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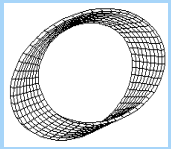
The converged network: Consolidated Passive Optical Networks

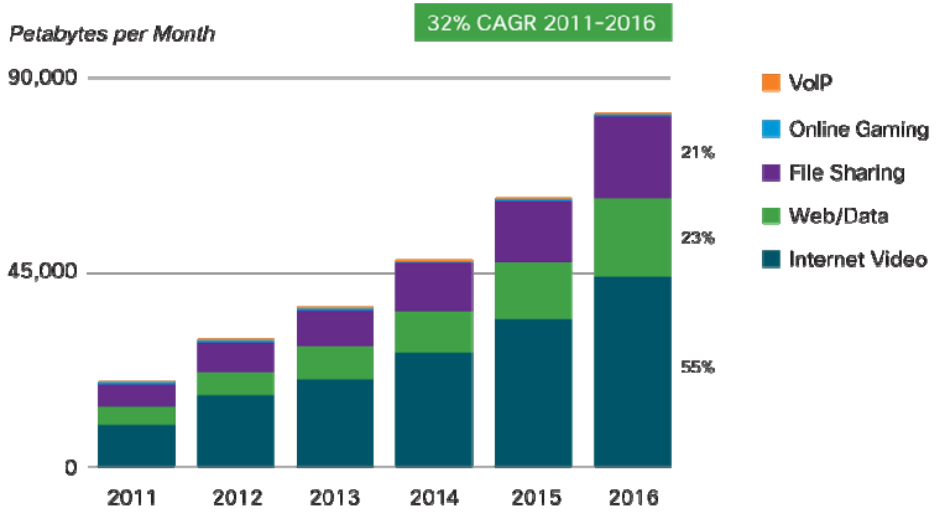
Radovan Salek
Corning Carrier Networks EMEA

Key Messages

- Telco, CATV, Wireless service providers all evolving to multi-service operators
-  Bandwidth demand, fixed and mobile, is stressing the networks
-  Consumers want both fixed and mobile connectivity, and they want it seamlessly
- Efficiencies of a converged approach can improve the business case for new network builds

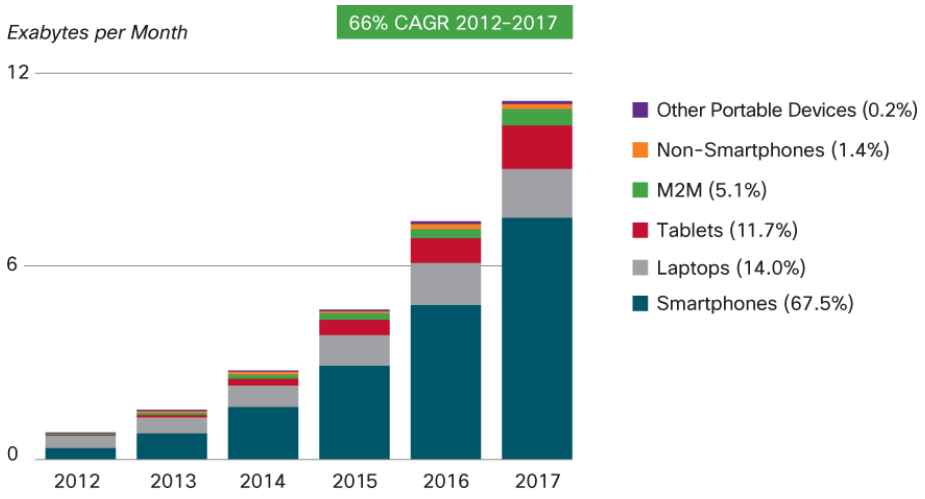
Bandwidth demand growth is stressing all segments of the networks

Global Fixed Internet Traffic



- Internet Video is 50% of total consumer demand at YE12
- Video drives exponential growth
- Measurements of bandwidth will go from petabytes to zettabytes by 2016

