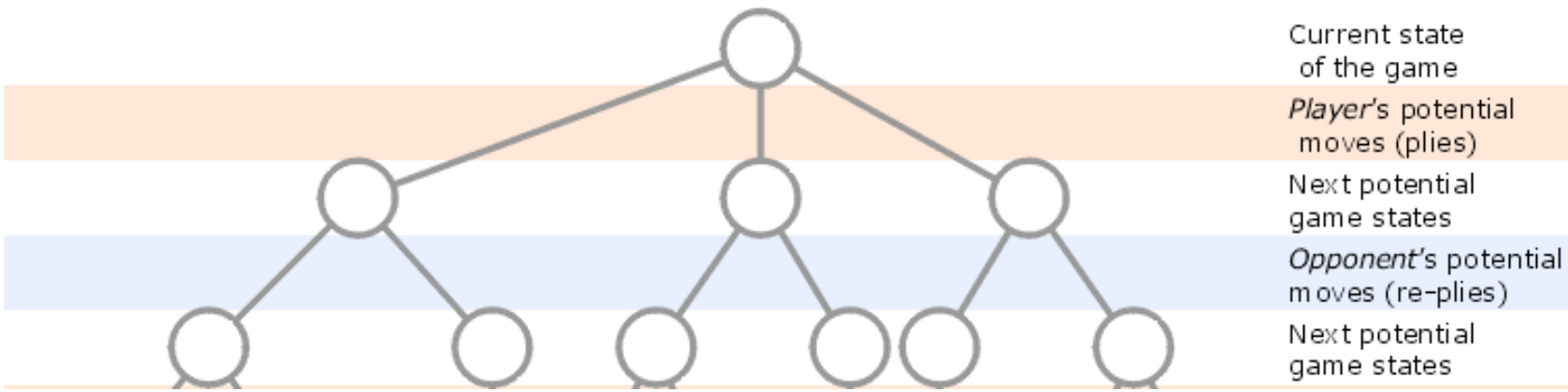
ETH zürich

Design of a Parallel Chess Engine

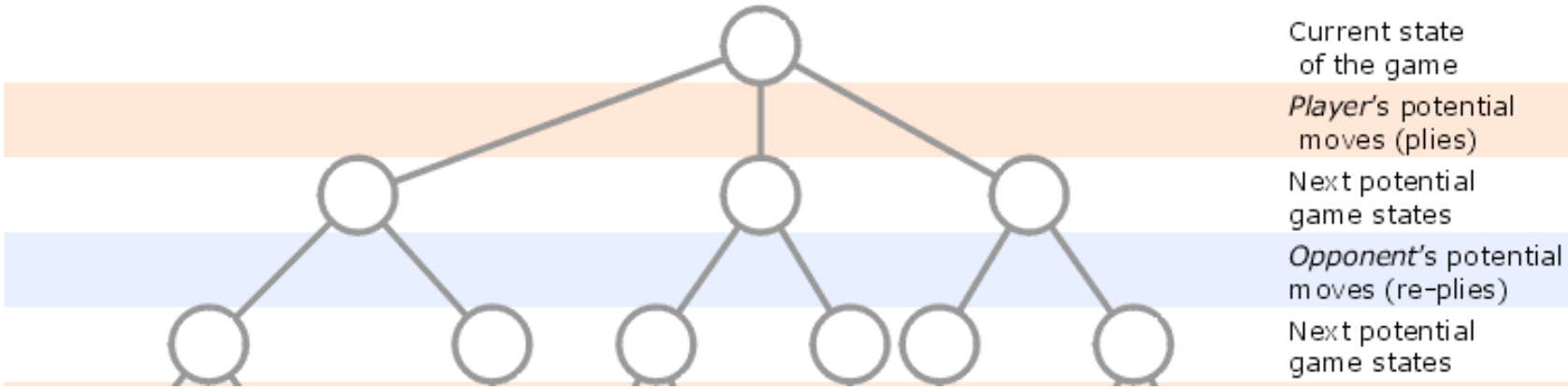
Jonathan Maurer, Jonathan Rosenthal, Jonas Kuratli

