

The 38th Annual Conference on Neural Information Processing Systems (NeurIPS 2024)

SILENCE: Protecting privacy in offloaded speech understanding on resource-constrained devices

Dongqi Cai¹, Shangguang Wang¹, Zeling Zhang¹,
Felix Xiaozhu Lin², Mengwei Xu¹

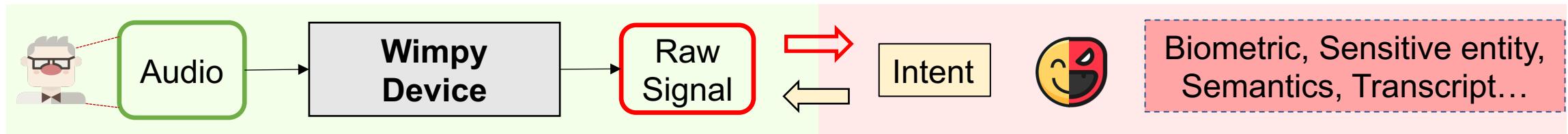


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² University of Virginia

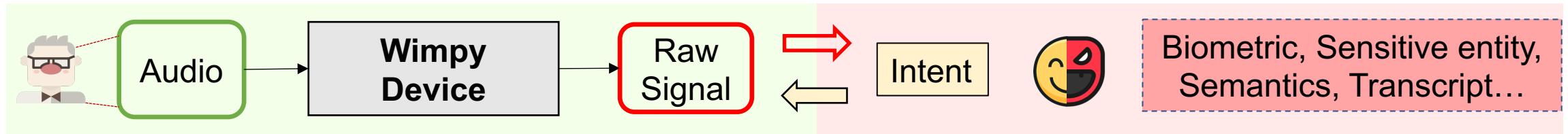


Privacy concern for cloud speech service

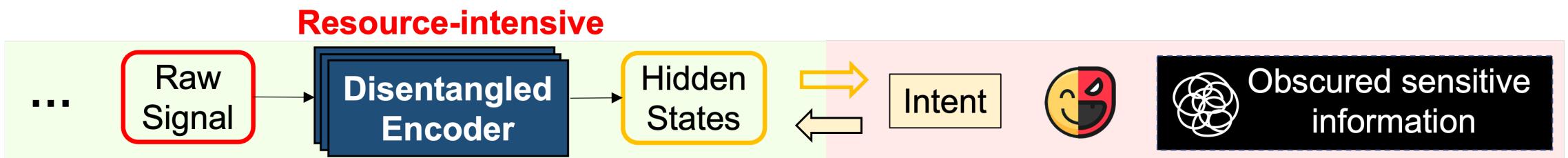


(a). Offloaded speech understanding on wimpy devices

Privacy concern for cloud speech service

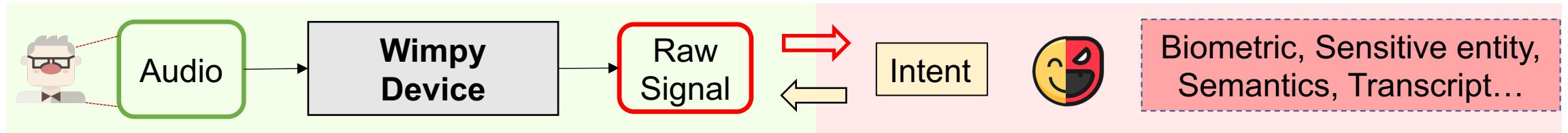


(a). Offloaded speech understanding on wimpy devices

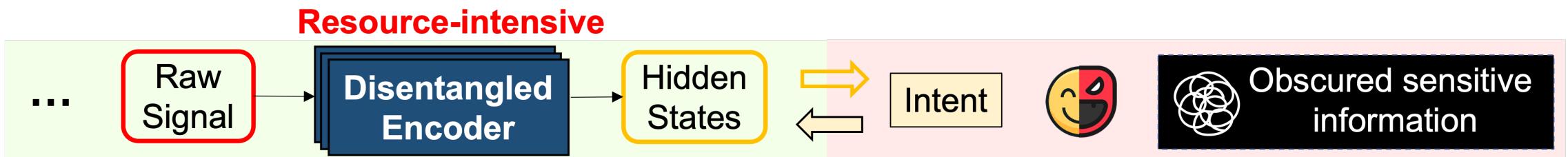


(b). Previous approaches to protect speech privacy

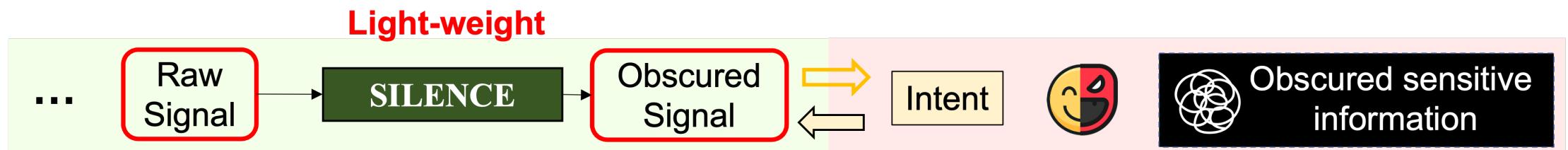
Privacy concern for cloud speech service



