

Initial Report

Last Modified: 10/01/2014

1. Are you content for the Government to publish your response?

#	Answer	Bar	Response	%
1	Yes, I would like the Government to publish my response.		1	100%
2	No, I do not want the Government to publish my response.		0	0%
	Total		1	

2. Please explain why you regard the information you have provided in response to this consultation as confidential.

This question was not displayed to the respondent.

3. Name

Text Response

John Lincoln

4. Are you responding on behalf of an organisation?

#	Answer	Bar	Response	%
1	Yes		1	100%
2	No		0	0%
	Total		1	

5. Organisation name

Text Response

Photonics Leadership Group

6. Contact email address

Text Response

john.lincoln@harlinltd.co.uk

7. Contact address

Text Response

36 manor Rd, Salisbury, SP1 1JS

8. Please select which category best describes you or your organisation

#	Answer	Bar	Response	%
1	Academia/research		0	0%
2	Broadcasting		0	0%
3	Consumer/user		0	0%
4	Consumer group		0	0%
5	Fixed communications provider		0	0%
6	Industry organisation		1	100%
7	Infrastructure provider		0	0%
8	Internet Service Provider		0	0%
9	Local Government or other public sector		0	0%
10	Mobile communications provider		0	0%
11	Satellite communications provider		0	0%
12	Technology company		0	0%
13	Other		0	0%
14	Business user or business group		0	0%
	Total		1	

9. If other, please give details.*This question was not displayed to the respondent.***10. Is this an appropriate role for Government?**

#	Answer	Bar	Response	%
1	Yes		1	100%
2	No		0	0%
	Total		1	

11. Are there other high level principles the Government might adopt?

#	Answer	Bar	Response	%
1	Yes		1	100%
2	No		0	0%
	Total		1	

12. If yes, please give details.

Text Response

An additional high level principle of flexibility and adaptability to rapid change in technology and business models would be appropriate in a sector that has and will continue to be characterized by rapid and disruptive change

13. What resources do you consider the Government should aim to deploy to effectively manage its role?

Text Response

In addition to current providers of services and infrastructure, to fully look into the future the government should also seek input from those researching next generation infrastructure. This is an area where the UK has significant internationally renowned academic strength.

14. What potential opportunities are there for Government to leverage its combined buying power to support policy objectives?

Text Response

Development of any large scale public sector communications network can influence the market, especially by establishing defacto standards for technology, network integration and implied business models. Leverage of existing infrastructure, and enabling private sector access to any public procured infrastructure, should be actively encouraged as exemplified by opening of rail side fibre network to wholesale traffic

15. If migration to IPV6 is required, are there any barriers to that migration?

#	Answer	Bar	Response	%
1	I think there are significant barriers.		0	0%
2	I think there are insignificant barriers.		1	100%
3	I do not think there are any barriers.		0	0%
4	I do not think IPV6 is required.		0	0%
	Total		1	

16. How might these barriers be addressed?

Text Response

Anything other than a seamless, transparent transfer from a user perspective would present a barrier

17. Is an ongoing disparity of provision of broadband services across the country inevitable?

#	Answer	Bar	Response	%
1	Yes		1	100%
2	No		0	0%
	Total		1	

18. If so, should this be addressed?

#	Answer	Bar	Response	%
1	Yes		1	100%
2	No		0	0%
	Total		1	

19. How might this be done most effectively?

Text Response

A disparity in the provision of broadband services is a natural result of the reliance on market driven commercial investment in broadband services. Industry will deploy next generation services in the most profitable and/or densely populated locations first. However, the deployment of increasing densities of fibre, where speed is almost independent of distance, essentially eliminates distance related disparities. For example, fibre to the cabinet, used by BT infinity, is already removing the disparity in internet speeds in some rural villages. Increasingly access speeds will be dependent on the distance to the nearest fibre access point rather than distance to the exchange. The more fibre, the less disparity. How the fibre is accessed, and how densely fibre is distributed in rural locations will be the biggest drivers of disparity. Strong competition in mobile access will have a positive impact. As indicated in the consultation in relation to 4G, there are substantial competitive pressures on mobile operators to provide blanket coverage. As 4G is a viable route to broadband access up to 25Mbps, even for non-mobile fixed location users, this may reduce some of the disparity, at least alongside main travel routes, as pressure to provide 4G coverage drives deployment of more access points along these routes which can then be used by isolated dwellings in their vicinity. However this creates the potential that geographic distribution of broadband access become correlated to the physical transport network.

