A Web-based Platform for
Mobile Service Delivery

Mohammed Samaka
Department of Computer Science and Engineering
Qatar University
Doha, Qatar
Samaka.m@qu.edu.qa

John Impagliazzo
Department of Computer Science
Hofstra University
Hempstead, New York USA
John.Impagliazzo@Hofstra.edu

Loay Ismail
Department of Computer Science and Engineering
Qatar University
Doha, Qatar
loay.ismail@qu.edu.qa

Khulood Khalil Aldos
Research Assistant
Qatar Computing Research Institute (QCRI) /Qatar Foundation
Doha, Qatar
khulood.k.2011@gmail.com

Fatima Abdulla Al-Saffar
Business Solution Department
Qatar Telecommunication (Qtel)
Doha, Qatar
fofo4ever@msn.com

Nura Shifa Hamed
Department of Computer Science and Engineering
Qatar University
Doha, Qatar
200662861@qu.edu.qa

Abstract—**The project presented in this paper involves designing and developing a web-based platform called "Content Management & Delivery Platform" (CMDP) in support of mobile service delivery that integrates with the mobile network of Qatar Telecom (Qtel). The design of the platform meets the current and future needs in content creation and delivery for Qatari businesses and governmental organizations. The CMDP allows aggregation, rendering and delivery of different type of contents, through various types of value-added mobile services. The CMDP will eventually provide a versatile platform to the application service providers and enterprises for managing, storing and distributing their wireless media, images, sounds and streaming video to their existing mobile subscribers.**

Keywords – content management system, mobile delivery systems, mobile- based business support system; mobile services, Valuae added services

I. INTRODUCTION

Qatar, characterized by its heterogeneous environment of mobile devices with varying characteristics, exhibits a situation that inhibits easy and readily accessible sharing of information through these devices because of limited mobile services, content creation, and delivery when compared to other developing countries in Asia and Europe. Consequently, local mobile communication does not always meet the needs of highly emerging businesses and industries. In an attempt to address this issue, the project presented in this paper involves designing and developing a platform called the "Content Management and Delivery Platform" (CMDP). The key achievement of this project involves building a platform in which content providers can inject their mobile content deliverable to their identified client list using Push SMS, Bulk SMS and WAP PUSH. Another achievement is the ability for the content provider to host SMS and MMS content on the platform marketed to the platform visitors. The platform supports the delivery of the hosted SMS items through Pull mobile services in two ways: the first is through the web; the second is by sending an item code through SMS. Another achievement is the implementation of a billing schema between the platform users for the services used and enabling the business support system (BSS) module to generate statistical reports on some service activities. The novelty of the CMDP architecture designed and developed in this project is scalability. It serves several content providers, integrated with several network providers. In addition, the design establishes a foundation upon which further capabilities could be added in support of rich multimedia and IP-based services. The CMDP will eventually provide a versatile platform to the application service providers and enterprises for managing, storing and distributing their wireless media, images, sounds and streaming video to their existing mobile subscribers.

II. SOLUTION OVERVIEW AND FUNCTIONAL REQUIREMENTS

For this project, several platforms for delivery of VAS were surveyed [1, 2, 3, 4, 5, and 6]. Most of these platforms appear in the literature as commercial applications with not much of details given about their design and development components. The UGetMobile platform offers several VAS including; SMS, MMS, blogs, LBS, video, and email [2]. The UGetMobile architecture contains three subsystems; *Web Portal, Service Delivery Engine* based on a SMPP protocol, and the *Content Management System (CMS) that* provides built-in services such as advertising, localization, customized

branding and content control. The CMS also enables the user community to communicate online with customers, colleagues and suppliers in different languages across multiple channels.

Many content management systems (CMSs) integrate with commercial platforms used for delivering of mobile services. In this study, the authors investigated and closely analyzed several CMSs including Jahia, Joomla, dotCMS, openCMS, and Magnolia [7, 8, 9, 10, and 11]. Based on that analysis, they chose Joomla because of its high functionality among the other CMS systems and because it was open source and more flexible for modeling and in meeting the design requirements.