(a). Offloaded speech understanding on wimpy devices

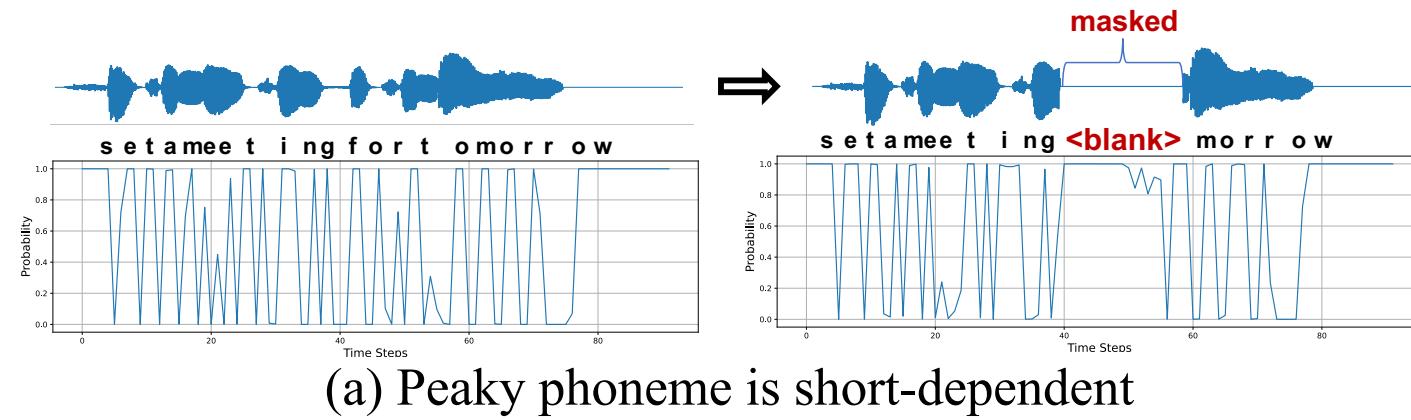


(b). Previous