

智慧生活科技發展新趨勢

郭耀煌 特聘教授
政治大學理學院院長

成功大學資訊工程系/數位生活科技研究中心



Center for Research of E-life Digital Technology
數位生活科技研究中心



演講大綱

- 智慧生活科技的回顧與發展趨勢
- 雲端時代下的智慧生活
- 智慧城市的可能面貌
- 社群媒體及資料科學對智慧生活的價值
- 穿戴式運算對智慧生活的貢獻
- 落實智慧生活的關鍵課題



智慧生活科技的回顧與發展趨勢



智慧生活市場產值預測

- 物聯網(IOT)全球市場2011產值約440億美金，至2017年預計成長至2900億美金，多樣化連網裝置帶動智慧生活的商機。(MarketsandMarkets, 2013)
- 全球智慧家庭市場2010產值約53億美金，預估2015達到109億美金，2010-2015年複合成長率(CAGR)為13.4%。(MarketsandMarkets, 2011)
- 家庭自動化系統用戶數從2011年約150萬，預計2017年成長至9千萬用戶。(ABI Research, 2012)
- 全球智慧家電市場2010產值約4千萬美金，預估2015年達到約62億美金。(Pike Research, 2011)

智慧生活的社會背景

- 科技演進(數位匯流、泛在網路、資訊處理、奈米、微機電等)提昇生活設施功能，協助人類面對生活空間與生活型態的變遷
 - 生活空間：氣候變遷、能源枯竭、都市化（犯罪率、居住安全及品質）
 - 生活型態：全球化、高齡化、少子化、個性化、效率化、生活服務依賴度高（分工化）、生活質感的追求、知識經濟化
- 安全、舒適、便利、健康、永續、節能

智慧生活的科技基礎：泛在網路

WAN/LAN →

PAN →

M2M/BAN

U化網路

U化寬頻網路

WLAN, WiMAX

GPRS, 3G, DVB

xDSL, Cable, FTTx

WLAN/UWB
Bluetooth
ZigBee
RFID
Sensors



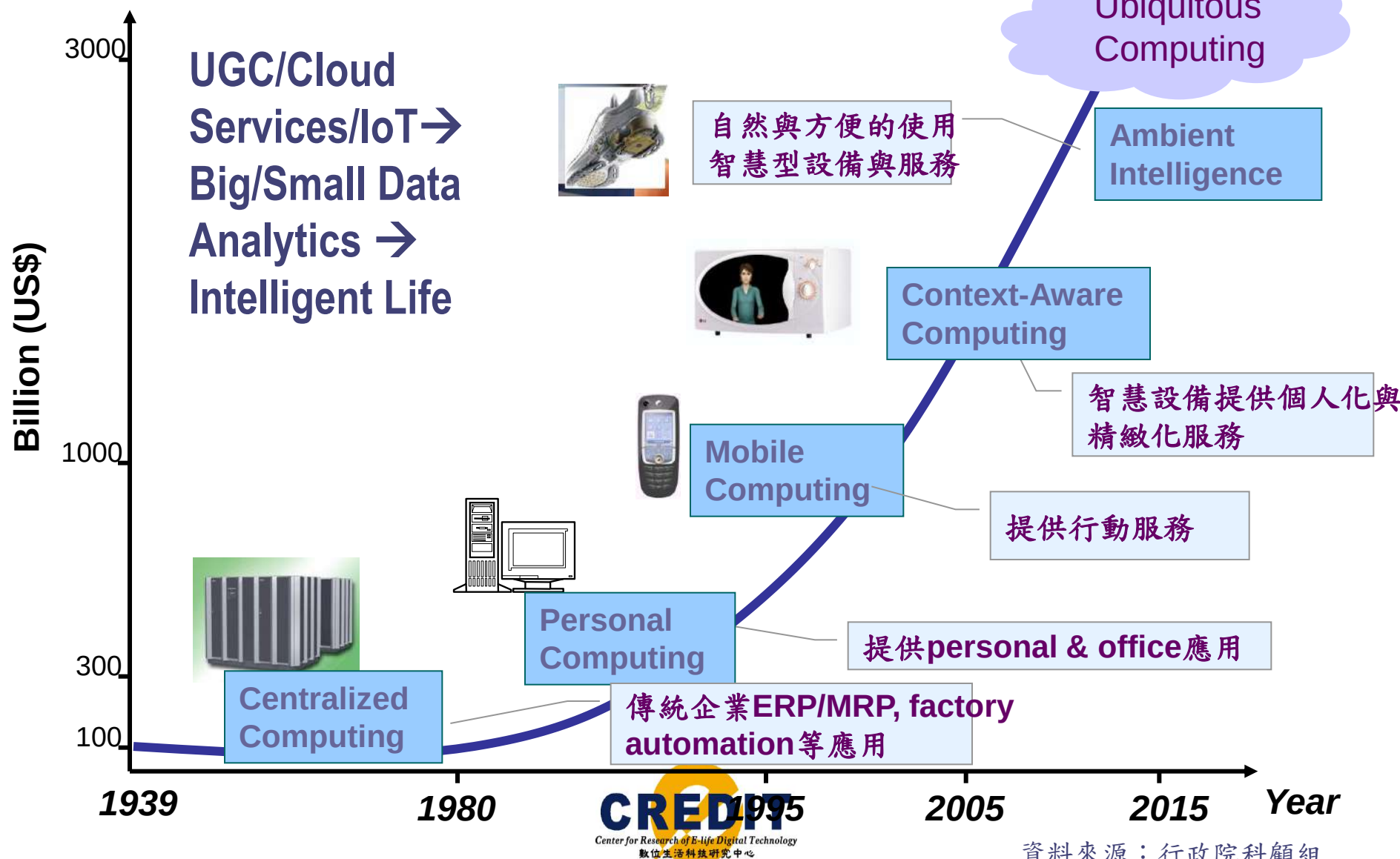
人與物件

人和人

物件與物件

智慧生活的科技基礎：環境感知智慧 (IoT)

