
Your world in real time.
RTDS
Technologies
AMETEK

# RTDS Technologies Inc.

- 30 years in business
- Headquarters in Winnipeg, Canda
- Customers in 57 countries
- Over 500 installations

# CUSTOMER BASE

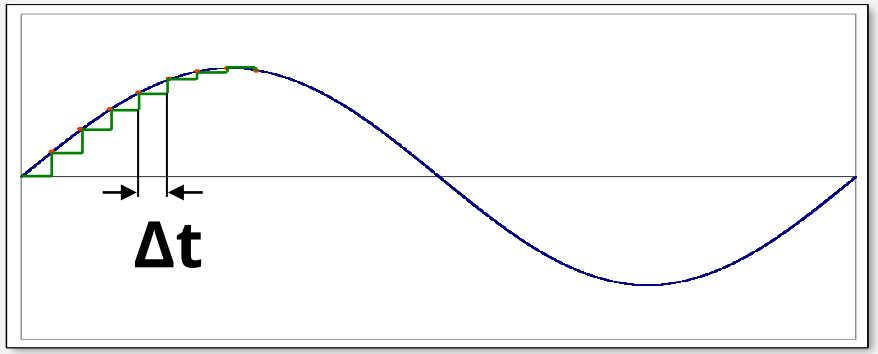
## Our clients are leading…

- Electrical power utilities
- Electrical equipment manufacturers (all major vendors of HVDC/FACTS, protection equipment, renewables, etc.)
- Research and learning institutions
- Consultants

# TRUSTED BY UTILITIES WORLDWIDE

# TYPES OF DIGITAL SIMULATION

| Type of Simulation | Load Flow | Transient Stability Analysis (TSA) | Electromagnetic Transient (EMT) |
|---|---|---|---|
| Typical timestep | Single solution | ~ 8 ms | ~ 2 - 50 μs |
| Output | Magnitude and angle | Magnitude and angle | Instantaneous values |
| Frequency range | Nominal frequency | Nominal and off-nominal frequency | 0 – 3 kHz (<15 kHz) |




