



# **DISTRIBUTED CONTROL: GAMING THE SYSTEM**

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ARCS PRESENTATION

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[WWW2.HAWAII.EDU/~MCKELL](http://WWW2.HAWAII.EDU/~MCKELL)







# DISTRIBUTED SYSTEMS







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Stanford University. [http://it.stanford.edu/classrooms/features/computer\\_labs.html](http://it.stanford.edu/classrooms/features/computer_labs.html)



Recycle.co.uk. <http://www.recycle.co.uk/blog/most-environmentally-friendly-mobile-phone/>

Speculative Design. <http://speculativedesign.blogspot.com/2009/09/robotic-wifi-network.html>



Mike Weston. <http://www.flickr.com/photos/mikeweston/1462086624/>



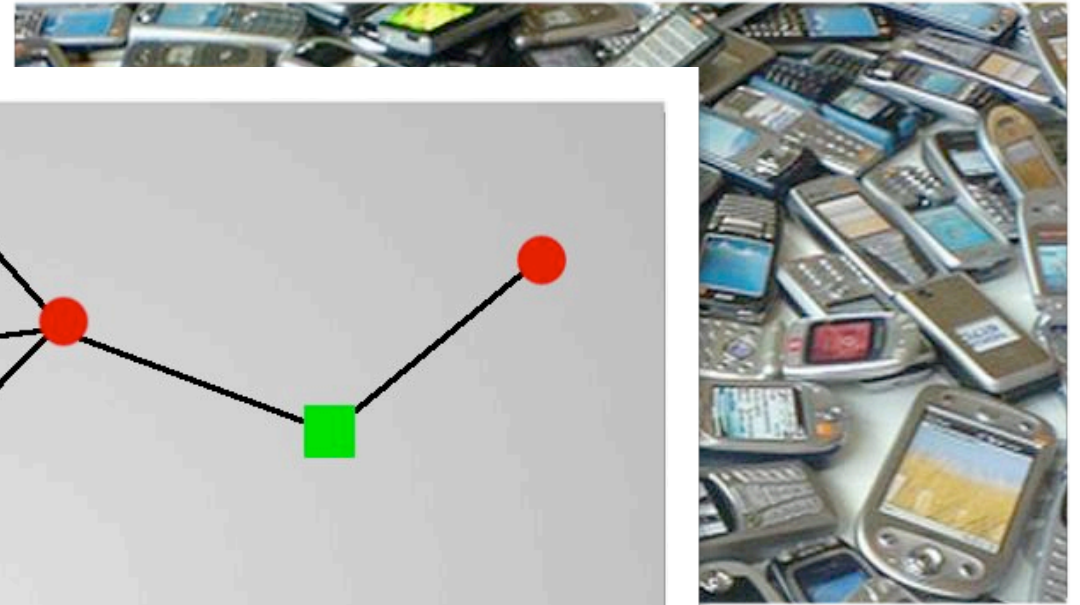
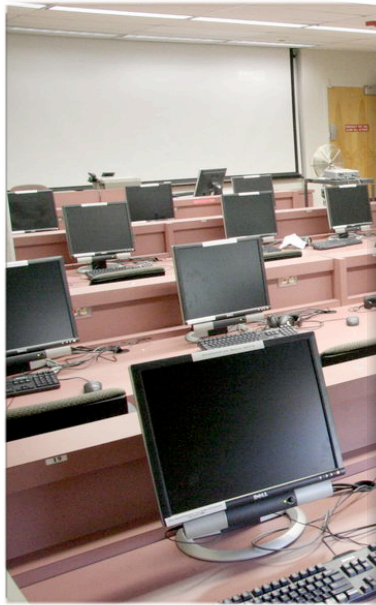




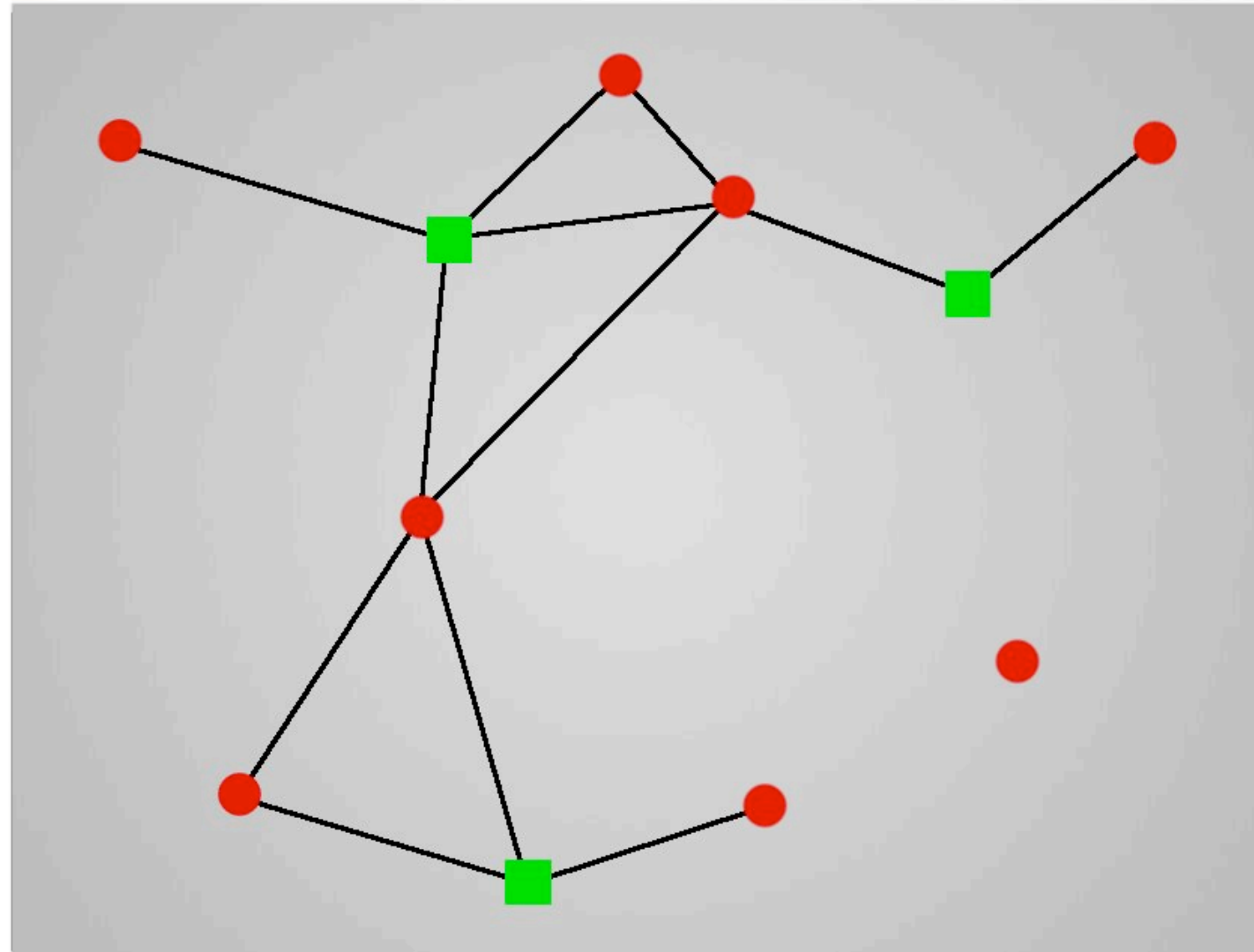
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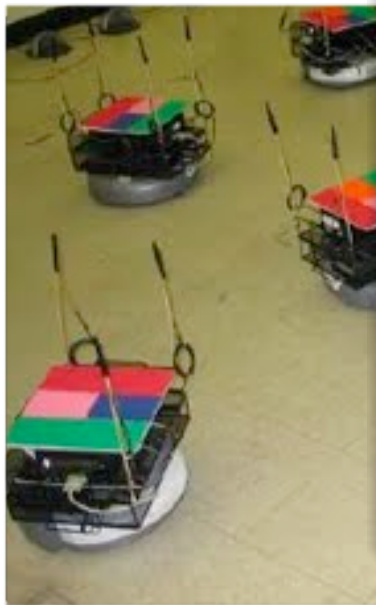
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Mike Weston. <http://www.flickr.com/photos/mikeweston/1462086624/>







