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Industrywide Patent Enforcement Strategies

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Part Two of a Two-Part Series

Game Theory

To model a multi-litigation enforcement let us play a simple game. The rules of the game are as follows: There are 10 closed boxes in front of us. There is a $10 bill on top of each box. For each box, there is a 50% chance that there is a $100 bill inside the box. We have two options with each of the boxes: 1) to play the game, which entails setting aside the $10 bill on top of the box and opening the box or 2) passing, which entails collecting the $10 bill on top of the box but leaving the box unopened. If we choose to play by opening the box and if there is a $100 bill inside, we can collect it and move to the next box. However, if the box is empty, the game is over and we do not get to play other boxes. The goal is to collect the maximum amount of money. What is the optimum strategy?

Let us first summarize the possible outcomes of each box. We will do this, as it is typically done in game theory, by constructing a payoff table:

	Contain a $100 bill	Empty
Play	$100	$0
Pass	$10	$10

In other words, by playing any given box we can either win $100 and the right to play the next box or nothing; by skipping this box (pass) we are guaranteed to win $10 and the right to play the next box. Since the probability of finding a $100 bill inside a box is 50%, the expected value of playing a box is $50. From this analysis it would seem that it pays to play each box since its expected value ($50) is greater than the guaranteed value of skipping the box ($10). Although this analysis may be correct if all 10 boxes were independent, our game is complicated by the rule that as soon as you open an empty box, the game is over.

One strategy is to play it safe and collect $10 dollar bills by skipping all of the boxes — playing pass. This strategy guarantees us the total win of $100 ($10 x 10).

Another simple strategy is to open each box. Let's see what is the expected value of this strategy. The first box has an expected value of $50 ($100 x 0.5). We only get to play the next box if the first one is not empty. Therefore, we have only a 50% chance to play the next box and a 50%

chance to find a $100 bill there. Since the probability of both events is the product of the probability of each of the events, the probability of finding a $100 bill inside the second box is only 25% (0.5 x 0.5). The probability of finding a $100 bill inside the third box is only 12.5% (0.5x0.5x0.5=0.5^3) and the expected value is accordingly $12.50. The probability of finding a $100 bill inside the box n is only 0.5^n. Thus, the probability of finding a hundred dollar bill inside the tenth box is only 0.09% (0.5^{10}). Let us now calculate the total expected value of this strategy:

BOX #	PROBABILITY OF FINDING A BILL	EXPECTED VALUE
1	50.00%	$50.00
2	25.00%	$25.00
3	12.50%	$12.50
4	6.25%	$6.25
5	3.13%	$3.13
6	1.56%	$1.56
7	0.78%	$0.78
8	0.39%	$0.39
9	0.20%	$0.20
10	0.10%	$0.10
Total		**$99.90**

As counterintuitive this may be, the result of both strategies is the same. If we change the parameters of the game, the result will change as well. If we play the game where on top of the box are $5 bills instead of $10 bills, the result would be quite different: The strategy of playing it safe by passing each box would only yield $50 and would be inferior to the aggressive strategy of playing each box. On the other hand, if the payoff inside the box is only $50 instead of $100, the aggressive strategy would yield $49.95. Let's change the number of boxes from 10 to 20 leaving all other parameters of the game the same as in the first example. Playing it safe will yield $200. However, playing it aggressively will still yield only $100. This is because, as we see from Table 3, the expected value of each consecutive box falls off geometrically.

Going back to the first example, what if we played it safe nine times and gambled on the last box? The first strategy yields $90 ($10x9) and the second part yields $50, because the expected value of each box is $50 ($100x0.5). Total expected value of this strategy is $140 — significantly better than either of the extreme strategies. Expanding on this hybrid strategy, let's play the first eight boxes safe and gamble on the last two. The resulting expected value is $155 ($10x8 + $50 +$25) — better yet. Let us construct a table showing the expected values for different hybrid strategies:

HYBRID STRATEGY		EXPECTED VALUE		TOTAL EXPECTED VALUE
Pass	Play	Pass	Play	
10	0	$100.00	$0.00	$ 100.00
9	1	$90.00	$50.00	$ 140.00
8	2	$80.00	$75.00	$ 155.00
7	3	$70.00	$87.50	**$ 157.50**
6	4	$60.00	$93.75	$ 153.75
5	5	$50.00	$96.88	$ 146.88
4	6	$40.00	$98.44	$ 138.44
3	7	$30.00	$99.22	$ 129.22
2	8	$20.00	$99.61	$ 119.61
1	9	$10.00	$99.80	$ 109.80
0	10	$0.00	$99.90	$ 99.90

The best strategy turns out to be playing seven boxes safe and gambling on the last three boxes. As a general rule, it pays to gamble only so long as the last gamble will have greater expected value than the reward for playing it safe. In our example such reward, "settlement," is $10. Table 3 shows that already the third gamble has a lower expected value — $6.25. Therefore, we should not exceed three gambles. Thus, the best strategy is to play it safe seven times and gamble the last three.

