

Lecture 8- Technology and the Bottom Line (2):

Frequency, Wavelength and the Cost of Coverage

1. If we need 20 cells to cover the necessary system area for startup at 900 MHz, about how many would we need at 2 GHz? What problem would this cause?

About 40 cells. Lecture 8 page 9 indicates a 2x cells needed at startup for 2 GHz. The received power when we double frequency is reduced to 1/4, simply because the oval area of the antenna aperture is reduced to 1/4 as shown in the slide. If the cell were in space, we would make up this 6 dB by reducing the cell radius to 1/2 (so 4 times as many cells would be needed in space). In the real world, where the signal deteriorates by 12 dB (1/16) when we double the distance (R^4), we reduce the cell radius by the square root of 2. And the number of cells increases by 2. This makes the number of 20 cells should be doubled to ~40 cells.

This would double the investment and reduce profitability during the initial phase of growth.

2. There is available spectrum at 100 MHz and 1 GHz (1000 MHz) and 5 GHz
 - a. Which would you choose for a police or fire system in hilly terrain with a central tower? Why?
 - b. Which would you choose for a cellular system? Why?
 - c. Which would you choose for WiFi?

100 MHz for police (good coverage from a single site; long antennas on cars OK).

1 GHz for cellular; needs less range, but still need a few miles from a base. Smaller antenna is an advantage.

5GHz for WiFi Short range OK, Spectrum cheaper and more plentiful

D&Q 8:

3. Calculate the required revenue/MB if Infostations cost \$5K and spectrum costs \$5/MHz/POP. **.06 cents/MB**

Balance Sheet:		P&L	
200K Infostations @ \$5K	\$1B	Infostations download 1.5 trillion MB	
20 MHz @ \$5/Mhz/POP	\$2B	Required rev/MB = .06 cents/MB	
Total Investment	\$3B		
		Req revenue	\$950M
		Tot Expenses:	\$500M
		SG&A:	\$200M
Assets (cells):	\$3B	20% Depreciated:	\$200M
Shareholders equity:	\$3B	5% Amortization:	\$100M
		BT Earnings:	\$450M
		33% Tax:	\$150M
		Required Profit:	\$300M
		(10% return on equity)	

4. What do these calculations suggest about the robustness of this idea? **It is very robust. It produces attractive numbers with a wide range of variations.**
5. Calculate the annual download of the Infostations if the occupancy doubles (to 20%) and the Infostations (with more power and a good line of sight path) can deliver 3 bits/sec/Hz instead of 1.5 bits/sec/Hz. **6 trillion MB**