Ubiquitous Policies and Location specific Frameworks

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Abstract— Computing systems are becoming increasingly mobile, facilitated by advances in wireless networking, battery technology, the emergence of low-powered and low-cost portable devices, wider deployment of standard communications technology and changes in user working patterns. During the course of a day mobile users may interact with many different mobile and stationary computers in many different locations and situations. Due to these developments, a new paradigm of computing interaction has emerged: this is termed context-aware. A context-aware system is one in which applications have knowledge of their surrounding physical and computing environment. This environment is composed of people, mobile and fixed computing devices, and such things as doors, walls, desks and chairs. Mobility of users causes frequent and unpredictable changes in user location and in consequently available resources. Access control to resources is crucial to leverage the provision of ubiquitous services and calls for novel solutions based on various context information, e.g. user location, device properties, user needs, local resource visibility. Context-aware applications aim to acquire and utilize information about the context of a device and its user to provide services that are appropriate to particular people, place, time and events. In this paper, we will discuss location specific policies and corresponding frameworks in literature and various issues to be dealt while understanding to make a context aware application.

Index Terms— Context-Aware, Framework, Moving Locations, Ontology, User’s Preferences etc.

I. INTRODUCTION

Mobile agents can play a critical role in enabling dynamic applications on mobile phones. They can carry executable code, making possible effortless downloading of new capabilities and services to mobile phones. When combined with services that support context awareness, user customization, and sensitivity to the mobile phone environment, mobile agents can be used to provide the basis for a rich set of applications. This paper provides an overview of the problems faced in location specific context environments/domains and outlines the various approaches which are being followed up to now in different perspectives. Ubiquitous computing has differed from traditional computing in terms of computing (such as desktop workstations or notebooks to smaller customized mobile terminals, PDA or Web-phones), and trend towards the proactive interaction of computing devices with their peers and surrounding network infrastructure, often without explicit operator control. By using a variety of technologies to track the current contexts, such as location and activity of the users (for example, whether walking or driving and whether in the office or home), future networks should be able to intelligently manage both the content and delivery of information. A pervasive system has three basic functionalities i.e. • Sensing – finding and presenting information and services to a user • Reasoning - tagging of context to information to support later retrieval; • Acting – executing a service for a user [8].

The rest of this paper is organized as follows. Section 1 discusses brief about some agent platforms, Contexts and definitions by different researchers. Section 2 discusses about different types of frameworks and middleware’s supporting mobile application to tune with contexts. Section 3 describes about different parameters affecting application development in context environments. Section 4 provides an adaptive mobile environments and suggesting some of related works made on principle of location aided services.

A. Softwares or Mobile agents

An application developed in context to location awareness must be developed using some software programs. Any context-aware software made as per policies should adapt according to the location of use, the collection of nearby people and objects, the accessible devices, as well as changes to those objects over time. Software agents do not operate on their own rather, they operate in an agent platform. One of the most popular, and still growing agent platforms is JADE (Java Agent DEvelopment Framework) that simplifies the implementation of multi-agent systems through a middleware that complies with the FIPA specifications. The agent platform can be distributed across machines (which do not even need to share the same OS) and the configuration can be controlled and even changed at runtime by moving agents via a remote GUI. Agent technology originated from research of collaborative agents, in particularly in distributed AI and
multi-agent systems to be used in context location environments.

II. CONTEXT DEFINITIONS AND FRAMEWORKS

Context information may be divided as per information • The primary context information consists in spatial information (identity, time and location) used to index or to identify entities. • The secondary context information consists of further aspects of a given entity, for example its current state, its activity. Typical location-based services can be distinguished in four categories i.e. Traffic coordination and Management -Traffic jams, inform the subscribers the fastest route between two positions at the moment, Location-aware advertising and content delivery- subscriber tells to the service about shopping mode, he receives sales information (e.g. discounts) with his shopping preferences ,Integrated tourist services-Advertisement options for numerous tourist services and guided tours, to accommodation information, transportation, cultural events and museum guides ,Safety-related services-Monitor tourists or workers traveling in dangerous terrain and guide to destinations along safe paths and Location-based games and entertainment-Treasure hunting, and the location-based ICQ service. The following additional information should be included like type of the location-based service, Identity of the location-based service, required location information accuracy, time stamps and type of user equipment. The development and deployment of context-aware mobile artifacts are still at their infancy, with few theories and little empirical evidence about how to develop an effective context-aware mobile application. In making any type of mobile application enabled via mobile device, Laptop, PDA, we need to make a framework which will guide whole process of working. Some of frameworks, already built up supporting desired services are given below

