# Journal Watch

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B.Balaprasad

SPC Lab, IISc

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**Policy Optimization for Content Push via Energy Harvesting Small Cells in Heterogeneous Networks**

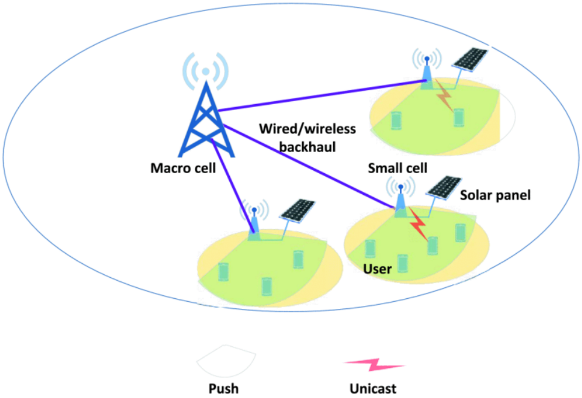
*(Jie Gong, Sheng Zhou, Zhenyu Zhou, Zhisheng Niu)*

- Contributions
  - With finite battery capacity, Problem is formulated as MDP
  - Two threshold-based policies are proposed
    - Push-Only Threshold-Based Policy
    - Energy-Efficient Threshold-Based Policy
  - Proposed policies are compared with greedy optimal threshold-based policy and the Dynamic programming policy

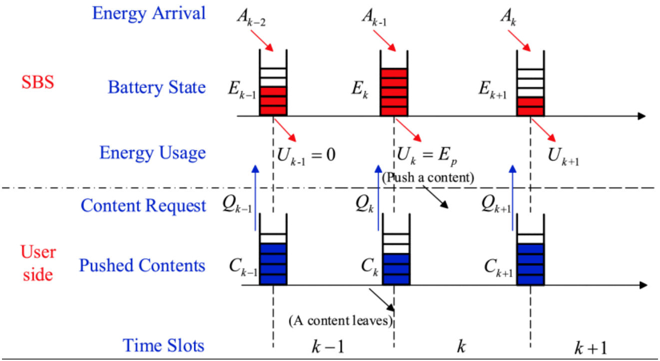
# System Model

- Content request is assumed to follow the Bernoulli distribution
- Each content is transmitted in one time slot with fixed target average data rate $r_0$,

$$r_0 = \mathbb{E}_h \left[ W \log_2 \left( 1 + \frac{P_t |h|^2 \beta d^{-\alpha}}{\sigma^2 + P_I} \right) \right], \quad (1)$$



# Timeline of the slotted system



# Problem Formulation

- Optimizing harvested energy to minimize the ratio of content requests blocked by the SBS (blocking probability)

$$\underset{u_1,u_2,\cdots}{\text{minimize}} \lim_{K\to+\infty} \frac{\bar{K}}{K}, \tag{2}$$

  $\bar{K}$ is the number of blocked requests, K is the total number slots, and the optimization variables are the SBSs actions $\{u_1, u_2, ...\}$

- Push-Only Threshold-Based Policy
  More contents are pushed to the user side, the fewer the unicast requests are triggered.

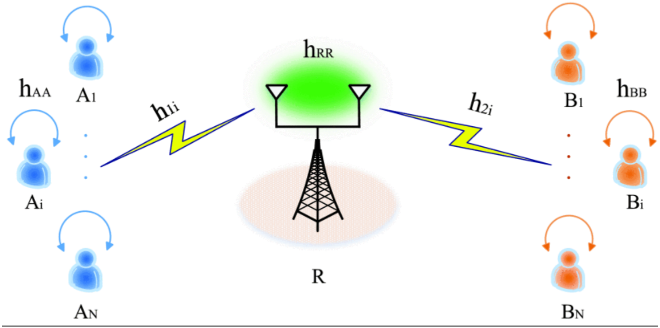
- Energy-Efficient Threshold-Based Policy
  There is a tradeoff between the energy consumed for content push and the energy saved by the reduction of duplicated unicasts

## Multi-User Scheduling of the Full-Duplex Enabled Two-Way Relay Systems

*Cheng Li; Bin Xia; Shihai Shao; Zhiyong Chen; Youxi Tang*

- **Contributions**
  According to the availability of the CSI and SSI,
  - When the full CSI is available at the relay node, the Max-Min scheduling scheme is proposed.
  - When the full SSI is available at the relay node, the Optimal scheduling scheme is proposed.
- Exact closed-form outage probability expressions corresponding to different schemes.

