DNS Does Not Suffice for MEC-CDN

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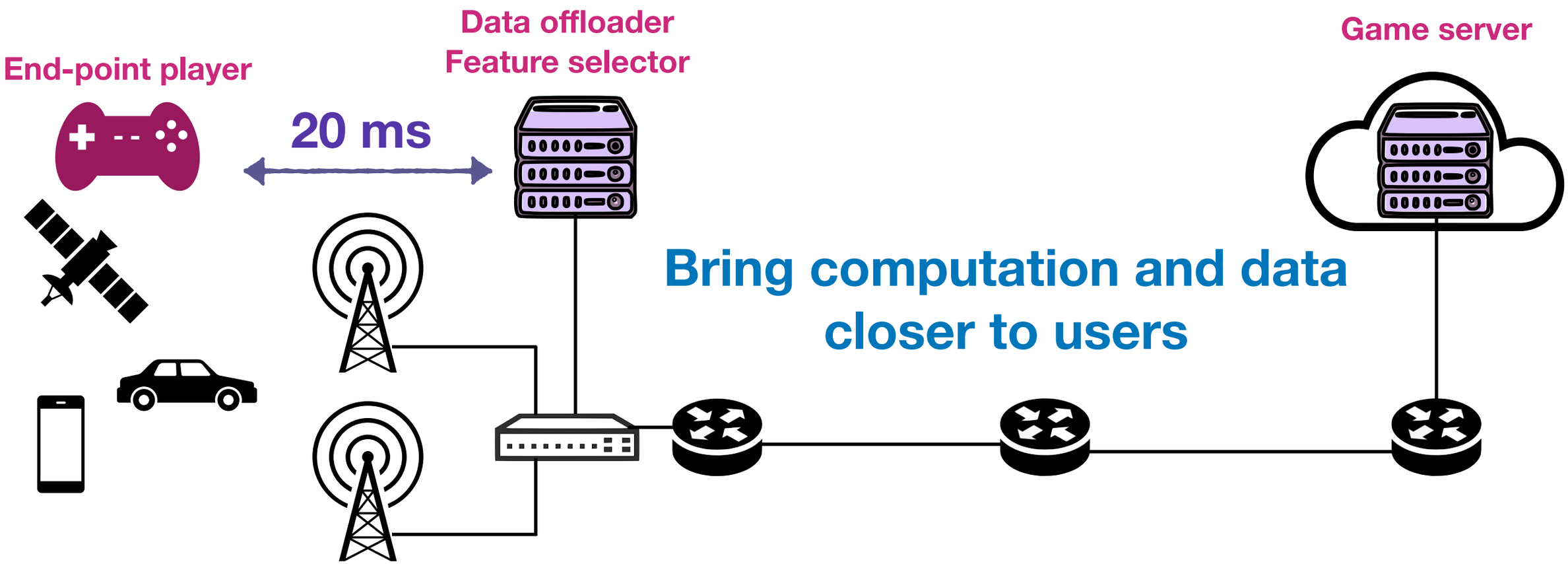
Ketan Bhardwaj Ada Gavrilovska

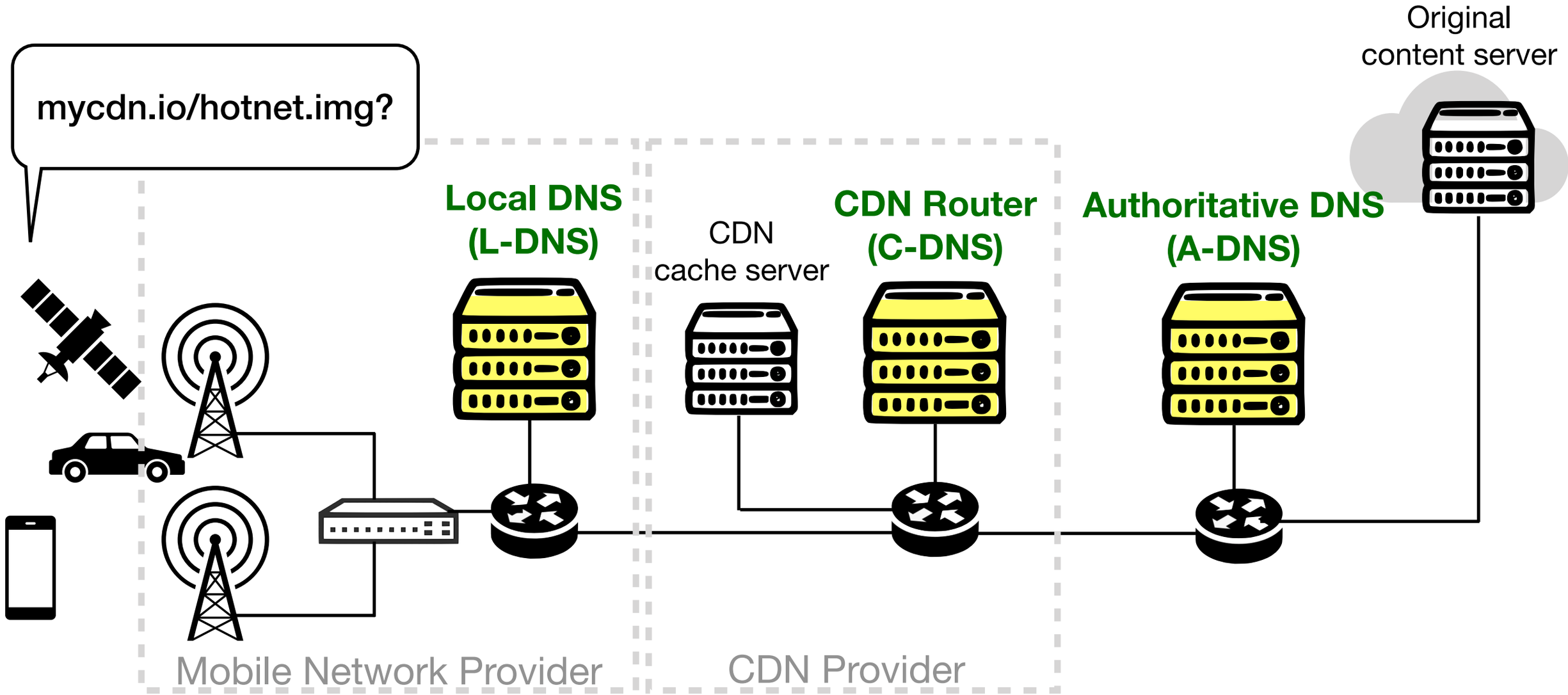
Mobile-Edge Computing (MEC) serves requests from short network distance