In addition, the authors investigated several methods for image rendering, mainly, the Attention Object Detection, Eye Fixation, Mesh Parameterization, and Seam Carving [12, 13, 14, 15, 16, and 17]. They selected the Seam Carving method embedded with salient object detection as a suitable rendering method for this project. Prominent object detection is an explicit algorithm they decided to use beside the Seam Carving method to detect the main objects of the images, it uses a high performance dynamic programming approach that has a linear complexity with respect to the images' sizes and it has open source availability while other methods did not have that feature.

One of the important operations on the CMDP system is payment. There are many payment methods available on the market that one can use to implement the payment operation on the CMDP and to manage the payment process between the Service Provider (SP) and the Content Provider (CP). For this study, the authors investigated three widely used payment methods: PayPal, Moneybookers, and Paymate [18, 19, and 20]. The project team chose Moneybookers as the best-fit payment method, mainly because it is an international service, it fits in the security desired for the CMDP system, and it has the lowest commissions on the market.

A. CMDP System Analysis

Three actors interact directly with the CMDP system:

- *Content Provider*: Initiates and approaches the system with contents to be published or hosted via the system.
- *Service Provider*: Supervises and controls the operations, requests and traffic of the Content Provider's accounts and content.
- *Visitors*: Who access the content providers hosted contents in the CMDP, browsing items and buying them.

Each actor in the system has various roles as shown in the UML use case diagram of Figure 1.

1. Content Provider (CP): The CP is responsible for injecting the CMDP with his contents. The CP would choose whether to deliver the content to clients or host the content on the system categories. These contents could be music, wallpaper, WAP pages, text, or images.
2. Service Provider (SP): The SP is the system manager who is responsible for managing the device profiles, activating the content provider accounts, managing the categories and Item Module.
3. Visitors: They are the targeted users who will purchase contents from content providers through the CMDP web portal.
4. Database: It is the Repository of the system where the data and content is stored, updated, and retrieved.
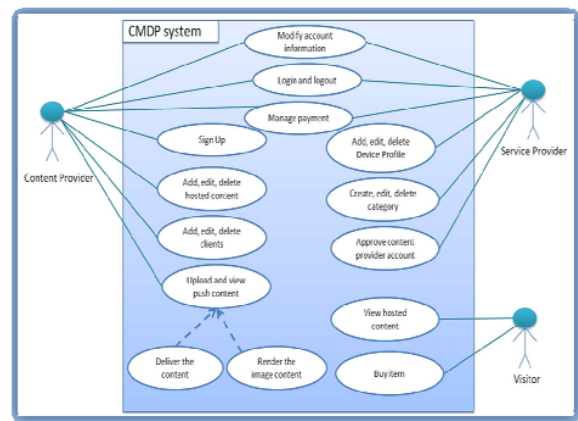

