

Software Agents

(Jennings and Wooldridge, 1996)

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Artificial Life Seminar

Identify three distinct classes of agent in “extant” (circa 1996) applications:

“gopher” agents, which execute straightforward tasks based on pre-specified rules and assumptions (eg inform me when the share price deviates by 10% from its mean position or tell me when I need to reorder stock items).

“service performing” agents, which execute a well defined task at the request of a user (eg find me the cheapest flight to Paris or arrange a meeting with the managing director some day next week). Finally, there are

“predictive” agents, which volunteer information or services to a user, without being explicitly asked, whenever it is deemed appropriate (eg an agent may monitor newsgroups on the INTERNET and return discussions that it believes to be of interest to the user or a holiday agent may inform its user that a travel firm is offering large discounts on holidays to South Africa knowing that the user is interested in safaris).

All of these three classes of agents have “Agenthood”:

The Key Characteristics of “Agenthood”: (Wooldridge and Jennings, 1995):

- ***Autonomy***: agents should be able to perform the majority of their problem solving tasks without the direct intervention of humans or other agents, and they should have a degree of control over their own actions and their own internal state.
- ***Social ability***: agents should be able to interact, when they deem appropriate, with other software agents and humans in order to complete their own problem solving and to help others with their activities where appropriate.
- ***Responsiveness***: agents should perceive their environment (which may be the physical world, a user, a collection of agents, the INTERNET, etc.) and respond in a timely fashion to changes which occur in it.
- ***Proactiveness***: agents should not simply act in response to their environment, they should be able to exhibit opportunistic, goal-directed behaviour and take the initiative where appropriate.

Three types of Applications of agents are examined:

Personal Information Management

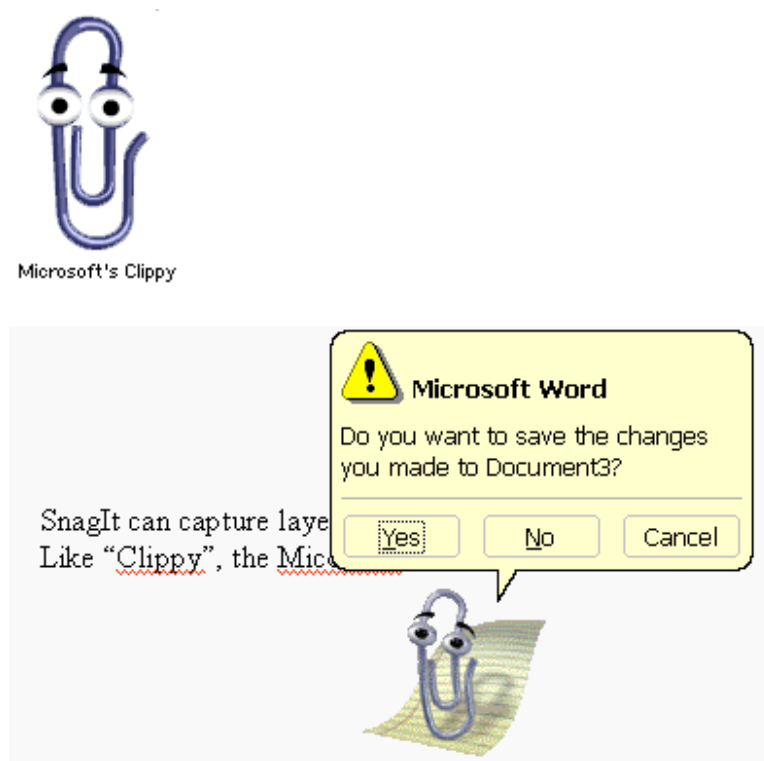
Electronic Commerce

Business Process Management

Their examples are somewhat dated, so I would like to take their definitions and characteristics and look at some modern applications that didn't exist in 1996, and also some **real** Electronic Commerce applications from that period, and see if they fit the criteria for "Agenthood" as set out by **Jennings and Wooldridge**

(Jennings and Woodridge 96) “Software Agents” Claim that “hundreds” of systems are already using “agent technology” (in 1995). Maybe so, but I doubt it.

Here’s one that did:



It all started with another great Microsoft idea ...



