22 AN INTERNATIONAL MOBILE SECURITY STANDARD DISPUTE: From the Actor–Network Perspective

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Abstract *In 2004 there was a trade and technology dispute of significance between China and the United States surrounding a mobile security standard called WAPI (Wireless LAN Authentication and Privacy Infrastructure). Using the remarkable size of its domestic market as a lever, China is challenging some existing or being-shaped standards to set its own standards not only within its own territory but also potentially in the world markets. WAPI is another example in a series of these attempts. Using the actor-network theory, we investigate the process of mobile standards setting in the international context where superpowers like China and the United States compete.*

Keywords Standards, actor-network theory, China, WAPI, WiFi

1 INTRODUCTION

In 2004 there was a trade dispute of significance between China and the United States. The Chinese government announced in November 2003 that its own wireless security protocol known as WAPI (Wireless LAN Authentication and Privacy

Infrastructure) would be put in effect from December 1, 2003. While the 802.11 WiFi[1] standard developed by the Institute of Electrical and Electronics Engineers (IEEE) was the internationally used, common security protocol for wireless equipment (Lemon 2004), China wanted to set up WAPI as a standard for domestic markets (Hoo 2004; Kanellos 2004). WAPI is not compatible with international standards, and does not work well with chips based on WiFi (Fordahl 2004). Mandatory compliance with the WAPI standard is to be required for both domestically produced and imported equipment such as Centrino notebooks, PDAs, and other wireless devices (Suttmeier and Yao 2004).

China gave the WAPI algorithms to 24 Chinese companies only—some of which are potential competitors with foreign firms (Suttmeier and Yao 2004). Western chipmakers are required to pay these Chinese companies a per-chip royalty for WAPI and/or cooperate with them on development (Kanellos 2004) if they want to market their products in China. For the foreign/Western chipmakers, it means that they may have to provide technical product specifications to potential competitors. The foreign chipmakers responded with dissatisfaction and resistance. These foreign companies might have to staff local facilities if they want to participate in the market as the WAPI technology cannot leave the country (Kanellos 2004). Complying with the WAPI standard would increase their manufacturing costs as they have to make a special type of device for China and another type for the rest of the world (Reuters 2004 as cited in Suttimeier and Yao 2004).

More importantly, this appears to be a violation of the national treatment commitment under the TBT (Technical Barriers to Trade) provisions of the World Trade Organization (Suttmeier and Yao 2004). Chipmakers, especially in the United States, went to their governments for intervention, and the incident developed to the extent that the U.S. Secretary of State, Collin Powell, and other high-level senior officials got involved. The Chinese government finally conceded that the WAPI implementation was to be delayed indefinitely.[2]

This recent controversy over WAPI has attracted much attention from various stakeholders including the U.S. and Chinese governments, wireless product manufacturers, technology professional bodies (e.g., IEEE), and other international regulatory bodies. However, there has been little attention from academic communities.

In this paper, we examine the development of the dispute through the lens of actor-network theory. Our goal is to understand the patterns of interaction and the dynamics among the stakeholders surrounding standards setting. With respect to the data collection method, this study is based on documentary data containing mostly media

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[1]WiFi is the short-form for ***wi****reless* ***fi****delity* referring to any type of 802.11 network, whether 802.11b, 802.11a, dual-band, etc. (Http://www.webopedia.com/TERM/W/Wi_Fi.html). The term is promulgated by the WiFi Alliance, founded in 1999 as an international association (industry consortium) to certify interoperability of wireless local area network products based on the IEEE 802.11 specification. Currently the WiFi Alliance has over 200 member companies from around the world, and over 1,500 products have received WiFi® certification since certification began in March 2000 (www.WiFi.org).

[2]Perkins Coie, China Legal Highlights, June 2004 (http://www.perkinscoie.com/content/ren/updates/china/june2004.htm).

data and some archival data (McCulloch 2004). We searched not only English-language sources, but also Chinese-language sources. The Chinese-language sources were searched by the first-named author who is bilingual in English and Chinese.

