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**Apple App Store as a Business Model Supporting
U.S. Navy Requirements**

**Douglas Brinkley and Brad Naegle
Naval Postgraduate School**

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Preface & Acknowledgements

Welcome to our Ninth Annual Acquisition Research Symposium! This event is the highlight of the year for the Acquisition Research Program (ARP) here at the Naval Postgraduate School (NPS) because it showcases the findings of recently completed research projects—and that research activity has been prolific! Since the ARP's founding in 2003, over 800 original research reports have been added to the acquisition body of knowledge. We continue to add to that library, located online at www.acquisitionresearch.net, at a rate of roughly 140 reports per year. This activity has engaged researchers at over 60 universities and other institutions, greatly enhancing the diversity of thought brought to bear on the business activities of the DoD.

We generate this level of activity in three ways. First, we solicit research topics from academia and other institutions through an annual Broad Agency Announcement, sponsored by the USD(AT&L). Second, we issue an annual internal call for proposals to seek NPS faculty research supporting the interests of our program sponsors. Finally, we serve as a “broker” to market specific research topics identified by our sponsors to NPS graduate students. This three-pronged approach provides for a rich and broad diversity of scholarly rigor mixed with a good blend of practitioner experience in the field of acquisition. We are grateful to those of you who have contributed to our research program in the past and hope this symposium will spark even more participation.

We encourage you to be active participants at the symposium. Indeed, active participation has been the hallmark of previous symposia. We purposely limit attendance to 350 people to encourage just that. In addition, this forum is unique in its effort to bring scholars and practitioners together around acquisition research that is both relevant in application and rigorous in method. Seldom will you get the opportunity to interact with so many top DoD acquisition officials and acquisition researchers. We encourage dialogue both in the formal panel sessions and in the many opportunities we make available at meals, breaks, and the day-ending socials. Many of our researchers use these occasions to establish new teaming arrangements for future research work. In the words of one senior government official, “I would not miss this symposium for the world as it is the best forum I've found for catching up on acquisition issues and learning from the great presenters.”

We expect affordability to be a major focus at this year's event. It is a central tenet of the DoD's Better Buying Power initiatives, and budget projections indicate it will continue to be important as the nation works its way out of the recession. This suggests that research with a focus on affordability will be of great interest to the DoD leadership in the year to come. Whether you're a practitioner or scholar, we invite you to participate in that research.

We gratefully acknowledge the ongoing support and leadership of our sponsors, whose foresight and vision have assured the continuing success of the ARP:

- Office of the Under Secretary of Defense (Acquisition, Technology, & Logistics)
- Director, Acquisition Career Management, ASN (RD&A)
- Program Executive Officer, SHIPS
- Commander, Naval Sea Systems Command
- Program Executive Officer, Integrated Warfare Systems
- Army Contracting Command, U.S. Army Materiel Command



- Office of the Assistant Secretary of the Air Force (Acquisition)
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- Program Executive Officer, Littoral Combat Ships

We also thank the Naval Postgraduate School Foundation and acknowledge its generous contributions in support of this symposium.

James B. Greene Jr.
Rear Admiral, U.S. Navy (Ret.)

Keith F. Snider, PhD
Associate Professor



Panel 20. Application of an App Store Software Model Within the DoD

Thursday, May 17, 2012	
1:45 p.m. – 3:15 p.m.	<p>Chair: Brigadier General Michael E. Williamson, USA, Joint Program Executive Officer, Joint Tactical Radio System</p> <p><i>Joint and Coalition Tactical Networking: There's an App for That! Improving Affordability and Accelerating Innovation in Tactical Networking Using the Joint Tactical Radio System Enterprise Business Model</i> Jeffery Hoyle, <i>Joint Tactical Radio System</i></p> <p><i>Widget and Mobile Technologies a Forcing Function for Acquisition Change: Paradigm Shift Without Leaving Bodies Behind</i> Michael Morris, Christopher Raney, Kenneth Trabue, Timothy Boyce, Kari Nip, <i>Space and Naval Warfare Systems Center Pacific</i></p> <p><i>Apple App Store as a Business Model Supporting U.S. Navy Requirements</i> Douglas Brinkley and Brad Naegle <i>Naval Postgraduate School</i></p>

Michael E. Williamson—General Williamson assumed his duties as joint program executive officer for the Joint Tactical Radio System in March 2011.

General Williamson was born in Tucson, AZ. He was commissioned at the University of Maine as a second lieutenant in the Air Defense Artillery in 1983.

His assignments include service as the automation officer for the 32nd AADCOM in Darmstadt, Germany. He then served as a chaparral platoon leader, vulcan platoon leader, maintenance officer, and executive officer in C Battery, 108th Brigade, Hahn Air Force Base, Germany. After attending the Air Defense Artillery Advance Course, he served as the chief, Forward Area Air Defense Weapons, Development Branch at Fort Bliss, TX. He then commanded B Battery, 3/1 ADA (Hawk) in the 11th Brigade at Fort Bliss and also in the 31st ADA Brigade at Fort Hood, TX. After completing command, he served as the Assistant S-3 in the 31st ADA Brigade.

His acquisition experience began as senior military software analyst at NATO's military headquarters in Mons, Belgium. He then served as the associate director, Battle Command Battle Lab at Fort Leavenworth, KS. After attending Command and General Staff College, he served as the chief of information technology, Acquisition Career Management, within the Office of the Assistant Secretary of the Army for Acquisition, Logistics, and Technology. He was then selected as a congressional fellow and served as a legislative assistant to a member of Congress. After completing the fellowship, General Williamson served as the product manager for the Global Command and Control System-Army, and then as the acquisition military assistant to the Secretary of the Army. He served as commander of the Software Engineering Center-Belvoir (SEC-B). He was then assigned as the project manager, Future Combat System (Brigade Combat Team) Network Systems' Integration within program manager, Future Combat System (Brigade Combat Team). He then served as the director of systems integration, within the Office of the Assistant Secretary of the Army for Acquisition, Logistics, and Technology. Prior to his current assignment, General Williamson served as the deputy program manager, Program Executive Office, Integration.

General Williamson's awards and decorations include the Legion of Merit with two Oak Leaf Clusters; the Meritorious Service Medal with two Oak Leaf Clusters; the Joint Service Commendation



Medal, the Army Commendation Medal with two Oak Leaf Clusters, the Joint Service Achievement Medal, the Army Achievement Medal with two Oak Leaf Clusters, the Army Superior Unit Award, the National Defense Service Medal with Bronze Star, the Global War on Terrorism Service Ribbon, the Army Service Ribbon, the Overseas Ribbon, and the Army Staff Identification Badge.

General Williamson's education includes a Bachelor of Science from Husson College in business administration, a Master of Science in systems management from the Naval Postgraduate School, and a PhD in business administration from Madison University. He also has graduate certificates in public policy from the JFK School of Government, Harvard University, and the Government Affairs Institute at Georgetown University. He is a graduate of the Army Command and General Staff College, a graduate of the Advanced Management Program at the Harvard Business School, and was a Senior Service College Fellow at the University of Texas at Austin. He is Level III certified in program management and communications and computers.



