Mobile Content Services: a Case of Oakland County's eGovernment

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Introduction

Personal Digital Assistants (PDAs), internet-ready mobile phones and other mobile devices have become an important part of daily life. In 2006, more than 34.6 million mobile subscribers accessed the Internet via wireless devices[1]. These devices transform the way people communicate by incorporating unprecedented user mobility and speed in the transfer of information allowing people to access information on-the-go; this in turn creates a demand for the reformat and delivery of content offered through conventional wired technologies. Many well invested businesses have established Content Management Systems (CMS) in house that handle the delivery of information. For companies hoping to meet such mobile information needs there are two options: either create duplicate information for mobile devices or leverage existing CMS data. As the creation of duplicate information is time consuming and costly, most businesses are typically better off leveraging their existing content by converting it to a mobile friendly format.

Oakland County, Michigan is committed to serving its communities through empowered and progressive leadership that is entrusted to embrace innovation in every aspect of government. The Oakland County eGovernment leverages existing technologies to provide state-of-the-art programs and services to the community in order to bring citizens, businesses and education closer together with government. Oakland County has a large investment in its CMS and an ever growing citizen base that has quickly adopted the mobile market. Responding to this trend, the Mobile Content Services Initiative (MCSI) was formed in 2006. The MCSI was a joint venture between the Oakland County eGovernment and Michigan State University's Colleges of Business, Communication Arts and Sciences, and Computer Science and Engineering. Michigan State University students worked with the Oakland County eGovernment to investigate the possibilities of leveraging information residing on existing Web content management systems for further delivery to and access by small-format mobile wireless devices.

This paper explores the MCSI and the potential for replicating its results to other organizations. This paper will present details of the MCSI, the proposed Process Transformation Framework, the developed Mobile Content Platform, the adopted Asset Leverage Strategy, and the flexibility, scalability and reuse potential of the MCSI at large. The MCSI was formed in an attempt to solve the problems faced with adapting mobile content distribution channels into existing wired distribution networks. The Process Transformation Framework (PTF) was developed by the MCSI as a structured methodology for leveraging existing assets in new areas. The Mobile Content Platform (MCP) was built as a bridge between Oakland County's existing network and the mobile end-user. The Asset Leveraging Strategy (ALS) was produced, as a complement to the MCP so that the MCP could address Oakland County's specific content and service delivery needs. The flexibility provided in the designs of the PTF, MCP, and ALS can lead to the MCSI work being adapted by other projects. The PTF as a methodology defines processes that can be followed from project start to completion. The MCP is customizable to adjust to any Windows server network. The strategies used in developing the ALS can be followed to customize the MCP to fit most organizations' needs. The modularity provided by these three components allows the MCSI's work to be customized and adopted by organizations looking to expand current wired-Web applications onto mobile formats.

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[1] Telephia: Mobile Internet report; June 2006

The Mobile Content Service Initiative

The Mobile Content Service Initiative (MCSI) was founded to solve the problem of maintaining a current network architecture and content servicing while moving into mobile content deployment. The MCSI offers evidence that the concepts, methodologies, and techniques used to develop the MCP and ALS are successful in this regard. As such, the results of the MCSI can be ported to other environments where organizations are facing similar dual format content deployment issues.

The goal of the MCSI was to provide the Oakland County eGovernment with a MCP, analytical break down and identification of key mobile content pages to be supported on mobile devices, and recommendations and strategies for building upon the provided mobile platform. The MCP was intended to act as the bridge that would connect to Oakland County's pre-existing assets and link them to a mobile user. The analytical break down was to be done on Oakland County's current Web traffic and crossed with a survey of the population in an attempt to identify key areas of users' content/service interests. These areas were than analyzed on the basis of their ease of portability to mobile displays. Recommendations and strategies were devised to give specific resolution to problems uniquely found in Oakland County. These instructions also explain how to move forward with the MCSI. MCSI achieved all its goals and in the process developed the PTF. In the end, the MCP became an integral part of the infrastructure and the recommendations and strategies proposed became consolidated into the ALS.

As mentioned earlier, the MCSI was composed of four Michigan State University students and one representative from Oakland County's eGovernment. The MCSI was supported by the faculty and staff of Michigan State University and Oakland Government. The four students worked as part of the Information Technology Specialization Capstone course at Michigan State University. The Specialization is intended to bring University students from the three colleges of Communication, Arts and Sciences, Business, and Engineering and Computer Science together. Jim Taylor, Chief of Program Services for Oakland County's eGovernment, worked along side the students to ensure that the team correctly addressed Oakland County's issues. The entire MCSI lasted four months and achieved all its goals, i.e. Oakland County was now equipped with a working mobile content distribution system.

Process Transformation Framework

The Process Transformation Framework (PTF) is a proposed methodology that emerged out of the design and implementation phases of the MCSI work. As a methodology the PTF is used to structure the preparation, design, and development of a project that specializes in building upon existing assets. What makes the PTF unique from conventional system development methodologies is its focus on the reuse and leveraging of existing assets. This allows for new value to be added into existing systems. The focus of the PTF is re-purposing and extending the life of existing assets. As such, any organization that looks to incorporate this methodology should have a focused vision for the developing system and a detailed inventory of existing assets.

During the evaluation phase of the MCSI, design and development techniques were abstracted from actual accounts of those who had worked on the MCSI. These techniques were then generalized and revisited to ensure that the motivations of the PTF had been realized. These motivations included asset re-use, flexibility, and modularity. The greatest emphasis within the PTF is placed on asset re-use. Incorporating this motivation significantly differentiates the PTF methodology from other approaches that also aim to facilitate the development of a new service. Asset re-use simply means that during the development phase of a project existing systems and hardware will be a major focus of re-use during the design and implementation of the new system. The PTF is a skeleton of linked goals and objectives that should be followed during the design and development phases of a project. Early in the conceptualization of the PTF an issue was identified regarding the over-specification of the MCSI project. In resolution, the PTF was injected with flexibility through the abstraction of processes. These abstractions led to generalized goals in place of specific scenarios. This flexibility was inevitably followed by further modularization of the goals into objectives. Each objective contains no specific instructions or structure. The PTF simply defines goals, objectives, tasks, deliverables, and relations between goals and objectives. It is the responsibility of the organization to devise exact tasks and actions that can be followed to complete the tasks and generate the deliverables defined by the goals and objectives. The PTF's overarching purpose is to achieve three goals: facilitate a problems definition, define a system's design, and facilitate the development of an IT solution. In its final form, the PTF consists of these three goals along with nine objectives all interconnected and eventually leading to the successful implementation of a new product/service (see Figure 1).

