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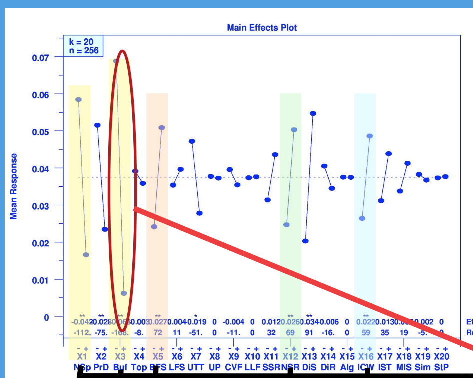
IMAGE OF THE MONTH

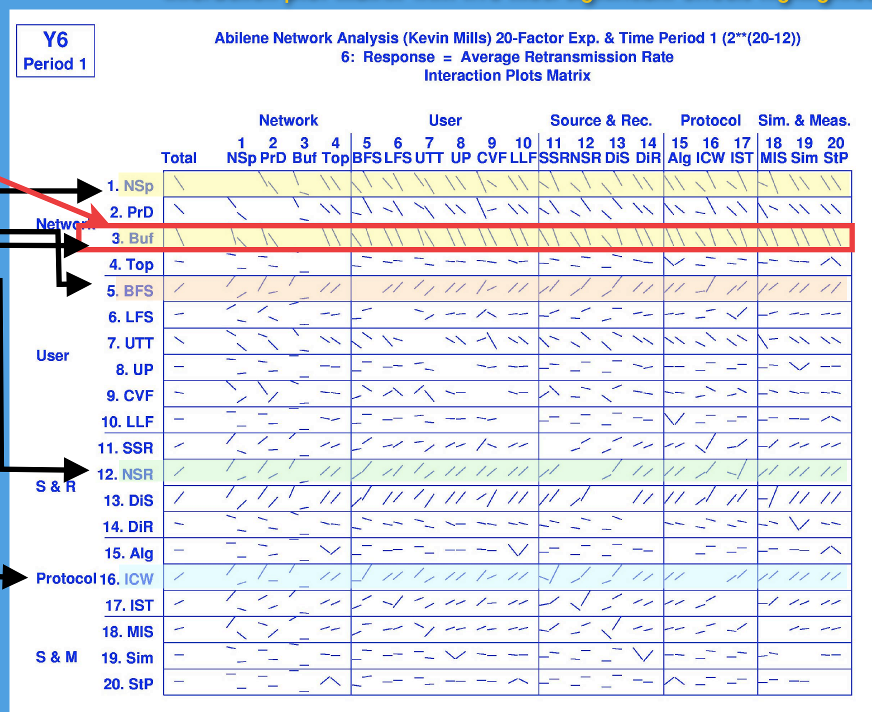
January

General Interaction Plot Analysis of 20-Factor Abilene Network Experiment



Main effects plot with 5 responses of 99% level of significance.

Interaction plot matrix with five most significant effects highlighted.



Each row of the Interactions Plot corresponds to a different factor. The first line in each row provides a reference trace representing the main effects for that factor. Each subsequent pair of traces within the same row shows the factor effect when each other factor takes on each of its two levels. Traces with differing slopes (compared to the reference) identify the existence of interactions. For example, factor 3 (buffer size)shows interactions only with (high) network speed and (long) propagation delay.

From "How to model a TCP/IP network using only 20 parameters."http://www.itl.nist.gov/ITLPrograms/ComplexSystems/Presentations.html

The Main Effects Plot (upper left) provides information about the relative importance of factors in a (network) system. The horizontal axis consists of each factor (here = 20) and each level (here = 2) within a factor. The vertical axis is the mean of the response for a given level within a given factor. Important factors will (by definition) have large differences in the mean responses for the 2 levels within the factor; this in turn will manifest itself by steeply-sloped lines on the Main Effects Plot.
A question of equal importance is whether (2-term) interactions exist. **The Interaction Effects Plot** (lower right) helps to graphically answer that question. From the Main Effects Plot, it was seen that the most important factor (that is, having the steepest line) was factor 3 (BUF = buffer size). The question is now posed: Does BUF interact with any of the 19 remaining factors in this system? On the interaction plot, BUF appears on the third row. Every trace on row three connects the mean response for each of the 2 settings of BUF. The first trace is a reference that indicates the main effects when BUF is small and large. The second trace indicates the effects of BUF size given a low network speed, while the third trace indicates the effects of BUF size given high network speed. Similarly, the third pair of traces (4 and 5) indicate the effects of BUF size given a short (trace 4) and long (trace 5) propagation delay. Traces 3 and 5 differ in slope from the reference, indicating that BUF size interacts with a high network speed (NSp) and a long propagation delay (PrD). All other traces have slopes similar to the reference trace, implying no interactions with BUF size
An additional important virtue of this Interactions Plot is that it is not restricted to 2-level designs—it may be applied to designs with factors with any number of levels.

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The Complex Systems Program is part of the National Institute of Standards and Technology's Information Technology Laboratory. Complex Systems are composed of large interrelated, interacting entities which taken together, exhibit macroscopic behavior which is not predictable by examination of the individual entities. The Complex Systems program seeks to understand the fundamental science of these systems and develop rigorous descriptions (analytic, statistical, or semantic) that enable prediction and control of their behavior.

Program information at: `www.itl.nist.gov/ITLPrograms/ComplexSystems`