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***X-commerce: Web platform to build single page
e-commerce application based on HTML5 Web
Components***

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Dedicated to my family

and ...

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Introduction

Today, the Electronic Commerce has changed the way we shop, Internet, in fact, has become a valuable communication tool for the enterprise network. The company, through the website, is able to provide you with a communication and promotion customized, personalized offer, a transaction customized, personalized assistance. Enter the network, it means coming to terms everyday, with the global market, the global consumer, competition global; to remain in the competition and gain greater visibility the company must adopt a new sales channel: e-commerce.

Electronic commerce is one of the main criteria of revolution of Information Technology and communication in the field of economy. Existence of this virtual markets, passages and stores that have not occupy any physical space, allowing access and circulation in these markets for a moment and anywhere in the world without leaving home is possible. Select and order goods that are placed in virtual shop windows at unspecified parts of the world and also are advertising on virtual networks and payment is provided through electronic services, all of these options have been caused that electronic commerce is considered the miracle of our century.

The increased availability of Internet access and the wide spread of mobile devices has allowed us to consolidate the habit of buying online by customers online already active, that have increased the share of online spending on total consumption. But what is the correct definition of e-commerce? “Commerce is the activity of buying and selling of goods and services, especially on



Figure 1: e-commerce wordle

a large scale. The system includes legal, economic, political, social, cultural and technological systems that are in operation in any country or internationally. Thus, commerce is a system or an environment that affects the business prospects of economies. It can also be defined as a component of business which includes all activities, functions and institutions involved in transferring goods from producers to consumers [Wikipedia].”

Other definition: “Interaction between communication systems, data management systems and security, which because of them exchange commercial information in relation to the sale products or services, will be available, so the definition, the main components of electronic commerce are: communication systems, data management systems and security [1].”

In the 1970s, the term electronic commerce, referred to electronic data exchange for sending business documents such as purchase orders and voices electronically. Later, with the development of this industry the term of electronic commerce is used to business of goods and services via the web. When

the first World Wide Web was introduced in 1994 as a comprehensive, many well-known researchers have been predicated this type of business “the web-based business” will became soon an important in the world economy, but it took four years that http based protocols should be widely available to users. The aim of this thesis either to analyze the main systems of e-commerce platforms and either facilitating their realization.

Therefore, this thesis is divided in two parts and organized as follows: Part one consists of five chapters. Chapter One describes the state of the art system of e-commerce and the platforms that their facilitate the realization. Chapter two, analyzes the main companies of e-commerce and the platforms that build systems. Chapter tree analyzes each technology used and describes the methodological approach of each. Fourth chapter analyzes the payment services used. Chapter five provides an overview of Single Page Application development pattern and explains pros and cons and technical functioning. The second part consists of three chapters. Chapter five describes the project as a whole showing the structure and organization pages. Chapters six is focus on specific components that have been developed, Payment Management and on all the theoretical and practical concepts that are behind the ideation of the component. Finally, Chapter seven, exposes project conclusions and further implementations of the work.

Part I

Part 1

Chapter 1

E-commerce & platforms

This chapter describes the main systems of e-commerce and the most popular platforms that facilitate their realization. The first section is an overview of the systems of e-commerce. The second section describes in a general way the platforms that facilitate the realization of a system of e-commerce. The three section describes what is the difference between a platform to build a system of e-commerce and the e-commerce's system. The four and five section will focus on the main systems of e-commerce as Amzon, Ebay. The six, seven sections will focus on platforms that facilitate the creation of an e-commerce as Shopify, BigCommerce.

1.1 E-commerce Overview

As already mentioned, “E-Commerce is the activity of buying and selling of goods and services, especially on a large scale. Today, most of the population, use these virtual stores to shop or simply to inquire. In fact, these systems allow for a timely basis to have information regarding the good we are seeking. In this way these systems help the customer in buying a particular good.”

The e-commerce in Europe has continued to grow even if at different rates



Figure 1.1: e-commerce overview

and in different ways in different countries. Online shopping is a habit well established in Britain, Germany and France, markets that together account for 70-80% of e-commerce Europe, while it is just starting out or is growing in the rest of Europe, including countries such as Italy and Spain. The most rapid growth, however, affect the emerging economies of Eastern Europe, led by Russia, the market for which is expected to grow by up to 200% over the next three years.

In mature markets, growth was driven primarily by an increase in the frequency of purchase by the consumer and by the tendency to spend more through online channels, while in countries where e-commerce is developing growth results especially by the increase in online shoppers[2]. The cabinet is the key factor in the growth of e-commerce. The diffusion of smartphones and tablets has extended much access to the online market, even in Italy, where 29 million end users access the Internet from the mobile. Companies that have not addressed this change have had a decline in the conversion rate on its website, while those who understood the new opportunities brought by the new type of access has been able to develop the offer of additional



Figure 1.2: e-commerce payment system

products and services dedicated, for example taking advantage of the geolocation of the customer. New entrants are mainly the physical stores, which saw in e-commerce for a way to expand its customer base, and producers of goods and services, they see the distribution companies increasingly as an obstacle to profitability. What are the advantages and disadvantages (risks) of a system of e-commerce?

1.1.1 Advantages and disadvantages of a system of e-commerce

The benefits of electronic commerce are general (system-wide) and specific for the seller or the buyer.

- Benefits for system:
 - It is a global phenomenon and that a potentially global market;
 - the transactions can develop throughout the day without inter-

ruption and realtime;

- the interaction between the parties can be synchronous or asynchronous;
- there is greater operational flexibility of relations between the parties.

- Benefits for buyer:

- amenity: e-commerce stores are always open every day including holidays: just a few clicks from home or from work to buy what you want. The convenience to receive the goods directly at home is an important added value: we forget the long lines in the parking lot and in front of the chest of the crowded malls and you live a better buying experience;
- convenience: a purchase through the Web is much more convenient. In addition to the discounts and promotions who flock the network there is convenience in movement (no need to move by car or public services) and in the time saved;
- information: buying on the Internet allows you to calmly assess the choice of major purchases due to the large amount of information that you can easily find, to the advice and comments from other consumers, the wide range of products and alternatives;

- Benefits for seller:

- the flexibility according to your needs of its commitments is easy to plan a few hours each day to devote to a new major project sales with the Internet. The mailbox collects communications and orders will be processed as soon as possible;
- visibility: there is no place in the world frequented the Internet, after an initial phase of advertising the same managers are sur-

prised of the amount of visits and contacts received. Those who already have a business and want to open a new sales channel with the Internet, should not overlook the excellent positive return in terms of image that the site produces and that also benefits traditional activity;

- the economy: starting a new project sales with Internet does not require large investments and for the creation of storefront, both for advertising, both for the organization. Furthermore a good design e-commerce based on appropriate contacts with the suppliers allows to reduce to a minimum investment of stock.

