

Highly secure cloud-enabled Industrial IoT suite

Internet-of-Things Conference
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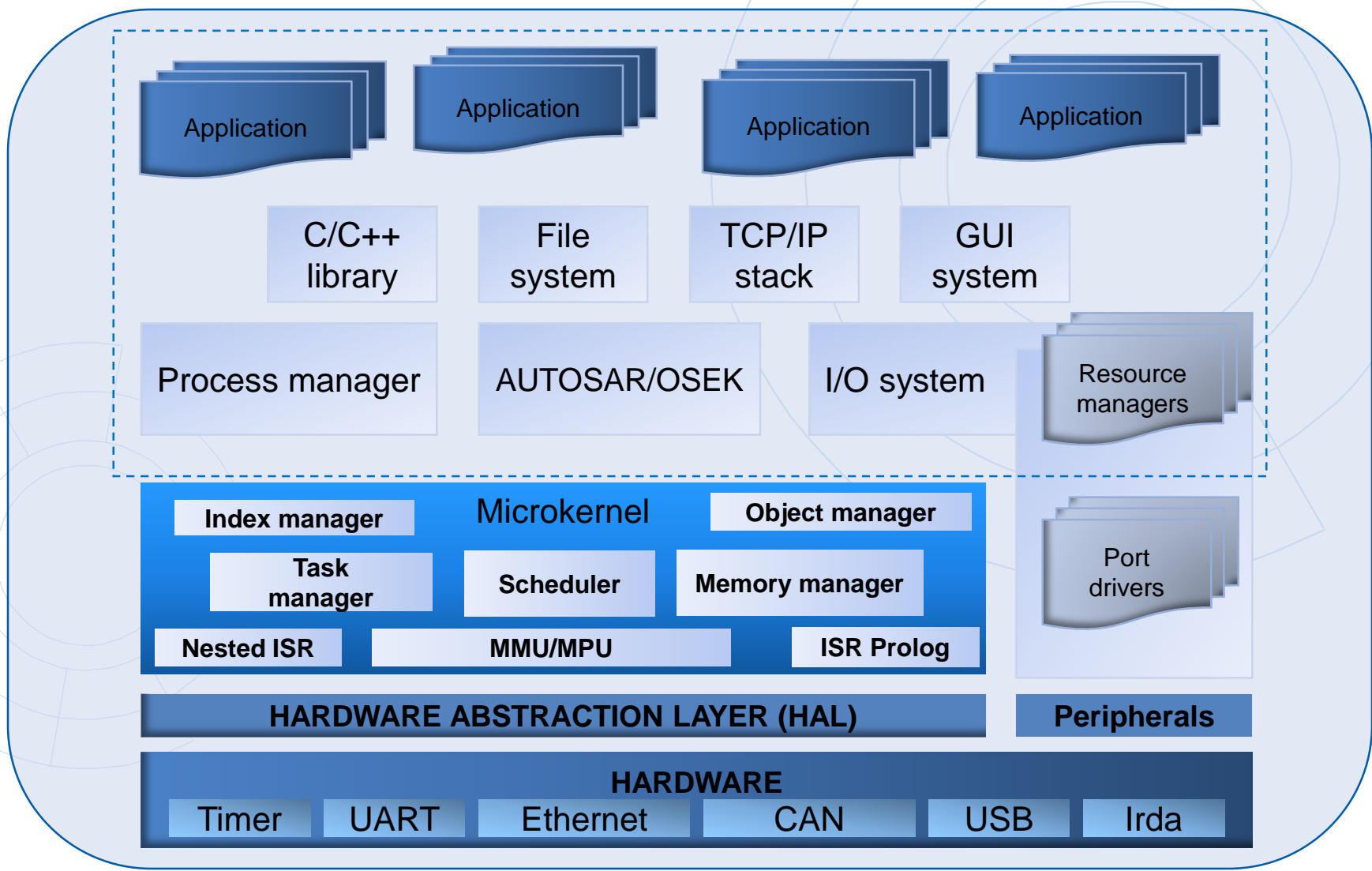
EUROS Embedded Systems GmbH

An embedded systems pioneer!

