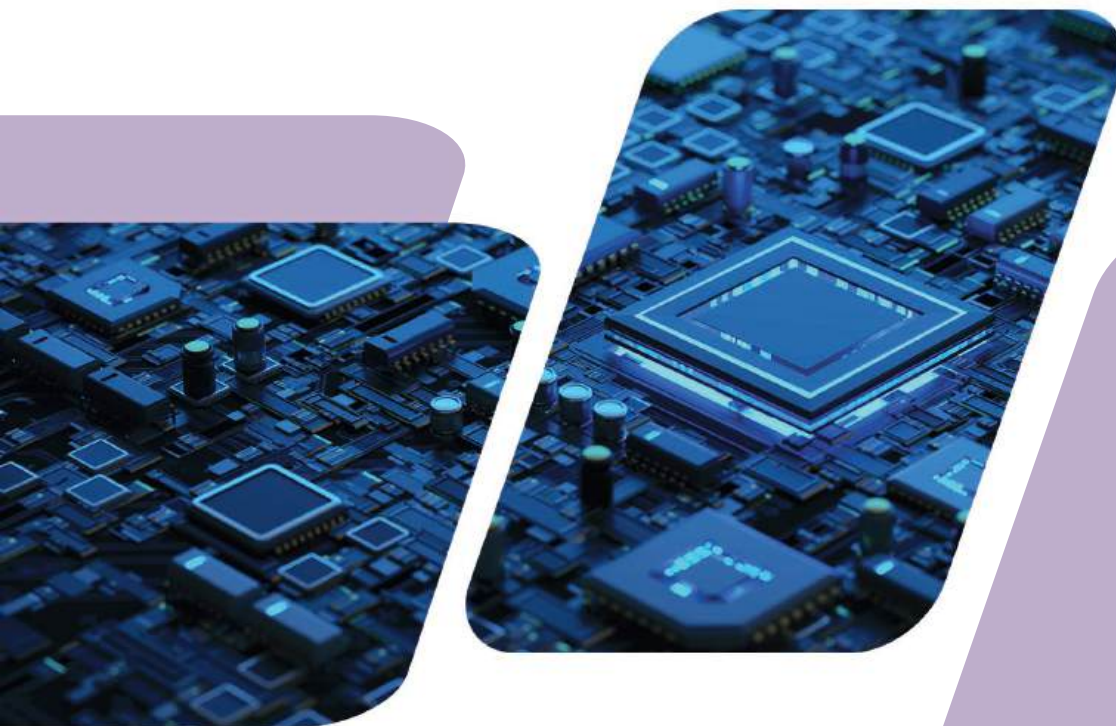




# The Rise of the SoM: a Blueprint for Accelerating Time to Market

Whitepaper



# Contents

<b>Introduction</b>	<b>3</b>
<b>Chapter 1:</b> The SoM Landscape	<b>4</b>
<b>Chapter 2:</b> What is the Market Looking for in SoMs?	<b>9</b>
<b>Chapter 3:</b> The Ascent of Connected Services & Future of SoMs	<b>12</b>
<b>Conclusion</b>	<b>14</b>

# Introduction

In today's fast-paced technological landscape, businesses seek innovative solutions to stay ahead. One such breakthrough is the System-on-Module (SoM), a compact and versatile approach to embedding complex processing systems, offering a streamlined path to market, significant cost savings, and enhanced scalability.

A System-on-Module integrates the core components of a processing system onto a single modular printed circuit board, suitable for applications ranging from digital signage to advanced robotics. Historically, SoMs were utilised mainly by smaller organisations lacking in-house technology capabilities. However, larger producers are now adopting this approach for its numerous benefits.