The remainder of the paper is organized as follows. The following section presents the actor-network theory, followed by a brief description of the method used. Then the case under study is described in a wider context of China's accession to the WTO and the technical background of WAPI. In section four, we examine the WAPI dispute through the ANT lens and discuss various implications. The concluding section presents contributions and limitations of the paper and suggests a direction for future research.

2 ACTOR–NETWORK THEORY

Actor-network theory was developed in the sociology of science and technology (Callon 1986a, 1986b, 1987; Callon and Latour 1981). It originates in a belief that "the study of technology itself can be transformed into a sociological tool of analysis" (Callon 1987, p. 83). Engineers who design, develop, and diffuse a technical artifact embody (*inscribe* by the ANT terminology) into the artifact how it is used, their intention, and their vision of the society and the world which the artifact best fits. In this sense, they become sociologists, or, using Callon's word, *engineer-sociologists*. The technical aspects of the engineer's work are profoundly social. Therefore, it is impossible to distinguish between the technical and the social during the process of innovation. When we accept that the technical is social, an artifact, on which engineers inscribe the social they want to see and realize, becomes an entity, or in ANT terminology, an actor with the same nature and characteristics of a human actor. The distinctiveness of ANT is that it does not distinguish between human and nonhuman actors.

ANT helps us to describe how actors form alliances and involve other actors and use nonhuman actors (artifacts) to strengthen such alliances and to secure their interests. This process is called *translation*, defined as "the methods by which an actor enrolls others" (Callon 1986b, p. xvii). Translation, when an actor-network is created, consists of four processes (Callon 1986a): *problematization* (the focal actor defines interests that others may share and establishes itself as indispensable and as the obligatory passage point through which all of the actors that make up an actor-network must pass), *interessement* (the focal actor convinces other actors), *enrolment* (other actors accept the interests as defined by the focal actor), and *mobilization* (the focal actor uses a set of methods to ensure that the other actors act according to their agreement and would not betray). To translate is to oblige an actor to consent to the passage defined by the focal actor (Callon 1986b). Translation is not always successful, but often fails and halts at any stage. Callon (1986a) stated that each entity enlisted by the problematization could choose to submit to being integrated into the initial plan or, inversely, refuse the transaction.

It is recognized that ANT has a potential for understanding the complex social interactions associated with information technology (Walsham 1997). Since the pioneering works of Hanseth and Monteiro (1997) and Walsham and Sahay (1999), ANT has been gaining attention from a section of the Information Systems research community and increasingly popular as a powerful tool "to help us overcome the current

poor understanding of the information technology (IT) artifact" (Hanseth et al. 2004). Hanseth and Monteiro investigate how standards in a health information infrastructure in Norway inscribe behavior among related actors, and suggest that the notion of inscriptions is a promising vehicle for understanding the complexity of information infrastructure and standardization processes. Walsham and Sahay analyzed the unsuccessful implementation of GIS for district-administration in India. Their finding was that the GIS initiatives failed to create and maintain a stable actor-network with aligned interests. ANT has theoretical advocates for its utility in studying the complex networks embedded in, or impacting on, various IS implementations involving technological innovation (Tatnall and Gilding 1999) and in generating detailed and contextual empirical knowledge about IS (Doolin and Lowe 2002). ANT has since been applied in various IS studies (see the special issue of *Information Technology & People* (17:2), 2004).

Two studies are introduced here because they deal with standards from the ANT perspective. Fomin and Keil (2000) reviewed economic literature on standard setting and alliance formation as well as the social network theories, including, but not limited to ,ANT, to come up with a socio-economic theory of standardization. Yang et al. (2003) analyzed the role of standards and their impact on the diffusion of broadband mobile services in Korea.

In this paper, we investigate through the lens of ANT how the WAPI controversy between China and the United States evolved. ANT is employed to understand the dynamics of international competition surrounding technological standard settings in the globalized context of technology development.

