

# Adapting to Change

Lessons from the Chip Crisis for Electronic Circuit Design

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CIKLUM

# Nice to meet you

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# Ciklum

Formerly CN Group, we have been providing high quality IT software development, consulting services, and mechanical & electrical design engineering to our partners in Scandinavia, Germany, Austria, Switzerland, Benelux, USA and the UK for more than 28 years.

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# Ciklum in embedded / IoT

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Mechanical Design Engineering



HW / Electronics



Embedded SW



AI / Machine Learning

# Our typical embedded project

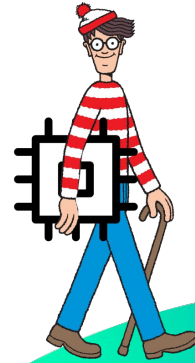
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- Consumer electronics (80%), Test & Measurement equipment (20%)
- Microcontrollers based on ARM M-profile or ESP32
- Typically low-power requirements
- Various sensors
- BLE or other wireless technology
- IoT

# Chip crisis

What is it?

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- Ongoing supply chain crisis, started 2020
- Complex reasons - local and global, political and environmental...
- Effects:
  - o Extreme lead times for even common ICs
  - o Production of high end devices halted due to lack of a few cent part
  - o Price gouging - 2\$ chip being sold for 40\$
  - o Rise of dubious suppliers
  - o Major disruption to pretty much every area of the industry
  - o Increased price or low availability for finished product
- Many companies did not make it

# Lessons learned - hardware

# 01

- Tips and tricks that helped us
- Documentation is your friend
- Variants are great
- Perfect is not always better
- Future-proofing your libraries

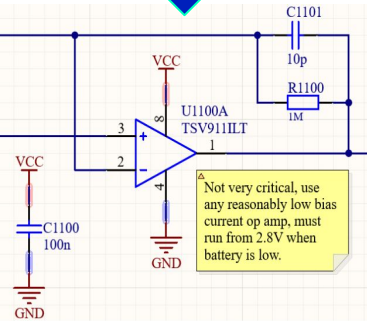
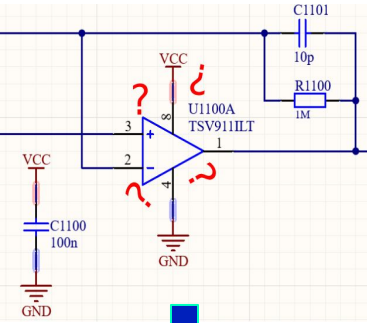
# Limiting the effect of shortages

What to prepare for?

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- What should your design be prepared for?
  - o Unavailability of critical parts
  - o Inability to source from reliable sources or extreme price gouging
  - o Rapid change of as many parts as possible





# Documentation

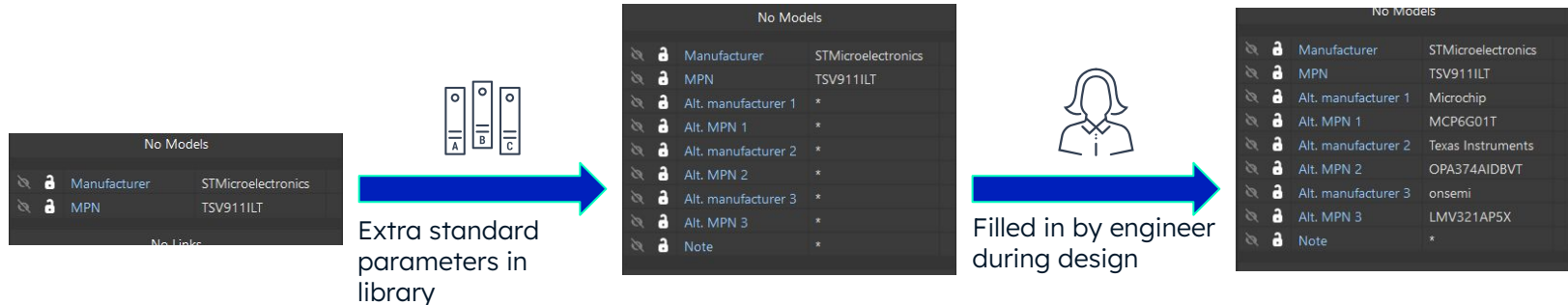
It really is your friend

- Proper documentation is important
- A circuit description of even seemingly obvious functions can help
- A schematic is enough to see the function, but it might not be enough to see the reasoning behind the choices
- Always document:
  - o What does that part of the circuit do
  - o Why were the specific parts chosen
  - o How it interacts the rest of the design