A. Prediction Frame for Resource Management Review Stage

A predictive framework is discussed for location-aware resource optimization in smart homes or intelligent (indoor) environment based on the hypothesis that the mobility of an inhabitant creates an uncertainty of his location and framework reduces that uncertainty. The concept of the asymptotic equi-partition property (AEP) is also used to predict the inhabitant’s most likely routes with a high degree of accuracy. The MavHome[4] architecture is a hierarchy of rational agents that co-operate to meet the overall goals of the home where an agent’s functionality is accomplished by four cooperating (logical) layers. The Decision layer is responsible for the selection of actions to be performed by the agents based on the processed information from other layers. The Information layer gathers, stores, and generates knowledge useful for decision making, routing information between agents, users. Finally, the basic hardware within the house, including device and networking technologies, are contained in the physical layer. The in-building sensors monitor the environment and transmit the necessary information through the Communication layer. The database updates the learned information and predictions and alerts the Decision layer of the presence of new data.

B. Platform for enabling Context Aware Services and advertisements to mobile users

A platform for enabling context aware services, allowing easy deployment in both home and business premises and flexible management of complex services is discussed[10] stating it to be an intelligent call redirection service which dynamically (re)routes communication sessions depending on the location, occupation and social networks of users e.g. traditional phone calls, Instant messaging, voice over IP sessions or Video Conferences. The context aware platform takes care of the aggregation and abstraction of context information e.g. locations of users, presence information, user preferences, etc. whereas the Service enabling platform facilitates the development, deployment and management of complex services as the use of context information is made transparent to the application developers and the platform does not impose any performance restrictions on the developed and deployed services. The framework’s persistence layer contains all static information needed by the other layers. This comprises context information about users, devices, the environment, etc. but also positions RFID tags used by sensor services in the context gathering layer. The device layer comprises all devices and software on those devices that deliver context information. For example a WiFi client on a PDA measures the signal strengths of access points in the neighborhood and sends this information to a location system. The Context gathering layer takes care of the acquisition of the specific context information (location and presence information).The Context framework layer is responsible for the aggregation of the context information according to a formal context model and the derivation of implicit information by reasoning and using ontologies for formal analysis and interpretation. In another paper, Location Aware Shopping Advertisement (LASA), with the main goal to maximize the service utility to users and advertisers is discussed[20] where LASA client is an application that can run on any mobile device equipped with WiFi to wirelessly connect to an AP linked with the server and retrieve advertisements of products. Ontology based formulation of user and advertised product profiles and the process followed by an Ontology reasoner are used to select ads that will interest a particular user with high probability. Dynamic parameters such as the time of day and user location and other parameters of user profile (age, income, education and basic interests) and specific interests in product categories are also considered. The framework provides a service-oriented architecture where components have the ability to issue new services, discover each other and therefore collaborate, using any service provided in the framework so mobile device does not need a GPS receiver or any other localization technique for user.