UGC/Cloud
Services/IoT →
Big/Small Data
Analytics →
Intelligent Life



智慧生活的服務內涵

- 生活照護：家電管理、飲食照護、行程管理、保全服務、購物服務、隨選影音服務、行動多媒體通訊服務、交通運輸服務
- 生命照護：健康管理、醫療照護
- 環境照護：能源管理、環保維護、空氣品質維護、照明管理
- 心靈照護：娛樂服務、情緒照顧、生活寫真、心理調適
- 社交經營：網路社群、訊息傳播、遠距互動
- 生涯照護：學習服務、居家辦公、知識服務
- 財富經營：財務管理、資產管理、投資諮詢

智慧生活空間範疇

Smart Home →



- 1.Scenario Simulation
- 2.Comfort Control
- 3.Safe Environment
- 4.Info Access & Communications
- 5.Housekeeping Facilities
6. Control Platform for Smart Home
- 7.Smart Home Appliances

Intelligent Building →



- 1.ICT Systems
- 2.Security/Rescue Systems
- 3.Healthcare Systems
- 4.Energy Saving Systems
- 5.Premises Distribution Systems
- 6.System Integration
- 7.Facility Management

→

Intelligent Community →



- 1.Security Entrance Systems
- 2.Owner/Visitor Identification Systems
- 3.Courier Processing Systems
- 4.Waste Collection / Recycling Service
5. Community Surveillance Systems

→

e-Taiwan
M-Taiwan
u-Taiwan



Intelligent City



- 1.ICT Infrastructure
- 2.City Control/Management Center
- 3.Intelligent Transportation System
- 4.Crime Prevention Systems
- 5.e-Gov Services
- 6.Intelligent City Control Platform

智慧生活國際發展趨勢

地區

發展概況

- | | |
|----|---|
| 美國 | 主要由大廠為領頭主導(Google、IBM、微軟、Intel等)，如IBM的智慧地球等。國家策略以政府機構應用為主，於2009年提出經濟復甦和再投資計畫，2012年提出數位政府策略與巨量資料技術研發，透過建構共享行動化數位政府架構，讓民眾以更聰明、更安全、更經濟存取政府資訊與服務。 |
| 歐盟 | 提出Europe2020計畫，以智慧成長、永續成長及包容成長為三大優先發展領域。 |
| 日本 | 2001-2003年e-japan從發展基礎設施到促進IT應用，2006提出u-japan以發展無所不在的網路為主，2009年提出i-Japan 2015計畫，以提升國民生活的便利性，完善基礎建設為出發點，實現以人為本的資訊社會。 |
| 南韓 | U-City策略，分成三階段(Digital Home, Smart Home, Convergence Home)，目標希望2018年成為智慧家庭產業領導國家。 |
| 中國 | 2010年公佈十二五規劃，培育發展七大新興戰略產業(節能環保、新一代資訊技術、生物產業、高端裝配製造業、新能源、新材料和新能源汽車。) |

Top 10 Strategic Technology Trends

2011	2012	2013
1. Cloud Computing	1. Media Tablets and Beyond	1. Mobile Device Battles
2. Mobile Applications & Media Tablets	2. Mobile-Centric Applications and Interfaces	2. Mobile Applications & HTML5
3. Next-Generation Analytics	3. Contextual and Social User Experience	3. Personal Cloud
4. Social Analytics	4. Internet of Things	4. Internet of Things
5. Social Communication & Collaboration	5. App Stores & Marketplace	5. Hybrid IT & Cloud Computing
6. Video	6. Next-Generation Analytics	6. Strategic Big Data
7. Context-Aware Computing	7. Big Data	7. Actionable Analytics
8. Ubiquitous Computing	8. In-Memory Computing	8. Mainstream In-Memory Computing
9. Storage Class Memory	9. Extreme Low-Energy Servers	9. Integrated Ecosystems
10. Fabric Based Infrastructure and Computers	10. Cloud Computing	10. Enterprise App Stores

物件聯網化

服務雲端化

應用行動化

系統智慧化

資源虛擬化



雲端時代下的智慧生活



Trends: Cloud and Device Symbiosis

- Cloud Device: Thin and Intelligent
 - Thin: Leave heavy computation/storage load to the Cloud
 - Intelligent:
 - User interface: Natural User Interface, Multimodal User Interface
 - Context/environment sensitive
 - Gathering information through sensors
 - Balancing resources among sensing, computing, and communications.
- Cloud Service: Elastic computing for computation and storage
 - User Interface/User Experience: NLP, Image recognition
 - Context aware computing: E.g., LBS, personalization
 - Big Data Analytics



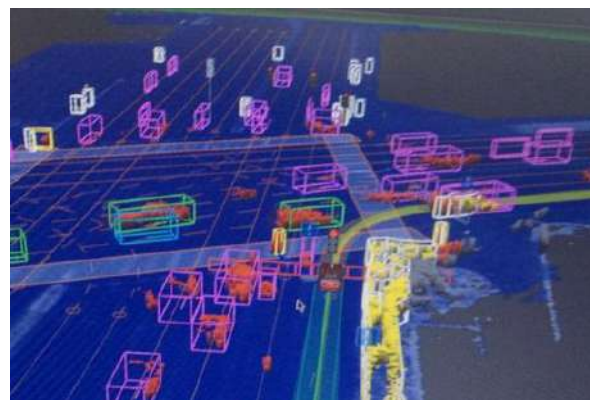
Trends: Innovative Cloud Services

A Collected Mind: cloud service is becoming smarter because there are more data gathering by sensors on cloud devices

- Intention understanding (recognize and act on intention)
 - Input: Sensors help devices adapt to the service/application scenes and make interactions more easily and naturally
 - E.g., motion and proximity sensors is used to automatically get into speech recognition mode (Google Voice Search)
 - E.g., audio sensor (microphone) is used as motion sensor (The SixthSense project)
- Web meets World: Fusion of data sets across virtual and physical worlds
 - Augmented Reality : E.g., Wikitude, You R Here
 - Augments the physical world around us with digital information
 - E.g., The SixthSense project
 - Bio/health applications: E.g., the wireless medical sensors can help users to record vital signs 24/7/365

Mobile Cloud Services

- Examples: Google Auto-Drive Car
 - Using video cameras, radar sensors and a laser range finder to “see” other traffic, as well as detailed maps to navigate the road ahead – which is all pulled from Google’s data centers.