Clippy is a predictive agent (by their definition). **Discuss?**

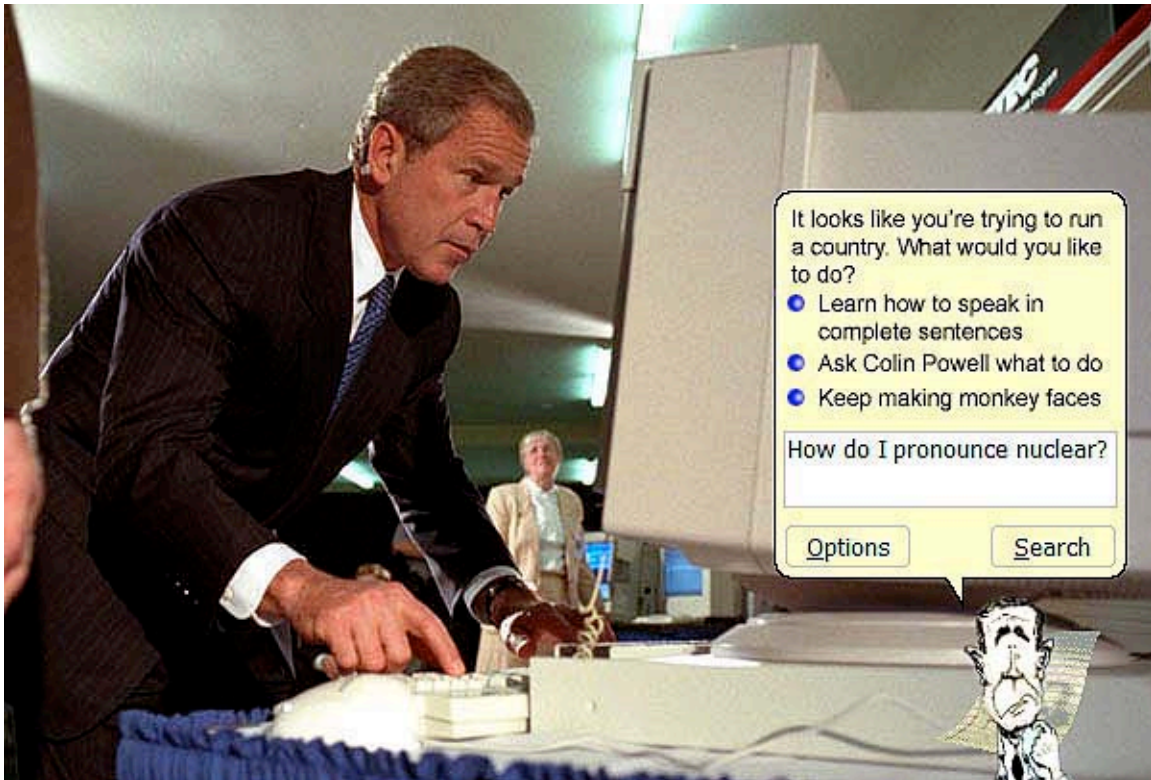
Clippy is

- **autonomous,**
- **has “social ability” (mostly the ability to get users very angry)**
- **responsive**
- **proactive.** Clippy brought itself up, much to the chagrin of most users.

Thankfully, Clippy got “The Boot”

