Software Agents

Motivation

- We want to have a lunch, but we don't want to spend time in choosing which restaurant. Instead we assign this task to a "Software program".

- Human beings, sometimes, are busy or lazy to buy or negotiate a deal. They need a software that can do that for them.

The Grocery Shopping Agency

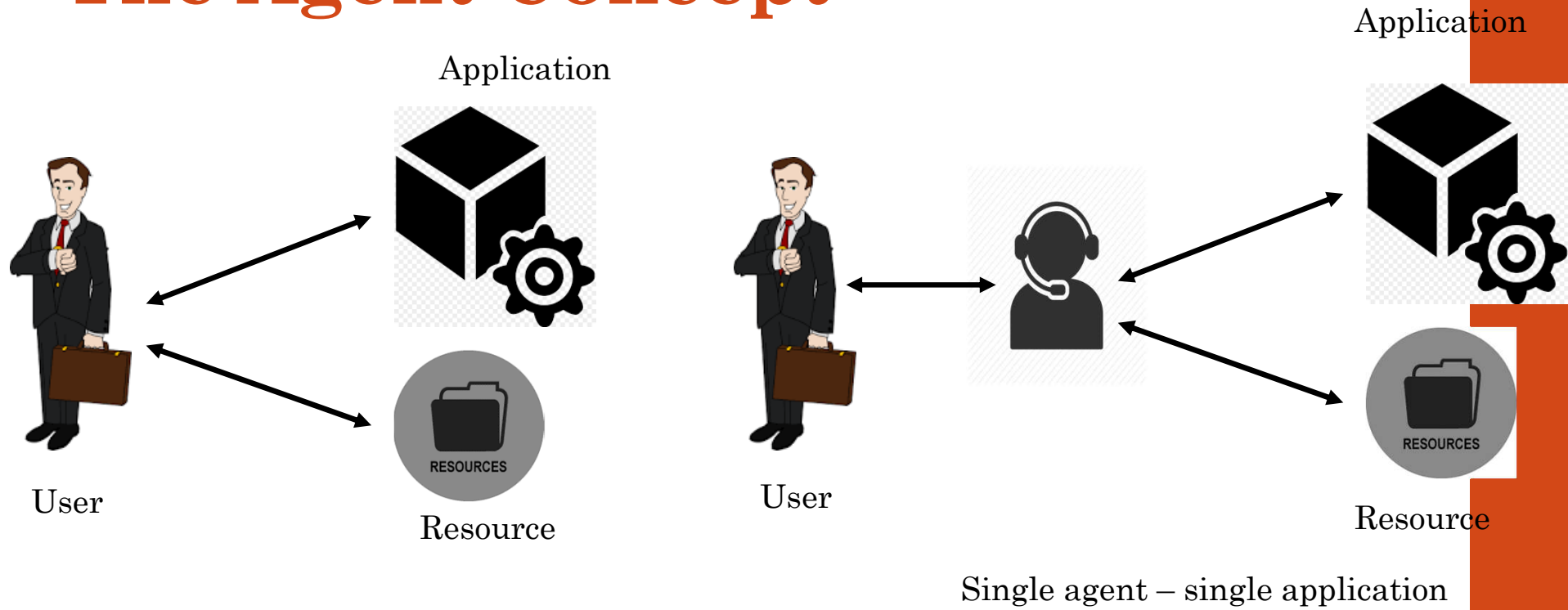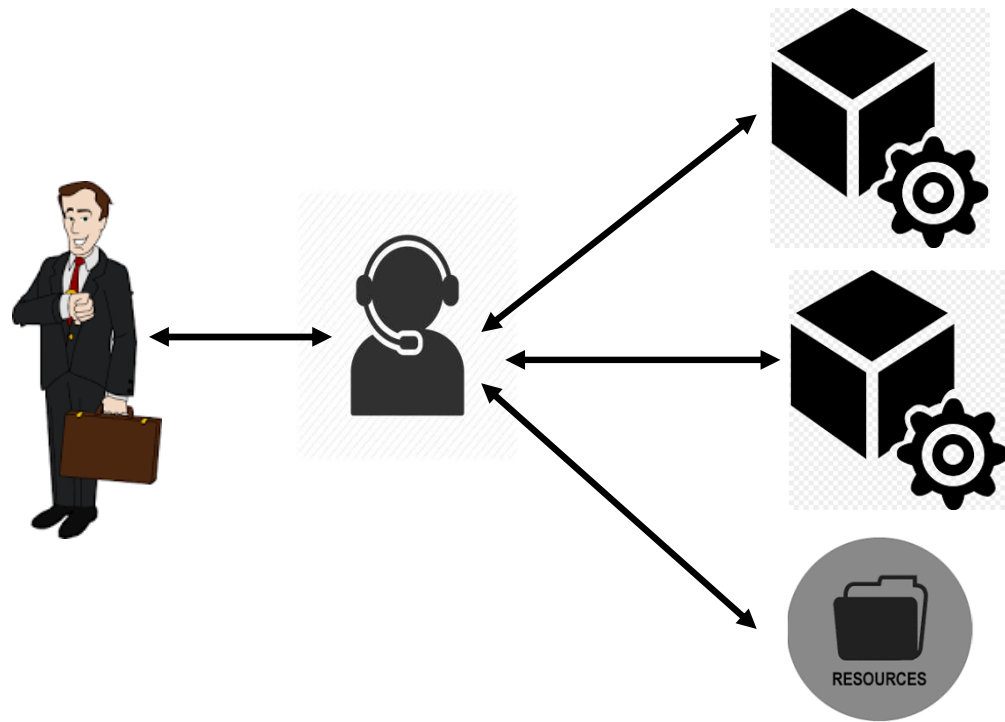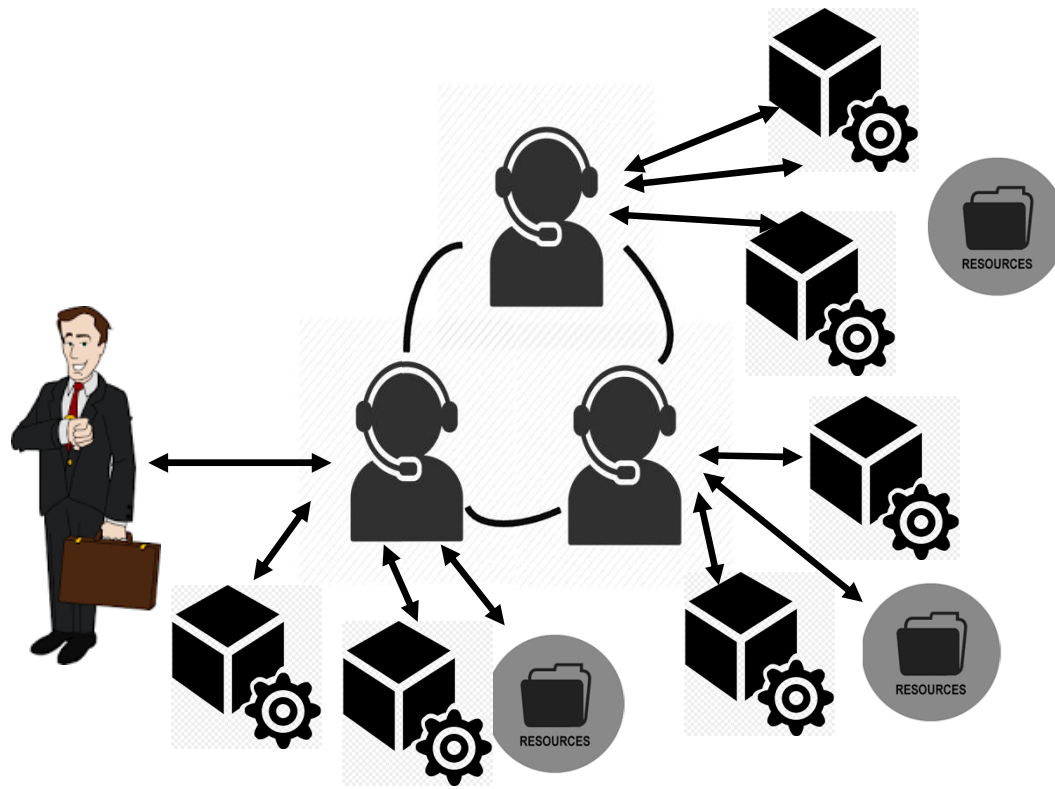User/Agent

Shopping Agent

Store1

Store2

Store3

The Agent Concept

Application

User

Resource

Application

User

Resource

Single agent – single application

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Single agent – Multi application