Apple App Store as a Business Model Supporting U.S. Navy Requirements

Douglas Brinkley—Brinkley (EdD) is a senior lecturer and the director of the Instructional Technology, Graduate School of Business and Public Policy, Naval Postgraduate School. He is also a retired U.S. Navy supply corps officer with a subspecialty in computer systems management. During his last two tours on active duty, he served as force information systems officer for Commander, U.S. Naval Air Forces Atlantic Fleet and as officer in charge of the Defense Information Systems Agency (DISA) Information Processing Center, Guam. His research agenda focuses on the management of information technology and the application of instructional technology. [brinkley@nps.edu]

Brad Naegle—Naegle, LTC, U.S. Army (Ret.), is a senior lecturer and academic associate for Program Management Curricula, Graduate School of Business and Public Policy, Naval Postgraduate School. While on active duty, LTC (Ret.) Naegle was assigned as the product manager for the 2 ½-ton Extended Service Program (ESP) from 1994–1996 and served as the deputy project manager for Light Tactical Vehicles from 1996–1997. He was the 7th Infantry Division (Light) division materiel officer from 1990–1993 and the 34th support group director of security, plans, and operations from 1986–1987. Prior to that, LTC (Ret.) Naegle held positions in test and evaluations and logistics fields. He earned a master's degree in systems acquisition management (with distinction) from the Naval Postgraduate School and an undergraduate degree from Weber State University in economics. He is a graduate of the Command and General Staff College, Combined Arms and Services Staff School, and Ordnance Corps Advanced and Basic Courses. [bnaegle@nps.edu]

Abstract

Naval Open Architecture (NOA) is the confluence of business and technical practices yielding modular, interoperable systems that adhere to open standards with published interfaces. This approach significantly increases opportunities for innovation and competition, enables re-use of components, facilitates rapid technology insertion, and reduces maintenance constraints. A key enabler of the NOA initiative is the Software Hardware Asset Reuse Enterprise (SHARE) repository. The repository was created in August 2006 to facilitate the reuse of software and thereby reduce future development costs. The total benefit of the repository will correspond to the quality and quantity of the applications deposited into it. Indisputably, the most successful software repository in the public sector is the Apple App Store. As of March 2012, Apple listed more than 500,000 available applications. The purpose of this research is to examine the business model of the App Store to identify which of its effective business practices might be applicable to the SHARE repository.

Introduction

This research analyzes Apple's industry-leading expertise using the App Store approach for developing applications for its devices as a possible business model that would benefit the U.S. Navy. The goal of this research is to understand how the U.S. Navy might use Apple's App Store business processes to establish similar processes that have the potential to leverage innovative application development from a wide variety of trusted sources, providing maximum benefits to naval entities and personnel while simultaneously ensuring the safety and security of operations and personnel.

Background

Apple's App Store concept is being researched as an approach to help facilitate the Naval Open Architecture (NOA) initiative. NOA is the confluence of business and technical practices yielding modular, interoperable systems that adhere to open standards with published interfaces. This approach significantly increases opportunities for innovation and competition, enables re-use of components, facilitates rapid technology insertion, and reduces maintenance constraints. The goal of NOA is to deliver increased warfighting



capabilities in a shorter time at reduced cost. A key enabler of the NOA initiative is the Software Hardware Asset Reuse Enterprise (SHARE) repository. The repository was created in August 2006 to facilitate the reuse of software and, thereby, reduce future development costs. The total benefit of the repository will correspond to the quality and quantity of the applications deposited into it. Indisputably, the most successful software repository in the public sector is the Apple App Store. The purpose of this research is to examine the business model of the App Store and identify which, if any, of its effective business practices would be applicable to the SHARE repository.

The Apple App Store

The Apple App Store is extremely popular for both users and developers alike. A testament to this is the phenomenal number of applications that have been registered for distribution. As of March 2012, Apple’s corporate website stated that the App Store was “the world’s largest collection of mobile apps—500,000 and counting in practically every category” (Apple Corporation, n.d.e). The number of applications being offered continues to grow each month. From March 2011–March 2012, the number of applications increased from 350,000 to more than 550,000. On March 5, 2012, Apple announced that more than 25 billion apps had been downloaded from its App Store (Apple Corporation, n.d.i). Figure 1 illustrates how the App Store facilitates the interrelationship between the customer and developer networks, which are also often referred to as separate ecosystems (Hinchcliffe, 2010). The success and growth of one ecosystem feeds the mutual proliferation of the other.



Figure 1. App Store Business Model

Apple’s innovative approach vastly increases the number and types of applications that might appeal to their user base. Useful or entertaining applications can be built under specific business rules, terms, conditions, protocols, and standards and, after vetting by Apple, be available for sale or free download by Apple device users around the world. Games or applications that might never even be thought of by in-house developers are now being developed and offered to eager Apple customers. Of course, there is a downside to

this innovative approach. Safeguards must be in place and enforced to counter malicious applications, viruses, spam, phishing, or even applications that do not work well or that are extremely slow. In addition, this business model invites criticism from those developers denied access, accusations of favoritism or other discriminatory actions, and in the worst case, lawsuits. This research addresses these opportunities and challenges, and proposes what the Navy might do to mitigate the downsides.

As all of the products become available on the Apple App Store, the company at least appears to endorse the products (despite disclaimers to the opposite) and must take active steps to ensure that there is little risk of customer backlash because of a malicious application or perceived “bad” product. Recognizing how the applications could impact its reputation, Apple has taken great care in controlling the development environments, prescribing the tools and resources to be used, and vetting all potential App Store products before allowing them to be available.

Apple’s Business Model

During the first phase of this research we contacted Apple’s corporate headquarters in Cupertino, California, to gain a better understanding of how the App Store works. We spoke with Apple’s Western Region manager, who was very supportive of our research mission, but he was not at liberty to reveal specific details about in-house policies and operation of the App Store. Instead, he suggested that a very thorough understanding could be gained by exploring the operation of the App Store through a developer’s perspective. Becoming a software developer for the App Store and documenting that process became the primary methodology to acquire the information needed for this research.

App Store Application Development

The first step to becoming an App Store developer is to access the developer introduction website located at <http://developer.apple.com>. This developer homepage is the gateway to the Apple Development Centers: iOS Dev Center, Mac Dev Center, and Safari Dev Center. The site is well organized and intuitive to use. It is also an effective marketing tool, which encourages developer participation.

Figure 2 is a screen capture of the web page, which is designed to welcome developer participation with headings such as “Learn Why You’ll Love to Develop with Apple Technologies.” Clicking on that heading takes users to another page that expands on the welcome theme with the following opening statement:

Apple provides a complete ecosystem for developers. All the components including hardware, the operating systems, and the developer tools are designed by one company, and they’re all designed to work together seamlessly—creating an easier, more intuitive experience so developers can focus on making great apps. (Apple Corporation, n.d.d)

This statement highlights the fact that the hardware, operating systems, and developer tools are all built by Apple. This closed-loop development process is in stark contrast with the open architecture philosophy of Apple’s major software competitor in the portable device market, Android. Because Apple is solely responsible for all aspects of their hardware and software environment, their level of support to users and developers must, accordingly, be as effective as possible.



