RoboCup Rescue Simulation League 2019

Introduction

- Last year:
  - K-means++ Algorithm
  - Team Detector(AT)
  - Dynamic Clustering(FB)
  - New Priority System(PF)
- This year:
  - fixed Team Detector(AT)
  - Beforehand Extinguish(FB)
  - Solve Congestion(PF)

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Algorithm

Clustering & Path Planning

- K-means++ algorithm (2018)
- A* Algorithm (2017)

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K-means++ Algorithm (2018)

K-means disadvantage

- Improper points can be chosen
  - The solution can be worse.
  - K-means unsuited to clustering in a biased map.

K-means++ algorithm solved these problems.

- K-means++ is conscious of below points.
  - Initial centers were chosen spreadly.

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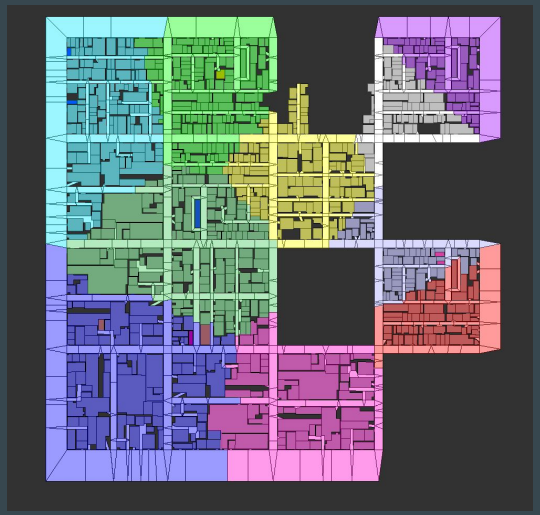
K-means++ Algorithm (2018)

K-means



K-means++

The clustering work adequately.

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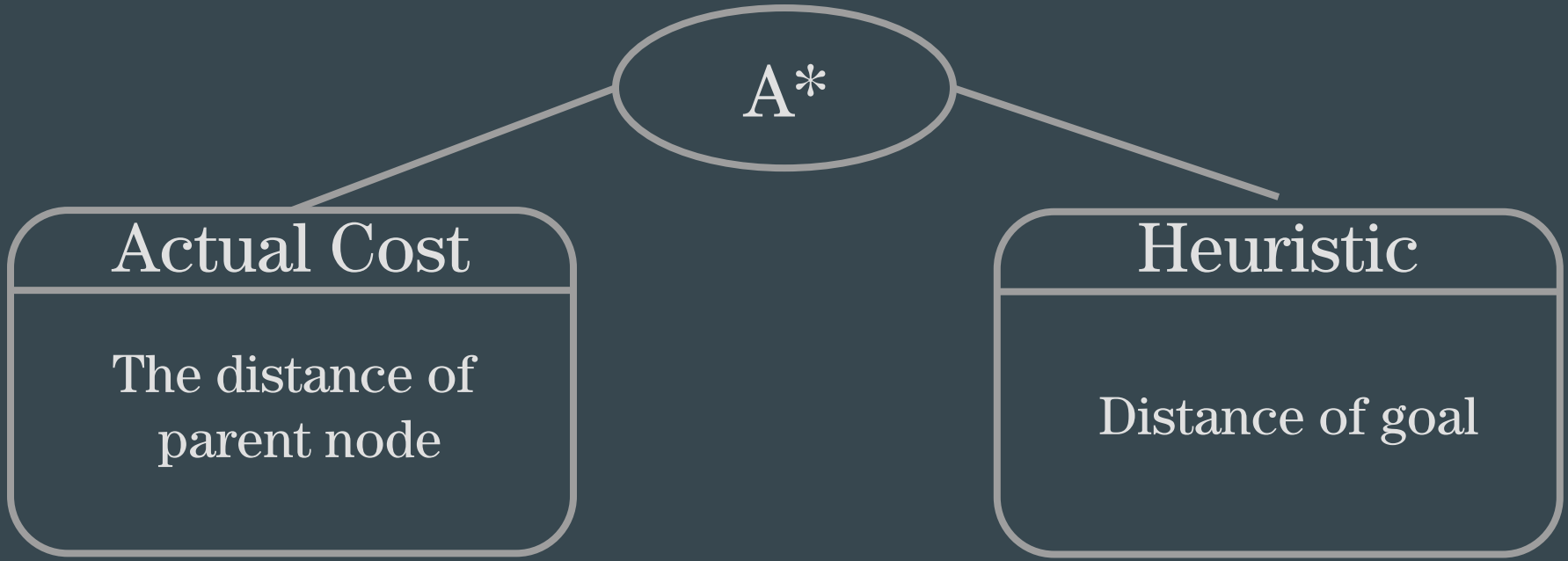
A* Algorithm (2017)



