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e-Service Journal, Volume 1, Number 1, Fall 2001, pp. 5-19 (Article)

Published by Indiana University Press
DOI: https://doi.org/10.1353/esj.2001.0006

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ABSTRACT

The World Wide Web has unleashed people's imagination and a plethora of new technologies have emerged. Since these technologies have sprung up to address different requirements, it has become imperative to understand how these different technologies fit together. This paper presents the state of the art of these different technologies and tries to present a coherent vision of their inter-operation.

Keywords: *e-Service, e-Marketplace, Agents, Users, Location, Internet*

INTRODUCTION

Recent developments in IT include such elements as agents, e-Services, exchanges/ e-MarketPlaces and those relating to user mobility, wireless web, voice portals, user based personalization and customization. We believe that these developments are beginning to form a coherent *big picture* that will enable the futuristic vision of ubiquitous e-services on the Internet. In this vision users will be able to access customized, context-aware e-services in an all-pervasive manner.

E-SERVICES: THE BIG PICTURE

E-services are appearing on the Internet in the form of e-business sites and portal sites. An *e-service* can be defined as a service available via the Internet that completes tasks, or conducts transactions and is accessible at a particular Uniform Resource Locator. E-services that are capable of intelligent interaction would be able to discover and negotiate

with each other, mediate on behalf of their users and compose themselves into more complex services. This composition could be static or dynamic. These e-services may also be federated in nature. They interact across management domains and enterprise networks. For example, *priceline.com* and *expedia.com* act as the brokers for airlines, hotel and car rentals respectively. They are statically composed e-services that have pre-negotiated understanding with certain airlines and hotels and broker their services through their portal sites. In the emerging dynamic composition scenario, these e-services would enter into agreements on the fly.

In order to enable registration and discovery of e-services, *exchanges* or *e-marketplaces* are emerging. These exchanges provide for businesses or e-services to register themselves, and to be discovered by other businesses in a unified manner.

Another trend that is increasingly becoming common is that of users becoming mobile. These mobile users are accessing one or more e-services for performing their tasks. Accessing e-services through mobile devices is often termed as *m-commerce* (as opposed to *e-commerce,* which assumes e-services being accessed by static users). Mobile users are tracked through schemes like GPS, which help determine their spatial location. Users often need location aware services. For example, a user on the move may desire to find the nearest restaurant of his/her choice.

Users typically will have their preferences and profiles in this emerging context. User behavior on the Internet is guided by these preferences. *Agents* are software entities that represent users. Agents receive requests from the users and act upon them to achieve certain objectives. These agents will be located at certain portals and will proxy for the users (static/mobile). Agents will use spatial and temporal locations of the user and their personal preferences to look up and deliver e-services to them. The agent, thus, not only

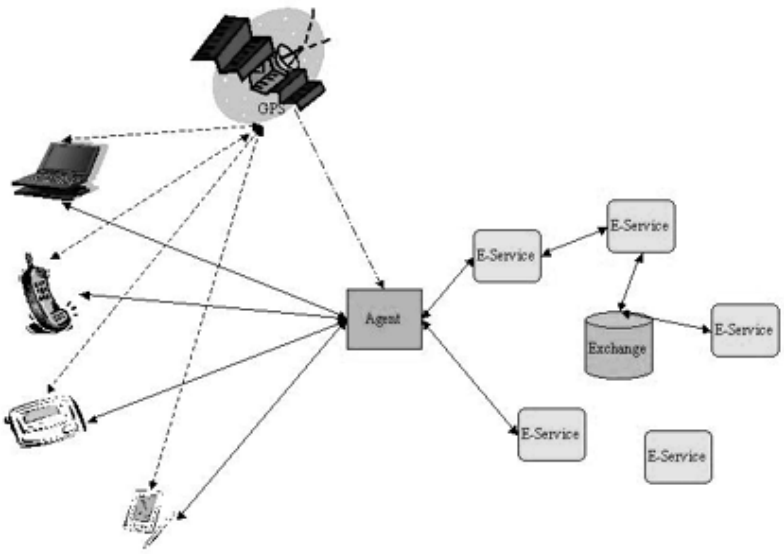

Figure 1. Inter-operation of e-Services and other enabling technologies

needs user preferences/profiles but also inputs about the user location from such location detection mechanisms. The agent in turn uses one or more e-services on behalf of the user. These e-services, in turn could be simple or composite in nature. The composite e-services interact with other e-services after discovering them at e-marketplaces.