20. How symmetrical will digital communications networks have to be in the future? Will this differ across user types? What implications does this have for fixed and wireless broadband provision?

Text Response

Asymmetry in domestic use is likely to persist as the core of entertainment involves low bandwidth interaction with high bandwidth content. Exceptions are possible in tele-health environments, where data from multiplexed sensors will be uploaded in real time creating a persistently high upstream data load. Business demand, especially from SME's, is likely to become fully symmetric as businesses increasingly generate as much data as they consume and all of this data is stored and processed remotely. The benefits of flexibility, scalability and, to some extent security, provide strong incentives to utilise cloud storage and processing for all business process from accounting, to email, to production data. With increased monitoring of manufacturing and services and full cloud utilisation, it is possible to envisage a reversed scenarios with greater upstream traffic than downstream, as only aggregate data is downloaded. Different technologies and network architectures, both within and between fixed and wireless broadband, will be able to meet symmetric requirements better than asymmetric ones. This would imply different technology being used for business and domestic broadband, although this would be partially countered by the greater use of home working noted in the report. Divergence in the symmetry of broadband provision could also negatively impact the realization of societal benefits of advances in communications if, for example, tele-health requires symmetric provision, yet the commercial returns are greatest in entertainment services with asymmetric provision.

21. Which countries should be our benchmarks on communications infrastructure to ensure that business remains in the UK and continues to invest?

Text Response

Our leading trading partners and competitors for inward investment provide the best set of countries to benchmark against as they provide the greatest business opportunity and the greatest potential competition. However, the stated ambition to be the best in the world suggests a more ambitious benchmarking against countries with particularly advanced infrastructures (eg South Korea, Japan) should also be considered

22. What metrics do you think should or will become relevant in comparing network performance in different countries?

Text Response

In addition to speed and coverage highlighted in report. • Symmetry, especially in business connectivity as this gives a strong indication of the viability of cloud utilisation. • Uptime/ reliability • Security although how the latter is benchmarked remains unclear • Latency especially for City of London and the financial sector, although this demand may met by specialist bespoke low latency infrastructure. • For emerging and future applications, headline peak speeds will become decreasingly relevant, and sustained connection bandwidths will become a priority for users

23. What metrics should most appropriately be used as the basis to set objectives for Government policy?

Text Response

As in 7a- metrics for policy and comparing performance should be aligned where ever possible in order ensure for drivers for change and measures of impact are convergent.

24. Do you agree with this scenario or elements within it?

#	Answer	Bar	Response	%
1	Strongly Disagree		1	100%
2	Disagree		0	0%
3	Neither Agree nor Disagree		0	0%
4	Agree		0	0%
5	Strongly Agree		0	0%
	Total		1	

25. Where do you agree/disagree? If you disagree what alternative scenario do you envisage?

Text Response

Overall this appears to be an excessively pessimistic scenario, with little consideration given to the emergence of new and currently emerging services. Notably:- 3.6 No evidence is provided to link digital competence to bandwidth demand. Indeed the highest bandwidth services e.g 4k live Premier league football with multi-angle viewing options will drive bandwidth demand with no greater skill requirement than today's consumer 3.7 Audiovisual will remain largest consumer of home bandwidth as indicated in the other scenarios. But there is no

reason this should be linked to the set top box storage capacity replacing on-demand catch up services. Indeed this is in contradiction to the greater use of cloud based services noted in 3.9 3.8 Widespread availability of 4G will enable mobile operators to offer an alternative to fixed line broadband, potentially significantly increasing time per day on mobile network connected devices. Points 3.9 to 3.12 are more realistic and are also an agreeable quantified base for scenarios 2 and 3.

