Social and Policy Issues Regarding Internet2

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1. Introduction

A discussion of the social and policy issues relevant to Internet2 necessarily begins with the recognition that the high-capacity research networks currently restricted to University Corporation for Advanced Internet Development (UCAID) [22] members and other universities and research centers are the testbeds for applications that will determine the shape of future networks. The vision of Internet2 was that high performance networking would further the goals and needs of higher education with a view to developing applications and standards usable by the education and research community and transferable to other environments. This means that while social and policy issues relevant to Internet2 are limited to its predominantly academic community, their implications extend beyond that constituency.

Hence, this white paper looks toward a future high capacity, broadly available network, although at what costs, where, and in what configuration we cannot say. We assume that the most important social and policy issues related to a high capacity network will be important to research and education (non-profit) as well as to commercial environments. Internet2 can help to develop the appropriate research methods, data and testbeds that will determine the outlines of the public Internet s structure, control, and capabilities. It may also help us to rehearse the nature of the public and the private values that we hope to engender and maintain in networks of the future.

The following sections loosely group wide-ranging sets of macro-level questions concerning some policy, cultural and social impacts of Internet2. They easily stray into considerations for the next generation Internet, which although conceptually distinct from Internet2, is related to it in terms of its proposed high-capacity environment and its presumed importance to the nation. The questions and issues noted here are by no means exhaustive, but the intent is that they will serve as a useful point of departure.

2. Seamless or Bounded? Alternative visions for a Global Network

There is a commonplace assumption that eventually the entire globe will be united with one single, seamless network that will allow anyone using it the same privileges and opportunities for communication. Since the development of the World Wide Web and the commercially-oriented applications that accompany it, a vision of a high capacity information system transcending both national boundaries as well as private and public system boundaries has highlighted issues of network integration. However, the rhetorical power and appeal of homogeneous network access and capability is belied by the actual configuration of network topologies. As Dr. Lievrouw [7] pointed out in her discussion at the Internet2 Sociotechnical Summit, the network terrain is actually pretty rugged.

The Web catalyzed the bumper crop of servers that store and distribute increasingly large amounts of information on the Internet, in turn dramatically affecting Internet traffic. The presence of more bandwidth-intensive applications involving video and audio traffic (including IP telephony, audio recording and movie distribution) also will escalate traffic demands on the commercial Internet. Internet2 already has some experiments that explore the network demands for these sorts of services. Suffice it to say, however, that their prominence may push network capabilities in one direction – and not necessarily a direction that is currently anticipated.

As more components of Internet traffic (the applications and portions of the network itself) are private, and, as they link to networks controlled and managed by public entities, the boundaries between public and private may

prompt questions of authority. This will be especially problematic when services closely identified with the public interest are concerned. The next section explores this matter with regards to telecommunications infrastructure, but the same argument is pertinent with respect to the source of applications themselves, and is related to who connects to Internet2 and under what terms.

The way in which Internet2 connectivity is implemented presents us with a case in point. At this writing, Internet2 s membership and use policies [23] have recently been changed with respect to the type of network access members and their partners enjoy and the nature of the traffic they carry (in terms of profit-making capabilities and commercial content). The fundamental issue concerns the . com traffic that should be permitted on Internet2 s networks. After all, this is a network dedicated to educational and research missions. Insofar as some partners (called *Secondary Participants*, often comprised of K-12 schools, businesses, or research agencies) undertake projects with regular University UCAID members, and insofar as these may be private companies, the potential commercial aspects of the Internet2 project cause many definitional and identity problems. As *Secondary Participants* use the advanced network for education and research related activities as well as other (possibly profit-making) activities, their relationship to the larger structure of Internet2 clearly raises the questions of where public and private should diverge and where they should intersect in this endeavor. Who uses the network for what purposes and what sort of boundary is most reasonable?

