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<tbody>
<tr>
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<tr>
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<td>Thousands to millions</td>
<td>Significantly varied in different implementations</td>
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<tr>
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<td>Thousands to millions</td>
<td>Significantly varied in different implementations</td>
<td>Changes frequently</td>
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<tr>
<td>Thousands to millions</td>
<td>Significantly varied in different implementations</td>
<td>Changes frequently</td>
<td>Other</td>
</tr>
<tr>
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<td>Changes frequently</td>
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<tr>
<td>Other</td>
<td>Other</td>
<td>Other</td>
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</tr>
<tr>
<td>c. Distance between entities:</td>
<td>c. Distance between entities:</td>
<td>c. Distance between entities:</td>
<td>c. Distance between entities:</td>
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<td>A few miles</td>
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<tr>
<td>Many miles</td>
<td>Many miles</td>
<td>Many miles</td>
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<td>Many hundreds of miles</td>
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<tr>
<td>Corporate building</td>
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<tr>
<td>Building</td>
<td>Building</td>
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<td>Building</td>
</tr>
<tr>
<td>Substation</td>
<td>Substation</td>
<td>Substation</td>
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</tr>
<tr>
<td>Field outside substation</td>
<td>Field outside substation</td>
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<td>Field outside substation</td>
</tr>
<tr>
<td>Customer site (Market Participant)</td>
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<td>Customer site (Market Participant)</td>
<td>Customer site (Market Participant)</td>
</tr>
<tr>
<td>Another corporation</td>
<td>Another corporation</td>
<td>Another corporation</td>
<td>Another corporation</td>
</tr>
<tr>
<td>Mobile</td>
<td>Mobile</td>
<td>Mobile</td>
<td>Mobile</td>
</tr>
<tr>
<td>Changes frequently</td>
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</tr>
<tr>
<td>- Corporate building</td>
</tr>
<tr>
<td>- Building</td>
</tr>
<tr>
<td>- Substation</td>
</tr>
<tr>
<td>- Field outside substation</td>
</tr>
<tr>
<td>- Customer site (Market Participant)</td>
</tr>
<tr>
<td>- Another corporation</td>
</tr>
<tr>
<td>- Mobile</td>
</tr>
<tr>
<td>- Changes frequently</td>
</tr>
<tr>
<td>- Other</td>
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<table>
<thead>
<tr>
<th>f. Communications configuration:</th>
</tr>
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<tbody>
<tr>
<td>- WAN</td>
</tr>
<tr>
<td>- LAN</td>
</tr>
<tr>
<td>- One-on-one</td>
</tr>
<tr>
<td>- One-to-many</td>
</tr>
<tr>
<td>- Many-to-many</td>
</tr>
<tr>
<td>- Multi-drop</td>
</tr>
<tr>
<td>- Ad hoc</td>
</tr>
<tr>
<td>- Other (e.g. email/fax/snail mail, telephone)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>g. Communications media:</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Any</td>
</tr>
<tr>
<td>- Landline preferred</td>
</tr>
<tr>
<td>- Wireless possible</td>
</tr>
<tr>
<td>- Wireless required</td>
</tr>
<tr>
<td>- Other</td>
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<th>h. Communications ownership:</th>
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<tr>
<td>- Any</td>
</tr>
<tr>
<td>- Utility-owned</td>
</tr>
<tr>
<td>- Jointly-owned</td>
</tr>
<tr>
<td>- Commercially provided</td>
</tr>
<tr>
<td>- Internet</td>
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<td>- Other</td>
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<tr>
<td>- &lt;2400 bps</td>
</tr>
<tr>
<td>- 2.4-56 kbps</td>
</tr>
<tr>
<td>- 10 Mbps-100Mbps</td>
</tr>
<tr>
<td>- &gt;1 Gbps</td>
</tr>
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### Data exchange methods:
- Any
- Master-slave
- Peer-to-peer
- Client-server
- Publish-subscribe
- Through database
- Ad hoc
- Other

### Communication access services requirements:
- Any or all
- Request-response
- Periodic reporting
- Report-by-exception
- Control command
- Select-before-operate
- Set parameter values
- Query for data by name
- Subscribe
- Broadcast
- Multi-cast
- Data discovery
- Use of data sets
- Query to find location of data
- Query to determine what data is available (discovery)
- Execute application
- Establish and end association
- Logging
- Journaling
- Remote restart
- Remote reconfiguration
- Remote diagnosis
- Other

