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for

Digital Communications Infrastructure
Strategy Consultation Document

by

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Summary

- Key challenge for UK is to disentangle policy and business models based on telecommunications infrastructure from that for data networking.
- expect an exponential increase in traffic flows for some decades to come
- move to sharing infrastructures for mobile and fixed to stimulate network services innovation
- IP supports general purpose data networks over any carrier &
- IP supports permission-less innovation by network users (neither features are both true for telecoms nor early propriety data networks).
- Network interconnections over IP are flexible and fast to build. Current access procurement to underlying telecoms carriers is opaque, slow, and inflexible. This needs to change to facilitate innovation in use of networks.
- Government can play an innovative hand and act as a good husband by being even handed and requiring such from the networks and service platforms it engages with for its own services and in regulatory framework for UK networks.
- Open government services such as being initiated by the GDS are based on the assumption that the data network in the UK is accessible affordably by everyone. Government needs to ensure that is the case.
- Government services online is predicated on networks treating traffic without prejudice. Government needs to ensure that is the case.
- Quality control that drops packets of non paying content in favour of paying content is discrimination which is not in the interests of Internet users including Government.

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- More metrics are needed for people to understand, monitor and hold to account service providers. Download speed defined broadband is not fit for purpose.
- Interconnects between data networks of different sizes should not be predatory. For instance a small specialist rural network should not be disadvantaged by a large metropolitan or backbone network in receiving or delivering traffic.
- Large publicly funded content and service organisations such as the BBC or Universities should not stifle innovation and services from private sector by deploying their content but engage positively to stimulate private innovation particularly from within the UK alongside or within their service offerings.
- Supporting access to open standards both in their definition and deployment as service platforms including sharing between them are all areas government can act as a good participant in support of user choice. This is particularly true for cloud orientated and similar platforms.
- Any focus by an ISP that shifts its revenue and interests away from optimising service over its network for its customers means it will not be optimising its investment in its network to serve those users.
- For UK Internet distinction between “business” and “consumer” is damaging as businesses operate everywhere and not just from business premises as do their customers.
- UK ISPs should deploy IPv6 as standardised to all their customers as soon as possible including the UK Government.
- UK Government should ensure that its services as deployed by GDS are available over IPv6 or having UK Government services will increasingly be mediated via network intermediary services for the growing IPv6 only population.
- OpenReach should be separated from the BT and its retail and global operations to manage investment and access to infrastructure carrier services independently of the business priorities of BTs retail service platforms.
- More open spectrum should be prioritised for UK and leadership internationally.
- Decentralised platforms based on global open standards offer the best route for UK commercial success in ICTs. in establishing infrastructures to support distributed management for IoT services, and transactional web to create open electronic markets (Web X). In particular new protocols to support Trust, Privacy, Transactions and data sharing via decentralised platforms are important opportunities for UK innovation.
- UK should open up its restrictions on financial innovation for instance to support convertible loan financing for start ups and SMEs and remove tax return and reporting complexity for both businesses and investors in SMEs.

Key Challenge for UK

A key challenge for UK as in many countries is to disentangle policy and business models based on telecommunications infrastructure from that for data networking.

Exponential increase in traffic

The consultation offers three scenarios on how much capacity or network activity we should expect in coming years. I have no idea what we should expect and in fact I would caution that if you ask network service providers that question you are asking the wrong people. You need to talk to the application and service innovators. They will probably tell you they don't know either and what is more it will depend on whether what they do catches on or is not snuffed out by a growing trend to place intelligence in the network such as filters, address translators etc. If you want to pin me to the wall on this question I would say that we should expect an exponential increase in traffic flows for some decades to come with the above proviso.

Telecom and Internet models

The current period is one of transition. The telecom model can be loosely characterised as vertically integrated from the physical wires or wireless or carrier through to the application service being delivered over that carrier.

The impact of this is to centralise the deployment of applications and services through the telecom service provider which acts both as a physical infrastructure carrier and as the supplier of services that run over that infrastructure. This is the permission required model.

This model was followed into the mobile world with 3G licences auctioned in 2000 valued largely on the assumption that the cellular network infrastructure business would benefit directly from the provision of all applications and services over their network.

That is the telecom model in its purest deployment determines a localised monopoly both over any infrastructure connecting people, devices and businesses and over their access to any services running over that infrastructure. Localised monopolies over infrastructure require heavy regulation in order to defend against market abuses. Such regulation necessarily becomes heavier still where that same provider takes responsibility for all uses over that infrastructure or in prioritising one over another.

