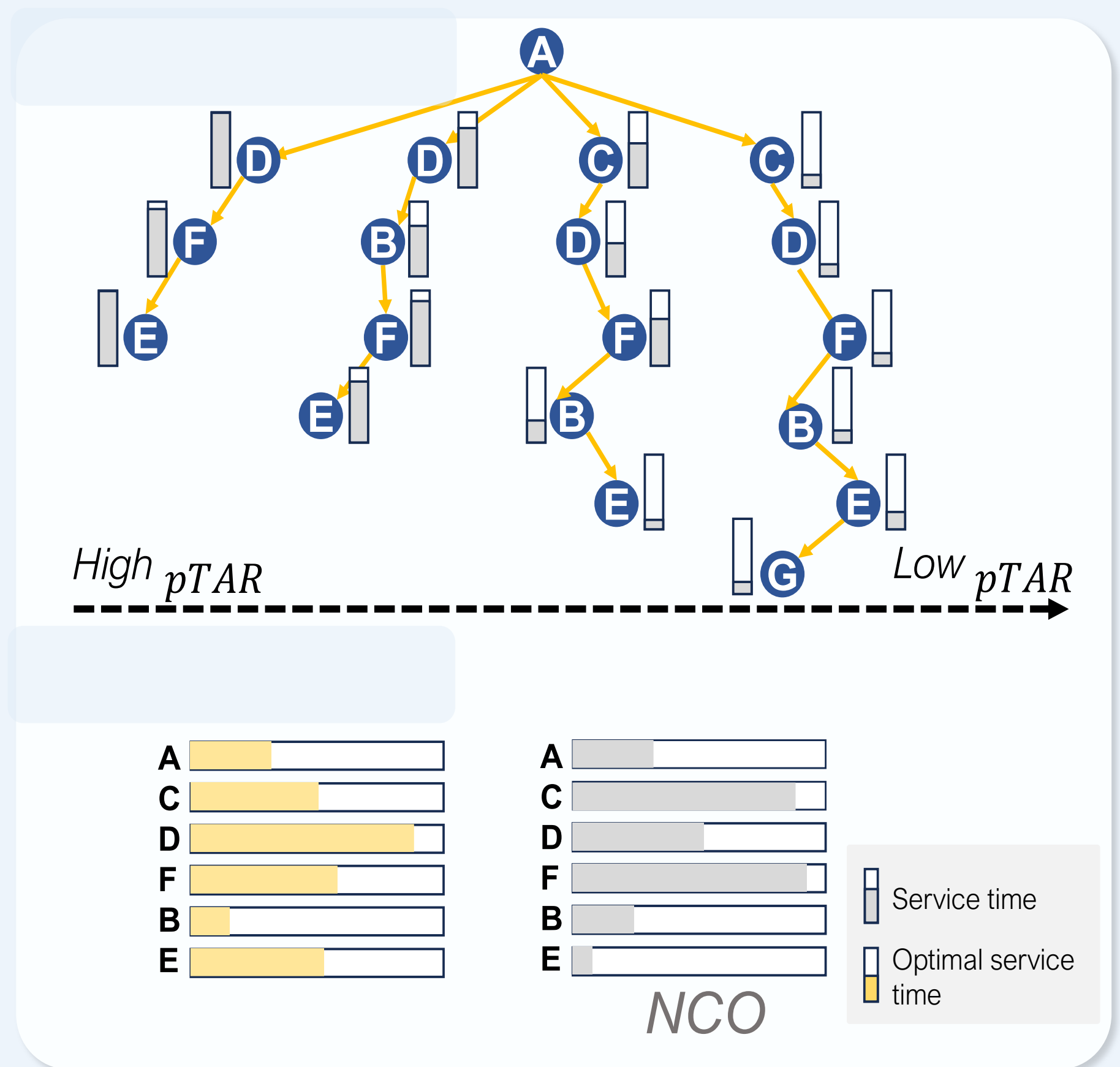
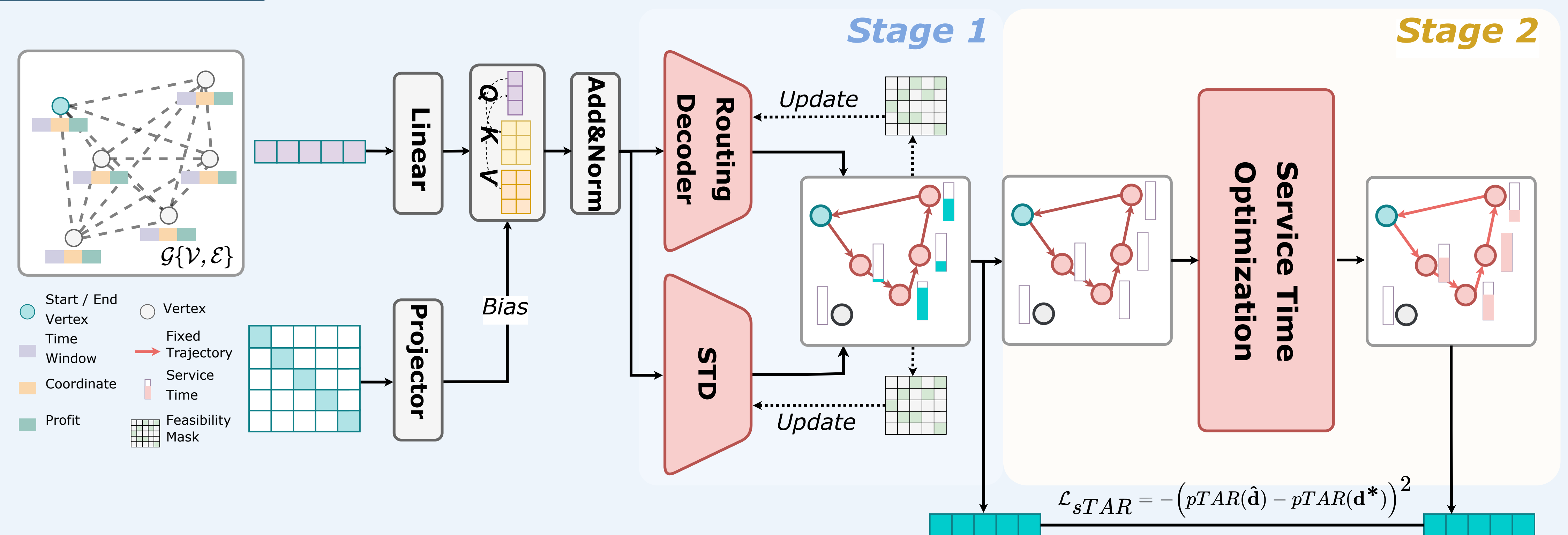


