出國報告（出國類別：會議）

出席國際通訊傳播協會舉辦之
2016電信與媒體論壇會議
及拜會美國FCC委員Michael O’Rielly
出國報告

服務機關：國家通訊傳播委員會

姓名職稱：陳委員憶寧

紀副處長效正

洪技士嘉璟

派赴國家：美國華盛頓哥倫比亞特區

出國期間：**105**年**11**月**27**日至**12**月**5**日

報告日期：**106**年**2**月**17**日

摘要

國際通訊傳播協會（International Institute of Communications， IIC）於 2016 年 11 月 29 日至 30 日於美國華府舉辦 2016 年「電信與媒體論壇（Telecommunications and Media Forum，TMF）」，由國家通訊傳播委員會（以下簡稱本會）陳憶寧委員率綜合規劃處紀效正副處長及洪嘉璟技士出席，希望藉由了解全球通訊傳播產業趨勢與政策走向，為台灣匯流法規與政策開拓新局。

本次電信與媒體論壇探討的議題相當廣泛，包括物聯網（IoT）、5G 等新興科技的崛起、消費者個資保護與信任、開放的網際網路、英國脫歐及美國總統大選對美國國內及國際通傳政策的影響等，相關主題都深具前瞻性，可供本會作為未來政策制定參考。

本次會議出席成員包括各國通傳監理機關、產業界及學術界會員外，亦邀請時任美國聯邦通信委員會（FCC）主任委員 Tom Wheeler、聯邦公平交易委員會（FTC）委員 Terrell McSweeny、美國貿易代表署（USTR）副代表 Robert Holleyman 大使等人發表談話。陳憶寧委員利用論壇機會，除與各國管制官員交換心得，並與產業界及智庫等人士交流，汲取最新產業發展與管制趨勢，進而提升我國的國際能見度。

另外，本會亦利用到訪華府之機會，至美國 FCC 拜會共和黨籍委員 Michael O’Rielly，就強化台美雙方監理經驗進行意見交流。晤談中，雙方除討論透過臺美數位論壇及雙方委員互訪，建立常態性溝通平臺的可能性外，亦就 OTT 服務發展及管制機關如何因應、如何維持管制機關的獨立性、普及服務發展、具誘因式競價（incentive auction）、併購案的處理等雙方關切議題，進行意見交換，達到實質性交流及分享彼此經驗之意旨。

我駐美代表處李公使光章、李組長大塊、林秘書俶如、黃秘書奕龍於華府期間，或與全團進行政策交流、或陪同拜會、或接送機照料；駐洛杉磯辦事處楊組長國添、駐紐約辦事處蘇副處長瑞仁、曾秘書靖惠，犧牲假期親臨機場協助轉機或接送機照料，協助本會順利完成任務，特此表達由衷感謝之意。

目　錄

壹、前言

為汲取先進國家之發展經驗及增加國際合作之機會，以面對未來挑戰，本會主委詹婷怡特別指派陳憶寧委員率綜合規劃處相關人員參與於國際通訊傳播協會(International Institute of Communication，IIC)於美國華府舉辦之2016年「電信與媒體論壇（Telecommunications and Media Forum，TMF）」，期間，通傳會特別安排陳憶寧委員一行人拜會美國聯邦通訊傳播委員會（Federal Communications Commission，FCC）共和黨籍委員Michael O'Rielly，就強化台美雙方監理經驗進行意見交流，希望藉由與各國管制官員及業界人士交流互動，為我國匯流政策與法規開創新局面。

一、國際通訊傳播協會（IIC）簡介

國際通訊傳播協會（IIC）係在美國、日本、加拿大、歐洲等國的通傳業界人士支持下，於1969年創立於英國的民間組織，是一個獨立、全球性、非營利的組織其會員及非常多樣話，包含各國監理機關、電信業者、廣播業者、內容提供者及資訊產業（IT）提供者等。

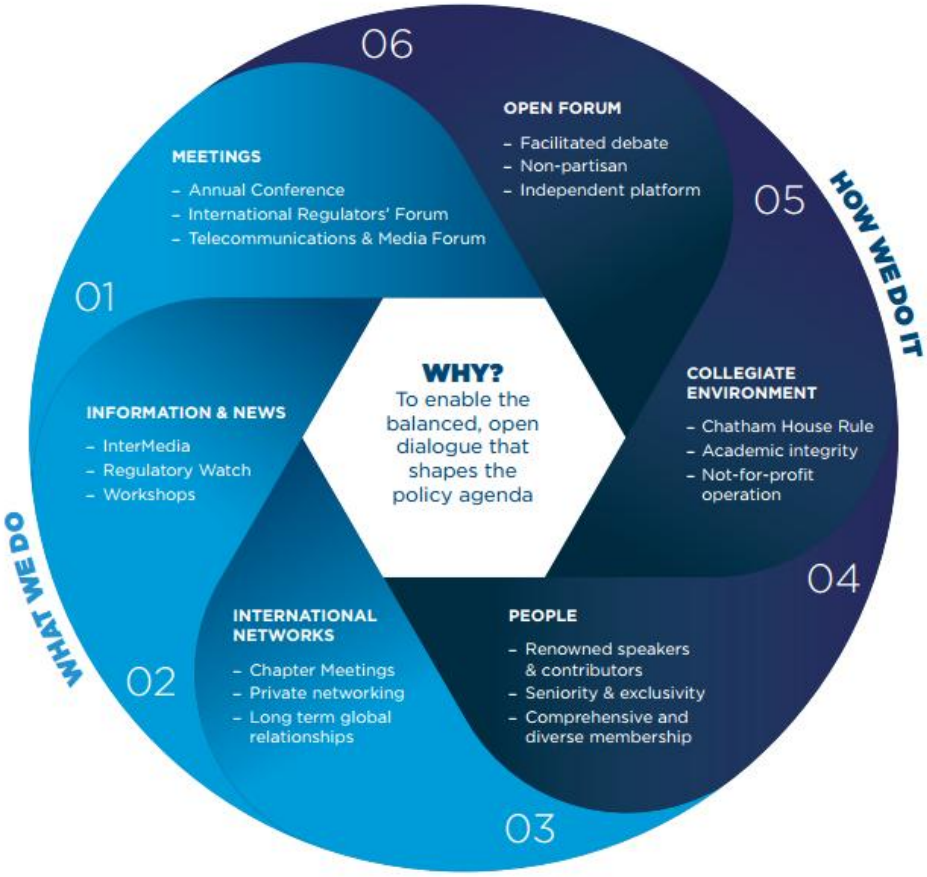
圖表1：IIC會員分佈

資料來源：IIC Information Brochure 2014

IIC 是全球唯一聚焦電信、媒體政策及管制業務的獨立會員組織，提供參與者一個平臺，以開放和令人深思的討論論壇方式探討電信傳播資訊的發展整合、管理架構及所面臨議題，及對經濟、文化、社會及公共政策領域帶

來的衝擊與影響，分析世界各地的市場和政策發展前景，並尋求如何達成公共政策與商業模式的雙贏局面。

圖表2：IIC成立宗旨



資料來源：IIC Information Brochure 2014

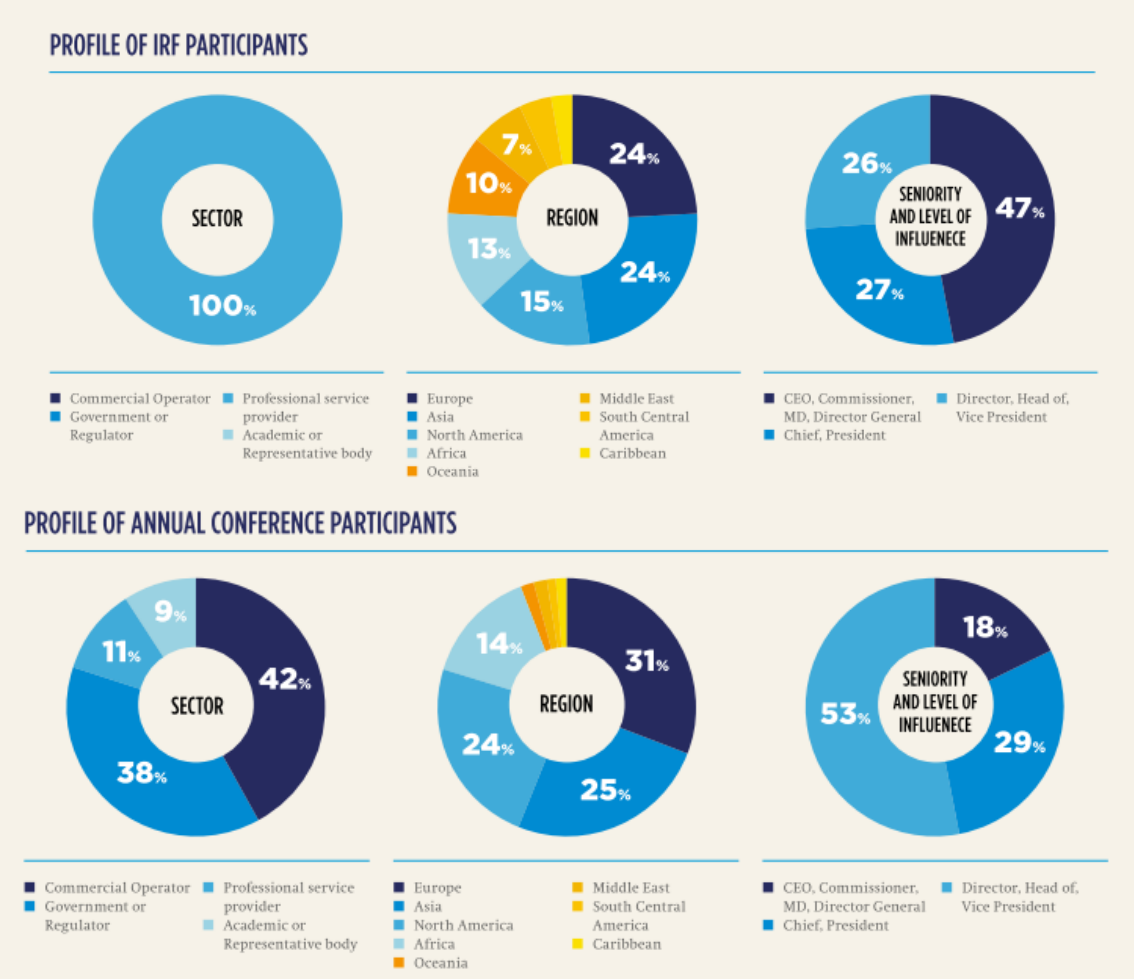
IIC的主要工作項目，包括召開通訊傳播國際會議、發行通訊傳播產業動態刊物「Intermedia」，以及建立國際聯繫網路等三大部分。

每年 10 月的第一週，IIC輪流在各會員國所在的城市，舉辦「通訊傳播政策與管制規範週（Communications Policy & Regulation Week，CPR Week）」活動，以世界各國通傳監理機關及產業界最關注的議題，作為該活動主題。CPR週的活動包含「國際管制者論壇（International Regulators Forum，IRF）」、「年度會議（IIC Annual Conference）」、相關研討會及交流活動等。

其中，「國際管制者論壇（IRF）」採邀請制，僅開放給各國通傳監理機關參加，IRF的舉辦宗旨，是讓資深管制者分享監理經驗，並使來自全球各

地的監理機關會員有機會在非公開且安全的環境下，定期交流、討論新興的政策議題與管制機制。年度會議（Annual Conference）則屬於開放活動，參與者通常包含監理機關、產業代表、專家學者及其他利益團體等，分享對於近期趨勢及發展的看法，並針對未來公共政策、管制措施提出規劃或建議。

圖表3：IIC管制者論壇及年度會議參與人員背景分析示意圖



資料來源：IIC Information Brochure 2014

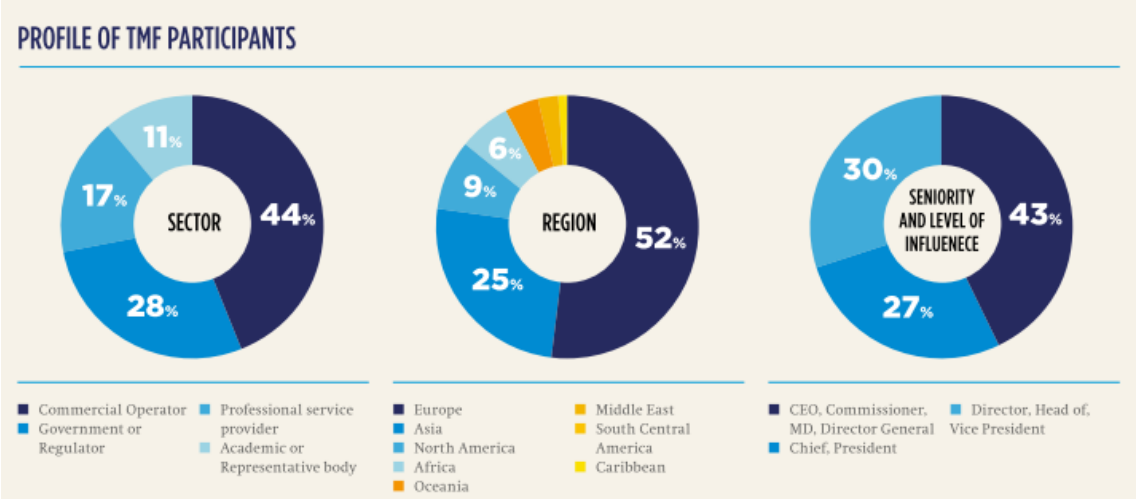
除了每年 10 月固定舉辦管制者論壇及年會外，IIC 也在不同會員國所在城市，每年至少舉辦三次「電信與媒體論壇（Telecommunications & Media Forum，TMF）」，將政府決策者、監管者及業界高層主管聚集在一起，在開放的氛圍中進行討論於溝通，提供參與者教育、學習與分享經驗的機會。

本次於華府舉辦之電信與媒體論壇（TMF）主題是技術進步及國際政治改變的影響，探討議題相當廣泛，包括物聯網（IoT）、5G等新興科技的崛

起、消費者個人資料保護與數位信任、開放的網際網路與網路中立性、英國脫歐及美國總統大選對國際通傳政策的影響等，相關主題都深具前瞻性，可供本會作為未來政策制定參考。

論壇由Verizon Communications主辦，而Verizon目前是全美最大的行動業者，約有三分之一的美國人為其語音和行動數據用戶。

圖表4：IIC電信及媒體論壇參與人員背景分析示意圖



資料來源：IIC Information Brochure 2014

圖表5：本會參與IIC電信與媒體論壇人員及主題一覽表

年度	主題	地點	出席者
2014	1.具誘因競價機制 2.網際網路治理 3.物聯網	美國 華盛頓 特區	彭委員心儀 曾科長文方
2016	1.物聯網、5G 等新興科技的崛起 2.消費者個人資料保護與數位信任 3.開放的網際網路與網路中立性 4.英國脫歐及美國總統大選對國際通傳政策的影響	美國 華盛頓 特區	陳委員憶寧 紀副處長效正 洪技士嘉璟

資料來源：本報告自行整理

二、美國聯邦通訊傳播委員會（FCC）簡介

美國聯邦通訊傳播委員會（FCC）為一獨立之聯邦政府機關，於1934年由電信法（Communication Act）授權建立，並直接對美國國會負責。

FCC負責管制州際及國際之無線電、廣播電視、固定網路、衛星通信、有線纜線，其權限涵蓋美國的50個州及華盛頓特區，同時，該委員會是美國對通訊傳播法律、法規、技術規範及政策之權責機關。

FCC由5位委員主導運作，委員由美國總統提名，並經由眾議院同意後通過。除非是遞補任期未屆滿的委員所留遺缺，否則FCC委員的任期為5年。美國總統會指定其中一名委員擔任主任委員，任一政黨委員不得超過3人，且所有委員不得與FCC監理的相關產業有財務上的利益關係。本會出訪時之5位委員分別為民主黨之Tom Wheeler、Mignon Clyburn、Jessica Rosenworcel及共和黨之Ajit Pai、Michael O'Rielly。（報告撰寫時，FCC配合川普新政府成立調整人事，故只有Ajit Pai、Mignon Clyburn及Michael O'Rielly等3位委員。）

圖表6：美國聯邦通訊傳播委員會（FCC）委員簡介（2016年11月）

委員	簡介
 **Tom Wheeler**	➢政黨：民主黨 ➢任期：2013.11.04~2017.01.20（辭職） ➢經歷：全國有線電視協會（NCTA）總裁暨執行長、行動通訊及網際網路產業協會（CTIA）總裁暨執行長 ➢關切議題：支持網路中立性、制訂網際網路隱私權規範、開放有線電視機上盒市場
 **Mignon Clyburn**	➢政黨：民主黨 ➢任期：2009.08.03~2013.01.08；2013.01.19~2018.1.19 ➢經歷：南卡羅萊納州公共服務委員會（PSC）委員暨主委，聯邦州政府普及服務聯合委員會、分立聯合委員會、先進服務聯合會議主席 ➢關切議題：貧富間之數位落差、身障人士網路近用

	政策、支持網路中立性
 **Jessica Rosenworcel**	➢政黨：民主黨 ➢任期：2012.05.11~2016.01.03（辭職） ➢經歷：參議院商業科學暨交通小組資深通訊傳播顧問，FCC 前委員 Michael J. Copps 的法律顧問、FCC 固網（wireline）競爭局局長的法務律師和該局法律顧問。 ➢關切議題：代表出席國際會議如 APEC、GSMA，關注頻譜、網際網路發展等議題
 **Ajit Pai**	➢政黨：共和黨 ➢任期：2012.05.07~2017；2017.1.23~（接任主委） ➢經歷：FCC 總顧問辦公室副總顧問、Verizon Com. 副總顧問、法務部法規政策辦公室資深顧問、參議院司法委員會次級小組（行政監督和法院）首席顧問 ➢關切議題：關注市場公平競爭、國家寬頻計畫，反對網路中立性
 **Michael O'Rielly**	➢政黨：共和黨 ➢任期：2013.11.04~2019.06.30 ➢經歷：參議院共和黨政策委員會政策分析師、參議員 Jon Kyl 辦公室政策主任、參議員黨鞭 John Cornyn 辦公室政策顧問 ➢關切議題：支持放寬外資許可管制、數位機上盒等議題

資料來源：摘錄自附件

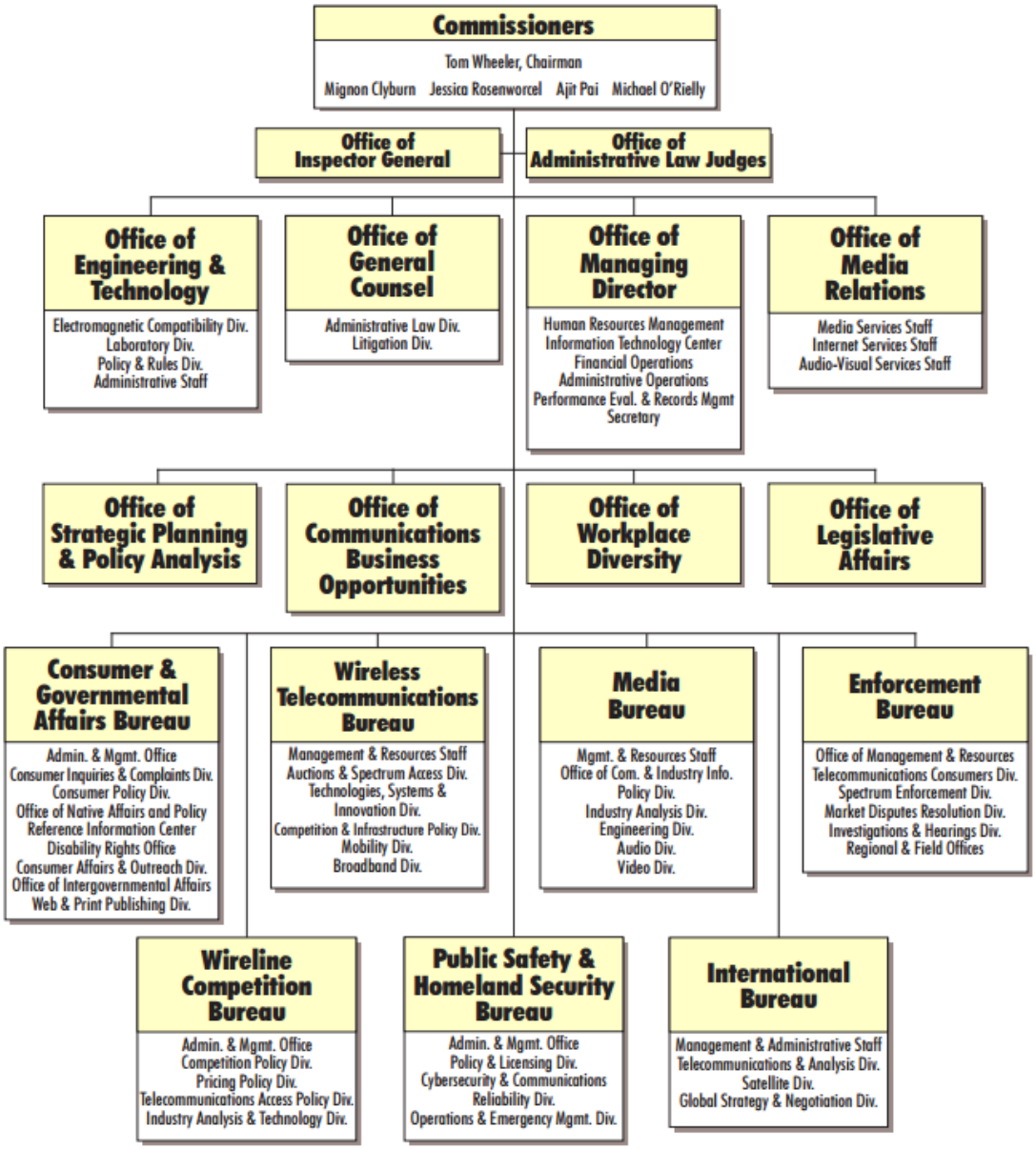
FCC設有7局（Bureau）10辦公室（Office），局的主要責任為辦理執照申請、投訴處理、規範制定及提出政策建議等，辦公室則為局提供支援，局和辦公室都有其單獨的責任，但在處理業務時通常都聯合參與。目前的7局10辦公室表列如下：

圖表7：美國聯邦通訊傳播委員會（FCC）組織架構

局 Bureau	➢消費者和政府事務局（Consumer & Governmental Affairs Bureau）
	➢執行局（Enforcement Bureau）
	➢國際局（International Bureau）
	➢媒體局（Media Bureau）
	➢無線通訊局（Wireless Telecommunications Bureau）
	➢有線競爭局（Wireline Competition Bureau）
	➢公共及國土安全局（Public Safety and Homeland Security Bureau）
辦公室 Office	➢行政審查辦公室（Office of Administrative Law Judges）
	➢通訊事業辦公室（Office of Communications Business Opportunities）
	➢工程技術辦公室（Office of Engineering & Technology）
	➢法律顧問辦公室（Office of General Counsel）
	➢監察辦公室（Office of Inspector General）
	➢立法事務辦公室（Office of Legislative Affairs）
	➢行政辦公室（Office of the Managing Director）
	➢媒體公關辦公室（Office of Media Relations）
	➢策略規劃分析辦公室（Office of Strategic Planning & Policy Analysis）
	➢就業機會管理辦公室（Office of Workplace Diversity）

資料來源：FCC網頁；本報告自行整理

圖表8：美國聯邦通訊傳播委員會（FCC）組織架構圖



資料來源：FCC網頁 https://www.fcc.gov/sites/default/files/fccorg-02082016.pdf

貳、行程安排

一、出國時間：2016 年 11 月 27 日至 12 月 5 日

二、地點：美國華盛頓特區

三、本會出席人員：

（一）陳委員憶寧

（二）綜合規劃處紀副處長效正

（三）綜合規劃處洪技士嘉璟

四、時間安排

日期	時間	行程	內容說明
11/27 (日)		臺北－洛杉磯 洛杉磯－華盛頓特區	長榮 BR16 聯合航空 UA411
11/28 (一)		準備會議資料	
11/29 (二)	9：10－17：30	IIC電信與媒體論壇 第一日	Verizon會議室
11/30 (三)	9：15－16：00	IIC電信與媒體論壇 第二日	Verizon會議室
12/1 (四)	11：00－12：00	與美國FCC雙邊交流	聯邦通訊傳播委員會8樓O’Rielly委員辦公室
	13：00－15：30	與駐美代表處工作餐敘	Sushiko餐廳
12/2 (五)		整理會議資料	

12/3 (六)		華盛頓特區－紐約	Blue Jet航空 B61308
	11：00－16：00	拜會駐紐約辦事處及餐敘	駐紐約辦事處及曼哈頓山王餐廳（Tang Pavilion）
12/4 (日)		紐約－臺北	長榮 BR31
12/5 (一)		抵達臺北	

