DESIGN, IMPLEMENTATION, AND OPERATION OF IPV6-ONLY IAAS SYSTEM WITH IPV4-IPV6 TRANSLATOR FOR TRANSITION TOWARD THE FUTURE INTERNET DATACENTER

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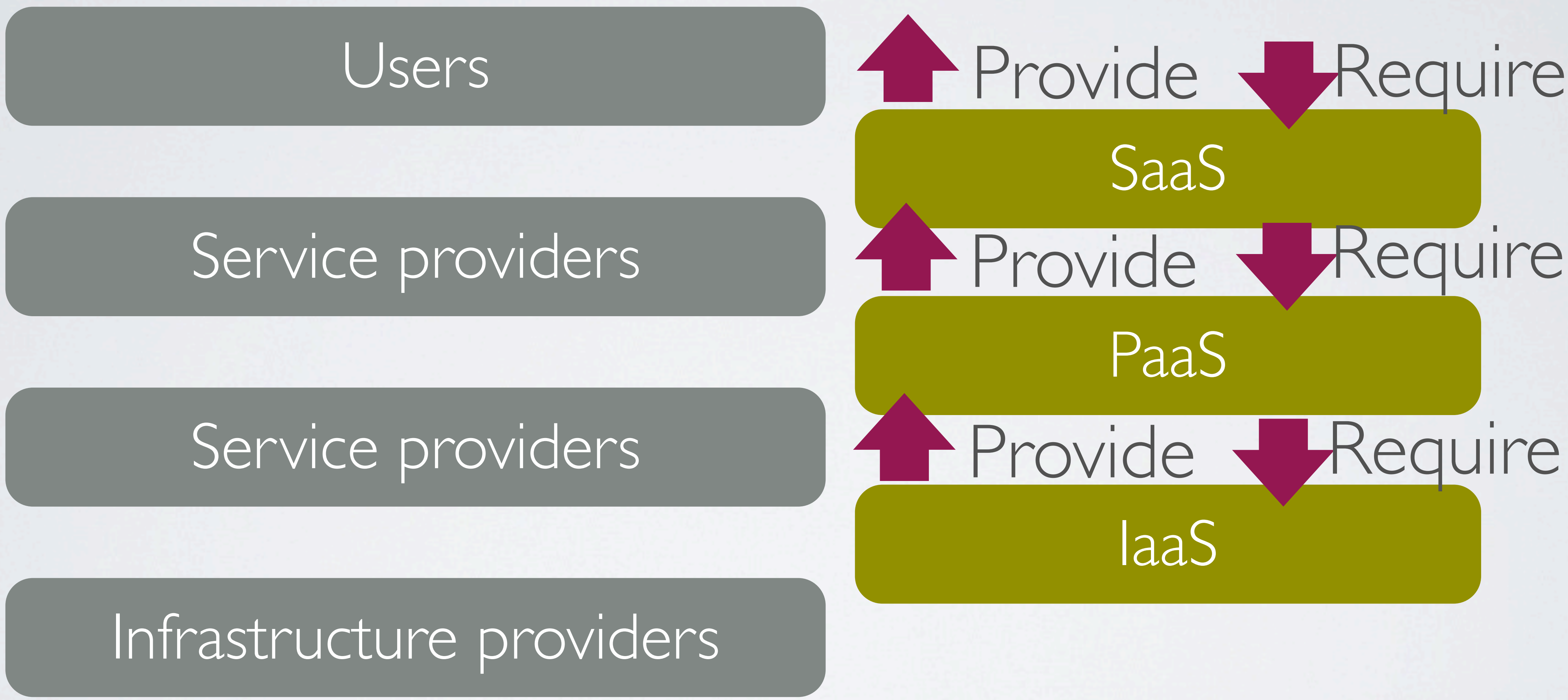
WIDE PROJECT

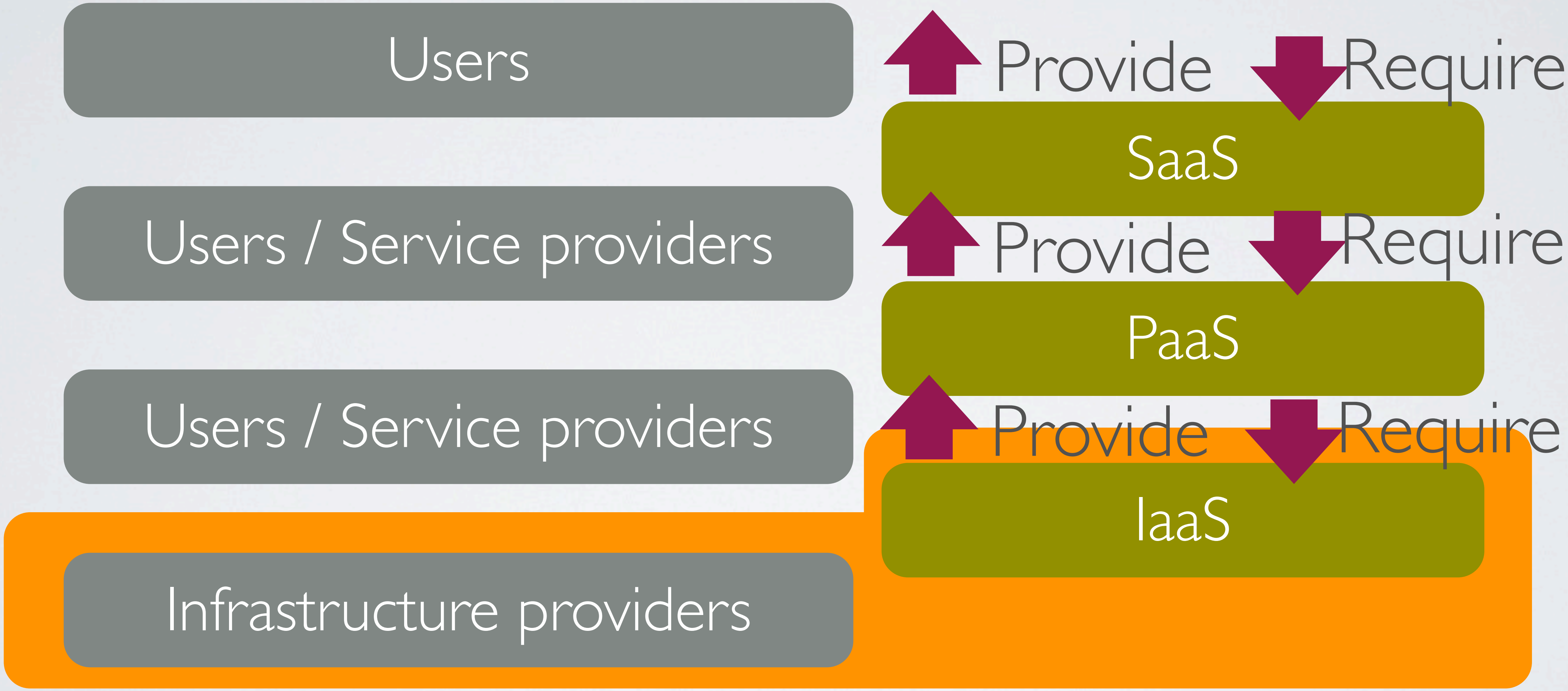
BACKGROUND

- Increasing computing power and wide spreading virtualization technology
- Demand for more flexible configuration of network service backend system and cloud computing technology
- IPv4 address depletion, IPv6 deployment, and operation cost of infrastructure

CLOUD SERVICES FROM DIFFERENT VIEWPOINTS



CLOUD SERVICES FROM DIFFERENT VIEWPOINTS



Our target

REQUIREMENTS FOR FUTURE INTERNET DATACENTERS

- Datacenter interconnection for scaling out infrastructure or service beyond geographical limitation
- Transparent resource availability over geographically distributed datacenters
- Migration to IPv6 with less operation cost without losing IPv4 client backend compatibility

