Automated Self-Optimization in Heterogeneous Wireless Communications Networks

David Lynch, Michael Fenton, David Fagan, Stepan Kucera,
Holger Claussen, and Michael O'Neill

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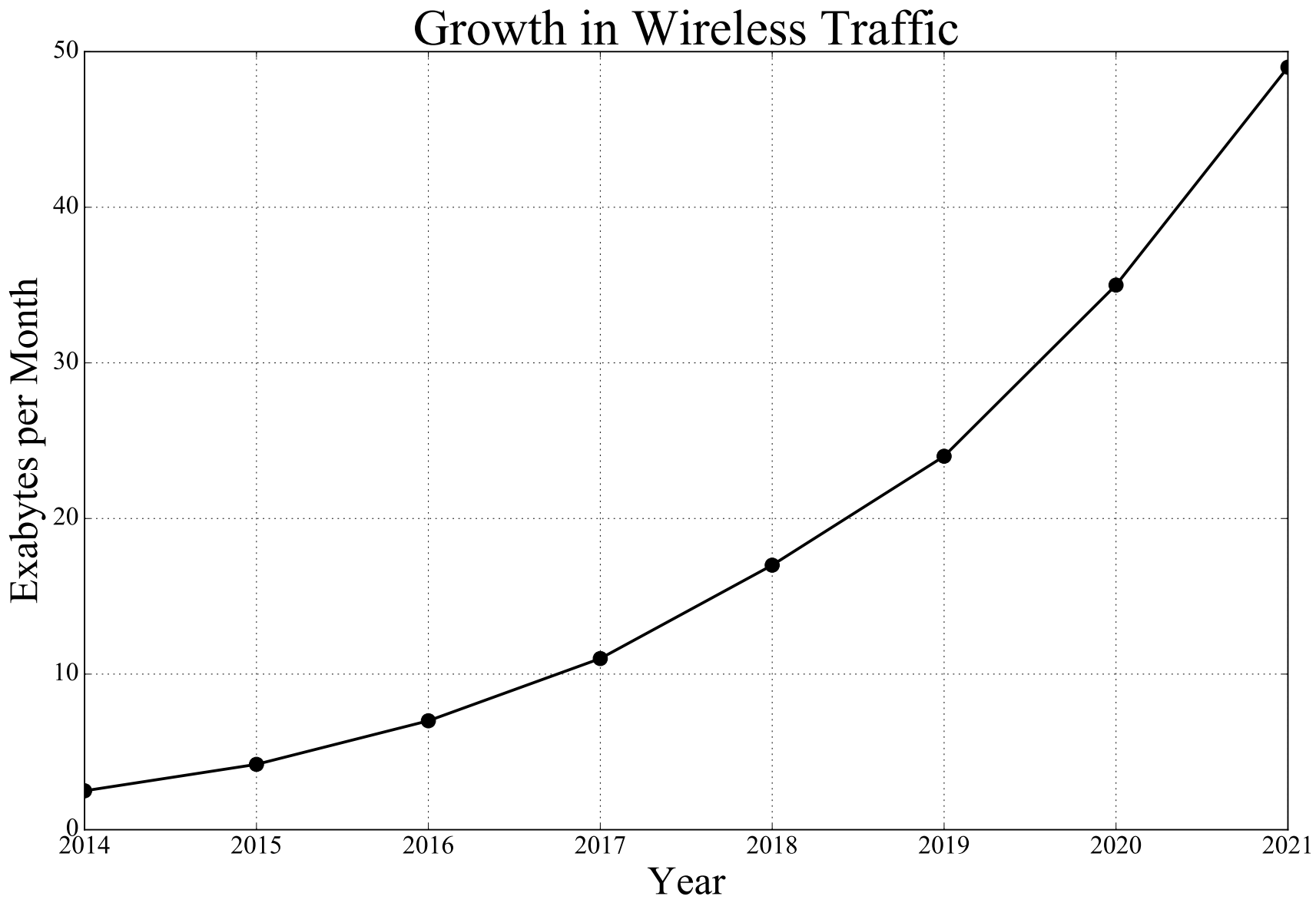

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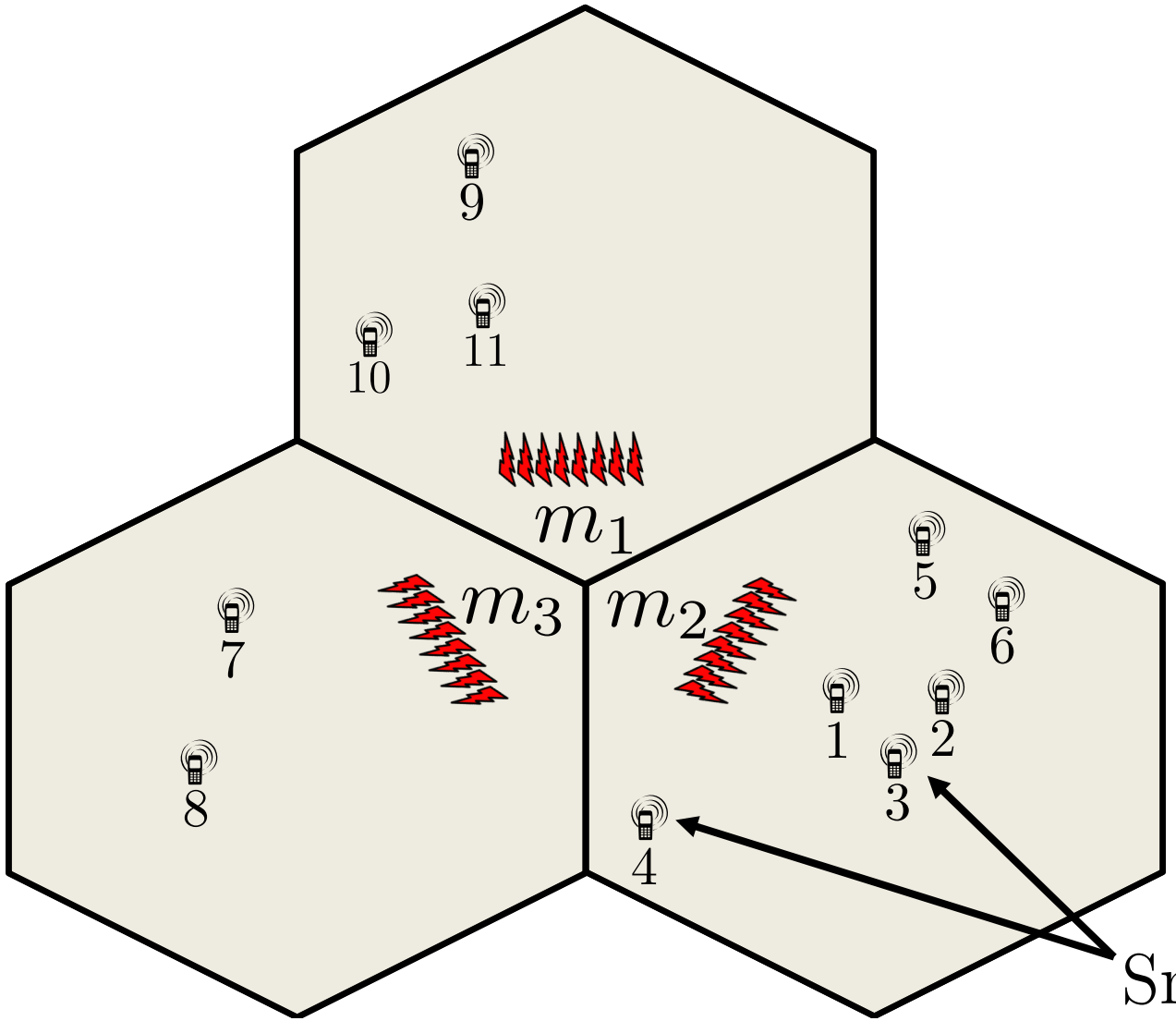

Macro Cell

Smartphones, Tablets
Laptops

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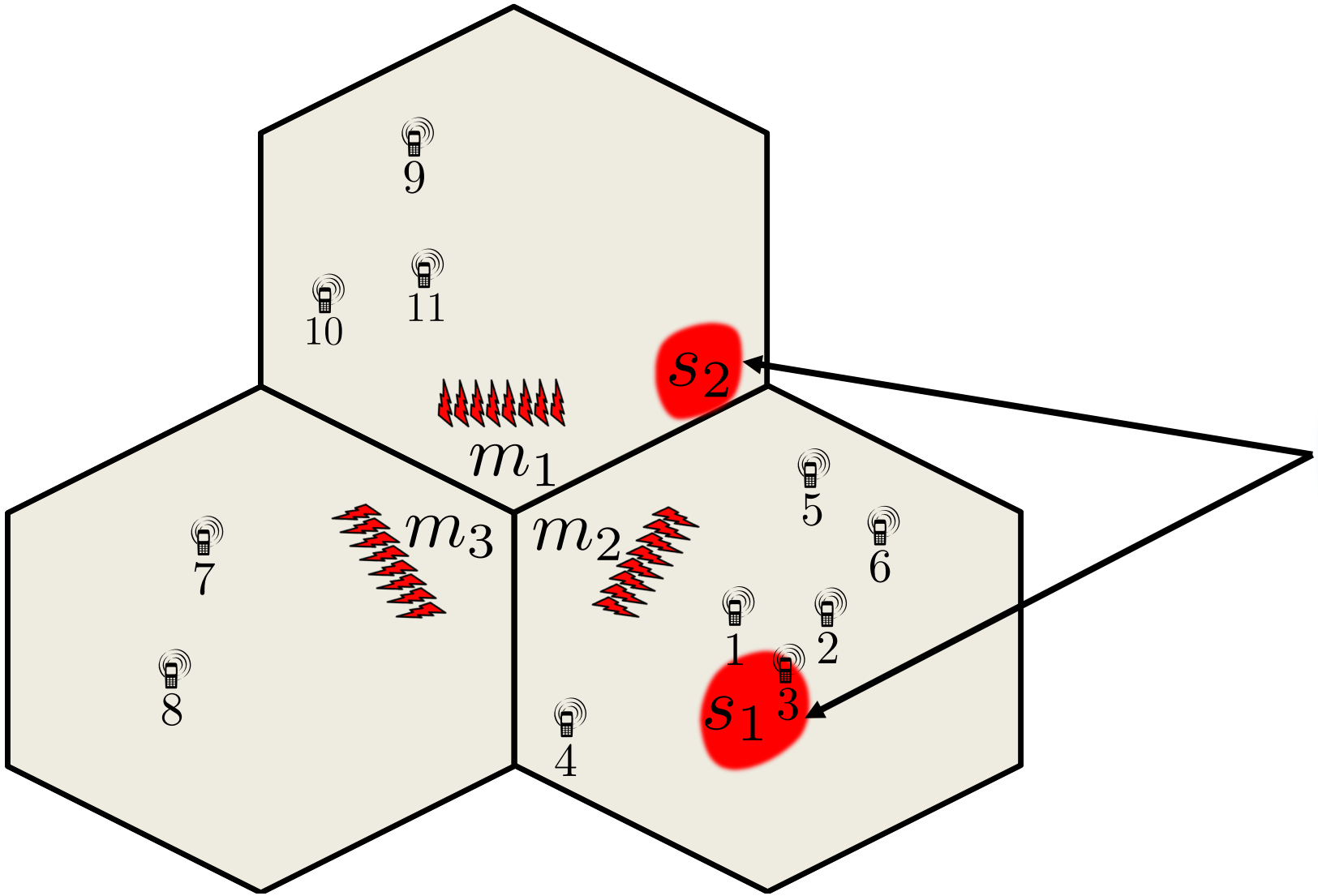

