

Performance Evaluation of the Approaches and Algorithms Using Hamburg Airport Operations

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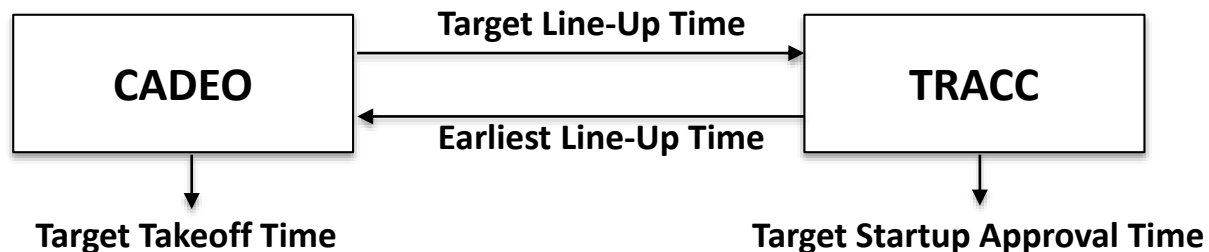
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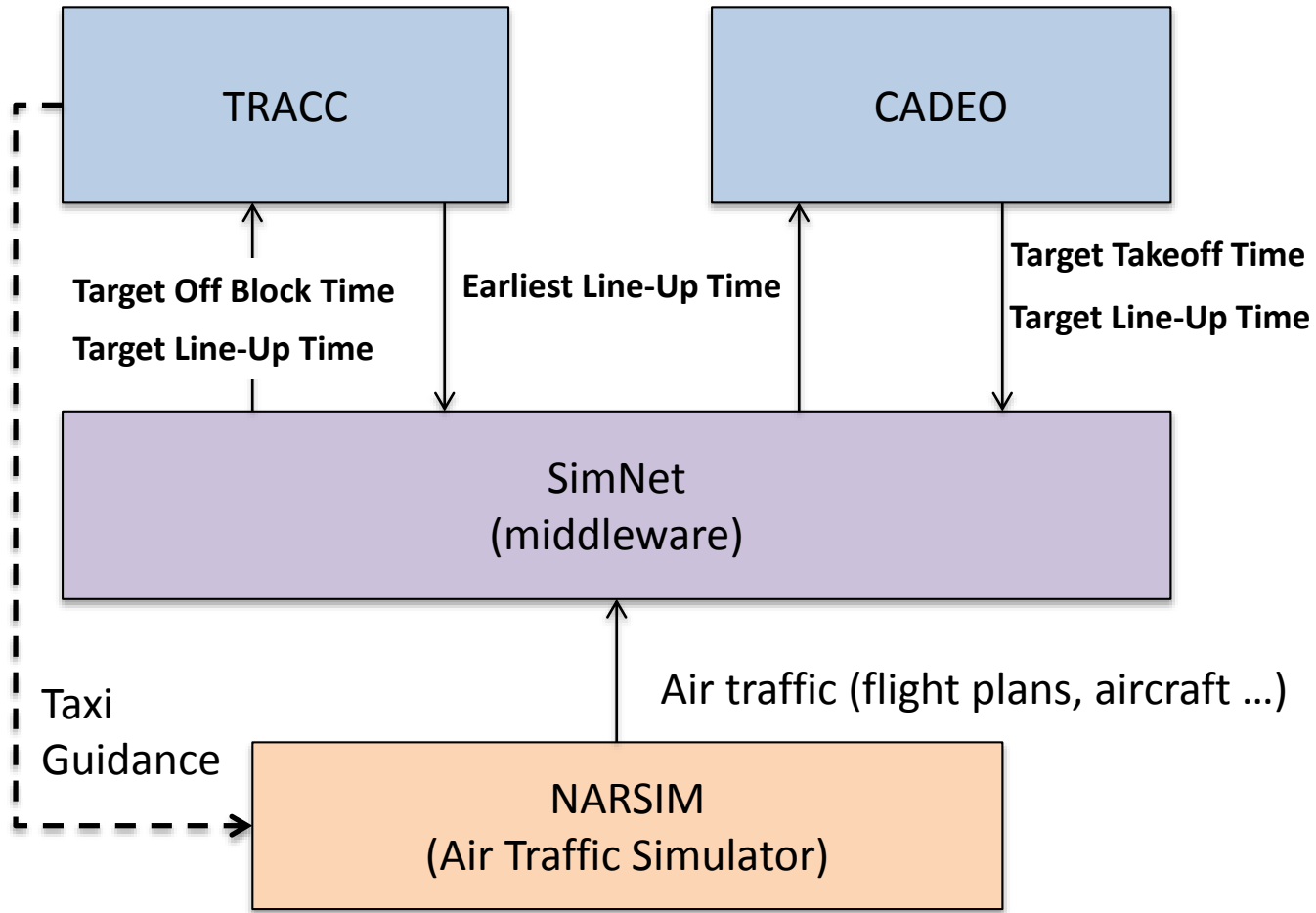
- Background & motivations
- Approaches and evaluation setups
- Results and analysis
- Summary and future work

