

Vision on Communication Networks in Europe

Constitution of an Open Network eXchange Europe (OnXE)

Company: Mindfruit B.V.
Author: ir. Jacco Kwaaitaal (MSc)
Date: 27 April 2020
Version: 1.0
Abstract: Problems exist with the Internet today. We gave much of the control away, are constantly being tracked by companies and governments and continue to walk down the road of decreasing options. What can we do about it? Can we take back ownership and control of our digital infrastructures? How should we organize ourselves? Can we create more freedom and choices by organizing our networks in a different way? Can we open them up and what constitutes an open network? Are we stuck with the Internet as it is today or can we create alternatives, the Multinet? With the vision laid out in this document and the constitution of the Open Network eXchange Europe, we can join forces and progress to a better version of the network than exists today.

Table of Contents

1	Problems with the Internet and Competition.....	3
2	Network Ownership and Fragmentation.....	3
3	Network Topology and the Active Layer.....	4
3.1	The Fiber Network or Passive Layer.....	4
3.2	Open Networks and the Active Layer.....	4
4	From Internet to Multinet, a Network for Everyone and Everything.....	5
5	Interconnecting the Multinet, is it about the Destination or the Route?.....	5
6	Open Networks of Europe Join Forces!.....	6
7	Research, Innovate and Progress.....	6
8	Constitution of an Open Network eXchange Europe (OnXE).....	6

1 Problems with the Internet and Competition

Who owns the Internet today? Who determines how we communicate and who owns our data? Are we free to go where and how we want, when making our digital road trips across Europe and the world? Can we live with large foreign companies and governments tracking our every moves or should we keep our digital sovereignty? What about politicians, CEO's and important individuals forming the texture of our societies: Are we vulnerable if *their* exact location is known? For the rest of us, it is of no concern, since we have "nothing to hide". Leave everything to the market and we will have "lots of choices, low prices and continuous improvements". The irony of today is that we put our whole lives in the hands of large foreign corporations and governments without considering where this road leads us to.

Imagine that we propose Tesla to buy our roads. They promise to take good care of them and they can add all kinds of improvements and innovative concepts to them. They have a lot of expertise to introduce autonomous driving and we can count on lots of additional and convenient services. We would be surprised if somewhat later we are being stopped with our Mercedes, because it is said to damage the road and prohibit a good traffic flow. Certainly, we would be better off buying a Tesla or stay at home. Other cars (competitors) are not allowed anymore. Tesla starts dictating who travels where, at what times, with what speed and how much you pay for using the roads per kilometer and per month. You cannot reach your house by public roads anymore, because they are all bought. You cannot reach the market place for your favorite products and services by public roads. Actually, there is no public market place anymore, because the road to it has been taken away (too expensive and of no use). The free market has reached it's monopoly: All roads lead to Tesla and we can happily buy their products and services or stay at home. How restricted would we feel in our mobility and freedom?

Similarly, stimulating innovation and competition in telecommunications is not about giving away our public roads and market places, but it is about strengthening these and let companies compete on services that we are interested in, which we can reach without obstacles through public roads and market places. If we want to determine what services and applications our future network will carry, we better make sure that we own our fiber-to-the-home (FttH) network, even if we have to invest it ourselves. There is no company that will provide us with a network for free, in the end we always pay it ourselves. And knowing that we pay it ourselves, we can better just keep the ownership and control and pay it only once. How many times have we already paid our cable and telephone network? Competition is not to be expected on the infrastructure (road) level. I don't need two roads or two fiber networks to my house. The competition is on the level of the services. What car do I prefer, where does this road lead me and what will I be able to take with me?

2 Network Ownership and Fragmentation

How can we have a network of our own? Several options come to mind. The (local) governments could buy or invest the (local) fiber networks. Why would our digital network be less important or vital to our European society and economy than the roads, gas, electricity, water, and sewer networks? We only need one public fiber network and as quickly as possible for the whole society and economy to benefit from and at the lowest cost.

