

ECONOMIC BENEFIT OF SPECTRUM SHARING

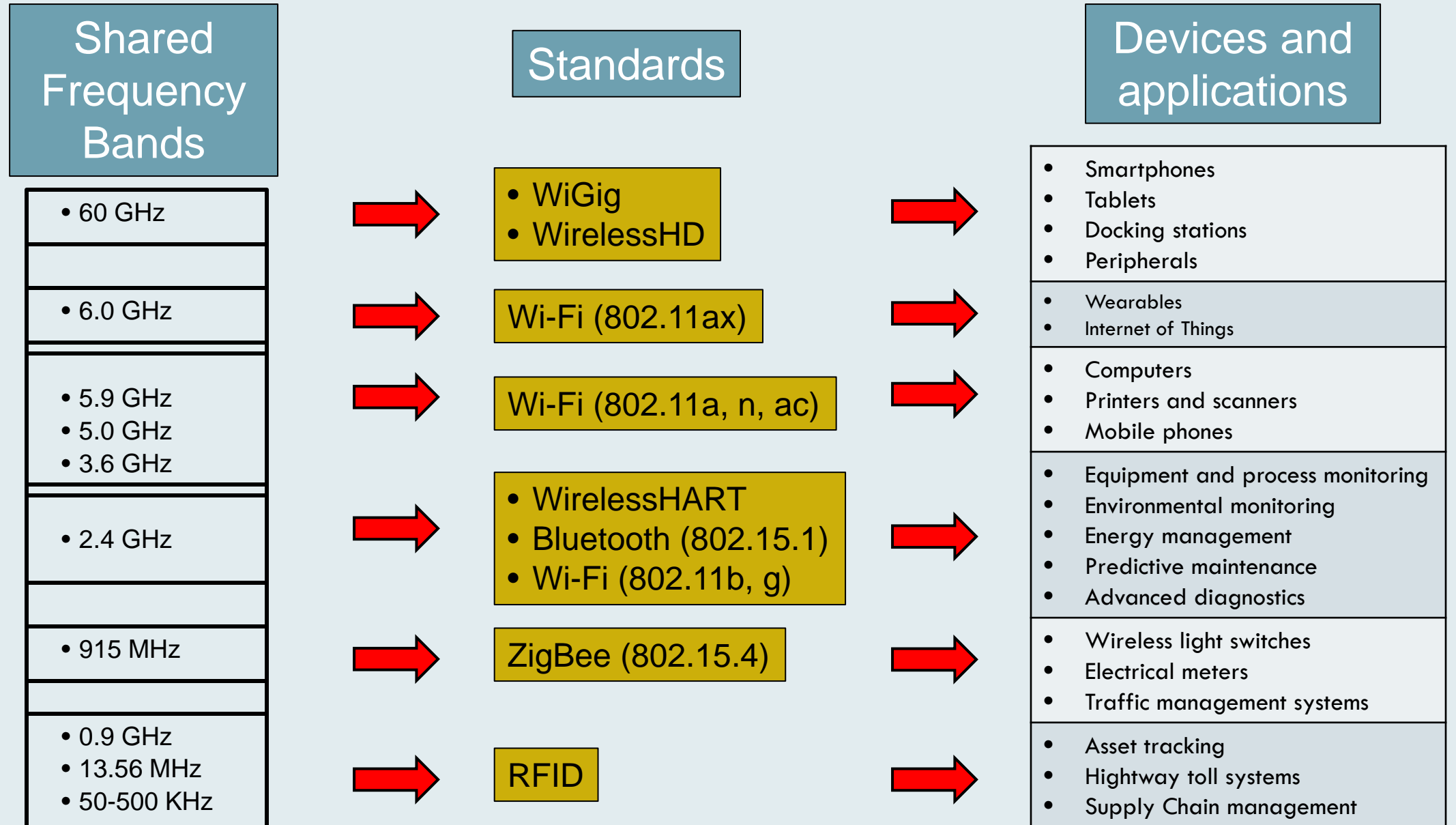
Dr. Raul L. Katz



Telecom Advisory Services LLC

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SPECTRUM SHARING HAS BEEN A CRITICAL ENABLER FOR THE DEVELOPMENT OF A BROAD AND DIVERSE DIGITAL ECOSYSTEM