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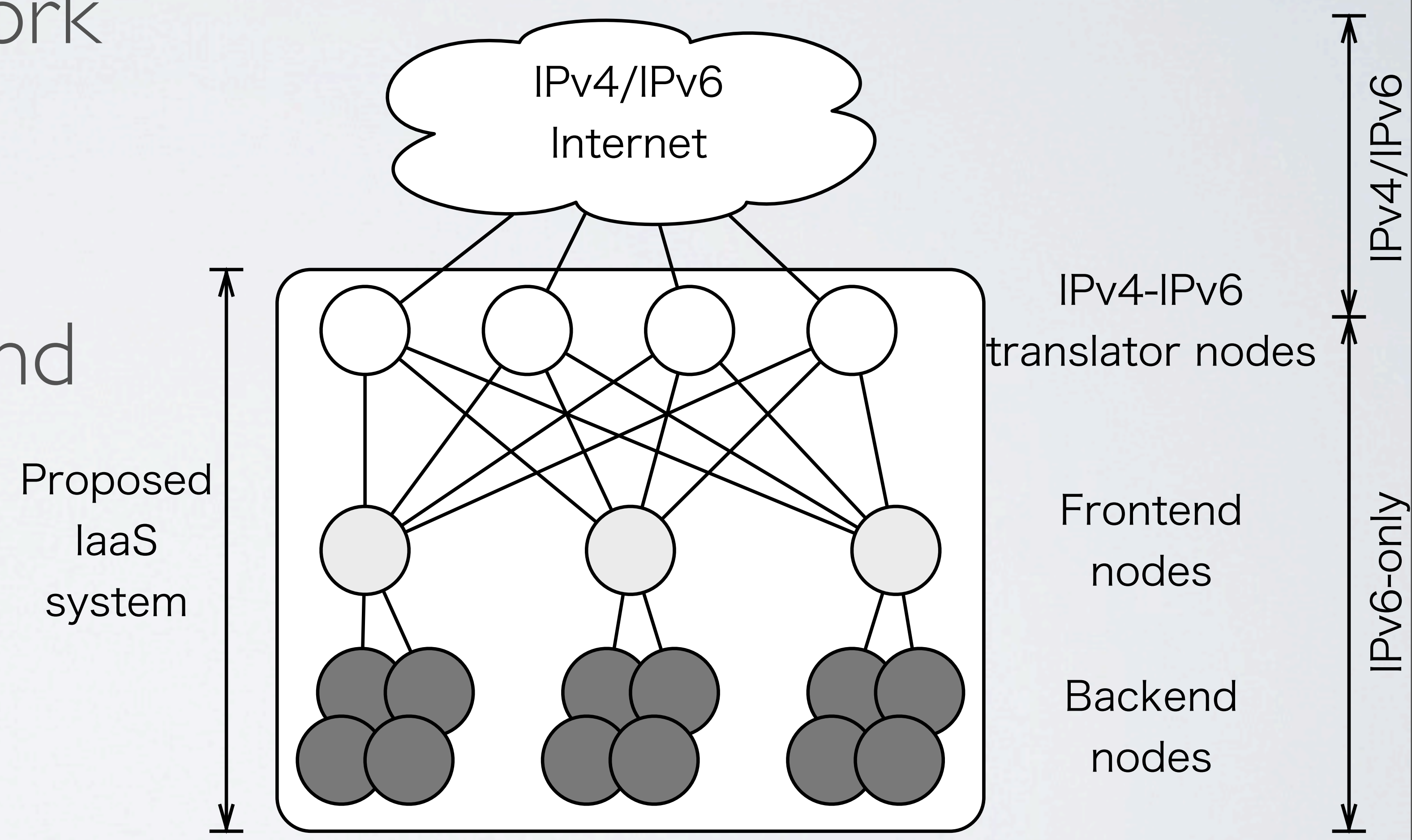
Our focus in this paper

BASIC CONCEPT

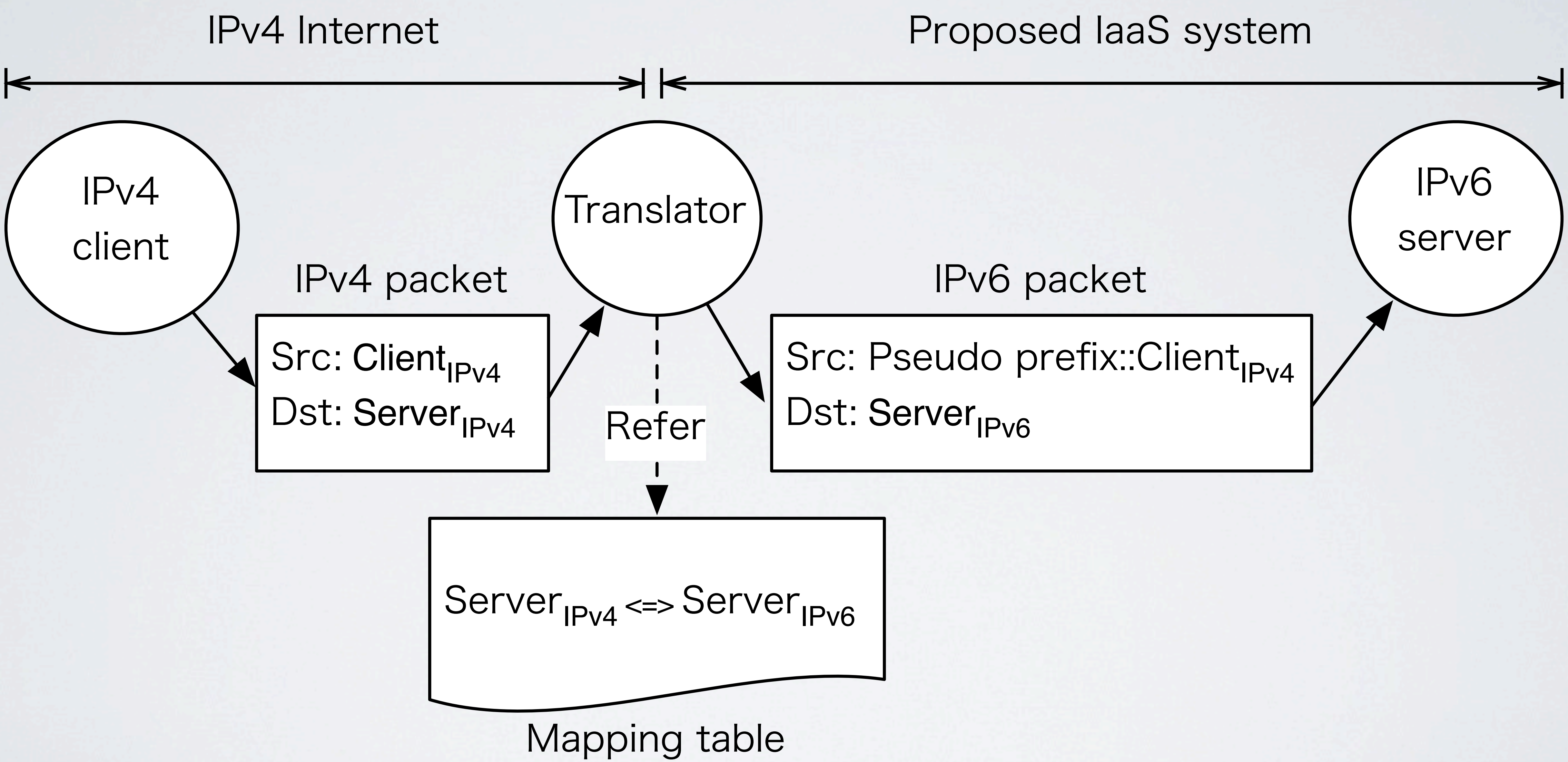
- Build infrastructure network only with IPv6
- IPv4 compatibility is necessary only for frontend nodes that interact with users
- IPv6-IPv4 translation is performed between frontend nodes and user nodes