Cellular model

In cellular mobile several competing infrastructures and services suggests there is potential for greater choice between service providers. But currently a service provider is dependent on offering only services over its own network infrastructure.

There are a few white label service providers in the UK (virtual mobile operators) but they have remained niche and many have had to cease trading. This does not indicate there is not demand for more innovative service offerings but that the current vertically integrated model for UK cellular is inhibiting the potential that I believe exists for mobile networks.

In particular unrealised potential for mobile data networking over cellular if cellular networks are not interested in innovating deeply as they are very fixated on their telco model for voice revenues.

Sharing infrastructure for innovation in network services

The ability to share underlying network infrastructures between any service carriers and investors would offer a way to build greater reach and competition in the market for connectivity services.

There are several suggestions on how this could be done which deserve further consideration outside this report. The key is to develop a model where any service provider including a user directly can provision capacity in either mobile or fixed line and contribute by so doing into a capacity infrastructure fund that invests in building new capacity and managing existing capacity so that demand flows can be anticipated sufficiently to ensure that adequate capacity exists in the network in a format that can be rapidly turned up into use to meet best effort packet delivery needs.

Several characteristics can identify a telecoms based infrastructure. Firstly connections are hard wired as circuits to provide a channel directly between parties using a service which is normally a phone call. Each channel takes up a fixed amount of capacity whether somebody is talking or is silent across the entire span of the connected circuit. That capacity cannot be reused for any other purpose. It has been dedicated to that connection for as long as it is setup. The connection and billing are charged and managed by the telephone company directly to the subscriber. If there is any other service provider (such as premium rate lines) they have to charge the telephone carrier for the fee to the number. There is very limited scope for any innovation and none is possible that the underlying carrier does not sanction. It is perhaps not surprising then that the telephony service has seen very little product and service innovation during the twentieth century that wasn't primarily designed to either reduce the cost to the carrier or extract extra revenues from the telephony service.

Data network model characteristics

The data network model in particular a data network using the internetwork model differs substantially from the telecom model. Data networks key characteristic is they do not require fixed capacity circuits as used in telecoms. Data is moved by being broken down into packets which are then sent between the parties. As each packet carries the addresses of who sent it and where it is going it is possible to have packets for many people and applications running simultaneously over shared network capacity. As most data services are bursty in the sense that like a telephone call not everybody is talking at the same time, data networks multi task in a way not possible using telecom.

Interconnecting data networks

The key technology deployment that supports current internetwork infrastructure is based on the IP protocol. As pure data network infrastructure was and remains fairly rare comparative to telecoms. Data network engineers designed IP to run over any underlying network infrastructure. The most prevalent monopoly infrastructure available has been the telecoms infrastructure installed for voice calls. So IP was engineered to run over telecom networks. It also more happily runs over ethernet and other pure data network technologies such as used in some fibre and wireless deployments.

Several early data networks ran over telecoms circuits and as such they tended to be run like a telephony switch where you dial in to connect, login and have access only to the services provided by that service provider. (remember Compuserve, GE net, MSN, AOL, IBM net, Prestel etc).

So it is not a given that any data network supports either general applications or that it would support applications from other sources. Something extra is needed.

How to achieve permission less innovation in UK

A government department in the early 1990's would have had to do private deals with each of the networks in order to gain access to that network's users. This would have been both very expensive and also not inclusive as it is very unlikely that all citizens would be subscribers to just those networks. The same challenge existed for developing electronic markets and information services. The vast bulk of important financial information and transactions could only be reached via subscribing to a physical network connection for each service provider. A situation that still persists today in some parts of the financial system. Connections are expensive and so requiring multiple connections to support a reasonable basket of online services would limit access to electronic content to the very few. It would also inhibit the development of new content

as it creates physical gatekeepers to content in a way never seen prior to the emergence of early data information service providers. Once you build IP over a telecom circuit you can run multiple services from many end points simultaneously for a capacity that would otherwise have been dedicated to one.

The IP protocol had a second major impact on the development of data services over physical infrastructure. Using IP (after 1982) did not tie you to any particular error correction or optimisation service for your application. This means that with IP you can run any high level service or application over an IP enabled connection on a best effort basis. The impact of this is that what is deployed is controlled only by the user devices and not by any intervening network segment and in particular not by any entity controlling such segments. This is not to say a user may not choose to have some aspect of their service managed by delegating authority to a network service entity for instance to colocate servers or switches.