- Example: Google Glass, Apple Siri



資料來源：台灣雲端
技術發展策略論壇

Future Multiple-Sense Mobile Device

SENSING

Local content & service discovery

SEEING

Augmented reality UI
Map, 3D, in building navigation

INTERACTING

Connection manager



KNOWS

You and what is around you

LEARNS

What you like

DISCOVERS

Things relevant to you

FILTERS

Out the irrelevant

Massive scale computations (billions of simultaneous transactions) needed to mash up personal data, preferences, real world data, and device capability

Source: Qualcomm

Mobile Health Assistance Device

Withings – Blood Pressure Monitor

- Integrated with iOS devices
- Keep measurements history
- Share the results for greater control



<http://www.withings.com/>

Wireless Pacemaker

- A wireless, cloud-connected device designed to simplify the programming of pacemakers.
- Facilitate access to electronic medical records during pacemaker procedures
- It enables nurses to operate equipment with real-time remote support from doctors and technicians.



<http://medgadget.com/2011/09/wireless-pacemaker-programming-device-unveiled-at-usc-body-computing-conference.html>

Table Type Computer Sommeliers

- The embedded into the table computer (SUR40) reads the bar-code on the bottom of the bottle, retrieves the wine data from its database, compares it with the information from a cloud network and presents it to the customer.



Reference: <http://futuristicnews.com/table-type-computer-sommeliers/>

Cloud-based Video Surveillance



資料來源：網通國家型計畫

❖ 能源管理雲端服務

- 企業極少針對節能減碳目的進行IT營運，因為自建投資所費不貲；若能建立第三方能源管理平台（Energy Cloud），善用ICT管理各區域的用電狀況，分析電能使用效率，並供應最適化的用電配送機制，方可達到極佳的區域節能效果



雲端閱讀：亞米多雲端圖書館

Browser window showing the Amido website (http://www.amido.com.tw/). The page features a large banner with the text "完全免費" (Completely Free) and "五大特色" (Five Major Features):

- 五大特色「線上製作」「自訂閱讀」「個人圖書館」「群組互動」「雲端同步」
- 亞米多圖書館提供完全免費服務。立刻加入，更多驚奇功能等你來體驗！

The page displays a wooden shelf with various digital book covers, including:

- 外星入 (Alien Invasion)
- 嗜食去 (Taitung)
- 吃 (Eating)
- Winding by Fans
- 巴斯達隘的文化探險
- NANTOU 71 南極報導

Navigation links: 推薦 (Recommended), 最新 (Latest), 熱門 (Popular), 高評 (High Rating). A "登入" (Login) button is visible in the top right corner.

Bottom banner: 好魚網 每包300g+-20g. 每包 原價\$340.

System tray: 上午 02:32 2014/6/15.

免費
製作
電子
書，
分享
書籍
的雲
端空
間

智慧農業產銷→農業雲→食品雲

- 原物料管理
- 客戶關係管理
- 供應商關係管理
- 作物生產排程管理
- 農業進銷存管理
- 品質檢測(如生產履歷)
- 風光水養氣等設備管理
- 運籌管理
- 物流管理





Key Issues of Cloud Services

- Security and Trustworthiness
- Service Availability
 - Single cloud might break down
- Data Lock-In
 - Data might be abducted by single cloud
- Data Transfer Bottlenecks
 - Data transmission will be limited by single cloud



智慧城市的可能面貌

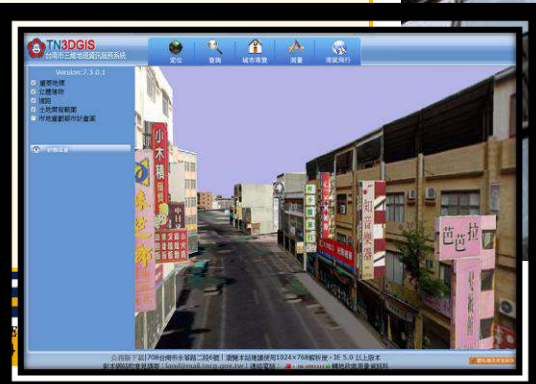


智慧城市的重要性

- Population: In 2050 70% of the population will live in cities. Today more than 50%
 - Energy: Cities consume high amounts of energy. About 75%
 - CO2 & Environment: 80% of emissions of greenhouse gases are generated in cities
 - Connectivity: In 2020, expect more than 50 billion connected devices
 - Mobility: The transportation sector is expected to grow more than any other in 2020
- it's necessary to transform of local government model: sustainability, efficiency, service improvement

智慧城市大台南

- ◆智慧便捷交通體系
- ◆城鄉衛生所社區健康照護智慧增值計畫
- ◆智慧觀光旅遊服務計畫
- ◆文化資產導覽智慧應用服務系統
- ◆生態智慧生活社區
- ◆智慧城鄉教室
- ◆智慧防災監控體系
- ◆城鄉社區智慧治安監控系統
- ◆三維地理資訊整合計畫