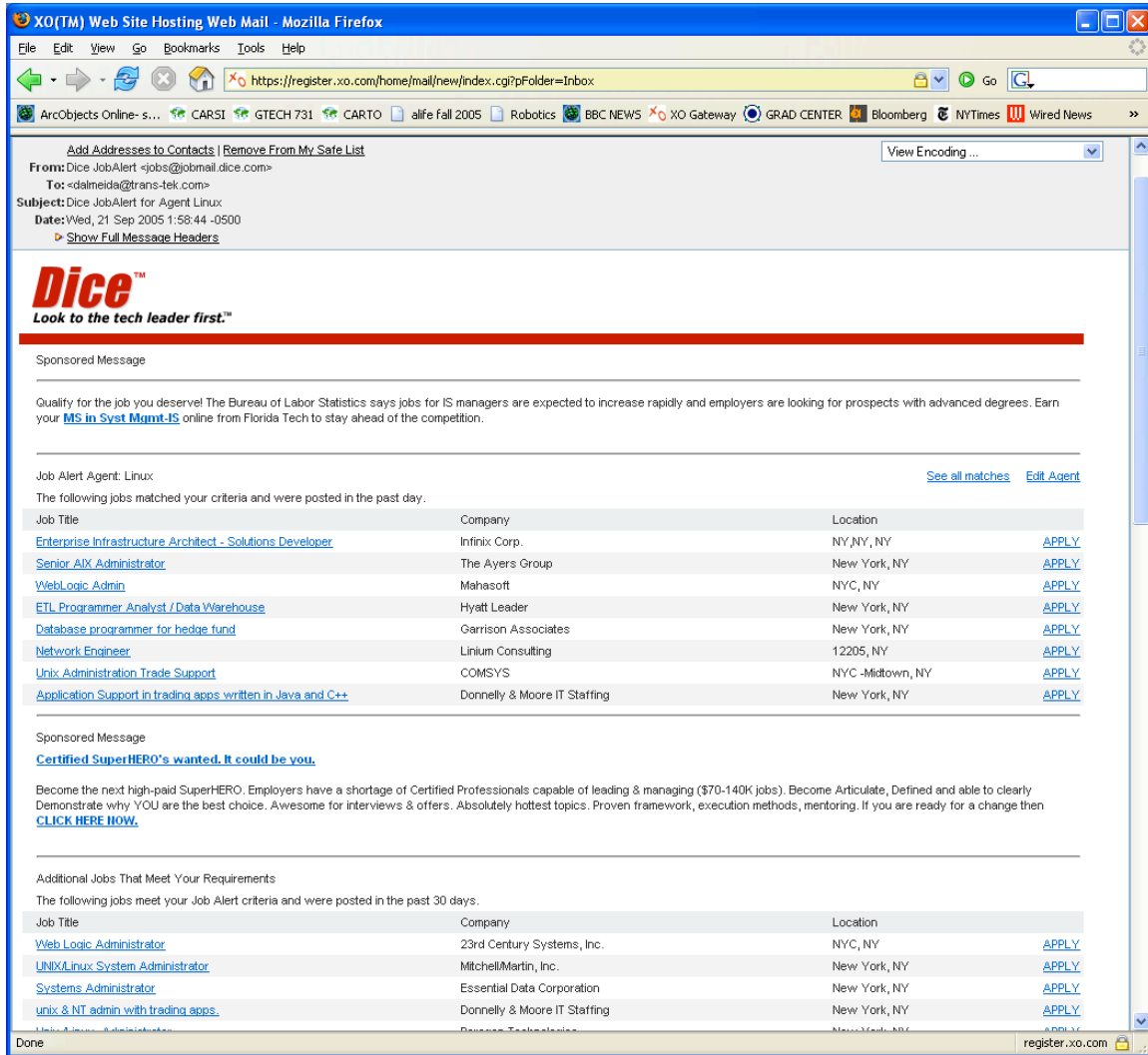


Another (potential) predictive agent:



PIMs (Personal Information Management)

Dice.com “bot”



The screenshot shows a Mozilla Firefox browser window displaying an email from Dice.com. The email header includes the sender 'Dice JobAlert <jobs@jobmail.dice.com>', the recipient 'To: <dalmida@trans-tek.com>', the subject 'Subject: Dice JobAlert for Agent Linux', and the date 'Date: Wed, 21 Sep 2005 1:58:44 -0500'. The email body features the Dice logo and the tagline 'Look to the tech leader first.' Below this is a 'Sponsored Message' section with text about the Bureau of Labor Statistics and a link to 'MS in Syst Mgmt-IS'. The main content is a 'Job Alert Agent: Linux' section, which states that the following jobs matched the criteria and were posted in the past day. This is followed by a table of job openings.

Job Title	Company	Location	Apply
Enterprise Infrastructure Architect - Solutions Developer	Infinix Corp.	NY, NY, NY	APPLY
Senior AIX Administrator	The Ayers Group	New York, NY	APPLY
WebLogic Admin	Mahasoft	NYC, NY	APPLY
ETL Programmer Analyst / Data Warehouse	Hyatt Leader	New York, NY	APPLY
Database programmer for hedge fund	Garrison Associates	New York, NY	APPLY
Network Engineer	Linium Consulting	12205, NY	APPLY
Unix Administration Trade Support	COMSYS	NYC -Midtown, NY	APPLY
Application Support in trading apps written in Java and C++	Donnelly & Moore IT Staffing	New York, NY	APPLY

Below the table is another 'Sponsored Message' section for 'Certified SuperHERO's wanted, it could be you.' with text about becoming a high-paid SuperHERO and a link to 'CLICK HERE NOW'. This is followed by an 'Additional Jobs That Meet Your Requirements' section, which states that the following jobs meet the criteria and were posted in the past 30 days. This is followed by another table of job openings.

Job Title	Company	Location	Apply
Web Logic Administrator	23rd Century Systems, Inc.	NYC, NY	APPLY
UNIX/Linux System Administrator	Mitchell/Martin, Inc.	New York, NY	APPLY
Systems Administrator	Essential Data Corporation	New York, NY	APPLY
unix & NT admin with trading apps	Donnelly & Moore IT Staffing	New York, NY	APPLY
Unix Admin - Infrastructure	Donnelly & Moore IT Staffing	New York, NY	APPLY

Discussion: Does this really qualify as an “agent”? I filled out some forms to do an automatic search.

I’m not sure I call that “learning”. But it does run this “autonomously” and email me results, without my having to do anything. It certainly “amplifies” my abilities in terms of searching for contracts.

It does not go out and negotiate a contract and rate for me.

Seems to fit the definition given of **Gopher Agent**, as well as a **Service Agent**.

