CASE: SM-236
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INTEL'S MOBILE STRATEGY IN 2015 AND BEYOND

At the end of the day our core strategy has remained unchanged for the last 47 years. Be the number one semiconductor company, lead in process technology, achieve economies of scale. Any questions?
—Renée James, President, Intel Corporation [1]

INTRODUCTION

In January 2015, Intel top management was reviewing the company's mobile strategy and deciding on the next steps to take to make Intel a more important mobile player. At that point Intel had virtually no presence in the smartphone market. It had only recently become a real player in the tablet market (19 percent share) through a strategy of compensating its manufacturing customers for the additional cost of using Intel's chips, which were initially more expensive to implement than its competitors' chips. Some top Intel executives had estimated that Intel needed to have a reliable 20-30 percent unit market share for both smartphones and tablets within five years to achieve a sustainable leadership position and not be locked out as a relevant mobile player. Most phones and tablets ran on a competing architecture designed and licensed by ARM Holdings (ten billion ARM-based chips were shipped in 2013 including over one billion in the smartphone market.[2]) Qualcomm, Apple, Samsung and MediaTek made most of the processors for mobile devices.

Despite the challenges, getting a strong foothold in the mobile market was strategically vital for Intel. The notebook market had been shrinking due to cannibalization from tablets; the popularity of tablets meant customers had been replacing their notebooks less often. This was especially

[1] Interview with Renée James, President of Intel Corporation, at Stanford Graduate School of Business, November 2014. Subsequent quotations are from this interview unless otherwise noted.
[2] Paul Sandle, "Smartphone Slowdown Hits ARM's Royalties in Fourth Quarter," Reuters, February 4, 2014, http://www.reuters.com/article/2014/02/04/us-arm-results-idUSBREA130KU20140204 (accessed August 3, 2014).

Debra Schifrin and Professor Robert Burgelman prepared this case as the basis for class discussion rather than to illustrate either effective or ineffective handling of an administrative situation.

problematic in mature markets, where the notebook market was almost entirely replacement. Flattening demand for notebook processors also meant that production volume in Intel's multi-billion dollar fabrication plants (fabs) was not growing, and as a result Intel had delayed putting one of its new facilities on line in 2014.

While Intel's 2014 financial results were excellent, and its stock rose about 38 percent in 2014, its Mobile and Communications Group lost over $4 billion that year. By January 2015, Intel had lost about $5 billion total in its mobile investment. (See **Exhibit 1 for** Intel's financials and **Appendix 1** for Intel's Business Groups and their revenue figures.)

A challenge to Intel's overall business model was that the mobile market had a much lower chip average selling price than those of Intel's traditional businesses; server chips sold for around $1,000, and notebook chips sold for $100-$250 versus $15-$20 for tablet chips, $10-$15 for chips for an entry level smartphone, and up to $40 for a higher end smartphone. Intel President Renée James observed the internal dynamic that led to Intel's position in the mobile market:

> In the case of mobile, we actually knew the answer a while back; we just did not like it. We were resisting selling lower-priced processors. In addition, we had internal presentations about mobile and we ignored the data. In fact, some of us probably convinced ourselves that the data was wrong—that people don't really want tablets. We continued to build what we wanted to build and told our customers that is what they needed. And, in mobile (outside of laptops), our customers left us.

James knew that it was time to get Intel's customers back. The change in leadership that took place a year and a half earlier had changed the mindset and mobile strategy of the company. Intel was seeing some results, but it still had a long way to go. It had to make the right strategy choices now to make up for lost time.

NEW LEADERSHIP BRINGS A NEW STRATEGY

In May 2013, Brian Krzanich became Intel's new CEO, and Renée James became president. They were both Intel veterans. James said that before the leadership change, Intel had a mobile unit, but its leadership at the time had been locked in debate about whether to aggressively go after the mobile market, and if so, whether to tackle both the smartphone and tablet markets. When Krzanich and James took the reins, they consciously separated the phone and tablet strategies, determining that tablets were a new segment of computing and disruptive to Intel's core business, while smartphones were not. They believed that the smartphone market, with over one billion units, was too big to ignore, but the tablet market was of immediate strategic importance. Krzanich and James then developed a "tablets at all costs" strategy. In November 2013, Intel announced that it would supply chips for 40 million tablets by the end of 2014. By fall 2014 Intel was on a trajectory to meet that goal, and it had a 19 percent tablet market share for application processors[3] (the main processors). However, since Intel's chips were initially more expensive to implement than its competitors', Intel was offsetting that cost with its

[3] "Intel Rose to Number Two Position in Application Processors in Q2 2014," Strategy Analytics press release, September 29, 2014, http://www.strategyanalytics.com/default.aspx?mod=pressreleaseviewer&a0=5605.

customers through marketing programs (Intel reported this as contra-revenue).[4] The goal was to gain market share quickly so Intel could drive third-party developers to invest in its platform and bridge the time until Intel came out with a cost-competitive chipset solution in 2015-2016 (much later than Intel had originally estimated).

Intel was also engaging in new tactics in China to address the tablet and smartphone markets. It was teaming up with Chinese company Rockchip to create and sell Intel-branded integrated chips for the low end of the tablet market (using 3G technology). In addition, Intel invested about $1.5 billion for a 20 percent stake in Chinese chipmaker Spreadtrum Communications. This involved providing additional business to the Taiwanese foundry Taiwan Semiconductor Manufacturing Company (TSMC), as Intel chips headed for the Chinese tablet market and beyond would be produced there rather than in Intel's own fabs. This was noteworthy because TSMC serviced Intel's competitors. Intel was also wooing smaller Chinese ODMs (Original Design Manufacturers) and OEMs (Original Equipment Manufacturers) to get them to switch from ARM-based chips to Intel chips. Intel had very little time to establish a relevant presence in the mobile market. The question was whether implementing these new strategies would be enough.

