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Scalability of Multimedia Streaming Service: A Cross Layer Perspective

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ABSTRACT:

In this project, we realized a prototype of this architecture to validate the feasibility of the proposed method. According to the experiment, this method could provide efficient self-adaptive multimedia streaming services for varying bandwidth environment.Video streaming is gaining popularity among mobile users. The latest mobile devices, such as smart phones and tablets, are equipped with multiple wireless network interfaces. How to efficiently and cost-effectively utilize multiple links to improve video streaming quality needs investigation. In order to maintain high video streaming quality while reducing the wireless service cost, in this paper, the optimal video streaming process with multiple links is formulated as a Markov Decision Process (MDP). The reward function is designed to consider the quality of service (QoS) requirements for video traffic, such as the startup latency, playback fluency, average playback quality, playback smoothness and wireless service cost. To solve the MDP in real-time, we propose an adaptive, best-action search algorithm to obtain a sub-optimal solution. To evaluate the performance of the proposed adaptation algorithm, we implemented a test bed using the Android mobile phone and the Scalable Video Coding (SVC) codec. Experiment results demonstrate the feasibility and effectiveness of the proposed adaptation algorithm for mobile video streaming applications, which outperforms the existing state-of-the-art adaptation algorithms.

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1 Project Description:

In the previous service, the mobile device side exchanges information with the cloud environment, so as to determine an optimum multimedia video. Scholars have done numerous researches toward conventional platform (CDN) to store different movie formats in a multimedia server, to choose the **right video** stream according to the current network situation or the hardware calculation capabilities. To solve this problem, many researchers have attempted dynamic encoding to transfer media content, but still cannot offer the best video quality. Video communication over mobile broadband networks today is challenging due to limitations in bandwidth and difficulties in maintaining high reliability, quality, and latency demands imposed by rich multimedia applications. Increasing in network traffic by the use of multimedia content and applications. Proposed system provided an efficient interactive streaming service for diversified mobile devices and dynamic network environments. When a mobile device requests a multimedia streaming service, it transmits its hardware and network environment parameters to the profile agent in the cloud environment, which records the mobile device codes and determines the required parameters. Then transmits them to the Network and Device-Aware Multi-layer Management (NDAMM). The NDAMM determines the most suitable SVC code for the device according to the parameters, and then the SVC Transcoding Controller (STC) hands over the transcoding work via map-reduce to the cloud, in order to increase the transcoding rate. The multimedia video file is transmitted to the mobile device through the service. The network bandwidth can be changed dynamically. This method could provide efficient self-adaptive multimedia streaming services.

1.1 Competitive Information

1) Media Cloud: When Media Revolution Meets Rise of Cloud Computing

Media cloud provides a cost-effective and powerful solution for the coming tide of the media consumption. Based on previous summary of the recent work on media cloud research, in this section, we first make some suggestions on how to build the media cloud, and then propose some potentially promising topics for future research.

2) Multimedia cloud computing

This article introduces the principal concepts of multimedia cloud computing and presents a novel framework. We address multimedia cloud computing from multimedia-aware cloud (media cloud) and cloud-aware multimedia (cloud media) perspectives. First, we present a multimedia-aware cloud, which addresses how a cloud can perform distributed multimedia processing and storage and provide quality of service (QoS) provisioning for multimedia services. To achieve a high QoS for multimedia services, we propose a media-edge cloud (MEC)
Architecture, in which storage, central processing unit (CPU), and graphics processing unit (GPU) clusters are presented at the edge to provide distributed parallel processing and QoS adaptation for various types of devices.

3) Seamless Support of Multimedia Distributed Applications through a Cloud

W t a validation and a thorough experimental assessment of the performance of our cross-layer architecture as soon as its development will be completed. In addition, we would like to extend our study on this class of architectures to investigate the impact of dependability issues, such as fault tolerance and security, on their design.

4) Distributed Scheduling Scheme for Video Streaming over Multi-Channel Multi-Radio Multi-Hop Wireless Networks

we have developed fully distributed scheduling schemes that jointly solve the channel-assignment, rate allocation, routing and fairness problems for video streaming over multi-channel multi-radio networks. Unlike conventional scheduling schemes focus on optimal system throughput or scheduling efficiency, our work aims at achieving minimal video distortion and certain fairness by jointly considering media-aware distribution and network resource allocation. Extensive simulation results are provided which demonstrate the effectiveness of our proposed schemes.

5) Toward Optimal Deployment of Communication-Intensive Cloud Applications

we propose a clustering-based cloud node selection approach for communication-intensive cloud applications. By taking advantage of the cluster analysis, our approach not only considers the QoS values of cloud nodes, but also considers the relationship (*i.e.,* response time) between cloud nodes. Our approach systematically combines cluster analysis and ranking methods. The experimental results show that our approach outperforms the existing ranking approaches.

6) Playback-Rate Based Streaming Services for Maximum Network Capacity in IP Multimedia Subsystem

The proposed cross-layer playback-rate based streaming services, which can maintain network transmission quality and receive data before playback reliably in IMS networks with many users. The experimental results show that the services could reduce the overall network load without the occurrence of dropped packets.

