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A scalable and efficient IPv4 address sharing approach in IPv6 transition scenarios

Key words: IPv6 transition, Carrier-grade NAT (CGN), A+P, Address sharing, Dynamic switching

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Introduction

• IPv6 transition is inevitable.

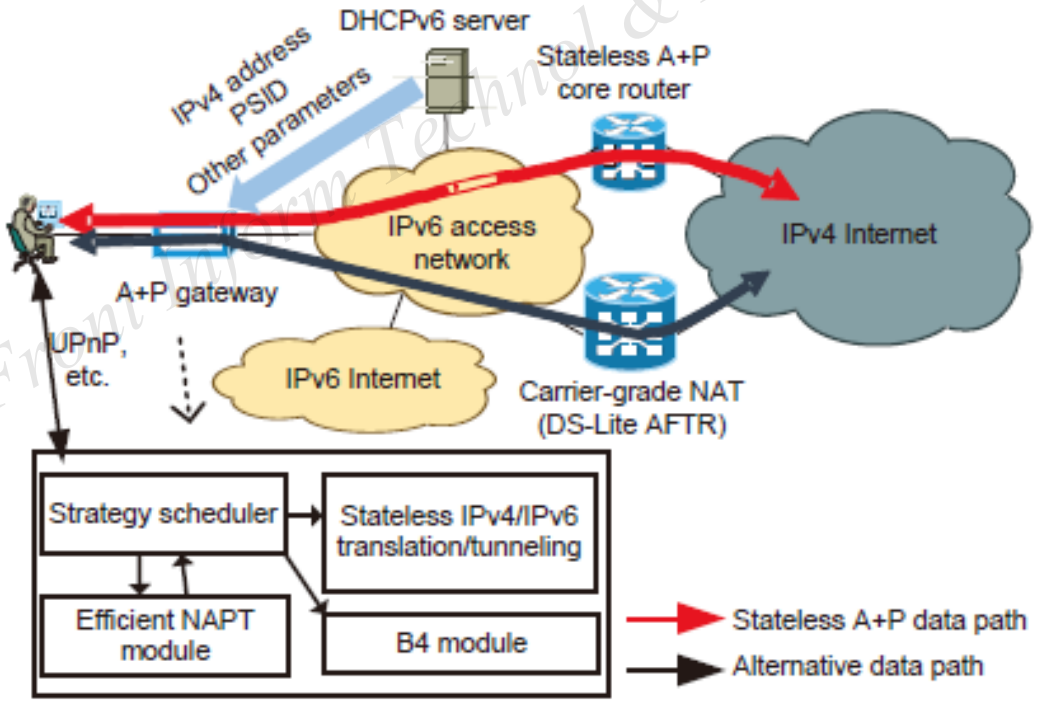
• Many large-scale service providers are constructing IPv6-only backbone networks to circumvent the shortage of IPv4 addresses. During the period, their customers still need to preserve connectivity with global IPv4 resources, requiring service providers share scarce global IPv4 addresses among numerous customers.

• Current IPv4 sharing solutions cannot be both scalable and efficient in sharing IPv4 addresses.

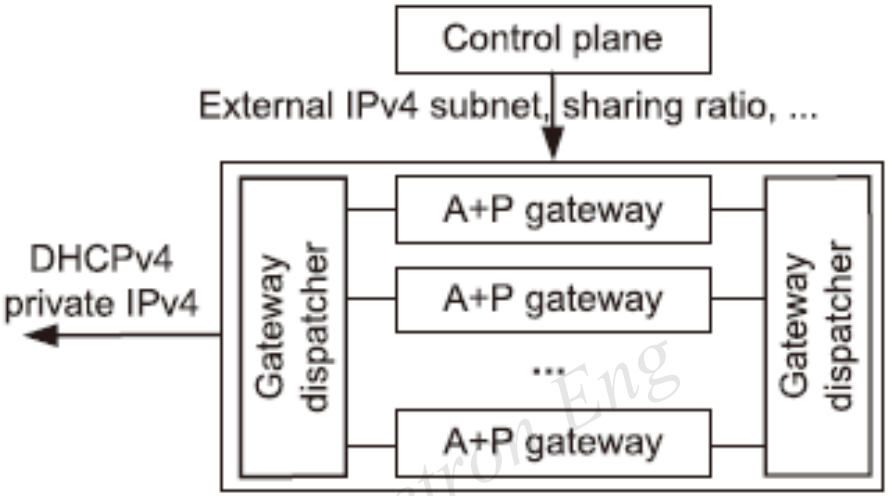
• This paper propose a scalable IPv4 address sharing approach which can utilize limited IPv4 addresses efficiently without degrading the performance of applications on end hosts.

