Digital force: disrupting life, liberty and livelihood in the information age

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6 Durable Disruption of Critical Infrastructures as a Territorial Blockade

"Councillor Hamann*: Almost no one comes down here, unless, of course, there's a problem. That's how it is with people - nobody cares how it works as long as it works. I like it down here. I like to be reminded this city survives because of these machines. These machines are keeping us alive, while other machines are coming to kill us. Interesting, isn't it? Power to give life, and the power to end it."*[474]

6.1 Introduction

In the movie trilogy the Matrix, from which the opening conversation of this Chapter originates, Mankind is in war with an army of machines. In the movie it is not made clear whether it was Mankind or the Machines which torched the sky, but the result was the same; earth is deprived of the sunlight needed to grow food or to keep warm. In this permanent dark and cold world, Mankind's last stance is in Zion, a small civilization numbering a couple of thousand people near the warm core of the earth.

The movie is very illustrative and deeply philosophical about the relation between Man and Machine. As the conversation demonstrates, even the people who were fighting against the Machines, continued to be dependent upon other machines for their lighting, heating and air-conditioning. In other words, technology continued to be a *conditio sine qua non* for Mankind to survive.

This chapter will argue, pursuant to the legal and moral philosophy behind the principles of State sovereignty, that in the Information Age, as described in Chapter 2, our society is very comparable to that in the movie the Matrix and that as a consequence, cyber operations which durable disrupt our access to our technology will be regarded as severe as a blockade of our territory by traditional kinetic means, such as through large-scale, state-sponsored (threats of) force (*e.g.*, artillery shelling, naval attacks, aerial strikes, *et cetera*)..

As explained in Chapter 3, State sovereignty is ultimately derived from the inherent drive of people to self-determination and the protection thereto by the State of the vital interests

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[474] The Matrix Reloaded (2003), part 3.

of individuals, namely; life, liberty and property, as well as their collective forms; state sovereignty, political independence and territorial integrity. This chapter and Chapter 5 deal with the inverse of State sovereignty, namely breaches to self-determination. Chapter 5 has dealt with threats to *products* in cyberspace such as through the large-scale theft of intellectual property. This chapter will continue to deal with threats to *services* in cyberspace such as through the durable disruption of critical infrastructures.

This chapter will contain three main sections. In Section 6.2, I will discuss the relation between Man and Machine. In this section, I will describe the process by which people moved from the state of nature to States proper and how this has changed the common life of the people living there in such a way that people began to trade and specialize the fruits of their labors. Resultantly, I will argue, people became dependent on each other and on the technologies they produced. It will be argued in this section that technology invariably develops from a nicety into a necessity and that it needs to be regarded as an extension of the human body. In Section 6.3, I will discuss how the State is also in a symbiotic relationship with technology. Pursuant to the anatomy analogy, I will argue that critical infrastructures are extensions of the State body and that the State has similarly become dependent upon continued access to these technologies for its very survival. Thereafter, Sections 6.3-6.6 will deal with, respectively the critical infrastructures of energy, matter and information and will argue that these infrastructures need to be regarded as the respiratory-, cardiovascular- and central nervous systems of the State body. In these sections it is also described how these critical infrastructures are being increasingly connected to cyberspace and that this results in an increasing reliance on cyber security. The chapter will conclude in Section 6.7 where a summary and concluding observations are provided.

6.2 Technology as an Extension of the Human Body

As individuals and bands of people move away from the zero-sum game tactics and strategies of conquest in the state of nature[475] and towards the non-zero-sum game tactics and strategies of cooperation in the laws of men,[476] contact with other people is no longer something which is mostly to be feared. As mentioned, resultantly, this greatly reduces the amount of time and energy both groups have to spend in (preparation of, waging of and recovering from) war

[475] *See generally supra* Section 3.2.3.3
[476] *See generally supra* Section 3.3.

against the other group.[477] Correspondingly, through cooperation, there can be a great increase in the amounts of time and energy both groups can spend on finding food and on reproducing.[478] The resources of time and energy can be spend much more productively through cooperation.[479] Slowly but surely, these agreements not to use force let participants to the agreement compete successfully against other groups which did not have such agreements.[480]

Additionally, as individuals and bands of people move away from a situation in which their contact with each other was mostly of a negative nature, this also opens up opportunities for positive contact as well. One band of people can take the excessive fruits of a successful hunt to another band of people and make basic trades with them – such as for different types of foods or tools.[481] Eventually, through such trade too comes specialization as different bands of hunter/gatherers focus specifically on developing techniques and technologies for hunting-, fishing- or gathering specific types of foods.[482] Subsequently, they trade the excessive fruits of their specialized labors among each other.[483] Through trade, the different bands of people achieve greater differentiation as to the quality of the products and services they can consume - through specialization, the different bands can achieve greater quantities.[484]

Through the process of specialization and trade, new professions soon explode onto the scene as well. Specialized tool builders produce special tools for hunting, fishing, gathering, cooking and for producing clothing and shelters. At some point, as the basic *physiological* needs of people are increasingly being met, professions arrive which start to cater to higher *psychological* wants as well - such as craftsmen, artists, and priests.[485] Higher value products and services are being created, such as jewelry, arts and salvation of the spirit. Life is getting better and, according to the services provided by the priestly class; eternal.

As cooperation continues to increase, people start forming larger sociopolitical groups.[486] Bands join into larger, over-arching tribes; tribes move into larger chiefdoms and

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[477] *Id.*
[478] *Id.*
[479] *Id.*
[480] *Id.*
[481] *See generally* M. Ridley, *The Rational Optimist: How Prosperity Evolves* (2011), Chapter 2. Chapter 2 is titled "The collective brain: exchange and specialization.". Ridley describes trade (in his words "exchange") and specialization as a process through which man outsources certain skills to the 'collective brain' of the group with which he interacts. Hence, the larger the group, the larger this brain becomes.
[482] *See* Ridley, *The Rational Optimist*, p. 47-84.
[483] *Id.*
[484] *Id.*
[485] *See* Maslow, A Theory of Human Motivation.
[486] *See* E. Service, *Primitive Social Organization* (1962).

chiefdoms themselves grow into States[487] As these groups grow larger and as their cooperation grows more complex, different types of food production are enabled and *vice versa*, different types of food productions enable more complex cooperation.[488] As chiefdoms and States increase the centralization and monopolization of the legitimate use of force and societies move into the laws of States,[489] people become increasingly freed from aggression against their lives, liberty and property. Consequently, without the fear of having the fruits of one's labors stolen, people can start to feel secure to invest more time, energy and resources into long-term schemes for food production.[490] Hunter/gatherer bands slowly turn into groups which engage in more long-term food production schemes based on these same types of foods.[491] In tribes, people take the fruits, vegetables and nuts they previously gathered and grow them themselves as they practice horticulture.[492] In chiefdoms, people take the animals they previously hunted and grow them themselves as they practice pastoralism.[493] In States, people take both the *flora* and *fauna* of their surroundings and grow them on a larger scale as they practice agriculture.[494] Food is increasingly being produced, rather than extracted.