# PERSISTENT EXAMPLE: AVOIDING OVERLAP IN SENSOR COVERAGE

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- ☐ ALSO CALLED “SPHERE PACKING”
- ☐  $n$  SENSORS IN A CONVEX MISSION SPACE
- ☐ OBJECTIVE: MAXIMIZE THE AREA EFFECTIVELY COVERED WHILE AVOIDING “DOUBLE COVERAGE”



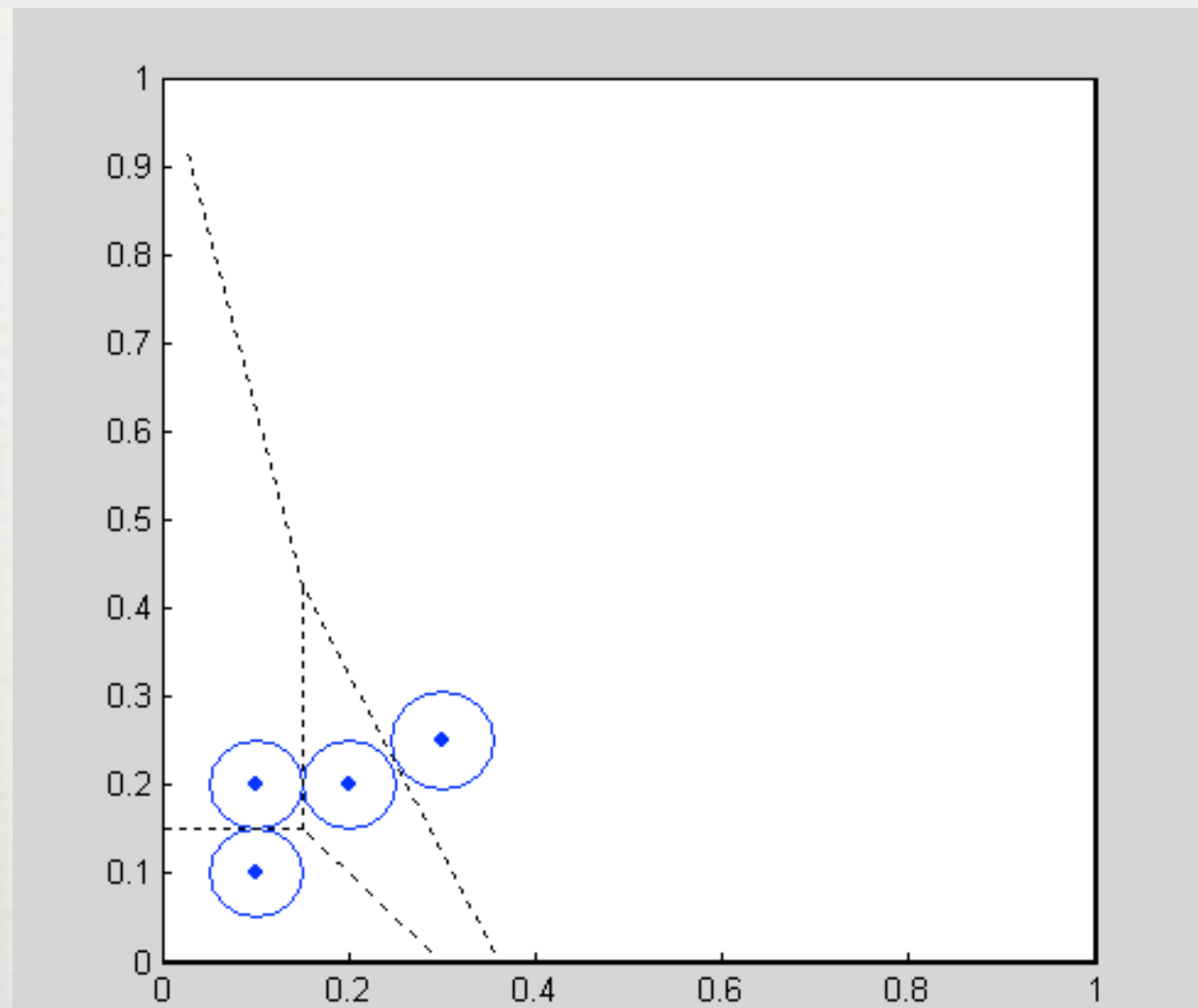


# PERSISTENT EXAMPLE

## THE GOOD, THE BAD...



SIMULATION:  
“MOVE AWAY FROM YOUR CLOSEST NEIGHBOR”