參、2016 年美國華府國際傳播協會（IIC）電信與媒體論壇（TMF）

一、會議時間：2016 年 11 月 29 日至 11 月 30 日

二、會議地點：華盛頓特區 Verizon Communications 會議室

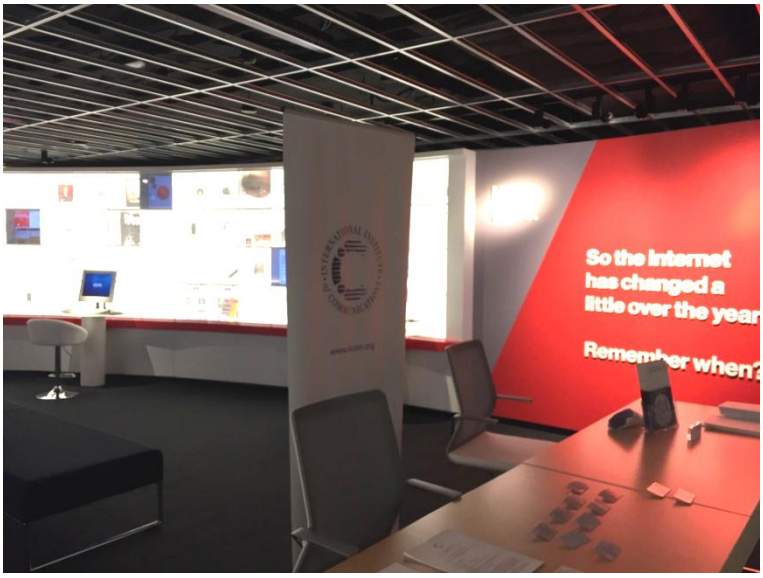
（1300 I Street, NW, Suite 500 East Washington, DC）

三、會議主題：技術進步及國際政治改變的影響（Implications of Technological Advancement and the Evolving Political Landscape Internationally）

圖表9：2016美國華府電信與媒體論壇

資料來源：IIC網頁

圖表10：電信與媒體論壇會場



四、會議議程：

（一）第一日（11 月 29 日星期二）

時間	議程
08：15	報到
09：10	歡迎致詞 IIC理事長**Chris Chapman**（澳洲ACMA前主委） Verizon Communications國際公共政策及規範事務處長**Cheryl Miller**
09：30	**議程一：** **轉變中尚待定義之科技：5G、IoT、AI及SDN** **為鼓勵創新並同時保衛關鍵系統及人民之必要措施為何？** Transformational, yet-to-be defined technologies: 5G, IoT, AI and SDN. What's needed to encourage innovation and at the same time safeguard critical systems, and citizens？ 主持人：Hogan Lovells US LLP 合夥人**Julie Brill** 與談人：Pew Center 網際網路科技研究總監**Lee Rainie** 美國聯邦公平交易委員會（FTC）委員**Terrell McSweeny** Verizon Communications聯邦及國際政府關係資深副總裁**Peter Davidson**
11：00	休息時間
11：15	**討論一** 技術的演進使傳統產業分裂或互相重疊，可能產生的政策、管制挑戰及機會為何？ As technology enables traditional industry silos to be broken down or overlap what policy and regulatory challenges and opportunities might arise？ 主持人：Hogan Lovells US LLP 合夥人**Julie Brill** 與談人：AT&T全球公共政策副總裁兼副首席隱私長**Jeff Brueggeman**

	Google公共政策經理**Sarah Holland** Facebook全球連接及技術政策**Dr. Robert Pepper** Oxera Consulting LLP資深顧問**Sumit Sharma**
13：00	午餐時間
14：00	**討論二** 檢視新興技術的破壞性潛力 －未來的應用、平臺、服務及裝置將如何趨動匯流通傳領域的需求？ Examining the disruptive potential of emerging technologies What are the future applications, platforms, services and devices that will drive demand in the converged communications field？ 主講人：Bell Labs總裁暨Nokia首席技術長**Marcus Weldon**
15：00	休息時間
15：15	**議程二：** **全球政策－本季重要會議之顯著成果及準備** Global policy – notable outcomes from, and preparations for, key meetings this quarter: ➢檢視之會議包含：國際電信聯合會（ITU）世界電信標準化會議WTSA-16、網際網路名稱與號碼指配機構ICANN 57、網路治理論壇IGF 2016 「實現包容及持續性的成長」 ➢在 WTSA 後，針對敏感性網際網路相關議題，如消費者保護、經濟／金融事務、命名及定址政策等，你期望 ITU 的作用為何？ ➢網際網路號碼分配局（IANA）管理權移交後，政府在 ICANN 及其政府諮詢委員會（GAC）或其他方面的作用？ ➢美國大選及英國脫歐公投後，美國與歐洲政府將對網際網路治理發揮什麼作用？ 主持人：Wiley Rein LLP律師**David A. Gross大使**（David A. Gross曾被小布希總統任命並由參議院一致同意為美國大使，並於2002至2008

	年期間率領美國代表團參與ITU及APEC等國際會議。） 與談人：美國國家電信暨資訊管理局國際事務副主任**Fiona Alexander** 華特迪士尼公司全球公共政策副總裁**Ellen Blackler** ICANN副總裁**Veni Markovski** Telefónica Internacional USA執行長**Alfredo Timermans** 美國國務院國際通傳及資訊政策資深副協調員**Julie Zoller**
17：30	第一日議程結束

（二）第二日（11 月 30 日星期三）

時間	議程
09：15	歡迎致詞 IIC理事長**Chris Chapman**（澳洲ACMA前主委）
09：30	主講人：美國聯邦通訊傳播委員會（FCC）主任委員**Tom Wheeler**
10：15	休息時間
10：30	**議程三：** **英國脫歐對跨大西洋ICT政策之影響** **－沒有英國影響之下，貿易、數位單一市場（DSM）及其他政策討論時的結構為何？英國存在與否之差異？** Implications of Brexit for trans-Atlantic ICT policy What is the texture of trade, DSM and other policy discussions without the influence of the UK position？ And by corollary, what might the UK do differently？ 主持人：Oxera consulting LLP資深顧問**Sumit Sharma** 與談人：美國副貿易代表**Robert Holleyman大使**（於2014年被歐巴馬任命） Akamai Technologies全球公共政策資深處長**Sanford C. Reback** EMEA Communications Law合夥人、Squire Patton Boggs (UK)

	LLP全球數據隱私及網路安全聯合主席、IIC處長**Ann LaFrance** Cullen International美洲通信、媒體及數位經濟主管**Elena Scaramuzzi**
12：00	午餐時間
13：00	**議程四：** **開放網際網路政策、付費優先、零費率及專業化服務－網路中立性政策是否已塵埃落定？** Open Internet policies, paid prioritization, zero rating and specialized services – Has the dust settled on net neutrality principles？ ➢討論：零費率及付費優先「完全不允許（never be allowed）」、「在某些情況下可允許（be allowed under some circumstances）」、「自由地允許（be freely allowed）」 ➢是否有在所有情況下均適用的答案？（Is there such a thing as a one-size-fits all answer？） ➢在什麼程度上，事前監管可以正確地辨別商業模式及作法，並且盡可能提高消費者權益及減少危害？ 主持人：喬治華盛頓大學法學院教授**Dawn C. Nunziato** 與談人：Wilkinson Barker Knauer, LLP合夥人**Russell P. Hanser** Cisco全球政府事務美洲地區副總裁**Jeffrey A. Campbell** Digicel Group加勒比地區首席顧問**David Geary** 烏干達通訊傳播委員會工程與通傳基礎設施處長 **Irene Kaggwa Sewankambo** Alliance for Affordable Internet研究經理**Dhanaraj Thakur** Brookings Institution技術創新中心治理研究研究員**Dr. Nicol Turner-Lee**
14：30	休息時間
14：45	**議程五：**

	美國選舉年對電信及媒體監理政策之影響 Election year – How might the telecom/media policy agenda for the new administration shape up, domestically and internationally？ ➢如果你打算向新政府提出建議，前五大優先事項是什麼？ 與談人：AJH Communications董事長、IIC美國分會主席**Andrew Haire** 墨西哥聯邦電信管理局（IFT）委員**Adolfo Cuevas Teja** Brookings Institution技術創新中心治理研究研究員**Dr. Nicol Turner-Lee** Verizon Communication聯邦及國際政府關係事務副總裁**Peter Davidson**
15：45	閉幕
16：00	本次論壇結束

五、會議重點：

（一）議程一：轉變中尚待定義之科技：5G、IoT、AI 及 SDN

（1）科技演進及數位信任

從200年開始到目前為止，已經觀察到三次重大的科技革命（technology revolution），而目前第四個革命正在進行中。

第一個革命是「網際網路和寬頻連接的興起」。這十幾年來，網際網路蓬勃發展，現在美國使用網際網路的民眾已經超過九成，家戶採用寬頻網路的普及率也已達到73%，隨著人們將網際網路逐漸融入日常生活中，例如利用網際網路使用社交媒體、蒐集資訊，人們的行為產生了重大的轉變，同時，也促使使用者可以接觸、連接到更多的人與媒體。

「行動連結力（mobile connectivity）的提升」則是第二個革命。近年來，智慧型手機及平板電腦快速普及，行動裝置已經成為史上成長速度最快的科技，目前有81%的成年美國人持有智慧型手機。行動裝置讓使用者可以很便利的在任何地方與他人聯繫、找尋需要的資訊、地圖導航、連接媒體，因此

行動裝置聯網已經逐漸成為人們生活中不可或缺的一部分。部分使用者甚至認為，行動聯網可以取代家用寬頻網路，目前約有13%的美國成人在家使用行動網路而非固網寬頻服務；但是，行動裝置有其侷限性，舉例來說，工作時使用桌上型電腦或是筆記型電腦仍然較為便利，因此，行動裝置及行動網路的快速發展預估不會對固網寬頻產生太過巨大的影響。

第三個革命為「社群媒體（social media）的蓬勃發展」，臉書（Facebook）、推特（Twitter）、Instagram及Pinterest等的崛起，徹底改變了社交媒體的模式。現在，每個用戶都可以發表或廣播自己喜歡的內容，這些民主化的社群媒體讓人們可以輕鬆地尋找到志同道合的夥伴們，並促使許多組織的形成，大家可以在組織中分享彼此的想法、熱情及生活方式。

目前超過三分之二（約有69%）的美國成人使用網路社群媒體，其中臉書是最主要被大家使用的平台，約有68%的美國人擁有臉書帳號，而人們有其他需求或目的的時候也會使用其他社交平臺，過半數的人會使用多個平臺。根據統計，使用Instagram、Twitter、Pinterest等平臺的美國人約為20%至30%，也就是說，這些平臺與臉書的使用率（68%）仍有極大的差距，但是人們會觀察、思考並選擇，要在那一個平臺、對那些人、發表什麼意見，因為每一個平台都有其特別關注的事項（例如：Twitter較常被使用來討論公共、政治等方面的議題）。

目前正在進行的第四個革命則是「物聯網（Internet of Things，IoT）的興起」，物聯網的概念是讓所有的物體都可以連接到網際網路，連網的物品可以創造並捕捉到許多新的資訊，而這些資訊就是「大數據（Big data）」的源頭。

據預估，到2020年全球將有380億的聯網裝置，而至2019年，連網裝置每年將可產生500ZB（zettabytes）的數據，這些數據的出現將改變人們解決問題、探索世界、了解環境變化的方式，未來將有機會創造出更好、更便宜、更個人化的產品。因此，物聯網在未來的10年中，將使醫療照護、社會結構、就業、組織活動產生劇烈的影響，甚至將促使新的工作、商業模式、企業、產業的興起。

圖表11：議題一綜合討論

寬頻服務的普及，行動連結力的提升，物聯網的發展，促使數據與日常生活緊密結合，但是這也對社會發展產生了許多改變並造成新的問題。

目前，仍然有大約10%的美國人無法連接到網際網路、27%的美國家戶無法使用寬頻網路服務，由此可以，數位落差仍然存在，如何促使所有人皆可接取網際網路一直是全球各國不斷努力的目標。另外，即便是已經可以連接網際網路的人們，仍約有半數的使用者（大多數為中老年人或低收入戶）尚無法快速、正確、有信心的使用數位裝置連接網際網路蒐集資料或達成其他目的，也就是說，不是所有使用者都已經準備好迎接數位生活，提升數位準備（digital readiness）及提高使用者的數位素養（digital literacy）仍有許多努力空間。

網際網路的發展對許多既有的產業造成巨大的衝擊，舉例來說，新聞媒體的商業模式出現了大幅的變化、新的分析及診斷方式促使醫療技術快速進步，因此，產業衝擊也進一步創造了許多高階的工作機會。現在，大部份的企業為了跟上科技變化，必須投入更多的人力及時間觀察產業趨勢的變化，並且學習、思考如何將這些新技術運用來加強工作模式。

另一方面，隨著科技快速進步及物聯網的發展，使用者被蒐集的個人資料亦隨之增加，這些資料具有許多正面的能量，但同時也造成人們對隱私保護（data protection）的擔憂，甚至有可能因為對線上個資保護的疑慮而造成

消費者不願意接受及使用新技術或服務。

根據美國國家電信資訊管理局（NTIA）公布的資料，在美國有84%的家戶對線上個資保護及網路安全表達了擔憂，也有45%的網際網路使用者會因為網路安全的因素而避免使用線上的產品及服務。因此，如何讓使用者可以很信任地使用數位服務是世界各國均面臨的重大議題。

大多數的網際網路使用者並不清楚個人資料如何被蒐集，蒐集的範圍，以及這些資訊如何被利用，也導致使用者對網際網路的個資安全及保護嚴重缺乏信心，而且根據統計，年輕人往往較年長者更注重隱私保護的議題，因為他們更清楚地了解個人訊息有可能被線上的服務提供者蒐集與利用。因此，個人資料保護中最重要的即是資訊透明及公開，消費者有權知悉其個資如何被蒐集與使用。

線上個人資料保護及網路安全是一個跨領域的複雜問題，需要個資保護主管機關與其他相關機關共同合作，持續關注、研究消費者個資和網路安全等議題，同時，也建議各國應制定整體性的的數據安全法制規範，以確保消費者的數位信任（digital trust），並提高政府效率。

（2）技術的演進產生的商業機會及管制挑戰

近十年來，網際網路、人工智慧（AI）蓬勃發展，逐漸改變我們的生活方式，目前人工智慧已經廣泛運用在醫療診斷、天氣預測、智慧運輸等方面，人們也因此而享用許多個人化的服務，生活變得也更為便利。對現在的人來說，使用智慧型手機連接網際網路，接收各種資訊是一件稀鬆平常的事，大家已經很難想像沒有這些高科技服務、產品的日子。而科技產業為了提供人們更便捷、舒適的生活，仍然不斷推出各式各樣的創新應用服務。

Google近年致力於發展「機器學習（machine learning）」。機器學習是人工智慧的一個分支，其目的是希望機器具有具備自我改進能力，讓機器透過各種樣本與案例（大數據）自動學習、尋找規則，並透過經驗自動最佳化下一次結果。簡單來說，機器學習就是讓機器學會自動的幫助人們完成需要

花費很多時間的瑣碎流程，進而可以更快速地達成工作目標，目前包括Google 搜尋、Google相簿（人臉辨識）、Google翻譯（語音、圖片辨識）、Gmail（垃圾郵件過濾）都已經運用機器學習的技術來提升品質。

舉例來說，Google的相簿不單純只是一個存放圖片的雲端空間，它還具備了分析檔案的智慧服務。早期，我們上傳檔案後必須自行將照片標註上出現的人物，系統經過多次的學習之後開始可以辨識常出現的人臉，但是有時候還是會有辨識錯誤的問題，如今，Google相簿除了可以明確辨認出一個人的各種樣貌外，還提供了照片分類及自動搜尋等新功能。

另外，Google翻譯也是一個很熱門的功能，根據統計，現在每天有5億的全球使用者，在103種語言之間進行10億次的翻譯，而這個數字仍然不斷在快速上升中。翻譯功能除了讓所有人可以便利地在全球旅遊外，對於資訊流通更是重要，以前我們可以在網際網路上獲得全球的資訊，但可能因為語言的因素而無法理解、使用，而線上翻譯工具的出現讓這個難題迎刃而解。近幾年，Google翻譯更推出了「自動口譯」及「圖片翻譯」等功能，現在，出國旅遊要點餐的時候，只要用智慧型手機的相機對準菜單，Google翻譯就可以立即掃描文字並將之轉換為使用者想要的語言，而且因為機器會不斷學習，翻譯結果的錯誤率也已經大幅下降。

機器學習可促使各行各業更容易、迅速達成目標，因此，Google為了鼓勵大家使用機器學習，也已經開放機器學習標準系統「TensorFlow」的原始碼供各界運用，例如，日本一個種黃瓜的農場，就將該系統運用在篩選黃瓜的賣相，也有些醫療研究單位已經開始使用TensorFlow系統分析帕金森氏症（Parkinson's disease）。

換句話說，機器學習就是讓機器不斷地從數據中學習及修正錯誤，最終用來提供人們更便利的服務，同時，因為機器不斷的最佳化，數據中心也可以大幅地達到節約能源的效果。

而臉書（Facebook）近年的商業模式，則更重視「連接性（connectivity）」因而致力於讓每一個人都有機會使用網際網路服務，尤重於促使那些尚無法

連結到網際網路的40億人口獲得連接網路的機會。臉書自2013年推出全球連網計畫，為新興國家的民眾提供網際網路連結及低價的智慧型手機，以提升全球上網普及率。

圖表12：議題一討論一綜合討論

但，伴隨科技快速發展、創新服務的興起，電信產業的商業模式也出現了巨大的改變。過去，電信業者的商業模式來自於傳統語音電話的成本，通話時間、通話距離、所在位置都會影響話務的成本，因此會有不同的費率，而這一套模式目前已經不適用於寬頻網路世界。現在，電信業者提供的服務是連接網際網路的能力（connectivity），計費的基礎也從分鐘數轉變為頻寬（bandwidth），而網路的成本也與時間、地點、距離無關。

電信產業的商業模式，由傳統語音服務轉向寬頻數據服務。現在，電信業者的資費方案多以數據流量做為計費基準，再額外贈送用戶語音及簡訊服務。消費者透過寬頻網路，可以連接到網際網路使用多元化的線上創新服務，也導致電信營收逐漸轉移至線上服務，因此，如果電信產業無法適時調整其營運模式，又仍持續受制於主管機關之傳統高強度管制，而無法與新興網路服務提供者（如Google、FB）競爭，將導致傳統電信產業逐漸淪為單純傳輸數據的笨水管（dumb pipe）。

面對數位匯流的時代，傳統垂直、穀倉式的管制模式（regulatory silos）已逐漸無法因應匯流時代的需求。舉例來說，在美國如果連網車輛（connected car）使用電信業者（如AT&T、Verizon）的熱點連接網路時出了問題，負責

單位是美國聯邦通訊傳播委員會(FCC);若是聯網車輛使用的Google或Apple系統有異常，則應該去找美國聯邦公平交易委員會（FTC）；而若是車輛本身蒐集的數據產生問題，則是由運輸部門負責。

再者，用戶被蒐集到的資訊，會在很多不同裝置、應用程式（Apps）及應用系統（Operation system，如Andriod、iOS）中相互傳輸，因此要明確的用傳統穀倉的管制思維將這些資訊分類，並尋找到正確的機關來負責、處理問題，幾乎是不可能的事。

隨著5G、SDN網路、物聯網（IoT）的興起，觀察市場及產業發展趨勢，以「水平管制」的思維，並思考如何促進市場公平競爭、保護消費者權益、建立數位信任，建立適用於所有的IT產業的一致性匯流法制架構，是全球各國監理機關刻不容緩的工作項目，舉例來說，美國聯邦公平交易委員會(FTC)近期建立的隱私架構就是一個很好的匯流架構範例。

但同時，監理機關也應該體認到，大部分的創新服務都尚處於起步階段，商業模式仍未確定，監理機關為保障消費者權益及網路安全，建立原則性的規範是有必要的，但仍應給予產業適度的彈性，若對其施予過度的管制，或以公平競爭的名義要求新興服務適用既有的電信管制架構，將可能妨礙創新服務的發展。

產業的發展永遠會走在監理模式的前面，因此，建議監理機關可以透過論壇的方式，加強與私人企業的合作、交流，藉由企業專家說明科技發展、產業趨勢及服務規畫，管制者及決策者方能跟上發展趨勢，並做出正確的政策及監理決定。

（3）檢視新興技術的破壞性潛力－未來的應用、平臺、服務及裝置將如何趨動匯流通傳領域的需求？

科技的發展，源自於人們的需求。因此，產業界在預測未來十年的趨勢時，首先思考的是人們從現在開始的十年內會有什麼需求，接下來才是考量要達成這個目標是否有技術上的困難，而面對這個問題該如何解決。

可以想像，未來的十到十五年，全球將嘗試建立一個全新的數位結構（digital fabric），不單純指網際網路，也包含了平臺、系統及應用服務等，這個數位結構包括所有事物的自動化，而自動化的目的是幫助我們創造更多的時間，這就是我們及將踏上的「科技革命（technology revolution）」時代。

圖表13：Bell Labs總裁暨Nokia首席技術長Marcus Weldon技術變革演講

在經濟學上，科技革命的必要條件是「新系統及技術的相互連接（interconnection of new systems and technologies）」，而「對社會及經濟產生深度的轉變（capacity to profoundly transform economies and society）」則是科技革命的充分條件。而就目前的觀察，網際網路將是促成下一階段科技革命的技術，可能有很多人會說網際網路已經不是一個「新」技術，但是其實網際網路除了我們現在使用的功能（搜尋資料、收看數位內容等）外，還有許多發展的潛力。

圖表14：科技革命列表

Tech. Revolution	Enabling Technology	Connectivity
Financial (1600 – 1740)	Stocks & Bonds	Banking & Stock Market Infrastructure
1st Industrial (1780 – 1840)	Steam Engine & Iron Production	Rail and Shipping Networks
2nd Industrial (1880 – 1920)	Steel & Chemicals	Extended Transportation Networks Networks
Scientific-Technical (1940 – 1970)	Analog & Digital Signal processing	Digital Communications Networks
Information (1985 – 2015)	The Web, Cloud computing & Mobile	Internet & Broadband Access
Automation of Everything (2015 –)	Digital interfaces & Data analysis	Future X Network

We are here

資料來源：主講人Marcus Weldon之簡報（詳附件）

從17世紀至今，已經經歷了五次科技革命。第一個革命是利用股票及證券交易貨物造成的「金融革命」，接下來的是兩次「工業革命」，鋼鐵及石化工業的出現讓我們可以生產鐵軌、船舶、引擎、塑膠等，而這兩次的工業革命也促使生產力的大幅增加；1940年代開始，「科學技術革命」及「資訊革命」相繼發生，人們開始使用類比及數位訊號傳送數據位元（bits），造就了網路、雲端（cloud）、行動裝置的誕生，並透過網際網路及寬頻將所有的技術連接在一起。

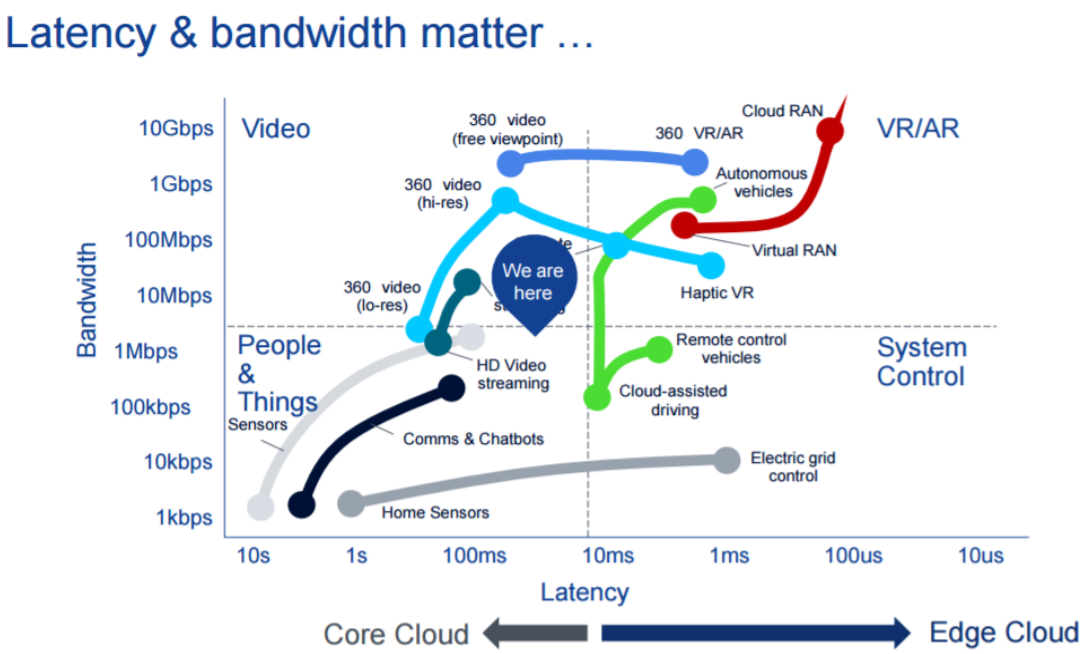
而現在即將邁入的下一個科技革命「物聯網」。我們希望可以讓所有的東西連接數位介面，不只是讓使用智慧型手機的人可以連接網際網路，而是物品本身就是一個數位感測器，這些物品包括道路、橋梁、汽車等。另外，為了處理、分析無所不在的感測器蒐集的大量數據，人工智慧（AI）及機器學習（machine learning）是有必要的，因此我們需要建立一個高度分散（highly distributed）、極小延遲（latency）、極大容量的「未來...網路（Future...Network）」。