...

Companies that sell products or services on the Internet to be successful must obtain credibility and visibility on the Web and to achieve this it is not enough to have a secure server. To get credibility companies need to know how to build for the users of their website, a positive experience not only during the purchasing process, but also before and after, so that the user wants to repeat the experience and advice to other users. Creating a positive experience for their customers and by advertising messages and techniques of SEO companies build a reputation or image of successful enterprise. In face-to-face transactions, customers and sellers use a number of physical signals to determine that they are dealing with a trustworthy partner. Retailers can check signatures and identity cards of their clients; buyers can see the badges with the name of employees, try the goods carefully and retain proof of their purchases. On electronic networks, none of these methods is applicable. For this reason, have been developed (and are now fully available and effective) some control systems performing similar functions. The low cost of entry and the ease with which text and graphics can be copied, make it possible for almost anyone to create a website that pairs represent an organization established trading. No new reports of false

virtual shops look professional, created to impersonate the Web version of existing activities, in order to illegally obtain credit card numbers. This problem has been resolved. Scammers are able to intercept transmissions. A thief can work hard to get the numbers of credit cards. A competitor or a disgruntled customer can enter an error in the company's website, in order to induce him to refuse service to potential customers or initiate other unauthorized actions. Sources intentional or accidental sometimes cause changes to the content of a communication route. User's name, credit card numbers and total currency are all vulnerable to such alteration. To this we have been developed safety systems to ensure the integrity of all the phases of the transaction. The data coming from America, are explicit: the continued growth of e-commerce is comforting. A concern, however, is the security front. In fact, the problems related to information security are increasing.

You can identify two types of Internet attacks to the network:

- Passive attacks: Need to get the most information about the network in question, but does not have the purpose of hostile intrusion; (Ex. Eavesdropping: sniffing the information being sent across it in order to acquire the contents of transactions for subsequent analysis on personal data, or on behalf of third parties);
- Active attacks: as a result of the information collected by passive attacks, you can attack systems identified to implement changes to the data, lock services, obtain confidential information....

Another worrying phenomenon, in terms of information security, is surely the phishing; It is an illegal system to collect sensitive data such as information about your credit card or access to bank accounts. The vast majority of messages takes place starting from phishing e-mail addresses stolen (ie where the authors have introduced illegally) or forged to perfection (in the eyes of the end user) on the basis of a known syntax or through the use of imitators

sites of companies-mirror. These threats can cause a loss of integrity of databases, a loss of profits, increased costs for security systems, a critical data loss, a loss of trade secret information and damage to corporate reputation. Systems e-commerce are the most famous Amazon, Ebay, etc..

1.1.2 Amazon

Amazon.com, Inc., often referred to as simply Amazon, is an American electronic commerce and cloud computing company with headquarters in Seattle, Washington. It is the largest Internet-based retailer in the United States. Amazon.com started as an online bookstore, later diversifying to sell DVDs, Blu-rays, CDs, videodownloads/streaming, MP3 downloads/streaming, audiobook downloads/streaming, software, video games, electronics, apparel, furniture, food, toys and jewelry. The company also produces consumer electronics—notably, Amazon Kindle e-book readers, Fire tablets, Fire TV and Fire Phone - and is the world's largest provider of cloud infrastructure services (IaaS). Amazon also sells certain low-end products like USB cables under its in-house brand AmazonBasics.

Amazon has separate retail websites for United States, United Kingdom and Ireland, France, Canada, Germany, Italy, Spain, Netherlands, Australia, Brazil, Japan, China, India and Mexico.

Amazon also offers international shipping to certain other countries for some of its products. In 2011, it professed an intention to launch its websites in Poland and Sweden. In 2015, Amazon surpassed Walmart as the most valuable retailer in the United States by market capitalization. The company was founded in 1994, spurred by what Bezos called his “regret minimization framework,” which described his efforts to fend off any regrets for not participating sooner in the Internet business boom during that time. In 1994, Bezos left his employment as vice-president of D. E. Shaw & Co., a Wall Street firm, and moved to Seattle. He began to work on a business plan for

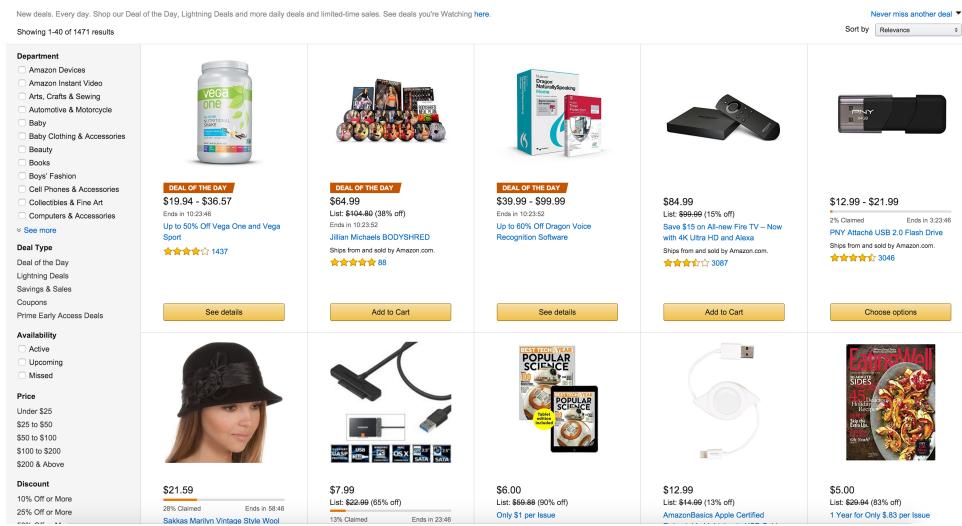


Figure 1.3: Amazon shop

what would eventually become Amazon.com. Jeff Bezos incorporated the company as “Cadabra” on July 5, 1994. Bezos changed the name to Amazon a year later after a lawyer misheard its original name as "cadaver". The company went online as Amazon.com in 1995.

