Embedded C Code on a neoVI

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Product and Applications Manager

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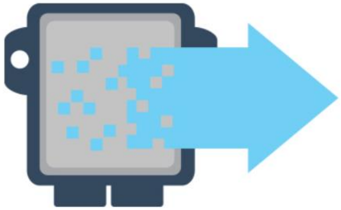
Scripting with Vehicle Spy and neoVI

Programming Intrepid hardware to perform certain tasks

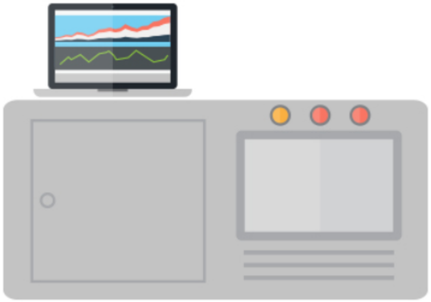


Simulate ECU
Gateway Traffic
Filter Traffic

Prototype Network

Data Logging

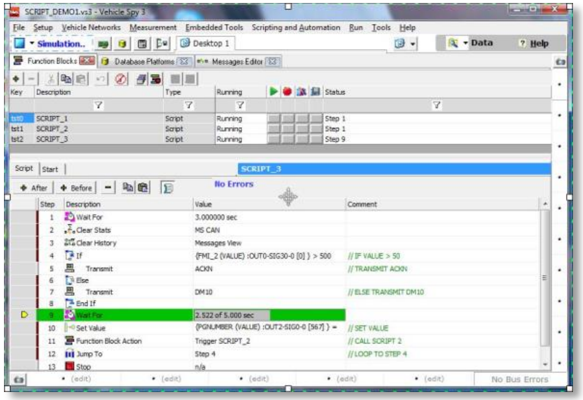
ECU Diagnostics



Automated Test Benches

ECU Flashing

Scripting #1: Function Blocks (PC)



Key	Description	Type	Running	Status
tst0	SCRIPT_1	Script	Running	Step 1
tst1	SCRIPT_2	Script	Running	Step 1
tst2	SCRIPT_3	Script	Running	Step 9

Step	Description	Value	Comment
1	Wait For	3.000000 sec	
2	Clear Stats	MS CAN	
3	Clear History	Messages View	
4	If	{FMI_2 (VALUE) :OUT0-SIG30-0 [0] } > 500	// IF VALUE > 50
5	Transmit	ACKN	// TRANSMIT ACKN
6	Else		
7	Transmit	DM10	// ELSE TRANSMIT DM10
8	End If		
9	Wait For	2.522 of 5.000 sec	
10	Set Value	{PGNUMBER (VALUE) :OUT2-SIG0-0 [567] } =	// SET VALUE
11	Function Block Action	Trigger SCRIPT_2	// CALL SCRIPT 2
12	Jump To	Step 4	// LOOP TO STEP 4
13	Stop	n/a	

