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UNIVERSITÄT FREIBURG

Algorithms for Radio Networks

OLSR

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Routing in MANETs

- **Routing**
  - Determination of message paths
  - Transport of data
- **Protocol types**
  - proactive
    - Routing tables with updates
  - reactive
    - repair of message paths only when necessary
  - hybrid
    - combination of proactive and reactive

Routing Protocols

- **Proactive**
  - Routes are **demand independent**
  - Standard Link-State und Distance-Vector Protocols
    - Destination Sequenced Distance Vector (**DSDV**)
    - Optimized Link State Routing (**OLSR**)
- **Reactive**
  - Route are determined when needed
    - Dynamic Source Routing (**DSR**)
    - Ad hoc On-demand Distance Vector (**AODV**)
    - Dynamic MANET On-demand Routing Protocol
    - Temporally Ordered Routing Algorithm (**TORA**)
- **Hybrid**
  - combination of reactive und proactive
    - Zone Routing Protocol (**ZRP**)
    - Greedy Perimeter Stateless Routing (**GPSR**)

Optimized Link State Routing

- **Literature**
  - RFC3626: Clausen, Jacquet, *Optimized Link State Routing Protocol, 2003*
  - First published 1999
- **Most proaktive protocols are are based on**
  - Link-state routing
  - Distance-Vector routing

Link State Routing

- **Connections are periodically published throughout the network**
- **Nodes propagate information to their neighbors**
  - i.e. flooding
- **All network information is stored**
  - with time stamp
- **Each node computes shortest paths**
  - possibly also other route optimizations

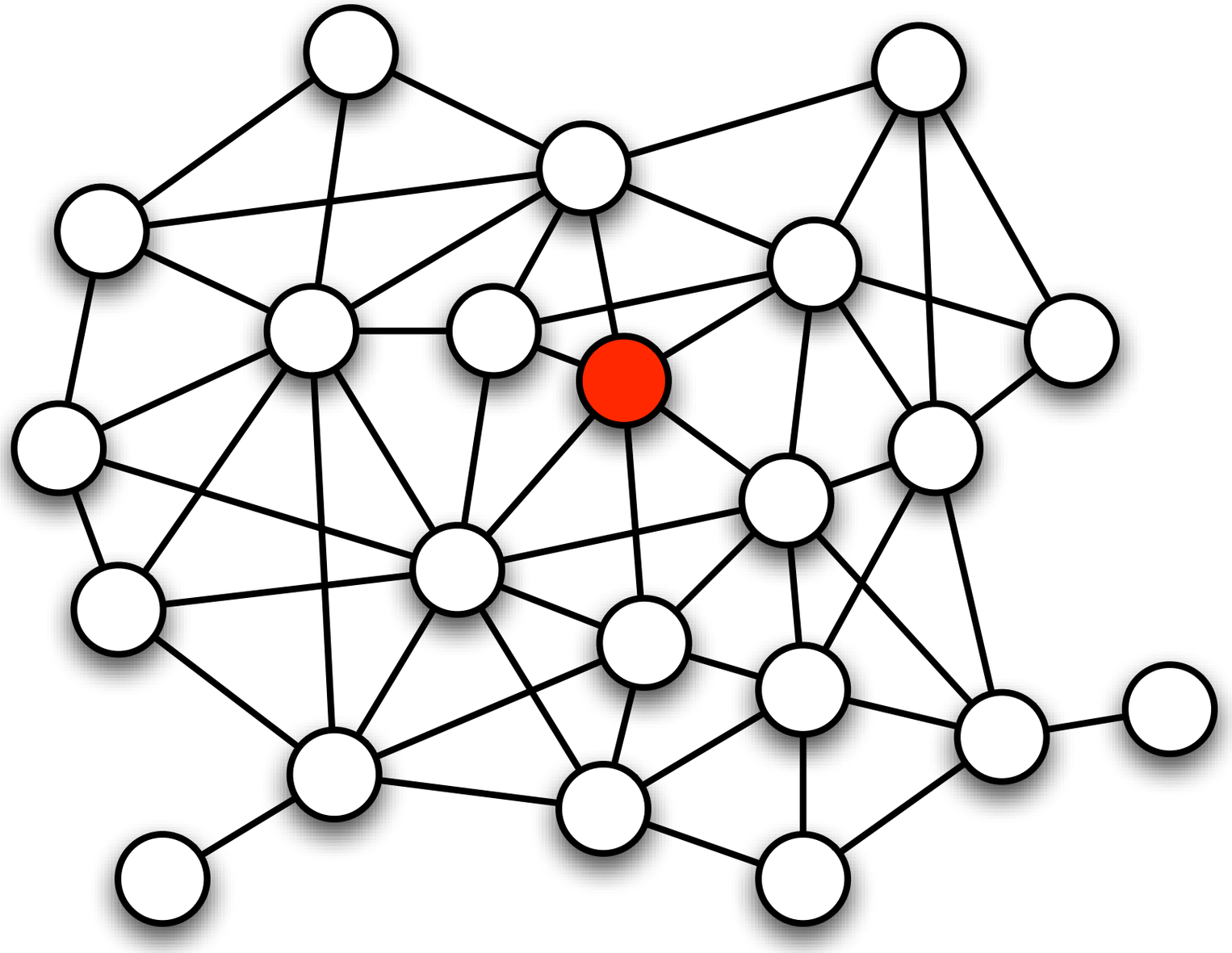
Optimized Link State Routing (OLSR)