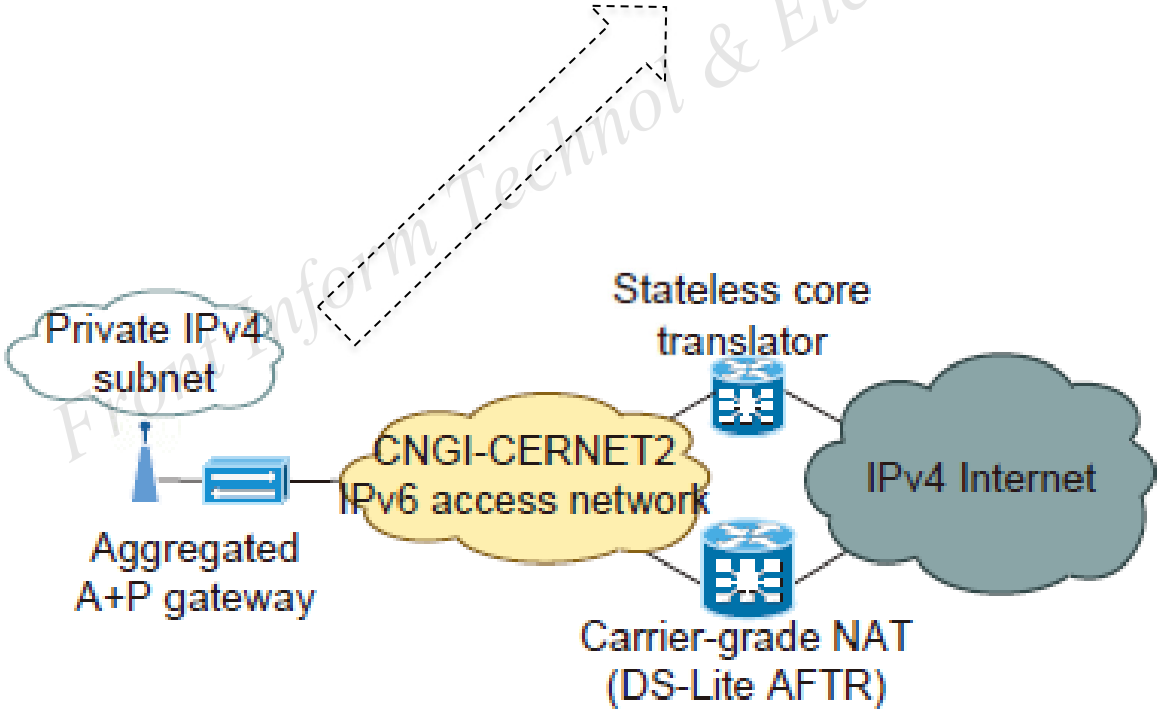
Architecture of the hybrid address sharing approach

- Stateless A+P solution + an intelligent gateway
- The intelligent gateway chooses the data path for outgoing packets dynamically