Small Cell

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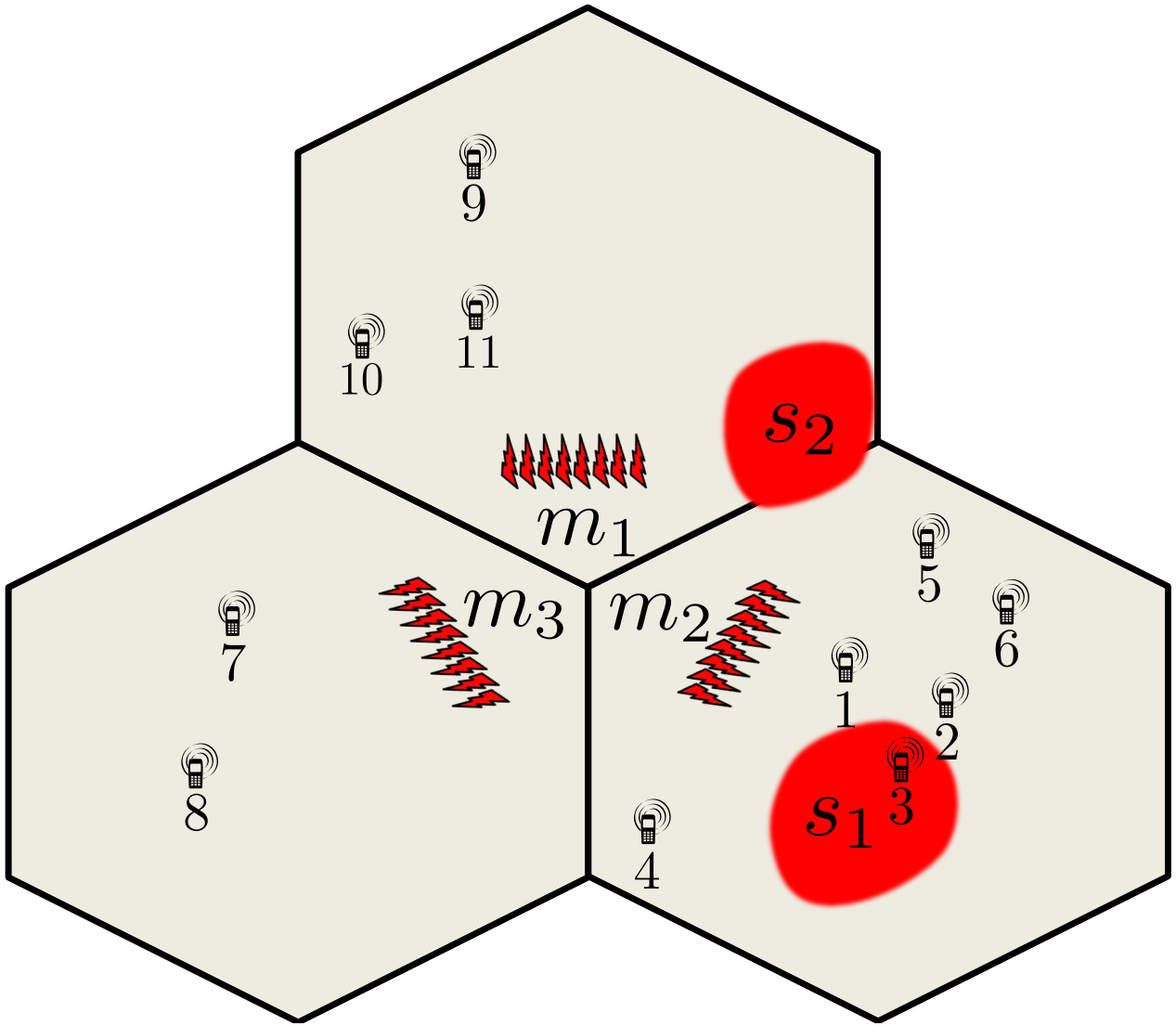

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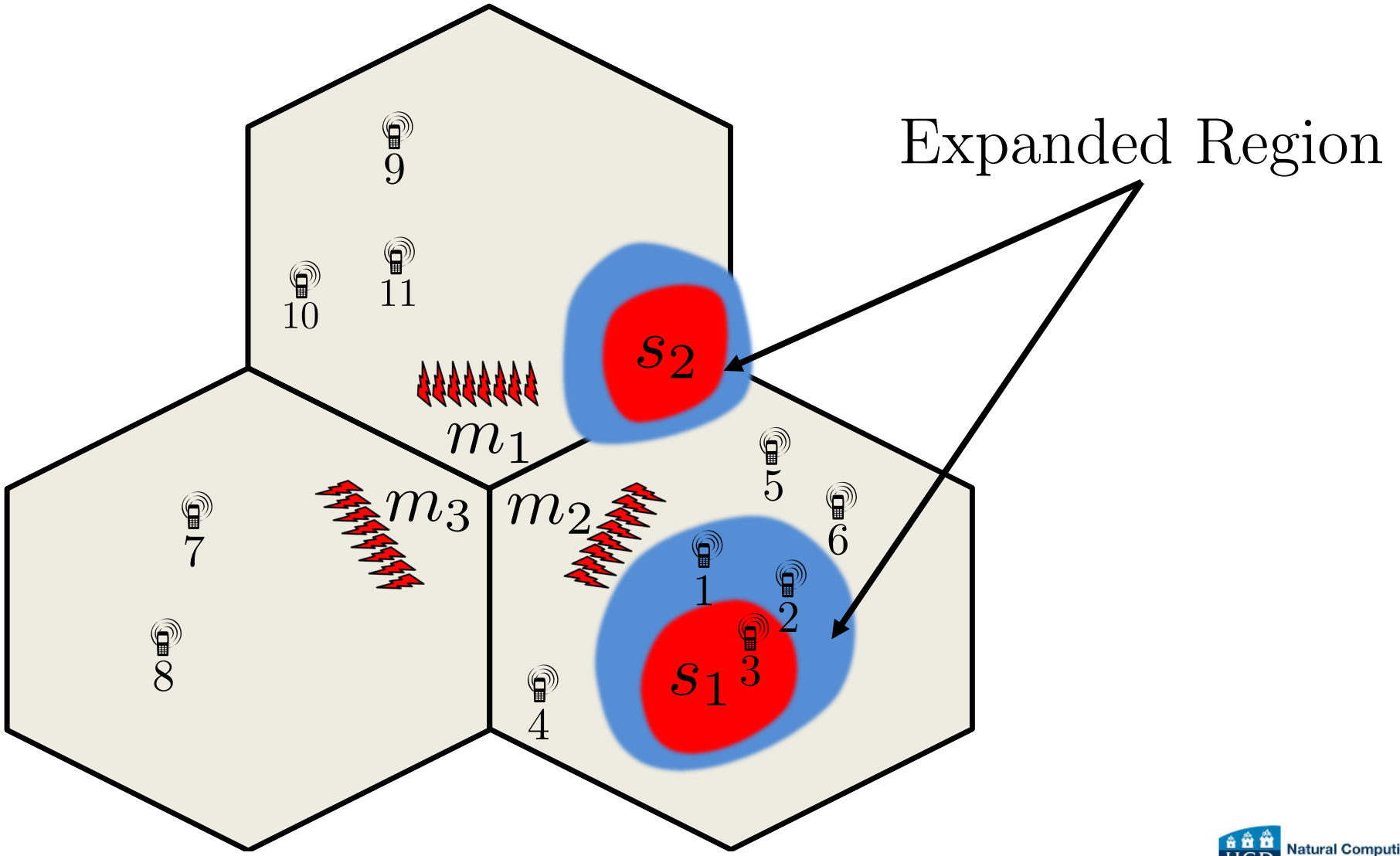

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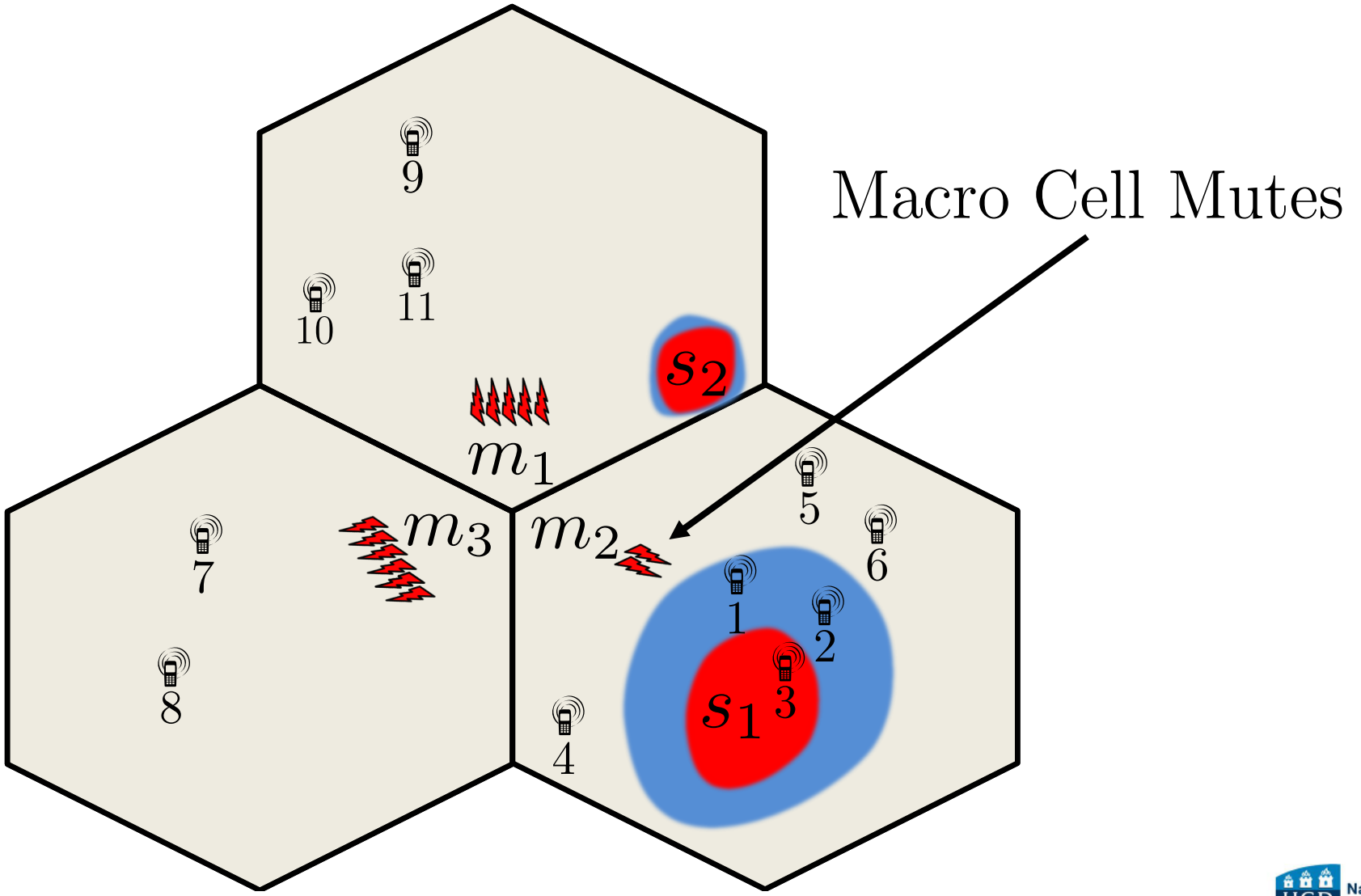

