Meeting of the LF AI & Data Technical Advisory Council (TAC)

April 6, 2023

LF AI & DATA

Antitrust Policy

- Linux Foundation meetings involve participation by industry competitors, and it is the intention of the Linux Foundation to conduct all of its activities in accordance with applicable antitrust and competition laws. It is therefore extremely important that attendees adhere to meeting agendas, and be aware of, and not participate in, any activities that are prohibited under applicable US state, federal or foreign antitrust and competition laws.

- Examples of types of actions that are prohibited at Linux Foundation meetings and in connection with Linux Foundation activities are described in the Linux Foundation Antitrust Policy available at http://www.linuxfoundation.org/antitrust-policy. If you have questions about these matters, please contact your company counsel, or if you are a member of the Linux Foundation, feel free to contact Andrew Updegrove of the firm of Gesmer Undergone LLP, which provides legal counsel to the Linux Foundation.

Recording of Calls

Reminder:

TAC calls are recorded and available for viewing on the TAC Wiki

Reminder: LF AI & Data Useful Links

- Web site: lfaidata.foundation
- Wiki: wiki.lfaidata.foundation
- GitHub: github.com/lfaidata
- Landscape: https://landscape.lfaidata.foundation or https://l.lfaidata.foundation
- Mail Lists: https://lists.lfaidata.foundation
- Slack: https://slack.lfaidata.foundation
- Youtube: https://www.youtube.com/channel/UCfasaeqXJBCAJMNO9HcHfbA
- LF AI Logos: https://github.com/lfaidata/artwork/tree/master/lfaidata
- LF AI Presentation Template: https://drive.google.com/file/d/1eiDNJvXCqSZHT4Zk_-czASlz2GTBRZk2/view?usp=sharing

- Events Page on LF AI Website: https://lfaidata.foundation/events/
- Events Calendar on LF AI Wiki (subscribe available): https://wiki.lfaidata.foundation/pages/viewpage.action?pageId=12091544
- Event Wiki Pages: https://wiki.lfaidata.foundation/display/DL/LF+AI+Data+Foundation+Events

Agenda

- Roll Call (2 mins)
- Approval of Minutes from previous meeting (2 mins)
- DeepRec Alibaba New project discussion (40 minutes)
- Open Discussion

TAC Voting Members - Please note

Please ensure that you do the following to facilitate smooth procedural quorum and voting processes:

- Change your Zoom display name to include your First/Last Name, Company/Project Represented
  - example: Nancy Rausch, SAS
- State your First/Last Name and Company/Project when submitting a motion
  - example: First motion, Nancy Rausch/SAS

TAC Voting Members - Please note

- TAC members must attend consistently to maintain their voting status
- After 2 absences voting members will lose voting privileges
- Voting privileges will only be reinstated after attending 2 meetings in a row

TAC Voting Members

Note: we still need a few designated backups specified on wiki

Member Representatives (8 out of 16 required for quorum)

Member Company or Graduated Project	Membership Level or Project Level	Voting Eligibility	Country	TAC Representative	Designated TAC Representative Alternates
4paradigm	Premier	Voting Member	China	Zhongyi Tan	
Baidu	Premier	Voting Member	China	Jun Zhang	Daxiang Dong, Yanjun Ma
Ericsson	Premier	Voting Member	Sweden	Rani Yadav-Ranjan	
Huawei	Premier	Voting Member	China	Howard (Huang Zhipeng)	Charlotte (Xiaoman Hu) , Leon (Hui Wang)
Nokia	Premier	Voting Member	Finland	@Michael Rooke	@Jonne Soininen
OPPO	Premier	Voting Member	China	Jimmy (Hongmin Xu)	
SAS	Premier	Voting Member	USA	*Nancy Rausch	JP Trawinski
ZTE	Premier	Voting Member	China	Wei Meng	Liya Yuan
Adversarial Robustness Toolbox Project	Graduated Technical Project	Voting Member	USA	Beat Buesser	Kevin Eykholt
Angel Project	Graduated Technical Project	Voting Member	China	Jun Yao	
Egeria Project	Graduated Technical Project	Voting Member	UK	Mandy Chessell	Nigel Jones, David Radley, Maryna Strelchuk, Ljupcho Palashevski, Chris Grote
Flyte Project	Graduated Technical Project	Voting Member	USA	Ketan Umare	
Horovod Project	Graduated Technical Project	Voting Member	USA	Travis Addair	
Milvus Project	Graduated Technical Project	Voting Member	China	Xiaofan Luan	Jun Gu
ONNX Project	Graduated Technical Project	Voting Member	USA	Alexandre Eichenberger	Prasanth Pulavarthi, Jim Spohrer
Pyro Project	Graduated Technical Project	Voting Member	USA	Fritz Obermeyer	

Minutes approval

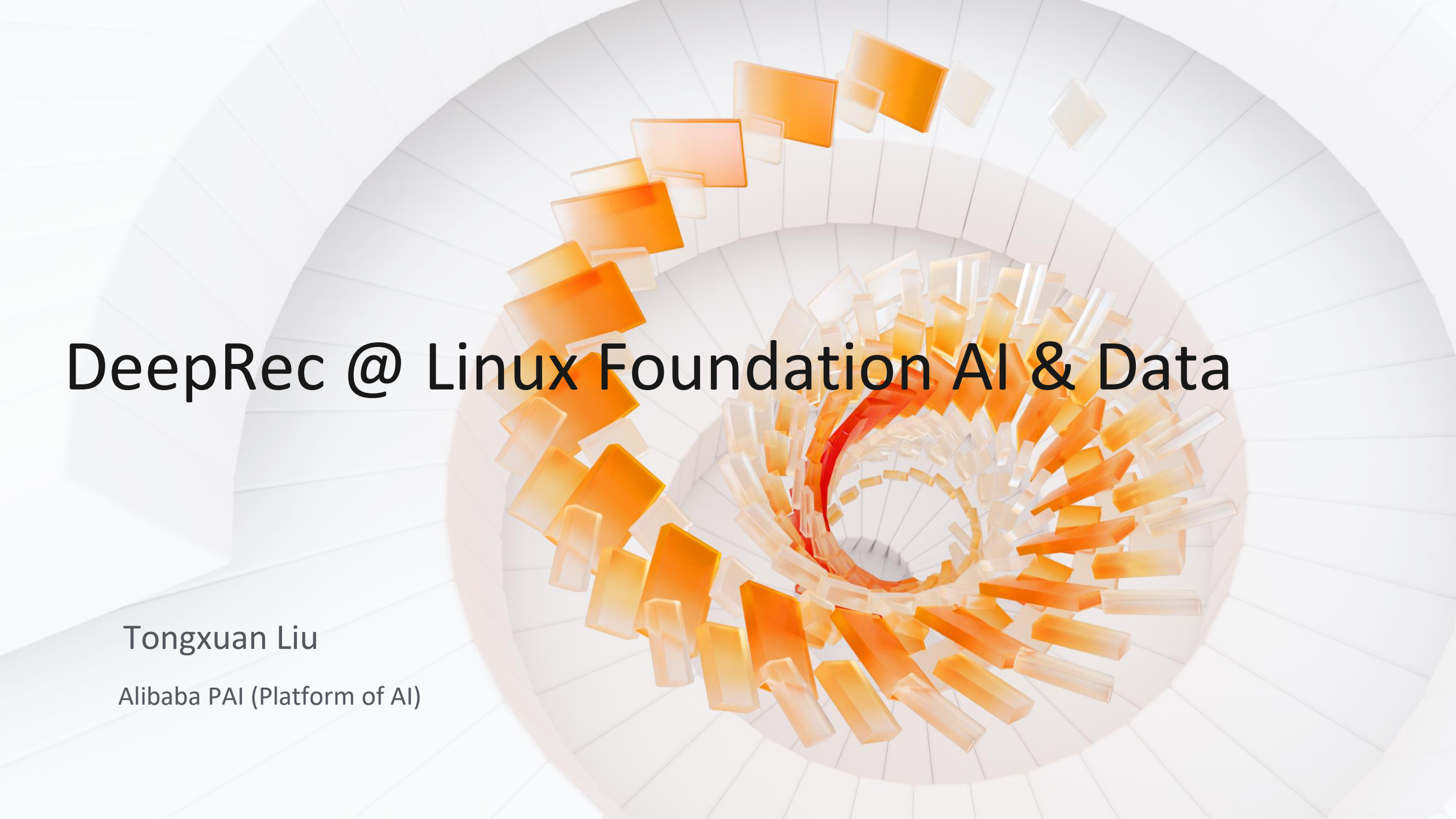
LF AI & DATA

Approval of March 23, 2023 Minutes

Draft minutes from the March 23 TAC call were previously distributed to the TAC members via the mailing list

Proposed Resolution:

- That the minutes of the March 23 meeting of the Technical Advisory Council of the LF AI & Data Foundation are hereby approved.



DeepRec @ Linux Foundation AI & Data

Tongxuan Liu

Alibaba PAI (Platform of AI)

Why host DeepRec in LF AI & Data?

