

# PMUs and synchrophasor data flows in North America

as of March 19, 2014



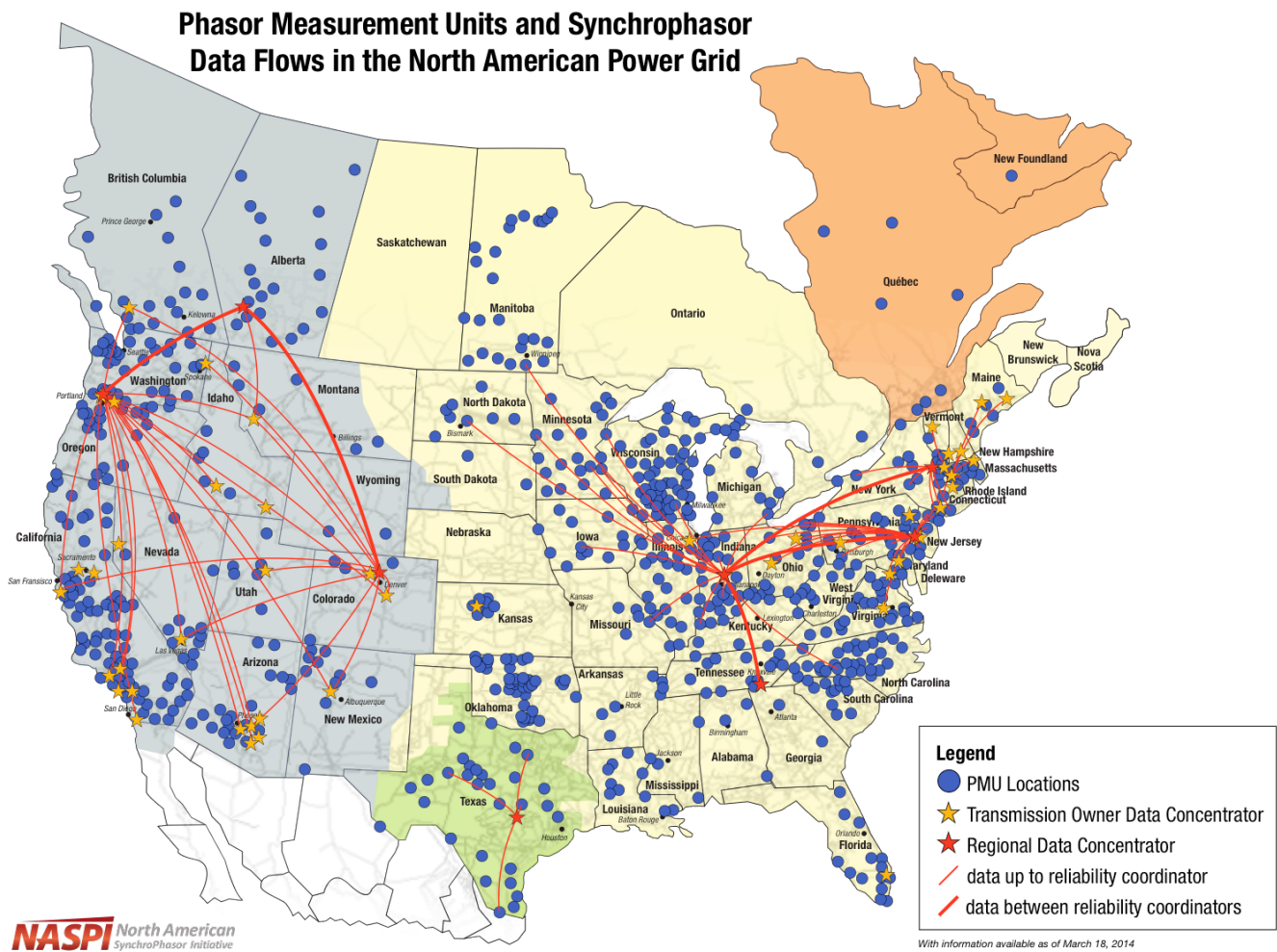
# PMUs and wide-area situational awareness – why synchrophasor data flows matter

In every significant blackout in North America over recent decades, grid operators' lack of "wide-area situational awareness" has been found to be a significant contributing factor causing the blackout. Situational awareness for a grid operator entails being able to track what is happening over time and space (topology) on the grid, understand what it means, and anticipate what could happen next and how the operator might be able to affect it. Accurate, granular grid condition monitoring and wide-area visualization are essential requirements for effective situational awareness.

With the 2009 funding of 13 synchrophasor projects under the American Reinvestment and Recovery Act, the North American electric industry added over 800 new phasor measurement units and numerous synchrophasor data communications networks into the power grid.

Today there are over 1,000 PMUs installed across North America, and many local and regional phasor data concentrators collecting real-time, high-speed, time-synchronized information about grid conditions to enhance grid operations and protect grid reliability. The map (Figure 1) shows the location of many of those PMUs and how the data are being shared between the transmission and power plant owners (which own the PMUs) and grid operators (reliability coordinators). This information sharing is improving wide-area visualization across large regions and enhancing situational awareness for better grid reliability.

**Figure 1 – Data Flows from Transmission Owners to Regional Data Hubs and Between RCs**



## Synchrophasor data flows today\*

In 2009 there was little data-sharing between PMUs and grid operators. Today there is extensive sharing of synchrophasor data. Figures 1 and 2 illustrate these information flows.

- In the Eastern Interconnection, most but not all of the transmission owners with PMUs are collecting their PMU fleet data (gold stars) and sharing their data with their regional reliability coordinators' data hubs (red stars). Several of the regional reliability coordinators are sharing synchrophasor data with each other (thick red lines); this is a work in progress and much more data will be shared over the coming year. (Figure 1)
- Within ERCOT (Texas), all of the transmission operators' PMU data are flowing into a single data hub. The data flows on this map represent the relationships in place in February, 2014. As synchrophasor data networks improve and synchrophasor applications become more widely accepted within grid operations, the number of entities sharing synchrophasor data between local data concentrators and reliability coordinators' regional data hubs will increase. (Figure 1)
- In the Western Interconnection, almost every PMU is feeding data into a transmission owner's phasor data concentrator (gold stars) and from there across an interconnection-wide data network (funded by the DOE Smart Grid Investment Grant to the Western Interconnection Synchrophasor Project and the WECC project partners) up to interconnection-wide data hubs (red hairlines up to red stars) for reliability monitoring. There are also extensive flows of synchrophasor data between reliability coordinator hubs (thick red lines) and directly between transmission owners (green hairlines on Figure 2). These flows allow true wide-area situational awareness.

\* Data flows accurate as of March 19, 2014

**Figure 2 – Data Flows from Transmission Owners to Regional Hubs, Between RCs, and Between TOs**

