

# Robotic Battlefield Control – State Diagrams

For the sake of clarity, the game dynamics are described as two state diagrams: the first scheme depicts the state of the game according to the positions of the players inside the gamefield and according to the conquest status of the Control Point – CP for short; the second diagram describes the evolution of combat situations (i.e. when at least one of the players sees the other).

## State variables (used in both diagrams)

### *Red player*

- Position = {Homefield, Midfield, CP}  
This is the position of the player in the battlefield:
- Health = {0...max}
- Score = {0...max}
- Activity = {Idle, Explore, Conquer, Neutralize, Defend, Shoot, Retreat}
- EnemyVisualContact = {Yes, No}

### *Blue player*

- Position = {Homefield, Midfield, CP}
- Health = {0...max}
- Score = {0...max}
- Activity = {Idle, Explore, Conquer, Neutralize, Defend, Shoot, Retreat}
- EnemyVisualContact = {Yes, No}

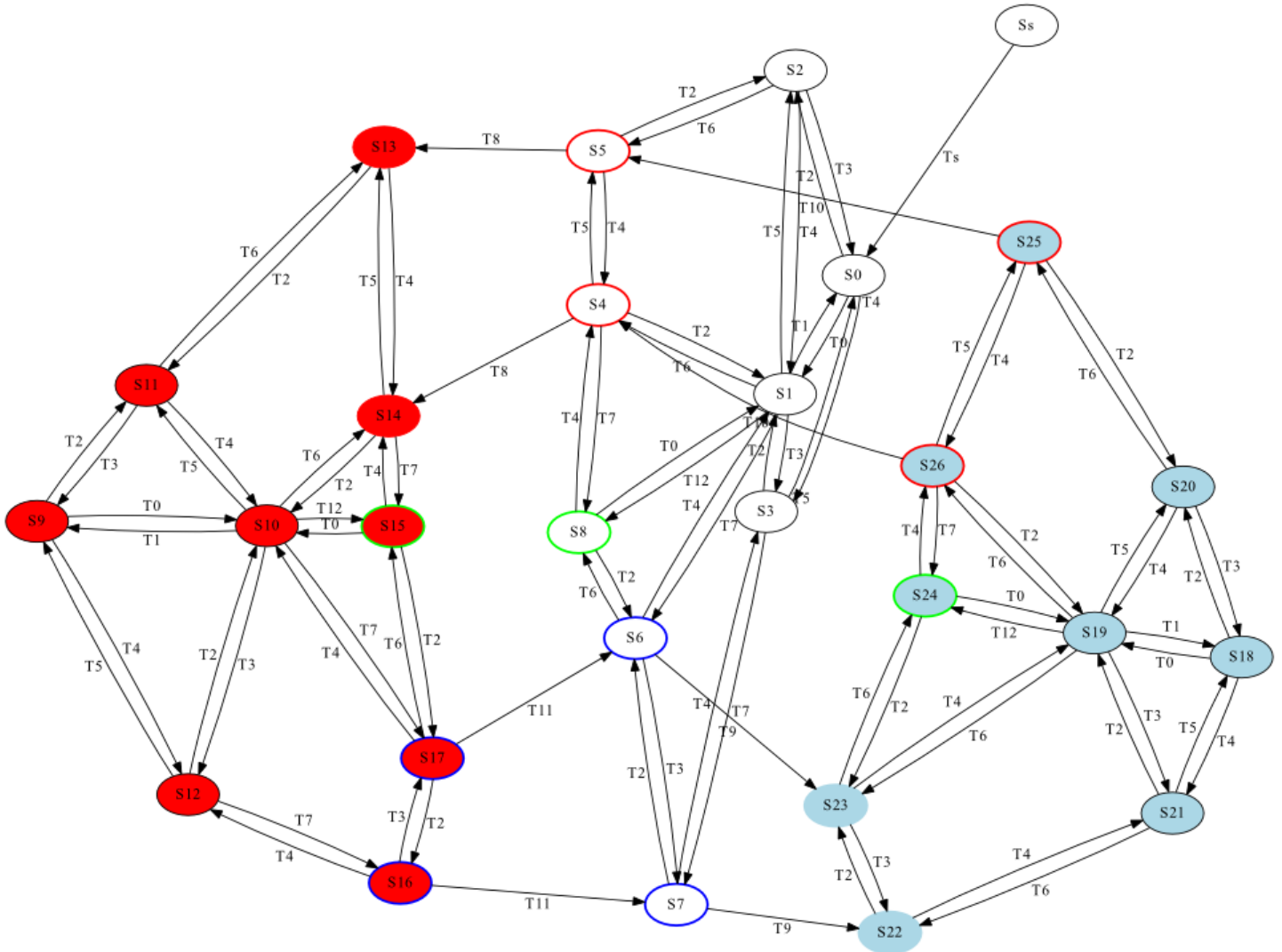
### *Game*

- Time = {0...Timeout}
- ConquerTimer = {0...max}
- CP = {Neutral, Red, Blue}

# Main state diagram

This is the diagram that explains the state of the game according to the position of the two players in the battlefield, and according to the conquest status of the Control Point.

- States in which no one controls the CP are filled in white;
- States in which either Red or Blue control the CP are filled with the appropriate color;
- States in which either Red or Blue are at the CP have a border colored with the appropriate color; if both players are present at the same time (and the CP is therefore "contended"), the border is green.



## States

Notes:

- when a variable is not mentioned in a state description, it means that it is not meaningful for that state (i.e. it can have any value);
- for the sake of clarity, every state different from Ss is considered as a final state. The game ends either when the time expires (Game.Time == Timeout), or when either Red's or Blue's score is equal to the threshold (Red.Score == max || Blue.Score == max);
- the players can shoot to each other either only when they are either in the midfield