Neutral Holding

Vendor-neutral

Growing community

Increase contributor & user

Cooperation

cooperation with hosted projects

Contents

01 Background

02 DeepRec Overview

03 DeepRec Features

04 Users Feedback

Background

01

Background – Why need DeepRec

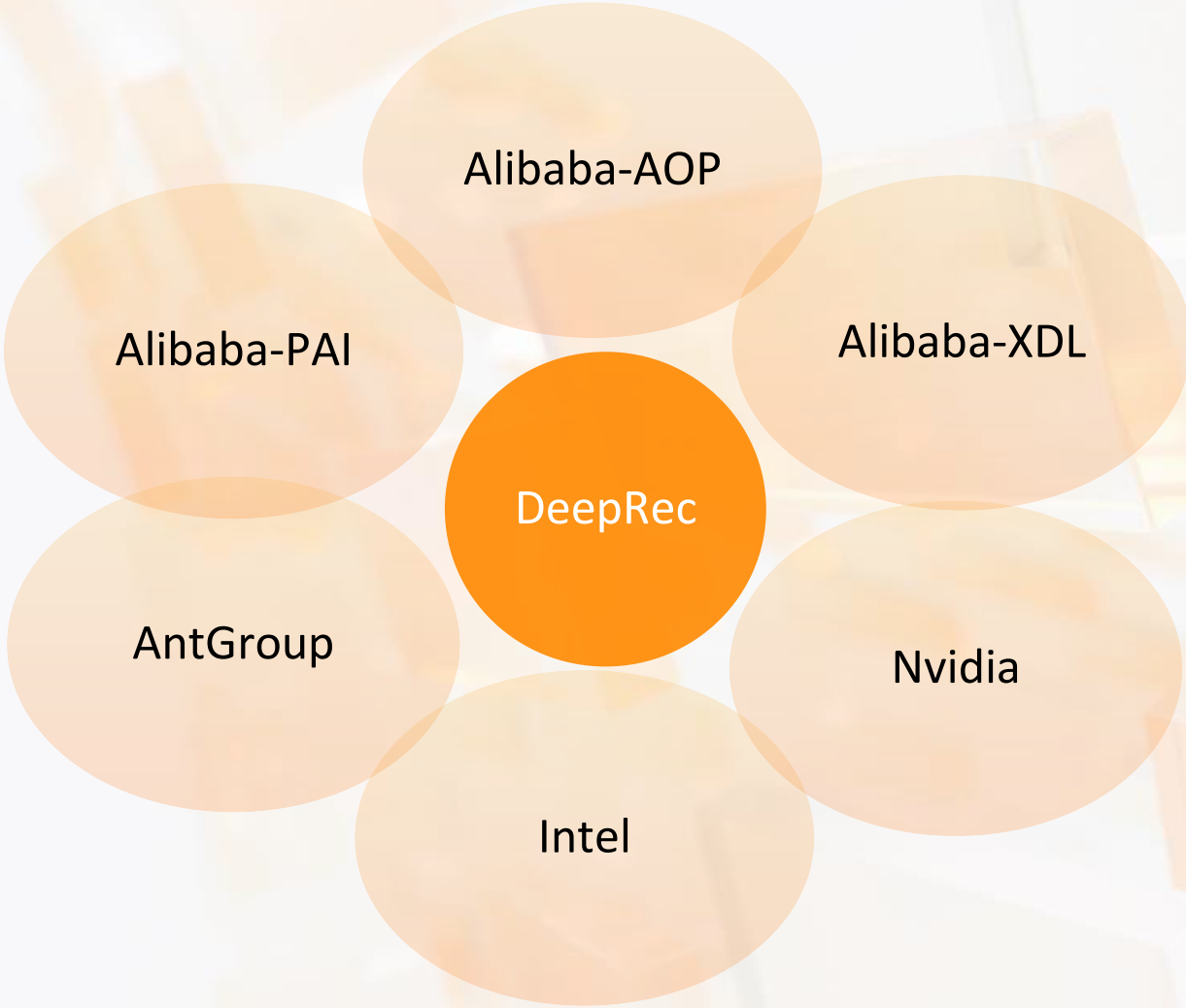
Recommendation	Search	Advertising
Better AUC	Higher Performance	Easier Deployment

A recommendation deep learning framework based on TensorFlow

Background – Existing project

	Usability	Performance	Embedding Functional	Ecosystem	Online Deep Learning
HugeCTR	Bad	Good	Partially supported	Bad	No
DeepRec	Good	Good	Fully supported	Good	Yes
TensorFlow + TFRA	Good	Bad	Partially supported	Good	No
PyTorch + TorchRec	Good	Bad	Partially supported	Good	No

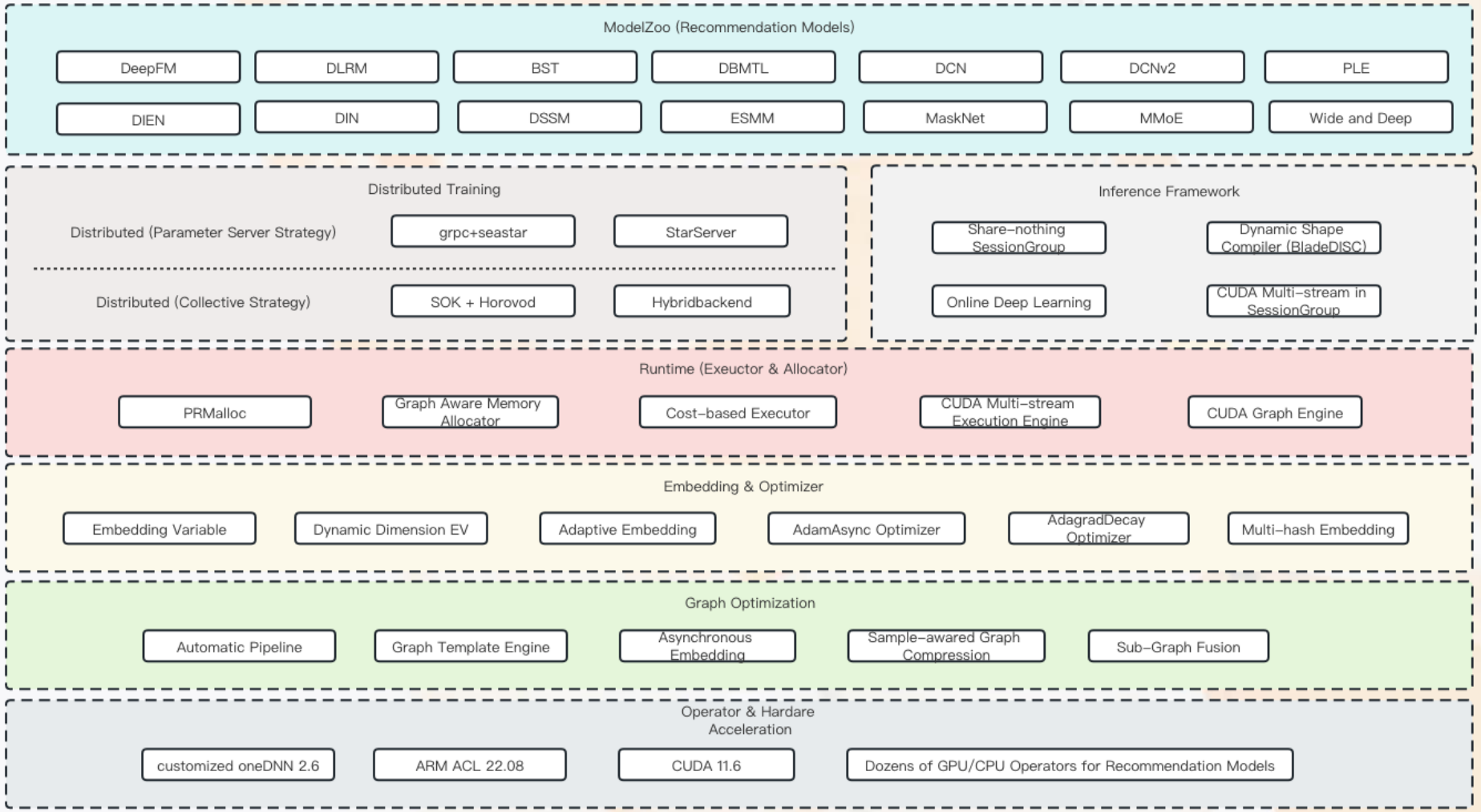
Background – DeepRec Dev teams



DeepRec Overview

02

DeepRec Architecture



DeepRec Features

Embedding & Optimizer

- Embedding Variable
- Feature Eviction and Filter
- Dynamic dimension EV
- Adaptive Embedding Variable
- Multi-Hash Embedding
- AdamAsync Optimizer
- AdagradDecay Optimizer
- Group Embedding

Training

- Async/Sync Distributed Training
- Distributed Training based on GBA
- Graph Aware Memory Allocator
- Automatic Pipeline
- Graph Template Engine
- Critical-path based Executor
- GPU Multi-Stream Engine
- Multi-tier Embedding

Serving & Deployment

- Share-nothing SessionGroup
- Multi-tier Embedding
- GPU Multi-stream In SessionGroup
- Dynamic Shape Compiler (BladeDISC)
- CUDA Graph Execution Engine
- Delta checkpoint
- Online Deep Learning
- Model Quantization

DeepRec Open Source

Collaboration

Alibaba, AntGroup, Intel & NVIDIA contribute.
20+ developers (Alibaba)
5+ developers (Intel)
5+ developers (NVIDIA)
10+ developers (AntGroup)

Open Community

Over 30 companies deploy DeepRec in their business.
Including vivo, weibo, Xiaomi, POIZON, Hupu, AntGroup, Alibaba, xiaohongshu, Sina, mogu, Autohome, Kanzhun, …

