High Capacity RoF Links at 75-300 GHz

Lucas C. P. Cavalcante,

J. J. Vegas Olmos, and Idelfonso T. Monroy

DTU Fotonik

Technical University of Denmark (DTU), 2800 Kgs. Lyngby, Denmark

DTU Fotonik
Department of Photonics Engineering

METRO-ACCESS
& SHORT RANGE COMMUNICATIONS

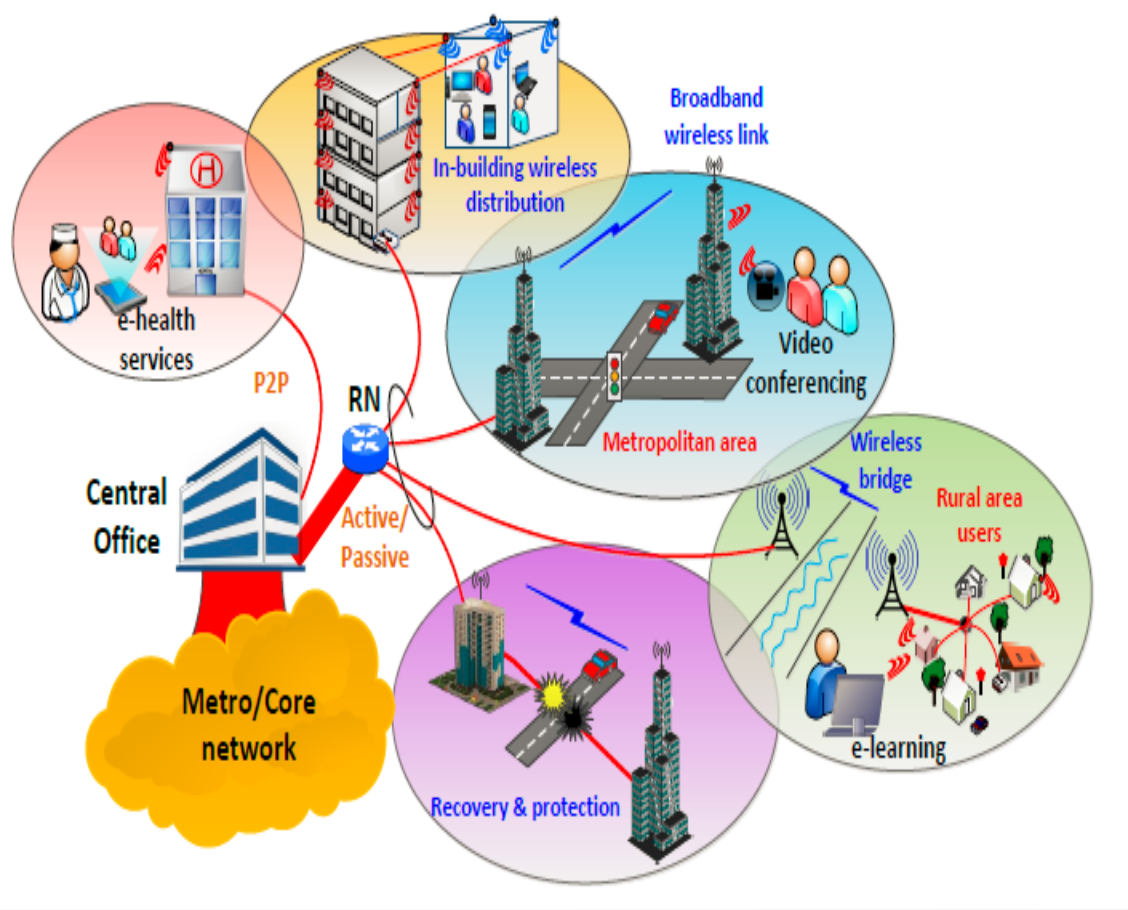
Agenda

1. The importance of building high-capacity RoF systems at the mm-wave range
2. The challenges imposed by the wireless link
3. Directive antenna as the enabling solution
4. A multidimensional-view framework for the design of x100 Gbps systems at mm-wave frequencies
5. Final considerations & next steps of the research

