

**Near East University**

Mobile Computing (**ECC417**)

Mobile Computing Environment Architecture

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**Abstract:**

In the era of this growing technology, Mobile Computing has become a major discussion thread for transforming the internet computing infrastructure. For IT world, it provides a vast platform where mobile users can explore their data anywhere anytime using services such as cloud services. Mobile Computing integrates the advantage of cloud computing, internet technology and mobile computing.

That facilitates it to become more users friendly to store their data at cloud with a great ease. Despite a lot of advancement is achieved by the Mobile computing architecture, but still, it is below the user expectations due to privacy and security issues of the regulated data. Significantly the thrust of the research is focused on exterminating various critical issues of mobile cloud computing to make it more reliable and secure.

In order to better understand the challenging issues, I’ll explain the mobile computing environment architecture with all of its specialities and flaws. We will talk about the 3-Layer model of the mobile computing architecture and provide perfect information the covers the whole topic.

**Introduction:**

This is a very sensitive topic which is researched a lot and it has been a hot topic in the field of IT and computers in general therefore we will briefly explain the mobile computing architecture in general then we get in depth with the 3-layer model of the architecture then we will explain the middleware categories then we will talk about the services that each layer provides.

Mobile computing architecture refers to the definition of multiple layers between user application interfaces, devices, and network hardware. A well-defined architecture is necessary for systematic calculations and access to data and software objects.

Mobile computing usually implies wireless transmission but, wireless transmission does not imply mobile computing. Mobile computing follows some of the attributes.

First layer is going to be User Interface or Presentation layer, second layer will be the process management or application layer, and last but not least the third layer will be the database management or data layer where all the data and its configuration is stored.



**Architecture for mobile computing:**

**The first layer is the user interface or presentation layer**

* Deals with user facing device handling and rendering
* Includes a user system interface where user services reside

**The second layer is the Process Management or Application layer**

* Here business logic and rules are executed.
* Capable of accommodating hundreds of users
* Controls transactions
* Asynchronous queuing to ensure reliable completion of transactions

**The third layer is Database Management or Data Tier**

* For database access and design
* Provides increased performance, flexibility, maintainability, reusability and scalability, while hiding the complexity of distributed processing from the user

**Three-layer architecture:**

* To have universal access, the server is connected to a ubiquitous network like the internet.
* To have access with network, an application called web browser is required such as internet explorer, Google Chrome or Mozilla Firefox etc…
* Three Layers
* Presentation Layer (Layer 1)
* Application Layer (Layer 2)
* Data Layer (Layer 3)

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**Presentation Layer (Layer 1)**

* First Layer
* Layer of agent’s applications and systems
* Applications run on the client device offer all the user interfaces
* Responsible for presenting the Information to the end user
* Humans use audio and video to receive information from the machine
* Information is given to the system from keyboard (computer, laptop, cell phones), pen (tablet. Palmtop) etc
* It includes web browsers

**Application Layer (Layer 2)**

* Considered as engine of the application
* Performs the business logic of the processing input, obtaining data and making decisions.
* Includes technologies like CGIs, Java, JSP, .NET services, PHP etc. Deployed in products as Apache, WebSphere etc.
* This layer is presentation and database independent
* Operations such as network management, Security are performed using a middleware software
* Middleware is defined as a layer of software, which sits in between the operating system and user facing software
* Can also be defined as a software gateway connecting two independent open objects

**Middleware Categories**

* Message-oriented Middleware (MOM)
* Transaction processing (TP) Middleware
* Database Middleware
* Communication Middleware
* Distributed Object and Components
* Transcoding Middleware
* Internet Content Adaption protocol (ICAP)
* Web Services

**Message Oriented Middleware**

* It connects different applications through asynchronous exchange of messages
* Works over a networked environment without knowing what platform or processor the other application is resident on.
* The message can contain formatted data, requests for actions or unsolicited response
* Provides a message queue between any two interoperating applications
* If the destination process is busy, then the message is held in a temporary storage until it is processed

It is asynchronous peer to peer; it works in publish/subscribe fashion. In this mode, one or more objects subscribe to an event as event occurs it will be published by the loosely coupled asynchronous object. MOM will notify about this event, is appropriate for event driven applications

Such examples are message queue from IBM known as MQ series.

**Transaction Processing (TP) Middleware**

* It provides tools and environment for developing transaction based distributed applications
* Inputs the data into a system at point of information source and output the data at information sink
* Used in data management, network access, security systems, delivery order processing, airline reservations, customer service etc..
* Capable of providing services to thousands of clients in a distributed client/server environment
* It includes features such as restarting failed process, dynamic load balancing and ensuring consistency of data.
* Independent of database architecture
* It Optimises the use of resources by multiplexing many client functions onto much smaller set of application service routines. Such as MVC

**Model View Controller (MVC):**

* Java uses MVC Architecture, which is an example of TP middleware
* It Splits application into separate layers i.e. presentation, domain logic and data access.

