



中山大学

SUN YAT-SEN UNIVERSITY

Asteroid: Resource-Efficient Hybrid Pipeline Parallelism for Collaborative DNN Training on Heterogeneous Edge Devices

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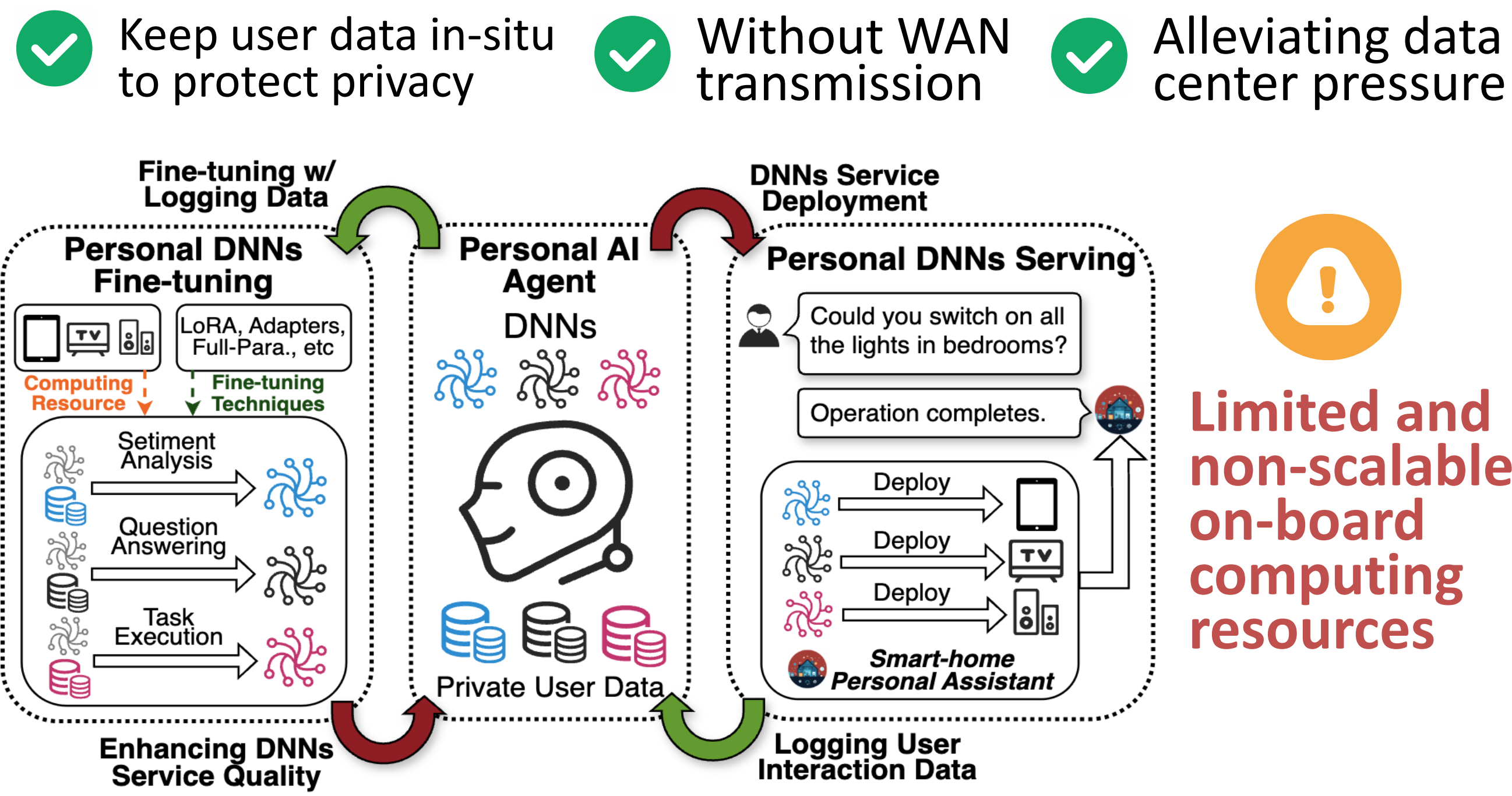
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² The Hong Kong University of Science and Technology (Guangzhou)