伴隨前述科技革命的發展，人們與科技不斷結合，智慧型機器人協助人們更快速地達成工作並節省時間，雖然人類實際的生產力下降，但整體生產力卻持續提升。

當所有東西都可以連網時，將使數位系統、商業模式、產業動態產生許多的改變，而「消費者不再是產業發展的驅動者」將是其中一個最重大的改變。在過去20年，我們持續致力於提供消費者更好的使用經驗，因此，我們不斷增加頻寬以提供語音、視訊及娛樂服務，而這也驅動了行動網路及寬頻服務的快速發展，但是未來將不再是如此，改由「產業將自行驅動產業的發展」。

消費者在乎的是終端是否可以接收到他需要的資訊，而產業關注的則是關鍵任務是否可以被達成，因此延遲及頻寬保證將更加重要。為了讓消費者可以平順使用視訊服務，我們已經建立了一個延遲為100毫秒、頻寬為10Mbps的網路，但若要供產業使用，網路的延遲必須降低至1毫秒，並且提升頻寬至1Gbps。

圖表15：延遲與頻寬的影響



資料來源：主講人Marcus Weldon之簡報（詳附件）

就光的速度來說，延遲有100毫秒時，光可以來回一萬公里，也就是說我們可以在容許的延遲內取得一萬公里外的網路服務；然而，當允許的延遲只有1毫秒時，光只能來回100公里，因此需要取得的資訊必須設置在100公里之內，而這就是「雲端（cloud）」存在的原因－讓資料距離使用者更近以減少延遲。另一方面，可用頻譜的日漸短缺，因此，提升頻寬至Gbps等級需要採用新頻段，這也是「5G」的開始。

談到延遲，一般而言人們可以感知到的最小變化約為100毫秒（比100毫秒更短則無反應），然而，人在移動頭部時眼睛隨之移動的前庭眼反射（Vestibular-ocular reflex）的反應時間約為7毫秒，因此，蓬勃發展中的虛擬實境（VR）、擴增實境（AR）首要解決的暈眩問題（眼睛沒有跟上大腦的節奏），就是要讓網路的延遲小於7毫秒。然而，如前所述，1毫秒的延遲代表提供的VR及AR只能位於100公里內，若是如此則虛擬實境運用在遠距教學、遠距手術的程度將被大幅限制，因此，建立一個低延遲的雲端網路是必然的趨勢。

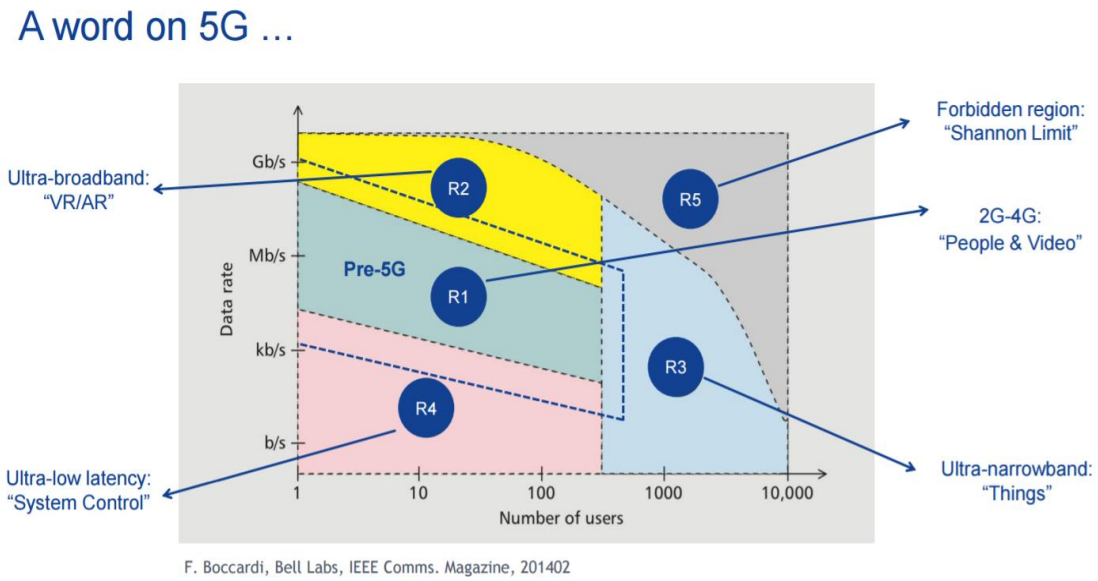
另一方面，根據預估，截至2017年底每個美國人每月平均使用大約92GB

的流量，而伴隨的虛擬實境的發展，在未來的幾年之內，網路的流量將會成長幾十倍。透過電視或電腦螢幕收看視訊時，我們大約可獲得30度的視角，但是透過虛擬實境所獲得的視角可以是180度，甚至到達360度，因此顯而易見，當虛擬實境娛樂越來越普及，隨著同時使用人數的上升，頻寬的需求也將會暴增。

因此，簡單來說，在未來的十年內，我們將致力於擴充大約100倍的頻寬容量，並且降低100倍的延遲，而這也就是5G的核心。

貝爾實驗室早在2010年就已經開始思考5G的發展方向，據預估，5G大約可以在2020年開始商轉，至目前為止我們處於下圖R1的位置，行動網路已經建設完成，提供用戶使用大約數十Mbps的服務，而這就是我們所謂的2G到4G行網服務；下一步，我們的努力的方向是將網路結構由集中式轉變為高度分散，由核心雲（Core Cloud）轉變為邊緣化雲（Edge Cloud），以達成大幅降低延遲時間的目的。

圖表16：5G的發展



資料來源：主講人Marcus Weldon之簡報（詳附件）

另外，網路接取結構也將需要有所改變。邊緣化雲端將是我們操作控制平台及應用的中心，因此它必須是個聰明的網絡，允許動態適應不斷變化的模式，而網路也必須是可編程的（programmable），當人們需要特殊服務的

時候可以立即有所回應。除此之外，因為將由無數未經認證的裝置可以連接到網路，因此建立網路安全系統亦相當重要。同時，該網路也將有一個知識學習系統，透過機器學習、分析網路流量，並允許網路的流量回饋通知應用程式，用來幫助消費者及企業節省時間。

雖然消費者不再是帶動發展的源頭，但消費者仍然可以從中獲得利益，舉例來說，自動車(autonomous vehicles)的發展是為了改善及優化交通問題，讓產業更有效率，但是消費者仍然可以從中獲益，因為仍然是人們坐在自動車裡面。因此，在科技不斷解決產業問題的過程中，消費者一直都是最終的受益者。

雲端及5G是將是未來十年的兩個重大的改變，而軟體定義（ software defined）及虛擬化（virtualised）將是未來的趨勢（軟體定義可以讓不同機器適應不斷變化的需求，虛擬化基礎設施則可以讓網路更具彈性），而其目的都是為了擴展現有網路，支援數以萬計將連接到網際網路的裝置，並協助解決產業的問題。

從根本上說，我們將建立一個全新的網路，具有更低的延遲及更大的容量，並透過預測及自動化節省及創造時間，提高生產效率，同時並利用個資保護及網路安全增加消費者信任。

（二）議程二：重要會議之顯著成果及準備

國際電信聯合會（International Telecommunication Union，ITU）的世界電信標準化會議(World Telecommunication Standardization Assembly，WTSA）、網際網路治理論壇（Internet Governance Forum，IGF）及網際網路名稱與號碼指配機構（Internet Corporation for Assigned Names and Numbers，ICANN）會議等國際會議是全球重要的政策溝通平台，各國政府可相互瞭解所重視的議題並交換意見，同時，因有許多私人機構亦會一同參與會議，使公、私雙方可互相交流彼此想法及立場，達成多贏的局面。

目前，針對消費者個資保護、頻譜管理、網路安全、內容管理及OTT服

務之管制等議題，都仍在各國際會議中持續熱烈討論中。近期舉辦之重要會議包含2016年世界電信標準化會議（WTSA－16）、網際網路名稱與號碼指配機構ICANN第 57次會議及網路治理論壇（IGF）2016年會議等。

圖表17：議題二綜合討論

世界電信標準化會議（WTSA）每四年舉行一次，主要目的是持續推進國際電信聯合會的標準化工作，並確定國際電信聯合會電信標準化部門（ITU－T）下一階段的策略方向及研究專家小組團隊，以支援全球政府、產業界、學術界實現其ICT推展目標。

2016的WTSA－16於10月25日至11月3日於突尼西亞的哈馬馬特（Hammamet）舉行，約有千名來自92個國家的專家學者出席。隨著技術進步和市場發展需求，各國代表團鈞認同第五代行動通信（5G）技術標準的制定是ITU－T今後的工作重點之一，同時各國應持續並擴大推展超高速傳輸網路，以作為未來物聯網、電子商務、遠距教育、智慧城市發展的基礎，而ITU則鼓勵已開發國家可將技術轉移給發展中國家，以縮小全球的標準化差距，使更多人享受到資通訊技術發展帶來的便利性。另外，參與者亦呼籲，ITU應持續鼓勵及推動數位金融包容、可負擔的行動漫遊費率、消費者保護、確保ICT服務品質等項目。

網際網路域名地址分配機構（ICANN）於1998年成立，主要由網際網路協會（ISOC）的成員組成，由美國商務部電信暨資訊管理局（NTIA）委託

ICANN 負責管理域名及IP位址的分配等任務，但NTIA仍保有決策的最終權力，因此長久以來被許多與美國敵對的國家批評美國可以掌控網際網路。而為達成網域名稱系統（DNS）控制權私有化，美國商務部NTIA於2016年10月1日正式將網際網路號碼分配局（IANA）的管理權移交給ICANN，轉型為「多方利益者」（Multistakeholder Model）模式，由全球各方利益相關團體彼此協調，制訂符合各方利益所需的機制，這也代表網際網路邁向全球共治的時代。

IANA管理權移交後的首次ICANN會議（ICANN第57次會議）於2016年11月3日至9日在印度海德拉巴（Hyderabad）舉行，約有三千多名代表參與，打破了ICANN與會人數的記錄。於會議上，各方代表均同意ICANN應團結一致，確保沒有任何的政府、組織、或利益集團會控制網址及域名的管理工作；除針對管理權移交等相關事項外，會議的主要目的仍是之前政策協調工作的延續，包含頂級域商標和品牌名稱權利保護機制、新通用頂級域名的國家地區代碼等議題。另外，ICANN第57次會議也舉辦了許多技術及政策研討會交流活動，討論議題包含網際網路治理、網路安全中的DNS安全、網路內容管理、隱私及個資保護問題等。

為了加強全球各利益相關方在公共政策及網際網路治理的交流與合作，聯合國從2006年開始，於每年最後一季舉行為期四天的**網路治理論壇（IGF）**，邀請全球各領域不同團體代表參加，藉由政策對話論壇的模式，討論網路網路治理相關議題，包含資訊安全、網路人權、關鍵資訊基礎建設、資通訊技術應用、網際網路永續穩定發展等議題。隨著參與IGF的人數與組織逐漸增加，議題也漸趨地區化，因此，區域型態的網路治理論壇也逐漸形成，如亞太區域網路治理論壇（APrIGF）、歐洲網路治理歐洲對話（EuroDIG）等。

IGF跟某些聯合國單位相同，雖然沒有政策的最終決策權，但它是一個讓多方利益相關者可以聚集在一起討論重要網際網路議題的平台，旨在收集並促使公、私部門關注在全球策略討論中容易被忽略的聲音，同時尋求達成對網際網路運用及未來挑戰的共識。

2015年的IGF於11月於巴西若舉行，約有超過2500位來自全球的企業、

政府、專家學者及公民團體參加。國際網際網路協會（ISOC）並藉此機會呼籲全球共同採取行動，推展網路至無法接取網際網路服務的地區，達成人人皆享有網路的理念，另外，伴隨網際網路發展，網路安全及個資問題也層出不窮，如資料庫外洩、企業非法使用個資等，造成人們對網路的信賴不斷降低，因此重新建立消費者的數位信任亦是當務之急。論壇亦涵蓋數位經濟、網際網路的多元開放性、強化多方利益相關者合作等議題。而2016年的IGF將於12月7日於墨西哥舉辦，以「保護網絡文化多樣性，促進交流」為主題，將尋求網路文化保護的新方法，並探討國際網路文化交流的方向。

重要國際會議是一個重要的交流平臺，處於現今這個充滿新契機的網路社會，全球各公、私部門均應以開放的心態與各方利益相關者相互交流，開拓視野並正式面對網際網路發展帶來的挑戰。

（三）FCC 主委 Tom Wheeler 演講

在21世紀，我們已經佈建了幾乎無所不在的有線及行動網路，並且讓智慧型手機快速普及，使所有人可以在任何地方、任何時間發揮自己的創造力。然而，行動網路的未來並不止如此，達成超高速（high speed）、高容量（high capacity）、低延遲（low latency）、安全的行動網路仍然是我們持續追求的目標，而這些也就是5G的特性。

因為前述特性，5G將可運用來實現智慧城市、智慧運輸、遠距醫療、遠距教學。到目前為止，我們已經確定5G網路必定會具有的特性，並觀察到很多發展的契機，但如何讓行動網路如何轉變到5G、物聯網將如何實現，都仍然尚未得到解答。

高速及低延遲將對現實世界的許多行為產生巨大的影響，美國無線產業協會（CTIA）做了一個有趣的實驗，以無人車（autonomous car）為例，命令一輛使用4G網路的無人車停止，該車將需要大約4.6英尺的距離，而若無人車使用的是5G網路，則只需要1英寸即可停下來，如此將可避免碰撞及降低事故的發生率。

圖表18：FCC主任委員Tom Wheeler演講5G發展測略

5G的發展策略將包含三個部份，充足的頻譜資源、持續佈建基礎建設、強化網路安全。

首先，5G具有高速傳輸的特性，因此必須確保5G技術有足夠的可用頻譜，FCC持續進行低、中、高頻譜整備，如以具誘因式競價（incentive auction）收回較沒有效率使用的廣播頻段，而目前已經確定5G將採用毫米波（millimeter wave，mmWave）頻段，並開放極大的頻寬，藉由明確的政策引導，帶動技術研發及產業投資方向外，亦可驅動新興創新通訊模式的發展。但是，作為一個政府機關，我們必須深切的了解，應由技術推動政策，而不是政策驅動技術演進，因此，監理機關應提供充足的頻譜，然後由私部門自由的發展，尋找最適合使用的頻段及技術標準；同時，未經許可的頻段（unlicensed band）將在5G網絡中發揮關鍵作用，因此監理機關亦應將之納入規劃思考。開放充足、彈性使用的頻譜，鼓勵、保護創新驅動的競爭，並降低參進障礙，吸引更多新進業者進入，促進市場有效競爭。

談到具誘因式競價，第三階段反向競價的結果將在近期揭曉（廣播業者回收1800MHz頻段可以得到多少補償），下一部將進行由行動業者出價的正向競價，若失敗則將進入第四階段的競價程序。而FCC仍須等待最終競價結果，才可確認具誘因式競價的成敗。

基礎建設亦是5G發展的關鍵之一。我們已經知道，5G將採用高頻段的頻率，而因為高頻段無法傳送遠距離的特性，小細胞基地台的數量需求大幅增加，可能達目前的十倍或是更多。目前，美國的小細胞基地台數量大約為20萬，而在5G的網路下，則約需要幾百萬個基地台，也就是說，行動業者將需要佈建數百萬支的天線，而如何鼓勵投資，並透過公、私合作加速基地台的部署，是政府機關應仔細思考的問題。

另外，這些小細胞基地台將需要相互連接，因此我們需要更穩定、完整的回程網路（backhaul）支援，回程網路的佈建成本相當高（一般而言約為營運成本的30%），因此，如何讓所有行動業者均可以合理價格租用大型業者的回程網路，將是監理機關的另一個挑戰。

5G的第三個發展策略是確保網路安全。眾所周知，5G是發展物聯網（IoT）的基礎，未來將有數以萬計的裝置（低成本的消費產品佔其中一大部分）連接到5G的網路，然而根據最新的研究顯示，物聯網裝置平均在連接到網際網路後的六分鐘內會遭受惡意病毒的攻擊，因此網路的穩定與安全性在5G時代將更加重要，政府部門、電信公司、設備製造商、專家學者應緊密合作並制定相對應的網路安全標準；但同時，5G的來臨，也是一個帶動整體網路安全產業的發展契機，全球各公、私部門均應利用這個機會重新深度思考如何消除人們對於網路安全的疑慮。

5G就像是缺少一塊拼圖的未來行動通訊藍圖，但是我們已經可以預測5G將帶來巨大的商業模式及創新服務轉變，而監理機關需要做的就是以輕撫（light touch）的管制思維，確保技術的演進不會降低市場的有效競爭。

演講的另一個重點是關於普及服務（accessibility），建構無障礙的通傳環境。

根據統計數據，目前約有五分之一的美國人（約5300萬）有某方面的障礙（disability），而現在我們擁有如此優質的數位技術，可以幫助這些身心障礙人士面對、對抗他們的挑戰，協助他們獨立生活、接受教育、與親友溝通、尋找理想工作，不僅是為他們帶來收入，更重要的是透過社會參與，幫

助他們找到個人的價值。

近年來FCC持續致力於推動無障礙通傳服務，包括改善視訊的同步字幕功能、傳訊息緊急求助（text-to-911 calls）等，讓聽障及視障人士透過數位工具可以獲得與一般人相同的服務。

另外，經過多年的嘗試，虛擬實境（VR）已經從實驗室走入我們的生活，甚至不再只是提供娛樂應用。已經有成功案例顯示，虛擬實境可以利用於教導自閉症幼童過馬路，或是幫助中風患者恢復認知，而隨著5G的持續發展，虛擬實境的應用可能性亦將大幅增加。

多年以來，身心障礙人士透過輔助技術以獲得與一般人相同服務，這些輔助方法通常很昂貴，也不一定有效，除了可能會造成自卑的心態外，他們亦無法享受最新的創新技術。隨著軟體技術的演進及應用程式的發展，這些現象都將獲得改善，現在，客製化的數位裝置（customize devices）可以滿足身心障礙人士非常具體及個別的特殊功能性需求。

因此，如同前面提到的網路安全，物聯網及5G的發展亦是無障礙通傳環境發展的契機，落實、達成無障礙的數位網路，讓數以萬計的消費裝置具有無障礙服務是目前的重要努力目標。

因此，FCC於兩年前成立了身心障礙諮詢委員會（Disability Advisory Committee），聚集近40名電子產業、電信公司、消費者代表、專家學者一起討論這些無障礙化議題。而2016年9月，該諮詢委員會批准了一個最佳實踐方案，鼓勵企業與認知障礙患者及相關組織合作，確實理解他們的需求，並將這些需求納入產品開發的考量因素，以確保認知障礙患者也可以使用新興的通傳產品及服務。

然而，我們並不能僅依靠數位技術的進步來協助身心障礙人士提升生活水平，更重要的是提供他們工作機會。FCC作為一個成功的範例，目前已經雇用六位有智能障礙的新員工，他們在接受培訓及教育後已經可以達成自己的工作，並且也不斷的進步，而目前FCC亦推薦其他聯邦機關共同加入雇用身心障礙人士的行列。

現在，正是應該有所改變的時代，我們應認真思考如何利用創新科技及技術演進帶來的契機改善人們的生活及工作。

圖表19：FCC主任委員Tom Wheeler演講無障礙近用

（四）議程三：英國脫歐對跨大西洋 ICT 政策之影響－沒有英國影響之下，貿易、數位單一市場（DSM）及其他政策討論時的結構為何？英國存在與否之差異？

在2015年英國大選後，卡麥隆首相為兌現競選時的承諾，於2016年6月23日舉行公民投票，以決定英國是否繼續留在歐盟。脫歐公投的投票率約達72%，其中近52%的投票者支持脫歐，而留歐支持者約佔48%，相差達120萬票。因此，英國接下來將與歐盟展開為期兩年的協商，討論脫歐的相關細節。

根據最新統計數據顯示，歐洲目前是全球第二大線上B2C（Business to Consumer）電子商務區域市場，僅次於亞洲地區；就個別市場而言，全球前五大電子商務市場分別是美國、中國大陸、英國、日本及德國，由此可見，英國不論是對歐盟或是全球的電子商務市場，皆有舉足輕重的地位，因此，脫歐行動將造成歐盟的電子商務市場大幅縮小，並且一定程度的影響歐盟的數位市場影響力。

前幾年，為消除歐盟成員國間的數位障礙，並擴展跨境電子商務的經濟效益，歐盟執委會於2015年5月公布的「數位單一市場（Digital Single Market，DSM）」計畫，以弭平區域間藩籬為目標，創造一個開放、公平、無縫的網絡環境，讓歐盟的創新科技可以自由拓展市場，並使境內5億的消費者可以選擇所有歐盟國家提供的線上產品及服務。

然而，英國脫歐後是否仍留在歐盟數位單一市場中仍有待觀察，後續發展結果將產生不同的影響，而影響的程度將取決於英國脫歐的形式，這一部分到目前為止尚未有結果。若徹底脫歐，英國將不再適用歐盟數位單一市場帶來的優惠，數位行銷與科技產業的優勢將大幅降低，而許多設立於英國或與英國來往的企業將受到嚴重影響，其中跨國科技公司預計將受到最強烈的衝擊。

另外，許多現行在歐盟數位單一市場實施的措施，例如降低漫遊費率、市場主導者（SMP）的認定及預防濫用市場力量的矯正措施等，是否持續適用於英國電信產業及用戶將有待觀察。

不論英國是否以某種方式維持與歐盟之間的夥伴關係，未來其他各國與歐盟之間談判合作時，是否須將英國納入考量將是一個不確定的因素，因此國際合作情況勢必將更複雜與困難。

但是，從另一個觀點來說，英國也不用過於悲觀。過去，在視聽媒體服務管制的想法上，英國就曾與其他歐盟會員國有所不同，舉例來說，法國想課予服務提供者一些本國文化保護的義務，然而，英國身為視聽媒體服務輸出的大國並不認同這類型的措施。脫歐後的英國政府將不再受限於歐盟的通傳管制架構，將取得對所有通傳政策的自主權，包括對OTT等新興數位服務的管制措施，相信英國政府將可自行提出更具開放性、競爭力的策略。

英國官員已於2016年10月的歐洲高峰會上表示，脫歐沒有回頭路，英國也不會舉行第二次公投，雖然這是一個艱難的挑戰，但將會以開放、建設性的精神與歐盟各國持續協商、談判，並強調英國在完全脫離之前，仍將完全參與歐盟所有活動，而脫歐後亦將與歐盟建立堅強的新夥伴關係。

圖表20：美國副貿易代表Robert Holleyman發表演說

另外，即便英國與歐盟各國的脫歐談判不順利，未來，英國亦可與美國、中國大陸等國家尋求其他國際合作模式，並與新興國家建立新的友好關係。

美國副貿易代表Robert Holleyman大使亦表示，不論英國脫歐將造成什麼影響，美國期望面對國際合作時，仍將持續維持開放的態度，並導入競爭的觀念。未來，美國將透過世界貿易組織（WTO）及亞太經合組織（APEC）等國際性組織，闡述對電子商務、降地關稅壁壘、促進數位自由流通等方面的主張，並爭取其他國家的支持，並將把美國對跨太平洋夥伴關係（TPP）的部分主張，於跨大西洋夥伴關係（TAP）中與歐洲各國進行協商。

面對英國脫歐及美國總統大選後的改變，目前的數位通傳環境充滿許多的不確定性，因此，全球各國均應以開放、創新的心態，來討論未來可能面對的挑展。

（五）議程四：開放網際網路政策、付費優先、零費率及專業化服務－網路中立性政策是否已塵埃落定？

隨著數位匯流時代的來臨，各式各樣的新興應用服務及線上隨選視訊蓬勃發展，消費者對於數據頻寬的需求日益增加，而基礎建設的佈建及演進尚不足以面對流量不斷攀升的情況，因此，網際網路服務提供者開始採取一些

