Entellisys™
Low Voltage Switchgear

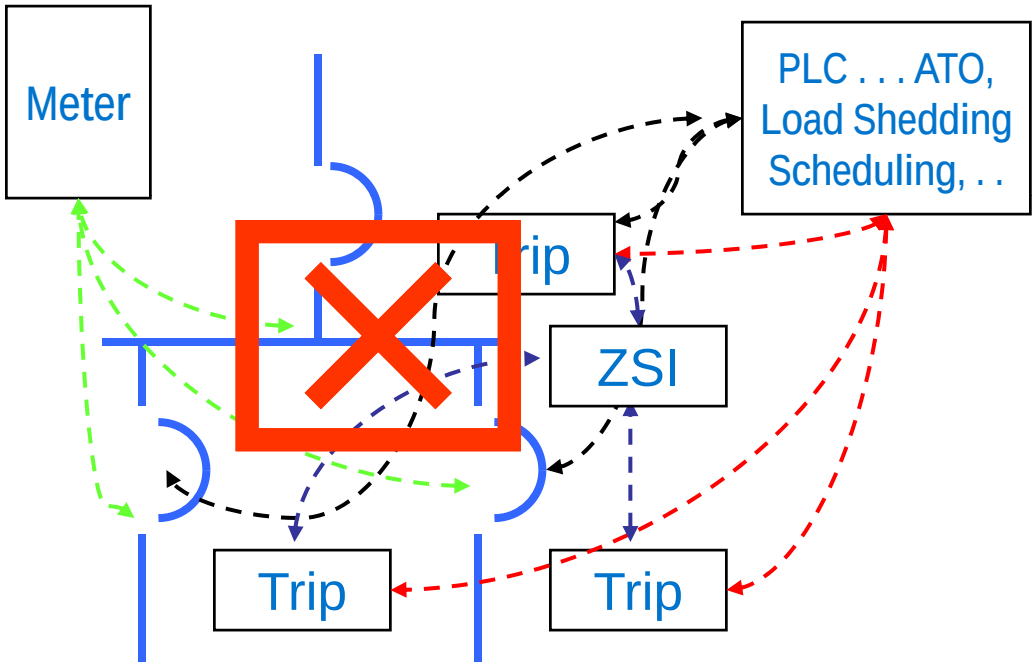
imagination at work


Thank you for your time

… Each evolution & enhancement = More Complexity

More complexity may mean less reliability

Multiple trips with different information … all independent



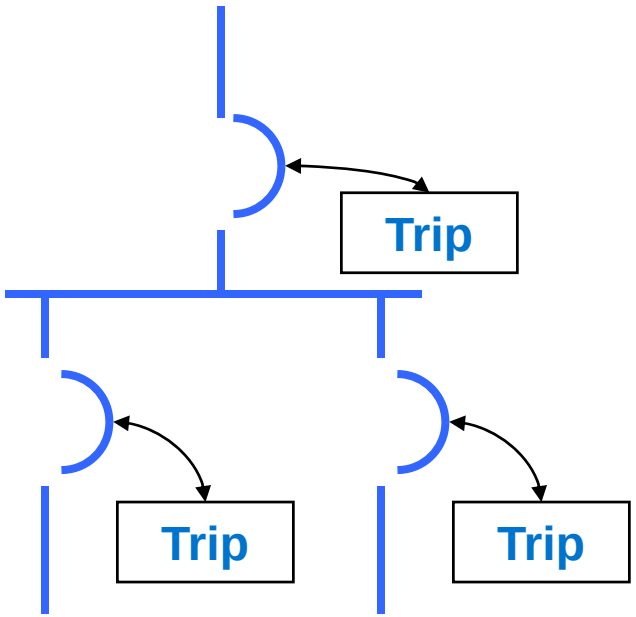
Let's not add more of the same, Let's change the way we do it completely

From intelligent CB to intelligent & educated equipment

Change from. . . 1 circuit . . . 1 breaker . . . 1 trip
To ➔ 1 system . . . Process all information simultaneously