# Bill of Materials (and Alternatives)

A few extra columns can help

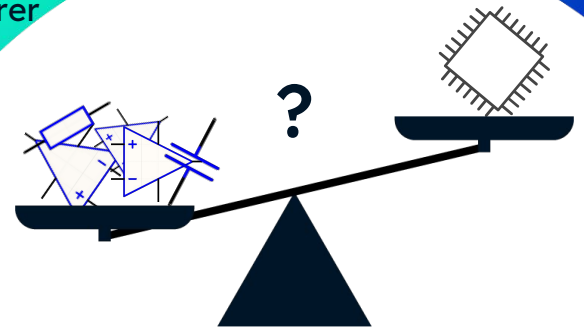
- Additional parameters in a part
- Good design practices that allows more freedom for assembling the board



# A perfect fit is not always better

Very specific ICs are great... until they aren't

- Advantage of specific parts: Application specific ICs can solve your problem in a single package with minimal external components - they are great
- Disadvantage: They bind your design to one and only one manufacturer and part
- Always consider using a solution from more generic parts



# Beware of dubious suppliers

Caveat emptor

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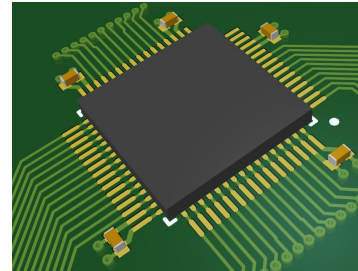
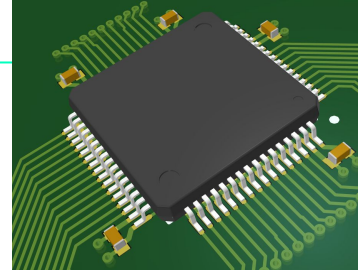
- Current situation amplified many of the already existing problems within our industry
- Counterfeit ICs have caused billions in damages
- Recycled, rebranded or factory reject ICs cause quality issues
- Whenever possible avoid dubious sources
- When impossible, verify

# Alternatives and blocks

Prepare whole block ahead of time



- When space constraints and other constraints allow , add an alternative block
- Assemble based on what is available
- Just in case - test as needed

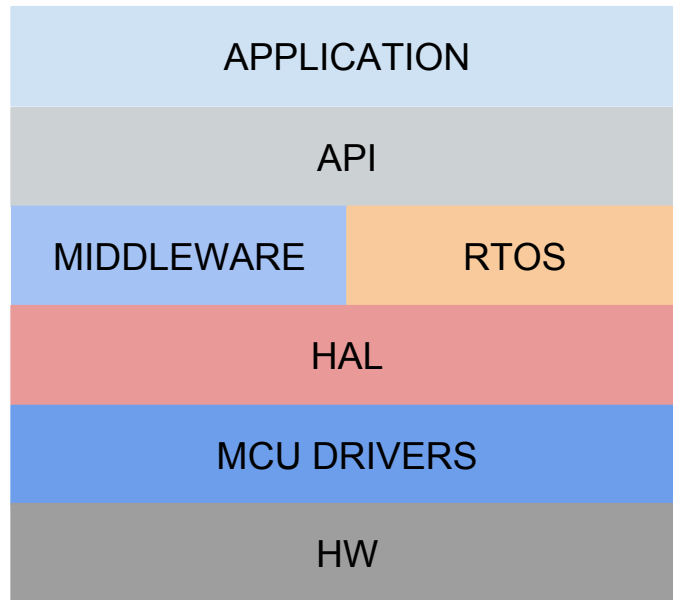


# Lessons learned - software

# 02

- Embrace hardware independence
- Emphasize modular and test-driven development
- Enhance collaboration with hardware teams

