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Testimony

Just a few years ago, mobile data traffic was at relatively small levels, the product a handful of text messages, mostly by our teenagers, some email, and rudimentary web browsing. Fast forward a few years later, however, and the mobile landscape has changed, dramatically.

Many of us have multiple mobile devices -- whether smartphones, tablets, or laptops, not to mention the increasing number of machine-to-machine mobile devices that work in the background of our daily lives. Not only do we send email and text messages constantly, but we're watching large amounts of video – from short clips of our children's first steps to entire feature-length movies to real time video calling and video conferencing.

Taken as a whole, this change has transformed mobile traffic, with profound implications for policy.

At Cisco – the worldwide leader in networking technology for the Internet -- we've been measuring these changes since 2006 through our Visual Networking Index. Our forecasts have been used by government, analysts, the media, academics, and providers to analyze the use and growth of Internet Protocol -- or IP -- networks worldwide. Last week, Cisco released its annual Visual Networking Index Forecast, encompassing the *mobile* traffic forecast that we published in February as well as a look at traffic growth for all types of IP traffic. While the findings may seem eye-

popping, if history is a guide, they may very well be conservative. Cisco's VNI has consistently under-projected *actual* traffic levels by around 10 percent.

When you look at the numbers, it is readily apparent that mobile data has become an indispensable part of our lives, as evidenced by the findings of the Cisco Visual Networking Index:

- In 2012, US mobile data traffic grew 62% in a single year.
- Looking forward, from 2012 to 2017, US mobile data traffic will grow nearly nine times, from 2.4 exabytes to 23.2 exabytes annually. To get to those volumes, traffic will have to grow an average of 56% each year of the five year forecast. If the term "exabyte" is not familiar to you, 23.2 exabytes is the equivalent of nearly 6 billion DVD movies transmitted across mobile networks.
- The incremental growth in mobile data traffic added to the network in a single year from 2014 to 2015 will be larger than all the traffic that was carried on US mobile networks in 2012.
- By 2017, Americans will use 1.1 billion mobile and portable devices, all employing licensed or unlicensed radio spectrum, and will use those devices to generate 70 percent of US Internet traffic. The Internet has gone mobile.

Four factors are driving this rapid growth of mobile traffic on the Internet:

(1) The number of users and connections to mobile networks is dramatically increasing. There will be 726 million mobile *connections* in the US in 2017, up from

439 million in 2012, nearly 2-fold growth. That device total means there will be 2.3 devices in use for every person in the US. In addition, to multiple devices per person, mobile broadband will also support machine to machine connections – connecting not just people, but things. These machine to machine connections will be deployed into a wide variety of sectors – from energy supporting smart home energy meters as well as transmission and distribution networks, public safety supporting sensor networks and mobile video imaging, to healthcare such as home healthcare services. The number of these M2M connections will grow 4.6-fold between 2012 and 2017, reaching 323 million. And there will be more users. There will be 286 million mobile *users* in 2017, 50 million more than in 2012.

(2) The types of devices being used to connect is advancing with the rising adoption of ever more powerful smartphones and tablets that consume more data. We are entering the era of smartphones, which dominate the device types that consumers will use. A smartphone generates 28x more mobile data traffic per month than a basic handset and by 2017, smartphones will be 52% of total mobile data traffic. The average smartphone today uses nearly 600 megabits of traffic per month. By 2017, the device manufacturers will be selling even more powerful 4G smartphones that we project will generate over 5 gigabits per month. They will be smarter, faster, more fun, and there will be many more things that consumers do with their smartphones than we do today.

(3) Mobile data networks themselves are getting faster due to investment and new technology -- the average mobile connection speed in the US will grow 6-fold between 2012 and 2017, reaching 14.4 Mbps in 2017. While 3G connections remain the dominant way in which most of us connect to the mobile data networks, faster 4G networks will represent almost one-third of mobile connections by 2017. Significantly, that one-third of 4G connections will be responsible for generating almost two-thirds of the mobile data traffic.

(4) Video in many forms will represent two-thirds of all mobile traffic by 2017. From YouTube, to video embedded in advertisements, to viewing video programming, to video "calls," the consumption of video on mobile networks is skyrocketing. Mobile video traffic will grow 11-fold from 2012 to 2017, a compound annual growth rate of 63%. That amount of video has an enormous impact on data traffic volume, as it takes a lot of data to generate a moving, full color, crystal clear image on a screen. In 2012, the average user was generating 763 megabits of mobile data per month, which meant the average user last year consumed about 2 hours of video and made 2 video calls per month. By 2017, the average user will be consuming 6 gigabits a month – nearly eight times the 2012 levels. To generate that demand, we forecast that the average user will be using about 18 hours of video and making 10 video calls per month.

Meeting the challenges created by this massive demand requires at least two simultaneous approaches.

One obvious policy initiative is to find more spectrum. Congress led the way last year with adoption of HR 3630, creating for the first time voluntary incentive auction authority that will allow the Federal Communications Commission (FCC) to repurpose part of the television broadcast spectrum for mobile broadband. The bill also extended the FCC's regular auction authority and made important improvements to the Commercial Spectrum Enhancement Act governing the transition of federal spectrum to commercial use. Congress now needs to ensure that the FCC follows through on its grant of auction authority by conducting the voluntary incentive auction for broadcast spectrum as soon as possible.

The National Telecommunications and Information Administration (NTIA) is also continuing its efforts to identify federal spectrum that can be repurposed to commercial use, with particular emphasis on the 1755-1850 MHz band that, in many countries of the world, is in use for cellular systems. Your attention to the NTIA process and progress in its talks with industry is important.

In addition, Congress has also asked the FCC to take a look at whether additional spectrum for Wi-Fi could be made available at 5 GHz. This is a very important initiative because, in addition to the exploding use of Wi-Fi, Wi-Fi networks are increasingly being used by carriers and consumers to offload mobile traffic. Our VNI report this year indicates the trend is increasing, as carriers will increasingly embrace a solution to push their customers to Wi-Fi where possible to avoid congestion on macrocell networks. By 2017, two thirds of mobile traffic will be

offloaded to small cell networks, predominantly Wi-Fi. That compares to about half the traffic today.

We appreciate this committee's interest in, and attention to, the profound changes now taking place in the mobile broadband industry. Our nation is the leader in mobile broadband. The wireless revolution spurs the construction of new high speed wireless networks. It drives the manufacturing of chips, routers, network equipment, and mobile devices such as smartphones, laptops, and tablets. It creates business and consumer software, the development of app stores, and substantial growth in electronic commerce.

Mobility has been an important driver of jobs and economic growth, and it has the potential to generate hundreds of thousands more jobs if the federal government acts promptly to ensure that additional spectrum is made available to fuel future mobile broadband growth. It's important that the Congress understand the dynamic growth occurring in this industry, and why public policy is critical to that growth. This Committee provides an excellent platform for making these connections more obvious to all.

We thank you for your attention to this highly dynamic and important industry, which continues to be a particularly bright spot in the nation's economy. We invite you to access the latest Cisco data for the US and the world anytime at www.cisco.com/go/vni.