Through the twin processes of the monopolization of the use of force and the process of trade and specialization which this enables, encounters with other people become something to look forward to, rather than something to be feared. To the average person, for the first time in human history, people outside of their own small groups are becoming worth more alive than dead.

Concomitantly, with this increasing specialization and trade also comes an outsourcing of the capacity to take care of all of one's own needs. A specialized builder of tools such as a blacksmith will no longer invest the time, energy and resources to learn the techniques which are necessary to be able to hunt, fish, gather or farm and neither will specialized clothing makers, weavers, potters, jewelers, bakers, brewers or butchers, let alone priests who are employed in the spiritual world. Although these professions all provide valuable products and services to other people's lives, they also become entirely dependent upon the remaining

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487 *Id.*
488 *Id.*
489 *See* Section 3.4.
490 Hobbes, Chapter XIII: "In such condition, there is no place for Industry; because the fruit thereof is uncertain; and consequently no Culture of the Earth; no Navigation, nor use of the commodities that may be imported by Sea; no commodious Building; no Instruments of moving, and removing such things as require much force; no Knowledge of the face of the Earth; no account of Time; no Arts; no Letters; no Society;".
491 *See* E. Service, *Primitive Social Organization* (1962).
492 *Id.*
493 *Id.*
494 *Id.*

hunters, fishers, gatherers and farmers to bring them even their minimum amount of calories. Concomitantly, specialized tool builders build an ever increasing amount of technological tools to keep increasing the yields of the remaining hunters, fishers, gatherers and farmers with – they build specialized spears, bows and arrows, nets, traps, shovels, plows, saddles and many other tools to improve the efficiency of these remaining hunters, fishers, gatherers and farmers. Furthermore, these technological tools continue to require maintenance, repair, replacement and improvement by these specialized tool builders. The dependency thus also often works the other way around, as these hunters, fishers, gatherers and farmers no longer invest the time, energy and resources to learn the techniques to build these tools, as they previously did. Instead, they become entirely dependent on the tool builders to keep building their technological products so that the same high level of food extraction and production can be maintained.

Resultantly, as societies become more complex and specialized, there is a slow but steady voluntary surrender by all of a specific freedom for a benefit whose value is greater than the value surrendered – just as we did when we gave up rights to preventive, pre-emptive and punitive self-defence in exchange of improved security provided by the State.[495] Producers of food surrender the freedom to be independent in their production of tools and the producers of tools surrender the freedom to be independent in their production of food. Resultantly, independency diminishes and (inter)dependency grows. Slowly but steadily, just as defensive (self-)preservation moved from the individual to the collective, so too does economic (self-)preservation move from the individual to the collective.[496]

However, it is important to not simply take this process as a *fait accompli*, but to explore for a moment whether it is in the interest of *all* men to surrender this independence in favour of cooperation. After all, if there are exceptions by which some men can pursue their self-interest better through economic independence and self-sufficiency, then cooperation is not in their self-interest and they will hence not wish to cooperate with others through exchange and specialization.[497] Fortunately, these exceptions do not seem to exist in any way which would warrant hesitance against taking cooperation as the goal to pursue. Although there is no unanimity in theory and philosophy about the benefits of exchange and specialization over independence and self-sufficiency in the state of nature,[498] it is the correct view. In practice,

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[495] *See supra* Section 3.4.
[496] *Id.*
[497] *See also generally supra* Section 3.2.
[498] *See e.g.* Rousseau, *On the Inequality Among Mankind*, Part I: “If we strip this being, thus constituted, of all the supernatural gifts he may have received, and all the artificial faculties he can have acquired only by a long process;

although self-sufficiency does not necessarily require specialization and expertise in every aspect of economic activity, it does require *proficiency* in all of them. Even in a primitive hunter/gatherer society, one needs to know where to hunt game, when and where to pick which fruits, vegetables and nuts, where to fish, and how to construct the hunting and fishing tools required for each of these, how to dry and sow hides for clothing and how to build basic shelters.[499] In a society, (much of) this knowledge is outsourced.[500] Not only is all of in all likelihood beyond the capacity of one individual, but even *if* one could successfully attain proficiency in all of these skills, life would still be an extremely poor existence. The natural way to best pursue one's self-interest in order to achieve greater differentiation as to the *quality* of the products and services we can consume, is hence through cooperation, exchange and specialization.[501]

Moreover, even if one would be able to live independently and if one could create more of the riches of life, then there is still another important argument against this type of self-sufficiency; it would be extremely inefficient. With increasing specialization and exchange, comes increased efficiency and *quantitative* benefits through economies of scale and through investment in better techniques and technology.[502]

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if we consider him in a world, just as he must have come from the hands of nature, we behold in him an animal weaker than some, and less agile than others; but, taking him all round, the most advantageously organized of any. *I see him satisfying his hunger at the first oak, and slaking his thirst at the first brook; finding his bed at the foodt of the tree which afforded him a repast; and, with that, all his wants supplied*.". (emphasis added)

[499] *See* Ridley, *The Rational Optimist*, p. 47-84.

[500] *Id.*

[501] *See e.g.* L. Read, I, Pencil: My Family Tree as Told to Leonard E. Read: "I, Pencil, simple though I appear to be, merit your wonder and awe, a claim I shall attempt to prove. In fact, if you can understand me—no, that's too much to ask of anyone—if you can become aware of the miraculousness which I symbolize, you can help save the freedom mankind is so unhappily losing. I have a profound lesson to teach. And I can teach this lesson better than can an automobile or an airplane or a mechanical dishwasher because—well, because I am seemingly so simple. Simple? Yet, *not a single person on the face of this earth knows how to make me*." […] "My family tree begins with what in fact is a tree, a cedar of straight grain that grows in Northern California and Oregon. Now contemplate all the saws and trucks and rope and the countless other gear used in harvesting and carting the cedar logs to the railroad siding. Think of all the persons and the numberless skills that went into their fabrication: the mining of ore, the making of steel and its refinement into saws, axes, motors; the growing of hemp and bringing it through all the stages to heavy and strong rope; the logging camps with their beds and mess halls, the cookery and the raising of all the foods. Why, untold thousands of persons had a hand in every cup of coffee the loggers drink!". (emphasis added) The essay continues with the miraculous journey of the lead, the graphite, metal and the complex lacquer which coats the cedar, coming from all around the world and involving millions of people in their production. All of this to illustrate that even the most basic of riches – a simple pencil to write down ideas with – involves trade and technology on a scale unfathomable to any single human being, yet requiring all of the people and technology involved. Moreover, what is true for the simple pencil is true for every item produced (and yes, the paper you are currently reading this sentence on is a true miracle of trade and technology as well, let alone the miraculousness if you choose to read this on a computer screen).

