Sedona Framework – Best Opportunity for Open Control

Introduction

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THE WORLD'S LARGEST HVACR MARKETPLACE

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The Need for Open Controllers

- When we mention open controllers we immediately think of BACnet, but BACnet is only a protocol and does not address control
- Even with BACnet compliance, a system integrator is not assured access to a BACnet site
 - The programming language may be proprietary to the controller manufacturer
 - The programming tool may only be available to the controller manufacturer's sales channel

Therefore, an open protocol like BACnet is necessary for an open controller but it is not sufficient



- Utilizes an open protocol for network communications
 - BACnet is an ISO standard with international acceptance
- Utilizes an open programming language for implementing control strategies
 - Sedona Framework is open source, and due to its similarity to Niagara Framework it is familiar to many integrators
- Utilizes a programming tool available without restriction
 - Those without access to Niagara Workbench can use Sedona Application Editor from Contemporary Controls or Sedona tools from others
- Fosters a community of developers and integrators that share technology for the public good
 - A Sedona community of developers and integrators exist using the resources at SedonaDev.org and the Sedona Alliance



Open Protocol for Network Communications – BACnet

- BACnet a communications protocol for Building Automation and Control Networks
- Intended to provide "interoperability" among different vendor's equipment
- Frees the building owner of being dependent upon one vendor for system expansion
- Allows BAS devices to be modeled such that they are "network viewable"
- BACnet devices are modeled using an object-oriented structure of ...
 - Objects
 - Properties
 - Services



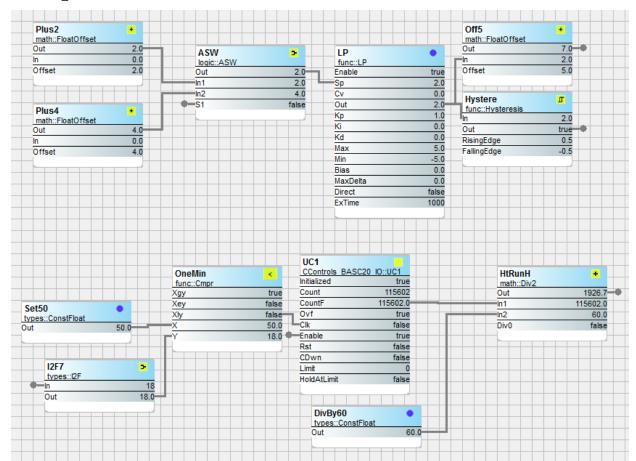


Open Programming Language for Control – Sedona

- The Sedona language is similar to Java or C# allowing developers the opportunity to create custom components
- These components can be assembled into applications by nonprogrammers using simple graphical methods
- A Sedona Virtual Machine (SVM) on the Sedona device executes the application program
- Sedona applications can be made to be portable to other Sedona devices
- Sedona is open source there are no royalties or commercial licenses required to develop and use Sedona components



Creating Applications by Linking Components



Using a drag-and-drop methodology, Sedona components are placed onto a wire sheet, configured, and linked together to create an application. Once placed on the wire sheet, components immediately begin execution thereby allowing for application debugging in real-time. 6

CAHR EXPO Open-Source Sedona Framework

- Originally developed by Tridium as a software framework for embedded controllers operating with less than 100kB of memory, the technology is accessible from the SedonaDev.Org web site
- Tridium owns the trademark Sedona Frameworktm but the technology is available to the public licensed under the Academic Free License version 3.0 with numerous products in existance
- The public has the right to use, develop and sell products based upon the Sedona Framework without royalties or commercial licenses but should acknowledge the copyright owner along with stating that the product was built on the Sedona Frameworktm





Programming Tool Available without Restriction – Sedona Applications Editor

- For those without access to Niagara Workbench, the Sedona Application Editor (SAE) is available free via download from the Contemporary Controls website
- Includes a Sedona virtual machine (SVM-PC) that runs on a PC that can be programmed with the SAE for testing
- Includes Tridium-Release kits and components
- Can be used with other Sedona devices as long as the proper platforms, kits and manifests are installed
- Intended for the Sedona community

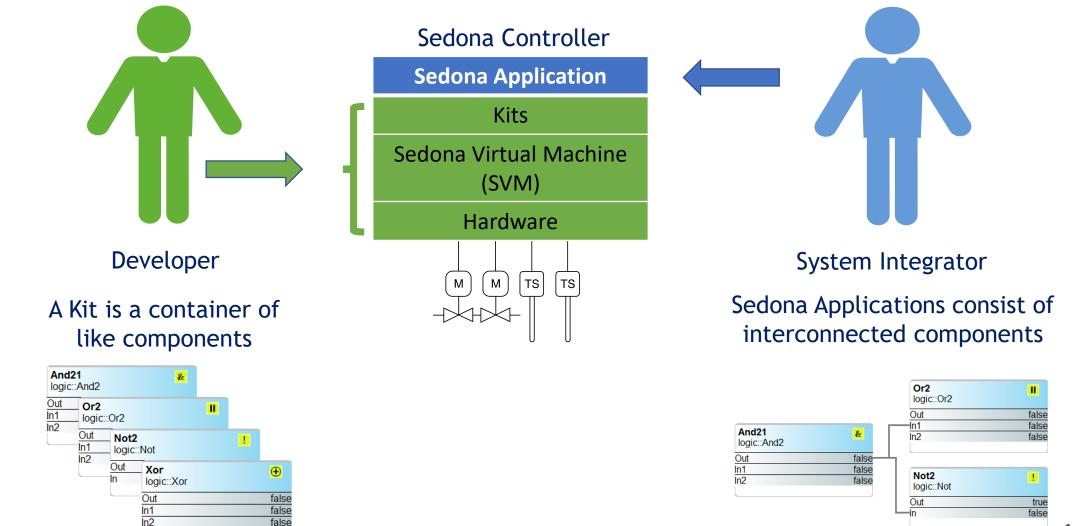




- The Sedona community consists of developers and integrators
- A developer is a skilled software professional or manufacturer who can
 - Create custom components beyond the standard components from Tridium some of which can be shared with others
 - Can modify the sample Sedona Virtual Machine to meet the hardware requirements of the target Sedona device
 - Can develop software tools for editing Sedona applications
- The integrator is a non-programmer with knowledge of control applications
 - Can assemble components onto a wire sheet to create a control strategy meeting a defined Sequence of Operation
 - May share with other integrators proven applications to benefit all integrators