This game, of course, is an allegory to litigation. A box is a lawsuit. A $10 bill on top of each box is a settlement amount in each lawsuit. A $100 bill inside the box is the damages expected to be awarded as a result of a trial. To open the box means litigate to trial, to pass means to settle.

Since statistically, a patentee has 68% probability to prevail at trial, it is useful to use this number as p leaving the settlement at 10 cents on a dollar. In this case, the optimal strategy is to settle the first five or six cases and to litigate to trial the last five or four cases. Interestingly enough, the number of cases it pays to litigate to trial does not depend on the total number of cases. If we have 20 cases instead of 10, it still pays to litigate to trial only the last five cases and settle the first 15.

A careful reader will notice that whether we gamble in the beginning or at the end, as long as we maintain the same ratio of settlements and trials, the expected value is the same. The difference, however, is that if we settle first and litigate later, the total settlement amount is guaranteed, while if we litigate first we may lose everything in the first case. This is a perfect illustration of the limitation of applying game theory or litigation risk analysis to a real life situation. As I mentioned in the beginning of this article, the probabilities require a large number of trials to be meaningful. If we could replay the same series of court cases time and again, indeed, there will be no difference between two strategies. In the real life, of course, we can only litigate a given court case once. If we lose, the game is over and there is no replaying it. Therefore, it is certainly advantageous to use the safer strategy of settling several cases first before trying your luck.

Although any multi-defendant patent infringement litigation is infinitely more complex than this simple game, a number of lessons may be learned. The first lesson is that any hybrid strategy is better than a single strategy, whatever this strategy may be.

The second lesson is that settling first and litigating later is a better strategy than the reverse.

The third lesson is that it pays to settle the first several cases and litigate to trial the last few cases so that the last litigated case will have an expected value greater than the next available settlement value.

The fourth lesson is that the number of last cases it pays to take to trial does not depend on the total number of cases.

In our analysis, we ignored the time value of money, which should be accounted for in any real-life analysis. As litigation may drag for a number of years, particularly if appealed and remanded for further proceedings, this diminishes the discounted net present value of any future award and further skews our analysis in favor of early settlements.

Our analysis is also oversimplified as it assumes that the probability of winning remains the same throughout the enforcement campaign. Obviously, it does not. If you try the first case and win, the probability of winning the subsequent cases will be much greater than if each of these cases had been tried first. Albeit not res judicata, establishing a precedent without a doubt is going to affect all subsequent cases. So much greater, if the case is appealed and affirmed by the Federal Circuit. Although to a lesser degree, each successful settlement may increase the probability of the subsequent settlement. Furthermore, it may increase the probability of winning a later case as the fact of industry acceptance of the patent-in-suit may be presented to the jury.

Let's assume that the probability to win the first case is statistically 68%. Suppose this probability goes up to 75% after the first successful litigation, to 85% after the second win and to 90% after the third. Suppose it stays at 90% for all subsequent cases, as the infringement issues may be slightly different and there is always a chance that someone can find a "slam dunk" prior art reference. Suppose the defendants are all ready to settle at 50 cents on a dollar. Let's construct the payoff table of different strategies:

HYBRID STRATEGY		EXPECTED VALUE		TOTAL EXPECTED VALUE
Settle	Litigate	Settle	Litigate	
10	0	$500.00	$0.00	$500.00
9	1	$450.00	$68.00	$518.00
8	2	$400.00	$124.25	$524.25
7	3	$350.00	$185.66	$535.66
6	4	$300.00	$251.27	$551.27
5	5	$250.00	$310.32	$560.32
4	**6**	**$200.00**	**$363.47**	**$563.47**
3	7	$150.00	$411.30	$561.30
2	8	$100.00	$454.34	$554.34
1	9	$50.00	$493.08	$543.08
0	10	$0.00	$527.95	$527.95

These more realistic assumptions suggest that the best strategy is to settle all but the last six cases and to litigate those six. Such a payoff table should be constructed in any specific patent enforcement campaign with its specific facts and assumptions to consider the optimum strategy. The assumptions may change along the way with more information becoming available as the cases unfold and should be fine-tuned at least after each case.

Conclusion

Game theory is a powerful tool in decision making and should be utilized in analyzing patent litigation strategy, particularly multi-defendant litigation. However, one must bear in mind that game theory was built on neoclassic economic theory, which assumes that everybody acts rationally to achieve the greatest personal gain. As every seasoned litigator knows, litigants often act irrationally, which places limitations on applicability of game theory.

In principle, the decision analysis of multi-defendant litigation strategy is no different from an analysis of a single litigation. The settlement value is compared with the expected value of litigation. The difference is that in a multi-defendant litigation the expected value of any given lawsuit is the sum of the expected value of that lawsuit and the expected value of an option of asserting the patent against the rest of the infringers. If this lawsuit is lost, so is the option. Methods of real options theory may be applied to determining the value of the option on subsequent litigation based on the Black-Scholes equation.

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