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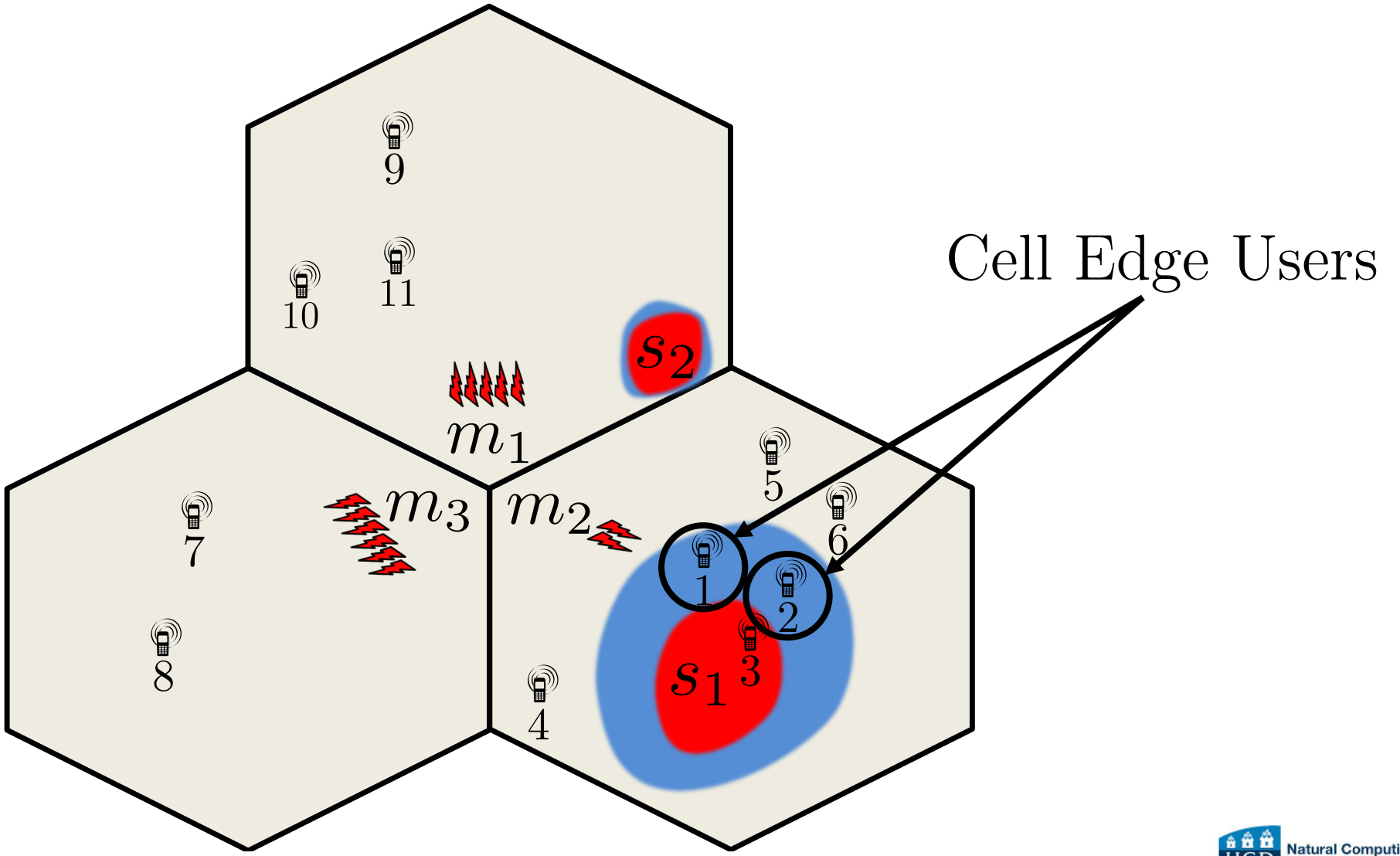

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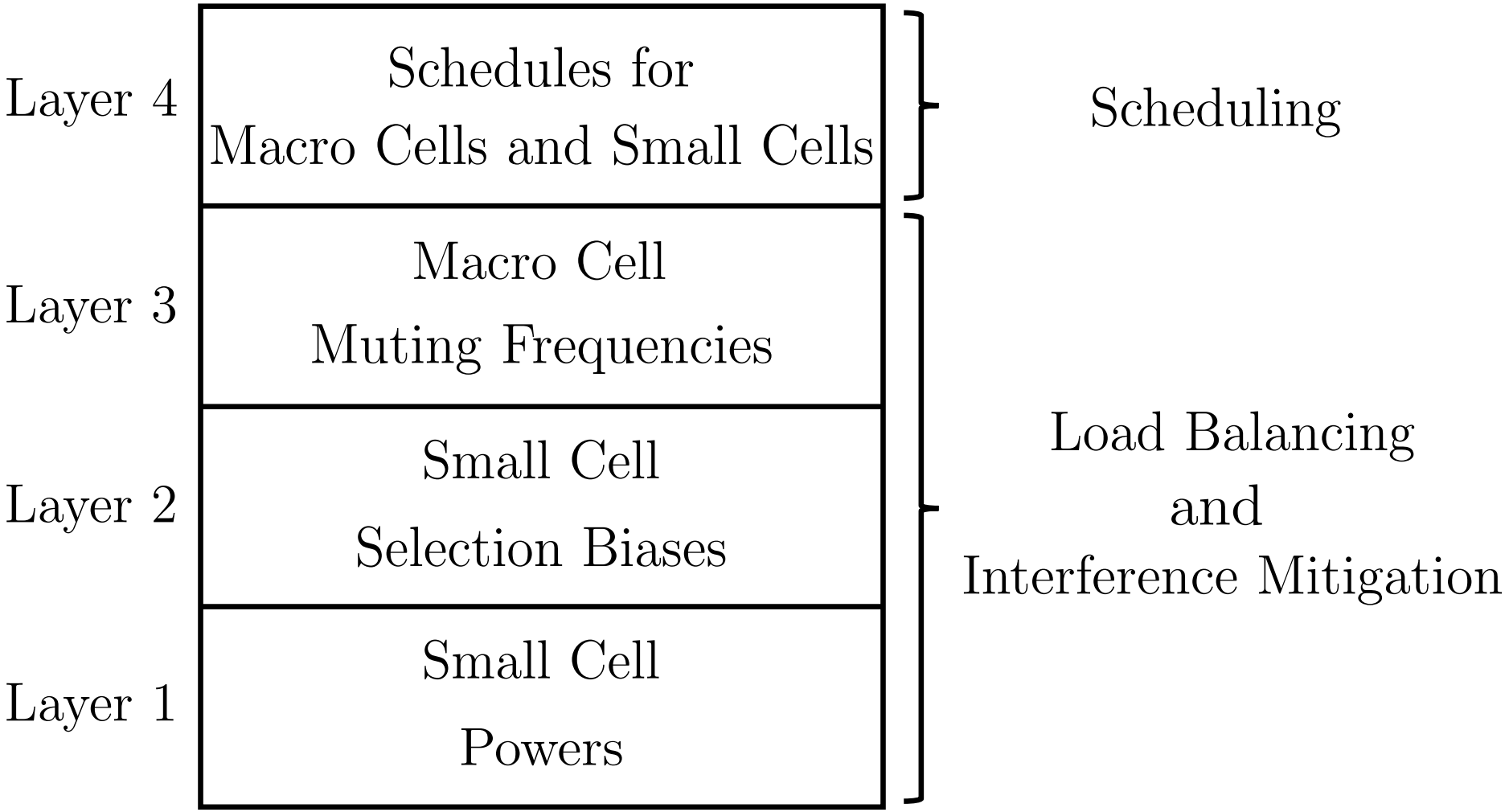
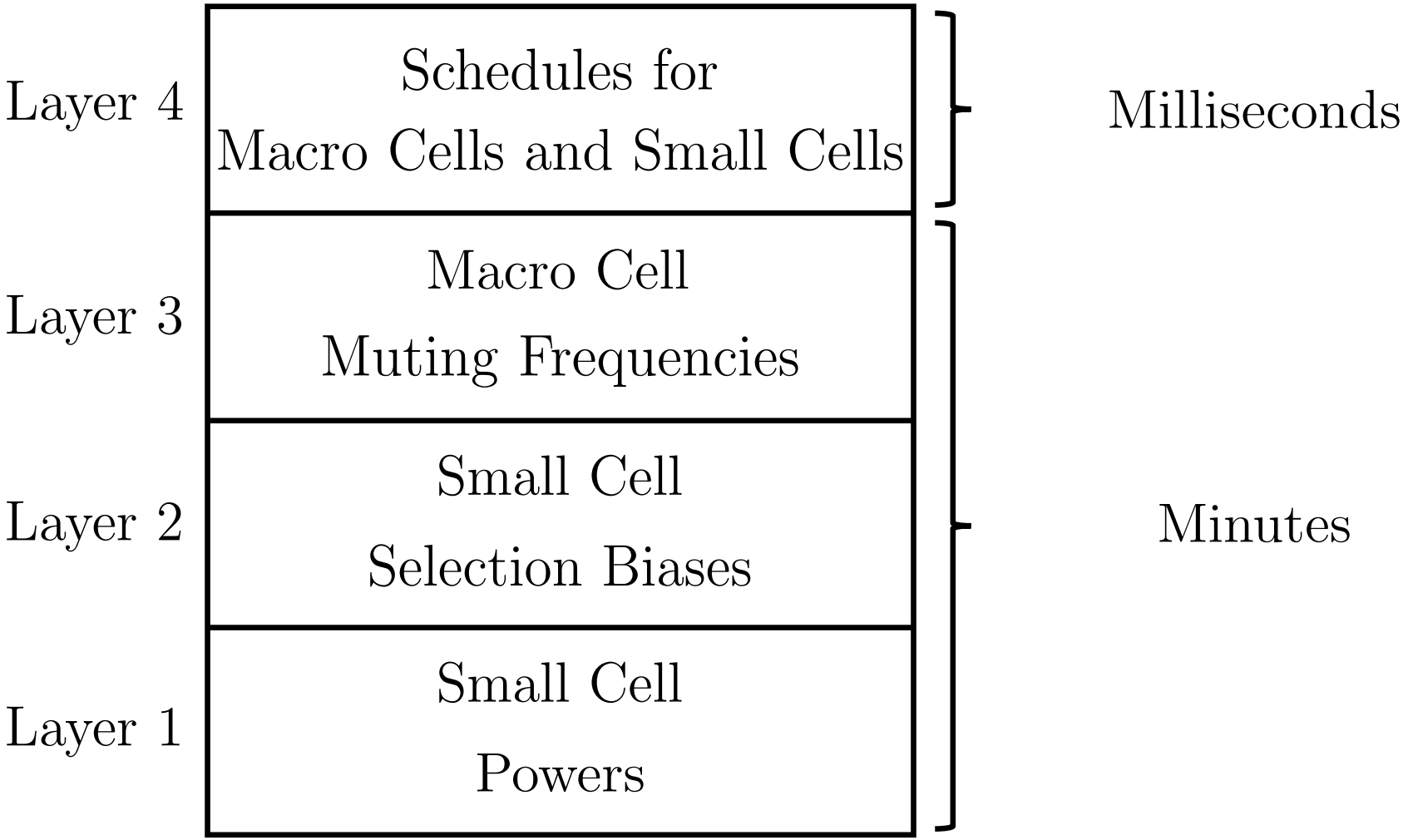