**Dommel algorithm of nodal analysis used in RTDS, PSCAD, EMTP, etc.**

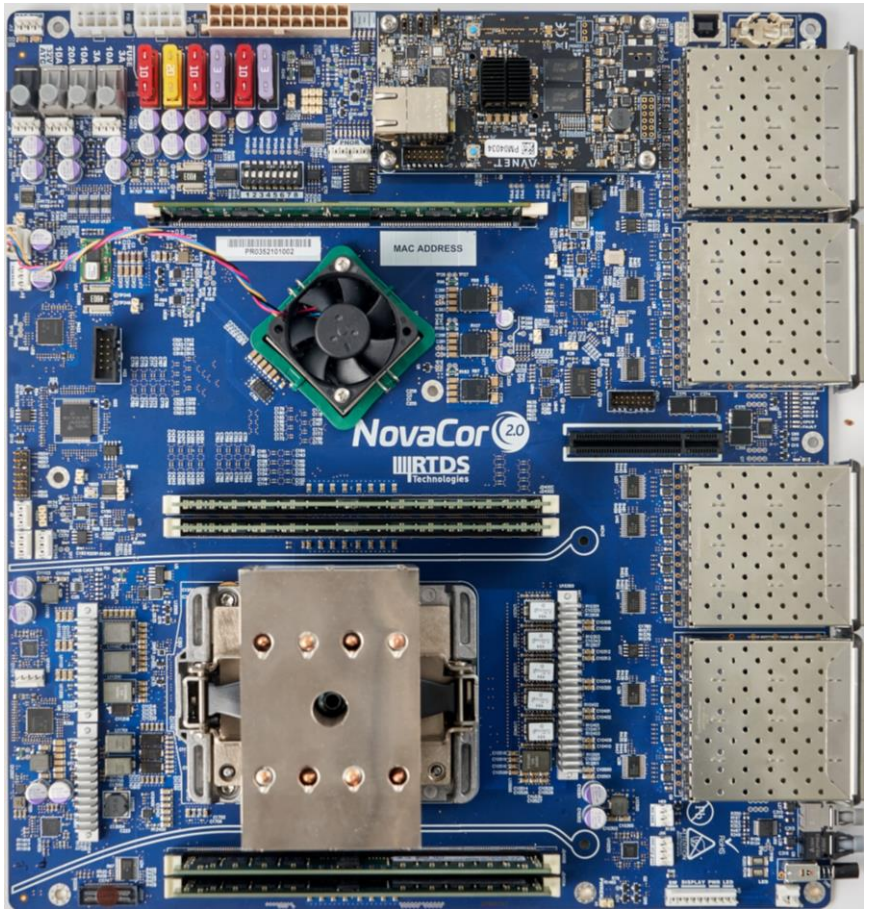
# NOVACOR 2.0: CURRENT-GEN HARDWARE


- Custom parallel processing computer
- Modular design
- Main interface is through user-friendly software
- Ample I/O to connect physical devices

