GE Energy
Digital Energy

Acquiring Operational and Non-Operational Data
from Substation IEDs
Smart Grid Tutorial

John McDonald, P.E.
Director, Technical Strategy & Policy Development

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"Operational" Data

- Data that represents the **real-time status, performance, and loading** of power system equipment
- This is the **fundamental information used by system operators** to monitor and control the power system
- Examples:
  - Circuit breaker open/closed status
  - Line current (amperes)
  - Bus voltages
  - Transformer loading (real and reactive power)
  - Substation alarms (high temperature, low pressure, intrusion)
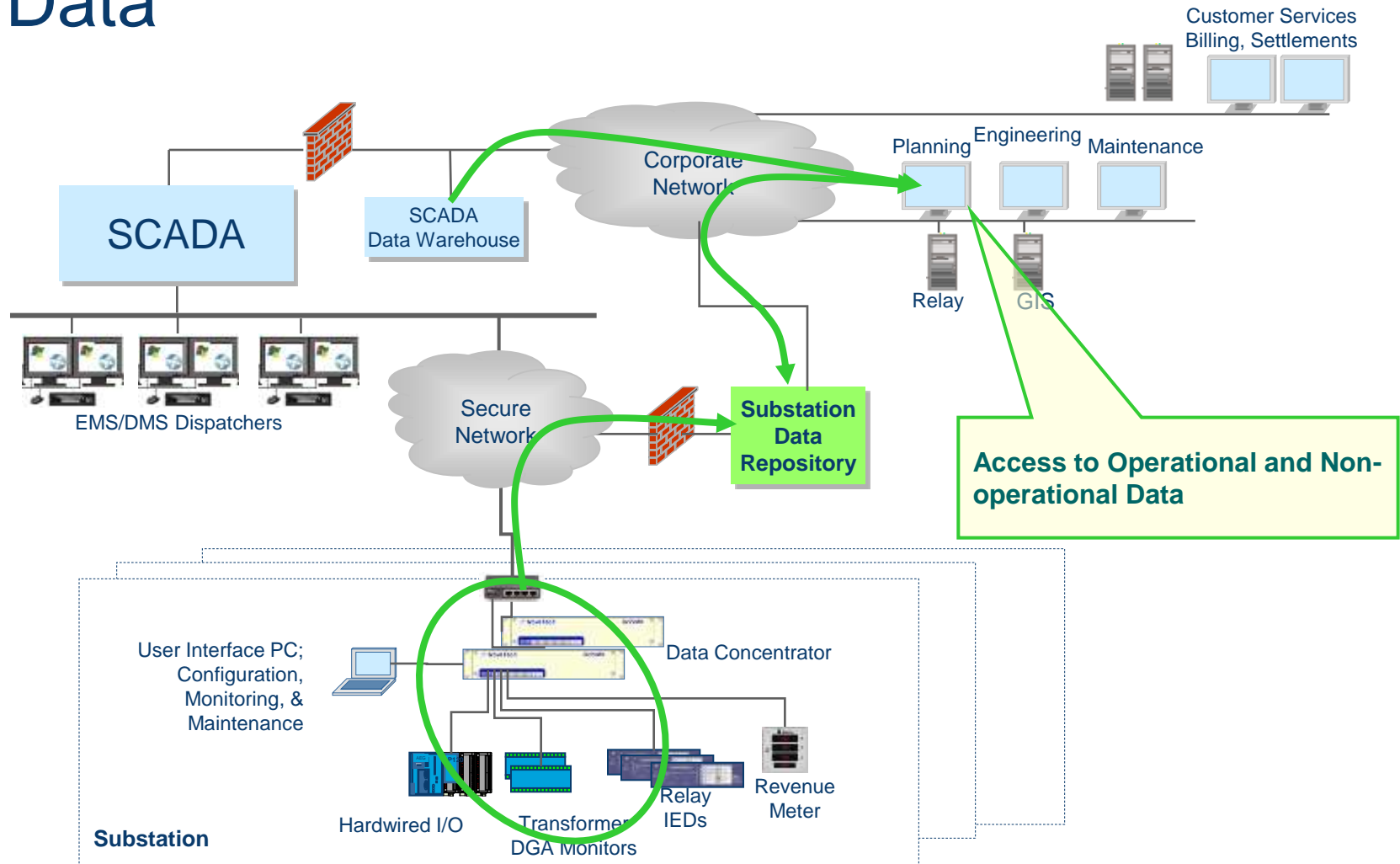
"Non-Operational" Data

