

Explanation of Assignment Algorithm

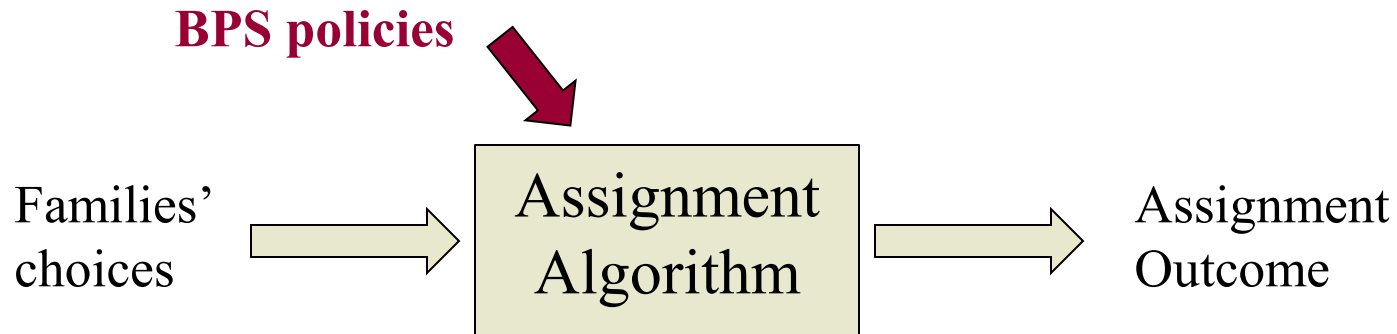
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DRAFT

With assistance from
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SEII @ MIT

What is an Assignment Algorithm?

- Assignment algorithm turns families choices into assignment outcome.



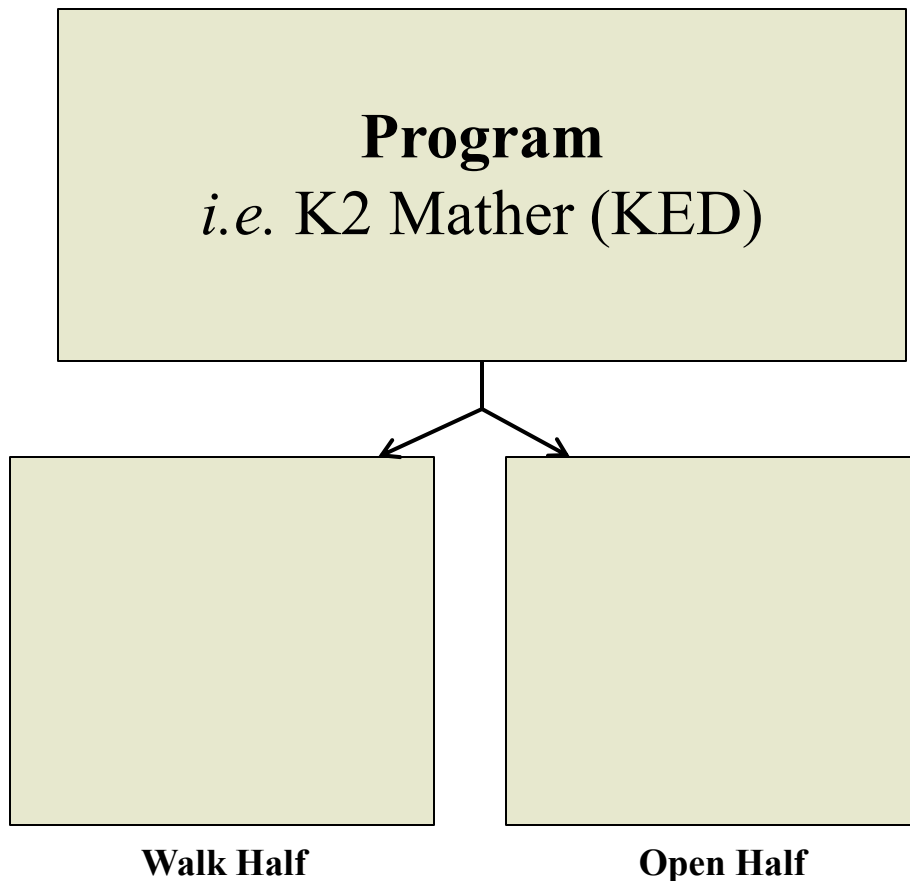
- How does it work?
- What parameters can the EAC use to determine placement?

Assignment Algorithm: Policy Parameters

- One parameter are the **priorities**:
 - Guarantee, SiblingWalk, Sibling, Walk, NoPriority
- Another parameter is the **school split**:
 - Currently 50/50 at nearly all schools (50% walk zone/ 50% seats open to all in-zone students)
 - At walk half, walk zone applicants ordered ahead of non-walk applicants
 - At open half, walk zone priority removed
- Decisions about these parameters determine placement, and with the data BPS has provided to us, we're now starting to systematically understand the implications