1.2 Relationship to Other Applications/Projects

A good dynamic communication mechanism can reduce the bandwidth needs and the power consumption of the device resulting from excessive packet transmission, and the transmission frequency can be determined according to the bandwidth and its fluctuation ratio based on such dynamic decision-making. The transmit mode is engaged until the device finds a variation of the transmitted variables that exceeds a threshold. Although the threshold can reduce the communication frequency effectively and precisely, in this mode the mobile device must start up additional threads for continuous monitoring; thus, the load on the device side is increased. When the network bandwidth difference exceeds a triple standard deviation, this indicates the present network is unstable. The overall communication frequency shall incline to frequency to avoid errors; however, when the network bandwidth difference is less than a triple standard deviation, the current network is still in a stable state, and the influence on bandwidth difference can be corrected gradually.

1.3 Assumptions and Dependencies

Agility improves with users' ability to re-provision technological infrastructure resources. API accessibility to software that enables machines to interact with cloud software in the same way the user interface facilitates interaction between humans and computers. Cloud computing systems typically use REST-based APIs. **Cost** is claimed to be reduced and in a public cloud delivery model capital expenditure is converted to operational expenditure. This is purported to lower barriers to entry, as infrastructure is typically provided by a third-party and does not need to be purchased for one-time or infrequent intensive computing tasks. Pricing on a utility computing basis is fine-grained with usage-based options and fewer IT skills are required for implementation (in-house).The e-FISCAL project's state of the art repository contains several articles looking into cost aspects in more detail, most of them concluding that costs savings depend on the type of activities supported and the type of infrastructure available in-house. **Device and location independence** enable users to access systems using a web browser regardless of their location or what device they are using (e.g., PC, mobile phone). As infrastructure is off-site (typically provided by a third-party) and accessed via the Internet, users can connect from anywhere. **Virtualization** technology allows servers and storage devices to be shared and utilization be increased. Applications can be easily migrated from one physical server to another. **Multitenancy** enables sharing of resources and costs across a large pool of users thus allowing for: **Centralization** of infrastructure in locations with lower costs (such as real estate, electricity, etc.)**Peak-load capacity** increases (users need not engineer for highest possible load-levels) **Utilization and efficiency** improvements for systems that are often only 10–20% utilized. **Reliability** is improved if multiple redundant sites are used, which makes well-designed cloud computing suitable for business continuity and disaster recovery.[30]**Scalability and elasticity** via dynamic ("on-demand") provisioning of resources on a fine-grained, self-service basis near real-time, without users having to engineer for peak loads. **Performance** is monitored, and consistent and loosely coupled architectures are constructed using web services as the system interface. **Security** could improve due to centralization of data, increased security-focused resources, etc., but concerns can persist about loss of control over certain sensitive data, and the lack of security for stored kernels. Security is often as good as or better than other traditional systems, in part because providers are able to devote resources to solving security issues that many customers cannot afford. However, the complexity of security is greatly increased when data is distributed over a wider area or greater number of devices and in multi-tenant systems that are being shared by unrelated users. In addition, user access to security audit logs may be difficult or impossible. Private cloud installations are in part motivated by users' desire to retain control over the infrastructure and avoid losing control of information security. **Maintenance** of cloud computing applications is easier, because they do not need to be installed on each user's computer and can be accessed from different place

1.4 Future Enhancements

In this work, we just consider a single flow scenario and ignore the interference from the other flows as well as the competitive bidding for spectrum usage from the other flows. In a CRN with multiflows, the CR source nodes need to develop sophisticated bidding strategies considering the competition from the peer flows, and the SSP should jointly consider the cross-layer factors and the bidding values to determine the sharing of the harvested spectrum.

1.5 Definitions and Acronyms

Acronym items should be included here. For each special term supply a definition here.

2 Project Technical Description

Cloud computing is the use of computing resources (hardware and software) that are delivered as a service over a network (typically the Internet). The name comes from the use of a cloud-shaped symbol as an abstraction for the complex infrastructure it contains in system diagrams. Cloud computing entrusts remote services with a user's data, software and computation.

