

large swaths of social and economic activity that rely on that infrastructure, while at the same time suggesting that this idea is neither radical nor new, but, rather, is already deeply embedded in the country's communications regulatory framework.

As recent electoral events have shown, however, sometimes the most radical imaginable change comes not from inventing new principles or doctrines, but rather simply from – at last – putting long-standing principles into practice.

At a high level, everyone understands what it means for a network to be open: (1) whatever else it might do, the network offers a pure “transmission” service, so that users can freely communicate with each other; (2) users can connect any devices they want, as long as they don't harm the network; (3) the network connects to other networks; and (4) the network doesn't discriminate among users or among the services, information, and applications users want to provide to each other.

None of these points should be controversial. The concept of open networks is at least 40 years old in the US. The FCC's seminal 1968 *Carterphone* decision held that a network operator may not forbid the use of devices on the network that benefit the user and do not harm the network itself. A decade later the FCC established its equipment registration program requiring interfaces to the telephone network to be standardized and fully disclosed. Shortly thereafter, in *Computer II*, the FCC required that the basic transmission functions used to provide an “enhanced” service offered by a network operator's affiliates must be made available to all competitors on non-discriminatory terms. The Telecommunications Act of 1996 mandated interconnection among networks (although the FCC has always had the power to require it). From the beginning, in fact, the Communications Act has banned “unreasonable” practices and discrimination by network operators – and most efforts by network operators to close or restrict their networks are, with a little thought, obviously unreasonable, discriminatory, or both. And as recently as a few years ago the FCC adopted four network access “principles” that, while not sufficient in themselves, go a very long way in the right direction.

Again, none of this should be controversial. But of course it is. It is an unfortunate fact that any for-profit network operator will have a natural incentive to identify those communications with the highest value and look for ways to impose excessive charges for them – whether by conditioning the very availability of such communications on paying a fee (that may far exceed the cost of providing the service), by preventing users from taking advantage of innovative alternative ways to bypass the network operator's own proprietary services with something better or cheaper, or in other more subtle ways. Charging the highest feasible price for a service, based on its value to the consumer, is the essence of capitalism; the point of competition is to force the price that can actually be charged down to a reasonable level. And, indeed, perhaps in a true competitive Nirvana of a dozen fully facilities-based competing networks, market forces alone would ensure that these natural, profit-driven desires on the part of network operators would be sufficiently frustrated that consumers could be assured of the availability of one or more truly open networks. But in most of the world there is only one broadband network available to the vast majority of citizens; the US is something of an outlier in that its current policies favor two – the telephone company's network and, typically, a competing

cable network. But while two networks is probably enough for competition along dimensions where the operators' interests are not aligned, neither telephone companies nor cable operators have any natural incentive to provide an open network. As a result, neither will see an advantage in competing by offering such a network (even though, in practice, open networks can be quite profitable). Unfortunately, then, ensuring that America's citizens have the advantages of open networks will require affirmative government action – at least in setting and enforcing the rules. We are confident, however, that the new administration understands that the public interest requires active regulation in some spheres and that invoking the concepts of “market forces” and “private sector choices” as magic talismans can (as we have seen in the financial sector) lead to serious harm.

If the ARRA funds are utilized to build open networks, we believe that the promise of open networks can be studied and understood within the US. This would be the beginning of the development of true open broadband networks in the US and encourage the new administration to expand and catalyze open network provisioning nationwide. More fundamentally, though, no significant communications network (in the US or elsewhere) is or can be entirely “private.” The basic infrastructure of these networks occupies scarce public rights of way, makes use of public airwaves, or both. We therefore believe that the US should – indeed, in the long run, must – require that all publicly available communications networks embrace and operate in conformity with the basic principles of openness that have underlay US communications policy for decades and that have only recently been set aside.

Again, we are not suggesting some radical new experiment in regulatory philosophy, but, rather, a return to traditional regulatory concepts and values that have served us well for many decades, both in communications regulation and elsewhere.

2. Open Networks.

A. Unlocking Potential for Economic Growth.

Like the fabled beggar who had sat on a box for 30 years only to one day discover that inside it was a fortune in gold, policy makers need to examine the potential already contained but not yet realized in America's telecoms infrastructure. During the past eight years the nation pursued a policy direction that assumed closing networks – mostly by removing requirements to keep them open – would increase economic output and overall business value. As a result, the market has consolidated and innovation in communications has lagged. Broadly speaking there are four reasons that it is important – indeed, critical – to insist that communications networks be open.