- Data items for which the **primary user is someone other than the system operators** (engineering, maintenance, etc.)
- Note that operators are usually interested in some data that is classified as non-operational
- Examples of "Non-Operational" data:
  - Digital fault recorder records (waveforms) (protection engineer)
  - Circuit breaker contact wear indicator (maintenance)
  - Dissolved gas/moisture content in oil (maintenance)

Characteristics of Operational and Non-Operational Data

Characteristic	Operational Data	Non-Operational Data
Data Format	Usually limited to **individual time sequenced data items**	**Usually a data file** that consists of a collection of related data elements
Real Time vs Historical	Usually consists of **real-time or near real-time** quantities	Mostly **historical** data: trends over time
Data Integration	Easily transportable by conventional SCADA RTUs using **standard (non-proprietary) protocols**	Typically use **vendor specific (proprietary) formats** that are not easily transported by SCADA communication protocols

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Flow of Operational and Non-Operational Data

Customer Services
Billing, Settlements

Corporate Network

Planning   Engineering   Maintenance

SCADA

SCADA Data Warehouse

Relay   GIS

EMS/DMS Dispatchers

Secure Network

Substation Data Repository

Access to Operational and Non-operational Data

User Interface PC; Configuration, Monitoring, & Maintenance

Data Concentrator

Hardwired I/O

Transformer DGA Monitors

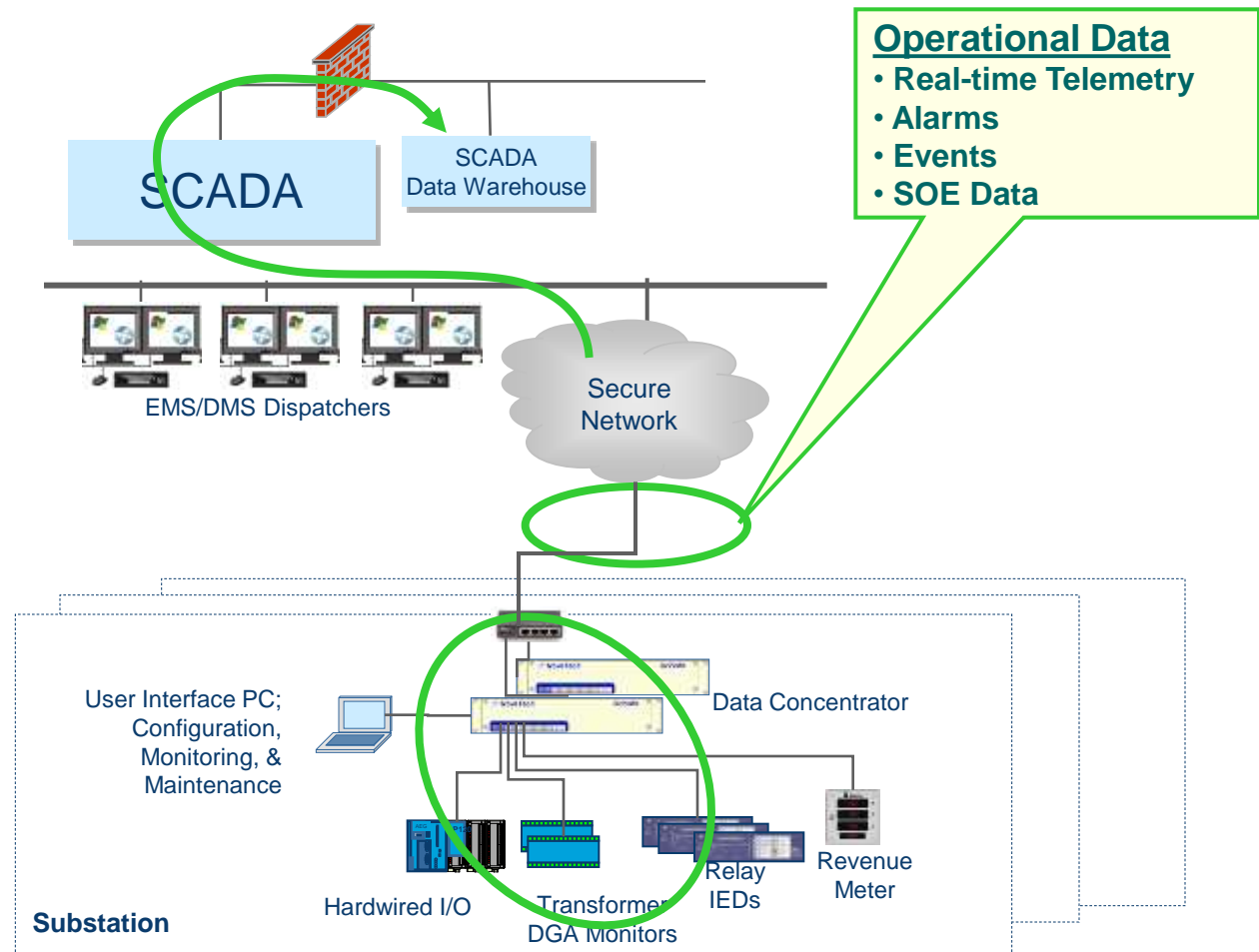Relay IEDs

Revenue Meter

Substation

Why Have Multiple Data Paths?

- Prevent "nuisance" alarms (alerts)
- Avoid burdening SCADA facilities
- Lack of SCADA support for file transfer and proprietary protocols
- Some useful IED non-operational data items use formats that may not be supported by legacy SCADA protocols
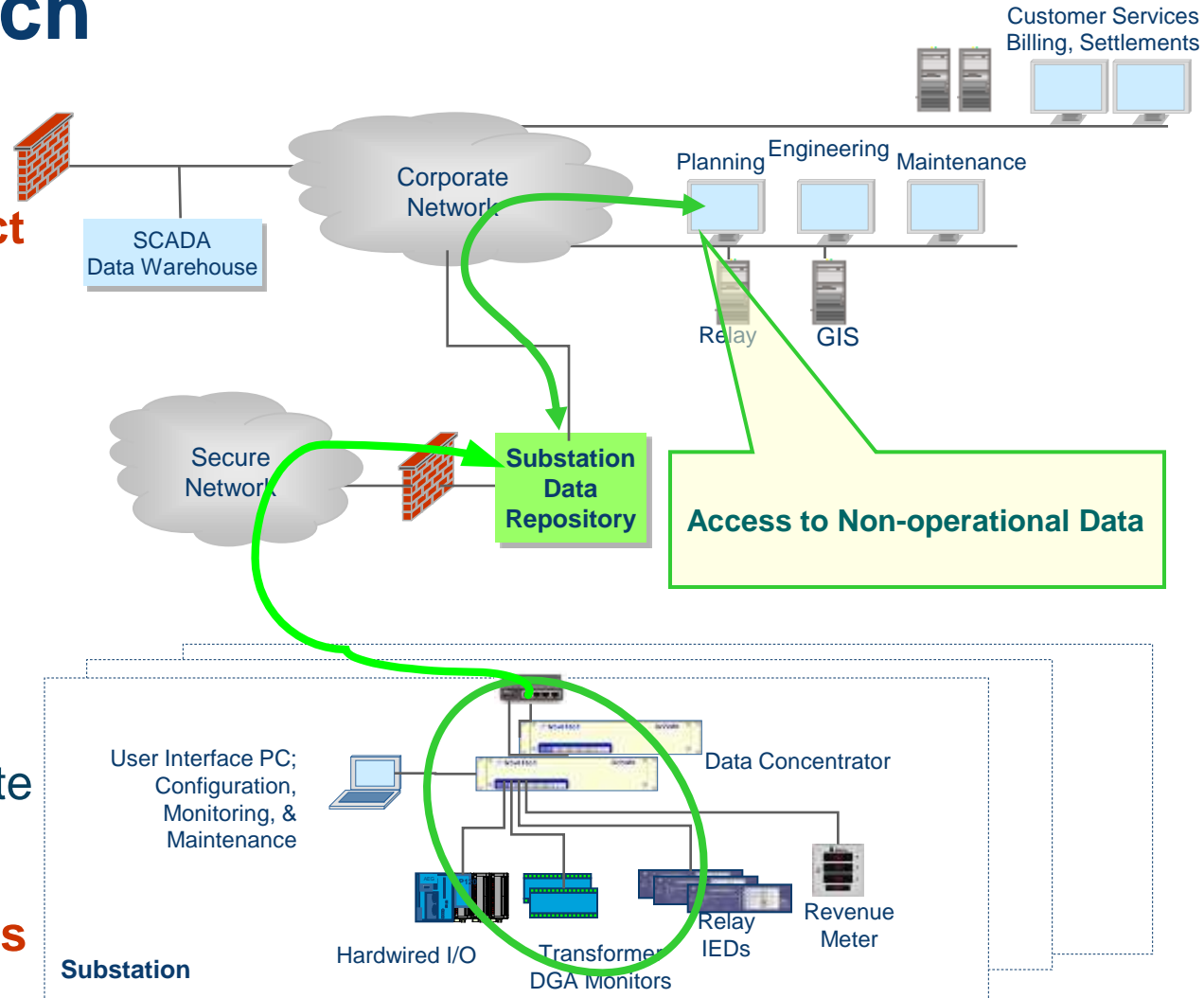- Sheer volume of data (especially non-operational data)!

