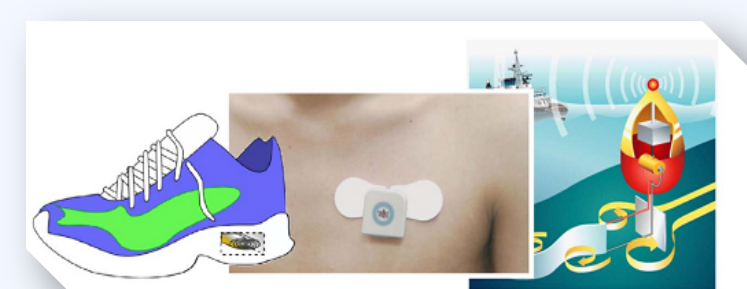


Energy Cooperation in Energy Harvesting Wireless Communications

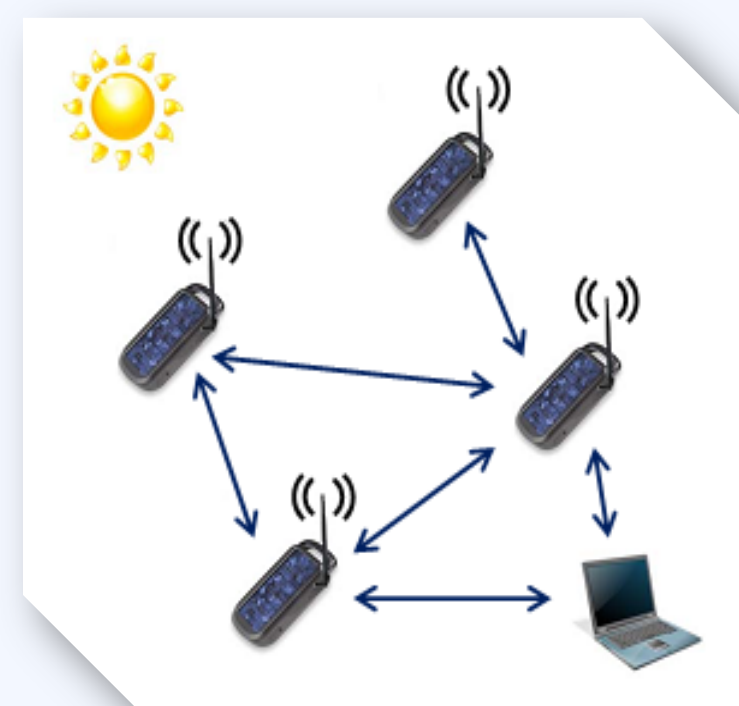