Amazon.com

This probably comes closer to being a real software agent, that acts autonomously,
And does not relate only to PIM, but to electronic commerce as well:



It “learns” from what I look at and what I have previously bought.

It “autonomously” comes up with recommendations for me.
And these recommendations are mostly not bad,
(But I would never buy a Paul McCartney album – with his money, he
should probably give them away.)

[But I see below that that I can actually buy Paul McCartney!]

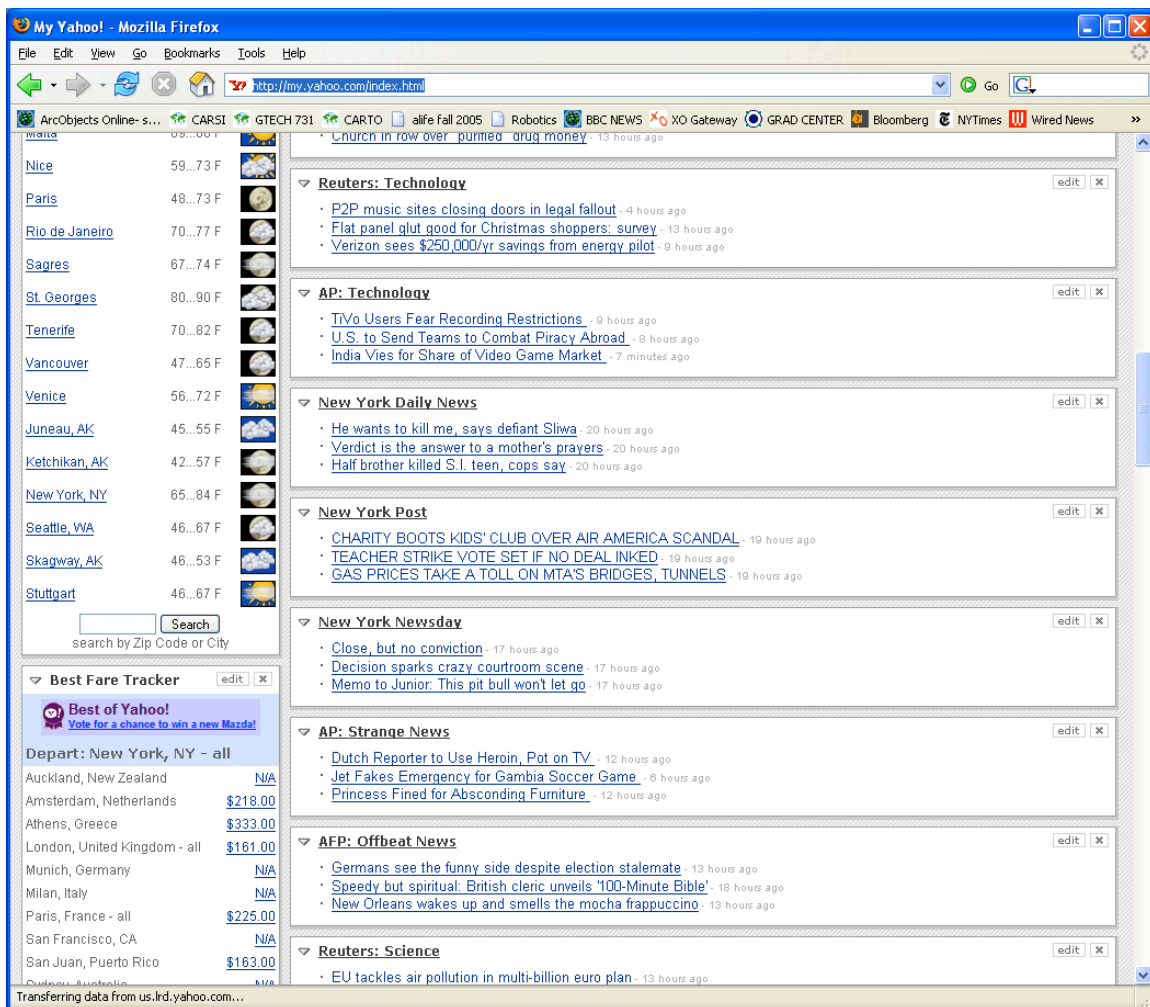
Amazon may even use some type of “Agent” software for this.



Seems to fit the definition of a **predictive** agent, as well as **service performing** agents.