Since our governments seem to lack a vision on this and think the market will still solve it (although this might change due to the Corona crisis that changes the opinion about strong government involvement), we probably have to organize this in the private domain as a cooperative and in this way take back control. A cooperative comes close to the joint and democratic ownership of that held by a government. The problem is that everyone must reinvent the wheel and lacks economy of scale advantages. You might even have competing initiatives that destroy the business case of both. The most logical scale of a cooperative seems to be that of a municipality. This encourages local

involvement and solidarity, lines up with local laws for digging and network construction and stays closest to the interest of the local population. Initiatives should be taken to consolidate all fiber-to-the-home networks within a municipality into a single cooperative organization. This allows full network coverage of the total municipal area, even addressing the more costly remote locations and prevents cherry picking, fragmentation, confusion within the population and lack of access. Everyone should perceive that this is just another infrastructure of common interest that we organize together, everyone included. In the Netherlands, we realized the [KempenGlas](#) fiber network along these lines, consisting of four local (municipal-wide) fiber cooperatives working together in the joint KempenGlas cooperative to achieve a minimum economy of scale.

3 Network Topology and the Active Layer

3.1 The Fiber Network or Passive Layer

Although there seems to be a lot of discussion and religious beliefs about technologies, in practice there's not so much choice or difficulty. The optical fibers follow ITU-standards and can be installed in a point-to-point (PtP: individual fiber) or passive-splitting (PS: shared fiber) fashion between the premises and a central location/point-of-presence (PoP). Most of the costs are in the digging, not the cabling. The point-to-point topology leaves all your options open for using both the current Ethernet and PON-technologies. It allows for individual (gradual) migration of connections to another, currently unknown, future technology. Multiple premises sharing the same fiber comes with (future) restrictions.

3.2 Open Networks and the Active Layer

With the active layer, we mean the optical communication between electronic devices on different ends of the fiber, realizing the actual flow of data. We could see this as an active overlay on top of the passive fiber network. The implementation of the active layer appears crucial for the openness of the network. So, how do we define openness of the network and who benefits? Is the fiber network/passive layer open for different telecom operators to bring their own network equipment or is the active layer open for different service providers to transport their services?

Let's look at the first case, where different telecom operators bring their own equipment. They all need access to and space in the PoP. How much openness can you handle to accommodate a large number of operators and can your network remain stable and safe with so many parties plugging cables in your PoP? A network with a passive-splitting topology won't even be able to accommodate individual choices of operator (shared fiber), which would further limit the openness of the passive layer. Full openness on the passive layer requires a PtP topology. Now, if this telecom operator connects the fiber between the PoP and one or more premises to its equipment, that prevents another operator from doing the same, assuming only one fiber (road) exists to each premises. It blocks the road for the others. All service providers should now use the active layer of this operator or they will not be able to reach these premises. Depending on the openness (conditions) of the active layer of this specific operator, service providers may or may not be given passage. It's like the situation where Tesla buys the road to my house and prevents competitors from driving to it. Furthermore, imagine a situation where users are connected to active layers of different operators and they want to interconnect their locations. They now depend on the willingness (and conditions) of the telecom operators to interconnect between these different active layers. This will lead to obstacles for interconnecting locations in an area even within the same passive FttH network. We can conclude that in such cases the openness on the passive layer is mainly in the interest of telecom operators and not of the users.

The second case, where the active layer is open for different service providers to transport their services seems more important and relevant to users. The open active layer can provide multiple VLANs (multiple lanes on the road) for different service providers to carry their services to the

premises. The question remains whether in practice an operator still has “preferred” service providers (and unknown business deals). And, even, it could be in the interest of both operator and service provider to block direct traffic between locations or users within the area. They might prefer you go through them for getting somewhere and pay on-the-go. So they still have ways to act as gatekeeper and toll collector on our roads.

The best way to guarantee openness and freedom to the benefit of users, is to let the cooperative take control of the active layer as well. The cooperative may outsource the maintenance and hire, lease or buy the equipment, but it still remains in control and instructs the way connections are setup. The cooperative maintains a single active layer, allowing direct interconnections between premises, without intervention of service providers. With a PtP topology, the cooperative can upgrade (individual) connections and technologies based on users’ and not on commercial interests. Service providers connect to the network at a central point and have no control over the internals of the FttH network. The PoP locations will not be accessible for third parties, improving the stability and safety of the network. You could see this also as the users coming to a central point themselves to connect service providers, instead of the telecom operators and service providers coming to the individual premises, meanwhile blocking the road for others.