Simple Approach



[0] Picture from English Language Wikipedia, https://en.wikipedia.org/wiki/File:Minmaxab.gif

Simple Approach



- Evaluate states up to a pre-defined depth d bottom-up
- Leaf evaluated using an evaluation function
- Other nodes evaluated by finding min or max of children

[0] Picture from English Language Wikipedia, https://en.wikipedia.org/wiki/File:Minmaxab.gif

Simple Approach

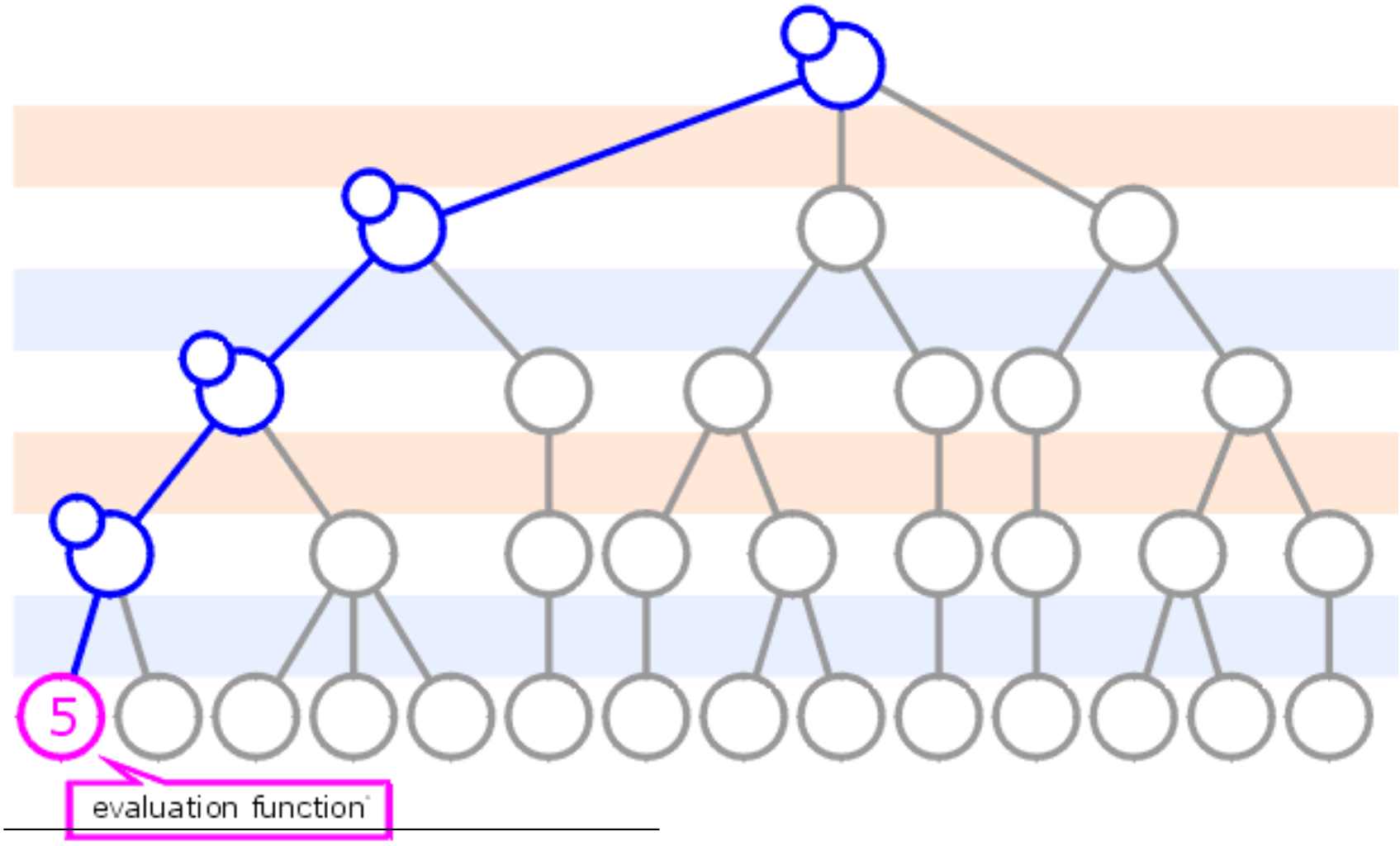
Pros:

- Easy to implement
- Easy to parallelize (Distribute evaluation of children)

Cons:

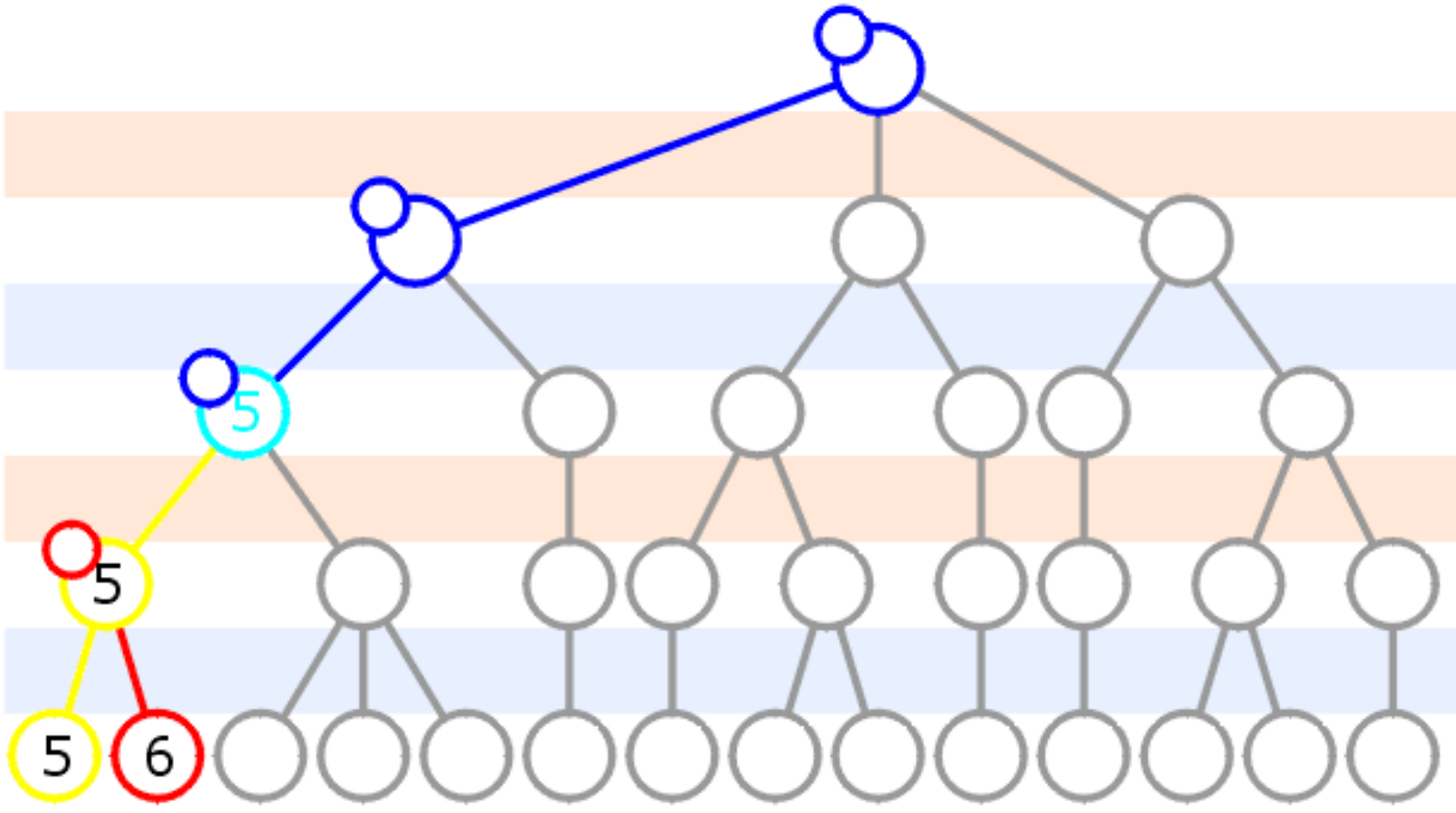
- Tree becomes broad very quickly
- Message passing overhead if parallelized