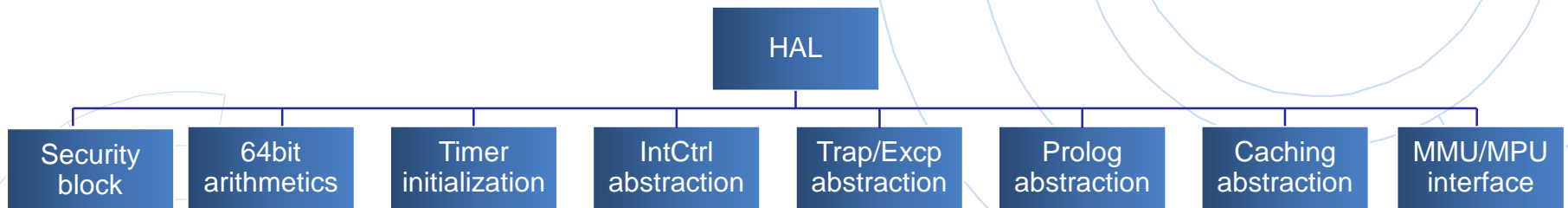
Agenda

- System concepts of the scalable RTOS EUROS
- Cross-Development Environment (IDE):
 - EUROS Embedded Studio®
 - EUROSscope, EUROSsfr, EUROScli, EUROSobjects,
 - EUROStrace, EUROScovrage, EUROSanalyze
- OPC UA Stack Implementation under EUROS
 - memory footprints, characteristics
 - security aspects
- Cloud SoftSPS
- The EUROS Industrial IoT Suite

System concepts of the RTOS EUROS



Hardware Abstraction Layer





EUROS

Cross-Development Environment

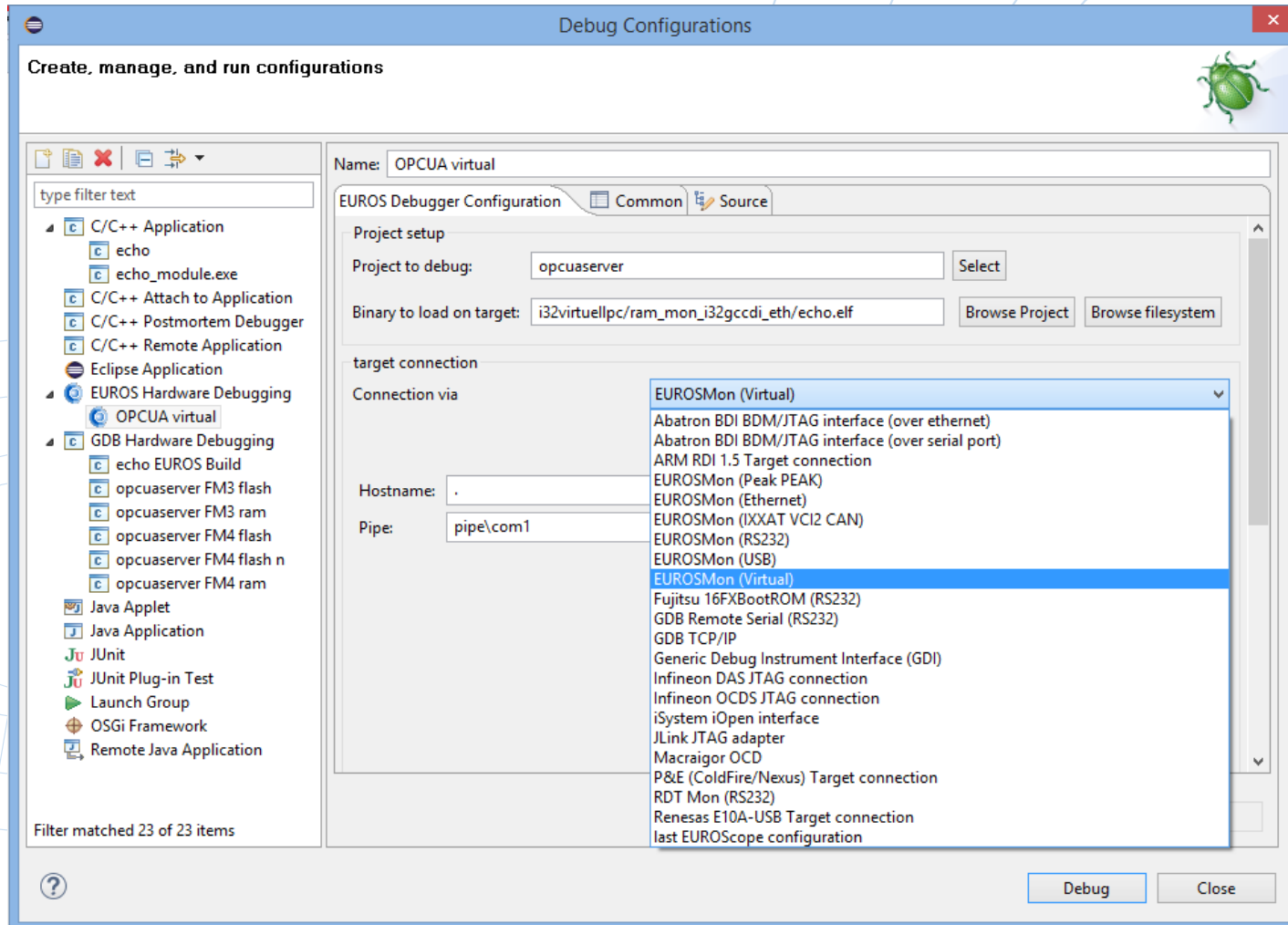
Eclipse-based, Cross-Development Environment

