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SOLVING THE DILEMMA OF STATE RESPONSES TO CYBERATTACKS: A JUSTIFICATION FOR THE USE OF ACTIVE DEFENSES AGAINST STATES WHO NEGLECT THEIR DUTY TO PREVENT

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*How do you account for your discoveries? Through
intuition or inspiration?¹*

*Both. . . I'm enough of an artist to draw freely on my
imagination, which I think is more important than
knowledge. Knowledge is limited, imagination encircles
the world.²*

I. Introduction

The greatest advances in law, like those in science, come through imagination. When scientific knowledge fails to explain new discoveries

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¹ George Sylvester Viereck, *What Life Means to Einstein: An Interview by George Sylvester Viereck*, PHILA. SATURDAY EVENING POST, Oct. 29, 1929, at 113 (questioning Albert Einstein about his discoveries).

² *Id.* at 117 (quoting Albert Einstein's response to his questions).

about the universe, scientists advance new theories to account for their discoveries—so too with the law. Revolutions in technology, like the Internet, challenge the framework that regulates international armed conflict. Legal scholars must use imagination to find ways to tackle this problem. If not, the law will become obsolete and meaningless to the states that need its guidance.

Man has long sought to regulate warfare. From the Chivalric Code to the Charter of the United Nations (U.N. Charter), man has placed restraints on the times one can resort to war and the methods with which it is conducted. To generalize, regulations are the response to perceived problems with the state of war at a given time. Sometimes these perceptions are the result of shifts in the social conscience. At other times, values have not changed, but problems arise due to radical changes in the way war is waged.

As warfare changes, so must the law, and warfare is changing fast. Traditionally, the instruments of war were controlled only by states. However, in today's world of globally interconnected computer systems, non-state actors with a laptop computer and an Internet connection can attack the critical infrastructure³ of another state from across the world. This is a major paradigm shift, which the law of war today fails to adequately address.

This article will explore the unique challenges that cyberattacks⁴ pose to the law of war and provide an analytical framework for dealing with them. Once the current state of the law of war is fully explored, this article will conclude that states have a right under international law to (1) view and respond to cyberattacks as acts of war and not solely as criminal matters, and (2) use active, not just passive, defenses⁵ against

³ Critical infrastructure are those “systems and assets, whether physical or virtual, so vital to the United States that the incapacity or destruction of such systems and assets would have a debilitating impact on security, national economic security, [and] national public health or safety.” Critical Infrastructure Protection Act of 2001, 42 U.S.C.S. § 5195c(e) (LexisNexis 2009).

⁴ This article uses derivatives of the root word “cyber,” such as cyberattack, cyberthreat and cyberwarfare. “Cyber” may be used as an adjective that means relating to computers or computer networks. So, a cyberattack would be an attack carried out against a computer or computer network; a cyberthreat would be a threat to a computer or computer network. Merriam-Webster Online Dictionary, <http://www.merriam-webster.com/dictionary/cyber> (last visited Mar. 22, 2009).

⁵ Active defenses are electronic countermeasures designed to strike attacking computer systems, shut them down, and stop a cyberattack midstream. Eric Jensen, *Computer*

the computer networks in other states, that may or may not have initiated an attack, but have neglected their duty to prevent cyberattacks from within their borders.

These conclusions are demonstrated over the next seven parts of this article. Part II provides background on the threat that international cyberattacks pose to states, the legal problems that states encounter when dealing with them, and why current interpretations of the law of war actually endanger states. Part III describes cyberattack methods, destructive capabilities, and defenses. Part IV lays out the basic framework for analyzing armed attacks. Part V explores the challenges that non-state actors present to the basic framework of the law of war. Part VI analyzes cyberattacks under the law of war. It demonstrates that cyberattacks can qualify as acts of war, that states have a duty to prevent cyberattacks, and that victim-states have a right to use active defenses against host-states that neglect their duty to prevent cyberattacks. Part VII examines the choice to use active defenses. It explains why states should use active defenses against cyberattacks, describes the technological limits to detecting, classifying and tracing cyberattacks, and explores the impact these technological limitations will have on state decision making. Finally, Part VIII urges states to start using active defenses to protect themselves from cyberattacks originating from states that neglect their duty to prevent them.

II. Cyberattacks, a Growing International Threat

The Internet is essential to every modern country in the world. It is a cornerstone of commerce.⁶ Strategic government activities are directed through it.⁷ Energy production and distribution, water treatment facilities, mass transit, and emergency services are controlled through it.⁸ The more developed a country is, the more it depends on it.⁹ Indeed,

Attacks on Critical National Infrastructure: A Use of Force Invoking the Right of Self-Defense, 38 STAN. J. INT'L L. 207, 230 (2002). Passive defenses are the traditional forms of computer security used to defend computer networks, such as system access controls, data access controls, security administration, and secure system design. *Id.*

⁶ See ANDREW COLARIK, CYBER TERRORISM: POLITICAL AND ECONOMIC IMPLICATIONS viii–xi (2006) (noting that trillions of dollars of electronic banking and global stock trading are conducted over the Internet each year).

⁷ *Id.*

⁸ *Id.*

⁹ *Id.* at xii.

networked computers have become the nervous system of modern society.¹⁰

Global connectivity, however, is a double-edged sword. While it provides tremendous benefits to states, it also opens the door to state and non-state actors who wish to attack and disrupt a state's critical information systems.¹¹ Furthermore, these attacks can have catastrophic consequences, such as bringing a state's economy to its knees, weakening its national defense posture, or causing the loss of life.¹² While these doomsday scenarios may seem farfetched, the reality is that catastrophic cyberattacks are more likely to occur as states grow more reliant on the Internet,¹³ as terrorists increasingly look to use cyberattacks against states,¹⁴ and as cyberattacks become more frequent and potent.¹⁵

No state is safe from cyberattacks. Recent high-profile cyberattacks highlight such vulnerability. In July 2008, shortly before armed conflict broke out between Russia and Georgia, hackers barraged Georgia's

¹⁰ THE WHITE HOUSE, THE NATIONAL STRATEGY TO SECURE CYBERSPACE vii (2003) [hereinafter CYBERSPACE NAT'L STRATEGY].

¹¹ COLARIK, *supra* note 6, at xii.

¹² CYBERSPACE NATIONAL STRATEGY, *supra* note 10, at 6–7 (2003); *see also infra* Part III.B.

¹³ *See* Richard Garnett & Paul Clarke, *Cyberterrorism: A New Challenge for International Law*, in ENFORCING INTERNATIONAL LAW NORMS AGAINST TERRORISM 465, 487 (Andrea Bianchi ed., 2004); DANA SHEA, CONG. RESEARCH SERV. REPORT, CRITICAL INFRASTRUCTURE: CONTROL SYSTEMS AND THE TERRORIST THREAT, RL 31534, at CRS-1 to CRS-3 (2003).

¹⁴ *See* SHEA, *supra* note 13, at CRS-6 to CRS-7; *see also* L. Gordon Crovitz, *Internet Attacks are a Real and Growing Problem*, WALL STREET J., Dec. 15, 2008, at 17 (describing terrorist attempts to trick military computers into mistaking the identities of friendly and unfriendly forces in Afghanistan and Iraq).

¹⁵ *See* CLAY WILSON, CONG. RESEARCH SERV. REPORT, BOTNETS, CYBERCRIME, AND CYBERTERRORISM: VULNERABILITIES AND POLICY ISSUES FOR CONGRESS, RL 32114, at CRS-7 to CRS-8 (2007) (noting cyberattacks are growing more frequent due to the use of automated attack programs; cyberattacks now happen so often the Computer Emergency Response Team Coordination Center gave up tracking them, after tracking several hundred thousand successful attacks a year for several years); JOHN ROLLINS & CLAY WILSON, CONG. RESEARCH SERV. REPORT, TERRORIST CAPABILITIES FOR CYBERATTACK: OVERVIEW AND POLICY ISSUES, RL 33123, at CRS-17 (2007) (reporting that the Department of Defense experiences more than three million scans of its computer systems each day by potential attackers, and that according to a study by IBM in 2005, roughly 237 million cyberattacks were conducted globally in the first half of the year); John Markoff, *Internet Attacks Grow More Potent*, N.Y. TIMES, Nov. 10, 2008, at B8 (describing the increasing capabilities of distributed-denial-of-service attacks to shut down computer systems and overcome computer defenses).

Internet infrastructure with coordinated cyberattacks.¹⁶ The attacks overloaded and shut down many of Georgia's computer servers, and impaired Georgia's ability to disseminate information to its citizens during its armed conflict with Russia.¹⁷ In June 2007, Chinese hackers disabled 1500 Pentagon computers, including those of the Secretary of Defense.¹⁸ In April 2007, cyberattacks from Russia crippled the Estonian government and commercial computer networks.¹⁹ These attacks lasted approximately three weeks, disrupted Estonia's ability to govern, harmed Estonia's economy, and damaged their networks so badly that Estonia had to reach out to its NATO allies for help recovering.²⁰ These are some of the more egregious international cyberattacks; however, there have been numerous others, often with severe consequences to the victim-states.²¹ Given the potentially

¹⁶ John Markoff, *Before the Gunfire, Cyberattacks*, N.Y. TIMES, Aug. 13, 2008, at A1.

¹⁷ *Id.*

¹⁸ Mark Hosenball, *Whacking Hackers*, NEWSWEEK, Oct. 15, 2007, at 10.

¹⁹ Mark Landler & John Markoff, *After Computer Siege on Estonia, War Fears Turn to Cyberspace*, N.Y. TIMES, May 29, 2007, at A1; James Sterngold, *U.S. on Guard Against Computer Attacks; Estonia's Disruption Shows Need to Fortify Internet's Defenses*, S.F. CHRON., June 24, 2007, at A4.

²⁰ Landler & Markoff, *supra* note 19, at A1; WILSON, *supra* note 15, at CRS-7 to CRS-8.

²¹ See, e.g., Siobhan Gorman et al., *Computer Spies Breach Fighter Jet Projects*, WALL STREET J., Apr. 21, 2009, at A1 (describing Chinese cyberattacks against the U.S. Joint Strike Fighter project); Siobhan Gorman, *Electric Grid in U.S. Penetrated by Spies*, WALL STREET J., Apr. 8, 2009, at A1 (describing Chinese cyberattacks against U.S. electric grids); Christopher Rhoads, *Kyrgyzstan Knocked Offline*, WALL STREET J., Jan. 28, 2009, at 10 (discussing the January 2009 denial-of-service attacks from Russia which effectively knocked Kyrgyzstan offline); Julian Barnes, *Cyber Attack Has Pentagon Worried: Russia Eyed in Hit on Defense Networks*, CHI. TRIB., Nov. 30, 2008, at C16 (discussing the November 2008 cyberattacks from Russia which disrupted U.S. Central Command's classified computer networks); Demetri Sevastopulo, *Chinese Hackers Penetrate White House Network*, FIN. TIMES ONLINE, Nov. 7, 2008, http://www.ft.com/cms/s/0/f16027f0-ac6e-11dd-bf71-000077b07658.html?nclick_check=1 (discussing the cyberattacks from China that penetrated the White House's computer network in autumn 2008, and the Obama and McCain presidential campaign networks in summer 2008); Rhys Blakely et al., *M15 Alert on China's Cyberspace Spy Threat*, TIMES ONLINE, Dec. 1, 2007, http://business.timesonline.co.uk/tol/business/industry_sectors/technology/article2980250.ece (discussing the November 2007 cyberattacks from China against vital British commercial, governmental, and military systems); Liam Tung, *China Accused of Cyberattacks on New Zealand*, CNET NEWS.COM, Sept. 13, 2007, http://news.cnet.com/China-accused-of-cyberattacks-on-New-Zealand/2100-7348_3-6207678.html (discussing the September 2007 cyberattacks from China against New Zealand's government networks); *Merkel's China Visit Marred by Hacking Allegations*, DER SPIEGEL ONLINE, Aug. 27, 2007, <http://www.spiegel.de.international/world/0,1518,502169,00.html> (discussing the August 2007 cyberattacks from China against Germany's government); Roger Boyes, *China Accused of Hacking into Heart of Merkel Administration*, TIMES ONLINE, Aug. 27, 2007,

catastrophic consequences of cyberattacks, it is imperative for states to be able to effectively defend themselves.

A. The Legal Dilemma of State Responses to Cyberattacks

Unfortunately, state responses to cyberattacks are governed by an anachronistic legal regime that impairs a state's ability to defend itself. No comprehensive treaty exists to regulate international cyberattacks.²² Consequently, states must practice law by analogy: either equating cyberattacks to traditional armed attacks and responding to them under the law of war or equating them to criminal activity and dealing with them as a criminal matter.²³ The prevailing view of states and legal scholars is that states must treat international cyberattacks as a criminal matter because the law of war forbids states from responding with force unless an attack can be attributed to a foreign state or its agents.²⁴ This limited view of the law of war is problematic for two reasons. First, it confines state computer defenses to passive defenses, which reduce a

<http://www.timesonline.co.uk/tol/news/world/europe/article2332130.ece> (discussing the August 2007 Chinese cyberattacks against Germany's government); *see also* Richard Behar, *World Bank Under Cyber Siege in "Unprecedented Crisis,"* FOX NEWS.COM, Oct. 10, 2008, <http://www.foxnews.com/story/0%2C2933%2C435681%2C00.html> (showing the vulnerability of intergovernmental organizations to cyberattacks by discussing Chinese cyberattacks against the World Bank).

²² *See* AHMAD KAMAL, *THE LAW OF CYBER-SPACE: AN INVITATION TO THE TABLE OF NEGOTIATIONS* 170–89 (2005); Duncan Hollis, *Why States Need an International Law for Information Operations*, 11 LEWIS & CLARK L. REV. 1023, 1024–38 (2007); Jon Jurich, *Cyberwar and Customary International Law: The Potential of a "Bottom-up" Approach to an International Law of Information Operations*, 9 CHI. J. INT'L L. 275, 283 (2008). A Convention on Cybercrime was adopted by the Council of Europe, which went into effect in 2004; however, it does not provide a comprehensive structure for dealing with cyberattacks. The United States is the only non-European nation that is a party to the convention. Notably, despite being part of the Council of Europe, Russia never entered the treaty; neither has China. *See* Council of Europe, *Convention on Cybercrime, opened for signature* Nov. 23, 2001, 41 I.L.M. 282 [hereinafter *Convention on Cybercrime*].

²³ *See* Hollis, *supra* note 22, at 1024–38.

²⁴ *See* LAWRENCE GREENBERG ET AL., *INFORMATION WARFARE AND INTERNATIONAL LAW* 83–84 (1997); WALTER GARY SHARP SR., *CYBERSPACE AND THE USE OF FORCE* 8 n.14 (1999); Sean Condon, *Getting it Right: Protecting American Critical Infrastructure in Cyberspace*, 20 HARV. J.L. & TECH. 404, 414–15 (2007); Daniel Creekman, *A Helpless America? An Examination of the Legal Options Available to the United States in Responding to Varying Types of Cyber-Attacks from China*, 17 AM. U. INT'L L. REV. 641, 653–54 (2002); Yoram Dinstein, *Computer Network Attacks and Self-Defense*, in *COMPUTER NETWORK ATTACK AND INTERNATIONAL LAW* 99, 111 (Michael N. Schmitt & Brian T. O'Donnell eds., Naval War College 2002).

state's ability to stop cyberattacks.²⁵ Second, it forces states to rely on criminal laws to deter cyberattacks, which are ineffective because several major states are unwilling to extradite or prosecute their attackers.²⁶ Given these problems with the prevailing view, states will undoubtedly find themselves in a "response crisis"²⁷ during a cyberattack, forced to decide between effective, but arguably illegal, active defenses, and the less effective, but legal, path of passive defenses and criminal laws.²⁸

The current legal paradigm, which requires attribution to a state or its agents, perpetuates the response crisis because it is virtually impossible to attribute a cyberattack during an attack. Although states can trace the cyberattack back to a computer server in another state, conclusively ascertaining the identity of the attacker requires an intensive, time-consuming investigation with assistance from the state of origin.²⁹ Given the prohibition on responding with force until an attack has been attributed to a state or its agents, coupled with the fact that the vast majority of cyberattacks are conducted by non-state actors,³⁰ it should come as no surprise that states treat cyberattacks as a criminal matter.³¹ This "attribution problem"³² locks states into the response crisis.

²⁵ Active defenses are one of the most effective defenses to cyberattacks, and can stop them in situations where passive defenses cannot. See Noah Shachtman, *Air Force Aims to "Re-Write Laws of Cyberspace,"* WIRED NEWS, Nov. 3, 2008, <http://blog.wired.com/defense/2008/11/air-force-aims.html>; Crovitz, *supra* note 14, at 17. Ideally, states would defend themselves with a layered defense of active and passive defenses. However, states currently confine their defenses to passive defenses because active defenses cannot be legally used unless force is authorized under the law of war. See Jensen, *supra* note 5, at 231.

²⁶ See *infra* notes 41–46 and accompanying text.

²⁷ "Response crisis" refers to the dilemma that states face in choosing an appropriate response to a cyberattack.

²⁸ Adding pressure to the response crisis is that delaying the use of active defenses will increase the overall risk to a state. See Lord: *Attack Attribution, Intent are Badly Needed Cyberwar Capabilities*, 29 INSIDE A.F., No. 26, June 27, 2008 (quoting Major General William Lord, Commander (Prospective), Air Force Cyber Command); see also Condon, *supra* note 24, at 407–08 (noting that delaying the use of active defenses, so that attacks can be attributed, can result in lost lives and massive damage).

²⁹ See Jensen, *supra* note 5, at 232–35 (discussing the difficulty of attributing cyberattacks across international borders); Jason Barkham, *Information Warfare and International Law on the Use of Force*, 34 N.Y.U. J. INT'L L. & POL. 57, 97–99 (2001) (noting that attributing cyberattacks cannot be done without extensive investigation, in which access to the originating servers is granted by the host-state's government).

³⁰ Jensen, *supra* note 5, at 232.

³¹ See Condon, *supra* note 24, at 407 (noting the United States treats international cyberattacks as a criminal matter); Hollis, *supra* note 22, at 1050 (noting that Estonia responded to the 2007 cyberattacks from Russia through diplomatic channels, despite

The high-profile cyberattacks discussed earlier highlight the link between the attribution problem and response crisis. In 2008, Georgia traced the cyberattacks against it back to Russia, but could not pin them on its government.³³ Similarly, U.S. officials believed that China sponsored the 2007 cyberattacks against the Pentagon, but could not prove the link.³⁴ Following a familiar pattern, Estonia traced the 2007 attacks back to Russia, but could not tie them to the Russian government.³⁵ Ultimately, in each of these cases, states were unable to solve the attribution problem, which legally limited them from using active defenses and forced them to rely on passive defenses and criminal laws.

Treating cyberattacks as a criminal matter would not be problematic if passive defenses and criminal laws provided sufficient protection from cyberattacks. Unfortunately, neither is adequate. While passive defenses are always the first line of defense and reduce the chances of a successful cyberattack,³⁶ states cannot rely on them to completely secure their critical information systems.³⁷ Furthermore, passive defenses do little to dissuade attackers³⁸ from attempting their attacks in the first place.³⁹

their belief that Russia sponsored the attacks, because of the legal requirement to attribute cyberattacks before treating them as violations of the law of war).

³² “Attribution problem” refers to the difficulty of ascertaining the identity of cyberattackers.

³³ Markoff, *supra* note 16, at A1. Evidence obtained much later suggests that a criminal gang, known as the Russian Business Network, was behind the cyberattacks with the support of the Russian government. *Id.* See generally Eneken Tikk et al., *Cyber Attacks Against Georgia: Legal Lessons Identified*, NATO COOPERATIVE CYBER DEFENSE CENTER OF EXCELLENCE (2008) (providing more detailed information on the cyberattacks).

³⁴ Demetri Sevastopulo, *Chinese Hacked into Pentagon*, FIN. TIMES ONLINE, Sept. 3, 2007, <http://www.ft.com/cms/s/0/9dba9ba2-5a3b-11dc-9bcd-0000779fd2ac.html>; Demetri Sevastopulo, *Beware: Enemy Attacks in Cyberspace*, FIN. TIMES ONLINE, Sept. 3, 2007, <http://www.ft.com/cms/s/0/a89c1c88-5a38-11dc-9bcd-0000779fd2ac.html>.

³⁵ Landler & Markoff, *supra* note 19, at A1.

³⁶ See LEHTINEN ET AL., *COMPUTER SECURITY BASICS* 3–21 (2d ed. 2006); COLARIK, *supra* note 6, at 10.

³⁷ See COLARIK, *supra* note 6, at 163.

³⁸ Up to this point, the term “hacker” has been used to generically refer to anyone conducting a cyberattack. However, from this point this article will either use the more appropriate term “attacker” to generally refer to individuals who conduct cyberattacks, or one of the more specific terms: “hacker,” “cracker,” “cybercriminal,” and “cyberterrorist.” Hackers are anyone with an eagerness to experiment with computers and test their limits. Crackers are hackers who unlawfully break into systems, usually for the thrill of it, but also to peek at interesting data contained in the systems targeted. Cybercriminals are crackers who go one step further and use their cyberattacks to steal

Deterrence comes from criminal laws and the penalties associated with them.⁴⁰ However, when states fail to pass stringent criminal laws or look the other way when attackers strike rival states, criminal laws are rendered impotent.⁴¹

Unfortunately, several major states refuse to take part in international efforts to eliminate cyberattacks and seem unlikely to start doing so in the near future.⁴² For instance, despite Chinese and Russian pledges to crackdown on their attackers,⁴³ no one has been brought to justice for any of the attacks discussed. China, in fact, conducts training for its hackers

and sell data, embezzle money, or engage in extortion. Cyberterrorists employ cyberattacks to create fear or violence through the destruction or disruption of computer systems, as a means of influencing a government or population to conform to a particular political or ideological agenda. See LEHTINEN ET AL., *supra* note 36, at 16–17; COLARIK, *supra* note 6, at 37–48.

³⁹ In the case of hackers and crackers, beating security measures is often seen as a fun challenge. See LEHTINEN ET AL., *supra* note 36, at 16–17; Frontline: Hacker Interviews, <http://www.pbs.org/wgbh/pages/frontline/shows/hackers/interviews/> (last visited Mar. 22, 2009). Furthermore, the more secure a system is, the more difficult it is for an attacker to penetrate the system's defenses; however, defensive measures alone pose little risk to the attacker. While defensive measures can trace attacks back to their source, absent stringent criminal laws and vigorous law enforcement defensive measures cannot harm an attacker. See COLARIK, *supra* note 6, at 40–45.

⁴⁰ See COLARIK, *supra* note 6, at 39.

⁴¹ CYBERSPACE NAT'L STRATEGY, *supra* note 10, at 8 (2003). State cooperation is essential to the criminal prosecution of international attackers. *Id.* However, state cooperation relies on the goodwill of nations. For instance, even when an attacker has been identified, the host-state may refuse to prosecute or extradite them back to the victim-state. Such obligations only arise from international treaties that set forth state responsibilities. See *Factor v. Laubenheimer*, 290 U.S. 276, 287 (1933); GREENBERG ET AL., *supra* note 24, at 69–72; KAMAL, *supra* note 22, at 215–22. Obtaining state cooperation often requires intense diplomatic activity, which presents its own challenges to relying on host-state criminal laws. For instance, diplomatic activity is usually required to get a host-state to prosecute an attacker under their criminal laws, or to get a host-state to turn over an attacker so that he can be prosecuted under victim-state's criminal laws; neither of which can be required absent a treaty requiring such action. It is worth noting that the United States does not have extradition treaties with China or Russia, and thus no legal right exists to demand the extradition from those states. See Creekman, *supra* note 24, at 658.

⁴² See Condron, *supra* note 24, at 414.

⁴³ See Richard McGregor & Hugh Williamson, *Beijing Pledges Crackdown on International Hackers*, FIN. TIMES ONLINE, Aug. 28, 2007, <http://www.ft.com/cms/s/0/9b4cfc4e-54fe-11dc-890c-0000779fd2ac.html>; Iain Thomson, *Russia Promises Piracy Crackdown*, VNUNET.COM, Mar. 19, 2007, <http://www.vnunet.com/vnunet/news/2185839/russia-promises-piracy> (reporting Russia's pledge to crackdown on online criminal activity).

at its military academies.⁴⁴ Furthermore, security experts believe that China intentionally ignores the criminal acts of its hackers, buys stolen information from them, and uses them to spy on other states.⁴⁵ Meanwhile, Russia has rejected numerous Estonian requests to help track down the attackers responsible for the 2007 cyberattacks.⁴⁶ As may be expected, China and Russia reject these accusations.⁴⁷ Still, all of this suggests that state cooperation is offered in name only, that these states are sponsoring cyberattacks, and that states cannot rely on criminal laws to eliminate the growing cyberthreat. The foregoing discussion illustrates the need to ascertain what states may legally do to defend themselves.

B. The Importance of Using Active Defenses

To escape this dilemma, states must use active defenses. Not only will active defenses greatly decrease the chance of a successful cyberattack, but it also logically follows that attackers will hesitate to attack a state when they know their attacks will be met with a forceful response. After all, “[m]aintaining a credible ability to use force, in cyberspace and elsewhere, is . . . a fundamentally important aspect of deterrence.”⁴⁸ But can states legally act in this manner? Even if so, is this the best way to address the cyberthreat?

⁴⁴ See generally U.S.-CHINA ECON. & SEC. REVIEW COMM’N, 2008 REPORT TO CONGRESS (2008), available at <http://www.uscc.gov> (describing China’s initiatives to augment its cyberwarfare capabilities to gain an advantage over the United States in any future conflict, amid other economic and security concerns).

⁴⁵ See Schneier on Security, http://www.schneier.com/blog/archives/2008/07/chinese_cyber_a.html (July 14, 2008, 07:08 EST) (speculating that China knows its leading hackers, intentionally ignores their international crimes, and even buy stolen intelligence from them).

⁴⁶ See Hollis, *supra* note 22, at 1026. Lending credence to Estonian assertions that Russia is intentionally obstructing the criminal investigation is the fact that the Russian public has hailed the hackers responsible for the cyberattacks against Estonia as national heroes. See Clifford Levy, *What’s Russian for “Hacker”?*, N.Y. TIMES (Week in Review), Oct. 21, 2007, at p. 1.

⁴⁷ Assoc. Press, *China Dismisses U.S. Espionage Report as Misleading*, Nov. 22, 2008, available at <http://abcnews.go.com/International/wireStory?id=6312145>; Richard McGregor & Demetri Sevastopulo, *China Denies Hacking into Pentagon*, FIN. TIMES ONLINE, Sept. 4, 2007, <http://www.ft.com/cms/s/0/a625db16-54c4-11dc-890c-0000779fd2ac.html>; Hollis, *supra* note 22, at 1026.

⁴⁸ SHARP, *supra* note 24, at 135; see THOMAS WINGFIELD, THE LAW OF INFORMATION CONFLICT, NATIONAL SECURITY LAW IN CYBERSPACE 361 (2000).

History shows that states will take matters into their own hands when legal means seem inadequate to protect themselves and their citizens.⁴⁹ One can imagine a scenario where a state was subject to a cyberattack so severe that it felt an armed response was required. Given the ease with which a non-state actor could trigger such a scenario, international law must provide states acceptable legal means to defend themselves. When states have legal means to resolve their disputes, they are more likely to behave in predictable ways that are accepted by the international community.⁵⁰ Thus, unless the international community wants to risk unpredictable and potentially unacceptable responses to cyberattacks, international law must adapt to provide states with legal means to effectively defend themselves.