Alpha-Beta Pruning



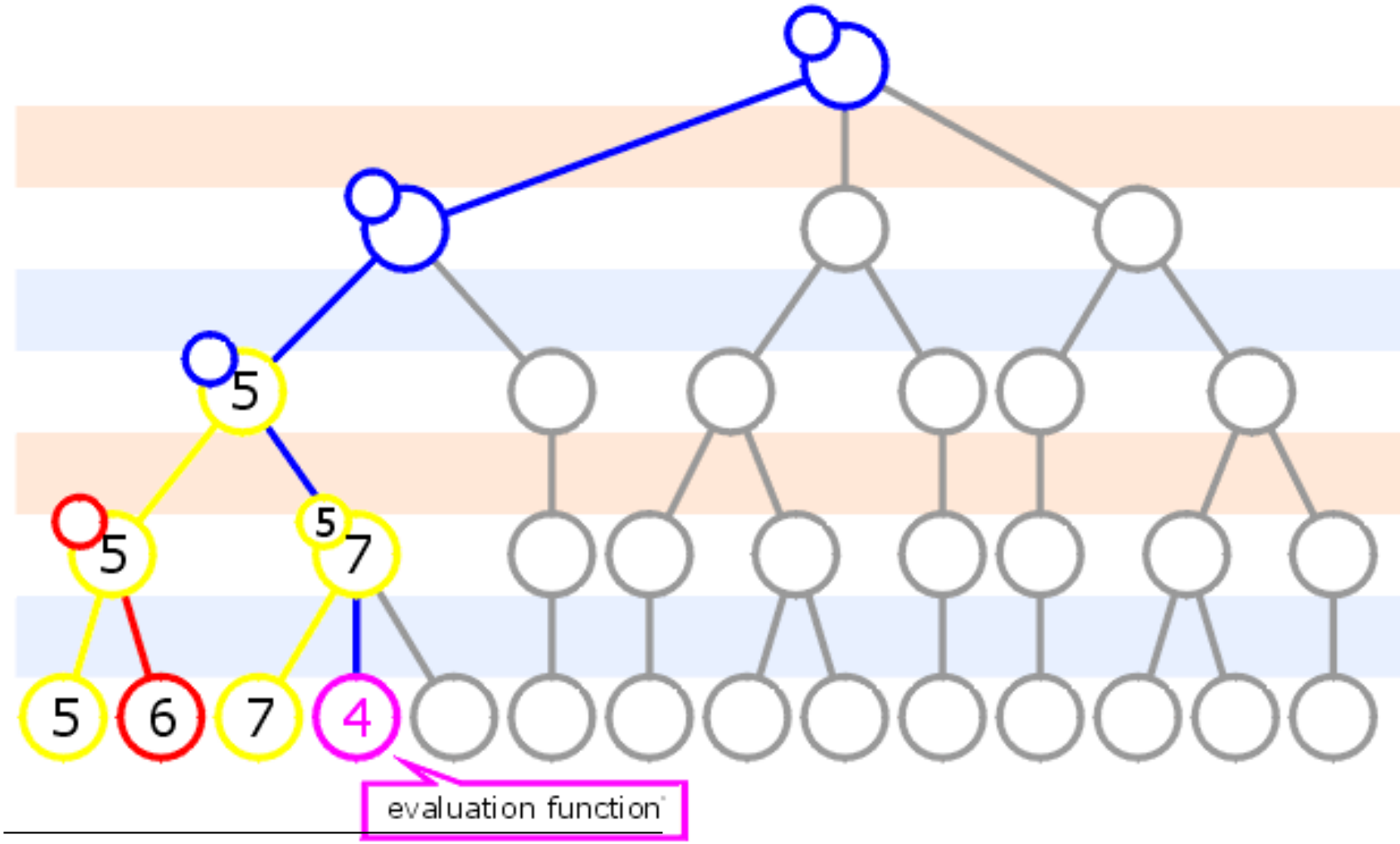
[0] Picture from English Language Wikipedia, https://en.wikipedia.org/wiki/File:Minmaxab.gif