Layer 4
Schedules for
Macro Cells and Small Cells
Layer 3
Macro Cell
Muting Frequencies
Layer 2
Small Cell
Selection Biases
Layer 1
Small Cell
Powers
Scheduling
Load Balancing
and
Interference Mitigation


Layer 4
Schedules for
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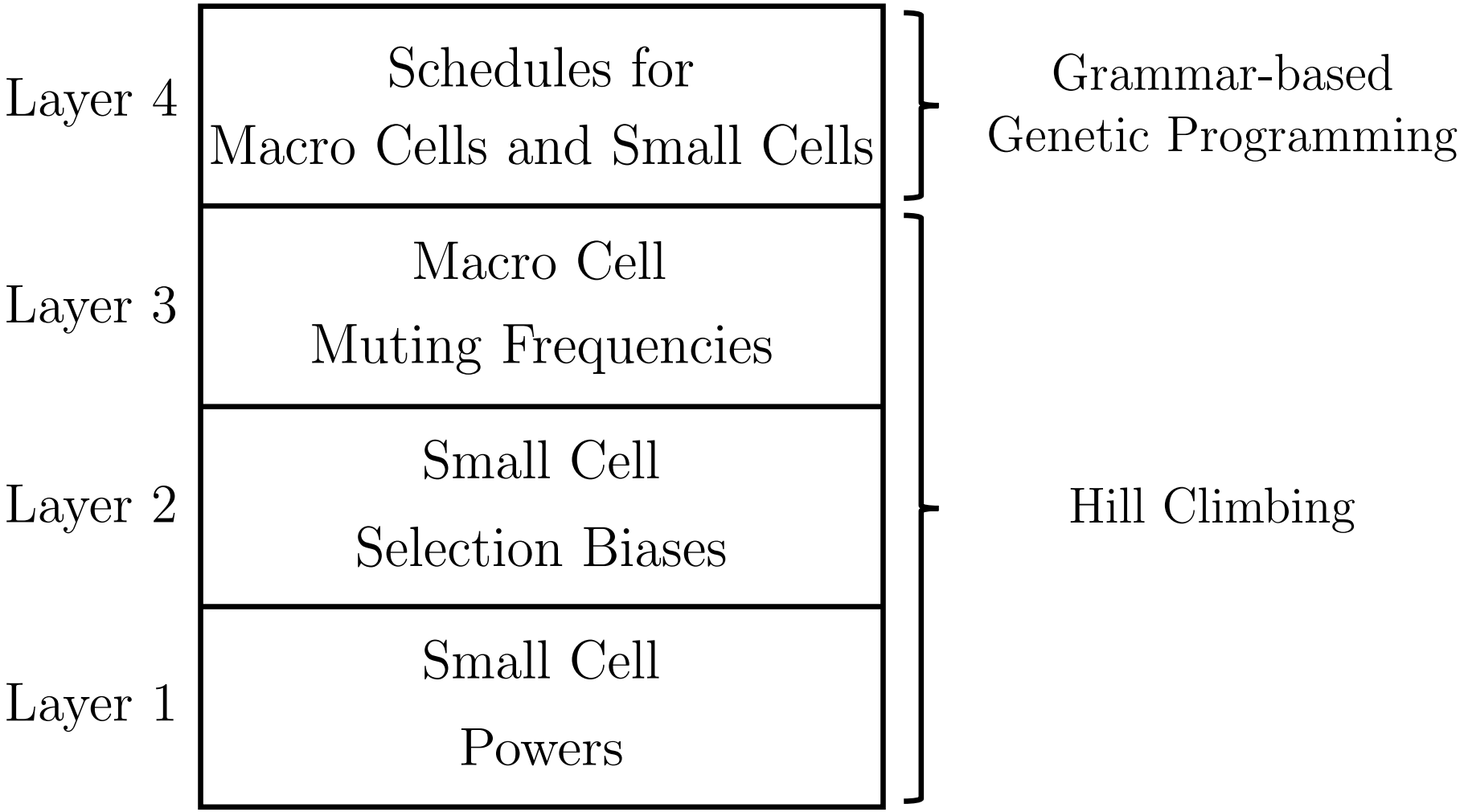
Macro Cell
Muting Frequencies
Layer 2
Small Cell
Selection Biases
Layer 1
Small Cell
Powers
Milliseconds
Minutes



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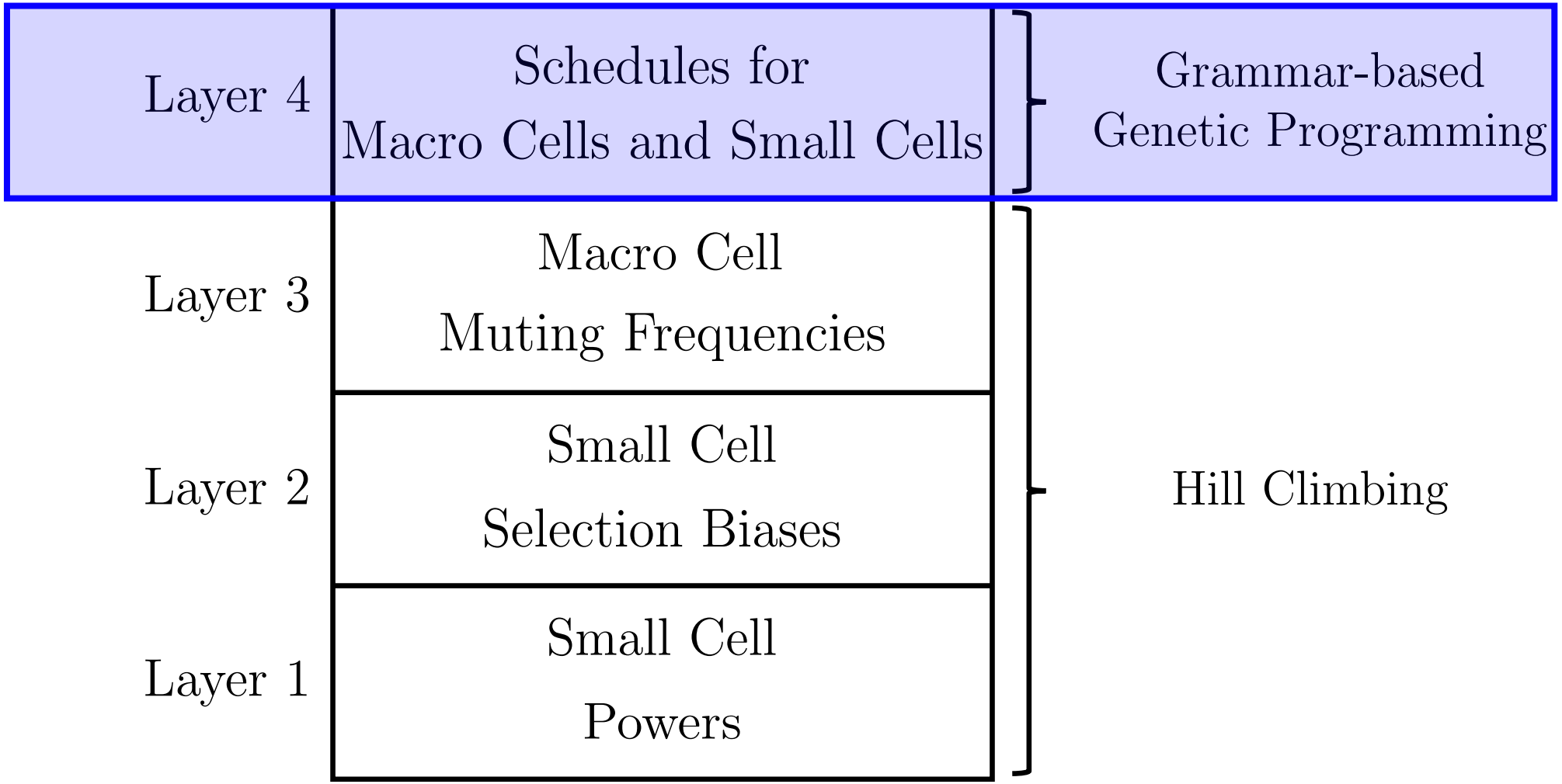
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Small Cell
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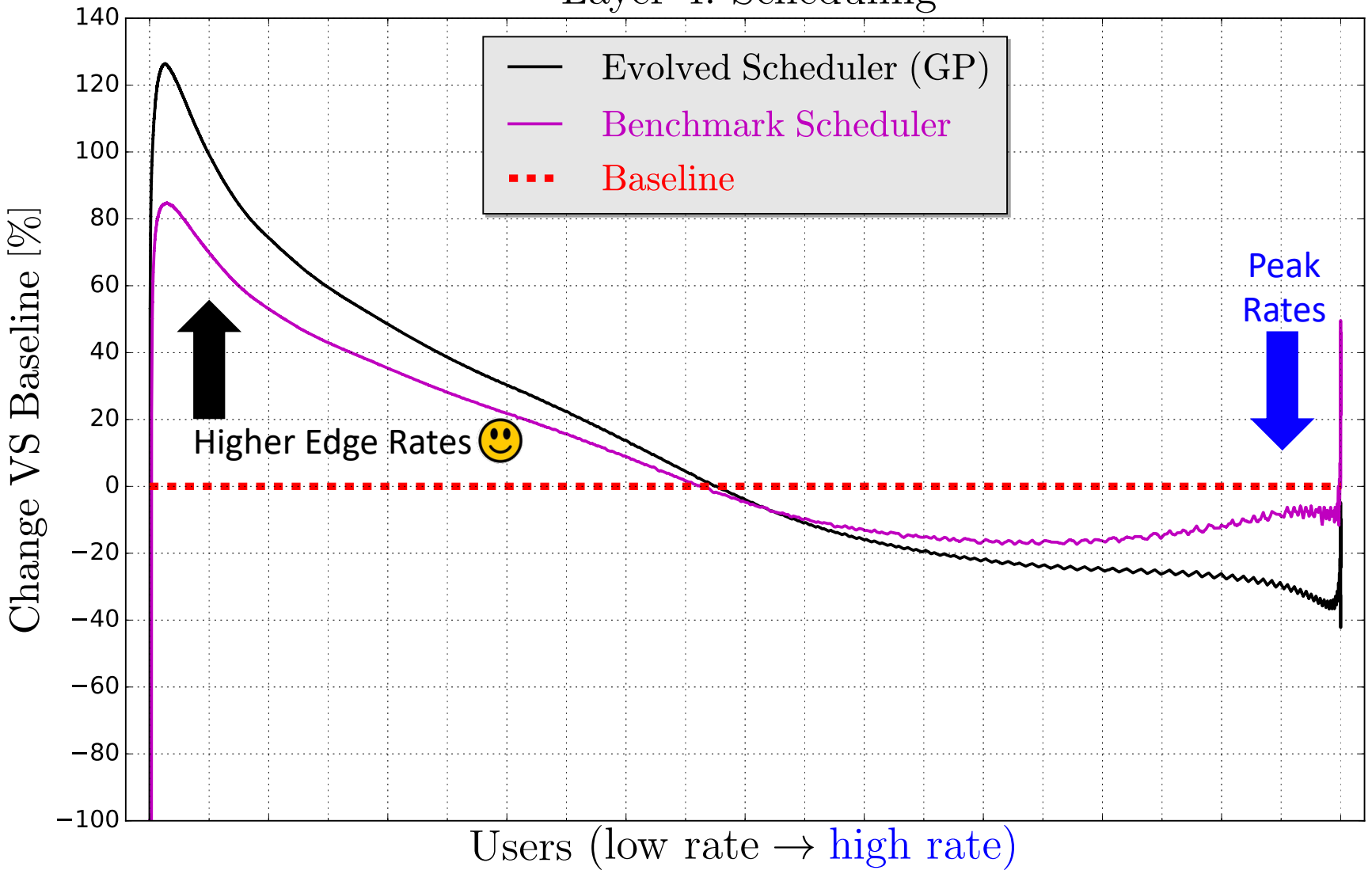
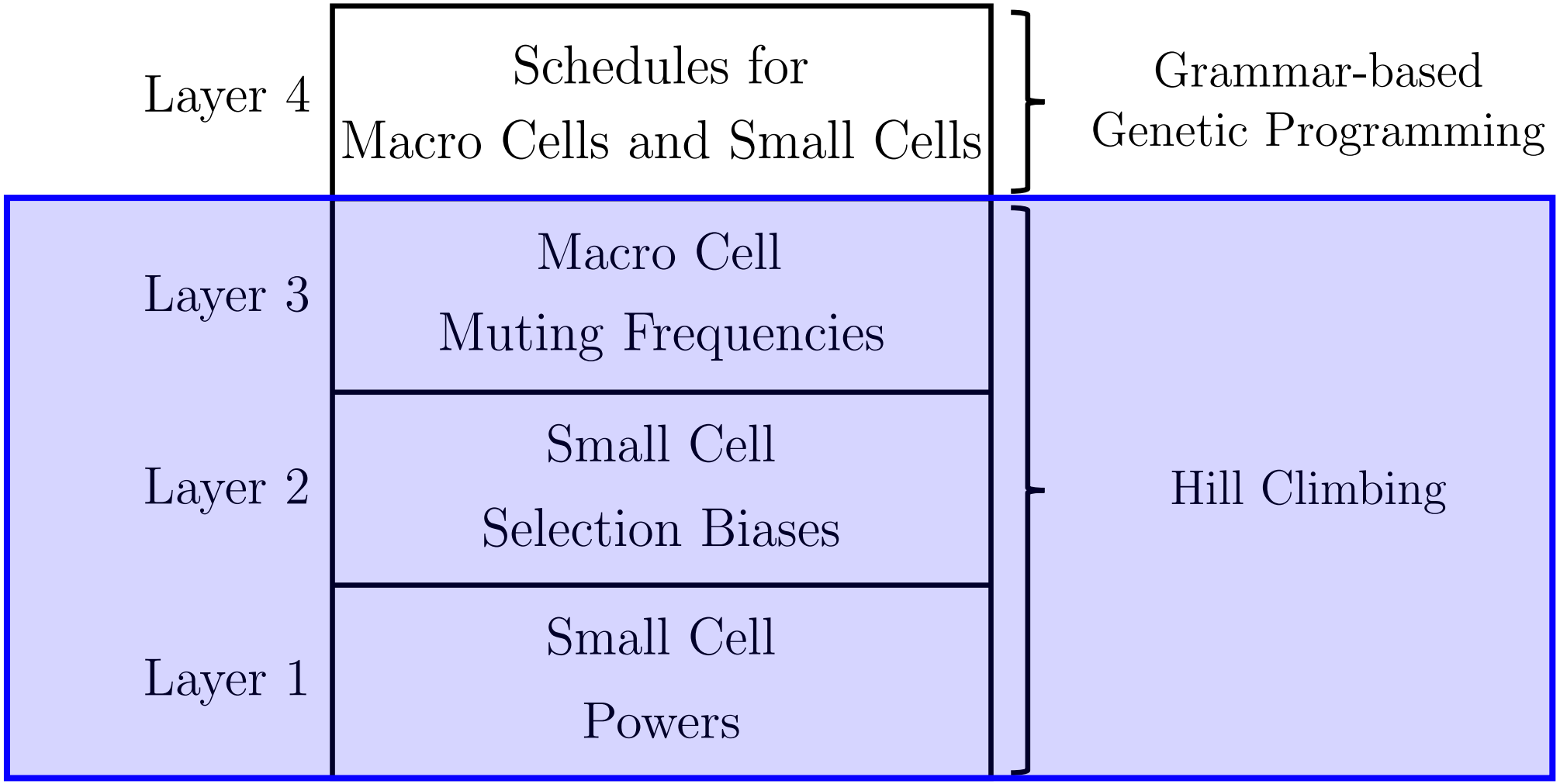
Layer 1
Small Cell
Powers
Hill Climbing