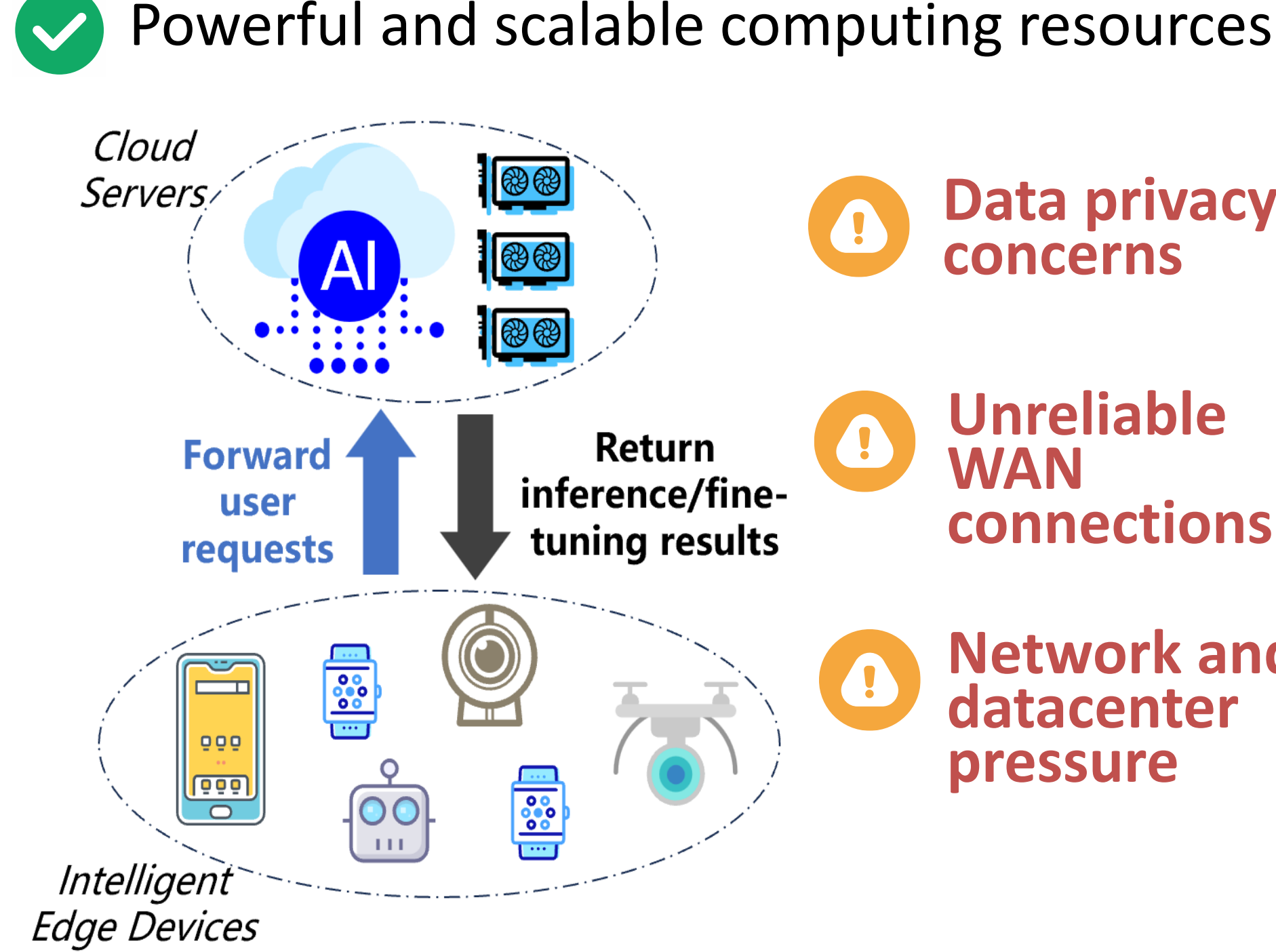
³ The Chinese University of Hong Kong

Introduction