### Ss: Beginning of the match

**Red:** Position = Homefield, Health = max, Score = 0, Activity = Idle, EnemyVisualContact = No

**Blue:** Position = Homefield, Health = max, Score = 0, Activity = Idle, EnemyVisualContact = No

**Game:** Time = 0, ConquerTimer = 0, CP = Neutral

### S0: Neutral CP, both players are in home field

**Red:** Position = Homefield, Activity = Idle|Explore, Health = max, Score < max

**Blue:** Position = Homefield, Activity = Idle|Explore, Health = max, Score < max

**Game:** Time < Timeout, ConquerTimer = 0, CP = Neutral

**S1: Neutral CP, both players are in midfield**

**Red:** Position = Midfield, Activity = Idle|Explore|Retreat, Score < max

**Blue:** Position = Midfield, Activity = Idle|Explore|Retreat, Score < max

**Game:** Time < Timeout, ConquerTimer = 0, CP = Neutral

**S2: Neutral CP, Red is in midfield, Blue is in home field**

**Red:** Position = Midfield, Activity = Idle|Explore|Retreat, Score < max

**Blue:** Position = Homefield, Activity = Idle|Explore, Health = max, Score < max

**Game:** Time < Timeout, ConquerTimer = 0, CP = Neutral

**S3: Neutral CP, Blue is in midfield, Red is in home field**

**Red:** Position = Homefield, Activity = Idle|Explore, Health = max, Score < max

**Blue:** Position = Midfield, Activity = Idle|Explore|Retreat, Score < max

**Game:** Time < Timeout, ConquerTimer = 0, CP = Neutral

**S4: Red is conquering neutral CP, Blue is in midfield**

**Red:** Position = CP, Activity = Conquer, Score < max

**Blue:** Position = Midfield, Activity = Idle|Explore|Retreat, Score < max

**Game:** Time < Timeout, ConquerTimer > 0 && ConquerTimer < max, CP = Neutral

**S5: Red is conquering neutral CP, Blue is in home field**

**Red:** Position = CP, Activity = Conquer, Score < max

**Blue:** Position = Homefield, Activity = Idle|Explore, Health = max, Score < max

**Game:** Time < Timeout, ConquerTimer > 0 && ConquerTimer < max, CP = Neutral

**S6: Blue is conquering neutral CP, Red is in midfield**

**Red:** Position = Midfield, Activity = Idle|Explore|Retreat, Score < max

**Blue:** Position = CP, Activity = Conquer, Score < max

**Game:** Time < Timeout, ConquerTimer > 0 && ConquerTimer < max, CP = Neutral

**S7: Blue is conquering neutral CP, Red is in home field**

**Red:** Position = Homefield, Activity = Idle|Explore, Health = max, Score < max

**Blue:** Position = CP, Activity = Conquer, Score < max

**Game:** Time < Timeout, ConquerTimer > 0 && ConquerTimer < max, CP = Neutral

**S8: Neutral CP is disputed**

**Red:** Position = CP, Activity = Idle|Explore|Retreat, Score < max

**Blue:** Position = CP, Activity = Idle|Explore|Retreat, Score < max

**Game:** Time < Timeout, ConquerTimer = 0, CP = Neutral

**S9: The CP is owned by Red, both players are in home field**

**Red:** Position = Homefield, Activity = Idle|Explore, Health = max, Score > 0 && Score < max

**Blue:** Position = Homefield, Activity = Idle|Explore, Health = max, Score < max

**Game:** Time < Timeout, ConquerTimer = 0, CP = Red

**S10: The CP is owned by Red, both players are in midfield**

**Red:** Position = Midfield, Activity = Idle|Explore|Retreat, Score > 0 && Score < max

**Blue:** Position = Midfield, Activity = Idle|Explore|Retreat, Score < max

**Game:** Time < Timeout, ConquerTimer = 0, CP = Red

**S11: The CP is owned by Red, Red is in midfield, Blue is in home field**

**Red:** Position = Midfield, Activity = Idle|Explore|Retreat, Score > 0 && Score < max

**Blue:** Position = Homefield, Activity = Idle|Explore, Health = max, Score < max

**Game:** Time < Timeout, ConquerTimer = 0, CP = Red

**S12: The CP is owned by Red, Blue is in midfield, Red is in home field**

**Red:** Position = Homefield, Activity = Idle|Explore, Health = max, Score > 0 && Score < max

**Blue:** Position = Midfield, Activity = Idle|Explore|Retreat, Score < max

**Game:** Time < Timeout, ConquerTimer = 0, CP = Red

**S13: The CP is owned by Red, Red is defending, Blue is in home field**

**Red:** Position = CP, Activity = Defend, Score > 0 && Score < max

**Blue:** Position = Homefield, Activity = Idle|Explore, Health = max, Score < max

**Game:** Time < Timeout, ConquerTimer = 0, CP = Red

**S14: The CP is owned by Red, Red is defending, Blue is in midfield**

**Red:** Position = CP, Activity = Defend, Score > 0 && Score < max

**Blue:** Position = Midfield, Activity = Idle|Explore|Retreat, Score < max

**Game:** Time < Timeout, ConquerTimer = 0, CP = Red

**S15: The CP is owned by Red, disputed (preventing Blue from neutralizing)**

**Red:** Position = CP, Activity = Defend, Score > 0 && Score < max

**Blue:** Position = CP, Activity = Idle|Explore|Retreat, Score < max

**Game:** Time < Timeout, ConquerTimer = 0, CP = Red

**S16: The CP is owned by Red, Blue is neutralizing, Red is in home field**

**Red:** Position = Homefield, Activity = Idle|Explore, Health = max, Score > 0 && Score < max

**Blue:** Position = CP, Activity = Neutralize, Score < max

**Game:** Time < Timeout, ConquerTimer > 0 && ConquerTimer < max, CP = Red

**S17: The CP is owned by Red, Blue is neutralizing, Red is in midfield**

**Red:** Position = Midfield, Activity = Idle|Explore|Retreat, Health = max, Score > 0 && Score < max

**Blue:** Position = CP, Activity = Neutralize, Score < max

**Game:** Time < Timeout, ConquerTimer > 0 && ConquerTimer < max, CP = Red

**S18: The CP is owned by Blue, both players are in home field**

**Red:** Position = Homefield, Activity = Idle|Explore, Health = max, Score < max

**Blue:** Position = Homefield, Activity = Idle|Explore, Health = max, Score > 0 && Score < max

**Game:** Time < Timeout, ConquerTimer = 0, CP = Blue

**S19: The CP is owned by Blue, both players are in midfield**

**Red:** Position = Midfield, Activity = Idle|Explore|Retreat, Score < max

**Blue:** Position = Midfield, Activity = Idle|Explore|Retreat, Score > 0 && Score < max