THE GROWING STRENGTH OF TABLETS AND SMARTPHONES IN THE MOBILE ECOSYSTEM

Tablets

The most immediate threat to Intel's core business was the growth of tablets. Tablet sales topped 206 million units in 2013 and were estimated to be 256 million units in 2014.[5] (See **Exhibit 2** for worldwide device shipments by segment.) The global tablet applications processor market grew 32 percent in 2013, with revenues of about $3.6 billion.[6] In the fall of 2014, Apple led the pack with a 26 percent market share, followed by Intel with 19 percent and Qualcomm with 17 percent.[7]

Initially, the tablet market impacted the PC/notebook market mainly by extending the replacement cycle (especially in mature markets where PC and notebook sales were primarily driven by replacement purchases), but going forward, tablets were expected to become more similar to notebooks in terms of usage. Microsoft Office products were available for tablets, for example, as were external keyboards that replicated typing on a laptop. These types of tablets could lead to direct cannibalization of Intel's PC/notebook market share.

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[4] A contra-revenue account is a revenue account that has a debit balance instead of a credit balance. Common contra-revenue accounts are sales returns and sales discounts.

[5] "Gartner Says Worldwide Traditional PC, Tablet, Ultramobile and Mobile Phone Shipments to Grow 4.2 Percent in 2014," Gartner press release, July 7, 2014, http://www.gartner.com/newsroom/id/2791017.

[6] "Intel, Marvell, Mediatek and Qualcomm Made Progress in Tablet Apps Processor in 2013 Says Strategy Analytics," PR Newswire, February 21, 2014, http://www.prnewswire.com/news-releases/intel-marvell-mediatek-and-qualcomm-made-progress-in-tablet-apps-processors-in-2013-says-strategy-analytics-246565291.html.

[7] "Intel Rose to Number Two Position in Application Processors in Q2 2014," Strategy Analytics press release, September 29, 2014, http://www.strategyanalytics.com/default.aspx?mod=pressreleaseviewer&a0=5605.

In mid-2014, there was a softening of the tablet market with growth slowing down,[8] and the industry was seeing a split between the business and consumer sides of the market. Companies were choosing to stick with PCs and notebooks for their workers, while individual consumers were choosing to buy tablets. At the same time, consumers were picking large smartphones over small tablets.

Smartphones

In 2013, 968 million smartphones were sold worldwide.[9] It was the first year that smartphones outsold basic mobile phones. For smartphone application processors (AP) specifically, second-quarter 2014 industry revenue was $5.2 billion. But Intel had less than five percent of that market, putting the company behind Qualcomm (58 percent revenue share), Apple (14 percent), MediaTek (13 percent), Samsung, and Spreadtrum.[10] The smartphone market was strongly correlated to tablets, especially for the smaller tablet screen sizes where the lines were blurring between a 5-inch smartphone, 6-inch "phablet" (phone/tablet device) and 7-inch tablet. Typically, however, smartphones and tablets used similar chipsets.

STRATEGIC CHALLENGES FACING INTEL IN MOBILE IN 2014

Core Business and Market Segment Share Dilemma

Intel's overall business and development processes were optimized (1) for the core business of PCs, notebooks, servers, and (2) a strong market segment share in the range of 80 percent. However, the mobile wireless industry had emerged from a highly competitive market with very different characteristics in terms of cost, power, features, and other aspects—and Intel had only a very small share.

In addition, Intel's core business necessitated that the company work hard to fight commoditization of its chips. James explained that commodity silicon is a more challenging place to make money:

> With tablets you have to be very careful because many tablets are sold for only $200, and so you have to think hard about that. Why would you be in that business? How do you want to be in that business? Do you want to engage in a chase to the bottom and chase something that is sold for $15, or are you going to say, "that might not be for me." Except if there are 300 million of them and they take share away from you. These are the things we had to think about.

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[8] "Gartner Says Worldwide Traditional PC, Tablet, Ultramobile and Mobile Phone Shipments to Grow 4.2 Percent in 2014," Gartner press release, July 7, 2014, http://www.gartner.com/newsroom/id/2791017.

[9] Natasha Lomas, "Gartner: Smartphone Sales Finally Beat Out Dumb Phone Sales Globally in 2013, With 968M Units Sold," *Techcrunch,* February 2, 2014, http://techcrunch.com/2014/02/13/smartphones-outsell-dumb-phones-globally.

[10] "Smartphone Apps Processor Market Share Q2 2014: Qualcomm Captures 58 Percent Revenue Share," Strategy Analytics report, September 10, 2014.

But she added that Intel had to be sure it did not take its eye off the ball with its hugely profitable data server market. "What keeps me up at night is that we need to pay attention to both of these businesses at the same time and they have hugely different dynamics in and impact on our profitability."