Layer 4: Scheduling



López-Pérez, David, and Holger Claussen. "Duty cycles and load balancing in HetNets with eICIC almost blank subframes." 2013 IEEE 24th International Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC Workshops). IEEE, 2013.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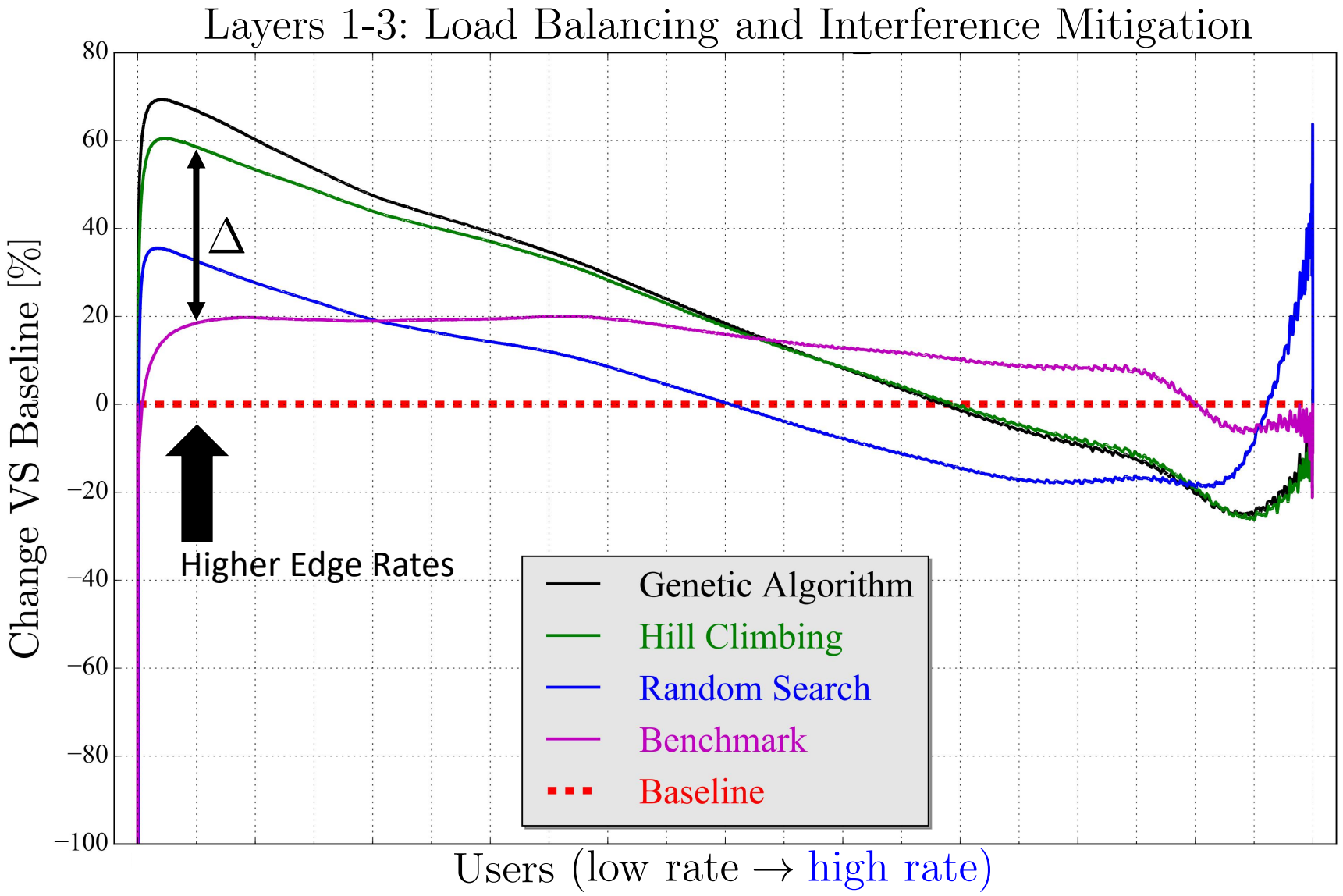

Tall, Abdoulaye, Zwi Altman, and Eitan Altman. "Self organizing strategies for enhanced ICIC (eICIC)." 2014 12th International Symposium on Modeling and Optimization in Mobile, Ad Hoc, and Wireless Networks (WiOpt). IEEE, 2014.

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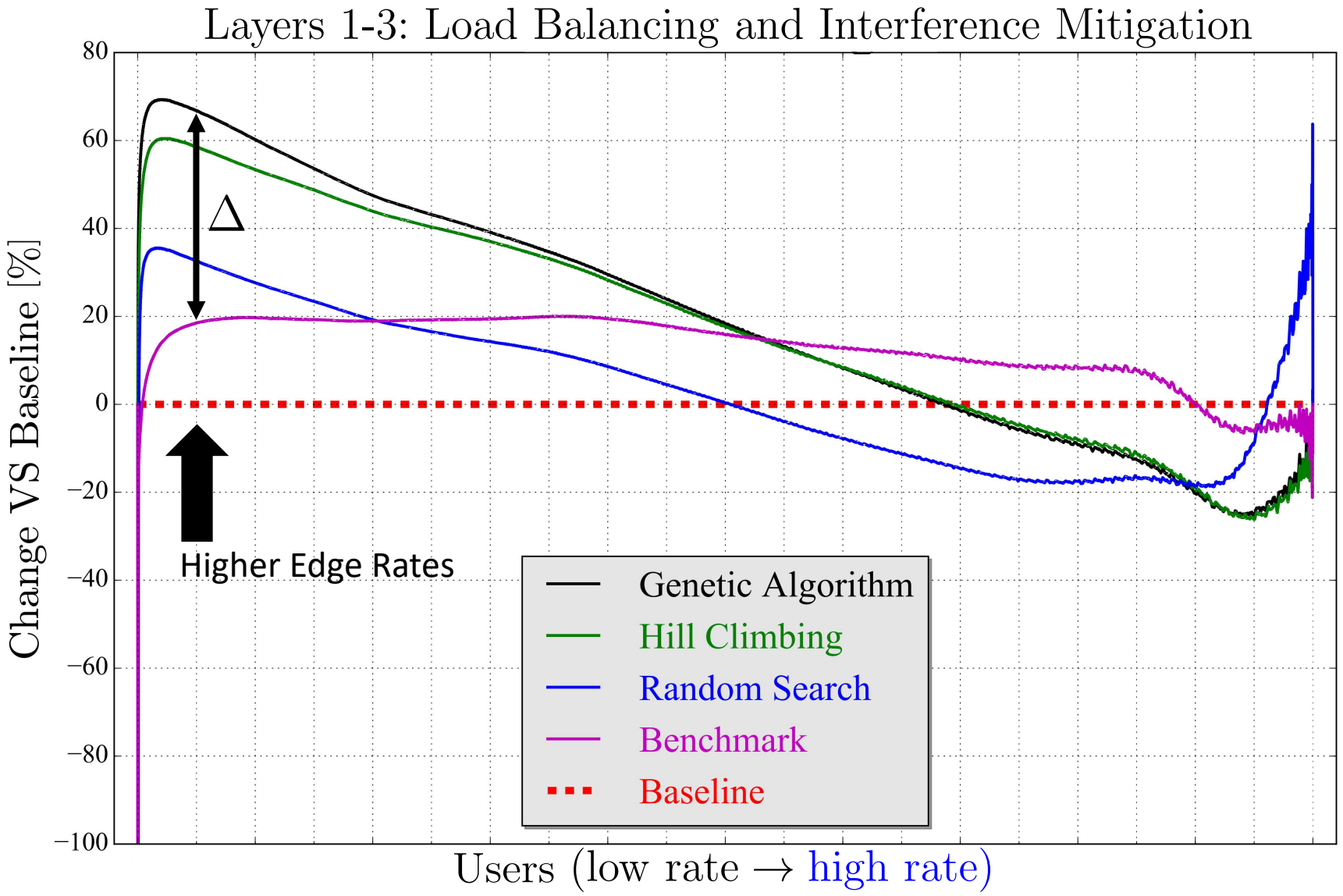

