IEEE P1159.3 PQDIF Task Force Web Meeting

Daniel Sabin
Electrotek Concepts, Inc.
Beverly, Massachusetts, USA
d.sabin@ieee.org

July 18, 2013
Meeting Agenda

• Patent Notice
• Task Force Overview
• PQDIF Overview
• Planned Task Force Activities
• Updates to PQDIF Values
  – New Web Site
• Next Steps
• Next Meeting
Participants, Patents, and Duty to Inform

• All participants in this meeting have certain obligations under the IEEE-SA Patent Policy.
  – Participants [Note: Quoted text excerpted from IEEE-SA Standards Board Bylaws subclause 6.2]:
    • “Shall inform the IEEE (or cause the IEEE to be informed)” of the identity of each “holder of any potential Essential Patent Claims of which they are personally aware” if the claims are owned or controlled by the participant or the entity the participant is from, employed by, or otherwise represents
      – “Personal awareness” means that the participant “is personally aware that the holder may have a potential Essential Patent Claim,” even if the participant is not personally aware of the specific patents or patent claims
    • “Should inform the IEEE (or cause the IEEE to be informed)” of the identity of “any other holders of such potential Essential Patent Claims” (that is, third parties that are not affiliated with the participant, with the participant’s employer, or with anyone else that the participant is from or otherwise represents)
      – The above does not apply if the patent claim is already the subject of an Accepted Letter of Assurance that applies to the proposed standard(s) under consideration by this group
      – Early identification of holders of potential Essential Patent Claims is strongly encouraged
      – No duty to perform a patent search
Patent Related Links

- All participants should be familiar with their obligations under the IEEE-SA Policies & Procedures for standards development.
- Patent Policy is stated in these sources:
  - IEEE-SA Standards Boards Bylaw
  - Material about the patent policy is available at
    - http://standards.ieee.org/about/sasb/patcom/materials.html

If you have questions, contact the IEEE-SA Standards Board Patent Committee Administrator at patcom@ieee.org or visit http://standards.ieee.org/about/sasb/patcom/index.html

This slide set is available at https://development.standards.ieee.org/myproject/Public/mytools/mob/slideset.ppt
Call forPotentially Essential Patents

• If anyone in this meeting is personally aware of the holder of any patent claims that are potentially essential to implementation of the proposed standard(s) under consideration by this group and that are not already the subject of an Accepted Letter of Assurance (LOA):
  – Either speak up now, or
  – Provide the chair of this group with the identity of the holder(s) of any and all such claims as soon as possible, or
  – Cause an LOA to be submitted
Other Guidelines for IEEE WG Meetings

- All IEEE-SA standards meetings shall be conducted in compliance with all applicable laws, including antitrust and competition laws.
  - Do not discuss the interpretation, validity, or essentiality of patents/patent claims.
  - Do not discuss specific license rates, terms, or conditions.
    - Relative costs, including licensing costs of essential patent claims, of different technical approaches may be discussed in standards development meetings.
      - Technical considerations remain primary focus
  - Do not discuss or engage in the fixing of product prices, allocation of customers, or division of sales markets.
  - Do not discuss the status or substance of ongoing or threatened litigation.
  - Do not be silent if inappropriate topics are discussed … do formally object.
- See IEEE-SA Standards Board Operations Manual, clause 5.3.10 and “Promoting Competition and Innovation: What You Need to Know about the IEEE Standards Association's Antitrust and Competition Policy” for more details.
IEEE P1159.3 Task Force Overview

IEEE Power & Energy Society
• Transmission and Distribution Committee
  – Power Quality Subcommittee
• P1159 Working Group on Power Quality Monitoring
  – P1159.3 Task Force on Power Quality Data Interchange

Task Force Web Site:
http://grouper.ieee.org/groups/1159/3/

Chair: Dan Sabin (d.sabin@ieee.org)
Secretary: Rich Bingham (r.bingham@ieee.org)
What is IEEE PQDIF?