1. Motivation

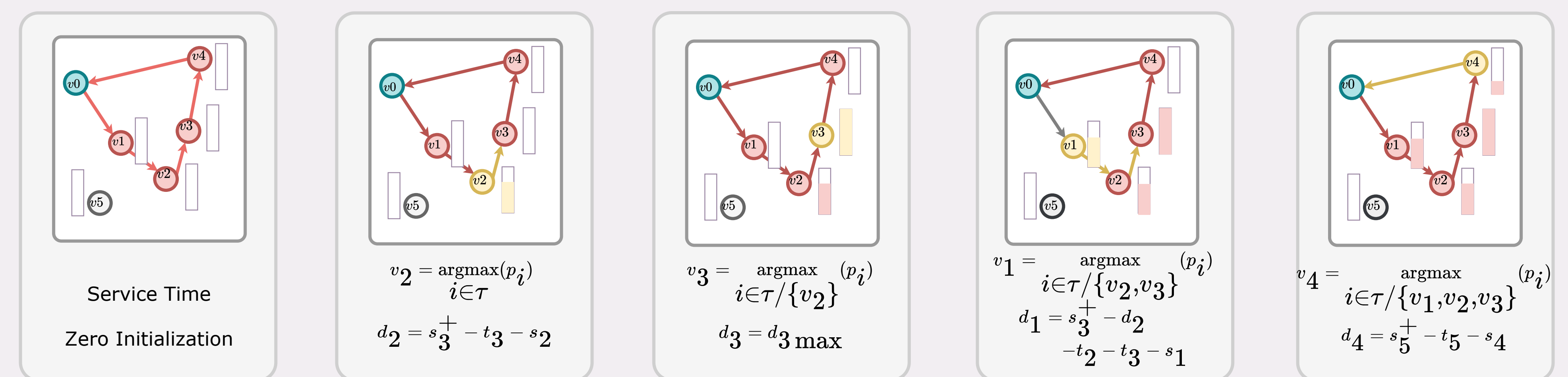
OPTWVP is a realistic extension of VRP where **routing decisions** and **service-time allocations** are tightly coupled through time windows and variable profits. This coupling induces an exponentially large joint discrete-continuous search space that existing NCO and heuristic methods struggle to handle.



