The Social Network of Things

The Evolution of the Smarter Everything

by MJ Petroni and Srini Koushik

Humans, Machines and Business Evolved

Everyone talks about trends. Every day we see charts, articles and infographics informing us that technology will change the lives of humans in the future. At NTT i³, we don't believe that technology is a trend, nor do we believe that technology only affects the future. Technology is changing our lives now, today. Like all major drivers for change, the interplay between technology and the evolution of human experience is complex. Just as the first human societies were shaped by their use of tools—the technology that we are inventing now is re-inventing us. Some of us are firmly planted in the new age we live in, and some of us even take technological evolution for granted. Many more of us have lived part of our lives in an analog society, and are struggling to find our way in this new world. It may seem that the shift to digitally-enabled life happened very quickly, but it did not happen overnight.

To understand this evolution, we must first understand what is driving it. When we entered the Information Age, we interacted with computers through a keyboard and a mouse. It was a 1-to-1 relationship. Now, our computers interact with us through voice, gestures, eye movements, and touch—we can even wear computers which respond to our bodies. As the way we communicate with computers has expanded, they have become more available than ever before.

By 2020, there will be 50 billion connected devices in the world, devices which are starting to interact with one another through the cloud—learning about us, predicting our behaviors, and understanding our preferences.The Internet of Things (IoT) has become part of the common vernacular today with many tech companies investing billions of dollars in developing everything from wearables and sensors to watches, appliances and even toilets.

We believe this industry will continue to evolve rapidly with more and more attention paid to features, functions and the technical capabilities of the environment needed to support and manage the IoT. While the design of these devices and how people use them will continue to change, we see a future where technology moves from being a tool which humans use to being integrated into the identities (and perhaps even bodies) of humans themselves. We are already responding to technology in ways that can be called evolutionary, changing how we relate to information, our capabilities, and even the idea of what qualifies as a product or service.

In the near future most of our devices will be increasingly able to interact, collaborate and coordinate with each other, forming what we call the Social Network of Things. We see this future emerging now with platforms such as Apple's HomeKit and HealthKit and Google's Built for Nest. The Social Network of Things ushers in an exciting future filled with possibilities that will reshape our view of technology and its impact on the humanity. The emergence of the Social Network of Things also creates significant opportunities for digital businesses—opportunities which will require their IT organizations to rethink concepts such as mobility, security, privacy and data.

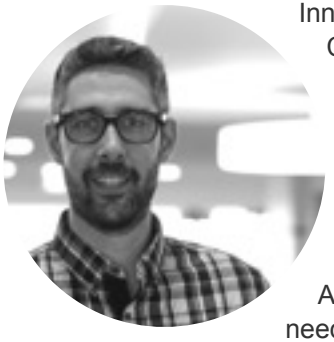
How can business leaders understand and stay on top of these changes, enabling them to evolve their businesses intelligently as human beings and machines continue to evolve one another? How can traditional businesses

compete, or even survive in this new digital world? How will an insurance company insure driverless cars? How can a hospital keep real-time records on thousands of patients? What purpose does a bank have in a cashless society? These are all questions that require our attention, and that demand a response from traditional companies who risk being overtaken by their competitors or startups.

We can approach these questions by looking at the evolution of humans and machines, and the specific ways in which our increasingly symbiotic relationship—and our technologies' relationships to each other—are changing the face of business forever.

MJ Petroni

Cyborg Anthropologist and Innovation Facilitator



I work with several organizations, chief among them my own Causeit, Inc., an innovation consultancy based on the West Coast of the US, and NTT Innovation Institute, Inc., in the heart of California's Silicon Valley. There, I serve as the Cyborg Anthropologist in Residence, working to translate the near-science-fiction world as we might know it in one hundred years for businesses focused on designs for the next 2-3 years.

As a firm, we focus on the emerging needs of digital business. Key among those needs is a broad view of the future and a keen eye for innovation opportunities—especially the opportunity to create platform-based businesses. At NTT i³, we can work with visiting executives to conceive of new business strategies, and then actually construct the critical technological platforms needed to make them possible.

Srini Koushik

President and CEO of NTT i3

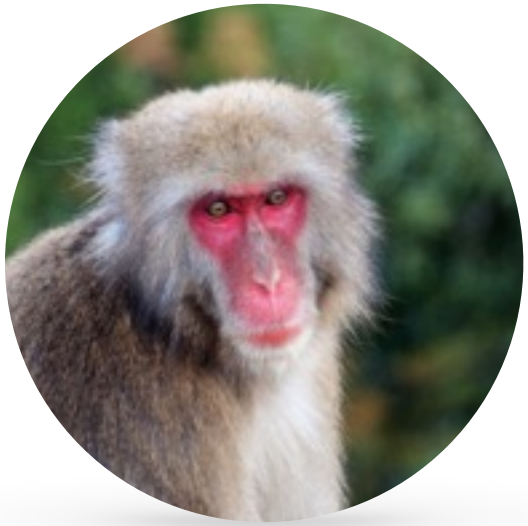
Srini Koushik is the President and CEO of NTT Innovation Institute Inc., the Silicon Valley-based R&D arm of the NTT Group, a global leader in information and communications technology ($112B in revenue in 2012). With thirty years of experience as a programmer, architect, CTO, CDO, and CIO for Fortune 100 Companies including IBM, HP and Nationwide, Srini has a track record of unpacking complex problems, and hacking the technology and culture of global enterprises to deliver extraordinary results.

He is an Open Group Distinguished Certified Architect and has published several articles, including co-authored a best-selling book, Patterns for E-Business in 2001. Srini was elected to the IBM Academy of Technology, and was named an IBM Distinguished Engineer in 1996. He was named an Elite 8 CIO by Insurance and Technology, a Top 25 CTO by Infoworld, a Top 10 All-Star in the financial services industry by TechDecisions, and a 2014 Computerworld Premier 100 Technology Leader.

Srini has a passion for lifelong learning and holds a bachelor's degree in physics from the University of Madras, a master's degree in computer science from the University of Bombay, a master's degree in business administration from Ohio State University, and executive education on Systems Thinking, Design Thinking, Clean Energy and Innovation from the MIT Sloan School of Management and Duke University.

Tools are a part of being human

Tools—objects we use to expand our capacity—are core to human experience. Now, for the first time, our tools are starting to talk to each other—not just a few of them on our desks or in server rooms, but nearly everything we use is beginning to be designed with rich data capabilities. To understand where all of this going, and what it means for both culture and business, let's take a brief look at our journey so far.



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We started as primates, and as we progressed to becoming human beings a few important changes happened to set us apart from our cousins.

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As groups and tribes began to emerge, we began to create more complex social systems, organizing ourselves in ways which persisted over time and allowed us to pool resources and maintain some degree of peace.

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We developed a new relationship to tools which were more than the simple rocks our primate predecessors picked up. Our tools, by contrast, were far more complex, and allowed us a much broader concept of ourselves and what we're capable of.

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As our creation of complex social systems and advanced tools progressed, people began to flock to urban centers, rich and dense with systems and data—such as the platforms we use to manage markets, transportation, government, housing, health care, sewage and refuse.