Maintaining Intel's Manufacturing Capacity

Krzanich had a strong Intel manufacturing background, and understood keenly the strategic importance of volume to long-term manufacturing leadership. Intel's multi-billion dollar fabs needed increasing volumes in order to operate at high capacity, pay the bills, and keep Intel's innovation process and Moore's law going.[11] As notebook sales began to flatten or shrink, Intel could end up having excess capacity in its fabs in the longer term. The volume of chips needed to fill the fabs was huge, especially going forward with further shrinking geometry nodes (defined in nanometers or nm) and expected migration from 300nm to 450nm wafer size by the end of the decade. (Both of these increase yield and the minimum efficient scale of a manufacturing facility: Shrinking geometry nodes involves making transistors and chips smaller; increasing the wafer size means more chips can be produced on one wafer). Over time, maintaining sufficient manufacturing volume would necessitate adding mobile chips to Intel's production, given the enormous market size for mobile chips compared to PC chips.

Intel had initiated a foundry business a couple of years earlier, opening up its fabs to some non-competitors, but the volumes were small, and if the volumes from these new markets did not develop, Intel might have to consider opening up its fabs to competitors as well.

Technology Challenges and Delays

One of Intel's top challenges was that its first integrated product for mobile devices, which combined its Application Processer (AP) and modem technology in one piece of silicon, was not yet in the market. In early 2011 Intel acquired the German company Infineon Technologies' AG Wireless Solutions to accelerate Intel's entrance into the mobile market. But as late as the end of 2014 Intel still had not fully integrated Infineon's modem technology with Atom, Intel's low-power microprocessor. That integrated product was scheduled to hit the market in 2015, much later than Intel had originally estimated. The main reason for this delay was that Intel was late to the market with its modem. Integrating a complex external IP subsystem like a cellular modem required a lot of effort to port on Intel manufacturing technology, which was initially not optimized for low-power/low-cost markets.

Integrating the baseband processor, the application processor, and other logic on one silicon chip created a strong cost advantage. This was especially important because of the fast-growing low-end mobile market. The biggest volume of smartphone sales was coming from the $200 and below price point, mainly from the Chinese and Indian markets. The smartphone and tablet markets were highly competitive and dynamic, driven by rapid feature introduction on short notice. When entering the market, Intel's application processor was the benchmark in compute

[11] Moore's law is the experience curve effect in semiconductor manufacturing that had resulted in a doubling of density and a halving of transistor cost approximately every two years for the prior 40 years, but due to the shrinking size of transistors, it also increased the effective capacity of a fab with each new technology generation.

performance but lagged behind in certain elements of the integrated System on a Chip (SoC) such as graphics/imaging features like megapixel resolution and video playback, which were critical in the mobile market. Therefore, the company's process technology advantage did not come through. Intel needed to get to features parity (meaning its features were as good as its competitors) in order to reap this technology advantage.

Design and Manufacturing Environment for fast cycle/development times

Intel's two-year manufacturing lead and the co-development and co-optimization of products and process (the tight integration of design and manufacturing) allowed the company to offer superior products in terms of computing performance. However, while the foundry ecosystem was behind Intel on technology nodes, foundries were able to achieve faster product development cycles by separating technology and product development and using industry standard design flows (methodology) and synthesizable IP. TSMC was the leading foundry and self-developed its process (manufacturing) technology and gave its customers "design rules." (Most large fab-less semiconductor companies like Qualcomm, MediaTek, and Marvell used TSMC's foundry.) Customers like Qualcomm then used the design rules to develop their SoC. In essence, the foundry ecosystem's design methodology was modular, more flexible, and optimized for rapid time to market and the ability to develop derivative product releases rapidly. In contrast, with its co-development process, Intel delivered significantly higher product performance and battery life, but had longer product development cycles and therefore its product features had to be locked in earlier.

Modem/LTE Challenges

The importance of the modem side of the mobile equation was growing at the same time the Application Processor side was at risk of commoditization pressures, especially in the low end. Intel had a modem with the latest technology, LTE (Long Term Evolution), on a Samsung tablet,[12] but was still in a catch-up mode to Qualcomm. For three years, Qualcomm was the only company that sold LTE, so it was the sole provider of the most advanced modem, which the company extended to the overall silicon platform by integrating the AP and Wi-Fi connectivity into the modem as well. For example, Samsung had to buy Qualcomm's integrated solution to get access to the latest modem technology. (However, Apple and Samsung had begun arranging deals in which they only purchased Qualcomm's cellular modem and RF transceiver.[13]) Another difficult challenge for Intel (and other modem manufacturers) was that Qualcomm had patent rights on critical modem technology (CDMA technology in wireless products), so every company using modem technology had to pay Qualcomm royalties—Qualcomm was earning about to $7.6 billion a year in royalties.[14]

The entry barrier for a multimode 2G/3G/LTE solution (modem technology) was much higher than for mid/low-end application processors. This was because ARM and other IP companies provided more and more advanced IP and tooling, enabling many small companies to do

[12] Shara Tibkin, "Intel LTE Poised to Join Upcoming Galaxy S5 Family," *cnet,* February 24, 2014, http://reviews.cnet.com/8301-13970_7-57619389-78/intel-lte-poised-to-join-upcoming-galaxy-s5-family.

[13] Ashraf Eassa, "Why Qualcomm Didn't Pop on Apple's China Mobile Deal," *The Motley Fool,* December 26, 2013, http://www.fool.com/investing/general/2013/12/26/why-qualcomm-didnt-pop-on-apples-china-mobile-deal.aspx.

[14] Don Clark, "Qualcomm to Pay $975 Million Antitrust Fine to China," *The Wall Street Journal,* February 10, 2015, http://www.wsj.com/articles/qualcomm-settles-china-probe-1423518143.

application processor/platform design with only a few hundred employees. Many small companies in China like Allwinner and Rockchip could design mid/low-end application processors/platforms and quickly gain market share in the tablet market. (Those small companies were unlikely to be able to produce high-performance graphics, image processing, and microprocessing, so these tablets would have less functionality than a high-end tablet). The modem side required much more effort, driven by the complexity of co-existence between 2G/3G/LTE cellular technology and worldwide interoperability between hundreds of network operators.