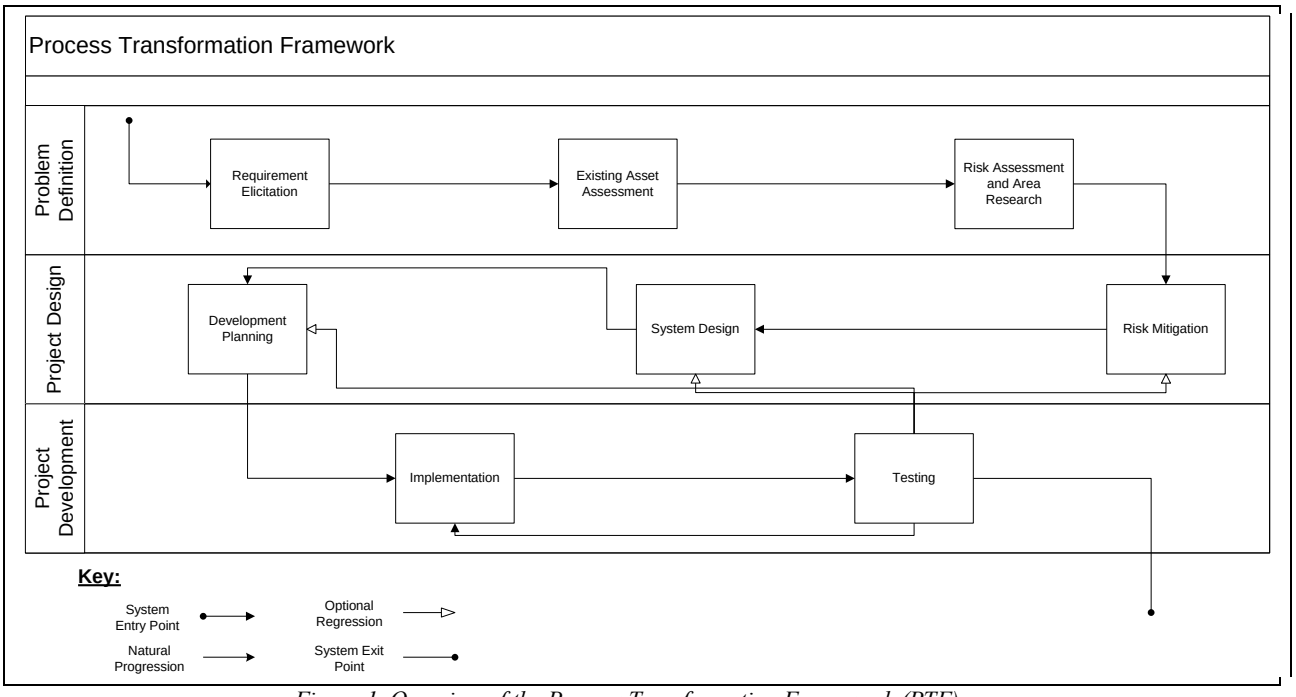

Figure 1. Overview of the Process Transformation Framework (PTF)

Problem Definition

The first goal of the PTF is titled *Problem Definition* (see Figure 2) and aims at improving the understanding of a problem. It has objectives and deliverables that generate outputs related to the description of existing systems and the problems that prevent a natural progression to the desired system. Requirement elicitation is the first objective of the *Problem Definition* and encompasses three tasks: discover system requirements, establish the high-level goals of the system, and establish customer needs and expectations. Once accomplished, the results are then written into the *System Requirements* document (i.e. the deliverable of this objective). The next objective, *Existing Asset Assessment*, consists of the following tasks: define systems in use within the organization, locate key assets and describe their involvement in the current systems' operations, locate systems and assets that can be incorporated into the developing architecture, and locate potential areas of inputs and outputs that exist within the current systems and assets that can be used as entry and exit points to communicate with the developing system. The results are then written into the *Existing Asset Summary*. The final objective involved in *Problem Definition* is *Risk Assessment and Area Research*. *Risk Assessment* and *Area Research* go hand in hand as identified risks must be properly researched before valid mitigation strategies can be formed. *Risk Assessment and Area Research* includes the following tasks: define potential hazards and unknowns that if unchecked would compromise the integrity of the developing system and its usefulness; and develop an understanding of these risks in preparation for mitigation strategies. The results are then written into the *Risk Analysis Report*. Upon completion of the *Problem Definition* goal three written deliverables should become available: *System Requirements*, *Existing Asset Summary*, and *Risk Analysis Report*.

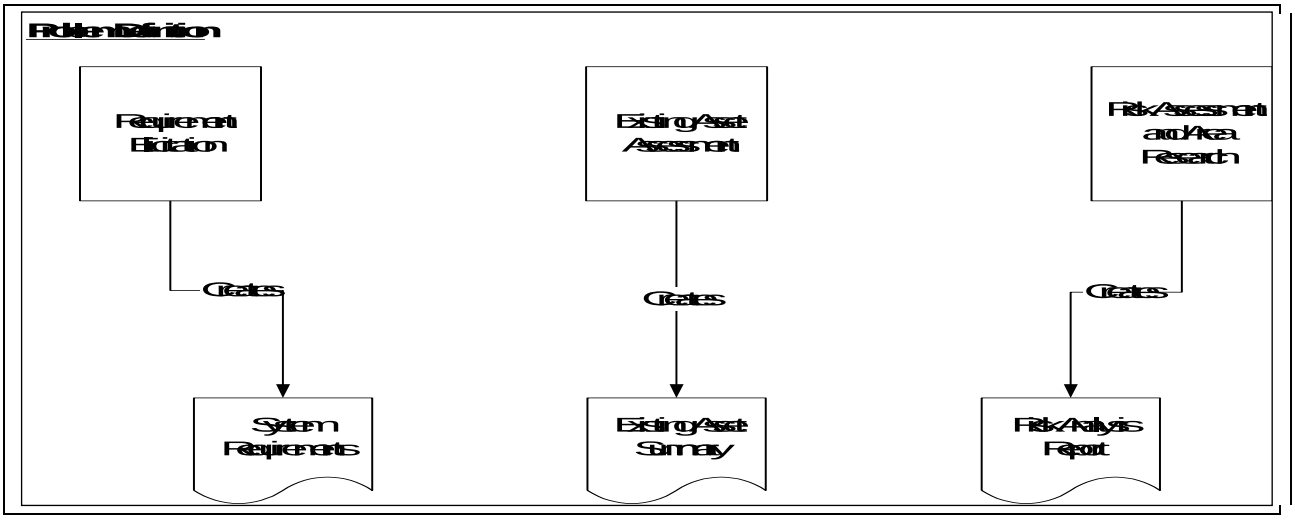

Figure 2. Problem Definition goal within the Process Transformation Framework

Project Design

The second goal of the PTF is titled *Project Design* (see Figure 3) and utilizes the information created during the realization of the *Problem Definition* goal. As the name would suggest, the *Project Design* goal aims to create a system design that meets the customer needs while addressing the risks, all achieved while utilizing existing systems and assets. The first objective in *Project Design* follows directly from the last one in *Problem Definition*. *Risk Mitigation* is designed to subsume the *Risk Analysis Report* created during the *Risk Assessment and Area Research* objective and develop mitigation strategies to resolve and prevent potential system disturbances. *Risk Mitigation* involves the following two tasks: map possible risks to risk resolution strategies, and classify risks into categories of unresolved, high priority, low priority and system resolution (note, these categories are sets, meaning they have operations of intersection, union, and contain unique entries). High priority risks are those that if unchecked would prevent the full functionality of the proposed system. Risks of low priority are those that would not significantly affect the productivity of the developing system and as such should only be addressed if time permits. System resolution risks are defined as risks that will be or are already mitigated through the system's design or implementation. During the first iteration of this objective there may be no risks in the category of system resolution although by the end of development all high priority risks should also be system resolution risks. The results are written into the *Risk Dictionary* document, which is left open to revisions as this objective is revisited during future iterations. The next objective is *System Design*, which subsumes the *System Requirements*, *Existing Asset Summary* and *Risk Analysis Report* documentation. The tasks that fall within the scope of *System Design* are to: develop an understanding of desirable input and output from and into the new system, describe the inner workings of the system, and describe connections between the new system and existing assets. The results are then captured by the *Technical Specification* document, which is left open for future modifications. The final objective in *Project Design* is *Development Planning*, which subsumes the *Risk Analysis Report* and *Technical Specification*. The tasks within *Development Planning* are to: structure the system's implementation procedure; reduce risks associated with time constraints, and optimize total implementation time. The results are then recorded in the *Project Schedule* documentation. In summary, upon completion of this goal three documents should be made available: *Project Schedule*, *Technical Specification*, and *Risk Dictionary*.