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To handle the need to organize all this new and increasingly complex data into useful information, we began to use computation —reducing our world's information into ones and zeroes.

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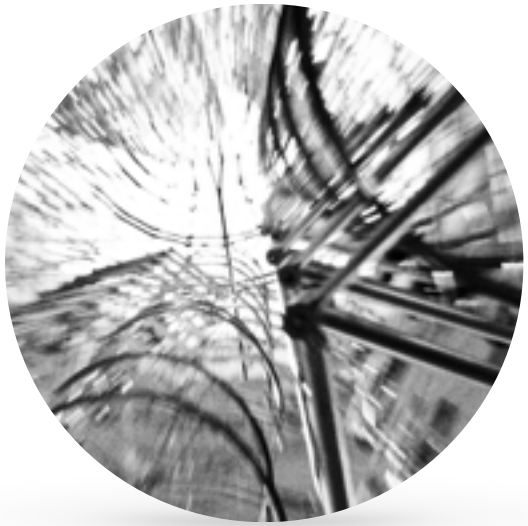
Our medium for displaying and connecting to complex information became the computer.



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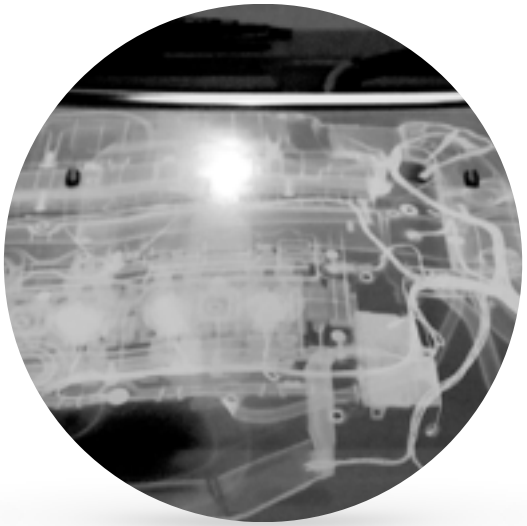
At the same time that we were managing all of this information, we also faced the problem of how to move people around these landscapes efficiently.



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Our transportation tools became increasingly complex.

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Infrastructure grew around our transportation methods, shaping our cities and nations.

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Common utilities collided with private space.

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Our access to information began to be pervasive, and has shaped who we are now.

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As we continue to explore and evolve our understanding of who we are, we have to ask what the essential information of being human is.

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How do we stay connected in a technological age—the right kind of connected?

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What does emotion look like in an information age?

How do we advance our hearts and our brains at the same time?

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How do we tell where we begin and the machine ends?

What if we end up not needing bodies the way we used to? How will everything change—health, mobility, class, work?

Machines have relationships too

Machines, like humans, are starting to have their own relationships. Fundamentally, to understand how humans are changing, we have to look not just at how humans relate to other humans, but at how machines relate to other machines—and how all of us might be evolving into a new way of life.

Eras of Technology

We can think about our progression in the relationship between humans and tech in terms of overlapping eras or ages. Right now, the **Industrial Age** is coming to an end, and the **Information Age** is rising. The future will take us into new ages and we can begin now to forecast those and consider the new problems and opportunities they might present.

At the apex of the Information Age is the Social Network of Things—a time when devices and people are connected through pervasive internet access, a rich web of sensors, advances in artificial intelligence, deep APIs and cultural changes.

We can also look into the distant future (20-100 years) at the Cyborg Age (a time merging human and machine in unprecedented ways) and even further out to the 'Singularity' at the horizon.

Beyond the Information Age lies what seems like science fiction to most people—the Cyborg Age followed by the Singularity. When we reach the Cyborg Age we'll be considering not just devices and networks, but changes in the idea of what makes a human a human. For example, what will our bodies be like when implants—including into brain and nerve centers—are not only possible but commonplace? What will happen as robotics advance—how will that change the future of work and labor? What happens if the once far-fetched but now seemingly possible option of 'uploading' our consciousness into the cloud arises—should we consider it? How would that change us as a species?

You can think of the progression of these concepts as a journey from our entirely human identities to that of an augmented or even post-human state. It's important to note that this article is not advocating for a particular endpoint or set of ethics or values here so much as describing changes that are already happening and some of their potential outcomes.

We look at the horizon many years out as a way to pull our minds towards a future which demands technological and cultural shifts which we might want to start working towards with intention and purpose.

Right now, many individuals in the world are participating in (or at least affected by) the peak of the Industrial Age. When we talk about things and devices we are still thinking of made, physical objects or resources. While many people use the Internet and digital devices in their daily lives, the technological experience of most of the world's citizens does not look anything like the web of cutting-edge, well-connected devices described by the "Internet of Things". At the same time, the leading edge of the tech industry and tech-assisted devices is somewhere between the Internet of Things and the full possibilities of the Social Network of Things.

Six shifts driving a new landscape

There are six key paradigm shifts which create context for the emergence of the Social Network of Things. Our colleague Mark Bonchek first articulated these shifts in his Harvard Business Review article, "Putting Facebook into Perspective" in 2012. The shifts are driven by—but also require—new kinds of innovation on a cultural, organizational and individual scale as we head to the Information Age. This model is incredibly useful for talking about what businesses and organizations need to do to stay culturally relevant in the 21st century. For our purposes, we'll list them briefly as indicators of an increasingly networked and system-oriented future of which the Social Network of Things is a part.

Business strategy is shifting from products to platforms.

Individuals are shifting from consumers to co-creators.

Media is shifting from audience to community.

Brands are shifting from push to pull.

Leadership is shifting from controlling to empowering people.

Organizations are shifting from hierarchies to networks.

“EVERY COMPANY IS NOW A SOFTWARE COMPANY”

—David Kirkpatrick, Forbes

David Kirkpatrick, founder of the Techonomy conference series backed by Forbes, does a great job of explaining that a shift from utility to capability in IT is inevitable because every company is now a software company. Volkswagen, which clearly did not originally envision itself as a software and data company, is one example of a business which is doing its best to respond to the IT shift powerfully and with enthusiasm. Their CEO, Martin Winterkorn, was one of the first automakers to take a strong and decisive stance on data privacy when he declared, “We intend to protect our customers against the abuse of their data. I clearly say yes to Big Data, yes to greater security and convenience, but no to paternalism and Big Brother.” Winterkorn’s position and statements like his should alert the business world to the reality that software, data and technology issues are no longer solely in the scope of companies like Google and Microsoft.

IT AS UTILITY

One very important change which these shifts require is in the way we think about business and organizational models. Traditional information technology skills and infrastructure such as networking, database management and internet access are more important than ever. However, organizations must shift their focus from IT as a utility—basically confined to a single department in a business—to informatics as a capability.

