EPMS-HD

Power Management in High Definition

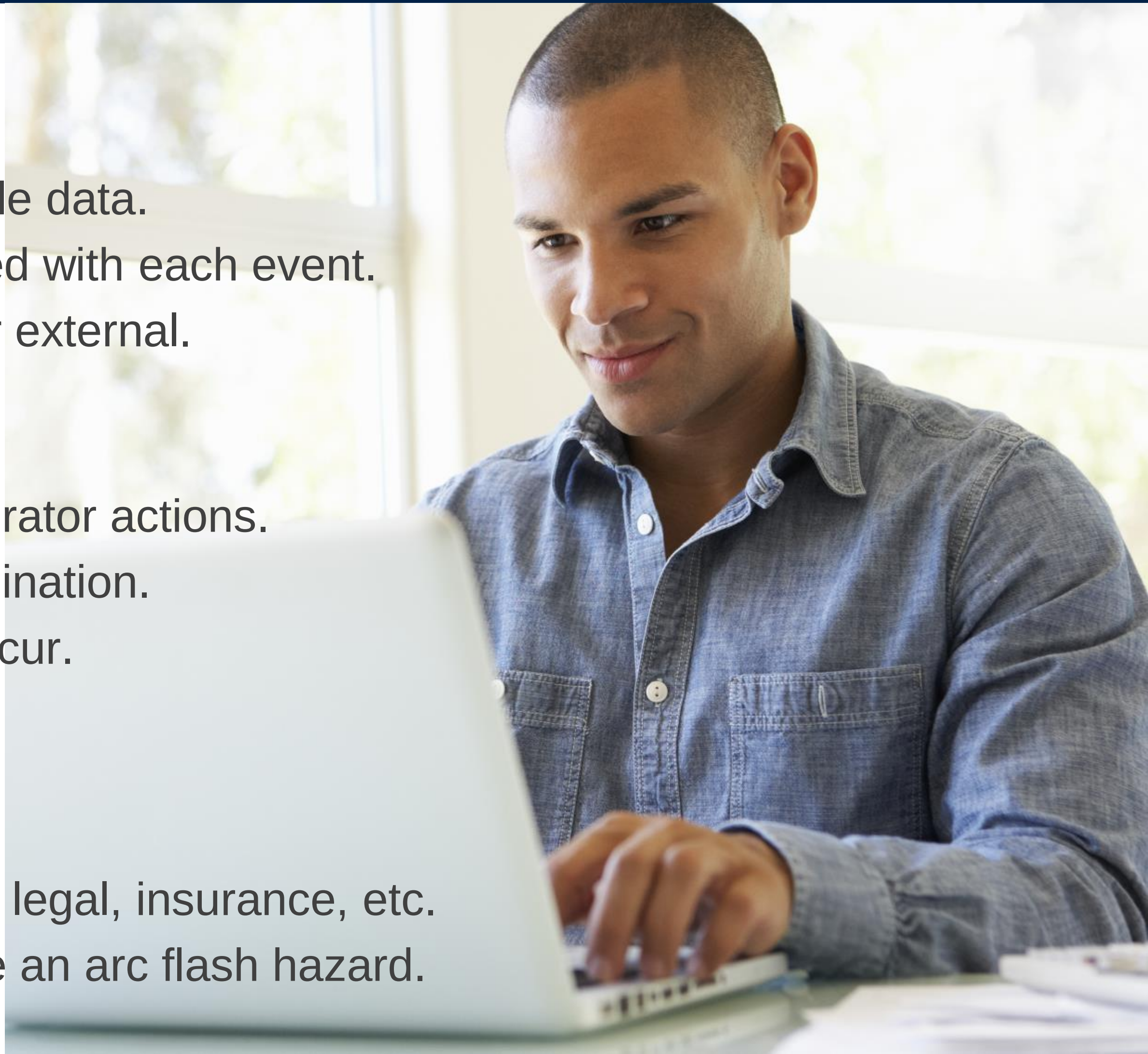
I ♥ 1588

System Presentation

CYBER SCIENCES™

Precision Timing for Reliable Power. *Simplified.* SM

Know what happened and when—*to 1 msec!*



1 ***Understand***—Forensics tool

- Perform root-cause analysis based on reliable data.
- View current and voltage waveforms captured with each event.
- Determine if the initial source was internal or external.

2 ***Respond***—Act quickly

- Evaluate control sequences, timing, and operator actions.
- Confirm protective device time-current coordination.
- Restore service quickly if an outage does occur.

3 ***Prevent***—Take corrective actions

- Resolve or mitigate persistent problems.
- Provide documentation for the electric utility, legal, insurance, etc.
- Identify slow breakers before they can cause an arc flash hazard.

EPMS-HD is needed where reliable power is important:

- Data centers

- Hospitals

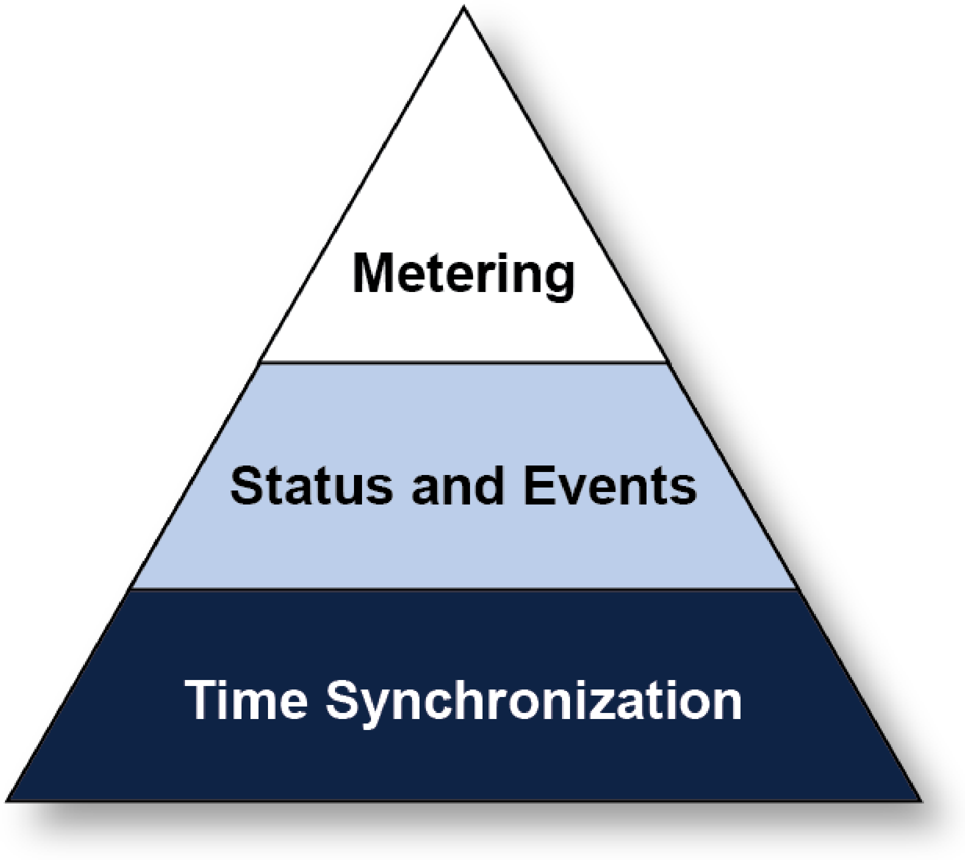
- Industrial facilities

- Universities

- Airports

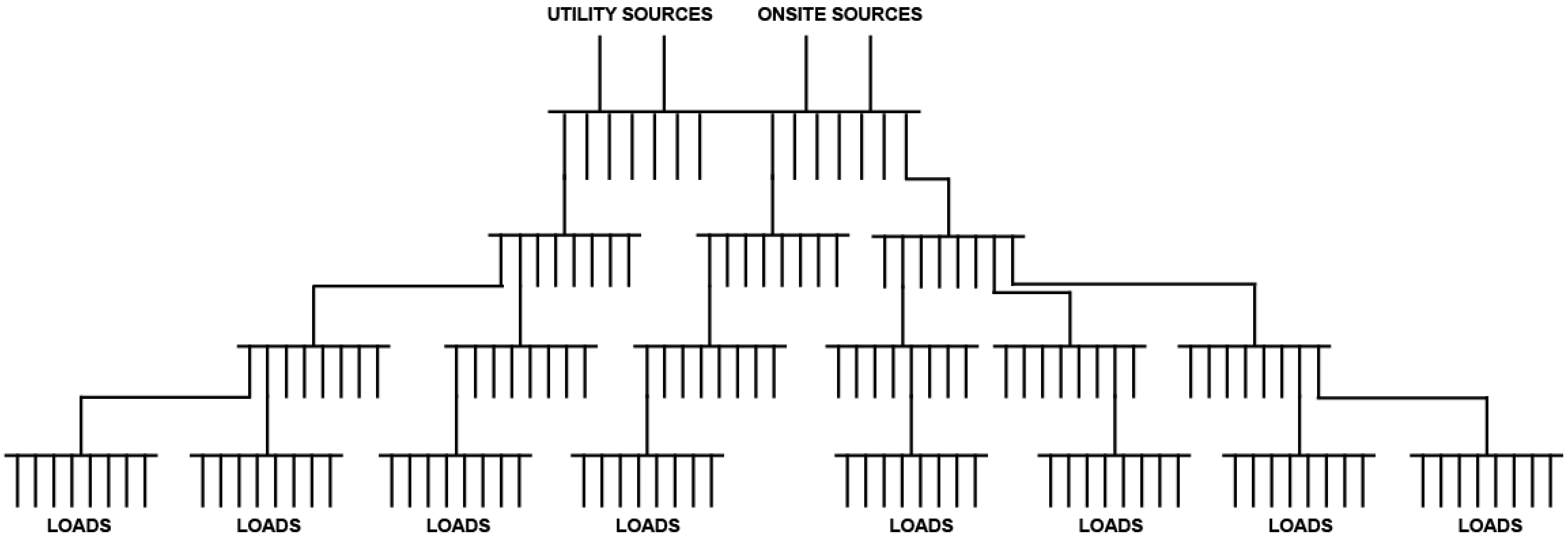
- Microgrids & alternative energy

High Definition Power Management

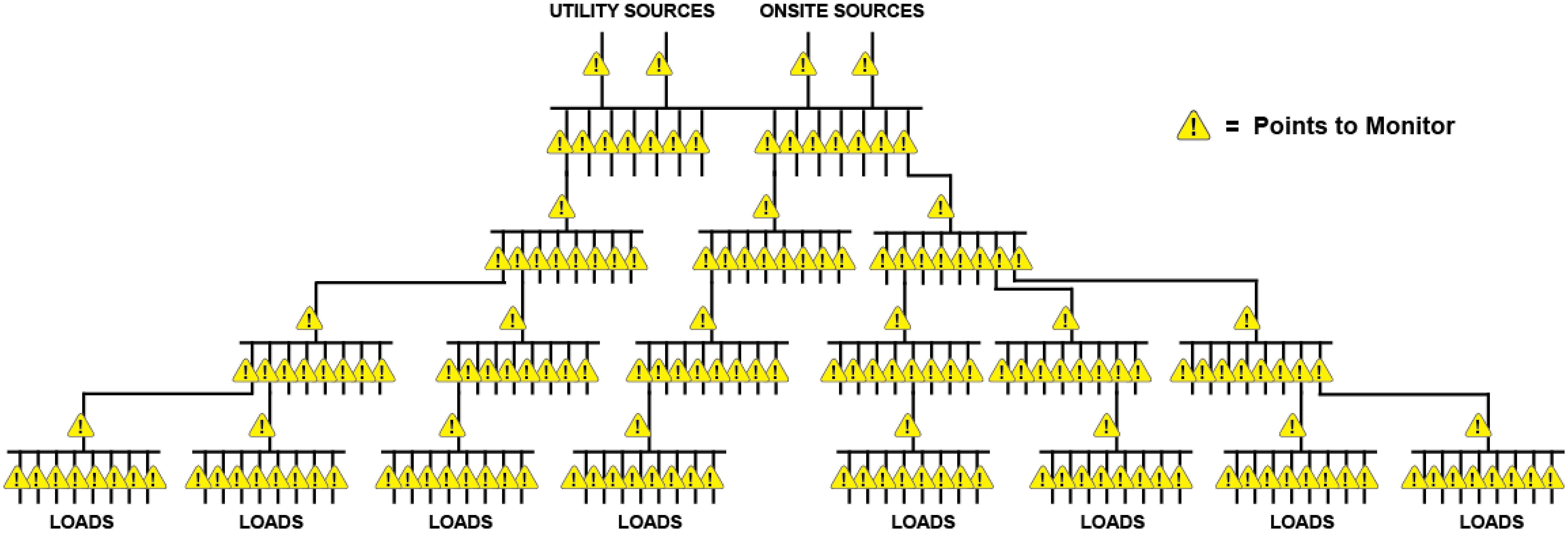


- Energy metering: just the start!
- Monitor everything: more data = better decisions
- Time sync: the foundation for meaningful analysis

