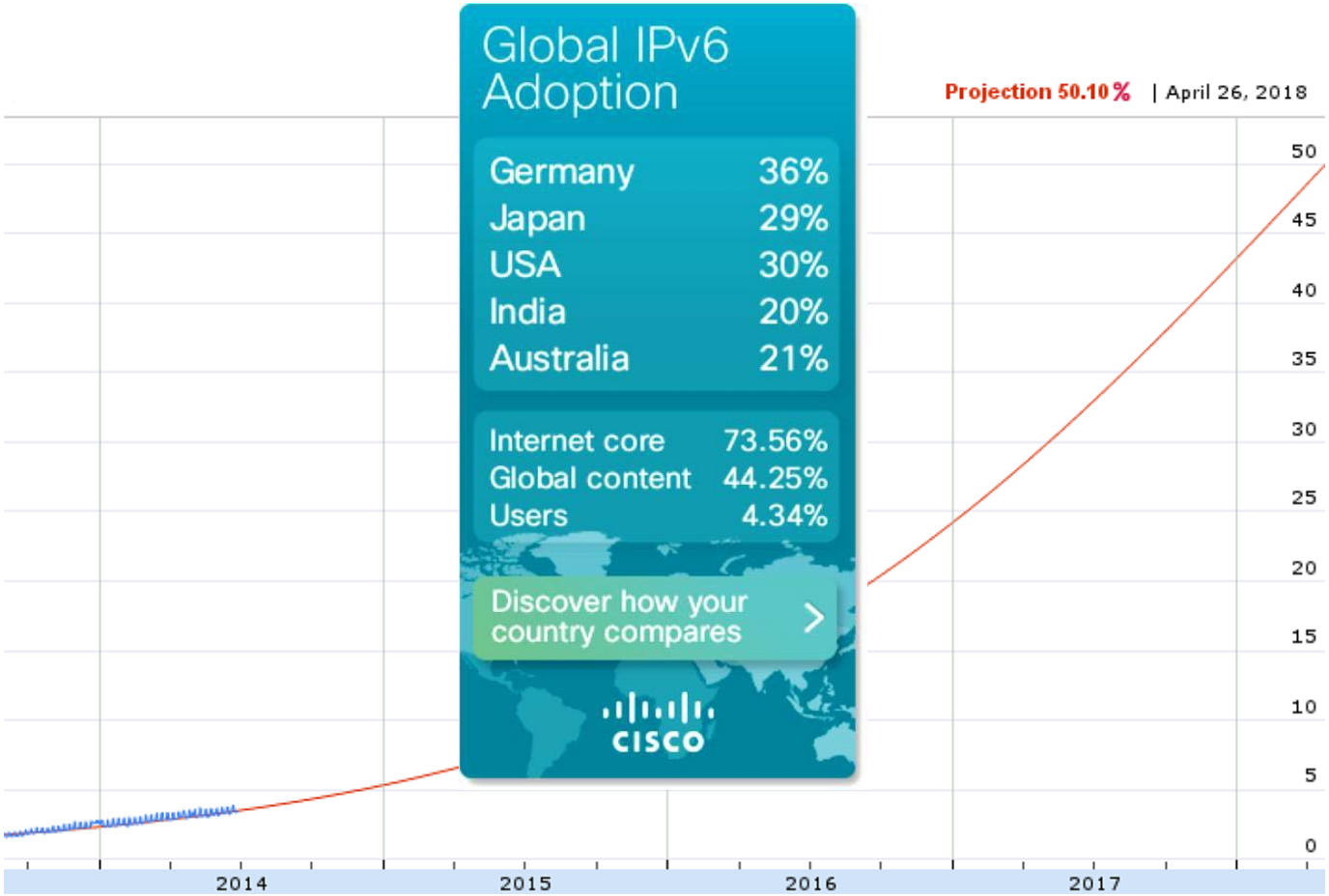
IPv6 Framework Project
April-July 2014



End-user IPv6 takeup is now projected to reach 50% within four years. Over 73% of Internet core infrastructure is already IPv6-capable. (Note, this graphic from 9 July shows the additional takeup in the few weeks since the image on page 52 was captured.)

QRNO IPv6 Framework Project

Executive Summary

Since 2000, the global technical community has looked on with increasing amazement and horror at the indifference shown by many organisations and most users towards the looming crisis of IPv4 exhaustion and the need to adopt IPv6. It's as if those dependent for survival on an increasingly rickety vehicle were mindlessly driving it into the ground rather than focusing on replacement. Or assuming that simply because there's money in the bank today no-one has to worry about replenishing it for tomorrow.

Has it been lack of information, apathy, fear of technology, the GFC, procrastination, inability to communicate the urgency, simple denial? No-one knows. One day, theses will be written about the strange forces that brought the Internet to such a vulnerable stage today – constrained by dependence on IPv4, a limited, costly form of its most essential functioning – when IPv6, a virtually unlimited equivalent with superior capabilities, was there for the taking.