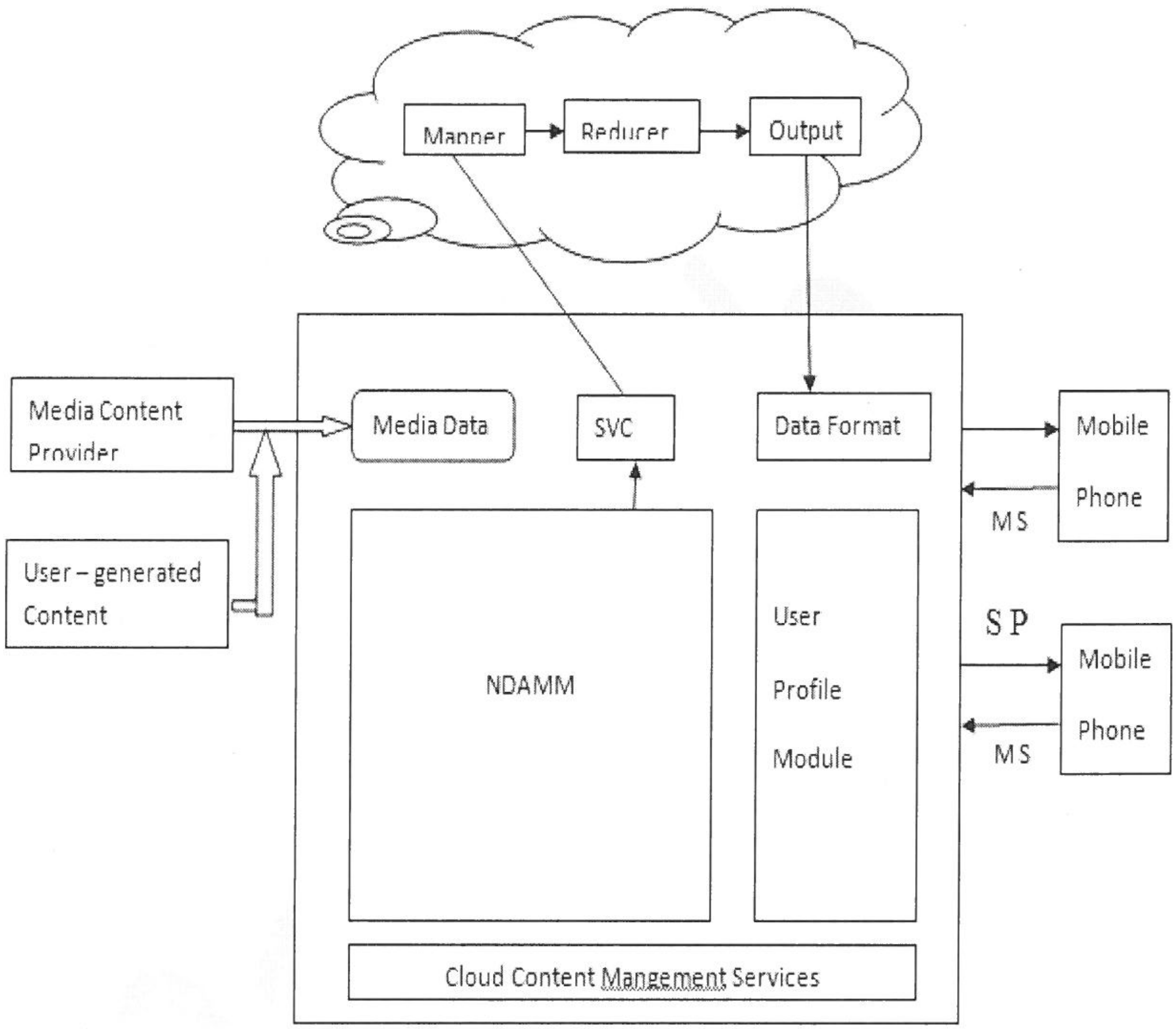
There are many types of public cloud computing:

- Infrastructure as a service (IaaS)
- Platform as a service (PaaS)
- Software as a service (SaaS)
- Storage as a service (STaaS)
- Security as a service (SECaaS)
- Data as a service (DaaS)
- Test environment as a service (TEaaS)
- Desktop as a service (DaaS)
- API as a service (APIaaS)

The business model, IT as a service (ITaaS), is used by in-house, enterprise IT organizations that offer any or all of the above services.

Using software as a service, users also rent application software and databases. The cloud providers manage the infrastructure and platforms on which the applications run. End users access cloud-based applications through a web browser or a light-weight desktop or mobile app while the business software and user's data are stored on servers at a remote location. Proponents claim that cloud computing allows enterprises to get their applications up and running faster, with improved manageability and less maintenance, and enables IT to more rapidly adjust resources to meet fluctuating and unpredictable business demand.

2.1 Application Architecture



2.2 Application Information flows

It is a free, open source mobile platform. Linux-based, multi process, Multithreaded OS. Android is not a device or a product it's not even limited to phones you could build a DVR, a handheld GPS, an MP3 player, etc. Android is a software stack for mobile devices that includes an operating system, middleware and key applications. The Android SDK provides the tools and APIs necessary to begin developing applications on the Android platform using the Java programming language. Makes mobile development easy.

2.3 Interactions with other Projects (if Any): No

2.4 Interactions with other Applications

Being a open development platform, Android offers developers the ability to build extremely rich and innovative applications. Developers have full access to the same framework APIs used by the core applications. **Views** used to build applications (lists, grid, buttons, text boxes and even embeddable web browser) **Content providers** – enable applications to access data from other applications or share their own data. **Resource manager** – provides access to non-code resources such as localized strings, graphic and layout files. **Notification manager** – enables applications to display custom alerts in status bar **Activity manager** – manages lifecycle of applications and provides navigation back stack Android ships with a set of core applications including an email client, SMS program, calendar, maps, browser, contacts, and others. All applications are written using the Java programming language.

2.5 Capabilities

The development of a computer based system or a product is more likely plagued by resources and delivery dates. Feasibility study helps the analyst to decide whether or not to proceed, amend, postpone or cancel the project, particularly important when the project is large, complex and costly. Once the analysis of the user requirement is complement, the system has to check for the compatibility and feasibility of the software package that is aimed at. An important outcome of the preliminary investigation is the determination that the system requested is feasible.

2.6 Risk Assessment and Management

NDAMM aims to determine the interactive communication frequency and the SVC multimedia file coding parameters according to the parameters of the mobile device. It hands these over to the STC for transcoding control, so as to reduce the communication bandwidth requirements and meet the mobile device user's demand for multimedia streaming. It consists of a listen module, a parameter profile module, a network estimation module, a device-aware Bayesian prediction module, and adaptive multi-layer selection. The interactive multimedia streaming service must receive the user profile of the mobile device instantly through the listen module. The parameter profile module records the user profile and determines the parameter this is provided to both the network estimation module and the device-aware Bayesian prediction module to predict the required numerical values. Rw and Rh represent the width and height of the supportable resolution for the device, CPavg and CP represent the present and average

CPU operating speed. Db and Db rate represent the existing energy of the mobile device and energy consumption rate, and BW, BWavg, and BWstd represent the existing, average and standard deviation values of the bandwidth. When this parameter form is maintained, the parameters can be transmitted to the network estimation module and the device-aware Bayesian prediction module for relevant production.