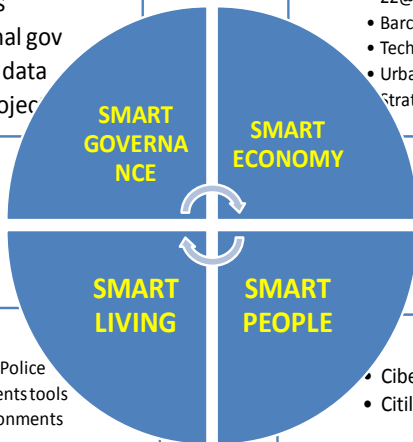
The “Smart City” concept

歐盟FIREBALL計畫的觀點

- ❑ Smart City: not a reality but an urban development strategy, and a mostly technology driven future vision
- ❑ Smart City is about how citizens are shaping the city, and how citizens are empowered to contribute to urban development
- ❑ Smart City is an urban laboratory, an urban “innovation ecology”, an accelerator and agent of change

Barcelona Smart City Development

- Kiosks
- Internal gov
- Open data
- 3D project



- 22@net
- Barc activa
- Tech park
- Urban Lab
- Strategic plan

- Municipal Police
- New incidents tools
- Intel environments

- Cibernarium
- Citilab Cornellà

Smart city model: Three pillars

- Ubiquitous infrastructures
- Information from sensors, open data, and citizens
- Human capital, actors, communities

Smart city Strategy

- **Smart Districts:** 22@Barcelona; triple helix collaborations
- **Living Lab initiatives:** 22@Urban Lab, Live, Bdigital, i2Cat, Fablab, Cornellà
- **Infrastructure building:** traditional and new. Integration of ICT. From fibre optic to Wi-Fi.
- **New services to citizens:** gov, quality of life, professional
- **Open data:** sensors, open standard, and city platform

SC Management

- Creation of networks of actors, organisations, departments
- Broadband network and sensor data management
- Creation of proof of concepts for systems and applications

Challenges

- Demand for human capital and skills
- VC funding for innovation
- Low global connectivity
- Development of triple helix alliances
- Collaboration between government departments

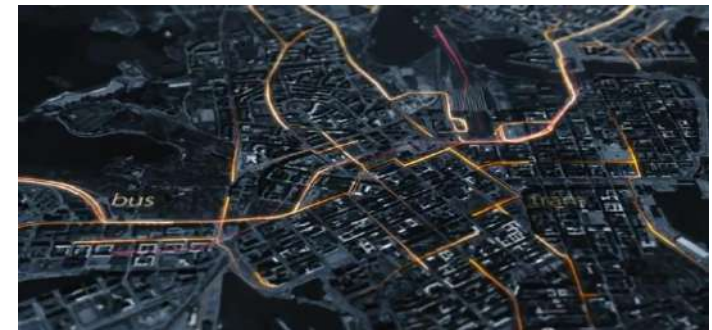
Smart citizens and Open Data – Helsinki examples

- ❑ Smart city – service organisation in an innovative environment
- ❑ Exploiting available information
- ❑ Idea incubators use city data – Apps4Finland competition
- ❑ Open interfaces are an important step in the development of the City's systems

*Tell-on-the-Map –
map-based
Commentary tool,
enabling a dialogue
between citizens
and city*



*Apps4Finland
competition –
Helsinki
Public Transport
Visualised*



*Service Map:
open information
channel about
offices and
services*





Lessons Learned from FIREBALL Project (1)

- ❑ Smart city is more an urban strategy than an urban reality. Smart cities will appear through numerous bottom-up initiatives besides some strategic planning, and infrastructure development.
- ❑ Top-down planning and bottom-up initiatives should complement each other. City hall is sometimes dominant. Dilemmas of citizen engagement.
- ❑ Widespread use of pilots is preparing cities for initiative, experiment and learning
- ❑ Districts, neighborhoods, and clusters are fundamental elements of smart city strategy, because the city is a system of systems, and cities co-exist within cities.



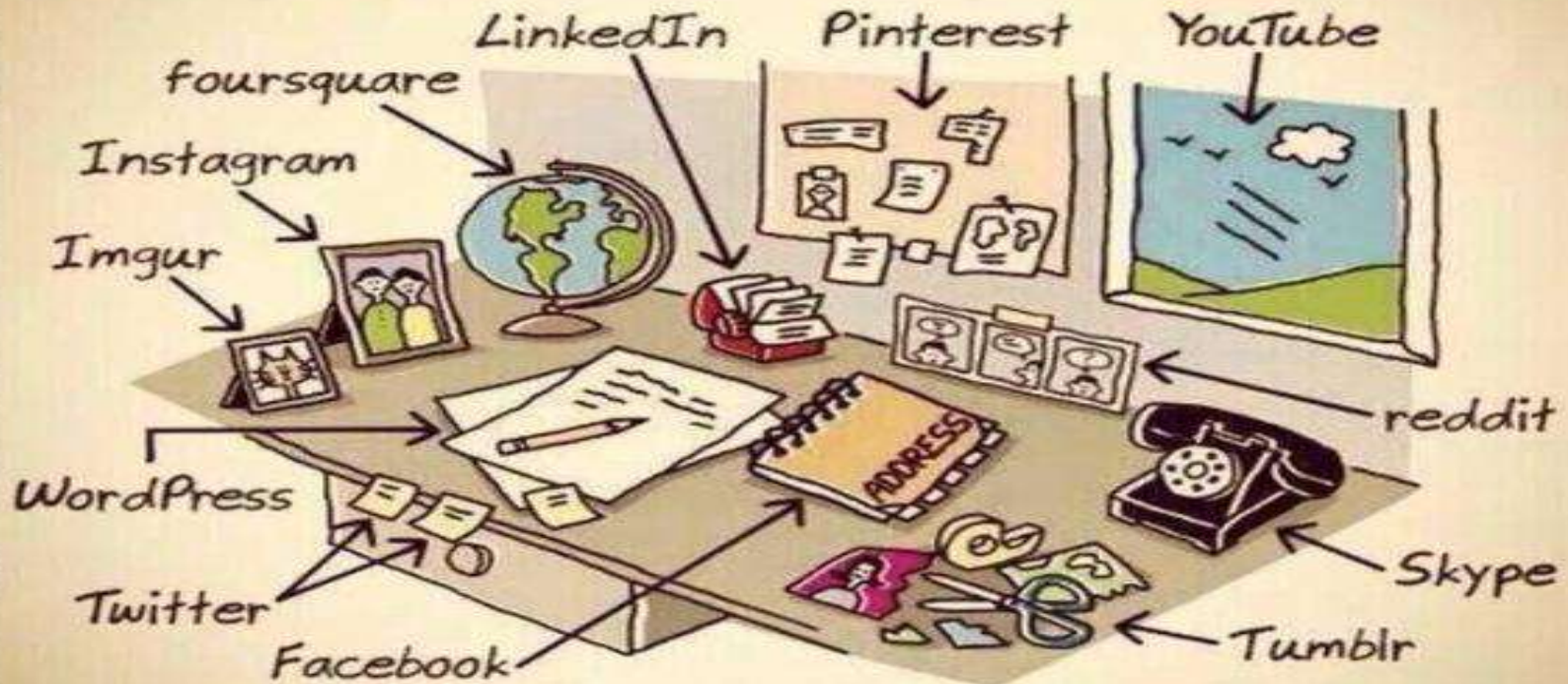
Lessons Learned from FIREBALL Project (2)