President Clinton and Vice President Gore launched one vision of a National Information Infrastructure [14] in the early 1990s, and the European Union [2] likewise has identified information infrastructure as a critical element for the Union s economic prowess as well as its global standing. Other regions of the world also have pursued the goals of Internet connectivity, although different countries or world regions adhere to variant goals of access and content control. The vision of the European Commission s Information Society Technologies Programme [3] is emulated in several other developed nations. While on the one hand such plans and goals underscore the appealing idea of a ubiquitous, linked, high capacity network, on the other hand they also force us to consider the heterogeneous nature of the underlying communications and telecommunications systems which different countries support. Some countries have very high telephone density, for example, while others do not; some nations charge per minute rates for accessing the Internet, while others —particularly the U.S. — do not. The European Union already has implemented certain types of content regulations on Internet sites that do not mesh entirely with either the sentiments or practices and laws in the U.S. How do the alternative visions of advanced Internet services differ across regions? What national priorities and expectations are associated with them? To what extent will different policies mean entirely different networks? Are there interconnection and interoperability issues?

Ubiquitous access and the absence of censorship are not universal policies, even within the higher education community that is Internet2 s core user group. Because Internet2 s *Secondary Participants* include the K-12 community, the policy issues of access and content control are important here in the U.S. even before considering the international context. While the vision of one homogeneously-available, high-capacity network conveying applications useful to a broad array of populations may be realized eventually, the current state of the Internet is a mix of nationally authorized (particularly in Europe) consortia, privately owned and operated networks, and public, non-profit endeavors. The organization of Internet2 s own projects and participants (the high performance, backbone Abilene network for example involves Qwest, Cisco, and many universities, among other groups) represents a similarly complex mix. The point is that as the heterogeneity of users or participants rises, so does the likelihood of fragmented control over the complete network.

Finally, another set of factors affecting the vision of a seamless network concerns the expanding range of connective tissue technologies that span the first "mile" between the user or participant and the initial network. Even as demand for capacity increases, a growing array of technologies satisfying that demand is emerging. They include wireless systems, more fiber-optic cable networks (such as those packet-switched links built by Qwest and IXC), satellites (VSAT, LEOS and MEOS systems), cable operators, and new lines configured for data transmission from existing telephone providers (such as the family of digital subscriber line technologies). These technologies are unequally distributed around the globe and even among urban as opposed to rural regions in developed countries. They constitute critical access points to the networks, and as such, operate literally as gatekeepers. Their placement, cost, and structure determine access in very concrete ways.

These consideration suggest some of the following questions for future research:

- Who will or should have authority over networks that are amalgams of public and private investments?
- How do individual countries assert control over the Internet and their advanced Internet efforts? What are their goals? How do separate goals (competitiveness, privacy protection, research support, etc.) influence network configuration issues? What is the most desirable configuration of national and international controls?
- Are there global content-control priorities? If so, what are the content-control priorities across the world? What are the political interests behind alternative policies? To what extent can filtering, security or privacy systems be adequate responses?
- What are the results of various governmental programs designed to affect access, and how will they bear on Internet2 s constituencies? How is access defined and what is the current state of Internet access around the world? How might advanced networks now linking to Internet2 from other countries handle access in their regions?

3. Privatization and liberalization of telecommunications networks

Internet2 s backbone relies on telecommunications networks in the U.S. Its international participants connect using telecommunications providers facilities in their countries. In most countries, telecommunications systems are moving toward less government regulation and more competition among providers. Typically this means that a country s formerly state-owned, well-established Post, Telegraph and Telephone (PTT) company (such as British Telecom in the UK) will be privatized and that new entrants will compete with it for telecommunications customers. For example, in the U.S., this is the overarching goal of the 1996 Telecommunications Act [21]. One of the key aims of that legislation was to create a structure within which the regional Bell Operating Companies could begin to offer long distance and other telecommunications services. As PTT s metamorphose into new service providers and as additional sets of companies compete to provide telecommunications services around the globe, the terms of competition can influence network arrangements.

The effect of deregulation and the attempt to bolster competitive conditions are unequally realized across geographic regions both within the U.S. and in other parts of the globe. Rural areas are generally less well served, and their typically sparse populations make them less attractive to providers. Consequently, competition is less robust (or nonexistent) in such regions. In addition, as mentioned earlier, the international telecommunications providers represent a mix of public and private corporations, some more closely tied to national interests than others. The mix of infrastructure providers and the complicated relationships to governments raise several issues, including the extent to which network development favors large markets over small markets, how publicly supported networks such as Internet2 transfer their service standards across institutional settings, and where competitive advantage translates into preferential treatment.