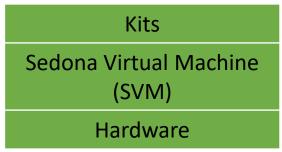
How are Sedona HVAC applications produced?





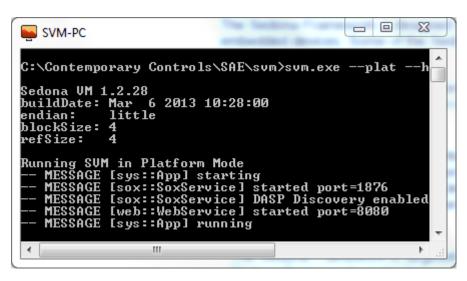
- A Sedona developer is either a hardware manufacturer or a software developer
- Physical hardware such as CPU, memory and I/O need to be designed
- The Sedona Virtual Machine must be modified to accommodate the hardware platform
- Custom kits called hardware-dependent kits need to be developed that support the native functions of the platform
- Once all elements are put together you will have a Sedona device awaiting an application





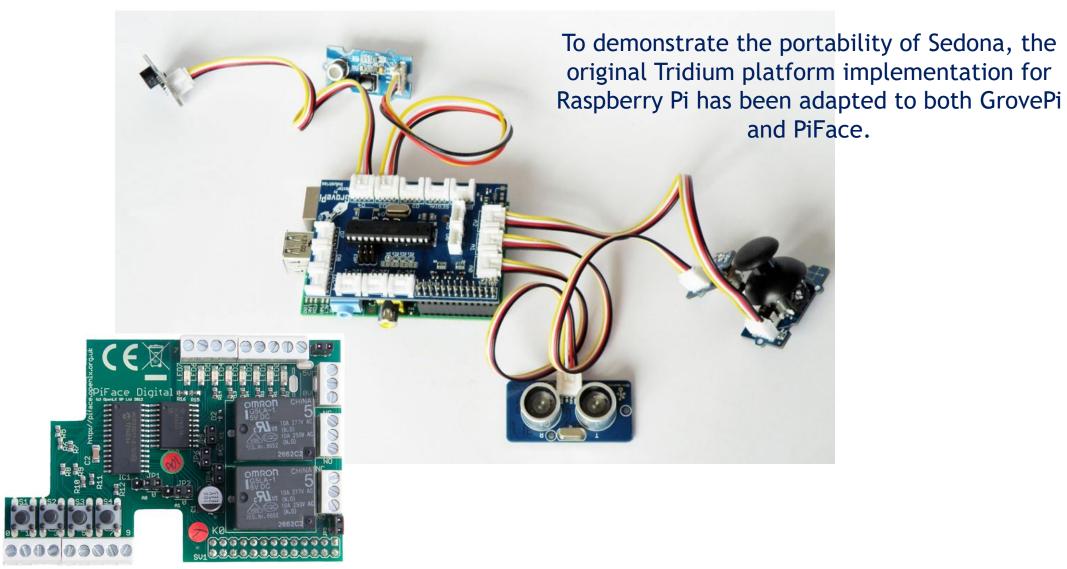


- A Sedona Virtual Machine (SVM) is a small portable fast interpreter that can reside on most any hardware platform or operating system while executing the same Sedona application
- The original Tridium SVM has been modified by developers to run on limited resource microcontrollers, Linux platforms, and powerful Windows workstations
- Intended to operate over IP networks



This SVM runs on a Windows PC

SVMs for Raspberry Pi Extensions





What is the Role of the System Integrator?

- The system integrator translates the required sequence of operation (SOO) into a Sedona application that executes the sequence
- Applications are created by extracting components from kits, placing them onto a wire sheet, configuring the components if necessary, and interconnecting the components with links
- Because of the system integrators' knowledge, the SI recommends to the developer any custom components that need to be developed that can be shared by all





What is the Difference Between Sedona Kits and Components?

- Components are the fundamental building blocks for creating applications
- However, components are deployed into a Sedona device in a container called a kit
- Similar types of components are assigned to kits with relevant names such as Math, Logic, HVAC and so on.
- There are three types of kits
 - Original Sedona 1.2 kits provided by Tridium available to all
 - Custom hardware-independent kits by Sedona developers that can be shared
 - Custom hardware-dependent kits by Sedona developers that cannot be shared
- The spirit of the Sedona Community is to share kits if possible



- With the Sedona 1.2 release, Tridium restructured their Control kit into several smaller manageable kits which we call the Tridium-release kits
- It is recommend that they not be modified from their release form so that they can be shared by the community

basicSchedule	math
datetimeSTD	pricomp
func	sys
hvac	timing
logic	types

There are 69 unique components in these kits



Tridium Time and Schedule Kits – datetimeSTD, basicSchedule

The Scheduling Group scheduling operations based on time of day DailyScheduleBoolDaily ScheduleDailyScheduleFloatDaily ScheduleDateTimeServiceSTDTime of Day —