imagination at work

A different concept

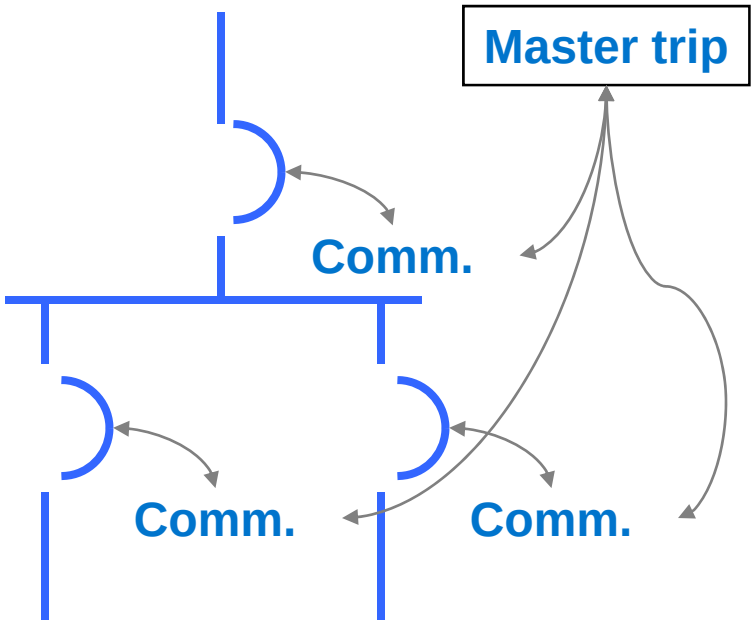


Each trip is independent & ignorant of what other trips see

From this

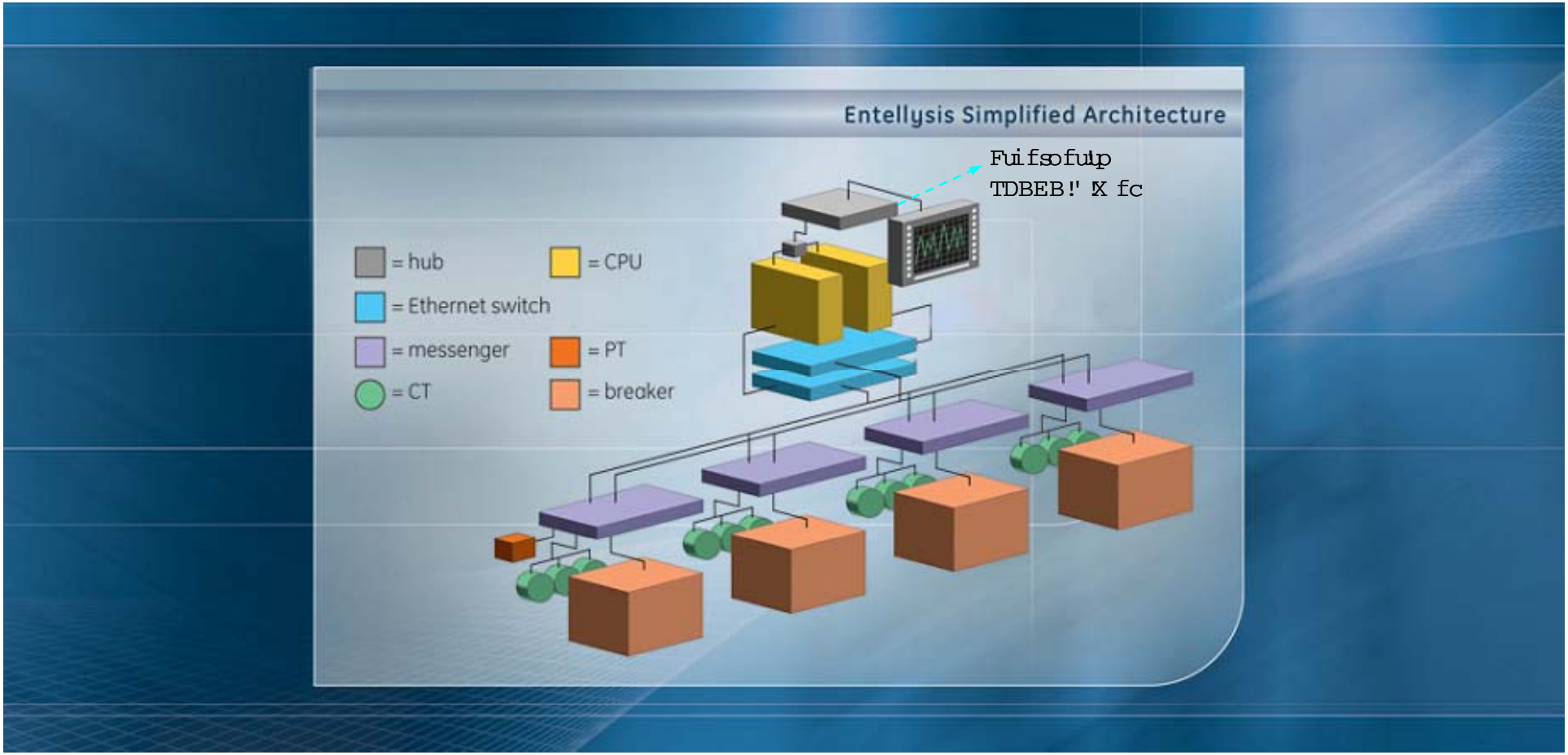
To this

- All information is processed simultaneously in one place.
- All information is considered.
- All trip commands issued simultaneously



Entellisys: streamlined design for enhanced functionality

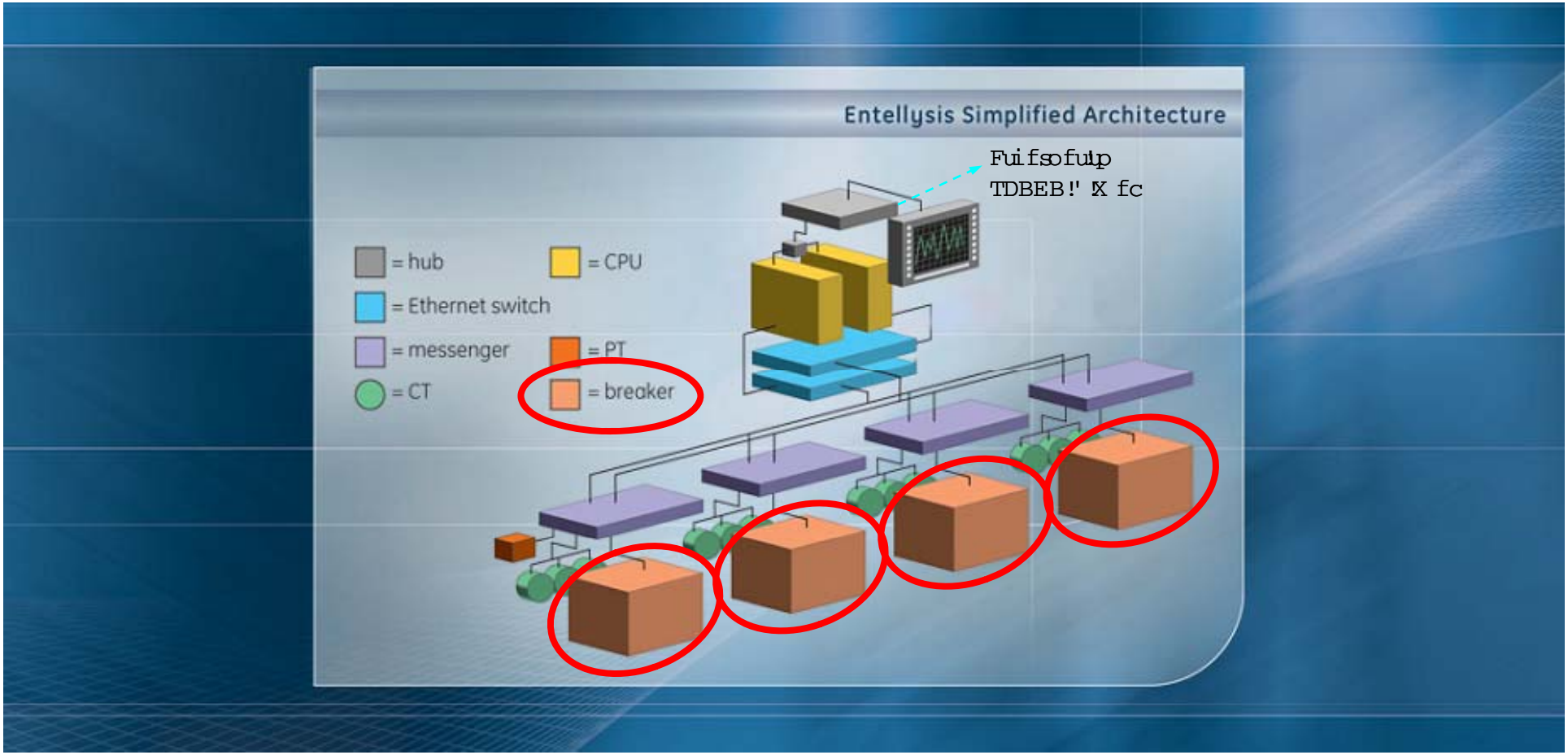
One standard set of hardware provides all functions



imagination at work

Simplified breakers…no trip units, no integral CTs

Simple switching devices



EntelliGuard Power Circuit Breakers

- **Built from proven WavePro design, ANSI design with full square ratings**
- **Electrical, manual and fusible available**
- **Less components = simplified maintenance, increased reliability**

