SECON

Efficient Pinpointing of Misplaced Tags in Large RFID Systems

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You can buy lots of healthy food
in this sup rket.

Optimal Placement

Product Misplacement

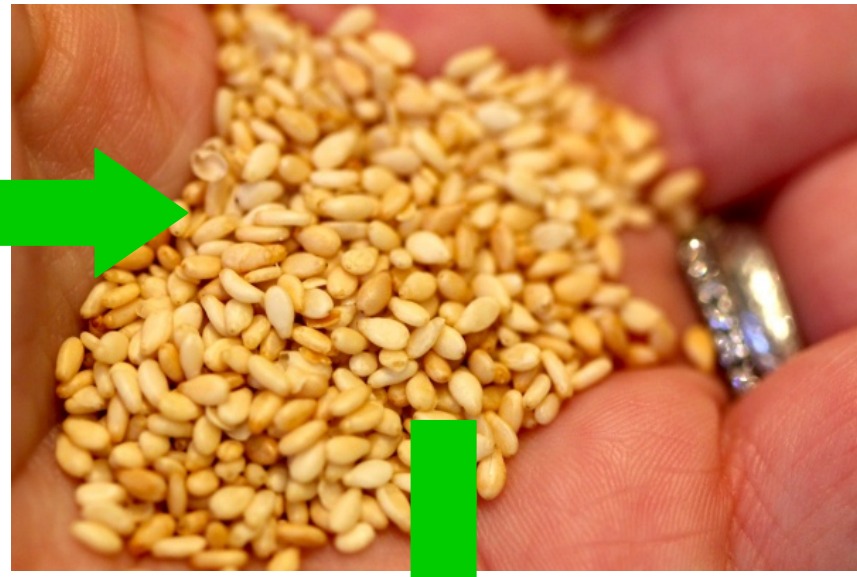
8.1%

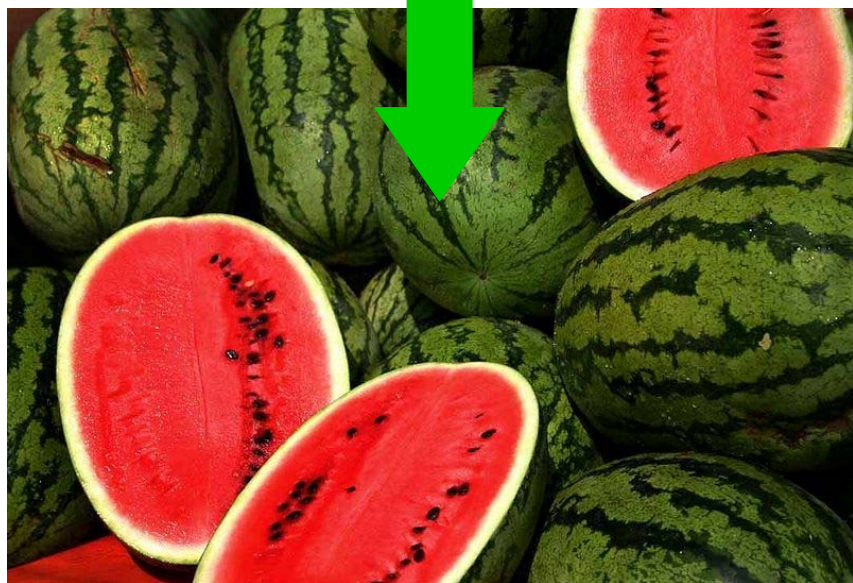
Profit Increase by Optimal Placement

$1.1 billion

Bonus for WAL★MART

Wait! It’s Not Easy





RFID Makes All The Difference

Products attached with RFID tags get connected, networked,
and enabled with abilities such as computation,
communication.

How to **pinpoint misplaced tags** in large RFID systems?

Assumptions

- Tag IDs, Category IDs
- A majority of tags in each category placing properly
- RFID localization system
- ***Not necessarily stick to layout plans***

Formulation

A **misplaced tag**

locates away from the area where **the majority of tags in the same category as it** locate.