3 THE CASE DESCRIPTION

Before we describe how the WAPI case evolved, we present the background: China's accession to the WTO and the technical origins of the WAPI standard.

3.1 China's Accession to the WTO and Standards

China joined the WTO in 2001. After China joined the WTO, Chinese domestic industries faced more challenges from globalization and foreign competition (Suttmeier and Yao 2004). Under the WTO principle of free international trade,[3] such traditional instruments of industrial or economic protection as tariffs would be limited by WTO obligations (Suttmeier and Yao 2004). WTO obligations limit traditional means of trade protectionism such as barriers or quotas. Standards are an effective means to protect and promote national industry within the WTO framework (Suttmeier and Yao 2004). China's post-WTO technology policy, therefore, emphasized the importance of standards (Standardization Administrative Commission of China 2001 as cited in Suttmeier and Yao 2004). Standards are China's deck of cards (Chen 2004).

[3]See the World Trade Organization's site, "The WTO…In Brief," at http://www.wto.org/english/thewto_e/whatis_e/inbrief_e/inbr00_e.htm.

National technology standards are an increasingly important item on China's development and foreign relations agenda. It is not surprising that the Chinese Standardization Administrative Commission conducted a major research project, "China's Technology Standards Strategy Development," and in September 2004 published its final report as a consultation draft setting out China's technology standards implementation plan from 2005 to 2020 among other issues (Standardization Administrative Commission of China 2004).

3.2 The Technical Background of WAPI

Although many claim that the wireless network standard proposed by China is proprietary, this claim is only partially true. It is similar in many ways, or even seems to be identical, to IEEE's 802.11 wireless networking standard (Wireless Fidelity or WiFi). There is only one difference. That is, it uses a different security protocol, called WAPI (Wireless LAN Authentication and Privacy Infrastructure Protocol), which is the symmetric encryption algorithm used between a wireless device and the access point after both of them have been authenticated (Zhu 2004). WAPI is not part of the 802.11 standard, which relies on WEP (Wired Equivalent Privacy) (Zhu 2004).

WEP is an encryption scheme introduced in IEEE 802.11a and 802.11b (September 1999). It is included in subsequent standards such as 802.11g. As the name implies, it is intended to make wireless networks as resistant to snooping and intrusion as wired networks. The standards make encryption with a 64-bit key a mandatory capability and 128-bit encryption an option (Geier 2004). Almost all vendors provided both 64- and 128-bit WEP encryption in their subsequent products. However, it was soon found that WEP could be easily cracked by intercepting and analyzing a sufficiently large amount of encrypted traffic. Used wisely and in conjunction with other measures, WEP can keep a low-traffic network quite secure, but is unsuitable for high-traffic corporate wireless LANs, where an attacker can quickly collect enough packets to extract the keys. Since WEP was found to have a security hole, vulnerable to the external attacks, efforts have been made to fix the problem, two of which are noteworthy: WPA and IEEE 802.11i.

In October 2002, the WiFi Alliance announced WPA (WiFi Protected Access), replacing WEP. It was a response to the delayed development by IEEE of a new security centric protocol 802.11i. When WPA was introduced, a task group of IEEE was still in the middle of developing 802.11i. Related firms needed a quicker solution, even though it might have restricted functionality. As the WiFi Alliance had been working closely with IEEE, it was determined that the interim standard WPA should be designed for forward-compatibility to become a subset of 802.11i.

The long-awaited wireless LAN security standard 802.11i was finally ratified in June 2004. IEEE 802.11i is an amendment to the 802.11 standard specifying security mechanisms for wireless networks. The WiFi Alliance refers to the new standard as WPA2.

China claimed that WAPI was developed to shore up the security of wireless networks. WAPI was announced in 2003, after the industry consortium WiFi Alliance approved the interim standard WPA. WPA is a standard agreed on by the members of

the consortium. It was not an international standard ratified by international standardization bodies like IEEE, of which 802 committees have been responsible for the standardization of LAN technologies and protocols for decades, although the WiFi Alliance and IEEE worked closely in this regard.

