NEURAL INFORMATION PROCESSING SYSTEMS

PubSub-VFL: Towards Efficient Two-Party Split Learning in Heterogeneous Environments via Publisher/Subscriber Architecture

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BACKGROUND

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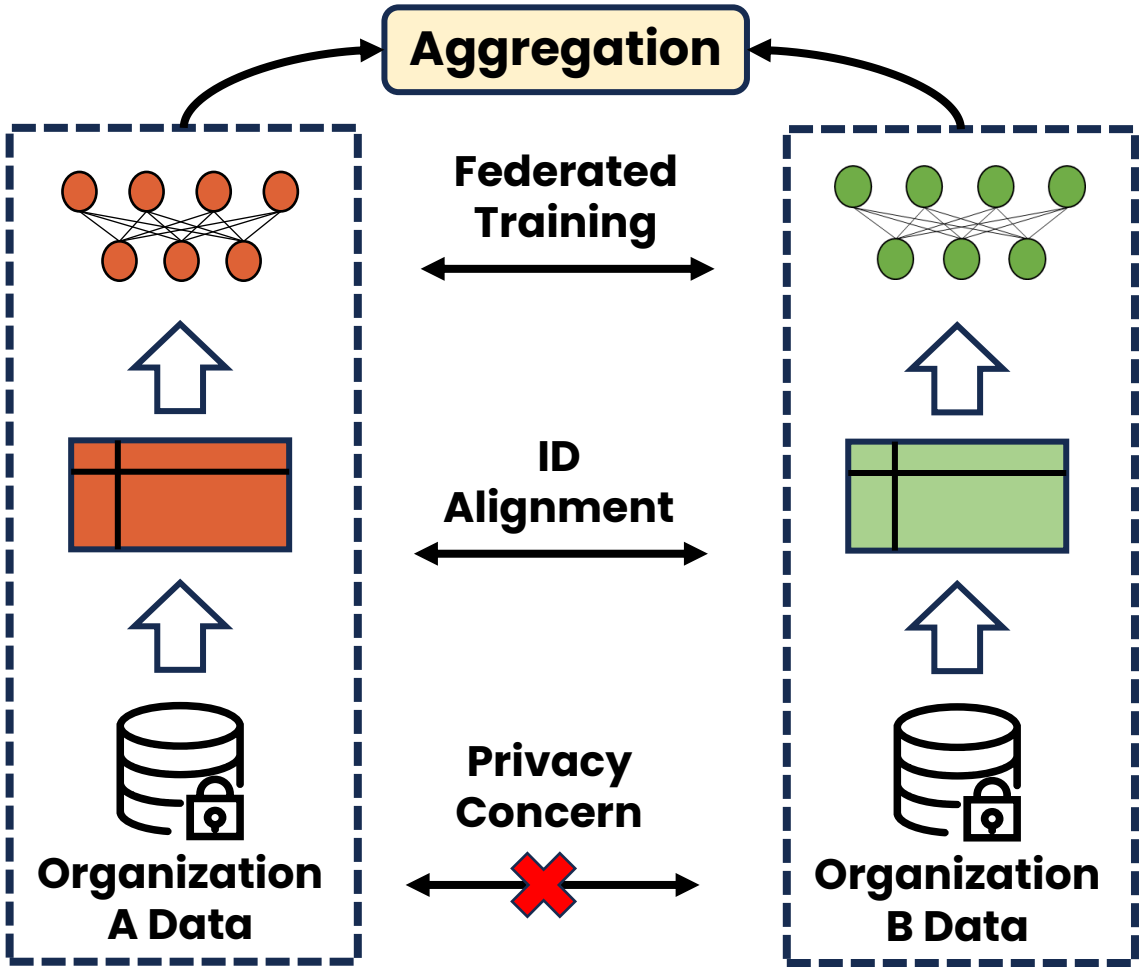
Vertical Federated Learning (VFL) is applicable to the cases that two data sets share the same sample ID space but differ in feature space.