網路流量管理，以解決日漸嚴重的網路壅塞困境。

而「網路中立性（net neutrality）」的概念則認為，網際網路是一個自由、開放、中立的平臺，各種線上的內容與服務均應受到相同的處理，才可以讓網際網路發揮其價值，而近年來，網路中立性的原則也越來越受到消費者、網際網路服務提供者的關切。

為保障自由與開放的網路，美國歐巴馬總統於2014年公開支持網路中立性政策，美國聯邦通訊傳播委員會（FCC）並於2015年發布規範的具體細節，該網路中立性規範包含以下三個重要原則，並將之落實於寬頻服務業者的管制措施。

1.不封鎖（no blocking）：禁止對合法的內容、應用、服務、裝置進行封鎖。

2.不延宕（no throttling）：禁止對合法的網路流量進行干預或調控。

3.禁止付費優先（no paid prioritization）：禁止在收費的基礎上給予部分網路內容的傳輸優先待遇。

換句話說，網路中立性原則要求網路服務提供者應公平對待所有網際網路上的流量，不可因為不同用戶、內容、網站、平台、應用、裝置或通訊模式而差別收費，以確保所有合法內容、服務提供者在網際網路上均享有平等地位。

網路服務提供者必須確保用戶使用所有線上服務時，連接的速度是相同的，不可因為其中一方與提供者有關或是因其支付了額外的費用，而降低另一方的連接速度，例如電信業者Comcast不可加速子公司NBC的影片，而卻限制Netflix的連接速度。截至目前為止，網路中立性原則仍然存在許多爭議，並受到各界諸多挑戰。

AT&T、Verizon等傳統的電信業者都反對網絡中立性原則，他們認為既然投資、佈建了網路，自然應享有對該網路的流量控制權，而根據市場經濟，買方出價的高低，電信業者有權提供質量不同的網路服務。而Google、Facebook、Netflix等新興科技服務提供者及大多數的消費者團體則支持網際網路上所有數據應被平等對待，失去網路中立原則將破壞創新服務的發展。

圖表21：議題四綜合討論

一般來說，所有網路流量均可以快速的在網路上傳遞，只有在網路使用的尖峰時段，出現流量壅塞時，才會有流量是否有優先順序的問題。另外，透過VoIP撥打緊急電話亦是一種常見的流量優先權形式，也就是說，流量優先權其實不一定是不好的行為，管制者禁止付費快車道（fast lanes）的主要目的，只是為了避免網際網路服務提供者利用付費優先權做出違反競爭的行為。

另外，零費率（Zero-rating）亦是網路中立性中的一個熱門議題。零費率是指行動業者、網際網路服務提供者不向用戶收取使用特定應用或服務所產生數據量費用的行為，雖然，用戶看似可從零費率得到許多額外的流量，但卻可能造成巨大的負面影響。

這些零費率提供的內容或服務通常由網際網路服務提供者篩選，大多是與提供者有關係的內容，或是由支付額外費用獲得曝光的企業所提供，而新興服務或新進業者的內容將因此被排除在外，除造成線上內容、服務的不多元外，亦可視為一種反競爭的行為。

而美國許多大型科技公司亦推出零費率計畫以快速搶佔新興市場，其中最知名的即是Facebook在印度的「Internet.org」專案，只要透過Internet.org上網，即可免費瀏覽包括Facebook、Wikipedia等數十個網站。這個專案可以有

效的讓無法負擔行動網路的人連接網際網路，接受更多資訊，達成普及服務的目的，但是卻也造成用戶使用網際網路時，不敢嘗試超出免費服務的範圍，造成其狹窄、受限的網路使用習慣。

零費率方案確實可能會造成競爭上的問題，但如果運用得宜亦有其正面效應，如運用在發展中國家的普及服務、公共教育、醫療衛生等方面。因此，管制機關應重新思考管制的目的，並且逐一檢視個案情況，才可以知道是否應有零費率的適用。

網路中立性的目標是期望可維持網際網路上的開放、公平競爭，但對消費者而言，更重要的是服務資訊的透明化，讓他們可以明確知道網際網路服務提供者的流量管理措施。另外，近年來大型企業已逐漸將其內容分散、儲存於各地的電信網路中，因此思考付費優先權時亦應一併考量各種服務及網路架構型態。

（六）議程五：美國選舉年對電信及媒體監理政策之影響

美國總統當選人川普曾經於選舉時期明確表態反對網路中立性原則，而負責FCC的交接工作的Jeffrey Eisenach亦不認同美國聯邦通訊傳播委員會（FCC）在多項政策上的理念，因此，電信及科技產業均認同美國政府的改朝換代勢必會對全球通訊傳播市場帶來某些衝擊。但是，大家亦認同對川普新政府而言，相較於醫療改革及稅制改革，通傳政策並非其上任後的首要、優先議題。

不論，川普政府及新任的FCC委員們將如何改變FCC現有的通傳管制架構，仍然有許多議題需要新政府持續關注及推動。

伴隨數位匯流的發展，通訊傳播的管制思維應維持由「基礎建設管制」轉向「服務行為管制」，以迎接跨域服務的挑戰；另外，嚴格的管制架構將無法跟上技術的快速演進，未來需要的是一種可以適應科技變革並促進創新發展的的彈性法規環境，因此，應繼續採用輕撫（light touch）、事後（ex-post）監理，解除不必要的管制措施，利用競爭達到管制目的，並同時加強法規的

透明化。

管制機關應深切的體認，公共政策必須著重於保護競爭，而監理的範圍不應超過保護公共利益所需的程度。 另一方面，業者總是比監管機構更了解消費者的需求，但對他們來說，保護股東、員工、客戶的利益才是更重要的，因此促進公共利益必須由監管機構來推動。

圖表22：議題五綜合討論及閉幕

另一方面，許多管制考量因素已無法適應數位匯流的趨勢，舉例來說，決定臉書（Facebook）或What's APP等服務提供者的影響力強弱時，是否應考量其用戶數而非營收。有鑑於此，各國管制機關應重新檢視市場的發展、消費者與產業的需求，與時俱進思考如何達到管制的目的。

持續推動普及服務及減少數位落差亦應列為重點工作項目之一。目前仍有很多偏遠地區的人們無法接取網路，如何讓這些人可以接取網際網路、使用數位裝置，並獲得更多數位服務帶來的好處，將是各國監理機關需要持續努力的目標。

同時，雖然大部分的人們已經可以連接到網際網路，但是其中也有一部分的網路使用者並未具有足夠的數位服務的素養，如何教育民眾善用數位工具蒐集資訊、解決問題，進一步提升創造力、創新力，並帶動就業機會，亦

是各國政府及相關產業應多著力的部分。

最後，促進基礎建設的佈建及投資、積極的頻譜策略、寬頻接取、網路安全等熱門電信產業議題，及內容管理、OTT新興服務管制方向等媒體產業的政策，亦是美國新政府及全球各國應持續積極關注的事項。

肆、與美國聯邦通訊傳播委員會（FCC）雙邊交流

本會代表團於2016年12月1日（星期四）與美國聯邦通訊傳播委員會（Federal Communications Commission，FCC）共和黨籍委員Michael O'Rielly等官員，就強化雙方監理經驗進行交流，並加深本會與FCC之互動。

圖表23：陳委員與O'Rielly委員合影

一、時間：2016 年 12 月 1 日（星期四）上午 11 時至 12 時

二、地點：美國聯邦通訊傳播委員會 8 樓 O'Rielly 委員辦公室

三、出席人員：

（一）美方聯邦通訊傳播委員會（FCC）：

（1） 委員 Michael O'Rielly；

（2） 委員 O'Rielly 之國際事務法律顧問 Erin McGrath；

（二）我方：

（1） 本會：陳委員憶寧、綜合規劃處紀副處長效正、洪技士嘉璟。

（2） 駐美代表處：新聞組林秘書俶如。

圖表 24：陳委員與 O'Rielly 委員交流監理經驗

四、討論情形：

（一）陳委員首先強調，希望透過臺美數位論壇等交流平臺或雙方委員層級的互訪，建立 NCC 及 FCC 兩機關間常態性的溝通管道。O'Rielly 委員亦對交流的建議表達贊同，但他也說明，雙邊交流的詳細細節，將有待 2017 年 1 月 FCC 配合川普新政府成立調整人事後，才能有較明確的進展。

（二）我方並表示，在通傳政策與匯流法規的制定上，期望能汲取美國的管制經驗。美國為因應全球產業匯流發展趨勢，以彈性、輕撫（light touch）的監理思維，採取促進市場競爭、降低不必要管制等措施，可做為我國目前調整、研訂匯流法規的參考。

（三）兩位委員並就 OTT 服務發展及管制機關如何因應、如何維持管制機關的獨立性、普及服務發展、具誘因式競價（incentive auction）、併購案的處理等雙方關切議題進行實質性討論。

（1） OTT 管理：OTT 為創新科技所延伸的一種服務樣態，至目前為止，仍處於發展階段，管制機關應持續關注市場發展及趨勢，除訂定消費者保護及網路安全的原則性規範外，應給予適度的發展空間，不宜貿然介入，否則將可能妨礙其發展。至於 FCC 先前將線上視訊服務提供者（OVD）視同

為多頻道視訊服務提供者（MVPD）之一種，O’Rielly 委員則表示他個人不偏袒於任何一種服務樣態。

（2） 創新服務管制：隨著數位匯流的發展，不同平臺及服務之間的界線日趨模糊，管制機關並不樂見因為政府的介入，而阻礙了創新的發展。

（3） 管制機關獨立性：陳委員表示，本會常需其他機關分工與合作，與本會設立時所欲彰顯之獨立性，似有不符，例如頻率之分配（allocation）係為交通部之權責，而頻率的指配（assign）則由本會辦理。O’Rielly 委員則表示，FCC 亦遭遇類似之問題，在頻率的管理上 FCC 仍需與商務部國家電信資訊管理局（NTIA）進行協調，NTIA 掌管聯邦政府之頻譜使用，而 FCC 負責商用、州政府及地方機構所使用之頻譜。另外，他並強調，獨立機關所作之決策應力求穩定，不宜在短期內有大幅度的變化，而先前 FCC 針對開放的網際網路（open internet）所作之決策即為一個錯誤的範例。

（4） O’Rielly 委員回應本會詢問：

1.具誘因式競價之程序目前仍在進行中，需視後續的發展結果才可論斷其成敗。

2.FCC 預計將斥資 110 億美金投入電信普及服務，補助偏遠及不經濟地區之網路建設，並致力於提供所有國民連接網際網路、使用寬頻服務，並獲得數位科技帶來的好處。但他亦表示，普及服務並非其個人所關注之重點工作項目。

3.有關併購案的處理，因為仍有許多案子等待委員會討論、決議，而為避免影響市場發展，他不願意針對任何個案進行評論。另外，涉及通傳產業之併購案，均由 FCC、司法部（DOJ）及聯邦公平交易委員會（FTC）依權責進行審查。

（5） 雙方均期待未來能深化兩機關的互動，持續分享彼此的經驗，並建立日後相互聯繫之管道。

伍、與駐美代表處工作餐敘

圖表 25：陳委員與駐美代表處李公使合影

一、時間：2016 年 12 月 1 日（星期四）下午 1 時

二、地點：Sushiko 餐廳（5455 Wisconsin Ave., Chevy Chase, MD 20815）

三、出席人員：

（一）駐美代表處：

（1） 李公使光章；

（2） 新聞組：李組長大塊、林秘書俶如；

（3） 政治組：甄一等秘書國清；

（4） 經濟組：徐一等秘書崇欽；

（二）本會：陳委員憶寧、綜合規劃處紀副處長效正、洪技士嘉璟。

四、討論情形：

（一）陳委員首先感謝代表處的長官與同仁們事前的準備工作與行政事務上的費心安排，協助本會此行能順利完成任務，特此表達由衷感謝。

（二）雙方並就本會此行拜訪 FCC 等事宜進行討論，公使建議：

（1）若希望與美方建立高層互訪機制，則應設計重要（substantial）及可達成（deliverable）之議題，以爭取美方關注。

（2）我國未來制定 5G 等技術標準時，應於考量國家政策與產業發展後，再行與外交部或國發會等機關討論在外交談判上如何搭配運用，以爭取國家最大利益。

（3）美方極度重視法規、規管方式及程序之透明與落實，才可強化美商投資台灣之意願。

（4）若 NCC 期望與 FCC 高層建立良好關係，可於明年新主委被提名或參議院行使同意權後，以賀函之方式，表達祝賀並提出議題邀請訪台。

（5）未來如需駐美代表處協助之處，尚請 NCC 不吝提出。

（三）陳委員感謝公使所提出之建議，並表示意見極具建設性，將攜回台灣向主委及其他委員討論，納入未來台美雙方交流時之參考。

陸、心得與建議

此次於華府舉辦之2016年IIC電信與媒體論壇，探討的重點包含新興科技轉變、網路安全、網路中立性、美國大選之影響等，皆是目前重要之通訊傳播政策及監理議題，因此論壇討論均極為熱烈，藉由各國監理機關、產業界及學術界代表分享經驗、剖析意見及相互辯論之過程，引發與會者更深度、廣泛的思考。

另外，由於本此論壇在華府舉辦，因此IIC亦邀請許多美國政府官員發表演說，聯邦通訊傳播委員會（FCC）主任委員Tom Wheeler分享5G及無障礙近用的推動策略、聯邦公平交易委員會（FTC）委員Terrell McSweeny說明隱私保護的政策概念、美國貿易代表署（USTR）副代表Robert Holleyman大使分析英國脫歐對歐盟數位單一市場的影響，可以聆聽到各領域的權威暢談熱門議題，是相當寶貴的經驗。

本會陳委員陳憶寧亦把握機會與各國代表交換心得、汲取經驗，透過對談激盪出不同的監理可能，並提升我國的國際能見度。面對目前瞬息萬變的科技發展，本會未來將透過持續參與國際會議，以了解全球通傳產業發展趨勢及監理轉變，方能開拓創新，與國際接軌。

圖表 26：陳委員與 Google 公共政策經理 Sarah Holland 討論網路的發展趨勢

本會代表團並藉由此次到訪華府的機會，進一步拜會美國FCC共和黨籍委員Michael O’Rielly，分享、交流彼此對於數位匯流趨勢、OTT服務發展、普及服務、頻譜整備等監理經驗。陳委員亦強調，期望能汲取美國的管制思維及經驗，作為我國制定匯流政策、法規的參考，因此，希望透過台美數位論壇等交流平臺及雙方委員層級的互訪，建立NCC及FCC的常態性的溝通平臺。

此次拜會亦是本會成立以來首度與FCC委員進行一對一實質性交流，雙方都期待未來能更深化兩機關的互動，持續分享彼此的經驗。

整體而言，此行陳委員率同仁以開放、創新的心態了解全球通訊傳播產業發展現況與監理政策方向轉變趨勢，經由比較，瞭解我國匯流發展之優勢及劣勢，並期望借鏡他國經驗作為未來政策規劃的參考。同時，本會代表團亦積極與美國FCC及各國論壇與會代表密切互動，並建立日後相互聯繫之管道，以期我國可接軌國際並與世界各國齊頭並進，共享全球數位匯流所帶來的豐碩成果。

致謝

我駐美代表處李公使光章、李組長大塊、林秘書俶如、黃秘書奕龍於本會停留華府期間，或與全團進行政策交流、或陪同拜會、或接送機照料；駐洛杉磯辦事處楊組長國添、駐紐約辦事處蘇副處長瑞仁、曾秘書靖惠，犧牲假期親臨機場協助轉機或接送機照料，協助本會順利完成任務，特此表達由衷感謝之意。

Telecommunications & Media Forum
Washington, D.C.
Tuesday 29 and Wednesday 30 November 2016

Kindly hosted by Verizon Communications

1300 I Street, NW, Suite 500 East Washington, DC 20005

FINAL PROGRAMME

*Forum presentations are on the record but subsequent discussions are under the Chatham House Rule**

TUESDAY 29 NOVEMBER 2016

08.15 Registration and networking

09.10 Welcome
Chris Chapman
President, **International Institute of Communications**

Cheryl Miller
Director, International Public Policy and Regulatory Affairs, **Verizon Communications**

09.30 SESSION ONE:
Transformational, yet-to-be-defined technologies: 5G, IoT, AI and SDN
What's needed to encourage innovation and at the same time safeguard critical systems, and citizens?

Chair: Julie Brill, *Partner***, Hogan Lovells US LLP**

Keynote speakers:

Lee Rainie, *Director of Internet, Science and Technology Research***, Pew Research Center**
How users anticipate the next technology revolution.
Early adopters have begun to embrace the next phase of technology change with wearables and connected homes, cars, and other objects. Lee will describe how they anticipate benefits from these changes and what worries them when it comes to privacy, cybersecurity and the bad things trolls can do, new "digital divides," and on society's increasing dependence on complicated things that sometimes break. They also have mixed views about the way that the spread of new technologies, especially robotics and artificial intelligence, will affect jobs and the future of work.

Terrell McSweeny, *Commissioner,* **Federal Trade Commission**
Given its dual mandate with regard to competition and consumer protection, the Federal Trade Commission has an interest both in fostering innovation and in ensuring that new technologies protect consumers' privacy and data. Commissioner McSweeny will address the role of competition enforcement in promoting innovation as well as the importance of security-by-design when

developing new products and technologies. She will discuss opportunities and challenges associated with the growth of the Internet of Things and the need for companies to exercise thoughtfulness and caution when implementing algorithms and big data solutions.

Peter Davidson, *Senior Vice President, Federal and International Government Relations,* **Verizon Communications**
Peter will discuss the important role that industry must play moving forward in driving the transformational changes that Internet users are seeking while ensuring that the network is an open, safe, and secure space for the future of global communication. She will discuss developments such as 5G, and the type of policymaking that will ensure innovation and investment will continue to flourish.

11.00 Break

11.15 Discussion

- As technology enables traditional industry silos to be broken down or overlap what policy and regulatory challenges and opportunities might arise?

Panellists:
Jeff Brueggeman, *Vice President, Global Public Policy,* **AT&T**
Sarah Holland, *Public Policy Manager*, **Google**
Dr Robert Pepper, *Head, Global Connectivity Policy and Planning,* **Facebook**
Sumit Sharma, *Senior Consultant,* **Oxera Consulting LLP**

13.00 Lunch

14.00 Afternoon keynote followed by discussion

Chair: Rick Lane, *Senior Vice President Government Affairs,* **21 Century Fox**

Examining the disruptive potential of emerging technologies
What are the future applications, platforms, services and devices that will drive demand in the converged communications field?
Marcus Weldon, *President,* **Bell Labs** *and Corporate Chief Technology Officer,* **Nokia**

15.00 Break

15.15 SESSION TWO
Global policy – notable outcomes from, and preparations for, key meetings this quarter

Chair: Ambassador David A. Gross, *Partner,* **Wiley Rein LLP**

- Reviewing key meetings including ITU WTSA 16, ICANN 57, IGF 2016
- Post-WTSA, what do you expect to be the role of the ITU regarding sensitive Internet-related issues such as in the areas of consumer protection, economics/financial matters, and policy issues associated with names, addressing, etc.?
- Post-IANA transition, what will be the role of governments at ICANN, on the GAC and otherwise?
- Post US election and post-Brexit, what role will the US and European governments play regarding Internet governance?

Panellists:
Julie Zoller, *Senior Deputy Coordinator, International Communication and Information Policy,* **US Department of State**
Alfredo Timermans, *Chief Executive Officer,* **Telefónica Internacional USA**
Veni Markovski, *Vice President, UN Engagement,* **ICANN**
Ellen Blackler, *Vice President, Global Public Policy,* **The Walt Disney Company**
Fiona Alexander, *Associate Administrator, International Affairs,* **National Telecommunications and Information Administration (NTIA)**

17.15 End of day one

18.00 Drinks reception hosted by Wilkinson Barker Knauer, LLP
Time: 18:00 to 19:30

Venue: Wilkinson Barker Knauer, LLP
1800 M Street, NW, Suite 800N, Washington, DC 20036

WEDNESDAY 30 NOVEMBER 2016

09.15 Welcome
Chris Chapman
President, **International Institute of Communications**

09.30 Keynote speaker:
Tom Wheeler, *Chairman,* **FCC**

10.15 Break

10.30 SESSION THREE
Implications of Brexit for Trans-Atlantic ICT policy

Chair: Sumit Sharma, *Senior Consultant,* **Oxera Consulting LLP**

What is the texture of trade, DSM and other policy discussions without the influence of the UK position? And by corollary, what might the UK do differently?

Opening speaker
Ambassador Robert Holleyman, Deputy United States Trade Representative

Panellists:
Elena Scaramuzzi, *Head Americas Telecoms, Media and Digital Economy,* **Cullen International**
Sanford C. Reback, *Senior Director, Global Public Policy,* **Akamai Technologies**
Ann LaFrance, *Coordinating Partner, EMEA Communications Law; Co-Chair, Global Data Privacy & Cybersecurity,* **Squire Patton Boggs (UK) LLP;** *Vice President,* **International Institute Of Communications**

12.00 Lunch

12.45 SESSION FOUR
Open Internet policies, paid prioritisation, zero rating and specialised services – has the dust settled on net neutrality principles?

Chair: Dawn C. Nunziato, *Professor of Law,* **The George Washington University Law School**

- Is there such a thing as a one-size-fits all answer?
- To what extent can ex-ante regulation correctly identify business models and practices that maximise consumer welfare/minimise harm?

Panellists:
Russell P. Hanser, *Partner,* **Wilkinson Barker Knauer, LLP**
Jeffrey A. Campbell, *Vice President, The Americas, Global Government Affairs***, Cisco Systems**
David Geary, *General Counsel Caribbean,* **Digicel Group**
Irene Kaggwa Sewankambo, *Director, Engineering & Communications Infrastructure,* **Uganda Communications Commission**
Dhanaraj Thakur, *Research Manager, Alliance for Affordable Internet,* **Worldwide Web Foundation**
Nicol Turner Lee, PhD, *Fellow, Center for Technology Innovation, Governance Studies,* **Brookings Institution**

14.30 Break

14.45 SESSION FIVE
Election year - how might the telecom/media policy agenda for the new Administration shape up, domestically and internationally?

If you were to advise the new Administration, what would be your top 5 priorities?

Chair: Andrew Haire, *Principal,* **AJH Communications;** *Chairman, US Chapter,* **International Institute of Communications**

Panellists:
Adolfo Cuevas Teja, *Commissioner***, IFT México**
Nicol Turner Lee, PhD, *Fellow, Center for Technology Innovation, Governance Studies,* **Brookings Institution**
Peter Davidson, *Senior Vice President, Federal and International Government Relations,* **Verizon Communications**

15.45 Closing remarks

16.00 End of Telecommunications & Media Forum DC 2016

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International Institute of Communications
Telecommunications and Media Forum

Washington, D.C.
Tuesday 29 and Wednesday 30 November 2016

Participants List

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Julie Zoller, Senior Deputy Coordinator, International Communication and Information Policy, US Department of State

SUMMARY REPORT
TELECOMMUNICATIONS AND MEDIA FORUM[1]
WASHINGTON, D.C.

29-30 NOVEMBER 2016[2]

Session 1: Transformational, yet-to-be defined technologies: 5G, IOT, AI and SDN. What's needed to encourage innovation and at the same time safeguard critical systems, and citizens?

KEYNOTE ONE

Lee Rainie - Pew Center

Currently, 90% of US adults use internet and 81% have smartphones, while 73% have broadband at home. Use of social media is widespread, with 56% of internet users having at least two different social media accounts. Despite the popularity of internet, 91% of adults believe that consumers have lost control over their data. The Internet of Things is likely to connect over 12 billion devices by 2020 (according to Cisco) and experts predict the internet will become 'like electricity' — less visible, yet more deeply embedded in people's lives. However, 14% of Americans are 'Unprepared' for digital life: they have low levels of tech adoption, no confidence in their tech skills and little trust in online information. These are likely to be women in their 40s/50s and lower income households. More worryingly, 52% of US adults are defined as 'reluctant digital adopters' on the basis of their low levels of skills and confidence with the new technologies. This digital divide is very likely to affect the trajectory of adoption and use of technology, particularly when it comes to working in tech-intensive jobs. Interestingly, while over ¾ of workers believe their current occupation will still exist in 50 years, nearly half of experts surveyed believe that digital agents will displace significant numbers of blue- and white-collar workers in the future. How is this going to progress onto an age when algorithms will spread everywhere? Diffused use of algorithms has many positive effects, as code processes get refined and issues are being worked out. However, there are concerns that as code takes over complex systems, humans are left out of the loop and displaced as smarter codes take their jobs. Algorithms may also deepen divides, as they will reflect the bias of the programmers and deficiencies in datasets. They may also limit people's exposure to a wider range of ideas and reliable information and eliminate serendipity. Policy that establishes accountability processes, oversight, and transparency is needed more than ever.

