Survey Results

Below is a summary of the results of a survey that was conducted by the NASPI Data and Network Management Task Team, DNMTT. The purpose of this survey was to gain an understanding of existing industry archiving processes for synchronized measurements. This information will help NASPI document existing archiving standards for industry guidance and promote the development of new archiving and network standards that will enable faster advancements in synchronized measurement tools. The survey consisted of fourteen questions. Seventeen members responded to the survey. Respondents were able to make multiple choices per question. The result tables for each question below shows the available responses and the frequency count of responses.

Question 1: Describe your overall synchronized measurement network architecture (i.e., PDC network configuration)?

|  |  |
| --- | --- |
| Response | Count |
| Routable communications UDP or TCP/IP | 13 |
| Substation PMUs to substation PDC to Control Center PDC | 10 |
| Substation PMUs direct to Control Center PDC |  |
| Serial Communication | 1 |
| Foreign Substation PMU – TSO PDC – own TSO PDC | 1 |

Many respondents are using multiple network architectures; only 5 had a single architecture. Three of those were using UDP or TCP/IP with the others using a substation or Control Center PDC setup.

One respondent chose not to respond to this question leaving a total of sixteen responses.

A total of eleven respondents specified transport methods.

Three respondents (27%) stated using routable communications UDP or TCP/IP but did not specify any defined architecture.

For signal transport method responses, 100% used routable communications UDP or TCP/IP with two respondents (18%) specifying the use of serial communication in additional to routable communication. This may be an artifact of first generation PMUs without Ethernet capability.

A total of twelve respondents specified defined architectures

There was an equal split in the use of individual architectures with three (25%) using intermediate substation PDCs and three (25%) using direct control center transmission. There were five (42%) respondents who used a mixture of architectures possibly for dedication of certain synchrophasor signals for direct control room use. One respondent specified a unique structure: foreign substation PMU to TSO PDC to own TSO PDC. This would be a foreign utility PMU transported through TSO connections to the respondent utility PDC.

Many entities are using well known PDC architectures and mixture of architectures to achieve their synchrophasor data needs with a possible minority using unique and/or advanced synchrophasor transport method.

Question 2: What product do you use for your archive?

|  |  |
| --- | --- |
| Response | Count |
| eDNA | 1 |
| OSISoft PI Archive | 6 |
| Relational Database (SQL, Oracle, SQL variants) | 2 |
| openHistorian | 3 |
| PingThings | 1 |
| Files | 1 |
| Proprietary | 6 |
| DataNXT | 2 |
| SynchroWAVe | 3 |
| PhasorPoint | 4 |
| Other | 3 |

Disclaimer: The responses to question 3 is not meant to showcase the total number of users of individual vendors but to show the diversity of vendor archive solutions available.

Six (35%) of the respondents use in-house proprietary software while six (35%) of the respondents use OSISoft PI for their archive solutions.

Other archive solutions used include Kx for Sensors and kdb+, AWS S3 and Glacier (Cloud-based solution) and Hadoop.

Nine (75%) of the respondents reported using multiple archive solutions.

The use of proprietary and mixtures of archive solutions is very prominent. In addition, there is a total of 13 vendor solutions available just from these survey results showing there is a diversity of options available.

Question 3: What is the format of your archived synchronized measurements (i.e., file folder, binary, SQL database)?

|  |  |
| --- | --- |
| Response | Count |
| Binary | 3 |
| Big Data | 1 |
| Time Series Based | 5 |
| SQL/KDB+/SynchroWAVe/PI/Parquest Database | 6 |
| CSV | 2 |

Most respondents had a custom storage style. Even those that responded with the same response category stored its data in slightly differently ways. For example, the time-series respondents were using a mixture of custom storage methods such as compression methods, proprietary methods, flat files, and others.

 Question 4: Archive Type?

|  |  |
| --- | --- |
| Response | Count |
| Fixed Size | 9 |
| Fixed Duration | 6 |
| Expanding | 2 |

Most respondents are keeping a fixed amount of data before deletion. Only two respondents are expanding their data storage to keep longer-term data. Also, only one respondent has chosen to keep a 2 week data repository.