Berk Gurakan and Sennur Ulukus

Energy Harvesting



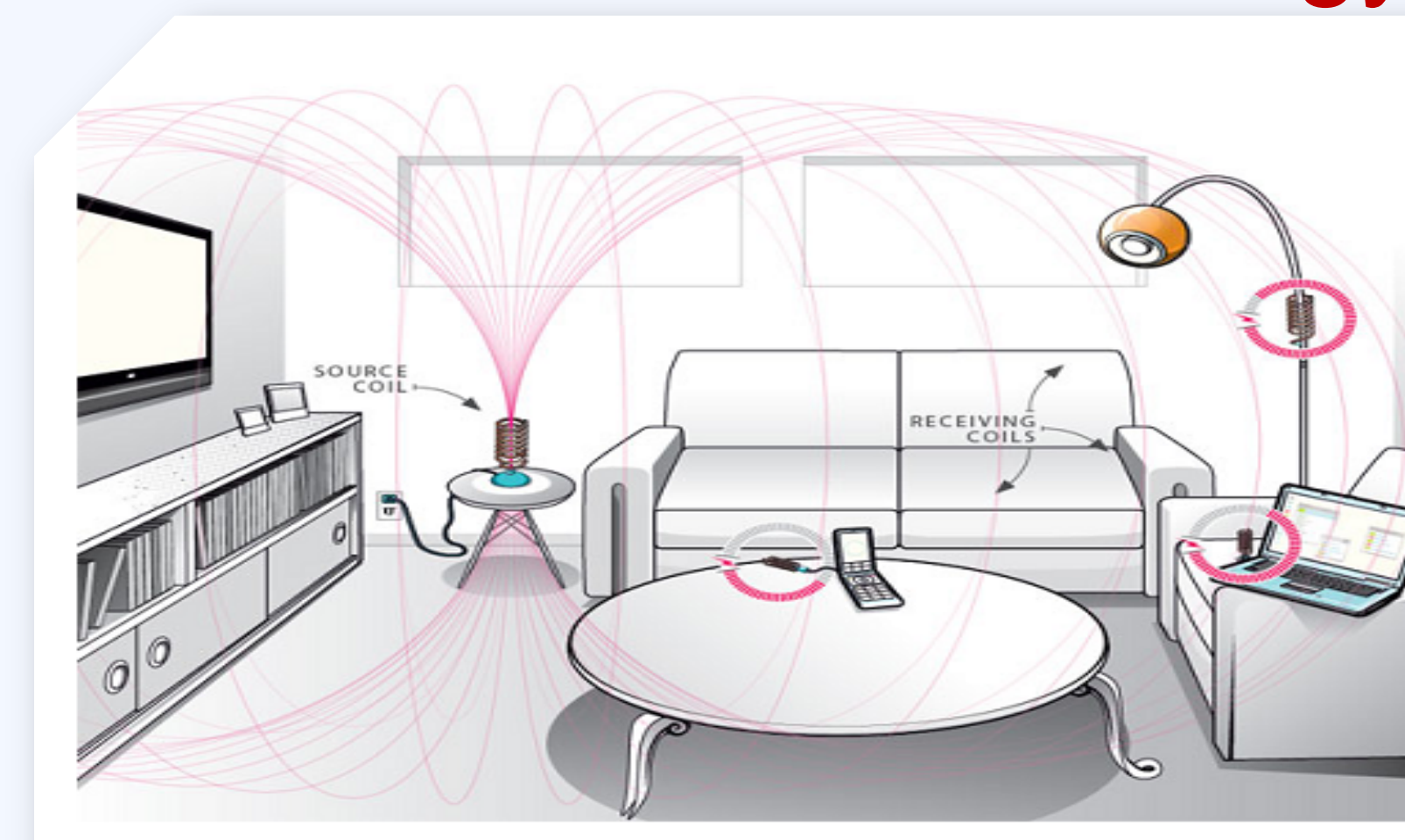
Extended network lifetime

Green, self sufficient nodes

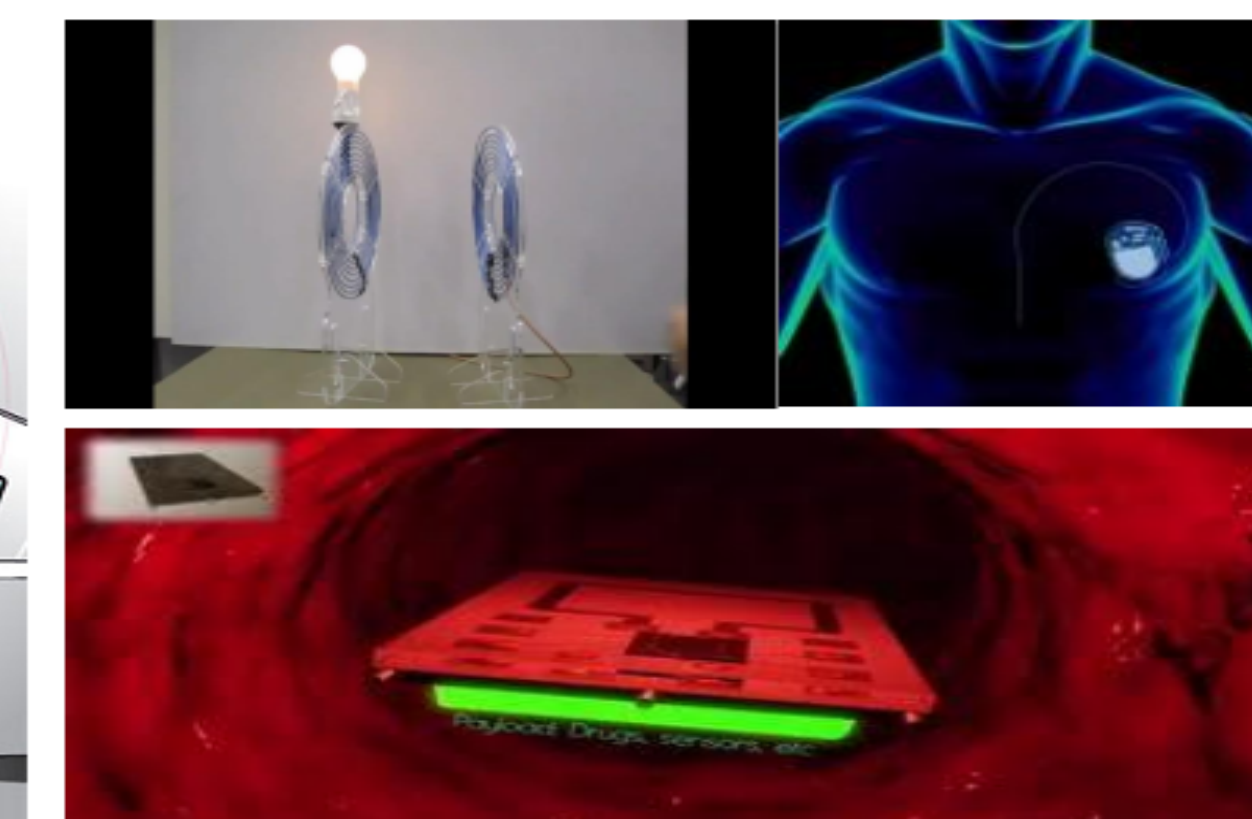


