

# WiP Abstract: Virtual Network Platform for Large Scale CPS Testbed

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**Abstract**—We propose virtualized network platform for optimal testbed of large scale cyber-physical system(CPS). We introduce network and performance isolation scheme of virtual network platform to support CPS.

**Keywords** - network virtualization; CPS; large scale testbed; XenRelated Works

## I. INTRODUCTION

Many studies of CPS have been studied such as CPS applications, sensors and middleware. However, there is insufficient of studying CPS testbed platform that evaluates performance and managing large groups of CPS network. To manage large scale CPS efficiently, we need virtualized network platform that can support data transmission and processing on real network. Therefore, we propose and study a virtualized network platform for large scale CPS testbed. The virtual network platform implements CPS more realize and supports interaction of various CPS service groups for CPS testbed.

## II. VIRTUAL NETWORK PLATFORM

The large scale CPS testbed needs general measure, ensuring link, security and also performance[1]. In our system as shown in figure 1, it is possible to make coexistent environment of various CPS services by using virtualization. We implement isolation scheme that means network isolation and performance isolation. The network Isolation means perfectly isolated virtual network form that does not affect other virtual networks. And the performance isolation is a management and a distribution of available network bandwidth to support various controllers and devices, Virtual network platform generates multiple isolated virtual networks by managing virtual routers that based on Xen[2] as shown in figure 2. The isolation grants integrity of certified CPS services by ensuring independency of each virtual network. And this isolation secures optimized quality of service for each CPS services. Our system supports multiple virtual networks on a physical network with virtual routers. These virtual networks are isolated each other by using VLAN ID(Virtual LAN ID) and tunneling method. With this network isolation, virtual network platform can support communication with integrity between CPS components that are sensors, devices and controllers. The CPS data in this isolated virtual network serviced independently. Therefore, they do not encroach on each other and minimize the pollution such as hacking or attacking from unauthorized influence. To configure virtual network that accessible anytime and anywhere between CPS

controllers, it needs that supporting fast and flexible generation of virtual network. Moreover, Virtual network platform provides isolated performance that allocates bandwidth dynamically to each virtual network. We implement performance isolation with three ways that BCN technique of Intel VM[3], priority based bandwidth control and virtual channel bonding. They optimizes network performance stable. Therefore, it can support controlling devices in real-time. In some cases, Virtual network platform provides better performance by combining the available bandwidth. Although, virtual network platform is flexible and scalable to be a good testbed for CPS, performance is still arguable. To improve performance, we apply SR-IOV(single root I/O virtualization)[4], and also use GPU(graphic processing unit) to our system.

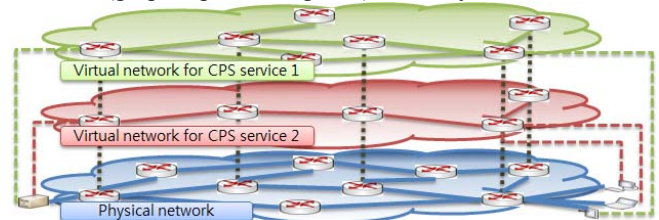


Figure 1. Isolation scheme

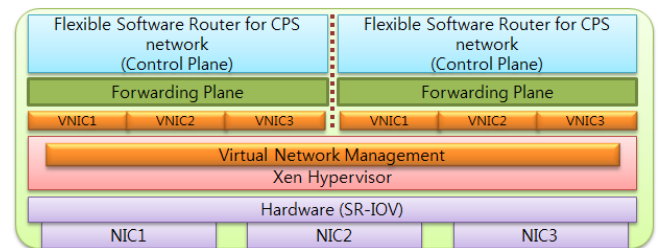


Figure 2. Virtual network platform architecture

## III. CONCLUSION

The virtual network platform can ensure many requirements of CPS such as security, flexibility and performance optimization. And we hope our system is a good testbed for CPS.

## REFERENCES

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