

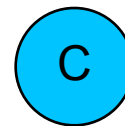
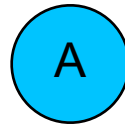
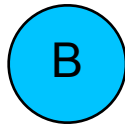
Measuring the Hidden Terminal Problem

Scott Raynel

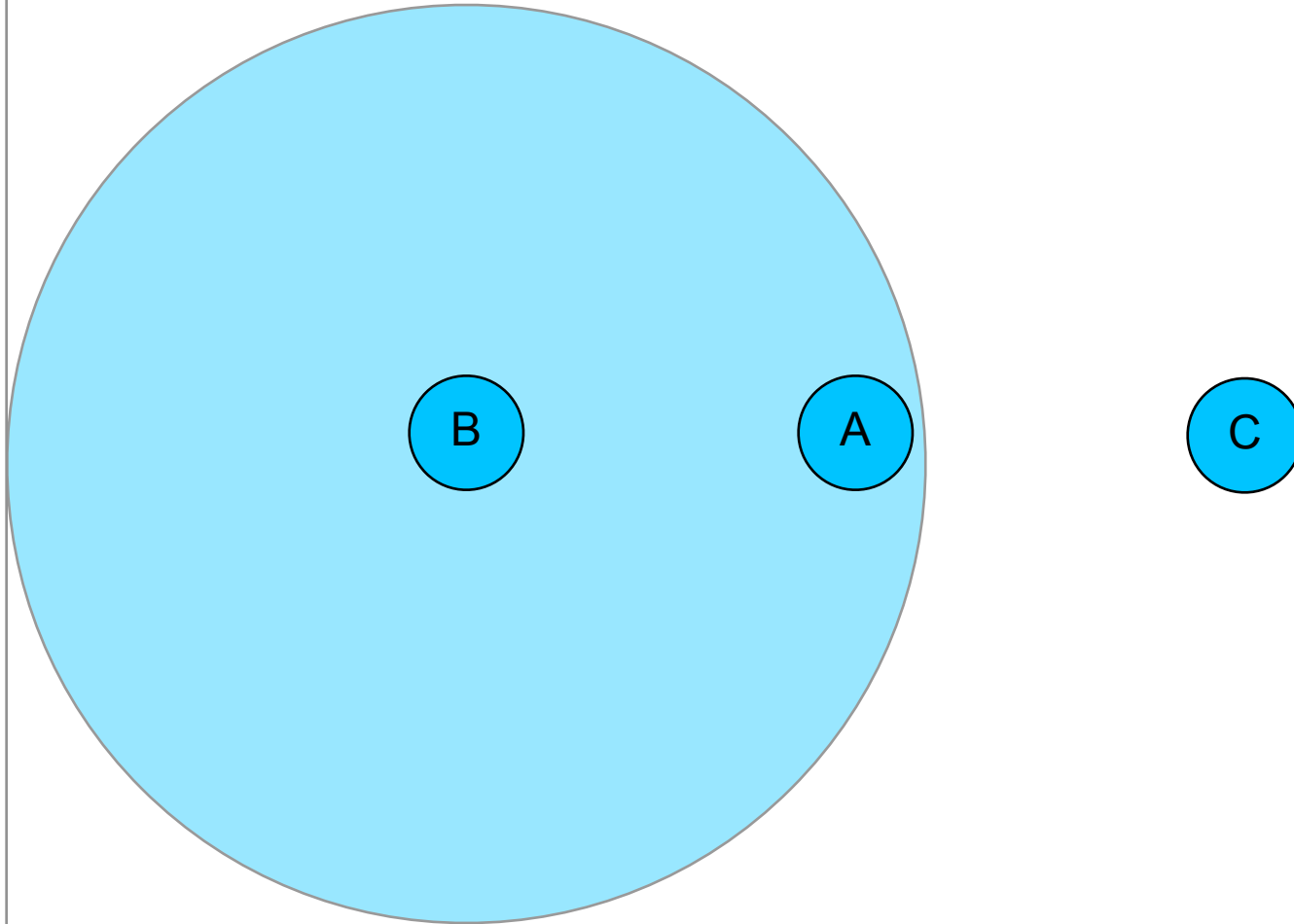
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Future Wireless 2009

