Microsoft

EXTREME COMPUTING GROUP

Defining the future.

Microsoft and Innovation

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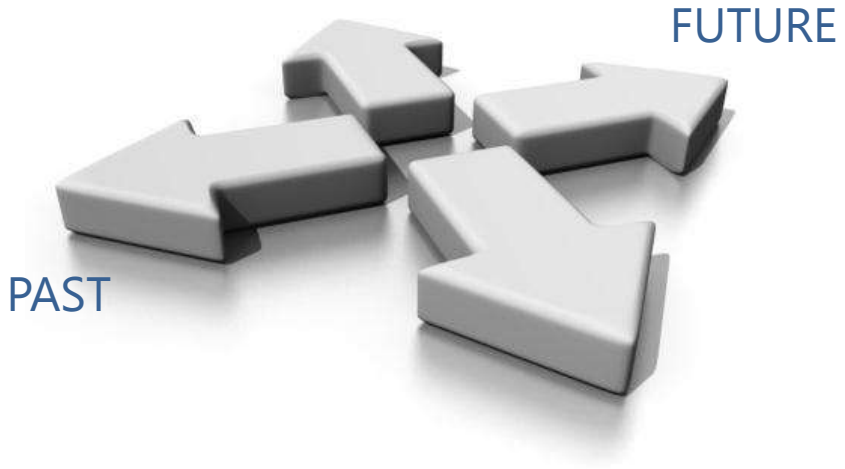
Roadmap For Today

What are the technology trends shaping the future – hardware, software and experiences?

How can computing change today's life experiences; computers that become 'assistants'?

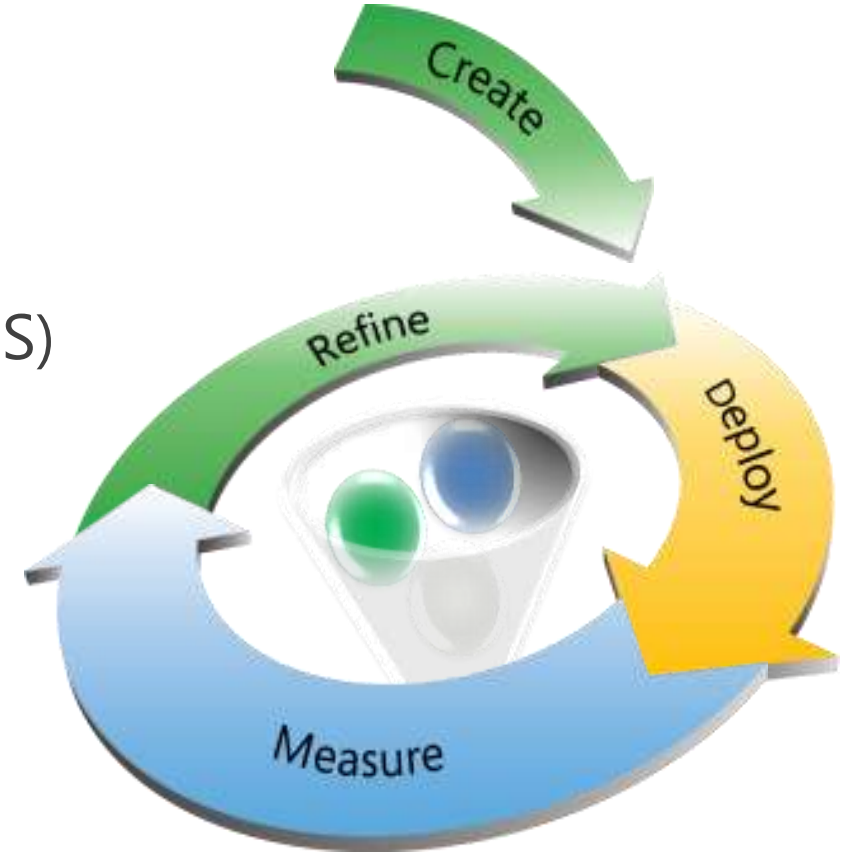
Challenges and Opportunities?