[502] *See e.g.* Smith, The Wealth of Nations, Book I, Chapter I: "I have seen a small manufactory of this kind, where ten men only were employed, and where some of them consequently performed two or three distinct operations. But though they were very poor, and therefore but indifferently accommodated with the necessary machinery, they could, when they exerted themselves, make among them about twelve pounds of pins in a day. There are in a

Moreover, contrary to common perception, there is nothing unnatural about the drive towards efficiency such as through cooperation, exchange and specialization, and through technology. Rather, this drive towards efficiency is a core guiding principle of nature. As set out in Section 3.2, every life form acts according to its perceived self-interest in order to survive and to reproduce. Doing so is the *conditio sine qua non* for its continued existence and reproductive success in an environment where there is competition for scarce resources - such as food and reproductive opportunities. In the *locus classicus* of evolutionary biology, the lion hence chases the zebra and natural selection pushes both specifies towards beneficial traits such as speed and strength. However, besides the push towards *increased benefits*, natural selection also pushes species towards the other side of cost/benefit analysis: *decreased costs*. If we revisit the *locus classicus* of evolutionary biology again, we see that if the hunt was successful and the lion has consumed the zebra, then the lion will prefer not to move for days (except perhaps for reproductive pursuits). Because the lion, being the King of the Jungle, is at the top of the food chain, he can sleep like a king without falling prey to another predator. He only has to eat to survive. The reason why lions are notoriously inactive after eating is however not just digestive. Rather, it is for the same reason why not every animal has fantastic senses, strengths and smarts; all of these features incur a great cost in the amount of energy they require to grow and maintain. Great mental and physical strengths do not just provide benefits, but they also incur costs. Moreover, more often than not, the additional benefits stand in a negative cost/benefit relation to the costs. In other words, even though such features would be improvement in the sense of survival of the strongest, they are not so in the sense of a survival of the fittest. The guiding principle of evolution is to look for designs which can survive and reproduce *efficiently*. Hence, If you don't use it, you better lose it. A great example of this binary focus on either survival or reproduction is the Kiwi bird of the genus *Apteryx*, which translates to 'without wing'. The Kiwi bird is a native species of flightless birds from New Zealand and surrounding Islands which, because of New Zealand's geographical isolation, has evolved in an environment without natural predators. Resultantly, this environment de-emphasized survival mechanisms and emphasized reproduction mechanisms. The result is a five pound bird which cannot fly or

pound upwards of four thousand pins of a middling size. Those ten persons, therefore, could make among them upwards of forty-eight thousand pins in a day. Each person, therefore, making a tenth part of forty-eight thousand pins, might be considered as making four thousand eight hundred pins in a day. *But if they had all wrought separately and independently, and without any of them having been educated to this peculiar business, they certainly could not each of them have made twenty, perhaps not one pin in a day; that is, certainly, not the two hundred and fortieth, perhaps not the four thousand eight hundredth, part of what they are at present capable of performing, in consequence of a proper division and combination of their different operations*.". (emphasis added) properly sense threats and which lays a one pound egg, one of the largest proportional to the size of any animal.

Homo sapiens too provides a very clear example of the drive in nature towards efficiency. By any comparison to the rest of the animal kingdom, we are an extremely unusual animal. As the hardware and software in our brains improved, it allowed us to wield fire, produce ever more advanced tools and to wear the skins of other animals as our clothing, instead of having to evolve the appropriate skins ourselves. Consequently, our bodies adapted. As Kelly observes:

> "We are not the same folks who marched out of Africa. Our genes have coevolved with our inventions. In the past 10,000 years alone, in fact, our genes have evolved 100 times faster than the average rate for the previous 6 million years. […] *Our teeth continue to shrink (because of cooking, our external stomach), our muscles thin out, our hair disappears.* […] We are coevolving with our technology, and so we have become deeply dependent on it. If all technology-every last knife and spear-were to be removed from this planet, our species would not last more than a few months. We are now symbiotic with technology.".[503] (emphasis added)

Mankind has long been in a symbiotic biological relationship with our technology. We can live without our technology like the lion can live without its teeth and claws. If we would take away our technology, we as a species would have a life expectancy comparable to the life expectancy of a lion without its teeth and claws. Just as the lion has adapted to a life with his teeth and claws, so too have we evolved to a life with our technology.

Moreover, our technology has kept evolving since the hunter/gatherer age and has done so at a much faster pace. As Kelly put it:

"*clothes are people's extended skin, wheels extended feet, camera and telescopes extended eyes. Our technological creations have become great extrapolations of the bodies that our genes built. In this way, we can think of technology as our extended body. During the industrial age it was easy to see the world this way. Steam-powered shovels, locomotives,*

[503] *See* Kelly, *What Technology Wants*, p. 21-42.

television, and the levers and gears of engineers were a fabulous exoskeleton that turned man into superman”.[504]

Furthermore, as discussed in Section 2.4, what the industrial age did for manual labor, the information age will do for mental labor. In the same way that the industrial age created an exoskeleton as an extension of our biological bodies, so too the information age will create an exobrain.

Moreover, we also continue to adapt to our technology and become dependent upon it, if not biologically as was the case with our shrinking teeth, thinning muscles and disappearing hair, then in the social organization around our technology. In the next section I will argue that the infrastructures which we have built, are the technology that we have become dependent upon as a society. Pursuant to the domestic analogy as discussed in Section 3.5, I will argue that this technology is the extended body of the State body.

6.3 Critical Infrastructures as an Extension of the State Body

As cooperation continues to increase further, specialization deepens and trade starts to take place over longer distances and over larger groups of people. Consequently, as the physical distance between trading groups of increasingly specialized products and services increases, the functional distance between them needs to be decreased in order to enable the trade of goods and services. Within chiefdoms and States, this is often done through the public construction of infrastructures.

The Oxford Dictionary defines ‘infrastructure’ as “The basic physical and organizational structures and facilities (e.g. buildings, roads, power supplies) needed for the operation of a society or enterprise”. In this reading, the operative word is ‘operation’. It is the *operation* of a society (public sphere) or enterprise (private sphere) which is enabled by the physical structures which traffic materials, energy and information.

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[504] *See* Kelly, What Technology Wants, p. 43-56. Kelly continues: “A closer look reveals the flaw in this analogy: The extended costume of animals is the result of their genes. They inherit the basic blueprints of what they make. Humans don’t. The blueprint for our shells spring from our minds, which may spontaneously create something none of our ancestors ever made or even imagined. If technology is an extension of humans, it is not an extension of our genes but of our minds. Technology is therefore the extended body for ideas.”. In this Chapter, Kelly argues that we should regard our technology as the ‘Seventh Kingdom’ of biology besides Eubacteria, Archaebacteria, Protista, Plantae, Fungi and Animalia, but consisting of memes rather than genes; *see also generally* M. McLuhan, *The Gutenberg Galaxy: The Making of Typographic Man* (1962) (hereinafter: “The Gutenberg Galaxy”).