- **Each nodes broadcasts its neighborhood list**
  - Each node can determinat its 2-hop neighborhood werden
- **Reducing the number of messages**
  - fewer nodes participate in flooding
- **Multipoint relay node (MPRs)**
  - are chosen such that each node has at least one multipoint relay node as in its 2-hop neighborhood
  - Only multipoint relay nodes propagate link information
- **Node sends their neighborhood lists**
  - such that multipoint relay nodes in the 2-hop neighborhood can be chosen

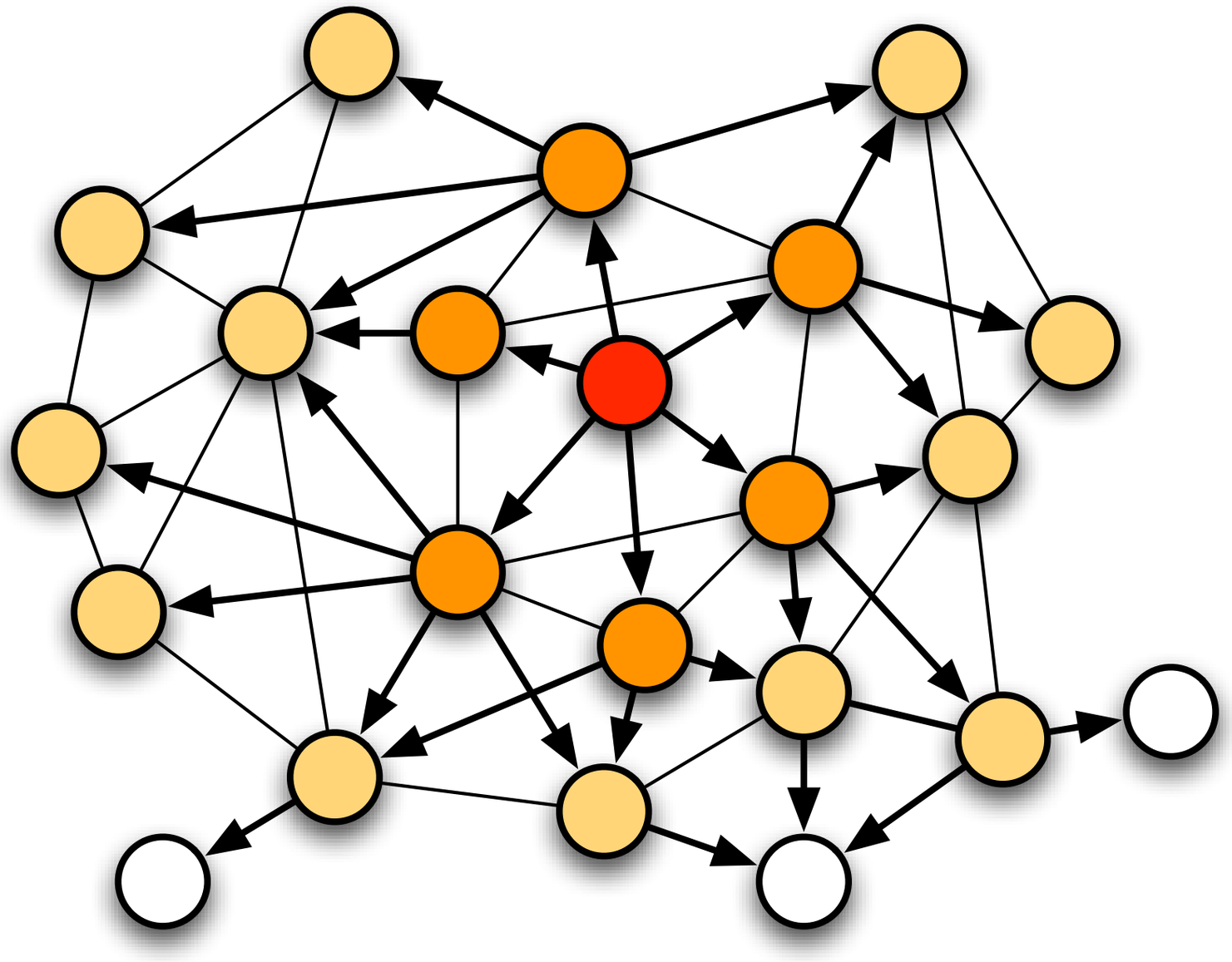
Optimized Link State Routing (OLSR)