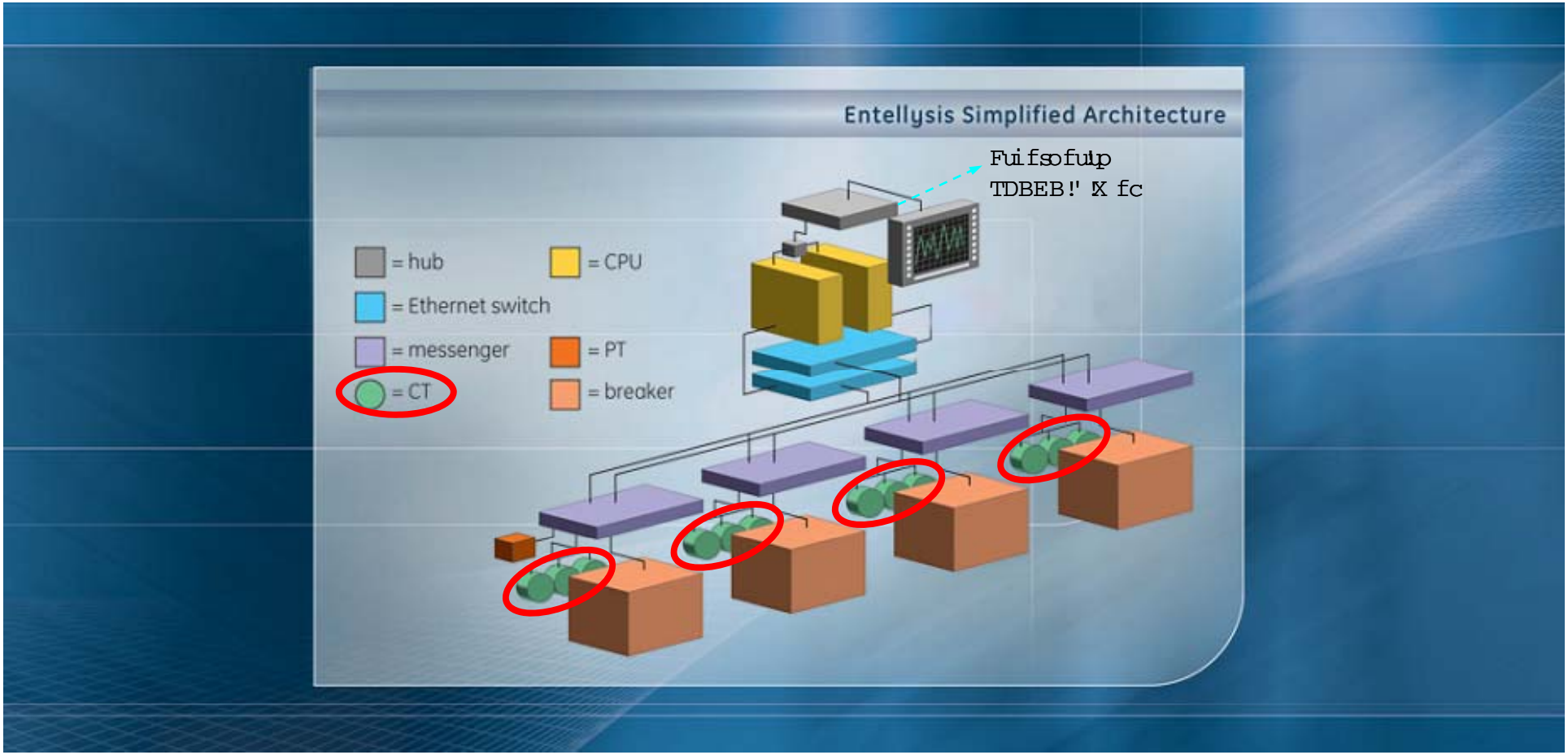
Universal Spares

- ✓ **Every 800A CB = any other 800A CB . . .**
- ✓ **2000A can replace 800, 1600 and 2000A**
- ✓ **4000A can replace 3200A or 4000A**

imagination at work

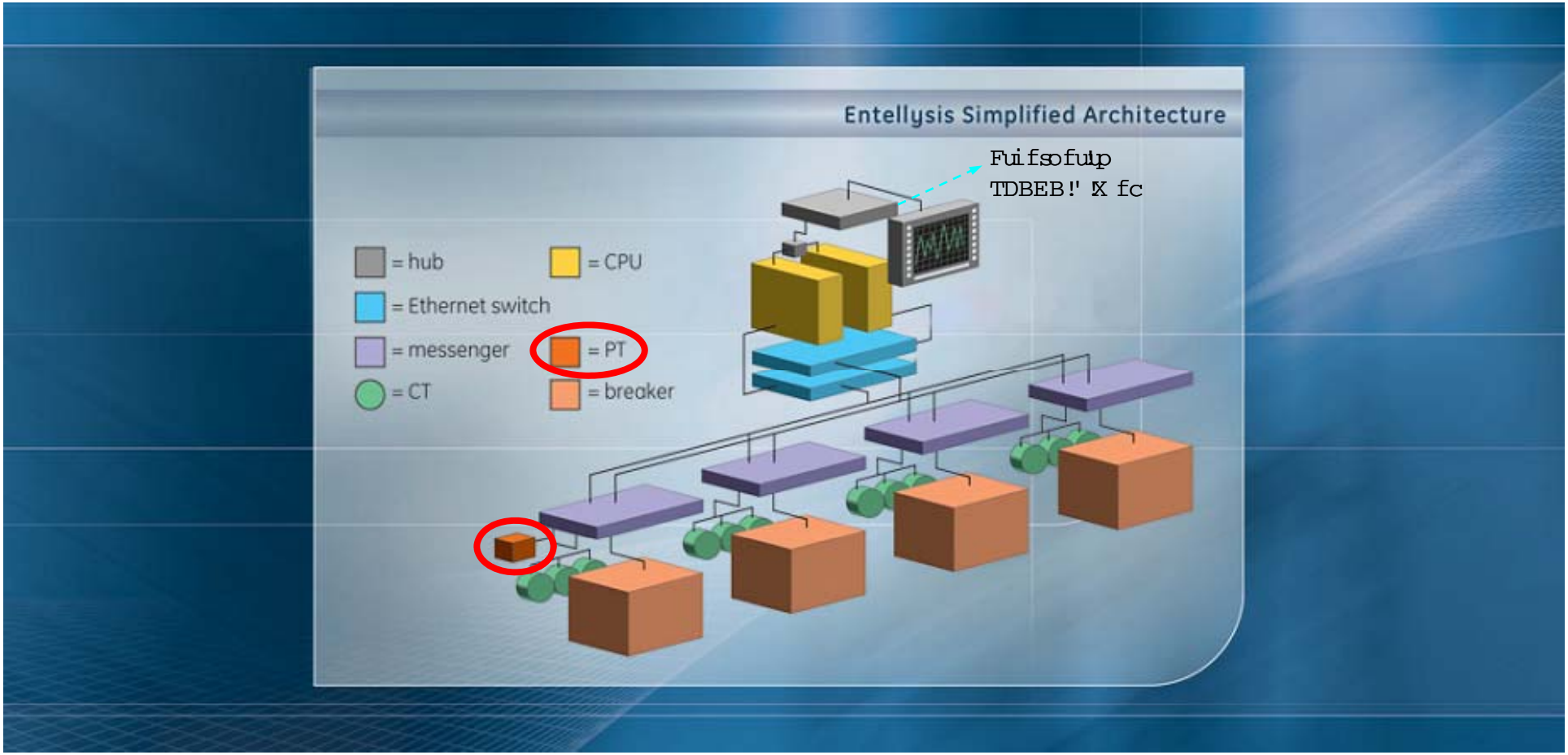
Current sensors. . . in equipment cubicle

