



The Future of Knowledge Work

An Outlook on the Changing Nature of the Work Environment

Companies with a Clear Vision for the Unfolding Trends Will Have an Unprecedented Opportunity to Excel in a Dramatically Different Landscape

Tim Hansen
tim.e.hansen@intel.com
Intel Corporation

Executive Summary

The world is changing dramatically in ways that will have a significant impact on everyday life. By 2025, the explosion in world population and automobile ownership, as well as urbanization trends, will make physical travel even more complex and time-consuming. In contrast, technology will continue to shrink, disappearing into the fabric of our lives, eventually becoming so small that it will be embedded in our clothes and environment.

Yet even while technology increasingly disappears, the influence it has on each of us will increase dramatically, fostered by cloud computing and massively expanded use of personal data.

The Future of Work

This paper identifies trends likely to shape the future of work and provides the reader with information and ideas to imagine the future that is rushing toward us.

It grew out of a Workplace of the Future Summit held at Intel in Haifa, Israel. Related research within Intel Labs, in addition to significant external research, has provided the source material for the conclusions drawn.

The content of this paper is focused on changes likely to impact global companies with a large number of knowledge workers, though many observations will apply more broadly. Key ideas include:

1. **Defining an employee on the cusp of a transformation.** Employee attitudes and expectations for flexibility will influence where, when, and how people work.
2. **Dynamic and agile team structures will become the norm.** The default

mode of employment will look more like a gun for hire (contractor) than employment structures of the past.

3. **The location of work will vary widely.** Offices will serve as temporary anchor points for human interaction rather than daily travel destinations. Office as a service (OaaS) will become a strategic tool to land employees in the right place at the right time.
4. **Smart systems will emerge and collaborate with humans.** This will change the nature of work and drive a reimagining of work content and process.
5. **A second wave of consumerization is coming via services.** This "servicification" will usher in changes to corporate IT organizations in a way that is more impactful than the first wave of consumerization. The magnitude and speed of disruption will be propelled by short software

Contents

Executive Summary1
 The Future of Work1
 The Changing World2
 Compute So Small, It's Everywhere .2
 More Congestion, Less Physical
 Mobility2
 The Changing Workforce3
 Knowledge Jobs Shape Workplace
 Opportunities3
 Emerging Smart Systems Collaborate
 with People4
 Employees Expect High Flexibility .5
 Cloud Computing Speeds the Pace
 of Innovation6
 Personal Data via the Cloud Changes
 Our Relationship with Technology .7
 The Second Wave of Consumerization
 in the Enterprise: Servicification8
 Employment Models are Transforming:
 Big Changes on the Horizon8
 Work Environments are Optimized for
 the New Location: Everywhere9
 Optimized Office Location Planning:
 Office as a Service10
 Hybrid Office Configurations are
 Shape-Shifting Spaces10
 Virtually Being There10
 Summary11

development cycles and quick and simple wide deployment of services and apps. Hardware changes driven by the iPhone* and iPad* in the first wave of consumerization will seem long-lived in comparison.

dedented opportunity to excel in a dramatically different landscape. As we move toward 2025, there are forces at work which will have dramatic impact to the work landscape.

The way people work will change, as will the attributes of employment.

Compute So Small, It's Everywhere

Computing power will evolve with Moore's law, becoming so small that it will easily be stitched into the fabric of our lives (and our clothes) in a pervasive and engrained way. This will result in an explosion of devices that will mesh together (Figure 1). By 2020, it is estimated that there will be over 50 billion devices connected to the internet.¹ In essence, we will be living inside a computing planet. Each person will access a myriad of devices on a daily basis. Cloud computing will enable these devices to intelligently communicate and collaborate. Imagine, for example, an automated message from home adding milk to the shopping list because the refrigerator recognized that the carton was almost empty.

The Changing World

The world is changing dramatically, both expanding and contracting in ways that will have a significant impact on everyday life. Old models of work, already in flux, will seemingly dissolve as new models rise in their place.

More Congestion, Less Physical Mobility

In contrast to the shrinking profile of computing, human population, urbaniza-

People working in 2025 may view today's work life as differently as we perceive the office life of the 1800s. Technology will be a major force of change, but the agents of change will be the innovative knowledge workers who envision, articulate, and implement the technology.

Companies with a clear vision for the unfolding trends will have an unprece-

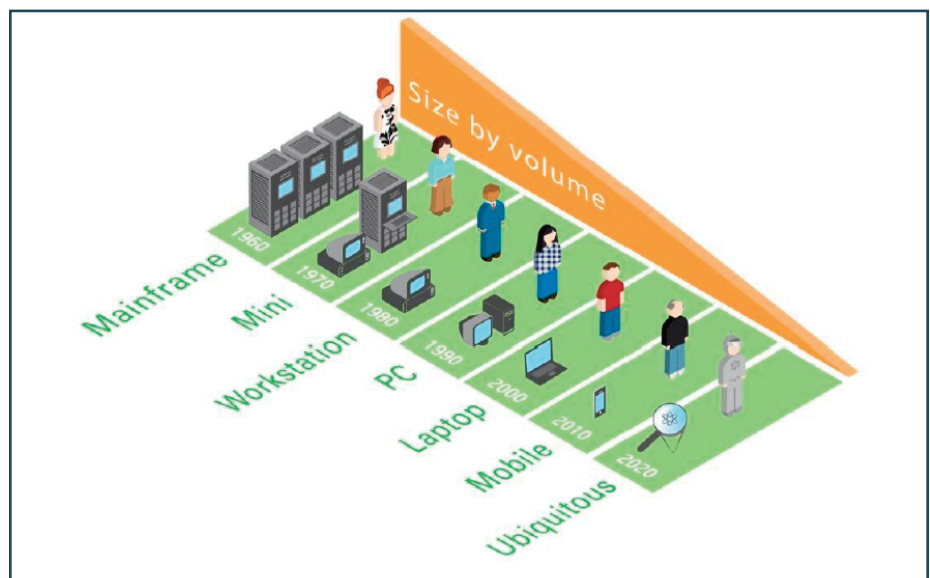


Figure 1. Computing power will easily be stitched into the fabric of our lives, leading to an explosion of devices that will mesh together.

tion, and automobile ownership are all expected to grow explosively. Today's human population of approximately 7 billion is forecast to grow to 9.5 billion by 2050², with 75 percent of the world's population expected to live in cities and 50 of those cities having more than 10 million people. About one billion cars on the road worldwide today may grow to four billion by mid-century.³

The amount of physical space we have will become ever more congested, with our ability to move physically from one location to another increasingly complex and time-consuming.