This is not a new thought. Legal scholars are increasingly recognizing that the current legal regime leaves states vulnerable to cyberattacks and needs to change.⁵¹ However, despite their recognition of the problem, no consensus has emerged on the best way to solve it. Some scholars advocate new treaties to get past this legal shortcoming. For example, one proposal calls for a treaty requiring states to rebuild the Internet's architecture in a more secure manner, so that law enforcement

⁴⁹ This happened in 2008, when the United States authorized its military to carry out air and ground assaults against al Qaeda inside other states without the approval of their governments. Since then, the United States has conducted raids inside Pakistan and Syria against their wishes. The United States justified its actions as self-defense due to those states' inability or unwillingness to handle the terrorists, despite evidence that Pakistan and Syria were cooperating and having some success with their counter-terrorism efforts. See Eric Schmitt & Mark Mazzetti, *Bush Said to Give Orders Allowing Raids in Pakistan*, N.Y. TIMES, Sept. 11, 2008, at A1; Jane Perlez, *Pakistan's Military Chief Criticizes U.S. Over a Raid*, N.Y. TIMES, Sept. 11, 2008, at A8; Eric Schmitt & Thom Shanker, *Officials Say U.S. Killed an Iraqi in Raid in Syria*, N.Y. TIMES, Oct. 28, 2008, at A1; Eric Schmitt & Mark Mazzetti, *Secret Order Lets U.S. Raid Al Qaeda*, N.Y. TIMES, Nov. 10, 2008, at A1; Ismail Khan & Jane Perlez, *Airstrike Kills Militant Tied to Al Qaeda in Pakistan*, N.Y. TIMES, Nov. 23, 2008, at A10.

When states take matters into their own hands, they tend to justify their actions under the mantle of law, even when they fail to meet the accepted legal threshold. This is done as a tactical measure to secure the broadest possible support for their actions, though at times, the states actually believe their actions are legal. Sean Murphy, *The Doctrine of Preemptive Self-Defense*, 50 VILL. L. REV. 699, 727–31 (2005).

⁵⁰ See Murphy, *supra* note 49, at 704–05.

⁵¹ Garnett & Clarke, *supra* note 13, at 488; GREENBERG ET AL., *supra* note 24, at 99–100; KAMAL, *supra* note 22, at 83–84; Davis Brown, *A Proposal for an International Convention to Regulate the Use of Information Systems in Armed Conflict*, 47 HARV. INT'L L.J. 179, 181–83 (2006); Condrón, *supra* note 24, at 415–16; Hollis, *supra* note 22, at 1023.

can easily track attackers.⁵² Another proposal calls for a comprehensive international treaty to regulate cyberattacks.⁵³ Other scholars advocate changing the law of war to allow states to respond to cyberattacks with active defenses, without having to attribute cyberattacks to a state. Thus, one scholar proposed exempting states from having to attribute attacks against their critical infrastructure.⁵⁴ Another posited that attributing attacks is unnecessary because states can legally respond to attacks by non-state actors with force under customary international law (CIL).⁵⁵ While these approaches are all preferable to the current legal paradigm, each has its shortcomings, which this article will address.⁵⁶

The legal authority for states to use active defenses flows from states' duty to prevent non-state actors within their borders from committing cross-border attacks. "It is a long-established principle of international law that 'a state is bound to use due diligence to prevent the commission within its dominions of criminal acts against another nation or its people.'"⁵⁷ Traditionally, this duty only required states to prevent illegal acts that the state knew about beforehand; however, this duty has evolved in response to international terrorism to require states to act against groups generally known to carry out illegal acts.⁵⁸ In the realm of cyberwarfare, states must take this duty one step further by requiring states to enact and enforce criminal laws as the only way to truly prevent cross-border cyberattacks. Otherwise, the current situation that states face with China and Russia will continue to exist. While no international treaty affirmatively obligates a state to hunt down attackers within its

⁵² See generally LAWRENCE LESSIG, CODE: VERSION 2.0 (2006).

⁵³ See generally Brown, *supra* note 51, at 179.

⁵⁴ See Jensen, *supra* note 5, at 236–37; Condron, *supra* note 24, at 415–22.

⁵⁵ See Barkham, *supra* note 29, at 104; Michael Schmitt, *Computer Network Attack and the Use of Force in International Law: Thoughts on a Normative Framework*, 37 COLUM. J. TRANSNAT'L L. 885, 933–34 (1999). This proposal would allow states to use active defenses regardless of who is conducting the cyberattack.

⁵⁶ See *infra* note 168 and accompanying text (discussing the shortcomings of treaty based solutions); *infra* note 377 and accompanying text (discussing the shortcomings of the current proposals to change the law of war).

⁵⁷ Michael Schmitt, *Preemptive Strategies in International Law*, 24 MICH. J. INT'L L. 513, 540–41 (2003) (quoting S.S. Lotus (Fr. v. Turk.), 1927 P.C.I.J. (ser. A) No. 10, at 88 (Sept. 7, 1927) (Moore, J., dissenting), and referring to numerous state pronouncements to that effect with regard to international terrorism).

⁵⁸ See *infra* Part V.B (discussing the traditional and contemporary views of a state's duty to prevent non-state actors within their borders from committing cross-border criminal acts).

borders, such as with piracy,⁵⁹ reinterpreting the duty of prevention to require states to hunt down attackers will solve the attribution problem and response crisis. Once this duty is reinterpreted, international law allows victim-states to impute state responsibility to host-states that neglected this duty, and respond in self-defense.⁶⁰ In effect, repeated failure by a state to take criminal action against its attackers will result in it being declared a sanctuary state, allowing victim-states to use active defenses against cyberattacks originating from within its borders.

Selectively targeting sanctuary states with active defenses will likely provide the added benefit of prompting sanctuary states to take cyberattacks seriously as a criminal matter. Since no state wants another state acting within its borders, even electronically, this reinterpreted duty will motivate states to hunt down attackers within their borders and work with victim-states to bring attackers to justice. States who wish to avoid being the targets of active defenses can easily do so; all they have to do is pass stringent criminal laws, conduct vigorous and transparent criminal investigations, and prosecute attackers.⁶¹

III. Examining Cyberattacks

Effective regulation requires an understanding of the conduct it seeks to regulate. Attempting to regulate a subject without understanding it can easily lead to ineffective regulations that fail to accomplish their intended purpose. This article shall, therefore, examine cyberattacks, their potential impact, and the defenses against them, as a precursor to exploring the legal regime governing them.

A. Types of Cyberattacks

Cyberattacks come in many different forms. To generalize, there are three main categories of cyberattacks.⁶² The first category is automated

⁵⁹ See U.S. DEP'T OF NAVY, NWP 1-14M, THE COMMANDER'S HANDBOOK ON THE LAW OF NAVAL OPERATIONS § 3.5 (2007) [hereinafter COMMANDER'S HANDBOOK] (referencing international law's long-standing obligation for states to repress piracy, and quoting the 1958 Geneva Convention on the High Seas and the 1982 Law of the Sea Convention).

⁶⁰ See *infra* Part V-VI.

⁶¹ See *infra* Part VI.B-C.

⁶² Cyberattacks can be categorized in different ways. It is this author's opinion that there are three main categories of cyberattacks. However, other authors categorize

malicious software delivered over the Internet.⁶³ The second category is denial-of-service (DOS) attacks.⁶⁴ The third category is unauthorized remote intrusions into computer systems by individuals.⁶⁵

Before considering these three, it is worth noting that cyberattacks can originate locally rather than remotely over the Internet. For instance, malicious software may be locally loaded onto a system via a storage device, such as a thumb drive or computer disk, and unauthorized intrusions may originate at a physical terminal connected to a computer network. However, while computer systems are more vulnerable to penetration at their physical location, this article focuses on external cyberattacks conducted via the Internet across international borders.⁶⁶

Malicious code, or malware, usually infects computer systems through infected e-mails, vulnerability exploit engines, or visits to infected websites.⁶⁷ Early malware fell into two main classifications, viruses and worms.⁶⁸ Viruses are code fragments that copy themselves into larger programs, modifying those programs to carry out functions

cyberattacks into as little as two or as many as four main categories. *See* LEHTINEN ET AL., *supra* note 36, at 79–95, 112–33 (categorizing cyberattacks into viruses and Internet vulnerabilities); COLARIK, *supra* note 6, at 84 (categorizing cyberattacks into viruses, denial-of-service attacks, web defacements, and unauthorized penetration).

⁶³ *See* COLARIK, *supra* note 6, at 84.

⁶⁴ *See id.*

⁶⁵ *See id.*

⁶⁶ Internal penetrations are a serious issue despite not being the focus of this article. Authorized users, also known as insiders, have greater access to computer systems than unauthorized users. This access makes it easy for them to load malicious code onto a system, or to do something beyond their authorization. *See id.* at 85–86. Internal penetrations can be inadvertent or intentional. In the case of an inadvertent penetration, a user might connect an infected storage device to a computer network, which then executes its code to the detriment of the system. In the case of an intentional penetration, a user could simply use their access to conduct harmful acts within their access rights, or attempt to use their limited access to try to gain greater access to the system and then conduct harmful acts. *See* LEHTINEN ET AL., *supra* note 36, at 96–111. However despite being a cyberattack of sorts, internal penetrations should fall under domestic law, as the cyberattack occurs as a result of a physical act at the location of the computer networks. This puts internal penetrations squarely in the domestic jurisdiction of the state in question. Absent an intentional act by a member of a transnational terrorist organization, who happens to have gained local access to a computer system, there is no international character to the penetration. In the case that such an act is committed by a transnational terrorist, some of the concepts discussed in this article may be appropriate for analogy.

⁶⁷ LEHTINEN ET AL., *supra* note 36, at 79; COLARIK, *supra* note 6, at 84.

⁶⁸ LEHTINEN ET AL., *supra* note 36, at 80. These definitions were derived from the methods the programs used to carry out an attack. *Id.*

other than those originally intended.⁶⁹ The virus is dependent on the main program, and cannot execute until the main program is run.⁷⁰ Once the main program is run, viruses load themselves into the memory of the computer system and execute their code.⁷¹ A virus then replicates itself, infecting other programs and files.⁷² After it finishes reproducing, it carries out whatever dirty work is in its programming, called delivering a payload.⁷³ Worms are self-sustaining independent programs that reproduce themselves by copying themselves in full-blown fashion from one computer to another via a network or the Internet.⁷⁴ Worms can spread rapidly from system to system, copying themselves to any computer systems connected to the infected computer and, if programmed to do so, delivering their payload on the new system after replicating.⁷⁵

As computer programs became more sophisticated, the terms viruses and worms failed to adequately describe the diverse nature of malware.⁷⁶ As a result, these categories were further defined by their function.⁷⁷ The most common subdivisions of viruses and worms are Trojan horses, rootkits, sniffers, exploits, bombs, and zombies.⁷⁸ Attackers may choose

⁶⁹ *Id.* at 81–82.

⁷⁰ *Id.*

⁷¹ *Id.* at 82; COLARIK, *supra* note 6, at 91.

⁷² LEHTINEN ET AL., *supra* note 36, at 82; COLARIK, *supra* note 6, at 91–92.

⁷³ LEHTINEN ET AL., *supra* note 36, at 82.

⁷⁴ *Id.* at 85.

⁷⁵ *Id.*; COLARIK, *supra* note 6, at 92.

⁷⁶ LEHTINEN ET AL., *supra* note 36, at 80.

⁷⁷ *Id.*

⁷⁸ *Id.* at 80–81. Trojan horses trick a user into running a program that appears beneficial but actually has a code fragment hidden inside the program, which performs a disguised function. *Id.* at 87. Rootkits install new accounts on a computer system or steal existing account information, and then elevate the security level of those accounts to the highest degree so that the attacker can later enter at will without obstruction. *Id.* at 81, 87. Sniffers monitor the keystrokes of authorized users and send the stolen information back to a storage facility for later access by the program designer. *Id.* at 81, 88. Exploits are programs that capitalize on known or undiscovered system vulnerabilities, such as weaknesses in a piece of software or the operating system, to gain access to the system and execute their program. *Id.* at 81, 87. Exploits may also capitalize on system vulnerabilities created through poor security practices and procedures, in addition to those created by technical errors. See WILSON, *supra* note 15, at CRS-25. Bombs are programs that destroy data by reformatting the hard disk, or by corrupting files by inserting random data into them. U.S. ARMY TRAINING & DOCTRINE COMMAND, DCSINT HANDBOOK No. 1-02, CRITICAL INFRASTRUCTURE THREATS AND TERRORISM, at VII-7 (2006) [hereinafter CRITICAL INFRASTRUCTURE THREATS]. Bombs can execute immediately after being loaded onto a system or be delayed. LEHTINEN ET AL., *supra* note

a single one of these programs or use them in conjunction with each other.⁷⁹ Additionally, attackers may also use malware in conjunction with DOS attacks and unauthorized remote intrusions.⁸⁰

Denial-of-service attacks use computers' communication protocols against them, overwhelming the targeted computer system with information until it seizes up and cannot function.⁸¹ This effectively denies the availability of the targeted system to legitimate users.⁸² Denial-of-service attacks can use malformed packets to overwhelm a system's processors, or flood the processor with so many data requests that it overwhelms the system itself or its supporting network bandwidth.⁸³ The most severe form of DOS attack is a distributed-denial-of-service (DDOS) attack.⁸⁴ Distributed-denial-of-service attacks are DOS attacks launched simultaneously from numerous computers.⁸⁵ The sheer volume of a DDOS attack makes it extremely difficult to defend against.⁸⁶ In addition to crippling computer systems attached to the Internet, DOS attacks can overwhelm system defenses, such as

36, at 88. Time bombs can be set to go off at a specific time; logic bombs can be set to go off after a particular event occurs. *Id.* at 88. A zombie is malware that entrenches itself inside a computer system and then lays low until the attacker triggers it into action. *Id.* at 81, 83.

⁷⁹ See LEHTINEN ET AL., *supra* note 36, at 79–95. For example, an attacker may use a trojan horse to deliver a rootkit or sniffer, or he may use an exploit to implant a zombie.

⁸⁰ *Id.*

⁸¹ See *id.* at 81; COLARIK, *supra* note 6, at 84, 103.

⁸² LEHTINEN ET AL., *supra* note 36, at 12.

⁸³ See COLARIK, *supra* note 6, at 103.

⁸⁴ See *id.*

⁸⁵ LEHTINEN ET AL., *supra* note 36, at 81. Distributed-denial-of-service attacks are usually launched from zombies, which attackers hijack ahead of time. These virtual networks of zombies all being directed at once for a single nefarious purpose are known as Botnets. It is not unheard of to have several hundred thousand zombies, or Bots, harnessed at once to unleash one coordinated massive attack. Botnets can be used to deliver malicious code, gather information, or conduct DDOS attacks. See WILSON, *supra* note 15, at CRS-5 to CRS-7.

An interesting evolution of DDOS attacks occurred in 2007 with the “e-Jihad” computer program. E-Jihad let computer owners freely give control of their system to the creators of e-Jihad, who agreed to use their computers to attack anti-Islamic entities. E-Jihad would coordinate the attacks of the freely lent computers, effectively turning them into a network of zombies, and report back to the owners on the success rates of the attacks. E-Jihad has since been shut down, but there will inevitably be similar programs in the future. See Larry Greenemeier, “*Electronic Jihad*” App Offers Cyberterrorism for the Masses, INFORMATIONWEEK.COM, July 2, 2007, <http://www.informationweek.com/news/Internet/show/Article.jhtml?articleID=20000193>.

⁸⁶ See COLARIK, *supra* note 6, at 103.

knocking down a firewall, so that the system becomes vulnerable to other forms of attack.⁸⁷

Remote intrusions are external penetrations of a computer system by an attacker.⁸⁸ They occur at user access points and require user account names and passwords.⁸⁹ Attackers usually use malware to infect computer systems to acquire the necessary access or create fake user accounts on target systems. However, attackers also use social engineering, packet sniffers, and password cracking tools to acquire user account information.⁹⁰ Once an attacker gains access to a system, the attacker can do a variety of harmful things with or to the system, including “caus[ing] people or processes to act on the changed data in a way that causes a cascading series of damages in the physical and electronic world.”⁹¹

B. Potential Impact of Cyberattacks

The Internet’s open architecture makes it “ideally suited for asymmetrical warfare.”⁹² Cyberattacks “can be used by both states and non-state actors to anonymously pry into a state’s public, sensitive and classified computers . . . to manipulate data; to deceive decision makers; to influence public opinion; and even to cause physical destruction from

⁸⁷ *Id.* Web-based attacks, such as a DOS attack, can be used to cause a buffer overflow in the memory of the targeted computer. Buffer overflows of the computer’s stack—the part of memory used for temporary variable storage—can cause the computer to write the overflow of data to the computer’s heap—the segment of memory that stores code waiting for execution. This is called “smashing the stack.” Smashing the stack allows attackers to implant executable programs into the targeted computer to gain further access. Imagine a rootkit being implanted this way. *See* LEHTINEN ET AL., *supra* note 36, at 131–32.

⁸⁸ *See* COLARIK, *supra* note 6, at 94.

⁸⁹ *See id.* at 97.

⁹⁰ *See id.* at 97–98. Social engineering tricks users into giving away their account information. This often happens when attackers impersonate company employees or system administrators over the phone. *Id.* at 94. Packet sniffers capture user data being transmitted to or from a system. *Id.* at 97–98. Password cracking comes in two forms, brute force and dictionary attacks. Brute force attacks guess passwords “by trying every possible combination of characters, one attempt at a time.” Dictionary attacks guess passwords by using commonly used words or variations thereof. Dictionary attacks are often aided by advance reconnaissance, as many people pick easy passwords, such as their initials or children’s names. LEHTINEN ET AL., *supra* note 36, at 61.

⁹¹ COLARIK, *supra* note 6, at 84.

⁹² WINGFIELD, *supra* note 48, at 21.

remote locations abroad.”⁹³ Cyberattacks overcome the requirement for conventional military forces, allowing attackers who understand computer systems to inflict damage on another state, anonymously and for minimal cost, from the other side of the globe.⁹⁴

Attackers can direct cyberattacks at any computer system connected to the Internet; however, the most dangerous attacks are those against critical national infrastructure (CNI).⁹⁵ These systems are so essential to a state’s well-being that states have sworn to protect them regardless of whether the systems are civilian or governmental.⁹⁶ While there is no inclusive list of CNI, a functional analysis of the role that computers play in key resource sectors shows that computer systems form the backbone of almost every nationally significant sector, including banking and finance, communications, energy, emergency services, government, transportation, and water supply.⁹⁷ Cyberattacks against these sectors can intimidate populations, damage an economy, and even injure or kill.⁹⁸ Furthermore, cyberattacks provide terrorists a way to increase the destructive impact of physical attacks.⁹⁹ In essence, cyberattacks are just another tool for a state’s enemies to use.

Cyberattacks, like conventional terrorist attacks, can terrorize a population. The National Security Agency has demonstrated that cyberattacks can disrupt operations at major military commands, cause

⁹³ *Id.* at 21–22.

⁹⁴ *See id.* at 22.

⁹⁵ *See* Timothy Shimeall et al., *Countering Cyber War*, 49 *NATO REV.* 16, 17–18 (Winter 2001/2002), available at <http://www.nato.int/docu/rev-pdf/eng/0104-en.pdf> (noting cyberattacks on CNI would likely result in significant loss of life, and economic and social degradation). While cyberattacks against CNI are the most dangerous form of cyberattack, lesser attacks are still destructive. For instance, the FBI recently estimated that cybercrime, a subset of cyberattacks, causes an average financial loss of \$167,713 per attack, and as a whole has caused over \$400 billion in damages in the United States. WILSON, *supra* note 15, at CRS-27 to CRS-29.

⁹⁶ *See* Homeland Security Presidential Directive 7: Critical Infrastructure Identification, Prioritization and Protection (2003); Condon, *supra* note 24, at 404–07; Jensen, *supra* note 5, at 226–28; JOHN MOTEFF, CONG. RESEARCH SERV. REPORT, CRITICAL INFRASTRUCTURES: BACKGROUND, POLICY, AND IMPLEMENTATION, RL 30153, at CRS-3 to CRS-13 (2008).

⁹⁷ *See generally* Department of Homeland Security, Critical Infrastructure and Key Resources, http://www.dhs.gov/xprevprot/programs/gc_1189168948944.shtm (last visited Mar. 22, 2009) (detailing the different sectors of critical national infrastructure and explaining their interrelations).

⁹⁸ *See* COLARIK, *supra* note 6, at 15–28 (2006).

⁹⁹ *See id.* at 51–52; WILSON, *supra* note 15, at CRS-21.

large-scale blackouts, and interrupt phone service across the United States.¹⁰⁰ Furthermore, much of the United States' CNI is controlled by Supervisory Control and Data Acquisition (SCADA) systems, which are particularly vulnerable to cyberattacks.¹⁰¹ When cyberattacks shut down these systems, people, businesses, and governments can be deprived of basic services. This can cause panic in a populace, effectively turning these cyberattacks into a means of scaring a population, potentially for political ends.¹⁰² Another vulnerability of corporate, government, and military critical systems is their frequent reliance on commercial-off-the-shelf (COTS) hardware and software.¹⁰³ Systems relying on COTS products are more vulnerable to penetration than specially designed systems, making them easier to exploit, more susceptible to damage, and thus more likely to lead to harm to a state and its citizens.¹⁰⁴ Intimidating populations with cyberattacks is just another way for terrorists to sow fear.

The potential economic consequences of cyberattacks are just as profound. Cyberattacks have the potential to cripple a state's commercial infrastructure, such as a stock exchange, and bring the state's economy to its knees.¹⁰⁵ Cyberattacks on the underlying economic infrastructure of a state are an attractive method of warfare for terrorists because so much of a state's economy is facilitated by

¹⁰⁰ See WINGFIELD, *supra* note 48, at 24–25 (discussing the 1997 *Eligible Receiver* military exercise).

¹⁰¹ WILSON, *supra* note 15, at CRS-21 to CRS-23. Supervisory control and data acquisition systems are often remotely located and unmanned, but still connected to the Internet to perform their command and control functions. *Id.* They are used to manage public and private utilities, and much of the communications infrastructure. COLARIK, *supra* note 6, at 122.

¹⁰² See COLARIK, *supra* note 6, at 19–20, 118–24 (2006). The vulnerability of SCADA systems has been demonstrated many times. In 2003, the “Slammer” worm shut down the control systems of an Ohio nuclear power plant. WILSON, *supra* note 15, at CRS-22. Also in 2003, the “Blaster” worm interrupted the warning systems of the northeastern power grid and contributed to the 2003 blackout across the eastern United States. *Id.* at CRS-23. In 2007, the Aurora Generator Test conducted by Idaho National Laboratories demonstrated that coordinated cyberattacks can overheat and shut down power turbine generators. *Id.* at CRS-19 to CRS-20. Furthermore, security experts believe that Chinese cyberattacks contributed to two blackouts in the United States. The first was the northeastern blackout in 2003; the second was the Daytona Beach and Monroe County, Florida blackout in February 2008. Shane Harris, *China's Cyber-Militia*, NAT'L J., May 31, 2008, cover story.

¹⁰³ WILSON, *supra* note 15, at CRS-23 to CRS-24; COLARIK, *supra* note 6, at 130.

¹⁰⁴ WILSON, *supra* note 15, at CRS-24. Government use of COTS systems have already resulted in the infiltration of top-secret computer systems on more than one occasion. *Id.*

¹⁰⁵ WINGFIELD, *supra* note 48, at 24–25; COLARIK, *supra* note 6, at 139.

telecommunications and computer systems.¹⁰⁶ Successful terrorist attacks on banking and finance CNI have the potential to undermine confidence in a state's economic infrastructure and increase the costs of doing business to the point of becoming commercially infeasible.¹⁰⁷ At a time when tens of trillions of dollars are held by international banks, worldwide annual credit card purchases nearly reach two trillion dollars, and online sales in the United States already amount to hundreds of billions per annum, cyberattacks provide an extremely attractive attack method for a state's enemies.¹⁰⁸

Cyberattacks also have the potential to injure or kill, either directly or indirectly.¹⁰⁹ Cyberattacks directed against the transportation sector, for example, could crash airplanes¹¹⁰ or cause trains to collide.¹¹¹ The transportation sector relies heavily on SCADA and COTS systems, and has already proven vulnerable to cyberattacks.¹¹² Cyberattacks could also be directed against dams, causing floodgates to open,¹¹³ or chemical, nuclear, and liquid natural gas plant control systems, which could easily lead to widespread physical damage or death.¹¹⁴ To illustrate these points, in 2000 a cyberattack took control of a sewage plant in Maroochy Shire, Australia, and dumped 264,000 gallons of untreated sewage into the local environment.¹¹⁵ Cyberattacks could also directly target medical systems, altering critical medical information, such as blood types, immunization histories, allergies, or other critical data.¹¹⁶ "The

¹⁰⁶ See COLARIK, *supra* note 6, at 124–28.

¹⁰⁷ See *id.* at 22.

¹⁰⁸ See *id.* at 124–28 (reviewing commerce over the Internet); WILSON, *supra* note 15, at CRS-21 (referencing Chinese military journals, which claim the ability to bring down U.S. financial markets with cyberattacks); U.S. Census Bureau, The 2009 Statistical Abstract: Online Retail Sales, http://www.census.gov/compendia/statab/cats/wholesale_retail_trade/online_retail_sales.html (recording \$128.1 billion in online sales in 2007 and projecting online sales to rise to \$147.6 billion in 2008, in the Online Retail Spending report).

¹⁰⁹ See CRITICAL INFRASTRUCTURE THREATS, *supra* note 78, at VII-7.

¹¹⁰ See COLARIK, *supra* note 6, at 128–30.

¹¹¹ See CRITICAL INFRASTRUCTURE THREATS, *supra* note 78, at VII-1 (noting the railroad signal and switching system could be manipulated to cause trains to crash into each other).

¹¹² While no one was hurt when it happened, hackers have previously taken over and shut off a regional airport's control tower and runway lights. COLARIK, *supra* note 6, at 130.

¹¹³ See WILSON, *supra* note 15, at CRS-21.

¹¹⁴ SHEA, *supra* note 13, at CRS-8.

¹¹⁵ *Id.* at CRS-7.

¹¹⁶ COLARIK, *supra* note 6, at 131.

modification of such details could cause the medical practitioners to diagnose a course of treatment that could be fatal to the patient.”¹¹⁷

The scenario that concerns experts the most, however, is the use of cyberattacks against electronic emergency warning and response systems in conjunction with physical attacks.¹¹⁸ When attackers use cyberattacks to degrade state defenses to physical attacks in this manner, they exponentially amplify the likely total damage from a physical attack.¹¹⁹ Given the devastating impact that cyberattacks can have on a population’s sense of security, economic well-being, and safety, it is imperative for states to defend themselves with the best computer defenses allowed under the law.