Yahoo profiles: my.yahoo.com

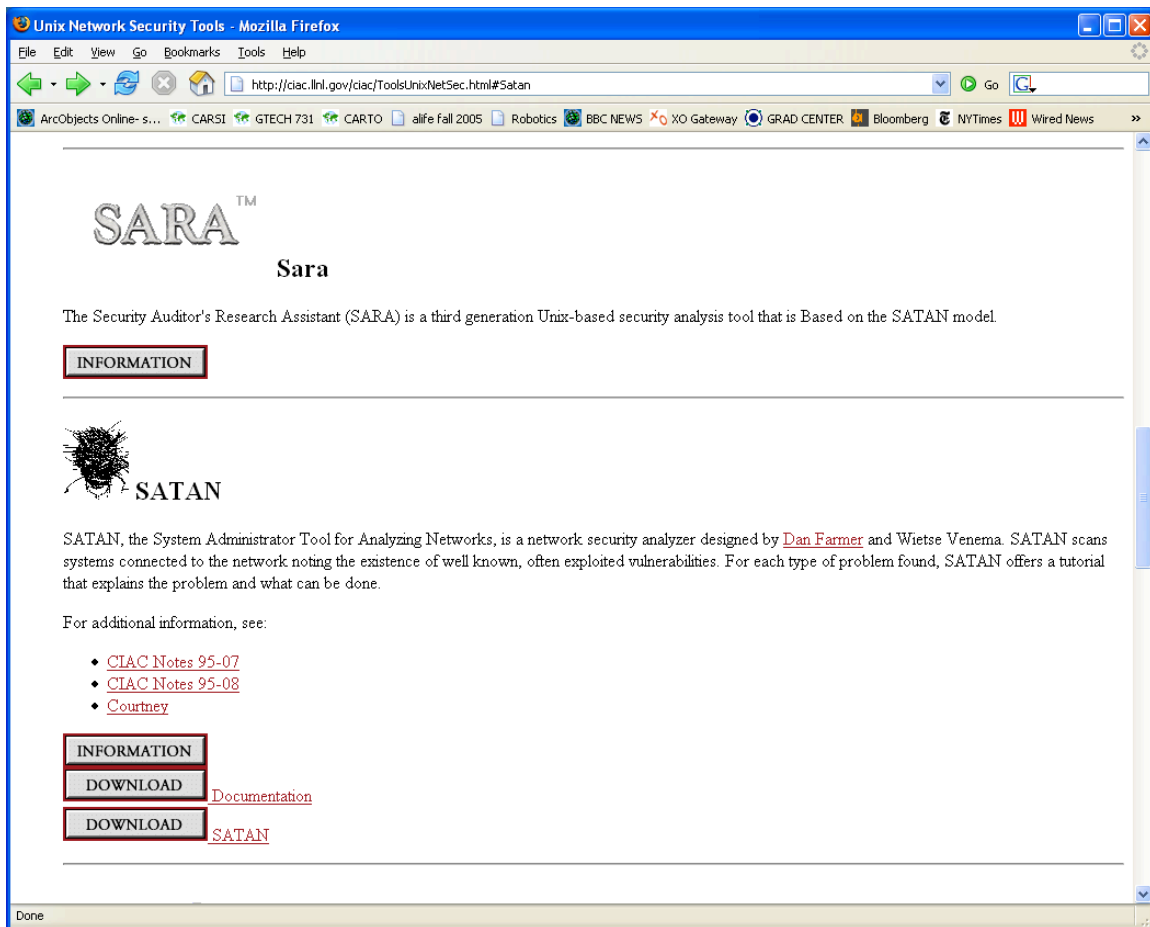
- does this qualify? It does go out and retrieve a number of things that I am interested in, without my doing any more work than authenticating myself.



- I suppose this could be called a Gopher Agent.

Another Application area:

A category that was mentioned only briefly in the paper was intelligent computer and network administration and diagnostic tools, such as vulnerability analysis tools like SATAN:



(Real) Electronic Commerce

Aside from Amazon, most EC on the Web is not very sophisticated.

Unless we look at **Financial Markets**.

“Auto-Execution” protocols and exchanges do allow for agent-type functionality.

And also allow agents to interact “socially” with humans buying and selling things on the other side.

GovTrade and RepoTrade (Credit Suisse First Boston)

I was involved in developing the first TCP/IP-based “automatic” bond-trading systems – GovTrade and RepoTrade, at CSFB in 1994-1996. The systems “negotiate” with other systems and with users (using the Bloomberg Financial Network).

This system had a variety of rules set up to tell it what it could trade, and went about this trading autonomously (with a “kill switch”, of course).
- criteria: prices, size limits, customer agreements

Were these systems agent-based? I’m not sure how to answer that, but the press said we were replacing people, and indeed, we were.

Here, we were automating very high-paid, egotistical “Bond Traders”.