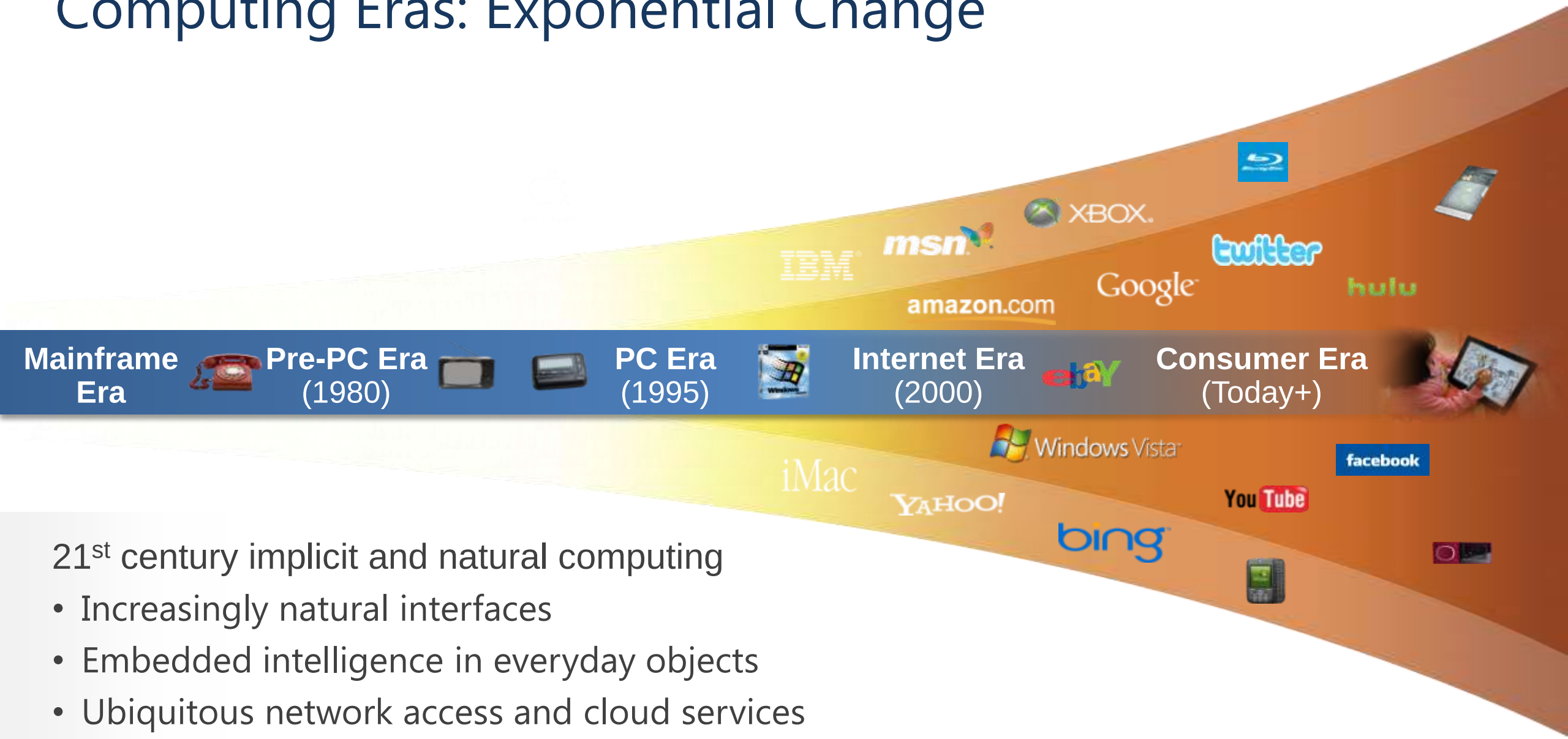
Market Current Transition

- Software plus services
  - Rapid software update cycles
    - Facebook updates *twice each week*
  - Recurring cost of goods and services (COGS)
    - Data centers, services …
  - Different price point expectations

- Seamless device experiences
  - Integrated hardware/software
  - Rich, multimodal services
  - ***Consumerization of IT***



Computing Eras: Exponential Change



21st century implicit and natural computing

- Increasingly natural interfaces
- Embedded intelligence in everyday objects
- Ubiquitous network access and cloud services

Disruptive Technologies and Trends

Client + Cloud
New Software Models

Computing Consumerization
Many Device world

The Internet of Things (IoT)
Computing everywhere

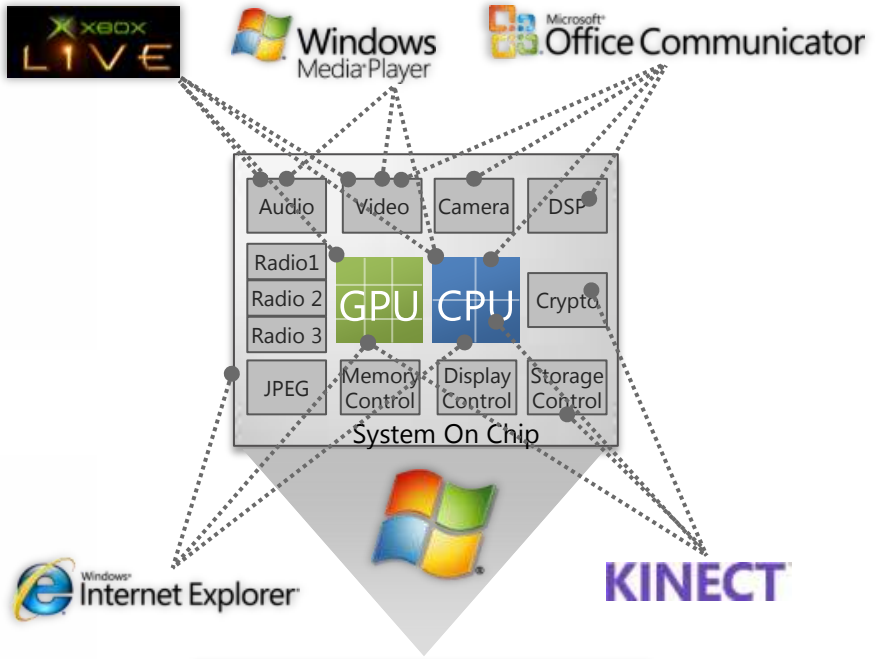
System on a Chip Designs
Powerful Devices

Ubiquitous Sensors and Media
Explosive Data Growth

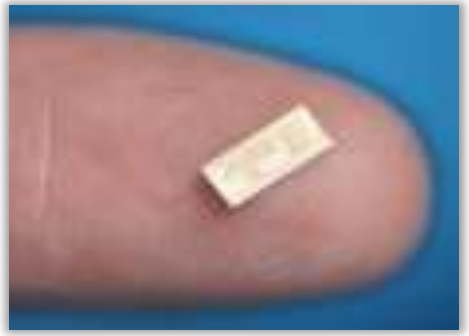
Natural User Interfaces
Moving beyond GUIs

