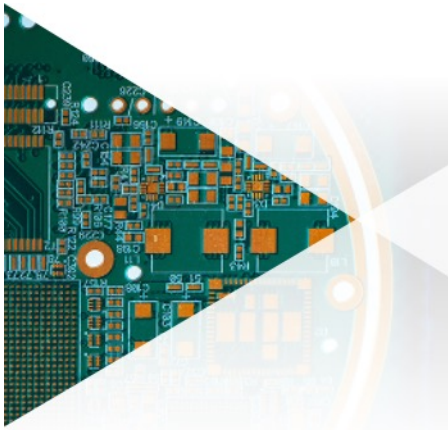
MICROEJ

WHITE PAPER

SUPPLY CHAIN RESILIENCE

MICROEJ VEE software container enables chip double-sourcing at no extra cost to support supply chain flexibility

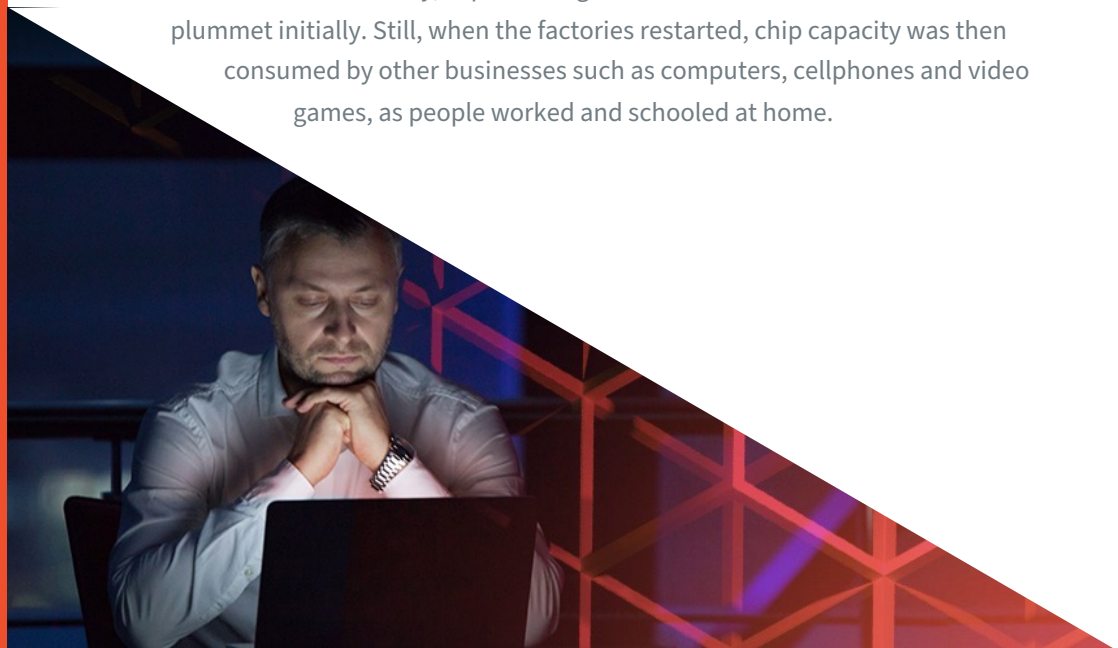
BREAKING POINT EXCEEDED: CURRENT SUPPLY CHAIN STATE-OF-PLAY



Many manufacturers are facing incredible pressure to contain their electronic costs to the minimum. **While just-in-time manufacturing and minimal inventory work great in a controlled environment, the current chip shortage shows that chip sourcing risk mitigation cannot be neglected for the sake of cost reduction.**

When the COVID-19 pandemic started to accelerate, automobile manufacturers had to slow down production. As the automotive industry is naturally focused on lean manufacturing to optimize the supply chain, automakers paused the purchase of semiconductors. As a result, chip factories redirected their focus towards the consumer electronics industry, experiencing a sales boom. The sales of new cars did plummet initially. Still, when the factories restarted, chip capacity was then consumed by other businesses such as computers, cellphones and video games, as people worked and schooled at home.

