

Where Should Content Float ? On Optimal Floating Content Configuration

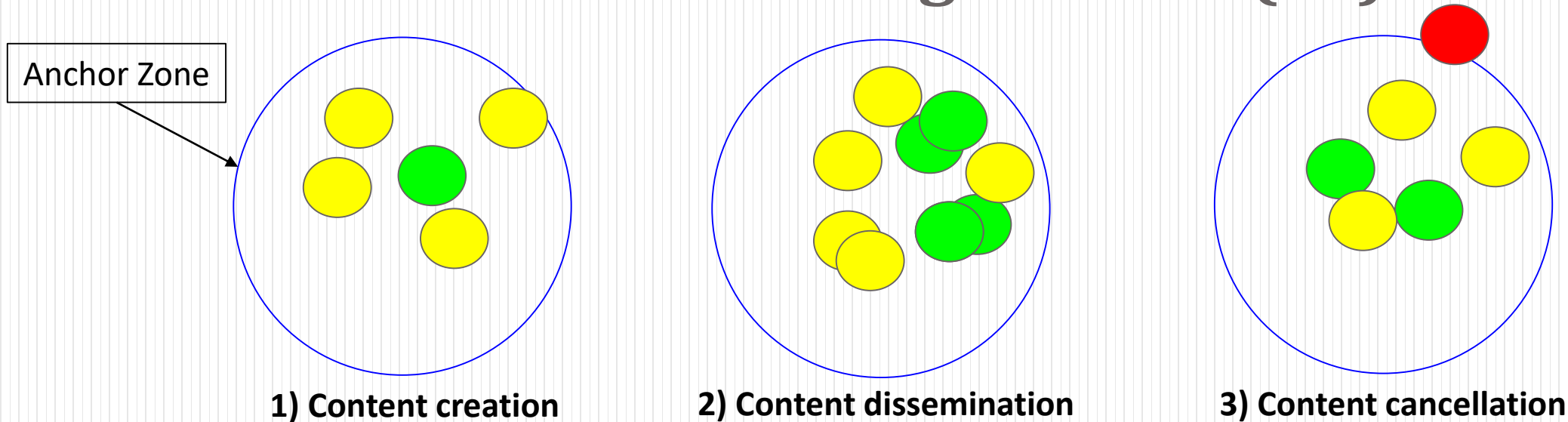
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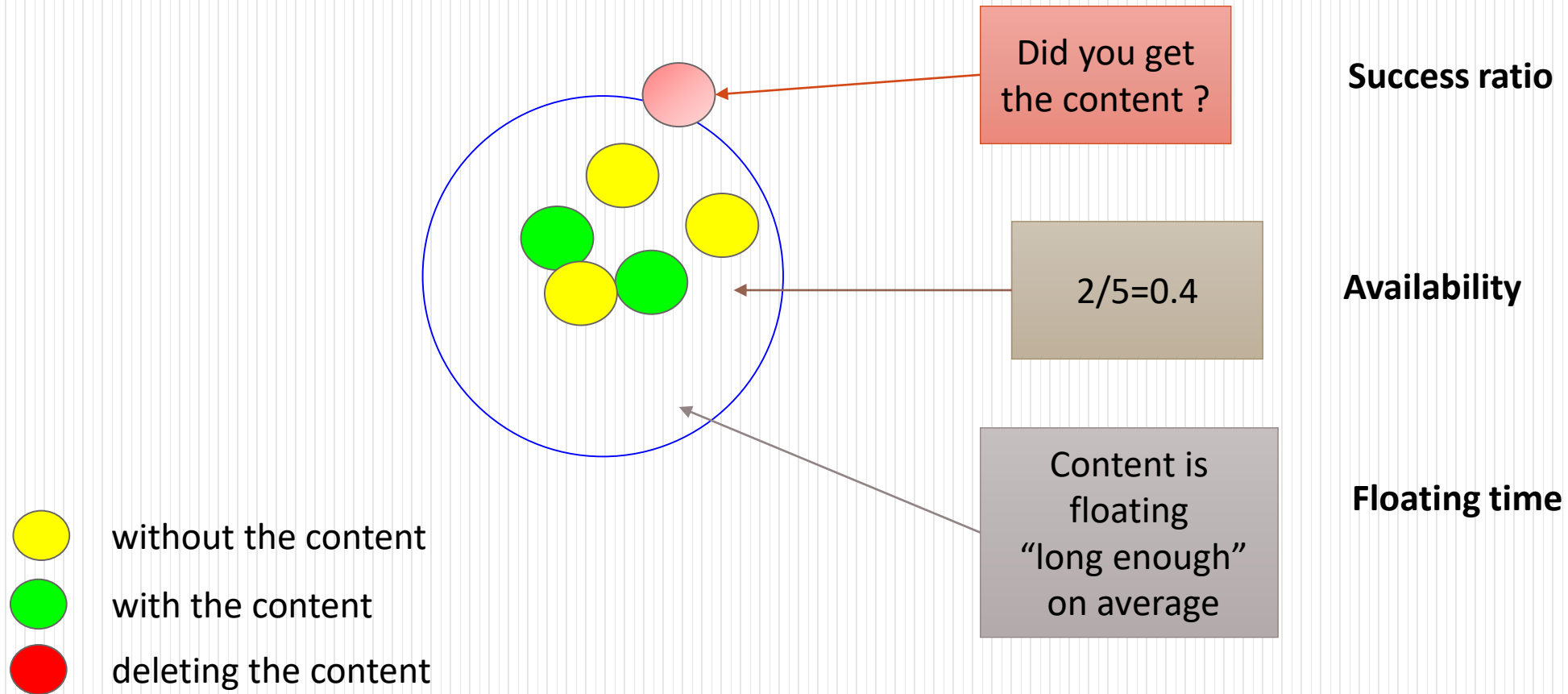
An infrastructure-less communication paradigm is a possible solution **to lead the information spreading** in VANETs: **Floating Content (FC)**



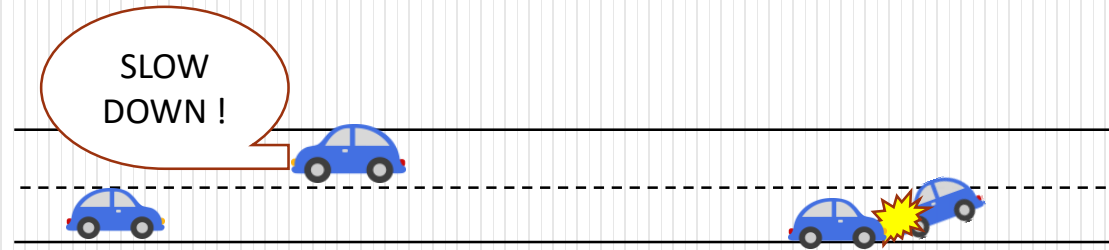
-  without the content
-  with the content
-  deleting the content

Node =  or  = 

FC Performance is measured in terms of success probability, availability and floating time



THE PROBLEM was: HOW to engineer a FC scheme for a specific service in a given setting?



