Cloud Computing, Mobility & Analytics

How to Drive Next-Decade Services

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Dec 2011 – IEEE

Outline

- Network Evolution Trends
- Cloud: What & Why?
- Numbers & Business Value
- Rules of Machine & Cloud
- Service Providers & Cloud
- What's Next?

Top-10 Questions for Service Providers' Network Evolution

1. Should Networks Be the Center of the Universe, or Should the Applications?
2. Should the Network Extend Itself to All Seven Layers of the OSI Stack or Should it Be Limited to Layers 1, 2 and 3?
3. Should Networks Be Open Like Some Operating Systems or Closed Like Google Android or Apple's iOS?
4. Should Networks Be Application Blind or Should Apps be Network Blind?
5. Should Networks' Rate Plans Operate Like Utility Companies', or Should Rate Plans Operate Based on Dollar Value?
6. Should Networks Manage and Control the Devices, or Should Devices Manage the Networks? Which One Is Getting Smarter?
7. Should Networks Adapt to User Mobility and Behavior, or Should Users Adapt to the Network's Behavior? (Both Are Very Dymanic!)
8. Should Networks Support All-IP Switching, or Should IP Switching Support Networks Switching (i.e., from Wi-Fi to Femto, 3G to 4G, etc.)?
9. Should Networks Control Security, or Should Security Control Network Innovation?
10. Should Networks Be the Basis for Internet 3 Innovation, or Should Innovation Be the Internet 3? What Does Internet 1 or 2 Mean (Over 90% of Video Traffic Is IP by 2015)?

What Is Cloud?
NIST Cloud Computing Definition

- "Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction."

Cloud: Global Impact

Social, Political and Financial Considerations

Cloud: Numbers & Business Value

(Traffic)

12-fold Cloud Growth:

- Global IP Traffic To Grow From 130 Exabyte to 1.6 Zettabytes Annually by 2015
- 22 Trillion Hours of Streaming Music
- 5 Trillion Hours of Business Web Conferencing with Webcam
- 1.6 Trillion Hours of On-Line HD Video Streaming

Cloud: Numbers & Business Value (cont')

(Traffic)

Data Center Traffic:

- Data Center Traffic 4.8 Zeta Bytes at 33% total IP Traffic Growth (2011 -2015)
- 76% of IP data stays within Data Center as Virtual Machines Migrate from one server to another server
- Massive data to manage as storage of the future and analytics including Linear Programming for this network and data.

Cloud: Numbers & Business Value (cont')

(Video)

North America Traffic:

- 60 % of all evening peak period downstream Internet traffic consists of real-time entertainment applications, such as Netflix and Hulu
- A clear shift away from PCs
  - 55% of traffic volume in North America is consumed on game consoles, set-top boxes, smart TVs and mobile devices. Only 45% is being accessed by laptops or PCs.
- Video makes up 32.6% of peak downstream mobile traffic, of which YouTube is the largest contributor.
- Netflix represents 32.7% of US peak downstream traffic

Source: Sandvine Intelligent Broadband Networks Report (Sep 2011)

Cloud: Numbers & Business Value (cont')

(Market)

- Estimated to be at $33B in 2011, Growing to 100B in 2015
- Cloud Unleashes The Power of Utility Computing That has Never Been Seen Before & It becomes a Game Changer When Matched with Advanced Communications & Applications

Rules of Machines & Cloud: Computing, Mobility and Analytics

1940

- 1 Calculation Per 150 Seconds – Maual
- IBM SSEC – 485 CPS

1980

- IBM PC – 250K CPS
- Cray Computer – 86M CPS

2000

- IBM PS/2 – 13M CPS

2011

- iPad 2 – 1.7B CPS
- Earth Simulator – 38 T CPS
- SONY PlayStation – 2.1 Trillion CPS