How the Assignment Algorithm Works Today

- Every program at a school is split into a walk-zone half and open half



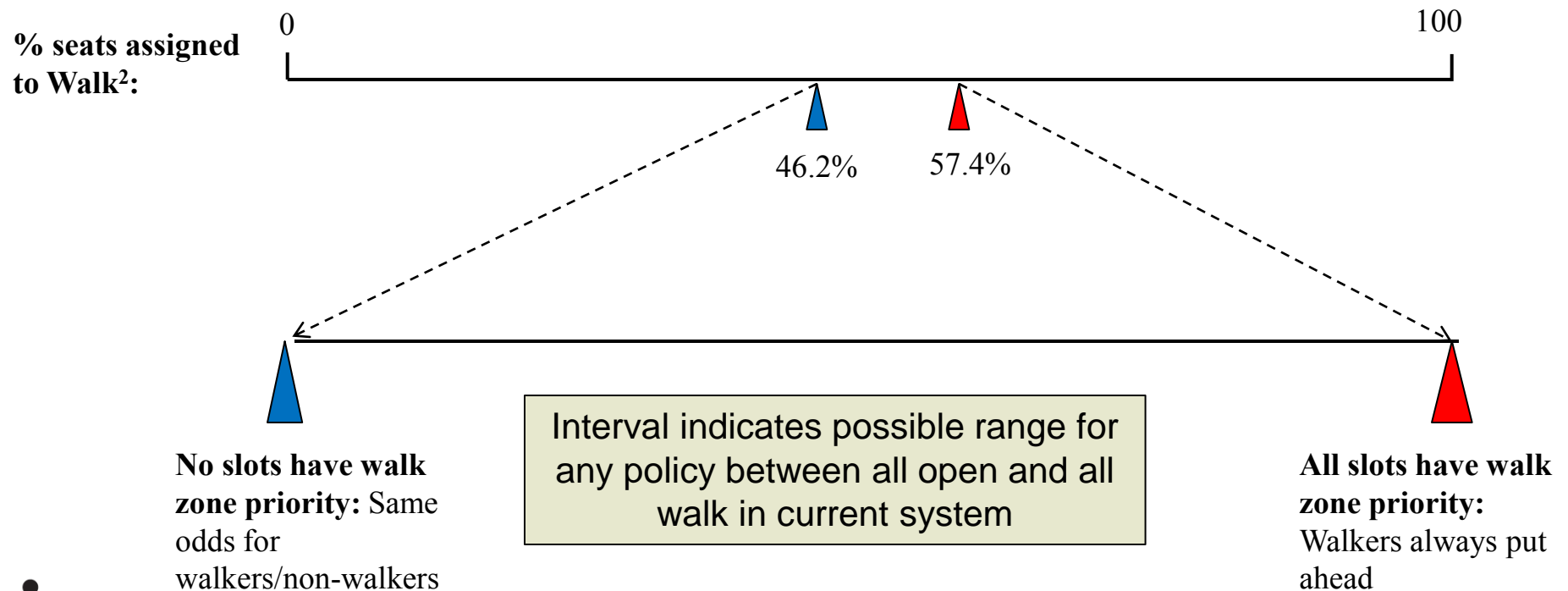
Understanding 50/50 Seat Breakdown

- Assignment algorithms and a 50/50 seat breakdown are a potential tool for providing access
- However, 50/50 does not imply that each school ends up with 50% of seats from the walk zone and 50% from outside the walk zone
- Why?
 - Walk zone students are also eligible for open seats
 - It also depends on student choices
 - If demand for walk zone schools is high, the fraction from walk zone will be higher, and vice versa

Understanding 50/50 Seat Breakdown

- First, as a **benchmark**, let's examine what happens to % seats assigned to walkers with open vs. all walkers first

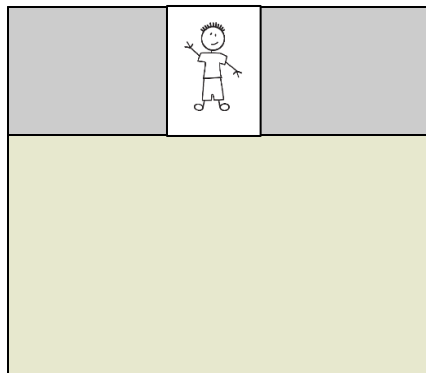
2009-2012 K1 (Round 1)¹



Notes: 1. Numbers for K2 (Round 1) in appendix. 2. Walk = SiblingWalk and Walk priority students and does not include guaranteed or administratively assigned to school in walk zone

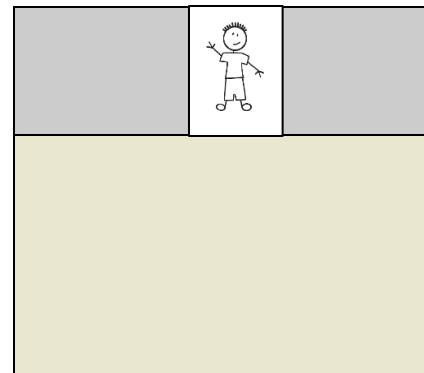
Understanding 50/50 Seat Breakdown: Policy Question

- Next, consider applicant **Estelle**  with both walk zone priority and a great random number
- **Policy question:** Which seat is Estelle placed into? A walk zone seat or an open seat?