E.g. AR/VR gaming



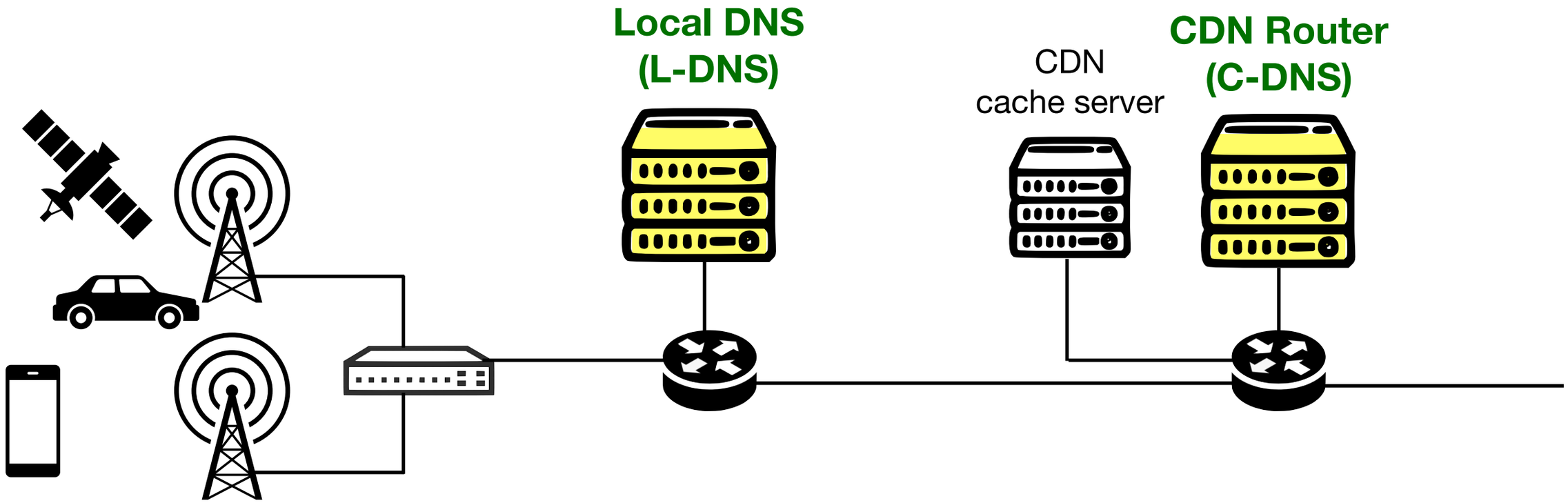
MEC deployment supports latency-sensitive workloads: AR/VR, Automation, ML services, and **CDN**

CDN process relies on DNS resolution



High performance CDN = fast DNS resolution + cache hit

Can MEC support current CDNs?



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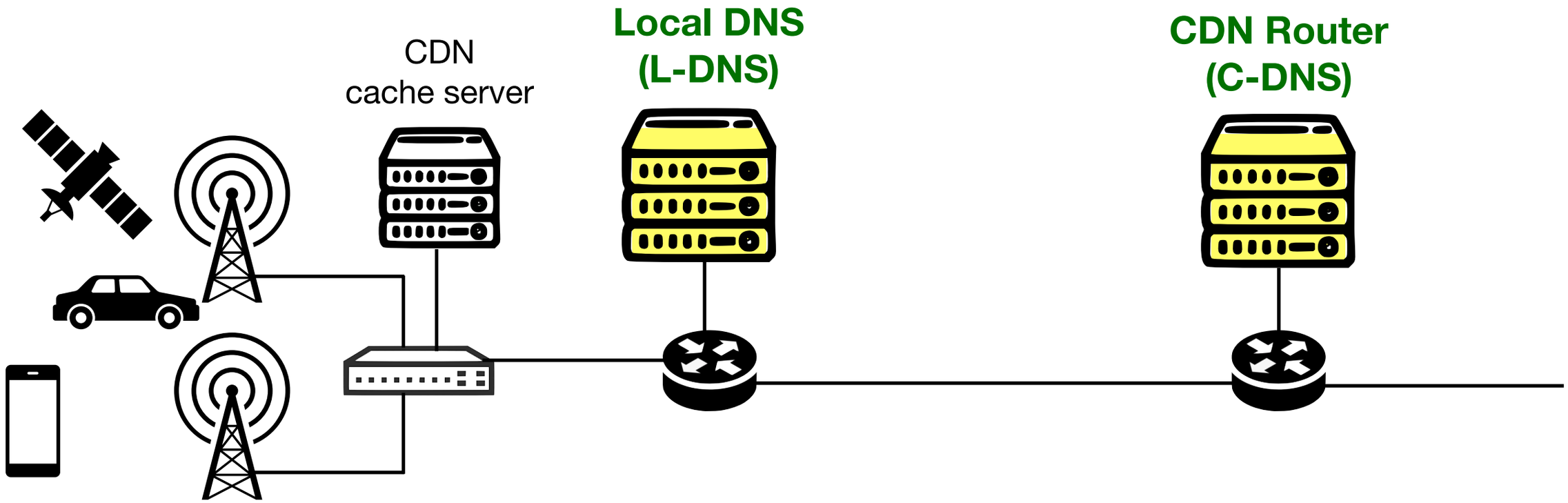

High performance CDN = fast DNS resolution + cache hit at really near place

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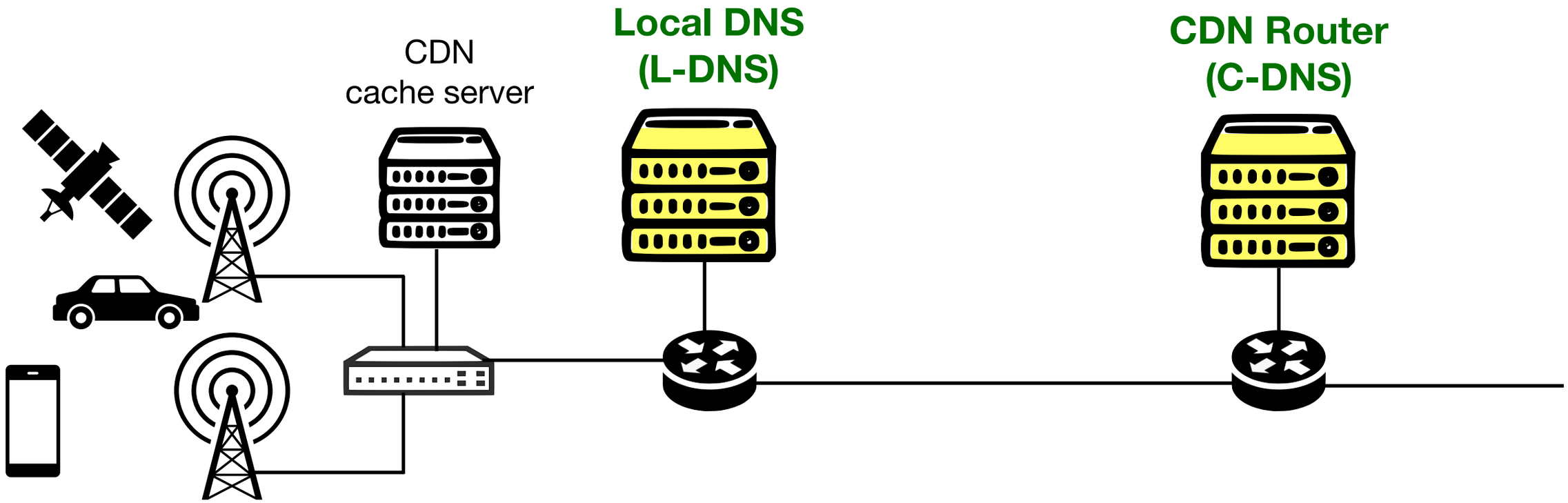
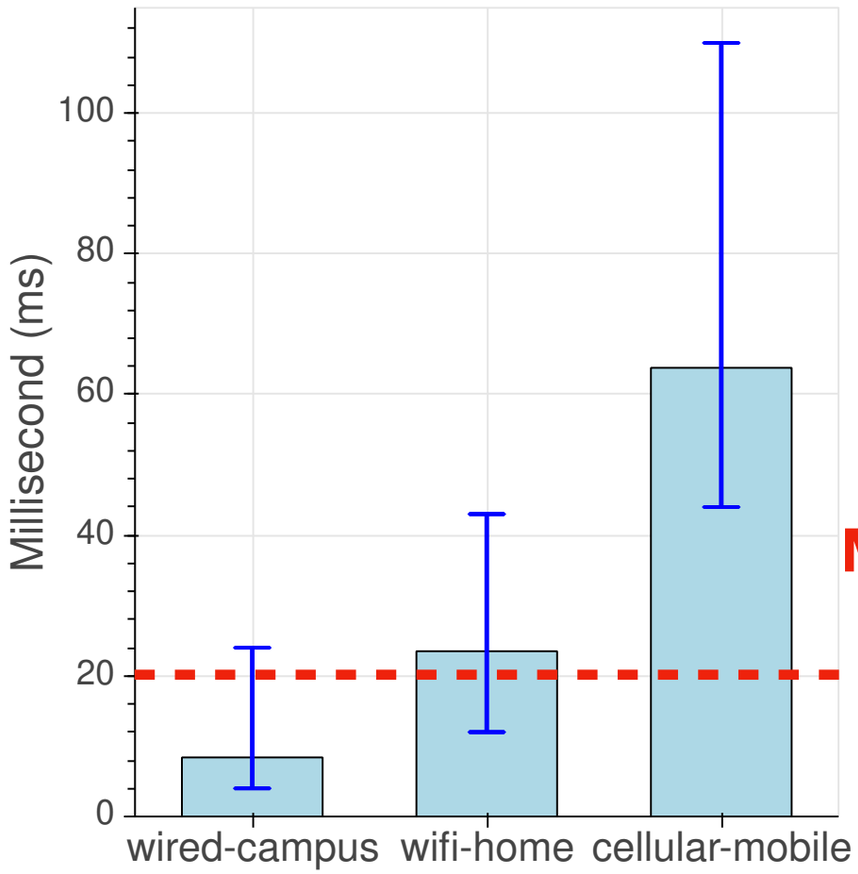