Figure 1: UML use case diagram

Sequence Diagrams—The CMDP system consists of two main services. One is the *push service*, represented in the pushing content management module in the content aggregation and the management subsystem where the CP could Push SMS, Push MMS, WAP Push, or Bulk SMS to the client list. The other service is the *pull service*, represented in the content hosting module on the content aggregation and management subsystem where the CP can host SMS or MMS content on the SP side with unique code. The CP hosted contents appear in the CMDP system for the visitor access level. Visitors can pull any content out from the server by sending item code through SMS or through the web. The sequence diagram of the *push* SMS service appears in Figure 2. The sequence diagram of *pull* SMS service through the web appears in Figure 3.
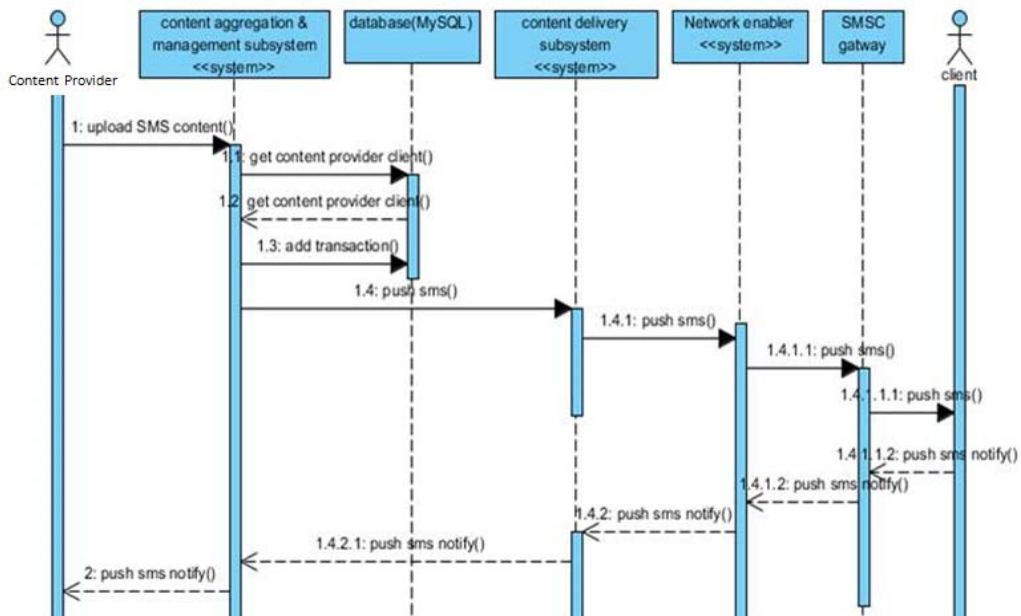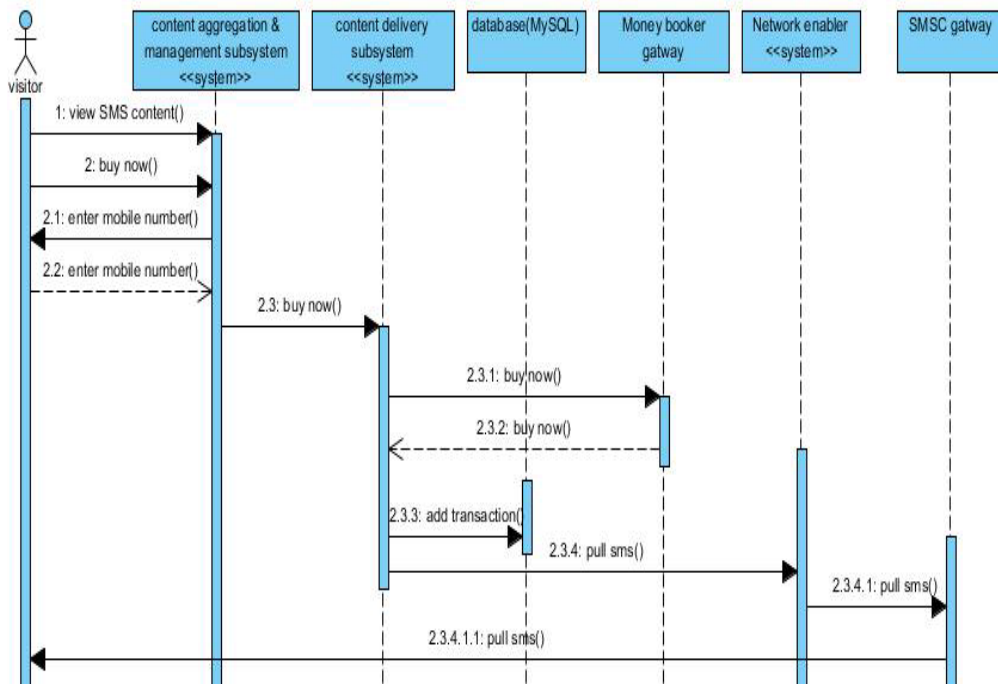
Figure 2: Push SMS sequence diagram