PC Running Vehicle Spy with Function Blocks

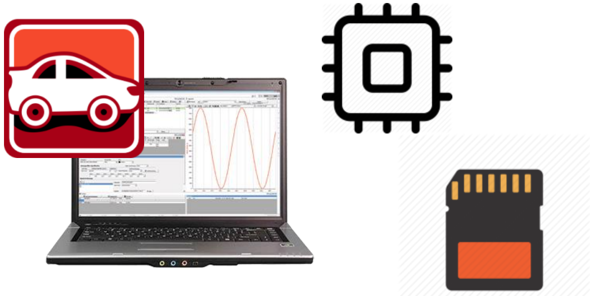
USB

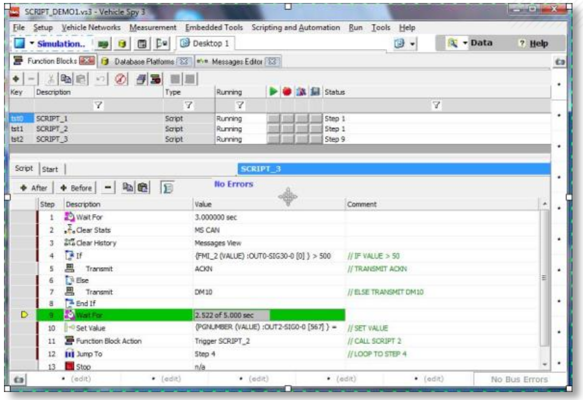
Intrepid Hardware as Interface

Vehicle Networks

CAN
CAN-FD
Ethernet
FlexRay
K-Line
LIN
…

Scripting #2: CoreMini (HW Accelereation)





SCRIPT_DEMO1.vs3 - Vehicle Spy 3

File Setup Vehicle Networks Measurement Embedded Tools Scripting and Automation Run Tools Help
Simulation..
Desktop 1
Data
Help
Function Blocks
Database Platforms
Messages Editor

Key	Description	Type	Running	Status
tst0	SCRIPT_1	Script	Running	Step 1
tst1	SCRIPT_2	Script	Running	Step 1
tst2	SCRIPT_3	Script	Running	Step 9

No Errors

Step	Description	Value	Comment
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PC Running Vehicle Spy
with Function Blocks

USB

Intrepid Hardware running
Realtime CoreMini Script

Vehicle
Networks

CAN
CAN-FD
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…

Scripting #2: CoreMini (HW Accelereation)

Key Benefits:

- Convenience to users
- No need to carry your laptop
- Better performance absent USB communication overhead
- Excellent for ECU replacement and data logging applications

Challenges:

- Security features
- Performance (in some cases)
- Code Space (but not really)

USB

Vehicle Networks

CAN
CAN-FD
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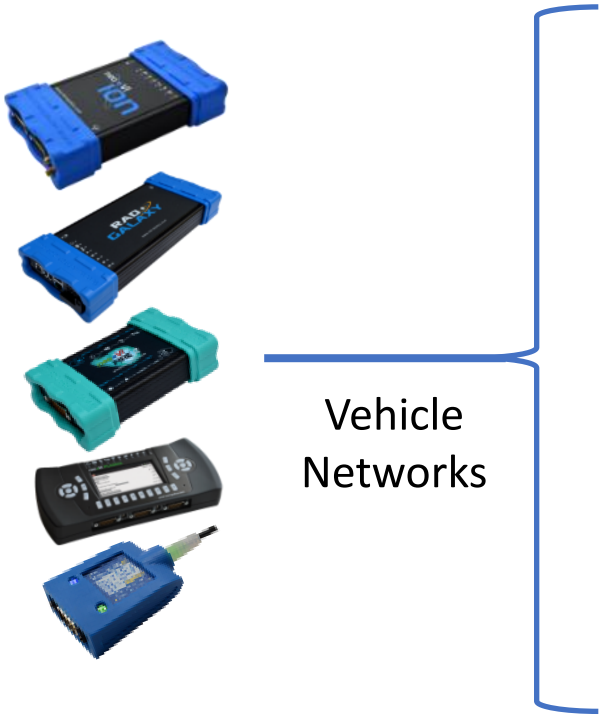
…

Intrepid Hardware running
Realtime CoreMini Script

Scripting #3: CoreMini + Embedded C

Key Benefits:

- CoreMini handles vehicle network tasks
- Offload most, if not all of the remaining scripting tasks to a separate microprocessor
- CoreMini and embedded C application co-exist and offer the best of both worlds
- CoreMini and embedded C application communicates securely over high speed serial bus



Vehicle Networks

CAN
CAN-FD
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FlexRay
K-Line
LIN
…