3. Approach



Service Time Optimization

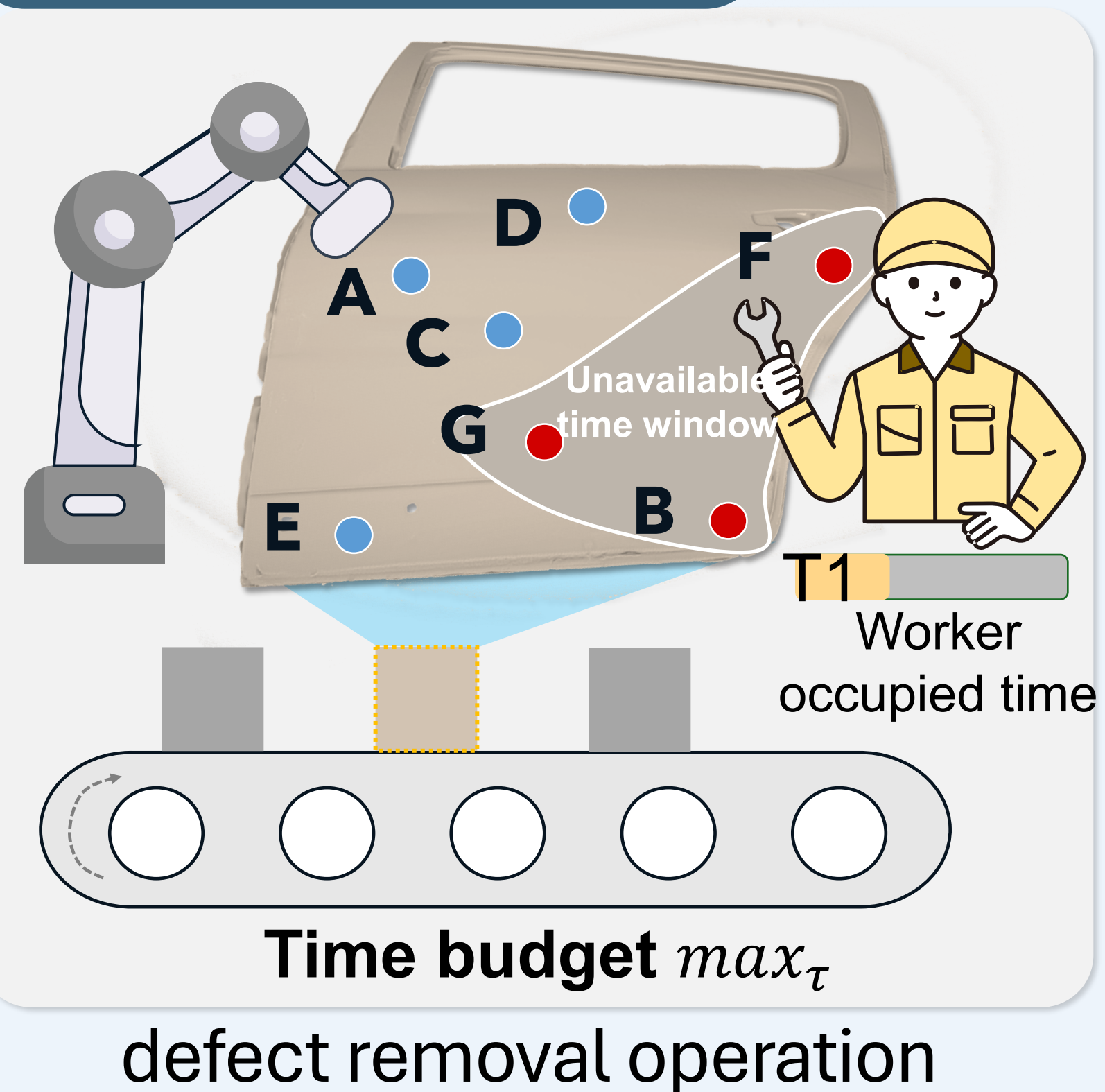


A two-stage *DEcoupled discrete-Continuous optimization with Service-time-guided Trajectory (DeCoST)*: First stage: a **parallel decoding structure** is employed to predict the path and the initial service time allocation.

Second stage: **the service times is optimized** through a linear programming (LP) formulation and a **long-horizon learning of service time estimation** is provided.

Training: pTAR-based supervisor improves long-horizon structure estimation.