3 *Project Requirements*

3.1 *Identification of Requirements*

In this project, we propose a clustering-based cloud node selection approach for communication-intensive cloud applications. By taking advantage of the cluster analysis, our approach not only considers the QoS values of cloud nodes, but also considers the relationship (*i.e.,* response time) between cloud nodes. Our approach systematically combines cluster analysis and ranking methods. The experimental results show that our approach outperforms the existing
Ranking approaches.

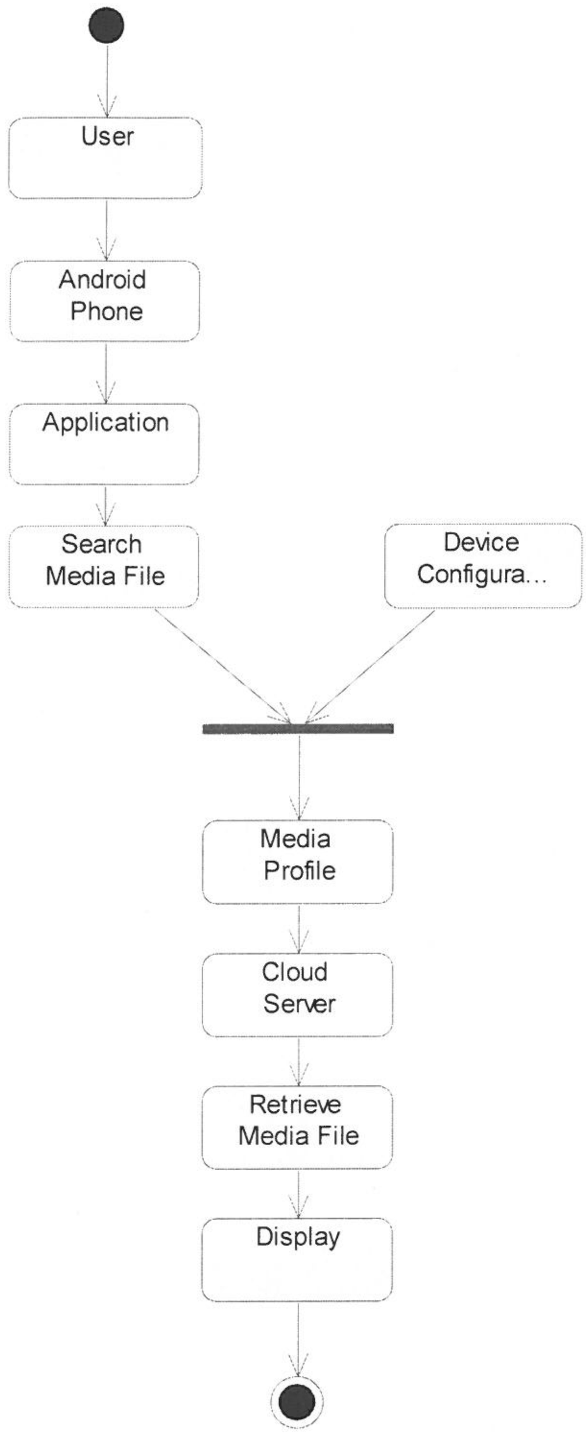
3.2 *Operations, Administration, Maintenance and Provisioning (OAM&P)*

This project proposed cross-layer playback-rate based streaming services, which can maintain network transmission quality and receive data before playback reliably in IMS networks with many users. The experimental results show that the services could reduce the overall network load without the occurrence of dropped packets.

