

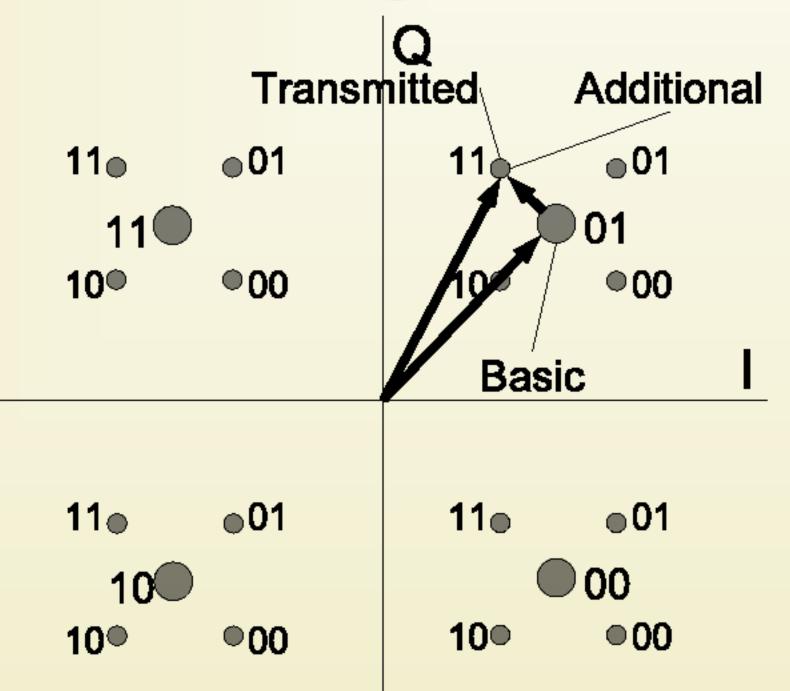
Varied distance from access point
 Different building materials

Basic Idea: Exploit diverse channels to simultaneously transmit multiple packets to clients

Superposition Coding Background

Encoding

- Weaker receiver's packet is allocated most power
- Stronger receiver's packet(s) is allocated remaining power
- Finally, modulated signals are summed



Decoding

- Weaker receiver decodes by treating additional packet as interference
- Stronger receiver decodes first layer, subtracts it out, then decodes remaining packet

Superposition Coding for Wireless Mesh Networks

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MAC Scheduling with Superposition Coding

- Treat existing scheduler as black box
- Always transmit head-of-line packet
- Maximize throughput given current channel conditions

Algorithm Sketch

Process (pkt_{hol}) – On receiving packet pkt_{hol} with next hop d_1 from basic scheduler.

01. for each rate r_1 and destination $d \neq d_1$ do

02. if r_1 not supported by d then

03. continue

04. $r_2 \leftarrow$ max rate supported by d in second layer

05. if scheduling transmissions serially has better throughput then

06. continue

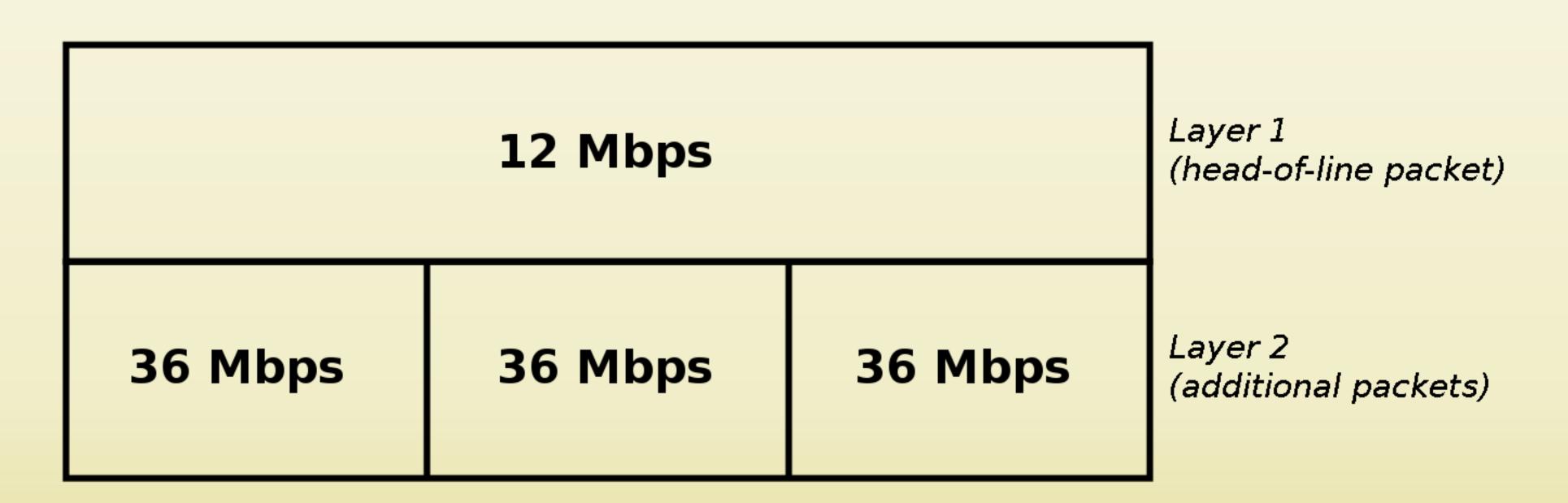
07. Select $N_{d,r_1,r_2} = \lfloor \frac{r_2}{r_1} \rfloor$ packets to d from queue