Daily Schedule Boolean — two-period Boolean scheduler
Daily Schedule Float — two-period float scheduler
Time of Day — time, day, month, year

DateTim datetimeStd::DateT	imeServiceStd
Nanos	53801112500000000
Hour	23
Minute	32
Second	5
Year	2017
Month	1
Day	17
DayOfWeek	2
UtcOffset	C
OsUtcOffset	false
Tz	

DailySc basicSchedule::DailyScheduleBool	-	DailyS1 basicSchedule::DailyScheduleFloat	-
Start1	0:0	Start1	0:0
Dur1	0:0	Dur1	0:0
Start2	0:0	Start2	0:0
Dur2	0:0	Dur2	0:0
Val1	false	Val1	0.0
Val2	false	Val2	0.0
DefVal	false	DefVal	0.0
Out	false	Out	0.0



The Function Group

convenient functions for developing control schemes

Cmpr	Comparison math — comparison (<=>) of two floats
Count	Integer counter — up/down counter with integer output
Freq	Pulse frequency — calculates the input pulse frequency
Hysteresis	s Hysteresis — setting on/off trip points to an input variable
IRamp	IRamp — generates a repeating triangular wave with an integer output
Limiter	Limiter — Restricts output within upper and lower bounds
Linearize	Linearize — piecewise linearization of a float
LP	LP — proportional, integral, derivative (PID) loop controller
Ramp	Ramp — generates a repeating triangular or sawtooth wave with a float output
SRLatch	Set/Reset Latch — single-bit data storage
TickToc	Ticking clock — an astable oscillator used as a time base
UpDn	Float counter — up/down counter with float output

Cmpr		Count 🗾	Lineari Xv	Hystere	IRamp 😁	LP
func::Cmpr		func::Count	func::Linearize	func::Hysteresis	func::IRamp	func::LP
Xgy	false		Out nul		Out 69	
Xey	true	In false	In 0.0	Out false	Min (Sp 0.0
Xly	false	Preset 0	X0 0.0	RisingEdge 50.0	Max 100	Cv 0
Х	0.0	Dir up	Y0 0.0	FallingEdge 50.0	Delta	Out 0.0
Y	0.0	Enable false	X1 0.0		Secs 1	Кр 1
		R false	Y1 0.0			Ki O
			X2 0.0	SRLatch 🔨		Kd 0
Limiter	7		Y2 0.0	func::SRLatch	TickToc 🗠	Max 100
func::Limiter		Ramp 🚾	X3 0.0	Out faise	Torrow To on	Min 0
Out	0.0	func::Ramp	Y3 0.0	S false		Bias 0
In	0.0	Out 84.7	X4 0.0	R false	TicksPerSec	MaxDelta 0
LowLmt	0.0	Min 0.0	Y4 0.0			Direct true
HighLmt	0.0	Max 100.0	X5 0.0			ExTime 1000
		Period 10				ExTINE
		RampType triangle	Y5 0.0			
Freq	N		X0 U.U			
func::Freq			Y6 0.0			
Pps	0		X7 0.0			
Ppm	0		<u>Y7</u> 0.0			
In	false		X8 0.0	CDwn false		
			Y8 0.0	Limit 0.0		
			X9 0.0	HoldAtLimit false		
			Y9 0.0			



LSeq

Reset

ReheatSeq

The HVAC Group

operations that facilitate control

	-
 InMin	0.0
InMax	100.0
NumOuts	16
Delta	5.88
DOn	0
Out1	false
Out2	false
Out3	false
Out4	false
Out5	false
Out6	false
Out7	false
Out8	false
Out9	false
Out10	false
Out11	false
Out12	false
Out13	false
Out14	false
Out15	false
Out16	false
Ovfl	false

Tstat	Thermost
Out2	false
Out3	false
Out4	false
In	0.0
Enable	false
DOn	0
Hysteresis	0.0
Threshold1	0.0
Threshold2	0.0
Threshold3	0.0
Threshold4	0.0

InMin InMax

OutMin OutMax

Reset —	output scal	linear sequence up to for es an input range betwee f temperature controller	•
14100		*** P111	
false	In	0.0 IsHeating	false

Linear Sequencer — bar graph representation of input value

0.0	IsHeating	false
0.0	Sp	0.0
4095.0	Cv	0.0
0.0	Out	false
100.0	Raise	false
	Lower	false



The Logic Group

logical operations using Boolean variables

ADemux2	Analog Demux — Single-input, two-output analog de-multiplexer
And2	Two-input Boolean product — two-input AND gate
And4	Four-input Boolean product — four-input AND gate
ASW	Analog switch — selection between two float variables
ASW4	Analog switch — selection between four floats
B2P	Binary to pulse — simple mono-stable oscillator (single-shot)
BSW	Boolean switch — selection between two Boolean variables
Demuxi2B4	Four-output Demux — integer to Boolean de-multiplexer
ISW	Integer switch — selection between two integer variables
Not	Not — inverts the state of a Boolean
Or2	Two-input Boolean sum — two-input OR gate
Or4	Four-input Boolean sum — four-input OR gate
Xor	Two-input exclusive Boolean sum — two-input XOR gate

