

Optical technologies in future personal networks

Citation for published version (APA):

Huiszoon, B., Augustin, L. M., Waardt, de, H., Fledderus, E., Khoe, G. D., Smit, M. K., & Koonen, A. M. J. (2007). Optical technologies in future personal networks. In *Photonics 2007* (pp. 1-1).

Document status and date:

Published: 01/01/2007

Document Version:

Publisher's PDF, also known as Version of Record (includes final page, issue and volume numbers)

Please check the document version of this publication:

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

www.tue.nl/taverne

Take down policy

If you believe that this document breaches copyright please contact us at:

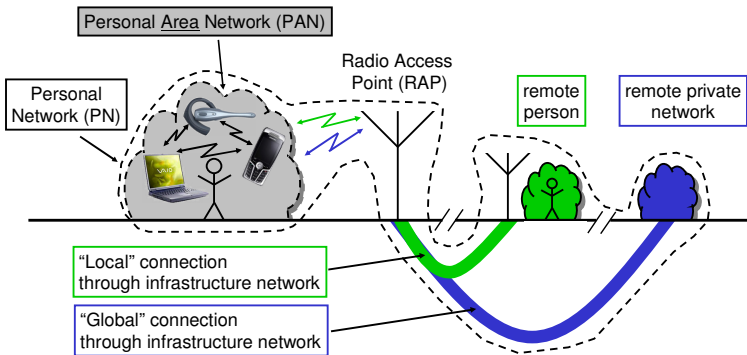
openaccess@tue.nl

providing details and we will investigate your claim.

Optical Technologies in Future Personal Networks

B. Huiszoon, L.M. Augustin, H. de Waardt, E.R. Fledderus, G.D. Khoe, M.K. Smit and A.M.J. Koonen

Future Personal Networking

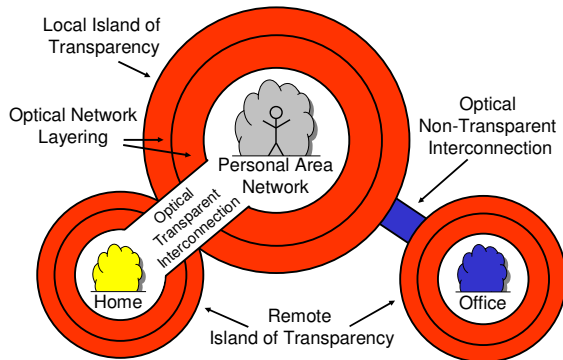


A Personal Network [1] requires a transparent and densely distributed infrastructure network to support

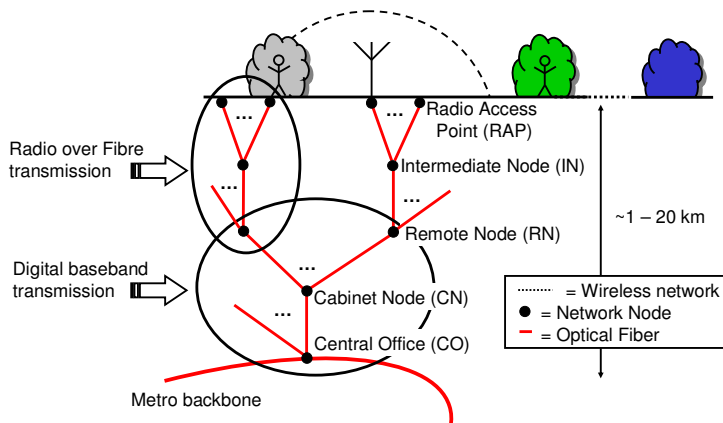
- High user mobility
- Heterogeneity of wireless networks and services
- High quality of service

