CHAPTER 8

CONCLUSIONS

This study is the first in a series of efforts to inductively identify the major parameters of the global diffusion of the Internet and assess that diffusion's likely impact on the future international security landscape. The framework of analysis previously developed by the MOSAIC Group[433] has been modified to accommodate Internet-specific issues and extended to include explicit links between the dimensions of presence and capability and the determinants that caused those dimensions to develop as they did. From this admittedly preliminary survey, several generalizations regarding the Internet may cautiously be tendered:

- **The global diffusion of the Internet has been extraordinarily rapid and extensive**, but not as uniform or rampant as some people think.

  After several years of 100 percent growth rates, during 1997 the rate of growth decreased and will likely continue to decrease over the next several years. The speed of the Internet's nearly worldwide proliferation is unprecedented; however, unlike earlier information technology developments that represented wholly new technologies (i.e., telephone, television), the diffusion of the Internet depended to a great extent on the existing telecommunications infrastructure. The density of the Internet does not parallel that of the telephone network, but the Internet is essentially non-existent anywhere there is no telephone service.

  This diffusion of the Internet has been very uneven. Although surveys count up the number of countries that are connected, the degree of connectedness varies widely. A significant number of connected countries have only one or a very few Internet hosts and access points and serve only a small percentage of the population. The apparent ubiquity of the Internet in the United States is unique; the Internet is more of a novelty than an everyday communications medium even in most other Western countries, with the notable exception of the Nordic countries and possible exception of the United Kingdom. The highest growth rates have occurred in only a few countries.

  Just as "the Internet" really exists only as a logical construct rather than a single system, much like the "global telephone network," so "the Internet" has no single form or model. The principal unifying characteristic is the use of the Internet Protocol suite for communications between computers. While "the Internet" in the United States comprises hundreds of ISPs, dozens of Internet exchanges, and a plethora of dedicated IP backbones, its more usual appearance in much of the world is as a single, small local area network that connects local dial-up and leased-line subscribers to "the Internet" off-shore. The total availability of "the Internet" in many countries amounts to far less service than is available from any one of many ISPs in the greater Washington, D.C., area.

  A related question is: "How big is the Internet?" No short answer can be accurate. The first problem with answering this question was addressed to some extent by the development of the first three dimensions of the analytic framework (Pervasiveness, Geographic Dispersion, and Sectoral Absorption). The "size" of the Internet can refer to a variety of measures, each useful in different ways. The two most apparently useful measures, the numbers of connected com-

[433] Wolcott, *et al., op. cit.*

puters (hosts or nodes) and subscribers (or users), are impossible to determine exactly. As for counting computers, the feasible methods are inaccurate, often in ways that are inconsistent between successive employment of the same technique. The most popular survey is that published semi-annually by Network Wizards (www.nw.com), but they acknowledge that none of their surveys has been accurate. Their surveys have been more useful for identifying trends and orders of magnitude than absolute numbers. However, the evolving nature of the Internet has forced Network Wizards to change the way their survey is conducted, resulting in figures for January 1998 that cannot be directly compared with any others previously published.[434] Any figures published fail to account for computers with full-time IP connections that are "hidden" behind gateways or firewalls. Even an exhaustive physical search of the Internet, for instance pinging every possible IP number, would not produce accurate results even if it were feasible. With respect to subscribers, there is no central source for subscriber data. This information could conceivably be obtained from ISPs—those who actually connect the subscribers to the Internet—but many ISPs don't want or cannot be bothered to make subscriber data available and in any event, there are thousands of ISPs in the United States alone (and there is no accurate central reference that lists the world's ISPs). Finally, there is the issue of "subscribers" versus "users." The former are those with accounts, i.e., a unique username@domain.tld. Many people who use the Internet are not themselves subscribers. Which is more important, knowing how many people (and companies?) have accounts, or how many people actually have routine access to and regularly use the Internet? The answer to that question depends upon what you are trying to understand.

