(Transscipt session http://www.isoc.org/isoc/conferences/bwpanel/)

KENJIRO CHO: So, I want to talk about trends in Japanese residential traffic. I'm a senior researcher can at IIJ and I'm also a board member of the WIDE project, the host of this IETF. And I have been involved in traffic measurement since 2004, using IIJ's data and also, we have collected data from other ISPs in Japan. And so, basically, background here is, this is a number of broadband subscribers in Japan. It reached 63 percent of households, and increased only three percent in 2008.

So, as you can see, the, this is, green one is fiber to the home. And DSL red line is decreasing in, here in Japan. And 60 percent of the Internet traffic, backbone traffic in Japan is basically residential related traffic. So, our data collection experience is basically with six ISP. It started in 2004, covering 42 percent of Japanese traffic and it's a (inaudible) for ISPs.

The goal here is to answer concerns about rapid growth of residential traffic. So, ISP's concerns often are not shared by other parties, because no data is available. So, concerns on technologies, fairness or net neutrality or profitability. So, although most ISPs collect data, data is seldom made available to others.

And measurement methods and policies differ from ISP to ISP. So it's very difficult to compare. And, what is specific to Japan here is, we have higher penetration of fiber access, so that leads to a larger skew, so more traffic and bandwidth usage here. So, this graph shows the traffic growth. The left one is called backbone and the right one is for residential traffic. So, the red one is total growth, and the blue line is more interesting. It's annual growth rate.

So for the last five years, we have very stable growth rate, around 40 percent. And this is the corresponding graph for residential traffic since 2004. And as you can see, the growth rate is very stable for the last five years. It's around 30 percent. So, changes in residential traffic has daily traffic and peak is at 9 p.m. to 11 p.m. And back in 2005, in and out were similar.

Back then, we had peer to peer file sharing dominating the traffic. But now, difference became larger, and which suggests a shift from peer to peer file sharing to content services. So, this graph shows increase in daily traffic volume per user. X axis is daily traffic.

Y axis is probability density. So this green line is for download and red one is for upload. So, download, the mode peak of the distribution moved from three megabytes per day, to 114 megabytes per day in 2009. And the average is much much higher. The average is about one gig, one gigabyte per day, because much of those is heavy hitters. Traffic is very skewed among users. And, this graph shows inbound and outbound traffic per user. And as you can see, there are roughly two classes.

This one is the user downloading about ten times larger than uploading. And this one is symmetry, hybrid users. But there's no clear boundary between heavy hitters and others, and client type here.

Client download, client type users and peer to peer type users. So, the reason is, most users use both client server type of applications and peer to peer style applications. They have different means.

So, there are large diversity here. And, this one basically shows, if we look at the total

volume, the traffic is dominated by TCP. But if we look at client type here, we just extract client type users, using less than 100 hundred megs, uploading less than 100, and here, UDP is, the whole data is increasing, and majority is peer to peer data. So, key observations here, is growth of Japanese residential traffic has been very stable at around 30 percent per year, for the last five years.

And there is a shift in traffic patterns. Peer to peer file sharing is still dominant in volume. But a shift to content services is clear.

And individual users have diverse traffic mix. And a few other observations: So high penetration of fiber access in Japan leads to larger skew in bandwidth usage among users, and we do have congestion issues in increasing mobile wireless access. And also, we have observed higher growth in international traffic for the last five years, but it is difficult to predict the future traffic, because it is significantly impacted by the behavior of the heavy hitters. And also, there are lots of factors that will affect the behavior of the users. Okay. That's it for me.