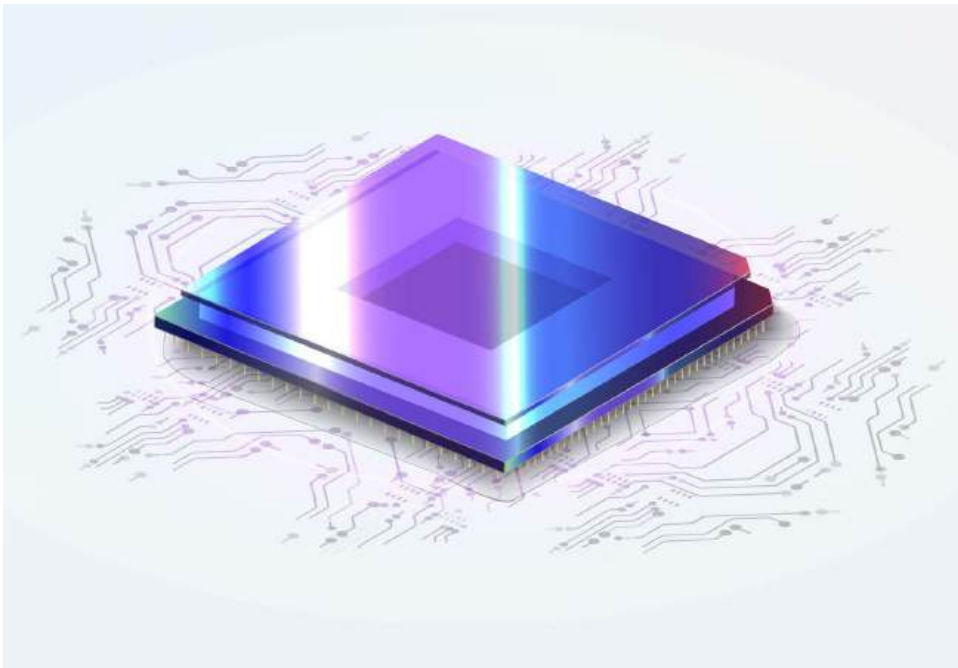
SoMs drastically reduce time to market, enhance product competitiveness, and lower development and sourcing costs. They enable businesses to seamlessly source replacements and additional modules with identical specifications, ensuring minimal production disruption.

This whitepaper explores the myriad benefits of SoMs, including cost efficiencies, accelerated time to market, and scalable, flexible solutions for evolving technological needs.

The rise of SoMs marks a pivotal shift in product development, allowing businesses to outsource complex CPU design and focus on core strengths and innovation. Welcome to the new era of embedded technology.

# Chapter 1

## The SoM Landscape



A System-on-Module, or SoM, is essentially an entire central processing unit (CPU) architecture that is designed and built into a compact module. A SoM provides the core components of a processing system on a single, modular printed circuit board that can be embedded into many different types of systems – everything from digital screens and cameras to robotics and machinery.

Historically, a SoM would be utilised by smaller organisations who had limited technology capabilities in-house, as a means of completing their final product and getting it to market by essentially outsourcing the technology contained within a SoM. However, we've seen a recent shift in the customer demographic, with those producing tens of thousands of units still opting to utilise a SoM approach.

A SoM brings a multitude of benefits. Developers can reduce time to market and increase product

competitiveness as well as reduce development and sourcing costs. With a SoM model, customers can source replacement and additional SoMs, for which specification and footprint are identical, to meet their ongoing needs, with minimal production and design disruption. So, let's take a closer look at some of those benefits.

### Cost efficiencies

“Often, utilising a SoM is initially discounted when comparing the price of a SoM versus the total price of components,” says Derek Stewart, Business Development Engineer at Solsta. “However, a significant cost in any production is development time. By minimising this cost, businesses can save a significant amount of money when compared to undertaking a discrete component design.”

Essentially, starting from scratch with a discrete design is both time consuming and also works on the assumption that the internal team has all the technological capabilities required to design all the elements. Utilising a SoM approach not only reduces time to market, but also enables businesses to order a single SoM component and receive a finished, approved product, rather than ordering the typically 200+ discrete component it integrates.

“SoM providers also take responsibility for delivery and handle availability and sourcing challenges. In fact, SoM providers often

have stronger buying power than individual customers and so can resolve supply chain issues more swiftly than smaller businesses would have been able to,” says Stewart.

Feedback from Quectel customers marries up with Stewart’s sentiments. “Our customers report a 20-30% cost saving when they factor in the design time as well as manufacturing, logistics and handling costs,” says Product Development Manager, Zeljko Maric.

The increasing complexity of design should not be underestimated. With their own products, customers will need to invest in engineering and advanced equipment for development and boarding up. With SoM, this can all be done for them.