26. What are your views on the technology commentary underpinning this scenario? To what extent might the infrastructure/technology discussed evolve irrespective of demand and how far it be a direct consequence of the level of demand?

Text Response

Whilst the overall technology scenario is plausible point 3.20 in a particular fails to note the significant hardware technology upgrades required in the core, access and data centre infrastructure if in this more pessimistic scenario of data growth. Data centre infrastructure is already migrating from electrical to optical communications fabric. Core networks will require upgrading with greater use of optical switching and more channels to support the greater bandwidth and agility in provision indicated.

27. Are there technologies not identified here that you think will have a major impact on the performance of existing infrastructure or the deployment of additional infrastructure in the next 10-15 years?

#	Answer	Bar	Response	%
1	Yes		1	100%
2	No		0	0%
	Total		1	

28. If yes, please give details.

Text Response

See scenario 2 and 3

29. Are there wider environmental issues not reflected in the scenario e.g. the price of availability of energy that will affect any of the scenarios?

#	Answer	Bar	Response	%
1	Yes		1	100%
2	No		0	0%
	Total		1	

30. In what way might these wider environmental issues affect any of the scenarios?

Text Response

The energy consumption of datacentres will be a major factor impacting the adoption of new technology that can

provide greater capacity without increasing energy demand over today's centres. This may impact the locations of datacentres with respect to sources of low cost energy or cooling and in turn impact the core network design and technology.

31. How likely is any unforeseen disruption to this scenario?

#	Answer	Bar	Response	%
1	Very Unlikely		0	0%
2	Unlikely		0	0%
3	Undecided		0	0%
4	Likely		1	100%
5	Very Likely		0	0%
	Total		1	

32. In what area might it occur?

This question was not displayed to the respondent.

33. Do you agree with this scenario or elements within it?

#	Answer	Bar	Response	%
1	Strongly Disagree		0	0%
2	Disagree		0	0%
3	Neither Agree nor Disagree		0	0%
4	Agree		1	100%
5	Strongly Agree		0	0%
	Total		1	

34. Where do you agree/disagree? If you disagree what alternative scenario do you envisage?

Text Response

This appears most realist scenario. As indicated service level expectations will be core with greater penetration of smart devices, in part driven by the aging of current consumers already familiar with these services/devices. Businesses will certainly require greater symmetry to fully utilize cloud services and the identification of a small business sector distinct from consumer or large corporate is likely

35. What are your views on the technology commentary underpinning this scenario? To what extent might the infrastructure/technology discussed evolve irrespective of demand and how far it be a direct consequence of the level of demand?

Text Response

Overall the technology commentary here is more accurate than scenario one, with some exceptions noted below. With reference to 3.31 siloing of access media is likely to breakdown due to bundling, with network operators encouraging the use of devices /apps that automatically switch access media (e.g wireless 4G/Wifi-wired) for greatest efficiency as indicated in 3.34. Although fibre virtualisation will increase as indicated, investment in new core network hardware will be required to enable seamless virtualisation via optical switching and also to provide additional core bandwidth. Rather than minimize spend on core capacity in general, caching will be used to relieve peak demand bottlenecks enabling investment to be focus on areas of network where aggregate demand approaches capacity limits. Overall the indicated technology developments are likely to be heavily demand driven. The exception perhaps being IoT where a critical mass of such devices is required to create demand as reflected in the relative conservative forecast for adoption of IoT in 3.35. Whole life costs of this strategy are potentially higher than necessary, as it predicts that technologies are deployed only as needed, requiring multiple technology upgrades

36. Are there technologies not identified here that you think will have a major impact on the performance of existing infrastructure or the deployment of additional infrastructure in the next 10-15 years?

#	Answer	Bar	Response	%
1	Yes		1	100%
2	No		0	0%
	Total		1	

37. If yes, please give details.

Text Response

Full integration of optical technologies at the wafer level in manufacturing, i.e Photonic Integrated Circuits (PICs) will provide new cost benefit scenarios especially in the access network. This will impact the penetration of fibre closer to the consumer and the development of backhaul capacity and technology. The availability of ultrahigh bandwidth fibre and associated systems and components may significantly change the return on investment decision and thus the timing for investment in the core network.