Bezos selected the name Amazon by looking through the dictionary, and settled on “Amazon” because it was a place that was “exotic and different” just as he planned for his store to be; the Amazon river, he noted was by far the “biggest” river in the world, and he planned to make his store the biggest in the world. Bezos placed a premium on his head start in building a brand, telling a reporter, “There’s nothing about our model that can’t be copied over time. But you know, McDonald’s got copied. And it still built a huge, multibillion-dollar company. A lot of it comes down to the brand name. Brand names are more important online than they are in the physical world.” Additionally, a name beginning with "A" was preferential due to the probability it would occur at the top of any list that was alphabetized.

Since June 19, 2000, Amazon’s logotype has featured a curved arrow leading from A to Z, representing that the company carries every product from A to

Z, with the arrow shaped like a smile.

After reading a report about the future of the Internet which projected annual Web commerce growth at 2,300%, Bezos created a list of 20 products which could be marketed online. He narrowed the list to what he felt were the five most promising products which included: compact discs, computer hardware, computer software, videos, and books. Bezos finally decided that his new business would sell books online, due to the large world-wide demand for literature, the low price points for books, along with the huge number of titles available in print. Amazon was originally founded in Bezos' garage in Bellevue, Washington. The company began as an online bookstore, an idea spurred off with discussion with John Ingram of Ingram Book (now called Ingram Content Group), along with Keyur Patel who still holds a stake in Amazon. In the first two months of business, Amazon sold to all 50 states and over 45 countries. Within two months, Amazon's sales were up to \$20,000/week. While the largest brick and mortar bookstores and mail order catalogs might offer 200,000 titles, an online bookstore could "carry" several times more, since it would have a practically unlimited virtual (not actual) warehouse: those of the actual product makers/suppliers. Amazon was incorporated in 1994, in the state of Washington. In July 1995, the company began service and sold its first book on Amazon.com: Douglas Hofstadter's Fluid Concepts and Creative Analogies: Computer Models of the Fundamental Mechanisms of Thought. In October 1995, the company announced itself to the public.] In 1996, it was reincorporated in Delaware. Amazon issued its initial public offering of stock on May 15, 1997, trading under the NASDAQ stock exchange symbol AMZN, at a price of US\$18.00 per share (\$1.50 after three stock splits in the late 1990s).

Amazon's initial business plan was unusual; it did not expect to make a profit for four to five years. This "slow" growth caused stockholders to complain about the company not reaching profitability fast enough to justify

investing in, or to even survive in the long-term. When the dot-com bubble burst at the start of the 21st century, destroying many e-companies in the process, Amazon survived, and grew on past the bubble burst to become a huge player in online sales. It finally turned its first profit in the fourth quarter of 2001: \$5 million, on revenues of more than \$1 billion. This profit margin, though extremely modest, proved to skeptics that Bezos' unconventional business model could succeed. In 1999, Time magazine named Bezos the Person of the Year, recognizing the company's success in popularizing online shopping.

Barnes & Noble sued Amazon on May 12, 1997, alleging that Amazon's claim to be "the world's largest bookstore" was false. Barnes and Noble asserted, "[It] isn't a bookstore at all. It's a book broker." The suit was later settled out of court, and Amazon continued to make the same claim." Walmart sued Amazon on October 16, 1998, alleging that Amazon had stolen Walmart's trade secrets by hiring former Walmart executives. Although this suit was also settled out of court, it caused Amazon to implement internal restrictions and the reassignment of the former Walmart executives.

1.1.3 Ebay

Ebay Inc. is an American multinational corporation and e-commerce company, providing consumer to consumer & business to consumer sales services via Internet. It is headquartered in San Jose, California. eBay was founded by Pierre Omidyar in 1995, and became a notable success story of the dot-com bubble. Today, it is a multibillion-dollar business with operations localized in over 30 countries.

The company manages eBay.com, an online auction and shopping website in which people and businesses buy and sell a broad variety of goods and services worldwide. In addition to its auction-style sales, the website has since expanded to include "Buy It Now" shopping; shopping by UPC, ISBN,

or other kind of SKU (via Half.com); online classified advertisements (via Kijiji or eBay Classifieds); online event ticket trading (via StubHub); online money transfers (via PayPal) and other services.

The website is free to use for buyers, but sellers are charged fees for listing items and again when those items are sold. The company also makes additional money through its PayPal subsidiary which is used by sellers to collect payment for items sold. AuctionWeb was founded in California, on Septem-