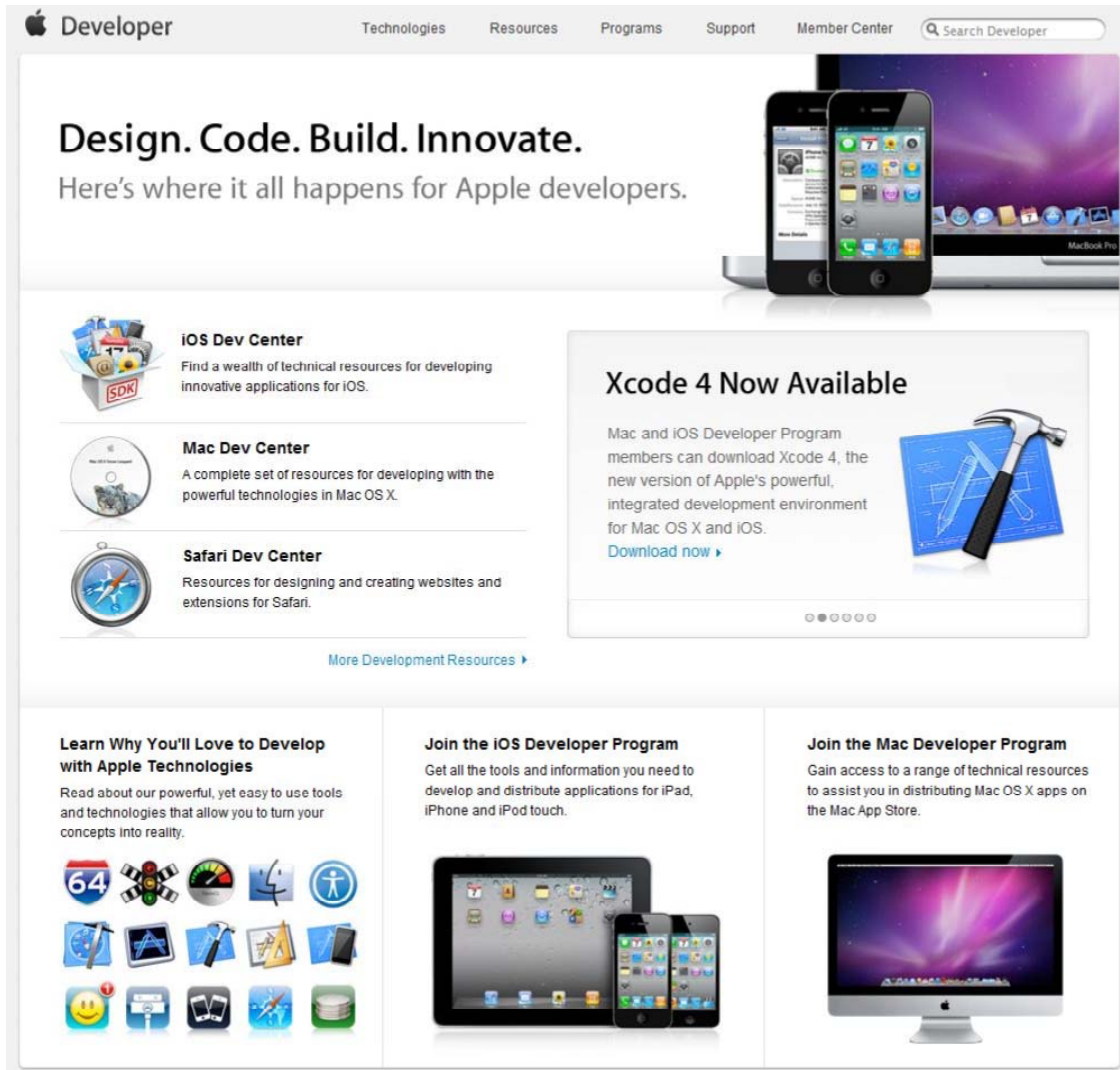


Figure 2. Apple Developer Welcome Page
(Apple Corporation, n.d.d)

It is the iOS Dev Center that is specific to creating applications for the iPad, iPhone, and iPod Touch, which are the devices supported by the App Store. Clicking on the “Join the iOS Developer Program” heading takes the user to <http://developer.apple.com/programs/ios>. Figure 3 is a screen capture from this page that depicts the seemingly simple three-step method of developing, testing, and distributing applications on the App Store. Each of the three sections provides a “Learn more” link to give the user additional information.

iOS Developer Program
The fastest path from code to customer.

[Enroll Now](#) \$99/year

1. Develop
Develop your application with the iOS SDK and a wealth of technical resources in the iOS Dev Center. [Learn more](#)

2. Test
Test and debug your code on iPad, iPhone and iPod touch to finalize your applications. [Learn more](#)

3. Distribute
Distribute your apps on the App Store and reach millions of iPad, iPhone, and iPod touch users. [Learn more](#)

Figure 3. Development Process for iOS
(Apple Corporation, n.d.f)

Becoming a Registered App Store Developer

Apple offers the following five different iOS developer programs:

- iOS Developer Program—Individual: This is the program used by individual developers wishing to develop apps that will be distributed via the App Store.
- iOS Developer Program—Company: This program is similar to the individual developer program, but also allows for the creation of a development team.
- iOS Developer Enterprise Program: A special program for organizations wishing to create proprietary in-house iOS apps. Applications created under this program are not distributed through the App Store, but rather only to members of the organization.
- iOS Developer University Program: A program for higher education institutions to introduce iOS application development into their curriculum. Apps are not distributed via the App Store, but can be shared by instructors and up to 200 students within the same development team.
- Registered as an Apple Developer: A free program designed to introduce new developers to the iOS coding tools, including the SDK. It does not allow for distribution of applications.

The authors chose the Individual iOS Developer Program to gain the greatest understanding of the features available to developers wishing to post and distribute

applications via the App Store. At the beginning of the on-line registration process, Apple advises the user of the following technical requirement: “You must have an Intel-based Mac running Mac OS X Snow Leopard to develop Mac OS X and iOS apps for the App Store” (Apple Corporation, n.d.g). The requirement that iOS applications can only be developed from within Apple’s proprietary OS X operating system emphasizes Apple’s tight control over the entire process.

During the first step of registration, users are given the option of creating a new account for the developer program or of using an existing Apple ID, such as that used by an iPod or iPhone user, when they register to access the App Store. The next step asks the user to choose between enrolling as an individual or a company. After selecting individual, the user is presented with a request to update their profile by answering the following questions:

- Which Apple platforms do you develop with?
- What is your primary market?
- Which types of iOS applications do you plan on developing?
- How many years have you been developing on Apple Platforms?
- Do you develop on other mobile platforms? (Apple Corporation, n.d.b)

The next step after creating/updating your profile is to agree to Apple’s extensive Apple Developer Agreement. Upon checking out, the developer is advised that the registration may take up to 24 hours to process. Receipt of the actual developer welcome e-mail was within one hour of the 24-hour estimate. The developer registration welcome e-mail is very short. It basically says, “thank you for joining the iOS Developer Program,” and it gives you a link to log into the Developer Member Center. Figure 4 is a screenshot of the Member Center.