# Layered firmware architecture



# Unit testing and CI/CD revisited

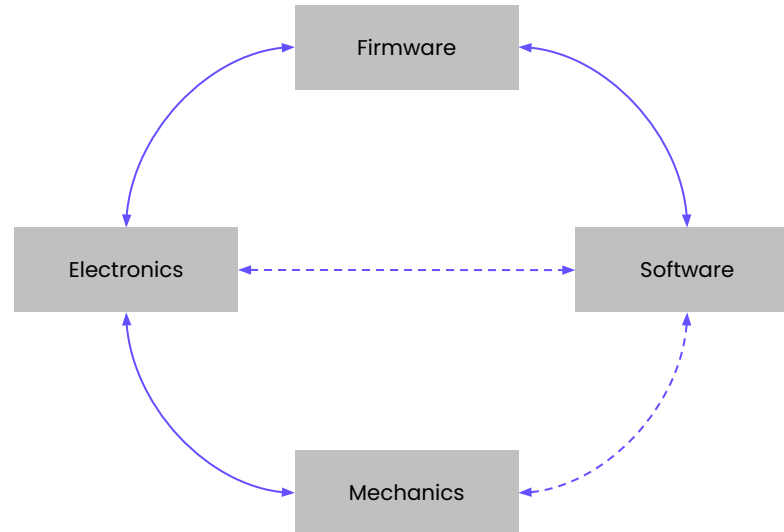
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- Early detection of issues
- Facilitating refactoring and reusability
- Continuous integration and automation
- Documentation





# Enhanced collaboration between teams



# Opportunities

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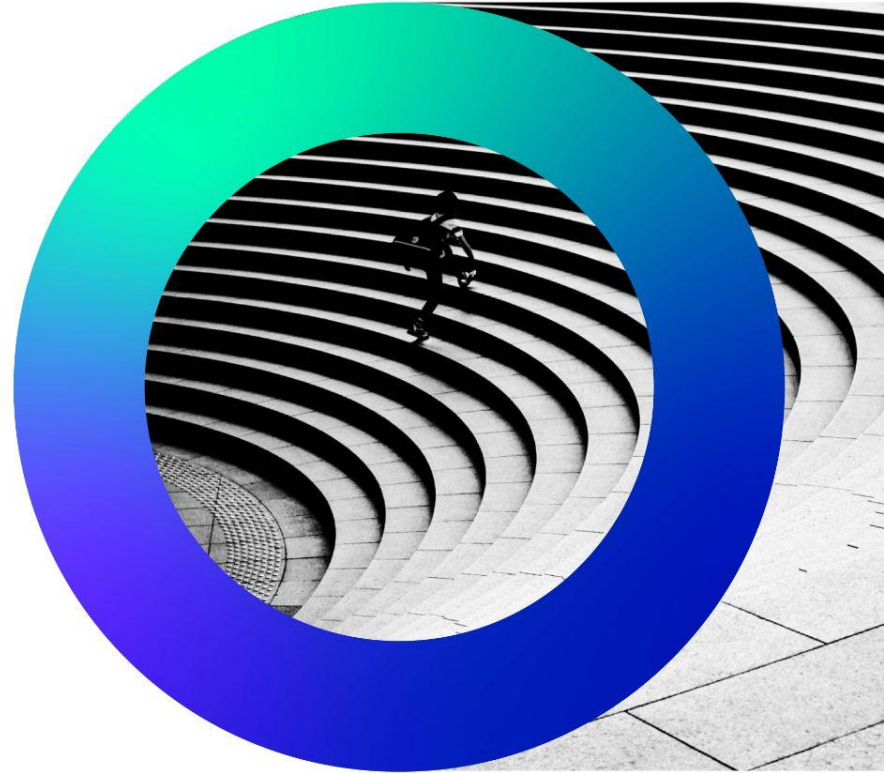
- When life gives you lemons make lemonade
- Implement low risk improvements
- Fix that minor bug
- Try something new

# An annoying redesign is an opportunity

How?