# PERSISTENT EXAMPLE

## THE GOOD, THE BAD...

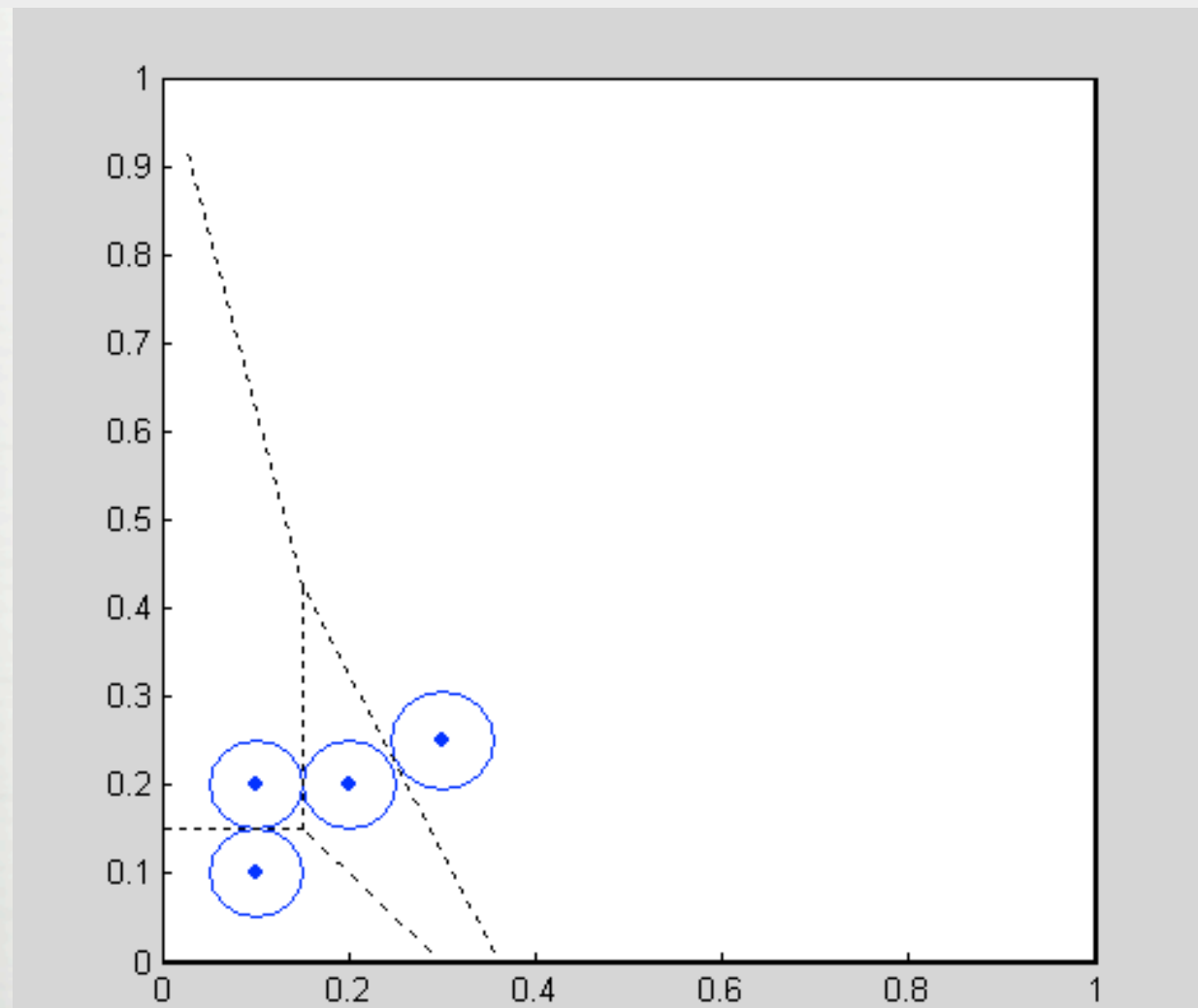


### SIMULATION:

“MOVE AWAY FROM YOUR CLOSEST NEIGHBOR”