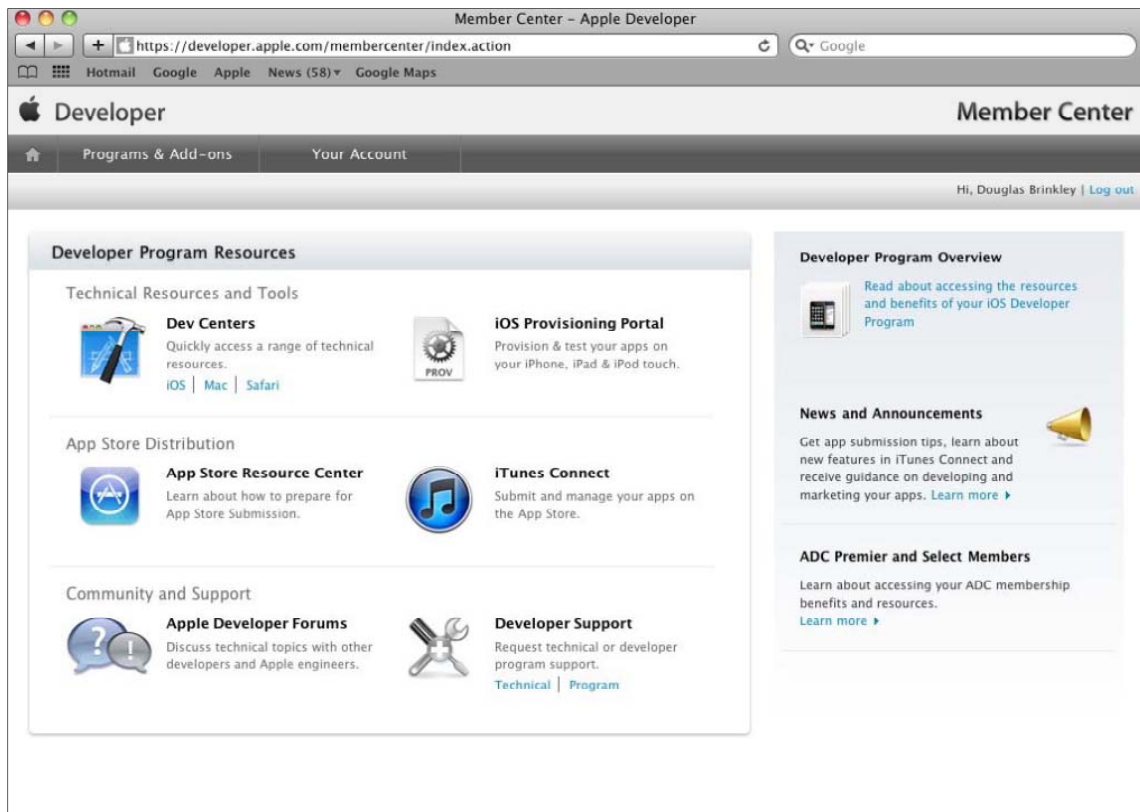


Figure 4. Developer Member Center
(Apple Corporation, n.d.a)

Clicking on the iOS link under the Dev Center's heading takes the user to a much more comprehensive page targeted at getting the developer started on building applications. The main section on the iOS Development page is titled Resources for iOS 4.3, and it includes links to the following items:

- Downloads—Link to several items, including the iOS SDK.
- Getting Started Videos—Watch Apple experts discuss a range of introductory concepts for iOS development.
- Getting Started Documents—Learn the fundamental concepts and best practices for iOS development.
- iOS Developer Library—Select from a range of technical documentation on iOS development.
- iAd JS Reverence Library—Select from a range of technical documentation on developing with iAd JS.
- Coding How-To's—Learn how to incorporate features of iOS in your application.
- Sample Code—Use these samples to inspire development of your own great applications.
- Apple Developer Forums—Discuss iOS development with other developers and Apple engineers. (Apple Corporation, n.d.h)

These links are only about one third of the resources available on the iOS Dev Center web page. There were several other sections, including the App Store Resource



Center, News and Announcements, iOS Developer Opportunities, and News and Announcements. As stated earlier, the iOS Dev Center portal is very comprehensive and serves as an effective one-stop-shopping source for just about any topic applicable to App Store development.

The Software Development Process

Perhaps the greatest resource made available to new developers is the iOS Software Development Kit (SDK). The tools in the SDK support a development process designed to encourage new developers and make them feel comfortable with the iOS environment. They allow you to quickly get a prototype user interface up and running to see what it will look like. You can add code a little at a time and then run it after each new addition to see how it works. The following is an overview of the general process:

- Step 1. Use Xcode to select a project template. The templates allow you to get off to a fast start, after which you add your unique code and more features.
- Step 2. Design and create the user interface using Interface Builder. Interface Builder has graphic design tools you can use to create your app's user interface. These tools save the developer time and effort from having to design the interface from scratch.
- Step 3. Write the app's unique code using the Xcode editor.
- Step 4. Run your app on your Mac using the iPad/iPhone Simulator. This is an excellent tool for quickly testing new iterations of your app, but there are many real-world characteristics that the simulators cannot adequately test, such as processing speed.
- Step 5. Because of the limitations of the simulators, you must also test your apps on a real iPad/iPhone. Apple provides Development Certificates that allow apps under development to be loaded on specific devices for the purpose of testing.

Apple's Vetting Process

Apple provides a detailed listing of their review guidelines at <http://developer.apple.com/appstore/resources/approval/guidelines.html>, and many of the guideline items were introduced earlier in this research. The guidelines cite more than 100 different reasons that applications might be rejected. In addition to the reasons associated with technical shortcomings, applications are just as likely to be rejected for non-adherence to Apple's policies. Noted authors Bove and Goldstein (2011) cited the following as some of the most common policy reasons for application rejection.

- Linking to private frameworks—Apple rejects apps that call external frameworks or libraries that contain non-Apple code.
- Straying too far from Apple's guidelines—The authors cited examples of their own apps that were rejected simply because their use of menu highlighting was not done in the manner described in Apple's guidelines.
- Copying Apple's existing functionality—Although you should use the functionality provided for developers, you should not copy something that Apple already does at the App level. For example, Apple has already developed a Web browser called Safari. Apple would reject other applications that duplicate (compete) with their own app.



- Not providing adequate user feedback—An example would be an application that requires an internet connection. Apple may reject the app if it does not automatically advise the user when the connection is lost.

During Apple's Worldwide Developers Conference (WWDC) 2010, Steve Jobs stated in his keynote address that apps are rejected for three main reasons: the application does not function as advertised, it uses private APIs (generally, this means creating programming functions in your app that are not available in the iOS SDK), and the app crashes frequently (Yarmosh, 2010). Most new apps are reviewed within seven days. As of May 5, 2011, the Apple developer's website stated that 91% of new apps and 95% of app updates had been reviewed within the last seven-day window.

For apps that are rejected for technical reasons, Apple encourages the developer to make the required modifications and resubmit the program for review. The \$99 developer sign-up fee includes two Technical Support Incidents (TSI), which Apple defines as follows:

A Technical Support Incident is a benefit of the Mac and iOS Developer Program and allows program members to request code level support from our developer technical support engineers. Your issue will be assigned to an engineer who can help you troubleshoot your code, offer direction to additional technical resources, or provide workarounds that will fast-track your development. (Apple Corporation, n.d.c)

Pros and Cons of the App Store Business Model

As stated at the outset, there can be no arguing that the App Store has been a phenomenal success for Apple. Their management of the App Store is in keeping with the company's proprietary nature for tightly controlled operations. The authors' personal experience with the App Store developer program has led to the following observations regarding the advantages of this business model.