Organization A Data

ID	x1	x2	x3	y
0	value	value	value	0
1	value	value	value	1
2	value	value	value	0
3	value	value	value	1

Organization B Data

ID	x4	x5	x6	x7
0	value	value	value	value
2	value	value	value	value
3	value	value	value	value
4	value	value	value	value

Split Learning-based VFL

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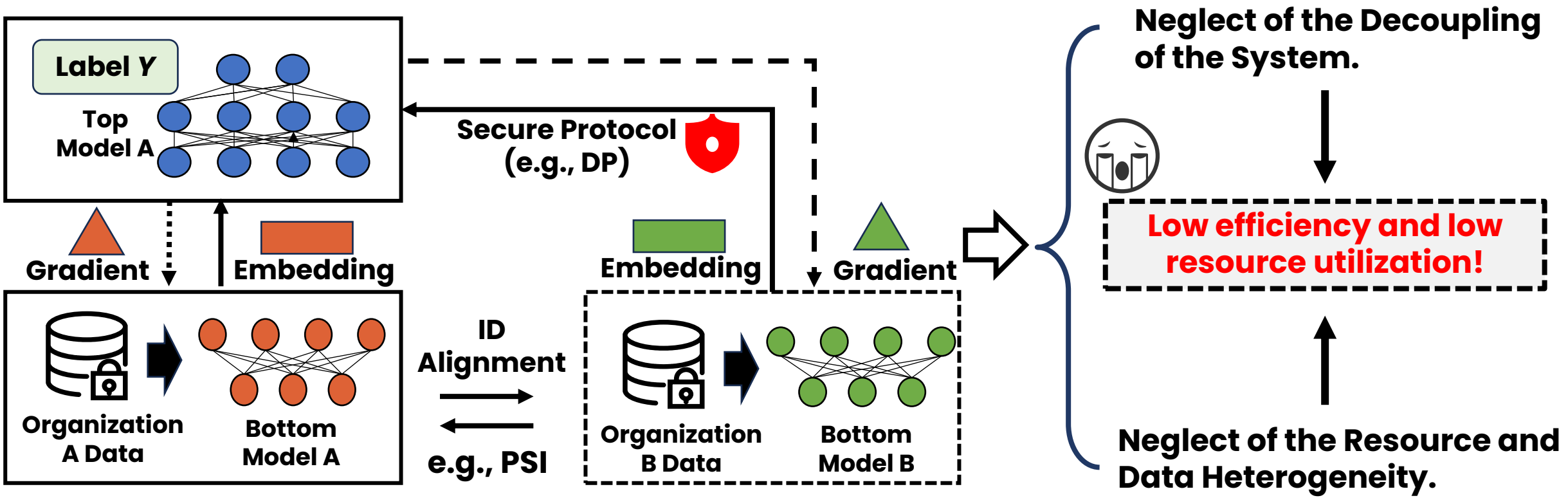
Two-Party Split Learning-based VFL has emerged as a promising solution for secure collaborative learning.



Overview of the split learning-based VFL framework.