ADemux2		ASW4 logic::ASW4	24	And4	ê	Demuxl2	•	ISW Insig: ISW	•	Or2	Ш
logic::ADemux2 Out1	0.0	Out	0.0	logic::And4 Out	false	logic::Demuxl2B4	0	logic::ISW Out	0	logic::Or2 Out	false
Out2	0.0	In1	0.0	In1	false	Out1	true	In1	0	In1	false
In	0.0	In2	0.0	In2	false	Out2	false	In2	0	In2	false
S1	false	In3	0.0	In3	false	Out3	false	S1	false		
		In4	0.0	In4	false	Out4	false			Not	
A CIAL	-	StartsAt	0			StartsAt	0	0-4		logic::Not	<u>.</u>
ASW logic::ASW	-	Sel	0	BSW	3	L		Or4 logic::Or4	Ш	Out	true
Out	0.0			logic::BSW	-	And2	ê	Out	false	In	false
In1	0.0	B2P	N	Out	false	logic::And2	-	in1	false		
In2	0.0	logic::B2P	-	In1	false	Out	false	In2	false	Хог	۲
S1	false	Out	false	In2	false	In1	false	In3	false	logic::Xor	
		In	false	S1	false	In2	false	In4	false	Out	false
								L		In1	false
										In2	false



	Add2	Two-input addition — results in the addition of two floats
	Add4	Four-input addition — results in the addition of four floats
	Avg10	Average of 10 — sums the last ten floats and divides by ten to provide a running average
	AvgN	Average of N — sums the last N floats and divides by N to provide a running average
The Math	Div2	Divide two — results in the division of two float variables
Group	FloatOffset	Float offset — float shifted by a fixed amount
	Max	Maximum selector — selects the greater of two inputs
math-based	Min	Minimum selector — selects the lesser of two inputs
components	MinMax	Min/Max detector — records both the maximum and minimum values of a float
	Mul2	Multiply two — results in the multiplication of two floats
	Mul4	Multiply four — results in the multiplication of four floats
	Neg	Negate — changes the sign of a float
	Round	Round — rounds a float to the nearest N places
	Sub2	Subtract two — results in the subtraction of two floats
	Sub4	Subtract four — results in the subtraction of four floats
	TimeAvg	Time average — average value of float over time

Add2	+	Avg10	٨	Div2	+	Mul4		Min	N	FloatOf	+	AvgN	л
math::Add2		math::Avg10		math::Div2		math::Mul4		math::Min		math::FloatOffset		math::AvgN	
Out	0.0	Out	null	Out	0.0	Out	0.0	Out	0.0	Out	0.0	Out	0.0
In1	0.0	In	0.0	In1	0.0	In1	0.0	In1	0.0	In	0.0	In	0.0
In2	0.0	MaxTime	0	In2	0.0	In2	0.0	In2	0.0	Offset	0.0	NumSamplesToAvg	5
				Div0	true	In3	0.0					Reset	false
						In4	0.0						
MinMax	N	Mul2	× .					Max	× .	TimeAvg	л		
math::MinMax		math::Mul2		Sub2	-			math::Max		math::TimeAvg		Sub4	-
MinOut	0.0	Out	0.0	math::Sub2		Add4	+	Out	0.0	Out	0.0	math::Sub4	
MaxOut	0.0	In1	0.0	Out	0.0	math::Add4	_	In1	0.0	In	0.0	Out	0.0
In	0.0	In2	0.0	In1	0.0		0.0	In2	0.0	Time	10000	in1	0.0
R	false			In2	0.0	In1	0.0					In2	0.0
						In2	0.0	Description			-	In3	0.0
						In3	0.0	Round	•	Neg	-	In4	0.0
						In4	0.0	math::Round	0	math::Neg	0.0		
								Out	0	Out		-	
								IN	0	IN	0.0		
								DecimalPlaces	0				



The Priority Group prioritizing actions of Boolean, Float and Integer variables PrioritizedBool PrioritizedFloat PrioritizedInt

Prioritized Boolean output — highest of sixteen outputs Prioritized float output — highest of sixteen outputs Prioritized integer output — highest of sixteen outputs

Priorit		Priori1		Priori2	
pricomp::PrioritizedBool		pricomp::PrioritizedFloat		pricomp::PrioritizedInt	
SourceLevel	fallback	SourceLevel	fallback	SourceLevel	fallbac
OverrideExpTime	0	OverrideExpTime	0	OverrideExpTime	(
In1	null	In1	null	In1	mi
In2	null	In2	null	In2	mi
In3	null	In3	null	In3	mi
In4	null	In4	null	In4	mi
In5	null	In5	null	In5	mi
In6	null	In6	null	In6	mi
In7	null	In7	null	In7	mi
In8	null	In8	null	In8	mi
In9	null	In9	null	In9	mi
In10	null	In10	null	In10	mi
In11	null	In11	null	in11	mi
In12	null	In12	null	In12	mi
In13	null	In13	null	In13	mi
In14	null	In14	nul	In14	mi
In15	null	In15	nul	In15	mi
In16	null	In16	null	In16	mi
Fallback	null	Fallback	null	Fallback	mi
Out	null	Out	null	Out	mi
MinActiveTime	0				
MinInactiveTime	0				



The System Group

platform and folder components

Folder **RateFolder**

PlatformService Platform service — indicates platform and available memory Folder — when accessed opens to another wire sheet Rate Folder — a folder that can be used for background tasks

Folder sys::Folder	RateFol sys::RateFolder		Platfor sys::PlatformSer	vice
-	AppCyclesToSkip	0	PlatformId	ccontrols-BASC22-3.1.0
			PlatformVer	BAScontrol 2.0.1
			MemAvailable	9024



The Timing Group	DiyOff DiyOn
time-based components	OneShot
· · · · · · · · · · · · · · · · · · ·	Timer

Off delay timer — time delay from a "true" to "false" transition of the input
 On delay timer — time delay from an "false" to "true" transition of the input
 Single Shot — provides an adjustable pulse width to an input transition
 Timer — countdown timer