- Improving airport operation remains a challenge and draws research efforts in both Europe and the U.S.
- German Aerospace Center (DLR) and NASA research teams each has been testing new ATM concepts/tools
- A research collaboration of DLR and NASA started in 2013 in the area of airport surface operations

- Evaluate two different approaches/algorithms (DLR's and NASA's) at same airport
- Inspect each approach's effectiveness in achieving its performance objectives
- Investigate applicability of the concepts and algorithms

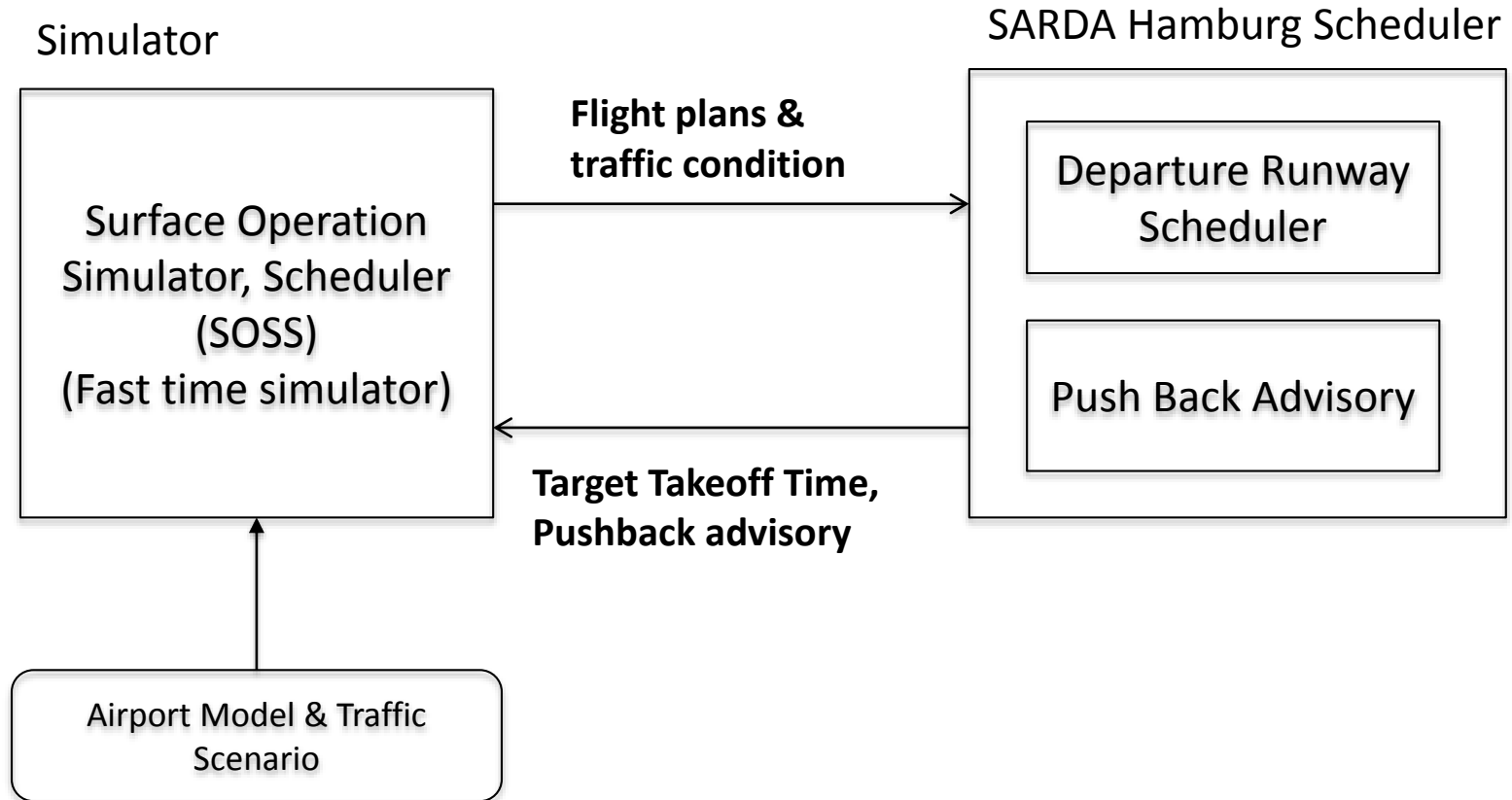
- CADEO -- Controller Assistance for Departure Optimization
- TRACC -- Taxi Routing for Aircraft: Creation and Controlling
- 4D trajectory and conflict-free taxi
- CADEO–TRACC integration