In the U.S., Internet Service Providers (AOL being the largest dial-up provider), cable modem providers (dominated by AT&T and AOL/Time-Warner), and local telephone companies all sell access to the Internet, with varying speeds, quality, costs and regulatory obligations. The terms of interconnection and peering arrangements already are two tools being used to maximize certain providers' internal efficiencies at the expense of other networks service quality. Some economists suggest that commercial network congestion can be solved by pricing different levels of network access and service quality [25]. Peering and interconnection agreements then become commodity elements of the service. Others note the spread of access points in the U.S. in patterns that suggest institutional adaptation to the competitive powers of peering arrangements [17]. These arrangements already affect Internet2 s access points and service conditions. More competition can only complicate matters for publicly inspired endeavors such as Internet2.

Additionally, with regard to some of the access problems now posed by vendors providing cable modem services, the matter of end users choices for Internet service also should be researched. As Dr. W. Russell Neuman [10] highlighted at the Internet2Sociotechnical Summit, as long as that tier of access providers essentially controls the conditions, price and interface of Internet network availability, ideas about what the current (or the next) Internet can be must be conditionally framed. If so-called bottleneck access facilities for broadband services remain bottlenecks (i.e. without many competitors), they should be scrutinized with a view to policies that can promote choice and equitable access in the future [11]. What are the

appropriate models to use to help obtain the levels and conditions of access that are most desirable? Public policymakers could use better ideas on this question.

Internet2 could be a testbed for alternative pricing schemes for commodity network services, but such price discrimination methods might be antithetical to this network s fundamental goals. The immediate telecommunications infrastructure pressures Internet2 faces offer some opportunities to consider how competition may influence network configurations and terms in the future. The future for non-commercial applications in educational and research environments should be a special concern. Where and how do the values and goals of education and research intersect those of the marketplace as far as telecommunications infrastructure for networking is concerned?

The changing set of telecommunications providers operating in competitive circumstances therefore suggests several research questions:

- What is the national and international status of routing and peering arrangements?
- How do national and international political and economic concerns translate into network configurations?
- What are the global access limitations likely to be in the future?
- How do legacy regulatory conditions influence telecommunications or access providers network planning and ability or willingness to participate in Internet2 activities?
- Which network conventions, capabilities and policies, if any, will distinguish higher education and research institutions from commercial institutions?

4. Content concerns

Very little attention has focused on the content or applications that will run on Internet2 -- or the next generation Internet. Internet2 was driven in part by the needs of the high-performance computing constituency. With the array of new applications requiring higher speeds, those interested in the capabilities of these networks will include other users with different intentions and content interests. We can predict that there will be much more development of video and audio-based applications, for example, because those applications combine elements of popular entertainment with Internet2 s ability to transmit with greater flexibility, vividness and fidelity than is possible in conventional network environments. A recent demonstration of High Definition Television (HDTV) over the Abilene network under the auspices of an Internet2 project called ResearchTV is one small step in this direction [16]. However, the question of what sorts of content are most amenable to these networks sidesteps the broader issue of what content might be most socially desirable and how its development might best be fostered.

Many realists predict that content additions to the Internet of the future will be in the arenas of sex, shopping and entertainment. Dr. Eli Noam [11] pointed out at the Internet2 Sociotechnical Summit that the speed of the Internet s use - and whatever network that supplants it - will be contingent on finding common uses, uses that numerous individuals would share. We have already seen that the above three content realms are highly related to the growth of the World Wide Web, and that they occupy a great deal of the attention of e-commerce developers as well. However, while the network-based commodity-related services and products will be propelled by the marketplace, some of the socially beneficial content areas that lack immediate market appeal may suffer.