- PQDIF is an IEEE “recommend practice” for power quality data interchange format that allows exchange of measurements and simulation results between computer hardware and software systems.
- PQDIF is a binary format
- PQDIF files uses the file extension “PQD”
What is IEEE PQDIF?

Design Details

• A PQDIF file is made up of a set of “records” which are logically related:
  – Container (start of stream or file identifier, global options)
  – Data Source (channel and series definitions generally representing an instrument or simulation program)
  – Monitor Settings (optional – PT/CT ratio’s, frequency response characteristics, calibration, etc.)
  – Observations (e.g. events, trends, statistics, etc.)

• Within each record, there are a set of “elements” which define the contents of the record.
PQDIF File Requirements for IEEE P1159.3 Task Force

- Must result in a single, compressed, binary file representation using a unique file extension to facilitate OS and MIME file/application associations
- Must be able to represent all PQ event types defined in the IEEE 1159 power quality monitoring standard, relevant IEC standards (61000-4-7, 4-15, 4-30), and others (e.g. UNIPEDE DISDIP, EN50160)
- Must be able to contain multiple event, trend, and other recordings over an arbitrary time period (nanoseconds to years) in a single file or stream
- Although compressed binary, the entire file or stream must not be corruptible by a single byte change. That is, the format must be inherently correctable, partitioned, or otherwise resynchronizable.
PQDIF File Requirements for IEEE P1159.3 Task Force

- Must be streamable over a serial communications channel (e.g. RS-232 or TCP/IP) and serially decodable. That is, you do not need to look at entire file/stream before decoding useful information.
- Must be versionable and user/vendor extensible without the need for a central registration authority.
- Extensions must be implemented in a way that readers unaware of the extensions can ignore unknown records, data blocks, and tags without knowing the format of the unknown elements.
- Nanosecond or better time stamp resolution
Recent P1159.3 Task Force Activities

Updates to P1159.3 Database in January 2012

• Revised a Microsoft Access database that was first built during the development of IEEE Std. 1159.3-2003 that was used to maintain the ID values that define PQDIF itself and be used to produce source code files for C++, C#, Java, and VB6.
  – Updated to allow use with Access 2007
  – Added records to support a new “PQDIF Version 1.6”
  – Added new values for vendor IDs, equipment IDs, and phase IDs that were submitted to the task force in 2010 and 2011.
  – Built new source code using the PQDIF Version 1.6 values
New tagVendorID Values in Draft Version of PQDIF Version 1.6

- ID_VENDOR_A_EBERLE
- ID_VENDOR_ALPESTEC
- HNOLOGIES
- ID_VENDOR_AMETEK
- ID_VENDOR_ARBITER
- ID_VENDOR_CESINEL
- ID_VENDOR_ELECTRO_INDUSTRIES
- ID_VENDOR_ELSPEC
- ID_VENDOR_EMEX
- ID_VENDOR_ENERNEX
- ID_VENDOR_HIOKI
- ID_VENDOR_LANDIS_GY
- R
- ID_VENDOR_METRUM
- ID_VENDOR_NEXANT
- ID_VENDOR_ORL
- ID_VENDOR_PSL
- ID_VENDOR_SST
- ID_VENDOR_UNIPOWER
New tagEquipmentID Values in Draft Version of PQDIF Version 1.6

