



*Challenge us  
to take you further*

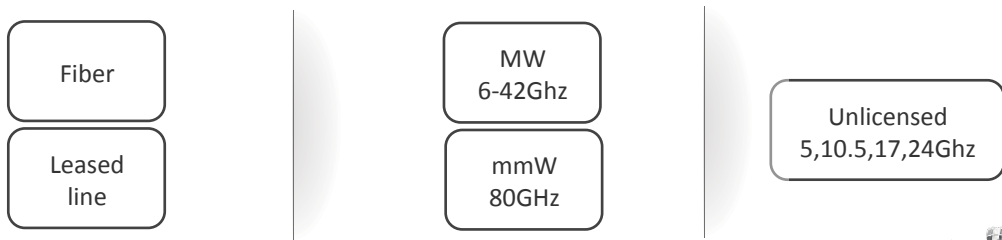
# Wireless connectivity trends and solutions for Internet Service Providers

Andrew Westerman

Vice President, Channel Sales, Europe

# The Technology Challenge

- Historically – ISP networks were built with a Fibre optic core complimented by license-exempt frequency connections (e.g. 5,10.5,17,24Ghz)
- Today – Many of the unlicensed bands are becoming congested and operationally challenging:
  - Offering limited throughput with unpredictable performance, particularly in urban areas
- A technology evolution is required to deliver future proof connectivity that is:
  - Cost effective
  - Fast to deploy
  - Capable of supporting Superfast gigabit speeds
  - Offers Carrier Class availability
- Wireless technology should be a part of this evolution
- Today's tool box of wireless technologies:



# ISP Network Applications in USA and Europe

- Business and domestic internet connectivity
- Rural Broadband connectivity
  - Extend reach / DSLAM backhaul
- Gigabit to the Home
  - Gigabit to the Apartment block
- Gigabit to the Business
- Campus connectivity
  - High capacity building interconnection
- CCTV/Video Surveillance
  - Backhaul CCTV camera traffic to control centers
- Special events
  - Festivals, Concerts
- Disaster recovery - true diversity



# Worldwide ISP Wireless Trends - USA

- ISP market is the 2<sup>ND</sup> largest Ceragon non operator market segment in the USA
  - Continual annual growth and 2015 was the largest year ever for Ceragon in this segment
- ISP market consolidation is happening:
  - Larger ISPs acquiring smaller ones
  - Google fibre recently acquired Web Pass
    - Google fibre now focusing on wireless for access and backhaul
    - 100% fibre business model proved too expensive and too slow
    - Larger ISPs very focused on using wireless for access and backhaul
    - E band – business and residential Gigabit access + High capacity links
    - 11Ghz and 80Ghz – fast growing backhaul frequencies
- Strong transition from unlicensed bands to E band happening in USA
  - Particularly in Urban/City areas
- Gigabit to the home and Gigabit to the business now becoming a reality via E band
- Wireless key in terms of:
  - Time to market
  - Low cost of deployment
  - Quality of service
  - High capacity and reliability



# Worldwide ISP Wireless Trends - Europe



- Largest Ceragon non operator market segment with continued strong annual growth
- Strong transition from unlicensed bands to E band happening in Europe
  - Particularly in Urban/City areas
  - E band market growing fast in countries with lower fees:
    - UK = 50 GBP per link per year
  - Unlicensed bands still ok in countryside/rural areas and for residential access
- Gigabit to the business now a reality in UK
  - Gigabit to the business emerging but behind USA
  - Gigabit to apartment blocks + internal cable distribution emerging
- Wireless key in terms of:
  - Time to market
  - Low cost of deployment
  - Quality of service
  - High capacity and reliability
- Key ISP Frequencies:
  - UK: 13,18,23,32,38,60,80Ghz
  - Germany: 18,23,24,38,60,80Ghz
  - Czech Republic: 11,18,26,38,80Ghz
- MIMO technology available but in general not used in ISP segment

# What are the connectivity choices for ISPs?



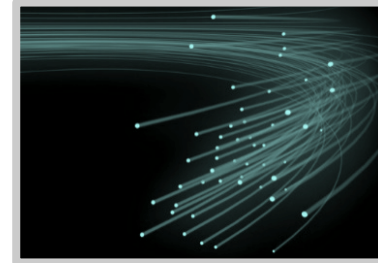
# Optical Fiber

## Pros

- “Infinite” speed
- Highly reliable

## Cons

- Limited availability - its not always where you need it
- Prohibitively expensive to retrospectively to dig and install: \$100-200/m+
- Expensive to lease connectivity from incumbent telco operators
  - E.g. UK = Gig E circuit £10k per annum +
  - Often unknown/unexpected High excess construction charges
- Long lead time times for new deployments
  - Often many months for new fibre to be dug or leased line connections to be connected
- Fibre is the ultimate solution but if its not available what are the alternatives?