38. Are there wider environmental issues not reflected in the scenario e.g. the price of availability of energy that will affect any of the scenarios?

#	Answer	Bar	Response	%
1	Yes		1	100%
2	No		0	0%
	Total		1	

39. In what way might these wider environmental issues affect any of the scenarios?

Text Response

As previous, the energy consumption of datacentres will be a major factor impacting the adoption of new technologies that can provide greater data centre capacity without increase energy demand. This may impact the locations of datacentres, with respect to sources of low cost energy or cooling, and in turn impact the core network design and technology.

40. How likely is any unforeseen disruption to this scenario?

#	Answer	Bar	Response	%
1	Very Unlikely		0	0%
2	Unlikely		1	100%
3	Undecided		0	0%
4	Likely		0	0%
5	Very Likely		0	0%
	Total		1	

41. In what area might it occur?

This question was not displayed to the respondent.

42. Do you agree with this scenario or elements within it?

#	Answer	Bar	Response	%
1	Strongly Disagree		0	0%
2	Disagree		0	0%
3	Neither Agree nor Disagree		1	100%
4	Agree		0	0%
5	Strongly Agree		0	0%
	Total		1	

43. Where do you agree/disagree? If you disagree what alternative scenario do you envisage?

Text Response

This scenario appears slightly optimistic in number of areas. Although integration of network connectivity will evolve, the rapid development of new RF and fibre technology will continue to drive service differentiation (and separation) based on underling technologies. One significant risk is Major and wide spread breaches in the security of cloud bases services could cause trends in cloud utilization to reversed driving greater localizing of IT services once more. This have most impact on demand for greater symmetry in broadband provision

44. What are your views on the technology commentary underpinning this scenario? To what extent might the infrastructure/technology discussed evolve irrespective of demand and how far it be a direct consequence of the level of demand?

Text Response

Greater build of fibre infrastructure will require additional development of integrated photonics as noted below. This scenario will put extreme stress on the core network. Radically new technologies will be required to expand core capacity beyond WDM technology currently used, solutions for which are not currently available and will require new physical infrastructure and investment. The regionalization of data centres noted in 3.48 is more likely

to occur on a virtual rather than a physical level. The flexibility and efficiency of operating large data centres with ability to dynamically redeploy capacity is already compelling and a trend that is likely to continue, particularly for business use and OTT content. There will be demand for a hyper highway of connectivity between such data centres to enable further virtualization. The regionalisation of CDNs indicated is likely to be more focused on entertainment and on-demand audio visual delivery and likely to heavily depend on the relative cost and performance of core capacity vs localised CDN's.

45. Are there technologies not identified here that you think will have a major impact on the performance of existing infrastructure or the deployment of additional infrastructure in the next 10-15 years?

#	Answer	Bar	Response	%
1	Yes		1	100%
2	No		0	0%
	Total		1	

46. If yes, please give details.

Text Response

Full integration of optical and electrical technologies at the wafer level in manufacturing (integrated photonics) will be required to provide optical access far into the network as demanded in this scenario. Within this max connected scenario security will become a very significant driver and resilience will become major if not the key factor impacting adoption. . In this scenario of rapid and disruptive change LiFi may also provide a highly disruptive technology likely to be more rapidly adopted alongside smart homes and wide spread penetration of the IoT

47. Are there wider environmental issues not reflected in the scenario e.g. the price of availability of energy that will affect any of the scenarios?

#	Answer	Bar	Response	%
1	Yes		1	100%
2	No		0	0%
	Total		1	

48. In what way might these wider environmental issues affect any of the scenarios?

Text Response

Energy consumption would be a major factor in this scenario and at all levels from the battery life of connected devices to the energy consumption of the networks and the larger number of datacentres. Metrics of energy per bit are likely to become dominant over bit rate in determining where and when further technology advances are deployed, and will be eventually replaced by optimisation of service quality to total end-to-end energy consumption (perhaps influenced by service pricing).