The rest of this paper presents an overview of upcoming technologies in the Internet space—particularly, in the areas of e-services, e-marketplaces, agents, users, and mobility. It describes how each of these technologies contributes to the big picture and inter-operates with other technologies.

E-SERVICES AND E-MARKETPLACES

Two predominant trends in computing over the past decade include: (i) a movement from monolithic software to objects and distributed components, and (ii) an increasing focus on software for the Internet as opposed to just the Intranet. E-services are a result of these two trends.

E-services are distributed services that are accessible via the Internet through Uniform Resource Locators (URLs). With this broad definition, any object that can be invoked using Internet protocols qualifies as an e-service. However, e-services—especially those that are used for business critical functions and generate revenue for enterprises—often exhibit many more properties:

1. Discoverable: One of the foremost requirements for an e-service to be useful in a commercial scenario is that it can be discovered by consumers (humans or other e-services). Naming services, trading services, brokers, and marketplaces are some of the ways in which e-services advertise themselves so that they can be discovered by consumers.
2. Communicable: There are two commonly used techniques for invoking or communicating with e-services—the network object model and the document model. The network object model requires the definition of programmatic interfaces (APIs) with a set of methods, arguments, and return values. E-services communicate with each other by invoking the methods defined in these APIs. Microsoft's Distributed Component Object Model (DCOM), Object Management Group's CORBA, and Sun's Remote Method Invocation (RMI) are examples of network object models. In contrast, e-services using the document model exchange documents to communicate with each other. These documents are made up of terms and concepts that are defined in a specific vocabulary. Communicating e-services agree upon the syntactic representation and the semantic meaning of terms in the vocabulary. Extensible markup language (XML) is a popular representation mechanism for expressing vocabularies and documents.
3. Conversational: Sending a document or invoking a method and getting a reply are the basic communication primitives. However, complex interactions between e-services

involve multiple steps of communication that are related to each other. A conversation definition is a sequencing of document exchanges (method invocations in the network object model) that together accomplish some business functionality. In addition to agreeing upon vocabularies and document formats, conversational e-services also agree upon conversation definitions before communicating with each other. A conversation definition consists of descriptions of *interactions* and *transitions*. Interactions define the atomic units of information interchange between e-services. Essentially, each service describes each interaction in terms of the documents that it will accept as input, or will produce as output. The interactions are the building blocks of the conversation definition. Transitions specify the ordering amongst the interactions. E-services need to examine other e-services and obtain each other's descriptions before they start communicating and collaborating.

4. Secure and Manageable: Properties such as security, manageability, availability, and fault tolerance are critical for a commercial e-service. One should be able to monitor the behavior and performance of an e-service and at the same time correct and control any deviations from the normal behavior.
5. Other properties: There are many other properties such as metering, charging, transactional behavior, and accountability that should be exhibited by business e-services.

E-services that exhibit these properties will be able to discover and negotiate with each other, mediate on behalf of their users and compose themselves into more complex services.

As described above, interoperation between e-services requires agreement of many forms—agreement of vocabulary, agreement of vocabulary representation language, and agreement of conversation definitions. Besides, there also needs to be an agreement in various industry segments or domains both horizontal and vertical. Horizontal segments refer to those areas that are common to many e-services—for example, payment, management, accounting, advertisement, discovery, and security. Vertical segments include specific markets such as manufacturing, finance, and health care. Agreement on the vocabularies and conversations used in horizontal segments is essential for most types of e-services. Consider an online banking e-service, for instance. This e-service will rely on various vocabularies and conversation description languages for different parts of its functionality. To advertise with a naming service, it needs to understand the advertisement vocabulary. To communicate with a management system, it needs a management vocabulary. Additionally, to execute its financial transactions, it needs to support a financial vocabulary.