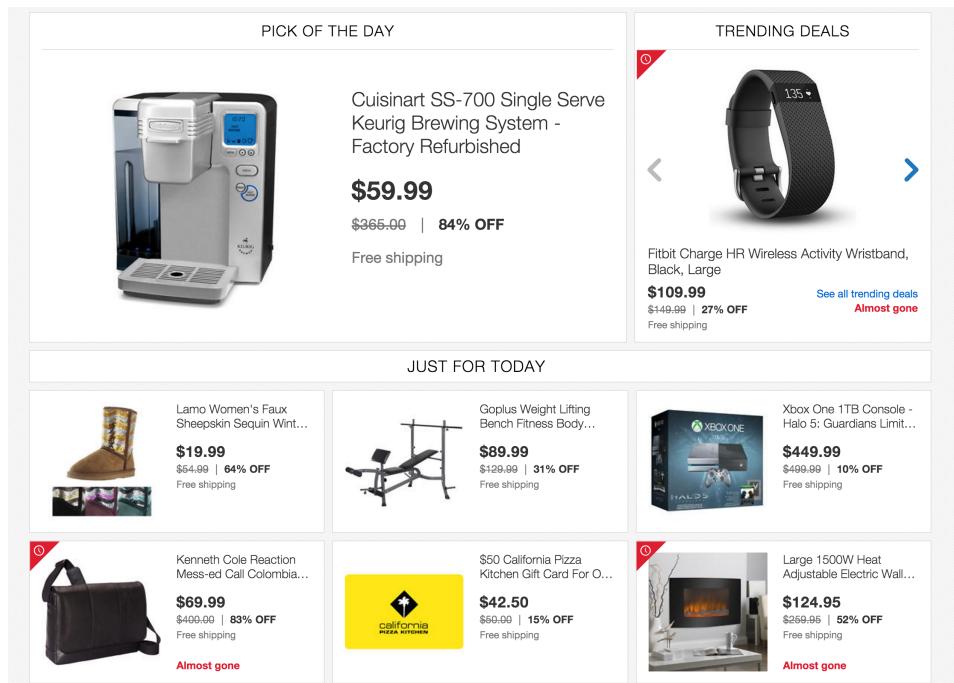


Figure 1.4: Ebay shop

ber 4, 1995, by French-born Iranian-American computer programmer Pierre Omidyar (born June 21, 1967) as part of a larger personal site. One of the first items sold on AuctionWeb was a broken laser pointer for \$14.83. Astonished, Omidyar contacted the winning bidder to ask if he understood that the laser pointer was broken. In his responding email, the buyer explained: “I’m a collector of broken laser pointers.” The frequently repeated story that eBay was founded to help Omidyar’s fiancée trade Pez candy dispensers was

fabricated by a public relations manager in 1997 to interest the media, which were not interested in the company's previous explanation about wanting to create a "perfect market". This was revealed in Adam Cohen's book, *The Perfect Store* (2002), and confirmed by eBay. Reportedly, eBay was simply a side hobby for Omidyar until his Internet service provider informed him he would need to upgrade to a business account due to the high volume of traffic to his website. The resulting price increase (from \$30/month to \$250) forced him to start charging those who used eBay, and was not met with any animosity. It resulted in the hiring of Chris Agarpao as eBay's first employee to handle the number of checks coming in for fees. Jeffrey Skoll was hired as the first president of the company in early 1996. In November 1996, eBay entered into its first third-party licensing deal, with a company called Electronic Travel Auction to use SmartMarket Technology to sell plane tickets and other travel products. Growth was phenomenal; in January 1997 the site hosted 2,000,000 auctions, compared with 250,000 during the whole of 1996. The company officially changed the name of its service from AuctionWeb to eBay in September 1997. Originally, the site belonged to Echo Bay Technology Group, Omidyar's consulting firm. Omidyar had tried to register the domain name echobay.com, but found it already taken by the Echo Bay Mines, a gold mining company, so he shortened it to his second choice, eBay.com. In 1997, the company received \$6.7 million in funding from the venture capital firm Benchmark Capital. Meg Whitman was hired as eBay President and CEO in March 1998. At the time, the company had 30 employees, half a million users and revenues of \$4.7 million in the United States. eBay went public on September 21, 1998, and both Omidyar and Skoll became instant billionaires. eBay's target share price of \$18 was all but ignored as the price went to \$53.50 on the first day of trading.

1.2 The platforms that build system of e-commerce

- Overview

The platforms that help build a system of e-commerce are exactly systems or portals that facilitate the life of a trader that want to start your own online business.

The process of setting up an online store with such systems is very fast and efficient, because essential information is easy to fit. The next moment is the choice of the graphical presentation of the store where the trader can choose from many themes and templates available. These systems handle transparently different services that help create the store such as: the domain, payment management, organizing inventory, shipping and tracking of shipments, invoice management, etc..

The advantages and disadvantages of these platforms are mainly linked to the flexibility of the system itself. In fact, a platform for e-commerce-rich services, has more chance of being used by a growing number of major traders. Obviously, a generic platform so can not meet the needs of every type of merchant because the platform has the purpose of facilitating the realization of a system of e-commerce in a more simple possibilie. Therefore it is difficult to meet the needs of each merchant from any kind of detail. Ease of use is another key point that leads to the platform to be chosen by dealers.

The platform of e-commerce are the most famous Shopify, BigCommerce, etc..

1.2.1 Shopify

Shopify is a Canadian commerce company headquartered in Ottawa, Ontario that develops computer software for online stores and retail point-of-sale systems.

Shopify was founded in 2004, and was initially based on earlier software writ-

ten by its founders for their online snowboard store. The company reports that it has 200,000 merchants using its platform, with total gross merchandise volume exceeding \$10 billion. Shopify was founded in 2004 by Tobias

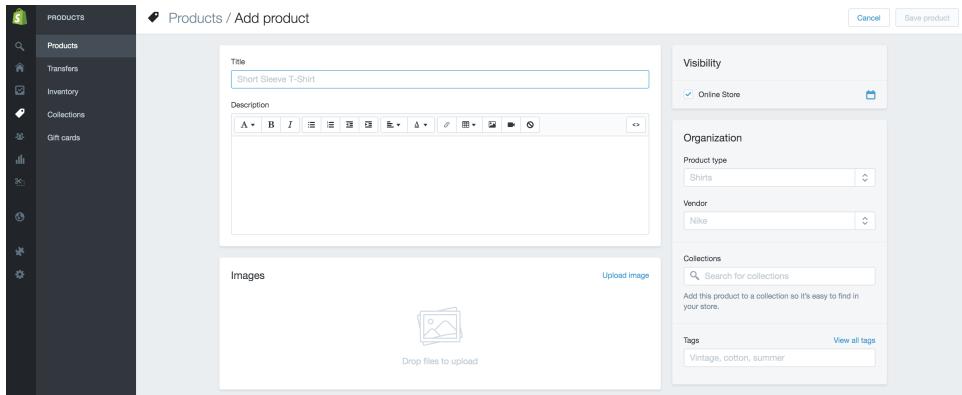


Figure 1.5: Shopify Dashboard

Lütke, Daniel Weinand, and Scott Lake after attempting to open Snowdevil, an online store for snowboarding equipment. Unsatisfied with the existing e-commerce products on the market, Lütke, a programmer by trade, decided to build his own. Lütke used the open source web application framework Ruby on Rails to build Snowdevil's online store, and launched it after two months of development. The Snowdevil founders launched the platform as Shopify in June 2006. In September 2015, Amazon announced it would be closing its Amazon Webstore service for merchants, and had selected Shopify as the preferred migration provider. Shopify's shares jumped more than 20% upon the news.