First, communications networks are, from one perspective, the most basic and profound aspects of a nation's infrastructure. Nearly everything else that happens in society depends on communications. Education, commerce, culture – all depend on communications among a nation's citizens. The notion that a private entity seeking private gain should be able to constrain, control, shape, or interfere with such communications should, upon reflection, generate deep concern, if not outright horror. The right of people to communicate with each other when, what, and how they choose

is a fundamental human right. Obviously the *means* of communication will not necessarily be “free” in the sense of “without charge” – providing communications uses resources which must be paid for, one way or another – but at a high level it seems anathema to a truly free society that people should ever be charged *more than* the cost of the actual resources actually used to make communications possible. So from this perspective a commitment to open networks follows logically from a commitment to a free and open society.

Second, even from a narrower, purely economic perspective, open networks are certain to deliver better overall economic performance than any sort of closed or restricted network. For businesses, communications – whether with customers, suppliers, or internally – is a cost. The cheaper and easier it is to communicate, the more effectively the business will operate. Note that this point is not limited to voice communications. Innovative fleet management, inventory management, customer relations management, and other business operations often require sophisticated and efficient data communications between a company’s headquarters and various far-flung personnel and locations. For example, the capability now offered by firms such as Federal Express and UPS to track the status of specific packages online is the result of a combination of sophisticated computing and communications technologies – from the handheld scanners that swipe the bar-codes on individual packages to the radio links that connect those scanners with a central database to the Internet connectivity that allows shippers to access that database anywhere in the world. Allowing network operators to restrict the use of their networks or to impose discriminatory fees or conditions designed to “encourage” businesses to use a network operator’s own services will necessarily impose costs on, and degrade the efficiency of, the businesses that use communications networks. Again, obviously businesses may be expected to pay a fair price for the resources they actually use when they invoke the capabilities of one or more communications networks. But allowing a network operator to limit or degrade those capabilities, or to impose excessive fees for their use, is simply granting to the network operator the power to tax and to indirectly regulate the businesses using the network. Requiring openness from network operators will redound to the benefit of essentially the entire economy.

Third, in the modern “information age” many businesses are entirely based upon communications. These are businesses that sell knowledge, entertainment, and information rather than, or mainly rather than, physical products. The inventive spirit of millions of American entrepreneurs is much more likely to come up with the Next Big Thing in the realm of communications-based products – not to mention hundreds if not thousands of Next Pretty-Big Things, and Next Small-But-Useful Things – than are the employees of a handful of large network operators. This is not by any means to denigrate the intelligence and inventiveness of those who work for large network operators, nor to denigrate the impressive financial resources those operators can bring to bear. It is simply to recognize the point that, no matter how good those employees are, the overwhelming majority of smart, inventive, capable people *do not* work for those entities. Open networks – that is, in this case, networks that allow any non-harmful application to run, and any non-harmful devices to be attached and used – provide the fertile ground needed for the ideas produced by those smart, inventive, capable people to grow. If the network operators view themselves as permitted to prefer some applications and some devices over others – that is, to prefer the ones

they invent and for which they can charge the most profitable rates – the inevitable effect will be a steady, corrosive degradation in the ability of American business to improve productivity, deliver new and innovative goods and services to the public, and compete with businesses elsewhere.

Note that a requirement of openness will *not* suppress the development of valuable new services and applications by the network operators themselves. To the extent that network operators develop services and applications that are useful to the public, a requirement of openness does not mean that those services and applications cannot or would not be deployed. It only means that the network operator can't use its control over the underlying network to put a thumb on the scales to favor its own service/application over those "not invented here." Of course, if a proposed service or application can only flourish if it is given privileged access to network capabilities, or if control over the network is used to steer customers to it, upon reflection that is simply an admission that the service or application isn't, in fact, superior to those that are being suppressed.

Fourth, even looking purely within the market for network services, openness makes sense. As we alluded to earlier, network operators' natural capitalistic instincts will be to try to identify and charge more for those communications that users view as high-value and to steer users towards the network operators' own "enhanced" or "vertical" services rather than those of competitors or of the users' own devise. While not as blatant or obvious an exploitation of monopoly power as refusing to interconnect with a small competitor or blatantly overcharging for a basic service, these practices are, at bottom, a form of exploitation of monopoly power over a key social and economic resource. It has been commonplace regulatory doctrine for more than a century that regulation is needed to prevent a monopolist from exploiting its market power to the detriment of consumers and competitors. Even if one believes (which we do not) that it is theoretically possible for there to be a robust competitive market among multiple facilities-based providers of broadband communications networks, no one could seriously assert that such competition exists today. So regulation – including regulation requiring open networks – is clearly necessary today, simply to prevent existing network operators from exploiting consumers.

B. Open Networks Operate With Greater Efficiency and Permit Higher Levels of Beneficial Economic and Technological Activity.