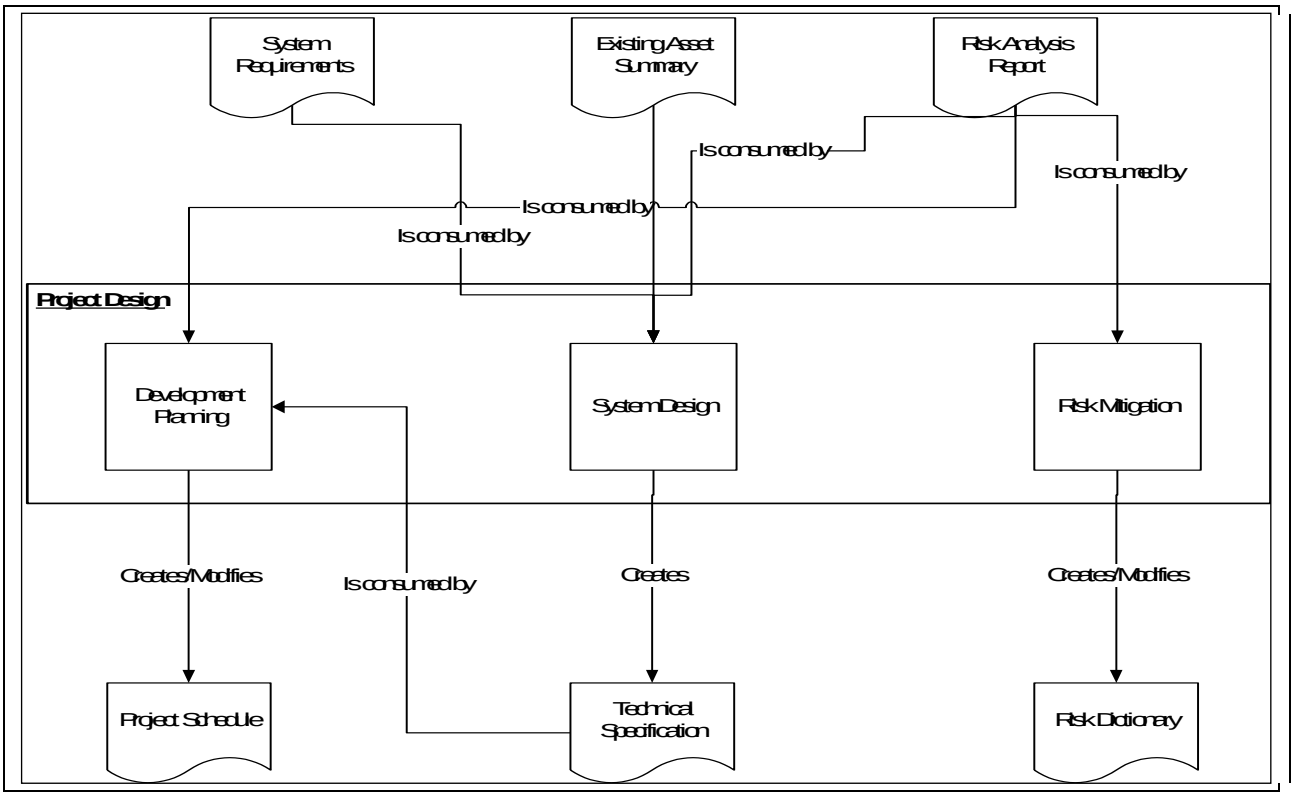

Figure 3. Project Design goal within the Process Transformation Framework

Project Development

The final goal within the PTF is *Project Development* (see Figure 4), and as the name suggests the outcome is a usable solution to the defined problem. *Project Development* takes advantage of the planning and design information generated during the completion of the *Project Design* goal and this information is used to begin system implementation and testing. The first objective is *Implementation*, which subsumes the *Project Schedule*, *Technical Specification* and *Risk Dictionary*. Testing later produces a document known as *Application Feedback*, which becomes available for inclusion into this objective during future iterations. The deliverable of this objective is a testable piece of application code and comes in the form of an *Application Component*, which if successfully tested can be built onto and incorporated into the final product. The next objective is *Testing*, which subsumes the *Application Component*. *Testing* tasks aims to locate bugs and feature flaws in the *Application Component* and are captured by the *Application Feedback* document. Bugs and flaws revealed during testing may produce the need for adjustment of the *Technical Specification* and the *Risk Analysis Report*. In the cases where these documents are modified the objectives that subsume them will need to be reevaluated and their corresponding outputs adjusted accordingly. In the end, the deliverable of this objective is a usable application that solves the customers' problem.