DlyOff timing::DlyOff	N	DlyOn timing::DlyOn	N	OneShot timing::OneShot	N	Timer timing::Timer	n
Out	false	Out	false	Out	false	Out	false
n	false	In	false	In	false	Run	stop
DelayTime	0.0	DelayTime	0.0	PulseWidth	0.0	Time	0
Hold	0	Hold	0	CanRetrig	false	Left	0



The Types Group variable types and conversion between types	B2F ConstBool ConstFloat ConstInt F2B F2I I2F L2F WriteBool WriteFloat WriteInt	Binary to float encoder — 16-bit binary to float conversion Boolean constant — a predefined Boolean value Float constant — a predefined float variable Integer constant — a predefined integer variable Float to binary decoder — float to 16-bit binary conversion Float to integer — float to integer conversion Integer to float — integer to float conversion Long to float — long integer to float conversion Write Boolean — setting a writable Boolean value Write Float — setting a writable float value Write integer — setting an integer value
--	---	---

ConstBo		ConstFl	•	Constin	•	B2F	-	F2B	-	F2I	-
types::ConstBool		types::ConstFloat		types::ConstInt		types::B2F		types::F2B		types::F2I	
Out	false	Out	0.0	Out	0	Out	0.0	In	0.0	In	0.0
						Count	0.0	Out1	false	Out	0
						In1	false	Out2	false		
Weite De		Maida El		Mathelia		In2	false	Out3	false		
WriteBo types::WriteBool	•	WriteFl types::WriteFloat	•	WriteIn types::WriteInt	•	In3	false	Out4	false	lar	
lypeswniebooi	false	In In Interiority	0.0	In In	0	In4	false	Out5	false	I2F	-
Out	false	Out	0.0	Out	0	In5	false	Out6	false	types::I2F	0
	10.00		0.0		Ĭ	In6	false	Out7	false	Out	0.0
		<u></u>				In7	false	Out8	false	Out	0.0
						In8	false	Out9	false		
						In9	false	Out10	false		
						In10	false	Out11	false	L2F	≠
						In11	false	Out12	false	types::L2F	
						In12	false	Out13	false	In	0

In13

In14

In15

In16

0.0

Out

false

false

false

false

Out14

Out15

Out16

Ovrf

false

false

false

false



Custom Hardware – Independent Kits Developer Supplied

- All non-Tridium-Release kits are called custom kits
- Custom kits that operate independent of specific hardware are called hardware-independent kits
- Unlike Tridium-release kits, custom kits must be identified by their developer
- It is encouraged that custom hardware-independent kits be shared by the Sedona community

There are numerous custom kits and components from the Sedona community



Custom Hardware – Independent Kit Function – CControls_Function

Custom Functions collection of helpful components	Cand2 Cand4 Cand6 Cand8 Cmt Cor2 Cor4 Cor6 Cor8 Cor8	Two-input Boolean product — two-input AND/NAND gate with complementary outputs Four-input Boolean product — four-input AND/NAND gate with complementary outputs Six-input Boolean product — six-input AND/NAND gate with complementary outputs Eight-input Boolean product — eight-input AND/NAND gate with complementary outputs Comment — comment field up to 64 characters Two-input Boolean sum — two-input OR/NOR gate with complementary outputs Four-input Boolean sum — four-input OR/NOR gate with complementary outputs Six-input Boolean sum — six-input OR/NOR gate with complementary outputs Circlinput Boolean sum — eight-input OR/NOR gate with complementary outputs Fight-input Boolean sum — eight-input OR/NOR gate with complementary outputs Circlinput Boolean sum — eight-input OR/NOR gate with complementary outputs Fight-input Boolean sum — eight-input OR/NOR gate with complementary outputs	
	Dff FtoC HLpre PsychrE PsychrS SCLatch	"D" Flip-Flop — D-style edge-triggered single-bit storage °F to °C — Fahrenheit to Celsius temperature conversion High-Low Preset — defined logical true and false states Psychrometric Calculator — English units Psychrometric Calculator — SI units Set/Clear Latch — level-triggered single-bit data storage "D" Flip-Flop — D-style edge-triggered single-bit data storage "D" Flip-Flop — D-style edge-triggered single-bit data storage "D" Flip-Flop — D-style edge-triggered single-bit data storage	l by

SCLatch N	Cand2 🔒	Cand4 🕹	Cand6 🕹	Cand8 🔒	PsychrE ≠	CtoF 🗾 💆
CControls Function::SCLatch	CControls Function::Cand2	CControls Function::Cand4	CControls Function::Cand6	CControls Function::Cand8	CControls Function::PsychrE	CControls Function::CtoF
Set false	Inp1 false	Inp1 false	Inp1 false	Inp1 false	InTempDegF 0.0	InTempDegC 0.0
Clear false	Inp2 false	Inp2 false	Inp2 false	Inp2 false	InRelativeHumidityPct 0.0	OutTempDegF 32.0
Out false	Out false	Inp3 false	Inp3 false	Inp3 false	OutDewPointDegF 0.0	
OutNot true	OutNot true	Inp4 false	Inp4 false	Inp4 false	OutEnthalpyBtu_per_lb 0.0	HLpre
		Out false	Inp5 false	Inp5 false	OutSatPressure_psi 0.0	CControls Function::HLpre
		OutNot true	Inp6 false	Inp6 false	OutVaporPressure_psi 0.0	Out true
Cmt 🐣	Cor8 II		Out false	Inp7 false	OutWetBulbTempDegF 0.0	OutNot false
CControls Function::Cmt	CControls Function::Cor8		OutNot true	Inp8 false		Cutivot
Comment	Inp1 false	Cor6		Out false		
	Inp2 false	CControls Function::Cor6		OutNot true	PsychrS =	Dff N
	Inp3 false	Inp1 false	Cor4	Cutivot true	CControls Function::PsychrS	CControls Function::Dff
	Inp4 false	Inp2 false			InTempDegC 0.0	Preset false
FtoC 🔽	Inp5 false	Inp3 false	CControls Function::Cor4		InRelativeHumidityPct 0.0	
CControls Function::FtoC	Inp6 false		Inp1 false	Cor2 II		
InTempDegF 0.0			Inp2 false	CControls Function::Cor2	OutDewPointDegC 0.0	
OutTempDegC -17.77	Inp7 false	Inp5 false	Inp3 false	Inp1 false	OutEnthalpy_kJ_per_kg 0.0	
	Inp8 false	Inp6 false	Inp4 false	Inp2 false	OutSatPressure_kPa 0.0	Out false
	Out false	Out false	Out false	Out false	OutVaporPressure_kPa 0.0	OutNot true
	OutNot true	OutNot true	OutNot true	OutNot true	OutWetBulbTempDegC 0.0	