Alpha-Beta Pruning



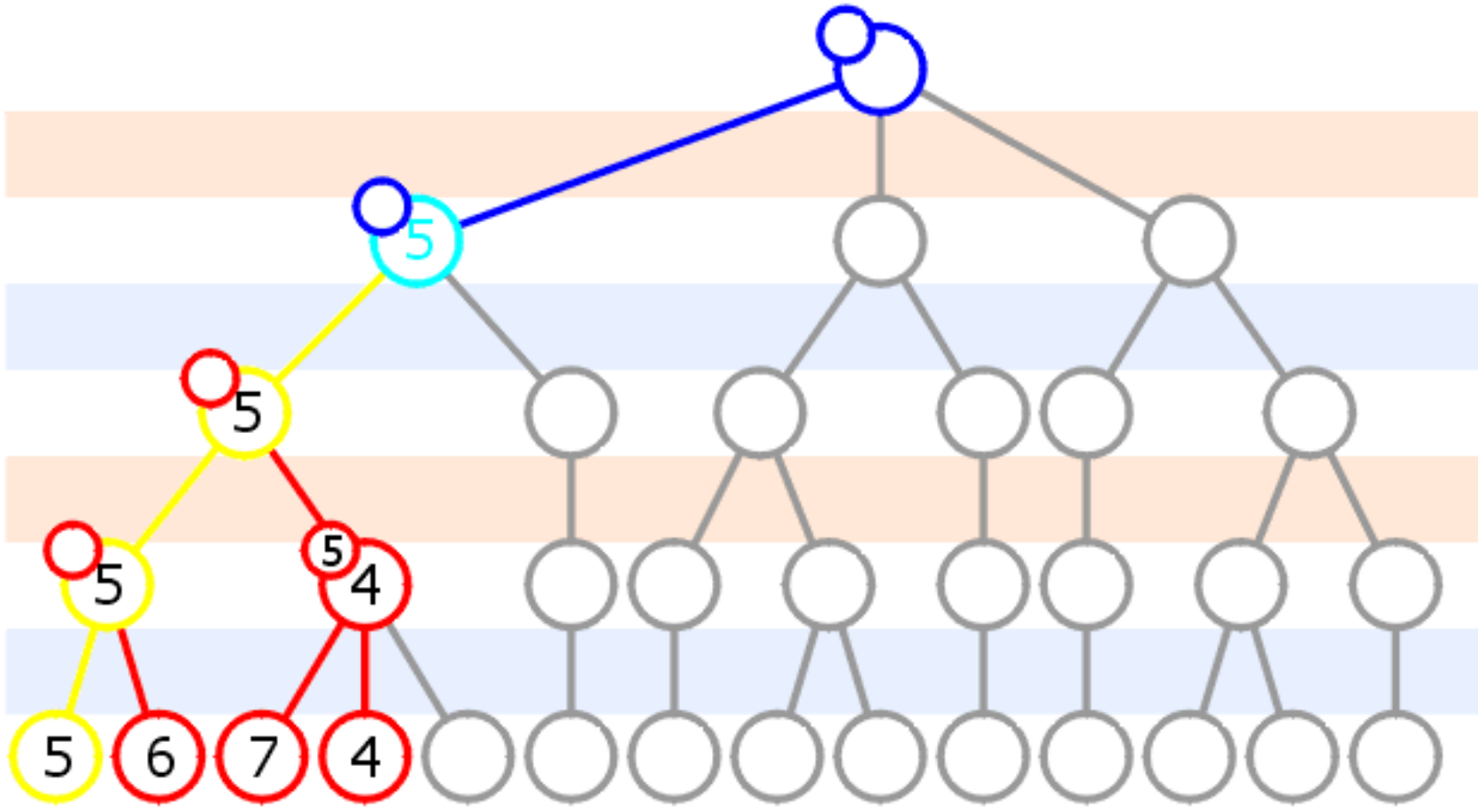
[0] Picture from English Language Wikipedia, https://en.wikipedia.org/wiki/File:Minmaxab.gif