Figure 3: Pull SMS through the web sequence diagram

B. High-level System Architecture

Figure 4 shows the overall architecture of the CMDP where it is integrated with the Telco platform and comprises two major subsystems. The first is the Content Aggregation and Management Subsystem (CAMS) in which content rendering element plays a major role. The second is the Content Delivery Subsystem (CDS) that interfaces via appropriate protocols to various types of Telco's Network Enablers.
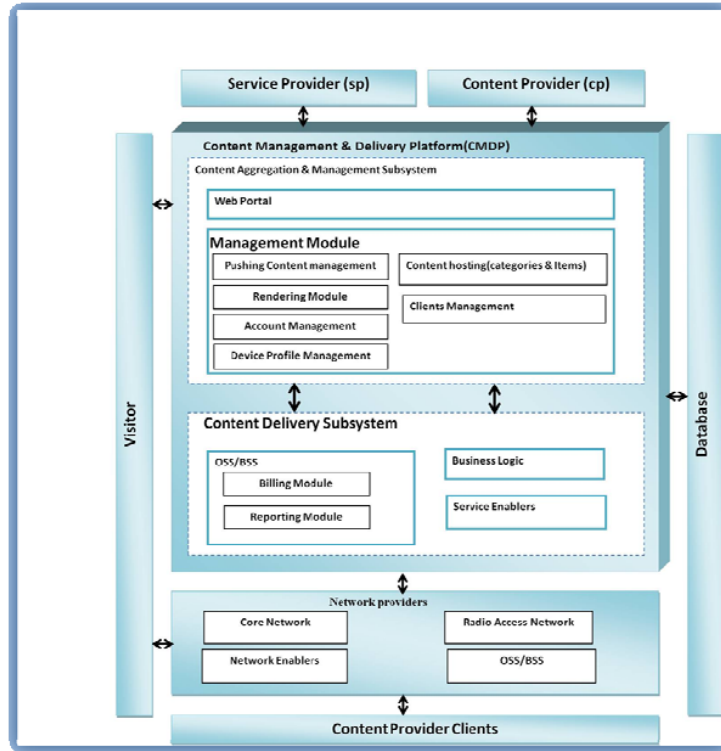

Figure 4: The CMDP overall Architecture

C. Components Overview

Content Management and Delivery Platform (CMDP)—This is a collection of procedures used to manage the workflow in a collaborative environment. These procedures can be manual or computer-based. It utilizes embedded software code to deliver content. It is composed of two subsystems, which are the Content Aggregation and Management Subsystem (CAMS) and the Content Delivery Subsystem (CDS) described as follows.

Content Aggregation and Management Subsystem (CAMS)—The subsystem that is responsible of gathering, adding, deleting, editing, previewing, hosting and publishing the content. Its purpose is to group several things together considered as a whole. It is also composed of the following:

- *Web Portal (WP)*: It is the interface for the system users who are CPs to manage their content and clients, visitors to view and buy the hosted content, SP to manage the device profile and hosted content, and for the registration of the CP.
- *Management Module*:

- o *Account Management Module (AMM)*: It is the module responsible to handle user accounts and different permissions and authentication levels.
- o *Pushing Content Management Module*: The CP ability for content uploading, previewing, publishing or submitting the content and choosing the delivery service to be used.
- o *Device Profiling Management Module*: SP can add, edit, and delete a device profile periodically.
- o *Rendering Module*: It is responsible for rendering the content (e.g., image), supplied by the CP to fit in the client's mobile device capability. It takes into consideration the variation in sizes, resolutions, and aspect ratios of the small displays of the target mobile devices. For this regard, a PHP function was developed and added to Joomla that acts as an interface to MATLAB. In this study, the rendering engine is capable of rendering content to be displayed in widely used handset devices (e.g., iPhone, Blackberry, and Nokia).
- o *Content hosting (categories & items)*: The CP can upload contents to be hosted in the system where the

visitors can view and buy. The CP can edit and delete this content. The content is organized by categories where each category has items. The SP is the one who is responsible for creating, editing and deleting categories.