Modern power systems = 1000s of points to be monitored

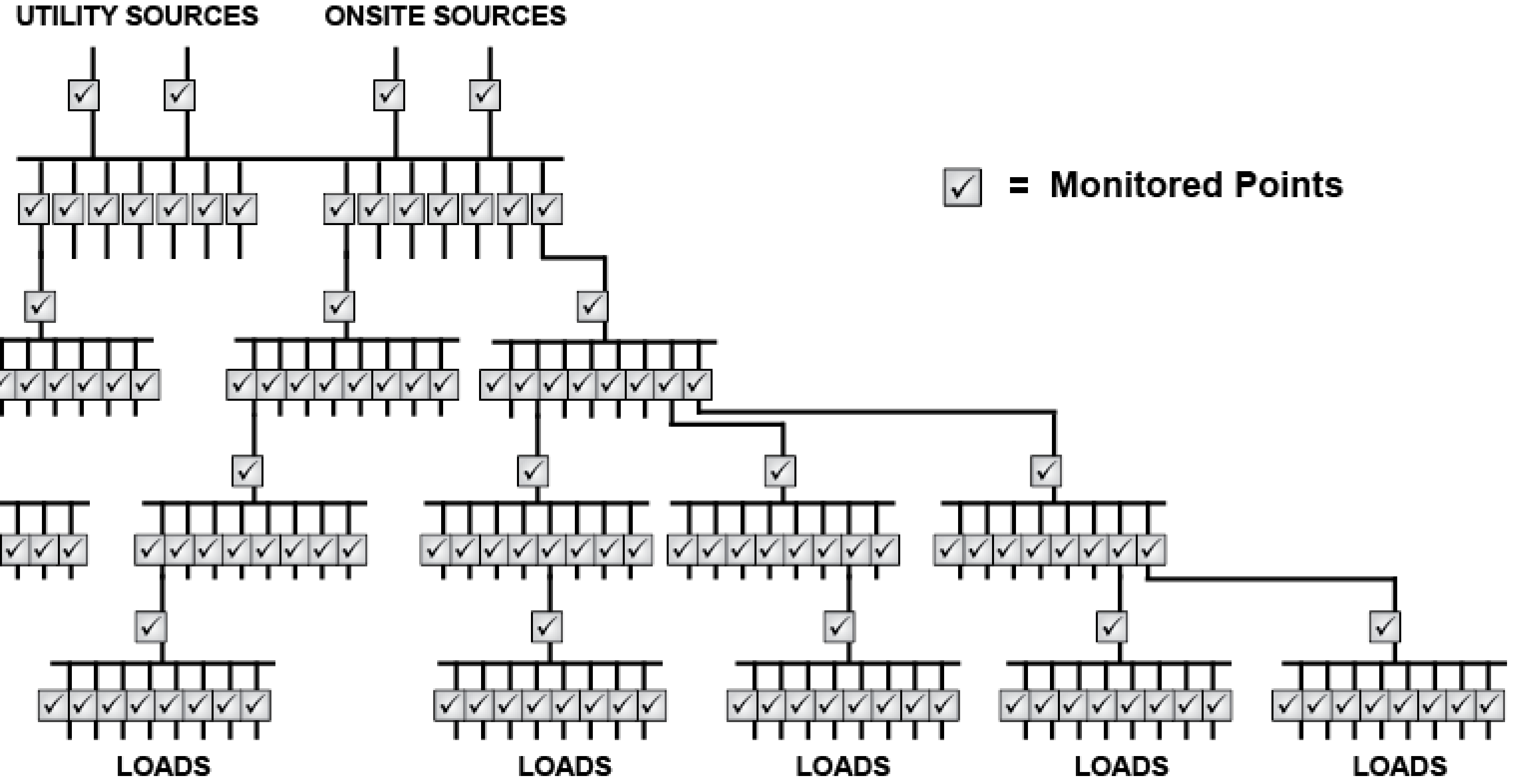


Thousands of potential blind spots!



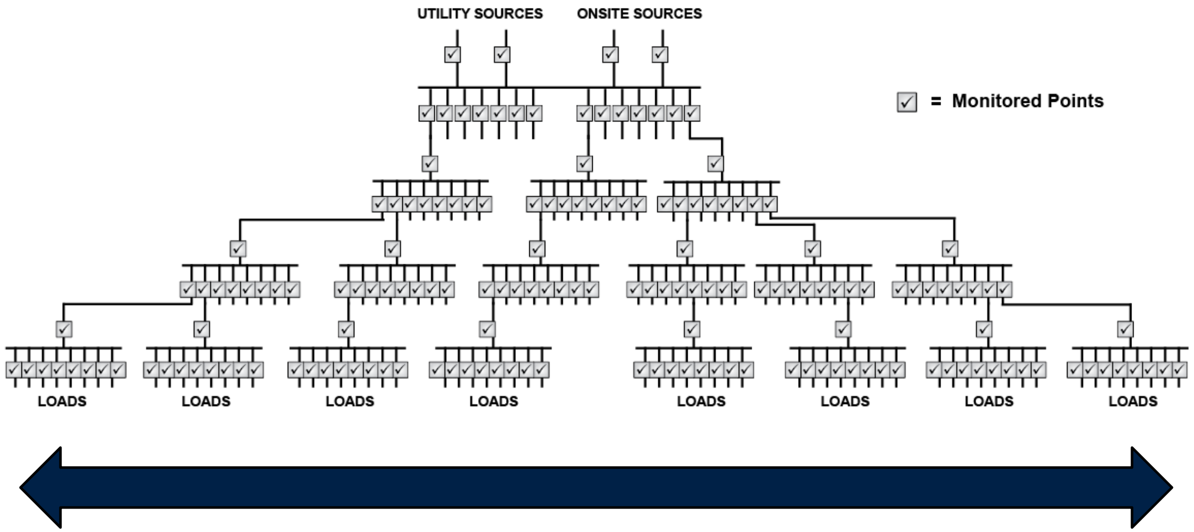
High Definition Power Management: Monitor Everything

CyTime SER-3200: 32-input
Sequence of Events Recorder

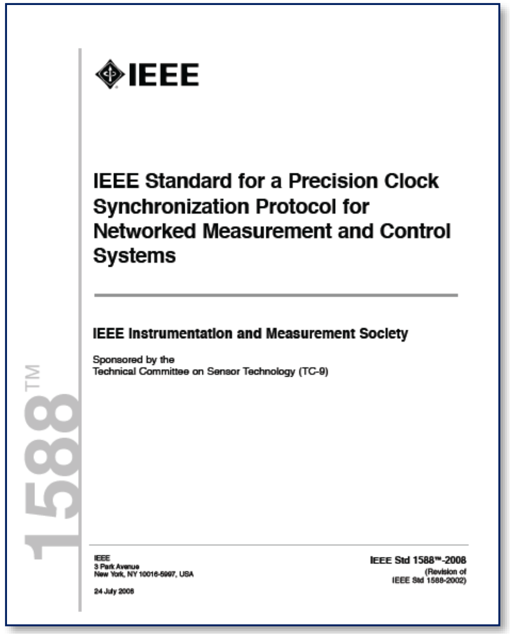


For data to be meaningful, devices must share a common (precise) time reference.

- Meter data
- Alarms
- Events
- Waveforms
- Data logs



Precision Time Protocol (PTP) per IEEE 1588


IEEE

IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems

IEEE Instrumentation and Measurement Society

Sponsored by the
Technical Committee on Sensor Technology (TC-9)

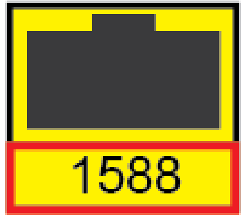
1588™

IEEE
3 Park Avenue
New York, NY 10016-5997, USA

24 July 2008

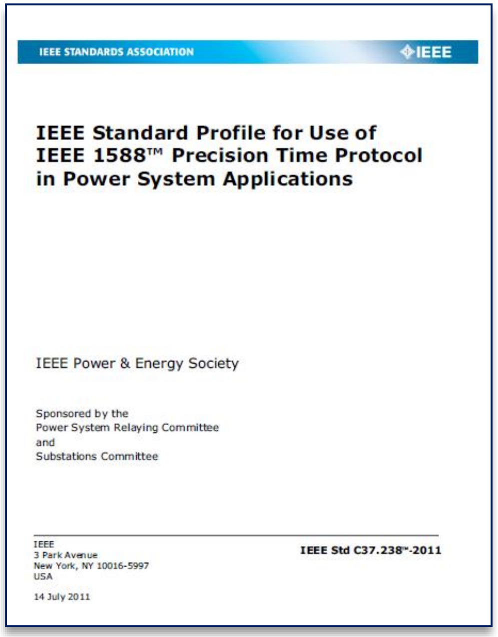
IEEE Std 1588™-2008
(Revision of
IEEE Std 1588-2002)

