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Where do you store your product today? Let's try AI, to make tomorrow's picking faster.

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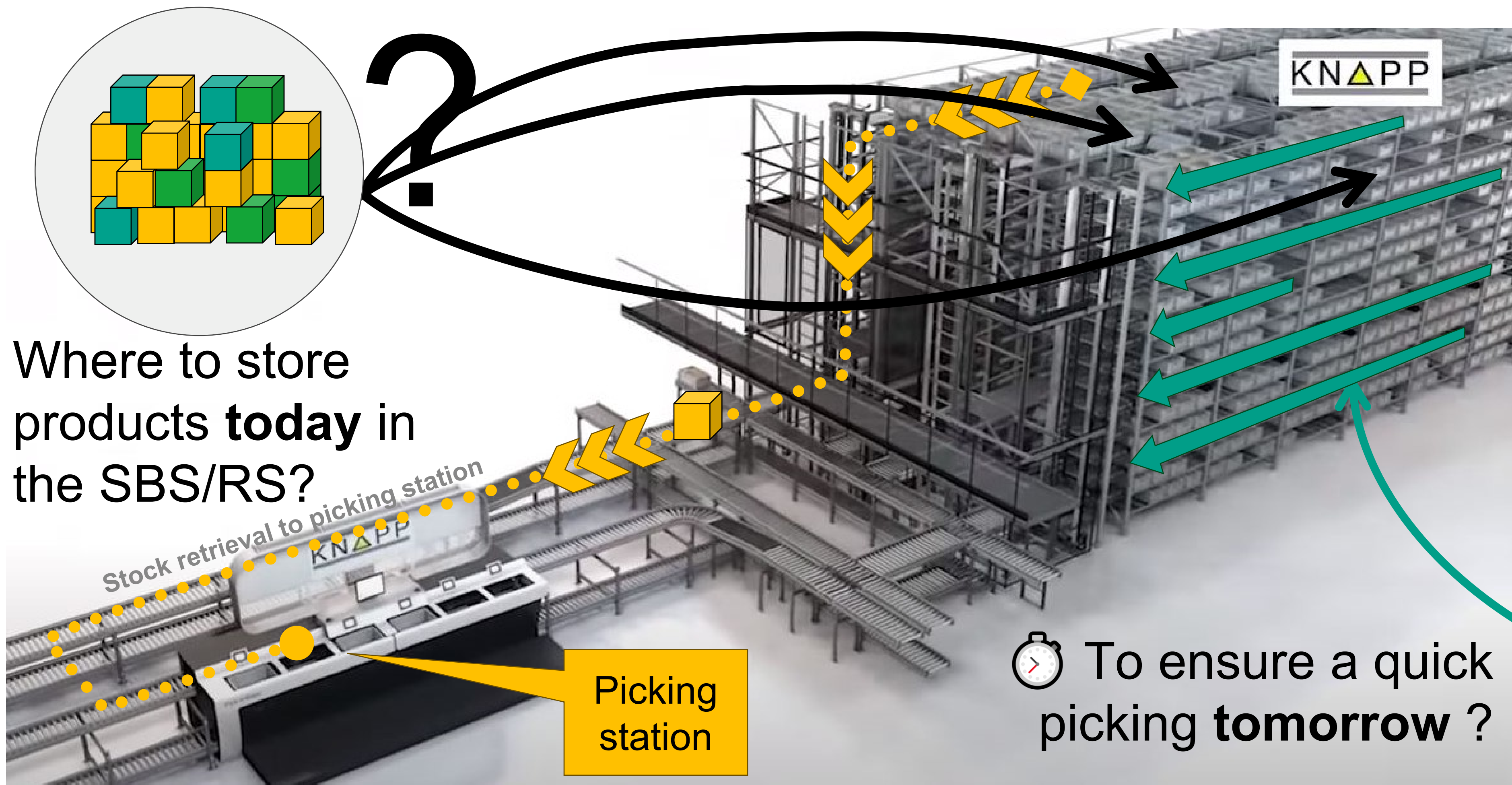
Where do you store your product today ? Let's try AI, to make tomorrow's picking faster.