Global Mobile Data Traffic



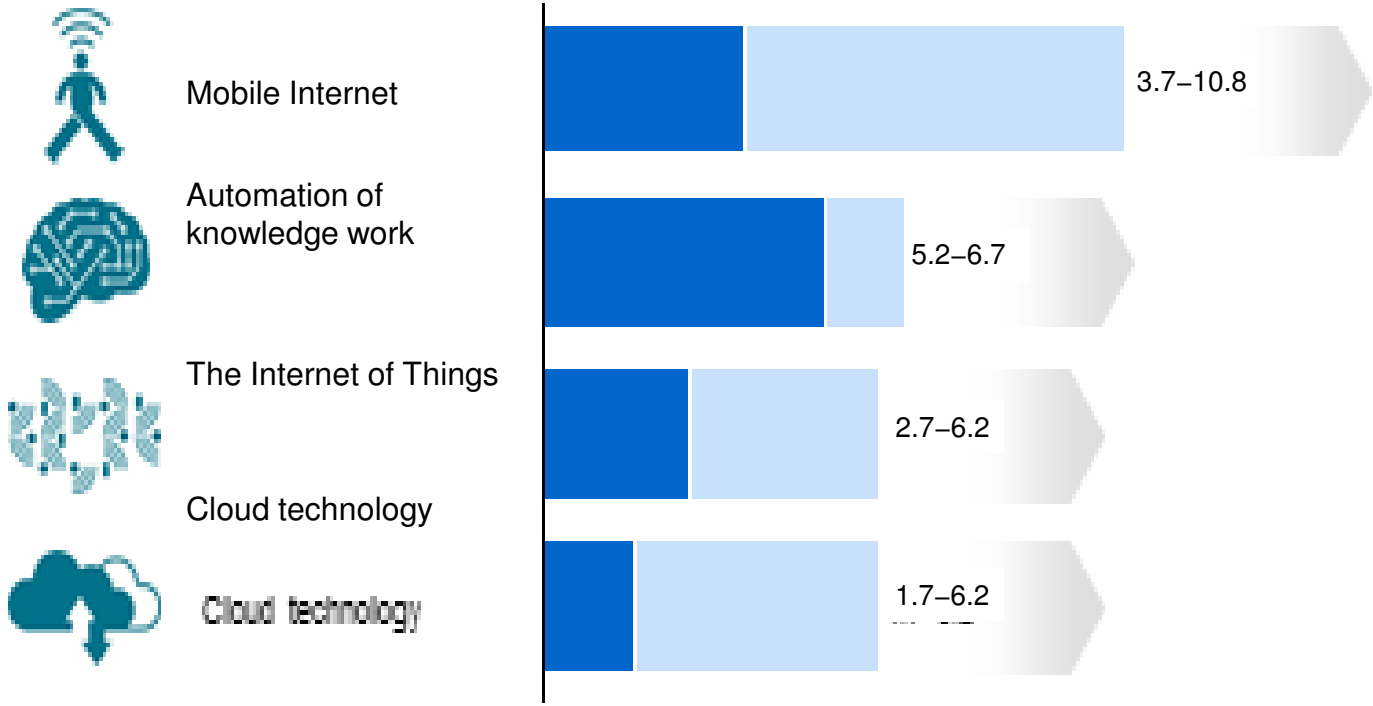
- In 2013, mobile devices exceed earth's population (1.0 per capita); by 2017, 1.4 mobile devices per capita
- Mobile video traffic >50% in 2012
- Mobile network speeds more than doubled in 2013

