Broadcasting in DTN as an Epidemic Dynamics
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BACKGROUND

- Message broadcasting in DTN and epidemic spreading are analogous.
- Epidemic spreading models like SIRS, SIR, SIS.
- Advent of Directional Antenna (DA).

PROBLEMS ADDRESSED

- Modeling broadcasting with mean field approach.
- Estimation of broadcasting time in DTN.
- Comparative study of omni-directional antenna (OA) and DA.

AGENT BASED MODEL

- Agents are self-propelled and move at constant speed while changing its direction at Poissonian distributed times.
- DA changes its orientation at each time with a fixed probability (prot).
- Agents can be in one of three possible states:
  - Susceptible - Active without the message
  - Infected - Received and broadcasting the message for a given time (\(\tau_i\))
  - Recovered - Idle mode for fixed amount of time (\(\tau_R\)) after broadcasting
- States are changed periodically in S-I-R-S cyclic order (SIRS model)

MOBILITY AND SIGNAL TRANSMISSION

- The motion of the \(i^{th}\) agent :
  \[
  \begin{align*}
  \dot{x}_i(t) &= v \cos(\alpha_i) \dot{\theta}_i + v \sin(\alpha_i) \dot{\theta}_i \\
  \dot{\theta}_i(t) &= F_\theta(t)
  \end{align*}
  \]
- Power received by agent \(i\) from transmitting agent \(j\) (Friis eq.)
  \[
  P_r(x_i, \theta_i, x_j, \theta_j) = \frac{\lambda^2 P_s G_i(\theta_i) G_j(\theta_j)}{4\pi^2 |x_i - x_j|^2}
  \]
  \(\lambda\) - signal frequency,
  \(G_i, G_j\) - gain of the agents in the direction to each other
- Agent \(i\) receive the message from \(j\) if \(P_r\) crosses a certain threshold

SYSTEM WITH DA & OA

- System can have a mixture of OA and DA agents.
- OA and DA both have the same power.

CONCLUSIONS

- DA agents always perform better than the OA agents.
- DA agents with smaller \(\gamma\) are more efficient than those with larger \(\gamma\).
- Rotation of the antenna has a definite positive effect on broadcasting.
- More research is needed to explore the effects of DA in DTN.

BIBLIOGRAPHY