Strategic Importance of the Ecosystem

Most developers (also called ISVs, or independent software vendors) supported two to three high-volume platforms in the market to maximize their profit with reasonable efforts. Generally, a small but important subset of applications were written natively, e.g., optimized and compiled on ARM-based platforms to provide superior user experience. So, Intel would have to be number two or number three in the market, with approximately 20-30 percent market segment share, in order to continuously attract developers and drive ecosystem investment on their platforms. Initially Intel had to provide incentives to developers such as easy-to-use tools, training, and Non-Recurring Engineering (NRE—money earmarked for product design or design support) to attract ISVs to its platform since the market segment share was low. The importance of mobile to developers presented other risks for Intel. If mind share moved away from the traditional PC ecosystem to the mobile ecosystem, then innovation would move away and slow down growth in the PC segment even more—slowing down Intel's core business.

The Changing Role of the OEM and Operator

With its PC business, Intel had a strong and stable relationship with OEMs and was able to exert a strong influence on the overall ecosystem up to the retail point of sale and even end consumers with its strong brand (i.e., using the well-known Intel Inside® trademark[15]). However, in the smartphone and tablet market the OEMs were much stronger in driving the roadmap of their chipset supplier and Intel did not have an end consumer brand for these devices. On top of which, mobile operators such as Verizon and AT&T were in a strong position. As a consequence, the interaction between chip companies, OEMs, and operators was much more challenging.

Intel's Short-Lived Phone

In 2011 Intel launched some phones in India, Kenya, Nigeria, and Europe. At the time this approach was the only way for Intel to get into the mobile market. The big phone OEMs did not want to commit to Intel chips because they were not familiar with the Intel Architecture for mobile applications, which was unproven at the time, and some in the industry thought it fell short of the market's low-power consumption requirements. The OEMs were not sure whether it was possible to build a phone out of Intel Architecture or how the chip would behave in the constrained environment of a phone. So Intel built a phone of its own and proved it would work.

[15] Intel Inside is a trademark of Intel Corporation in the United States and/or other countries.

A year and a half later, Krzanich stopped the initiative to make phones and pulled the company away from a more vertical strategy—possibly because it was creating conflicts with the existing phone customers on the modem side, but also because the initial intent to prove that Intel Architecture would indeed work in phones had been accomplished.

The Need for a Mindset Shift

Intel needed a mentality shift to enable the company to grow into the mobile space. A lock-in could be mental as well as material. Many processes and recipes (from Design to Marketing and Sales) that worked for many years in the core business where Intel had a strong position did not apply for the mobile space where Intel was a newcomer.[16]

INTEL'S POTENTIAL STRATEGIC ADVANTAGES IN MOBILE

Manufacturing Lead

Intel was two nodes ahead in manufacturing and also had a significant lead in 3D transistors. This was an important advantage—especially with the transition to 3D FinFET transistors,[17] where Intel had about a four-year lead. FinFET is a transistor structure that essentially takes advantage of silicon "fins"—the surface area of the Field Effect Transistor junction wraps around a fin rather than being "planar." (See **Exhibit 3** for FinFET images.) This increase in surface area improves the ability to control the transistor at small dimensions and improves performance/power, but it is very complicated to manufacture. FinFET was critical technology and essential for shrinking geometry nodes in Intel's chips. Intel's 14 nanometer (nm) process still showed significant density scaling compared to its 22nm node, whereas foundries that competed with Intel elected to suspend density scaling in order to develop the FinFET technology and avoid making too many changes at once. That meant silicon die area and cost was going up for competitors while Intel could still add features and enjoy higher density.

Brand

Most smartphone volume was being driven through the operator channel, but tablets were mostly driven through the retail channel. Intel, with a robust position in the PC space, already had a strong foothold and established relationships with the big retailers like Best Buy and Wal-Mart, and could connect these retailers to the Original Design Manufacturers to drive the Intel-equipped mobile products through the retail channel.

Investment capabilities

Intel had a large investment capability, with $92 billion in total assets (including $2.6 billion in cash and cash equivalents),[18] and with those deep pockets it could provide the financial resources necessary to carry out a mobile strategy. Intel was showing this advantage through its ability to

[16] See Burgelman R.A., 2002, "Strategy as Vector and the Inertia of Co-evolutionary Lock-in," *Administrative Science Quarterly*, 47, 325-357.

[17] FinFET is a Field Effect Transistor (FET) where the conducting channel is wrapped by a thin silicon "fin." There are other, previous types of FETs that are not FinFET.

[18] Intel 2013 Annual Report.

offset the additional bill of material costs to help customers put its chips into 40 million tablets, and through its $1.5 billion investment in Spreadtrum.

Device continuum

Because it had a strong position in the PC/notebook market, Intel could deliver experiences that were seamless—from notebooks to tablets to phones to wearables—similar to the approach taken by Apple. This ability could allow developers to scale the applications from notebooks to tablets to phones based on the same architecture. In early 2015 this was a theoretical advantage that had not materialized yet, but could be important in the future.