***Source*: Cisco**

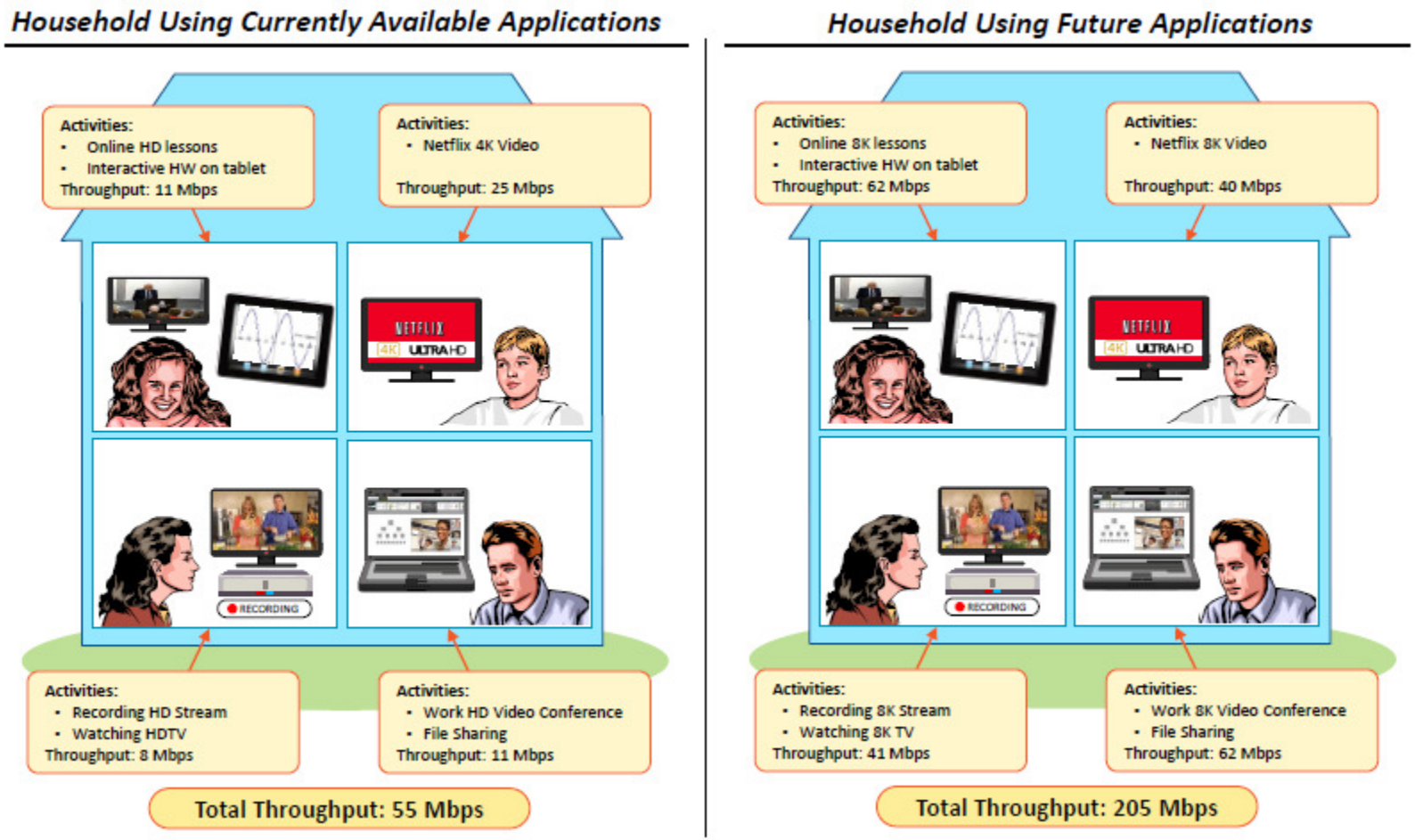
http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-520862.pdf

Catalyst for change in service provider networks

Disruptive technologies: Advances that will transform life, business, and the global economy



A household using everyday day applications in the future will require speeds well above 100 Mbps



Source: Cartesian. Exhibit from "Ultra-fast Broad Band Study: Investigating Demand and Benefits " May 2014,