COMMUNICATION STANDARDS

There are numerous efforts in the industry that are aimed at standardizing one or more of these vocabularies or conversation definitions. XML is emerging as a popular lan-

guage of choice for representing vocabularies, documents, and conversation definitions. These specifications are described in the form of Document Type Definitions (DTDs) or XML schemas. CDL (E-speak, 2001), Biztalk (MS, 2000), cXML, cBL, WSDL (IBM, 2001), TPA-ML, X-EDI, UDDI (UDDI 2001), and Eco (CommerceNet, 2000) are all XML-based specifications for representing vocabularies or conversation definitions.

Hewlett Packard's E-speak Conversation Description Language (CDL) is an XML document format for defining conversations. Each conversation comprises of a set of *interactions*. An interaction is defined in terms of the document being received and being sent out. An e-service can be "introspected" to obtain its *service property sheet* consisting of its conversation description in CDL, before indulging in conversation with it. Web Services Description Language (WSDL) is a specification proposed by IBM, Microsoft and Ariba as the standard format for describing web services. WSDL is an XML format for describing network services as a set of endpoints operating on messages containing either document-oriented or procedure-oriented information. In WSDL, the abstract definitions of endpoints and messages are separated from their concrete network deployment or data format *bindings*. This feature allows the reuse of abstract definitions: *messages*, which are abstract descriptions of the data being exchanged, and *port types*, which are abstract collections of *operations.* WSDL is extensible to allow description of endpoints and their messages regardless of what message formats or network protocols are used to communicate.

ECo (CN, 2000) specification has been proposed by CommerceNet for e-service inter-operation over the existing http based framework and requires e-services to provide for certain well known URL addresses at their sites that can be queried to receive their details. This facility enables an *introspection* mechanism on the Internet. For example, in order to provide for successful execution of a query "BusinessGetProperties" on a business it must provide a document at the following URL, which would be invoked by other interested parties, http://www.xyz.com/eco/BusinessGetProperties. ECo is a layered architecture and provides for networks, markets, businesses, services, interactions, documents and information items layers.

E-SERVICES IMPLEMENTATION

Implementing all the properties defined earlier in this section for all e-services is a formidable task. However, the job of an e-service developer is being simplified through software development tools and e-service frameworks. Application servers, web servers with legacy software, asynchronous messaging based middleware platforms like E-speak, .Net (.Net, 2001), and CORBA (OMG, 1998) are being used widely in developing e-services.

Application servers: J2EE was designed to provide for n-tier service architecture as opposed to a 2-tier client-server architecture. J2EE compliant application servers from HP (BlueStone, 2001) and BEA (WebLogic, 2000) combine web server farms with EJB

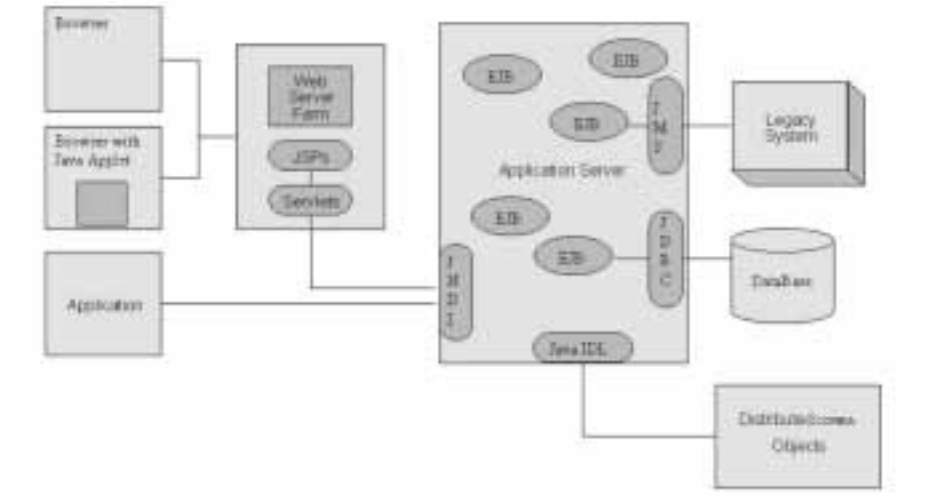

Figure 2: A simplified view of a typical J2EE compliant server

engines. The n-tier architecture consists of the presentation layer, which could be static as is the case with a simple browser or could be more dynamic depending on the usage of Java Server Pages (JSPs), Servlets. The application server logic or business logic as it is usually termed is implemented in the form of Enterprise Java Beans (EJBs). The business logic accesses data from databases through entity beans that in turn use Java Database Connectivity (JDBC) for accessing the databases. They can also access legacy software through Java Messaging Service (JMS).