- o Clients Managements: The CP can add, edit, and delete the information of his clients who will receive the content uploaded for delivery.

Content Delivery Subsystem (CDS)—The system that is responsible for administering the method of delivery, supporting operations, such as maintaining networks and managing faults, and supporting business-related processes, such as taking orders and collecting payments. It is decomposed to the following items.

- *Business Logic (BL)*: It consists of functional algorithms and procedures that handle information exchange between the database and the system interface.
- *Service Enablers (SE)*: They are the technologies used to deliver the content. For instance, messaging enablers, browsing enablers and WAP push.
- *OSS / BSS*: This layer is the support layer. It is essential to run the process of delivery in two perspectives, *operational* support and *business* support. These two supports are systems because they follow certain procedures and have inputs and outputs as per the definition of system. This layer involves two support systems:
  - o *Reporting Module (RPM)*: It is responsible for generating periodical reports and statistics to measure performance and customer satisfaction.
  - o *Billing Module (BM)*: It is responsible for calculating prices and handling payments and invoicing.

Telecom Provider (TP)—A telephone company (Telco) used for transmitting messages over a distance electronically.

We have two telecom providers in Qatar. The first is Qtel and the second is Vodafone. It is composed of the following:

- *Core Network (CN)*: It is the central part of Telecom network that provides various services to customers who are connected by the access network.
- *Radio Access Network (RAN)*: It is part of a mobile Telecommunication system. It implements a radio access technology. Conceptually, it sits between the Mobile phone, and the core network (CN). Examples of RANs are GRAN for GSM.
- *Network Enablers (NE)*: They are gateways and servers that isolate the end user from the complexities of the underlying network. For example, if WAP gateway is enabled, customers can use the WAP technology.
- *OSS/BSS*: Intuitively, it is similar to OSS/BSS layer in CMDP layer. It may have some variations depending on the work nature of the telecom company.

III. DEPLOYMENT AND IMPLEMENTATION

The deployment scenario mainly depends on the client/server architecture of the system, where all system users that are SP, CP, and visitors are clients, as shown in Figure 5. They all attempt to connect to the system from their client PCs using a network connection (TCP/IP) and a web browser. The system server validates the identity of the user who is trying to connect to the CMDP server, then grants the connection, and it starts receiving services requests. The CMDP server conveys MySQL commands to the database to fetch data or to update the database with new changes. For instance, it receives requests from the CP and updates the clients' information table located in the database with the new information. Also, at the client end the CMDP connects to the Moneybookers payment gateway (server) that provides an online payment interface for the end-users to be able to process payments securely.
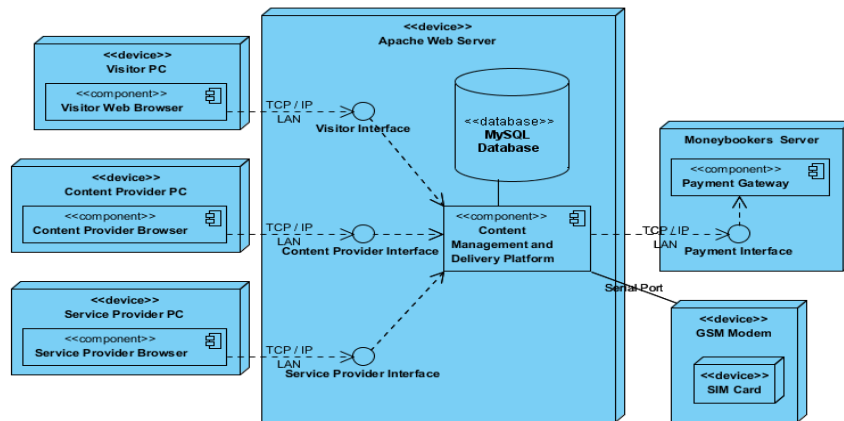