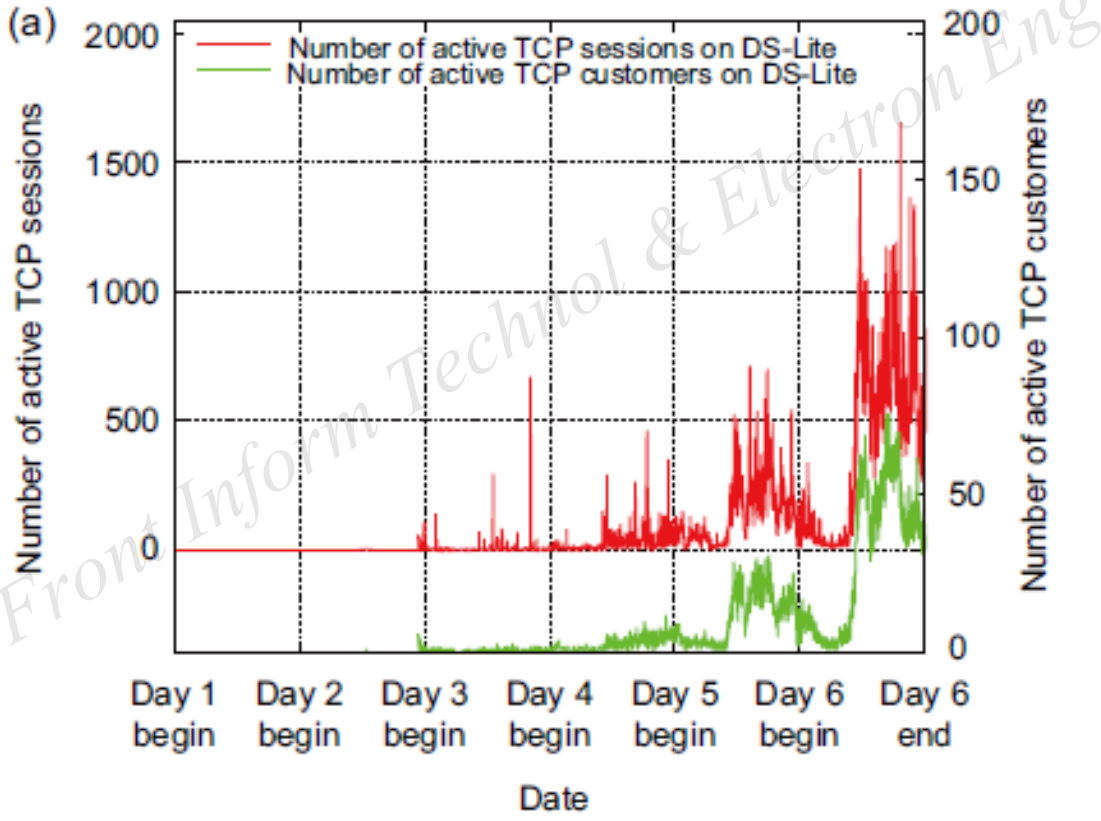


Evaluation

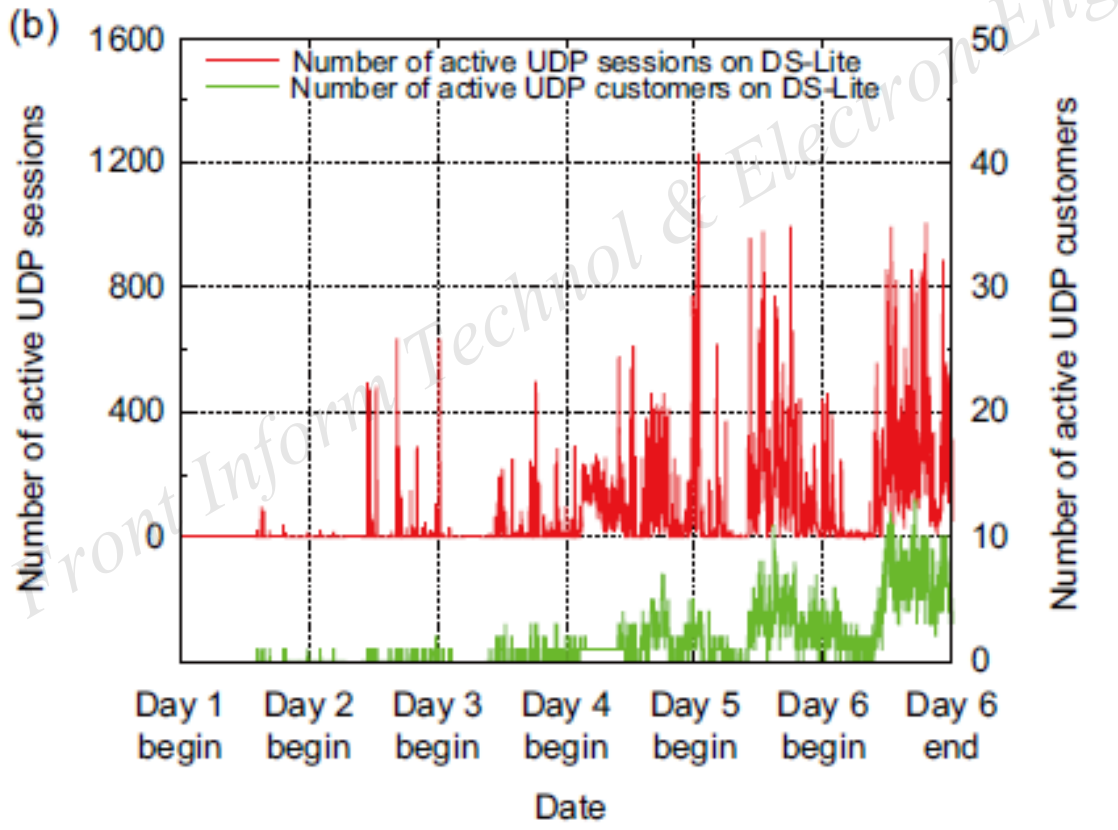