<table>
<thead>
<tr>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID_EQUIP_ARBITER_1133A</td>
</tr>
<tr>
<td>ID_EQUIP_ELSPEC_PQSCADA</td>
</tr>
<tr>
<td>ID_EQUIP_EMAX_DIRECTOR</td>
</tr>
<tr>
<td>ID_EQUIP_ETK_PQDIFFRACTOR</td>
</tr>
<tr>
<td>ID_EQUIP_LANDIS_GYR_MAXCOM</td>
</tr>
<tr>
<td>ID_EQUIP_ORL_AP300</td>
</tr>
<tr>
<td>ID_EQUIP_ORL_OTHER</td>
</tr>
<tr>
<td>ID_EQUIP_ORL_PM1000</td>
</tr>
<tr>
<td>ID_EQUIP_ORL_PM1200</td>
</tr>
<tr>
<td>ID_EQUIP_ORL_PM2000</td>
</tr>
<tr>
<td>ID_EQUIP_ORL_PM2200</td>
</tr>
<tr>
<td>ID_EQUIP_ORL_PM3000</td>
</tr>
<tr>
<td>ID_EQUIP_ORL_PM3006</td>
</tr>
<tr>
<td>ID_EQUIP_ORL_PM4000</td>
</tr>
<tr>
<td>ID_EQUIP_ORL_PM6000</td>
</tr>
<tr>
<td>ID_EQUIP_ORL_PM7000</td>
</tr>
<tr>
<td>ID_EQUIP_ORL_RANGER_II</td>
</tr>
<tr>
<td>ID_EQUIP_ORL_RANGER_III</td>
</tr>
<tr>
<td>ID_EQUIP_ORL_RANGER_III</td>
</tr>
<tr>
<td>ID_EQUIP_ORL_RANGERHA5000</td>
</tr>
<tr>
<td>ID_EQUIP_ORL_RANGERMETER_SOCKET</td>
</tr>
<tr>
<td>ID_EQUIP_ORL_RANGERRR1250</td>
</tr>
<tr>
<td>ID_EQUIP_ORL_RANGERSCOUT</td>
</tr>
<tr>
<td>ID_EQUIP_PQUBE</td>
</tr>
<tr>
<td>ID_EQUIP_SST_IGRID</td>
</tr>
<tr>
<td>ID_EQUIP_GPT_61000</td>
</tr>
<tr>
<td>ID_EQUIP_GPT_ES210</td>
</tr>
<tr>
<td>ID_EQUIP_GPT_ES230</td>
</tr>
</tbody>
</table>
New tagPhaseID Values in Draft Version of PQDIF Version 1.6

• ID_PHASE_LN_MAX
• ID_PHASE_LN_MIN
• ID_PHASE_LL_MAX
• ID_PHASE_LL_MIN

The existing version already includes ID_PHASE_LN_AVG and ID_PHASE_LL_AVG
Recent Task Force Activities

Updates to PQDiffractor in June 2013

• A new version of the PQDiffractor® software application was released in June 2012. It supports the draft PQDIF 1.6 ID values.
  – PQDiffractor is a free software application for viewing measurements within PQDIF files using interactive charts and tables.
  – It also provides a diagnostic mode for assessing noncompliance with IEEE Std 1159.3-2003.

• Available to download on the IEEE P1159.3 Web Site from [http://grouper.ieee.org/groups/1159/3/docs.html](http://grouper.ieee.org/groups/1159/3/docs.html)
PQDiffractor Screen Capture
Recent P1159.3 Task Force Activities

Meeting Notes Posted

• Meetings from 2009 to 2011 were posted to the web site
• PQDIF Links section added to web site
Recent P1159.3 Task Force Activities

Updates to Software on P1159.3 Web Site in January 2012

• PQDCOM4.DLL
  – An ActiveX/COM Library for reading and writing PQDIF files

• PQDIF Libraries
  – Includes C++, VB6/VBA, C#, and Java header code with new the PQDIF Version 1.6 values
  – Includes source code to PQDCOM4.DLL
Recent P1159.3 Task Force Activities

Updates to Software on P1159.3 Web Site in January 2013

• PQDIF.NET
  – A .NET Component Library for reading and writing PQDIF files that has similar interfaces to PQDCOM4.DLL
## Quantity Type Tags of PQDIF 1.5