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- Any change should be followed up by appropriate tests
- When moving to a different MCU architecture or doing other significant modifications, changes are unavoidable and extensive testing is a must
- Ideal time for low risk changes or fixes






# Small changes and fixes

Fix the minor bugs or known issues

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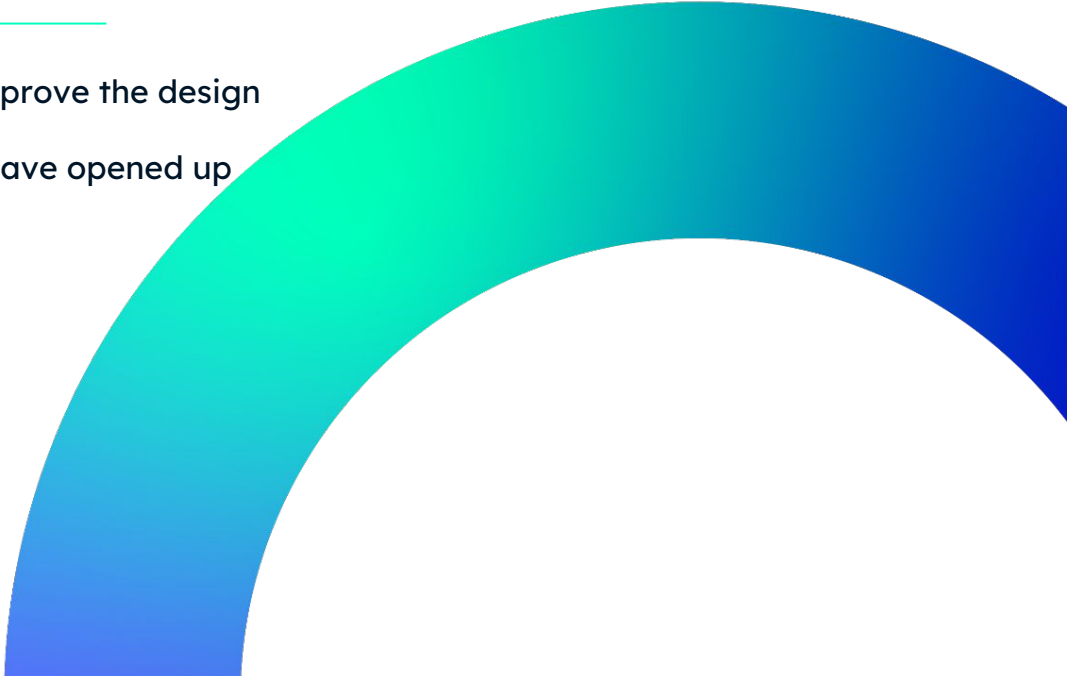
- Bugs and issues will be discovered
- Major ones need to be addressed ASAP, non-critical minor ones can wait
- Small ones are often added to a “when there’s time” TODO list 
- A redesign is the ideal opportunity to fix the minor issues that have accumulated over the years



# Update, explore, sync

Improve your product

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- A redesign may be a good opportunity to improve the design
  - New understanding about the circuits may have opened up new options
  - New parts may have become available
  - Any change should be followed up by tests
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# Rewrite it with the future in mind

Think of the next crisis

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- If a major rewrite becomes necessary, it may as well be done right
- Think of the next time an MCU will need to be exchanged for whatever reason
- As mentioned, add an abstraction layer, structure the firmware in such a way that makes future porting less painful



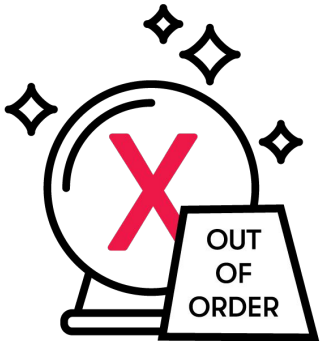
# Conclusion

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- What the future holds
- How can we help

# What does the future hold?

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- Impossible to know what the future holds
- A globalized supply chain will always be sensitive to global problems
- Predictions range from cautiously optimistic to very pessimistic
- Either way, designs with easily replaceable part or blocks will have an advantage

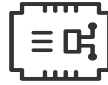


# How can we help?

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**Mechanical  
Design**



**Electronics**



**Embedded SW**



Machine Learning



Backend / Cloud  
Development



Web/mobile app  
development

# Thank you!



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