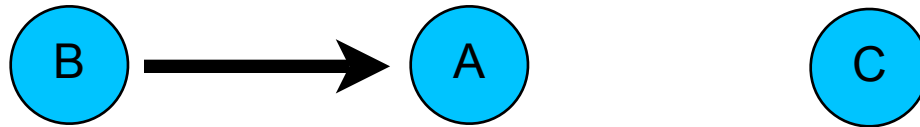
Hidden Terminals



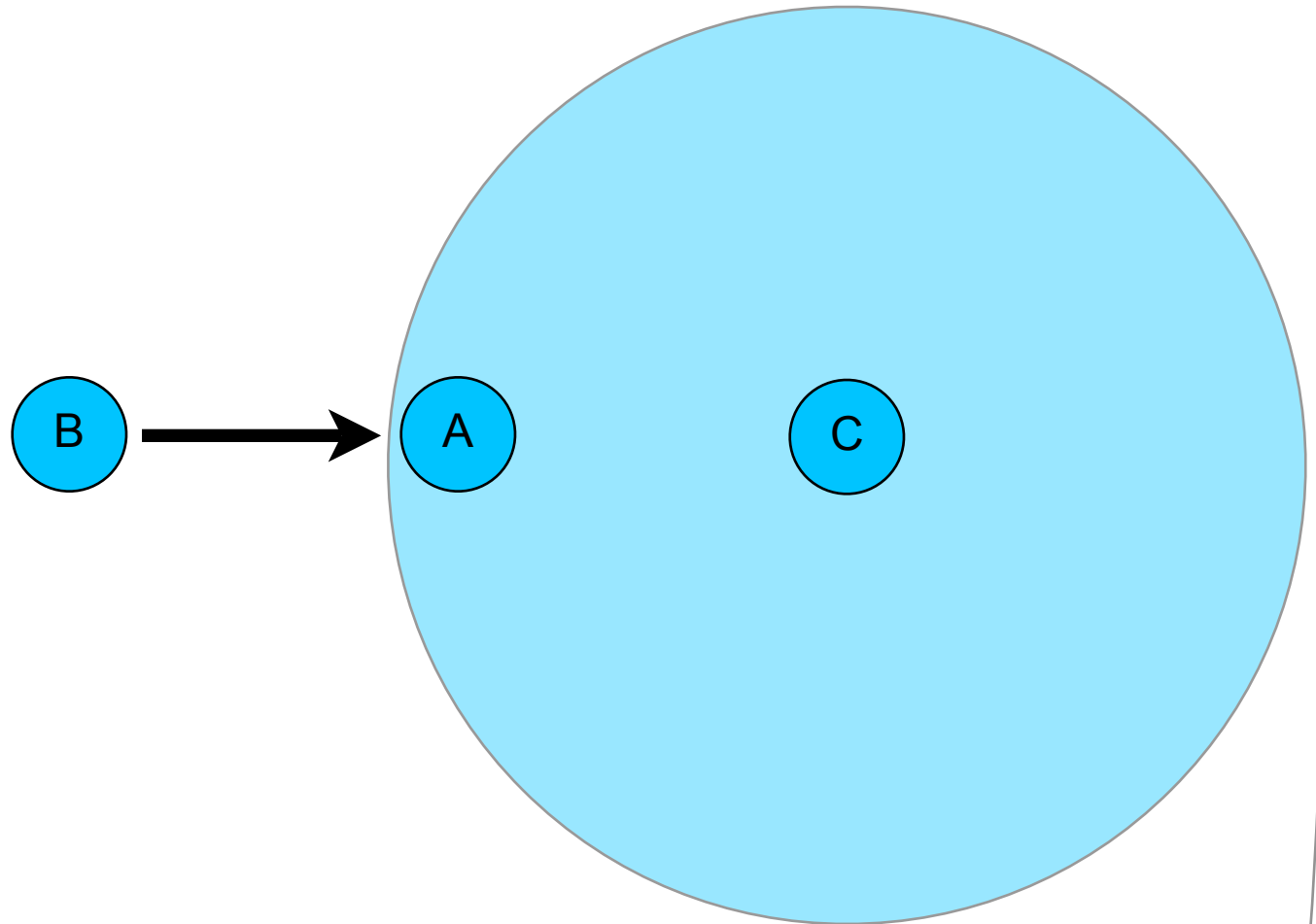
Hidden Terminals



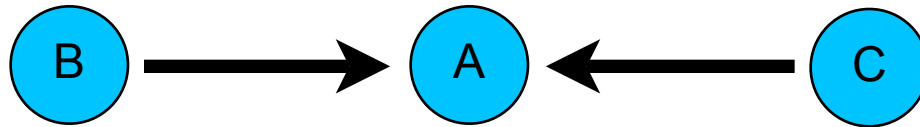
Hidden Terminals



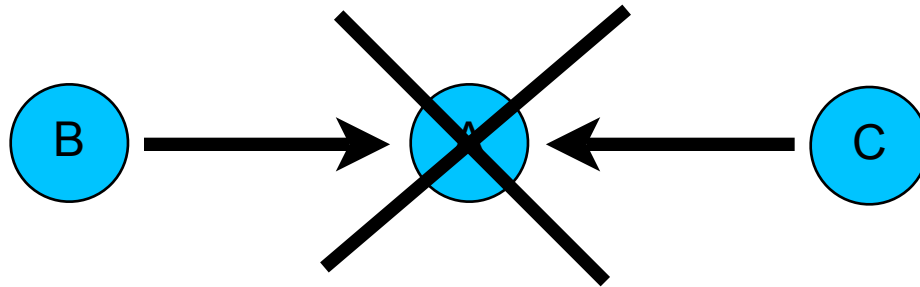
Hidden Terminals



Hidden Terminals



Hidden Terminals



Avoiding Hidden Terminals

- PHY layer avoidance

- “ZigZag” Decoding

- S. Gollakota and D. Katabi. ZigZag decoding: combating hidden terminals in wireless networks. In *SIGCOMM '08: Proceedings of the ACM SIGCOMM 2008 conference on Data communication*, pages 159–170, New York, NY, USA, 2008. ACM.

