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CLIENT CASE STUDY

Driving Efficiency and Cost Savings with Span.IO and Dojo Five

BACKGROUND

Span.IO, a forward-thinking technology company, develops home energy connected and smart electrical panels that ease adoption of clean energy and optimize power use in the home.

The company partnered with Dojo Five to address critical challenges in their software development and production processes.

While Span.IO had its own internal software team, the company chose to use Dojo Five as a specialized external resource. The partnership significantly improved operational efficiency, cost savings, and product reliability through innovative problem-solving, collaboration, and technical expertise.

CHALLENGES

To continue scaling effectively, Span.IO proactively partnered with Dojo Five to enhance their development and production workflows.

Slow Build Speeds

- Span.IO identified opportunities to streamline their build system and partnered with Dojo Five to effectively accelerate development cycles.
- Developers experienced context-switching losses while waiting for builds to complete.

Inefficient OTA Testing

- OTA testing was time-consuming due to slow SPI bus speeds.
- Errors in SPI drivers made panel states difficult to access during testing.
- Again, developers experienced context-switching losses while waiting for builds to complete.

Hardware Constraints

- Pin selection issues on certain boards limited SPI bus speed improvements without hardware changes.
- Vendor constraint limited valid pin configuration of external interrupts.

Debugging Bottlenecks

- Debugging SPI peripherals revealed unhandled error conditions that could lead to production failures.

Additional Challenges

- Complex physical architecture.
- New microcontroller family with two variants depending on model.
- Variations in third-party vendor code prompted proactive validation and integration efforts. + Missing errata documentation.
- Span.IO adapted team structures to meet evolving development goals, supported by Dojo Five's flexible collaboration model.

SOLUTIONS

Build Speed Optimization

Dojo Five implemented changes to Span.IO's build system that resulted in:

- A 1.4x–1.9x improvement in clean build speeds.
- A 10x improvement in incremental build speeds. across various hardware configurations.
- These optimizations saved approximately 1.35 hours per developer per day, equating to at least $200,000 annually in labor cost savings.

SPI Driver Hardening

- The SPI bus handling was debugged and hardened to handle error conditions effectively.
- Flash speed on the primary module was increased from 1.5 MHz to 50 MHz (a 33x improvement), while up to six downstream modules achieved a speed of 3.125 MHz despite hardware limitations.

OTA Testing Acceleration

- Improved SPI bus speeds reduced file transfer times by 10–15 minutes per test. This resulted in savings of at least 40 person-hours during a single week of intensive OTA and UDP-over-USB testing involving ~10 team members conducting four tests daily.

Collaborative Debugging Efforts

- Through collaborative problem-solving, the team rapidly addressed issues critical to maintaining production timelines.

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RESULTS

Time Savings

- Clean builds now take an average of 695 seconds compared to the previous 1,102 seconds—a reduction of over 37%.
- Incremental builds dropped from an average of 389 seconds to just 48 seconds—a massive 87% improvement.

Cost Savings

- Weekly CI (Continuous Integration) cost savings amount to $150, with yearly savings projected at $7,800 for CI alone.
- Developer productivity improvements save $196,917 annually in labor costs.

Improved Product Reliability

- Hardened SPI drivers now prevent difficult-to-access panel states during production.
- Debugged systems brought Span.IO over 50% closer to meeting their specified OTA time requirements.

Enhanced Collaboration

- Cross-functional teamwork between Span.IO and Dojo Five ensured rapid progress on critical tasks.
- Patrick and Minh from Dojo Five team were instrumental in resolving critical debugging challenges, exemplifying the team's technical leadership and dedication."

LONG-TERM IMPACT

- Simplified building and testing processes.
- Streamlined OTA updates.
- Improved SPI bus handling.
- Identified and corrected hardware issues related to debugging.

RECOMMENDATIONS

- Create a consistent build environment.
- Identify and fix testing gaps.
- Automate the build process.
- Use reproducible and consistent configuration management tools.

> ***"Patrick and Minh have been outstanding support ... I sincerely appreciate this."***
>
> **Tex Shah**
> Program Manager
> SPAN.IO

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ABOUT DOJO FIVE

Dojo Five seeks to modernize the firmware development and deployment experience through innovations in the quality, efficiency, and security of modern embedded firmware. With more than 335 years of combined expertise, Dojo Five helps companies optimize their embedded software development systems by bringing together tools, techniques, technologies, and culture to deliver modern firmware for embedded systems. We give our clients superpowers to accelerate development and effortlessly orchestrate successful projects that delight their customers.

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Or contact us for a **complimentary demo** of EmbedOps and our embedded services offerings at hello@dojofive.com