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Mapping the Network Society

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Abstract

This paper critically examines the maps being produced to represent and promote the so called network society. Drawing on the deconstructionists approach pioneered by Brian Harley, we attempt to read and expose the "second text" of the geographic maps of the Internet, Cyberspace and the network society.

We examine, in detail, maps that display, with varying degrees of subtlety, the ideological agendas of Cyberboosterism of their creators. These maps are important because they are widely reproduced and consumed without critical comment. Many contain serious problems of ecological fallacies and commonly use choropleth cartographic methods.

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http://www.casa.ucl.ac.uk/martin/aag99.pdf

Introduction

In this paper we critically examine the maps and visual images of the network society. A large trope of maps are being produced as important elements of the rhetoric of the market-driven network society project. Understanding the rhetorical power of maps has come to the fore in the field of cartography in the past ten or so years, lead by the deconstructionist work of Brian Harley (1989, 1992) and Denis Wood (1992). Our aim is to apply a critical reading of the geographic maps of the Internet, the network society and Cyberspace that are increasing prevalent, both online and in print.

In Peter Whitfield's splendid map anthology, *"The Image of the World: 20 Centuries of World Maps"*, he traces the long cultural evolution of world maps from the classical Ptolemic foundations, through the Hereford Mappa Mundi of the 13th century, Mercator in 1569, colonial maps, right up to the 1990s (Whitfield 1994). Importantly, he asserts the political and cultural power represented by the maps, going beyond simply a consideration of their communicative role and aesthetic value. Whitfield says of the map that:

> "*There is a natural assumption that maps offer objective depictions of the world. The message of this book is that they do not, and that the innumerable ways in which they do not, serve to place maps as central and significant products of their parent cultures.*" (Whitfield 1994:viii).

Interestingly, Whitfield's anthology stops short of the network society, finishing with a satellite map from 1990 showing global sea temperature during an El Niño event. What is missing from his book is some consideration of Cyberspace Mappa Mundi. In many ways we are attempting to continue Whitfield's deconstruction into the Information Age by examining the geographic maps of Cyberspace. In the last twenty years Cyberspace has been developed at the convergence of telecommunications and computers, forming global communications networks used by millions (Benedikt 1992, Kitchin 1998). Many maps and visual representations have been created to make the structures and flows of Cyberspace visible and tangible, using all manner of cartographic metaphors (Anders 1998, Dodge 1999, Dodge & Kitchin 1999, Holtzman 1997, Jiang & Ormeling, 1997). In this paper we are focusing on geographic world maps of the most visible element of Cyberspace, the Internet. There are many maps that have been produced, primarily for marketing and propaganda purposes, by a range of people and companies who are involved in pushing the global expansion of Cyberspace and who benefit financially from its growth. These are largely Western, particularly American, companies and individuals who are forging the rapid development of the Net. And they are deploying maps to support their expansionists rhetoric, to assert their global position and to control the new electronic spaces. The use of maps in this fashion is obviously not new, as the powerful elites through history have done much the same. It is just the world these companies are seeking to expand, colonise and map is now a fusion of the material and the digital. The control of the virtual territory through its mapping is now as important as the control of real-world.

An exemplar of these kinds of hegemonic maps of the Cyberspace is the World Link map called, appropriately, The Network Society Map, produced in 1997. It is a large poster world map (measuring 32" x 54") and figure 1 shows an image of it. The subtitle on the map states that it was produced "*… on the occasion of the 1997 Annual Meeting of the World Economic Forum in Davos, Switzerland.*"[1] The map was also sponsored by Hewlett Packard and Novell, two major multinational IT companies. The propagandist role of this map is stated explicitly on it, "*The Network Society Map aims to show how well prepared 49 of the largest and most dynamic economies are to compete in the network society.*" A typical crop of measures of technological 'progress', at the national level, such as phone lines, PCs and Internet hosts per capita are used to rank the countries in the map. The map is well produced and uses an

interesting donut-type symbol located within each country to represent the data (shown on the inset in figure 1).

The Network Society Map exhibits, with little subtlety, many of the key conceits present in propaganda maps of Cyberspace. First, is the selection of criteria employed by the cartographer to measure and map the "preparedness" of the countries for competition with each other. The criteria are wholly concerned with technological superiority, with no wider social or cultural dimensions. The measures are also presented at the national level and this imposes a sense of order and unrealistic internal homogeneity within the countries. Within even the richest, most technologically developed nations access to PCs and the Internet is far from uniform, with significant inequalities between different sections of the population. Differential access to and use of the Internet has been demonstrated in terms of class, gender, education, wealth and race (Keller 1996). For example, evidence of racial inequalities was provided by Hoffman and Novak's analysis of the so called "World White Web" (Hoffman & Novak 1998, Katz 1998), differences by class and education were highlighted in the "falling through the Net" studies by US government (McConnaughey *et al.* 1995, 1998), and access by income (Moss & Mitra 1998). There is also significant geographical diversity in the deployment of Internet infrastructure such as fibre-optic networks, routers and address within the USA (Gorman 1998, Moss & Townsend 1998, Zook 1998). All this real variation and inequality is masked in maps like The Network Society Map, in the desire to show global progress. William Gibson, the iconic fountainhead of Cyberspace, is quoted as saying "*the future is already here, just unevenly distributed*" (in Irvine 1998). Many of the world maps of the network society serve to, consciously or subconsciously, render this unevenness invisible.

In many respects the demarcation of Cyberspace into the straightjacket of national borders makes little sense. The network technologies of the network society are forging connections and virtual groups that subvert the primacy of national boundaries represented on maps by crisp lines. For example Web surfers in London and Lima may well have more in common in terms of their online lives (and also their wealth, education, etc) than their 'unwired' neighbours in those cities. How much sense do existing political borders of the material world make in mapping Cyberspace? Clearly, for propaganda maps of the Internet, the political borders of countries provide a powerful template, a familiar, known framework onto which the strange and potentially subversive world of Cyberspace can be mapped and in some senses contained. The geopolitical framework of the known is used in the conquest and control of the virtual unknown.

Another important conceit revealed by the Network Society Map is that much of the world is left unmeasured, unmapped in these types of map. Therefore is not part of the new world of the Net. The selection of only 49 countries[2], which are many in the West, forcible excludes vast swathes of the globe from the map and by inference from the network society. This is particularly noticeable for Africa.

These types of conceits in maps have been well explored by cartographic theorists like Harley, Monmonier and Wood. Deconstruction of the maps of the Internet and Cyberspace has begun in a recent, prescient article by Terry Harpold entitled "*Dark Continent: Critique of Internet Metageographies*". Interestingly, Harpold is outside the geographic sciences, being an assistant professor in the School of Literature, Communication and Culture at the Georgia Institute of Technology. In his article he advances a powerful critique of the maps of the network society, particularly the attempts to represent global Internet diffusion. The basis of his argument is as follows:

"*I propose that these depictions of network activity are embedded in unacknowledged and pernicious metageographies - sign systems that organize geographical knowledge into visual schemes that seem straightforward …., but which depend on historically and politically inflected misrepresentation of underlying material conditions.*" (Harpold 1999).