Previous studies on FC focused mainly on pedestrian scenarios

Proposal

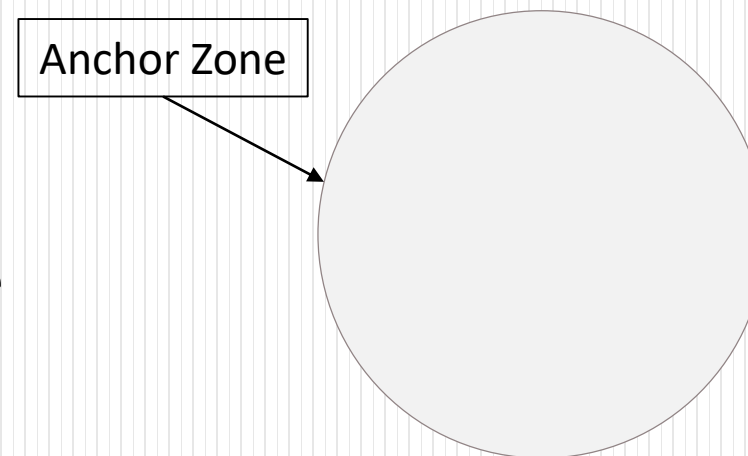
an analytic approach to performance evaluation of
FC in vehicular scenario

In order to:

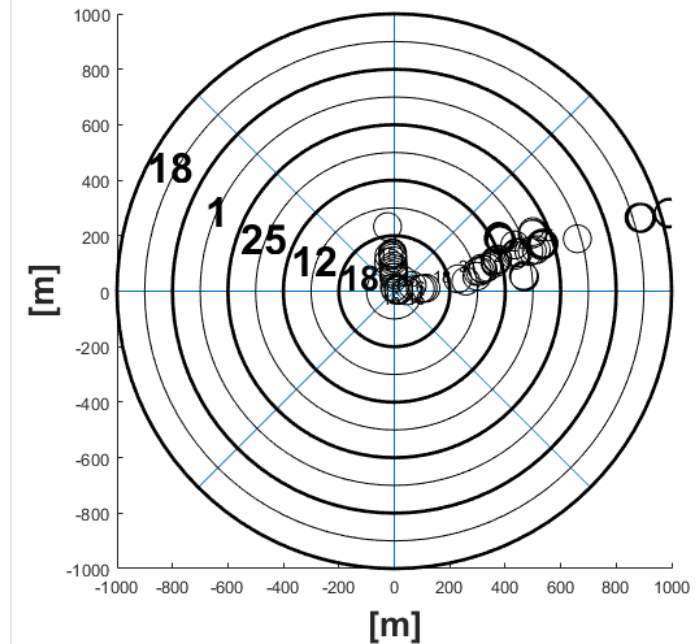
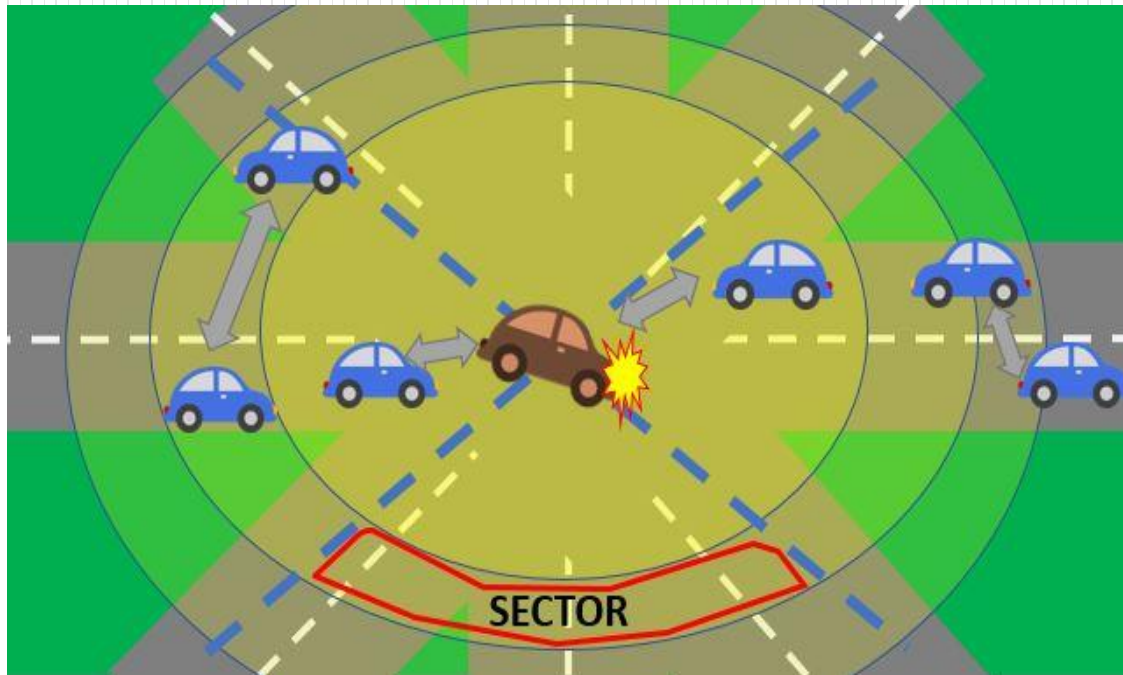
Predict the likelihood to get the content

The **old model is not suitable** for the non-linearity of the real world

- Zone of Interest = Anchor Zone
- Anchor Zone circular
- Node collaboration only within Anchor Zone
- Success probability is not linear



State of the Art: Two approaches to save resources with a Floating Content approach



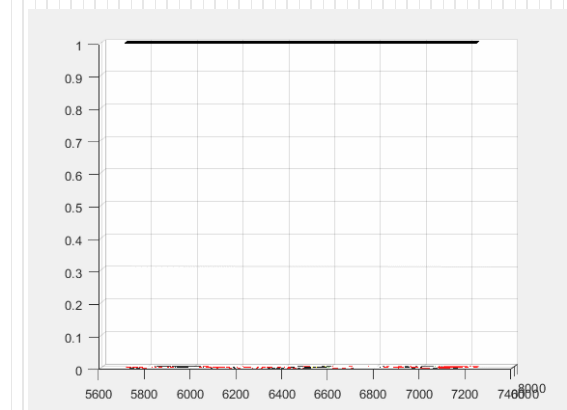
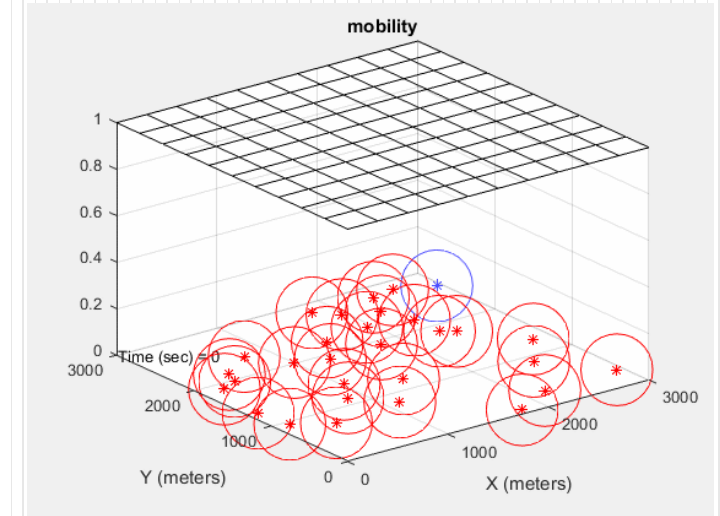
The estimation has to be computed by vehicles/RSU, possible in a cooperative way