Custom Hardware – Independent Kit HVAC Kit – CControls_HVAC

	AnaHiLo	Analog High/Low — analog variable out-of-range limit or detection
	AntiSCY	Anti-Short Cycle — minimum run time and minimum start time limiter
Custom	BTUh	BTU/Hour Calculator — calculates energy usage based on temperature difference and flow
HVAC	NumDamp	Numeric Dampener — digital filter dampens amplitude and rate changes
advanced HVAC	EnhPID	Enhanced PID Loop Controller — same as LP component except with better output control
	LeadLag	Lead Lag Sequence Controller — lead/lag control for up to four devices
components	OATrueB	Outside Air True Blend — percentage of outside air based on OAT, MAT and RAT
	RnProof	Run Proving — verifies that a commanded device indeed executes
	TockTic	Period Driven Clock — similar to TickToc component but with period control

AnaHiLo	N	EnhPID •	LeadLag	N	NumDamp	N	BTUh	N	RnProof 💦	OATrueB	N
CControls HVAC::A	naHiLo	CControls HVAC::EnhPID	CControls HVAC::	LeadLag	CControls HVAC::NumDamp		CControls HVAC::BTUh		CControls HVAC::RnProof	CControls HVAC::OATr	ueB
LimitDelay	1	Enable true	RunTime	10	UpdateInterval	5	ExeDelay	0	ProofDelay 1	ExeDelay	1
HiLimit	10	Sp 0.0	ProofDelay	1	RiseIncrement	0.5	OffCal	0.0	In false	OffCal	0.0
LoLimit	-10	Cv (OverlapTime	0	FallDecrement	0.5	InGPM	0.0	Proof false	OutsideAT	0.0
Differential	0.1	Out 0.0	OutQty	Two	RiseDampInhibit	false	InTemp	0.0	Out false	ReturnAT	0.0
HoldAtLimit	false	Кр	In	false	FallDampInhibit	false	OutTemp	0.0	OutNot true	MixedAT	0.0
LimitOutEnable	false	Ki (OutA	false	In	0.0	Out	0.0	Fail false	Output	0.0
In	0	Kd (OutB	false	Out	0.0	TonOutR	0.0	Faillnhibit false	Fault	true
Out	0	Max 100	OutC	false			TonOutC	0.0			
OverLimit	false	Min (OutD	false							
UnderLimit	false	Bias (ProofA	false	AntiSCY 🔉						
		MaxDelta (ProofB	false	CControls HVAC::AntiSCY		TockTic	200	This cust	om kit was	
		Direct true	ProofC	false	MinRunTime 1		CControls HVAC::TockTi	с	THIS CUS	UIII NIL Was	
		ExTime 1000	ProofD	false	MinOffTime 1		Period	1.0	dovol	oped by	
			Alarm	false	In false		Enable	true	uevei	oped by	
		*			Out false		Out	true	Contempo	rary Control	lc
			7		Reset false				contempo	ary control	(S



Custom Hardware – Independent Kit Math Kit – CControls_Math

Custom MATH

accommodate configurable inputs

Add Add two with configurable inputs — results in the addition of two floats
Sub Subtract two with configurable inputs — results in the subtraction of two floats
Mul Multiply two with configurable inputs — results in the multiplication of two floats
Div Divide two with configurable inputs — results in the division of two float variables

Add	+	Sub	-	Mul		Div	+
CControls Math::Add		CControls Math::Sub		CControls Math::Mul		CControls Math::Div	
np1	0.0	Inp1	0.0	Inp1	0.0	Inp1	0.0
np2	0.0	Inp2	0.0	Inp2	0.0	Inp2	0.0
Dut	0.0	Out	0.0	Out	0.0	Out	0.0
						Div0	true

This custom kit was developed by Contemporary Controls



Hardware – Dependent Components BAScontrol20

		UIS BII BIZ BI3 BI4	C HI COM CHASSIS
ni	UIS_UIS	BI1	LED Power 24 VDC :10% 4W 24 VAC :10% 6W 47-63 Hz H1: DC+ or AC H1 COM: DC COM or AC L0 CAss 2 Circuits Only
13	UI7	813 814	
oi	B01	BAScontrol	Contraction
03	802 803	IP	IND. CONT. EQ. 4EA4 Ethernet
	A04 B01 B02 B0 A C A B A B A	Default = 192.168.92.68 Reset IP B A B ↓	/24 LED Solid - Link Flashing = Data

