Assignment Part 2

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1 Part 2.1

To solve the excercise we need to start by making some observations. First of all we remember that, in a Jelltfish network, the number of servers S is given by the formula:

$$N_j = S_j(n - r). \tag{1}$$

Note that we're assuming that the networks uses the maximum amount of servers (that's reasonable so to develop conclusions in the most efficient setting) and that the same amount of server ports $n-r$ is reserved for every switch (and that's because the problem asks us to work with a unique r).

The number of servers in a fat tree network is given by the formula:

$$N_f = \frac{n^3}{4}. \tag{2}$$

The formula can be obtained by noting that there are n pods, for every pod there are $\frac{n}{2}$ edge level switches and every edge level switch is connected to $\frac{n}{2}$ servers.

On the other side the number of switches in a fat tree network is given by:

$$S_f = \frac{5}{4}n^2 \tag{3}$$

That's because we count n switches for every one of the n pods and then, since one pod is connected to all of the core level switches and one pod has a total of $\frac{n^2}{4}$ of these connections, we get a total of $n^2 + \frac{n^2}{4} = \frac{5}{4}n^2$ switches.

We can now easily solve the excercise. We just need to use the fact that

$$N_j = N_f$$

and

$$S_j = S_f$$

In fact, from (1) and (2) we get

$$\frac{n^3}{4} = S_j(n - r)$$

and then using (3) we obtain

$$\frac{n^3}{4} = \frac{5}{4}n^2(n - r) \Rightarrow n = 5(n - r) \Rightarrow r = \frac{4}{5}n.$$