Smooth Floating Content

- **Adapts** to the actual performance requirements
- **Efficient** usage of bandwidth and user memory
- **Decoupling** the content replication and storage strategies
- **Adapts** to the spatio-temporal mobility patterns of the region

System Model

- **Wireless node** moving in a region of the plane
- **Region partitioned** into a set of equally sized
- **Node uniformed distributed** in the space
- Stationarity assumption

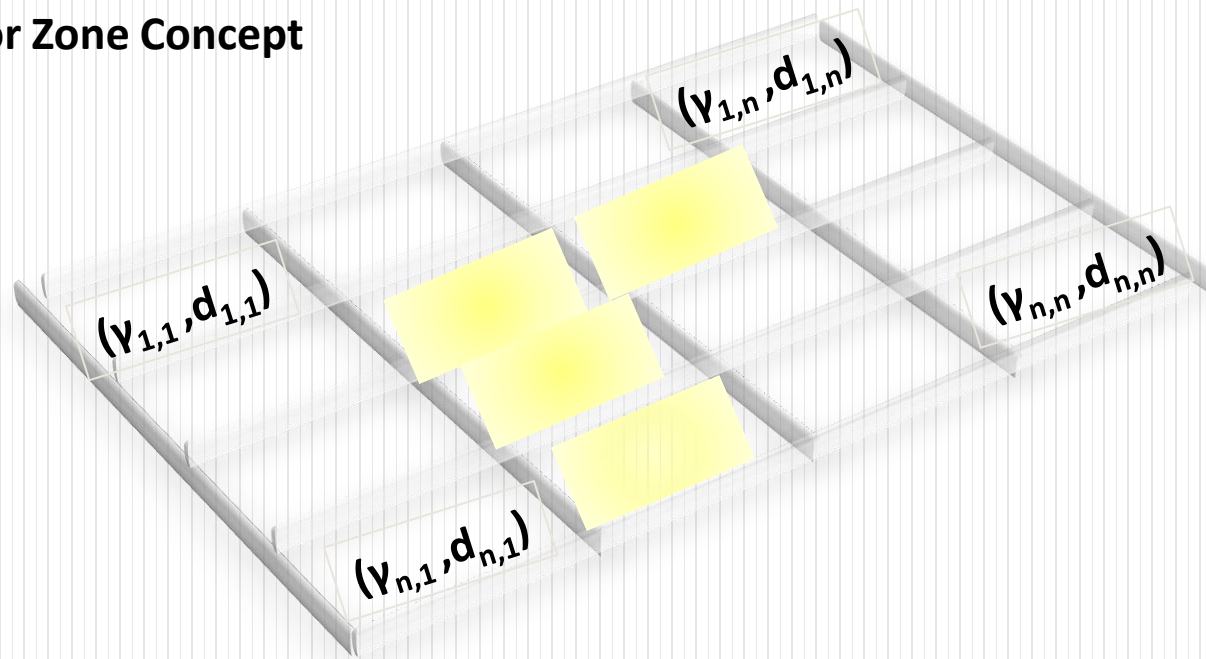


A grid based approach

- For every cell: **content infectivity** and **recovery rate**
- At time t_0 a node generate a message
- For each content there is a Zone of Interest
- The main performance parameter is the availability

The Anchor Zone is made via D and Γ

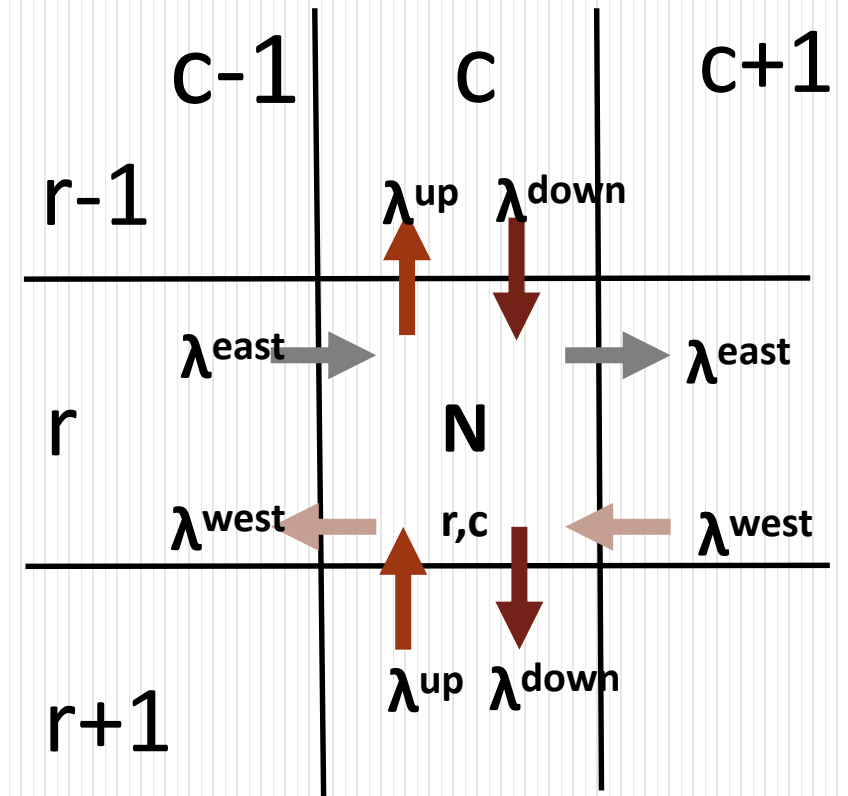
 → New Anchor Zone Concept



$(\gamma_{i,j}, d_{i,j})$ --> Infection and recovery rate cell (i, j)

In order to obtain D and Γ !

- The arrival rate
- Contact heat map
- Cell's area
- The message and the technology used
- Number of nodes