Rather than focusing on advancing one business's interests versus another or balancing all sorts of competing industry interests, policy makers need to step back and reaffirm basic goals and principles. The aim should be to provide a universal communications platform, composed of multiple interconnected and interoperable networks. The parameters for this platform will need to be set according to what is to be delivered over the infrastructure. We need to get away from the idea that the infrastructure is the "service." The infrastructure provides connectivity and access. Users will the employ applications, services and devices of choice. The infrastructure must "support" these things, not "provide" them.

Obviously neither we nor anyone else is in a position to identify the specific new beneficial applications and services that will arise in a truly open network environment. From this perspective, one either has faith and confidence in the inventiveness and entrepreneurial spirit of the nation's citizens and businesses or one does not. The point of requiring openness is to enable that inventiveness and entrepreneurial spirit to flourish. The aim should be to provide a universal communications platform, composed of multiple interconnected and interoperable networks. The parameters for this platform will need to be set according to what is to be delivered over the infrastructure.

One example of the capability of an open broadband network, however, might be the ability to provide basic video monitoring for medical purposes – a capability that should be made available to everyone, independent of whether a person buys Internet or telephone service (*e.g.* totally unbundled from those services). Obviously the quality and the nature of such services would need to be debated (policy makers can certainly set the broad parameters for such services) but politicians should never pick technologies. The conditions requiring this capability should be technology-neutral and it should be left to the infrastructure providers to ensure that whatever they build is able to deliver the basic e-health services as described by the policy makers. Similar policy parameters can be set for tele-education, smart grids, basic video entertainment, etc.

In this regard, we should carefully distinguish between the basic infrastructure on which communications depends, and the notion of a “service” provided using that infrastructure. Newspaper delivery is a “service” provided using roads – a physical transportation infrastructure. We do not normally think of the roads themselves as a “service” being provided to anyone – even though it obviously costs money to provide and maintain roads, and even though there must be rules regarding the use of and access to roads. This is another reason that traditional free-market-based analyses do not necessarily fit very well when applied to communications infrastructure. The point of the infrastructure is not to be a market-driven service *itself*. The point of the infrastructure is to enable and facilitate the *provision* of services that will be subject to the normal operation of market forces.

Note also that, while the authors of this report generally favor some form of so-called “network neutrality,” we do not believe that the communications infrastructure should be limited to providing a single undifferentiated “transmission” capability. To the contrary, the topology and the architecture of the open network should be such that infrastructure, service and content providers all can also offer higher quality and different ‘premium’ products and services. Similar structures exist elsewhere – public health and private health, public education and private education, public and private transport, tollways, and so on. While this might stir up the net neutrality debate, it must be clear that the basic national high-speed broadband service should be defined at such levels as to provide sufficient quality to satisfy the people who are using it. This will also change over time – as with other public services, what was seen as a good service ten years ago will require a review every to make sure it still meets the expectations of the users today.

C. Interconnecting Open Networks.

As noted above, one of the basic parameters that makes a network “open” in our view is the fact that the network is interconnected with other networks. One can imagine a world in which all communications networks were, in effect, nationalized – provided on an end-to-end basis by the government. We have no strong objection to the notion of the government owning and operating infrastructure – indeed, governmental units in the US today typically provide roads, water and sewer service, airports, as well as a great deal of gas, electricity, and health care. But obviously today in America the overwhelming majority of communications networks, by any measure, are privately owned. There is no single integrated national “network.” There are, instead, a multiplicity of local landline networks, intercity fiber networks, wireless networks, cable networks, satellite-based networks, and so on. Each of these networks occupies public space in some regard, and is thus “public property” yet is privately constructed and operated. Constructed out of and grafted onto these diverse networks are innumerable truly private networks – ranging from in-home connections between a few computers and printers to internal corporate communications networks that literally span the globe.

Because there are so many different networks in place today it is absolutely essential that interconnection among them for the exchange of any kind of traffic – Internet packets, voice calls, email messages, text messages – be simple, seamless, standardized, and efficient. It is commonplace in this field to note the existence of “network effects” and “tipping points” – situations in which a network becomes more valuable and efficient, the bigger it gets and the more users it has. Unfortunately this means that larger networks almost always have a private economic incentive to delay or deny interconnection to smaller networks, since doing so may prevent the smaller network from winning customers from the larger one and may even hasten the smaller one’s demise – bringing users back to the larger one. We strongly recommend that the new administration be extremely firm and aggressive both in requiring networks to interconnect and in preventing networks from imposing undue delays and expenses on their interconnected partners.