PubSub-VFL

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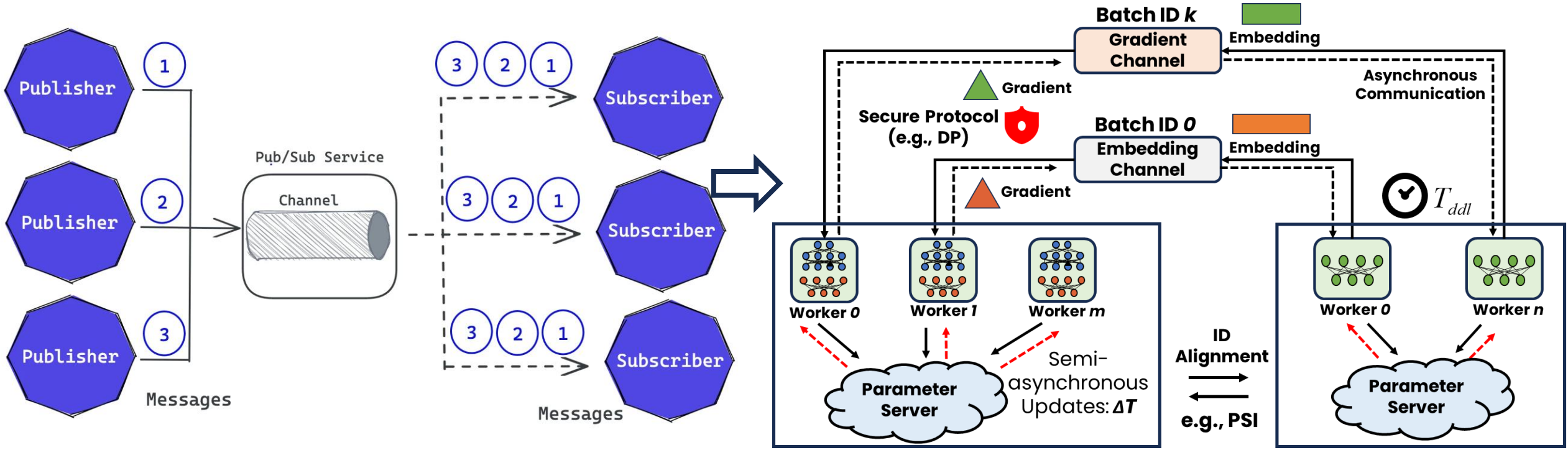
Core Design 1: We first leverage the ***loose coupling of the PubSub*** model to enable asynchronous exchange of gradients and embeddings in VFL, thereby improving efficiency.



PubSub Model **PubSub-VFL Model**

PubSub-VFL

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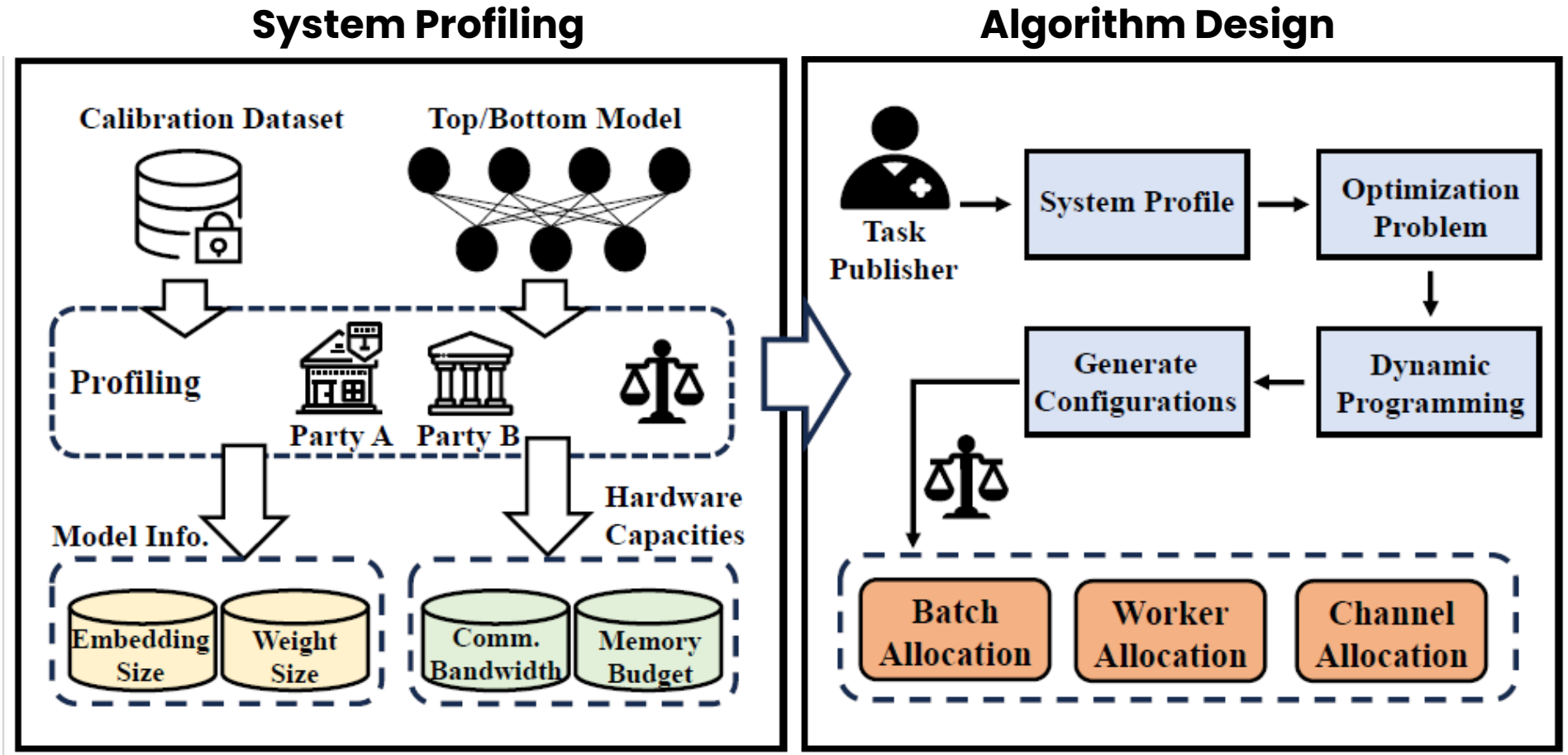
Core Design 2: We ***formalize an optimization problem*** based on participants' system profiles, enabling the selection of optimal hyperparameters while preserving privacy to mitigate the training imbalance caused by resource and data heterogeneity.