This is what is meant by permission-less innovation. Unlike a telecom or early vertically integrated data information service such as Compuserve an IP network is general purpose from a user perspective out of the box. So not only can you run services simultaneously for many people but you can run multiple services. IP networks are characterised as general purpose.

A third characteristic of IP networks is that the connection between IP networks is managed via low cost (comparative to telecom switches) routers and data switches where traffic is delivered between networks very largely without any financial settlement using open peering. Telco companies connect via formal bilateral contracts based on how many minutes of telephony traffic they pass between each other. Negotiating such contracts can take nine months to over a year before any traffic passes between them. Data networks typically can have a peering session established ten minutes to an hour or so after agreement is initiated.

Developing application infrastructures for digital UK

In terms of developing an application infrastructure the Internet model is highly flexible in a way telecom services cannot emulate. Only when new physical infrastructure is needed to carry traffic and supply connectivity does the lead time to provisioning an IP network become dependent on other factors including access to existing unused telecom circuits, new build of circuits and planning and access regulations and costs etc. Clearly lowering barriers to deploy, acquire and use and drop data network ready circuits will impact innovations facilitated by Internet networks favourably.

The first step to that is to have accurate accessible information on UK's networks and provisioning that fits more effectively with the shorter lead times of Internet data network deal flows than the current telecom model supports.

This would encourage new build capacity and new service providers that would manage shorter leases and data infrastructure support such as layer 2 ethernet, and QoS services such as VPLS as well as connectivity and application platform support via IPv6 / DNS etc.

How to ensure a fair and viable UK internetwork for everybody

Interconnections in data networks is a topic that requires attention to prevent predatory behaviour. Some larger ISP networks have implemented a mix of charged peering and transit fees on smaller networks and this is an area potentially for future regulatory visibility. Inter connection disagreements are growing between some IP networks. In the US there have been several examples where one network has imposed or tried to impose financial settlement terms on another network and or another network owned by a content service. The US infrastructure for communications infrastructure remains highly dominated by a winner takes all commercial model that is underpinned by a telecoms business model that is driving a network neutrality debate that is specific in many ways to the regulatory background in the US. The UK sees a spill over of this effect in the way applications and content services soak up as much user data as possible and flow that data back as an asset to be resold (slice and diced) outside any user downstream control.

Why security, privacy, trust are broader and deeper than can be provided by a network service provider

The implications for privacy and security in using applications services is not something an ISP carrier can manage. The scale and scope of the factors go well beyond any network boundary let alone national border. Even regional trade negotiations can assume a capability and capacity that in practice does not work. Local courts anywhere in the world can impose decisions that can impact UK users and vice versa.

Therefore it is likely that privacy and user security require further innovations in networking applications to establish new infrastructures to manage these important protections. For those innovations to succeed in the market requires that they can be deployed by users without prejudice. In a similar way to how the world wide web was made possible by the open platform of the Internet during the early 1990s. Attempts for network services to try to solve this themselves as a network service would be deeply problematic to energising a scalable solution.

Why Government needs to ensure the UK network is open and treats traffic equally

It is possible for predatory practices to occur which would not be in the interests of Internet users at the edge of the network in the UK. A key and growing user of Internet networks in the UK is the UK Government. It should be clear

that it is not in the interests of the British taxpayer for the Government services be subjected to discrimination either by being required to pay for prioritised delivery of its services or for other applications and services to be disadvantaged due to capacity constraints exacerbated by any potential Government prioritisation of its services over local networks. Government can play an innovative hand and act as a good husband by being even handed and requiring such from the networks and service platforms it engages with.

Role of open standards

Supporting open standards both in the definition of potential technologies and protocols to deploy and in service platforms and interconnections including data sharing between them are all areas government can act as a good participant.

As much as possible it is crucial to support and encourage support for understanding and participation in developing communications tools which allow users to innovate and build platforms rather than seed and establish proprietary platforms where source code is not known and cannot be inspected, modified or repurposed. Public funds should be prioritised to support activities that are open to expand a community for future innovations and not simply solve a short term problem today. Doing the latter leads to silos and dead ends in government computing.