<table>
<thead>
<tr>
<th>tagQuantityTypeID</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ID_QT_CPF</td>
<td>Cumulative probability values, which are required by many IEC standards for power quality and are proposed for IEEE standards</td>
</tr>
<tr>
<td>ID_QT_FLASH</td>
<td>Lightning flash densities</td>
</tr>
<tr>
<td>ID_QT_HISTOGRAM</td>
<td>Histogram data for a single variable</td>
</tr>
<tr>
<td>ID_QT_HISTOGRAM3D</td>
<td>Histogram data for two variables</td>
</tr>
<tr>
<td>ID_QT_MAGDUR</td>
<td>The magnitude and duration for rms voltage variations (voltage sags, swells, interruptions, overvoltages, and undervoltages)</td>
</tr>
<tr>
<td>ID_QT_MAGDURCOUNT</td>
<td>The cross-tabulation of magnitude and duration for rms voltage variations (voltage sags, swells, interruptions, overvoltages, and undervoltages)</td>
</tr>
<tr>
<td>ID_QT_MAGDURTIME</td>
<td>The magnitude and duration for rms voltage variations (voltage sags, swells, interruptions, overvoltages, and undervoltages) with time stamps</td>
</tr>
<tr>
<td>ID_QT_PHASOR</td>
<td>Phasor measurements, used for both phasors with phase angles and for cycle-by-cycle measurements of rms voltage variations – core event type</td>
</tr>
<tr>
<td>ID_QT_RESPONSE</td>
<td>Frequency responses</td>
</tr>
<tr>
<td>ID_QT_VALUELOG</td>
<td>Value logs for steady-state measurements, including means to store the minimum, average, and maximum of hundreds of different quantity, characteristics, and phase combinations - core trend type</td>
</tr>
<tr>
<td>ID_QT_WAVEFORM</td>
<td>Waveforms of voltage, current, and power – core event type</td>
</tr>
<tr>
<td>ID_QT_XY</td>
<td>Scatter plot data for two variables</td>
</tr>
<tr>
<td>ID_QT_XYZ</td>
<td>Scatter plot data for three variables</td>
</tr>
</tbody>
</table>
Example Observation Record with tagQuantityTypeID set to ID_QT_VALUELOG

- Minimum, average, maximum of steady-state quantities (e.g., rms voltage, rms current, voltage THD, V3, etc.)
- `tagPhaseID = ID_PHASE_AN`
- `tagQuantityTypeID = ID_QT_VALUELOG`
- `tagQuantityMeasuredID = ID_QM_VOLTAGE`
- `tagSeriesDefns`
  - `tagOneSeriesDefn`
    - `tagValueTypeID = ID_SERIES_VALUE_TYPE_TIME`
    - `tagQuantityUnitsID = ID_QU_TIMESTAMP`
    - `tagQuantityCharacteristicID = ID_QC_NONE`
    - `tagStorageMethodID = ID_SERIES_METHOD_INCREMENT`
  - `tagOneSeriesDefn`
    - `tagValueTypeID = ID_SERIES_VALUE_TYPE_MIN`
    - `tagQuantityUnitsID = ID_QU_VOLTS`
    - `tagQuantityCharacteristicID = ID_QC_TOTAL_RMS`
    - `tagStorageMethodID = ID_SERIES_METHOD_VALUES`
  - `tagOneSeriesDefn`
    - `tagValueTypeID = ID_SERIES_VALUE_TYPE_AVG`
    - `tagQuantityUnitsID = ID_QU_VOLTS`
    - `tagQuantityCharacteristicID = ID_QC_TOTAL_RMS`
    - `tagStorageMethodID = ID_SERIES_METHOD_VALUES`
  - `tagOneSeriesDefn`
    - `tagValueTypeID = ID_SERIES_VALUE_TYPE_MAX`
    - `tagQuantityUnitsID = ID_QU_VOLTS`
    - `tagQuantityCharacteristicID = ID_QC_TOTAL_RMS`
    - `tagStorageMethodID = ID_SERIES_METHOD_VALUES`
Example Observation Record with tagQuantityTypeID set to ID_QT_WAVEFORM