**Model**

* Domain specific representation of the information on which the application operates
* Domain logic manipulates and adds the meaning to the raw data

**View**

* Responsible for rendering the model into a form suitable for interaction and understood by the user

**Controller**

* Manages the process and responds to events, typically user actions, may invoke changes in the model

**Communication Middleware:**

* Similar to connecting one application to another with the help of telnet
* Used in telecommunication
* User interface is through telnet
* A mediation server automates the telnet protocol to communicate with these nodes in the network

Examples: TN5250, TN3270

**Distributed Object and Components:**

* Such as CORBA (Common Object Request Broker Architecture)
* Open distributed computing infrastructure being standardized by object management group.
* It is a vendor independent infrastructure.
* CORBA based program from any vendor almost any computer, operating system, programming language and network can interoperate with a CORBA based program from the same or another vendor
* Handles large number of clients at high rates with high reliability

**Transcoding Middleware**

* Used to transcode one format of data to another to suit the need of the client
* To access web pages on phone, the HTML pages are transcoded into WML pages so that mobile phone can access it
* It is used for content adaptation to fit the need of the device
* Content adaptation is also required to meet the network bandwidth
* Content adaptation is done through proprietary protocols.

**Internet Content Adaptation Protocol (ICAP)**

* Content present in the internet is accessed from different agents and devices.
* It Is a protocol aimed at providing simple object-based content vectoring for HTTP services.
* Lightweight protocol to do transcoding on HTTP messages.
* Allows ICAP clients to pass HHTTP messages to ICAP servers for some sort of transformation.
* The server sends back the transformed message back to its clients.
* Before the document is displayed for the agent, it is checked for viruses

**Steps performed:**

* The user agent makes a request to an ICAP client for an object on an object server
* The client sends the request to the ICAP server
* The ICAP server executes the ICAP resource service on the request and sends the possibly modified request or a response to the request ICAP client
* The client sends the request, possibly different from the original client’s request to the original server.
* The origin server responds to the request
* The ICAP server sends the reply to the client

**Services provided by ICAP servers**

* Virus checking for the requested content
* Content filtering based on the sensor rating like PG,R
* Local real time advertisement insertion like television
* Wireless protocol translation
* Imagine magnification for elderly
* Peer to peer compression
* Encryption of data and many more

**Web Services**

* It provides a standard means of communication and information exchange among different software applications, running on a variety of platforms or frameworks.
* It is a software system that is Identified by URL whose public interfaces and bindings are defined using XML
* The basic architecture includes web service technologies capable of: exchanging messages and describing web services as well as publishing and discovering web service descriptions
* Web services architecture defines the standard for exchange of messages between the service requester and the service provider
* Service providers are responsible for publishing a description of the services they provide
* Requester must be able to find and discover descriptions of the services.

Software agents in the basic architecture can take on one or all of the following:

* Service Requester: Requests the execution of the web service
* Service Provider: processes a web service request
* Discovery Agency: agency through which a web service description is published and made discoverable

**Data (Layer 3)**

* This layer is used to store data needed by the application and acts as repository for both temporary and permanent data.
* The data can be stored in any form of datastore or database
* Data can be stored in XML format for interoperability with other systems and data sources.

**Database Middleware**

* Database independence helps in maintenance of the system
* It allows business logic to be independent and transparent of the database technology and the database vendor
* Runs between the application program and the database
* Also called database connectors as well
* Examples: ODBC, JDBC
* With the help of these middleware, the application will be able to access data from any data source securely.
* Data sources can be text files, flat files, spreadsheets or network, relational, indexed, hierarchical, XML database etc.

**SyncML**

* Is a protocol that is an emerging standard for synchronization of data access form different nodes
* New industry initiative to develop and promote a single common data synchronization protocol that can be used industry wide
* Supports the naming and identification of records and common protocol commands to synchronize local and network data
* Supports identification and resolution of synchronization conflicts

**Design Consideration for mobile computing**

* The term context means, all the information that helps determine the state of an object or actor
* It can be a person, device, a place, a physical or computational object

**Content with context awareness**

* Build each application with context awareness
* There are different services for different client context
* Bank providing services on internet, for mobile phones and PDA
* Have different URL for each type of device

**Content Switch on Context**

* Provides adaptation of content within service
* Transparent to the client
* Here service is the same for internet, PDA and WAP
* All access the bank site from the same URL

**Content Transcoding on context**

* Performs the adaptation of content based on the context and behaviour of the device
* Transparent for the client and the application, the Middleware is used to perform all the operation
* Middleware is intelligent to convert from HTML to XML as need occurs or vice versa.

**Conclusion:**

Mobile Computing is a technology that allows transmission of data, voice and video via a computer or any other wireless enabled device without having to be connected to a fixed physical link. This tutorial will give an overview of Mobile Computing and then it will take you through how it evolved and where is the technology headed to in future along with the classifications and security issues involved.

Today's computing has rapidly grown from being confined to a single location. With mobile computing, people can work from the comfort of any location they wish to as long as the connection and the security concerns are properly factored. In the same light, the presence of high-speed connections has also promoted the use of mobile computing.

Being an ever growing and emerging technology, mobile computing will continue to be a core service in computing, and Information and Communications Technology.

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