A particular concern of Harpold is the lack of representation of the 'unwired' masses on many of the maps, as we noted in relation to Africa's exclusion from The Network Society Map. He draws parallels to the colonial mapping of Africa as the "Dark Continent" with a blank interior. The Western cartographers of the colonial era showed the vast interior as unknown because it had not been explored and conquered by the white man. The cyber-cartographers of today are unwittingly repeating this pattern in their maps which draw disconnected nations that lack phones and high-speed network connections as empty and blank.

Of course this type of critique of maps of the network society fits into a much wider critical analysis of powerful discourses of the Information Age and Cyberspace being developed by both academic scholars and popular writers (see for example, Brook & Boal 1995, Dery 1994, Markley 1996, Slouka 1996, Stoll 1996). There have also been strong critical voices from geographers and planners challenging the powerful rhetoric and Information Age myths of the "death of distance", "end of geography" and the "dissolution of the cities". This Cyber-mythology is fundamentally based on the emotional desire for human transcendence over, and liberation from, the bounds of materiality, to end the tyranny of geography. Important work unpacking this mythology has been undertaken by Stephen Graham (1997 & 1998), Andrew Gillespie (1998) and Helen Coucleis (1994 & 1996) amongst others. There is also a special issue of the Geographical Review, edited by Paul C. Adams and Barney Warf (April 1997, Vol. 87, No. 2) with a useful collection of papers examining various elements of the Cyberspace discourse, with particular attention to the contestation of the Internet by divergent groups.

Geographic metaphors of place and territoriality are at the very heart of the discourse of Cyberspace (Adams 1997, Graham 1998). There are electronic *frontiers*, chat *rooms*, web *sites*, *home* pages, off-ramps, highways and all manner of virtual offices, schools, malls, cities and communities. As Graham comments, "*The expanding lexicon of the Internet - the most well-known vehicle of Cyberspace - is not only replete with, but actually constituted by, the use of geographical metaphors.*" (Graham 1998:166). We would argue that in addition to these textual, descriptive spatial metaphors there is a whole trope of geographic images and maps that are being used by powerful groups to construct a tangible representation of Cyberspace to suit their purposes. These purposes are often commercially driven. Easily the most commonly deployed image is that of the Earth from space in various guises, which can be found on so many Web sites.[3] The geographic images need to be carefully examine because they are ideologically loaded and their role in the Cyberspace discourse is not neutral. They are also increasing in number, sophistication and more widely distributed both on the Internet and in traditional media. As yet there has been little analysis of this, but see Brunn & Cottle 1997 and Jackson & Purcell 1997 for interesting exceptions.

Many of the geographic maps and images employed in the Cyberspace discourse play a powerful role because they are visually striking and provide that tangible picture that people are looking for. They provide people with a simple image of "what Cyberspace looks like". It is easy to imagine that people will accept existing maps of Cyberspace as 'real' and definitive, just like many people accept the Mercator view of the world, centred on the Atlantic, as the 'proper' world map. When, in fact, these maps are just one cartographers particular representation, containing any number of subjective design decisions, distortions and

ideological biases. A good example of the power of Cyberspace maps to become accepted as a definitive "so this is what the Internet looks like" type map is the Arc map of global Internet traffic flows produced by computer science researchers at Bell Labs (Cox *et al.* 1996). Figure 2 shows the Arc map and as Harpold says it is an "arresting image", with fountain-like arcs of light traversing the world. It seems that the power of this map is that it looks like people imagine the Internet to look like! Because of this, the Arc map has been deployed, without critical assessment, in various populist newspaper articles on the Internet (May 1998, Brown 1998). It also one of maps that is proposed to be part of a major project of the National Museum of Photography, Film & Television, in the UK, entitled the "Wired Worlds Gallery" (Redler 1999). In this manner, a few of most visually impressive and compelling maps of the Internet are widely reproduced and become seen as the actual, objective image of Cyberspace.

We would also argue, that a critical appraisal of maps of the network society needs to draw on the analyses of the ideological, hegemonic nature of geographic information systems (GIS) technologies that was ignited by the Ground Truth book (Pickles 1995). The maps of the Internet are very often embedded within it. Many examples are specifically designed to be distributed, viewed and used on the Internet. In this sense the maps of the Net has become an important component of the Net. The Network Society Map we considered at the start of this paper was somewhat of an exception being specifically designed as a printed poster map. Most others are purely digital and are not always simply flat, static maps. Many are really geographic visualisations, for example, the Arc map in figure 2 is really just a single screen-grab from an interactive visualisation system of network traffic (Cox *et al.* 1996). They employ many of the interactive features of GIS that allow users some control over the representation, and they often utilise visual metaphors from scientific visualisation and VR. The interlocking themes of map criticism and geographic visualisation has been explored in a recent paper by Jeremy Crampton, "Maps as Texts, Maps as Visualizations". There are a multitude of online maps of the real world that are providing increasingly powerful and interactive cartographic tools in the hands of the Internet public (MacEachren 1998). Indeed, one of the first interactive Web applications, launched in June 1993, was the Xerox PARC Map Viewer (Putz 1994), which is still available at http://mapweb.parc.xerox.com/map. In recent years GIS technologies themselves have also begun to move online (Plewe 1997). Not surprisingly the interactive Web maps and online GIS are being utilised to map the network society itself, an interesting example of this being the Pennsylvania Technology Atlas Mapping Service which we will consider later in the paper.

Images of Cyberspace

The popular imagination of "what Cyberspace looks like" has in many ways been constructed by the spatial descriptions and images created by artists, with science-fiction writers being particularly influential. These images and descriptions are largely subjective and far from the reality of actually using the Internet or sending email today, and yet they have pervaded the popular imagination through reproduction in the media. Obviously this is nothing new, for example from the beginning of digital computing in the 1940s, the media distorted their representation to make computers more interesting. There is a, perhaps apocryphal, story that flashing lights were artificially added to the front of computers so news reports could film some activity. The lights played no practical part in the operation of the computer itself. The representation of computers with banks of flashing lights became such a strong image that it became almost mandatory in both fiction and non-fiction. There is an interesting feedback loop, in that the computer manufacturers realised the power of the flashing lights and then added them into future designs. In this fashion, what the media thinks a thing should look like becomes reality.