49. How likely is any unforeseen disruption to this scenario?

#	Answer	Bar	Response	%
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1	Very Unlikely		0	0%
2	Unlikely		0	0%
3	Undecided		0	0%
4	Likely		1	100%
5	Very Likely		0	0%
	Total		1	

50. In what area might it occur?

This question was not displayed to the respondent.

51. Are there factors, for example technical or unrelated to the regulatory framework, that could create bottlenecks and delay future infrastructure deployment in the UK in this timeframe, that would result in demand not being met or the UK not being seen as a leading digital nation?

#	Answer	Bar	Response	%
1	Yes		1	100%
2	No		0	0%
	Total		1	

52. Please give details.

Text Response

All of the above scenarios require investment in fibre based mobile backhaul and increase fibre density which requires measures to ease its deployment.

53. Do you expect commercial providers to deliver future infrastructure and meet demand on a purely commercial basis, or is some form of public intervention likely?

#	Answer	Bar	Response	%
1	Commercial providers will meet demand on a purely commercial basis.		0	0%
2	Some form of public intervention is likely.		1	100%
	Total		1	

54. If public intervention is likely how might that work with the commercial provision of infrastructure? What form might that intervention take?

Text Response

Expanding the core communications network is as essential to the UK's future as maintaining the motorway or rail

network. Keeping the core network capacity ahead of demand is likely to require public investment and provide a backbone on which commercial access and content services can be grown. As for most major infrastructure the timescale and costs of upgrading are significant, but no greater than other recently announced major infrastructure projects and arguably with significantly greater reach. Investment is needed in advance of market demand to insure against potential failure and enable maximum growth in commercial services.

55. Which current or draft legislation might prevent or facilitate the emergence of any of the scenarios?

Text Response

European REACH regulations may have a significant negative impact on the availability of networking technologies and adversely impact the ability of next generation optical and RF communications hardware to be manufactured in the UK.

56. Do you have views on which scenario (or combination of scenarios) is most likely and should influence the development of future strategy?

#	Answer	Bar	Response	%
1	Scenario 1		0	0%
2	Scenario 2		1	100%
3	Scenario 3		0	0%
4	None		0	0%

57. Please give your reasoning for why you think this scenario or combination of scenarios is most likely.

Text Response

As indicated in scenario 2, service level expectations will be core with greater penetration of smart devices, in part driven by the aging of current consumers already familiar with these services/devices. In addition as indicated businesses will certainly require greater symmetry to fully utilize cloud services and the identification of a small business sector distinct from consumer or large corporate is likely. However siloing of access media is likely to breakdown yet further

58. How might efficient investment in communications infrastructure be supported, for example by changes in the regulatory framework?

Text Response

The regulatory framework should always considered the timescales and mechanisms for network operators to make a return on infrastructure investment.. Expanding PIA for mobile backhaul, would encourage investment in advanced backhaul infrastructure.

59. Are any further measures necessary to incentivise the rollout of future mobile infrastructure in currently underserved areas?

#	Answer	Bar	Response	%
1	Yes		0	0%

2	No		1	100%
	Total		1	

60. Please give details.

This question was not displayed to the respondent.

61. Is there a role for a revised USO or USC to ensure that minimum consumer demand requirements are met and to reduce the potential for a new digital divide? What might this look like?

#	Answer	Bar	Response	%
1	I think there is a role for a revised USO		0	0%
2	I think there is a role for a revised USC		0	0%
3	I think there is a role for both a revised USC and a revised USO		1	100%
4	I do not think a revised USO or USC are needed		0	0%
	Total		1	

62. What might this look like?

This question was not answered by the respondent.

63. In terms of supporting future innovation and long-term investment in infrastructure, what areas of broadcasting regulation may have served its purpose by 2025 -2030 (or indeed earlier). What future technical developments may also have longer term implications for regulation and wider public policy?