In networks over the last fifteen years there are a number optimisation methods that do not discriminate such as Content Delivery networks which despite their name are not networks but distributions of localised cache services at local ISPs. These optimise content delivery into local edge networks used by Internet users. Mostly CDNs actually deliver traffic over the public Internet and charge content owners for the use of their cache facilities. CDNs of this type do not impact network neutrality as the CDN is not filtering to favour a content provider traffic but provide a local resource to localise popular content to improve or optimise the delivery performance into that network. Clearly larger publishers or service application networks which have financial muscle to fund the use of a CDN across the UK are in a more advantageous position than those who do not. So the use of CDNs are an optimisation for some types of remote content service. But such arrangements should not mitigate ISPs securing adequate interconnection infrastructure and local network capacity to maintain bidirectional traffic flows by an ISP for its customers.

Competition in content and role of the public funded organisation

The BBC web site and its iPlayer is an interesting case in point. It is clearly a brilliant service but the role and scope of the BBC and its subsidised financial model places a responsibility on it not to intermediate content from other sources. There is a big difference between fostering creativity and content for the UK and snaffling or stifling content created by others for its own interests.

The same can increasingly be said about massive online learning resources from public funded universities. Efforts are needed to foster and promote new content from a broad base of potential innovation whilst exploring these new service and application opportunities.

What sort of network does the UK Government need to foster?

That we today can think about developing open government services such as being initiated by the GDS is based on the assumption that the data network in the UK is accessible affordably by everyone. It is predicated also on those networks treating traffic without prejudice. Quality control that drops packets of non paying content in favour of paying content is discrimination which is not in the interests of Internet users.

Such practice establishes a dependency revenue stream in ISPs that sways who the ISP serves from the users subscribing at the edge of its network to rich content providers who pay it to optimise its network for their content. This in practice means dropping somebody who is not paying (as much) for traffic more frequently which will most deeply prejudice against new market entrants.

It is therefore a given that the weight of UK government policy to deliver services over electronic networks can only be successfully achieved via an openly accessible, universally deployed and affordable Internet for everyone.

It is a further given that the nature of IP networks provides an opportunity for public services that are initiated by citizens themselves.

Defining the characteristics of such services and how they interconnect with existing government services and those of other citizens is an area where considerable innovation can occur. Such innovations by the nature of the decentralisation that IP data networks support cannot be predicted today anymore than the success of the world wide web was predicted by Internet users in 1990.

How to define the role of an Internet Service Provider in the UK

So a key aspect of defining a future for the role of Internet Service Provider in the UK is to keep in mind the importance of the relationship of a network service infrastructure entity with those it serves at the edges of its network - its direct subscriber customers. Any focus by an ISP that shifts its revenue and interests away from optimising service over its network for its customers means it will not be optimising its investment in its network to serve those users. How can we incentivise building new capacity to users if those users are not providing the core part of that incentive? The only other method is subsidy or dependency on the business plan of another entity. Neither of those options should be seen as attractive for an open innovative UK digital economy.

In UK definitions of broadband have tended to drift towards telephony terms for subscribers such as “business” customers and “consumers”. For UK Internet this distinction is not helpful and in fact is damaging.

Businesses are increasingly geographically diversified and their communities they need to engage with internally and as key partners cannot be assumed to be using "business premises". This is true for home workers as it is for travellers on trains, planes and automobiles.

This implies that a UK infrastructure for Internet-works should not distinguish networks end points into business or consumer categories. Very largely they use the same infrastructure.

One current assumption behind the largely telecom xDSL inspired UK broadband network of today is that it is standard practice for subscriptions to be demarcated in terms of the download speed only. So broadband is sold as being 4Mb/s, 10Mb or 20Mb or 80Mb when the upload speed can be as low as 400kbps.

In an age of increasingly synchronous use of network applications such as VoIP, video conferencing, Internet of Things appliances, and medical applications and online storage, this assumption that consumers are not themselves information sources needs to be challenged. Clearly the more self employed and SMEs an economy has the more the home connection is going to be a vital element in the overall health of the UK economy. The UK economy has a very high number of such businesses.

But it is also the case that with rapid growth in home workers both full and part time from larger organisations including the UK Government that the demands for local broadband into homes needs to reflect a more mission critical approach as well as greater flexibility and capability at the edges of UK networks.