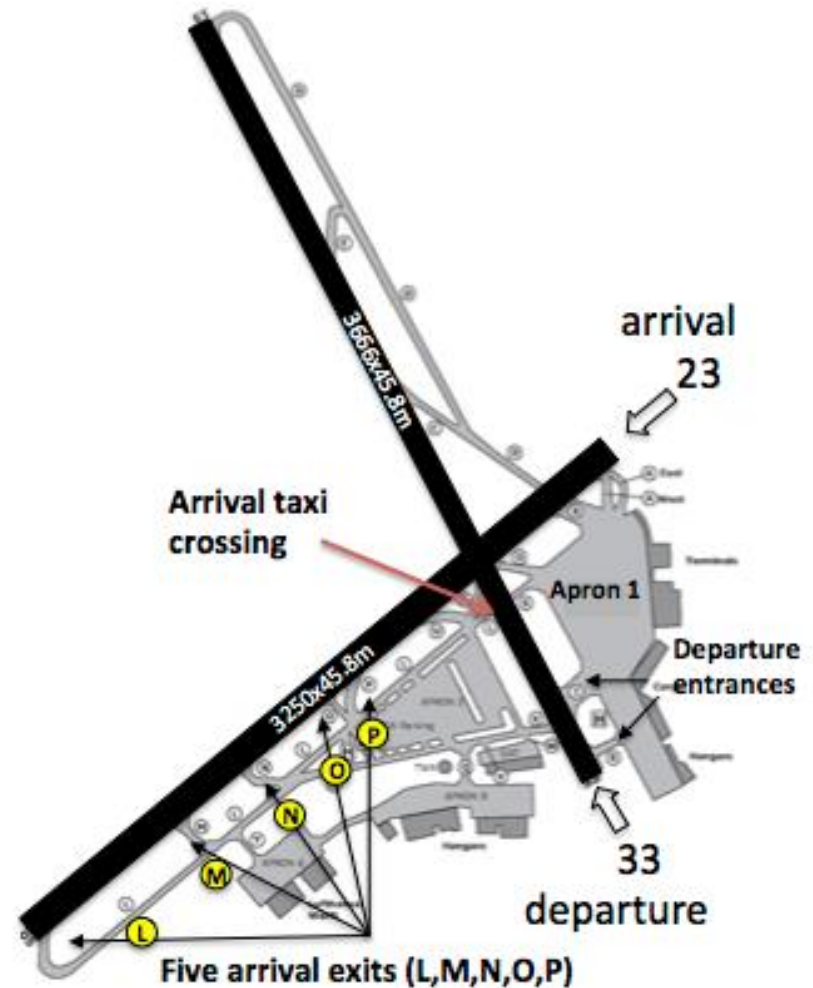


- SARDA -- Spot and Runway Departure Advisor
- A tactical decision support tool for controllers
- Optimized runway sequence for maximum throughput and reduction of taxi time
- Time-based taxi (spot/gate release) advisory





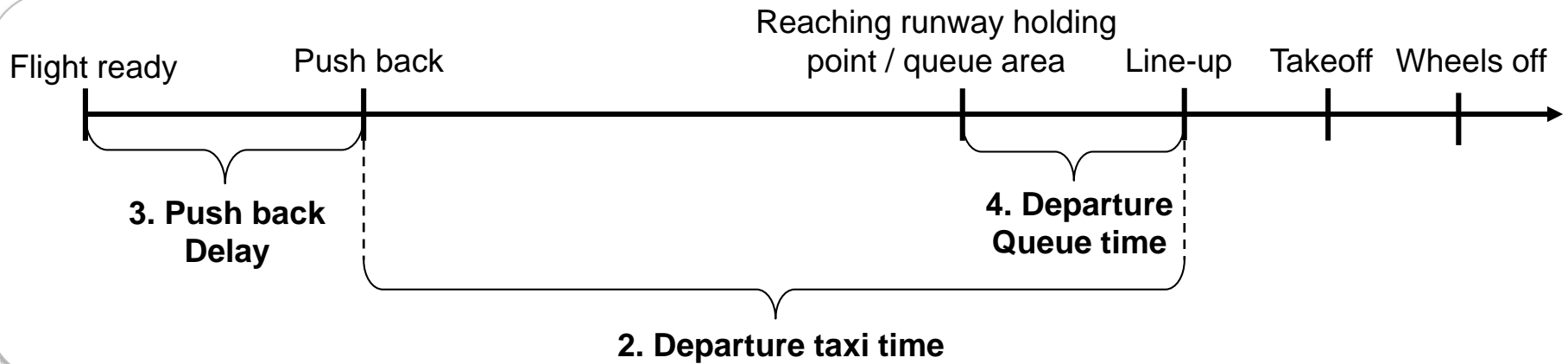
- Two intersecting runways
- Five arrival exits at left hand side
- Arrival aircraft cross departure runway before enter apron
- Two departure queues
- Control responsibilities: ATC – maneuvering area, Airport – apron
- A two-hour traffic scenario (35 departures and 34 arrivals)