### Data exchange pattern:
- Data flow is <10% of bandwidth available
- Data flow is 10% but less than 50% of bandwidth available
- Data flow is 50% of bandwidth available
- Data flow is >50% of bandwidth available
- Data flows patterns basically even
- Data flows include high volume bursts
- Other

### Growth:
- 2x number of participating devices - Over the next 5 years
- 10x number of participating devices - Over the next 5 years
- 100x number of participating devices - Over the next 5 years
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### n. Commonly used data exchange technologies

- **Public Internet as communications media**
  - ✔
- **Internet-based protocols (e.g. HTML, XML)**
  - ✔
- **Computer Industry Component Technology Standards (e.g. CORBA, EJB, .Net, Web Services)**
  - ✔
- **Transaction Technologies (e.g. Corba, EJB, .NET, Web Services)**
  - ✔
- **Database Access Services (SQL, OQL, object browsing)**
  - ✔
- **Methodologies for process management (e.g. EDI, ebXML)**
  - ✔
- **NAESB protocols (OASIS, E-tagging, RTO (TBD))**
  - ✔
- **IEC 61970 Common Information Model (CIM) Standard**
  - ✔
- **IEC 61970 Generic Interface Definition (GID) Standard**
  - ✔
- **IEC 61968 Interface Exchange Model (IEM) Message Definition Standards**
  - ✔
- **IEC 61850 (UCA) Standard**
  - ✔
- **IEC 60870-5 TASE.2 (ICCP)**
  - ✔
- **IEC 60870-5 and/or DNP**
  - ✔
- **Other legacy SCADA protocols**
  - ✔
- **Building Automation Protocols SSPC135**
  - ✔
- **Other Building Automation Protocols**
  - ✔
  - ✔
- **Graphics data exchange standards**
  - ✔
- **Through a database using proprietary database interfaces**
  - ✔
- **Flat files or CSV files**
  - ✔
- **Other standard technologies**
  - ✔
- **Vendor proprietary technologies**
  - ✔
- **Other non-standard technologies**
  - ✔
- **None since interface has never been implemented**
  - ✔
- **None of the above/ not relevant/ don't know**
  - ✔

### o. Relative maturity of current implementation

- **Very mature and widely implemented**
  - ✔
- **Moderately mature**
  - ✔
- **Fairly new**
  - ✔
- **Future, no systems, no interactions**
  - ✔

### p. Existence of legacy systems

- **Many legacy systems**
  - ✔
- **Some legacy systems**
  - ✔
- **Few legacy systems**
  - ✔
- **Extensive changes will be needed for full system functionality**
  - ✔
- **Moderate changes will be needed**
  - ✔
- **Few changes will be needed**
  - ✔
- **No changes will be needed**
  - ✔
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### Quality of Service

#### a. Elapsed time response requirements for exchanging data:
- 1-4 milliseconds
- 4-10 milliseconds
- Less than 1 second
- 1-2 seconds
- 10 seconds
- More than 10 seconds
- No specific response requirements
- Other

#### b. Contractual timeliness for exchanging data is required:
- Within 1 second
- Within 1 minute
- Within 5 minute
- Within some longer time:
- No specific contractual timeliness is required
- Other

#### c. Availability of information flows:
- 99.9999% + availability ~ 1/2 second per year
- 99.999% + availability ~ 5 minutes per year
- 99.99% + availability ~ 1 hour per year
- 99.9% + availability ~ 9 hours per year
- 99% + availability ~ 3.5 days per year
- 90% + availability ~ 1 month per year
- Less than 90%
- Continuous availability not required so long as downtime is scheduled
- Continuous availability not required but must be available at specific times or under specific conditions
- No specific availability is required
- Other

#### d. Precision of data requirements (normally relevant only for conversions, e.g. analog to digital):
- 100% accurate
- > 5% variance
- > 1%
- > 5%
- Not relevant
- Other

#### e. Accuracy of data requirements:
- Requires quality flag indicating at least normal and not normal
- Age of data needs to be knowable
- Time skew of data must be known
- Adequate accuracy can be assumed
- Accuracy of data not an issue
- Other
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<td>Offer Parameters</td>
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</tbody>
</table>

### 1. Frequency of data exchanges:
- Essentially continuous
- Every few milliseconds
- Every few seconds
- Periodicity greater than a few seconds
- Upon event
- Upon request
- Random
- Sparse
- Other

### 2. Commonly used techniques for meeting quality of service requirements of this data exchange
- Failure detection
- Automatic restart
- Automatic failover to second source of data or function
- Automatic failover of communication channels to secondary channel
- Backup of data
- Transaction rollback
- QoS monitoring
- Alarming on QoS failure
- None
- Not needed or not relevant
- Other