Figure 5: CMDP UML deployment diagram

IV. CONCLUSION AND FUTURE WORK

The innovative part of this project is the overall evaluation of the engineered solution for designing and developing a platform for content aggregation, rendering and delivery. Such a solution should penetrate into the world market as the demand of real-time services arises where the service provider can serve several content providers through several network providers. Trends throughout the world require that the future engineering solution should address a broad range of real-time services such as multimedia and IP-based services. In

addition, the design establishes a foundation upon which further capabilities could be added in support of rich multimedia and IP-based services. The CMDP will eventually provide a versatile platform to the application service providers and enterprises for managing, storing and distributing their wireless media, images, sounds and streaming video to their existing mobile subscribers.

After the CMDP was tested and evaluated, the project team involved in this study used the SWOT analysis to present the Strength, Weaknesses, Opportunities, and Threads for the CMDP system, as given in Figure 6.

Strengths	**Weaknesses**
- Supports Push SMS, Pull SMS, Bulk SMS, WAP Push - Integrated payments for several Network providers - Uses open-source framework - Stable tools used (PHP, MySQL, Joomla) - Real-time payment, message delivery, reporting - HTTPS secure protocol utilized - User-friendly interface and high speed and performance - Web system accessible through any web browser	- The architecture need enhancement to better fit Qatari business industry - Making real analysis of its requirements - MMS service is not working in Pull and Push - Additional cost of payment solution - Some supportive software are trial version
Opportunities	**Threats**
- Fit in the developing demand existing in the market - Scalable implementation (e.g. new mobile services can be added easily) - New Items can be uploaded using friendly interface to put it up for sale - Ability to publish it on the world wide web	- It takes time to step in the market especially when local competitors exist - Threat of centralized database - SP must possess strong ethical value and mission with the system users - Threat of new regulations and rules if imposed on service provides by government

Figure 6: SWOT analysis of the system

REFERENCES

[1] Microsoft Service Delivery Platform: Technical Overview, Microsoft Corporation, October 2003. Available:http://download.microsoft.com/download/a/8/e/a8e610d8-fdd9-4529-b5b6 1a37b342bf96/Microsoft_Service_Delivery_Platform_Technical_Description.doc

[2] Volantis Framework: Application Development Platform. Available: http://www.volantis.com/products [Accessed: Dec. 1 2010]

[3] Mobile Web Content: Available: http://www.wire2air.com/mobilecontent.asp

[4] McDonald, J. "Systems and infrastructure for billing next-generation corporate ICT services", BT Technology Journal, Vol 26 No 2, April 2009. Available: http://www.btplc.com/Innovation/Journal/BTTJ/current/HTMLArticles/Volume26/23Systems/Default.aspx

[5] Pfeifer, T.; Haughney, H.; Downes, B.; "UGetMobile End-user Mobile Publishing Platform," *E-Commerce Technology, 2006. The 8th IEEE International Conference on and Enterprise Computing, E-Commerce, and E-Services, The 3rd IEEE International Conference on* , vol., no., pp.78, 26-29 June 2006

[6] Next Generation Mobile Service Platform. Authors: JungSook Bae, SookYang Kang, JaeHo Kim, Brad HyunSeo Park (IEEE)

[7] Jahia. "Jahia : The Web Content Integration Software" [HTML]. Available: http://www.jahia.com/ [Accessed : Nov 5, 2010]

[8] Joomla. "Joomla : Features Overview" [HTML]. Available: http://www.joomla.org/core-features.html [Accessed: Nov15, 2010]