Internet of Things and Systems on a Chip

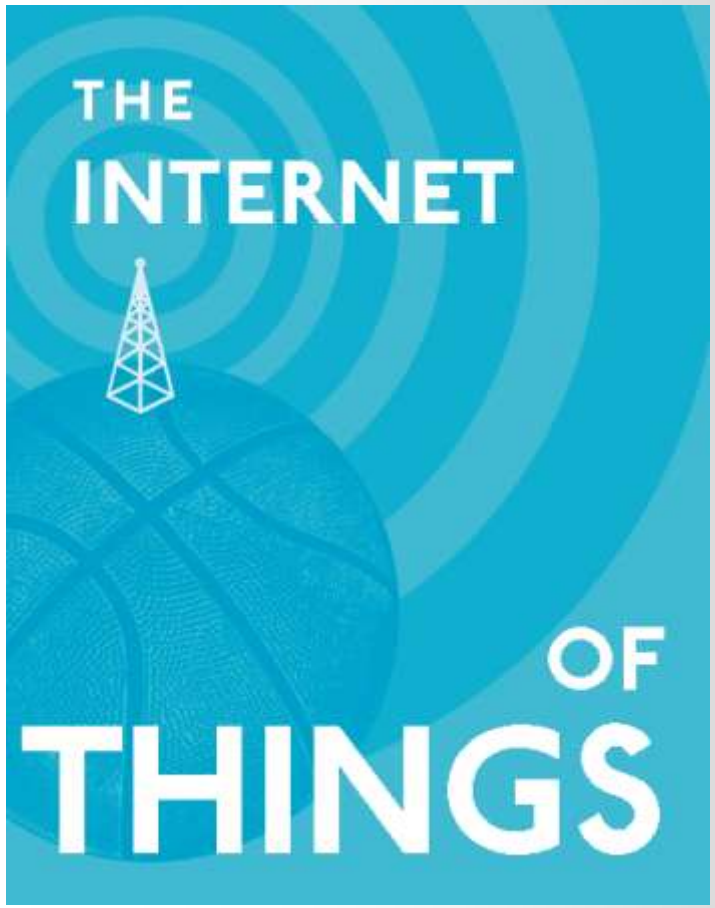
- System on a Chip (SoC): The New Motherboard
  - Core(s), memory controller, I/O
  - Function-specific accelerators
    - Graphics, communications, sensors, security



- Internet of Things (IoT)
  - Embedded intelligence in everyday objects
  - Experiences and natural user interfaces (NUIs)
  - Resource discovery, security, services, programming