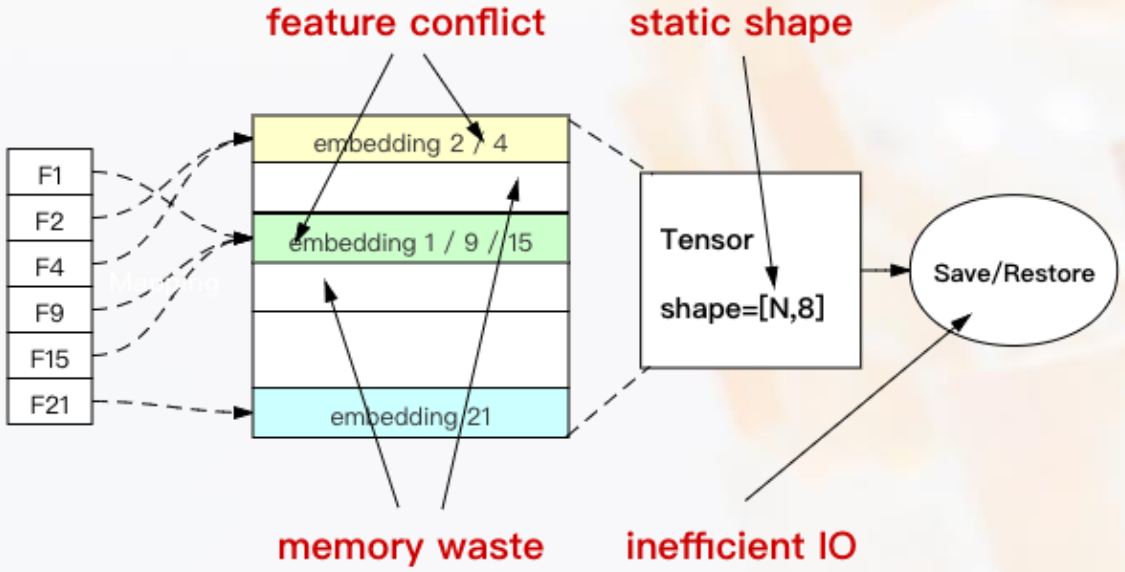
Developer

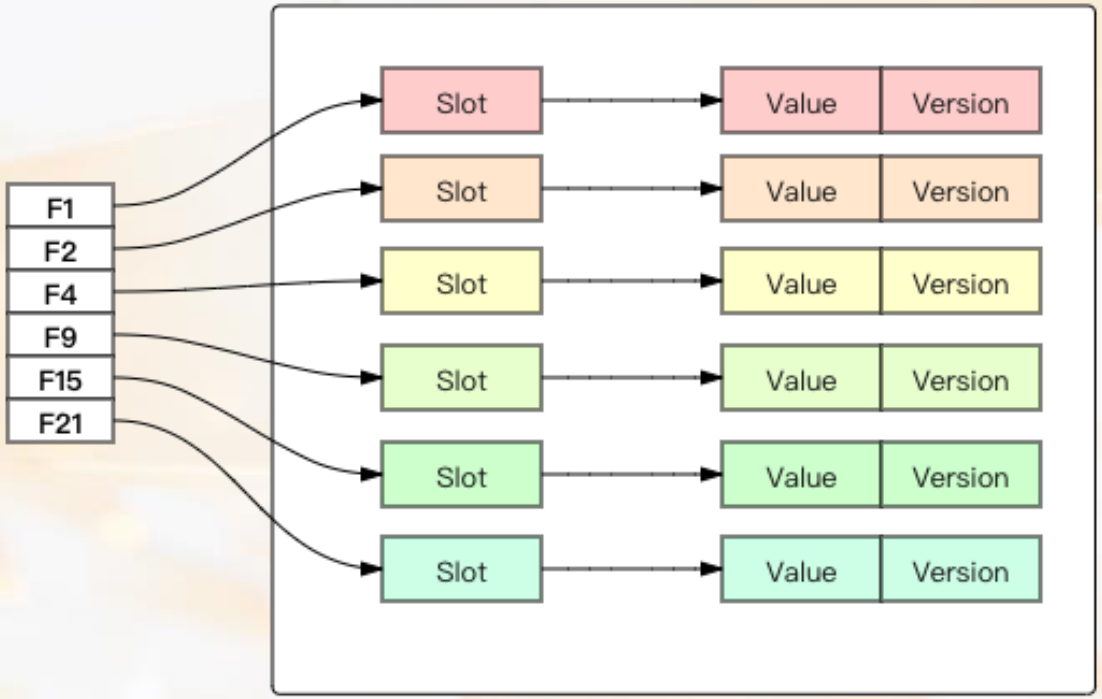
1500+ commits
100+ contributors
700+ pull requests

DeepRec Optimization

03

Embedding Variable





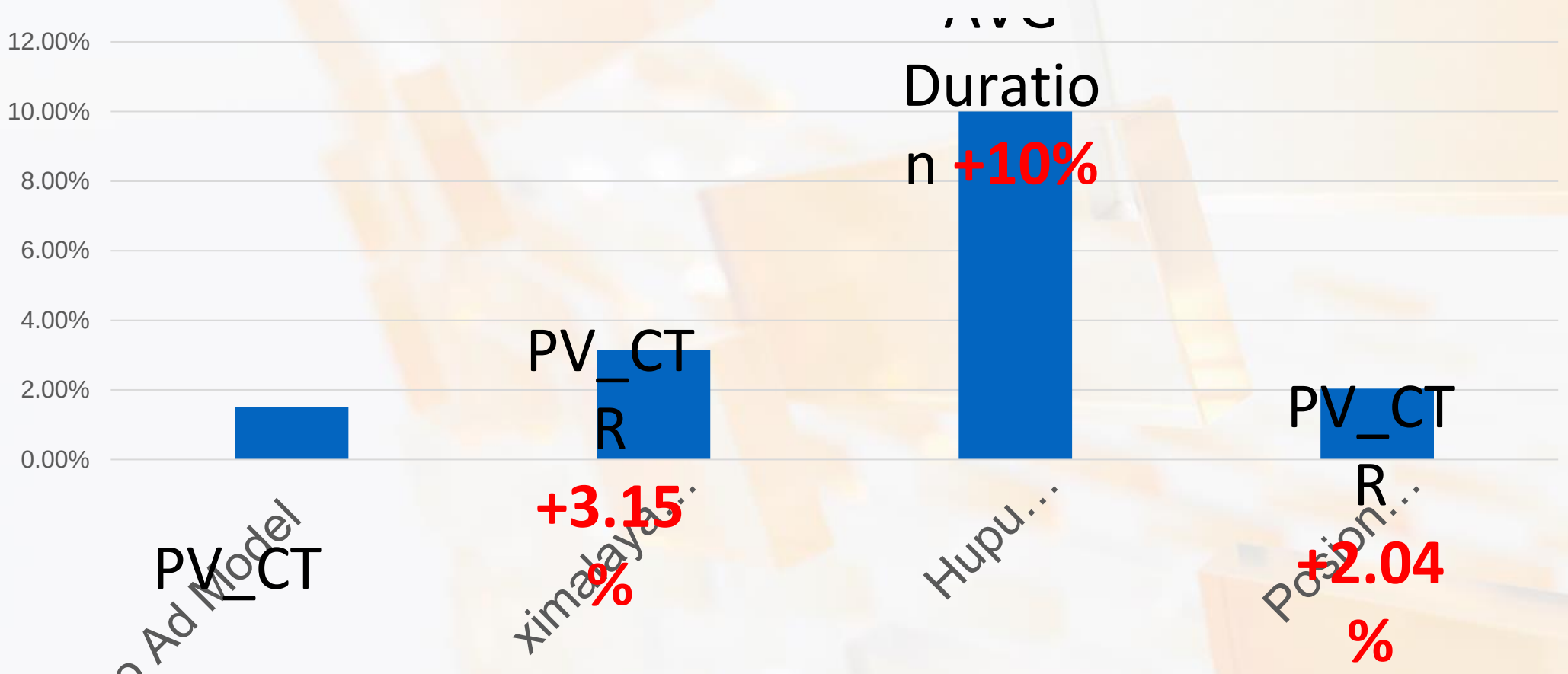
Variable (static shape) disadvantage:

1. Feature conflict
2. Inefficient IO
3. Memory waste

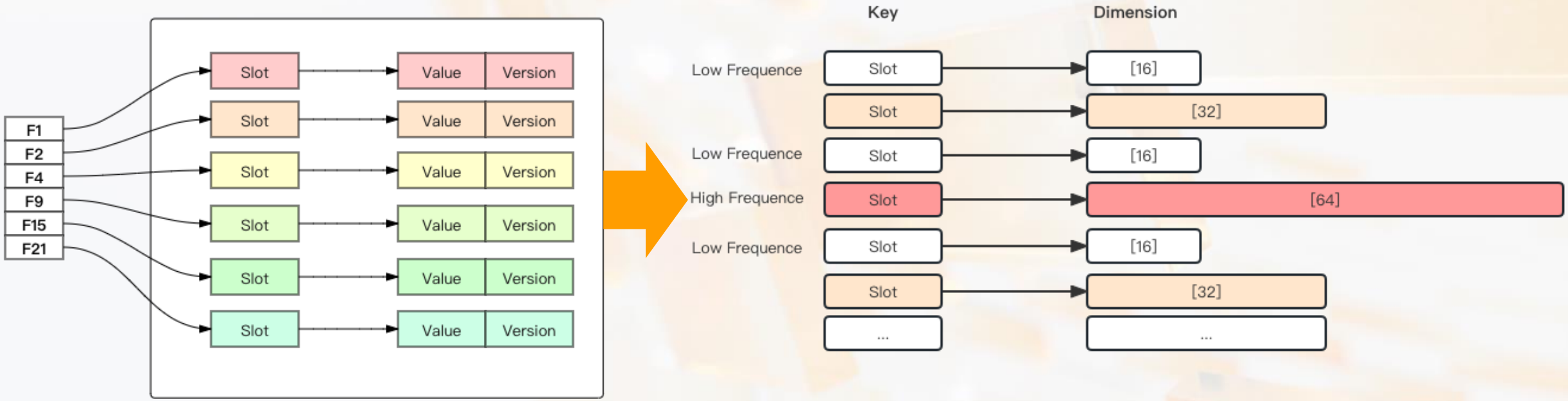
Embedding Variable:

1. Feature eviction to clear useless features
2. No feature conflict
3. Feature filter to avoid overfit

Embedding Variable

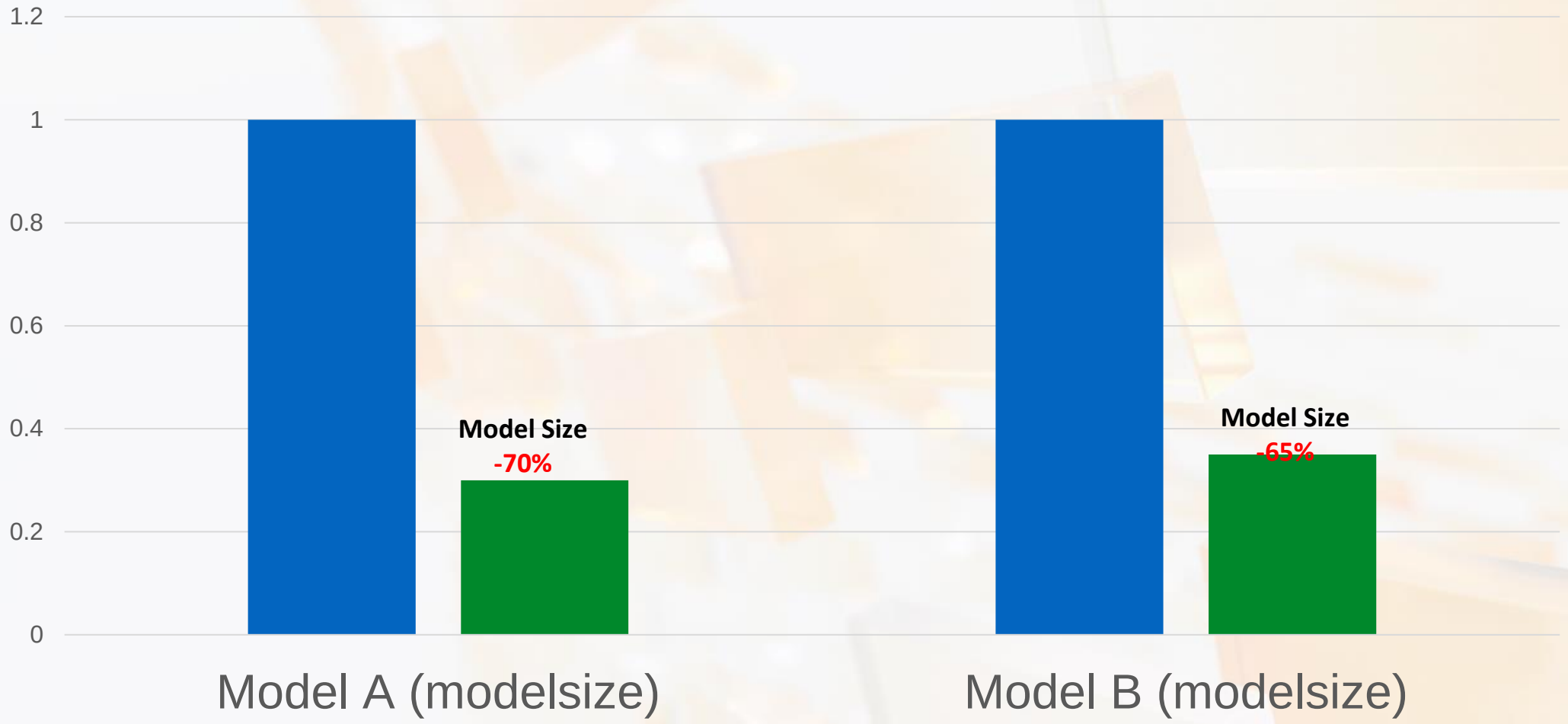


Dynamic Dimension Embedding Variable



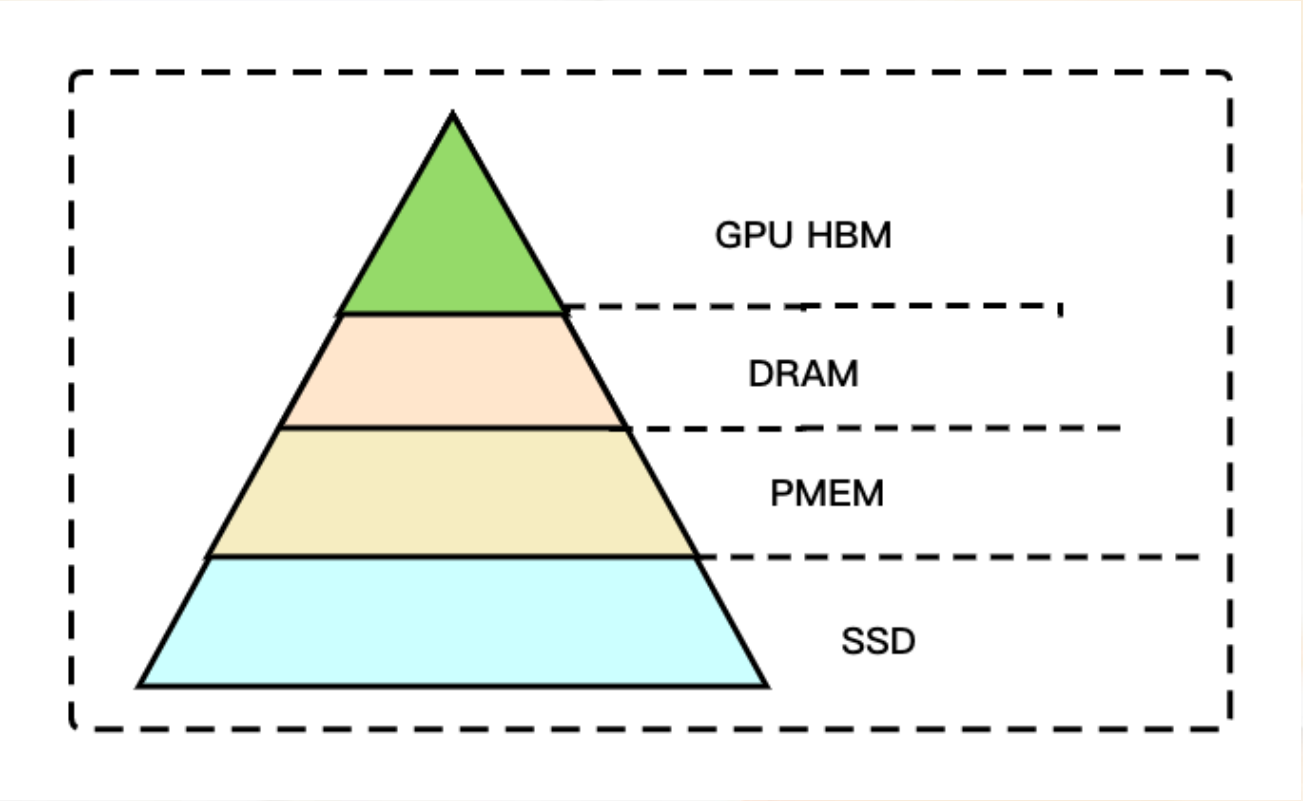
1. 80% features are cold, waste memory (1TB model means 800GB are cold data)
2. Dynamic Dimension Embedding Variable:
   1) Low frequency less dimension; 2) High frequency more dimension

Dynamic Dimension Embedding Variable



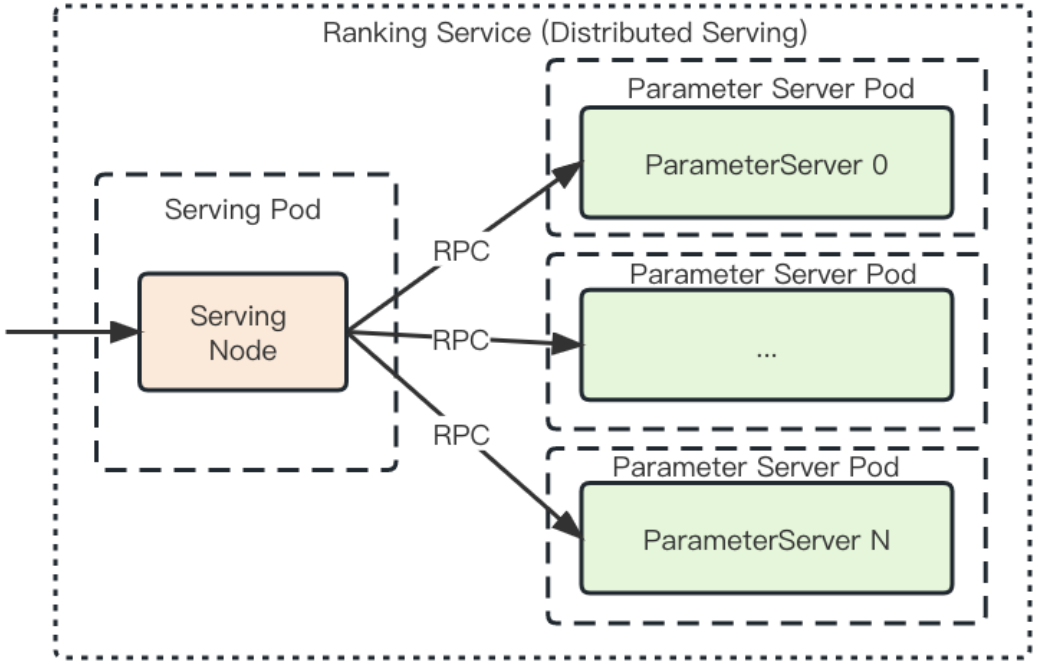
Multi-tier Embedding Variable

- Support Model with 10TB+ (Training and Inference)
- Less Memory or GPU Memory Usage
- Hot/Cold Features for Embedding (Pareto Principle, hot features 20%)