Fortunately, the Internet backbone, most of the network companies and many of the global giants of content understand the need for the technical lifeblood of IPv6, and have made the transition. Some governments also understand. As one example close to Australia's interests, in April 2014 the Chinese government allocated the equivalent of ***3.2 billion US dollars*** for IPv6 adoption.

Unfortunately, the end-branches of the globe-spanning tree, the organisational networks for which the Internet is daily bread-and-butter, have been surprisingly slow to make the move. Hence IPv6Now would like to place on record our recognition of the foresight of QRNO in initiating this IPv6 Framework Project, and our appreciation for allowing us to be involved.

The requirements of the project were to discuss IPv6 benefits, describe IPv6 best practice, survey QRNO member IPv6 status and hold a workshop, report on member readiness for IPv6, examine IPv6 security, define a self-assessment checklist, and provide recommendations to the QRNO Board.

Report 1: IPv6 Benefits

This examined the major reasons for IPv6 migration from a more technical perspective, discussing the *carrots*, advantages to be gained through IPv6, and the *sticks*, problems arising without it.

Report 2: Best Practice in Migration to IPv6

This discussed the process of defining best practice for Internet protocols, the development of IPv6, and common migration features, pathways, important elements and resources.

Online Survey

A survey was used to find out from QRNO members their IPv6 implementation status, the drivers they'd experienced for migration, the obstacles in the way, their staff IPv6 knowledge and experience, their inventories of hardware and software and their IPv6 audit status and records.

Report 3: Workshop

A one-day Workshop was held on 19 May 2014 at QUT. Technical staff from nine out of twelve members attended, and discussed their IPv6 readiness and experiences, and the results of the online survey.

Report 4: Member Readiness for IPv6

Three groups were identified from the workshop: two Implementers, two Testers and five Preparers. They discussed their activities and obstacles faced, and the lessons arising from their experiences. IPv6Now provided recommendations for future progress for each of the groups.

Report 5: IPv6 Security

The report discussed IPv6-specific security issues, encryption in IPv6, routing security, monitoring tools, resources and a sample set of firewall rules. A

potential problem was identified: most QRNO members lack IPv6 firewalls, which is a serious security vulnerability.

Report 6: IPv6 Checklist

This report examined the stages of migration to IPv6, focusing on the need for much planning and preparation before getting to the stage of technical adoption. It examines in detail the arguments for *universities in particular to reap benefits from IPv6 at non-technical levels*. It provides a Checklist for preparation steps and a self-assessment survey for regular progress reporting.

Report 7: Recommendations to QRNO BoM

The project culminated in a set of recommendations to QRNO for future progress in IPv6:
1. Common Ground: to identify common IPv6 transition tasks or facilities that would be cheaper for members to address collectively.
2. Measure Progress: to survey members on a regular basis to measure their progress against targets such as the IPv6 Checklist.
3. Training Club: to set up group IPv6 training sessions for member personnel at different levels of expertise in IPv6.
4. Information Hub: to set up an IPv6 information hub and wiki service.
5. Progress Traffic-Lights: to set up a simple web page showing level of progress in member IPv6 migration for external network capabilities.
6. Event Promotion: to use events to promote IPv6 understanding, bring together technical personnel, and raise the IPv6 profile of members.

IPv6 is Essential for Universities

We believe that QRNO member universities adopting IPv6 will reap multiple benefits. Unlike businesses that can afford short-term thinking, academic institutions must always be gearing up for the demands of years ahead, especially in terms of which disciplines students will choose to study, and what research areas will attract funding. By even the most conservative projections, IPv6 will be the dominant Internet protocol *within four years*.

Four years is the length of time any new student today must look ahead critically for their own employment prospects. To attract students, universities must become IPv6-capable, and offer that capability as an advantage to potential students, especially those from countries actively transitioning *today* to IPv6.

The IPv6 journey takes time, and those in a conspicuously technical-laggard situation will not maintain their reputations as dynamic or proficient institutions. The IPv6 capabilities of Australian universities are publicly available online at http://www.mrp.net/ipv6_survey.

Academic researchers have great scope with IPv6, as it is the only technology scaleable for massively distributed Clouds and the Internet of Things. IPv6 allows for vast numbers of networked sensors providing levels of data collection and control in many fields not previously possible. The demand for IPv6-based research can only increase, bringing with it appropriate funding.

IPv6 enhances network efficiency and security. Insecure networks are bad for an institution's reputation, data integrity and legal obligations to privacy. Outmoded or slow networks are unappealing to researchers or students. Networks carrying unmonitored illegal IPv6 traffic may incur usage or piracy penalties. Out of date networks can end up *costing* an institution in both legal liability and damaged reputation.

The outcome of this process is not IPv6 for its own sake, but IPv6 for the benefits it can bring to QRNO member universities. Universities should regard IPv6 as a *low-cost business continuity strategy*, to enhance institutional reputation, attract students looking to their prospects in an IPv6 world, attract funding for innovative research, and build cheaper and more secure networks.

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