Some critics worry that the customer focus of many commercial Internet providers will result in systems catering to users accustomed to *receiving* content rather than *creating* it (akin to the audience created by other media industries), and also result in systems that deliver lowest-common-denominator services to fragmented population segments. Such developments could undermine the spirit of community that has propelled the original Internet as well as Internet2. Experiences with market-driven television programming and cinema offer the lesson that in certain cases, subsidies or non-market mechanisms must be put into place to safeguard certain interests [20]. Hence, for example, we have the affirmative obligation on broadcasters to produce a certain amount of television content appropriate for children. Should similar content concerns apply to the future Internet? In what ways might Internet2 spearhead applications now that would foster more debate concerning the creation of content that is socially desirable? In monitoring the current Internet environment, what are the trends in content development? Are multiple users or participants interests evident?

In the enterprise Internet world, the development of the Web drove an increase in host computers from 1.313 million in January 1993 to about 30 million in January 1998, according to figures in the National Research Council s *Fostering Research on the Economic*

and Social Impacts of Information Technology [8]. While figures on overall Internet and Web users continue to escalate, there is always a difference between those who use these resources regularly as opposed to sporadically, and those who actually distribute or publish information via FTP or the WWW as opposed to those who simply receive it. Such figures prompt questions regarding the extent to which this medium and its structure reinforce a more passive mode of media use and reception as opposed to an active one of creating information and content. There are scant data on actual use patterns with respect to the contemporary Internet. The Department of Commerce s studies entitled Falling through the Net [9] and the surveys undertaken by Project 2000 at Vanderbilt University [15] summarize the relationship between demographic variables and certain aspects of Internet usage. However, they do not allow us to understand the complex interactions of variables, including cultural factors, that influence how an average user approaches the Internet and its resources and thinks about sharing insights and information via publishing or other expressive means. Internet2 could offer opportunities for researchers to more carefully assess dimensions of social interaction in this rich environment and to probe the relationship between interface, individual, and the network environment.

Enabling Internet2 to become a content medium suggests certain research priorities:

- In what ways might Internet2 spearhead applications now that would foster more debate concerning the creation of socially desirable content?
- In monitoring the current Internet environment, what are the trends in content development, and are multiple users or participants interests evident? How can more content creation be encouraged?

5. Spatial effects

Some historians of technology raise questions regarding the spatial effects of networks. Claude Fischer s [4] work on the telephone and automobiles (as well as the network of roads that supports the auto) suggests that such networked systems eliminate some of the effects of distances while they magnify others. For example, people using the telephone might be able to reduce their trips to certain areas by substituting a conversation for what would have required a personal visit. On the other hand, the telephone can substitute for visits with nearby people, and hence alter the interpersonal nature of local community ties. We understand very little about the effects on the constellation of interpersonal ties, community relationships, and spatially based resources that occur when we use mediated systems as opposed to unmediated systems of communication. What is the research networking experience represented by Internet2? How might other networking opportunities link new communities together in unanticipated ways? We know from our history with the Internet of new professional communities formed on the basis of the exchanges facilitated by that network. Informal community building opportunities spawned personal civic, scientific, and other group efforts. Such groups have encompassed people in rural as well as in urban areas. Where the networks of the future go, and what capabilities they bring with them, will in turn influence new social groups and new social activities.

If electronic networks continue the pattern of spatial characteristics associated with canals, railroads, and roads [18], certain effects might be expected regarding regions that become part of the network as opposed to those that do not, or those that have lower capacity or lower quality networks. Even as the city bypassed by an Interstate freeway may wither - so too the places and communities bypassed by information networks might also decline. The extent to which the electronic resources provided in an Internet2-type environment could substitute for locally-based resources (including, for example, social relationships or neighborhood centers or malls) or affect the development of location-based resources suggest other types of spatial impacts.

Some of the questions concerning such effects might include:

- What is the effect of high capacity networks on the physical locations that have them – as opposed to those that lack them?
- What are the changes in the ways that faculty, researchers, and other Internet2 members approach their physically based resources? In what ways are those locations with superior access or network-based resources better off than those comparable locations that lack comparable access? For example, would sharing the capacities of an electron microscope via Internet2 enhance university research, or would it stimulate regional commercial interest in its capabilities? (In a field setting, this may be difficult to assess insofar as there may be other third variables that account for the absence of superior network resources.)

- What are the effects of using network-based resources on Internet2 constituencies ties to place or their personal/professional social relationships?
- How does the nature of community change when more interactions are virtual? Do the dynamics of trust or cooperation, for example, assume new shapes?

