

WAP listener

WAP devices

listening framework

message broker

personal agents