This implies that there are more metrics that are needed for people to understand, monitor and hold to account service providers. There is the speed both up and downloading. There is the availability of public IP addresses and routing of traffic to and from the edge premises or devices. There is the quality of traffic such as measures of latency, packet loss and jitter and there can be measures around the shared capacity at various parts of the ISPs network. Critical areas are likely to be at the street cabinet, local exchange, peering exchange locally if there is one, backhaul to a regional or national switch and into a large peering exchange and peering partners at that exchange.

Such a string of potential metrics looks complicated but in my view it should be possible to provide a series of traffic light style indicators which give sufficient clue for users to make informed decisions and to detect where problems

are happening and so work more successfully with their service providers by having clear demarcations of who is responsible for what.

How to deal with transitioning networks to IPv6

It is not widely recognised for instance that some major UK ISPs are deploying carrier grade network address translation services in their network infrastructure because they have failed to deploy IPv6 in a timely way and now cannot do so with the remaining quantity of IPv4 without this highly disruptive intermediation technique. CGNATs are clever but they break the logical global internet connection inside the local carrier network. This means that the carrier is defining what its users and those they connect with can do over the Internet limiting them to the services and applications that the carrier elects to support.

It also means that the overall connections and services that can run are limited not by the network capacity or the demand from users but by the capacity of the carrier grade NAT infrastructure inside that carrier. This is not a good state of affairs. It also puts the UK potentially at the bottom of the global league table as an attractive place to innovate over data networks.

There is a case for CGNAT but it is also the case that IPv6 has been available for over fifteen years and that it works as JANET UK can testify for well over a decade and many other large commercial networks around the world. It is also the case that claims it is expensive to deploy are highly exaggerated. UK ISPs should deploy IPv6 as standardised to all their customers as soon as possible including the UK Government.

Having a major infrastructure service provider dictate what a user may or may not effectively use over a network is not tenable in this day and age. Even if that provider can offer alternatives such as static public IPv4 for difficult side cases these inevitably cost more and take time to implement. With unused IPv4 now exhausted it is urgent that UK networks that claim to be Internet access providers do now provide IPv6. Observationally I expect many if not most operators in the UK to be keen to see IPv6 fully supported across the broadband network.

Quality and security improvements via DNSSEC

Other crucial Internet protocols exist which also require greater awareness and support in order to manage the current generation of security services. The DNS in particular is hugely important for the world wide web which uses URIs depending to a great extent on the availability and soundness of the DNS infrastructure.

Knowing that a site is the site it purports to be is not as easy as it should be unless new protocols such as DNSSEC are implemented. The .uk domain name has full DNSSEC support but implementation can be improved. Government

services should in particular look to support methods to ensure users are secure and that they understand ways to manage their security and what to look for from well managed and implemented Internet services.

Separation of a 'carrier UK' for all service providers from BT's own service platforms business.

Currently many ISPs are completely dependent on OpenReach for downtime at local exchanges or copper tails and I see many reports of frustration over repair times, lack of information and where there is information what it actually means. The use of DSL and many telecom legacy technologies over copper adds a host of terms and complexities by adding many more joins to a line than a pure data network would prefer and which requires considerable know how across the telecom and data network terminology to grasp.

DSL still has potential and is continuously being extended but it was designed for a telephony era and in my view should be rapidly phased out to niche.

The ambiguity of OpenReach as even handed supplier for the entire UK network as part of BT Group whose retail muscle is considerable and has been not above some rough commercial practices is not sustainable. Cities, and regions need to promote themselves and it is increasingly critical that they can show they have excellent network connectivity in depth. In depth I mean that network service companies or start ups can readily take up or initiate capacity to service customers and peer amongst themselves at a local level. It is not for instance tenable that rateable value charges on fibre in the UK discriminate against everybody apart from BT.

Addressing policy of network services in the UK

Addressing policy by network services is particularly weak from a user perspective in UK mobile networks. The UK cellular networks are currently rolling out 4G which telco style operators have determined to be more centralised LTE model rather than a more pure data networking lightweight wimax.

It is the case that cellular networks still are keen to avoid being seen as purely bitstream players and are determined to mix the underlying networking capability with their own private applications services in particular they have high hopes for VoLTE which uses widely available high definition voice quality with some tweaks for their LTE infrastructure.

It is possible to use any web orientated or email service via these networks today but it is not possible to run private applications reliably as none of these networks currently provide public IP addressing in particular IPv6 addressing to users.