6. Institutional Settings: Technology Transfer and user interests

Two of the founding goals of Internet2 were to provide an environment for developing applications that could be transferred to the commercial sector and to foster improved research opportunities among Universities. In this sense it was conceptualized as a technology transfer project from the outset. Its projects are comprised of the work of institutions. Members, the other institutions with which they work and the networks they use as access points all are potential sites of and contributors to technology transfer. Because many of the connectivity conditions are experimental and because many of the applications likewise are pilot tests, a great deal of learning occurs routinely. This is a type of technology transfer that is as important as more formal technology transfer activities, and such learning takes place alongside a range of practices that define the process of moving ideas, concepts, behaviors and innovations from one organization to another. The Internet2 environment and the institutions it has spawned provide fertile sites for research on technology transfer practices and possibilities.

The GigaPoPs are particularly important because they represent a tangible point of confluence. The term denotes a high volume site (the giga portion) that functions as a point of presence for switching purposes or POP in telecommunications parlance. GigaPoPs are regional network aggregation points formed and managed by Internet2 universities (sometimes with other partners, public and private) to connect and route traffic to a variety of networks, including the Internet2 backbone. GigaPoPs function as high-speed connection points. The GigaPoPs themselves, their management policies, and the UCAID members that either link to or manage them represent critical technology transfer points in the larger network scheme. The learning that occurs there might be more formally investigated so that we can understand how best to structure network access operations for optimal technology transfer opportunities.

In addition, the applications experiments various members sponsor with other public or private partners also represent interesting technology transfer sites. What is the role of the network in catalyzing collaborations? How does it influence both incentives and opportunities for people from public institutions to work with people in private institutions?

Several questions concerning technology transfer might focus on the role of network capabilities and structure:

- What kinds of technology transfers occur now among UCAID members using Abilene and the GigaPoPs?
- What are the perceived successes and failures in sharing or extending certain applications environments?
- What are the private sector expectations regarding technology transfer for Internet2 experiments? What is their role in technology transfer events?
- What are the mechanisms by which Internet2 and its associated network capabilities encourage technology transfer situations?
- How can technology transfer models be used to improve relationships among all the parties potentially benefiting from Internet2?

7. Next generation services and Middleware

The architecture of the Internet traditionally utilizes open standards, with its Internet Protocol as a base layer on which a range of both transport services and middleware services depend. The term middleware encompasses a broad array of tools and data that are or will be vital for sharing resources and services both within and across institutional environments. The growing variety of applications and their ability to provide customizations suggest a need for some centralized capability to enhance their efficiency and effectiveness. Middleware emerged as a layer of code that adds functionality to the handling of information - its transmission, its presentation and its protection [24].

[SEE FIGURE 1.]

Internet2 now is developing its middleware initiatives for a variety of applications that are germane to the next generation of services most people envision for the Internet. Many of them derive from security issues, and will entail digital certificates and public-key infrastructures (PKI). Internet2 s initiatives [24] as enumerated in their documents include:

- Identification - developing a set of computer-readable codes that uniquely specify a subject.
- Authentication - the process of a subject electronically establishing that it is, in fact, the object associated with a particular identity.
- Directory Services - central repositories that hold information and data associated with identities. These repositories are accessed by people and by applications to get information, customize generic environments to individual preferences, route mail and documents, etc.
- Authorization Services - those permissions and workflow engines that drive transaction handling, administrative applications, and automation of business processes.

Internet2 s vision is to develop such applications within the interoperable philosophy that has dominated the network s development. At the same time, it is important to recognize that many different communities and constituencies are interested in middleware, including large commercial businesses such as financial institutions that depend on secure transactions; higher education and government institutions that maintain private records about individuals and that have an interest in and obligation to maintain security; and libraries and other repositories of information that depend on authorized access to protect intellectual property and that have as their missions the appropriate distribution of information. Universities in particular will require middleware in order to enhance their collaborative endeavors. The specific goals of these constituencies do not always mesh. Intrusions on privacy through profiling and data mining could become easier. In particular, the practice of and right to anonymous communication is taken for granted in the U.S., and middleware developments may conflict with anonymity.