RoF Systems

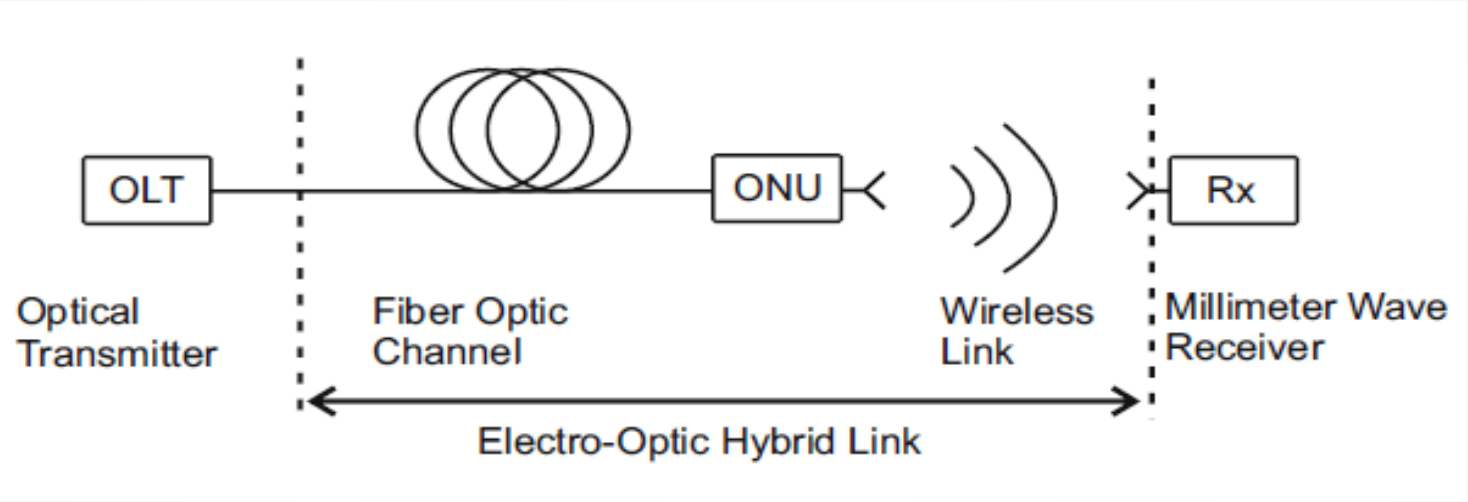
Integration is a promissing solution

- Minimizing deployment cost
- Shortening upgrading period
- Increasing mobility
- Flexibility of broadband services access.



RoF Systems

Towards seamless convergence



- Radio over Fiber (RoF) represents a hybrid concept
  - Fiber
    - high bandwidth and low losses
    - continuously increasing bandwidth
  - Wireless
    - flexibility and mobility
    - lower capacity
    - operation in higher frequencies