Walk Half

or

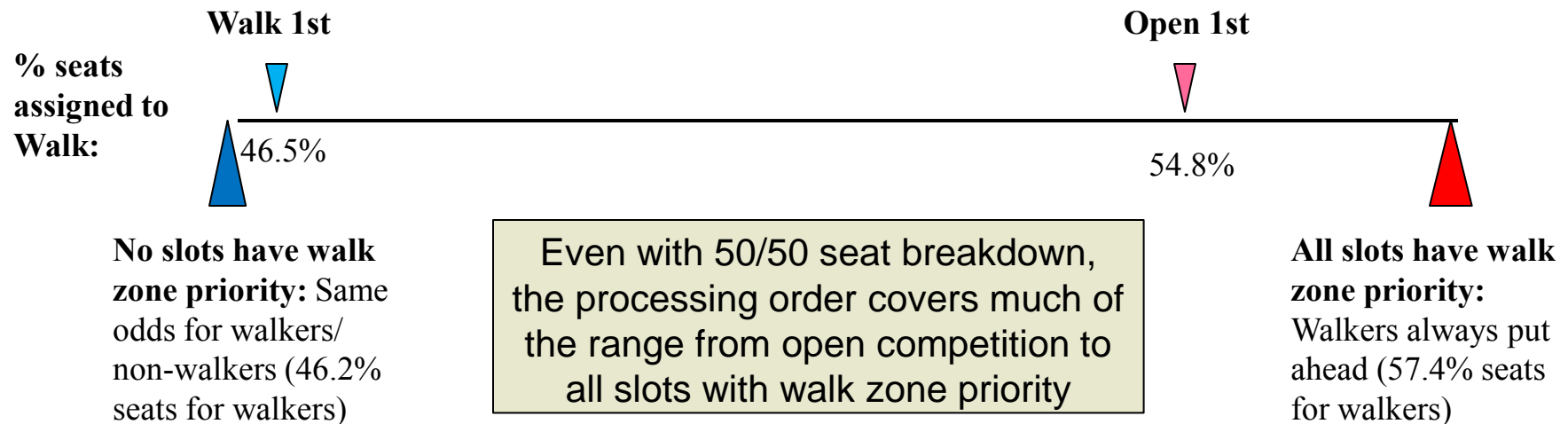


Open Half

Understanding 50/50 Seat Breakdown

- **Option 1:** Estelle receives a seat reserved for walk zone (Walk 1st)
- **Option 2:** Because she has a great random number, Estelle receives an open seat (Open 1st)

2009-2012 K1 (Round 1)



Why is Option 1 so close to having no walk zone priority?

- Consider school with 8 seats
- 6 walk zone and 6 non-walk zone applicants

W W W W W W N N N N N N

- Order by random number

W N N W W N W N N W N W

1	2	3	4	5	6	7	8	9	10	11	12	Random #	Priority
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- Three scenarios

- Completely open competition

W N N W W N W N N W N W

4 W & 4 N

- Option 1: Walk first / Open next

W N N W W N W N N W N W

4 W & 4 N

- Option 2: Open first / Walk next

W N N W W N W N N W N W

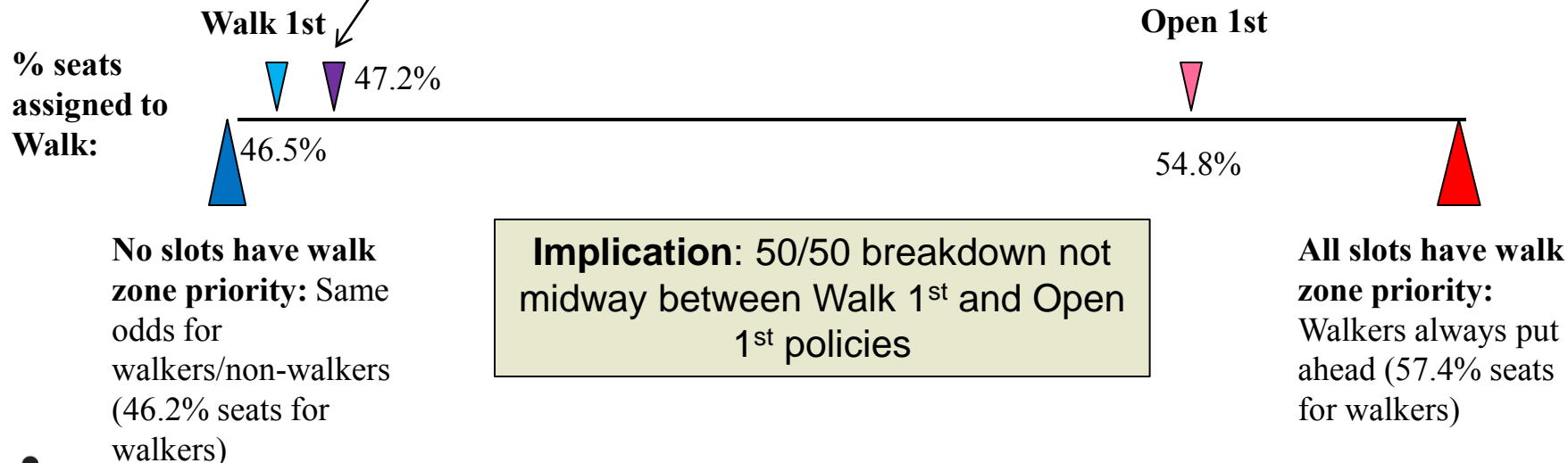
6 W & 2 N

Understanding 50/50 Slot Breakdown

- BPS's current implementation is very close to Option 1 (see appendix for technical details)

2009-2012 K1 (Round 1)

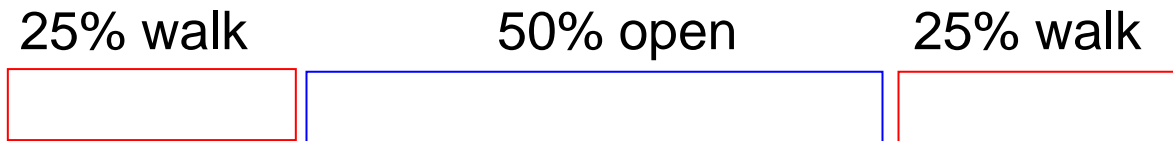
Current policy is very close to open placement



Intermediate implementation of 50/50 seat breakdown

- Is it possible to be roughly midway between Walk 1st implementation and Open 1st implementation?

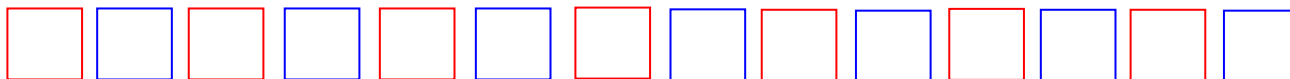
- Yes, compromise method:



- Is it possible to be midway between All Open and All Walk Zone?