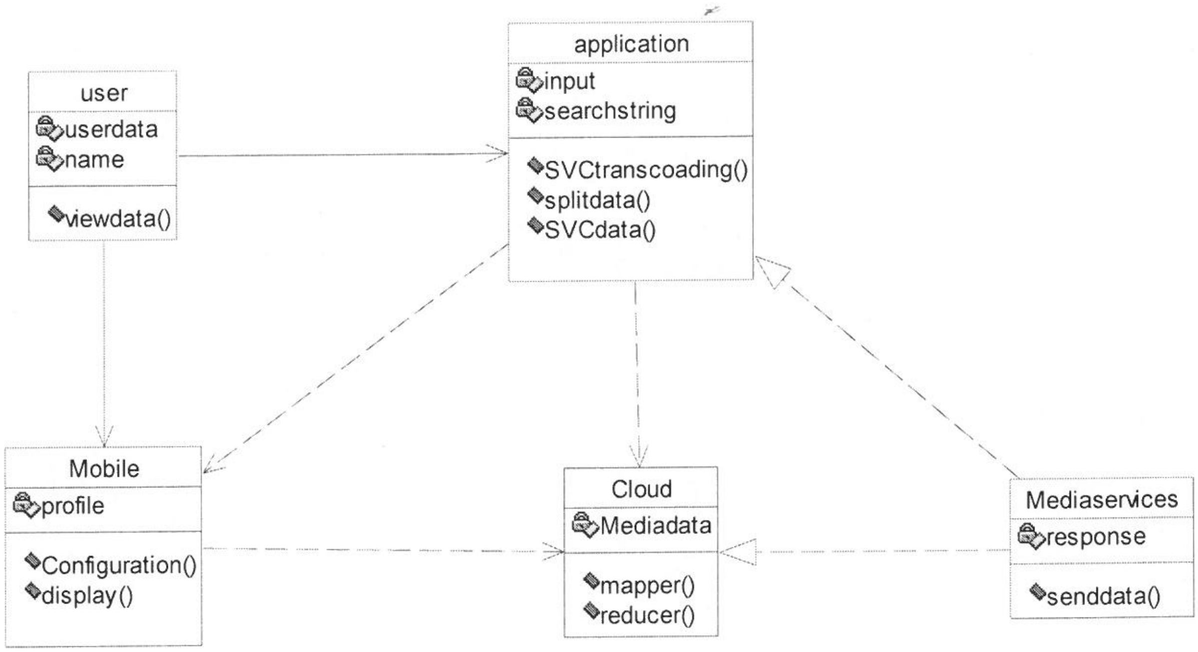
3.3 *Release and Transition Plan*

Using software as a service, users also rent application software and databases. The cloud providers manage the infrastructure and platforms on which the applications run. End users access cloud-based applications through a web browser or a light-weight desktop or mobile app while the business software and user's data are stored on servers at a remote location. Proponents claim that cloud computing allows enterprises to get their applications up and running faster, with improved manageability and less maintenance, and enables IT to more rapidly adjust resources to meet fluctuating and unpredictable business demand.