4 DISCUSSION: ANALYZING OR INTERPRETING THE CASE THROUGH THE ANT LENS

The key theoretical tenet of ANT is *translation*. This section discusses, analyzes, and interprets the case of the WAPI dispute between China and the United States through the stages of translation.

4.1 China as the Focal Actor Translation: Problematization

Callon (1986a) stated that there are four moments of translation. The first one is *problematization*, during which the focal actor seeks to become indispensable to other actors by defining the nature and the latter's problems and then suggesting that these would be resolved if the actors negotiated the "obligatory passage point." The CSAC, representing the Chinese government, spotted the security holes in the WiFi standards. They problematized this and proposed a solution (WAPI), at least within its own territory. WAPI was created as an actor and became an obligatory passage point through which all the actors who want to participate in the China market must pass.

The first step in this problematization is the "interdefinition of the actors" (Callon 1986a). The WAPI dispute was very much about the Chinese government wanting the international (predominantly American) community to adopt and comply with WAPI as an internationally accepted mobile security standard. It appears that the focal actor was the Chinese government as represented by the CSAC. Having WAPI as the internationally recognized mobile security standard would require the alliance from three other main actors in this scenario: the U.S. government, the world (or non-Chinese, although mostly American) IT business community represented by the WiFi Alliance, and international bodies such as IEEE 802 Local and Metropolitan Area Networks Standards Committee.

Callon (1986a) mentioned that the second step in the problematization would involve the definition of the obligatory passage point (OPP) in relation to the focal actor making itself indispensable to the other actors and defining the latter's interests and problems. CSAC, representing the Chinese government, defined the interests of the other actors as follows. For the U.S. government, the interests would be protecting and expanding the American national and business interests (Fang et al. 2004). With respect to the American IT business community, their interests would be tapping into the vast commercial potential of the world's largest telecommunication market—China (Chang et al. 2005). Regarding international bodies, the interests would be maintaining international mobile security standards (Fang et al. 2004).

4.2 WAPI as the Obligatory Passage Point

China's immense market potential had made the Chinese government more confident in using its economic might as a bargaining chip in shaping international technology standards (Standardization Administrative Commission of China 2004). Equipped with such sheer confidence and given that China is the world's largest telecommunication market (Chang et al. 2005), China's official statements and media reports emphasized "market" as the main or almost the sole criterion in determining a country's power in setting international technology standards. During a meeting of the Chinese officials in July 2003 with respect to WLAN national standards, they reached a consensus: "Standards form the foundation stone of the information industry, and that market is the pillar of standards" (Fang et al. 2004). Some experienced technology professionals also commented, "Why can't we use the huge market to make Chinese standards as international standards?" (Fang et al. 2004). In the CSAC's consultation report (Standardization Administrative Commission of China 2004), the Commission commented that the foundation on which China could realize its Chinese technology standards strategy (part of the strategy would be to make Chinese standards the international standards) is the continual growth of the Chinese national economy.

In light of the Chinese perception of the market as the main or even sole criterion in granting China the power in setting international technology standards as explained above, it appeared that CSAC thought it could make WAPI the OPP for various other actors that would need to accept WAPI in order to realize their respective interests. Accepting WAPI would mean paving the way for American business corporations to have more participation in the Chinese telecommunications industry and this would realize the U.S. government's interests in expanding American business activities. Accepting WAPI and working with those 24 Chinese companies having the WAPI algorithms would be a way to cultivate good relationships with Chinese IT industry (critically important to doing business in a country such as China, where relationships can prevail over rules in many situations) and would realize the interests of American IT businesses in reaping commercial benefits in the huge China telecommunications market. Recognizing WAPI as an international mobile security standard would show that international bodies appreciated the importance of the market in shaping international technology standards, and that these bodies realized the importance of carrying out their duty of maintaining international standards, often reflected by the interests of industry members.