While chips are massively produced in "gigafabs" located abroad (mainly Asia), the current shortage has been a ticking time bomb from the start. And it has been reinforced with aggravating factors such as the Trump administration banning Chinese suppliers, a fire in a massive Renesas plant in Japan, and global transportation challenges.



Suddenly, semiconductor-reliant manufacturers realized they could no longer depend on a linear mono-source supply chain.

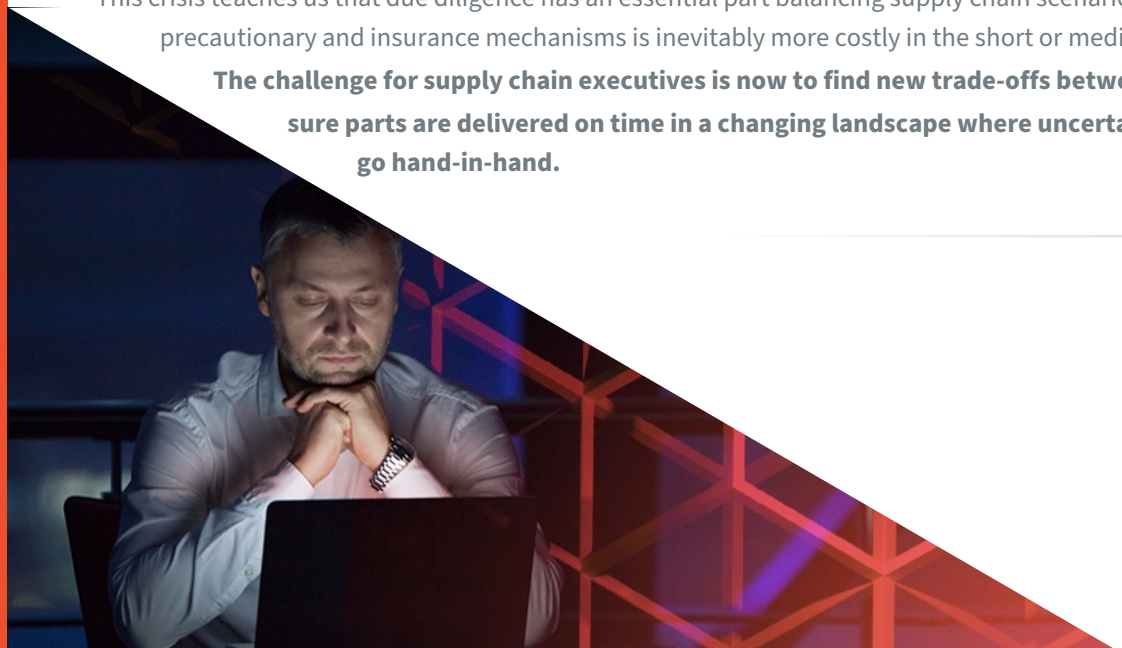
Now 100% of the ordered quantity (delivered on time) is measured with a probability, and some may only receive less than 40% of the necessary electronic components that are required to keep their production running, which generates revenue loss ranging between -60% to -80% for specific product lines, with an overall impact on large companies that can be as high as -10% on the overall income, and without counting indirect losses of not being present on a competitive market as a brand.

As the demand on chips is extremely high, chip prices can inflate product costs as referenced by Marc Bitzer, Whirlpool's CEO, who:

"… is raising prices by 5% to 12% in various countries because of rapidly rising inflationary pressures from the shortage of chips …"[1]

This crisis teaches us that due diligence has an essential part balancing supply chain scenarios. Indeed, removing too many precautionary and insurance mechanisms is inevitably more costly in the short or medium term. The breaking point is reached.

The challenge for supply chain executives is now to find new trade-offs between cost, time-to-market, and making sure parts are delivered on time in a changing landscape where uncertainty and higher customer expectations go hand-in-hand.