Takeoff count in 10-min



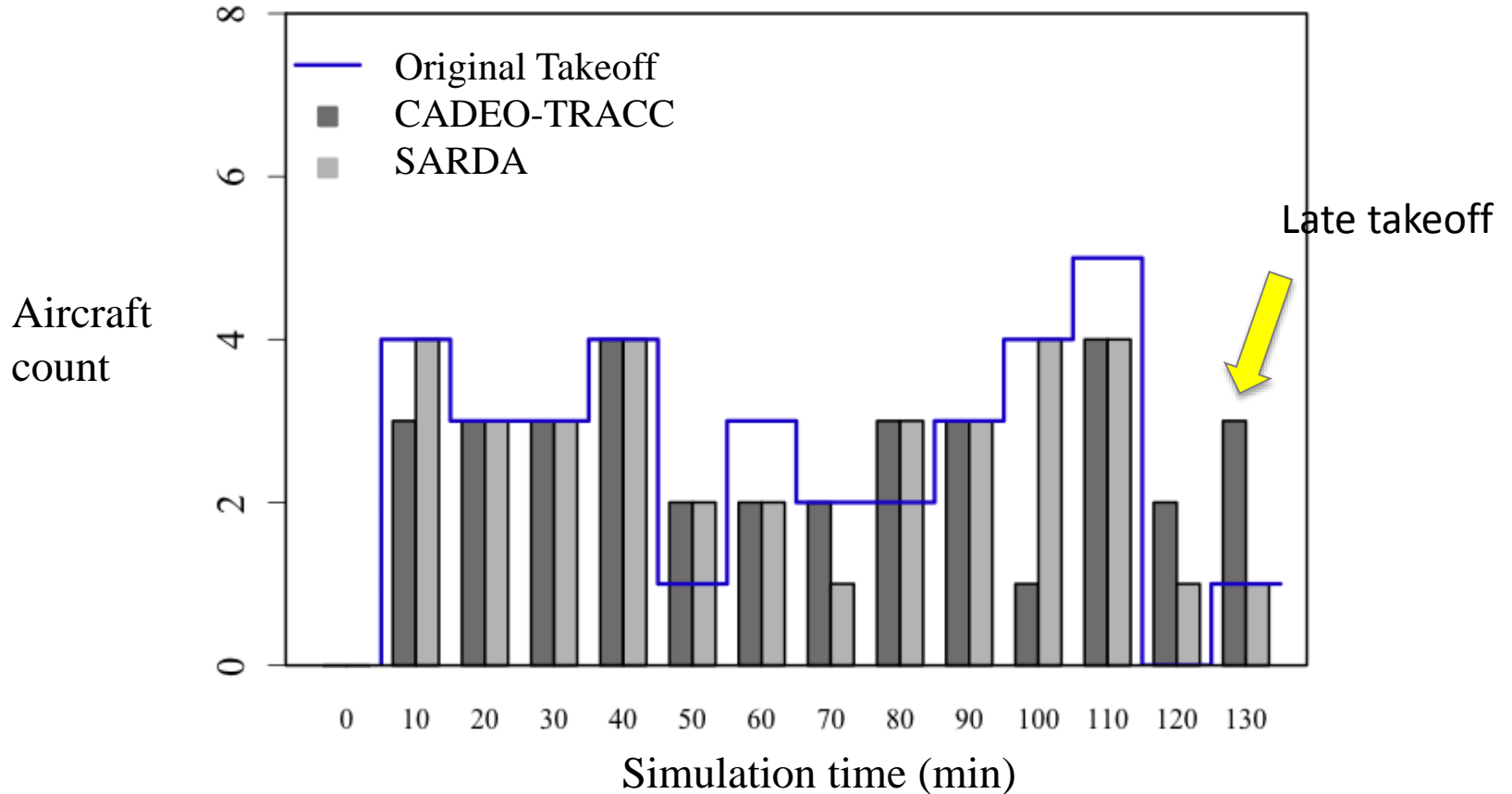
1. Departure throughput

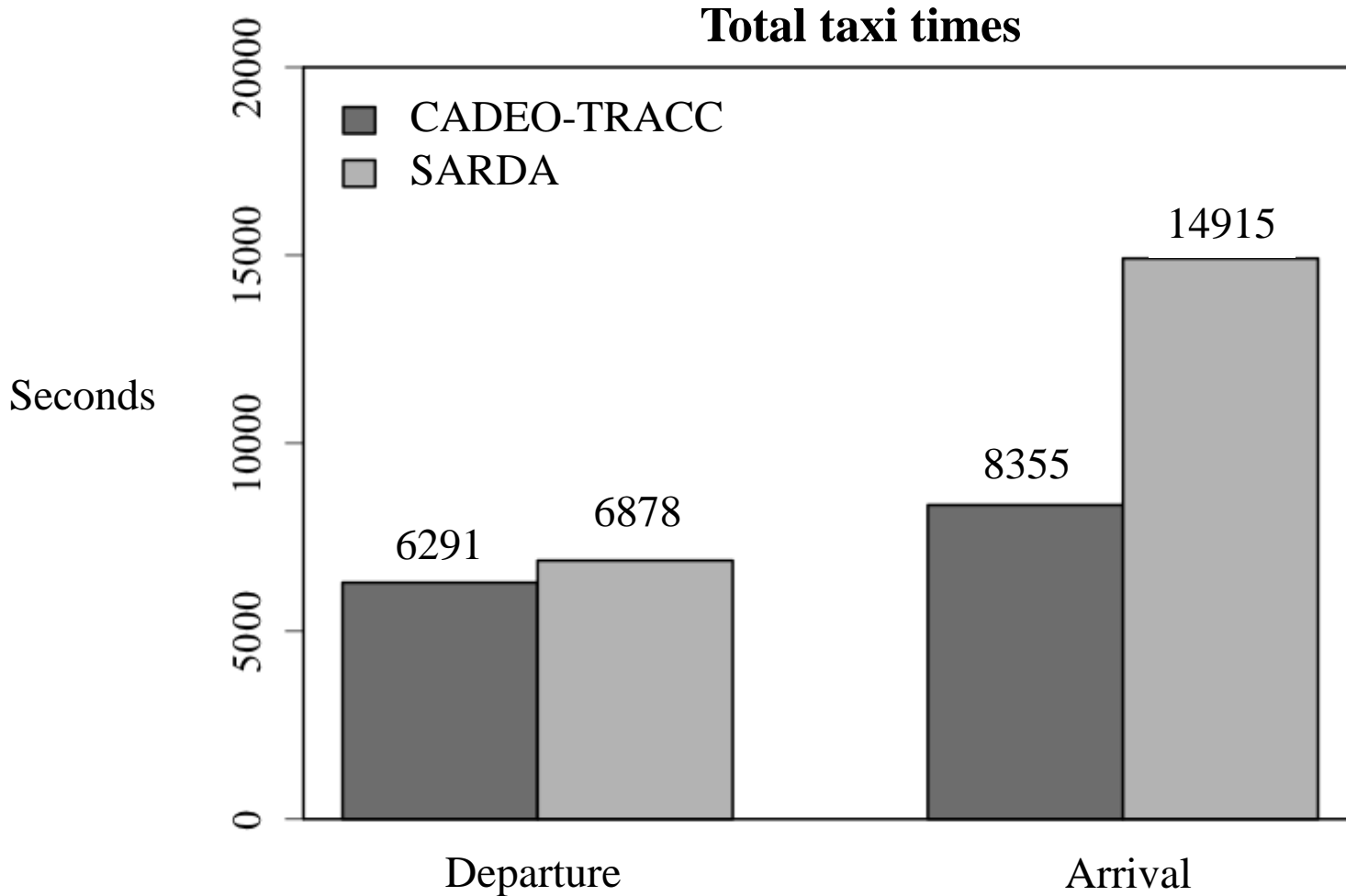


	CADEO-TRACC	SARDA
Taxi Advisory	Conflict-free taxi taxi guidance	Time-based gate push back guidance
Scheduling	Negotiation between CADEO and TRACC	Best effort in push back advisory to meet departure sequence

	NARSIM	SOSS
Maximum taxi speed	30/15 kts at maneuvering/apron area	15/10 kts at maneuvering/apron area
Arrival runway exit selection	Exit at P and O	Exit at M and N