### ADVANTAGES

- LOCAL KNOWLEDGE
- DISTRIBUTED DECISIONS
- CONVERGES





# PERSISTENT EXAMPLE

## THE GOOD, THE BAD...

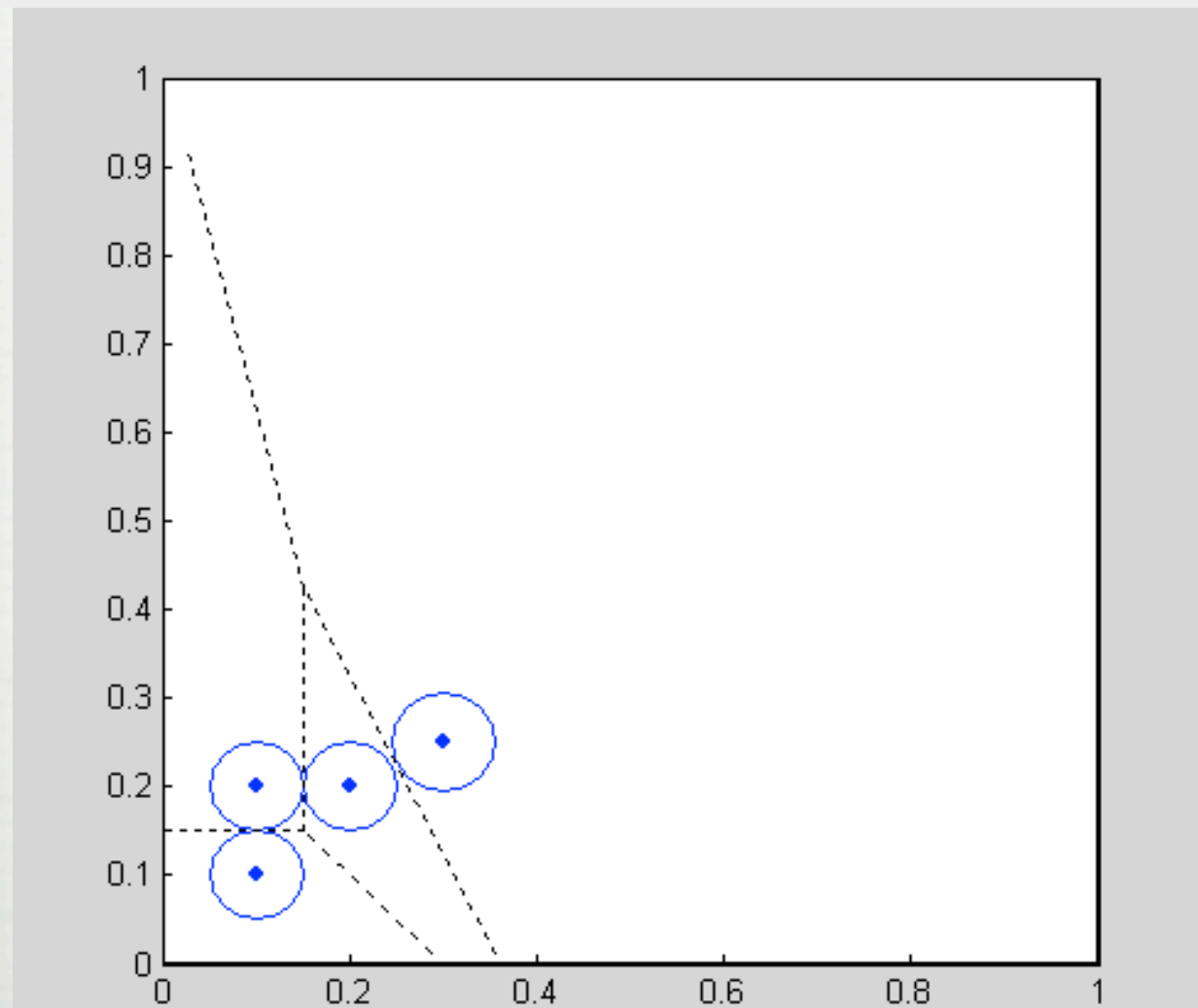


### SIMULATION:

“MOVE AWAY FROM YOUR CLOSEST NEIGHBOR”

#### ADVANTAGES

- LOCAL KNOWLEDGE
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- CONVERGES