In agricultural societies, the transportation of produced agricultural goods and tools stands central.[505] Correspondingly, most infrastructures deal with the traffic of materials.[506] Raw materials such as agricultural goods are carried over constructed roads which extend the distance over which the wheels of a cart can carry goods before they break down, bridges are built over creeks, rivers and valleys to diminish the time and energy required to carry goods from point A to point B and harbors are dug out so that ships with deep hauls can be docked and (un)loaded.[507] In industrial societies, the manipulation of materials with energy stands central.[508] Correspondingly, most infrastructures deal with the traffic of energy.[509] Energy is extracted from mines, wells and springs in the form of coal, oil and gas and transported with trains, tankers and pipelines to places where their energy is directly used for the manipulation of material resources or indirectly through the turning of turbines which generate electricity which can be transported over larger distances through electrical grids.[510] In information societies, the extraction and processing of data into information resources stands central. Correspondingly, most infrastructures deal with the traffic of information. Information is extracted from the natural world through sensors, processed and transmitted through wired and wireless telecommunications.[511]

Just as the yields of hunters, fishers and farmers is increased through technology, so too is the functional capacity to trade goods and services across greater distances increased through the technology of infrastructures.

As cooperation increase further, specialization deepens further and trade soon starts to take place internationally as well. The process of specialization and trade that takes place among individuals within a State, also takes place beyond the State as people look for lower prices and greater product variety.

Concomitantly, just as people were no longer independent and self-sufficient within States when they started trading amongst each other, so too States are no longer independent and self-sufficient when they start trading across State borders. The consequence of this dependencies is that one is potentially exposed to great vulnerability - closing a State of from

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505 *See supra* Section 2.4.
506 *Id.*
507 *Id.*
508 *Id.*
509 *Id.*
510 *Id.*
511 *Id.*

the outside world or access to one's technology is likely to have dire consequences for said individual or State. States thus become dependent on other States for goods and services through trade and specialization analogous to the way that individuals become dependent on each other for goods and services through trade and specialization.[512]

In international law and philosophy, this is well understood. Resultantly, when one State uses force to block another State from access to the goods and services it acquires from other States, then the severity of this event is understood and this act is commonly considered an act of aggression and potentially also a *casus belli*.[513] Consequently, the State whose access to the goods and services it acquires abroad is allowed to use a proportional response to right this wrong.[514]

In practice, a blockade does not need to cover the entire border of another State in the case of a land blockade, the entire coast line in the case of a sea blockade, or the entire airspace in the case of an air blockade. Instead, a blockade can be enforced when the infrastructures of roads, sea- and airports are blocked. In other words, due to the fact that it is infrastructures through which this international trade is enabled, it is also its blockade which can disable it. It is for this reason that we often speak of certain infrastructures as being critical.

Whether a specific infrastructure is considered 'critical' would logically depend on the measure of necessity for the operation of a society or enterprise or, inversely, the severity of disruption to it.[515] Regardless of dealing with societies or enterprises, this can only be determined on a case by case basis so that all relevant dependencies can be considered. When it comes to critical infrastructures of States specifically, the same logic applies. To one State one thing will be critical, whereas to another State, other things might be critical. Unsurprisingly, what is 'critical' is defined differently in nearly every State and it is even often defined differently within specific States in different times. For example, the United States Department of Homeland Security (hereinafter: "US DHS") - pursuant to American Presidential directive PDD-63 of May 1998, which set up a national program of 'Critical Infrastructure Protection' – currently considers those infrastructures (or 'infrastructure sectors" as they term it) critical "*whose assets, systems, and networks, whether physical or virtual, are considered so vital to the United States that their incapacitation or destruction would have a debilitating effect*

[512] *See supra* Section 3.5.
[513] *See supra* Section 4.3.
[514] *Id.*
[515] *Id.*

on security, national economic security, national public health or safety, or any combination thereof.".[516] In other words, when the physical or economic health of (the citizens of) a country is threatened by disabling a specific infrastructure, then this infrastructure is deemed critical. In the most recent iteration of 2013, the US DHS lists 16 such critical infrastructure sectors, namely; Chemical, Commercial Facilities, Communications, Critical Manufacturing, Dams, Defense Industrial Base, Emergency Services, Energy, Financial Services, Food and Agriculture, Government Facilities, Healthcare and Public Health, Information Technology, Nuclear Reactors, Materials, and Waste, Transportation Systems, Water and Wastewater Systems. Similarly, the European Union has its own program for Critical Infrastructure Protection and considers those infrastructures critical which are "of the highest importance for the Community and which if disrupted or destroyed would affect two or more MS [Member States], or a single Member State if the critical infrastructure is located in another Member State. This includes transboundary effects resulting from interdependencies between interconnected infrastructures across various sectors.".[517]

In order to avoid the subjectivity inherent to the consequence based approach, as discussed in Section 4.3, for the purposes of this thesis, only those infrastructures will be deemed critical when they contribute substantially to the 'measures of civilization' of a State, as described by Ian Morris in his 2010 book *Why The West Rules - For Now*.[518] In this book Morris attempted to explain why, according to him, the West has ruled during 14 out of the last 15 millennia with regards to the level of 'development' of its civilization. Perhaps even more interesting than Morris' explanations on why this was the case,[519] Morris provided an appendix in the book on how he, perhaps daringly, attempted to quantitatively measure the level of qualitative development of different civilizations which allowed him to rank them accordingly.[520] He later expanded this measurement appendix into the 2013 companion volume

[516] US DHS, Directive PDD-63, May, 1998.
[517] COM(2006) 786, Brussels, 12 December 2006.
[518] *See* Morris, *Why the West Rules – For Now*.
[519] Morris concluded that during the previous centuries the single most important factor for determining whether a certain civilization ruled, was its geographic location. Morris argues that factors such as the concentration of cultivatable foods, the distances of different sea-routes and the availability of resources in certain regions determined the likelihood that those regions would instigate, respectively, the agricultural revolution, colonization efforts and the industrial revolution. The reason why geographical location is becoming less relevant according to Morris, closely relates to one of the central theses of this dissertation; that physical space is decreasing in importance and that digital space is taking over as the most important space.
[520] *See* Morris, *Why the West Rules – For Now*, Appendix. Note: this measurement does not include a measurement of morality, merely a measurement of, mostly economic development.

book *Measuring Civilization: How Social Development Decides the Fate of Nations*.[521] In the book, he goes through his extensive considerations for his measurements.[522] These measures have proven extremely apt at measuring civilization and useful as an inspiration for the purposes of this dissertation. Based on the UN Human Development Index, Morris discerns four factors which measure the development of a civilization.[523] I will discuss them in the order mentioned below and explain to which State infrastructures (public- or privately owned) these measures correspond. Subsequently, I will apply the expansion of cyberspace (caused by the acceleration, miniaturization and dematerialization in the capabilities of information technologies as discussed in Section 2.4) to these infrastructures in order to see how this expansion of cyberspace to these infrastructures influences the measure of civilization. Thereby, it becomes possible to properly appreciate the 'severity' when these infrastructures are disrupted by cyber operations.

