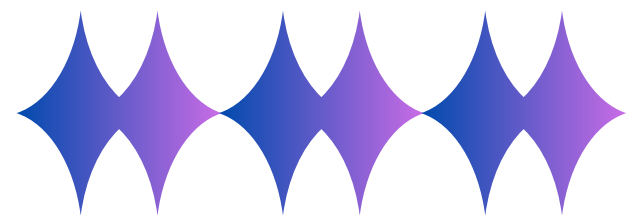


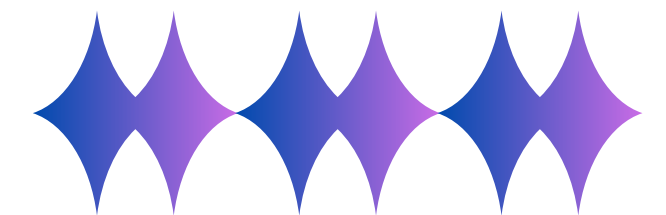
When Buildings Blur the Lines: Revealing the Hidden Performance Equivalences in MANET Routing Protocols



Hugo Le Dirach^{*✦}
Ph.D. student at ONERA
Supervised by Ph.D. Boyer^{*} and Ph.D. Lochin[✦]

^{*} DTIS, ONERA, Université de Toulouse

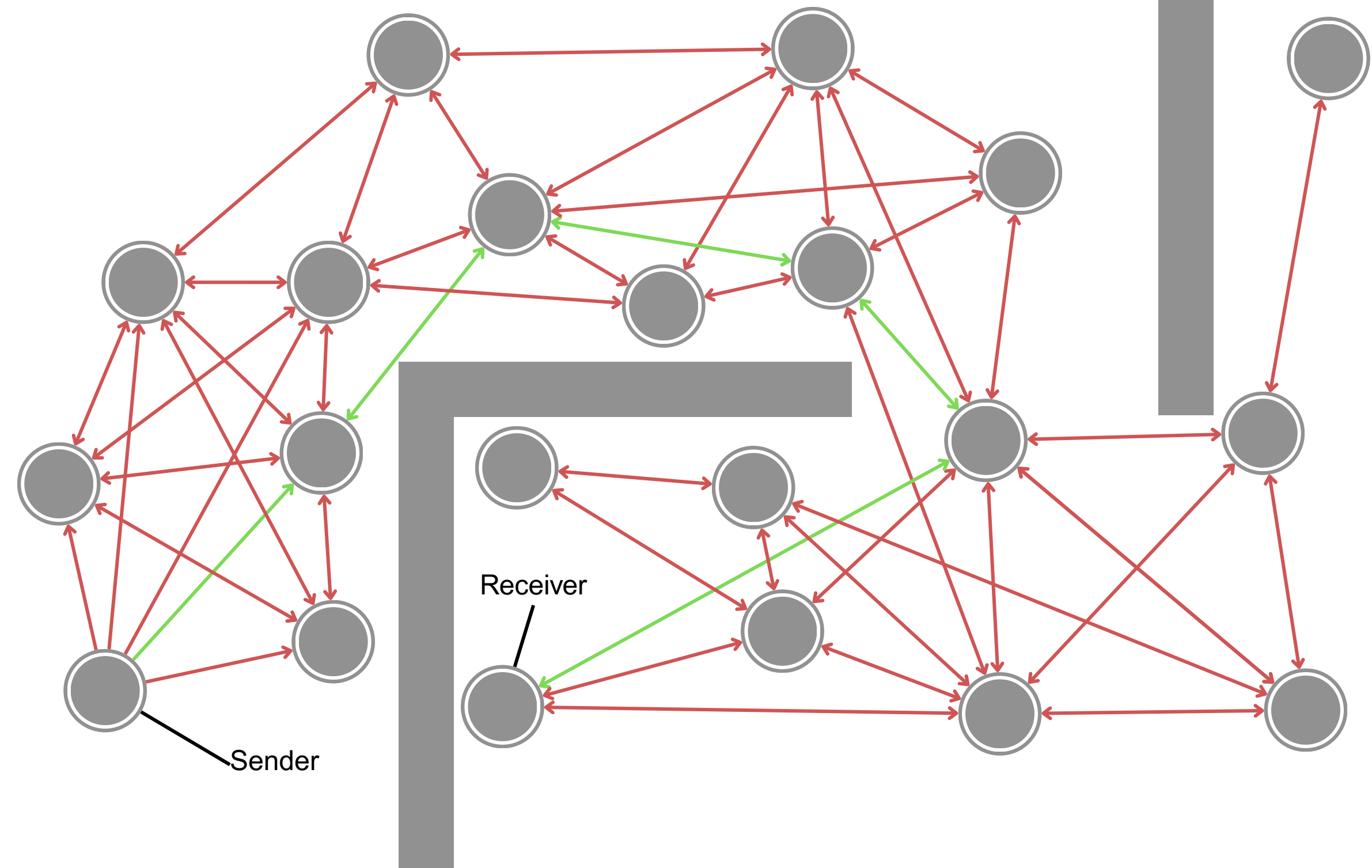
[✦] Fédération ENAC ISAE-SUPAERO ONERA, Université de Toulouse



Mobile Ad-hoc Networks

Mobile Ad-hoc Networks

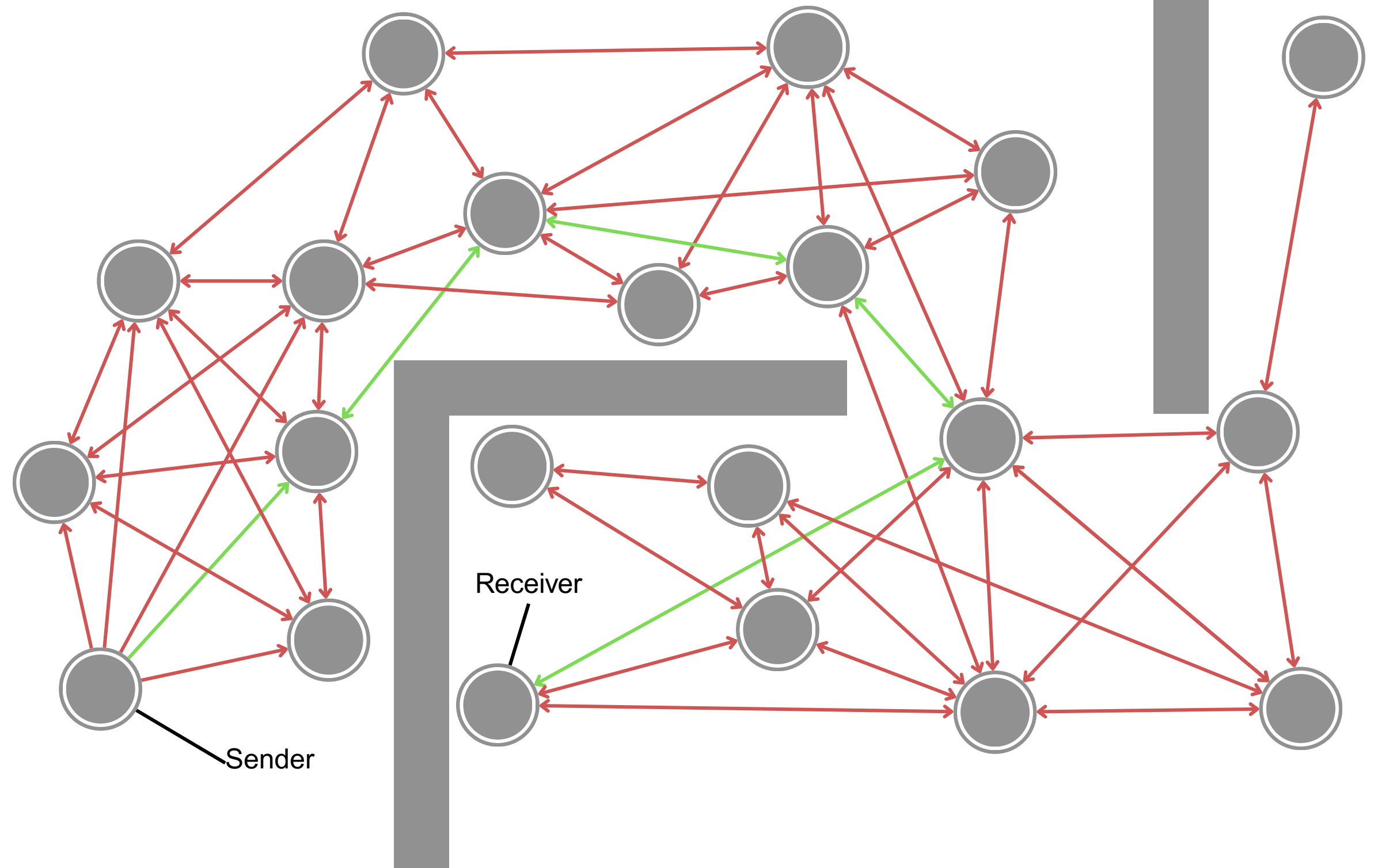
Wireless network



When Buildings Blur the Lines

Mobile Ad-hoc Networks

Wireless network
Infrastructureless

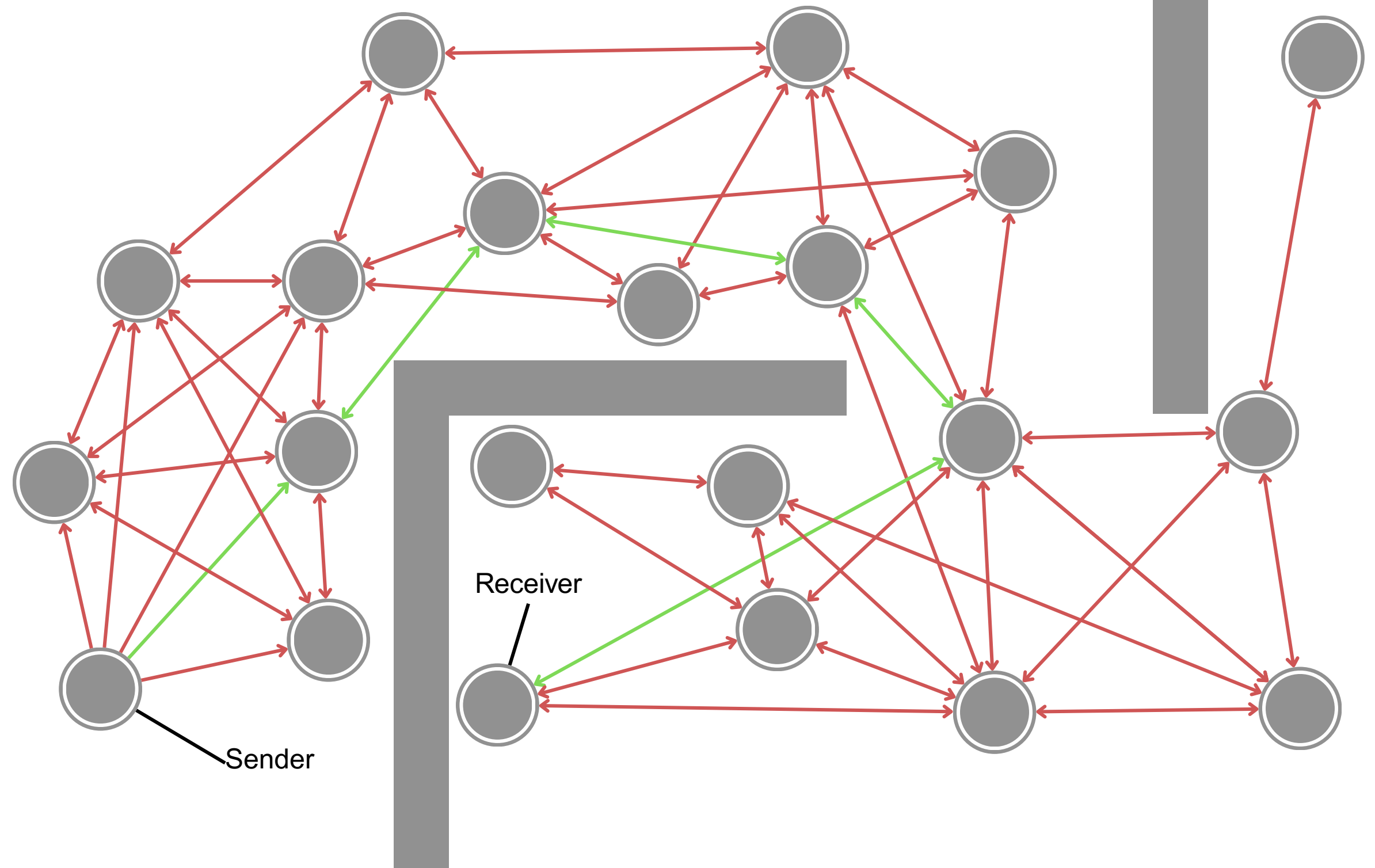


Mobile Ad-hoc Networks

Wireless network

Infrastructureless

Self-configuring



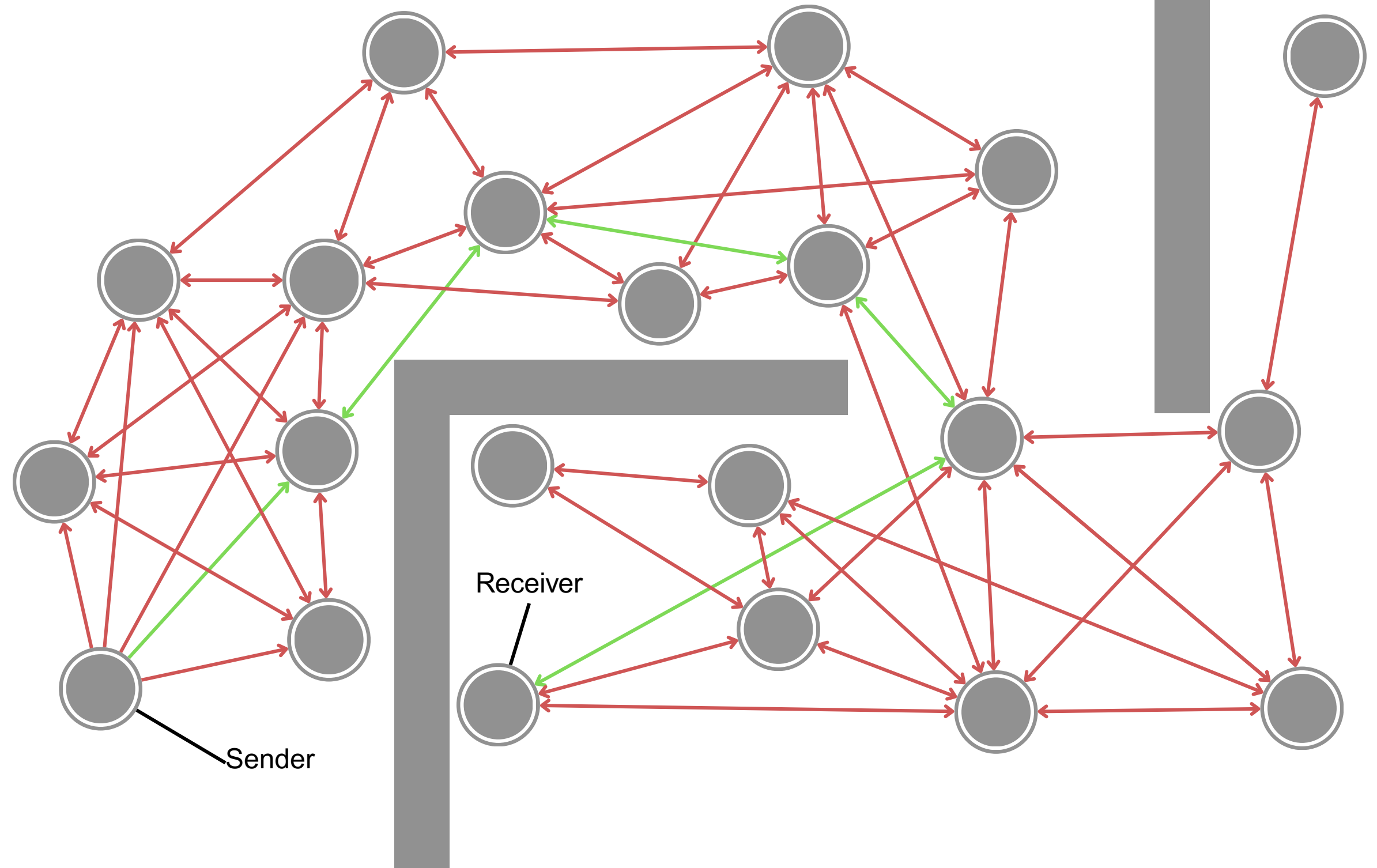
Mobile Ad-hoc Networks

Wireless network

Infrastructureless

Self-configuring

Self-healing



Performance evaluations in urban settings *must* use a building aware loss model

I. Performance evaluations results can not be compared and do not use proper loss models

71%

Among 35 papers on routing algorithm performance evaluations, 71% use ns-3

ns-3

I. Performance evaluations results can not be compared and do not use proper loss models

0 %

Have common set up

I. Performance evaluations results can not be compared and do not use proper loss models

38 %

Explicitly give the loss model used

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0 %

**Use models that take
obstacles into account**

I. Performance evaluations results can not be compared and do not use proper loss models

71 %

of 28 papers on routing algorithm
performance evaluations are done with

$n_s - 3$

0 %

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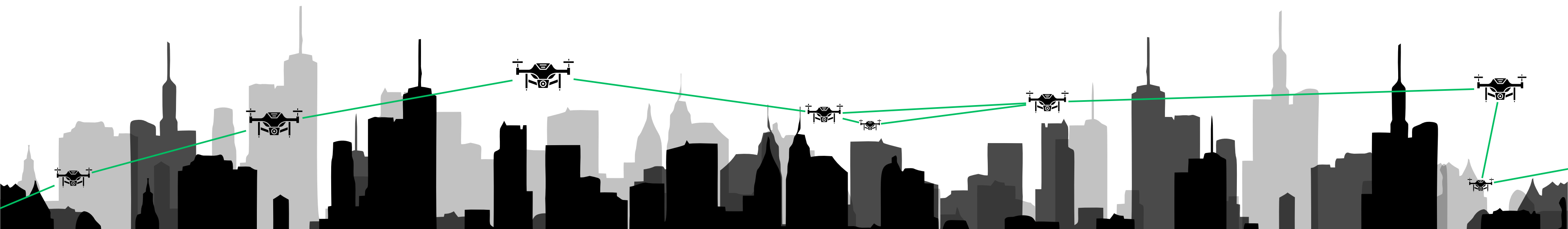
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0 %

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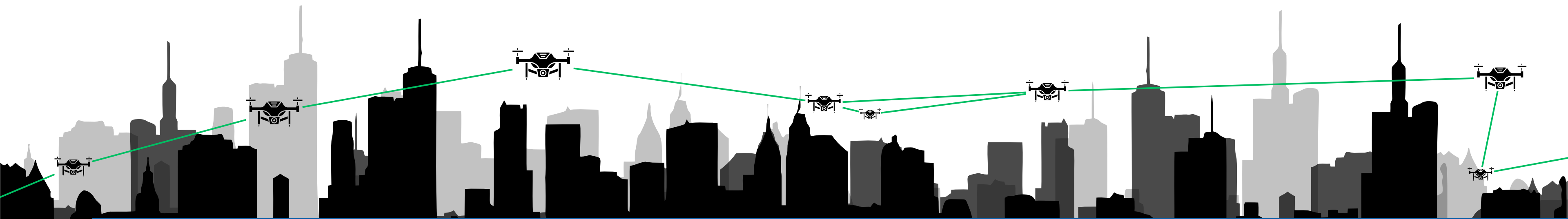
Summary

I. Performance evaluations results can not be compared and do not use proper loss models



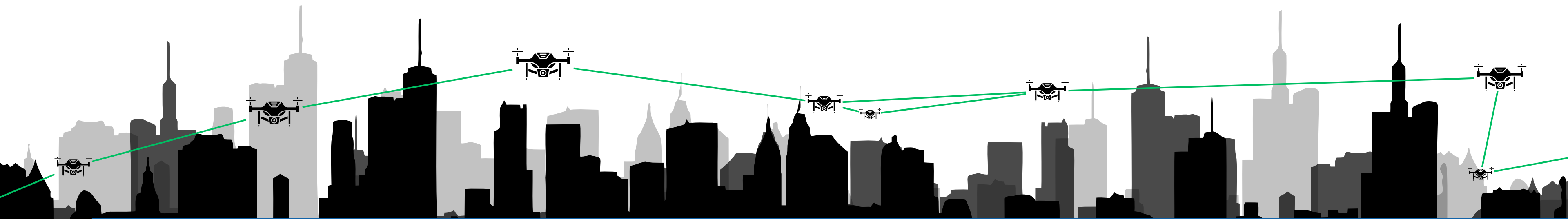
Summary

- I. Performance evaluations results can not be compared and do not use proper loss models
- II. Why propagation models matter? Connectivity!**



