JavaScript* Meets Zephyr™ OS

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Intel
Outline

Why JavaScript*
Architecture
Arduino 101* Port
Building
Security and Memory Consumption
APIs and Roadmap
Browser IDE
Open Source Project
Demo

*Other names and brands may be claimed as the property of others.
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JavaScript* Runtime for Zephyr OS

- Enable JavaScript application development on Zephyr OS
- Address large JavaScript developer community
- Fast development cycle - No flashing, just copy .js files
- Good tooling including browser based IDE and debugging
- Based on open source JerryScript JS engine and API layer
- Well known JavaScript APIs (Node.js* like)
- Application portability between MCU and MPU platforms
- Support now for Arduino101 and FRDM-K64F, all Zephyr OS supported boards in the future

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JavaScript* on Zephyr OS - Benefits

- Big JavaScript developer community
- Well known cross-OS APIs
- Single skill set for device, client, gateway and cloud application development
- Code sharing
- Development and simulation on host systems (PC)
- Fast development cycle
- Browser based IDE
- Easy integration to cloud systems

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Development Flow

Native

Edit ➔ Compile ➔ Run ➔ Reboot ➔ Flash ➔ Reboot ➔ Reboot

JavaScript*

Edit ➔ Run ➔ Copy

Much Faster Development

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JavaScript* Runtime for Zephyr OS

- Node.js* is too big for MCU devices
- We need something like Node.js but smaller
- PoC: JavaScript Runtime for Zephyr OS based on JerryScript
  - Arduino 101 (256K ROM / 80 K RAM)
  - Timers, BLE, PWM, AIO, GPIO, and OCF APIs
- Target
  - Same APIs on Linux* and Zephyr OS
  - Same JavaScript application runs (unmodified) on Linux and Zephyr OS, or even in the browser

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Architecture

- **JavaScript App**
  - Business logic by the app developer
- **JavaScript API Layer**
  - API bindings - NEW
  - Open source (Apache 2.0) - NOW
- **JS Engine**
  - Micro JS engine - JerryScript
  - Open source (Apache 2.0)
- **Integration**
  - Separate repo in GitHub
  - Make pulls in all the dependencies

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Build

$ git clone git@github.com/01org/zephyr.js
$ cd zephyr.js
$ make

Building...

$ make flash

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Arduino 101* Port

JavaScript* Application

JavaScript Runtime

Zephyr OS / Drivers

X86 Core

ZJS Support Image

Zephyr OS / Drivers

ARC Core

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Security

- **Build time**
  - JavaScript* source is converted into C string and embedded into zephyr.bin image
  - JavaScript `eval()` function is disabled
  - Special developer mode can be enabled via make command (`make DEV=ashell`)

- **Runtime**
  - Only the embedded JavaScript application is executed
  - Web pages or foreign scripts are NOT executed

- **Developer Mode**
  - JavaScript application is executed from Zephyr OS filesystem
  - JavaScript application replaceable via USB or BLE using browser IDE or CLI tool

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Memory Consumption

- **Runtime**
  - The JS engine boot up memory is around 5 KB RAM

- **Application**
  - Depends on the application and what it does
  - For reference, JavaScript* application running on Zephyr OS/Arduino 101*
    - 80K RAM/384 ROM
    - BLE physical web advertising
    - BLE GATT service with two characteristics (temperature and LED)
    - PWM and AIO for controlling temperature sensor and RGB LED
    - I2C for LCD
    - 200 lines of JavaScript code

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Zephyr Project Booth Demo Details

1. Advertise URL
2. Connect to URL
3. Load App
4. Connect to BLE Service
5. Read & Control Device

Zephyr OS-hosted JavaScript* App on Arduino 101* board

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Browser IDE

- Only in DEV mode
- Copy-n-Run
- 3rd Party IDEs
- CLI Tools
- Web USB - NEW

JavaScript* App

JS Runtime

Web USB

Zephyr OS

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Demo Time
## JavaScript APIs

<table>
<thead>
<tr>
<th>API</th>
<th>Zephyr OS</th>
<th>Node.js</th>
</tr>
</thead>
<tbody>
<tr>
<td>Events</td>
<td>Now</td>
<td>Core API</td>
</tr>
<tr>
<td>Buffer</td>
<td>Now</td>
<td>Core API</td>
</tr>
<tr>
<td>BLE</td>
<td>Now</td>
<td>Bleno NPM</td>
</tr>
<tr>
<td>GPIO, I2C, AIO, etc.</td>
<td>Now</td>
<td>Johnny-Five like</td>
</tr>
<tr>
<td>OCF</td>
<td>Now</td>
<td>IoTivity-node NPM</td>
</tr>
<tr>
<td>CoAP</td>
<td>Planned</td>
<td>CoAP NPM</td>
</tr>
<tr>
<td>MQTT</td>
<td>Planned</td>
<td>MQTT NPM</td>
</tr>
<tr>
<td>W3C Sensors</td>
<td>Planned</td>
<td>TBD</td>
</tr>
<tr>
<td>HTTP</td>
<td>Planned</td>
<td>Core API</td>
</tr>
</tbody>
</table>
Roadmap

**WHEN**

**1H/16**
- PoC
- Few APIs
- Arduino 101* support

**2H/16**
- Subset of Node.js APIs
- OCF
- BLE
- PIN and BUS Access
- Copy-and-Run
- Browser IDE
- FRDM-K64F support

**1H/17**
- More Node.js* APIs
- Power and Battery
- CoAP, MQTT
- NFC
- Security and Crypto
- W3C Sensors
- Remote debugging
Open Source Project

- https://github.com/01org/zephyr.js
- We want people to participate and contribute
- Alpha quality status
- Sample Code
- API documentation
- README
Summary

- JavaScript Application development on Zephyr
- Open Source Project - Please Join
- This the first step - Let’s make many more together
Questions ?
Thank You!

Please Visit Zephyr Project Booth for Demo