2015

- K Computer – 8.6 Quadrillion CPS

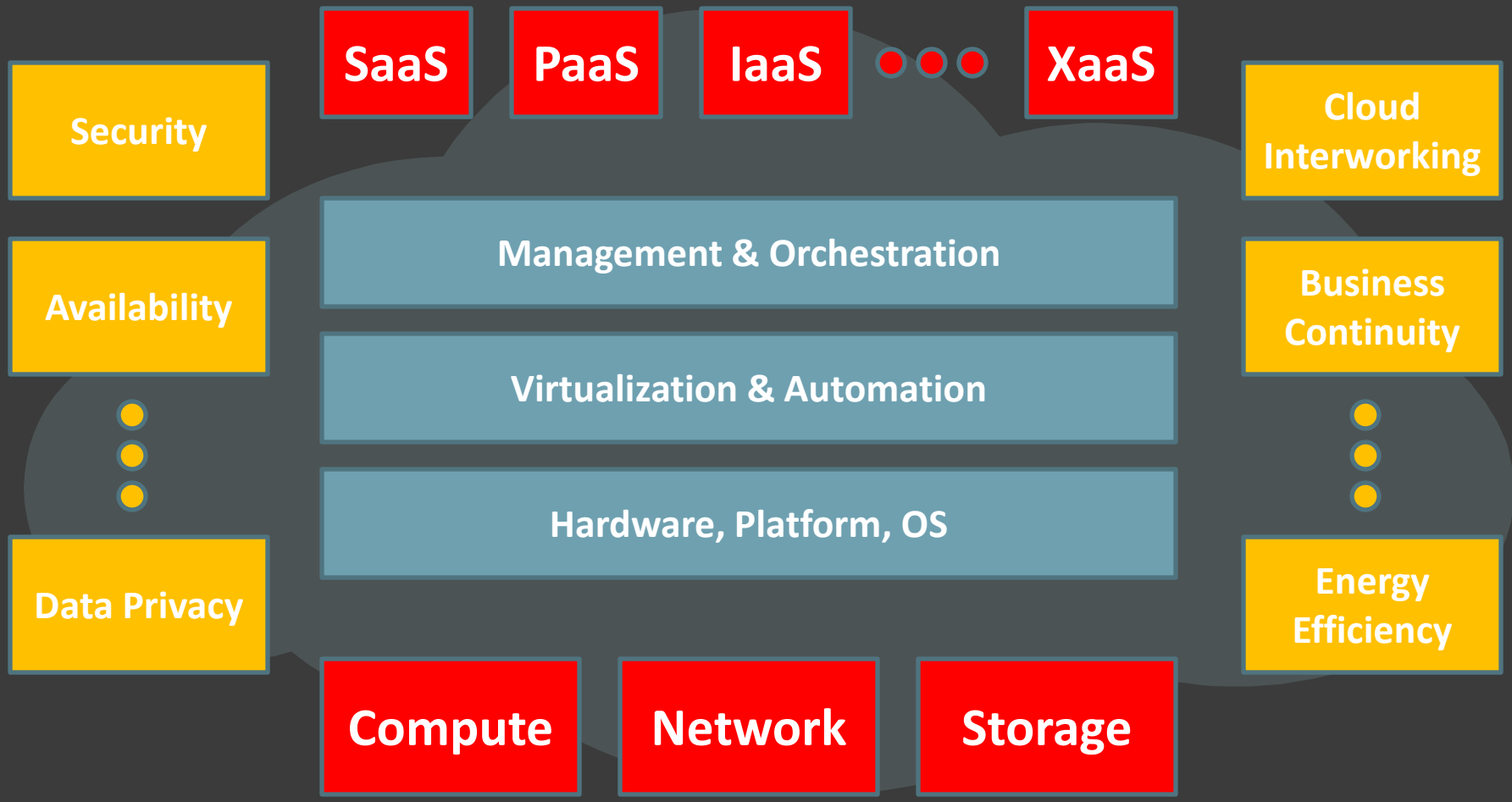
Computing Surpasses Moore's Law!