52% of US adults are relatively hesitant about digital life

48% are relatively more prepared

65% believe robots and computers will do most human work within 50 years

but 80% of workers believe their jobs will still exist

91% agree or strongly agree that consumers have lost control on how their information is used

[1] Programme attached

[2] This meeting took place ahead of the inauguration of Donald Trump as President of the USA.

KEYNOTE TWO

Terrell McSweeney - Federal Trade Commission

We are experiencing an era of incredibly fast technological progress. The processing capacity of computers nearly doubles every two years, and more and more devices have computer and connectivity built into them. Internet connectivity becomes deeper and deeper, increasing the volume and variety of data collected about consumers. But also increasing, at the same time, the velocity by which that data is analysed and used. With the near-universal adoption of smartphones and other connected gadgets, the economic impact of the internet sector is also changing fast: in 1995, the total market capitalisation of public internet companies was something like $16 billion; last year the total market cap at just the top 15 firms was $2.4 trillion. This is a huge economic system based on data, and on the fact that consumers feel safe when they purchase and use internet-connected gadgets: so much of this innovation is actually reliant on consumer trust. Just as it creates economic and personal opportunities, data collection is also creating new risks for consumers, new enterprises for criminals, new opportunities for prejudice and discrimination, new risks to consumer privacy, and potentially new impediments for innovators entering the marketplace. How do we maximise the benefits of data processing while minimising those harms? When it comes to privacy policy, the FTC relies on three principles: transparency, choice and context. A key step is to ensure that the policy concerns (such as safety and privacy) are built-in at the earliest stages of product development (privacy by design, safety by design), which in turn means that consumers and other stakeholders must be involved in those early stages of product design. As data needs to cross borders, reaching agreements with other countries' regulators becomes a key issue. The FTC and nine other privacy agencies from North America, Europe and Asia Pacific have formed the *Global Privacy Enforcement Network Alert System*, a secure information and sharing system for coordinating privacy investigations. The FTC's consumer protection mission does not simply rest on enforcement, it is also about research on trends and technology.

As we inch closer and closer towards Artificial Intelligence, we need to understand the limits of computerised decision-making. It should be subjected to human oversight consistent with good public policy, to ensure that AI enabled systems are governable, transparent and understandable, that they work effectively with people, and that their operation will remain consistent with human values and aspirations. Trust in algorithms and machine learning goes hand in hand with trust in data and devices, and this trust is essential to adoption.

Safety by design

Privacy by design

Ethics by design?

The operation of AI enabled systems must remain consistent with human values and aspirations

KEYNOTE THREE

Peter Davidson – Verizon Communications

Verizon is developing the new products that create growth and enhance digital experiences for users, even if this means cannibalizing some of the existing products, because this is the only way to remain relevant in an age of fast technological change. In addition to developing its own products, Verizon set up several centres for digital innovation that work as open labs, where other companies developing IoT products and applications can test them at no charge. The first step is to actually prepare the networks to support IoT devices. These are going to create more than 10,000 times more traffic, we have to keep innovating at the edge of the technology to keep up with the waves of growth that are coming toward us. This means working with businesses, governments,

Innovation is the only way to go in this sector

Several open labs are available to industry to develop 5G products

civil society groups, and the technical community to create the right policy environment where innovation can thrive and policy concerns, such as safety and security, can be addressed.
5G is huge on the agenda, as this will be the enabling infrastructure for many IoT applications: it can offer 50 times the throughput of 4G. However, 5G requires close proximity to the device being used and lots of fibre back up, so piloting is confined to heavily fibred areas. Those cities, like Boston, that are willing to lead in Smart City applications, have laid fibre very densely and are therefore able to pilot both Smart City and 5G. The new developments are therefore very infrastructure hungry: the tech and telecom industries invest about $49 billion a year in capital expenditure. For these companies investing in infrastructure, a fiscal reform that provides incentives for Capex makes a huge difference. Finally, there is a noticeable trend towards data localisation policy in several foreign countries, which, while addressing legitimate concerns about national security and data privacy, is often also a form of digital protectionism. As such, it is also likely to harm international developments and, especially, domestic consumers. Security concerns can and should be resolved without restricting choice for consumers.

Panel discussion

As technology enables traditional industry silos to be broken down or overlap, what policy and regulatory challenges and opportunities might arise?

Jeff Brueggeman (AT&T) pointed out two technology trends in particular: mobile video and software-defined networks. The latter describes the new, converged networks that can host any OTT application by running software. IoT brings significant challenges to current regulation: a plurality of agencies have oversight over the same application (think driverless car) and a plurality of companies may need to share consumer data. There is a need for regulatory frameworks that work across industries, for example on privacy, even though it makes sense to retain some industry specific regulatory oversight – for example around health.
Sarah Holland (Google) spoke about the developments in Artificial Intelligence. This is actually a collection of techniques rather than a single one, and Google is developing a specific aspect of it: Machine Learning, that is, making machines that learn, as opposed to machines that are smart. Machine learning is the invisible backbone in many Google core products and applying it to its data centres has enabled huge savings. But, as machines learn from data, it becomes very important that datasets are complete and representative. From a regulatory viewpoint, it is important to fill the gaps between agencies but also recognise the role of best practice: there is a lot we do not know about the technology, and there is a lot that we can develop along the way.
Dr. Robert Pepper (Facebook) described Facebook's effort to bring internet to areas with no infrastructure by using solar wings that receive connectivity and beam it back. Like most new services, these are not linked to a particular network, player or even country. The application layer is separated from the network layer, and this supports more horizontal regulation. Another huge factor is spectrum: regulated and non-regulated, spectrum of all kinds is needed. Finally, on the demand side, digital education and capacity building is essential as more and more people use digital technologies and depend on them.
Sumit Sharma (Oxera), explained the implications of the separation between network and application layers for competition policy, and measuring market power in particular. Inputs used by internet firms can be network inputs (those you need to build and run a network) or digital inputs (research, customer data, etc.) and these have different characteristics in terms of their availability, upfront costs, network effects and so on. These features, in turn, determine how much market power is generated by input control. The key take-away is that we now have an interdependent eco-system, and therefore the inter-relationships are relevant when it comes to market power. Case specific analysis, in this kind of world, may be a better policy instrument than revenue or pricing indicators.

Q&A

Is there a single agency that is dealing with these issues of ethics and trust?

- The way forward is to ensure on-going cooperation across agencies, which has already began.
- Ensure that technology experts are part of the policy conversation.
- Autonomous systems must be built with transparency, i.e. why they do what they do must be comprehensible

What can companies do to help regulators?

- Companies need to support research and to share their knowledge about technology with regulators, but also with the wider civil society.
- Both sides need to set up more and more opportunities to learn from each other.
- Ideally, this should happen globally.

How realistic is horizontal data regulation?

- The best chances of a real regulatory reform usually come with a new administration, but it may be more realistic to think about agencies cooperating.

Examining the disruptive potential of emerging technologies

What are the future applications, platforms, services and devices that will drive demand in the converged communications field?

AFTERNOON KEYNOTE

Marcus Weldon – Bell Labs and Nokia

Future X: Building the digital networks, systems and platforms for the automation of everything and the creation of time

Bell Labs look at visions for the future that are biased by only two things: the speed of light and spectrum's ability to accommodate information (Shannon Law). From these two building blocks, the idea is to produce a new digital fabric whose task is to automate everything and free up time. Then, everything and anything will be able to signal to a network and it will be a true technological revolution, unlike our current one, which has simply distributed networks and made sharing possible. The future revolution will also increase productivity, which has not increased in recent years despite the huge ICT investments. There is currently a debate on this; one side of the debate argues that productivity has not increased, while the other argues that we do not really know how to measure intellectual productivity. Another thing that will be different is that the future revolution will not be focussed on the consumer but rather on industry. Industry had different requirements from consumers, for example industry is concerned with latency.

Humans are not, because our brains work with relatively high latency – 100 ms – but some applications (for example VR\AR) require a latency of, say, 7ms and a lot of bandwidth. In order to deliver a lot of bandwidth in a few milliseconds, you need to be very close to the consumer/device, even at the speed of light. Hence, to respond to industrial latency requirements, networks will need to change through a lot of virtualisation and software. They will need to be a lot more distributed and automated when millions of objects are connected to it. This is 5G. The key point is that connected, intelligent, automated objects are all around us, and intelligent automated networks will allow humans to need less time to perform their mundane tasks and dedicate themselves to higher ones like creative thoughts, knowledge, teaching… Time is likely to be the commodity of the future. There is going to be a shift towards optimising the delivery of content and control locally, (within 100km), with the access piece within a couple of hundred meters. Products may be delivered as a file and 3D printed locally. And instead of having global brand power somewhere else, we're going to rely on trusted brands locally, offering personalised, rather than generalised, goods. Privacy is going to be protected,

The digital revolution has not happened yet

Future networks will be serving industry, not consumers

They will be a lot more distributed and automated.

There will be a shift to optimising delivery of content and control locally.

Time is the commodity of the future

rather than monetised. And security is going to matter more, because 'we are trusting our entire definition of us to this system'.

Session 2: global policy - notable outcomes from, and preparations for, key meetings this quarter

Julie Zoller (US Dept. of State) reported on the WTSA recently concluded in Tunisia. WTSA are global ITU-T meetings that take place every four years to develop technical standards in communications. Among the many points of discussion held with the 700 delegates who attended, were Digital Object Architecture (DOA), and OTTs. DOAs are information storage location and retrieval systems running over the internet; many entities expressed an interest in becoming involved and the US delegation made the point that the ITU should remain neutral on the choice of technology. OTTs were discussed at length but no resolution was adopted in the end. All of the candidates appointed for chairs of study groups are from the United States. The key lesson from this first experience is that we need to engage in conversations *before* these meetings, to ensure there is some level of mutual understanding that can progress at the meeting.

Alfredo Timermans (Telefonica) observed that too many international fora seem to be competing to become the space where international regulation takes place, which is not a good thing. Not only has this generated confusion, but it also risks compromising the very useful coordination and standard settings roles of the ITU. As policy agency, the ITU is not the most efficient organization, and it should focus instead on the areas where it can add value to both industry and governments.

Veni Markovski (ICANN) reported on the ICANN 57th meeting in Hyderabad, India, where attendance was the highest ever, at 3,128 delegates. ICANN is going through a number of changes, and among the key topics on this meeting's agenda was how to involve new people and organisations. Those who are currently involved are the internet pioneers and now many from other countries want to be involved in internet policy discussions, things are very different: we may be talking to people who still use dial-up internet or the basic phones we stopped using 15 years ago. This is especially true at UN level, where the only relevant issue used to be ICT for development, now internet security, privacy and human rights are discussed by diplomats with little or no knowledge of the internet.

Ellen Blackler (The Walt Disney Company) explained that the Internet Government Forum (IGF) was created as a space for stakeholders to exchange ideas about internet without the consequences of having these exchanges at the ITU or UN. The IGF changes as people experiment with ways to work together. The goal is to involve all stakeholders on an equal footing, such as people from civil society, academia, business and government. In practice, it is civil society that tends to participate the most, as there are no other fora where concerns can be addressed, and government the least.

Fiona Alexander (NTIA) reported on the process of transformation of ICANN, which took two years. What has changed in ICANN is not the way it works, but its accountability and power sharing structure. The kind of issues that are on ICANN's agenda – privacy and security - are likely to stay relevant for many years and are best debated among practitioners and experts rather than just governments. The real question is how do we take these multi-stakeholder models forward? How should they evolve?

Q&A

Is the multi-stakeholder model the best solution for international policy making?

- Multi-stakeholder models share key ingredients: inclusiveness, openness, transparency, and consensus. Many feel that more than the plurality of voices, it is the openness and transparency of the process that make the difference.
- Informal exchanges between countries in preparation for governmental meetings also improve the chances of better decisions being taken in the formal fora.
- The fast pace of technological change in industry makes it important to involve technical expertise in the design of regulation, but there are other many ways do that, both formal and informal.

DAY 2

KEYNOTE

Tom Wheeler - Chairman of the FCC

While we all know that 5G is coming, right now we can only see the shadows of it and do not know the exact shape it will take. This is why the FCC believes that regulation should encourage and protect innovation, but the industry is best placed to decide on technology and standards. The FCC approach to 5G essentially goes through three key areas: spectrum, siting and security. On *spectrum* the United States have been leading the world with innovative auctions and are the first country in the world to assure the availability of millimetre wave internet frequencies for 5G purposes.

Siting refers to the issue of increasing the density of cell sites, as required by 5G networks: there are about 200,000 cell sites in the United States today, with the potential of 5G it could be millions. The FCC stresses the importance of community involvement in siting decisions, but is also watching against the creation of bottlenecks, as cities franchise their siting to a third party who then acts as a gatekeeper. The Commission is committed to cutting red tape and facilitating siting.

Cyber *security* is another major area of intervention: cyber experts tell us that within six minutes of a device being connected to the network, it has typically been discovered by those who exploit it. Our argument is that 5G represents the opportunity for cyber security to be a forethought rather than an afterthought and it must be at the top of developers' concerns as early as possible in the design stage.

Like cyber security, accessibility needs to be 'baked-in' to the development of mainstream consumer electronics and services. We are at a historic juncture. We can act now, doing everything possible to harness this marvellous new technology revolution, to attack the challenges of individuals with disabilities.

Today it is easier than ever before to incorporate accessibility features into off-the-shelf products. The ability to customise devices now empowers consumers with disabilities to set their own devices, to meet their very specific, individual and functional needs. We need to encourage this and that is why two years ago the FCC set up the Disability Advisory Committee. We can and need to do more.

The FCC recipe: make spectrum available, encourage innovation, drive competition and stay out of the way of technological development.

Spectrum, Siting Security are the key 5G challenges

Unique opportunity to use new technology to overcome the challenges of disability

Q&A

So the current political shift towards local data storage is actually where we should be?

- Yes, but it should be for technical reasons rather than nationalism. If in the future we want services like remote robotic surgery, virtual personal assistants etc..

With new benefits come new risks….

- In a world like the one described for the future, where products can be 3D printed and assembled locally, there will be great room for patent and copyright infringement.
- Is having more time necessarily a good thing? What if it means less employment, or less money?

SESSION 3: IMPLICATIONS OF BREXIT FOR TRANS-ATLANTIC ICT POLICY
What is the future of trade, DSM[3] and other policy discussions without the influence of the UK position? And by corollary, what might the UK do differently?

Ambassador Robert Holleyman (Deputy United States Trade Representative) acknowledged that the main question is how Brexit will affect UK-US trade relations and discussions on digital and telecom issues with the EU. But in order to attempt an answer to this question, several other smaller questions must be dealt with. First is timing: Prime Minister Teresa May has said that they would trigger Article 50 in March 2017, but there is also a legal challenge in the UK High Court as to whether Parliament should authorize the Art. 50 notification, which could delay matters. Second comes the question of the degree to which the UK will remain in the EU single market. If the UK remains in the customs union, its ability to negotiate free trade agreements with non-EU countries will be somewhat limited, but on the other hand, will satisfy many companies that have invested in the UK in order to reach the larger EU market. Finally, there is the issue of whether the UK would be able to influence (formally or informally) any EU trade deals and regulatory policy once it leaves the Union. The principles that govern the US position in the ICT space and trade are highlighted in a document, 'Digital 2 Dozen', which was designed at the conclusion of the Trans-Pacific Partnership negotiations. The principles can be grouped into three categories. The first deals with creating a level playing field for digital products, issues like customs duties and non-discrimination. The second is a discussion about protecting network competition in the cloud, allowing free flow data, dealing with issues like server, data localisation, and competition in markets. The third is how to create an adaptable framework for digital trade, and the idea taking shape is to have a negative list of services that are excluded from free trade. This will provide greater certainty for new entrants and new services that will be able to expand globally. It will also increase the shelf life of the any trade agreement, which is important considering how complex and time-consuming trade negotiations can be, particularly with the EU. As the UK is the EU's largest digital market, its decision to leave changes some elements of the value proposition of a US trade agreement with the EU. Meanwhile, in the US, the presidential elections have made it clear that US approval of TPP is not on the agenda for the New Year.

Elena Scaramuzzi (Cullen International) opened by stating that the immediate implication for the UK will be the need to formally amend the many current laws that have a reference to EU rules. Once exited, the UK will no longer be able to take any part in EU decisions on the DSM. The European Union is currently embarked on a major review, which encompasses audio-visual, e-commerce, telecoms and data management. As a consequence of this review, some new regulations are immediately binding for the UK, for example those regarding Net neutrality and roaming charges. These are some positive consequences too: since EU rules on State Aid will no longer apply, after Brexit the UK will have more leeway for direct government investment in telecommunications, should it choose to use that route.

Sanford C. Reback (Akamai Technologies) reminded the meeting of how many things are still uncertain: whether the UK will actually be able to trigger Art. 50, the future of the European Union, given the refugee crisis and the rise of nationalism, the future of Nato… There is a possibility that the final idea of DSM in Europe may be taken hostage by protectionist tendencies. Certainly, enthusiasm for TTP (the Trans-Pacific Partnership) in the States has gone. Most likely, significant change will not take place immediately, and in the future, a UK-US bilateral agreement could be what happens.

Ann LaFrance (Squire Patton Boggs (UK) LLP; International Institute of Communications) also highlighted the many areas of uncertainty that opened up with the Brexit vote, particularly since no contingency plan had been made in case of a YES vote. In the UK, there are expectations that Brexit will be an amicable divorce, but in the EU even those who would like it to be so realize that they need to avoid creating a precedent that could tempt other countries to follow the UK example. If the divorce becomes bitter, then the situation could really get troublesome. As for specific telecom issues, data protection is a first issue, since the UK latest laws, the Investigatory Powers Act, has been challenged in the EU courts and the GDPR from the EU is likely to be applicable before Brexit can truly happen. Then there is a discussion in the EU about extending some

[3] Digital Single Market

regulatory requirements to number-based OTTs – from interconnection and emergency numbers to consent and data management requirements. One possible development could be that a lighter approach in Britain could make it the digital hub of geographic Europe once the UK leaves the EU.

Q&A

Does the delay in TTP approval leave the door open for other countries to advance their principles?

- TTP is going ahead with other countries, particularly Japan, and the US is arguing for the same principles in other trade fora. Digital services are developing without a history of barriers, which once erected, become very difficult to bring down, hence they are good candidates for free trade. Better to advance an agreement than see barriers put in place.

If all this uncertainty leaves a vacuum, is there a risk that countries like China step in and influence trade policy?

- While the EU sees China's counterweight as a potential worry, the UK looks at it as a potential new main trade partner.
- The greater danger may be internal, as the EU itself has never been questioned like this before.

One common issue allegedly behind both Brexit and Trump votes is that internet companies and new jobs are concentrated in a few centralised areas and the rest of the country feels left out. Will policy address this issue?

- In the UK it appears that immigration fears were actually the main issue. In this area, technology may help find solutions that are more sophisticated than simple YES/NO to immigration.
- One policy that could help is more and better training for people who do not have a technology background. Also, developing those localised solutions that will be possible with 5G.

SESSION 4 - Panel discussion: Open Internet policies, paid prioritisation, zero-rating and specialised services – has the dust settled on net neutrality principles?

Chair **Dawn C Nunziato** (The George Washington University Law School) opened the panel discussion offering a brief review of the state of net neutrality in the US. The FCC ruled for net neutrality through the 2015 Open Internet Order, which was upheld by the DC courts last summer, but there are expectations that the new administration will reset the rules. There are no FCC rules on zero-rating yet, but the practice has been banned or restricted in several countries like India, Chile, Brazil, Norway and The Netherlands. Other countries argue that zero-rating benefits many people.

Russell P. Hanser (Wilkinson Barker Knauer, LLP) explained that the new technical legal definition that allowed the FCC to rule on net neutrality (internet access being a telecommunications service) brought with it a wide reach of regulations. Among these, the General Conduct Standard, containing a broad and generic statement of 'any other behaviour' that the FCC may consider illegal. These were successfully challenged in court by a number of ISPs. On zero-rating, the FCC has proposed to look on a case-by-case basis and currently seems to be especially worried about ISPs who try to put competing services at a disadvantage.

Jeffrey A. Campbell (Cisco Systems) reported on the speculation that the incoming Administration would reverse current rules, as the Republican (FCC) commissioners had been very vocal in their opposition to the move. Since Republicans are now the majority in both House and Senate, as well as having the White House, there may be a chance for new legislation. But of course it is all speculation. In fact, most ISPs are more concerned with the reclassification, which brought with it many other obligations, than they are with the ban on blocking and throttling. The General Conduct Standard was viewed as a real chiller of innovation. Traffic prioritisation can be a good thing, as long as it is not used to disadvantage competitors, and indeed with 5G there is going to be an even stronger need for rules to prioritize traffic during network congestions.

David Geary (Digicel Group) highlighted the different context of small developing countries, where the key concerns are (1) to be able to become a digital economy (infrastructure, skills, services) and (2) to be able to take advantage of the new converged global economy. To some extent, net neutrality (NN) rules are about who pays for the internet and its infrastructure: one should wonder if the NN rules lock-in a particular business model that favours the global internet companies. When you look at these different contexts, the best approach to NN is flexibility. Zero-rating can be a great way to encourage people to go online, especially if it focuses on local content. Specialised services may also be useful to get more people online. Similarly, pay prioritisation may result into a transfer from internet giants to small local economies, and global internet companies are better equipped to deal with it anyway. Any basic principles such as no blocking, no tracking, and any intervention should only occur in the case of clear evidence of harm to consumers. Many countries around the world are getting on just fine without these rules.

Irene Kaggwa Sewankambo, (Uganda Communications Commission) also praised the potential of zero-rating, if it can get illiterate people to use health care or education applications on their phones. The UCC is more concerned with the offer being transparent. Generally speaking, the 'wait and see' approach has worked better than ex-ante rules, also providing better incentives to innovation.

Dhanaraj Thakur (Alliance for Affordable Internet, Worldwide Web Foundation) reported on research on zero-rated services from developing countries. There is a lot of innovation in this space and there is no universally correct policy response, it depends on the country. It appears that people use services like Free Basics to manage their online costs, not to access internet for the first time. Finally, the mobile operators who offer these services appear to have no financial interest in the service being zero-rated. Which suggests there is no evidence of consumer harm, and no evidence of detrimental effects on competition. Some governments are offering zero-rated government services. It is important, of course, that these are offered on a non-exclusive basis.

Dr Nicol Turner-Lee, (Center for Technology Innovation, Brookings Institution) echoed the last few panellists defending zero-rating as a useful way to make services more affordable, an issue that remains relevant in the USA as well. In fact, public services should be all zero-rated. This practice should not be thrown out or should not be seen as something that cannot co-exist with the values and principles of open internet.

Q&A

Pros and cons of zero-rating …

- Maybe not the solution to the digital divide, or at least not as much as initially hoped, zero-rating is certainly helpful in bringing relevant content to people, fostering the digital mindset, and helping users manage their data budgets. It also helps increase take up rates in poorer countries with low ARPU.
- Opponents worry that it exposes people to bias and offers a walled garden view of the internet, although this may not be the case if the zero-rating offer is non-exclusive and any content provider can join in.
- The debate has moved from an ideological phase ("zero-rating is against the open nature of the internet") to a more pragmatic approach that recognizes that situations are different, there are infinite variations of data plans and these are nuanced decisions.

SESSION FIVE - PANEL DISCUSSION: Election year - how might the telecom/media policy agenda for the new Administration shape up, domestically and internationally?

If you were to advise the new Administration, what would be your top 5 priorities?

Andrew Haire (International Institute of Communications), acting as both chair and panellist, focused on the likely event of a regulatory authority reset in the USA, to sketch the profile of the ideal regulator. Ideally, regulators should be goal/outcome driven and work towards de-regulation, being as light touch as possible. Regulators will always be needed to manage scarce resources, like spectrum and numbering and, possibly, critical infrastructure. Operators will always know the customer better than any regulator, but they inevitably protect their interests (broadly: their shareholders, staff and customers) and it is up to the regulator to define and promote the public interest. As to the priorities, the first is upgrading competition policy tools, understanding the value of data rather than just looking at company revenues. Secondly, there is a dire need of training. Finally, the regulator needs to be open, transparent, fast and decisive.

Adolfo Cuevas Teja (Federal Institute of Telecommunications, Mexico) also proposed his five priorities for a reset regulator. Firstly, public policy should centre on using and maintaining strong networks, that is promoting investment in infrastructure. Secondly, the regulator must work with industry, and be prepared to be flexible. Regulation has to be carefully considered before it is implemented: it is a valuable resource to be used only when necessary and only as much as is needed to protect the public interest.