Mobile explosive bandwidth demand has implications across the network

Stronger demand for:

- Access points
- Backhaul
- Switching & Data centers

Optical provides:

- Higher capacity
- Higher speed
- Higher density

More Connected
(# mobile subscribers)

2010	2018
5 B	7.5 B

Source: Infonetics

+

More Capable
(% mobile broadband subs)

2010	2018
11 %	52%

Source: Infonetics

=

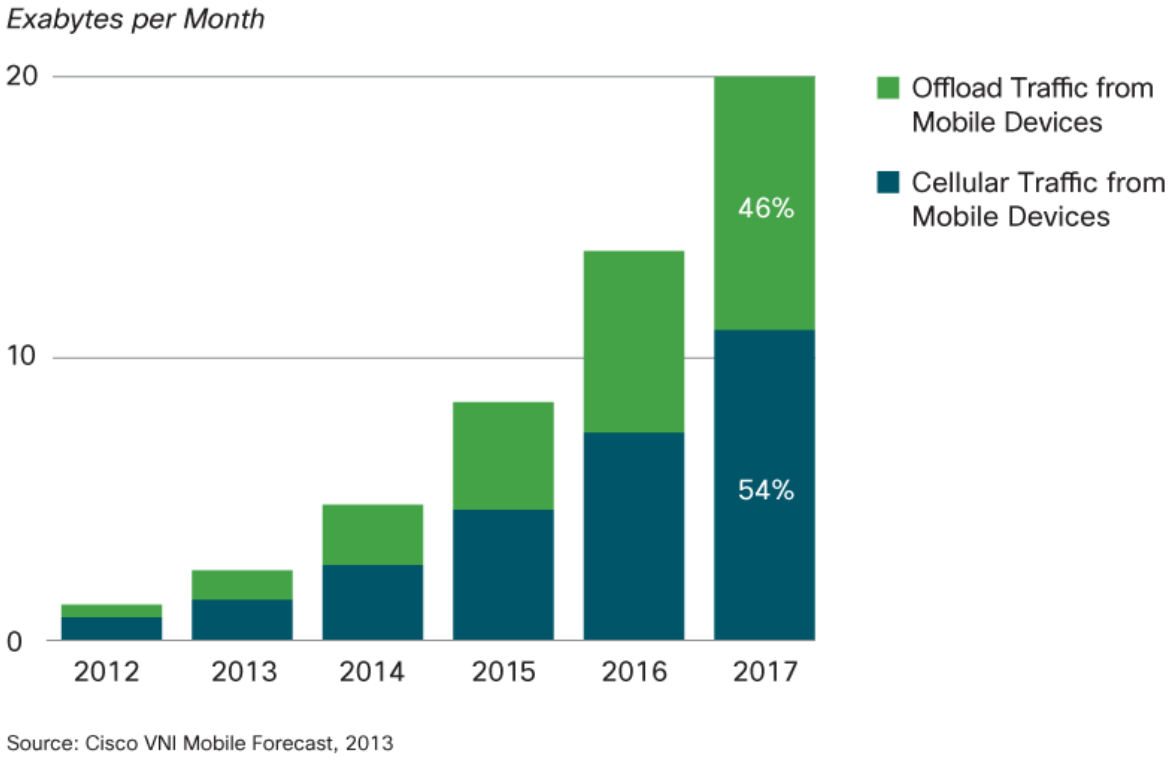
More Traffic
(Petabytes per month)

