GLOW 2025: Serial Router Firmware Analysis & Advice

Teensy 4.1 Serial Router Acceptance and Testing Plan

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Content

1. Introduction

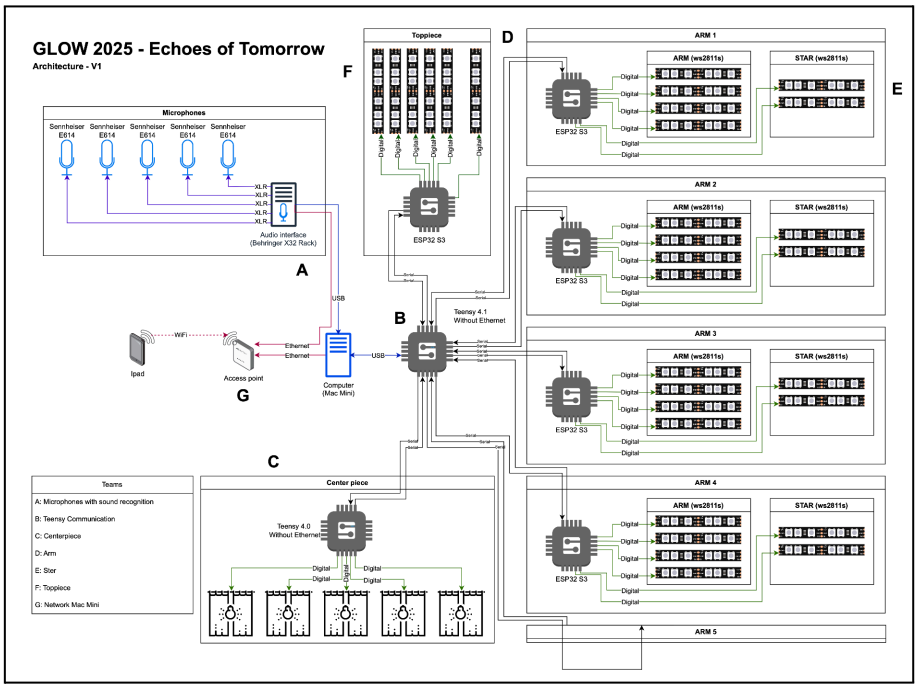
GLOW Art & tech installation is a regular challenge for Delta students at Fontys ICT. A team of 9 students with different backgrounds and tracks was working on the prototype in the previous semester. This semester is dedicated to realization and participation in GLOW 2025. This technical report defines how the Teensy 4.1–based Serial Router firmware will be verified for acceptance and integrated into the Echoes of Tomorrow system-of-systems. The router mediates bidirectional command traffic between the Mac Mini (show controller) and distributed ESP-based subsystems (arms) plus a centerpiece controller. The report consolidates objectives, protocol constraints, verification methodology, acceptance criteria, and a staged, abstract integration plan. It references the project's Hardware Communication Agreement to ensure protocol compliance and operational safety. Complementary documents mentioned below contain full analysis and advice for serial router firmware.

1.1. Background & Collaborative activities

Joining this project in 2025 is steered by the need to practice more with collaboration, team building and develop new professional skills. Having relevant skills with hardware engineering and IoT a challenge with Edge AI was prioritized. However, due to irrelevance and lack of teams in other projects had to downgrade to firmware only. Through discussions with the GLOW team a problem was discovered with the system architecture and an opportunity to develop serial router firmware.

2. System architecture

Initial hardware architecture was compiled together with Bartosz and Patryk. Relevant feedback was added to the document in order to achieve a higher standard [1]. However, the diagram was rejected by the coach. And based on the coach's feedback Bram produced a new diagram:



New GLOW 2025 Hardware Architecture [2]

3. Acceptance and Integration tests plan for Teensy Serial Router Firmware

3.1. Closing the gap Serial router Teensy4.1

Going through meetings and discussions of the new architecture a gap was identified with the Teensy4.1 serial router. It was taken as a subgroup challenge together with Bas and Timo. All details for the functionality of the serial router were handled to us by Bram in the Hardware Communications Agreement document [3].

The Serial Router is the communication backbone for interactive choreography across multiple microcontroller nodes. It performs: (a) parsing of framed commands; (b) routing to addressed endpoints; (c) optional automatic acknowledgement; and (d) telemetry and diagnostics over USB. Acceptance focuses on functional correctness, robustness under malformed traffic, and timing behavior at specified baud rates. Integration proceeds incrementally from bench validation to rehearsal-grade system tests.

4. Scope

- **In scope:** States diagram, Firmware build `teensy4-1_routing`; parsing and routing (CmdLib); UART links to arms and centerpiece; USB logging/diagnostics; watchdog/health behavior.
- **Can be in scope:** Hardware simulation, automated testing.
- **Out of scope:** Mac Mini application logic; ESP firmware internals; mechanical validation; cloud/backends.

5. Github

Following repos will be used. One for the serial router firmware. And another to handle commands.

- **Serial Router Firmware Repo:** https://github.com/GLOW-Delta-2025/serial-router/tree/feature/teensy41_esp32_tx_rx

6. Acceptance Test & Integration Plan

A complementary document contains complete acceptance test and integration plan: https://github.com/GLOW-Delta-2025/serial-router/blob/feature/teensy41_esp32_tx_rx/docs/GLOW%202025_%20Serial%20Router%20Firmware%20acceptance%20test%20%26%20integration.pdf

7. Technical Advice

Another complementary document contains technical advice and recommendations: https://github.com/GLOW-Delta-2025/serial-router/blob/feature/teensy41_esp32_tx_rx/docs/GLOW%202025_%20Serial%20Router%20Firmware%20Technical%20Advice.pdf

8. Conclusion

Following this acceptance and integration plan will ensure seamless integration of a functioning hardware component. The tests are designed for effective collaboration with the diverse team. Severe issues will be mitigated and effectively responded to if they arise during the test.

Reference

1. Kraskov A., Olejnik P., Kaszuba B., (2025), Hardware Architecture v.1.3 https://stichtingfontys.sharepoint.com/:w:/r/sites/GLOW2025-TheLight/Gedeelde%20documenten/General/!%20Building%20Phase%20of%20GLOW/Research%20and%20documentation/Microcontrollers%20and%20Architecture/Architecture%20Hardware.docx?d=we65950663fd14f808bc8cf0c57195995&csf=1&web=1&e=mQ9Jgt
2. Kempen B., (2025), New Hardware Architecture https://stichtingfontys-my.sharepoint.com/:i:/g/personal/500395_student_fontys_nl/EamHXKoUTgdPspcLpu3rU7cB-OPlRmLMFPvxTTmk5HEiAg?e=bgPSMY
3. Kempen B., (2025), Hardware Communication Agreement https://stichtingfontys.sharepoint.com/:w:/s/GLOW2025-TheLight/Ea0UeopGqINAh8g6dlxvu0sB68_n9zvcl6AERUGbmB22Yg?e=MdRc6M

Attachment

1. Kraskov A., (2025), GLOW 2025: Serial Router Firmware Acceptance Test & Integration Plan https://github.com/GLOW-Delta-2025/serial-router/blob/feature/teensy41_esp32_tx_rx/docs/GLOW%202025_%20Serial%20Router%20Firmware%20acceptance%20test%20%26%20integration.pdf
2. Kraskov A., (2025), GLOW 2025: Serial Router Firmware Technical Advice https://github.com/GLOW-Delta-2025/serial-router/blob/feature/teensy41_esp32_tx_rx/docs/GLOW%202025_%20Serial%20Router%20Firmware%20Technical%20Advice.pdf