With rapid change and heavy investment, industries tend to show a natural tendency to consolidation, so public policy must focus on protecting competition. Finally, communication is a basic human need. Regulation and public policy have to put people at the centre. That is the most important reference, both in the economic dimension as consumers and in the political interest as citizens. It is important to remember, however, that change cannot happen through the regulator alone, it has to come from the entire political system.

Nicol Turner-Lee (Center for Technology Innovation, Brookings Institution) observed that the explosion in internet and smartphone take up that we have today, and the way it has changed our lifestyle, had not been anticipated but must underpin any new policy. A focus on innovation is particularly important now. Infrastructure is another big issue, as is the full issue of universal access, particularly for rural areas where polls suggest there was strong support for Trump. Also local media ownership, training, creating jobs. This new Administration will enjoy a majority in every institution, something that has not happened for many years; hence it has a unique chance to push policy forward. It should do so looking forward rather than focusing of un-doing what had been done in the past

Peter Davidson (Verizon Communications) underlined the general policy statements made by incoming President Trump, who promised smaller, less intrusive government, lower taxes and the repeal of regulation. Also, the three people appointed to the Transition Team are high quality people with a reformist agenda. However, telecom reform is not likely to be high on the agenda, so it is more likely to happen in 2018, and likely to focus on internet governance, pledging light touch, ex-post regulation underpinned by broad, transparent rules. Also there will be fiscal reforms, lowering corporate tax to 20%-15% and incentives to capital expenditure, even up to 100% depreciation. Finally, trade is likely to be a central issue; the emphasis appears to be on bilateral trade rather than multilateral and discussions on international data flows ought to be central in those negotiations.

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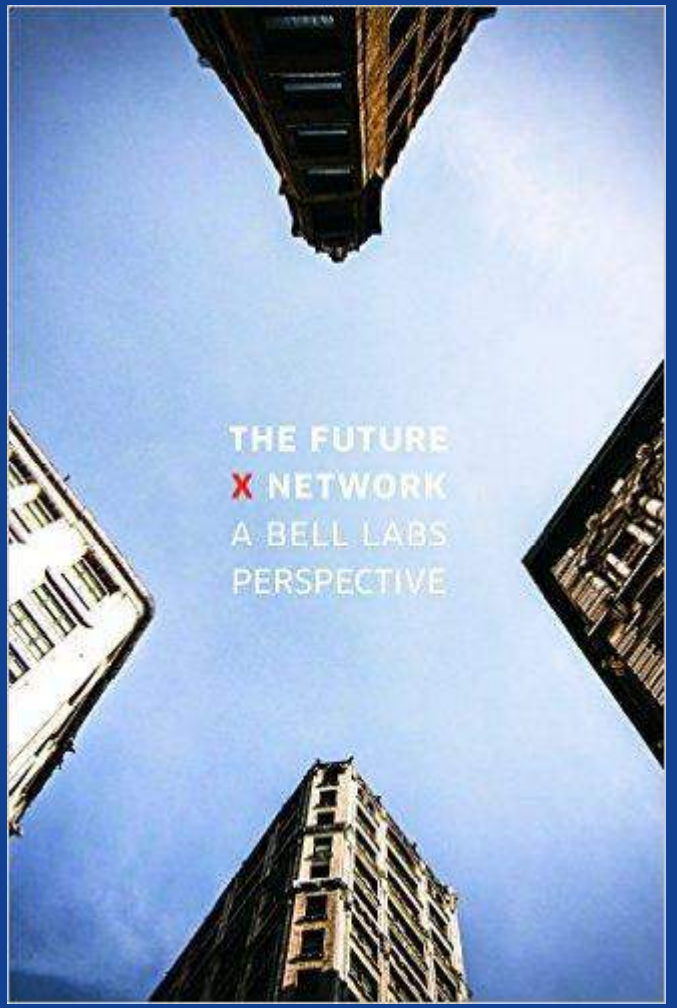
Future X: Building the digital networks, systems and platforms for the automation of everything and the creation of time



Marcus Weldon

President of Bell Labs & CTO of Nokia

The revolution

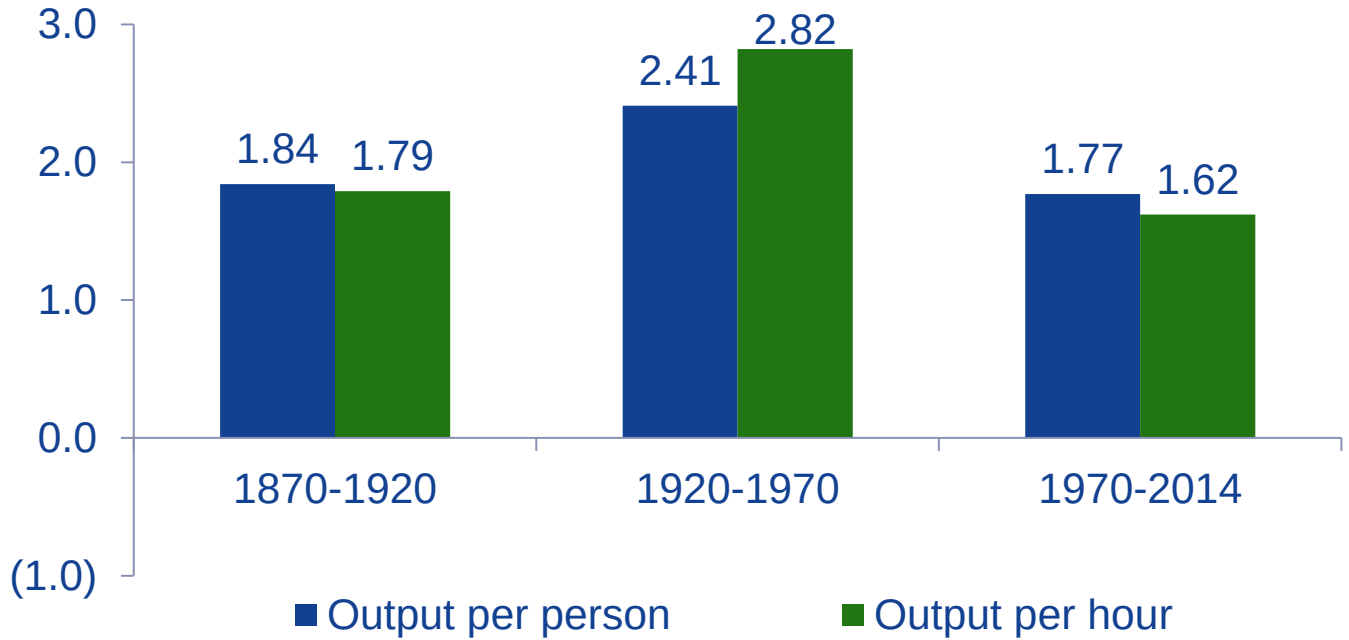
Technological Revolution (def):

Interconnection of new systems and technologies + capacity to profoundly transform economies & society

Tech. Revolution	Enabling Technology	Connectivity
Financial (1600 − 1740)	Stocks & Bonds	Banking & Stock Market Infrastructure
1st Industrial (1780 − 1840)	Steam Engine & Iron Production	Rail and Shipping Networks
2nd Industrial (1880 − 1920)	Steel & Chemicals	Extended Transportation Networks Networks
Scientific-Technical (1940 − 1970)	Analog & Digital Signal processing	Digital Communications Networks
Information (1985 − 2015)	The Web, Cloud computing & Mobile	Internet & Broadband Access
Automation of Everything (2015 −)	Digital interfaces & Data analysis	Future X Network

We are here

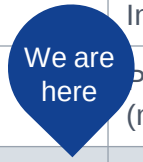
The quest for digital value



Source: Robert Gordon, The rise and fall of American growth

The end and the beginning

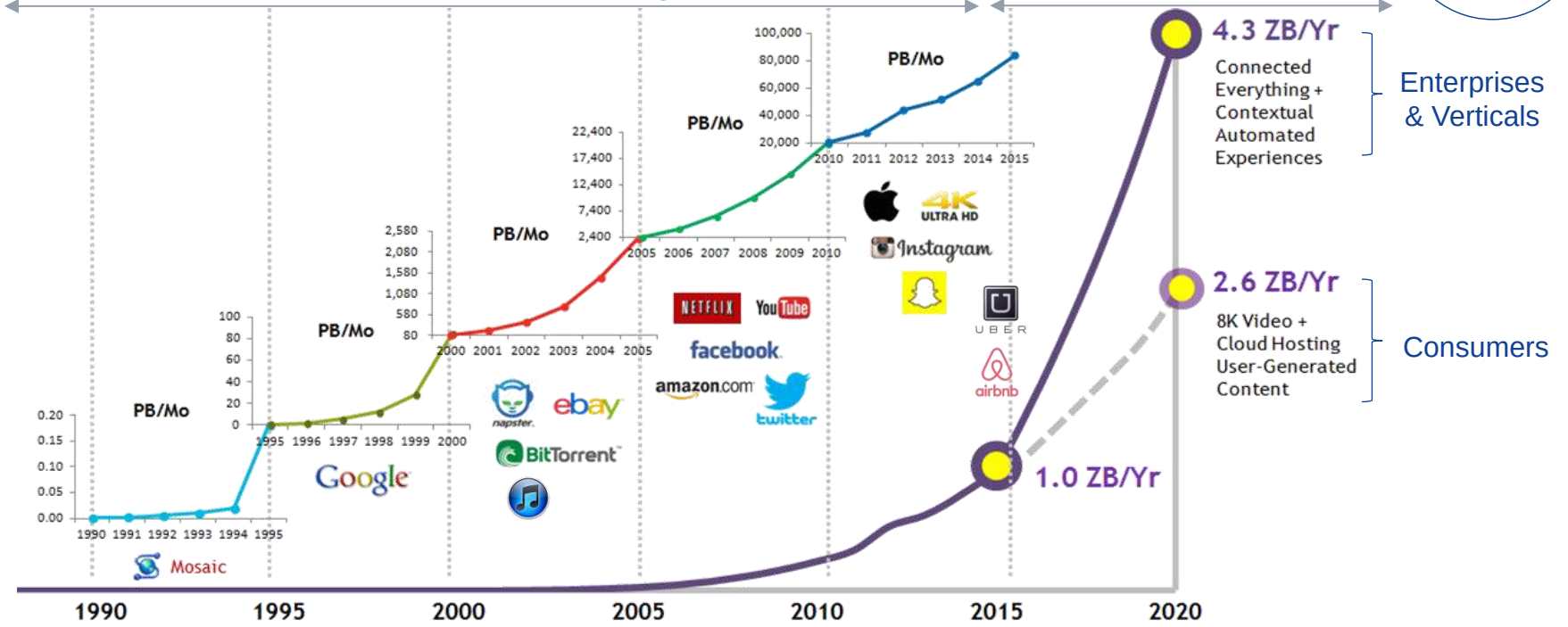
		Past/Present	Future
Business	Solutions	Technology-driven	Human/Business-driven
	Driver	Consumer (GB)	Industry (BW, Latency, SLA)
	Innovation Speed	Per decade (new services)	Per day (new apps)
Technology	Architecture	Heavily Centralized (100ms, 10M)	Massively Distributed (1ms, 1G)
	Flexibility	Limited (Provisioned)	Large (Software definable)
	Sharing	Static and Limited (HW VPNs)	Dynamic and Infinite (SW Slices)
Industry Dynamic	Investment	Singular (Operator only)	Multiple & Cooperative (Many contributors/new players)
	Standards	Definitive	Iterative
	Partnership	Limited w/APIs	Co-design w/Open specs



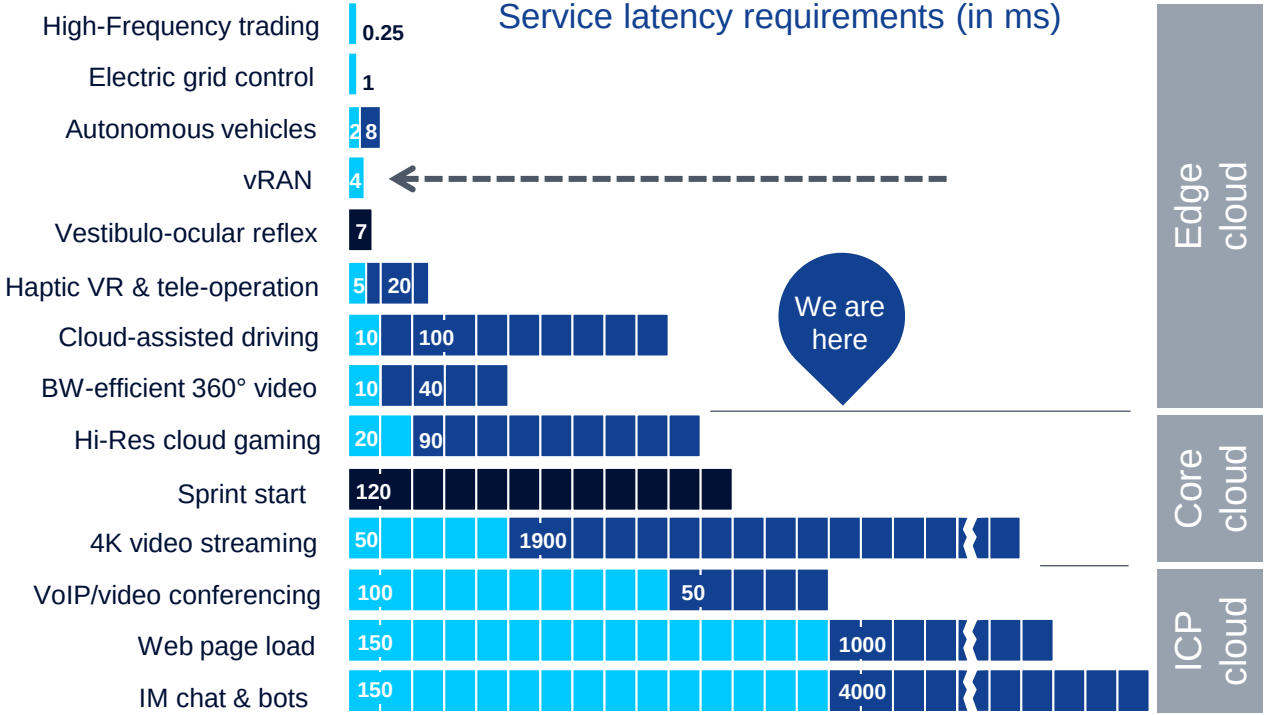
The new digital era

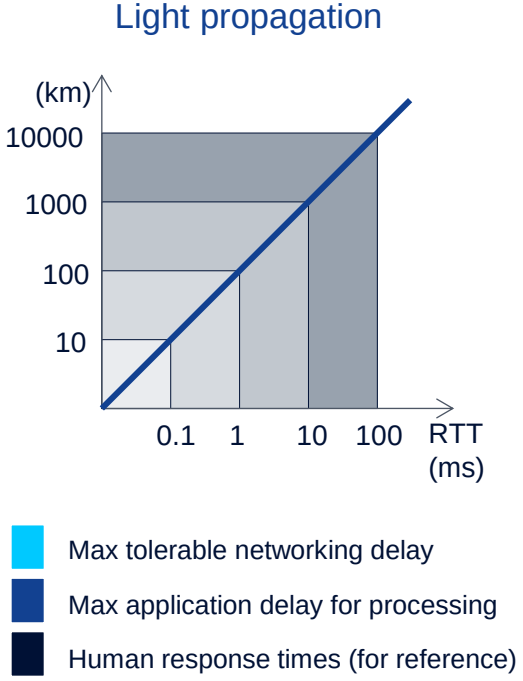
Digitization, delivery & sharing of:

Digitization, distribution & optimization of:

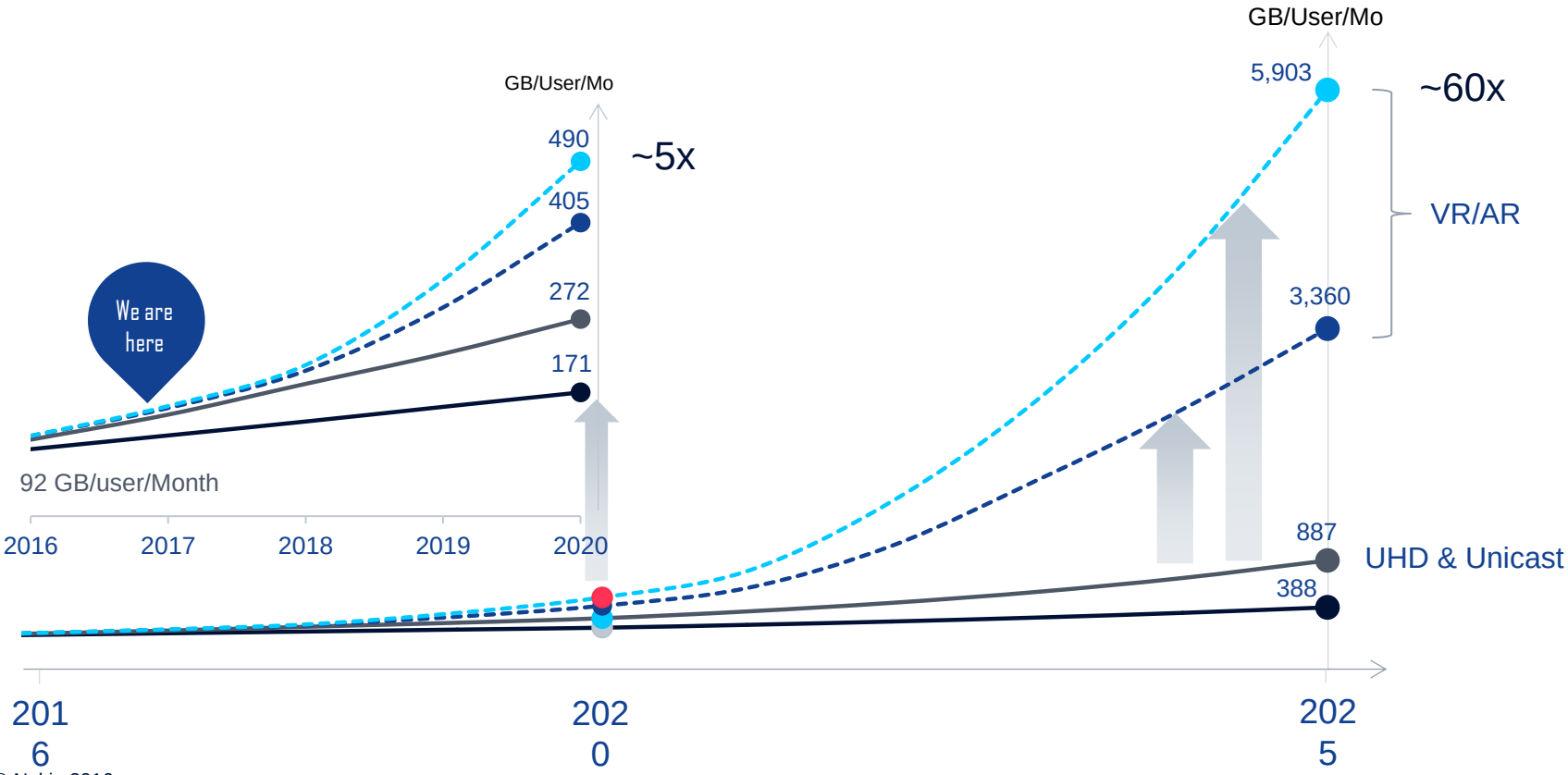


Latency matters …

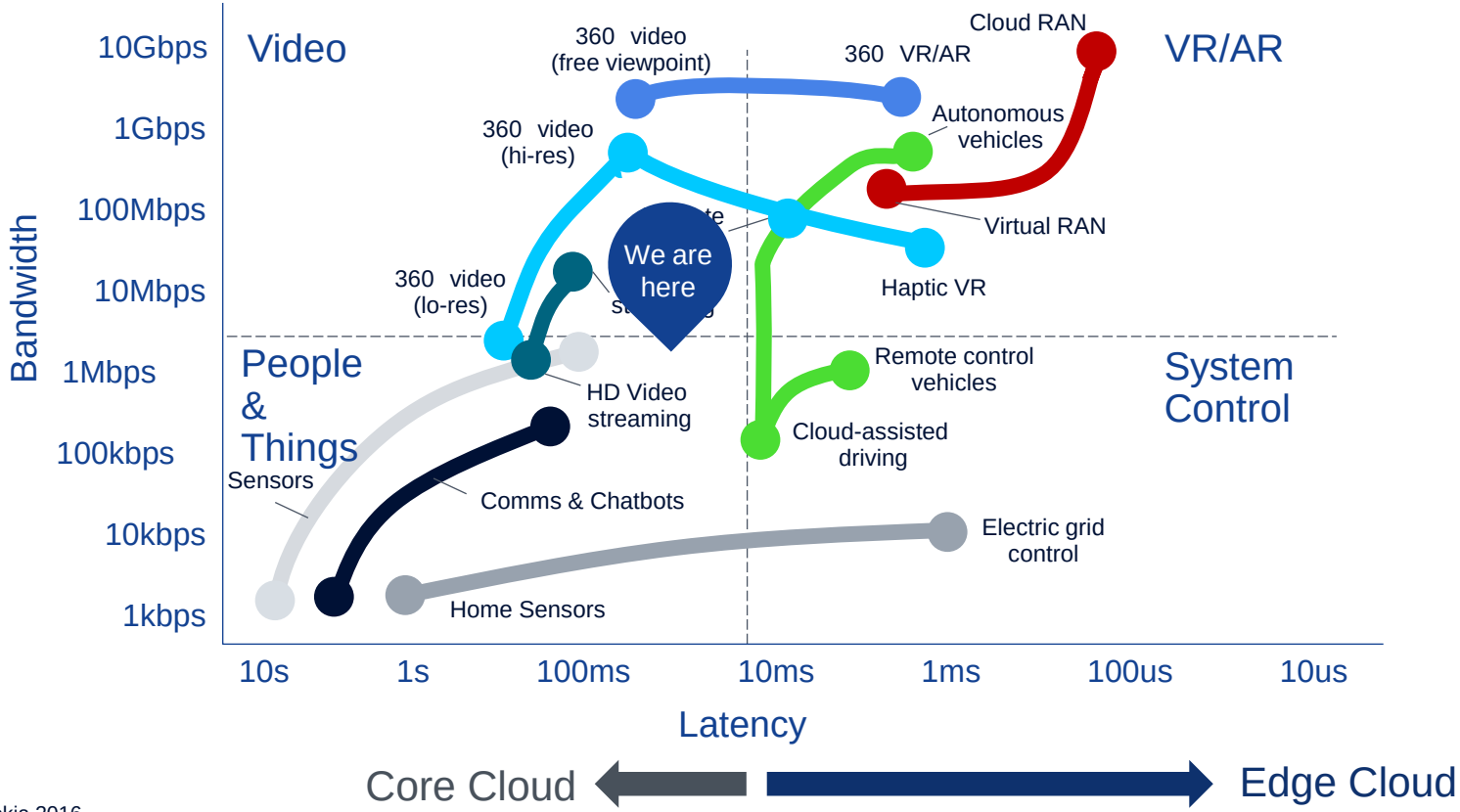




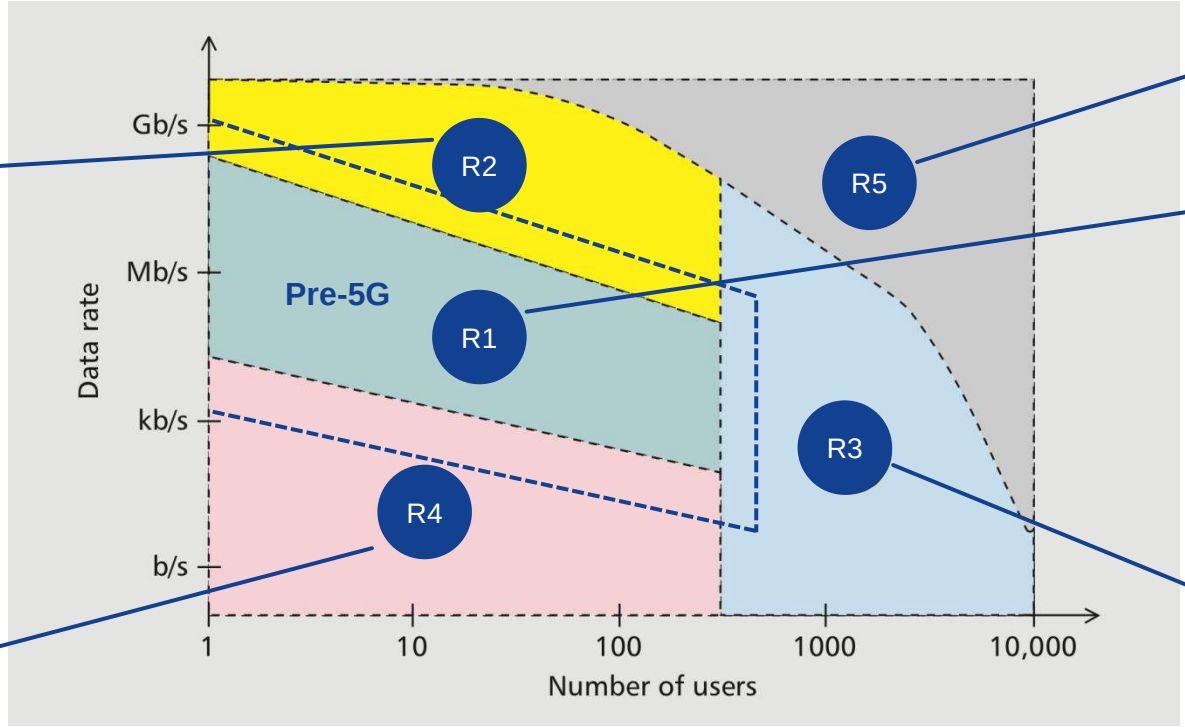
Bandwidth matters …



Latency & bandwidth matter …



A word on 5G …



Ultra-broadband:
"VR/AR"