Without thoughtful intervention, commute times—already significant in many cities around the world—will continue to rise. New strategies will need to address the negative health outcomes and overall decrease in life satisfaction that results from longer commute times.^{5,6}

There is a real opportunity for technology to ease the human burden in this regard. Solutions such as smart transportation systems, autonomous cars, and richer telecommuting options could all contribute to meaningful changes.

The Changing Workforce

Economic wealth is expected to shift over time from west to east with the growth of the world population. Educated knowledge workers from the east, especially China and India, will form an ever-larger percentage of the available workforce.

Projections for the U.S. labor force indicate there could be 14.6 million new non-farm payroll jobs created between 2008 and 2018. Assuming no major immigration changes, there will only be about 9.1 million new workers to fill the positions. The basic issue in the U.S. is that there are fewer young people to replace the aging Baby Boomer generation. This will leave a gap of approximately 5.5 million workers.⁷ Europe is facing similar challenges (Figure 3).

Europe and the U.S. will need to tap new and underutilized resources to fill knowledge worker jobs. These may include a greater percentage of mature workers, women, students, transient workers, and immigrants. Globally, businesses are likely to recruit a larger per-

centage of workers from varied sources including contract pools, academic collaborations, open innovation challenges, and crowd-sourcing.

Workers on both ends of the age spectrum will increasingly be involved in the work force. According to the World Health Organization, mature workers will be physically capable of working into their mid- to late 70s.⁹ It is also likely that organizations will tap the energy, enthusiasm, and insight from bright high school and college students. In the U.S., this will translate into a social phenomenon not yet witnessed: five generations working side-by-side (Figure 4).⁹

Knowledge Jobs Shape Work Opportunities

The shift in workforce demographics will also be influenced by a larger issue: the changing skill and knowledge levels needed to find and keep a job in an increasingly competitive global economy. Though there is still debate on the specific definition, knowledge work is generally seen as work that most uses human intellect, creativity, and analytic skills.

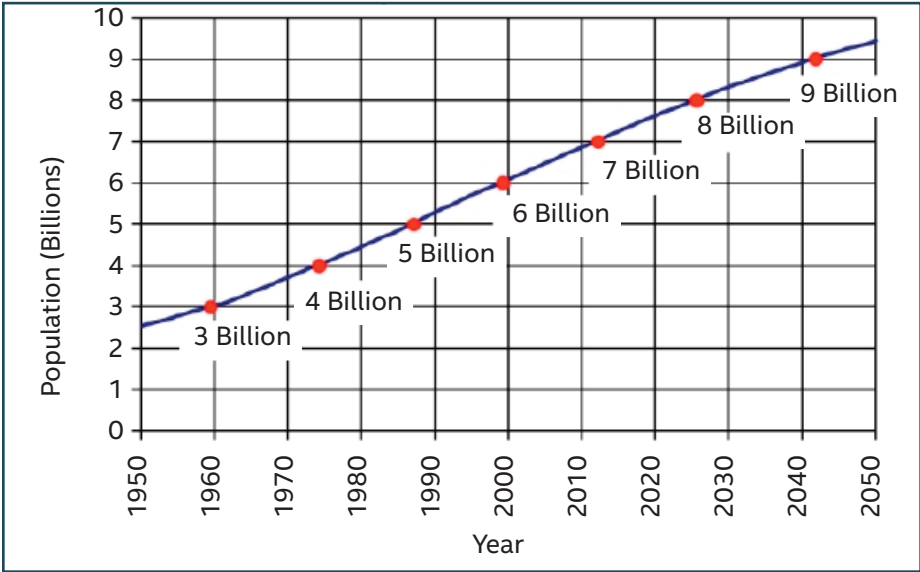


Figure 2. World population will have tripled from about 3 billion in 1960 to 9 billion by 2042. (Source: U.S. Census Bureau International Database)

Trends are already indicating that a growing number of jobs will require a significantly more complex set of interdisciplinary skills such as problem solving, judgment, listening, data analysis, relationship building, collaborating, and communicating with multinational co-workers.

Knowledge jobs are growing two-and-a-half times faster than transactional jobs, which involve fewer conceptual duties.

Knowledge workers represent the fastest-growing talent pool in most organizations. Approximately 48 million of the more than 137 million U.S. workers are knowledge workers.¹¹ As a result of the expected impact of technological innovation, knowledge workers will have an unprecedented opportunity to shape the future and influence societal change.

Emerging Smart Systems Collaborate with People

While a growing percentage of the population shifts towards knowledge jobs, the rise of smart machines and systems will also make an impact. Humanity is on the cusp of a major transformation in its relationship with tools. In the next decade, smart machines will enter the office, factory, and home in numbers we

Figure 3. The U.S. will be the first to face the Baby Boomer tsunami, with Europe and Asia following closely. The rectangles show the year with the highest percentage of the population in the pensionable age (60 to 65) in the respective countries. (Source: UN World Population Prospects)