High performance CDN = **fast DNS resolution** + cache hit at really near place

Require evaluation on DNS processing in mobile network

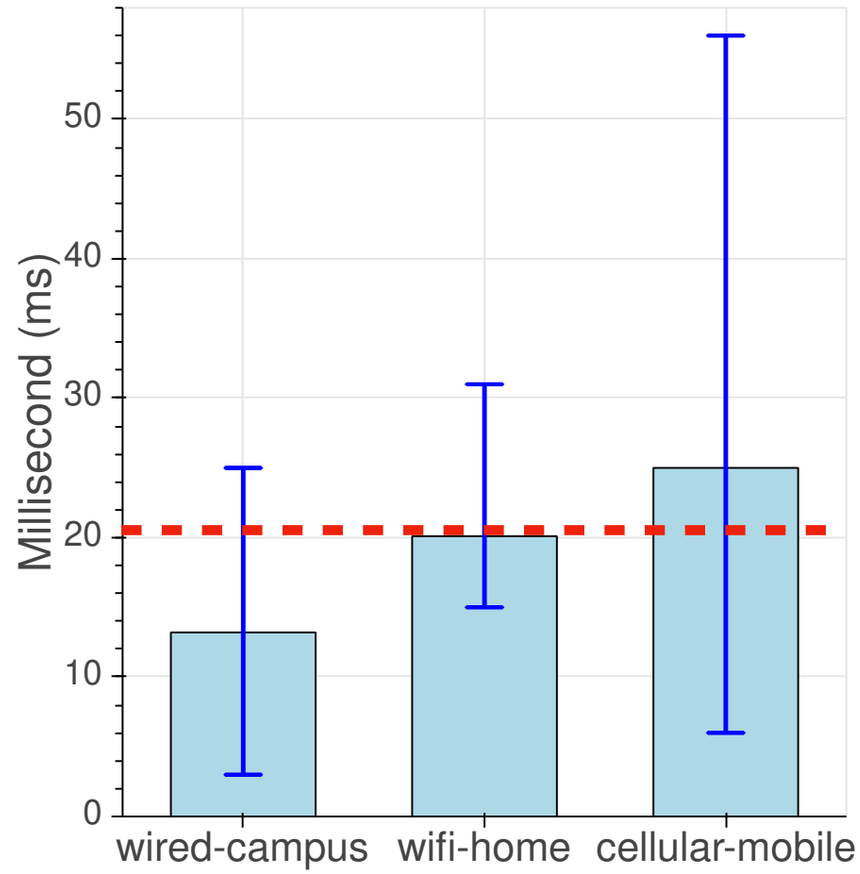
CDNs' DNS lookup time Evaluation



Airbnb

Content domain: a0.muscache.com

The 20-ms MEC expectation

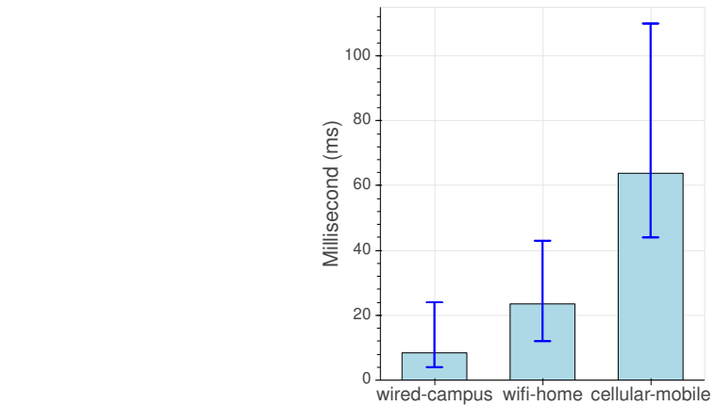


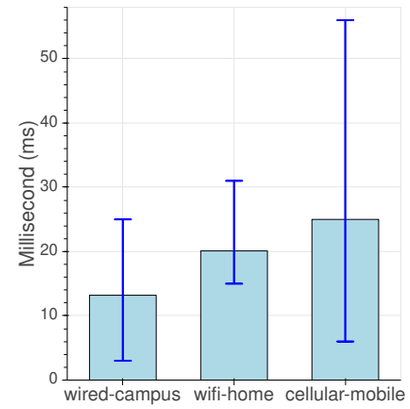
Booking.com

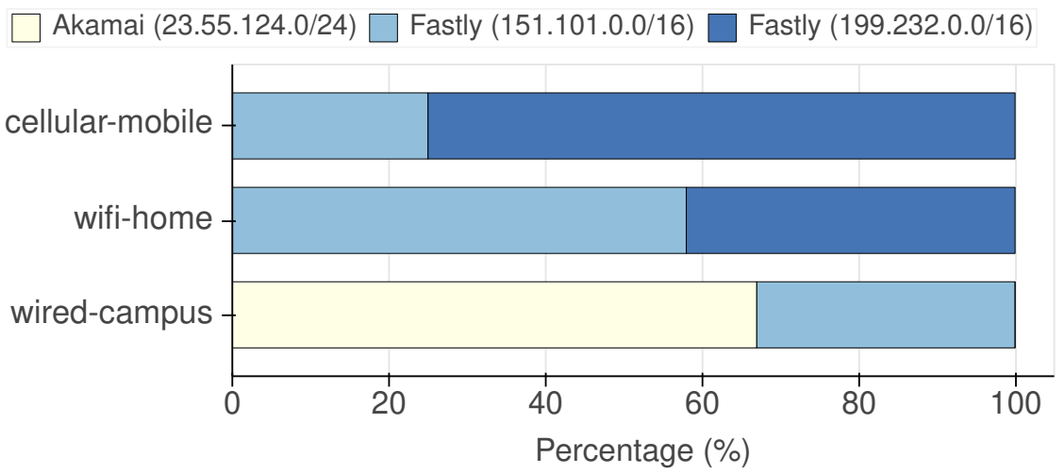
q-cf.bstatic.com

➡ High DNS lookup latency and variability

Behind-the-scene complexity