We argue, that a similar process has happened in terms of the cartographic representations of the Internet and Cyberspace, with the artistic imagination of the cyberpunk writers of the 1980s influencing scientists and computer programmers who designed and built the technologies of the Net and VR in the 1990s. This is even more the case in term of Cyberspace which is so intangible compared to computers which have some physical form (especially the room sized versions in the 1940s and 50s). Electronic spaces have no inherent representation, as is demonstrated by the media's attempts to show data traffic flowing through the Net, which is effectively invisible, so they often resort to a familiar physical metaphor of cars speeding along a highway at night, with their tail lights blurring. This is was data flows "should look like". The best of the cyberpunk writers, like Gibson, Stirling and Stephenson, produced powerful and influential literary representations of Cyberspace, which are replete with spatial metaphors, particularly drawing on the urban experience (Kitchin 1999, Kneale 1999). Chesher comments on the influences, even inspirations, provided by science fiction representations of Cyberspace thus:

> "*It is somewhat ironic that Gibson's dystopic nightmare has become inspiration for computer scientists to create the entity he feared. … Cyberspace, which embodied Gibson's fears, is now being built from his blueprint.*" (Chesher nd)

Along with cyberpunk literature, computer game (Herz 1997) and cinematic (Hayward 1993, Napleton 1996) representations of Cyberspace have seeped into the cultural imagination. The cinematic representations of Cyberspace are interesting in that they provide fascinating visual images inside narrative failures. In the early 1990s there was a rash of Cyberspace films (The Lawnmower Man, The Net, Hackers, Johnny Mnemonic, Sneakers), along with earlier efforts such as Tron and War Games. They were nearly all of dubious critical merit and many were box-office failures, but they did provide a trope of visual images of Cyberspace. Figure 3 shows a montage of some of these.

Mapping Wired Worlds - Ameri-Centrism & Ecological Fallacies

Within the analysis and mapping of the geography of the network society there is considerable, conscious and unconscious, bias and distortion. Two of the most serious are the inherent propagation of ecological fallacies and the Western, particularly Ameri-centric, world views. For example, much of the analysis of the geography of Internet diffusion uses the nation state as the units of analysis and the results are mapped using the choropleth cartographic method, which are often compounded by poor selection of classification. This has the effect of promoting an artificial sense of homogeneity and totally masking variation and inequality within countries.

Many of the maps also focus their attention, either deliberately or unconsciously, on the centre of the wired world in the West, especially the USA. This all to easily relegates other parts of the world metaphorically, and sometimes literally, to the edge of the map. Pushing countries to the periphery just re-enforces the existing world hegemony in the network society. Most of the analysis and mapping is also wholly unquestioning in the positive, beneficial nature of diffusion of Internet technologies.

Examples of research into the global diffusion of the Internet include Batty & Barr (1994), Press (1997), Elie (1998), Hargittai (1998). Although these papers contain much of value to those interested in the geography of the Internet, they all fall, to varying degrees of culpability, into the trap of ecological fallacy. That is, they encourage the reader through a lack of critical comment to assign the characteristics of nations to the actual individuals of those countries. This is particularly so with the graphic representations typically employed - choropleth maps and scattergram charts. Ecological fallacies and choropleth mapping are well known bed

fellows. The scattergram (or x-y chart) performs a similar pernicious role of presenting national level data in a way that emphasis differences between countries and thereby masks the internal inequalities. Scattergrams are employed to show a positive relationship between two variables - in the case of this type of analysis the variables are usually some measure of wired'ness (like PCs per capita) and a measure of economic development (often GDP). Figure 4 shows a typical example taken from Elie (1998).

One of the major causes of the ecological fallacies and Western-centric view in so much of the mapping of the network society is that researchers rely on "off-the-shelf" data that is readily available at the country-level aggregation. In many studies of Internet diffusion the same data sources, like the World Bank, OECD, International Telecommunications Union, CIA world database and Network Wizards Internet data, appear time after time. These organisation publish nice, orderly tables of statistics at the national-level that can be turned into choropleth maps with great ease and little thought. If there is no commentary in the analysis highlighting the dangers of ecological fallacies then the people who consume the research can easily be misinformed. Of course, the conscious or unconscious misuse of national-level statistics is not new to the analysis of Internet diffusion, as standard atlases has long provide reams of statistics for countries of the world listed in tables. In the past year or so, there have been published a number of compendiums of Internet statistics and demographics aimed at the mass market, like *"The State of the Net: The New Frontier"* (Clemente 1998) and the *"Internet Industry Almanac"* (Juliussen & Petska-Juliussen 1998). These provide a completely biased selection of statistics, aimed unquestioningly at Cyberboosterism. The Clemente book is also perniciously Ameri-centric as it wholly disregards the Internet outside the USA, despite the misleading title.

We will now examine in some detail a number of interesting maps of the network society that have been widely consumed and try to deconstruct them. The first example is The Wired World Atlas which was presented as a fold-out, six page spread in WIRED magazine in November 1998 (Conners Petersen 1998). WIRED magazine is the bible for the true Cyberspace convert. The magazine cover marketed the map as *"Globally Wired: Your Foldout Guide to Every Nation's Tech Wealth"*, which unashamedly reveals the agenda of the map. The ideological aim and statistical method employed in The Wired World Atlas are essentially the same as The Network Society Map we looked at earlier. It is the same kind of positivists measurement of national 'Tech' progress. However, the WIRED map does use a more sophisticated cartographic style in keeping with the design pretensions of the magazine. The WIRED map is also an improvement in that at least it covers most of the nations of the world, mapping some 140 odd countries.

The heart of The Wired World Atlas is a two page map of the world using a cartogram approach. Figure 5 shows one half of the map covering the Americas, half of Europe and Africa. In the cartogram countries are represented as regular shaped blocks which are proportionally sized and shaded according their national-level tv & phone penetration score. The use of the cartogram approach is arguably somewhat more progressive in its representation of the world, than a strictly geographic approach. It certainly produces a striking visual impression of a tiny Africa being crushed by huge, overbearing European blocks. And yet, how revealing is the map when it is so wedded to positivists measures of progress and the traditional containers of the nation state. Despite the claims of the commentary under the map that, *"Envision the globe according to the density of traditional media - tvs and telephones - and you get a brand new map."*, the map serves a traditional propagandist role.

The map legend innocuously notes, *"Countries for which no data was available are not included."*! A few countries that are deemed interesting are linked to small, largely vacuous, "facts" in blue text. For example, *"Monaco is the world's second smallest national (less than 1 square mile), but arguably the most wired."* Inside The Wired World Atlas fold-out there is a four page long spreadsheet type graph showing the 'Tech' scores for each nation as shaded cells. Along with more vacuous "facts" and short country biographies for Hungary, Finland, the Cayman Islands, Bhutan, Lebanon and Papua New Guinea. These biographies are supposed to give the reader some flavour of the individual circumstances of the countries, but they are so short and superficial as to be useless.