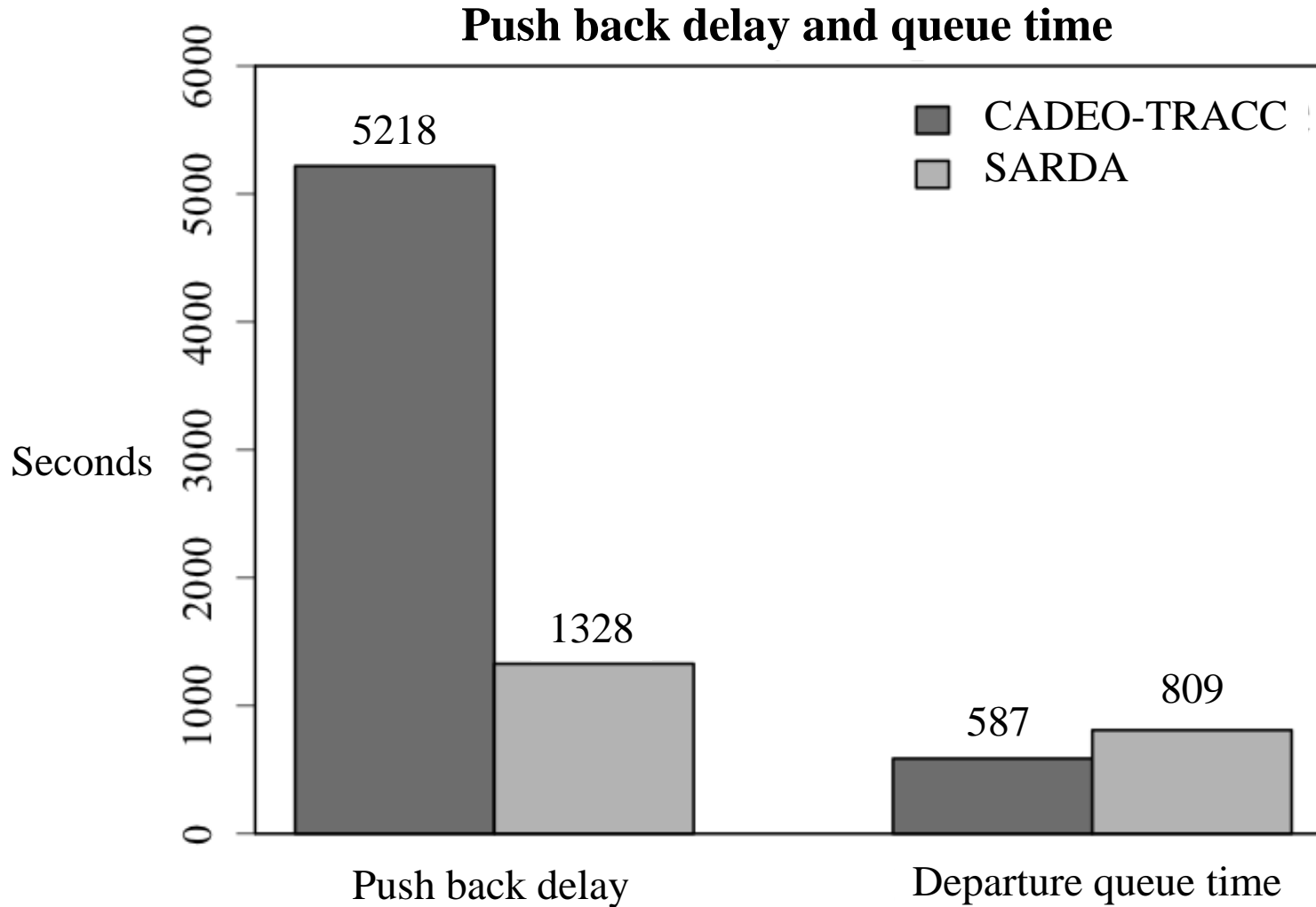
Departure runway throughput



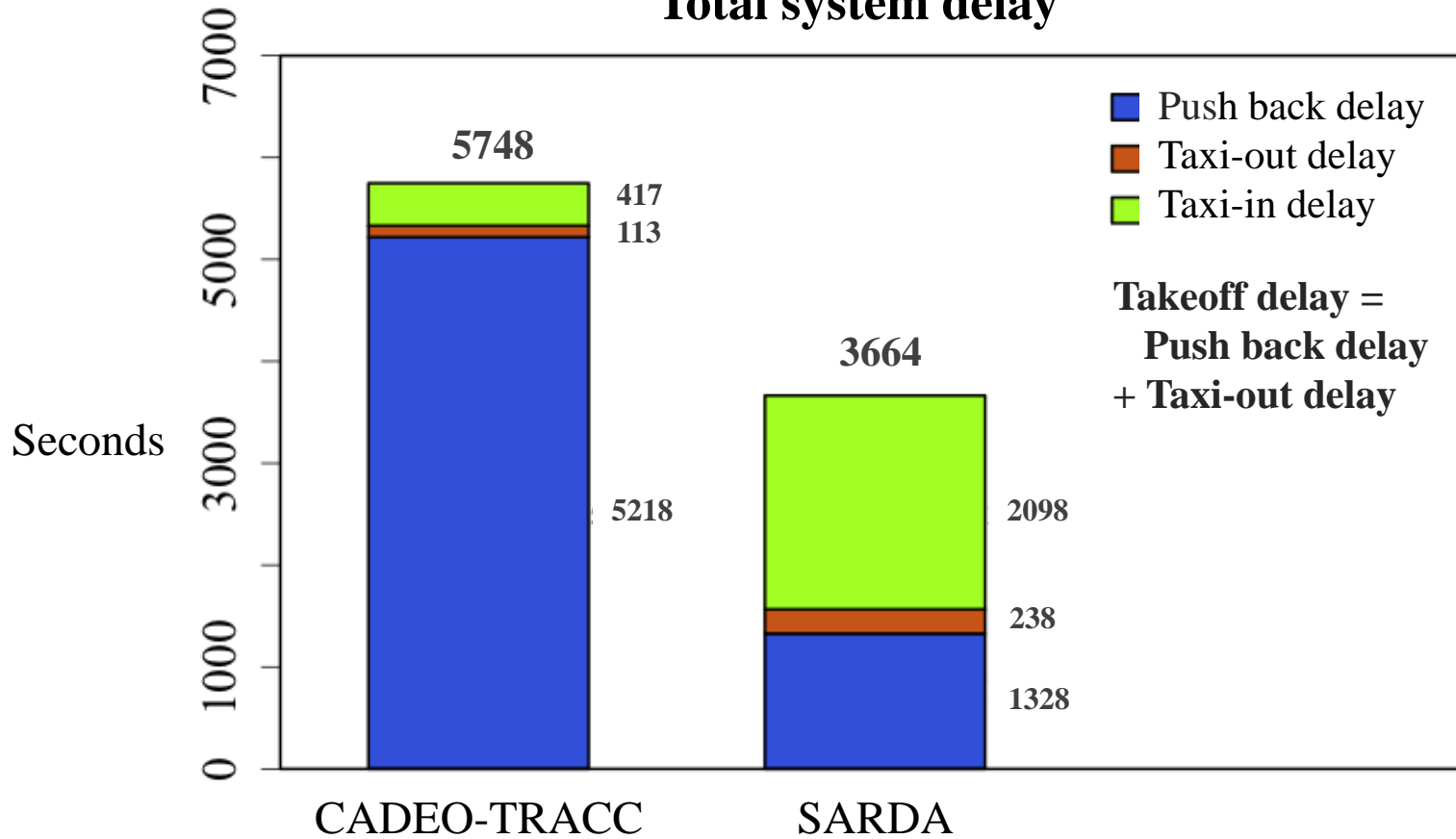


Results and Analysis – Unimpeded and Normalized Taxi Times

	CADEO-TRACC	SARDA
Departure unimpeded taxi time	6,178 seconds	6,640 seconds
Arrival unimpeded taxi time	7,884 seconds	12,877 seconds
Departure normalized taxi time	1.018	1.036
Arrival normalized taxi time	1.06	1.16



Total system delay



- Both systems used gate holding to shift the potential taxi delay to the gate
- Both systems sought to maintain maximum departure throughput
- The conflict-free taxi solution by TRACC led to less taxi times and longer gate holding
- SARDA's taxi advisories of releasing aircraft at gate/spot aimed to balance the surface traffic and runway pressure for throughput
- TRACC showed the ability of negotiating target takeoff time with CADEO for departure throughput trade-off

- Evaluation of the two approaches in a same simulation environment
- Feasibility evaluation of conflict-free taxi concept at a busy US airport
- Impact on other constraints, e.g., controller/pilot workload
- Additional metrics, e.g., uncertainties/predictability

Questions