Related to the lack of a prototypical Internet, there is also no single model of how and why the Internet is brought into a particular country or region. There appear to be two general paths to Internet connectivity, however: academic and commercial. In the early days, the diffusion of the Internet was often primarily driven by academic interests and efforts. Most of the growth of the Internet through the early 1990s followed this model, including in such disparate countries as the United States, Cuba, the People's Republic of China, the Islamic Republic of Iran, and the Kingdom of Saudi Arabia. More recently, the Internet has become increasingly commercialized. This evolution of the Internet coincided generally with the development of the Hypertext Mark-up Language (HTML) and efficient interfaces ("browsers") that brought about the Worldwide Web. Commercial interests have brought the Internet to many of the countries that have been more recently connected, and the very rapid growth of the Internet in countries previously connected has been driven almost exclusively by commercial interests and applications. Some of the countries that are connected but experiencing little or no Internet growth, such as Iran and Saudi Arabia, are those where the transition from academic to commercial applications has been hampered.

[434] "The 'old' domain survey, as we will now call it, counted hosts by walking the domain name tree, and doing zone transfers of domain data, in order to discover hosts and further subdomains. It is described more completely in RFC1296. The old survey counted the number of domain names that had IP addresses assigned to them. … The new domain survey is the reverse of the old survey. It counts the number of IP addresses that have been assigned a name. This distinction is subtle but it does mean the new survey is counting a different "thing" than the old survey. Because of this, comparing data from the old and new surveys will not necessarily be a good thing to do in all cases. … The new survey works by querying the domain system for the name assigned to every possible IP address." Network Wizards, *The Internet Domain Survey*, 6 February 1998, <http://www.nw.com/zone/WWW/new-survey.html> (2 March 1998).

- **The Internet has become an important issue on the agendas of many governments, with a growing set of stakeholders in most countries.** Governments are dealing with mixes of issues and constituents in different ways, and at different rates, but overall the Internet has an increasing presence almost everywhere.

  While national wealth is a major factor in Internet development within a country, perhaps more important is the issue of constituents, or stakeholders, for and against the acceptance of the Internet. The adverse effects of "negative stakeholders" can be seen clearly in the case of Saudi Arabia, which can afford the technology financially, but where a preponderance of stakeholders believe that the country cannot morally or politically "afford" the Internet without significant controls and constraints. On the other hand are countries like Finland and Yemen, where there are constituents for the Internet but no significant opposition. In Finland, the "pull" is strong and the country's relative wealth supported early, extensive development. Yemen appears at first to be an anomaly, because of its poverty, but there again at least the supporters of the Internet could afford the investment, so in the absence of opposition a basic capability was developed.

  There are important evolutions underway in the communities from which Internet constituencies arise. One of the most obvious is the previously-mentioned development of commercial interest in the Internet. Commercial stakeholders cannot be said to more strongly support the Internet than their academic predecessors, but there are more of them and, importantly, they have significantly more money to invest. Another development relevant to the Internet results from the growth over the past decade or so of trans-national interest groups and NGOs, whose numbers have swelled since 1985. The Internet appears to be a technology tailor-made to support these groups through better coordination and more timely information sharing and dissemination. Perhaps the societal evolution currently in progress that has the most implications for the future development of the Internet and its assimilation into society worldwide is the rise to positions of influence of a younger, more technically-oriented generation.

  It appears clear at this point in the studies that government policy plays a key role in the diffusion of the Internet. A general rule that has emerged is that stronger centralized control results in slower Internet development and less proliferation. This is likely due to the fact that the strength of government control is somewhat inversely proportional to popular participation in and support of the government. That is, the more coercive the government, the more it has to lose from easing controls; it is caught in a self-reinforcing cycle whereby strong controls are necessitated by lack of popular support and a lack of popular support is due in large part to oppressive government controls. In this regard, we have postulated a "balance of national tensions" that can be calculated (in relative rather than absolute terms) as a factor of the number and relative strength of the constituencies on either side of the Internet development question. This balance could be calculated by summing the opportunities and their constituents and graphing the results opposite the sum of the risk elements and their constituents, according to the following formulas:

$$\text{Perceived Opportunities} = \sum_{\substack{\text{opportunity}\\ \text{elements}}}^{m} (\text{weight of constituents for that element})_i$$

$$\text{Perceived Risks} = \sum_{\substack{\text{risk}\\ \text{elements}}}^{n} (\text{weight of constituents for that element})_i$$