C. Intelligent map agents and Location tourist guide-ubiquitous personalized GIS

Authors in the IMA architecture[19] advocate replacing the monolithic approach to geographic information systems with a new dynamic, lean, and customizable system
supporting spatially-oriented applications. These systems are special purpose systems each of which targets a particular application i.e. Project CREATION of User-friendly Mobile services PErsonalised for Tourism (CRUMPET)[18] seems to be one of the first systems employing agent technology for implementation, validation and trial on GIS applications and developing an integrated, spatially enriched information architecture supporting FIPA standard. Some of the key technologies used in CRUMPET are intelligent agent technology, embedded devices technologies (PDAs, Mobile phones), UML, XML and Java. Equipped with a handheld device, users of CRUMPET (e.g., tourists) can request information, such as the Italian restaurant closest to their current location, or schedule information for public transport in another city. The Crumpet project enables a mobile agent to find certain sights, to present them on a Map and to calculate a route to a selected one. The software developed by eNarre[26] provides predetermined tours presenting the most important sights in many big cities all over the world. The tourist needs a PDA with a special player loaded with the content for the particular tour. Another research framework is the Deep Map Project with its objective to develop a digital personal mobile tourist guide using GIS, databases, natural language processing, intelligent user interfaces and knowledge representation. The guidelines to make IMA are organized in three categories: user, services, and user community. The three categories reflect user behavior and user activity types. The user category consists of guidelines related to user characteristics and behavior that a user exhibits during his/her activities. The DTG[22] is a mobile agent that selects attractions, plans an individual tour, provides navigational guidance and offers location based interpretation. During the execution of the tour, the tourist will be guided to the next Tour Building Block (TBB) using standard navigation software, like MS Mappoint or Navigon[19]. When the tourist starts walking, the DTG determines the actual walking speed of the tourist on this day, given the conditions of the sidewalks and streets. This update of the personal context might make a recalculation of the remaining necessary tour. DTG provides introductory information via a headset suitable to the direction from which the tourist is approaching the TBB. As long as she/he is in the proximity of the TBB, the tourist will receive audio information. As soon as she/he leaves the TBB, the DTG will stop the information provision and restart the navigational guidance towards the next TBB. In case the tourist stays much longer than initially assumed, the tour for the remaining amount of time will be recalculated. Based on an ontology, it selects a restaurant according to the guest’s preferences and makes a reservation when planning an evening. In order to build the DTG, the following challenges are addressed like acquisition of the interests of a tourist in a mobile context to seek the profile, ranking of TBBs by semantic matching, computation of a tour in less than 5 seconds, Context aware interpretation of the environment and tour tracking and adaptation.

D. Uniform Web Presence Architecture for People, Places, and Things

The dynamic generation of web contents based on the user context (location, identity, device capabilities), security permissions, and the relationships with other web presences[6] using ASP/JSP model explains that when a patron enters the museum, the Web presence of the museum is automatically updated and linked to the web presence of the patron. This supports the ability to get the count of the number of patrons and showing where the patron currently is. The patron visits her favorite painting, and selects the poster-making service available through the Web page. A life-sized poster is created for her in the gift shop while she continues to browse the collection, available for her to pick up on leaving. This supports the patron’s husband finding out where she is. The patron web presence could as well be automatically linked to the web presence of the devices (cell phone, handheld computer, etc), she is currently carrying. Analogously, the museum Web presence could be linked to the Web-present devices or things (printers, computers, paintings, etc.) located inside the museum. The dynamic generation technologies consist of combining static HTML code with script commands that are processed on the server side and can generate dynamic HTML[10]. The XML format represents an entity in a relationship between web presences, is used for sending raw data to a client application.

III. PARAMETERS AFFECTING CONTEXT CO-ORDINATION MANAGEMENT

There are a number of issues which are needed to be resolved while making an application so there are some research papers highlighting essential technicalities/issues so as to aid application development in context ubiquitous environment.

A. Rule-Based approach for Applications

The authors [11] propose support for the development of a rule engine component capable of processing context-aware applications behaviors. This component can be implemented by using Jess[21], a well-known tool for developing rule-based systems. Event-Control-Action (ECA) pattern is defined whenever some specific circumstances change in the user’s context, the applications should be able to consequently adjust their behavior in an architectural pattern that can facilitate the development of context-aware applications, since it presents solutions for recurring problems associated with managing context information and reacting upon context changes.