INFORMATICS AS CAPABILITY

Informatics as a capability is the strategic ability of a company to consider the impact of business decisions on their technology needs, as well as the impact of technology decisions on the entire chain of value from concept to production and maintenance. This means that each person in the company must have at least a conversational ability—if not fluency—in top technologies which impact their business. For example, in many companies marketing and branding departments were the first business units to begin to bringing their own technology savvy to bear on their work, sometimes in accidental or intentional conflict with existing IT policy. Whether through third party vendors like agencies, or because they choose to hire their own technologists, marketing and branding departments have shown us that IT cannot be limited to a 'come and fix it' utility within the business.

For platform-centric businesses to be successful, every person involved must be fluent in the technology decision-making process on a strategic level.

Internet of Things: v1.0

The Internet of Things (IoT) holds the promise of the future in a pithy, Silicon Valley catchall for any non-browser Internet experience. In this age, devices promise us data which is pervasive, convenient, useful and accurate.

However, even with all that sparkle, the IoT fanfare is missing something. Mark Bonchek and Sangeet Paul Choudary's Harvard Business Review article "The Age of Social Products" (and the subsequent Inc. piece, Will Yankowicz "Get Ready for the Social Network of Things") challenges us to think about the increasingly networked nature of our world in a more ambitious way. We've been approaching the IoT concept from the idea of machines talking to their humans and vice versa, but not doing the work of setting up social networks between the machines and devices themselves. To really get at the further implications of this emerging connectivity, it is useful to invoke the concept of the cyborg—but first we need to make sure we understand clearly what the progression from the IoT to Social Network of Things (SNT) entails.

This simple, useful British Gas meter display is an example of the Internet of Things: it displays old information in a newer, easier-to-access way—creating a simple feedback loop so the end user sees the consequences of their energy consumption, live, and can compare it to a manually-input budget for energy usage.

Here's what's happening at the first point in the progression from Internet of Things to the Social Network of Things:

Systems and data are mostly closed to other systems and data sets. Difficulties in coordinating multiple companies and legacy systems make redundant data necessary—for example, a power company can gather simple data about overall energy usage while another company's thermostat gathers a different version of the same data, from a different but perhaps duplicated set of sensors.

The Internet of Things is affected by the key technology terms of the day: the cloud, big data, and especially proximity-based tools like near-field communication (NFC) and Bluetooth™ Low Energy (BLE).

Purposes for our devices are still relatively isolated—a thermostat's display is just to adjust the furnace's temperature, and a wristwatch that monitor's heart function is doing just that.

Devices are designed within the constraints of our current view of the future, with the hope that whatever functions and capabilities they are made with will be good enough for potential uses down the line.

Information from our devices, like the smart meter referenced earlier, are mostly about reporting data from the (usually recent) past.

As these things happen, the convergence—or orbit—of data, purpose, humans and technologies—forms an ad hoc biome. I use biome purposefully and in the absence of a better term (suggestions welcome) to indicate the convergence of a specific set of circumstances and purposes.

v1.0 Exploring the Internet of Things

Characteristics

- Using devices to be more efficient
- Machine learning driven by humans
- Product thinking (rather than platform)
- On-demand information about the recent past (what just occurred)
- Data feedback loop is simple/for humans

Challenges

- Privacy vs. functionality
- Network security vs. innovation
- “Dumb” networks
- Interoperability

Emerging Roles

- Data engineer
- Product developer
- Industrial designer
- Manufacturing supervisor
- Developer
- Data architect
- Data monetizer

The challenges of the IoT mostly center around privacy and interoperability. The old networks and systems struggle to keep data secure while stretching their capabilities and infrastructure to innovate as much as possible. Old devices and new devices have less in common as innovation accelerates, and without platform-thinking interoperability is a major issue. Engineers and developers are increasingly called upon to manage security and capabilities, while designers and strategists must find ways to productize new sources of data and what that data is telling us. Devices are helping people and processes increase efficiency and can even learn if directed by a human operator. Information becomes available quickly but not quite instantly, and most of the data collected about humans is linked to direct input by humans in some form or other.

Web-Enabled Maps: Early IoT

Web-enabled GPS navigation is an example of an early IoT technology. It took decades for this tech to make it to the consumer level, and now it is becoming at least somewhat pervasive in environments with high technology usage and good network access. In such a system, we are taking the concept of traffic radio, paper maps and some intuition and combining them into a system which drastically increases the ease of use for the end user. However, such systems by no means utilize the full potential of the technologies at hand even with existing devices.

In this system, we have a limited set of tools—GPS satellite coordinates, local sensors and phones, basic network connections and a shared data store—combining various pieces of information to provide everyone on the network more accurate traffic and routing information. Web-enabled GPS in your vehicle provides huge improvements in ease of use, but it doesn't solve the problems which cause traffic in the first place.

Much of the technology required for the Social Network of Things is already here

The challenge in progressing to this next age is actually more about the need for us to change the way we think about and use networked systems: moving away from thinking in terms of objects and humans and instead thinking of the world in terms of fuzzier lines between the two—as what might be called cyborgs.

When we have fully made this transition in our thinking—and it has been integrated into our culture and our legal system—we will have either gone further towards the Social Network of Things (SNT) or put on the brakes. This next paradigm deepens in impact when you apply it to the concept of social products (useful, as the business portion of a larger trend) and platforms (again, a business-centric view). Those who coined the term Social Network of Things, like Mark Bonchek, mentioned earlier, allude to (and understand) the larger shift: **as we progress technologically it is less and less possible to decouple human social networks from devices' social networks.**

Social Network of Things: v2.0

The Social Network of Things touches on many of the same technologies which began to emerge in the IoT, like the cloud, machine learning and platforms—but it also begins to explore the implications of those technologies. Terms like little data, the data surrounding individual users, will emerge alongside big data. Issues around robotics and new applications thereof—like robotic architecture which changes the fundamental shapes of buildings in response to their occupants or the weather, or the concept of driverless cars—will bring about new functional and ethical issues. **For example, how do we interact with machines which make key decisions for and about human beings—such as two driverless cars coordinating with each other to avoid an accident?**

In a real-life example where a Social Network of Things could make a huge difference, a pedestrian crosses a busy street without a crossing signal. The first vehicle to pass by him taps its brakes quickly and then chooses to keep driving. The pedestrian runs between this car and another van behind it, which doesn't even touch its brakes. In the world of automated vehicles, we have the capacity to ensure his safety and that of the drivers through the transmission of data between multiple devices and people instantaneously. For example, the humans here couldn't convey from one vehicle to another what they had seen, or how they made the judgement call they did—but an automated vehicle could.

How do we design systems which can tap into the full potential of a social network of things—leveraging sidewalk sensors, the on-board systems of both conventional and driverless cars, traffic cameras and everything else available in the digital world—to augment human capacity?

Even more complex is the possibility of having these devices not just inform each other, but negotiate an outcome. Let us suppose that two driverless vehicles identified an imminent crash. Without being able to communicate with each other, as is currently the case with most driverless technology, the vehicles have to guess about what the other vehicle is going to do and use their on-board information to try to avoid or at least lessen an impact. If those cars could coordinate their decisions, they could synchronize their trajectory to more reliably lessen or avoid an impact altogether.