The balance cannot be explicitly calculated because the weights of the constituents, i.e., the number or people or organizations and their relative influence, cannot be quantified meaningfully. In fact, in most cases we have only incomplete knowledge of the various opportunity and risk elements and their constituents. However, in dealing with the modest number of countries studied for this report, the countries can be ranked according to how risk-averse or receptive to opportunities they are, and some gross subjective assessment of the distance between their positions in the rankings can be made. For example, it is readily apparent that Saudi Arabia is more risk averse than Cuba to a greater degree than Cuba is more risk averse than Iran. The absolute magnitude of these differences cannot be known, but when graphing the risk perceptions of these three countries, we leave more space between Saudi Arabia and Cuba than between Cuba and Iran. The resulting graph is displayed in Figure 53.

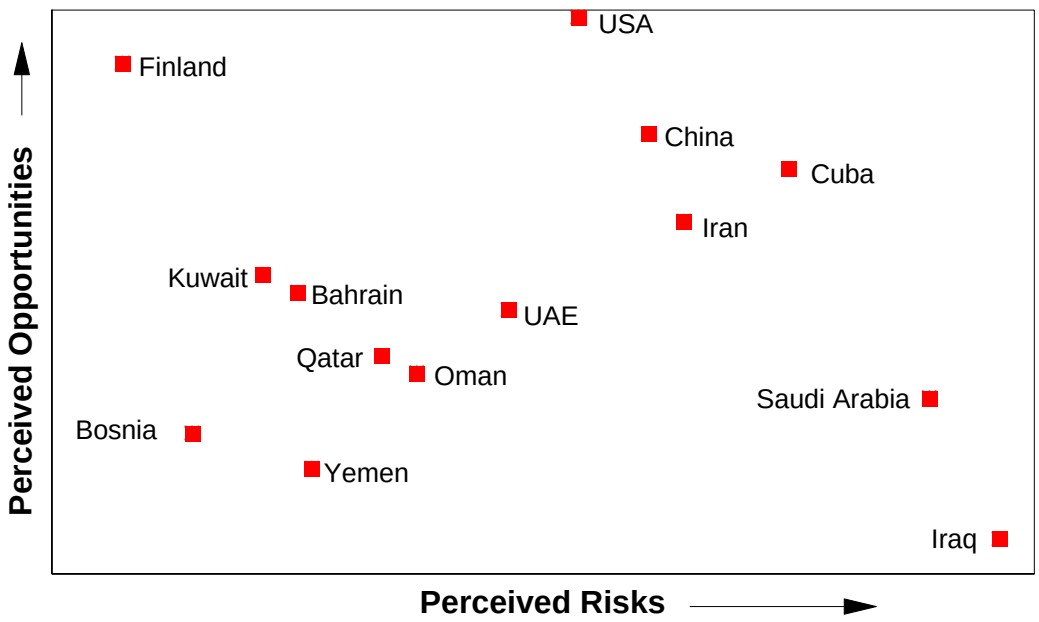

Figure 53. National Tensions Affecting the Absorption of the Internet

Depicted in this manner, some interesting points emerge, most particularly the grouping of China, Cuba, and Iran together. Upon reflection, however, this is not so surprising, as all three countries have expressed the desire to exploit the opportunities presented by the Internet while avoiding the potential negative consequences of the increased information flows. Also in each of these three countries, such Internet presence as exists is surprisingly distributed throughout the country due to specific government policies. Countries like Bosnia and Yemen lay to the bottom left because, while there is no strong opposition to the Internet in either country, neither are there extensive constituencies that could drive further development. Iraq stands alone on this chart, and in the world with a few countries like Libya and North Korea, because

there are only a few, weak constituents in favor of an Internet connection, but an absolute refusal to consider taking the chance on the part of the supreme leader. Saudi Arabia appears to be closer to Iraq in this subjective representation. While there is no single constituent in the country that equals the weight of Saddam Hussein in Iraq, the preponderance of stakeholders with serious concerns regarding the Internet has precluded development of the Internet in that country consistent with the country's wealth and other investments in infrastructure. The countries of the Persian Gulf's west coast lie somewhere in the middle, with moderately strong proponents and opponents having reached a compromise that has allowed some degree of Internet development, albeit generally with some sort of government oversight or surveillance. Although not explicitly studied by this project, a subjective assessment of the United States was made for comparison purposes. There are serious concerns about the Internet in this, the origin of the Internet, but these have largely been overrun by the extensive interest in exploiting the (as-yet not fully understood) opportunities. On the other hand, Finland is more well-wired than the United States in relative terms, largely because of the paucity of concerns regarding the Internet and a long history of open competition in the telecommunications sector.