C. Defenses Against Cyberattacks

Today, computer security is typically divided into four general categories: system access controls, data access controls, security administration, and secure system design.¹²⁰ These defenses function on the general axiom of computer security that states can limit the damage from cyberattacks by reducing an attacker’s ability to gain unauthorized access to a computer system.¹²¹ The more secure a system is designed, the more difficult it is for attackers to penetrate the system and cause harm.¹²²

Computer security has a potential fifth category: active defenses.¹²³ Passive defenses differ from active defenses in that they do not use force, and as a result, are considered lawful under international law.¹²⁴ Active defenses, on the other hand, employ electronic force to counterattack the

¹¹⁷ *Id.*

¹¹⁸ SHEA, *supra* note 13, at CRS-9.

¹¹⁹ COLARIK, *supra* note 6, at 138–40; CRITICAL INFRASTRUCTURE THREATS, *supra* note 78, at VII-7; SHEA, *supra* note 13, at CRS-9. Furthermore, evidence indicates that terrorists are conducting cybersurveillance on U.S. critical infrastructure for this purpose. SHEA, *supra* note 13, at CRS-6 to CRS-7.

¹²⁰ LEHTINEN ET AL., *supra* note 36, at 49–50.

¹²¹ *See* COLARIK, *supra* note 6, at 83 (noting that without access, all an attacker can do is shut down a system or prevent access to it).

¹²² *See* LEHTINEN ET AL., *supra* note 36, at 49 (noting that computer security makes sure computers do what they are supposed to do by protecting the data stored in a computer from being read, destroyed, or modified by those without authorized access).

¹²³ *See* Jensen, *supra* note 5, at 230.

¹²⁴ *Id.*

source of a cyberattack, and may only be used when force is authorized under the law of war.¹²⁵ So far, states have confined their computer security to passive defenses, as active defenses are forbidden under the prevailing view of the law of war.¹²⁶ However, all five categories of computer security provide states with essential tools to protect themselves from cyberattacks.

The first form of passive defenses are system access controls. They prevent unauthorized users from getting into a system, and force authorized users to be security conscious.¹²⁷ System access controls start with identification and authentication.¹²⁸ This may be as simple as providing a username and password,¹²⁹ or it may require technological devices to login, such as an electronic key, token, badge, or smart card.¹³⁰ Some systems are so advanced that biometric or behavioral information is required to access them, such as fingerprints, handprints, retina pattern, iris pattern, voice, signature, or keystroke patterns.¹³¹ Other system access controls include transmission encryption,¹³² challenge and response procedures,¹³³ and password controls.¹³⁴

¹²⁵ *Id.* at 231.

¹²⁶ *See supra* Part II.A.

¹²⁷ LEHTINEN ET AL., *supra* note 36, at 49.

¹²⁸ Identification is how users tell the system who they are. Authentication is how users prove to a system they are who they say they are. *Id.* at 50–51.

¹²⁹ *Id.* at 51.

¹³⁰ These devices contain electronic code that allows access a system, and may even be so sophisticated as to continually calculate new passwords based on time of day or secure algorithms. The computer system being accessed will have matching information to the security device, and will grant access once the petitioning party's password matches. *Id.*

¹³¹ *Id.*

¹³² LEHTINEN ET AL., *supra* note 36, at 52. Encryption scrambles data during transmission, which can only be unlocked with the correct session key. Numerous encryption protocols can be used, such as DES, Kerberos, and Rijndael, all of which use some version of session keys to authenticate messages and protect communications. *See* LEHTINEN ET AL., *supra* note 36, at 137–72; COLARIK, *supra* note 6, at 72–73.

¹³³ Challenge and response is a protocol where users are asked to re-authenticate themselves frequently at random intervals throughout their session with the system. LEHTINEN ET AL., *supra* note 36, at 52.

¹³⁴ Password controls may attempt to stop unauthorized users from accessing a system. These controls include warning messages to unauthorized users, limiting the number of attempts to enter the correct password, implementing login failure wait times between attempts, and password locks for incorrect logins. Password controls may also force users to be more security conscious. These controls may force users to change their password at regular intervals, have minimum length passwords, and read the date/time of their last login. *Id.* at 59–60.

Data access controls are similar to system access controls, except that instead of protecting the system at-large, their protection is aimed at the data and programs inside the system.¹³⁵ Authorization is the key to data access controls. It checks to see if the users of a system have rights to access particular files.¹³⁶ Data access controls allow multiple users to use a system without having to grant everyone access to every file on the system.¹³⁷ Other data access controls include data storage encryption¹³⁸ and reference monitors.¹³⁹

Security administration is the human side of computer security.¹⁴⁰ It uses security procedures to protect a system, delineates system administrator responsibilities, ensures users are trained on computer security, and monitors users to ensure security policies are observed.¹⁴¹ Examples of security administration are setting and publicizing security policies,¹⁴² performing risk analysis and disaster planning,¹⁴³ training and monitoring employees,¹⁴⁴ creating and maintaining user security profiles,¹⁴⁵ penetration testing,¹⁴⁶ backing up system files,¹⁴⁷ arranging

¹³⁵ *Id.* at 50.

¹³⁶ Systems typically maintain a file containing information about user privileges and characteristics. This is often called a security profile. *Id.* at 61–62.

¹³⁷ See LEHTINEN ET AL., *supra* note 36, at 61–67; COLARIK, *supra* note 6, at 69–71. This is another important layer of security on top of system access controls, as it helps stop attackers from accessing sensitive data or programs after they have gained unauthorized access to a system. LEHTINEN ET AL., *supra* note 36, at 66.

¹³⁸ Encryption of stored data helps prevent the access of and tampering with sensitive information. COLARIK, *supra* note 6, at 71.

¹³⁹ Reference monitors review access attempts and cross-reference them against user security profiles. If a user attempts to access files above their access level, then the reference monitor alerts the system administrator. *Id.*

¹⁴⁰ LEHTINEN ET AL., *supra* note 36, at 96.

¹⁴¹ *Id.* at 50.

¹⁴² Security policies are designed to make systems more secure. An example of a security policy is the separation of administrator duties. The separation of duties prevents any one user from controlling the system's security mechanisms. By separating duties among a group of individuals, it becomes harder for cyberattackers to take control of a system through the impersonation of an individual account. *Id.* at 97, 108–10.

¹⁴³ *Id.* at 97.

¹⁴⁴ *Id.*

¹⁴⁵ *Id.* at 97.

¹⁴⁶ Penetration testing is when the system administrator simulates cyberattacks to test a computer system for security holes. *Id.* at 97, 107–08.

¹⁴⁷ Backing up data may occur on site or at remote secure facilities, and is one of the most important things a system administrator can do to enable a compromised system to recover from a cyberattack. *Id.* at 96, 102.

for the use of other computer facilities or equipment in case of an emergency,¹⁴⁸ and performing security audits.¹⁴⁹

Secure system design uses hardware and software to protect the system.¹⁵⁰ Examples of security hardware are segmented system memory¹⁵¹ and physical gateways.¹⁵² In addition, a system can be built to withstand denial-of-service attacks.¹⁵³ Examples of security software are anti-virus programs,¹⁵⁴ encryption programs, firewalls,¹⁵⁵ and intrusion detection systems.¹⁵⁶

¹⁴⁸ Backup systems may be essential in case a cyberattack cripples an organization's primary systems. *Id.* at 96.

¹⁴⁹ Security audits review user profiles and activity within a system and look for suspicious account settings or activity. An effective component of a security audit is to review audit logs/trails. Audit logs/trails are designed to record activities and events within a computer system. Reviewing audit logs/trails can reveal security breaches inside a system and help trace the attacks back to their source. For instance, an audit log might contain information about the origin of a computer transmission, show which files were accessed or attempted to be accessed, and reveal changes to the computer system. *Id.* at 108–09; COLARIK, *supra* note 6, at 71–72 (2006).

¹⁵⁰ LEHTINEN ET AL., *supra* note 36, at 50.

¹⁵¹ Segmented system memory physically isolates privileged processes from non-privileged processes. *Id.*

¹⁵² The easiest way to secure a computer network is to physically isolate it from the outside world. However, as systems become increasingly dependent on global communication to achieve its purpose, this becomes more difficult to do. There is a middle ground, though. Systems can be physically designed so that communication to and from the system are routed through a single channel, known as a gateway. Gateways can be designed to run a variety of security programs, all aimed at ensuring that communication is coming from trusted sources for legitimate purposes. *Id.* at 189.

¹⁵³ This can include increasing bandwidth to handle the scope of the attack, building redundant or fault-tolerant systems that are harder to disrupt, or building the network so that it is easy to reconfigure in case of attack. *See id.* at 196.

¹⁵⁴ Anti-virus programs contain registries of virus code patterns that can be used to detect viruses. Anti-virus programs lurk in the background of computer systems, constantly running and scanning ongoing processes and incoming data for viral code. Upon detecting a potential virus, the program sounds an alarm and attempts to quarantine the dangerous code. *Id.* at 92–93.

¹⁵⁵

[F]irewalls protect[] [computer systems] by examining each packet [of data] that travels over the network. Clues about a packet's purpose can be read from its destination address. Firewalls contain a list of allowed and disallowed destinations and functions. If a packet is heading for a forbidden address or comes from one, the firewall stops it. If a packet is heading for a valid address, but its port identifier (the clue to packet function) is unknown or disallowed, the firewall stops that packet as well. Advanced firewalls even keep track of outgoing packets, and open up only if a packet is expected and returning.

Active defenses involve an in-kind response to a cyberattack—effectively, a counter-cyberattack against the attacker’s system, shutting down the attack before it can do further harm and/or damaging the perpetrator’s system to stop it from launching future attacks.¹⁵⁷ Security professionals can set up active defenses to automatically respond to attacks against critical systems or can carry them out manually.¹⁵⁸ For the most part, active defenses are classified, though programs that send destructive viruses back to the perpetrator’s machine or packet-flood the intruder’s machine have entered the public domain.¹⁵⁹ The specific capabilities that the Government has developed are beyond the scope of this article; however, it is essential to note that active defenses greatly enhance a victim-state’s defensive capabilities against cyberattacks by providing it with a crucial additional option over passive defenses alone.¹⁶⁰

Defending against cyberattacks goes beyond computer security. On the macro level in the United States, “the federal government has taken steps to . . . encourage the private sector to also adopt stronger computer security policies and practices to reduce infrastructure vulnerabilities.”¹⁶¹ The National Strategy to Secure Cyberspace encourages the private sector to partner with federal agencies to improve computer security for U.S. critical infrastructure.¹⁶² The National Cyber Security Division of the Department of Homeland Security is “tasked with conducting analysis of cyberspace threats and vulnerabilities, issuing alerts and

Firewalls help prevent active threats such as worms and viruses, which attempt to enter a computer via forbidden pathways. *Id.* at 92.

¹⁵⁶ Intrusion detection systems monitor systems for attacks, much like anti-virus programs do for viruses. The intrusion detection systems have libraries of the steps that attackers typically take to conduct attacks. If an attack pattern is identified, it tries to stop the transaction (if it can) and places a call to the system administrator, informing them of the attempted attack. *Id.* at 107.

¹⁵⁷ See Jensen, *supra* note 5, at 231; Condrón, *supra* note 24, at 410–11.

¹⁵⁸ See Jensen, *supra* note 5, at 231; David Wheeler & Gregory Larsen, *Techniques for Cyber Attack Attribution*, INST. DEF. ANALYSIS, Oct. 2003, at 23–24, available at <http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA468859&Location=U2&doc=GetTRDoc.pdf>.

¹⁵⁹ See Jensen, *supra* note 5, at 231; Condrón, *supra* note 24, at 410–11.

¹⁶⁰ See Shachtman, *supra* note 25 (quoting the Air Force Research Laboratory as saying that passive defenses are insufficient to stop cyberattacks, and that active defenses are needed to mount an effective defense against cyberattacks); Crovitz, *supra* note 14, at 17 (arguing active defenses are needed to stop the cyberthreat).

¹⁶¹ WILSON, *supra* note 15, at CRS-31.

¹⁶² *Id.*

warnings for cyberthreats, improving information sharing, responding to major cybersecurity incidents, and aiding in national-level recovery efforts.”¹⁶³ Furthermore, the Government has set up the Cyber Warning and Information Network and National Cyber Alert System, which is an early warning system for cyberattacks across the United States that coordinates national cybersecurity defenses across critical U.S. sectors.¹⁶⁴

Unfortunately, computer security in its present form is not enough to stop cyberattacks. Computer software frequently has design flaws that open systems to attack, despite system administrators’ best efforts to fully secure their computer systems.¹⁶⁵ These design flaws are compounded by administrator and user carelessness in both system design and use, which often nullify the security measures put in place to defend a system.¹⁶⁶ Furthermore, poor design of federal computer networks has left them with more entry points than U.S. early warning programs can effectively monitor at one time, leaving U.S. computer systems vulnerable to attack until the amount of entry points is reduced.¹⁶⁷ These vulnerabilities highlight the fact that passive defenses alone are not enough to protect states from cyberattacks. As a result, it is likely that states will feel the need to use active defenses. In such event, it would be best if international law could provide parameters regarding their proper use.¹⁶⁸

¹⁶³ *Id.*

¹⁶⁴ *Id.* at CRS-31 to CRS-32.

¹⁶⁵ *See id.* at CRS-24 to CRS-26.

¹⁶⁶ *See* LEHTINEN ET AL., *supra* note 36, at 96; WILSON, *supra* note 15, at CRS-25.

¹⁶⁷ *See* Ryan Naraine, *Chertoff Describes “Manhattan Project” for Cyber Defenses*, EWEEK.COM, Apr. 8, 2008, <http://www.eweek.com/c/a/Security/Chertoff-Describes-Manhattan-Project-for-Cyber-Defenses> (referencing former Secretary of Homeland Security Michael Chertoff’s speech on federal computer systems’ vulnerability).

¹⁶⁸ There are three different ways for international law to deal with cyberattacks. First, international law can continue to force states to deal with cyberattacks as a criminal matter. However, not only does this option fail to provide any guidance on the use of active defenses, but it continues to leave states vulnerable to cyberattacks. *See supra* Part II.A.

Second, states can amend international law through international treaties to provide new ways to combat cyberattacks. These treaties could either regulate state responsibilities concerning international cyberattacks or regulate the architecture and code used to build the Internet. *See generally* Brown, *supra* note 51 (discussing the importance of an international convention on cyberattacks); LESSIG, *supra* note 52 (arguing for an international treaty to regulate the design of cyberspace to make it easier for law enforcement to trace attacks and prosecute attackers). However, since meaningful international agreements require the agreement of a substantial majority of sovereign states, it seems unlikely that any comprehensive treaty will be forthcoming in the near future. *See* LESSIG, *supra* note 52, at 298–324. Furthermore, it is naïve to think

IV. The General Framework of *Jus ad Bellum*

The law of war is divided into two principal areas, *jus ad bellum* and *jus in bello*.¹⁶⁹ *Jus ad bellum*, also known as the law of conflict management, is the legal regime governing the transition from peace to war.¹⁷⁰ *Jus in bello*, also known as the law of armed conflict, governs the actual use of force during war.¹⁷¹ The analysis of whether states can respond to cyberattacks with active defenses predominantly falls under *jus ad bellum*, which provides (1) the thresholds that cyberattacks must cross to be considered a use of force, which would then bring cyberattacks under the *jus in bello*, and (2) the legal options that states have to respond to cyberattacks.

Historically, the transition from peace to war fell under the prerogative of the sovereign; however, it came under international law following World War II with the ratification of the U.N. Charter.¹⁷² While the U.N. Charter is not the only source of *jus ad bellum*,¹⁷³ it has redefined and codified “contemporary *jus ad bellum* in its entirety” and has become the starting point for all *jus ad bellum* analyses.¹⁷⁴ The relevant articles of the U.N. Charter are Articles 2(4), 39 and 51, which provide the framework for modern *jus ad bellum* analyses.¹⁷⁵

that treaties will motivate states to cooperate, as states like China and Russia already turn a blind eye to cyberattacks despite international condemnation of their practices, and numerous U.N. General Assembly resolutions calling for state cooperation. *See supra* Part II.A (discussing China and Russia’s unwillingness to investigate and prosecute attackers); *infra* Part VI.C (discussing U.N. General Assembly resolutions calling for international cooperation to eradicate cyberattacks).

Finally, states can try to find a way around the legal crisis under the law of war, so that they can employ active defenses in addition to passive defenses. Of these options, finding a way to authorize active defenses under the law of war is the only realistic way to protect states from cyberattacks. The first two options require state cooperation, which is not happening at present and seems unlikely to happen in the near future.

¹⁶⁹ WINGFIELD, *supra* note 48, at 31.

¹⁷⁰ *Jus ad bellum* “is a set of rules that govern the resort to armed conflict and determine whether the conflict is lawful or unlawful in its inception.” *Id.* at 33. It governs what amounts to a use of force, and when force is authorized. *Id.* at 31, 33.

¹⁷¹ *Jus in bello* “governs the behavior of both belligerents and neutrals during hostilities.” It governs what types of force are authorized during hostilities and places limits on the use of force. *Id.* at 131.

¹⁷² *Id.* at 31.

¹⁷³ *See* Hollis, *supra* note 22, at 1039 (noting that *jus ad bellum* comes from diverse sources, including the U.N. Charter, international humanitarian law treaties, and customary international law (CIL)).

¹⁷⁴ WINGFIELD, *supra* note 48, at 31, 37–38.

¹⁷⁵ *Id.* at 31, 37–40.

A. General Prohibition on the Use of Force

Article 2(4) prohibits states from employing “the threat or use of force against the territorial integrity or political independence of [another] state, or in any other manner inconsistent with the Purposes of the United Nations.”¹⁷⁶ Sometimes known as *jus contra bellum*,¹⁷⁷ Article 2(4) criminalizes both the aggressive use of force and the threat of the aggressive use of force by states as crimes against international peace and security.¹⁷⁸ Although the U.N. Charter’s protections apply only to those states that are parties to it, the prohibitions contained in Article 2(4) have come to be recognized as CIL, binding on all states across the globe.¹⁷⁹

On its face, Article 2(4) might suggest that the threat or use of force is prohibited only when directed against the territorial integrity or political independence of another state.¹⁸⁰ This is not the case.¹⁸¹ Article 2(4) also prohibits any threat or use of force inconsistent with the purpose of the United Nations.¹⁸² When read in conjunction with Article 1 of the U.N. Charter, Article 2(4) forbids threats or uses of force that threaten international peace and security.¹⁸³ Thus, states may not threaten to use or actually use force against another state unless an exception is carved out within the U.N. Charter.¹⁸⁴ This position is further supported by Article 2(3), which requires states to “settle their international disputes by peaceful means in such a manner that international peace and security, and justice, are not endangered.”¹⁸⁵ Only two exceptions exist to this seemingly all-encompassing

¹⁷⁶ U.N. Charter art. 2(4).

¹⁷⁷ *Jus contra bellum* means the law against the aggressive use of force. WINGFIELD, *supra* note 48, at 38.

¹⁷⁸ *Id.* at 31, 38–39.

¹⁷⁹ Schmitt, *supra* note 57, at 521. Unlike treaty-based law, which only binds parties to the treaty, CIL binds all states to it. Customary international law is formed when state practice matures to the point that it evidences *opinio juris sive necessitates*, a belief on the part of states that engaging in that practice is legally obligatory. *Id.* at 524; *see infra* notes 380–81 and accompanying text (discussing the formation of CIL in depth).

¹⁸⁰ *Id.* at 521–22.

¹⁸¹ *Id.*

¹⁸² U.N. Charter art. 2(4).

¹⁸³ *See id.* art. 1 (stating that the purpose of the United Nations is to maintain international peace and security); Schmitt, *supra* note 57, at 522.

¹⁸⁴ YORAM DINSTEIN, *WAR, AGGRESSION AND SELF-DEFENCE* 87–88 (4th ed. 2005).

¹⁸⁵ U.N. Charter art. 2(3).

renunciation on the use of force:¹⁸⁶ actions authorized by the U.N. Security Council¹⁸⁷ and self-defense.¹⁸⁸

B. Actions Authorized by the U.N. Security Council

The first exception to the general prohibition on the use of force is actions authorized by the U.N. Security Council. This coercive authority stems from Article 42 of the U.N. Charter, which allows the Security Council to use military force to restore international peace and security.¹⁸⁹ However, while the U.N. Charter grants the Security Council power to use military force, the Security Council cannot do so until it has met certain conditions laid out in Articles 39, 41, and 42.¹⁹⁰

Article 39 is the first threshold that the Security Council must cross before it can authorize the use of force.¹⁹¹ The Security Council must consider whether a “threat to the peace, breach of the peace, or act of aggression” exists.¹⁹² Should the Security Council determine that this threshold has been met, in essence determining that a state has violated its obligations under Article 2(4), the Security Council may then move on to Articles 41 and 42 to determine the appropriate course of action to restore international peace and security.¹⁹³

¹⁸⁶ Jensen, *supra* note 5, at 216.

¹⁸⁷ See U.N. Charter art. 39 (stating that the Security Council shall decide what constitutes a threat to international peace and security, and what measures to take in response to any such threat); *id.* art. 42 (granting the Security Council the power to use military measures to restore international peace and security).

¹⁸⁸ See *id.* art. 51 (re-affirming the inherent right of states to use force in self-defense under CIL).

¹⁸⁹ *Id.* art. 42.

¹⁹⁰ WINGFIELD, *supra* note 48, at 31, 52–54.

¹⁹¹ U.N. Charter art. 39.

¹⁹² *Id.*

¹⁹³ See *id.* arts. 2(4), 39. Remember, states are generally prohibited from threatening to use or using force, and are required to seek peaceful means to resolve their disputes. See *id.* arts. 2(3), 2(4). Fortunately, the drafters of the Charter understood that some states would not live up to these requirements and created a framework to deal with them. “As an exercise of the international community’s inherent right of collective self-defense, Article 39 of the Charter imposes an obligation on the Security Council to maintain international peace and security.” WINGFIELD, *supra* note 48, at 52. From this obligation, and through the mechanisms prescribed by Articles 41 and 42, the Security Council derives the power to authorize the force against states who threaten the peace. *Id.* at 52–54.

Article 41, the use of non-military measures, is the Charter's preferred method for restoring international peace and security.¹⁹⁴ Under it, the Security Council may authorize non-military measures to coerce an offending state into ceasing its aggression.¹⁹⁵ The non-military measures are implemented by U.N. member states and may include the "complete or partial interruption of economic relations . . . and other means of communication, and the severance of diplomatic relations."¹⁹⁶

Like Article 41, the use of military measures under Article 42 requires an Article 39 threshold decision to be made, and only then used after non-military measures have proven unsuccessful or after the Security Council determines that it would be fruitless to adopt them.¹⁹⁷ However, unlike its Article 41 powers, the Security Council may only authorize member states to take military action; it cannot compel them to do so.¹⁹⁸

C. Self-Defense

The second exception to the general prohibition on the use of force is self-defense. This defensive right of states is enshrined in Article 51 of the U.N. Charter, which proclaims that "[n]othing in the present Charter shall impair the inherent right of [states to engage in] individual or collective self-defense" in response to an "armed attack."¹⁹⁹ As the text of Article 51 implies, the right of self-defense existed long before the

¹⁹⁴ See Schmitt, *supra* note 57, at 525.

¹⁹⁵ See *id.*

¹⁹⁶ U.N. Charter art. 41. Article 41 explicitly recognizes the Security Council's authority to give orders to Member states. WINGFIELD, *supra* note 48, at 53–54. "The Members of the United Nations agree to accept and carry out the decisions of the Security Council in accordance with the present Charter." U.N. Charter art. 25.

¹⁹⁷ See U.N. Charter art. 42; Schmitt, *supra* note 57, at 525.

¹⁹⁸ WINGFIELD, *supra* note 48, at 54. When the Security Council authorizes the use of force against a state under Article 42, its authorizing resolution serves as legal authority. The Security Council can authorize states to use military force in three different ways. First, it can authorize states to use force to enforce its resolution. Second, it can authorize international organizations, such as NATO, to use force on its behalf. Third, it can create a U.N. military force and ask states to provide military forces to it. In all of the cases, state participation is strictly voluntary and cannot be compelled. SCHMITT, *supra* note 57, at 525–28.

¹⁹⁹ U.N. Charter art. 51. Article 51 only allows states to act in self-defense until the Security Council takes action to restore international peace and security. Furthermore, states are required to immediately report measures taken in self-defense to the Security Council. *Id.*; DINSTEIN, *supra* note 184, at 177 (quoting Article 51 of the U.N. Charter).

U.N. Charter and has been re-affirmed in the Charter as an inherent right of states under CIL.²⁰⁰ Self-defense is derived from the fundamental right of states to survive, allowing them the self-help measure of using force defensively to protect themselves and their citizens.²⁰¹ Since this right exists independent of and has not been subsumed by the U.N. Charter,²⁰² self-defense analysis draws on both the provisions of Article 51 of the U.N. Charter and the principles of CIL.²⁰³

The bedrock principle of self-defense is that it may be invoked in response to an armed attack.²⁰⁴ Unfortunately, while this cornerstone is universally recognized under international law, ambiguity in the U.N. Charter has led to an ongoing debate about when states may invoke self-defense.²⁰⁵ This is because the Charter never defines “armed attack.”²⁰⁶ Since the timing of self-defense is contingent on when an armed attack occurs, it is critical to resolve what constitutes an armed attack.²⁰⁷ This debate has become even more pronounced regarding cyberattacks, which are often seen as a use of force short of armed force, making cyberattacks far more difficult to classify than traditional attacks with conventional weapons.²⁰⁸

Self-defense analysis is further complicated because of competing theories among legal scholars on the interplay between the U.N. Charter

²⁰⁰ See DINSTEIN, *supra* note 184, at 175–82.

²⁰¹ *Id.* at 175–76.

²⁰² See *Military and Paramilitary Activities in and against Nicaragua (Nicar. v. U.S.)*, 1986 I.C.J. 14, 94, 96–97 (June 27) (noting that the inherent right of self-defense has not been subsumed by the U.N. Charter); DINSTEIN, *supra* note 184, at 181 (citing the International Court of Justice’s (ICJ) opinion in the *Nicaragua* case); Jensen, *supra* note 5, at 221 (citing the ICJ’s opinion in the *Nicaragua* case). *But see* WINGFIELD, *supra* note 48, at 41 (citing THE CHARTER OF THE UNITED NATIONS: A COMMENTARY 666 (Bruce Simma ed. 1994), which concludes that Article 51 excludes any right of self-defense “other than that in response to an armed attack”).

²⁰³ See DINSTEIN, *supra* note 184, at 181; WINGFIELD, *supra* note 48, at 41 (noting that the Article 51 right of self-defense is coextensive with the right of self defense under CIL).

²⁰⁴ U.N. Charter art. 51.

²⁰⁵ Hollis, *supra* note 22, at 1040–41.

²⁰⁶ See WINGFIELD, *supra* note 48, at 73; Hollis, *supra* note 22, at 1040–41.

²⁰⁷ See WINGFIELD, *supra* note 48, at 41 (noting that the pivotal focal point in any self-defense debate is the meaning of an armed attack, since that will determine the time that an armed attack occurs and when self-defense may be invoked); Jensen, *supra* note 5, at 219–20.

