Executive Summary

The Internet of Things






Opportunities and challenges for semiconductor companies

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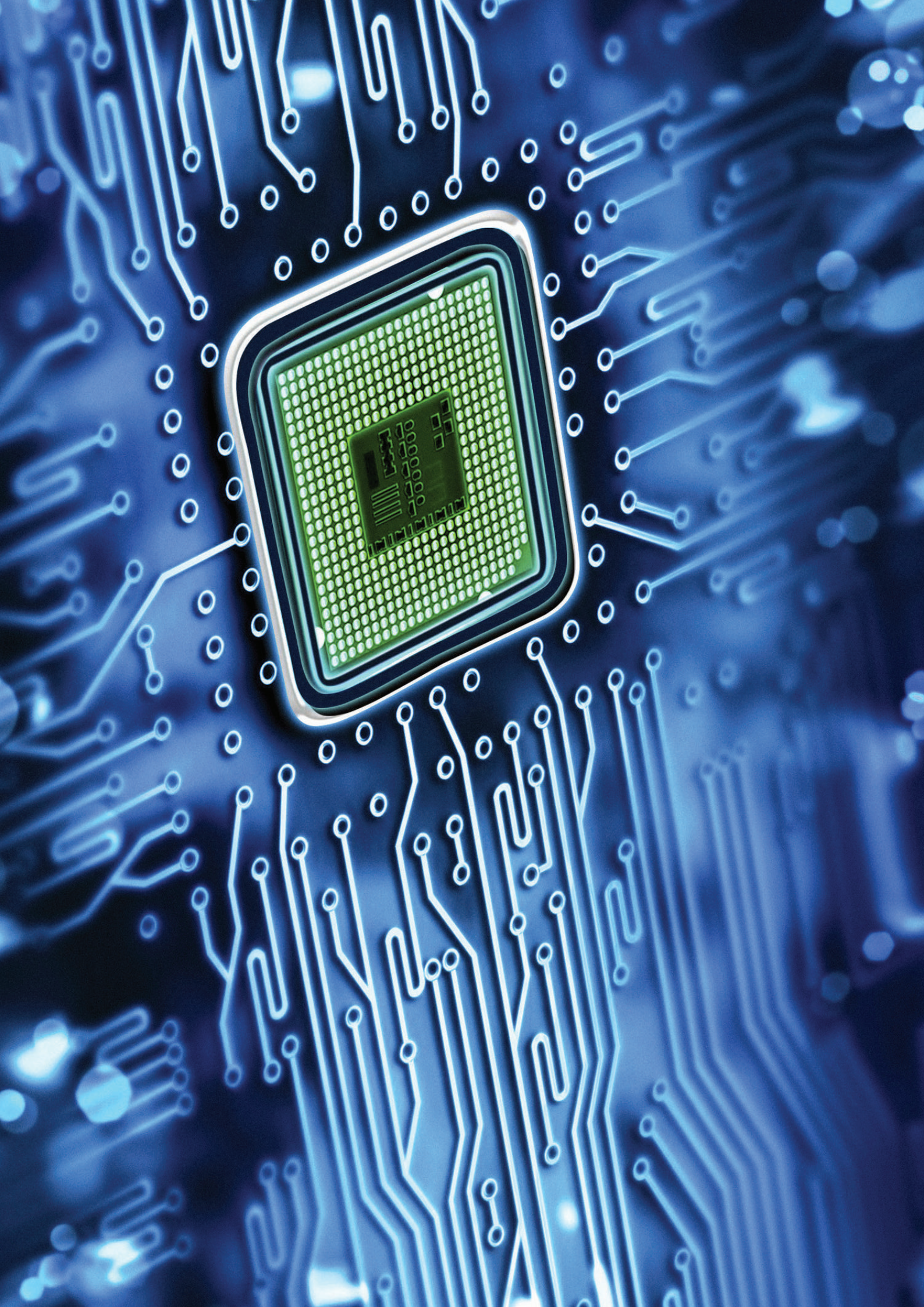
McKinsey&Company