More Connected Objects Than Internet Connected People …

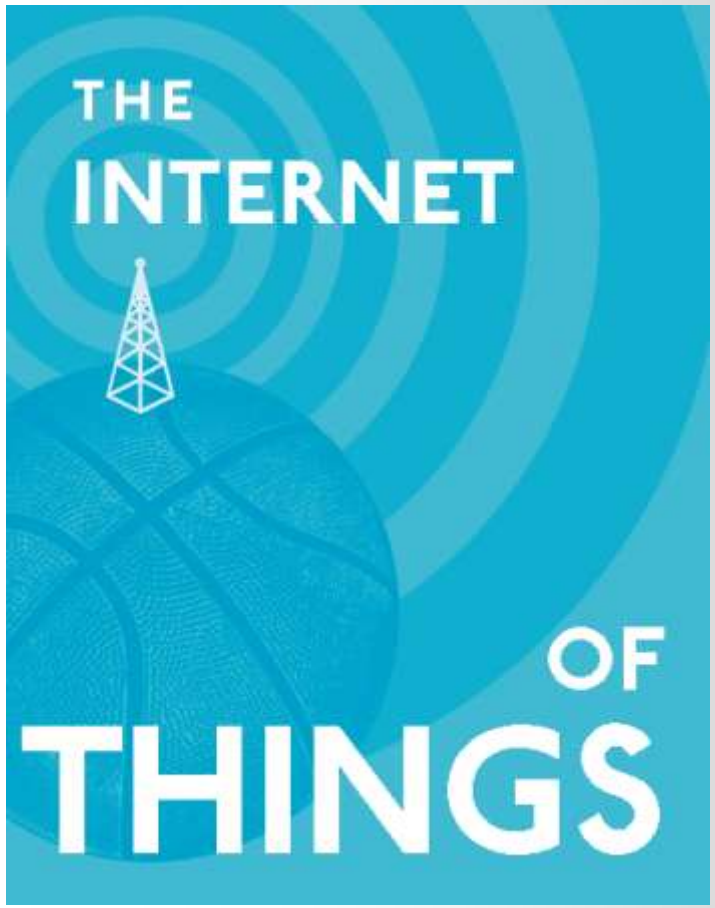


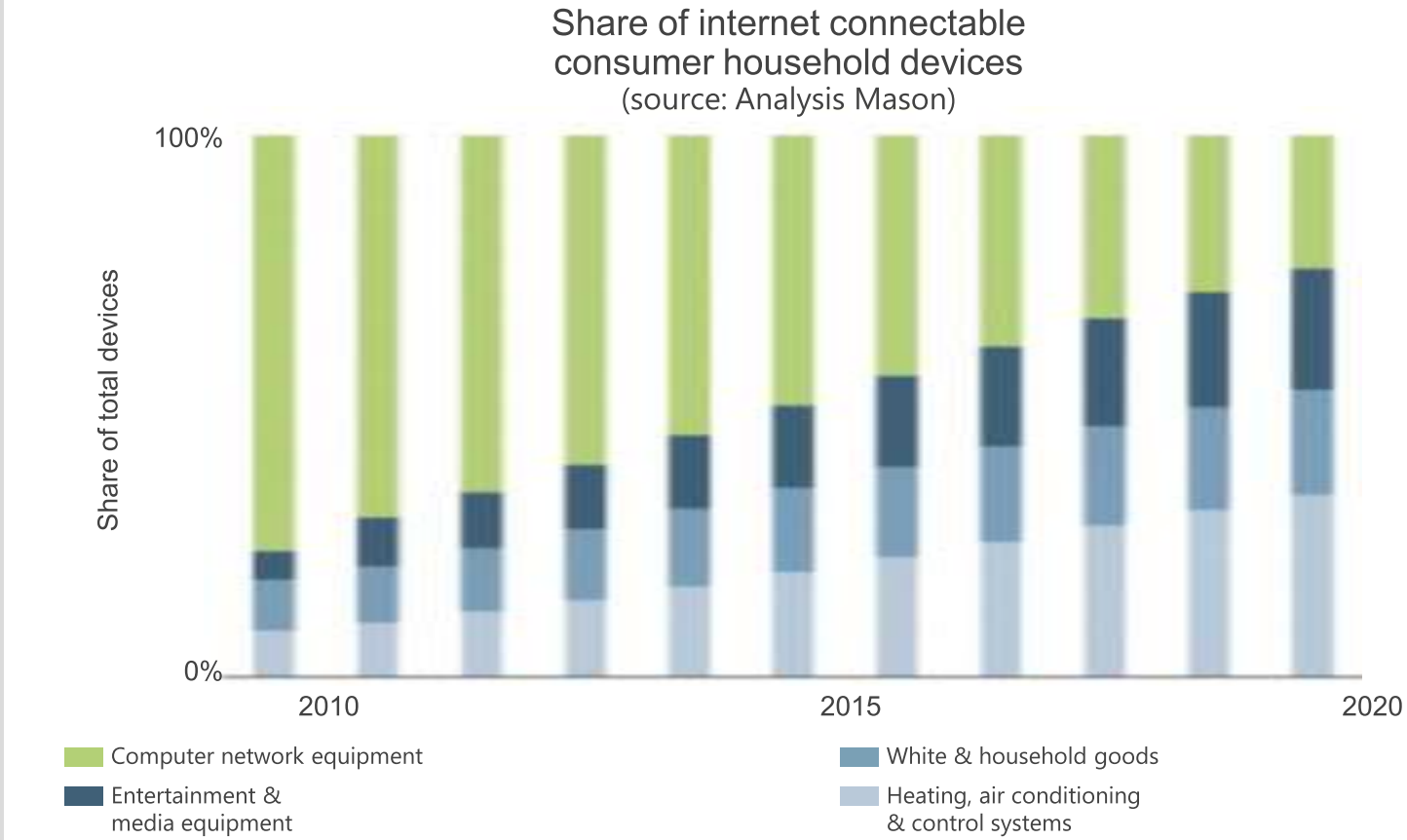
As the number of Internet users nears 02 billion globally, estimates on the number of web connected devices range from **05 billion to 35 billion**

Within a decade, more than **50 billion everyday objects** could be collecting data and making it available online

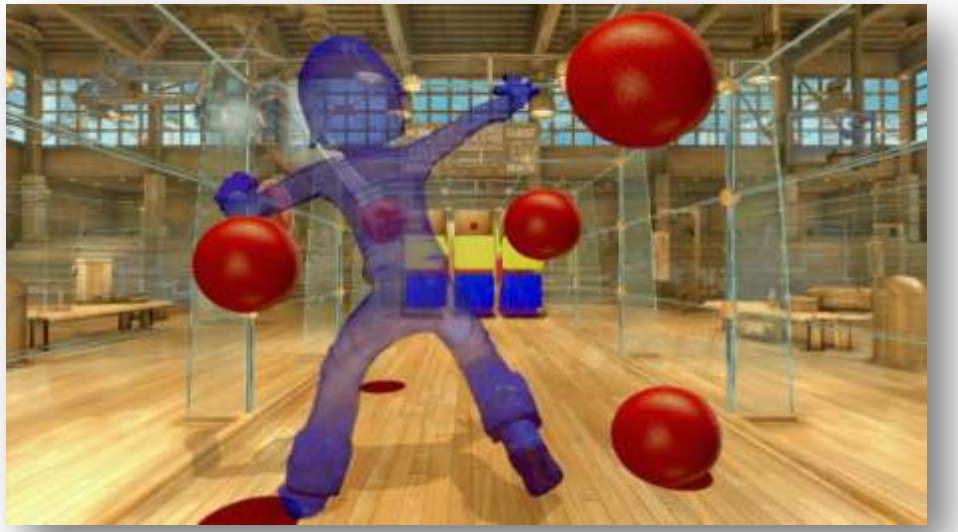
This has the potential to empower users with new knowledge, services

More Connected Objects Than Internet Connected People …





Integrated Capabilities Are Increasingly Common



Hardware Companies

- Applications
- Languages, Compilers, Operating Systems
- Specialization (ASIC, GPUs, FPGAs)
- Architecture (ISA) (x86, ARM, EDGE)
- Microarchitecture
- Chip Fabrication