²⁰⁸ See *infra* Part VI.A (addressing the question of whether a cyberattack constitutes an armed attack).

and CIL.²⁰⁹ Some commentators place heavier emphasis on the U.N. Charter, arguing that Article 51 limits self-defense to responses against actual armed attacks.²¹⁰ Others place more emphasis on CIL, arguing for a broader interpretation of armed attacks that includes imminent armed attacks.²¹¹ Imminent armed attacks are addressed in Part IV, Section D. For now, it is worth noting that while there are different theories about the definition of an armed attack, once a state is targeted with an armed attack, the state and its allies are legally authorized to use force against the aggressor.

Self-defense responses must comply with international law. Just because an armed attack has occurred against a victim-state does not mean that the victim-state has a blank check to wage unlimited war against an aggressor.²¹² Self-defense must comply with two principles of CIL—necessity and proportionality.²¹³ Necessity means that self-defense is actually required under the circumstances because a reasonable settlement could not be attained through peaceful means.²¹⁴ Therefore, a state that is subject to an all-out invasion will no doubt be required to use force to overcome the aggressor, whereas a state that is subject to an isolated border skirmish might not need to use force to protect itself.²¹⁵ Proportionality requires self-defense actions to be limited to the amount of force necessary to defeat an ongoing attack or to deter future

²⁰⁹ See WINGFIELD, *supra* note 48, at 46–47 (noting the different opinions legal scholars have on the interplay between Article 51 and CIL regarding anticipatory self-defense); Murphy, *supra* note 49, at 705 (noting the lack of consensus on the legality of anticipatory self-defense due to competing views on the interplay between the U.N. Charter and CIL).

²¹⁰ See Jensen, *supra* note 5, at 219–20; Barkham, *supra* note 29, at 74; Murphy, *supra* note 49, at 706–11 (discussing the strict-constructionist school of thought on the U.N. Charter and armed attacks, which holds that Article 51 of the U.N. Charter consumes all previous CIL relating to self-defense).

²¹¹ See Jensen, *supra* note 5, at 221–26; Barkham, *supra* note 29, at 74–75; Murphy, *supra* note 49, at 706–11 (discussing the imminent threat and qualitative threat schools of thought on CIL and armed attacks, which hold that the right of self-defense under CIL still exists independent of Article 51 of the U.N. Charter).

²¹² See DINSTEIN, *supra* note 184, at 235–37.

²¹³ WINGFIELD, *supra* note 48, at 41–44. *But see* DINSTEIN, *supra* note 184, at 237, 242–43 (noting that self-defense must comply with three principles of CIL—necessity, proportionality and immediacy; under this analysis, immediacy means that self-defense measures cannot be delayed indefinitely and must be taken in a reasonable amount of time after an armed attack). The principle of immediacy originated in relation to anticipatory self-defense, and, for the most part, is accepted as a third principle which only applies to anticipatory self-defense. *See infra* Part IV.D.

²¹⁴ DINSTEIN, *supra* note 184, at 237.

²¹⁵ *Id.*

aggression.²¹⁶ This principle does not require the size and scope of defensive actions to be similar to those of the attack. A defensive action may need to employ significantly greater force than the attacker used to successfully repel the attacker.²¹⁷ The key is to determine the amount of force needed to either defeat the current attack or to deter future attacks. For instance, after an all-out invasion a proportionate response might entail a full-scale war to defeat the aggressor's military, including the use of nuclear weapons.²¹⁸ On the other hand, a proportionate response to an isolated missile strike might be to strike the launching facility for that missile.²¹⁹ These principles define the scope of self-defense responses and explain the reasons behind self-defense requirements.

D. Anticipatory Self-Defense

Anticipatory self-defense is a subset of self-defense.²²⁰ Its basis is that "aggression often begins without shots being fired or borders being crossed."²²¹ Sometimes states will obtain information that reveals that an armed attack is about to be launched against them. Although the attack has not yet occurred, "States can rightfully defend themselves against such violence."²²²

The crux of the issue, therefore, is not who fired the first shot but who embarked upon an apparently irreversible course of action, thereby crossing the legal Rubicon. The casting of the die, rather than the actual opening of fire, is what starts the armed attack. It would be absurd to require that the defending State should sustain and absorb a devastating (perhaps a fatal) blow,

²¹⁶ See Schmitt, *supra* note 57, at 532.

²¹⁷ See *id.*

²¹⁸ See DINSTEIN, *supra* note 184, at 237–42.

²¹⁹ See WINGFIELD, *supra* note 48, at 48.

²²⁰ MICHAEL WALZER, *JUST AND UNJUST WARS* 74 (1977); see also Murphy, *supra* note 49, at 706–11 (noting students of the imminent threat and qualitative threat schools of thought on CIL treat imminent armed attacks as armed attacks for purposes of self-defense). *But see* Murphy, *supra* note 49, at 706–11 (noting some legal scholars strictly construe the U.N. Charter to authorize self-defense only in response to actual armed attacks).

²²¹ *Id.*

²²² *Id.*

only to prove the immaculate conception of self-defence [sic].²²³

Anticipatory self-defense is a long-standing tenet of CIL, dating back to the 1836 *Caroline* case.²²⁴ In *Caroline*, the United Kingdom and the United States agreed that self-defense was lawful in advance of an armed attack, when “the necessity of that self-defense is instant, overwhelming and leaving no choice of means, and no moment for deliberation.”²²⁵ As discussed in Part IV, Section C, anticipatory self-defense is not a universally accepted principle among legal scholars;²²⁶ however, despite ongoing debate, stronger arguments exist in support of anticipatory self-defense as a fundamental axiom of international law.²²⁷ The real question is, when can states act in anticipatory self-defense?

²²³ DINSTEIN, *supra* note 184, at 191. Dinstein calls this interceptive self-defense, arguing that armed attacks should be more broadly construed than invasive force across national borders; however, his justification for interceptive self-defense is the same justification for anticipatory self-defense. The only real distinction between the Dinstein and other legal scholars is the timing of anticipatory self-defense, which shall be addressed in this section. Barkham, *supra* note 29, at 76–77.

²²⁴ See Barkham, *supra* note 29, at 75; Murphy, *supra* note 49, at 705.

²²⁵ WINGFIELD, *supra* note 48, at 47 (quoting THE CHARTER OF THE UNITED NATIONS: A COMMENTARY 675 (Bruno Simma ed. 1994) (quoting then Secretary of State Daniel Webster)).

²²⁶ See *supra* Part IV.C.

²²⁷ Since anticipatory self-defense was a long-standing tenet of international law prior to the U.N. Charter, it is important to note that the English language version of the U.N. Charter states that it does nothing to impair states’ inherent right of self-defense. Furthermore and even more persuasively, the French language version of the Charter, which is equally as authoritative as the English version, preserves the inherent right of nations to act in self-defense in situations where *the member-state is the object of an armed aggression*. Since “armed aggression” is less restrictive than “armed attack,” the choice to use “armed aggression” in the French version supports the view that the drafters intended to preserve the right of self-defense as it existed prior to the Charter. See Murphy, *supra* note 49, at 706–15.

Since the ratification of the U.N. Charter, states have continued to rely on anticipatory self-defense as a justification for war, showing that international custom also supports the continuing right of states to act in anticipatory self-defense. See Murphy, *supra* note 49, at 713; Thomas Franck, *When, If Ever, May States Deploy Military Force Without Prior Security Council Authorization?*, 5 WASH. U. J.L. & POL’Y 51, 59 (2001).

Further supporting anticipatory self-defense as a maxim of international law, the ICJ has found that self-defense was not subsumed by the U.N. Charter. See *Military and Paramilitary Activities in and against Nicaragua (Nicar. v. U.S.)*, 1986 I.C.J. 14, 110 (June 27); see also DINSTEIN, *supra* note 184, at 181 (citing the ICJ’s opinion in *Nicaragua*); Jensen, *supra* note 5, at 221 (citing the ICJ’s opinion in *Nicaragua*).

Finally, respected legal scholars also believe that anticipatory self-defense continues to be a maxim of international law. See WALZER, *supra* note 220, at 82–85; DINSTEIN, *supra* note 184, at 191 (rejecting the doctrine of anticipatory self-defense, but recognizing

The legality of anticipatory self-defense actions depends on the imminency of an attack.²²⁸ Imminency, sometimes called immediacy and sometimes referred to as the third principle of self-defense, supplements the traditional self-defense principles of necessity and proportionality of anticipatory self-defense.²²⁹ Generally speaking, imminency allows a state to use force against an identified aggressor, in advance of an armed attack, to repel the attack before it is launched.²³⁰ Initially, the concept of imminency restricted anticipatory self-defense to situations immediately before an attack, where an attack was detected, but there was no time to deliberate about other means of preventing the attack short of forceful self-defense.²³¹ The principle effectively balanced the victim-state's right to ward off violence against its international obligation to find peaceful means to resolve disputes.²³² However, due to changes in the nature of warfare, imminency has evolved significantly.²³³

Today, imminency allows states to legally employ force in advance of an attack, at the point when (1) evidence shows that an aggressor has committed itself to an armed attack and (2) delaying a response hinders the defender's ability to mount a meaningful defense.²³⁴ Thus, imminency is actually a relative concept,²³⁵ which operates as follows:

Weak States may lawfully act sooner than strong ones in the face of identical threats because they are at greater risk as time passes. In the same vein, it may be necessary to conduct defensive operations against a terrorist group long before a planned attack because there is unlikely to be another opportunity to target terrorists before they strike. . . . In other words, each

the right of interceptive self-defense before an attack occurs); WINGFIELD, *supra* note 48, at 47, 94; Schmitt, *supra* note 57, at 528–36.

²²⁸ See Schmitt, *supra* note 57, at 528–36.

²²⁹ See *id.* at 533.

²³⁰ See *id.* at 533–34.

²³¹ See *id.* (recalling the standards set forth in the *Caroline* case).

²³² See *id.* at 534.

²³³ See *id.* (noting that it has become accepted to invoke anticipatory self-defense earlier and earlier, in advance of an attack, as the consequences of a single attack become more severe (in the case of chemical, biological or nuclear weapons) and as intelligence gathering tools become more advanced (satellite imagery, intercepted electronic communications and other state-of-the-art surveillance techniques)).

²³⁴ See *id.* at 534–35.

²³⁵ See *id.* at 534.

situation presents a case-specific window of opportunity within which a State can foil an impending attack.²³⁶

Finally, just because a single attack may be complete does not mean that future attacks are not imminent. When evidence suggests that an attack is part of an ongoing campaign against a state, such as the terrorist attacks against the United States on 9/11, future armed attacks will be considered imminent and anticipatory self-defense will be authorized.²³⁷ Some scholars support the same conclusion but disagree with the legal rationale behind it, claiming that a proportional response in self-defense to a single armed attack can be far-reaching to deter future attacks, and that anticipatory self-defense is the wrong lens through which to view the response to an ongoing campaign.²³⁸

E. Proportionate Countermeasures/Reprisals

Proportionate countermeasures, also known as reprisals, provide another way for states to address illegal uses of force against them.²³⁹ As discussed in Part IV, Section C, no consensus exists as to what constitutes an armed attack, meaning that a cyberattack could be seen as a use of force below the armed attack threshold.²⁴⁰ As a result, it is important to explore the rights that states have to react to illegal uses of force against them which fall short of an armed attack.

Proportionate countermeasures are an exception to the general rule that states are required to solve their disputes peacefully.²⁴¹ “A reprisal ‘is an act which is unlawful *per se*, unless it can be justified as a countermeasure triggered by an unlawful act and is designed to induce the offending state to return to full compliance with the law.’”²⁴² Should a state decide to use proportionate countermeasures, it must comply with

²³⁶ *Id.*

²³⁷ *See id.* at 535–36.

²³⁸ *See* Murphy, *supra* note 49, at 734–36 (arguing that self-defense allowed the United States to conduct a far reaching campaign against al Qaeda in response to the 9/11 attacks on the grounds of self-defense, not anticipatory self-defense).

²³⁹ *See* WINGFIELD, *supra* note 48, at 85; Jensen, *supra* note 5, at 220.

²⁴⁰ *See supra* Part IV.C.

²⁴¹ *See* WINGFIELD, *supra* note 48, at 84–85.

²⁴² *See id.* at 85 (quoting THE CHARTER OF THE UNITED NATIONS: A COMMENTARY 101 (Bruno Simma ed. 1994)).

the three criteria enumerated by the International Court of Justice (ICJ) in *Gabcikovo-Nagymaros Project*.²⁴³ These criteria are:

In the first place [countermeasures] must be taken in response to a previous international wrongful act of another State and must be directed against that State. . . . Secondly, the injured State must have called upon the State committing the wrongful act to discontinue its wrongful conduct or to make reparation for it. . . . [Third] the effects of a countermeasure must be commensurate with the injury suffered, taking account of the rights in question.²⁴⁴

Reprisals may be carried out in various ways. Economic and political coercion are the two main forms of reprisals; however, reprisals could also include the use of limited cyberattacks against an aggressor.²⁴⁵ Reprisals may not involve the use of force contrary to Article 2(4) of the U.N. Charter;²⁴⁶ however, the consensus among international scholars is that this prohibition really only amounts to a prohibition against armed force.²⁴⁷ While this article contends that states should treat certain cyberattacks as armed attacks, and deal with them using self-defense and anticipatory self-defense legal principles, reprisals provide an important alternate theory for dealing with cyberattacks to those who contend that cyberattacks fall short of the armed attack threshold.²⁴⁸

The general framework of *jus ad bellum* discussed so far has primarily evolved in response to state-on-state attacks. When attacks are carried out by non-state actors across state borders, it complicates the framework governing state responses to the attacks. Since most cyberattacks are carried out by non-state actors, this article will explore *jus ad bellum* in greater depth and explain the intricacies of state responses to attacks by non-state actors.

²⁴³ *Gabcikovo-Nagymaros Project* (Hung. v. Slov.), 1997 I.C.J. 7, 55–56 (Sept. 25) (Merits).

²⁴⁴ *Id.*

²⁴⁵ See WINGFIELD, *supra* note 48, at 84–92.

²⁴⁶ See *id.* at 85.

²⁴⁷ See *id.* at 87 (quoting THE CHARTER OF THE UNITED NATIONS: A COMMENTARY 112 (Bruno Simma ed. 1994)).

²⁴⁸ See *infra* Part VI.A (discussing cyberattacks as armed attacks).

V. Non-State Actors and *Jus ad Bellum*

International cyberattacks by non-state actors complicate the general framework of *jus ad bellum*. Since the prevailing view of international law requires states to attribute an attack to a state or its agents before responding with force,²⁴⁹ states feel obligated to undertake lengthy, time-consuming investigations before responding to cyberattacks, thereby increasing the risks that the cyberattack poses.²⁵⁰ This creates a dilemma for states. While states can trace an attack back to a server in another state, identifying who is at the other end of the electronic connection directing the attack takes more time than states have to decide how to respond to the attack. Thus, the prevailing view of the law forces states into a response crisis during an international cyberattack.²⁵¹

Unfortunately, a lack of state cooperation has exacerbated the response crisis.²⁵² In an ideal world, states would not commit cyberattacks and would assist victim-states in tracking down attackers. Under this utopian paradigm, states could contentedly rely on passive defenses, knowing that attackers who breached their defenses would be hunted down and punished. Unfortunately, this is not the reality, and states are left in limbo during an attack. Yet even if a cyberattack were attributable to a non-state actor, and states wanted to respond with force, they are bound not to intervene in the domestic affairs of other states.²⁵³ Not surprisingly, despite a lack of state cooperation, states attempt to respond via criminal laws, rather than risk unlawfully violating the sovereignty of another state.²⁵⁴

There is, however, a way to avoid the attribution problem and response crisis. When a victim-state can lawfully impute a cyberattack to its state of origin, it can immediately respond with force under the law of war, regardless of whether the attack was conducted by the state itself or by non-state actors within it.²⁵⁵ Thus, imputing state responsibility creates a legal path for states to respond to cyberattacks with active defenses in a timely and effective manner. Given the technological and

²⁴⁹ See Condrón, *supra* note 24, at 415; DINSTEIN, *supra* note 184, at 111.

²⁵⁰ See Condrón, *supra* note 24, at 407–08.

²⁵¹ See *supra* Part II.A (discussing the response crisis).

²⁵² See *id.* (discussing the lack of state cooperation in tracking down attackers).

²⁵³ Hollis, *supra* note 22, at 1049–50. To do so would be a violation of the sovereignty of the other state, and would be in violation of CIL. *Id.*

²⁵⁴ See *supra* Part II.A.

²⁵⁵ See *infra* Part VI.B–C.

diplomatic limitations to timely attack attribution,²⁵⁶ it is crucial for legal scholars to reexamine the legal regime governing state responses to cyberattacks committed by non-state actors through the lens of imputed responsibility.

The legal analysis for determining whether cyberattacks can be imputed to their state of origin starts with the underlying law behind armed attacks by non-state actors. From there, the analysis continues with the duties states have to one another concerning non-state actors within their territory, then moves on to the ways to impute state responsibility for acts by non-state actors, and ends with the legality of certain cross-border operations against other states.

A. Armed Attacks by Non-State Actors

Non-state actors can and have committed armed attacks against states.²⁵⁷ Most legal scholars believe these attacks fall under the law of war.²⁵⁸ This opinion enjoys broad support from all four sources of international law: international conventions, international custom (as evidence of a general principle accepted as law), the general principles of law recognized by civilized nations, and the judicial decisions and teachings of the most highly qualified international legal scholars (as a means for determining the rules of law).²⁵⁹ However, since this opinion is not universally held,²⁶⁰ it is worth discussing at some length.

Of the four sources of international law, international treaties lend the least support for the proposition that non-state actors may commit an armed attack. Their support is, at best, indirect, based on their silence on

²⁵⁶ See *supra* Part II.A (discussing the attribution problem).

²⁵⁷ See DINSTEIN, *supra* note 184, at 187, 204; WALZER, *supra* note 220, at 197–206 (discussing various terrorist campaigns); Schmitt, *supra* note 57, at 536–40 (discussing the Sept. 11, 2001 terrorist attacks by al Qaeda).

²⁵⁸ See DINSTEIN, *supra* note 184, at 204–08; Michael Schmitt, *Counter-Terrorism and the Use of Force in International Law*, in INTERNATIONAL LAW AND THE WAR ON TERROR 7, 33–47 (Fred L. Borch & Paul S. Wilson eds., Naval War College 2003); Schmitt, *supra* note 57, at 536–40; Rein Mullerson, *Jus Ad Bellum and International Terrorism*, in INTERNATIONAL LAW AND THE WAR ON TERROR 75, 106–11 (Fred L. Borch & Paul S. Wilson eds., Naval War College 2003).

²⁵⁹ See WINGFIELD, *supra* note 48, at 72 (quoting Statute of the International Court of Justice art. 38(1), June 26, 1945, 59 Stat. 1055, 1060 (1945)).

²⁶⁰ Some scholars argue that the law of war only governs attacks by states. Schmitt, *supra* note 57, at 536.

the subject. This silence allows states to infer support because no treaty has ever prohibited states from treating attacks by non-state actors as acts of war, despite the opportunity to do so. As noted earlier, modern *jus ad bellum* analysis starts with the U.N. Charter.²⁶¹ However, the Charter was written to govern armed conflict between states.²⁶² As a result, the Charter is silent about armed attacks by non-state actors.²⁶³ While it appears that the minimalist language of Article 51 allows a state to respond in self-defense to armed attacks against it,²⁶⁴ the lack of any specific language on point forces us to look to the other three sources of international law to determine the controlling standards for armed attacks by non-state actors.

Although the issue of non-state actors was not originally envisioned in the drafting of the U.N. Charter, analysis of CIL reveals that “[i]t is incontrovertible that states now treat the law of self-defense as applicable to acts by non-state actors.”²⁶⁵ The international community’s response to the terrorist attacks of September 11, 2001 (9/11) crystallized the validity of this principle.²⁶⁶ Following the 9/11 attacks, the U.N. Security Council passed Resolution 1368, characterizing the attacks as a threat to international peace and security under Article 39 of the Charter and reaffirming the United States’ inherent right to engage in either individual or collective self-defense in accordance with Article 51 of the

²⁶¹ See *supra* Part IV, intro.

²⁶² See U.N. Charter art. 1 (stating that its purpose is to maintain international peace and security through the regulation of state action); Schmitt, *supra* note 57, at 536 (noting that the U.N. Charter was drafted to regulate state-on-state armed conflicts); Mullerson, *supra* note 258, at 112 (stating that there is little doubt that the drafters of the Charter had not contemplated armed attacks by non-state actors).

²⁶³ See generally U.N. Charter (making no mention of non-state actors anywhere in the Charter).

²⁶⁴ *Id.* art. 51; DINSTEIN, *supra* note 184, at 204 (noting that Article 51 regulates state responses to armed attacks, but never specifies the character of the perpetrator of the attacks, therefore implying that self-defense could be invoked against states or non-state actors); Schmitt, *supra* note 258, at 33–34 (noting that Chapter VII of the Charter, which includes both Articles 39 and 51, dictates what states may do in the face of threats to international peace and security and acts of aggression, without ever stating what those might be). *But see* Schmitt, *supra* note 57, at 536 (noting a number of commentators assert that because the U.N. Charter does not specifically address armed attacks by non-state actors, those attacks therefore fall outside the scope of the law of war and should, instead, be governed by international and domestic criminal laws).

²⁶⁵ Schmitt, *supra* note 57, at 539.

²⁶⁶ See DINSTEIN, *supra* note 184, at 207–08; Schmitt, *supra* note 258, at 7–47; Schmitt, *supra* note 57, at 536–40; Mullerson, *supra* note 258, at 84, 106–19.

Charter.²⁶⁷ Two weeks after the attacks, when it appeared clear that al Qaeda was behind the attacks, the Security Council passed Resolution 1373, once again affirming the United States' inherent right of self-defense in response to the attacks.²⁶⁸ These Security Council declarations are particularly significant because the 9/11 attacks could have been dealt with under Article 42 of the Charter, but instead were dealt with under Article 51, even though the attacks were committed by non-state actors.²⁶⁹ The North Atlantic Treaty Organization, the Organization of American States, and Australia all made similar declarations, invoking the collective self-defense provisions of their mutual defense treaties, to assist the United States in its response to the 9/11 attacks.²⁷⁰ The statements and actions of scores of other states, including major states such as Russia, China, India, Japan, South Korea, Pakistan, Saudi Arabia, and Egypt, lend support to the principle that attacks by non-state actors fall under the law of war.²⁷¹ Finally, this principle was supported by the ICJ in its 2004 Advisory Opinion in *Legal Consequences of the Construction of a Wall in the Occupied Palestinian Territory*,²⁷² as well as from the publications of legal scholars.²⁷³

²⁶⁷ See Schmitt, *supra* note 57, at 536–37 (noting that at the time Resolution 1368 was passed, no one believed that a state was behind the attacks, yet the attacks were found to be a threat to international peace and security under Article 39).

²⁶⁸ See *id.* at 537.

²⁶⁹ See Schmitt, *supra* note 258, at 16. Had the Security Council wanted to deal with the 9/11 attacks under Article 42 of the U.N. Charter, it could have authorized the United States, a coalition of forces, or a regional organization to use force pursuant to it, “as the Council is entitled to do in the face of a ‘threat to the peace, breach of peace or act of aggression.’” *Id.* (quoting Article 42 of the U.N. Charter).

²⁷⁰ The NATO unanimously invoked Article 5 of the Washington Treaty, based on Article 51 of the U.N. Charter, which provides for collective self-defense in response to armed attacks against a member-state. The Organization of American States invoked the collective self-defense provision of the Rio Treaty. Australia invoked Article IV of the ANZUS Treaty. See *id.* at 16–18.

²⁷¹ See Schmitt, *supra* note 258, at 18; Schmitt, *supra* note 57, at 538–39.

²⁷² See DINSTEIN, *supra* note 184, at 204 (referencing the Separate Opinions of Judge Higgins and Judge Kooijmans, as well as the Declaration of Judge Buergenthal, in *Legal Consequences of the Construction of a Wall in the Occupied Palestinian Territory*, 2004, 43 I.L.M. 1009, 1063, 1072, 1079 (2004)). While the ICJ held that Israel could not respond in self-defense to terrorist attacks from non-state actors in this case, the court explicitly stated this was because Israel never asserted the acts were imputable to a state. *Legal Consequences of the Construction of a Wall in the Occupied Palestinian Territory*, 2004, 43 I.L.M. 1009, 1050 (2004). Thus, the case shows that attacks by non-state actors fall under the law of war, but that the law of war only permits states to respond in self-defense when the actions of the non-state actors are imputable to a state, which was not the case here.

²⁷³ See DINSTEIN, *supra* note 184, at 204–08; Schmitt, *supra* note 258, at 33–47; Schmitt, *supra* note 57, at 536–40; Mullerson, *supra* note 258, at 106–11.

While attacks by non-state actors fall under the law of war, the law of war only allows states to forcibly respond to these attacks when the attacks are imputable to a state,²⁷⁴ meaning the state also bears some responsibility for the actions of the non-state actors. The next step of the analysis toward imputing state responsibility for these attacks is, therefore, to examine the duties that states have concerning non-state actors within their territory.

B. Duties Between States

“It is a long established principle of international law that ‘a state is bound to use due diligence to prevent the commission within its dominions of criminal acts against another nation or its people.’”²⁷⁵ This principle is reflected in numerous state declarations, judicial opinions, and publications from leading scholars.²⁷⁶ State declarations that support this principle include the following: the 1970 Declaration on Friendly Relations, which urges states to “refrain from . . . acquiescing [to] organized activities within [their] territory directed towards the commission of [civil strife or terrorism in another State];”²⁷⁷ the 1994 Declaration on Measures to Eliminate Terrorism;²⁷⁸ and the 1996 Declaration on the Strengthening of International Security, which stated that states “must refrain from organizing, instigating, assisting or participating in terrorist acts in territories of other states, or from acquiescing in or encouraging activities within their territories directed towards the commission of such acts.”²⁷⁹ International case law also

²⁷⁴ See *supra* note 272 and accompanying text; *infra* Part V.C–D.

²⁷⁵ Schmitt, *supra* note 57, at 540–41 (quoting John Bassett Moore in *S.S. Lotus* (Fr. v. Turk.) 1927 P.C.I.J. (ser. A) No. 10, at 4, 88 (Moore, J., dissenting)).

²⁷⁶ See DINSTEIN, *supra* note 184, at 205–06; Schmitt, *supra* note 258, at 39–40, 48; Schmitt, *supra* note 57, at 541.

²⁷⁷ Declaration on Principles of International Law Concerning Friendly Relations and Cooperation Among states in Accordance with the Charter of the United Nations, G.A. Res. 2625, ¶ 1, U.N. GAOR, 25th Sess., Annex, Agenda Item 85, U.N. Doc. A/Res/2625 (Oct. 24, 1970); see also Vincent-Joel Proulx, *Babysitting Terrorists: Should States Be Strictly Liable for Failing to Prevent Transborder Attacks?*, 23 BERKELEY J. INT’L L. 615, 629 (2005); Schmitt, *supra* note 258, at 39–40 (quoting the 1970 Declaration on Friendly Relations).

²⁷⁸ Schmitt, *supra* note 258, at 40 (citing the 1994 Declaration on Measures to Eliminate International Terrorism, G.A. Res. 49/60, U.N. GAOR 6th Comm., 49th Sess., 84th plen. mtg., Annex, U.N. Doc. A/49/743 (1994)).