EUROS Embedded Studio[®] provides all functionalities required for modern cross-development:

- File and revision management
- Code generation, parsing and preprocessing
- Symbolic Source Code Debugger
- Multiple tool chain configuration and error parsing support
- On-the-fly code analysis with support for coding rules
- Integration of user-defined tools
- Context sensitive help system
- etc.

Unique features

- Wizard-guided basic configuration including:
 - Memory mapping of the target system
 - Selection from the following target and debug connections:
 - BDM, serial, USB, CAN, arcnet
 - Ethernet, SDB, OCD
 - Real-Time Debug Agent (EUROSSrda)
- Wizard-guided system configuration
- Wizard-guided OPC UA configuration



The screenshot shows the 'Debug Configurations' dialog in Eclipse IDE. The configuration is named 'OPCUA virtual' and is of type 'EUROS Debugger Configuration'. The 'Project to debug' is 'opcuaserver' and the 'Binary to load on target' is 'i32virtuellpc/ram_mon_i32gccdi_eth/echo.elf'. The 'target connection' is 'EUROSMon (Virtual)'. The 'Pipe' is 'pipe\com1'. The 'Connection via' dropdown menu is open, showing a list of connection options.

Name: OPCUA virtual

EUROS Debugger Configuration | Common | Source

Project setup

Project to debug:

Binary to load on target:

target connection

Connection via: **EUROSMon (Virtual)**

Hostname:

Pipe:

Connection via options:

- Abatron BDI BDM/JTAG interface (over ethernet)
- Abatron BDI BDM/JTAG interface (over serial port)
- ARM RDI 1.5 Target connection
- EUROSMon (Peak PEAK)
- EUROSMon (Ethernet)
- EUROSMon (IXXAT VCI2 CAN)
- EUROSMon (RS232)
- EUROSMon (USB)
- EUROSMon (Virtual)**
- Fujitsu 16FXBootROM (RS232)
- GDB Remote Serial (RS232)
- GDB TCP/IP
- Generic Debug Instrument Interface (GDI)
- Infineon DAS JTAG connection
- Infineon OCDS JTAG connection
- iSystem iOpen interface
- JLink JTAG adapter
- Macraigor OCD
- P&E (ColdFire/Nexus) Target connection
- RDT Mon (RS232)
- Renesas E10A-USB Target connection
- last EUROScope configuration

EUROSubjects

SFR view

EUROSubjects

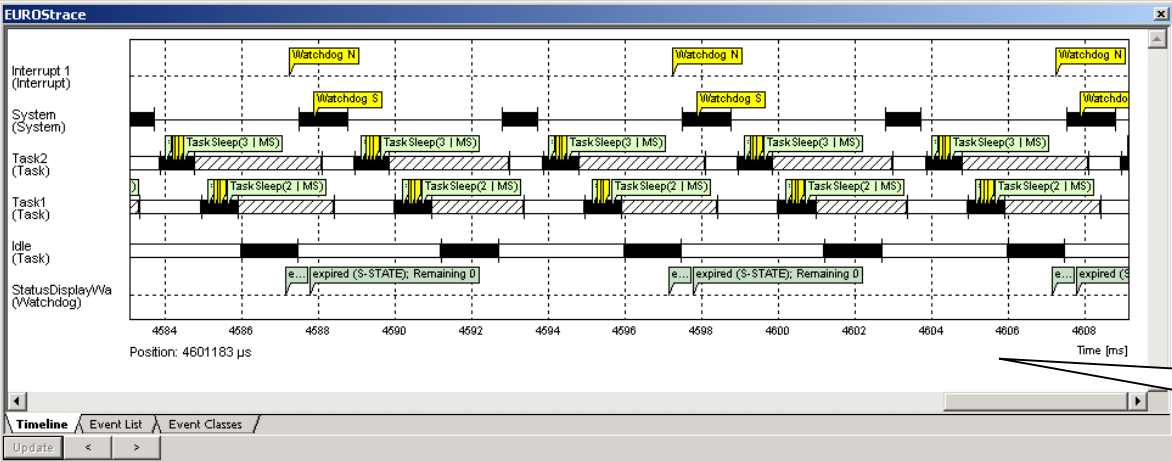
- Task
 - Idle
 - Task1**
 - Task2
- Watchdog
 - StatusDisplayWa