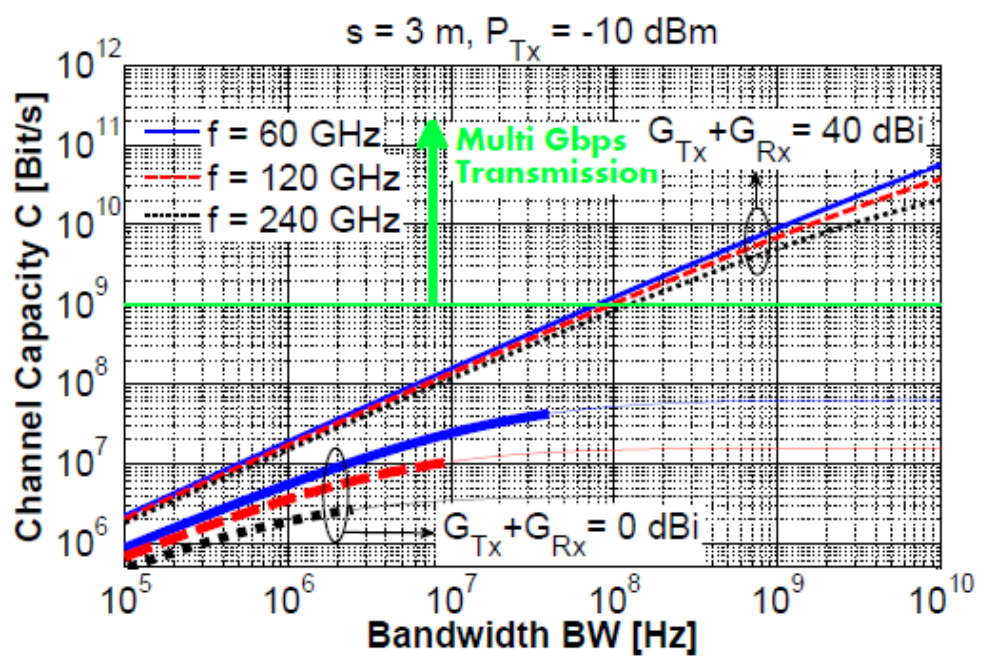
Wireless links at mm-wave freq.

Channel capacity in drastic attenuation

$$C = BW.ld|1 + SNR|$$

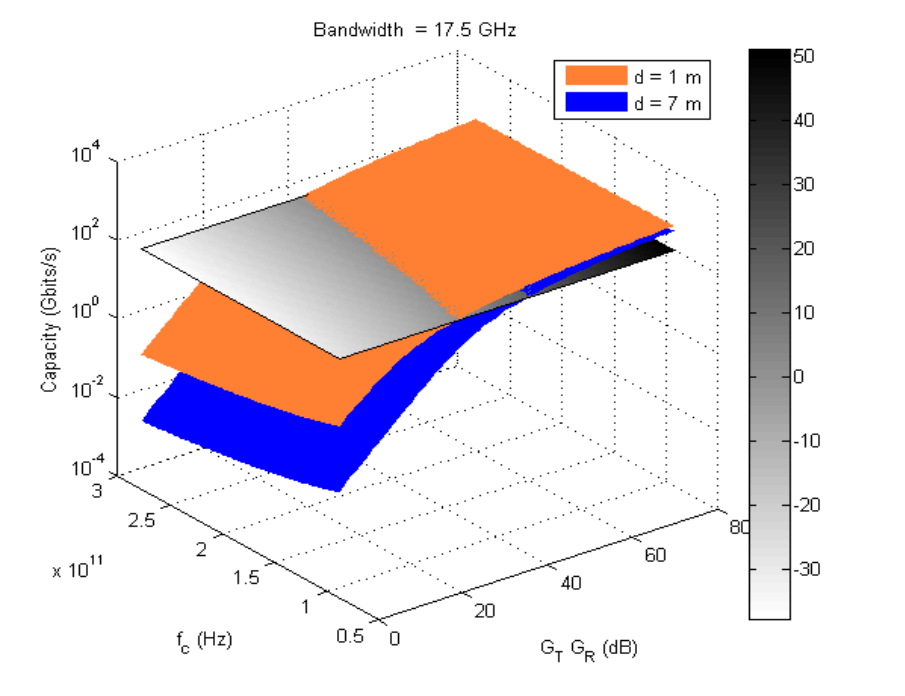
$$SNR = P_T + G_T + G_R - PL - IL - (N_0 + 10log_{10}B + NF)$$

