

Network Innovation Competition Full Submission

Supplementary Answer Form

Tick if this answer is Confidential: ☐

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Project code:	SPT EN 01	Question Number	20
Question date	21-08-2013	Answer date	23-08-2013
Submission section question relates to	Appendix 2		
Topic	Technical Description of Project		
Question	Please clarify whether SSO monitoring is conducted by the PMUs or by separate standalone devices, and whether any of the existing 8 PMUs could be used for SSO monitoring.		
Notes on question			
Answer	<p>VISOR will install a relatively small number of new, standalone, non-PMU devices to provide continuous monitoring of SSO – the reasoning for this is described below.</p> <p>A small number of new SSO continuous monitoring devices are envisaged to provide a continuous detection and alarming capability. This cannot be achieved from PMU data because of the fundamental bandwidth of the phasor calculation, but must rather be derived from data with a faster sampling rate.</p> <p>The PMU function provides magnitude and phase values of the fundamental 50Hz voltage and current signals, reported up to 50 times per second (once per cycle) with a very accurate timestamp. By the fundamental Nyquist sampling theorem, the highest theoretical frequency represented is $\frac{1}{2}$ of the sampling rate, ie 25Hz. In practice, the highest reliable frequency captured is around 10Hz, because of the filtering and windowing required to achieve accurate phasor data. This bandwidth does not reliably capture the entire bandwidth of potential SSO issues, which is 5-50Hz. Some work has been done on extending the PMU sampling rate to 100 times per second, but there is a trade-off between accuracy and response rate, this is not seen as a reliable and general approach.</p> <p>SSO monitoring involves extracting magnitude and phase values of a range of “sub-synchronous” frequency components between 5 and 50Hz that may be present along with the main 50Hz voltage and current signals. Results</p>		

	<p>would be typically be reported once every 1-20 seconds.</p> <p><u>In conclusion</u>, whilst the measurement principles in PMU & SSO are similar (though the post-processing is different) and the concept of one device providing both capabilities is desirable, <u>there is no device currently commercially available that fills both these roles</u>. The PMU function filters out frequencies higher than ~10-50Hz to avoid aliasing (the confusion of higher frequency components for low frequency components, resulting from digital sampling). On the other hand, those devices which currently do provide frequency analysis over a wide range do not have streaming capabilities for the SSO analysis results suited to Wide-Area Monitoring applications.</p> <p>VISOR will however explore the use of the existing installed base of devices that serve as both PMU and Disturbance (or "Fault") Recorders to provide <i>discontinuous</i> monitoring of SSO, in order to extend the geographic visibility without a large-scale rollout of new equipment. SSO monitoring requires faster sampling than standard PMU data, which would not easily be streamed to a central location. As part of their existing functionality these devices are capable of taking short, high time-resolution snapshots of measurements at regular time intervals or as triggered events.</p> <p>The concept of adding the disturbance recorder-based monitoring is that a small number of new dedicated devices will provide continuous observation and alarming, while regular or triggered snapshots from existing standard devices will provide extensive geographic coverage.</p>
Attachments	
Verbal Clarifications (Consultants)	