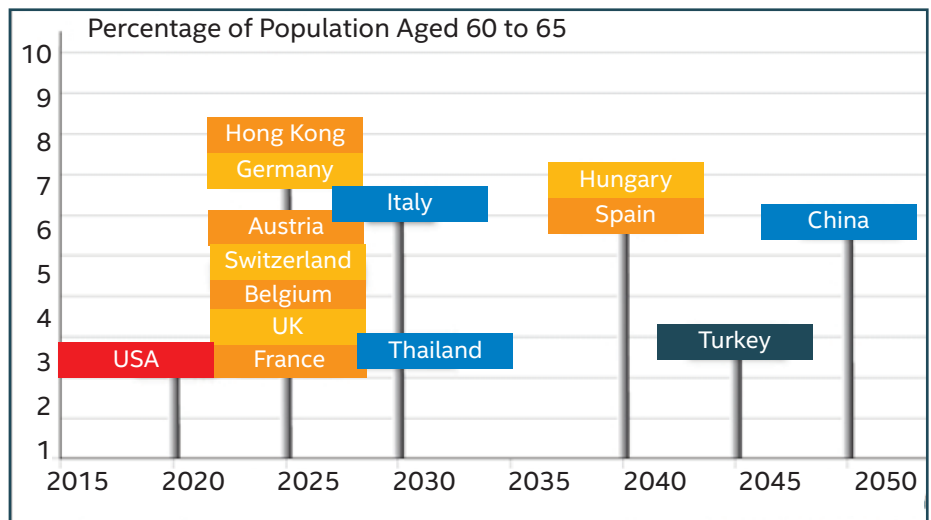
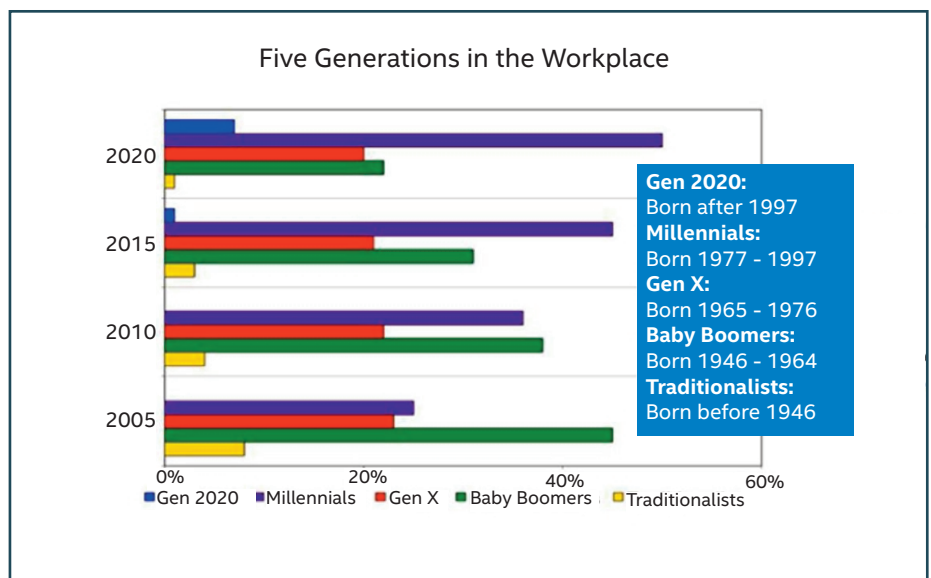


Figure 4. For the first time, five generations will be in the workplace at the same time. (Source: Bureau of Labor Statistics employment projections)



have never seen before. They will become integral to production, teaching, combat, medicine, security, and virtually every domain of our lives.

As these machines replace humans in some tasks and augment us in others, their largest impact may be less obvious. Their very presence among us will force us to confront important questions:

- What are humans uniquely good at?
- What is our comparative advantage?
- What is our place alongside these machines?

We will have to rethink the content of our work and our work processes in response."¹²

There are already leading indicators of how these new smart systems will work. IBM's Watson* is one such example. In an ongoing collaboration with the Memorial Sloan-Kettering Cancer Center in New York, IBM is working with a team of oncologists to teach Watson how to diagnose tumors and suggest treatments. Watson can ingest more data in one day than any human could in a lifetime. It can read all of the world's medical journals in less time than it takes a physician to drink a cup of coffee. All at once, it can:

- **Review** patient histories
- **Keep an eye on** the latest drug trials
- **Stay apprised** of the potency of new therapies
- **Adhere** to state-of-the-art guidelines that help doctors choose the best treatments¹³

Watson can then suggest a range of potential treatments by confidence level, providing doctors with an effective tool to more efficiently help patients. Because systems like Watson can continually ingest an enormous amount of recent and relevant data, the system itself will outstrip a human's ability to keep current with all relevant information.¹³

It's a small step to imagine other domains that could benefit from similar systems. A legal-based smart system could be implemented to expedite the processing of patent applications, which have increased by more than 50 percent over the last decade and are significantly backlogged. More valuable still, this same system could improve the quality of application review, provide actionable recommendations to junior staffers, and reduce gaming of the process. Investment bank fraud systems, corporate expense tracking, and personal finances are other examples.

The new partnership between humans and machines will open opportunities for people to focus on uniquely human strengths. High-level "sense-making"

skills will be increasingly valued as humans use data to create unique insights critical to decision-making. This trend will also necessitate workforce training and transition plans for workers impacted by the automation shift.¹²

Employees Expect High Flexibility

As the composition of the workforce shifts, so do the attitudes, wants, and expectations of employees. There are indications that both young and mature workers want significantly more flexibility in work times, schedules, and locations to pursue other valued life activities. Social responsibility is becoming a significant differentiator as employees expect their company to provide opportunities to contribute in a meaningful way to societal good (Figure 5).¹⁴

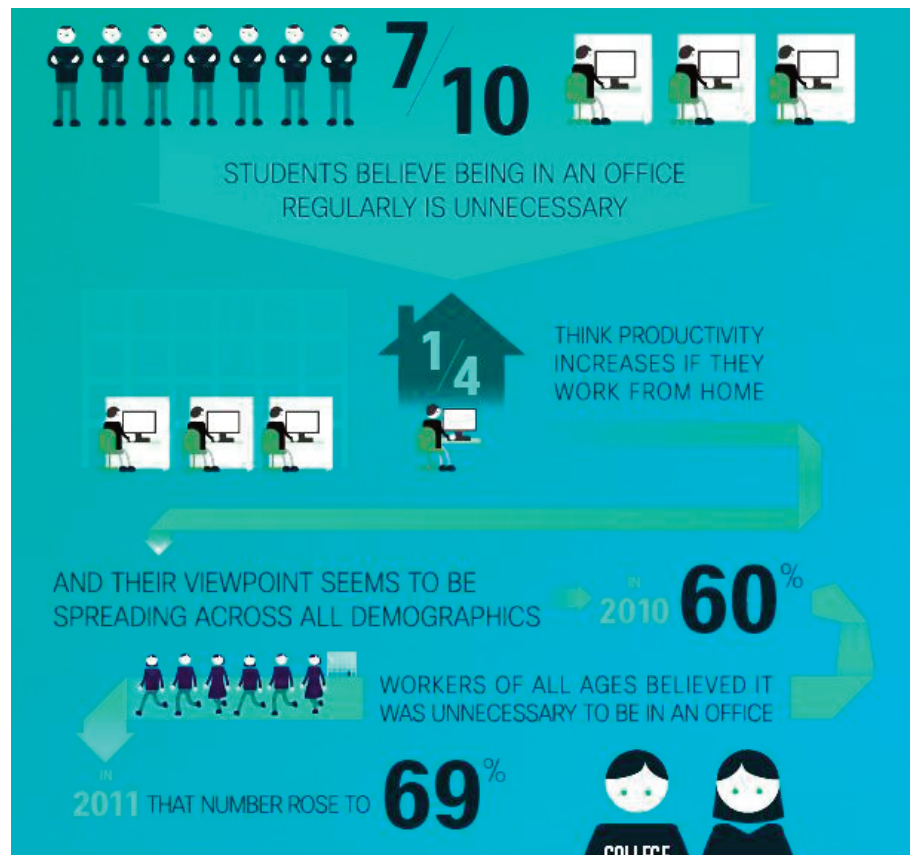


Figure 5. Social responsibility is becoming a significant workplace differentiator. (Source: Cisco Connected World Technology Report)

