

**COMMENT SOUGHT ON HEALTH CARE DELIVERY ELEMENTS OF NATIONAL  
BROADBAND PLAN NBP Public Notice #17  
PLEADING CYCLE ESTABLISHED**

**GN Docket Nos. 09-47, 09-51, 09-137; WC Docket No. 02-60**

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**2. Connectivity Requirements to Support Health IT Applications. For each relevant health IT application we seek to know:**

- a. Electronic health records**
- b. Real time video for Telehealth consultations and diagnoses**

- i) What are the specific network requirements (e.g., transmission speeds, minimum guaranteed bandwidths, latency, jitter, reliability, coverage, others)? How might these differ based upon the content (e.g., text, image, or video) of the application? We welcome detailed network requirement analyses for pertinent applications.***

Response

Many electronic health records today store only text data which can be transported with relatively modest bandwidth. More capable medical records, however, support multimedia files and include radiology images, photos, video clips, and other media. The comments below pertain to both multimedia medical records and to real time video. The commercial Internet today does not expect to reliably achieve the kind of end-to-end performance needed by medical providers. Matt Mathis and his fellow researchers from Pittsburgh Super Computer Center figured out the effect of packet loss on TCP performance in 1997. It is expressed as:

$$\text{throughput\_bit\_sec} < (\text{payload\_per\_packet} / \text{round\_trip\_time}) * (1/\text{sqrt}(\text{packet\_loss\_rate}))$$

where:

$\text{payload\_per\_packet} = \text{MSS (max segment size)} = \text{TCP payload (minus headers)}$

This equation says that the maximum speed of TCP is limited by a combination of packet loss and distance. Transferring a 100 MB file over a gigabit network takes a few seconds. However, if the network exhibited a packet loss rate of just one percent and the distance of the transfer was coast to coast, it would take at least 10 minutes to transfer the video. A 500 MB MRI study under similar conditions would take an hour or more.

The DICOM communications protocol commonly used to move radiology images performs much more poorly than TCP. If the file transfer used DICOM rather than TCP, it would take forever. The best performance may not be limited by bandwidth - a 10-gigabit per second network would NOT perform better.