Developing standards for sharing files and protecting users goes beyond the protocols that institutions develop so that they can talk to each other with security. These standards must be cognizant of users concerns and interests. Consequently, developing middleware poses some questions:

- What are the implications of specific middleware options for different constituencies, and specifically for higher education?
- Who owns data about individuals? Will new individual data rights have to be defined as middleware capabilities grow? Varying international standards (e.g., Europe s strong personal data protections) may imply different technological applications.
- If middleware s authentication capabilities enhance an institution s abilities to profile individuals, what are the economic and political consequences of that practice? Where do these capabilities intersect privacy concerns?
- More broadly, where does anonymity fit within privacy and security protections, especially within Internet2 s constituent institutions?
- What are the technology transfer implications of Internet2-developed middleware?
- The prospect of different legal jurisdictions (especially international) enforcing their unique regulations or laws on certificates, digital signatures and electronic commerce raises the likelihood of conflicts. How can these be anticipated and addressed?

8. Trust, reputation, property: The conditions of exchange

Information creation, sharing and gathering in the Internet and Internet2 contexts alter many conventions regarding trust and reputation. A higher bandwidth environment may offer new ways to enhance trust and to convey reputation by transmitting different sorts of information (or combinations of information) simultaneously. By the same token, however, there are more opportunities to violate presumed trust as well.

New applications provide more opportunities to covertly gather information about users, raising questions about the use of that information. The National Research Council published a detailed research agenda that included extensive discussion of aspects of trust in the networked environment entitled Trust in Cyberspace [19]. It scrutinizes correctness, security, reliability, safety and survivability of networked systems, concluding, building of trustworthiness into an [networked information system] has proved to be impractical. It is neither technically nor economically feasible for designers and builders to manage the complexity of such large artifacts or to anticipate all of the problems that a [network information system] will confront over its lifetime. It is no accident that the market for virus detectors and firewalls is thriving (p. 2).

Issues of trust, privacy, and security are not inconsequential in public or private institutional environments. Certain conventions of

communication have been negotiated over many years that convey or imply protections that are unavailable (or discouraged) in new environments. Property relationships and various legal standards that apply to old media domains need to be modified for this new one. The large field of intellectual property is undergoing rapid change in the face of commerce problems in the enterprise Internet, and we can expect similar issues to arise in more advanced network media environments [5]. The needs of Internet commerce track alongside those of institutions that endeavor to share more and more information (identity, authentication, etc.) about their members or constituencies. Lawrence Lessig [6] refers to an architecture of trust (p. 40) that enables secure and private transactions. Such an architecture is pertinent equally in profit as well as non-profit spaces.

A long list of research questions flows from these observations. A few are offered here:

- How can trust and reputation be conveyed through the multiple communication capabilities of Internet2?
- How can Internet2 develop standards for safeguarding identity that can set a benchmark for the commercial domains?
- How do users adjust to new indicators?
- What are the economics of trust and reputation? What thresholds for privacy and trust apply in different environments?
- To what extent can specific network innovations enhance or control them?

I single out one area of particular interest to educational institutions. The new energy in distance education opportunities afforded by Internet2 raises important questions regarding intellectual property. Distance education applications are one of the essential target areas for developing applications, although protections for faculty members efforts are scant to date. Likewise, protections for other materials, such as videotapes normally used in classes, are less certain when a network intervenes in their course use. For example, when materials such as commercial movies are shown to a class, they are considered a performance (related to an educational experience) and they carry no copyright liability. However, having that same film served from a central point to various classes may not qualify similarly as an educationally protected performance. With respect to faculty members own lectures and class materials, intellectual property protections are not always backed up by the universities in which faculty members work. (In fact, faculty members own their course content, but may lack the means to protect that content.) Basic approaches to intellectual content and teaching that offer fair protections to faculty, to students, and to educational institutions should be a priority among those interested in encouraging distance education. Some important questions are:

- Under what circumstances should the educational institution aid in protecting faculty members intellectual property?
- What are the intellectual property aspects of distance education? Which still need resolution, and what is the best process for such resolution?