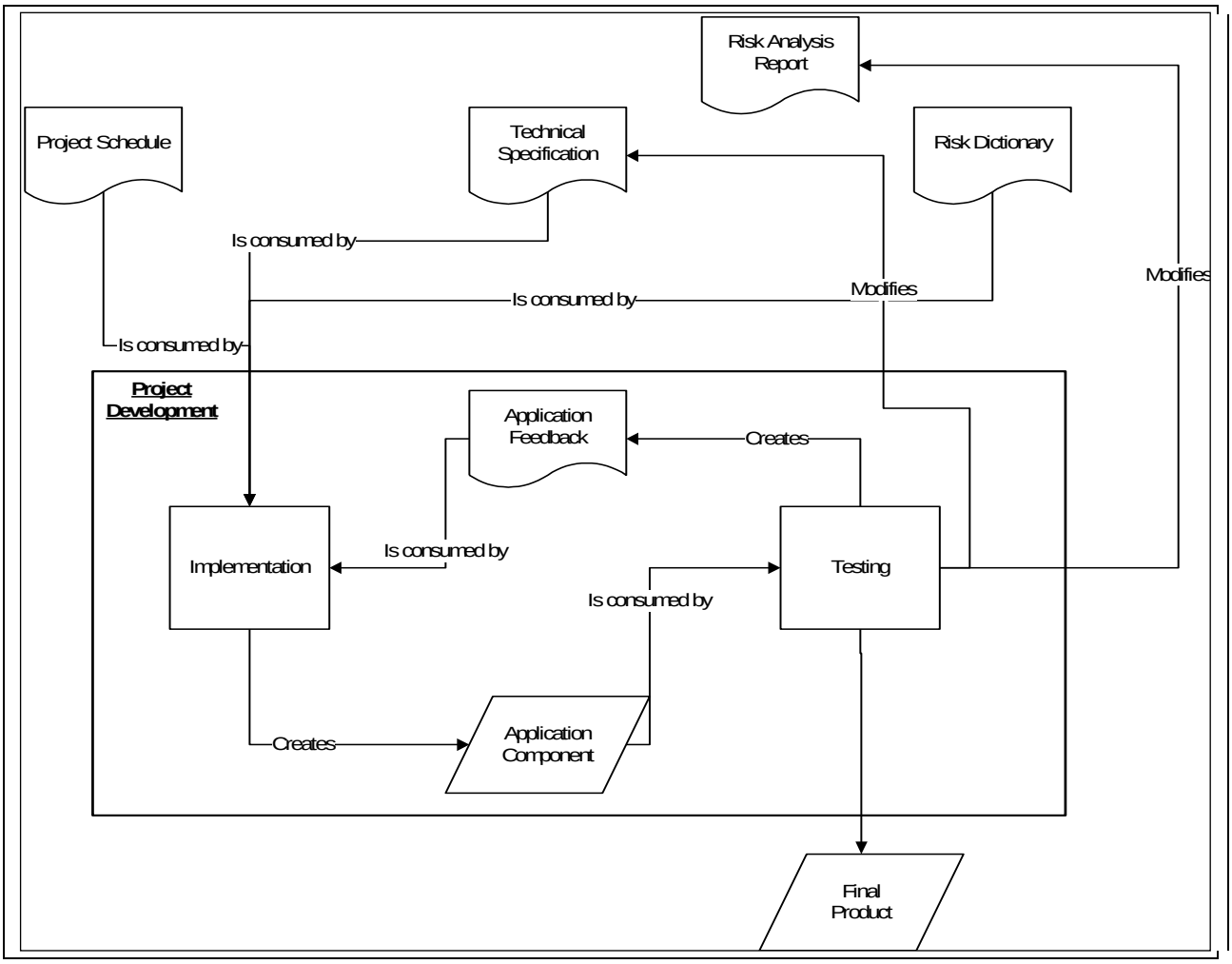

Figure 4. Project Development goal within the Process Transformation Framework

Implementation may not always be a constant process from start to finish. Agile methods are becoming increasingly popular in software design. These methods encourage a more rapid approach to implementation. Through the approach proposed by the PTF, the implementation is broken into small testable segments. These segments are then tested and improved before moving on to the next one, which usually adds more functionality. In this case the *Project Development* goal would be non-linear and more of a circular process that moves back and forth between the *Implementation* and *Testing* objectives.

In summary, the PTF (shown in full in Figure 5) may be best described as a set of operational guidelines classified into sections but linked by related processes. These guidelines contain sets of goals, objectives and deliverables that are used to direct the outcome of the process. It is important to note that the PTF is not a specific set of "How-to" instructions that claims to work in all situations. The PTF is designed to be used as a framework that can be customized and expanded by an organization to meet its project's needs.

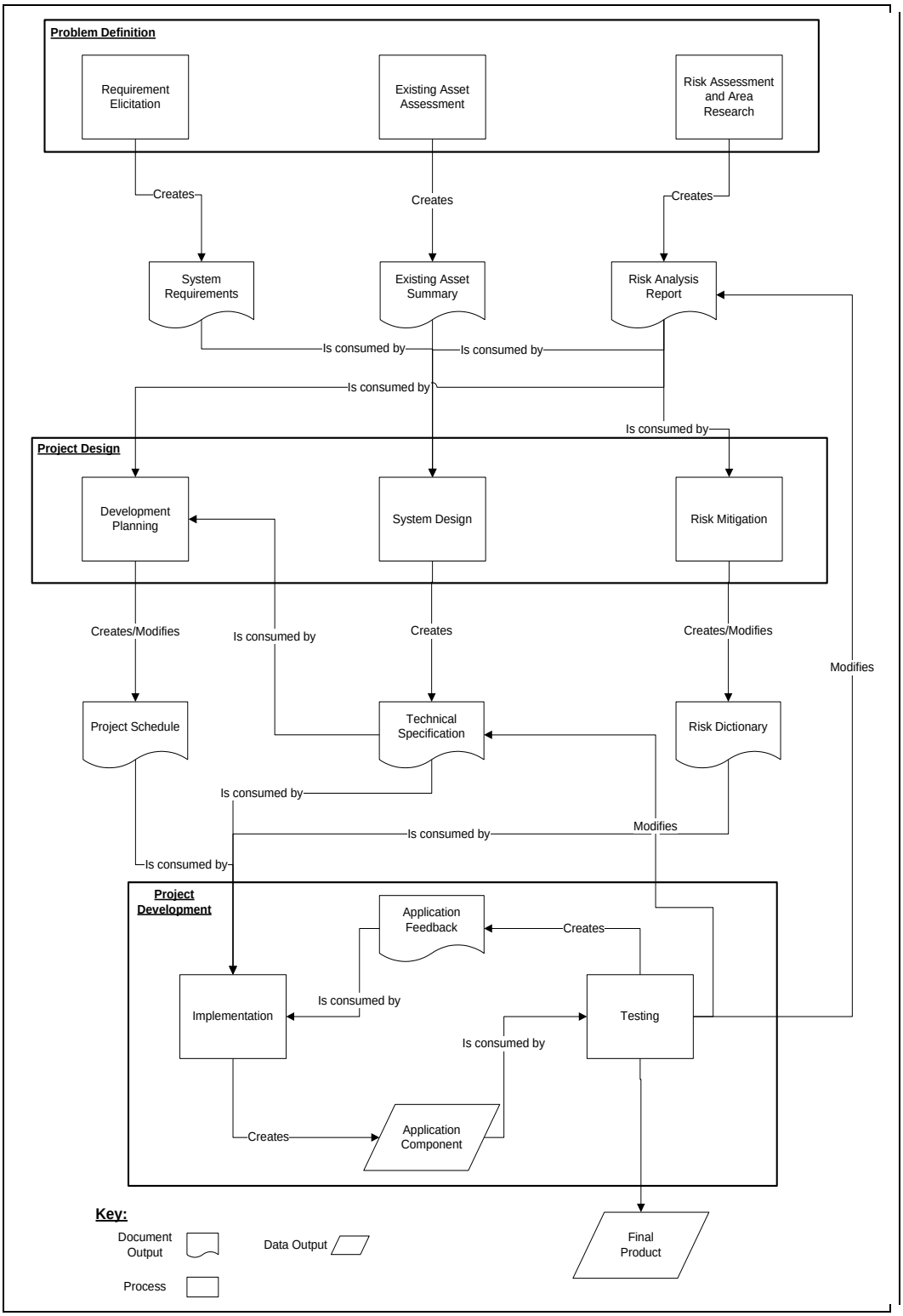

Figure 5. Full view of the Process Transformation Framework

The Mobile Content Platform

The Mobile Content Platform (MCP) (see Figure 6) is the methodology that enables a mobile distribution within an existing, previously non-mobile supporting Content Management System. The MCP acts as a gateway for incoming HTTP page requests. When a client makes a page request to the server it passes through the MCP, which detects the device and routes it to the correct page. Microsoft Windows servers were the initial target environments for the MCP. Consequently, all gateway code was written in ASP.net. This does not limit the potential for the MCP to be ported to Linux Servers with code rewritten in PHP. Implementation of the MCP resulted in the existing Content Management System (CMS) gaining additional functionality and value.

Oakland County's CMS is a repository of data used to produce the content that makes up the County's online Web presence. In 2006, more than 34.6 million mobile subscribers accessed the Internet via wireless devices[2]. Without the MCP this County's Web presence is restricted to traditional means of access via Web browsers found on desktops and laptops. Extending the CMS meant incorporating emerging mobile technologies found in mobile phone and personal digital assistants (PDA). With the completion of the MCP Oakland County was able to bridge the gap that existed between their legacy CMS and new access nodes found in mobile Internet browsers. To create this bridge the MCP was broken into three layers. These layers worked together seamlessly to support the dissemination of Oakland County's digital information based on the software found on the accessing client's machine or node. The next sections describe the three MCP layers, i.e. the *Analysis*, *Formatting*, and *Content* layers.