Text Response

no comment

64. Are there changes to the EU Framework that the UK might seek to encourage more competition in UK markets?

#	Answer	Bar	Response	%
1	Yes		1	100%
2	No		0	0%
	Total		1	

65. Please give details.

Text Response

In the context of EU regulatory impact on UK building regulations. Fibre to the home/premises deployment is substantially more economic in large scale new developments than in retrofit scenarios. Consideration should be given to requiring fibre to the premise in new developments above a certain size, going beyond the requirements of EU regulation

66. Should Government seek changes to the European Framework which put more reliance on competition law?

#	Answer	Bar	Response	%
1	Strongly Disagree		0	0%
2	Disagree		0	0%
3	Neither Agree nor Disagree		1	100%
4	Agree		0	0%
5	Strongly Agree		0	0%
	Total		1	

67. How might this be done?

This question was not displayed to the respondent.

68. In what ways can you see competition driving technological change in the UK in the future?

Text Response

Continuing competition is likely to serve the individual and household consumer well. Greater competition in the provision of business services and connectivity especially targeted at SMEs rather than large corporate requires additional encouragement. As noted previously this sector has different needs to the consumer with more symmetric traffic, different peak demand profile and more interest in bundling with cloud services than entertainment or audio visual content. Greater competition for connecting small business users will drive adoption of more symmetric technology, data centre location/design, security & reliance technology, and core network traffic profiles/solutions.

69. How can the regulatory framework keep up to date with new business models and changes in technology?

Text Response

Technology, business models and services in these areas are changing very rapidly. The regulatory framework needs be flexible to unpredictable change and encourage new business models whilst maintaining stability and predictable to encourage investment. Increased bundling of services and, as noted below vertical integration in content provision and infrastructure, will mean the regulatory framework will need to increasingly consider the mobile, broadband and content markets together rather than the current separate situation indicated in 4.26

70. Are there any changes to legislation other than the Communications Act that would incentivise the provision of communications infrastructure?

#	Answer	Bar	Response	%
1	Yes		0	0%
2	No		1	100%
	Total		1	

71. What might these changes be?

This question was not displayed to the respondent.

72. Would there be benefits to investment from a focus on broadband only services? Are there any barriers to the emergence and adoption of broadband only services, whilst still providing necessary access to emergency services?

#	Answer	Bar	Response	%
1	Yes		1	100%
2	No		0	0%
	Total		1	

73. Please give details.

Text Response

VoIP and mobile services are already providing a viable alternative to fixed line voice as evidenced by the 15% of household noted in the consultation that live in a mobile only household. Whilst challenging, VOIP services should be considered as equivalent to wired telephony. Innovative solutions for emergency services contact should be encouraged. Number porting within the VOIP environment is vital for encouraging wider adoption and competition, especially with small business users where a telephone number is a business asset and its loss a major barrier to switching services. Note that operation of legacy and overlay networks is common practice for major network operators, and legacy networks transporting POTS remain profitable and dual working of broadband and POTS is perfectly feasible. However, the obligation to provide access to emergency services currently favours copper technologies where power may be supplied exchange side and the provider is in full control of their service obligation. This restricts high speed innovation to some extent, especially in new build where legacy copper networks are not in place. Aligning regulation to the realities of increasing numbers of mobile only households, e.g. by restricting obligations to only those areas without diverse mobile coverage, could free the market significantly without adversely impacting the safety of the public.

74. Are there any barriers to the emergence and adoption of broadband only services, whilst still providing necessary access to emergency services?

#	Answer	Bar	Response	%
1	Yes		1	100%
2	No		0	0%
	Total		1	

75. Please give details.

Text Response

see 36a

76. How might copper access networks evolve over time alongside other access technologies? Is there a role for policymakers in helping manage any transition from copper to other access networks?