- **The United States is, by far, the most visible object on the Internet "radar screen" of almost all other countries.** This presence extends over all technological, economic, political, cultural, and national security aspects of the Internet.

  From virtually every perspective, the United States looms large in considerations of the risks and opportunities presented by the Internet. Virtually all of the routers in the world today are American, and this situation is changing only very slowly. A few countries have made some inroads with specific software applications, but the United States is also the basic source for most relevant software. The United States is leading the development of new hardware and software applications for the Internet, and is the principal proponent of the new protocols currently under development. American telecommunications companies carry the bulk of the world's IP traffic, a circumstance that raises security and economic concerns for many countries.

  Because the preponderance of Internet-related and Internet-specific hardware is American technology, the diffusion of the Internet appears to be one of the few post-Cold War development areas that is meaningfully affected by unilateral U.S. export controls. On the other hand, despite existing export controls, subsidiaries of an American company provided at least technical expertise and high-speed Internet connections to two countries designated as terrorist states by the U.S. Department of State and subject to significant export controls and commercial sanctions.[435]

[435] The countries in question are Iran and Syria, both of which were assisted by subsidiaries of UUNet Technologies in late 1997. Iran significantly up-graded its connection to the Internet by obtaining a high-speed satellite link to Archway s.r.l. in Milan, Italy, and Syria obtained its first-ever Internet connection—a high-speed satellite link to Amsterdam—from EUNet. In both cases, the national networks of these countries are now "hidden" behind gateways in Italy and The Netherlands, most likely for reasons of satellite bandwidth economy rather than security. The computers that are connected to the Internet via these gateways now fall under Autonomous System numbers assigned to UUNet Technologies, making it impossible to retrieve network topology information with respect to these two countries using AS numbers. The extent of technical assistance provided is not known, nor is any information about possible transfers of hardware or software available. Any such assistance and transfers would have been subject to U.S. export licensing requirements.

Nobody has been heard complaining recently about French or Japanese "cultural imperialism." The United States, as the origin and embodiment of much of Western mass culture, is the enemy of those who view increased contact and information flows as threats to local culture and mores. American dominance of Internet traffic and the Worldwide Web, now decreasing but still predominant, is viewed as "evidence" that the United States is using the Internet to promulgate its opinions, culture, and way of life. What is often overlooked is the fact that, unlike television or radio, the only information to which one is exposed on the Internet, excepting e-mail "spam," is that for which one has asked. It is a "pull" technology, and is likely to remain so for some time to come, developments of "push" applications notwithstanding. If the international information flows on the Internet are principally from West to East and North to South (they are), it is because the West and North, mainly America, are where the bulk of the desired information exists, both absolutely and in a form deliverable via the Internet, and it is the East and South that desires this information.

The United States is at once the place where everyone goes to make money and the recipient of most of the largess generated to date by the proliferation of the Internet. Countries express concern about the dominance of Microsoft software and the expense of keeping up to date. There is a general perception almost worldwide, however, that there is money to be made via the Internet. It remains to be seen how long the economic dominance of the Internet by the United States can last.

Many countries fear the potential for the United States to use its dominance of the Internet to engage in espionage and information warfare. Cuba, for instance, takes pains to keep its trade data off the Internet, lest the U.S. track down and intimidate its sources of supplies and export markets. For the moment, however, it appears that the most lucrative targets for government espionage remain well beyond the Internet's reach, although it provides a rich field for corporate "competitive intelligence" collection. In principle, the proliferation of competitive intelligence should make markets more transparent and therefore more efficient, a situation that should benefit developing countries the most. Thus far, the only "information warfare" that visibly appears to be conducted via the Internet is by lone or small groups of hackers.

- **The "killer application" is electronic mail**, although there is extensive interest in the Worldwide Web and its use for commercial purposes is increasing rapidly.

