NM STATE UNIVERSITY

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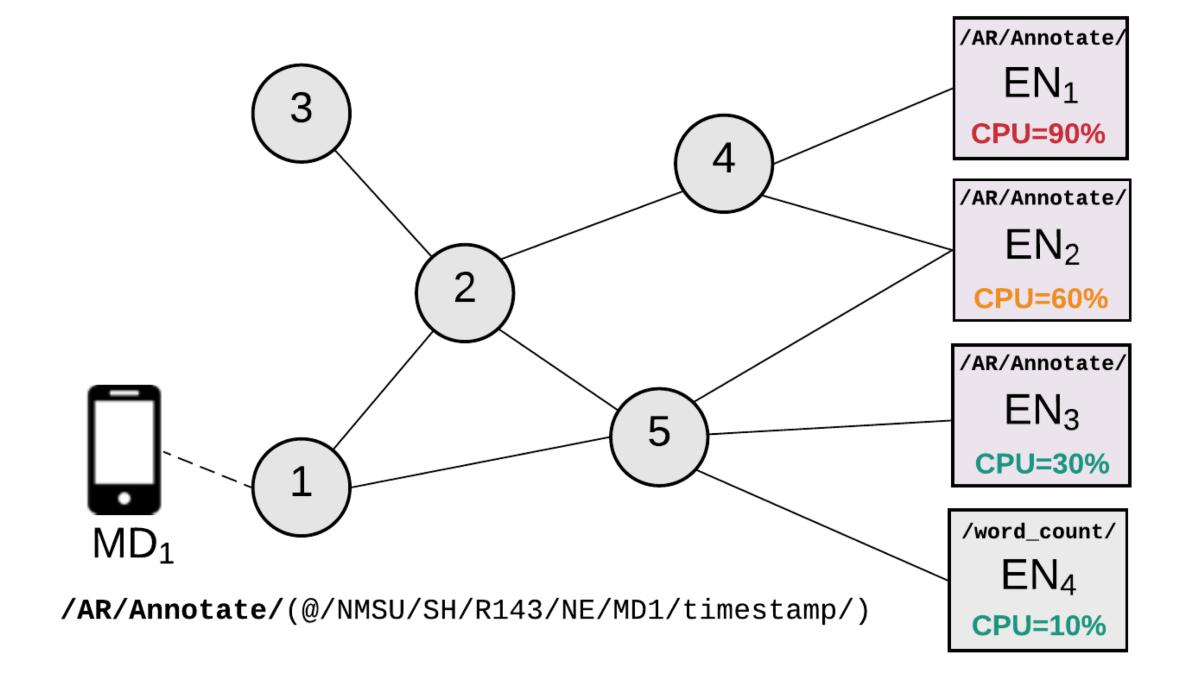# Edge Computing Over Named Data Networking

Traditional Edge Computing (EC) services:
- Routes, scheduling, and execution decisions at application layer
- Schedulers/proxies placement to make efficient decisions

NDN inherently enables seamless EC
- Seamless in-network forwarding
- Better mobility and security support