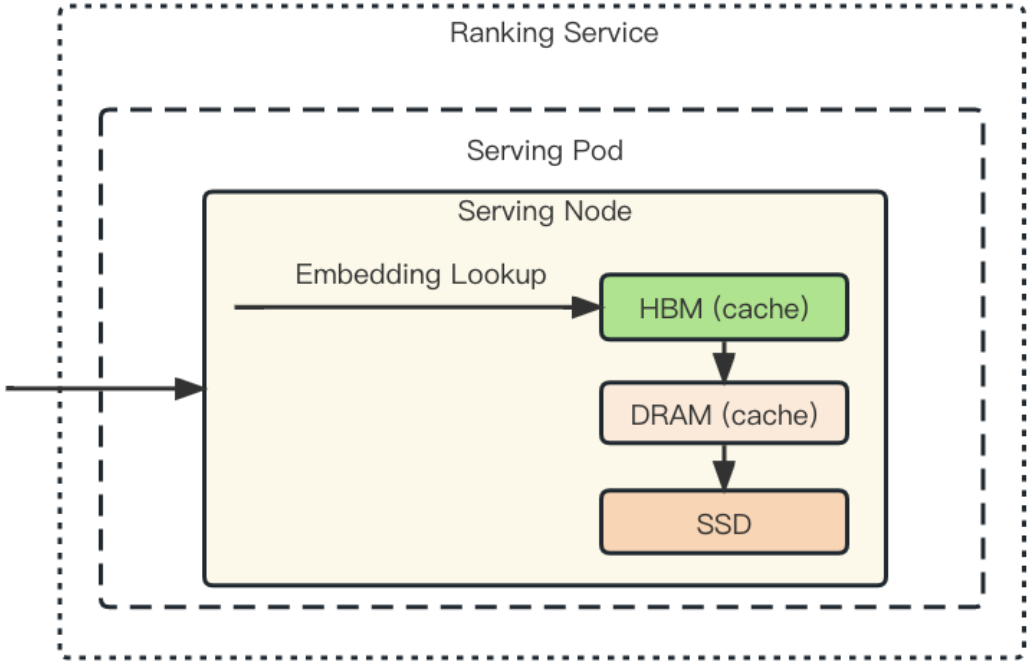
Multi-tier Embedding Variable in Inference

Distributed Parameter Server



VS

Multi-tier Embedding Variable



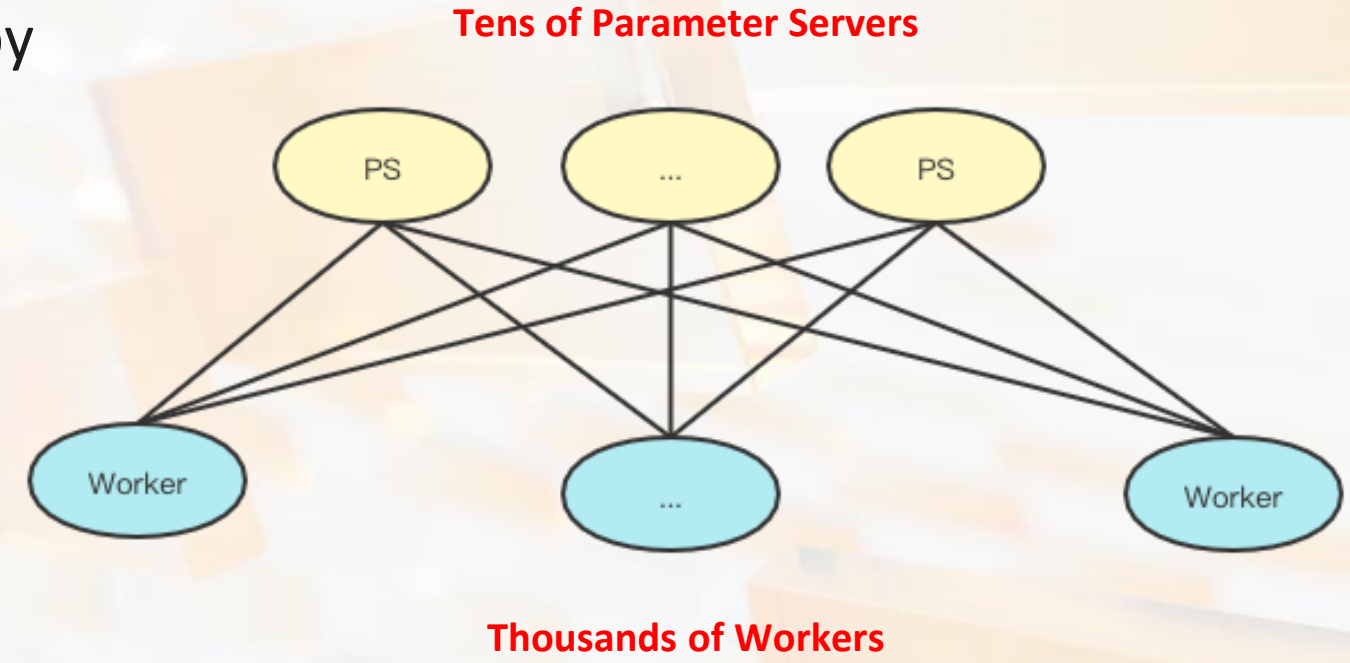
- Compare to Distributed Parameter Server, multi-tier Embedding Variable could bring **3X** faster (TP99 latency)