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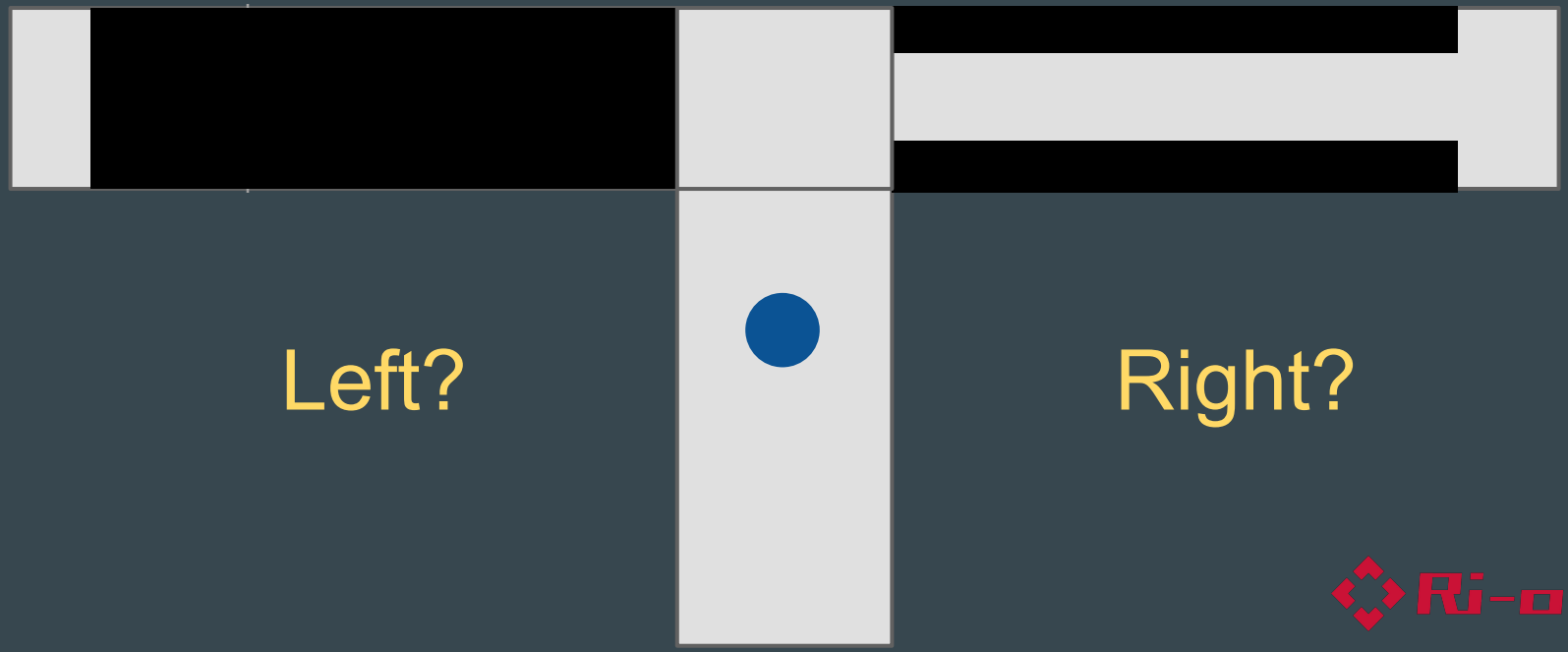
A* Algorithm (2017)



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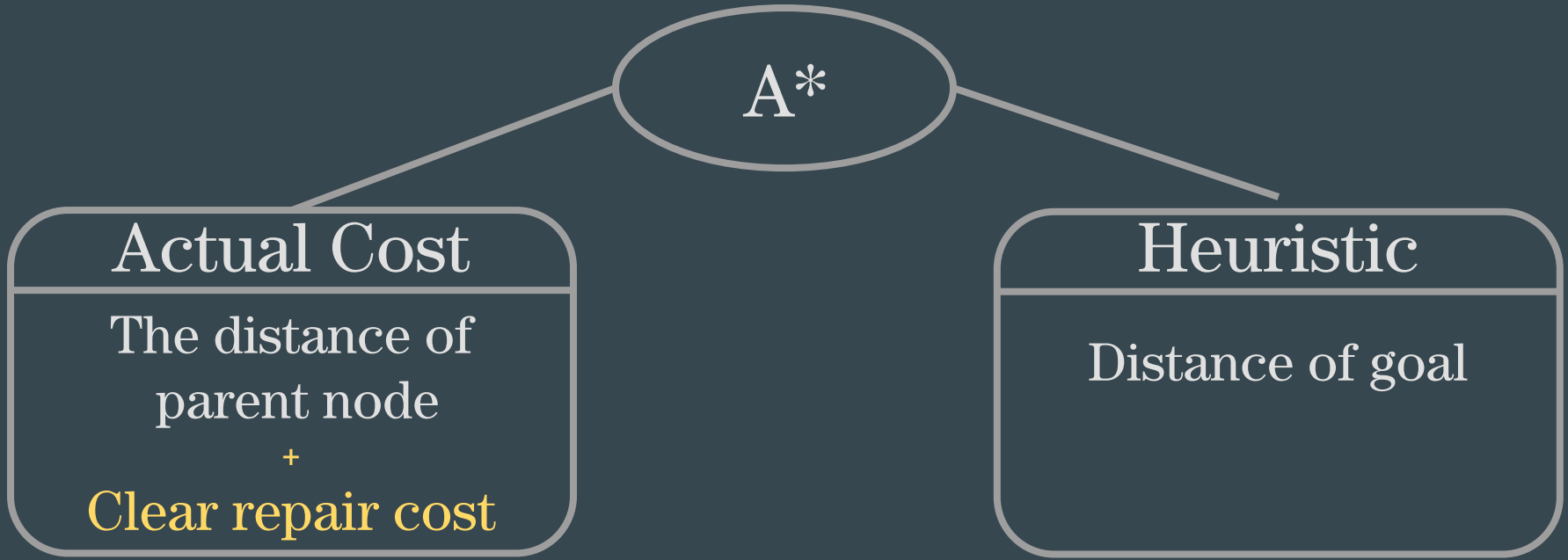
A* Algorithm (2017)