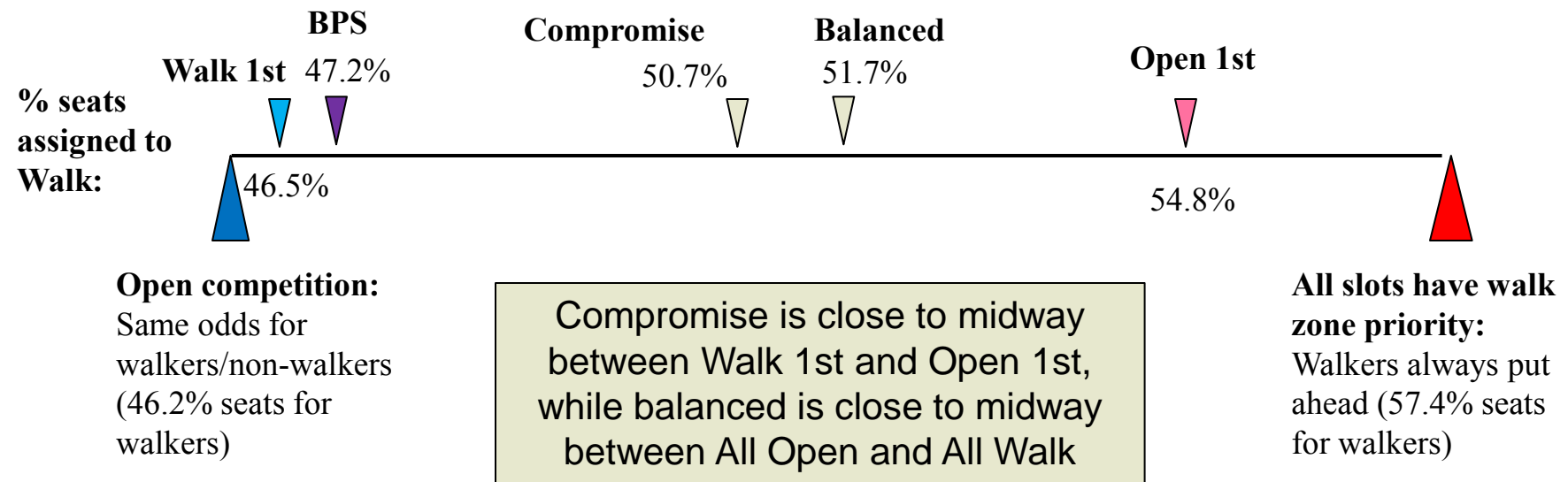
- Yes, balanced method:

- Alternate between walk zone and open seats while using different random numbers for these two types of seats



Implementations of 50/50 seat breakdown

2009-2012 K1 (Round 1)



Ways to Modify Walk Zone Access: Details matter

1. Increase/decrease slots reserved for walkers
 - i.e. 25% reservation; 75% reservation
2. Change the “processing order”: the order students apply to walk/open seat in the algorithm
 - Different processing orders correspond to different outcomes:
 - A) If prefer higher priority for walkers in walk zone seats and lower priority to walkers in open seats: maintain current policy
 - B) If want highest neighborhood assignment within 50/50 breakdown: switch to Open 1st
 - That is,
 - A) is most non-walk zone friendly implementation of 50/50 seat breakdown
 - B) is most walk zone friendly implementation of 50/50 seat breakdown
 - Intermediate implementations are available

Bottom line

- The goal of this presentation is to explain the implications of the current policy and alternatives
- These issues have not been highlighted in discussions about the alternative plans, but are important
- If a recommendation retains a school breakdown, then the slot reservation policy needs to be accompanied by a recommendation on how to process placements

Appendix

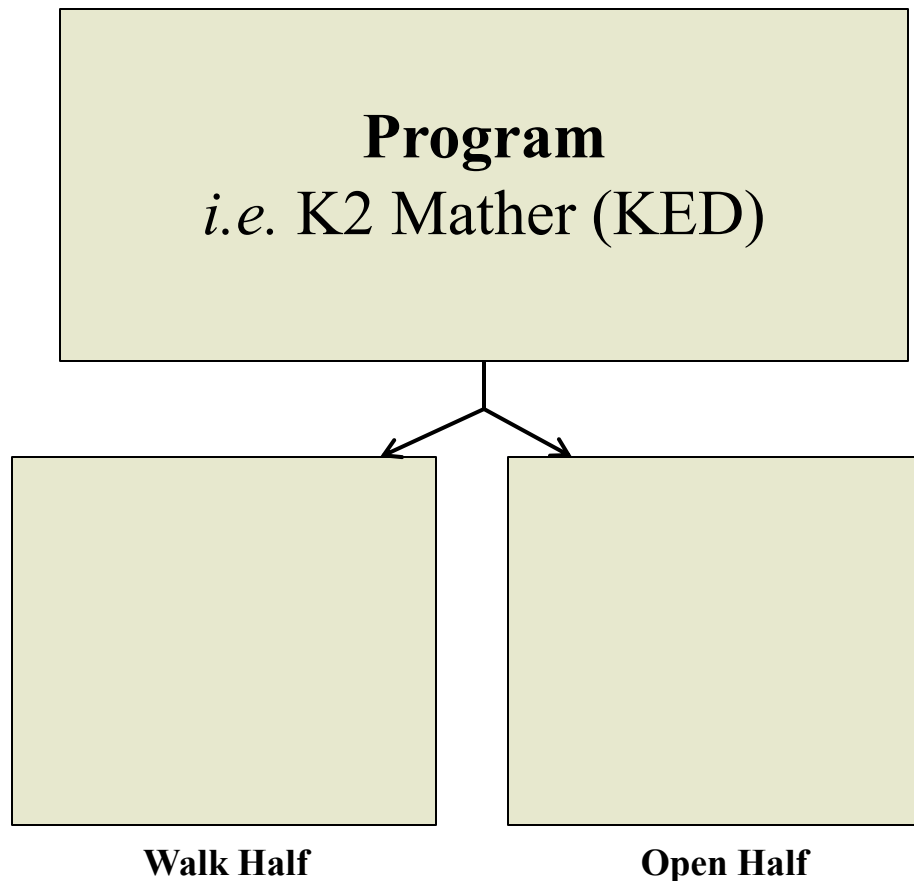
- Technical references
- More technical details on BPS current algorithm implementation
- Comparison for Grade K2 (2009-2012)