- **Combines Link-State protocol and topology control**
- **Topology control**
  - Each node chooses a minimal dominating set of the 2 hope neighborhood
    - ***multipoint relays (MPR)***
    - Only these nodes propagate link information
    - More efficient flooding
- **Link State component**
  - Standard link state algorithm on a reduced network

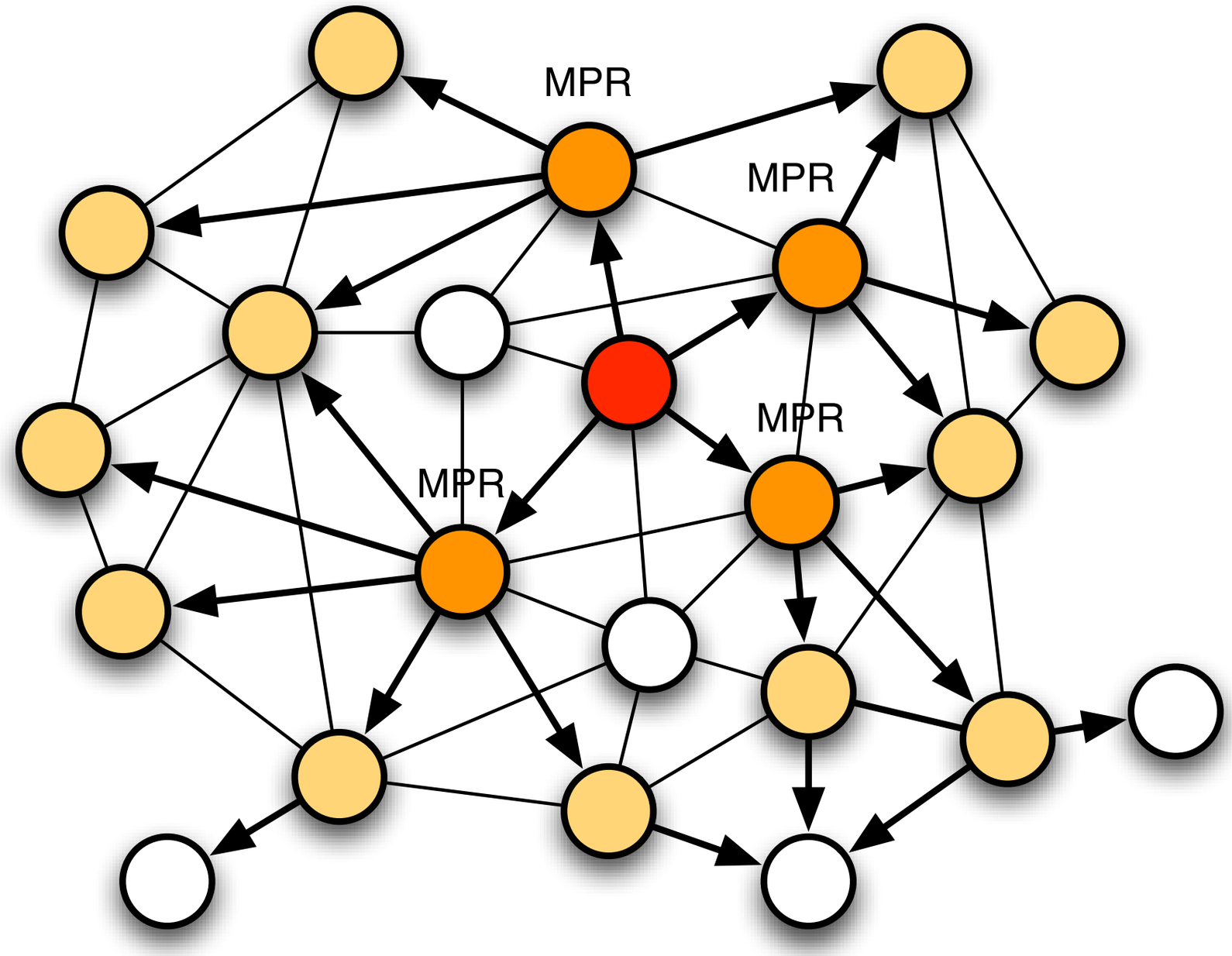
Optimized Link State Routing (OLSR)



