

# Ultra Wide Band Communications



University of Rome  
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School of  
Engineering

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# Practice 11

## Ranging and Positioning with UWB

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# Main objective

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- Study the accuracy of LSE positioning as a function of:
  - Ranging error
  - Number of reference nodes

## Exercise 1

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- Write a Matlab script that evaluates the average positioning error as a function of the ranging error variance

Parameter	Value
Simulation area	50x50 m <sup>2</sup>
Total number of nodes	10
Number of reference nodes	3
Ranging error variance $\sigma^2$	0:2:10
Number of iterations for each $\sigma^2$ value	5000

- Compare the results obtained when a) reference nodes and target are selected randomly at each iteration vs. b) they are selected once for each  $\sigma^2$
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## Exercise 2

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- Write a Matlab script that evaluates and plots the average positioning error as a function of the number of reference nodes  $N_{\text{ref}}$

Parameter	Value
Simulation area	50x50 m <sup>2</sup>
Number of topologies $N_t$	100
Total number of nodes	10
Number of reference nodes $N_{\text{ref}}$	[3:2:9]
Ranging error variance $\sigma^2$	[2, 8]
Number of iterations $N_i$ for each $(\sigma^2, N_{\text{ref}})$ combination	100

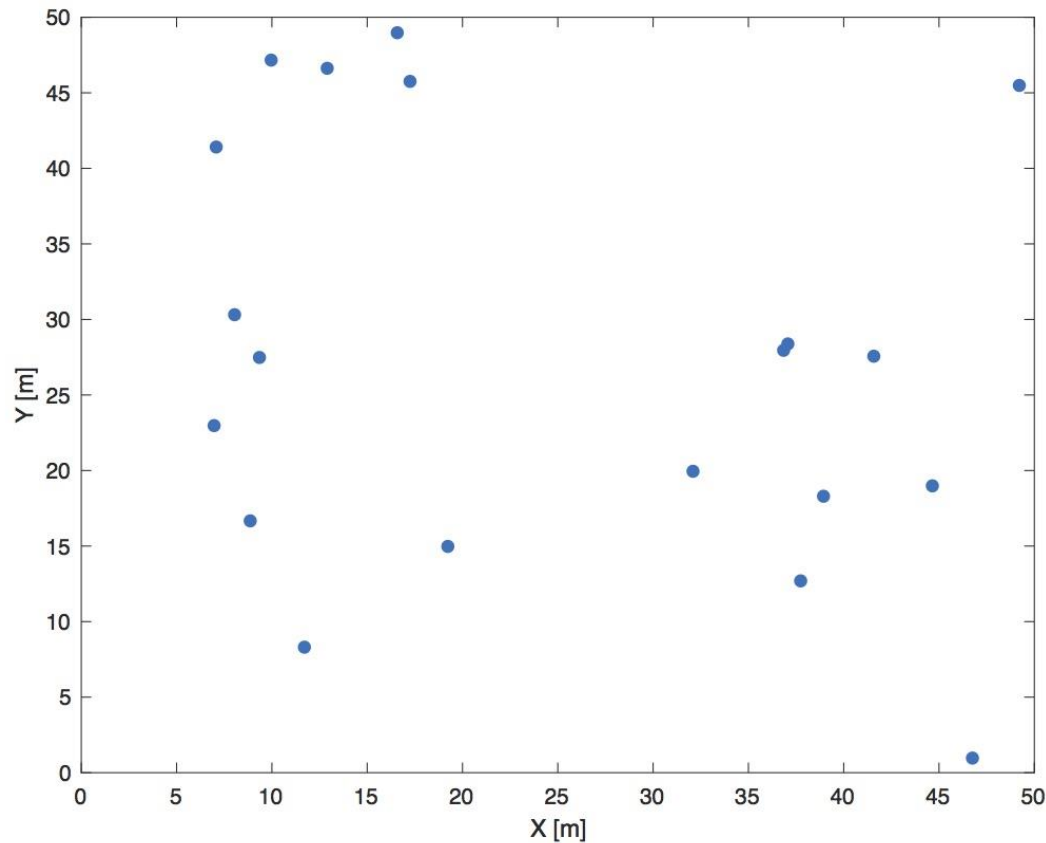
- What happens if one sets instead  $N_t=1$ ,  $N_i=10000$ ?

# Support functions

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function [positions, ranges] = create\_network(N, area\_side, G)