The Wired World Atlas is not the first time WIRED has employed cartographic representations to support its agenda. Previous examples have used choropleth maps to show the control of cryptography across the world in a piece entitled "Planet Crypto" in May 1998 (Lappin 1998). While the "Freedom to Connect" map was an attempt to shows the different levels of freedom to access the Internet (Conners 1997); Harpold examines this map in some detail in his critique.

The next example we want consider are the International Connectivity maps produced by Larry Landweber. They are simple choropleth world maps with countries classified into four categories from no public network connectivity to full Internet link. Landweber's maps are some of the most widely reproduced geographic maps of the Internet. He started mapping the global diffusion of connectivity back in 1991 and figure 6 shows his earliest available map from September 1991. A series of sixteen maps are available from ftp://ftp.cs.wisc.edu/connectivity_table/ tracing the global diffusion of the Internet at the national-level. Landweber is a professor in the computer science department at the University of Wisconsin - Madison, and just like software each of his maps has a version number. He was one of the key personalities in the development of the Internet in 1980s being the prime mover in the building of CSNET (Cromer 1983).

The maps provide a conceptually simple, one might say simplistic, picture of the geography of the Internet. They are also free to use and are endorsed by the Internet Society, one of the key institutions guiding the development of the Net. However, the maps suffer from gross problems of ecological fallacy, which are compounded by the constricting classification employed. An uncritical reading of these International Connectivity maps would give a very distorted view of the network society, as Holderness comments on Landweber's last map, "*Almost the whole world, it seems from a casual inspection of this map, has turned Internet-coloured. The sun never sets on the Internet; it appears to reach everywhere except some war-torn corners of the world.*" (Holderness 1998:39). Holderness has attempted to reconfigure the Landweber map to remove some of the grossest distortion by fading non-metropolitan regions outside of the OECD countries and greyed out the uninhabited deserts, tundra and icefields.

There are many more wired world maps that could be cited. We shall briefly mention two further examples. First, is The Wired World map taken from The Atlas of the Future (Pearson 1998: pages 56-57) which features a choropleth world map of phone lines per capita. Again falling into the ecological fallacy trap and with no critical commentary in the text. Also included on the page are a map of undersea cables and a graphic illustrating new satellite systems; we shall look at the propaganda maps used by these technologies later in this paper. The Atlas of the Future as a whole has a very clear positivists agenda, set no doubt by the editor of book, Ian Pearson who is a futurologist and strategy analyst for British Telecom, a global company that has much to gain from the expansion of the Net. The Atlas of the Future

also makes a stark contrast to a similarly produced volume called The State of the World Atlas (Kidron & Segal 1995) which presents a much more socially and culturally progressive picture of the world.

The final example in this section of the paper are the choropleth world maps deployed by Christopher Kedzie in his research into the possible relationship between the degree of democratisation and level of communications technologies (Kedzie 1995). His analysis uses national-level aggregations and the maps are used as a visual prelude to statistical analysis. He presents two choropleth maps side by side, one showing countries classified in five categories according to their democracy rating and the other showing interconnectivity scores. He says of the two maps, *"Visual evidence of this relationship is provocative"*. Regardless of the validity of his analysis, the way he uses choropleth maps without critical comment is certainly a cause for concern.

Marketing the Internet with Maps

The provision of Internet services and infrastructure is a highly competitive business, dominated by large corporations, many of which operate globally. These corporations make significant use of geographic maps in their marketing strategies. The Internet marketing map is an important tool to demonstrate the power of the company's network to potential customers. There are many examples, you can find them on most Internet network provider's web sites. They employ all manner of cartographic styles to represent the topology of the network, but the most common is some form of arc-node representation on a geographic base map. The companies invest considerable effort in producing high-quality maps that present their networks in the best possible light. The two main ways to do this are firstly to demonstrate the geographic reach of the network, emphasising all the distant places that are linked together. Secondly, the map shows the tremendous capacity of the 'pipes' of the network to cope with huge demands. In this way, Internet marketing maps fit into a long tradition of maps used by companies to promote their networks, be they shipping, airlines, rail or post. It is also not a new phenomena in Internet terms as the history books of the Net, like Quarterman (1990), Salus (1995), Hafner & Lyon (1996), contain many promotional maps of networks from the 1970s and 80s.

It would be impossible to survey the whole gamut of Internet marketing maps in this paper, instead we consider two good examples[4]. The first, is the marketing map of PSINet (http://www.psi.net/), a major Internet network company based in the US, but with significant operations in Europe and Asia. The map is visually impressive and is shown in figure 7. At the heart of the map is the continental USA, surrounded by insets of Western Europe, Mexico, Hawaii and Japan. The map uses a stylised geographic background of coastline and state boundaries overlaid with the network topology represented by arc-node symbols. Emphasis in the map is on the numerous nodes - so called "super points-of-presence" and the plentiful external links. The map is also partially interactive in that clicking on Europe or the USA will load a more detailed map.

Our second example is a map of the Abilene network, shown in figure 8. The network is part of Internet2 to connect large US universities and research centres with very fast, high-capacity links. This is a promotional map, even though the network is not strictly a commercial venture, the consortium still needs to sign up universities to participate. The name of the project and the cartographic style of the map harks back to the railroad pioneering days of the nineteenth century (McCarthy 1998). The network topology is represented on the map by a snaking line, that weaves throughout the whole country, interconnecting all corners of the nation.

Mapping the Wired World Above and Below

Many billions of dollars are being invested in massive new infrastructure projects to support the network society. Two key areas of development are in new undersea fibre optic cables linking continents and constellations of new communications satellites. The companies investing so much in these schemes are using geographic maps to promote their projects to potential investors and customers.

In terms of new satellite systems the most well known is Iridium (http://www.iridium.com/) because it is already operating, providing global cellular phone services from a constellation of sixty-six satellites (Bennahum 1998). A much more ambitious plan to create what they call the "Internet-in-the-Sky" is called Teledesic (http://www.teledesic.com/), which is partially funded by Bill Gates. The aim of the project is to provide global, high-speed Internet access and it will use a huge constellation of 288 low-Earth orbit satellites to achieve this. To market the project, Teledesic use sophisticated geographic visualisation on their web site of the orbital patterns of their 'birds' (satellites). These a high-quality animated maps show the 'birds' literally marching across the sky in orderly precision. Figure 9 shows a frame from one of the animations. The key aim of these geographic visualisations is to show the power of their system to encircle the whole the globe.