1.2.2 Bigcommerce

Bigcommerce is a privately held technology company that develops e-commerce software for businesses. The company was founded in 2009 and has 370 employees with headquarters in Austin, Texas and additional offices in San Francisco, California and Sydney, Australia. The company reports that

\$5 billion in total sales have been processed by the Bigcommerce platform. Bigcommerce was founded in 2009 by Australians Eddie Machaalani and

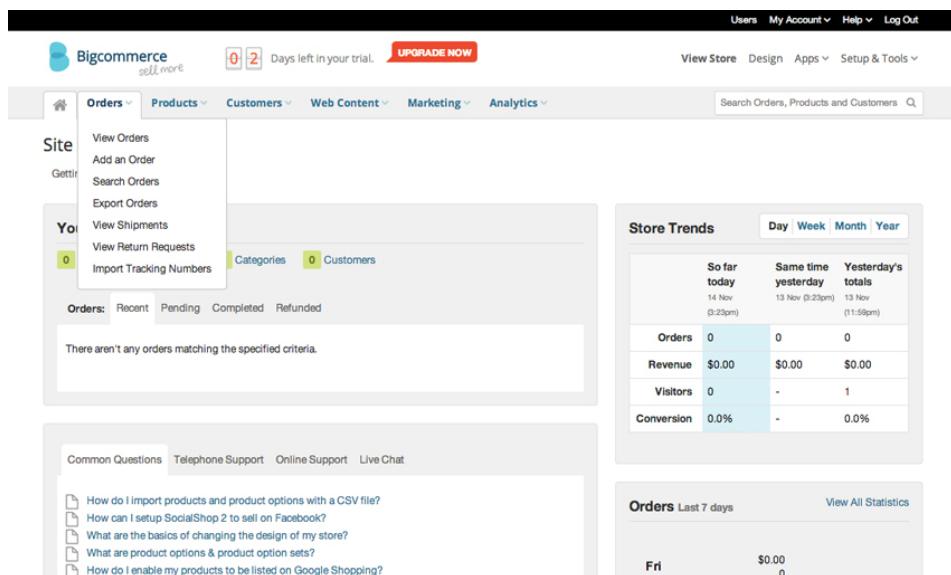


Figure 1.6: Bigcommerce Dashboard

Mitchell Harper following a chance meeting in an online chatroom in 2003. In August 2009, the two relaunched a hosted version of Interspire Shopping Cart called “BigCommerce” and opened its first U.S. office.

Bigcommerce was 100% bootstrapped until July 31, 2011, when it closed \$15 million in Series A funding from General Catalyst Partners. At the time, the company announced its client count had grown 680% year over year.

In January 2012, Bigcommerce launched a \$2 million integration fund for developers, which was used to fund 31 applications in the Bigcommerce App Marketplace. The company subsequently received \$20 million in Series B financing in September 2012, led by General Catalyst Partners and Floodgate Fund.

Chapter 2

Enabling Technologies

This chapter describes X-Learning enabling technologies. The first three sections concern server-side technologies: MongoDB, NodeJS and Loopback by Strongloop (an IBM company). MongoDB is a NoSQL document-oriented database management system; NodeJS is an event-driven framework to handle Javascript server sides; Loopback is a NodeJS based framework created to use and edit set of APIs. The fourth, fifth and sixth sections are related to client-side technologies: HTML5, Web Components and Polymer-Project by Google. HTML5 is a markup language aimed at web pages structuring; Web Components are a set of standards that allow for the creation of reusable widget and components in web documents; Polymer-Project provides a thin layer of API on top of Web Components and several powerful features, such as custom events, delegation, mixins, accessors and component life-cycle functions, to facilitate the creation of Web Components.

2.1 HTML5

This section provides an overview of HTML5. HTML5 is the latest version of Hypertext Markup Language, the code that describes web pages. There are actually three kinds of code: HTML, which provides the struc-



Figure 2.1: Server and client sides enabling technologies

ture; Cascading Style Sheets (CSS), which take care of presentation; and JavaScript, which makes things happen.

HTML5 has been designed to deliver almost everything it is possible to do online without requiring additional software such as browser plugins. It does everything, from animation to apps, music to movies, and can also be used to build complicated applications that run in browsers.

Moreover, HTML5 isn't proprietary, so it is completely free. It's also a cross-platform standard, which means it doesn't care whether the device is a tablet or a smartphone, a netbook, notebook or ultrabook or a Smart TV: if the browser supports HTML5, it should work flawlessly.

While some features of HTML5 are often compared to Adobe Flash, the two technologies are very different. Both include features for playing audio and video within web pages, and for using Scalable Vector Graphics.

HTML5, on its own, cannot be used for animation or interactivity, it must be supplemented with CSS3 or JavaScript. There are many Flash capabilities that have no direct counterpart in HTML5. See Comparison of HTML5 and Flash. Although HTML5 has been well known among web developers

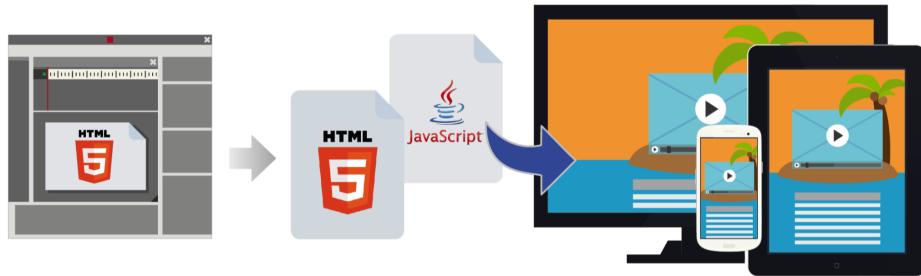


Figure 2.2: Html5 Responsive

for years, its interactive capabilities became a topic of mainstream media around April 2010, after Apple Inc's then-CEO Steve Jobs issued a public letter entitled "Thoughts on Flash" where he concluded that "Flash is no longer necessary to watch video or consume any kind of web content" and that "new open standards created in the mobile era, such as HTML5, will win". This sparked a debate in web development circles where some suggested that while HTML5 provides enhanced functionality, developers must consider the varying browser support of the different parts of the standard as well as other functionality differences between HTML5 and Flash. In early November 2011, Adobe announced that it would discontinue development of Flash for mobile devices and reorient its efforts in developing tools using HTML5.

