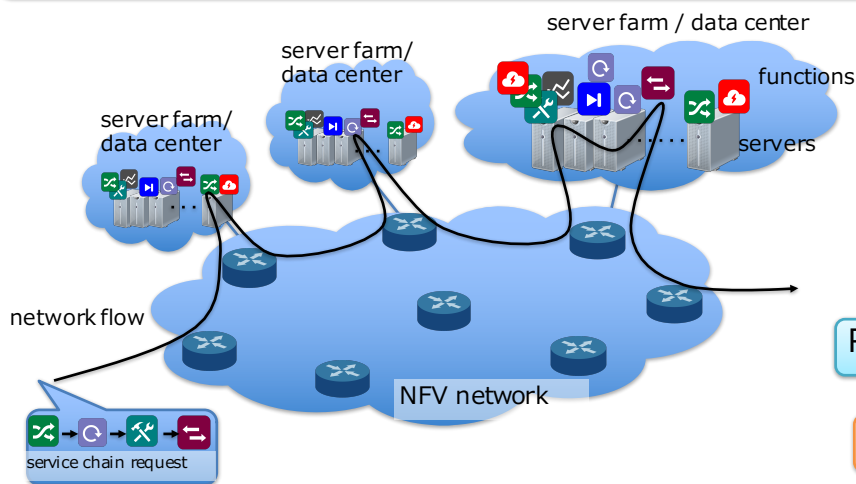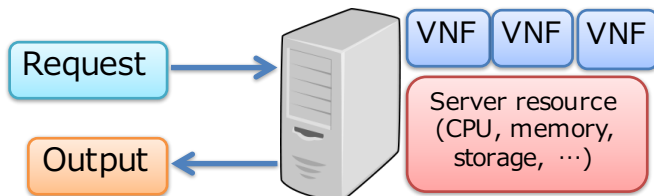# Biochemically-inspired method for constructing service space in virtualized network system
*Go Hasegawa, Shun Sakurai and Masayuki Murata from Osaka University, JAPAN

server farm / data center

server farm / data center

server farm / data center

functions

servers

network flow

NFV network

service chain request

Problem: Construction of NFV network
- (Re)placement of Virtual Network Functions (VNFs) according to server resources and flow's service chain requests
- Distributed, adaptive, and scalable mechanism is required for large-scale deployment of NFV.

Request → [server] VNF VNF VNF

Server resource (CPU, memory, storage, …)

Output ←

Solution: Biochemical reaction model
Behaviors of a server is modeled as **chemical reactions** in a beaker
- Processing requests from packets for virtual functions
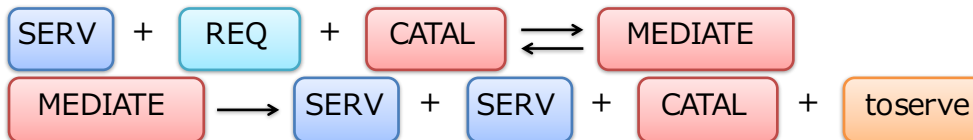- Server resource sharing among multiple functions on a server according to demand for functions

toserve

REQ

toserve

REQ

SERV

SERV

SERV

CATAL

SERV : Resource share of a function
REQ : Packets of NFV flow with requests for functions
toserve : Result of applying function to packet
CATAL : Remaining server resource (CPU, memory, storage, ...)
MEDIATE : Assigned server resource to function

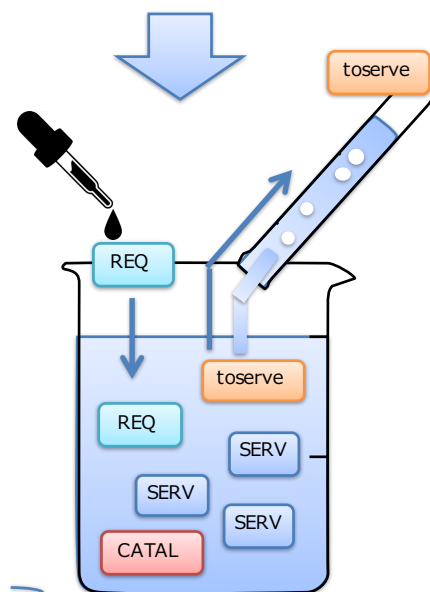**Reactions for service processing:**
Server processes function to packet and increase resource share of the function
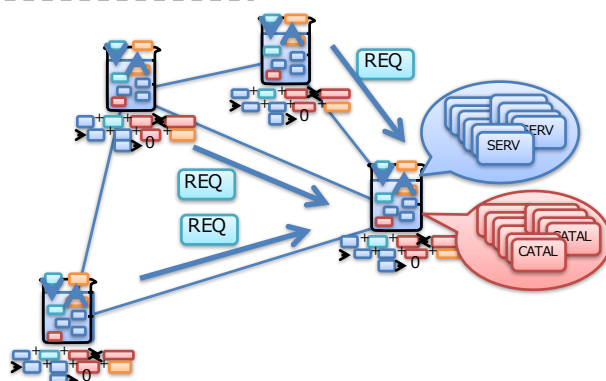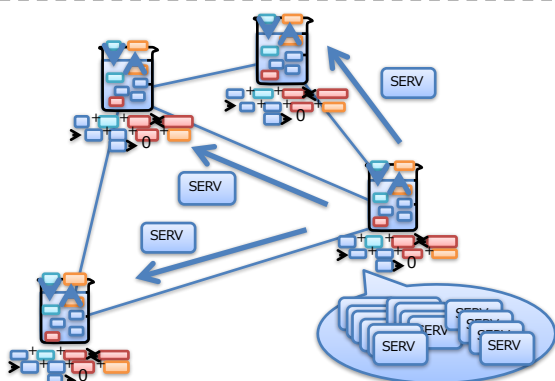Reaction speed is controlled by concentrations of reactants
CATAL behaves as a catalyst to control the overall reaction speed

$$SERV + REQ + CATAL \rightleftharpoons MEDIATE$$

$$MEDIATE \rightarrow SERV + SERV + CATAL + toserve$$

Reaction for decaying resource share: $SERV \longrightarrow 0$

Concentration of SERV means server resource share reflecting demand for corresponding function

SERV

SERV

SERV

REQ

REQ

REQ

SERV

CATAL

NFV network is modeled as a network of beakers.
SERV diffuses to surrounding beakers to distribute functions with high demand.

REQ (NFV flow packets) moves to a beaker with plenty of SERV (service share at server) and CATAL (remaining resource).

Contribution of our paper:
- Build chemical reactions for constructing network service scape like NFV network
- Validate the proposed model with computer simulation based on tau-leaping method

Future work:
- Mathematical analysis of the characteristics of the proposed model
- Implementation experiments