**Game:** Time < Timeout, ConquerTimer = 0, CP = Blue

**S20: The CP is owned by Blue, Red is in midfield, Blue is in home field**

**Red:** Position = Midfield, Activity = Idle|Explore|Retreat, Score > 0 && Score < max

**Blue:** Position = Homefield, Activity = Idle|Explore, Health = max, Score < max

**Game:** Time < Timeout, ConquerTimer = 0, CP = Blue

**S21: The CP is owned by Blue, Blue is in midfield, Red is in home field**

**Red:** Position = Midfield, Activity = Idle|Explore|Retreat, Score < max

**Blue:** Position = Homefield, Activity = Idle|Explore, Health = max, Score > 0 && Score < max

**Game:** Time < Timeout, ConquerTimer = 0, CP = Blue

**S22: The CP is owned by Blue, Blue is defending, Red is in home field**

**Blue:** Position = Homefield, Activity = Idle|Explore, Health = max, Score < max

**Red:** Position = CP, Activity = Defend, Score > 0 && Score < max

**Game:** Time < Timeout, ConquerTimer = 0, CP = Blue

**S23: The CP is owned by Blue, Blue is defending, Red is in midfield**

**Red:** Position = Midfield, Activity = Idle|Explore|Retreat, Score < max

**Blue:** Position = CP, Activity = Defend, Score > 0 && Score < max

**Game:** Time < Timeout, ConquerTimer = 0, CP = Blue

**S24: The CP is owned by Blue, disputed (preventing Red from neutralizing)**

**Red:** Position = CP, Activity = Idle|Explore|Retreat, Score < max

**Blue:** Position = CP, Activity = Defend, Score > 0 && Score < max

**Game:** Time < Timeout, ConquerTimer = 0, CP = Blue

## S25: The CP is owned by Blue, Red is neutralizing, Blue is in home field

**Red:** Position = CP, Activity = Neutralize, Score < max

**Blue:** Position = Homefield, Activity = Idle|Explore, Health = max, Score > 0 && Score < max

**Game:** Time < Timeout, ConquerTimer > 0 && ConquerTimer < max, CP = Blue

## S26: The CP is owned by Blue, Red is neutralizing, Blue is in midfield

**Red:** Position = CP, Activity = Neutralize, Score < max

**Blue:** Position = Midfield, Activity = Idle|Explore|Retreat, Health = max, Score > 0 && Score < max

**Game:** Time < Timeout, ConquerTimer > 0 && ConquerTimer < max, CP = Blue

## Transitions

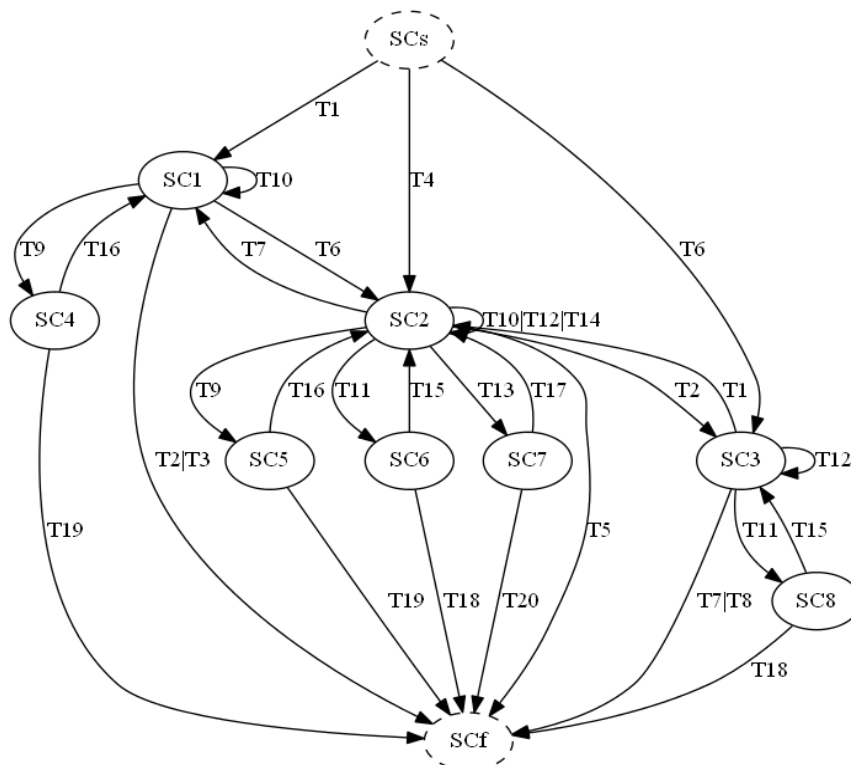
- Ts: 5 seconds passed
- T0: Both players enter in the midfield
- T1: Both players enter their home fields
- T2: Red enters in the midfield
- T3: Red enters its home field
- T4: Blue enters in the midfield
- T5: Blue enters its home field
- T6: Red arrives to the Control Point
- T7: Blue arrives to the Control Point
- T8: Red captures the Control Point
- T9: Blue captures the Control Point
- T10: Red neutralizes the Control Point
- T11: Blue neutralizes the Control Point
- T12: Both players arrive to the Control Point

## Combat state diagram

The following state diagram describes the flow of combat situations, that is when:

- both players are *not* in their home fields;
- whenever at least one of the robots has direct visual contact of its opponent.