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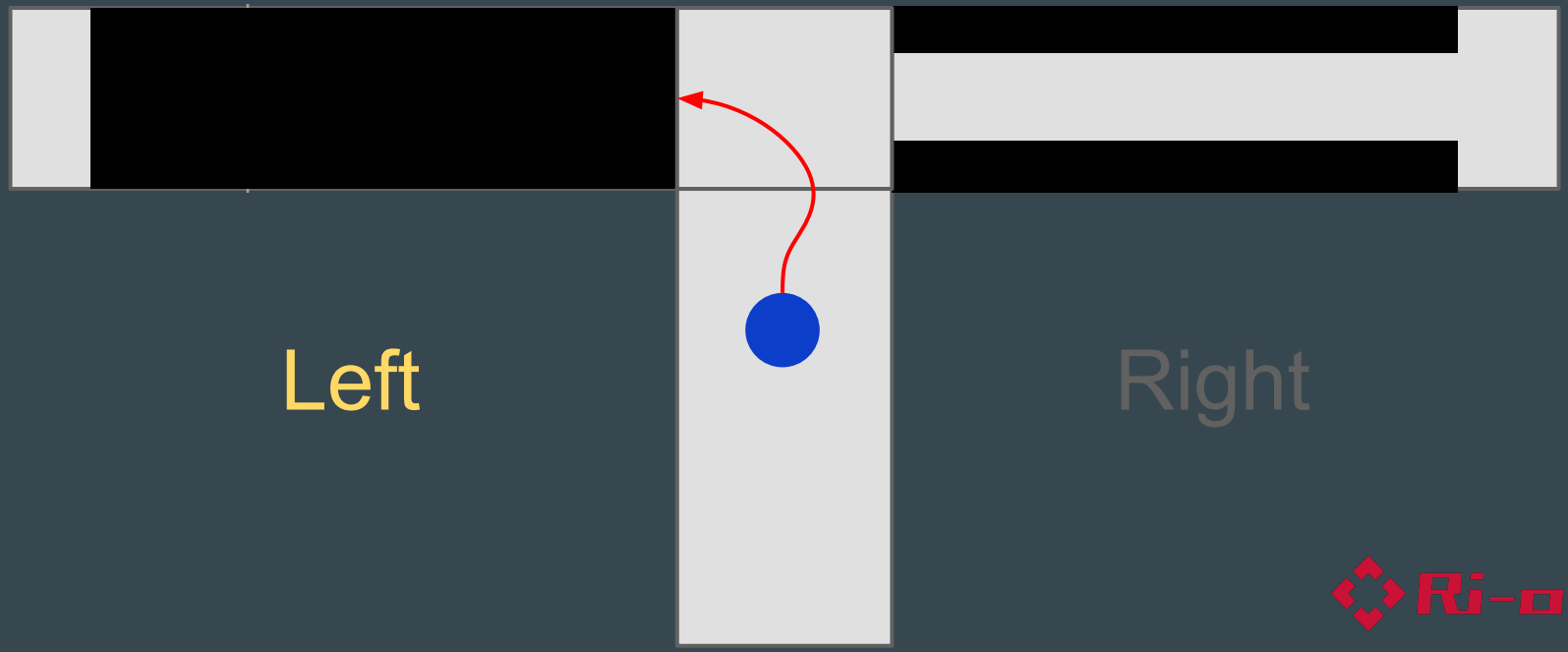

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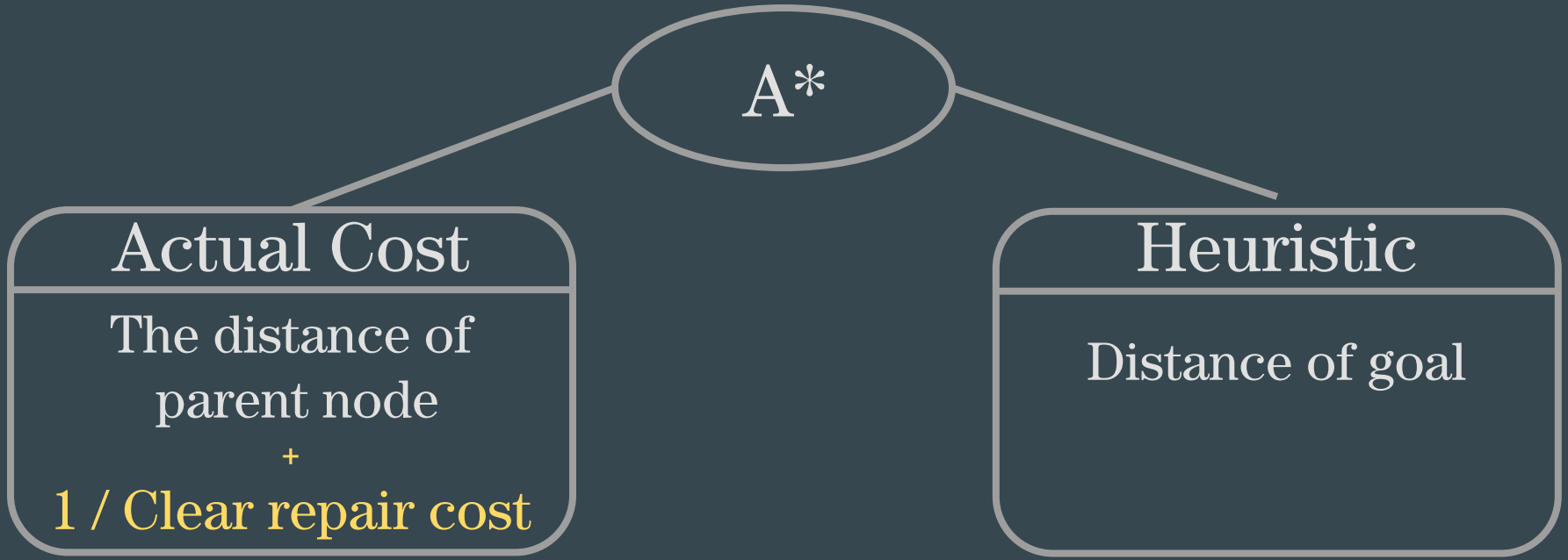