2010	2015
237	15,838

Source: Cisco

A wireless network requires optical fiber backhaul; carriers must get off the air and onto fiber

46% of total mobile data traffic will be offloaded by 2017



Source: Cisco VNI Mobile Forecast, 2013

Carriers are struggling to keep up with mobile data demand

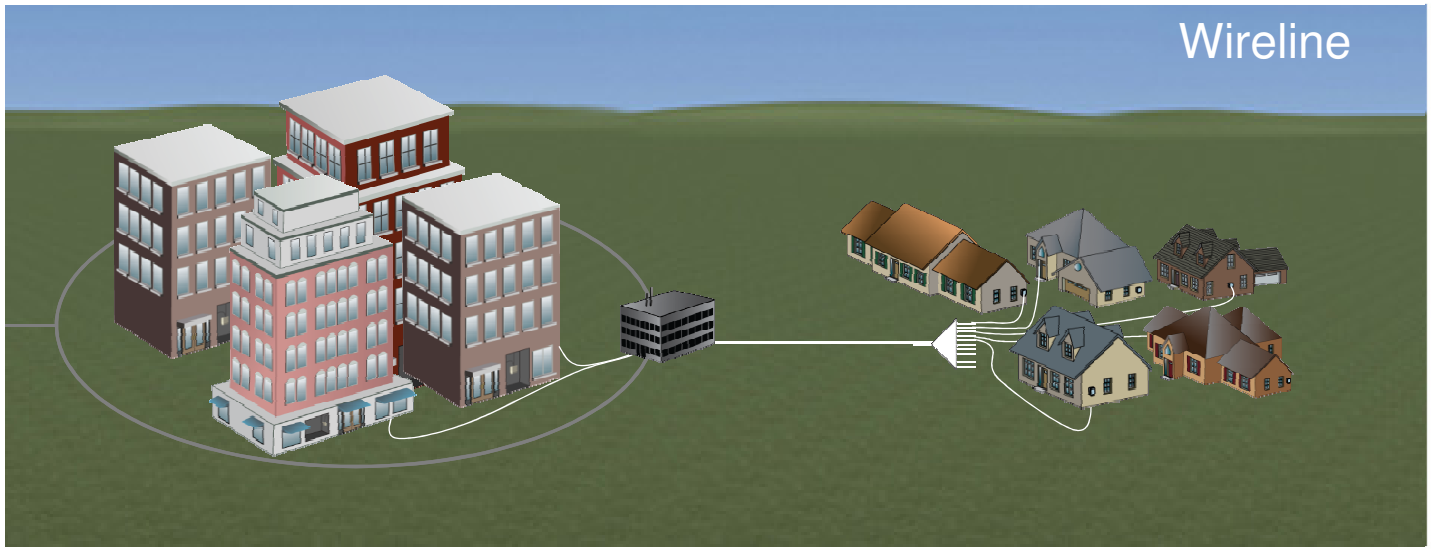
- Driving fiber to the top of cell towers and into buildings