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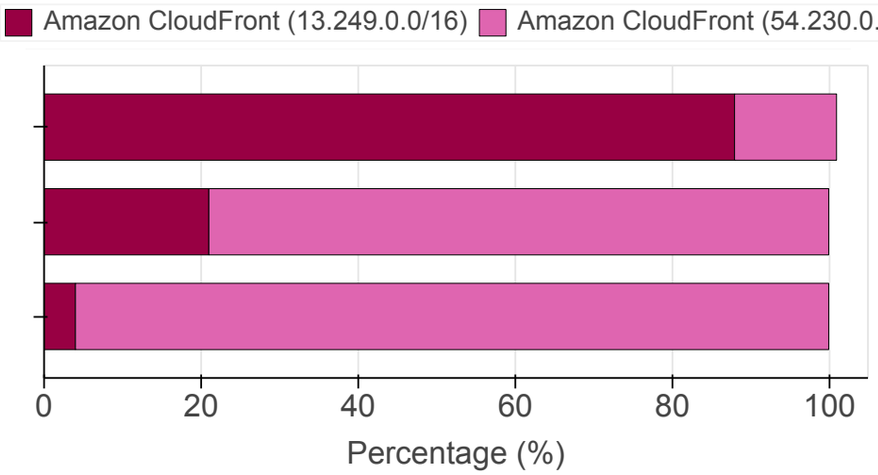

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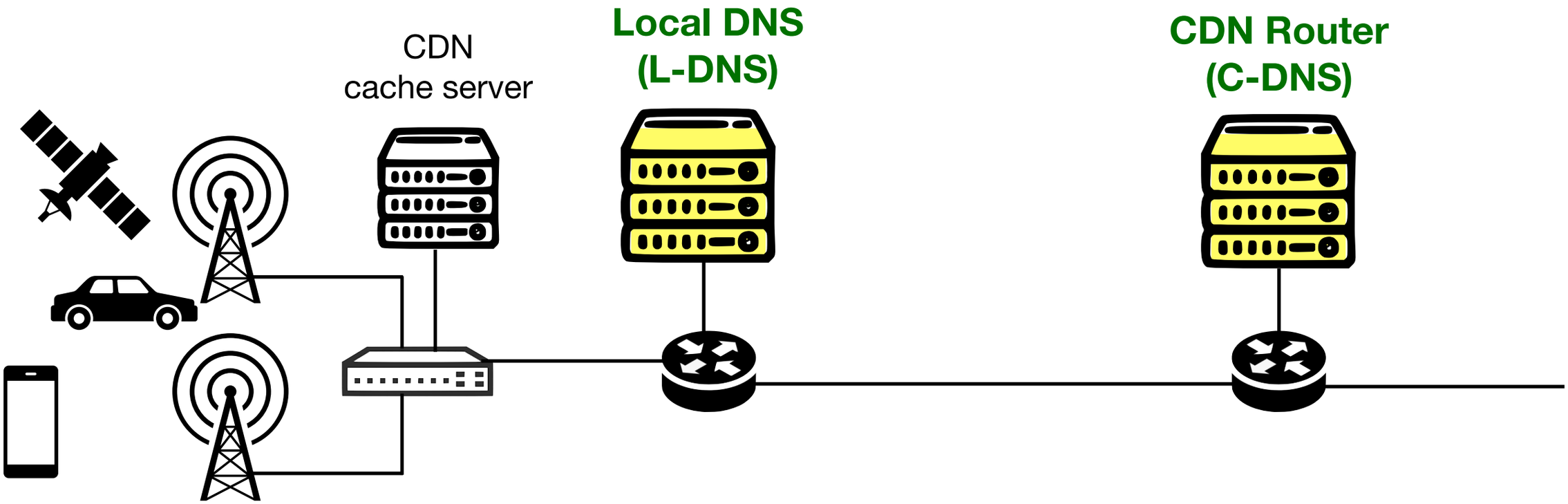
➡ Same geo-location, different connectivities, may be served by different CDN cache servers or CDN providers

MEC-CDN needs new system design for low DNS lookup latency and high cache hit rate

Our MEC-CDN Design



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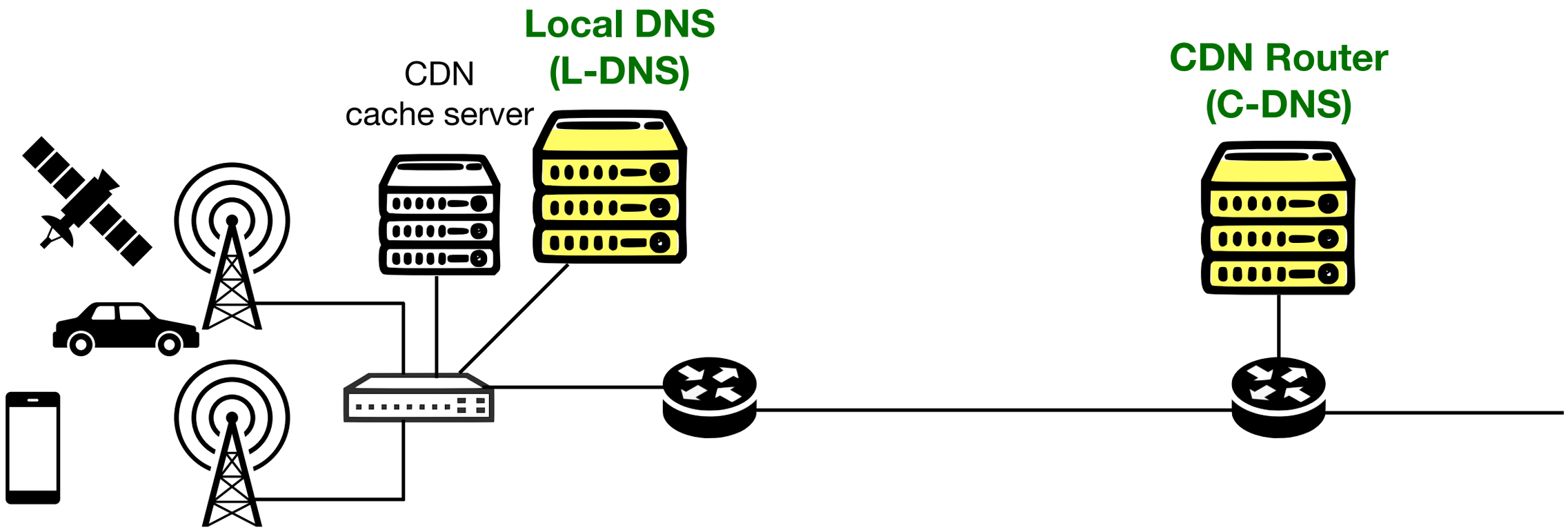
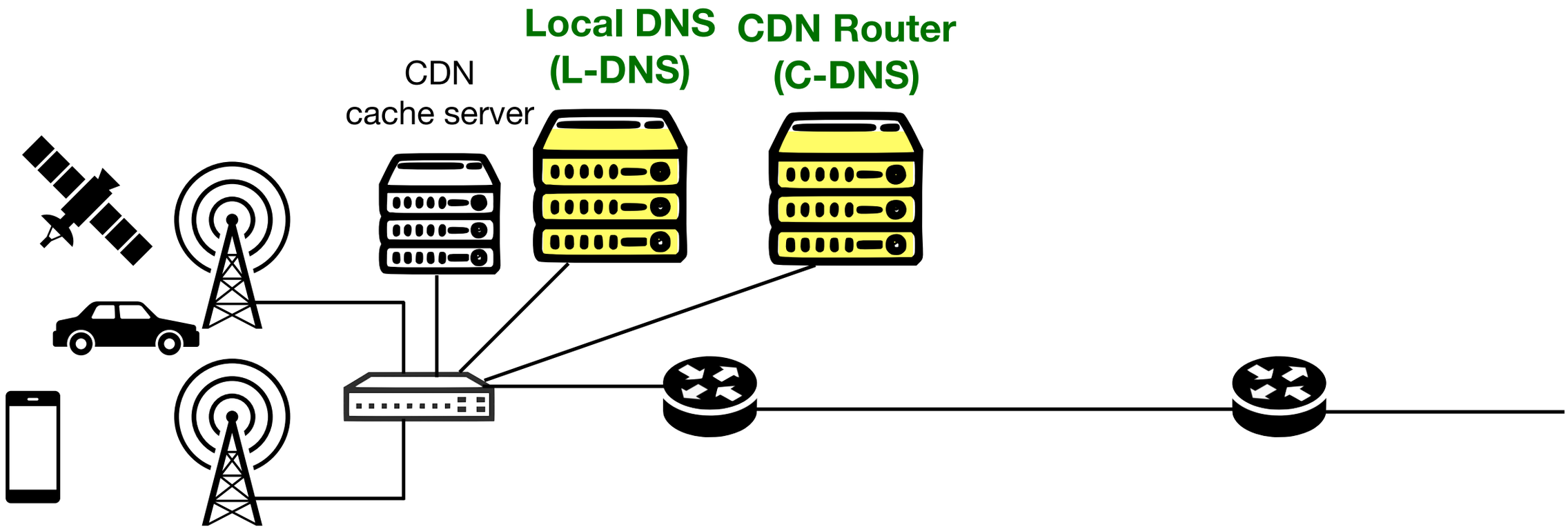