Also, at a higher level, there may be an unfortunate “Gresham’s law” of network non-openness.¹ In the absence of a robust competitive Nirvana that will likely never exist for facilities-based networks, a network operator really can obtain financial advantages over its users and even its rivals by suppressing openness and instead favoring its own services, applications, and facilities. If some networks are permitted to operate on a non-open basis, they may well obtain short-run advantages over open networks, and use those advantages to expand – further pressuring open networks. It is therefore important that the principle of openness be applied to all networks, not merely a few.

¹ Gresham’s Law says that “the bad money drives out the good.” Back when coins were made of gold or silver and were therefore actual stores of value, people would shave small amounts of metal from a coin and hoard it, while passing the coin on as supposedly of full value. Once this process begins, everyone has an incentive to remove any unadulterated coins from circulation and instead only circulate the shaved, damaged coinage. The “bad money” drives the good from circulation. See http://en.wikipedia.org/wiki/Gresham's_law.

That said, once the basis for open networks is in place, we are convinced that commercial structures will be built without too much regulatory interference. This results from a simple and obvious fact that to the extent the underlying physical plant occupying public property is operated in ways that always align its interests with public property, there will be no internal contradiction of purpose: operating private facilities using public resources where there are massive barriers to the public's replication of those private facilities. In other words, once the property interests of the underlying infrastructure provider are aligned with the nature of the property it uses, the resulting technological and economic of such open networks, will be as rich and varied as the use of any other reasonably aligned public infrastructure – whether a bridge, road, reservoir, water system, and so on.

While it may appear a daunting prospect at the beginning (particularly as incumbents have and will continue to try to block any open network developments), things will start looking up once the reality of open networks is accepted, and opponents will recognise the new business opportunities that will arise from that point. Good examples here are now starting to emerge in Europe and Asia (see below).

We believe that, once the principle of openness is clearly established, most networks will find it advantageous to establish multiple peering points with other networks, including a multiplicity of local peering points. This will not only make communications more efficient, it will also make communications more robust, secure, and survivable. A hidden vulnerability of allowing network operators to vertically integrate to the exclusion of other networks is an increased centralization and vulnerability of the overall system. A commonly understood benefit of the basic design of the Internet is that communications is not necessarily or particularly concentrated; instead, as the old saying goes, when the network detects damage, it simply routes around it. We believe that this advantage of the fundamental Internet architecture has been compromised in recent years, and that a national requirement of openness will begin to reverse that unfortunate trend. We also believe that a requirement of openness and interconnection, by promoting the establishment of local peering points, will spur the re-development of “mom-and-pop” style Internet access providers.

For this to happen, however, there needs to be some sort of fixed, reasonable pricing on backhaul/middle mile costs to an upstream Internet access point. In such an infrastructure more and different ‘meet-me-points’ can be created with others (telcos, Internet Service Providers, Application Service Providers, Cloud Computing, WISPs, media companies and other content providers, health and education organisations) to link their network, data center, content hosting, healthcare, education and other facilities. To make it even more cost effective, municipalities in rural areas could assist by making ‘commons’ available within public facilities. In order for this to work, you need a map of the entire infrastructure. A good example here is the telco infrastructure mapping done in New Zealand and available on the Internet.

Once the vertical systems are broken down, it logically follows that separated infrastructure companies will seek to cooperatively utilize and empower other existing infrastructure. By contrast, today's regulatory environments reward customer capture.

Accordingly loop plant is primarily deployed as a method of capturing market, not as a method of enabling customers to do anything they want with it, including, for example, firing the “service provider” in favor of simply purchasing connectivity as a commodity input (at commodity prices) and self-provisioning things like voice service, video content, employing cloud computing, or any of the innumerable activities possible for very low cost on the Internet today.

As we have seen in other countries, however, enabling open networks is not done without resolve and firm commitment to a new vision. Instead, incumbents will try to use their influence to protect their existing dominant positions in the market. This is perfectly rational behavior relative to the interests of private business. It is increasingly apparent that regulatory systems that reward such behavior are not rational in the sense of more broadly benefitting a broader segment of the public. A strong FCC, backed by strong government policies, is therefore essential in establishing open access along the lines advocated in this report. Lessons learned, especially in Australia, should be studied to find the best way forwards for America.

D. Open Networks Encourage Increased Productive use of all Infrastructures.

We have been quick to criticize those who believe that the free market can magically solve the problem of delivering an appropriate open broadband infrastructure, because whatever the free market might be able to do in theory, conditions in the real world do not allow those results to actually come to fruition. Of course the same is true to some extent for a solution based on regulation. What regulation can do in theory is not at all the same of what regulation can accomplish in practice. It is therefore important that any regulatory solution take account of, and minimize, the amount of actual regulatory activity that is required, and the amount of knowledge that regulators must possess in order to achieve reasonably optimal results.