Wireless networks with rechargeable, energy harvesting nodes

Wireless Energy Transfer



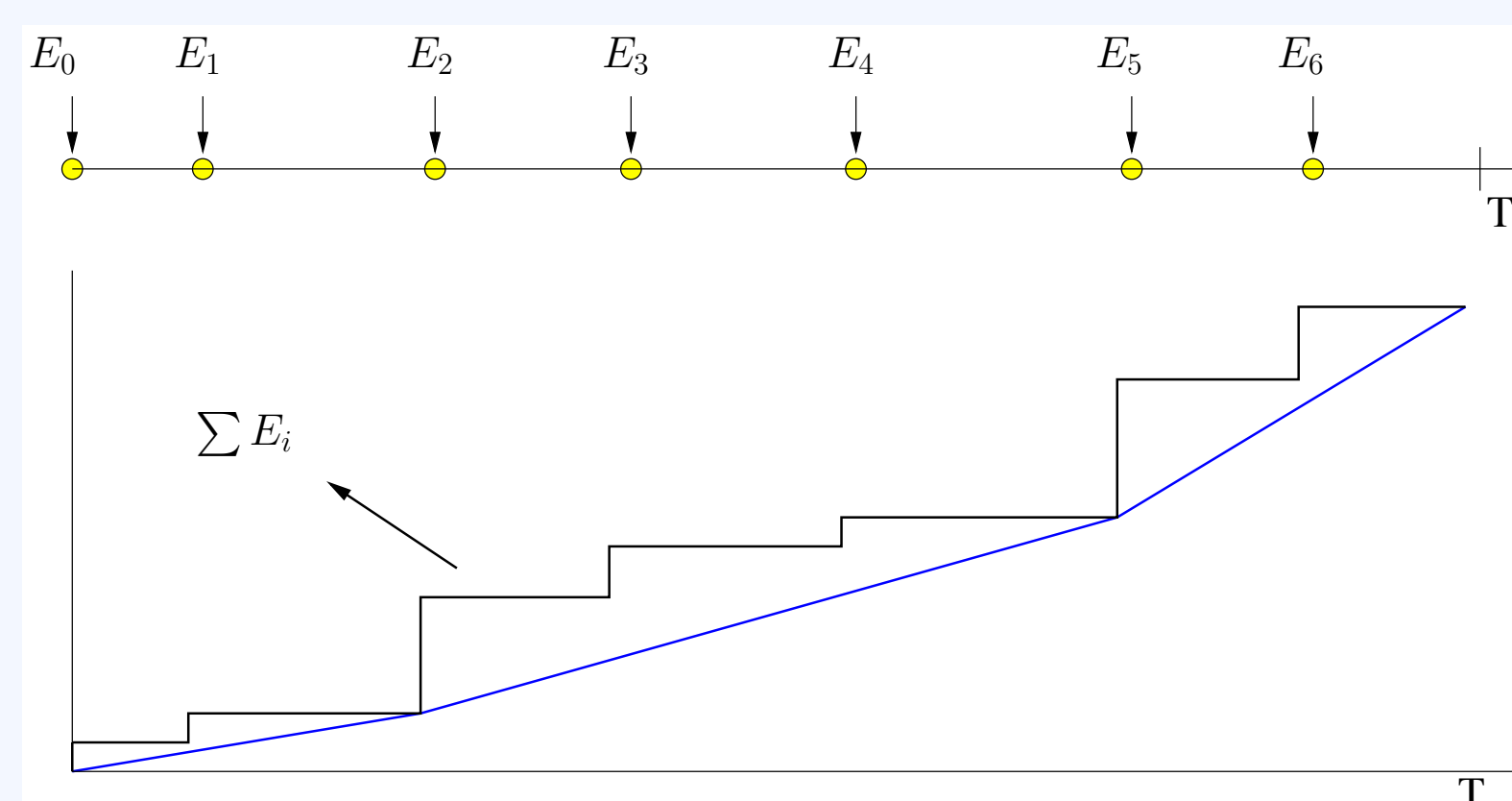