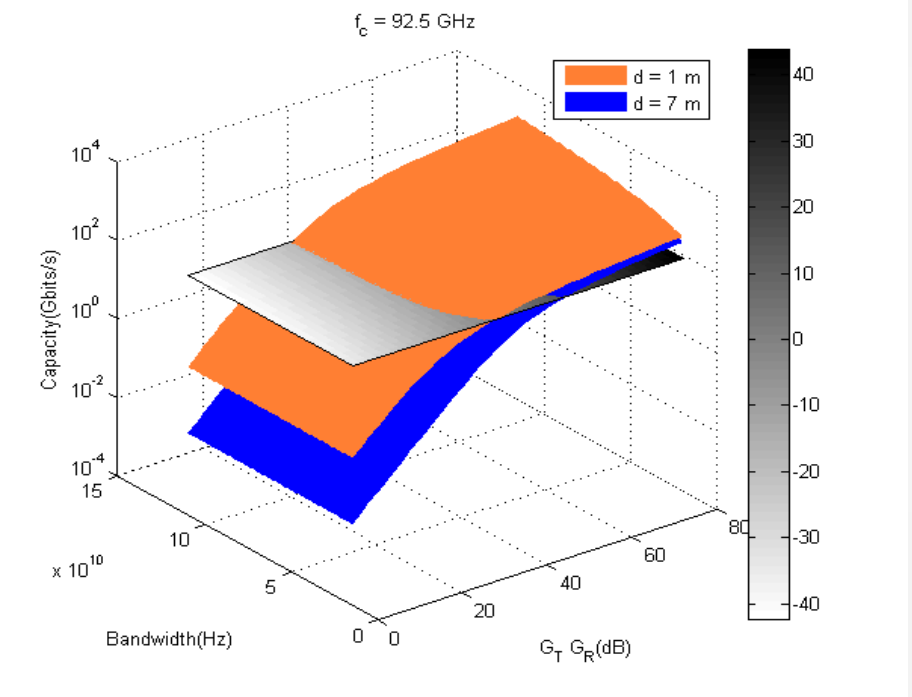
$$PL = 20\log_{10}\frac{4\pi f d_0}{c} + 10n\log_{10}\frac{d}{d_0}$$



Wireless links at mm-wave freq.

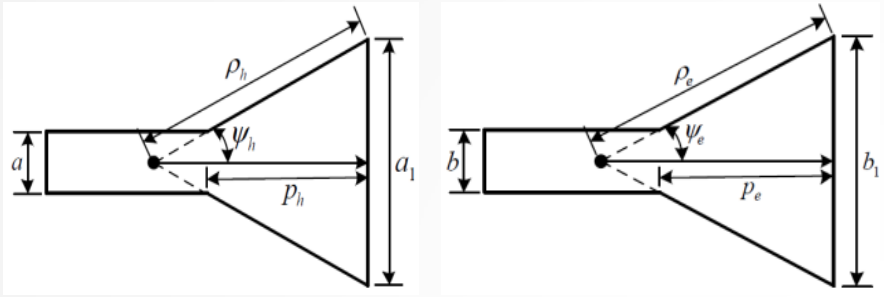
A multidimensional-view framework for the design of x100 Gbps systems at mm-wave frequencies