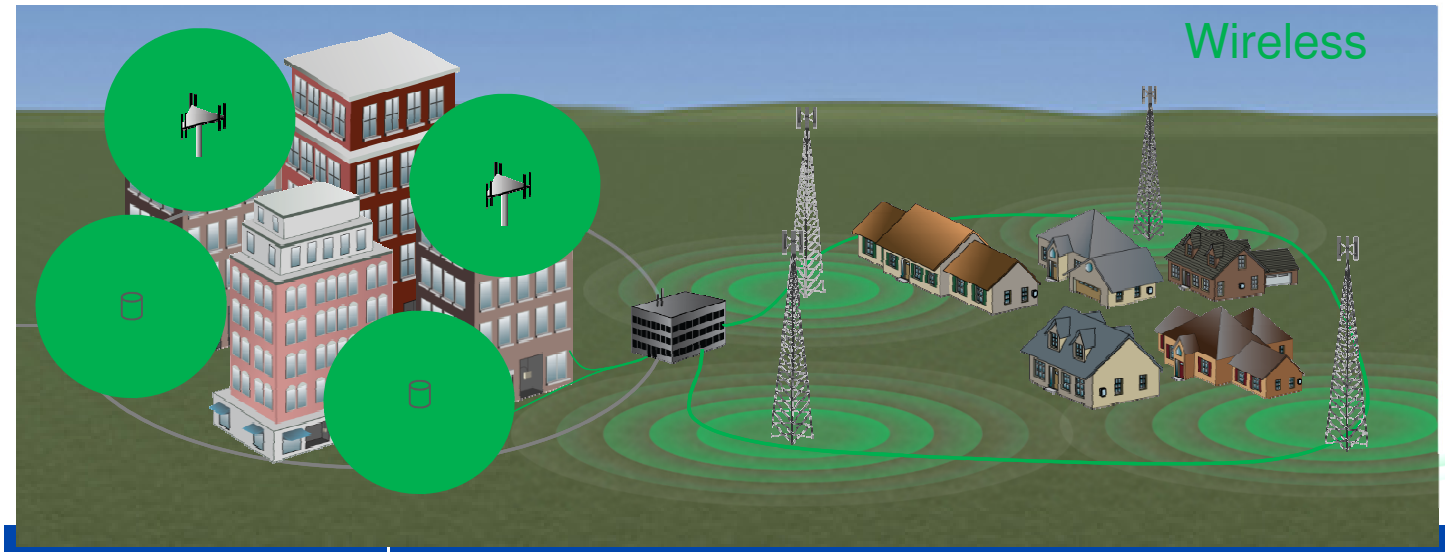
Networks are already merging

- Users don't know or care about the difference between 3G/4G and Wi-Fi

Home and office networks are ideal for mobile offload

Network Convergence:
Services will be supported by one network





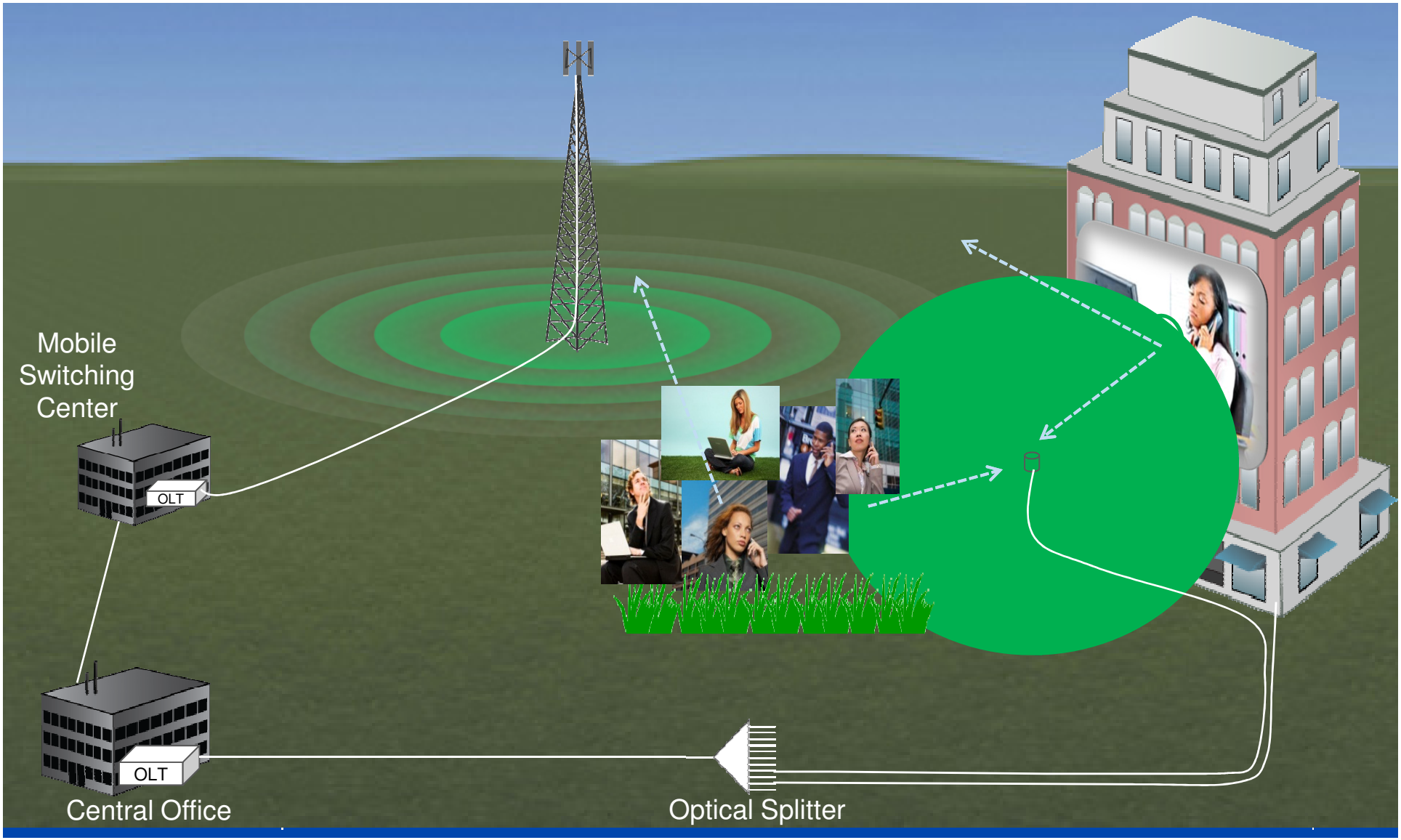
Carriers support multiple networks that have been built in silos based on service offerings. Network efficiency requires planning for all services, known and unknown.
A service-agnostic, future-ready network optimally designed will converge fixed and wireless infrastructure.

FTTH wire line operators own infrastructure exactly where wireless operators need it