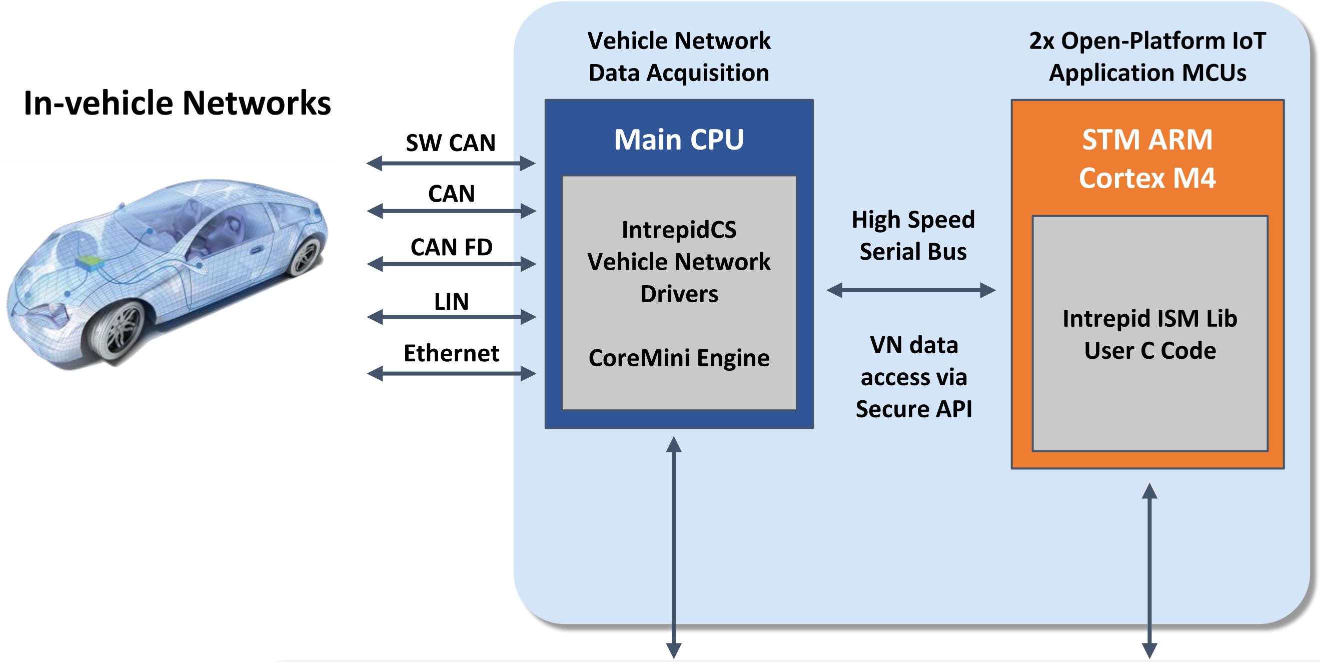
Intrepid Hardware running CoreMini + a dedicated microprocessor running embedded C app

Intrepid Security Module (ISM)

- Pre-compiled static C library (.a)
- Gives your embedded C application access to vehicle network data
- Construct and transmit messages in C code
- Get desired receive messages as C callback function
- CoreMini Application Signal API: Get/set application signals
- Device control API: change LED color, enable/disable power output, buzzer…

neoVI FIRE2

neoOBD2 PRO



In-vehicle Networks

SW CAN
CAN
CAN FD
LIN
Ethernet
Vehicle Network Data Acquisition
Main CPU
IntrepidCS Vehicle Network Drivers
CoreMini Engine
High Speed Serial Bus
VN data access via Secure API
2x Open-Platform IoT Application MCUs
STM ARM Cortex M4
Intrepid ISM Lib User C Code

Security Applications:

- Implement ECU security unlock logic in C and program it in the ISM chip
- Prototype bus encryption / decryption
- Bus anomaly detection

Simulation Applications:

- Build your own gateway
- Build your bench test in C

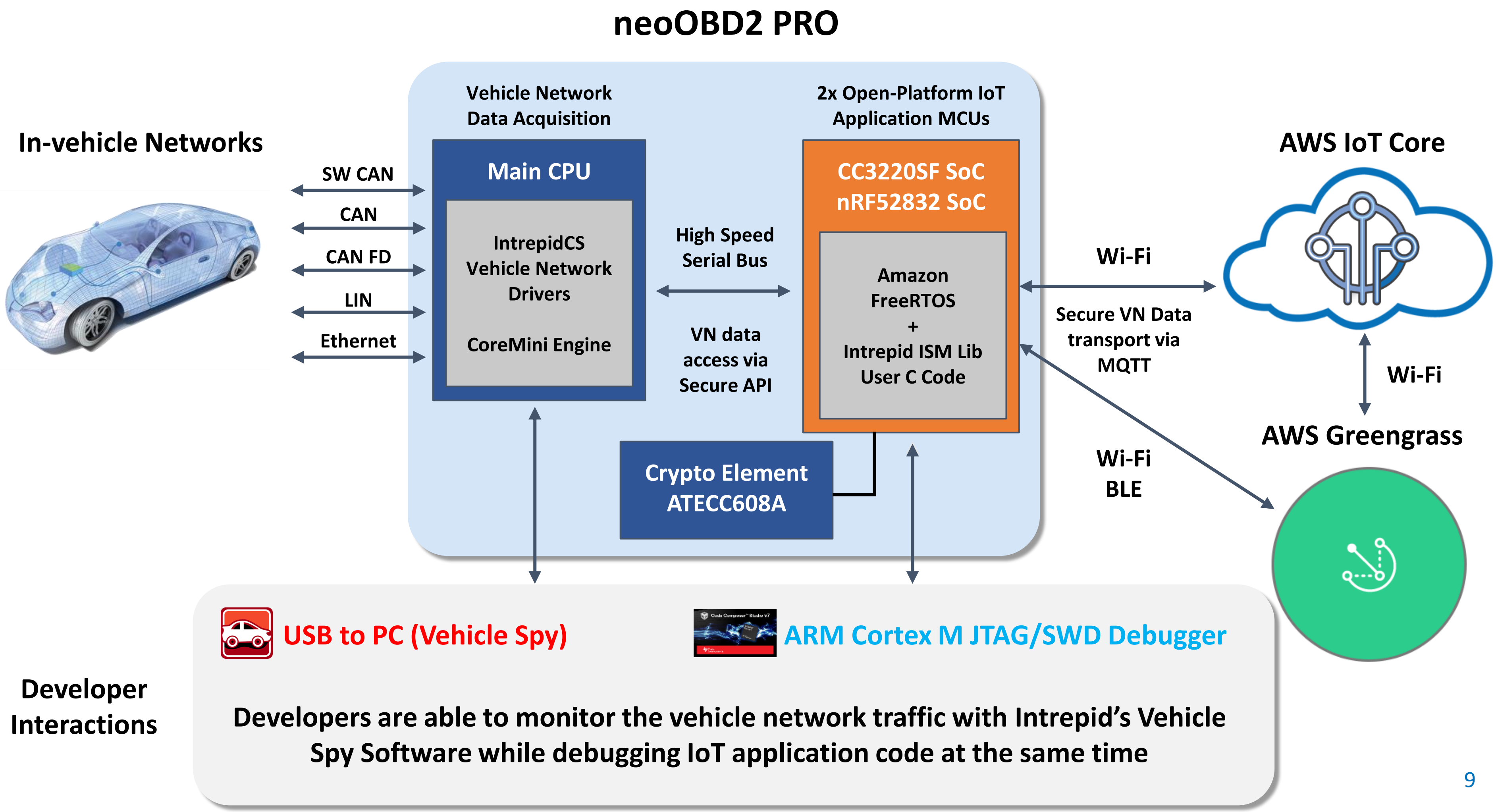
Developer Interactions

USB to PC (Vehicle Spy)