- Exploit the fact that senders will typically collide multiple times per packet
 - Use error-free portions at start of packet to bootstrap decoder
 - Decode both packets through collision
 - Achieves backwards compatibility with existing 802.11 PHYs.
 - Incurs no overhead during periods of non-collision.

Avoiding Hidden Terminals

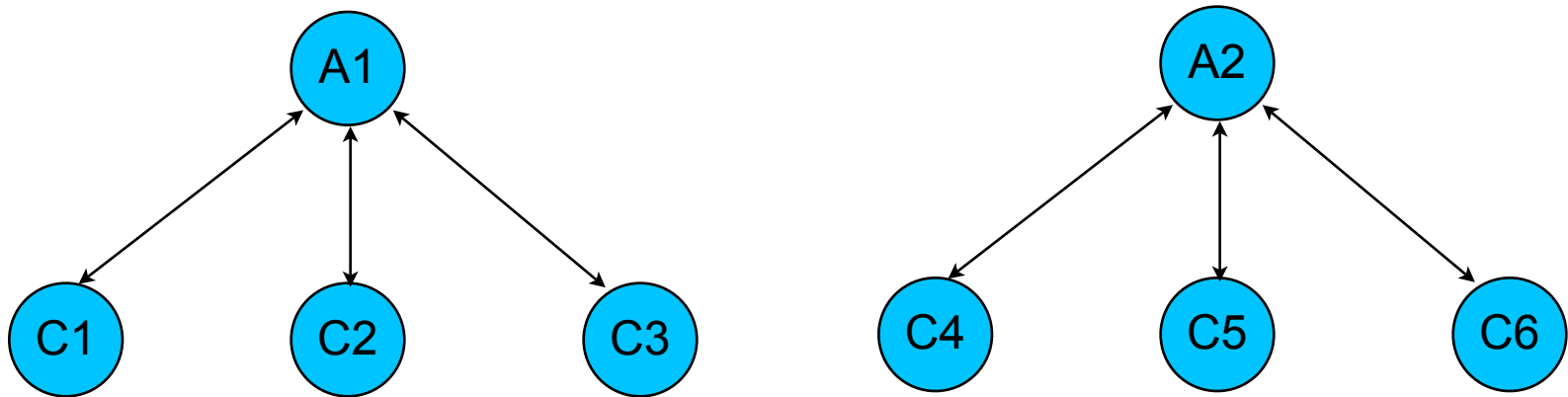
- MAC layer avoidance
 - BTMA, TDMA, etc
 - RTS/CTS
 - Scheduling based on two-hop neighbourhood