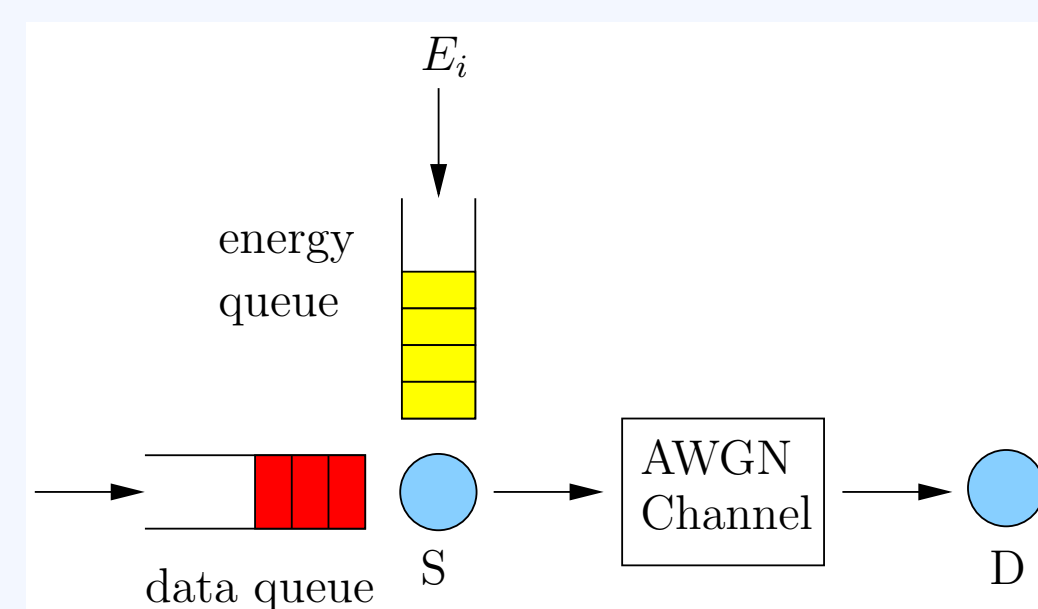
Ability to wirelessly recharge nodes by inductive coupling



Helps exploit new dimensions in energy efficient wireless network design.