Life with a Social Network of Things—if properly implemented—is safer and easier

Life in the age of the Social Network of Things—at least, properly implemented—is potentially safer and easier. At this stage, we are doing something which has never been done before: negotiating between devices without passing decisions through humans first. In the world of mobility, for example, we are attending to multi-modal transit, major safety issues and even the possibility of ultra-light vehicles which rely on intelligence, rather than mass, for safety. Some cars will be fully automated, while others will be augmented with simple systems like accident avoidance and traffic routing, and yet others will be basic machines little different than the cars of the late 1990s. It is this complex landscape of old and new technologies which is the reason why future devices must be built to be adaptable, extensible and able to communicate between each other.

The US Department of Transportation and many other regulatory and industry agencies are spending energy and resources to get ahead of the coming complexity of such systems. It's just in time, too—as evidenced by the opinions in articles like the 2013 Wired piece "The Ethics of Saving Lives With Autonomous Cars Is Far Murkier Than You Think."

v2.0: Exploring the Social Network of Things (SNT)

Characteristics

- Messy and chaotic
- Very high rate of change
- As much culture work as code
- Enormous digital divide
- Machines begin to learn on their own
- Entirely new value opportunities and markets
- Interoperability required for success
- Mature platforms
- Enormous security issues
- Predictive information about the present

Challenges

- Fairness and equality
- Safety conflicts
- Legacy system retirement
- Political and cultural backlash

Emerging Roles

- AI Developer
- Regulatory liaison
- Cyborg Anthropologist
- Machine teacher

At this point in the progression toward the SNT, systems and data have become interoperable and leverage rich APIs. Purposes for devices become highly shared, much as our smartphones have, so that our cars display our calendars, share processing power and network connectivity with a connected phone, serve as sensors and even power storage units on larger utility and transportation grids.

Design by our engineers and developers is premised in responsiveness—the ability to make adaptive, resilient platforms and devices which can change as their circumstances and users evolve. Information in this phase, unlike the simple tools at the beginning of the IoT Age, will take real-time information about the present and predict the future.

The digital divide—the gulf between not just the haves and have-nots, but the knows and know-nots—will widen

In order for our devices and networks to provide predictive information about the present, the transition to the SNT will require platforms with interoperability, strong machine learning, and robust network bandwidth. Platform thinking will have become a de facto business strategy and technology doctrine. By today's standards, the flow of data and evolution of devices will look more organized and reliable, but the overall technology landscape may look overwhelmingly chaotic and messy, because a very high rate of change will mean that we have as much culture work to do as coding.

Those with access to the right technology, bandwidth and tools will have exponentially bigger capabilities in business, health and other critical domains. Disparity will start to appear as much or more along educational and bandwidth-access lines than national identities, as globalization and urbanization play out.

Devices and machines will increasingly be automating the tweaks to their own algorithms. All of this will result in entirely new opportunities for value, new markets for services, products and platforms, and the ability for individuals to move from being consumers to becoming co-creators of their digital lives.

At the same time, machines will be learning on their own

Evolving the IoT: v1.5

Right now, tech industry leaders are starting to conceptualize and release products which are designed to be interoperable in new, exciting and sometimes hard-to-manage ways.

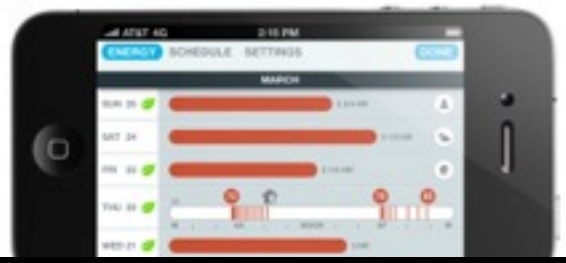
In this phase (between the IoT and the SNT), we're making better use of the network effect of coordination between various people and devices. Here, we've improved on old functions and devices, but we're also able to do new things—like communicate with other drivers about traffic while we're on the road and selectively share information about ourselves with others—in ways which require a more robust network infrastructure, real-time machine learning, and many data points for the best prediction.

Nest: A Connected Home

Nest, the learning thermostat released in 2011, does some very smart and helpful things. It employs machine learning technologies to discover the patterns of users' heating and cooling habits, and coordinates between multiple thermostats in a network. Nest also allows users to remotely view their heating and cooling usage, and to set smarter patterns for their own use, from their phones and browsers.

As the platform evolved, Nest Protect was released, bringing simple machine learning to smoke and carbon monoxide detection. Unlike most other home smoke detectors, Nest Protect connected to other Nest Protects placed in various locations throughout the house to coordinate responses to emergencies, providing smart information like "there is smoke in the upstairs hallway" rather than a simple alarm. Perhaps most useful was its ability to both learn from users' kitchen usage (simply by waving a hand under an active Nest Protect, a user could disable it temporarily while also teaching it that that type or smoke—or time of day—might indicate that someone was cooking dinner, rather than a more serious safety threat). At the same time, alerts on the device would remotely trigger users' mobile apps, letting them know that an alert was going on even if they weren't home.

None of those functions, however, goes beyond the basic Internet of Things concept—until the system is connected with other platforms.



Works with Nest: Devices Gone Social

As it evolved, though, the Nest family got bigger. In 2014, Nest announced "Works With Nest," a platform and API which allowed products outside the Nest brand to coordinate around a shared purpose with Nest. For example, Whirlpool appliances can coordinate with your Nest to find out if you are home—if you're not, but your laundry is still in the washer, they can run a 'refresh' cycle to make sure the clothes don't become mildewed or wrinkled. If you wear your Jawbone fitness device to bed, it can tell Nest to heat up the house when it detects that you are moving around more and are thus starting to wake up. LIFX programmable lights can flash red throughout the house if there is a smoke alarm. And Mercedes vehicles can tell Nest when you are leaving or returning to the house so it adjusts its energy consumption accordingly. Even Virgin America announced an integration wherein each and every seat in their fleet will feature Nest thermostats (well, alright—that was an April Fool's joke, but it could actually be quite useful).

By giving the user the ability to write "if this, then that" constructions (such as "if the house is empty, turn down the thermostat and turn off most of the lights"), the Nest ecosystem immediately responds to the user's needs but also learns from all of its users globally about potential uses for its system—shifting from conceiving of individuals as consumers, instead viewing them as co-creators of the products, services and platform.

Many of the problems and benefits of the Social Network of Things are beginning to have an impact right now, in the transitional period. Our old systems are sharing space and purpose with new systems which operate under entirely different assumptions, and organizations struggle to find solutions which allow them to keep what's been working and simply integrate the old tech with the new. As the pace of business continues to accelerate, companies can no longer afford to use traditional, inefficient styles of communication and governance, and are turning to outside companies, consultants and thought leaders to help restructure the way decisions get made.

Value looks different now

Privacy and identity politics are tense issues of discussion and legislation, as the collection and use of data becomes increasingly invisible to individuals, with new roles calling for experts who can manage the ethical questions that arise and attend to the impact of reputation and brand that come with security failures.