²⁷⁹ *Id.* at 48 (quoting Declaration to Supplement the 1994 Declaration on Measures to Eliminate International Terrorism, G.A. Res. 51/210, U.N. GAOR 6th Comm., 51st Sess., 88th plen. mtg., Annex, U.N. Doc. A/51/631 (1996)).

supports this principle. In *Corfu Channel*, “the International Court of Justice pronounced that every state is under an obligation ‘not to allow knowingly its territory to be used for acts contrary to the rights of other States.’”²⁸⁰ In *Tehran*, the ICJ re-affirmed that States “are required under international law to take appropriate acts in order to protect the interests” of other states from non-state actors within their borders.²⁸¹ Finally, scholars have noted this principle “is so widely recognized that it should not fuel a debate.”²⁸²

In short, it is clear from state practice and *opinio juris* that states have an affirmative duty to prevent non-state actors within their borders from committing armed attacks on other states.²⁸³ Toleration of such attacks constitutes a crime under international law.²⁸⁴ Thus, “a host-State that has the capability to prevent [an armed attack by non-state actors] but fails to do so will inherently fail to fulfill its duty” under international law.²⁸⁵ However, it is not realistic to expect states to completely prevent armed attacks by non-state actors from ever occurring.²⁸⁶ As a result, the dispositive factor in evaluating whether states live up to their duty “will lie, rather, in the conduct of the host-state itself in addressing the potential threat and in attaining a realistic result in light of the factual circumstances.”²⁸⁷

²⁸⁰ DINSTEIN, *supra* note 184, at 205–06 (quoting *Corfu Channel* case (Merits), 1949 I.C.J. Rep. 4, 22 (Apr. 9)); *see also* Schmitt, *supra* note 258, at 49.

²⁸¹ DINSTEIN, *supra* note 184, at 206 (citing Case Concerning United States Diplomatic and Consular Staff in Tehran, 1980 I.C.J. Rep. 3, 32–33, 44 (May 24)).

²⁸² Proulx, *supra* note 277, at 629–60; *see also* DINSTEIN, *supra* note 184, at 205–06 (noting further support from Ian Brownlie); Proulx, *supra* note 277, at 659–66 (noting further support from Davis Brown, Lee Feinstein, Matthew Lippman and Anne-Marie Slaughter); Schmitt, *supra* note 258, at 39–40, 48; Schmitt, *supra* note 57, at 540–41.

²⁸³ *See* Proulx, *supra* note 277, at 660 (referencing this duty in regard to terrorism). State practice and *opinio juris* are the two elements that the international legal community recognizes as the basis for CIL. Jeremy Marsh, *Lex Lata or Lex Ferenda? Rule 45 of the ICRC Study on Customary International Humanitarian Law*, 198 MIL. L. REV. 116, 121 (2008). State practices, state declarations, and U.N. General Assembly declarations and resolutions are all forms of state practice. RESTATEMENT (THIRD) OF THE FOREIGN RELATIONS LAW OF THE UNITED STATES § 102 (1987) [hereinafter RESTATEMENT]. Furthermore, these declarations and resolutions serve as evidence of *opinio juris*. *Id.* § 103.

²⁸⁴ *See* DINSTEIN, *supra* note 184, at 207.

²⁸⁵ Proulx, *supra* note 277, at 660 (discussing host-states’ duty to stop acts of terrorism against other states when those attacks originate from within their borders).

²⁸⁶ *See id.* at 662.

²⁸⁷ *Id.*

In and of itself, the duty to prevent attacks does not make states responsible for every cross-border attack by non-state actors that emanates from their territory. However, it does bridge the gap between the actions of non-state actors and state responsibility for those acts. The next section completes the analysis of imputing state responsibility for the cross-border attacks of non-state actors.

C. Imputing State Responsibility for Acts by Non-State Actors

The question of a state's legal responsibility for the acts of non-state actors has evolved significantly during the past thirty-seven years.²⁸⁸ Before 1972, states were generally not viewed as legally responsible for the acts of private or non-state actors.²⁸⁹ Only the actions of the host-state's organs were imputable to it, and state responsibility arose only from acts by qualifying "agents" of the state.²⁹⁰ Qualified agents amounted to actors over whom a state exercised direct authority, and whom the state directed to conduct the acts.²⁹¹ As time passed, international law shifted away from a direct control approach and moved toward an indirect responsibility approach regarding the acts of non-state actors.²⁹² This shift began with the International Tribunal for the former Yugoslavia's (ICTY) seminal opinion on state responsibility, in which it revised the effective control test to impute host-state responsibility for the actions of groups of non-state actors over whom a state had "overall control."²⁹³ While overall control is still a form of direct control, the

²⁸⁸ See *id.* at 616–19.

²⁸⁹ See *id.* at 619.

²⁹⁰ See *id.* at 619–20.

²⁹¹ See *id.* at 620–21. The standard for assessing state responsibility under this paradigm was the "effective control test," which was first espoused by the ICJ in *Nicaragua*. In *Nicaragua*, the United States financed, organized, trained, supplied, and equipped contra rebels who were fighting against the government of Nicaragua. Yet despite the contras' dependence on the United States, the ICJ refused to hold the United States legally liable for the contras' actions. The court took the view that while the United States provided decisive support to the contras, a state was not legally responsible for the actions of non-state actors unless the state "had effective control of the military or paramilitary operations in the course of which the alleged violations were committed." *Id.* at 620–21 (quoting the *Nicaragua* case). But see Mark Baker, *Terrorism and the Inherent Right of Self-Defense*, 10 HOUS. J. INT'L L. 25, 41 (1987) (raising the question that state responsibility might arise from the mere toleration of terrorist groups within a host-state's borders, without providing any active support).

²⁹² See Proulx, *supra* note 277, at 621–23.

²⁹³ See *id.* (referring to the *Tadic* case, Prosecutor v. Tadic, Case No. IT-94-1-A, I.C.T.Y. App. Ch., at 49 (July 15, 1999), in which the court held that states were responsible for

opinion marked a significant relaxation of the standard for state responsibility.²⁹⁴ The shift to indirect responsibility continued through the middle of 2001, with a general consensus emerging that any breach of a host-state's international obligations to other nations, whether from treaty law or customary law, resulted in international responsibility for the host-state.²⁹⁵ These breaches can result from a state's acts or its failure to act.²⁹⁶ This consensus solidified following the 9/11 terrorist

the acts of militarized groups when the state coordinated or helped in the general planning of the group's military activity). This shift was not without precedent. In 1923, several members of an international commission, who were overseeing the delimitation of the Greek-Albanian border, were assassinated in Greek territory. The League of Nations organized a special committee to address the legal questions involved. While the committee found that the evidence did not support Greek responsibility, "it opined that a host-state could be held responsible in like circumstances if it 'neglected to take all reasonable measures for the prevention of the crime and pursuit, arrest and bringing to justice of the criminal.'" *Id.* at 627 (quoting the *Tellini* case, 4 League of Nations O.J. 524 (1924)).

While not yet culminating in a shift in international law, further precedent for the shift to indirect state responsibility comes from the *Tehran* case. In 1979, Iranian student militants took over the U.S. embassy and consulates in Iran. The ICJ found no evidence that the militants were operating on the direct behest of the Iranian State, and therefore found that the attacks could not be attributed to the State. However, the court laid some blame on Iran, finding that Iran had not lived up to its international obligation to protect the victims of the attack. It justified this position on the grounds that Iran bore indirect responsibility for its failure "to take any 'appropriate steps' . . . either to prevent this attack or to stop it before it reached its completion.'" *Id.* at 628 (quoting from the *Tehran* case, *Tehran Hostages Case (U.S. v. Iran)*, 1980 I.C.J. 64 (May 24)).

Lastly, the trend towards indirect responsibility was evident in several cases before the Security Council in the 1990s. In these cases concerning international terrorism, the Security Council recognized the rights of injured states to pursue terrorists into other states to eliminate their bases of operation. Examples of such were in 1995 and 1996 when Turkey pursued Kurdish irregulars on Iraqi soil; in 1992 and 1995 when Senegal entered Guinea-Bissau to strike at safe havens used by opposition forces; and in 1998 when the United States bombed parts of Afghanistan following terrorist attacks on U.S. embassies in Tanzania and Kenya. *See id.* at 630–31.

²⁹⁴ *See id.* at 621.

²⁹⁵ *See id.* at 622–23 (referencing the International Law Commission's adoption of the 2001 Draft Articles on the Responsibility of States for Internationally Wrongful Acts, U.N. Doc. A/CN.4/L.602/Rev. 1 (2001)). After the International Law Commission approved the Draft Articles, the U.N. General Assembly took note of them and commended them to state governments on two different occasions; first in 2001 and next in 2004. *See* G.A. Res. 56/83, U.N. Doc. A/RES/56/83 (Jan. 28, 2002); G.A. Res. 59/35, U.N. Doc. A/RES/59/35 (Dec. 16, 2004).

²⁹⁶ *See* Proulx, *supra* note 277, at 626 (referencing Article 2 of the 2001 Draft Articles of the Responsibility of States for Internationally Wrongful Acts).

attacks on the United States, bringing us to today's framework for state responsibility.²⁹⁷

September 11, 2001 marked the culmination of the shift of state responsibility from the paradigm of direct control to indirect responsibility.²⁹⁸ On that date, al Qaeda terrorists hijacked four airplanes, flew three of them into buildings in the United States, and killed more than three thousand U.S. citizens in what was widely recognized as an armed attack.²⁹⁹ Al Qaeda was based in Afghanistan, which at the time was ruled by the Taliban.³⁰⁰ While the Taliban harbored al Qaeda and occasionally provided it limited logistical support, the Taliban did not exercise effective or even overall control over al Qaeda.³⁰¹ Further distancing the Taliban from 9/11 is the lack of evidence suggesting that the Taliban knew of the 9/11 attacks beforehand, or even endorsed them after the fact.³⁰² Yet despite all of this, it was internationally accepted that al Qaeda's acts were legally imputable to the Taliban, and thus to Afghanistan, because it had harbored and sheltered al Qaeda, and refused to stop doing so, even after being warned to stop.³⁰³

Thus, following 9/11, state responsibility may be implied based on a state's failure to fulfill its international duty to prevent non-state actors from using its territory to attack other states.³⁰⁴ The contemporary doctrine of state responsibility does not require a causal link between a wrongdoer and a host-state; rather, it focuses on the state's duty to prevent attacks from its territory into that of another.³⁰⁵ "Hence, a state's passiveness or indifference toward [a non-state actor's] agendas within its own territory might trigger its responsibility, possibly on the same scale as though it had actively participated in the planning."³⁰⁶ Much of the legal analysis of whether a state is responsible will "turn[] on an *ex-*

²⁹⁷ See generally *id.* at 618–19, 625–43 (explaining the shift from direct responsibility to indirect responsibility for the acts of non-state actors and the state of the law post-9/11).

²⁹⁸ See *id.* at 634–52.

²⁹⁹ Schmitt, *supra* note 258, at 33.

³⁰⁰ See Proulx, *supra* note 277, at 634–37.

³⁰¹ See *id.* at 635–36.

³⁰² See *id.* at 636.

³⁰³ See *id.* at 637–41.

³⁰⁴ See TAL BECKER, TERRORISM AND THE STATE: RETHINKING THE RULES OF STATE RESPONSIBILITY 3 (2006); 2001 Draft Articles on the Responsibility of States for Internationally Wrongful Acts, U.N. Doc. A/CN.4/L.602/ Rev. 1 (2001).

³⁰⁵ See BECKER, *supra* note 304, at 3; Proulx, *supra* note 277, at 633.

³⁰⁶ Proulx, *supra* note 277, at 624.

post facto analysis of whether the state could have put more effort into preventing the . . . attack.”³⁰⁷

However, even when state responsibility is imputed for the armed attacks of non-state actors, states may still be forbidden from responding with force. The final step in the legal analysis for determining when victim-states can forcibly respond to the armed attacks of non-state actors ends with an examination of the legality of cross-border operations against other states.

D. Cross-Border Operations

Cross-border operations into the territory of an offending state are the natural consequence of imputed state responsibility for the armed attacks of non-state actors.³⁰⁸ However, states must meet a number of legal requirements before they may pursue a non-state aggressor into another state in self-defense. To understand the rationale behind why states may breach a host-state’s general right to territorial integrity in self-defense and the requirements states must meet in order to do so, one must first look to the U.N. Charter’s general prohibition on using force against another state.

The right of territorial integrity generally gives way to the right of self-defense.³⁰⁹ The principle underlying this balancing act is that when one state violates another state’s territorial integrity, it forfeits its own right to territorial integrity. Of course, this principle evolved out of state-on-state attacks. Nonetheless, it may be applied in a similar manner when states are indirectly responsible for the violations of another state’s territorial integrity by non-state actors.

Ascertaining the appropriate balance between one State’s right to territorial integrity and another’s right to self-defense depends in part on the extent to which the former has complied with its own international obligations vis-à-vis the latter. It is a long-established principle of international law that “a State is bound to

³⁰⁷ *Id.* at 663–64.

³⁰⁸ See Schmitt, *supra* note 57, at 540–41.

³⁰⁹ After all, “it is manifestly legal to cross into another State to conduct military operations in self-defense if it is that State which has committed aggression.” *Id.* at 540.

use due diligence to prevent the commission within its dominions of criminal acts against another nation or its people.”

....

If a State is unable or unwilling to comply with this obligation, the victim State may then cross into the offending State to conduct defensive operations.

....

It cannot be otherwise, for the unwillingness or inability of one State to meet its legal obligations cannot deprive other States of the most important right found in international law, the right to defend oneself against an armed attack.³¹⁰

As always, before a state resorts to self-defense, it must ensure that it meets the criteria of necessity, proportionality, and, if using the subset of anticipatory-self defense, imminency.³¹¹ Effectively, a state must have no viable alternatives to the use of force, and it must limit its use of force to securing its defensive objectives.³¹² Naturally, no two situations are alike, and justifications for self-defense are case-specific.

The application of these requirements may vary depending on whether the acts of the non-state actors were imputed based on direct control or indirect attribution. In cases of direct control, the victim-state may immediately impute responsibility to the host-state and act in self-defense against it and the non-state actors inside it.³¹³ In cases of indirect attribution, victim-states must overcome another hurdle before conducting cross-border operations. Namely, the victim-state must ensure that it has properly linked the actions of the non-state actors to the host-state; this may be achieved by issuing a demand to the sanctuary state to “comply with its obligation to prevent its territory from being improperly used.”³¹⁴ The sanctuary state must then act against the non-

³¹⁰ *Id.* at 540–42 (quoting *S.S. Lotus (Fr. v. Turk.)* 1927 P.C.I.J. (ser. A) No. 10, at 4, 88 (Moore, J., dissenting)).

³¹¹ *See id.* at 542.

³¹² *See id.*

³¹³ *See id.* at 543.

³¹⁴ *Id.* at 542.

state actors, or willingly allow the victim-state to enter its territory and mount operations against the non-state actors.³¹⁵ Should the host-state be unwilling to meet these requirements, the victim-state can fully impute responsibility and conduct its cross-border operations into the host-state.³¹⁶ However, in doing so, the victim-state must limit its targets to the non-state actors, unless the host-state uses force to oppose the lawful cross-border operations.³¹⁷

There are numerous examples of internationally accepted cross-border operations into states that were indirectly responsible for the actions of non-state actors. Examples prior to 9/11 include: Turkey's entrance into Iraq in 1995 to pursue Kurdish irregulars; Senegal's entrances into Guinea-Bissau in 1992 and 1995 to strike safe havens used by opposition forces; and the U.S. bombings of Afghanistan in 1998 to strike at terrorist training camps.³¹⁸ Post-9/11 examples include Israel's initial entrance into Lebanon in 2006, following Hezbollah's raid into Israel,³¹⁹ and Turkey's air strikes into Iraq in 2007 against Kurdish irregulars.³²⁰

Based on the foregoing analysis, it is evident that victim-states may forcibly respond to armed attacks by non-state actors located in another state when host-states violate their duty to prevent those attacks. With cyberattacks, imputing state responsibility in this manner provides states a legal path to utilize active defenses without having to conclusively attribute an attack to a state or its agents. In effect, imputing responsibility is the equivalent of attributing the attack to the state or its agents. Thus, imputing responsibility provides states a way around the attribution problem and response crisis. However, just because a legal pathway exists to employ active defenses does not mean that responding to cyberattacks by non-state actors lends itself to this framework. As a result, it is imperative to explain why cyberattacks constitute armed attacks, what a state's duty to prevent cyberattacks means, and the

³¹⁵ See *id.* at 543.

³¹⁶ See Proulx, *supra* note 277, at 641–42; Schmitt, *supra* note 57, at 543; Mullerson, *supra* note 258, at 109.

³¹⁷ See Schmitt, *supra* note 57, at 543.

³¹⁸ See Proulx, *supra* note 277, at 630–31.

³¹⁹ See Greg Myre & Steven Erlanger, *Clashes Spread to Lebanon as Hezbollah Raids Israel*, N.Y. TIMES, July 13, 2006, at A1.

³²⁰ See Sebnem Arsu & Stephen Farrell, *Turkey Bombs Kurds in Iraq; 2 Sides Differ on Casualties*, N.Y. TIMES, Dec. 23, 2007, at A27.

factual circumstances that would allow a victim-state to forcibly respond to a cyberattack.

VI. Analyzing Cyberattacks under *Jus ad Bellum*

Cyberattacks represent a conundrum for legal scholars. Cyberattacks come in many different forms, their destructive potential limited only by the creativity and skill of the attackers behind them.³²¹ While it may seem intuitive that such attacks can constitute armed attacks, especially in light of their ability to injure or kill, the legal community has been reluctant to classify them this way because they do not resemble “classic attack[s] with traditional military force.”³²² Further clouding the legal waters are the erroneous views of states and scholars alike on the need for states to attribute cyberattacks to a state or its agents before responding with force under the law of war. While it is true that cyberattacks do not resemble traditional armed attacks, and that cyberattacks are difficult to attribute, neither of these characteristics of cyberattacks should preclude states from responding with force under the law of war. This part explores different analytical models for assessing armed attacks, the logical meaning of the duty of prevention as it relates to cyberattacks, and the technological capacity of programs to trace attacks back to their point of origin. It concludes with the position that states may legally use active defenses against cyberattacks originating from states that violate their duty to prevent them.

A. Cyberattacks as Armed Attacks

Victim-states must be able to classify a cyberattack as an armed attack or imminent armed attack before responding with active defenses. Armed attacks and imminent armed attacks are the triggers that allow states to respond in self-defense or anticipatory self-defense.³²³ Ideally, clear rules would be in place classifying cyberattacks as armed attacks,

³²¹ WINGFIELD, *supra* note 48, at 100; *see also* Part III.A–B.

³²² THOMAS WINGFIELD, WHEN IS A CYBERATTACK AN “ARMED ATTACK?”: LEGAL THRESHOLDS FOR DISTINGUISHING MILITARY ACTIVITIES IN CYBERSPACE 6 (Cyber Conflict Studies Assoc. 2006); *see also* GREENBERG ET AL., *supra* note 24, at xvii–xviii (noting the ambiguous state of international law regarding cyberattack classification).

³²³ *See supra* Part IV.C–D.

imminent armed attacks, or lesser uses of force.³²⁴ Unfortunately, since cyberattacks are a relatively new attack form, international efforts to classify them are still in their infancy,³²⁵ even though the core legal principles governing armed attacks are well-settled.³²⁶ This has left whether cyberattacks can qualify as armed attacks as open questions in international law.³²⁷ To answer these questions, this section examines the core legal principles governing armed attacks, applies them to cyberattacks, explains why cyberattacks can qualify as armed attacks, and attempts to provide some insight into which cyberattacks should be considered armed attacks.

“Armed attack” is not defined by any international convention.³²⁸ As a result, its meaning has been left open to interpretation by states and scholars. While this might sound problematic, it is not. The framework for analyzing armed attacks is relatively well-settled, as are the core legal principles governing its meaning.³²⁹ The international community generally accepts Jean S. Pictet’s scope, duration, and intensity test as the starting point for evaluating whether a particular use of force constitutes an armed attack.³³⁰ Under Pictet’s test, a use of force is an armed attack

³²⁴ See WINGFIELD, *supra* note 322, at 1–2, 13. State coercion comes in three different forms: threats to international peace and security, uses of force, and armed attacks. *Id.* at 2. Threats to international peace and security and uses of force are both prohibited by Article 2(4) of the U.N. Charter. Armed attacks, including imminent armed attacks, are a more specific subset of uses of force that trigger a victim-state’s inherent right of self-defense in response to them under Article 51 of the U.N. Charter. *See id.* at 4–5.

³²⁵ *Id.* at 2–3, 13.

³²⁶ *Id.* at 12.

³²⁷ *Id.*

³²⁸ See WINGFIELD, *supra* note 48, at 73 (noting the failure of international treaties to define “use of force,” “armed force” or “armed attack”).

³²⁹ See WINGFIELD, *supra* note 322, at 12.

³³⁰ See SHARP, *supra* note 24, at 57–58 (referencing COMMENTARY ON THE GENEVA CONVENTION RELATIVE TO THE PROTECTION OF CIVILIAN PERSONS IN TIME OF WAR 17–21 (Jean S. Pictet ed., 1958)); WINGFIELD, *supra* note 48, at 57, 60–68 (referencing COMMENTARY ON THE GENEVA CONVENTION RELATIVE TO THE PROTECTION OF CIVILIAN PERSONS IN TIME OF WAR 17–21 (Jean S. Pictet ed., 1958)). Courts and scholars have also used a similar “scale and effects” test to judge whether a particular attack rises to the level of an armed attack or constitutes a lesser use of force. *See Military and Paramilitary Activities in and against Nicaragua (Nicar. v. U.S.)*, 1986 I.C.J. 14, 214–16 (June 27); DINSTEIN, *supra* note 184, at 193–96 (using the “scale and effects” test from the *Nicaragua* case to assess armed attacks).

Pictet formulated this test to help clarify when international armed conflict exists under Common Article 2 of the Geneva Conventions. *See SHARP, supra* note 24, at 57–58; WINGFIELD, *supra* note 48, at 57–60. Common Article 2 expresses three circumstances under which international armed conflict exists, and is widely accepted as

when it is of sufficient scope, duration, and intensity.³³¹ Of course, as is the case with many international legal concepts, states, non-governmental organizations, and scholars all interpret the scope, duration, and intensity test differently.³³²

State declarations help flesh out which uses of force are of sufficient scope, duration, and intensity to constitute an armed attack. Harkening back to the French language version of the U.N. Charter, which refers to “armed aggression” rather than an “armed attack,” the U.N. General Assembly passed the Definition of Aggression resolution in 1974.³³³ The resolution requires an attack to be of “sufficient gravity” before it is considered an armed attack.³³⁴ While the resolution never defines armed attacks, it provides examples that are widely accepted by the international community.³³⁵ Unfortunately, the list of armed attacks from

the transition point between peace and war. WINGFIELD, *supra* note 48, at 57. The Common Article 2 circumstances are a declared war between states, the partial or total occupation of another state, or any other armed conflict between states (also known as *de facto* hostilities). Geneva Convention for the Amelioration of the Condition of the Wounded and Sick in Armed Forces in the Field, Aug. 12, 1949, 6 U.S.T. 3114, 75 U.N.T.S. 31 [hereinafter Geneva I]. Once any of these circumstances are met, the threshold between peace and armed conflict is crossed, and the full body of the law of war applies in its entirety. See WINGFIELD, *supra* note 48, at 57–60. Since the first two situations are relatively straightforward, the bulk of the law focuses on what constitutes an armed conflict. See *id.*

The term “Geneva Conventions” generally refers to the four Geneva Conventions of 1949. Article 2 of each convention is exactly the same, which is why it is called a common article. Individual citations are as follows: Geneva I, *supra* note 330; Geneva Convention for the Amelioration of the Condition of the Wounded, and Shipwrecked Members of Armed Forces at Sea, Aug. 12, 1949, 6 U.S.T. 3217, 75 U.N.T.S. 85; Geneva Convention Relative to the Treatment of Prisoners of War, Aug. 12, 1949, 6 U.S.T. 3316, 75 U.N.T.S. 135; Geneva Convention Relative to the Protection of Civilian Persons in Time of War, Aug. 12, 1949, 6 U.S.T. 3516, 75 U.N.T.S. 287.

³³¹ See WINGFIELD, *supra* note 48, at 57.

³³² See *id.* at 60–68, 111–23 (noting disagreements between the International Committee of the Red Cross’s interpretation and the United States’ interpretation, and reviewing different methods for evaluating the scope, duration, and intensity cyberattacks); Brown, *supra* note 51, at 187–89 (discussing instrument-based evaluations of armed attacks versus effects-based evaluations of armed attacks).

³³³ See WINGFIELD, *supra* note 48, at 111 (2000) (referencing Definition of Aggression, G.A. Res. 3314, U.N. GAOR, 29th Sess., U.N. Doc. A/RES/3314 (Dec. 14, 1974)).

³³⁴ Definition of Aggression, G.A. Res. 3314, Annex, art. 2, U.N. GAOR, 29th Sess., U.N. Doc. A/RES/3314/Annex (Dec. 14, 1974) (noting that the uses of force “shall constitute *prima facie* evidence of an act of aggression although the Security Council may . . . conclude that a determination that an act of aggression has been committed would not be justified in the light of other relevant circumstances, including the fact that the acts concerned or their consequences are not of sufficient gravity”).

³³⁵ See WINGFIELD, *supra* note 48, at 111. Its view of what constitutes an armed attack

the resolution is not comprehensive, as it only deals with conventional attacks.³³⁶ While the resolution has helped settle the meaning of armed attacks for conventional attacks, the more technology has advanced, the more attacks have come in forms not previously covered by state declarations and practices.³³⁷ Consequently, states recognize that

encompasses the following:

- (a) *Invasion, bombardment and cross-border shooting.* These examples represent the classic cases of armed attacks, provided “that the military actions are on a certain scale and have a major effect, and are thus not to be considered mere frontier incidents.”
- (b) *Blockade.* An effective blocking of a state’s ports or coasts by the armed forces of another state is an armed attack. The barring of passage for land-locked states to the open sea across another state’s territory has not been accepted as an armed attack.
- (c) *Attack on the land, sea or air forces or on the civilian marine and air fleets.* An armed attack occurs when the armed forces of one state attack the land, sea, or air forces, or the civilian marine and air fleets, of another state. The regular forces of a state, wherever they are, always have the right to defend themselves by military force.
- (d) *Breach of stationing agreements.* An armed attack may occur when a state uses its armed forces within the territory of another state in contravention of the conditions provided for in the agreement, or any extension of their presence beyond the termination of the agreement; provided, however, that the breach of the terms of the agreement has the effect of an invasion or occupation.
- (e) *Placing territory at another state’s disposal.* The voluntary action of a state in allowing another state to use its territory for committing an armed attack is also an armed attack.
- (f) *Participation in the use of force by military organized unofficial groups.* It is widely accepted that indirect force falls under the definition of armed attack. The sending of armed bands to use force in another state makes the armed bands a *de facto* state agent, thus the sending state has engaged in an armed attack. Similarly, “substantial involvement” in the activities of an armed band may also constitute an armed attack.

Id. at 111–12 (quoting THE CHARTER OF THE UNITED NATIONS: A COMMENTARY 669–74 (Bruno Simma ed. 1994)).

³³⁶ See *id.* at 112–15 (noting that the use of bacteriological, biological, and chemical agents against another state is considered an armed attack, despite not being listed in the Definition of Aggression resolution).