Muti-agents

Agent System Components

- Agent
- User
- resource

Agent – user interface

Agent- resource interaction

Knowledge + Inference mechanism

Agent – agent communication

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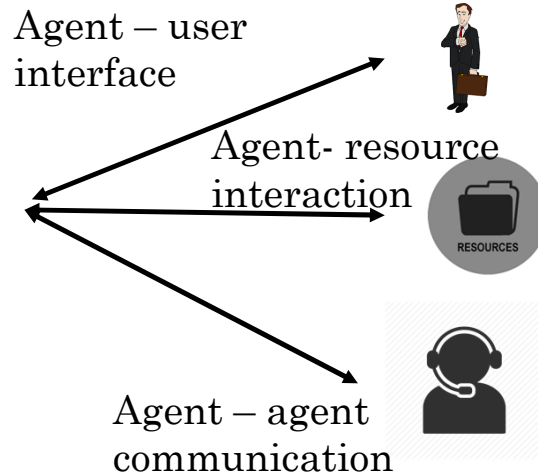
What is an agent?

- Intelligent agents are software entities that carry out some set of operations **on behalf** of a user or another program with some degree of **autonomy**, and in so doing, employ some knowledge or representation of the user's **goals** or desires.

Autonomy

- Agent operate without the direct intervention of humans or others, and have some kind of control over their action and internal state.

- Autonomy is typically limited or restricted to particular area.
  - Locus of Decision making.

- Within a prescribed rang, an agent is able to decide for itself what to do.
  - Find me a flight from Cairo to London on Monday.
    - Note: I didn't say what to optimize – I'm allowing the agent to make tradeoffs.

Proactive

- Pro-activeness: agents do not simply act in response to their environment, they are able
  - To exhibit goal directed behavior by taking the initiative

- Reacting to the environment is easy
  - (eg stimulus -> response rules)
  - Not driven solely by events
  - Taking the initiative

- Recognizing opportunities.

Adaptation

- Agent adapt to their environment and users and learn from experience.

  - Via machine learning, knowledge discovery
  - Interface agent acquire and use users models
  - Situated in and aware of their environment

Cooperation

- Some goals can only be achieved with the cooperation of others

- Agents communicate with each other to achieve a common goal

- Social ability in agents is the ability to interact with other agents(and possibly humans) via some kind of agent communication language and perhaps cooperate with other.

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Reactivity(i)

- A ***reactive*** system is one that maintains an ongoing interaction with its environment and responds to change that occur in it.

- Agents respond to changes in the environment.

Reactivity(ii)

- If a program's environment is guaranteed to be fixed, the program need never worry about its own success or failure
  - Example of a fixed environment – a compiler

- The real world is not like that
    - Things changed
    - Information is incomplete
  - Many environment are *dynamic*

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Other properties

- Mobility
  - The ability of an agent to move around an electronic network

- Rationality
  - Agent will act to achieve its goals, and will not act in such a way as to prevent its goal from being achieved – at least insofar as its beliefs permit.

- Learning / adaptation
  - Agent improve their performance over time.

What is the different between an agent and a payroll program?

- A payroll program does not sense the environment

- It runs once and then closes(until called again), it is not proactive.

- Agents are, by definition are programs, but a program must measure up to several marks to be an agent.

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Examples of agent systems

- Ebay agents can watch an auction and increment the price for you.

- British telecom. Agents that manage business processes.

Agent reasoning

- Agents reason in terms of the following

  - Goals
  - Facts
  - Preferences
  - Beliefs

Example

- Consider an agent that is delegated the task of finding books for a user.

- Goal: representation of outcomes.
  - BuyBook("Egypt")

- Facts: categories of books,bookseller websites,etc.

Preferences and Utility

- Agents will typically have preferences
  - This is declarative knowledge about the relative value of different stats of the world.

- Often , the value of an outcome can be quantified (perhaps in monetary terms).

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Preferences and Utility

- This allows the agent to compare the utility of different actions.

- A rational agent is one that maximizes expected utility.

Example

- Again , consider our book agent

- If I can tell it *how much value* I place on different books, it can use this do decide what actions to take.

- *preferences- a ranking over states*
  - *HasBook("tourism")> hasBook("politics")*

Agent in open system

- Closed system agents are usually designed by the same designer
  - Collaboration systems
  - No communication problems

- Open systems are those in which no one implements all the participants.
  - E.g. the internet.

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