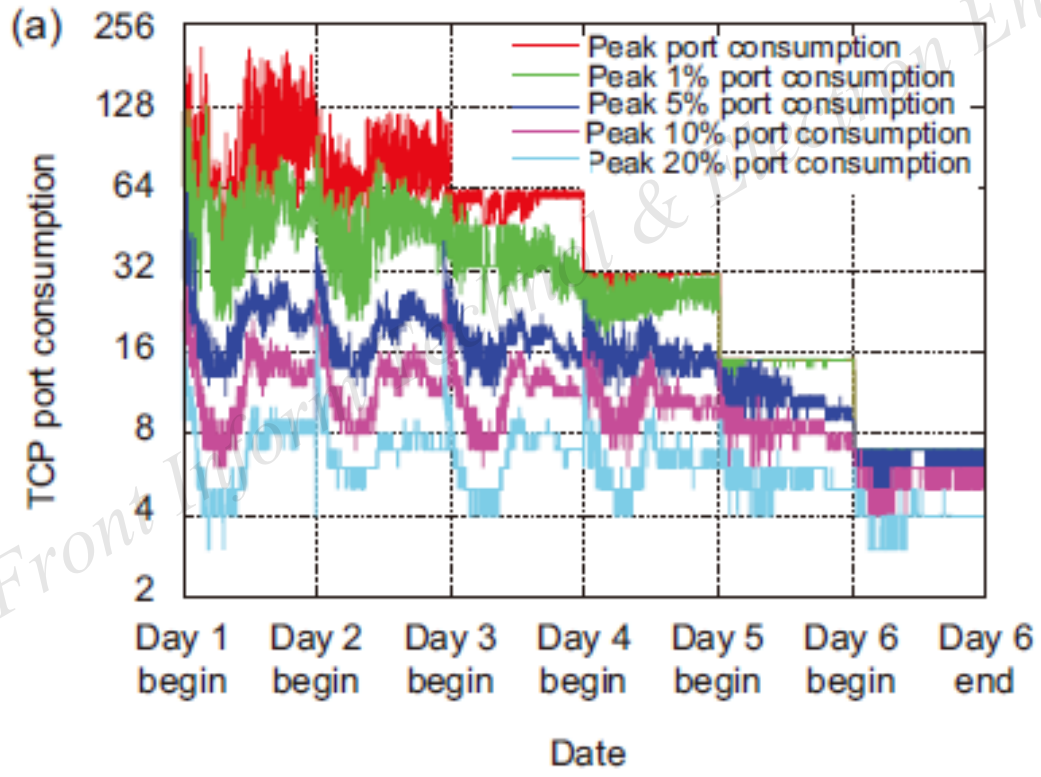
Impact on the stateful path traffic (TCP)