4.3 Unsuccessful Interessement: United States Protesting China

The actions by which the focal actor attempts to impose and stabilize the identity of the other actors, defined during problematization, is called *interessement* (Callon 1986a). If successful, interessement confirms (more or less completely) the validity of the problematization and the alliance that it implies (Callon 1986a). When CSAC announced in May 2003 the promulgation of the WAPI standards and then in November

2003 the implementation of the same (Fang et al. 2004), one could contend that it was an action of interessement. This is because regulations have legal binding force, and the potential acceptance of the legal force by various other actors would suggest their confirmation that WAPI is the OPP addressing the problems or realizing the interests of various actors that China defined for them.

Subsequent events showed that CSAC as the focal actor failed to make WAPI the OPP for the other actors and was unsuccessful in the interessement process. Callon (1986a) stated that each entity enlisted by the problematization could choose to submit to being integrated into the initial plan or, inversely, refuse the transaction. As mentioned earlier in the WAPI background information, opposition to accepting WAPI as an international mobile security standard from all of the other actors (U.S. government, American IT businesses, and international bodies) was so intense that the Chinese government announced, in April 2004, an indefinite postponement of the WAPI implementation.[4]

It appeared that CSAC failed because it had overlooked factors other than market in determining the power of a country in setting international technology standards. These other factors include *international influence* and *international behavior*. The WAPI background information shows that the WiFi Alliance successfully elicited support from the U.S. government and the international community in taking action to protest the Chinese government's decision on mandatory WAPI implementation and advocate using WiFi as the universally applicable mobile security standard. This is because while China is a growing major power, the U.S. is more influential in international relations.

Callon (1986a) also mentions that if other actors choose to refuse the transaction defined for them by the focal actor and do not submit to the latter during interessement, they can define their identity, goals, orientations, motivations, or interests in another manner. This is exactly what the other actor, the WiFi Alliance, chose to do. During its course of opposing China's WAPI decision, the WiFi Alliance redefined the various actors' identity and interests by initiating another actor-network with itself as the focal actor and the other actors (the U.S. government, the international regulatory bodies, and CSAC representing the Chinese government) and making them all passing through the obligatory passage point of WiFi.

4.4 Competing Actor Networks: WAPI Versus WiFi Standards, an Unfinished War

Standards are classified into three types by the processes by which they are established: formal, *de facto*, and *de jure* standards (Hanseth and Monteiro 1997; Hanseth et al. 1996; Schmidt and Werle 1992). *De facto* standards are established through market mechanisms; there are no regulating, institutional arrangements

[4]See Perkins Coie "China Legal Highlights" at http://www.perkinscoie.com/content/ren/updates/china/january2004.htm and http://www.perkinscoie.com/content/ren/updates/china/june2004.htm.

influencing the process. *De facto* standards are often developed by industrial consortia or vendors (Hanseth and Monteiro 1997; Weiss and Cargill 1992). *De jure* standards are imposed by law. Formal standards are worked out by standardization bodies which are often voluntary standardization organizations like IEEE.

The CSAC spotted security concerns regarding WiFi. They identified these concerns as an opportunity to establish WAPI as an alternative standard in China in the first instance. They problematized WiFi and tried to set up WAPI as a ***de jure* standard** in the territory of China.

In response to China's WAPI, the WiFi Alliance built an actor-network to protect WiFi. The Alliance was closely working with IEEE, a voluntary standardization organization, which had a working group for mobile security standards. They were in the process of producing a formal standard for mobile security. The Alliance was developing its own standard, compatible with IEEE 802.11. Defied by the Chinese WAPI, the WiFi Alliance approached the IEEE. Because the WiFi market did not grow enough for a standard to be established as a *de facto* standard, they needed a formal approach. The Alliance mobilized all of the actors favorable to WiFi by convincing them that WiFi would be in their interests, and WAPI would be a threat to their interests. In the end, China announced the indefinite delay of WAPI implementation.