RESULTS

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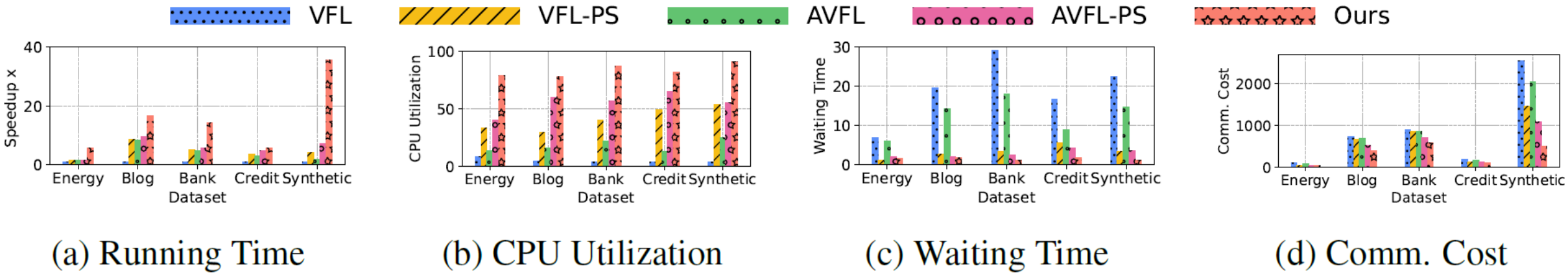

Fig. 1. Comparison with existing baselines in computation and communication efficiency.