Increasingly, job flexibility and remote access are valued more highly than salary considerations.¹⁴ A full 69 percent of employees polled in a Cisco survey indicated they believe it is unnecessary to be in the office to be productive. And 60 percent of students polled believed they should have the right to work remotely, with a flexible schedule.¹⁴

The definition of an employee may also change significantly as knowledge workers look to bounce part-time between traditional corporate roles, cultivation of entrepreneurial opportunities, pursuit of societal contributions, and leisure activities. Employees may request—and in some cases, expect—flexible schedules to accommodate their lifestyles. These may include partial work weeks, time-shifted hours, and time-on and time-off scheduling. While it is still uncertain whether knowledge workers will have the power to require this flexibility from their employers, if supply imbalance projections hold true, marketplace conditions would likely provide workers with that opportunity. Contract-like work models could become a more popular and dynamic way to assemble successful teams. In-sourcing models may be used to create a priority retainer on valuable talent, giving those employees flexibility to take on outside endeavors in exchange for their availability at critical junctures. Progressive employers looking to recruit and keep top talent are likely to be the first implementers of a highly flexible work environment.

Studies show that while employees want ever greater flexibility and opportunity, they will also want a direct engagement with their company. Interaction should reflect a more personalized understand-

ing of the employee.¹⁵ As technology evolves, employees will come to expect tailored corporate services that will recognize them individually and proactively offer suggestions like a friend would. Imagine a corporate coach service able to recommend:

- **A specific** job training curriculum
- **An increase** in retirement savings
- **Potential tax consequences** of a planned stock exercise

The expectations of the future workforce will also be shaped by the differing attitudes of each generation of workers. This will present unique challenges in the way people relate, interact, and collaborate with each other. Productivity will be highest for employers that can find innovative techniques to unify their multi-generational, multi-national workforce in pursuit of organizational objectives.

Cloud Computing Speeds the Pace of Innovation

Cloud computing will shape the future of work in at least three significant ways. It will:

- **Change** the way companies plan physical office space
- **Provide** an ability for unprecedented agility and speed in the deployment of new concepts, regardless of company size
- **Usher in** changes to corporate IT organizations in a way more impactful than consumerization

New technology will have a dramatic effect on how and where work is done. The accelerating adoption of mobility, and the migration to cloud computing, pro-

vide a transition point to empty or thin office space.¹⁶ Thin office space occurs as people and computing infrastructure can be decoupled from specific long-term physical properties. The proliferation of data warehouses will enable corporations to centralize computing to large offsite facilities or to dynamically use external cloud services (e.g., Amazon Cloud*) for needed compute capability. The movement away from office buildings containing data centers and technology infrastructure will provide opportunities to create office location strategies that are agile and transient and can be more focused on human-centered usage.

Cloud computing is also a significant disruptor behind the swift creation and implementation of new business opportunities. Almost overnight, a small startup consisting of a few employees can develop a novel concept and deploy it globally. Social media platforms can be used to construct a Web presence that appears established and allows a startup organization to compete against large corporations in an unprecedented way. The cloud enables organizations to crowd source, data aggregate, collaborate, and play at extreme scales from the micro to the massive.¹²

Penetration rates for new Web sites and apps enabled by cloud computing are staggering (Figure 6). The Draw Something* app from OMGPOP had 15 million daily active users just eight weeks after deployment. Over two billion drawings were created in the first six weeks alone.¹⁸ If you put these numbers in context it is simply stunning. It took radio 38 years, television 13 years, the Internet four years, and Facebook* 3.5 years each to reach 50 million households.^{19,20}

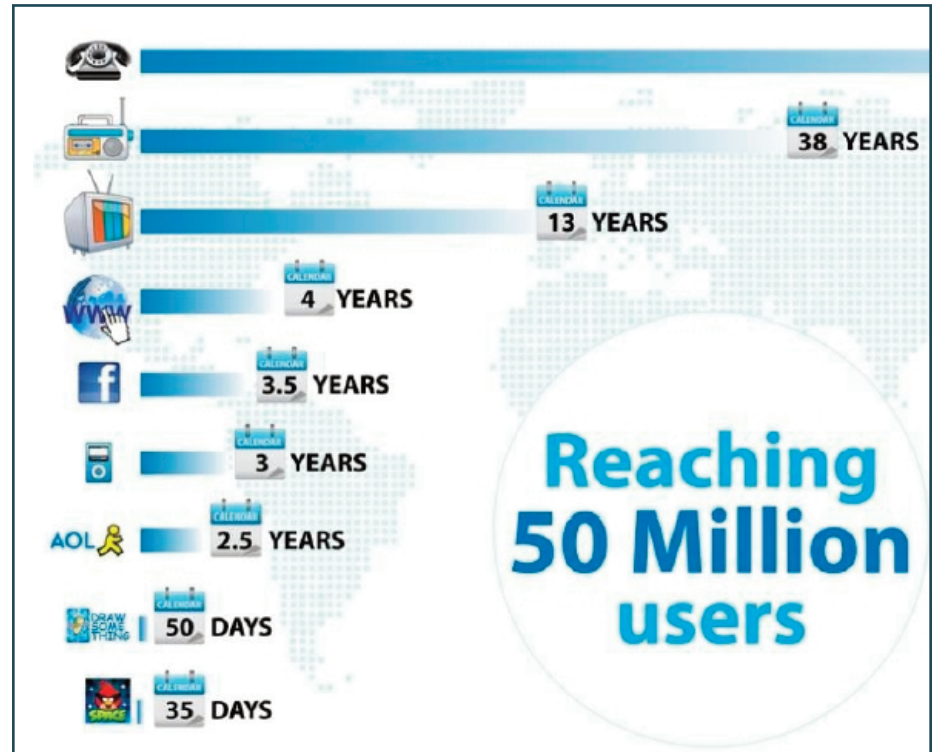


Figure 6. "It took about 75 years for the telephone to connect 50 million people. Today, a simple iPhone* app like Draw Something* can reach that milestone in a matter of days. In the last 10 years, the rate of adoption of new technologies has accelerated at a dizzying speed. Can we keep up with it all?" (Source: G. Kofi Annon)

Personal Data via the Cloud Changes our Relationship with Technology

The World Economic Forum has predicted the emergence of a new personal data economy which will provide high value in the use of personal data.²¹ People will have consistent access to their own personal knowledge repository. The cloud will facilitate sharing and tying of this personal information across computing devices that will litter the landscape. Personal data will be able to inhabit any available device authorized to assist the user. Imagine every computing device working cooperatively with us because it can become temporarily possessed of our digital persona.

