P-values are a convenient way to communicate the results of a hypothesis test. When communicating a P-value, the reader can perform the test at whatever Type I error rate that they would like. Just compare the P-value to the desired Type I error rate and if the P-value is smaller, reject the null hypothesis.

Formally, the P-value is the probability of getting data as or more extreme than the observed data in favor of the alternative. The probability calculation is done assuming that the null is true. In other words if we get a very large T statistic the P-value answers the question "How likely would it be to get a statistic this large or larger if the null was actually true?". If the answer to that question is "very unlikely", in other words the P-value is very small, then it sheds doubt on the null being true, since you actually observed a statistic that extreme.