#### LIMITATIONS

- CANNOT PROVIDE PERFORMANCE GUARANTEES
- CAN'T SAY *WHICH* STABLE EQUILIBRIUM WILL EMERGE

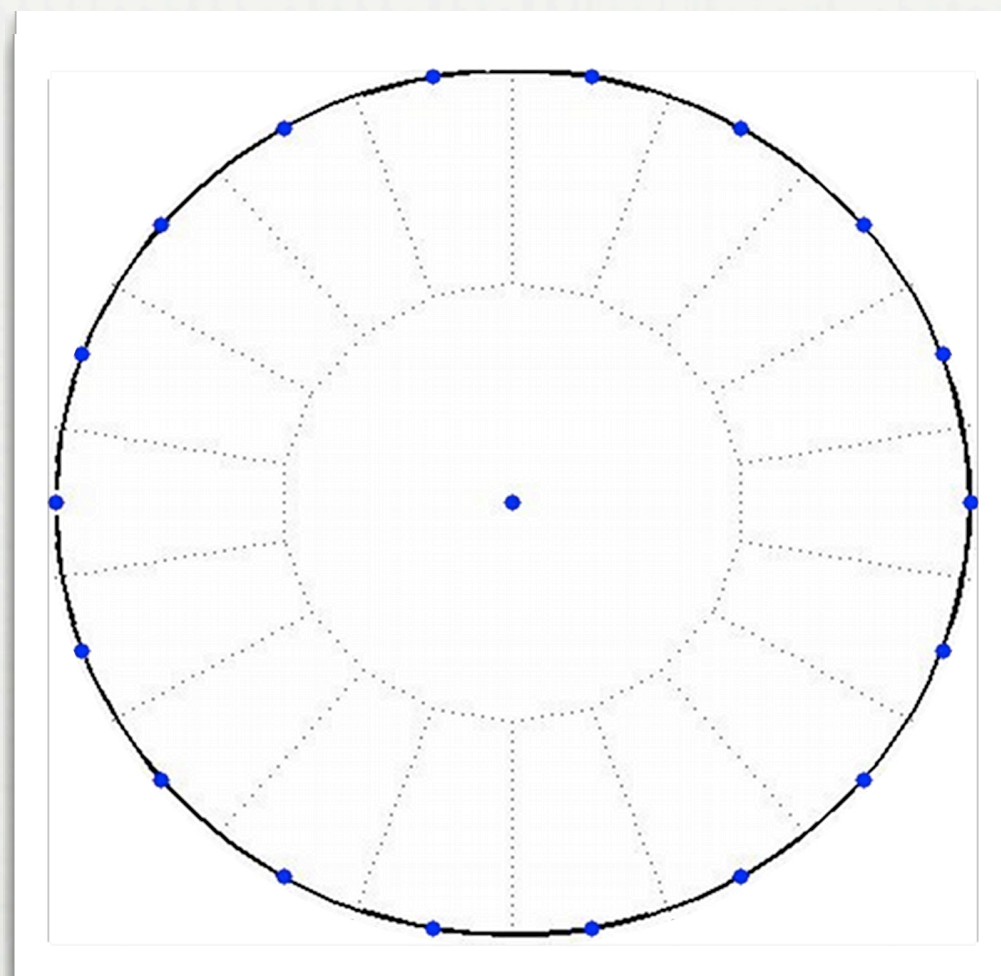






# PERSISTENT EXAMPLE ...AND THE UGLY

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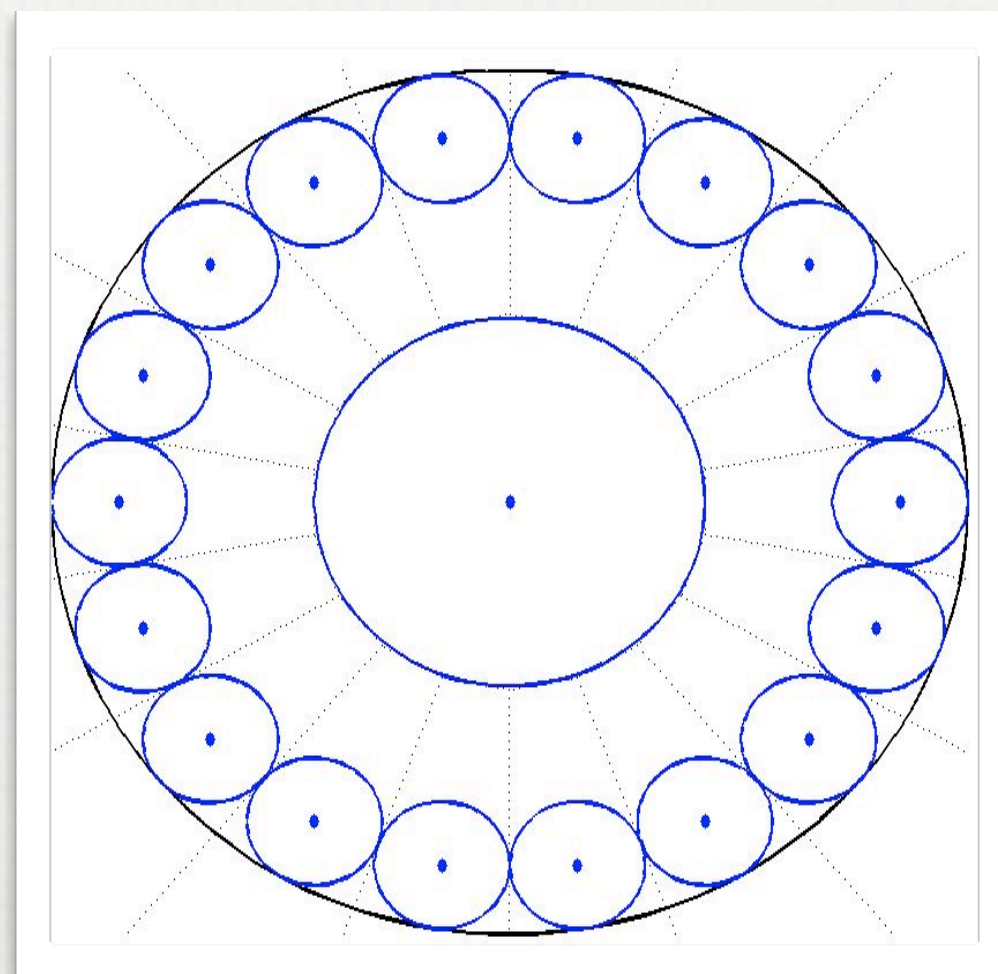






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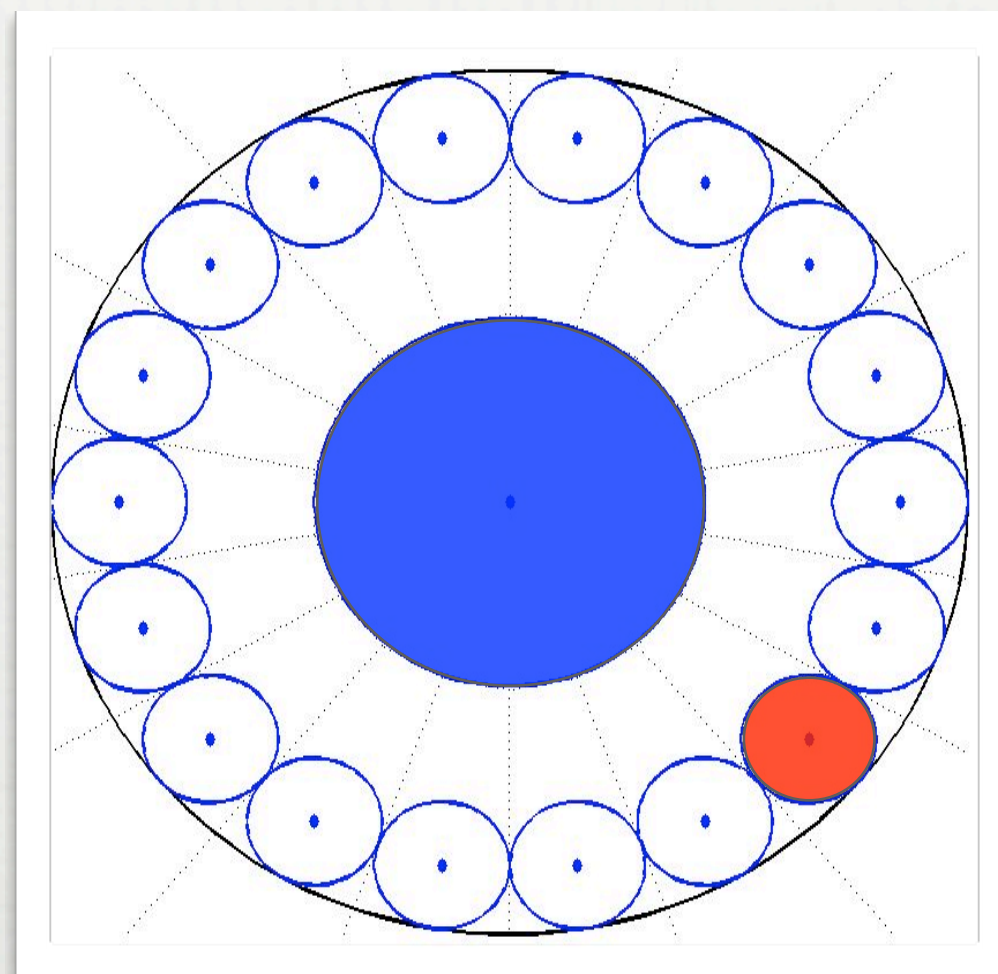






# PERSISTENT EXAMPLE ...AND THE UGLY

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# PERSISTENT EXAMPLE ...AND THE UGLY

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WORST CASE EFFICIENCY  
CAN BE AS BAD AS

$$\frac{1}{1 + \frac{\text{blue circle}}{\text{red dot}}}$$



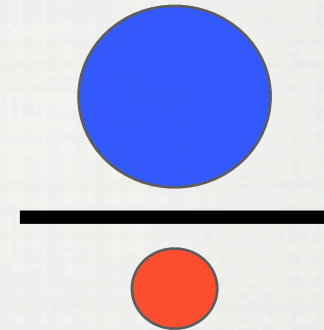




# WHAT NOW?

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- SOCIAL DISPARITY DRIVES INEFFICIENCY