As equally important to the satellite projects, are the schemes to lay new transcontinental undersea cables. These are providing undreamed of capacity to carry data (Staple 1997). Three of the most ambitious schemes all use geographic maps to market their projects on their web sites. The schemes are FLAG, Project Oxygen and Africa ONE[*]. FLAG is the 'Fibreoptic Link Around the Globe' and stretches for 17,000 miles from the UK to Japan, connecting eleven nations along the way. Neal Stephenson recounts the effort required to build FLAG, drawing parallels to the attempts to lay the first transatlantic telegraph cable in the 1860s (Stephenson 1996). Project Oxygen is even more ambitious, constructing a high-capacity fibre-optic network encircling the whole globe. Lastly, Africa ONE is a 39,000 kilometre cable around the whole continental coastline of Africa, linking all the major coastal cities. The infrastructure for Africa ONE is partly funded by AT&T as part of their global expansion plans (Warf 1998). The Africa ONE web sites states the agenda of the project thus:

> *"With its technologically advanced features, Africa ONE represents the best, most cost-effective solution to the continent's present and future international telecommunications connectivity needs."* (http://www.africaonesystem.com/over.html)

The project is also likely to prove highly profitable for AT&T. The Africa ONE web site contains an interesting map to support the project which is shown in figure 10.

A True Map of the Network Society?

Maps throughout history have distorted and selected to meet the purposes of their cartographers and the cartographers pay masters. Maps of the network society, the Internet and Cyberspace are no different in this respect, as we hope we have demonstrated in this paper. As cartographers and geographers we need to critically read the "second text" of the maps of the Net that are being produced and consumed today, and in particular we need to be ready to alert the users of these maps of the dangers, such as ecological fallacies. We also need to encourage the researchers outside the geographic discipline to be aware of the inherent dangers of national-level analysis and mapping using choropleth maps. We should also vigorously investigate the geography and mapping of the network society ourselves and develop least dangerous cartographic approaches to map Cyberspace. In this manner we can,

[*] Their web sites are at http://www.flag.bm/, http://www.oxygen.org, http://www.africaonesystem.com/.

hopefully, provide a truer image of the Net, although it is clearly impossible to produce the single true, objective map. However, we can improve on the examples shown in this paper.

Any maps we produce of the network society need to be imbued with the rich, individual experiences of the Net for real people, going beyond mechanistic per capita measure, scattergrams and shaded maps. Fundamental to this is to encourage the development and use of more meaningful measures of Cyberspace beyond the simplistic penetration scores of the hardware like phone lines and computers. We need measures that reveal what people are doing with the cyberspatial technologies, how it is being adopted and adapted into people's everyday lives. For example, the existing analytical approaches and mappings completely fail in their representation of the African experience of Cyberspace. The result, at present, leaves Africa largely as a blank, the 'dark continent' of old. The blankness on Western-centric maps of the network society masks the fascinating richness and diversity of the Net's percolation through Africa. Some of this richness is captured in articles by Barlow (1998), Hall (1998) and Oguibe (1996).

We also need to loosen the geopolitical shackle of the nation state as a unit of analysis and look at the local, contingent forces that affect the patterning of the Net within countries (see the MOSAIC Project for progressive work in this direction). As Harpold says:

> *"Sustained, progressive critique of the metageographies of Internet diffusion and traffic must look beyond the limited (and limiting) visual vocabularies of national-political identity, and base its investigations on new schemes for representing the archipelagic landscapes of the emerging political and technological world orders."* (Harpold 1999).

Another potentially interesting way forward, to a more progressive mapping of Cyberspace, is to utilise the interactive power of the Internet itself to let the reader create their own maps of the network society. Crampton suggests that part of progressive cartographic research agenda that can flow from Harley's work is to "… *emphasize the importance of multiple perspective and multiple maps."* (Crampton 1999:15). Online GIS is one possible route that can provide the means for users to create their own multiple maps. An interesting example is the Pennsylvania Technology Atlas (http://www.technology.state.pa.us/atlas/) which uses a basic online GIS that allows users to produce thematic maps of the technology infrastructure in the state. Although, the system is limited, the user has control over which data to map and the ability to pan, zoom and interactively enquire. Figure 11 shows an example of the Atlas in action.

Of course, the tools of the GIS and the data provided will inherently set the limits of what is possible for the user to do, but still it could offer the user power to choose their projection, classification and symbology,. It also offers the user the ability to explore the data and, hopefully, critically examine the results that is not possible with a fixed, single map mode. There are also clear links in this approach to the work on public participation in GIS that aims to reconfigure the technology, and how it is used, in ways that empower communities rather than dominate them. See the paper by Schroeder (1997) for an interesting exploration of this theme with particular relevance to the issue of mapping the network society.

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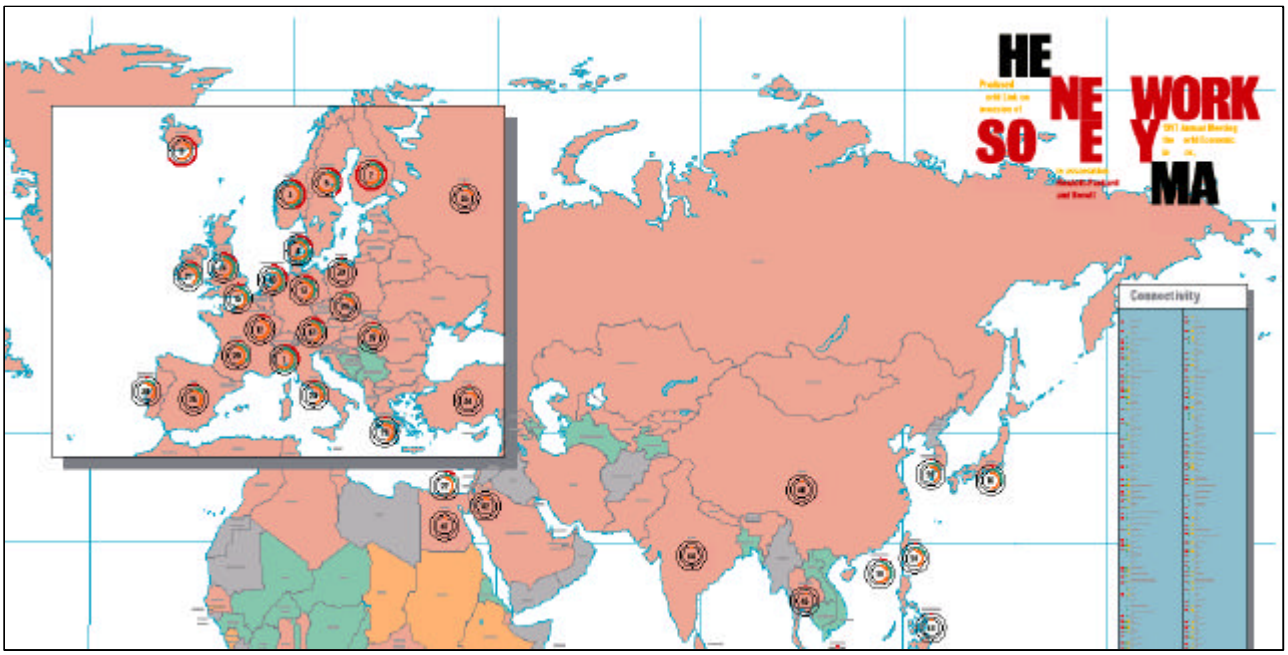