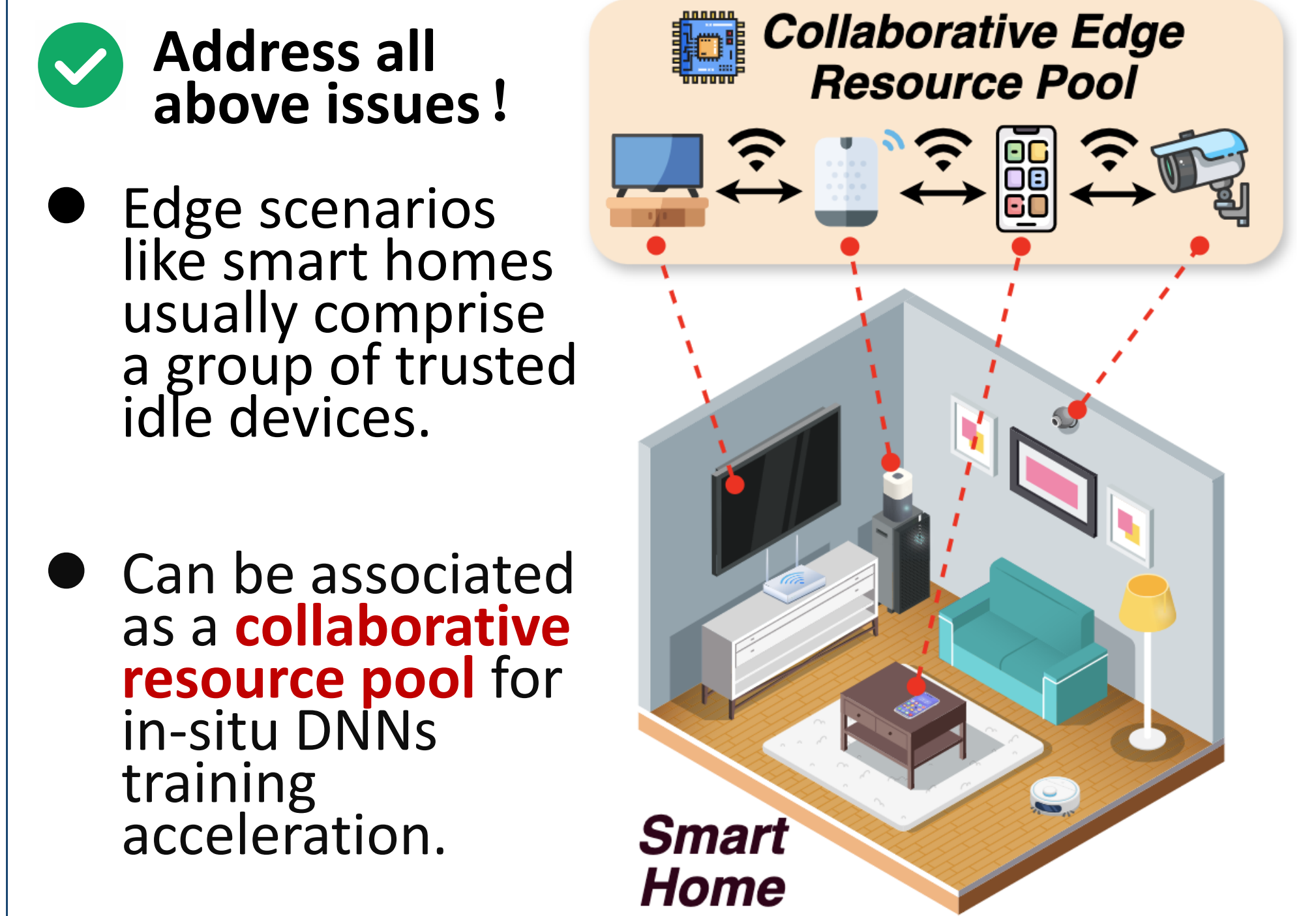
On-Device Deployment



Cloud-Based Deployment

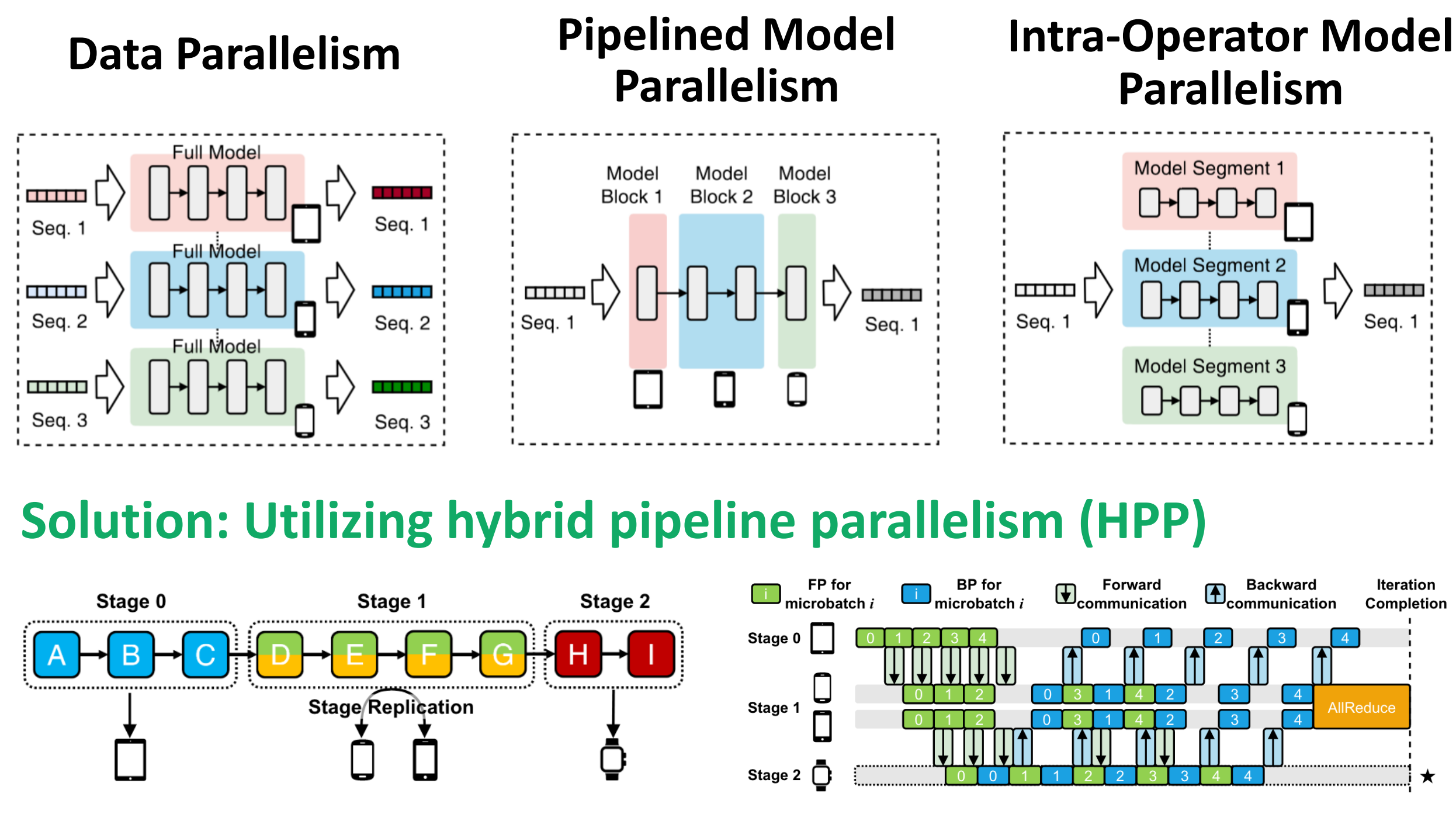