Academic references

- Abdulkadiroglu and Sönmez (2003). “School Choice: A Mechanism Design Approach,” *American Economic Review*, vol. 93(3).
- Kominers and Sönmez (2012). “Designing for Diversity: Matching with Slot-Specific Priorities,” *Boston College Working Papers in Economics* 806.
- Dur, Kominers, Pathak, Sönmez (2012). “Priorities vs. Precedence in Boston,” *Manuscript*.
- Pathak and Sönmez (2012). “Property Rights and Agents Claims in Priority-Based Resource Allocation.” *Work-in-progress*

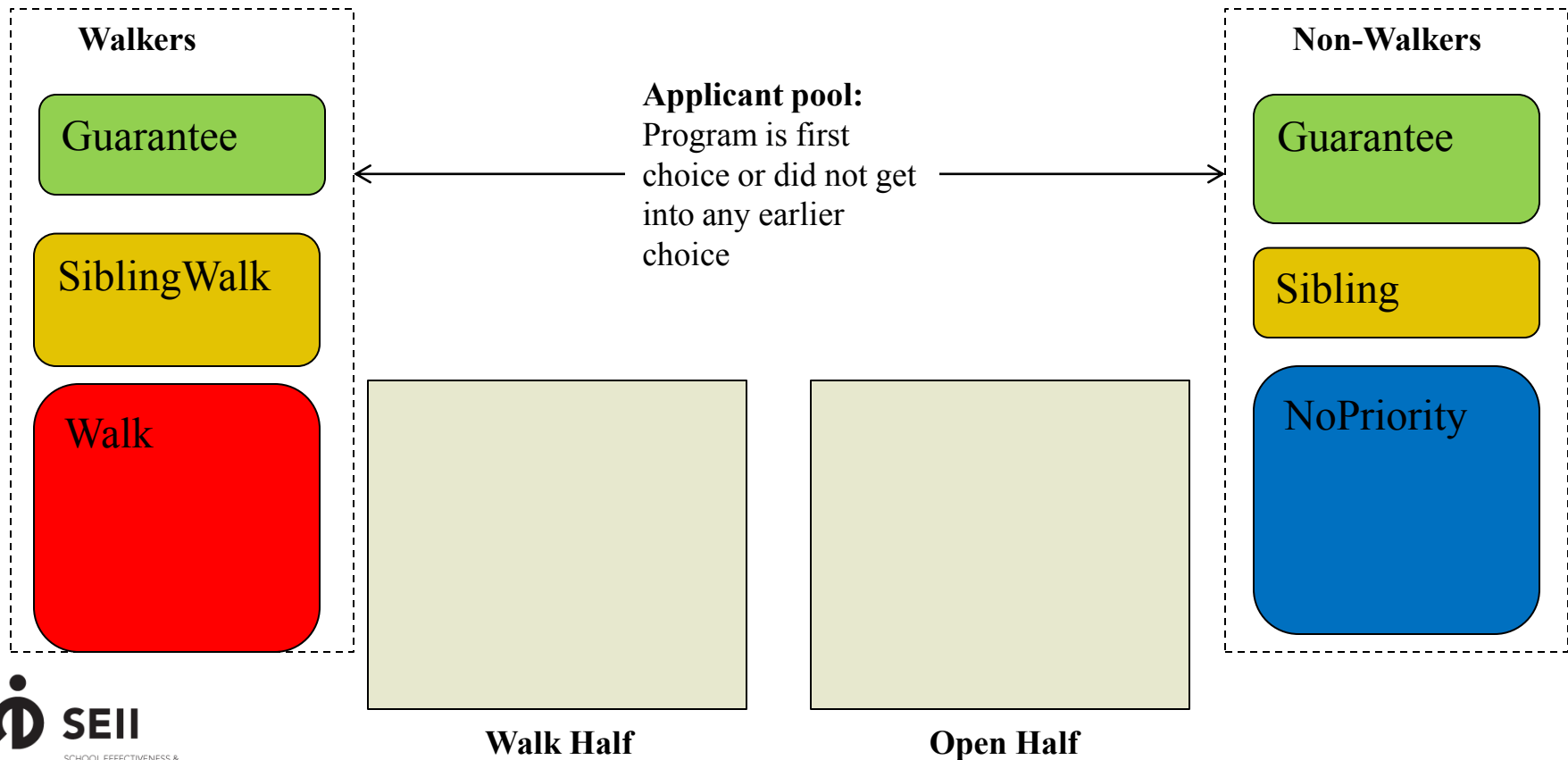
How the Assignment Algorithm Works: More details

- Every program at a school is split into a walk-zone half and a non-walk-zone half