- IEEE Std 1588-2008 (v2)
  - Special Ethernet hardware does time-stamping
  - Mechanism to correct for network latency
  - Multicast messaging
  - High accuracy over Ethernet possible



- Many optional features
  - Several clock types (grandmaster, slave-only, transparent, etc.)
  - Domain number, 0 to 127 (default = 0)
  - Delay mechanisms: End-to-end (E2E) or Peer-to-peer (P2P)
  - UDP vs. Layer 2, 2-step vs. 1-step, etc.
- Flexible—but interoperability requires a “profile”

Power Profile (per C37.238) defines PTP characteristics in "Power System Applications"



IEEE STANDARDS ASSOCIATION IEEE

IEEE Standard Profile for Use of IEEE 1588™ Precision Time Protocol in Power System Applications

IEEE Power & Energy Society

Sponsored by the
Power System Relaying Committee
and
Substations Committee

IEEE
3 Park Avenue
New York, NY 10016-5997
USA

14 July 2011

IEEE Std C37.238™-2011

IEEE-C37.238 (2011)

- Power Profile: Standard set of PTP characteristics defined by IEEE Std C37.238-2011
- Primarily for utility substation automation
- Profile characteristics:
  - Target accuracy: 1 µs (up to 16 switches)
  - 802.3 Ethernet (Layer 2) mapping
  - Multicast only
  - Peer to peer (P2P) delay measurement
  - Switches must be transparent clocks (PTP-aware)

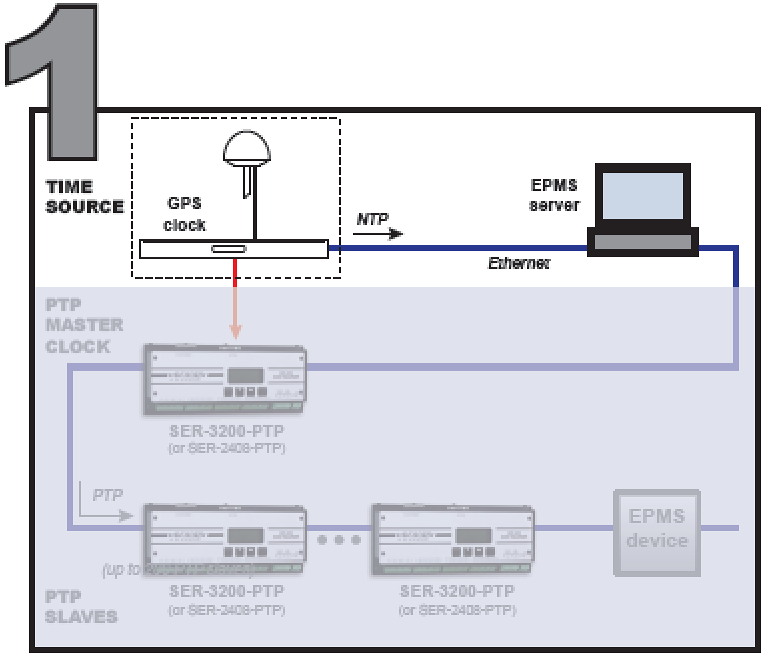
"Simple PTP“ (SPTP) is based on the PTP default profile

(<100 µs: Goldilocks solution—just right.)

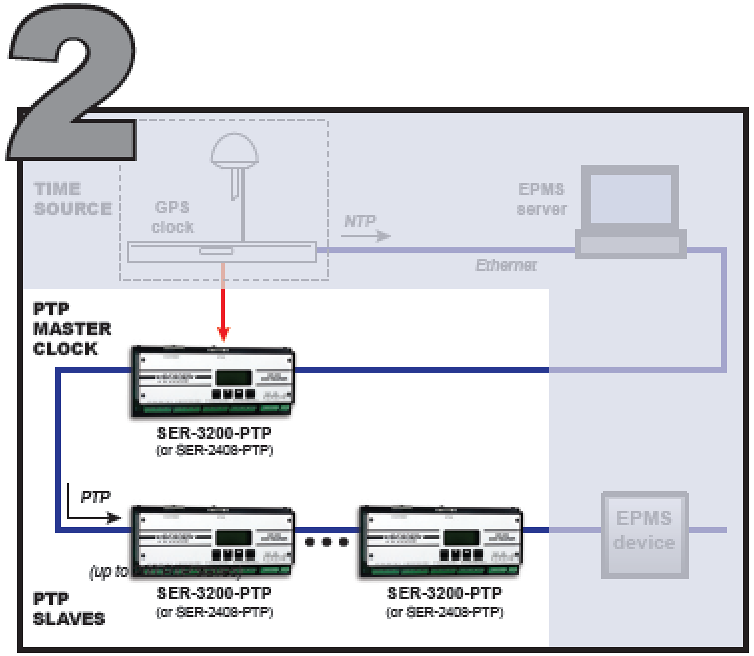
PTP (IEEE 1588)	“Simple PTP” Profile	Power Profile (C37.238)
Accuracy: nanoseconds	Accuracy: < 100 µs	Accuracy: < 1 µs
All clock types	Master and Slave-only	Most clock types
Multicast or Unicast	Multicast	Multicast
802.3 or UDP/IPv4, v6	UDP/IPv4	802.3 only (layer 2)
PTP-aware switches	No special switches req’d.	PTP switches required
P2P or E2E delay mech.	E2E only	P2P only
1-step or 2-step	2-step	1-step or 2-step
Variable delay requests	32s	1s
Timescale: TAI, UTC or arbitrary	Timescale: UTC (or TAI)	Timescale: TAI only
TLV, MIB, VLAN tags	None	TLV, MIB, VLAN tags req’d.
General	**Simple**	**Strict**

CSI “Simple PTP” Profile is based on IEEE 1588 default profile (E2E).