New digital agents and digital assistance services will likely use methods to analyze individual data, make recommendations, and often act on our behalf with little or no intervention. Instead of asking questions to a Siri*-like service and waiting for a result, we will find ourselves unexpectedly delighted by the actions that have been taken on our behalf. As with any relationship, trust will need to be built through positive interactions over time. Frequent incidents of delight will ultimately lead to moments of unexpected surprise (Figure 7).

Our relationship with technology will shift from obsession with mobile gadgets to wanted experiences that our personal data make possible. This will enable unparalleled life flexibility, introspection, productivity, social interactions, and convenience.

For example, digital agents working on our behalf could:

- **Coordinate** the myriad of daily activities for a busy family
- **Help arrange** common meeting time with friends and loved ones
- **Seamlessly track** shopping needs
- **Have products delivered** to our door at the right time

Like a life coach, these agents could help us understand how we spend our time and manage our expenditures and finances, remember social interactions, and recall frequent activities. Digital agents may also help us plan specific goals and respond reliably to questions like, "Where did I leave my keys?"

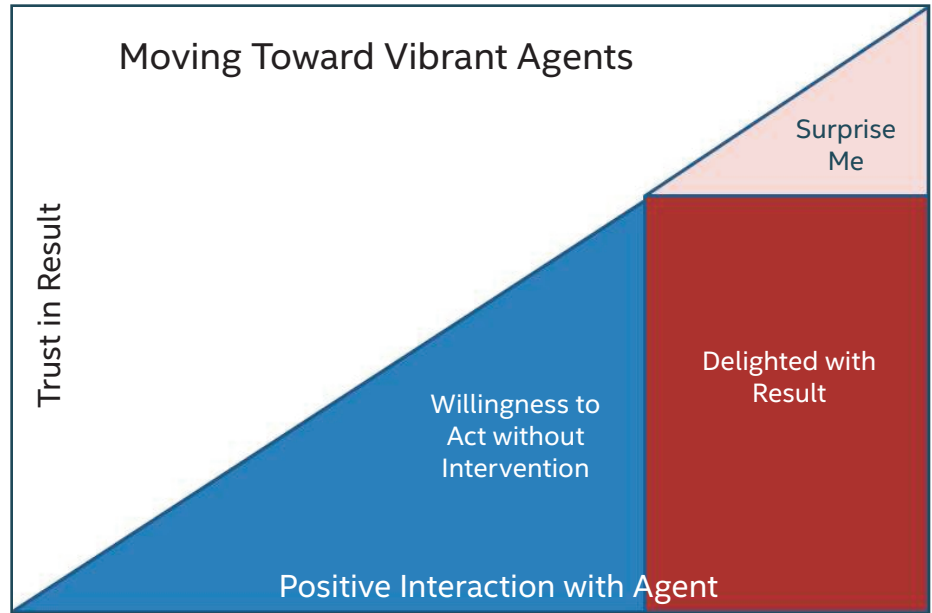


Figure 7. Frequent incidents of delight will ultimately lead to moments of unexpected surprise.

The Second Wave of Consumerization in the Enterprise: Servicification

Changes in the consumer landscape will spill over into the workplace as employees increasingly want the flexibility to integrate the best life-changing consumer services into the flow of their work life. Digital agents that facilitate unprecedented personal life convenience will initially be obstructed from becoming useful in the work environment due to corporate security barriers. Many employees—especially the Millennial generation—view work and life as intertwined and want all-the-time access. They will find this situation untenable. This will drive the second wave of consumerization, which will include servicification, the need to integrate, adapt and adopt, or enable access to consumer-based services in the enterprise. The trend will resemble the corporate consumerization transition that occurred with smartphones and tablets, but the impact will be much more expedited and disruptive for IT organizations.

The magnitude and speed of disruption will be propelled by short software development cycles and quick, simple wide deployment of services and apps. Hardware changes driven by the iPhone and iPad in the first wave of consumerization will seem long-lived in comparison.

Nimble companies will define strategies to quickly harness the new consumer services and integrate them with work-related services as a way that makes employees more productive. Imagine a personal assistant aware of both home and work calendars that can adjust an employee's day based on that knowledge. Workplace-based analytic engines will interact with employee-provided data to seamlessly suggest (and change) benefit coverage for major life events such as the birth of a child.

Employment Models are Transforming: Big Changes on the Horizon

The knowledge worker supply imbalance is likely to cause several organizational changes. One of the most dramatic is a

shift toward dynamic employee staffing. Projects and programs would be identified to meet specific business objectives, with teams forming dynamically in response. People needed for projects and programs will be drawn from varied resource pools based on their skills, interests, and availability. Instead of strict alignment to a corporate organizational structure, employees would be able to provide benefit across corporate business boundaries. Contributors could come from multiple geographies and, in some instances, drawn from outside the company to fill gaps for specialized skills.

Talent marketplaces that provide a way to match skilled employees to programs, projects, and tasks are one such approach. Projects could be listed in an exchange that would match organizational needs to employee skills and interests. A talent marketplace could provide more opportunity for employees to stay engaged and challenged while enabling a company to make best use of its resources. Since project durations may vary significantly, the employee could find new

opportunities once existing projects were complete. In a marketplace approach, employees could rotate from project to project instead of from organization to organization. The role of a manager in this type of environment would shift towards coach, counselor, and facilitator.

Creative work models like open innovation and crowd sourcing are likely to become more prevalent. The traditional model for innovation—which has been largely internally focused and closed off from outside ideas and technologies—is becoming obsolete. Emerging in its place is a new paradigm, open innovation, which strategically uses both internal and external sources of ideas and takes them to market through multiple paths.²² Crowd-sourced models use a distributed problem-solving approach to tap into large pools of people with unique skills, each of whom can contribute to a final solution.