Rules of Machines & Cloud: Computing, Mobility and Analytics

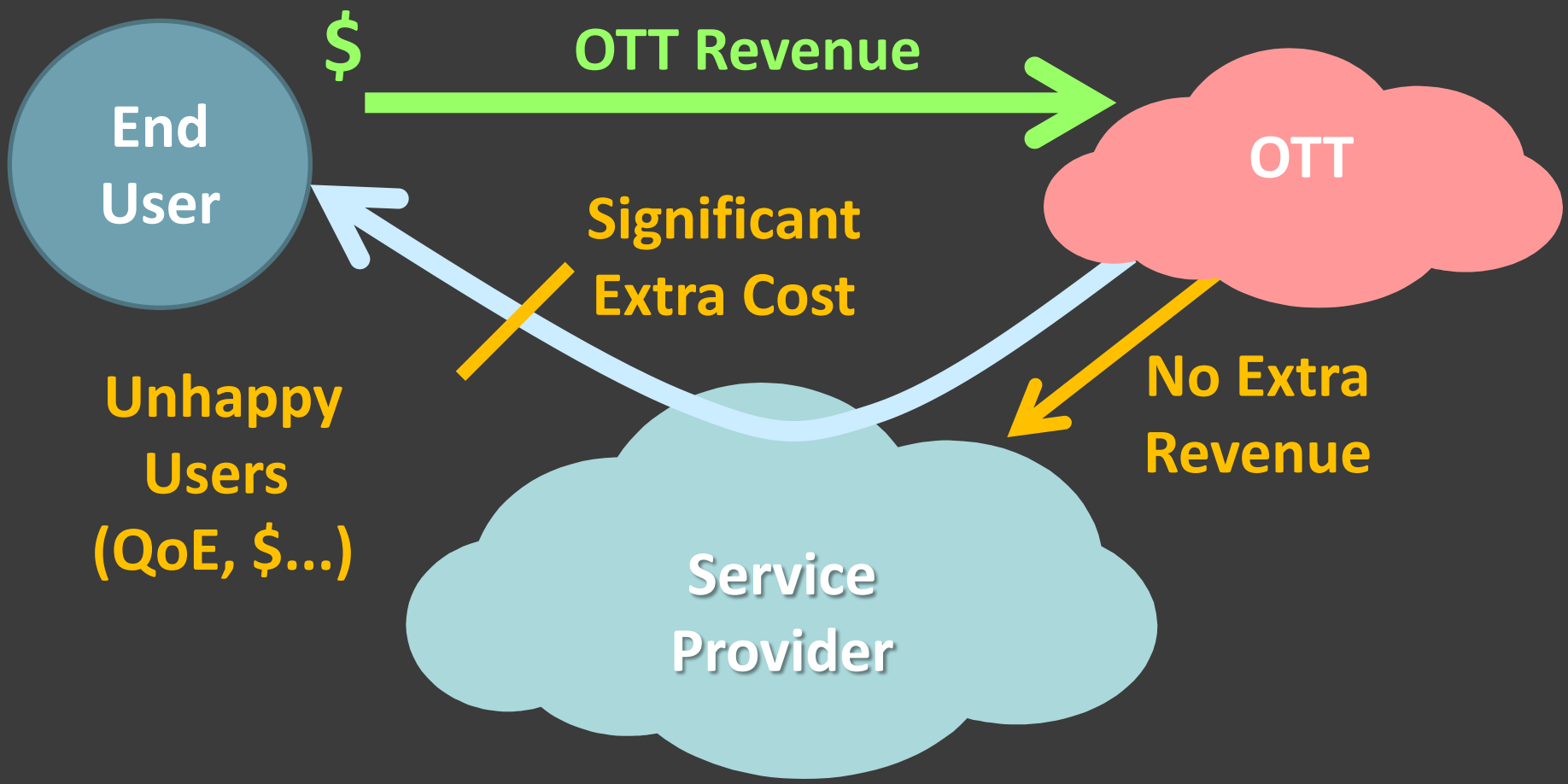
- Un-Structured Versus Structured
- We Could See:
  - 1950: Whole Galaxy – 10MLY
  - 2010: 10BLY – Most Distant Object in Hubble Deep Field
  - 2015: Gamma Ray Burst – 12 BLY

We are Moving to Database of Databases (Context)