- Exemplary and comprehensive web portal—Apple's developer web portal is second to none. It is truly a one-stop shopping experience with the ability to lead even a novice developer through the steps necessary to achieve success. The website's extensive use of multimedia, using a broad range of products from hyperlinked text documents to instructional videos, helps to ensure a clear understanding of important topics.
- Greatest possible assurance of safe applications—Apple's rigorous review process and tight control of programming minimizes the adverse risk of viruses, worms, malware, and adware. This inherent safety instills confidence and effectively removes any hesitation end users might have about downloading new applications.
- A symbiotic relationship between the end user and developer ecosystems—The success and proliferation of the end user and developer networks feed each other. As more and more users join the Apple customer base, the greater the potential market and attraction for developers to contribute new applications to the App Store.
- Effective management and marketing of application updates— Most software goes through a life cycle of continuous improvement as long as the developer is incentivized to continue working on it. The App Store business model encourages continued application development by giving developers mechanisms to advertise new versions of "old favorites" that customers might be interested in.



- A self-contained application directory and store—End users only need to access one site to both view the directory of available applications and download the applications. Because the directory and the store are one, there is no question that what is listed is available.
- Multi-device compatibility simplifies user access—The App Store can be accessed by all of Apple’s portable devices. This universal access reduces the effort to discover and download new applications to as simple a process as possible and eliminates the need for additional resources (like another computer). This direct download and install capability gives the users instant gratification and thus encourages them to frequent the App Store and to try out new applications.
- Centralized payment processing—Apple simplifies the payment process by setting up a single account for each user that is used to pay for any application in the App Store. Apple keeps 30% of each sale as its commission and gives the other 70% to the respective developer. Previous business models for software distributed as “shareware” required the end user to download the program from one source and then pay the developer directly. Purchasing from several different developers meant setting up a separate payment process for each of them.
- End-user feedback and rating system—The App Store includes a feature to allow customers to rate and comment on their satisfaction with the applications they have purchased. This public feedback then gives the developer a clear, customer-driven set of criteria to improve against and gives customers the information they need to determine if an application really meets their needs. This is an extremely valuable feature for customers when they are presented with a large number of similar applications. The public feedback system helps to narrow the field to those applications judged best by previous customers.

The following are some of the disadvantages of the Apple App Store business model:

- Potential bottleneck for distribution—Apple has taken some criticism in the past for taking excessive time to approve new applications. Developers are extremely sensitive to delays that could have an adverse impact on their competitive advantage. They understand that one key to their success is being the first to market an app with new functionality. The competitive nature of the business results in a limited lifespan for most applications.
- Excessive delays in correcting application bugs—Even if a developer discovers and fixes a bug in an application within 10 minutes of its being posted, Apple still requires a week-long process to review the fix. During this time, users can leave thousands of angry comments in the App Store, which could doom the revised software from even being looked at by future potential customers.
- Users can only download the current version of an application—Apple routinely updates the operating system on its portable devices. Some applications have compatibility problems with specific versions of the operating system. Once a developer updates an application to run on the most recent version of the operating system, the application may not work for a large number of users who have not updated their device. Apple’s policy of



not allowing simultaneous versions of applications for different versions of the OS forces developers to abandon some of their customer base.

- Inability for developers to contact users who leave negative feedback—The App Store’s public feedback system does not allow a developer to communicate with a customer who may have left a negative comment based on erroneous information. For example, as stated previously, some features of an application might only work with the current version of the operating system. If a user has not updated their device then they may leave a review stating that the application is faulty.
- Rejection of apps that employ non-Apple code—Perhaps the greatest disadvantage of Apple’s proprietary developer policies is the rejection of apps that use code not included in the iOS SDK. Apple is very strict about this and it effectively bars developers from creating apps that use features or functions of Apple’s portable devices in a manner not sanctioned by Apple. For example, some early apps were rejected because they gave the user the ability to tether their phone to other computing devices and thus share the iPhone’s data connection.

Navy and DoD Business Practices, Laws, and Regulations

While Apple was free to set its own rules for managing their App Store, there are voluminous laws and regulations designed to control and guide the Department of Defense’s (DoD) procurement of materiel, goods, and services that the Navy must contend with. Virtually all of these regulations apply directly to the Navy’s business practices, along with their own regulations that supplement laws and DoD regulations, policy, and guidance. One critical area is Information Assurance (IA). Systems that interoperate or interface with specified operational systems will need to be certified under the DoD Information Assurance Certification and Accreditation Process (DIACAP; Under Secretary of Defense for Acquisition, Technology, and Logistics [USD(AT&L)], 2007). The Navy App Store business model must be in compliance with, and will be shaped by, these directing and guiding documents. Whereas the totality of the laws and other guiding documents appears to severely limit the Navy’s ability to implement an innovative approach such as Apple’s App Store, there is still significant flexibility within the federal acquisition system for such innovation.

Establishing the Requirement

Within the DoD, requirements for goods and services must be established and prioritized. Usually, a DoD user group will establish the “need” for the goods or services, which will be approved and identified with a program, flow up through the Service and the DoD, be prioritized against all other programs, and be forwarded for consideration for funding. After consideration, Congress will provide authorization to expend the funds and appropriate the actual funding at some specified level. This process establishes one of the key DoD financial management tenets: Bona Fide Need. The funding provided by Congress is generally applied according to priority until all funding is allocated, typically leaving many authorized programs and budget items unfunded.

Funding

Financial laws, regulations, and guidance are closely linked to the organizations controlling the procurement of materiel, goods, and services. Financial management within the federal government is much more complex and restrictive than that of commercial enterprises. The U.S. Congress provides budget authority to federal agencies (including the DoD and the Navy) through a two-step process. First, Congress provides the authority



(authorizations law) to expend funding in a specified manner. Second is the appropriation of public funds (appropriations law), which provides a specified amount of funding, specifies the time period, and designates the purpose for the obligation of authorized and appropriated funds.

DoD and Navy Contracting

Given all of the laws, regulations, and guidance governing procurement and financial management, a contract is typically the vehicle that binds the U.S. government to expend funds in exchange for goods and services provided by another entity (FAR, 2005, part 4). The DoD typically contracts with business entities. Individuals desiring to contract with the DoD must establish a business identity and register on the Central Contractor Registrations (CCR) system (FAR, 2005, part 9). The CCR can be accessed through the U.S. government website shown in Figure 5 (General Services Agency [GSA], 2011). The type of contract awarded is typically selected based on which party must bear the risk of performance. For delivery of mature, low-risk products and services, a fixed-price contract is usually appropriate and the contractor bears the risk of delivery at contracted prices. As the risk of performance increases, the federal government must accept more risk to ensure that contractors will attempt to provide the goods or services required. Cost-plus contracts are typically used under these circumstances so that contractors' risk is minimized, and they remain incentivized to develop the product that the federal government is requiring.