Software Companies

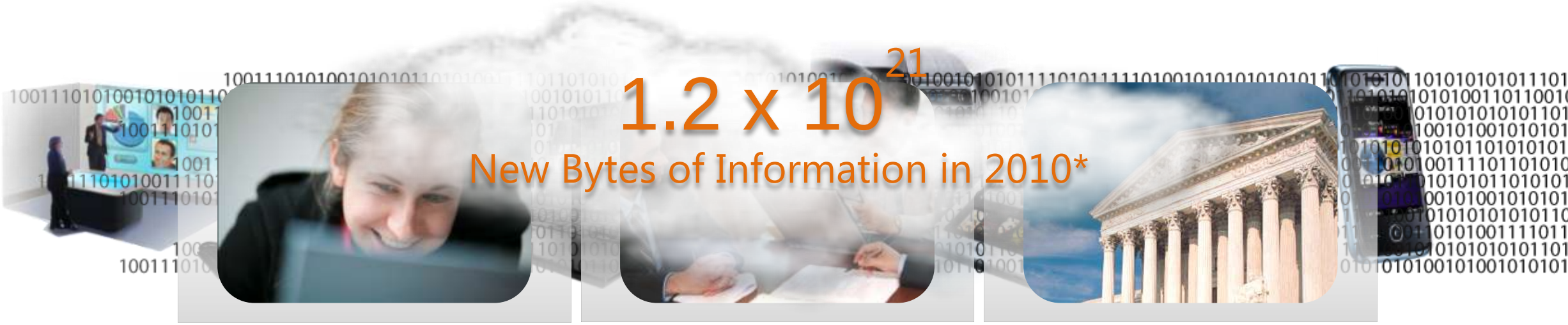
Clients Create The Experiences

Fixed

Portable

Specialty

Mobile



1.2×10^{21}

New Bytes of Information in 2010*

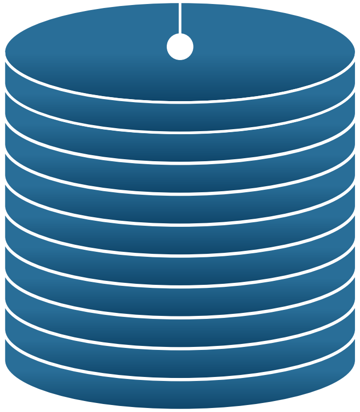
Fix | Consumer | t | Enterprise | c | Government | bile

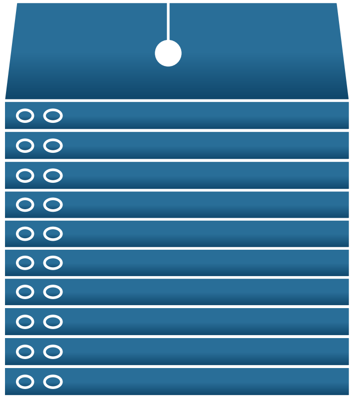
*Source: IDC, as reported in The Economist, Feb 25, 2010

Economics of Storage

[illegible] [illegible]

Disk Storage
(per gigabyte)





Web Storage
(per gigabyte)

[illegible]

Remember, … free storage is like free puppies …

Source: Wired Magazine April 2010; Figures represented in USD

What's A Cloud?