It appears that China failed or was defeated in this dispute. However, translation is a never-completed process (Callon 1986a). According to one Chinese article (Digil63 2004), the U.S. government promised the Chinese government that WAPI would be reviewed by IEEE. This means that WAPI may be included in IEEE related regulations and recognized as an international standard. Furthermore, the recent decision to discuss WAPI by the ISO (International Organization for Standardization) indicates that this standard war will continue. Figure 1 presents the two competing actor networks. It shows how in each of the WAPI and WiFi actor-networks, various actors were entangled in a complex web of alliances in the context of the ANT theoretical principles of problematization, interessement, enrolment, and mobilization.

5 Conclusion

Standard setting involves a variety of stakeholders. There are multiple interests at stake, particularly when they are concerned with international standards. Standards embody interests of nations, industries, and organizations. In the case of WAPI, China attempted to capitalize on its market size and increasingly capable technical community to set up a national (ultimately aiming to be international) standard that reflects its national interests.

In this paper, we have presented an international case as to how China's increasing market power stimulated its desire to have more say in mobile security standardization, thereby challenging the traditional landscape of international technology standards setting. We examined the dispute surrounding China's attempt to set its own mobile security standard (WAPI). The process and dynamics between stakeholders in standards setting are more complex at the international level. To understand the complexity of standard setting, we used the perspective of ANT.

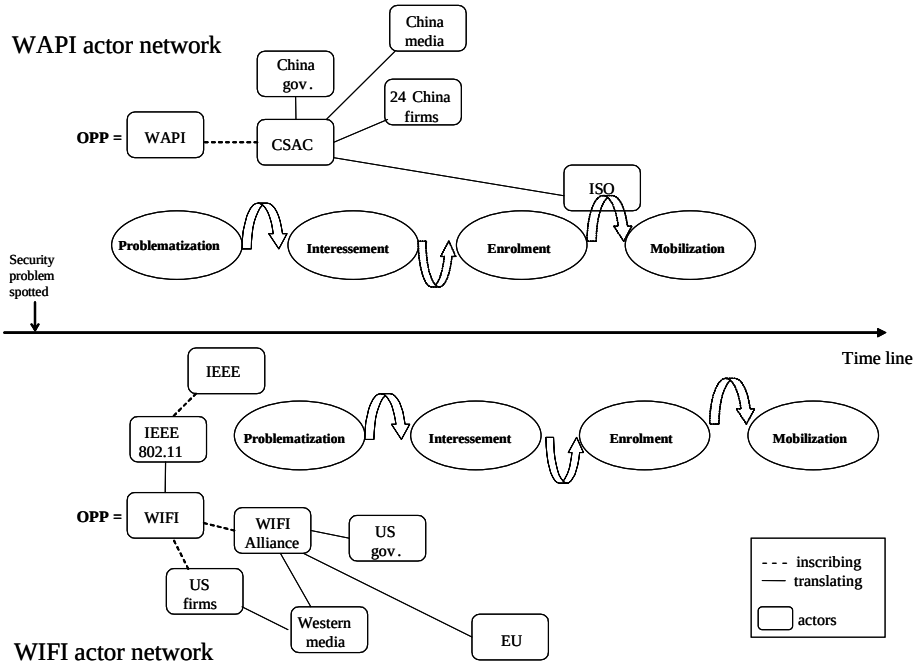

Figure 1. Two Competing Actor Networks

Translation is a never-completed process. As seen in the recent development (the decision to discuss WAPI by the ISO), the WAPI actor network is continuously developing, competing against other related actor networks. Therefore, to be able to understand the process of standard setting, further research is required which follows the development over a longer period of time. WAPI is just one instance in which China endeavored to set its own technological standards different from, if not totally incompatible with, international standards. Other instances include EVD (Enhanced Versatile Disc), IGRS (Intelligent Grouping and Resources Sharing), AVS (Audio, Video Coding Standard), and TD-SCDMA (Time Division Synchronous Code Division Multiple Access) standards (Suttmeier and Yao 2004). All of these attempts offer opportunities to investigate the process of standards setting.

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