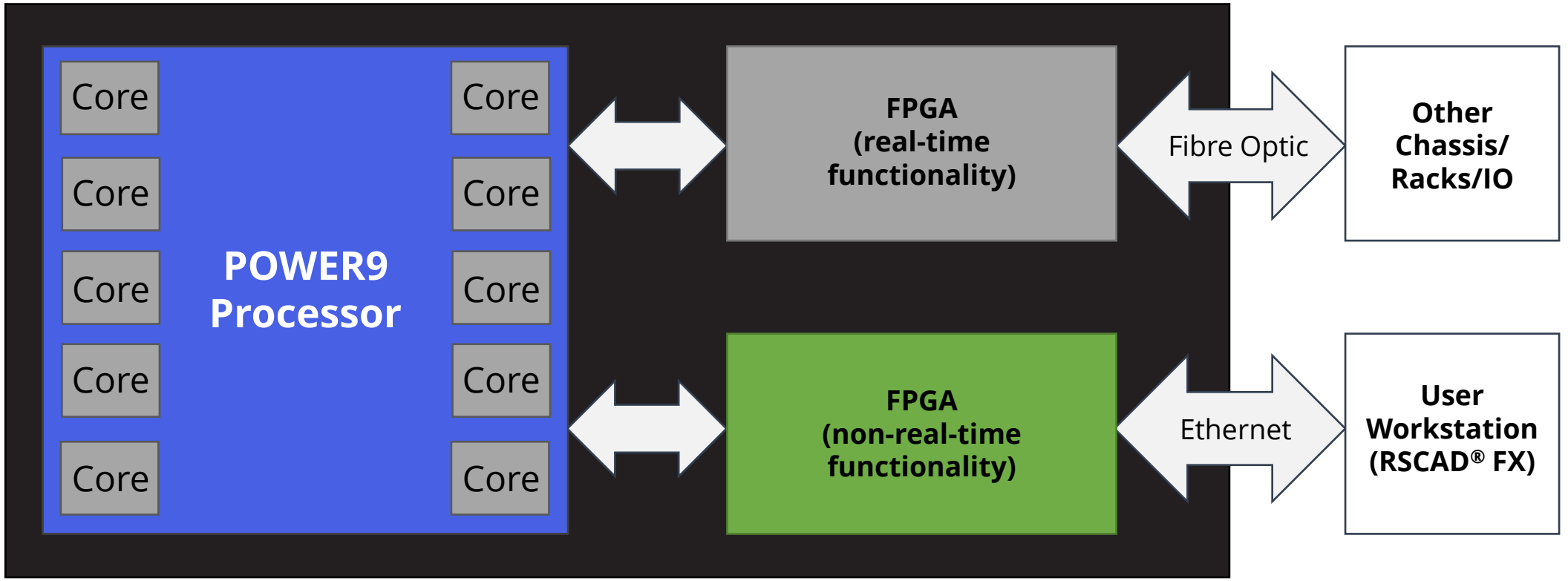
NovaCor 2.0

# NOVACOR 2.0: DEDICATED DESIGN

- RTDS Technologies is maintaining the competitive advantage afforded by a dedicated design
- Platform optimized for hard real-time simulation
- IBM POWER9 RISC processor
- No operating system used by the processor while simulation running — bare metal operation
- Operates directly from cache memory for maximum efficiency
- Worked closely with IBM for optimal communication settings
- **Provides ultimate in determinism and performance**