4 From Internet to Multinet, a Network for Everyone and Everything

With the possibility of controlling your own active layer, a number of opportunities arise. Different (competitive) service providers can be connected in parallel through the use of separate VLANs. You may have a separate VLAN (and provider) for Internet, telephony/VoIP and television/IPTV. New providers may introduce services such as e-Health, security camera monitoring, elderly people monitoring, local television, etcetera. And thinking further about this, why not use a separate VLAN to securely connect the Intranet of multiple locations of a company? Extending this idea, we could just give everyone a VLAN/network of their own to interconnect the locations they want. Imagine that I want to exchange backups with friends. We could setup a storage VLAN and interconnect our NAS-devices. We could have a Network for Everyone and Everything, a Multinet.

An important aspect of the Multinet is that it’s not limited to the Internet Protocol. First, it allows running different versions of the Internet Protocol in parallel and allows for gradual testing and upgrading the IP network. Second, new and dedicated protocols for certain applications can be introduced and further developed. You could think of highly secure protocols (e-Health, banking), low latency/real-time protocols, efficient peer-to-peer protocols, advanced video distribution protocols, low energy “things” protocols. The restrictions of the Internet Protocol as provided by the Internet Service Provider (ISP) do not apply anymore. This encourages (protocol) innovation and development and the creation of new services and applications.

5 Interconnecting the Multinet, is it about the Destination or the Route?

In the current workings of the Internet, the ISPs play a dominant role. They, for example, determine the route a packet takes from source to destination. The users have no say in this and generally have no clue about the parties involved in passing along the packets and potentially monitoring the traffic and its content. Why would we allow our sensitive conversations to travel abroad or along unknown paths, while we are only connecting to someone nearby? Maybe the ISP prefers the cost-effective detour, while our real-time application needs the shortest path. Wouldn’t it be great if we could interconnect our Multinets and grow the reach of our open networks, services and applications? We could interconnect Multinets carrying advanced protocols that allow distributed/peer-to-peer routing (resilience), shortest path routing (low delay), performance routing (high bandwidth) or secure path routing (only go through trusted parties). We could configure our interconnected Multinets to best support the specific service or application. Would we prefer remote surgery through the Internet or

through a dedicated low-latency interconnected Multinet (hopefully the knife stops cutting in time)?

Interconnecting the Multinets involves organization and standardization, connecting the dots, and further aligning and developing the open network philosophy. How can users easily and securely request a VLAN throughout a number of participating open networks and between connection endpoints in different maintenance domains? Can we develop procedures for this and possibly automate it? Can we trust each other? How do we obtain the (digital) permission from end-users to put certain VLANs onto their connection? Questions that must be discussed and resolved, but we can start small, experiment and learn along the way.

6 Open Networks of Europe Join Forces!

How do we build our European sovereign network? Hands-on! We know many initiatives in Europe where citizens joined together to construct their own fiber network. We came across similar problems and found our ways. Now it's time to bundle our knowledge and make a strong and extensible case for open networks in Europe. All we need to do is join forces! We start with exchanging ideas, bundle our demand for innovative services and applications and grow towards exchanging our Multinets.

Introduction of a new approach, protocol, service or application in one of our networks, could then de facto mean they will be available in all of our networks. Gradually, we grow the footprint of our interconnected networks and show that in Europe we can take joint ownership and control of our infrastructures with respect for users' interests, privacy and security, while facilitating our open society and supporting an advanced, innovative, competitive and sustainable economy.

7 Research, Innovate and Progress

Europe has always been strong in setting the standards for innovative services. The European approach is not only about harsh competition, not about top-down enforcing, but about quality, freedom, creativity, working together and challenging each other to the next level. We can learn from the good and bad developments of the Internet and transform it into our Multinet, allowing for diversification and innovation of our network. We shouldn't settle with the current state and team up with our universities and institutes to come up with new ideas, implementations and continuous improvements, try them in the field and allow new technologies to emerge. Let's make the digital infrastructure work with us, instead of against us and, based upon our requirements, let us progress to a better version of the network than exists today.

8 Constitution of an Open Network eXchange Europe (OnXE)

To create a platform and vehicle to exchange, progress and scale our ideas, guidelines, standards and approaches to open networks, we propose the constitution of Open Network eXchange Europe (OnXE). If you are interested to discuss or join the initiative, please contact us at info@onxe.eu.