Therefore, the starting state SCs can be identified with more than one state of the main state diagram. Also, SCf (the final state) usually corresponds to SCs in the main diagram, but not always: for example, when Red damages Blue heavily when they are both close to the Red-controlled Control Point (S15), the second robot is forced to move away and therefore SCf is going to be S14.



## States

### SC1: Red sees Blue

**Red:** Position = Midfield|CP, Activity = Idle|Explore|Conquer|Neutralize|Defend, Health > 0, Score < max, EnemyVisualContact = Yes

**Blue:** Position = Midfield|CP, Activity = Idle|Explore|Conquer|Neutralize|Defend, Health > 0, Score < max, EnemyVisualContact = No

**Game:** Time < Timeout

### SC2: Both players see each other

**Red:** Position = Midfield|CP, Activity = Idle|Explore|Conquer|Neutralize|Defend, Health > 0, Score < max, EnemyVisualContact = Yes

**Blue:** Position = Midfield|CP, Activity = Idle|Explore|Conquer|Neutralize|Defend, Health > 0, Score < max, EnemyVisualContact = Yes

**Game:** Time < Timeout

### SC3: Blue sees Red

**Red:** Position = Midfield|CP, Activity = Idle|Explore|Conquer|Neutralize|Defend, Health > 0, Score < max, EnemyVisualContact = No

**Blue:** Position = Midfield|CP, Activity = Idle|Explore|Conquer|Neutralize|Defend, Health > 0, Score < max, EnemyVisualContact = Yes

**Game:** Time < Timeout

### SC4: Blue gets damaged (only Red sees Blue)

**Red:** Position = Midfield|CP, Activity = Shoot, Health > 0, Score < max, EnemyVisualContact = Yes

**Blue:** Position = Midfield|CP, Activity = Idle|Explore|Conquer|Neutralize|Defend, Health > 0, Score < max, EnemyVisualContact = No

**Game:** Time < Timeout

### SC5: Blue gets damaged (both players see each other)

**Red:** Position = Midfield|CP, Activity = Shoot, Health > 0, Score < max, EnemyVisualContact = Yes

**Blue:** Position = Midfield|CP, Activity = Idle|Explore|Conquer|Neutralize|Defend|Shoot, Health > 0, Score < max, EnemyVisualContact = Yes

**Game:** Time < Timeout

### SC6: Red gets damaged (both players see each other)

**Red:** Position = Midfield|CP, Activity = Idle|Explore|Conquer|Neutralize|Defend|Shoot, Health > 0, Score < max, EnemyVisualContact = Yes

**Blue:** Position = Midfield|CP, Activity = Shoot, Health > 0, Score < max, EnemyVisualContact = Yes

**Game:** Time < Timeout

### SC7: Both players get damaged

**Red:** Position = Midfield|CP, Activity = Shoot, Health > 0, Score < max, EnemyVisualContact = Yes

**Blue:** Position = Midfield|CP, Activity = Shoot, Health > 0, Score < max, EnemyVisualContact = Yes

**Game:** Time < Timeout

### SC8: Red gets damaged (only Blue sees Red)

**Red:** Position = Midfield|CP, Activity = Idle|Explore|Conquer|Neutralize|Defend|Shoot, Health > 0, Score < max, EnemyVisualContact = Yes

**Blue:** Position = Midfield|CP, Activity = Shoot, Health > 0, Score < max, EnemyVisualContact = No

**Game:** Time < Timeout

## Transitions

- T1: Red gets visual contact of Blue
- T2: Red loses visual contact of Blue
- T3: Red walks away
- T4: Red and Blue can see each other
- T5: Both Red and Blue walk away
- T6: Blue gets visual contact of Red
- T7: Blue loses visual contact of Red
- T8: Blue walks away
- T9: Red shoots and hits Blue

- T10: Red shoots and misses
- T11: Blue shoots and hits Red
- T12: Blue shoots and misses
- T13: Both players shoot and hit their opponent
- T14: Both players shoot and miss
- T15: Red is still alive
- T16: Blue is still alive
- T17: Both players are still alive
- T18: Red is heavily damaged ("dead") and retreats towards its home field
- T19: Blue is heavily damaged ("dead") and retreats towards its home field
- T20: Both players are heavily damaged and retreat towards their home fields