Distributed – StarServer

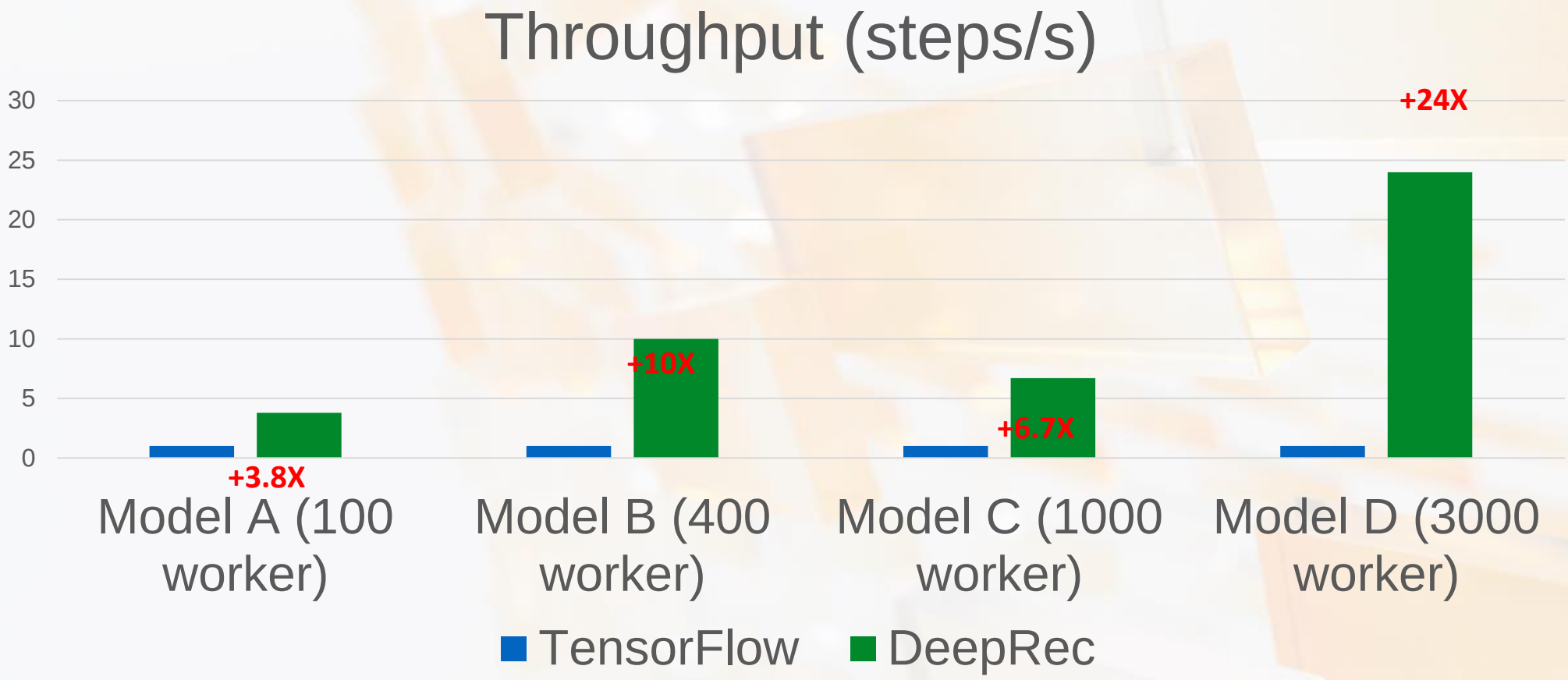
RPC Optimization such as zero copy

Graph Fusion based on topology

PS Runtime: Lockless graph execution and run to completion

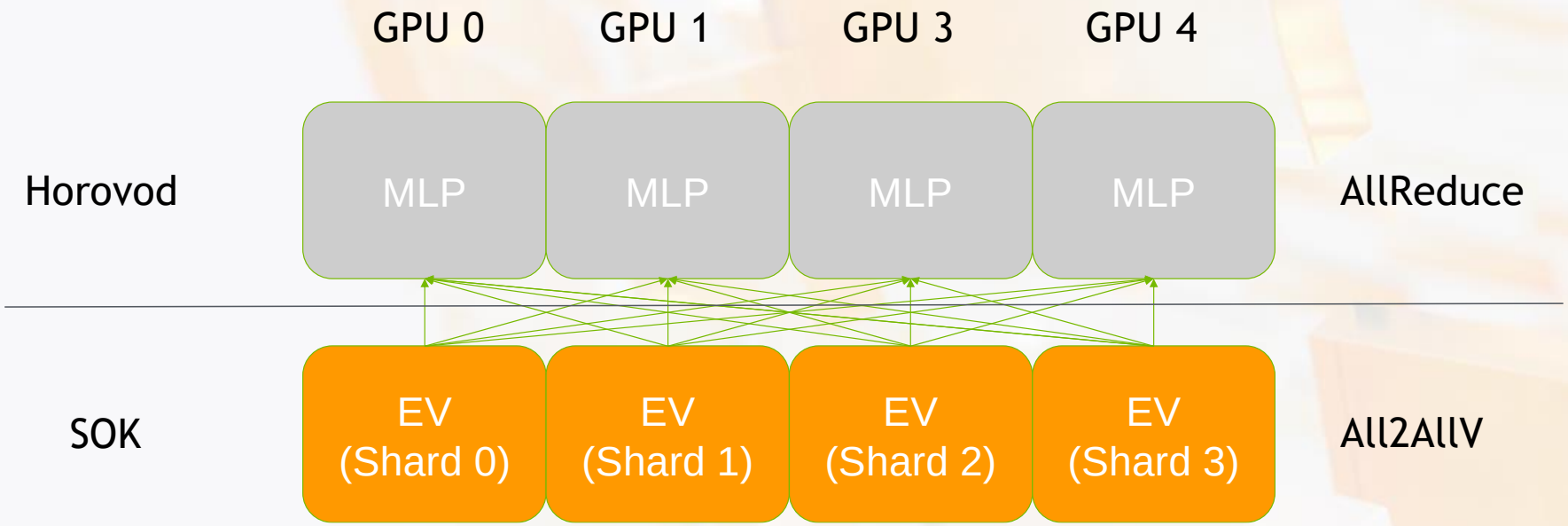


Distributed - StarServer

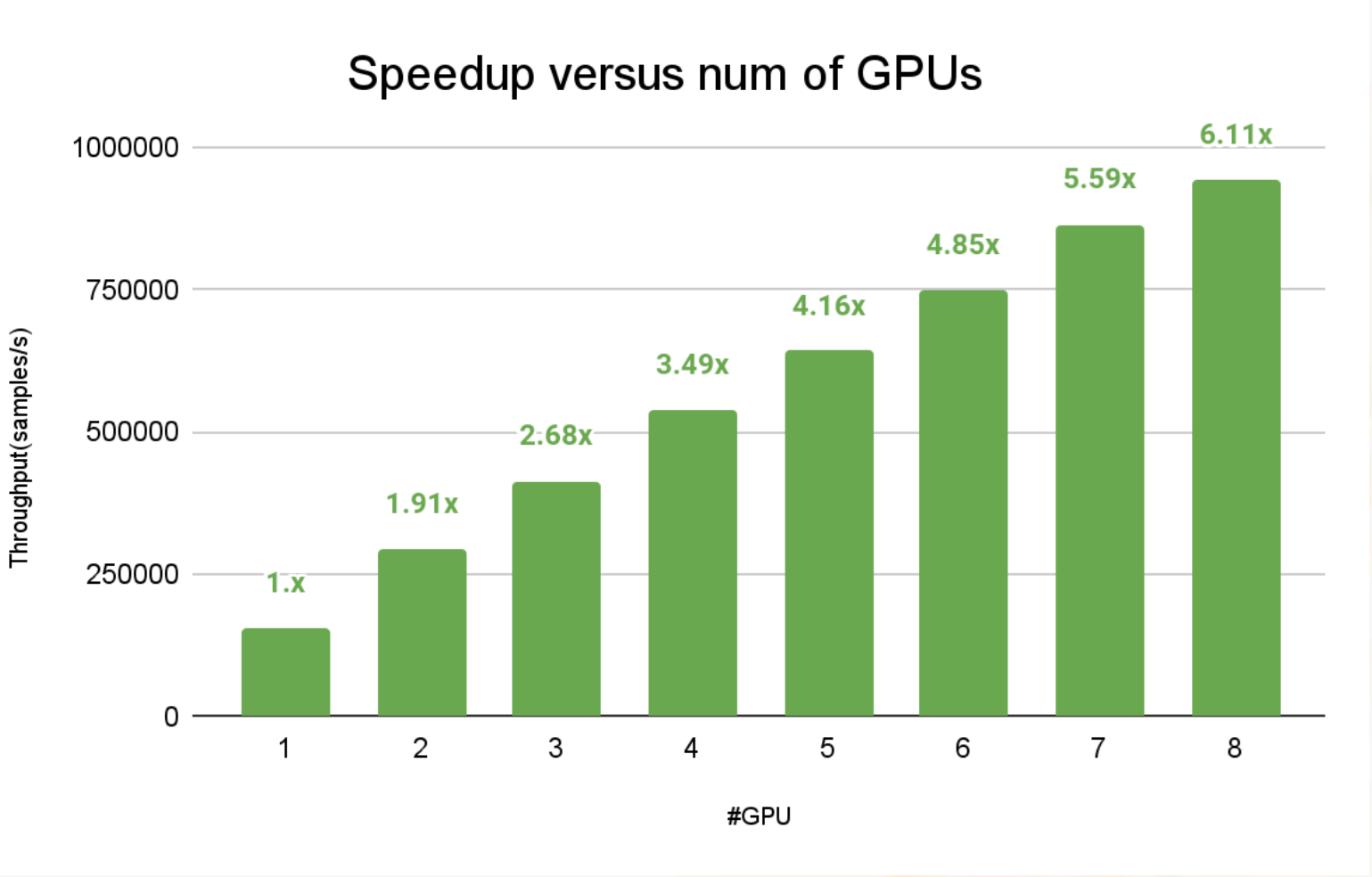


Distributed – SOK + Horovod

- Dense layer use Horovod to synchronize gradients
- Sparse layer (Embedding) use SOK to synchronize gradients and variables.