How cellular wireless growth requires backhaul growth and wifi growth

The growth in the potential bandwidth and directional antenna coverage in wireless technologies is growing very fast. It is hard for any provider with a fixed prepaid licence for spectrum to deploy infrastructure successfully that is future proof.

Yet the emergence of 3G and now LTE and recent governmental airing of the term 5G which is not standardised in any way at this time, and the acknowledgement that its use for general purpose Internet applications such as Government services along with expectations that these access technologies can take the strain for delivering broadband to remote areas where fixed line resources are seen as uneconomic is a special concern.

It is widely acknowledged for instance that the mobile backhaul infrastructure is not adequate for carrying the data that is generated by 4G wireless. So a variety of techniques are being prioritised to offset this 4G data onto private / or public wifi networks and then backhauled over the fixed line Internet.

Clearly in areas where fixed line Internet is not available this is going to further limit capacity and connectivity with consequences for economic potential if there are insufficient backhaul or connection services to local wireless nodes.

What is also clear is that the current wifi open spectrum frequencies are very narrow for the amount of work and expectation they are being expected to do. Wifi, bluetooth and some other services has shown that open spectrum is an incredibly efficient way to allocate spectrum.

More open spectrum for UK

The UK should look very hard at how the economic benefits and potential tax revenues benefit from opening spectrum than from limiting it via licence sales. The UK should earmark much more spectrum to be available as open and encourage such via the EU, ITU and other fora so the world can co-ordinate effectively to increase the availability of open spectrum frequencies. This will encourage lower priced devices in the UK. It might even encourage the development of such devices in the UK.

UK as a centre for business innovation

The UK has tremendous technical leadership in wireless technologies in particular wireless such as White Space. The recent acquisition of Neul is however yet another indication that the UK retains few growth prospects in ICTs as locally owned and controlled UK entities.

A new strategy is needed to translate UK boutique innovations into global brands. It may be instructive to compare how the UK motor sport and Fashion sectors compare with UK ICT and application services sector.

Some part of this conundrum needs to look at the overly bureaucratic and suspicious nature of UK authorities to entrepreneurs seeking financing and the reporting by SMEs. US start ups I have mentored have raised considerable early funding via issuing convertible loan stock. The level of formalities required are minimal. They have managed to maintain high privacy over their finances and structure which has not prevented them enjoying from excellent scores with Dunn & Bradstreet and other agencies.

Compared to UK where there are hugely complex tax rules and return filing to claim back tax by investors and no facility to make convertible loans legally the US entrepreneur has a significant advantage to win early stage liquidity.

Energising UK businesses means encouraging investors to make loans and broadening the opportunity for financiers to develop innovative approaches to stabilise short to mid range funding and allowing companies to enjoy targeted disclosure under NDAs etc.

Innovate for open decentralised application and service platforms

Recent innovations I am engaging with are developing a new layer of platforms over the Internet that potentially sit alongside the world wide web and offer the opportunity to build infrastructures to answer some pressing questions the web and email and other popular Internet applications are posing. Issues such as Trust, security, identity, privacy, data sharing, transactions, communities, are deeply compromised using existing world wide web technologies.

The tendency to centralise controls for web services in large winner takes all businesses that are not UK owned and controlled leaves UK and European innovators having to directly compete with the US VC model. This is not likely to be successful other than for a few niche players. Large UK or European companies cannot fill that void.

What is needed is an alternative decentralised approach to deploying platforms over the Internet that broadens the footprint to include more players. Current work on decentralised Web by the Web Sciences Institute, Blockchains by a number of start ups, Web Observatory and Data Institute on data and others are starting to show some of the potential. The UK is frequently leading much of these ideas. At the same time I see Internet of Things initiatives which are again trying to push a winner takes all approach via proprietary technologies controlled by larger companies as de facto platforms. This is entirely wrong approach in my view.

The UK is leading on open web orientated alternatives. It is very important for the UK to support broadly footed open global standards and foster platforms which support decentralised services that support multiple operators. Depending on platform standards thrashed out between a few larger industry players misses the point that these have trended to winner takes all where the data flows get sucked out of the UK and benefit foreign businesses who then resell this data back to the UK at higher prices than if we managed the data flow internally and more securely within a European footprint.

Only by focussing on fostering decentralised platforms will we see the emergence of true electronic markets rather than allow a new generation of dominant market monopolists in IoT as an example as we have seen emerge from Web 2.0 .

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