Morris distinguished the following four measures of civilization:

1. The capacity within a civilization to capture and use energy;[524]
2. The capacity within a civilization to organize and urbanize;[525]
3. The capacity within a civilization to communicate,[526] and;
4. The capacity within a civilization to wage war in order to protect or expand a civilization.[527]

These measures of civilization provide the inspiration for my categorization below:

1. The infrastructures of energy;
2. The infrastructures of matter;
3. The infrastructures of information;

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[521] *See* I. Morris, *The Measure of Civilization: How Social Development Decides the Fate of Nations* (2013) (hereinafter: "The Measure of Civilization").
[522] *See generally* Morris, *The Measure of Civilization*, p. 25-52.
[523] *See generally* Morris, *The Measure of Civilization*, p. 53-237.
[524] *See generally* Morris, *The Measure of Civilization*, p. 53-143; *see also* Morris, Why the West Rules – For now, Appendix.
[525] *See generally* Morris, *The Measure of Civilization*, p. 144-172; *see also* Morris, Why the West Rules – For now, Appendix.
[526] *See generally* Morris, *The Measure of Civilization*, p. 218-237; *see also* Morris, Why the West Rules – For now, Appendix.
[527] *See generally* Morris, *The Measure of Civilization*, p. 173-217; *see also* Morris, Why the West Rules – For now, Appendix. *See* Morris, The Measure of Civilization, p. 25-52, Section 9; *see also* I. Morris, The Measure of Civilization, Chapters 3,4,6,5 for discussions on energy, social organization, information technology and war-making capacity respectively; I. Morris, Why the West Rules – For now, Part I, Section 3; I. Morris, Why the West Rules – For now, Appendix.

4. The infrastructures of effective control.

In the sections below, I will discuss the infrastructures of energy, matter and information and justify my interpretation of Morris' classification. The 4th measure of effective control through war-making capacity has already been discussed in Chapter 4.[528]

6.4 The Infrastructures of Energy as the Respiratory System of the State

The first type of infrastructure which will be discussed is the infrastructure dealing with energy. It is defined by Morris as the full range of energy captured and used by a civilization, divided into the categories of food and fuel.[529]

Food, both plant- and animal-based, is the energy derived from food which can be consumed directly or which can be fed as feed to other animals in exchange for labor services or animal based products – such as meat, milk, wool and leather. Food as a category of energy capture is the primary means of energy capture and use in hunter-gatherer and agricultural civilizations.[530] Fuel, defined by Morris as non-food energy sources, consists of *inter alia* dung, wood, peat, coal, oil, natural gas, solar, wind, hydro, geo-thermal and nuclear power and can be used for lighting, cooking, heating, cooling, computing and powering other machines. It is the primary means of energy capture and use in industrialized civilizations.[531]

The "capacity to capture and use energy" as defined by Morris is translated in this dissertation as those infrastructures dealing with energy. In other words, it concerns those infrastructures which are responsible for the capture, transportation and use of energy. Energy is what powers civilizations and has, according to Morris, historically been the most defining measure of civilization.[532] The reason why the ability to capture and use energy is so determinative for the collective measure of civilization, is because it greatly influences the carrying capacity of the territory over which a civilization rules. Consider the following example of the fictitious *Terra Cyberia*.

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[528] *See generally* Chapter 4; *see especially* Sections 4.2-4.3 and 4.7

[529] *See* Morris, *The Measure of Civilization*, at. 52-142. Morris also considers raw materials used for clothing and shelter to fall within the term 'energy capture', although this would technically fall under energy conservation. Since the impact of conservation is only of minimal importance according to Morris, for the sake of brevity, this will not be covered separately; s*ee also* I. Morris, *Why the West Rules – For Now*, Appendix.

[530] *See* Morris, *The Measure of Civilization*, at. 52; see especially Figure 3.1 on the Framework by Earl Cook.

[531] *See* I. Morris, *The Measure of Civilization*, p. 52.

[532] *See* Morris, *The Measure of Civilization*, p. 25-52.

Terra Cyberia is an island archipelago a 1000 kilometers west of mainland Ecuador, consisting of a group of quantitatively and qualitatively identical islands – they are identical in size and identical in all relevant other properties.

On *Terra Praedator Congregantis* people patiently spend their days gathering fruits and vegetables. The people are semi-settled, moving around the island when this or that food is in season. Occasionally, the men leave their women and children for a few days or weeks to hunt the local birds and boars that came to the island from the mainland. When they return after a successful hunt, festivities are held in their honor and the people thoroughly enjoy the meat as a delicacy. The people mostly live in the moment, eat organically and enjoy an unpolluted environment. Their largely monotonous lives are only interrupted by the occasional scarcity of food. Due to these shortages, girls on the island are older when they have their first periods and often skip menstrual cycles when their fat percentage drops below 15%. Pregnancies, when they do occur, are often naturally aborted for the same reason and when pregnancies do result in birth, both the child and the mother have a great chance of dying during or soon after birth. Infanticide is an accepted choice of contraception. If the child and/or mother do survive birth and if the child is not post-natally aborted, the rest of their lives are generally short regardless. Senicide is not unheard off. The people on *Terra Praedator Congregantis* are part of nature and life is in balance.

On *Terra Agracultura Victum* people have cut into the jungle and have replaced parts of it with agricultural lands. They spend their days producing their food by tilling the soil, sowing seeds and reaping the fruits of their labor. Food is rarely in short supply, but the elders still remember the tropical storms that once wreaked havoc on the crops. They live by the seasons, but they also try to diversify their investments in food production by engaging in long-term schemes to further domesticate more plants and animals. With each harvest, the crops give better yields and the domesticated boars are nicely fattened by the organic waste left-over from the fields. The people on *Terra Agracultura Victum* are settled near their agricultural lands and nature and man live next to each other.

On *Terra Labor Industria* it seems as if every year new mechanical contraptions are invented to which much of the heavy labor is outsourced. Water mills grind the grain into flower, wind mills seem to divert the water of entire rivers to agricultural lands and large ovens are build where wood and coal are burned to shape the local iron ore into all sorts of useful tools such as axes to clear more land, shovels to dig deeper ditches and strong wheels for carts to bring produce from the land to the people. The people on the island not only survive; they thrive. People reproduce with great success and on this island the elders are not just extra mouths to feed, but also extra brains to store information about the way the world works. The people expand in breadth and depth on the island – they increase the productivity of their existing lands and expand further into the jungle.