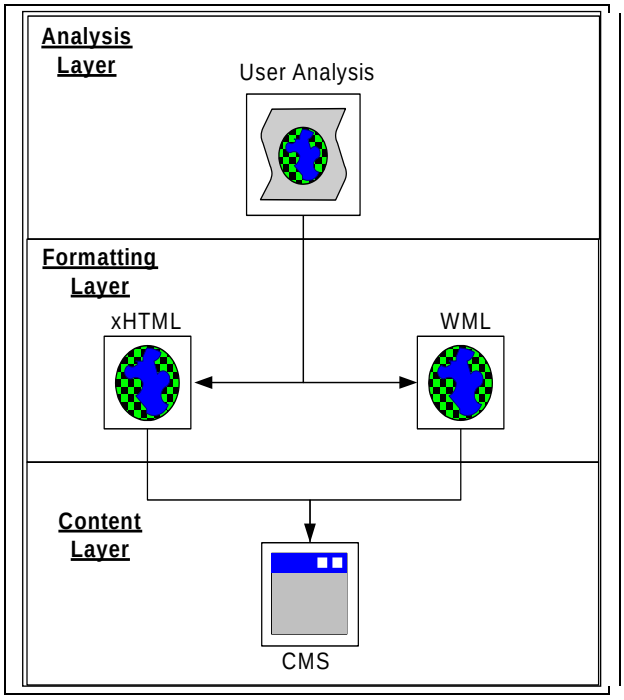

Figure 6. The implemented Mobile Content Platform (MCP)

[2] Telephia: Mobile Internet report; June 2006

Analysis Layer

The MCP consists of three layers that may be represented hierarchically, i.e. there is a top, middle, and bottom layer (see Figure 6). The top layer, i.e. *Analysis*, manages initial incoming requests from a client. When a user accesses the root of the Web site the root points the user to the top layer of the MCP. Here the MCP requests information about the client's software. The MCP then analyzes the information describing a user's browser capabilities. Once the analysis is complete, the MCP redirects the user to the appropriate Web page within the *Format* layer.

Format Layer

In the case of Oakland County, the *Format* layer consisted of two options: a Wireless Markup Language (WML) format and an Extensible HyperText Markup Language (xHTML) format. The need for two formats stems from a transition in mobile phone generations and in versions of the Wireless Application Protocol (WAP). WAP was established by Ericsson, Motorola, Nokia, and Unwired PlanetWML to develop an industry wide standard, which could be used to create wireless applications usable on all mobile phones . WML 1.0 was a product of WAP 1.0 and used as the programming language for wireless applications. WML incorporates the Extensible Markup Language (XML) structure and is delivered to browsers in the form of "decks". Unlike traditional Web development languages such as HTML where pages are delivered on an individual basis WML decks contain a set of pages. WAP 1.0 was developed during the early generation of mobile phones when the technology had obstacles such as low memory storage, processing speed and data transfer rate to overcome[3]. As mobile phones evolved into their second generation WAP 2.0 emerged. WAP 2.0 incorporated a new version of the WML and supported xHTML. Investigation into current mobile Web pages by the MCSI showed that xHTML was quickly becoming the popular choice for page formatting, while it was the popular choice for the development of traditional Web pages. It was the intuition of the MCSI that xHTML would be the preferred development language for Oakland County as it would be easier for developers to know one language instead of two. This led to the MCSI decision to choose xHTML as its primary focus of development. At the time of the MCSI and the development of the MCP many Oakland County citizens owned mobile phones that fell in the category of first- or early second-generation, meaning that these citizens would not be able to process wireless applications developed in xHTML. This meant that the MCP had to further support WML in addition to xHTML pages. Thus, the MCP *Format* layer was created to support mobile phones of all generations. All pages of each format included hooks, which pulled content from the data layer.

Data Layer

The *Data* layer contained the CMS, which was queried by a formatted page in order to pull out all necessary information. This allowed for data in the CMS to be easily reused by different pages across multiple formats. The three layers of the MCP come together to produce pages with the correct content in the correct format for a specific view. Thus, the result of the MCSI and the development of the MCP was a three-layered system of client analysis, page formatting and finally data retrieval and presentment. The MCP is a very important piece of the MCSI. It allows

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[3] http://xml.coverpages.org/wap-wml.html

for easy extensions of new formats within the *Format* layer. New devices and software can be recognized and accounted by simply adjusting the *Analysis* layer. Finally, new content can be easily added into the CMS and utilized without changing retrieval procedures. Arguably, the most meaningful outcome of the MCP is that it bridges Oakland County's preexisting CMS with mobile device applications. In its implemented form the MCP was functional at detecting the software and hardware of incoming mobile device requests. This functionality has the possibility of being expanded into a larger domain, which could include not only mobile requests but also desktop and laptop requests. After development, Oakland County used the MCP as a proof of concept. Once satisfied that the MCP could function within the Oakland County environment the eGovernment pursued a more robust-industrial version of the MCP from an outside vendor.

Asset Leveraging Strategy

The Asset Leveraging Strategy (ALS) is a document put together by the MCSI that explains the MCP. It summarizes how the MCP was customized to meet Oakland County's needs and includes strategies and recommendations for building upon the MCP. The ALS provides both a record of the development of and the information necessary to customize the MCP to fit into Oakland County's existing infrastructure. Due to the specific nature of the ALS, its intended use is exclusively for Oakland County, although the steps taken in developing the ALS can be used by most organizations. The non-specific nature of the MCP meant that in order for Oakland County to extract optimal value it needed to specify instructions on how to incorporate their existing assets into the MCP. The ALS provides these instructions in the form of strategies and actionable recommendations. The ALS also provides documentation on the MCP to support an easier implementation of these strategies and recommendations. In order to generate appropriate strategies and recommendations the MCSI had to research and infer the state of Oakland County's technologies and citizens' I.T. readiness on various levels.

Three major components were used in crafting the ALS: a Mobile Device Survey of the population; a current Page Ranking Analysis; and an On-site Asset Evaluation.

Survey Data

A mobile Web strategy is essential for any organization with customer-facing systems or relationships[4]. In order to formulate an effective mobile Web strategy the MCSI devised a Mobile Device Survey (see Figure 7). The Mobile Device Survey consisted of six questions aimed at gaining insight into public interest in mobile devices and mobile content. These questions were used to gauge: mobile acceptance in the community; interest in mobile content; interest in push vs. pull distribution of content; and interest in government services. The survey results were first broken into two categories: those who were interested in mobile content distribution and those who were not. Those who expressed complete disinterest in or inability to access mobile content were discarded to generate a more robust set of results for the targeted audience (i.e. mobile users interested in mobile Government services). Results were reported by ranking services and pages from highest to lowest interest (see Figures 8 and 9).