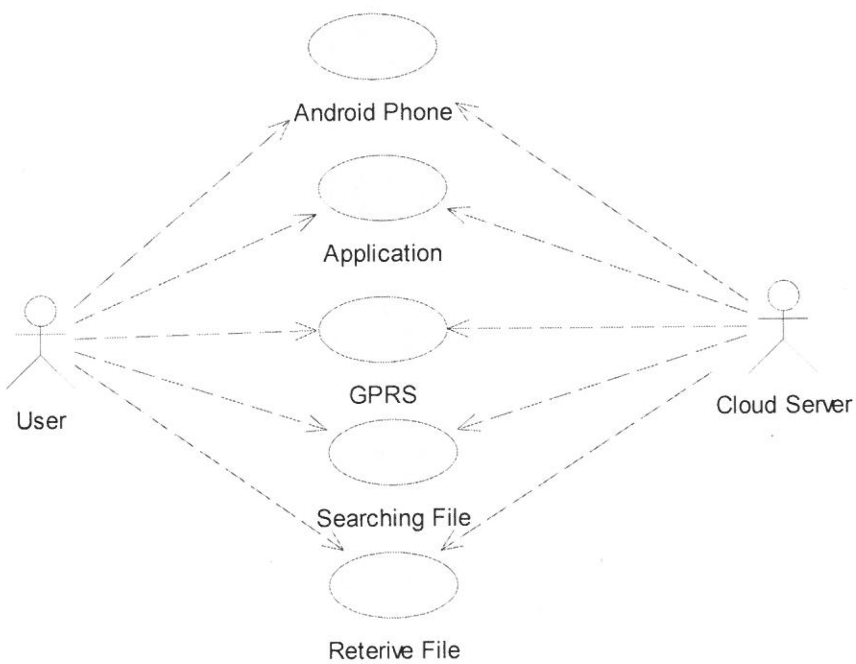
4 ***Project Design Description***



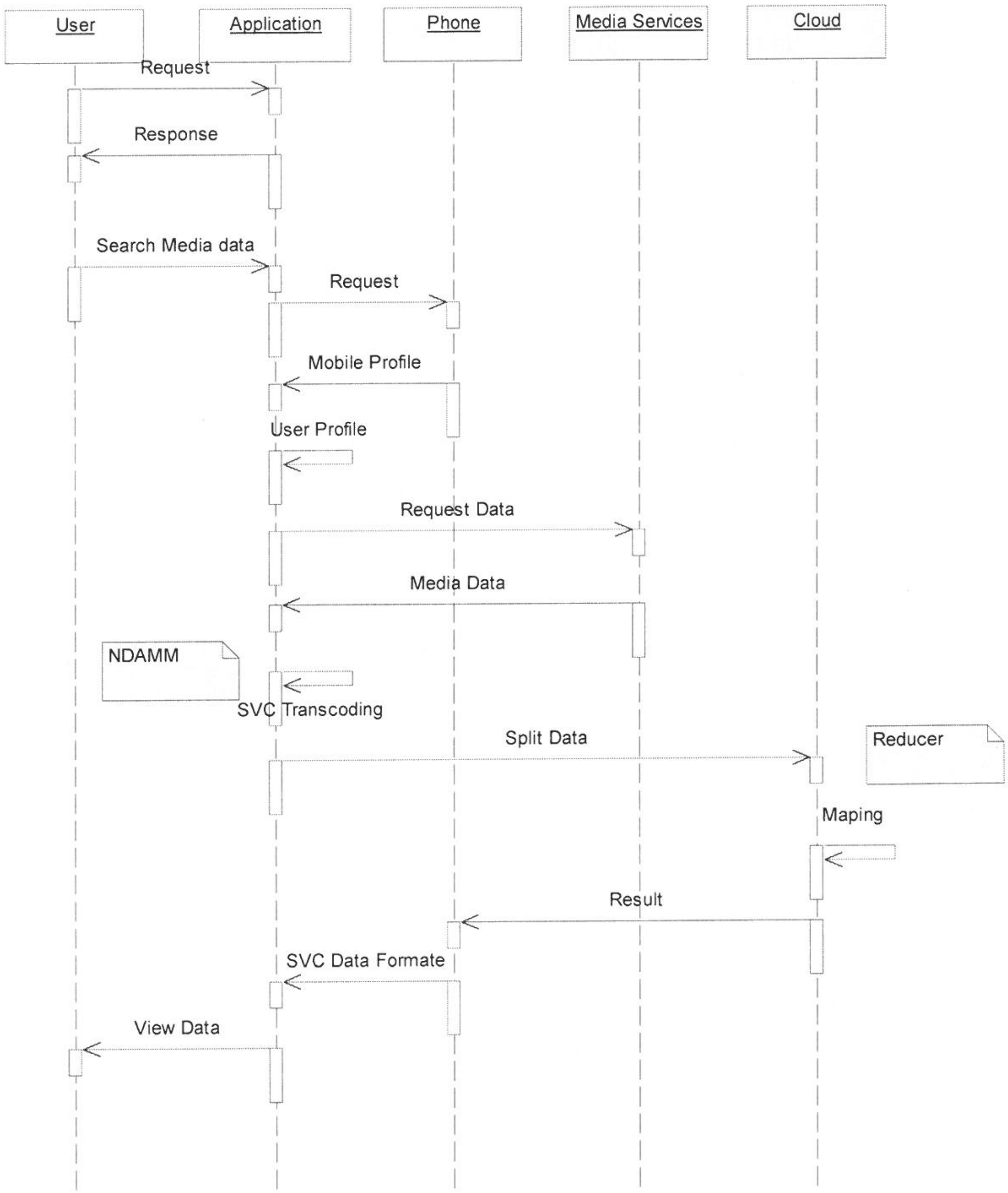
Class Diagram



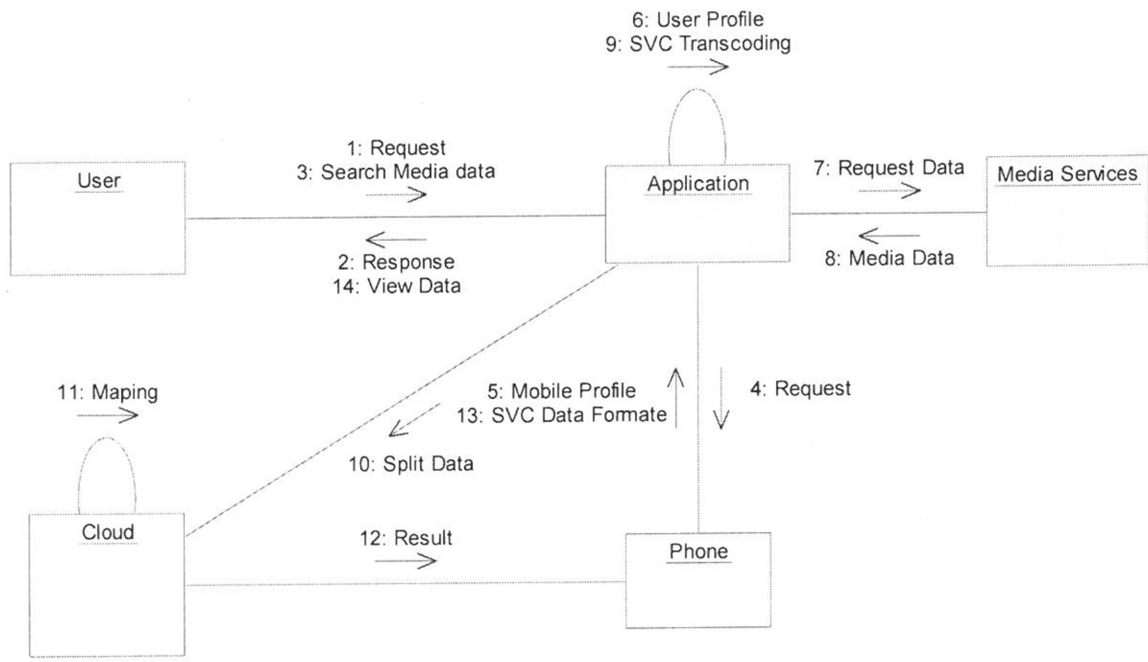
USECASE



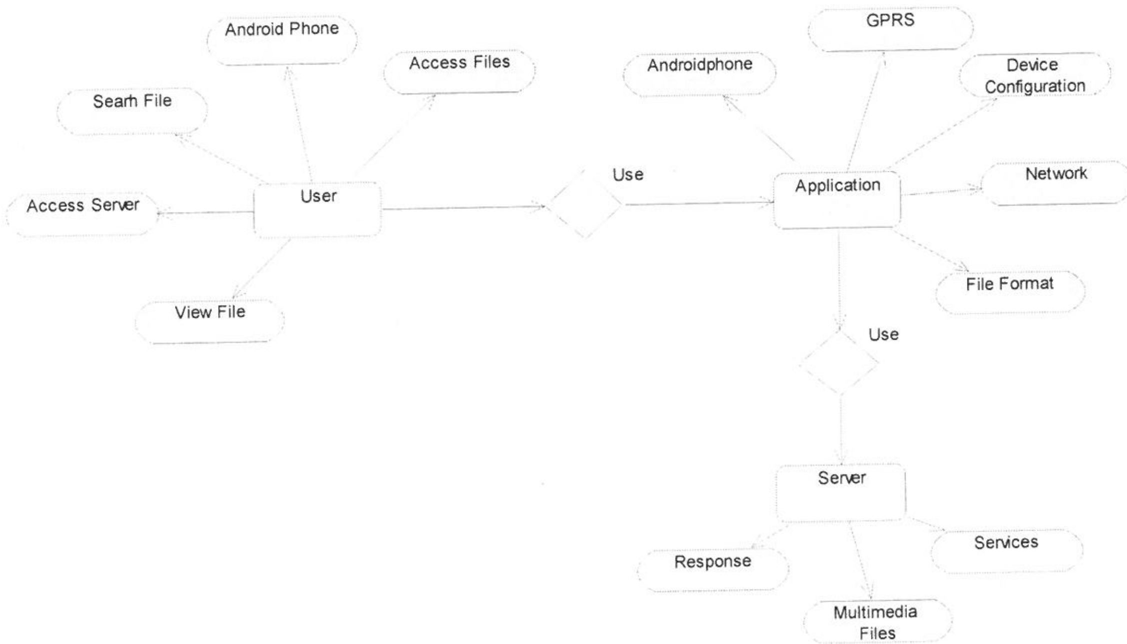
Sequence Diagram



Collaboration Diagram



ER Diagram



5 Internal/external Interface Impacts and Specification

EWMA uses the weights of the historical data and the current observed value to calculate gentle and flexible network bandwidth data for the dynamic adjustment of weights. In order to determine the precise network bandwidth value, the EWMA filter estimates the network bandwidth value in which is the estimated bandwidth of the No. t time interval, is the bandwidth of the No. time interval, and is the estimation difference. For different mobile network estimations, this study considered the error correction of estimation and the overall standard difference and estimated the different bandwidths by adjusting the weights among which, is the moving average weight and is the standard deviation weight. When the prediction error is greater than, the system shall reduce the weight modification of the predicted difference; relatively, when the prediction error is less than, the system shall strengthen the weight modification of the predicted difference. When the changed bandwidth of the system is greater than the standard difference, the predicted weight will increase as the corrected value of the standard deviation is reduced. The predictor formula for the overall mobile network quality uses the standard normal state value range concept of plus-minus three standard deviations of statistics, referring to identify the stable or unstable state of the current mobile network. If