- ❑ A smart city strategy involves all actors, organizations, communities, R&D, NGOs, clusters, and authorities. The partnership strategy should achieve a common vision, flagship projects, collaboration and synergy.
- ❑ Major challenges for successful smart city strategies deal with skills, creativities, user-driven innovation, entrepreneurship, VC funding, and management of intra-government rivalries.
- ❑ Lack of evidence on impact and effectiveness of smart city strategies.



社群媒體及資料科學在智慧生活 扮演的角色

the world before social media...



Twitter促成阿拉伯茉莉花革命

Source: <http://learningneverstops.wordpress.com/>

CREDIT
Center for Research of E-life Digital Technology
數位生活科技研究中心

資料科學： 運用大量而多元之資料產生新的洞察及應用



Multi-channel customer sentiment and experience analysis



Detect life-threatening conditions at hospitals in time to intervene



Predict weather patterns to plan optimal wind turbine usage, and optimize capital expenditure on asset placement



Make risk decisions based on real-time transactional data



Identify criminals, networks, and threats from disparate video, audio, and data feeds

資料來源：台灣雲端
技術發展策略論壇

Big Data熱潮：Netflix (1)

- 「紙牌屋」(House of Cards)
 - 紐約時報：任何一門生意，若能預見未來，是相當有利的，而 Netflix 可能靠著「紙牌屋」辦到了
 - Netflix利用大數據分析，發現喜歡看BBC舊版「紙牌屋」的觀眾，同樣也喜歡大衛芬奇導演的電視劇，或者凱文史貝西主演的電視劇
 - 大數據分析讓Netflix的推薦引擎也產生很大作用，75%的觀眾都會被Netflix推薦觀看所影響

Big Data熱潮：Netflix (2)

● 「紙牌屋」(House of Cards)

- 2900萬觀眾每次搜尋、正評或負評、第三方數據，如尼爾森收視數據、地理位置數據、裝置數據、社群媒體分享數據、觀眾加書籤數據、每次觀眾登入授權的數據，以及每部影片或者劇集的數據，都會進入數據分析系統裡去
- Netflix可以針對某一幀畫面進行內容分析，分析當時的觀看習慣，甚至可能包括音量、顏色、背景等等數據，

Big Data熱潮：Wal-Mart/Microsoft

● Wal-Mart

- 運用 Hadoop 技術，針對駐留於 Facebook 或 Twitter 等社群媒體的商品討論訊息，加以深入分析，進而快速掌握消費者的真實意向

● T-Drive: 微軟研究院與北京市政府合作

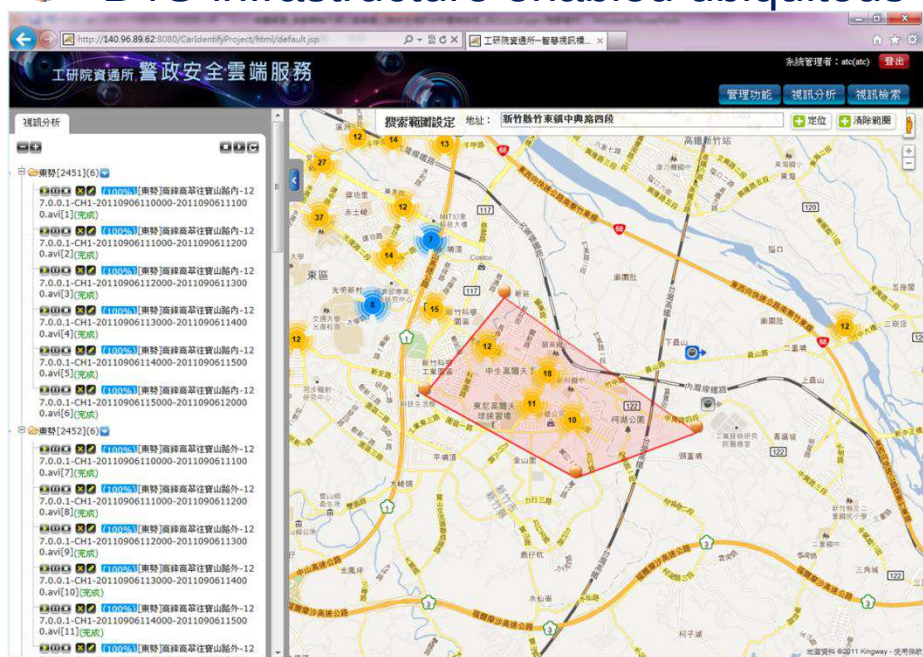
- 為 33,000 輛計程車裝置GPS，汲取駕駛人的智慧及經驗，針對持續累積的導航數據進行分析
- 發現北京市區最明顯的交通瓶頸，北京市政府遂決定新建長達 1.7 公里的北湖渠西路，果真有效化解交通堵塞難題