The object function to save resources makes the content floats over cells

minimize
A, D, Γ

$$\alpha \sum_{z,i} a_i N_i + \beta \sum_{z,i} I_i^z$$

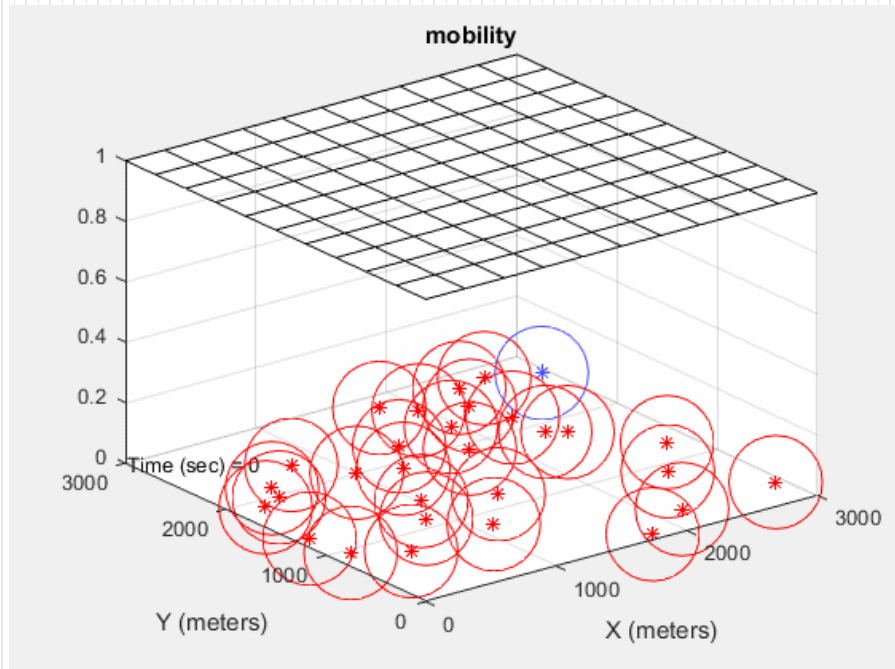
weight



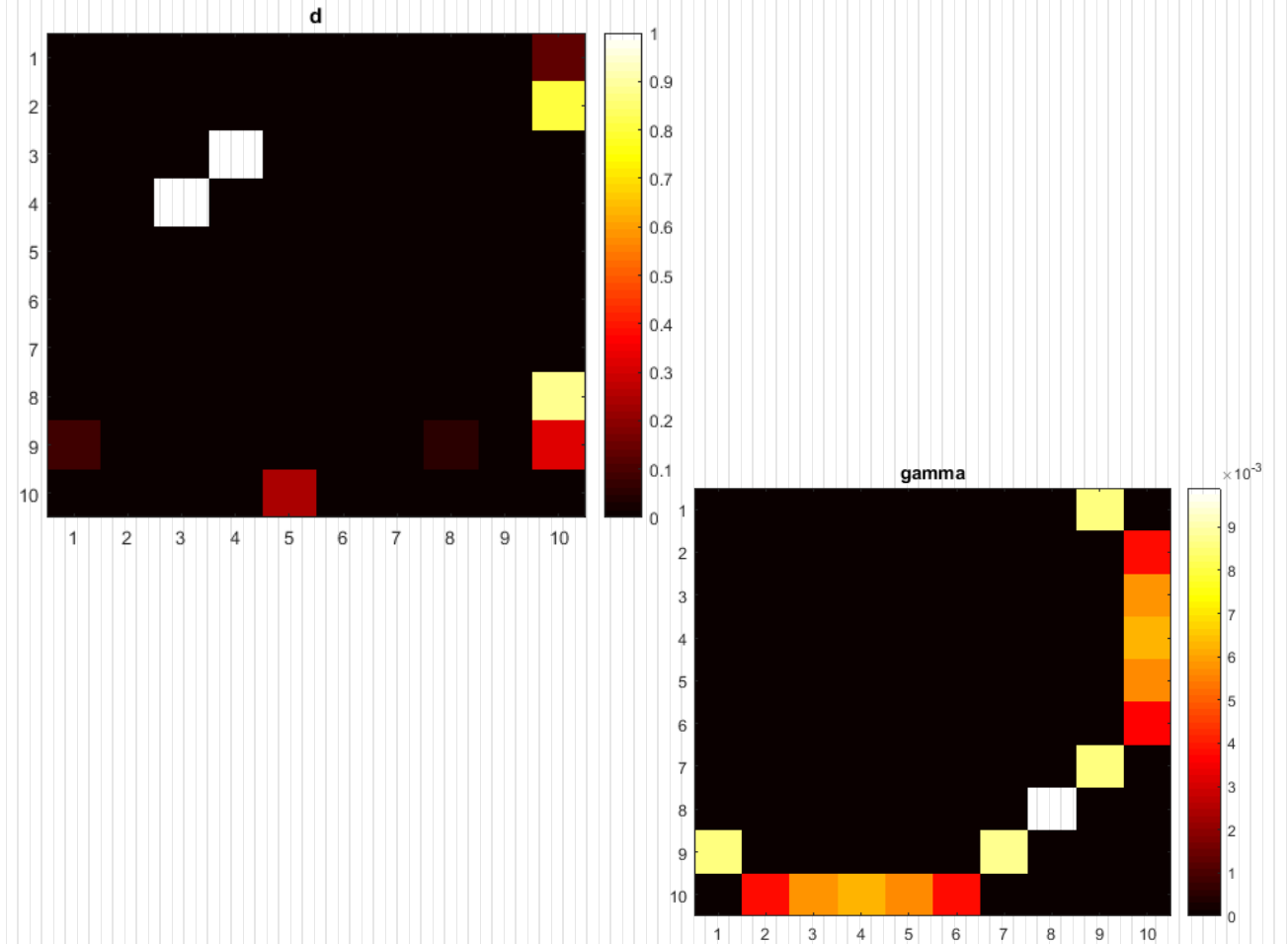
Subject to: **Success rate desired**

- Availability $A=\{a_i^z\}$
- Content Infectivity $D=\{d_i^z\}$
- Recovery rate $\Gamma=\{\gamma_i^z\}$
- I_i^z infection rate
- Z contents

A first experiment in the Ad-Hoc scenario (4)