- Voltage and/or Current Waveforms due to Power Quality or Fault Disturbances

![Graph showing voltage and current waveform samples on 2/22/2003 at 16:08:59.0860]
Example Observation Record with tagQuantityTypeID set to ID_QT_PHASOR

- RMS Voltage Variations due to Faults and Large Load Increases
Example Observation Record with tagQuantityTypeID set to ID_QT_MAGDURTIME

- Voltage/Current Magnitude and Duration of RMS Voltage Variations

<table>
<thead>
<tr>
<th>Site Name</th>
<th>Time Stamp</th>
<th>Phase</th>
<th>Magnitude (Volts/Amps)</th>
<th>Duration (seconds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SITE1</td>
<td>1995-05-02 09:39:55</td>
<td>Va</td>
<td>8328</td>
<td>0.250</td>
</tr>
<tr>
<td>SITE1</td>
<td>1995-05-02 09:39:55</td>
<td>Vb</td>
<td>9156</td>
<td>0.100</td>
</tr>
<tr>
<td>SITE1</td>
<td>1995-05-02 09:39:55</td>
<td>Vc</td>
<td>5508</td>
<td>0.100</td>
</tr>
<tr>
<td>SITE1</td>
<td>1995-05-02 09:39:55</td>
<td>Ia</td>
<td>765</td>
<td>0.250</td>
</tr>
<tr>
<td>SITE1</td>
<td>1995-05-02 09:39:55</td>
<td>Ib</td>
<td>740</td>
<td>0.100</td>
</tr>
<tr>
<td>SITE1</td>
<td>1995-05-02 09:39:55</td>
<td>Ic</td>
<td>2367</td>
<td>0.100</td>
</tr>
<tr>
<td>SITE1</td>
<td>1995-05-08 08:36:12</td>
<td>Va</td>
<td>9264</td>
<td>0.033</td>
</tr>
<tr>
<td>SITE1</td>
<td>1995-05-08 08:36:12</td>
<td>Vb</td>
<td>5640</td>
<td>0.133</td>
</tr>
<tr>
<td>SITE1</td>
<td>1995-05-08 08:36:12</td>
<td>Vc</td>
<td>6540</td>
<td>0.483</td>
</tr>
<tr>
<td>SITE1</td>
<td>1995-05-09 20:23:04</td>
<td>Vc</td>
<td>8160</td>
<td>0.100</td>
</tr>
<tr>
<td>SITE1</td>
<td>1995-05-14 08:03:00</td>
<td>Vc</td>
<td>9972</td>
<td>0.067</td>
</tr>
<tr>
<td>SITE1</td>
<td>1995-05-14 09:06:59</td>
<td>Vb</td>
<td>9936</td>
<td>0.050</td>
</tr>
</tbody>
</table>
New Web Site in July 2012 to Assist in Collecting Information for New PQDIF IDs

• The task force has created a new web site that will allow users an easy way to submit new IDs for existing tags.
Example of Submitting a New ID for tagPhaseID
Planned Task Force Activities during 2013-2015

- Apply for PAR for new version of IEEE Std 1159.3
- Complete editorial changes and corrections to 2003 edition of IEEE Std. 1159.3
- Add new ID values for existing tags
- Add new tags and ID values
- Add new quantity types
- Add annex on PQDIF and its relationship to IEC 61850
- Add annex on PQDIF and its relationship to IEEE/IEC COMTRADE
- Vote on new version of IEEE Std 1159.3 in 2016
  - Note: to vote, membership in IEEE and IEEE Standards is required
Proposed New Quantity Characteristic Needed?

• Asked by Alex McEachern
  – How should we go about adding to PQDIF the new IEC 61000-4-30 measurements of 2kHz-150kHz conducted emissions?