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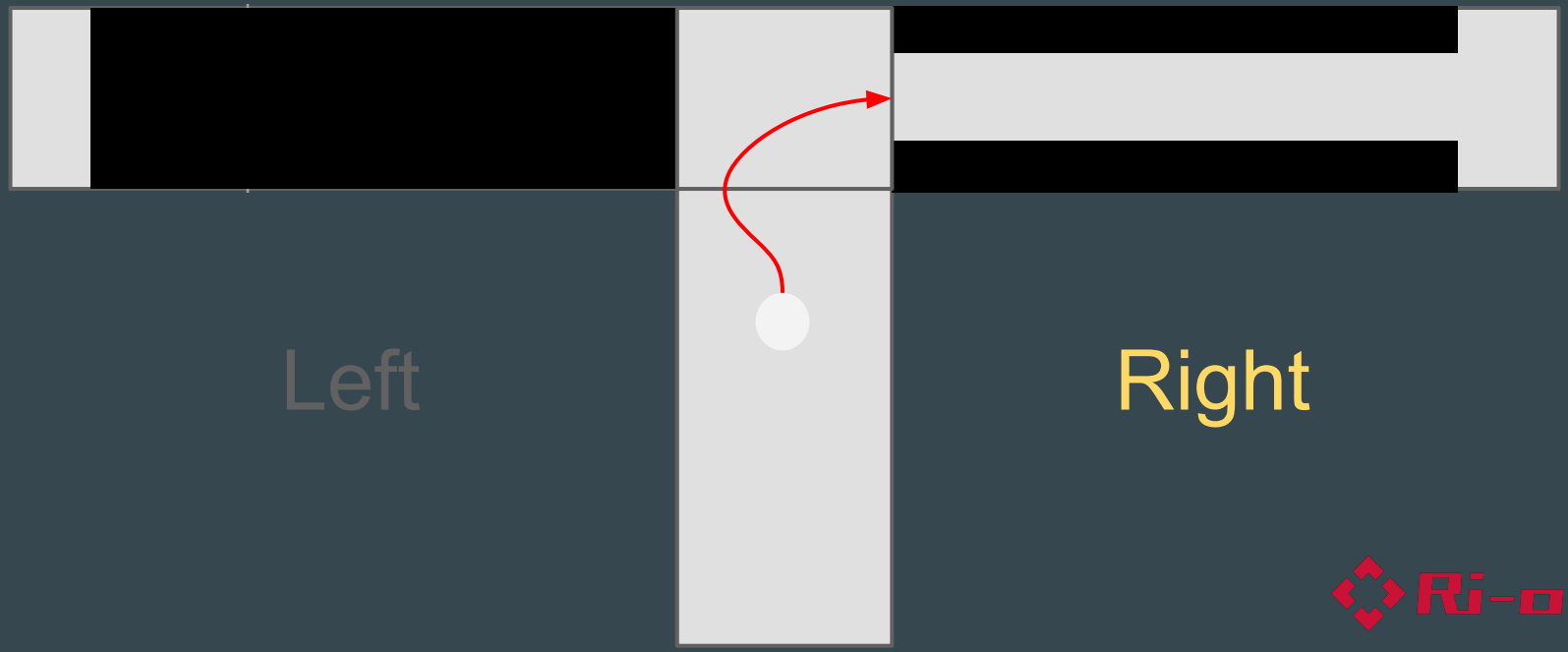

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Communication

- Same as Sample.

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Search

- Same as Sample.

Ambulance Team

fixed Team Detector

AT was implemented :

- Efficient assignment for victims according to condition of AT and time.

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Team Detector (2018)

We analyzed strategies of other teams to improve to make a better score.

Table. The results of analysis of VC3's log data of the top 4 in RoboCup2017

Team	Rate of rescued civilian	Rate of rescue action	Rate of *cooperation*
Aura	10%	20%	23%
MRL	22%	17%	22%
RoboAKUT	13%	18%	21%
SEU-UniRobot	9%	22%	19%

Other team built groups of AT dynamically
and reduced time to rescue civilians.

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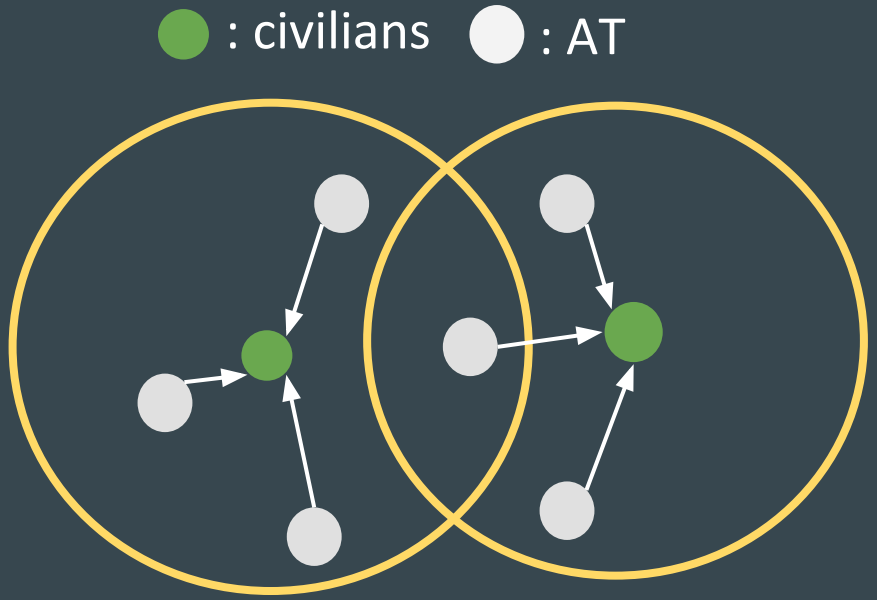
Team Detector (2018)

- AT set victim as a candidate for allocation in order of highest priority.
- Selected AT : existing in the circle centering on a victim in order of closeness.



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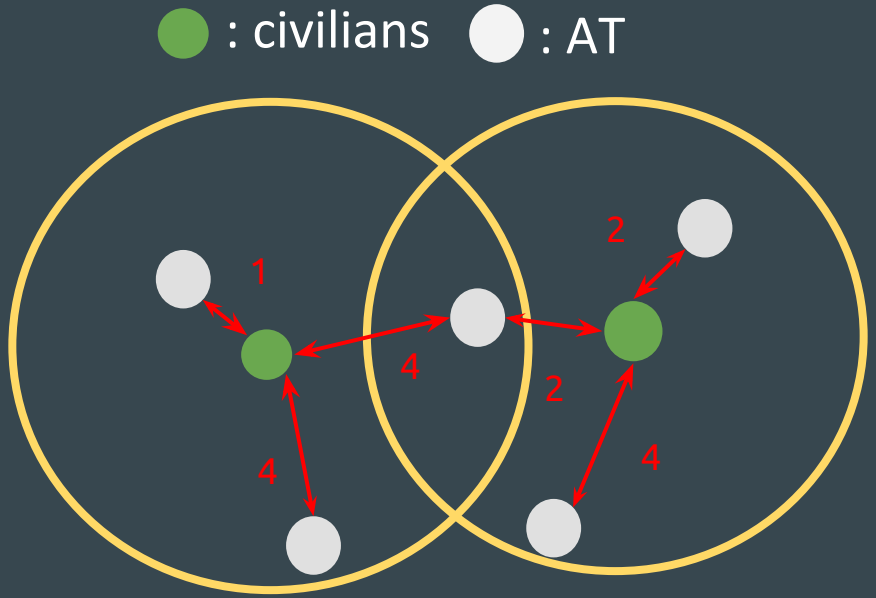
Team Detector (2018)