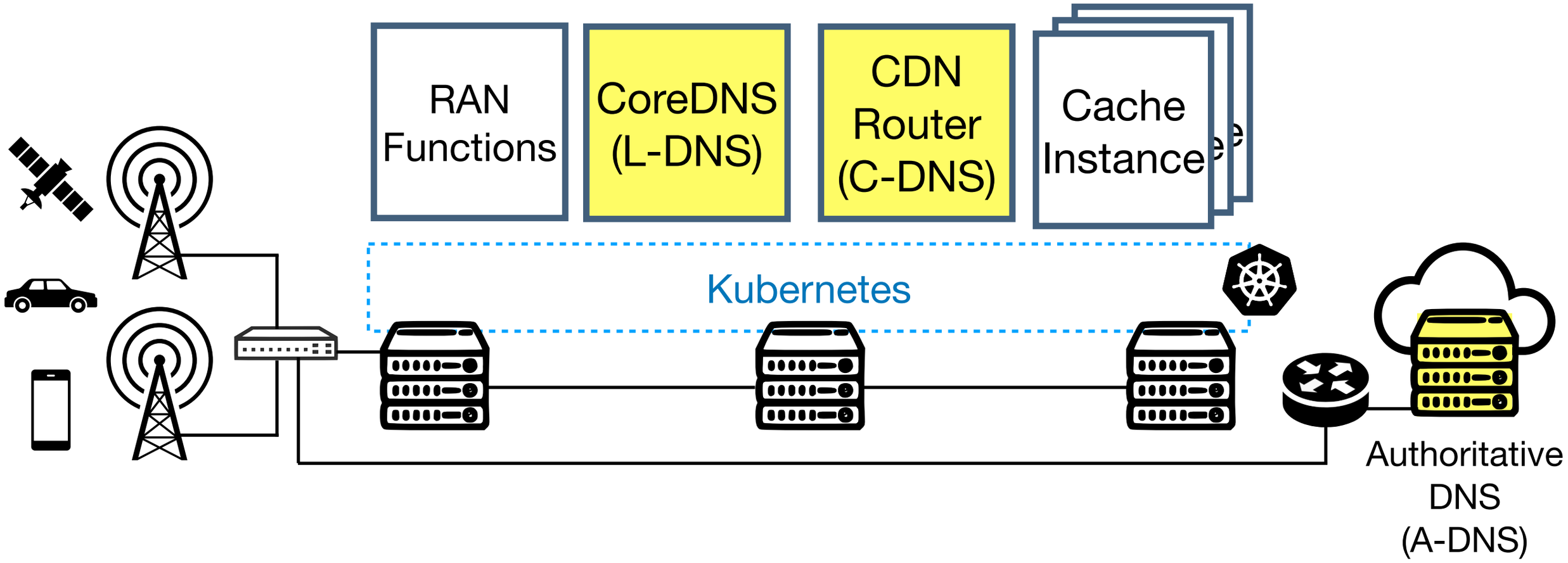
L-DNS at edge can respond clients' DNS requests quickly

Our MEC-CDN Design



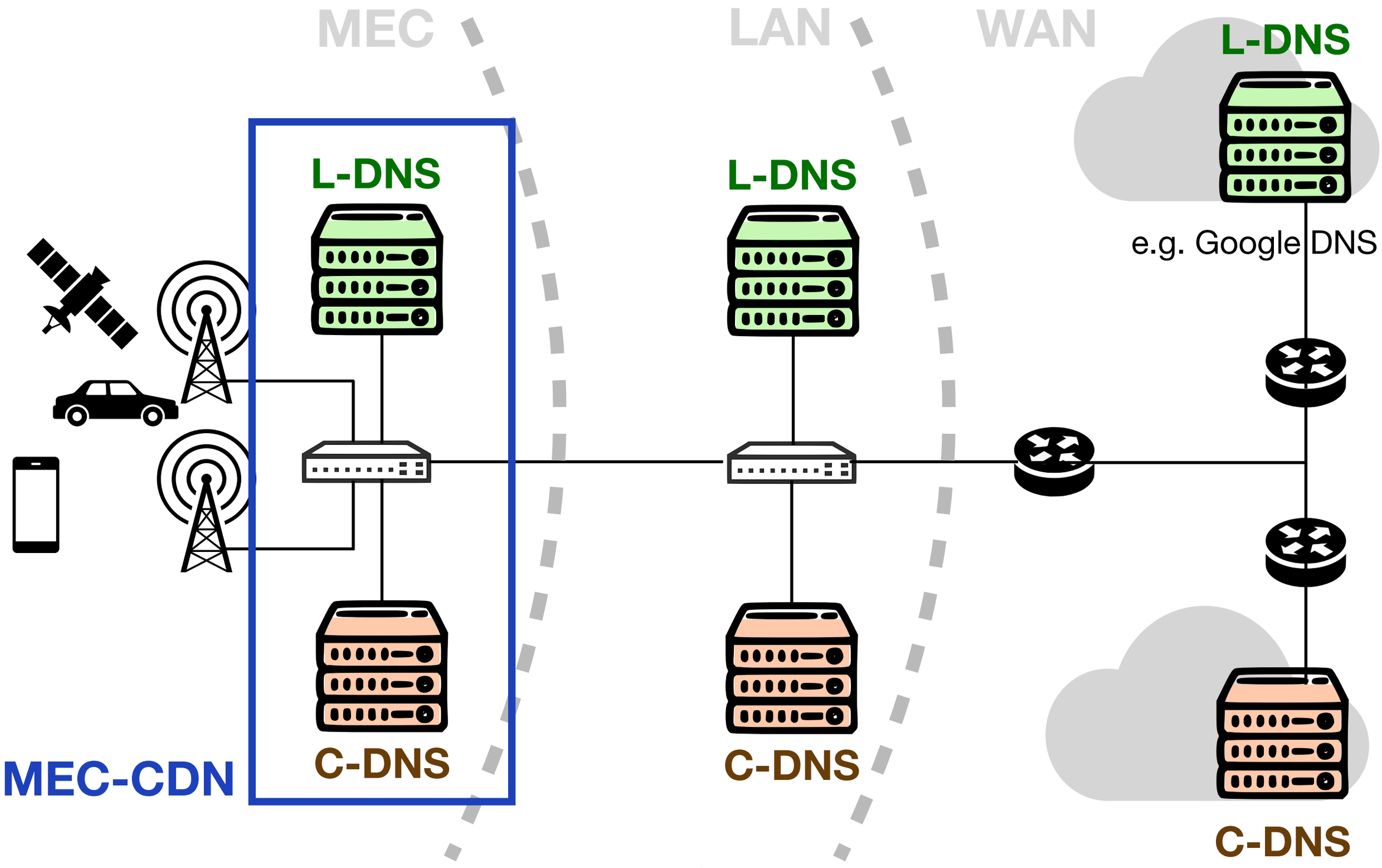
C-DNS at edge can quickly respond the specific cache-in-MEC