Acquisition of Operational Data Items

- **SCADA protocol like DNP3 can be used to access most "simple" IED data items**
- **Data passed to SCADA supplier's data warehouse (historian)**

Operational Data
- **Real-time Telemetry**
- **Alarms**
- **Events**
- **SOE Data**

SCADA

SCADA Data Warehouse

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Acquisition of Non-Operational Data Files – **Basic Approach**

1. Use manufacture specific software (or equivalent) to **extract data from the IED** (acSELerator, TapTalk, etc
2. **Capture the data** acquired by this software in a non-proprietary format
3. **Transmit (push or pull) the resultant data file** to a shared drive on the corporate network
4. **Enable authorized personnel to access the data** using standard analytical tools

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Approaches for Obtaining Non-Operational Data

- **Approach 1:** Download directly from the IED

- **Approach 2:** Use "Pass through" capabilities of substation data concentrator

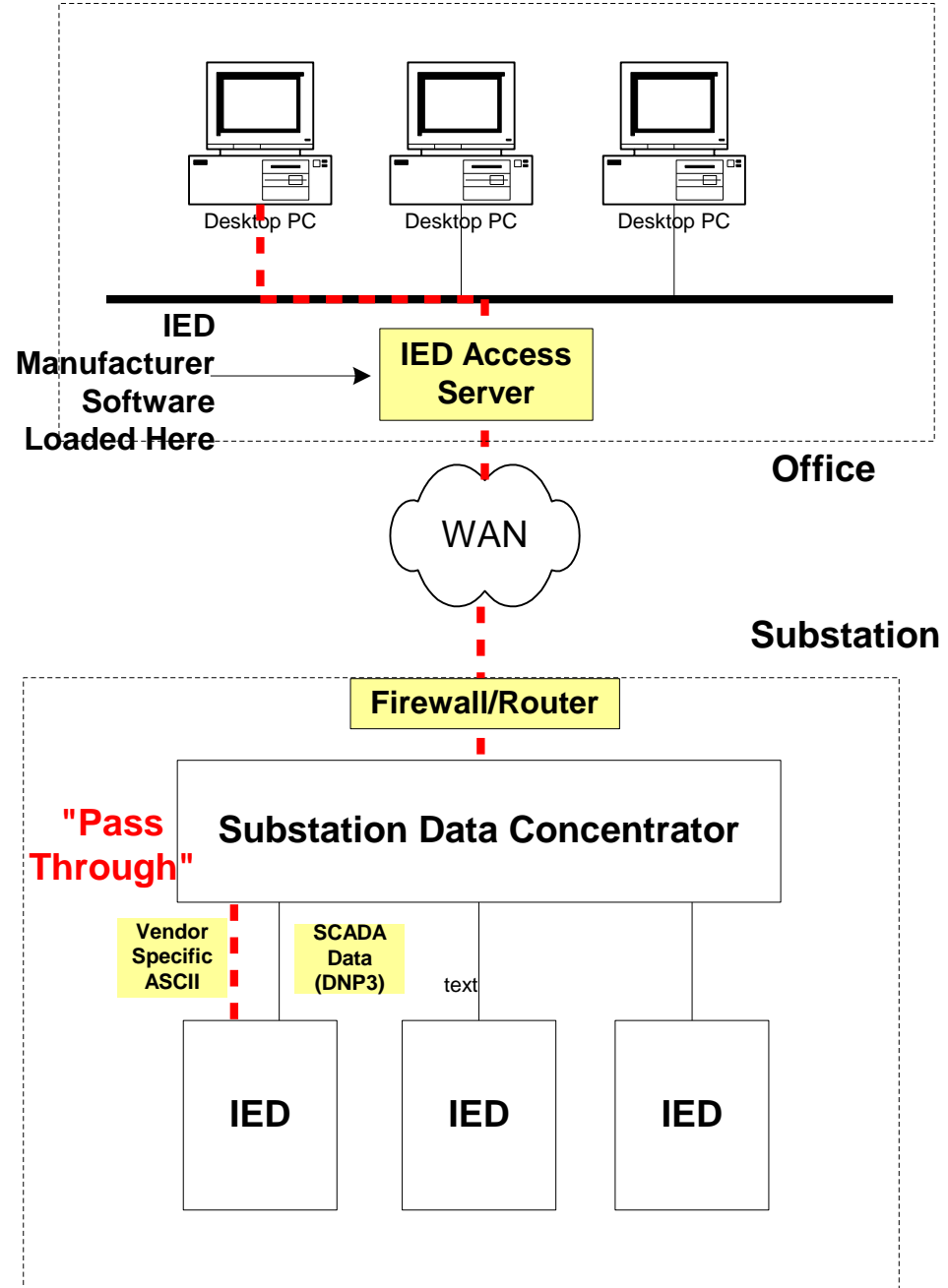- **Approach 3**: Local data concentrator as non-operational data server

Approach 1 - Direct Download Approach

- Travel to the substation

- Plug laptop containing manufacturer specific data into PC

- Download data directly from the IED onto the laptop

- Transfer the data to the corporate network via docking station or other data off load mechanism