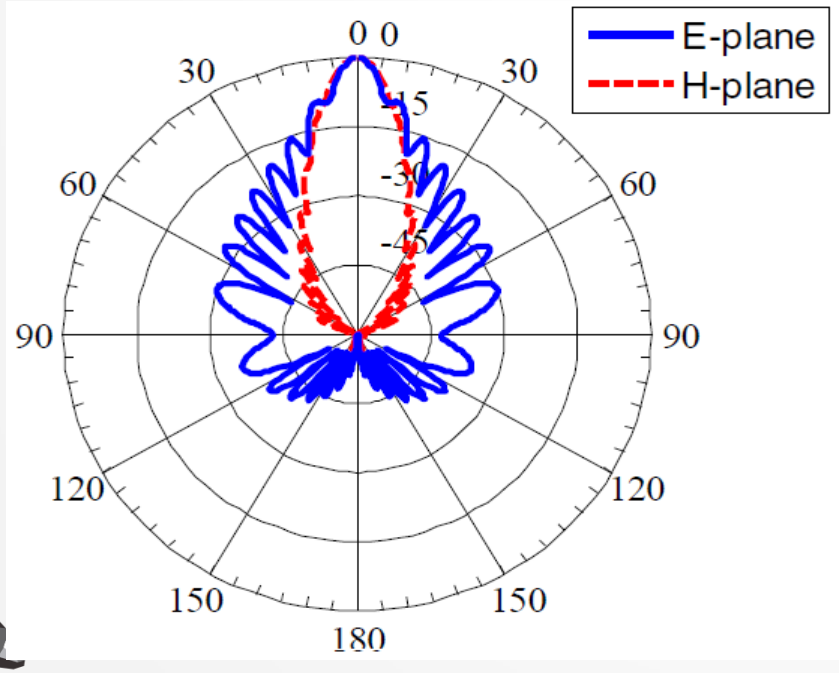




Directive antenna as a solution

Horn antenna design: Narrow beam, wide frequency range & bandwidth

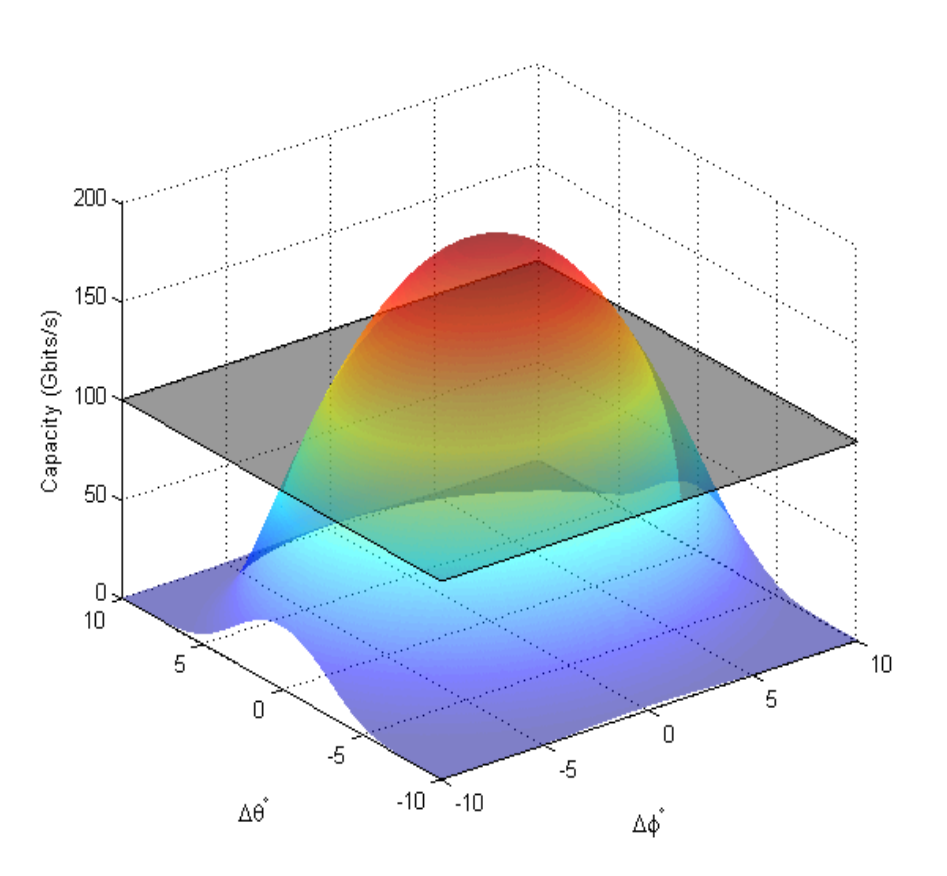




Parameters	Value
a_1 b_1	0.97 cm 0.79 cm
a b	0.0863 cm 0.0431 cm
ρ_e ρ_h	3.12 cm 3.24 cm
ψ_e ψ_h	7.27° 8.74°
p_e p_h	2.93 cm 2.93 cm