Text Response

Most domestic connections terminate in wireless router inside consumers premises, meaning that the final connection to a device is already over wireless. The debate is therefore better focused on the merits of placing this wireless router in the individual home/ business premises, or in the cabinet at the street end. In both cases backhaul is required and there merits of copper vs. fibre for this backhaul depend on the traffic parameters, number of aggregated users/traffic per access point, and business model/ regulatory dependency on access point location. The best service and investment will be facilitated by having maximum flexibility in how this back haul/last ½ mile can be bridged so that so the most appropriate and efficient technology can be deployed. In the future copper will be one of many, rather than the only option, for consumer connection with maximum flexibility and competition provided by maintaining it as an option. The situation may be considered differently in the following two scenarios, (1) new build where the cost difference for deployment of e.g. fibre vs copper are much lower, but the future capability of fibre is much greater than copper. In this case regulation could provide a basis for encouraging installation of fibre to the premises in new build. Such incentives would increase the market for fibre base premises equipment in turn driving innovation especially around volume integration technologies and ultimately helping reduce cost of retrofitting fibre to premises in the future. 2) Migration from wireless to LiFi or other premises network technologies, offering higher bandwidths for high definition media streaming and content generation activities within the home/office. Here, wireless connections with multi-user contention issues could serve as a significant bottleneck, increasing consumer demand for fibre to the premises

77. Views are sought on whether there are any additional actions the Government should consider to ensure that the provision of all areas of the UK's digital communications infrastructure remains competitive in order to ensure that the UK can take full advantage of growth opportunities in the Digital Age.

Text Response

Continued support for multiple technology options for remote locations. Single technology approaches are unlikely to be appropriate in all cases and multiple solutions will be required to provide high-speed broad to full population and all locations

78. Aside from legislation and adapting the regulatory framework in the broad sense which other actions should the Government take to encourage investment in communications infrastructure?

Text Response

Support for demonstration deployments especially of different access technologies and the fibre to the premises. These should cover domestic and business customers with the latter focused on Hi-tech business hubs giving early indication of future and stimulating new business growth in such as innovation centres. Support for pilot line manufacturing facilities, based on UK R&D excellence (below) that would create a step change in the cost/ performance of critical communications components through automation and integration. This would enable the hardware for next generation networks to be made in the UK, enabling a proportion of the investment in communications infrastructure to be captured by UK manufacturing businesses and enable that investment to seed hardware exports

79. Views are sought on whether there are any additional actions the Government should consider to ensure that potential investment in the provision of digital communications infrastructure offers a suitable risk and reward profile to ensure that they can be financed by the private sector.

Text Response

A network is only as good as its weakest link. Where different parts of the networks are owned and invested in by different parties this creates a strong interdependency, right through to the services and content that can be delivered on that network. This is well illustrated by OTT content providers, e.g. Google, investing first in data centre and increasingly in network infrastructure, and in traditional infrastructure companies investing in content e.g. BT Sport. Such vertical integration between content and infrastructure is likely to be a continuing feature of private sector business models. This means investment in infrastructure cannot be fully separated from investment in and access to content, Government will need to closely consider the coupling of the two, especially given the unique position of the BBC in content generation and delivery

80. Views are sought on the case for the UK to invest to gain 'early mover advantage'.

Text Response

As indicated above the network is only as good as its weakest link. Investment is also most difficult furthest from the consumer especially in an environment of decline revenue patterns for traditional communications operators and the emergence of new business models noted in the consultation. This there is strong case for the UK to invest early in the development and upgrading of the Core communications network. This is an asset that can be utilized by many operators/ service companies. Having the most advanced core network provides excellent early mover advantage, removes barriers to, and facilitates downstream services, new business models and drive direct industrial investment closer to consumer.

81. Views are sought on what areas in particular the UK should aim to see investment in.

Text Response

Next generation core network capacity with flexible provisioning as noted above. Pilot lines and advanced manufacturing in optoelectronics as noted below to capture more of the proceeds of growth here and abroad.

82. Are there any actions not covered elsewhere in this report that the government should consider to ensure digital communications infrastructure is in place before it is needed and such that it helps generate need?

Text Response

See notes elsewhere in response

83. How might we maximise the current R&D and innovation UK landscape to help take advantage of the opportunities provided by future technologies? What needs to be done by Government and its agencies, and industry to tackle any gaps?