“There is also the opportunity debt to consider,” says Ron Singh, Sales Director at Digi International. He continues: “Businesses have a finite engineering resource and tying them up in building a whole board might not be the most efficient route. By using a SoM, the internal team can instead focus on their strengths; factors of the design that can differentiate their products and business and deliver competitive advantage. You may limit potential business opportunities by doing it all from scratch rather than outsourcing.”

“The next debt to consider is that of a technology debt. Once a printed circuit board (PCB) has been designed by a manufacturing company, they then own that for its entire lifetime and all the burden and responsibility of supporting it throughout its entire lifecycle.”

Whilst there are perceived benefits to this, such as internal capabilities and proprietary technology, for any required software or vhardware updates and changes, the responsibility lies with the manufacturing company and can cost both time and money to update. By using SoMs, that technology burden can be entirely outsourced.

“There can be an element of naivety when it comes to the cost of SoMs,” Singh

continues. “The price tag can be reviewed and considered, but often the total cost of ownership is underestimated. The cost of designing, sourcing, and manufacturing the components, whilst factoring in potential manufacturing or shipping delays, can paint a very different pricing picture. The ability to offload the design and manufacture, as well as the risk, should be duly considered and given a value.”

Businesses can tie their money up in inventory to build a product, but one missing component means they cannot complete, ship, or sell that product. SoMs can negate the ‘golden screw’ challenge for businesses. They can order one SoM which effectively delivers between 200-400 parts already completed, tested, and approved.

With SoMs, it’s not just the chips on the board that customers get; it comes with a complete software development kit. Both software and hardware are built in so customers can access the most up-to-date software on the market, which makes using SoM an even more attractive offering.

### **Time to market acceleration**

Precertification is another compelling benefit of using SoMs. Utilising technology that is already pre-certified substantially reduces the customer’s time to market, giving them access to technology that is ready to use.

A component-led, ‘chip down’ design takes a significant amount of time. “There are up to twelve layers of PCB to build, and designers need to accommodate and track every single component whilst allowing for electromagnetic compatibility and various other design considerations,” explains Singh.

“SoM strips all that out. The bulk of the work is done with ready-made components that are already tested and proven. The need to design and test power, software and hardware is handled by the module provider and designers can strip up to four layers out of their carrier board, only accommodating the SoM itself

rather than potentially up to 400 components.

“The timing benefit of SoMs cannot be overstated. In many industries, the speed in which the product is brought to market is critical to success. A current example of this is EV chargers. Given our climate and renewable energy commitments, there is a huge push to implement an EV infrastructure, and at a rapid pace. Charge-point providers need to be able to bring their technology to market quickly. The timeframe between designing their product ‘chip down’ and then sourcing regulatory approval could be two or more years before the product is market ready. By that time, the infrastructure roll-out is likely to have moved on, therefore limiting the company’s market opportunity to sell their product.”



New product introductions have the potential to make or break businesses. Launching on time is critical, particularly if they are a publicly listed company or have planned the launch for a specific date. Tying up valuable resources and finances in designing and manufacturing products is high risk, whereas outsourcing the SoM element removes that risk, as well as giving companies access to expert capabilities with faster development and deployment.

Utilising SoMs not only undertakes a sizeable portion of the development of products, but also streamlines the design and approval processes. ‘Chip down’ design can take anything up to a year, followed by the arduous task of gaining required approvals and certifications. This can delay product launches to a point where businesses lose all competitive advantage. Making use of pre-approved SoMs means businesses can simply

‘plug and play’ and focus instead on the elements of their product that reflect their ethos and skillset rather than deploying resources on the development of a bespoke CPU.

“Our SoMs are globally certified, and our customers can benefit from reutilising these existing certifications on their finalised products,” says Maric of Quectel. “This further reduces their time to market with a single-sourced, feature-rich product.”

Solsta’s Derek Stewart agrees. “Many customers choose to utilise SoM technology to free up valuable internal engineering time to focus on their organisation’s ‘value-add’ in other areas that their product is known for and lean on SoM providers for the more standardised parts.”

### **Scalability and flexibility**

“Good module providers should be supplying modules with a common form factor or footprint,” says Singh. “This gives end customers the ability to flex or upscale their design to meet their evolving needs without having to start over. It also factors in a layer of resilience. If there is a component shortage, one component can be swapped out for another to meet the end customers’ needs and thereby mitigate risk.”

