sentative of all Mbone sessions, the May traces cover two quiet days (a Sunday and a public holiday in Europe and the US) and a normal working day, and routes covered by the traffic cover most of the Mbone backbone links. The September traces cover several weekdays, although the network may be lighter loaded than normal because this is still during the period when UK university students are on holiday.

RTCP statistics from the vic video tool which was used by all participants give the loss rate calculated by dividing the packets received by the packets expected in that interval. This fraction is sent as an integer in the range 0-255, which is sufficient granularity for these purposes. It is possible that some of the RTCP receiver reports are reporting loss which occurs in the end-system rather than the network as vic suffers from processor starvation and overflows its UDP receive buffer. However, given that the traffic measured constitutes a relatively low frame-rate video stream (typically only 3-4 fps when the video is in motion, higher when there's no motion, but very little decoding needs to be done then) it is unlikely that this is a significant source of loss. On the author's 60MHz SparcStation 20, decoding and displaying this video stream requires between 4% and 10% of the CPU time. Even low performance workstations are unlikely to be CPU starved by this video stream alone. Thus although we cannot be sure that the statistics have not been affected to some degree, it is expected that the influence of this effect is small.

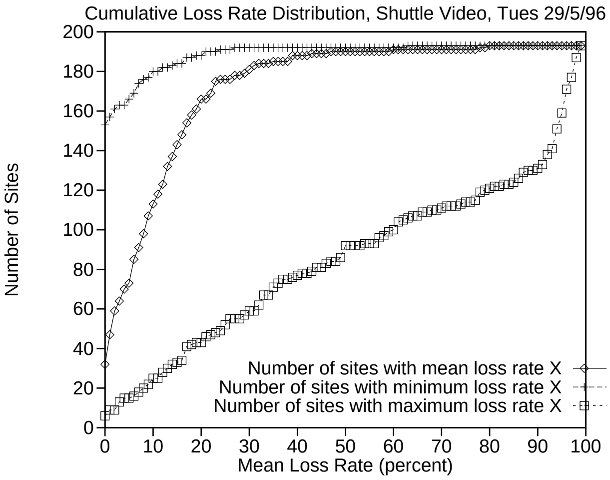


Figure 2: Loss Rates by Site

### Loss Rates by Site

Figure 2 shows the breakdown of loss by site as a cumulative graph. Each RTCP loss rate field gives the mean loss rate seen by that receiver for the NASA source in that RTCP reporting interval. Reporting intervals vary depending on the number of receivers, but for this session they are typically between 10 and 60 seconds. For each receiving site, the minimum reported loss rate, the mean reported loss rate, and the maximum reported loss rate during the day are calculated.

This graph shows that 50% of receivers have a mean loss rate of about 10% or lower, and that around 80% of receivers has some interval during the day when no loss was observed. However, 80% of sites reported some interval during the day when the loss rate was greater than 20%, which is generally regarded as being the threshold above which audio without redundancy becomes unintelligible, and about 30% of sites reported at least one interval where the loss rate was above 95% at some time during the day.

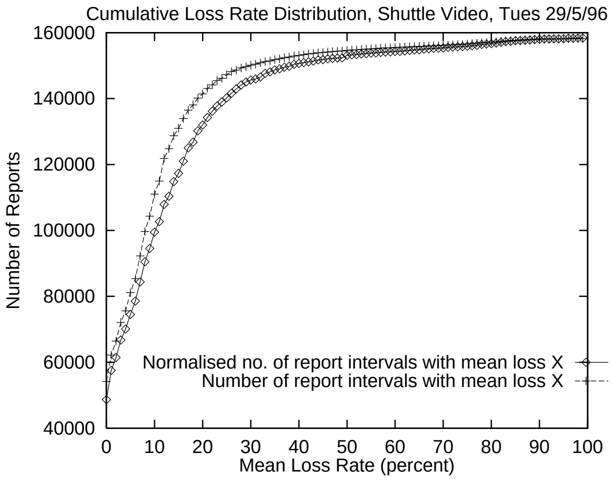


Figure 3: Loss Rate Report Distribution

### Loss Rates Report Distribution

Figure 3 shows the number of loss rate intervals reporting each loss rate during the day as a cumulative graph. This includes reports from all receivers. As this graph may have been affected by the loss of RTCP reports, we show the raw results and the results by normalizing the reports from each individual receiver, such that a report from receiver $i$ is given weight $w_i = n_i/\overline{n}$ where $n_i$ is the number of reports received from $i$ and $\overline{n}$ is the mean number of reports received by a receiver. The normalized curve is intended to weight receivers whose RTCP reports get lost on the way to the monitor as if their reports had arrived. Whether this is in fact the case is not clear, as it may overweight such receivers as some receivers duration in the session may also be shorter because the loss rate is high. However, as the true situation is likely to lie between the two curves and as the two curves are sufficiently close to each other this does not matter significantly.