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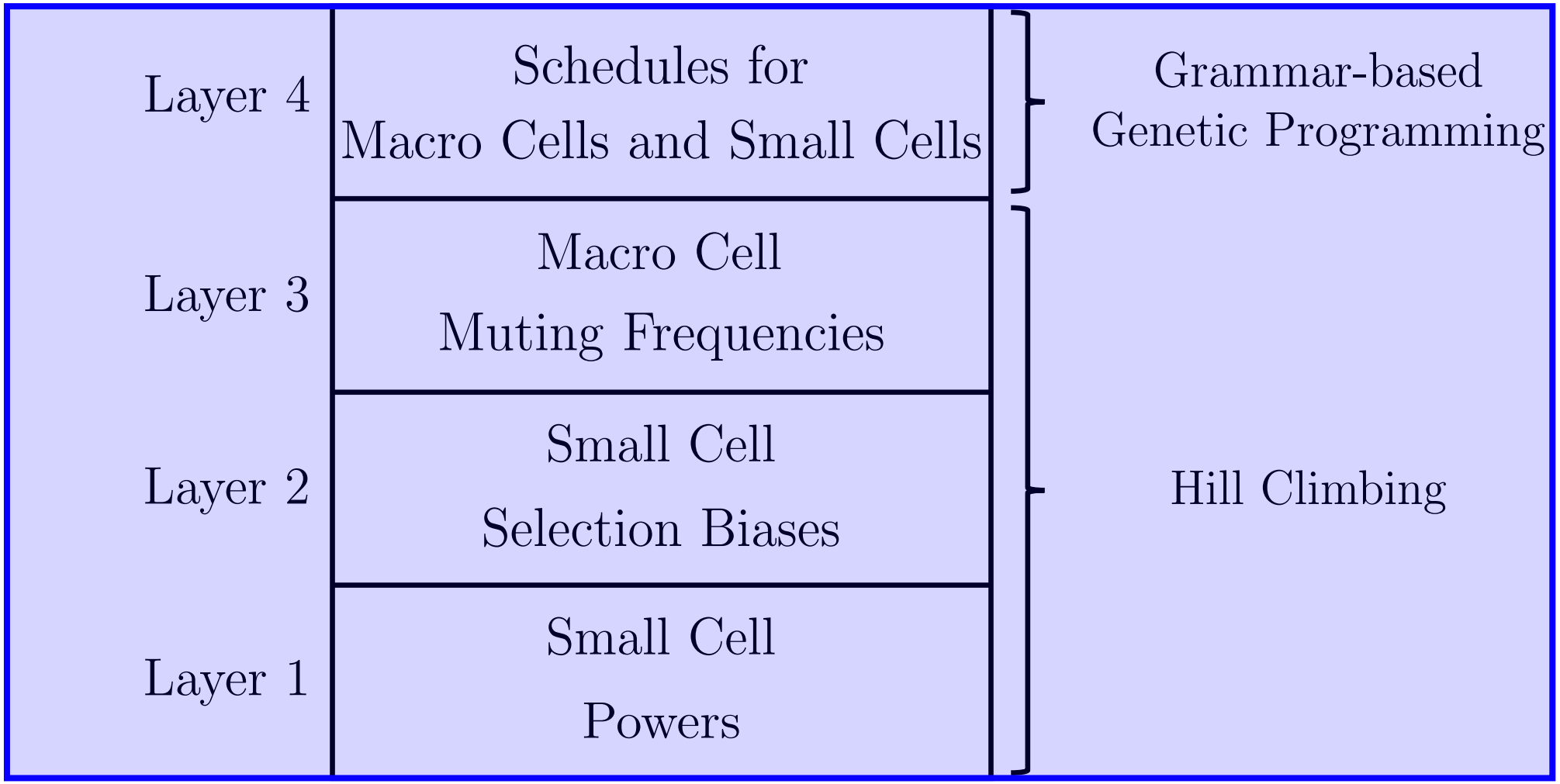
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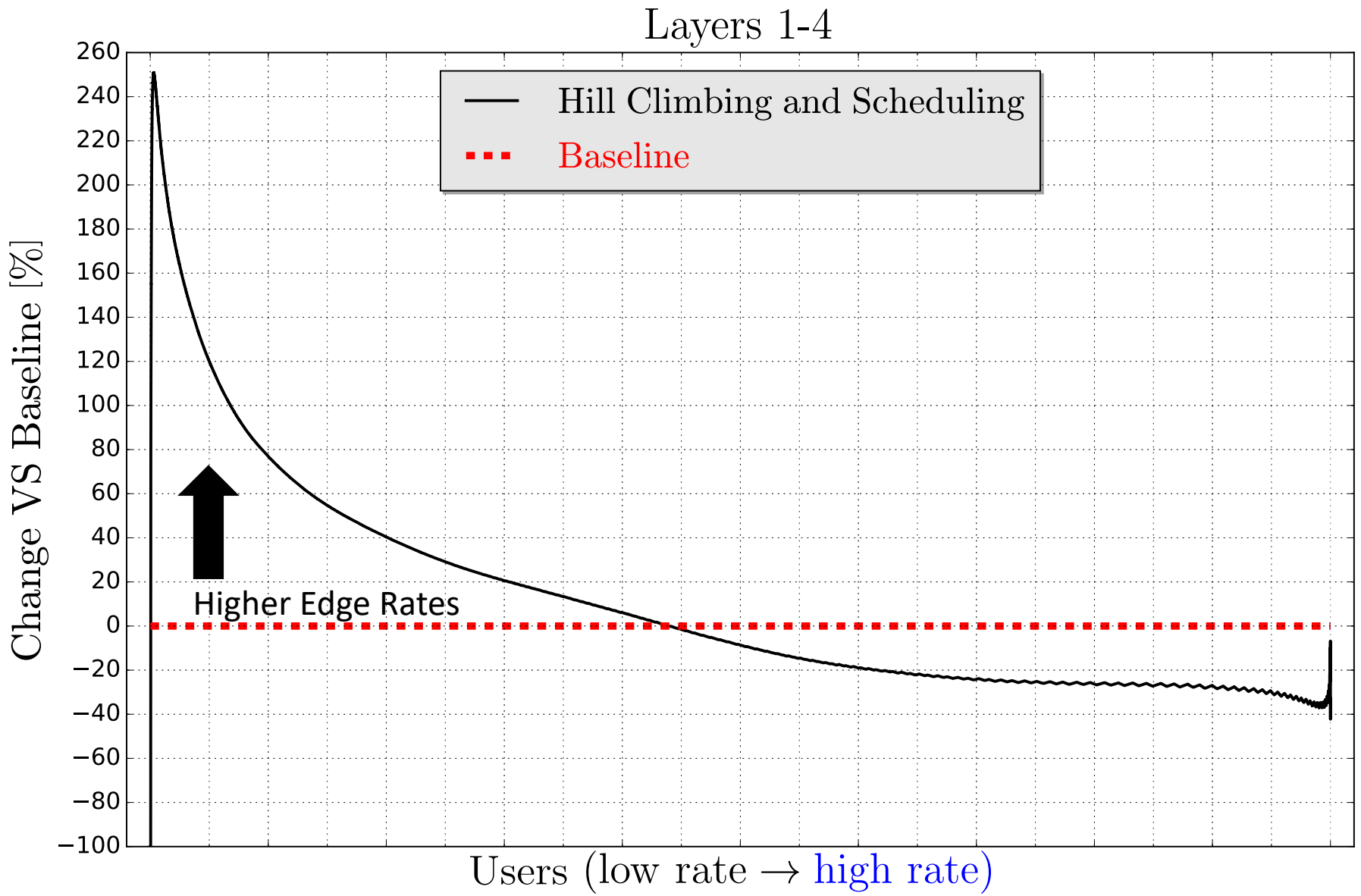

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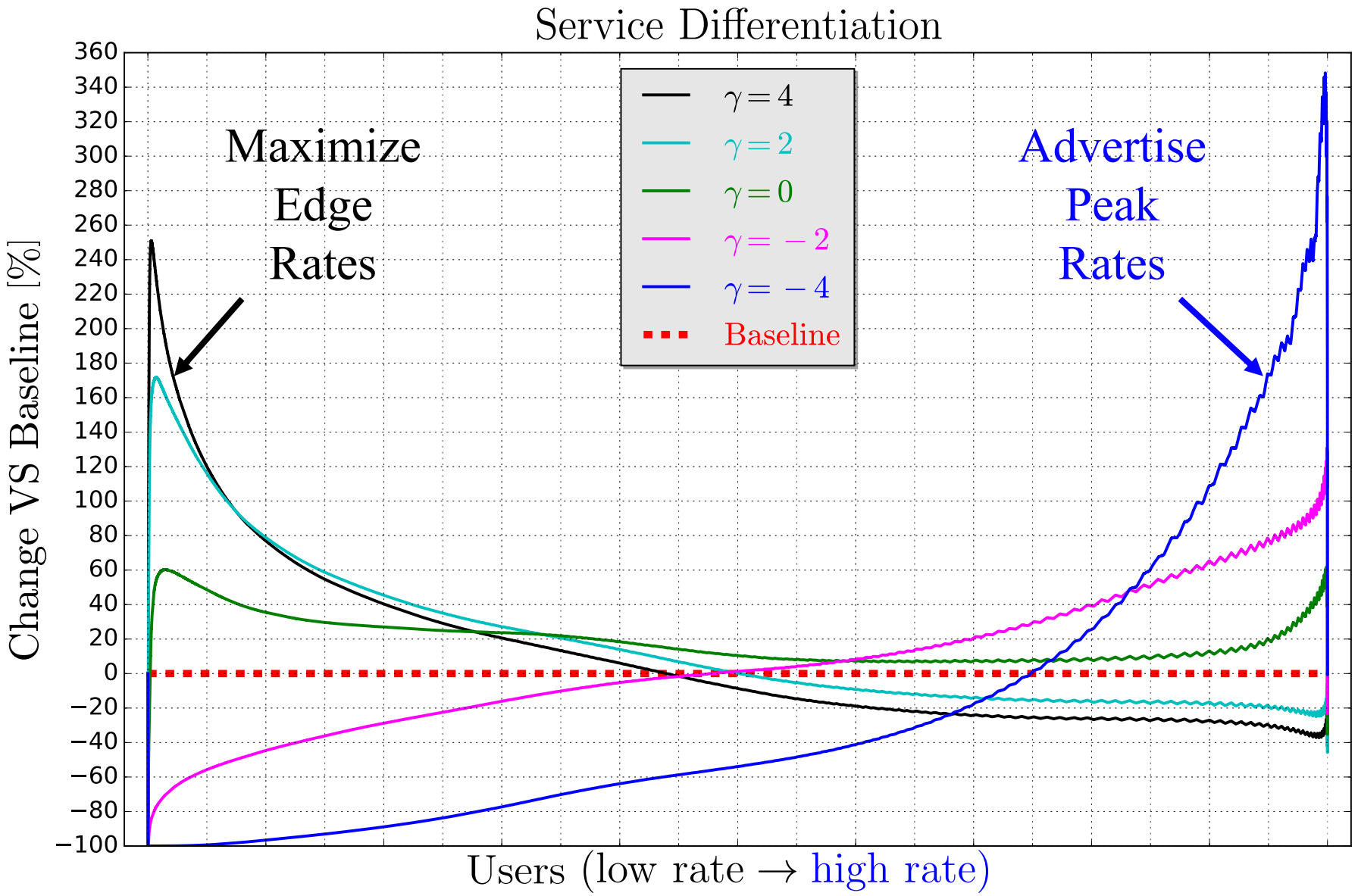