Collaborative Edge Computing

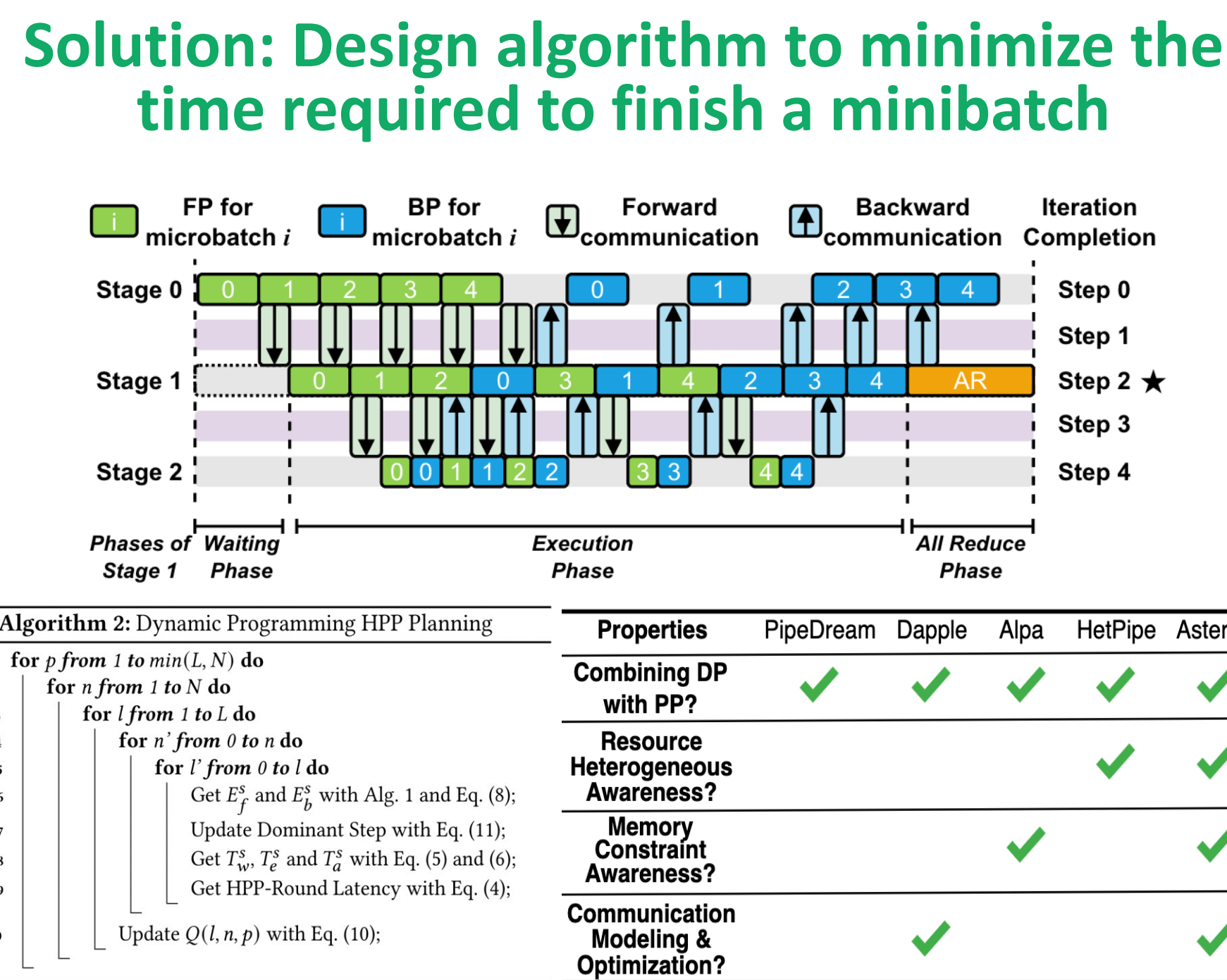


Challenges