GSA Global Semiconductor Alliance



Executive Summary

McKinsey & Company and the Global Semiconductor Alliance (GSA) recently collaborated to understand the implications of the Internet of Things (IOT) for the semiconductor industry and the economy as a whole. This effort was overseen by a steering committee of 11 senior executives from GSA member companies and McKinsey. It involved the following methods:

- interviewing 30 GSA members who were senior executives at semiconductor companies or at companies in adjacent industries that are part of the IOT ecosystem, such as network equipment and industrial automation
- surveying 229 semiconductor executives at GSA member companies
- assembling a fact base on the IOT, focusing on issues relevant to semiconductor companies

Among other insights, we found that semiconductor companies are well positioned to help the IOT gain momentum, despite the obstacles ahead, provided that they embrace innovation and rethink their traditional business model.

This executive summary briefly reviews major findings from the joint McKinsey/GSA effort. A comprehensive report that describes all findings from our research is available on the members section of the GSA website (gsaglobal.org/gsa-resources/publications/).

Understanding the IOT

In this report, we defined the IOT as a network containing all "smart" devices with some sort of sensing mechanism that can communicate via the Internet with other smart devices or the cloud, without human interaction. Most GSA executives prefer this explanation to broader definitions.

Semiconductor companies could supply products for hundreds, if not thousands, of IOT verticals, including wearable devices, automated lighting and heating, and industrial automation (for instance, remote servicing and predictive maintenance).

Our interviews revealed some ambiguity about whether the IOT would be the top growth driver for the semiconductor industry or just one of several important forces. Our survey of executives from GSA member companies also showed that they had mixed opinions about the IOT's potential, with 48 percent stating that it would be one of the top three growth drivers for the semiconductor industry and 17 percent ranking it first.

McKinsey research in other high-tech sectors suggests that three factors may determine when the IOT reaches the inflection point at which demand surges: solid technology, a strong market, and a suitable ecosystem, including a sufficient number of product options, developer tools, and adequate infrastructure—for example, connectivity (Exhibit 1). Almost all the executives we interviewed said that IOT applications and verticals satisfied these three requirements to varying degrees, and the fact base we assembled supports this belief.

Exhibit 1

Strong growth in IOT verticals has several prerequisites.

✓ Widely available ✓ Partially available

Prerequisite	Wearables	Smart homes	Medical electronics	Industrial automation	Connected cars	Smart cities
Solid technology that is both innovative and affordable	✓	Current price level generally restricts market to premium/ enthusiast customers	Further development of chemical sensors, miniaturized implants ongoing	✓	Affordability is an issue for complex IOT applications, such as autonomous driving	✓
Strong market, including a strategy for making niche products profitable, clear standards, and high security	Profitable products still under development	Various applications need to be integrated to spur demand	Regulations require strict security and standards for medical apps; initial growth expected from lifestyle, fitness, assisted living	System security needed for safe connection of manufacturing controls to Internet; "private clouds" are available but have limited functionality	Highest safety and reliability need to be guaranteed; legal issues must be clarified	Need for strong business models that do not require large investments; applications must be integrated more fully
Well-developed ecosystem/ Infrastructure, including enough available products and adequate network coverage	✓	✓	Hospitals lack technical capabilities needed to use IOT devices	✓	✓	✓

Source: Expert interviews; GSA and McKinsey IOT collaboration; IHS: McKinsey and GSA survey of semiconductor executives, November 2014

The challenge ahead

Many new high-tech industries have initially generated much excitement but encountered problems after growth accelerated. With the IOT, we have identified six issues that could derail progress and present a challenge to semiconductor companies:

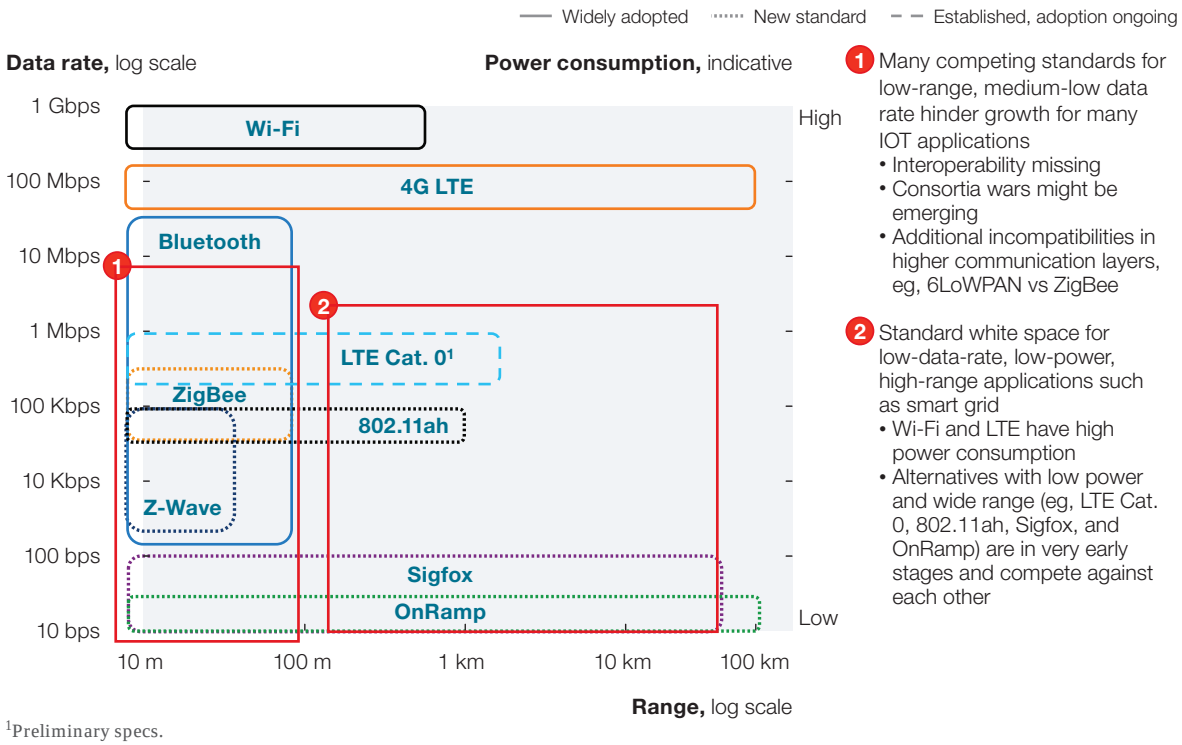
- **Unresolved issues about the security and privacy of user data.** Our assessment suggested that security is an important requirement for growth in IOT applications. However, our interviewees were bullish about the technology needed to secure the IOT, asserting that it is already sufficiently advanced. The interviewees noted that the real challenge lies in using available technology to implement end-to-end security solutions for the entire IOT stack—cloud, servers, and devices. As one executive said, "Overall security is only as good as its weakest point."

- **Difficulty building customer demand in a fragmented market.** Demand for IOT applications is in its early stages, and its future growth is expected to result from a string of attractive but small opportunities that use a common hardware and software platform, rather than a single "killer app." Semiconductor companies can indirectly play a role in boosting consumer demand by helping developers create innovative applications or by providing assistance to businesses that want to use IOT products and services, including nontraditional clients like start-ups and businesses outside the technology sector—for instance, retailers or hospitals.

- **A lack of consistent standards.** Some levels of the IOT stack have widely accepted, well-defined standards, but others have none. In still others, there are multiple, competing standards with no obvious winner. For example, Exhibit 2 shows the multiple standards for connectivity. Given the current uncertainty, semiconductor players should pursue a hedging strategy—in other words, focusing on selected standards that are likely to gain widespread acceptance but planning for alternative scenarios. In parallel, semiconductor companies should actively engage with industry associations or other groups that are trying to develop IOT standards, with the goal of supporting the best ones. Such collaboration is important even when companies are trying to help create marketplace standards.

Exhibit 2

IOT standards are not mature in many categories, including connectivity.



[1]Preliminary specs.