Misplaced-**T**ag **P**inpointing (**MTP**)

Protocols To Be Proposed

- B-MTP: Basic MTP Protocol
- T-MTP: Time-efficient MTP Protocol
- ET-MTP: Energy- and Time-efficient MTP Protocol

B-MTP: Basic Protocol That Locate All Tags

for each category **do**

locate all tags in this category;

cluster tag positions;

CategoryArea ← the cluster by positions of a majority of tags;

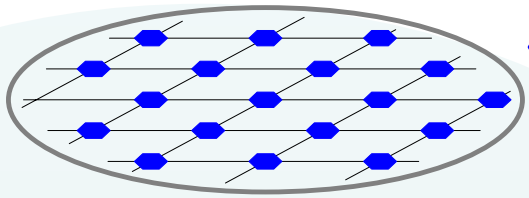
if a tag is away from ***CategoryArea*** **then**

the tag is misplaced;

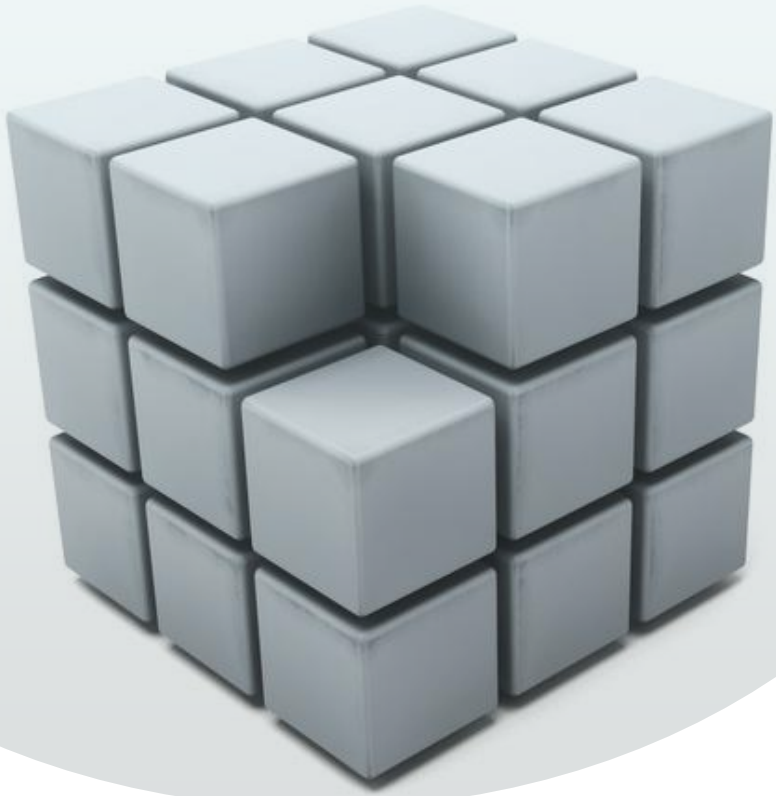
end

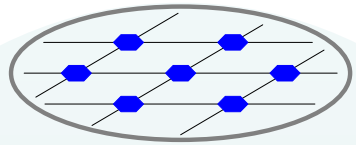
Seriously? Locate all tags?

T-MTP: **T**ime-efficient **MTP** Protocol



Reader





Detect misplaced tags using separate ***reader clusters***;
Locate only misplaced tags.

Reader Cluster Formation

for each category **do**

for each reader **do**

the reader broadcasts a query message containing the category ID;