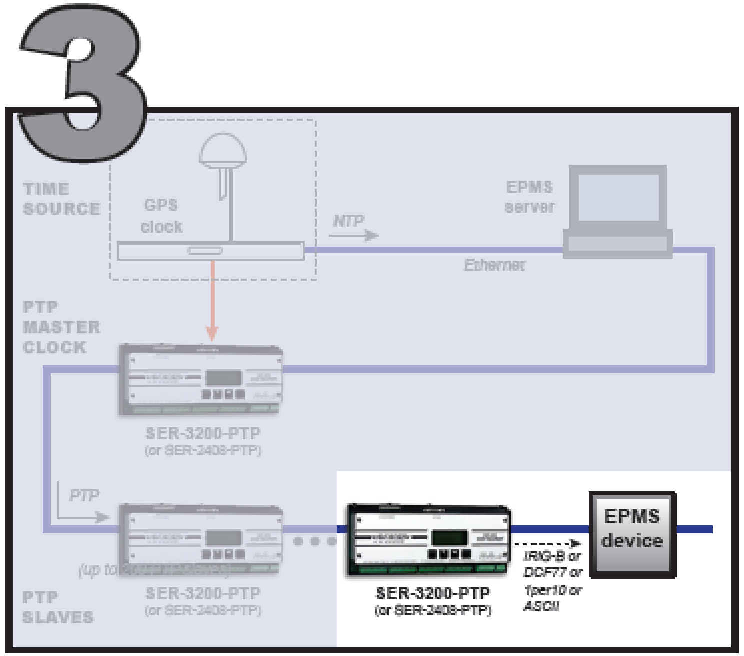
Time sync—easy as 1-2-3



Choose time source

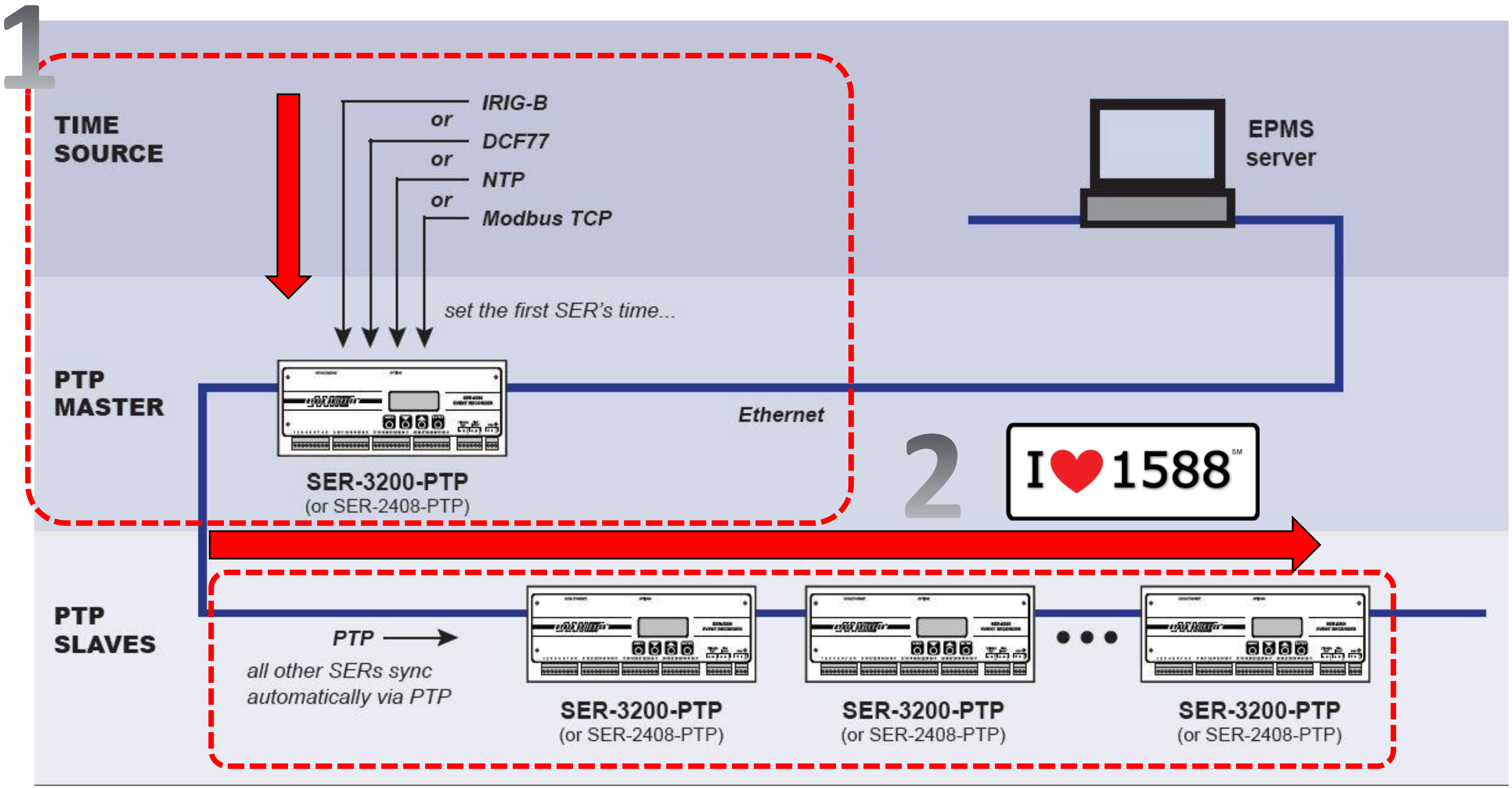


Time sync via PTP

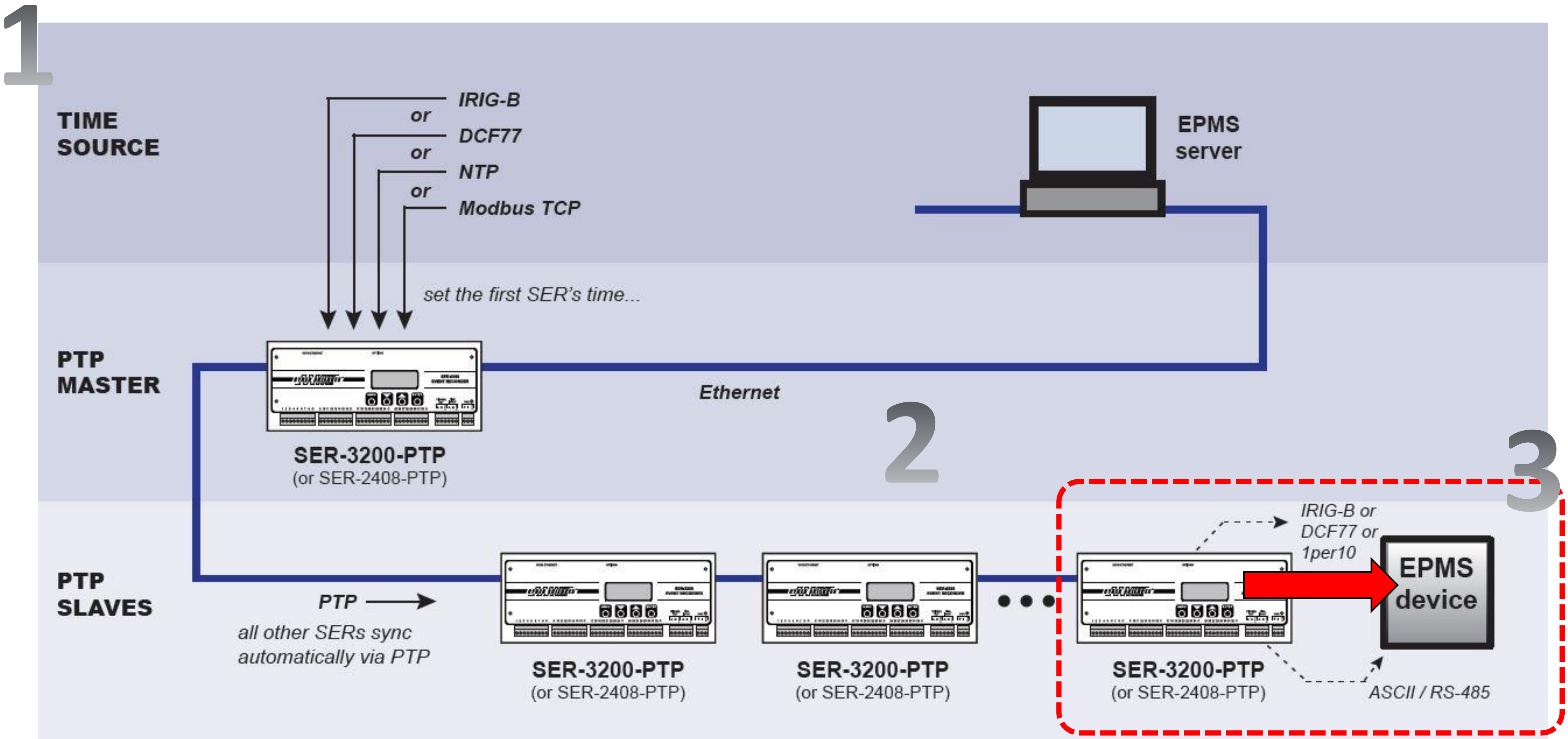


Sync non-PTP devices

PTP (IEEE 1588): Precision time sync over Ethernet