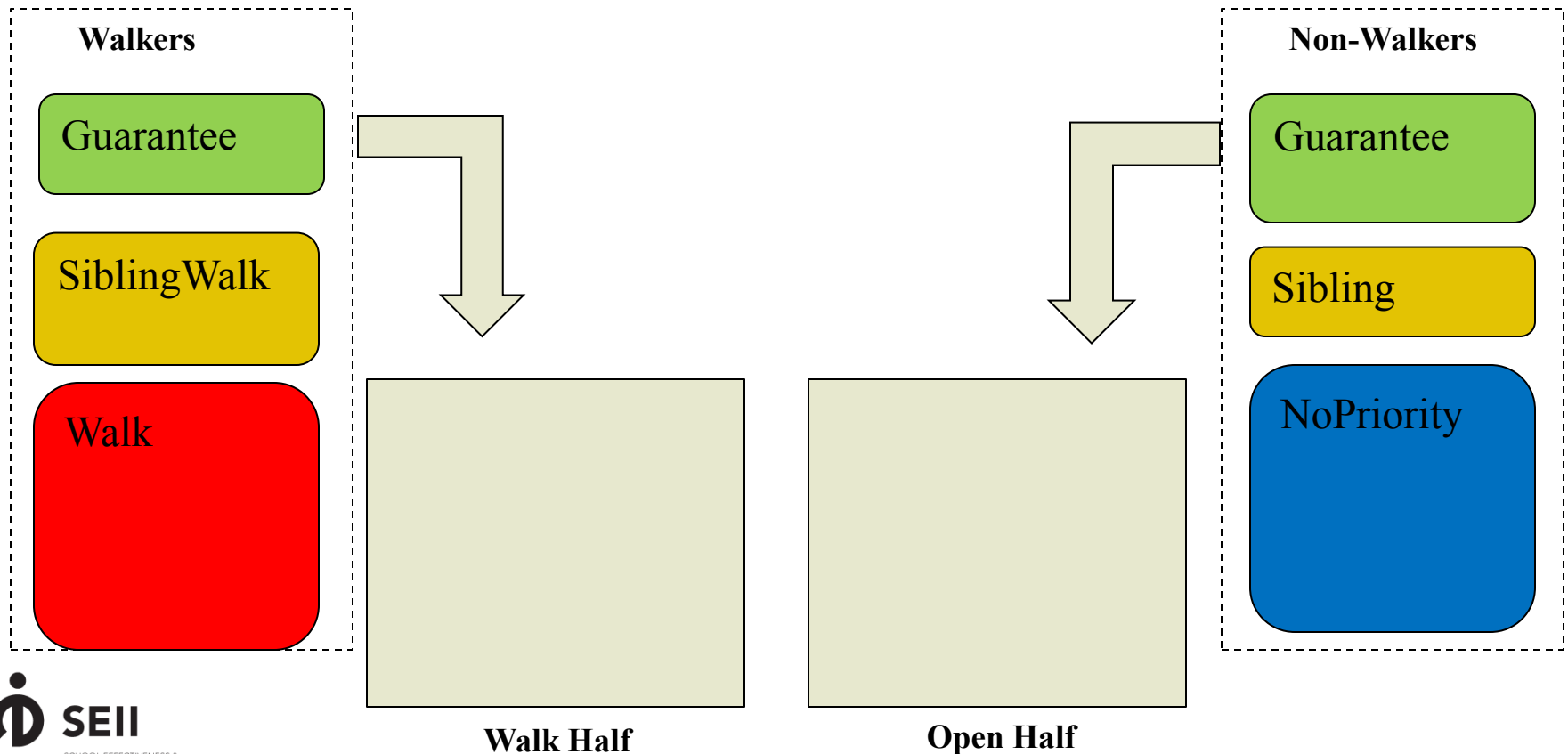
How the Assignment Algorithm Works: More details

- Applicants apply to their most-preferred program (that have not yet rejected them)



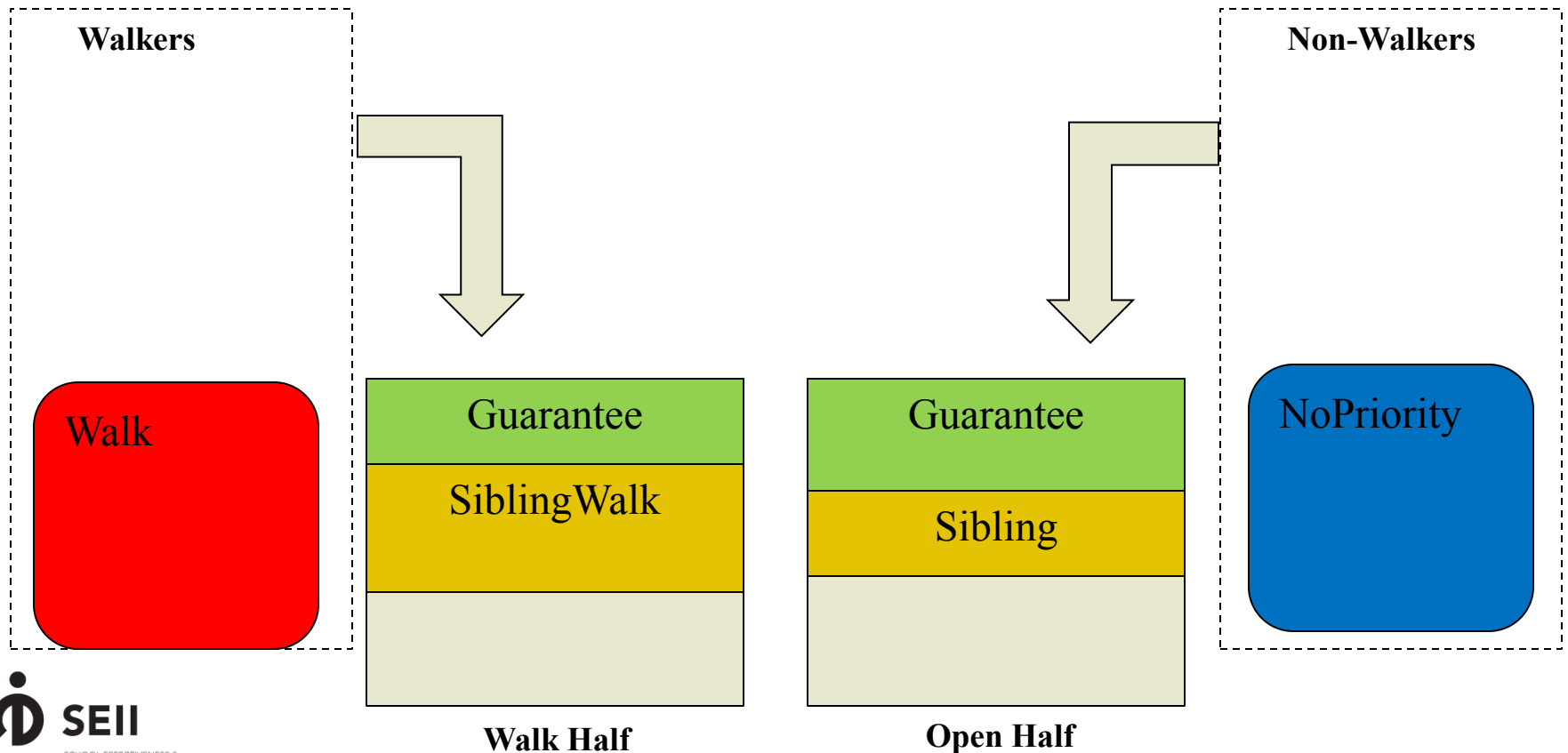
How the Assignment Algorithm Works: More details