³³⁷ See WINGFIELD, *supra* note 48, at 113–15; QIAO LIANG & WANG WIANGSUI, UNRESTRICTED WARFARE 1–5 (1999) (speculating that technological advancement and globalization are changing warfare so that future wars will be carried out using non-military war operations, such as cyberattacks, in addition to conventional military force).

unconventional uses of force may warrant treatment as an armed attack when their scope, duration, and intensity are of sufficient gravity.³³⁸ As a result, states are continually making proclamations about new methods of warfare, slowly shaping the paradigm for classifying armed attacks.³³⁹

Scholars have advanced several analytical models to deal with unconventional attacks, such as cyberattacks, to help ease attack classification and put the scope, duration, and intensity analysis into more concrete terms.³⁴⁰ These models are especially relevant to cyberattacks because they straddle the line between criminal activity and armed warfare.³⁴¹ There are three main analytical models for dealing with unconventional attacks.³⁴² The first model is an instrument-based approach, which checks to see whether the damage caused by a new attack method could only have been previously achieved with a kinetic attack.³⁴³ The second is an effects-based approach, sometimes called a consequence-based approach, in which the attack's similarity to a kinetic

³³⁸ See WINGFIELD, *supra* note 48, at 100.

³³⁹ For instance, the United States has made several declarations regarding cyberattacks, each of which generally implies that certain cyberattacks can be treated as armed attacks, provided their scope, duration, and intensity have the same consequences as those normally associated with armed attacks. See Jensen, *supra* note 5, at 226–28; see also Dep't of Def., Office of Gen. Counsel, An Assessment of International Legal Issues, May 1999, reprinted in WINGFIELD, *supra* note 48, at 431 [hereinafter DoD Assessment] (treating cyberattacks as armed attacks when their consequences mirror those of an armed attack); Exec. Order No. 13,010, 61 Fed. Reg. 37,347 (July 15, 1996) (vowing to protect critical infrastructure against cyberattacks because their incapacitation or destruction could have a debilitating effect on U.S. defense and economic security); Exec. Order 13,321, 66 Fed. Reg. 53,063 (Oct. 16, 2001) (vowing to respond to cyberattacks against critical national infrastructure due to their potentially devastating effects on the United States).

³⁴⁰ Brown, *supra* note 51, at 187–88.

³⁴¹ See *id.* at 187. Cyberattacks can be as simple as defacing a website, or as severe as crashing another state's stock markets and keeping them shut down for some time.

³⁴² See *id.* (discussing the instrument-based and effects-based approaches); Jensen, *supra* note 5, at 223–26 (discussing the strict liability and consequence-based approaches); Horace Robertson Jr., *Self-Defense Against Computer Network Attack*, in COMPUTER NETWORK ATTACK AND INTERNATIONAL LAW 121, 134–38 (Michael N. Schmitt & Brian T. O'Donnell eds., Naval War College 2002) (discussing the consequence-based and strict liability approaches); Schmitt, *supra* note 55, at 913–17 (discussing the instrumented-based and consequence-based approaches).

³⁴³ See Brown, *supra* note 51, at 187–88; Dinstein, *supra* note 24, at 103–05. For instance, under an instrument-based approach, a cyberattack used to shut down a power grid is an armed attack, since shutting down a power grid typically requires dropping a bomb on a power station or some other kinetic use of force to incapacitate the grid. Since conventional munitions were previously required to achieve the result, under the instrument-based approach the cyberattack is therefore treated the same way.

attack is irrelevant and the focus shifts to the overall effect that the cyberattack has on a victim-state.³⁴⁴ This is the approach that the United States has adopted.³⁴⁵ The third is a strict liability approach, in which cyberattacks against CNI are automatically treated as armed attacks, due to the severe consequences that can result from disabling those systems.³⁴⁶

While these analytical models differ, the common thread between them is that the proponents of each analytical model all agree that cyberattacks can constitute an armed attack.³⁴⁷ In fact, a large number of the scenarios covered in Part III, Section B fit into the meaning of armed attack under all three models of analysis.³⁴⁸ Cyberattacks short of armed attacks would still be considered an unlawful use of force in violation of Article 2(4) of the U.N. Charter,³⁴⁹ and would have to be addressed with measures short of self-defense, such as a reprisal.³⁵⁰

³⁴⁴ See IAN BROWNLIE, *INTERNATIONAL LAW AND THE USE OF FORCE BY STATES* 362–63 (1963); WINGFIELD, *supra* note 48, at 117–30; Brown, *supra* note 51, at 187–88; Schmitt, *supra* note 55, at 1071–72; Schmitt, *supra* note 55, at 911–15. For instance, under an effects-based approach, a cyberattack that manipulated information across a state’s banking and financial institutions to seriously disrupt commerce in the state is an armed attack. While the manipulation of information does not resemble a kinetic attack, as required under an instrument-based approach, the disruptive effects that the attack had on the state’s economy is a severe enough overall consequence that it warrants treatment as an armed attack.

³⁴⁵ See DoD Assessment, *supra* note 339, at 431, 453–54.

³⁴⁶ It is important to note that this third analytical model for dealing with cyberattacks is intended to justify anticipatory self-defense before any harm actually results. Walter Gary Sharp Sr. proposes this model due to the speed with which a computer penetration can transition into a destructive attack against defense CNI. He reasons that once a penetration has occurred, an imminent threat exists with the ability to cause harm of extreme scope, duration, and intensity, thereby justifying anticipatory self-defense. See SHARP, *supra* note 24, at 129–31; *see also* Condrón, *supra* note 24, at 415–22 (discussing the need to treat cyberattacks on CNI as armed attacks); Jensen, *supra* note 5, at 228–31 (advocating changing the current *jus ad bellum* paradigm to use strict liability for cyberattacks against CNI).

³⁴⁷ See WINGFIELD, *supra* note 48, at 117–30; Brown, *supra* note 51, at 190; Dinstein, *supra* note 24, at 103–05; Schmitt, *supra* note 55, at 911–15; Robertson, *supra* note 342, at 134–38; Condrón, *supra* note 24, at 415–22; Jensen, *supra* note 5, at 228–31; KAMAL, *supra* note 22, at 76–84.

³⁴⁸ See WINGFIELD, *supra* note 48, at 117–30; Brown, *supra* note 51, at 187–88; Dinstein, *supra* note 24, at 103–05; Schmitt, *supra* note 55, at 911–15; Robertson, *supra* note 342, at 134–38; Condrón, *supra* note 24, at 415–22; Jensen, *supra* note 5, at 228–31; KAMAL, *supra* note 22, at 76–84.

³⁴⁹ See WINGFIELD, *supra* note 48, at 91–99 (discussing cyberattacks that don’t rise to the level of an armed attack). Unfortunately, trying to formulate an exact line to delineate armed cyberattacks from lesser uses of force is nearly impossible. Thus, this section shall

Of these three approaches, the effects-based approach is the best analytical model for dealing with cyberattacks. Not only does effects-based analysis account for everything that instrument-based approaches cover, but it also provides an analytical framework for situations that do not neatly equate to kinetic attacks.³⁵¹ Effects-based analysis is also superior to strict liability because responses to cyberattacks under an effects-based approach comport with internationally accepted legal norms and customs, whereas a strict liability approach may cause victim-states to violate the law of war.³⁵²

Of all of the scholars who advocate effects-based models, Michael N. Schmitt has advanced the most useful analytical framework for evaluating cyberattacks. In his seminal article, *Computer Network Attack and the Use of Force in International Law: Thoughts on a Normative Framework*, Michael Schmitt lays out six criteria for

advance several analytical models to help classify attacks, recognizing that it will be up to victim-states to form their view, declare whether particular cyberattacks against them are armed attacks, and defend their conclusion to the international community.

³⁵⁰ This is because at a minimum, cyberattacks are an illegal use of force. As a result, states can use reprisals to deter attackers from attacking them, and to deter sanctuary states from ignoring cyberattacks by attackers. See *supra* Part IV.E (discussing reprisals); *supra* Part V.E (discussing sanctuary states that allow attackers to act inside their borders); *infra* Parts VI.C (discussing state responsibility for failing to prevent cyberattacks).

³⁵¹ For instance, a cyberattack might shut down a system, rendering it inoperable for some time, or a cyberattack might cause an explosion at a chemical plant by tampering with the computers that controlled the feed mixture rates. The results of those attacks mirror the results of conventional armed attacks, previously only achievable through kinetic force, thus satisfying the instrument-based approach.

Unfortunately, cyberattacks can cause extreme harm without mirroring the results of conventional armed attacks. For instance, coordinated cyberattacks could bring financial markets to their knees without ever employing anything that looked remotely like a kinetic attack; altered data on a massive scale could disrupt banking, financial transactions, and the general underpinnings of the economy, sowing confusion throughout the victim-state for some time. Under an effects-based approach, the scope, duration, and intensity of this attack would equate to an armed attack, despite the fact that it was not previously only achievable through kinetic force.

³⁵² The proponents of a strict liability approach advocate automatically responding to cyberattacks on critical infrastructure with active defenses. See Condrón, *supra* note 24, at 415–22; Jensen, *supra* note 5, at 228–31. However, automatically responding to cyberattacks in this manner can easily lead a victim-state to counter-attack a state with a long history of doing everything within its power to prevent cyberattacks and prosecute its attackers. Were a victim-state to respond with active defenses against a non-sanctuary state, it would violate *jus ad bellum* because there is no way to impute state responsibility to such a state, directly or indirectly, even though the cyberattack may constitute an armed attack. See *supra* Part V.C.

evaluating cyberattacks as armed attacks.³⁵³ These criteria are: severity,³⁵⁴ immediacy,³⁵⁵ directness,³⁵⁶ invasiveness,³⁵⁷ measurability,³⁵⁸ and presumptive legitimacy.³⁵⁹ Taken together, these criteria allow states to measure cyberattacks along several different axes. While no one criterion is dispositive, cyberattacks satisfy enough criteria to be characterized as armed attacks.³⁶⁰ Since their publication, Schmitt's criteria have gained traction in the legal community, with several prominent legal scholars advocating for their use.³⁶¹ Many hope that Schmitt's criteria will help bring some uniformity to state efforts to classify cyberattacks. However, until they gain wider acceptance, states are likely to classify cyberattacks differently, depending on their understanding of armed attacks as well as their conception of vital

³⁵³ Schmitt, *supra* note 55, at 913–15.

³⁵⁴ Severity looks at the scope and intensity of an attack. Analysis under this criterion would include looking at the number of people killed, size of the area attacked, and amount of property damage done. The greater the damage, the more powerful the argument becomes for treating the cyberattack as an armed attack. *See* WINGFIELD, *supra* note 48, at 124–27 (examining Schmitt's use of force analysis).

³⁵⁵ Immediacy looks at the duration of a cyberattack, as well as other timing factors. Analysis under this criterion looks at how long the cyberattack lasted, how soon its effects were felt, and how long it took for the effects to abate. The longer the duration and effects, the more it looks like an armed attack. *See id.* (examining Schmitt's use of force analysis).

³⁵⁶ Directness looks at the harm caused. If the attack was the proximate cause of the harm, it strengthens the argument that the cyberattack was an armed attack. If the harm was caused in full or in part by other parallel attacks, the weaker the argument that the cyberattack was an armed attack. *See id.* (examining Schmitt's use of force analysis).

³⁵⁷ Invasiveness looks at the locus of the attack. An invasive attack is one that physically crosses state borders, or electronically crosses borders and causes harm within the victim-state. The more invasive the cyberattack, the more it looks like an armed attack. *See id.* (examining Schmitt's use of force analysis).

³⁵⁸ Measurability tries to quantify the damage done by the cyberattack. Quantifiable harm is generally treated more seriously in the international community. The more a state can quantify the harm done to them, the more the cyberattack looks like an armed attack. Speculative harm generally makes a weak case that the cyberattack was an armed attack. *See id.* (examining Schmitt's use of force analysis).

³⁵⁹ Presumptive legitimacy focuses on state practice and the accepted norms of behavior in the international community. Actions may gain legitimacy under the law when the international community accepts certain behavior as legitimate. The less a cyberattack looks like accepted state practice, the stronger the argument that it is an illegal use of force or an armed attack. *See id.* (examining Schmitt's use of force analysis).

³⁶⁰ *See id.* at 122–29 (examining Schmitt's use of force analysis).

³⁶¹ *See* WINGFIELD, *supra* note 322, at 6–7; WINGFIELD, *supra* note 48, at 115–29; Vida Antolin-Jenkins, *Defining the Parameters of Cyberwar Operations: Looking for Law in all the Wrong Places?*, 51 NAVAL L. REV. 132, 169–72 (2005); Robertson, Jr., *supra* note 342, at 134–38.

national interest.³⁶² Moreover, universal acceptance of Schmitt's criteria is still probably some time away.

Detractors generally criticize effects-based analysis as useful only long after a cyberattack occurs. They argue that an effects-based analysis forces states to delay their responses to the point that the state suffers preventable harm.³⁶³ More specifically, some detractors acknowledge that effects-based analysis may be useful, but advocate treating all cyberattacks on CNI as armed attacks because it is too dangerous to waste time analyzing the attack when CNI is at risk.³⁶⁴ These detractors generally advocate a strict liability approach to cyberattacks against CNI, and further advocate responding to all cyberattacks against CNI in self-defense as the only effective method to protect CNI.³⁶⁵

While the strict liability model deals adequately with threats to CNI, the model runs the risk of unlawfully escalating a situation. Effects-based analysis, on the other hand, does not require a state to delay its response until it can fully measure a cyberattack against all six of Schmitt's proposed axes. Decision-makers, at times, must make choices with imperfect information. "As a legal matter, however, the principle of anticipatory-self-defense does not, and has never, required that the threat have been genuine—only that it be perceived to be so in good faith."³⁶⁶ The imminent danger that some cyberattacks pose will force decision-makers to attempt a good faith assessment based on the facts at hand. Other cyberattacks will not be as urgent, allowing decision-makers to take time to analyze the attacks more fully. In all cases, an effects-based

³⁶² See WINGFIELD, *supra* note 322, at 8.

³⁶³ See Barkham, *supra* note 29, at 83–84.

³⁶⁴ See Condrón, *supra* note 24, at 415–22 (advocating strict liability for cyberattacks on CNI); Jensen, *supra* note 5, at 228–31 (advocating strict liability for cyberattacks on CNI).

³⁶⁵ See Condrón, *supra* note 24, at 415–22; Jensen, *supra* note 5, at 228–31.

³⁶⁶ David Rivkin Jr. et al., *War, International Law, and Sovereignty: Reevaluating the Rules of the Game in a New Century: Preemption and Law in the Twenty-First Century*, 5 CHI. J. INT'L L. 467, 496 (2005); see also Eric Jensen, *Unexpected Consequences from Knock-On Effects: A Different Standard for Computer Network Operations?*, 18 AM. U. INT'L L. REV. 1145, 1181–82 (2003) (discussing *United States v. Wilhelm List*, XI Trials of War Criminals Before the Nuremberg Military Tribunals Under Control Council Law No. 10, 1295–96 (1950)). The legal standard for judging a military commander's decision is whether what the commander believed to be true at the time (not the actual facts) met the appropriate legal standards. This is known as the Rendulic Rule, and has been the international standard since the Nuremberg trial of General Rendulic. *Id.*

approach provides a better analytical tool to analyze an attack. Furthermore, when a threat is considered urgent, such as an attack against CNI, the potential severity and imminence of the attack may be great enough to outweigh all other considerations. Furthermore, even if cyberattacks against CNI generally constitute armed attacks, automatically responding to them in self-defense may result in the use of force against an innocent state, i.e., one that does not meet the threshold for imputing state responsibility.³⁶⁷

Classifying cyberattacks will be difficult for states to do in practice.³⁶⁸ While the initial decision to respond to cyberattacks under the law of war will have to be made by state decision-makers as a matter of policy, the actual decision to use active defenses will have to be pushed down to the system administrators who actually operate computer networks. One of the challenges states will face is translating international law into concise, understandable rules for their system administrators to follow. However, classifying cyberattacks as armed attacks or imminent armed attacks is only the first hurdle system administrators must clear before responding with active defenses. The second and equally important hurdle is establishing state responsibility for the attack.

³⁶⁷ State responsibility for cyberattacks may be established when states violate their duty to prevent cyberattacks. *See infra* Part VI.B–C.

³⁶⁸ While classifying cyberattacks will be difficult, there is no doubt that some cyberattacks will qualify as armed attacks, and should be dealt with using self-defense and anticipatory self-defense legal principles as a justification for using active defenses.

Some scholars will undoubtedly critique this conclusion. However, scholars who argue that cyberattacks cannot rise to the level of armed attacks misunderstand how states have classified unconventional attacks in the past. New attack methods frequently fall outside the accepted definitions of armed attacks. This does not mean that the attacks are not armed attacks, merely that the attacks don't fit traditional classifications. *See supra* Part VI.A (discussing the classification of new attack forms). Furthermore, scholars who argue that cyberattacks cannot rise to the level of armed attacks miss an important facet of international law—reprisals, which can be used as an alternate basis to authorize active defenses against cyberattacks. Since, at a minimum, cyberattacks are an illegal use of force, states can use reprisals to deter attackers from committing such acts in the future and to deter sanctuary states from allowing attackers to commit them. *See supra* Part IV.E (discussing reprisals); *infra* Part VI.B–C (discussing state responsibility for failing to prevent cyberattacks).

As an important sidebar, reprisals may theoretically justify using active defenses to protect non-vital computer systems. Since attacks on non-vital computer systems amount to an illegal uses of force, reprisals may provide a justification for defending those systems with active defenses (assuming the active defenses targeted non-vital systems in return). In effect, active defenses may provide a way to deter cyberattacks in general.

B. Modernizing the Approach to State Responsibility for Cyberattacks

States cannot respond to a cross-border cyberattack with force without establishing state responsibility for the attack.³⁶⁹ Historically, this meant attributing an attack to a state or its agents on the premise that a state is only responsible for its acts or the acts of those under its direct control.³⁷⁰ However, as non-state actors have attacked states with increased frequency, international law has shifted away from this traditional requirement to a model of indirect state responsibility based on a state's failure to meet its international duties.³⁷¹

This shift is especially important for cyberattacks because the prevailing view that states must treat cross-border cyberattacks as a criminal matter, rather than as a national security matter, seems to be based on the historic view of state responsibility. This limited view of state responsibility locks states into the response crisis by requiring states to attribute cyberattacks to a state or its agents,³⁷² even though the likelihood of successfully achieving such attribution is extremely remote.³⁷³ Consequently, states that subscribe to the traditional model of state responsibility will find themselves in the response crisis during a cyberattack, laboring under the false assumption that they must decide between effective, but illegal, active defenses, and the less effective, but legal, path of passive defenses and host-state criminal laws.³⁷⁴

Given the shift in the law of state responsibility, states should determine whether a cyberattack can be imputed to the state of origin, rather than trying to conclusively attribute it. Once a cyberattack is

³⁶⁹ See *supra* Part V.D.

³⁷⁰ See *supra* Part V.C.

³⁷¹ See *id.*

³⁷² See *supra* Part III.B; *supra* Part V, intro.

³⁷³ A cyberattack could be directly linked to a state under a few circumstances. Potential direct links might include a state declaration that it had made the attack; pre-attack intelligence suggesting that a state was about to make an attack; or tracing an ongoing attack to computer systems known to belong to a foreign military. Further complicating the attribution problem is that cyberterrorists and cybercriminals often hijack innocent systems and use them as zombies to initiate their cyberattacks. See *supra* Part III.A. While victim-states must try to penetrate such guises, current technology may not always allow them to do so in a timely manner. See Brown, *supra* note 51, at 201. In effect, attackers complicate the decision-making process of victim-states, who must account for these electronic disguises when trying to attribute the true identity of an attacker.

³⁷⁴ See *supra* Part III.B; *supra* Part V, intro.

imputed to a state, the legal barriers restricting self-defense disappear.³⁷⁵ States that continue to follow the prevailing view of state responsibility will unduly limit their right to use active defenses, and increase the chances of a successful cyberattack.³⁷⁶ Considering the potential catastrophic consequences of cyberattacks, states should not follow the prevailing view when the law does not require them to do so.

While neither state practice nor the publications of legal scholars support this view regarding cyberattacks yet,³⁷⁷ the accepted principles of

³⁷⁵ See *supra* Part V.C–D.

³⁷⁶ See Condrón, *supra* note 24, at 415–22; Jensen, *supra* note 5, at 228–31.

³⁷⁷ Legal scholars generally agree that states may not respond in self-defense until after an attack is attributed. See Condrón, *supra* note 24, at 415; Dinstein, *supra* note 24, at 111; Garnett & Clarke, *supra* note 13, at 478–79. As a result, state practice is currently to respond to cyberattacks with passive defenses and criminal laws. See *supra* Part II.B. However, there is a growing recognition among legal scholars that the current paradigm governing state responses to cyberattacks is inadequate to protect states and must change. See *supra* note 52. The scholars who argue against the current paradigm have tried to solve the response crisis by finding creative ways around the attribution problem. The three main proposals advanced by scholars before this article are discussed below.

One group of scholars advocates a strict liability approach to attacks against CNI. Eric Jensen first argued for this approach on the basis that attacks against CNI automatically amount to armed attacks and that attacks against them demonstrate hostile intent. See Jensen, *supra* note 5, at 236–37. Sean Condrón supports this approach arguing that international law should grant states an exception to use active defenses to protect CNI, due to the grave harm that cyberattacks against CNI can cause. See Condrón, *supra* note 24, at 415–22.

Another group of legal scholars advocates that self-defense is always a legal response to armed attacks. Their rationale is that the U.N. Charter does not subsume a state's inherent right of self-defense under CIL, which allows states to respond to armed attacks by both non-state actors and states. Thus, states can always respond to cyberattacks that amount to an armed attack regardless of who conducted it. See Barkham, *supra* note 29, at 104; Schmitt, *supra* note 55, at 933–34.

Finally, two legal scholars correctly hone in on state responsibility as the solution to the attribution problem. However, instead of tying state responsibility to a state's failure to meet its duty to prevent cyberattacks, they contend that when cyberattacks are repeatedly launched from one state against other states, the state of origin should be presumed to have involvement in the attacks. Garnett & Clarke, *supra* note 13, at 479.

Unfortunately, all three of these approaches are flawed, less likely to gain international acceptance than the approach in this article, and more likely to lead to unintended consequences with international ramifications. Scholars who advocate for first two approaches miss a critical part of the legal analysis. Namely, just because a state is under armed attack does not give it the legal authority to respond with force. It is only lawful to violate the territorial integrity of a host-state after state responsibility has been established. Were a state to respond to all cyberattacks against CNI with automated active defenses, it would result in counter-attacks against every attacking computer across the world, regardless of their state of origin. While targeting the systems of sanctuary states is an acceptable and lawful option, it is unlawful to target states that fully

customary *jus ad bellum* support imputing state responsibility for armed attacks by non-state actors when the attacks originate from a state that allows non-state actors to conduct criminal operations within their borders.³⁷⁸ States that allow non-state actors to conduct those operations breach their duty to prevent attacks against other states, and are known as sanctuary states.³⁷⁹ This principle is extremely important to the victim-states of cyberattacks because when a cyberattack originates from a sanctuary state, a victim-state may employ active defenses, thereby averting the response crisis.

It is next necessary to answer two key questions: (1) What is a state's duty to prevent cyberattacks? and (2) What must a state do (or not do) to violate its duty of prevention? The answers are the legal keys that will establish the basis for imputing state responsibility for cyberattacks, and unlock the restraints that states have placed on themselves by following the prevailing view of state responsibility.

C. The Duty to Prevent Cyberattacks

States have an affirmative duty to prevent cyberattacks from their territory against other states. This duty actually encompasses several smaller duties, to include passing stringent criminal laws, conducting vigorous investigations, prosecuting attackers, and, during the investigation and prosecution, cooperating with the victim-states of cyberattacks that originated from within their borders. These duties are the duties of all states, and, as will be shown in this section, are binding as CIL.³⁸⁰ The authority for these duties comes from all three sources of

participate in international efforts to secure cyberspace. Furthermore, counter-attacks against those states could be seen as acts of war.

³⁷⁸ See *supra* Part V.C (reviewing the principles of state responsibility).

³⁷⁹ See *supra* Part V.B (reviewing the duty to prevent non-state actors from using a state's territory to commit criminal acts against another state); *supra* Part V.D (reviewing sanctuary states and the legality of holding them responsible for the actions of those non-state actors).

³⁸⁰ For a discussion and definition of CIL, see *supra* notes 179 and 283. The other principal source of international law is international agreements. *Id.* § 102. The third and somewhat ancillary source of international law is the general principles of law common to the major legal systems of the world; however, this is infrequently used as a source of international law. An example of a general legal principle is the prohibition on torture in most domestic legal systems. *Id.*

These definitions roughly mirror the sources of international law found in the Statute of the ICJ. The Statute of the ICJ lists four sources of international law, the first three of

CIL—international conventions, international custom, and the general principles of law common to civilized nations, as also evidenced by judicial decisions and the teachings of the most highly qualified international legal scholars.

1. Support from International Conventions

The only international treaty directly on point is the European Convention on Cybercrime. While the treaty is only a regional agreement, it influences CIL because of the importance of the states that have ratified it under the specially-affected-state doctrine.³⁸¹

which mirror these sources of international law, and then uses judicial opinions and the publications of scholars as a subsidiary means for determining the law. Furthermore, the statute's description of international custom roughly mirrors the Restatement's description of CIL. See Statute of the International Court of Justice art. 38(1), June 26, 1945, 59 Stat. 1055, 1060 (1945).

³⁸¹ Customary international law does not require state practice to be universal. General practices can satisfy the requirements of customary international law. State practices become customary international law when the practice is extensive and representative. "That is to say, it is not simply a question of how many States participate in the practice, but also *which* States." Jean-Marie Henckaerts, *Customary International Humanitarian Law Study: A Contribution to the Understanding and Respect for the Rule of Law in Armed Conflict*, in *THE LAW OF WAR IN THE 21ST CENTURY: WEAPONRY AND THE USE OF FORCE* 37, 42 (Anthony M. Helm ed., Naval War College 2006) (emphasis added). The specially-affected-state doctrine comes into play when states whose interests are specially affected by a practice all follow the practice, and the practice becomes CIL even if the majority of states do not participate, as long as the majority acquiesces to the practice. Likewise, if the majority of states declare something to be CIL and the specially affected states do not accept the practice, it cannot become CIL. *Id.* at 42–43. In other words, states whose interests are particularly impacted by a particular state practice are specially-affected-states, and their practices carry more weight in contributing to CIL about that practice. Yoram Dinstein, *The ICRC Customary International Law Study*, in *THE LAW OF WAR IN THE 21ST CENTURY: WEAPONRY AND THE USE OF FORCE* 99, 109 (Anthony M. Helm ed., Naval War College 2006). The specially-affected-state doctrine was developed by the ICJ in *North Sea Continental Shelf*. *North Sea Continental Shelf (F.R.G. v. Den.; F.R.G. v. Neth.)*, 1969 I.C.J. 3, 43 (Feb. 20).