Source: Company websites; expert interviews; GSA and McKinsey IOT collaboration; press research

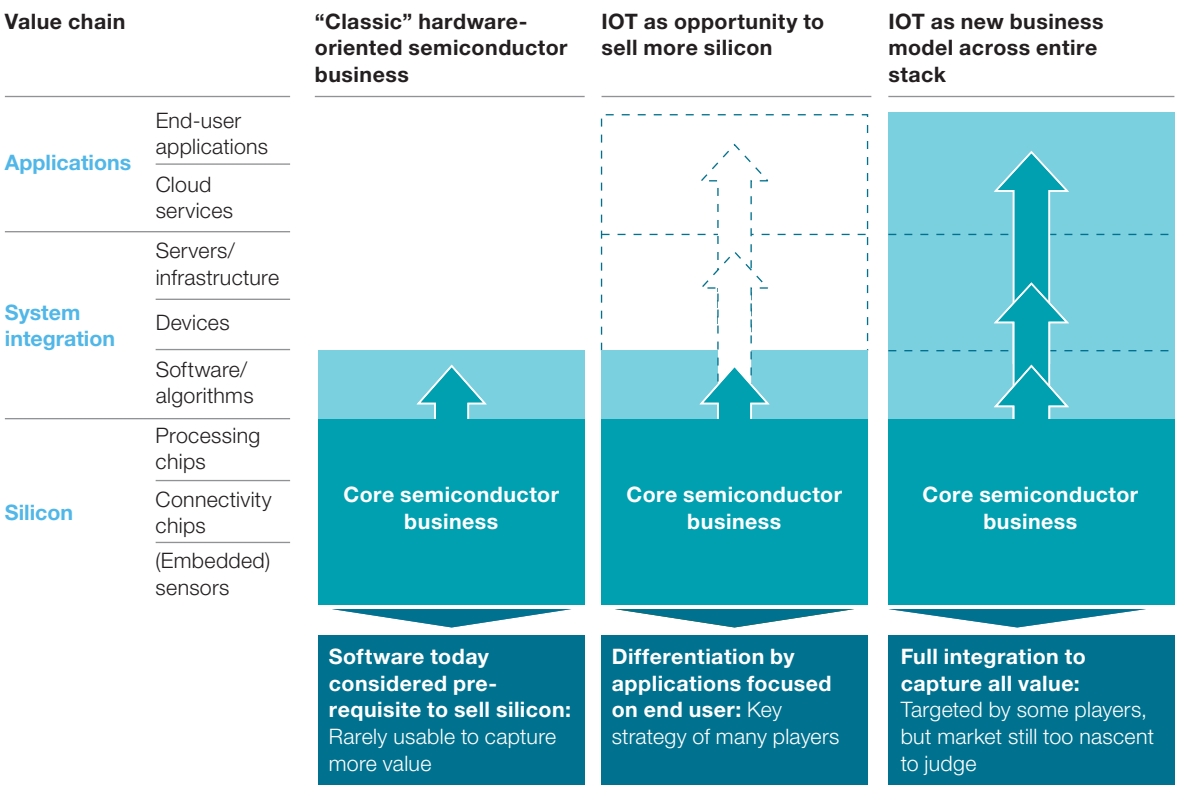
- **A fragmented marketplace with many niche products.** Most IOT applications do not generate enough sales to justify design of a single chip specifically targeted at them. However, semiconductor companies may be able to achieve the necessary sales volume by classifying IOT devices into archetypes based on their specifications. The companies can then create a single platform to cover each archetype, which will have more widespread appeal than a chip tailored to a niche application.

- **The challenge of extracting more value from each application.** Many of our interviewees feared that semiconductor companies would not extract full value from the IOT if they focused solely on silicon, so they were determined to deliver complete solutions that cover multiple layers of the technology stack. The opportunities that most interested our interviewees included software, security, and systems integration (Exhibit 3).

Exhibit 3

Semiconductor companies must seek value beyond silicon and software.

Semiconductor players' approaches to IOT business model



Source: GSA and McKinsey IOT collaboration

- **Technological issues that affect the IOT's functionality.** In our survey, two-thirds of respondents stated that technological issues present little to no challenge to the success of the IOT. The remaining respondents were split evenly between those who thought technical issues were above average in importance and those who considered them a major challenge. When we asked our interviewees about the most crucial technological innovations for the IOT, most focused on lower power consumption as the key improvement that could substantially stimulate demand.