- Walk applicants first apply to walk half; non-walk applicants first apply to non-walk half



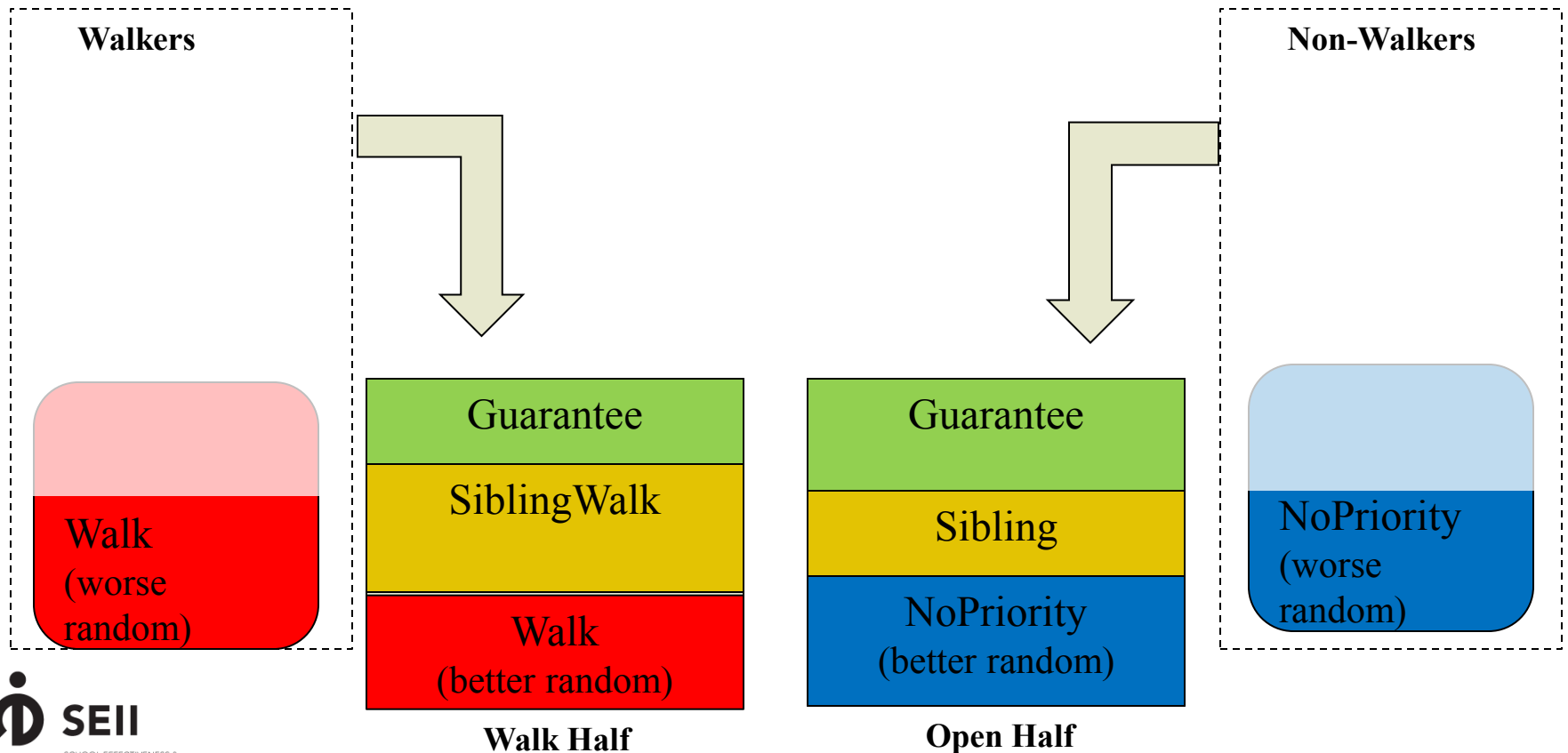
How the Assignment Algorithm Works: More details

- The highest priority applicants (Guarantee/ SiblingWalk / Sibling) get in first.