Figure 5. Central Contractor Registration Login Page
(GSA, 2011)

DoD App Store Experience

The Army and the Air Force have initiated limited steps towards using an App Store approach in their respective services. Concerns over vetting and security continue to be significant challenges in fully using the applications in a military environment. In the June



2011 *National Defense Magazine*, in the article titled “Smartphones-for-Soldiers Campaign Hits Wall as Army Experiences Growing Pains,” Sandra Erwin (2011) writes,

A growing frustration for smartphone proponents is that the very features that make the gadgets so attractive would be neutralized by restrictive security policies. “I need these devices and applications to be CAC enabled,” [Deputy Army CIO Maj. Gen. Steven] Smith says, referring to the “common access card” that military and government employees use to log into computers or to enter secure facilities.

The Army’s former CIO [Chief Information Officer], Lt. Gen. Jeffrey Sorensen, garnered the media spotlight when he launched “Apps for the Army” more than a year ago. But the vision is still catching up with the service’s onerous regulations. “We need a way that we can vet the applications,” Smith says. “If you go to some companies, they can vet applications in hours or days, and it takes us 81 months,” he says. “There has to be a happy medium. We need an apps store with TTP’s [tactics, techniques, and procedures] that you’ve already worked.” “We have serious questions about operating and maintaining those apps,” Smith says.

The Army plans to launch a new apps store in 2012. The current CIO, Lt Gen. Susan Lawrence, says there will be another “Apps for the Army” challenge that will be open to any developer. CIO officials now are “designing monetization business models and addressing intellectual property rights,” in preparation for the 2012 competition.

The concerns are not unique to the Army. The Air Force also is exploring ways to expand the use of smartphones, says Lt. Gen. William T. Lord, Air Force CIO. But like the Army, the Air Force worries about troops having possibly too much access to information at their fingertips. “How do we secure data?” Lord asks. “Do we tell them to park their Facebook accounts, their iPhones at the door? What are you going to do 18 months from now when that thing [the phone] is absolutely ancient?” he says. (Erwin, 2011)

While the article specifically references “smartphones,” the challenges surrounding the military’s use of applications developed for widely distributed and interconnected devices remain the same, with the possible exception of the device (“phone,” in the article cited previously) becoming “ancient” in 18 months. The question remains: how do you leverage the innovation of the App Store business model, while at the same time ensuring security and complying with all applicable laws, regulations, and directives?

Apple App Store Concept Analysis

It is clear from the research that Apple has been successful in leveraging innovative products and services using the App Store developmental approach. Apple continues to offer potential application developers a method to develop, refine, and market applications within their defined processes, providing their customers with an extremely wide variety of useful and entertaining products. In addition, the number and variety of the developed applications could not have been produced in house by the available Apple development staff, and outside developers would not have a method for effectively developing Apple product-ready applications or marketing them without the App Store concept. The App Store business approach is a classic “win-win” scenario.

The goals of Apple and of the App Store developers appear to be significantly met through the App Store concept. Apple is able to provide its customers with a dizzying array



of innovative products and outside developers have a method to develop and market their intellectual property to Apple's extensive customer base. Those developers who market their applications for profit are especially well served through the App Store arrangement, and Apple recovers App Store operating costs through their profit-sharing agreement with developers.

The data presented indicate that Apple expends a significant amount of resources to support the App Store concept. The amount of application developer support, detailed previously, is substantial. The production of the developer application and support websites, the software engineering support provided to developers, the extensive product vetting process, the online marketing, and the App Store financial management and reporting resources represent a massive commitment of personnel, time, and funding resources. As Apple continues to offer and promote the App Store process, it is clear that the concept has a positive cost benefit for the company.

Apple must comply with applicable laws and regulations, and, beyond those, must protect its corporate image and products. Apple's App Store vetting process is designed to identify and eliminate any product with potential illegal, immoral, or controversial application and, further, any product that changes or adversely affects any Apple software or product. To that end, Apple carefully controls the development process from initiation through implementation, and then continues to monitor applications for user acceptance and any latent problems that may appear after deployment. Developers are restricted to using only Apple software and development tools, which is essential for Apple's testing and vetting processes. This proprietary control of the application development process is in stark contrast to the open approach used by Apple's major competitor, Android.

Navy App Store Implementation Analysis

Our research indicates that it may be plausible for the Navy to establish its own App Store concept, if it is able to define and communicate its requirements, control the process, resource its support for the process, and establish effective business rules within the DoD and Navy laws, directives, and guidelines. The products and applications the Navy desires will obviously be quite different from those of Apple, requiring an end-to-end process definition to incentivize innovation, but narrowing the focus to meet well-defined Navy needs.

Defining and Communicating Product and Business Requirements

Unlike Apple, which is interested in almost any application that appeals to its customers, the Navy will likely need to define more specifically the types of applications it desires. This need should not overly restrict innovative solutions, but should help potential developers focus on desired areas. For example, the Navy might indicate that it desires applications that assist in "logistics tracking." There may be hundreds of innovative applications that would apply to that broad area, most of which would likely have utility for the Navy. There would be a significant amount of requirements analysis to develop the broad areas before any effective solicitation could be publicized.

Whereas Apple is free to enter into the App Store agreement with both businesses and individuals, the DoD and the Navy typically contract with businesses and corporations for products, imposing laws, policies, regulations, and guidance from all levels of government into the contracting process. Individuals who are not part of any corporation would likely have to establish a business identity and register on the U.S. government's Central Contractor Registration (CCR) website at URL <https://www.uscontractorregistration.com/>.



With the Apple App Store concept, profit-seeking developers clearly understand the method for making money and the associated risks for developing an application that is not popular or is perceived to be too expensive. Potential developers for the Navy App Store will need to be similarly knowledgeable on both the potential for profit and the associated risks. Because profit is based on application sales and there is a fee to participate, Apple does not need to limit the number of participating application developers because the corporation is not the source of funding. There will likely be a limit on the available government funds; thus, Navy App Store participation would necessarily be limited, too. The government solicitation will need to be very clear regarding requirements, bidding, source selection, and how potential developers will earn the funds. The contract will need to be carefully worded to garner the maximum developer innovation, yet guide the efforts towards the maximum utility for the Navy and provide appropriate levels of control.

Controlling the Process

It is evident that Apple tightly controls the application development process from beginning to end, and even characterizes itself as a “control freak.” This controlled process is effective for Apple and appears to provide the same type of controls likely to be needed by the Navy.

The Navy will need varying levels of control over the application development process, depending on the classification or sensitivity of the systems being accessed by the applications. In classified or information assurance (IA) environments, the Navy would likely require significant control and access to source code to properly assess risks and for the DIACAP certification process. The Apple App Store model appears to provide that level of control, and the Navy would necessarily need to provide a similar level of support with software engineers, software tools, testing environments or software integration laboratories, and other development support. If the applications developed were not supporting or interfacing with sensitive or classified systems, a lower level of control over the process and products would appear to be acceptable. However, there would continue to be a need for some level of government-provided support for analyzing proposals and products, as well as for conducting risk analyses.

The government solicitation and contracting processes will need to clearly identify the level of control that will be imposed on potential application developers. Potential Apple App Store developers enter into binding agreements with all of the Apple-imposed controls over the development, content, and interoperability of any proposed application development, and the Navy would need to do something similar.

Identifying contract deliverables, data requirements, data rights, progress payments (if any), government acceptance criteria, and government oversight and control mechanisms will likely be challenging. The U.S. government acquisition process is controlled through a substantial number of laws, regulations, and guidance documents, and these will likely add to the challenge of crafting a contract that is compliant yet allows for the innovation sought.