Directive antenna as a solution

Considering the impact of steering misaligment



$$G(\emptyset,\theta) = G_0 . e^{-\left(\frac{\emptyset,\emptyset_0}{\sigma_{g,\emptyset}}\right)^2} . e^{-\left(\frac{\theta,\theta_0}{\sigma_{g,\theta}}\right)^2}$$

- d = 1 m
- pt = 0 dBm
- fc = 282.5 GHz
- BW = 17.5 GHz

Final considerations

Conclusions and future work

- Directive antennas as the enabling path towards
  - the use of Higher frequencies
  - while complying to EIRP restrictions
- We provide guidelines for enabling Radio-over-Fiber (RoF) systems over mm-wave frequencies range
- Future work should consider experimental measurements through several practical scenarios
  - Indoor
    - Home/Office
  - Outdoor
    - Street kiosk
    - Bus stop
    - Train/metro stations

THANK YOU

You can find us…

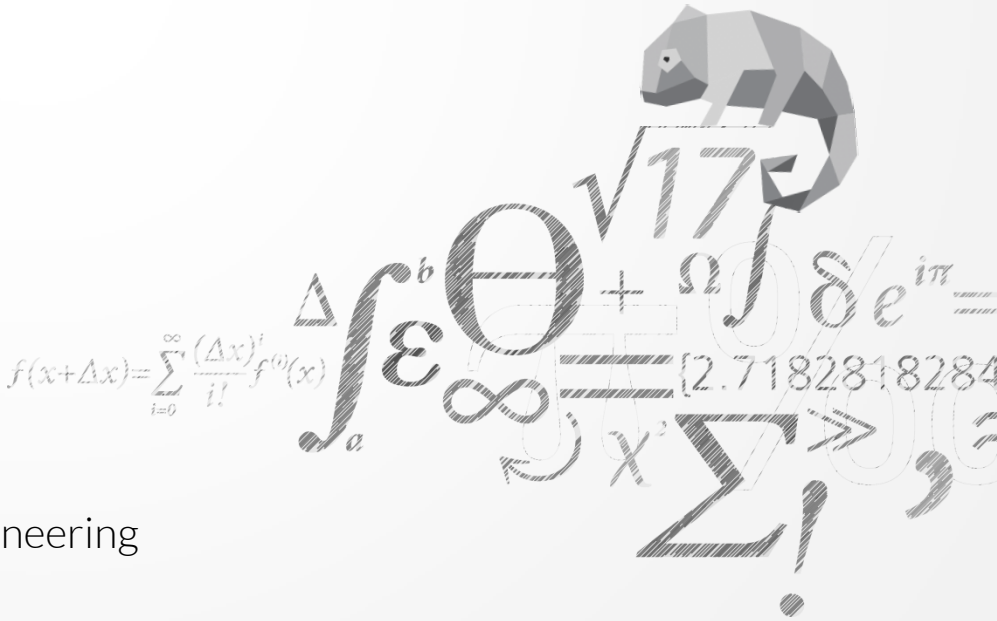
Metro-Access & Short Range Systems

www.metroaccess.dk

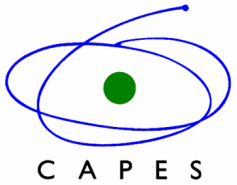
MetroAccess DTU Fotonik

MetroAccessGroup

Metro Access Photonics Engineering



Lucas C. P. Cavalcante acknowledges CAPES for supporting his research through the program “Science without Borders”.



J.J Vegas Olmos acknowledges the support of Marie Curie FENDOI and IPHOBAC-NG projects