TRANSLATOR DESIGN

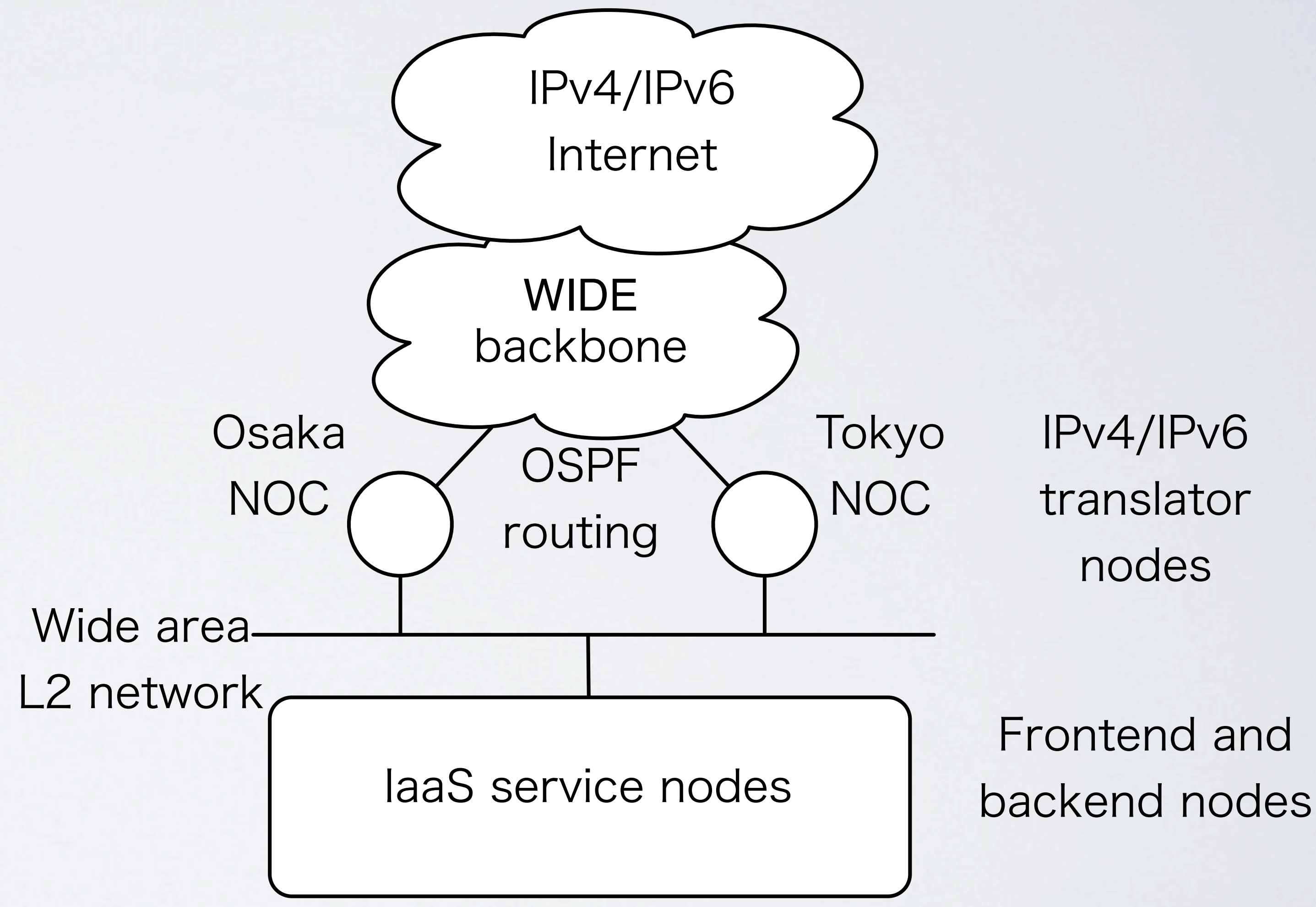
- The basic idea is same as DNS64/NAT64
- The important design choice and limitation is that one IPv4 and one IPv6 addresses are mapped directly one by one
  - For redundancy and scaling out
  - Drawback: IPv4 address utilization (but remember that IPv4 addresses are assigned only to frontend nodes)

HOW TRANSLATOR WORKS



IMPLEMENTATION AND DEPLOYMENT

- Frontend nodes and backend network, built on top of the wide area L2 network
- Two exit points located at Tokyo and Osaka