What this means in practice is that for regulation to work it needs to be as simple, clear, and straightforward as possible. Detailed rules choreographing the process of interconnection, the details of what devices may or may not be attached to the network, etc., may be necessary in some cases but should be avoided if possible as any complexity is an opportunity for dispute, misinterpretation or, minimally, confusion.

Given the technical complexity of some communications technologies, we believe that it is important for the requirements of openness to be simply stated and easily understood. We are not naïve and fully expect that today’s incumbents and any number of new networks will seek ways to use whatever control over their own networks and users they may have to favor their own “vertical” services.

One possibility for avoiding this is simply to ban network operators – those controlling physical transmission infrastructure – from offering vertical services at all. This was the basic approach of the FCC’s old Computer II rules. We would not oppose returning to such a regime for all network providers. If that is not politically achievable, however, then at a minimum, a few key rules should be laid down that would apply to all facilities-based communications networks, whether landline

(fiber/copper/coax) or wireless. These rules would then, as need be, be enforced on a case-by-case basis. We suggest the following as a starting point:

1. Users may attach any equipment to the network whose functioning does not harm the network and the use of which does not interfere with the functioning of the network itself. Adding traffic to a network does not constitute "interference."

2. Each network operator must offer one or more pure transmission capabilities on terms that are just, reasonable and non-discriminatory, so that user data may traverse the network unchanged in form or content when considered on an end-to-end basis.

3. Each network operator that offers services other than pure transmission ("vertical services") must offer, on an unbundled basis, each network capability, feature, or function that the network operator uses as inputs to its own vertical services.

4. A network operator may not unreasonably discriminate among users of the network, among such users' transmissions, or among applications or services provided using the network.

5. All interfaces and/or protocols needed to link a network to other networks and/or to connect end user equipment and devices to the network shall be publicly stated on the network operator's web site and filed with the FCC. If accepted industry standards exist for such interfaces/protocols, the network operator's practices shall be compatible with such standards. Adoption of such standards in any jurisdiction, whether within or without the United States, so long as the technology employed is substantially similar shall be sufficient for establishing such standard.

We believe that these five simple rules will be sufficient to resolve the overwhelming majority of possible disputes among network operators or between a network operator and a user. How these rules apply in particular cases cannot be specified with precision in advance. Indeed, we believe that going down the path of trying to specify all possible applications of these rules in advance is, essentially, a fool's errand, and may indeed be a rhetorical and political trap that network operators resisting a requirement of openness will from time to time set for those supporting it.

E. Open Networks Principles are Simpler and More Transparent. As a Result Less Regulation is Required.

After the initial regulations have been set up for the establishment of open networks, we should step back and identify the bottlenecks and where infrastructure is missing or upgrades are needed that will not take place without government funding.

With the vertical business structure gone, infrastructure operators will become far more prepared to cooperate and investigate how to interconnect with other infrastructure, rather than to continue with the 'overbuild-at-all-costs' scenarios they

sometimes indulge in under the vertically-integrated model. Vertically-integrated networks are more expensive to develop and less likely to run as open networks. Obviously this infrastructure will require good governance, both on a regulatory and a technical level, and a workable policy can only be implemented if open networks are applied across the full national telecom infrastructure. By removing the economically unviable competition elements from at least the basic national infrastructure, we should be able to get really good cooperation between the infrastructure players. This allows for their key engineers to take a more independent role and, as such, they should be able to govern the technology, security, reliability, provisioning, IP evolution, investments, etc.

F. Open Networks Require Significantly Less Public Funding.

Open networks extend the economic feasibility for infrastructure projects that were infeasible under the vertical structures in the industry. Once these structures are dismantled, only the infrastructure projects that are not otherwise economically feasible will need government funding.

Under the current vertical integrated structure, some parts of the current network might not be economically viable based on the ROI required by the incumbents and/or the technologies/systems/structures used by them. Note that the costs of incumbents are at least 30% higher than those of “lean and mean” infrastructure builders.

If the regulations are changed so that more elements of the network become economically viable (*see also* our report plans for the transition of the US telecom industry), less government funding will be required. The remaining network elements would require government funding. We are only talking about infrastructure as once the correct regulations are in place -- the services that run over them should be self-sustainable once the extra costs of closed infrastructure are removed from the equation. This is totally in line with the NTIA and RUS statutes indicating that they will give priority to projects that would not be viable but for the grant, but will be viable after the one-time infusion of capital from the grant.

The social value of properly regulated open networks is more than the market will capture from the current closed networks. Any further investments in closed networks, any subsidies under the Economic Stimulus package in these closed networks is not going to provide the social and economic benefits that can be delivered through open networks.