Big Data熱潮：流行病學研究

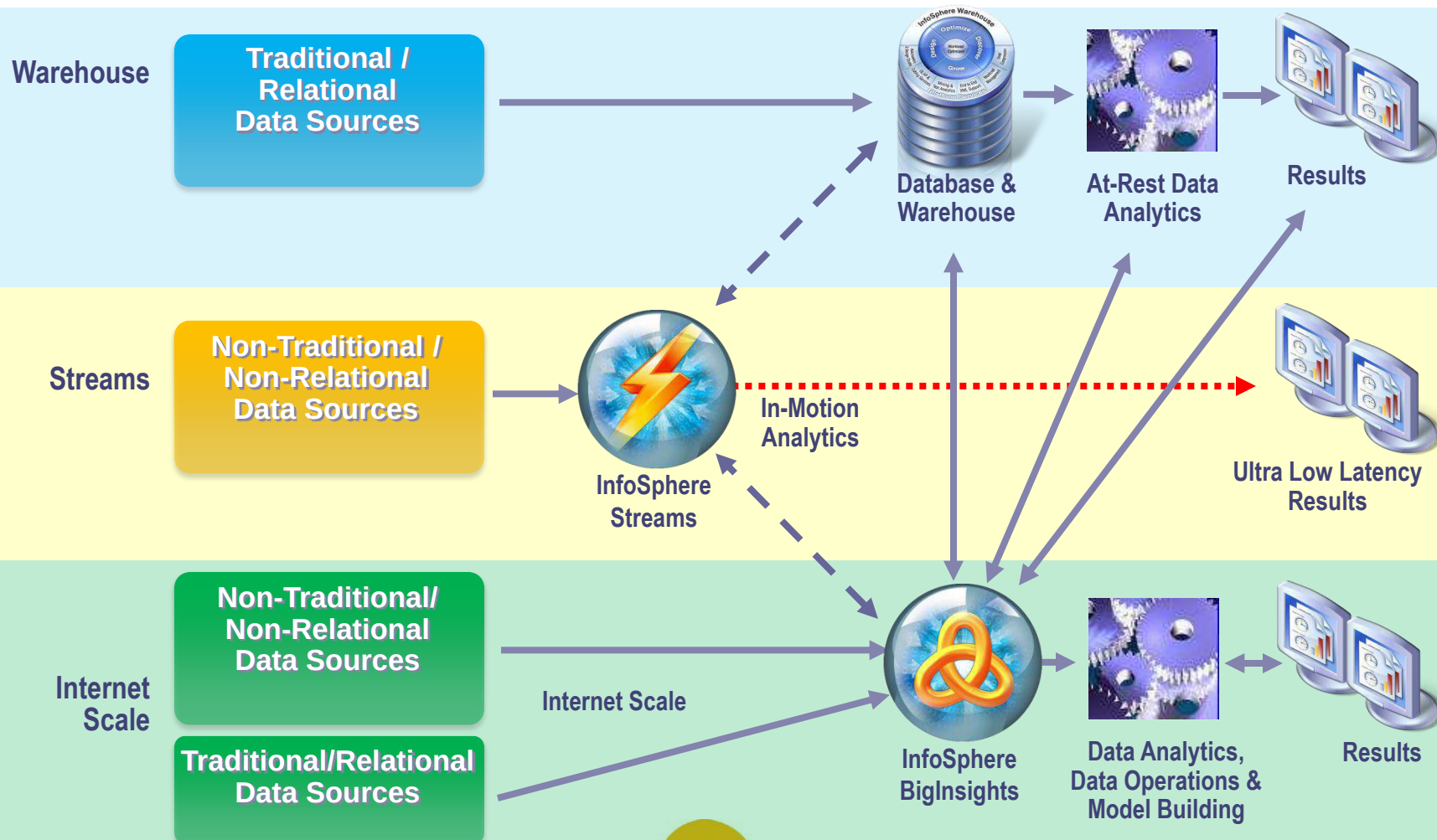
- When people use smart phones, the biomedical signal are recorded simultaneously
- may include sensors of temperature, Galvanic skin response (GSR), pulse, respiration, etc.
- The signal could be transmitted to the cloud and processed anywhere.
- The analysis results may indicate the occurrence of flu, accidents, sudden events or activities.

Big Data熱潮：City-wide Surveillance

- Cloud and Web 2.0 based
 - Dynamic allocation of computing/storage resources
- Multimodal User Interface
 - Browser based UI
 - Integrate with geographical information
 - Intelligent search
- Intelligent Video analytics
 - including moving object type classification, car color classification, license plate information, etc.
- B4G infrastructure enabled ubiquitous video access



Big Data: Volume, Variety, Velocity, Veracity



Big Data的發展基礎

- 公私部門運作e化日益成熟
 - 網際網路及雲端服務快速普及
 - Social media及social network服務快速普及
 - Intelligent analytics技術日漸成熟
 - IoT建置與應用受到重視
 - 平行與分散式運算能力持續增強
- 如何解決data-rich but insight-poor的問題



Big Data關鍵技術

- Data Acquisition, Recording & Maintenance
- Information Extraction, Cleaning & annotation
- Data Integration, Aggregation, and Representation
- Query Processing, Data Modeling, and Analysis
- Interpretation



Key challenges

- Data heterogeneity and incompleteness
- Scale & scalability
- Timeliness
- Human collaboration through crowd-sourcing
- Privacy & Security
- New & efficient architectures and technologies
- Lack of skills
- Risk of ‘standards’ proliferation



穿戴式運算對智慧生活的貢獻

Attributes of Wearable Computing Solution



KPCB

Source: MIT, KPCB.