# INSIDE THE NOVACOR 2.0 CHASSIS

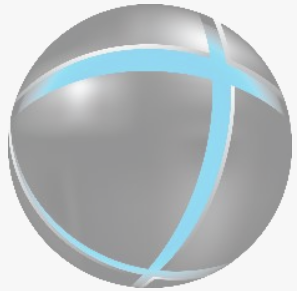


# CORE LICENSING

Core 1

Core 2

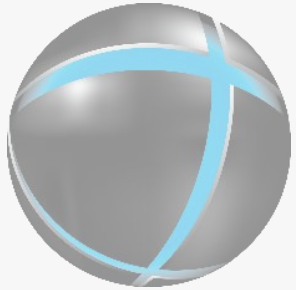
Core 3



Core 4

Core 5

Core 6



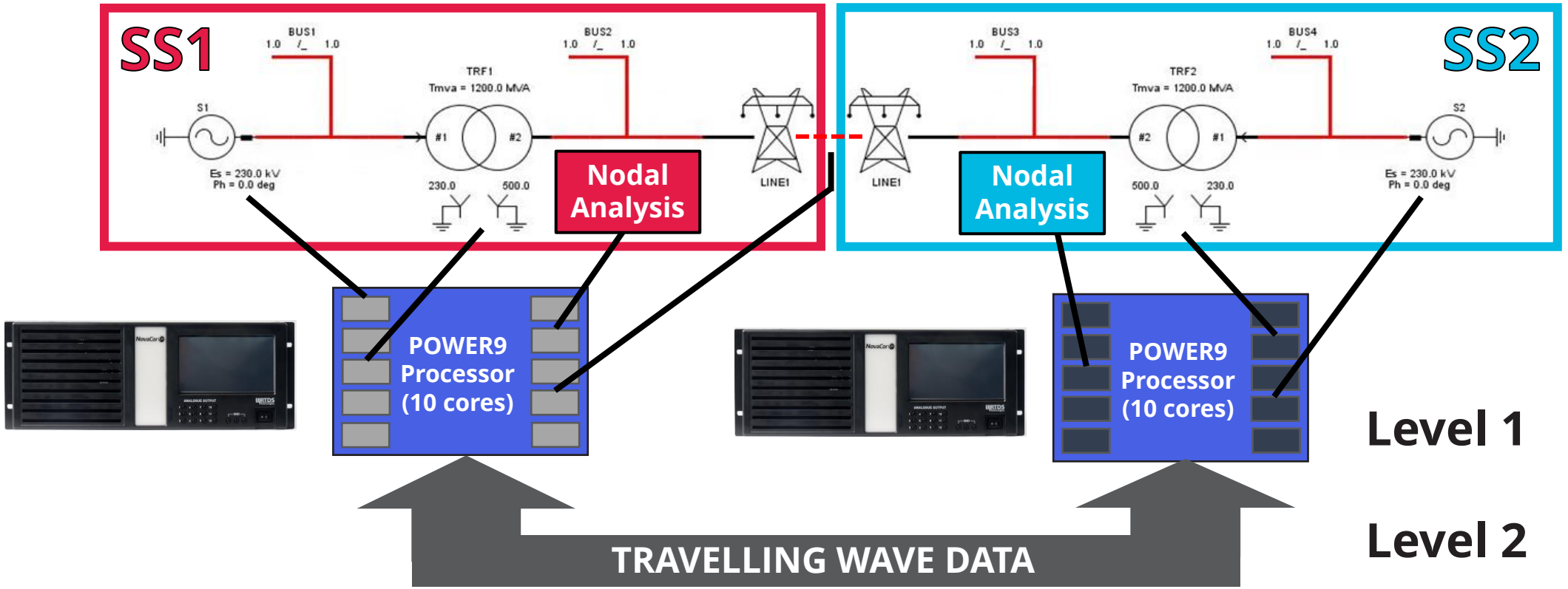
Core 7

Core 8

Core 9

Core 10

# PARALLEL PROCESSING ON TWO LEVELS



# LARGE-SCALE SIMULATION

- Maximum of 144 NovaCor chassis in one simulation
- Precise timing shared between all chassis, one master
- Star point interconnection between all chassis for ease of communication
- Tens of thousands of buses running hard real time EMT simulations

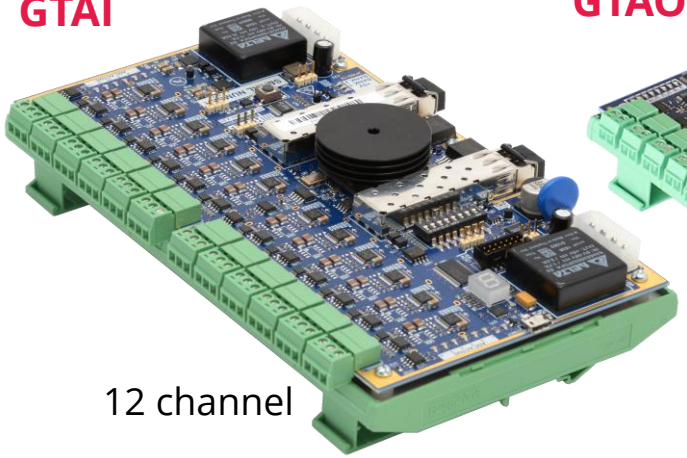
# CUSTOM HARDWARE COMPONENTS

## Flexible and Expandable I/O

- Isolated 16-bit analogue input/output cards
- Easily daisy-chain connected to a single NovaCor fibre port