Optimized Link State Routing (OLSR)



Optimized Link State Routing (OLSR)



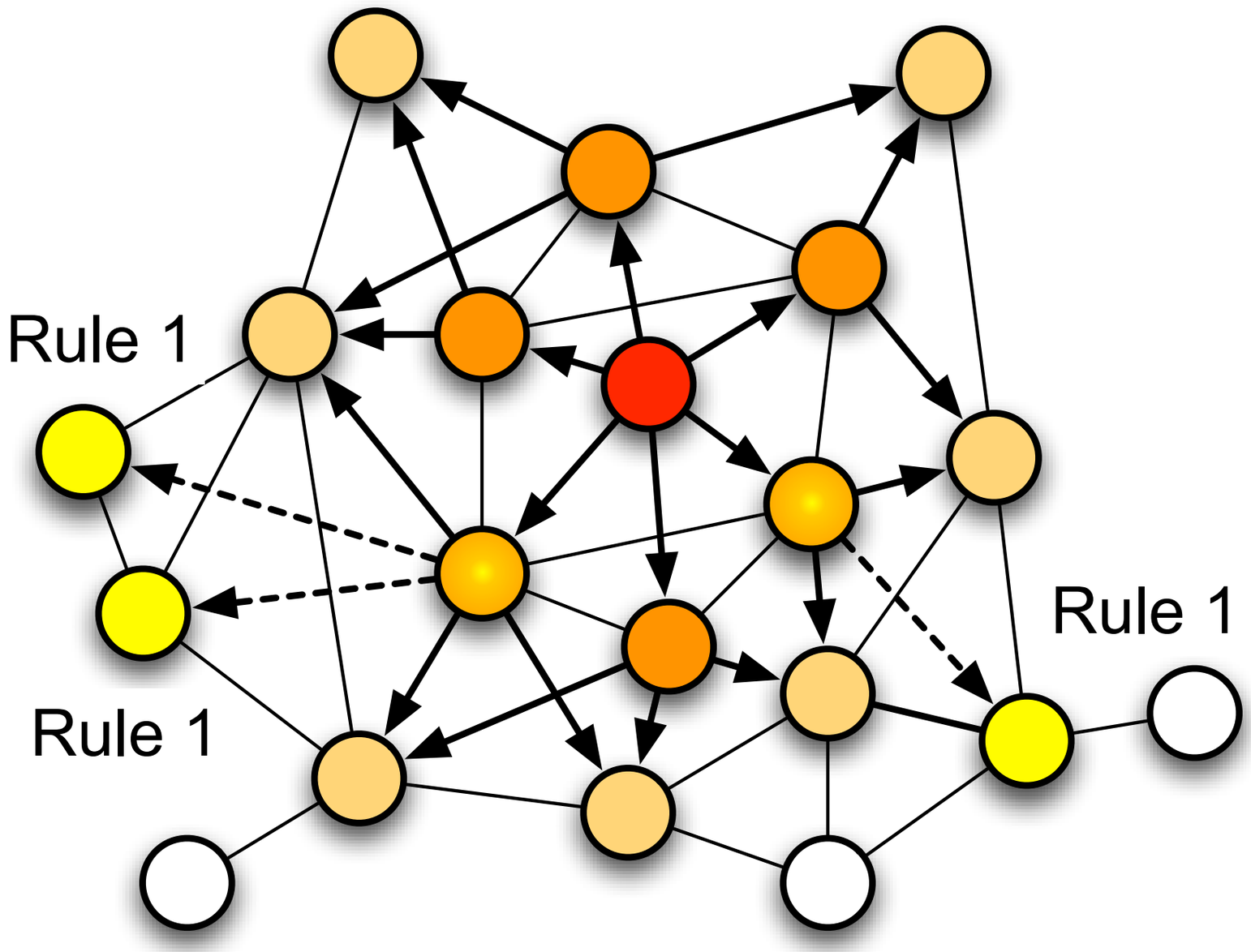
Selection of MPRs

- **Multipoint Relaying for Flooding Broadcast Messages in Mobile Wireless Networks, Amir Qayyum, Laurent Viennot, Anis Laouiti, HICCS 2002**
- **Problem is NP-complete**
- **Heuristics**
  - recommended for OLSR
- **Notations**
  - N(x): 1 hop neighborhood of x
  - $N^2(x)$: 2 hop neighborhood of x
  - Alle connections are symmetrical