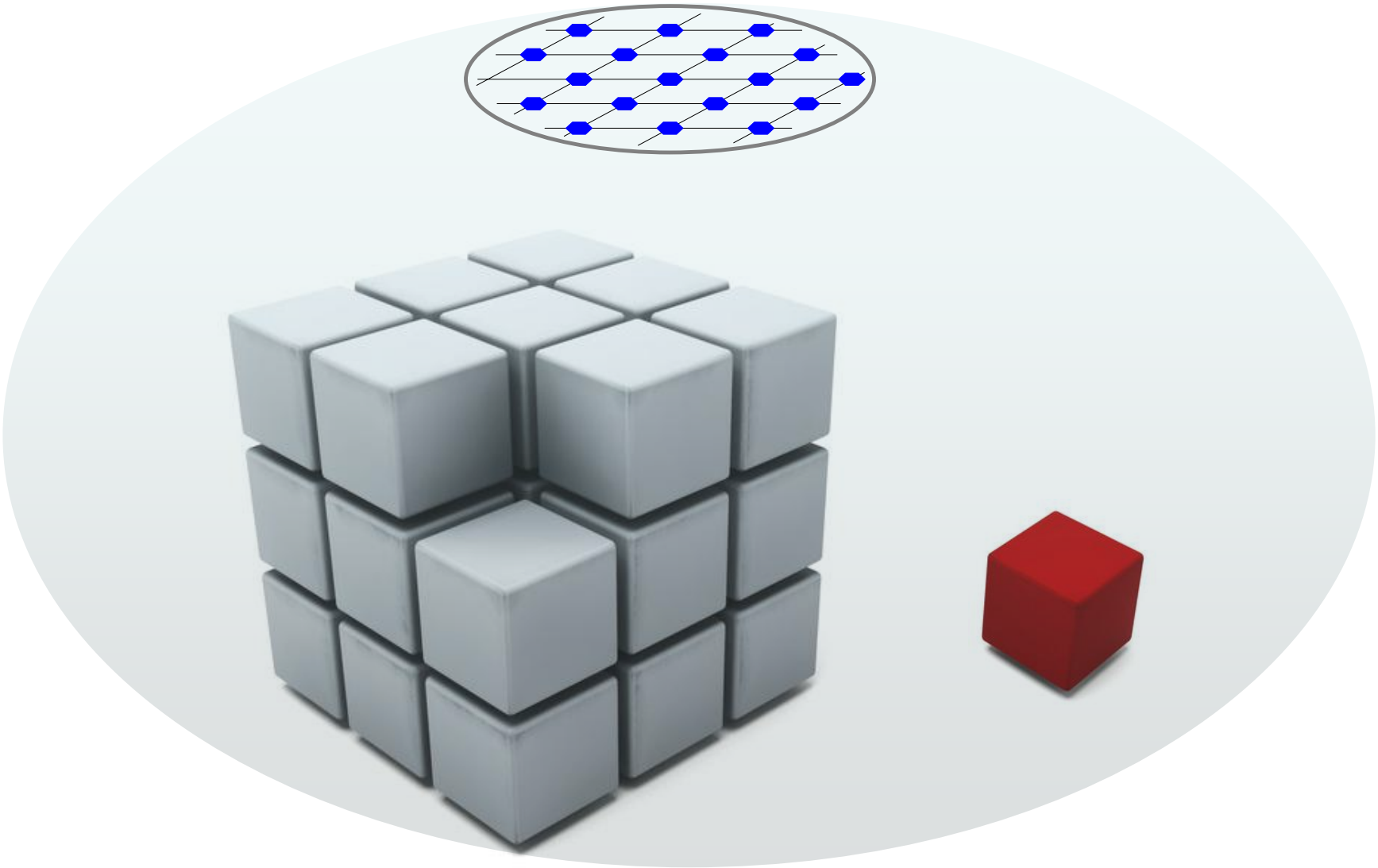
tags in the queried category respond to the reader;

end

ReaderCluster ← neighboring readers that received tag responses;