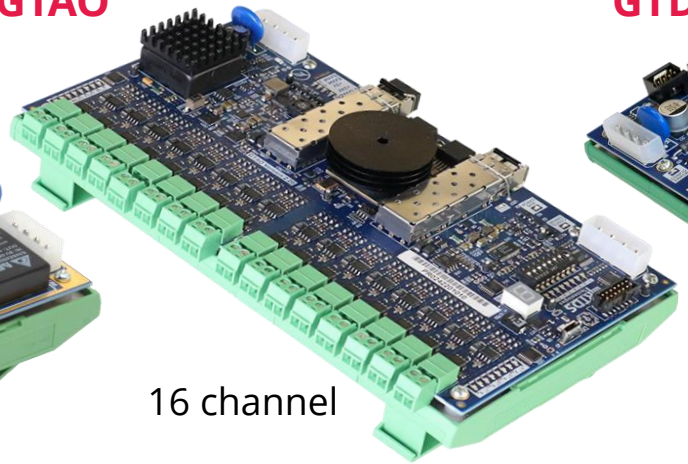
***Analogue***

**GTAI**



12 channel

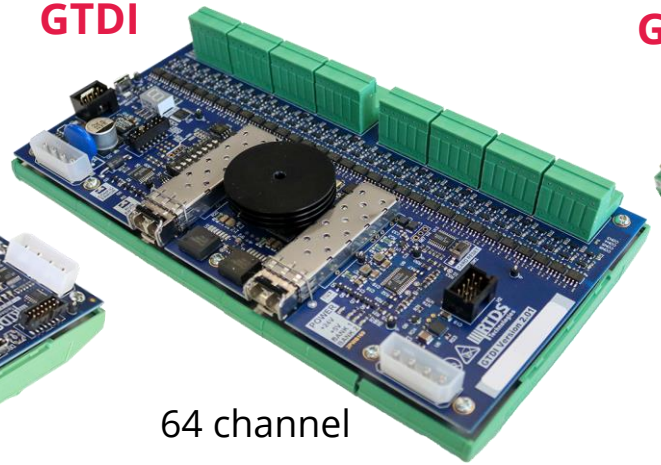
**GTAO**



16 channel

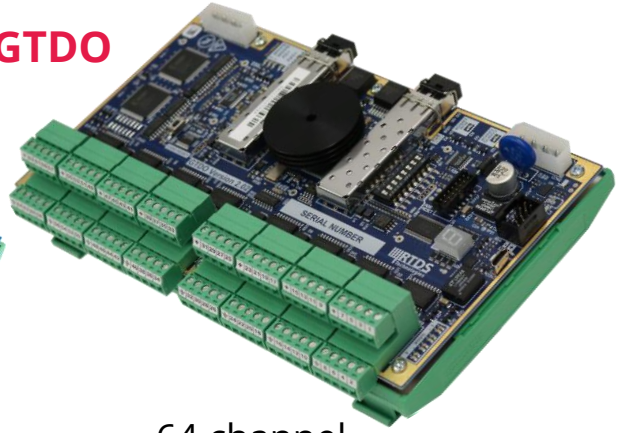
***Digital***

**GTDI**



64 channel

**GTDO**



64 channel

# CUSTOM HARDWARE COMPONENTS

## GTNETx2: Network Communication

- Communication with external devices over Ethernet
- Card has two “modules” and can have two network protocols operating simultaneously

**IEC 61850**

- GOOSE Messaging
- IEC 61850-9-2LE, IEC 61869-9 Sampled Values

**SCADA**

DNP3 and IEC 60870-5-104

**Large data playback**

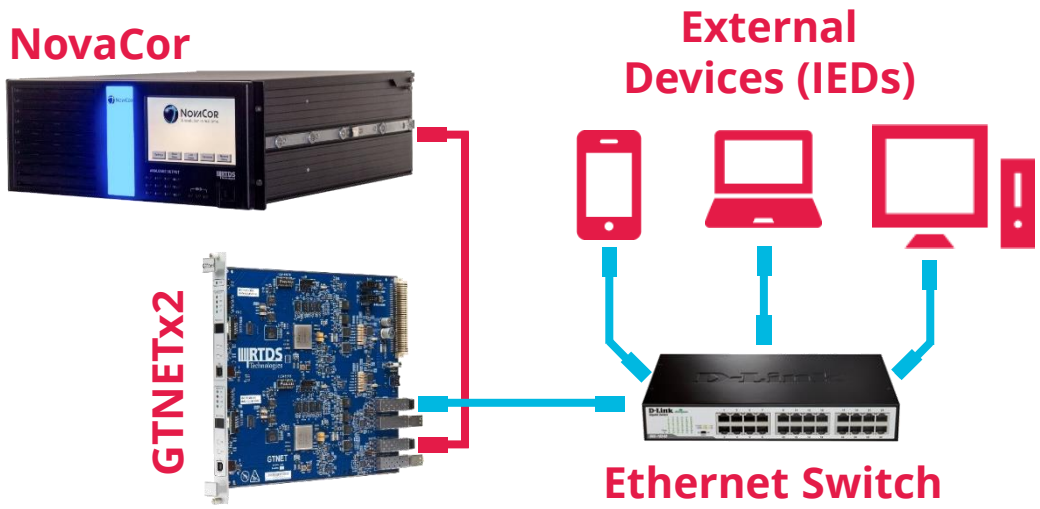
**PMU**

IEC/IEEE 60255-118-1

**MODBUS**

TCP, RTU over TCP, ASCII over TCP

**Generic TCP/UDP Sockets**



# GTSOC V2

## Optional auxiliary hardware based on FPGA and system-on-a-chip (SOC)

- Amalgamates the functionality of the GTFPGA Unit (previous hardware), plus black box control
- Function defined by active firmware
- MMC Valve and Control
- Sampled Values (-9-2LE + IEC 61869-9)
- Small timestep frequency dependent tline
- Generic Power Electronics Solver (GPES)
- Black box control