To date, twenty-six states have ratified the Convention on Cybercrime, the majority of which are major western powers, three of which hold permanent Security Council seats, and five of which place among the twenty states with the most Internet users in the world—France, Germany, Italy, the United Kingdom, and the United States. Together, these five states account for twenty-five percent of the Internet users in the world. Furthermore, while not yet parties to the treaty, Canada, Japan, Spain, and Poland are signatories to it and are expected to ratify it soon. These four states are among the remaining twenty states with the most Internet users in the world, and their ratification would greatly move state practice to the standards set forth in the convention. See Council of Europe, Convention on Cybercrime, Chart of Signatures and Ratifications,

Furthermore, it demonstrates state recognition of both the need to criminalize cyberattacks, and the duty of states to prevent their territory from being used by non-state actors to conduct cyberattacks against other states.³⁸² Significantly, the Convention also recognizes that cyberattacks cannot be interdicted during the middle of an attack, and that the only way to prevent them is through aggressive law enforcement, coupled with state cooperation.³⁸³

International treaties to criminalize terrorism provide further support, albeit indirectly, for the duty to prevent cyberattacks. The international community recognizes terrorism as a threat to international peace and security, but cannot agree on a definition of it.³⁸⁴ As a result, states have adopted the approach of outlawing specific terrorist acts each time terrorists adopt new attack methods, rather than outlawing terrorism itself.³⁸⁵ These treaties impose several common requirements on states

<http://conventions.coe.int/Treaty/Commun/ChercheSig.asp?NT=185&CM=8&DF=18/06/04&CL=ENG> (listing the forty-six signatories and twenty-six parties to the Convention on Cybercrime) (last visited Sept. 2, 2009); Top 20 Countries with the Highest Number of Internet Users, <http://www.internetworldstats.com/top20.htm> (last visited Sept. 2, 2009).

³⁸² The Convention on Cybercrime requires its signatories to establish criminal offenses for almost every conceivable type of cyberattack under their domestic laws. *See* Convention on Cybercrime, *supra* note 22, arts. 2–11, at 284–87. It also recognizes the importance of prosecuting attackers, demonstrated by its requirement for states to extend their jurisdiction over any cyberattacks conducted from within their territory, or conducted by their citizens regardless of their location at the time of attack. *See id.* art. 22, at 291–92. Finally, the convention recognizes the importance of state cooperation to hunt down attackers and bring them to justice; requiring states to cooperate with each other and provide “mutual assistance to the widest extent possible for the purpose of investigations or proceedings concerning criminal offences.” *See id.* arts. 23–25, at 292–93.

³⁸³ *See* KAMAL, *supra* note 22, at 71.

³⁸⁴ Pierre-Marie Dupuy, *State Sponsors of Terrorism: International Responsibility*, in *ENFORCING INTERNATIONAL LAW NORMS AGAINST TERRORISM* 3, 4–6 (Andrea Bianchi ed., 2004).

One reason why it has been difficult to secure a universally accepted definition of terrorism has been that some States, primarily from the developing world, have sought to resist condemnation of practices and activities which they may have resorted to in their acquiring of independence, particularly during decolonization.

Gannett & Clarke, *supra* note 13, at 466.

³⁸⁵ Dupuy, *supra* note 384, at 4–6; Gannett & Clarke, *supra* note 13, at 466. These treaties include the 1963 Tokyo Convention on Offences and Certain Other Acts Committed on Board Aircraft, the 1970 Hague Convention for the Suppression of

with regard to terrorist attack methods, such as taking all practicable measures for the purpose of preventing these attacks, criminalizing the attacks, submitting cases to competent authorities for prosecution, and forcing states to cooperate with each other throughout the criminal proceedings.³⁸⁶ While these treaties do not address cyberattacks, the principles contained in them help influence state requirements under CIL with regard to terrorism. Since there is growing evidence that cyberattacks will soon be a weapon of choice for terrorists,³⁸⁷ states should refer to the common principles found in these treaties as *opinio juris* when cyberattacks are used as a terrorist weapon.

2. Support from State Practice

State treatment of cyberattacks under their criminal laws also evidence recognition of the duty to prevent cyberattacks under CIL. Numerous states criminalize and prosecute cyberattacks as a way to deter attackers from conducting them, on the basis that vigorous law enforcement is the only way to protect and prevent harm to their

Unlawful Seizure of Aircraft, the 1971 Montreal Convention for the Suppression of Unlawful Acts Against the Safety of Civil Aviation, the 1979 International Convention Against the Taking of Hostages, the 1988 Convention for the Suppression of Unlawful Acts Against the Safety of Maritime Navigation, the 1988 Montreal Protocol on the Suppression of Unlawful Acts of Violence at Airports Serving International Civil Aviation, the 1997 International Convention for the Suppression of Terrorist Bombings, the 1999 International Convention for the Suppression of the Financing of Terrorism, and the 2005 International Convention for the Suppression of Acts of Nuclear Terrorism. See Dupuy, *supra* note 384, at 4–6 (using several of these as examples of treaties that outlawed particular terrorist attack methods); Gannett & Clarke, *supra* note 13, at 466 (using several of these as examples of treaties that outlawed particular terrorist attack methods).

³⁸⁶ See generally Hague Convention for the Suppression of Unlawful Seizure of Aircraft, *done* Dec. 16, 1970, 22 U.S.T. 1641, T.I.A.S. No. 7192; Montreal Convention for the Suppression of Unlawful Acts Against the Safety of Civil Aviation, *done* Sept. 23, 1971, 24 U.S.T. 564, T.I.A.S. No. 7570; International Convention Against the Taking of Hostages, *opened for signature* Dec. 18, 1979, 18 I.L.M. 1456; Convention for the Suppression of Unlawful Acts Against the Safety of Maritime Navigation, *done* Mar. 10, 1988, 1678 U.N.T.S. 221, 27 I.L.M. 668; International Convention for the Suppression of Terrorist Bombings, *opened for signature* Jan. 12, 1998, 37 I.L.M. 249; International Convention for the Suppression of the Financing of Terrorism, *opened for signature* Jan. 10, 2000, 39 I.L.M. 270; International Convention for the Suppression of Acts of Nuclear Terrorism, *opened for signature* Sept. 14, 2005, 44 I.L.M. 815.

³⁸⁷ Gannett & Clarke, *supra* note 13, at 467; ROLLINS & WILSON, *supra* note 15, at CRS-1.

computer systems.³⁸⁸ This lends credence to the notion that, unlike a conventional attack which can be stopped after detection, cyberattacks can only be stopped by establishing *ex ante* barriers that attackers are fearful of crossing. Furthermore, these practices demonstrate a growing recognition among states that cyberattacks must be stopped, and that the way to do so is through vigorous law enforcement.

State responses to transnational terrorist attacks further support recognition of a duty to prevent cyberattacks under CIL. After the 9/11 terrorist attacks, states across the world condemned terrorism as a threat to international peace and security, and provided various forms of support to the United States in its war against al Qaeda.³⁸⁹ Ensuring that terrorism will forever be legally recognized as a threat to international peace and security, the Security Council passed Resolution 1373, which reaffirmed that acts of international terrorism were threats to international peace and security and called on states to work together to prevent and suppress terrorism.³⁹⁰ The resolution further directed states to “[r]efrain from providing any form of support” to terrorists through act or omission, to “[d]eny safe haven” to those who commit terrorist acts, and “[a]fford one another the greatest measure of assistance in connection with criminal investigations . . . [or] proceedings” related to terrorism.³⁹¹

While the international community’s response to terrorism does not directly define CIL regarding cyberattacks, it is persuasive on several fronts. First, it shows that states have a duty to prevent threats to international peace and security. Second, it demonstrates that passive acquiescence to threats to international peace and security will not be tolerated. Finally, it demonstrates that states must work together to prevent and suppress threats to international peace and security. Because states are growing more dependent on computer systems connected to the Internet,³⁹² and cyberattacks are increasing in both frequency and

³⁸⁸ See KAMAL, *supra* note 22, at 17–22, 40–42, 175–184 (discussing the criminal laws of Australia, Austria, Belgium, Brazil, Canada, Denmark, France, Germany, India, Japan, the Netherlands, South Africa, the United States, and the United Kingdom). Many other states have criminalized computer crimes, such as the unauthorized access or alteration of data, or computer sabotage, but those laws shall not be covered in this article. Garnett & Clarke, *supra* note 13, at 471.

³⁸⁹ See *supra* Part V.A.

³⁹⁰ S.C. Res. 1373, U.N. Doc. S/RES/1373 (Sept. 28, 2001).

³⁹¹ *Id.*, ¶ 1.

³⁹² See *supra* Part II, intro; Part III.B.

potency,³⁹³ cyberattacks are a growing threat to international peace and security. The more cyberattacks resemble terrorism, the more easily they will fit into the paradigm constructed to deal with transnational terrorism. However, no matter their purpose, cyberattacks represent a threat to international peace and security, and should be dealt with like other recognized transnational threats.

Numerous U.N. declarations about international crime also support recognizing the duty to prevent cyberattacks. These declarations urge states to take affirmative steps to prevent non-state actors from using their territory to commit acts that cause civil strife in another state.³⁹⁴ Furthermore, these declarations bolster the duty of states to cooperate with one another to eliminate transnational crime, which supports the duty to cooperate with victim-states during the criminal investigation and prosecution of cyberattacks.³⁹⁵

³⁹³ See Part II, intro; Part III.B.

³⁹⁴ The 1970 Declaration on Friendly Relations urges states to “refrain from . . . acquiescing [to] organized activities within [their] territory directed towards the commission of [civil strife or terrorism in another state].” G.A. Res. 2625, *supra* note 277, ¶ 1. The 2000 Vienna Declaration on Crime and Justice states that “We [must] commit ourselves to working towards enhancing our ability to prevent, investigate and prosecute high-technology and computer-related crime.” 2000 Vienna Declaration on Crime and Justice: Meeting the Challenges of the Twenty-First Century, G.A. Res. 55/59, Annex, ¶ 18, U.N. Doc. A/RES/55/59/Annex (Jan.17, 2001). The 2001 Draft Articles of State Responsibility require states to affirmatively take action to uphold their international duties to other states, including those arising from CIL, and declare that when states fail to act, they may be held indirectly responsible for such inaction. Draft Articles on the Responsibility of States for Internationally Wrongful Acts, U.N. Doc. A/CN.4/L.602/Rev. 1 (2001).

³⁹⁵ The 1970 Declaration on Friendly Relations notes that “[s]tates have a duty to cooperate with one another . . . in order to maintain international peace and security.” G.A. Res. 2625, *supra* note 277, ¶ 1. The 2004 Report of the High-Panel on Threats, Challenges and Change recognizes the growing threat of organized transnational crime as a threat to international peace and security, stating that “today, more than ever before, threats are interrelated and a threat to one is a threat to all.” The Secretary-General, *Report of the High-Panel on Threats, Challenges and Change*, ¶ 17, delivered to the General Assembly, U.N. Doc A/59/565 (Dec. 2, 2004). It goes on to further state:

No State, no matter how powerful, can by its own efforts alone make itself invulnerable to today’s threats. Every State requires the cooperation of other States to make itself secure. It is in every State’s interest, accordingly, to cooperate with other States to address their most pressing threats, because doing so will maximize the chances of reciprocal cooperation to address its own threat priorities.

Id. ¶ 24.

Focusing specifically on cyberattacks, states have made declarations themselves, and used the U.N. General Assembly to make numerous declarations about the importance of preventing cyberattacks. For instance, the U.N. General Assembly has called on states to criminalize cyberattacks,³⁹⁶ and to deny their territory from being used as a safe haven to conduct cyberattacks through state practice.³⁹⁷ The General Assembly has also called on states to cooperate with each other during the investigation and prosecution of international cyberattacks.³⁹⁸ Even China has said it will “take firm and effective action to prevent all hacking attacks that threaten computer systems.”³⁹⁹ Furthermore, states are starting to recognize the threat that cyberattacks pose to international peace and security, with some states and the General Assembly directly recognizing cyberattacks as a danger to international peace and security.⁴⁰⁰ These declarations all recognize that the duty of states to

³⁹⁶ G.A. Res. 45/121, ¶ 3, U.N. Doc. A/RES/45/121 (Dec. 14, 1990) (embracing the principles adopted by the Eighth United Nations Congress on the Prevention of Crime and the Treatment of Offenders, and inviting states to follow them); G.A. Res. 55/63, ¶ 1, U.N. Doc. A/RES/55/63 (Jan. 22, 2001); *see also* Eighth United Nations Congress on the Prevention of Crime and the Treatment of Offenders, Havana, Cuba, Aug. 27–Sept. 7, 1990, *report prepared by the Secretariat*, at 140–43, U.N. Doc. A/CONF.144/28/Rev.1 (1991).

³⁹⁷ G.A. Res. 55/63, *supra* note 396, ¶ 1.

³⁹⁸ G.A. Res. 45/121, *supra* note 396, ¶ 3 (embracing the principles adopted by the Eighth United Nations Congress on the Prevention of Crime and the Treatment of Offenders, and inviting states to follow them); G.A. Res. 55/63, *supra* note 396, ¶ 1; *see also* Eighth United Nations Congress on the Prevention of Crime and the Treatment of Offenders, Havana, Cuba, Aug. 27–Sept. 7, 1990, *report prepared by the Secretariat*, at 140–43, U.N. Doc. A/CONF.144/28/Rev.1 (1991).

³⁹⁹ McGregor & Williamson, *supra* note 43 (quoting China’s Premier Wen Jiabao’s pledge to prevent international cyberattacks in response to allegations that China is ignoring international cyberattacks).

⁴⁰⁰ *See* CYBERSPACE NAT’L STRATEGY, *supra* note 10 (noting the threat that cyberattacks pose to international peace and security); Convention on Cybercrime, *supra* note 22 (recognizing cyberattacks as a threat to international peace and security, and calling on states to work together to end the cyberthreat); Huw Jones, *Estonia Calls for EU Law to Combat Cyberattacks*, REUTERS, Mar. 12, 2008, <http://www.reuters.com/article/reutersEdge/idUSL1164404620080312> (reporting Estonia’s call to fight cyberattacks as a threat to international peace and security); G.A. Res. 53/70, U.N. Doc. A/RES/53/70 (Jan. 4, 1999) (expressing concern that information technology can be used to disrupt international stability and noting that it is necessary for states to stop information technology from being used for criminal or terrorist purposes); G.A. Res. 54/49, ¶ 2, U.N. Doc. A/RES/54/49 (Dec. 23, 1999) (recommending states develop international principles to combat cybercrime and cyberterrorism); G.A. Res. 55/28, U.N. Doc. A/RES/55/28 (Dec. 20, 2000) (urging states to cooperate to eliminate the misuse of information technology); G.A. Res. 56/19, U.N. Doc. A/RES/56/19 (Jan. 7, 2002) (reaffirming the conclusions of General Assembly Resolutions 53/70, 54/49, and 55/28); G.A. Res. 56/121, U.N. Doc. A/RES/56/121 (Jan. 23, 2002) (urging states to continue to

prevent cyberattacks as a matter of CIL also includes the following lesser duties: passing stringent criminal laws, vigorously investigating cyberattacks, prosecuting attackers, and having the host-State and victim-state cooperate during the investigation and prosecution of cases.

3. Support from the General Principles of Law

The general principles of law common to civilized nations also support recognition of a duty to prevent cyberattacks. It is a well-established principle under the domestic laws of most states that individuals should be responsible for acts or omissions that have a causal link to harm suffered by another individual.⁴⁰¹ While international law is not obligated to follow the domestic laws of states,⁴⁰² international law may be “derived from the general principles common to the major legal

work to eliminate the criminal misuse of information technology); G.A. Res. 57/53, U.N. Doc. A/RES/57/53 (Dec. 30, 2002); G.A. Res. 57/239, ¶¶ 1–5, U.N. Doc. A/RES/57/239 (Jan. 31, 2003) (calling on states to “create a global culture of cybersecurity”); G.A. Res. 58/32, U.N. Doc. A/RES/58/32 (Dec. 18, 2003); G.A. Res. 58/199, ¶ 1–6, U.N. Doc. A/RES/58/199 (Jan. 30, 2004) (recognizing the threat that cyberattacks pose to CNI; recognizing that protecting CNI requires international cooperation and law enforcement; and calling on states to create a global culture of cybersecurity); G.A. Res. 59/61, U.N. Doc. A/RES/59/61 (Dec. 16, 2004); G.A. Res. 59/220, ¶ 4, U.N. Doc. A/RES/59/220 (Feb. 11, 2005) (endorsing the Declaration of Principles adopted at the 2003 World Summit on the Information Society, *available at* <http://www.itu.int/wsis/docs/geneva/official/dop.html>, which recognizes the need for states to prevent information technology from being used for criminal or terrorist purposes); G.A. Res. 60/45, U.N. Doc. A/RES/60/45 (Jan. 6, 2006); G.A. Res. 60/252, ¶ 8, U.N. Doc. A/RES/60/252 (Apr. 27, 2006) (reiterating the need for states’ cooperation); G.A. Res. 61/54, U.N. Doc. A/RES/61/54 (Dec. 19, 2006); *see also* G.A. Res. 51/210, ¶ 3, U.N. Doc. A/RES/51/210 (Dec. 16, 1996) (calling upon states “[t]o note the risk of terrorists using electronic or wire communications systems and networks to carry out criminal acts and the need to find means, consistent with national law, to prevent such criminality and to promote cooperation where appropriate”); S.C. Res. 1373, *supra* note 390, ¶ 3 (calling upon states to cooperate and share information about the “use of communications technologies by terrorist groups”).

⁴⁰¹ BECKER, *supra* note 304, at 285–86. Causation is applied differently by states. Some states use a “but for” test, looking to see whether the harm in question “would have occurred were it not for the conduct in question.” *Id.* at 291. Other states use a “proximate cause” test, looking to see whether harm was reasonably foreseeable as a result of an individual’s actions or omissions. *Id.* Omissions are generally treated the same as acts. So, for instance, if a parent chose not to feed a child, the parent would still bear responsibility for the harm to the child because the failure to act caused harm when it was the parent’s duty to prevent such harm. *Id.* at 294–97.

⁴⁰² *Id.* at 287.

systems of the world.”⁴⁰³ Most states use causation as a principle for establishing individual responsibility, strengthening the idea that a state’s responsibility should also be based on causation. Thus, if a state failed to pass stringent criminal laws, did not investigate international cyberattacks, or did not prosecute attackers, it should be held responsible for international cyberattacks against another state because its omission helped create a safe haven for attackers to attack other states. Furthermore, the general duty to prevent attacks already accounts for causation to some degree,⁴⁰⁴ which supports using causation analogies from domestic laws when interpreting the customary duty to prevent cyberattacks.

4. Support from Judicial Opinions

Finally, judicial opinions further support recognition of a state’s affirmative duty to prevent cyberattacks from its territory against other states. In *Tellini*, a special committee of jurists held that a state may be held responsible for the criminal acts of non-state actors when it “neglect[s] to take all reasonable measures for the prevention of the crime and pursuit, arrest and bringing to justice of the criminal.”⁴⁰⁵ In *S.S. Lotus*, the Permanent Court of International Justice (ICJ) held that “a state is bound to use due diligence to prevent the commission within its dominions of criminal acts against another nation or its people.”⁴⁰⁶ In *Corfu Channel*, the ICJ held that states have a duty “not to allow knowingly its territory to be used for acts contrary to the rights of other states.”⁴⁰⁷ While these are older cases, their principles still stand for and support the notion that states have a duty to prevent their territory from

⁴⁰³ RESTATEMENT, *supra* note 283, § 102.

⁴⁰⁴ For instance, in the *Corfu Channel Case*, the ICJ held that Albania was responsible for notifying British ships of a minefield in their waters, even though the mines were laid by non-state actors, because it was unreasonable to assume that Albania did not know of their presence (even though Albania claimed not to know of them) and because states have a duty to prevent their territory from being used to harm other states when it is within their power to do so. In effect, Albania could have prevented the British ships from hitting the mines, but their failure to act caused the British ships harm. See *Corfu Channel Case (Merits)*, 1949 I.C.J. 4 (Apr. 9). *But see* BECKER, *supra* note 304, at 287–89 (noting that some scholars argue that international law and domestic law are so dissimilar that comparisons between the two are useless).

⁴⁰⁵ *Tellini case*, 4 League of Nations O.J. 524 (1924).

⁴⁰⁶ See *S.S. Lotus (Fr. v. Turk.)* 1927 P.C.I.J. (ser. A) No. 10, at 4, 88 (Moore, J., dissenting).

⁴⁰⁷ *Corfu Channel Case (Merits)*, 1949 I.C.J. 4, 22 (Apr. 9).

being used to commit criminal acts against another state, as well as a duty to pursue, arrest, and bring to justice criminals who have conducted cross-border attacks on other states.

5. *Further Defining a State's Duty to Prevent Cyberattacks*

A state's duty to prevent cyberattacks should not be based on a state's knowledge of a particular cyberattack before it occurs, but rather on its actions to prevent cyberattacks in general. Cyberattacks are extremely difficult for host-states to detect prior to the commission of a specific attack⁴⁰⁸ and are often committed by individuals or groups who are not even on a state's radar. However, just because cyberattacks are difficult to prevent does not mean that states cannot breach their duty to prevent them. Stringent criminal laws and vigorous law enforcement will deter cyberattacks.⁴⁰⁹ States that do not enact such laws fail to live up to their duty to prevent cyberattacks. Likewise, even when a state has stringent criminal laws, if it looks the other way when cyberattacks are conducted against rival states, it effectively breaches its duty to prevent cyberattacks; its unwillingness to do anything to stop the cyberattacks is as if it had approved them.⁴¹⁰ A state's passiveness and indifference toward cyberattacks make it a sanctuary state from where attackers can safely operate. When viewed in this light, a state can be held indirectly responsible for cyberattacks under the established principles of CIL.

D. Becoming a Sanctuary State: Practices that Lead to State Responsibility

Determining if a state is acting as a sanctuary state is extremely fact dependent. When considering this question, victim-states must look at the host-state's criminal laws, law enforcement practices, and track

⁴⁰⁸ See Naraine, *supra* note 167 (referencing Secretary of Homeland Security Michael Chertoff's speech on the vulnerability of federal computer systems).

⁴⁰⁹ See COLARIK, *supra* note 6, at 39; KAMAL, *supra* note 22, at 176.

⁴¹⁰ A state that is unable to fulfill its duty to prevent cyberattacks due to a lack of technical expertise should be viewed in compliance with its duty to prevent when it accepts technical assistance from the victim-state to hunt down the attackers. Cooperating in law enforcement efforts demonstrates the state's willingness to prevent cyberattacks. Conversely, a state that lacks technical expertise, but refuses to accept outside assistance, would be viewed as unwilling to take the necessary steps to bring attackers to justice.

record of cooperating with the victim-states of cyberattacks that previously originated from inside its borders. In effect, host-states will be judged on their efforts to catch and prosecute attackers who have committed cyberattacks, which is probably the only way that states can deter and prevent future attacks. Since victim-states will end up judging whether a host-state has lived up to its international duties, host-states must cooperate with victim-states to ensure transparency. Cooperation will necessarily entail a host-state showing its criminal investigations to a victim-state, so victim-states can correctly judge the host-state's actions. Furthermore, when a host-state lacks the technical capacity to track down an attacker, international law should require it to work together with law enforcement officials from the victim-state to jointly track down the attackers.⁴¹¹ These two measures will prevent host-states from being perceived as uncooperative and complicit in the use of their networks for attacks against other states. States that deny involvement in a cyberattack, but refuse to open their investigative records to the victim-state, cannot expect to be treated as a state living up to its international duties. In effect, host-states that refuse to cooperate with victim-states are unwilling to prevent cyberattacks and have declared themselves a sanctuary state.

Once a host-state demonstrates, by inaction, that it is a sanctuary state, other states can impute responsibility to it. At that point, the host-state becomes liable for the cyberattack that triggered an initial call for investigation, as well as for all future cyberattacks originating from it. This opens the door to a victim-state to use active defenses against the computer servers in that state during a cyberattack.

VII. The Choice to Use Active Defenses: Moving Towards a Workable Approach

While this article urges states to use active defenses to protect their computer networks, states that use them will find themselves confronted with difficult legal decisions. Technological limitations will place states in a position where a timely decision to use active defenses requires

⁴¹¹ This position is supported by numerous U.N. General Assembly Resolutions, the European Convention on Cybercrime, and other U.N. documents, which all generally urge states to cooperate in investigating and prosecuting the criminal misuse of information technologies. *See supra* notes 382, 394–98, 400 and accompanying text; UNITED NATIONS MANUAL ON THE PREVENTION AND CONTROL OF COMPUTER RELATED CRIME ¶ 268–73 (1995), available at <http://www.uncjin.org/Documents/irpc4344.pdf>.

states to decide to use them with imperfect knowledge. Since forcible responses to cyberattacks must comply with both principal areas of the law of war—*jus ad bellum* and *jus in bello*⁴¹²—the decision to use active defenses raises several other questions of law resulting from these technical limitations. From a practical standpoint, this will affect state decision-making at the highest and lowest levels of government. State policymakers will need to account for these limitations when setting state policy, while state system administrators will need to account for these limitations when responding to actual cyberattacks.

This part will analyze these issues. First, it will analyze the technological limitations that are likely to affect state *jus ad bellum* analysis. Next, it will move on to *jus in bello* issues. *Jus in bello* analysis will begin with the decision to use force, analyzing why active defenses are the most appropriate forceful response to cyberattacks. The *jus in bello* analysis will conclude with the impact that technological limitations are likely to have on state decisions to use force. Once complete, it will be clear that active defenses are a viable way for states to protect themselves despite the fact that technological limitations complicate state decision-making.

A. Technological Limitations and *Jus ad Bellum* Analysis

While cyberattack analysis is greatly simplified by looking at whether a state of origin has violated its duty to prevent an attack, rather than having to attribute it, states are still likely to find cyberattacks difficult to deal with in practice. *Jus ad bellum* requires states to carefully analyze a cyberattack and ensure that (1) the attack constitutes an armed attack or imminent armed attack; and (2) the attack originates from a sanctuary state. Both of these conditions must exist before a state can lawfully respond with active defenses under *jus ad bellum*.

Cyberattack analysis will be conducted by system administrators, whose position puts them at the forefront of computer defense. System administrators can use various computer programs to facilitate their analysis. Automated detection and warning programs can help detect intrusions, classify attacks, and flag intrusions for administrator action.⁴¹³

⁴¹² See *supra* notes 170–71 and accompanying text.

⁴¹³ See Naraine, *supra* note 167 (referencing former Secretary of Homeland Security Michael Chertoff's discussion of the Federal Government's computer system defenses).

Automated or administrator-operated trace programs can trace attacks back to their point of origin.⁴¹⁴ These programs can help system administrators to classify cyberattacks as armed attacks or lesser uses of force, and evaluate whether attacks originate from a state previously declared a sanctuary state. When attacks meet the appropriate legal thresholds, system administrators may use active defenses to protect their networks.⁴¹⁵

Unfortunately, technological limitations on attack detection, attack classification, and attack traces are likely to further complicate state decision-making during cyberattack analysis. Ideally, attacks would be easy to detect, classify, and trace. Unfortunately, this is not the case. This section will analyze the technological limits of these programs and explore their likely impact on state decision-makers and system administrators.