Our MEC-CDN Design



- L-DNS and C-DNS are collocated with cache instances at edge, within first hop
  - L-DNS can respond to clients quickly
  - Content can be accessed quickly
  - C-DNS can redirect the address of accurate content cache instance

Latency comparison of DNS lookup via LTE



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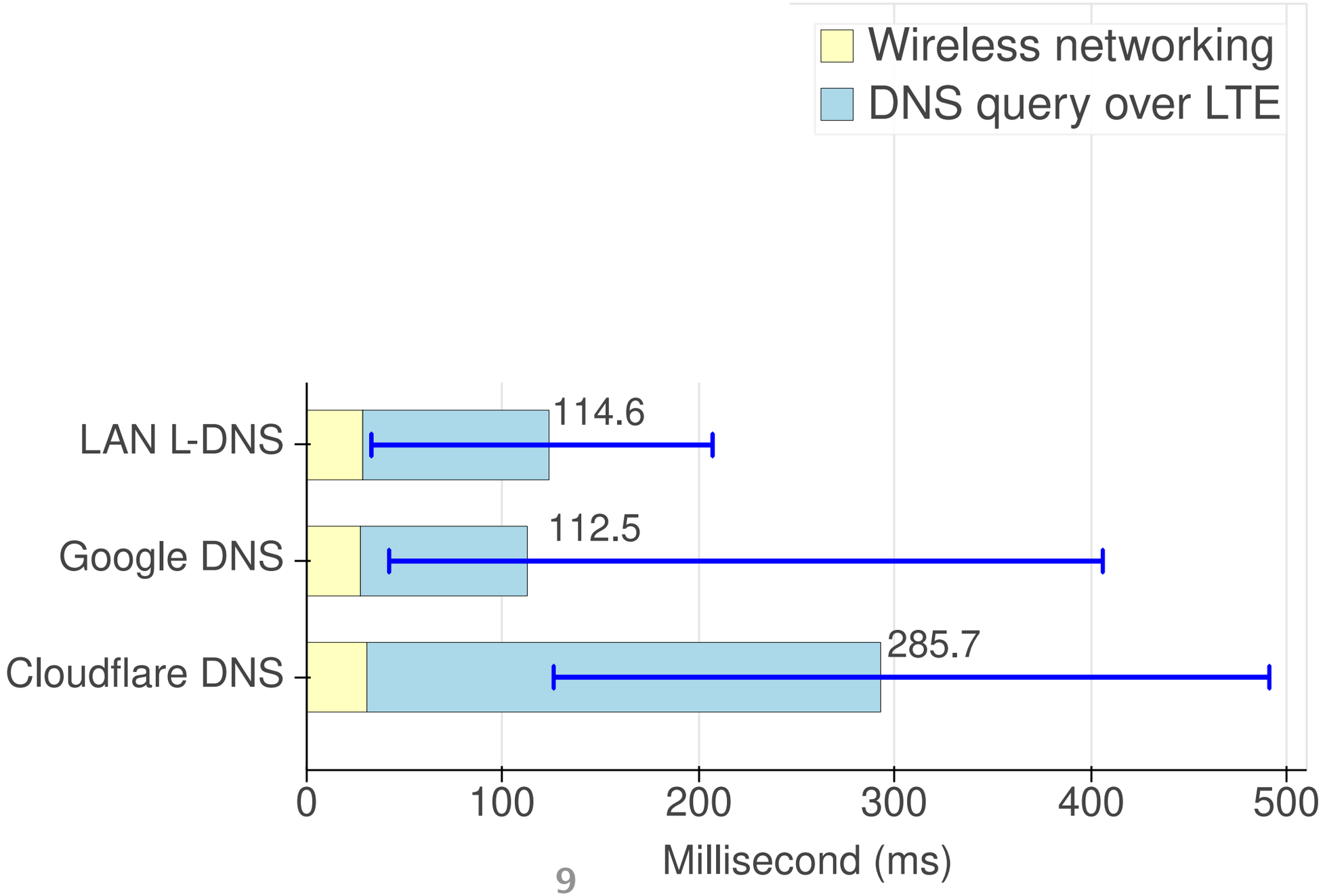
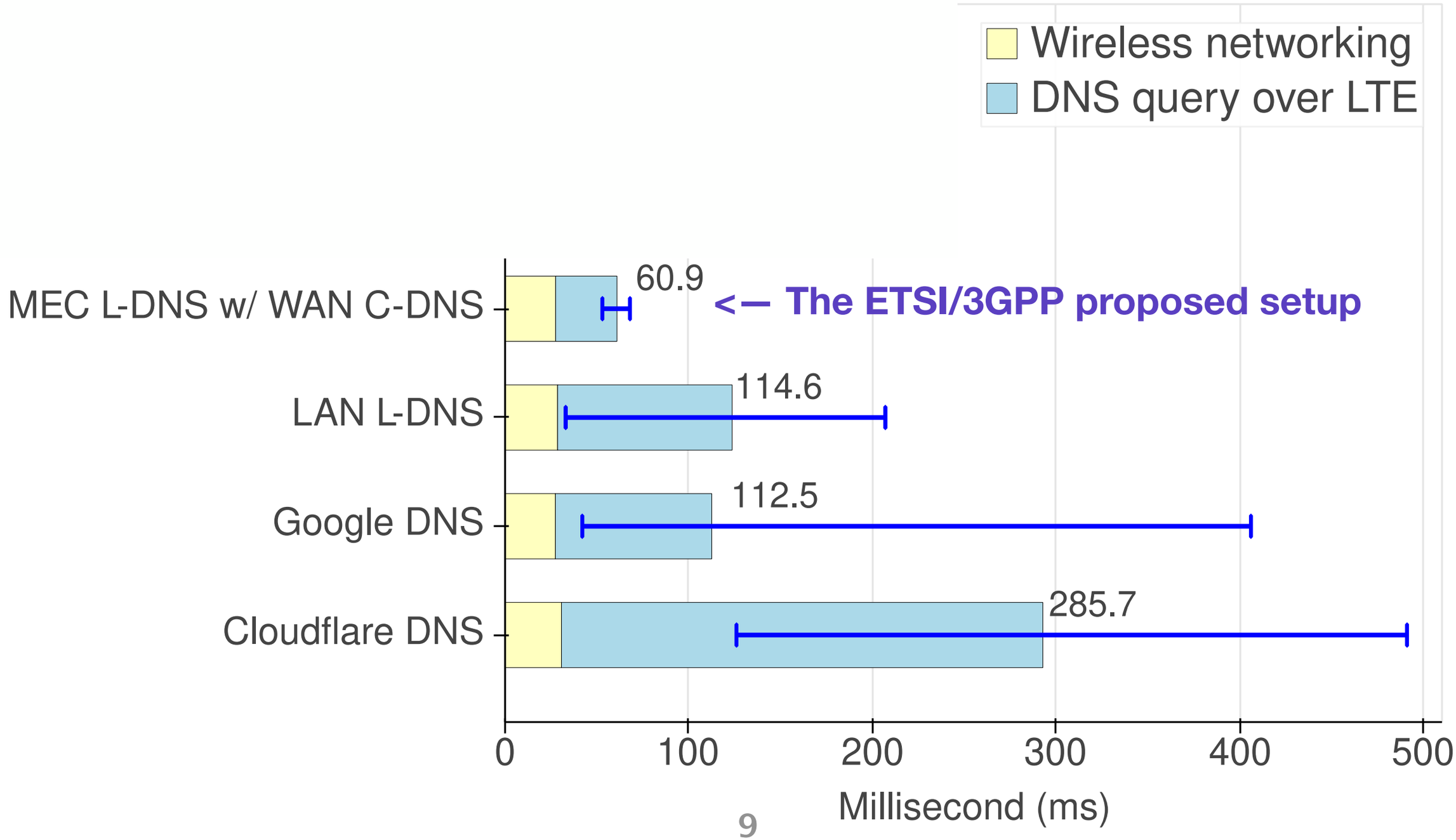
DNS query w/o CDN:

The request needs to go accessing original content server



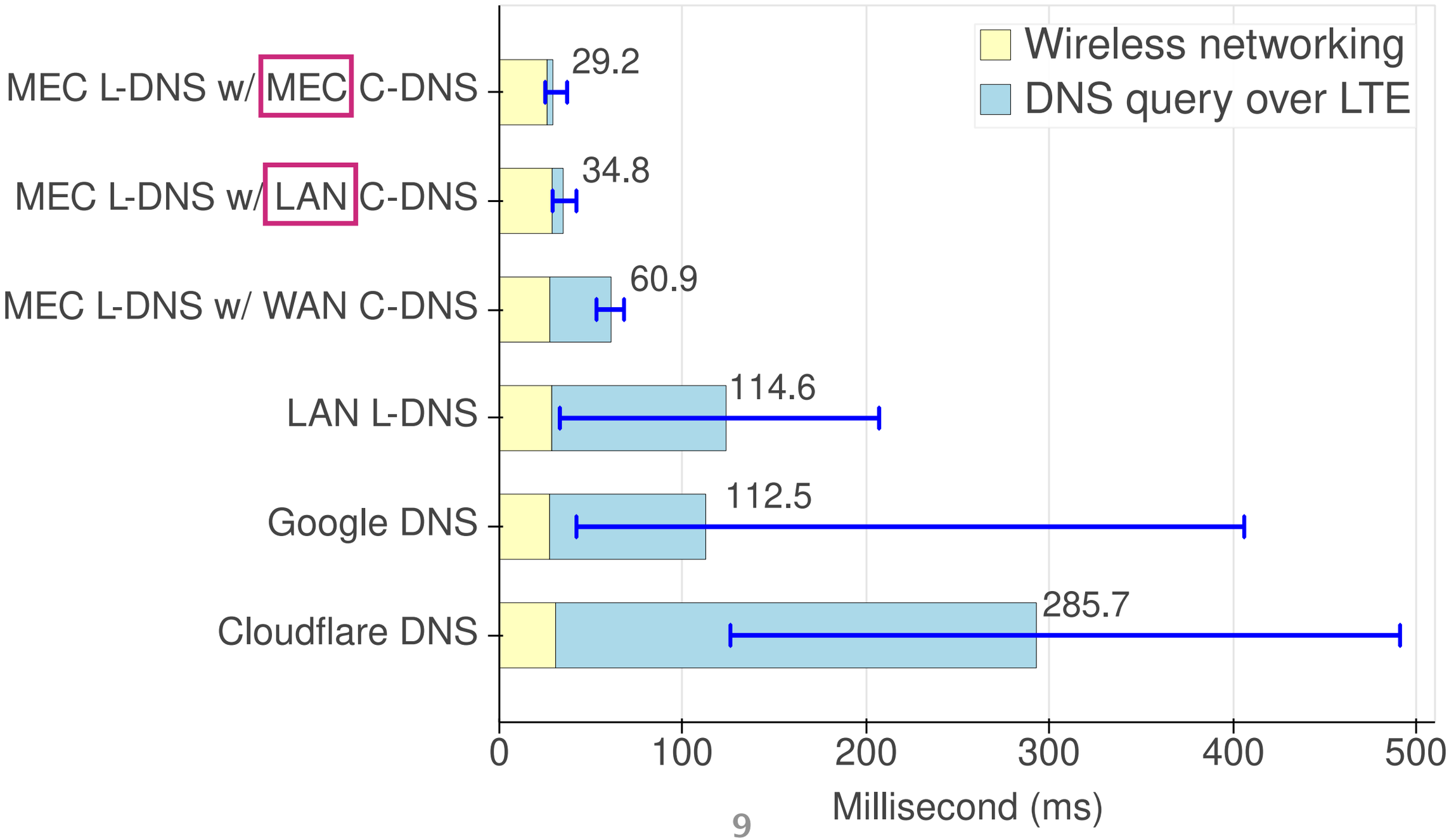
Latency comparison of DNS lookup via LTE