Question 5: Current Storage Capacity (TBs)?

|  |  |
| --- | --- |
| Response | Count |
| 0-29 | 3 |
| 30-75 | 4 |
| 76-150 | 7 |
| >150 | 0 |

The size of storage needed can vary according to many factors, such as, the number of PMUs, compression methods, resolution, and frequency of PMU data.

Question 6: Current Storage Duration (in years)?

|  |  |
| --- | --- |
| Response | Count |
| <0.5 | 2 |
| 0.5-1.5 | 2 |
| 1.5-2.5 | 3 |
| 2.5-3.5 | 5 |
| 3.5-4.5 | 1 |
| 7 | 1 |

Most respondents are keeping their data for more than a year, with only two indicating for less than that. Many respondents indicated that exciting events are saved in different locations for permanent review.

Question 7: Data accessibility?

|  |  |
| --- | --- |
| Response | Count |
| Online | 14 |
| Only Offline | 1 |

Most, if not all, respondents can access PMU data online. The only offline response referred to archived data. Old archived data was only available offline for many other responders. One respondent stated that data is accessible only to operators.

Question 8: Data Granularity?

|  |  |
| --- | --- |
| Response | Count |
| Raw | 10 |
| Compressed | 6 |
| Down Sampled | 2 |

Many respondents are recording data in a raw format. This may be due to the low cost to storage as well as the immediate access to data that raw files provide.

Question 9: Data Sampling Rate (Hz)?

|  |  |
| --- | --- |
| Response | Count |
| 10 | 2 |
| 25-30 | 10 |
| 50-60 | 4 |
| 100-120 | 3 |

Most respondents are sampling at half the line frequency (25-30 Hz). Also noted was that, 6 (35%) of the respondents sample at multiple sample rates.

Question 10: Describe tools used for synchronized measurement data quality assurance and lost signal alarming and mitigation?

|  |  |
| --- | --- |
| Response | Count |
| Uses Commercial Software | 10 |
| Uses Custom Software/Methods | 2 |
| Sends Alarms on poor data quality | 1 |
| No Response/No Tool | 5 |

Most respondents used commercial software like EPG RTDMS, DataNXT, PI Datalink, XM, to name a few. Most do not send alarms. One respondent indicated they had extensive PMU coverage, and the loss of data from isolated units was not problematic, not requiring alarming.

Question 11: What types of data do you archive?

|  |  |
| --- | --- |
| Response | Count |
| Synchrophasors | 17 |
| Line Frequency | 1 |
| Digital Fault Records | 4 |
| Relay records | 3 |
| Power Quality | 2 |
| Application Data (oscillation detection, etc.) | 1 |

All respondents record synchrophasor data. Of the 17 respondents 64% report recording only synchrophasor data.

Question 12: Do you store synchrophasor data with non-time synchronized data?

|  |  |
| --- | --- |
| Response | Count |
| No | 14 |
| Yes | 2 |

Of the 16 respondents to this question of mixing synchronized and non-synchronized data, only 2 responded in the affirmative. One stored the non-synchronized and synchronized data in the same database in a flexible data model. The other affirmative respondent stored all data on the PingThings PredictiveGrid platform or in a side SQL Database depending on frequency.

Question 13: What features would you like to see in a next-generation synchrophasor data service platform?

|  |  |
| --- | --- |
| Response | Count |
| On-board data analytics | 10 |
| PDC-less collection | 4 |
| Multiple data source collection (non-synchrophasor) | 8 |
| Data output streaming services | 5 |
| Cloud storage | 4 |
| Easy access by multiple parties and standard API to enable advanced data analytics | 1 |

Most respondents were interested in on-board data analytics and multiple data source collections. Both of these items are features that some respondents have already implemented. This shows the respondents' need for quick access to raw data and summary data for simplified and decision making. This also speaks to the respondents desire to have capabilities to quickly develop and obtain quick new insights into what information their synchrophasor data can provide.