approaches to protect speech privacy

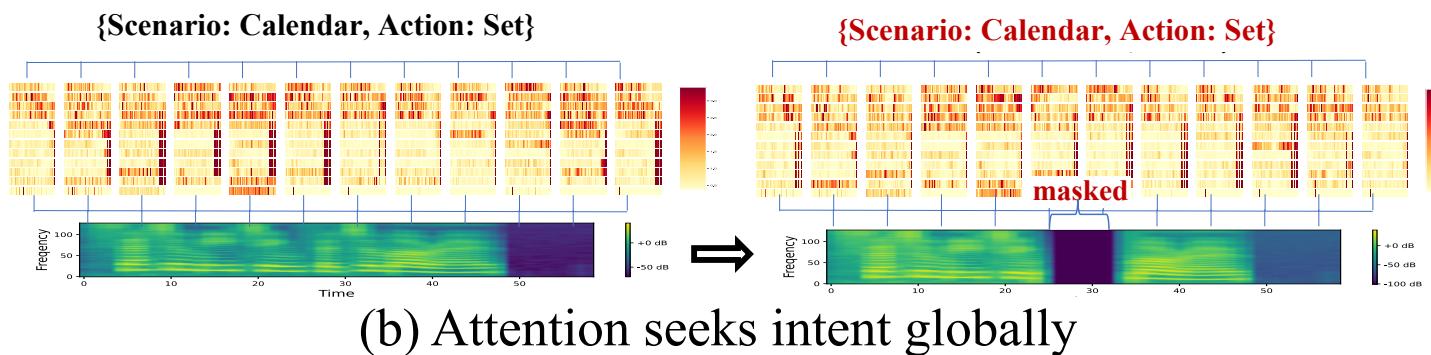
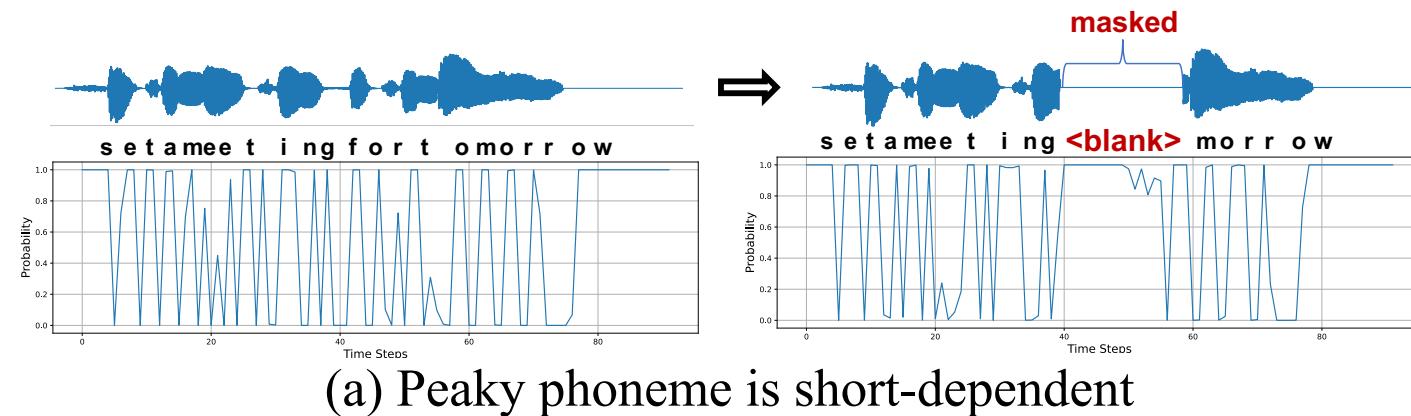


