Taxation of virtual currency

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2 Digital environment

2.1 INTRODUCTORY REMARKS

Virtual items and currencies could not exist and be exchanged without to the support of global computer networks. As the development of rational tax policy can be accomplished only if the nature of the industry is properly understood, this chapter seeks to provide the background, i.e. to explain how the digital industry operates and what services it offers. It begins by describing the underlying technology (Internet and World Wide Web), which the virtual economy and communities are built upon. Next, it explains the functioning of peer-to-peer networks, the technology after which the Bitcoin system in modeled. As trade in virtual currencies and items is a form of electronic commerce, it is also necessary to explain how e-commerce transactions are carried out and how electronic payment systems function. Finally, the definition of virtual communities and virtual economy is provided to set the scene for the phenomena described in Chapter Three (virtual worlds and virtual currency).

2.2 INTERNET

Although it is beyond the scope of this thesis to examine the history and operation of the Internet in detail, a brief explanation of how it works is necessary to understand the nature of virtual trade.[76]

The Internet is an international network of computer networks that is not, as a whole, owned or operated by any single entity. Its origins date back to the Cold War, when the US Department of Defense wanted to establish a loose and decentralized communication system that would be resilient in a nuclear exchange. The Internet began in 1969 as an experimental project of the Advanced Research Project Agency (ARPA) and was called ARPANET. It linked computer networks owned by military services, defense contractors and university laboratories that were conducting military-related research. In 1986, the National Science Foundation (NSF) developed a high-speed network to

76 The explanation is based on: US Treasury, *Selected Tax Policy Implications of Global Electronic Commerce* (1996), *supra* n. 18; and Interactive Services Association Task Force, *White Paper on Cyberspace Tax Policy*, 8 Intl. VAT Mon. 3 (1997).

allow researchers to access its sites and to provide a faster medium for data transmission. The NSF's network (NSFNET) developed into the technical backbone of the Internet since the ARPANET was no longer in use. Starting as a system that connected governmental and academic institutions, the Internet soon expanded beyond its initial participants to a worldwide network with user numbers growing rapidly.

From its inception, the Internet has been designed to be a decentralized and self-maintaining series of links between computer networks, capable of rapidly transmitting packets of data without direct human involvement or control, and having the ability to re-route communications automatically if one or more individual links became unavailable. The Internet has no central technical control point. It is more like a spider web, with many ways of getting from point A to point B. What links the Internet together and allows its many disparate parts to communicate is the transmission control protocol and Internet protocol (TCP/IP), which are simply a means of specifying how data is broken up in packets and transferred. The protocols allow computers to communicate regardless of differences in hardware, software or communications technology. Instead of a central computer, the Internet uses millions of computers called routers. Routers act as postal stations; they make decisions on how to route packets of data, just like a postal station decides how to route envelopes. Packets of data are sent in the right direction using the best route available until they finally arrive at their destination.

The Internet has always been rich in content but not always user friendly. Because of this constraint, it had limited commercial applications until the development of Web technologies, beginning in the 1990s. The World Wide Web (WWW or the "Web") was designed at the European Particle Physics Laboratory (CERN) in Switzerland. What distinguishes it from other Internet components is a system of linked hypertext multimedia documents. Users can retrieve these documents without knowing where they are located. A coding language HTML (Hyper Text Markup Language) is used to create links to different locations on the Internet. Every website has a unique Internet address, called a URL (Uniform Resource Locator). As websites are linked via hypertext markers and share a common appearance, they seem to be joined together seamlessly, even though, in reality, they are scattered all over the world. The Web blends text, images, video and audio which can be accessed through a browser program. The browser reads information from the web and presents it in a user-friendly format. Search engines (for example, Google or Yahoo) allow users to locate websites containing the desired information. That information is stored on computers called servers. For user, the location of a server is irrelevant since its contents can be accessed from any place in the world.