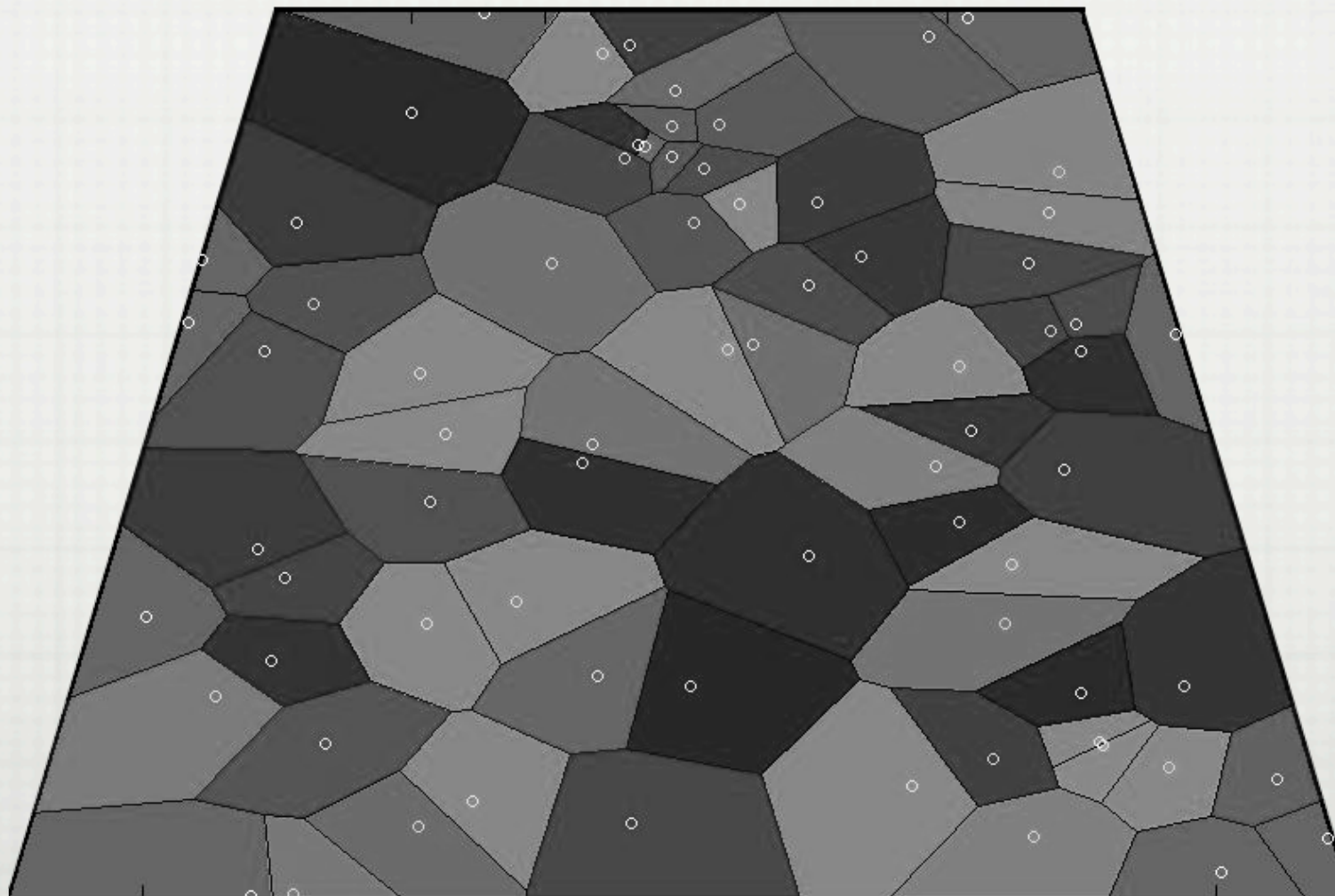




# WHAT NOW?

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- RELAX LOCALITY & INCREASE INFORMATION SHARING