2. Formulation



(OP) Time limit on assembly line

(VP) Profit increases with time.

(TW) Human affects defect accessibility.

Solution rooted on the Orienteering

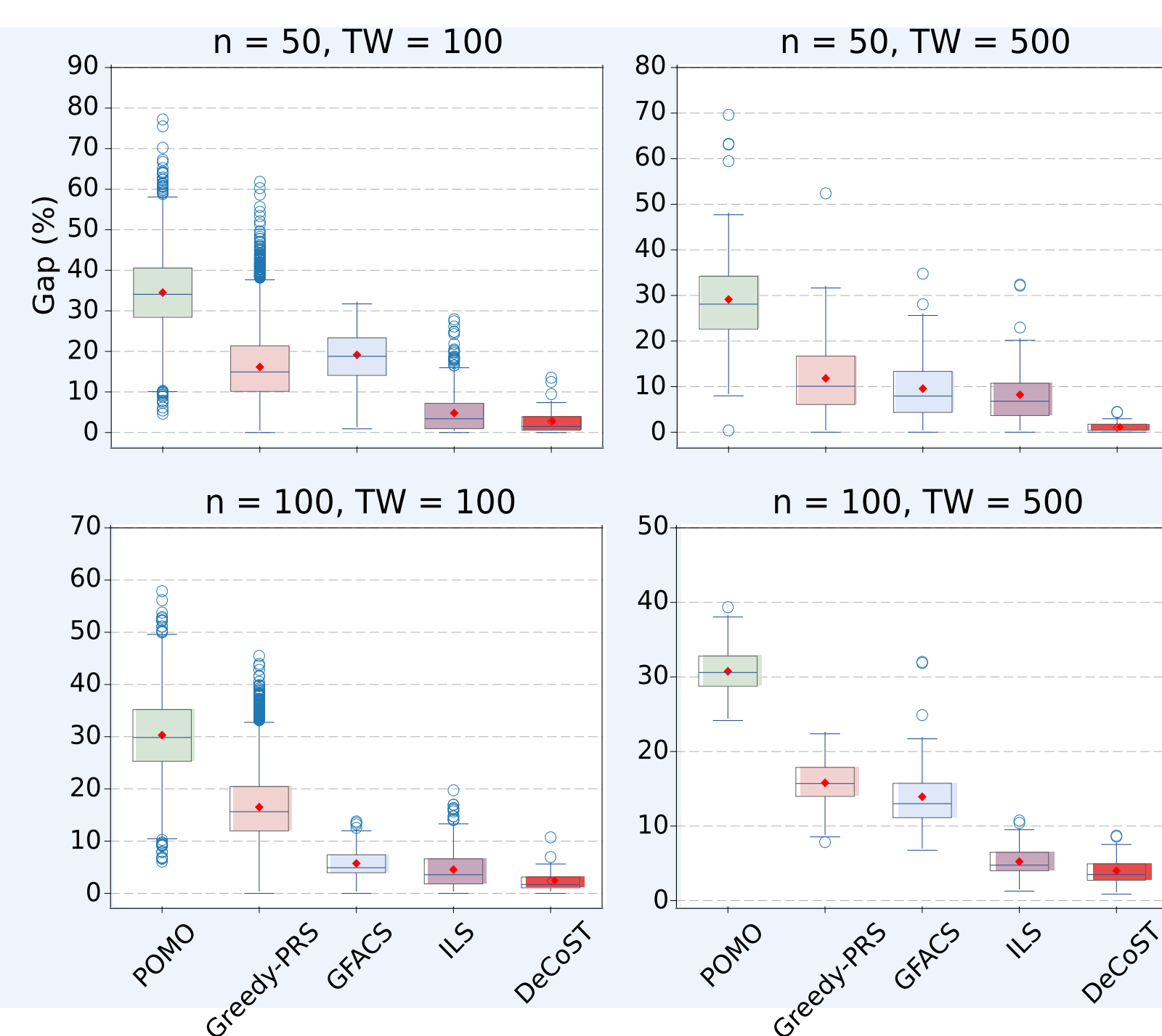
Problem with Time Windows and

Variable Profits (OPTWVP)