As demonstrated by *Terra Cyberia*, the strategies for capturing and using energy vary greatly and so do their survival and reproductive successes. One could imagine that *Terra Praedator Congregantis* could contain a population numbering a thousand people, *Terra Agracultura Victum* 10.000 people and *Terra Labor Industria* 100.000 people, despite the islands being of identical proportions and identical properties.

Inversely, when a civilization such as *Terra Labor Industria* would lose access to its technology, its large population would collapse, fast. As historian Jared Diamond documents in *Collapse – How Societies choose to Fail or Succeed* and in *Guns, Germs and Steel: The Faith of Human Societies*, historically speaking, energy shortages through exhaustion of important resources (or through a changing climate), have been the most predictive factors in determining whether a civilization would continue to survive or whether it would start to die. It thus behooves us to briefly reflect on how our energy infrastructures expose us to potential disruptions. Our modern global civilization is powered by fossil fuels, ranging from the fertilizers used to produce the foods on our farms to the fuels used to power the machines in our factories. As Diamond warns, as a result of this reliance and dependency on fossil fuels, our modern global civilization is not immune to the threats of climate change and energy shortages. Since Mankind started using fossil fuels (coal, oil, natural gas) to power our industrial machines and fertilize our agricultural lands, the modern global civilization has exploded in the carrying capacity of our territories and in population growth. Coincidentally however, the use of fossil fuels has contributed to a changing climate, the likely results of which include extreme weather, floods, droughts, famines, wars and streams of refugees. At some point, this process of climate change needs to be slowed (and possibly even reversed) at its cause or great investments need to be made in fighting its symptoms. Additionally, even if fossil fuels did not contribute to ecological destruction or if its consequences could be dealt with in a cost-effective way, the *fossil* in fossil fuel indicates that this source of fuel is not a fuel which will last us into the future, at least not forever. It is important to understand that our modern civilization is built on the ability to withdraw energy from the fossil fuel bank, without making deposits to it, the eventual consequence of which should be clear to anyone who has ever owned a bank account. Although it is unlikely that our modern global industrialized civilization will ever completely exhaust fossil fuels, the increasing costs to capture and use the next drop of oil or nugget of coal will, at some point, likely make fossil fuels economically unfeasible to power our civilization. Hence, at some point, sooner or later, we will either have to switch our modern global civilization to other sources of fuel, or, as other civilizations have done before us, grind to a halt and collapse.

It is important to have a proper appreciation of the gravity of this possibility. If our civilization comes to be without the fuel to power our industrial machines or fertilize our agricultural lands, then any discussions within legal theory or political science on civilization will largely be a theoretical (or even moot) exercise, because there will be no more civilization to discuss legal theory or political science for, just a much smaller world population consisting of groups of hunter-gatherers and subsistence farmers who will have been thrown back into a state of nature. Hence, in order to avoid the collapse of our modern global civilization, at some point, the increasing costs of our unsustainable energy usage - both with regards to the economical and ecological costs – means we will have to switch our energy infrastructure from fossil fuels to more sustainable sources of energy – such as solar, wind, hydro, geo-thermal and possibly, temporarily, nuclear energy as well.[533] We either go green or we will have more urgent matters to worry about than law, namely our “nasty, brutish and short lives”.[534]

Making this switch to sustainable sources of energy however, will make our energy infrastructure wholly dependent upon cyber security. As detailed above, the measure of energy is divided into the categories of food and feed on the one hand and fuel on the other, the former dealing mainly with the infrastructures of the agricultural and fishing industry and the latter dealing with the infrastructures of oil, electricity and nuclear. Their connection to cyberspace will be discussed in their respective order.

The connection of the food infrastructures of agriculture and fisheries to cyberspace will only be covered briefly as it has been mentioned before.[535] In short, cheap sensors and connectivity can cast a nervous system over the means of food production to monitor and

[533] Nuclear power currently supplies between 10-15% of annual energy production and consumption, mostly in Western states such as Japan and France. Although there are no economical or technical barriers to scale this up to 100% of worldwide energy production and consumption, there are three main reasons why such adoption of nuclear energy is unlikely and/or undesirable. First, nuclear energy is unpopular due to perceived risks. Two, scaling up nuclear energy up worldwide could open up a Pandora’s box of proliferation risks. Third, nuclear energy is also a non-renewable fossil fuel which will run out at some point.
[534] *See* Hobbes, *Leviathan*, Chapter XIII.
[535] *See supra* Section 2.4, 5.4.

experiment with the most resource efficient means of production. The result of this will be that agricultural farms can do much more with much less and that fish farms can provide us with great amounts of *fruit de mer*. Similar to the expansion of cyberspace, we could take the same amount of agricultural land and increase the capacity on it or we could have the same agricultural output on a smaller land. For example, The Netherlands is 134th in size, but 2nd in agricultural exports in absolute numbers.

The connection of the infrastructures of fuel is even more promising. Electrical infrastructure is currently organized as a so-called just-in-time system, which means that all of the electricity used by our lighting, cooking, heating, cooling, computers and other machines has been generated just milliseconds prior to use.[536] Balancing the tremendously complicated supply and demand of all this electricity – which needs to happen in order to prevents black- or brownouts - is already being done by connecting our energy infrastructure to cyberspace.[537] This connection of our electricity infrastructure assets to cyberspace allows utilities to analyze and predict the electricity demand and adjust the power supply accordingly - using mostly peaker gas plants and some hydro storage.[538]

In the future, this will become even more so, due to the intermittency of green energy sources.[539] Intermittency means that the output of these energy sources is not consistent due to varying intensities of wind and solar power during the days, weeks and year(s).[540] Moreover, our current centralized electricity infrastructure is based on dozens or hundreds of power plants per State.[541] A green infrastructure will be decentralized and contain millions upon millions of power plants in the form of solar panels and wind mills.[542] Basically, the electricity infrastructure will become a network, like the internet is today. Balancing this exponentially more complicated infrastructure requires intensive connection of electricity to cyberspace in order to predict electricity supply and demand based on everything from daily weather predictions which influence solar radiance and wind strength to the match schedule of the football world cup finale every four years when millions of people turn on their televisions and frying pans. With cyberspace it becomes possible to make these tremendously complicated

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[536] *See generally* A. Lovins, *Reinventing Fire – Bold Business Solutions for the New Energy Era* (2011) (hereinafter: "Reinventing Fire"), p. 164-222.
[537] *Id.*
[538] *Id.*
[539] *Id.*
[540] *Id.*
[541] *Id.*
[542] *Id.*

calculations and to turn on so-called virtual power plants, demand response units and to charge and discharge electric car batteries.[543] Without cyberspace, this tremendous balancing act is simply impossible. In other words, the energy grid of the future will have to become a network for energy like the internet is a network for data. This requires tremendous amounts of data and continuous reliance on cyberspace.