There may be an opportunity to leverage App Store products that already exist, although there would be the obvious limitation of operating on Apple devices exclusively if they are used as developed. If the desired capabilities were known, searching the 550,000 applications could yield positive results. This process might also identify developers with particular skills in developing desired capabilities, and solicitations for Navy-specific development could include those high-potential developers.



Vetting the Products

It is clear that the product-vetting process is significantly important for Apple's App Store applications and would be critical for the Navy if applications were used operationally or interoperated with networks and other systems. Apple dedicates significant resources for the vetting process and has controlled the development process to help facilitate the vetting. From Erwin's *National Defense* article cited earlier, it is evident that the Army has had significant challenges in properly vetting applications, taking up to 81 days to do so (Erwin, 2011).

Navy App Store vetting processes would necessarily need to be established and resourced prior to any solicitation because developers would need to know the process for qualification and acceptance of developed applications. The vetting process would likely include security, IA, vulnerability analysis, and other critical issues for military operations.

Conclusions and Recommendations

The Apple App Store process has been an effective way for Apple to attract innovative application development and provide its customers with an extensive array of products that are beyond the company's ability to create them internally. Implementing the Apple business model, the Navy would need to focus potential developers on areas that it considers most beneficial.

Setting the Navy requirements for application development is an essential step in initiating the App Store business model. Establishing the requirements would also define how and at what level the applications would be operated and would identify the systems that need interoperability or interfaces. Defining the requirements would help determine the need for IA and other classified or sensitive system considerations involved with the application development and help determine the necessary level of control over the development process and delivered products.

Apple's tight control of the development software and procedures is a key enabler of their vetting process. An open-source model would significantly complicate the control and vetting processes. The solicitation and contract will need to specify the development controls that will be implemented.

Vetting or qualifying the products will likely entail significant effort and resources. Depending on the intended use of the applications, the vetting may require varying degrees of analysis and testing, DIACAP certification, or other risk-based analysis and testing for use on classified and non-classified systems. The degree of control over the development process would have an effect on the difficulty in the vetting process. The more that is known about the software, engineering tools used, and testing regiments, the easier it is to complete the vetting process, which is the control philosophy used by Apple for App Store development.

Significant resources are required to research and establish the requirements, provide the solicitation, process and select potential developers, control the process, vet the products, and support the fielding of successful applications. Apple would not divulge the actual number of people or the cost associated with the App Store model, but it is clear that the investment in personnel, company resources, and time is substantial. Resourcing this level of effort would require a significant investment by the Navy.

The Navy may be able to leverage Apple App Store products that have already been developed and are currently available. Although they have been built to support Apple's i-devices, it may be cost effective to purchase the appropriate equipment and buy the applications directly. If the Navy does not want to limit the hardware to Apple products,



desirable applications might be contracted and redeveloped by the same expert or experts in a form that meets the Navy's criteria.

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Examining the Apple App Store Business Model for Application to U.S. Navy Requirements

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Naval Open Architecture (NOA)

- The use of open standards with published interfaces to achieve modular and interoperable systems.
- A primary goal of this model is to reduce software acquisition costs through the re-use of modular software components.
- A key enabler of the NOA initiative is maintaining an efficient and effective software repository.
 - The Navy's Software Hardware Asset Reuse Enterprise (SHARE) is accessed through Forge.mil
 - Other services have similar software repositories



- The total benefit of software repositories will correspond to the quality and quantity of the applications deposited into them.

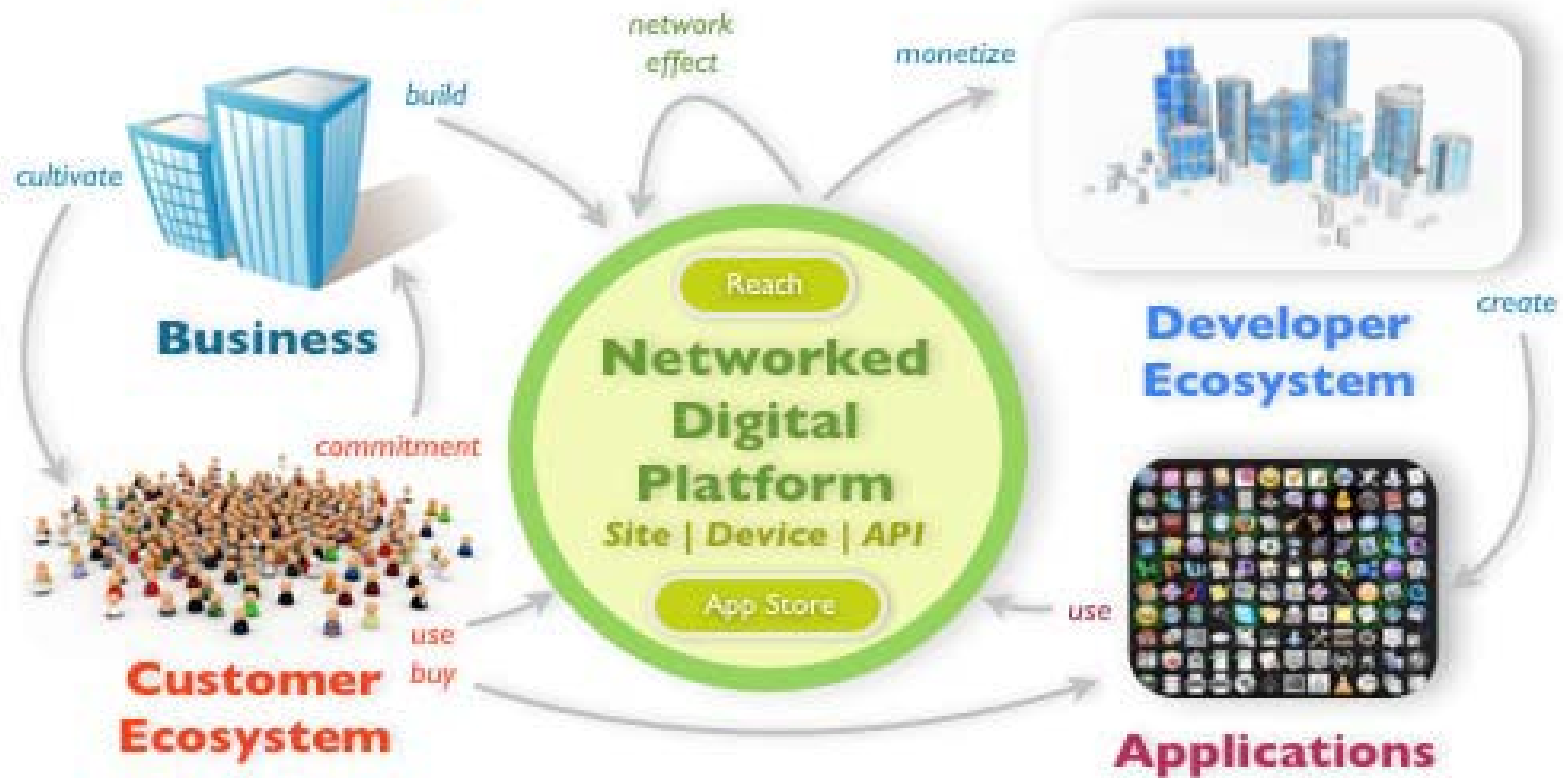
- The Apple App Store is indisputably the most successful software repository in the private sector.
 - As of March 2012, Apples lists more than 550,000 applications available.
 - On March 5, 2012 Apple announced more than 25 billion apps have been downloaded.