Forbidden region:
"Shannon Limit"

2G-4G:
"People & Video"

Ultra-narrowband:
"Things"

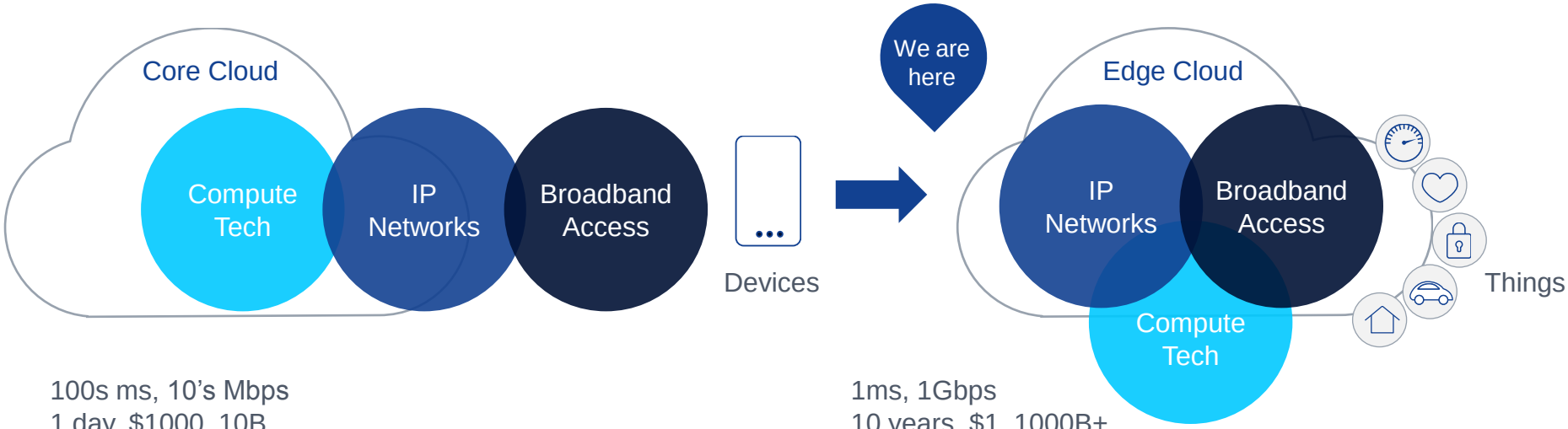
Ultra-low latency:
"System Control"

F. Boccardi, Bell Labs, IEEE Comms. Magazine, 201402

Summary: The 100yr, 100x shift

Enabled by: Global reach and power; SW platforms for business model disruption, stability, non-privacy preserving & inadequately secure

Enabled by: Local real estate, fiber, trust, optimized HW/SW network platforms , programmability, privacy preserving, & secure



100s ms, 10's Mbps
1 day, $1000, 10B

1ms, 1Gbps
10 years, $1, 1000B+

The 8 domains of the new digital reality

Massive Scale Access

1

The creation of ultra-small and ultra-close access nodes

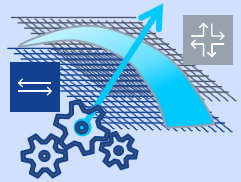
Converged Edge Cloud

The emergence of the edge cloud for low latency and high performance

2

Smart Network Fabric

3

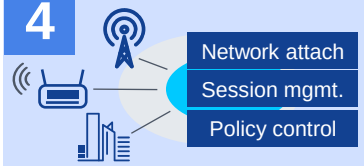


Creating dynamically reconfigurable IP + optical metro and core networks

Universal Adaptive Core

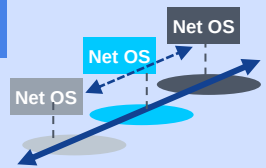
Access-agnostic core for seamless user experience

4



Programmable Network OS

5



The emergence of the network OS to enable programmability and network federation

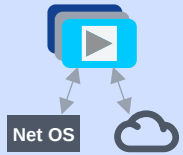
Augmented Cognition Systems

Pervasive cognitive capabilities for operating networks & systems

6

Digital Value Platforms

7



Digital value platforms augmented by advanced network capabilities

Dynamic Data Security

The emergence of new trust models & security architectures

8

Digital Trust

Adaptable Security

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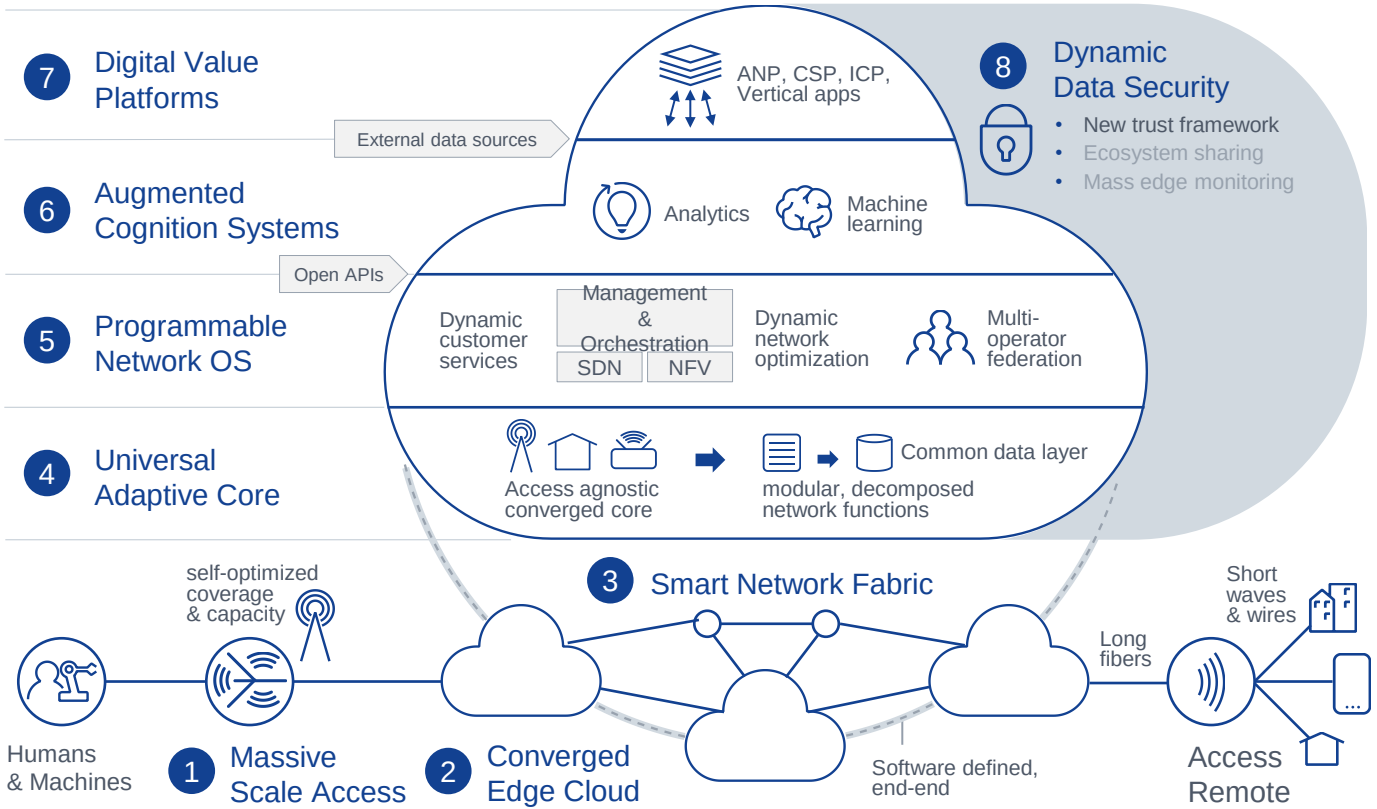
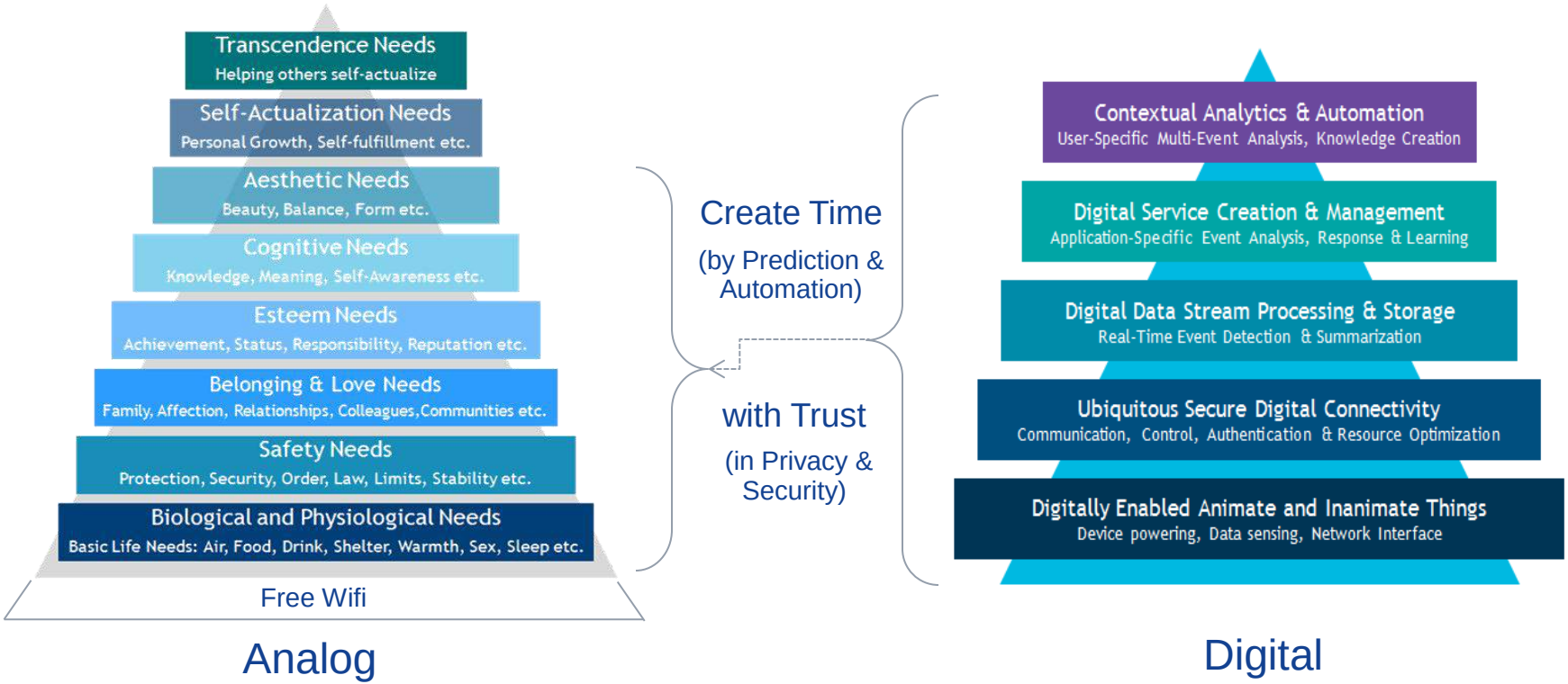
The New Architecture



The New Value (1): Time (& Trust)



The New Value (2): Global-Local Equilibrium

Local Forces

Optimized **Delivery** of Digital Content

Trusted Brand Relationship

Personalization

Personal **Privacy Protection**

Economies of **Secure Network Platform**

Global Forces

Optimized **Discovery** of Digital Content

Massive **Brand Power**

Generalization

Personal **Data Monetization**

Economies of **Cloud Platform** Scale

The New Value (3): Digital Value Platforms

Media & entertainment

YouTube hulu iTunes Spotify NETFLIX

Needs
- Massive scale content delivery
- Dynamic bandwidth control

Data & knowledge discovery

Google

Needs
- Global network coverage
- Immediate response

Comms, commerce, context & Content

VoLte

Needs
- Global network coverage
- Uplink capacity for sharing

Vertical & infra automation

Smart city · Withings Inspire health · Health care · Smart home

Needs
- Tera-scale access and core
- Network slicing for verticals

VR/AR

NETFLIX magic leap NEXTVR

Needs
- Massive access capacity
- Low latency edge processing

Expert assistance

IBM Watson

Needs
- Global network coverage
- Immediate response

Supply-demand matching

UBER airbnb LendingClub

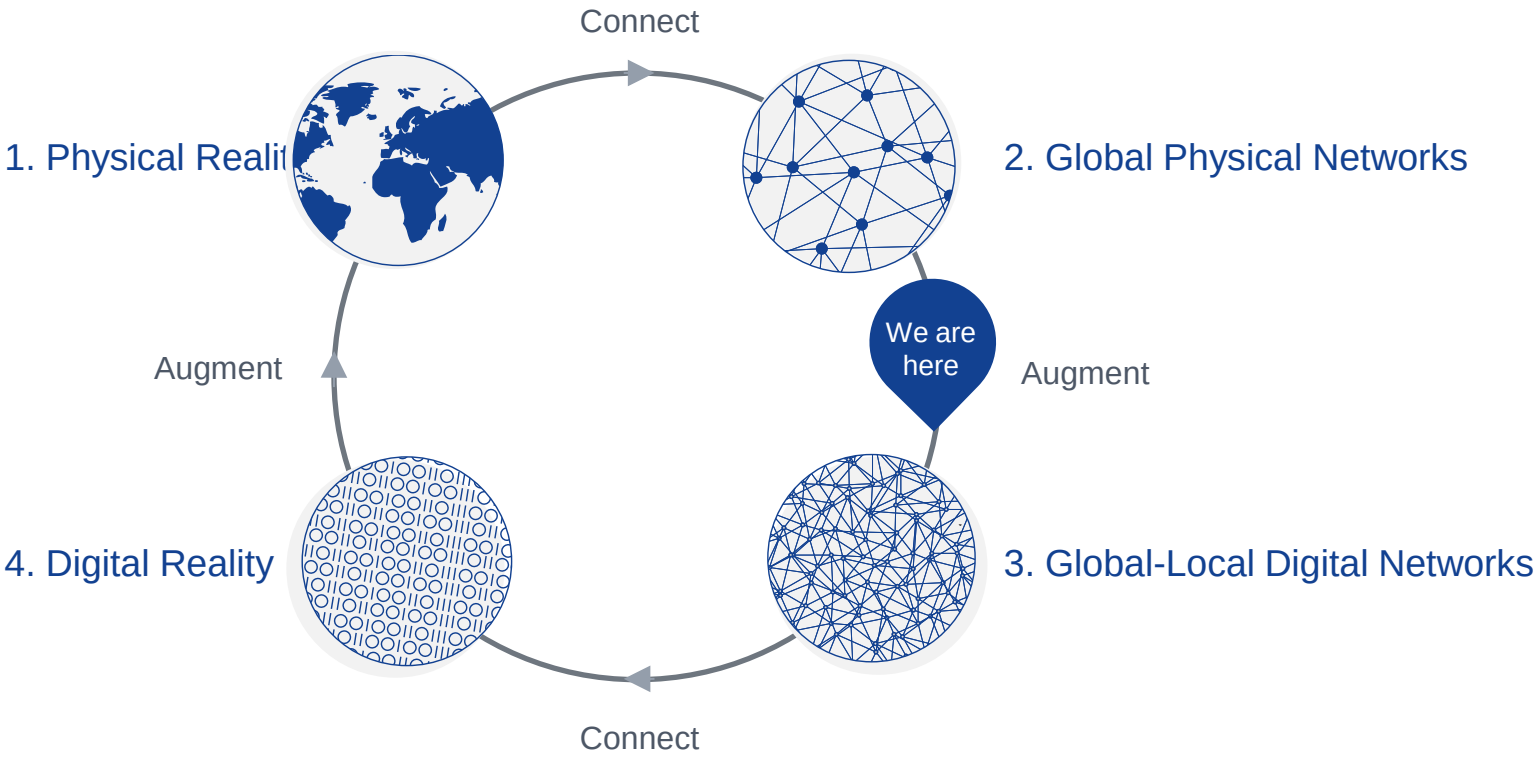
Needs
- Global network coverage
- Network-enhanced trust

Critical control platforms

Self-driving · Industry · Smart grids

Needs
- Latency/reliability constraints
- Control systems in edge cloud

The human (networked) revolution



NOKIA

Examining the disruptive potential of emerging technologies
What are the future applications, platforms, services and devices that will drive demand in the converged communications field?
(Annotated transcript of presentation given at IIC Telecommunications and Media Forum, 29 November 2016, Washington D.C.)

Chair:
RL = Rick Lane - Senior Vice President, Government Affairs, 21st Century Fox

MW = Marcus Weldon - President, Bell Labs and Corporate Chief Technology Officer, Nokia

RL: Marcus is going to talk a little bit about how he sees the future, the future of technologies and the impact that it'll have going forward, on business and society.

MW: In my Bell Labs role, I have to look 10, 15 years ahead. I would argue that is ahead of human needs, because we don't look at technology first, we tend to think about what it is that humanity needs 10, 15 years from now. Then what are the technological blocking issues? And then we work on those problems. What we do is look at big problems confronting the future of information communications networks and systems, etc. And then by looking far enough out and understanding there are some real limits, when you work to solve those problems, you generally discover new stuff, and that's when we win the Nobel Prizes. We have eight, the last one was a couple of years ago, so we're doing quite well.

This talk therefore thinks about what the world might look like 10 to 15 years from now, and what is the world of networks? It's about a vision for the future that isn't biased by anything other than two factors:

The speed of light is one of the biases. So that's a bias that most people would agree we should have. Although there's recent work saying, perhaps in the early part of the universe it went a bit faster than it currently does. But, for the sake of argument, say the speed of light is a reasonable bias to have.

The second one is Shannon's law, which is about the information carrying capacity of spectrum, it doesn't matter whether it's optical spectrum or wireless.

Now, it's not just about the speed of light and Shannon's law, the reason those things matter is we're going to try and build a new type of digital fabric. I don't just mean the network, I mean the platform, the systems and the applications, a digital fabric that will allow the automation of everything. And fundamentally the goal of automating things is to create time. So that's why the title is, something, blah, blah, blah, creation of time.

What I'm going to propose is that this era we're about to embark on is actually going to be what's called, 'a technology revolution'. That's actually not a trivial term, there's an economist definition of this. The definition is, it's a revolution, a technological revolution, it's the interconnection of new systems and technologies. That makes sense - it has to have a new technology to be called a technological revolution, but that's the necessary condition. But its sufficient condition is for it to be a technological revolution and the capacity to profoundly transform economies in society. I'm going to argue we're going to do that with the next phase of the internet, and I would argue we haven't done that so far. What we've done so far is to allow people to see and find stuff, that is each other, media, digital content, but that's about all we've done with the internet so far.

So these are the technological revolutions that are recognised so far, the bottom one is the one I'm going to talk about, so there's only really been five up 'til now. The first one was called a 'financial agricultural revolution', the technology was bits of paper that were trading

goods that were stocks and bonds. The connectivity or the network was physical infrastructure where you've got together and you traded those stocks and bonds.

A couple of industrial revolutions were production of steel which allowed us to produce tracks, boats and engines, so we produced both the network with the steel and the things that ran on the network. Petrochemicals helped as well, we could make some plastics and things like that. So overall we managed to transform our world, in fact Robert Gordon's work says, that's the only thing that's ever increased human productivity, that era. Since then we have not increased human productivity, and the quest is to actually find another way to increase productivity. But he argues it's the two industrial revolutions, and he would include a bit of the scientific technical revolution where we did a bit more, so that's the only time we changed humanity with technology.

What do I mean by scientific technical? I like to say that's when we stopped shipping goods and starting shipping bits. The bits we started shipping were mostly signalling things, voice was there too, but it was a lot of signalling of systems that we interconnected to allow us to get more efficient, and voice was just one of those applications. But that's what we did with the analogue and digital signalling processing, we shipped bits around, but they were mostly control bits. And enabling technologies, we all know it was the web, www infrastructure. Cloud helped because it gave massive capacity to the server side of things, mobile helped because it gave facile access better than a laptop. And then of course we had to build connecting networks, which was the internet broadband system. So those are the ones we've had so far.

I'm going to argue that we have a new one. It is driven by the desire to put digital interfaces on everything, so everything can signal, not just humans with phones, but everything will be able to signal, whether it's a road, a bridge, a truck, a person, your physiology - these sensors will be everywhere, that's the so called Internet of Things.

Of course we have to be able to analyse that data. That's where AI will come in, and machine learning because we cannot possibly as humans analyse that data when we can't even analyse the data we're presented with today. And I'll show you some arguments about how much more data there'll be. And to do that we're going to build a new network. I'm going to call it the 'Future...Network', because that's the title of a book we wrote. It's a network that is highly distributed with millisecond latency and gigabits of capacity - so I'm going to talk about that. So this is a big deal, there haven't been many technological revolutions.

So, we're sitting at the precipice of a revolution. So I said I would talk briefly about Robert Gordon. These are the industrial revolutions up to and including the digital signal processing era. And Gordon says that basically over this magical 100 years we increased human productivity for the first time since when you were doing mechanical things with wheels and stuff. And his thesis is, we haven't done it since. In fact the first phase of the information era we decreased human productivity, we distributed systems but not necessarily made them better. So rather than having monolithically integrated factories and things, we've distributed everything, we've outsourced, we've built IT infrastructure, but we haven't actually made it better. So his argument is we've decreased human productivity over that period of time. There may be more humans producing more interesting goods, but that's his argument. Now it's hotly debated, you can find economists on both sides of this argument.

The other side say the problem is we just measure productivity in the wrong way because this was labour intensive, but what about intellectual productivity, that's not measured here. So the point is the next era has to solve this, because I think we haven't done something remarkable up until now.

At Bell Labs we're thinking, "Can we actually prove that the next era will actually solve those problems?" And it does get into what's the right combination of humans and robots.

Robots are going to have to be physical robots, they can be software robots that actually might increase overall productivity, even if human productivity might go down. That doesn't mean to say out of work, it simply means you work less hours because you have a software or hardware robot assistant. If you add that up it might be that productivity goes up - so that's what we're working on.

What I'm going to try and convince you of is that lots of stuff is going to change if we bring everything online, if we instrument everything. Basically every aspect of building digital systems, networks and intelligence systems is going to change. This is going to change business...technology is going to enable that, and the industry dynamic is going to change. So, I'm not going to go through it all, but I will point out a couple of things. One of our theses is that consumers are not going to be the drivers, and this is important because it changes everything. I would argue that we have, for the last 20 years, been focused on the consumer, meaning giving more bandwidth that allows voice data and video coms and entertainment services, and that's what's been driving mobile networks and broadband networks. But I would argue that's done.

Business, on the other hand, is hardly instrumental at all, hardly digitised. So the point is industry is going to be digitised this time round; think of industry in the broadest sense meaning our world, everything will be digitised. But if that's true, then industry has different requirements, consumers only care about gigabytes in the end. Industry cares about mission critical things, so latency starts mattering, bandwidth has to have guarantees, and so on. Because we've been consumer or communications-centric, we've built networks that have 100ms of latency and they have 10Mb per second roughly, because that's all you need for a video per session. But in fact if I want to serve industrial needs, then I have to build networks that have 1ms of latency, and possibly gigabits per second per session not just on the pipe, but per session. And it turns out that 1ms, because of the speed of light, is hard and so I will show you that, but I will give you a summary here. 100ms, if I have 100ms available to me light can go 10,000km round trip, there and back. So I can get to a web service and back if it's 10,000km away, it can do that in 100ms. Pretty amazing, because light's pretty fast. But it turns out if I only have 1ms available to me, I can only go 100km, so suddenly any application that has a 1ms timing requirement, and we'll talk about what those are, it can only be situated 100km away from me. I have no choice unless I fix the speed of light, which is again the only bias I'm going to have, other than Shannon's law.