9. Conclusion

These preliminary and far from exhaustive questions should prompt us to question not only what the Internet2 research potentials might be but also what we might learn from studies using the existing Internet. Understanding many of the issues noted above would profit from simply developing and gathering baseline data. Several of the issues raised may ultimately pertain more to political and value decisions than to research conclusions, but political decisions should be informed by research to whatever extent feasible.

Internet2 promises to be an excellent opportunity for researchers to ask interesting questions and to undertake research that is impossible in the increasingly commoditized realm of the other Internet. This experimental environment s role in establishing procedures, protocols, and practices that will be adopted as network capabilities migrate toward broader constituencies could be extremely important. Answering some of the questions offered here could help us mold the next communication environment in ways that render it a better place for the next generations of users.

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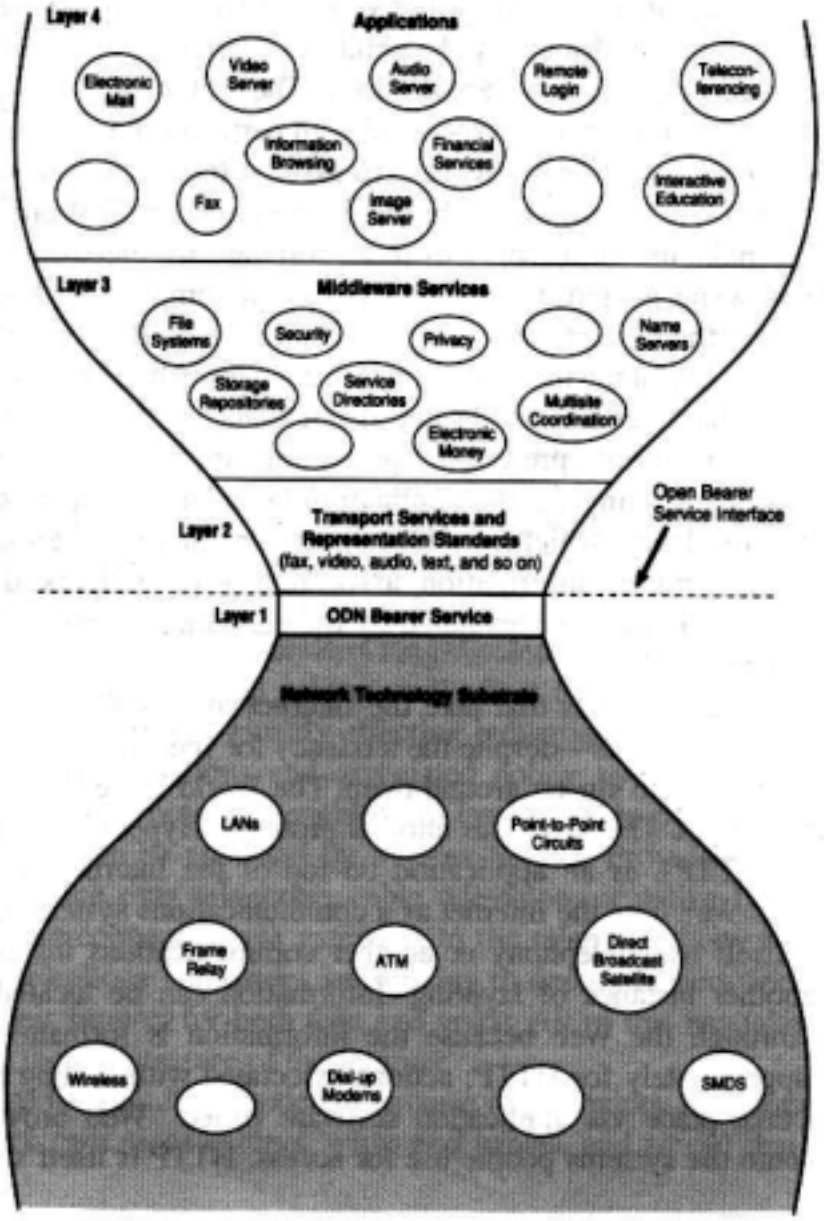
Figure 1: Conceptual Model for an Open Data Network (the Internet)



Source: Blumenthal, 1999, p. 7.