[1] https://www.wsj.com/articles/expanding-from-autos-to-appliances-and-sex-toys-the-chip-shortage-is-far-reaching-11619783117

FINANCE, RISK, AND SINGLE SOURCE

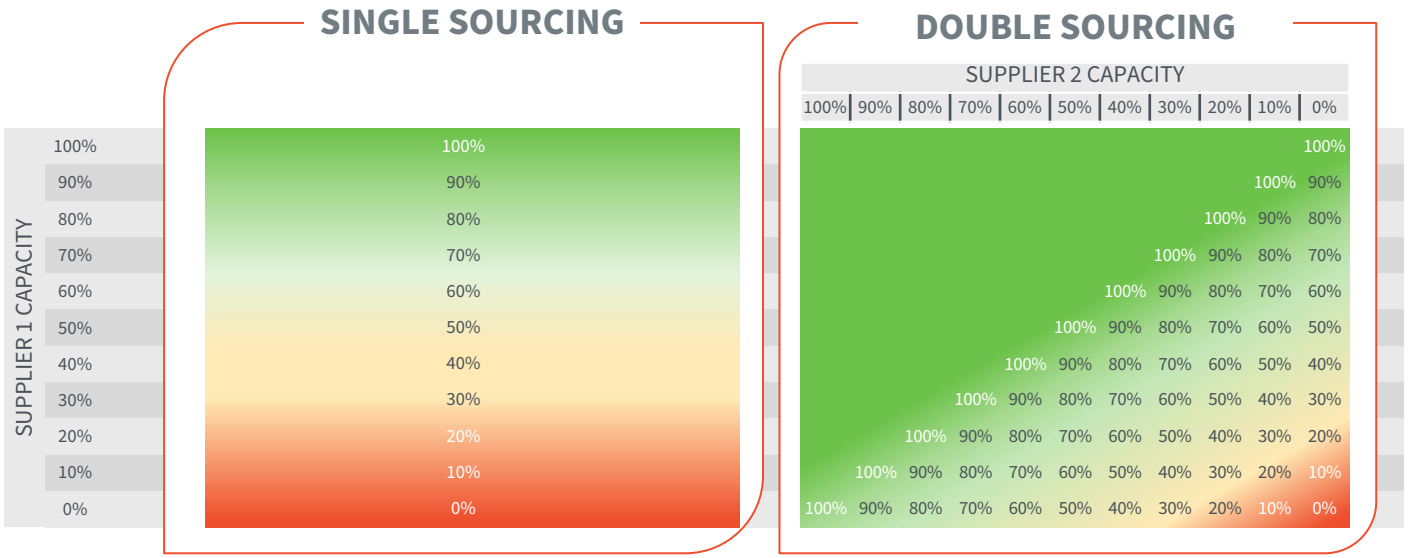
Finance is about managing risks, with one fundamental rule to strictly respect: don't put your eggs in the same basket. As reasonable as it sounds, some electronic products in some corporations rely only on a single chip reference, even for volumes above 1 million units per year. Let's analyze why large corporates have taken such a risk, which may (will?) result in a net loss of hundreds of millions of dollars. And let's ackowledge today's technical solution, its overall cost in terms of time & money. Such a solution highly contributes to building a resilient supply chain and effectively overcoming the multiple disturbances that may occur.

The COVID-19 pandemic, trade restrictions, and unprecedented market demand due to the fast digitalization caused huge production bottlenecks in the smart devices industry. As a result, entire industries struggle to acquire the crucial chip parts that are (often) single-sourced to build specific devices. Hardware chips that run the executable software are becoming more and more difficult to source as shipping and delivery times are dramatically increasing.

Unfortunately, things may turn worse before they get better, as the global semiconductor crisis is projected to last years, considering the high obstacles to tackle the semiconductor supply chain challenges.

Before moving to explanations and solutions, let's visualize risk mitigation by comparing single-source versus double-source regardless of financial risks: market share losses, income losses, brand image deterioration, cost of double designs, etc.

The below two figures compare, using color surfaces, the probability of getting a chip that fulfils the device production volume requirements: single-source (left) and double-source (right) with the color code as follows: dark green is better than light green, and dark orange is worst.



The probability of obtaining 20% or less of the required chip parts is more than five times (x5) higher with a single-source.

The guarantee to achieve 100% of the production, is more than six times (x6) more prominent than for the single-source policy.

Let's materialize with today's actual data: a device with a retail price of $100, production of 1 million per year, based on a $3 chip.