This is owing to relate to Shannon, it turns out we've run out of wavelengths and spectrum, and the way we've built networks, so we've got to go much, much closer and use new spectrum which is...wave and 5G comes in, in order to solve the gigabit thing - and that's my Shannon thing. I'm going to have to build the Cloud, if you want, where the application is hosted 100km away, not 10,000. And I have to build the access piece, the radio piece, such that I can deliver a gigabit over that link, and that's generally going to mean a couple of 100m away from the user not kilometres away. So those are the two big changes. And all the other things fall out of that ; it's going to be software defined, virtualised and a lot of that is just to allow us to scale these networks to support the massive amount of devices we're going to be connected. I need to virtualise that infrastructure so I can scale in and scale out, I need to software define it so I can adapt to the changing demands of these different machines, I need to network slice everything. So all that changes as a consequence of us solving industrial problems, rather than consumer problems.

You must be thinking, "What's going to happen to consumers?" They're going to benefit from solving these industrial problems, and I'll give you an example in a minute of how the two connect. In fact they're not really separable, it's just who's driving and who's in the passenger seat, and that's a bit of a pun on on autonomous vehicles, but it's actually the point. Autonomous vehicles are in fact an industrial problem we're solving - traffic management and optimisation, etc., and people will benefit, because in the end it's people who in the cars, but they are not the drivers of that. Consumers weren't really asking for an autonomous vehicle, were they? No, because in fact they quite like driving, they think they're quite good at it, but of course industrial problems say there's too much traffic, there

are too many accidents, there are too many fatalities. So in cars perhaps you'll get more efficient...so it's an industrial problem solved driven by web skilled companies driving then the car companies, but it's an industrial problem from which consumers will benefit. So that's what I mean they're not completely decoupled, we don't think consumers are going to live lousy lives in the future, but drivers are going to be industrial problem solvers - so that's where we are.

Let's talk about the last 20-ish years. We've digitised, delivered and shared stuff. But the next era is digitalisation, distribution, optimisation of everything. And so here's my point, is consumers will keep sharing stuff and watching stuff, video, host in the Cloud, you can access it everywhere, also using generated content from GoPros and VR and AR. But up here is the industrial revolution, that's where we're going to connect everything, we're going to understand what it means, and we're going to optimise everything, and that's a much bigger and more interesting problem to solve. Industrial applications, which then consumers benefit from, and you can do many of these. So they're not really as separable as they make them, but the point is, if this is the driver we build networks that meet these requirements, and then consumers ride on those networks.

So one of the requirements for that would be a certain amount of bandwidth and a lot of latency and mission critical control. If I'm having a heart attack, you'd rather not that the TCP connection goes down. That was the case in Amazon Cloud, where people with pacemakers couldn't get the signal through when Amazon went down, and it took 10 hours to get back up - that's not very good for a heart attack patient. So you see that we have to build networks of much higher fidelity and capacity and latency requirements, and mission critical attributes. And I'd argue actually, Uber here have been big, sort of on this path, they've solved industrial ride and real estate problems. It wasn't really consumers asking for that, so much as they saw an opportunity to disrupt those markets, because they were so closed and inefficient. And yes, consumers were large scale users of that, but you get the idea. Now it turns out they didn't need special networks.

I'm going to talk about latency. In humans, it turns out, if you're hearing or seeing or sprinting or blinking, it takes about 100ms. So now it suddenly makes a world of sense why we built networks that took 100ms to do things, 'cause humans can't do anything faster, whether you're hearing something or seeing, or whatever, and sprinting is just one example of that. But basically humans are only good for 100ms. Why would you build a network that was better than that? You wouldn't. Except it turns out they're better at one thing - vestibular-ocular reflex. It's exciting because it's the basis of VR/AR. if you think about it from an engineering perspective, when someone moves their head, their eyes should actually move over, they should remain locked and move over. But no matter how much I do this, I'm still looking at you. Your brain does this...it's called vestibula-ocular reflex - when I move my head one way, it moves my eyes in exactly the inverse way at the exactly the rate that I move my head. If I don't do that, if I don't abide by this then you actually start feeling sick, your brain is programmed to require this. So VR/AR, when you put on goggles and you move your head, and you expect to have a focus that remains, you know, things can move around, requires 7ms of latency. That's for the whole application, so what I tend to say is the network part of that, if I'm running a network, is 1 or 2ms. Because there's application processing, there's image processing, there's the augmented reality part, where people are putting in information - so the network part is about 1ms, I can't get away from that.

So I did have one more bias I didn't admit to at the beginning - the human brain. Unless we can change how the human brain reacts to that, those images, faster than the speed of light plus Shannon, is a fact that remains true. So, it says that if we're ever to do, sort of, VR/AR applications across networks, we need 1ms of latency, 1ms of latency = 100km away, that's where the application is going to have to be hosted. Now think what that means, that means the person who's providing the VR or the system that's providing the VR content, can only be 100km away from you, at most, it cannot exist...so if it's an AR application where you're attached to another person who's guiding you - remote instruction, remote

teaching, remote surgery, remote whatever, they can only be 100km away from you as well. So certainly instead of off-shoring everything and outsourcing, you have to ensure...to within 100km for these applications. And again, all I've invoked is the speed of light, and a head movement.

But if I'm going to put 10,000 machines in that sector, or sensors, I've got to change how I scale networks, so I'm going to virtualise them, which means I can run a control plane in the Cloud and everything works better, so that's why I have to do it. But the point is, if I do that, I have a timing requirement in those networks that's 4ms. So I actually will be building the network for itself, to have a 4ms timing requirement, and oddly it's the same timing requirement for VR and AR applications. The only reason I point this out is, it means we have no choice, network operators are going to build networks that have 4ms of latency for the network itself. And that 4ms of latency is exactly the type of thing you need for the new application. So the world is going to move here, 'cause you don't have to pick here between the new applications and the network, the new applications and the network have the same performance criteria. So it means everything is going to move in this direction.

On to the bandwidth thing, this is virtual reality itself. Typically users are using about 92GB per user, per month somewhere at the end of 2017, is in the US. Within a few years that'll be five-fold, within 10 years it'll be 60-fold. And the reason 60 fold is very simple, VR/AR, if you think about how you watch TV or video on any screen, you get about a 30 degree field of view, you see this...you don't see over there. VR/AR, the whole idea, 180 degrees or 360 degrees, so you just multiply at the numbers screens 15 or 20 times. You get to bandwidth on the order of 100Mbps, maybe it's 200Mbps, 300Mbps per second of the bandwidth you're going to need per session. Do that times the number of people, and this is usage per month, and you get up to 60...so here we're only assuming, I think, 10% utilisation of VR at the same time. So think of it as peak hour VR entertainment, that's the sort of level, about 10% simultaneous usage, and you get to about 60 times the bandwidth increase in 10 years. So, the very simple way I have of summarising this, is to say that the future is 100 times more capacity, and 100 times lower latency, and we have to do that in 10 years.

So far we have lived in this world, they call it the people and simple things world. It's communications, it's chatbolts, it's HD video streaming, it's some sensors, etc. The characteristics where latency was about 100ms and bandwidth per session was about 5Mbps per second, maybe 10 in some cases. This is the world that we've lived in for 100 years, we've built networks that do this. Where we have to go to get the latency down is to shift the network to be 100km away, and to get the bandwidth up, I have to get the radio piece to within 100m of you. That's a big deal, so that requires this change from centralised to highly distributed. Okay, that's where we are, we've got a lot more to do. But we're going to do this in 10 years, so this is what 5G is all about.

So here's 5G. I'll explain what the goggles mean in a minute. So Bell Labs have been working on 5G for about 10 years, because Bell Lab's job is to think 10 years ahead. The 5G will be coming available in trials this year, with full commercial roll-out in say 2020. So by definition Bell Labs should have been thinking about this in somewhere around 2010, which is roughly when we started thinking about it - so about seven years ago. Now what the Bell Lab's guys said is, "Well, what should a network do?". It should serve a large number of users with a lot of bandwidth - a pretty simple thought. But then if you frame it that way, you say, "Well, let's see how we've done so far." And we realise that we only ever built R1s, we built networks, wireless networks in particular, to serve a couple of 100 users, and maybe a few tens of Mbps per second and we've done that for years. They call it the 2G to 4G people and video network group.

And, of course, things have different amounts of bandwidth depending on whether they're a video camera or they're just a sensor. My point is, we've built this, for 100 years we've built this, this is the 100 time shift. What do I mean by 100 times? 100 times more bandwidth, 100 times lower latency. So we built networks that look like this, there's access, there's IP

and optimal networks and then there's centralised Cloud, and it was good for this...100ms, 10Mbps per second, one day of battery life...I correct that, five hours of battery life, $1,000 roughly, there are some cheaper devices than 10 billion. But what we're going to do is build this...same ingredients but massively shifted towards the edge, so the Cloud goes to the edge, the access IP networks go towards the edge, and we're serving things this time. And the things have the characteristic thing, 1ms of latency, a gigabit bandwidth, 10 year battery life, it can cost $1, some of them, and there'll be 100 billion, some people say a trillion. So there's hundred-fold, every one of those dimensions, and there's the hundred-fold shift. So that's what we've got to do, and we're going to do that in the next 10 years.

Now I'm going to talk about a little bit of architecture and stuff. This is where we see the value of the future. Massive...and this is across all the ecosystem, so it's not just in the network portion, we see there's a lot of value in the access layer, because we've got to put a tonne of capacity out there and lower latency. We've got to build this edge Cloud, and essentially this is where I'm going to run the control plane and the new applications. It has to be a smart network that allows that to dynamically all adapt to changing patterns. There has to be a way to manage sessions, that's what the adaptive core sessions subscribers machines have to be managed, so that it's organised. The network has to be programmable, in a way that's abstractable, so that people can just ask for the service they need, and it instantly gets created.

There have to be knowledge systems on top of that, cognitive systems that learn not only from the traffic over the network, but actually allow the traffic from the network to inform the application. Think of those as the new Ubers, new Googles, new Facebooks that actually take advantage of all this and create new services. And then we have to think differently about security, because end-to-end we now have to secure things in a brand new way, because most of the devices we're attaching will have no imbedded security whatsoever. They will come from uncertified, unknown providers...running on unknown components, so we have to certify these things at the point of ingress, which is going to be in the network way. But we have to do that in new ways that allows devices to form groups and think of things like block chain and other methods to do that.

So, we build it as a network, because that's what we do, but this is the sort of value of the future. So it's not just think of the network architecture, it's a value architecture, and I've mentioned all the different pieces, but this describes the future of digital industry. Now, it doesn't say there's equal value in each of the loads. They may be presented as roughly equal size, but you could argue right now we're in a world where most of the value has moved to digital value platforms, think of web services. What we're going to argue, is that's going to be rebalanced a bit, because of this need to move to hyperlocal. So let's go into some of those values, but I want to take a minute to pause on the idea of saving time, then I'll do hyperlocal and we'll wrap up.

This is called, 'Maslow's hierarchy of human needs'. This is Maslow, who was a psychiatrist, psychologist, he said that this is what people seek - they seek actually to spend less time down here and more time up there. These are mundane tasks, those are pleasing cognitive tasks. Down here not so mundane, you can read for yourself, but the idea is...and at the top, you teach others, transcendencies, you have the time to teach someone else. What I'm going to argue is that, we're going to build a next generation digital infrastructure, think of it as putting sensors on things, connecting those things, analysing the data from those things, making sense of that analysis and then creating knowledge - that's what this is. But it's got all this to create time, and how we're going to do that is, because we're going to reduce the amount of time that people have to spend in the mundane part of their lives, and spend more time in the upper part, which is where they do creative, esthetic idea things, intellectual things - so this is the game we're going to play. If we do that, then the network part, and that's network and platforms and things, essentially will have more value than it has today, where it's essentially just a pipe. The next generation network, because it's imbedded, the Cloud is imbedded in the network,

essentially applications will run in the network, there's much more it can do to help people save time. And those people are industrial people and consumer people.

It was an economist who said, maybe the new commodity, that isn't the things down here - food, water, shelter, is time, and any applicational platform or system that actually manages to save time has value in the future. So that's where we should be looking about where new value is. Some of that is in networking, some of that is in the systems, the control network, some of it is in the applications that run on these networks. But fundamentally, the next generation digital fabric, its goal is to save time. And that should increase human productivity, human plus robot, because it may be the outcome is we work less. Because remember the goal was that people could spend more time up here, be more creative, more esthetic, more appreciative. But it might be some of the mundane tasks are taken over by robotic system.

Now, that sounds a little bit frightening, but I'm going to off-set that with one thing. The counter effect of this, which is related, is 3D printing. So just when I said I might do everything digitally, in fact what I'm going to do is send everything digitally as far as I can, and then recreate the physical at the edge - and that's what 3D printing is. I will recreate goods at the edge that then need assembling, because a printer can't assemble. Yes, maybe a robot could be there to assemble components so that would be part of it, but very often it's going to be a human assembling most of this. So we can actually move to a world where, because we've digitised and connected everything, and we have physical output systems that are both robots and printers, we are actually going to be able to send the file to as far as possible to you, wherever you are, and you can make whatever it is you want to, or recreate it. So again, instead of off-shoring everything, everything's going to be in-shored for manufacture.

There's a very interesting example, it's a UK example. There's a doll company, children's dolls in the UK that 3D prints dolls. They are 3D printing dolls to order, and then they send them to you. In fact, in future they'll be able to send you the 3D file, you will print it, or have it created, it will be shipped to you from a local Walmart, which is where the 3D printer was, and that's how it would work for now. And they make a good business, they charge £99 for those dolls, because they're tailor made for you. It's your doll looking like whatever you want it look like. So, that's already an example, it's a trivial example, of how we're moving off-shore to in-shore because of this next generation of robotics, 3D printing and digital fabric.

What I'm saying in the end is, we are changing to a new equilibrium. And this is really important to realise in any policy or regulation is that we're going from a world where we were going in this direction, we were globalising everything, because it seemed like the right thing to do. It was cheaper, everything was everywhere, everything was the same, but what I can't do if I do that, is deliver low latency, high capacity, virtual reality, augmented reality. Or tightly controlled systems flying a drone, for example, or driving a car. So we're going to shift in the other direction, and we're going to optimise the delivery of content and control locally, and locally my definition you know now is within 100km, and the access piece within a couple of hundred meters. And instead of having massive brand power over here, we're going to rely on trusted brands locally, it's going to be personalised, rather than generalised, privacy's going to be protected, rather than monetised. And then security is going to matter a whole hell of a lot, because you're trusting your entire definition of you into this system.

Now I'm not saying that we shift all the way back, I'm arguing that we simply get to a happy medium. There will be companies that provide this...and there will be companies that provide that...and those two things are going to work together as an alliance, where the applications owned by these companies get hosted on the networks that are owned by these companies, and vice versa. There'll be some novel applications that run locally here, that actually can be leveraged by those. So it's a rebalancing industry driven, I would argue, by the speed of light, Shannon and my brain.

So I'm going to stop there, I hope you found it interesting. But there's nothing we can do about this, the only thing you can dispute is, whether or not we need to go there, or something else is going to happen, so we don't need to go there. That's it - thanks very much.

美國聯邦通訊傳播委員會各委員背景一覽表

2016 年 11 月

★美國聯邦通訊傳播委員會（Federal Communications Commission，FCC）是由 5 位委員主導運作，這 5 位委員由美國總統提名，並經由眾議院同意後通過。除非是遞補任期未屆滿的委員所留遺缺，否則 FCC 委員的任期為 5 年。美國總統會指定其中一名委員擔任主任委員，任一政黨委員不得超過 3 人，且所有委員不得與 FCC 監理的相關產業有財務上的利益關係。

姓名	 **Tom Wheeler**	 **Mignon Clyburn**	 **Jessica Rosenworcel**	 **Ajit Pai**	 **Michael O'Rielly**
生日	1946 年 4 月 5 日	1962 年 3 月 22 日	1971 年 7 月 12 日	1973 年 1 月 10 日	N/A
任期	2013.11.4～2017.1.20	2009.08.03～2013.01.08 2013.01.19～2018.01.19	2012.5.11～2017.1.03	2012.5.07～2017 2017.01.23~（接任主委）	2013.11.4～2014.6.30 2015.1.29～2019.6.30
出生地	Redlands, CA.	N/A	West Hartford, CT.	Buffalo, NY. （在 Parsons, KS.長大）	Lock Port, NY.
政黨	民主黨	民主黨	民主黨	共和黨	共和黨
學歷	Ohio State Univ.	Univ. of South Carolina 碩士、並取得銀行、金融和經濟系學士	Wesleyan Univ.及 New York Univ. 法學院碩士	• 1994 年 Harvard Univ 學士。 • 1997 芝加哥大學法律學博士，並擔任芝加哥大學法學評論期刊編輯，曾獲 Thomas J. Mulroy Prize 優秀上訴辯護獎得主。	Univ. of Rochester 學士

姓名	 **Tom Wheeler**	 **Mignon Clyburn**	 **Jessica Rosenworcel**	 **Ajit Pai**	 **Michael O'Rielly**
				• 2010 年為馬歇爾紀念獎學金 55 位得主之一。	
經歷	• 在擔任 FCC 主委之前，Wheeler 是 Core Capital Partners 的總經理，這是一家專門投資還在起步階段的網路公司的創投企業。 • **他曾擔任 Shiloh Group, LLC 的總裁暨執行長。**這是一家專注在電信服務策略發展和私人投資的公司，以及另一家共同成立的公司 SmartBrief，則是網際網路垂直整合市場中最大的電子資訊服務公司。 • **1976-1984 年間，**Wheeler 在全國有線電視協會工作	• **2013 年 5 月 20 日**總統歐巴馬提名 Clyburn 擔任第二任期委員期間，她曾任 FCC 代理主委。 • **2009 年 8 月**開始擔任 FCC 委員之前，Clyburn 擔任南卡羅萊納州公共服務委員會（PSC）第 6 區的委員達 11 年之久。2002-2004 年間擔任該委員會主委。 • **在進入 PSC 工作前，Clyburn 是 The Coastal Times 的出版者暨總經理，**這是一份南卡羅萊納州 Charleston 市的報紙，主要以非裔美國人為目標讀者。她經營這份家族創辦的報紙達 14	• 在擔任 FCC 主委之前，Rosenworcel 擔任參議院商業科學暨交通小組資深通訊傳播顧問，該小組主席是參議院 John D. Rockefeller IV，前一任主席是 Daniel K. Inouye，她負責立法、聽證，以及各項通訊傳播議題包括頻譜拍賣、公共安全、寬頻布建及採用、普及服務、視訊節目、衛星電視、社區廣播，以及數位電視轉換等的政策發展。 • 在進入參議院擔任顧問之前，她是 FCC 前委員 Michael J. Copps 的法律顧問。	• **2007-2011 年間，**Pai 在 FCC 總顧問辦公室擔任多項職務，最高職務為副總顧問。他負責督導行政法部門數十位律師，並處理無線、固網（wireline）、線纜（cable）、網際網路、媒體，以及衛星產業的管制和交易事務。 • **在進入 FCC 工作之前，**Pai 先後在民間及公部門工作。Pai 曾在 Jenner & Block 律師事務所的 DC 辦公室擔任通訊傳播法合夥律師。數年後，他在 Verizon Com. 擔任副總顧問，處理競爭議題、法規管制、寬頻計畫事業單位的顧問	• **2010-2012 年**在參議員黨鞭 John Cornyn 辦公室任職；**2013 年 1 月起**擔任 Cornyn 的政策顧問。 • **2012-2013 年**擔任參議員 Jon Kyl 辦公室幕僚副主任及政策主任。 • **2009-2010 年**在參議院共和黨政策委員會擔任銀行、科技、交通、貿易和商業議題政策分析師。 • **2007-2009 年**在參議員 John Sununu 辦公室提任立法主任；**2003-2007** 年擔任 Sununu 的資深立法助理。 • **1998-2003 年**於眾議院能源暨商業委員會擔任

姓名	 **Tom Wheeler**	 **Mignon Clyburn**	 **Jessica Rosenworcel**	 **Ajit Pai**	 **Michael O'Rielly**
	（NCTA），他在**1979-1984 年間**擔任總裁暨執行長。之後他在多家高科技公司擔任過執行長，包括第一家提供高速傳輸數據到府、第一個提供數位視訊衛星服務的電腦公司。 • **1992-2004 年間，**Wheeler 擔任行動通訊及網際網路產業協會（Cellular Telecommunications & Internet Association，CTIA）總裁暨執行長。	年。 • Clyburn 是聯邦—州政府普及服務聯合委員會、聯邦—州政府分立聯合委員會，以及聯邦—州政府先進服務聯合會議的成員。她成為 FCC 委員第一個任期時，擔任這三個組織的主席 3 年。	她也同時擔任 FCC 固網（wireline）競爭局局長的法務律師和該局法律顧問。 • 在進入公職之前，Rosenworcel 曾在 Drinker Biddle and Reath 律師事務所專攻通訊傳播法。	工作。 • **1998 年，**Pai 到 DC 第一份工作是在法務部信託部門擔任電信工作小組出庭律師，當時他處理過併購案和 1996 年電訊傳播法的法規鬆綁。 • 之後 Pai 重返法務部擔任法規政策辦公室的資深顧問。Pai 也在國會山莊先後擔任參議院司法委員會次級小組（行政監督和法院）的首席顧問。 • 在取得法律博士之後，他為路易斯安那州東區聯邦地方法院 Martin L.C. Feldman 法官工作。	專業幕僚；1995-1998 年擔任電信政策分析師。 • **1994-1995 年**擔任眾議員 Tom Bliley 立法助理。
關心議題	支持網路中立性；近制訂網際網路隱私權；開放有線電視機	關切貧富間之數位落差；身障人士網路近用政策；支持網路中立性。	國際場合多由該位委員代表出席，如 APEC、GSMA。	關心市場公平競爭、國家寬頻計畫；反對網路中立性。	支持放寬外資許可管制、數位機上盒等議題

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	上盒市場。		關心頻譜、網際網路發展等議題		
婚姻家庭	• 妻 Carol	• 參議員 Jim Clyburn 之女。	• 現與夫 Mark 及二名子女 Caroline 和 Emmett 居住 DC。 • 弟弟 Brian 為 Guster 樂團鼓手。	• 印度移民之子。 • 現居維吉尼亞州 Arlington。 • 妻 Janine Van Lancker • 兒 Alexander Madhav Pai（Aug. 26, 2011） • 女 Annabelle Malathi Pai（Oct. 11, 2013）	N/A
其他	• FCC 第 31 任主委 • 在電信網路和服務產業已超過 30 年，歷經電信產業演變，是位政策專家、遊說者，以及實業家。做為一個企業家，他創始或協助創辦提供創新有線、無線，以及視訊通訊傳播服務的各種企業。他同時獲選列入「有線電視名人堂」和「無線通訊名人堂」。總	• **Clyburn 是強化身障者通訊傳播近用政策的堅定擁護者**，與聽障和視障代表團體合作互動密切。 • **Clyburn 認為所有通訊傳播平臺都應促進高度競爭**，市場越是壯大具有競爭，越不需要管制。不過，當市場在消費者保護上有所不足時，Clyburn 認為必須採取聰明的、針對性的管制手段。			• 接任 Robert M. McDowell 所餘任期至 2014 年 6 月 30 日，並由美國總統歐巴馬（民主黨）再度提名、參議院通過擔任新一任期委員。

姓名	 **Tom Wheeler**	 **Mignon Clyburn**	 **Jessica Rosenworcel**	 **Ajit Pai**	 **Michael O'Rielly**
	統歐巴馬開玩笑稱 Wheeler 是「電信界的 Bo Jackson（譯註：Bo Jackson 是棒球、美式足球雙棲天才球員）。 • 以從 The Ohio State University 畢業並獲得傑出校友獎章為榮。 • 著作包括："Take Command: Leadership Lessons of the Civil War（Doubleday, 2000）"、"Mr. Lincoln's T-Mails: The Untold Story of How Abraham Lincoln Used the Telegraph to Win the Civil War（HarperCollins, 2006）。 • 他對時事相關評論朝見於華盛頓郵報、美國今日、洛	• Clyburn 推動能夠反映美國人口變項的媒體所有權規範，可負擔得起的普及電話、高速網際網路接取、更寬廣的全國寬頻布建，並且管制透明化。			

姓名	 **Tom Wheeler**	 **Mignon Clyburn**	 **Jessica Rosenworcel**	 **Ajit Pai**	 **Michael O'Rielly**
	杉磯時報、新聞日報（Newsday），以及其他主流媒體。 ・前總統柯林頓和布希分別指定 Wheeler 擔任約翰甘迺迪表演藝術中心信託管理人，他在那服務達 12 年。 •Wheeler 也同時是國家檔案基金會的前任主委暨總裁，這是一個專門透過紀錄文獻敘述美國歷史的非營利組織。 •Wheeler 曾擔任美國公共廣播電視服務（PBS）的董事。				