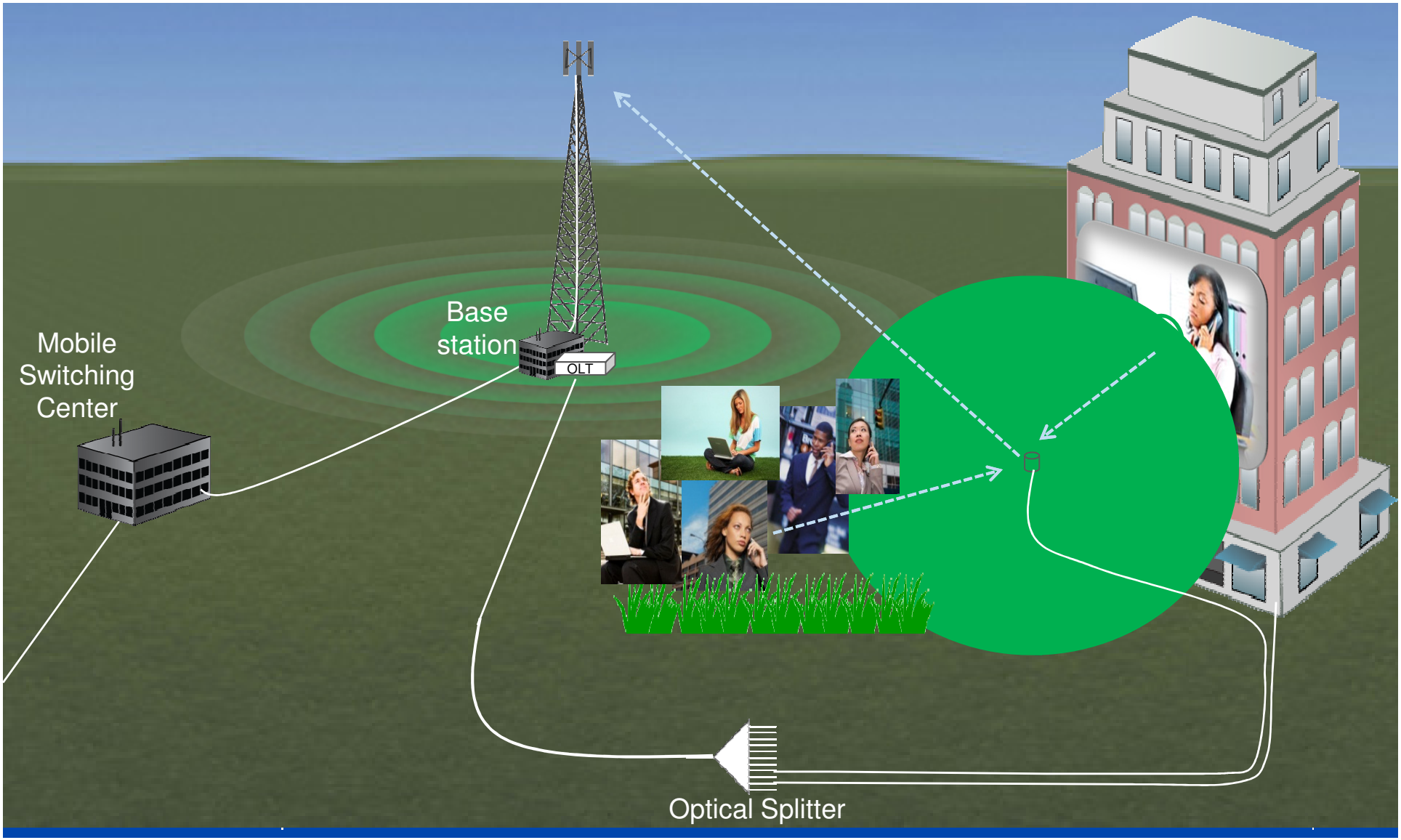
Study on Small Cell Deployment

Source: AT&T Analysis "A Small Cell Augmentation to a Wireless Network Leveraging Fiber-to-the-Node Access Infrastructure for Backhaul and Power

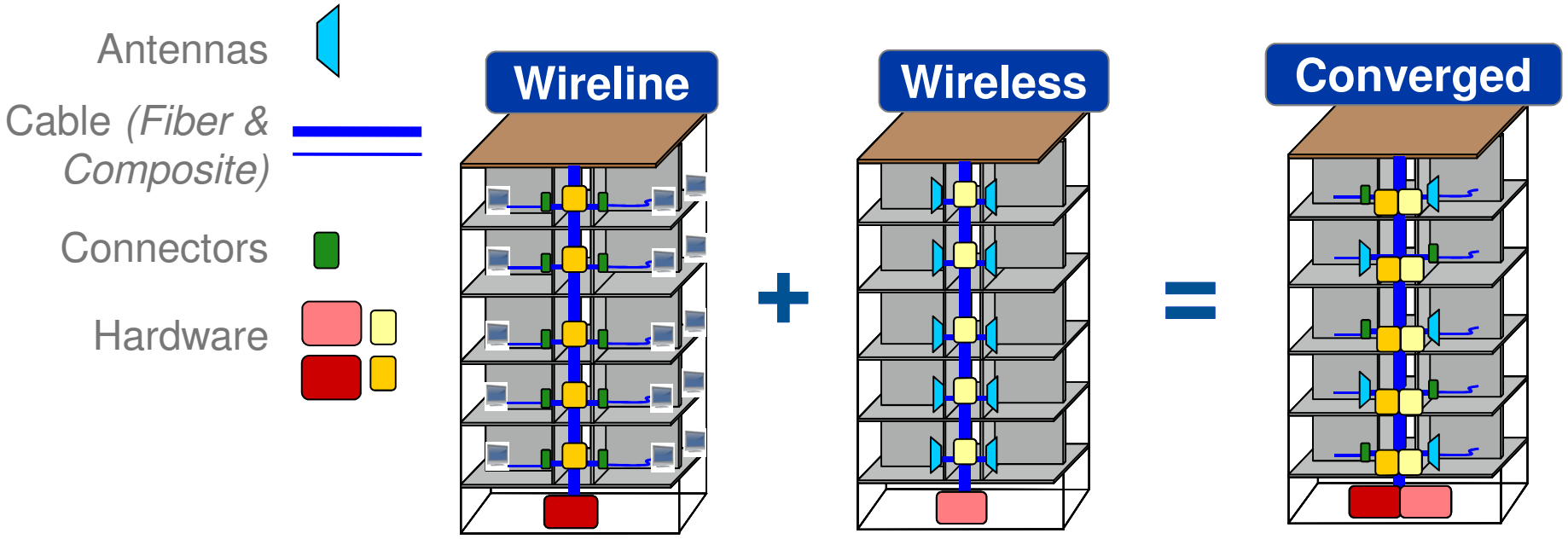
Fixed-Mobile Convergence:
The Fixed-line Centric Network