end

False Negatives of T-MTP



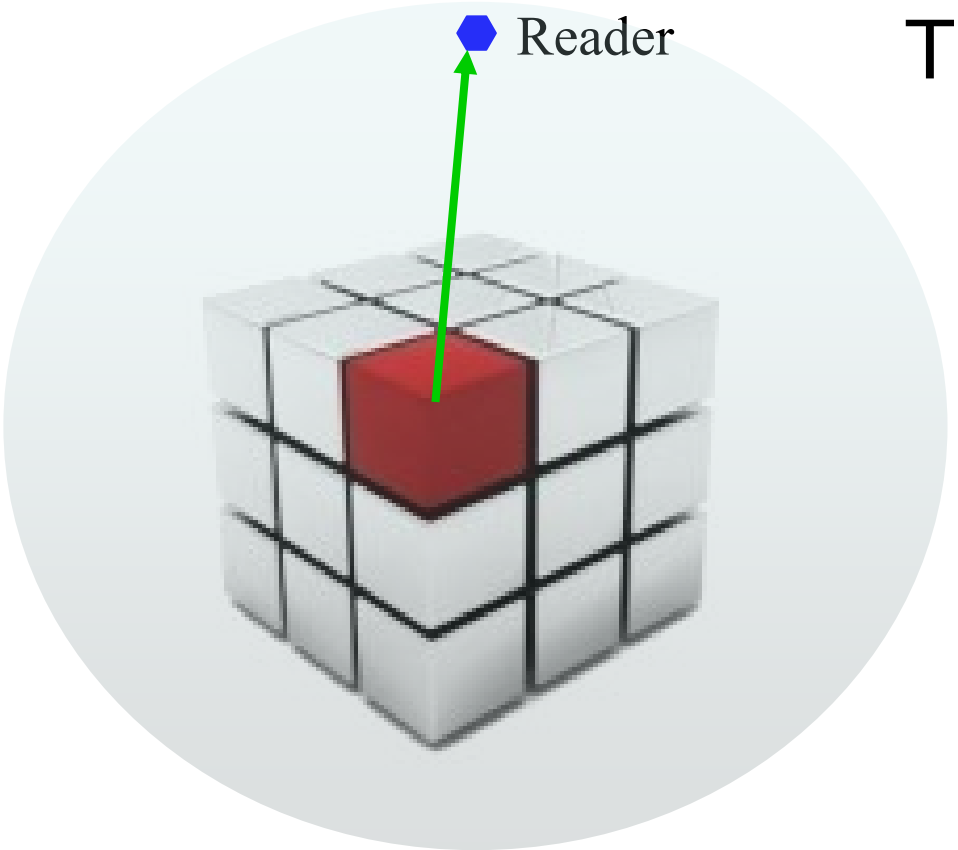
Huh? All tags respond?

Active tags

initiate communication,
have longer communication radius,
But, **work with self-equipped batteries**.

Active tags:
“We want to respond less!”

Reader Cluster Formation Without All Tags Responding

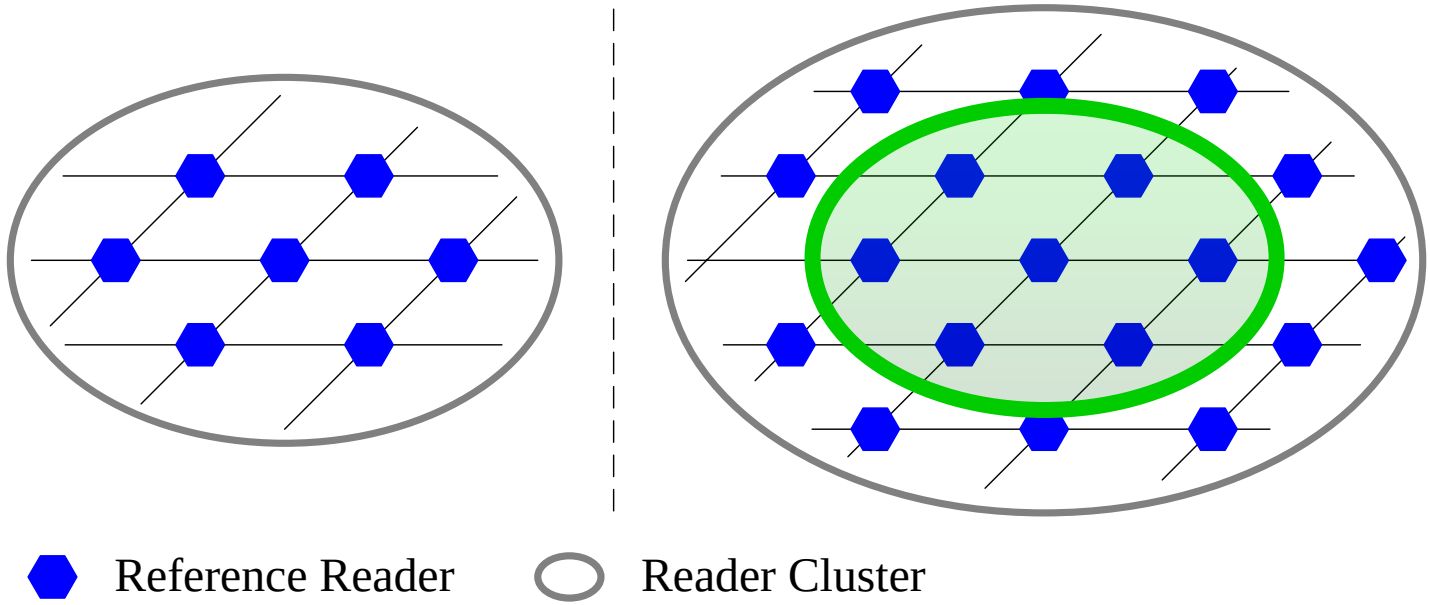


The reader informs tags a probability *p* (e.g., 1/27);

Tags respond with probability *p*;

One tag response is enough for the reader verifying tag coverage.

