

Power of Towers – Telecom strategic game

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1. Introduction

The task of Nokia Code Jam coding competition will be Power of Towers – Telecom strategic game. During the competition, you, as participant will need to automate the management of a virtual telecommunication company with the code developed by you.

For the game, apart from this sheet, the Organizers also provide you demo game codes, and a downloadable framework to run tests and to help you understand how the competition works. These will be available after the registration deadline, until then you can study this description.

1.1. The goal of the competition, earning points, basic terms

The goal of the competition is to generate the largest company profit in each game round and to outdo the other 3 teams of the game round, which means winning it.

In each game round you can earn max 4 points, you can see the detailed awarding of points in the table.

1st place	4 points
2nd place	2 points
3rd place	1 point
4th place	0 point

In Nokia Code Jam we do not limit the number of teams who can enter.

Basic terms

The Power of Towers game is a strategic game with maps, divided into circles. The game round lasts 30 years in each case, with monthly decision circles, which means altogether 360 circles.

Circle – The decision-making stage of a game round

Game round – Or simply game. 4 teams compete with each other through 360 circles.

Round – The qualifying stage of Nokia Code Jam consists of multiple rounds. In each round our goal is to make all the teams participate in several game rounds, now we plan to have **10-10 game rounds** in each round for the teams.

Tower – The basis of the game. Your Virtual Telecom company offers its services to the customers through towers in Power of Towers.

Map – The area of the game in which we can find the 500 towers and the population (your potential customers).

Research points – **RP** in short. As a general decision, your company can allocate money in each circle to Research and Development (R&D) in order to achieve a higher technological level that allows bigger data traffic. The technological level affects the quality of the service.

Technological level – Technological development has 5 levels, the capacity of the next level is four times bigger, than the capacity of the previous. In each game the teams start from level 1. You will find out the RP levels necessary for technological development while playing the game.

The structure of the game round, the goal of the game

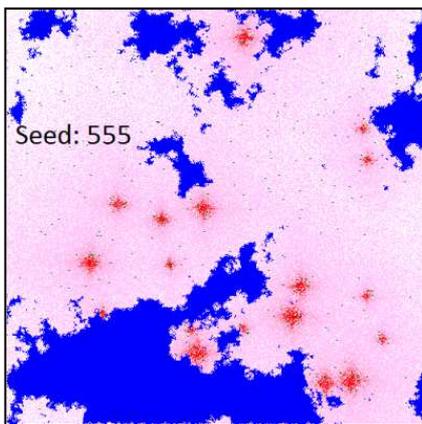
The codes submitted by the teams will be sorted into groups of 4 people, and the codes of the 4 groups will compete in a game round.

Before the beginning of each game round we reallocate the groups. The goal is to make each team face many different opponents who are of similar strength.

The goal of the game is to achieve the biggest profit by the end of the game round, which you can do by investing the starting capital into telecommunication services through renting towers, and gaining more customers. At the end of the game, after the last circle we calculate the sum of all the profit and loss amounts collected through the whole game, and that sum will determine the ranking of the participating teams.

When calculating the points, we will consider the ranking formed by the end of the game.

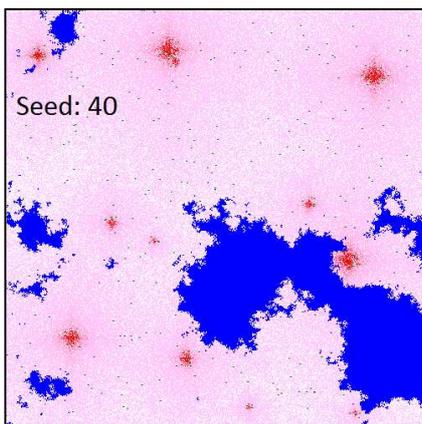
2. The map



Each game takes place in a randomly generated, two-dimensional (500x500) map, which is uniquely authenticated by the identifier (seed) of the map. We draw a different map for each game round.

On the map you can find water (blue area) and mainland. The population is not equally distributed on the mainland. There are city centers (red areas), where many people live, but the areas that are further are not completely deserted either.

