

### fast facts

**Project:** Towards the World's First IPv6 Ready Country

**Lead Organization:** DrukNet, Bhutan Telecom

**Country:** Bhutan

**Budget:** 40,000 AUD



### situation

Bhutan was one of the last countries in the world to connect to Internet in June 1999 by DrukNet, an Internet Service Provider (ISP) under Bhutan Telecom. Since its inception, Bhutan Telecom has been concerned with the topic of IPv4 depletion (the depletion of the pool of unallocated Internet Protocol Version 4 [IPv4] addresses, which are the basis for the standard URL and webpage addressing system) and has taken steps to prepare itself for the transition to the emergent IPv6. Bhutan aims to promote ICT growth to increase socio-economic development with the goal of becoming the world's first completely IPv6-ready country.

### solution

Given the small size of existing networks in Bhutan, DrukNet believes IPv6 implementation can be achieved with lesser effort compared to other countries. Doing so, however, is not without its challenges.

Internet Protocol version 4 (IPv4) is a system of addresses used to identify devices on a network. When commercial internet first became widely available, there were just over four billion addresses available for use worldwide. Unfortunately, this pool has now become depleted, and it has become necessary to move to a new system, IPv6. For the purposes of this project, the term "IPv6-ready" refers to the conversion of existing IPv4-based systems in Bhutan, to newer, IPv6-ready, ones. To achieve this goal, the project team proposed a two-phase process.

The first phase consists of outreach and raising awareness of IPv4 exhaustion and the need to deploy IPv6. This was achieved by reaching out to potential stakeholders such as other ISPs and university network administrators through letters and email. A questionnaire was attached with these mailings for the purposes of data-collection, which in turn allowed for an evaluation of the current infrastructure-readiness of existing networks and systems in Bhutan. These exchanges were further complimented by meetings and workshops held during the 16th Annual South-Asian Networking Operators Group (SANOG) meeting in 2010.

The second phase of the project consisted of continued outreach efforts, as well as additional training and actual deployments throughout Bhutan. Starting in March of 2010, DrukNet assisted in the purchase and delivery of necessary server, laptops, software, and network equipment to classrooms and labs across the country. Advanced training curricula were then developed for use by the project team and recipient organization by external experts and consulting groups detailing exactly what the process of becoming IPv6-ready would entail, and how it could be accomplished. These smaller sessions culminated in a series of group training sessions in October and December of 2010, and January of 2011.

Then the project team began the assessments of Bhutan's existing internet infrastructure support for IPv6, as well as DrukNet's own core infrastructure. Unfortunately, the data collected showed only two ISPs had taken the steps necessary to make IPv6 addresses available. The remaining two in-country ISPs were shown to not have exhausted even 15% of their existing IPv4 spaces, and as such, did not feel pressured to upgrade their systems at that point in time. This challenge has been further complicated by a

lack of accurate survey responses, indicating that the respondents did not know how to answer some of the questions regarding IPv6 transition readiness. Despite this lack of information, however, the project team decided to proceed directly with IPv6 preparation efforts by beginning the conversion process at governmental and educational institutions.

The team deployed IPv6 in academic institutions first, and received technical and labor support from these institutions while doing so. Despite some initial roadblocks, the team considers its IPv6 deployment in the test environments to have been very successful, as end-users were “completely unaware” of the implementation. The networks themselves were shown to be stable, showing only intermittent disruptions in service following the changes made by project participants.

### broader impact

Since completion of the original project, the team has been working part-time because each team member has day-to-day operational and functional duties to attend. However, the management of DrukNet's parent organization, Bhutan Telecom, is supportive of the project and encouraging of the team to successfully complete their objective. It is believed the successful completing of the IPv6 preparation efforts will open up opportunities for numerous creativity and innovations in the ICTs.

By helping Bhutan become the world's first IPv6 ready country, DrukNet will have helped the country leapfrog ahead of the other advanced countries in transition to the IPv6 implementation and be a source of inspiration. More importantly, it may bolster the country's image in the international arena by highlighting Bhutan as a place to conduct ICT investment.

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