Employees will have more opportunities and flexibility. Also, the definition of an employee is likely to shift. Individuals may choose to invigorate their careers by being part-time employees for some companies and held on retainers for specific skills by others. They could choose to become entrepreneurs for a period of time, or to participate in open innovation challenges that use their unique skills. The Millennial generation in particular is likely to want frequent shifts between differing work modalities.

Employers will consider expanding their use of talented part-time resource pools to more quickly add specialized skills, fill needs for constrained skill sets, or to pile on large and diverse sets of people to more quickly innovate.

In a world where employees frequently transition to new job opportunities with a myriad of companies, and employers

source people from widely distributed and external sources, more flexible intellectual property models will be needed. Rewarding invention without stifling innovation will be an increasingly significant issue to resolve in the coming years.

Compensation systems will need to change to accommodate the new work models. Employee compensation is likely to be more closely tied to results produced rather than hours worked. Human resources departments will need to consider new methods for identifying, assigning, and tracking the completion of deliverables while incentivizing organizational teamwork. In some cases, employees may choose to distribute a portion of their compensation to use other employees as subcontractors. Employees will exercise more control over work selection, work load, and salary.

Training, education, and employee development nurtured by employers could be a strategic differentiator to foster employee allegiance and grow employee value through educational opportunities. Mentors and training systems could proactively identify courses and projects to build worker skills. In an environment of worker scarcity, creating a path to grow worker knowledge will help address future needs and help connect employees to their company.

Changes in how people collaborate and communicate are also starting to take shape. An evolution from directed one-to-one conversation (e.g., email, phone) to multi-point communication (e.g., enterprise social networks) is projected to yield significant productivity gains. The global distribution of employees—and corresponding time zone differences—require efficient methods to work asynchronously. A McKinsey Global Institute report notes that while 72 percent of

companies use social technologies, very few are close to achieving the potential benefit from them. McKinsey predicts that a shift that moves single-threaded communication to social media can reduce the time employees spend on searching for information by as much as 35 percent.²³ Once the corporate consciousness is captured and searchable, more people can be working from the same set of assumptions and information.

Work Environments are Optimized for the New Location: Everywhere

While it is likely that workers will increasingly be spread geographically and across time zones, colocation will still be required to fulfill the human need to establish connection with coworkers, build relationships and trust, and provide opportunities to grow as a team through social interaction. Colocation is also important because it is known to spur knowledge spillover, serendipitous interactions, and innovation.²⁴

The competing forces of worker fragmentation and human colocation suggest a coming paradigm change. In some cases, this will mean new methods for establishing and building rapport via travel to a common location (temporarily) at project inception, and at periodic intervals. In other cases, technology could help fill the gap virtually. Regardless of the location, businesses will want to proactively optimize the work environment where people meet to best facilitate productivity.

Three strategies are likely to emerge, aligned with work location:

- **Optimized** office location planning
- **Hybrid** office configurations
- **Virtually** being there

Optimized Office Location Planning: Office as a Service (OaaS)

Real estate costs today represent for most organizations the second biggest overhead after salaries. This is now under scrutiny as companies grow in headcount without expanding their square footage.²⁵ The location of the office will be much more dynamic in the future and require more consistent planning. Population and urbanization trends will more negatively skew commute times, influence the use of satellite offices, and be a determinant in the location for permanent locations. Proximity to air travel hubs will be an important consideration to cope with an increasing geo-fragmentation of the employee base, and to minimize travel time when workers come together. Dynamically created project teams co-locating to temporary sites is likely to rise as a way to drive team cohesion, especially in the early stages of new projects.

Leased, rented, and multi-company shared office (temporary) formats are expected to be more prevalent as a way to address capital and operational expenses, provide flexibility for team colocation, and facilitate broader cross-company collaboration. Offices will serve as temporary anchor points for human interaction rather than daily travel destinations. Temporary locations may be used on a daily, weekly, or monthly basis. Where permanent locations are used, they will increasingly be structured for ease in reconfiguration and use. Office as a service (OaaS) will become a strategic tool to land employees in the right place at the right time. OaaS will use both internal and external sites, consider travel requirements, and address a robust set of logistics and collaboration needs over varying time frames. Imagine a work location that could be unique for each project. After formation of a project team, one of the

first tasks would be to schedule an office location.

Hybrid Office Configurations are Shape-Shifting Spaces

Once workers arrive at the office, employers will want optimum worker productivity. Physical space will be configured based on the type of task, the role of the job, and even the personality of the worker. In some cases, this will mean open environments designed for group collaboration and opportunistic encounters. In other cases, it will include private areas that allow for quiet thinking or heads-down engineering.

Sometimes, the physical configuration will be based on job types requiring specific space and equipment (e.g., hardware engineering or testing). Other times, the configuration may be based on an understanding of the differing personality and psychology of people (i.e., introverts versus extroverts). Fluid locations—such as those on short-term lease, cross company hoteling models, and virtual commuting—will also influence new configuration methods. Many companies are already configuring activity-based work environments. The sophistication of these solutions is expected to rise.

Regardless of the physical configuration, an adaptive compute workspace will increasingly understand and tailor the environment (e.g., compute, displays) to the people and situation of the moment. Imagine a local environment that is activated by a personal digital assistant on behalf of each participant. Collaboration material (e.g., video, audio, documents) would appear for group work sessions without the need to search. Individual workers would be able to use the compute environment at each location in concert with their mobile digital assistant to complete their job. Meeting transcription, identification of key points,

and decisions would automatically be documented and summarized so all people would be free to concentrate on the topic rather than the process of articulating what occurred.

The end goal would be a configurable physical environment interwoven with technology that enables productive work based on the needs of the individual and the successful collaboration of groups of people.

Virtually Being There

Companies will use a myriad of hiring practices, travel, and colocation strategies to enable teamwork, trust-building, and serendipitous innovation. But the key to addressing workforce fragmentation over the long term is most likely to be solved by a technological innovation.

Virtual colocation is expected to include a combination of technologies that will enable people to be virtually present when they can't be there physically. Successful virtual solutions would allow people to feel and interact as if they were sitting in the same room, provide ambient sociability, and enable better understanding and trust building. Capabilities such as virtually sketching ideas or sharing 3D physical models across a distance would provide rich interaction. These solutions would ultimately encourage the unanticipated moments that occur when people are able to bump into, hang out, and connect personally with others. This would not be the simplistic two-dimensional video conference systems in place today, but a set of technologies that would provide a rich interpersonal experience.