穿戴式運算→互動藝術與展演



投影結合表演藝術的案例



將舞者身上裝設以無線電子陀螺儀的動作捕捉硬體，配合投影的影像，將真實的舞者與虛擬的電腦動畫可以無縫地結合在一起

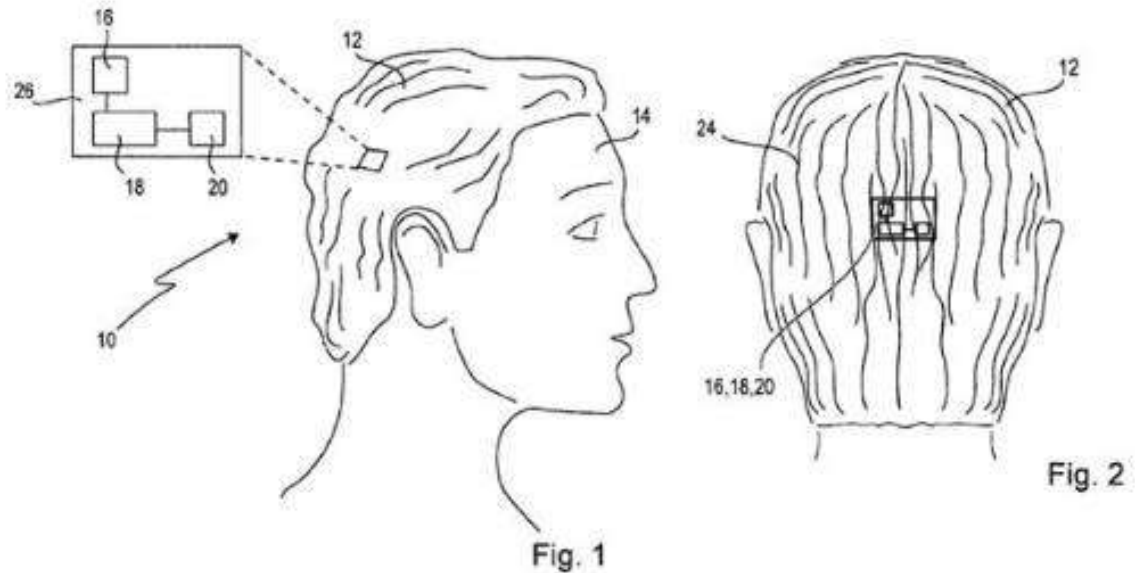
Protus (Google ATAP) 智慧藥丸

- 藥片吞入後，會有一個可以停留在腸胃中的感測器(1平方毫米)。
- 記錄心跳等各項數據後，將數據送到貼在皮膚上的貼紙，貼紙再藉此通過藍芽傳遞到智慧裝置上。
- 感測器的電池:胃酸
- 可隨人體排出體外



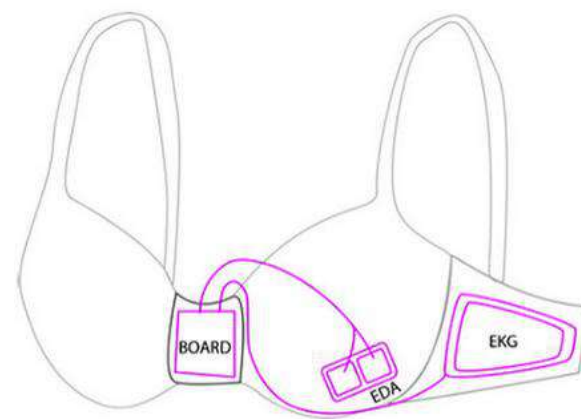
SmartWig (Sony)

- Sony 公司認為將感測器藏在假髮裡是最好的選擇，在生活中人們對於頭部的保護大於其他部位。Sony 還嘗試利用假髮獲取使用者的臉部訊息來發出指令，可識別抬起眉毛等動作。
- 智慧型假髮功能(SmartWig)：人體健康狀況監控ECG、接收郵件和簡訊通知(透過藍芽傳輸訊號使假髮震動)、內建 GPS 導航和超聲波傳感器，可以自動判斷路況，盲人戴上智慧型假髮即可自動導航



Microsoft Mood Bra

- Microsoft 推出智慧型內衣（Mood Bra），可以感測壓力。
- 透過心電圖判讀（EKG），內衣裡頭有壓力感測微晶片，同樣也可以使用藍牙裝置將數據傳輸到智慧型手機上。
- Microsoft 宣稱此項技術可以協助女性偵測情緒變化，避免過度的情緒反應，**例如在女性因情緒失控大吃大喝之前，就使內衣震動，藉此達到提醒之效。**



（圖片來源：[Microsoft's research on the Smartbra](#)）

Reference:

<http://techorange.com/2013/12/24/sonys-smartwig-and-microsofts-mood-bra-are-as-stupid-as-you-think/>

隨心情變色的毛衣

- 感應人的情緒，隨著心情變色，喜怒哀樂表露無遺，讓人輕易「察言觀色」。



ThermOn

- A system that dynamically applies warm or cold stimuli, synchronized to music, to users



Figure 1. Concept of ThermOn.