Figure 1: The Network Society Map produced by World Link, January 1997.
(Source: http://www.spy.co.uk/research/worldlink/index.html)

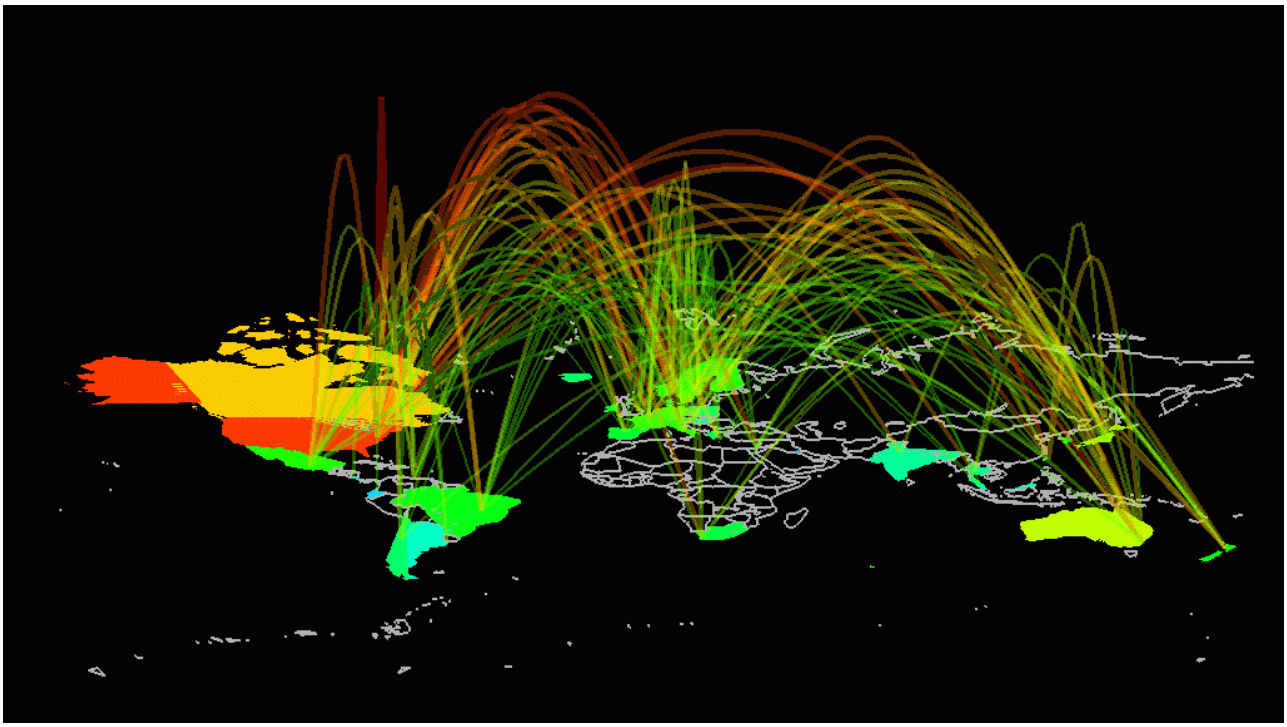


Figure 2: Arc map of global Internet traffic flows produced by Bell Labs. (Source: Cox *et al.* 1996)

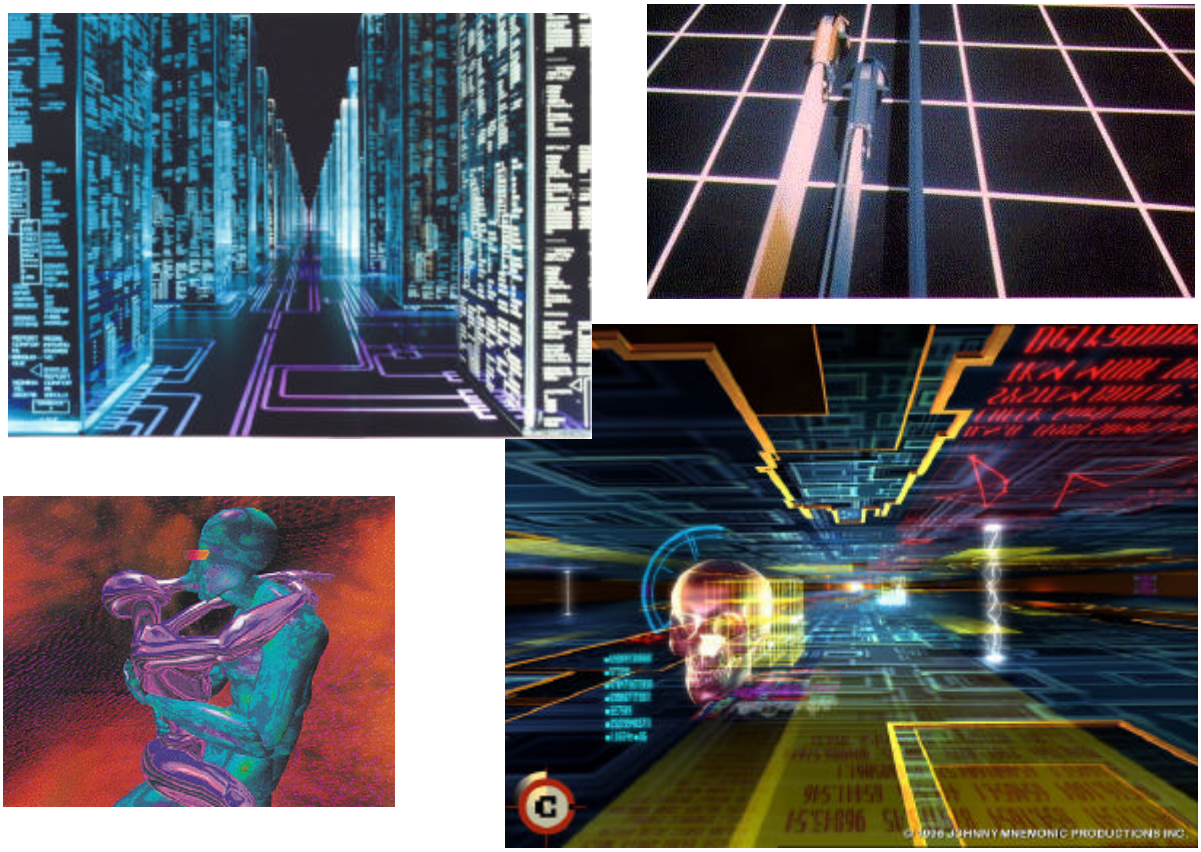


Figure 3: Cinematic images of Cyberspace. (Source: http://www.cybergeography.org/atlas/artistic.html)