Alpha-Beta Pruning



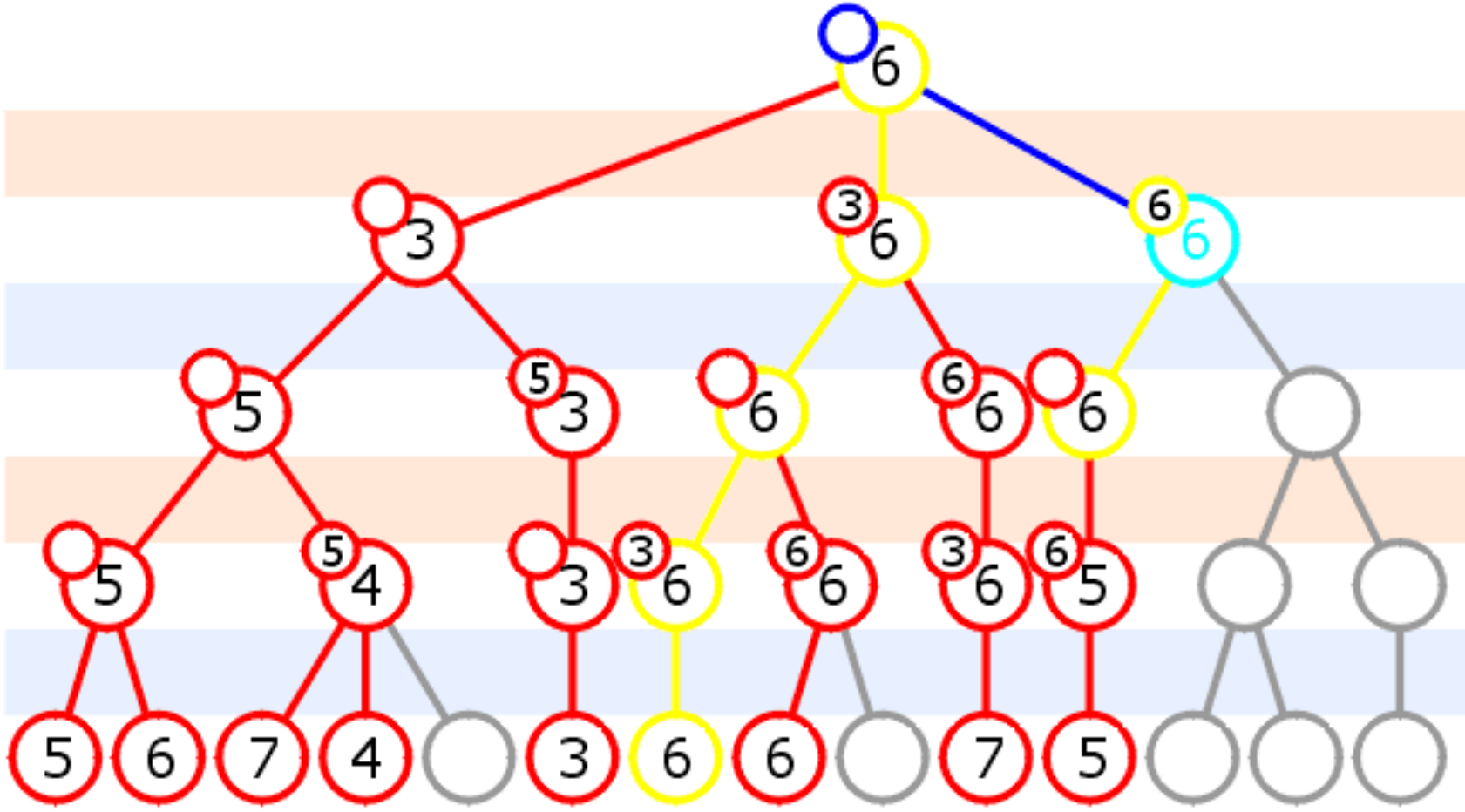
[0] Picture from English Language Wikipedia, https://en.wikipedia.org/wiki/File:Minmaxab.gif