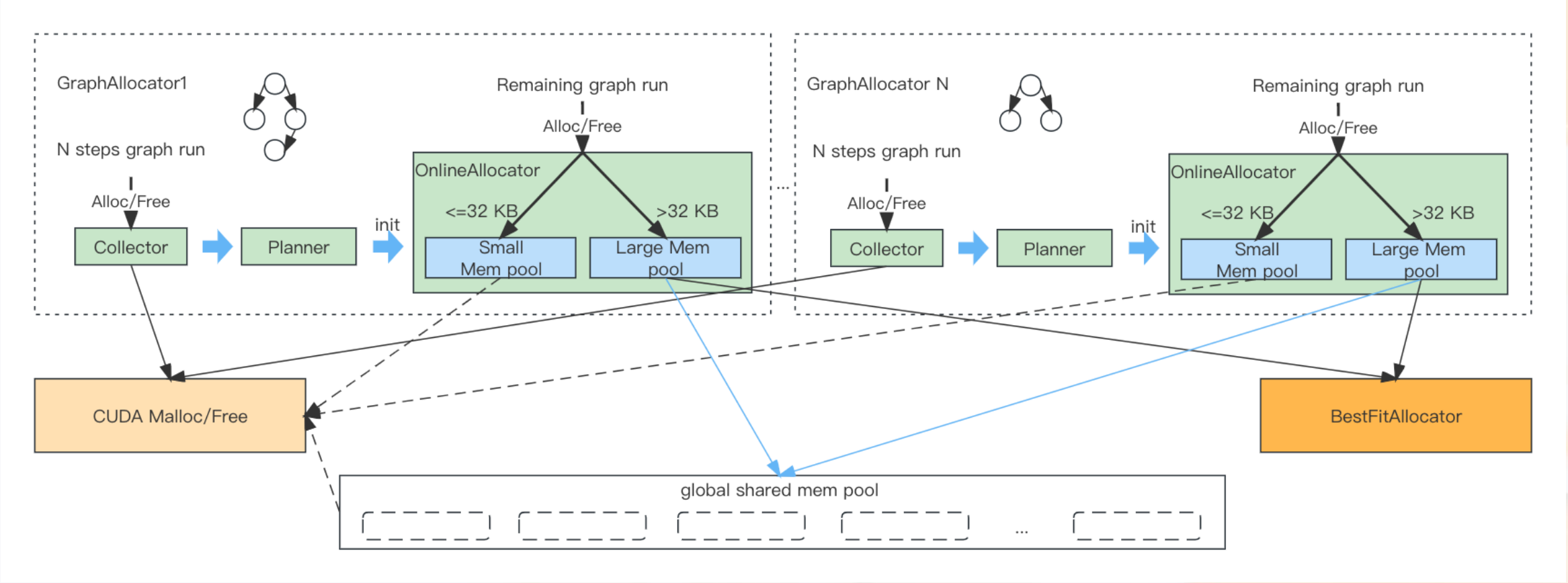


Distributed – SOK + Horovod

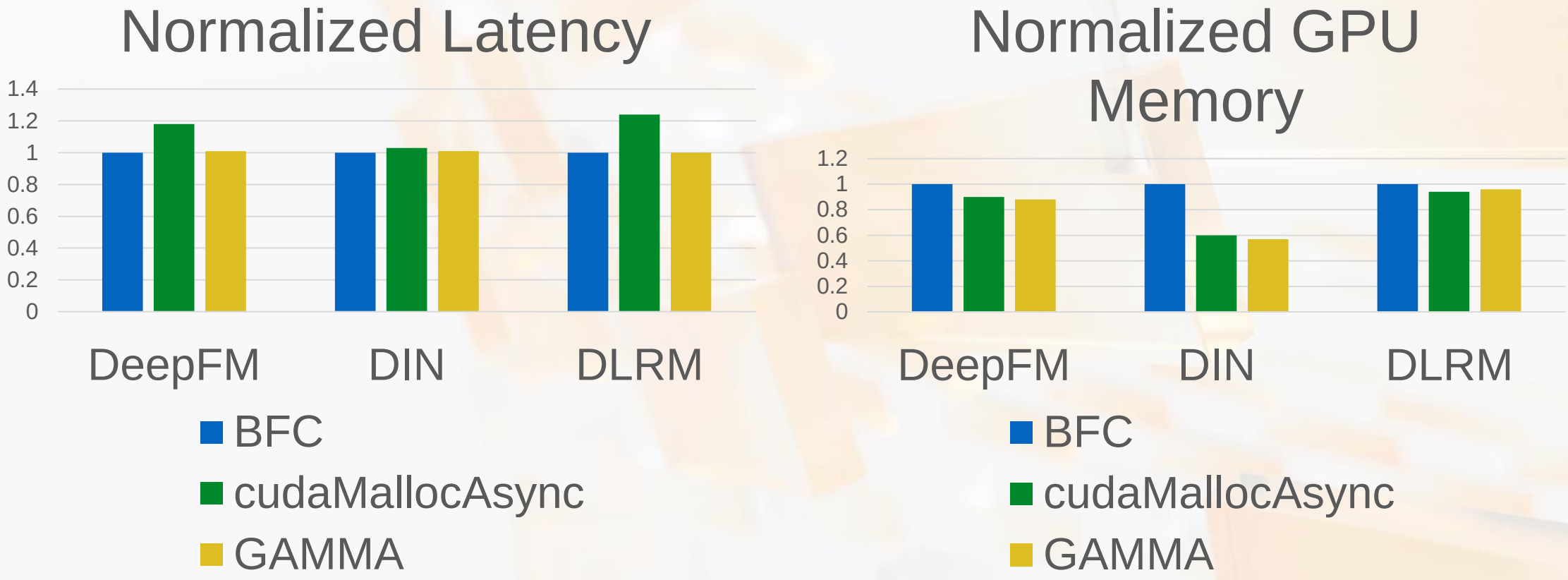


- Dataset: Train & eval dataset using Kaggle Display Advertising Challenge Dataset (Criteo Dataset)
- Model: DCNv2
- Platform:
  - 8 cores AMD EPYC 7232P CPU @ 3.20GHz.
  - DGXA100 (8x NVIDIA A100 SXM4 80 GB)
- Batch size per GPU: 8192