Deb, Supratim, et al. "Algorithms for enhanced inter-cell interference coordination (eICIC) in LTE HetNets." IEEE/ACM Transactions on Networking (ToN) 22.1 (2014).

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Evolving Tailored Algorithms

New York

Prague

Swiss Alps

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Why the best HUMIES entrant?

1. The result is better than human competitive. ✓

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- A patent application has been filed.

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Why the best HUMIES entrant?

1. The result is better than human competitive. ✓
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3. Is the result better than the most recent human-created solution to a long-standing problem?

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1G

2G

3G

4G

5G…

Increasing need for automation

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Why the best HUMIES entrant?

1. The result is better than human competitive (criterion B). ✓
2. The result is publishable in its own right (criterion D). ✓
3. The result is better than the most recent human-created solution to a long-standing problem (criterion E). ✓

Acknowledgements

This research is based upon works supported by the Science Foundation Ireland under grant 13/IA/1850.

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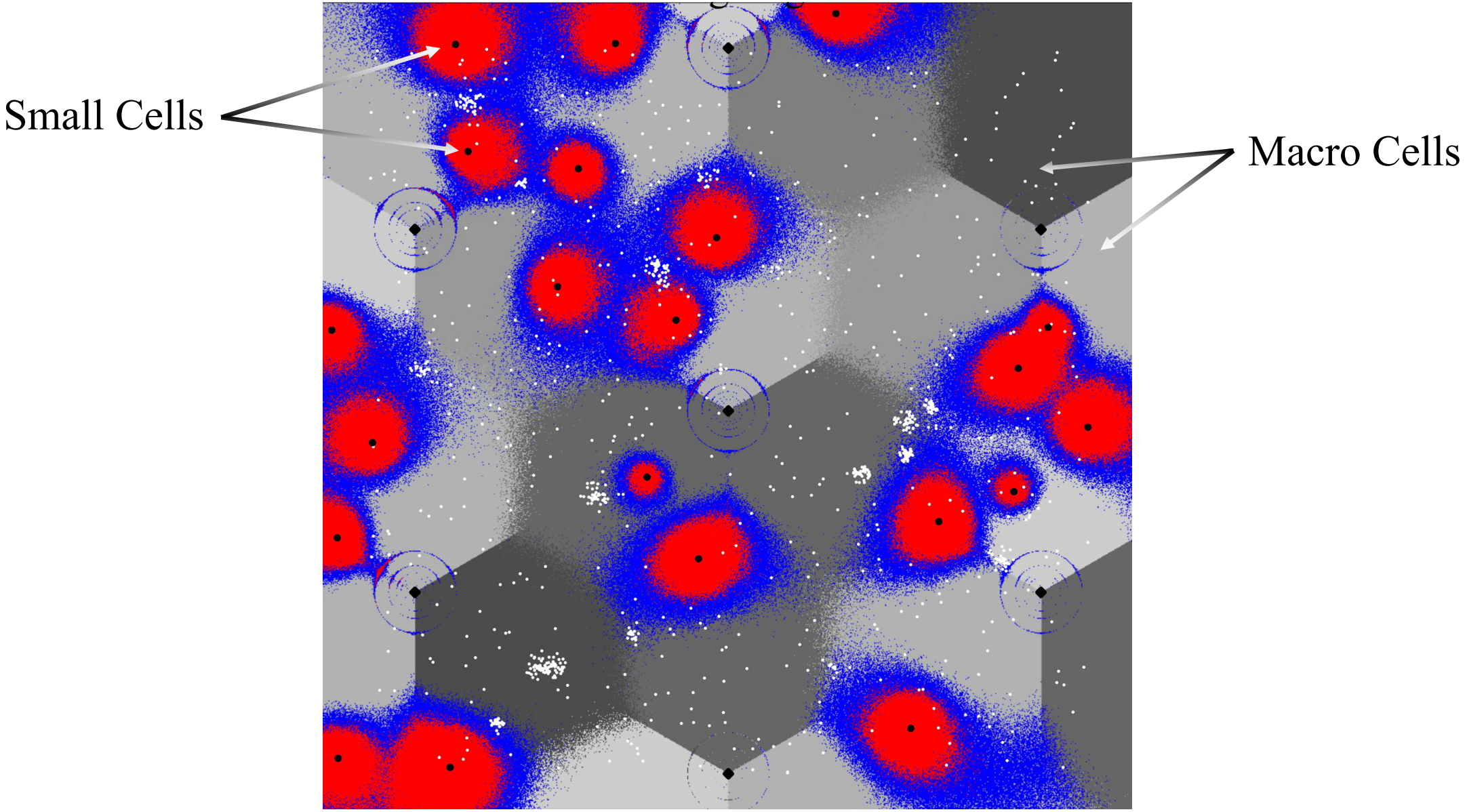
Why the best HUMIES entrant?

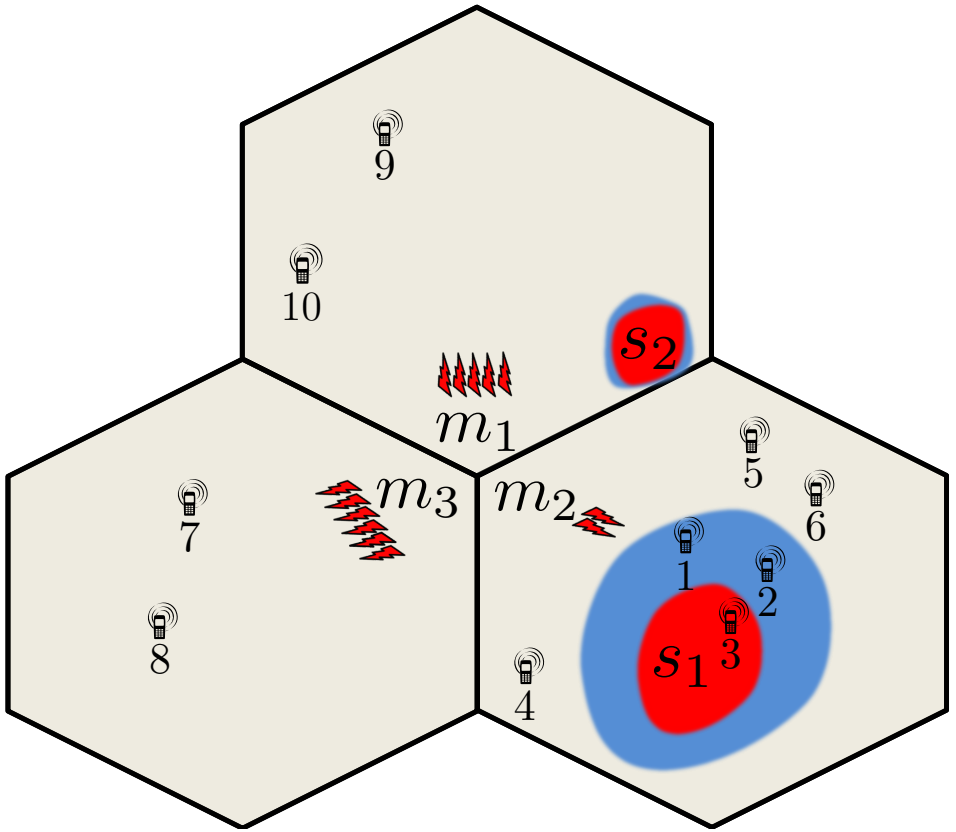
1. The result is better than human competitive (criterion B).
    - Proposed techniques outperform state-of-the-art benchmark algorithms.
    - More *automated*, *tailored*, and *flexible* than human-designed controllers.

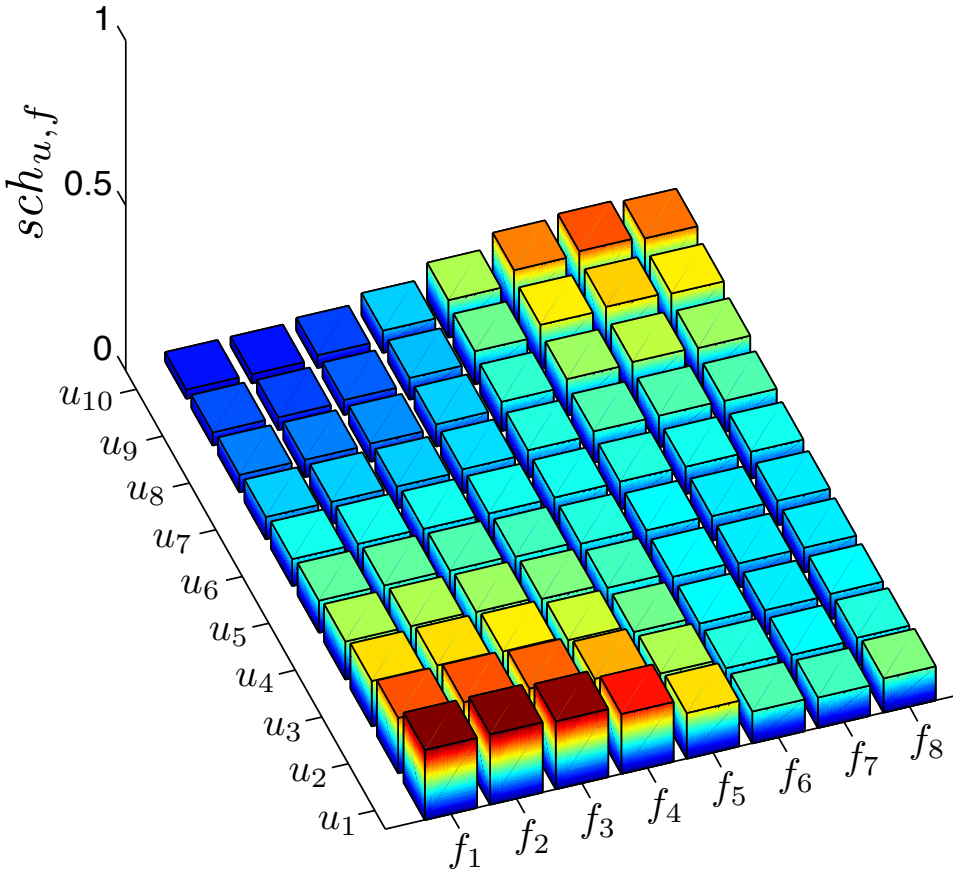
2. The result is publishable in its own right (criterion D).
    - Work published top wireless networking journal.
    - Publications in leading EC journals and conferences.
    - Patent application.