(c). Our SILENCE: a novel asymmetric dependency-based encoder

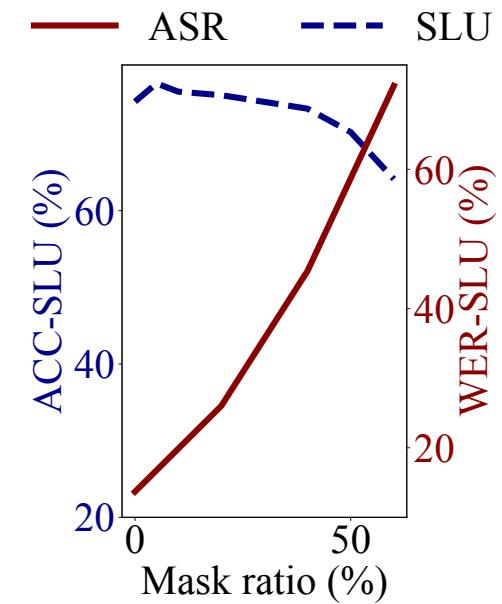
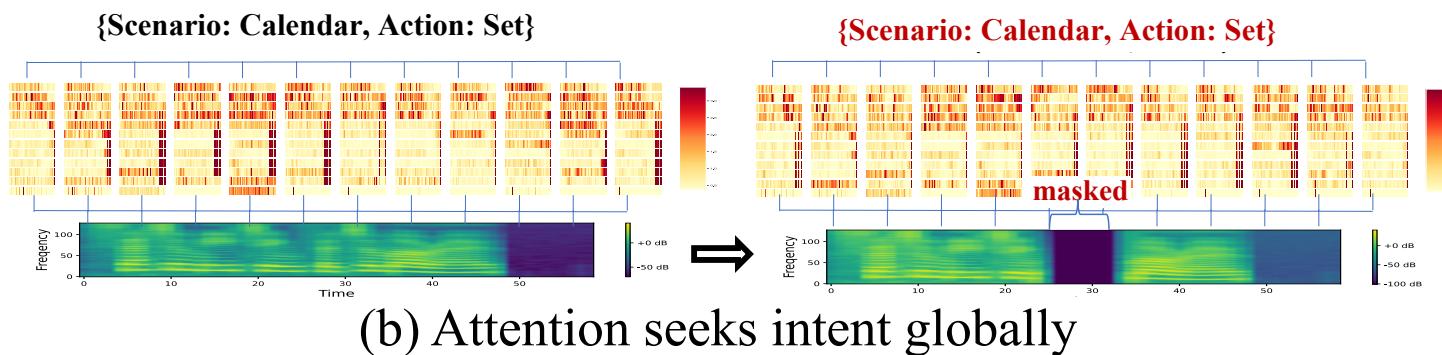
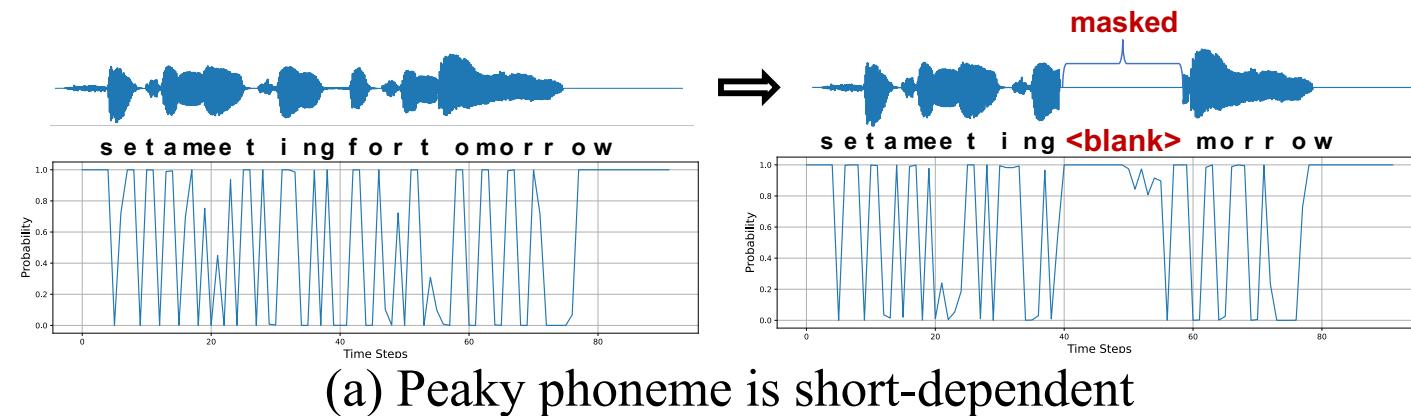
Observation: Asymmetric dependency