1. Limitations on Attack Detection

While early detection and warning programs can help catch cyberattacks before they reach their culminating point, even the best programs are unable to detect all cyberattacks.⁴¹⁶ As a result, cyberattacks are bound to harm states. From a legal perspective, the failure to catch an attack until after its completion has both an upside and a downside. On the upside, states would gain the luxury of time to evaluate an attack, since the threat of danger will have already passed. On the downside, tracing an attack back to its source becomes more difficult the further removed the trace becomes from the time of attack.⁴¹⁷

⁴¹⁴ See Wheeler & Larsen, *supra* note 158, at 23–24 (discussing the use of automated tracer programs to find the originating point of a cyberattack). See generally Wheeler & Larsen, *supra* note 158, for a technical discussion on tracing cyberattacks back to their point of origin.

⁴¹⁵ See *supra* Part IV.C–D (discussing the thresholds for armed attacks and imminent armed attacks); *supra* Part VI.A (discussing cyberattacks as armed attacks); *supra* Part VI.B–C (discussing state responsibility for cyberattacks when states violate their duty to prevent them); see also Wheeler & Larsen, *supra* note 158, at 24 (noting that the U.S. Department of Defense has already developed these capabilities, but has been restricted from using them by the U.S. Department of Justice due to the legal issues that active defenses raise).

⁴¹⁶ See Naraine, *supra* note 167 (quoting former Secretary of Homeland Security Michael Chertoff).

⁴¹⁷ See Wheeler & Larsen, *supra* note 158, at 51–52. An ongoing attack is the easiest to trace, allowing states to trace an electronic pathway back to the source. *Id.* at 9–42, 51–

Furthermore, even when it turns out that an armed cyberattack originates from a sanctuary state, state decision-makers would need to think long and hard about using active defenses as a matter of law and policy. The longer it takes to detect an attack, the less compelling the need for states to use active defenses, especially when the attack seems truly complete. On the other hand, when an attack that has reached completion is seen as part of a series of ongoing attacks, the need to use active defenses to deter future attacks is more compelling.⁴¹⁸

2. *Limitations on Attack Classification*

Early detection and warning programs will detect many cyberattacks mid-attack. However, detecting an attack before its culmination makes it harder to classify. Naturally, a system administrator will immediately attempt to shut down a cyberattack with passive defenses as soon as it is detected. However, that is not the full extent of his job. The system administrator must also assess the damage that has been done, as well as any likely future damage, so that an informed decision can be made about whether to use active defenses.⁴¹⁹

When an ongoing cyberattack has already caused severe, invasive, and measurable damage, it can safely be classified as an armed attack,

52. Completed attacks are much more difficult to trace because the electronic pathways no longer exist and data may have been destroyed. In addition, piercing the shield that zombies or other intermediaries (if any) had created for the true attacker may be a challenge. *Id.* at 51–52.

⁴¹⁸ The more an attack is seen as part of a series of attacks originating from the host-state, the more extensive a victim-state's response can be. The permissible response will be highly fact dependent based on behavioral trends of the host-state and intelligence about the host-state's intentions. *See supra* Part IV.C–D. Thus, cyberattacks from sanctuary states are more likely to be seen as part of an ongoing series of attacks, even when the attacks are actually committed by different attackers within the state, because the sanctuary states have already demonstrated that they allow attacks from within their territory. *See supra* Part VI.B–D.

⁴¹⁹ System administrators must determine whether the attack meets the threshold of an armed attack. To do so, they would need to weigh (1) the potential harm that could occur from the attack to ensure that it was an armed attack; (2) the likelihood of fending off the attack with purely defensive measures, to ensure that active defenses were necessary; and (3) the imminency of such harm, since active defenses may not be employed until delaying their use starts to endanger the state. These decisions will, no doubt, be based on rules promulgated by the victim-state before the attack ever occurs. These rules would simplify the legal framework into a set of rules more easily understood by the layperson, similar to the rules of engagement that military personnel follow.

even though it is still ongoing.⁴²⁰ On the other hand, when an attack has not caused severe, invasive, or measurable damage, a system administrator will need to look at the immediacy of future harm to determine whether the attack should be classified as an imminent armed attack.⁴²¹ Given the lightning speeds with which computer codes can execute, this decision will be very difficult to make, since delaying the use of active defenses increases the likelihood of harm to a state.⁴²²

The limitations on attack classification should give system administrators pause before deciding to use active defenses in anticipatory self-defense. While it is lawful to make a decision based on their best analysis of the facts,⁴²³ such determinations will be highly speculative due to the shadowy nature of cyberattacks. Most likely, when a computer intrusion is detected, the purpose of the attack will be difficult to discern without dissecting a program's code or reviewing the

⁴²⁰ See *supra* Part VI.A. The 2007 cyberattack against Estonia is a good example of an ongoing attack that had risen to the level of an armed attack when it was detected. That attack no doubt rose to the level of an armed attack early in the process, disrupting the ability of the Estonian government to govern; yet the attacks continued for several weeks afterwards, further damaging Estonian systems far beyond the damage at the point of detection. See *supra* Part I, introduction.

Furthermore, when evaluating a cyberattack as an armed attack, states need to determine whether the cyberattack is part of a series of coordinated cyberattacks against a state. When this happens, it is possible for the collective effect of the attacks to rise to the level of an armed attack, even though none of the individual attacks did so. In this type of situation, the collected cyberattacks against non-critical infrastructure can be considered an armed attack. See *supra* Part VI.A. This would require analysis at a higher national level than the particular institution being individually attacked. The Cyber Warning and Information Network and National Cyber Alert System is an example of such an effort in the United States. See WILSON, *supra* note 15, at CRS-31 to CRS-32. The 2007 cyberattacks against Estonia were an example of a coordinated set of cyberattacks that collectively rose to the level of an armed attack. While some of the attacks on Estonia were against critical infrastructure, and might have been considered armed attacks singly, the collective effect was much greater than the damage done in any of the individual attacks, and certainly pushed those cyberattacks to the level of armed force. See *supra* Part II, introduction.

⁴²¹ See *supra* Part VI.A.

⁴²² System administrators can attempt to quarantine and analyze malicious code to buy time. However, this is not always possible. Furthermore, unauthorized remote penetrations cannot be quarantined or slowed down. For these cyberattacks, system administrators will need to sever the connection and end the attack, which may not always be possible. However, all of this takes time, which is why it is easier to automate classification and trace programs to uncover the basic facts about a cyberattack and its point of origin, flag the attack for a system administrator's attention, and have active defenses at the ready. See *supra* Part III.C.

⁴²³ See *supra* note 366 and accompanying text.

audit logs of an attacker's activity.⁴²⁴ Furthermore, the speed with which cyberattacks execute will force system administrators to make their best guess, even though they will probably be missing critical information. Given the speculative nature of any such calculus,⁴²⁵ as a matter of policy, state decision-makers may want to direct their system administrators to respond to cyberattacks in anticipatory self-defense only as an act of last resort, to prevent an escalation of hostilities between states.

3. *Limitations on Attack Traces*

Cyberattacks are frequently conducted through intermediate computer systems to disguise the true identity of an attacker.⁴²⁶ While trace programs are capable of penetrating intermediate disguises back to their electronic source, their success rate is not perfect.⁴²⁷ Thus, trace programs run the risk of incorrectly identifying the true source of an attack. This limitation creates an apparent problem because an attack could be incorrectly perceived as coming from a state that is not the actual state of origin. However, the problem is not as big as it appears. State responsibility should still be judged on the facts at hand, even if it results in misattribution. First, as long as a state assesses an attack to the

⁴²⁴ For instance, the purpose of malware may range from collecting information, to testing a state's defenses, to launching a full scale attack. Furthermore, since remote penetrations are conducted by individuals, the purpose of the attack may be impossible to know without questioning the attacker.

⁴²⁵ Using active defenses in anticipatory self-defense will undoubtedly come under intense international scrutiny the first few times it happens and anger the host-state whose borders were electronically crossed. While states may legally act in anticipatory self-defense when it appears that an armed attack is imminent, it must be prepared to be questioned by other states who do not agree with its analysis. Ultimately the state's actions will be judged using the Rendulic Rule from a legal perspective and in the court of public opinion from a diplomatic perspective. Thus, anticipatory self-defense should only be used when a state feels that an after-the-fact analysis will truly support its actions. See *supra* note 366 and accompanying text.

⁴²⁶ See WILSON, *supra* note 15, at CRS-5 to CRS-7 (discussing the use of zombie computer systems to disguise the identity of an attacker); Ruth Wedgwood, *Proportionality, Cyberwar, and the Law of War*, in *COMPUTER NETWORK ATTACK AND INTERNATIONAL LAW* 219, 227-30 (Michael N. Schmitt & Brian T. O'Donnell eds., Naval War College 2002) (discussing the use of looping and weaving to disguise the identity of an attacker). See generally Wheeler & Larsen, *supra* note 158 (discussing the technical methods of using intermediary computer systems to disguise the source of a cyberattack).

⁴²⁷ See generally Wheeler & Larsen, *supra* note 158 (discussing the technical capabilities of trace programs).

best of its technical capability and acts in good faith on the information on hand, it has met its international obligations.⁴²⁸ Second, states that refuse to comply with their international duty to prevent their territory from being used to commit cyberattacks have chosen to risk being held indirectly responsible by accident. After all, a state can avoid being the target of active defenses, even when attacks originate from it, by taking affirmative steps to prevent cyberattacks, such as enacting stringent criminal laws, enforcing those laws, and cooperating with victim-states to bring attackers to justice.

B. *Jus in Bello* Issues Related to the Use of Active Defenses

Decisions to use force, once in a state of armed conflict, are governed by *jus in bello*. States do not have a right to use unlimited force against other states during war.⁴²⁹ At its core, *jus in bello* uses four basic principles to regulate the conduct of states during warfare.⁴³⁰ These are the principles of distinction, necessity, humanity, and proportionality.⁴³¹

⁴²⁸ See *supra* note 366 and accompanying text.

⁴²⁹ This proposition is derived from Hague Convention IV, Annex, Article 22, which states, “[t]he right of belligerents to adopt means of injuring the enemy is not unlimited.” Hague Convention IV Respecting the Laws and Customs of War on Land and its Annex (Regulations), Oct. 18, 1907, 36 Stat. 2277, 1 Bevans 631 [hereinafter Hague IV].

⁴³⁰ COMMANDER’S HANDBOOK, *supra* note 59, §§ 5.3, 12.1.2.

⁴³¹ *Id.* Distinction, also referred to as discrimination, “is the requirement to distinguish combatants and military objectives from noncombatants . . . and civilian objects, and to attack only the former.” WINGFIELD, *supra* note 48, at 131. This principle is derived from Additional Protocol I, Article 48, which states, “[p]arties to the conflict shall at all times distinguish between the civilian population and combatants and between civilian objects and military objectives and accordingly shall direct their operations only against military objectives.” Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts, June 8, 1977, 1125 U.N.T.S. 3 [hereinafter AP I]. However, distinction does not protect civilians who directly participate in hostilities. *Id.*, art. 51(3).

Necessity limits the amount of force a state can use against legitimate targets “to that required for mission accomplishment and force protection,” and forbids using force purely “for the sake of destruction.” WINGFIELD, *supra* note 48, at 131.

Humanity prohibits the use of weapons designed to cause unnecessary suffering. WINGFIELD, *supra* note 48, at 131. This principle is derived from Hague Convention IV, Annex, Article 23, which states, “it is especially forbidden . . . to cause unnecessary suffering.” Hague IV, *supra* note 429.

Proportionality protects civilians and their property the same way necessity and humanity protect lawful targets from excessive uses of force. WINGFIELD, *supra* note 48, at 154. Understanding that attacks on legitimate targets will often cause incidental

1. Active Defenses, the Most Appropriate Forceful Response

While, as this article argues, states are legally authorized to respond to cyberattacks with force, states may only use force to the extent authorized under *jus in bello*.⁴³² In other words, unless limited by *jus in bello*, forcible responses are not limited to cyberspace. Therefore, it is worth explaining why state decision-makers should choose to use active defenses, as a matter of policy, as the most appropriate response to cyberattacks.

Active defenses are the most appropriate type of force to use against cyberattacks in light of the principles of *jus in bello*. First, in terms of military necessity, active defenses probably represent all the force needed to accomplish the mission of defending against a cyberattack. Active defenses can trace an attack back to its source and immediately disrupt it, whereas kinetic weapons will be slower and less effective than the lightning speed of a hack-back.⁴³³ Employing kinetic weapons over active defenses will not only be less effective, but will also violate the principle of necessity by employing force purely for destruction's sake. Second, in terms of proportionality, active defenses are less likely to cause disproportionate collateral damage than kinetic weapons. The traceback capabilities of active defenses allow them to target only the source of a cyberattack.⁴³⁴ While collateral damage may still result because the originating computer system may serve multiple functions, unless an attacker uses CNI to conduct the attack, damage should be fairly limited from the use of active defenses. Furthermore, since the majority of cyberattacks are conducted by non-state actors,⁴³⁵ it seems

damage beyond the lawful target itself, proportionality limits the use of force to situations in which the expected military advantage outweighs the expected collateral damage to civilians and their property. WINGFIELD, *supra* note 48, at 154–55. This principle is derived from Additional Protocol I, Article 51(5)(b), which states that it is prohibited to use force that “may be expected to cause incidental loss of civilian life, injury to civilians, damage to civilian objects, or a combination thereof, which would be excessive in relation to the concrete and direct military advantage anticipated.” AP I, *supra* note 431.

⁴³² See *supra* note 171 and accompanying text.

⁴³³ See *supra* Part III.C (discussing defenses to cyberattacks).

⁴³⁴ See *id.* (discussing the capabilities of active defenses); Wheeler & Larsen, *supra* note 158, at 23–24 (discussing the use of automated tracer programs to find the originating point of a cyberattack). *But see infra* Part VII.A.3 (discussing the limitations of trace programs).

⁴³⁵ See Jensen, *supra* note 5, at 232.

unlikely that many attacks will come from CNI.⁴³⁶ Thus, active defenses provide states a way to surgically strike at their attacker with minimal risks of severe collateral damage to the host-state,⁴³⁷ thereby meeting the proportional requirement “to select [the] method or means of warfare likely to cause the least collateral damage and incidental injury, all other things being equal.”⁴³⁸ Finally, while not stemming from *jus in bello*, choosing active defenses versus kinetic weapons should reduce the chance of escalating these situations into full scale armed conflicts between states.

2. *Technological Limitations and Jus in Bello Analysis*

Unfortunately, despite the increased security that active defenses provide, using them is not without legal risk. Technological limitations may prevent states from conducting the surgical strikes envisioned with active defenses.⁴³⁹ The more an attacker routes his attack through intermediary systems, the more difficult it is to trace the attack.⁴⁴⁰

⁴³⁶ However, when cyberattacks originate from critical systems, the host-state bears responsibility for allowing them to be used in such a manner because states have an obligation to police their own citizens. *See supra* Part V.B. By failing to do so, states declare themselves sanctuary states and give other states the legal grounds to respond in self-defense to cyberattacks from them. *See supra* Part V.C–D. The principle of discrimination requires states to segregate their civilian objects from military objects. *See Jensen, supra* note 366, at 1174 (referencing AP I, Article 58). Thus, the host-state is effectively responsible for the collateral damage that occurs because it has allowed attackers within its territory to mix their means of attack with civilian objects making them dual use in nature and legitimate subjects of attack. *See Michael Schmitt, Wired Warfare: Computer Network Attack and the Jus in Bello, in* COMPUTER NETWORK ATTACK AND INTERNATIONAL LAW 187, 198–99 (Michael N. Schmitt & Brian T. O’Donnell eds., Naval War College 2002).

⁴³⁷ *See Jensen, supra* note 366, at 1174 (noting that active defenses can be designed to simply shut a computer off to stop an attack, rather than permanently disabling it); Schmitt, *supra* note 436, at 204–05 (arguing that active defenses may simply shut down computer systems for a brief time, rather than having to use kinetic weapons, which, by their nature, cause physical destruction to achieve their objectives). *But see* Wedgwood, *supra* note 426, at 227–30 (arguing that it is harder to confine the effects of active defenses than it is with kinetic weapons because the links from a computer to the civilian infrastructure it controls are less apparent).

⁴³⁸ Schmitt, *supra* note 436, at 204.

⁴³⁹ *See* Wedgwood, *supra* note 426, at 227–30 (arguing that there is not enough time to properly map the functions of an attacking computer system when using active defenses, which may result in counter-strikes having broader than intended consequences).

⁴⁴⁰ *See generally* Wheeler & Larsen, *supra* note 158 (discussing ways to trace cyberattacks to their source).

Furthermore, complex traces take time, which is not always available during a moment of crisis.⁴⁴¹ Adding to these difficulties, trace programs often have problems pinpointing the source of an attack once an attacker terminates his electronic connection.⁴⁴² Sometimes these difficulties will simply result in a failure to identify the source of an attack; other times it may result in the incorrect identification of an intermediary system as the source of an attack.⁴⁴³ Even when the source of an attack is correctly identified, the victim-state's system administrator must map out the attacking computer system to distinguish its functions and the likely consequences that will result from shutting it down.⁴⁴⁴ However, system mapping takes time, often more time than a state has to make an informed decision.⁴⁴⁵ Sometimes an administrator will be able to map a system quickly, allowing states to make informed decisions about likely collateral damage. Other times a state will be forced to predict the likely consequences of using active defenses without having fully mapped a system. As a result, any state that employs active defenses runs the risk of accidentally targeting innocent systems and causing unintended, excessive collateral damage.⁴⁴⁶

To ensure the lawful use of active defenses in accordance with the principles of distinction and proportionality, states must do "everything feasible" to mitigate these risks.⁴⁴⁷ In the realm of active defenses, this

⁴⁴¹ See Wedgwood, *supra* note 426, at 227–30.

⁴⁴² See generally Wheeler & Larsen, *supra* note 158 (discussing ways to trace cyberattacks to their source).

⁴⁴³ See Wedgwood, *supra* note 426, at 227–30 (noting that looping and weaving techniques may cause faulty traces); WILSON, *supra* note 15, at 5–7 (noting that zombies are often used to conduct cyberattacks). See generally Wheeler & Larsen, *supra* note 158 (discussing ways to trace cyberattacks to their source).

⁴⁴⁴ See Barkham, *supra* note 29, at 82–83; Jensen, *supra* note 366, at 1184–85.

⁴⁴⁵ See Wedgwood, *supra* note 426, at 227–30.

⁴⁴⁶ See Barkham, *supra* note 29, at 82–83; Jensen, *supra* note 366, at 1178–79. Targeting innocent systems violates the principle of distinction, unless it meets the safe harbor of the Rendulic Rule. Jensen, *supra* note 366, at 1178–86. Causing excessive collateral damage in relation to the military advantage gained violates the principle of proportionality, unless it meets the safe harbor of the Rendulic Rule. *Id.*

⁴⁴⁷ Jensen, *supra* note 366, at 1183–86. This principle is derived from AP I, Article 57(2), which states:

- (a) those who plan or decide upon an attack shall:
 - (i) do everything feasible to verify that the objectives to be attacked are neither civilians nor civilian objects . . . ;
 - (ii) take all feasible precautions in the choice of means and methods of attack with a view to avoiding, and in any event minimizing,

means doing everything feasible to identify (1) the computer system that launched the initial attack; and (2) the probable collateral damage that will result from using active defenses against that system.⁴⁴⁸ Once a state does everything feasible to ensure it has the right information and acts in good faith in accordance with *jus in bello*, it is legally protected from erroneous calculations, even when it targets civilian systems or causes excessive collateral damage in relation to its military objective.⁴⁴⁹ “The important point is that a [state] is required only to do what is feasible, given the prevailing circumstances, including the time [it] has to make a decision and the amount of information it has during that time.”⁴⁵⁰ Thus, states may still act with imperfect information, based on the way facts appear at the time, when the potential danger forces them to act.⁴⁵¹ The real test will be whether danger to the victim-state’s systems justified the use of active defenses in light of the likely collateral damage to the host-state.⁴⁵²

While beyond the scope of this article, states should consider several issues before they decide to implement active defenses. First, due to the compressed timelines of cyberattacks, a state may need to automate its active defenses so that it can respond in a timely manner. However, using automated defenses will increase the likelihood of violating the principles of distinction and proportionality. As a result, defenses should probably only be automated for detection purposes, requiring human analysis and approval before actually counter-striking. Second, just because it is legal to use active defenses under the circumstances described in this article, does not mean it is sound policy. States must

incidental loss of civilian life, injury to civilians and damage to civilian objects;

(iii) refrain from deciding to launch any attack which may be expected to cause incidental loss of civilian life, injury to civilians, damage to civilian objects, or a combination thereof, which would be excessive in relation to the concrete and direct military advantage anticipated.

AP I, *supra* note 431.

⁴⁴⁸ See Jensen, *supra* note 366, at 1183–86. Probable consequences are judged as the consequences that “may be ‘expected,’ not what is likely or possible, or even what is foreseeable.” *Id.* at 1179. See generally Brown, *supra* note 51, at 198–202 (discussing the requirements of distinction, necessity, humanity, and proportionality regarding cyberattacks).

⁴⁴⁹ See Jensen, *supra* note 366, at 1184–86 (discussing the legal protection granted to states and decision makers under the Rendulic Rule).

⁴⁵⁰ *Id.* at 1186.

⁴⁵¹ See *id.* at 1183.

⁴⁵² See Brown, *supra* note 51, at 201–02.

decide whether the diplomatic fallout is worth the risk. Unfortunately, technological limitations can cause state calculations to be erroneous at times, and cause civilian systems to be targeted or excessively damaged. States must decide that the second guessing that other states will engage in is worth the benefit gained from protecting their computer systems. Third, the servers from which the initial attacks originate may be intimately tied to important systems in the host-state, and if disrupted could have devastating effects and cause unnecessary suffering. This possibility must be factored into the state's evaluation of military necessity versus probable collateral damage, especially if a state responds with active defenses without fully mapping an attacking system. Fourth, states should carefully design their active defenses. Poorly coded active defense programs run the risk of self-propagating in cyberspace beyond their initial purpose, and can run the risk of evolving from a defensive program into a computer virus or worm whose damage goes far beyond its intended design. Since active defenses represent a new frontier in cyberwarfare, their initial use will be controversial, no matter the situation. States should expect public scrutiny and diplomatic protests until such time as active defenses are recognized as a lawful method of self-defense under international law.

VIII. Conclusion

Cyberattacks are one of the greatest threats to international peace and security in the twenty-first century. Securing cyberspace is an absolute imperative. In an ideal world, states would work together to eliminate the cyberthreat. Unfortunately, our world is no utopia, nor is it likely to become one. Sanctuary states refuse to cooperate with other states to eliminate cyberattacks, which casts doubt on reaching a global international agreement to secure cyberspace at any time in the near future. Perhaps one day global cooperation to eliminate cyberattacks will be a reality. Unless something changes to pressure sanctuary states into changing their behavior, there is no impetus for them to do so. As a result, states must use their imagination to get past the current legal roadblocks that prevent them from adequately addressing the current cyberthreat and compel sanctuary states into fulfilling their international duty to prevent cyberattacks.

The way to achieve this reality is to hold sanctuary states responsible for violating their duty to prevent cyberattacks and use active defenses against cyberattacks originating from within their borders. Not only will

this allow victim-states to protect themselves from cyberattacks, but it should also push sanctuary states into taking their international duty seriously. After all, no state wants another state using force within its borders, even electronically. Thus, the possibility that cyberattacks will be met with a forceful response is the hammer that can drive some sense into sanctuary states.

Since states do not currently use active defenses, any decision to use them will be a controversial change to state practice. This proposal is bound to be met with criticism on a number of fronts.⁴⁵³ However, there is sound legal authority to use active defenses against states that violate their duty to prevent cyberattacks. States that violate this duty, and refuse to change their practices, should be held responsible for all further attacks originating from within their borders in accordance with the law of war.⁴⁵⁴ At a time when cyberattacks threaten global security and states are scrambling to find ways to improve their cyberdefenses,⁴⁵⁵

⁴⁵³ The largest critiques are likely to come from those who believe that (1) cyberattacks are not acts of war and should be treated as a criminal matter or (2) victim-states should have to prove that a state initiated the cyberattack or exercised direct control over the attacker before it is allowed to use active defenses. However, some critics are even likely to critique this article's approach as not going far enough to protect state CNI from cyberattacks because it prevents states from using active defenses when attacks are not from sanctuary states. Critics who argue that cyberattacks cannot rise to the level of armed attacks miss the way the law has responded to unconventional attacks in the past. Furthermore, these critics also miss an important facet of international law—the theory and practice of reprisals, which can be used as an alternate basis to authorize active defenses against cyberattacks. *See supra* notes 350, 368 and accompanying text.

Critics who argue that this article goes too far by advocating for the use of active defenses without having to prove a state's involvement in the attacks miss the way that the law of state responsibility has evolved over the past thirty-years. Their arguments rest on the prevailing view of state responsibility for cyberattacks, which is rooted in outdated understandings of the law. *See supra* Part II.A (discussing the response crisis); *supra* Part V.C (analyzing the law of state responsibility); VI.B (analyzing state responsibility for cyberattacks).

Critics who argue that the approach advocated by this article does not go far enough to protect state CNI, and advocate using strict liability as the legal standard to protect CNI, miss a crucial part of the legal analysis—namely, just because CNI is under armed attack does not give a victim-state legal authority to violate the territorial integrity of the host-state. *See supra* notes 346, 352, 377 and accompanying text.

⁴⁵⁴ Today, state responsibility for the actions of non-state actors results from a state's failure to live up to their international duties to other states with respect to those non-state actors. *See supra* Part V.C. This includes the duty to prevent cyberattacks. *See supra* Part VI.B–D.

⁴⁵⁵ During President George W. Bush's administration, the United States initiated a \$30 billion cyberdefense plan to protect government computer networks from attack. Since President Obama has taken office, he has identified cybersecurity as one of the most

there is no reason to shield sanctuary states from the lawful use of active defenses by victim-states and every reason to enhance state defenses to cyberattacks by using them.

important national security concerns of the United States and has ordered a review of U.S. cyberdefenses to find ways to improve cybersecurity. The review of U.S. cyberdefenses is still ongoing at the time of this article's submission. However, one report already prepared for the President recommends a reexamination of the law regarding military responses to cyberattacks. See Keith Epstein, *U.S. is Losing Global Cyberwar, Commission Says*, BUSINESSWEEK.COM, Dec. 7, 2008, http://www.businessweek.com/bwdaily/dnflash/content/dec2008/db2008127_817606.htm; Peter Eisler, *Raids on Federal Computer Data Soar; "Major Intrusions" on Networks are Up 40%*, USA TODAY, Feb. 17, 2009, at 1A; Byron Acohido, *Obama Taps Cybersecurity Expert to Assess U.S. Defenses*, USA TODAY, Feb. 17, 2009, at 8B; Byron Acohido, *White House Urged to Stop Cyberattacks*, USA TODAY.COM, Mar. 11, 2009, <http://blogs.usatoday.com/technologylive/2009/03/the-united-stat.html>; CTR. FOR STRATEGIC AND INT'L STUD., COMM'N ON SECURING CYBERSPACE FOR THE 44TH PRESIDENCY, SECURING CYBERSPACE FOR THE 44TH PRESIDENCY 8 (2008) (recommending to the President to direct the Attorney General to reexamine the law and "issue guidelines as to the circumstances and requirements for the use of . . . [the] military . . . in cyber incidents").