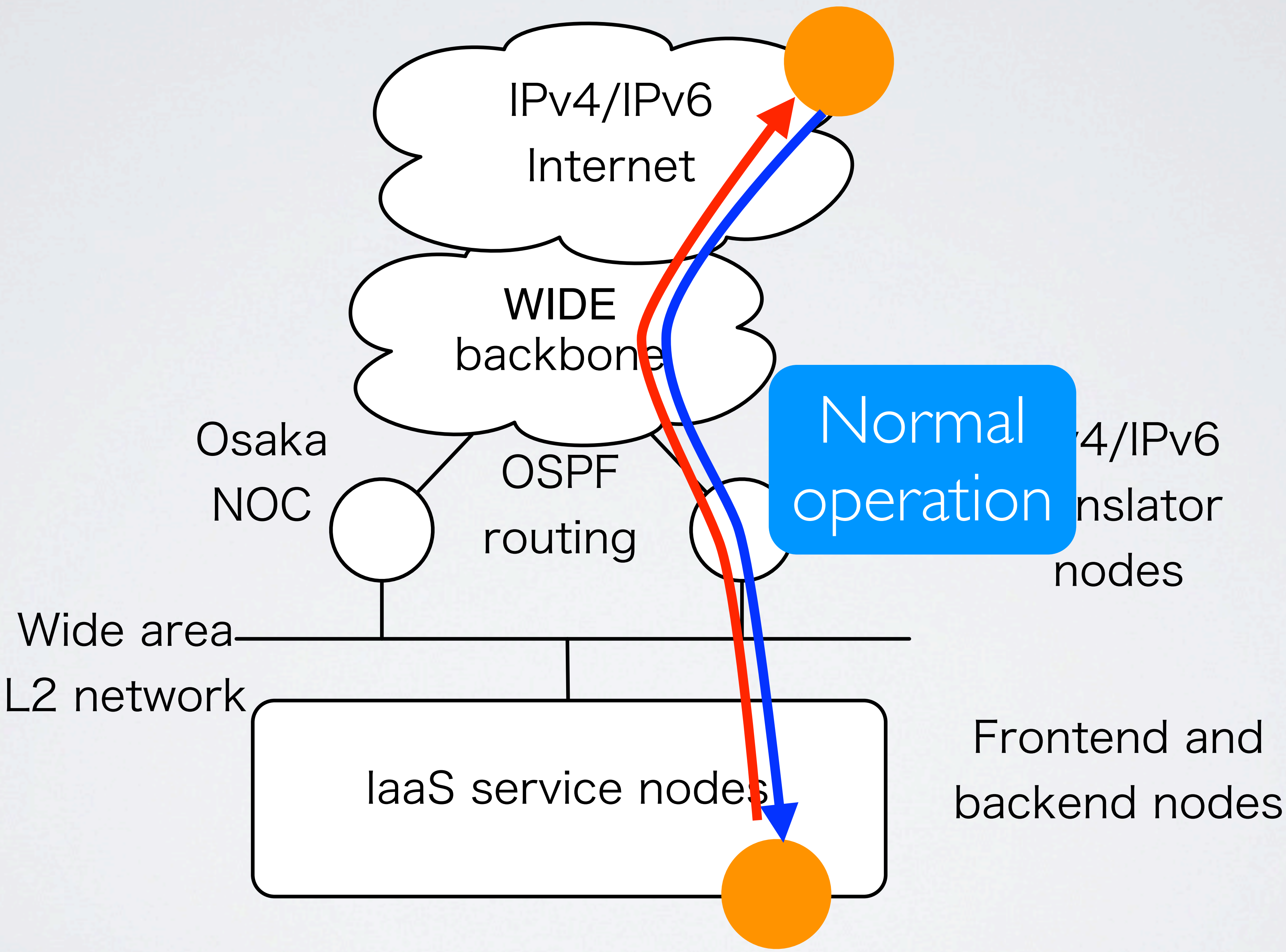


SYSTEM EVALUATION

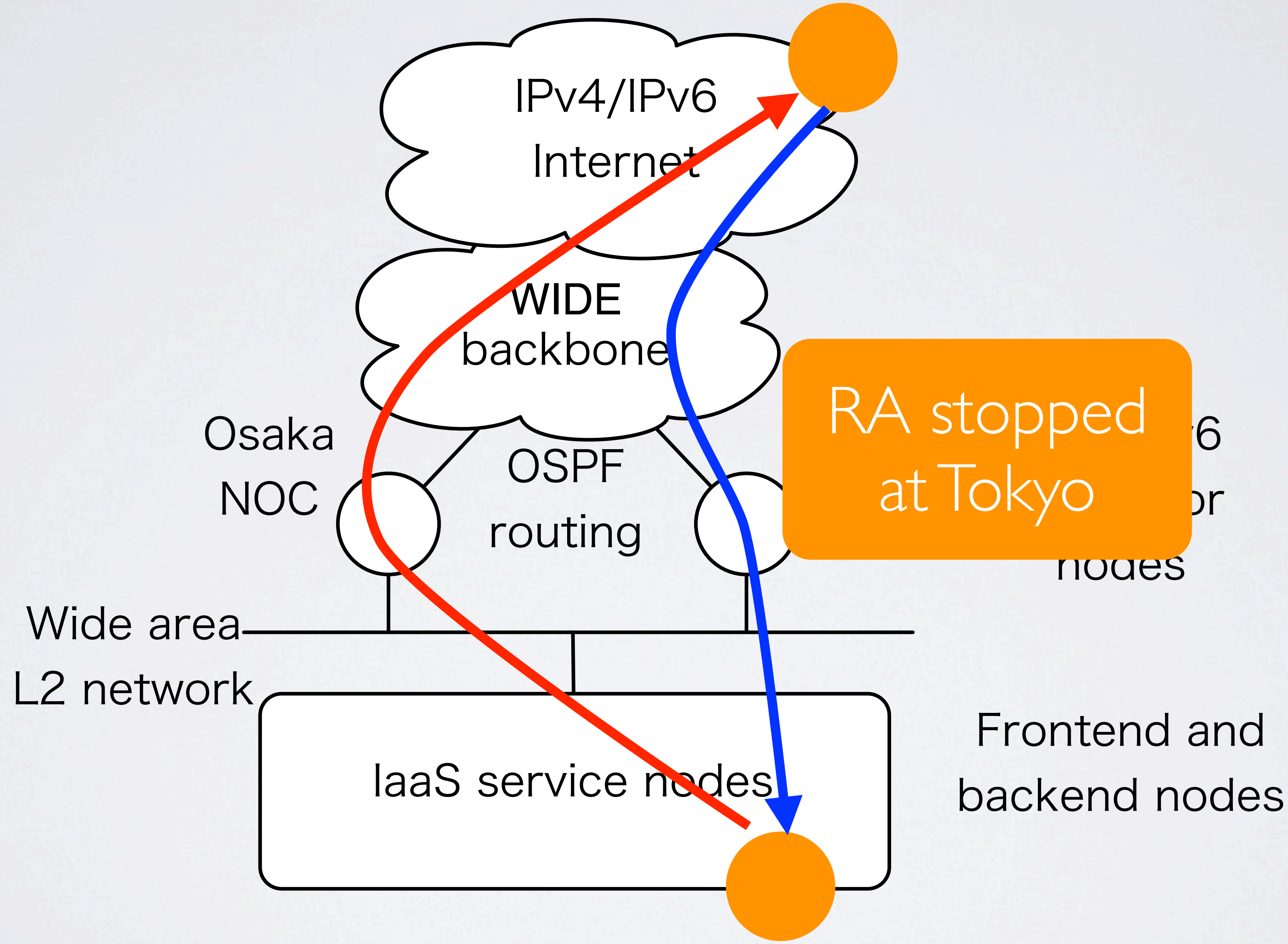
- Redundancy verification between Tokyo and Osaka

1. Stop radvd on the translator node at Tokyo
2. Stop translator function on the translator node at Tokyo
3. Restart radvd, translator at Tokyo

SYSTEM EVALUATION



SYSTEM EVALUATION



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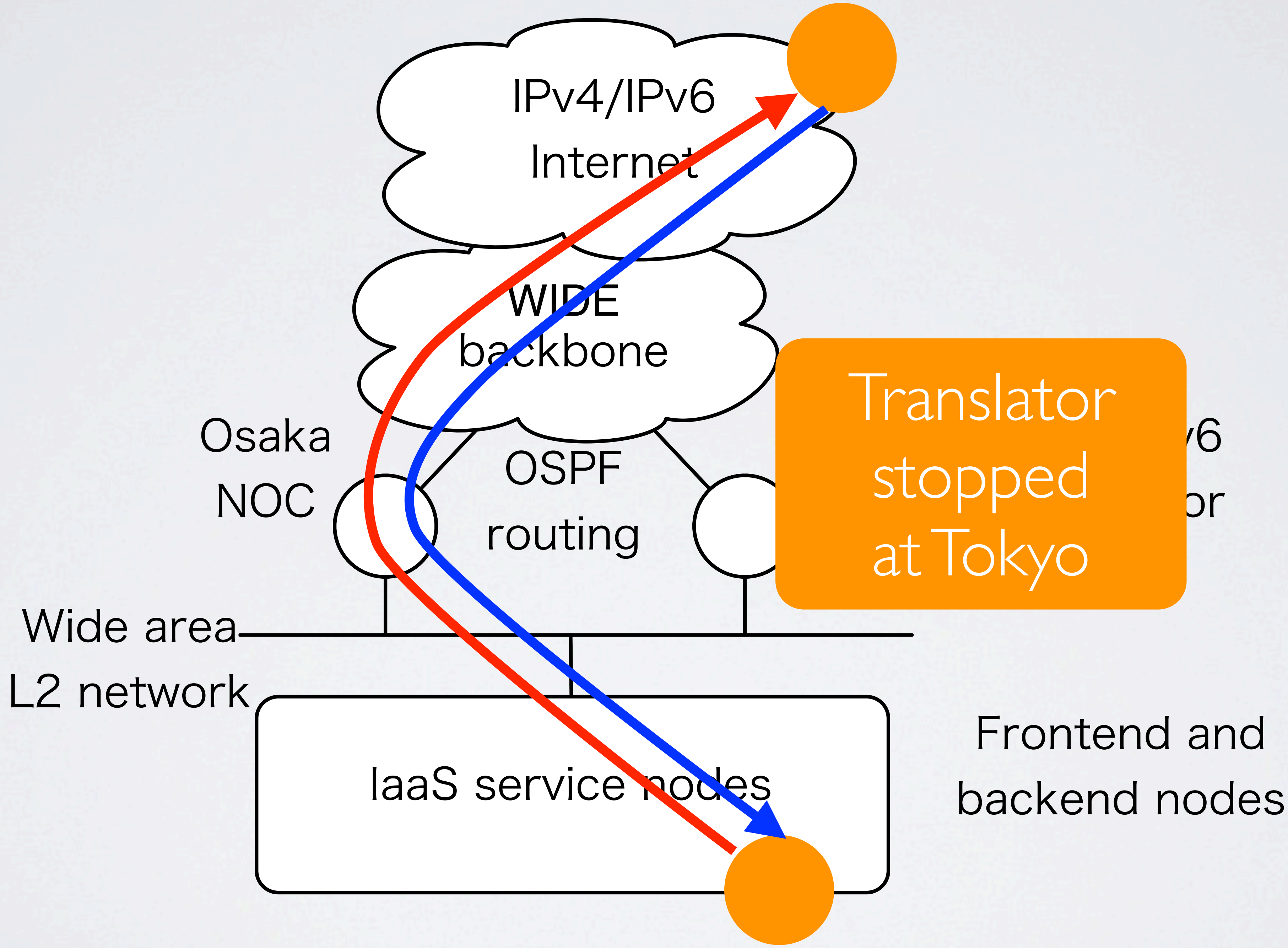
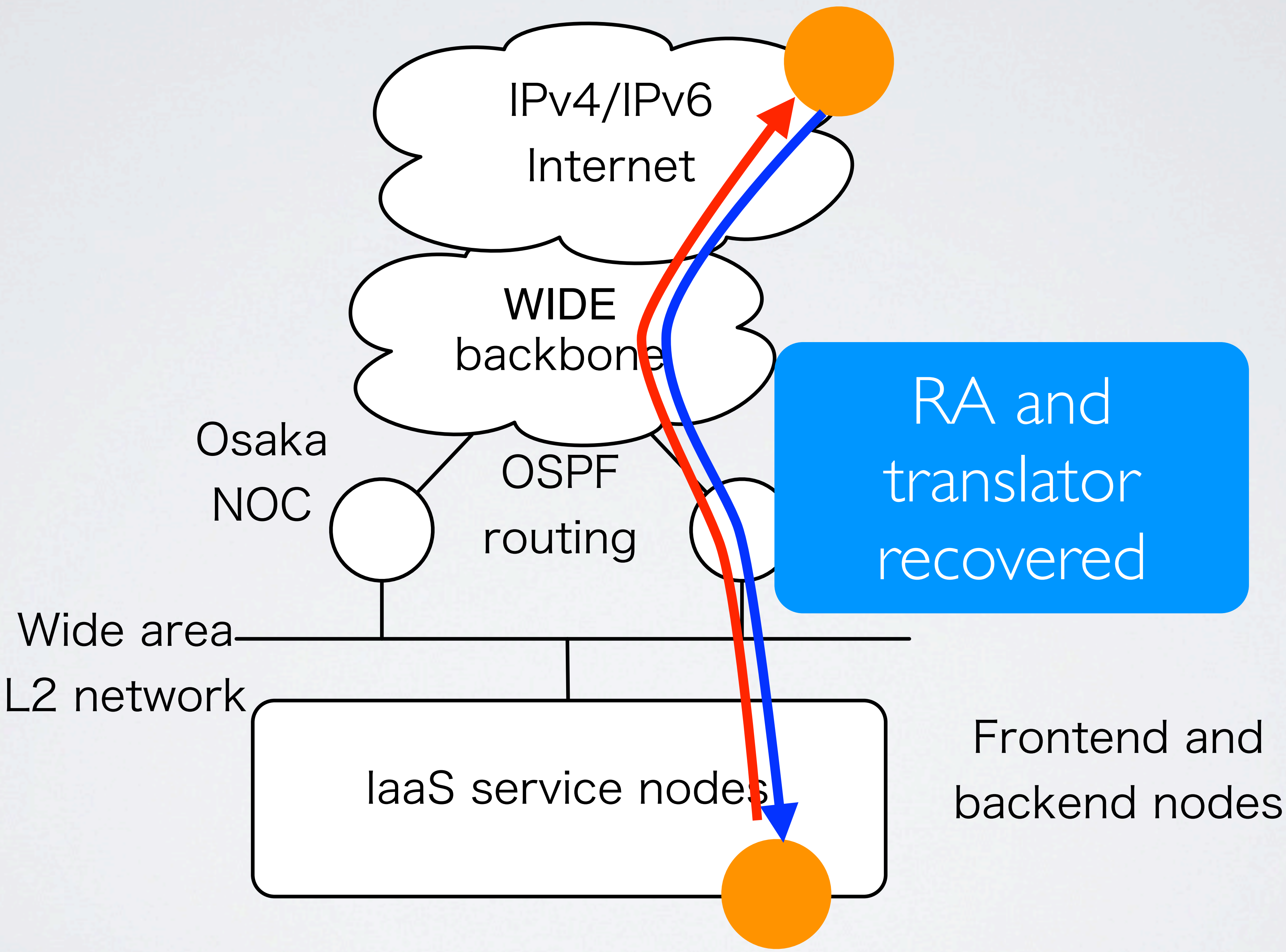