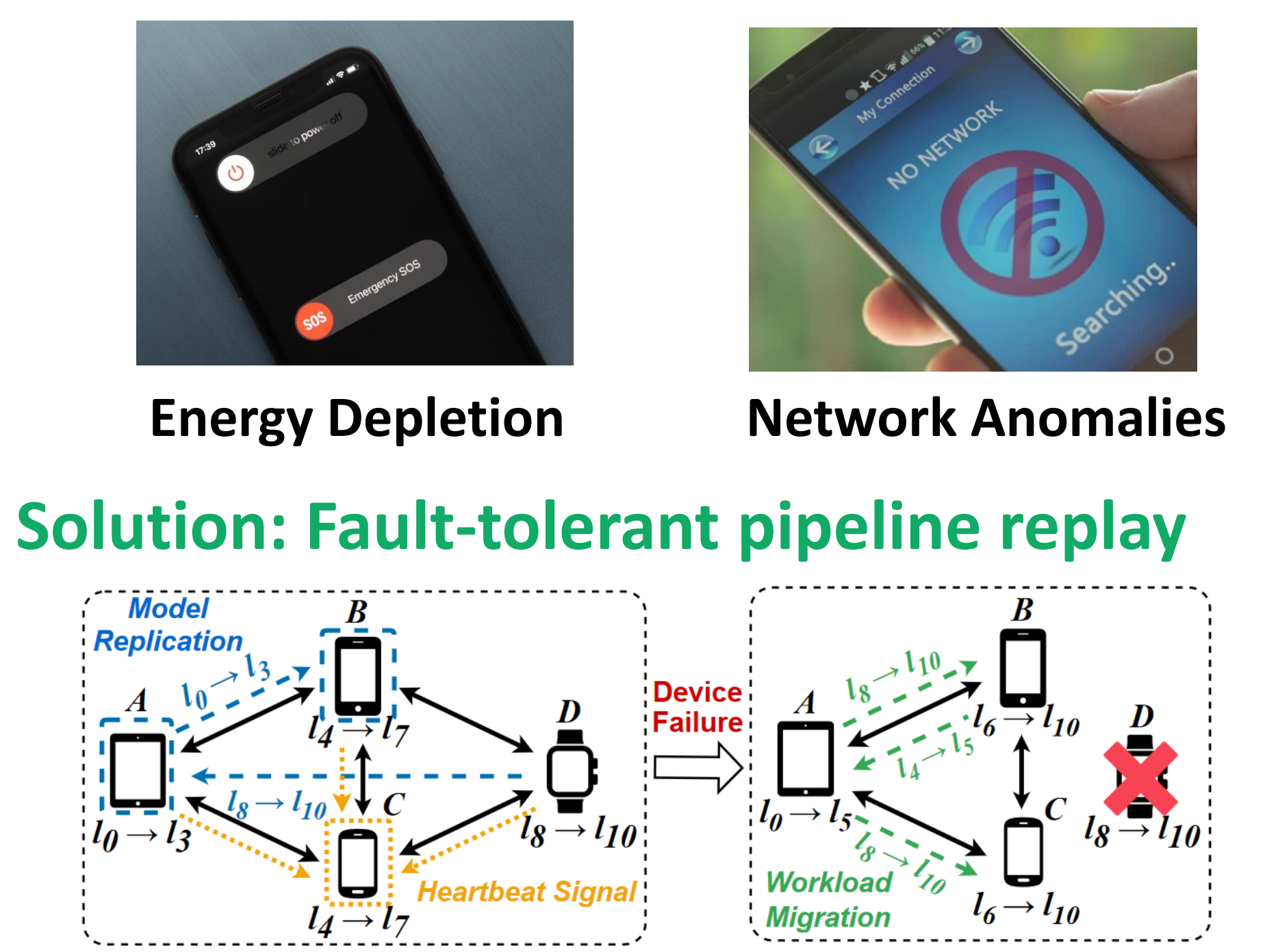
Challenge #1: How to select best parallelism architecture.