In order to get connected to the Internet, a specific IP-address is required. Each device on the Internet, such as a computer or a mobile telephone, must be assigned an IP address in order to communicate with other devices. The Internet Corporation for Assigned Names and Numbers (ICANN), based in

California, defines policies on how those addresses operate.[77] ICANN delegates authority for the management and creation of IP addresses to a body called the Internet Assigned Numbers Authority (IANA). IANA allocates blocks of addresses to one of five Regional Internet Registries (RIRs). These regional bodies allocate smaller blocks of addresses to Internet service providers and other network operators.

Two versions of IP addresses are currently in use: IP Version 4 (IPv4) and IP Version 6 (IPv6).[78] An IPv4 address consists of 32 bits, which limits the address space to 4,294,967,296 (2^{32}) possible unique addresses. The rapid exhaustion of IPv4 address space prompted the development of IPv6. Mathematically, the new address space provides the potential for a maximum of 2^{128} unique addresses. In the IPv4 system, dynamic addresses are frequently used as this allows many devices to share limited address space on a network if only some of the devices are online at a particular time.[79] IPv6 supports globally unique static IP addresses that can be used to track a single device's Internet activity. However, users have the option to enable privacy extensions, in which case the operating system generates ephemeral IP addresses instead of traceable static ones. The use of ephemeral addresses makes it difficult to track a user's Internet activity. Internet providers record which customer was allocated which dynamic IP address (to remove technical malfunction or for invoicing purposes). However, such records are not allowed to be stored for a long period of time for data protection reasons.

IP addresses have no direct connection to an individual. They might refer to several members of a family and even to completely independent persons using the same Internet connection. Users may circumvent the identification of their location based on the IP address by using proxy servers. They can also install special (legal) software on their computers to remain untraceable. One of them is the open source, free-of-charge Tor application.[80] Its aim is to prevent others watching a user's Internet connection from learning what websites that user visits and to prevent the operators of the websites visited by a person from learning his physical location.

2.3 PEER-TO-PEER NETWORKS

Originally, the predominant model for the use of Internet applications was the client server model, in which the client computer initiates a request for

77 *See* www.icann.org/en/about/welcome.

78 ICANN, *Beginner's Guide to Internet Protocol (IP) Addresses* (2011), available at: www.icann.org/en/about/learning/beginners-guides.

79 Users can find out what IP address is currently being used by visiting: www.myipaddress.com/show-my-ip-address/.

80 *See* www.torproject.org.

data and the server responds to that request. The main disadvantages of this model are the client's inability to access data and applications in the case of server failure and the fact that the server has a limited amount of resources (storage capacity and processor time).

In peer-to-peer (P2P) networks, each participating computer, referred to as peer, may act both as a client and as a server within the context of a given application. A peer can initiate requests, and it can respond to requests from other peers in the network. The ability to make direct exchanges with other users liberates P2P users from the traditional dependence on central servers. Users have a higher degree of autonomy and control over the services they utilize. One of the main benefits of P2P computing is community. P2P makes it possible for users to organize themselves into ad hoc groups that can efficiently and securely fulfil requests, share resources, collaborate and communicate.[81]

Peer-to-peer networks have become an important medium for the exchange of digital information in both legitimate and illegitimate scenarios. In the latter context, they are perceived as a threat to the music and content industry as a whole. The music industry has a long history of taking legal action against companies using the file-sharing model. But those new ways of information delivery do not have to be associated with illegal file sharing and copyright infringement. As a form of technology, they are neutral: what can be done with them depends on the users. Skype is an example showing that successful business models can be based on P2P technology.

Peer-to-peer file sharing became popular in the 1990s with the introduction of Napster, a file sharing application with a set of central servers that linked people who had files with those who requested files. When someone searched for a file, the server searched all available copies of that file and presented them to the user. The files were transferred directly between the two private computers. As the first P2P file-sharing systems relied on central servers, they were susceptible to centralized shutdown. Currently, torrent networking is the most popular form of P2P file sharing. Torrents work by downloading small bits of files from many different sources at the same time. Users are remotely connected with each other and share files without any central servers. As this format compensates for bottleneck points, it is faster than downloading a large file from a single source.