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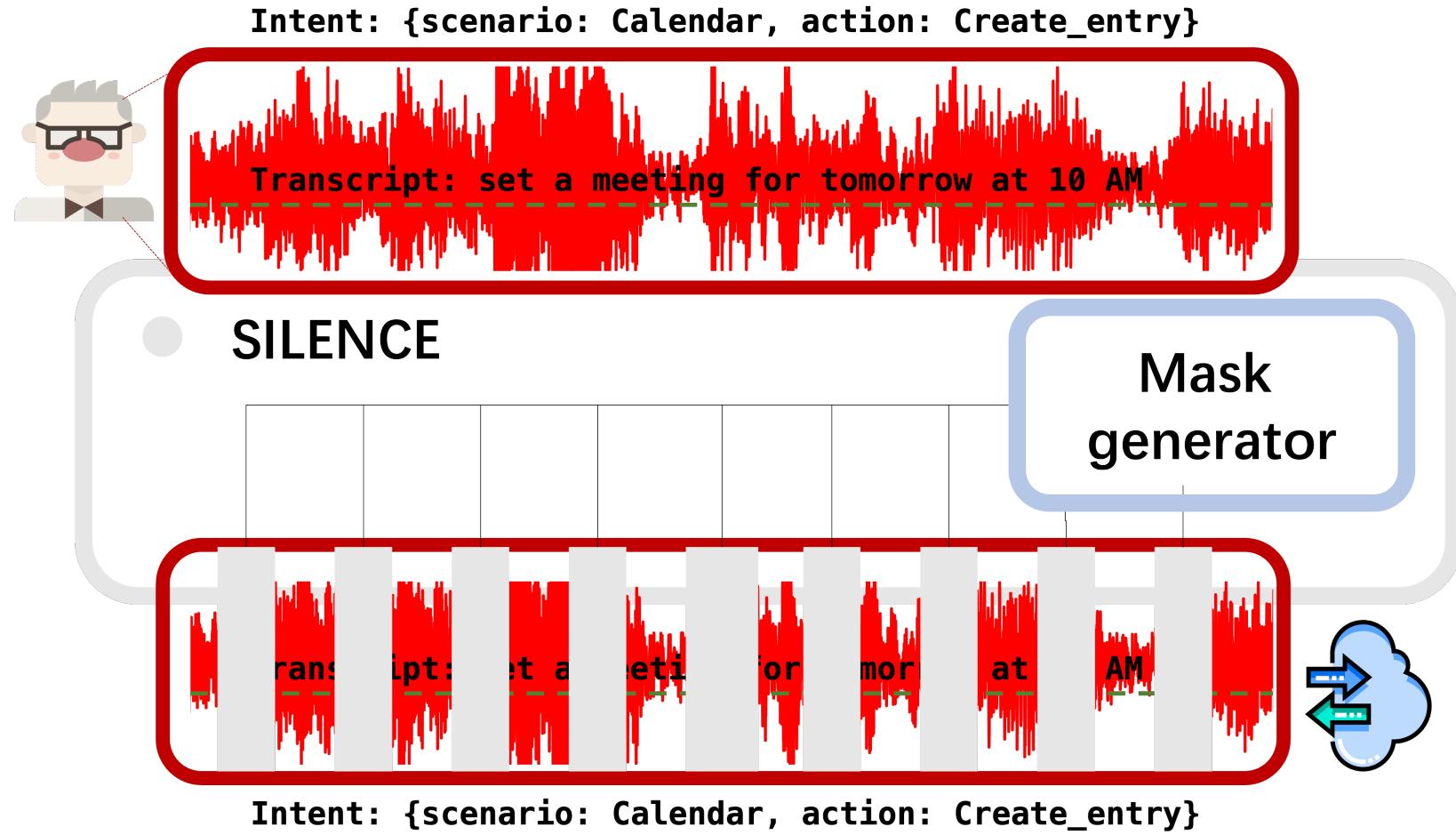