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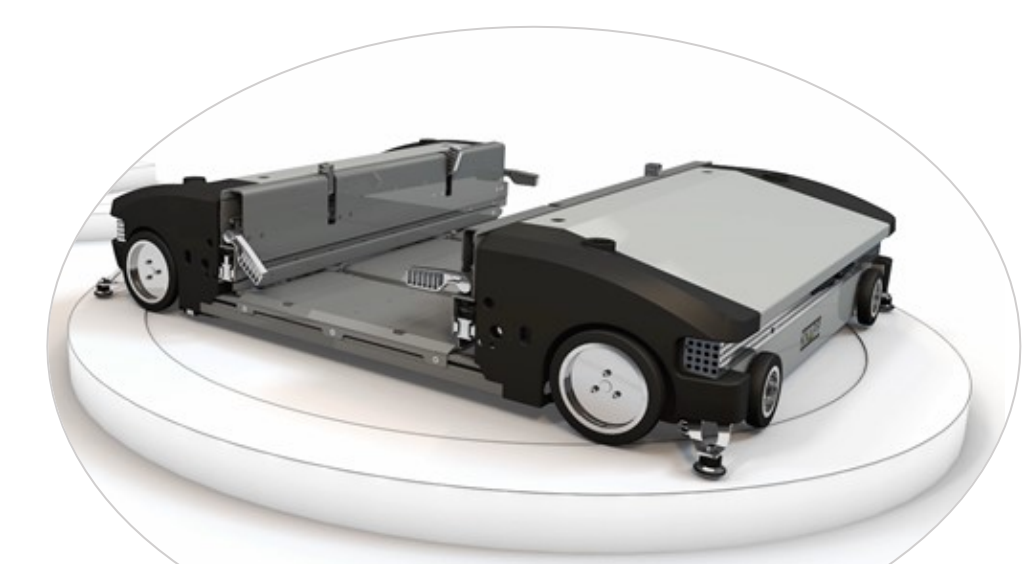
² Knapp France, 3 Cours de la Gondoire, Carre Haussmann Marne La Vallée, Bâtiment A, 77600 Jossigny, France

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1. Background

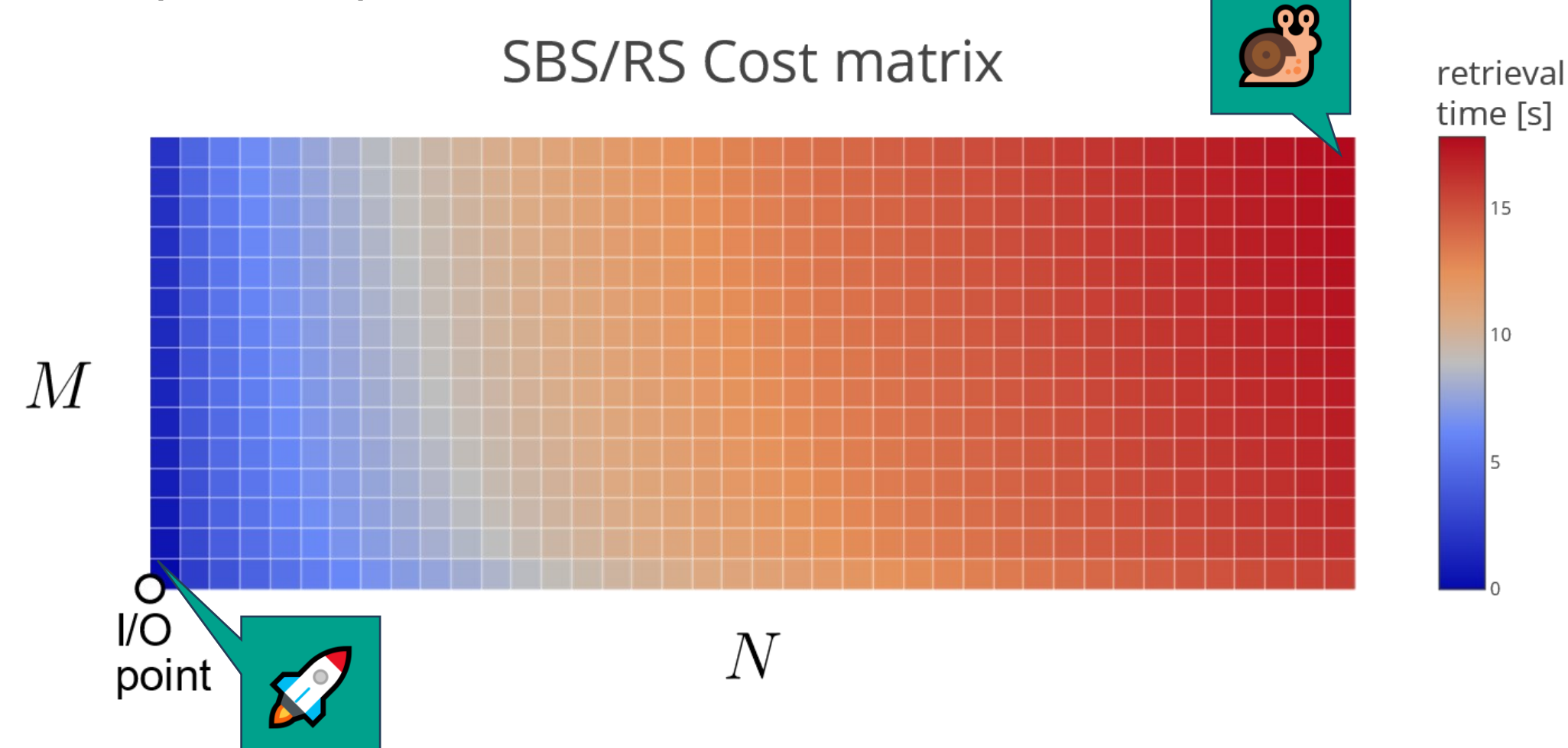
- Automated warehouse
- Goods-to-man configuration
- Real data with trend, seasonal and peaks situations
- Shuttle-Based Storage and Retrieval System (SBS/RS)