Privacy is everything

Machines are managing much of their own data collection and exchange now, with the capability to learn automatically, deliver information right when it's needed, and respond and adapt to one another using feedback loops. While the access to all this data creates serious security challenges, it also makes entirely new value possible, especially in personalization and predictive features. Innovation begins to happen on a platform level, rather than an isolated, product-focused one.

v1.5: Exploring the Transition to the Social Network of Things

Characteristics

- Data makes entirely new value possible, not just improving old products and services
- Evolving platforms
- Machines learn automatically when directed
- Just-in-time information about the present
- Feedback loops are more complex, for humans and also for other devices

Challenges

- Privacy and identity politics
- Unclear business models
- Legacy system integration
- Lack of standards

Emerging Roles

- Standards Developer
- Ethics & Privacy Team
- Public Relations Guru
- API Community Manager
- Network & Design Thinker

The beginning of the transition to the SNT brings concepts like prediction, automatic machine learning and more into the discussion alongside the existing concepts from the IoT. The nature and movement of information in the early years of the SNT will trend towards increased speed, access, and personalization. Systems and data which were once closely guarded and proprietary will become interoperable as platform thinking is adopted by most successful organizations, and the products those companies create will begin to collaborate towards shared purposes. Increased connectivity and infrastructure make information available instantly to entire networks, and users can access real-time data through their personal devices. As people grow accustomed to their tech knowing about their needs and preferences, an expectation for personalized design makes “one size fits all” devices a thing of the past.

Waze: the Rush to Socialize

The community-based travel and navigation app Waze is an example of what networked GPS looks like in the current, early SNT phase. Waze is a social mapping service. Like Google Maps or Apple Maps, it provides turn by turn navigation, including multiple routes to the same destination, and like them it provides traffic data for route optimization. The 1.1 billion dollar question, then, is "Why did Google buy Waze?"

Waze is a system which does something basic mapping systems couldn't—and which was definitely not possible in the age of traffic radio and paper maps: it connects various users to each other in real time. Specifically, users can quickly report traffic accidents, police, speed cameras, road hazards and the like—allowing a driver like me to save 15-20 minutes on my average commute. While most navigation systems were designed to help people avoid getting lost, Waze was designed specifically to help people avoid traffic delays. This difference in paradigm led its designers to focus on the users' need to know about non-permanent objects and events which are out of sight or around the next turn. To accomplish this, Waze connects drivers into a rich, user-augmented web that combines both artificial-intelligence-generated routes and instantaneous edits based on human input into the same system.

Google couldn't afford to be behind the social mapping curve, so the acquisition made sense for several reasons: clearly, the algorithm helps users, but also, something about the interface and business strategy of Waze meant that they could gather a critical mass of users. Although Google could likely have done either themselves, they chose to acquire Waze instead and secure their position as the leader in mobile mapping.

Driving Legislation

Let's look at a recent example of how serious our policymakers are taking the shift to the SNT, and how quickly they are moving to prepare for its implications. USA Today published an article on March 13th, 2014 about California's push to launch regulation for driverless cars. In it, the author notes that the Department of Motor Vehicles pledged to have draft regulations out by June and acknowledged that it had to have regulations finalized by the end of the year. In a state plagued with bankruptcy, it was a challenging deadline.

Just 10 weeks later, FastCompany reported that autonomous vehicle regulations had been released, and would be active by September 2014. It's easy to suppose that such a quick turnaround was influenced in part by the large public policy presence of technology companies and media attention on the promising future of automated vehicles.

The Cyborg Age: v3.0

As the Social Network of Things becomes more real, the Cyborg Age will come into fruition. At this point in our future, we can expect the conversation about technology to become more complex than discussing the devices or software we use, because such tools will become nearly indivisible from ourselves. Unlike Google Glass or Oculus Rift, devices which add an information layer to our daily experience but which we can easily remove, the technologies of the Cyborg Age—some of which are already here—will not be so easy to turn off.

Our first forays into this age started when we began implanting inorganic technologies in our bodies, like pacemakers (or attaching them, like prosthetics). The apex of the Cyborg Age, however, will be marked by technologies like wetware—neural implants, for example—and nanotechnological chemicals and devices entering our bodies through our blood. Imagine being able to download an entire language in seconds—or, more likely, to just "know it when you need it" with no additional thought. Or picture nanobots which can remove plaque from arteries or repair torn ligaments. If you are concerned (and maybe also a bit excited), you are not alone.

Neural and direct-to-organ technological interfaces will be either commonplace—or at least commonly understood

The Cyborg Age will be defined by discussions about ethics, neuroscience (a burgeoning field even today), robots and the digital divide. We will also have to begin to accept the idea that artificial intelligence technologies which we create may begin to be sentient—aware of themselves and conscious. The emergence of self-aware artificial intelligence entities would force us to consider core issues of personhood, humanity and rights.

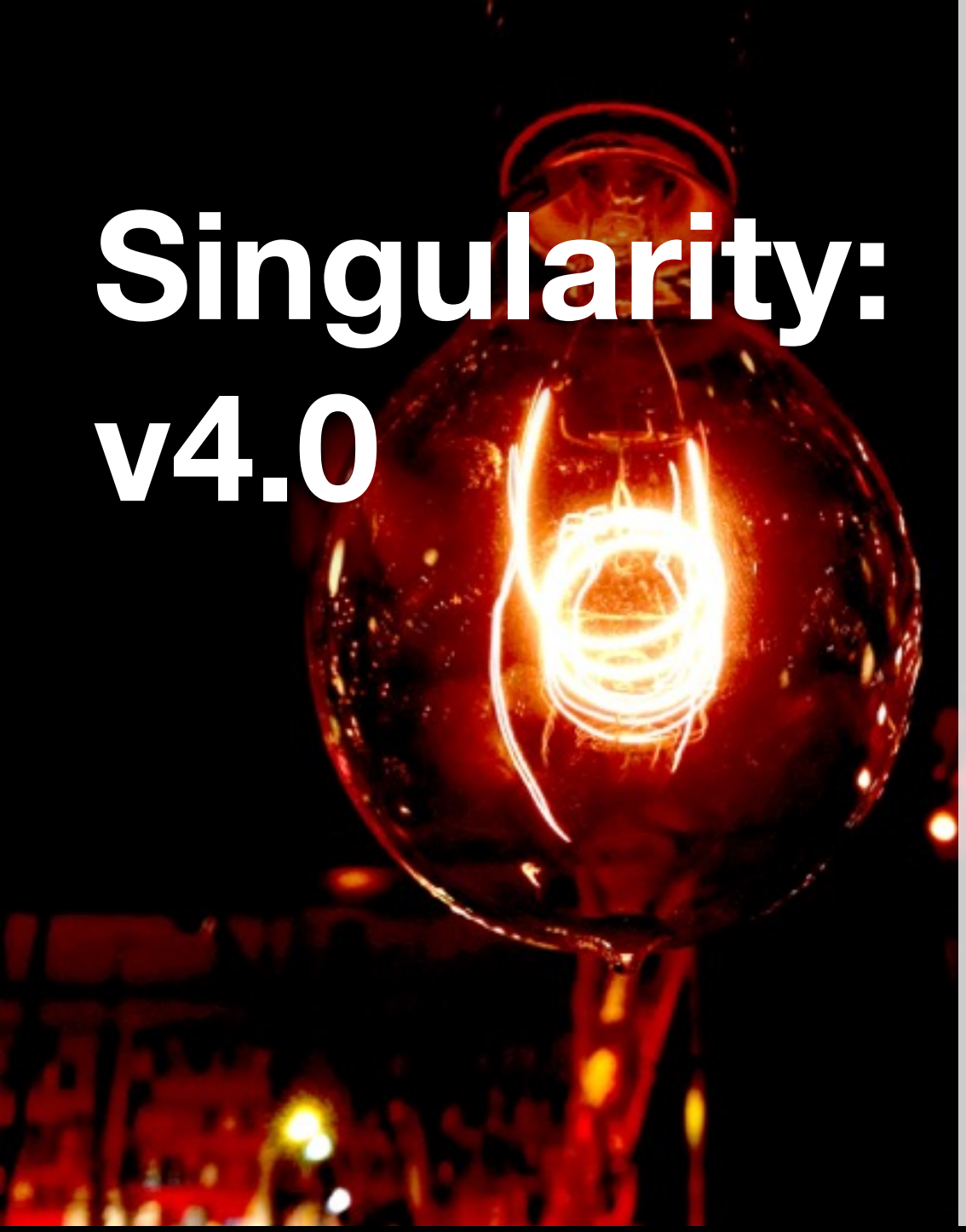
At the same time, tech-enhanced systems and individuals will have changed our expectations of capacity and function so deeply that a machine or human on their own will seem archaic and incredibly limited, and our concept of what is human will adapt accordingly to include modifications which have become commonplace. This is already happening. For example, there is an expectation that professionals will have and know how to use smartphones to enhance their memory, access to data, and availability—it is hard to find an executive today who relies solely on desktop computers for access to email or carries a paper calendar for scheduling.