Asynchronous messaging based middleware

Asynchronous messaging based middleware provide tools and an execution engine for creation and deployment of business logic objects. CORBA and E-speak are examples of such middleware solutions.

CORBA (Common Object Request Broker Architecture), is OMG's open, vendor independent architecture and infrastructure that computer applications use to work together over networks. Using the standard protocol IIOP, a CORBA-based program can interoperate with a CORBA-based program from the same or another vendor. CORBA applications consist of objects that have interfaces defined in OMG's IDL (Interface Definition Language). The IDL definition is language independent. These IDL are compiled into client stubs and object skeletons. The implementation of the interface is hidden from the client. The client acts as if it is invoking an operation on the object instance, but it is actually invoking an operation on the IDL stub which acts as a proxy. Passing through the stub on the client side, the invocation continues through the ORB (Object Request Broker), and the skeleton on the implementation

side, to get to the object where it is executed. Commercial implementations of CORBA like ORBIX are often used as middleware for e-service implementations.

E-speak provides a service engine for creation and deployment of service elements. The service elements are Java objects that encapsulate e-service business logic. Each service specifies its type and intended operation to be performed. The operation could be using the E-speak service engine's basic *infrastructure services* or invoking other e-services. An E-speak service engine consists of a set of infrastructure services including:

- Registration and Discovery: A repository is used to store information about the services registered with the engine. These services can be discovered by other services.
- Routing Service: ensures that data sent by a service to another service is properly routed depending on whether the service invoked is on the same engine or another.
- Events and Advertisement Service: enables services to advertise themselves in certain vocabularies to one or more E-speak engines. These e-services can also send events to each other.
- Management and Security: E-speak provides mediation between e-services and provides for the management of its services.

Web E-speak provides for web-based access to an e-speak service engine. An E-speak service engine can thus be used to create a web based e-service implementation.

Legacy software with web server farms

There is a set of legacy software like SAP R/3, which have been traditionally used to implement business software. These implementations are based on a client-server architecture. In order to make this software web enabled, efforts have been directed towards using web server farms in conjunction with such software.

E-MARKETPLACES

An e-MarketPlace is a virtual meeting place managed by an intermediary supplying a series of benefits to participating e-Services:

- Enabling registration and discovery of e-services;
- Enabling inter e-service interaction with or without the direct participation of the e-marketplace in the actual interaction after the discovery;
- Matching e-service supply and demand requirements through either fixed pricing mechanisms (catalog purchasing, RFP) or through dynamic pricing (auctions, exchanges);
- High value added services, such as payment, financial, logistic, rating and certification services, etc; and,
- Co-operation in managing supply chain (collaborative planning, collaborative inventory management, collaborative product development).

Vertical and horizontal e-MarketPlaces are emerging in this regard. VerticalNet (VNet, 2001), GlobalNetXchange (Gxchange, 2001), and Retailers Market Exchange (Retxchange, 2001) are examples of Vertical Exchanges which target a specific section of the industry with key players performing B2B transactions. Other examples like Chemdex, E-Steel and DirectAg.com have been successful in their respective industries. There are now more than 500 companies that are in some stage of creating an e-marketplace. Horizontal exchanges in turn are directed at a broad range of players; e-Bay is a typical exchange which targets a range of clients and businesses.

Universal Description Discovery Integration (UDDI) is an emerging standard for enabling inter-operation of e-services through registration and discovery at *operator sites.* An operator site maintains a repository at which e-services can register themselves in certain template models (tModels). A tModel specifies certain attributes, which can be used to describe the e-services. UDDI specification provides APIs for e-services to register themselves and discover each other in certain tModels.