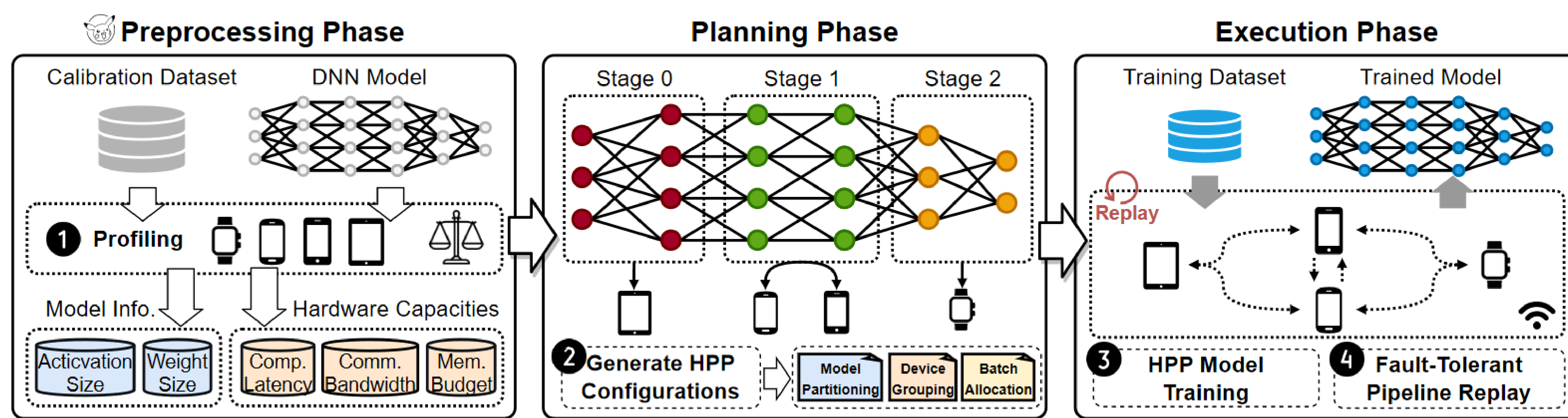
Challenge #2: How to tailor parallelism planning for heterogeneous devices.



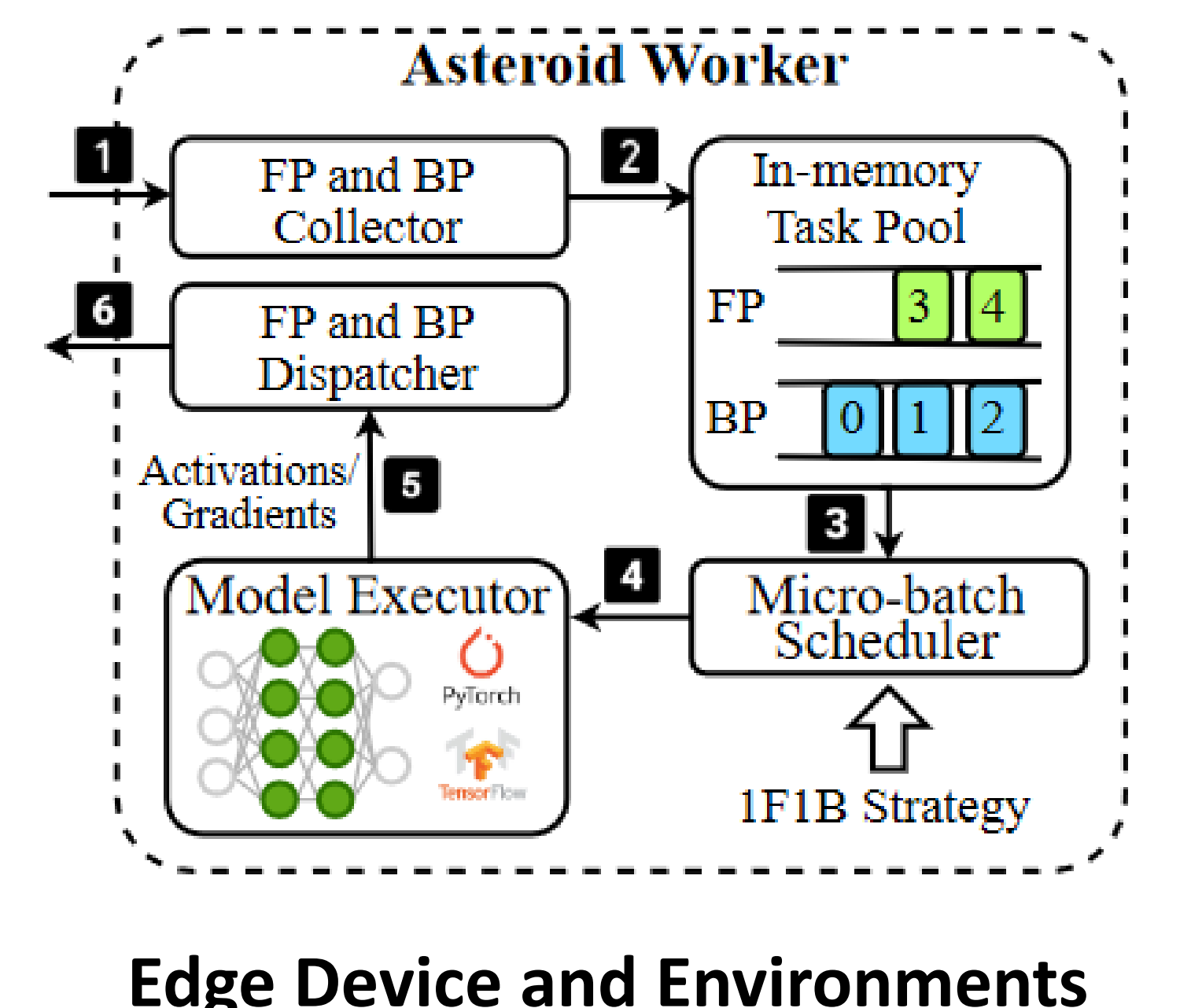
Challenge #3: How to render robust training under dynamic edge environment.