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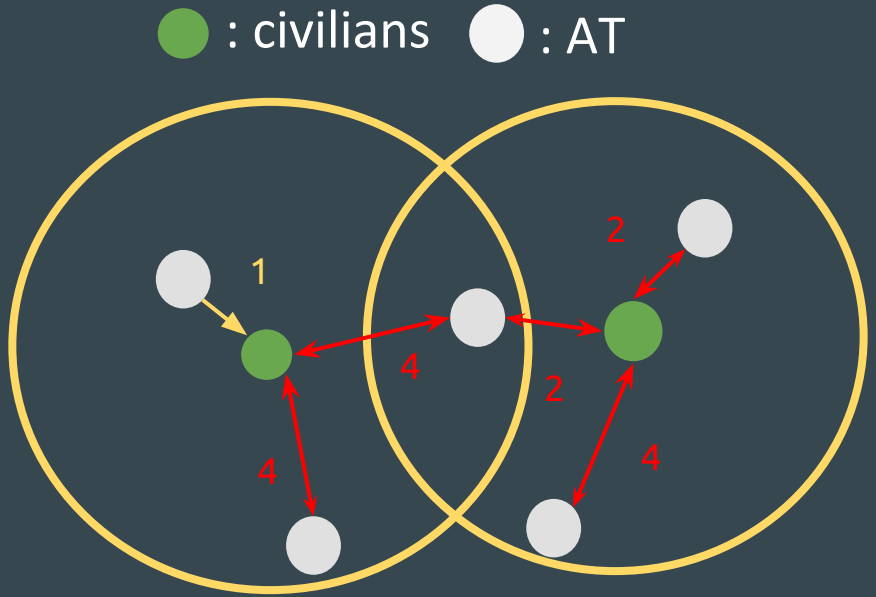
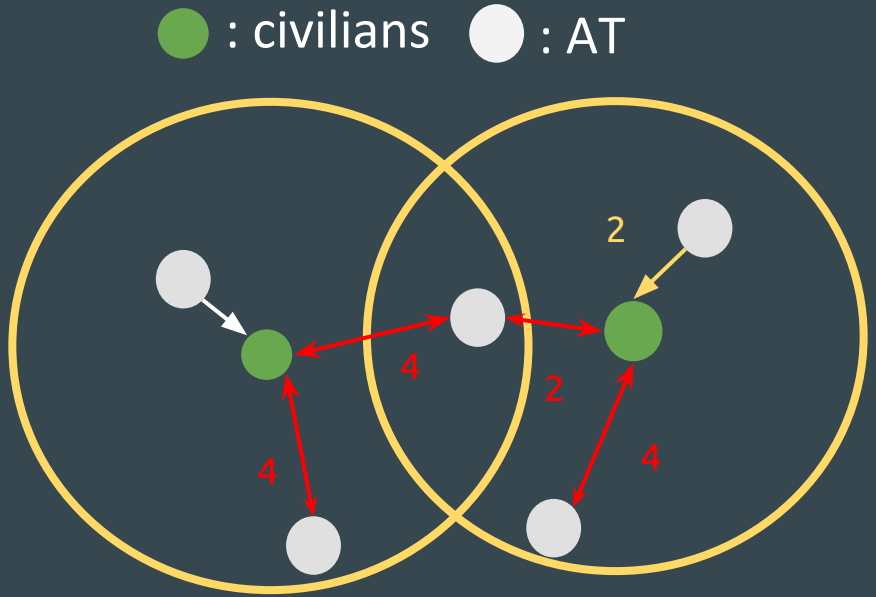
Team Detector (2018)



Team Detector (2018)



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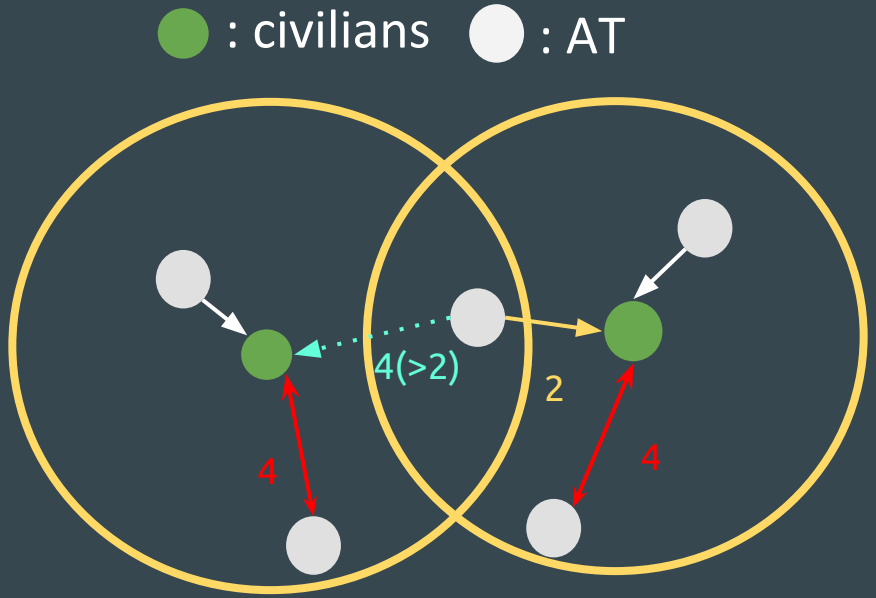
Team Detector (2018)