2.2 Web Components

This section provides an overview of Web Components. Web Components are a set of standards currently being produced by Google engineers

as a W3C specification that allows for the creation of reusable widgets or components in web documents and web applications. The intention behind them is to bring component-based software engineering to the World Wide Web. The components model allows for encapsulation and interoperability of individual HTML elements.

Support for Web Components is present in some WebKit-based browsers like Google Chrome and Opera and is in Mozilla Firefox (requires a manual configuration change). Microsoft's Internet Explorer has not implemented any Web Components specifications yet.[1] Backwards compatibility with older browsers is implemented using JavaScript-based polyfills.[35] Web Compo-



Figure 2.3: Web Components

nents consist of 4 main elements which can be used separately or all together:

- Custom Elements: Custom Elements allow authors to define their own custom HTML elements. Authors associate JavaScript code with custom tag names, and then use those custom tag names as they would any standard tag. Custom elements are still elements. It is possible

to create, use, manipulate, and compose them just as easily as any standard <div> or today.[8]

- Shadow DOM: Shadow DOM addresses the lack of true DOM tree encapsulation when building components. With Shadow DOM, elements can get a new kind of node associated with them. This new kind of node is called a shadow root. An element that has a “shadow root” associated with it is called a “shadow host”. The content of a shadow host isn’t rendered; the content of the shadow root is rendered instead. Shadow DOM allows a single node to express three subtrees: light DOM, shadow DOM, and composed DOM. Together, the light DOM and shadow DOM are referred to as the logical DOM. This is the DOM that the developer interacts with. The composed DOM is what the browser sees and uses to render the pixels on the screen.[9]
Structure of a Shadow DOM An element that has a shadow root associated with it is called shadow host. The shadow root can be treated as an ordinary DOM element, so it is possible to append arbitrary nodes to it. With Shadow DOM, all markup and CSS are scoped to the host element. In other words, CSS styles defined inside a Shadow Root won’t affect its parent document, CSS styles defined outside the Shadow Root won’t affect the main page.
- HTML Import: This webcomponents.js repository contains a JavaScript polyfill for the HTML Imports specification. HTML Imports are a way to include and reuse HTML documents in other HTML documents. As <script> tags let authors include external JavaScript in their pages, imports let authors load full HTML resources. In particular, imports let authors include Custom Element definitions from external URLs.
- Templates: This specification describes a method for declaring inert DOM subtrees in HTML and manipulating them to instantiate docu-

ment fragments with identical contents.

2.3 Polymer

This section there will be an overview of Polymer. Polymer provides a thin layer of API on top of Web Components and several powerful features, such as custom events and delegation, mixins, accessors and component life-cycle functions, to facilitate the creation of Web Components. Polymer does this by:

- Allowing to create Custom Elements with user-defined naming schemes.
These custom elements can then be distributed across the network and used by others with HTML Imports
- Allowing each custom element to have its own template accompanied by styles and behavior required to use that element
- Providing a suite of ready-made UI and non-UI elements to be used and extended in projects
- The elements collection of Polymer is divided into more sections:
 - Core Elements — These are a set of visual and non-visual elements designed to work with the layout, user interaction, selection, and scaffolding applications.
 - Paper Elements — Implement the material design philosophy launched by Google recently at Google I/O 2014, and these include everything from a simple button to a dialog box with neat visual effects.
 - Iron Elements — A set of visual and non-visual utility elements. It includes elements for working with layout, user input, selection, and scaffolding apps.

- Gold Elements — The gold elements are built for e-commerce use-cases like checkout flows.
- Neon Elements — Neon elements implement special effects.
- Platinum Elements — Elements to turn web pages into a true webapp, with push, offline, and more.
- Molecules — Molecules are elements that wrap other javascript libraries.

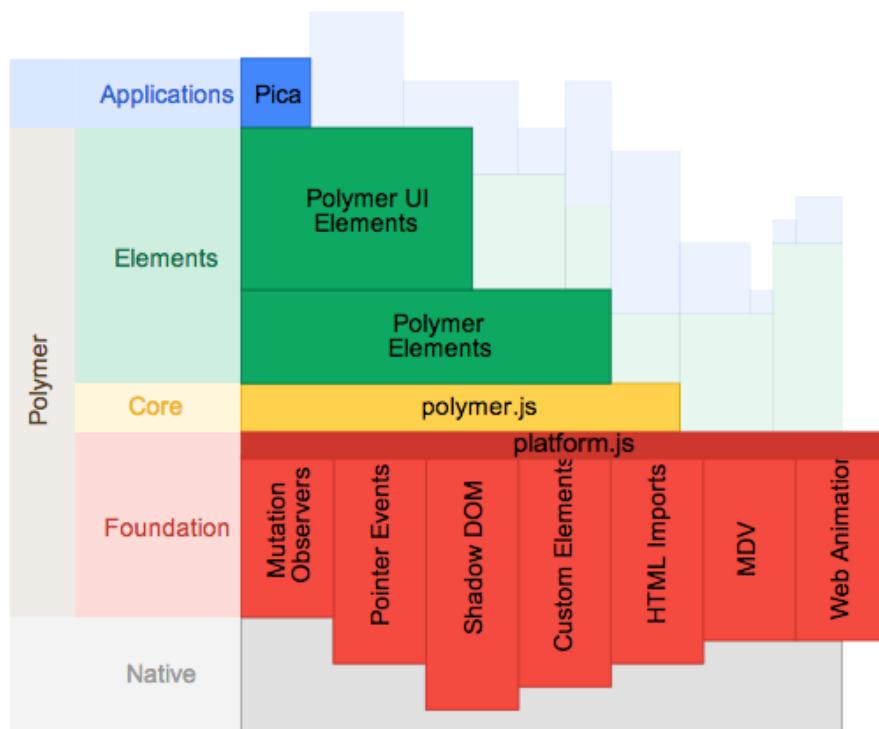


Figure 2.4: Polymer Architecture

Web components standards provide the needed primitives to build new components. It is possible to build custom elements using these primitives, but it can be a lot of work. The Polymer library provides a declarative syntax that makes it simpler to define custom elements. Furthermore, it adds

features like templating, two-way data binding and property observation to help developers build powerful, reusable elements with less code. Custom elements. If users don't want to write their own elements, there are a number of elements built with Polymer that it is possible to drop straight into existing pages. These elements depend on the Polymer library, but they can be used without using Polymer directly, as well.[6]

Polymer is one of the first implementations of a user interface library built upon the Web Components standard. Web Components are not fully supported by browsers, but they provide a polyfill library, webcomponents.js, that provides enough functionality to support Web Components and Polymer.