With this connection of the energy infrastructure to cyberspace however, also comes a vulnerability for cyber attacks. Given the outward facing nature of our current and future energy infrastructures systems, cyber operations can potentially bring down the entire energy system. Even without causing any physical destruction, the mere functional disruption of our energy infrastructure through cyber attacks, can hence bring an entire State to its knees much quicker and much easier than traditional armies every could.

In the Hobbesian analogy of the State body, our energy infrastructures can be considered as the respiratory system in the body of the State. It provides us with the oxygen which fuels everything. Any disruption to it will therefore be as severe as suffocating. The more a State's energy infrastructures become dependent upon the well-functioning of cyberspace and the more durable the functional disruption which is caused by a cyber operation, the more severe the effects of this disruption become and therefore, the more likely it is that a State will consider such disruption as a blockade of energy from its territory.

6.5 The Infrastructures of Matter as the Cardiovascular System of the State

The second type of infrastructure which will be discussed, corresponds to the capacity within a civilization to transport goods and persons. Morris uses the size of the largest city within a civilization as a proxy to measure its level of social organization and urbanization.[544]

The reason for choosing the largest city as a proxy, is that up until the industrial revolution, the capacity within a civilization to capture and use energy had been largely fixed - the energy available to these civilizations came from the food which could be hunted, gathered or farmed.[545] It is important to understand that in hunter-gatherer and agricultural civilizations, it matters a great deal how much energy it costs to bring food from where it is hunted, gathered

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[543] *Id.*
[544] *See* Morris, *The Measure of Civilization*, at. 143-171.
[545] *See* Morris, *The Measure of Civilization*, at. 143-171; *see also* Morris, *The Measure of Civilization*, at. 52-142.

or harvested, into a population center.[546] As cities grow beyond a certain size, they require increasingly more energy to transport the same amount of calories into population centers.[547] At some distance, the amount of food brought into a population center requires more energy to transport, than that it carries in calories. When this happens, a city can no longer feed itself and will collapse unto itself.[548] As explained in the previous subsection, most civilizations had already discovered, through trial and error and artificial selection and domestication of certain food species, which food sources provided the most efficient calorie per unit of volume, weight and necessary resources invested. Beyond this point, since the amount of energy which could be captured and used in a specific territory was largely fixed in hunter-gatherer and agricultural civilizations, the size of a certain city depended largely on how efficient it could transport goods and persons.[549] With a fixed ability to capture and use energy, the logistics of urbanization and transportation constitute the defining factors for city size within these earlier civilizations.

Transportation infrastructure deals with the logistics of moving around goods and persons. In other words, transportation of goods and persons deals with the infrastructure and logistics of matter. It concerns infrastructures dealing with every which physical way – such as water, land and air.

Historically speaking, the wheel, the domestication of animals, large seafaring ships and other ways of increasing the efficiency with which atoms can be moved per unit of energy, have all provided a multiplier effect on the energy captured and used.[550] Both the Islamic and Dutch golden ages owe much of their success to their respective ships – large wooden seafaring ships in the case of the Dutch and camels in the case of the Arab world (often referred to as 'ships of the desert').[551] With the industrial revolution, paved roads, rail roads and water ways took it one step further and increased the functional space of land, air and water ways exponentially. Unsurprisingly, most cities used to be based around water ways, because transportation by water is far more efficient than over roads, especially wobbly roads which easily destroy wheels and carts.[552]

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546 *See* Morris, *The Measure of Civilization,* at. 143-171.
547 *Id.*
548 *Id.*
549 *Id.*
550 *See* Morris, *The Measure of Civilization,* at. 143-171.
551 *Id.*
552 *Id.*

The connection of cyberspace to our transportation infrastructure has been an ongoing process in our ever-urbanizing world, but there is much room for functional growth through the connection of atoms with bits. In our modern industrialized civilization we have built cities with populations numbering in the tens of millions, whereas the largest cities in pre-industrial times numbered a mere fraction of this.[553] Perhaps even more amazingly, we have not just sprawled these cities ever wider, but we have actually managed to maintain cities with population densities of tens of thousands of people per square kilometer. In these cities, energy is no longer the problem, physical space is. The connection of transportation infrastructure to cyberspace has long been an indispensable tool to unclog the congestion in the arteries of our cities.

With the acceleration and demassification of the capacity of information technologies, cyberspace is expanding further into our transportation infrastructures. The result of this expansion will be that the transfer of goods and persons can become much more efficient with regards to the time, energy and other resources used. The three trends most important in this regard are the electrification of transportation, autonomous transportation and on-demand public transportation, all of which are entirely dependent upon cyberspace.

Electrification of transportation is an obvious necessity in order to diminish our dependence on fossil fuels, as discussed in the previous section.[554] However, transportation consumes a relatively large amount of energy and in order to make electric driving practical, batteries need to be filled quickly.[555] Switching transportation to electricity therefore requires a tremendous coordination of demand and supply in energy. Cars need to be in constant communication with the energy infrastructure so that it can be predicted when and where which cars will either charge or discharge on the net.[556] Autonomous transportation enables Mankind to take the next step after cruise control, crash prevention and auto-park and eliminates the need for human driving altogether, first just on the freeway, then on every way.[557] Not only will this free people from the task of driving and enable them to work during commutes, but it will also save hundreds of thousands of deaths caused by human driving.[558] Also, having cars think for

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[553] *See* Morris, *The Measure of Civilization*, at. 143-171; *see also* Morris, Why The West Rules – For Now, Appendix.
[554] *See* Section 6.4; *see also* Lovins, Reinventing Fire, p. 14-69.
[555] *See* Lovins, Reinventing Fire, p. 14-69.
[556] *Id.*
[557] *See especially* S. Heck, M. Rogers, *Resource Revolution – How to Capture the Biggest Business Opportunity in a Century* (2014) (hereinafter: "Resource Revolution"), Chapter 3.
[558] *See* Heck, *Resource Revolution*, p. 59-100.

themselves makes it possible for them to drive very close together, almost as a train.[559] This helps reduce aerodynamic drag and frees up space on the roads so that both energy and time in transportation are reduced.[560] The effect will be a further freeing of Mankind from the limits of distance. People can start living beyond city centers as time and space experientially, functionally disappear. Additionally, autonomous driving also enables the elimination of the need for ownership of vehicles altogether. Just as music, movies and TV-series are no longer owned, autonomous driving cars also make it possible for transportation to be accessible at the press of a button.[561] When you consider that the average car is used perhaps during just 5% of its lifetime and is collecting dust and rust during the other 95% on expensive parking spaces, and when you consider that when cars are actually driving, that they tend to be occupied to only 20-25% of capacity, then it becomes clear that our transportation would benefit greatly from a switch from ownership to access at the press of a button.[562] Compared with that kind of convenience, a car that you own — which you have to park, fill up, fix, insure, clean and pay for deprecation whether you use it or not — begins to seem like kind of a drag. Goods and services are becoming on-demand or on-tap, accessible at the flip of a switch, rather than owned and stocked.