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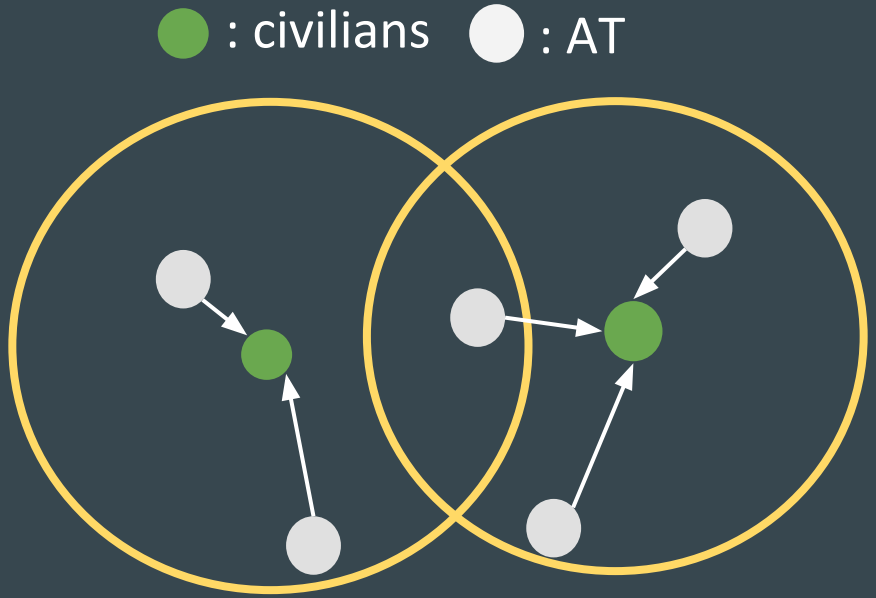
Team Detector (2018)



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Team Detector (2019)

Last year

- It was not considered what criterion would form the AT group.

This year

- As the cycle progressed and the fire spread, the radius increase. In the end, the area is doubled in the final step.

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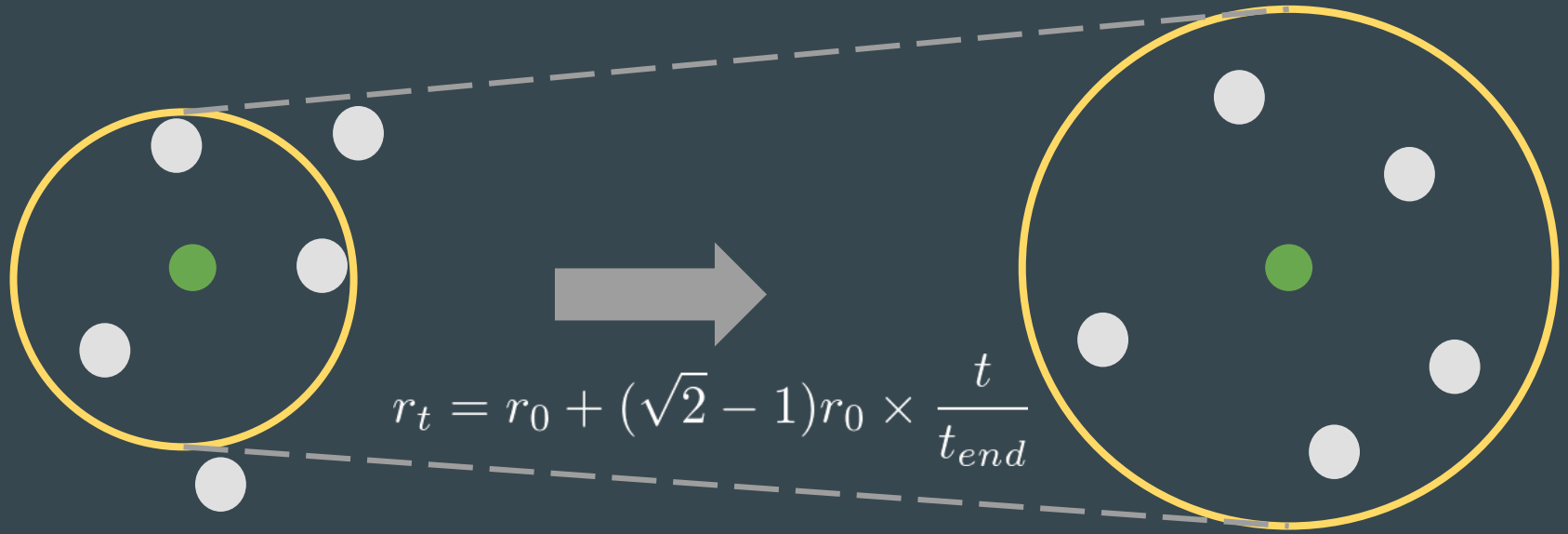
Team Detector (2019)



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Fire brigade

deal with gas station
&
Beforehand Extinguish

FB was implemented :

- extinguish the fire near the gas station in priority.
- beforehand extinguishing the buildings that were not burning and adjacent to the burning building.

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Problems of our team’s FB

- The number of FBs was limited
- Fire occurred at multiple locations
- The situation of the disaster was changing by every moment

→needed appropriate action of FB according to the situation of the fire.

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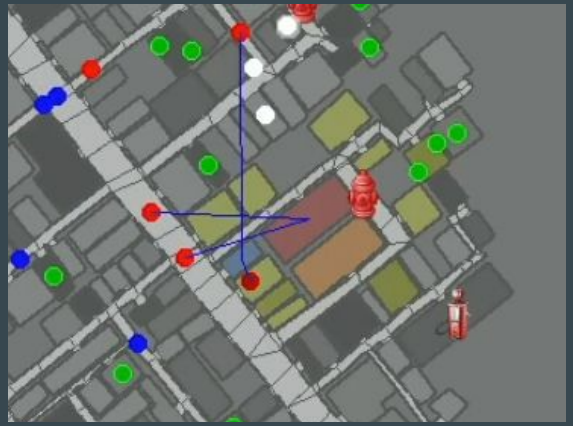
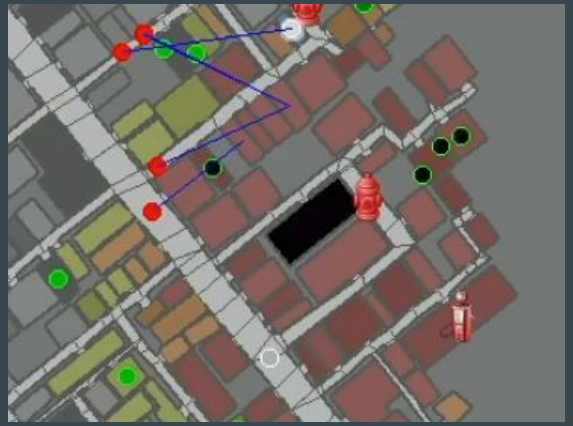
Problems of our team’s FB

It is difficult to suppress the fire spread once.
→need extinguish as soon as possible.