### Security
#### a. Eavesdropping: Ensuring confidentiality, avoiding illegitimate use of data, and preventing unauthorized reading of data, is:
- Crucial
- Quite important
- Not particularly important
- Detection that a security violation was attempted is crucial
- Other

#### b. Information integrity violation: Ensuring that data is not changed or destroyed is:
- Crucial
- Quite important
- Not particularly important
- Detection that a security violation was attempted is crucial
- Other

#### c. Authentication: Masquerade and/or spoofing: Ensuring that data comes from the stated source or goes to authenticated receiver is:
- Crucial
- Quite important
- Not particularly important
- Detection that a security violation was attempted is crucial
- Other
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</tr>
</tbody>
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**d. Repudiation:** Ensuring that the source cannot deny sending the data or that the receiver cannot deny receiving the data is:
- Crucial
- Quite important
- Not particularly important
- Detection that a security violation was attempted is crucial
- Other

**e. Replay:** Ensuring that data cannot be resent by an unauthorized source is:
- Crucial
- Quite important
- Not particularly important
- Detection that a security violation was attempted is crucial
- Other

**f. Information theft:** Ensuring that data cannot be stolen or deleted by an unauthorized entity is:
- Crucial
- Quite important
- Not particularly important
- Detection that a security violation was attempted is crucial
- Other

**g. Denial of Service:** Ensuring unimpeded access to data is:
- Crucial
- Quite important
- Not particularly important
- Detection that a security violation was attempted is crucial
- Other

**h. This data exchange has the following requirements with respect to proof of conformance and/or non-repudiation with contractual agreements**
- Logging of all information exchanged during this interaction is required
- Logging of only key information is required
- Logging of the source, destination, requesting application, and requesting user of information exchanges is required, but not the data itself
- Logging is not required
- Other logging
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### Security measures commonly used with this data exchange

- Access control through passwords
- Access control through database security mechanisms
- Virtual Private Networks (VPNs)
- Private (secret) key encryption
- Public key encryption (e.g. SSL/TLS)
- Firewalls with Access Control Lists and/or proxy servers
- Dial-back modems
- Bilateral data access control tables
- Time stamping, logging, and data records
- Non-repudiation techniques
- Kerberos
- Network management such as SNMP or CMIP
- Physical isolation
- Backup
- Security policies with procedures to follow
- Trusted parties so no cyber security needed
- None, but needed
- None, and not needed
- Other

### Confidentiality

- High
- Medium
- Low

### Integrity

- High
- Medium
- Low

### Availability

- High
- Medium
- Low

### Data Management

#### a. Type of source data

- Source data was directly measured
- Source data was previously automatically stored in a database
- Source data was previously manually entered in a database
- Source data was calculated or output by an application
- Other

---

#### Legend

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#### 1.0.1a 1.0.1b 1.0.1c 1.0.2 - 11.0.16 2.1.1 2.1.2 2.1.3 2.2.1 2.2.2 3.1.1 3.1.2 3.1.3 3.2.1 3.2.2 4.1 & 4.2 4.x.1 4.x.2 4.x.3 4.x.4

| Service Location / Asset Group / Resource | Enroll Location Request | Enrollment Parameters | Award Schedule | Availability Parameters | Advanced Notification | Regulation Signal | Dispatch Instruction | Real-Time Response | Deployment Instructions | Event Response | Meter Data | Meter Data Rejection | Performance and Meter Data | 4.x.1 | 4.x.2 | 4.x.3 | 4.x.4 | 4.x.4 |
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#### b. Correctness of source data
- **Source data is always correct** (e.g. by definition)
- Source data is usually correct
- Source data is often not correct (incorrectly entered, out of date, not available)
- Source data is rarely correct
- Correctness of source data is not relevant
- Other

#### c. Up-to-date data management
- Received data must be up-to-date within seconds of source data changing
- Received data must be up-to-date within minutes of source data changing
- Received data must be up-to-date within hours of source data changing
- Received data does not need to be up-to-date if source data changes
- Other

#### d. Management of large volumes of data that are being exchanged
- Major part of step involves handling large volumes of data
- Some part of step involves handling large volumes of data
- No part of step involves handling large volumes of data
- Other