- Generates a network topology in a square area



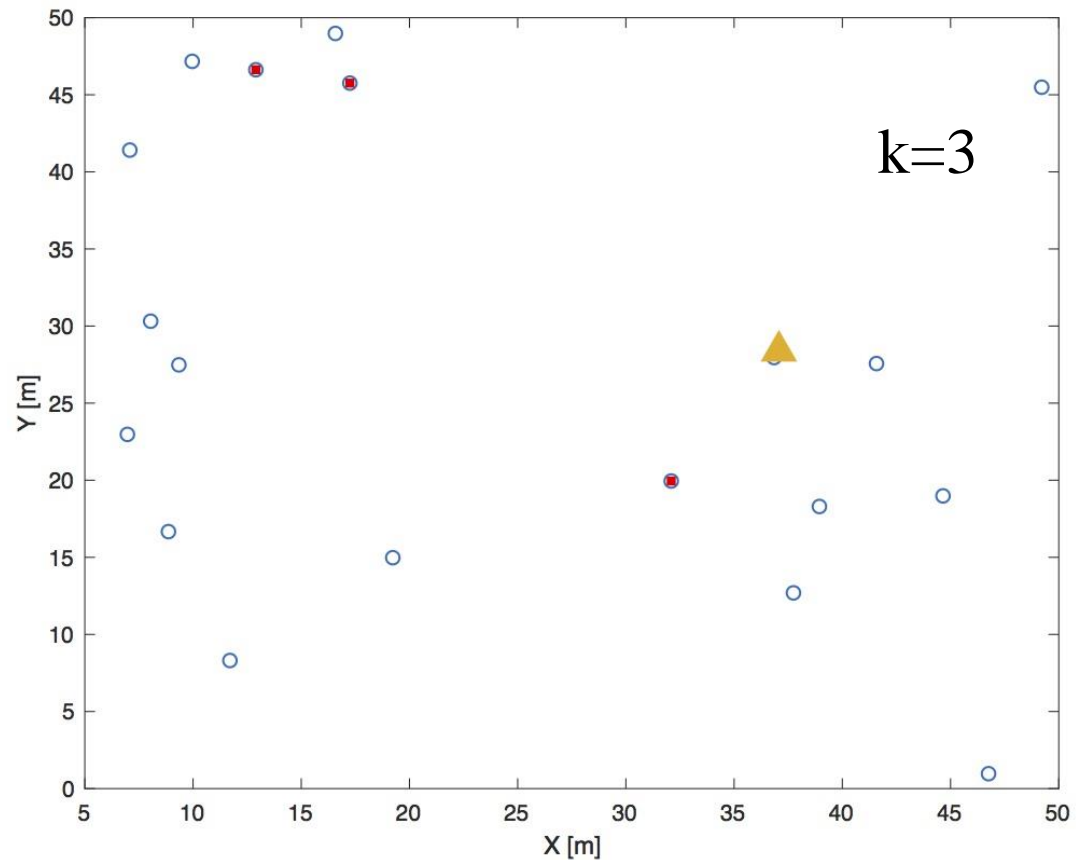
N=20  
area\_side=50

# Support functions

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function [Nx,Ref] = select\_nodes(N,k)

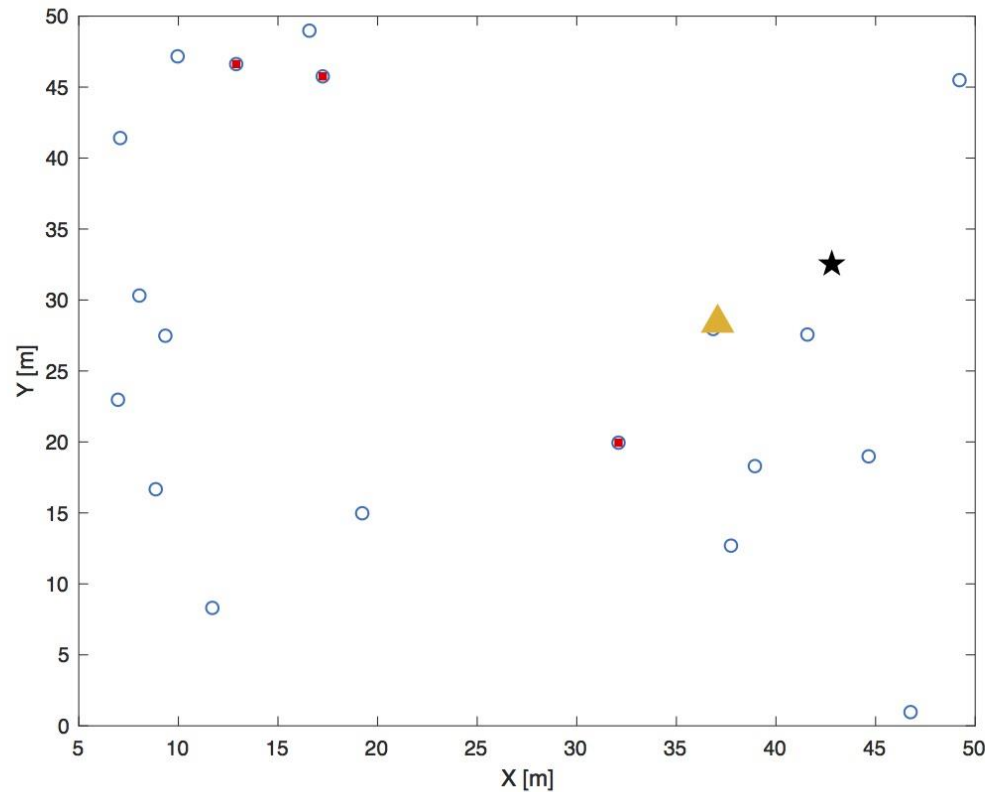
Selects a target node and a set of reference nodes out of N total nodes



# Support functions

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function [PosNx, ErrNx] = find_LSE_position(positions, ranges, Nx, Ref, sigma_2, G)
```

Estimates target position using LSE algorithm



sigma\_2=1