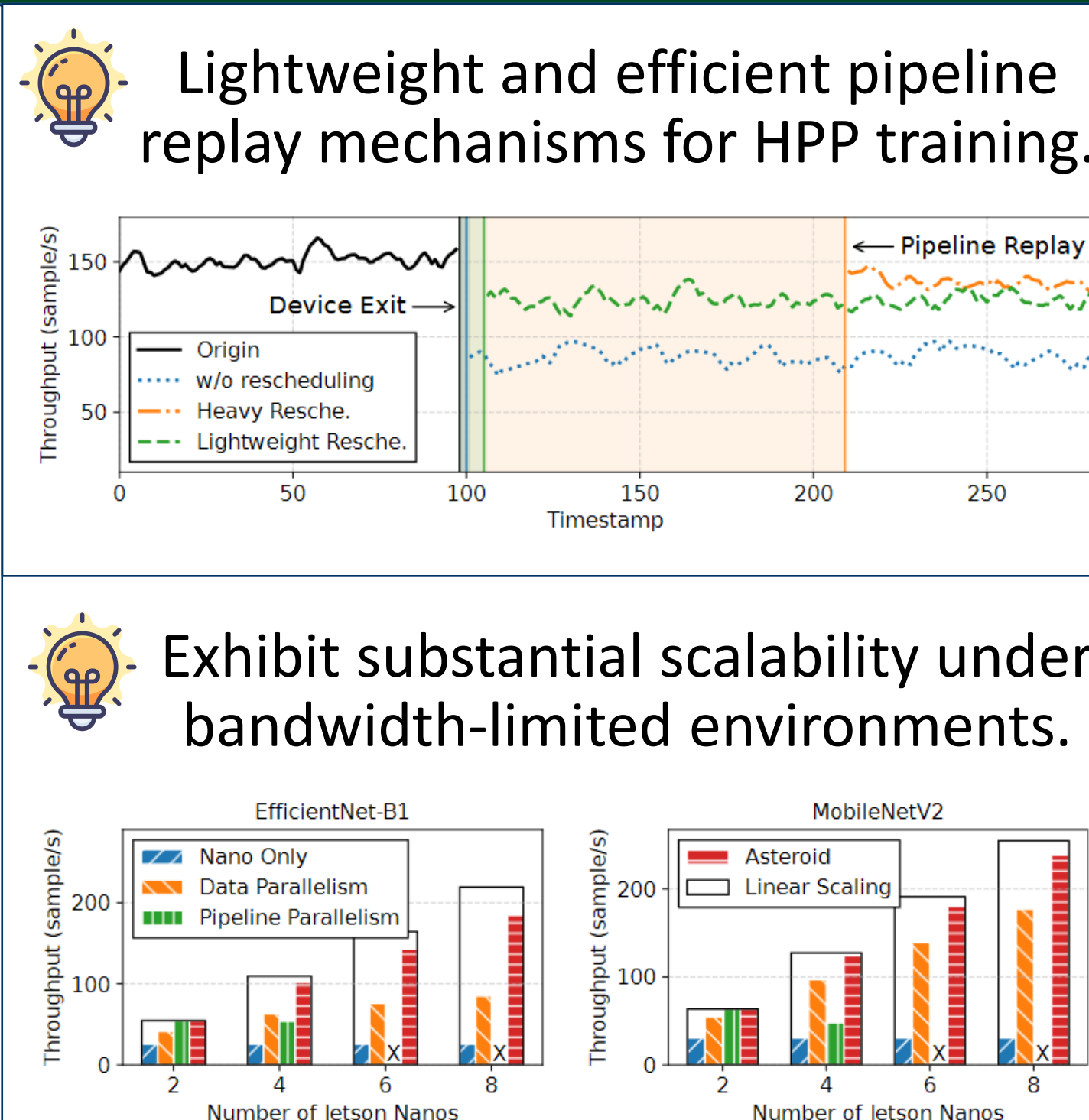
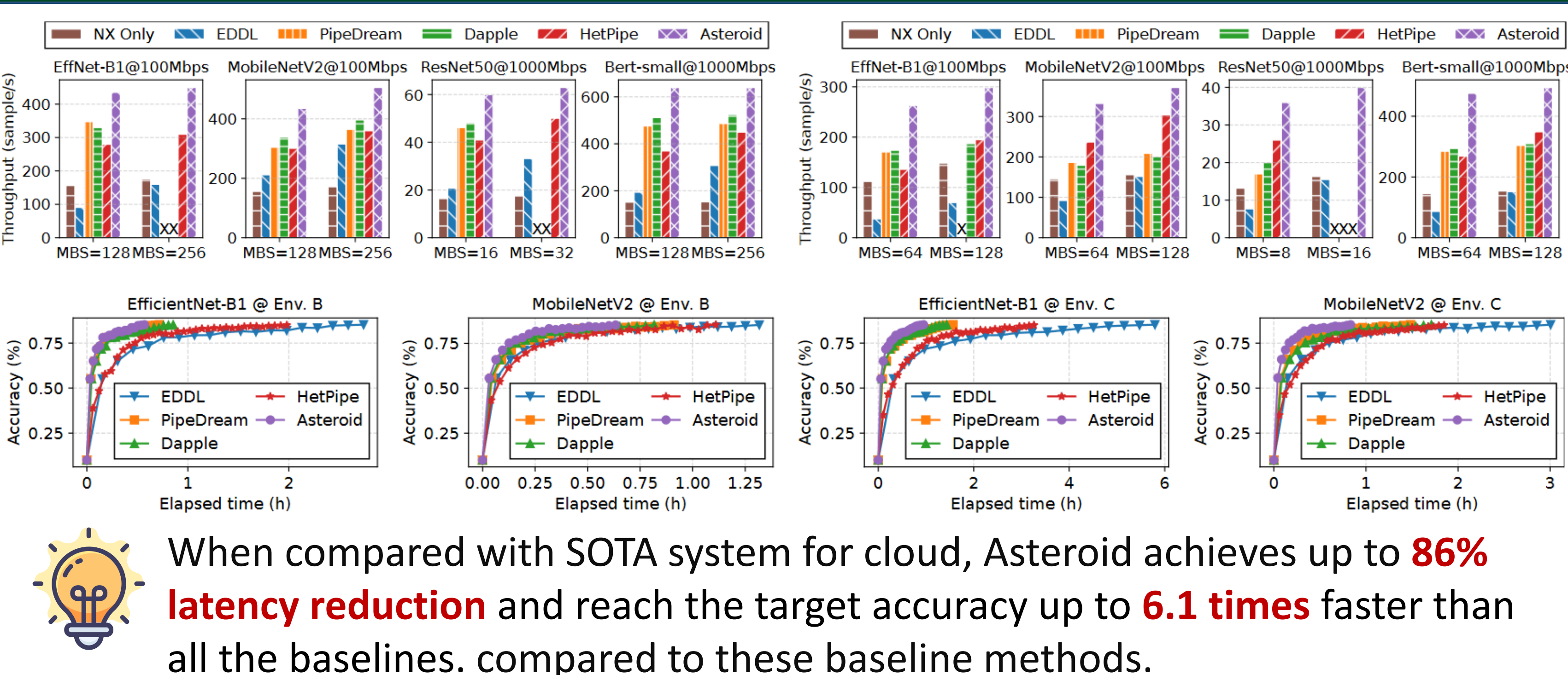
Asteroid: System Overview



Asteroid: Implementation



Evaluation Results



Edge Device and Environments

Edge Device	GPU Processor	Memory
Jetson Nano [2]	128-core NVIDIA Maxwell	4GB
Jetson TX2 [1]	256-core NVIDIA Pascal	8GB
Jetson NX [3]	384-core NVIDIA Volta	8GB

ID	Devices	ID	Devices
A	5 × Nano	C	1 × NX, 2 × TX2, 3 × Nano
B	3 × NX, 2 × TX2	D	1 × TX2, 3 × Nano

Conclusion

This paper proposes Asteroid for collaborative DNN training across heterogeneous and resource-constrained edge devices. Asteroid addresses multiple challenges faced in edge environments and achieves **12.2×** faster training than traditional methods and **2.1×** faster than state-of-the-art HPP methods.

Acknowledgements

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