## Criteria for Fiber alternatives

- ✓ Cost effective equipment cost (CAPEX)
- ✓ Minimal installation lead time and cost
- ✓ Cost effective annual running costs (OPEX)
- ✓ Mature and reliable technology
- ✓ Capacity scalable to gigabit rates



**WIRELESS TICKS  
ALL THE BOXES**



# The Wireless Toolbox



# Wireless backhaul frequency bands

	Frequency	Capacity	Advantages	Disadvantages
LOS/Non LOS	Sub-6,10.5, 17, 24GHz	<200Mbps	<ul style="list-style-type: none"> <li>• Low Cost equipment</li> <li>• Long Distances possible</li> <li>• Weather Resillient</li> <li>• Licence free</li> </ul>	<ul style="list-style-type: none"> <li>• Congested spectrum</li> <li>• High interference inner cities (5Ghz)</li> <li>• Low Capacity (5Ghz)</li> </ul>
Microwave	6-42GHz	Up to 4 Gbit	<ul style="list-style-type: none"> <li>• Long distance possible at low frequencies</li> <li>• Low equipment cost</li> <li>• Mature technology</li> </ul>	<ul style="list-style-type: none"> <li>• Congested spectrum</li> <li>• Expensive annual license fee</li> </ul>
E-band	71-86GHz	Up to 2.5 Gbit	<ul style="list-style-type: none"> <li>• Up to 2.5Gbit Capacity</li> <li>• Zero license cost</li> <li>• Very uncongested spectrum</li> <li>• Narrow beams allow highly dense networks to be built</li> </ul>	<ul style="list-style-type: none"> <li>• Distance &lt; 5 Km</li> </ul>



# Unlicensed Bands (5,10.5,17,24Ghz)

- Low equipment cost
  - Point to point and point to Multi point options
    - Residential ISP connectivity
    - Per camera CCTV connectivity
- Unlicensed bands
  - Zero licence cost
- In urban areas a high capacity/high availability link can be challenging
- Many ISPs looking to transition to the next step
  - E band is becoming the next step



# Licensed Microwave (6-42Ghz)

- Pros
  - Readily available
  - Inexpensive equipment
  - Gigabit + capacities possible
  - Long distances possible
- Quick and simple installation
  - All outdoor versions mean no indoor space needed
  - SW Wizards enable low cost / lower skilled installers
- Mature and reliable technology
- Deployed massively on a global basis



## E-Band (71 -86Ghz)



- Uncongested – newly opened band, More than 10Ghz of spectrum available
- Very wide channels  $\Rightarrow$  Multi Gigabit throughputs possible
  - Ceragon IP-20E offers Channel sizes from 62.5Mhz up to 500Mhz
    - 1Gbit in 250 Mhz channel
    - 2.5 Gbit in 500 Mhz channel
- Pencil-beams (beam-width  $< 1^\circ$ ):
  - Minimum interference
  - Secure (hard to detect and intercept)
  - Allows very high levels of co - location
- All outdoor
  - Lower cost and simplified I&C
  - Low power consumption – POE powered
- Band of massive capacity
  - Up to 2.5 Gbit today
  - 10Gbit in the future
- Will be the big band for the future of ISP networks:
  - Offers high capacity, high density network possibilities at Gigabit plus capacities
  - Zero license cost

# FibeAir IP-20 platform

A SINGLE platform under a single CERA-OSS serving

ALL your wireless backhaul needs



V-Band  
(future)

E-Band

6 - 42GHz

4 - 11GHz

Public Safety

Wireless ISP's

Utilities

Oil & Gas



# Summary

- Hybrid Fibre/Wireless ISP Networks can now be built to offer high capacity and high reliability services
  - E band is emerging as the default wireless band for many ISPs globally
- Fibre enabled points of presence with wireless extensions offers a great model for a high capacity, high availability, low cost network
- Use Ceragon's Wireless IP20 portfolio as your wireless toolbox to build hybrid fibre/wireless networks:
  - 6-42Ghz and E Band options
  - Multi Gigabit over-the-air capacity
  - Carrier-grade performance
  - Fast and easy deployment
  - Quick ROI



Increase your  
operational efficiency



Ensure your  
peace of mind



Enhance your  
customers' quality  
of experience



*Challenge us  
to take you further*