the present mobile network is in a stable state, it shall conform to the following equation among which, is the coefficient of the evaluated standard deviation. The value is almost 1.128. If the network bandwidth value of this time cycle is within plus-minus three standard deviations of the standard value, the present mobile network will be in a stable state; otherwise it will be in a fluctuating state.

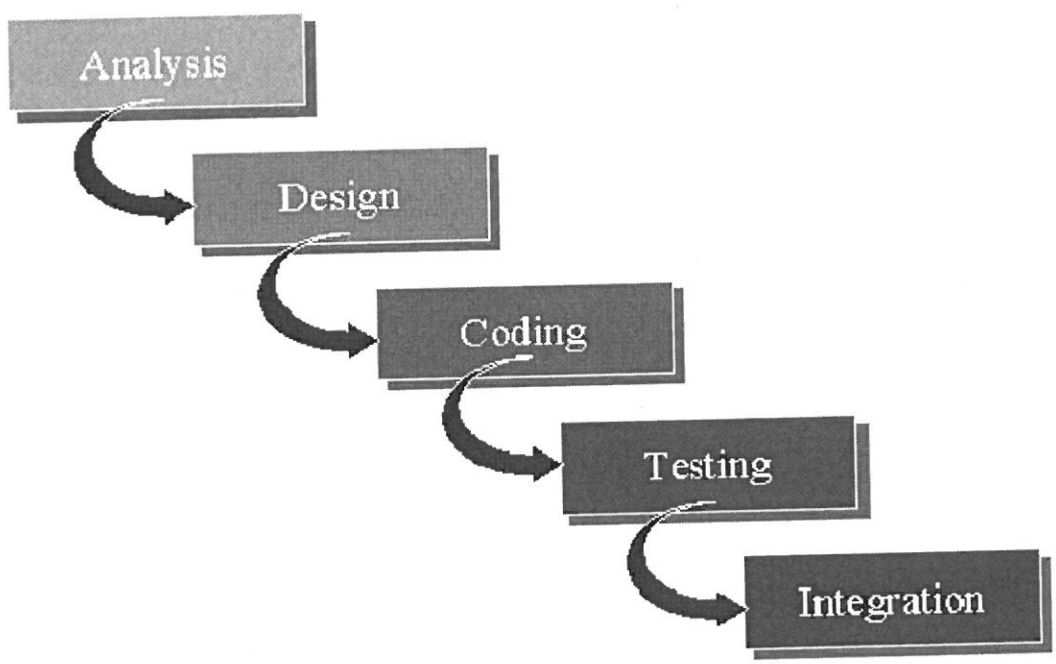
6 Design Units Impacts

We have given clear description of the Designing in Section 4.

6.1 Functional Area A/Design Unit A And Functional Area B/Design Unit B

While the Waterfall Model presents a straightforward view of the software life cycle, this view is only appropriate for certain classes of software development. Specifically, the Waterfall Model works well when the software requirements are well understood (e.g., software such as compilers or operating systems) and the nature of the software development involves contractual agreements. The Waterfall Model is a natural fit for contract-based software development since this model is document driven; that is, many of the products such as the requirements specification and the design are documents. These documents then become the basis for the software development contract. There have been many waterfall variations since the initial model was introduced by Winston Royce in 1970 in a paper entitled: "managing the development of large software systems: concepts and techniques". Barry Boehm, developer of the spiral model (see below) modified the waterfall model in his book *Software Engineering Economics* (Prentice-Hall, 1987). The basic differences in the various models is in the naming and/or order of the phases.