Neural and direct-to-organ technological interfaces will be either commonplace or at least commonly discussed, and network access will be pervasive, robust and incredibly reliable—at least in privileged areas. **A person's access to data and bandwidth, and how reliable and high-quality that access is, will directly correspond to the amount of socioeconomic privilege they have.**

At this point, the division between the vast amount of data we have access to and our physical brains will be very hard to distinguish

As it becomes more difficult to distinguish between people and the tech that enables their lives, fundamental questions of humanity and fairness come into focus. These questions are largely about relative issues, rather than functional or strategic ones. What is fair? What is natural? How we do we decide whether we should do the things we are now capable of? How and when do we stop before we modify ourselves too much? What is too much?

In most domains, machine intelligence and robotic production methods will be accepted and preferred over the work and discretion of “pure humans”, but emotion and empathy will become more openly valued as qualities which are exclusive to humans. As a result, the Cyborg Age will necessitate many roles which put the emotional intelligence of humans to work filling the emotional gap in cyborg and artificial intelligence capabilities as coaches, counselors and empathy experts. These considerations may seem like science fiction now, but so did the idea of a smartphone which can translate signs and languages instantly even ten years ago.

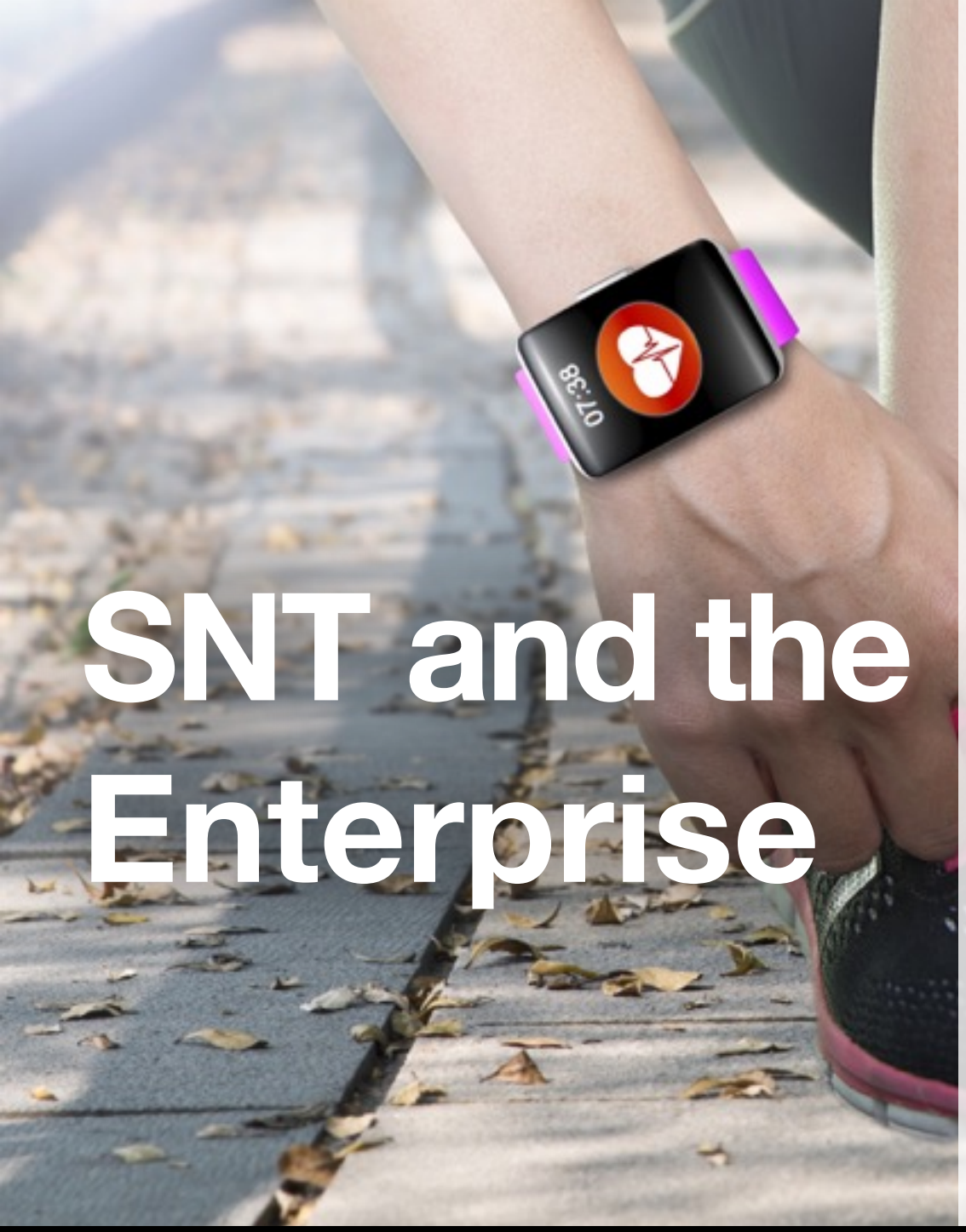


Singularity: v4.0

Now we get to the things that we're seeing in our science fiction films and books right now, what we might call the Post-Human Age, or Singularity, in which the line between humans and tech is no longer distinguishable. The Singularity concept is championed and explored most prominently by the work of futurist, author, engineer and inventor Ray Kurzweil, whom Google hired in 2013 as their Director of Engineering to work on machine learning and language processing. At this point we'll be dealing with pervasive artificial intelligence, major existential crises, fundamental paradigm shifts, and more questions about economic upheaval, bodies, and human beings in general. The move to integrate tech into our bodies and daily experiences is complete, and the shift now moves towards extending and exporting ourselves into our digital environment—for example, uploading our minds into the cloud.