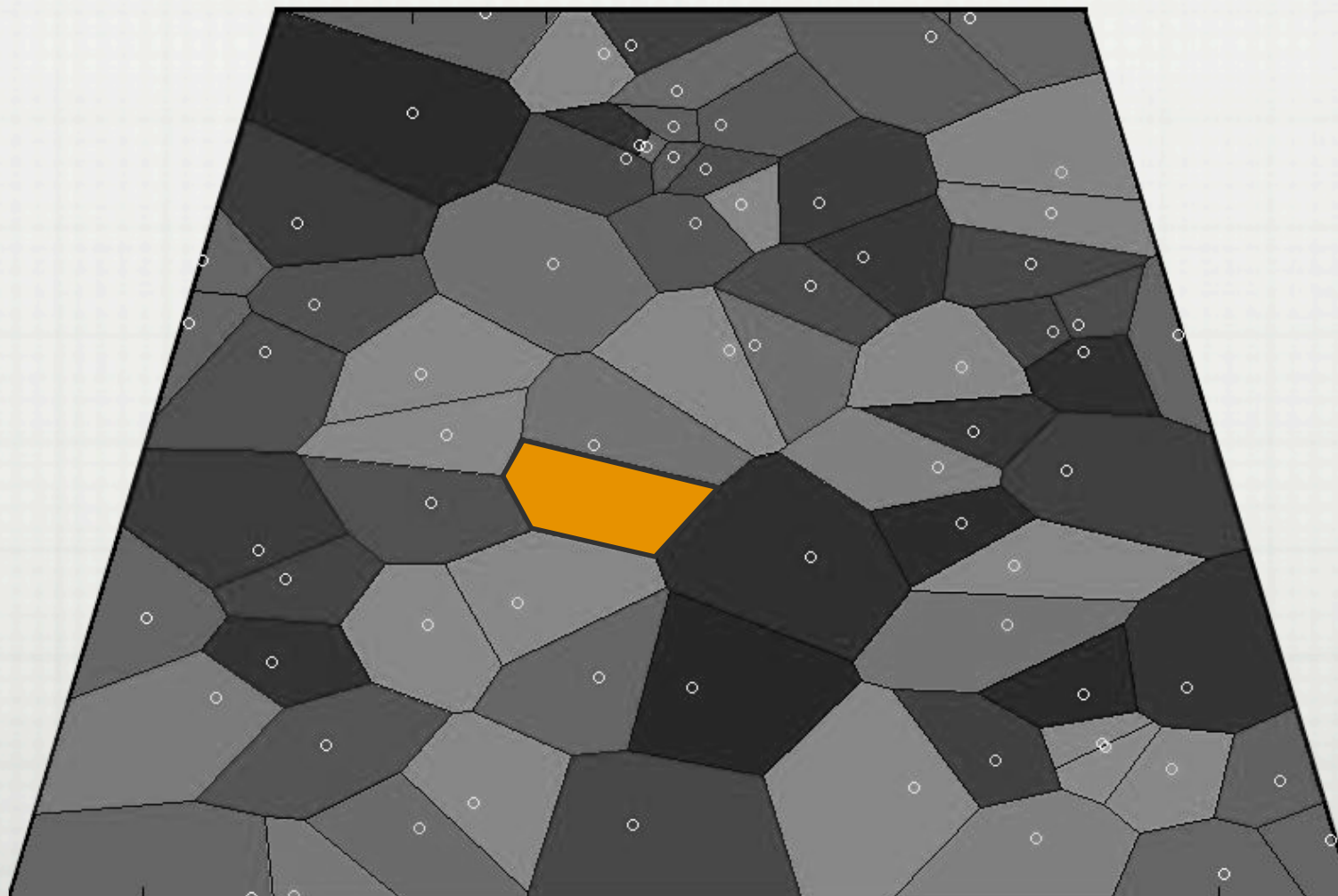




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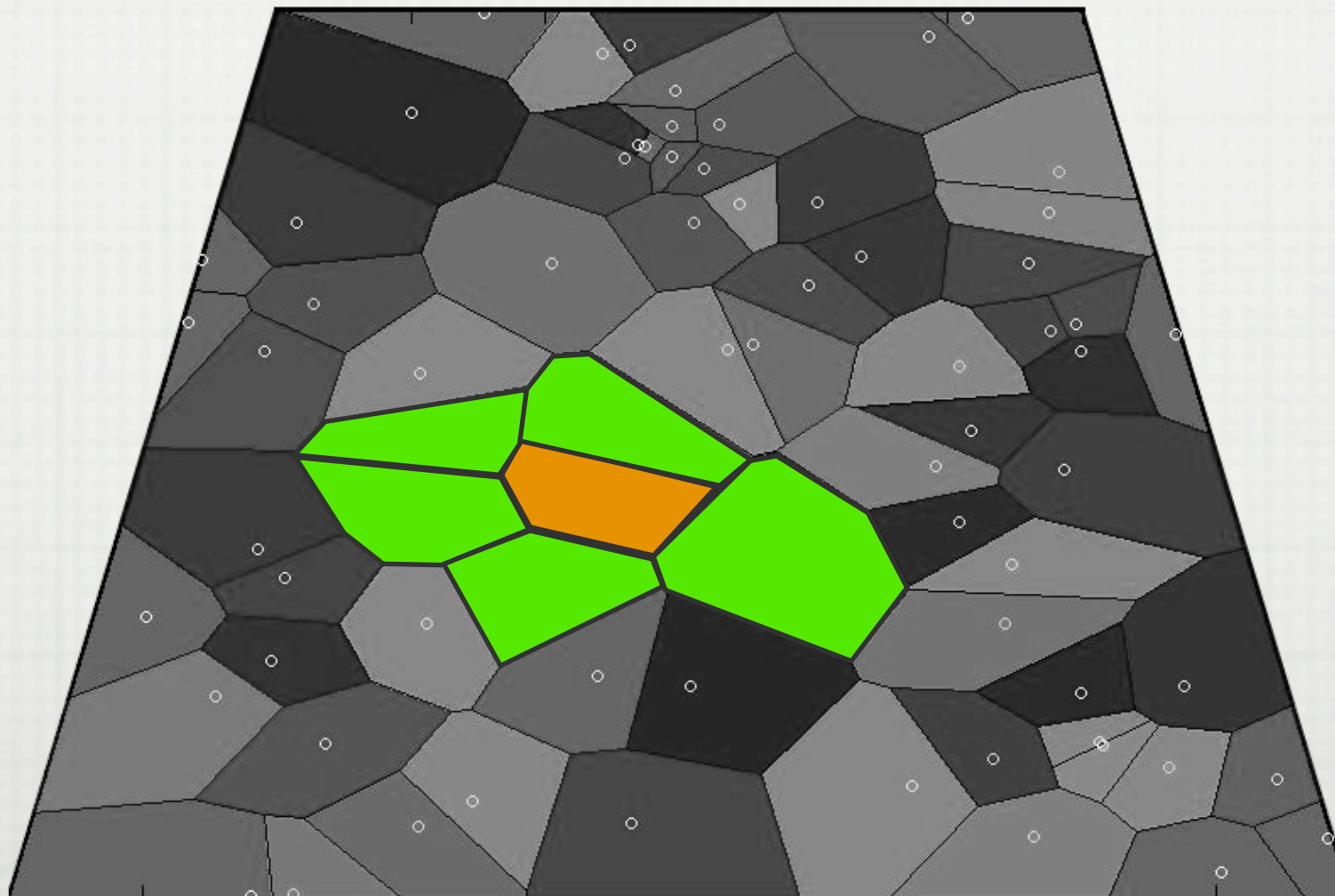