When circuit breakers swapped for maintenance the settings stay with the circuit



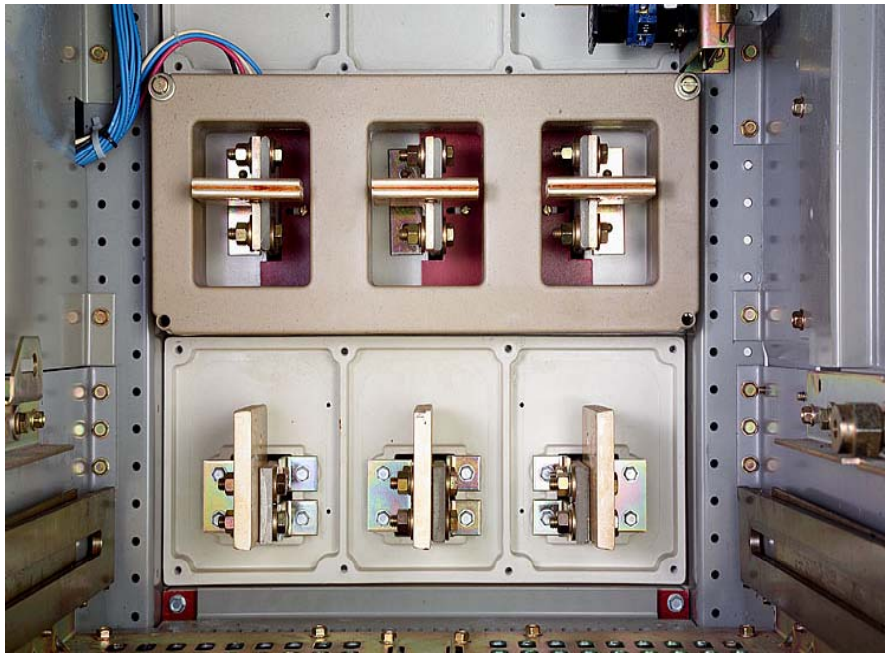
Potential Transformers

System keeps track of which source is connected, which voltage signal is needed . . . Less PTs needed