SYSTEM EVALUATION



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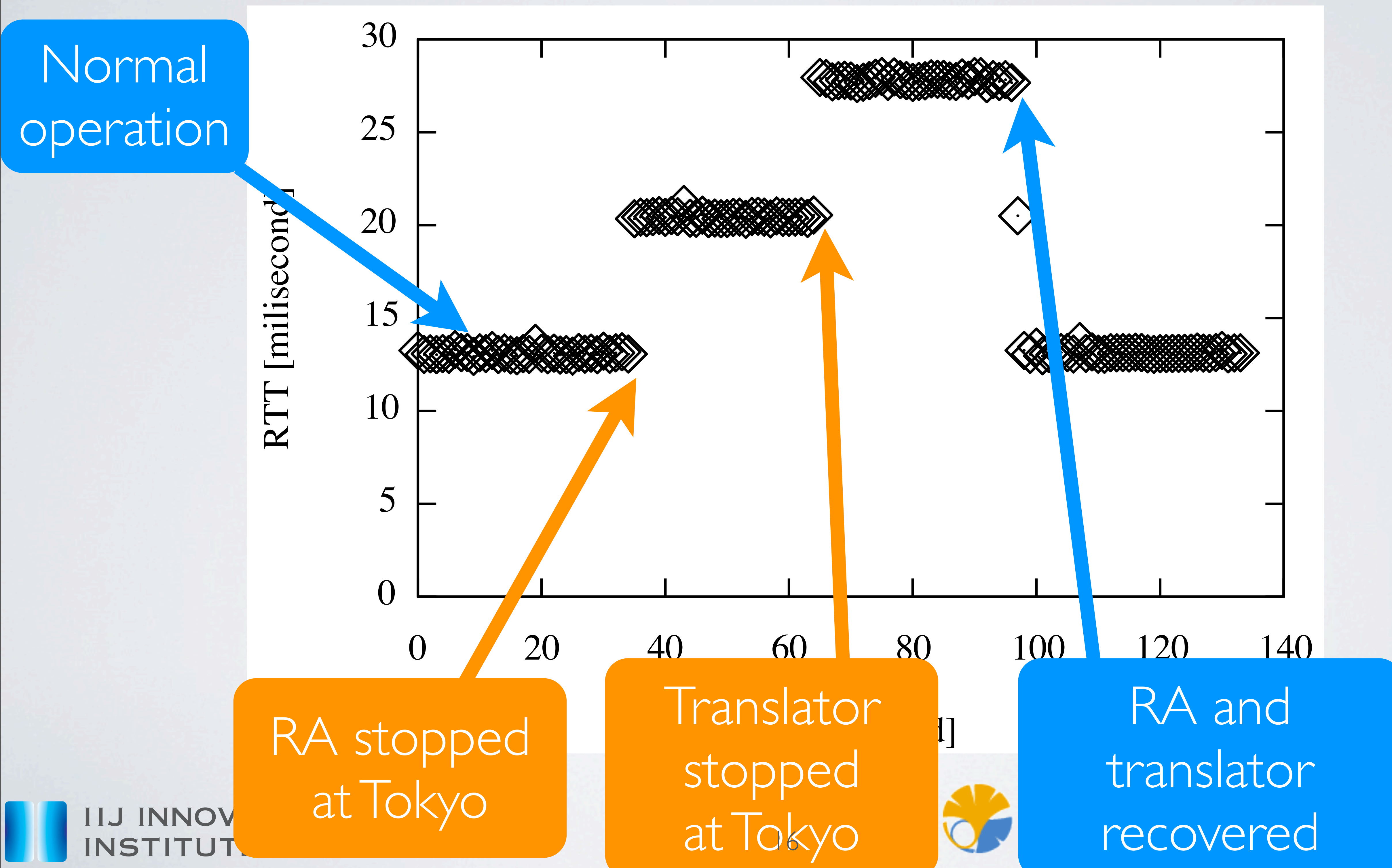
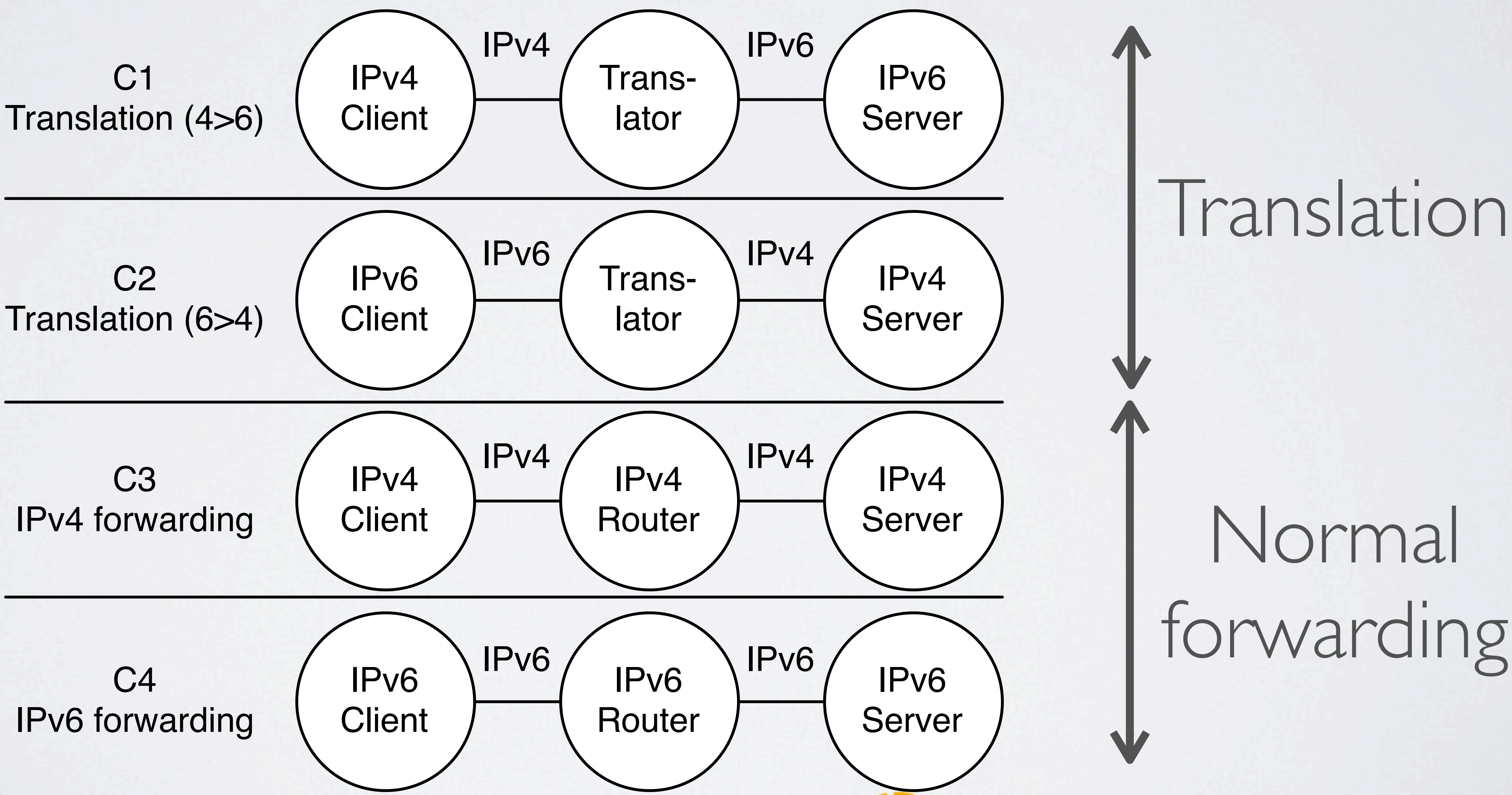
WIDE PROJECT