AGENTS

The term "Agent" is overloaded with many meanings in the industry and literature. Multiple definitions of Agent have been proposed. Ferber's definition of an agent (Ferber, 1999) is that it is a physical or virtual entity,

1. which is capable of acting in an environment.
2. which can communicate directly with other agents.
3. which is driven by a set of tendencies (in the form of individual objectives or of a satisfaction/survival function which it tries to optimize).
4. which possesses resources of its own.
5. which is capable of perceiving its environment (but to a limited extent).
6. which has only a partial representation of its environment (and perhaps none at all).
7. which possesses skills and can offer services.
8. which may possibly be able to reproduce itself.
9. whose behavior tends towards satisfying its objectives, taking account of the resources and skills available to it and depending on its perception, its representation and the communications it receives

Various notions of Agenthood or *Agency* have been defined in the agent literature. These include weak and strong agency, which are defined below.

Weak Agency

An agent is considered to adhere to a weak notion of agency if it comprises all of the following properties:

- **Autonomy.** An agent needs to operate independently of its user, after having been

given tasks and limitations (Castelfranchi, 1995; Maes, 1990). To this end, an agent needs to have control over its actions so that it can determine what to do when an action succeeds or fails.

- **Social ability.** Agents must be able to communicate with the outside world (Maes, 1990; Genesereth, 1994). This interaction can exist at a number of levels depending upon the capability of the agent, but typically an agent would need to communicate with other agents and the local environment and sometimes with users.
- **Reactivity.** An Agent must be able to react to changes in its environment. Agents need not only be aware of their environment, but they need to be aware of what the state and changes in that environment mean and how to react to them.
- **Proactivity.** Agents need to be able to exhibit pro-activity, that is, to demonstrate goal-directed behavior and to take initiative to achieve these goals.

Strong Agency

Further notions of attributes for agents include descriptions that possess more specific meaning than weak agency, that is, they are attributed characteristics and tasks that would normally be ascribed to humans. Mentalistic notions of knowledge, belief, intention and obligation might be attributed to strong agents above and beyond those defined for a weak agent (Shoham, 1993). Additionally, agents can be represented visually by attaching an icon or a face (Maes, 1994). These types of agents are being used in both Human Computer Interaction (HCI) scenarios to help the social interaction between a user and their agents, and also in the computer gaming community to produce virtual characters that react in believable and human ways to given situations.

Several software agents have been designed and implemented. Zeus (Nwana et al., 1999), Mole (Strasser, 1999), Tacoma (Johansen, 1998), Aglets (Lange, 1998) are some examples of agent systems/toolkits that can be used to create agents. In addition to agent toolkits there are certain online personal agents that can be used. BargainFinder is an example of such an agent that searches several online music stores for lowest prices on CDs and cassettes. The system is essentially a database search engine. Shopping is limited to retailers that subscribe and pay for the customer referrals. Firefly was designed to be an agent based mail-order outlet. Through surveys and ratings it learnt user preferences in music styles and selected a list of CDs according to these preferences. Agents have been designed to buy and sell on behalf of users in marketplaces (Maes, 1999). Kasbah (Chavez, 1996) is such a web-based system. Bizbots (Bizbots, 2000) and Frictionlesscommerce (FC, 2000) use agent technology for enabling e-commerce.

The Foundation for Intelligent Physical Agents (FIPA, 1996) is an international organization that is dedicated to promoting the industry of intelligent agents by openly developing specifications supporting interoperability among agents and agent-based

applications. Its intent has been to standardize the different agent implementation. For this purpose, FIPA has defined an agent abstract architecture which consists of *Agents* and *Services*. Agents communicate by exchanging messages which represent speech acts, and which are encoded in an *Agent-Communication-Language (ACL)*. Service provide support mechanisms for agents. The current version of the Abstract Architecture defines two support services: *directory-services* and *message-transport-services.*

USER

Users are humans who use e-services. They have unique preferences and possess a variety of different devices to access these e-services. With the arrival of portable devices more and more users are becoming mobile.

User Mobility

Mobile users pose a new problem to the networks and applications designed for static users. Mobile users are characterized by fallible and resource constrained links they utilize and the resource constrained devices they operate on. These mobile devices need to be small and portable. Because of fallibility of their connections and being battery powered, these devices are prone to frequent disconnections. The connection made by the user could be temporary or permanent. Permanent connections are made using wireless networks. The wireless networks that are available for use are cellular networks, wireless LANs, wide area wireless networks and paging networks. Wireless communications use several different common access techniques such as FDMA, TDMA, GSM, CDMA and CDPD. As wireless technologies have progressed, mobile devices have proliferated. Mobile devices being used are either PDAs (Windows CE based or PalmOs based), cell phones, laptops, palmtops or combinations of the above.