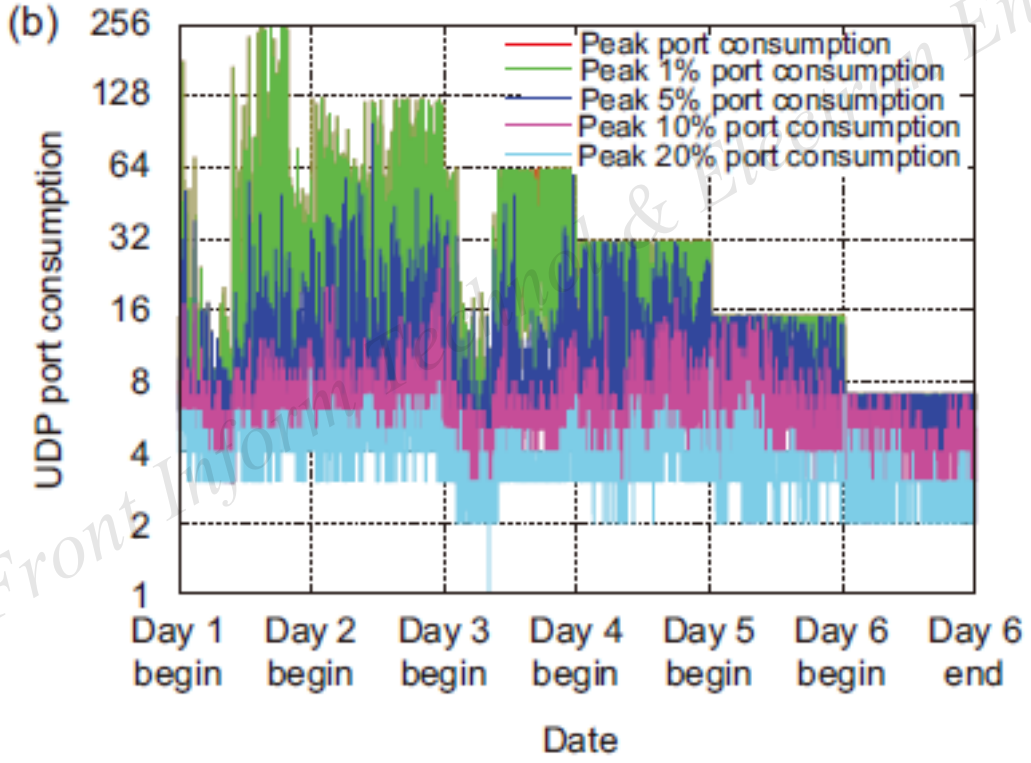
Impact on the stateful path traffic (UDP)



