# Tiled Display Wall with Network Failure Avoidance Mechanism using Software Defined Networking

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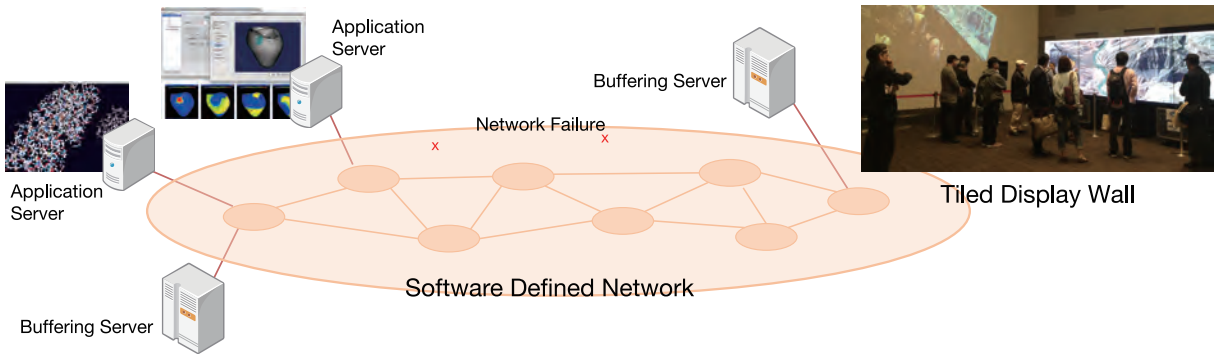


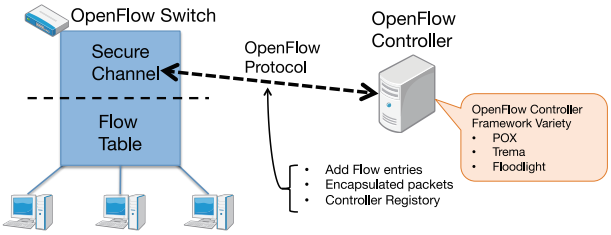


## Summary

In this study, we seek a new design of tiled display wall middleware that are aware of network condition and tries to avoid instabilities.
We modified tiled display wall middleware to be able to detect network failures and packet buffering mechanism based on OpenFlow technology, one of the Software Defined Network implementation. With the modified version of SAGE, a visualization application can detect a network failure, and change network path according to the circumstances. And also the packet buffering mechanism can compensate dropping packets, that might lead to corruption of video frames.

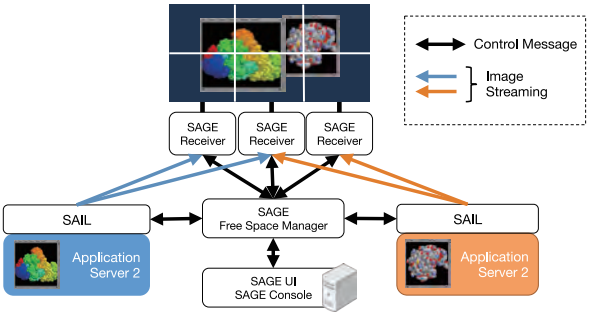

## Key Technologies
## SDN/OpenFlow

Software Defined Network (SDN) is a newly-emerged network concept that allows us to separate the network control plane from the data transfer plane. That can help network administrators to manage network resources in centralized manner. And also SDN enables us to realize flexible control of network resources, such as redundant pathway, packet buffering and so on.
OpenFlow is the most popular SDN implementation which is being standardized by the Open Networking Foundation [1]. The OpenFlow protocol, which is used to split the control plane from the data plane,
has been affected by SDN concept.



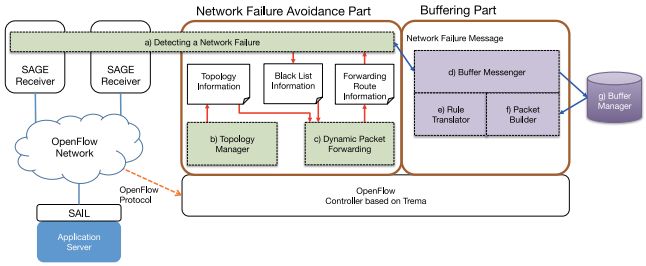

## TDW/SAGE

SAGE (Scalable Adaptive Graphics Environment)[2] is a middleware designed to control tiled display walls. Notable features of SAGE include distributed rendering, display number scalability, and multiple viewing applications. We believe that these features are very important for spreading and encouraging e-Science movement.




## System Overview

We implement detecting and avoidance a network failure with SAGE and Trema [3]. Trema is one of OpenFiow controller framework, which provides easy-to-use framework for developing OpenFlow controller in Ruby and C language[4].




## Network Failure Avoidance Part

a) Detecting a Network Failure
If network flow is down, SAGE receiver stops the rendering image and adds failed network flow to the black list. Then, it sends a message to the Buffering Part.

b) Topology Manager
Topology Manager has been capturing the network topology.

c) Dynamic Packet Forwarding
If black list updates, this function rewrite flow entry as an un-failed network flow. Then, receiving a dropped packet from the Buffering Part and sending it to SAGE Receiver.

## Buffering Part

d) Buffering Messanger
If network flow is down, SAGE receiver stops the rendering image and adds failed network flow to the black list. Then, it sends a message to the Buffering Part.

e) Rule Translator
It aims the function of packet filter for buffering. A user create filter rules which apply and filter a packet using TCP-dump.

f) Packet Builder
If network flow is down, Packet Builder exports the captured packets and recover failed packets.

g) Buffer Manager
Buffer Manger has buffer captures on a per-flow basis. Packet capture is continuous once a flow has been added.


[1]. The Open Flow Switch Specication, Version 1.1.0, http://www.openflow.org/documents/openflow-spec-v1.1.0.pdf, (2011).
[2]. Leigh, J., Johnson, A., Renambot, L., Peterka, T., Jeong, B., Sandin, D., Talandis, J., Jagodic, R., Nam, S., Hur, H. and Sun, Y.: Scalable Resolution Display Walls, Proc. of the IEEE, Vol. 101, Issue 1, pp.115-129, (2013).
[3]. Furuichi, T., Date, S., Yamanaka, H., Ichikawa, K., Abe, H., Takemura, H. and Kawai, E.: A Prototype of Network Failure Avoidance Functionality for SAGE using OpenFlow, Proc. of IEEE 36th International Conference on Computer Software and Applications Workshops, pp.88-93, (2012).
[4]. Trema, http://trema.github.io/trema/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