A01-A04	Analog output — analog output voltage point
BI1-BI4	Binary input — binary input point
B01-B04	Binary output— binary output point
UI1-UI8	Universal input — binary, analog, thermistor, resistance or accumulator
ScanTim	Scan time monitor— records the min, max and average scan times
UC1-UC4	Retentive universal counters — up/down retentive counters
VT01-VT24	Virtual points — share wire sheet data with BACnet/IP clients
WC01-WC48	Web components — share wire sheet data with controller web pages

	UC4		VT8		WC01	WahuWOOd	ScanTim	
CControls BASC20 IO::UI6 ChnType Input10V	CControls BASC20 Initialized	true	CControls BAS(Initialized	true	CControls BASC20 WcType	Input	CControls BASC20 I SampleSize	0::ScanTim 10
OutF 0.00	Count	0	ChnType	FloatInput	MinVal	0.0	TimeMs	44
OutB false	CountF	0.0	Reset	false	MaxVal	100.0	MinimumMs	43
Outl 0	Ovf	true	FloatV	0.0	FltVal	0.0	MaximumMs	49
	Clk	false	BinaryV	false	IntVal	0	AverageMs	43
	Enable	true	WireSheet	InputTo	BinVal	false	Reset	false
	Rst	false						
AO4	CDwn	false						
CControls BASC20 IO::A04	Limit	0	BI4		BO2	plat		
InpF 0.0	HoldAtLimit	false	CControls BASC	C20 IO::BI4	CControls BASC20 IO:	BO2 CContro	s BASC20 Platform::BAS	C20PlatformService
Enable true			OutB	true	InpB	false Platformk	1	ccontrols-BASC20-3.1.0
					Enable	true Platform\	/er	BAScontrol 2.0.1
						MemAvai	lable	19560

Hardware-dependent components cannot be shared because they use native functions.



Hardware – Dependent Component for the Metz DIO 4/2 MS/TP I/O Module

DIO4_2	•
CControls CubelO::DI	04.2
Devinstance	-1
Inp1Use	NotUsed
Inp2Use	NotUsed
Inp3Use	NotUsed
Inp4Use	NotUsed
Out1Use	NotUsed
Out1Priority	10
Out2Use	NotUsed
Out2Priority	10
Inp1	false
Inp2	false
Inp3	false
Inp4	false
Out1	false
Relinguish1	false
Out2	false
Relinquish2	false
Status N	otConfigured



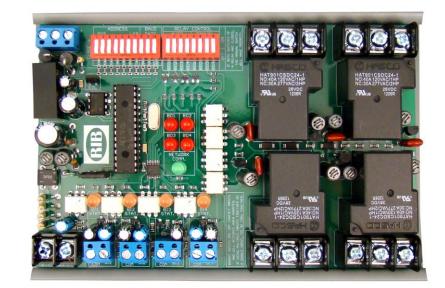
A custom component can be made to drive a remote I/O module from a BACnet client controller over MS/TP.



Hardware – Dependent Component for the RIBMW24B-44 MS/TP I/O Module

MW24B	•
CControls RIB::MW2	4B
DevInstance	-1
Inp1Use	NotUsed
Inp2Use	NotUsed
Inp3Use	NotUsed
Inp4Use	NotUsed
Out1Use	NotUsed
Out1Priority	10
Out2Use	NotUsed
Out2Priority	10
Out3Use	NotUsed
Out3Priority	10
Out4Use	NotUsed
Out4Priority	10
Inp1	false
Inp2	false
Inp3	false
Inp4	false
Out1	false
Relinquish1	false
Out2	false
Relinquish2	false
Out3	false
Relinquish3	false
Out4	false
Relinguish4	false
Status I	NotConfigured

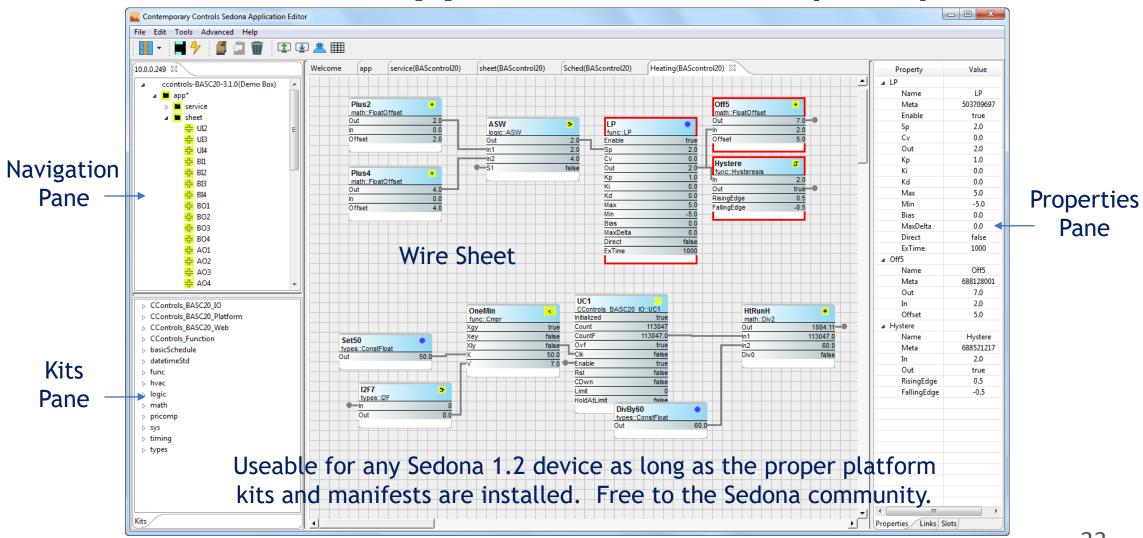




Although BACnet compliance is not necessary with Sedona, the combination can be advantageous.