Keep shuttles travel distance small

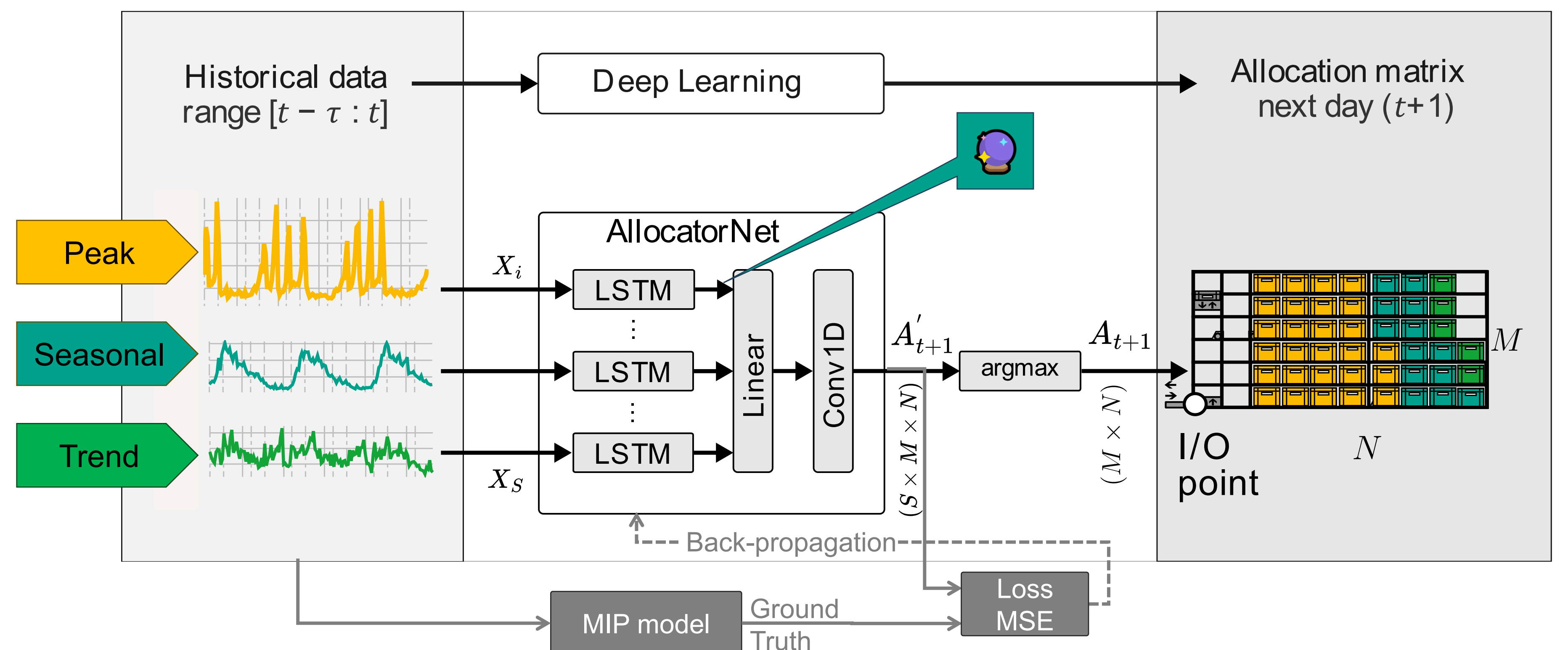
2. Challenges

- Products demand varies over time. How much will have to be picked the next day? Can we forecast?
- "Fast"-retrieve storage locations are limited
- Up to +150,000 storage locations
- Up to +200,000 SKUs
- Storage Location Assignment Problem (SLAP) was proven NP-Hard