THE ECOSYSTEM GENERATED BY SPECTRUM SHARING RESULTS IN AT LEAST THREE SOURCES OF VALUE

	Definition	Example	Benefit
Complementary technologies	A resource that, due to its intrinsic strengths, compensates for the limitations of another	Wideband cellular networks and Wi-Fi	<ul style="list-style-type: none">• Lower cellular CAPEX• Faster wireless access
Alternative technologies	By generating a substitute, consumers benefit from a larger set of choices	Communications platforms dependent on Wi-Fi access	<ul style="list-style-type: none">• Lower consumer wireless spending
Innovative business models	Unlicensed spectrum prevents license holders from restricting development of new business models	Wearable devices, telemetry and monitoring systems	<ul style="list-style-type: none">• No need of prior agreement of license holders• No disincentive from revenue splits• No time to market penalty

THESE THREE SOURCES OF VALUE GENERATE ECONOMIC BENEFITS THROUGH MULTIPLE EFFECTS

	Consumer Surplus	Producer Surplus	GDP Contribution
Complementary technologies	Free Public Wi-Fi	Orange	Orange
	Residential Wi-Fi	Orange	Orange
	Network off-loading	White	Orange
	Faster wireless	Orange	Orange
Alternative Technologies	AR/VR	Orange	White
	Internet of Things	Orange	White
	Residential Wi-Fi devices	Orange	White
Innovative Business Models	Bluetooth products	White	Orange
	Commercial Wi-Fi	White	Orange
	WISPs	Orange	Orange

Source: Telecom Advisory Services analysis

FOR EXAMPLE, SPECTRUM SHARING IS A CRITICAL APPROACH TO HELP COUNTRIES DEAL WITH THE PERSISTENT DIGITAL DIVIDE

NON-INTERNET USERS (2019)

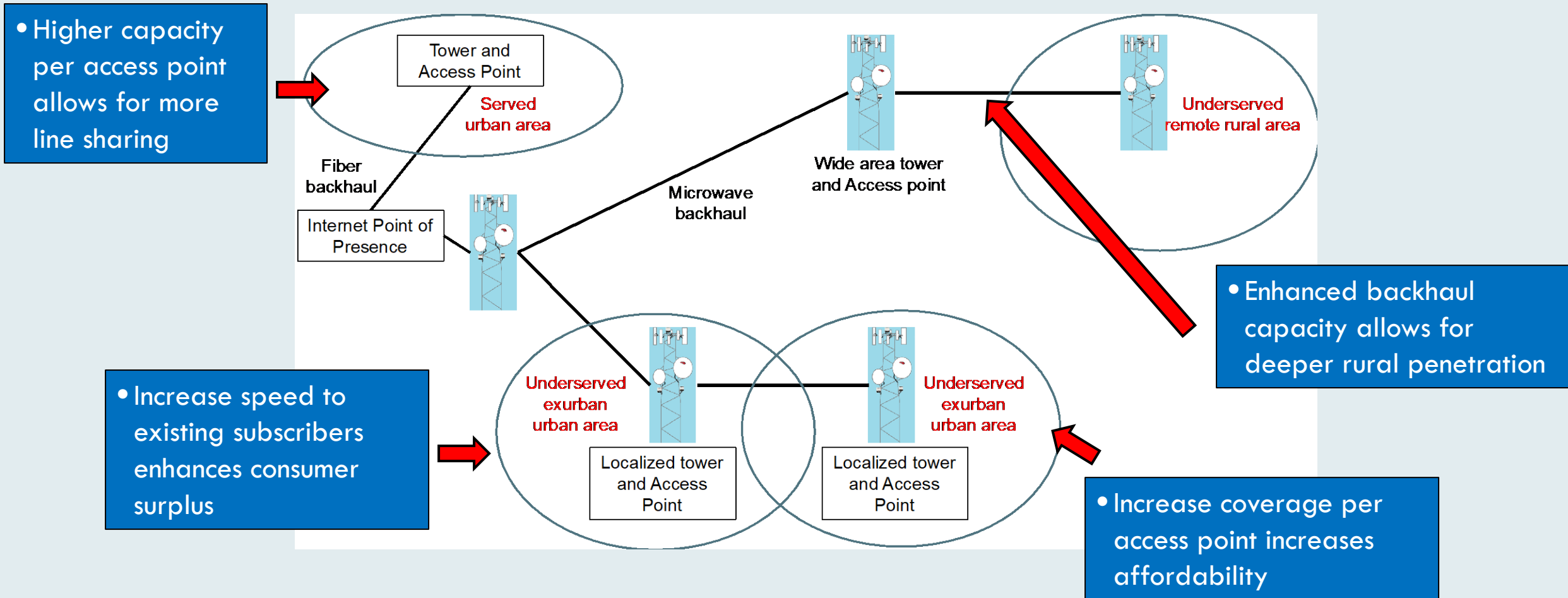
UNSERVED BROADBAND (2020)