Intel's 64-bit Lead over ARM

Intel had a technological advantage with 64-bit chips because it was a node ahead and provided the best compute performance. The node advantage could also translate to a cost advantage. From a market perspective, many companies were moving to 64-bit for mobile. Apple was the first in September 2013 with its ARM-based A7 chip with iOS on the iPhone 5s. A few months later at the Mobile World Congress in February 2014, Intel demoed its 64-bit dual core Atom processor. Intel also had a 64-bit Android kernel, so Android devices would be able to use the processor's full power.[19] The most recent versions of Android used 64-bit, and thus Intel was the first to be qualified on the first 64-bit Android operating system. If the 64-bit operating system support was adopted, it could give Intel's x86 mobile chips an advantage over competitors in the ARM camp in terms of both speed and power consumption.[20] However, it should be noted that other subsystems were also relevant, such as imaging and graphics and modem features—and Qualcomm delivered higher customer value than Intel on those.

Staying Power in the High-End Modem Space

Although Intel was two years behind Qualcomm in the modem space as of the first quarter of 2015, the number of companies able to sell LTE modems had decreased substantially in a short period of time, as top players such as Nvidia and Broadcom had exited that market. This rarefication of competition in the high-end modem market could put Intel in a strong second-source position—if it could catch up, or get close, to Qualcomm. It also meant there was less downward pressure on pricing for both companies, which could lead to higher profits.

INTEL'S MOBILE STRATEGY IN 2015 AND BEYOND

Intel knew that it needed to gain market segment share quickly to drive third-party investment and create an ecosystem and installed mobile base around its platforms. All of these were difficult to achieve on the implementation side. But Intel had developed a strategy to reach these goals and was being bullish on execution. Part of that execution involved looking at its mobile unit in new ways.

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[19] Sascha Segan, "Intel Details 64-bit Phone Processor, Roadmap to 2015," *PCMag*, February 24, 2014, http://www.pcmag.com/article2/0,2817,2453954,00.asp.

[20] Agam Shah, "Intel Shows Off 64-Bit Android for Smartphones," *PCWorld*, February 24, 2014, http://www.pcworld.com/article/2101200/intel-ends-wait-for-64bit-android-on-smartphones.html.

Tablets

Intel's strategy to win tablet share with its Bay Trail chips (x86 chips) helped the company quickly get market segment share. The strategy included compensating OEMs for any differential increase in the cost of bill of materials (BOM) through marketing funds and paying some engineering costs for designing an Intel tablet. But the strategy had a big negative impact on the mobile and communications group's bottom line, resulting in high losses. Intel saw the strategy as temporary; at the beginning of 2015, Intel's new lower-cost, 3G integrated Atom chip codenamed "SoFIA" would come out. SoFIA's BOM would be lower than Bay Trail chips' BOM due to its greater integration and smaller die size.[21] Intel saw a big opportunity in getting its chips into lower-priced Android devices, so lowering the cost was critical. Intel would also be coming out with an LTE version of SoFIA, which would be followed in 2016 by "Broxton," designed for higher-end mobile devices.

To get the SoFIA chips out quickly, Intel was contracting the chips' manufacture to TSMC. The Infineon heritage business was at TSMC, and Infineon's modem technology had been developed on TSMC's process technology. (As mentioned earlier, Intel acquired Infineon's wireless business and was using its mobile technology.) The SoFIA platform was developed out of a competitive, integrated ARM-based product from Infineon's wireless business (renamed Intel Mobile Communications (IMC) after the acquisition), which was already running at TSMC on 28nm. So, the fastest way to bring a cost-competitive, integrated Intel product to market was to take this product and replace the ARM microprocessor core with a synthesizable Intel Architecture core. (Intel's traditional microprocessor cores were highly customized to the Intel process technology in order to maximize performance and other factors, and it was not easy to move those cores to a different fabrication process like TSMC.) A synthesizable core is a representation of the core abstracted from the physical layout, and can be more easily adapted to be manufactured on a different process technology like TSMC. The hand crafting and tight linkage between Intel microprocessor cores and its process technology presented a huge inflexibility with using different manufacturing processes to accelerate time to market. All of the IP Intel bought from Infineon was "hardened" in TSMC and converting to Intel would create a time delay. It was a big challenge for Intel to create a synthesizeable core first and then "harden" it on different process technologies. The technical feasibility of the project was of key importance to Intel, as designing mobile platforms on IMC's industry standard design system with synthesizable IP opened up many new options for Intel to compete in the market, in particular several partnering options in China.

Creating Two Product Lines

A big strategy shift was Intel's decision to create two product lines, using the Atom processor for mobile and another one for its core business (PCs and servers). James said this came out of much debate:

> We initially purposefully de-featured Atom so that it would not be as good, and then we decided that was wrong. What we needed to do was make the best, highest-integrated and cost-effective mobile product on earth and just have a

[21] James Niccolai, "How Intel is Buying, Building a Piece of the Tablet Market," *PCWorld,* January 18, 2014.

> mobile brand because it has a different value proposition than the core product. So that mobile product is launching in 2015. We have Chinese partners that are going to create that in phones and tablets, and then we have our core product line, which is now mind-blowing. So we argued and we fought because we were so concerned, and then we realized that people value the Intel brand. We just needed to bifurcate our product line and be super clear about it and not let them overlap.

New Efforts in China

Intel was concerned about the lack of greater consumption of Intel products in China, and Intel was therefore engaging in some new tactics in that country to break into the lower-end market both in China and globally. In May 2014, Intel announced that it was teaming up with China-based Fuzhou Rockchip Electronics (Rockchip) to create and sell Intel-branded chips for entry-level tablets running on Google Android.[22] It would be the first time Intel combined an application processor (the Atom processor) and modem in one chip. Rockchip would add other parts of the chip such as graphics.