Islands of Transparency in Optical Networks

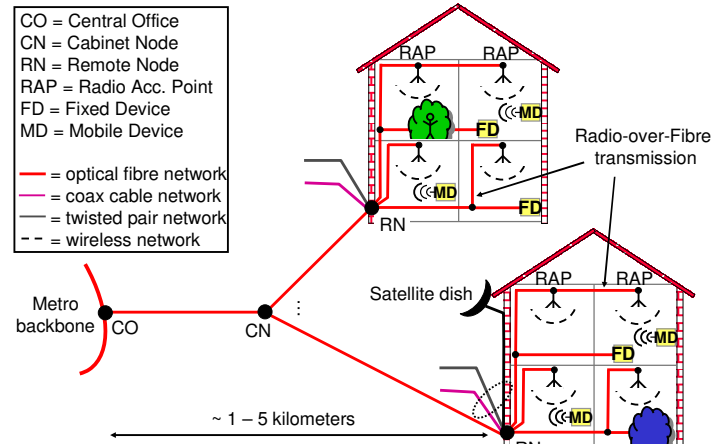
- All-optical end-to-end connection has limited reach thus "Islands of Transparency" appear in the network
- An Island of Transparency has to be introduced in the Access domain → Fiber-to-the-X (FTTX)
- For Personal Networks, the X in FTTX stands for the PAN of a user → Fiber-to-the-PAN (FTTPAN) [2]



Fiber-To-The-PAN: Architecture

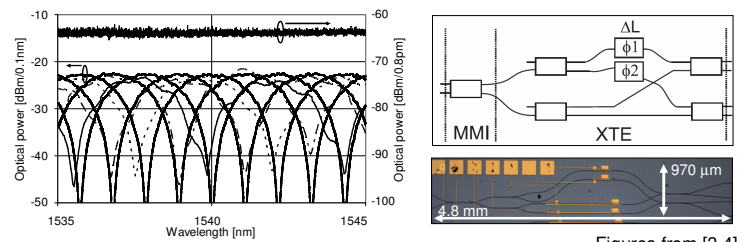


Fiber-To-The-PAN: Urban Indoor Scenario



Spectral Amplitude Encoded Optical CDMA

- All-optical CDMA has a powerful and natural fit on FTTPAN
- Four clear advantages of Optical CDMA (OCDMA):
 - **Cost-effective** → frequency band sharing
 - **Asynchronous** → no central clock required
 - **Soft capacity degradation** → no hard user limit
 - **Inherent security** → information spread over large frequency band
- Spectral Amplitude Encoded OCDMA (SAE OCDMA) with integrated Mach-Zehnder based encoder/decoders (E/Ds):
 - **Integrateable** → cost-effective node designs
 - **Reciprocal** → single design for transmitter and receiver
 - **Periodic** → fits a Wavelength Division Multiplexing (WDM) scheme
 - **Spectral Shift Keying (SSK)** → receiver bandwidth at data rate
- Patented tree E/D for increased cost-efficiency at Central Office



Conclusion and Outlook

- Optical fiber is expected to gradually replace the existing non-fiber based fixed access networks.
- We propose an FTTPAN architecture employing SAE OCDMA to transparently and cost-efficiently close the gap between mobile end-user and higher layer optical networks.

Acknowledgements

This research is carried out in the COBRA SWOOSHING project. The Netherlands Organization for Scientific Research (NWO) is gratefully acknowledged for funding through the NRC Photonics grant.

References

- [1] I.G. Niemegeers and S.M. Heemstra de Groot, "Research Issues in Ad-Hoc Distributed Personal Networking", *Wireless and Personal Comm.*, Vol 26, no. 2-3, 2003, pp. 149 – 167
- [2] Huiszoon, B., Khoe, G.D., Koonen, A.M.J., "Fiber-to-the-PAN: Towards Optical in Personal Networks", in *Proc. 2004 Symposium of the IEEE LEOS Benelux Chapter*, pp. 5 – 8, Ghent.
- [3] Huiszoon, B., NL patent application 1031833, May 17th 2006.
- [4] Huiszoon, B.; Augustin, L.M.; Hanfoug, R.; Bakker, L.; Sander-Jochem, M.J.H.; Fledderus, E.R.; Khoe, G.D.; Tol, J.J.G.M. v.d.; Waardt, H. de; Smit, M.K.; Koonen, A.M.J., "Integrated Parallel Spectral OCDMA En/Decoder", *IEEE Photonics Letters*, vol. 19, no. 7, pp. 528 – 530, April 2007.