Given the likelihood that team members may need to travel more frequently to co-locate physically (at least during project inception), the same type of rich interpersonal virtual solution could also be a significant factor for homing from

work. An interactive experience that provides ambient sociability with family members while away on travel would ease some of the angst employees experience while away.

An increase in the geographic dispersion of coworkers, and a shift toward management by results, are two trends that could spur increased travel to facilitate the human-human connection. However, this trend is likely to diminish over time in direct correlation to the fidelity of virtual solutions that become available. As the virtual medium enables robust interpersonal interactions, the need to be physically present will lessen.

Summary

Over the coming years, there will be significant changes to the way we socialize, interact, play, and work. This paper has highlighted some of the significant trends that appear on the horizon and offered a view of potential changes. Some of these changes will come as a result of global environmental factors such as world population growth. Many others will be driven through technological innovation.

New challenges on the horizon present questions to resolve:

- **What type of work model** should be used to manage knowledge workers?

- **When workers** are increasingly distributed in far-flung global and multiple physical locations, how do effective interpersonal relationships form and grow?
- **How will** technology and people considerations impact the locations where people come together?
- **How can** the office environment be configured for the best productivity of the worker?
- **How will organizations** source the best workers and cope with differing attitudes across a five-generation workforce?

Against a backdrop of worldwide social change, and as technology facilitates broad global socialization, the need for human connection and understanding of differing viewpoints will become more pressing. Travel and temporary colocation, especially at project inception, may provide an anchor for human relationships until the fidelity of the virtual experience approximates being there in person.

Employee identification, cultivation, and retention will be a strategic focal point. Development of person-centric human resources systems could help keep employees engaged and engendered to their company. They could also be a competitive advantage in retaining employees. Those systems would integrate, adapt, and use the coming wave of personalized consumer services.

Human resources processes and guidelines will need consideration to maximize the use of the knowledge worker, and to provide employee flexibility and choice. New models for performance evaluation, compensation, and time off could be created to foster collaboration and innovation. Employee satisfaction will become an important barometric guide.

The location for work will increasingly be varied as workers are spread over a larger geographic landscape. Telecommuting and working on the go are likely to become the norm with the spread of mobile technologies and the increasing expectation by workers to work remotely. Optimizing office location and configuration will be another important consideration.

In short, a technological change tsunami is rolling towards us that will wash away many previous perceptions of the world. The way we work will be swept into this new reality, and the knowledge worker is positioned to be the primary agent of change. Astute organizations will see and embrace these trends and aggressively plan for the new landscape.

For more insights, research, and reports, and to connect with your peers and IT experts at Intel, visit the Intel.com IT Center (www.intel.com/itcenter).

Thanks to Liad Bareket (Intel HR), Tony Salvador (Intel Labs), Chris Shockowitz (Intel IT), Tom Stroebel (Intel Labs), Phil Muse (Intel Labs), Steve Power Brown (Intel HR), and Linda Kiehne (Intel IT) for their contributions to this white paper. Special acknowledgment to Nirit Cohen (Intel HR), Liad Bareket (Intel HR), Shlomit Izhaky (Intel HR), and the Intel Israel HR team, who hosted the Workplace of the Future Summit in Haifa, Israel. The seed for many of the ideas in this paper were facilitated by their innovative efforts.