B. Negotiations Context Information

The dynamic, adaptive provisioning of context information by agents require negotiating context features[9](location, identity, and activity), engagement(condition, events, and actions) and dependency. So, context-aware systems require components like Context ontology and inference to facilitate the sharing, management, and inference of a given context, Context-level negotiation to agree on levels of context that can be provided and enable personal context provisioning and Context management to store, retrieve, query, and modify context information if no user is interested in all available contexts. These negotiations give a concept of context-level agreement (CLA), in which
entities negotiate context specifications using an ontology-based model as CLA’s do protection against unexpected performance degradation because context providers know users’ needs and can thus better manage their resources. There are three broad types of CLA’s. (a) Passive context (b) Active context (c) Spontaneous context. Negotiation at this level lets a personalized group of context providers manage user context requirements such as information persistence, delivery methods, remote access, and inference on each user’s context.

C. Activity maps for location-aware computing

A location context mechanism based on activity maps of consumers[1], defines regions of similar context based on observations of 3-D patterns of location and motion in an environment. They describe an algorithm for obtaining activity maps using the Spatio-temporal clustering of visual tracking data. An application writer would like to access categorical context information, such as what activity a user is performing. In addition, other features such as motion and shape (configuration) of the user are often important to distinguish activity: Contrast a person walking past a desk with a person sitting at that desk. Location regions are defined by user activity, and are automatically estimated by observing user behavior. There is a concept of developing an articulated body tracker that estimates the body pose of a user (arms, torso and head positions). By using the body pose information in approach (instead of using location only), many sub-classes of activity will automatically emerge from the segmentation process.

D. User Profiles in Context-Query Processing for the Semantic Web

The objectives are to: 1) develop a heuristics-based methodology to capture, represent, and use user profiles; 2) incorporate the methodology into a prototype, and 3) test the effectiveness of the methodology. The contribution of the research is to help realize the Semantic Web[5] by capturing and using the semantics of a query through user profiling. The research focuses on the third step, of information retrieval, query creation. A user sends a query to a search engine using keywords and syntactical operations. The search engine is a black box: a user submits a query and the search engine lists the results. Black box focuses on refining the query before it reaches the interface. Refinement is important because users submit short queries that return many irrelevant results. A major challenge is contextual retrieval: combining search technologies and contextual knowledge to provide the most appropriate answer. One obstacle to contextual retrieval is the lack of intelligence in Web-search systems. Terms on Semantic web pages will be marked up using ontologies that define each term’s meaning. The paper improves query refinement to increase the relevance of results on the current and Semantic Web. For web queries, the definition (parts of a discourse that surround a word/passage) refers to a query’s lexical context; the other one (the inter-related conditions in which something exists to the user submitting the query). By considering both a fully contextualized query is made. A query is relevant if it satisfies a user’s information need [7]. Thus, a contextualized query returns relevant results by accounting for (a) the meaning of query terms and (b) the user’s preferences.

E. Dimensions-basis of context-aware communication applications

Context-aware communication is defined as the class of applications that apply knowledge of people’s context to reduce communication barriers. It is suggested that a two-dimensional space for such applications is based on simple distinction between “context acquisition” and “communication actions”. Along the “acquisition” dimension, an application might ask people to manually enter their context, such as whether they are in a meeting or at lunch, or it may sense and infer a person’s context with varying levels of autonomy and sophistication[12]. Along the “action” dimension, communication might be manually controlled. Continue with call or leave a message, relies on the caller to take manual action. In contrast, applications might act more autonomously, such as automatically routing a voice call to a nearby phone and application designers should simultaneously try to maximize autonomy in both dimensions since this removes human common sense which is very hard to implement. Context aware communication applications are presented in five application categories i.e. routing, addressing, messaging, providing caller awareness, and screening as when scanning research papers.

This also demands adapting M-services to the logical location of users (e.g., a request can lead to different executions for users belonging to different groups/applications). In fact, in several cases, the design and development of effective M-services[17] have characteristics like type of device exploited to access a service, the physical location of the user, its personal preferences, or the preferences of a group to which the user belongs and emphasizing that both physical location (e.g., a user located in a specific street in a town or in a specific room in a building), and “logical” location, the activities of a user may be logically located within a specific distributed group/application (e.g., a user located in a team of coworkers, or in the administrators’ group of a specific information system). This is called “location-dependent services” when related to physical location in space, and to “group-dependent services” when related to the logical location of users within a specific application group. Via an appropriate middleware, a building is modeled by identifying each building’s room as a local service context. An agent, moving across the building, would enter and leave different rooms (i.e., local service context) and its actions, performed in a specific local service context depending on the room in which it is in. This increasing range of information[2] can enable context aware informational services as well as linking digital objects to physical objects, a user is observing. Thus, mobile users can obtain relevant information about real-world objects while simultaneously staying in touch with other users.