2.4 ELECTRONIC COMMERCE

The Internet has evolved from a communication tool to a global trading platform. It has increased the ease with which businesses can be formed and

81 D. Barkai, *An Introduction to Peer-to-Peer Computing,* Intel Developer Update Magazine (Feb. 2000).

trade conducted. Anyone can now sell goods or provide services for consumers all over the world.

The term "electronic commerce" refers to trade in goods and services conducted over a network that uses computers and telecommunication.[82] It covers business-to-business transactions (B2B), business–to-consumers trade (B2C), as well as dealings between consumers (C2C). The objects of e-commerce transactions may be both tangible goods (mail-order delivery system) and intangible products.

All types of electronic commerce are global, in the sense that trade takes place without real meaning being attached to territorial borders between countries. Another feature of e-commerce is its anonymity, in the sense that the transaction details or parties involved may remain anonymous or require intensive investigation to be determined.

E-commerce transactions usually require an intermediary to be processed. Most online purchases are paid for by a credit card. To use this system, customers simply enter their credit card number, the date of expiry and the security code in the appropriate area on a webpage. When the purchase is made, the customer borrows money from the credit card issuer to pay the seller. The credit card issuer transfers the payment to the seller and gets the money back from the credit card holder at the end of the billing period. A new more secure form of credit cards is a smart card, which store information on a microprocessor chip instead of magnetic strips. A smart card can be password-protected to guarantee that it is only used by the owner, whereas magnetic strip cards can be read by any magnetic reader. Both types of cards cannot be used to send money between private individuals.

The transfer of funds between private individuals became possible with the establishment of PayPal.[83] PayPal uses encryption software to allow people to make financial transfers between computers. It owes much of its initial growth to eBay users who promoted it as a way to exchange money for their online auctions: in 2002, eBay bought PayPal and integrated it into its services. PayPal can be used to buy items online or send money to others. All the user needs to know is the recipient's email address or mobile phone number. Although a PayPal account is associated with a bank account or credit card, when a payment is made, the recipient does not see the payer's details, such as his credit card or bank account numbers and address. That information stays within PayPal, which acts as an extra layer of security. In contrast, in a credit card transaction, information is transmitted to all the parties involved in the transaction (the merchant and the credit card processor). There are generally no transaction fees for sending and receiving money between PayPal accounts. Recipients can withdraw money from their PayPal accounts by

82 Westberg, *supra* n. 21.
83 *See* www.paypal.com.

transferring it to their bank accounts or by making purchases with a PayPal debit card.

2.5 VIRTUAL COMMUNITY

A virtual community is a technology-supported cyberspace, centred on communication and interaction among participants, resulting in relationships that are built for certain purposes.[84] It is a place within cyberspace where individuals interact and follow mutual interests or goals by changing and observing the state of a common database.[85] Chat rooms, blogs and networking sites, such as Facebook and Twitter, are examples of virtual spaces. All information is stored in a common database, although not everyone can see all of it. The most sophisticated virtual communities are virtual worlds, which are persistent computer-generated online environments that can be accessed remotely and simultaneously by a large number of people who interact with each other for social, entertainment or commercial purposes.

2.6 VIRTUAL ECONOMY

The widespread adoption of information technology in everyday life has given rise to a massive new market for digital goods and services. Castronova (2001) first used the term "virtual economy" to refer to artificial economies inside online games, especially when the artificially scarce goods and currencies of those economies where traded for real money.[86] However, according to the *Knowledge Map of Virtual Economy* (2011), a report prepared by Lehdonvirta and Ernkvist for the World Bank, this term has a broader meaning and includes both exchanges of virtual goods and digital labour.[87] The report mentions three main characteristics of virtual economy:

- it is focused on commodities that are digitally scarce yet;
- demand arises from the increasing use of digital services in business and leisure;
- supply is created through the expenditure of human effort, and doing so requires relatively few specialized skills or resources.

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84 J. Guo, A. Chow & R.T. Wigand, *Virtual Wealth Protection through Virtual Money Exchange*, Electronic Commerce Research and Applications 10, p. 313 (2010).

85 R.J. Bloomfield, *Worlds for Study: Invitation – Virtual Worlds for Studying Real-World Business (and Law, and Politics, and Sociology, and....)*, p. 17 (May 2007), available at: http://ssrn.com/abstract=988984.