SYSTEM EVALUATION



TRANSLATOR PERFORMANCE

Test network configurations



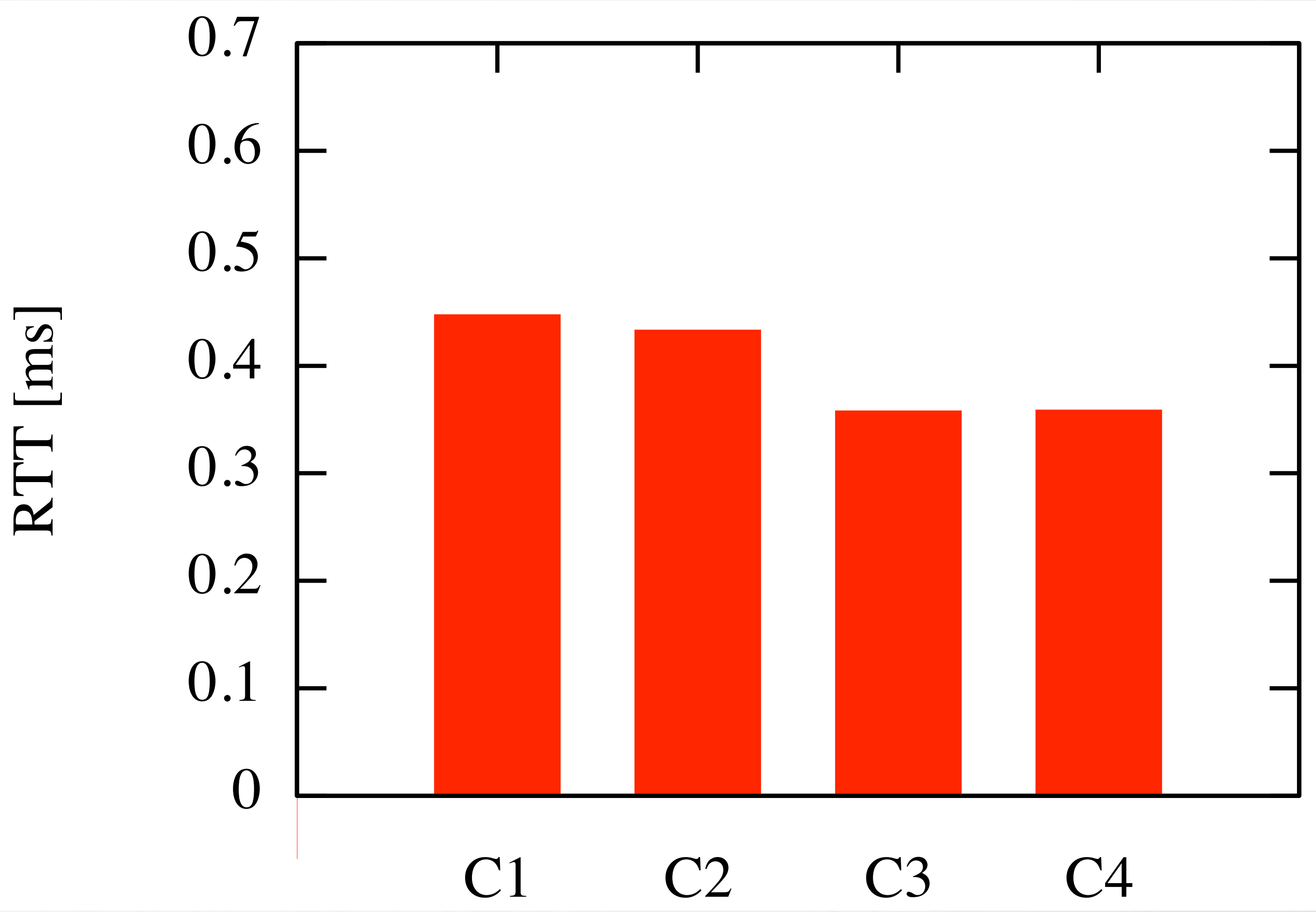
SPECIFICATION OF EQUIPMENTS USED

Table 1: Specification of nodes

	Client/Server	Translator/Router
CPU	Core2 Duo 3.16GHz	Xeon L5630 2.13GHz × 2
Memory	4GB	24GB
OS	Linux 3.0.0-12-server	Linux 3.0.0-12-server
NIC	Intel 82573L	Intel 82574L