Task/Task1
(Task Object)

Id	13
Mode	0
Priority	10
Time Slice (reload)	25
Time Slice (current)	25
Function	0x2202FE (= &_Task)
Status	ready
Flags	0
Stack	0x201EC0..0x2020F2 (562 Byte)
Events	0000000000000000
Signals	0000000000000000
Last erno	0000000000000000
Last erno_loc	at user specific location
Last erno_id	16191

SFR: c167cs.sfr

Register	Address	Value	Description
C167CS	0x0		Central Processing Unit
CPU	0x0		External Bus Interface
EBI	0x0		Asynchronous/Synchronous Serial Interface
ASCO	0x0		Serial Channel 0 Baud Rate Generator Reload Register
S0BG	0xFEB4	0x0002	Serial Channel 0 Transmit Buffer Register
S0TBUF	0xFEB0	0x007E	Serial Channel 0 Receive Buffer Register
S0RBUF	0xFEB2	0x007E	Serial Channel 0 Control Register
S0CON	0xFFB0	0x8011	Serial Channel 0 Transmit Interrupt Control Register
S0TIC	0xFF6C	0x0080	Serial Channel 0 Receive Interrupt Control Register
S0RIC	0xFF6E	0x007C	Interrupt Request Flag
IR	bit 7	0: Disabled	Interrupt Control
IE	bit 6	1: Enabled	Interrupt Priority Level
ILVL	bits 2..5	15: Highest	Group Level Priority
GLVL	bits 0..1	0: Lowest	Serial Channel 0 Error Interrupt Control Register
S0EIC	0xFF70	0x0000	Serial Channel 0 Transmit Buffer Interrupt Control Register
S0TIC	0xFF9C	0x0080	Port 3 Register
P3	0xFFC4	0x1C18	Port 3 Direction Control Register
DP3	0xFFC6	0x0400	



EUROTrace

Profiling Tools (cont.)