The place of the towers is fixed on the map during the whole game, these can only be rented. The location and number of the population fluctuate a bit, which is determined by two factors: the growth of the population and the urbanisation factor.



The algorithm of generating maps is public. However, the algorithm by which the customers choose a service provider is not (as it cannot be determined exactly in real life either), this can be guessed by your experiences gained in the game, and during the preparations.

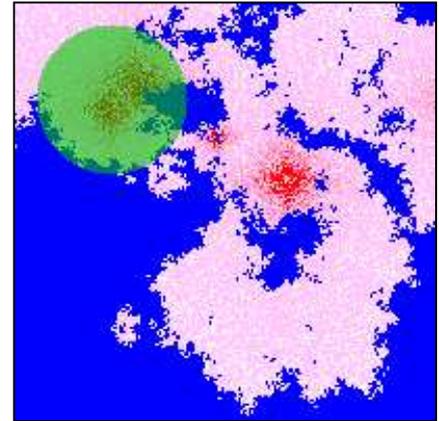
3. The towers

A tower has a rental fee and an operation cost.

The towers have two types of capacities: effective range and data traffic capacity. The tower can only provide service to customers who are within the effective range, but within this range there is no difference in quality.

The effective range can be increased to a certain extent, but it also means in an increase in the operation cost.

The data traffic capacity can only be increased by technological development. By spending money on development, you get research points, and if they reach a certain value, then you are able to use the next level of technology.



Technological development has 5 levels, the capacity of the next level is four times bigger than the capacity of the previous, other than this, it is completely the same as the earlier technologies regarding the game.

3.1. Costs

The right to rent a tower can be obtained by bidding on an empty tower. If there are more than one bidders, the tower is given to the one who offers the higher rental fee. This cannot be modified later, and when you earn the right to rent, you need to pay 3 months in advance, this amount can be used up in the transitional period, when you decide to terminate your lease, or someone else takes over the tower. You need to pay the monthly rent continually from the day when the rental right takes effect.

You can leave the tower and terminate your lease, at that point you do not need to pay the rent anymore, but you can still use the tower for 3 months, to use up the amount you paid when you first rented the tower.

With each tower you can have a separate offer for your customers, but these offers cannot be totally different from each other. **The rental fee of the towers can only change less than 50% compared to the average price of the last circle.**

Changing tenants in towers: you can bid on those towers as well, which already have tenants. When you bid you need to pay one month rent, and put 3 months' rent in deposit. (The rent for one month will be lost, this is the price of bidding). The present tenant has the pre-emption right, the primary right for rent, if they can pay the price that you offer for it, they can keep the tower. They have 3 months to decide.

There is no credit in the game, which means that if a team loses all their money (**bankruptcy**), they are deleted from the game, and will not be ranked in the given game round.

In that extreme case, when all the 4 player go bankrupt before the end of the 360th circle, no one gets a point.

3.2. Commands concerning a certain tower

Commands that players can give (more at Costs):

- Bid on an empty tower
- Bid on an occupied tower
- Bid on your own tower (in case of defence)
- Terminating the lease at a tower
- Changing the effective range (distance)
- Changing price offer: the price for which you offer your service to your customers in the area of the tower

You can give more than one commands at once. There is no penalty for invalid commands, they are simply ineffective, for example trying to increase the effective range of a tower that you do not rent.

3.3. Commands in general

Research and development (R&D) cost: you get research points for the amount you pay. However, after a certain amount you do not get research points in proportion with the amount you paid, but you only get 70% of the points (restriction). Research is global, and if you reach a certain RP level, all of your towers will automatically level up, and all the towers you rent after will be rented on this present level. This means that a newly acquired tower will also start its operation on your current level, despite the operation level of the previous tenant.

4. The customers

The customers will always choose to get the service from the closest tower of the given provider.

The customers' demand of data traffic constantly grows, each months 1.015 times the last one. This demand can be met by renting more towers or technological development.

The customers always choose the closest tower from a provider, whose tower is in effective range of their homes. They choose the provider based on the price and the quality.