Sedona Tool Sedona Application Editor (SAE)





Example HVAC Application Adding an Economizer to an RTU

- With Sedona you have a freely-programmable controller that is capable of implementing several HVAC applications.
 - Multi-stage heating/cooling rooftop unit (RTU) with economizer
 - Air-handing unit (AHU) with analog heating/cooling valves
 - Fan-coil unit (FCU)
 - Make-up air unit (MAU)
 - Energy Recovery Ventilation (ERV) unit
- In this example a 22-point Sedona controller was installed during an RTU retrofit of an economizer requiring the installation of mixed-air and outside air sensors
- By having a BACnet compliant controller, performance of the economizer was easy to monitor with a BACnet client



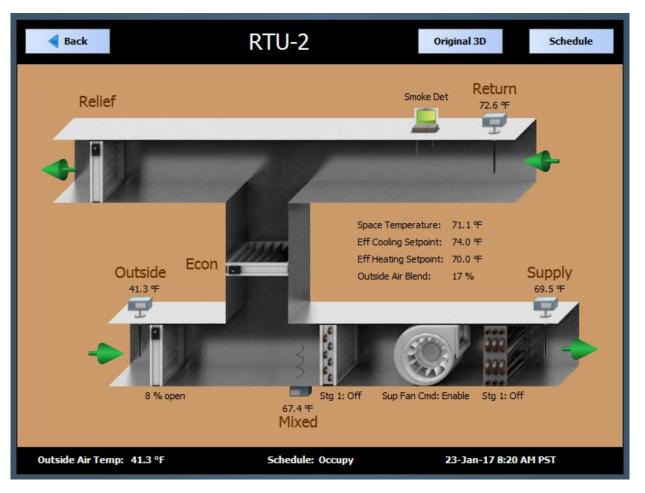
Example RTU Application Work of an Integrator

ر		In	72.	.151		×	72
ZN_TEMP		DecimalPlac				Y	230
Initialized true		Y_limT					
ChnType Thm10KT3		types::Con	stEloat				
OutF 72.15		Out		30.0	0		
OutB false					Cmt2 CControls Functi	a au Cart	
Outl 72		·			Comment	0=LocalZnSensor, 1:	-BAS/Network 7
Reset false						0-2008/2110011301, 14	-DAGMONTON 2
ZNT_NET CControls BASC22 IO::VT02 Initialized true		ZNT_SEL CControls BA WcType	SC22 Web::WC	:16 Input	DlyOn2 timing::DlyOn Out	N false	
ChnType FloatInput		MinVal		0.0	In	false	
Reset false		MaxVal		100.0	DelayTime	6.0	
FloatV 0.0		FltVal		0.0	Hold	0	
BinaryV false		IntVal		0			
WireSheet InputTo		BinVal		false			
CControls BASC22 Web::WC15 WcType MinVal MaxVal FitVal IntVal BinVal	Input 0.0 100.0 70.0 70 true				f	LimitSP func::Limiter Out In LowLmt HighLmt	68.48 68.48 50.0 90.0
ZNL_SET CControls BASC22 IO::UI2 Initialized true ChnType Resistance OutF 3650.45- OutB false	Out In	Round 3	,650.5 50.459 1 Ir	OHMS hvac::Reset Dut n nMin nMax	<u>≰</u> 3484.16 3650.5 20.0 10440.0	Z_SETPT hvac::Reset Out In InMin InMax	68.48 3484.26 0.0 10000.0

Hardware-dependent, hardwareindependent and Tridium-release components were assembled onto wire sheets and interconnected to create the logic for setpoint, mode, heating and cooling, as well as economizer control. A BACnet client provided an occupancy schedule. By adding an economizer, demand control ventilation was obtained.



"H" Diagram of Typical Rooftop Unit w/Economizer



Sedona provides the control while a BACnet client provides the supervision and graphics





Rooftop unit (RTU) with two-stages of heating and cooling plus economizer was upgraded to Sedona when the economizer was installed



- The graphical experience of selecting components, configuring parameters, and linking components to create applications is easy to do and to explain to others
- The technology is open source and supported by several companies so the opportunity exists to share experiences
- A community exists of users who create applications and developers who make components and virtual machines
- The technology is portable to other platforms and will run on a small micro-controller or a powerful computer
- The opportunity exists to share in the exchange of custom components and kits within the community
- Program debugging is fast because the affect of any change is seen instantly

For those familiar with Tridium's Niagara Framework, learning Sedona Framework will require minimal effort.



- The best way to learn Sedona is to try it by downloading SAE and connecting to the SVM-PC that will run on your computer and then create a program
- Community member Contemporary Controls has a multi-part video series on its website devoted to SAE
- There is ample help files in SAE that explain the functioning of the components

SAE Part 1: Introduction Video (8:50)

Introduction to the Sedona Application Editor (SAE) which allows graphical and BASremote.

SAE Part 2: Variable Types Video (6:48)

This video introduces users to the different variable types in the Sedona A

SAE Part 3: Logic Kit Video (9:07)

This video introduces users to the different components located within the components.

SAE Part 4: Math Kit Video (9:11)

This video introduces users to the different components located within the components.

SAE Part 5: Timers and Counters Video (13:28)

This video introduces users to the different timers and counters available t time-critical routine can be implemented.

SAE Part 6: HVAC Kit Video (13:24)

This video introduces users to the different components located within the as example applications created using the components.

SAE Part 7: Introduction to the Kit Manager Video (9:37)

This video introduces users to the Kit Manager and details how to install ar

Thank You



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