The screenshot shows a web browser window with the title "Wall Street & Technology : CS First Boston automates its repo men.(RepoTrade interactive electronic marketplace) @ Hi...". The address bar shows the URL "http://static.highbeam.com/w/wallstreetamp/technology/july011995/csfirstbostonautoma". The browser's toolbar includes "File", "Edit", "View", "Go", "Bookmarks", "Tools", and "Help". The page content is from HighBeam Research, with a navigation bar including "Library", "Web", "Executives", and "New! Reference". The article title is "CS First Boston automates its repo men.(RepoTrade interactive electronic marketplace)". The author is "Smith, Carrie R." and the date is "July 01, 1995". The article text begins with "In the words of Michael Bloomberg, the key to successfully automating a traditionally manual process is to technologically imitate processes humans are already familiar with. As an example, Bloomberg points to the automatic transmission automobile which essentially operates the same as it did in the late '50s, only with advanced technologies hidden under the hood." The article continues with a quote from Bloomberg: "Automation will be accepted where it basically does what you want in a way that you are comfortable with already," says Bloomberg, founder of Bloomberg L.P. "Automation is seldom accepted where you have got to force the users of it to do something different." The article then states: "Building on the 'familiar' theme, Bloomberg joined CS First Boston to announce the launch of RepoTrade, an interactive electronic marketplace for repurchase agreements, securities lending and buy-sell transactions. The system is the latest in a long line of joint electronic trading services that includes GovTrade for U.S. treasuries, ...". The article ends with a "Read the Full Article" button. On the right side of the page, there is a "Quick Tour" section with a "Take the Tour" button, a "Stay current with HighBeam Research" section with a "FREE TRIAL MEMBERSHIP" offer and a "SIGN UP NOW" button, and a "News@Cisco" section with a "CISCO VIDEO NEWS CHANNEL" and "COMPANY STRATEGY" link, accompanied by a photo of four people.

They autonomously negotiated in the set-up environment.

They negotiated with other “autonomous” systems.

They negotiated “socially” with humans in the exchange market environment.

They fed information onto other processing systems so that proper “business process management” occurred.

Discuss: do any of these Real E-Commerce systems qualify as “Software Agents”?

They certainly fit the model shown for Electronic Commerce in the paper:

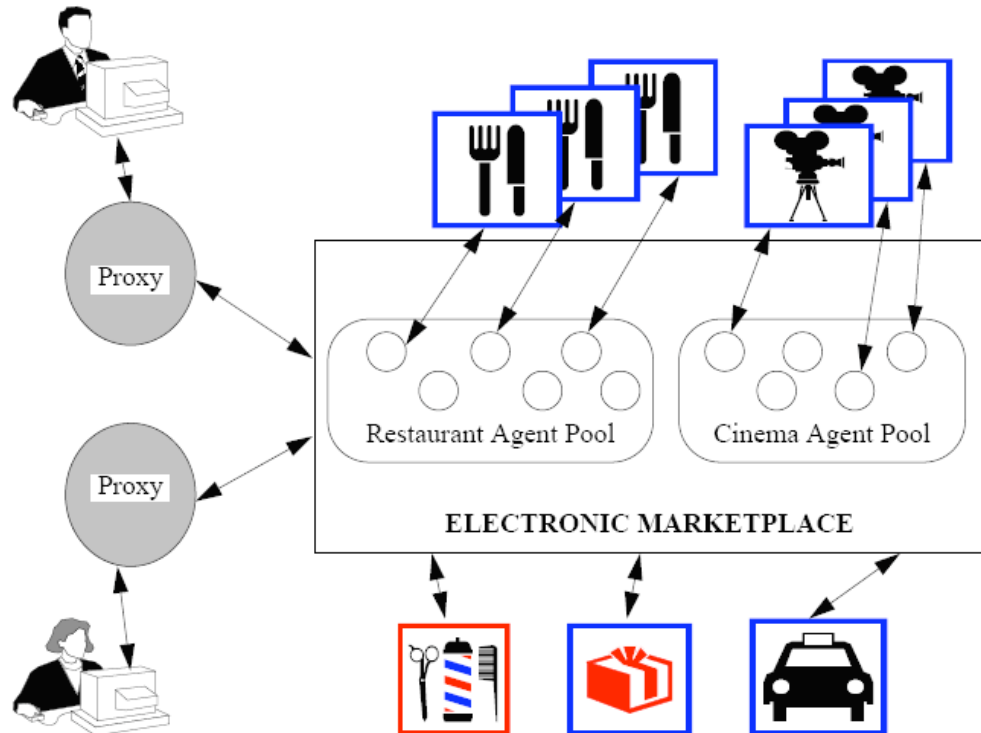


Figure 2: The Electronic Marketplace

These systems combine all of the application characteristics that were mentioned –

Personal Information Management
Electronic Commerce
Business Process Management

They were not built with any specific “Agent” technology – they were built with C++, Unix, and NT.



TradeWeb LLC

Is an electronic “exchange”, that I also helped develop (in 1997), that acts as an agent to allow users to buy and sell fixed income securities (Bonds) for the best price, from a large number of sources. The system itself is automatic, so it performs the functions that Humans used to do (with telephones).