- Pro's And Con's

  + Low tech- low cost approach

  - Not continuous monitoring – delays in retrieving data

Local communications on site using a portable or a local computer
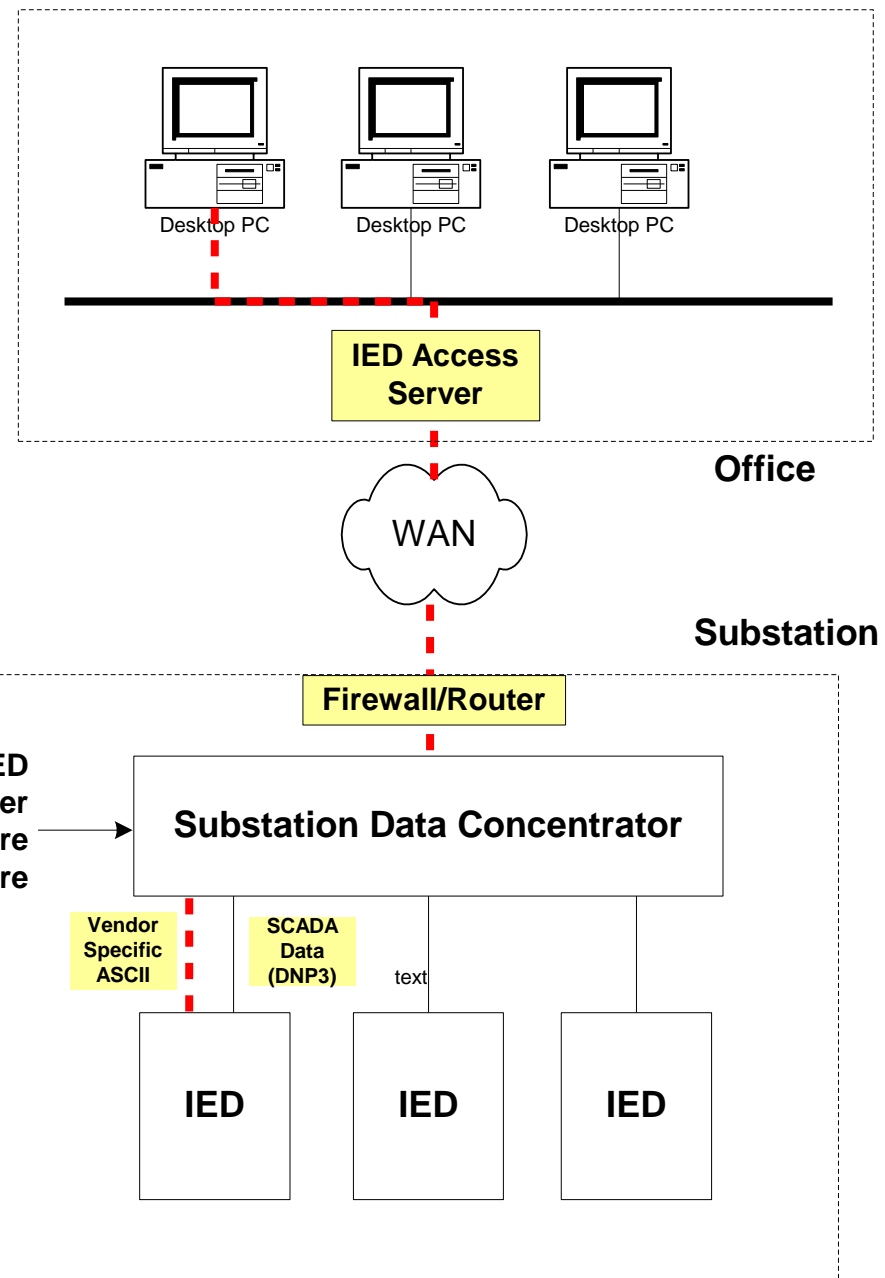
Approach 2 - "Pass Through"

- Copy of IED manufacturer specific software stored on IED access server
- End user connects to access server using multi-level authentication
- Access server establishes a "pass through" connection to IED in question via the substation data concentrator
- End user interacts with the IED and downloads the required data as though desktop PC was directly connected to the PC in the substation
- Downloaded data is then copied to a shared drive as necessary
- Pro's/Con's:
  - + Technically simpler than network approach
  - – Promotes data silos
  - – Requires special IED software on each desktop PC

- **Today, most systems use this approach!**

Desktop PC   Desktop PC   Desktop PC

IED Manufacturer Software Loaded Here

IED Access Server

Office

WAN

Substation

Firewall/Router

Substation Data Concentrator

"Pass Through"

Vendor Specific ASCII

SCADA Data (DNP3)

text

IED   IED   IED

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Approach 3 - Data Concentrator as Non-Operational Data Gateway

- IED manufacturer software (acSELerator, Tap talk, etc) or equivalent loaded onto substation data concentrator

- Data concentrator communicates directly with the IEDs to acquire non-operational data files

- Data concentrator converts data files to standard format

- Converted data file "pushed" or "pulled" into ELSI

Desktop PC **Desktop PC** **Desktop PC**

IED Access Server

Office

WAN

Substation

Firewall/Router

IED Manufacturer Software Loaded Here →

Substation Data Concentrator

Vendor Specific ASCII **SCADA Data (DNP3)** text

IED **IED** **IED**

Approach 3 - Data Concentrator as Non-Operational Data Gateway

- Advantage of this approach:
  - Fewer field devices to manage from central location – 1 SDC versus multiple IEDs
  - Data files transferred over WAN using FTP, OPC or other standard method versus IED specific protocol
- Disadvantage
  - SDC must support the IED proprietary ASCII protocols
    - Not many do at this time

Desktop PC   Desktop PC   Desktop PC

IED Access Server

Office

WAN

Substation

Firewall/Router

IED Manufacturer Software Loaded Here →

Substation Data Concentrator

Vendor Specific ASCII   **SCADA Data (DNP3)**   text

IED   **IED**   **IED**

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