What is “human” has been redefined—or deprecated—to the same conceptual space traditionally occupied by “primate” or “ape”

We’ll be dealing with such complexity of emotion and systems that we’ll become reliant on intuitive information about the future, because the machine can predict things faster than our human consciousness could, and what is “human” has been redefined—or deprecated—to the same conceptual space traditionally occupied by “primate” or “ape”. Intelligence becomes largely separable from the body, and the term “human” changes meaning to include non-biological systems and devices which are not even confined to our physical forms. With the reality of sentient AI’s comes the need for experts and services to support their health and regulate their role in society, such as AI immunologists who address the impact of digital viruses on sentient digital consciousness and AI law enforcement to handle the risk of criminal activity which happens at speeds and levels of complexity which make it impossible for “human” police to track or intercept.



SNT and the Enterprise

Today, the primary focus of IoT is around the technical features of devices, and their ability to connect through the Internet—sharing, processing and analyzing data to provide valuable insights for a specific domain. Our utility companies use smart meters to collect information on energy usage and aggregate this information to provide us with the ability to track and manage our electricity and gas consumption. Our activity trackers collect information about our activity (steps walked, stairs climbed, hours slept etc.) and aggregate this information with other data sources to provide a comprehensive view of our wellness.

This hub-and-spoke model of collecting information about a specific activity and analyzing usage and behavioral patterns to provide insights is the norm of today's IoT industry. This model provides us with significant benefit by capturing data, democratizing it and putting it back into our hands, empowering us to take action on it. However, as devices are getting smarter and more pervasive, the model needs to evolve beyond today's passive devices to ones that support decentralized and autonomous decision-making. The new model must support smart devices that collect information and can also perform many basic tasks autonomously and collaborate with one another to make decisions on our behalf. In short, it needs to support the Social Network of Things.

We are already seeing the next step of this evolution. Large technology companies are beginning to provide platforms for specific domains to support the evolution of The Social Network of Things (SNT). Apple's "HomeKit" will connect devices and applications in a brand new way to comprehensively manage our health. Google's "Works With Nest"—which we profiled earlier—will enable the smart home and the hundreds of smart devices that will proliferate into tomorrow's smart homes. These platforms represent the next step in the evolution of SNT by putting integrated information into the hands of the consumer. They also lay the foundation for tighter integration and more collaboration across devices. With these platforms, device manufacturers will be able to access and communicate with other devices on the platform with relative ease using a set of APIs.

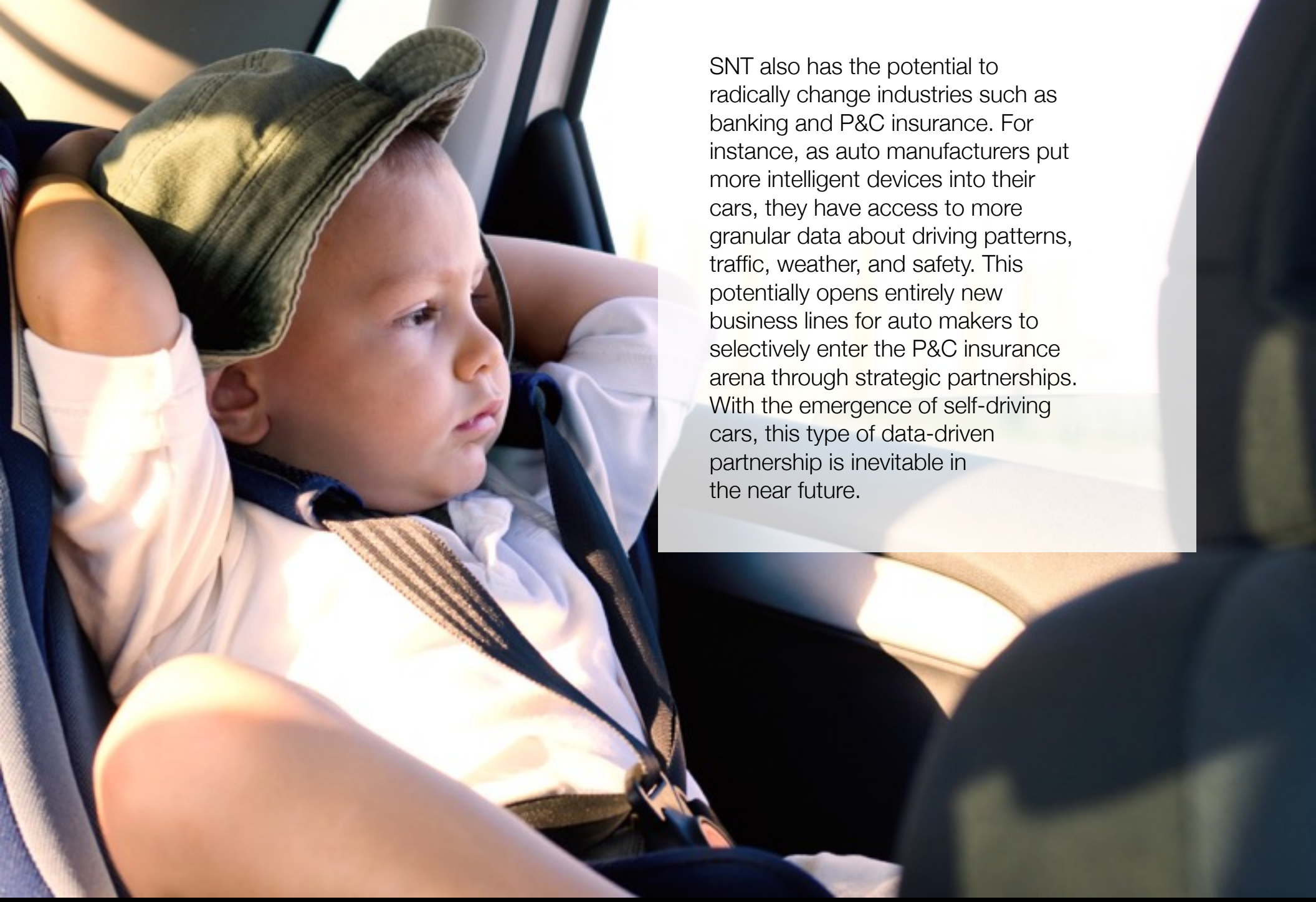
The SNT is a foundational element of self-driving cars that will communicate, negotiate, and collaborate with other vehicles to make real-time decisions without human intervention. For example, if the Nest Smoke Alarm detects smoke in the house, it can instruct the Nest Learning Thermostat to shut down the oil-burning furnace with no human intervention.