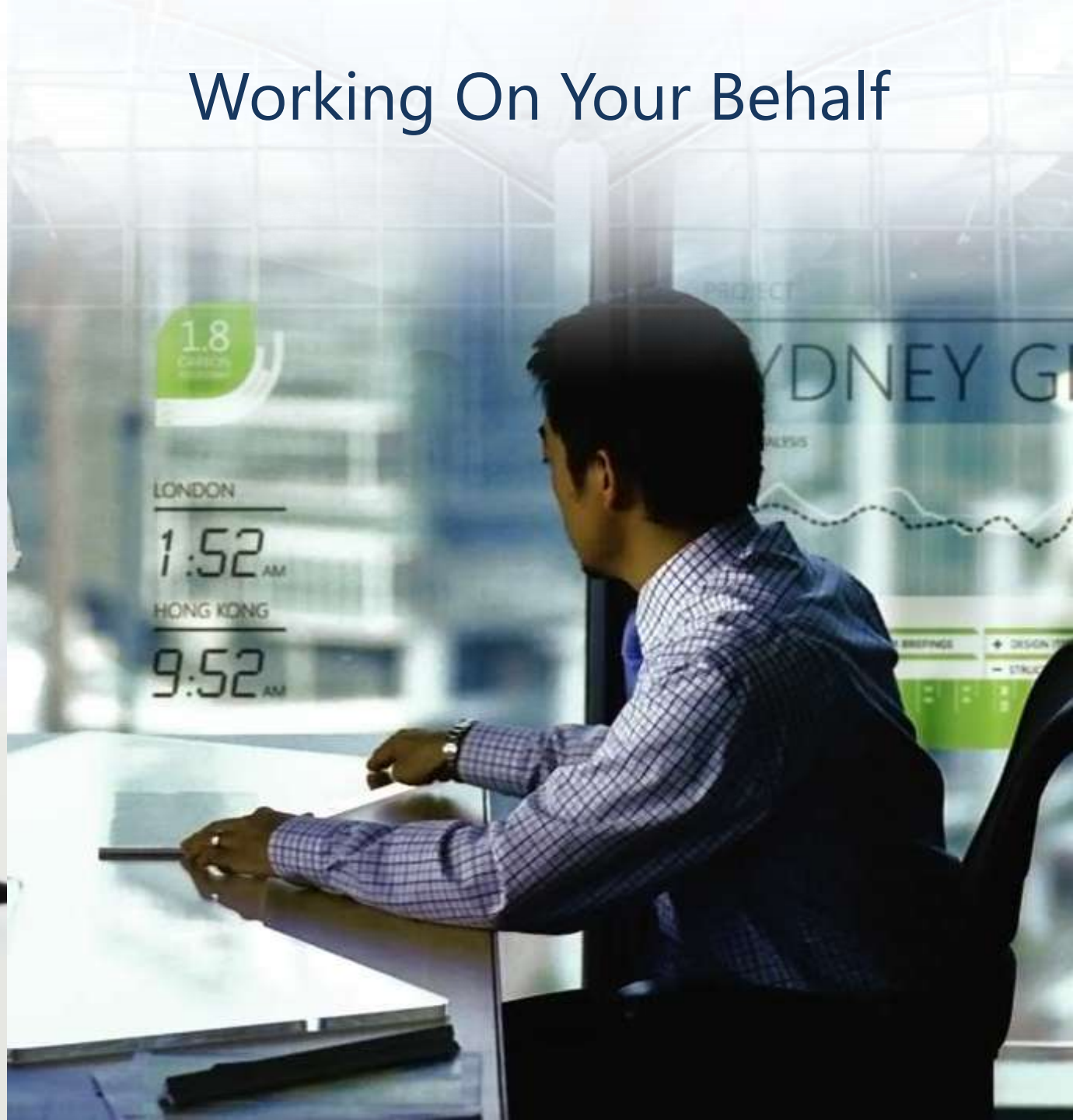
A Transition: Computing Power + Data

As individuals, we have more computing power than the fastest supercomputers once provided to a select few

We have enough computing and enough data that when combined with the power of the cloud, new kinds of experiences can emerge

Working At Your Command

Working On Your Behalf



Not Everyone Can Have An Assistant…Or Can They?

I'll research options, and let you know what will work.

There is only one connection that will work, but it requires you to stay an extra day.

I'll adjust your schedule, so that meetings don't conflict.

I'm running l
clients & staf
v.

I need to be
next week fo
Can you arra

The team wil
in London by

A Good Assistant:

- Leverages "Memory"
- Anticipates
- Holistically Completes Tasks
- Senses Emotion
- Recognizes Patterns

Intelligent, Adaptive Routing

Concept Only

The Connected Home and Lifestyle

Cloud Energy Services
- Remote Control
- Reporting, Analytics, Alerts
- Remote Diagnostics
- CRM/Billing
- Competitive Retail Offerings
- Appliance Diagnostics and offers
- Smart Energy Wizards

Local Distributed Generation (Wind, Solar, etc…)

Utility Z

Meter (bi-directional power flows)

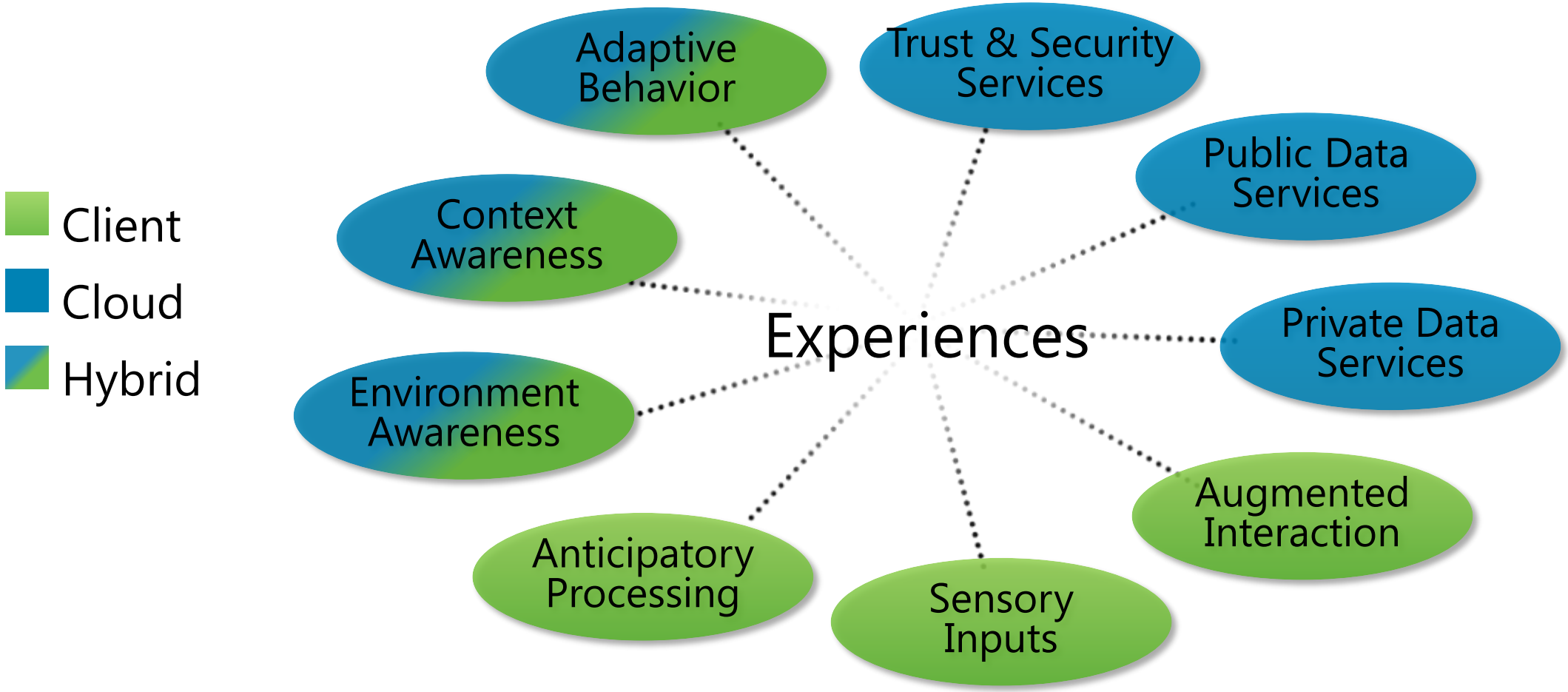
Home Energy Management System

Battery Storage

Managed Circuits:
- HVAC Systems
- Hot Water
- Pool Pump
- Comfort lighting
- Accessories
- Other loads