Intel was also wooing smaller companies in China, which were beginning to have a disproportionately large impact on the tablet market. Intel was working to get these companies to switch from ARM-based chips to Intel chips. In addition, Intel made reference designs (ready-made tablet designs) available to Chinese manufacturers, enabling them to get new products on the shelves about once a month. Part of Intel's strategy for getting smaller Chinese companies to switch to Intel chips was to offer those companies a level of service that was unusual for companies so small to receive from a large company.

These Chinese companies were taking advantage of the price differential between their products and the well-known tablet brands. For example, Apple's least-expensive tablet was $299, whereas Chinese companies could sell tablets for around $50.[23] Some of these tablets were showing up in U.S. sales channels such as Wal-Mart stores starting at $70, and consumers were buying them even though the tablets had fewer features than tablets from Apple, Samsung, or other premium brand-name makers.

In September 2014, Intel announced it would be investing up to $1.5 billion for a 20 percent stake in Chinese chipmakers Spreadtrum Communications and RDA Microelectronics. These two companies were owned by the private equity firm Tsinghua Unigroup, which was controlled by Tsinghua University in Beijing (the alma mater of Chinese President Xi Jinping).[24] The collaboration would involve creating an inexpensive Intel-based System on a Chip, which could make Intel a relevant player in China's mobile market. The deal would give the Chinese chipmakers support on chip design and development. According to Americo Lemos, vice president of Intel's platform engineering group, "Spreadtrum has demonstrated that they can

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[22] Don Clark, "Intel-Rockchip Deal Aimed at Android Tablets; Tie-Up with Chinese Chip Maker is Aimed at Intel's Push into Entry-Level Devices," *The Wall Street Journal,* May 27, 2014.

[23] Eva Dou and Don Clark, "Intel's Answer to iPad: Cheap Tablets; Chip Maker, Frozen out of Market, is Wooing Little-Known Suppliers in Shenzhen, China," *The Wall Street Journal,* July 13, 2014.

[24] Gerry Shih and Noel Randewich, "Intel to Invest up to $1.5 Billion in Two Chinese Mobile Chipmakers," Reuters, September 26, 2014.

produce large volumes fast, and we really want to increase the cadence that we bring out new products." He said he wanted to produce these SoCs "at the range of several hundred million units."[25]

CONCLUSION

Intel's bullish moves in the mobile industry seemed to be paying off in the tablet segment, but the company needed to keep up that growth trajectory. Intel needed to decide how long it should continue to make major market development investments once its lower-cost chips became available. It was not clear yet if Intel would have a strong enough foothold with tablet manufacturers at that point to sell products unsupported by marketing funds and still hold onto its market position. With its mobile strategy, Intel was pursuing new ways of doing business, including new partnerships and investments in China. The question was whether the semiconductor giant could be innovative and nimble enough to continue to develop these new ways and then implement them successfully. Intel also had to figure out the next steps in its strategy, so if its implementation was successful, it could keep ahead of its competitors. Intel's Mobile and Communications Group generated operating losses of over $5 billion by the end of 2014. Even with the company's deep pockets, those levels of losses were not sustainable over the long term.

[25] Quentin Hardy, "Intel Invests $1.5 Billion to Tap Mobile Phone Chip Market in China," *The New York Times,* September 26, 2014.

Exhibit 1
Intel Consolidated Financial Statements
2012 – 2014

In millions of USD	Year ending Dec. 27, 2014	Dec. 28, 2013	Dec. 29, 2012
Revenue	55,870	52,708	53,341
Cost of Revenue	20,261	21,187	20,190
Gross Profit	35,609	31,521	33,151
Marketing, general and administrative (MG&A)	8,136	8,088	8,057
Research & Development (R&D)	11,537	10,611	10,148
Total Operating Expense	40,533	40,540	38,703
Operating Income	15,347	12,291	14,638
Net income	11,704	9,620	11,005
Property, plant and equipment, net	33,238	31,428	27,983
Total Assets	91,956	92,358	84,351
Debt	13,711	13,446	13,448
Temporary equity	912	–	–
Stockholders' equity	55,865	58,256	51,203

Source: Intel 10-K, http://www.intc.com/secfiling.cfm?filingID=50863-15-15.

Exhibit 1 (continued)
Intel Share Price
March 2005 – March 2015

Adjusted Closing Price in USD

Source: Yahoo Finance.

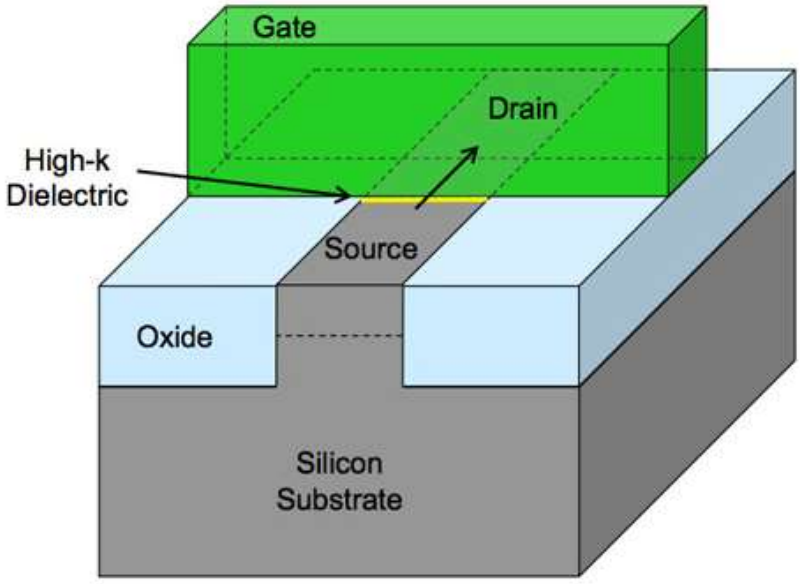
Exhibit 2
Worldwide Device Shipments by Segment (in millions)