The ability to offer customers multiple iterations of the same form factor offers flexibility and enables scalability for the customer’s end product, but also futureproofs the SoM for generations to come.

This flexibility can also enhance product scalability. Variants of a SoM may offer different processor core architectures, memory options or varying types of Wi-Fi and Bluetooth

connectivity. End users may need an upgraded product to meet additional requirements, and the memory within a SoM can be swapped for a different version with little to no latency.

“A significant benefit of SoMs is having multiple variants with the same footprint but different memory configurations or capabilities,” says Quectel’s Maric. “Customers can provide multiple variations of their product, with the enhanced capabilities contained within the SoM that is completely interchangeable. This takes the pressure off the customer when it comes to altering their product designs - these alterations all sit within the SoM.”

Similarly, when looking to update or introduce variations of a product, the central SoM element can be handled by the module partner, further freeing up time and resource.

The ability to swap out the SoM can enable customers to offer multiple iterations of a product to the market. An example of this would be a scalable product that can process more or less data depending on the end application by varying the number of processing cores and memory selected, all in footprint compatible solutions. Product variants can also be produced offering local display and touch screen control/monitoring driving capabilities or remote monitoring with the addition of optional connectivity again in footprint compatible solutions. This flexibility means businesses can hold lower levels of stock, but still maintain the flexibility to meet varying demands by one SoM insertion.

Technology is developing at pace and cutting-edge technology five years ago is often being usurped and made obsolete through such rapid digital advancements - for example, as seen by the introduction of support for AI in the latest SoMs. The potential need for businesses to start from scratch every few years to keep up with technology is unsustainable. Rather than continuously starting a new discrete product design each time, employing a SoM allows companies to scale their business offering with relative ease.



## Risk mitigation and reliability

SoM providers create a product in itself, one that can be applied and utilised across many different industries and applications. By definition, their SoM product will have hundreds or thousands of applications and therefore there is security in its volume. With new technology development, module providers can design these updates into their SoMs, creating a newer version of the product, but one that is still applicable to their customers.

“SoM providers don’t simply deal with physical hardware,” says Solsta’s Derek Stewart. “They’re often implementing a lot of the software for customers, the security elements, undertaking testing and obtaining approvals; there’s a lot of value outside of simply the cost of the hardware. Similarly, many SoMs have value-adds such as remote management capabilities, whereby customers can remotely log in to monitor, control and update their firmware.”

A benefit in risk mitigation as well as scalability is having common factors within the SoM, enabling customers to have more control and understanding of their SoM, as well as the ability for module providers to swap out similar components to maintain a reliable supply of SoMs.

Dan Kephart, Senior Product Manager at Ezurio, explains; “We’ve seen multiple supply chain challenges over the past few years, and security of supply is another benefit of using a SoM approach. SoM providers will have strong buying power and will purchase hundreds of



thousands of components to ensure a steady stream of materials. Alternatively, individual product designs will require far fewer numbers of each component, which can exacerbate supply chain issues or component obsolescence due to a lack of buying power. This can cause supply gaps which grind production lines to a halt.”

### **Long-term sustainability**

The electronics industry is under increasing scrutiny in terms of sustainability. With consumers increasingly encouraged to swap out technology such as laptops, mobile phones and televisions every 18-24 months, the amount of wastage generated is staggering. The dichotomy, however, is that OEMs ideally want to design a component, seek regulatory approval, and use it in the marketplace for as long as possible, often ten or even twenty years.

Industries such as medical, automotive and industrial manufacturing need the assurance that they will be able to access their components throughout the lifecycle of their product and will rely on this secure supply. Industries also want to manage their sustainability credentials, as well as reduce their carbon footprint wherever possible. Having SoMs that are compatible with multiple iterations of their equipment reduces their carbon footprint, as does the ability to replace outdated SoMs rather than simply scrapping and replacing entire products.

If an element of a SoM becomes obsolete, 99% of the time it can be swapped with little disruption and no change to the overall SoM performance. Working with a module partner also means they take on the responsibility – and headache – of managing obsolescence and end-of-life on behalf of customers, rather than customers needing to redesign their entire product to allow for the change in component, effectively scrapping their previous iteration and generating huge volumes of waste.