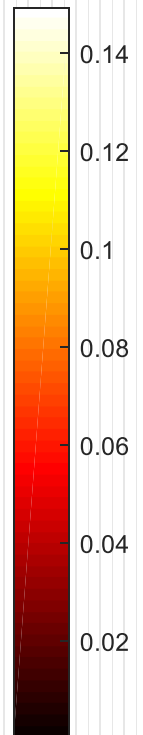
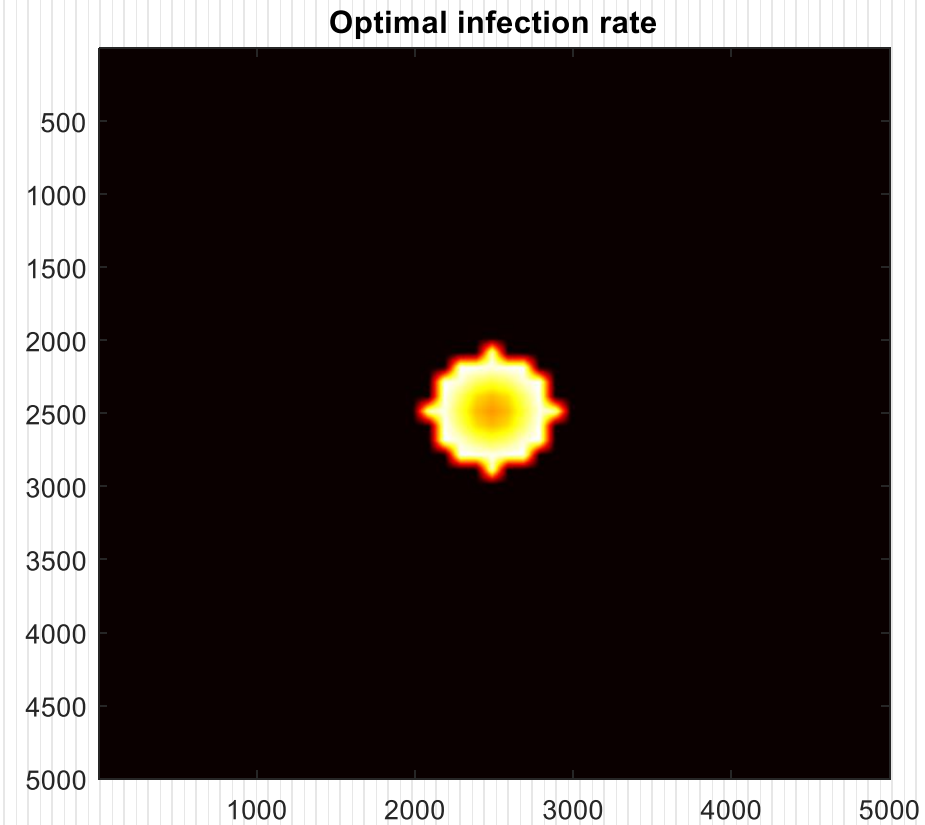
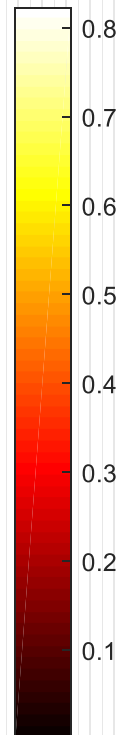
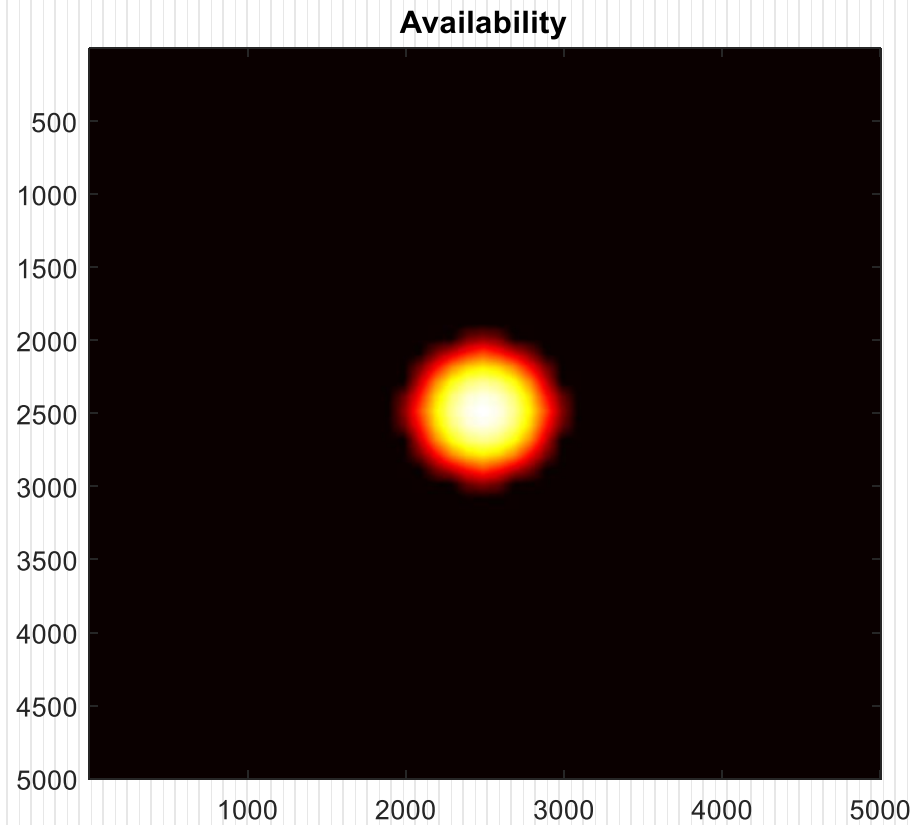
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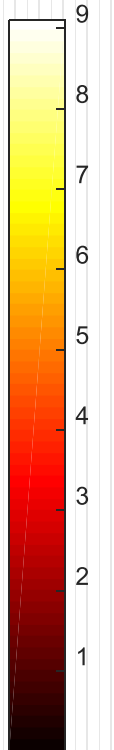
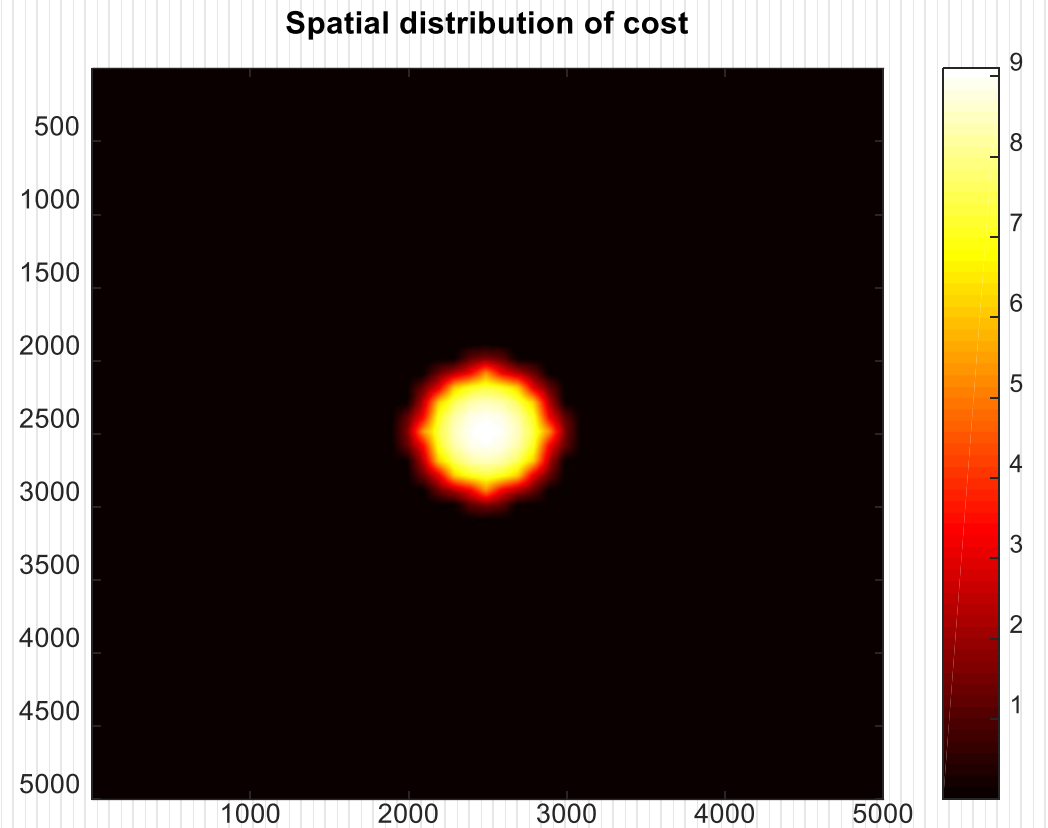
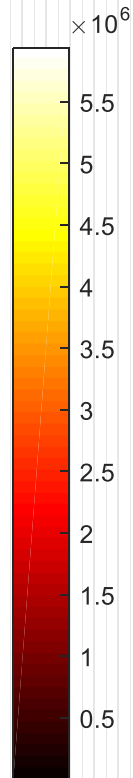
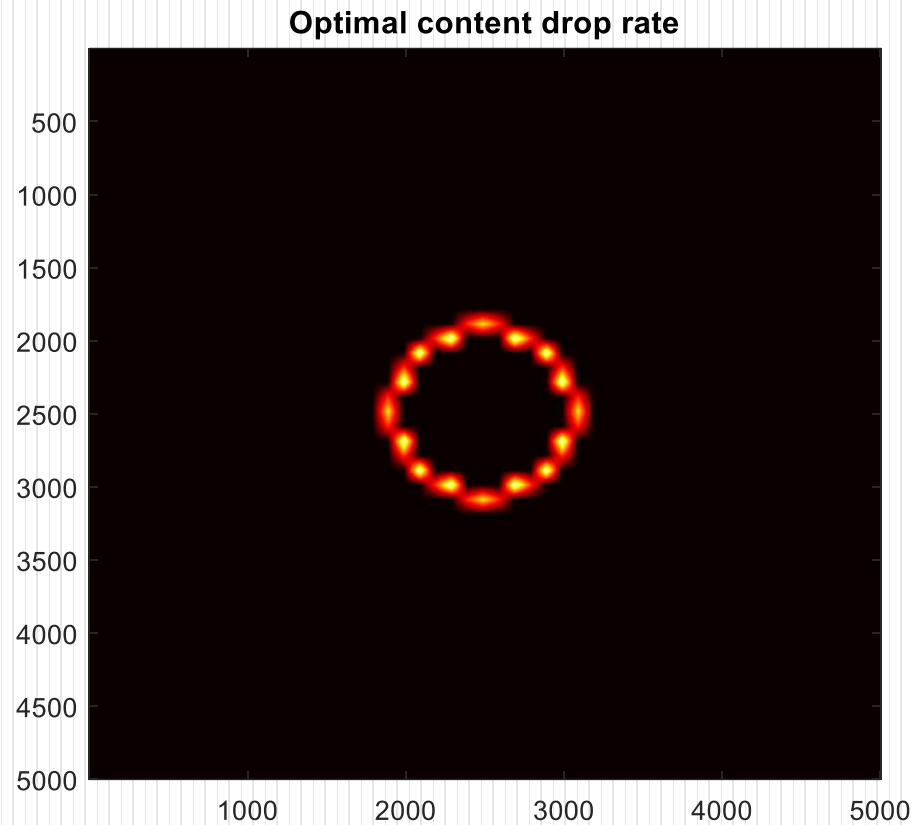
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The model performance has been simulated in ad-hoc scenario with alpha and beta =10 (1)

