WHITE PAPER

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Improving Wave Productivity

The purpose of this paper is to bring to light some of less intuitive characteristics of waves and discuss the opportunities for improving wave productivity through better wave management. The initial thought in improving waves immediately comes to eliminating the so-called "stragglers". There are some very important mathematical relations that exist which are normally overlooked that make this approach most difficult. An alternative approach is presented in this document.

It is important to first define a wave and the purpose of a wave. A wave is a "collection" of activities or efforts that are to be completed together. Most often the purpose of a wave is to manage the sequence or timing of those activities. There are situations where wave-less opportunities exist for controlling the sequence of efforts however this paper addresses situations where wave-less operation is not currently possible.

Ideally, a wave should have a productivity profile that immediately upon starting reaches full capacity, continues at that full capacity for it's full duration and then immediately completes. If you are reading this paper you know that this ideal situation is rarely realized. For the purpose of this discussion we will divide a wave into three periods, the wave start, the wave body and the wave tail. Normally waves seem to start pretty well (abruptly) and continue well until nearing the end or tail of the wave. The tail of the wave is normally the problem with productivity reducing to nearly nothing and the tail seems to just drag on. Why do waves have this shape? What are the factors that effect each of the periods of the wave? How can improvements be made?

First of all, the productivity shape difference of a real and ideal wave is primarily due to exceptions. Pretty obvious! What is an exception? It is an un-predicted event. If it were predictable, we could fix it before it happened and there would be no exception. There is a difference between un-predictable and un-preventable. Many systems are afflicted with many preventable so-called "exceptions". This paper is not attempting to discuss the correction of so called "preventable exceptions". Some may argue that all exceptions are preventable. Prevention of an exception comes at a cost. There comes a point where the cost of prevention far exceeds the price paid to recover from the exception. As long as this condition exists we believe that exceptions will always be present.

Exceptions have two unique time related attributes: 1) the time (when) they are detected and 2) the time (duration) of correction. In a wave based system, if an exception is detected early in the wave, and the duration of the corrective action is small, the exception is not manifest as significantly impacting the wave. These exceptions are manifest as merely a reduction in the productivity. However, when the same exception is not detected until the end of the wave, the exception manifests itself as extending the tail of the wave. These are the "exceptions" that become topics of conversation. Interestingly they became the focus of attention only because they had the misfortune of occurring near the end of a wave. When addressing the reduction exceptions we must not neglect those exceptions that have been masked as "reduced productivity" because they occurred during the body of the wave. The next time that they occur could be just as likely to be at the end of the wave. It is interesting to note that while some exceptions affect only a few orders or activities, equipment failures (exceptions in their own right) affect many activities. Equipment exceptions are most prominent right at the moment that the productivity requirements are at their peak!

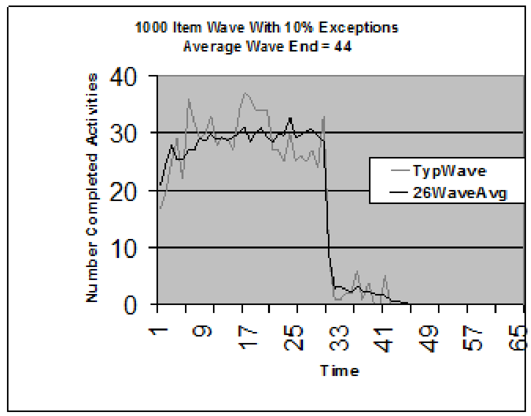
A short discussion of the shape of the "start of a wave" productivity is in order. Our hypothesis is: the primary contributor to waves starting slower than the ideal is because resources are being applied to the cleaning up of the prior waves tail! For this paper we will not attempt to prove this hypothesis just merely state it.

Attributes of Wave Tails

Although the actual shape of each operations wave tail is unique, they can be considered to have two attributes, duration and a magnitude. The magnitude is primarily determined by the number of exceptions occurring near the end of the wave, while the wave tail duration is primarily determined by the detection time and duration of the correction of the longest exception. It is interesting that the actual size of the wave has little impact on the shape of the tail of the wave. It did not matter how much work was accomplished in the body of the wave, once the wave is ending, all of the earlier completed work is no longer of any consequence, the tail of the wave is governed only by the completion of the remaining exceptions. We will now discuss the potential for reducing wave duration through the reduction of the number of exceptions and the reduction of the duration of the corrective time of an exception.

For simplicity, if the corrective time for exceptions existing at the end of the wave body is uniformly distributed between 0 and t, the expected length of the wave tail is:

T = t * n/(n+1) If t = 12 minutes and there are 10 exceptions, the wave would be extended by 12 * 10/11 or 10.9 minutes. If the number of exceptions were cut in half to just 5, the extension to the wave is now 12 * 5/6 or 10 minutes. Cutting the number of exceptions in half yielded a reduction in wave time of less than 10%. If the exceptions were reduced to only 1, the reduction in wave duration would be 12 * 1 / 2 or 6, a reduction of wave duration of less than 50%. Usually attempts to reduce wave duration focus on reducing the number of exceptions. Although this focus has other benefits, the majority of the effect is only noticed once the number of exceptions are completely eliminated 12 * 0 / 1 = 0!



Another approach to the reduction of wave time is to focus on the reduction in the time to correct an exception. This approach yields a direct relationship between the reduced wave extension time and the corrective action time. If the time to correct exceptions is reduced by ½ the extension of a wave tail will be reduced by ½.

The two charts show wave productivity for a 10 times reduction in the number of exceptions for a 1000 item wave!