Entellisys Current Sensors & Potential Transformers

Provide Protection & Metering Data



Current Transformers

- 150A – 5000A

Freed from size restrictions imposed by CB

All CT's have –

- Integral open circuit protection
- Plug connection to Messenger

✓ **Cannot be wired incorrectly**

✓ **Cannot be faulted by open ckt**

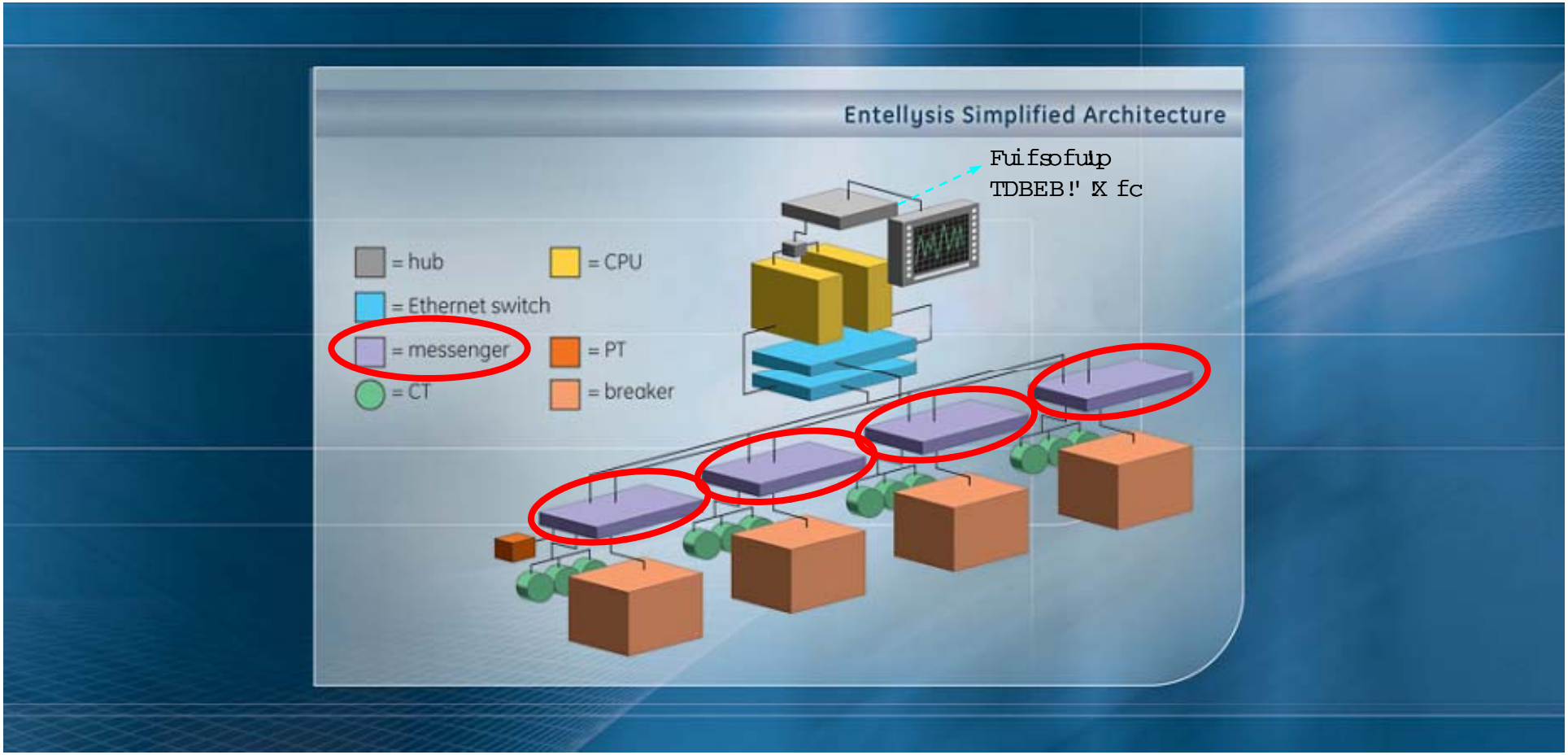
Potential Transformers

18V, system keeps track of what V signal represents voltage used

imagination at work

Messengers

Provide communications, A/D, D/A and self powered back-up protection

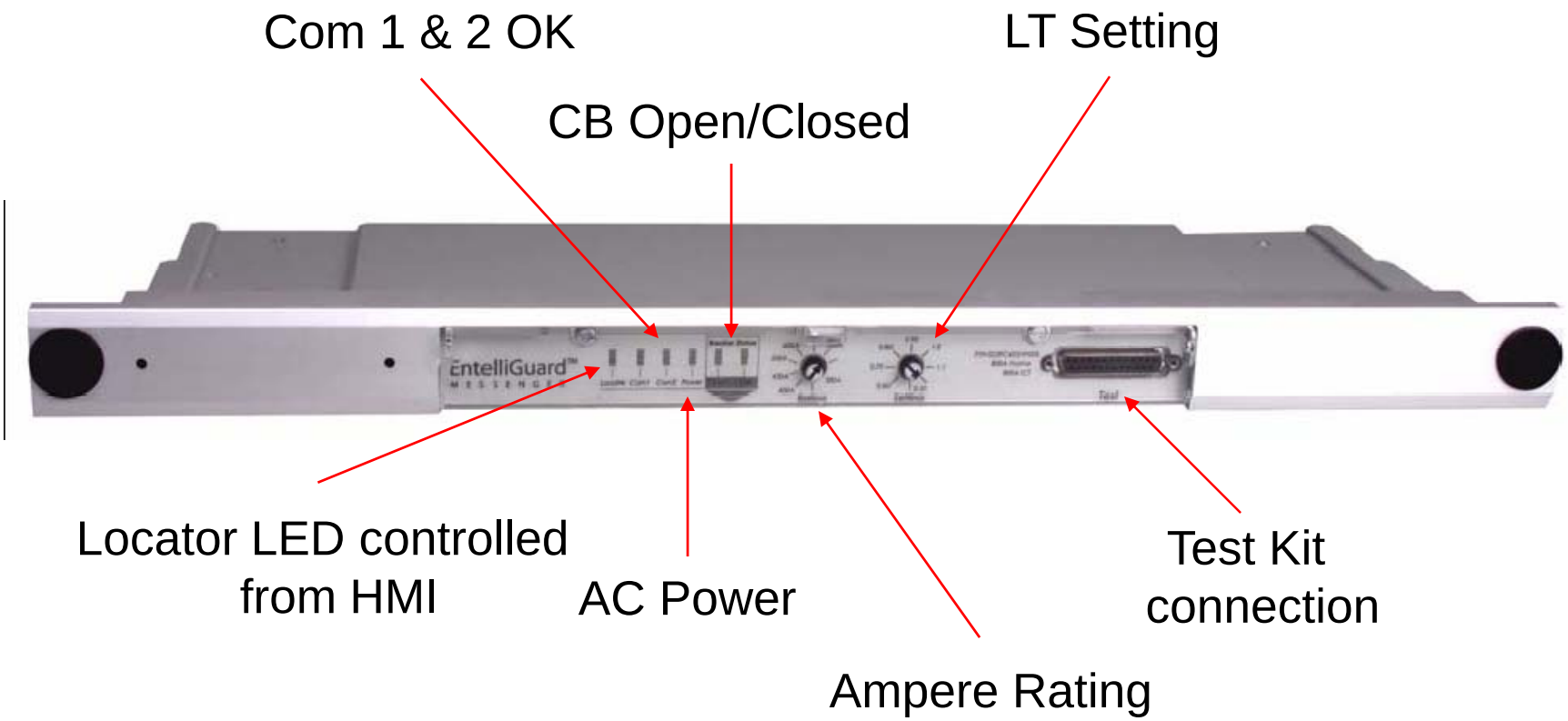


EntelliGuard Messenger

Located above CB

- Digitizes sensor signals & sends data to CPUs
- Receives CB commands from CPU
- Powered by 120v ac control power
- Self powered from CTs for back-up protection (LI)

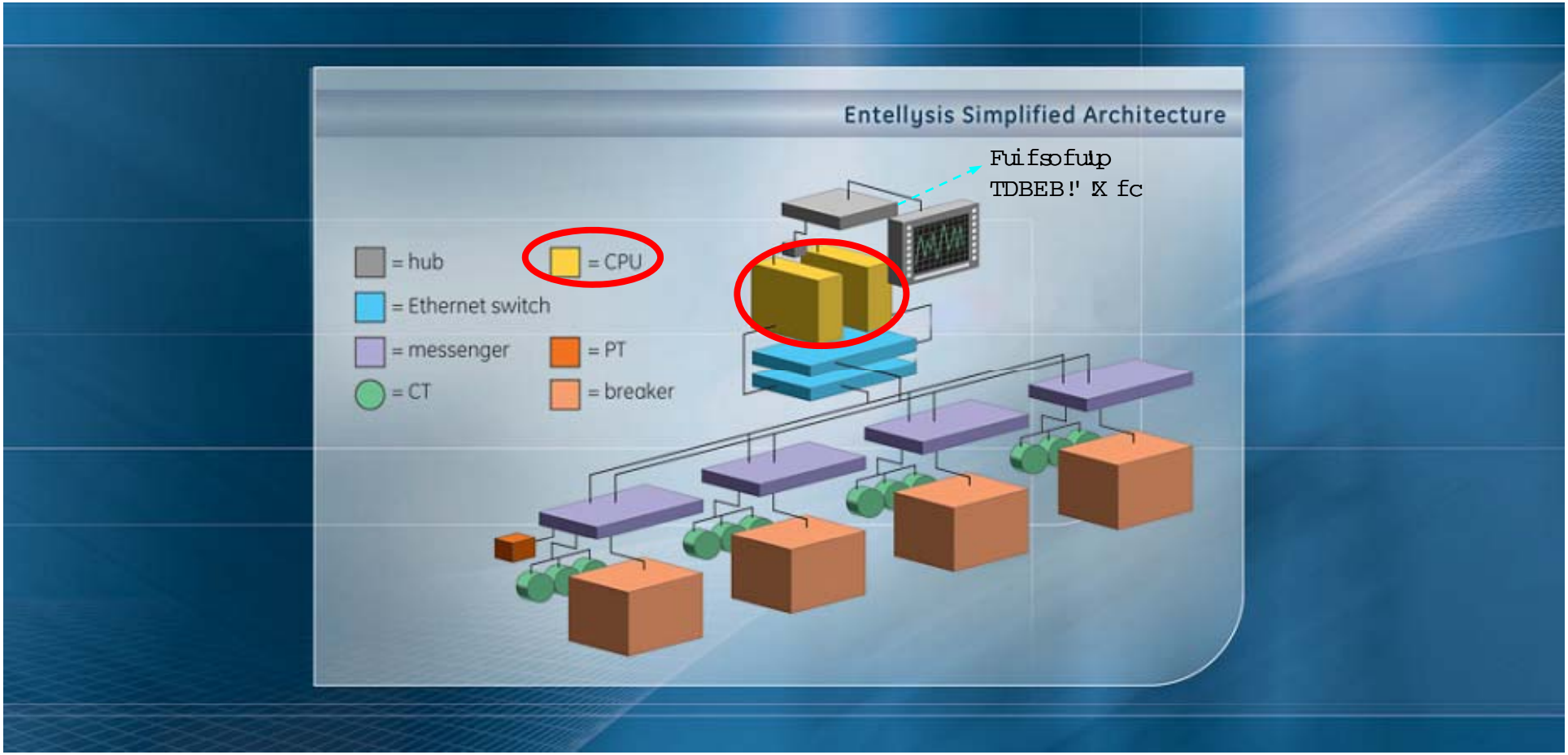
EntelliGuard Messenger



Communications between circuit and CPU
Back-up self-powered protection

Central Processing Unit (CPU)