Call tree /
Cross reference

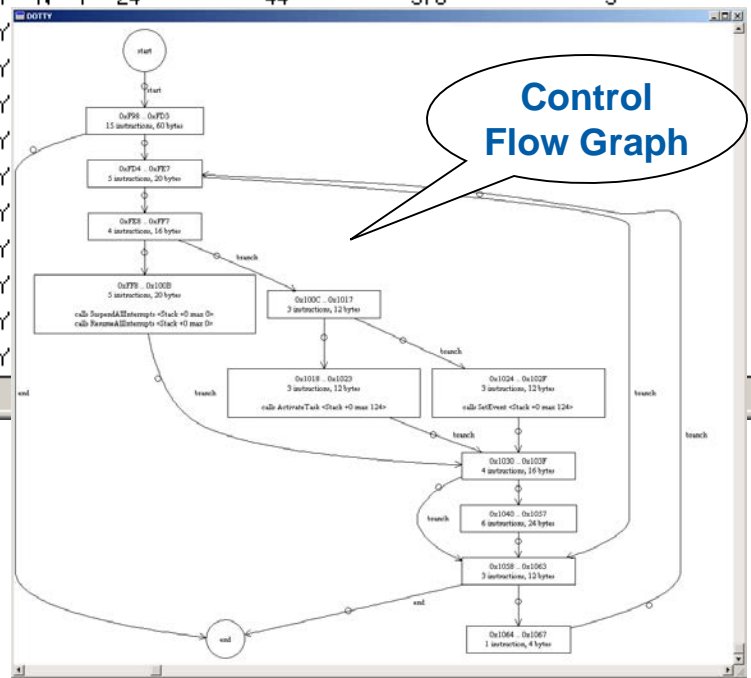
Stack usage

Code size,
of sequential
code blocks

Function	Address	Module	A	R	T	U	S	Stack usage	Stack (sum)	Code size (bytes)	Sequence Blocks
main()	0x78	steuerung	Y	N	Y	N	Y	16	140	28	1
StartOS()	0x9C4	strtos	Y	N	N	N	Y	24	124	492	17
_IntDisable	0x1C8	_switch	Y	N	Y	N	Y	0	0	16	1
_InitContext()	0xD8C	_ictxt	Y	N	Y	N	Y	24	44	376	5
StartupHook()	0xC8	steuerungcfg	Y	N	Y						
_Reschedule()	0x10D8	_rschd	Y	N	Y						
_IntEnable	0x1D8	_switch	Y	N	Y						
_EnqueueContextLast()	0xFB4	_nqlst	Y	N	Y						
Task1Func()	0x94	steuerung	Y	N	Y						
Task2Func()	0xA8	steuerung	Y	N	Y						
ErrorHook()	0xBC	steuerungcfg	Y	N	Y						
PreTaskHook()	0xC0	steuerungcfg	Y	N	Y						
PostTaskHook()	0xC4	steuerungcfg	Y	N	Y						
StartupHook()	0xC8	steuerungcfg	Y	N	Y						

Control
Flow Graph

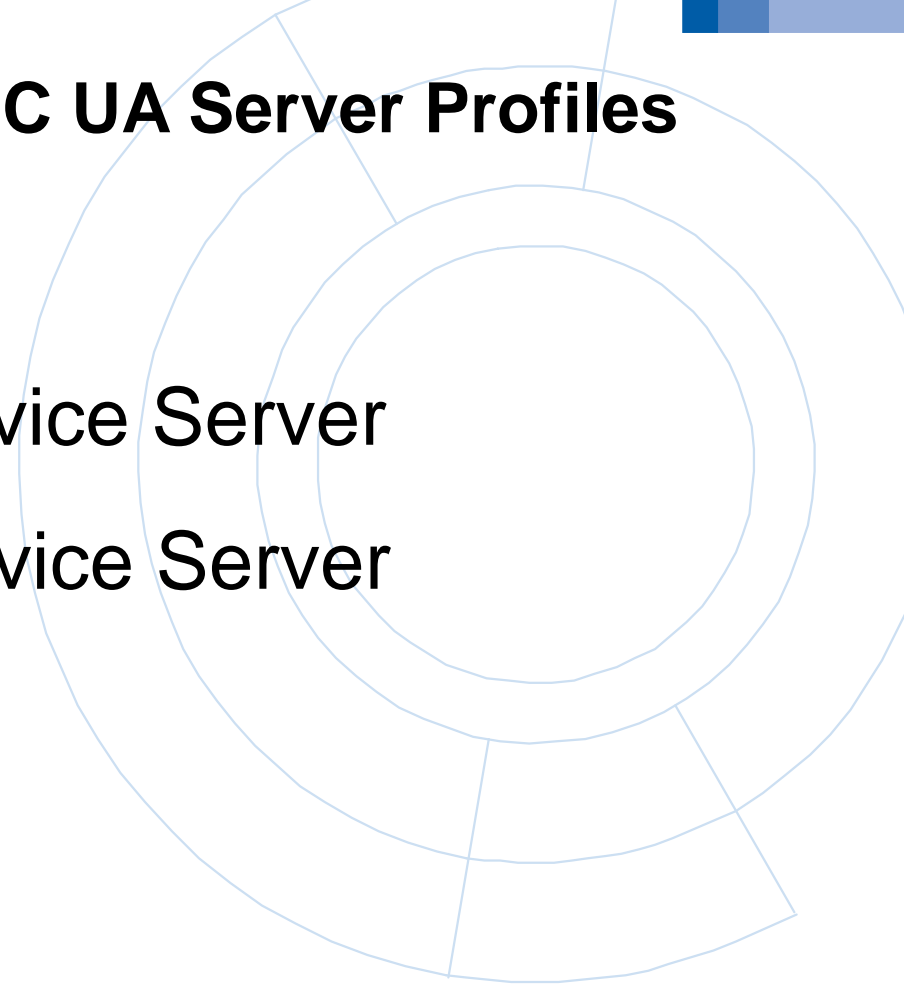
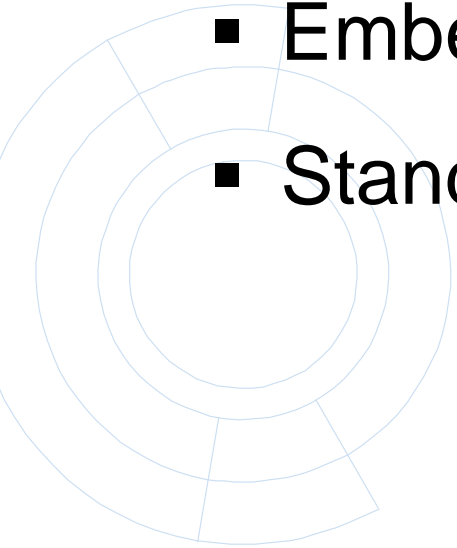
Analyses machine code
– no source code needed!