This is increasingly becoming better understood by our policy makers. Around the world there is an increasing consensus on the social and economic benefits of high-speed broadband infrastructure (*i.e.* e-health; e-government, tele-education, smart grids etc.), and this allows governments to step in and fund the gaps. A *rational* designed national network can lead to a much better, faster and more efficient network than those built by individual entities. (Please note the stress on ‘*rational*’. Networks are rarely well-designed when the goal is to protect an infrastructure monopoly, or when rates of return are guaranteed with public funding.)

A restoration of the Computer II environment would also go a long way to re-opening the value of existing networks in America.

G. Rural Infrastructure is Critical to Economic Development.

Open networks must be linked into a national open access infrastructure on a commercially viable basis. This will lead to more local peering points, particularly in underserved areas. As has happened in other countries, by allowing individuals, groups, businesses, and governments located in rural areas commercially viable access to these critical “middle mile” facilities, communities are able to build and operate new forms of businesses, provide needed services, improving local economies, local schools, and quality of life. But this does not happen if tools of technology remain locked away in corporate boardrooms – whether in terms of pricing or rules of use - thousands of miles away.

4. Examples of Open Networks.

A. France

The position of the French regulator, ARCEP, is crucial for the country’s future fiber projects. Essentially, operators are prepared to fund fiber installations in the centers of major cities, but to forestall geographic monopolies (and to allow individuals and business to choose their provider) sharing among operators will be required. The regulator has mandated access to rights of way, poles, ducts, and existing sheaths, and on the sharing of the terminal part of fiber networks. It has developed a fiber framework which applies symmetric regulation to all operators – whoever is first to construct within a building is required to provide shared access to competitors. Inter-connection also ensures ‘any-to-any connectivity’, while pricing is also regulated.

Paris represents one of the largest fiber deployments in Europe, with the involvement of France Telecom, neuf Cegetel and Iliad. Legislation provides public authorities the right to build, subsidise and develop passive telecom infrastructure and transfer them to carriers or independent local users, build open networks, operate open telecom networks and provide telecom services to end users.

France is one of the top three countries in Europe for fiber deployment, and the regulator’s equal access approach will ensure that by 2012 the country will have more fiber subscribers than any other EU member state. France Telecom expected to sign up 180,000 customers by the end of 2008, out of a potential client base of one million, using Gigabit PON (GPON) technology. In contrast to Deutsche Telekom, eircom, KPN and Swisscom which are deploying FttC networks with VDSL2 serving the last mile, France Telecom is the only incumbent carrier in Europe that is deploying FttH on any meaningful scale.

Other operators such as Free have pursued a strategy of linking exchanges with a fiber network to provide full independence from France Telecom. The company’s fiber service was opened commercially in October 2007 as part of a €1 billion investment (through to 2012) which will reach 2.1 million people in the Paris

region and connect more than ten million customers, representing over four million connection points. For less than €30 per month customers have Internet access at 100Mb/s downstream and 50Mb/s upstream, free landline, unlimited national and international calls, and access to more than 100 video channels (including HD). The open-access fiber network is available to any service provider on a wholesale basis. The company anticipated a 15% return on capital once rollout is complete. Free represents a model for net neutrality in Europe, solving the bandwidth bottleneck in the last mile on an open, competitive, non-discriminatory basis. The company is one of the growing band of innovative operators able to identify and capitalise on new horizontal business models for fiber rather than the traditional vertical monopoly of telcos and cabelcos, in particular by specialising in the physical transport of fiber and letting other companies deliver cable TV, telephony and Internet services.

Table 1 – Free projections – Paris fiber – 2006; 2008; 2010; 2012; 2014

Year	Market penetration	Market share	Subscribers
2006	50%	27%	754,000
2008	66%	29%	995,000
2010	79%	31%	1,231,000
2012	91%	33%	1,320,000
2014	102%	33%	1,320,000

(Source: BuddeComm based on JPMorgan estimates)

B. Sweden

Sweden is one of the world's leading countries for fiber deployment, largely due to the population density in a small geographical area – more than 50% of the country's workforce lives within the three main cities, many in apartment buildings. The country was the first in the EU to develop widespread local access fiber infrastructure. Numerous networks open to a range of content and service providers have been built by organisations other than telcos, including municipalities, regional governments, housing associations and local utilities. Swedish municipal broadband has successfully adopted the 'stadsnätt' urban area network model, by which a city builds and administers fiber infrastructure which is then rented at cost price to service providers which set up their own transmission equipment. In Stockholm more than 30 organisations have built their facilities through the municipality's open fiber network, operated by Stokab.