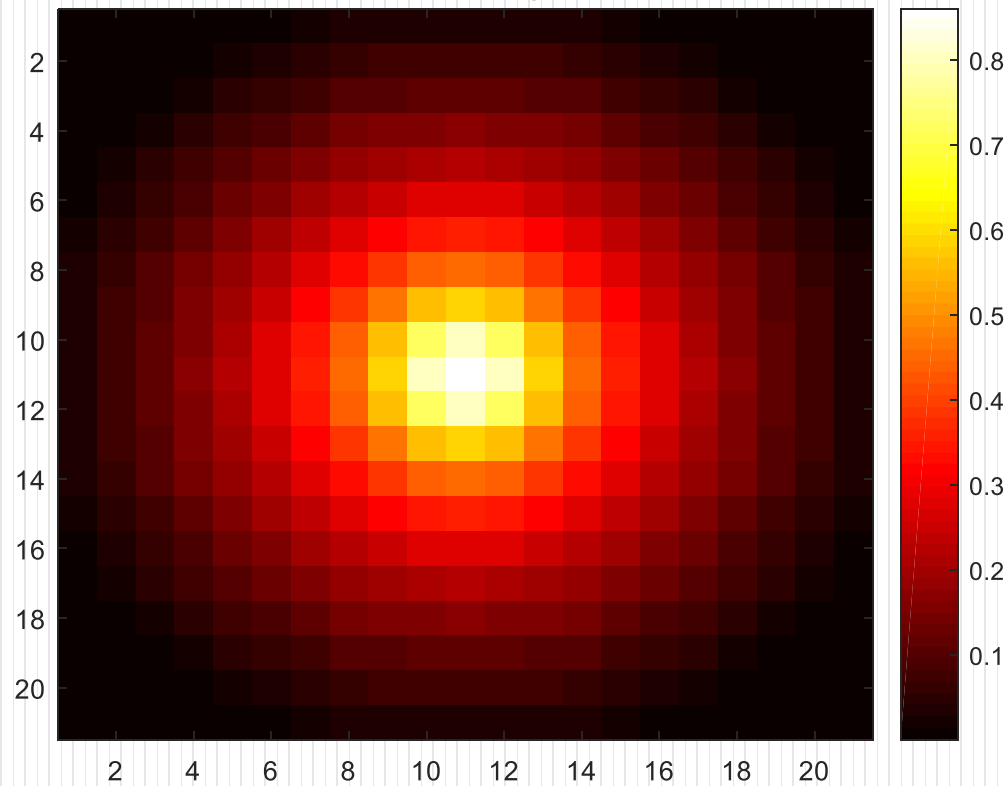


The model performance has been simulated in ad-hoc scenario with alpha and beta =10 (2)

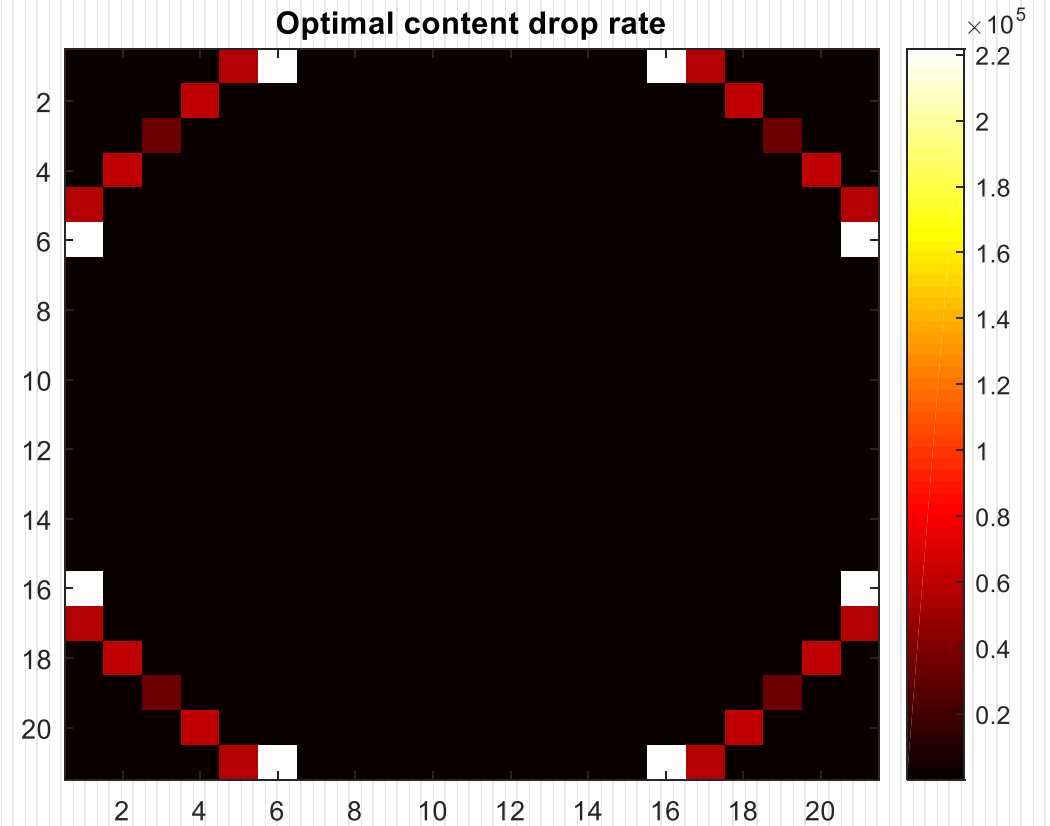


alpha=1, beta=100 predominance of replication costs (3)