Implementation of the Embedded OPC UA Stack under EUROS

- Nano Embedded Device Server
- Micro Embedded Device Server
- Embedded Server
- Standard Server



- Minimal functionality of a OPC UA server
- Only one session (connection to a client) guaranteed
- No encryption
- No data monitoring, i.e. the data has to be queried by the client

Micro Embedded Device Server

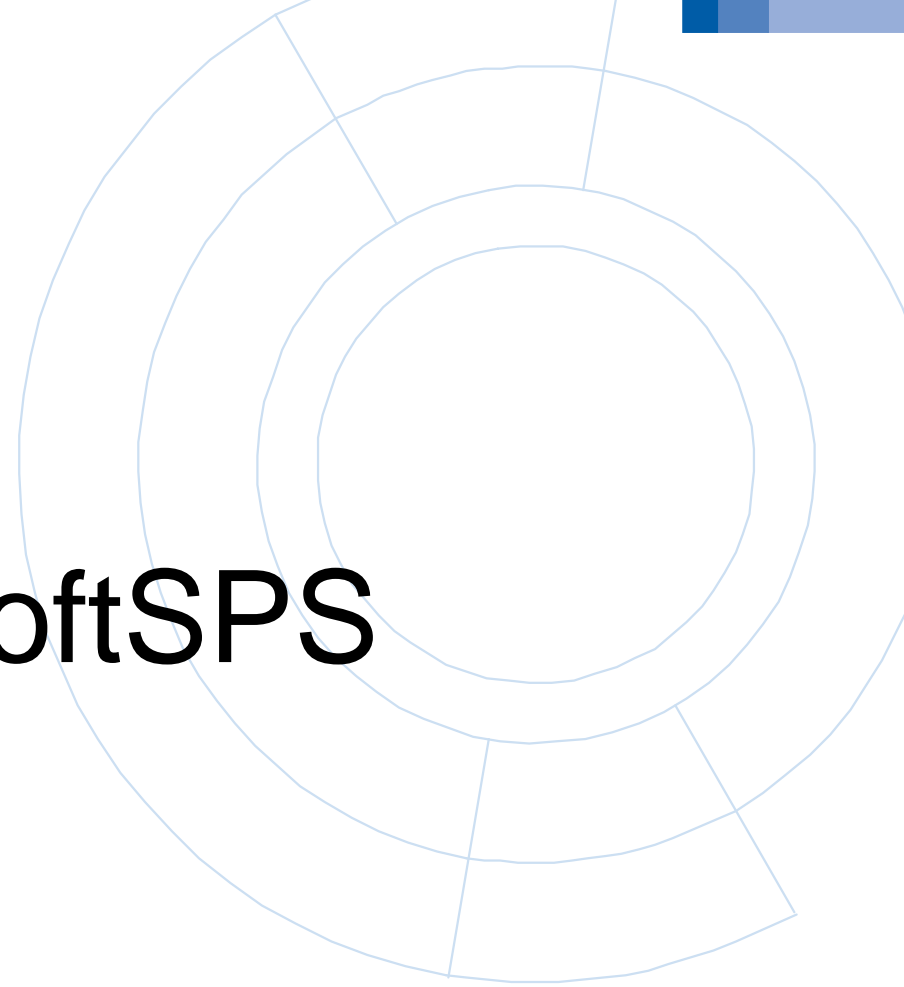
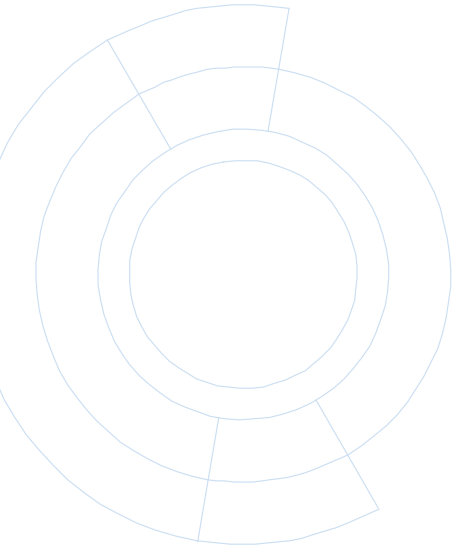
- Additional functionality in comparison to the Nano Embedded Device Server:
 - Two parallel sessions allowed
 - Data can be monitored (i.e., the server sends regularly the specified data to the client)
 - Own data types can be defined within data hierarchies