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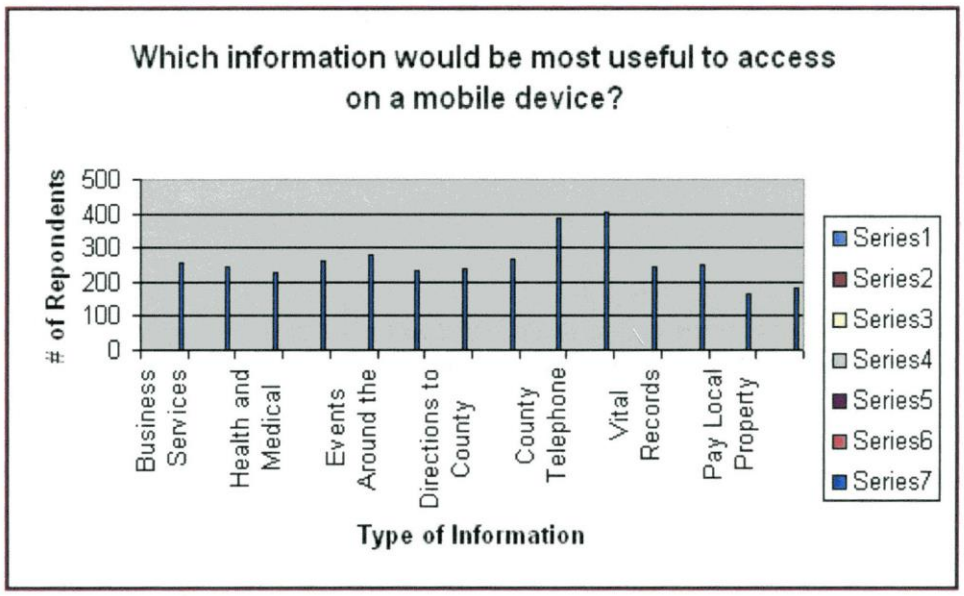
[4] Gartner: Mobile Web Trends 2007 to 2011; 18 June 2007; Nick Jones

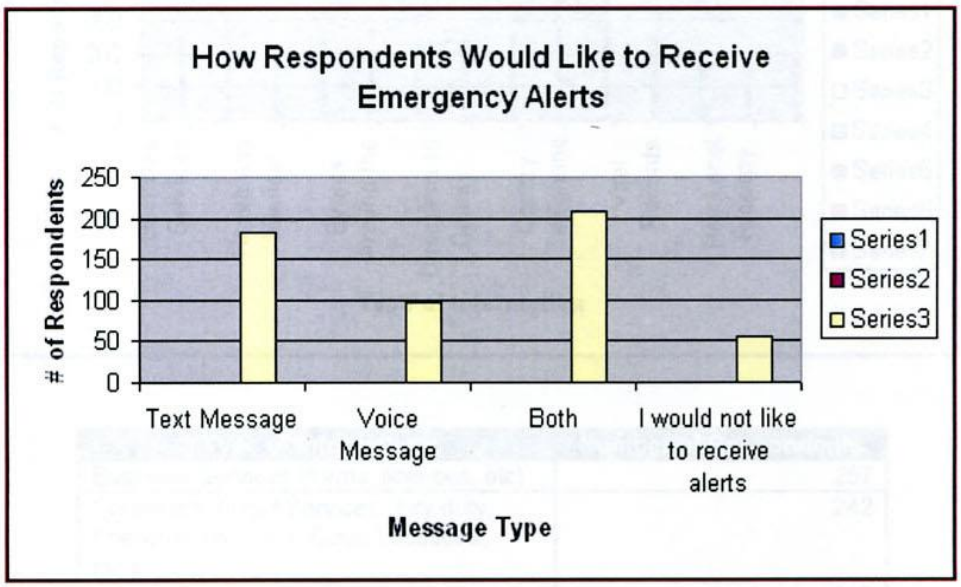
1. Do you own a mobile phone, pager, PDA, handheld computer, or other device capable of browsing the web?
   - Yes
   - No
2. Would you be interested in viewing Oakland County information on a mobile device?
   - Yes
   - No
3. Would you be interested in using Oakland County online services on a mobile device? (e.g. order copy of birth certificate, download property maps, pay taxes or tickets)
   - Yes
   - No
4. Do you own a mobile phone, pager, PDA, handheld computer, or other device capable of receiving text or voice messages?
   - Yes
   - No
5. If applicable, how would you prefer to receive Oakland County information updates or emergency alerts?
   - Text message
   - Voice message
   - Both
   - I would not like to receive alerts.
6. Which information or online service would be most useful to access on a mobile device? Please select as many as apply.
   - Business Services (forms, licenses, etc.)
   - Courts and Legal Services (jury duty, Friend of the Court, Court locations, etc.)
   - Health and Medical Services (information, programs, classes, etc.)
   - Oakland County News
   - Events around the County
   - Jobs with Oakland County government
   - Directions to County offices
   - Parks and Recreation information
   - County telephone directory
   - Emergency information and alerts
   - Vital Records (order copy of birth, marriage, or death certificate)
   - Property Maps
   - Pay local property taxes
   - Pay tickets
   - Other - Please type your suggestions in the box below (response limited to 200 characters).

Figure 7. Mobile Device Survey administered by Oakland County eGovernment



Type of Information	Number of Respondents
Business Services (forms, licenses, etc)	257
Courts and Legal Services (jury duty, Friend of the Court, Court Locations, etc.)	242
Health and Medical Services (information programs, classes, etc)	227
Oakland County News	262
Events Around the County	279
Jobs with Oakland County Government	232
Directions to County Offices	237
Parks and Recreation Information	267
County Telephone Directory	389
Emergency Information and Alerts	401
Vital Records (order copy of birth, marriage, or death certificate)	245
Property Maps	251
Pay Local Property Taxes	162
Pay tickets	181

Figure 8. Survey results regarding citizens' interest in mobile content offered by Oakland County eGovernment