In the context of AR/VR applications, we (i) describe how NDN supports EC functionalities, (ii) present the design challenges of EC over NDN, and (iii) discuss potential solutions/directions.
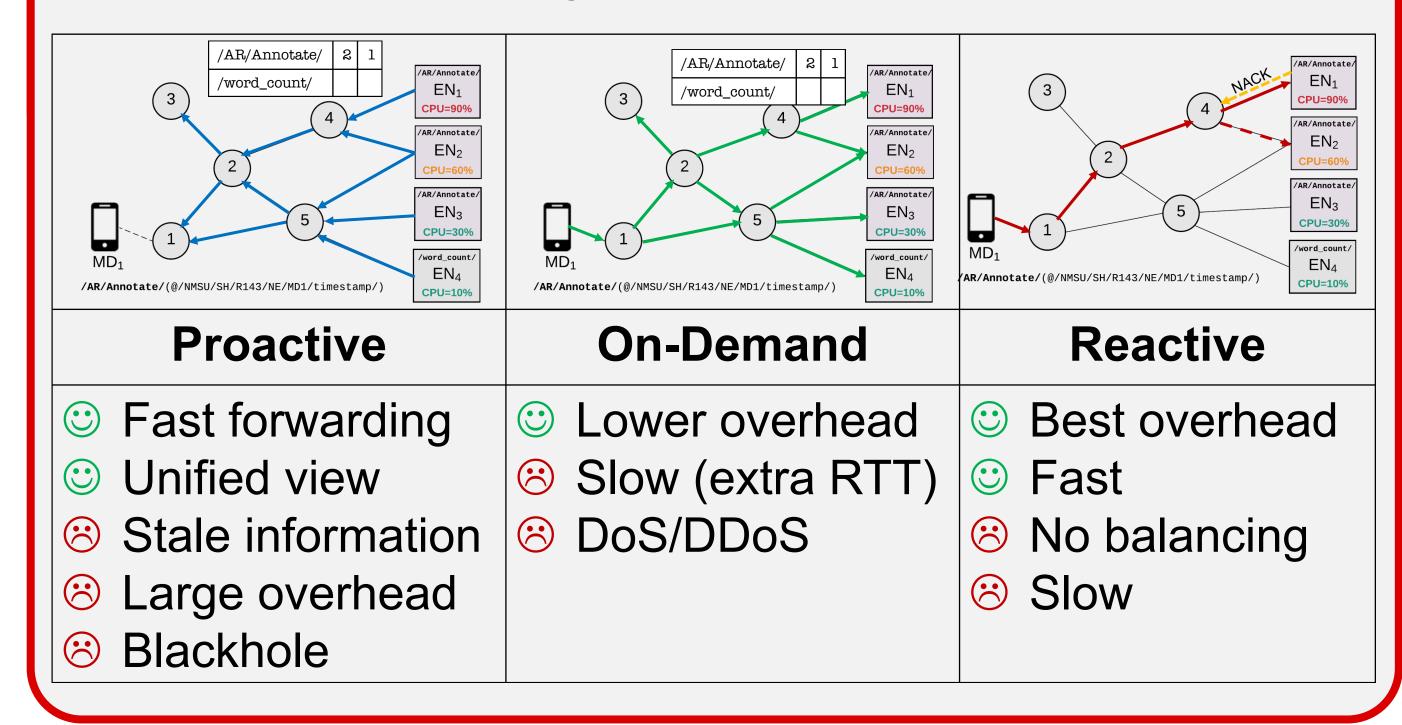

/AR/Annotate/(@/NMSU/SH/R143/NE/MD1/timestamp/)

EN$_1$ CPU=90%
EN$_2$ CPU=60%
EN$_3$ CPU=30%
EN$_4$ CPU=10%
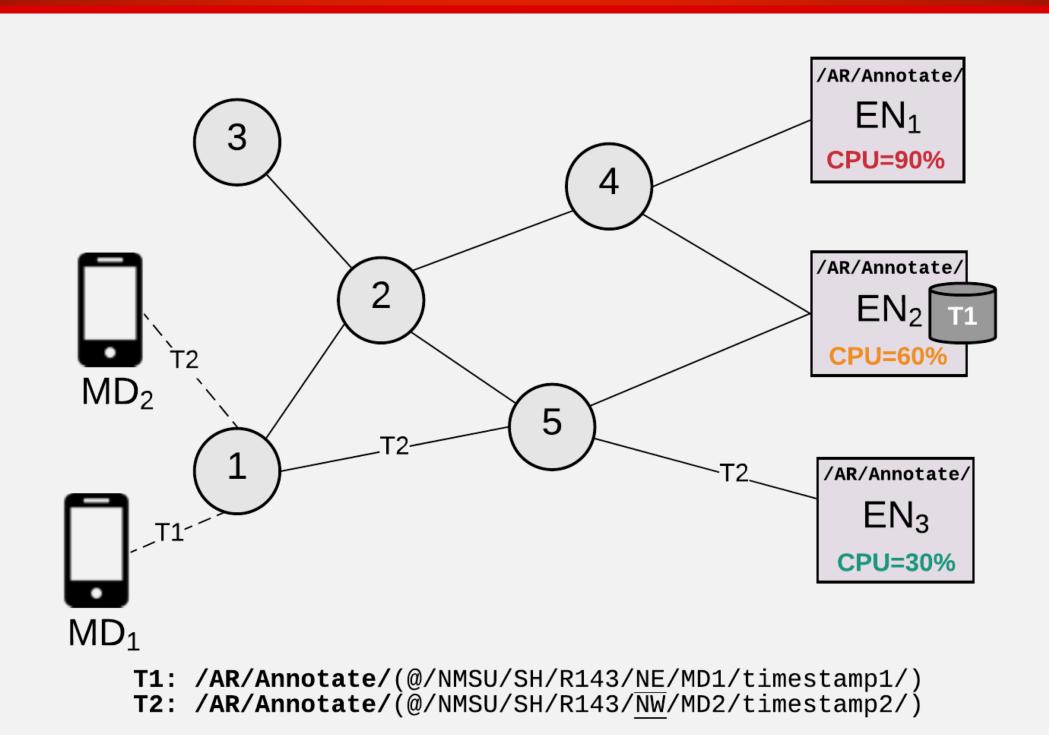
Resource Load Discovery