RTT COMPARISON

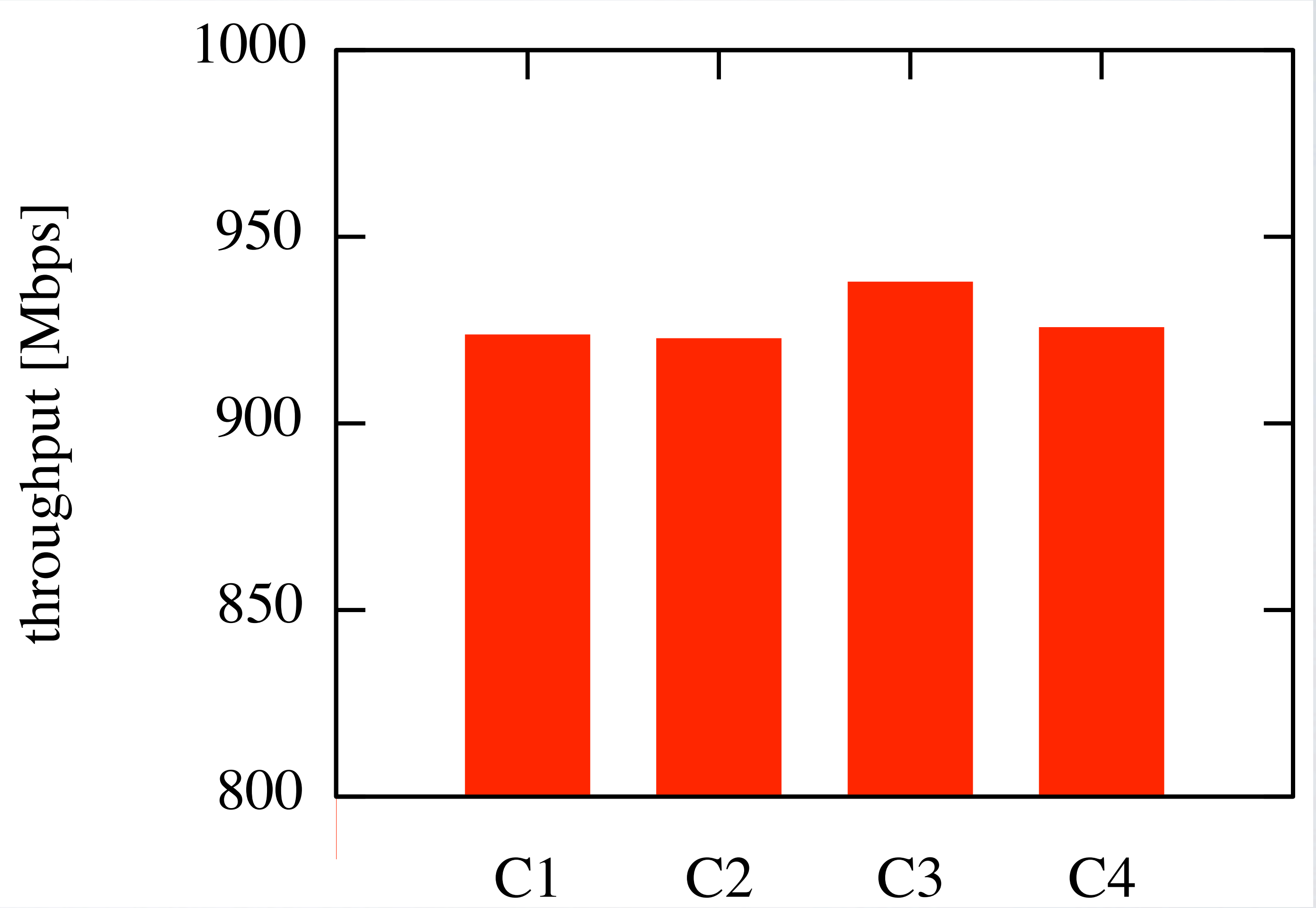
- RTT degradation is around **0.07ms to 0.09ms worse**



Translate Normal

TCP PERFORMANCE

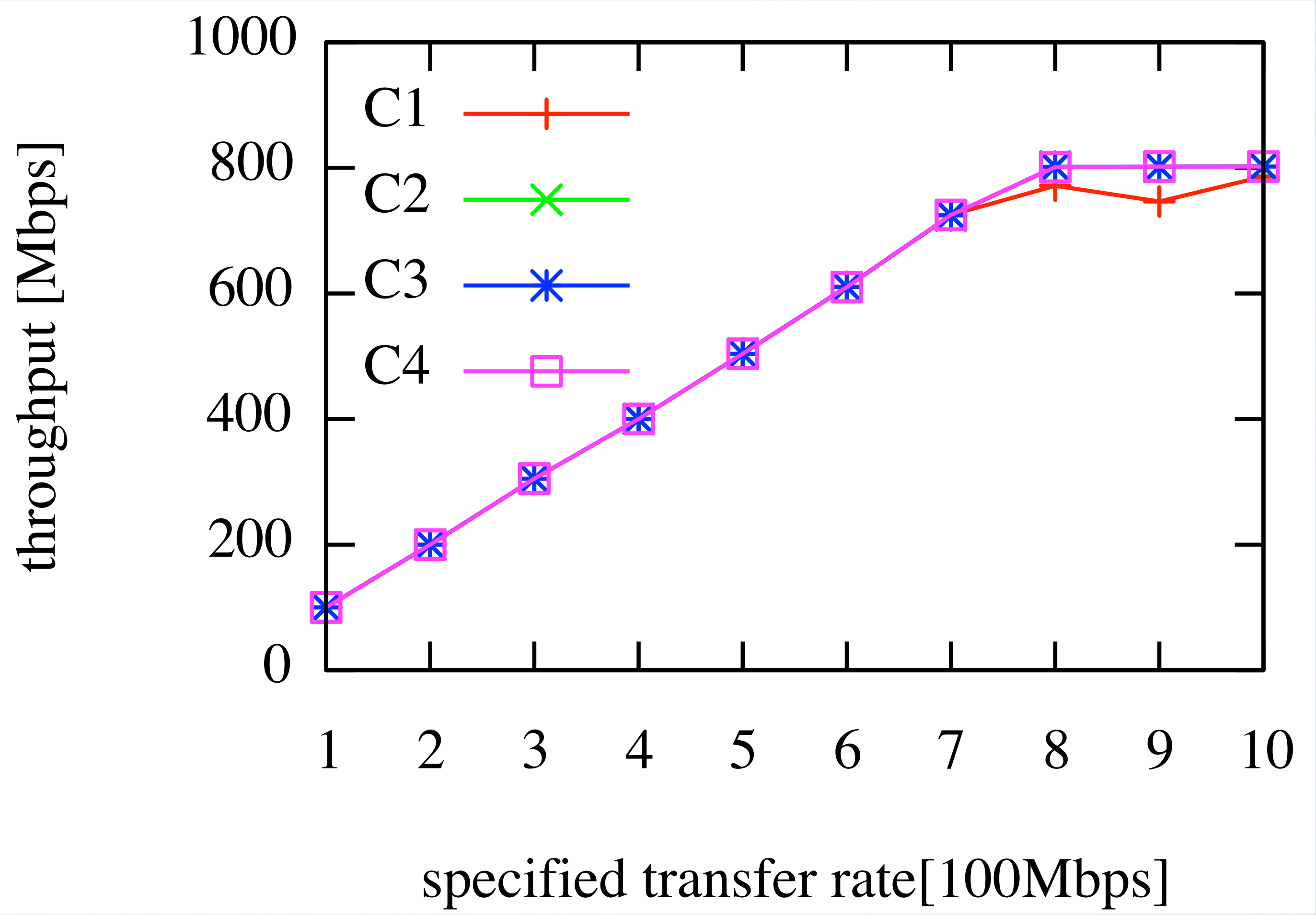
- The forwarding performance of translator is **1.5% to 1.6% worse** than normal forwarding



Translate Normal

UDP PERFORMANCE

- The forwarding performance of translator is **2.0% worse** than normal forwarding



RELATED TECHNOLOGIES

- Application layer gateway
  - Pros: useful when complicated application protocol conversion is required
  - Cons: per application gateway is required

RELATED TECHNOLOGIES

- Transport layer gateway
  - Pros: transparent from users
  - Cons: library upgrade (e.g. SOCKS64), DNS service upgrade (TRT and DNS64)