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Beforehand extinguish

- If four FBs are assigned the same target and extinguish it, a FB do beforehand extinguishing.

- The FB who is the farthest from the target extinguish the highest temperature building near the burning building.

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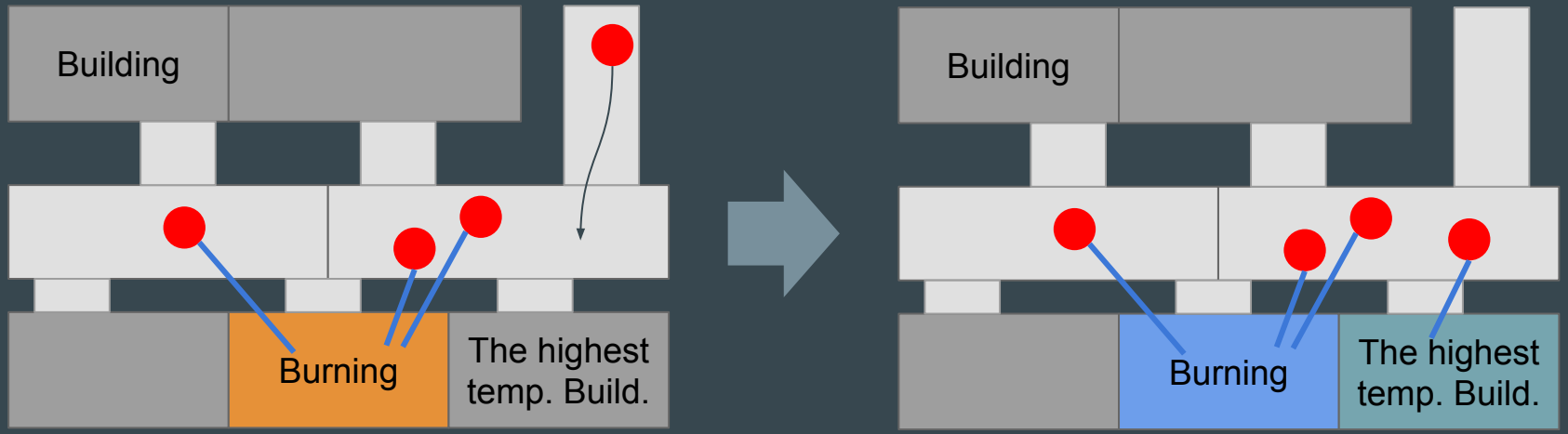
Beforehand Extinguish