Implications for semiconductor players

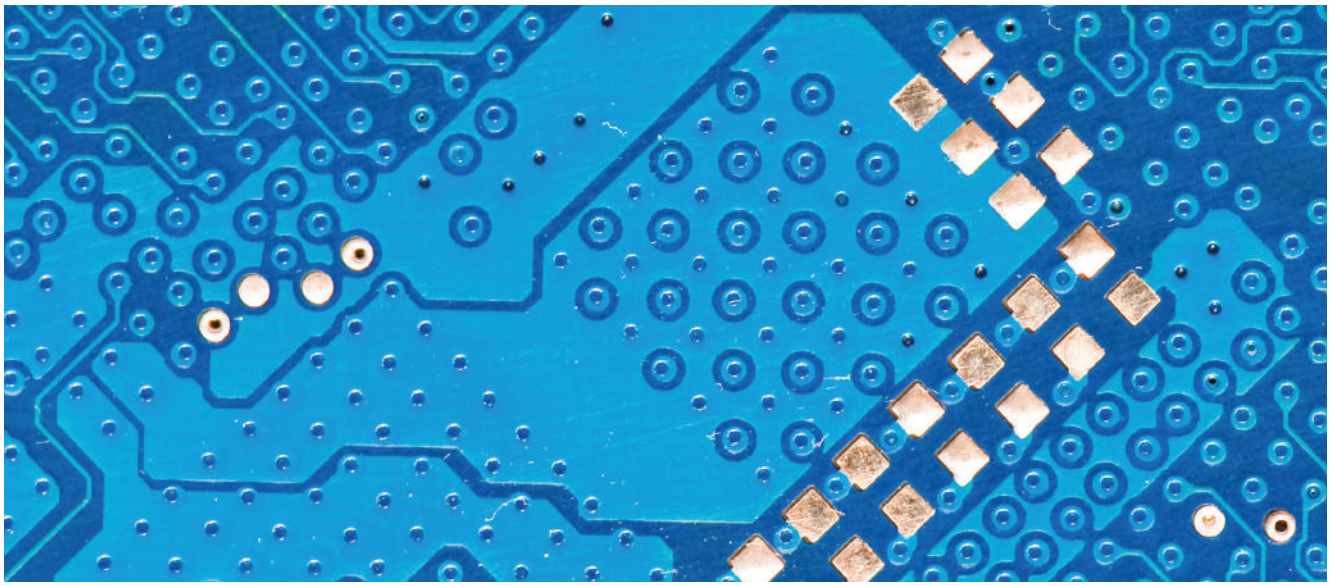
With so much at stake, semiconductor companies need to reevaluate all aspects of their businesses and make some radical changes. Three tactics will be particularly important:

- **Finding the right niches.** There may be many profitable IOT niches within the fragmented market, and semiconductor companies will need to identify and quickly serve the most promising ones. In doing so, they must consider their own capabilities and expertise. For instance, a semiconductor player that has strong ties to consumer-

electronics companies and possesses full-system-integration capabilities might decide to focus on wearables and smart-home devices, providing all appropriate chips as well as software/algorithms, devices, and servers or other infrastructure.

- **Developing a solid strategy to seek value beyond silicon.** Expanding beyond silicon may necessitate a completely new business model, such as one that focuses on usage-based pricing. To mitigate risks and avoid moving too far from their core competencies, semiconductor companies should carefully test any new approaches before widespread rollout. For example, they could create a team to test it in a niche application market and then undertake a broader rollout with more applications.

- **Revisiting (and revolutionizing) the corporate operating model.** Since the IOT presents new challenges, semiconductor companies should consider an overhaul of their operating model, with a particular focus on organizational changes. For instance, most semiconductor companies now include a limited number of large business units, a focus on direct sales and field-application engineers, and an emphasis on application-specific R&D programs. A more appropriate structure for the IOT might emphasize a multimarket sales approach and a greater reliance on channel partners, such as distributors, as part of their go-to-market strategy. Other possible areas for improvement include R&D, investments, and change management.



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