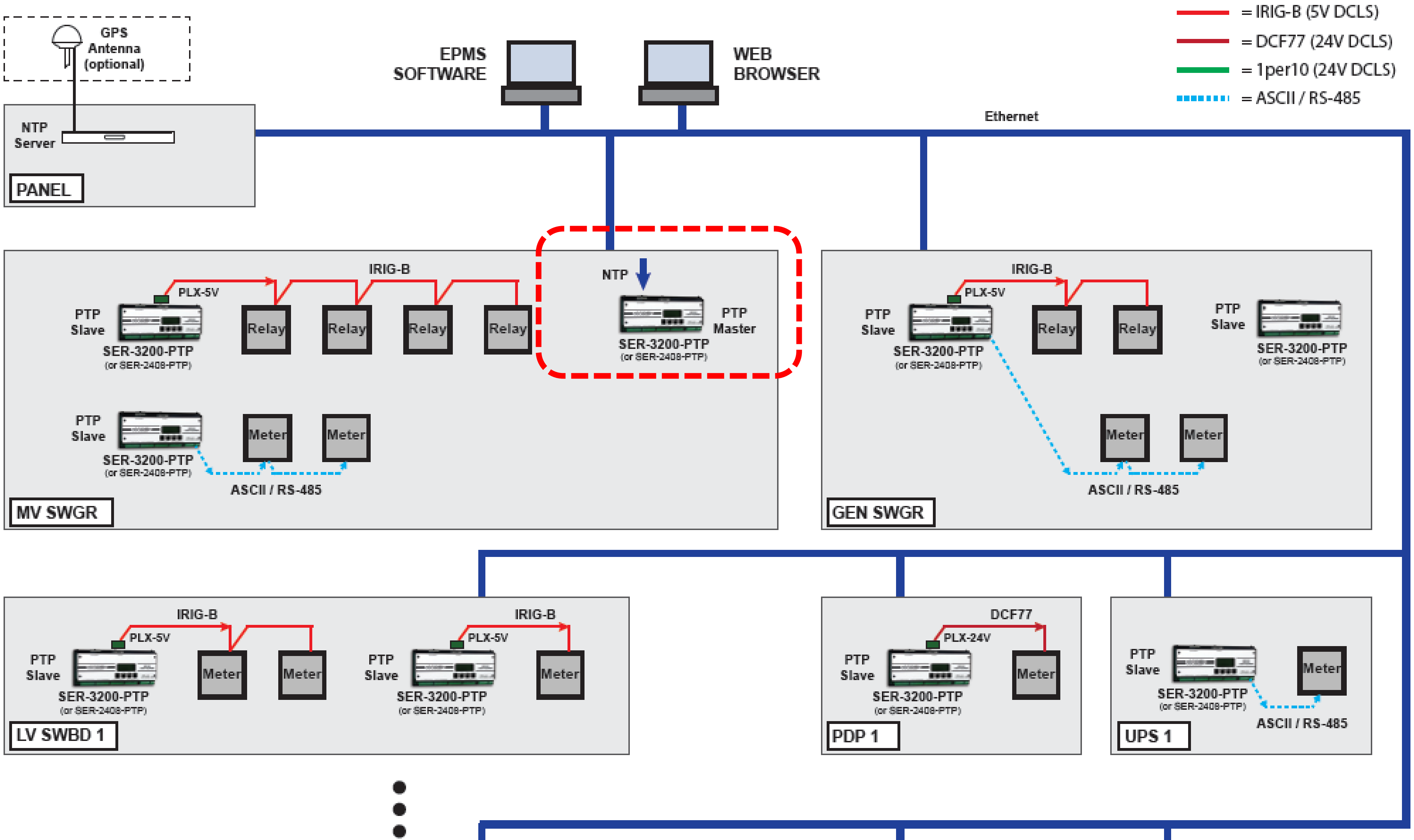
PTP-enabling other EPMS devices (via legacy protocols)



EPMS time-sync system examples

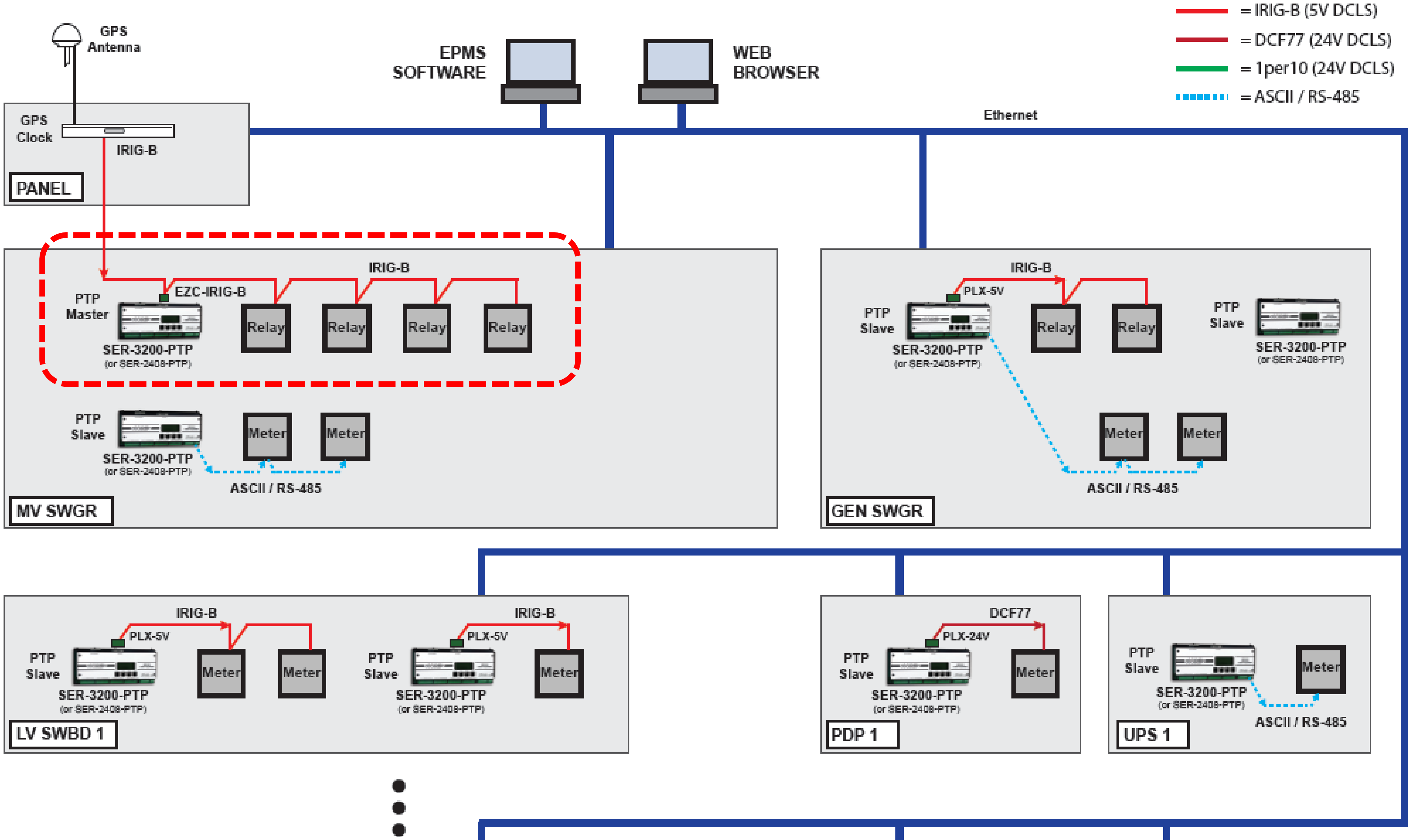
Example: sync first SER from NTP server (GPS optional)