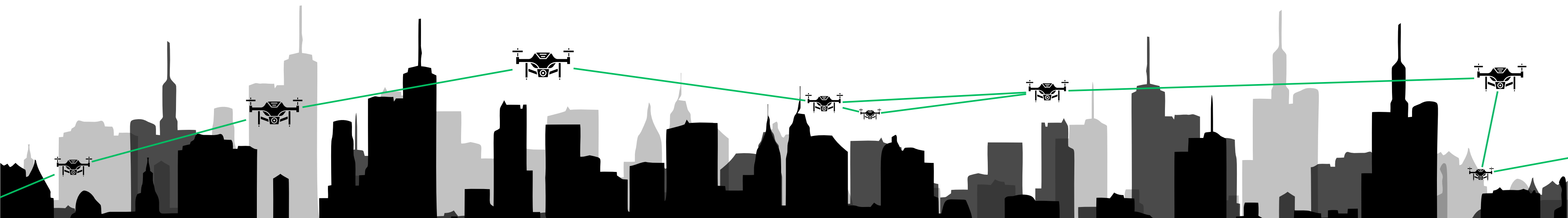
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- III. Simulation set-up**



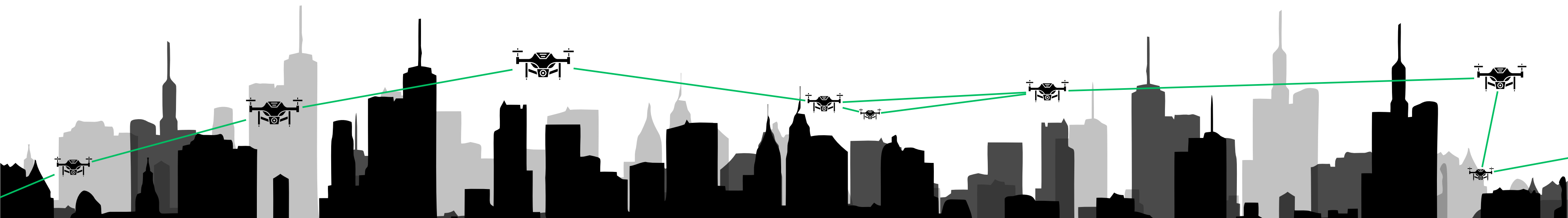
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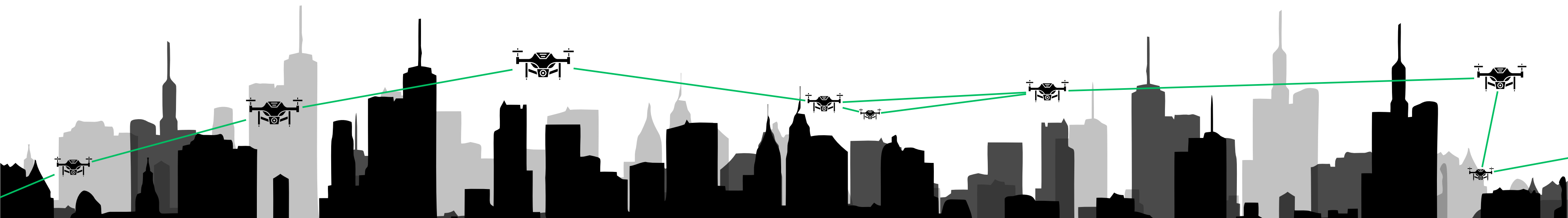
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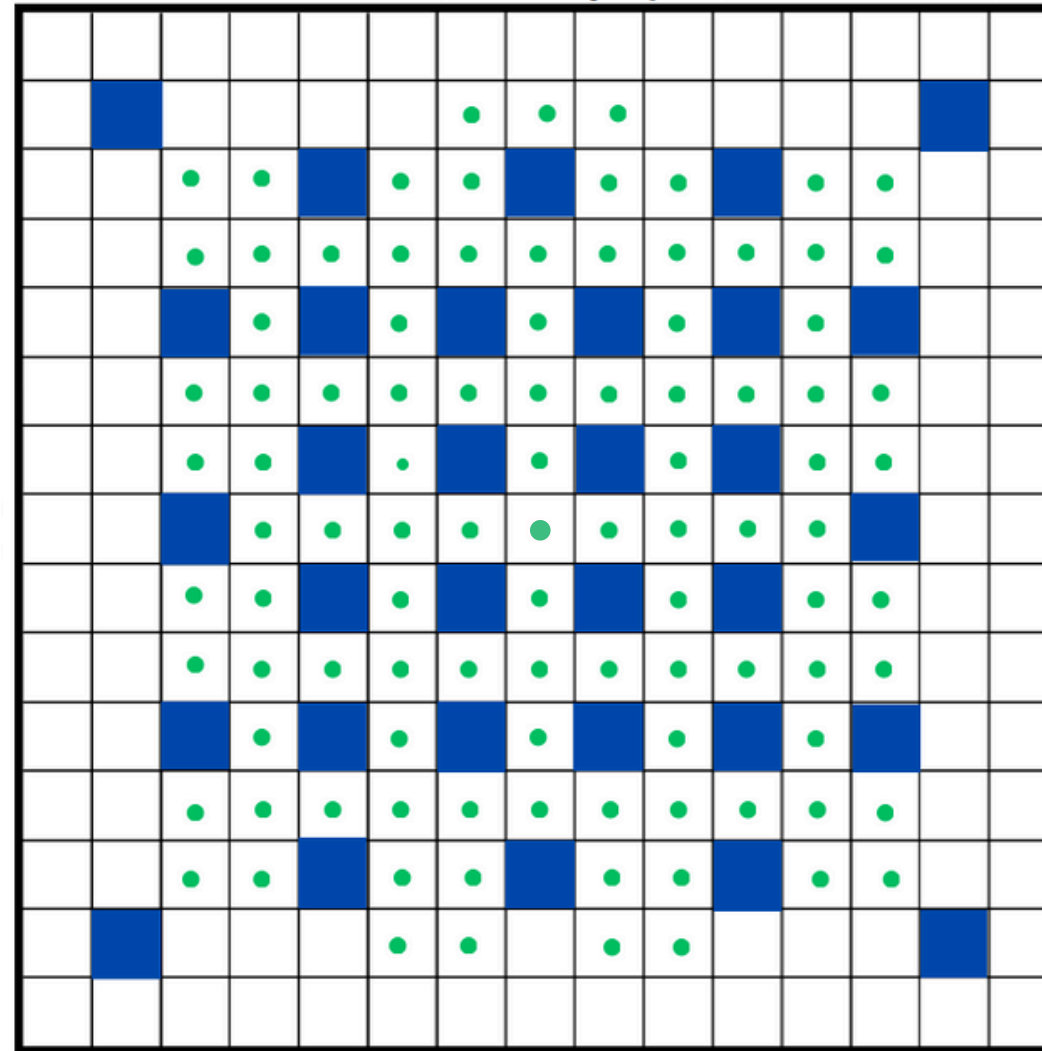
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- I. Performance evaluations results can not be compared and do not use proper loss models
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- VI. What now ?



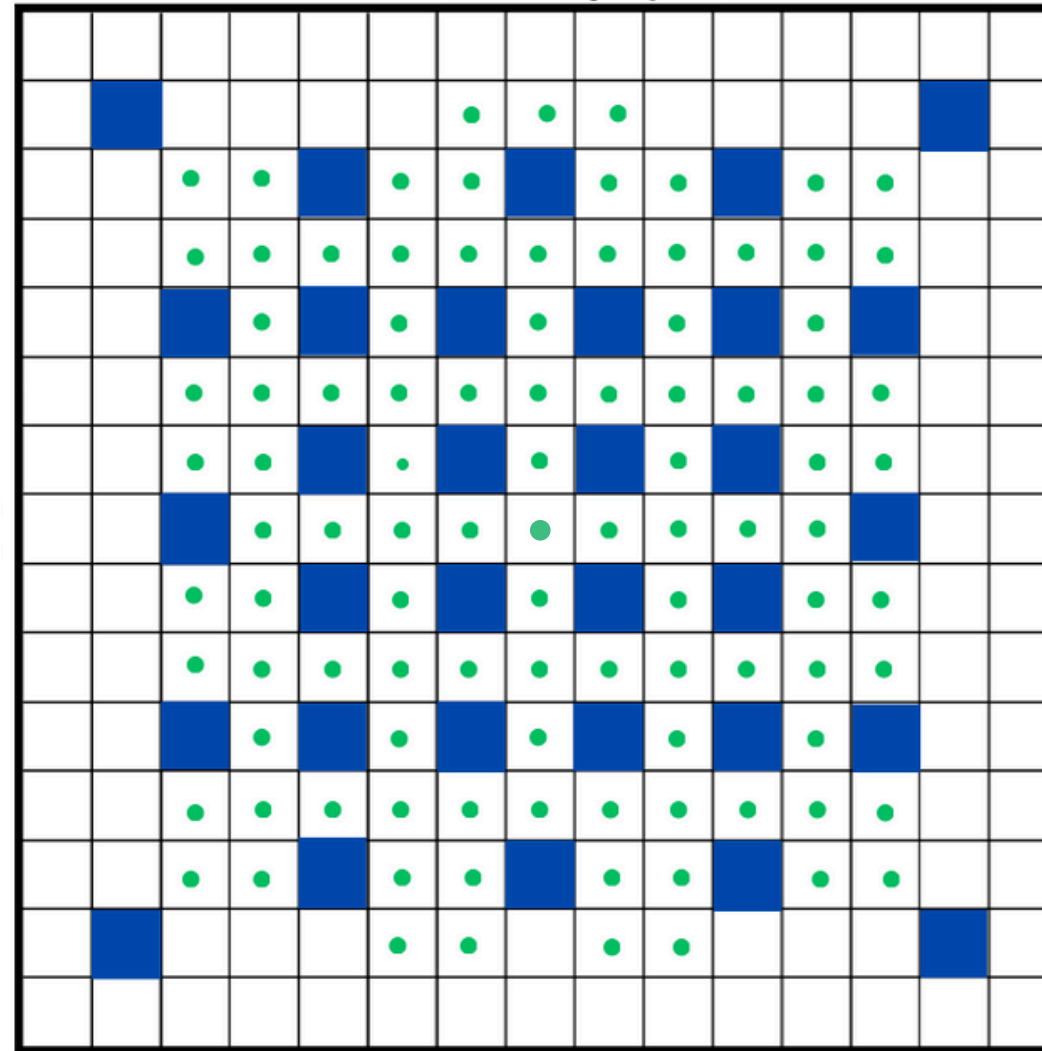
II. Why propagation models matter? Connectivity!

Taking a simple example



II. Why propagation models matter? Connectivity!

Taking a simple example

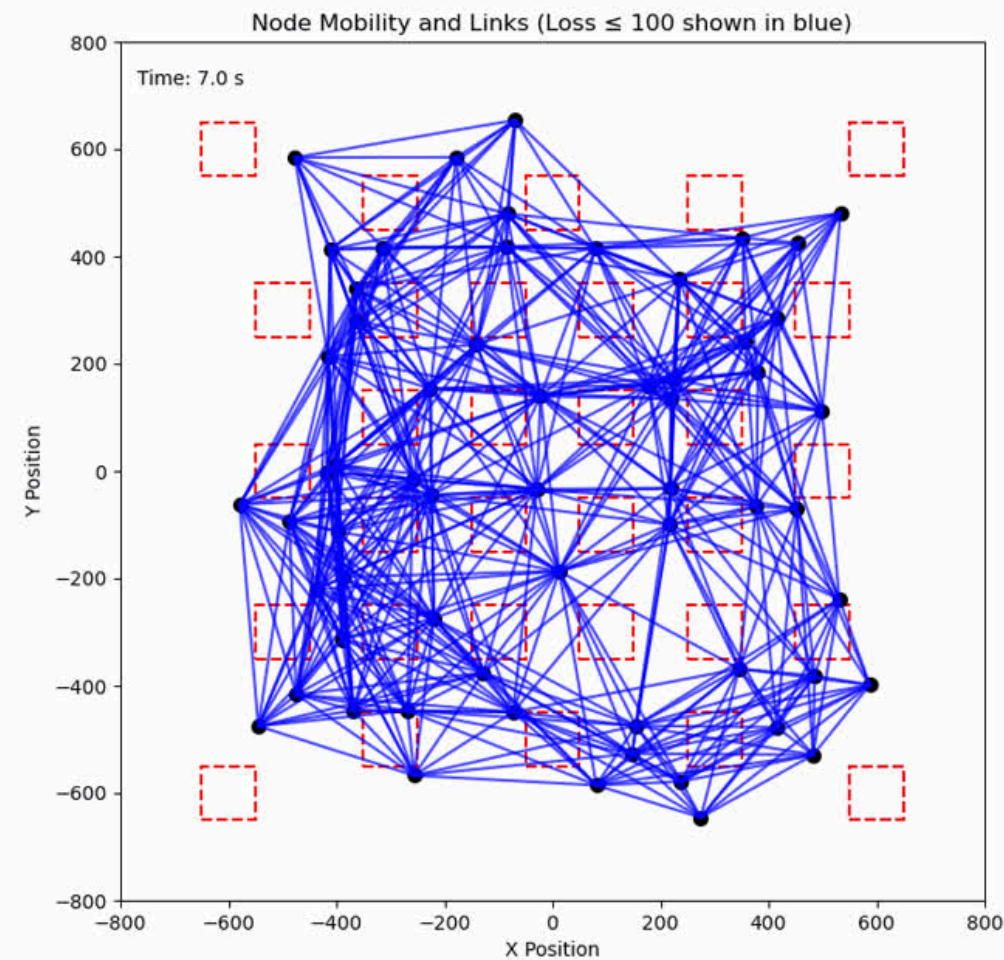


+ Random walk

● Nodes ■ Buildings

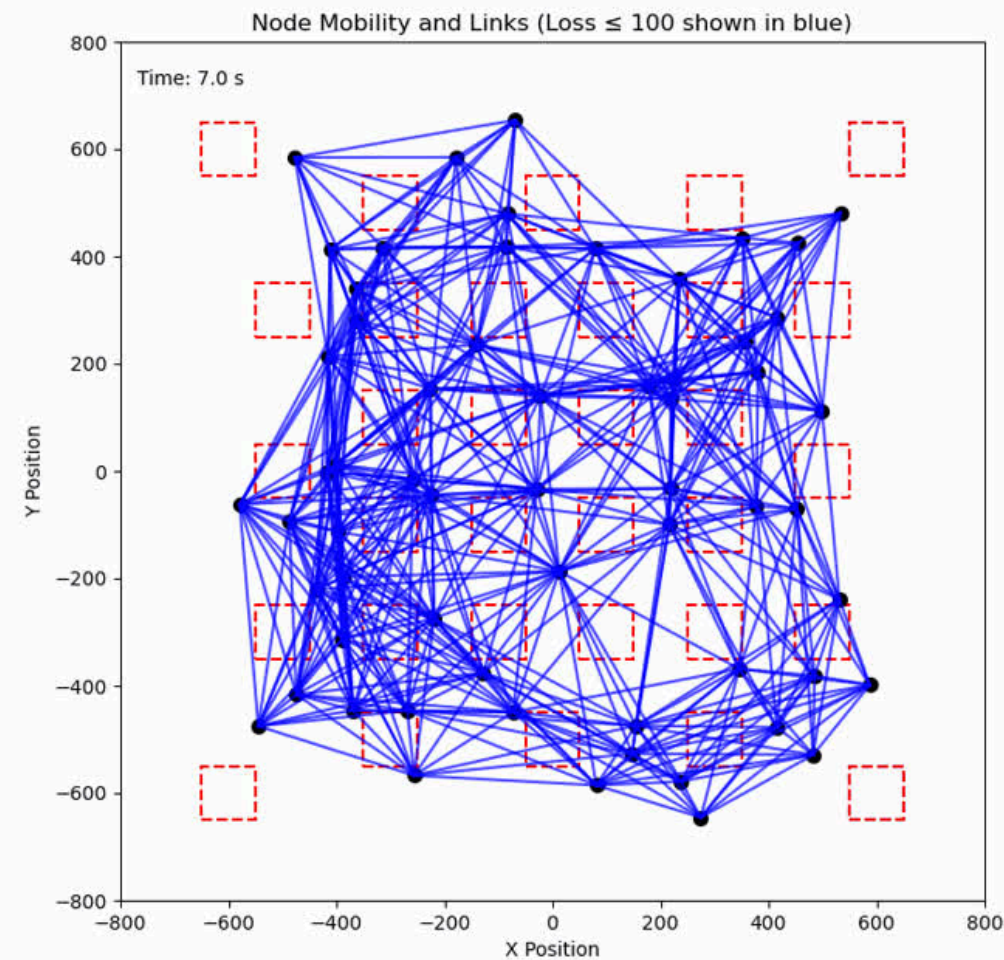
II. Why propagation models matter? Connectivity!

Connectivity with open-field loss model

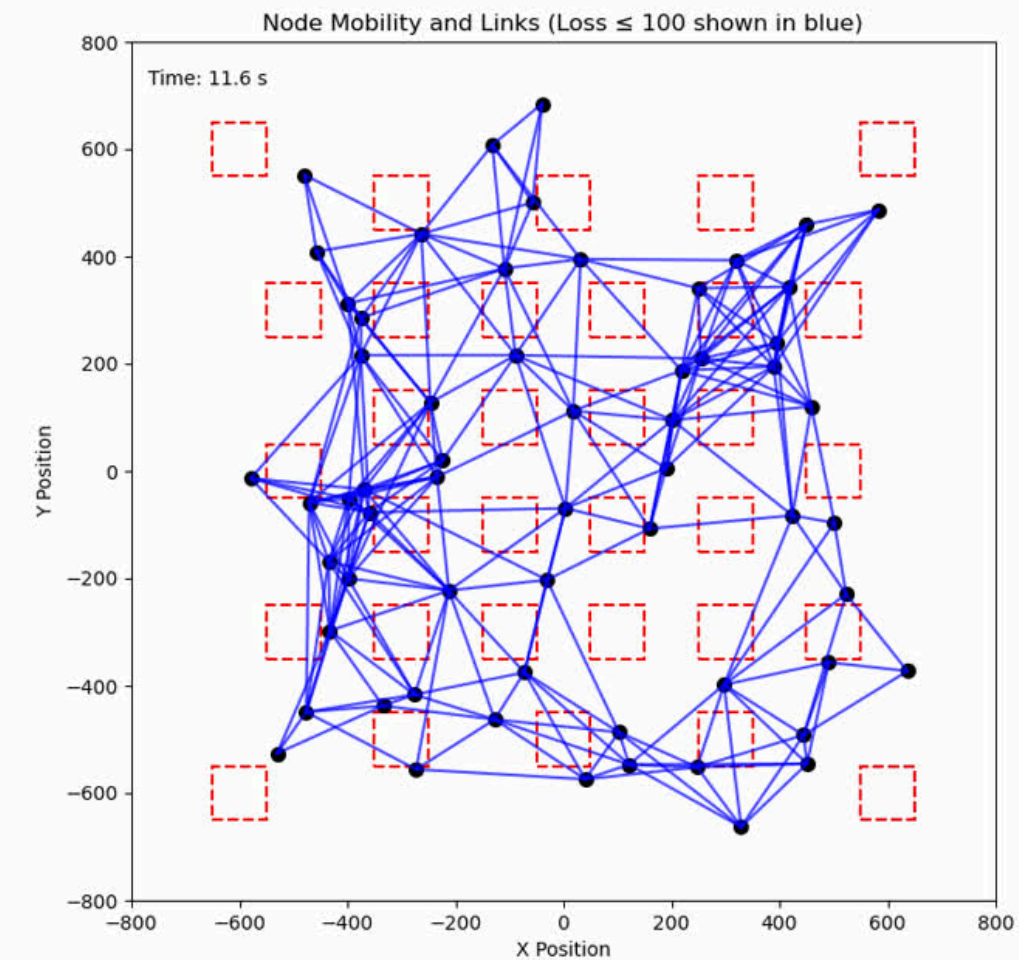


II. Why propagation models matter? Connectivity!

Connectivity with open-field loss model



Connectivity with building-aware loss model



Simulation set-up

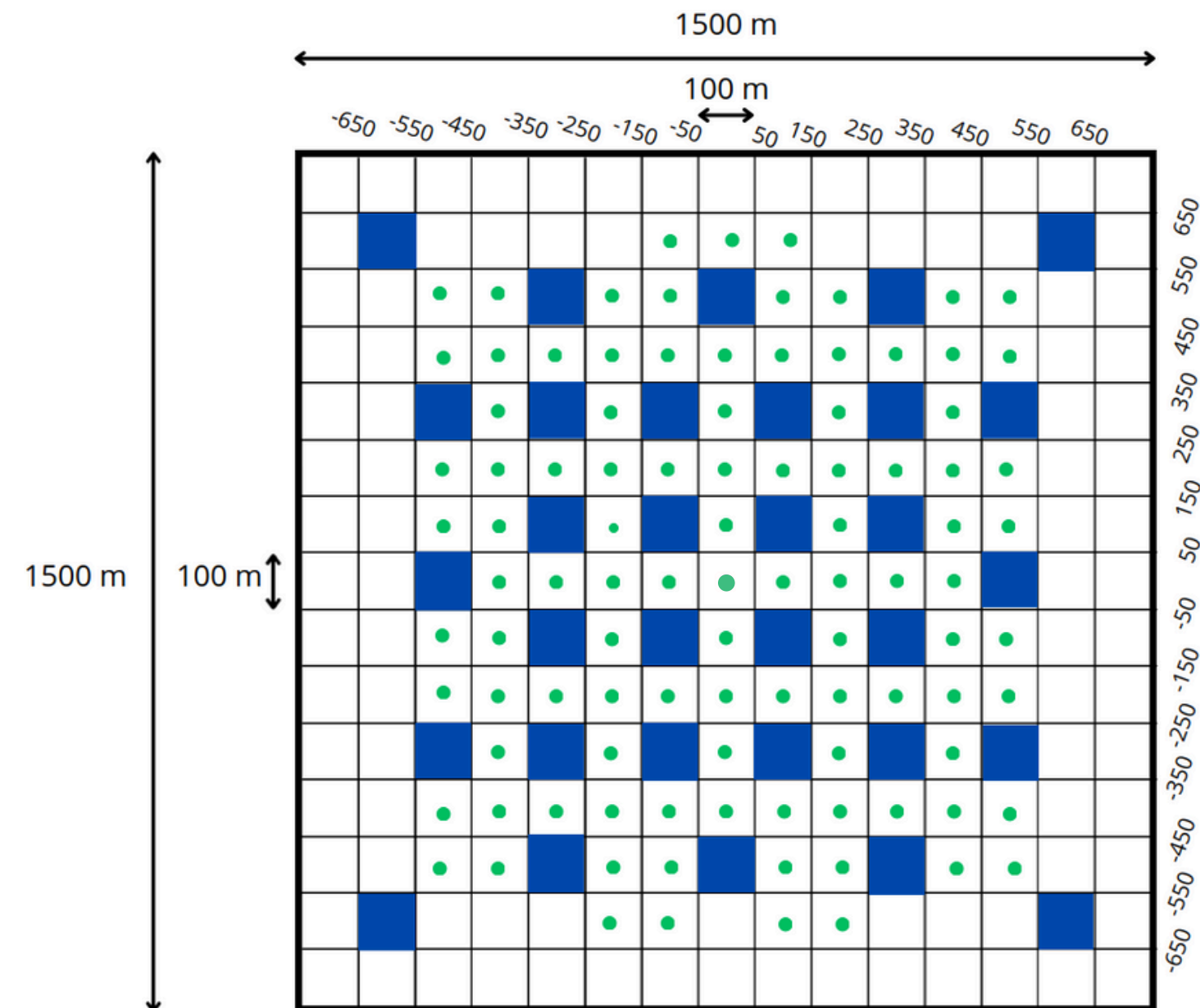
III. Simulation Set-Up

What's the plan?