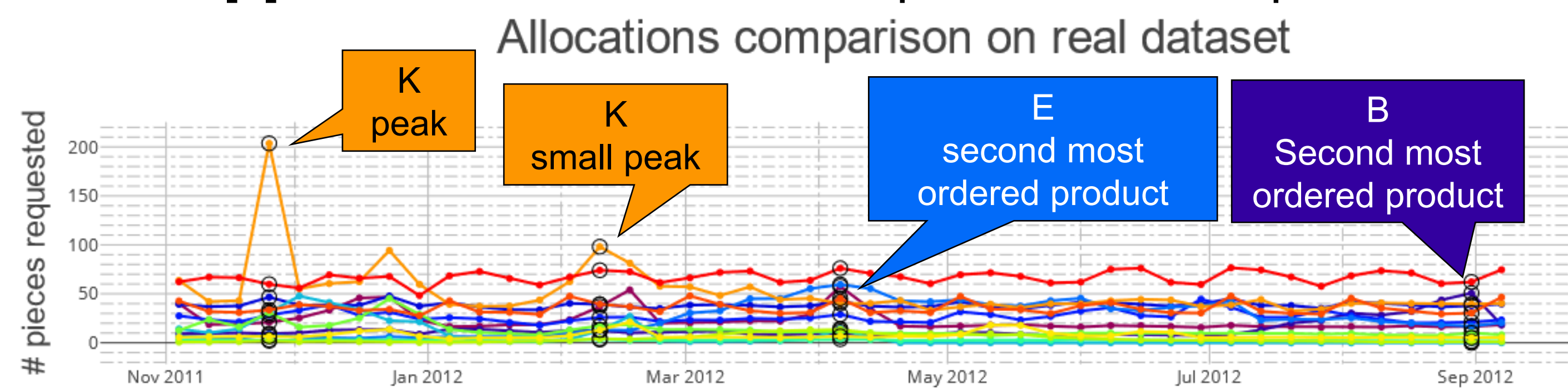
3. Our approach

- Data-driven approach
- Dedicated Deep-Learning model
- Input: Historical picking data $[t - \tau : t]$
- Output: Allocation for the next day $(t + 1)$



4. Benchmark results

- Public dataset from Kaggle "Retail Data Analytics"
- Metric BAR [%]: Bad Allocation Rate, compare to optimal allocation (Ground Truth)
- Metric RT [s]: Shuttles retrieval time in seconds to fulfill daily pick demands
- Metric RTP [s]: Shuttles retrieval time at peaks timestamps



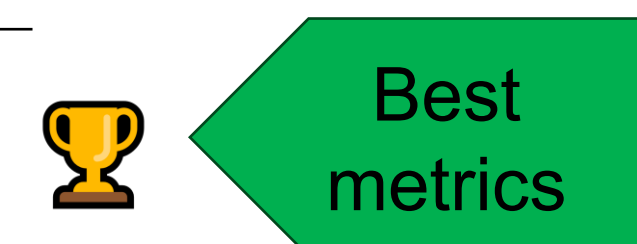
	BAR [%]	RT [s]	RTP [s]
Random $A_{t+1} = \text{random}(X_{t+1})$	48.96	3425 (+36%)	3526 (+12%)
Mean $A_{t+1} = \text{assign}(\bar{X}_{[t-30:t]})$	21.35	3763 (+49%)	4704 (+49%)
Naive $A_{t+1} = \text{assign}(X_t)$	5.57	2935 (+16%)	3736 (+18%)
Our approach $A_{t+1} = \text{AllocatorNet}(X_{[t-8:t]})$	3.20	2917 (+16%)	3367 (+7%)
Ground Truth $A_{t+1} = \text{MIP}(X_{t+1})$	-	2525	3154

5. Conclusions

- New data-driven approach validated on real data
- Working Deep-Learning model with LSTM
- Peaks situations are tackled

6. Next steps

- Scale-up number of products and locations handled
- Design a custom loss
- Evaluate with Transformers



LINK TO PAPER



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