Observation: Asymmetric dependency

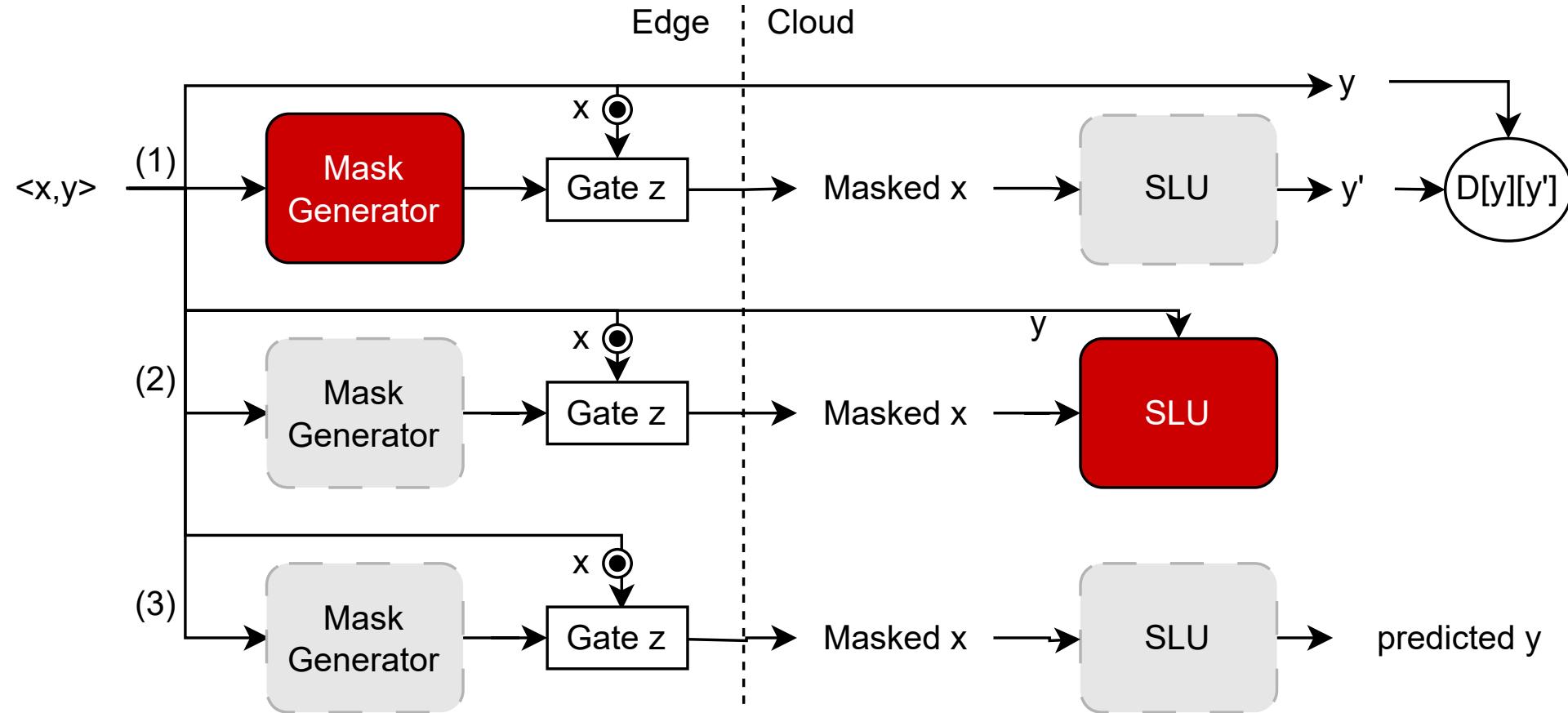


(c) Empirical performance under different ratios of masked portion.