Backbone networks have grown to 13,000km and city and local area networks have quadrupled in reach since 1999. Bredbandsbolaget, TeliaSonera, PiteEnergi and Utfors have significant networks in the country. In January 2008 TeliaSonera began switching on 100Mb/s fiber to customers as part of its commitment to deliver the service to Sweden's 15 largest cities, often in partnership with local governments.

Fiber in Sweden is typically deployed through a 100Mb/s link to a block of flats that is then shared via an Ethernet LAN, offering each flat a maximum 10Mb/s two-way connection. ADSL2+ and VDSL services are priced similarly within the same areas where fiber is available, but as 100Mb/s services are introduced directly to the premises, and more bandwidth intensive services are launched, the speed advantage over DSL will see fiber taking a greater share of the market in future.

C. The Netherlands

The Netherlands is also a European leader in the development of FttH networks. Much of this success is due to the involvement of telcos, housing associations, local councils and the national government. In early 2008 there were some 25 municipalities in The Netherlands involved in or making preparations for broadband projects based on fibre, and more than 40 fiber projects. Municipal involvement in fiber roll-outs was cleared by the EC in early 2006 as being compatible with EU State aid rules.

Co-operation between government and telcos is intended to manage the investment costs and avoid potential financial difficulties. The Netherlands has also demonstrated that fiber networks can be built from the ground up without government subsidies. The success of the FttH network in Hillegom, built by a commercial company without public money, has encouraged many similar initiatives in other cities and towns and stimulated the major broadband players to step-up their own FttH plans.

Regulators have also promoted the wholesale access model, used successfully with DSL networks. Given that a first-entry FttH developer can secure about 70% market share among passed households, competitors can choose either to build

networks in non-fibred towns or pursue a wholesale agreement with the new local incumbent.

The incumbent, KPN, is currently extending fiber to street cabinets throughout its network, with VDSL serving the last mile. The fiber deployment is part of the company's open-access NGN, first planned in early 2005, which incorporates a combination of FttH and FttC. During 2008 the company will step up its hybrid FttC / VDSL2 network to end users (providing 50Mb/s) while deploying regional FttH in partnership with building corporations and municipalities

KPN has also collaborated with existing fiber players in areas it does not manage its own network. Since October 2007 KPN has collaborated with Reggefiber to connect residents in Almere with fibre: KPN has encouraged its PSTN customers to migrate to the Reggefiber network while it positions itself as a non-exclusive service operator.

Table 2 – Forecast fiber subscriber growth in the Netherlands – 2008 - 2011; 2017

Year	Weaker growth scenario	Stronger growth scenario
2008	190,000	250,000
2009	220,000	290,000
2010	250,000	370,000
2011	320,000	450,000
2017	570,000	790,000

(Source: BuddeComm based on forecasts)

D. Oceania

In Oceania, structural separation is occurring for incumbents as well as on infrastructure levels (Singapore). The New Zealand government is forging ahead with its plan to split Telecom New Zealand into three separate operational units to provide retail, wholesale and network services, with complete compliance required by 2011. Access Network Services (ANS) must provide services over existing copper and future fiber and fixed wireless access networks, including Equivalence of Inputs (EoI) for key services including unbundled local loop and unbundled bitstream access (high-speed common carriage for ISPs and other service providers. Nevertheless, New Zealand has a poor ADSL2+ and fiber footprint, and it is unlikely that loop unbundling, being rolled out during 2008, will have any significant impact for a number of years even though the Operational Separation of Telecom New Zealand will provide more equitable wholesale access to its network.

E. Singapore

In Asia, the government of Singapore has also been progressive in developing open-access networks to encourage fiber deployment. The government's plan for the island state's NGN, buttressed by up to S\$1 billion (US\$690 million) in public

funding, includes three service layers: a passive infrastructure operator providing wholesale access to lines; a number of wholesale operators responsible for building and managing the active NGN (providing wholesale open-access services); and retail service providers (ISPs). The government has already selected the passive infrastructure operator (referred to as the NetCo) following a bidding process, with the contract and up to S\$750 million going to the SingTel-backed OpenNet consortium. OpenNet has committed to roll out fiber to 95% of the city's homes by June 2012.

In the meantime the next stage, the process of selecting the wholesale operator (known as the OpCo), is well underway with the result expected in early 2009. The government has budgeted S\$250 million in funds to support the OpCo. When the required infrastructure is in place, open access will be assured by structural separation on the passive infrastructure level and operational separation on the active infrastructure level. The end result will see national fiber coverage with access speeds in excess of 50Mb/s uplink and 100Mb/s downlink (OpenNet have promised 1Gb/s), and competitive pricing on both the wholesale and retail service levels.