What's the plan?

**Test AODV, OLSR and DSDV with
open field **vs** buildings aware
loss models**

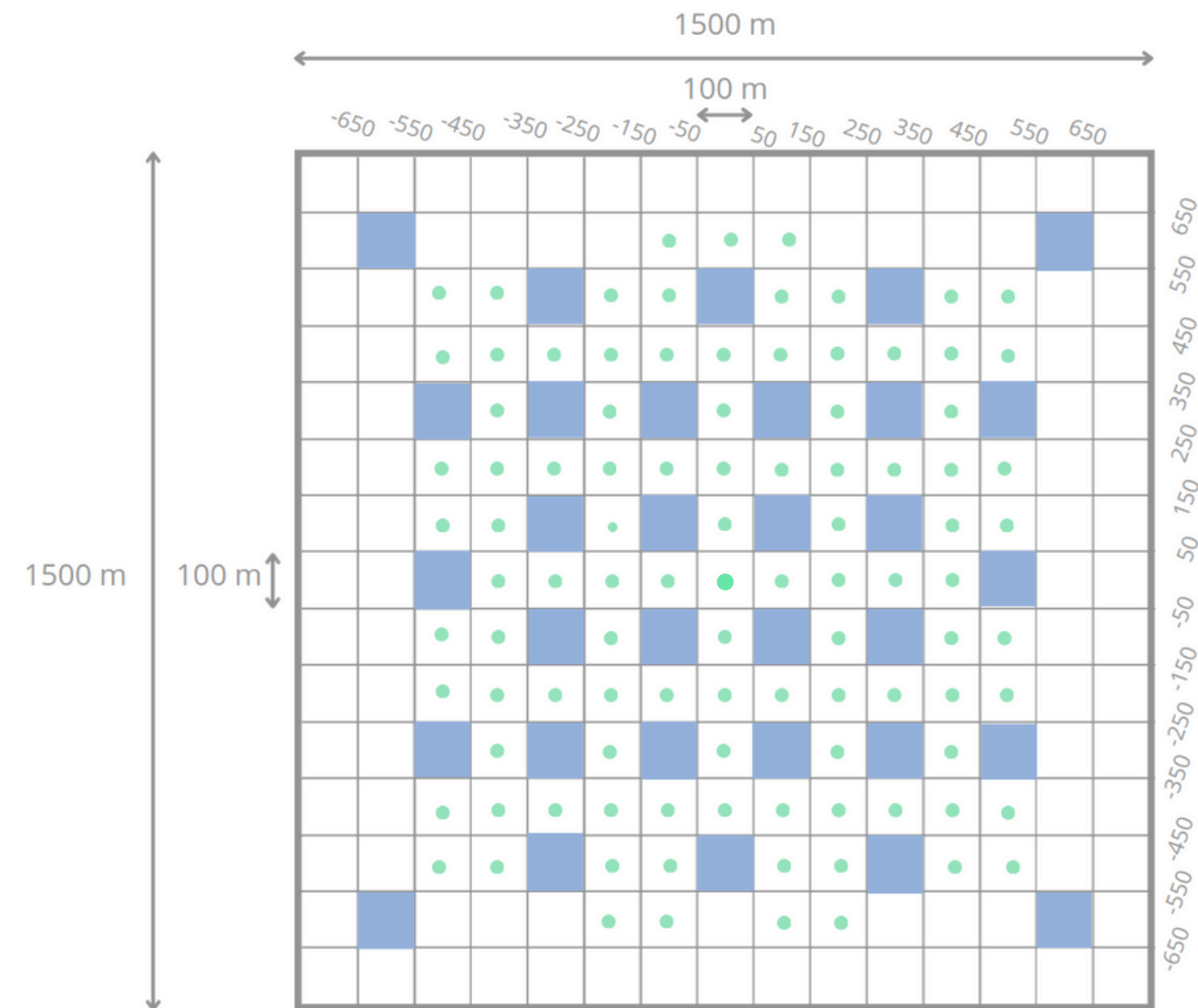
III. Simulation Set-Up



● Nodes ■ Buildings

III. Simulation Set-Up

Parameters



● Nodes ■ Buildings

Metrics

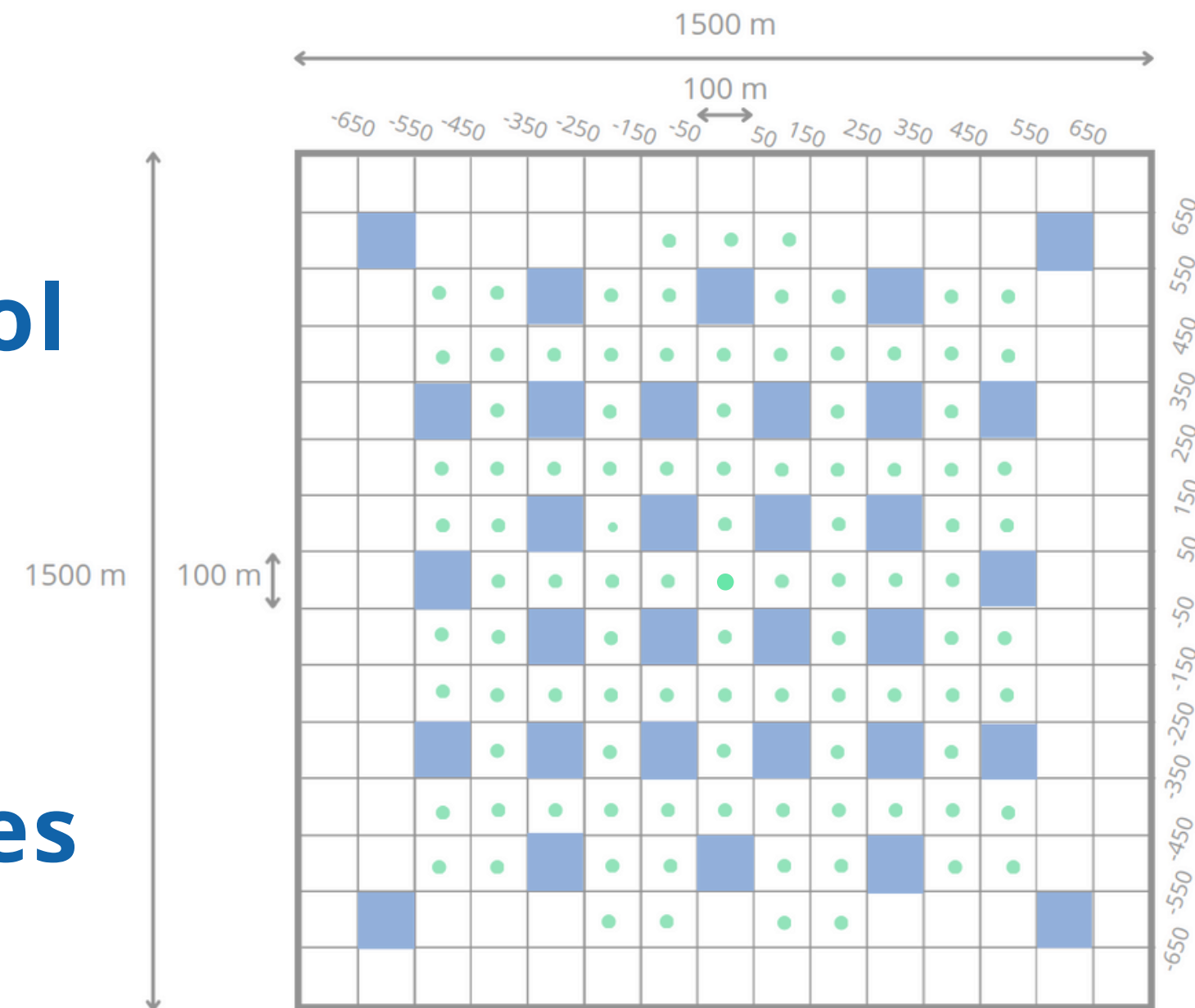
III. Simulation Set-Up

Parameters

Routing Protocol

Loss model

Number of nodes



● Nodes ■ Buildings

Metrics

III. Simulation Set-Up

Parameters

Routing Protocol

Loss model

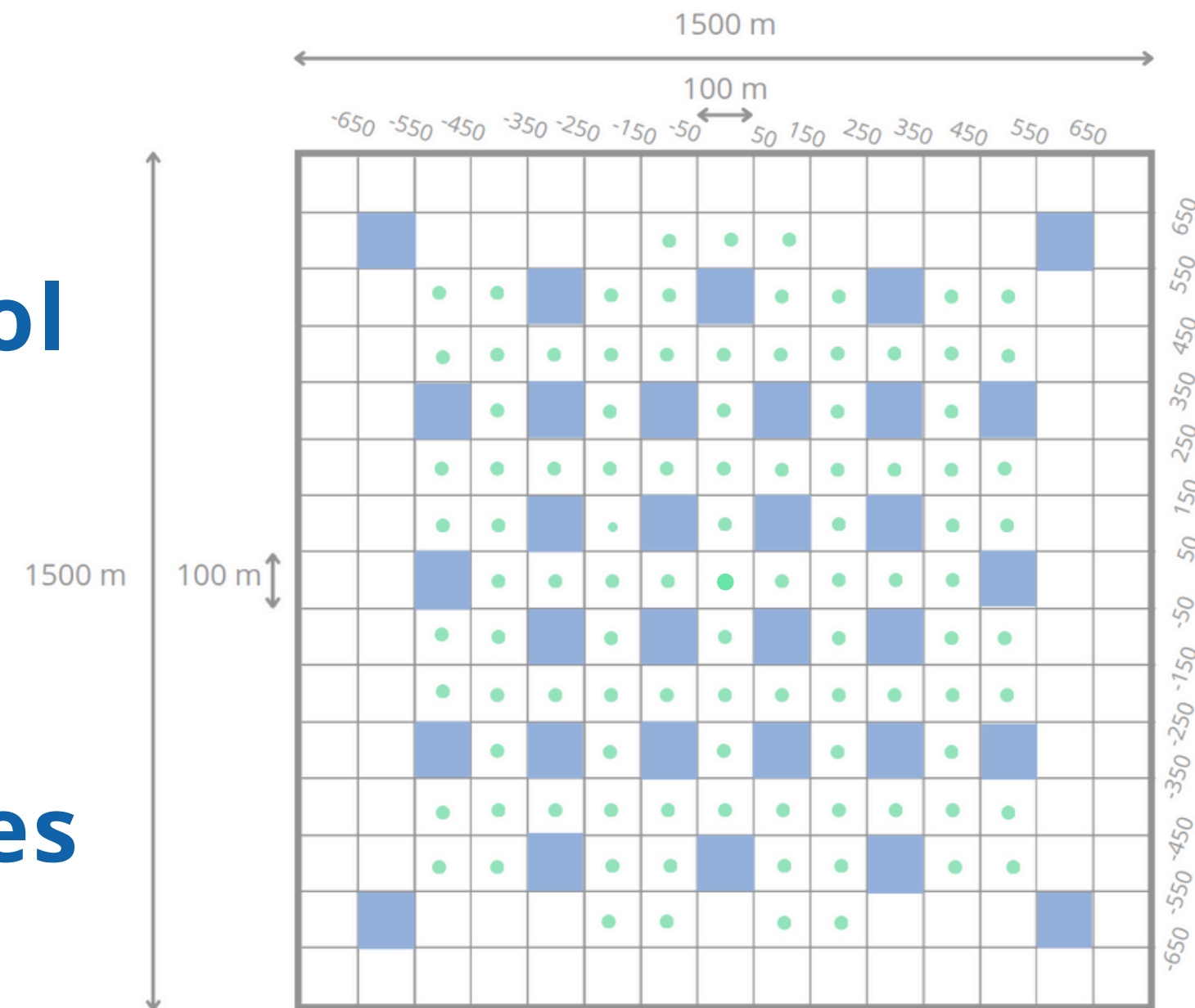
Number of nodes

Metrics

Packet Delivery Ratio
(PDR)

End-to-End Delay
(EED)

Goodput



● Nodes ■ Buildings

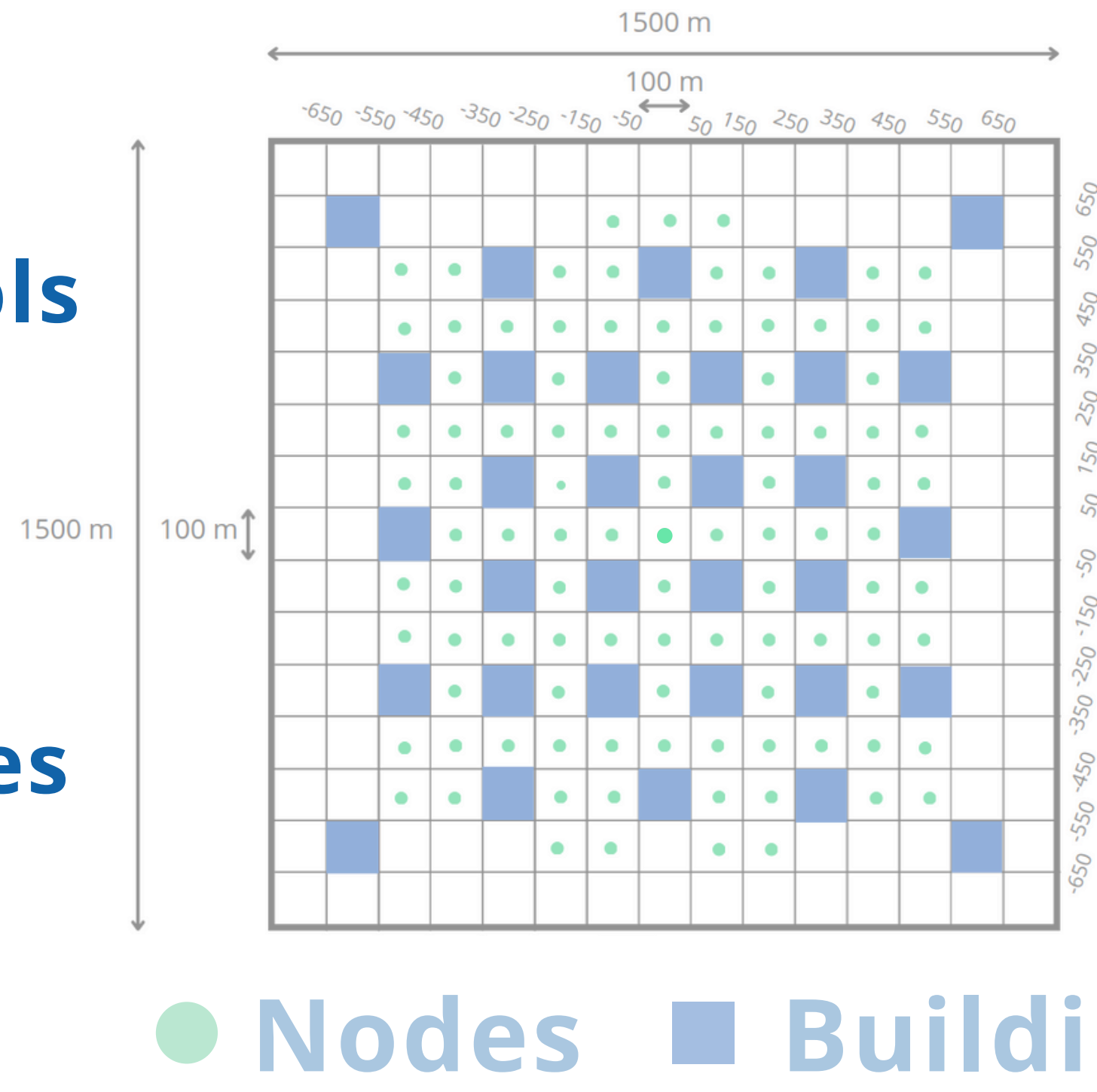
III. Simulation Set-Up

Parameters

Routing Protocols

Loss models

Number of nodes



Metrics

Packet Delivery Ratio
(PDR)

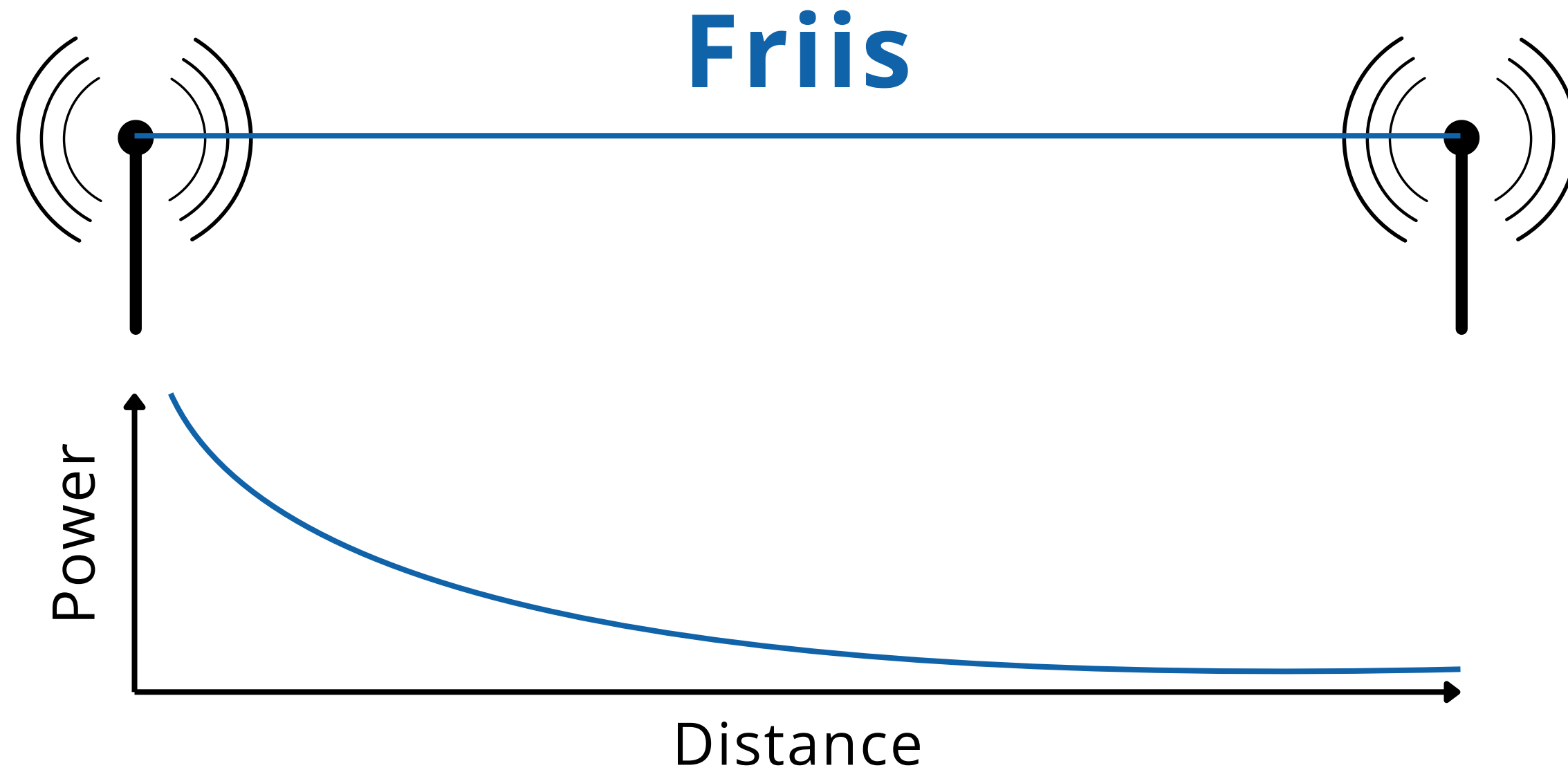
End-to-End Delay
(EED)