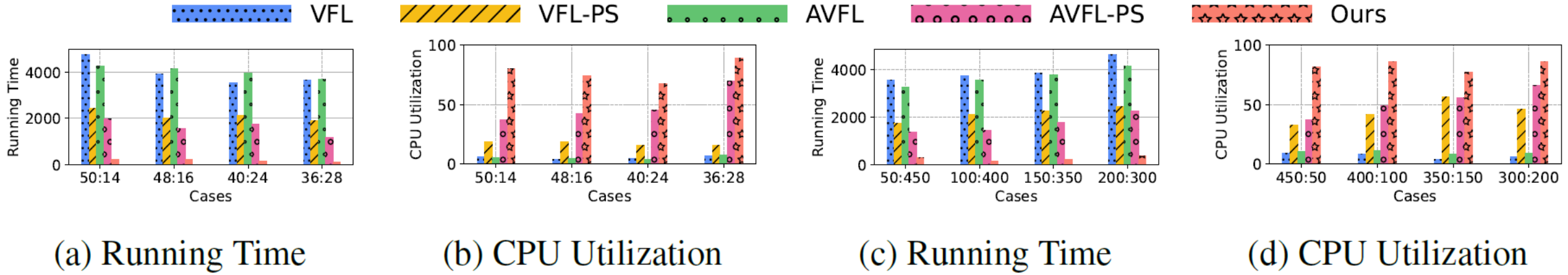

Fig. 2. Comparison with existing baselines on computation efficiency in resource and data heterogeneous scenarios.

RESULTS

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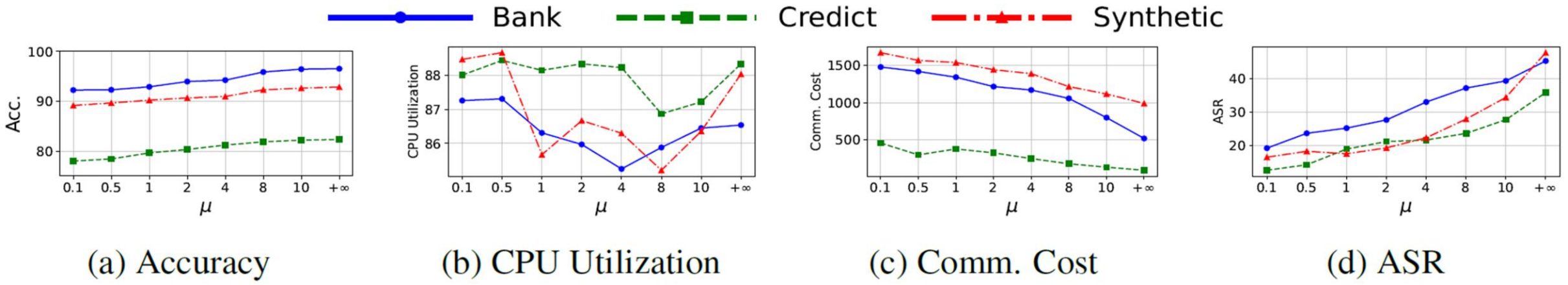

Fig. 3. The impact of privacy budget on the performance, efficiency, and security of PubSub-VFL.

Table 1: Effect of the number of workers.

# of Workers	4	5	**8***	10	20	30	50
Acc.(%)	92.13	92.05	**92.06**	92.28	92.00	92.36	92.21
Time (s)	712.78	805.90	**668.11**	885.01	1420.32	1067.57	1661.74
CPU (%)	67.52	63.30	**88.04**	76.18	42.77	40.78	45.12
Waiting (s)	1.4686	1.9273	**1.5288**	3.461	8.088	9.687	19.843
Comm. (MB)	878.91	1098.63	**888.77**	1318.36	1867.68	1538.09	2197.27

Table 2: Effect of the different batch size.

Batch Size	16	32	64	128	**256**	512	1024
Acc.(%)	91.70	92.06	91.75	92.63	**92.67**	92.36	92.21
Time (s)	987.64	668.11	344.76	124.01	**92.54**	578.69	865.74
CPU (%)	48.64	88.04	90.12	89.97	**91.07**	84.47	52.67
Waiting (s)	1.087	1.5288	1.688	1.263	**1.1389**	1.324	1.789
Comm. (MB)	1298.32	888.77	329.59	439.45	**439.45**	736.89	1070.36

Thanks for your Listening!