5. Other points

Finally, we note that in some cases users have been so desperate to have broadband connectivity that they have been willing to take matters into their own hands with regard to funding and even in some cases construction. Projects such as Fiber-to-the Farm in the Netherlands, DIY fiber in Stavanger, Norway and municipal government networks should be looked at from this perspective. Mesh networks in wireless broadband – with each node provided by an individual who wants to be part of the network – would be an even farther step in this direction. This is a totally different way to finance infrastructure and overcomes the problem of ‘economically unviable investments’. In our report “*Costings and open network issues in relation to FttH deployments*” we mentioned the report on “*Homes with Tails*” which also addresses this issue from that perspective.

6. Action Plan

We believe that our vision of open communications networks is entirely achievable in the United States.

In the short run, we believe that the new administration should work with Congress to clearly direct the FCC to require that all communications networks be operated in a manner consistent with the principles of openness we have espoused here. Although we have not attempted to craft any specific legislative or regulatory language, we believe that the five basic rules specified above could form the basis of a modification of the Communications Act that could then be enforced by the FCC. Indeed, the FCC itself could adopt these five rules as its own and begin to apply them to existing networks. At a minimum, Congress should require that networks that receive public funding, whether under the currently pending stimulus package or otherwise, must adhere to these principles.

Over the long term, we believe that several developments would be appropriate.

First, given the complete transformation of the communications landscape over the last 15 years – which, among other things, has seen the development of mass-market broadband services and the replacement of landline voice service by wireless as the primary means of communication in the US – it is inevitable that the basic structure of the current Communications Act will need to be overhauled to reflect new realities.

Second, we think it is inevitable that a greater portion of basic communications infrastructure will be funded and deployed by governmental entities – whether local, state, or national – than has occurred in the past. On some level this is simple economics: there are strong positive externalities to having a robust and open communications infrastructure, which means that the benefits of such an infrastructure exceed – we believe, far exceed – the returns that the operator of the network can actually extract from its users. This means that the economically and socially optimal open network will never be financed and built by private entities – again, they cannot capture the benefits that arise from such a network so they will have no incentive to build it. Given this, we believe that the national government should establish a means to fund and construct the next generation broadband network infrastructure, just as the national government plays a crucial role in the construction, funding and maintenance of the interstate road system. State and local governments would necessarily be involved in planning and deploying local communications infrastructure.

6. Conclusion: Open Networks Cost Less, Create Naturally Competitive Markets rather than Complex and Heavily Regulated Mandated Markets, and Return Vastly Greater Economic Benefits.

The reason for the viability of open networks is easily illustrated by the Internet's success. It is an open, flexible network, which has proved to be an enormous engine for market innovation, economic growth, social discourse and the free flow of ideas. As said by Internet pioneer Vint Cerf:

“the remarkable success of the Internet can be traced to a few simple network principles – end-to-end design, layered architecture, and open standards -- which together give consumers choice and control over their online activities”

An interesting side effect of open networks is that, once these are in place, you can virtually throw away most of the industry-specific telecom regulations. Telcos will still have the right under an open network policy to properly manage these networks in order to prevent abusive usage.

This functionally ‘neutral’ network has supported an explosion of innovation at its edges, with the growth of companies like Google, Yahoo, eBay, Amazon and many others. Because the network is neutral, the creators of new Internet content and services need not seek permission from carriers or pay special fees to be seen online.

As a result, we have seen an array of new offerings – from VoIP to wireless home networks to blogging. These developments could never have taken place under the telcos' online strategy of the last 30 years, when central control of the network was required by design. Still, some potential legislative forms of "neutrality" would cripple ISPs' ability to manage their costs, customize their offerings, and deal with usage that violates their terms of service. This problem is solved by restoring and maintaining the distinction between bit-neutral carriage on "open" networks and the provision of "information service" on these networks by multiple parties, such as ISPs, whose misbehavior could be dealt with by customer choice. This marketplace is not likely to function correctly in a vertically-integrated market that limits the provision of retail services to the handful of owners of the physical infrastructure.

It is estimated that around one million companies worldwide now rely on the Internet economy for more than 50% of their revenue. This group of companies is growing at a rate of 20-30% per annum – imagine what that will do to the local economies!

7. The "Big Think Strategies" International Expert Group

This report has been produced by an international team of telecommunications experts from the following countries: America, Australia, Canada, France, Germany, Japan, Netherlands, New Zealand, Sweden and the United Kingdom. This group is composed of strategists, economists, attorneys, technologists, representatives of national and international telecommunication organisations and telecommunications company directors. Members include:

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