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Connecting Everything.
Dream Becomes Reality.

Leveraging Collaboration and Shared IP to Innovate in an Always Connected World

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Twenty years ago Broadcom's tagline, 'Connecting everything,' was just a dream – a big idea for seamlessly unifying communication between the hand, home and network. Today, if technology can be connected, it will be, and this far-reaching concept is fueling a societal shift in the way people work, think and live. Engineering innovation is at the core of this phenomenon, perpetuated by technology advancements and wide-ranging convergence of markets, services and devices.

The semiconductor industry is the primary technology enabler for this connected universe, demonstrating profound and sustained impact on the entire electronics value chain. Today we recognize that mobility is central; our smart devices are always on and always with us, perform non-stop, and are expected to adapt to the context and locations in which we are using them. We understand that connectivity enables data ubiquity – sharing information for intelligent business and a new era of connected communications. Further, we are consumed by the need to keep building on this promise, connecting everything and ultimately changing the world in the process. From broadband technology to cloud infrastructure to mobile and wireless to home networking, key sectors are both enabling and capitalizing on a connected world, setting an exciting stage for the next revolution in electronics design.

Evolution and Revolution

The evolution of connecting everything is extensive, storied and incremental. Advances in integrated circuits technology, Internet development and broadband communications are not separate histories; rather, each new technological breakthrough evolved from the previous technology, and each created new generations of computers. Each new pioneer recognized the limits of current technology and boldly engineered the next step in improving performance, power usage, device size and more. The telegraph, the telephone, the television and the mobile smartphone were all 'killer apps'
that developed from this ongoing process of engineering inspiration.

In the same progression of evolution, the microprocessor caught the world's attention 40 years ago; still it took the introduction of the personal computer to create a step function change in the semiconductor industry. IBM launched the first PC in 1981 and one year later, Time Magazine named "The Computer" as its Man of the Year.

ARPANET was proven, and the Internet followed soon after. Not surprisingly, the next major disruption within the semiconductor industry was the focus on broadband communications. This was at a time when the Internet was accessed via dial-up modems, and our earliest shared vision was to dramatically improve the connection speed by enabling high-speed cable and digital subscriber line (DSL) networking for the masses. Mixed signal chip integration was a key technology enabler for the broadband communications era. By integrating the high-performance analog front ends with the digital signal processing back-ends, in standard CMOS technology, the costs of the devices were significantly reduced thereby enabling a new generation of broadband access and digital set-top box products.

Following the broadband wired revolution, there was an even more noteworthy revolution of broadband wireless technology with the introduction of Bluetooth technologies for wireless personal area networking, Wi-Fi technologies for wireless local area networking and 3G and 4G cellular technologies for wireless wide area networking. Again it was innovation in the semiconductor industry that enabled

this revolution. Mixed-signal integration was taken to the next level with the integration of GigaHertz radio frequency (RF) circuits on the same low-cost CMOS chips as the analog and digital circuits. The resulting dramatic reduction in cost, power and size has enabled us to carry around in our hands a computing and communications device that was unimaginable only a decade ago.

Communications Everywhere

Today, the expectation of endless performance improvement is the hallmark of broadband communications chips. Integration, complexity and capabilities are increasing, with one million transistor chips in the early 1990s evolving to 10 million to 100 million to 1 billion transistor chips – and poised to become 10 billion transistor systems-on-a-chip (SoCs) within a few years.

The impact of these multi-billion transistor SoCs is even more noticeable in the network infrastructure, where advancements are visible through Ethernet-enabled Internet everywhere. And infrastructure's role in the growth cycle is to not only build and expand enterprise network capabilities and performance, but also to fuel growth in global consumer electronics markets. Today there are more users accessing greater levels of content requiring more bandwidth; the cloud is taking hold in public environments as well as enterprise hybrid data centers, and multi-Gigabit Ethernet networks are evident everywhere as consumer broadband demands grow exponentially.

Broadband access and home networking in turn is expanding, capitalizing on wireless connectivity and enabling new connected environments and standards. In fact, the range of devices and standards for the digital home is staggering. Technologies such as cable, satellite, terrestrial and IP set-top boxes, Femtocell, Powerline, xDSL/PON, cable modem and Wi-Fi are setting a fast pace for standards development and engineering innovation. Fiber access is poised as the new frontier, and a CPU arms race is fueling a new class of high-end networked home media servers.

What is driving this complexity today? Consider the dramatic multimedia evolution over a very short historical period: black and white and even early color television had vacuum tubes rather than chips, solid-state analog TV evolved, followed by widespread digital standard definition TV. High definition TV is now the new bar, and we are evolving to 3D in the home. Media networking is driving the connected home toward convergence based on new applications and the desire to share digital media between devices and environments. In turn, wireless capabilities have an important role in continuing to transform the multimedia landscape, as users have high expectations for affordable, intuitive access to all types of streaming media. Each new generation of media technology demands yet another step function increase in bandwidth, thereby placing further demands on infrastructure and broadband access networks.

Always Connected

Today's connected world is all about mobility and the platforms that enable it. The relevance, growth and impact of this sector demonstrate the scope of its importance to everyday life. While this 'connectedness' can be traced to the proliferation of cell phones, it now encompasses and enables so much more.

Chip advances are transforming and enabling technologies such as 3G cellular, 4G/LTE cellular, WiMAX, Wi-Fi, Bluetooth, GPS, NFC, and 60GHz. And like smartphones, the convergence of PC and tablet platforms brings with it a high level of user expectation. Just as the Blackberry was the killer app that started the smartphone revolution, today's engineers must determine 'the next big thing.' For example, secure NFC (Near Field Communication) technology is making great strides in finance and commerce. The technology will likely result in the eventual elimination of the traditional wallet, replacing a worn-out, often bulky piece of 'equipment' with access to the consumer's financial data via the inherent wireless connectivity of the user's smartphone. With this and yet to be discovered examples, mobile technology is in essence filling a void for real-time, convenient access to everything we need, all the time. So what is next?

Moving Forward

Every decade or so, evolution turns into revolution and builds on our knowledge, experience and existing technology – vacuum tube to transistor to microprocessor to communications to superchip. Ubiquitous, nonstop connectivity is what is next; for instance, improving global business operations with real-time cloud-based data sharing, seamlessly accessing information and entertainment in our homes and cars. Advances in miniaturized sensors will further enhance this connected world as we are able to monitor in real-time our health and our environment which opens up endless new opportunities for innovative new models for healthcare.

Whatever comes next is defined only by the limits of engineering innovation and our ability to collaborate. We can solve problems, improve established or outdated business practices, grow the world economy, and just make life better. 'Connecting everything' may have been a lofty tagline 20 years ago, but today it is a reality – providing continued inspiration and meaningful impact on our global society and business economies.