Single User Throughput Maximization

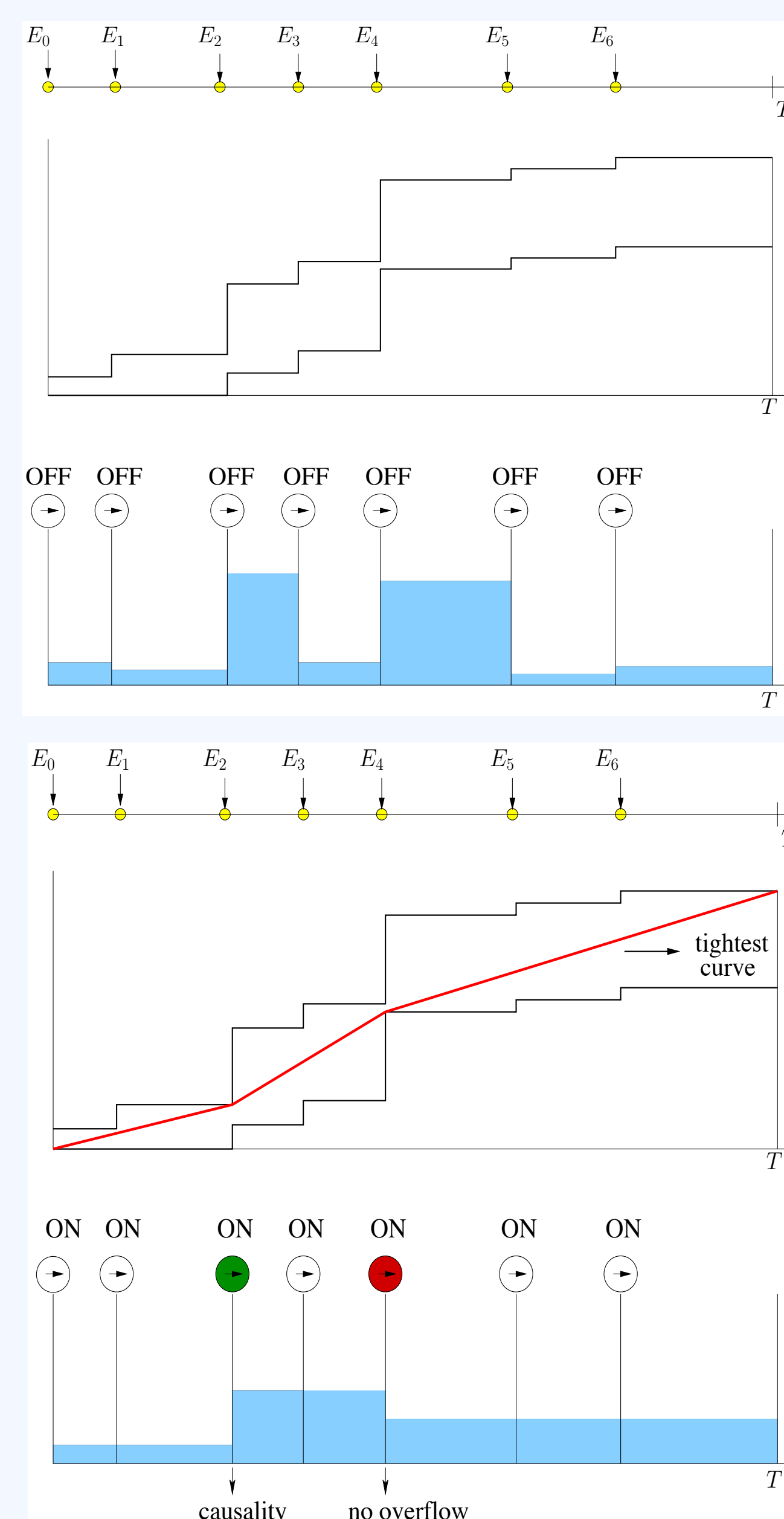
[Yang and Ulukus, 2010]