Goodput
(Applicative throughput)

Route Acquisition Time
(RAT)

Routing Overhead
(RO)

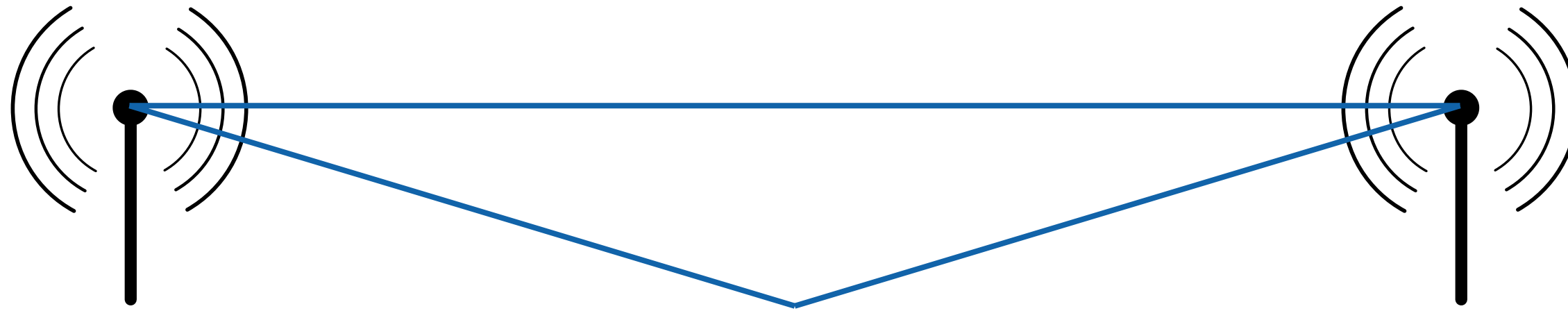
III. Simulation Set-Up



Loss is calculate following a log function on distance

III. Simulation Set-Up

2 Ray Ground



**Friis as a base
plus taking the ground in account**

III. Simulation Set-Up

ITU-R P.1411

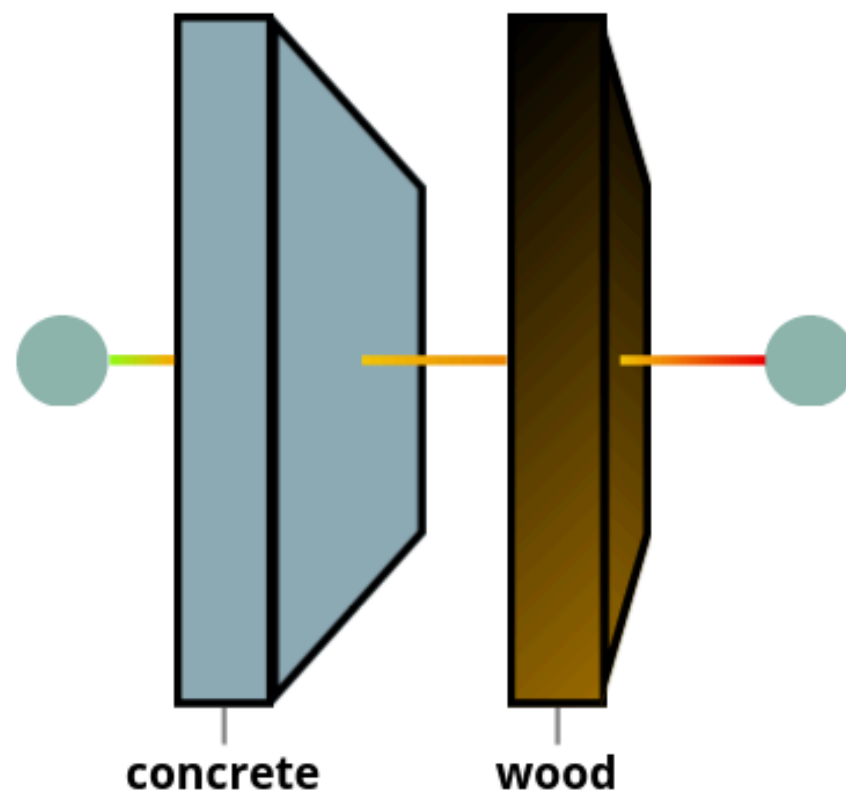
**Based on measurement giving recommendation on
path loss in given standard scenario**

III. Simulation Set-Up

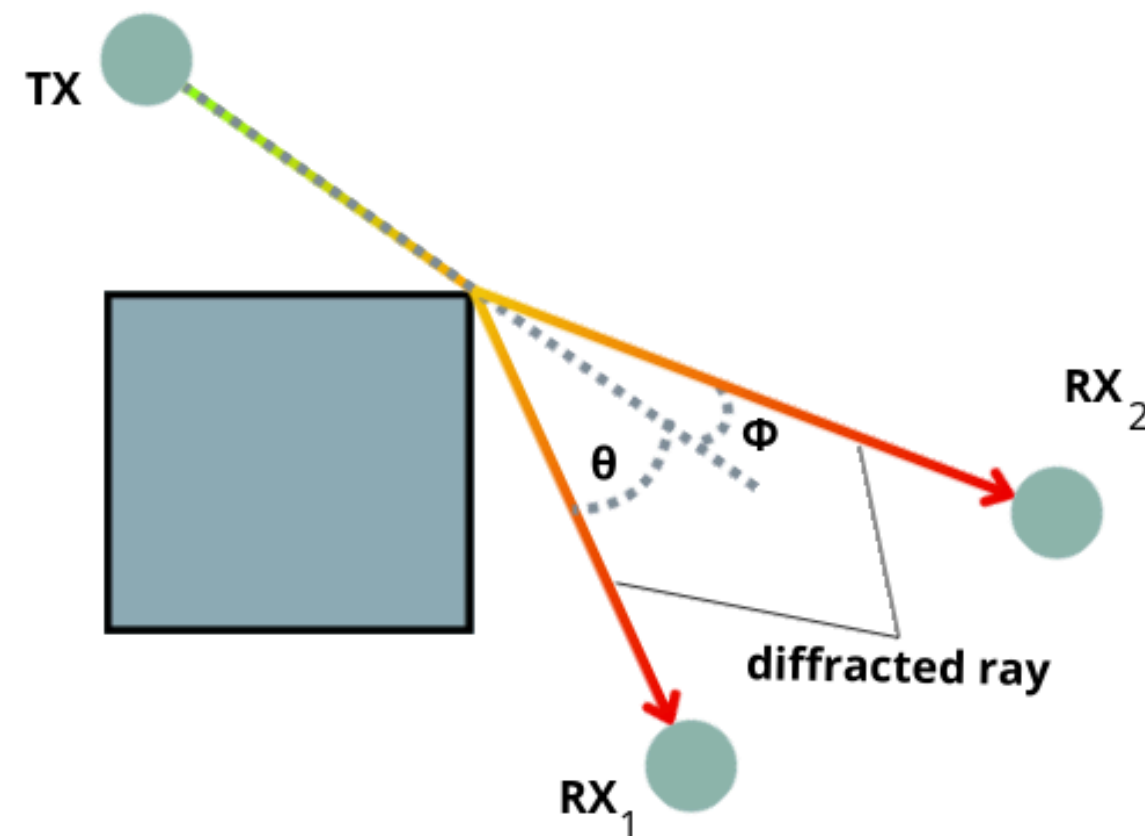
FOBA

Dominant path model

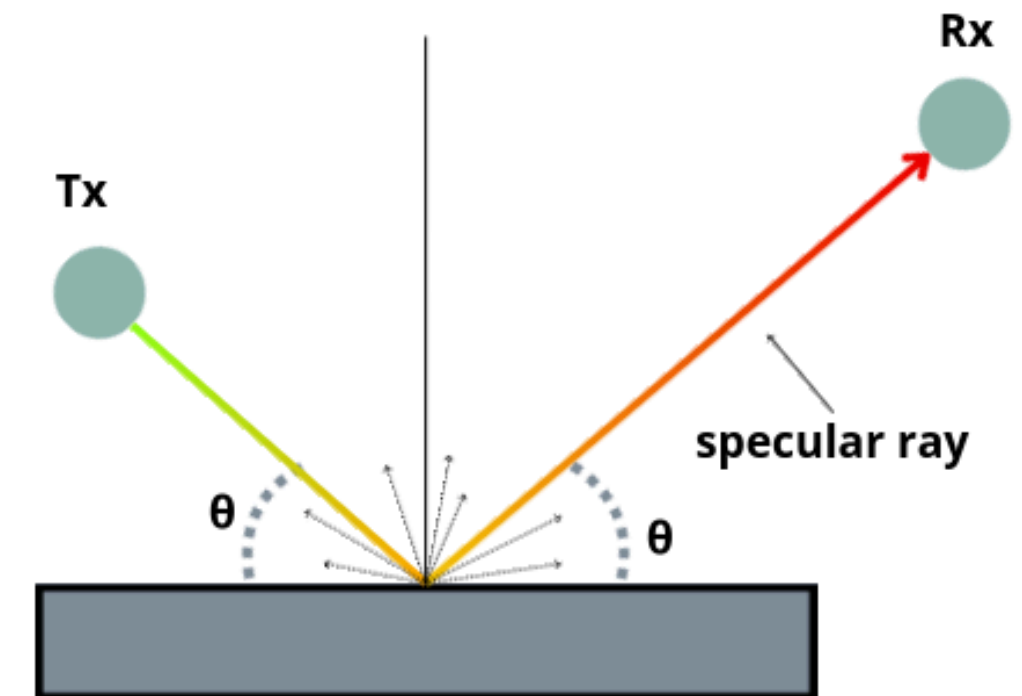
Penetration



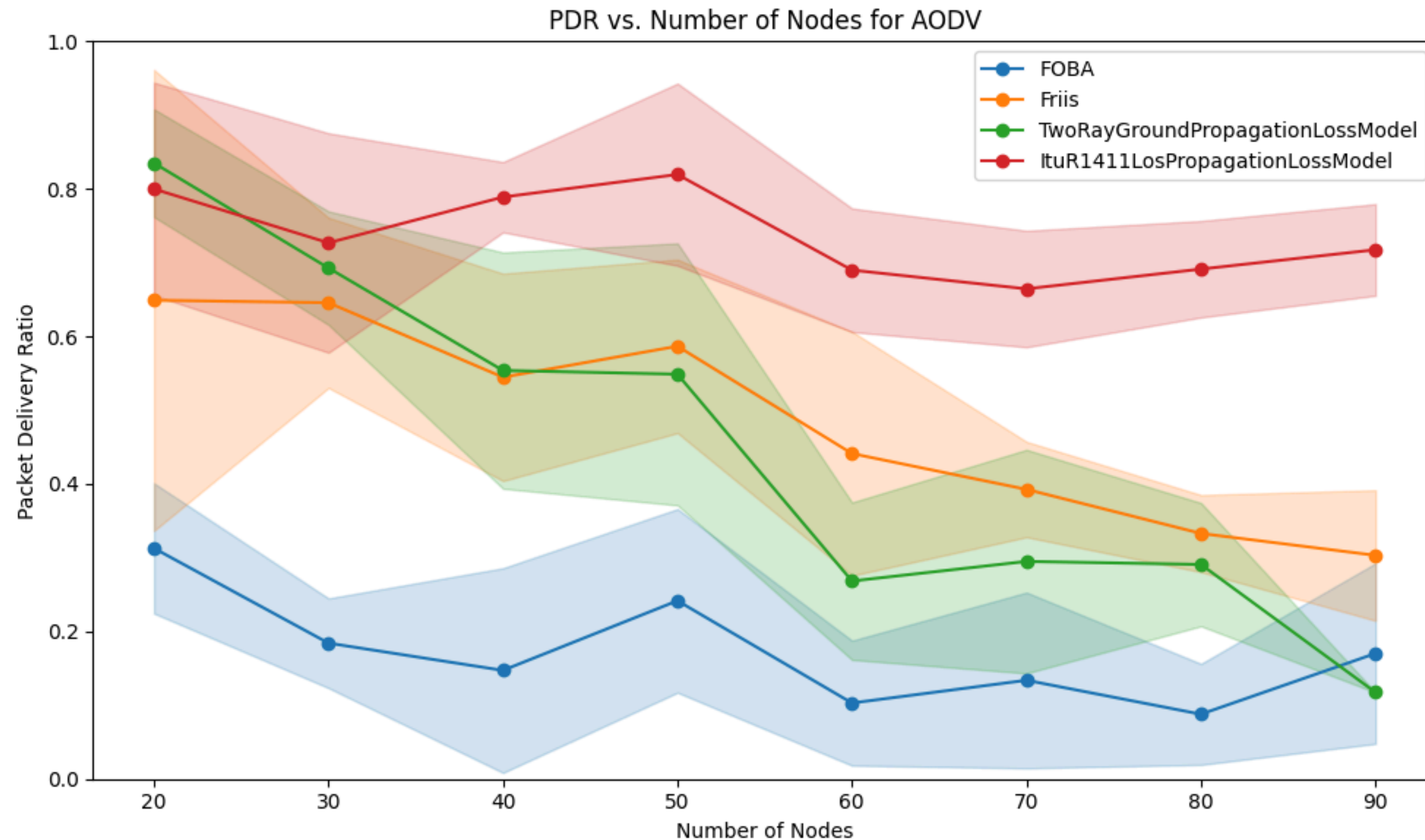
Diffraction



Reflection



VI. Monotonicity is questionable as results are clear: the difference is blurry



VI. Monotonicity is questionable as results are clear: the difference is blurry

	AODV	DSDV	OLSR
--	-------------	-------------	-------------

PDR

GoodPut

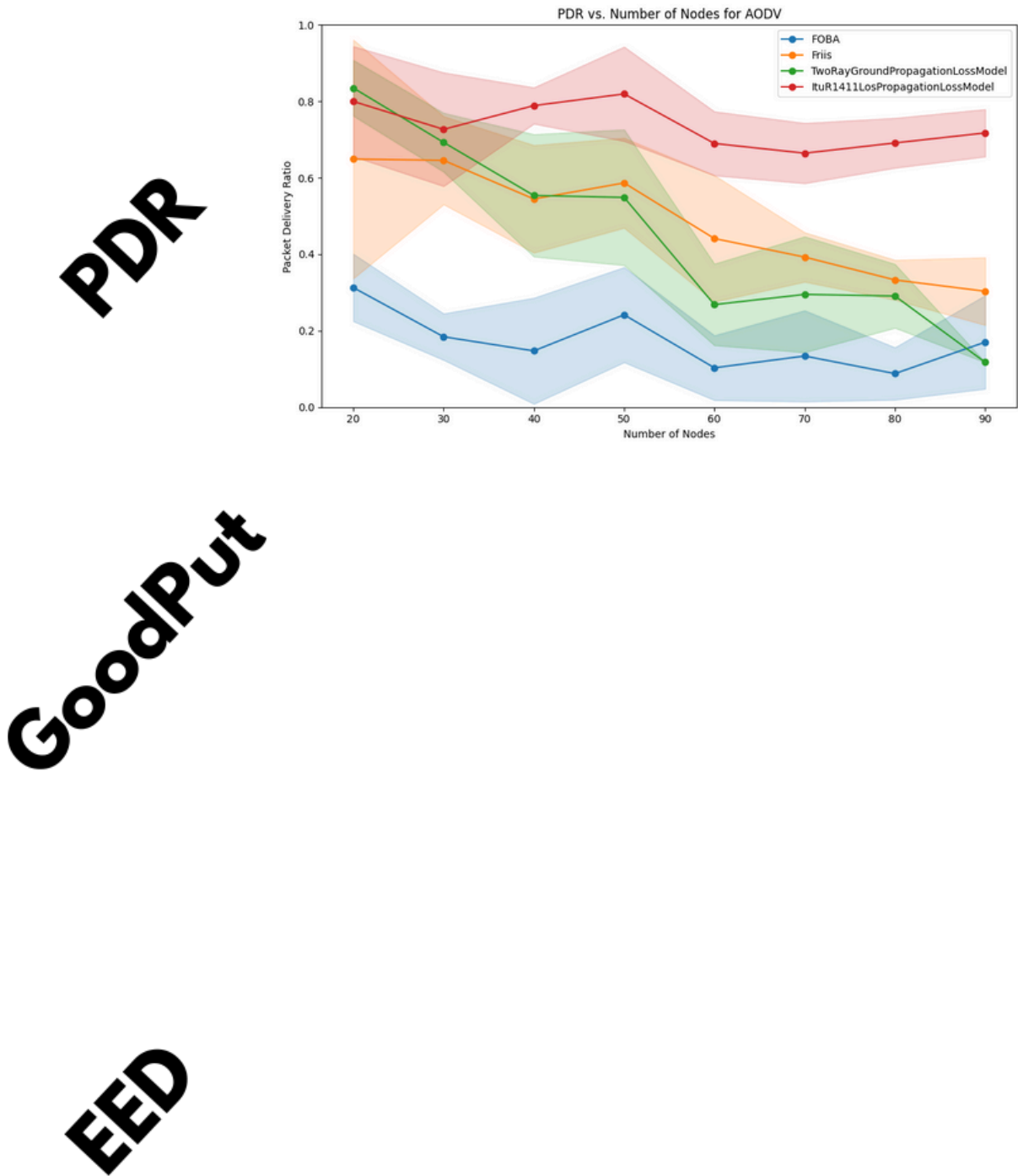
EED

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AODV

DSDV

OLSR



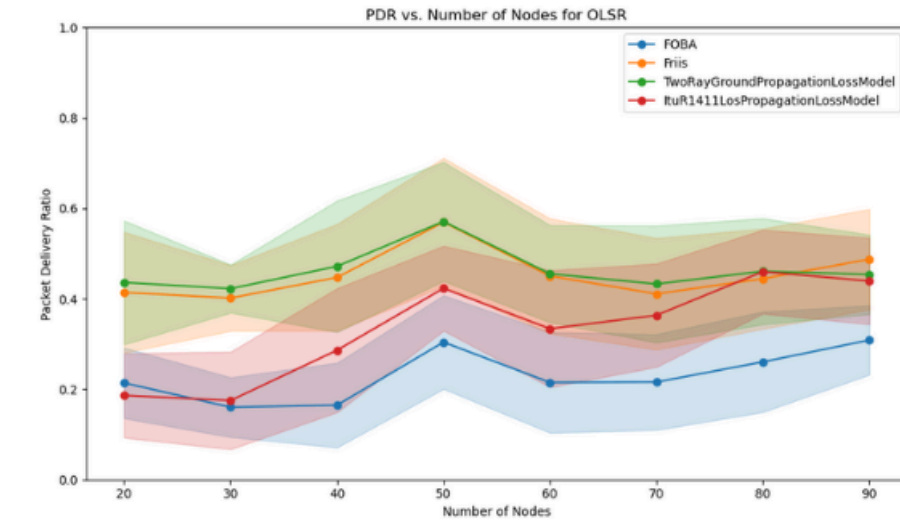
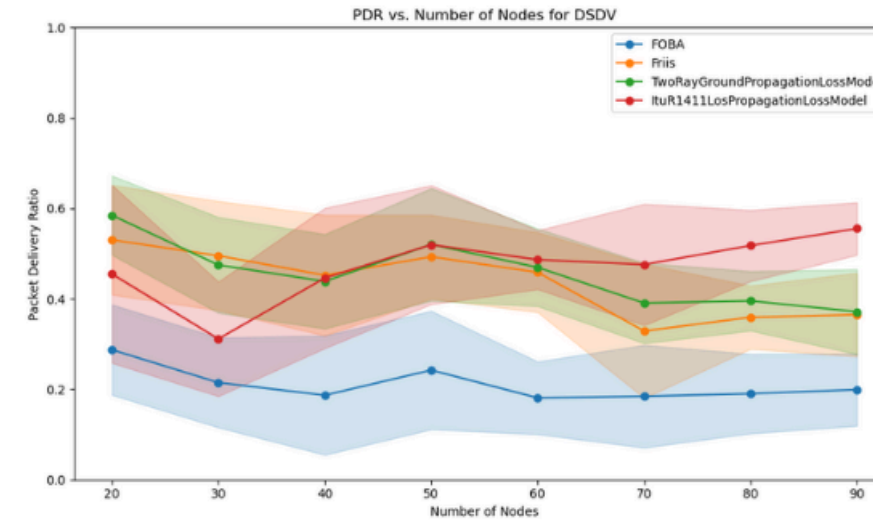
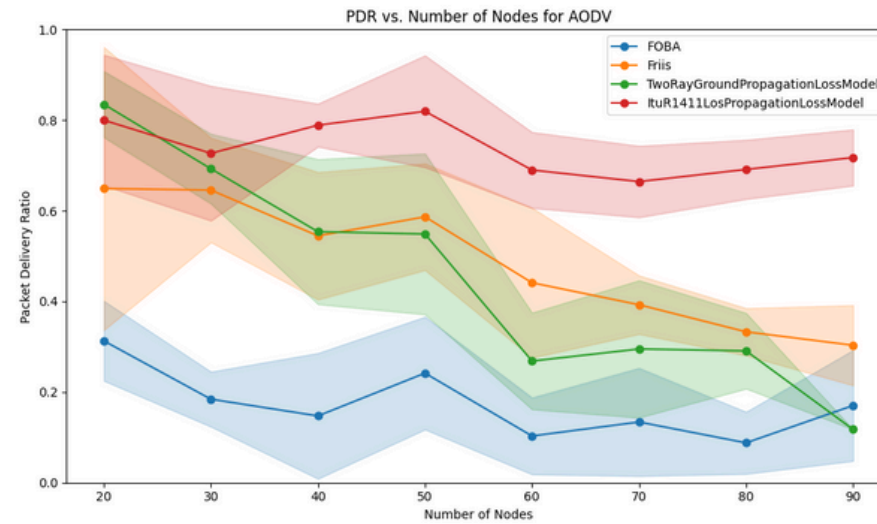
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AODV