#### e. Data consistency and synchronization management across systems
- Second-by-second synchronization: Data being exchanged must be kept consistent and synchronized with other systems within seconds
- Minute-by-minute synchronization: Data being exchanged must be kept consistent and synchronized with other systems within minutes
- Day-by-day synchronization: Data being exchanged must be kept consistent and synchronized with other systems within hours or days
- No synchronization: Data being exchanged does not need to be kept consistent or synchronized with other systems
- Other

#### f. Management of timely access to data by multiple different users
- Contractual/required time windows for multiple access are less than one second
- Contractual/required time windows for multiple access are within seconds
- Contractual/required time windows for multiple access are within tens of seconds
- Contractual/required time windows for multiple access are within minutes
- Other
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- Timely access by multiple users is not relevant
- Other

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### g. Validation of data exchanges
- All data must be validated on each data exchange
- Data must include quality codes to indicate its validity
- Data from different sources must be validated against each other
- Data mapping of data item names is required for data from different sources
- Data can be assumed as valid (or validity checking is handled elsewhere)
- Data is usually not validated
- Data cannot be validated
- Validity of data is not relevant
- Other

### h. Management of accessing different types of data to be exchanged
- Each data exchange could entail different types of data (e.g. query a database)
- Numbers or types of data being exchanged are changed or updated every few minutes
- Numbers or types of data being exchanged are changed or updated every few hours
- Numbers or types of data being exchanged are rarely changed or updated
- Not relevant
- Other

### i. Management of data across organizational boundaries
- Data exchanges go across corporate boundaries
- Data exchanges go across departmental boundaries
- Data exchanges go across boundaries between systems developed by different vendors
- Data exchanges are within one vendor’s system
- Not relevant
- Other

### j. Transaction integrity required (backup and rollback capability)
- Data exchanges require the ability to rollback to previous data states
- Data exchanges require full backup for immediate “failover” to a second source of data
- Data exchanges require backup of crucial data for “cold” failover
- Data exchanges do not require rollback or backup
- Other
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### k. Data format requirements:
- Standard computer formats (e.g. binary, integers and floating pt, files)
- Standard serial transfer formats (e.g. DNP, Modbus, LonTalk, BACnet)
- Graphics formats
- EDI
- HTML-based
- XML-based
- Standardized data objects
- Exchange of unstructured or special-format data (e.g. text, documents, oscillographic data) must be supported
- Any formats are acceptable
- Other

### l. Management of data formats in data exchanges
- The same data exchanged between different applications have different formats that need to be “converted”
- The same data exchanged between different applications have the same formats
- Conversion of data formats is automatically handled by each application
- Other

### m. Naming of data items
- Names of data items are different in different applications and must be “mapped” to each other
- Meanings of data items are different in different applications and must be “converted”
- Other

### n. Management across different implementations
- Types of data being exchanged can vary significantly in different implementations
- Types of data being exchanged vary very little in different implementations
- Not relevant
- Other

### o. Data exchange maintenance in which a human changes or updates what is to be exchanged
- Data exchanges require maintenance every few hours
- Data exchanges require maintenance every few days
- Data exchanges require maintenance every few weeks or months
- Data exchanges rarely require maintenance
- Not relevant
- Other
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### Database maintenance in which a human changes or updates what is in the database
- Database requires maintenance every few hours
- Database requires maintenance every few days
- Database requires maintenance every weeks or months
- Database rarely requires maintenance
- Database rarely requires maintenance
- Not relevant
- Other

### Data maintenance effort: human versus automation
- Data maintenance involves significant human time and manual data entries
- Data maintenance is partially automated but involves some human time and manual data entries
- Data maintenance is mostly automated but requires occasional intervention
- Data maintenance is (or can be if so authorized) completely automated (e.g. Live Update of virus definitions or Microsoft updates)
- Not relevant
- Other

### Commonly used data formats and management techniques for this data
- Standard computer formats (e.g. integers and floating pt, files)
- Standard serial transfer formats (e.g. analog points, status points, control points, such as used in DNP, Modbus, LonTalk)
- Graphics formats
- EDI formats
- HTML-based formats
- XML-based formats
- Comma separated variables (CSV) in a file
- Proprietary data format
- Data updates are done manually by a database administrator or maintenance personnel
- Data is validated automatically
- Data objects have well-known names (e.g. CIM and IEC61850)
- Transaction and data exchanges "discovery" is handled automatically (e.g. ebXML)
- Mechanisms are in place to ensure consistency of data
- Transaction rollback capabilities are used
- Not relevant
- Other

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**Columns**
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- Deployment & Event Response & Deployment Instructions & Meter Data & Meter Data Rejection & Meter Data Rejection & Calculated and Meter Data