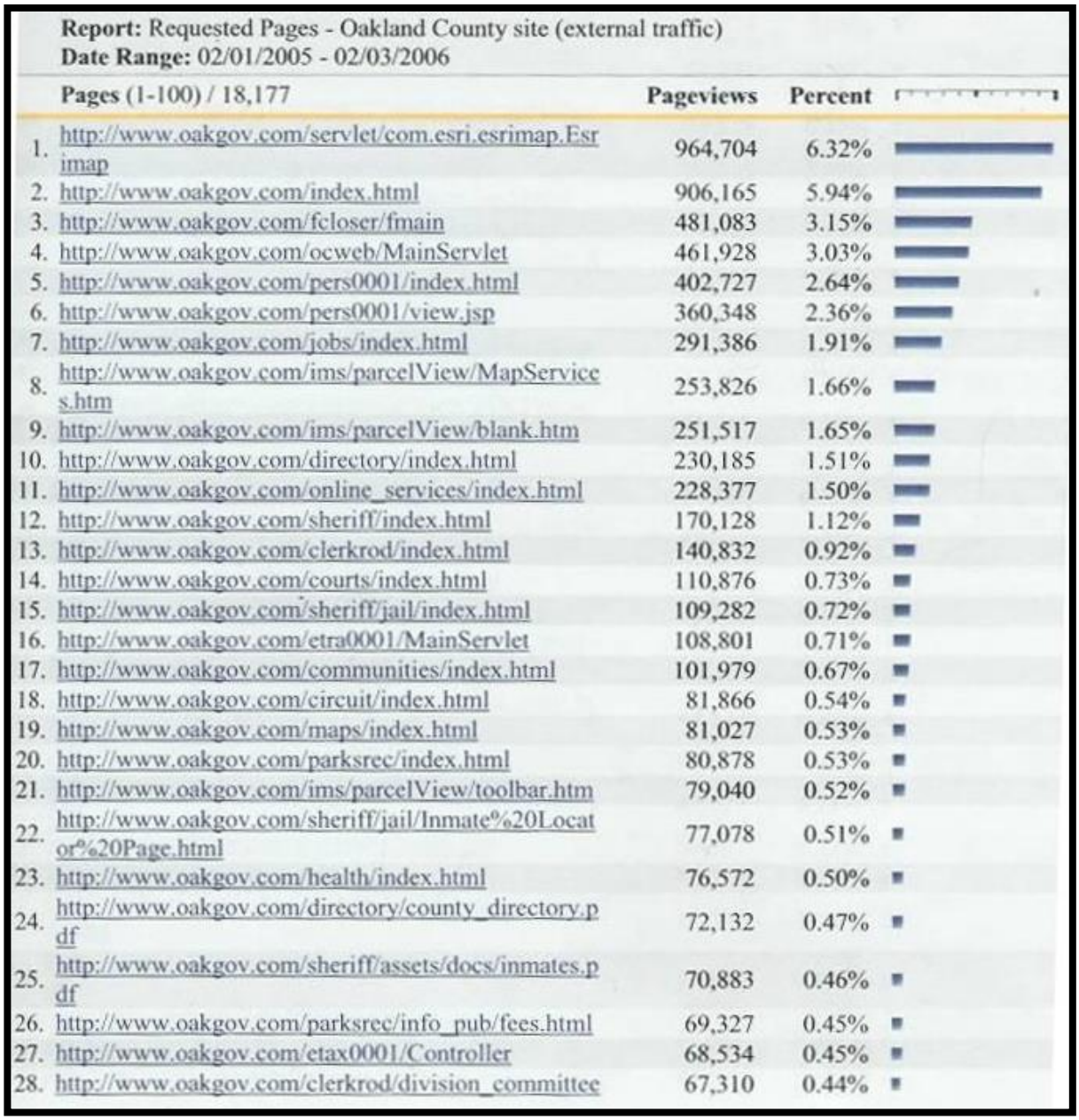
Message Type	Number of Respondents
Text Message	184
Voice Message	97
Both	208
I would not like to receive alerts	55

Figure 9. Survey results (continued) regarding citizens' interest in mobile content offered by Oakland County eGovernment

The survey results were then compared to Oakland County's Page Analysis (see Figure 10). The Page Analysis is a break down of Oakland County's wired-Web traffic into total page views, percentage of total traffic, and a popularity ranking relative to the other pages. The Page Ranking report provided an additional dimension to gauge the public's interest in various information types provided by Oakland County.

The MCSI group also conducted an on-site visit to Oakland County eGovernment to identify the assets currently utilized. Additionally, the group was able to get a first hand look at the organization's day-to-day operations and gain insight on future assets being considered for development. This information was attained early during the *Area Research* phase to assess the project's feasibility.

The Mobile Device Survey results and Page Ranking Analysis offered complementary information and as such were both utilized to identify the most valuable Web pages and services to offer in a mobile format. After identifying these most valuable mobile features the results from the on-site asset investigation were incorporated and project feasibility was re-evaluated.
All of these elements worked in combination to support the generation of the strategies and recommendations used to customize the MCP to Oakland County's unique situation.



Report: Requested Pages - Oakland County site (external traffic)
Date Range: 02/01/2005 - 02/03/2006

	Pages (1-100) / 18,177	Pageviews	Percent
1.	http://www.oakgov.com/servlet/com.esri.esrimap.Esrimap	964,704	6.32%
2.	http://www.oakgov.com/index.html	906,165	5.94%
3.	http://www.oakgov.com/fcloser/fmain	481,083	3.15%
4.	http://www.oakgov.com/ocweb/MainServlet	461,928	3.03%
5.	http://www.oakgov.com/pers0001/index.html	402,727	2.64%
6.	http://www.oakgov.com/pers0001/view.jsp	360,348	2.36%
7.	http://www.oakgov.com/jobs/index.html	291,386	1.91%
8.	http://www.oakgov.com/ims/parcelView/MapServices.htm	253,826	1.66%
9.	http://www.oakgov.com/ims/parcelView/blank.htm	251,517	1.65%
10.	http://www.oakgov.com/directory/index.html	230,185	1.51%
11.	http://www.oakgov.com/online_services/index.html	228,377	1.50%
12.	http://www.oakgov.com/sheriff/index.html	170,128	1.12%
13.	http://www.oakgov.com/clerkrod/index.html	140,832	0.92%
14.	http://www.oakgov.com/courts/index.html	110,876	0.73%
15.	http://www.oakgov.com/sheriff/jail/index.html	109,282	0.72%
16.	http://www.oakgov.com/etra0001/MainServlet	108,801	0.71%
17.	http://www.oakgov.com/communities/index.html	101,979	0.67%
18.	http://www.oakgov.com/circuit/index.html	81,866	0.54%
19.	http://www.oakgov.com/maps/index.html	81,027	0.53%
20.	http://www.oakgov.com/parksrec/index.html	80,878	0.53%
21.	http://www.oakgov.com/ims/parcelView/toolbar.htm	79,040	0.52%
22.	http://www.oakgov.com/sheriff/jail/Inmate%20Locator%20Page.html	77,078	0.51%
23.	http://www.oakgov.com/health/index.html	76,572	0.50%
24.	http://www.oakgov.com/directory/county_directory.pdf	72,132	0.47%
25.	http://www.oakgov.com/sheriff/assets/docs/inmates.pdf	70,883	0.46%
26.	http://www.oakgov.com/parksrec/info_pub/fees.html	69,327	0.45%
27.	http://www.oakgov.com/etax0001/Controller	68,534	0.45%
28.	http://www.oakgov.com/clerkrod/division_committee	67,310	0.44%

Figure 10. Page Ranking Analysis of Oakland County eGovernment Web Traffic

Oakland County Mobile Content Services Strategy and Prototype

The final result was a document titled *"Oakland County Mobile Content Services Strategy and Prototype"*. This document served as the ALS and was handed off to Oakland County at the project's end. The *"Oakland County Mobile Content Services Strategy and Prototype"* was broken into six major topics: Strategy, Approaches and Findings, Recommendations, Barriers and Mitigation Strategies, Prototype Implementation, and Tactical Initiatives. Also contained in this documentation was a series of appendices that displayed the raw survey results and questions, sample code, data analysis and raw data on the tactical incentives.

The Strategy section contained eight strategic points that the MCSI followed and Oakland County continued to follow for customizing the MCP. The Approach and Findings provided a brief summary defending the feasibility of the MCP and its customization to Oakland County. This section also showcased important conclusions that shaped the MCSI decisions and the survey data that produced these conclusions. The Recommendations section provided 15 recommendations for Oakland County to consider as it moves forward with its mobile content and services enablement. Recommendations included topics on improving mobile traffic, valuable services, and improvements for ease of use. The Barriers and Mitigation Strategies section provided a list of potential barriers that could affect the success of the mobile transitioning. This list was balanced with a list of strategies that can be followed to mitigate the barriers once they exist or prevent them all together. The Prototype Implementation section described the current status of the MCP at the time of the document's authoring. Finally, the Tactical Incentives section was a list of the primary goals that should be achieved as Oakland County adapts the MCP.