The Social Network of Things has great potential to improve our quality of life—giving us access to insights about ourselves, our homes, and our daily choices through smarter devices that collaborate with one another and make informed decisions that benefit us.

The Social Network of Things will redefine business processes and transform traditional industries.

The manufacturing industry was an early adopter of robotics and computer-assisted manufacturing techniques—leveraging robots and other intelligent devices that communicate with one another to make rudimentary decisions on the plant floor. With the evolution of the SNT, these types of devices will collaborate across domains to significantly improve the throughput of manufacturing operations, improve worker safety and wellness, and increase efficiency through better energy management.

The retailing and wholesale industries can leverage the SNT to radically transform front-end and back-end operations. Today market leaders such as Amazon and Abbot Labs have automated warehouses that use robots, sensors, and smart devices that collaborate to locate, retrieve, and deliver products. Retail innovators such as Apple and Starbucks use proximity sensors and devices that use Near Field Communications or Low Energy Bluetooth technology to deliver a personalized and enhanced shopping experience. They are using the Social Network of Things to deliver a highly interactive, immersive, and customized shopping experience to every customer without the need for high-touch sales techniques or extra staff.



SNT also has the potential to radically change industries such as banking and P&C insurance. For instance, as auto manufacturers put more intelligent devices into their cars, they have access to more granular data about driving patterns, traffic, weather, and safety. This potentially opens entirely new business lines for auto makers to selectively enter the P&C insurance arena through strategic partnerships. With the emergence of self-driving cars, this type of data-driven partnership is inevitable in the near future.

As enterprises take advantage of the new opportunities created by SNT, they should be ready to adapt their models for managing IT.

Big data is having an enormous impact on the financial services industry, especially in fraud prevention. Analysis of customer spending patterns has allowed companies to identify “red flag” transactions and patterns of activity which are likely linked to a stolen card or identity. This is great news for companies who have been losing millions each year to credit card fraud, but it’s also great for customers whose information is stolen. Frost Bank’s two-way text alert option will send users a text when there is a suspicious transaction posting to their account. The speed at which transaction data is processed now allows the bank to alert a customer in real-time and the two-way option means they can authorize or decline the suspicious activity with a text reply. The customer is saved the embarrassment of standing on the phone in front of a merchant with a line of customers or a declined card at their next point-of-sale, while the bank is saved the administrative costs associated with processing travel notifications and making direct calls to the customer for authorization of flagged transactions.

While big data is fueling innovations which largely benefit big companies with access to huge pools of information, companies and individuals are also finding value opportunities informed by little data—detailed information about an individual person.

Little data includes just about every type of data a person produces: schedule, shopping choices, patterns of travel, temperature preference in home or car, physical health, emotions—if you can measure it through a sensor or interface, data about humans can be collected and analyzed. The key issue is that you have to get permission from someone to collect their data, but with opportunities for innovation at nearly every point of the spectrum related to little data it is increasingly appropriate to start asking what your users want in exchange for theirs. Asset management startup Trov has formed an appraisal and insurance platform based entirely on the value of little data. Users upload information about their tangible assets, add new purchases through a mobile app, receive updated information about changes in the value of their possessions, share that information with their insurers for accurate real-time adjustments in coverage, and have the option to sell valuables through Trov's connection to "specialized marketplaces" online. Having real-time, detailed information about customers' assets and purchasing behavior is a clear benefit for the insurers who are partnering with Trov, and users are getting more customized service from features and partners in return.

Security data collected by sensors and other devices is a critical element of the Social Network of Things. As the SNT evolves, smartphones become even more central to our lives, and we trust them with crucial data and communications which will inform many other devices which we use. To be ready for this evolution, we need to look at mobile security solutions that go beyond MDM (Mobile Device Management) to understand and protect the data collected by our smartphones and other personal devices.

Privacy is another concern that needs to be addressed in new ways because of the SNT, as more data is being collected while customers are increasingly aware of how that data is used and who gets access to it. As the Social Network of Things matures, large enterprises need to evolve their privacy policies to address customer concerns over the privacy of their data.

Rethinking integration is vital for enterprises who are implementing SNT solutions. Digital businesses must re-architect their models for communication and collaboration with external systems and solutions. This process of redesign includes:

- Understanding the implications of data-at-rest and data-in-motion across the enterprise with a focus on SNT
- Strategically enabling key services within key enterprise systems through light-weight REST based APIs
- Looking to build secure cloud based integration models to collect, collate and analyze data to enable collaboration across these devices
- Exposing key API services to the broader ecosystem of partners to enable the development of new and innovative services through the combination of APIs and data.

Software Defined Networking and Network Function Virtualization support enterprises in leveraging the Social Network of Things by providing flexibility and adaptability at the edge and within the core of the enterprise network. The SNT relies on the ability of many different types of pervasive devices to collaborate with one another. This variety and pervasiveness presents a significant challenge to today's hardware intensive hard-wired networks. While there are many other reasons driving SDN and NFV within the enterprise, the Social Network of Things will require that digital businesses adopt more flexible IT solutions to stay competitive.

The Technologist's Challenge

These futures are not a given. Both the positive and negative aspects of what we have described are only some of the possible scenarios for our trajectory as human beings. The bright, shiny, positive elements—interoperability of devices for coordinated savings of energy or increased safety, for example—are shadowed by concerns about ethics, privacy and environmental sustainability. For example, is it really a good idea to make it easier to drive petroleum-based vehicles, or should we switch to different modes of transit or at least energy sources? Just because we can make it easy to forget our laundry in the washer or have our home pre-heated or cooled so that we are never inconvenienced or uncomfortable doesn't mean it is a good idea.

The science-fiction examples of tech-enhanced bodies are also questionable in their benefits and consequences. Huge advances in standards, ethical guidelines, regulations and cultural understanding are needed. These problems are explored in incredible depth in other articles and resources.

As technology-aware businesspeople and concerned citizens, it is our job to ask both what is needed to enable these technologies and also whether we are ready (or interested) in doing so. The ever-growing "snowball effect" of technological change is hard to counteract, but if it accelerates too quickly, cultural backlash or public misunderstanding can set back progress or derail legitimately socially-conscious innovations along with those under critique.

In order to build such technologies, robust and well-designed technological and strategic platforms must be put into place. Legacy systems must also be integrated in a way which acknowledges complex privacy, speed and reliability needs inconceivable at the time of the original design. This kind of innovation and rapid change requires companies which may never before have had to consider such complexities to quickly deepen strategic partnerships in technology, public policy and many other functions while also increasing their own capacity.

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Building Platforms for Digital Businesses

NTT Innovation Institute, Inc., (NTT i³, pronounced "i-cubed") is the Silicon Valley-based, open innovation/applied research & development center of NTT Group. NTT i³ builds platforms that are transforming today's enterprises into the digital businesses of the future. Our platforms help our clients engage with customers and markets in exciting new ways by pushing the boundaries of cloud computing, information security, machine learning and the social network of things. NTT i³ builds on the vast intellectual capital base of NTT Group, which invests more than $2.5 billion a year in R&D, an extensive network of technology partners, engineers and scientists.

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