SUMMARY OF DEEP BLUE by the IBM Watson Team (Fun fact, Deep Blue beat Gary Kasparov in Chess in one of the most famous AI spectacles of the 20th century).

The paper described deep blue, the chess playing machine that defeated Gary Kasparov by a score of 3.5–2.5 in 1997.Deep blue is the culmination of a multi year effort to build a world class chess machine, predecessors of deep blue were:

1- Deep thought(1988)- The first chess machine to beat a chess grandmaster in a tournament play. Used single chip chess move generator speed of 500000 to 700000 positions per second.
2- 2 -Deep thought2(1989- 1990) also called deep blue prototype. It had the following improvements over deep thought- medium-scale multiprocessing-Enhanced evaluation hardware, improved search software, extended book.
3- 3 -Deep blue 1- single chip chess search engine, used 216 chess chips. 1.6-2 million chess positions per seconds(50 – 100 million in total) but was still defeated by gary kasparov 4-2.

Deep blue 2(1997)-Was built to have new significantly enhanced chess chips, better evaluation function, chip search now about 2-2.5 million and chess chips were doubled and better software tools to aid debugging. Deep Blue relies on many of the ideas developed in earlier chess programs, newer upgrades include use of larger but highly non-uniform searches , use of hardware evaluation allowing for a fixed time for execution but with no privilege to add new features to the evaluation function, use of an hybrid software/hardware search(the hardware search offers speed while the software search offers efficiency and complexity) ,deep blue also employed a massively parallel search system with over 500 processors.

Deep Blue is organized in 3 layers of SP processors, 1 is designated as the master, and the remainder as workers. The master searches the top levels of the chess game tree, and then distributes "leaf" positions to the workers for further examination. The workers carry out a few levels of additional search, and then distribute their leaf positions to the chess chips, which search the last few levels of the tree. The early iterations of the Deep Blue parallel search are carried out on the master node. There is not much parallelism in the first few iterations, and the master is fast enough (it has 16 chess chips) that there is little to be gained by attempting to further parallelize the search. As the search gets deeper, jobs get allocated throughout the system. It should be noted that the Deep Blue parallel search is nondeterministic making debugging the system much more difficult.

The chess chip divides into 3 parts: the move generator(same as its predecessors with additional features such as: including the generation of checking and check evasion moves, as well as allowing the generation of certain kinds of attacking moves, which permits improved quiescence searching), the evaluation function(which takes into account high value captures, xrays, king safety e.t.c), and the search control(null-window alpha-beta search with the advantage of eliminating the need for a value stack, simplifying the hardware design,the disadvantage is that it is necessary to do multiple searches when an exact score is needed.)

The Deep Blue evaluation function is essentially a sum of feature values. . A feature value can be either static or dynamic. Static values are set once at the beginning of a search. Dynamic values are also initialized at the beginning of a search, but during the search they are scaled, via table lookup, based on the value and type of pieces on the board at evaluation time.

Important databases were also used in the deep blue system. The opening book which was compiled by grandmasters consisted of about 4000 positions, an extended book which summarized the information available from a 700000 game database and an endgame database. Deep blue also had to take into account the constraint of time. For example, the Deep Blue–Kasparov games initially required 40 moves to be played in two hours. Failure to make the specified number of moves leads to forfeiting the game.

In the course of the development of Deep Blue, there were many design choices from many options that had to be made leaving many alternatives unexplored. Hopefully, they would be explored in the future.