User mobility and proliferation of mobile devices have led to the concept of Mobile Commerce. *M-Commerce* and wireless transactional services are the consummate extension of the e-commerce revolution that is changing the business and consumer marketplaces.

M-commerce clients (as opposed to e-commerce clients) are more likely to directly buy than do comparison-shopping. In the case of m-commerce users, geography plays an important role. It is necessary to identify their location and provide them location-based services. For example, @Road is building an application that uses GPS technology to track the location of a vehicle and provide services based on the user location.

GeoVector also has an interesting application. They are developing a technology with which you can point your device (cell phone, PDA) towards an entity to find out more information. Pointing to a restaurant for example, downloads its menu onto your

device. Also you can point to indicate the direction you are interested in. For example, you are driving in a particular direction and you are interested in finding only restaurants ahead in your direction of driving; so, you can point your device to the front.

Inventrix is another company that is building a portal solution which deals with wireless carriers, providers and presence locators on one side so that users can connect to their portal and access the m-commerce content providers.

Entertainment applications are the top revenue earner for NTT DoCoMo's widely popular Internet service. DoCoMo uses the I-mode server technology. I-mode servers maintain user and billing information and mediate between the users who connect through PDC-P (Personal Digital Cellular-Packet) network on the one hand and content providers on the other. They have come up with a mobile markup language (MML) and deliver content to about 13,014,000 subscribers. Most of these services are gaming-oriented (virtual fishing, golf, gambling, dating game etc). Some of the I-mode enabled phones are embedded with J2ME (Java 2 Micro Edition) to deliver interactive and dynamic content.

Certain standards are emerging for the message exchange protocols over wireless networks. One of these standards is WAP/WML. WAP is emerging as the defacto standard for providing Internet communications and advanced telephony services on mobile devices. If a phone or other communications device is said to be WAP-capable, this means that it has a piece of software loaded onto it (known as a micro browser) that fully understands how to handle all entities in the WML DTD. WML is a markup language that is based on XML (eXtensible Markup Language). The official WML specification is developed and maintained by the WAP Forum (WAP, 2000), an industry-wide consortium founded by Nokia, Phone.com, Motorola, and Ericsson. This specification defines the syntax, variables, and elements used in a valid WML file.

Voice access to Internet-based content is going to become increasingly important, especially in the case of mobile users. A host of enterprises are trying to provide portal solutions that can be accessed by voice. BeVocal, a pioneer in this arena is a voice-based portal (available at 1-800-4Bvocal) that provides location-based services like driving directions, restaurants and hotels in a particular area. It uses voiceXML and creates speech Objects for modeling the vocal interactions. PipeBeach is another player in this arena and provides voice-based email, m-commerce services like trading, and auctions. It has a platform called speechWeb and uses voiceXML and custom templates to deliver results. The custom templates enable operator branding. VoiceXML (VoiceXML, 2000) and the arrival of voice portals have given an interesting dimension to the concept of m-commerce. Mobile users would, in the near future, be using voice to interact with e-services either directly or through voice portals. Voice portals like TellMe (TellMe, 2000) and beVocal (BeVocal, 2000) are a step in this direction.

User Preferences and Customization

Users are unique in their preferences and proclivities. They visualize and access e-services in a unique manner leading to the concepts of user profile and customization. Also, the different capabilities of their mobile devices need content transformation. The content of web pages needs to be adapted for pervasive computing devices. This tailoring process is called *transcoding* (Mohan, 1999). The transcoding system adapts video, images, audio and text to the individual pervasive devices.

The goal of the Client Capabilities/Personal Preferences (CCPP, 2000) framework at W3C is to specify how client devices express their capabilities and preferences to the server that originates content. The origin server uses the user profile to produce and deliver content appropriate to the user device.