F. Location based models for pervasive road networks

Context-aware mobile computing aims at designing applications that automatically adapt their behaviors to the available location information and the available nearby

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sensors and devices. To achieve this, context representation and manipulation are important issues, so as to establish formal context models in different locations[13], which can be classified as topographical, topological, or hybrid models.

- **Topographical models** use geometry to model space. They model the spatial entities as geometric shapes that are placed within a coordinate system. The relations between the entities, e.g. which entities are next to each other, are implicitly defined by their location.

- **Topological models** describe the relations between spatial objects explicitly without localizing them in a coordinate system.

- **Hybrid models** combine the localization of the spatial entities within a coordinate system with the explicit modeling of their relations.

IV. REQUIREMENT-ADAPTATION NEEDS FOR CONTEXT AWARENESS APPLICATIONS

Adaptive services must take the user requirements, the current Geo-location, the situation, a person is facing, the available network connection so concentrating issues related to mobile agent based services should be aware to context of user, so a mechanism is needed to allow agent to adapt behavior to current situation and a mechanism that automatically adopts agent execution to given context with an example of Music System.

A. Adaptive Customized Billing for Location-Based Services

The enrichment of mobile services with attributes related to user profiles, context, location, presence and other elements i.e. preferences providing customization, affect the charging and billing process requiring a need of an integrated architecture[3], which allows flexible charging and customized billing for the usage of location-based services. Since mobile users would like to get highly location-specific, real-time information at the precise moment they are making a decision. For example, a driver can be alerted to alternative traffic routes on a turn-by-turn basis, a traveler can be informed of the nearest hotel at night in an unknown city, etc. In practice, mobile network operators, service and content providers, equipment vendors, handset manufacturers and software developers need to co-operate to bring efficient location-based services in the daily life of mobile consumers as a morale of theory.

B. Adaptive Context-Awareness in a Mobile Learning Environment

There are three locations where learners perform learning tasks: formal locations such as classrooms or scheduled computer laboratory sessions; semi-formal locations such libraries or walk-in laboratories; and informal locations such as residences or nonacademic settings as because of the increasing distance away from wireless hotspots, social presence is less or muted. In this regard, in conscious of the already existing social network, a learner although with less presence awareness is able to interact and consult via short message services (SMS) interface. As a learner moves across different learning contexts, a learner does not have access to

the same social networks for consultation and hence receives information of variable quality depending on where they are. Social presence via Instant Messaging(IM),provides learners with continuous awareness of available support and encourages sharing of learning experiences. The conceptual model[14] is a learning environment that supports the mobility of a learner, facilitating on demand “anywhere, anytime” consultation and continuously assures a learner of availability of a support network. Intimacy depends on factors such as physical distance, eye contact, facial expression and personal topics of conversation. Immediacy is a measure of the psychological distance which a communicator puts between himself and the object of his communication. The context-awareness is achieved via IM tool Jabber version of pocket PCs, iMov messenger where a desktop version of Jabber, is installed on the desktop testing machines which can be available for interaction based on hotspot proximity with challenges like integrating IM with the location awareness is now built into cellular phone systems.