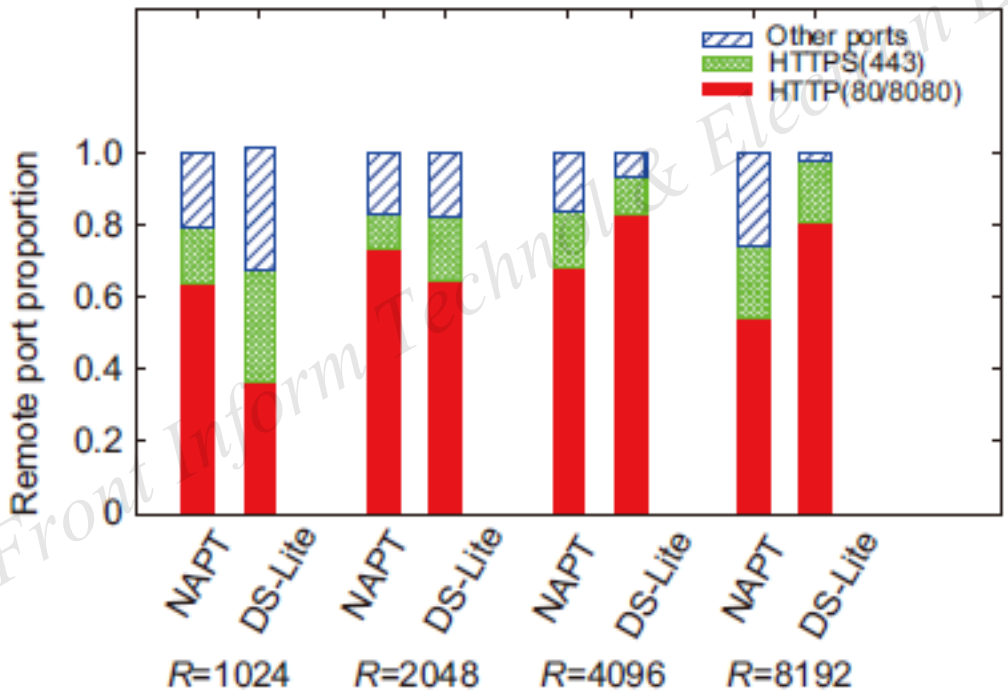
Impact on the stateless path traffic (TCP)



Impact on the stateless path traffic (UDP)

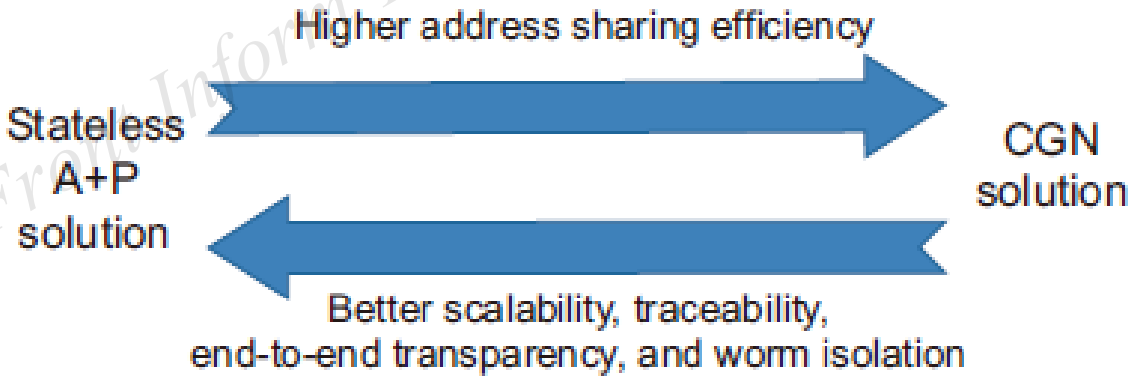


Impact on the data paths of applications



Making flexible address plans

- The hybrid address sharing approach provides a tuner between the stateless solutions and the stateful solutions, which can help providers make flexible address plans according to their actual requirements.



Conclusions

- Sharing scarce IPv4 address effectively is especially important in the IPv6 transition process.
- The hybrid address sharing approach proposed in this paper can use limited IPv4 addresses efficiently without degrading the performance of applications on end hosts. The real evaluation and deployment show the validity of our approach.
- The approach is especially useful for providers who want to use limited IPv4 addresses to accommodate a large number of customers.