Hybrid/Electric Vehicle Interface

The Future of Experiences



Looking into the future

YouTube

24 HOURS
UPLOADED EVERY
60 SECONDS

Video
Uploads

cisco

20X - 40X
OVER THE NEXT
FIVE YEARS

Streaming Video
Increasing Wireless Demand

50 BILLION
CONNECTED DEVICES
BY 2020

Devices
Proliferation*

35X
2009 LEVELS
BY 2014

Mobile
Data Traffic**

∗*See* Ericsson Press Release, quoting its President and Chief Executive Officer Hans Vestberg, April 13, 2010, available at http://www.ericsson.com/thecompany/press/releases/2010/04/1403231

**. Federal Communications Commission, Staff Technical Paper, Mobile Broadband: The Benefits of Additional Spectrum, OBI Technical Paper No. 6 (Oct. 2010).

The Challenge: Data Volumes, Solutions, Devices and Spectrum

1.2×10^{21}

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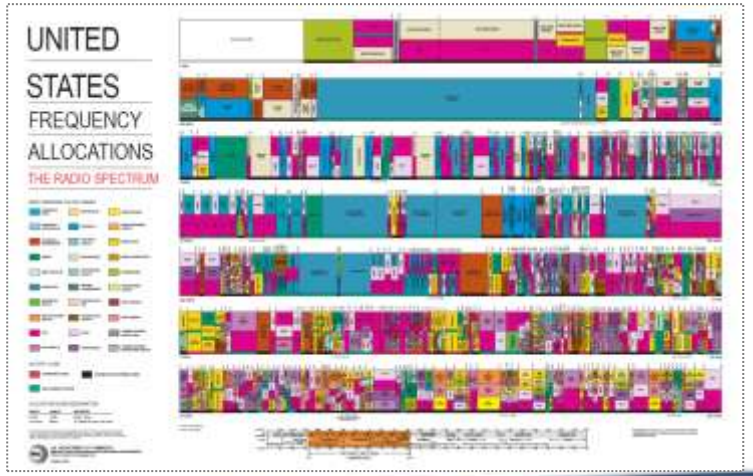
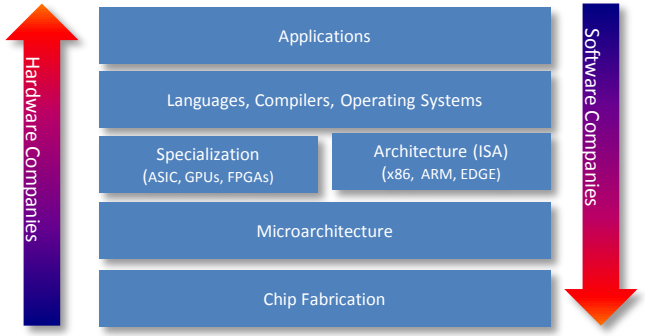
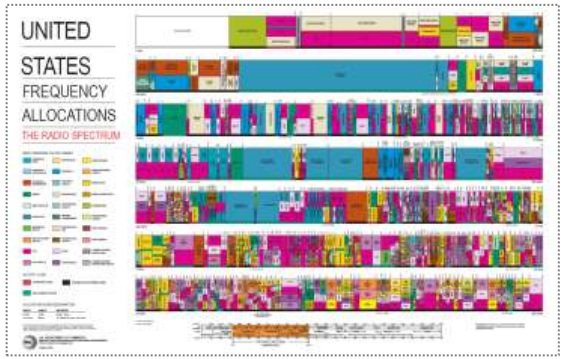


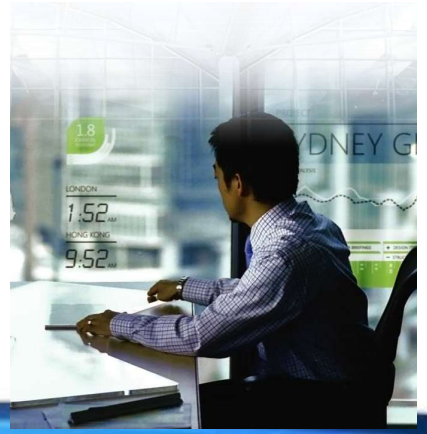
The Opportunity : Integration and better utilization

1.2×10^{21}
New Bytes of Information in 2010*

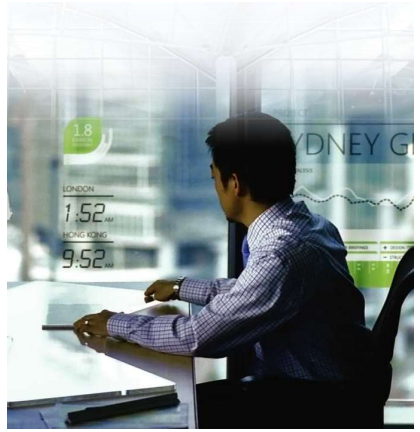




TELECOM Industry



Internet of Things enablement



It’s in the radar???