86 Castronova, *Virtual Worlds: A First-Hand Account of Market and Society on the Cyberian Frontier*, *supra* n. 22.

87 Lehdonvirta & Ernkvist, *supra* n. 5.

Virtual economy builds on IT infrastructure (wireless networks, broadband connectivity, software and hardware) and on the digital economy. The latter includes traditional industries that produce content that can be represented in digital form (music, video and images).[88] Digital items are referred to as information goods because they differ from most ordinary goods in two ways. The first difference is that, from a producer's point of view, information goods involve high fixed costs of production with (almost) zero costs of reproduction and distribution. Creating the first copy of an information good may require substantial effort and investment, but once that is done, the cost of creating additional copies by duplicating the original is negligible. The second difference is that, from a consumer's point of view, information goods are "experience goods", i.e. their value is derived from experiencing them and absorbing their content. In contrast, the commodities of the virtual economy (virtual goods) are similar to ordinary goods as their production can involve significant marginal costs: although game items could be duplicated at no cost, they are made unique by requiring that significant effort be expended in order to obtain them in the game. The value chains and markets of the virtual economy are also different from those of the traditional digital content industries. Traditional content industry employs a small number of highly skilled producers, whereas suppliers in the virtual economy use a large number of less skilled workers.[89]

Commercially significant activities in the virtual economy can be broken down into four segments: third-party online gaming services, microwork, cherry blossoming and creation of virtual goods. The third-party online gaming services segment consists of activities known as "gold farming" and "power leveling". The former involves the sale of virtual goods to players by third parties (not affiliated with the game publishers). The latter is a "player-for-hire" service, where a professional player takes control over another player's avatar for an agreed period of time to build up the skills of that avatar. Power levelers also sell "ready-made" characters. Third-party gaming services are used to obtain the virtual rewards of the play without having to spend much time and effort.[90]

Microwork[91] segment consists of services catering to business clients. It involves breaking insurmountable computational problems into simple human

88 The definition of digital economy used here is narrower than the one used in the current BEPS debate. For BEPS purposes, the digital economy is defined as economy based on the convergence of information and communication technologies that impacts a wide variety of sectors (retail, media and entertainment, manufacturing, financial services and advertising).

89 Id., at ch. 2.

90 Id., at ch. 3.

91 One of the companies offering microwork services is CrowdFlower (http://crowdflower.com). According to the company's self-introduction: "CrowdFlower is the world's leading crowdsourcing service, with over one billion tasks completed by five million contributors. We specialize in microtasking: distributing small, discrete tasks to many online contributors in assembly line fashion."

tasks that can be distributed to and addressed by human workers (for example, testing a search system to improve the accuracy of search algorithms, data verification or product labeling).[92] "Cherry blossoming" involves users recommending brands or products for money. It refers to small marketing-related digital tasks, such as "liking" a brand's Facebook page against a small payment. In the digital world, consumer endorsements have direct economic value since comments, blog posts and forum entries by individual consumers greatly influence the buying decisions of their peers. On social networking systems, such as Facebook or Twitter, the number of followers that a brand has works as an indicator of its popularity and helps it appear more often in search results. "Cherry blossoming" resembles microwork in that it involves recruiting large numbers of workers to complete small tasks for a client. However, unlike microwork, the tasks involve overcoming artificial scarcities created by the designers of the platforms.[93]

The segment of user-created virtual goods consists of producing and selling user-generated virtual items, textures and other artificially scarce virtual objects.[94] Virtual worlds, such as *Second Life* and *Project Entropia*, created easily accessible entrepreneurship opportunities by enabling ventures, such as the creation of virtual goods for sale, the development of virtual real estate and the provision of virtual services. Both worlds operate a virtual currency that is exchangeable into real money. This sector of the virtual economy is of particular relevance for this thesis and is discussed further in Chapter Three.

92 Lehdonvirta & Ernkvist, *supra* n. 5, at ch. 4.
93 Id., at ch. 5.1.
94 Id., at ch. 5.2.