# The new GTSOC V2

## Supporting Vendor Black-Box Controls

- ARM cores on the GTSOC V2 support execution of static library file (.a) compiled from original source code using .exe provided by RTDS Technologies
- Control code is not accessible by user, but vendor can choose to make some parameters changeable
- Compatible with NovaCor systems (connected via fiber cable)

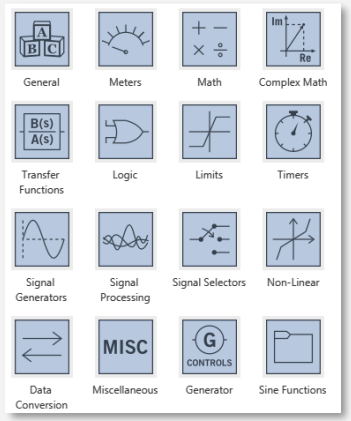
# SIMULATION SOFTWARE:

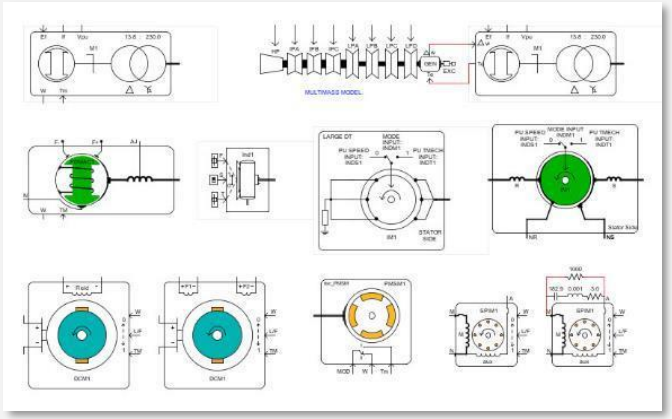
# RSCAD® FX

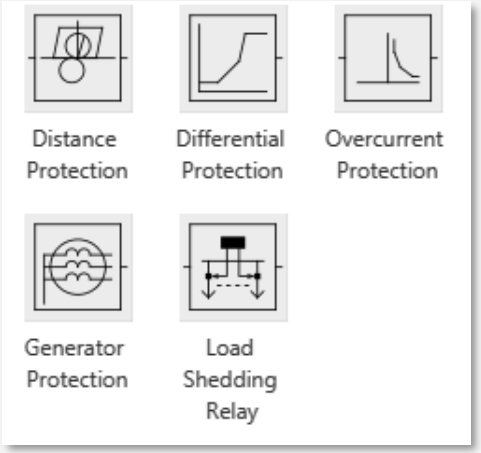
- **Includes everything required for simulation studies**
- Comprehensive and proven component libraries
- No additional add-on modules required for any aspects of simulation
- No third-party modules
- Site license and one maintenance agreement