RELATED TECHNOLOGIES

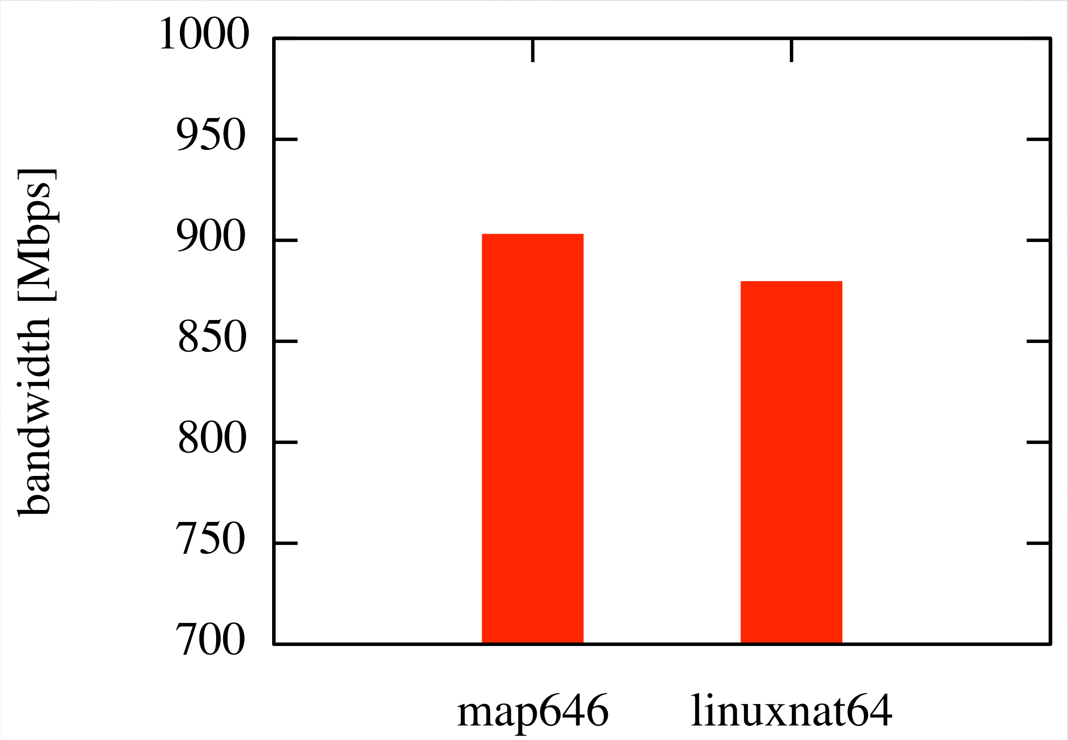
- DNS64/NAT64 (IP layer approach)
  - Pros: transparent from users
  - Cons: DNS service upgrade

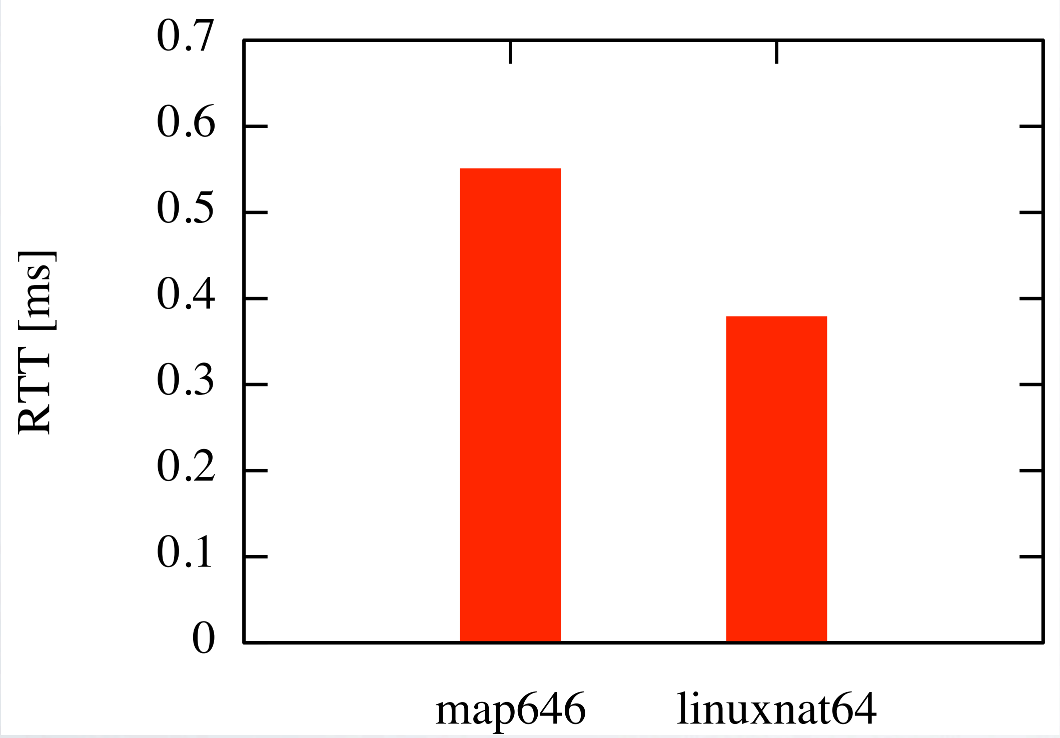
RELATED TECHNOLOGIES

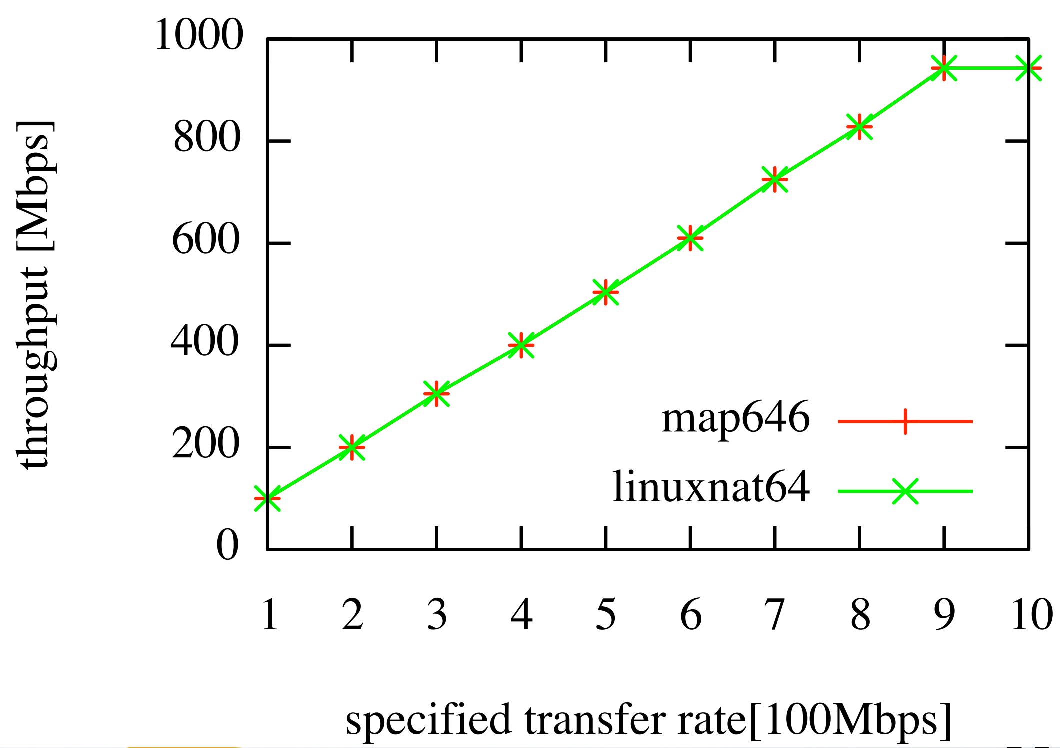
- In theory, every translation technologies can be used as a translation component of our proposal
- Most of the current implementation doesn't support our operation (IPv6 nodes as servers for IPv4 clients)
- And they have too rich function for our solution (such as one to many mapping function)

COMPARISON WITH NAT64

- Almost same or even better performance







CONCLUSION

- Proposed a new style of IaaS operation based on IPv6 only network to reduce operation cost, and provide IPv4 compatibility with a 64 translator
- Verified redundant operation of the translation system
- Implemented a simple 64 one to one translator for the proposed IaaS system and evaluated its performance