# System model:



- The received signal at the relay after self interference cancellation,

$$Y_R = h_{1i}X_{A_i} + h_{2i}X_{B_i} + I_R + n_R, \tag{3}$$

$X_{A_i}$,$X_{B_i}$ denotes the transmit signal power, $I_R$ is the residual self interference.

- The received signals at the user nodes $X_{A_i}$,$X_{B_i}$ are

$$Y_{A_i} = h_{1i}X_R + I_{Ai} + n_{A_i}, \tag{4}$$

$$Y_{B_i} = h_{2i}X_R + I_{Bi} + n_{B_i} \tag{5}$$

- Outage event: The achievable rate of any involved link cannot afford the minimum required rate r,

$$\mathcal{P}_i \triangleq \mathbb{E}\{Pr\{C_i < r\}\} \tag{6}$$

- Random scheduling: Non-CSI case, for this case Random scheduling scheme is used.
- Max-Min Scheduling: Full CSI case, the sub-optimal efficient user scheduling scheme is:

$$i = \arg \max_{j=1,..,N} \min\{|h_{1j}|^2, |h_{2j}|^2\} \tag{7}$$

- Optimal Scheduling: Full SSI case, The relay estimates the outage states, then chooses the pairs which are not in the outage region.

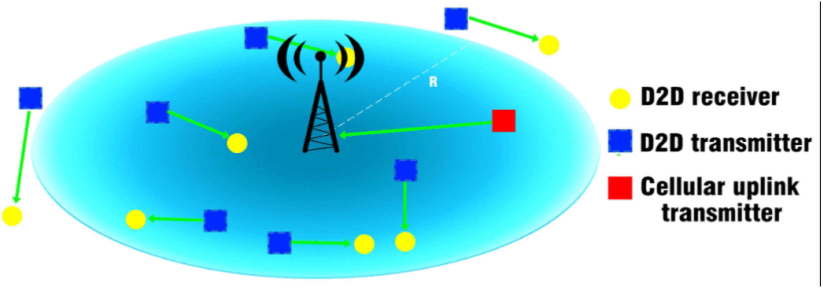
## Power Control for D2D Underlay Cellular Networks With Channel Uncertainty

*(Amen Memmi; Zouheir Rezki; Mohamed-Slim Alouini)*

- In this paper, achievable performances evaluated under channel uncertainty.
- **Contributions**
  - Centralized approach: based on noisy CSI, the BS handles the design of transmit power profile of all users to maximize SINR.
  - Coverage probabilities in the decentralized case are expressed in function of the estimation error $\alpha$.
  - For the distributed approach, an on-off power control as well as a truncated channel inversion power control are proposed.

# Network Model

- The cellular users are uniformly located in this region.
- D2D transmitters are distributed according to a homogeneous PPP.



- SINR in the proposed network model with imperfect CSI is

$$\text{Cellular } \mathrm{SINR}_c(K, \boldsymbol{p}, \alpha) = \frac{(1-\alpha)|\hat{h}_{0,0}|^2 d_{0,0}^{-\delta} p_0}{\alpha d_{0,0}^{-\delta} p_0 + \sum_{k=1}^{K} \left[(1-\alpha)|\hat{h}_{0,k}|^2 + \alpha\right] d_{0,k}^{-\delta} p_k + \sigma^2}$$

- Centralized Power Control: objective is to find optimal transmit power

$$\max_{p_0, p_1, \ldots, p_k} \mathrm{SINR}_c(K, \boldsymbol{p}, \alpha)$$

- Coverage probabilities
- For the distributed approach