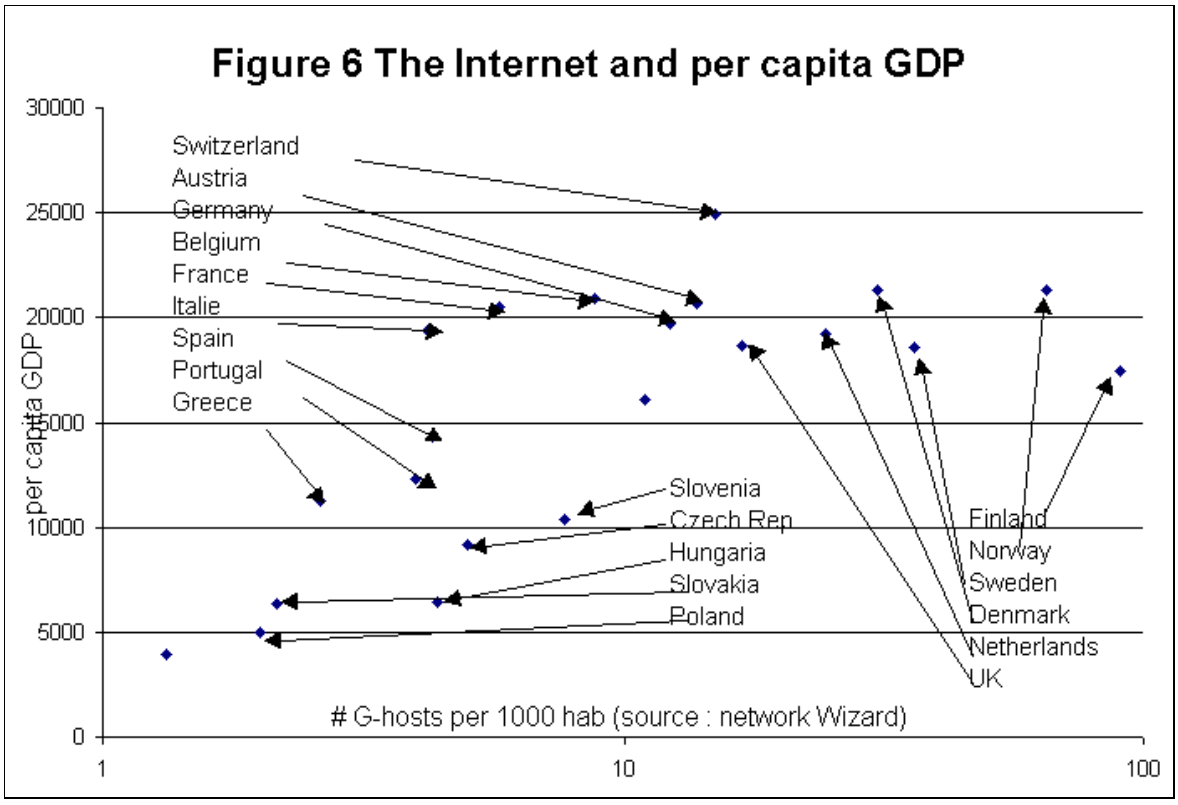


Figure 4: Typical scattergram of national-level data used in Internet diffusion research. (Source: Elie 1998)

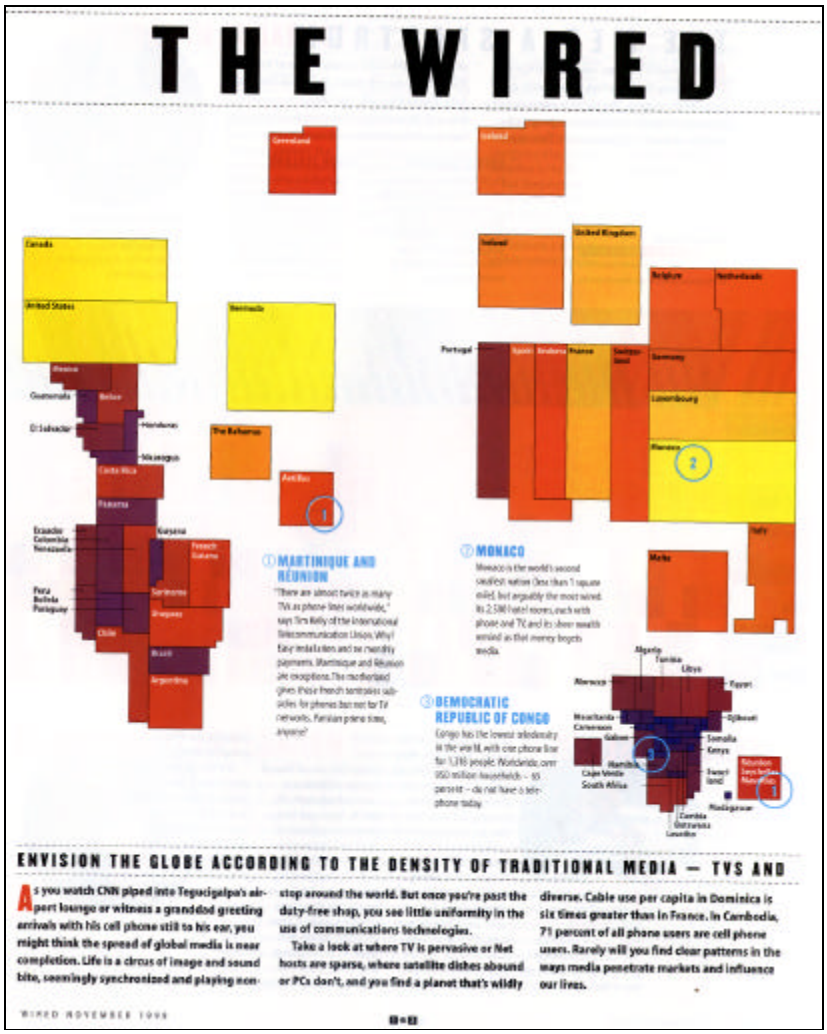


Figure 5: The Wired World Atlas. (Source: WIRED magazine, November 1998, page 162)

