



# *Is the PHY layer dead?*

## **Some thoughts..**

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# A few pointers

1. The PHY layer **should not be only associated with a “single link.”** While the MIMO concept has boosted significantly the rate potential of individual links, most promising work nowadays comes from the consideration of so-called “system-level” configurations, which consist of several links in a system context (see Broadcast Channel, Network MIMO, etc.). There is still lots of work to be done in the PHY layer for such configurations.
2. **Cross-layer:** some cross layer techniques (such as combining scheduling and beamforming as per the Opportunistic Beamforming Concept) are very useful, as they show e.g. that a good system-level MISO design is comparable to a corresponding MIMO scenario. So cross-layer techniques should not be ignored. Delay-sensitive applications further strengthen this need.



## A few pointers (2)

3. A number of **emerging wireless communication paradigms and architectures** (such as relay networks and cognitive radios) still lack quite a bit of fundamental understanding in terms of their capacity potential – still lots of work to be done there (recall that computing the capacity of the simplest relay n/w of a single source, relay and destination remains an unsolved problem!)
4. **Wireless vs. wireline**: whereas in the fixed internet, work may be mostly focused on higher protocol layers, due the reliability of the fixed links, wireless will always be impaired by the propagation environment and its mobility – the physical layer can hence not be ignored. [Several of us still get no mobile voice on a daily basis in a number of locations.]



## A few pointers (3)

5. **Device-level work:** there is still a lot to be learned in my opinion in the direction of packing closely many antennas in order to create more spatial degrees of freedom and allow a higher degree of miniaturization, as required e.g. in sensor networks (recent advanced in parasitic arrays show some promise in this direction)

In the end.. *All other layers are sitting on top of the PHY layer*, which remains particularly vulnerable in wireless comms due to the nasty propagation environment. If you kill it, nothing on top can save you..



**Thank you!**