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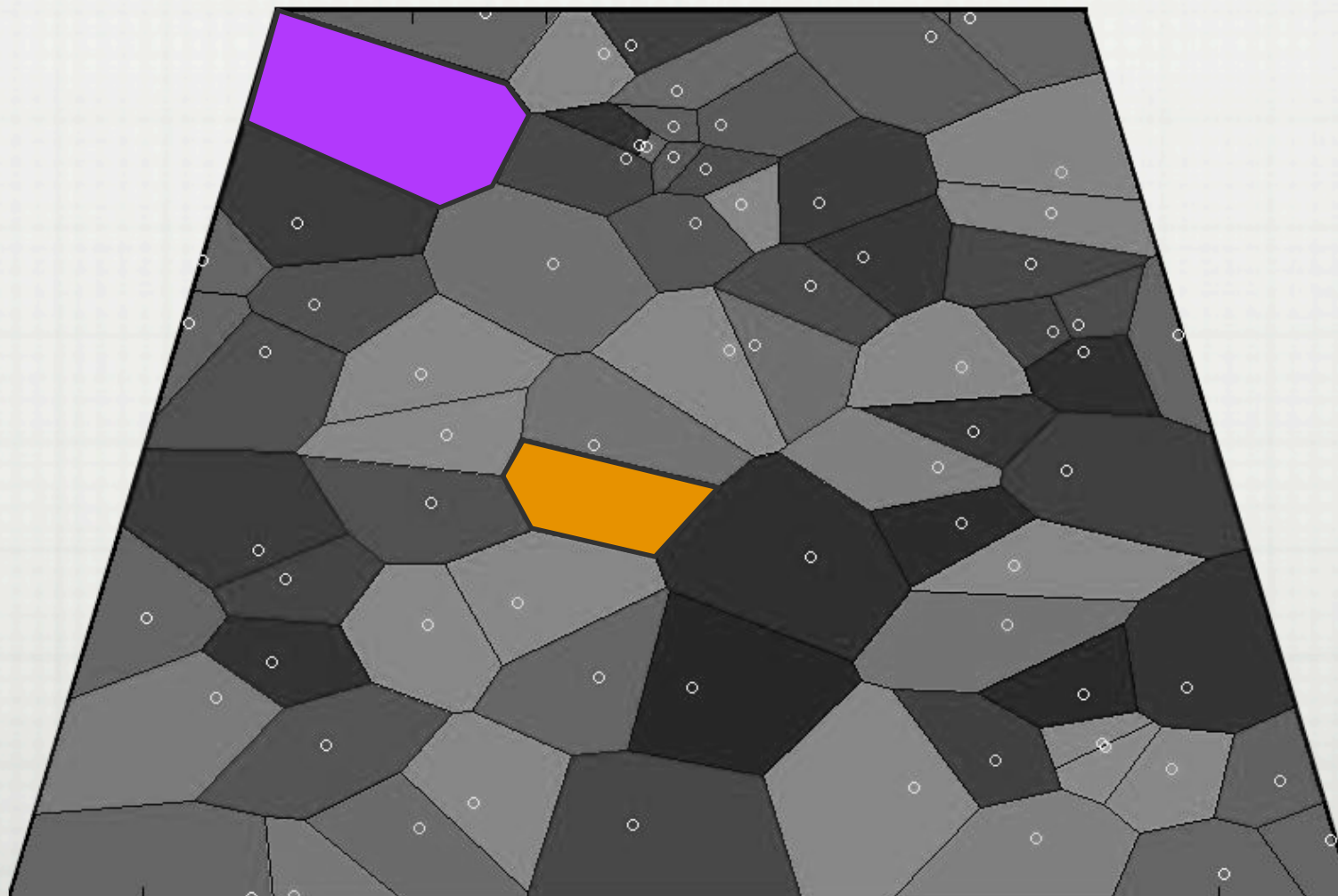




# WHAT NOW?

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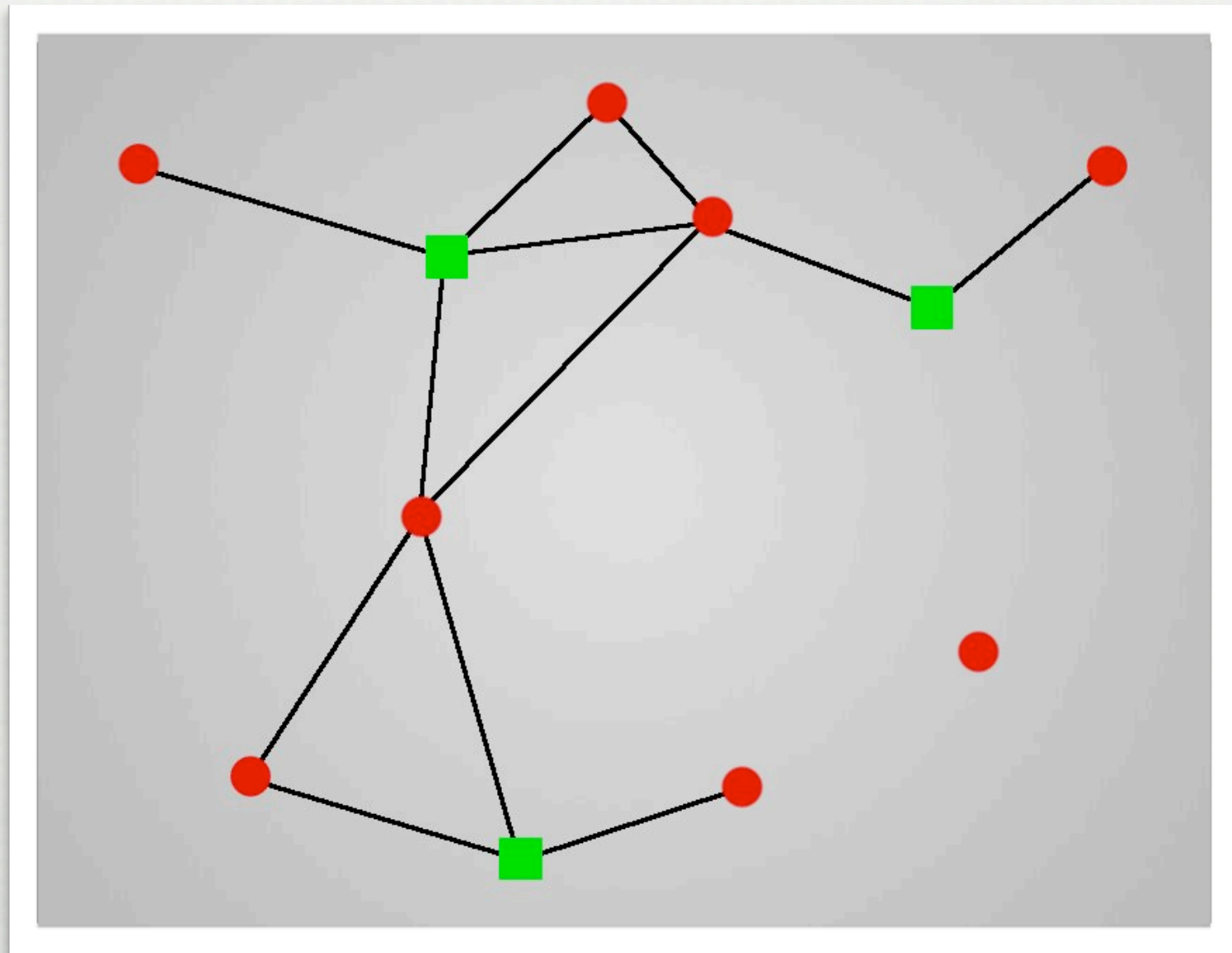
- RELAX LOCALITY & INCREASE INFORMATION SHARING







# ABSTRACTIONS & EXTENSIONS







THANK YOU







# A BATTLE OF WITS?

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