[9] dotCMS. "dotCMS Documentation". Available: http://dotcms.com/docs/1.9/ContentManagement [Accessed: Nov 5, 2010]

[10] Slava Asipenko, Yuval Zukerman. (2006, 09 17). "OpenCms 6.0: A Review" [HTML]. Available: http://www.realstorygroup.com/Feature/152-OpenCms-6 [Accessed: Nov 5, 2010]

[11] Mangolia. "Mangolia : Mangolia Features" [HTML]. Available: http://www.magnolia-cms.com/magnolia-cms/evaluation/features.html [Accessed: Nov 5, 2010]

[12] Liqun Chen, Xing Xie, Xin Fan, Wei-Ying Ma, Hong-Jiang Zhang, Heqin Zhou. (2002, 11 14). "A visual attention model for adapting images on small displays" [PDF]. Available: http://research.microsoft.com/pubs/69977/tr-2002-125.pdf [Accessed: Nov 5, 2010]

[13] Privitera, C.M.; Stark, L.W.; "Algorithms for defining visual regions-of-interest: comparison with eye fixations," *Pattern Analysis and Machine Intelligence, IEEE Transactions on*, vol.22, no.9, pp.970-982, Sep2000; doi:10.1109/34.877520 Available: http://0ieeexplore.ieee.org.mylibrary.qu.edu.qa/stamp/stamp.jsp?tp=&arnumber=877520&isnumber=19001 [Accessed: Nov 5, 2010]

[14] Yanwen Guo; Feng Liu; Jian Shi; Zhi-Hua Zhou; Gleicher, M.; , "Image Retargeting Using Mesh Parametrization," *Multimedia, IEEE Transactions on*, vol.11, no.5, pp. 856-867, Aug. 2009 doi:10.1109/TMM.2009.2021781, Available:http://0ieeexplore.ieee.org.mylibrary.qu.edu.qa/stamp/stamp.jsp?tp=&arnumber=4907044&isnumber=5166527 [Accessed: Nov 5, 2010]

[15] Subramanian, S.; Kumar, K.; Mishra, B.P.; Banerjee, A.; Bhattacharya, D.; "Fuzzy logic based content protection for image resizing by seam carving," *Soft Computing in Industrial Applications, 2008. SMCia'08. IEEE Conference on*, vol., no., pp.78-83, 25-27 June 2008 doi:10.1109/SMCIA.2008.5045939Available: http://0ieeexplore.ieee.org.mylibrary.qu.edu.qa/stamp/stamp.jsp?tp=&arumber=5045939&isnumber=5045920 [Accessed: Nov 5, 2010]

[16] Zhi Liu, Hongbo Yan, Liquan Shen, King Ngi Ngan, Zhaoyang Zhang. (January 2010). "Adaptive image retargeting using saliency-based continuous seam carving" [PDF]. Available: http://www.ee.cuhk.edu.hk/~knngan/JOE_v49_n1_p017002.1-10.pdf [Accessed : Nov 5, 2010]

[17] Jacob Stultz. (2008, 05 16). "Seam Carving: Parallelizing a novel new image resizing algorithm". Available: http://beowulf.lcs.mit.edu/18.337-2008/projects/reports/stultz-6338.pdf [Accessed : Nov 5, 2010]

[18] Giridhar. "How paypal works, case studies, advantages, disadvantages, features, phone numbers." Available: http://dotgiri.com/2009/06/19/how-paypal-works-case-studies-advantages-disadvantages-features-phone-numbers/, Jun. 19, 2009 [Accessed: Dec. 4, 2010]

[19] Moneybookers. "Moenybookers.", Available: http://insta-change.com/en/wiki_moneybookers.php [Nov.10, 2010]

[20] EBay. "EBay - Choosing a payment method (for buyers)." Available: http://pages.ebay.com/help/pay/methods.html [Accessed: Dec. 19, 2010]