• Current values for tagQuantityCharacteristicID related to harmonics:
  – ID_QC_SPECTRA
  – ID_QC_SPECTRA_HGROUP
  – ID_QC_SPECTRA_IGROUP
Revision Requested by NVE in November 2012

- Provide quantity types of quantity characteristic ID values that could be used to store rapid voltage change (RVC) values for individual events and for RVC event lists.
Proposed New Value Type ID: ID_SERIES_VALUE_TYPE_RMS

Issue Raised by Stéphane Do and by Dan Sabin

• When storing a data log, many PQ monitors will store a minimum, average, and maximum value in regular intervals (e.g., once every ten minutes).

• When storing the data log for these values, you would set tagValueTypeID to ID_SERIES_VALUE_TYPE_TYPE_MIN, ID_SERIES_VALUE_TYPE_TYPE_AVG, or ID_SERIES_VALUE_TYPE_TYPE_MAX

• However, IEC 61000-4-30 requires that the average be computed as the quadratic mean (not the arithmetic mean). The quadratic mean is also known as the root mean square or RMS value.

• Do we need to have an ID known as ID_SERIES_VALUE_TYPE_RMS to differentiate between the two averages?
Next Task Force Activities
Volunteers Needed Tag Review

- **tagPhaseID**
  - ID_PHASE_AN, ID_PHASE_BN, and ID_PHASE_CN, etc.
- **tagQuantityMeasuredID**
  - ID_QM_VOLTAGE, ID_QM_CURRENT, etc.
- **tagQuantityUnitsID**
  - ID_QU_AMPS, ID_QU_PERUNIT, ID_QU_TESLAS
- **tagQuantityCharacteristicID**
  - ID_QC_RMS, ID_QC_THD, ID_QC_FLKR_PST, etc.
- **tagQuantityTypeID**
  - ID_QT_WAVEFORM, ID_QT_PHASOR, ID_QT_MAGDUR, etc.
Proposed Annex on PQDIF’s Relationship to IEC 61850

- IEC 61850-8-1 defines file classes that can be mapped to the Manufacturing Message Specification (MMS) file object.
  - PQD file
    - IEEE 1159.3 Format (Power Quality Data Interchange Format – PQDIF)
  - COMTRADE folder
    - A folder of COMTRADE files.
    - If the directory contains a file with a suffix of “zip”, that file shall convey the compressed contents of the COMTRADE hdr, cfg, and dat files of the files of the same name.
  - Other supported file types: bin, dtd, gif, htm, txt, xml, xsd, zip
- However, these file classes are not widely used in commercial software.
Proposed Annex of PQDIF’s Relationship to IEEE/IEC COMTRADE

• Should we include an annex that compares PQDIF and COMTRADE?

• Source material for the annex could draw on the IEEE Power Systems Relaying Committee Working Group H5C report on “Common Data Format for IED Sampled Data”
  – Summarized PQDIF, COMTRADE, and 61850
  – Explained issues related to converting data between the formats
What can you do to help?

• If you want to join the task force to receive drafts of new versions of to help in the revision, send your name, company, mailing address, telephone number, and e-mail address to d.sabin@ieee.org and r.bingham@ieee.org.

• Submit Suggested New IDs for Existing Tags to d.sabin@ieee.org and r.bingham@ieee.org or to www.pqdif.info.

• Submit Structure of Proposed new Quantity Type Records to d.sabin@ieee.org and r.bingham@ieee.org.
PQDIF Group on LinkedIn

• New Group on LinkedIn
• Proposed Use: An open forum on changes to PQDIF
• Search for a group named “PQDIF Power Quality Data Interchange Format” or enter this hyperlink into a web browser: [www.linkedin.com/groups?gid=5108537](http://www.linkedin.com/groups?gid=5108537)
Next P1159.3 Task Force Meeting

2013 IEEE PES General Meeting
• Vancouver, British Columbia, Canada
• Vancouver Convention Center, West Meeting Room 113
• Tuesday, July 23, 2013
• 1:00 to 2:00 PM

Next Web Meeting
• Mid December 2013?