Redundant CPUs, self monitoring



Central Processing Units

Redundant industrial computers

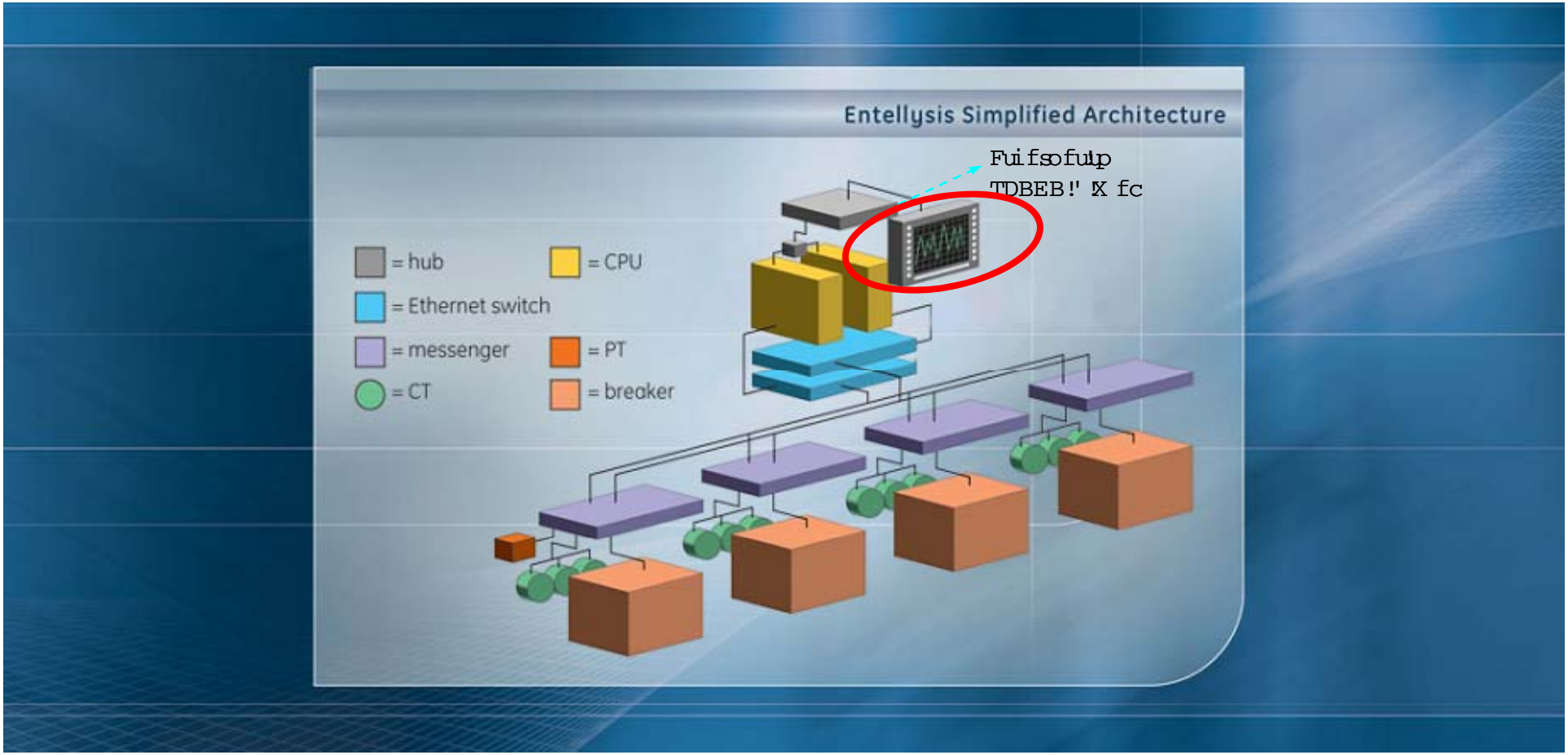
- Rack mounted
- Real time operating system
- Run simultaneously

  – Operating simultaneously they . . .
    - Back up each other
    - Monitor each other

