**KARO ENGINE TECHNICAL DESIGN**

**KBS GAMING**

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07-06-2011

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# Class diagram

*This is the class diagram of the whole engine.*



# The architecture

*This chapter will explain the architecture of the engine and how the engine works.*

## The KaroEngine

The KaroEngine is built in C++ and so are the classes that the engine uses. The engine uses three enumerations, one for the gamestate, one for the tiles and one for the players. The move class represents a move and can be used for the engine to do a move or to undo a move. The visitedlist class is used for the algorithm to check if the tiles are still connected.

To represent the game Karo the engine uses a tile array to store the board. The engine also keeps track of all the pieces of all the players. These are stored in a map<int, bool> for each player, the bool represents if a piece is flipped or not. The moveable tiles are also stored in a map<int, int>, the two integers present the position of the tile, all the empty tiles are stored in the same way.

The Engine uses the minimax algorithm to compute a computer’s move. The engine also implements alpha-beta pruning, move-ordering, transposition tables and zobrist hashing to speed up the minimax algorithm. To use transposition tables the engine uses two tables one for each player. The table is represented in a map<int, pair<int, int>>, the first integer presents the hash, the first integer of the pair represents the depth and the second one represents the score.

## The KaroEngineWrapper

The wrapper is not written in C++ but in managed C++. We did this because the GUI is writted in C# and C# is managed and that’s why it can’t communicate with a DLL that is writted in C++ ( unmanaged ). So now the GUI talks to the KaroEngine through the KaroEngineWrapper. The Wrapper has a pointer to the KaroEngine and implements functions to let the engine do the things the GUI wants to perform on the engine.