The basic waterfall approach looks like the illustration below. Each phase is done in a specific order with its own entry and exit criteria and provides the maximum in separation of skills, an important factor in government contracting.



The waterfall is the easiest of the approaches for a business analyst to understand and work with and it is still, in its various forms, the operational SLC in the majority of US IT shops. The business analyst is directly involved in the requirements definition and/or analysis phases and peripherally involved in the succeeding phases until the end of the testing phase. The business analyst is heavily involved in the last stages of testing when the product is determined to solve the business problem. The solution is defined by the business analyst in the business case and requirements documents. The business analyst is also involved in the integration or transition phase assisting the business community to accept and incorporate the new system and processes.

V Model

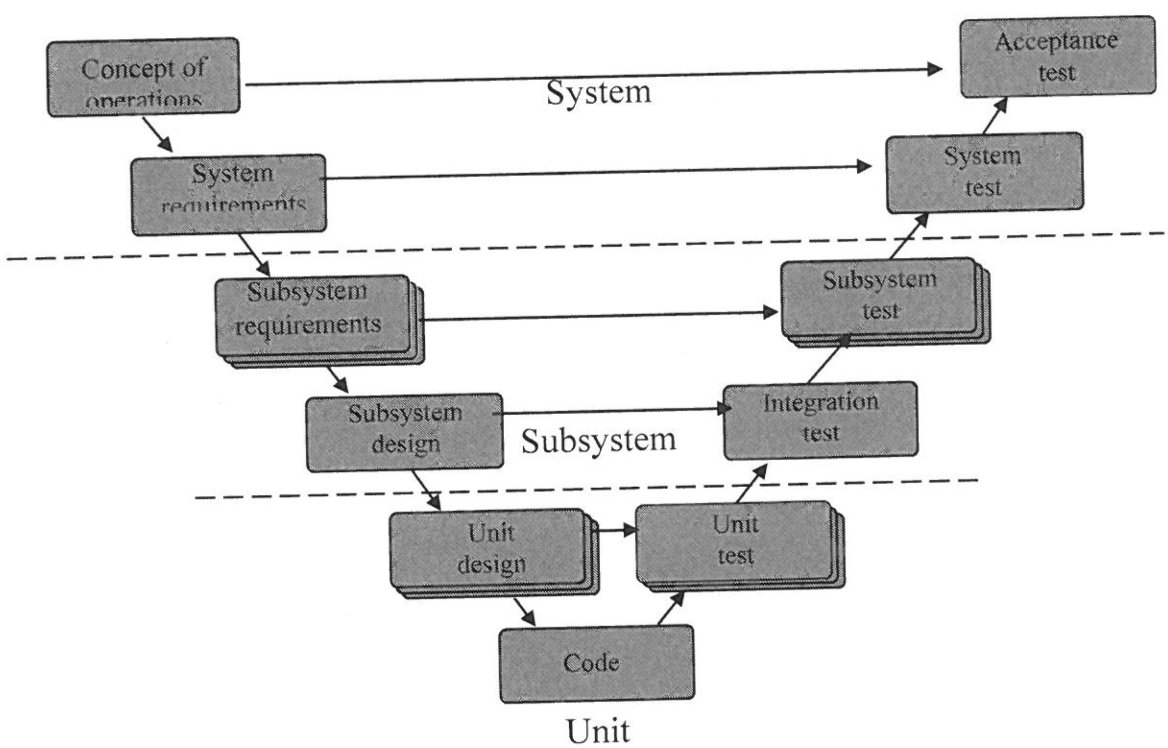
The "V" model (sometimes known as the "U" model) reflects the approach to systems development where in the definition side of the model is linked directly to the confirmation side. It specifies early testing and preparation of testing scenarios and cases before the build stage to simultaneously validate the definitions and prepare for the test stages.

It is the standard for German federal government projects and is considered as much a project management method as a software development approach.

"The V Model, while admittedly obscure, gives equal weight to testing rather than treating it as an afterthought. Initially defined by the late Paul Rook in the late 1980s, the V was included in the U.K.'s National Computing Centre publications in the 1990s with the aim of improving the efficiency and effectiveness of software development. It's accepted in Europe and the U.K. as a superior alternative to the waterfall model; yet in the U.S., the V Model is often mistaken for the waterfall…

"In fact, the V Model emerged in reaction to some waterfall models that showed testing as a single phase following the traditional development phases of requirements analysis, high-level design, and detailed design and coding. The waterfall model did considerable damage by supporting the common impression that testing is merely a brief detour after most of the mileage has been gained by mainline development activities. Many managers still believe this, even though testing usually takes up half of the project time."

As shown below, the model is the shape of the development cycle (a waterfall wrapped around) and the concept of flow down and across the phases. The V shows the typical sequence of development activities on the left-hand (downhill) side and the corresponding sequence of test execution activities on the right-hand (uphill) side.



Software Requirement

1. Language - Java (JDK 1.7)
2. OS - Windows 7- 32bit
3. MySql Server
4. Android ADK

Hardware Requirement

1. 1 GB RAM
2. 80 GB Hard Disk
3. Above 2GHz Processor
4. Android Mobile With GPRS

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