Text Response

Whilst the UK has extensive strength in communication R&D (below) this is not being translated to UK manufacturing as widely as it could be. Support is required for higher Technology readiness level (TRL) development to translate this research in industry ready innovation. Given the volumes and stringent requirements of the communications industry this requires support for large scale projects, rather than feasibility projects. Investment is required in development of automated manufacturing technologies for packaging and systems integration, particularly of optoelectronic components to enable more efficient UK manufacturing and capture of a greater fraction of the value chain and the proceeds of growth in the UK economy. Support for pilot scale fabrication facilities and open access foundries where design and fabrication can be separated should be actively

encouraged to increase rates of innovation, reduce time to market and lower barriers to entry in the communications supply chain. It is notable that the UK has been successful in attracting foreign direct investment to the UK for a number of design centres related to communications technology (including both optical and wireless technology). The output of these centres, along with the research from the many leading UK Universities groups in the sector, can be most efficiently transferred to manufacturing close to where the innovation is original developed i.e within the UK. This creates significant opportunities for inward investment, expansion of manufacturing and in turn exports, but requires strong UK support for the manufacture of communications optoelectronics as indicated above.

84. In which future communications technologies that you consider the UK has, or could achieve, an international leadership position?

Text Response

The UK has world leading strength in optical communications R&D in multiple Universities and industrial centres covering all areas from network design to systems and component hardware. This heritage has created a globally significant UK industry in data storage (Seagate/Xyratex) and communications components (Oclaro, Gooch and Housego). Extensive investment by EPSRC has enabled UK to be an international leader in research into next generation communication technologies including ultrahigh bandwidth optical fibre, silicon photonics, photonic integrated circuits, III-V material systems as well systems integration of photonics electronics and software. Extending these core strengths, the UK also has an emerging capability in optical communications on, and between, satellites and LiFi which will strength its positon in communications technology further in the future. These technologies are fully complimentary to UK's parallel expertise in wireless and satellite communications.

85. What more might government and industry do to exploit future technologies, associated new applications and emerging business models?

Text Response

Whilst design and manufacture of the communications components at the wafer level is thriving in the UK, packaging and integration of components into systems frequently takes place offshore. As indicated above support for UK manufacturing including further development of high value manufacture of communications equipment in the UK would help UK benefit not just from the use of future communications technology but also its production and development.

86. What role might local bodies have in facilitating the future delivery of digital communications infrastructure?

Text Response

Provision and optimization of transport access infrastructure (road/rail) has long been a focus of local bodies and used as a method of supporting urban regeneration. Local bodies should consider the provision of communications infrastructure on par with transport infrastructure through planning and regional development plans. The provision of advanced communications infrastructure can be used to encourage development, in an analogous way to the improvement of transport access. In the future local communications bottlenecks will become a throttle on local growth as much as the transport bottlenecks of today. It is notable that broadband access speeds are increasingly reported by estate agents facilitating housing sales. Within the planning process, the impact of new development/redevelopment on communications infrastructure should be considered alongside the impact on physical infrastructure. Direct support from developers for expansion of communications infrastructure should be a requirement alongside support for road or education infrastructure for large scale new development. Thus contributions for upgrading local exchanges or increasing penetration of fibre should be fully integrated into development approvals. Support for local authorities in the technical aspects related to the impact of development on the communications infrastructure will be required.

87. How can councils maximise the digital communications infrastructure in their local area to support their work on economic regeneration?

Text Response

As indicated above early provision of next generation access and communications infrastructure will increasingly be as important as the provision of transport infrastructure in economic regeneration. Provision of high speed high reliability access, especially coupled with low property costs is highly attractive to the new generation of knowledge intensive, always on-line, location independent businesses. The mobility of such companies creates significant opportunity, but also demands attention to maintaining communications infrastructure as the barriers to relocation are lower than for a traditional business. The erosion of traditional separation between home and business created by rise in home working and cloud services also creates additional regeneration opportunities for those areas that provide active support to these new mixed environments.

88. Please provide details of information you feel is relevant to the development of the Digital Communications Infrastructure Strategy and not already covered by the consultation questions.

This question was not answered by the respondent.