—*first SER is located in MV switchgear*



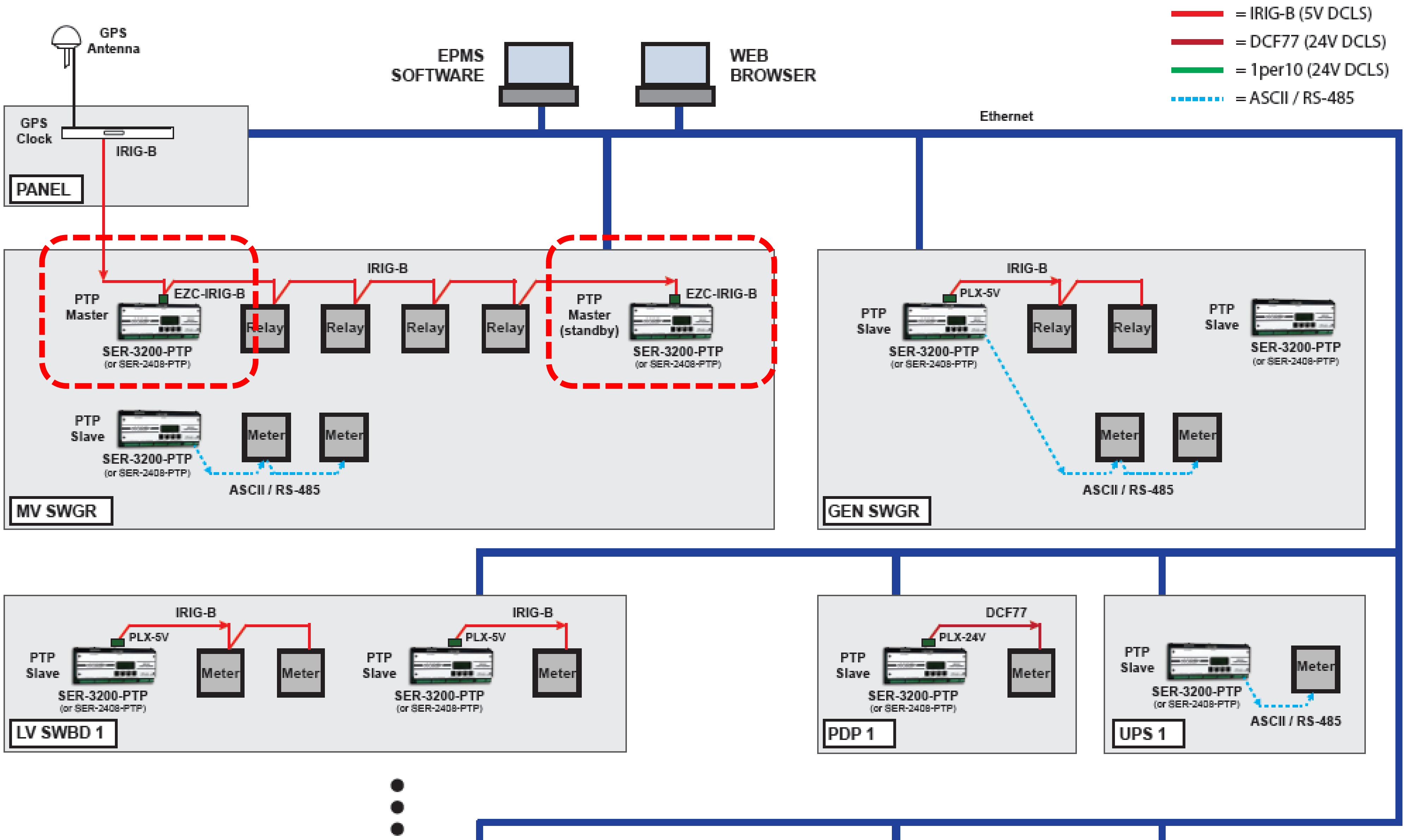
Example: sync first SER from GPS clock (via IRIG-B)