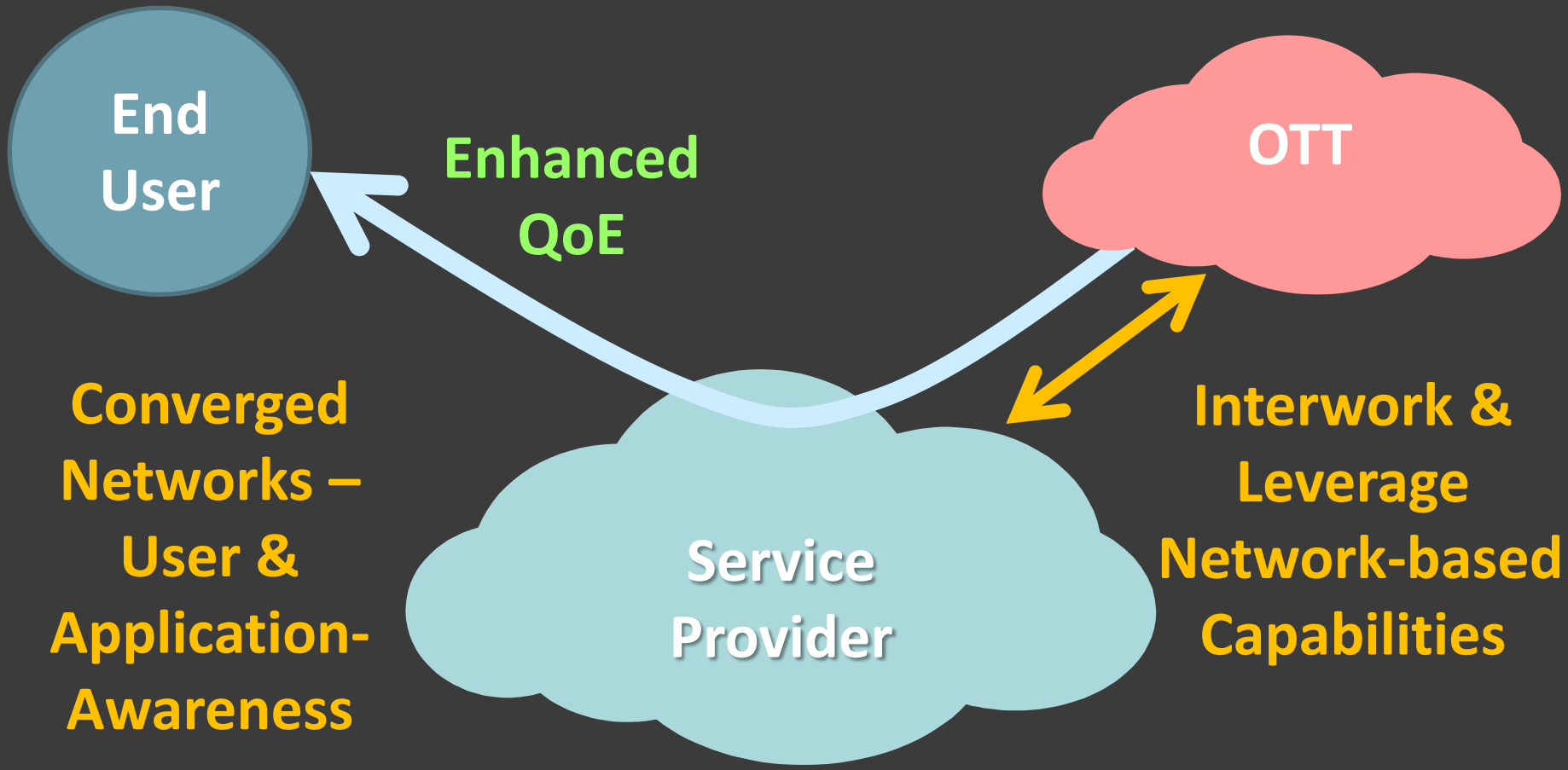
Cloud Ecosystem



Service Providers' Challenge



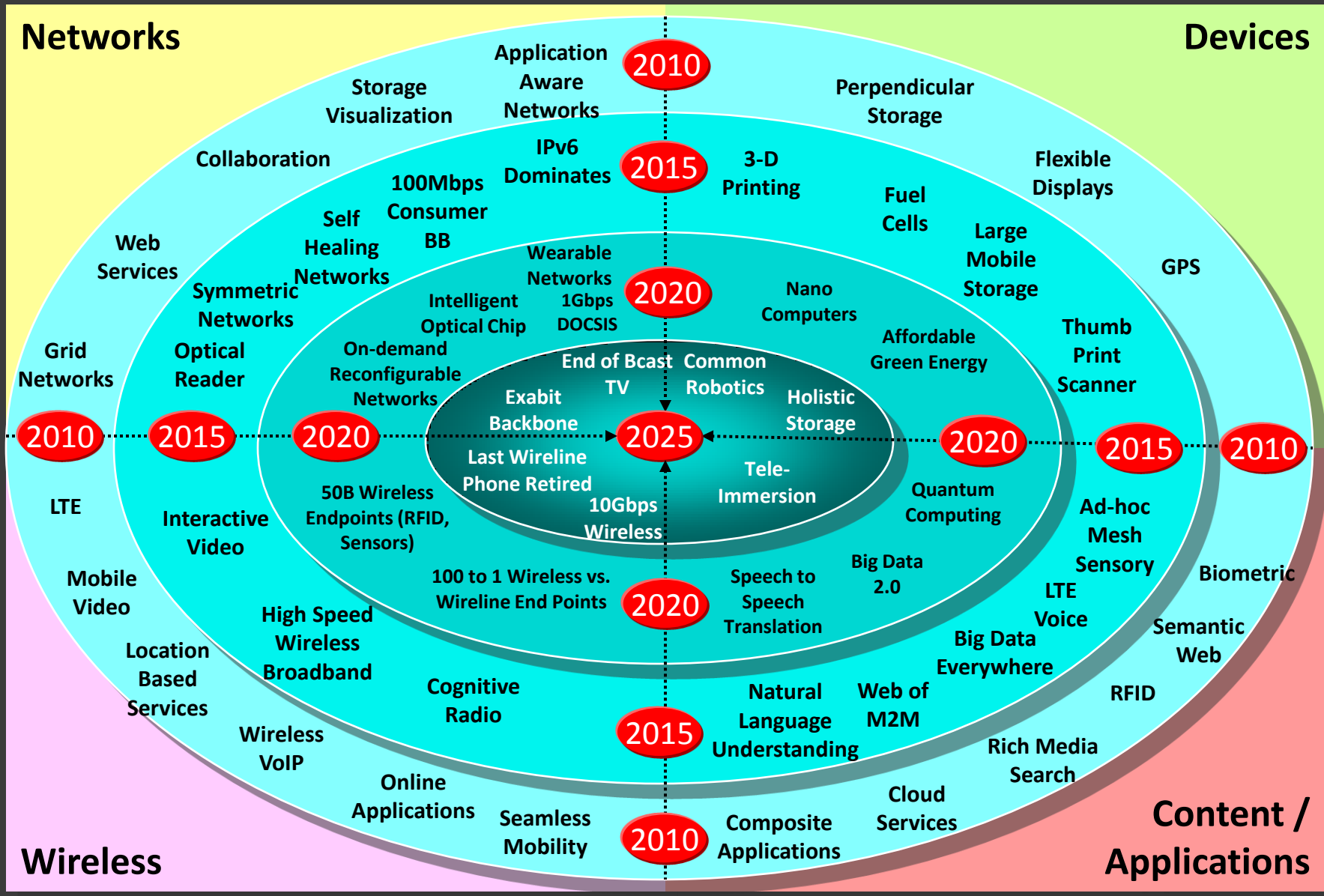
Service Providers' Opportunity



Service Providers' Do-or-Die List

Security & Availability	Support Public and Hybrid Clouds
Unified Comms	Move to Cloud and Work with OTTs
Enterprise Apps	Re-engineer Tiers for Hybrid Model
Cloud Orchestration	Integrate with End-to-End OSS
Cloud-based Services	Build All New Services in Cloud
Data Analytics	Unique Network & User Analytics
Converged Services	Differentiated, Personalized Policy
Infrastructure Value	Strengthen & Expose Capabilities
Platform Virtualization	Move to a Software Model
Network Virtualization	Elasticity for New Traffic Patterns

What Is Next?


Networks
Devices
Wireless
Content / Applications
2010
2015
2020
2025
2020
2015
2010
2010
2015
2020
2020
2010
Application Aware Networks
Storage Visualization
Perpendicular Storage
IPv6 Dominates
Collaboration
3-D Printing
Flexible Displays
100Mbps Consumer BB
Fuel Cells
Self Healing Networks
Large Mobile Storage
Web Services
GPS
Wearable Networks
Symmetric Networks
Intelligent Optical Chip
1Gbps DOCSIS
Nano Computers
Grid Networks
Optical Reader
On-demand Reconfigurable Networks
Affordable Green Energy
Thumb Print Scanner
End of Bcast TV
Common Robotics
Exabit Backbone
Holistic Storage
Last Wireline Phone Retired
Tele-Immersion
LTE
Interactive Video
50B Wireless Endpoints (RFID, Sensors)
10Gbps Wireless
Quantum Computing
Ad-hoc Mesh Sensory
Mobile Video
100 to 1 Wireless vs. Wireline End Points
Speech to Speech Translation
Big Data 2.0
Biometric
LTE Voice
High Speed Wireless Broadband
Semantic Web
Location Based Services
Big Data Everywhere
Cognitive Radio
Natural Language Understanding
Web of M2M
RFID
Wireless VoIP
Rich Media Search
Online Applications
Cloud Services
Seamless Mobility
Composite Applications

Thank You

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