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Advanced visualization strategies for network operation (including examples for 2D and 3D visualizations)

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Abstract

Increasing amount of data in control centers demands new visualization strategies for preventing information overload. This discussion contribution will present examples of how data can be turned into useful information for increasing situation awareness of operators, such as 2D bubbles and 3D cones for voltages. This visualization is optimized for highlighting significant deviations from normal state. Each bubble/cone represents a deviation that needs the operator's attention. The color density indicates the severity of the deviation (low density = upcoming problems; high density = severe problems). Violated limits are coded additionally by showing a small black ring. With increasing excess of the limit value, the bubble grows beyond the initial radius, creating a halo effect around the black ring. Feeders that are connected to a violated bus bar are highlighted in the same color as the bubble to indicate the impact of the deviation on the network. Colors indicate the type of deviation (high voltage = yellow, low voltage = orange). The 3D view additionally uses the orientation of the cone to provide a more intuitive coding for low-voltage (pointing down) and high voltage (pointing up) deviations:

Further examples to be presented for discussion will be enhanced contour gradients and indication of one-side open lines. Additionally, the concept of display profiles will be introduced that allows users to adjust displayed information on-the-fly according to the needs of the actual situation.