	Internet		4G	Fixed Broadband
Africa	71 %		55.7 %	53.3 %
Arab States	45 %		38.1 %	23.9 %
Asia and Pacific	55 %		5.8 %	37.6 %
Commonwealth of Independent States	27 %		19.2 %	6.2 %
Europe	17 %		2.8 %	5.1 %
North America	9 %		2.1 %	4.1 %
Latin America and the Caribbean	31 %		14.0 %	11.0 %
WORLD	49 %		15.3 %	30.1 %

Source: ITU (2021). *Telecommunications Industry in the Post-COVID-19 World Report of the VII ITU Economic Experts Roundtable*

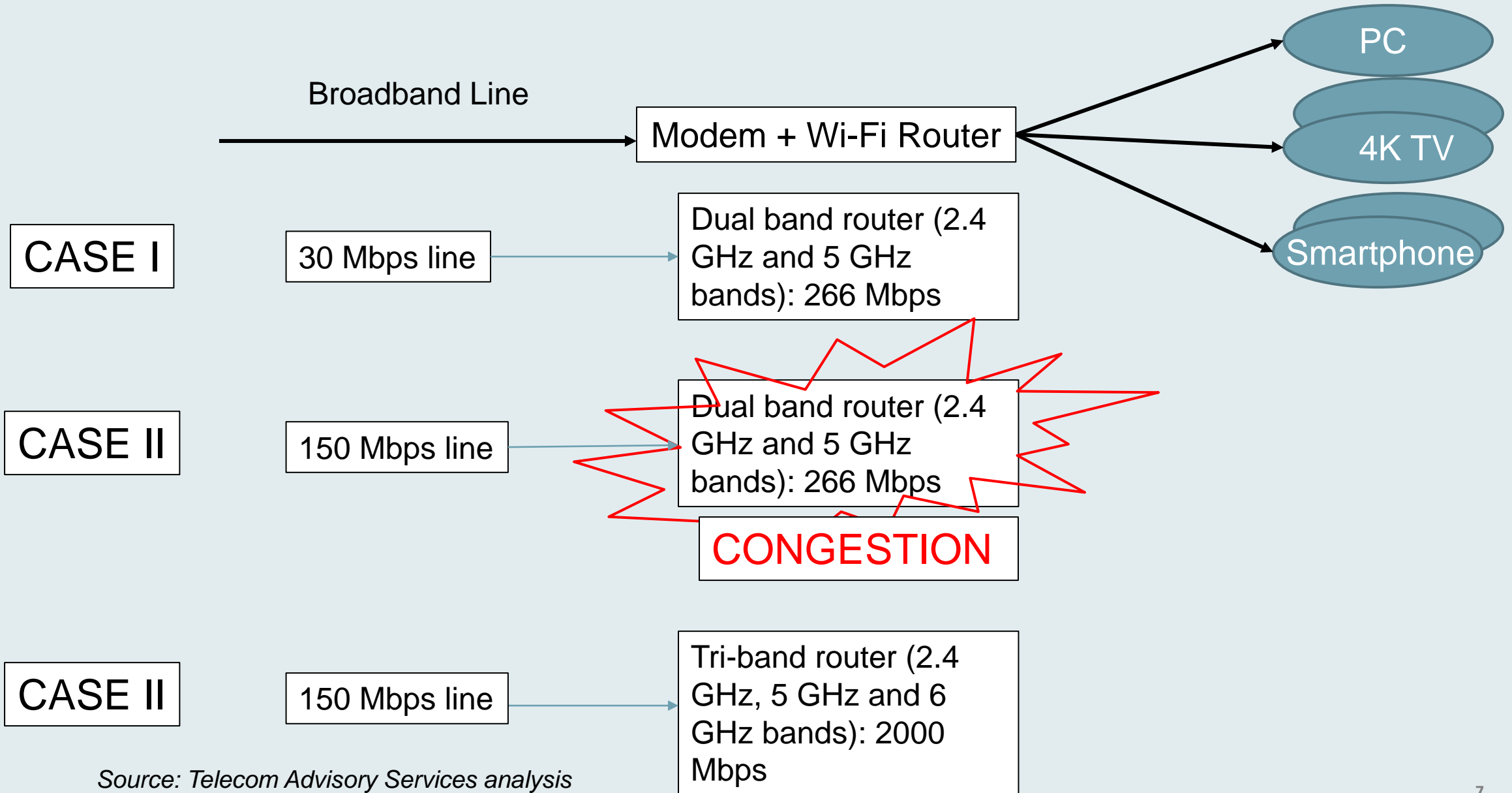
WI-FI IS THE TECHNOLOGICAL ENABLER OF WIRELESS ISPs TO HELP TACKLE THE DIGITAL DIVIDE