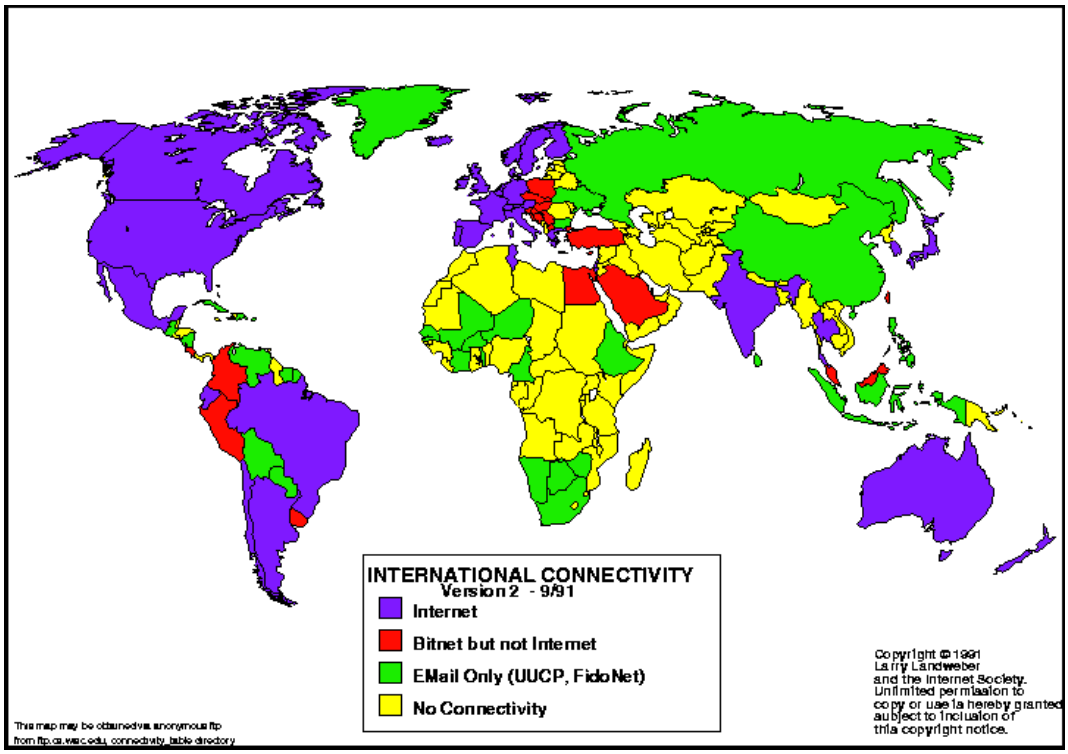
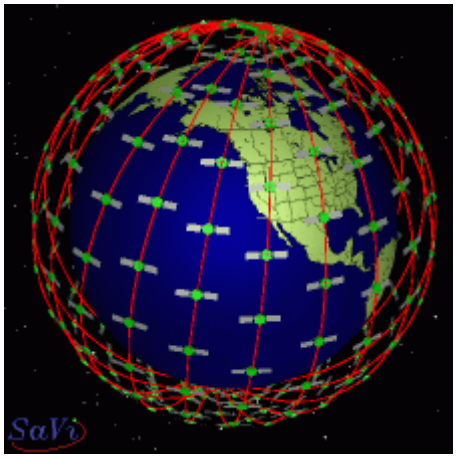


Figure 6: International Connectivity map from September 1991 produced by Larry Landweber. (Source: ftp://ftp.cs.wisc.edu/connectivity_table/)

Figure 7: PSINet World Connectivity Map. (Source: http://www.psi.net/network/connectivitymaps.html)

Figure 8: Abilene Network Map. (Source: http://www.ucaid.edu/html/abilene_map.html)

Figure 9: The Teledesic satellite constellation.
(Source: http://www.teledesic.com/technology.html)



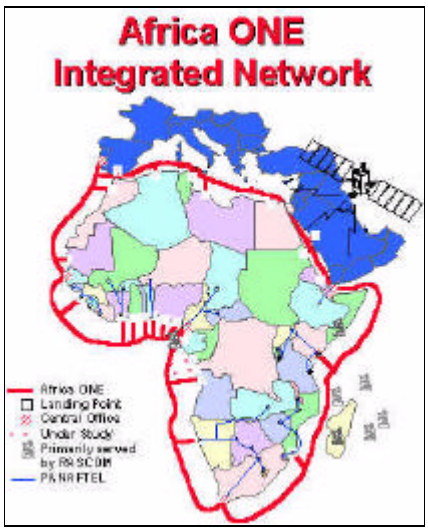


Figure 10: Map of the Africa ONE scheme.
(Source: http://www.africaonesystem.com/integrat.html)

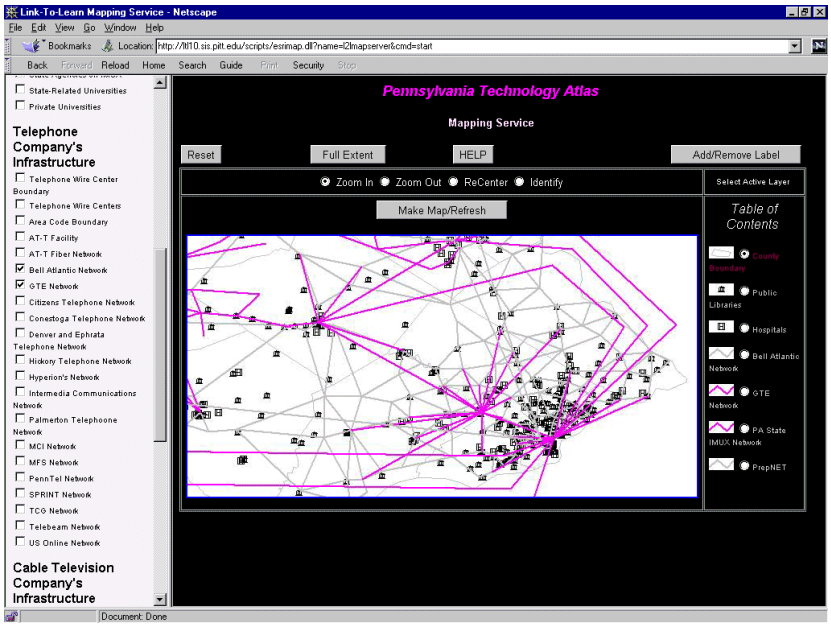


Figure 11: The Pennsylvania Technology Atlas (Source: http://www.technology.state.pa.us/atlas/)

[1] The World Economic Forum is a powerful group of international businessmen who hold a high-powered meeting in Davos. From the Forum's web site (http://www.weforum.org/), the meeting in Davos is described as "*…the world's global business summit. At the Annual Meeting, 1000 top business leaders, 250 political leaders, 250 foremost academic experts in every domain, including many Nobel Prize winners, and some 250 media leaders come together to shape the global agenda. Together, they address the key economic, political and societal issues in a forward-looking action-oriented way.*" The Network Society Map was given to attendees at the 1997 meeting.

[2] The selection is likely to have been dictated by the ease to which statistics were available, rather than any other more object criteria.

[3] One of the authors of this paper is also an 'offender' in this respect, using three different Earth-type images on his web site (Dodge 1999). See Cosgrove (1994) for a discussion of the use of the Earth image.

[4] Those who are interested can see further examples from around companies around the world at http://www.cybergeography.org/atlas/isp_maps.html. Russ Haynal's web site also provide links to maps of US companies, see http://navigators.com/isp.html.