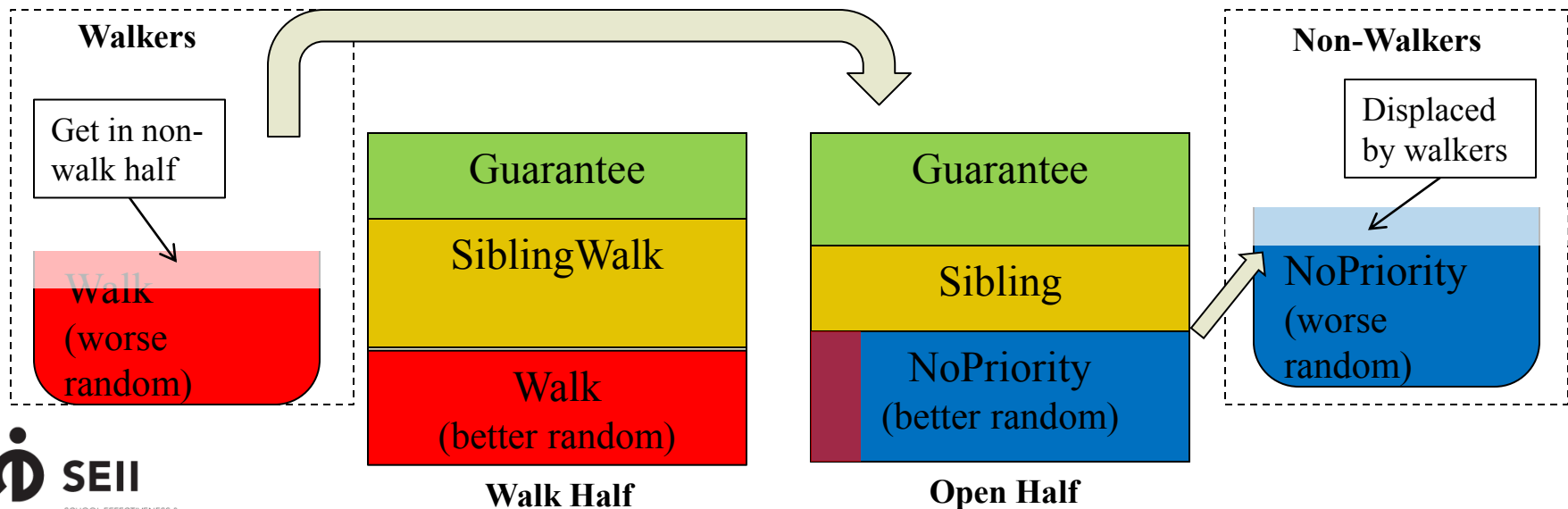
How the Assignment Algorithm Works: More details

- For the remaining space, the applicants with the best random numbers get in.



How the Assignment Algorithm Works: More details

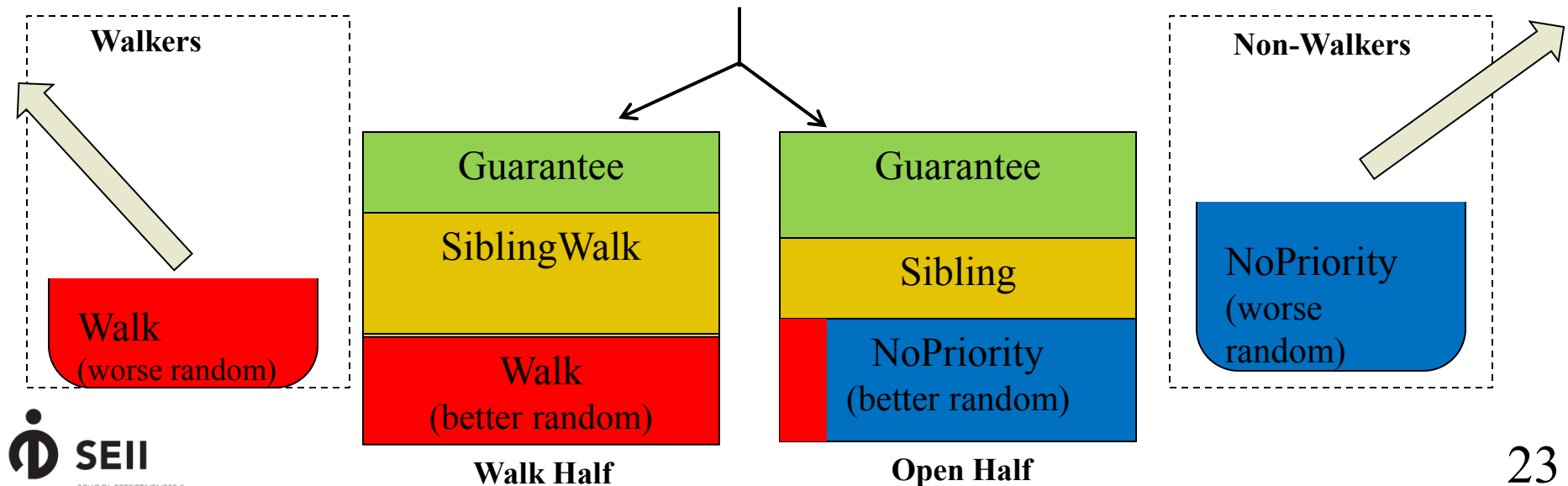
- The remaining applicants try to apply to the other half of the school; according to the other half's priority.
 - Walk (non-siblings) kids can get into non-walk half if they have better random number than some NoPriority kids tentatively assigned.
 - Non-walk (non-siblings) can get into walk half only if there is empty space there.



How the Assignment Algorithm Works: More details

- The remaining applicants try to apply to their next choice.

Tentative assignment:



Understanding 50/50: Grade K2

2009-2012 K2 (Round 1)