  Provide complete redundancy &
  Instant Diagnostic information

Human Machine Interface

Easy access to system and information

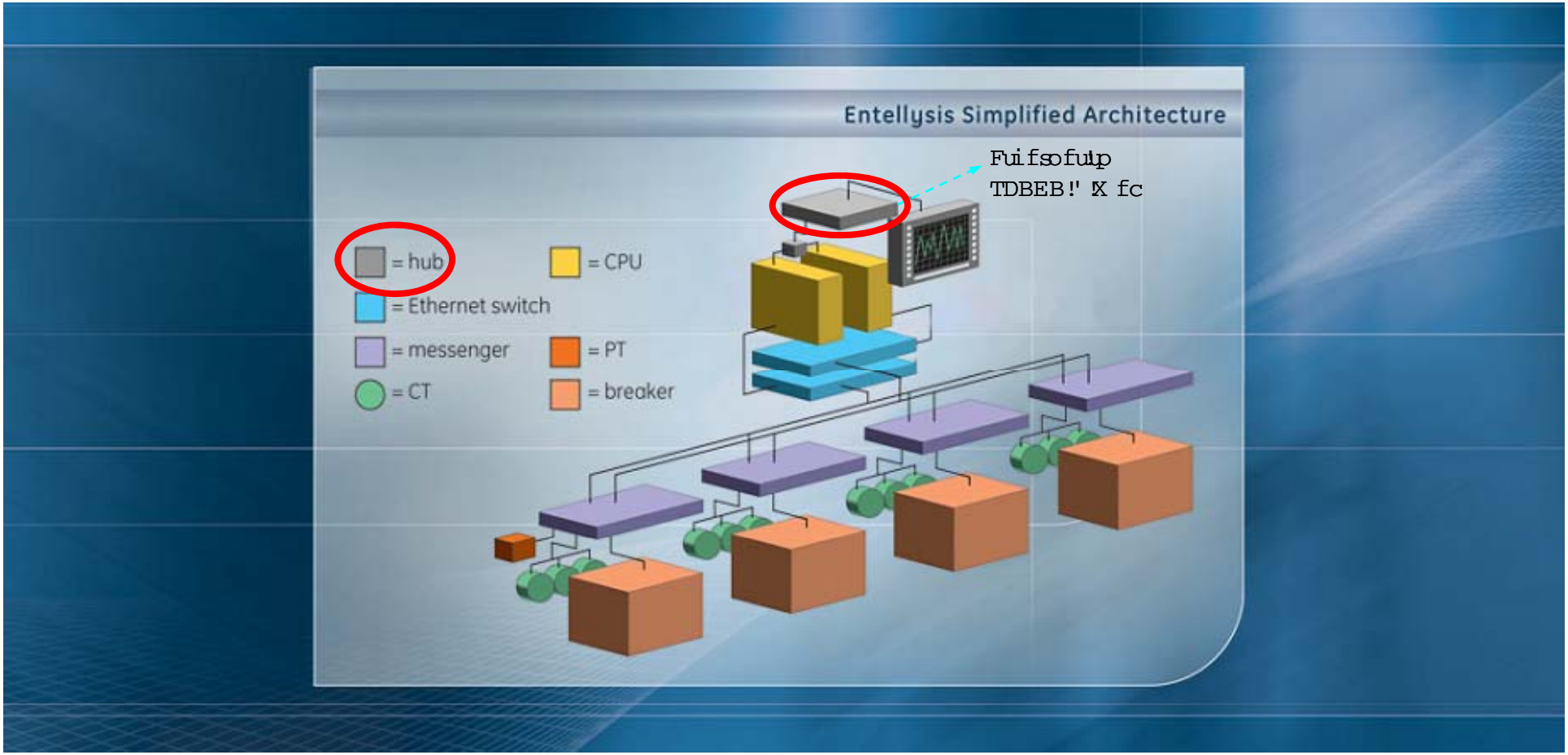


imagination at work

Human Machine Interface (HMI)

- Intuitive system interface via Touch Screen
- Individual password protection
- Independent of system operation
- Located in lineup or “near gear”

Ethernet Hub … interface to external communication



Simplicity

Simplified components and subsystems

- Less wiring, less peripheral devices, simpler CB

Before Entellisys

After

Reduced
- **Installation time**
- **Start up time**
- **Maintenance time**

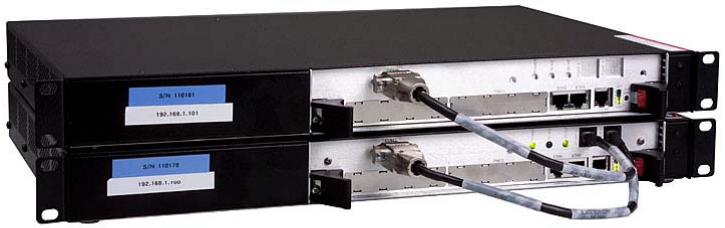
imagination at work

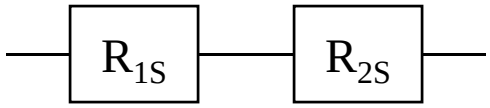
Redundancy

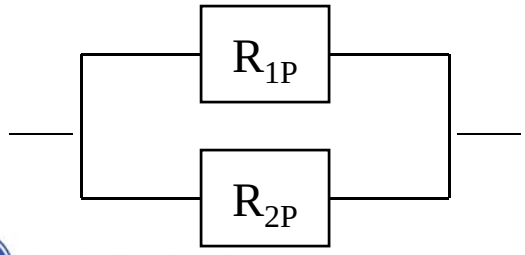
All system wide components, wiring & power sources are redundant

Redundancy

- Dual UPS . . With dual sources
- Dual communications
- Dual C/CPU
- Dual wiring







Where R_x = reliability of component x &
P_Y = probability of failure for system Y

$P_S = R_{1S} * R_{2S}$ For a series system with 90% reliability for each component. Two components in series yields 81% reliability, three yields 72.9%, etc.

$P_P = 1-[(1-R_{1P})*(1-R_{2P})]$ The same components in parallel at 90% reliability yield 99% system reliability.

Control Power

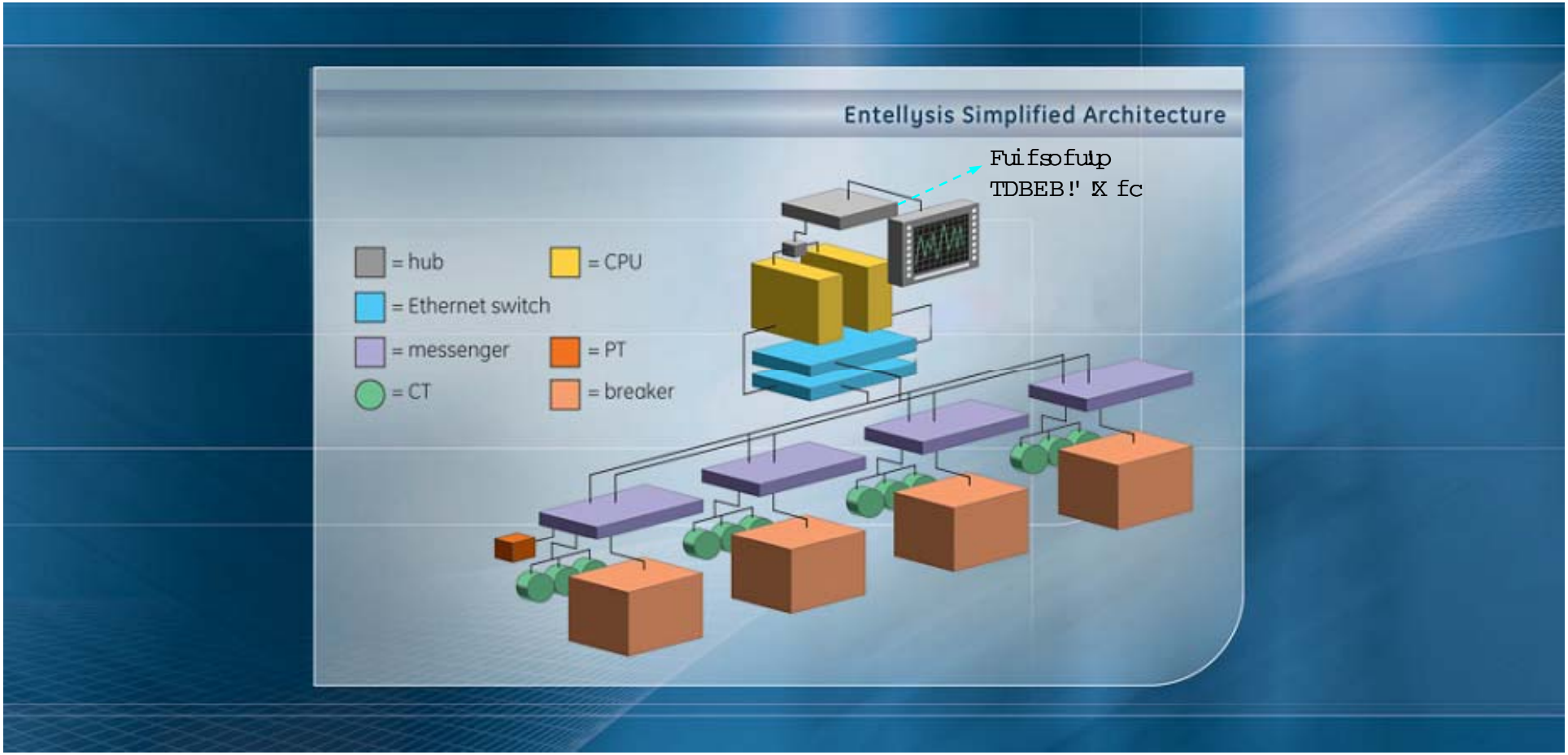
Redundant Control Power

- 2 CPT or separate AC control power sources
  - 5KVA switchgear CPT's
- 2 control power throwover relays
  - Throwover relay on each source
- 2 UPS
  - GE Digital Energy GT Series
  - 3000VA
- ALL control power is 120VAC

