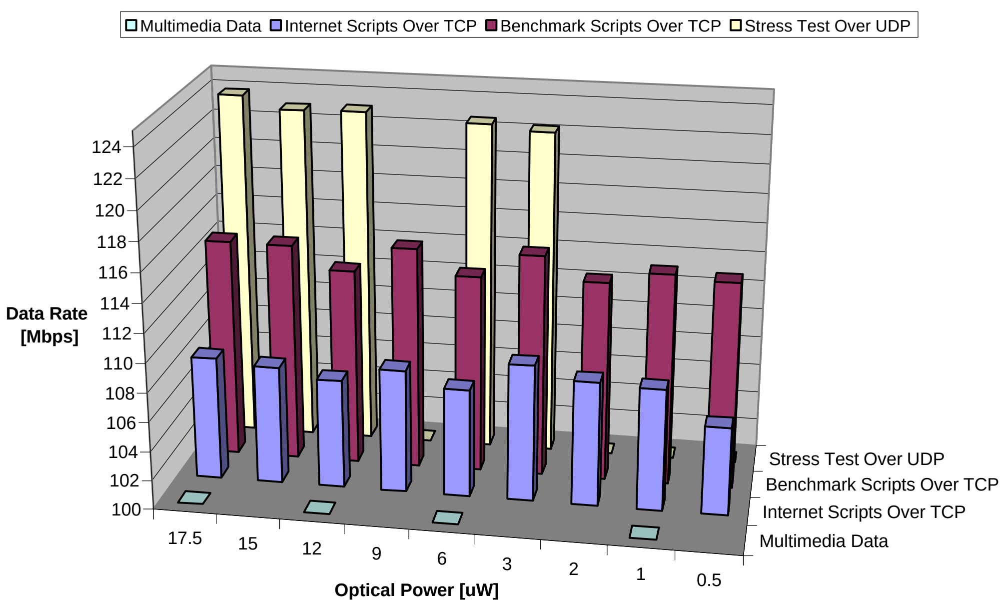
Chapter 8. Conclusions and Recommendations

A comparison graph of the throughput of the four tests is presented in Figure 8.1. Throughput was the common metric for all four tests, exibiting a similar oscilatory, yet generally decreasing trend. The unexpected performance behavior of the network shows the dependence of the higher network layers to the changes in lower network or physical layer. It is significant to note that the dependance as well as degradation in performance occur before the onset of hard failures. The dependance, no matter how complicated and nonlinear it may be, confirms the existence of "gray" area in computer network performance.



	17.5	15	12	9	6	3	2	1	0.5
Multimedia Data	14.428		14.482		14.341			14.474	
Internet Scripts Over TCP	108.412	108.063	107.439	108.412	107.374	109.366	108.513	108.313	106.046
Benchmark Scripts Over TCP	115.01	114.98	113.437	115.214	113.548	115.252	113.689	114.501	114.213
Stress Test Over UDP	123.785	122.961	123.061	0	122.605	122.258	0	0	0

Figure 8.1 Throughput Comparison of the Four Tests

8.1 Conclusions

Although it would be hard to find an exact relationship between the network performance and degradations in the physical layer, the results show that there is a definite influence of soft failures on end user performance. It can also be pointed out that TCP seemed to be more robust than UDP, which is not surprising based on TCP's reliable delivery mechanisms.

It was also noticed that at the power levels at which UDP's performance suffered the most, TCP was performing the best and vice versa. It is almost as if the UDP's and TCP's performance oscillations are offset by a 90° phase shift.

As witnessed from the link characterization data, the initial assumption of difficulties associated with defining and fully understanding all the phenomena interacting in multimode fibers were only further strengthened.

Horizontal cabling and fiber to the desktop dictate short fiber lengths; cheaper components and ease of use demand the use of multimode optical fibers. Coupled with an increasing demand for multimedia traffic transported over more vulnerable UDP, soft failures will likely continue to play an increasing role as yet another parameter crucial for overall network performance optimization. Therefore, the need for possible definition and classification of soft failures has been further accentuated.

8.2 Recommendations

There are several opportunities for further study. In order to better assess the influence of soft failures on network performance, it would be desirable to further load the network either by adding more endpoints and/or by adding some background traffic, such as high rate real-time video. The goal would be to assess the data transfer performance when there are multiple PVCs or SVCs servicing higher QoS traffic types.

In addition, ABR service category could be studied as opposed to the UBR used in this project. More research could determine whether the closed-loop feedback mechanism available in ABR service class would make the network performance more immune to soft failures.

From a physical link perspective, it is suspected that singlemode fibers could be more robust to soft failures such as the one introduced in this project. This is mostly due to the presence of only one propagating mode. Unfortunately the small core size makes the light sources more expensive, light coupling into the fiber more difficult and less efficient. These disadvantages may in turn make singlemode fiber more vulnerable to some other types of soft failures. Additional research analyzing network performance under soft failures of singlemode fibers may offer additional insight.