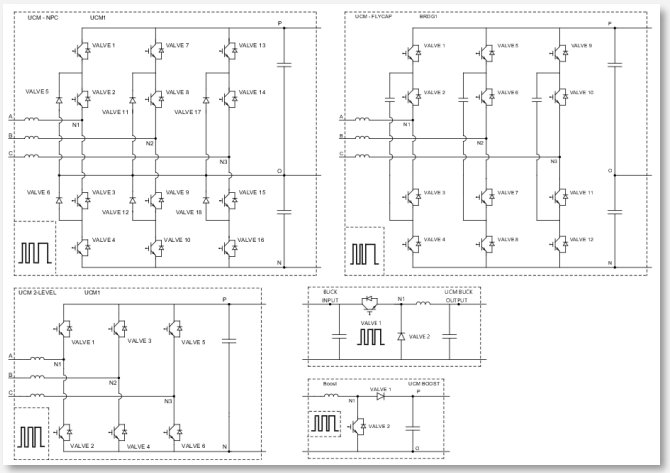
# RICH COMPONENT LIBRARIES

- Power systems
- Controls
- Power electronics
- HVDC & FACTS
- Protection
- Renewables
- Etc.



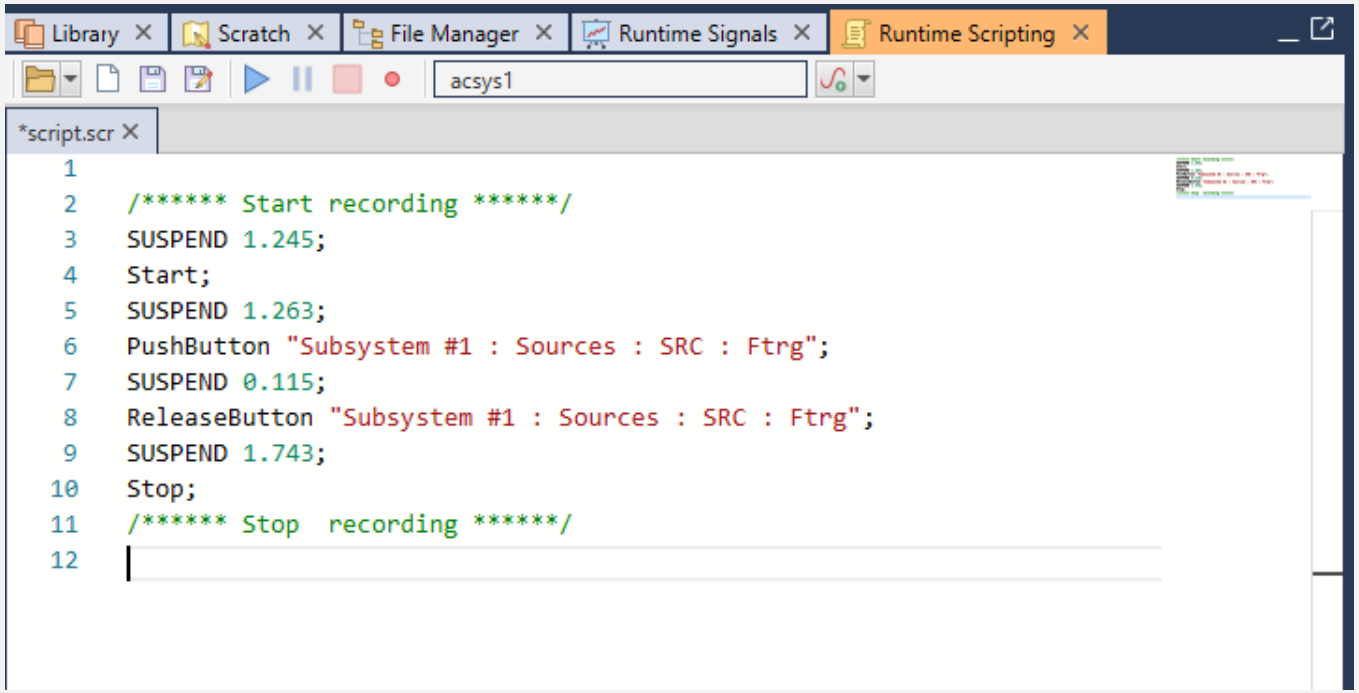





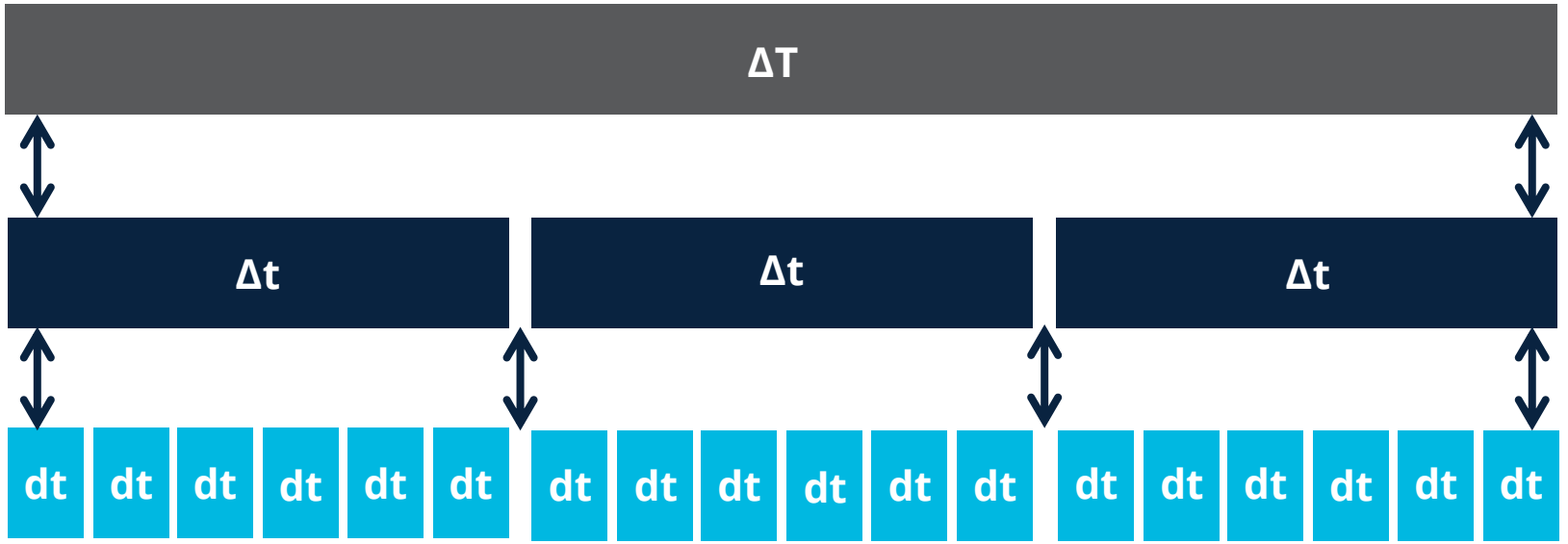



# SCRIPTING

- Efficient means of running many cases
- Scripting Utility Tab
- Scripts can be written or recorded from user actions
  - C-like programming language
  - Adaptive via **if, for, while** statements
  - User-defined subroutines
  - Customized results reporting
  - Automated plot printing
- **Python scripting support**



# MULTI-RATE SIMULATION



# HARDWARE IN THE LOOP FOR GRID MODERNIZATION

## Distribution

- Microgrid testing
- Renewables/DERs
- Distribution automation
- Inverter testing

## Power Electronics

- HVDC and FACTS
- Energy conversion
- Drives
- PHIL

## Smart Grid

- WAMPAC testing
- PMU studies
- Cyber security

## Protection

- Digital substations (IEC 61950)
- Travelling wave based relay testing

# THE ADVANTAGES OF THE WORLD LEADER

**RTDS Technologies is the world leader in real-time power system simulation.**

- Customers in 50+ countries — **trusted** by leading manufacturers, utilities, research institutions across the globe
- Proven reputation for a **quality** product and excellent customer **support**
- Continued product **development** in response to customer needs
- Flexible, modular solution composed of **custom** hardware and software designed in-house
- Global market leadership means **experience** with a range of applications

# THANK YOU!
# QUESTIONS?

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