- A -30% of chip volume costs the company a loss of $1{,}000{,}000\ units \times 100\ USD \times 30\% = 30{,}000{,}000\ USD$ whereas the unpaid 30% chips have created a "gain" of $1{,}000{,}000\ units \times 3\ USD \times 30\% = 900{,}000\ USD$
- With a double-source chip policy, a -30% drop from one provider is compensated by the other one, and it is only when the second one is below a -70% rate of provided chips volumes that the company starts to experiment losses (column 70%, and raw 20% and below).

HOW SOFTWARE CONTAINERS ENABLE DOUBLE SOURCING POLICIES

To summarize, device manufacturers are experiencing a growing need to diversify procurement risks to continue serving customers around the world to keep a predictable revenue.

An electronic device is (schematically) made of some mechatronics and a printed circuit board (PCB) on which the silicon parts are soldered: input/output peripherals, passive components, and a processor that holds executable software. Of course, if a single component were missing, the entire production would be interrupted.

So, what is the time and cost to design a "copy" of an electronic board with all distinct components, assuming a first design has been done, validated, and in the so-called "production-ready" state? The answer is well known: between 3 to 6 months (by a small number of engineers). But this assumes that you can reuse the software applications without being redesigned, recompiled, retested, or recertified.

The technology involved is software containerization. It packages up code and all its dependencies, so the application runs quickly and reliably from one environment to another "as-is". Executable software is then decoupled from the hardware dependencies.

Can the same software application of a Smartphone be used on several different chips?
Yes.

Can the same software application be run over various cloud servers' chips?
Yes.

The technology involved:
software containerization

The software container is responsible to bridge the executable application with the underneath hardware capabilities. It hides the processors ISA and RTOS/OS prolific offering: Cortex-M0/0+/3/4/7, Cortex-A5/7/9, ARM7/9, PowerPC, MIPS, Xtensa, AndeStar, RX, V850, Risk-V, Amazon FreeRTOS, QP/C, Silabs µC/OS, Microsoft ThreadX, ARM Mbed OS, VxWorks, PikeOS, Integrity, Blackberry QNX Neutrino, Zephyr OS, Linux, etc. to name a few.

Structuring the added value of an electronic device into hardware, RTOS/OS, software container, and executable software is the most effective way to enable an effective double-sourcing procurement policy for chips.

Indeed, the port of the software container onto any combination of chips with an RTOS/OS (and drivers/stacks) is a matter of 4 to 6 weeks (by one embedded software engineer).

This is much lower than the time required to design a new board. And of course, it can be done in parallel to the hardware design, using silicon starter kits, therefore, remaining within the 2 to 4 months development window.

The software container offering is mature enough to cope with the full spectrum of the MCU/MPU market constraints. Indeed, footprints start as low as 30KBytes of flash authorizing execution in place with no MMU support, to several MBytes of memory requiring an MMU and code loading in RAM.

CONCLUSION: CHIPS DOUBLE SOURCE INSURANCE BY DESIGN WITH SOFTWARE CONTAINERS

With manufacturers now laser-focused on supply chain resilience, reliability, and risk-reduction, they have a golden opportunity to abandon rigid (and risky) product development methods and add flexibility into their development process by taking advantage of software containers.

- Software containers such as MICROEJ VEE allow manufacturers to keep production lines running by sourcing their electronic components, including the MCU/MPU, from different suppliers, when and where they can be sourced.
- The extra costs associated with managing multiple suppliers are greatly compensated by lesser risk exposure, predictable revenue streams, and productivity gains enhanced by software containerization.

Procurement's resilience with double-sourcing based on software container such as MICROEJ VEE (dedicated to the cost-effective electronics markets**)** is a well-proven strategy, and many businesses have been able to gain a considerable competitive advantage by enhancing their electronics supply chain capabilities.

For more information about how MicroEJ contributes to build profitable smart devices in less time, contact us on sales@microej.com

MICROEJ VEE

GET IN TOUCH WITH US

sales@microej.com

MICROEJ USA
Boston

MICROEJ JAPAN
Tokyo

MICROEJ FRANCE
Nantes

MICROEJ CHINA
Xi'an

MICROEJ GERMANY
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