“We can’t underestimate the knock-on time and cost implications when it comes to obsolescence,” says Zeljko Maric at Quectel. “With SoM, customers need only manage the single lifecycle of the module instead of needing to track the lifecycles of every individual component within a discrete design - a mammoth and time-consuming task. By definition, SoMs are designed with longevity in mind, often set to last a decade or more.”

### **The benefits are plentiful**

It’s evident that the SoM landscape isn’t just a technical playground – it’s a veritable cornucopia of benefits waiting to be reaped. The adoption of SoM is akin to finding a hidden treasure map in a sea of complex technology solutions. From the nimbleness in product development to the cost-effectiveness that makes CFOs smile, SoM stands out as a beacon of efficiency and innovation.



# Chapter 2

## What is the Market Looking for in SoMs?

SoMs work across many different industries including agriculture, medical, machine and factory automation, infrastructure and building management.

One sweet spot for SoM usage is in a market with multiple players. In an industry with only two or three main players, the majority of system design will be undertaken in-house within these massive technology houses. However, in a sector with multiple smaller competitors, making use of SoMs helps them to streamline the research stages of product design and save money in the early stages of development.

In terms of markets, B2B industries such as agriculture, medical and factory automation tend to be more successful when it comes to integrating SoMs, rather than consumer applications.

Industries that are embracing an IoT mindset, and are wanting to access the latest innovations as swiftly as possible, are a sweet spot.

Digi International's Ron Singh further explains; "The medical market tends to favour SoMs based on their longevity. The industry typically makes high value, low volume CapEx equipment, for example dental seats with integrated screens, MRI machines and X-ray scanners. With the levels of investment in these pieces of equipment, the medical market needs guaranteed availability of spare parts for these pieces of equipment for at least ten years, or more.

Ezurio's Dan Kephart agrees; "With the medical sector so highly regulated, using SoMs within their equipment helps to obtain the required approvals quicker, often by reusing subsystems that are already used elsewhere. SoMs lend themselves to that by definition; end manufacturers want long lifecycles and so, utilising existing SoMs that are woven into the fabric of a broad range of equipment – both within medical and elsewhere – helps ensure availability and avoid obsolescence.





“It’s important to consider that whilst manufacturers within healthcare, or in other industries such as agricultural equipment or rail, are producing large pieces of equipment, there are often times where they aren’t a big enough customer or so high value that manufacturers maintain and guarantee the ongoing manufacture of all components within their equipment, even when they are purchasing 100,000 units a year. With a SoM vendor, businesses get a partner that maintains their product-specific SoM and handles potential end-of-life challenges, sourcing alternatives that can slot into the SoM socket easily and with little to no impact on the end application.”

Dominant verticals for Quectel include retail and warehousing. “We find that SoM capabilities lend themselves perfectly to mobile payment devices that are now so commonplace in retail environments,” says Maric. “The integration of displays or touchpads is relatively simple and produces a feature-rich, handheld device that has transformed the retail space in recent years.”

“It’s a similar case for warehousing. With digitalisation prominent within warehousing and logistics, handheld devices can be used on the floor to assist with stock management, tracking and shipping. Integrating barcode scanners or cameras on the handheld device is relatively straightforward when utilising a feature-rich SoM and can result in smart warehousing and real-time reporting.”

### **Security is crucial**

SoM vendors are manoeuvring within the market to meet customer needs but also to a position where they are proving invaluable.

“SoM vendors are able to focus on security developments related to the components on their modules and release updates in an incremental fashion, future-proofing customer requirements ahead of updates or redesigns,” says Ezurio’s Dan Kephart.

“Rather than redesigning entire software systems, SoM customers can incorporate the incremental firmware or software updates to address security.”

### **Complexity is snowballing**

Increasingly, it's becoming too complicated for smaller customers to be able to handle the design of components in-house. As recently as five years ago, the bulk of SoM usage was in smaller projects, whilst larger customers often felt SoMs were too expensive in comparison to the cost of producing the design in-house. This has shifted in recent years to customers with 20,000+ units employing SoMs. With the pandemic and chronic supply chain issues, many end customers have recognised the

value of guaranteed, completed SoMs, whilst removing the logistical and design challenges.