- Additional functionality in comparison to the Micro Embedded Device Server :
 - Encryption and authentication via X.509 certificates
 - Asymmetric encryption: PKCS #1 compliant RSA
 - Symmetric encryption: AES for 128 bit key length
 - Method calls: Server performs actions according to the corresponding input parameters and returns a result to the calling client
 - Data can be associated with measuring units

Standard OPC Server

- It has the full functionality of OPC UA
- Compared with the other profiles, mainly improved capacity
- Additional functionality compared to the embedded OPC UA server :
 - Change of a logged-in user within the same session is possible
 - Diagnostic capabilities

Cloud SoftSPS

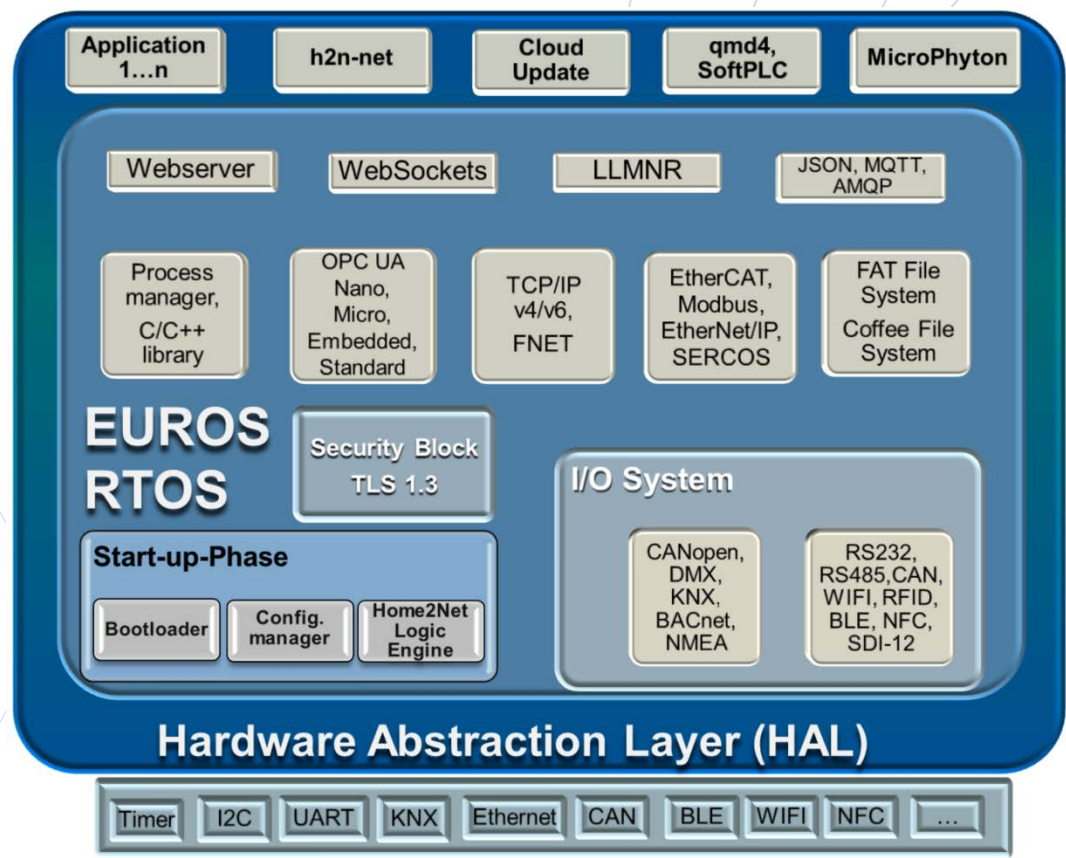


Cloud SoftSPS

- An IEC 61131 compliant integrated development environment
- HTML5 based
- Completely independent of the host operating system and the used web browser
- Easy-to-use web-based programming/configuring suite
- Secure cloud connection