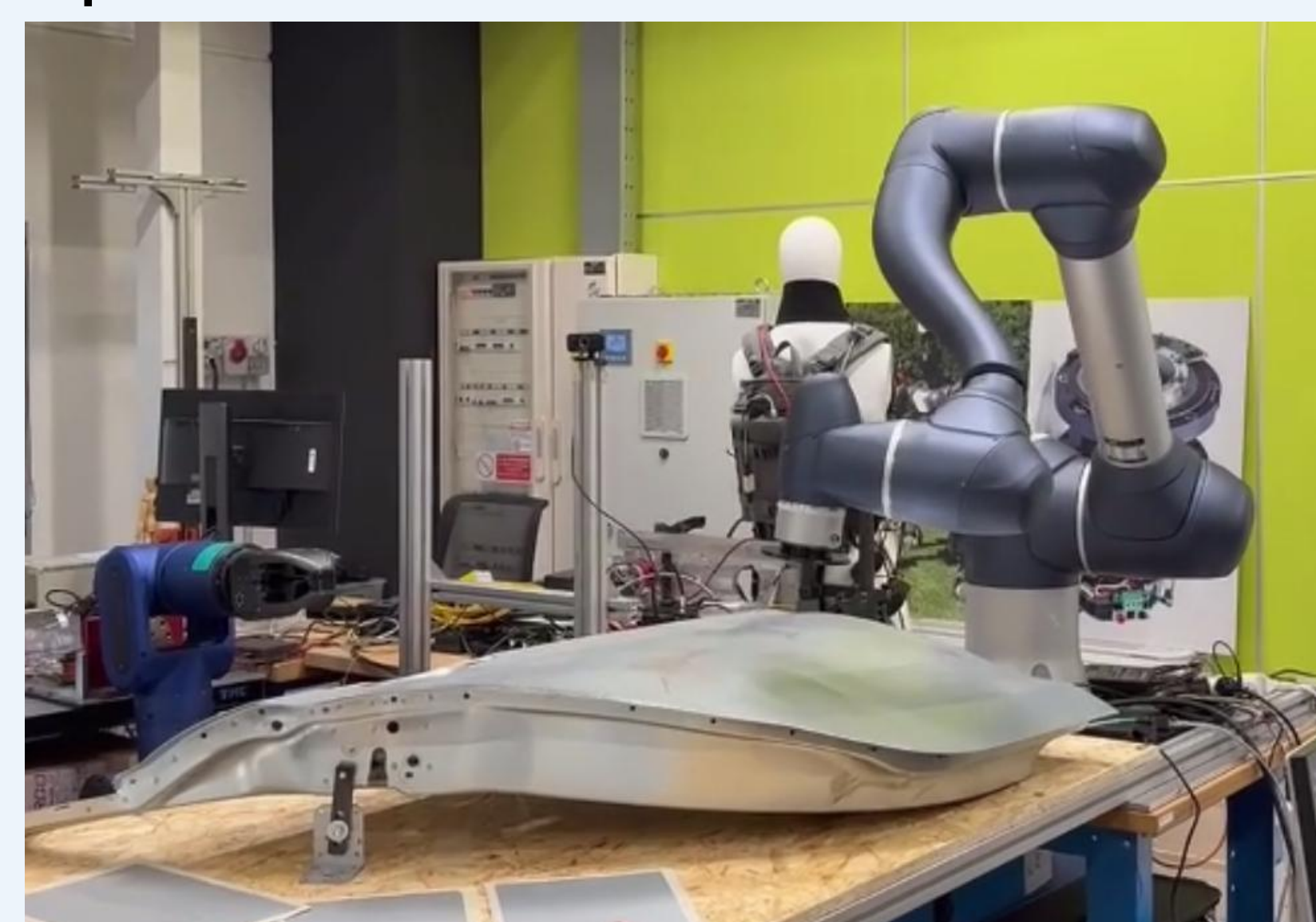
4. Results

TABLE I
PERFORMANCE ON OPTWVP WITH LARGE-SCALE CONFIGURATION (NUMBER OF NODES = 500). **BOLD** VALUES INDICATE THE BEST RESULT.

Method	Score ↑	Gap ↓	Runtime (ms) ↓
Branch & Cut	82.3	0.00%	68400
ILS [1]	78.2	4.98%	8803
GFACS (Greedy) [2]	67.4	18.1%	112
GFACS	73.1	11.3%	9420
POMO [3]	58.6	28.8%	747
DeCoST (Ours)	79.6	3.31%	1329



Implementation:



5. Conclusion

- DeCoST decouples routing and service-time allocation in a two-stage framework for OPTWVP.
- The LP-based STO module refines service times with guaranteed global optimality of STO problem.
- DeCoST delivers a strong quality-efficiency trade-off and generalizes well across constructive solvers.