NDN inherently supports in-network forwarding
Service prefix advertisement
- Service naming: e.g., /ICE-AR/Annotate/

Resource Discovery Approaches:

Proactive	On-Demand	Reactive
😊 Fast forwarding	😊 Lower overhead	😊 Best overhead
😊 Unified view	☹ Slow (extra RTT)	😊 Fast
☹ Stale information	☹ DoS/DDoS	☹ No balancing
☹ Large overhead		☹ Slow
☹ Blackhole		

Re-Using Computation

T1: /AR/Annotate/(@/NMSU/SH/R143/NE/MD1/timestamp1/)
T2: /AR/Annotate/(@/NMSU/SH/R143/NW/MD2/timestamp2/)

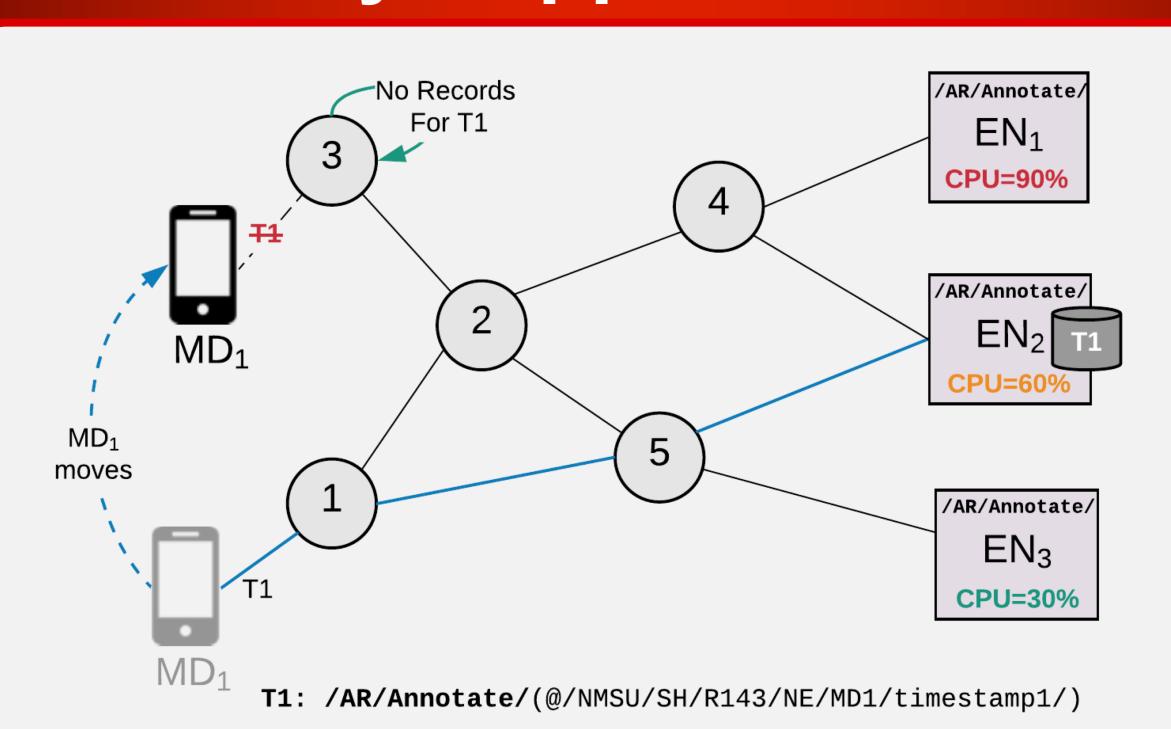**Goal: Execution of similar tasks at same EN**

In-Network Approach:
- Routers forward based on task name similarities
- ☹ Costly

EN-based Approach:
- Unified database of previously executed tasks
- ENs delegate tasks based on historical execution

Mobility Support

T1: /AR/Annotate/(@/NMSU/SH/R143/NE/MD1/timestamp1/)

Goal: Ensure efficient delivery when MDs move
- For data packets, NDN uses re-transmission upon timeouts
- For tasks, re-executions can be very expensive

A Reactive Approach:
- MDs, upon disconnection, advertise new route

A Proactive Approach:
- ENs share their names with the requesting MD

Summary & Discussions

NDN as a facilitator for edge computing
- Naming enables sharing
- In-network forwarding and efficient discovery
  - e.g., stateful forwarding
- Built-in security and mobility support

Future Work
- Investigate privacy and security concerns
  - Names reveal identity and locations
  - Broadcast mechanisms may be used for DoS/DDoS
  - Blackhole/sinkhole attack by EN(s)

- Design & implementation a potential solution for EC over NDN

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[*] A. Mtibaa, et. al., "Towards Edge Computing Over Named Data Networking". IEEE EDGE, July 2018.