	2013	2014 (e)
Device Type		
Traditional PCs (Desk-based and Notebook)	296.1	276.2
Ultramobiles, Premium	21.5	32.3
PC Market Total	**317.6**	**308.5**
Tablets	206.8	256.3
Mobile Phones	1,807.0	1,862.8
Other Ultramobiles (Hybrid and Clamshell)	3.0	5.4
Total	**2,334.4**	**2,432.9**

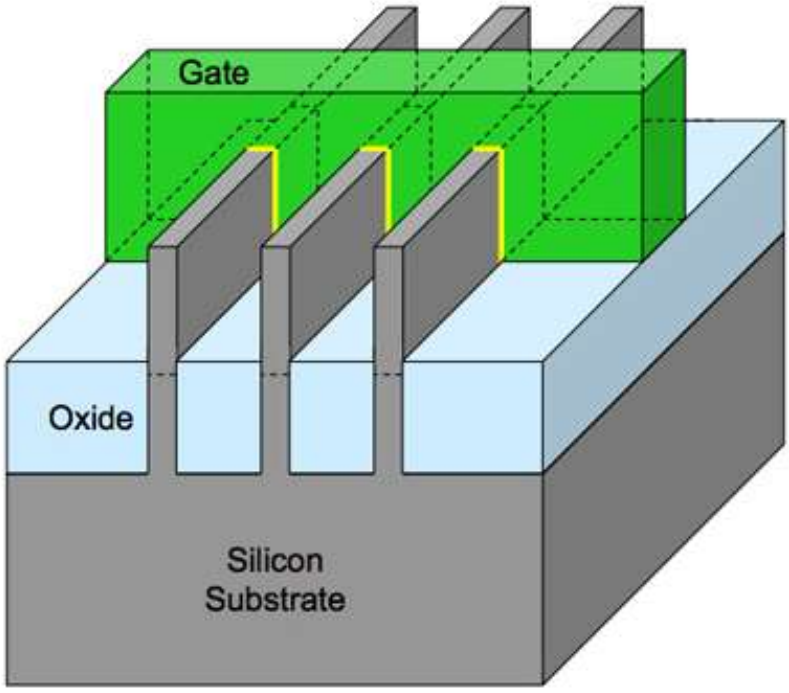
Source: Gartner, June 2014.