EUROS Industrial IoT Suite

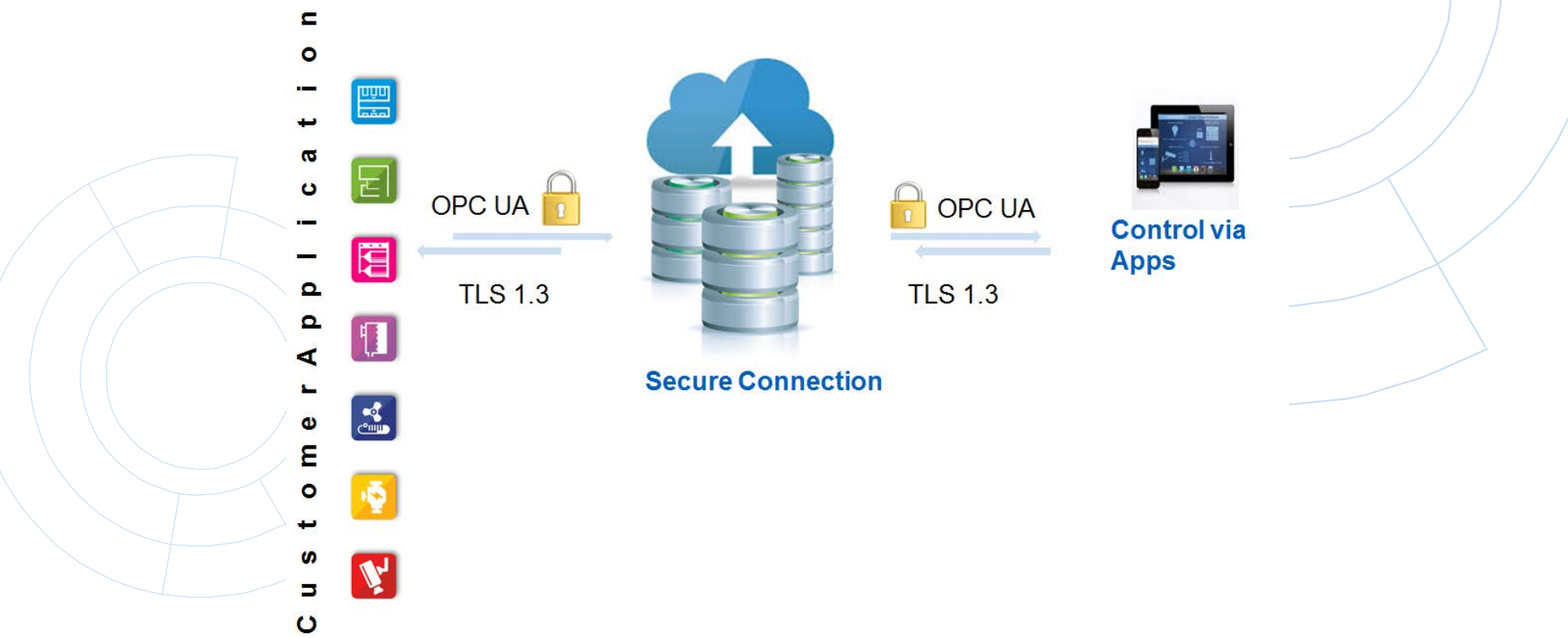
The background features two large, light blue circular diagrams. Each diagram consists of three concentric circles with radial lines extending from the center to the outer edge, dividing the circles into segments. One diagram is positioned on the left side, and a larger one is on the right side.



EUROS Industrial IoT Suite – a powerful Software Suite

- **High-performance RTOS EUROS:**
 - Highly hardware independent
 - Modular object design
 - Extremely scalable
- **A wide number of firmware adaptations:**
 - All common driver packages, network protocols, middleware, file systems, USB host stack, OPC UA stack, etc.
- **Comprehensive cross-development environment:**
 - Automatic system configuration
 - Profiling tools for static and dynamic analyses

Optimal end-to-end encryption without gateways



Industrial IoT Suite – a uniform solution from device to the cloud



Industrial IoT Suite – a uniform solution from device to the cloud

- **Widely scalable modular RTOS EUROS**
incl. a large number of firmware adaptations
- **Scalable embedded OPC UA stack**
Nano, Micro, Embedded or Standard profiles
- **Integrated SoftPLC solution**
HTML5-based
- **Secured cloud connection with TLS 1.3**
without tedious gateway configuration
- **App control interface**
for Windows, Android and iOS

Contact us!

Thank you very much for your attention

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