LOCATION AWARENESS

As the users become more and more mobile, mechanisms are being developed to detect their locations. Several technologies have either become well established in this domain or are being researched/developed. Location awareness has utility for desktop and nomadic users, as well as for phones and other appliances. Physical location can be provided from the cellular or enterprise network, from a GPS signal or even a user, and all these techniques are likely to co-exist. Location awareness however raises the issue of user privacy. Users should be in control of the information revealed to other service providers.

A Global Positioning System (GPS) is a satellite navigation system that provides specially coded satellite signals that can be processed in a GPS receiver, enabling the receiver to compute position, velocity and time. Four GPS satellite signals are used to compute positions in three dimensions and the time offset in the receiver clock. (GPS is funded by and controlled by the U. S. Department of Defense.)

While GPS solves the problem in a global manner, a limited location detection technology is the ActiveBadge technology (Want, 1992). An ActiveBadge is a tag that emits a beacon. A network of sensors placed around the host building picks up these periodic signals. A master station also connected to the network polls the sensors for badge "sightings," processes the data and makes it available to clients in a visual form if need be. Pulse width modulated infrared signals are used for signaling between the badge and sensor.

The CoolTown Project (Debaty, 2000) at HP Labs envisions a world where people, places and things are web enabled. All of them will have unique URLs. Within CoolTown there are two fundamental types of locations: the semantic location and the physical location. The semantic location specifies the context of the person, place or thing in the context of a *space*. A space can have resources and being in a particular space can give

a person access to these resources. The physical location of the person/place or thing in turn is based on the absolute position. Beacons are used to provide the semantic location of a space. A Personal Access Devices (PAD), such as a WAP enabled cellular phone, which is in range of such a beacon, will be able to access the Web page pointed to by the URL.

EMERGING DEVELOPMENTS

Recent developments point towards a gradual shift towards the big picture as enunciated earlier. This shift, however is happening in a piecemeal fashion as described below:

Interoperation of E-Service Implementations with Mobile Devices

Application servers like Bluestone and asynchronous messaging based middleware like E-speak are providing mechanisms for closer integration with mobile devices. Bluestone, for example, provides for a Universal Listener Framework (ULF) for WAP/WML enabled mobile devices to send queries and receive results. E-speak has a web-based component that provides for XSL transformations of WML documents into E-speak XML documents to create sessions with the e-speak service engine, and perform registration, discovery and communication with one or more e-services.

Integration of Mobile Devices with GPS

Mobile devices are being coupled with location awareness mechanisms like GPS. Such devices, like all consumer technology devices, have gotten smaller and cheaper. The state of the art is as follows:

- **HandSpring Visor** PDAs can accept an attachable GPS Springboard module.
- **Casio's GPS Watch** puts the GPS on the wrist.
- **Magellan Map GPS** is a stand-alone handheld GPS that enables planning of routes and helps leave marks when venturing into uncharted territory.
- **Alpine's Navigation System** for cars uses GPS to track and calculate the route while driving, and provides warnings and directions as turns are taken.

In addition to travel, GPS devices will be embedded in a host of new devices including the following:

- The FCC's E911 program mandates cell phone companies be able to locate their callers within 100 meters by 2001.
- Freeplay Energy is developing a human-powered GPS receiver.
- Digital Angel is working on a GPS device that, if implanted in a human body, transmits location and health information.

Inter-operation between Agents and E-services

Most of the e-services being developed communicate in XML. Agent technology, however, predates the e-services wave and relies on Agent Communication Languages like KQML, KIF for inter-agent communication.

Recently, there have been efforts on two fronts; (a) Agent languages have been revisited in XML. (b) BRML (Benjamin 1999) is an XML Rule Interlingua for Agent Communication, based on Courteous/Ordinary Logic Programs. It is used in connection with *CommonRules* from IBM, and was developed in connection with IBM's Business Rules for E-Commerce Project.

On the other hand efforts are emerging to make e-services more agent like by becoming more autonomous, reactive, proactive and communicative.

CONCLUSION

A host of Internet-related technologies have emerged over the years. They have been developed to meet various needs in the marketplace. While E-services and E-marketplaces are relatively new technologies that are being developed to enable the Business-to-Business (B2B) model of operation, personalization and agent technologies were developed for enabling delegation of user tasks. However, these technologies are beginning to form a coherent picture to deliver the ubiquitous e-services vision.

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