Problems with quality arise when - in the area of a given tower - we have contracts with more customers than what we can serve in terms of demand for data traffic. The customers have a certain tolerance with quality problems, but if these are long-lasting and grave problems, it will surely lead to customer loss.

5. The timing of the game

The qualification will have 3 rounds. In each round there will be multiple game rounds. A game round is divided into 360 circles, which is 30 virtual years game time, with opportunities to make decisions on a monthly basis.

The programs will need to be uploaded with an online program. After the upload an automated system will translate them, and will send you a list of errors, if the translation was not successful.

5.1. Qualifying and online rounds

The 3 online rounds will happen weekly. Each week the programs, that were turned in before the given deadline will compete, and within 36 hours, we will announce the results in the morning (if the round ends earlier, than we will announce it even sooner). You will not only see the results of the competition, but also each game round will be available to see on an online page.

The participants will be divided into leagues. Each league will consist of 40-50 groups, based on the number of participants we expect to have 4-5 leagues. The first round is special, everybody will start off as equals.

It is determined in the first round, which team will be sorted into which league.

Later we will continue the competition in the bottom (e.g. D) league. The best teams of league D will continue in league C and so on. If in the first round someone does not send in a program that could be translated, they will automatically start off later in the bottom league. However, if their program is good, and makes it to the best ones in each league, then it can get to the top, to league A even in the course of one round!

The best teams will be able to compete in the live final. In the last round there will be surprise rules, for which you will need to find a strategy on the spot. The game codes written earlier can be used, taking the new rules into consideration.

5.2. Circles

One game round lasts 30 virtual years, with monthly decision circles, which means altogether 360 circles.

During one circle, the following things happen:

- Asking the players, collecting the commands
- Time change on the map (population change)
- Deleting bankrupt players
- Leaving abandoned towers
- Administration of investments, development of towers, if necessary
- Changes in your own towers: effective ranges, price offers, leaving towers, defending towers against bidding
- Change of ownership, if the tower could not be defended
- Bidding to operating towers
- Renting new towers
- Checking the price offers, if the price is too high, changing them back to the maximum price
- Increase in the demand for data transfer
- Finding the closest tower to each pixel, distribution of customers in regard of the prices and quality
- Calculating incomes and expenses

6. Tools, starter pack

The program that generates the maps can be downloaded by each player in a C++ and JAVA program form as well. This way you can test your program on different maps.

We will give you a framework, with which you can simulate a game round among 4 players. You can use your own program in different forms, but you can also use the demo players provided by us.

The framework will own verifying and monitoring properties that will make debugging easy. You can see what is happening on the map, you can change the time one by one, but you can also run it till the end of the game. When you go through each step one by one, you can inquire about the players' offers, the properties of towers and the statistics of the game.

7. FAQ

What if I do not have enough money for renting the tower, but I was bidding on it?

The bidding for the empty towers happen at the same time. If you do not have the money for the tower, your bid is invalid. There is no penalty for it, we simply do not take it into consideration.

It is important to know that in this case, the ranking is based on the serial number of the towers, not on the value of the bids!

Do we place our bids at the same time as the others?

Yes.

If you are bidding on 3 towers, you lose the first, you win the second, but you do not have enough money for the third, then you will only rent the second tower. It is important to know that in this case, the ranking is based on the serial number of the towers, not on the value of the bids!

What if the first 3 months are paid, but there is a higher bidder in that time, and I want to exercise my pre-emption right? Do I need to pay again the amounts paid for the first 3 months, or only the difference?

Only the difference.

Do we still have our pre-emption rights (primary right to rent) after we have terminated our lease and spend our period of notice, the last 3 months there?

You always have pre-emption rights while you are a tenant.

Can we terminate our lease in the first 3 months after the contract is made? Will we get back the money then?

Yes you can, but we never give money back, you can simply use the tower for those 3 months that you paid for.

8. We reserve the right to alter the game

If during the competition – for any reason – there is a need to alter or specify the rules, we will notify the participants in advance.