NailDisplay

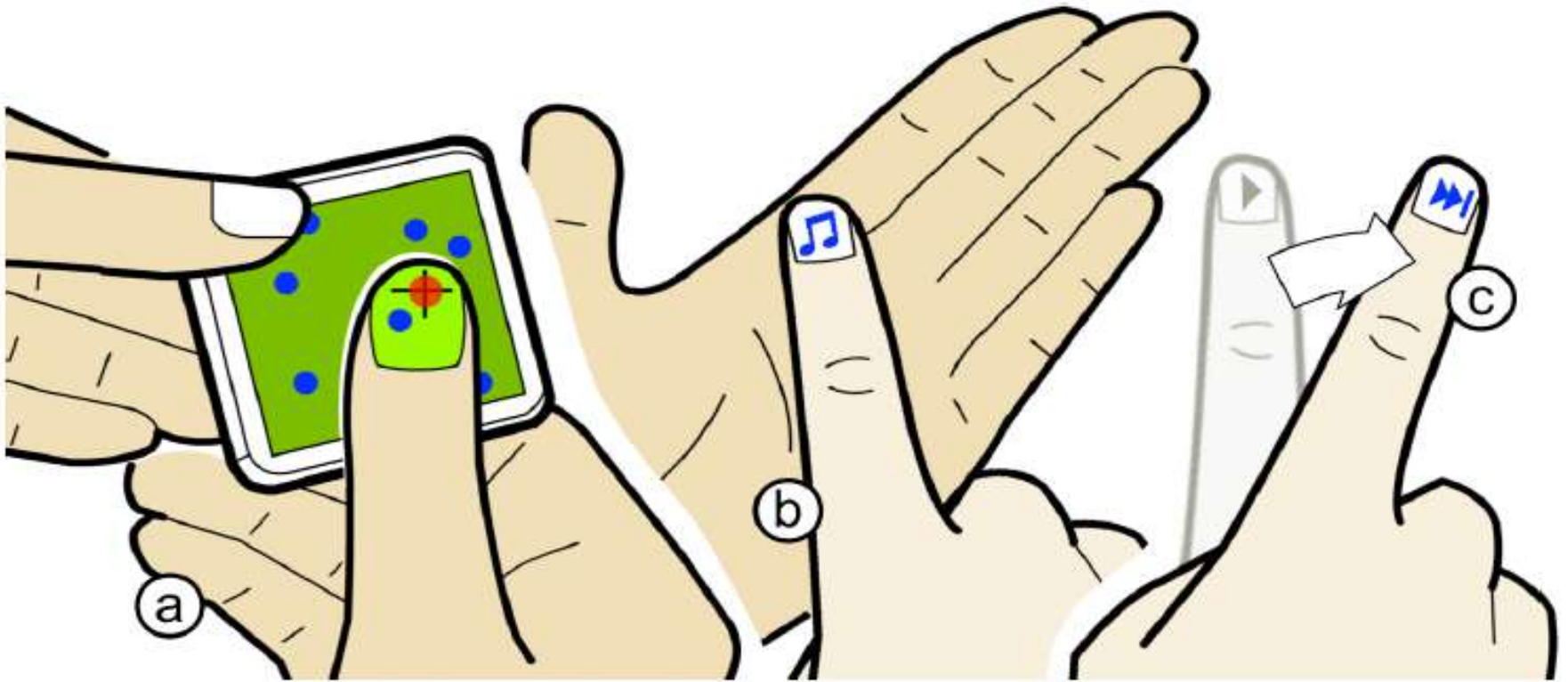


Figure 1. Three scenarios of operating with *NailDisplay*. (a) *NailDisplay* allows users to select small targets precisely with their fingertips becoming transparent. (b) *NailDisplay* helps users learn imaginary interface and reassure a function (e.g., play music) when their memory of the interface becomes unclear. (c) Users can switch to the next music selection by swiping their fingers rightward with *NailDisplay*.

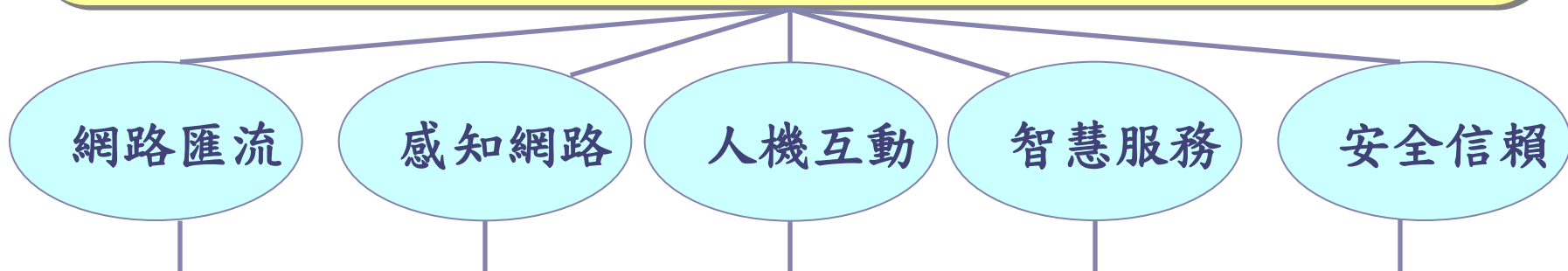


落實智慧生活的關鍵課題

智慧生活的核心議題

有效運用科技發展智慧生活環境

基於物聯網設施，以數位匯流運作方式，提供滿足人類生活需求之貼心、安心服務的生活型態



- 網路泛在
- 高速行動網路
- 不同網路互通
- 物件無縫連網

- 感知網路
- RFID等電子標籤
- 一物件一ID

- 人性化介面
- 資訊家電連網
- 萬用終端設備

- 使用者的觀點
- 科技化服務解決生活議題
- 服務自動融入
- 重視非PC族群

- 資訊通信安全
- 維護資訊倫理(隱私、著作權、網路色情、垃圾郵件...)



發展智慧生活服務的關鍵思惟

- 智慧生活的落實是一個持續演化前進的歷程
- 推動智慧生活不單純是科技議題，也是社會、文化、商業、法律議題
- 跨領域專業的融合是成功的主要關鍵之一
- 發展智慧生活不只是生活設施的進化，也應該是生活品質的進化，生活素養的進化

發展智慧生活服務之挑戰

- 可永續營運的服務運轉模式：
 - 新興服務模式、照護產業轉型、異業結合、用戶規模等議題
- 可觸動用戶接受的服務及介面設計：
 - 使用行為障礙、使用成本障礙、隱私權保護（魔鬼藏在同意書）、健康顧慮等的改善議題
- 可靠而成熟穩定的科技：
 - 技術可靠度、親和度、穩定性等技術實用化議題
- 可被各利益關係者接受的財務模式：
 - 建置成本、維運成本、使用成本等技術商業化議題
 - 社會公平正義議題