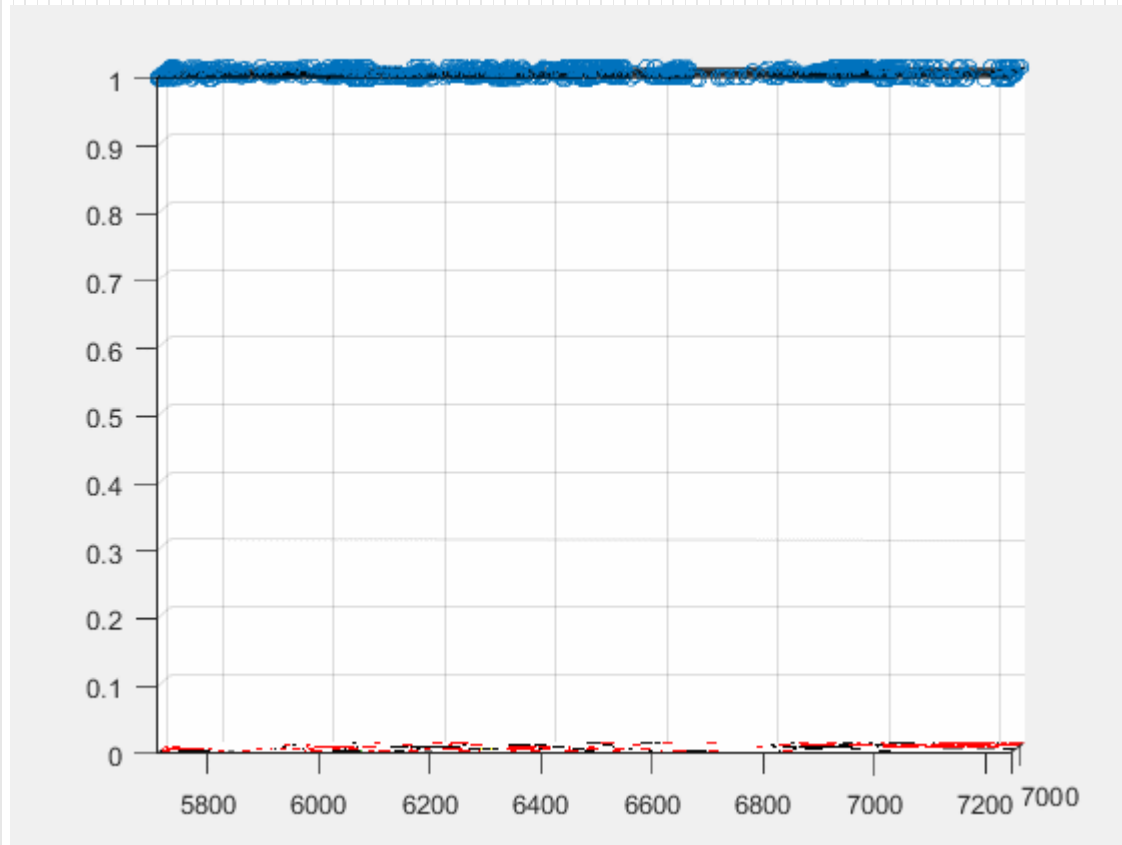
Availability



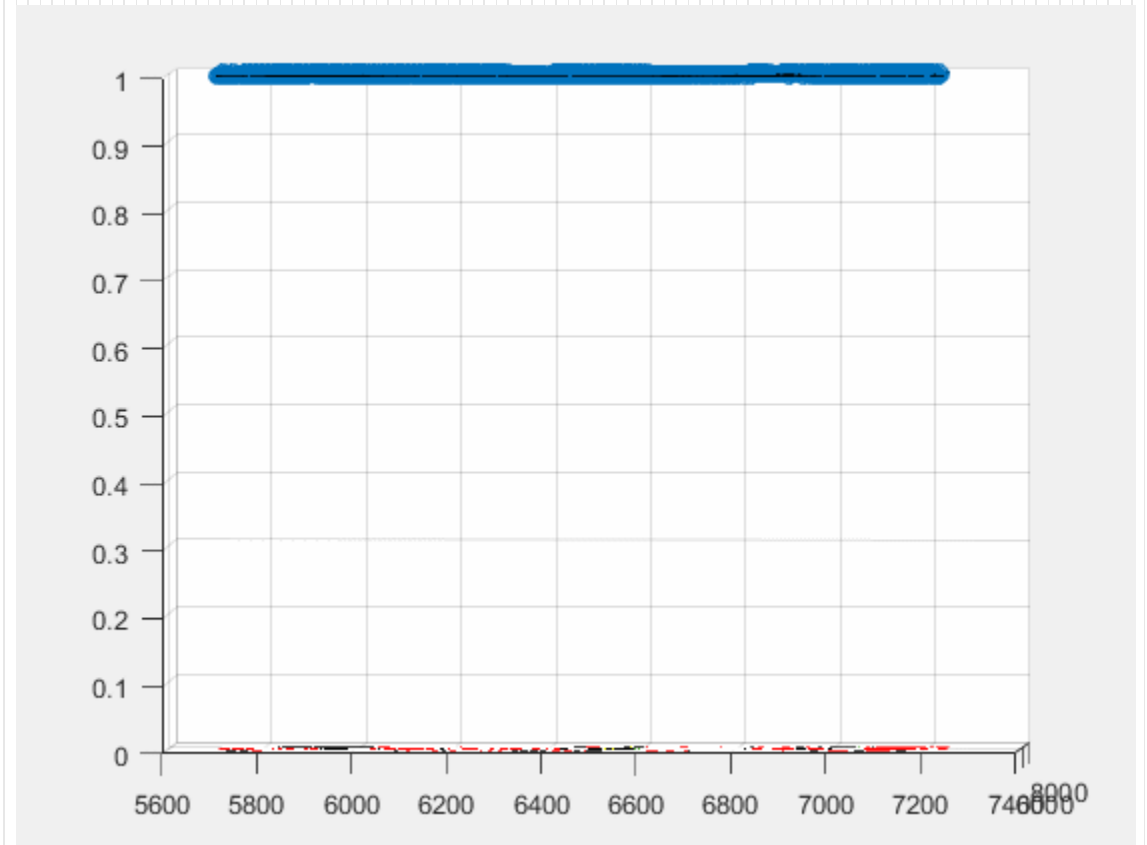
Optimal content drop rate



A first attempt to real/sintetic scenario (5)