- It’s decentralized decision
- using only distance and temperature

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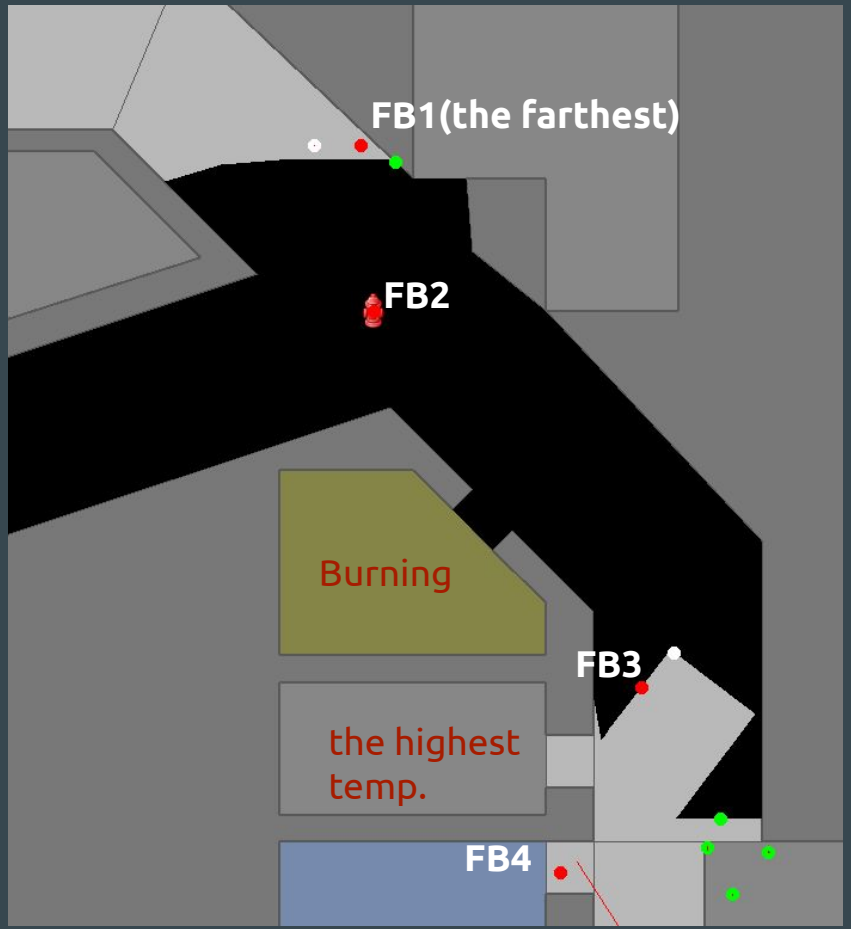
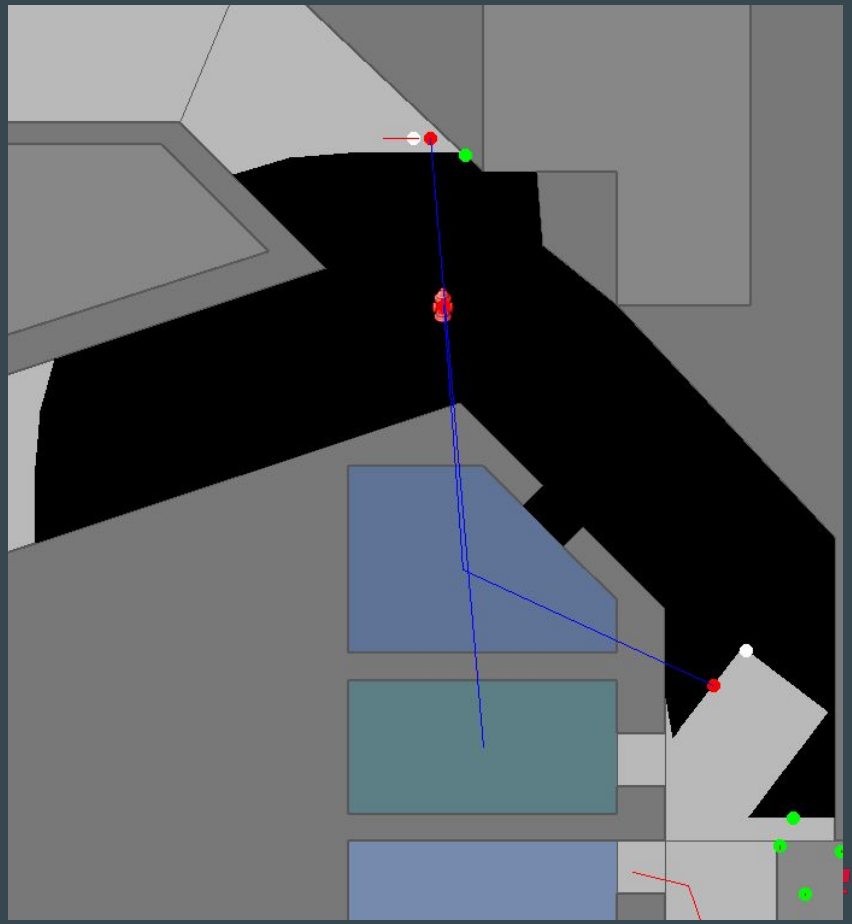
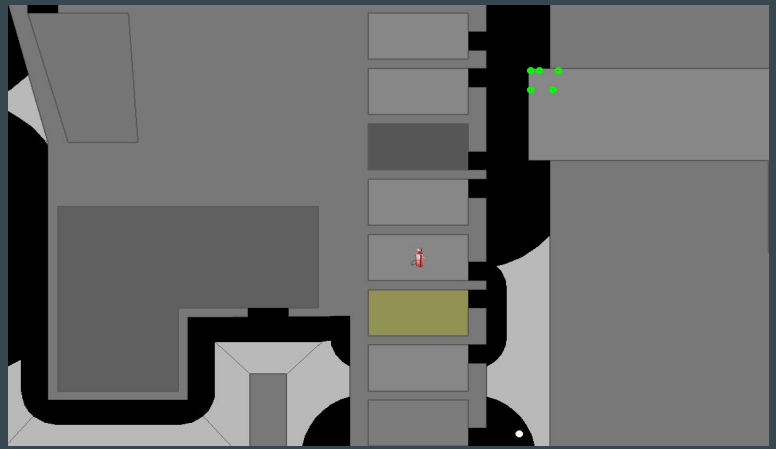
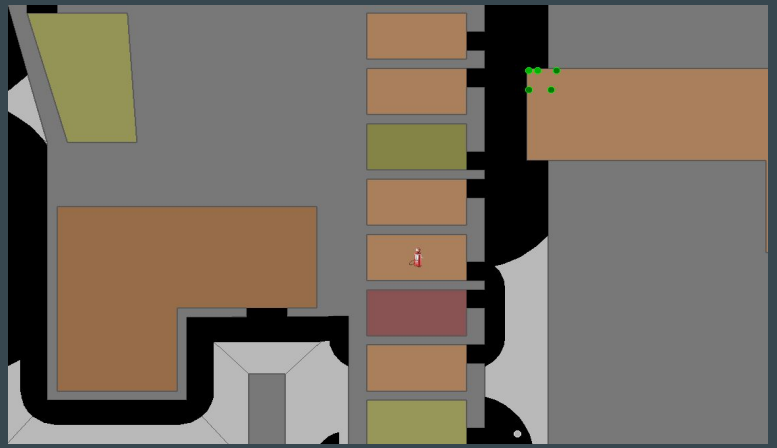

FB1(the farthest)
FB2
Burning
FB3
the highest
temp.
FB4



Deal with gas station





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Deal with gas station

- Ignition of gas stations can cause massive explosions and cause serious damage not only to surrounding buildings but also to agents and civilians.

- FBs extinguish buildings near to gas stations as priority.

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Police Forces

Refuge Clear System
&
Solve Congestion

PF was implemented :

- A method of removing blockades on roads near a refuge in priority.

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Hurdles and mission of PF

- The number of PFs was limited
- Needs quick rescue other agents and civilians with blockades.
- Necessary to secure paths to Refuge.

→Prioritize the road to the refuges and rescue the agents and civilians.

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Refuge Clear System

- Blockades on roads near refuges could prevent agents and civilians from reaching refuges and prevent FBs supplying water.

- PFs add roads with blockades and near refuges to the target list, and give priority to clear blockades on those roads.

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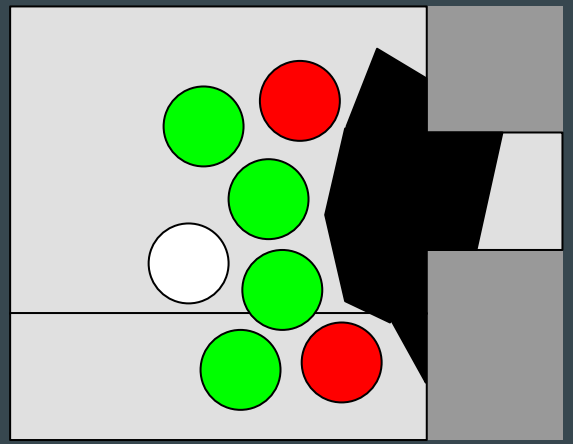
Solve Congestion

- Blockades on roads which many agents and civilians passed cause congestion.
- Caught agent with blockade couldn’t move and take actions.



- PFs add roads where has many agents and civilians to the target list, and give priority to clear blockades on those roads.

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Result

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Result

Team	map		
	kobe	berlin	sakae
Ri-one 2019	**136.19**	**70.56**	**12.31**
Ri-one 2018	84.06	83.63	14.55

- **berlin** and **sakae** have
  - too many victims in building compare with AT
  - too many fire buildings compare with FB at the start of simulation.

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Thank you for listening