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EED

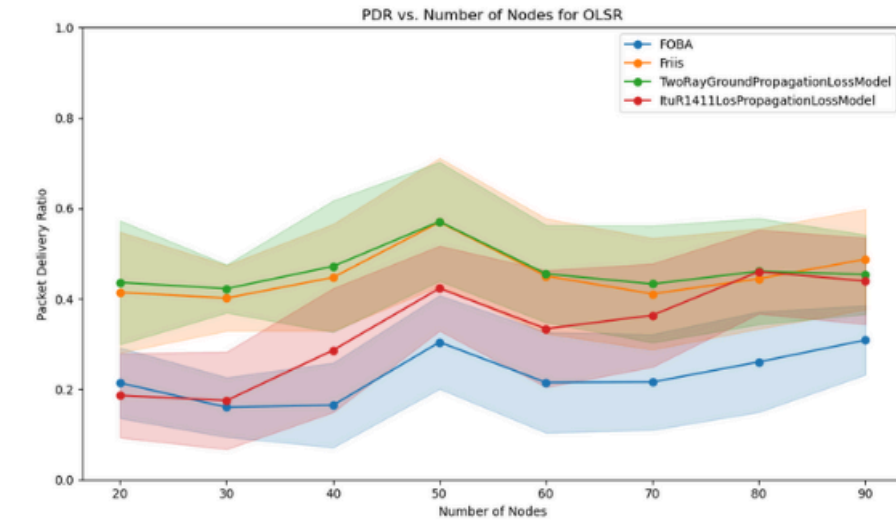
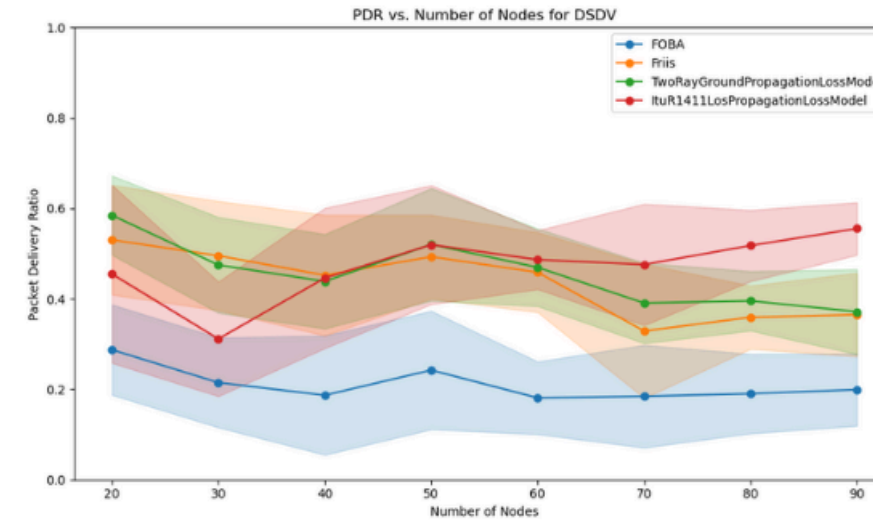
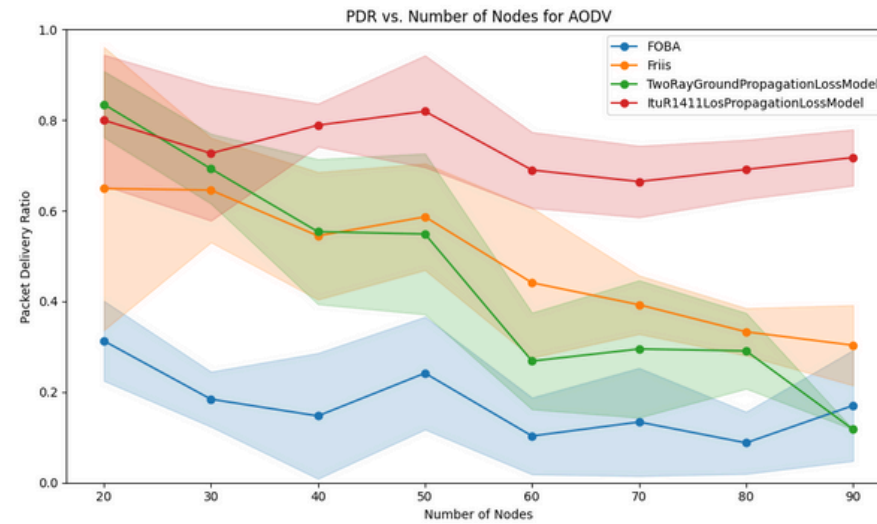
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AODV

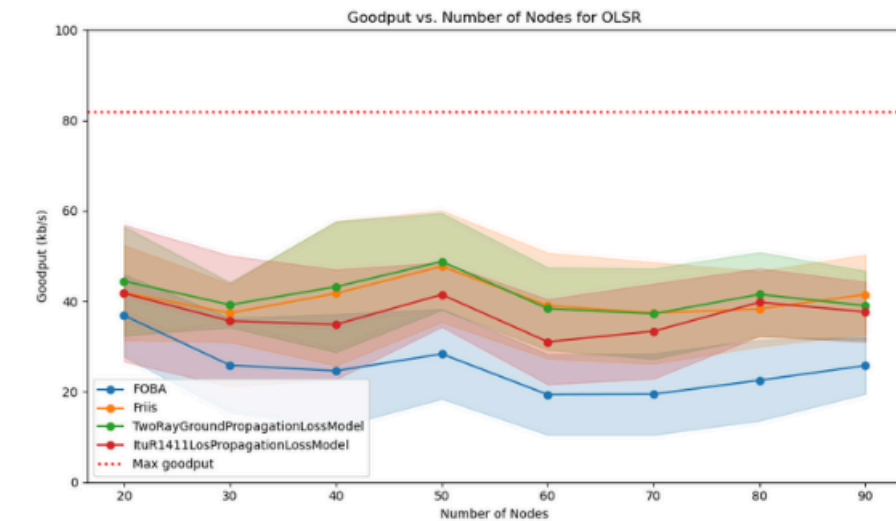
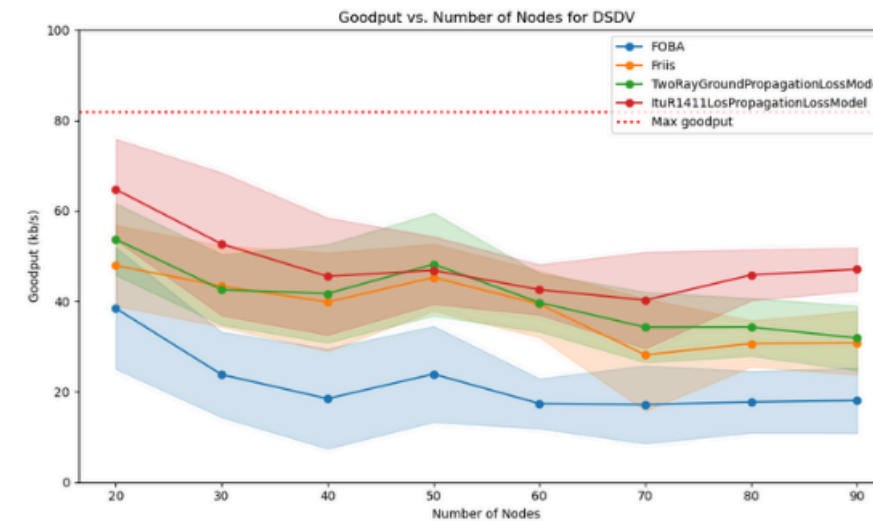
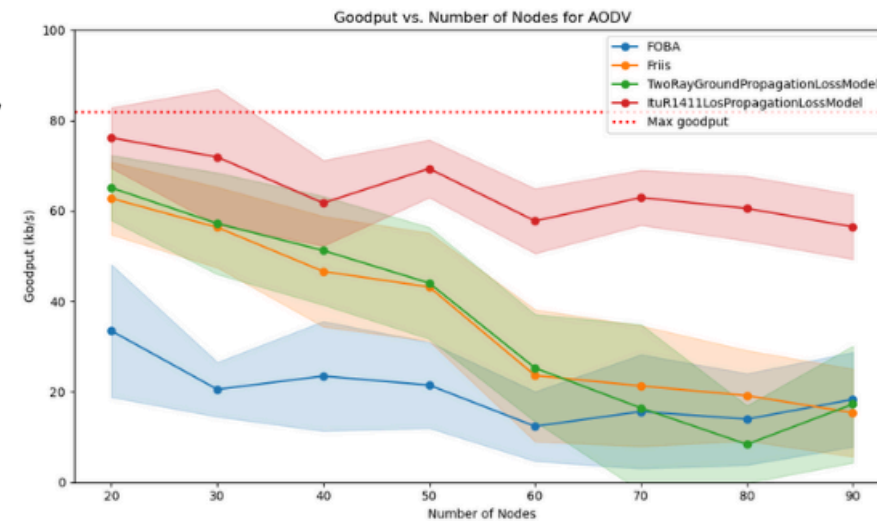
DSDV

OLSR

PDR



GoodPut



EED

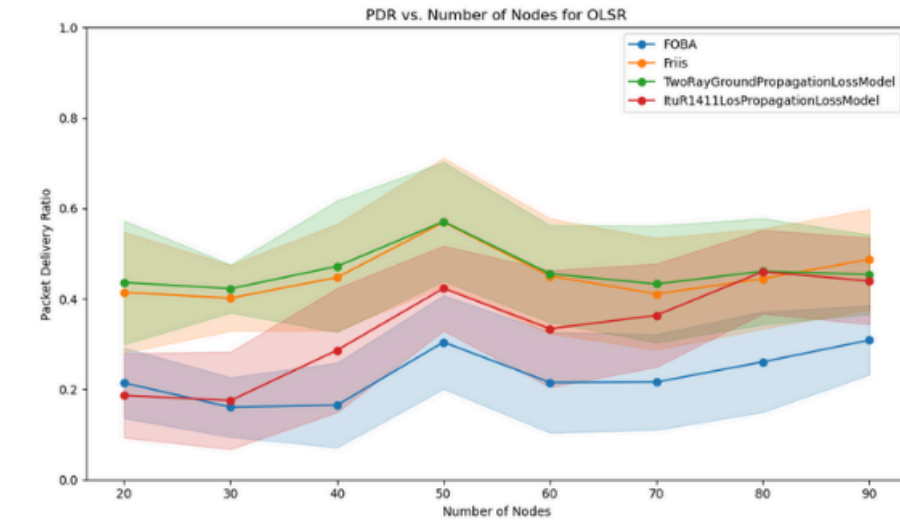
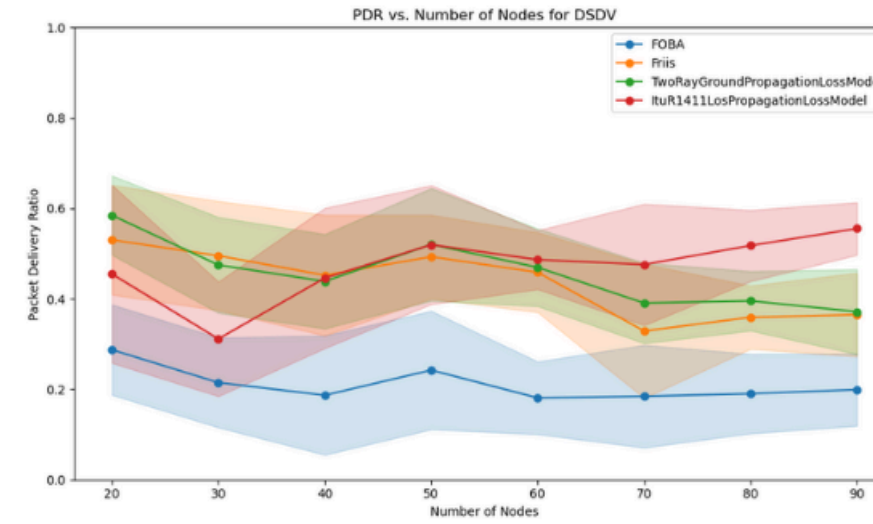
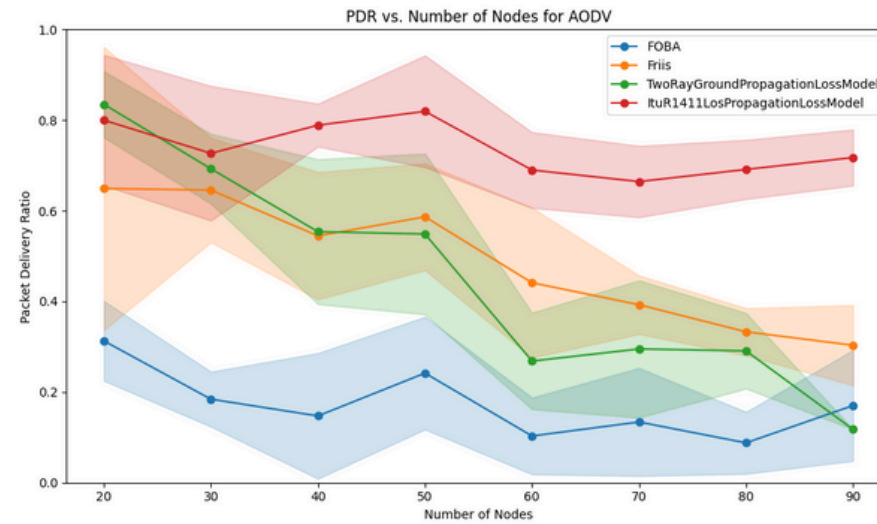
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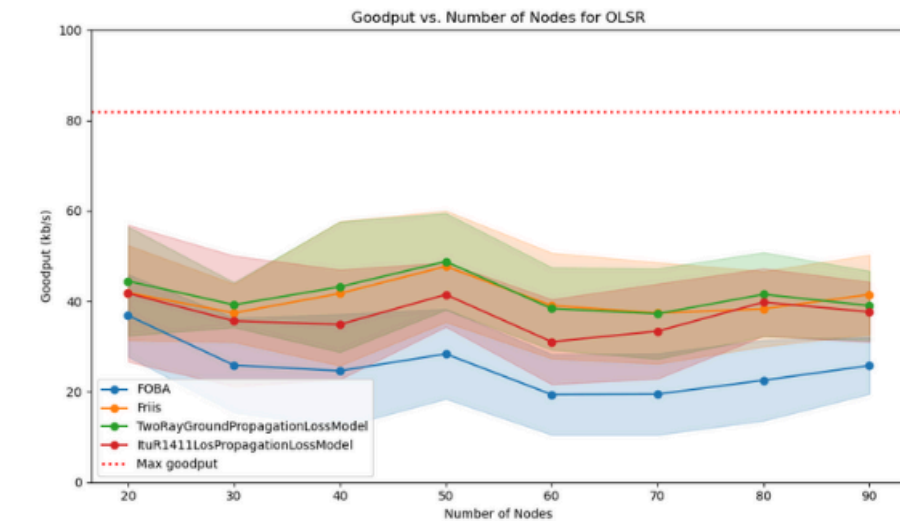
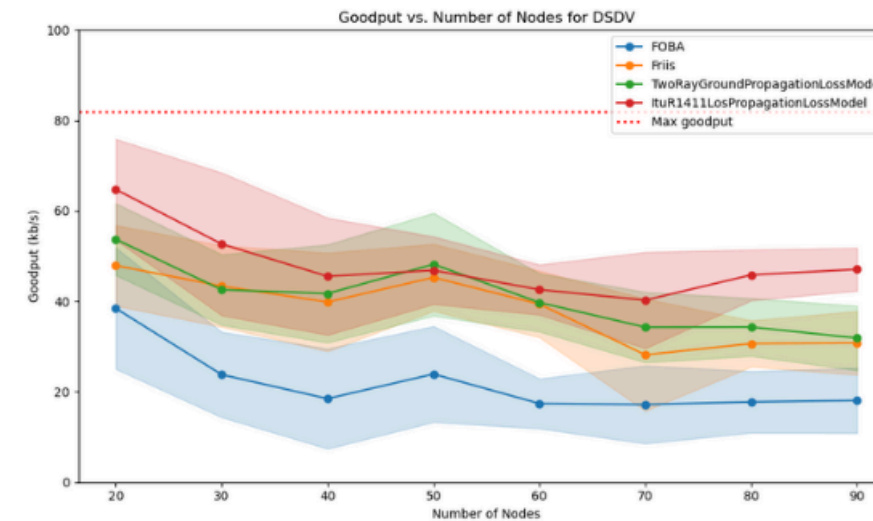
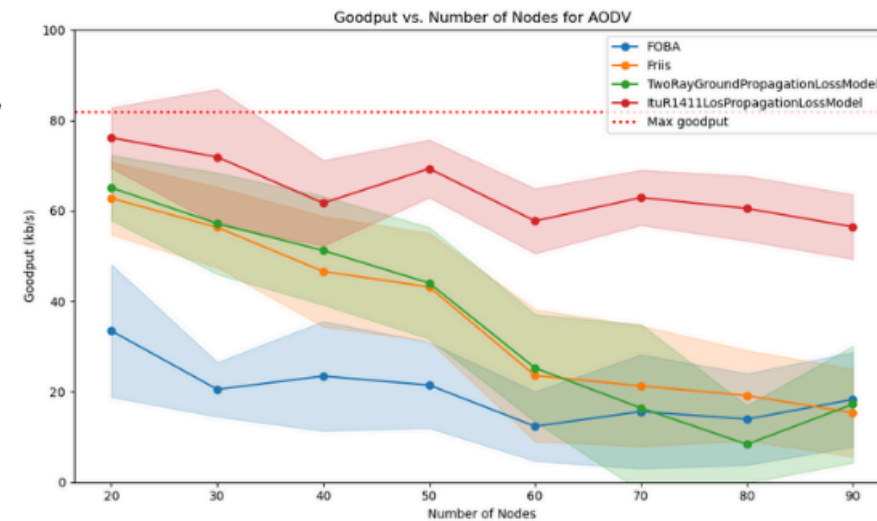
DSDV

OLSR

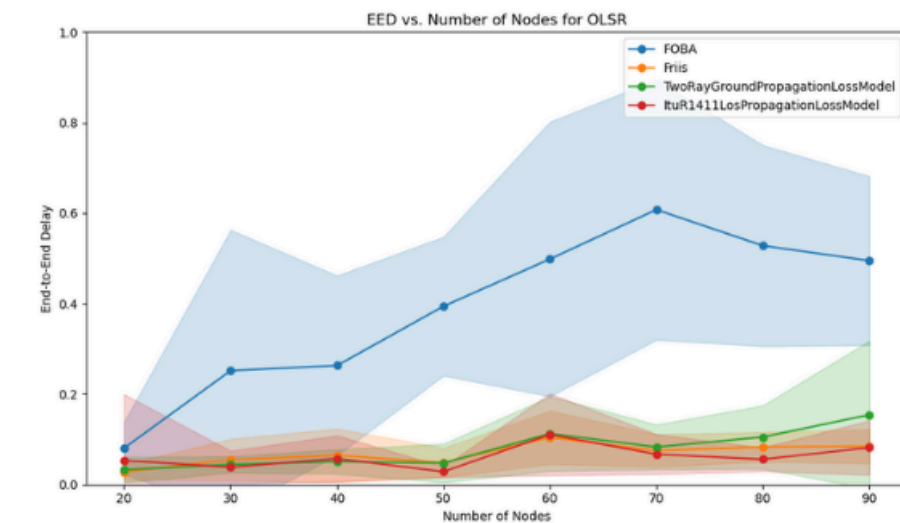
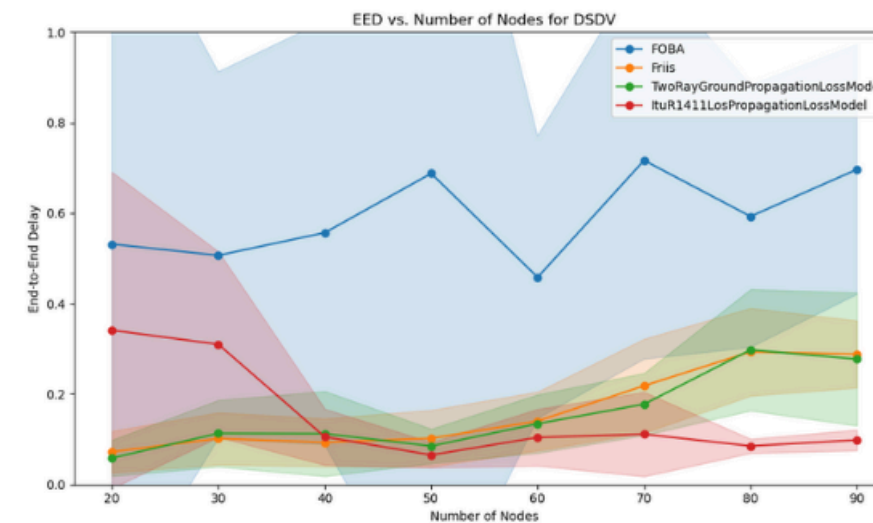
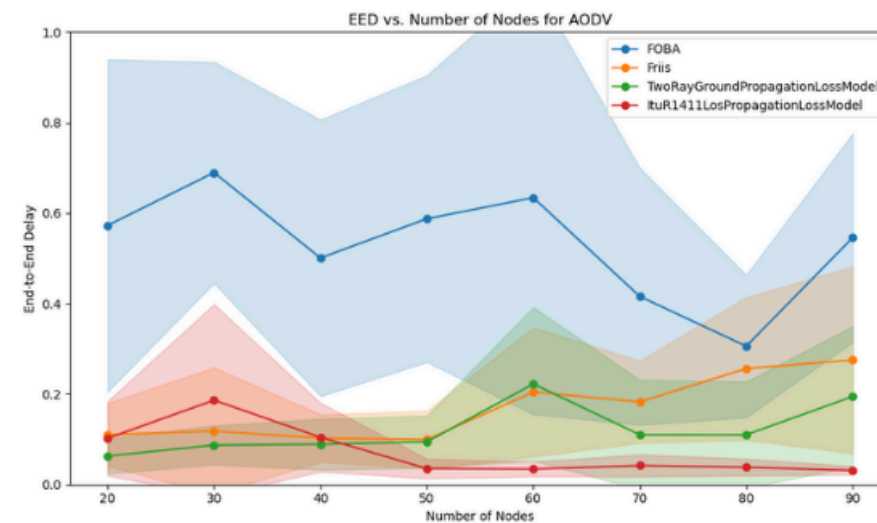
PDR