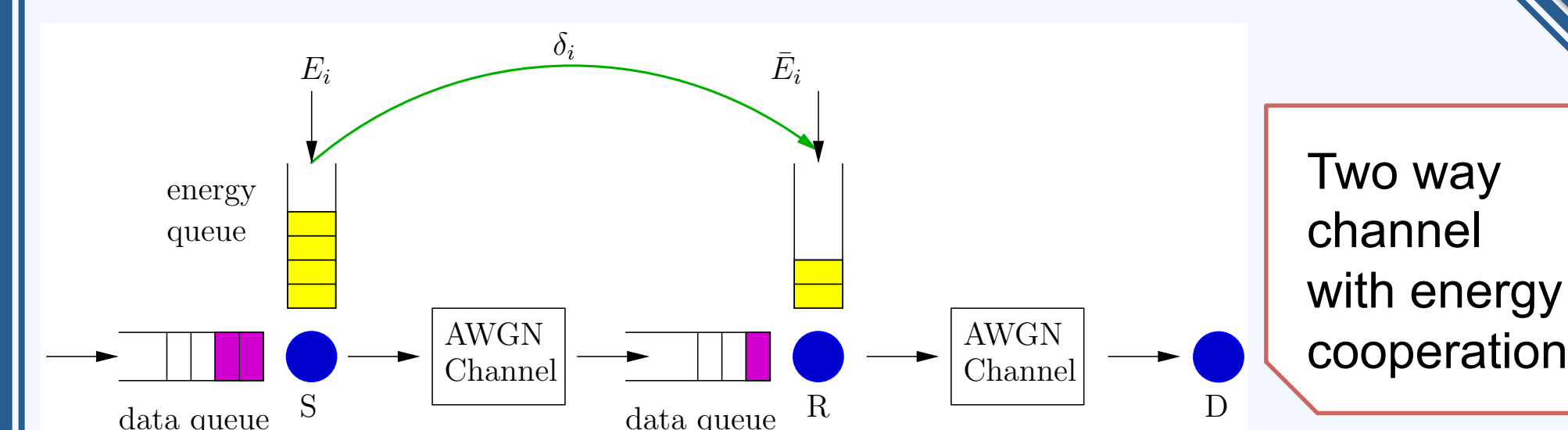
Tightest curve under the cumulative energy staircase

Directional Water Filling

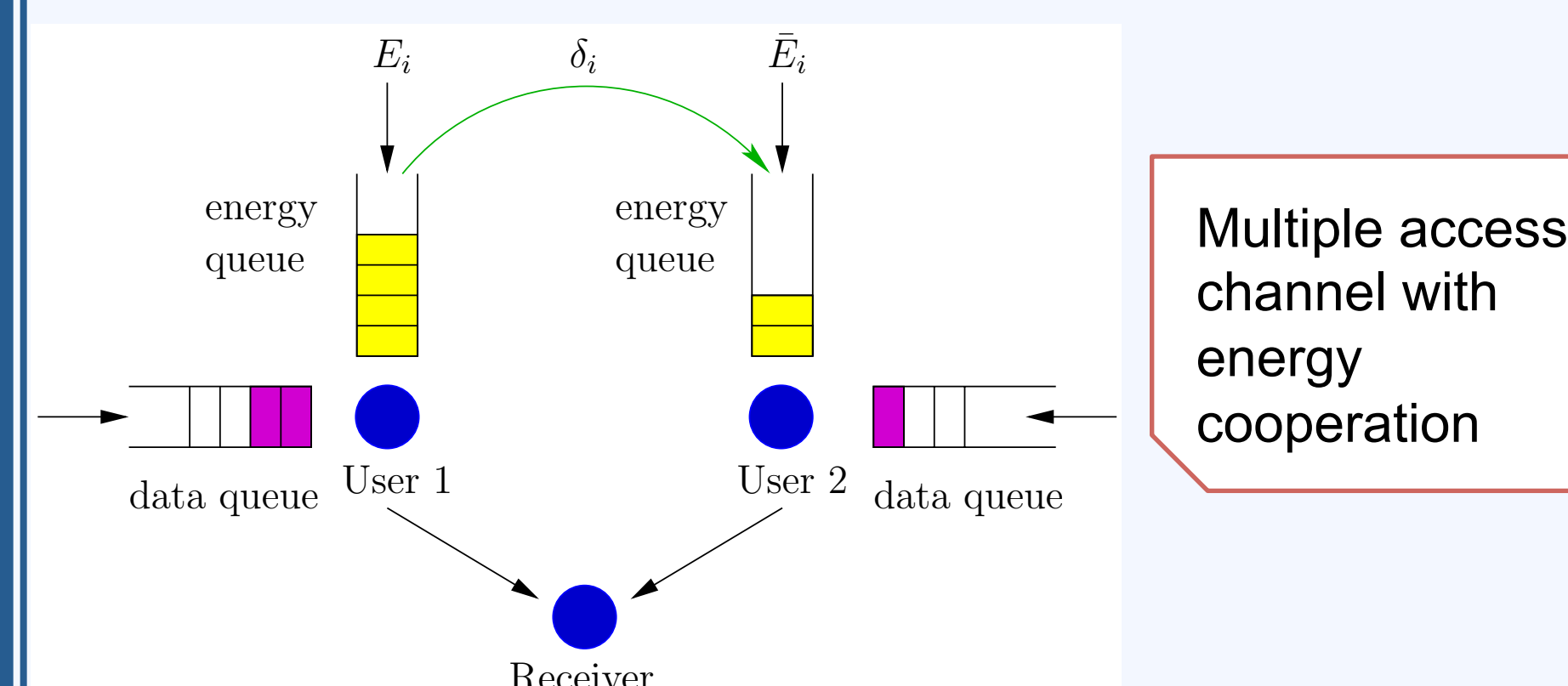
[Ozel, Ulukus et. al., 2011]