- **Research Goal:** Examine the business model of the Apple App Store to identify which of its effective business practices might be applied to the DoN/DoD software repositories.
- **Methodology:** Apple declined fact gathering interviews but recommended enrolling in the App Store Developer program to gain first hand knowledge (including access to restricted web portals).

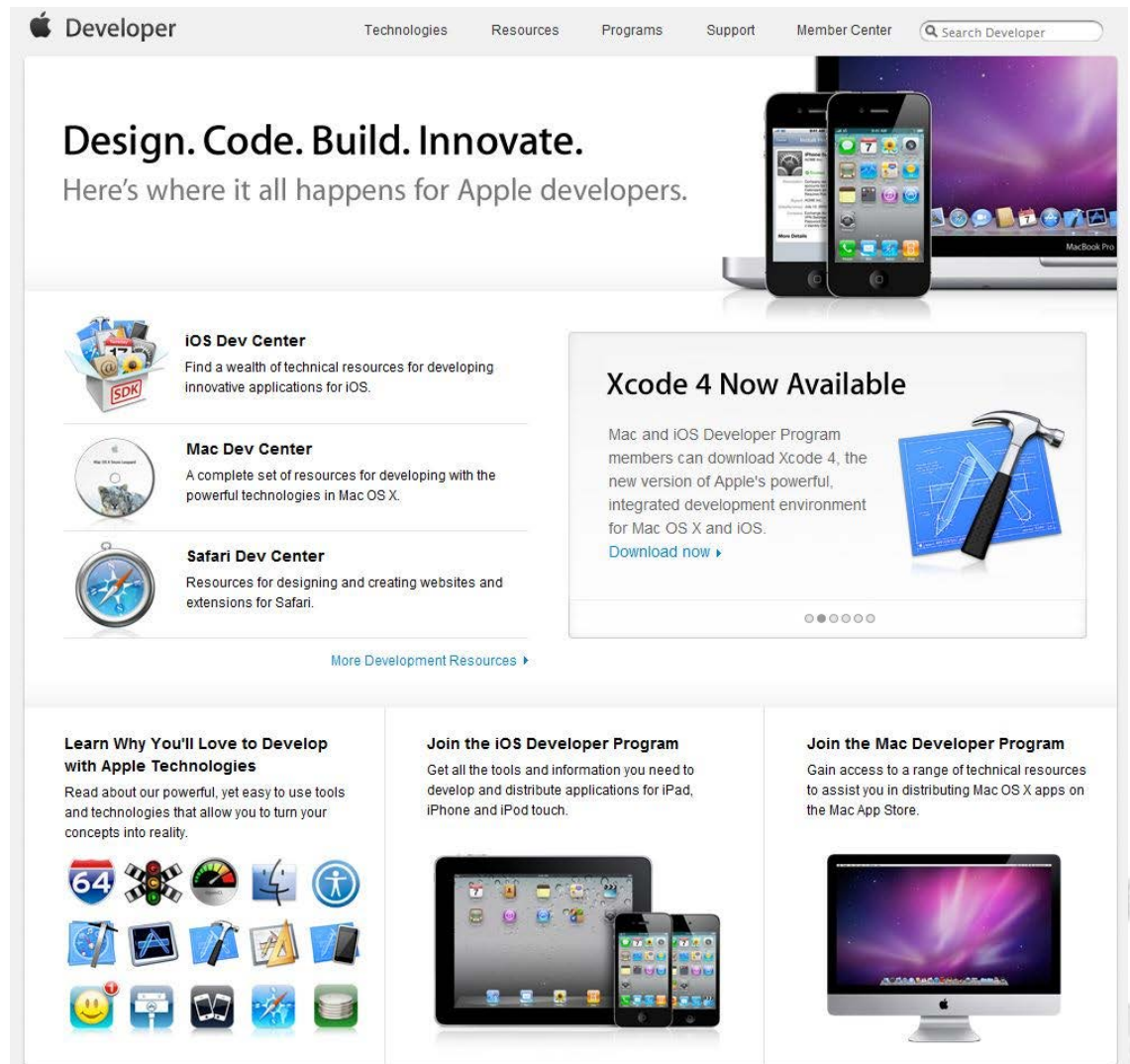


The App Store As A Digital Business Model



Apple Developer Welcome Page

- Intuitive
- Efficient
- Comprehensive



The screenshot shows the Apple Developer website's welcome page. At the top, there's a navigation bar with the Apple logo, 'Developer', and links for 'Technologies', 'Resources', 'Programs', 'Support', and 'Member Center'. A search bar is on the right. The main heading reads 'Design. Code. Build. Innovate.' followed by 'Here's where it all happens for Apple developers.' Below this, there are three main sections: 'iOS Dev Center' (with an SDK icon), 'Mac Dev Center' (with a Mac OS X icon), and 'Safari Dev Center' (with a Safari icon). To the right, a large banner for 'Xcode 4 Now Available' features an image of a hammer on blueprints and a 'Download now' link. At the bottom, there are three columns: 'Learn Why You'll Love to Develop with Apple Technologies' (with a grid of icons), 'Join the iOS Developer Program' (with images of an iPad and iPhones), and 'Join the Mac Developer Program' (with an iMac image).

Apple's Welcoming Statement to Developers

Apple provides a complete ecosystem for developers. All the components including hardware, the operating systems, and the developer tools are designed by one company, and they're all designed to work together seamlessly—creating an easier, more intuitive experience so developers can focus on making great apps.



Apple's developer portal provides one-stop shopping to resources:

- Download tools like the iOS Software Developer Kit (SDK)
- Getting started videos
- Coding how-to guides and sample code
- Forums to brainstorm with other developers



The Software Development Process

1. Select a project template and design the user interface.
2. Write the app's unique code.
3. Test the app on your Mac using the iPad/iPhone simulator.
4. Test the app on a real iPad/iPhone
5. Submit to Apple



Apple's Vetting Process

- Apps can be rejected for either policy violations or technical problems.
 - Apple cites more than 100 different reasons an app might be rejected.
 - Policy guidelines are very restrict, such as all apps must be developed using only the tools provided by Apple.
 - No app can duplicate the functionality of an Apple app.



Pros and Cons of the Apple App Store Business Model

Pros:

1. Greatest possible assurance of safe applications
2. Exemplary and comprehensive web portal
3. A symbiotic relationship between the end user and developer ecosystems
4. Effective management and marketing of application updates
5. A self-contained application directory and store
6. Centralized payment processing
7. End-user feedback and rating system



Pros and Cons of the Apple App Store Business Model (cont'd)

Cons:

1. Potential bottleneck for distribution
2. Excessive delays in correcting application bugs
3. You can only download the current version of an application
4. Inability for developers to contact users who leave negative feedback
5. Rejection of apps that employ non-Apple code



Challenges to Applying the App Store Business Model to DoN/DoD

1. Complying with or changing existing software acquisition policies and regulations
2. Defining and communicating product and business requirements
3. Controlling the process
4. Incentivizing and supporting developer participation
5. Establishing an effective vetting process



Questions?

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