End-to-End Perspective

NEW EXPERIENCES

NOVEL INFRASTRUCTURE

FLEXIBLE TOOLS

INTELLIGENT MANAGEMENT

END-TO-END TRUST

Offer New Potential Solutions

New technologies can enable **more efficient approaches to information access and delivery**

Allowing diverse device to communicate among one another and with rich services can **put the right information in the right hands and the right time**

Intelligent infrastructure offers opportunities to deliver low-cost broadband to the masses using both *ad hoc* and planned networks

Education and workforce
Healthcare and lifestyle
Transportation and planning

New kinds of technical, economic , government and social opportunities

Environment and sustainability
Government and information
Business and markets

Increase Spectrum Utilization

Technologies that allocate spectrum at different times, locations and frequencies to enable better sharing of spectrum

Internet managed spectrum databases

Online databases or distributed allocation systems allow for more dynamic use of underutilized spectrum. Internet-managed radio networks can accommodate new uses while preserving the functions of incumbent users

Software-defined cognitive radios

New radio technologies, software-defined cognitive radios, that allow wireless systems to use disparate spectrum bands, enabling many innovative uses of wireless networks.

Wide-spectrum radios

New radio designs are emerging that can make use of any part of the wireless spectrum and often make the use of several parts of the spectrum at one time.

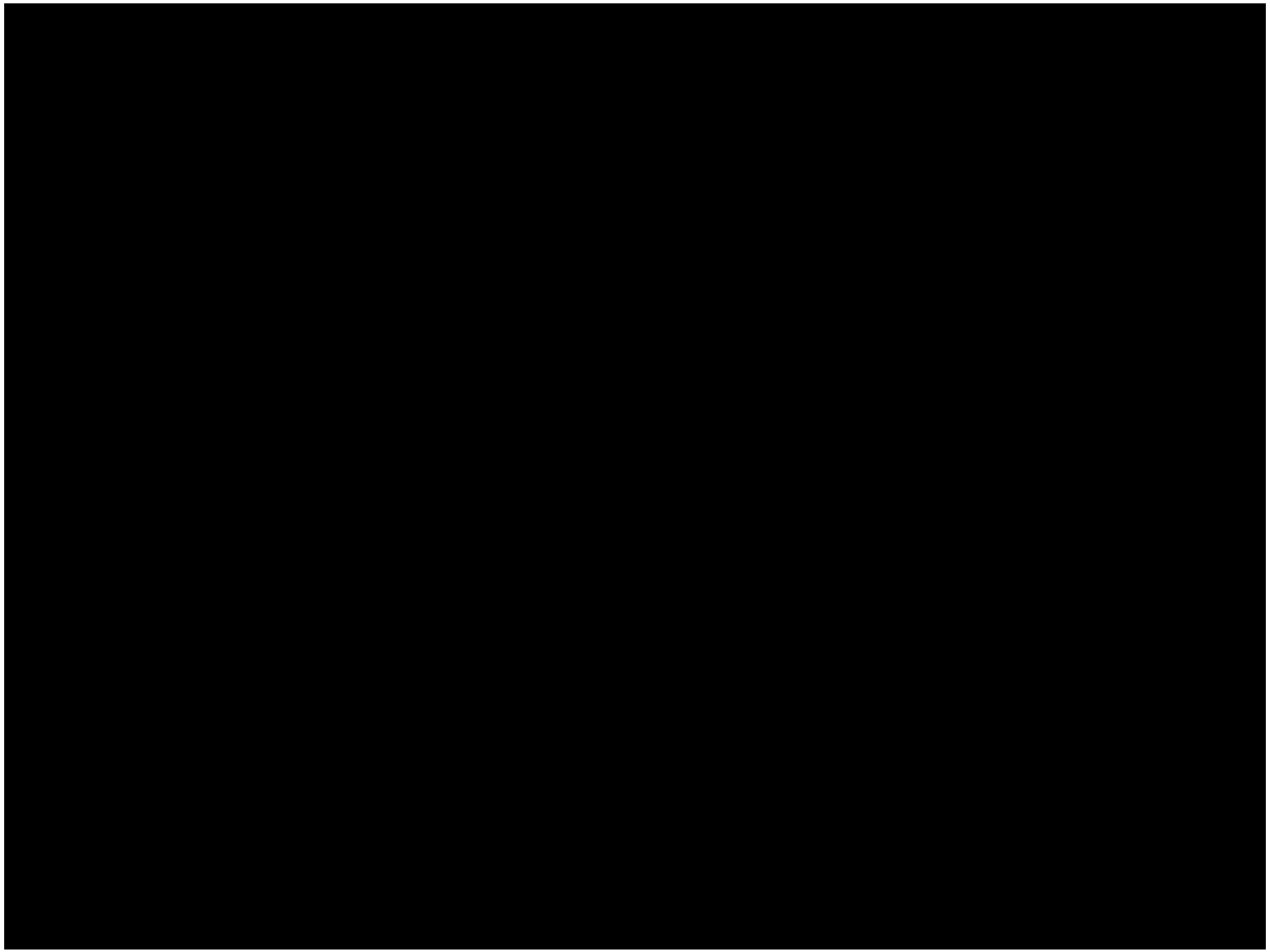
The same advances in computing power that "cause" the pressure on spectrum can also provide a solution…

Future Shock: Technology, Policy and Culture

- Exponential technical change creates **future shock**
  - Technology change outstrips social processes
- The {virtuous, sinful} cycle
  - Technological capabilities enable and constrain people, businesses and government
  - People, business and government enable and constrain technology adoption and usage

- But we can work to facilitate the future; to stimulate innovation and new capabilities
  - Public and private partnerships
  - More nimble policy frameworks to accommodate the new and unexpected
  - Citizen awareness and engagement

Future Vision Video



Be what's next.™