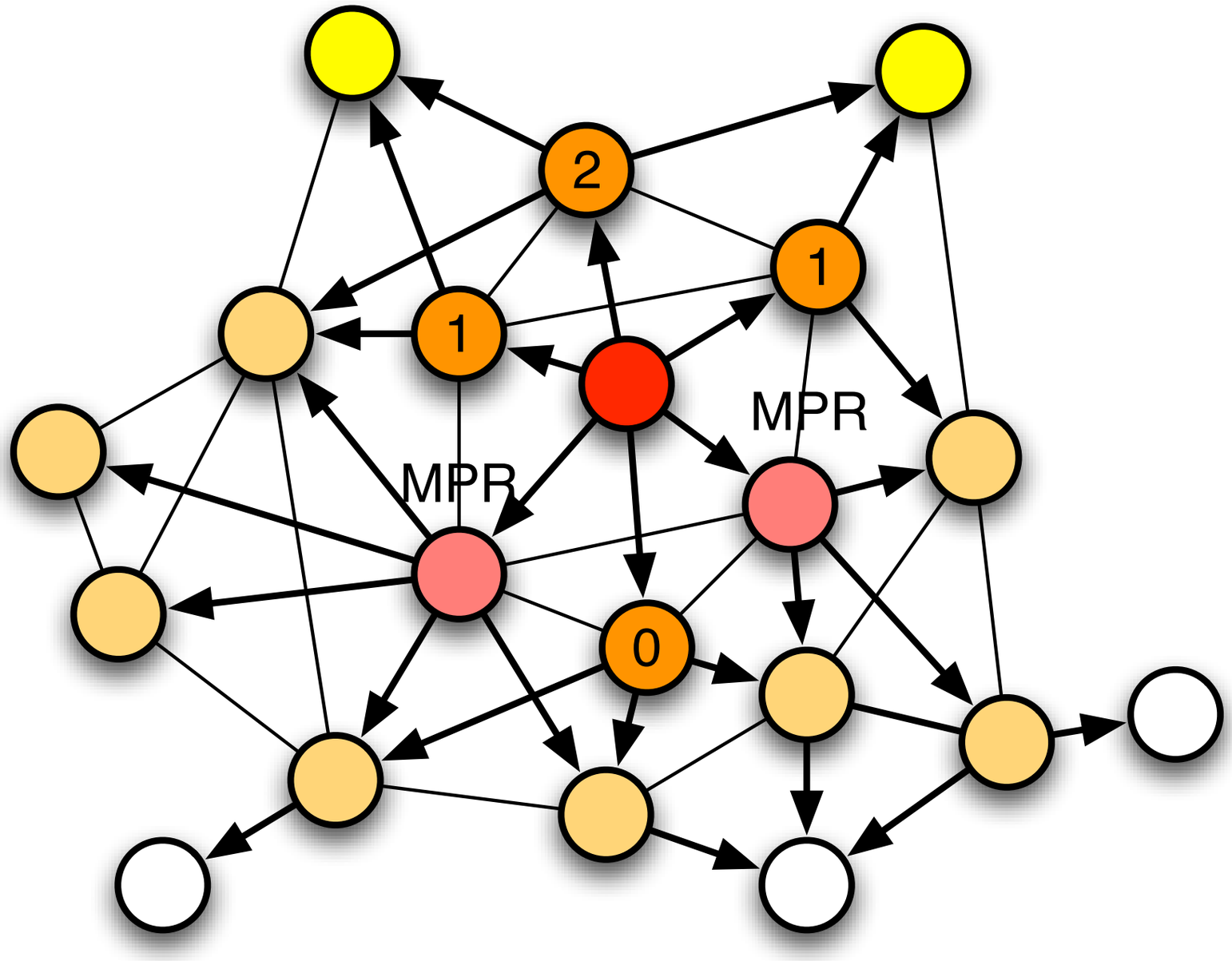
Selection of MPRs

- **At the beginning there is no MPR**
  - Each node chooses its MPRs
- **Rule 1: A node of x is selected as MPR, if**
  - it in N(x) and
  - it is the only neighborhood node in the node $N^2(x)$
- **Rule 2: If nodes in N^2 (x) are not covered:**
  - Compute for each node in N(x) the number of uncovered nodes in $N^2(x)$
  - Select as MPR the node that maximizes the value