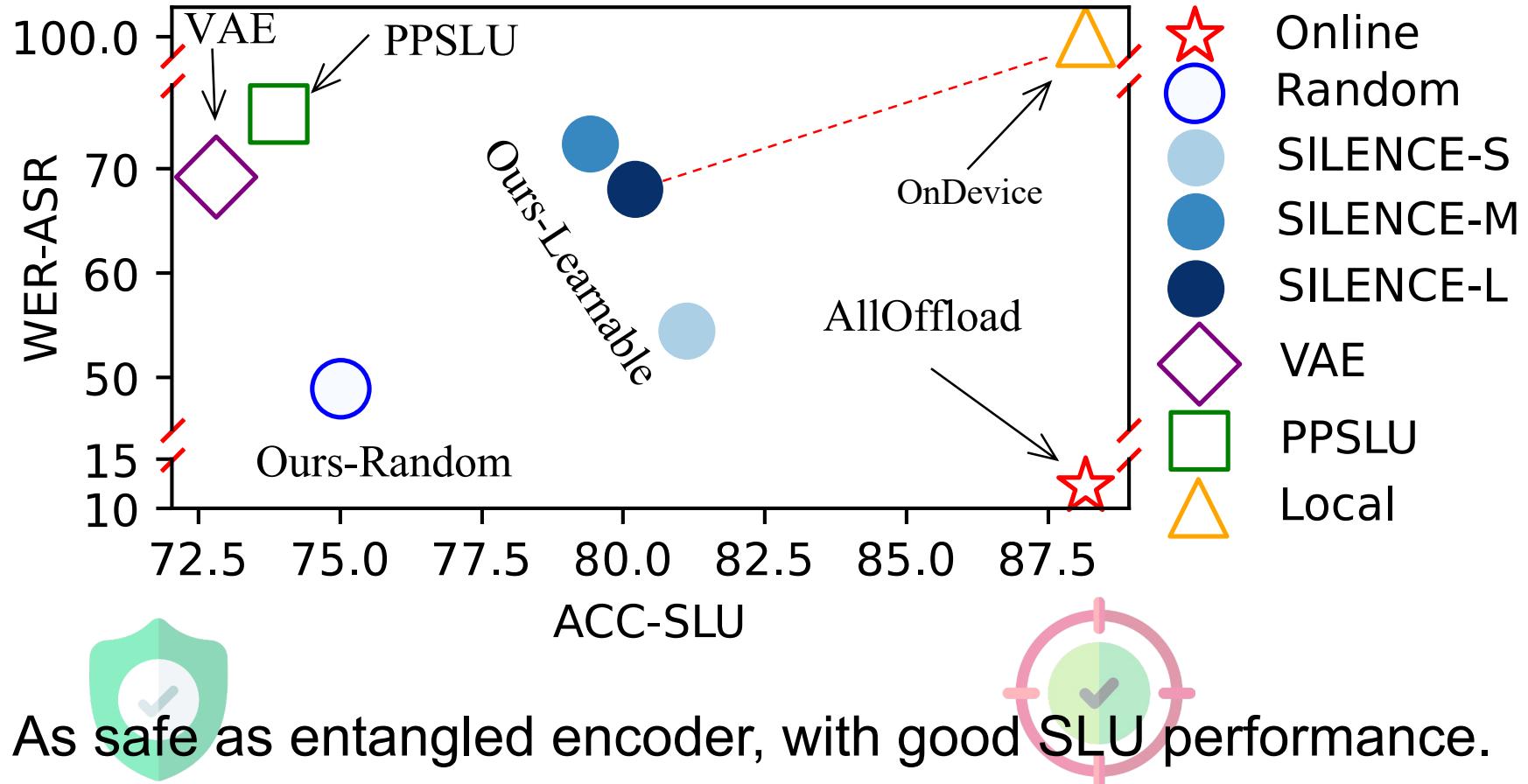
System overview



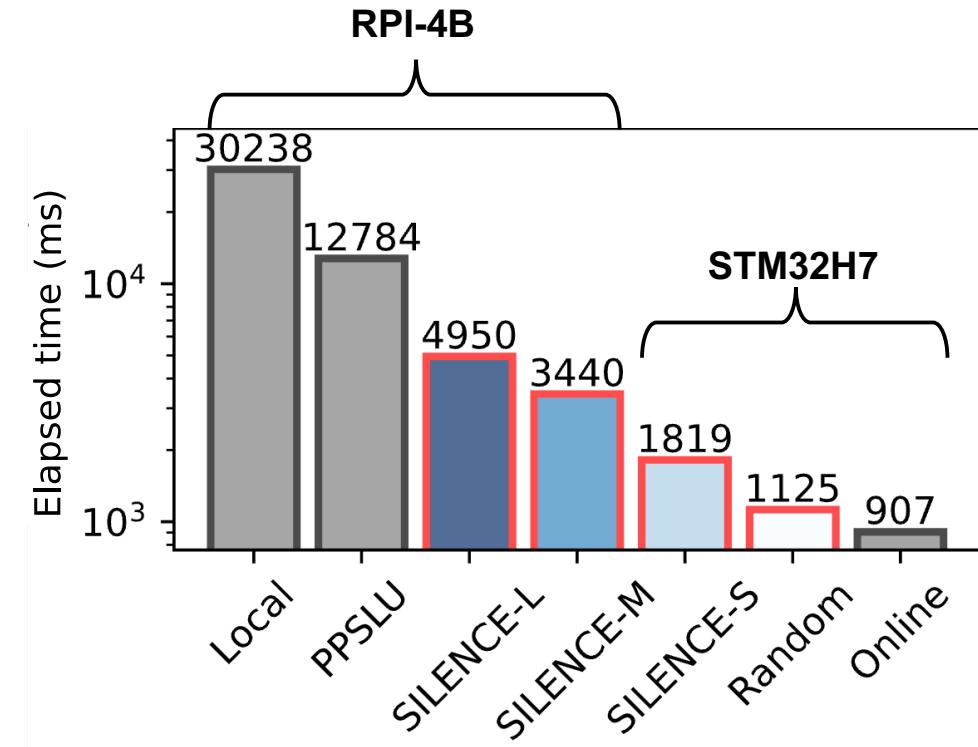
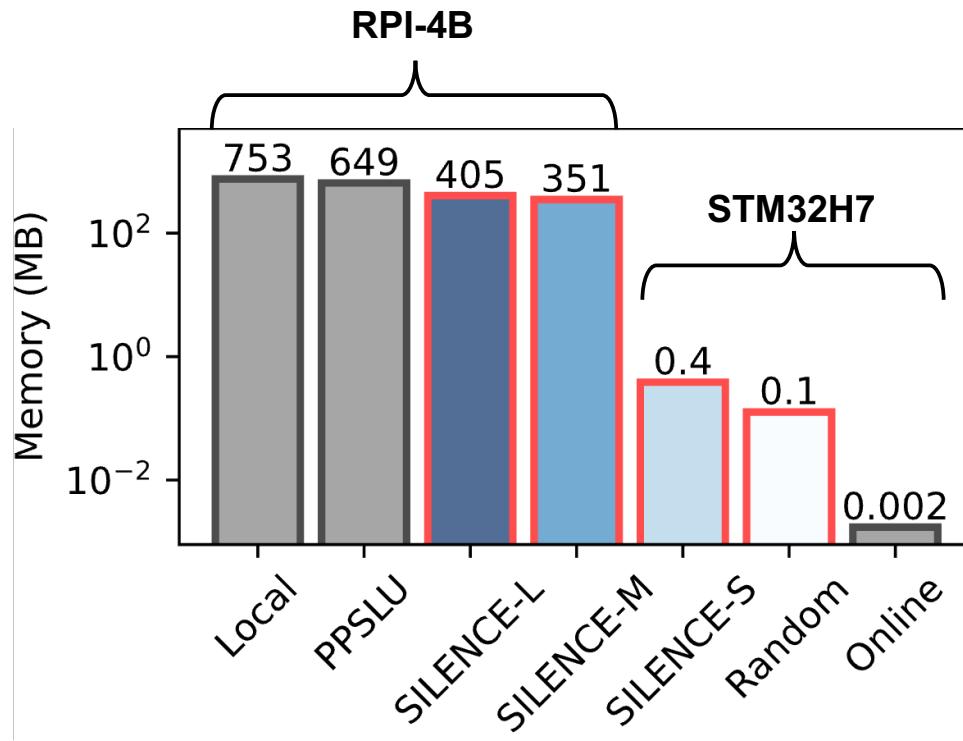
Concrete design: interpretable mask



Results: attack protection



Results: on-device efficiency



134.1x less memory, making it runnable on MCU!
With up to **53.3x** speedup.

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