Web Components standard is the result of the evolution of user interface libraries over the past decade, finally reaching the goal of separating HTML, CSS and JavaScript and running HTML through W3C validators. For example, looking at a .css file, it is possible to easily determine which selectors are actually used in HTML and especially programmatically used in JavaScript. Similarly, it is easy to organize JavaScript code so that everything could be reused efficiently on multiple pages.[23]

2.4 NodeJS

This section provides an overview of NodeJs. Node.js is an open source, cross-platform runtime environment for server- side and networking applications. Node.js applications are written in JavaScript and can be run within the Node.js runtime on OS X, Microsoft Windows, Linux, FreeBSD, Non-Stop, IBM AIX, IBM System z and IBM i. Its work is hosted and supported by the Node.js Foundation,a Collaborative Project at Linux Foundation.

Node.js provides an event-driven architecture and a non-blocking I/O API that optimizes an application's throughput and scalability. These technologies are commonly used for real-time web applications.

Node.js uses the Google V8 JavaScript engine to execute code, and a large percentage of the basic modules are written in JavaScript. Node.js contains a built-in library to allow applications to act as a Web server without software such as Apache HTTP Server, Nginx or IIS.

Node.js allows the creation of web servers and networking tools, using JavaScript and a collection of “modules” that handle various core functionality. Modules handle file system I/O, networking (HTTP, TCP, UDP, DNS, or TLS/SSL), binary data (buffers), cryptography functions, data streams , and other core functions. Node’s modules have a simple and elegant API, reducing the complexity of writing server applications. Frameworks can be used to accelerate the development of applications, and common frameworks are Express.js, Socket.IO and Connect. Node.js applications can run on Microsoft Windows, Unix, NonStop and Mac OS X servers. Node.js applications can alternatively be written with CoffeeScript (an alternative form of JavaScript), Dart or Microsoft TypeScript (strongly typed forms of JavaScript), or any language that can compile to JavaScript. Node.js is primarily used to build network programs such as web servers, making it similar to PHP and Python. The biggest difference between PHP and Node.js is that PHP is a blocking language (commands execute only after the previous command has completed), while Node.js is a non-blocking language (commands execute in parallel, and use callbacks to signal completion).

Node.js brings event-driven programming to web servers, enabling development of fast web servers in JavaScript. Developers can create highly scalable servers without using threading, by using a simplified model of event- driven programming that uses callbacks to signal the completion of a task. Node.js was created because concurrency is difficult in many server-side programming languages, and often leads to poor performance. Node.js connects the ease of a scripting language (JavaScript) with the power of Unix network programming.

2.5 MongoDB

This section provides an overview of MongoDB.

MongoDB is a cross-platform document-oriented database. Classified as a NoSQL database, MongoDB eschews the traditional table-based relational database structure in favor of JSON-like documents with dynamic schemas (MongoDB calls the format BSON), making the integration of data in certain types of applications easier and faster. Released under a combination of the GNU Affero General Public License and the Apache License, MongoDB is free and open-source software.

MongoDB was created by Dwight Merriman and Eliot Horowitz, who had encountered development and scalability issues with traditional relational database approaches while building Web applications at DoubleClick, an Internet advertising company that is now owned by Google Inc. According to Merriman, the name of the database was derived from the word humongous to represent the idea of supporting large amounts of data. Merriman and Horowitz helped form 10Gen Inc. in 2007 to commercialize MongoDB and related software. The company was renamed MongoDB Inc. in 2013.

The database was released to open source in 2009 and is available under the terms of the Free Software Foundation's GNU AGPL Version 3.0 commercial license. At the time of this writing, among other users, the insurance company MetLife is using MongoDB for customer service applications, the website Craigslist is using it for archiving data, the CERN physics lab is using it for data aggregation and discovery and the The New York Times newspaper is using MongoDB to support a form-building application for photo submissions.

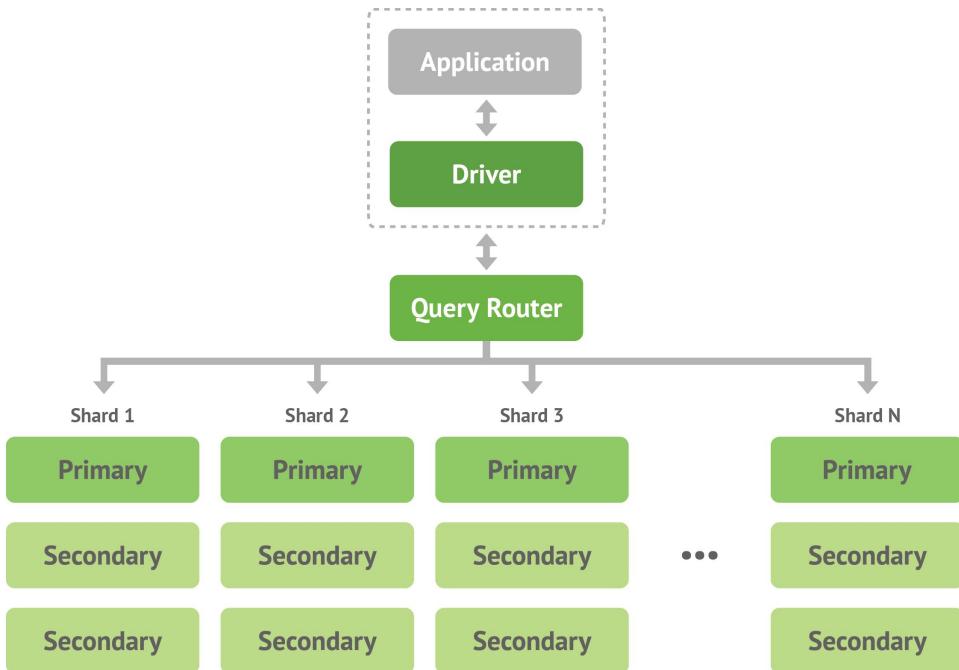


Figure 2.5: MongoDB Architecture

2.6 Strongloop Loopback

This section provides an overview of LoopBack.