Exhibit 3
Planar vs. FinFET Transistors

Traditional Planar Transistor

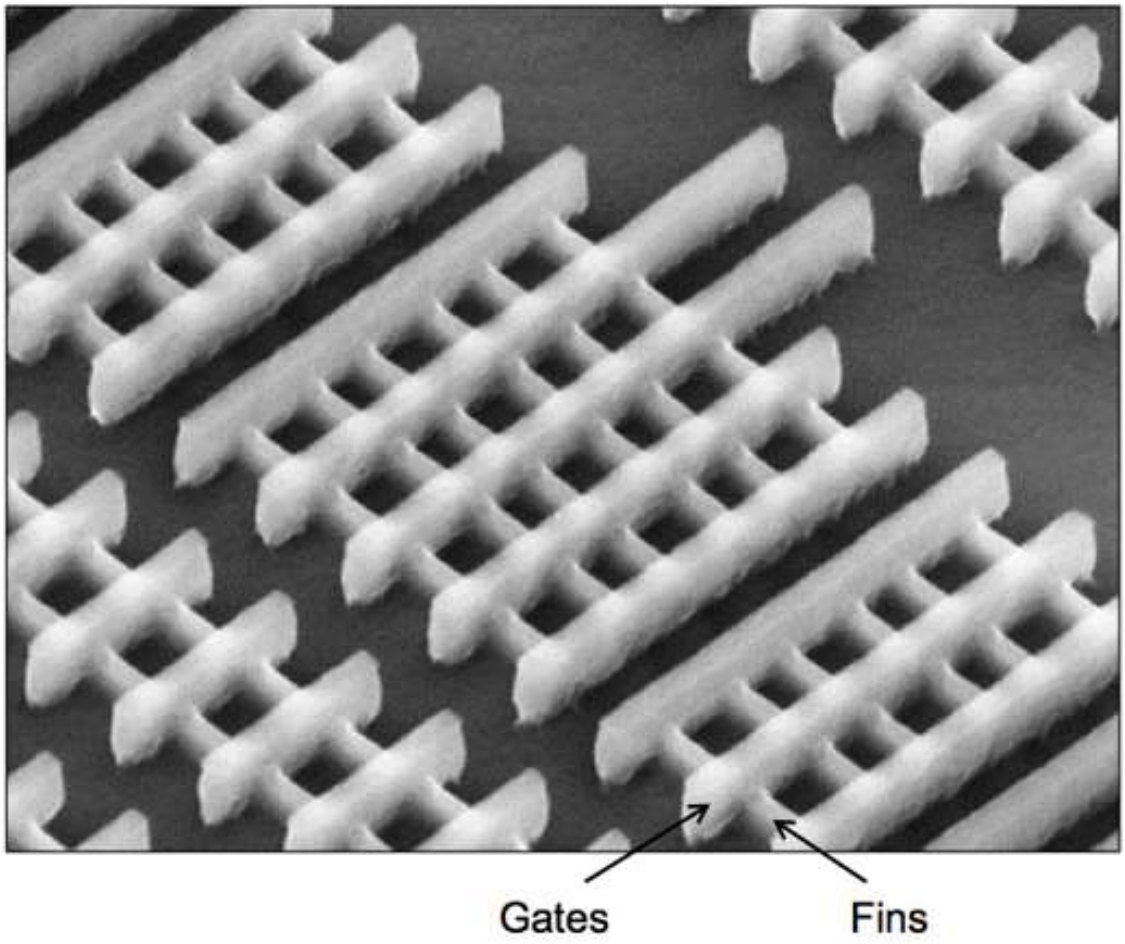


22 nanometer Tri-Gate Transistor (FinFET)



Source: Intel Corporation.

Exhibit 3 (continued)
FinFET Transistors
(22 nanometer Tri-Gate Transistor)



Source: Intel Corporation.

Appendix 1
Intel's Business Groups

PC Client Group (PCCG) — Includes platforms designed for the notebook, desktop, certain tablet market segments (10" with keyboards) and wireless and wired connectivity products. The group's revenue was up 6 percent in the second quarter of 2014 to $8.7 billion, and its operating income was $3.7 billion. These numbers reflected the potential reversal of a long slide in PC sales and the decision of some companies to upgrade their older machines after Microsoft ended technical support for Windows XP.

Data Center Solutions Group (**DCG) —** Includes platforms designed for the server, workstation and storage computing market segments, as well as wired network connectivity products. Second quarter 2014 revenue was $3.5 billion (up 19 percent) and operating income was $1.8 billion, reflecting the explosive growth of cloud computing.

Internet of Things Group (IoTG) — The group focused on embedding computing into devices and connecting them to the Internet. Second Quarter 2014 revenue was $539 million and operating income was $155 million.

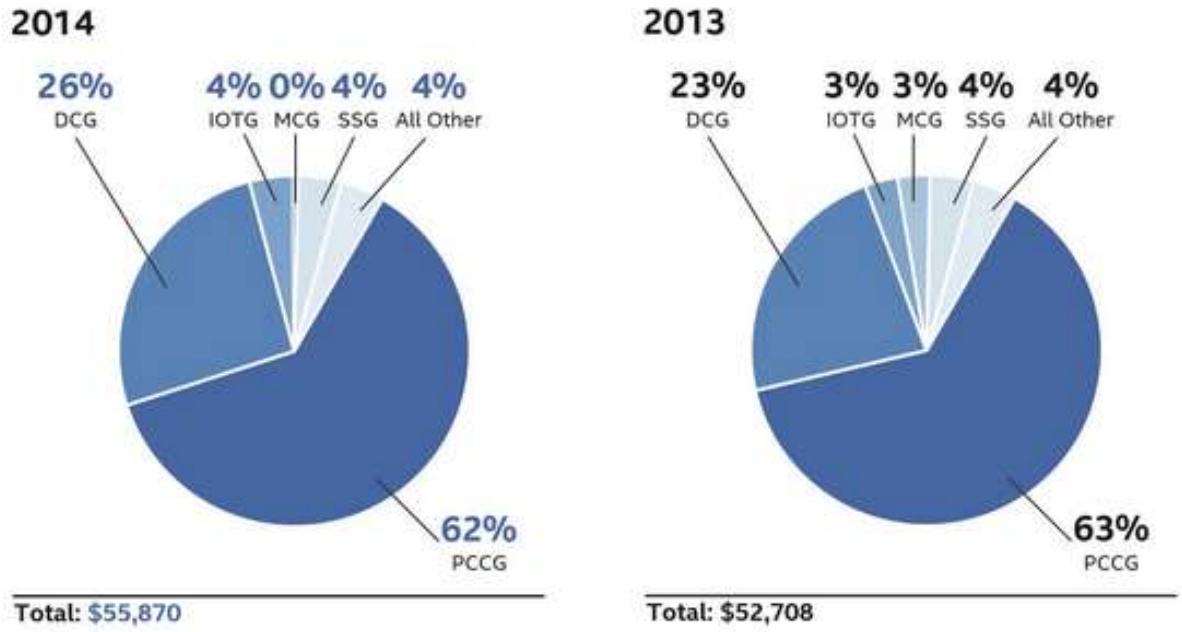
Mobile and Communications Group (MCG) — The group focused on tablets and smartphones. MCG was created in 2011 by combining Intel's four previous mobile groups. Second Quarter 2014 revenue was $51 million and operating loss was $1.1 billion.

Software and Services Group (SSG) — Includes software products for endpoint security, network and content security, risk and compliance, and consumer and mobile security from Intel's McAfee business; software-optimized products for the embedded and mobile market segments; and software products and services that promote Intel Architecture as the platform of choice for software development. Second Quarter 2014 revenue was $548 million, and operating income was $8 million. (Intel was transitioning this segment to a larger "Software and Services Operating Segments" that will include SSG)

Other — Includes the remaining components of the other IA operating segments, specifically: New Devices Group and the Netbook Group. Second Quarter 2014 revenue was $517 million and operating loss was $746 million.

Source: Intel 2013 Annual Report.

Appendix 1 (continued)
Intel Percentage of Revenue by Major Operating Segment
(Dollars in Millions)



Source: Intel Corporation.