Measuring Hidden Terminals

- Active measurement
 - Building and analysing network connectivity
- Passive measurement
 - Analysis of inter-frame spacing

Measuring Hidden Terminals

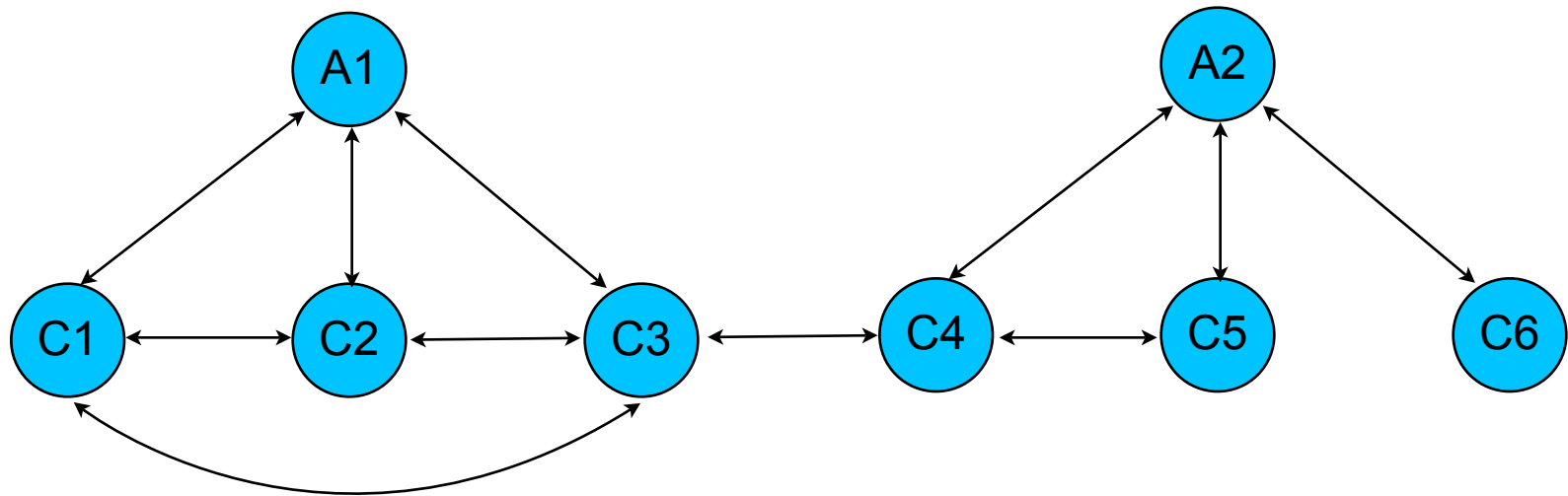
- Active measurement
 - Creates connectivity graphs of the entire network
 - Shows exactly what each node can “hear”



- May be fooled by two transmitters being within CS range but not RX range.

Measuring Hidden Terminals

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Measuring Hidden Terminals

- Passive measurement
 - Analysing inter-frame spacing to detect collisions and IFS failures.
 - If space between two frames is less than the minimum IFS for the frame pair we can infer transmitters are hidden from one another.
 - Can detect collisions if the receiver hardware is able to pass up enough of the frame
 - Shows the actual effect of hidden terminals in the network, rather than potential.

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