A New Slicing Scheme
for Efficient Use of Wireless Testbeds *

Angelos-Christos Anadiotis† Apostolos Apostolaras† Dimitris Syrivelis†
Thanasis Korakis‡ Leandros Tassiulas†
Dept. of Computer and Communications Engineering
University of Thessaly
†{aganadio, apaposto, jsyr, leandros }@inf.uth.gr ‡{ korakis@poly.edu}

ABSTRACT

The gradually growing need for testbed use so as networking algorithms to be validated in real environments, has given rise to optimal utilization of testbed resources. Despite the fact that, many laboratories around the globe have deployed testbeds, so as experimenters have the opportunity to test their algorithms, the majority of those testbeds suffer from bad management that prevents users from efficiently exploiting testbed's resources. Moreover, as the number of testbed users increases, experimenters needs for more sophisticated allocation of testbed resources are growing. Toward, this direction, we propose a managerial framework that exploits testbed utilization by introducing *slicing* over frequency spectrum. This new framework will allow a more sophisticated way to optimally control and manage network resources of a testbed.
Lab's website: http://nitlab.inf.uth.gr

Keywords

Slicing, Network Virtualization, Wireless Testbed Framework

1. SLICING AND NETWORK VIRTUALIZATION

The significant drawback of testbeds deployed for experimental reasons is that they are used locally and in a single-user mode. The typical problem that is occurred after a testbed deployment, is the testbed reservation process. The testbed assignment is usually done by an oral agreement between users. As a result, it is very likely inconsistencies and errors to happen, since users may use the same network resources due to the informal way of the oral agreement. Subsequently, this method of assignment rules out the prob-

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ability of retrieving reliable results and measures are less likely to represent real information.
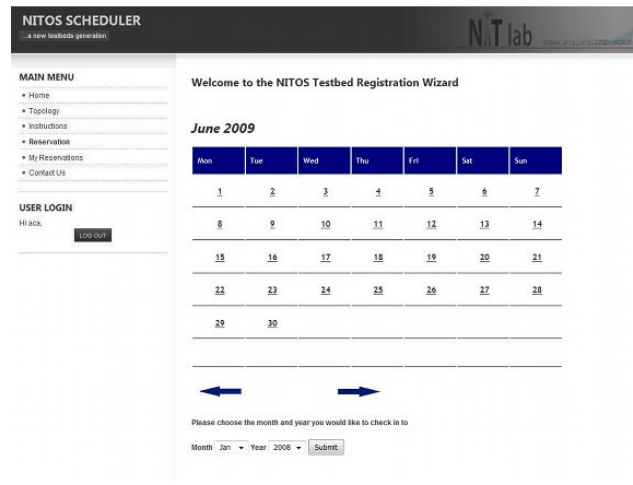

Figure 1: NITOS Scheduler Calendar.

Due to the above limitations, wireless testbed ORBIT [5] in WINLAB [3] has developed a management mechanism that offers users the ability to book and reserve remotely the testbed at available time slots. As a result, every user knows exactly when another experimenter uses the testbed and potential conflicts and inconsistencies are prevented. However, the particular system design does not take into consideration that a sufficient large number of testbed nodes is left idle, since in the majority of the experiments applied, just a small number of nodes is being used. This is a significant design drawback as it leaves a part of testbed resources unexploited. Taking into consideration the above structural defect, it is important for a management mechanism to incorporate *slicing* features, in terms of applying concurrent use of a testbed at the same time by many users. It is straightforward to comprehend that this mechanism must prevent users from interfering with each other by attacking the problem of choosing the same frequency spectrum. Specifically, the new managerial mechanism must allocate a particular group of channels to a group of nodes that is assigned to a specific user and must monitor users activity to deter malicious intruders.