Entellisys – Designed for State of the Art Performance

No system wide single point of failure

Reliability through redundancy and continuous self monitoring



imagination at work

Comprehensive safety & complete system visibility. Keep staff away from live gear - complete remote monitoring and control capability

imagination at work

Entellisys “Near Gear” HMI

- Stand-alone stack or Wall Mount
- Maximum 300 cable feet from CPUs
- Can be in addition to HMI in lineup
- Can replace HMI in lineup for the safety conscious

Personnel safety: Remote racking mechanism . . .

Combined with remote monitoring & control capability No excuse for "ever" getting near an energized circuit breaker

imagination at work

Entellisys Remote Racking

Motor-operated racking device for EntelliGuard breakers

- One motor unit & two attachment plates
  - Small frame (800-2000A)
  - Large frame (3200-5000A)
- Start / Stop PB on 30FT cord
- 120VAC Control Power

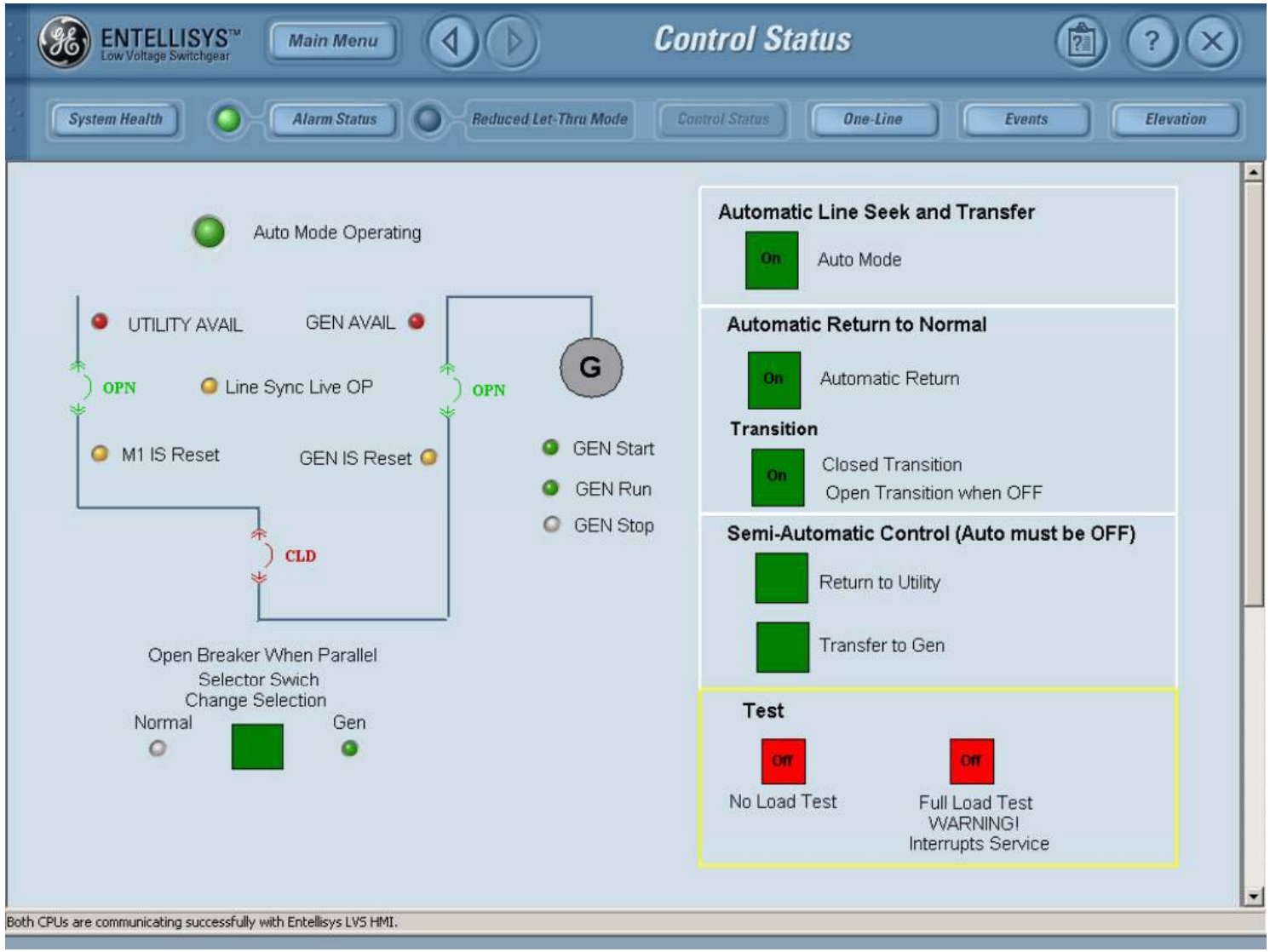
Automatic Transfer

Structured Auto Transfer Scheme for Main-Tie-Main (3-Breaker Transfer)

- Uses Entellisys internal protective relay functions and Flex Logic programming
- Under/overvoltage, under/overfrequency, phase loss, sync check on each main breaker
- Manual or Auto Return to Normal
- Open Transition (Break-before-Make) or Closed Transition (Make-before-Break) on Return to Normal
- ✓ Future generation up to 8 CB throw-over

Automatic Transfer

HMI Screen for Auto Transfer (Control & Status)



Metering

Standard – All breakers	Amps and Volts
Expanded Meter Package	kW, kvar, KVA, Power Factor, kWH, varh
Demand Package	Block demand, Rolling Demand, Demand logging
Harmonics Package	K Factor Harmonic Distortion
Standard for each meter package	Dynamic Locations, meters can be moved from circuit to circuit at any time

Protective Relaying

Voltage Package	Undervoltage, Overvoltage, Phase Loss
Frequency and Power Package	Over Frequency, Under Frequency, Reverse Power
High current	High Current Alarm
Early notice of possible trip conditions	Alarm and / or Trip Settings

Event Recording

~ 600 different kinds of events possible

Date & Time	True sequence due to synchronization across lineup
Source of event , Cause and Description	Ease of analysis
Fault Data	Magnitude of current levels, Waveform capture
Notification	Email messages, Local screen, Remote, Email

GE imagination at work