Built on top of the open source LoopBack framework, the StrongLoop API Platform is the first end-to-end platform for the full API lifecycle that allows to visually develop REST APIs in Node and get them connected to new and legacy data. In addition, the API Platform features built-in mBaaS features like push and offline sync, plus graphical tools with DevOps features for clustering, profiling and monitoring Node apps.

LoopBack generates model API from the models schemas, to let CRUD operations on models. LoopBack models automatically have a standard set of HTTP endpoints that provide REST APIs for create, read, update, and delete (CRUD) operations on model data:

- **POST /Model** — Create a new instance of the model and persist it into the data source.

- **GET /Model** — Find all instances of the model matched by filter from the data source.
- **PUT /Model** — Update an existing model instance or insert a new one into the data source.
- **PUT /Model/id** — Update attributes for a model instance and persist it into the data source.
- **GET /Model/id** — Find a model instance by id from the data source.
- **DELETE /Model/id** — Delete a model instance by id from the data source.
- **GET /Model/count** — Count instances of the model matched by where from the data source.
- **GET /Model/findOne** — Find first instance of the model matched by filter from the data source.
- **POST /Model/update** — Update instances of the model matched by where from that data source.

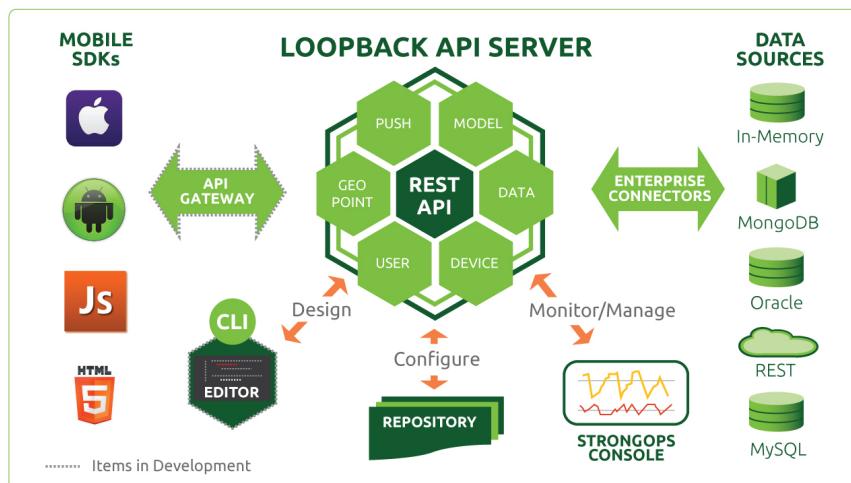


Figure 2.6: Loopback Architecture

A LoopBack model represents data in backend systems such as databases, and by default has both Node and REST APIs. Additionally, developer can add functionality such as validation rules and business logic to models. Every LoopBack application has a set of predefined built-in models such as User, Role, and Application. Developer can extend built-in models to suit application's needs.

The model JSON file defines models, relations between models, and access to models.

```
{  
  "  
    "name": "ModelName", // See Top-level properties below  
    "description": "A  
      Customer model representing our customers.", "base": "User",  
    "idInjection": false,  
    "strict": true,  
    "options": { ... }, // See Options below  
    "properties": { ... }, // See Properties below  
    "validations": [...], // See Validations below  
    "relations": {...}, // See Relations below  
    "acl": [...], // See ACLs below  
    "scopes": {...}, // See Scopes below  
    "http": {"path": "/foo/mypath"}  
  }  
}
```

Where:

- “name”: Name of the model.
- “description”: Optional description of the model.
- “base”: Name of another model that this model extends. The model will “inherit” properties and methods of the base model.
- “IdInjection”: Whether to automatically add an id property to the model:
 - true - id property is added to the model automatically. This is the default.

- false - id property is not added to the model.
- “strict”: Specifies whether the model accepts only predefined properties or not. One of:
 - true - Only properties defined in the model are accepted. Used to ensure that the model accepts only predefined properties.
 - false - The model is an open model and accepts all properties, including ones not predefined in the model. This mode is useful to store free-form JSON data to a schema-less database such as MongoDB.
 - validate - The unknown properties will be reported as validation errors.
 - throw - Throws an exception if properties not defined for the model are used in an operation.
 - undefined - Defaults to false unless the data source is backed by a relational database such as Oracle or MySQL.
 - “options”: JSON object that specifies model options.
 - “properties”: JSON object that specifies the properties in the model.
 - “relations”: Object containing relation names and relation definitions.
 - “acls”: Set of ACL specifications that describes access control for the model.

The API can be extended: the developer can add remote functions to models or add hooks to existing API to add custom behavior before and/or after the API handler (to pre-process the request and/or post-process the response). The resulting API is RESTful, cookie free, signed by authentication token. By default, applications have a built-in model that represents a user, with

properties username, email and password and role for authentication and authorization. Loopback also introduces an indirection layer that allows to choose from almost all particular DBMS to be used. In Chapter Two the technologies used for developing this work, have been described. Each technology has been described in relation to its function and its use in the project.

Part II

Part 2

Chapter 3

Chapter 3

In this chapter...

3.1 Section 1

In this section...

3.2 Section 2

In this section...

In conclusions...

Chapter 4

Chapter 4

In this chapter...

4.1 Section 1

In this section...

4.2 Section 2

In this section...

In conclusions...

Chapter 5

Conclusions

In this chapter...

5.1 Section 1

In this section...

5.2 Section 2

In this section...

In conclusions...

Part III

Appendix

Appendix A

Appendix 1

In this appendix...

This is the appendix.

Appendix B

Appendix 2

In this appendix...

This is the appendix.