### **The rise of AI and machine learning**

Artificial intelligence and machine learning have entered the market very quickly, with both business and consumer demand growing for smarter devices. Camera use has grown and, with varying architecture and the subsequent complexities around integration, finding a single supplier that can combine, integrate, and test the various drivers and software can make life much easier for customers and allows them to outsource this challenge to a SoM specialist.



# Chapter 3

## The Ascent of Connected Services & Future of SoMs

The benefit of having an accessible operating system should not be underestimated. SoM vendors may create customised software and hardware, but supporting this via the original vendor usually comes at a cost to the client and introduces an element of risk. If the vendor ceases trading or diversifies away from that system, end customers can find themselves with an obsolete SoM.

Conversely, using an operating system such as embedded Linux or embedded Android enables end customers to manage software updates independently, as well as giving them the confidence of employing a recognised platform. Regardless, it's vital that SoM vendors can offer support to customers, further building the value-add of outsourcing SoMs.

System on Modules are becoming increasingly complex with the industry witnessing multilayered SoMs with many subsystems within them. This complexity either requires a diverse range of in-house capabilities – at a cost – or needs partners who can deliver more complex solutions to customers. Choosing the right SoM and making sure the source code is readily available for further development is important. Customers invest heavily in SoMs for their product sets and do not want to be left in a high-risk situation whereby they cannot access elements of their own product.

It's important for customers to have full access to the source code to be successful both in the development of their products, as well as being able to take ownership when needed.





The alternative can be likened to a hostage situation; businesses could be sidelined by a supplier, having a significant impact on their business.

Similarly, having a bridge partner is invaluable. Acting as a facilitator, they can introduce and connect tech providers with customers, and have the working knowledge of both parties to advocate and support the project.

Technology moves at an unparalleled pace, and SoM development is no different. Cyber security is a major concern worldwide and across all technology. With increasing capabilities for hacking, coupled with utilising digital crime as a form of warfare in recent years, SoM security is of vital importance. Building robust security standards within SoM not only makes the technology more broadly applicable across multiple industries such as medical and defence, but also provides reassurance to customers that each element of their product is secure and that security updates can be easily carried out.

Artificial intelligence and machine learning are developing at pace and there is an overwhelming desire and focus to continue this

evolution,” says Ron Singh at Digi International. “The next frontier of SoM will mean increasing processing power to enable AI and machine learning applications in the future. Customers want more intelligence and more analysis. With increasingly intelligent SoMs, this can be accessed more easily and quickly to bring the latest technology to market: SoMs with neural processing units.”

“As we see with all technology, there is a desire for more intelligence overall and more analysis at the edge, sending smaller packets of pre-processed data to the central data hub to speed up processing and reduce energy usage.”

Communication and connectivity are increasingly expected within technology and standard wired interfaces such as Ethernet and USB are generally supported by default. Wireless options such as WiFi and Bluetooth are also options on many SoMs, and we’ll start to see more wireless modules that incorporate cellular modules. The use of traditional SIMs uses valuable space within SoMs, so instead we’ll likely see the obsolescence of physical SIMs, replaced with the inbuilt technology in the form of eSIMs and iSIMs.

# Conclusion

The adoption of System-on-Module (SoM) technology will continue to gather pace, transforming product development and market strategies, as well as delivering substantial cost efficiencies by reducing development time and sourcing expenses.

Companies no longer need to manage the intricacies of component design and procurement. This is proving to be particularly critical in industries such as the electric vehicle (EV) charging infrastructure, where speed to market is essential for success.

Scalability and flexibility are other core benefits of SoMs. They allow businesses to adapt quickly to changing technological demands without extensive redesigns. Variants of SoMs can offer different processing power, memory options and connectivity features, enabling multiple product iterations with minimal disruption.

Moreover, SoMs mitigate risks related to supply chain challenges and component obsolescence. SoM providers ensure a reliable supply of components, offering long-term sustainability and reducing the burden on businesses to manage lifecycle issues.

In summary, SoMs are transforming the way businesses develop and deploy technology, providing a competitive edge through cost savings, rapid deployment and flexibility. Embracing SoM technology is fast becoming a strategic imperative for companies looking to accelerate ahead and be first to market before their competition.