Different Channel Models

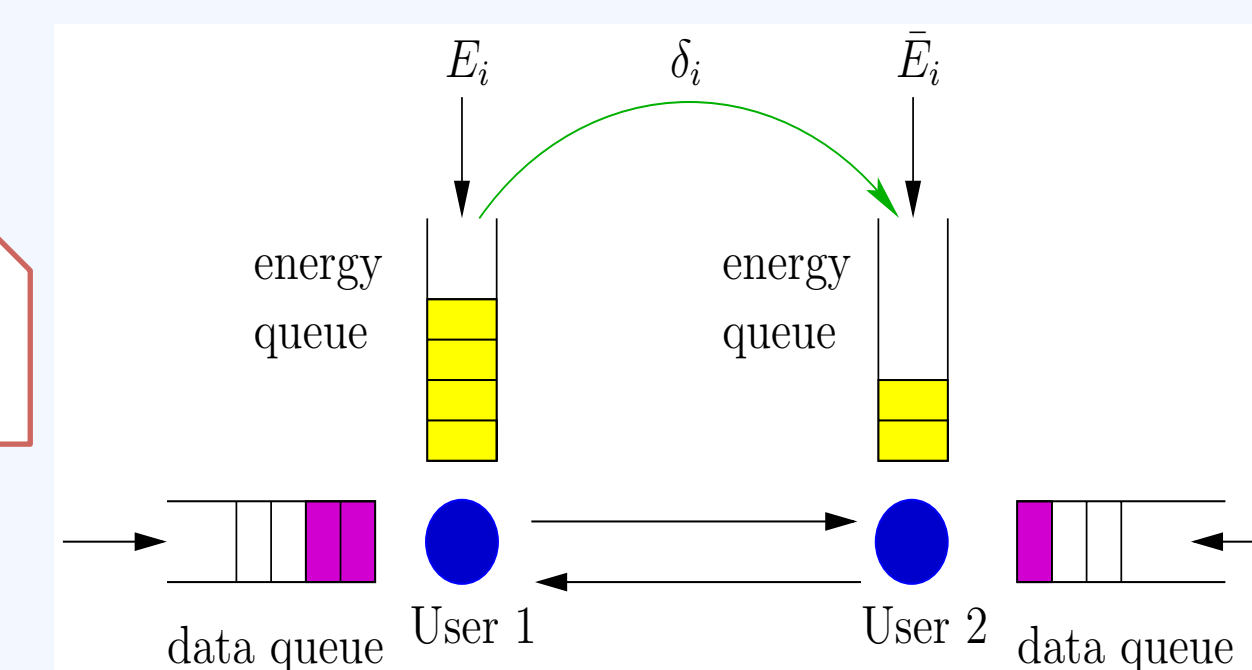


Two way channel with energy cooperation

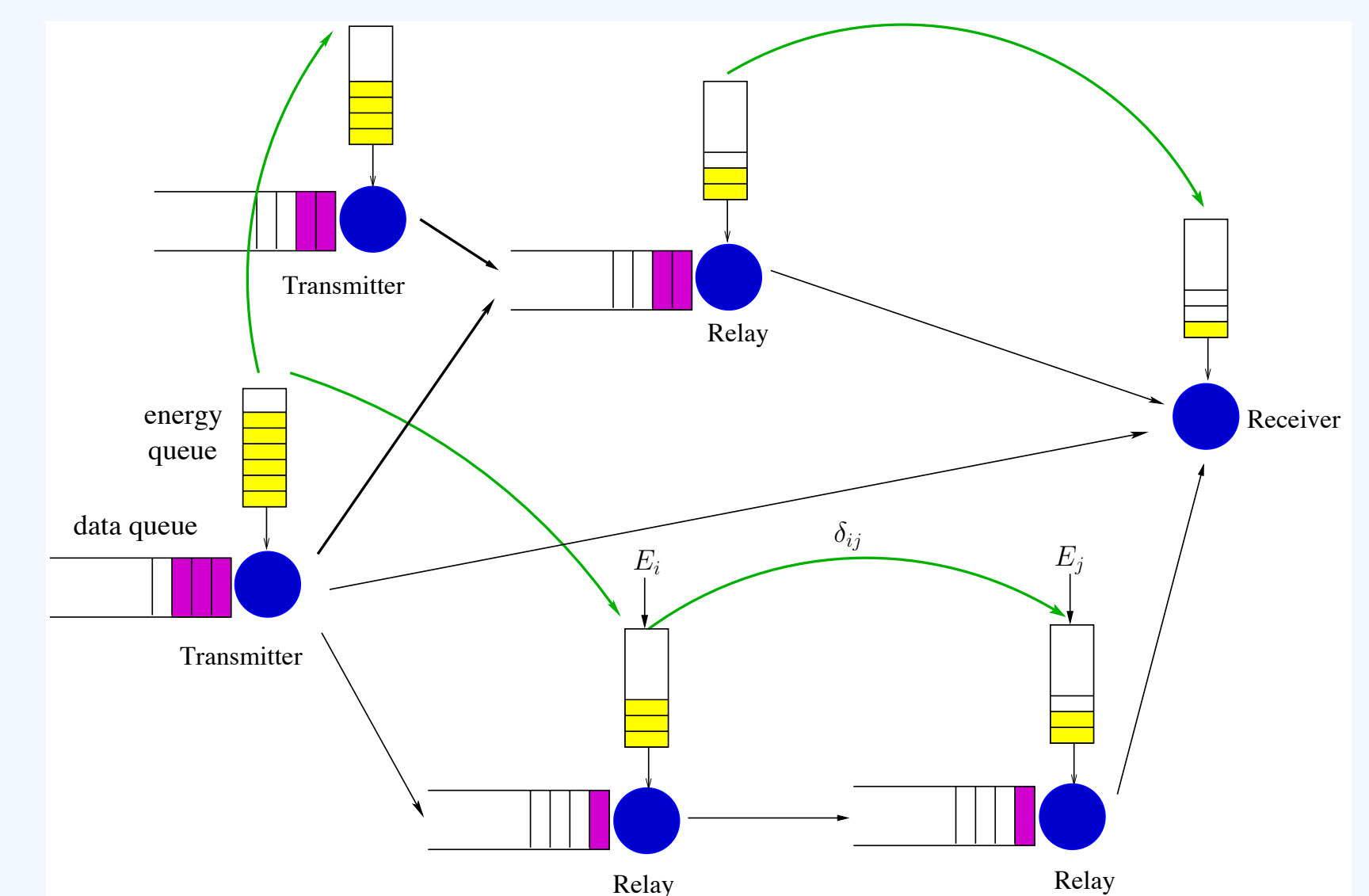


Multiple access channel with energy cooperation

Two hop channel with energy cooperation



Multi-user Energy Harvesting Systems with Energy Transfer



Delay Minimization with Energy Cooperation