08. Effective throughput is $r_1 (1 + N_{d,r_1,r_2})$ 09. endfor

10. Select neighbor d^* and rate r_1^* combination with best effective throughput

11. Schedule pkt_{hol} in first layer at rate r_1^* , and N_{d^*,r_1^*,r_2^*} packets in second layer at rate r_2^*

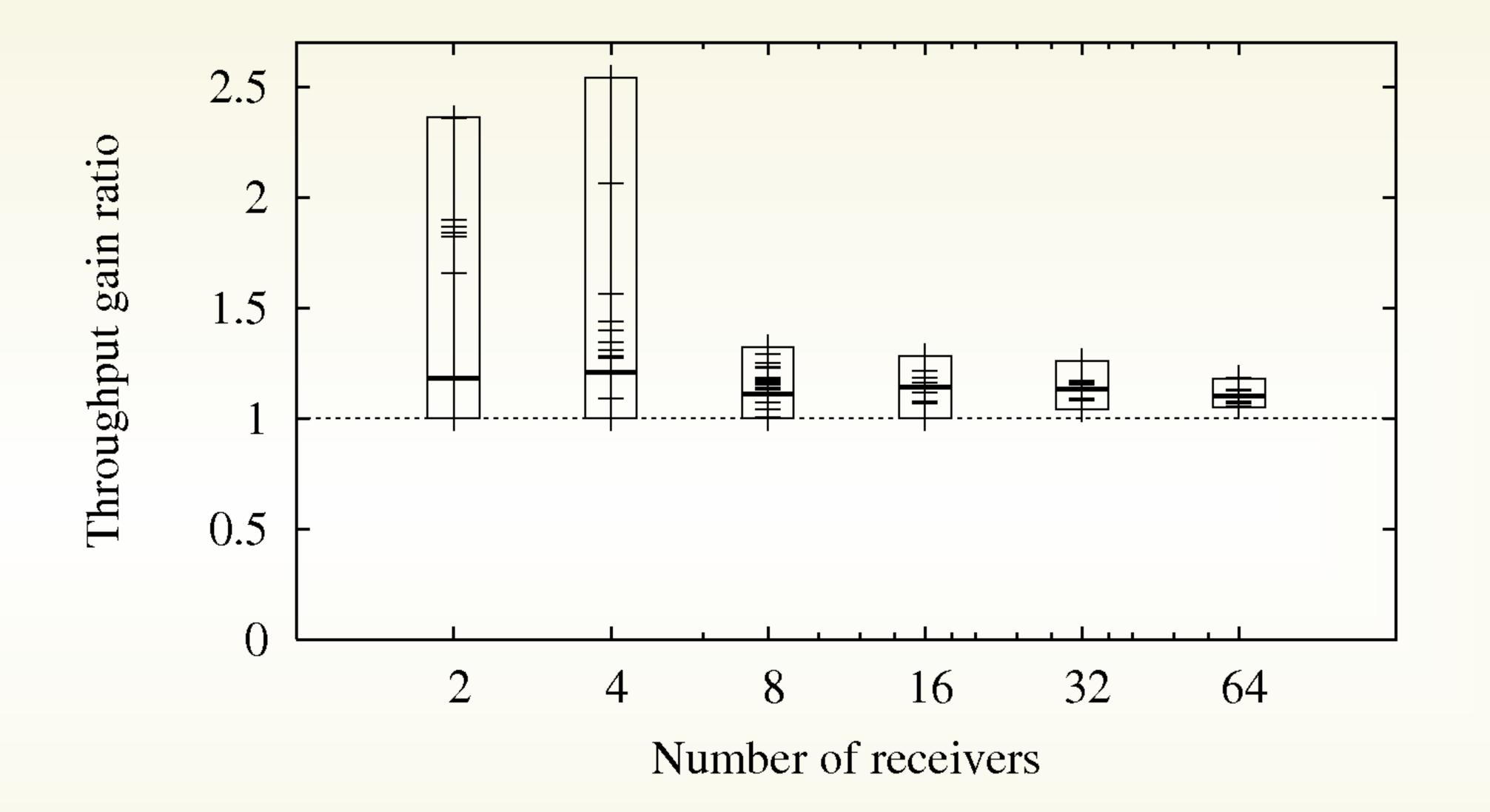
Transmitted Packet



ns-2 Evaluations

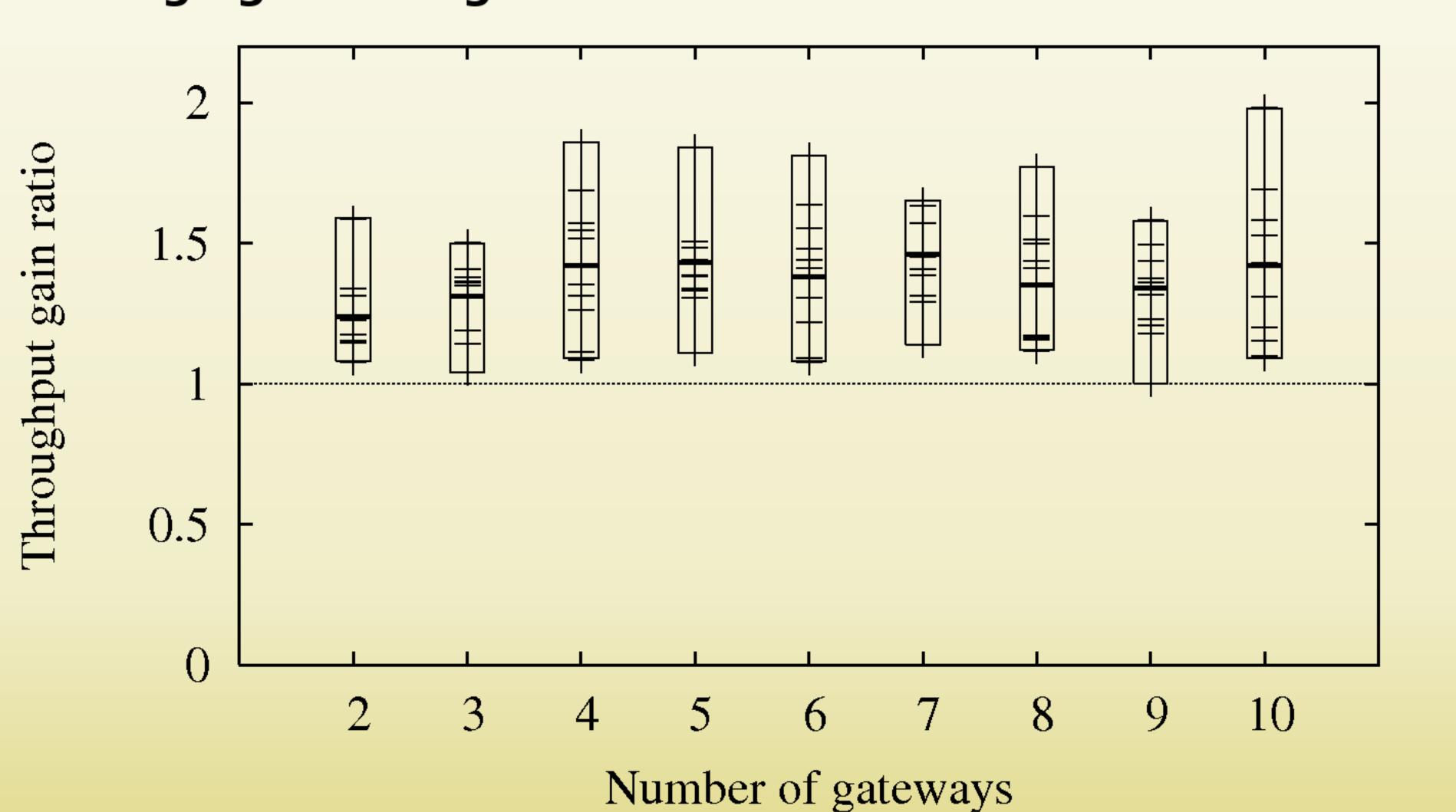
Single transmitter with multiple receivers

- Receivers placed at random around transmitter
- Average gains around 20% with 2 or 4 receivers



Mesh network with multiple gateways

- 25 flows from gateways to non-gateways via multi-hop path
- Average gains range from 26% to 46%



GNU Radio Prototype

- Extend 802.11 standards for superposition coding
- First known implementation of superposition coding in GNU Radio
- Measurements show similar gains as displayed in evaluations

Scheme	Norm. exp. trans. time	Gain ratio
No Coding	3.92	1
Superposition	2.88	1.4