Slicing can be considered as a part of a larger entity which is known as network virtualization. Particularly, network virtualization combines hardware, software resources and network functionality into a software based administrative entity, called virtual network. Slicing belongs to internal
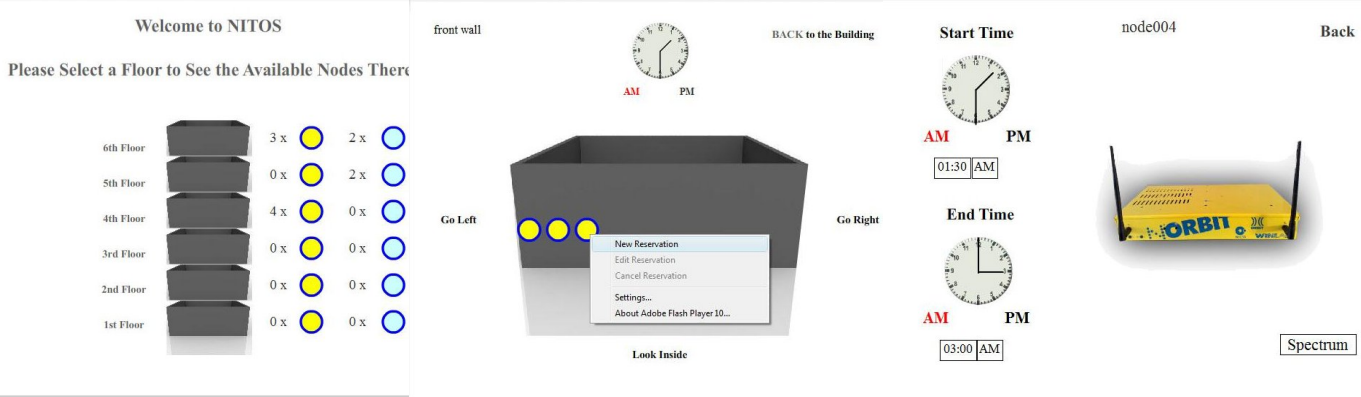
(a) Testbed deployment overview. (b) Selection of particular testbed node. (c) Time reservation of particular node.

Figure 2: NITOS Scheduler Reservation Process

network virtualization, since it enables partitioning of testbed resources, while external network virtualization is used to combine different testbed networks or parts of them into a virtual unit.

2. PROPOSED FRAMEWORK

Having defined on the previous section the conceptual structure of the managerial mechanism that will exploit slicing features, on this section we will describe the software entity that implements it.

2.1 Slicing Scheme

A description of Slicing Scheme through the whole procedure of booking nodes on NITOS scheduler will be clarified next. NITOS scheduler is comprised of three entities: a web interface, a database and a set of scripts. The web interface is the interactive tool that experimenters use to book a part or whole testbed for some time. In addition the scheduler informs the database at every booking step, so as to guide users correctly. The database maintains data concerning information about reservation from users to the testbed nodes and spectrum frequency. Besides, a set of scripts is activated to set up the testbed according to users preferences after his reservation request submission.

Specifically, at first the user selects through web interface the date that he wants to use the testbed [Fig. 1]. Then the user gets an overview of testbed deployment [Fig. 2(a)] and clicks on the floor where he chooses the node he would prefer and clicks *New Reservation* [Fig. 2(b)] . Then he goes to the next step where he selects the reservation time and clicks on *Spectrum* to select the channels he would like to use [Fig. 2(c)]. In sequence, he chooses the start and the end time for his experiments. To continue, he selects frequency channels among the available ones [Fig. 3]. Finally,

he submits his request.

Furthermore, the scheduler is in charge to update the database according to the user's request. In addition the scheduler keeps track of the channels that every user has reserved. This way, the scheduler knows at anytime the available channels and prevents testbed from any overlapping. The database is being updated every time the user chooses a channel so that a channel is not chosen by more than one users. After user's submission request, the system schedules at start time to enable the user account, to allow the user to communicate only with the nodes he has booked, to disable any communication with nodes that are not assigned to the same user (*Note.* Nodes are able to communicate through wired network.)

2.2 Monitoring and Control

Even in the most sophisticated systems, a trustworthy user might make mistakes that probably cause system's failure and incompliance to specifications. For those reasons, it becomes essential a monitoring scheme for slicing control. Indeed, there is a mechanism, that interacts with the scheduler and ensures user's ability to get access of testbed resources, so that any conflict or malicious actions be prevented.

3. CONCLUSION

In this demo paper we present a slicing scheme that enables better utilization of testbed under effective resource exploitation. In particular, different users can dynamically define the slices (testbed resources) they want to use by denoting their intending preferences to a scheduler. Thus, dynamical allocation of slices is supported in an on-fly booking way. The slicing scheme offers better and more effective use of testbed resources, since it allows multiple users to execute experiments and share the testbed.

Figure 3: Frequency Spectrum Selection

4. REFERENCES

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