Sell-side Systems that use TradeWeb’s protocol can connect to it and do bond trading.

Buyers use a specialized browser that allows real-time financial information to be disseminated quickly to make Fixed Income (bond) trades, or, their own or third party software that can also allow them to automate this work.

The screenshot shows a web browser window titled "Decision Software - DSTS: Electronic Trading - Mozilla Firefox". The address bar shows the URL "http://www.dsoftware.com/elect_trading.html". The page features a navigation menu with links for Home, Company, Products, Clients, and Contact Us. A sidebar on the left lists various system components: DSTS: Overview, DSTS: Supported Products, DSTS: Trading & Sales, DSTS: Electronic Trading, DSTS: Repo & Finance, DSTS: Treasury System, DSTS: Technology, and BondOne: Overview. The main content area includes a description of the Decision Software Trading System as a real-time sales & trading system for fixed income securities. It also features a "Multiple Distribution Channels" section explaining the system's bi-directional API and its integration with various trading channels. A large data table is visible, displaying columns for Security, Price, Quantity, and other trading-related metrics. The table contains multiple rows of data, likely representing different bond securities and their trading status.

TradeWeb has both the described characteristics of an electronic marketplace:

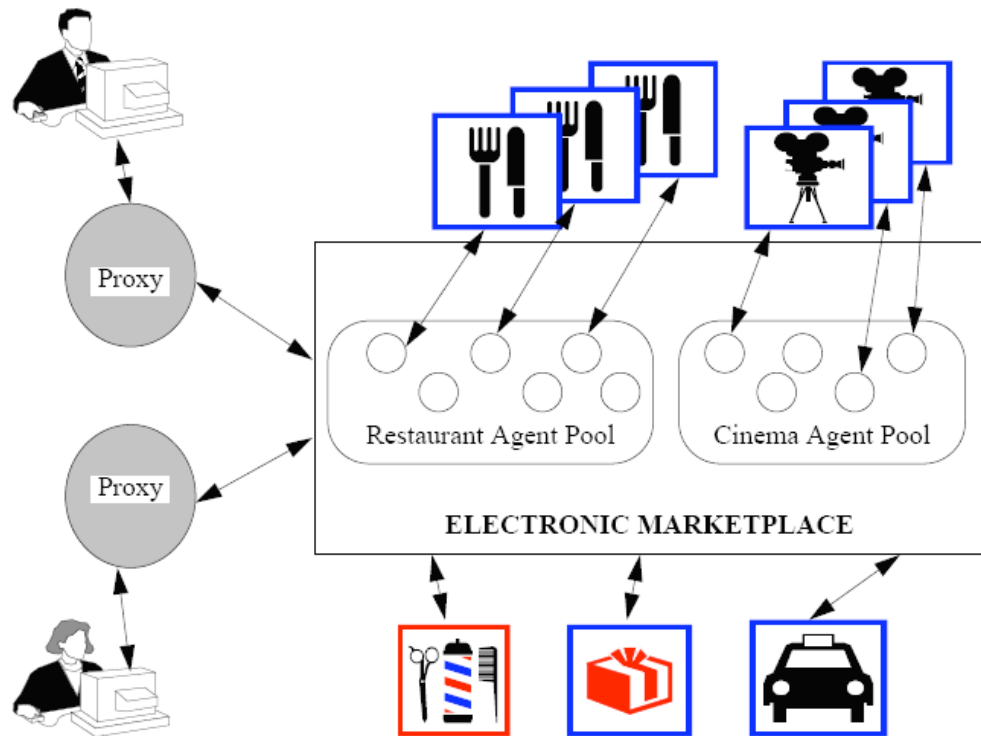


Figure 2: The Electronic Marketplace

And those of business process management:

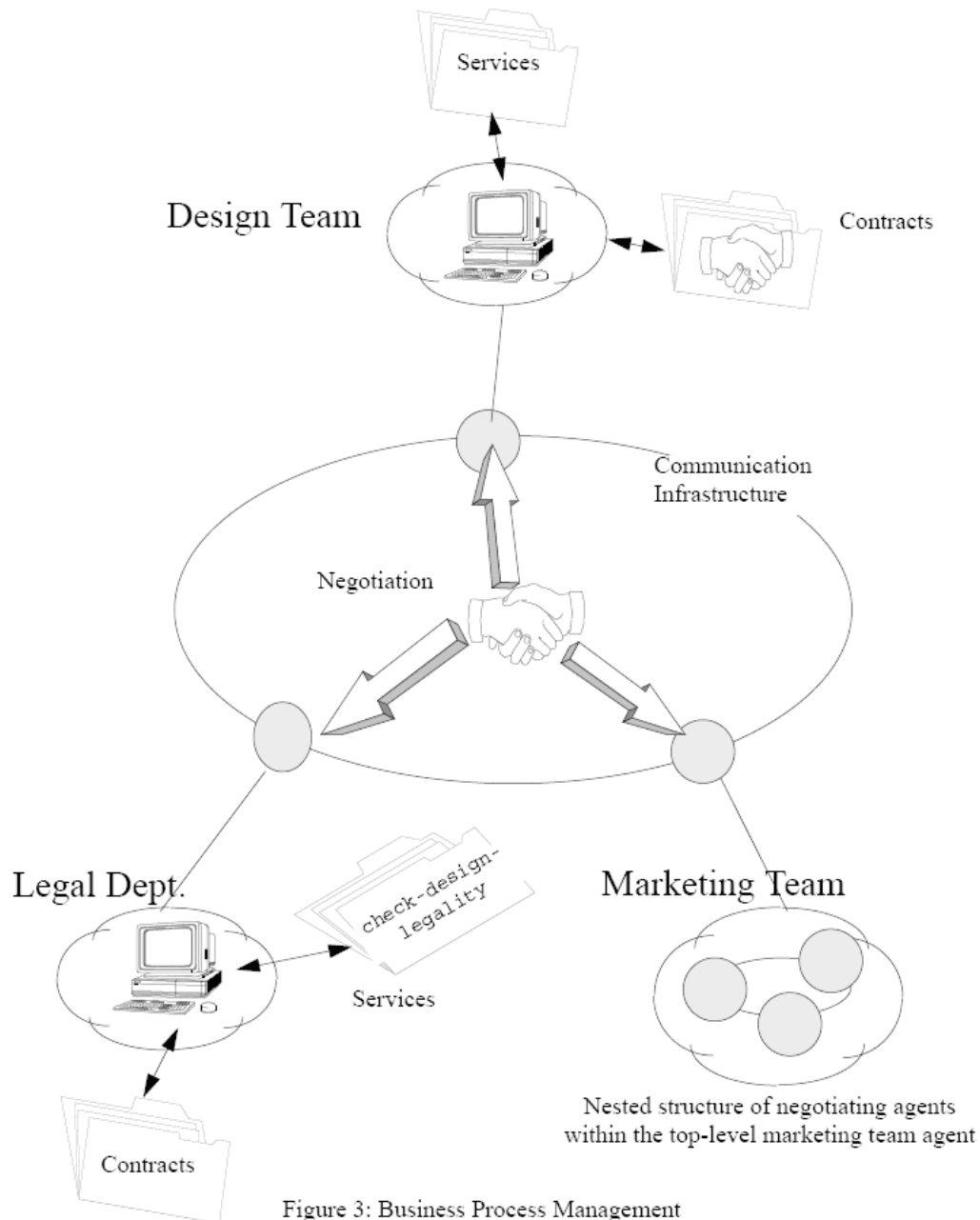


Figure 3: Business Process Management

But there was very little overall effort made to think of “Agents” in the development of any of these systems.

Discuss? So, if it walks like a duck, and quacks like a duck, is it a duck?

In the conclusion, Problems and Promises, Woodridge and Jennings mention:

Software agents may be used to help make software friendlier.

Software agents may be over-hyped.

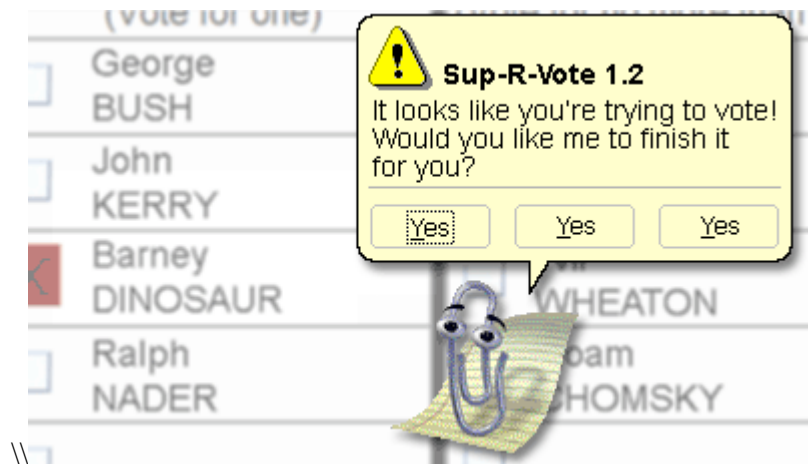
Software agents will not solve all problems

Significant Concerns exist

- privacy
- loss of information (Spam or email filters)
- financial concerns (Automatic transactions may subject users to loss).

Future Directions for Software Agents?

E-Voting



Thank You