Alpha-Beta Pruning



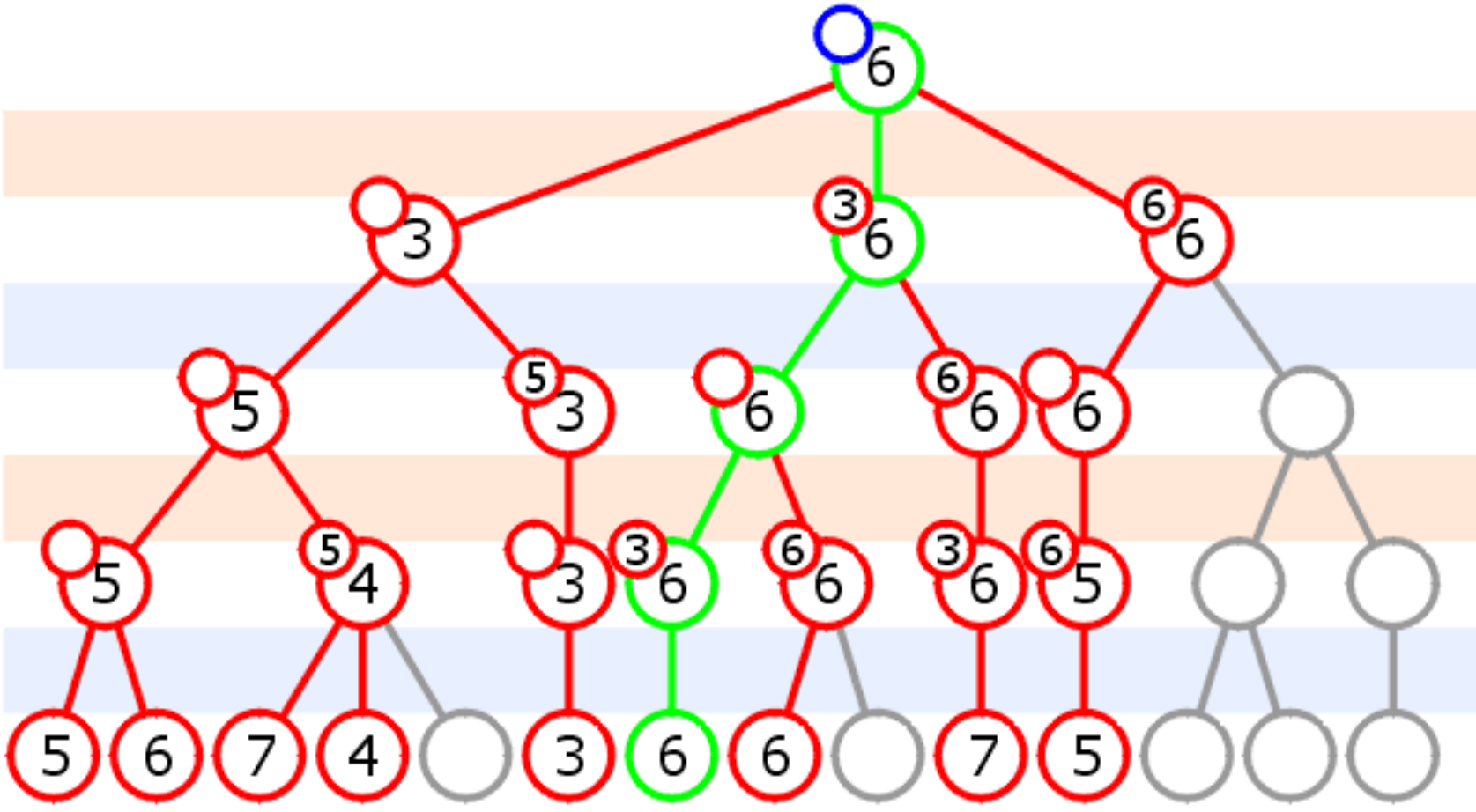
[0] Picture from English Language Wikipedia, https://en.wikipedia.org/wiki/File:Minmaxab.gif