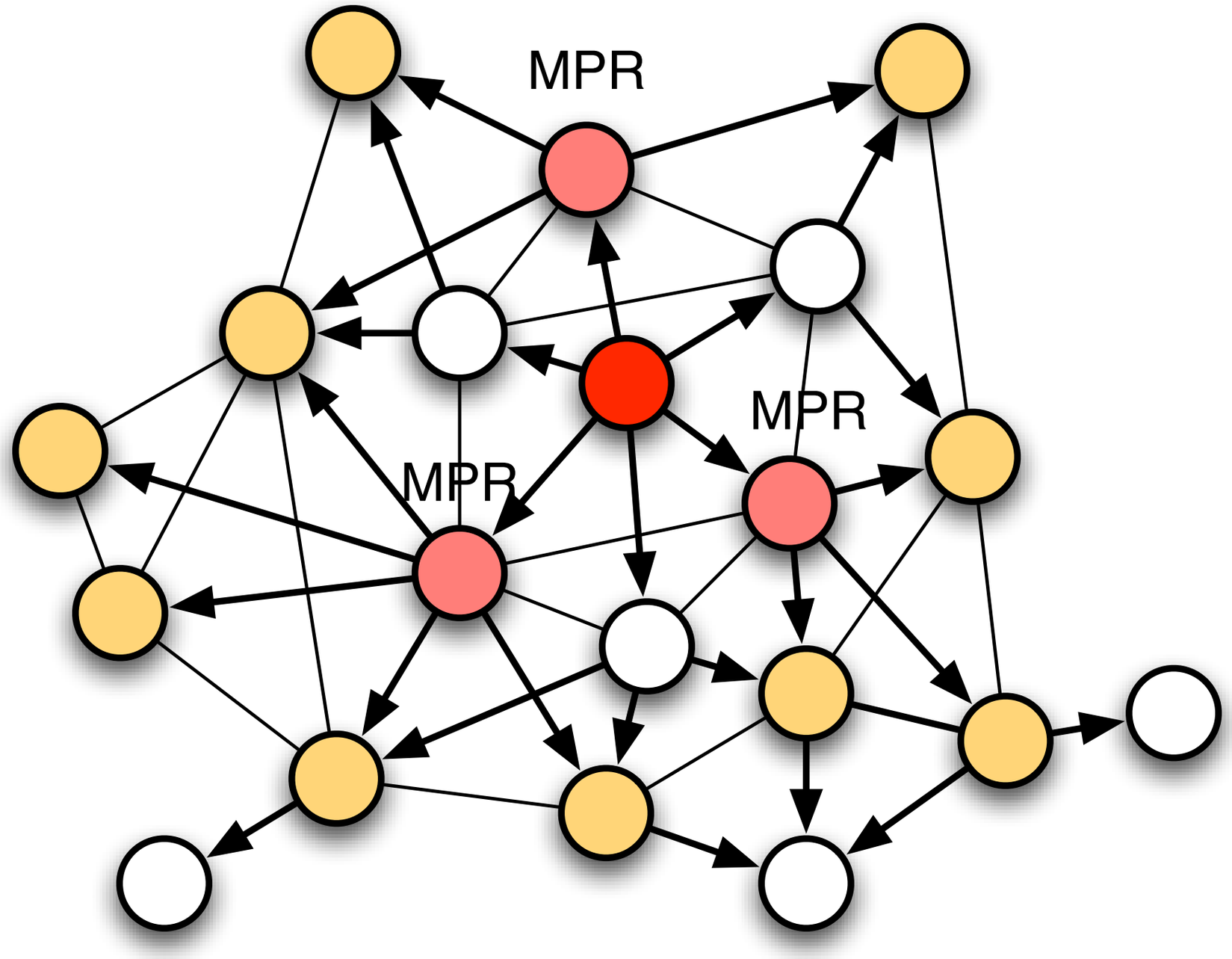
Rule 1



Rule 2



MPRs



OLSR

- **OLSR is flooding link information using MPRs**
  - Multipoint-Relays
- **Receivers choose their own MPRs for propagating**
  - Each node chooses its own MPRs
- **Routes use only MPRs as intermediate nodes**

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