IMPACT OF 6 GHz SPECTRUM ON A WISP NETWORK



Source: Telecom Advisory Services analysis

WI-FI6 IS ALSO AN APPROACH TO DEAL WITH RESIDENTIAL BROADBAND SERVICE CONGESTION



Source: Telecom Advisory Services analysis

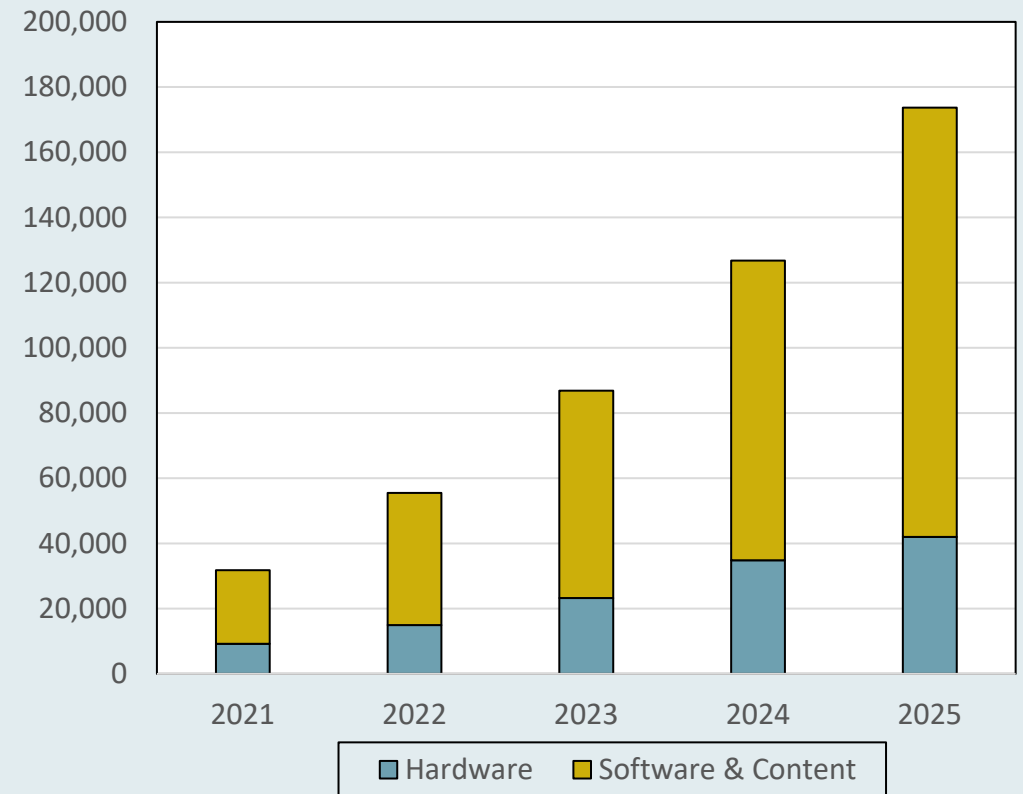
AUGMENTED REALITY AND VIRTUAL REALITY ARE A KEY ECOSYSTEM COMPONENT ENABLED BY SPECTRUM SHARING

AR/VR Applications

Industry	Domain	Use Case
Health Care	Diagnostic	A/R can help patients before they are diagnosed with Alzheimer or Dementia
	Surgical procedures	Platforms that combine visualization and display technologies with a new class of operating robots to support remote surgical interventions
	Training in ER procedures	Provide training in pediatric ER experience
Entertainment	Event enhancing	A/R can make experiences, like concerts, more enjoyable and interactive, with the potential to completely change how the audience interacts with the event environment.
Oil and Gas	Maintenance	Oil firms have adopted AR headsets and glasses, which superimpose digital images on what the wearer sees in real life to fix problems on rigs, refineries and plants
Mining	Emergency rescue operations training	V/R creates situations that are impossible to recreate in the physical world in order to train rescue personnel.

Source: Compiled by Telecom Advisory Services

AR/VR Worldwide Market (US\$ Millions)



Source: ABI Research

IN CONCLUSION

- Spectrum sharing has been already for some time a key enabler of ecosystem development
- The resulting ecosystem complements existing technologies, enhances consumer choice, and enables innovative business models
- These sources of value creation can contribute to GDP growth, grow producer surplus or enhance consumer benefit
- In particular, the ecosystem generated by shared spectrum represents a key contributor to addressing the digital divide, improve residential broadband service, and grow new technologies such as augmented and virtual reality

TELECOM ADVISORY SERVICES

For further information please contact:

Raul Katz, raul.katz@teleadvs.com, +1 (845) 868-1653

Telecom Advisory Services LLC
139 West 82nd Street, Suite 6D
New York, New York 12581 USA