Statistical Multiplexing.

Suppose that users of a computer network are idle 90% of the time, and when not idle require 1Mbps of bandwidth. Assume that the users act independently. To answer the questions below, you will want to leverage the formula that gives the probability that K of N users are active at a given time, assuming independent users who are active with probability p. (This is just the binomial distribution.)

$$\text{Prob}(K) = N!/(K!(N-K)!) \times p^{K} \times (1-p)^{N-K}$$

a) What's the probability that exactly 2 users are active?

b) Suppose the network is owned by a bank, which requires that the network always have sufficient capacity to support its users. How much network capacity is needed to support 10 users?

c) Suppose the network is owned by an ISP, which decides that satisfying user demand 90% of the time is sufficient. How much network capacity is needed to support 10 users now?

d) How much more is the "cost per user" for the bank in part a) than the ISP in part b)?

e) Suppose that the users are not independent 10% of the time, to model effects such as when all users demand access at a popular time, such as a stock market crash. What is your answer now to parts b) and c)?