C. Adaptation to Location-Dependent Queries

The Distributed processing system[15] present the main advantages like 1) General solution for the processing of location-dependent queries in scenarios where not only the users issuing queries, but also other interesting objects can move; 2) Efficient processing of these queries in a continuous way; 3) Well adapted to environments where location data are distributed in a network and processing tasks can be performed in parallel, allowing a high scalability; and 4)Optimizes wireless communications. Thus, Mobile agents are in charge of tracking the location of interesting moving objects and refreshing the answer to a query efficiently. Continuous queries keep active until they are cancelled by the user. Thus, two related tasks: 1) to keep the network of agents ready to obtain an answer according to the current location of the reference objects and 2) to update the answer to the query automatically, must be performed. For example, as a reference object moves, its associated areas move too. Therefore, the associated Tracker agent must rearrange its network of Updater agents and update their standard queries with the new location of the reference object. In case the reference object becomes undetectable, the Tracker will poll the proxy infrastructure periodically. The system provides a general mechanism to detect when a moving object changes to another proxy area (continuously monitoring the object with a certain tracking frequency). Here user wireless devices are not overloaded with query processing tasks; the query processing is performed on proxies and fixed networks are used whenever possible. A context centric access control middleware[23], called UbiCOSM, that dynamically determines the contexts of mobile users and effectively rules the access to them, by taking into account different types of metadata: user profiles and system/user-level authorization policies.

D. Example Adaptivity: A Music System Based on Context Reasoning

The task of using context data for inferring a user’s situation is referred to as context reasoning is illustrated in

music recommendation system[16] which contains such modules as Intention module, Mood module and Recommendation module. The Intention module performs context reasoning that infers whether a user wants to listen to music or not by using the environmental context data. The Mood module determines the genre of the music suitable to the user’s context. Finally, the Recommendation module recommends the music to the user. Context reasoning is implemented using case-based reasoning. Generally, the products are recommended based on the demographic features of the customer, or based on an analysis of the past buying behavior of the customer. If the customer accesses an online bookstore, for example, through internet, then one can be recommended him/her appropriate books by analyzing the book data. Kofod- Petersen and Aamodt [24] incorporated context information as cases in case-based reasoning (CBR) for user situation assessment in a context-aware mobile system. Kumar et al. [25] proposed a context enabled Multi-CBR approach i.e., user context CBR and product context CBR, for aiding the recommendation engine in retrieving appropriate information for e-commerce applications and also the capability of recognizing the user’s context and preferences, example, John came to the department store to buy a birthday present for his girlfriend. Then products for women should be recommended and not superficial factor’s judgments like person, place and time are collected and accordingly the products are recommended to him. Therefore, by analyzing his past buying patterns and the kinds of shops he has been browsing today, we need to find out his intention.

For example, a mobile user may wish e-mail to be delivered automatically at the earliest possible opportunity, removing the need to return periodically to the personal desk-top to check for new mail. As the user moves, a context-aware e-mail delivery application needs to know the identity of equipment near the user and its suitability for delivering e-mail. Once an unused and suitable item of equipment is nearby, the user can be alerted and the e-mail delivered. Another example is that of a user attempting to contact a colleague. A suitable context-aware application may determine that the colleague is in a meeting, implied by the fact that other users are present in the same room. The contact attempt may therefore be postponed until the colleague is alone. Once alone, the application may then determine whether video-phone equipment is deployed and unused near the colleague. If not the telephone may be used.

V. CONCLUSION

We presented a user-centered approach that supports understanding context awareness for mobile computing in this paper. We believe that a context-aware system developed based on the input parameters and various issues can reduce the complexity of the traditional context acquisition and interpretation approach, by leveraging users’ natural dialogue with mobile computing’s value-added services currently available on most mobile devices, such as GPS and messaging services, in enriching the context-acquisition and context-awareness patterns. We believe that such simplification is necessary for a successful design, development, and deployment of context-aware artifacts. We also emphasized the importance of enabling flexibility and scalability capabilities in context-aware artifacts to cope with users’ naturalistic dynamicity of their situational-context. We believe that such inherent properties are necessary to capture users’ context in a more effective way. We believe that our analysed context-awareness approach has addressed some of the limitations of the traditional context awareness approaches. On the other hand, we still believe that many other issues still need to be addressed. We haven’t addressed how dialogue between user’s preferences with system will be carried out. We also haven’t tackled how the corresponding system awareness services of the users defined context profiles will be offered in reality. We believe that such issues need to be further explored as an important step in the direction towards applying any context-awareness framework in mobile and ubiquitous computing.

REFERENCES


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