  Despite the "common knowledge" about the Internet's wondrous capabilities, the fact remains that the main use of the Internet is as an alternative to the telephone or facsimile machine. For the vast majority of users, the Internet is simply a more convenient and/or efficient way of doing the same things that they have always done. The Internet is only beginning to make small differences in the conduct of business in the most developed countries and will likely remain a high-technology adjunct to business-as-usual in the rest of the world for the foreseeable future.

The implications of the global diffusion of the Internet for U.S. national security are less clear. Will the Internet make the world a better, more peaceful and friendly place in which to live? Or will it give rise to new threats and problems? The uses of the Internet are in fact only beginning to be understood and will evolve with the continuing development of the physical infrastructure, Internet-related software tools, and our experience in using the Internet. Much of the current enthusiasm for, and criticism of, the Internet revolves around the perception that it will more closely bind the world's people. This perception excludes the reality, however, that half of the

world's population has never used a telephone, much less a computer, and those who arguably need the Internet's potential benefits most desperately, the poorest segments of society, are unlikely to be aware of the Internet's existence, much less be able to employ it should the opportunity become available.

This study has made only a cursory start in considering the emerging issues raised by the global proliferation of the Internet. There are many issues that bear further examination, including:

- The extent to which the Internet in general, and the Worldwide Web in particular, can and will be used for propaganda and peacetime information operations, and the potential for the success of these efforts. Given that the Internet is a "pull" technology, can the Internet be used to influence the opinions of those who are not already interested in the point of view being promulgated?
- What prospects are there for the use of the Internet to foster the further growth in numbers, size, and influence of non-governmental and other trans-national organizations? Have many NGOs made a particular effort to use the Internet in any sophisticated fashion? Have any of their operations changed or their effectiveness been improved through use of the Internet? The proliferation of non-state actors with the intention to make countries take actions that would not have occurred absent outside influence is a potential source of concern, not only for the possible diminution of national sovereignty but also because of the potential partial disenfranchisement of the citizens of affected countries and the potential for purely malicious activities.

  Can the framework elaborated in this study be used effectively to analyze non-state actors?
- Is a connection to the Internet the *sine qua non* of economic competitiveness in the coming years? If so, what new vulnerabilities might connected economies face and how might they protect themselves? From whom?
- To what extent will countries be forced to face the "Dictator's Dilemma,"[436] caught between the Scylla of isolation in an increasingly interconnected world and the Charybdis of potentially fatal information flows? Is this statement by former Secretary of State George Schultz correct?

  > Totalitarian societies face a dilemma: either they try to stifle these [information and communication] technologies and thereby fall further behind in the new industrial revolution, or else they permit these technologies and see their totalitarian control inevitably eroded. In fact, they do not have a choice, because they will never be able entirely to block the tide of technological advance.[437]

  This is not the first time in history that national governments have been faced with the necessity of embracing technologies or modes of intercourse that might cause their downfall. Earlier examples might include the expansion of international commerce in the 16th century and the scientific and academic exchanges between the Communist and non-Communist

[436] The term was coined by Dr. Laurence I. Press to describe the Cuban government's problems in dealing with modern information technology.

[437] As cited in Christopher R. Kedzie, *Communication and Democracy: Coincident Revolutions and the Emergent Dictator's Dilemma*, Ph.D. dissertation, RAND RGSD-127 (Santa Monica, CA: RAND Graduate School, April 1996), p. 6.

blocs beginning in the 1960s. Are there other examples? How were these situations resolved and are there any lessons for today's information revolution?

The Internet is likely to grow in importance around the world, and we might do well to **establish a means for long-term, worldwide, sustainable coverage of its development and use**. We recommend:

- That efforts be funded to address the issues raised above and expand the analysis over the next several years to form a truly global understanding of the history and diffusion of the Internet.
- That a central database of relevant information be created and maintained as a community-wide resource. Given the rapid proliferation of the Internet and equally rapid advances in the information technologies, specific, detailed information has proven to be very ephemeral. It is critical to the establishment of a historical view of the "information revolution," including the diffusion of the Internet and its contribution to that revolution, that developments be captured and stored as they occur.
- That the framework be further refined to establish more explicit linkage between the dimensions and determinants on the on hand, and the issues of governance, national power, and national security on the other.