ARM Cortex M JTAG/SWD Debugger

Developers are able to monitor the vehicle network traffic with Intrepid's Vehicle Spy Software while debugging IoT application code at the same time

neoOBD2 PRO



neoOBD2 PRO

In-vehicle Networks

SW CAN

CAN

CAN FD

LIN

Ethernet

Vehicle Network Data Acquisition

Main CPU

IntrepidCS Vehicle Network Drivers

CoreMini Engine

High Speed Serial Bus

VN data access via Secure API

2x Open-Platform IoT Application MCUs

CC3220SF SoC
nRF52832 SoC

Amazon FreeRTOS
+
Intrepid ISM Lib
User C Code

Crypto Element ATECC608A

Wi-Fi

Secure VN Data transport via MQTT

Wi-Fi
BLE

AWS IoT Core

Wi-Fi

AWS Greengrass

Developer Interactions

USB to PC (Vehicle Spy)

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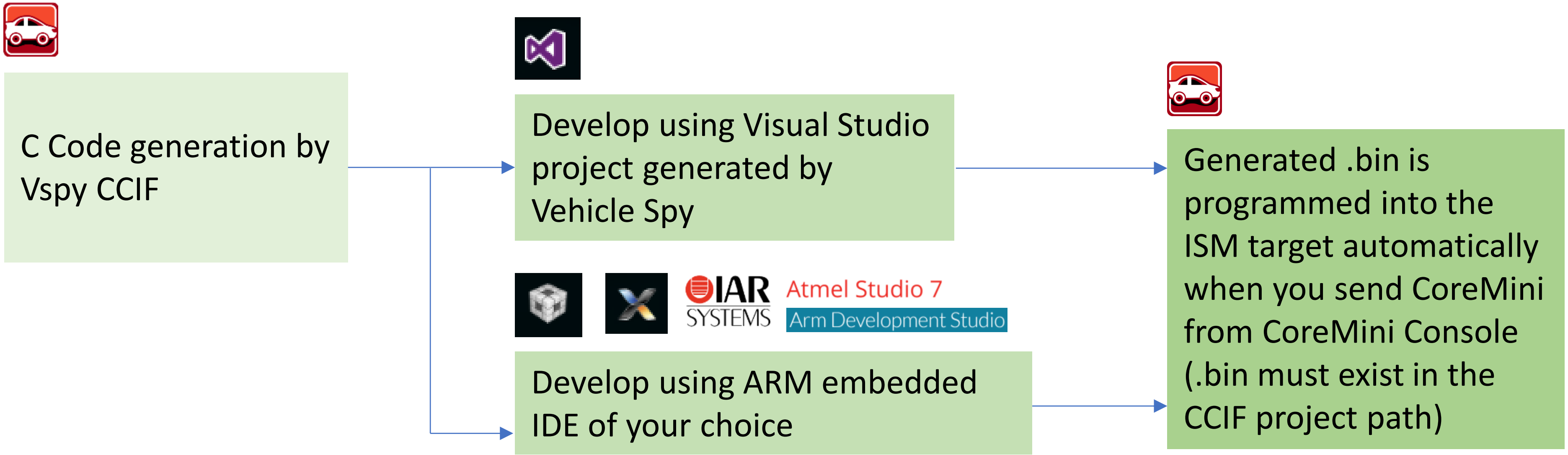
Developing with Embedded CCodeInterface



C Code generation by Vspy CCIF

Develop using Visual Studio project generated by Vehicle Spy

Develop using ARM embedded IDE of your choice

Generated .bin is programmed into the ISM target automatically when you send CoreMini from CoreMini Console (.bin must exist in the CCIF project path)

Use Vehicle Spy to load any database files needed and select messages and application signals to use in your C code

Option 1. Use Visual Studio project that is auto-generated by Vehicle Spy for development (No debugging)

Option 2. Use ARM IDE of your choice with JTAG/SWD debugger for debugging

Program the output executable binary into the target ISM chip together with CoreMini

Demonstration

Building a simple embedded C Code Interface application

Thank You!

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