Building Environment for Stage-based Service Development and Experiment

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Many services are running on the Internet. External factors such as other services' traffic, failure in the route and transmission delay have on effect these services. When a new service is developed, developers need to confirm the effects of these external factors. I propose to build the experiment environment that provides smooth experiment targeting service development and experiment.

When developing a service, developers must confirm service's behaviors that are expected. I define "stage-based experiment". Developers need to experiment service's behaviors and experiment with effect of external factors. At early stage of development, developers need to experiment about service's behaviors without external factors. If service has unexpected action on environment with external factor, developers can not find cause easily that are caused by external factors, service's behaviors or both. Therefore, developers need to experiment on environment without external factors. At the next stage, developers need to experiment after add external factors to environment. In validating the service, developers need to build experiment environment that is appropriate for experimental stage.

I proposed to use some experimental stage. I defined three stages as follows: service only, external factors added and real experiment on the Internet. Testbeds are facilities to support experiment that has different feature and purpose. One is deployed distributedly that is suitable for real

experiment on the Internet. One is a centralized facility that is suitable for service only experiment. That kind of testbed is suitable for external factors added stage too. Developers use multiple testbeds for "stage-based experiment" because building environment to support all stages on single testbed is hard.

Each testbed has different system such as operating system and management system because each testbed's purpose is different. Developers need to perform different operations on each testbed. If developers use multiple testbeds separately, these testbeds can not share common configuration and management information. If developers can handle these testbeds as one large scale testbed, developers can operate them via single testbed management system. They can operate transparent stage changing. Developers must build experiment environment that use same operating system and management system for each testbed.

I proposed and implemented testbed system as a prototype. The proposed prototype targets to StarBED which is a centralized testbed. I leverage MyPLC to build an experiment environment on StarBED that use same operating system and management system as PlanetLab that is deployed distributedly testbed. I extended MyPLC for handling PlanetLab and StarBED as one large scale testbed. I made possible building a larger scale experiment environment using StarBED's machines and PlanetLab's machines. I implemented programs that can switch network connection using tunneling protocol as method to staging. It programs adds external factors and connects to the Internet. I studied existing experiment supporting technologies to do experiment on my proposed environment. I also implemented tools to support experiment for use with existing software.

For evaluation, I compared environment built by my system on StarBED with PlanetLab, the sole StarBED and environment built by MyPLC on local environment about possibility of all stages. My system provide all experiment stages in "stage-based experiment". Real experiment on the Internet stage can be achieved by two methods using PlanetLab and using tunneling protocol.

I designed testbed architecture included those technologies for smooth "stage-based experiment". I realized various experiments on different stages by collaboration existing testbeds that have different features. I confirmed

them.