

## Introduction

Mobile telephony network is essential for modern life, but Company SimTel has received some complaints about the dropping and blocking from customers on the highway.

In order to improve the system by decreasing the block and drop rate under a certain standard, we build models to simulate in Arena. By comparing three models, we conclude that it is a superior scheme to reserve channel used first for handover.

## Objective

- To simulate the initial mobile telephony system to determine if it meets the quality of service requirements
- To remedy the problems by improving the model if there are some problems indeed
- To study the effect of variables on blocking and dropping tendency for validation
- To modify the model to avoid the boundary problem
- To do traffic capacity planning

## Input Data Analysis

- The speed of cars ~ NORM(90 , 8.14)
- Duration of calls ~ EXPO(119)
- Time between arrivals ~ EXPO(1.35)
- Call initial stations ~ Uniform (1,20)
- Call initial places within a cell ~ Uniform (0,2)

## Validation and Verification

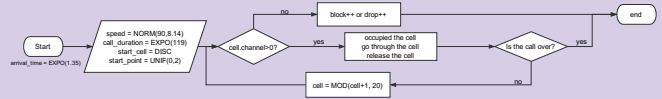
model	1_primary model	block rate	drop rate	tendency
num of channel	9	1.73%	2.24%	the number of channel $\nearrow$ block rate $\searrow$ drop rate $\searrow$
	10	0.79%	1.06%	
	11	0.33%	0.46%	
duration of call	EXPO(110)	0.52%	0.67%	duration of the call $\nearrow$ block rate $\nearrow$ drop rate $\nearrow$
	EXPO(119)	0.79%	1.06%	
	EXPO(129)	1.17%	1.67%	
arriving interval	EXPO(1.25)	1.15%	1.50%	interval between two arrivals $\nearrow$ block rate $\searrow$ drop rate $\searrow$
	EXPO(1.35)	0.78%	1.05%	
	EXPO(1.45)	0.54%	0.72%	
speed	NORM(80, 8.14)	0.79%	0.97%	speed of car $\nearrow$ block rate keeps steady while drop rate $\nearrow$
	NORM(90, 8.14)	0.79%	1.06%	
	NORM(100, 8.14)	0.81%	1.15%	

replication length: 12h times: 20 warm-up: 2h

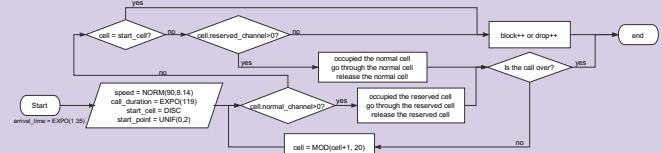
item analysis	to make sure that all events represented correctly
input analysis	to calculate the distribution of input correctly
flow chart	to contain all aspects of the conceptual model
debug in Arena	to eliminate coding errors in the model

## Simulation Experiments

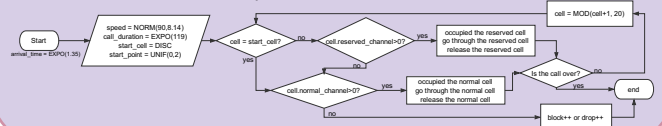
Model 1: the initial mobile telephony system of SimTel



Model 2: channels are reserved for handover, and normal channels are used firstly

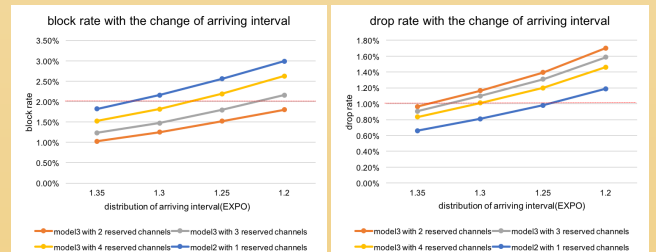


Model 3: channels are reserved for handover, and reserved channels are used firstly



## Results and Discussion

The block and drop rate of four schemes which meets the requirement in the initial traffic situation are changing as the traffic is increasing. The yellow line represents lower drop rate and block rate, which is better.



We obtain our initial model, optimized model and results by controlling variables. In view of users' complaints, we recommend setting up reserved channels to optimize the fixed channels allocation.

As for the boundary problem, we transmit the unfinished call in the last cell to the first cell. We also conduct a lot of repeated experiments to avoid the random errors.

## Conclusions, Lessons Learnt

We build the initial model of SimTel and find that the block rate is less than 2% which meets the requirement, while the drop rate is higher than 1% which is not satisfied.

We adopt the handover channel reservation scheme to improve the system. Considering the increasement of traffic, we determine the optimal model, that is, reserving 4 channels for handover which is prior to 6 normal channels.

- ✓ analysing and understanding of the system
- ✓ basic modeling methods
- ✓ the use of simulation software Arena
- ✓ statistical data analysis
- ✓ the verification and validation of experiments
- ✓ the experimental thinking and computer thinking