—IRIG-B to first SER and to relays and meters that support it



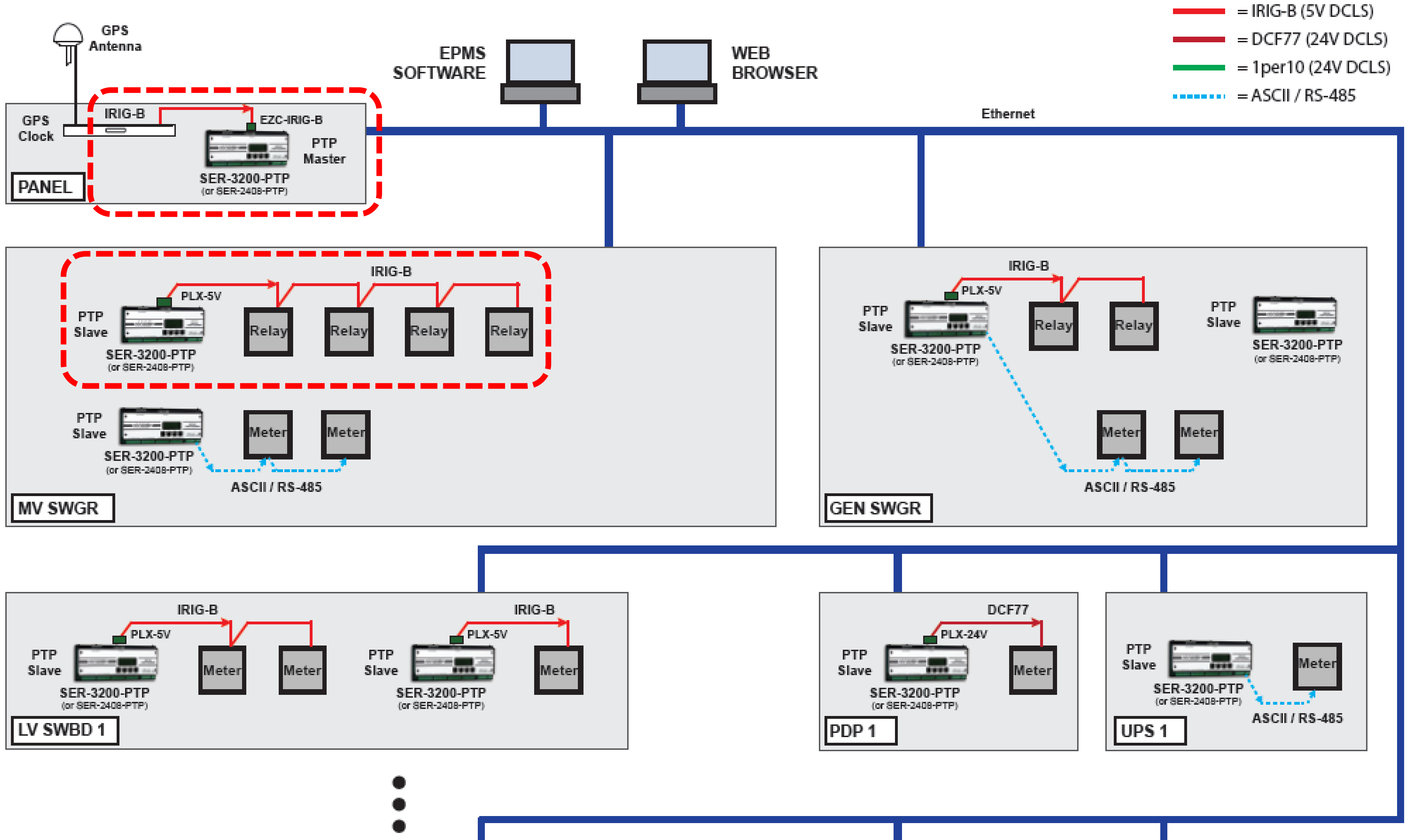
Example: SER #1 as PTP Master, SER #2 as standby

—*IRIG-B to both SERs (and others if desired)*

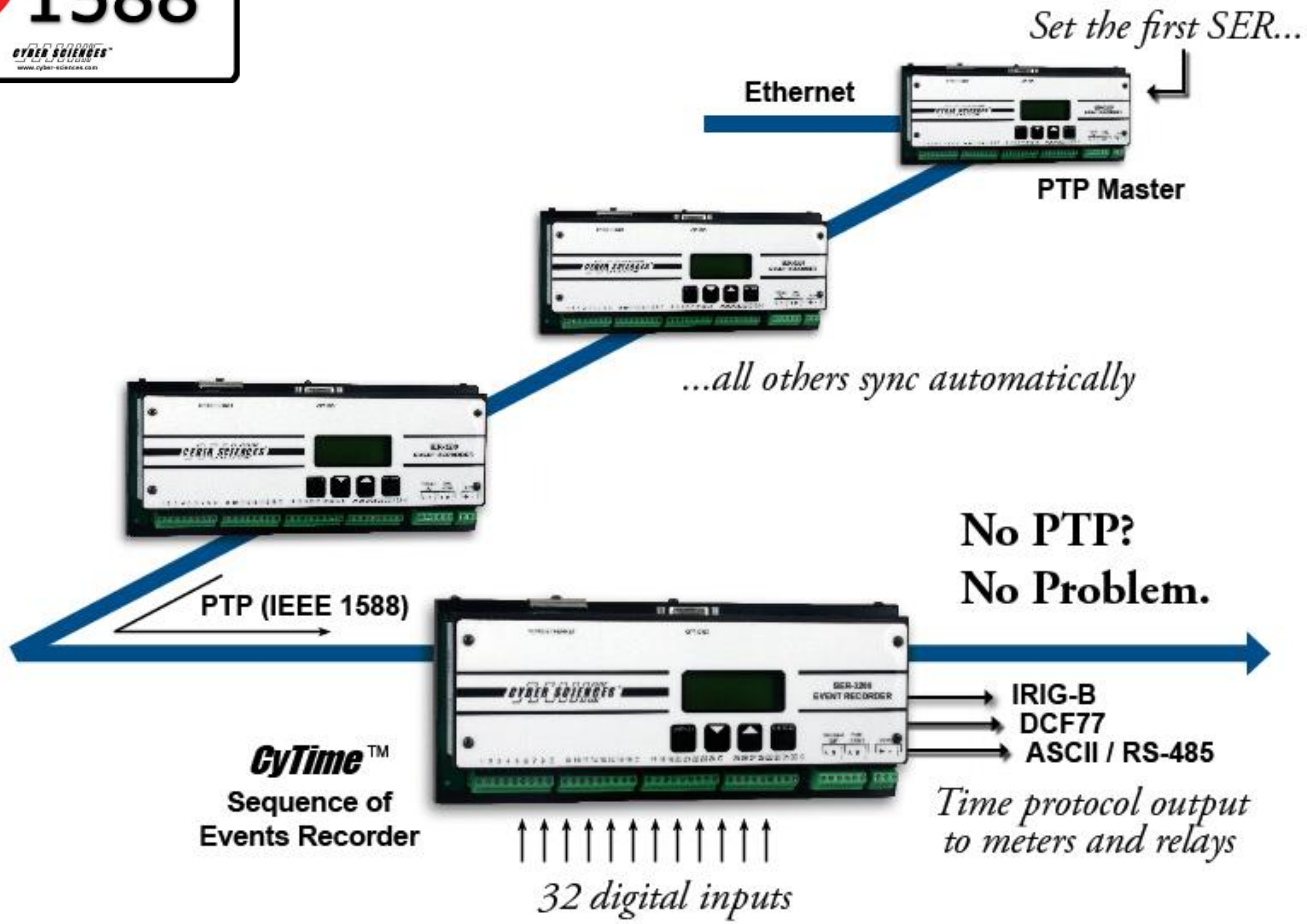


Example: sync first SER from GPS clock (IRIG-B)

—*first SER in same panel as clock, relays sync via IRIG-B*



PTP-enabled SER: Simple. Affordable. Scalable.



Events Happen...

(in milliseconds)

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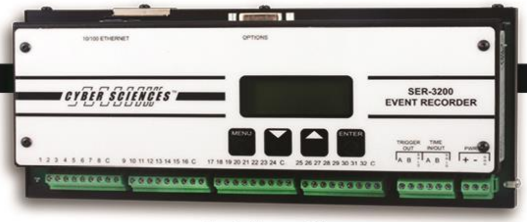

CyTime ™
Sequence of Events Recorder

Power monitoring at the speed of *NOW* !

Precision Time Protocol (PTP), per IEEE 1588, enables 1-ms time-sync over Ethernet. Diagnose root cause, verify control schemes operate as designed, identify slow breakers before they increase arc flash hazard.

Download our 20-page white paper on PTP and you'll ♥ 1588 too:

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Sep-2017