GoodPut



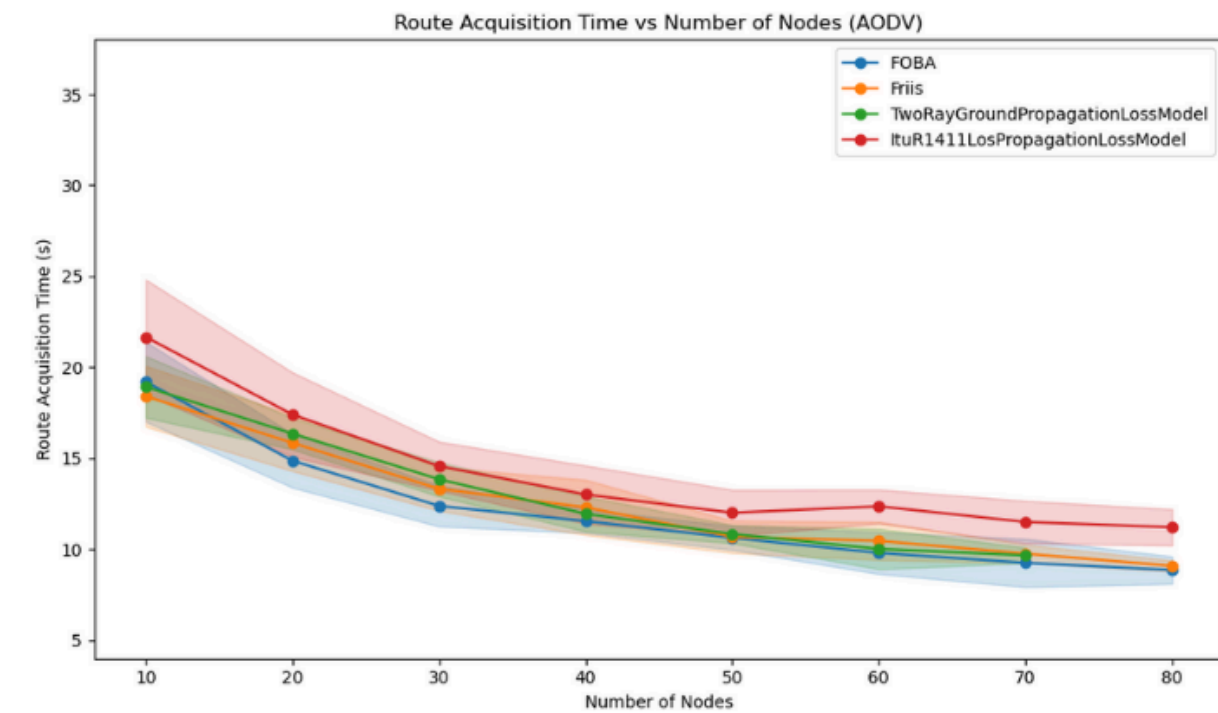
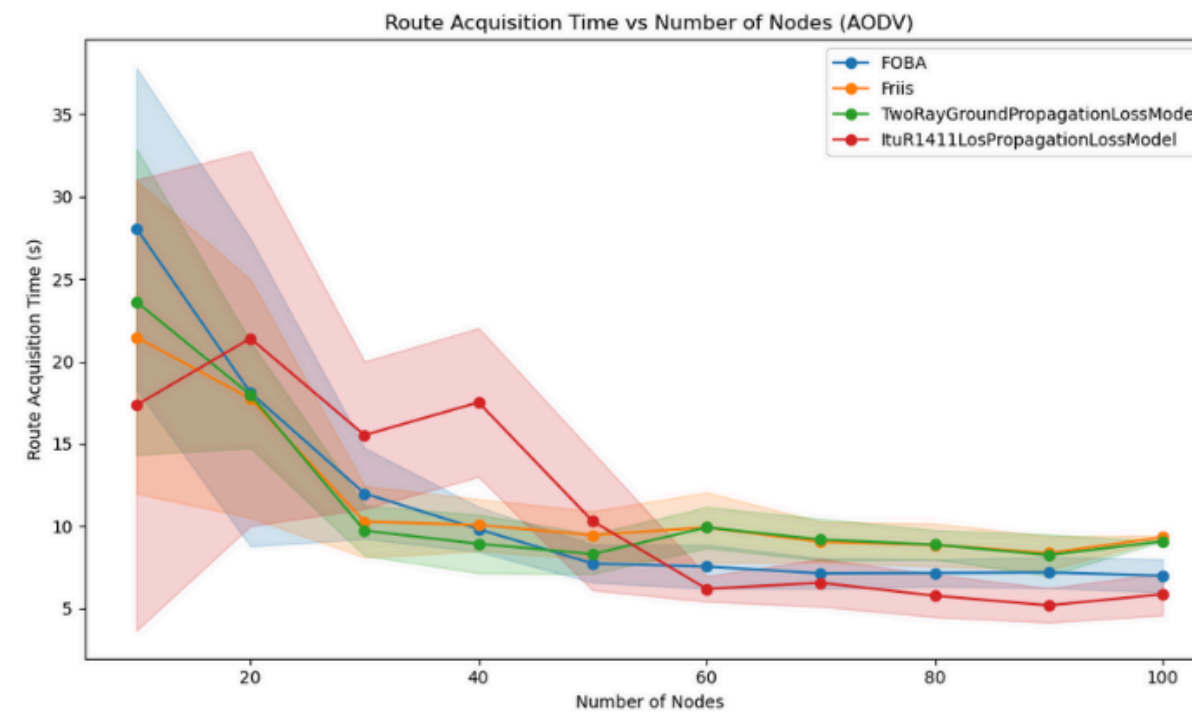
EED



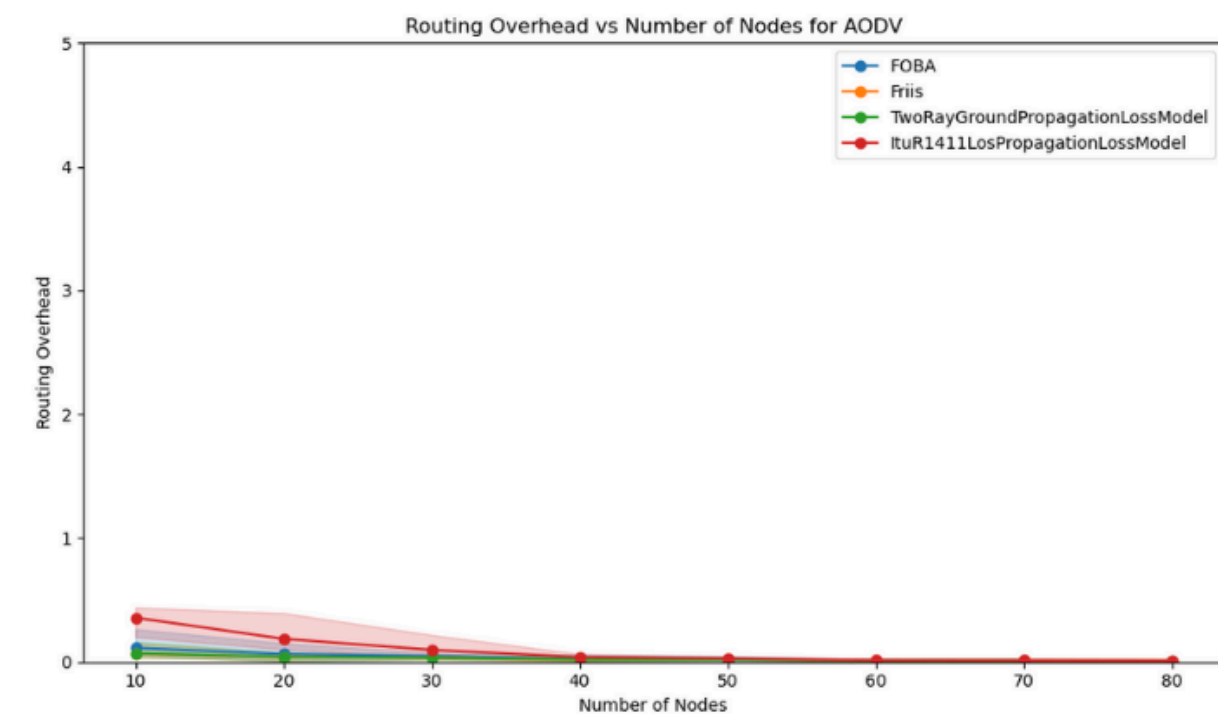
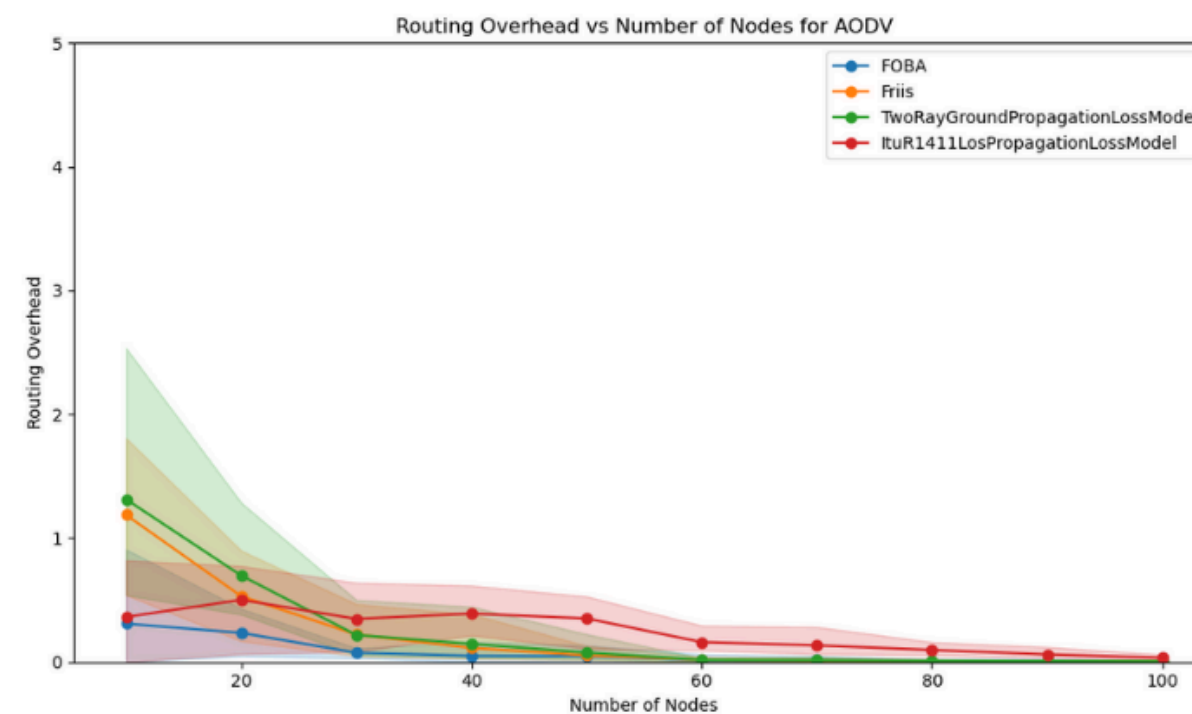
VI. Monotonicity is questionable as results are clear: the difference is blurry

[6 sources] AODV [24 sources]