"Oakland County Mobile Content Services Strategy and Prototype" was able to bring Oakland County up to date with the progress that was made by the MCSI. It provided graphs and charts displaying survey results, sample code that was used to develop the MCP, and the raw data used by the MCSI when making its conclusions. The data provided in this documentation serves as justification for the MCSI work and a reason to continue the transition into mobile content. By following the results provided by this ALS Oakland County could now successfully increase the value of its existing CMS and extend new services to its citizens. Figure 11 displays the prototype of the implemented system and Figure 12 shows a view of the MCP and how content pages are related by the Analysis and Formatting layers.

Figure 11. Prototype of the implemented system as viewed on a mobile device

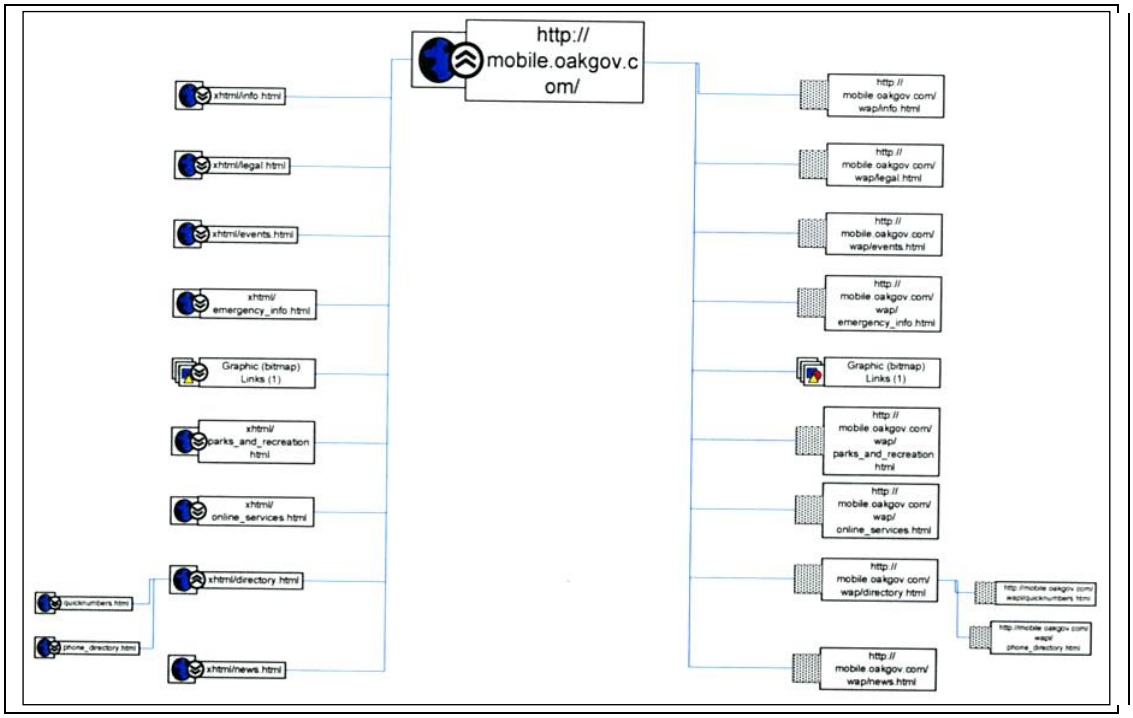


Figure 12. MCP View of the Prototype (i.e. Top Page Runs on Analysis Layer and leads to appropriate set of pages according to Format)

Flexibility, Scalability, and Reuse

Flexibility

Flexibility is the ability to be easily swayed by the influence of, in this case, a changing environment. The most flexible objects resulting from the MCSI are the MCP and the PTF. The MCP structure is such that any organization can build a similar architecture to extend a unique CMS. The PTF is flexible, a quality found in its generality, and is designed to be an ordered set of guidelines broken into logical sections. These guidelines contain goals that any organization could set during an asset transformation process. The instantiated ALS is not very flexible as it is designed to be specific to Oakland County's needs although there is flexibility in the lessons learned from the ALS, which could serve as starting points for other organizations looking to leverage existing assets.

The MCP was designed to incorporate the flexibility of an ever-growing organization in both the top and middle layers. The top (*Analysis*) layer was implemented to focus specifically on mobile hardware and software. It is possible that an organization would want to develop a similar system to the MCP, but to do so while incorporating the ability to also detect various desktop and laptop hardware and software. This could easily be accomplished through the retooling of the *Analysis* layer to include system details, connection details, and system display layout recognition. The PTF is flexible in the way that its goals and objectives can be customized to the needs of an organization or project. Also, the goals provided in the PTF are not specific to the MCSI or the MCP rather they are specific only to the facilitation of specific assets' transformation. The structure by which the ALS was produced can be utilized by another organization to produce comparable results specific to that organization's processes. The survey data collection, recommendations, and strategies can – and should - all be performed by an organization to obtain specific insight about their project.

Scalability

Scalability is the ability to easily expand or grow. The most scalable objects resulting from the MCSI are the PTF and the MCP. The PTF exists as a base framework, which presents general goals and objectives to achieve throughout the asset transformation process. Goals and objectives can be added to the existing list as needed. The PTF doesn't give specific instructions on how to reach the stated goals; this is where scalability is most effective. The PTF leaves the "means to the ends" in the hands of the organization and specific project. Each domain and section of the PTF can take as long as needed. The PTF provides direction in moving between its goals, but doesn't limit the number of iterations to occur at each domain. The flexibility and scalability found in each of these objects frees them from the bounds of this specific project and opens them up for use by other organizations. Scalability is incorporated in the MCP through the inclusion of new formats. An example of this would be to create a new format for XML documents. By attaching the proper hooks into the CMS and adjusting the *Analysis* layer to recognize the new format, the MCP could be expanded in its usefulness.

The PTF is designed to incorporate scalability by not limiting its use to any specific project size. The PTF provides guidelines that are designed to facilitate the reuse or repurposing of assets. In

the case of Oakland County, the asset that the MCSI leveraged was the CMS. A larger asset or set of assets could be transformed into a new or additional functionality by following the same procedures found in the PTF. The MCP is scalable in the way that new features can be easily added into its layers.

Summary

Mobile device acceptance is continuing to grow, it is estimated that by 2010, more than 50% of cellular subscribers in the U.S. and Western Europe will access the Web on a mobile device at least once a week[5]. With analytical foresight in 2006, Oakland County assembled a group of Michigan State University students and one government official to form the MCSI. This initiative was tasked with developing a method to distribute Oakland County's existing Web content to mobile devices within the community. After extensive research, planning, and execution the MCSI produced three valuable deliverables: an Asset Leveraging Strategy (ALS), Mobile Content Platform (MCP), and a Process Transformation Framework (PTF).

These three components worked together to bring resolution to Oakland County's challenge of increasing the quality of service offered to its citizens in light of an increasing demand in mobile content. For the benefit of other organizations, these components were analyzed and decomposed to expose their adaptability in other settings and presented in this paper. Each component has its own part to play in the asset leveraging solution produced. User sophistication of mobile Web browsing will only increase with time. By 2010, manufacturers will be able to produce low-end smartphones that will retail under $120, broadening the mobile Web user base[6]. Any organization looking to make additional use of their available assets, especially when trying to capitalize on the growing mobile Web market, should look to these components and their impact on Oakland County’s eGovernment service delivery.

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[5] Gartner: Mobile Web Trends 2007 to 2011; 18 June 2007; Nick Jones

[6] Gartner: Mobile Web Trends 2007 to 2011; 18 June 2007; Nick Jones