For the last 30 years, the future of computing has been almost single-mindedly driven by a quest for ubiquity. Coined in the early pioneering days at Xerox PARC, the ubiquitous vision was of a world where computing would provide a universal substrate for every human activity.

Indeed, the computing infrastructure has grown since the halcyon days of Silicon Valley, driven by Moore’s Law and the inexorable march of silicon engineering. But while “ubicomp” seemed to imply a uniform distribution of computing capability, the people and organizations that deployed computing in the real world had a different agenda. Put simply, economics and time conspired to create an abundance of computing power in some places, rather than spreading it evenly everywhere.

Today, high-performance computing applications, from simulations to intense supercomputer-powered visualizations, are mostly limited to capital-intensive industries and technology research laboratories. But, as we look out over the next 10 years, it’s in these places of abundant computing that we can find hints of the capabilities that will migrate to mass markets and eventually into the hands of consumers. High-powered computing capabilities will be embedded in our physical environment—in living things, on walls, in furniture, fabric, garments, medicines, hand tools, utensils, toys, and objects. Rather than achieving ubiquity, these capabilities will become portable and personal and their diffusion will be shaped by the preferences of, and availability to, individual consumers and companies, and particular environments and regulatory regimes adopted by governments.

The Institute for the Future’s Abundant Computing Map is an introduction to the technologies and applications that will shape a world of digital abundance. Because the landscape will be shaped not just by new technological innovations but also by innovative uses of existing technologies, a comprehensive list of every future application would be simply impossible to create. What we present instead is a guide that will serve as an outline of key directions of the evolution.
Over the next ten years, we will view the self as a subject for computational sensing and modeling with increasing frequency. Abundant computing will provide the ability to make sense out of the volumes of personal data that we will accumulate about ourselves, and link it to other data and models on the web. Our identity, our health, and our activities in the workplace will all be the subject of intense pondering by machines—both ours and those of our employers, insurers, and marketers.

How can we make communication over distance more like being in the same room? Face-to-face human contact is the oldest and most valued form of human interaction. From immersive desktop video to multimedia presence streams, communication technology is advancing toward realistic 3-D telepresence driven by accurate modeling of the physical world. As computational power increases in the future, the functionality of telepresence technology will seek to more accurately recreate the feeling that someone is in the same room. More realistic telepresence is not likely to replace face-to-face contact, but rather function as an additive: it will drive an expansion in the kinds of interactions and activities we conduct online and enable new genres of communication.

Reality will get an upgrade as the capabilities of abundant computing are mapped onto our human sensory inputs such as vision and hearing. Abundant computation means abundant augmentation, from immersive travel systems to on-the-go risk analysis through a pair of ordinary glasses. As photorealistic displays meet full-sensory immersion experiences, we will draw closer to a world where everyone escapes to different made-for-me realities.

As abundant computing diffuses from the hands of scientists to the deeply networked DIY community, we will see a new ecosystem of democratized sensing emerge. From green hackers to public health activists, tapping into sensing technology is opening a world of real-time accounting and data recording. Cheaper and more widely available sensors will enable more self-management and result in a call for accountability as not just sensing is democratized but so is the information it produces.

With bandwidth all around us, location will cease to constrain connectivity. And as the quality of abundant bandwidth improves, we will see an explosion of services and networks that allow us to manage complex tasks on the go. Large mesh networks and lightweight logistics will enable smart disaster response and crowdsourced voting. We will move freely without sacrificing computational power and capability, and that will make us move more intelligently in response to the dynamics of the world around us.

Abundant computation allows us to connect and use ambient digital information in a way never done before. A lot of the personal information in our lives is unstructured and unusable—think of all the names and phone numbers in your email inbox—or in silos across your life. Large-scale artificial intelligence services will offer to take on your personal data, attention data, and social data and create a coherent, usable interface for you and your trusted network. Unlabelled photos and video can be literally stitched together with the media of others, inheriting all the information associated with the group.

Today’s tools for understanding and communicating knowledge have not kept pace with a growing torrent of visual and quantitative data in multiple languages. Abundant computing will provide tools that let us quickly build compelling stories drawn out of complex data automatically, permitting humans to focus on higher-level problems. Complex translation devices and abundant connectivity will break down the language barriers that stand between speakers of different tongues allowing us to communicate freely regardless of native language.

The ability to simulate the efficacy of a business model before its launch will revolutionize enterprise design. Business models can be tweaked and even designed around dynamic simulations of product success and failure. This informed design can be applied to institutions outside the business world, such as disaster response. Testing a system through rigorous simulation will allow us to identify the strengths and weaknesses and thus optimize the system to minimize potential breakdowns. It will take the risk out of endeavors that today are full of chance.
Forecast how the fundamental capabilities and augmentations will be delivered by abundant computing.

Map the key areas of human activity that will be transformed by abundant computing, from communications and mobility to business planning.

Forecast some specific ways we'll see abundant computing integrated into our personal lives, organizations, and communities.
About the ...

TECHNOLOGY HORIZONS PROGRAM

The Technology Horizons Program combines a deep understanding of technology and societal forces to identify and evaluate discontinuities and innovations in the next three to ten years. We help organizations develop insights and strategic tools to better position themselves for the future. Our approach to technology forecasting is unique—we put humans in the middle of our forecasts. Understanding humans as consumers, workers, householders, and community members allows IFTF to help companies look beyond technical feasibility to identify the value in new technologies, forecast adoption and diffusion patterns, and discover new market opportunities and threats.