# Deep Blue

Deep Blue is a computer chess system developed at IBM which was a result of series of machines developed like Deep Thought. There were two version of Deep blue one which lost to Kasparov in 1996 and one which defeated him in 1997.

After match in 1996 it was realised there were lot of deficiencies .

- A new chip was designed whose evaluation function moved from 6400 features to 8000 features.
- Number of chess chips were doubled to increase search speed .
- Set of tools was developed to help in evaluation tuning and for debugging and match preparation.
- Iterative deepening , transposition tables, quiescence search were used to optimise complexity in terms of space and time as well as to give better results to overcome issues like horizon effects.

Deep blue had following challenges

- Large searching capacity with high non uniform and selective search to hand specific playing styles and due to counter the ability of human players to search way deep that computer players that search uniformly. Also it wanted to guaranteed that all moves were searched to a certain minimal depth to provide insurance against simple errors.
- Hardware Evaluation functions : Time to execute evaluation function is constant with limitation of not being able to add new features.
- Hybrid Software and Hardware Search : Deep blue used software search with transposition tables for upper levels along with hardware search with quiescence search for lower levels.
- Massive Parallel Search : Deep blue is massive parallel search system that has over 500 processors participating in search tree.

Chip used in Deep blue consisted of three parts

- Move Generation : It has additional functions like check for evasion moves, look for attacking moves and also choose reasonable move ordering as close to best first as possible.
- Evaluation function: Consisted of slow and fast evaluation functions to skip full evaluation in cases when approximation would be good enough.
- Search control : Used null window alpha beta search so that need for value stack was eliminated. Also software search had access to transposition tables.

Results

Success of deep blue in 1997 was due to many factors

- Large non uniform selective searching capability
- Complex and Tunable evaluation functions
- End game databases
- Extended book of moves by past chess grandmasters
- Keeping Opening book of moves