Alpha-Beta Pruning



[0] Picture from English Language Wikipedia, https://en.wikipedia.org/wiki/File:Minmaxab.gif

Alpha-Beta Pruning



[0] Picture from English Language Wikipedia, https://en.wikipedia.org/wiki/File:Minmaxab.gif

Alpha-Beta Pruning

Pros:

- Reduces # of visited nodes

Cons:

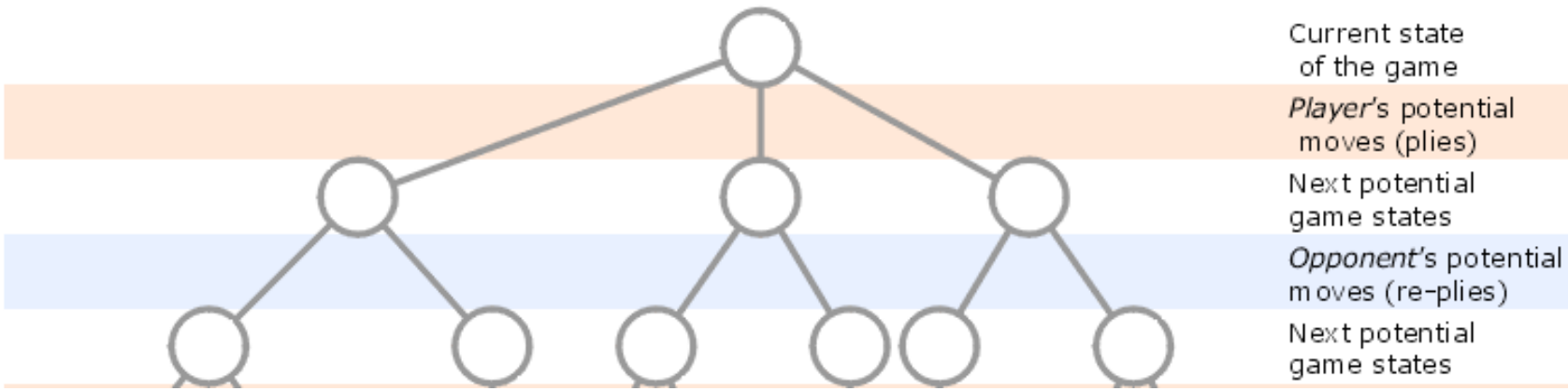
- Harder to parallelize (Message propagation top-down AND bottom-up)

Parallel Alpha-Beta Pruning

Rough Plan:

- Parallel evaluation of nodes at a certain depth
- Cut nodes with significantly worse evaluation than best node
- Evaluate nodes ordered by evaluation value
- Allocate resources by value

Parallel Alpha-Beta Pruning



[0] Picture from English Language Wikipedia, https://en.wikipedia.org/wiki/File:Minmaxab.gif

Goals

- Serial version of both approaches
- Parallelize both appraoches
- Determine gain from parallelization
- Compare approaches depending on resources
- Compare our approaches with existing ones

Existing Work

- First parallel engine was less efficient than its serial version
- By 2013, 2 out of top 3 engines ran in parallel
- By now, almost no top engines run serial implementation

Current state

- Serial versions of both approaches exist
- Depth considered dependent on time remaining
- Demonstration coming up...