RAT

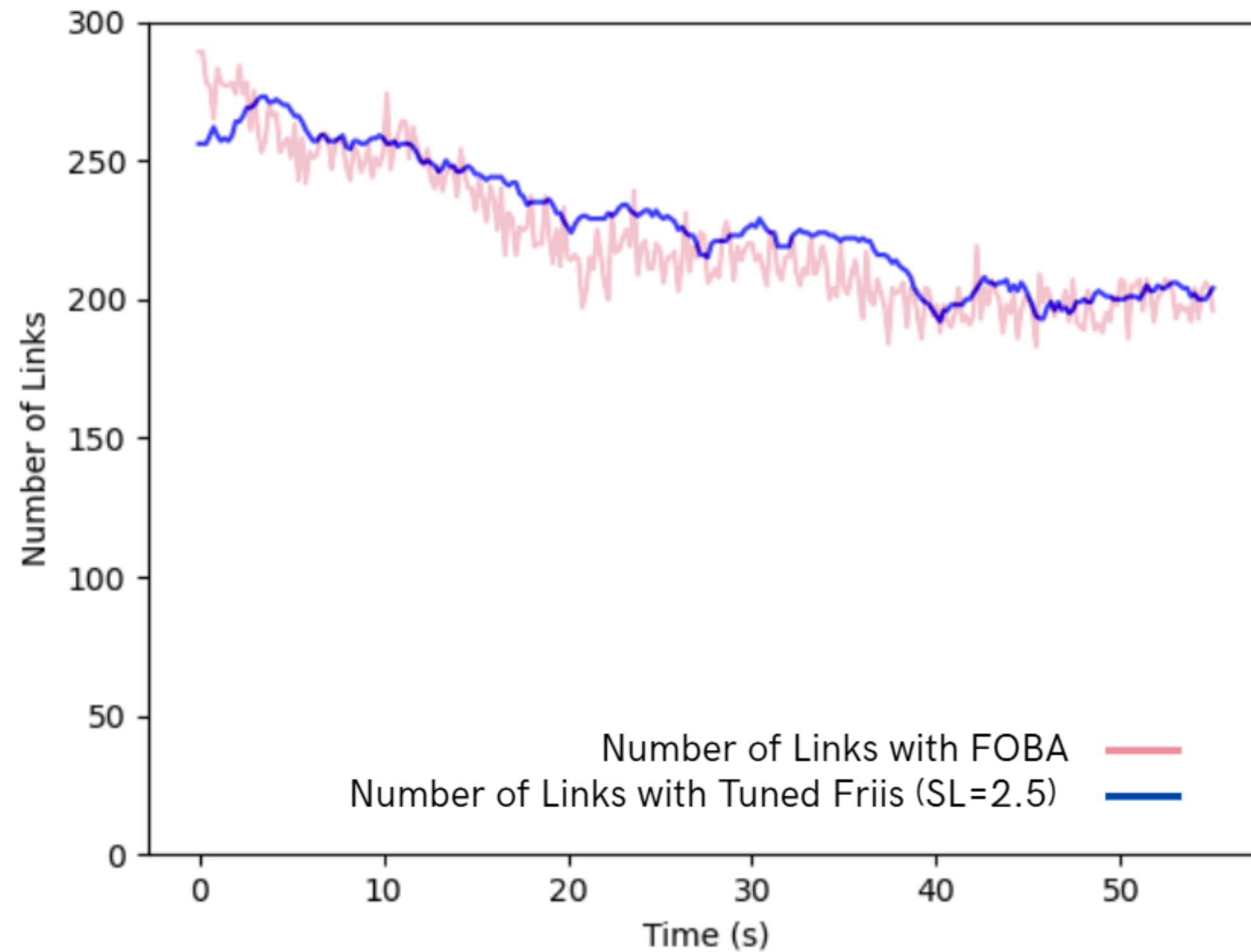


RO



When Buildings Blur the Lines

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AODV **DSDV** **OLSR**

PDR

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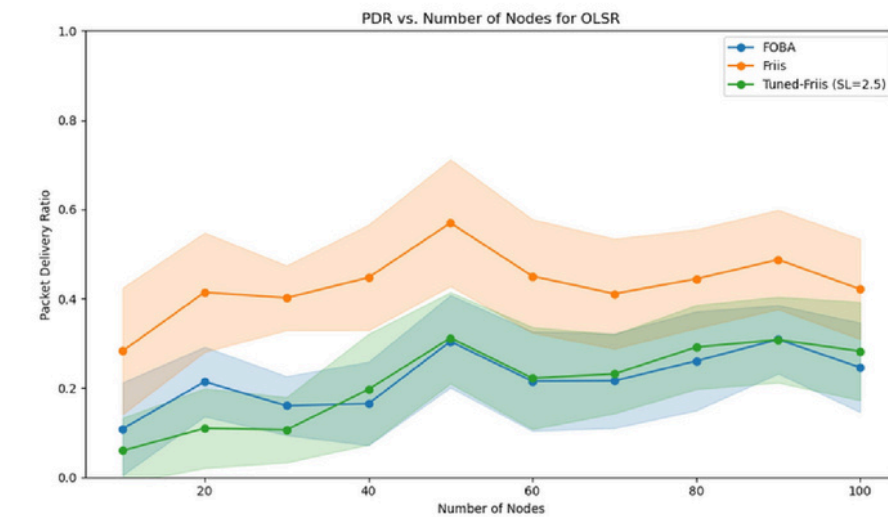
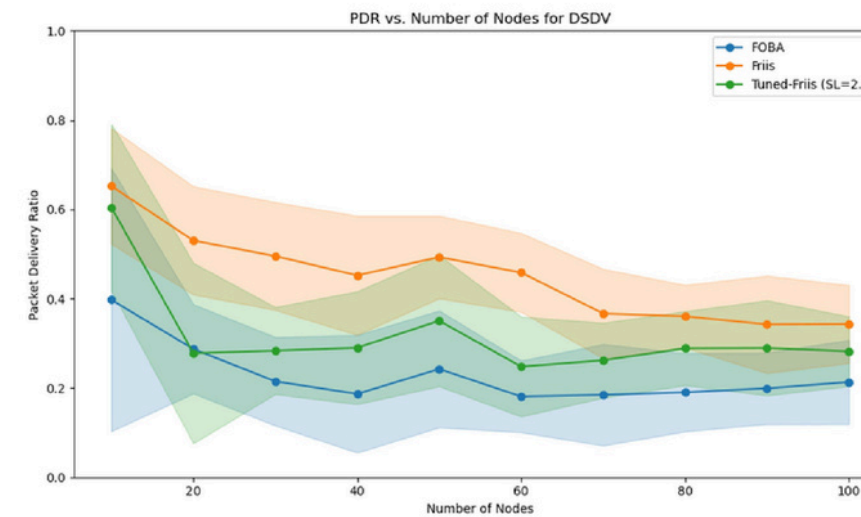
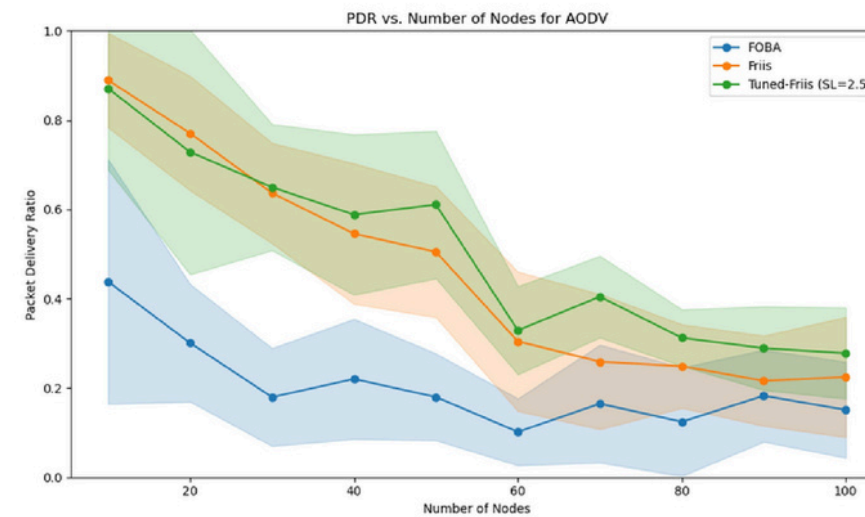
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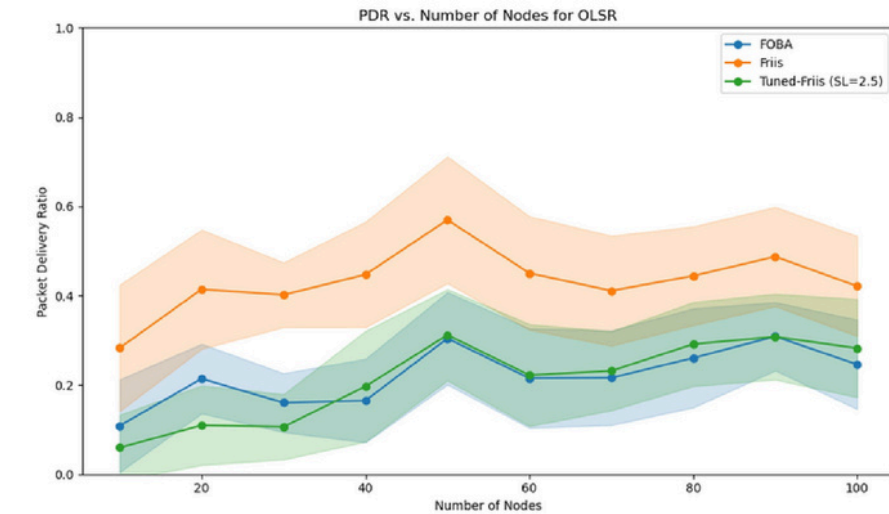
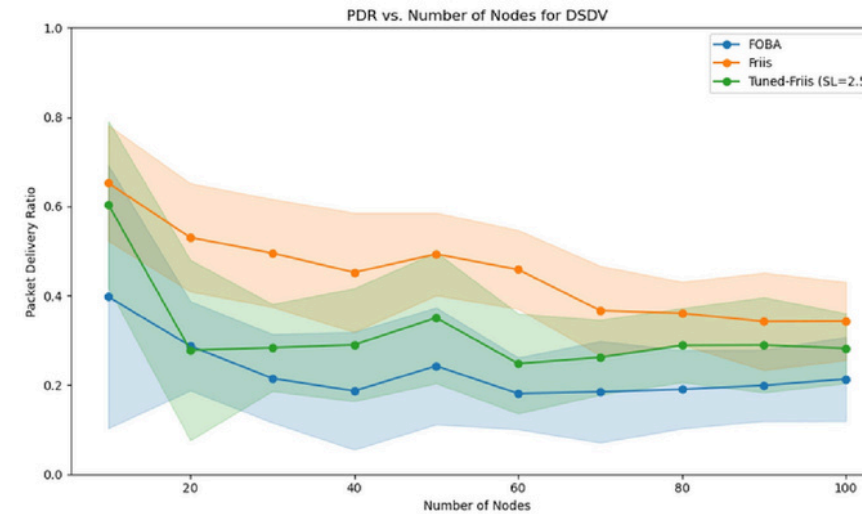
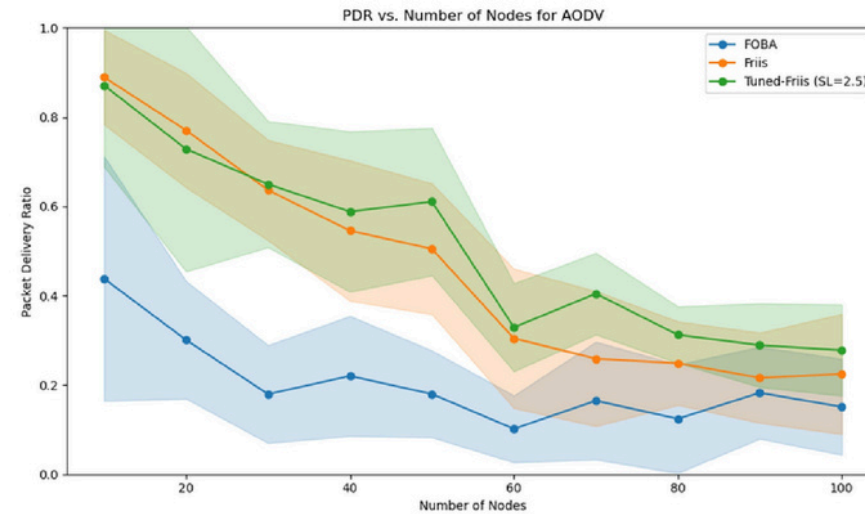
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AODV

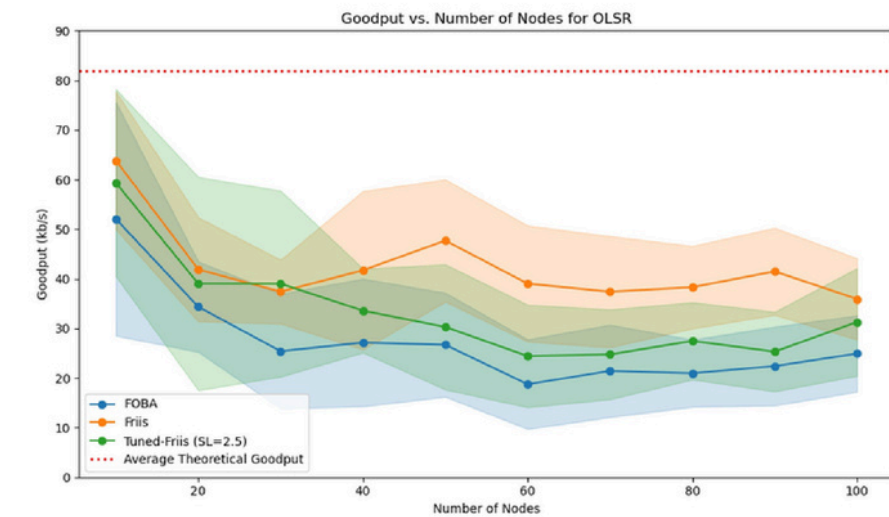
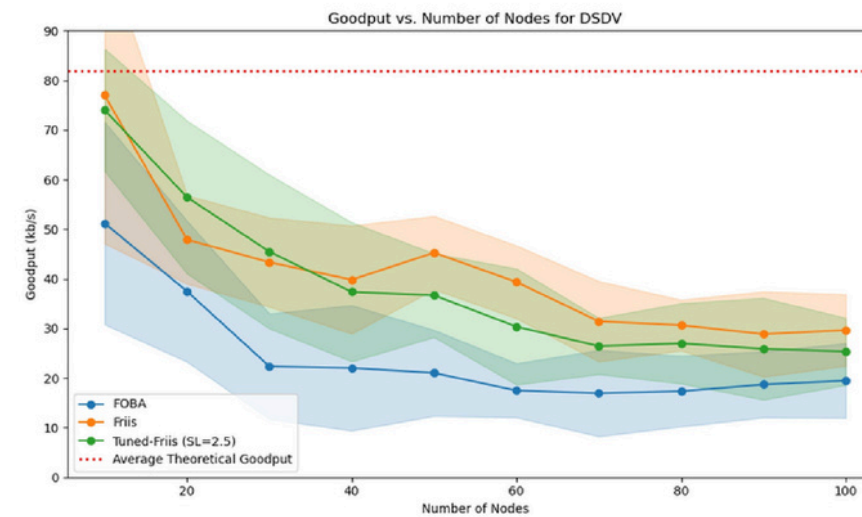
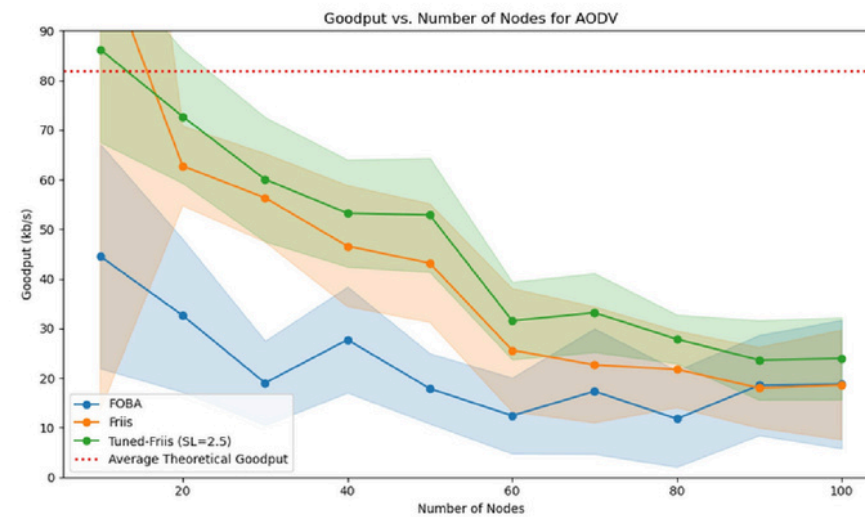
DSDV

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PDR



Goodput



EED

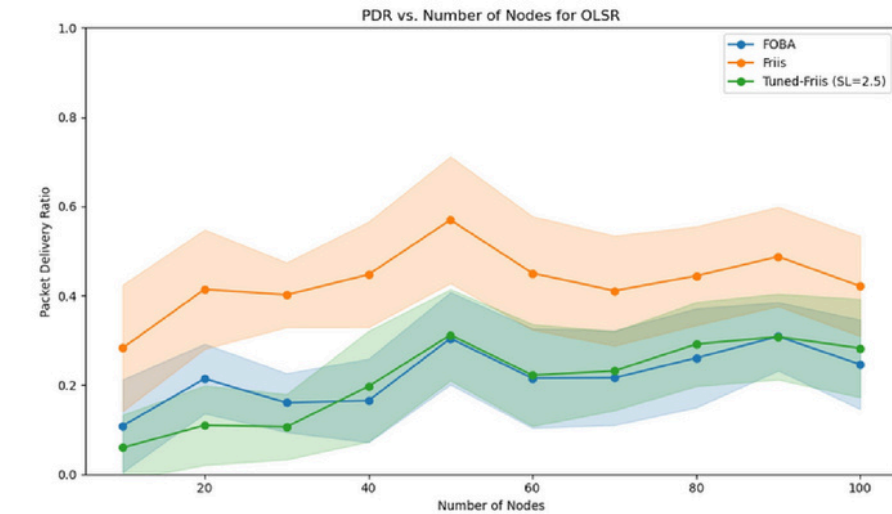
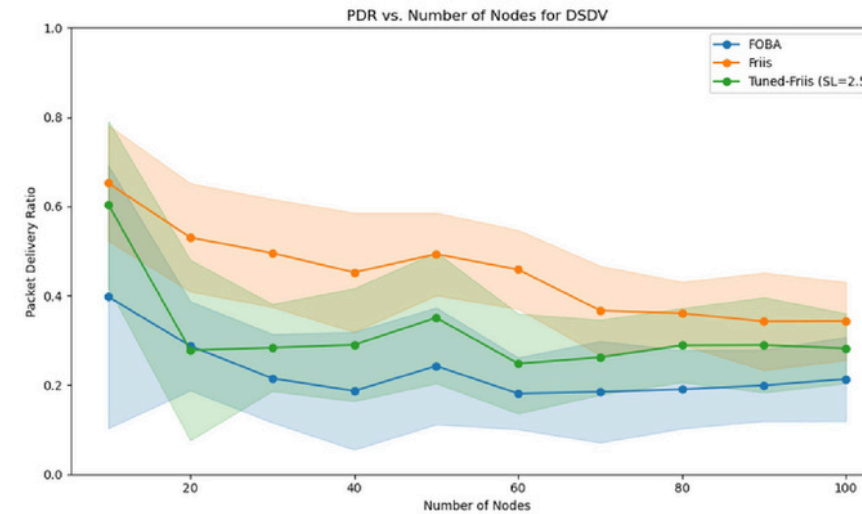
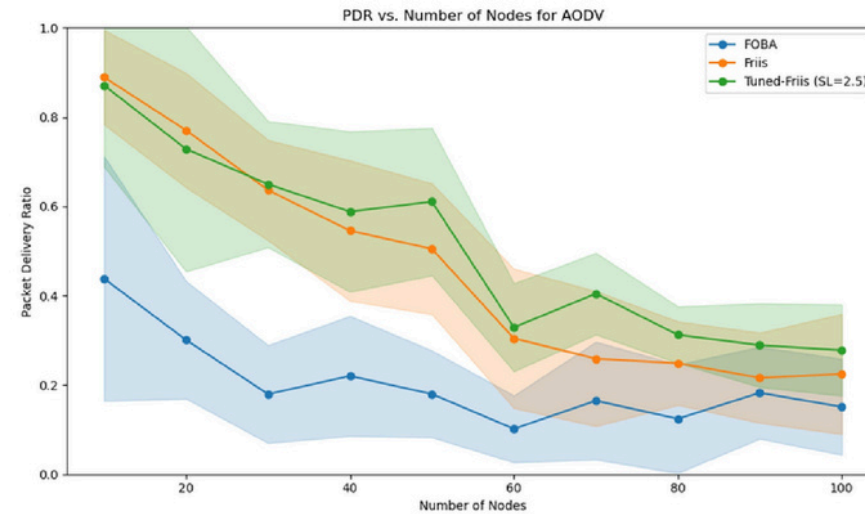
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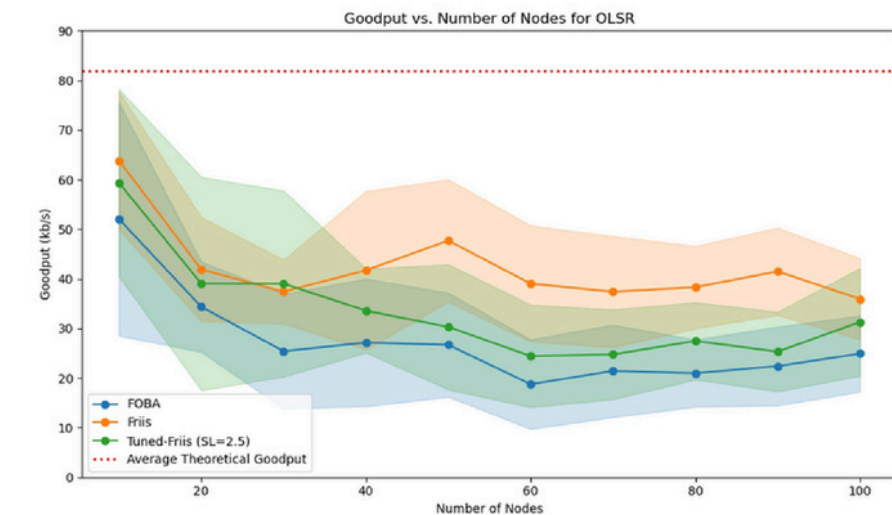
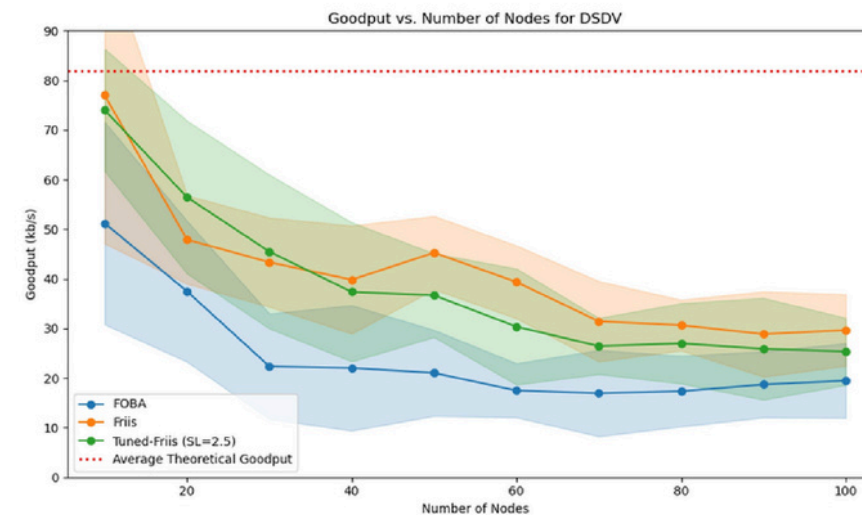
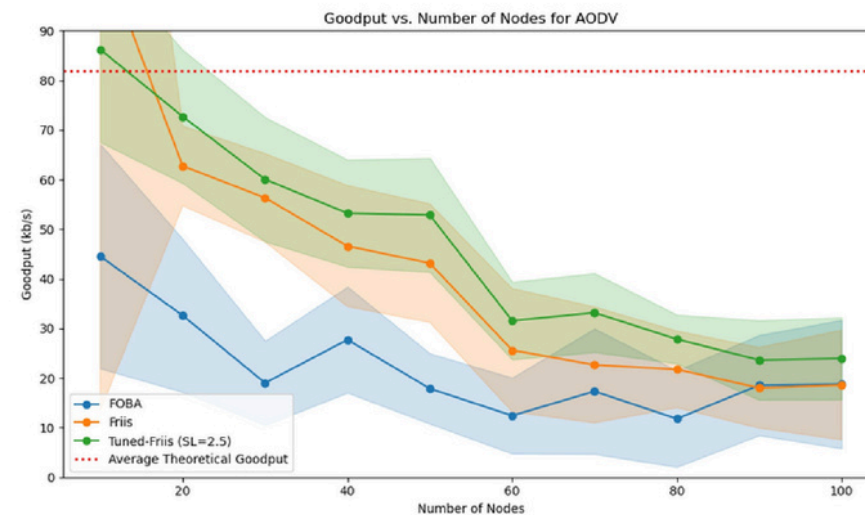
DSDV

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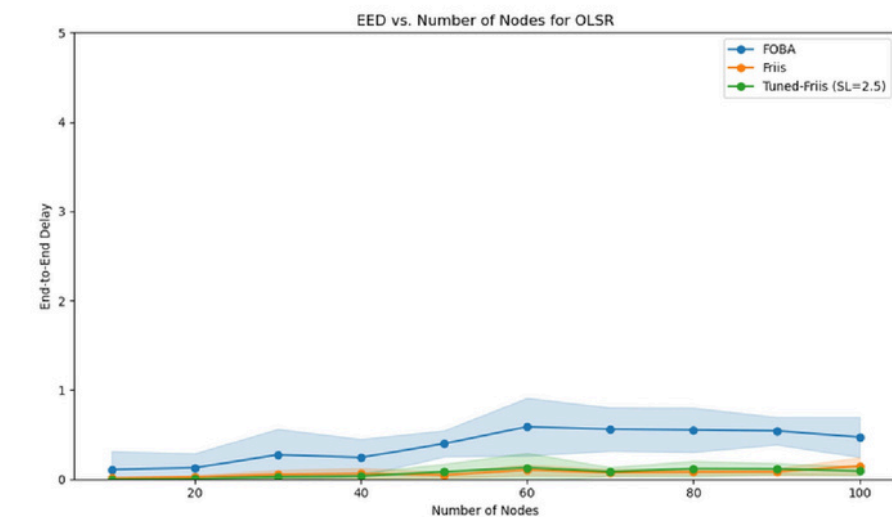
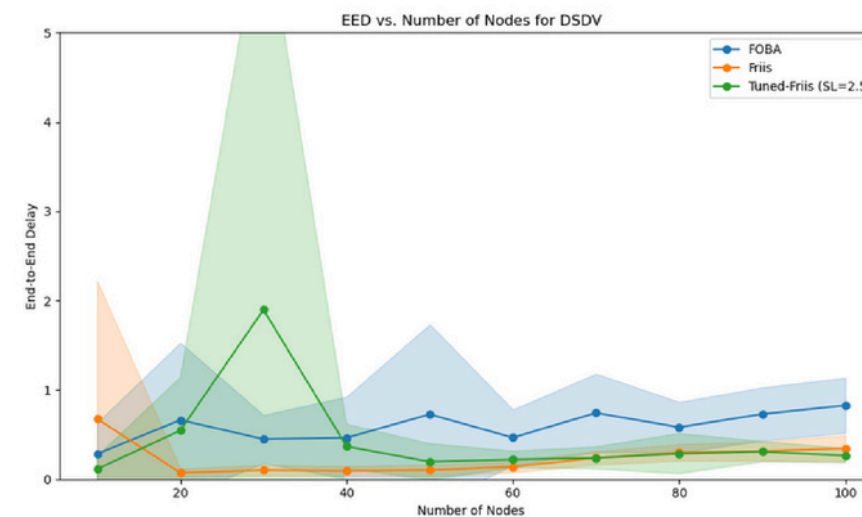
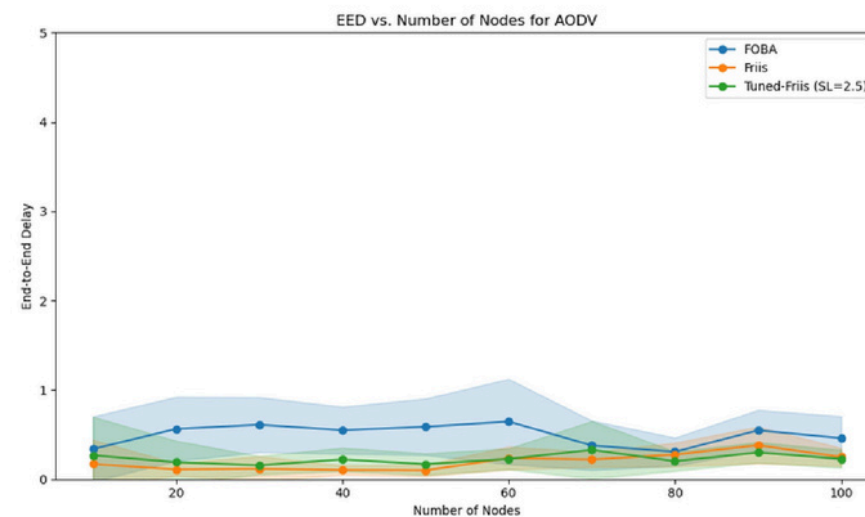
PDR