Runtime - Graph Aware Allocator

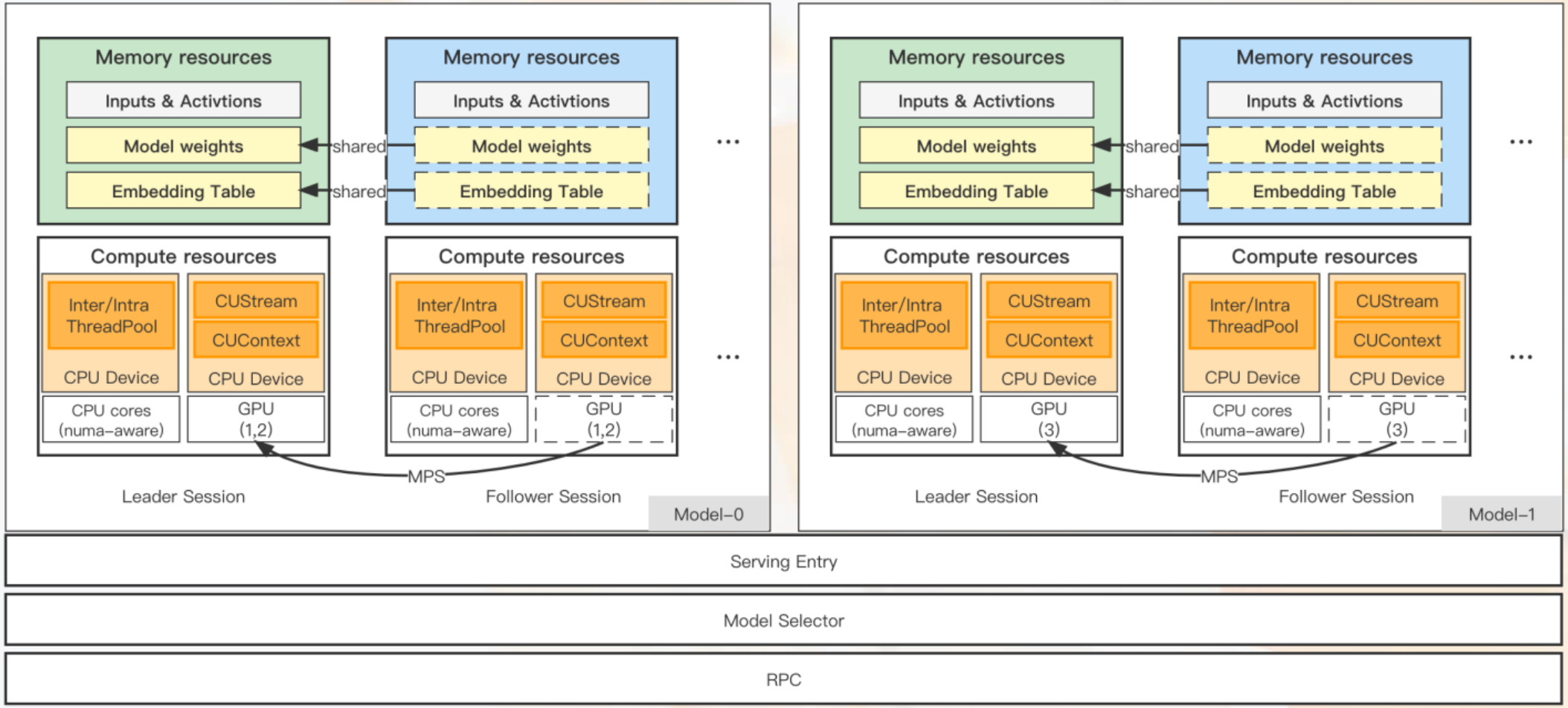


Runtime - Graph Aware Allocator

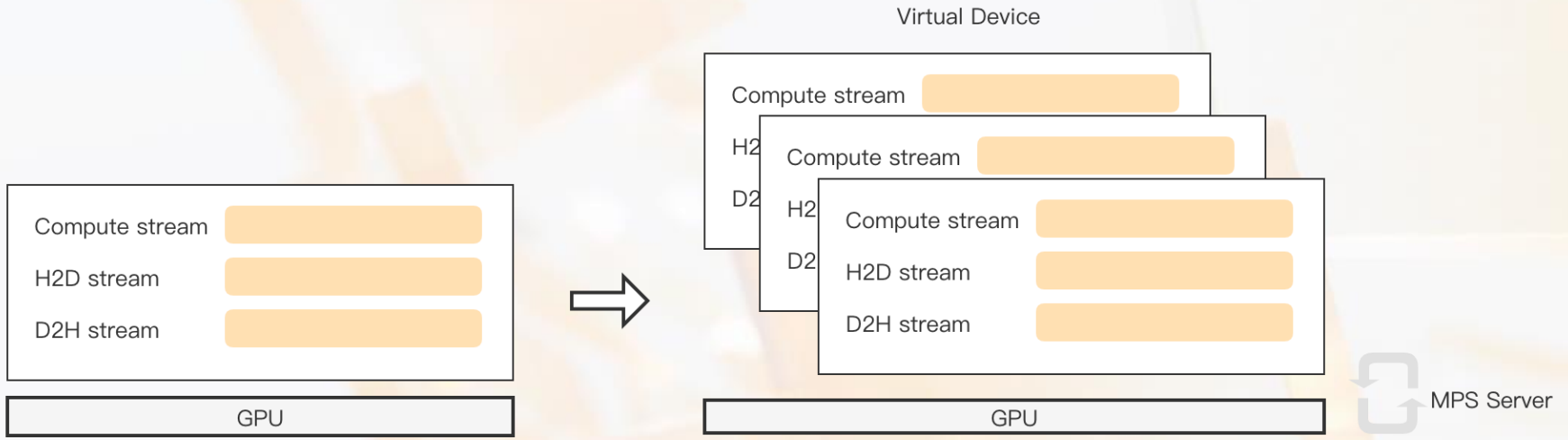


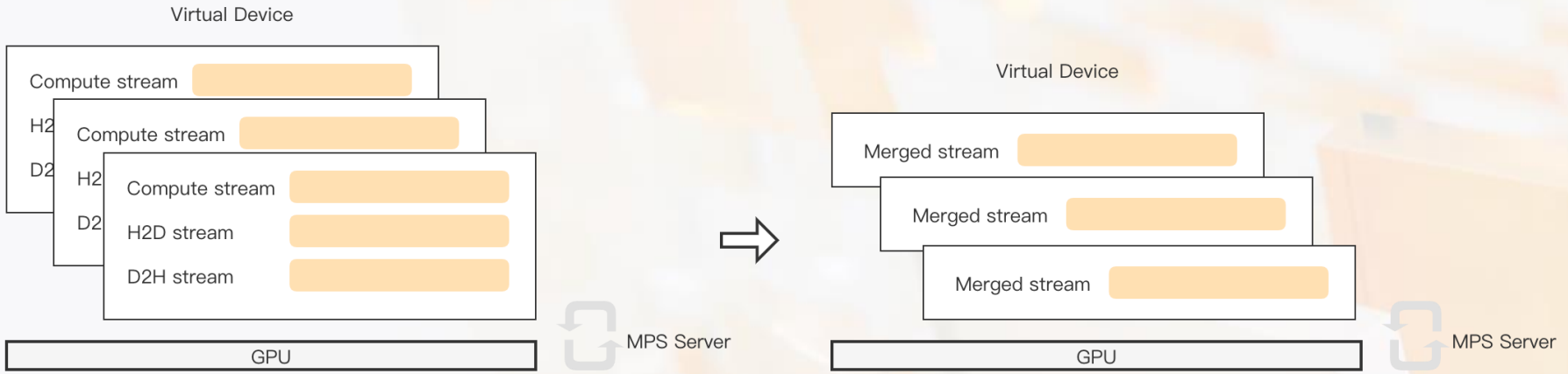
- GAMMA save 12%-43% GPU memory compare to BFC
- GAMMA improve performance at most 2%-24% compare to cudaMallocAsync

Inference - Share-nothing SessionGroup

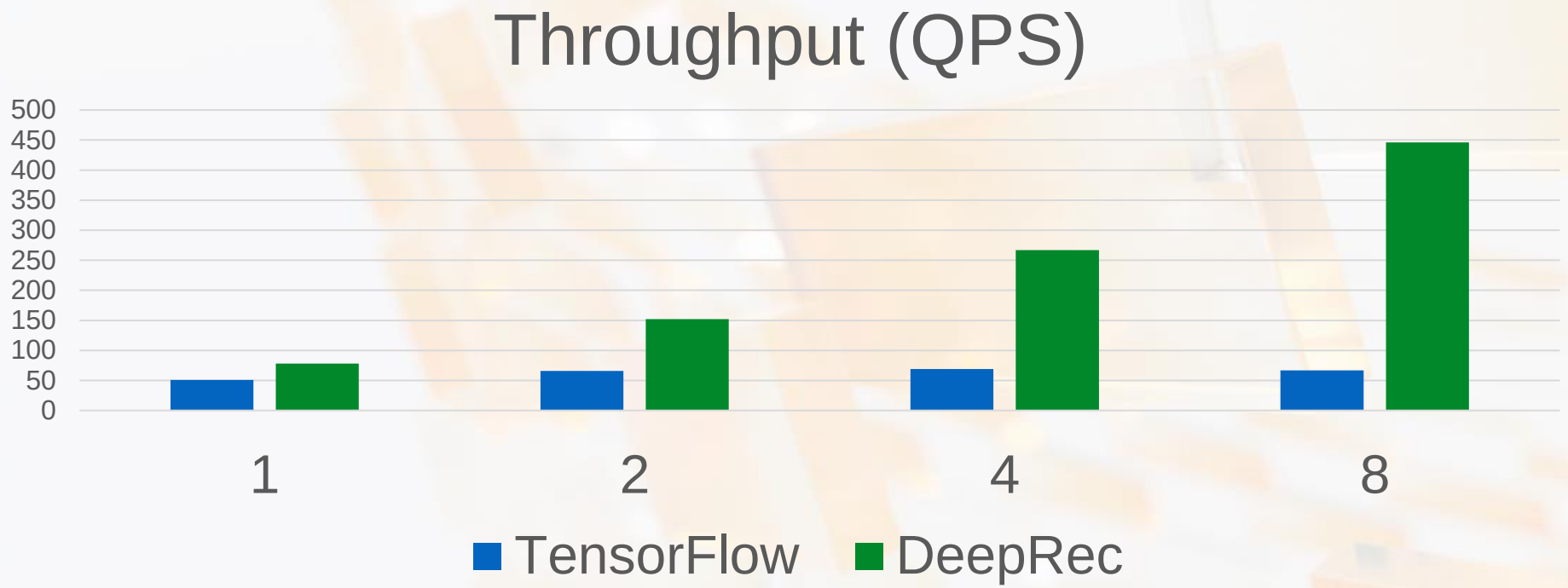


GPU Multi-stream in SessionGroup





GPU Multi-stream in SessionGroup



- DeepRec could brings **6X** QPS than TensorFlow.

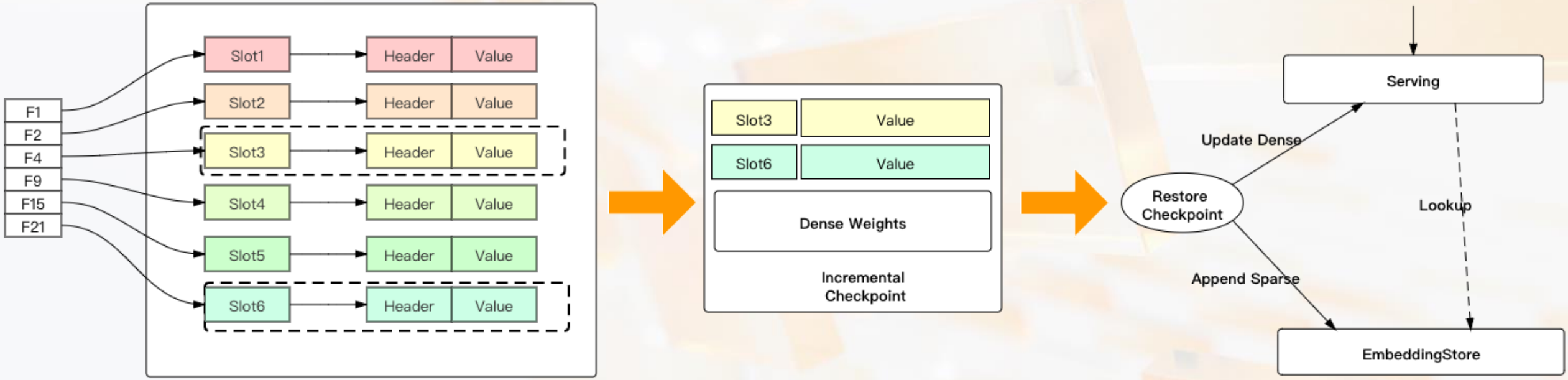
Deployment – Delta Checkpoint

Realtime User Interest

New Product

Daily Model Update

Deployment – Delta Checkpoint



- Short video, News apps have highly deployment frequency.
- Online Deep Learning:
  - Huge recommendation model (10TB) need to deploy online in minutes or tens of seconds.

Users Feedback

03

poizon.com

- POIZON is a fashion marketplace that curates global styles in extensive categories including shoes, clothing, luxury, etc.
- Monthly active users has reached 81 million and download exceeded 240 million.

- PV_CTR **+2.04%**
- Inference: QPS **+9X**, latency **-50%**

Weibo

- Weibo Corp is a China-based company mainly engaged in social media advertising business.
- Daily active users has reached 249 million, monthly active users exceed 573 million.

- Training: performance **+2X**
- Inference: QPS **+50%**, latency **-60%**

vivo

- vivo is a world leading brand of innovative smartphones and accessories.
- vivo global smartphone market shipments 24.9 million, global market share (8.6%)

- PV_CTR **+1.5%**
- Training: performance **+30%**
- Storage **-30%**
- Inference: QPS **+2X**, latency **-50%**

Himalaya

- Himalaya is an audiobook app that aims to provide a brand-new listening experience.
- Monthly active user 250 million. The biggest internet audio app in China.

- PV_CTR **+3.15%**
- Inference: QPS **+3X**, latency **-40%**

Requesting incubation at Sandbox Level in LF AI & Data

Welcome to join us
https://github.com/alibaba/DeepRec

Upcoming TAC Meetings

LF AI & DATA

Upcoming TAC Meetings

- April 20 – Project annual review (open to be scheduled)
- May 4 – Amundsen annual review (tentative)

Please note we are always open to special topics as well.

If you have a topic idea or agenda item, please send agenda topic requests to tac-general@lists.lfaidata.foundation

Open Discussion

LF AI & DATA

TAC Meeting Details

- To subscribe to the TAC Group Calendar, visit the wiki: https://wiki.lfaidata.foundation/x/cQB2 _____
- Join from PC, Mac, Linux, iOS or Android: https://zoom.us/j/430697670
- Or iPhone one-tap:
  - US: +16465588656,,430697670# or +16699006833,,430697670#
- Or Telephone:
  - Dial(for higher quality, dial a number based on your current location):
  - US: +1 646 558 8656 or +1 669 900 6833 or +1 855 880 1246 (Toll Free) or +1 877 369 0926 (Toll Free)
- Meeting ID: 430 697 670
- International numbers available: https://zoom.us/u/achYtcw7uN

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