3. The result is better than the most recent human-created solution to a long-standing problem (criterion E).
    - Proof of concept for Evolutionary Algorithms in this domain.
    - Potential for major impact in multi-trillion dollar industry.

Adapting to Dynamic Traffic







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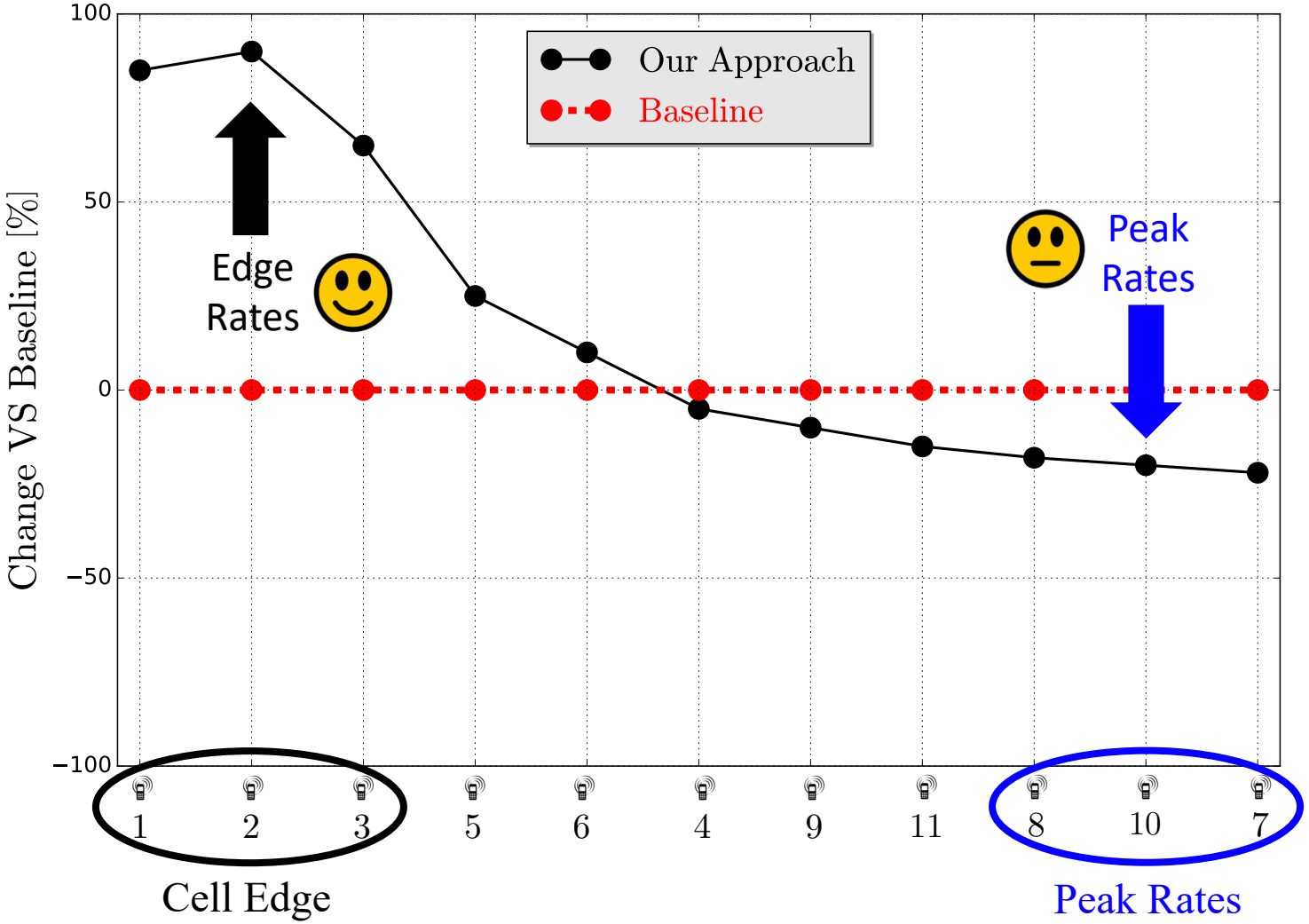

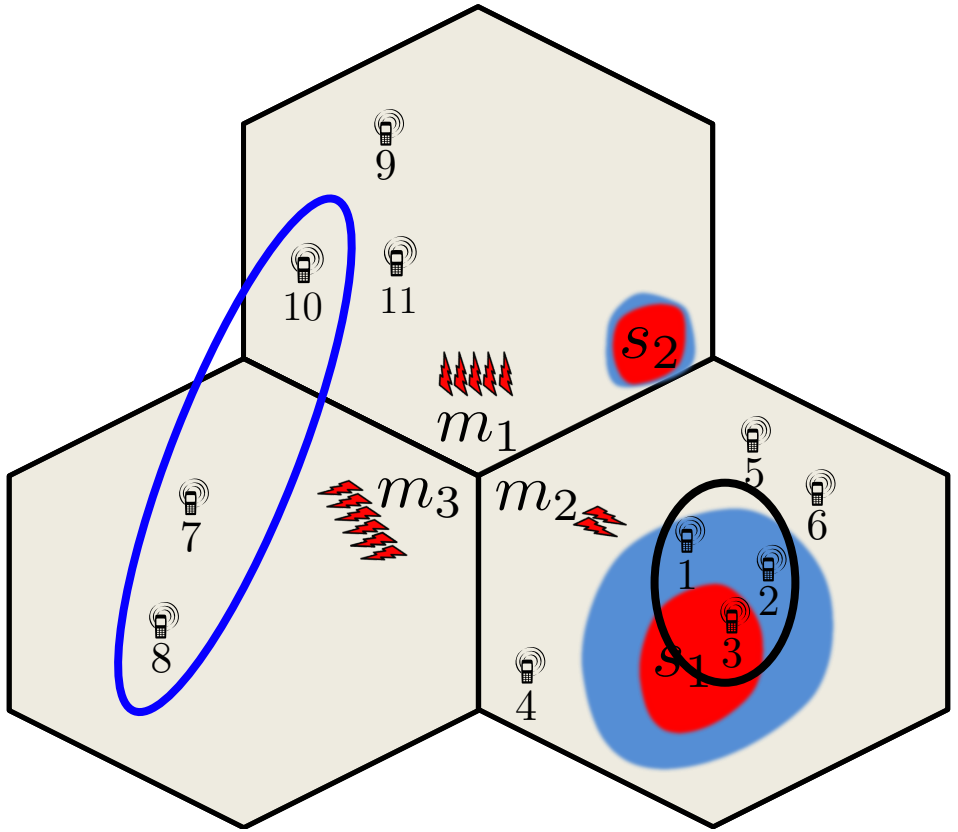

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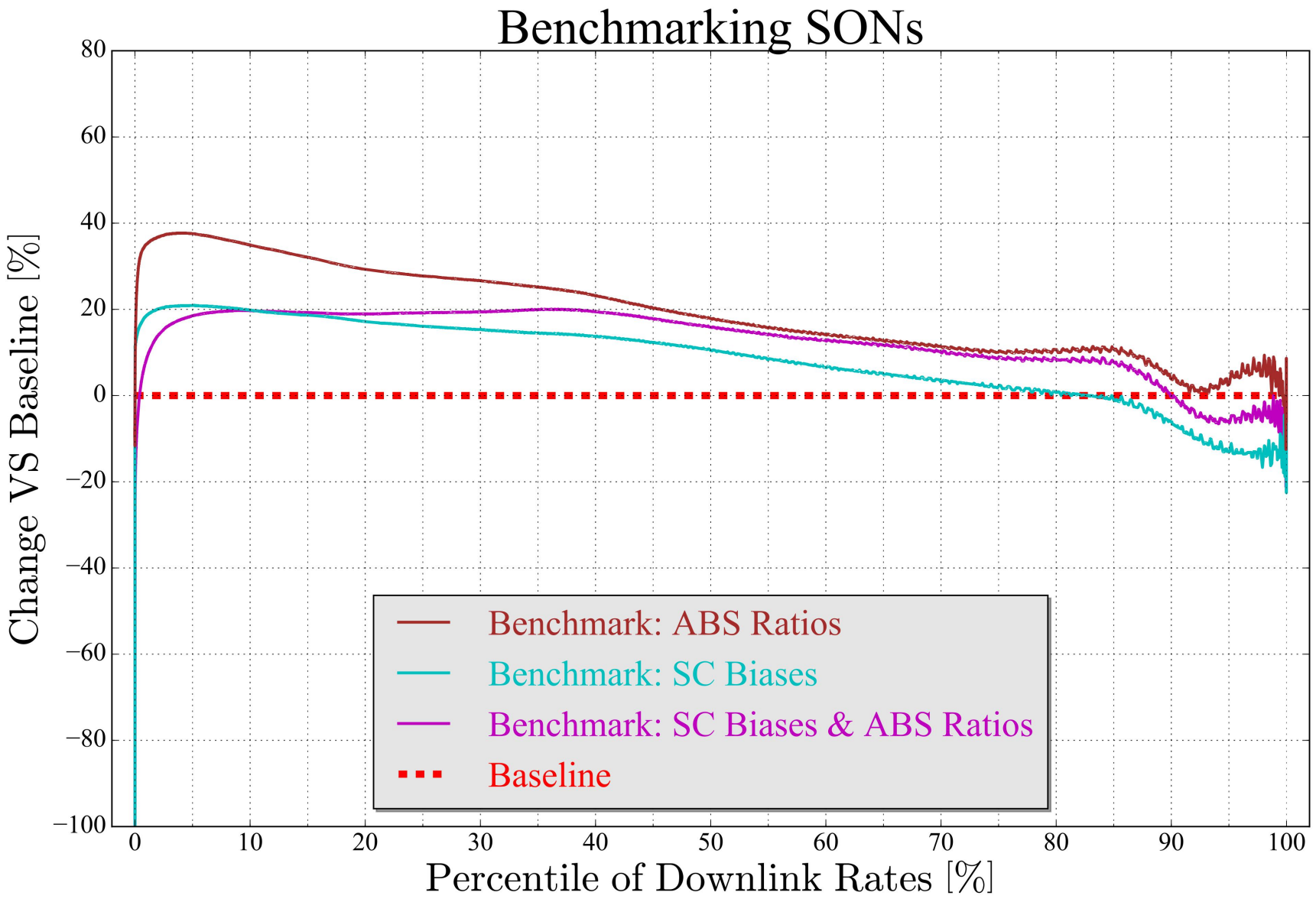

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