ET-MTP:
Energy- and **T**ime-efficient **MTP** Protocol



Stage I : tags respond to readers with probability *p*;

Stage II: readers receiving no responses send one more query message, and tags must respond.

Simulation Results

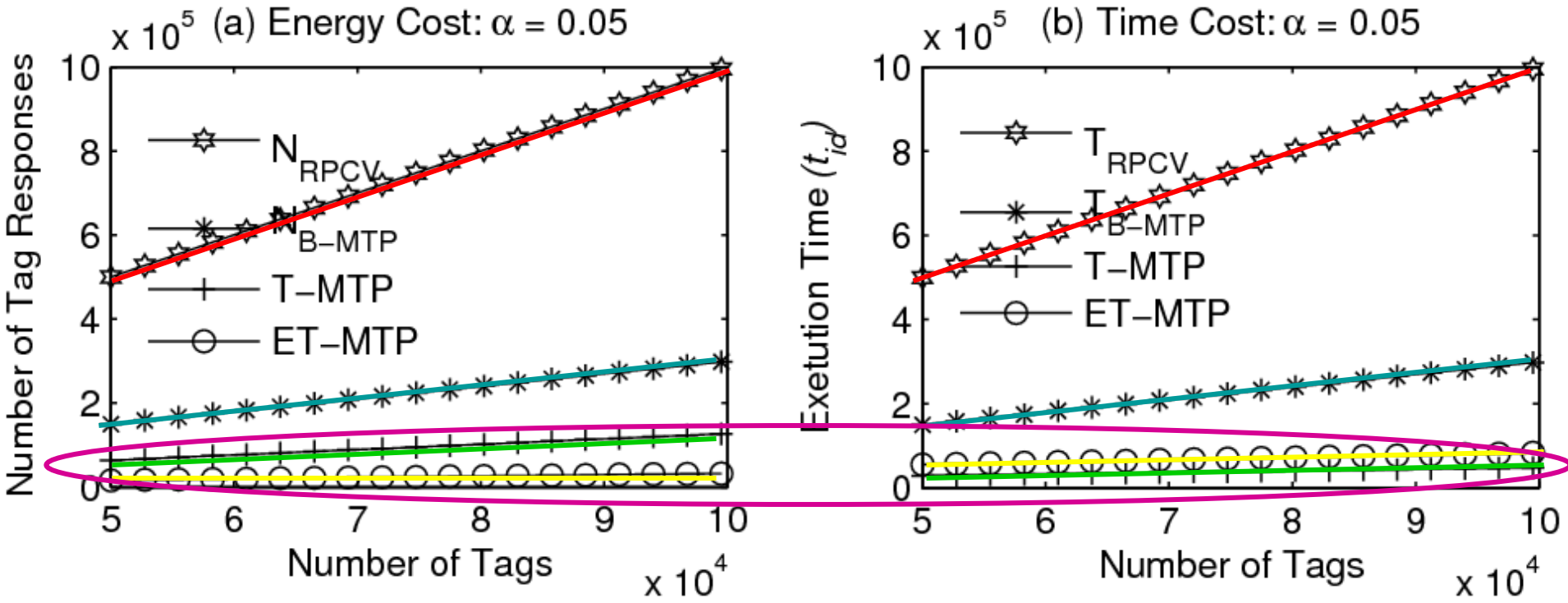


Fig. 7. Performance comparison of RPCV, B-MTP, T-MTP, and ET-MTP with varying tag number n and misplacement ratio α.

>70%

time/energy reduction compared with *RPCV*

Conclusion

- Misplaced products affect retailer profits but are hard to deal with.
- Finding misplaced tags in RFID-enabled retails makes it different.
- The proposed protocols pinpoint misplaced tags more time- and energy-efficiently than does the state-of-the-art.

Q&A


Thanks
Enjoy your travel
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