Goodput



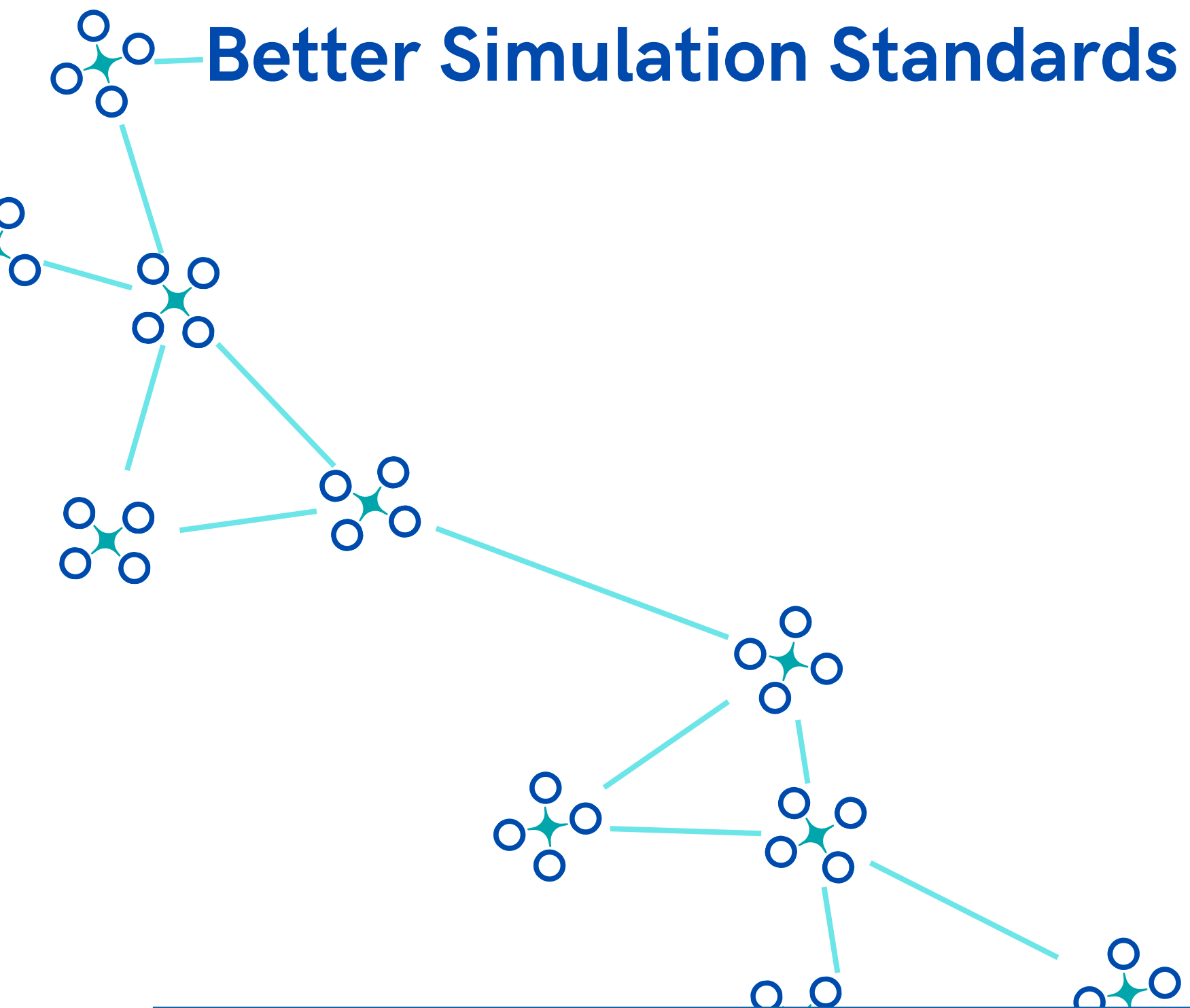
EED



What next ?

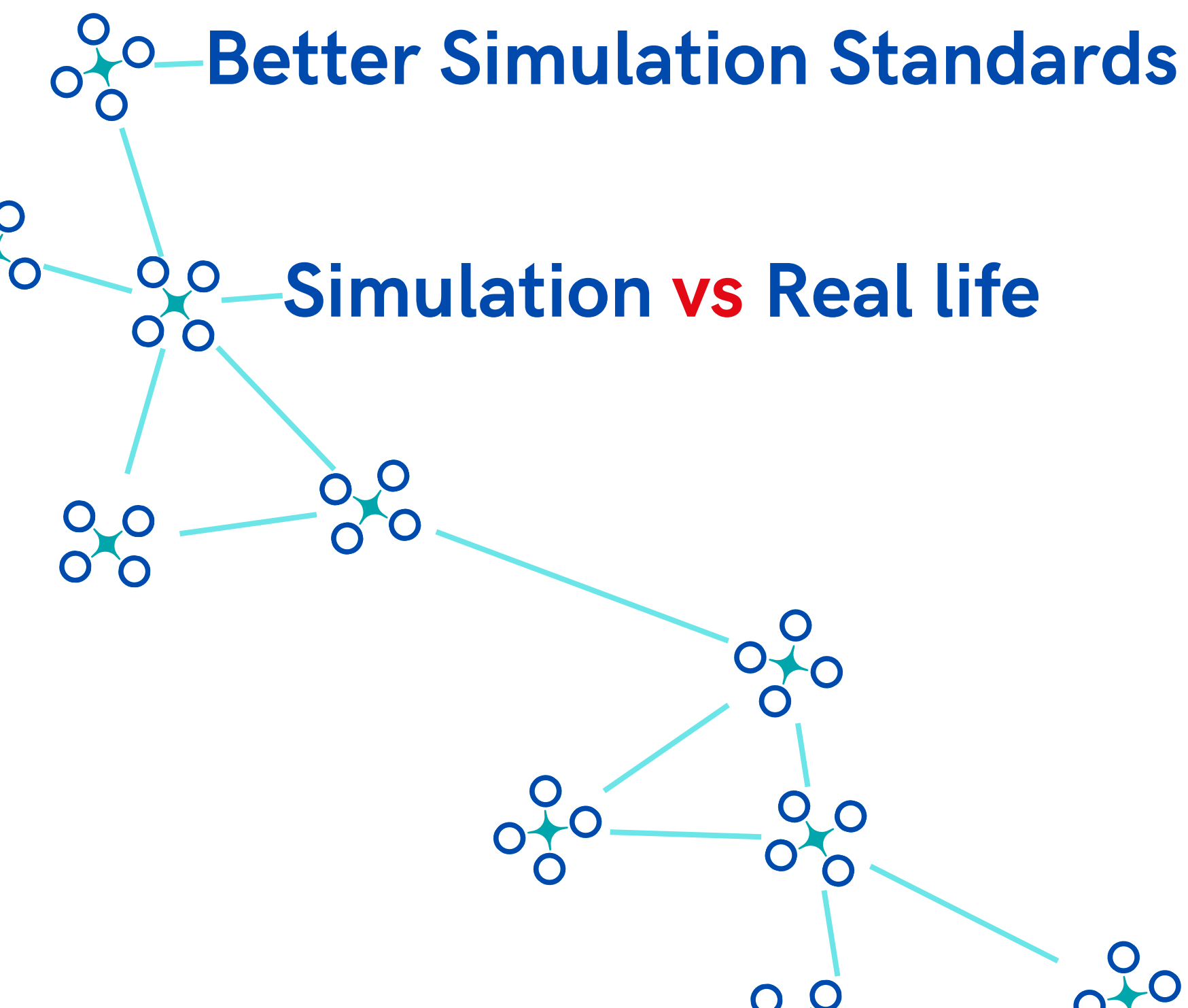
V. What now ?

Multiple options



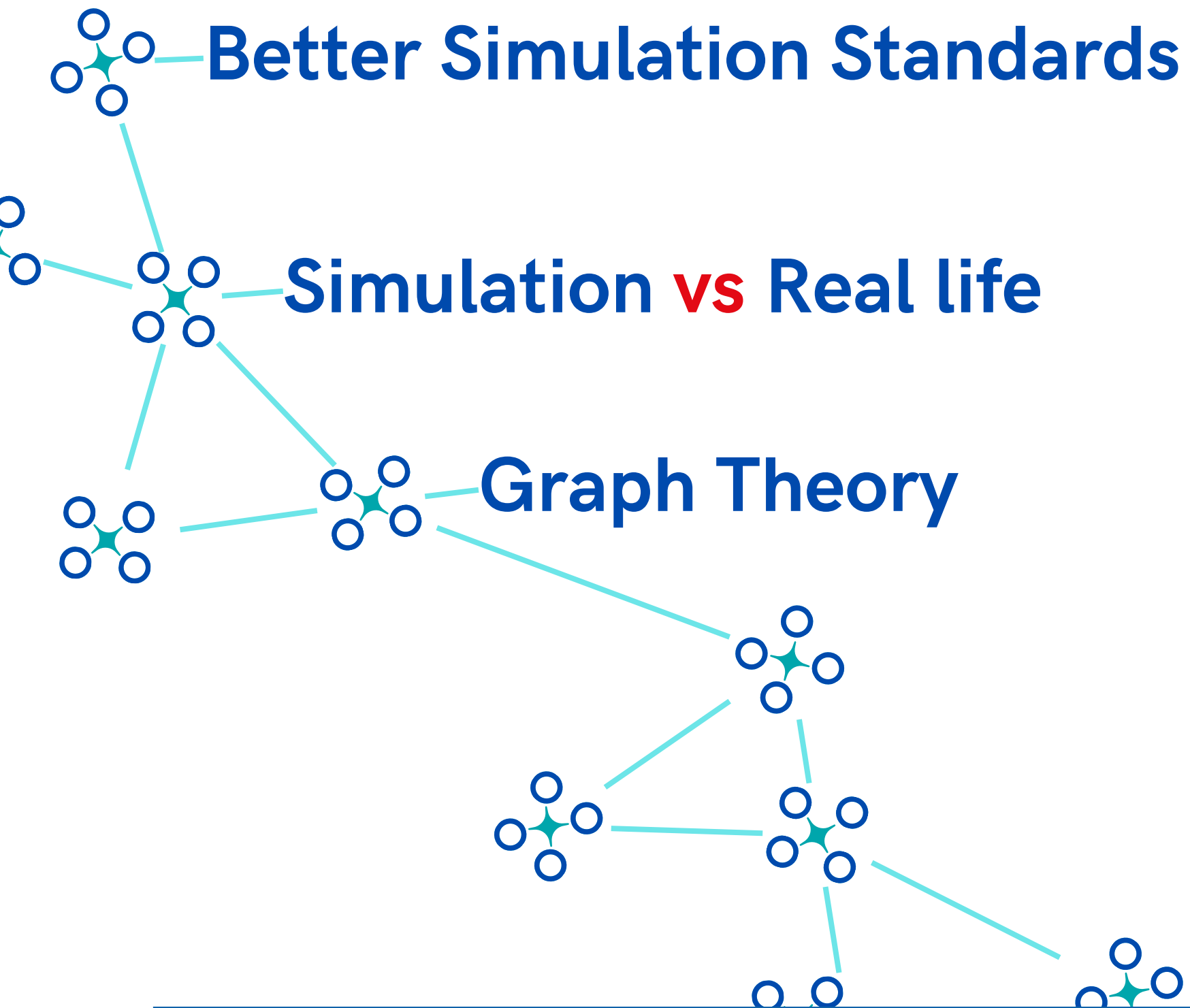
V. What now ?

Multiple options



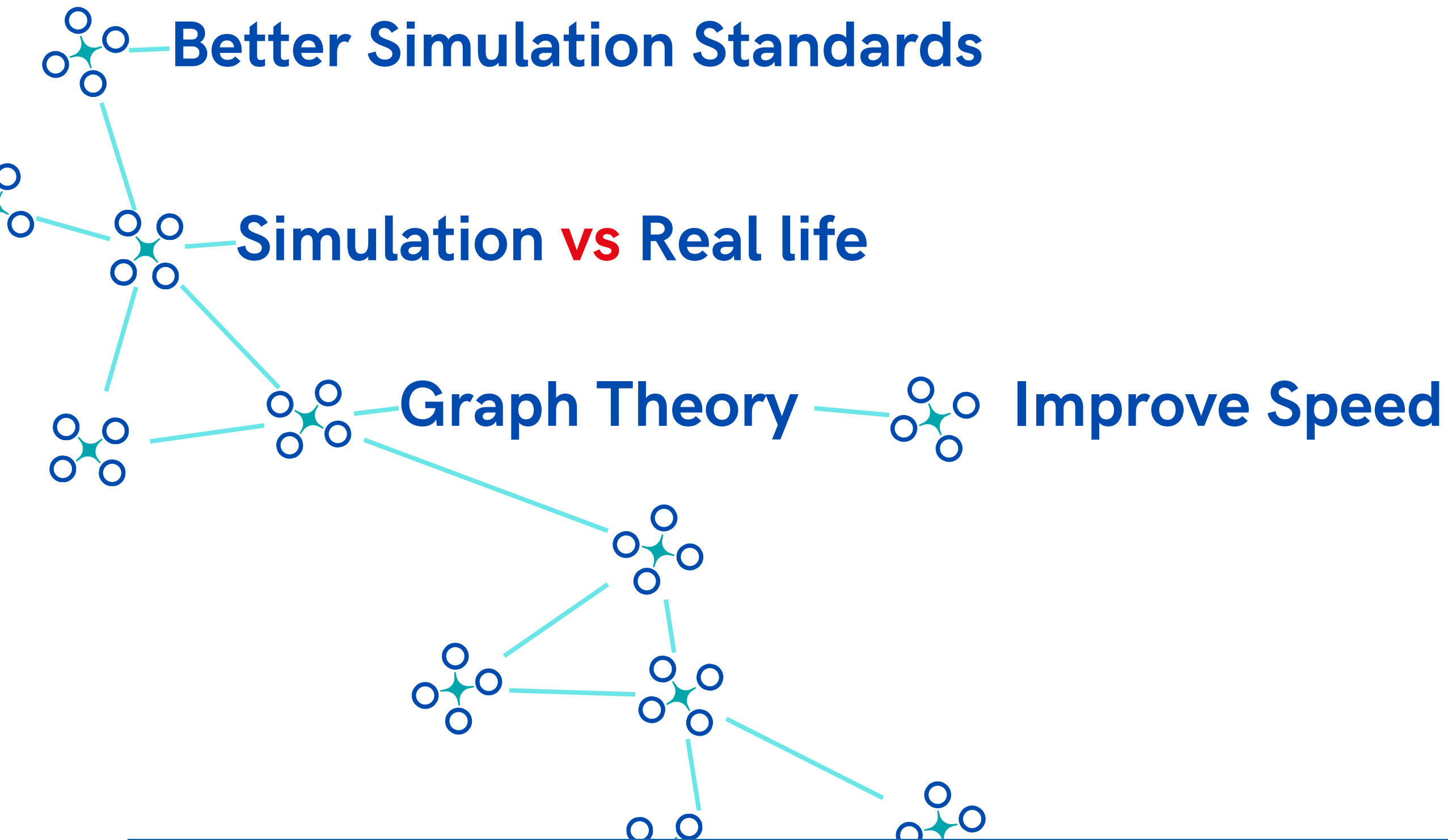
V. What now ?

Multiple options



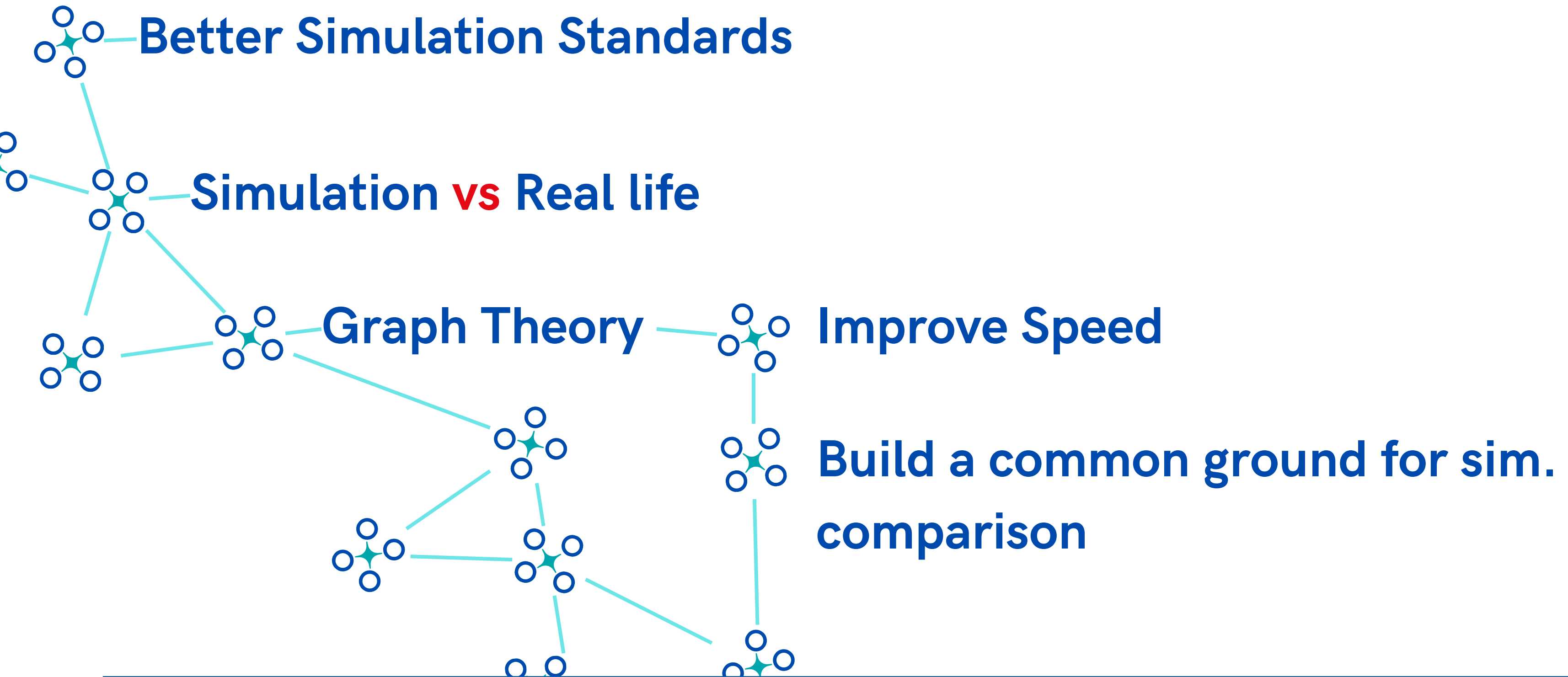
V. What now ?

Multiple options

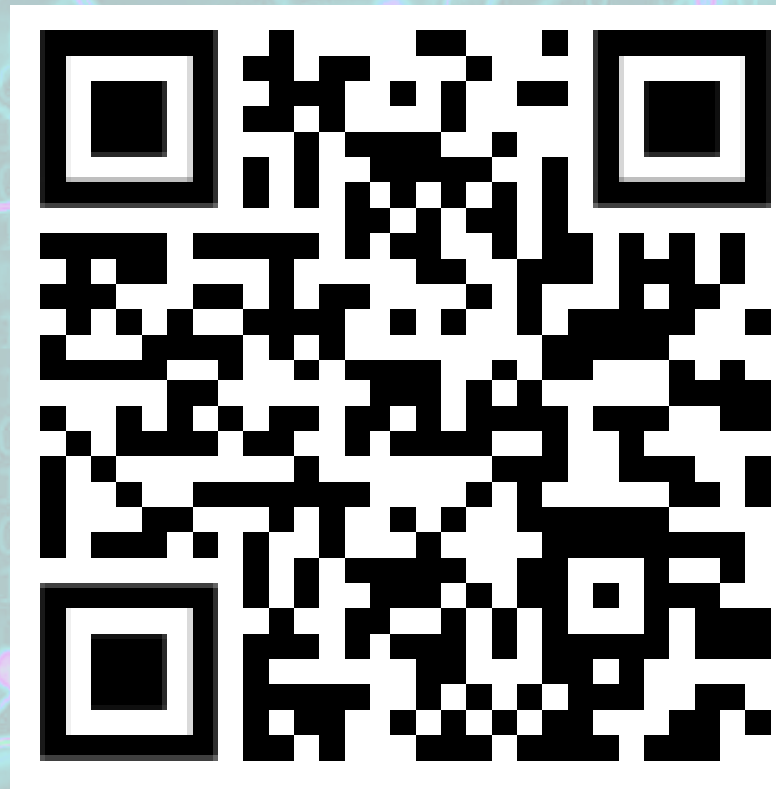


V. What now ?

Multiple options



Available on GitHub



**Exp. Set up for
reproducibility**



Hugo Le Dirach^{*✦}
Ph.D. student at ONERA
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When Buildings Blur the Lines

Questions ?

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