L-DNS at MEC w/ CDN: (ETSI/3GPP proposed deployment)
more than 2x speedup



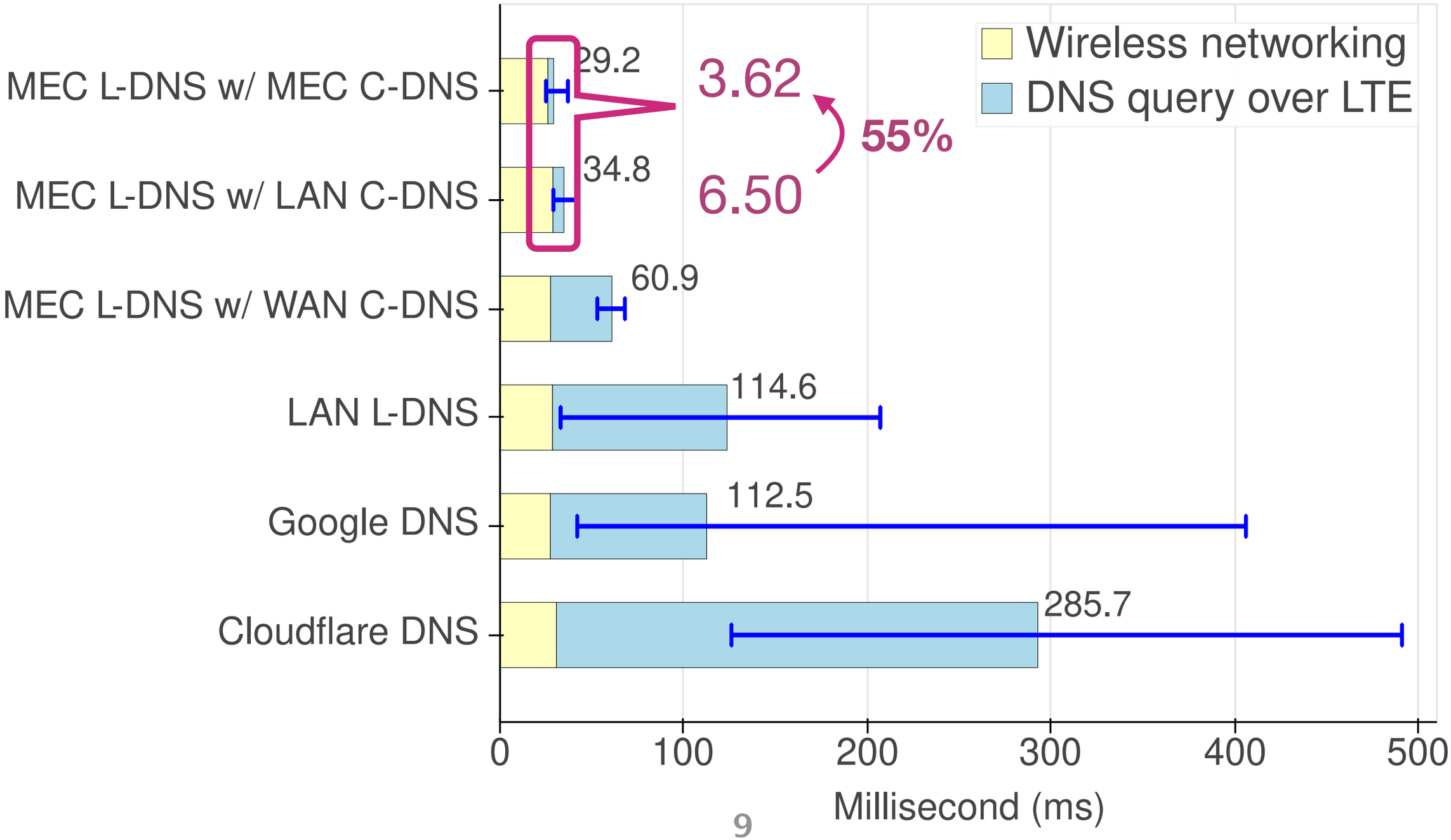
Latency comparison of DNS lookup via LTE

C-DNS (CDN router) at LAN or MEC location
dramatically improve query time!



Latency comparison of DNS lookup via LTE

C-DNS (CDN router) deployed with MEC platform
minimizes the latency of DNS resolution for cache instance



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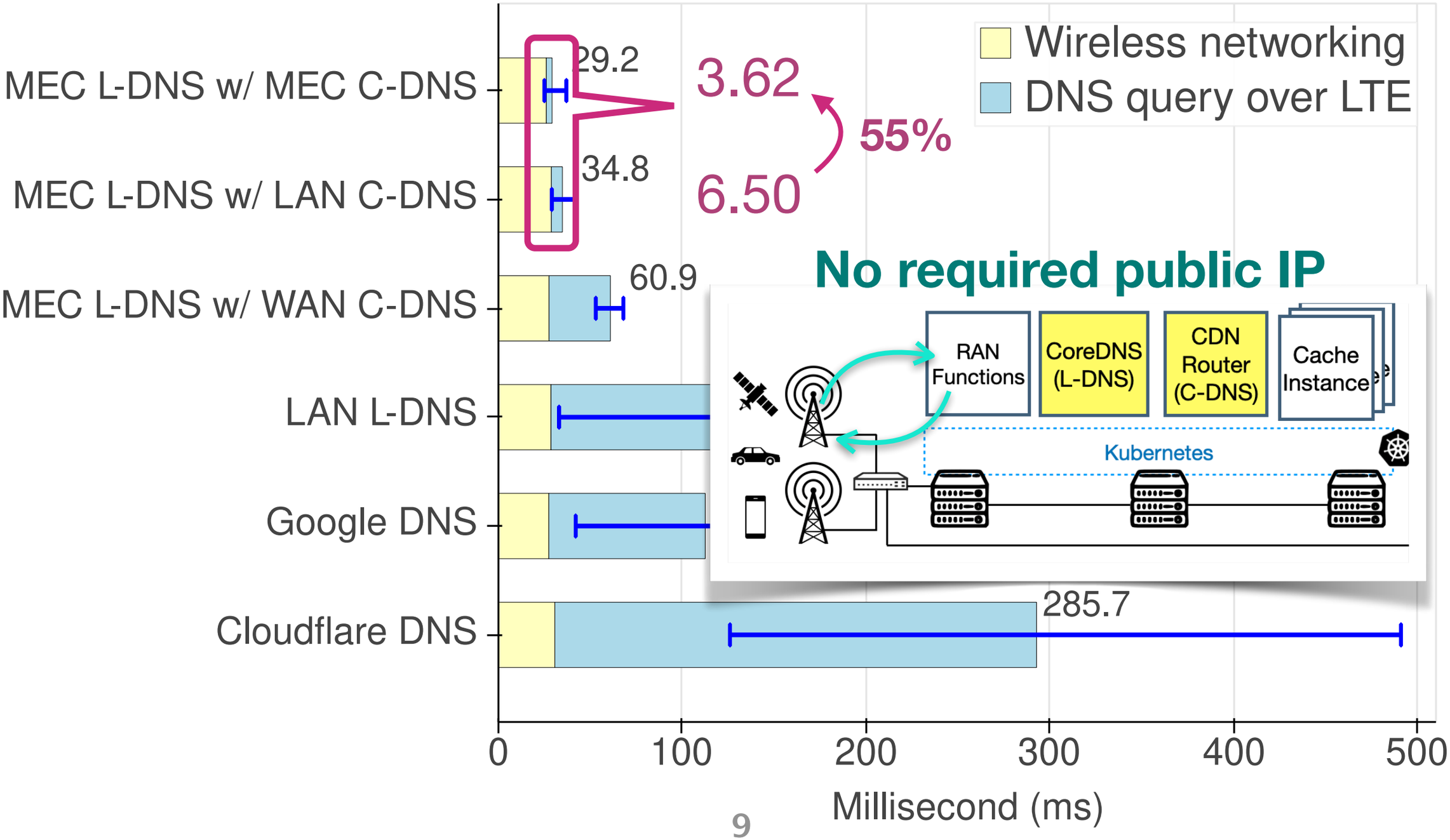

Conclusion and Next Step

- **Evaluate DNS query overhead in mobile network**
  - Latency far from sub **20 ms** expectations of latency-critical services
  - Complex CDN eco-system makes performance improvement more difficult

- **Propose MEC-CDN design**
  - **96%** DNS query time reduction compared to Public DNS/LAN DNS
  - and **90%** compared to current ETSI proposed structure
  - and **55%** compared to LAN C-DNS

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- **Further MEC-CDN performance evaluation at edge**
  - DNS TTL, content cache update, synchronization across core networks
  - realistic testbed and workloads

- **Coordination of MEC-CDN and MEC platform services**
  - Finer resource isolation and management

Thanks for your attention!