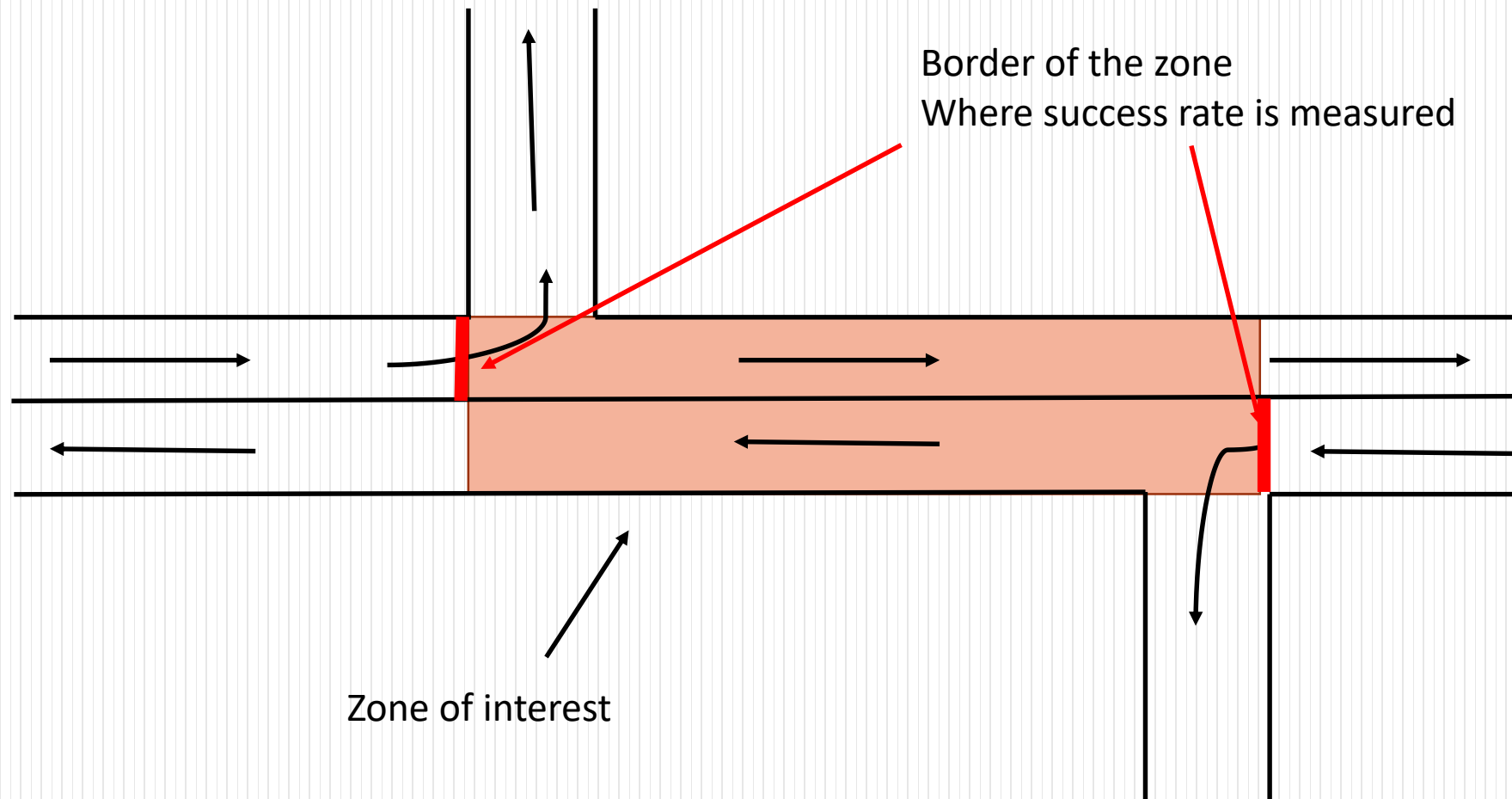
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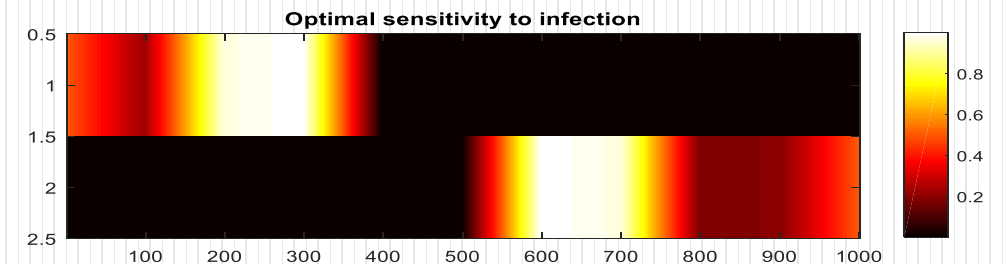
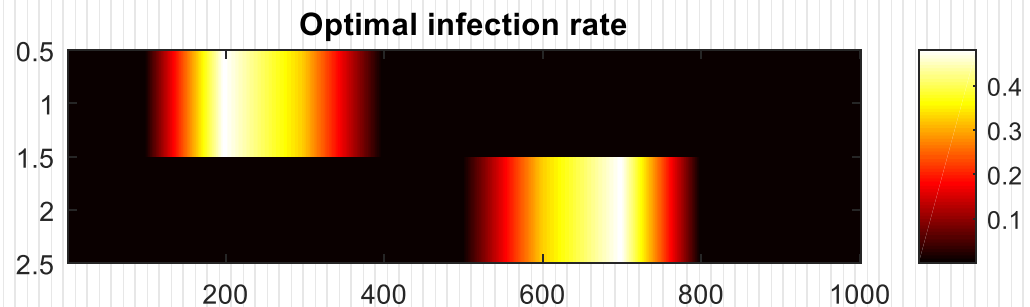
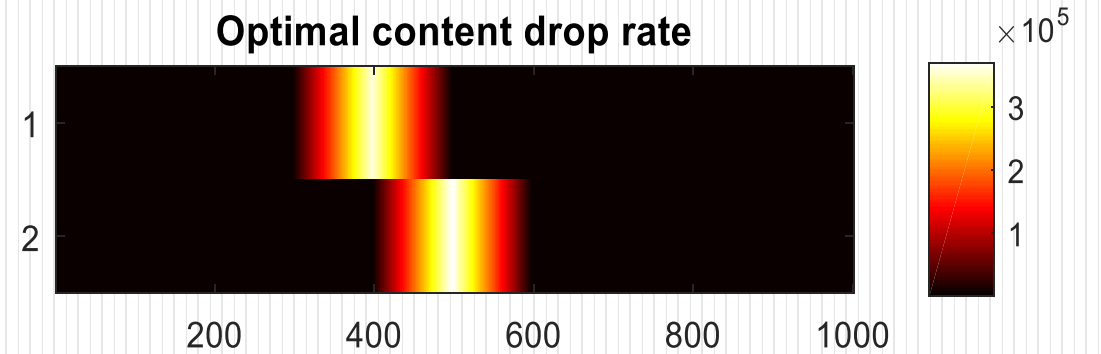
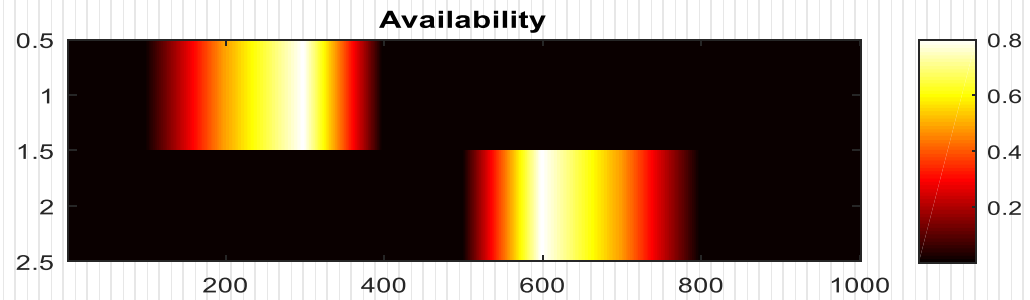
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Practical applications over not circular area, such as highway, were not suitable with the old model



The model is in good accordance with the simulations



Key Issues / Conclusion

- General Floating Content model
- Anchor Zone shaped to save resource
- Good accuracy of the model

Future Work

- Model assessment
- Simulation on real traces
- Simulation of specific application

Thank you

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