The Future of Knowledge Work

1. "Cisco Connected World Technology Report 2011," (<http://www.cisco.com/en/US/solutions/ns341/ns525/ns537/ns705/ns1120/CCWTR-Chapter1-Report.pdf>).
2. Geo Hive Population Statistics (<http://www.geohive.com/>).
3. Green Car Congress coverage of Bill Ford, "Blueprint for Mobility" (<http://www.greencarcongress.com/2012/02/billford-20120228.html>).
4. "World Population Graphic 1950 – 2050," U.S. Census Bureau, June 2011 Update (<http://www.census.gov/population/international/data/idb/worldpopgraph.php>).
5. "Stress that Doesn't Pay: The Commuting Paradox," *The Scandinavian Journal of Economics*, 2008, Alois Stutzer and Bruno S. Frey (<http://commonsenseatheism.com/wp-content/uploads/2011/01/Stutzer-Frey-Commuting-Doesnt-Pay.pdf>).
6. Relationship between commuting and health outcomes in a cross-sectional population survey in southern Sweden, BMC Public Health, 2008, Erik Hansson, Kristoffer Mattisson, and Jonas Bjork, per Olof Ostergren and Kristinia Jakobsson (<http://www.biomedcentral.com/1471-2458/11/834>).
7. "After the Recovery: Help Needed, The Coming Labor Shortage and How People in Encore Careers Can Help Solve it," Barry Bluestone and Mark Melnik, Northeastern University, 2010 (<http://www.encore.org/files/research/JobsBluestonePaper3-5-10.pdf>).
8. "United States Faces Retirement Tsunami," graphic courtesy of Allianz, January 2011, data courtesy of UN World Population Prospects, 2008 (https://www.allianz.com/media/responsibility/documents/demographic_pulse_retirement_tsunami_all_over_the_world.pdf).
9. "Are You Ready to Manage Five Generations of Workers?" Jeanne C Meister and Karie Willyerd (http://blogs.hbr.org/cs/2009/10/are_you_ready_to_manage_five_g.html).
10. "Multiple Generations @Work: What Should You Do Differently?" posted by Jeanne Meister, November 03, 2009, New Learning Playbook (<http://newlearningplaybook.com>).
11. "The 2020 Workplace: How Innovative Companies Attract, Develop, and Keep Tomorrow's Employees Today," Jeanne C Meister and Karie Willyerd, May 2011.
12. "Future Work Skills 2020," Institute for the Future for the University of Phoenix Research Institute (<http://apolloresearchinstitute.com/research-studies/workforce-preparedness/future-work-skills-2020>).
13. "IBM's Watson is Learning Its Way to Saving Lives," Jon Gertner, October 15, 2012, Fast Company (http://www.fastcompany.com/3001739/ibms-watson-learning-its-way-saving-lives?utm_source=feedburner&utm_medium=feed&utm_campaign=Feed%3A+fastcompany%2Fheadlines+%28Fast+Company%29).
14. "Cisco Connected World Technology Report 2010" (<http://www.cisco.com/en/US/netsol/ns1120/index.html#~2010>).
15. "Voices from the Inside: Key Intelligence from 2011 IT UX Research with Employees," Intel Corporation (<http://www.intel.com>).
16. "Agility at Work: Adopting the Corporate Six Pack," Phillip Ross (<http://www.regus.presscentre.com/imageLibrary/downloadMedia.ashx?MediaDetailsID=365>).
17. Reaching 50 Million Users Graphic. G.Kofi Annan, (http://www.google.com/imgres?hl=en&sa=X&rlz=1C1CHF_enUS383US383&biw=1296&bih=977&tbm=isch&prmd=imvns&tbnid=1JXFShtFv9e71M:&imgrefurl=http://www.gkofiannan.com/&docid=gF07nbULdXx6tM&imgurl=http://getfile2.posterous.com/getfile/files.posterous.com/temp-2012-05-01/dHpkqtJuqhbDlCguEpzGJLhwrtxpGEvjgnabyNuBFodAGwHBqzamIcpuyDb/reach50million_gkofiannan.jpg.scaled1000.jpg&w=1000&h=619&ei=iPlgUJJD43oiQLEiYCYBA&zoom=1&iact=hc&vpx=433&vpy=429&dur=2733&hovh=178&hovw=286&tx=107&ty=203&sig=101351832358428417249&page=1&tbnh=120&tbnw=193&start=0&ndsp=33&ved=1t:429,r:28,s:0;162).
18. "How Draw Something Drew 50 Million Users" (<http://www.getelastic.com/how-draw-something-drew-50-million-users-infographic/>).
19. Digital statistics (<http://digital-stats.blogspot.com/2011/04/it-took-radio-38-years-to-reach-50.html>).
20. United Nations Cyberschoolbus (<http://www.un.org/cyberschoolbus/briefing/technology/tech.pdf>).
21. "Personal Data: The Emergence of a New Asset Class," World Economic Forum Report, 2011 (<http://www.weforum.org/reports/personal-data-emergence-new-asset-class>).
22. "Open Innovation: The New Imperative for Creating and Profiting from Technology," H.W. Chesbrough, 2003.
23. "The Social Economy: Unlocking Value and Productivity through Social Technologies," McKinsey Global Institute report (http://www.mckinsey.com/insights/mgi/research/technology_and_innovation/the_social_economy).
24. "The Importance of Proximity and Location," Maryann P. Feldman, Barak S. Aharonson, and Joel A. C. Baum. Rotman School of Management, University of Toronto (http://www.google.com/url?sa=t&rc=1&q=&esrc=s&source=web&cd=2&sqi=2&ved=0CFQQFjAB&url=http%3A%2F%2Fadvancingknowledge.groups.si.umich.edu%2Fdrafts%2FFeldman-MF%2520importance%2520of%2520proximity%2520and%2520location-revised.doc&ei=6HTbT4G1G-ao0AGiqYw_Cg&usq=AFQjCjNH1LoyQC-Bkary9HdMm13jsLFOIQ&sig2=bWBVdfsbraj0iB9yJ0Nktw).
25. "Agility@Work: The Impact of Six Forces on the Way we Work," UNWIRED Research, Mark Dixon and Philip Ross. 2010.
26. Brian David Johnson (Intel Futurist), Intel Workplace of the Future Summit, May 2012.
27. "Five Trends that Are Dramatically Changing Work and the Workplace," Joe Aki Ouye, Ph.D., Knoll Workplace Research (http://www.knoll.com/research/downloads/WP_FiveTrends.pdf).
28. "10 Pinterest Infographics: Visual Explanations for a Visual Social Network" (<http://blog.hubspot.com/blog/tabid/6307/bid/33078/10-Pinterest-Infographics-Visual-Explanations-for-a-Visual-Social-Network.aspx>).
29. David Arkless (Manpower Group's President of Corporate and Government Affairs), Intel Workplace of the Future Summit, May 2012.
30. Philip Ross (CEO of Cordless Group), Intel Workplace of the Future Summit, May 2012.
31. Greg Lindsay (Author of "Aerostropolis: The Way We'll Live Next"), Intel Workplace of the Future Summit, May 2012.
32. Dr. Tony Salvador (Director of Experience Insight Research, Intel Labs), Intel Workplace of the Future Summit, May 2012.
33. "Activity Based Working: The Hybrid Organisation: Buildings," Philip Ross.

INFORMATION IN THIS DOCUMENT IS PROVIDED IN CONNECTION WITH INTEL® PRODUCTS. NO LICENSE, EXPRESS OR IMPLIED, BY ESTOPPEL OR OTHERWISE, TO ANY INTELLECTUAL PROPERTY RIGHTS IS GRANTED BY THIS DOCUMENT. EXCEPT AS PROVIDED IN INTEL'S TERMS AND CONDITIONS OF SALE FOR SUCH PRODUCTS, INTEL ASSUMES NO LIABILITY WHATSOEVER, AND INTEL DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY, RELATING TO SALE AND/OR USE OF INTEL PRODUCTS INCLUDING LIABILITY OR WARRANTIES RELATING TO FITNESS FOR A PARTICULAR PURPOSE, MERCHANTABILITY, OR INFRINGEMENT OF ANY PATENT, COPYRIGHT OR OTHER INTELLECTUAL PROPERTY RIGHT. UNLESS OTHERWISE AGREED IN WRITING BY INTEL, THE INTEL PRODUCTS ARE NOT DESIGNED NOR INTENDED FOR ANY APPLICATION IN WHICH THE FAILURE OF THE INTEL PRODUCT COULD CREATE A SITUATION WHERE PERSONAL INJURY OR DEATH MAY OCCUR.

Intel may make changes to specifications and product descriptions at any time, without notice. Designers must not rely on the absence or characteristics of any features or instructions marked "reserved" or "undefined." Intel reserves these for future definition and shall have no responsibility whatsoever for conflicts or incompatibilities arising from future changes to them. The information here is subject to change without notice. Do not finalize a design with this information. The products described in this document may contain design defects or errors known as errata which may cause the product to deviate from published specifications. Current characterized errata are available on request. Contact your local Intel sales office or your distributor to obtain the latest specifications and before placing your product order. Copies of documents which have an order number and are referenced in this document, or other Intel literature, may be obtained by calling 1-800-548-4725, or by visiting Intel's Web site at www.intel.com.

Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products.

Copyright © 2014 Intel Corporation. All rights reserved. Intel and the Intel logo are trademarks of Intel Corporation in the U.S. and/or other countries.