Correspondingly, as our transportation infrastructure transforms our cities, we become exposed to new disruptions to it. Whereas traditional military instruments would use explosives to destroy roads, airports and bridges, cyber operations can now, functionally, create the same amount of functional disruption to our societies at the push of a button.

In the Hobbesian analogy of the State body, our transportation infrastructure can be understood as the cardiovascular system in the body of the State. It provides us with the transportation of nutrients where they are needed. Any disruption to it can be as severe as a heart attack. The more a State's infrastructures of matter become dependent upon the well-functioning of cyberspace and the more durable the functional disruption which is caused by a cyber operation, the more severe the effects of this disruption become and therefore, the more likely it is that a State will consider such disruption as a blockade of matter from its territory.

[559] *Id.*
[560] *Id.*
[561] *Id.*
[562] *Id.*

6.6 The Infrastructures of Information as the Central Nervous System of the State

The third type of infrastructure which will be discussed, deals with the capacity within a civilization to communicate. In other words, it is the means of moving information, which more or less takes place without adding significant marginal energy or material costs for each additional bit of information. Where transportation infrastructure deals with the infrastructure and logistics of matter, and energy infrastructure deals with the infrastructure and logistics of energy, information infrastructure deal with the infrastructure and logistics of data.

From the stone tablets of Moses to the high-tech tablets of Jobs, efficient communication has greatly influenced the ability within a society for knowledge to be stored, processed and transmitted. In the case of Moses, the ten commandments, the Torah and the Talmud allowed the Jewish people to survive an exile from their historic homeland lasting two millennia without being destroyed or assimilated, a feat unequaled in recorded history. In the case of Jobs, the focus on the efficiency of communication has resulted in a user interface of home screen- and icons which has remained largely unchanged even after a decade (which translates to about two millennia in technology years).

The connection of cyberspace to our information infrastructure is of course by now a well-known phenomenon – actually, when most people think of cyberspace or the internet, the first thing they think about are our modern communication platforms. Shirky discerns five historical events in modern history, which, according to him, qualify as communications revolutions – which he defines as a moment in history when a communication technology greatly increased the expressive capacity of persons.[563] The first such revolution was the advent of the printing press, which, for the first time, allowed for one-to-many static text-based communication.[564] The second revolution was the advent of the telephone, which allowed for one-to-one real-life communication between individuals over great distances.[565] The third revolution was the advent of audio and video recorders and players, which allowed for one-to-many dynamic audio- and video-based communication.[566] The fourth revolution was the harnessing of the broadcasting spectrum, which allowed for real-time one-to-many audio and

[563] *See* C. Shirky, How the Internet will (one day) transform government, June 2012, TED 2012 *available* at: http://www.ted.com/talks/clay_shirky_how_the_internet_will_one_day_transform_government (accessed on 31st July, 2017).
[564] *Id.*
[565] *Id.*
[566] *Id.*

video-based communication.[567] The fifth and current revolution in communication is that of the internet, which allows, for the first time in history, many-to-many dynamic communication – including everyone everywhere - through text, audio and video on *inter alia* websites, -logs (web- and video based) and social platforms.[568] Moreover, as Shirky notes, the internet is more than the printing press writ large. Rather, the addition of cyberspace to our communications has, to a large degree, usurped all previous communication technologies – such as books, radio and television.[569] Information has never spread so far and wide – crossing time and space without friction. Additionally, with the continuing increase in transmission speeds, tele-conferencing and other communication technologies aimed at collaboration in the workplace, we can expect to attain virtual reality types of resolution and thus decrease the need to travel to an office building altogether (or the office building to be built in the first place).

With this connection of all of our communication infrastructures to cyberspace, our communication has become wholly dependent upon the security of our cyberspace. Moreover, any disruption to our communication infrastructure does not just influence our communication, but it also has cascading effects to our other infrastructures, including to our infrastructures dealing with energy and matter.

In the Hobbesian analogy of the State body, our information infrastructures truly are the central nervous system in the body of the State. They control and command all within the body. Disruption to it can be as severe as having a stroke. The more a State's information infrastructures become dependent upon the well-functioning of cyberspace and the more durable the functional disruption which is caused by a cyber operation, the more severe the effects of this disruption become and therefore, the more likely it is that a State will consider such disruption as a blockade of information from its territory.

6.7 Conclusion

This chapter started with the observation that Mankind is in a symbiotic relationship with Machines and that the same is true for the State; we are becoming increasingly dependent upon the well-functioning of our technology. Blocking us from our technology can therefore have

567 *Id.*
568 *Id.*
569 *Id.*

severe consequences. Resultantly, the State needs to adjust accordingly and protect our access to our technology if it wants to maintain its *raison d'être*.

Section 6.2 started with the state of nature and our first contact with technology. It discussed the process by which we first acquired tools as extensions of our human bodies. Subsequently, it discussed how we gradually moved from our animal bodies to the modern cyborgs we are today and it discussed how we became dependent upon our continued access to our technology for our very survival.

Section 6.3 continued with our social organization and argued that the State has developed a symbiotic relationship with technology as well. Pursuant to the anatomy analogy, I have argue that critical infrastructures are extensions of the State's body and that the State has similarly become dependent upon continued access to these technologies for its very survival.

Sections 6.4-6.6 discussed three types of critical infrastructures of the State body, namely; the infrastructures of energy, matter and information. These sections argued why these infrastructures correspond to the respiratory-, cardiovascular and central nervous systems of the State body and these sections have discussed how these infrastructures are each becoming increasingly connected to cyberspace. Consequently, cyber operations can increasingly cause severe functional disruption to these infrastructures, thereby blocking the movement of energy, matter and information in the State body. In these sections, it has been argued why the durable disruption of these critical infrastructures through cyber operations therefore needs to be considered as severe as disruptions to the respiratory-, cardiovascular- and central nervous system of the body. Just as with the human body, these systems do not need to be destroyed to cause severe effects, durable disruption is enough. Therefore, as States become increasingly dependent upon the well-functioning of critical infrastructures and as these infrastructures become increasingly dependent upon the well-functioning of cyberspace, the State will follow us there and will start to consider disruption of these infrastructures through cyber operations as severe as a blockade of energy, matter or energy from its (cyber) territory.