Fixed-Mobile Convergence: The Mobile Centric Network



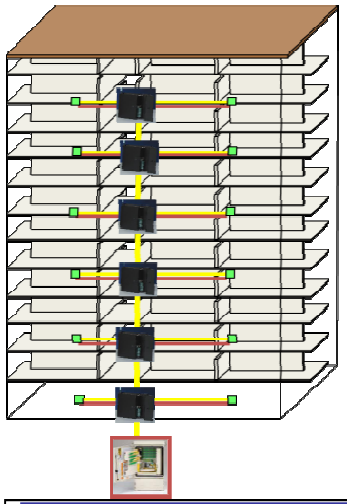
ISP Converged Scenario Analysis



MDU Wireless Supports

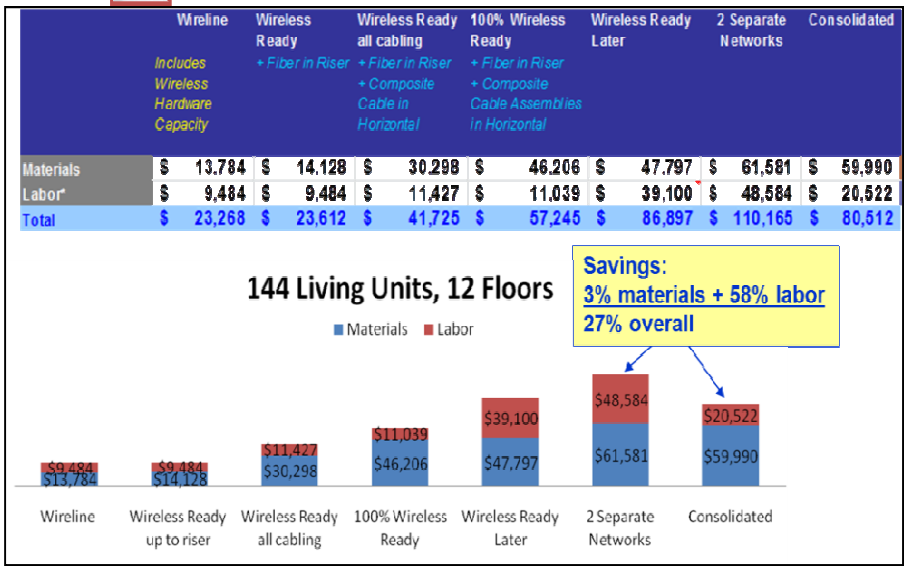
- Wi-Fi in the apartment
- Public Wi-Fi in the common areas
- Cellular services
- Public safety

MDU Case Study
Large MDU (144 Living Units, 12 Floors)



Component	Level of "Wireless Ready"	% Wireless Ready
Hardware	1. Place FTTH hardware with capacity for • fiber terminations at wireless headend (96 for MIMO, in this case) • 1U hardware per floor (8 fibers, 8 fuses each)	6%
Riser cabling	2. Place 96 additional fibers in the riser	14%
Horizontal cabling	3. Place composite cables in the horizontal (two 4-fiber 4-conductor) per floor	19%
Connectivity	4. Or, place composite assemblies in the horizontal (two 4-fiber 4-conductor) per floor	100%

	Wireline *Includes Wireless Hardware Capacity*	Wireless Ready *+ Fiber in Riser*	Wireless Ready all cabling *+ Fiber in Riser + Composite Cable in Horizontal*	100% Wireless Ready *+ Fiber in Riser + Composite Cable Assemblies in Horizontal*	Wireless Ready Later	2 Separate Networks	Consolidated
Materials	$ 13,784	$ 14,128	$ 30,298	$ 46,206	$ 47,797	$ 61,581	$ 59,990
Labor*	$ 9,484	$ 9,484	$ 11,427	$ 11,039	$ 39,100	$ 48,584	$ 20,522
Total	$ 23,268	$ 23,612	$ 41,725	$ 57,245	$ 86,897	$ 110,165	$ 80,512



Logical efficiency gains from combining wireline and wireless infrastructure

Savings depend on MDU size, number of operators, and types of planned services

Phasing the build to suit unique situations of each building

Minor labor savings in materials, labor savings ~58% by avoiding a separate install

Total potential savings ~27%

Key Messages

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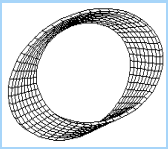
-  Wireless and wireline services are complementary, not competing technologies
-  Consumers want both fixed and mobile connectivity, and they want it seamlessly
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